

ISUZU

N SERIES

TRAINING MANUAL

ISUZU MOTORES LIMITED

ISUZU



Service Marketing Department

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GENERAL INFORMATION



GENERAL INFORMATION

GENERAL REPAIR INSTRUCTIONS

General Repair Instructions

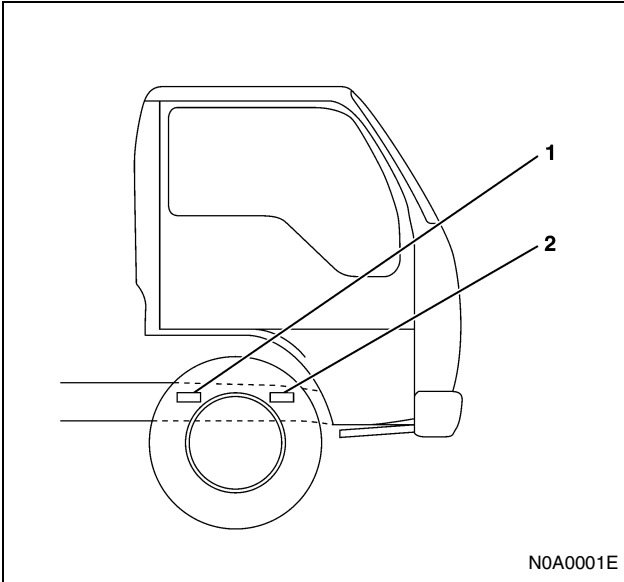
1. Park the vehicle on level ground and chock the front or rear wheels before lifting the vehicle.
2. Use covers on the vehicle body, seats, and floor to prevent damage and/or contaminations.
3. Disconnect the grounding cable from the battery before performing service operations. This will prevent cable damage or burning due to shortcircuiting.
4. Raise the vehicle with a jack set against the axle or the frame.
5. Support the vehicle on chassis stands.
6. Handle brake fluid and engine coolant with great care.
Spilling these liquids on painted surfaces will damage the paint.
7. The use of the proper tool(s) and special tool(s) where specified is essential to efficient, reliable, and safe service operations.
8. Always use genuine ISUZU replacement parts.
9. Discard used cotter pins, gasket, O-rings, oil seals, lock washers, and self-locking nuts at disassembly.
Normal function of these parts cannot be guaranteed if they are reused.
10. Keep the disassembled parts neatly in groups.
This will facilitate smooth and correct reassembly.
11. Keep fixing nuts and bolts separate.
Fixing nuts and bolts vary in hardness and design according to installation positions.
12. Clean all parts before inspection or reassembly.
13. Clean the oil ports and other openings with compressed air to make certain that they are free of dirt and obstructions.
14. Lubricate the rotating and sliding faces of all moving parts with oil or grease before installation.
15. Use the recommended liquid gasket to prevent leakage.
16. Be sure to tighten bolts and nuts to the specified torque, using a properly maintained torque wrench.
17. When service operation is completed, make a final check to be sure service has been done properly and problem has been corrected.
18. When removing or replacing parts that require refrigerant to be discharged from the Air conditioning system, be sure to use the ACR4 or equivalent to recover and recycle Refrigerant-134a, to promote the movement for the protection of the ozone layer covering the earth.
19. To assure safety, always slowly release air pressure from the air tanks before disconnecting pipes, hoses or other parts from any unit under pressure.

IDENTIFICATION

Chassis Number:

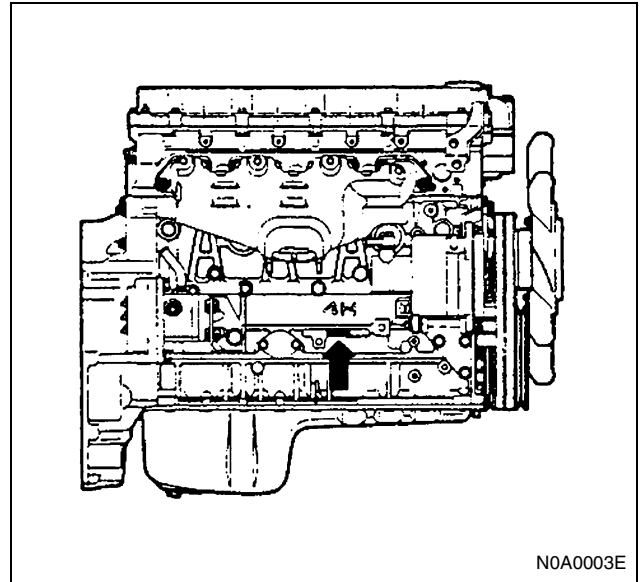
It is stamped on the front right-hand side face of the chassis side member.

1. NKR models with independent front suspension
2. NHR, NKR, NPR, NQR and NPS models with rigid axle front suspension



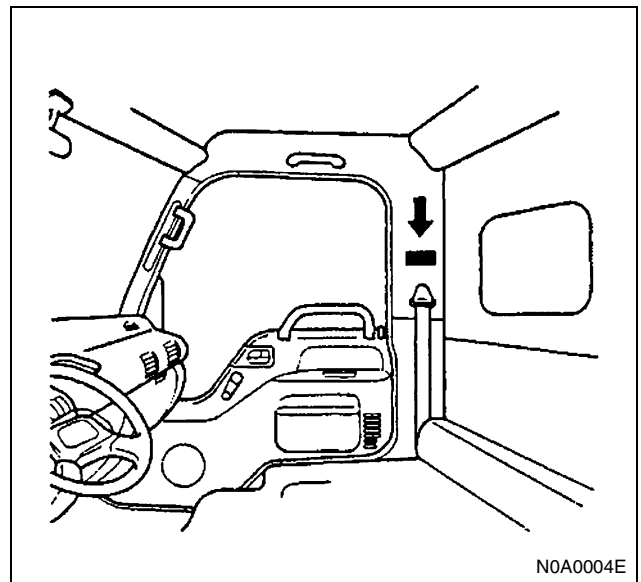
4H Series Engine

The engine number is stamped on the right side of the cylinder body.



Vehicle Identification Plate

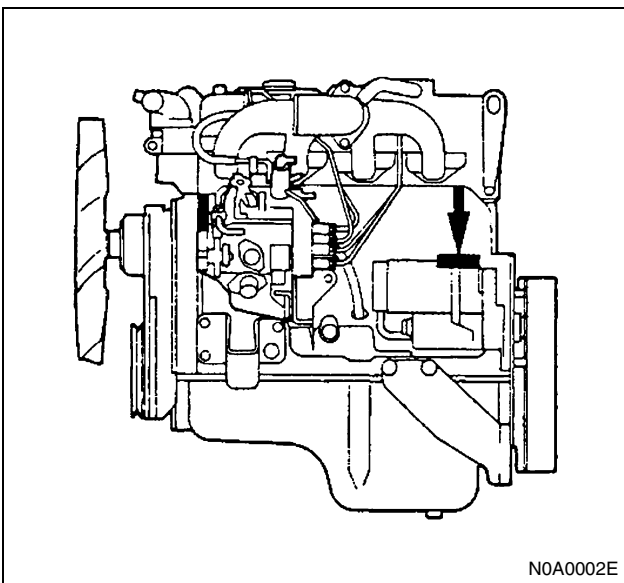
The vehicle identification plate is attached to the interior side of the cab side panel on the right side.



Engine Number:

4J Series Engine

The engine number is stamped on the left side rear of the cylinder body.



LIFTING INSTRUCTION

Lifting Instruction

If it is necessary to use a lifting device other than the original equipment jack, see illustration for acceptable lifting points.

Lifting should only be done at the positions indicated to prevent possible damage to the vehicle.

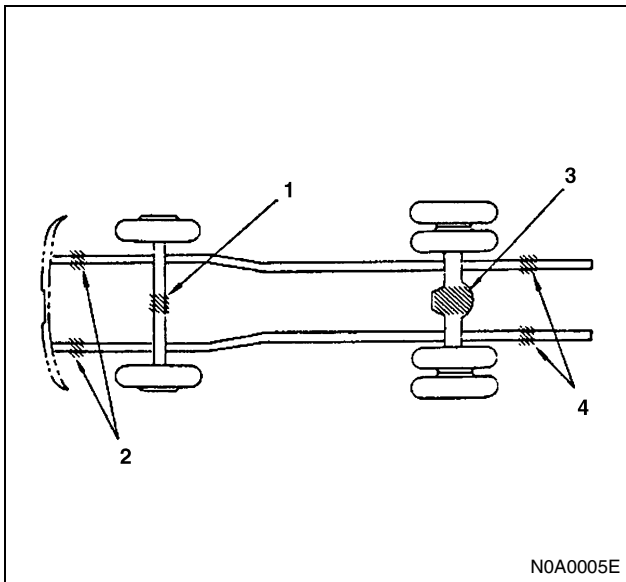
Caution:

Failure to observe the acceptable lift points may result in unsatisfactory vehicle performance or a durability failure which may result in loss of control of the vehicle.

Garage Jack and Safety Stand

Lifting Point and Supportable Point Location

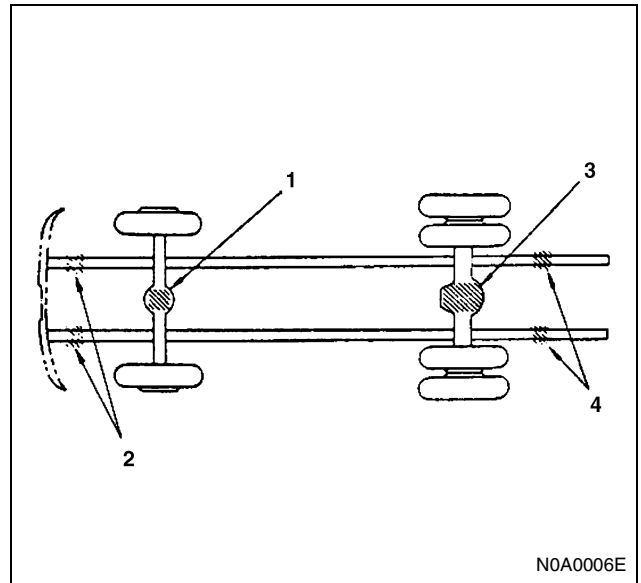
NHR, NKR, NPR, NQR



Legend

1. Front axle
2. Side frame front side
3. Rear axle center
4. Side frame rear side

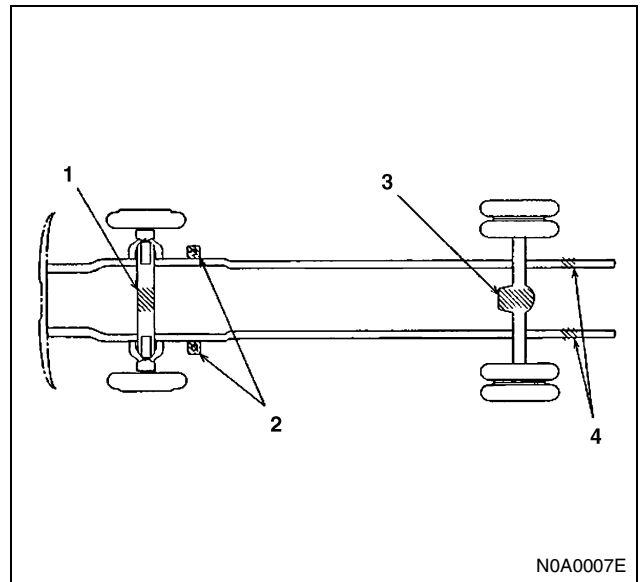
NPS



Legend

1. Front axle
2. Side frame front side
3. Rear axle center
4. Side frame rear side

NKR (Front independent suspension)



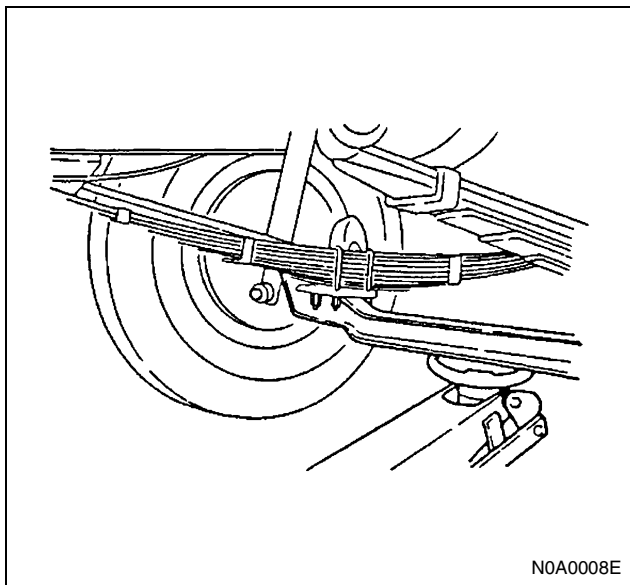
Legend

1. Suspension cross member
2. Jack up bracket
3. Rear axle center
4. Side frame rear side

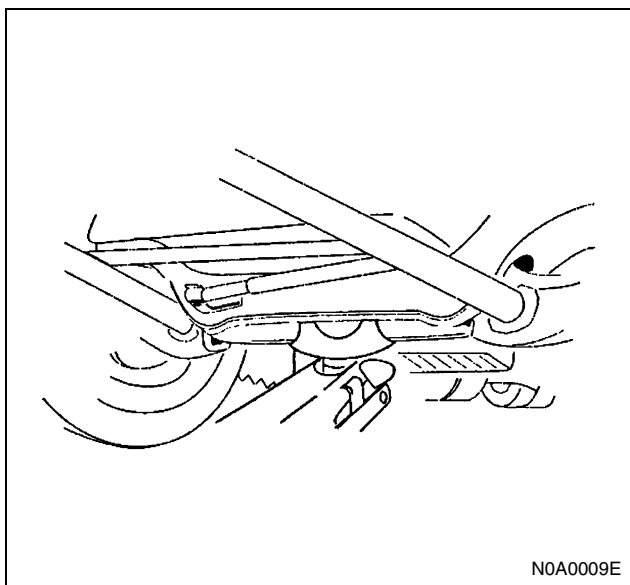
Front Side Lifting Point

Notice:

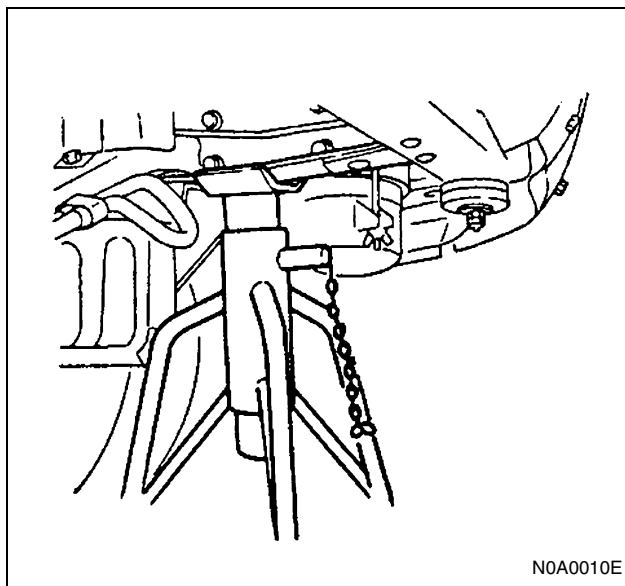
Do not lift or support on engine oil pan.



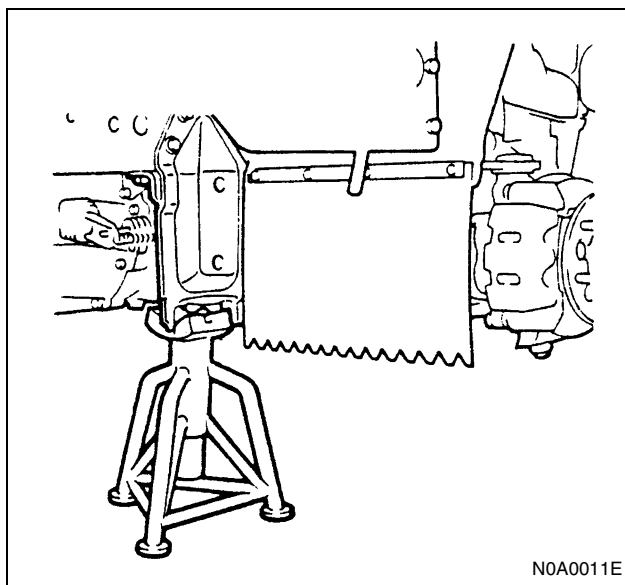
NKR (Front independent suspension)



Front Side Supportable Point



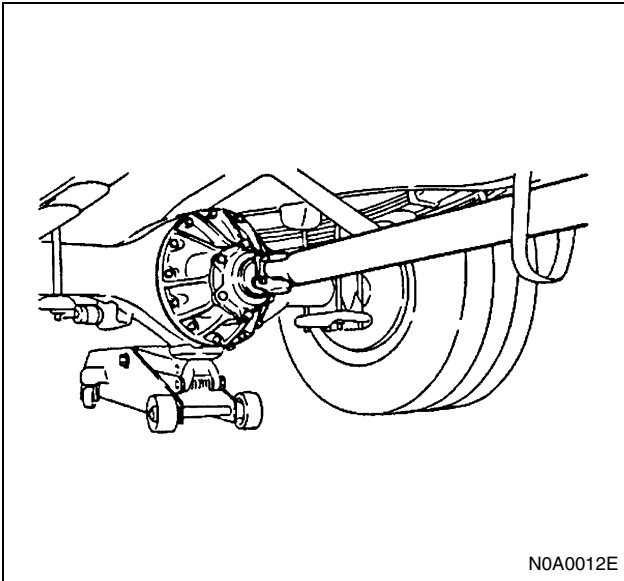
NKR (Front independent suspension)



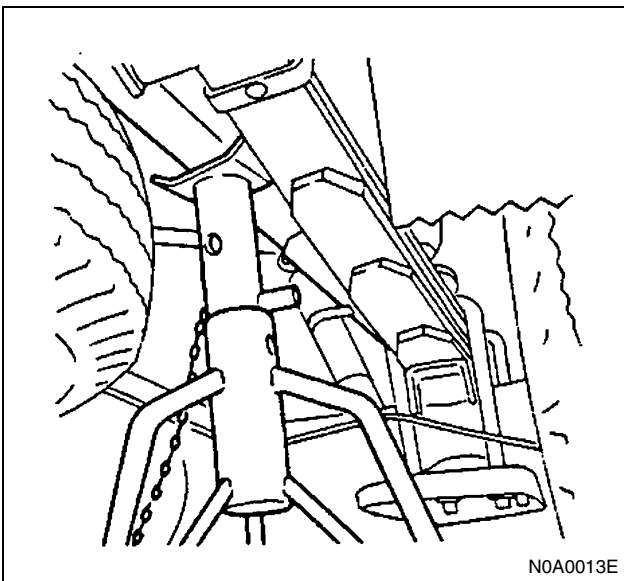
Rear Side Lifting Point

Notice:

Do not lift or support on rear axle tube.



Rear Side Supportable Point





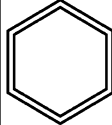





TORQUE SPECIFICATIONS

Standard Bolts

The torque values given in the following table should be applied where a particular torque is not specified.

N·m (kg·m / lb·ft)
N·m [kg·cm / lb·in]

Bolt Diameter × Pitch (mm)	Strength Class	4.8		8.8		9.8	
				Refined	Non-Refined		
	Bolt Identifi- cation						
			No mark				
M6×1.0	6 [60 / 52]		7 [75 / 69]		—		
M8×1.25	13 [130 / 113]		18 [180 / 156]		24 [240 / 208]		
M10×1.25	27 (2.8 / 20)		37 (3.8 / 27)		50 (5.1 / 37)		
M12×1.25	61 (6.3 / 45)		76 (7.7 / 56)		95 (9.7 / 70)		
M14×1.5	96 (9.8 / 71)		117 (11.9 / 86)		142 (14.5 / 105)		
M16×1.5	130 (13.3 / 96)		170 (14.3 / 125)		200 (20.4 / 148)		
M18×1.5	188 (19.2 / 139)		244 (24.9 / 180)		287 (29.3 / 212)		
M20×1.5	258 (26.3 / 190)		337 (34.4 / 249)		396 (40.4 / 292)		
M22×1.5	332 (33.9 / 245)		454 (46.3 / 335)		530 (54.1 / 391)		
M24×2.0	449 (45.8 / 331)		538 (54.9 / 397)		692 (70.6 / 511)		
*M10×1.5	26 (2.7 / 20)		36 (3.7 / 27)		48 (4.9 / 35)		
*M12×1.5	57 (2.8 / 42)		71 (7.2 / 52)		89 (9.1 / 66)		
*M14×2.0	89 (9.1 / 66)		110 (11.2 / 81)		133 (13.6 / 98)		
*M16×2.0	124 (12.7 / 92)		162 (16.5 / 119)		191 (19.5 / 141)		
N0A0023E							

The asterisk * indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.

Flare Nuts

N·m (kg·m / lb·ft)

Pipe diameter mm (in)	Torque	Pipe diameter mm (in)	Torque
4.76 (0.187)	16 (1.6 / 12)	10.00 (0.94)	54 (5.5 / 40)
6.35 (0.250)	26 (2.7 / 20)	12.00 (0.472)	88 (9.0 / 65)
8.00 (0.315)	44 (4.5 / 33)	15.00 (0.591)	106 (10.8 / 78)

RECOMMENDED LIQUID GASKET

Recommended Liquid Gasket

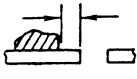

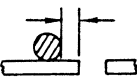



TYPE	BRAND NAME	MANUFACTURER	APPLICATION PARTS (EXAMPLE)
RTV* Silicon	ThreeBond 1207B	ThreeBond	Engine Oil Seal Retainer
	ThreeBond 1207C	ThreeBond	Engine Oil Pan
	ThreeBond 1215	ThreeBond	Timing Gear Case
	ThreeBond 1216	ThreeBond	Cylinder Head Cover
	ThreeBond 1281	ThreeBond	Fuel Pump
Water Base	ThreeBond 1141E	ThreeBond	Rear Axle
Solvent	ThreeBond 1104	ThreeBond	etc.
	BelcoBond 4	Isuzu	
	BelcoBond 401	Isuzu	
	BelcoBond 402	Isuzu	
Anaerobic	LOCTITE 515	LOCTITE	Engine Oil Seal Retainer
	LOCTITE 518	LOCTITE	Water Pump Transaxle etc.

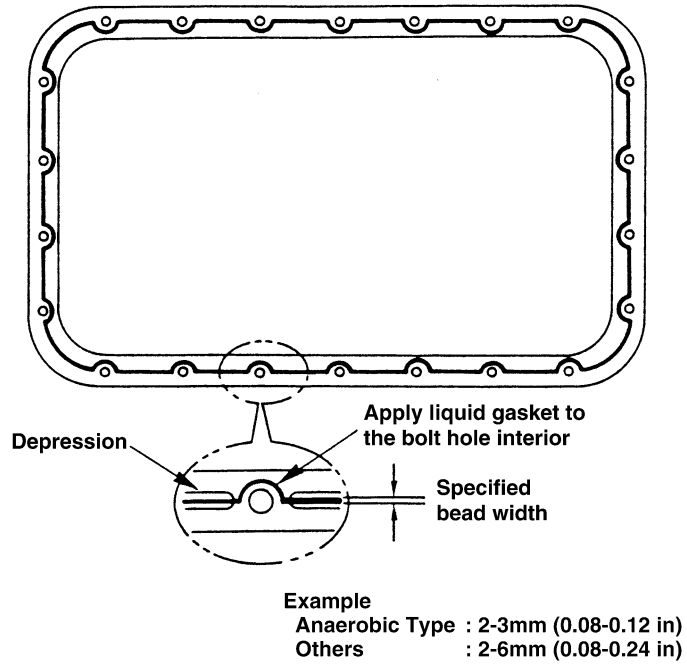
*RTV: Room Temperature Vulcanizer

Notice:

1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
2. LOCTITE 515 and LOCTITE 518 harden upon contact with a metal surface.
Do not apply LOCTITE 515 or LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.001 in). Poor adhesion will result.
3. Be careful to use the specified amount of liquid gasket.
Follow the manufacturer's instructions at all times.

Application Procedure

SCREW HOLE	DEPRESSION	JUDGEMENT
1~3 (0.04~0.12) 		OK
1~3 (0.04~0.12) 	More than 2(0.08) 	OK
		NG



N0A0014E

1. Completely remove lubricant and moisture from the connecting surfaces.
The surfaces must be perfectly dry.
2. Apply specified bead width of liquid gasket to one of the connecting surfaces.

Notice:

When the application procedures are specified in this manual, follow them.

RECOMMENDED THREAD LOCKING AGENT

Notice:

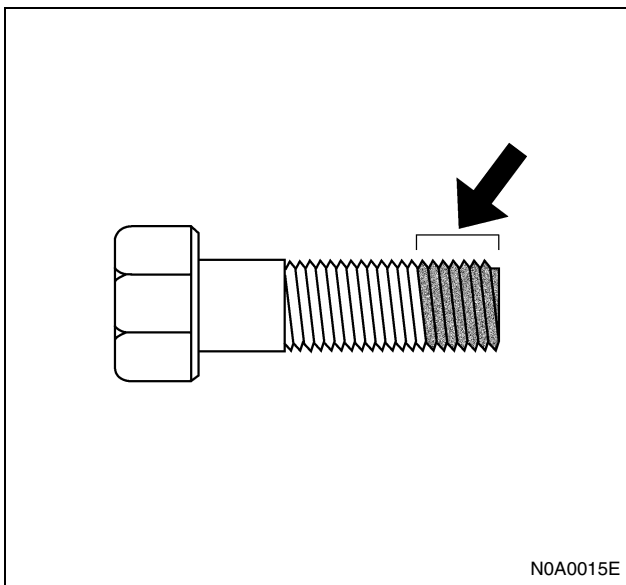
When the application procedures are specified in this manual, follow them.

LOCTITE

TYPE	COLOR
LOCTITE 242	Blue
LOCTITE 262	Red
LOCTITE 271	Red

Application Steps

1. Completely remove all lubricant and moisture from the bolts and the female threaded surfaces of the parts to be joined.
The surfaces must be perfectly dry.
2. Apply LOCTITE to the bolts.
Apply LOCTITE to at least 1/3 of the bolt's threaded area.



3. Tighten the bolts to the specified torque.

Notice:

After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until LOCTITE hardens.

MAINTENANCE AND LUBRICATION

MAINTENANCE SCHEDULE

When performing the checks on the following items, regular inspection items should also be checked.

Abbreviations

I : Inspect, clean and correct or replace as necessary

A : Adjust

R : Replace or change

T : Tighten to specified torque

L : Lubricate

[V] : Variation (optional on some models).

[OPT] : Optional equipment.

[SA] : For Smoother model only.

*Marks: Under severe driving conditions, more frequent maintenance is required. Refer to "Maintenance schedule under severe driving conditions".

Maintenance Schedule: 4JH1-TC Engine Model (Engine Oil that Meets or Exceeds ACEA B3 Specification)

SERVICE INTERVAL: (Use odometer reading or months Whichever comes first)	× 1,000 km	20	40	60	80	100	120	
	× 1,000 mile	12	24	36	48	60	72	
ENGINE								
*Engine oil		R	R	R	R	R	R	Or every 9 months
*Engine oil filter		R	R	R	R	R	R	Or every 9 months
Fuel filter		R	R	R	R	R	R	Or every 18 months
*Air cleaner element		I	I	R	I	I	R	Or every 36 months
Idling speed and acceleration		—	I	—	I	—	I	Or every 18 months
Valve clearances		—	—	A	—	—	A	Or every 36 months
Fuel tank cap and fuel pipes for loose connections or damage		—	—	I	—	—	I	Or every 36 months
Drive belt tension and damage		I	I	I	I	I	I	Or every 9 months
Radiator coolant		—	—	R	—	—	R	Or every 36 months
*Exhaust pipes and mountings for looseness or damage		—	I	—	I	—	I	Or every 18 months
Cooling system for water leakage		—	I	—	I	—	I	Or every 18 months
Engine operation condition		I	I	I	I	I	I	Or every 9 months
CLUTCH								
Clutch fluid		I	I	R	I	I	R	Or every 24 months
Clutch pedal travel and free play		I	I	I	I	I	I	Or every 6 months
TRANSMISSION								
*Manual transmission oil		I	I	R	I	I	R	Or every 24 months
Gear control mechanism for looseness		—	—	I	—	—	I	Or every 24 months
Gear control cables		—	A	—	A	—	A	Or every 12 months
PROPELLER SHAFT								
*Universal joints and sliding sleeve grease		L	L	L	L	L	L	Or every 12 months

SERVICE INTERVAL: (Use odometer reading or months Whichever comes first)	× 1,000 km	20	40	60	80	100	120	
	× 1,000 mile	12	24	36	48	60	72	
Loose connections		I	I	I	I	I	I	Or every 6 months
Splines for excessive wear		—	—	I	—	—	I	Or every 24 months
Bearings and related parts for looseness		—	—	I	—	—	I	Or every 24 months
Center bearing		L	L	L	L	L	L	Or every 12 months
REAR AXLE								
*Differential gear oil		I	I	R	I	I	R	Or every 24 months
FRONT AXLE								
*Kingpins		L	L	L	L	L	L	Or every 9 months
STEERING								
Power steering system oil leakage		I	I	I	I	I	I	Or every 9 months
Power steering system for looseness or damage		I	I	I	I	I	I	Or every 9 months
Power steering fluid		—	—	R	—	—	R	Or every 36 months
Power steering hoses		—	—	—	—	—	R	Or every 72 months
Fitting of knuckles and front axle for looseness		I	I	I	I	I	I	Or every 9 months
Steering mechanism for looseness or damage		—	—	I	—	—	I	Or every 36 months
Ball joints for damage (Independent suspension model only)		I	I	I	I	I	I	Or every 9 months
Ball joints for excessive play (Independent suspension model only)		I	I	I	I	I	I	Or every 9 months
Relay lever shaft for excessive play (Independent suspension model only)		I	I	I	I	I	I	Or every 9 months
Steering wheel play		I	I	I	I	I	I	Or every 9 months
Steering function		I	I	I	I	I	I	Or every 9 months
Wheel alignment		—	—	I	—	—	I	Or every 36 months
SERVICE BRAKES								
Brake fluid		I	I	R	I	I	R	Or every 36 months
Brake system for fluid leakage		I	I	I	I	I	I	Or every 9 months
*Brake linings and drums for wear		I	I	I	I	I	I	Or every 9 months
*Disc brake pads and discs for wear		I	I	I	I	I	I	Or every 9 months
Brake pedal travel and free play		I	I	I	I	I	I	Or every 9 months
Pipes and hoses for loose connections or damage		I	I	I	I	I	I	Or every 9 months
PARKING BRAKE								

SERVICE INTERVAL: (Use odometer reading or months Whichever comes first)	× 1,000 km	20	40	60	80	100	120	
	× 1,000 mile	12	24	36	48	60	72	
Parking brake cables		I	I	I	I	I	I	Or every 9 months
Parking brake function		I	I	I	I	I	I	Or every 9 months
Parking brake lever travel		I	I	I	I	I	I	Or every 9 months
Linings for wear		—	—	I	—	—	I	Or every 36 months
Drum for wear or damage		—	—	I	—	—	I	Or every 36 months
Ratchet for wear or damage		—	—	I	—	—	I	Or every 36 months
SUSPENSION								
Spring leaves for damage		I	I	I	I	I	I	Or every 9 months
Torsion bar spring (Independent suspension model only)		I	I	I	I	I	I	Or every 9 months
Ball joint boots for damage (Independent suspension model only)		I	I	I	I	I	I	Or every 9 months
Ball joints for excessive play (Independent suspension model only)		—	—	I	—	—	I	Or every 36 months
Mounts for looseness or damage		I	I	I	I	I	I	Or every 9 months
Shock absorbers for oil leakage		I	I	I	I	I	I	Or every 9 months
Shock absorbers mount for looseness		I	I	I	I	I	I	Or every 9 months
Upper links (Independent suspension model only)		L	L	L	L	L	L	Or every 9 months
WHEELS								
Wheel pins and nuts		—	T	—	T	—	T	Or every 18 months
Wheel discs for damage		—	I	—	I	—	I	Or every 18 months
Hub bearings grease		—	—	R	—	—	R	Or every 36 months
Tire pressures and damage		I	I	I	I	I	I	Or every 9 months
ELECTRICAL EQUIPMENT								
Specific gravity of battery electrolyte		I	I	I	I	I	I	Or every 9 months
OTHERS								
Lights, horn, windshield, wiper and washers		I	I	I	I	I	I	Or every 9 months
Bolts and nuts on chassis and body		—	—	I	—	—	I	Or every 36 months

(I): Inspect and correct or replace as necessary (A): Adjust (R): Replace or change (T): Tighten to specified torque (L): Lubricate

Maintenance Schedule: 4JH1-TC Engine Model (ACEA B2 Specification Engine Oil)

SERVICE INTERVAL: (Use odometer reading or months Whichever comes first)	× 1,000 km	15	30	45	60	75	90	105	120	135	150	
	× 1,000 mile	9	18	27	36	45	54	63	72	81	90	
ENGINE												
*Engine oil		R	R	R	R	R	R	R	R	R	R	or every 9 months
*Engine oil filter		R	R	R	R	R	R	R	R	R	R	or every 9 months
Fuel filter		—	R	—	R	—	R	—	R	—	R	or every 18 months
*Air cleaner element		I	I	I	R	I	I	I	R	I	I	or every 36 months
Idling speed and acceleration		—	I	—	I	—	I	—	I	—	I	or every 18 months
Valve clearances		—	—	—	A	—	—	—	A	—	—	or every 36 months
Fuel tank cap and fuel pipes for loose connections or damage		—	—	—	I	—	—	—	I	—	—	or every 36 months
Drive belt tension and damage		I	I	I	I	I	I	I	I	I	I	or every 9 months
Radiator coolant		—	—	—	R	—	—	—	R	—	—	or every 36 months
*Exhaust pipes and mountings for looseness or damage		—	I	—	I	—	I	—	I	—	I	or every 18 months
Cooling system for water leak- age		—	I	—	I	—	I	—	I	—	I	or every 18 months
Engine operation condition		I	I	I	I	I	I	I	I	I	I	or every 9 months
CLUTCH												
Clutch fluid		I	I	I	R	I	I	I	R	I	I	or every 36 months
Clutch pedal travel and free play		I	I	I	I	I	I	I	I	I	I	or every 9 months
TRANSMISSION												
*Manual transmission oil		I	I	I	R	I	I	I	R	I	I	or every 36 months
Gear control mechanism for looseness		—	—	—	I	—	—	—	I	—	—	or every 36 months
Gear control cables		—	A	—	A	—	A	—	A	—	A	or every 18 months
PROPELLER SHAFT												
*Universal joints and sliding sleeve grease		—	L	—	L	—	L	—	L	—	L	or every 18 months
Loose connections		I	I	I	I	I	I	I	I	I	I	or every 9 months
Splines for excessive wear		—	—	—	I	—	—	—	I	—	—	or every 36 months
Bearings and related parts for looseness		—	—	—	I	—	—	—	I	—	—	or every 36 months
Center bearing		—	L	—	L	—	L	—	L	—	L	or every 18 months
REAR AXLE												
*Differential gear oil		I	I	I	R	I	I	I	R	I	I	or every 36 months
FRONT AXLE												
*Kingpins		L	L	L	L	L	L	L	L	L	L	or every 9 months
STEERING												

SERVICE INTERVAL: (Use odometer reading or months Whichever comes first)	× 1,000 km	15	30	45	60	75	90	105	120	135	150	
	× 1,000 mile	9	18	27	36	45	54	63	72	81	90	
Power steering system oil leakage		I	I	I	I	I	I	I	I	I	I	or every 9 months
Power steering system for looseness or damage		I	I	I	I	I	I	I	I	I	I	or every 9 months
Power steering fluid		—	—	—	R	—	—	—	R	—	—	or every 36 months
Power steering hoses		—	—	—	—	—	—	—	R	—	—	or every 72 months
Fitting of knuckles and front axle for looseness		I	I	I	I	I	I	I	I	I	I	or every 9 months
Steering mechanism for looseness or damage		—	—	—	I	—	—	—	I	—	—	or every 36 months
Ball joints for damage (Independent suspension model only)		I	I	I	I	I	I	I	I	I	I	or every 9 months
Ball joints for excessive play (Independent suspension model only)		I	I	I	I	I	I	I	I	I	I	or every 9 months
Relay lever shaft for excessive play (Independent suspension model only)		I	I	I	I	I	I	I	I	I	I	or every 9 months
Steering wheel play		I	I	I	I	I	I	I	I	I	I	or every 9 months
Steering function		I	I	I	I	I	I	I	I	I	I	or every 9 months
Wheel alignment		—	—	—	I	—	—	—	I	—	—	or every 36 months
SERVICE BRAKES												
Brake fluid		I	I	I	R	I	I	I	R	I	I	or every 36 months
Brake system for fluid leakage		I	I	I	I	I	I	I	I	I	I	or every 9 months
*Brake linings and drums for wear		I	I	I	I	I	I	I	I	I	I	or every 9 months
*Disc brake pads and discs for wear		I	I	I	I	I	I	I	I	I	I	or every 9 months
Brake pedal travel and free play		I	I	I	I	I	I	I	I	I	I	or every 9 months
Pipes and hoses for loose connections or damage		I	I	I	I	I	I	I	I	I	I	or every 9 months
PARKING BRAKE												
Parking brake cables		I	I	I	I	I	I	I	I	I	I	or every 9 months
Parking brake function		I	I	I	I	I	I	I	I	I	I	or every 9 months
Parking brake lever travel		I	I	I	I	I	I	I	I	I	I	or every 9 months
Linings for wear		—	—	—	I	—	—	—	I	—	—	or every 36 months
Drum for wear or damage		—	—	—	I	—	—	—	I	—	—	or every 36 months
Ratchet for wear or damage		—	—	—	I	—	—	—	I	—	—	or every 36 months
SUSPENSION												
Spring leaves for damage		I	I	I	I	I	I	I	I	I	I	or every 9 months

SERVICE INTERVAL: (Use odometer reading or months Whichever comes first)	× 1,000 km	15	30	45	60	75	90	105	120	135	150	
	× 1,000 mile	9	18	27	36	45	54	63	72	81	90	
Torsion bar spring (Independent suspension model only)		I	I	I	I	I	I	I	I	I	I	or every 9 months
Ball joint boots for damage (Independent suspension model only)		I	I	I	I	I	I	I	I	I	I	or every 9 months
Ball joints for excessive play (Independent suspension model only)		—	—	—	I	—	—	—	I	—	—	or every 36 months
Mounts for looseness or damage		I	I	I	I	I	I	I	I	I	I	or every 9 months
Shock absorbers for oil leakage		I	I	I	I	I	I	I	I	I	I	or every 9 months
Shock absorbers mount for looseness		I	I	I	I	I	I	I	I	I	I	or every 9 months
Upper links (Independent suspension model only)		L	L	L	L	L	L	L	L	L	L	or every 9 months
WHEELS												
Wheel pins and nuts		—	T	—	T	—	T	—	T	—	T	or every 18 months
Wheel discs for damage		—	I	—	I	—	I	—	I	—	I	or every 18 months
Hub bearings grease		—	—	—	R	—	—	—	R	—	—	or every 36 months
Tire pressures and damage		I	I	I	I	I	I	I	I	I	I	or every 9 months
ELECTRICAL EQUIPMENT												
Specific gravity of battery electrolyte		I	I	I	I	I	I	I	I	I	I	or every 9 months
OTHERS												
Lights, horn, windshield, wiper and washers		I	I	I	I	I	I	I	I	I	I	or every 9 months
Bolts and nuts on chassis and body		—	—	—	I	—	—	—	I	—	—	or every 36 months

(I): Inspect and correct or replace as necessary (A): Adjust (R): Replace or change (T): Tighten to specified torque (L): Lubricate

Maintenance schedule: 4HK1-TC engine model

SERVICE INTERVAL: (Use odometer reading or months Which-ever comes first)	km	11250	22500	33750	45000	56250	67500	78750	90000		
	mile	7000	14000	21000	28000	35000	42000	49000	56000		
ENGINE											
*Engine oil	—	R	—	R	—	R	—	R	—	R	or every 14 months
*Engine oil filter	—	R	—	R	—	R	—	R	—	R	or every 14 months
Fuel filter: Main fuel filter	—	R	—	R	—	R	—	R	—	R	or every 14 months
[OPT] Main fuel filter and Sub fuel filter: with Sub fuel filter	—	—	—	R	—	—	—	—	—	R	or every 28 months
*Air cleaner element	I	I	I	R	I	I	I	I	I	R	or every 28 months
Idling speed and acceleration	—	I	—	I	—	I	—	I	—	I	or every 14 months
Valve clearances	—	—	—	A	—	—	—	—	—	A	or every 28 months
Feed pump strainer	—	I	—	I	—	I	—	I	—	I	or every 14 months
Fuel tank cap and fuel pipes for loose connections or damage	—	—	—	I	—	—	—	—	—	I	or every 28 months
Drive belt tension and damage	I	I	I	I	I	I	I	I	I	I	or every 7 months
Radiator coolant	—	—	—	R	—	—	—	—	—	R	or every 28 months
*Exhaust pipes and mountings for looseness or damage	—	I	—	I	—	I	—	I	—	I	or every 14 months
Cooling system for water leakage	—	I	—	I	—	I	—	I	—	I	or every 14 months
Engine operation condition	I	I	I	I	I	I	I	I	I	I	or every 7 months
CLUTCH											
Clutch fluid	I	I	I	R	I	I	I	I	I	R	or every 28 months
Clutch pedal travel and free play	I	I	I	I	I	I	I	I	I	I	or every 7 months
TRANSMISSION											
*Manual transmission oil	I	I	I	R	I	I	I	I	I	R	or every 28 months
[SA] Smoother clutch fluid	I	I	I	R	I	I	I	I	I	R	or every 24 months
Gear control mechanism for looseness	—	—	—	I	—	—	—	—	—	I	or every 21 months
Gear control cables	—	A	—	A	—	A	—	A	—	A	or every 14 months
PROPELLER SHAFT											
*Universal joints and sliding sleeve grease	—	L	—	L	—	L	—	L	—	L	or every 14 months
Loose connections	I	I	I	I	I	I	I	I	I	I	or every 7 months
Splines for excessive wear	—	—	—	I	—	—	—	—	—	I	or every 28 months
Bearings and related parts for looseness	—	—	—	I	—	—	—	—	—	I	or every 28 months
Center bearing	—	L	—	L	—	L	—	L	—	L	or every 14 months

SERVICE INTERVAL: (Use odometer reading or months Which-ever comes first)	km	11250	22500	33750	45000	56250	67500	78750	90000	
	mile	7000	14000	21000	28000	35000	42000	49000	56000	
REAR AXLE										
*Differential gear oil		I	I	I	R	I	I	I	R	or every 28 months
FRONT AXLE										
*Kingpins		L	L	L	L	L	L	L	L	or every 7 months
STEERING										
Power steering system oil leakage		I	I	I	I	I	I	I	I	or every 7 months
Power steering system for looseness or damage		I	I	I	I	I	I	I	I	or every 7 months
Power steering fluid		—	—	—	R	—	—	—	R	or every 28 months
Power steering hoses		—	—	—	—	—	—	—	R	or every 56 months
Fitting of knuckles and front axle for looseness		I	I	I	I	I	I	I	I	or every 7 months
Steering mechanism for looseness or damage		—	—	—	I	—	—	—	I	or every 28 months
Steering wheel play		I	I	I	I	I	I	I	I	or every 7 months
Steering function		I	I	I	I	I	I	I	I	or every 7 months
Wheel alignment		—	—	—	I	—	—	—	I	or every 28 months
SERVICE BRAKES										
Brake fluid		I	I	I	R	I	I	I	R	or every 28 months
[V] Hydro booster fluid (ATF)		I	I	I	R	I	I	I	R	or every 28 months
Brake system for fluid leakage		I	I	I	I	I	I	I	I	or every 7 months
*Brake linings and drums for wear		I	I	I	I	I	I	I	I	or every 7 months
*Disc brake pads and discs for wear		I	I	I	I	I	I	I	I	or every 7 months
Brake pedal travel and free play		I	I	I	I	I	I	I	I	or every 7 months
Pipes and hoses for loose connections or damage		I	I	I	I	I	I	I	I	or every 7 months
PARKING BRAKE										
Parking brake cables		I	I	I	I	I	I	I	I	or every 7 months
Parking brake function		I	I	I	I	I	I	I	I	or every 7 months
Parking brake lever travel		I	I	I	I	I	I	I	I	or every 7 months
Linings for wear		—	—	—	I	—	—	—	I	or every 28 months
Drum for wear or damage		—	—	—	I	—	—	—	I	or every 28 months
Ratchet for wear or damage		—	—	—	I	—	—	—	I	or every 28 months
SUSPENSION										
Spring leaves for damage		I	I	I	I	I	I	I	I	or every 7 months
Mounts for looseness or damage		I	I	I	I	I	I	I	I	or every 7 months

SERVICE INTERVAL: (Use odometer reading or months Which-ever comes first)	km	11250	22500	33750	45000	56250	67500	78750	90000	
	mile	7000	14000	21000	28000	35000	42000	49000	56000	
Shock absorbers for oil leakage	|	|	|	|	|	|	|	|	|	or every 7 months
Shock absorbers mount for looseness	|	|	|	|	|	|	|	|	|	or every 7 months
WHEELS										
Wheel pins and nuts	T	T	T	T	T	T	T	T	T	or every 7 months
Wheel discs for damage	|	|	|	|	|	|	|	|	|	or every 7 months
Hub bearings grease	—	—	—	R	—	—	—	—	R	or every 28 months
Tire pressures and damage	|	|	|	|	|	|	|	|	|	or every 7 months
ELECTRICAL EQUIPMENT										
Specific gravity of battery electrolyte	|	|	|	|	|	|	|	|	|	or every 7 months
OTHERS										
Lights, horn, windshield, wiper and washers	|	|	|	|	|	|	|	|	|	or every 7 months
Bolts and nuts on chassis and body	—	—	—	|	—	—	—	—	|	or every 28 months

(I): Inspect and correct or replace as necessary (A): Adjust (R): Replace or change (T): Tighten to specified torque (L): Lubricate

Maintenance Schedule under Severe Driving Conditions

Severe driving conditions

A : Repeated short trips

B : Driving on rough roads

C : Driving on dusty roads

D : Driving in extremely cold weather and/or on salted roads

Item	Interval	Condition				
		A	B	C	D	A+D
Engine oil	Change every 5,000 km (3,000 miles)			○		○
Engine oil filter	Replace every 5,000 km (3,000 miles)			○		○
Air cleaner element	Replace every 20,000 km (12,000 miles)			○		
Exhaust pipes and mountings for looseness or damage	Inspect every 10,000 km (6,000 miles)	○	○		○	
Manual transmission oil and differential gear oil	Change every 20,000 km (12,000 miles)		○			
[SA] Smoother clutch fluid	Change every 20,000 km (12,000 miles)		○			
Universal joints and sliding sleeve grease	Lubricate every 10,000 km (6,000 miles)		○			
Kingpins	Lubricate every 5,000 km (3,000 miles)			○	○	
Steering system for looseness or damage	Inspect every 5,000 km (3,000 miles)		○			
Brake linings and drums for wear	Inspect every 5,000 km (3,000 miles)	○	○	○		
Disc brake pads and discs for wear	Inspect every 5,000 km (3,000 miles)	○	○	○		

RECOMMENDED FLUIDS, LUBRICANTS AND DIESEL FUELS

Recommended Fluids, Lubricants and Diesel Fuels

In order to obtain maximum performance and longest service life from ISUZU vehicles, it is very important to select and use correctly best lubricants and diesel fuels.

When lubricating, be sure to use ISUZU genuine lubricants or recommended lubricants listed below, according to the maintenance schedule for each vehicle model.

The lubrication intervals in the maintenance schedule and the coverage and period of new vehicle warranty are based on the use of ISUZU genuine lubricants or recommended lubricants as given in the chart which will serve as a guide for selecting lubricants of proper brand name.

LUBRICATION	MAKER	BRAND/TYPE	GRADE		
			API	ACEA	JASO
Diesel engine crankcase	ISUZU GENUINE	BESCO MULTI-Z TYPE CF-4 (10W-30)	CF-4		
	ISUZU GENUINE	BESCO S-3 (10W, 20W, 30, 40)	CD		
	Caltex/Chevron	Delo CXJ (15W-40/20W-50/40)	CF		DH-1
		Delo 400 Multigrade (15W-40)	CE/CF/CI-4	E3/E5	DH-1
	Shell	Rimula X (15W-40)	CH-4	E3	DH-1
		Rimula D (15W-40/30/40)	CF		
	Elf	Perfo 3F (15W-40)	CF-4/CE	B2/E2	
	Total	Rubia XT (15W-40)	CF-4	E2	
	Castrol	RX Super Plus (15W-40)	CH-4	E3	
		Tecton J Plus (15W-40)	CH-4	E3/B3	DH-1
	BP	BP Vanellus C6 (15W-40)	CH-4	E3	
ExxonMobil	Essolube XTJ (15W-40)	CF-4		DH-1	
	Exxon/Essolube XD-3 (15W-40)	CI-4			
Differential	ISUZU GENUINE	BESCO GEAR OIL SH (80W-90, 90, 140)	GL-5		
	Caltex	Thuban GL-5 EP (80W-90/85W-140)	GL-5		
	Shell	Spirax A (140)	GL-5		
	Elf	Tranself Type B (80W-90/85W-140)	GL-5		
	Total	Transmission TM (80W-90/85W-140)	GL-5		
	Castrol	EPX 90 (90)	GL-5		
		Dynadrive (80W-90)	GL-5		
	BP	Energear Hypo (90)	GL-5		
		Energear EP (80W-90)	GL-5		
	ExxonMobil	Mobilube HD (80W-90)	GL-5		
		Esso Gear Oil GX (80W-90)	GL-5		

LUBRICATION	MAKER	BRAND/TYPE	GRADE		
			API	ACEA	JASO
Differential (Limited slip differential)	ISUZU GENUINE	BESCO GEAR OIL LSD (140)	*GL-5		
	Caltex	Gear Oil LSD (90)	GL-5		
	Shell	Spirax A LS 90 (90)	GL-5		
	Elf	Tranself Type BLS (90)	GL-5		
	Total	Transmission DA (85W-90)	GL-5		
	Castrol	Hypoy LSX (90)	GL-5		
	BP	Energear LS-M (90)	GL-5		
	ExxonMobil	Mobilube LS (85W-90) Esso Gear Oil LSA (85W-90)	GL-5 GL-5		
Manual transmission Transfer case	ISUZU GENUINE	BESCO GEAR OIL TRANSAXLE (5W-30)	SG		
	Caltex/Chevron	Delo 400 Multigrade (15W-40)	CD/CE/CF/CI4	E3/E5	DH-1
	Shell	Helix Plus (15W-50)	SJ/CF	A3/B3	
	Elf	Super Sporti (15W-40)	SG/CD		
	Total	Quartz 5000 (15W-40/20W-50)	SJ/CF	A2/B2	
	Castrol	RX Super Plus (15W-40)	CD/CE/CF		
	BP	BP Vanellus C6 (15W-40)	CD/CE/CF		
Power steering Hydro brake booster	ISUZU GENUINE	BESCO ATF II, ATF III			
	Caltex/Texaco	Texamatic 1888 (Dexron III)			
	Shell	Donax TG (Dexron III)			
	Elf	ELFMATIC G3 (Dexron III)			
	Total	Total Fluid AT 42 (Dexron III)			
	Castrol	TQ Dexron III (Dexron III)			
Clutch (Smoother)	ISUZU GENUINE	BESCO ATF III or equivalent to BESCO ATF III			
	ISUZU GENUINE	BESCO L-2 GREASE (No.2), L-3 GREASE (No.3)			
	Caltex/Texaco	Starplex-2 (No.2)			
	Shell	Retinax LX2 (No.2)			
	Total	Multis EP2/EP3 (No.2/No.3)			
	Castrol	LM Grease (No.2/No.3)			
Center bearing King pin Upper links (Multi purpose grease)	BP	Energrease LS (No.2/No.3)			
	ISUZU GENUINE	ONE LUBER MO GREASE			
	Caltex	Molytex Grease EP2 (No.2)			
	Shell	Retinax HDX2 (No.2)			
Propeller shaft sliding yoke Universal joint (Multi purpose grease containing molybdenum disulfide)	Total	Total Multis MS2 (No.2/No.3)			

LUBRICATION	MAKER	BRAND/TYPE	GRADE		
			API	ACEA	JASO
Engine cooling system	ISUZU GENUINE Caltex/Texaco/ Chevron	BESCO LLC SUPER TYPE E Extended Life Coolant Havoline XLC Delo XLC			

* If GL-5 Limited Slip Differential Lubricant is not available, use GL-5 Lubricant together with Limited Slip Differential Lubricant additive (Parts No. 8-01052-358-0) or equivalent.

FLUID	TYPE
Clutch and brake fluid reservoir	Besco brake fluid SUPER Hydraulic brake fluid SAE J1703 FMVSS 116 DOT.3 grade

DIESEL FUEL/APPLICABLE STANDARD	
JIS (JAPANESE INDUSTRIAL STANDARD)	Based on K2204 GAS OIL
DIN (DEUTSCHE INDUSTRIE NORMEN)	Based on EN590: 1997
SAE (SOCIETY OF AUTOMOTIVE ENGINEERS)	Based on SAE J-313C
BS (BRITISH STANDARD)	Based on BS EN590-1997

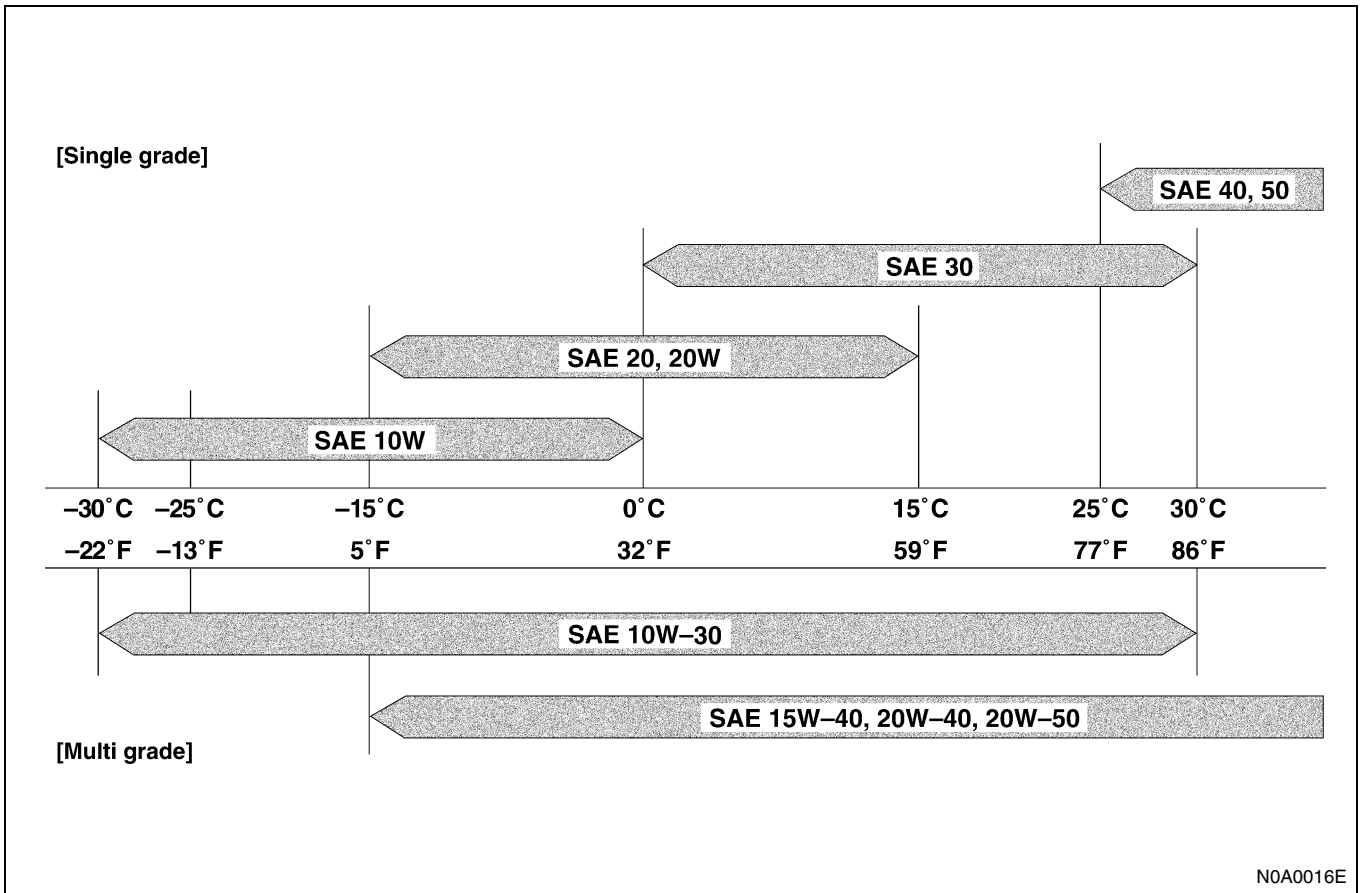
Notice:

When the recommended lubricants are specified in this manual, follow them.

OIL VISCOSITY CHART

Engine Oil

Engine Oil Viscosity Grade - Ambient Temperature

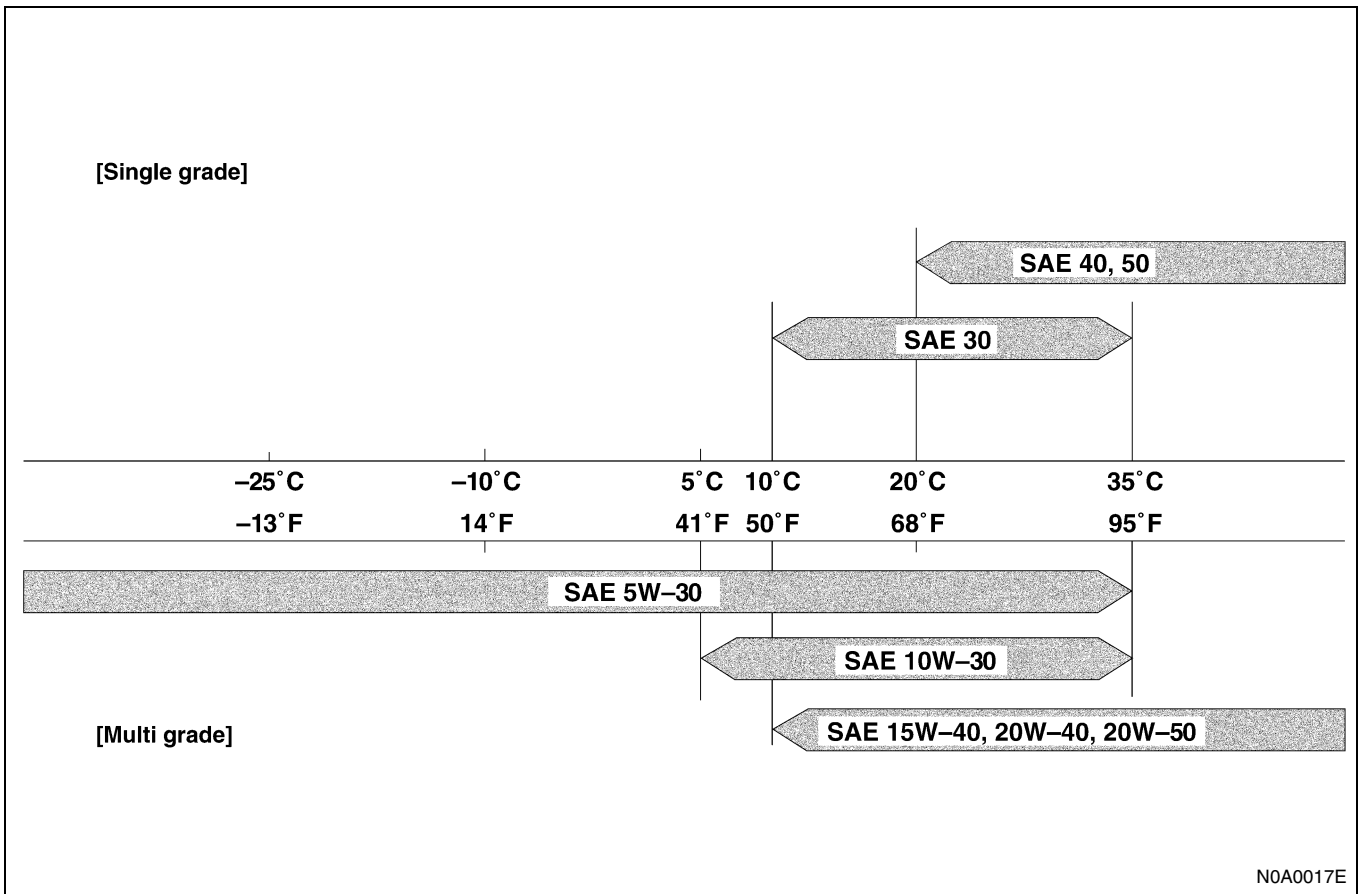


DO NOT USE SYNTHETIC OILS.

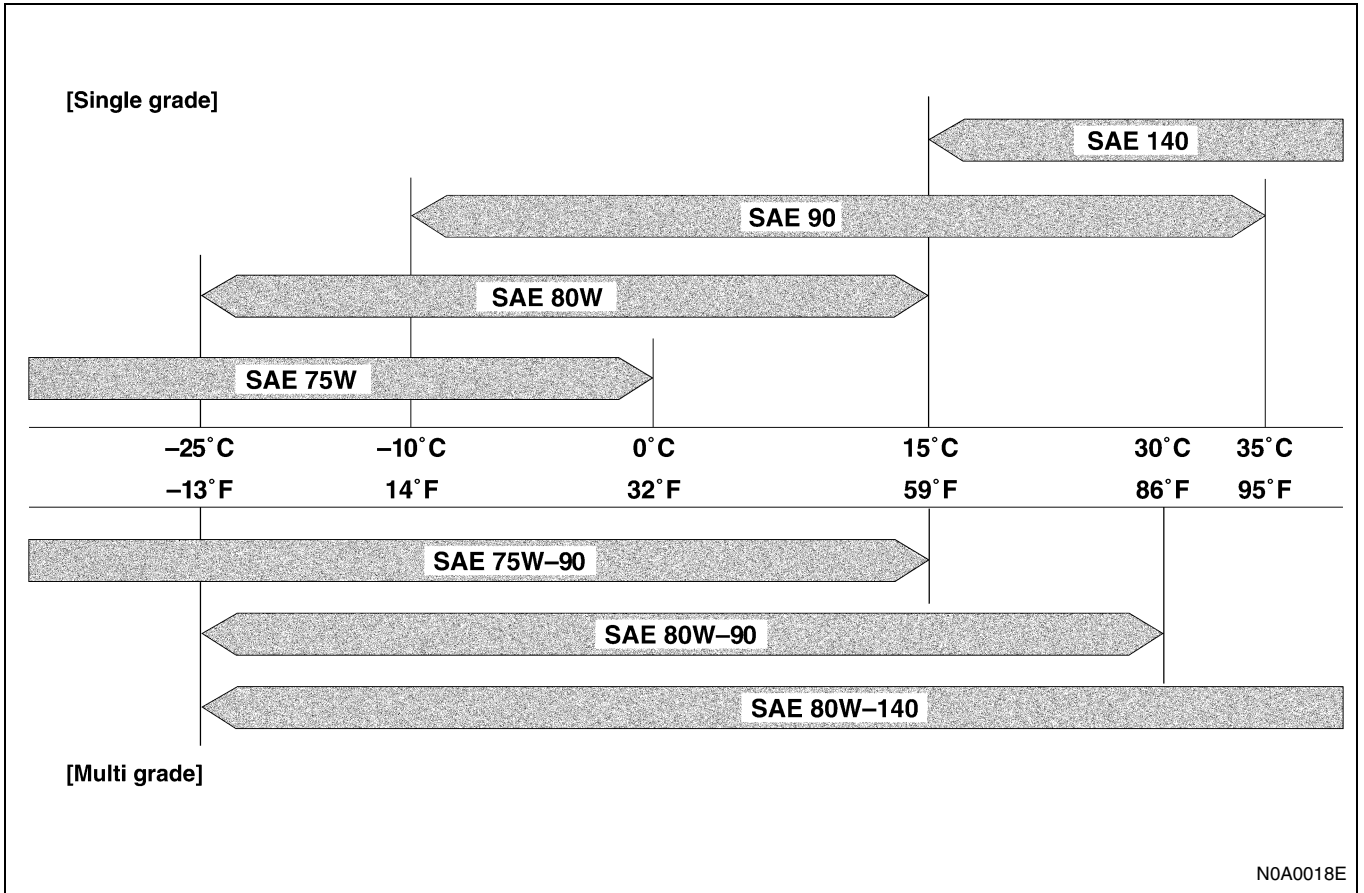
* At ambient temperatures below -25°C (-13°F), starting aids (oil pan heater, block heater, etc.) are recommended to prevent hard starting and other engine problems.

Manual Transmission and Transfer Case Oil (Engine Oil)

Viscosity Grade - Ambient Temperature

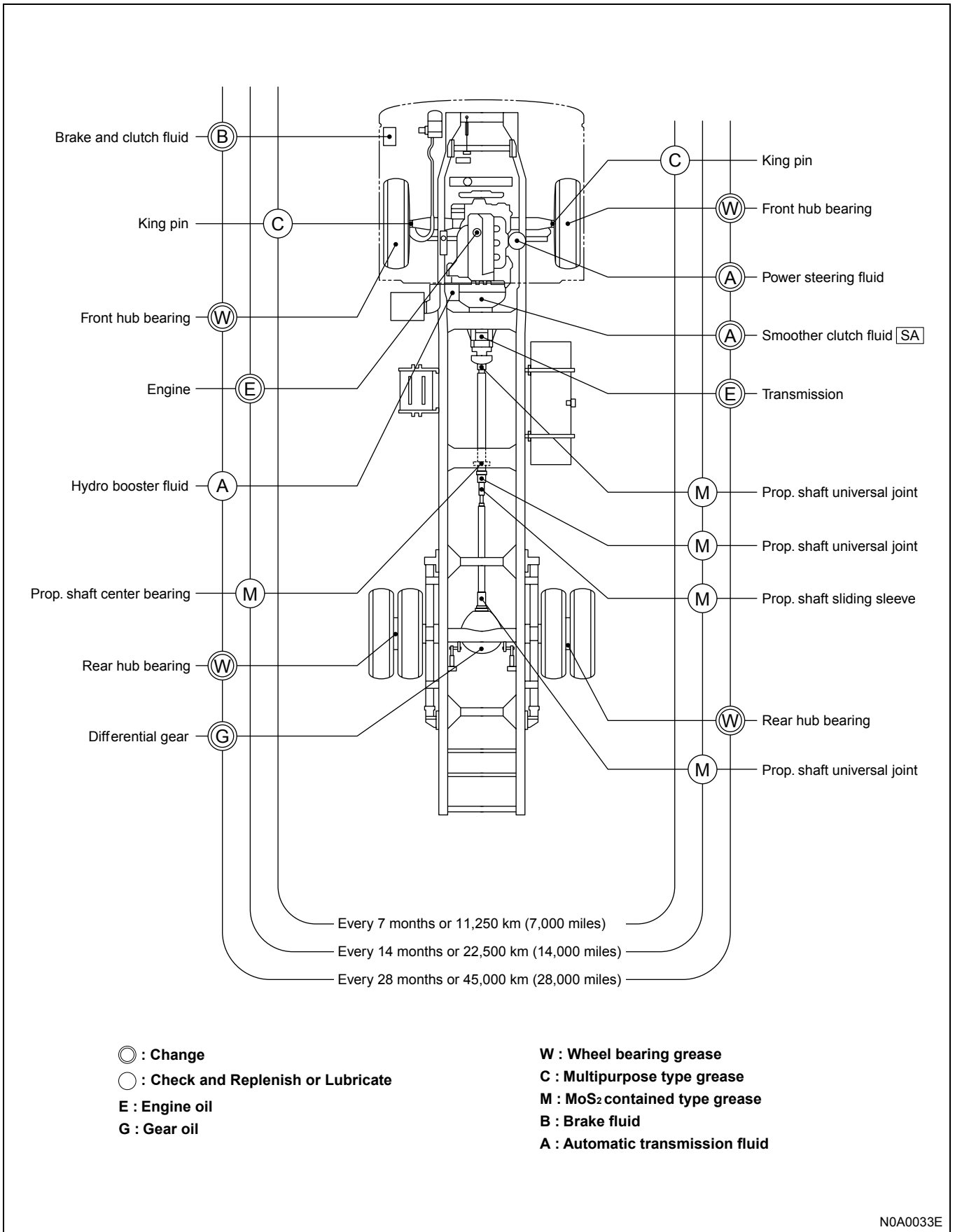


**Front Axle and Rear Axle Oil
Gear Oil Viscosity Grade - Ambient Temperature**



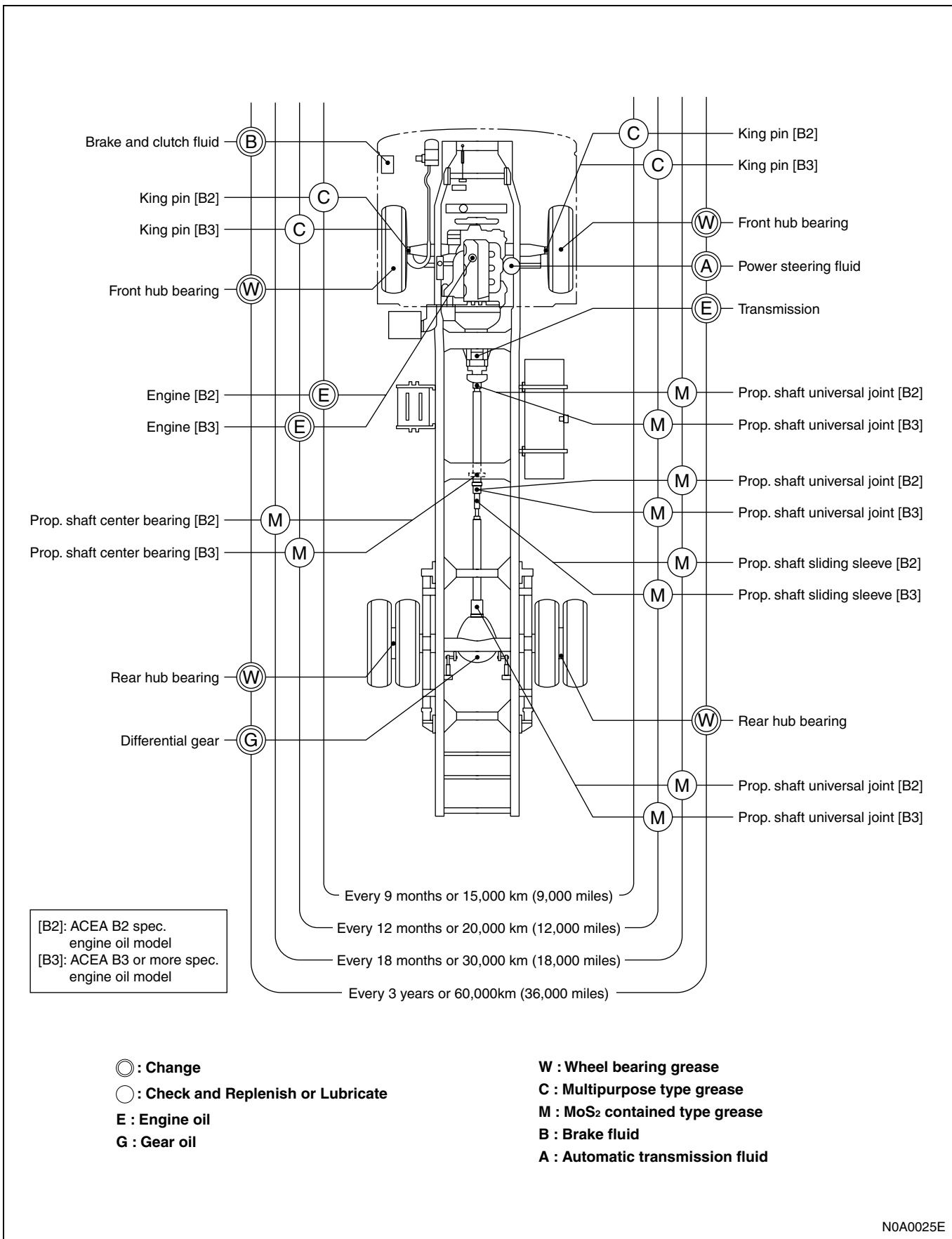
LUBRICATION CHART

NPR75 and NQR75 Models



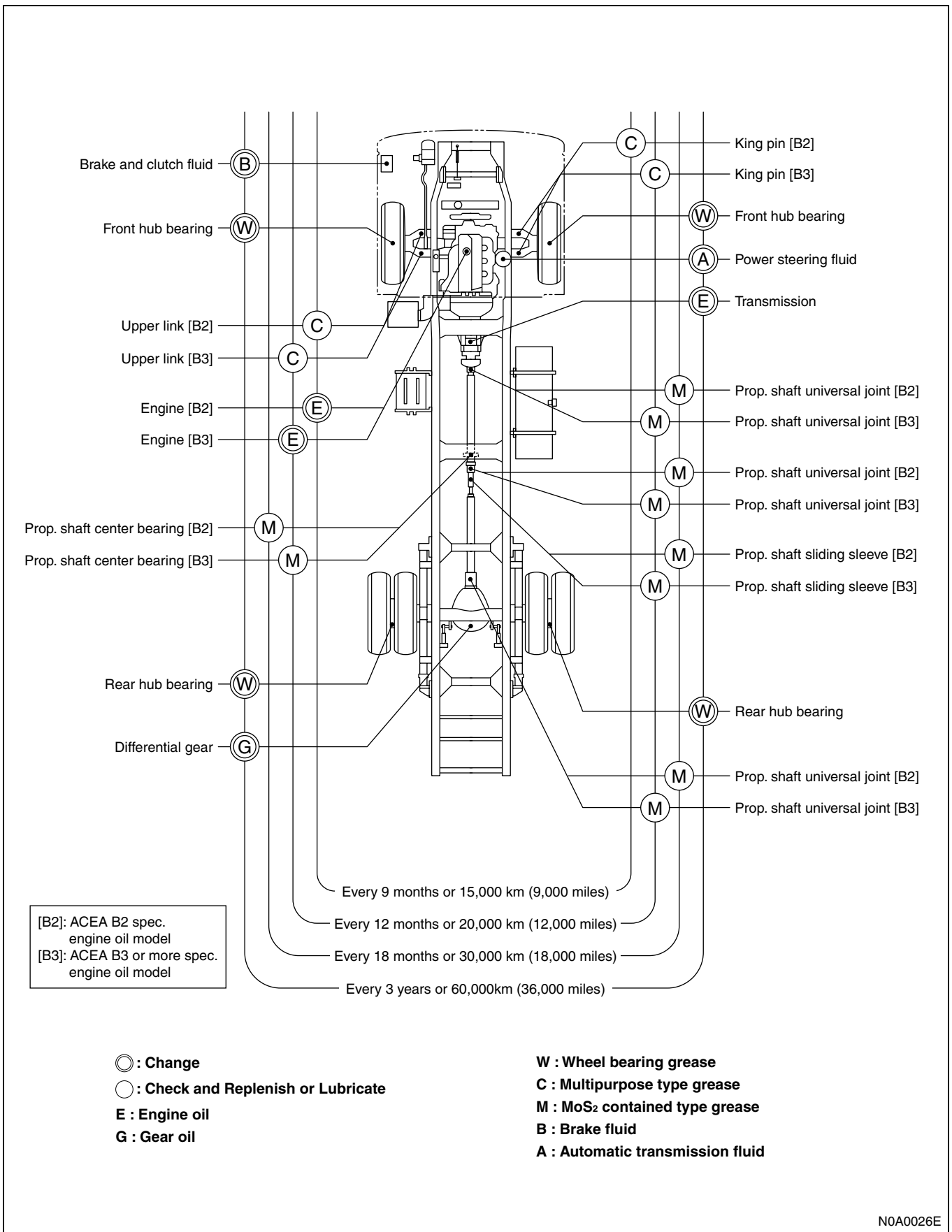
N0A0033E

NKR77 and NPR77 (Front Rigid Suspension) Models



N0A0025E

NKR77 (Front Independent Suspension) Model



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BRAKES

SERVICE INFORMATION

TROUBLESHOOTING

Brake System

PROBLEM	POSSIBLE CAUSE	CORRECTION
No Brakes	<ol style="list-style-type: none"> 1. Restricted tubing or hose. 2. Brakes out of adjustment. 3. No fluid. 	<ol style="list-style-type: none"> 1. Replace defective parts. 2. Adjust. 3. Fill the reservoir with brake fluid.
Insufficient Brakes	<ol style="list-style-type: none"> 1. Pedal improperly adjusted. 2. Worn linings/pads or drum/discs. 3. Plugged, crimped, restricted lines or hoses. 	<ol style="list-style-type: none"> 1. Adjust. 2. Replace as necessary. 3. Repair or replace.
Slow Brake Application	<ol style="list-style-type: none"> 1. Pedal binding. 2. Wheel cylinder piston sticking. 3. Restriction in the lines. 4. Worn linings/pads or drums/discs. 	<ol style="list-style-type: none"> 1. Lubricate pivot pin, clean-check for foreign objects. 2. Repair the wheel cylinder. 3. Remove the restriction or replace the line. 4. Replace as necessary.
Uneven Braking (Front or Rear Brakes not Working)	<ol style="list-style-type: none"> 1. Damaged hydraulic lines. 2. No brake fluid at the master cylinder. 3. Safety valve not opened. 	<ol style="list-style-type: none"> 1. Repair or replace. 2. Check for plugged, kinked or damaged hose to the reservoir. 3. Correct.
Wet Weather: Brakes Grab or won't Hold	<ol style="list-style-type: none"> 1. Linings too sensitive to water. 2. Dirty brakes. 3. Bent mounting plate - opening. 4. Scored drums/discs. 	<ol style="list-style-type: none"> 1. Replace in axle sets. 2. Clean out. 3. Replace. 4. Machine in pairs. Replace if necessary.
Brakes Squeak	<ol style="list-style-type: none"> 1. Mounting plate bent or shoes twisted. 2. Metallic particles or dust imbedded in the lining. 3. Lining rivets loose or lining not held tightly against the shoe at the ends. 4. Drums distorted tampered, or not Square. 5. Incorrect lining/pad. 6. Mixed size linings. 7. Weak or broken return spring. 8. Loose wheel bearings. 9. Loose mounting plate, drum, wheel cylinder. 10. Linings/pads located wrong on the shoes. 11. Linings/pads worn out. 12. Lining glazed. 13. Cracked or threaded drums/discs. 	<ol style="list-style-type: none"> 1. Replace damaged parts. 2. Replace the linings/pads in axle sets. 3. Replace the rivets and/or tighten the lining by riveting. 4. Machine or replace drums/discs. 5. Replace the linings/pads in axle sets. 6. Use all standard or oversize linings in a brake. 7. Replace the return spring. 8. Tighten to the proper setting. 9. Tighten. 10. Install the linings correctly. 11. Reline the brakes. 12. Replace. 13. Replace in axle pairs.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Brakes Chatter	<ol style="list-style-type: none"> 1. Incorrect lining/pad to drum/disc clearance. 2. Loose mounting plate. 3. Grease, fluid, road dust on the lining pad. 4. Weak or broken return spring. 5. Loose wheel bearings. 6. Drums out-of-round. 7. Discs warped. 8. Cocked or distorted shoes. 9. Distorted, tapered, or barrel-shaped drums. 10. Incorrect lining/pad material. 11. Linings/pads worn out. 12. Lining loose on the shoes. 13. Foreign material imbedded in the linings/pads. 14. Cracked or threaded drums/discs. 	<ol style="list-style-type: none"> 1. Adjust to specification. 2. Tighten securely. 3. Clean or reline. 4. Replace the return spring. 5. Readjust. 6. Machine the drums in axle sets. 7. Machine the discs in axle sets. 8. Straighten or replace. 9. Machine drums in pairs. Replace if necessary. 10. Reline with correct linings/pads. 11. Reline the brake. 12. Rivet the linings to the shoes. Replace if necessary. Check for damaged or distorted shoes. 13. Replace the linings/pads in axle sets. 14. Replace in axle pairs.
Shoe Click	<ol style="list-style-type: none"> 1. Return spring weak. 2. Shoe bent. 	<ol style="list-style-type: none"> 1. Replace the spring. 2. Straighten or replace.
Noise and Chatter Squealing, clicking, or scraping sound upon brake application	<ol style="list-style-type: none"> 1. Bent, damaged or incorrect shoes. 2. Worn out lining/pad. 3. Foreign material embedded in the lining/pad. 4. Broken shoe return spring. 5. Cracked or threaded drums/discs (lathe marks). 	<ol style="list-style-type: none"> 1. Replace with the correct shoes and lining. Always replace in axle sets. 2. Replace the shoes and lining/pad in axle sets. 3. Replace the shoes and lining/pad in axle sets. 4. Replace the return spring. 5. Replace the drums/discs in axle sets.
Pulls to One Side	<ol style="list-style-type: none"> 1. Grease or fluid soaked lining/pad. 2. Loose wheel bearings, loose (or distorted) mounting plate on the rear or front axle or loose spring bolts. 3. Linings/pads not of the recommended kind. 4. Tires not properly or evenly inflated or unequal wear of tread. Different tread non-skid design. 5. Water, mud, etc., in the brakes. 	<ol style="list-style-type: none"> 1. Replace in axle sets. 2. Adjust the wheel bearing, tighten (or replace) the mounting plate to the axle and tighten the spring bolts. 3. Install recommended linings/pads. Install the shoes correctly. 4. Inflate the tires to recommended pressures. Rearrange the tires so that a pair of non-skid tread surfaces of similar design and equal wear will be installed on the front wheels, and an other pair with like tread will be installed on the rear wheels. 5. Remove any foreign material from all of the brake parts and inside of the drums.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Pulls to One Side (Cont.)	<ul style="list-style-type: none"> 6. Wheel cylinder sticking. 7. Weak or broken shoe return spring. 8. Out-of-round drums or different sized drums on the same axle. 9. Brake dragging. 10. Weak chassis springs, loose U-bolts, loose steering gear, etc. 11. Loose steering. 12. Unequal camber. 13. Restricted brake line or hose. 14. Wheel cylinder size different on opposite sides. 15. Loose kingpin. 16. Distorted, damaged, or scored drum/disc. 17. Front end alignment. 18. Excessively worn lining/pad. 19. Uneven adjustment of brake lining clearance. 20. Water/wet linings. 	<ul style="list-style-type: none"> 6. Repair or replace the wheel cylinder. 7. Check the spring—replace distorted, open coiled, or cracked spring. 8. Refinish or replace the drums in axle pairs. 9. Check for loose lining. Adjust. (Refer to “Dragging Brakes”.) 10. Replace the spring, tighten the U-bolts, adjust the steering gear, etc. 11. Repair and adjust. 12. Adjust to specifications. 13. Check for soft hose or damaged lines. Replace as necessary. 14. Replace with correct cylinders. 15. Replace the kingpins or bushing. 16. Refinish the drums/discs in axle pairs. Replace if necessary. 17. Align the front end. 18. Replace in axle sets. 19. Adjust the brake lining clearance in all wheels. 20. Apply the brakes a few times while moving at a slow speed to dry the linings.
One Wheel Locks	<ul style="list-style-type: none"> 1. Gummy lining/pad. 2. Tire tread slick. 3. Brake adjustment not correct. 4. Restricted brake line or hoses. 5. Incorrect linings/pads. 6. Grease or fluid soaked lining/pads. 7. Foreign material in the brakes. 	<ul style="list-style-type: none"> 1. Replace in axle sets. 2. Match up tire treads from side to side. 3. Adjust the brakes. 4. Check for soft hoses or damaged lines. Replace as necessary. 5. Replace. Linings/pads must be the same on the axle. 6. Replace in axle sets. 7. Remove the material.
Light Pedal Pressure Brakes too Severe (Grabby Brakes)	<ul style="list-style-type: none"> 1. Brake adjustment not correct. 2. Loose mounting plate on the front axle. 3. A small amount of grease or fluid on the lining/pad. 4. Incorrect lining/pad. 5. Wheel bearings loose. 6. Lining loose on the shoe. 7. Excessive dust and dirt in the drum. 8. Out-of-round drum. 	<ul style="list-style-type: none"> 1. Adjust the brakes. 2. Tighten the plates. 3. Replace the linings/pads. 4. Install factory specified linings/pads. 5. Adjust the wheel bearings. 6. Replace the lining or the shoe and lining. 7. Clean and sand the drums and linings. 8. Turn the drums in pairs or replace.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Low Pedal or Pedal Goes to Floor	<ol style="list-style-type: none"> 1. Excessive clearance between the linings and drum. 2. Pedal stop not adjusted, or missing. 3. Weak brake hose. 4. Leaking wheel cylinder. 5. Air in the hydraulic system. 6. Improper brake fluid (low boiling point). 7. Low fluid level. 8. Bent or distorted brake shoes. 9. Leaks at hydraulic line connections. 	<ol style="list-style-type: none"> 1. Adjust the brakes. 2. Adjust or install the pedal stop. 3. Replace with new hose. 4. Clean and rebuild. 5. Bleed the hydraulic system. 6. Flush the system and refill with recommended brake fluid. 7. Fill the reservoir with brake fluid; check for leaks and bleed system. 8. Replace in axle sets. 9. Check for hydraulic leaks and repair.
Slow Brake Release	<ol style="list-style-type: none"> 1. Foot pedal binding. 2. Restriction in the line. 3. Weak shoe return spring. 	<ol style="list-style-type: none"> 1. Lubricate the pivot pin; clean-check for foreign objects. 2. Remove the restriction or replace line. 3. Replace the spring.
Poor Assist or Loss of Assist	<ol style="list-style-type: none"> 1. Low brake fluid level. 2. Air in the hydraulic system. 3. Weak brake hose. 4. Loss of vacuum. 5. No brake fluid at the master cylinder. 	<ol style="list-style-type: none"> 1. Fill the reservoir to the proper level. Bleed the system. 2. Locate the source of the air leak and repair. Bleed the system. 3. Replace. 4. Inspect for vacuum leaks or malfunctioning pump. Repair or replace as necessary. 5. Check for plugged, kinked, or damaged hose to the reservoir.
Brake Fade	<ol style="list-style-type: none"> 1. Incorrect lining/pad. 2. Poor lining/pad contact. 3. Thin drum. 4. Dragging brakes. 5. All conditions listed under "Pulls to One Side". 	<ol style="list-style-type: none"> 1. Replace with recommended lining/pad. 2. Grind the lining/pad to the proper radius; adjust. 3. Replace the drum. 4. Adjust. 5. All corrections listed under "Pulls to One Side".
All Brakes Drag when Adjustment is Known to be Correct	<ol style="list-style-type: none"> 1. Pedal does not return to stop. 2. Improper fluid. 3. Use of incorrect rubber parts. 	<ol style="list-style-type: none"> 1. Lubricate the pedal linkage; adjust the pedal. 2. Replace rubber parts and fill with the recommended brake fluid. 3. Install the proper parts.

PROBLEM	POSSIBLE CAUSE	CORRECTION
One Wheel Drags	<ol style="list-style-type: none"> 1. Weak or broken shoe return spring. 2. Brake shoe to drum clearance too small. 3. Loose wheel bearings. 4. Wheel cylinder piston cups swollen and distorted or piston stuck. 5. Pistons sticking in the wheel cylinder. 6. Drum out-of-round. 7. Disc warped. 8. Restricted brake line or hose. 9. Distorted shoe. 10. Defective lining/pad. 11. Loose or bent mounting plate. 12. Loose calipers. 	<ol style="list-style-type: none"> 1. Replace the return spring. 2. Adjust to specification. 3. Adjust or replace the wheel bearings. 4. Rebuild the cylinders. Flush the hydraulic system and fill with recommended fluid. 5. Clean or replace the pistons; clean the cylinder bore. 6. Machine the drum. 7. Machine the disc. 8. Check for soft hoses or damaged lines. Replace as necessary. 9. Replace. 10. Replace with the recommended lining/pad. 11. Tighten the fasteners; replace the plate. 12. Tighten the fasteners.
Dragging Brakes	<ol style="list-style-type: none"> 1. Improper fluid. 2. Brake pedal adjustment incorrect. 3. Incorrect shoe return spring. 4. Brake pedal linkage interference or binding. 5. Incorrect lining/pad. 6. All conditions listed under "One Wheel Drags". 	<ol style="list-style-type: none"> 1. Flush the hydraulic system and fill with recommended brake fluid, and replace rubber components. 2. Adjust the pedal. 3. Replace the shoe return spring. 4. Free the linkage and lubricate. 5. Replace the linings/pads. 6. All corrections under "One Wheel Drags".

Hydraulic Booster

PROBLEM	POSSIBLE CAUSE	CORRECTION
Large force pressing on the brake pedal (boosting insufficient)	1. Booster operation insufficient <ul style="list-style-type: none"> • Large internal leakage • Sticking of the spool valve • Insufficient sliding around the input and output rods 	<ul style="list-style-type: none"> • With the engine on, press the brake pedal repeatedly, and confirm the presence of manual operation. With regard to manual operation, turn the engine off, and judge whether the pedal is as stiff and its play is as small as when the pedal is pressed repeatedly ten times or more. • When there is manual operation, the hydro boost assembly is replaced.
Brake dragging	1. Bad dimensions of the booster <ul style="list-style-type: none"> • The amount of protrusion of the output rod is large 	<ul style="list-style-type: none"> • Confirm whether the amount of protrusion of the output rod (the distance from surface of the master cylinder attachment flange to the end of the rod) is no greater than 18.2 mm (0.717 in). • If the above dimension is outside the range, replace the hydro boost assembly.
	2. Bad pedal circumference attachment dimensions <ul style="list-style-type: none"> • Clevis position dimension is large 	<ul style="list-style-type: none"> • Confirm whether the clevis position dimension (the distance from surface of the vehicle attachment flange to the center of the clevis center) is in the range 109 ± 1 mm (4.29 ± 0.04 in). • If the above dimension is outside the range, loosen the lock nut and adjust the clevis position dimension to be inside the above range. After making this adjustment, be sure to securely tighten the lock nut and to do a stop light switch reconfirmation.
	3. Booster return is bad <ul style="list-style-type: none"> • Input-output rod circumference sticks • Bad spool valve operation 	<ul style="list-style-type: none"> • With the engine on, repeatedly press the brake pedal and confirm the pedal return state. • If the pedal does not return, replace the hydro boost assembly as necessary.
Oil leakage	1. Hydro boost assembly external leakage <ul style="list-style-type: none"> • Leakage from the seal material 	<ul style="list-style-type: none"> • If the oil leakage is caused by looseness in the piping connections, retighten the connections. • If there is oil leakage from the connections of the accumulator, replace the affected seals of the connections with new seals. • If there is any oil leakage from parts other than the above that are included in the hydro boost assembly, replace the hydro boost assembly or the repair setting parts (accumulator).

PROBLEM	POSSIBLE CAUSE	CORRECTION
Bad brake operation (lack of smoothness in operation)	1. Poor operation of the booster <ul style="list-style-type: none"> • Input-output rod circumference sticks • Bad spool valve operation 	<ul style="list-style-type: none"> • With the engine on, repeatedly press the brake pedal and confirm the pedal operation state. • If there is sticking or some other abnormality in the pedal operation, replace the hydro boost assembly as necessary.
Abnormal brake noise (when pressing the pedal)	1. Air in the hydraulic booster lines	<ul style="list-style-type: none"> • With the engine running, check the amount of hydraulic fluid remaining in the reserve tank for the hydraulic booster. • If low, add fluid (Besco ATF III) and bleed to remove air as necessary before starting the engine. Operate the pump and repeatedly step on the pedal to confirm the gear noise (caused by cavitation).
	2. Water in the hydraulic fluid	<ul style="list-style-type: none"> • Check the color of the hydraulic fluid in the reserve tank for the hydraulic booster (normal: purple, abnormal: milky white). • If the hydraulic fluid is milky white, change the fluid (Besco ATF III) and bleed to remove air as necessary before starting the engine. Operate the pump and strongly press the pedal until reaching full boost range to confirm the gear noise (caused by cavitation). The length of time to keep the pedal pressed all the way down is no more than five seconds.
No pedal boosting effect immediately after turning the engine off	1. Faulty charge valve <ul style="list-style-type: none"> • Gas leaking from the accumulator • Leakage inside the charge valve 	<ul style="list-style-type: none"> • Keep the engine running for more than 10 seconds. Turn off the engine, and within 60 seconds, step on the pedal once to confirm boosting effect. Boosting effect means the same pedal effort if the engine was running. • If boosting effect does not exist, either the hydraulic booster assembly or the accumulator may need to be replaced.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Warning buzzer continuously sounds	1. Faulty hydraulic booster assembly <ul style="list-style-type: none"> Faulty pressure switch Leakage inside the charge valve 	<ul style="list-style-type: none"> Confirm that the electric devices (pressure switch, relay, buzzer, etc.) are working correctly. If all are working correctly, pump the brake pedal at least 10 times after turning the engine off to reduce pressure in the hydraulic booster. Start the engine, and release the parking brake. Check to see if the alarm stops within ten seconds (if it does, the electrical devices are working properly). When testing the electrical devices, always keep your foot on the brake pedal with just enough pressure to prevent the vehicle from moving. If the alarm does not stop, the hydraulic booster assembly may have to be replaced.
Charge operation remains in effect	1. Bad charge valve operation <ul style="list-style-type: none"> Bad valve switching operation 	<ul style="list-style-type: none"> Turn the engine on, and without pressing the brake pedal, check whether any charging sound continues, such as the sound of the fluid. If it continues and will not stop, replace the hydro boost assembly as necessary.

Notice:

- When the brake pedal is operated after the engine is turned off and the oil pump stops, during a few operations a fluid sound due to the flow of high-pressure oil or a sound of movement by the charge spool may be produced, but this sound is not abnormal; it merely indicates that boosting by the accumulator (accumulator operation) is proceeding normally.

Also, a similar fluid sound is produced during quick operation of the brake pedal even if the engine is on, but this too is normal.

- If the pressure of the oil in the accumulator drops with operation of the brake pedal after the engine is turned off or when the engine has been off for a long time, then immediately after the engine is turned on, fluid sound during charge valve operation or switching sound when charging ends will be produced, but this sound is not abnormal; it merely indicates that the accumulator is being normally charged.

Also, a similar charging operation sometimes occurs and sound is sometimes produced when the pressure inside the accumulator drops even when the engine is on and charging has ended, due to such causes as rapid operation of the brake pedal, internal leakage that is too slight to affect brake performance, or a change in temperature; this too is normal.

- When the brake pedal is pressed strongly as far as the booster full load region while the engine is on, sometimes sound is produced by the flow of hydraulic oil discharged from the oil pump, but this is not abnormal. Also, pressing the pedal in as far as this booster full load region can cause a significant increase in the oil temperature inside the oil pump and can lead to a failure, so keep the pedal pressed for no longer than 5 seconds.

Brake Lining

PROBLEM	POSSIBLE CAUSE	CORRECTION
Poor Contact at the Center of Shoe	<ol style="list-style-type: none"> 1. Bell-mouthed drum. 2. Distorted mounting plate. 3. Bent brake shoe. 4. Undersize linings. 5. Loose wheel bearing. 	1-5. Repair or replace as required.
Unequal Wear on the Shoes in the Same Brake	<ol style="list-style-type: none"> 1. Brake linings not a balanced set. 2. Sticking wheel cylinder piston. 	1-2. Repair or replace as required.
Material at the Center of the Shoe Excessively Thin	<ol style="list-style-type: none"> 1. Undersize linings. 2. Oversize drum. 	1-2. Repair or replace as required.
Lining Tapered across the Width	<ol style="list-style-type: none"> 1. Bell-mouthed drum. 2. Bent shoe. 3. Distorted mounting plate. 	1-3. Repair or replace as required.
Lining Worn at One End	Bent mounting plate.	Repair or replace as required.
Linings Glazed	<ol style="list-style-type: none"> 1. Grease on lining. 2. Wrong type lining for service involved. 	1-2. Repair or replace as required.
Rivets Tear Loose	<ol style="list-style-type: none"> 1. Improper set rivet. 2. Improper setting of the rivet. 3. Enlarged rivet holes in the shoe. 	1-3. Repair or replace as required.
Unequal Wear Opposite Brakes, Same Axle	<ol style="list-style-type: none"> 1. Weak shoe return spring. 2. Obstructed hydraulic line. 3. Stuck wheel cylinder piston. 4. Brake drum surface in poor condition. 5. Loose wheel bearing. 	1-5. Repair or replace as required.
Linings at Scored	<ol style="list-style-type: none"> 1. Scored drum. 2. Abrasive material between the lining and drum. 	1-2. Repair or replace as required.
Cracks at Rivet Holes	<ol style="list-style-type: none"> 1. Wrong type rivets. 2. Rivets not properly set. 3. Dirt or rust on the shoe table. 4. Wrong size lining. 	1-4. Repair or replace as required.
Elongation of the Rivet Holes	<ol style="list-style-type: none"> 1. Loose rivets. 2. Wrong size rivets. 	1-2. Repair or replace as required.
Wear on the Edge of the Lining	<ol style="list-style-type: none"> 1. Wrong width lining. 2. Holes improperly drilled. 3. Loose wheel bearing. 4. Bent shoe. 	1-4. Repair or replace as required.
Groove on the Edge of the Lining	<ol style="list-style-type: none"> 1. Lining too wide. 2. Worn drum. 	1-2. Repair or replace as required.

Brake Drum

PROBLEM	POSSIBLE CAUSE	CORRECTION
Brake Drum Heat Checked in Spots	<ol style="list-style-type: none"> 1. Out-of-round brake drum. 2. Eccentric mounting of the drum. 3. Loose wheel bearing. 	1-3. Repair or replace as required.
Drum Uniformly Heat Checked	<ol style="list-style-type: none"> 1. Improper friction materials. 2. Overworked brake. 3. Driver abuse. 	1-3. Repair or replace as required.
Excessive Scoring of the Drum	<ol style="list-style-type: none"> 1. Improper friction materials. 2. Overworked brake. 3. Abrasive material between the lining and drum. 4. Soft drum. 5. Bent or warped shoe. 	1-5. Repair or replace as required.
Excessive Drum Cracks	<ol style="list-style-type: none"> 1. Drive abuse. 2. Weak drum. 3. Wrong friction material. 4. Overworked brake. 	1-4. Repair or replace as required.

Exhaust Brake

PROBLEM	POSSIBLE CAUSE	CORRECTION
Exhaust Brake does not Operate	<ol style="list-style-type: none"> 1. Blown fuse. 2. Improperly adjusted or faulty accelerator or clutch switches. 3. Poor connections or corroded terminals at switches or control valve. 4. Improperly adjusted or seized exhaust brake valve. 5. Vacuum lines kinked, restricted, or plugged with ice. 6. Seized vacuum chamber. 7. Valve linkage broken. 8. Chamber or control valve jammed with ice. 9. Faulty control valve. Valve should open when approximate battery(s) voltage is applied to terminals. 10. Faulty vacuum chamber. 11. Broken wire in wiring harness. 	<ol style="list-style-type: none"> 1. Replace. 2. Adjust or replace. 3. Clean or replace. 4. Adjust, or repair. 5. Repair. 6. Repair. 7. Repair. 8. Melt ice and drain lines of water. 9. Replace. 10. Replace. 11. Repair.
Exhaust Brake Slow to Operate	<ol style="list-style-type: none"> 1. Tighten exhaust brake valve or linkage. 2. Improperly adjusted accelerator or clutch switches. 	<ol style="list-style-type: none"> 1. Free up and lubricate. 2. Adjust.

PROBLEM	POSSIBLE CAUSE	CORRECTION
Weak Braking Action	<ol style="list-style-type: none"> 1. Improperly adjusted or tight exhaust brake valve. 2. Tight linkage. 3. Vacuum lines kinked or partially plugged with ice. 4. Leaking fittings at vacuum lines. 5. Leaky vacuum chamber. 	<ol style="list-style-type: none"> 1. Free up and/or adjust. Lubricate as needed. 2. Free up and lubricate. 3. Repair. 4. Tighten. 5. Replace.
Exhaust Brake will not Shut Off (Exhaust Brake Control Switch "Off")	<ol style="list-style-type: none"> 1. Seized exhaust brake valve or linkage. 2. Control valve or chamber jammed with ice. 3. Short in wiring harness (approximate battery(s) voltage) at control solenoid regardless of control switch position. 4. Faulty control switch. 	<ol style="list-style-type: none"> 1. Free up and lubricate. 2. Melt ice and drain lines. 3. Repair. 4. Replace.
Exhaust Brake "On" Continuously when Exhaust Brake Control Switch is "On" (not Controlled by Clutch or Accelerator Switches)	<ol style="list-style-type: none"> 1. Improperly adjusted clutch or accelerator switches. 2. Switches improperly wired. 3. Short in wiring harness. 	<ol style="list-style-type: none"> 1. Adjust. 2. Check wiring against wiring diagram. Repair as needed. 3. Repair.
Engine Overheats or Loses Power	<ol style="list-style-type: none"> 1. Engine brake valve stuck partially closed. 2. Engine brake valve adjusted so that it is partially closed. 	<ol style="list-style-type: none"> 1. Free up and lubricate or replace. 2. Adjust.

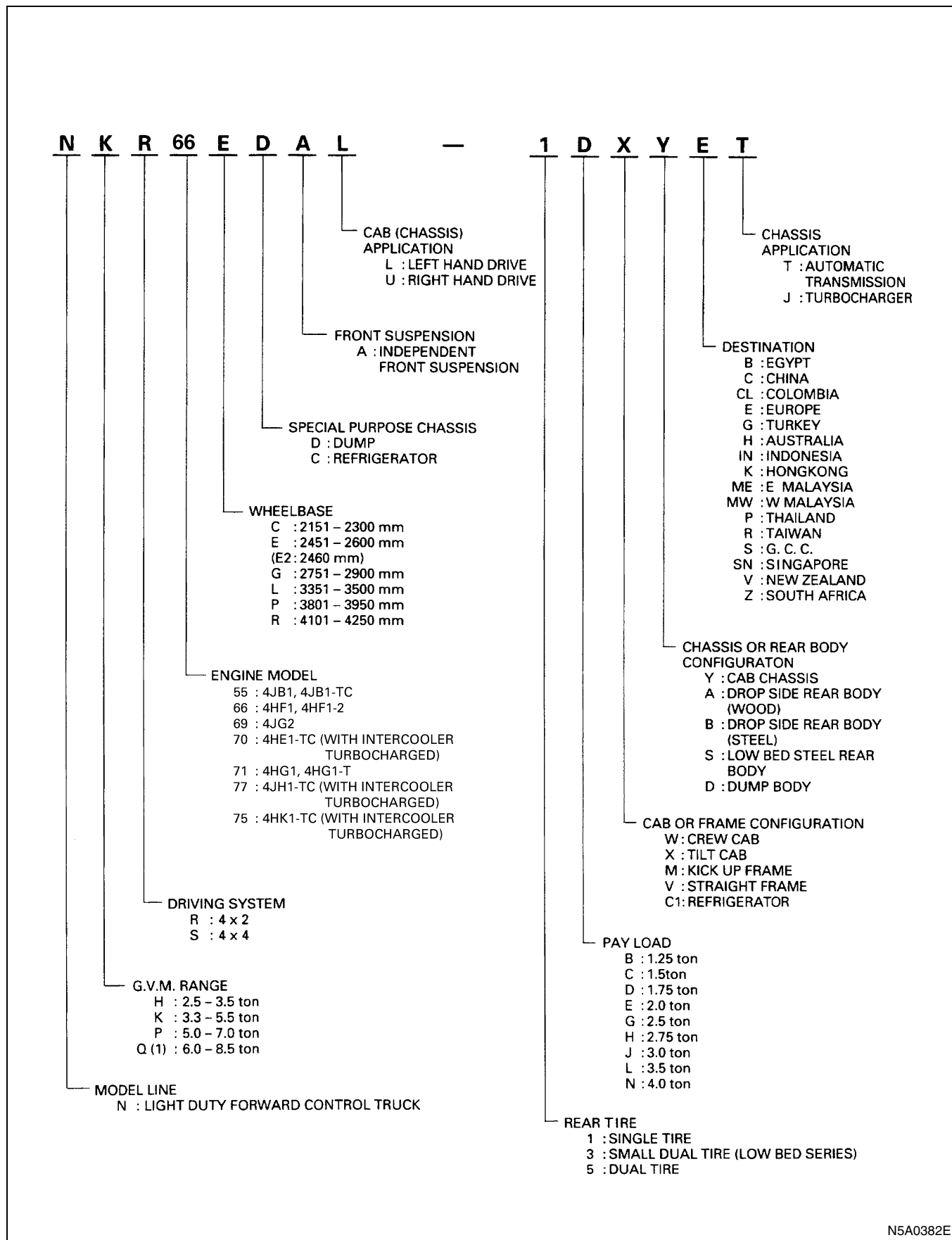
Parking Brakes

Insufficient Braking Force

PROBLEM	POSSIBLE CAUSE	CORRECTION
Brake lining and drum clearance	Clearance between the brake lining and the brake drum excessive	Adjust the brake lining and the brake drum clearance.
Brake lining	Brake lining worn out	Replace the brake lining.
Camshaft	Camshaft worn out	Replace the camshaft.
Control wire	Control wire stretched	Adjust the control wire length or replace the control wire.

MAIN DATA AND SPECIFICATIONS

Model Designation (Explanation Only)



N5A0382E

Front Brakes (NHR)

		FRONT BRAKE																				
		DISC BRAKE								DRUM BRAKE												
		WHEEL CYL		DISC				Type		WHEEL CYL.		DRUM.		LINING								
		Inside dia. (in)		Thickness (mm)		Outside dia. (mm)		D L		Inside dia. (in)		Inside dia. (in)		Width (mm)								
		2	2	3	4	2	2	2	2	1	1	2	3	1	1	1	1	1				
		+	+	1	4	6	9	L	+	+	7	0	3	7	0	7	0	2				
		/	/	/	2	5	3		/	/	9	0	/	0	5	5	0	0				
		8	4				0		8	16	4		8					0				
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	NHR55EU-1CB																					
2	NHR55EU-1CY																					
3	NHR55EU-1CYIN																					
4	NHR55EU-1BWS																					
5	NHR55EU-3CB																					
6	NHR55EU-3CZJ																					
7	NHR55EU-3CBSN																					
8	NHR55EL-1CBS																					
9	NHR55EL-1CYS																					
10	NHR55EL-1CY																					
11	NHR55EL-1CXY																					
12	NHR55EL-1CYCLJ																					
13	NHR55EL-1BWS																					
14	NHR55EL-3CBS																					
15	NHR55EL-3CYS																					
16	NHR55EL-3CB																					

—	Not available
○	Standard
□	Factory option
	Non

Rear Brakes (NHR)

No.	Models	REAR BRAKE										PARKING BRAKE					BRAKE CONTROL																		
		DRUM BRAKE					DRUM BRAKE					DRUM.					LINING					MASTER CYL.													
		Type	WHEEL CYL	DRUM.	LINING	DRUM.	Type	WHEEL CYL	DRUM.	LINING	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.	DRUM.				
			Inside dia. (in)	Inside dia. (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (mm)			
1	D 2 L (W A U T O)	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
2	D 2 L (W O A U T O)	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
3	NHR55EU-1CYIN	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
4	NHR55EU-1BWS	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
5	NHR55EU-3CB	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
6	NHR55EU-3CYZJ	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
7	NHR69EU-3CBSN	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
8	NHR55EL-1CBS	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
9	NHR55EL-1CYS	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
10	NHR55EL-1CY	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
11	NHR55EL-1CXY	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
12	NHR55EL-1CYCLJ	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
13	NHR55EL-1BWS	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
14	NHR55EL-3CBS	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
15	NHR55EL-3CYS	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3
16	NHR55EL-3CB	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	1	1	2	2	3	3	1	1	2	2	3	3	1	1	2	2	3	3

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NKR)

		FRONT BRAKE																				
		DISC BRAKE								DRUM BRAKE												
		WHEEL CYL		DISC				Type		WHEEL CYL.		DRUM.		LINING								
		Inside dia. (in)		Thickness (mm)		Outside dia. (mm)		2 L		Inside dia. (in)		Inside dia. (in)		Width (mm)								
		2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	NKR55EU-1EXY	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	○	-	-	-	-	-
2	NKR77EAU-1DXYEJ	-	○	-	○	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	NKR66EU-1EYIN2	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-
4	NKR77E2U-5DXYEJ	○	-	-	-	○	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-
5	NKR77E2U-5HXYKJ	○	-	-	-	○	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-
6	NKR66E2U-5HXY2	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-
7	NKR77E2U-5EXYHJ	○	-	-	-	○	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-
8	NKR77LU-5EXYHJ	○	-	-	-	○	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-
9	NKR55LU-5HXY	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-
10	NKR66LU-5HXYZ	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-
11	NKR77LU-5HXYKJ	○	-	-	-	○	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-
12	NKR77LU-5DXYEJ	○	-	-	-	○	-	-	○	-	-	-	-	-	-	-	-	-	-	-	-	-
13	NKR66LU-5HXY2	-	-	-	-	-	-	-	-	-	○	-	-	-	-	-	-	-	-	-	-	-

<input type="checkbox"/>	Not available
<input type="radio"/>	Standard
<input type="checkbox"/>	Factory option
<input type="checkbox"/>	Non

Rear Brakes (NKR)

No.		REAR BRAKE																					BRAKE CONTROL																																				
		DRUM BRAKE											PARKING BRAKE					MASTER CYL																																									
		Type	WHEEL CYL			DRUM.			LINING					DRUM.		LINING			DRUM.																																								
		D																																																									
		2																																																									
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		O)																																																									

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NKR)

		FRONT BRAKE																					
		DISC BRAKE									DRUM BRAKE												
		WHEEL CYL			DISC			Type			WHEEL CYL.			DRUM.			LINING						
		Inside dia. (in)			Thickness (mm)			Outside dia. (mm)			2 L (W/O A U T O)			2 L (W A U T O)			Inside dia. (in)			Width (mm)			
		2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
—	Not available																						
○	Standard																						
□	Factory option																						
	Non																						
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
14	NKR66LU-5HYIN2	—	—	—	—	—	—	—	—	—	○	—	—	○	□	—	—	—	○	○	○	□	—
15	NKR71LU-5LYIN	—	—	—	—	—	—	—	—	—	○	—	—	—	○	—	—	—	○	—	—	—	—
16	NKR66LU-5GWY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	NKR77EU-3EXYHJ	○	—	—	—	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	NKR55EL-1EY	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
19	NKR55EL-1EXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	NKR55EL-1DXYG	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	NKR69EL-1EXYCH	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	NKR77EAL-1DXYEJ	—	○	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	NKR66EL-1EXY2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
24	NKR77E2L-5DXYEJ	○	—	—	—	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	NKR55E2L-5HXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	NKR55E2L-5HXYCLJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	NKR66E2L-5HXY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	NKR66E2L-5HXAA2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	NKR66E2L-5HXY52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NKR)

No.	Models	REAR BRAKE										PARKING BRAKE										BRAKE CONTROL															
		DRUM BRAKE					DRUM BRAKE					DRUM.					LINING					DRUM.					LINING					MASTER CYL.					
		Type	Wheel Cyl	Drum	Width (mm)	Inside dia. (mm)	Wheel Cyl	Drum	Width (mm)	Inside dia. (in)	Wheel Cyl	Drum	Width (mm)	Inside dia. (in)	Wheel Cyl	Drum	Width (mm)	Inside dia. (in)	Wheel Cyl	Drum	Width (mm)	Inside dia. (in)	Wheel Cyl	Drum	Width (mm)	Inside dia. (in)	Wheel Cyl	Drum	Width (mm)	Inside dia. (in)							
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33					
14	NKR66LU-5HYIN2	○	○	○	□	—	—	—	—	—	○	○	○	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
15	NKR71LU-5LYIN	○	—	—	○	—	—	—	—	—	○	○	○	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
16	NKR66LU-5GWY2	○	—	—	○	—	—	—	—	—	○	○	○	○	○	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
17	NKR77EU-3EXYHJ	—	○	○	—	—	—	○	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
18	NKR55EL-1EY	○	○	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
19	NKR55EL-1EXY	○	○	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
20	NKR55EL-1DXYG	—	○	○	—	—	—	—	○	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
21	NKR69EL-1EXYCH	○	○	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
22	NKR77EAL-1DXYEJ	—	○	○	—	—	—	—	○	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
23	NKR66EL-1EXY2	○	○	○	—	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
24	NKR77E2L-5DXYEJ	—	○	○	—	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
25	NKR55E2L-5HXHY	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
26	NKR55E2L-5HXHYCLJ	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
27	NKR66E2L-5HXHY2	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
28	NKR66E2L-5HXA2	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
29	NKR66E2L-5HXY52	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NKR)

		FRONT BRAKE																					
		DISC BRAKE						DRUM BRAKE															
		WHEEL CYL			DISC			Type		WHEEL CYL.		DRUM.		LINING									
		Inside dia. (in)		Thickness (mm)		Outside dia. (mm)		D		Inside dia. (in)		Inside dia. (in)		Width (mm)									
—	Not available	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
○	Standard	+	+	+	4	4	4	2	6	9	2	L	2	1	+	3	7	0	2	6	7	0	2
□	Factory option	1	1	1	0	0	2	5	3	1	(W	(	2	1	+	3	9	0	0	0	5	0	0
	Non	/	/	/	3	5	2	3	0	0	A	)	L	1	+	3	0	0	0	0	0	0	0
		8	4	4	—	—	—	—	—	—	U	)	2	8	8	4	—	—	—	—	—	—	—
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
30	NKR66EDL-5EMXD2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
31	NKR66EDL-5EMXDS2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
32	NKR55LL-5HXY	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
33	NKR77LL-5DXYEJ	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
34	NKR69LL-5HXYCH	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
35	NKR66LL-5HXY2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
36	NKR66LL-5HXA2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
37	NKR66LL-5HXY2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
38	NKR66LL-5HXAS2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
39	NKR66LL-5GWY2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
40	NKR66LL-5GWA2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
41	NKR66LL-5GWYS2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
42	NKR66LL-5GWAS2	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
43	NKR55EL-3DXYG	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NKR)

No.	Models	REAR BRAKE										PARKING BRAKE										BRAKE CONTROL															
		DRUM BRAKE					LINING					DRUM.					LINING					MASTER CYL.															
		Type	WHEEL CYL	DRUM.	DRUM.	Width (mm)	Width (mm)	Width (mm)	Inside dia. (mm)	Inside dia. (mm)	Width (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (in)	Width (mm)	Width (mm)	Width (mm)	Inside dia. (in)	Inside dia. (in)	Width (mm)	Width (mm)	Width (mm)	D S P V	L S P V	E X H A U S T	H B B	A B S									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33					
30	NKR66EDL-5EMXD2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
31	NKR66EDL-5EMXDS2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
32	NKR55LL-5HXY	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
33	NKR77LL-5DXYEJ	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
34	NKR69LL-5HXYCH	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
35	NKR66LL-5HXY2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
36	NKR66LL-5HXA2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
37	NKR66LL-5HXY2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
38	NKR66LL-5HXAS2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
39	NKR66LL-5GWY2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
40	NKR66LL-5GWA2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
41	NKR66LL-5GWYS2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
42	NKR66LL-5GWAS2	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
43	NKR55EL-3DXYG	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NKR)

		FRONT BRAKE																					
		DISC BRAKE						DRUM BRAKE															
		WHEEL CYL			DISC			Type		WHEEL CYL.		DRUM.		LINING									
		Inside dia. (in)			Thickness (mm)			Outside dia. (mm)			2 L (W/O A U T O)		2 L (W A U T O)		Inside dia. (in)		Width (mm)						
—	Not available	2	2	3	4	2	2	2	3	2	2	1	2	3	1	1	6	7	1				
○	Standard	+	+	5	4	6	9	1	1	+	+	+	+	0	0	0	0	0	0				
□	Factory option	2	2	1	2	5	3	0	0	/	/	/	/	0	0	0	0	0	0				
	Non	/	/	4						8	4	16	8	4									
No. Models		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
44	NKR77EL-3EXYRJ	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	○	—	—	—	—	—
45	NKR77EL-3EXARJ	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	○	—	—	—	—	—
46	NKR77LL-5EXYRJ	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	○	—	—	—	—	—
47	NKR77LL-5HX YRJ	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	○	—	—	—	—	—

Rear Brakes (NKR)

		REAR BRAKE										PARKING BRAKE					BRAKE CONTROL																
		DRUM BRAKE																															
Type	D 2 L (w/o A U T O)	WHEEL CYL.		DRUM.		LINING		DRUM.		LINING		DRUM.		LINING		MASTER CYL.		D S P V	L S P V	E X H A U S T	H B B	A B S											
		Inside dia. (in)	Width (mm)	Inside dia. (mm)	Width (mm)	Inside dia. (in)	Width (mm)	Inside dia. (in)	Width (mm)	Inside dia. (in)	Width (mm)	Inside dia. (in)	Width (mm)	Inside dia. (in)	Width (mm)																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
44	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
47	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NPR / NQR / NPS)

		FRONT BRAKE																						
		DISC BRAKE						DRUM BRAKE																
		WHEEL CYL.		DISC				Type		WHEEL CYL.		DRUM.		LINING										
		Inside dia. (in)		Thickness (mm)		Outside dia. (mm)		2 L (W/O A U T T O)		D 2 L		Inside dia. (in)		Width (mm)										
		2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
—	Not available	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
○	Standard	+	+	—	—	—	—	—	—	—	—	○	—	—	○	—	—	—	—	○	—	—	—	—
□	Factory option	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Non	/	/	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		8	8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	NPR66GU-5JXY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	NPR66GU-5JXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	NPR77GU-5DXYEJ	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	NPR75GU-5EXYHJ2	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	NPR66GDU-5LX	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	NPR66GU-5LXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	NPR70GU-5JXYKJ	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	NPR70GU-5LXYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	NPR77LU-5DXYEJ	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	NPR77LU-5HXYEJ	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	NPR75LU-5EXYHJ2	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	NPR66LU-5JXA2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13	NPR66LU-5JXY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	NPR66LU-5JVXYZ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	NPR66LU-5LXA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	NPR66LU-5LXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	NPR66LU-5LVXYZ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	NPR75LU-5JXYHJ2	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	NPR71LU-5JXYSNJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	NPR75LU-5JXYEJ2	○	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NPR / NQR / NPS)

— ○ □ Non	REAR BRAKE					PARKING BRAKE					BRAKE CONTROL																								
	DRUM BRAKE					DRUM BRAKE					DRUM BRAKE					DRUM BRAKE																			
	Type	WHEEL CYL.		DRUM.		LINING		DRUM.		LINING		DRUM.		LINING		MASTER CYL.																			
D 2 L (W O A U T O)	Inside dia. (in)	1 + 3 / / 16 16 8	2 6 0 0 2 7 0 0 3 7 0 0	3 3 0 0 0 0 0 0 0 0	Width (mm)	1 9 0 0 7 5 0 0 6 0 0 0 5 0 0 0 0	1 5 0 0 2 0 0 0 1 2 0 0 3 0 0 0	Inside dia. (in)	1 2 0 0 0 0 0 0 0 0	Width (mm)	2 2 0 0 0 0 0 0 0 0	2 6 0 0 2 7 0 0 3 7 0 0	3 3 0 0 0 0 0 0 0 0	1 9 0 0 7 5 0 0 6 0 0 0 5 0 0 0 0	1 5 0 0 2 0 0 0 1 2 0 0 3 0 0 0	8 + 9 T	9 + 10 T	1 + 1 / / 16 8	1 + 1 / / 4	1 + 3 / / 8	30 D S P V	31 L S P V	32 E X H A U S T B R A K E	33 H B B	34 A B S										
No. Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
1	○	—	○	○	—	—	—	—	—	—	—	○	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
2	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
3	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
4	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
5	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
6	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
7	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
8	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	
9	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
10	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
11	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
12	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
13	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
14	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
15	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
16	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
17	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
18	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
19	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—
20	○	—	○	○	—	—	—	—	—	—	○	—	—	○	—	—	—	—	—	—	○	○	—	○	—	—	○	—	—	—	—	—	—	—	—

Front Brakes (NPR / NQR / NPS)

		FRONT BRAKE																						
		DISC BRAKE							DRUM BRAKE															
		WHEEL CYL.		DISC			Type		WHEEL CYL.		DRUM.		LINING											
		Inside dia. (in)		Thickness (mm)			Outside dia. (mm)		2 L (W/O A U T T O)		2 L (W A U T T O)		Inside dia. (in)		Width (mm)									
		2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
—	Not available	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
○	Standard	+	+	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
□	Factory option	2	2	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Non	+	+	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
21	NPR70LU-5JXYKJ	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	NPR70LU-5LXYKJ	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	NPR75LU-5LXYHJ2	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	NQR75LU-5LXYEJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	NQR75LU-5LXYEJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	NQR75LU-5NXYHJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	NPR75LU-5KWYHJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	NPR75LU-5HWYEJ2	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	NPR70LU-5HWYKJ	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	NPR66PU-5JXA2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	NPR66PU-5JXY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	NPR66PU-5LXA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33	NPR66PU-5LXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
34	NPR66PU-5LVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35	NPR66PBU-5LVY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
36	NPR66PU-5LVXYZ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
37	NQR66PU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
38	NQR71PU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
39	NPR75PU-5JXYEJ2	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	NPR70PU-5JXYKJ	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NPR / NQR / NPS)

No.	Models	REAR BRAKE										PARKING BRAKE				BRAKE CONTROL																						
		DRUM BRAKE										DRUM BRAKE				MASTER CYL.																						
		Type	WHEEL CYL.			DRUM.			LINING				DRUM.		LINING																							
D 2 L (W O A U T O)	Inside dia. (in)			Inside dia. (in)			Width (mm)				Inside dia. (in)		Width (mm)																									
D 2 L (W O A U T O)	1 + 3 /	1 + 5 /	1 + 3 /	1 + 3 /	2 6 0	2 7 0	3 0	3 7 0	1 5 0	1 2 0	1 9 0	2 0	1 2	8 + 9 T	9 + 10 T	1 + 1 /	1 + 1 /	1 + 3 /	1 + 3 /	1 + 3 /	8 + 9 T	24	25	26	27	28	29	30	31	32	33	34						
21	NPR70LU-5JXYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
22	NPR70LU-5LXYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
23	NPR75LU-5LXYHJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	NQR75LU-5LXYEJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	NQR75LU-5LXYEJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	NQR75LU-5NXYHJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	NPR75LU-5KWHYHJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	NPR75LU-5HWYEJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	NPR70LU-5HWYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	NPR66PU-5JXA2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
31	NPR66PU-5JXY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32	NPR66PU-5LXA	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
33	NPR66PU-5LXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
34	NPR66PU-5LVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
35	NPR66PBU-5LVY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
36	NPR66PU-5LVXYZ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
37	NQR66PU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
38	NQR71PU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
39	NPR75PU-5JXYEJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
40	NPR70PU-5JXYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NPR / NQR / NPS)

		FRONT BRAKE																							
		DISC BRAKE							DRUM BRAKE																
— ○ □	Not available Standard Factory option Non	WHEEL CYL.		DISC			Type		WHEEL CYL.		DRUM.		LINING												
		Inside dia. (in)	Thickness (mm)	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		2	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
		8	4	2	5	0	2	4	6	5	3	0	3	(W A U T O)	D 2 L	8	16	8	9	0	0	0	0	0	0
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
41	NPR70PU-5LXYKJ	—	—	○	—	—	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
42	NPR75PU-5LXYHJ2	—	—	○	—	—	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
43	NQR75PU-5LXYEJ	—	—	○	—	—	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
44	NQR75PU-5LXYEJ2	—	—	○	—	—	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
45	NQR70PU-5NXYKJ	—	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○
46	NQR66RU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○
47	NQR71RU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○
48	NQR75RU-5NXYZJ	—	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○
49	NQR75RBU-5NXYZJ	—	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○
50	NQR75RU-5NXYHJ	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
51	NQR70RU-5NXYKJ	—	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	○
52	NQR75TU-5JXYEJ	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
53	NQR75TU-5LXYEJ2	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
54	NQR75TU-5KWYEJ	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
55	NQR75TU-5KWYEJ2	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
56	NPR71LU-4EXYSNJ	○	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
57	NPS75LU-5JXYHJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
58	NPS71LU-5JXYIN	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
59	NPR77GL-5DXYEJ	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
60	NPR66GL-5JXY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NPR / NQR / NPS)

		REAR BRAKE										PARKING BRAKE		BRAKE CONTROL																						
		DRUM BRAKE																																		
Type	WHEEL CYL.	DRUM.					LINING					DRUM.	LINING	MASTER CYL.																						
		Inside dia. (in)					Width (mm)							Inside dia. (in)	Width (mm)	D S P V	L S P V	E X H A U S T B R A K E	H B B	A B S																
D 2 L (w/o A U T O)	1 1 + 3 / 16 8	2 2 6 0 8	3 2 7 0 0	4 3 0 0 0	5 3 7 0 0	6 1 0 0 0	7 1 9 0 0	8 1 7 5 0	9 1 6 0 0	10 1 5 0 0	11 1 4 0 0	12 1 3 0 0	13 1 2 0 0								14 1 1 0 0	15 1 0 0 0	16 1 0 0 0	17 1 0 0 0	18 1 0 0 0	19 1 0 0 0	20 1 0 0 0	21 1 0 0 0	22 1 0 0 0	23 1 0 0 0	24 8 + 9 T	25 9 + 10 T	26 1 16	27 1 8	28 1 4	29 1 + 3 / 8
No. Models		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
41	NPR70PU-5LXYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
42	NPR75PU-5LXYHJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
43	NQR75PU-5LXYEJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
44	NQR75PU-5LXYEJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
45	NQR70PU-5NXYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	NQR66RU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
47	NQR71RU-5NVXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
48	NQR75RU-5NXYZJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
49	NQR75RBU-5NXYZJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
50	NQR75RU-5NXYHJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
51	NQR70RU-5NXYKJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
52	NQR75TU-5JXYEJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
53	NQR75TU-5LXYEJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
54	NQR75TU-5KWYEJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
55	NQR75TU-5KWYEJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
56	NPR71LU-4EXYSNJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
57	NPS75LU-5JXYHJ2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
58	NPS71LU-5JXYIN	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
59	NPR77GL-5DXYEJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
60	NPR66GL-5JXY2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NPR / NQR / NPS)

		FRONT BRAKE																					
		DISC BRAKE							DRUM BRAKE														
	WHEEL CYL.	DISC			Type	WHEEL CYL.	DRUM.	LINING	WHEEL CYL.			DRUM.			LINING								
		Thickness (mm)	Outside dia. (mm)						Inside dia. (in)	Inside dia. (in)	Width (mm)												
	Inside dia. (in)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
—	2	2	+	4	2	2	2	2	3	2	L	D	1	1	2	3	3	3	6	7	1	1	
○	+	+	1	4	2	6	9	1	6	—	(W	2	+	+	+	7	0	2	0	0	0	2	
□	1	1	1	0	5	5	3	0	3	—	A	L	3	3	3	9	0	0	0	5	0	0	
	/	/	/	2	—	—	—	—	—	—	U	—	/	/	/	—	—	—	—	—	—	—	
	8	4	—	—	—	—	—	—	—	—	T	—	8	8	8	—	—	—	—	—	—	—	
											O												
No. Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
61	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
62	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
63	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
65	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
66	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
67	○	—	—	○	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
68	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
69	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
70	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
71	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
72	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
73	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
74	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
75	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
76	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
77	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
78	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
79	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
80	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NPR / NQR / NPS)

		REAR BRAKE										PARKING BRAKE				BRAKE CONTROL																						
		DRUM BRAKE																																				
Type	WHEEL CYL.	DRUM.					LINING					DRUM.	LINING	MASTER CYL.				L S P V	E X H A U S T	B R A K E	H B B	A B S																
		Inside dia. (in)					Width (mm)							Inside dia. (in)									D S P V															
D 2 L (w/o A U T O)	1 + 3 / 16	2 6 0	2 7 0	3 3 0	3 7 0	1 0 0	1 9 0	2 0 0	2 5 0	3 0 0	1 7	1 8	1 9	2 0	2 1	2 2	2 3	2 4	2 5	2 6	2 7	2 8		2 9	3 0	3 1	3 2	3 3	3 4									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					
61	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
62	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
63	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
64	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
65	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
66	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
67	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
68	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
69	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
70	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
71	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
72	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
73	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
74	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
75	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
76	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
77	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
78	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
79	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
80	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

—	Not available
○	Standard
□	Factory option
—	Non

Front Brakes (NPR / NQR / NPS)

— Not available		FRONT BRAKE																							
○ Standard		DISC BRAKE						DRUM BRAKE																	
□ Factory option		WHEEL CYL.		DISC				Type		WHEEL CYL.		DRUM.		LINING											
Non		Inside dia. (in)		Thickness (mm)		Outside dia. (mm)		2 L (W/O A U T T O)		2 L (W A U T T O)		Inside dia. (in)		Width (mm)											
No.	Models	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	
81	NPR75LL-5JXYEJ2	○																							
82	NPR70LL-5LXYRJ2																								
83	NPR71LL-5LVXYCLJ																								
84	NQR75LL-5LXYEJ																								
85	NQR75LL-5LXYEJ2																								
86	NPR77LL-5CWYEJ																								
87	NPR66LL-5HWY																								
88	NPR75LL-5HWYEJ2																								
89	NPR66PL-5JXA2																								
90	NPR66PL-5JXY2																								
91	NPR66PL-5JXAS																								
92	NPR66PL-5JXYS																								
93	NPR66PL-5JXY																								
94	NPR70PL-5JXYR2																								
95	NPR66PL-5LXA																								
96	NPR66PL-5LXY																								
97	NPR66PL-5LXAS																								
98	NPR66PL-5LXYS																								
99	NPR66PBL-5LVY																								
100	NPR66PL-5LVXY																								

Rear Brakes (NPR / NQR / NPS)

—	○	□	Non	REAR BRAKE				PARKING BRAKE				BRAKE CONTROL																											
				DRUM BRAKE				DRUM.	LINING		DRUM.	LINING	MASTER CYL.																										
													Type	WHEEL CYL.		Inside dia. (in)		Width (mm)		Inside dia. (in)	Width (mm)																		
D 2 L	2	L	(W I T H O U T A U T O	1 1 +	1 3 5	1 /	3 /	7 /	8	2 2 6	7 0 0	3 0 0		1 1 1 5 0	1 1 1 2	1 9 0 0	2 1	20	21		22	23	24	25	26	27	28	29	30	31	32	33	34						
																																				1	2	3	4
81	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
82	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
83	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
84	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
85	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
86	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
87	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
88	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
89	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
90	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
91	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
92	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
93	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
94	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
95	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
96	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
97	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
98	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
99	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
100	○			—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

Front Brakes (NPR / NQR / NPS)

		FRONT BRAKE																							
		DISC BRAKE					DRUM BRAKE																		
—	○	□	Non	WHEEL CYL.		DISC			Type		WHEEL CYL.		DRUM.		LINING										
				Inside dia. (in)	Thickness (mm)	Outside dia. (mm)	2	L	(W A U T O)	1	2	3	4	5	6	7	8	9	10						
				2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23			
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NPR / NQR / NPS)

		REAR BRAKE										PARKING BRAKE			BRAKE CONTROL																							
		DRUM BRAKE																																				
Type	Wheel Cyl.	Drum	Lining					Drum Dia. (in)	Lining Width (mm)	Drum Dia. (in)	Lining Width (mm)	Drum Dia. (in)	Lining Width (mm)	Drum Dia. (in)	Lining Width (mm)	Master Cyl.					D S P V	L S P V	E X H A U S T	B R A K E	H B B	A B S												
			Inside dia. (in)	Width (mm)	Inside dia. (in)	Width (mm)	Inside dia. (in)									Width (mm)	8	9	1	1							1	1	1	1	1	1						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○				
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○			
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

—	Not available
○	Standard
□	Factory option
	Non

Front Brakes (NPR / NQR / NPS)

		FRONT BRAKE																						
		DISC BRAKE						DRUM BRAKE																
		WHEEL CYL.		DISC				Type		WHEEL CYL.			DRUM.		LINING									
		Inside dia. (in)		Thickness (mm)		Outside dia. (mm)		D L		Inside dia. (in)			Inside dia. (in)		Width (mm)									
		2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
—	Not available	2	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
○	Standard	+	+	+	4	4	4	6	9	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
□	Factory option	2	2	1	3	4	4	6	9	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Non	2	2	1	3	4	4	6	9	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		+	+	1	5	0	2	5	3	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		1	1	1	5	0	2	5	3	0	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		/	/	/	4																			
		8		4																				
No. Models		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
121	NQR70RL-5LYXJT	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
122	NQR70RL-5NXYRJ	—	—	—	—	—	—	—	—	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—
123	NQR75TL-5LXEJ	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
124	NQR75TL-5LXEJ2	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
125	NQR75TL-5KWYEJ	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
126	NQR75TL-5KWYEJ2	—	—	○	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
127	NPS71LL-5JXY	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
128	NPR71LU-5LXYPJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
129	NQR70LU-5NXYPJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
130	NQR75LU-5NXYPJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
131	NPR71PU-5LXYPJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
132	NQR70RU-5NXYPJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
133	NQR75RU-5NXYPJ	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Rear Brakes (NPR / NQR / NPS)

No.	Models	REAR BRAKE										PARKING BRAKE				BRAKE CONTROL																						
		DRUM BRAKE					LINING					DRUM. LINING		MASTER CYL.		D S P V	L S P V	E X H A U S T	H B B	A B S																		
Type	WHEEL CYL.		DRUM.		LINING		DRUM.		LINING		DRUM.		LINING		MASTER CYL.																							
		Inside dia. (in)		Inside dia. (in)		Width (mm)		Inside dia. (in)		Width (mm)		Inside dia. (in)		Width (mm)		Inside dia. (in)																						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					
121	NQR70RL-5LYXJT																																					
122	NQR70RL-5NXYRJ																																					
123	NQR75TL-5LXYEJ																																					
124	NQR75TL-5LXYEJ2																																					
125	NQR75TL-5KWYEJ																																					
126	NQR75TL-5KWYEJ2																																					
127	NPS71LL-5JXY																																					
128	NPR71LU-5LXYPJ																																					
129	NQR70LU-5NXYPJ																																					
130	NQR75LU-5NXYPJ																																					
131	NPR71PU-5LXYPJ																																					
132	NQR70RU-5NXYPJ																																					
133	NQR75RU-5NXYPJ																																					

—	Not available
○	Standard
□	Factory option
	Non

SERVICE STANDARD

ITEMS		SERVICE STANDARD	SERVICE LIMIT
FRONT DISC BRAKE ASSEMBLY			
Pad Thickness (φ 265 mm)	mm (in)	14.0 (0.551)	1.0 (0.039)
Pad Thickness (φ 293 & φ 310 mm)	mm (in)	13.0 (0.510)	1.0 (0.039)
Piston and Cylinder Clearance	mm (in)	0.08 — 0.18 (0.0031 — 0.0071)	0.23 (0.0091)
Disc Lateral Run out	mm (in)	0.13 (0.005) or less	—
Disc Maximum Parallelism	mm (in)	0.02 (0.0008)	—
Disc Thickness (φ 265 mm)	mm (in)	35.0 (1.378)	28.5 (1.122)
Disc Thickness (φ 293 mm)	mm (in)	40.0 (1.575)	37.0 (1.457)
Disc Thickness (φ 310 mm)	mm (in)	42.0 (1.654)	39.0 (1.535)
FRONT DRUM BRAKE ASSEMBLY			
Brake Drum Inside Diameter	mm (in)	279.4 (11.00) 300.0 (11.81) 320.0 (12.60)	281.0 (11.06) 301.5 (11.87) 321.5 (12.66)
Brake Drum Run-out	mm (in)	0.13 (0.005) or less	—
Brake Lining Thickness or Rivet Depth	mm (in)	—	1.0 (0.039)
Wheel Cylinder and Piston Clearance	mm (in)	—	0.15 (0.006)
REAR DRUM BRAKE ASSEMBLY			
Brake Drum Inside Diameter	mm (in)	228.6 (9.00) 240.0 (9.45) 260.0 (10.24) 279.4 (11.0) 290.0 (11.42) 300.0 (11.81) 320.0 (12.60) 370.0 (14.57)	230.0 (9.06) 241.5 (9.51) 261.5 (10.30) 281.0 (11.06) 291.5 (11.48) 301.5 (11.87) 321.5 (12.66) 372.0 (14.64)
Brake Drum Run-out	mm (in)	0.13 (0.005) or less	—
Brake Lining Thickness or Rivet Depth	mm (in)	—	1.0 (0.039)
Wheel Cylinder and Piston Clearance	mm (in)	—	0.15 (0.006)
BRAKE PEDAL AND CONTROL			
Master Cylinder and Piston Clearance	mm (in)	0.11 — 0.195 (0.004 — 0.008)	0.22 (0.009)
PARKING BRAKE			
Brake Drum Inside Diameter	mm (in)	178.0 (7.01) 190.0 (7.48) 203.2 (8.00)	179.0 (7.05) 191.0 (7.52) 205.0 (8.07)
Brake Drum Run-out	mm (in)	0.05 (0.002) or less	—
Brake Lining Thickness	mm (in)	—	1.0 (0.039)
EXHAUST BRAKE			
Butterfly Valve and Body Clearance			
(4HF1 Engine)	mm (in)	0.4 — 0.6 (0.016 — 0.024)	—
(Other Engine)	mm (in)	0.1 — 0.2 (0.004 — 0.008)	—

SERVICING

Service Brakes

Wheel Brake Adjustment

Brake Lining Clearance Adjustment (2L and D2L)

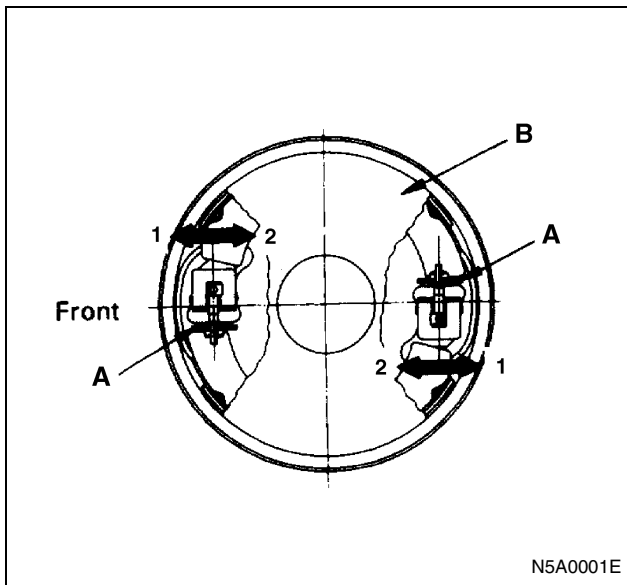
Without auto-adjuster type

1. Chock the wheels not being adjusted.
2. Jack up the axle until the wheels can be turned freely.
3. Manually shake the wheel to check for excessive play.
4. Remove the grommet fitted to one of the brake drum cover adjuster holes.
5. Insert a screwdriver into the adjuster hole. Manually rotate the wheel while turning the adjuster (A) in the direction of the arrow (1) until resistance is felt at the wheel.
6. Back off the adjuster (A) in the direction of the arrow (2) the specified number of notches.

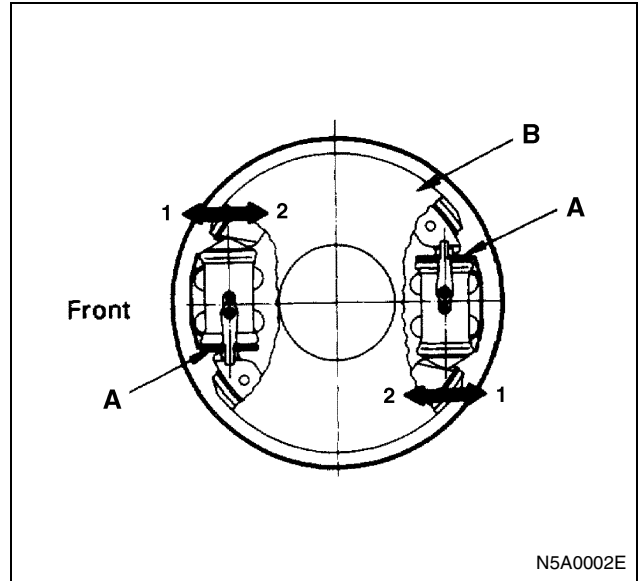
Specified Notches

Front	5-6
Rear	

2L



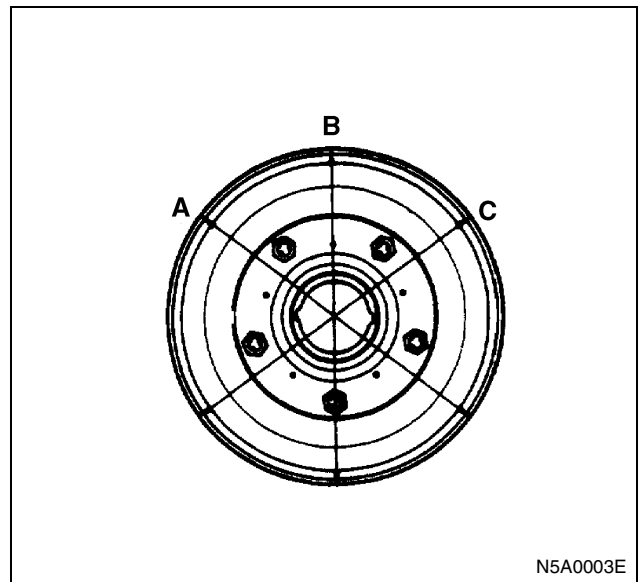
D2L



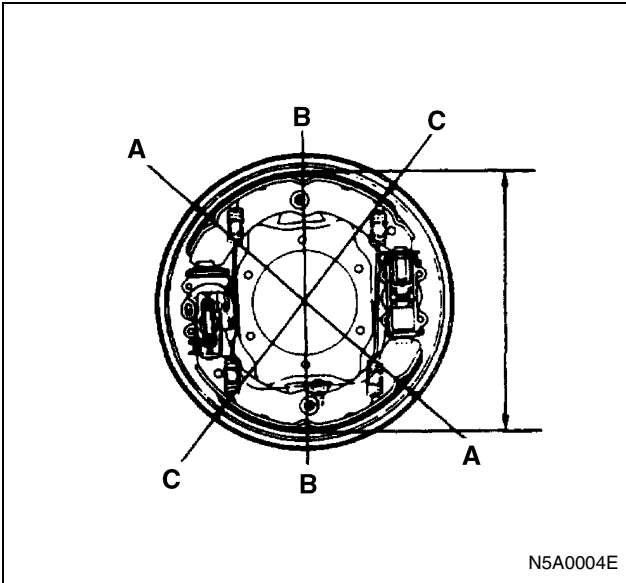
7. Install the grommet to the adjuster hole.
8. Repeat Steps 4 through 7 on the other wheels.
9. Lower the vehicle to the ground.

With auto-adjuster type

1. Measure the internal diameter of the brake drum.
 - Take measurement of the distance at (A), (B) and (C) points.



2. Measure the external diameter of the brake shoe.
 - Take measurement of the distance at (A), (B) and (C) points.



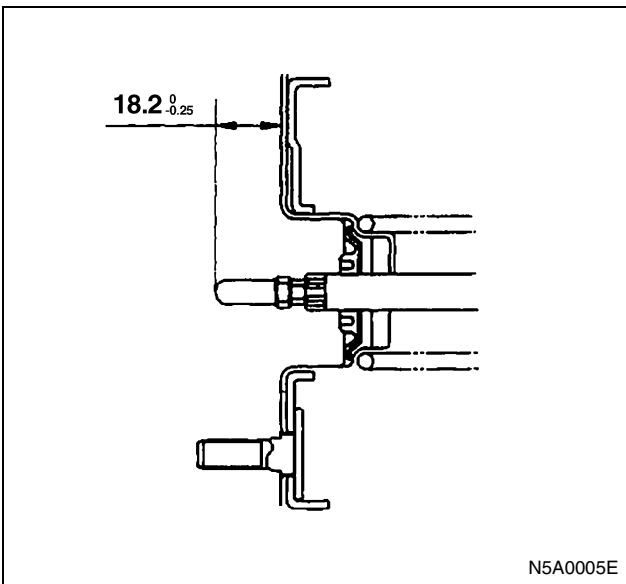
N5A0004E

- Turn the adjuster gear so that the difference between the internal diameter of the brake drum and the external diameter of the brake shoe becomes 0.6 mm (0.024 in).
- Step on the brake hard while turning the brake drum in the forward direction, or while driving forward.

Brake Pedal Adjustment

Brake Pedal Height and Free Play Adjustment Vacuum Booster (Master Vac) Type:

The height of push rod should be adjusted so that the distance from its master cylinder mounting surface to end measures 18.2 mm (0.717 in).

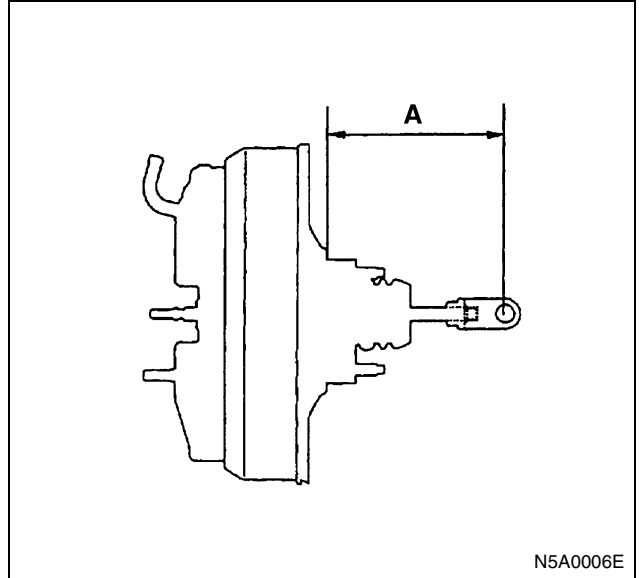


N5A0005E

For push rod length adjustment, the distance from the center of crevis pin hole to brake pedal mounting surface should be set at 109 mm (4.291 in); without spacer, 129 mm (5.079 in); with spacer. When fixed under this condition, there is no need to adjust the height of brake pedal from floor and free play.

Notice:

- As vacuum booster (Master Vac) is undetachable type, it should be replaced as an assembly if it does not work well.
- Be sure to adjust the stop light switch.



N5A0006E

Brake Pedal Free Play and Allowance

Standard value

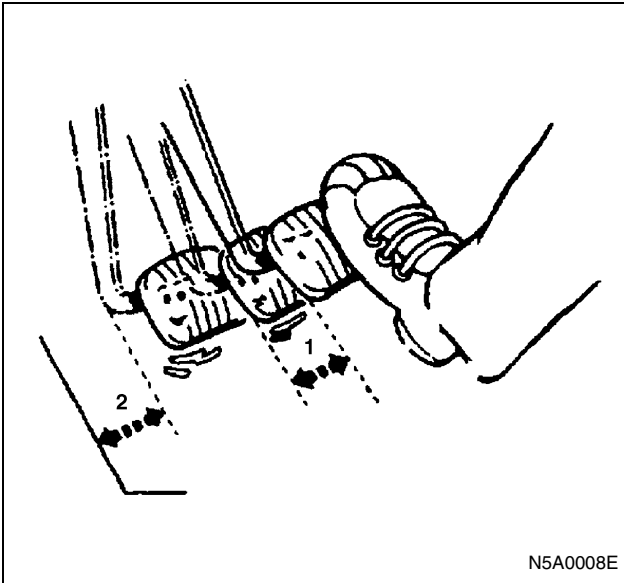
- Free play: 4 to 7 mm (0.16 to 0.28 in)
24 to 29 mm (0.94 to 1.14 in) for HBB type

2. Allowance		mm (in)	
NHR	Front Drum Brake	50 (1.97)	
NKR	Front Disc Brake Model	40 (1.57)	
	Front Drum Brake Model	Less than GVM 6.5 ton	60 (2.36)
		GVM 6.5 ton	40 (1.57)
NPR NQR	Front Disc Brake Model	40 (1.57)	
	Front Drum Brake Model	Less than GVM 6.5 ton	60 (2.36)
		GVM 6.5 ton or more	40 (1.57)
NPS	Front Drum Brake	40 (1.57)	

(When depressed with force of the 490 N (50 kg / 110 lbs).)

NPR, NQR (HBB type)	Front Disc Brake Model	35 (1.38)
	Front Drum Brake Model	45 (1.77)

(When depressed with force of the 294 N (30 kg / 66 lbs).)

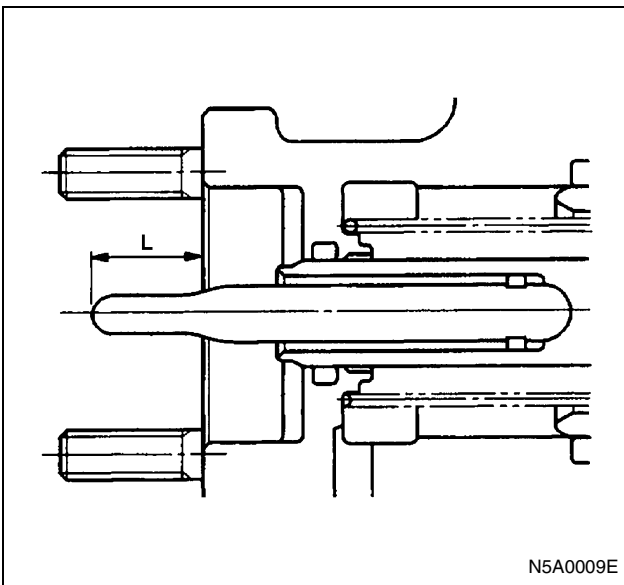


N5A0008E

Hydraulic Booster Type

Push Rod Length

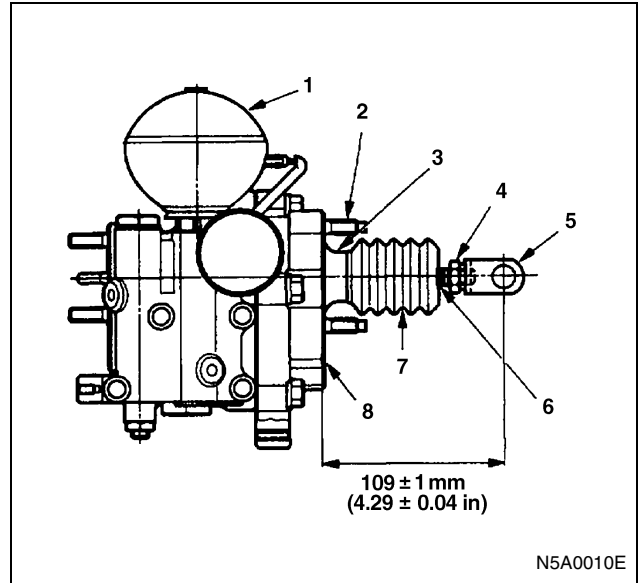
- Use a scale to measure the push rod length (push rod to flange face clearance). Push Rod Length "L" to 17.95 — 18.2 mm (0.707 — 0.717 in). If the push rod length is not equal to the specification, the hydraulic booster assembly must be replaced.



N5A0009E

Operating Rod Length

- Loosen the jam nut at the stop light switch.
- Loosen the jam nut on the hydraulic booster operating rod.
- Turn the operating rod until the distance from the center of clevis pin hole to mounting surface of the brake pedal bracket should be set at 109 ± 1 mm (4.29 ± 0.04 in). When fixed under this condition, there is no need to adjust the brake pedal height and free play.



N5A0010E

Legend

- Accumulator
- Stud bolt
- Cover boss
- Lock nut
- Clevis
- Operating rod
- Guard
- Flange

- Tighten the operating rod jam nut.

Tighten:

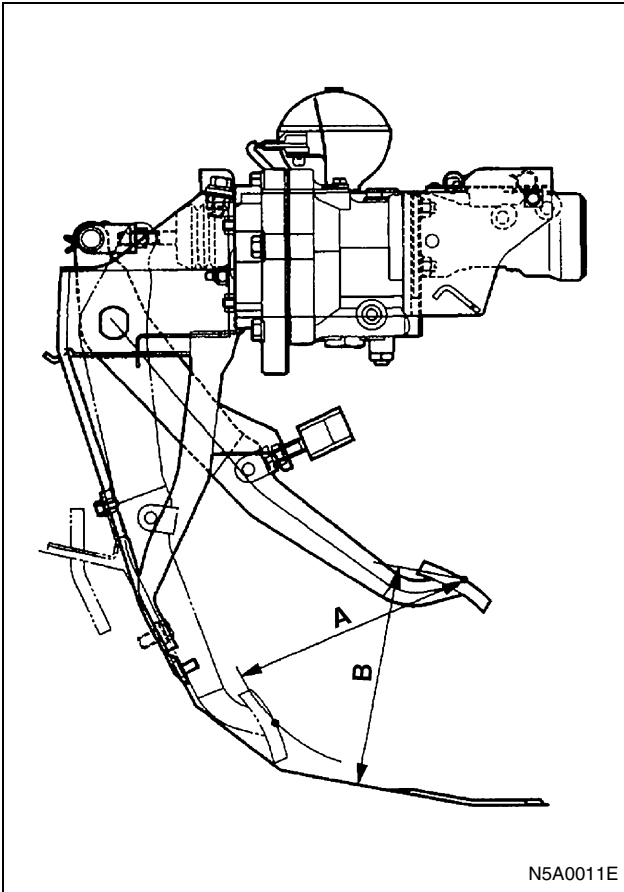
Jam nut to 20 N·m (2.0 kg·m / 14 lb·ft)

- Stop light switch so that the end of the switch threaded portion contacts the brake pedal, then back off the switch 1/2 turn.

Tighten:

Stop light switch locknut to 20 N·m (2.0 kg·m / 14 lb·ft)

- Check light pedal operation to be sure that it is operating properly.
 - Measure the brake pedal free play, after reducing the pressure of the hydraulic oil in the accumulator by pedal operations at least 10 times with engine off. Brake pedal normal play is between 21 — 24 mm (0.83 — 0.94 in).
 - Pressing the brake pedal with a force of 294 N (30 kg / 66 lb) with the engine on, the clearance between the brake pedal and floor panel is more than 35 mm (1.4 in).
 - Brake pedal height "B" is 167 mm (6.58 in) (reference).
 - Brake pedal travel "A" is between 180 ± 5 mm (7.09 ± 0.2 in) (reference).



Legend

- A. Pedal travel
(Reference).....180 ± 5 mm (7.09 ± 0.2 in)
- B. Pedal height
(Reference).....167 mm (6.58 in)

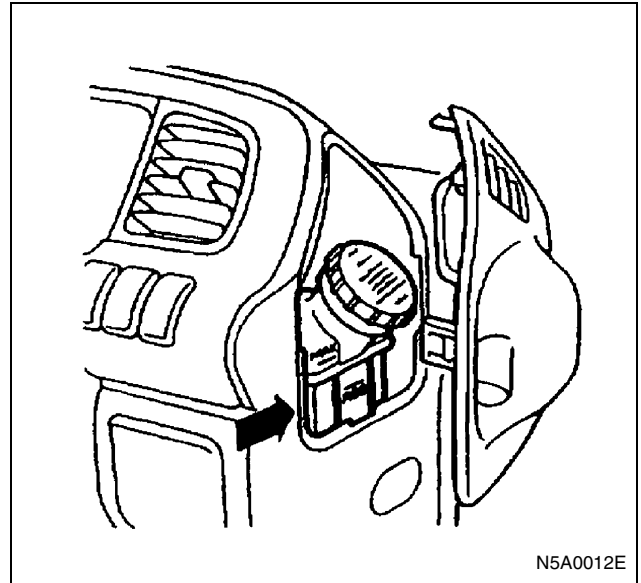
Brake Bleeding

Brake Bleeding Precautions

Air in the brake hydraulic circuit will result in dangerous reduced braking efficiency.

The brake hydraulic circuit must be bled whenever the vehicle has been operated with the reservoir brake fluid level at an excessively low level or any time the brake pipes have been disconnected in the course of brake servicing.

The brake bleeding procedure requires the cooperative action of two men.



Brake Bleeding Procedure

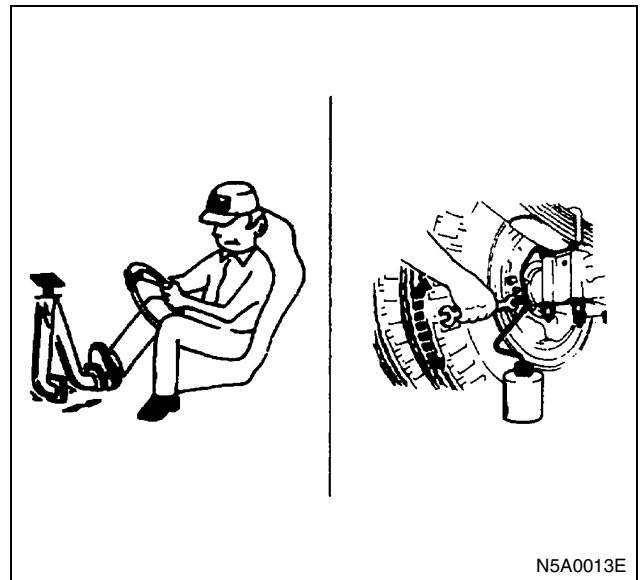
Bleed the brake hydraulic circuit in the following sequence.

LHD

Left-hand rear wheel (vehicle equipped with ABS) → Right-hand rear wheel → DSPV or LSPV → (If so equipped) → Right-hand front wheel → Left-hand front wheel

RHD

Left-hand rear wheel (vehicle equipped with ABS) → Right-hand rear wheel → DSPV or LSPV (If so equipped) → Left-hand front wheel → Right-hand front wheel



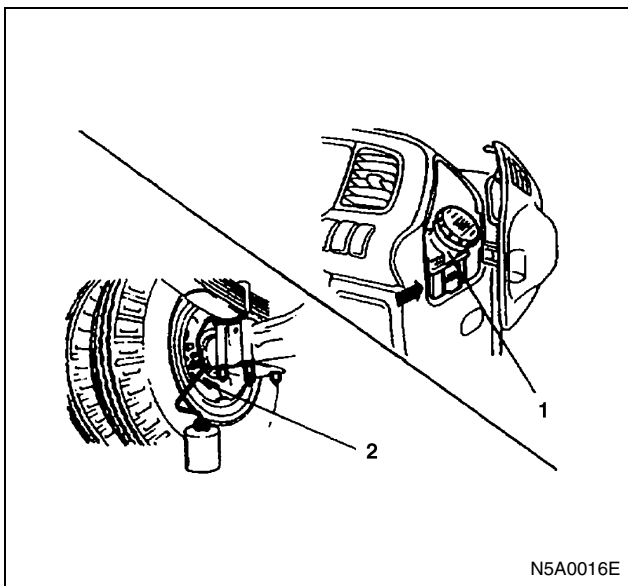
1. Check to make sure that the service area is well ventilated.
Apply the parking brake firmly. Start the engine and allow it to run until the vacuum pressure rises sufficiently.

Notice:

Brake booster (master-vac) will be adversely effected if bleeding operation is performed without running engine.

If the vehicle is equipped with ABS, be sure to remove the ABS fuse (60 A) from the fuse box before beginning the air bleeding procedure. If this is not done, air is not bled completely from ABS unit, so that ABS unit will be broken. (Be sure to install the ABS fuse (60 A) in specified position when the air bleeding procedure is completed.)

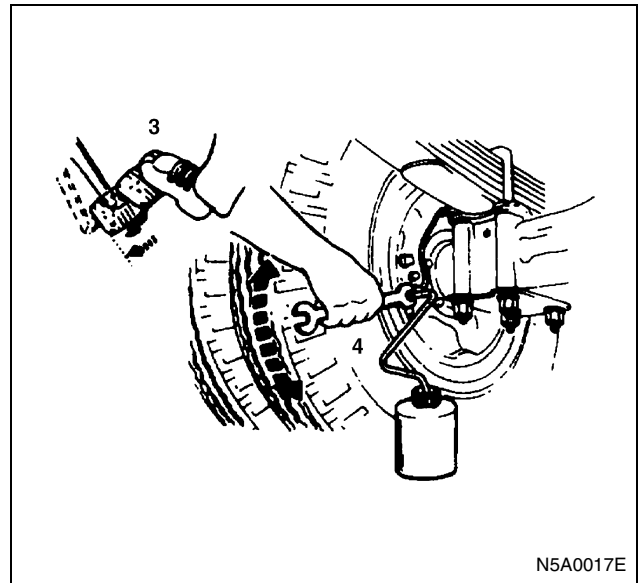
2. Fill the brake fluid reservoir (1) up to the "MAX" level with clean brake fluid.
It may be necessary to replenish the brake fluid reservoir several times during the bleeding procedure to maintain the required level of brake fluid.



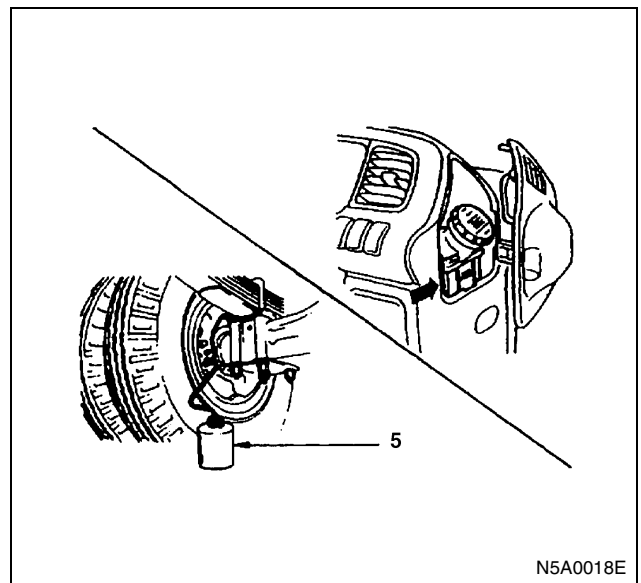
Notice:

Pour the brake fluid carefully so as not to produce air bubbles.

3. Remove the right hand rear wheel cylinder (left hand rear wheel cylinder if ABS is equipped) bleeder screw rubber cap and wipe it clean.
4. Connect one end of a vinyl tube (2) to the bleeder screw.
5. Insert the other end of the vinyl tube into a transparent container approximately 1/3 full of brake fluid.
6. Depress the brake pedal (3) slowly 3 times and hold it depressed.



7. Loosen the bleeder screw (4) approximately 1/2 of a turn.
This will release the brake fluid with air bubbles into the transparent container (5).



8. When the brake fluid being released into the transparent container is completely free of air bubbles, retighten the bleeder screw (4).
9. Slowly release the brake pedal.
10. Replace the bleeder screw rubber cap.

Notice:

In order to bleed the air completely from the brake line, repeat the above procedures.

Bleeding of the brake fluid circuit should be performed for front wheel 10 times or more, for rear wheel 15 times or more.

11. Repeat Steps 3 through 10 for each bleeder screws as mentioned before.
12. After the air bleeding procedure is finished in all wheels, depress the brake pedal, and verify wheth-

er there is no abnormality in operation of the brake system.

13. After the air bleeding procedure for individual wheel is completed, inspect the fluid level of the reservoir tank. If it is insufficient, replenish brake fluid. Do not overfill above "MAX" level.
14. Stop the engine.

Hydraulic Booster Line Bleeding

Bleeding Precautions

After removing the hydro boost assembly or piping and making repairs, do not run the vehicle until you perform the below-described air bleeding and then verify that everything is normal, including hydro boost boosting and accumulator operation.

Bleeding Procedure

1. Attach the hydro boost and the master cylinder to the vehicle and connect the piping.
2. Fill the hydro boost reservoir with hydraulic oil between its minimum and maximum range.
3. Turn the engine on for about 5 seconds.
4. Then turn the engine off and check the quantity of hydraulic oil in the reservoir.
5. If the hydraulic oil is below the minimum, pour in more hydraulic oil so that it is in the range from minimum to maximum.
6. Repeat the above steps 2 — 5 until there is no foaming or change in the level of the hydraulic oil in the reservoir. But if the hydraulic oil foams during the above steps, let it stand for a while, wait for the foam to dissipate, then continue the work.
7. With the engine on, repeatedly press the brake pedal slowly about five times.
8. Then turn the engine off and check the quantity of hydraulic oil in the reservoir. If the hydraulic oil is below the minimum, once again pour in more hydraulic oil so that it is in the range from minimum to maximum.
9. Leaving the engine off, repeatedly press the brake pedal at least ten times.
10. Verify that there is no foam or change in the level of the hydraulic oil in the reservoir. If any foam remains, let it stand for a while, wait for the foam to dissipate, then repeat the above steps 7 — 9.
11. If it is necessary at this time to bleed out the air from the brake fluid pressure system, such as the master cylinder or the wheel cylinder, be sure to first complete step 10 above and make sure that the engine is on.
12. With the engine on, strongly press the brake pedal as far as the booster full load region slowly and repeatedly about 30 times (for 1 — 3 seconds each time). When doing so, do not keep the pedal at the full load region (no longer than 1 second).
13. Then turn the engine off and repeatedly press the brake pedal at least 10 times.

14. Check the state of the hydraulic oil in the reservoir, and if there is no foaming or change in the level of the oil, the operation of bleeding the air out is considered completed. If any foam remains, let it stand for a while, wait for the foam to dissipate, then repeat the above steps 12 — 13.

Notice:

Precautions when bleeding the air from the brake fluid pressure system

When doing air bleeding of the brake fluid pressure system, such as the master cylinder or wheel cylinder, verify that the air has been bled out of the hydro boost, and make sure that the engine is on.

Be aware that if air bleeding of the brake fluid system is to be done with the engine off, air bleeding cannot be done.

If air bleeding of the brake fluid pressure system is to be done at the same time as air bleeding of the hydro boost, do so when the operation of the above hydro boost air bleeding method 10 has been completed.

Supply Parts Replacement

1. The hydro boost is a precision part that operates with high-pressure hydraulic oil. Never remove any parts from the hydro boost except replacement parts.
Trouble may occur if a part other than a replacement part is removed and a non-matching part is included or the assembly is bad. For example, misoperation may occur and the brake becomes ineffective, or a bad seal may allow high-temperature hydraulic oil under high pressure to spatter and cause a burn.
2. The hydraulic oil to be used for the hydro boost is ATF DEXRON® III. Using any other hydraulic oil could adversely affect the rubber parts and cause poor operation or oil leakage.
In particular, the hydraulic oil for the hydro boost is quite different from the brake fluid that is used in the master cylinder.
Be careful that hydro boost parts do not come into contact with the brake fluid for the master cylinder, and that master cylinder parts do not come into contact with the hydraulic oil for the hydro boost.
Any mixing together of the hydraulic oil for the hydro boost and the brake fluid for the master cylinder could cause degradation such as the swelling of rubber parts, brake failure due to oil leakage or bad operation, or a serious mishap such as a vehicle fire caused by brake friction.
3. Operation of the pump while the engine is on will cause the hydro boost hydraulic oil to get hot. In particular, frequent repeated operation of the brake will sometimes increase the temperature of the hydraulic oil in the hydro boost assembly to 100°C (212°F) or more. Be careful in handling.
When performing work such as removing the hydro boost assembly from the vehicle, before starting

the work, first turn the engine off, wait 30 minutes, and verify that the temperature has cooled off.

4. Even when a long time passes after the engine is turned off, the high-pressure hydraulic oil in the accumulator of the hydro boost remains stored under pressure.

Before removing the hydro boost assembly or piping, be sure to repeatedly press the brake pedal at least ten times with the engine off, and make sure the pressure of the hydraulic oil in the accumulator has been reduced to atmospheric pressure before doing the work.

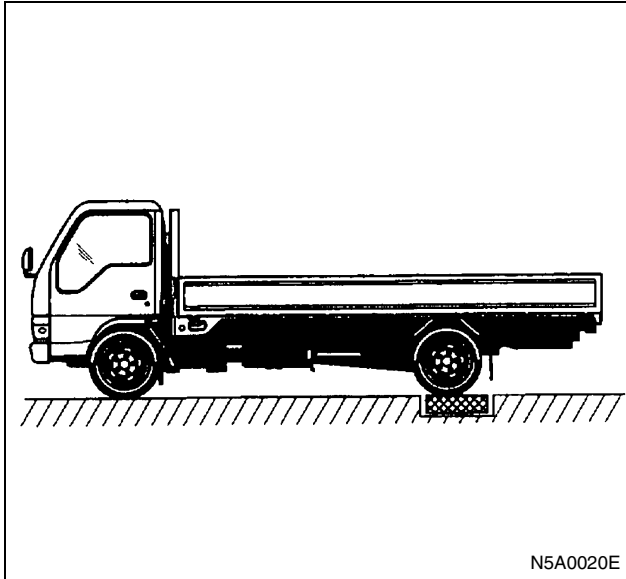
In particular, when removing the replacement-part accumulator from the hydro boost assembly, the hydraulic oil may spatter if it remains stored under high pressure inside the accumulator, so be careful of this.

Parking Brake

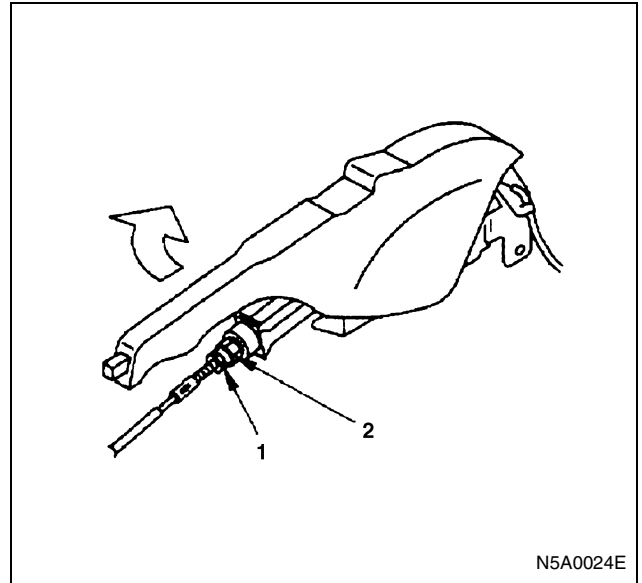
Parking Brake Adjustment

Before beginning to adjust the parking brake, park the vehicle on a level surface, chock all of the wheels, and place the parking brake lever in the released (off) position.

Then loosen the parking brake control wire lock nut (1), and turn the adjuster (2) to completely loosen the parking brake control wire.



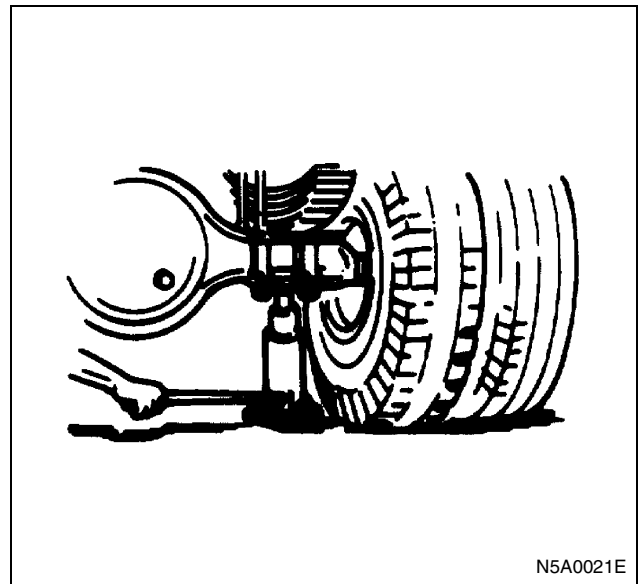
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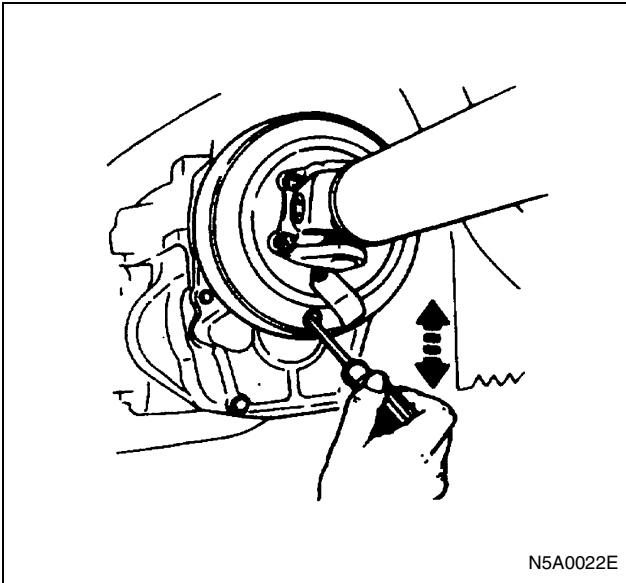
Parking Brake Lining Clearance Adjustment

1. Jack up the rear axle until the wheels can be turned freely.



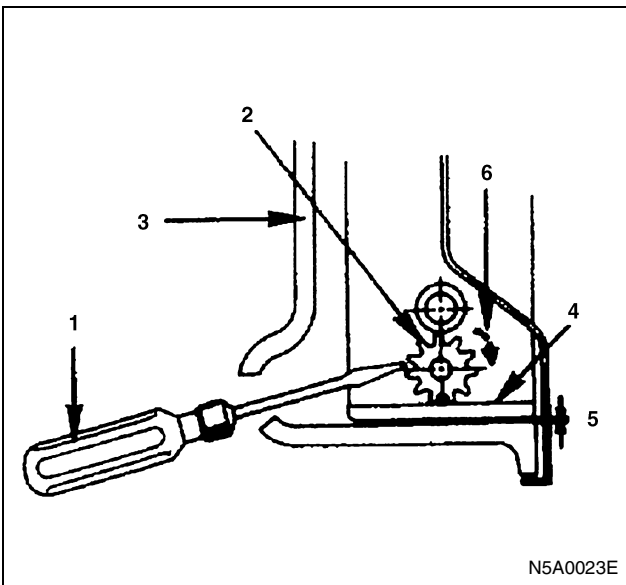
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2. Remove one of the two check hole covers from the parking brake drum.
3. Rotate the brake drum to align the check hole with the adjusting screw.
4. Move the camshaft lever from side to side several times to center the brake shoes.
5. Insert a screwdriver into the check hole and rotate the adjusting screw by pushing it upward. Continue doing this until the brake shoes begin to drag on the drum.



6. Back off the adjusting screw the specified number of notches.

Adjusting Screw Notches and Clearance		
Brake Type mm (in)	Notches	Clearance mm (in)
178 (7.008), 190 (7.480)	30	0.75 (0.029)
203.2 (8.000)	8	0.23 (0.009)



Legend

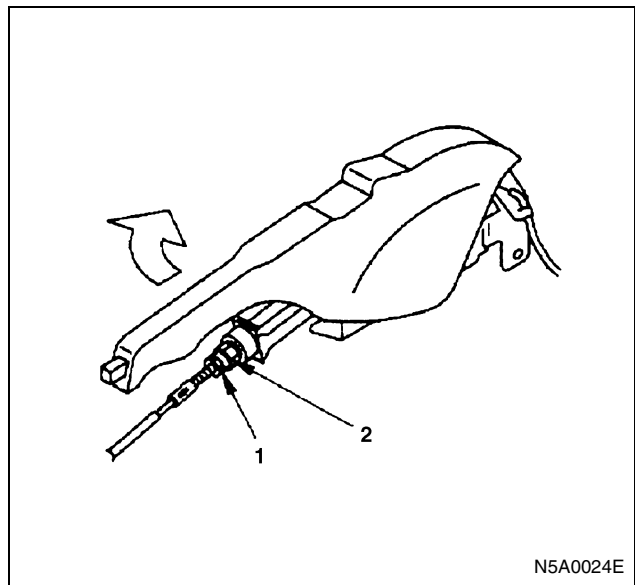
- 1. Screwdriver
- 2. Adjusting screw
- 3. Brake drum
- 4. Brake shoe
- 5. Clearance
- 6. Direction of brake shoe expansion (for 178 mm, 190 mm)
Brake Type (203 mm) is direction to the counter rotation.

- 7. Reinstall the check hole cover.
- 8. Lower the rear wheels to the floor.

Parking Brake Lever Travel Adjustment

- 1. Fully set the parking brake lever and release it several times.
Leave the parking brake lever in the released position.
- 2. Loosen the parking brake control wire lock nut (1).
- 3. Turn the adjuster (2) to adjust the lever travel to the specified notches.

Parking brake lever travel at 147 N (15 kg / 33 lbs) notches
6 to 8



- 4. Retighten the control wire lock nut (1).
- 5. Check the parking brake lever travel (measured in notches).

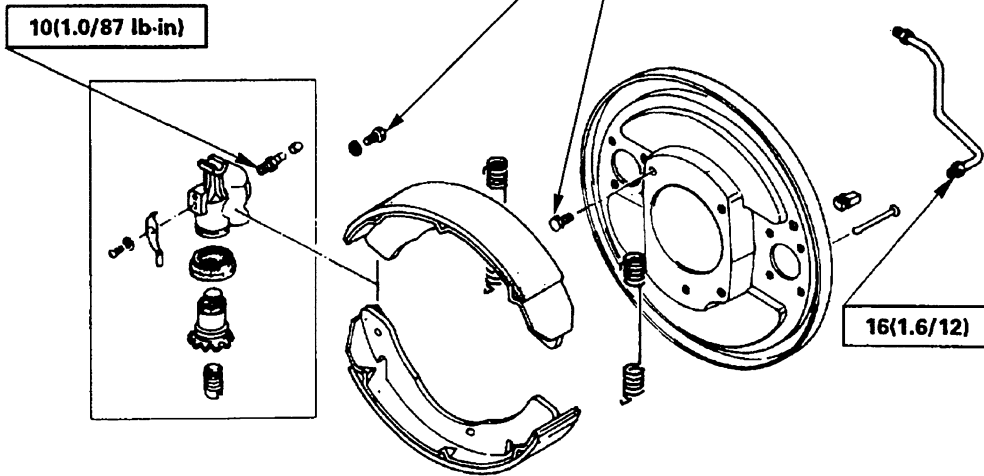
FIXING TORQUE

Front Wheel Brake (NHR / NKR / NPR / NQR)

N·m (kg·m / lb·ft)

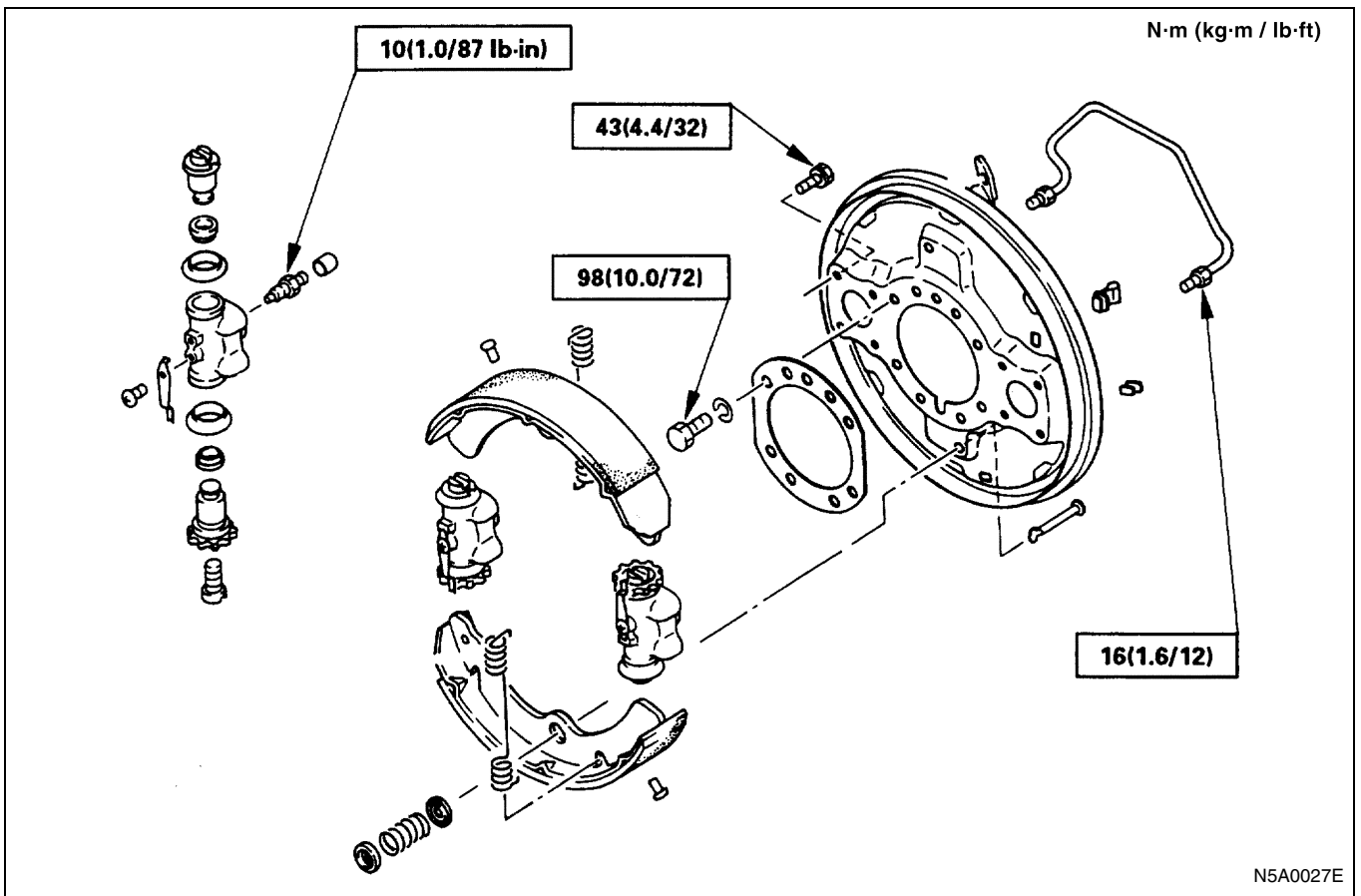
Drum Inside Dia. mm (in)	Lining Width mm (in)	Fixing Torque
279.4 (11.00)	60 (2.36)	27 (2.8 / 20)
300.0 (11.81)	75 (2.95)	34 (3.5 / 25)
320.0 (12.60)		43 (4.4 / 32)
320.0 (12.60)	100 (3.94)	74 (7.5 / 54)
320.0 (12.60)	120 (4.72)	94 (9.5 / 69)

Lining Width mm (in)	Fixing Torque
60 (2.36)	88 (9.0 / 65)
75 (2.95)	
100 (3.94)	
120 (4.72)	157 (16.0 / 116)



N5A0026E

Front Wheel Brake (NPS)



Rear Wheel Brake (Except Drum Inside Diameter 370 mm)

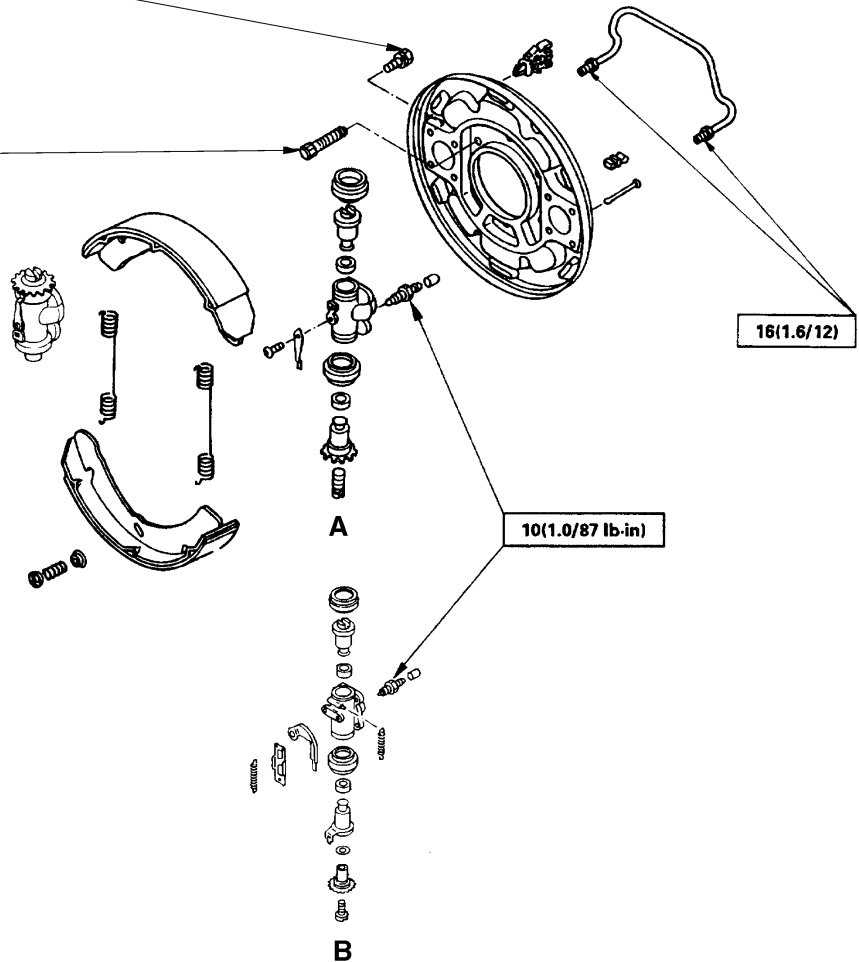
N·m (kg·m / lb·ft)

Drum Inside Dia. mm (in)	Lining Width mm (in)	—
228.6 (9.00)	75 (2.95)	34 (3.5 / 25)
240 (9.45)	60 (2.36)	25 (2.5 / 18)
279.4 (11.00)	60 (2.36)	27 (2.8 / 20)
290 (11.42)	75 (2.95)	25 (2.5 / 18)
300.0 (11.81)	75 (2.95)	34 (3.5 / 25)
320.0 (12.60)	75 (2.95)	43 (4.4 / 32)
	100 (3.94)	74 (7.4 / 55)
	120 (4.72)	94 (9.6 / 69)
260 (10.24)	90 (3.54)	43 (4.4 / 32)

Drum Inside Dia. mm (in)	Lining Width mm (in)	—
228.6 (9.00)	75 (2.95)	108 (11.0 / 80)
240 (9.45)	60 (2.36)	108 (11.0 / 80)
279.4 (11.00)	60 (2.36)	74 (7.5 / 54)
290 (11.42)	75 (2.95)	108 (11.0 / 80)
300.0 (11.81)	75 (2.95)	* 44 (4.5 / 33) **108 (11.0 / 80)
320.0 (12.60)	75 (2.95)	108 (11.0 / 80)
	100 (3.94)	108 (11.0 / 80)
	120 (4.72)	157 (16.0 / 116)
260 (10.24)	90 (3.54)	108 (11.0 / 80)

*1

**2



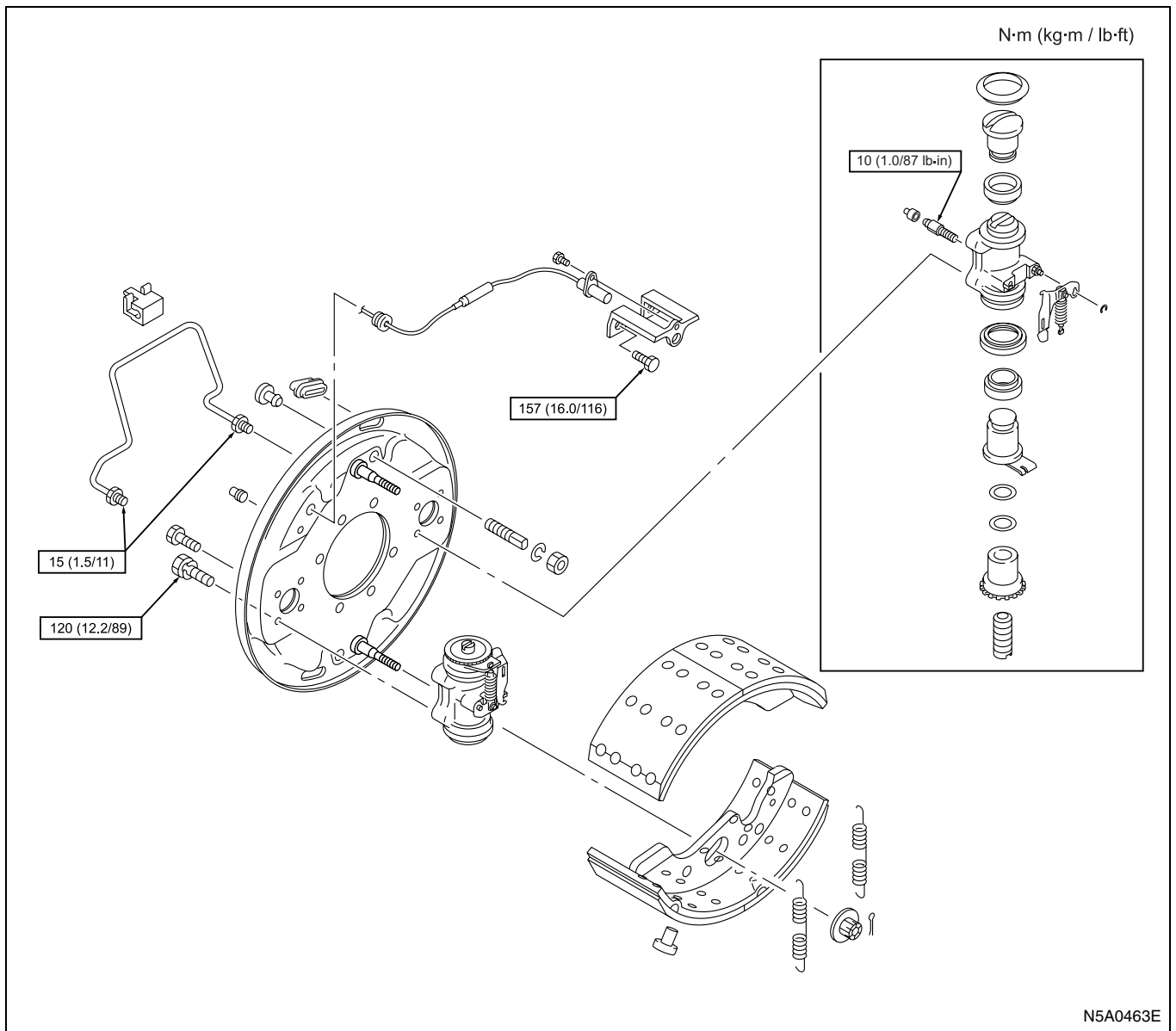
Legend

- A. Without auto-adjuster
- B. With auto-adjuster

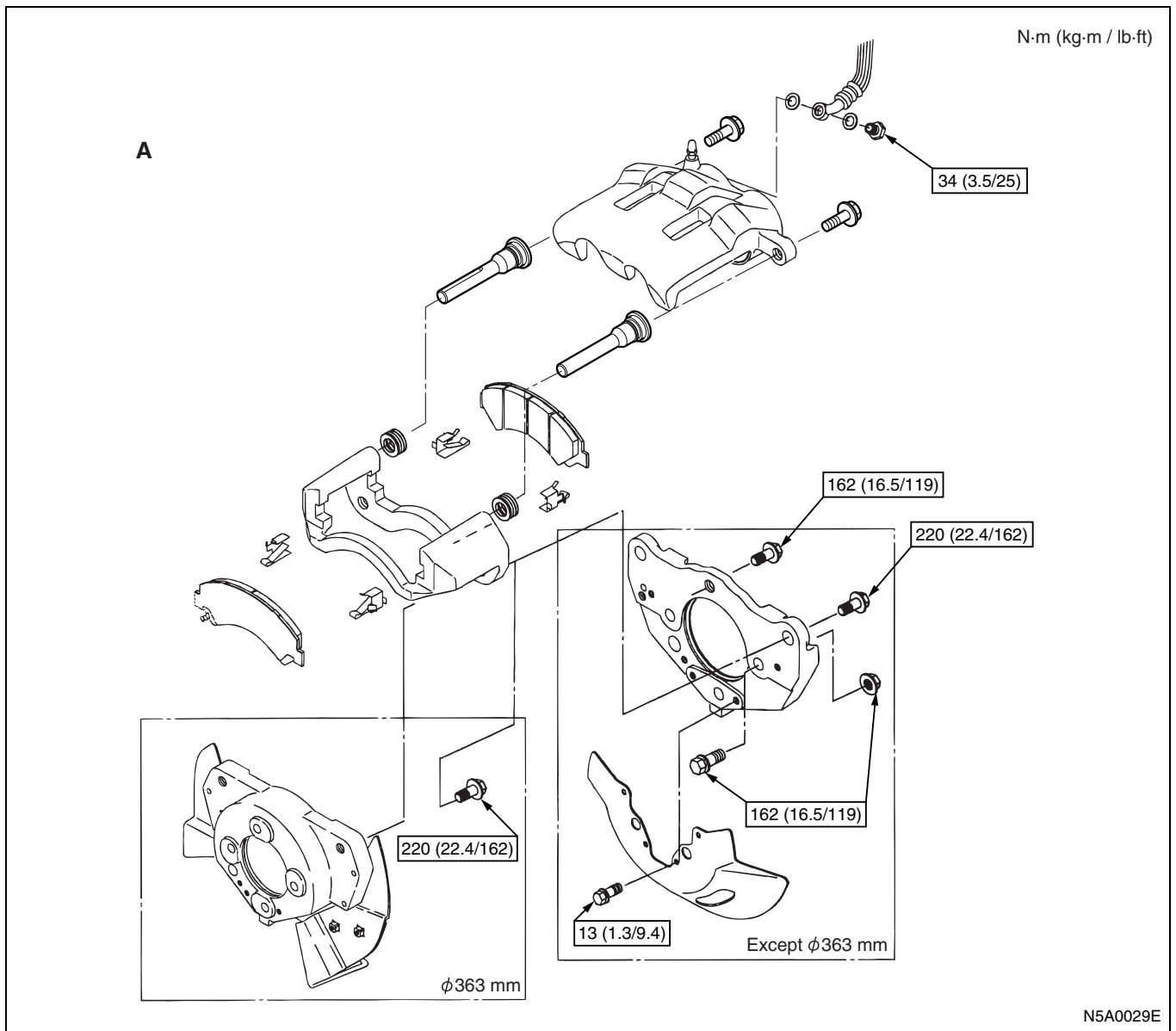
- 1. Single tire models
- 2. Dual tire models

N5A0028E

Rear Wheel Brake (Drum Inside Diameter 370 mm)



Front Disc Brake (NKR / NPR / NQR)



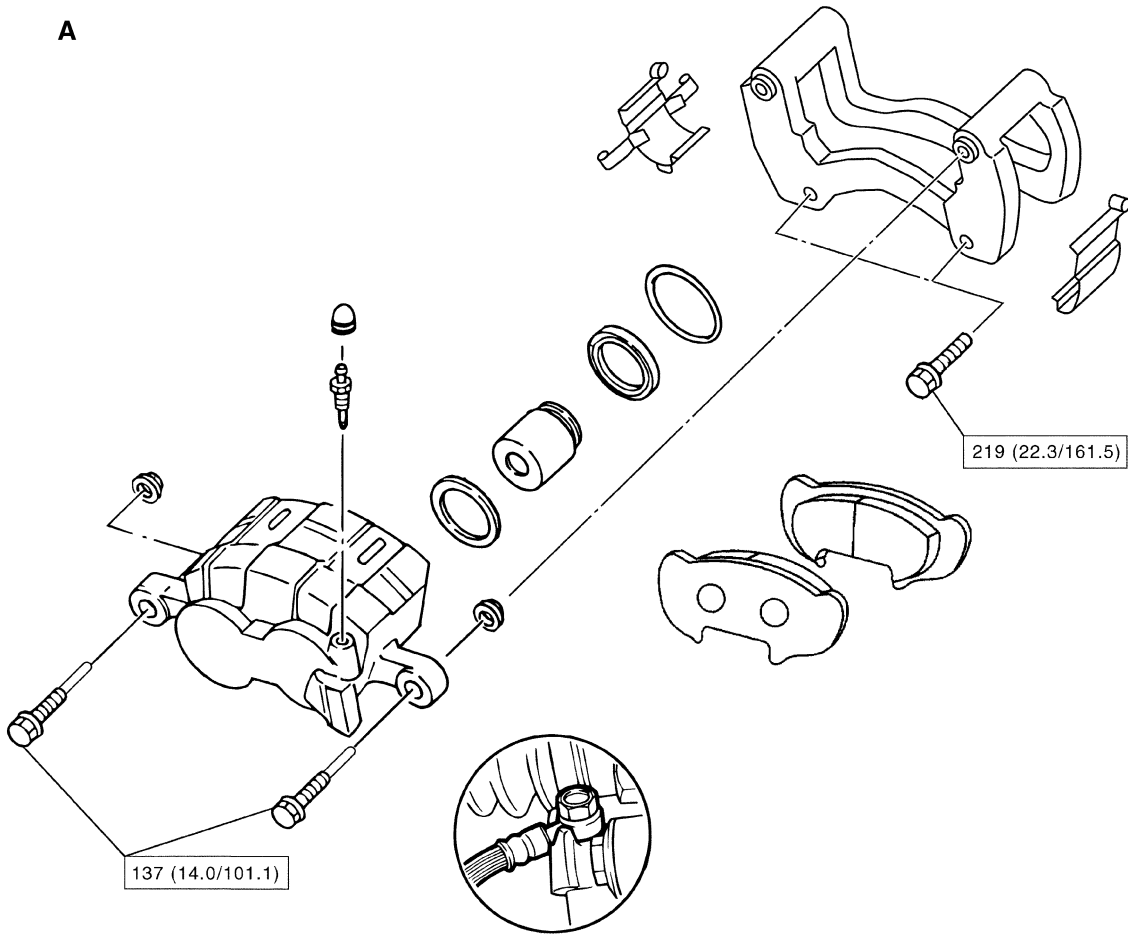
Legend

A. Leaf spring suspension models (Rigid axle type)

Front Disc Brake (NKR)

N·m (kg·m / lb·ft)

A



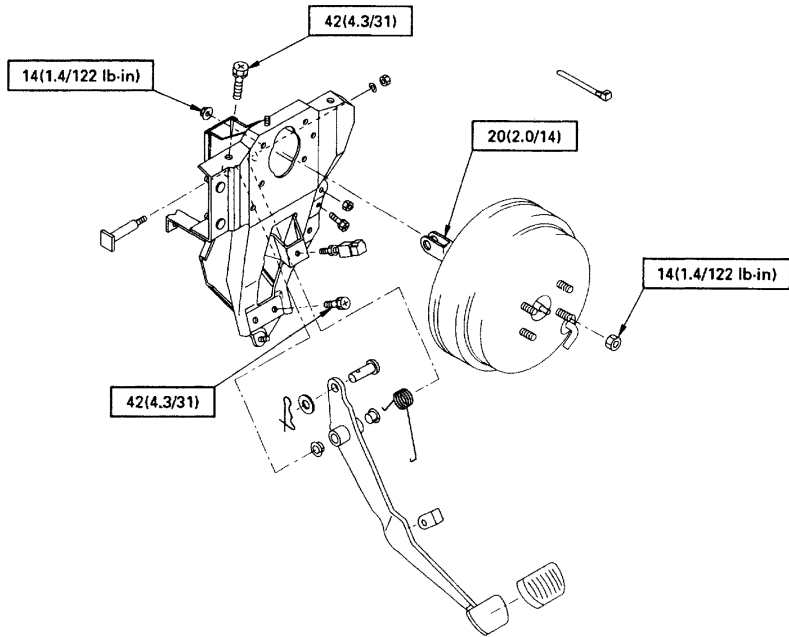
N5A0030E

Legend

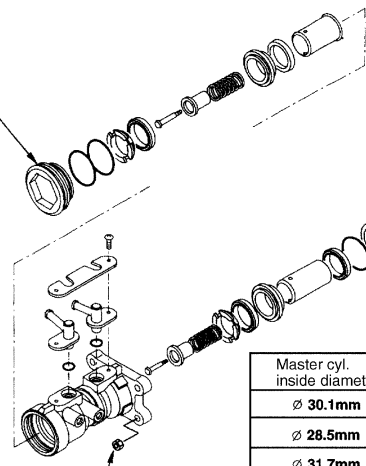
A. Independent suspension models

Brake Pedal and Control (Vacuum Booster Type)

N·m (kg·m / lb·ft)



Master cyl. inside diameter	
∅ 30.1mm	44 (4.5/33)
∅ 28.5mm	40 (4.1/30)
∅ 31.7mm	44 (4.5/33)
∅ 34.9mm	49 (5.0/37)



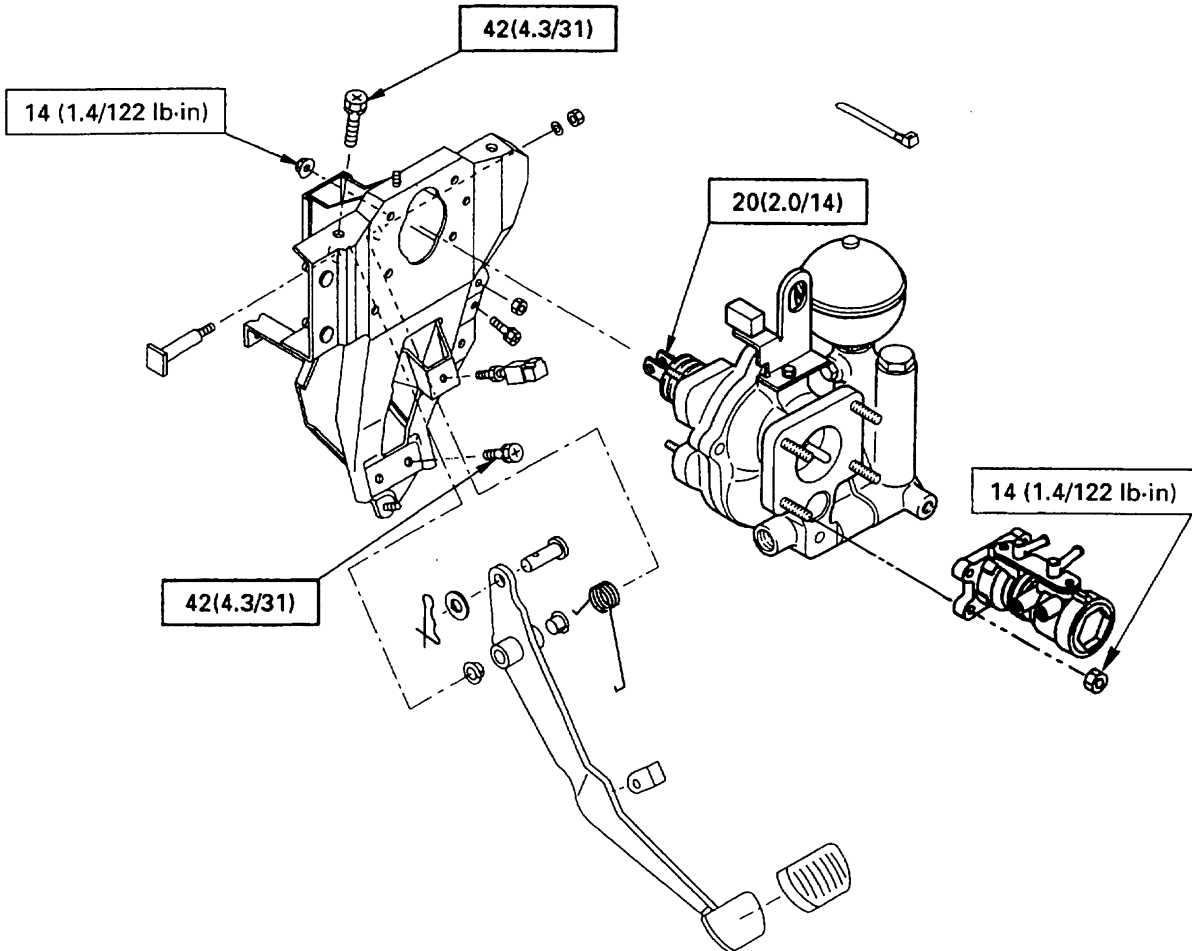
14(1.4/122 lb-in)

Master cyl. inside diameter	
∅ 30.1mm	44 (4.5/33)
∅ 28.5mm	40 (4.1/30)
∅ 31.7mm	44 (4.5/33)
∅ 34.9mm	49 (5.0/37)

N5A0031E

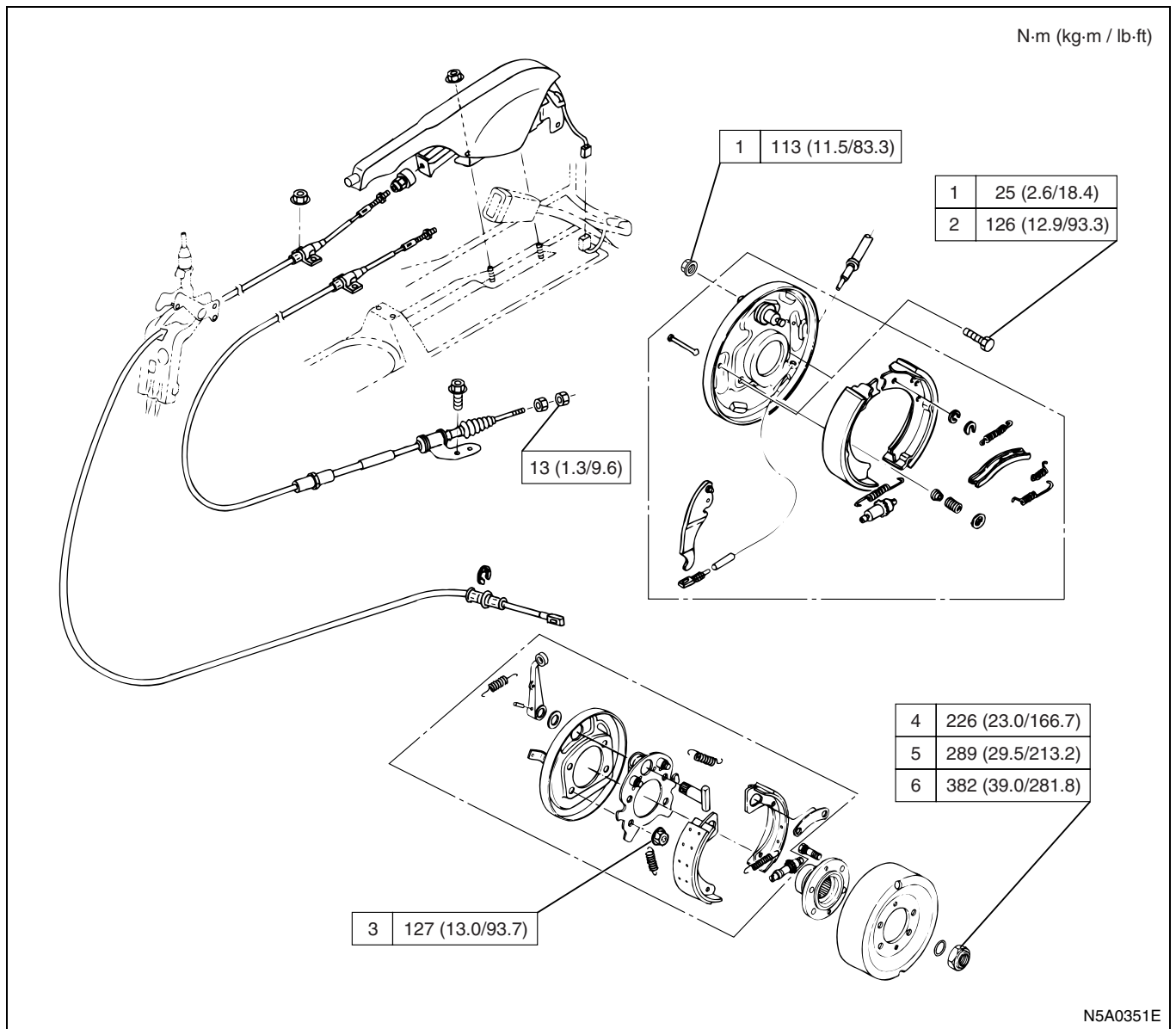
Brake Pedal and Control (Hydraulic Booster Type)

N·m (kg·m / lb·ft)



N5A0032E

Parking Brake

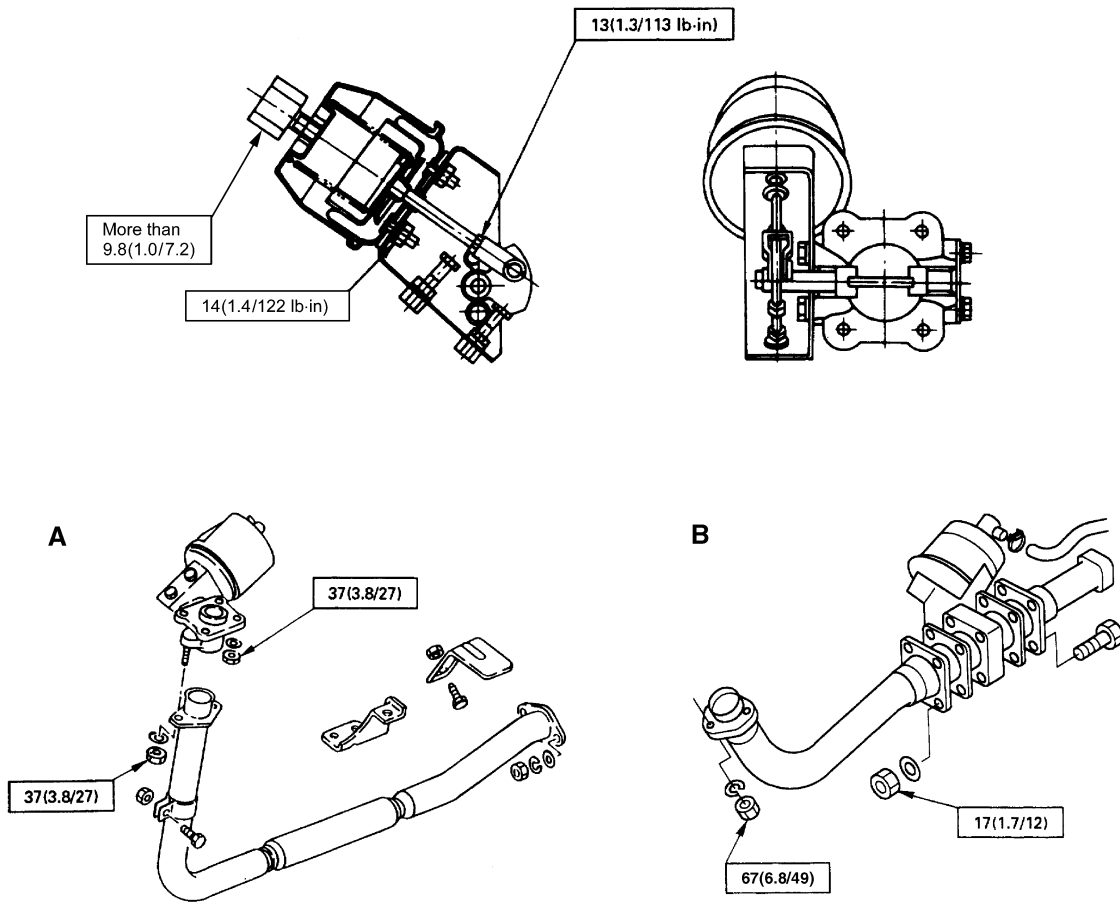


Legend

- | | |
|--------------------------------|--------------------------|
| 1. ϕ 178 mm parking brake | 4. MSB type transmission |
| 2. ϕ 190 mm parking brake | 5. MYY type transmission |
| 3. ϕ 203 mm parking brake | 6. MZZ type transmission |

Exhaust Brake

N·m (kg·m / lb·ft)



N5A0465E

Legend

A. 4J engine without turbocharger

B. 4J engine with turbocharger and 4H engine

SPECIAL TOOLS

Hydraulic Brakes

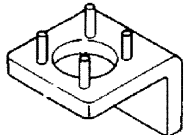
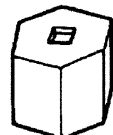
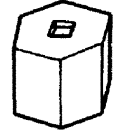
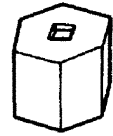
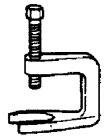

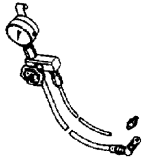
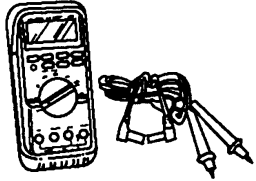
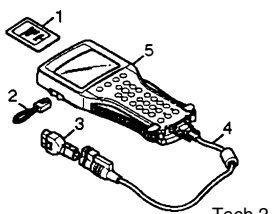
Illustration	Tool Number / Description / Remarks
 5884023710	5-8840-2371-0 / Master cylinder support plate
 5884023700	5-8840-2370-0 / Wrench (Cylinder inside diameter 30.1 mm, 31.7 mm)
 5884023690	5-8840-2369-0 / Wrench (Cylinder inside diameter 28.5 mm)
 5884028050	5-8840-2805-0 / Wrench (Cylinder inside diameter 34.9 mm)
 5884022150	5-8840-2215-0 / Remover: steering wheel
 9852200260	9-8522-0026-0 / Return spring plier

Illustration	Tool Number / Description / Remarks
 5884021900	5-8840-2190-0 / Pressure gauge: brake fluid

Anti-lock Brake System (ABS)

Illustration	Tool Number / Description / Remarks
 5884002850	5-8840-0285-0 (J-39200) / High impedance multimeter
 Tech 2	1. PCMCIA Card 2. RS232 Loop Back Connector 3. SAE 16/19 Adapter 4. DLC Cable 5. Tech 2

Parking Brakes

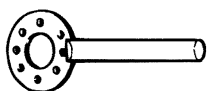
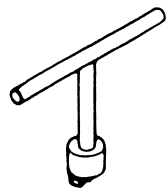

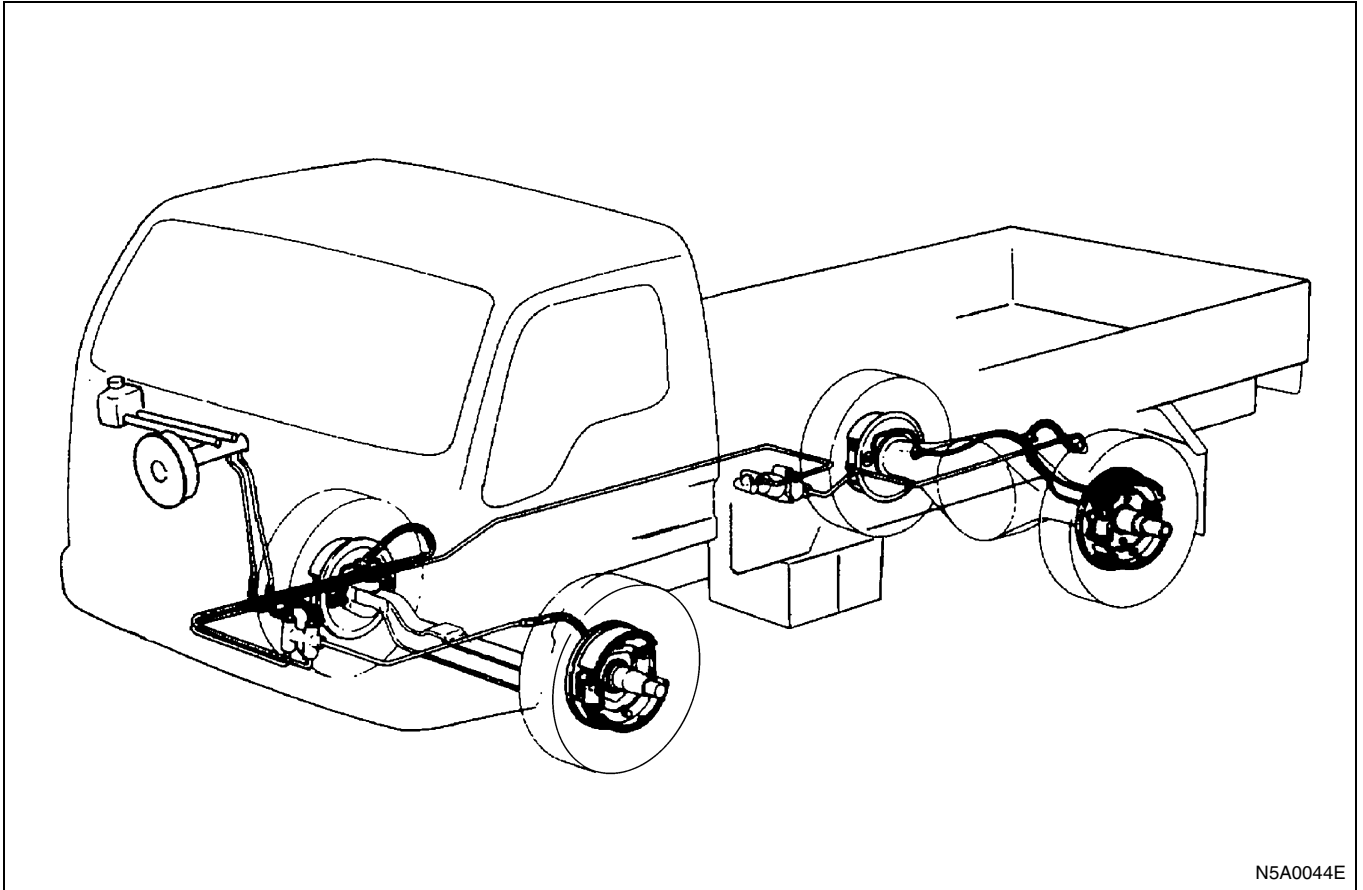
Illustration	Tool Number / Description / Remarks
 5884020430	5-8840-2043-0 / Flange holder
 1852370020	1-8523-7002-0 / Return spring remover

Illustration	Tool Number / Description / Remarks
 <p>9852212310</p>	<p>9-8522-1231-0 / Return spring setting tool</p>

HYDRAULIC BRAKES

GENERAL DESCRIPTION

Hydraulic Brake System

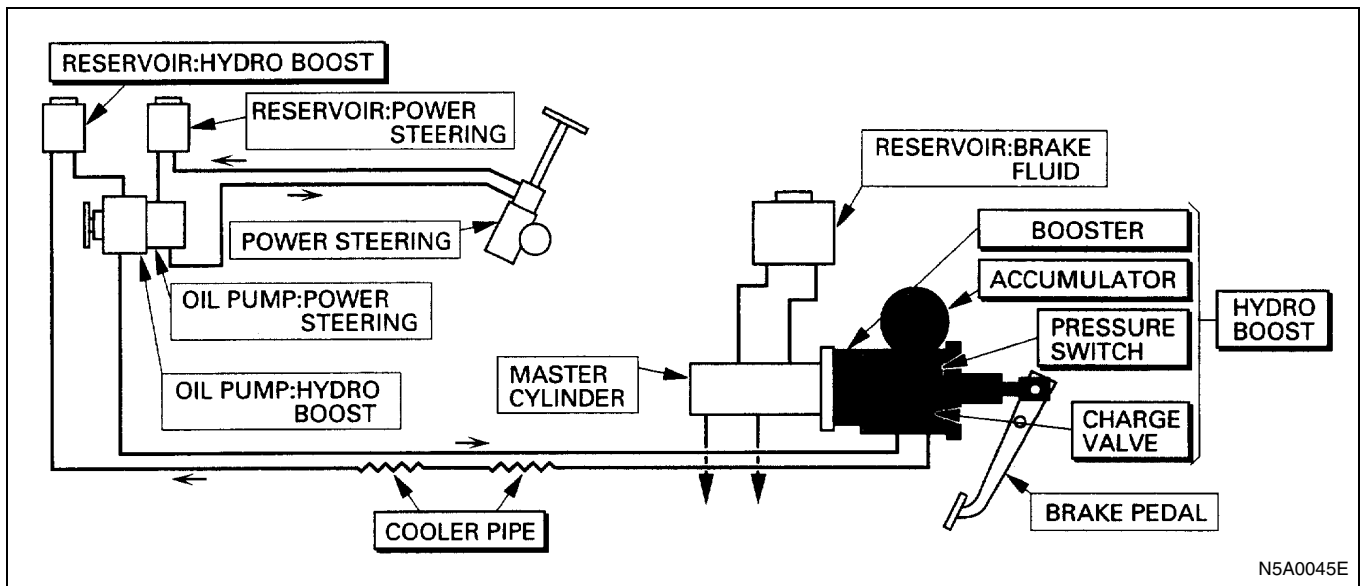


The brake system has dual hydraulic circuit with vacuum booster (Master-vac).

The master cylinders and the wheel cylinders at the front and rear of the vehicle are connected by steel piping and flexible hoses.

The vacuum booster is connected to the vacuum pump through the vacuum tank. This provides the most effective vacuum assist.

Hydraulic Booster Brake system



N5A0045E

The hydro boost system, which functions as a brake force boosting device that allows the brake to be operated with less force than otherwise, includes the hydro boost, which has the booster, accumulator, charge valve, and pressure switch in an integrated structure, a reservoir, and a cooler pipe.

Functions of the Main Constituent Parts

Booster:

Controls the hydraulic oil ejected from the oil pump and amplifies the force on the pedal.

Accumulator:

Accumulates the hydraulic oil under pressure for the boosting operation after the pump stops.

Charge valve:

Performs switching operation and feeds the hydraulic oil to the accumulator when the accumulator oil pressure declines.

Pressure switch:

Detects that the accumulator oil pressure has declined to the warning set pressure and operates the warning buzzer.

Oil pump:

Is driven by the engine rotation and feeds the hydraulic oil to the hydro boost through the piping.

Reservoir:

The pump stores the hydraulic oil for doing suction and expulsion.

Cooler pipe:

Located before the radiator, facilitates heat radiation of the hydraulic oil in the system piping, and inhibits an increase in the temperature of the oil.

Other units relating to this system include, as shown in the figure, the power steering, the pump and reservoir for the power steering, the master cylinder, which receives the output of the hydro boost and activates the brake, the reservoir for the master cylinder, and the brake pedal that activates the booster.

The master cylinder is integrally bolted to the booster of the hydro boost. The pump for the power steering is integrated as a tandem pump that shares the hydro boost pump and the drive unit. But as systems, the hydro boost and the power steering are independent of each other, and their reservoirs are separate as well.

Booster Assembly

The hydraulic booster is a device that applies force to the master cylinder when the brake pedal is applied. The fluid flowing through the booster head is controlled by brake pedal movement.

The hydraulic booster cylinder rod attaches to a piston that connects with the spool valve. This assembly moves when brake pedal pressure is applied. The spool valve restricts fluid flow and builds pressure on one side of the piston. The pressure overcomes the return spring and moves the piston to a balanced position. As the piston moves, it pushes the cylinder rod and applies pressure to the master cylinder.

A relief valve inside the pump limits the pressure to 11,770 kPa (120 kg/cm² / 1707 psi). This pressure level provides good braking without damaging the brake pipes or hoses. When actuated, the relief valve allows fluid to bypass the piston.

Fluid and Fluid Handling

This system uses no special fluids. However, care must be taken to use the correct fluids. The master cylinder and brake system uses brake fluid, while the hydraulic brake booster pump uses power steering fluid.

Substandard or Contaminated Fluid

Notice:

Hydraulic brake systems use two distinct and incompatible fluids. Power steering fluid is used in the hydraulic booster brake system. Brake fluid is used in the master cylinder and brake pipes to the wheels. Be extremely careful when selecting brake system fluids or seal damage can result. Refer to Section 0B MAINTENANCE AND LUBRICATION to select the correct fluid.

Notice:

Do not reuse brake system fluids. Do not mix power steering fluid with brake fluid. Swelling and deterioration of rubber parts can result from fluid contamination. This can lead to reduced brake performance and the eventual loss of braking capability.

Contaminated fluid causes swelling and deterioration of rubber parts that can lead to reduced brake performance and the eventual loss of braking capability. Check the condition of the fluid at regular intervals and note any unusual consistency, color, and signs of contaminants in the fluid. Do not reuse brake system fluids. Always discard used fluids. Do not mix power steering fluid with hydraulic brake fluid. If contamination occurs, flush the hydraulic booster system with clean power steering fluid.

Booster components bench servicing should be done in a clean work area separated from the brake servicing area. Wash hands before changing between brake or booster work areas. Do not use the same containers for fluids.

Flushing the Hydraulic Booster System

Flushing is required when dirt, sludge, or water is found in the system. Flushing involves running clean fluid through the system until the draining fluid appears the same as clean fluid.

Contaminated fluid in the booster system can cause rubber parts to deteriorate.

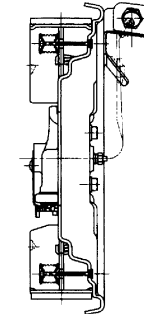
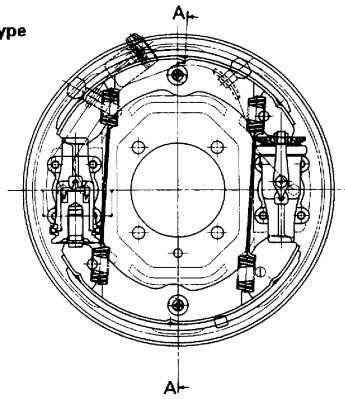
The hydraulic booster system should be cleaned and flushed when the hydraulic pump is replaced.

Metal shavings from a worn hydraulic pump often contaminate the system. Pipes and hoses should be removed and blown clean of all metal shavings.

Front Drum Brake

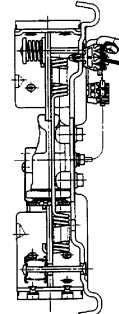
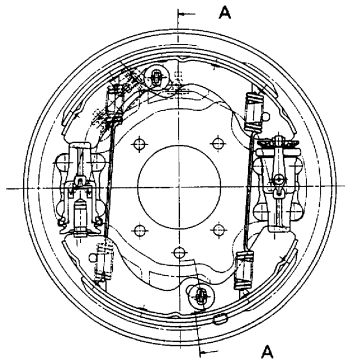
Drum Inside Diameter

279.4 & 300 mm - 2L Type



Section A-A

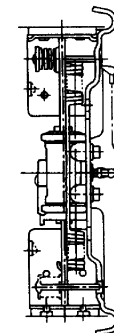
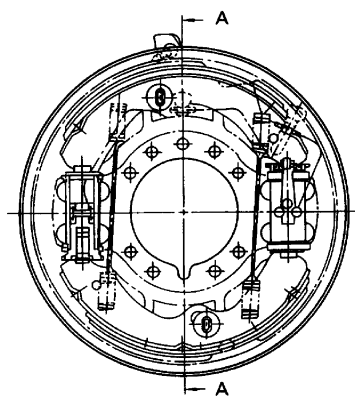
320 mm - 2L Type



Section A-A

N5A0047E

NPS



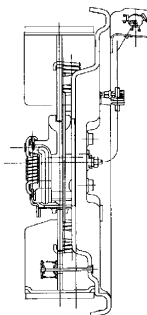
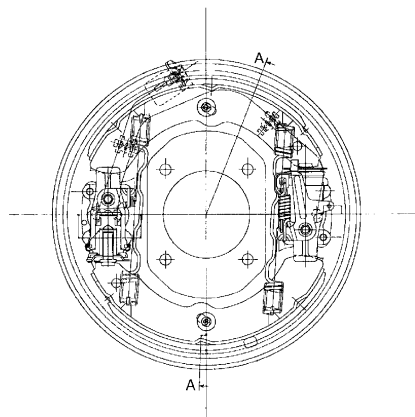
Section A-A

N5A0048E

Front Drum Brake (Auto-adjuster Type)

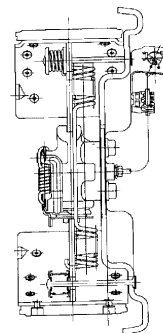
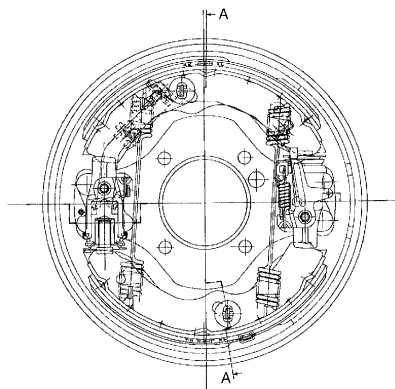
Drum Inside Diameter

300mm - 2L Type



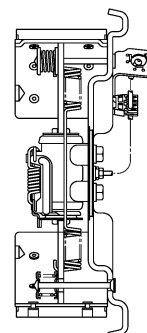
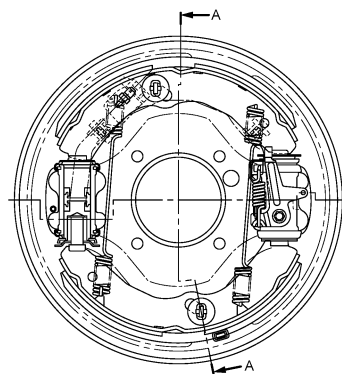
Section A-A

320mm - 2L Type



Section A-A

320mm - D2L Type

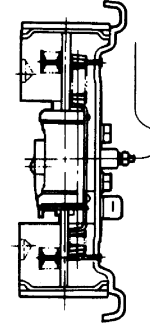
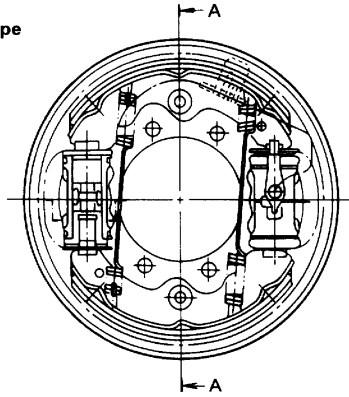


Section A-A

Rear Drum Brake (Manual Adjuster Type)

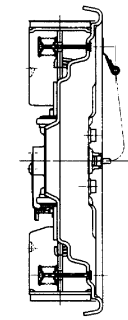
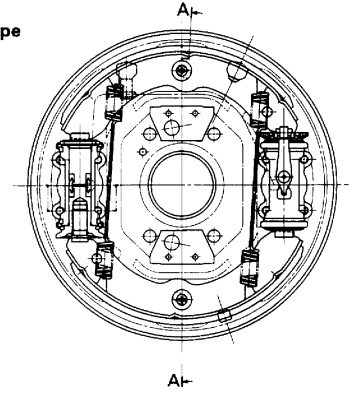
Drum Inside Diameter

228.6 mm – D2L Type



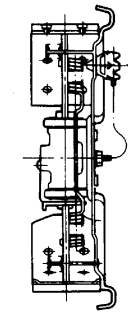
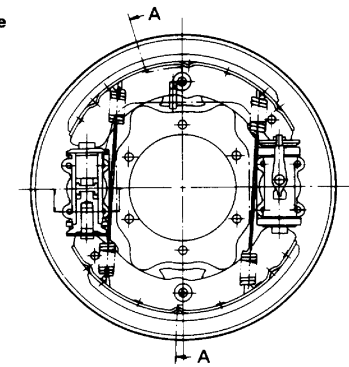
Section A-A

279.4 mm – D2L Type



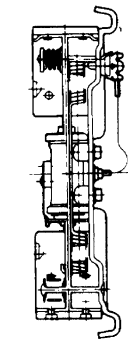
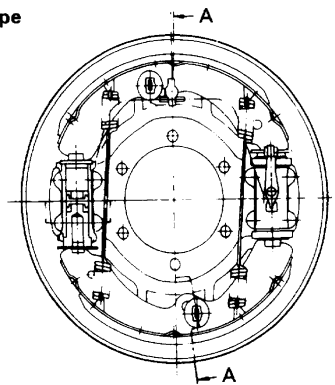
Section A-A

300 mm – D2L Type



Section A-A

320 mm – D2L Type



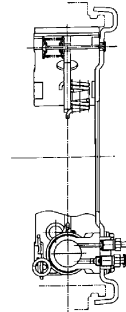
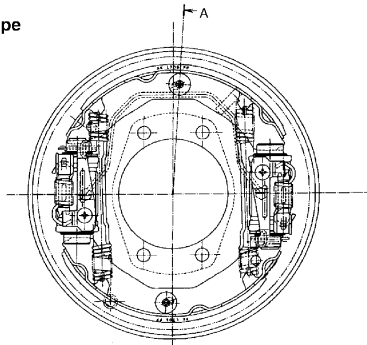
Section A-A

N5A0050E

Rear Drum Brake (Auto-Adjuster Type)

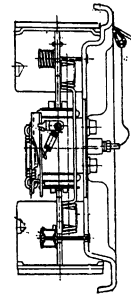
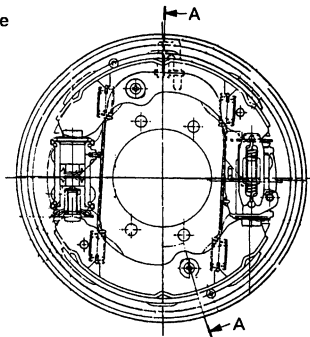
Drum Inside Diameter

240mm - D2L Type



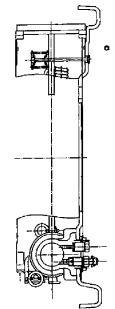
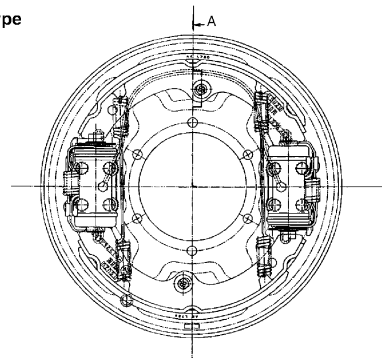
Section A-A

260mm - D2L Type



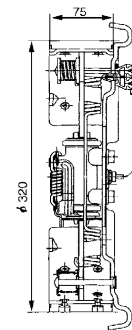
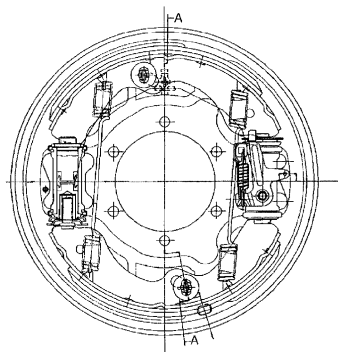
Section A-A

290mm - D2L Type



Section A-A

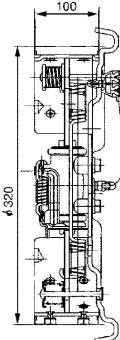
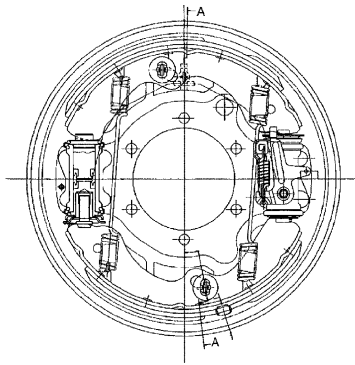
320mm - D2L Type



Section A-A

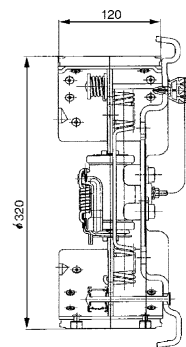
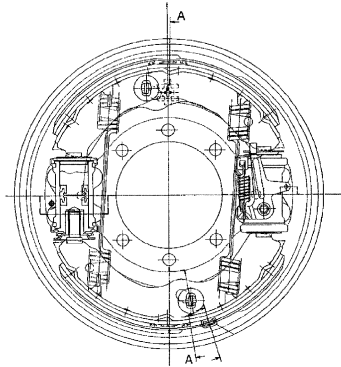
N5A0053E

320mm - D2L Type



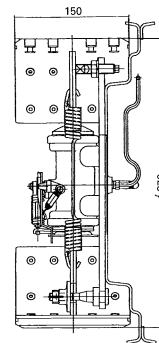
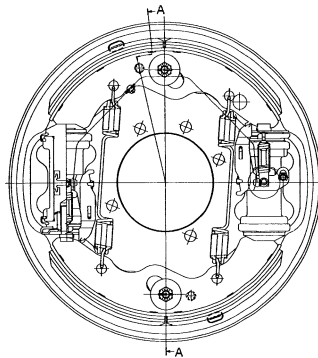
Section A-A

320mm - D2L Type



Section A-A

370mm - D2L Type



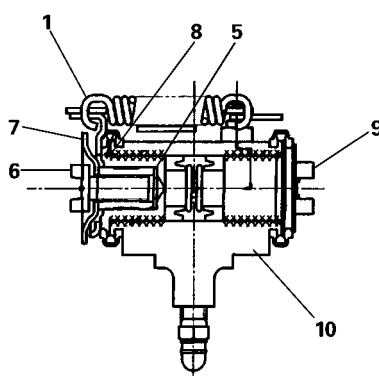
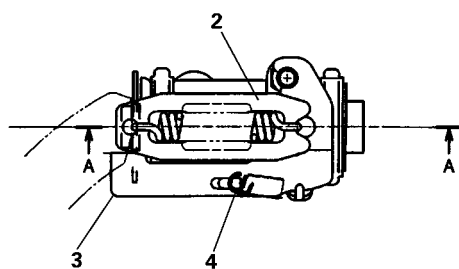
Section A-A

N5A0054E

The dual two leading shoe type brake eliminates the problem of weaker braking force on reverse stops common to two leading shoe type brakes while maintaining the many advantages of this type of brake. This combination of two leading shoes provides nearly equal braking force. This prevents an uneven load distribution on the wheel hub bearings. This type of brakes is widely used on the rear wheels of many vehicles.

Auto-Adjuster

Drum Inside Diameter 260 mm



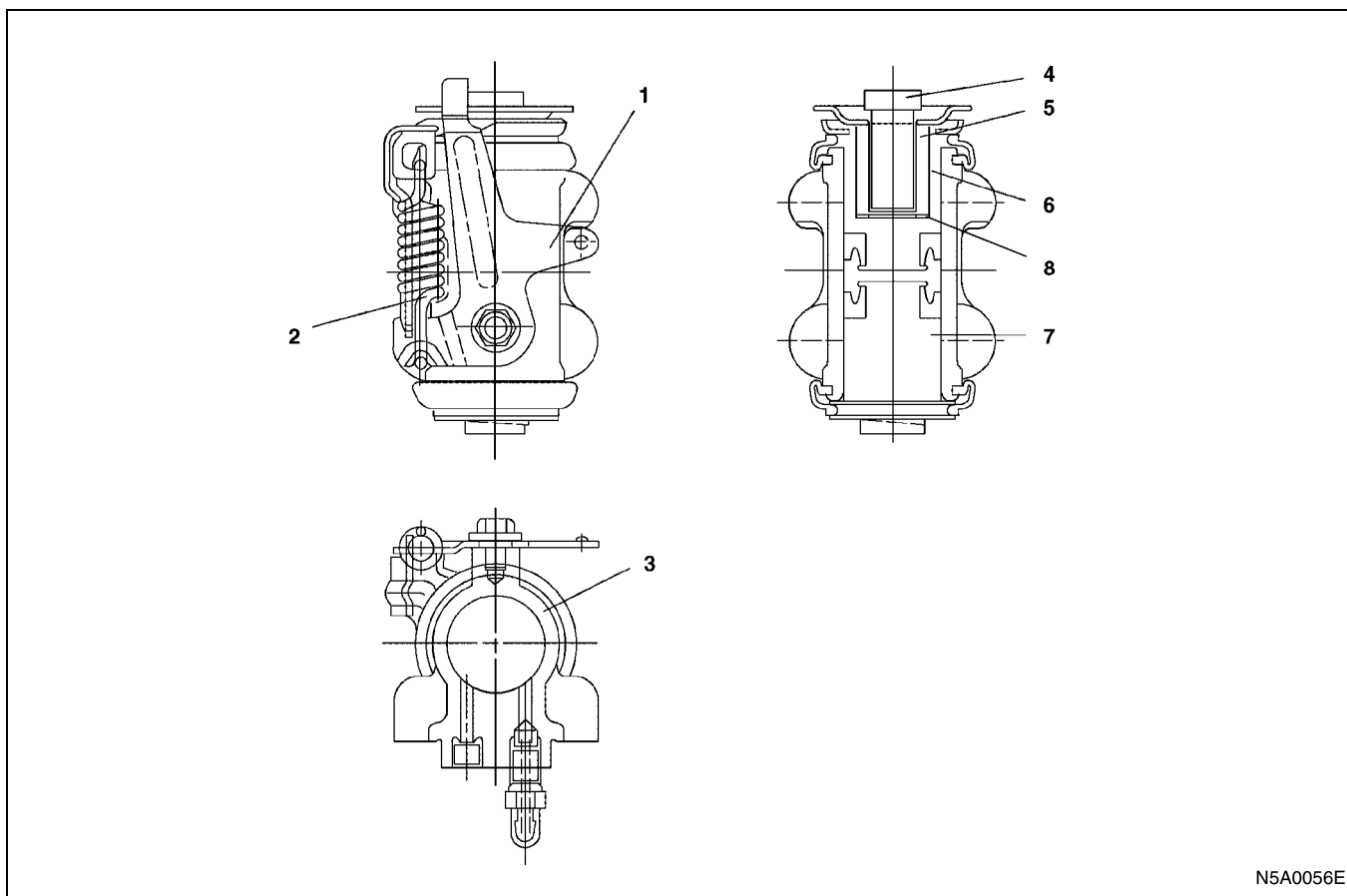
Section A-A

N5A0055E

Legend

- | | |
|------------------------|---------------------------------|
| 1. Over-travel spring | 6. Adjust screw |
| 2. Fitting | 7. Adjust gear and nut assembly |
| 3. Adjust lever | 8. Piston and bracket assembly |
| 4. Lever return spring | 9. Anchor piston |
| 5. Washer | 10. Body |

Drum Inside Diameter 300 mm, 320 mm

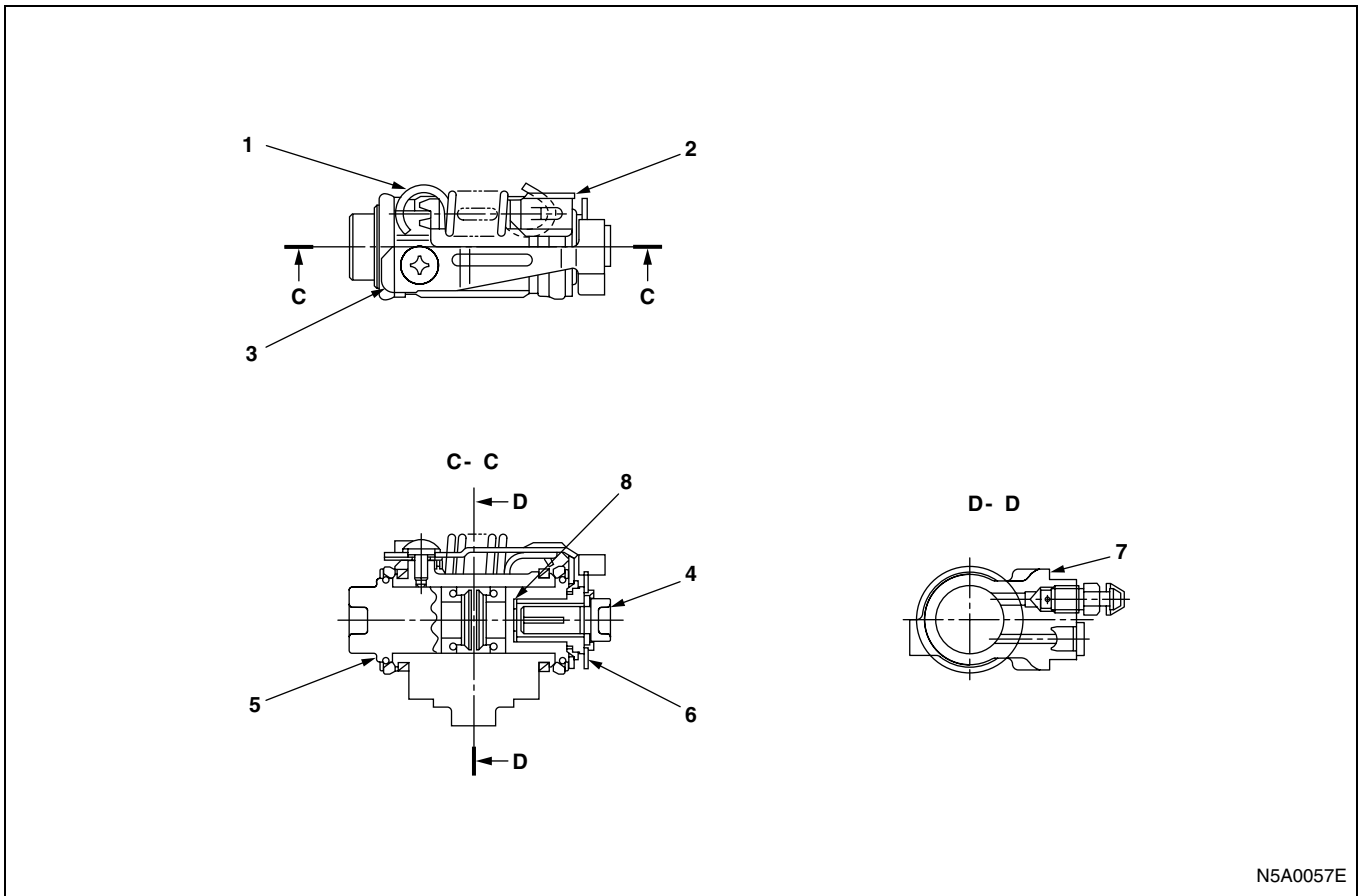


N5A0056E

Legend

- | | |
|---|---------------------------------|
| 1. Adjust lever | 5. Adjust gear and nut assembly |
| 2. Over-travel spring and fitting (Bracket) (including:
lever return spring) | 6. Piston and bracket assembly |
| 3. Body | 7. Anchor piston |
| 4. Adjust screw | 8. Washer |

Drum Inside Diameter 240 mm

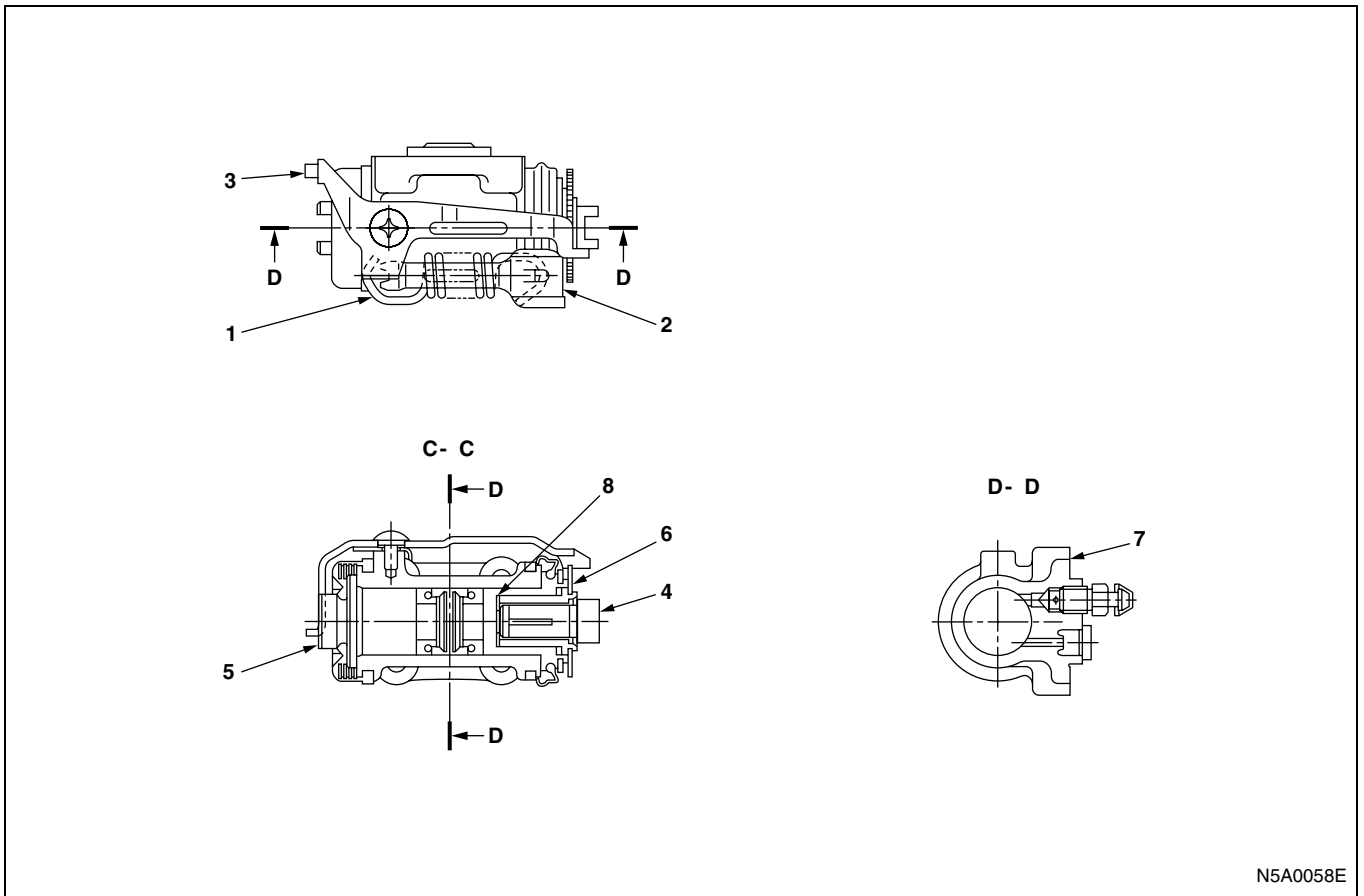


N5A0057E

Legend

- | | |
|--------------------------------|---------------------------------|
| 1. Overtravel spring | 5. Anchor piston |
| 2. Piston and bracket assembly | 6. Adjust gear and nut assembly |
| 3. Adjust lever | 7. Body |
| 4. Adjust screw | 8. Washer |

Drum Inside Diameter 290 mm

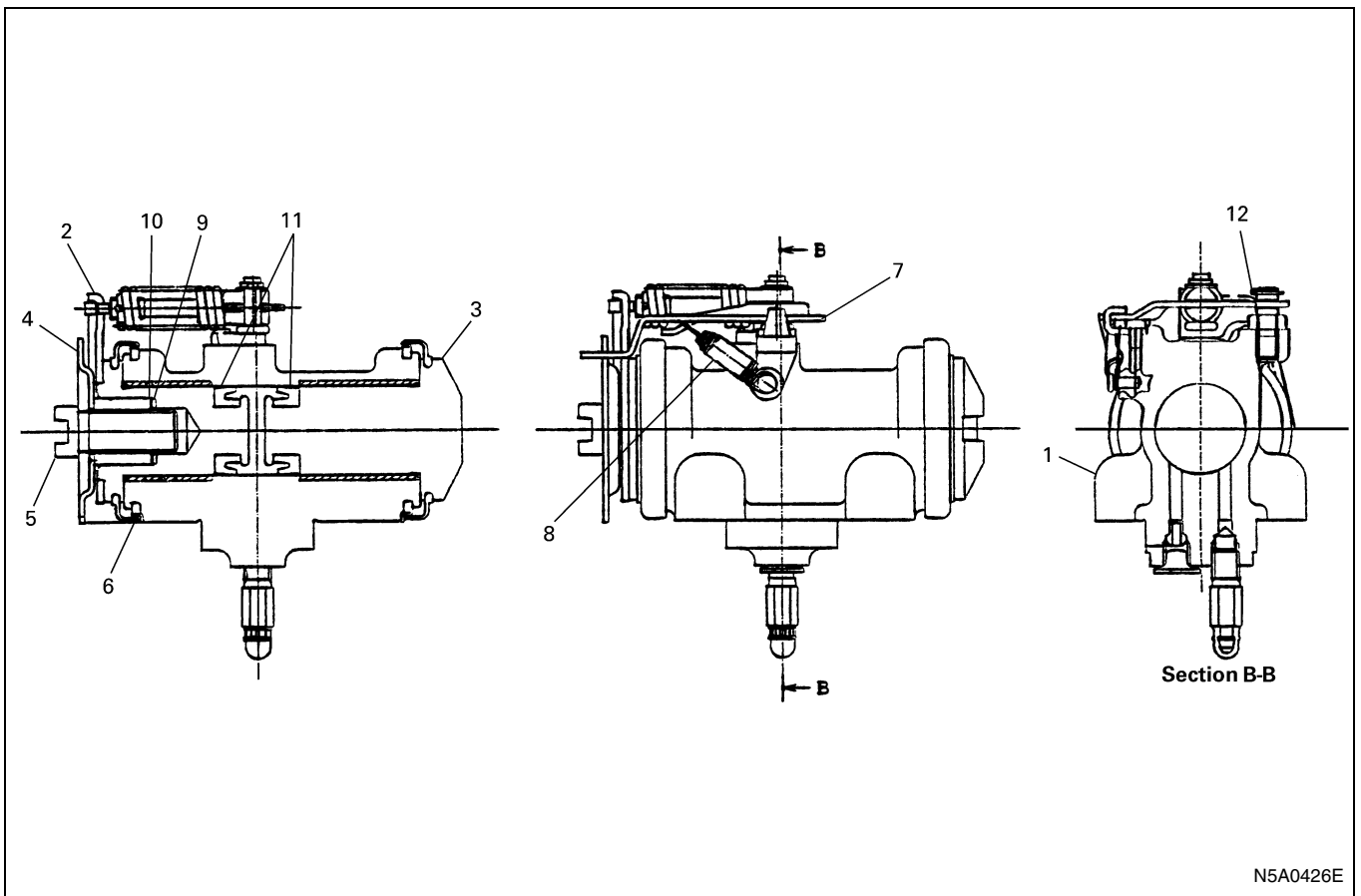


N5A0058E

Legend

- | | |
|--------------------------------|---------------------------------|
| 1. Overtravel spring | 5. Anchor piston |
| 2. Piston and bracket assembly | 6. Adjust gear and nut assembly |
| 3. Adjust lever | 7. Body |
| 4. Adjust screw | 8. Washer |

Drum Inside Diameter 370 mm

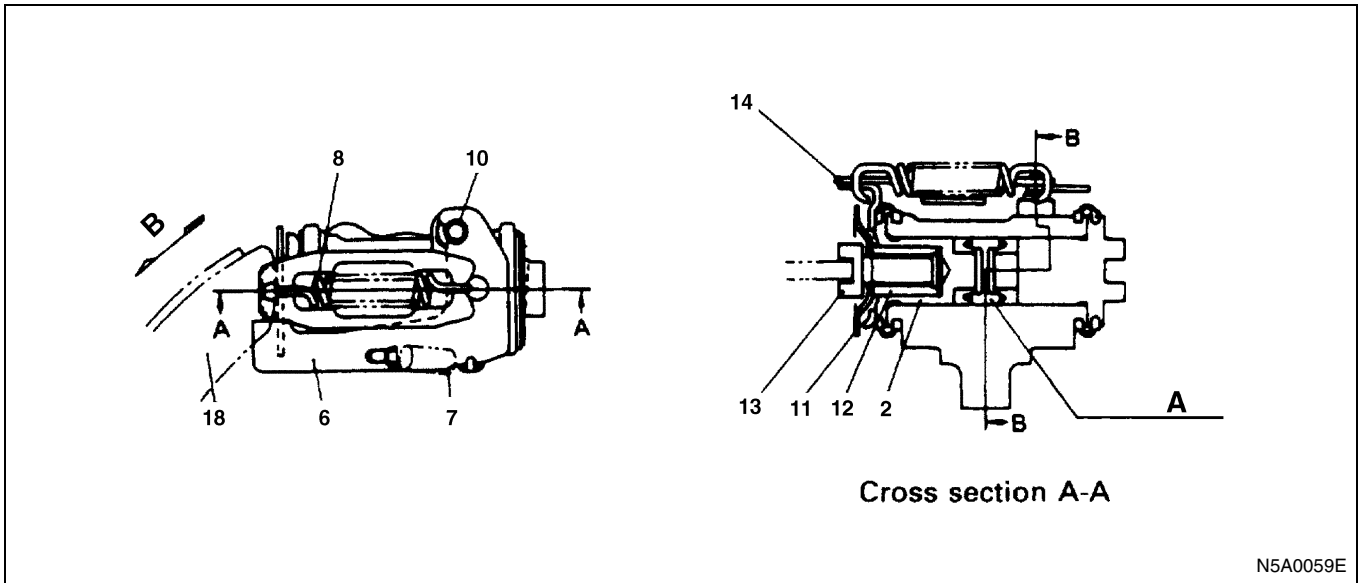


N5A0426E

Legend

- | | |
|--------------------------------|----------------------|
| 1. Body | 7. Lever assembly |
| 2. Piston and bracket assembly | 8. Spring |
| 3. Anchor piston | 9. Plain washer |
| 4. Gear and nut assembly | 10. Plain washer |
| 5. Adjust screw | 11. Cup |
| 6. Boot | 12. Snap ring-E type |

Operation of Auto-adjuster



Legend

A. Oil chamber

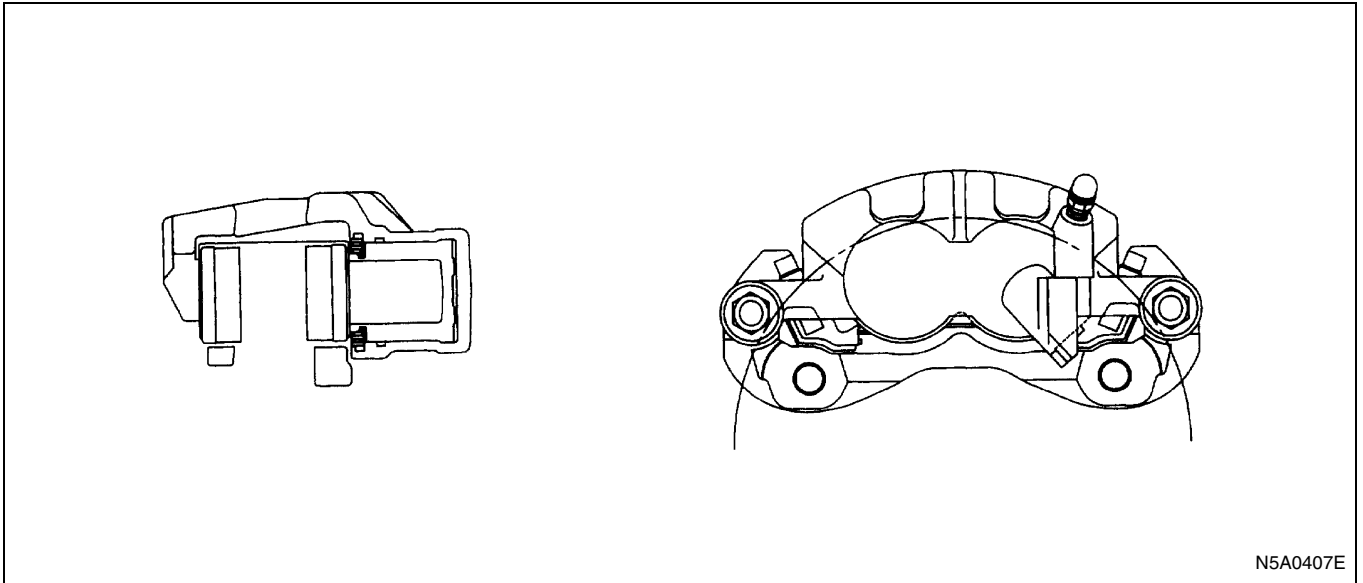
B. Rotational direction of the drum (forward)

The entire auto-adjust mechanism is incorporated into the wheel cylinder assembly, and the adjust operation is carried out only when in the forward movement.

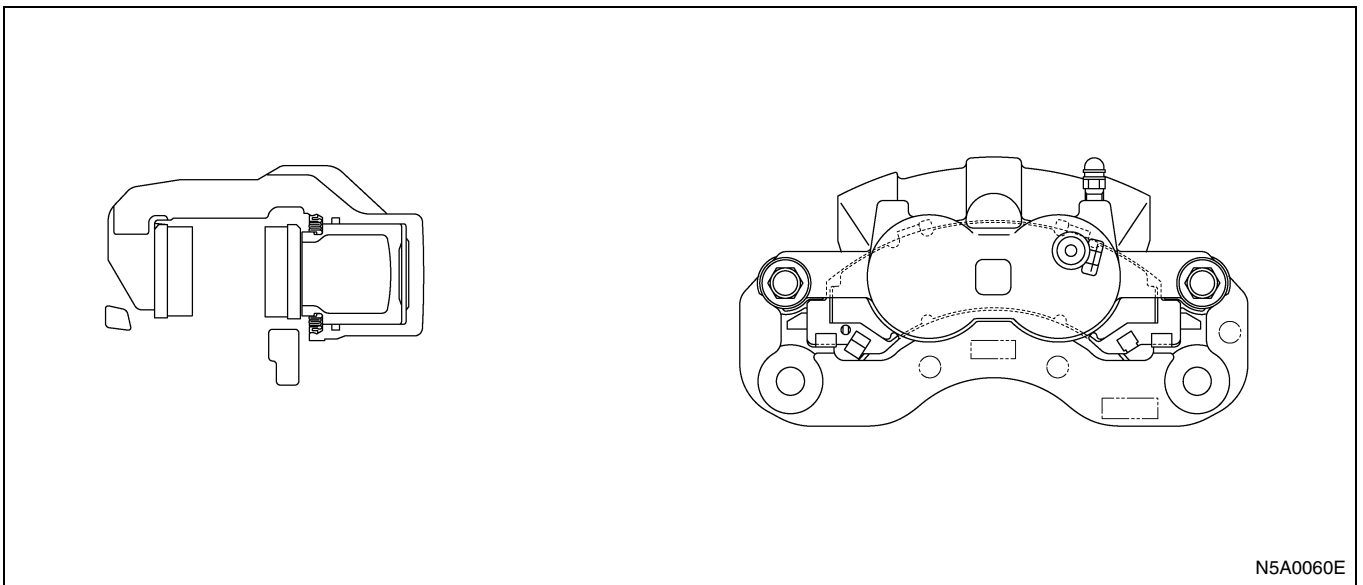
The operation of the auto-adjuster is as follows:

- When fluid pressure is applied to the oil chamber (A), the piston, which is resistant to the over-travel spring installed between the bracket (14) and the adjust lever (6), is forced out to the brake shoe (18) side. (The piston and bracket are welded into a monolithic construction.)
- When force delivered by the over-travel spring (18) is intensified as the piston (2) moves, the balance maintained with the lever return spring (7) installed between the adjust lever (6) and lever pin (10) is destroyed, and the adjust lever (6) with the lever pin (10) as a pivot, rotates the adjust gear (11) in the rotational direction.
- When the shoe clearance (clearance between the brake shoe and the brake drum) gets to the specified value, the adjust lever (6) adjusts the shoe clearance by driving one gear tooth or more of the adjust gear (11) in the rotational direction through the force of the over-travel spring (8).
- When the brake shoe (18) comes into contact with the brake drum, the frictional force generated between the adjust screw (13) and the adjust nut (12) gets larger, and the adjust gear (11) cannot be rotated by the force of the over-travel spring (8). (The adjust gear and the adjust nut are welded into a monolithic construction.) That is, the automatic adjustment of the shoe clearance is carried out until the brake shoe comes in touch with brake drum. However, over adjust can be avoided since this automatic adjustment will not be performed for the increased amount of the piston shift caused by the deformation of the drum and shoe after their contact.
- When the fluid pressure is released from the oil chamber (A), the force by which the lever return spring (7) rotates the adjust gear (6) adversely gets weaker than the frictional force generated between the adjust screw (13) and the adjust nut (12), therefore, the adjust lever (6) slides on the adjust gear (11) to get back to its former state before operation and this operation is completed with the adjust gear (11) left in the state in the rotational direction into which it has been driven.

Front Disc Brake Independent Suspension Models



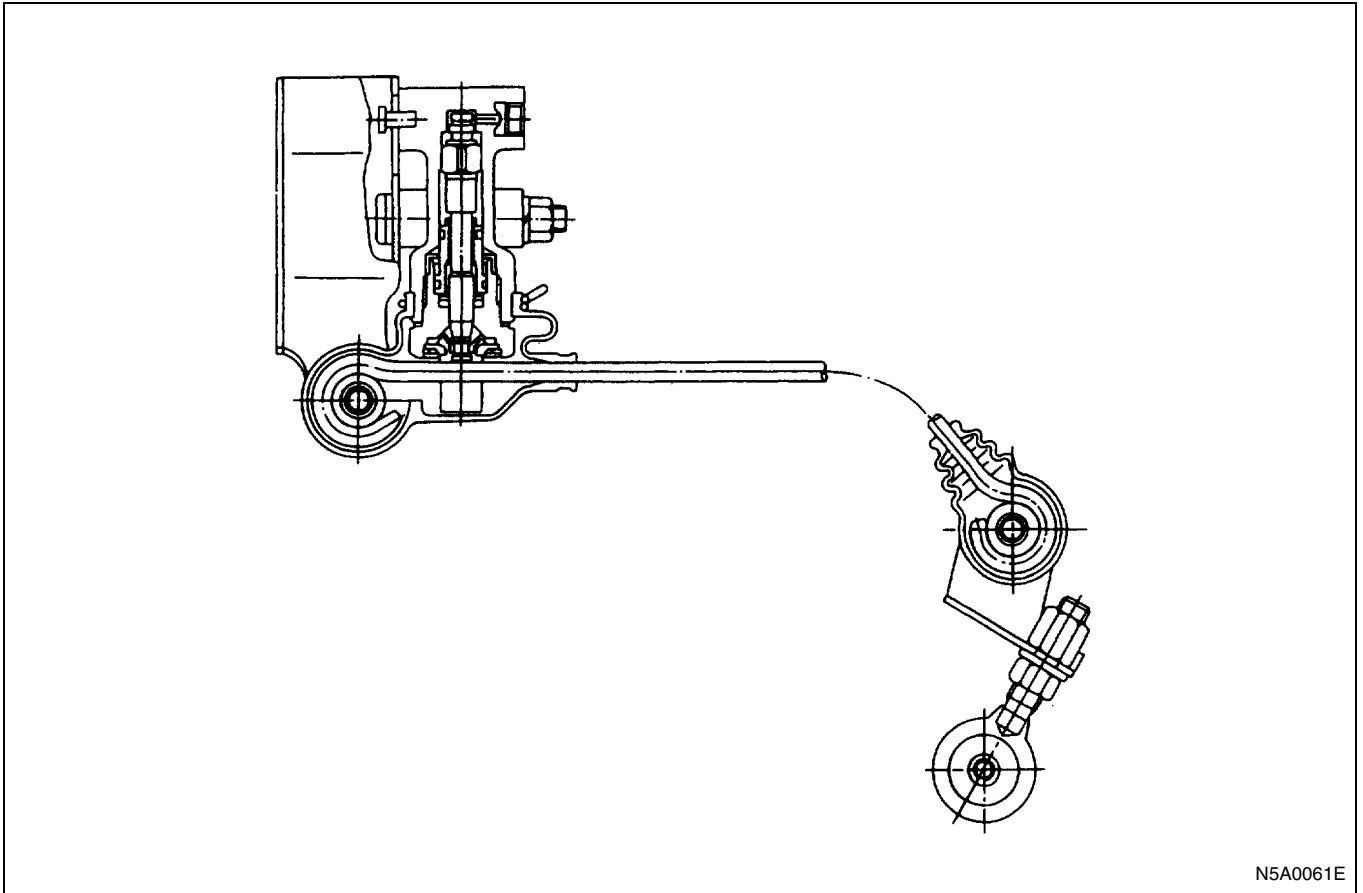
Leaf Spring Suspension Models (Rigid Axle Type)



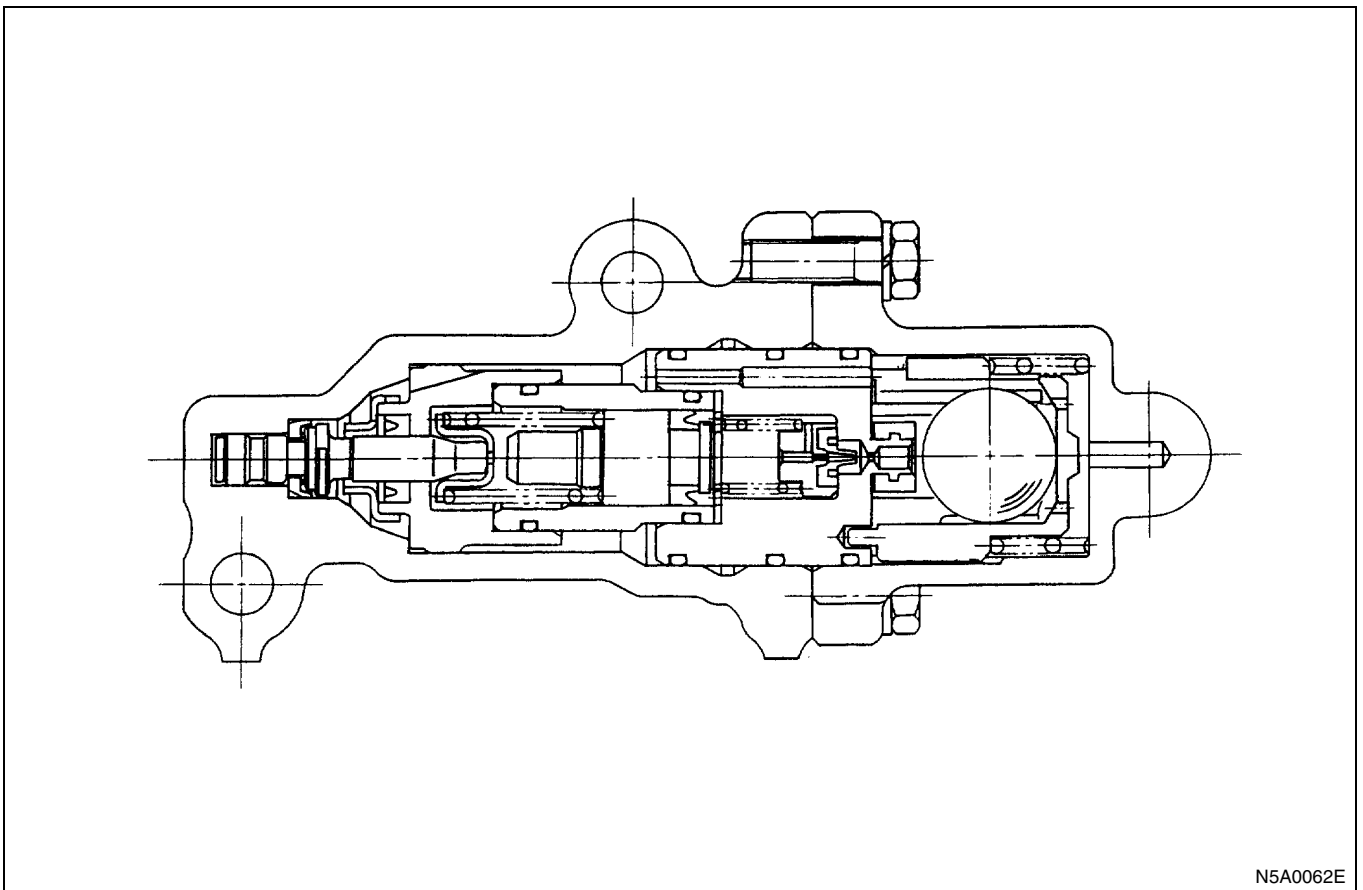
The disc brake assembly consists of a caliper, piston, disc, pad assembly and support bracket.

The caliper assembly has two bores and is mounted to the support bracket with 2 mounting bolts. The support bracket allows the caliper to move laterally against the disc. The caliper is a one-piece casting with the inboard side containing the piston bore. A square cut rubber seal is located in a groove in the piston bore which provides the hydraulic seal between the piston and the cylinder wall.

Load Sensing Proportioning Valve (LSPV)



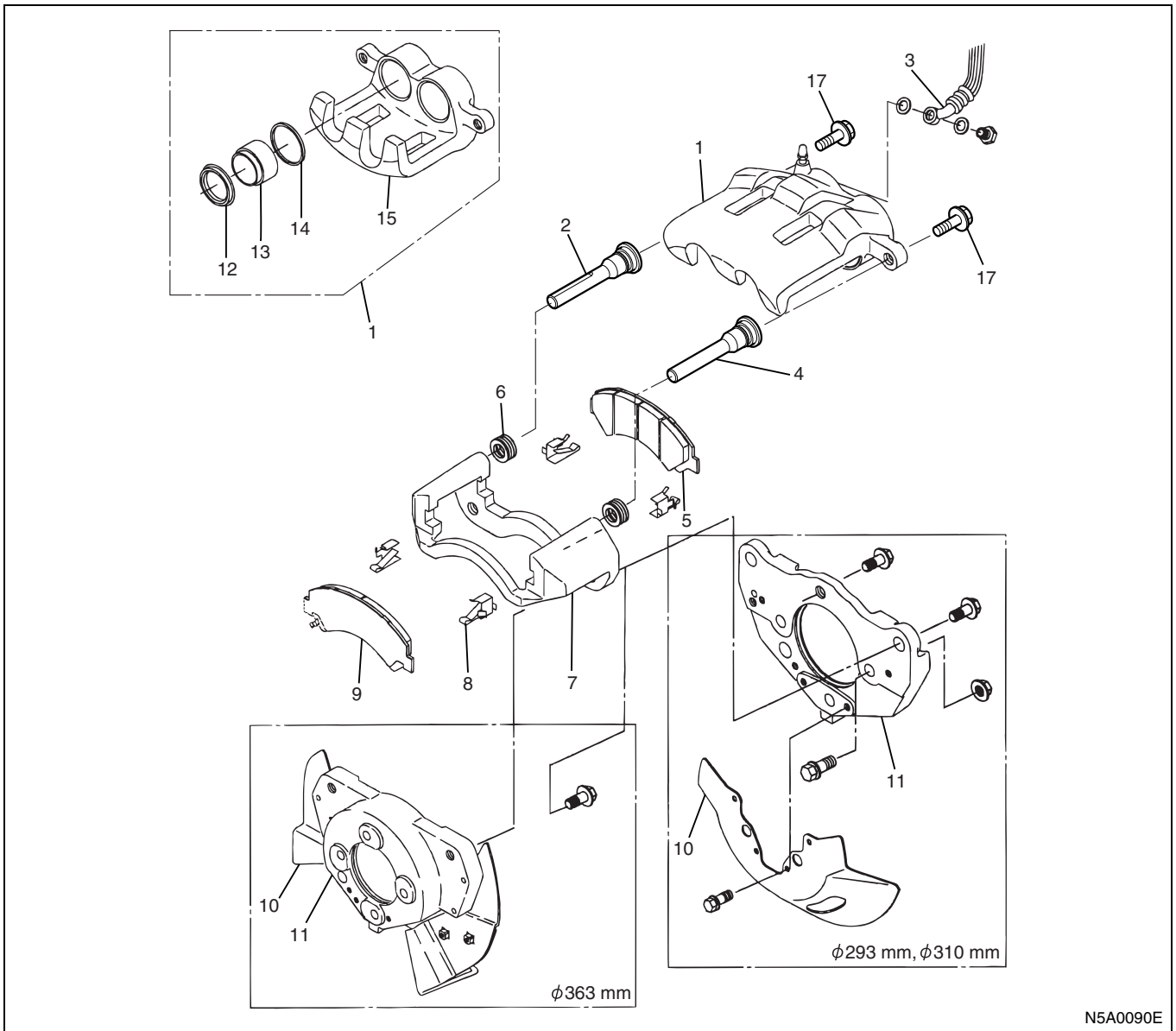
Deceleration Sensing Proportioning Valve (DSPV)



ON-VEHICLE SERVICE

Front Disc Brake Assembly

Leaf Spring Suspension Models (ø293, ø310 and ø363 mm)



Legend

- | | |
|------------------------|----------------------------|
| 1. Caliper assembly | 9. Outer pad (Pad Kit) |
| 2. Guide pin (Green) | 10. Wind guide |
| 3. Flexible hose | 11. Adapter |
| 4. Lock pin (Yellow) | 12. Piston boot (Seal Kit) |
| 5. Inner pad (Pad Kit) | 13. Piston |
| 6. Pin boot (Seal Kit) | 14. Piston seal (Seal Kit) |
| 7. Support assembly | 15. Body assembly |
| 8. Pad clip | 16. Pin bolt |

Removal

Position jack stands under vehicle.

Notice:

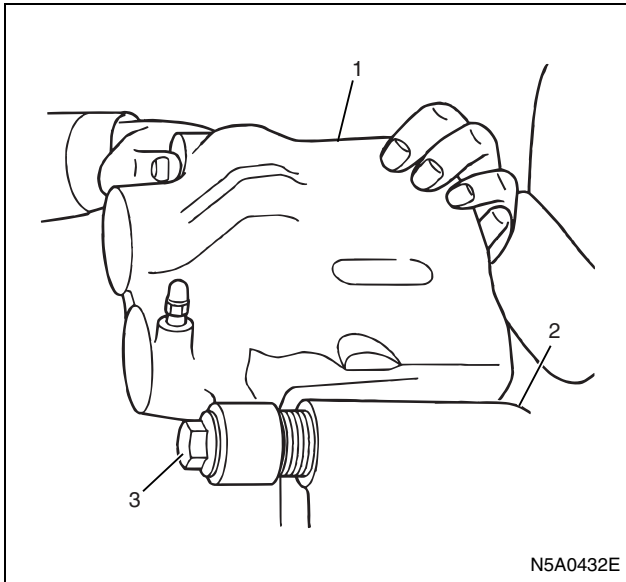
- Block vehicle wheels and apply the parking brake.
- Rise the axle to clear the tire from the ground.

- Remove the wheel.

Notice:

Seal parts cannot be reused. When reassembling, be sure to replace with a new seal kit.

1. Flexible hose
2. Pin bolt (Lock pin side)
3. Caliper assembly
 - Slide the caliper assembly free from the inside.

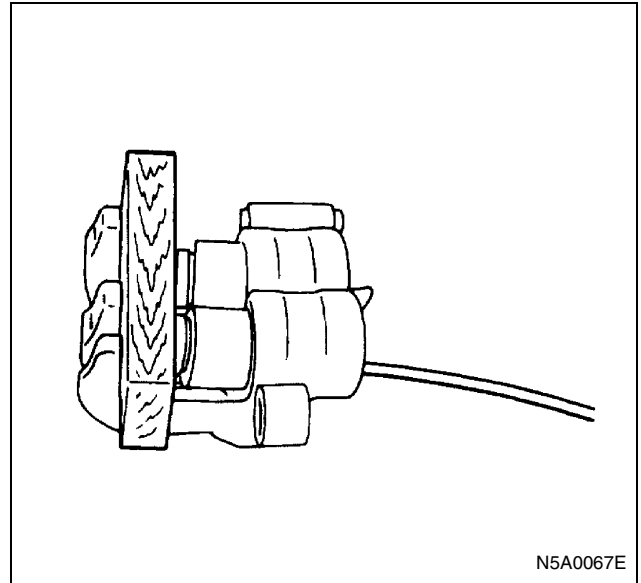
**Legend**

1. Caliper Assembly
2. Support Assembly
3. Pin Bolt

4. Outer pad
5. Inner pad
6. Pad clips
7. Support assembly
 - Remove the hub and disc before removing the support assembly.
8. Wind guide
 - Remove the hub and disc before removing the wind guide.
9. Adapter

Disassembly

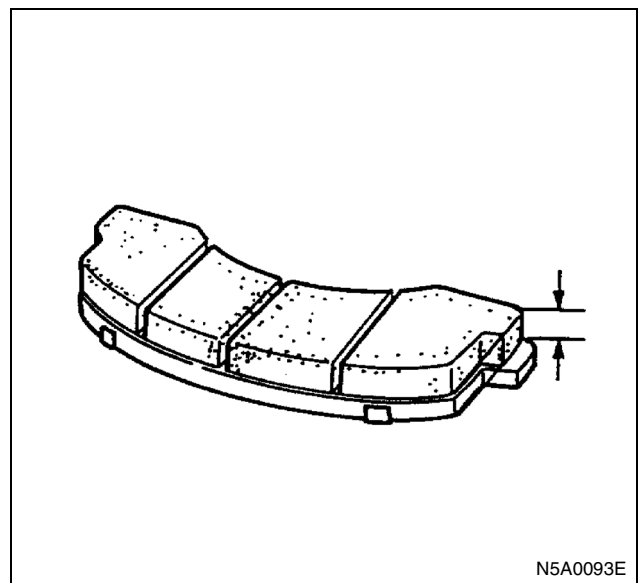
1. Place a piece of wood across the body assembly to prevent piston damage.
2. Apply approximately 196 kPa (2.0 kg/cm² / 28.4 psi) of compressed air to the body assembly oil port to remove the pistons.

**Inspection**

1. All parts for wear distortion or other conditions and replace as needed.
2. Inner and outer pads.
 - Use a vernier caliper to measure the inner pad and outer pad thickness.

Pad Thickness		mm (in)
Standard	Limit	
13 (0.51)	1 (0.04)	

- If the measured value is less than the specified limit, the pads must be replaced with the repair pad kit.

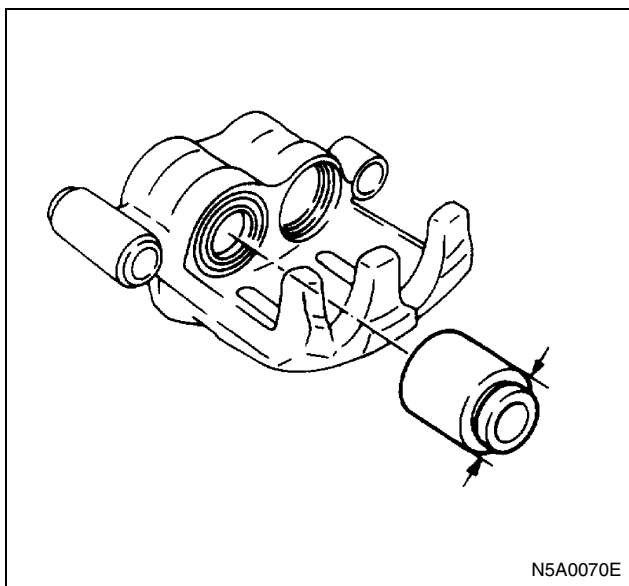


3. Piston and Cylinder Clearance.
 - Use a micrometer to measure the piston diameter.
 - Use an inside dial indicator to measure the cylinder bore.

- Calculate the piston and cylinder bore clearance.

Piston and cylinder bore clearance		mm (in)
Standard	Limit	
0.08 — 0.18 (0.003 — 0.007)	0.23 (0.009)	

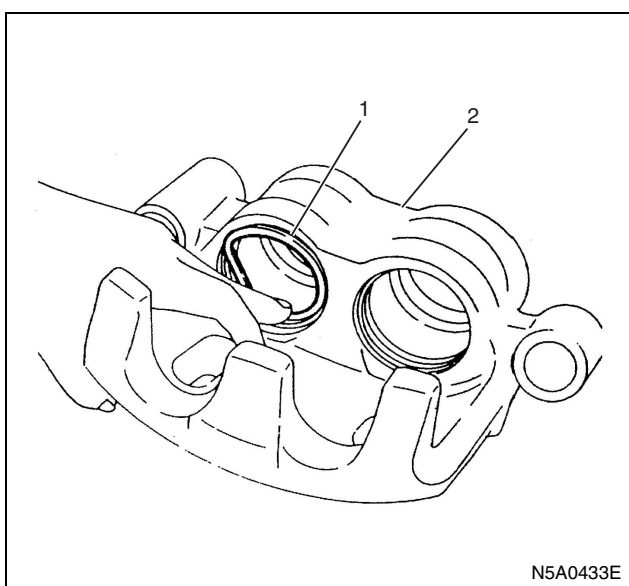
- If the clearance exceeds the specified limit, the piston and/or the body assembly must be replaced along with the repair seal kit.



Reassembly

1. Piston Seal

- Be sure to use a new seal ring.
- Apply rubber grease to the piston seal. The rubber grease is included in the seal kit.
- Install the piston seal to the cylinder bore groove.

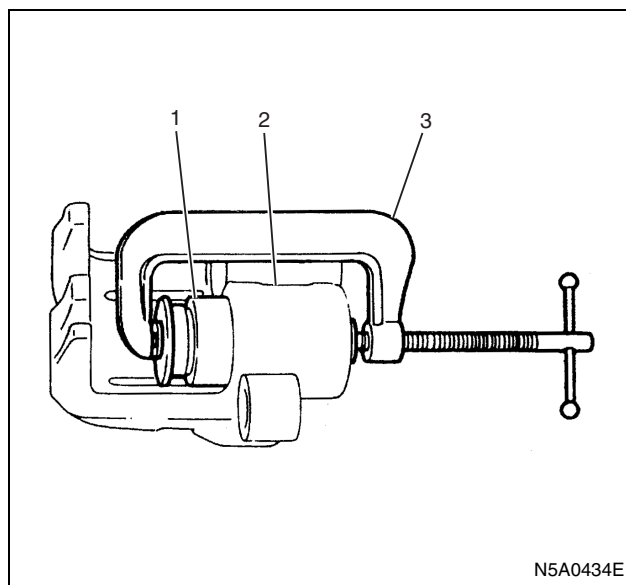


Legend

1. Piston Seal
2. Body Assembly

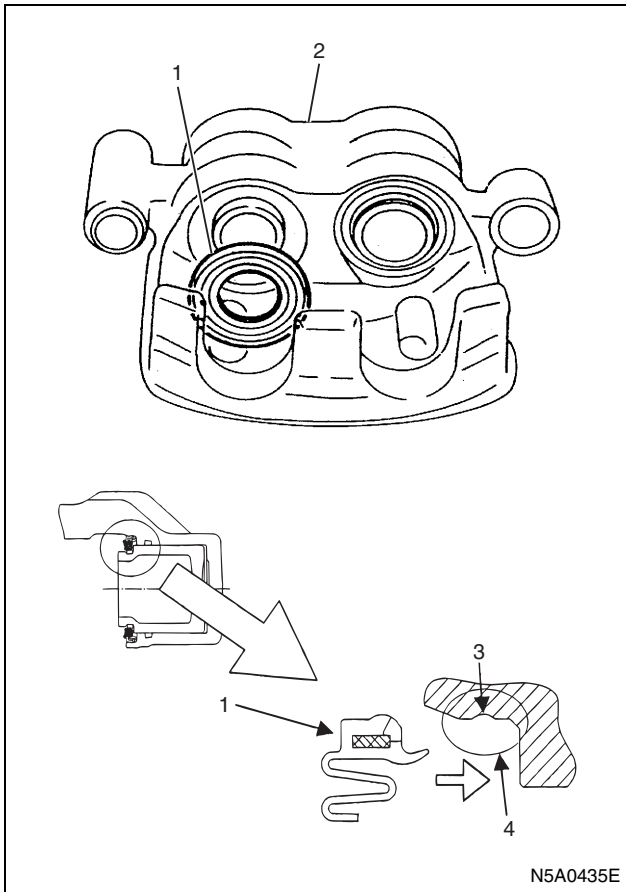
2. Piston and Piston Boot

- Apply brake oil to the piston outer circumference.
- Use a hand vise to install the pistons to the cylinder.
- Apply special grease to the piston. This will prevent cylinder and piston corrosion.
- Use a new piston boot. Do not confuse the front and rear sides of the boot. Carefully press the insert portion of the boot into the cylinder body groove. Be sure that the insertion depth is uniform.
- Install the piston boot inner lip to the piston groove. Handle the piston boot carefully.



Legend

1. Piston
2. Body Assembly
3. Hand Vise



N5A0435E

Legend

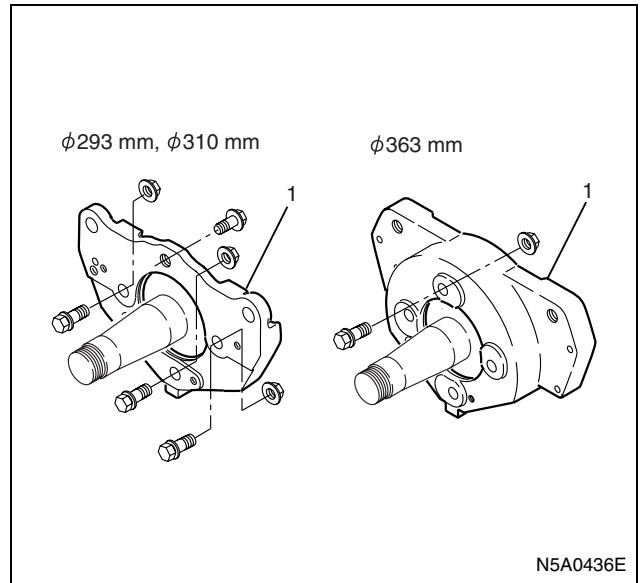
1. Piston Boot
2. Body Assembly
3. Cylinder Body Groove
4. Boot Insert Portion

Installation

1. Adapter
 - Install the adapter to the knuckle.
 - Tighten the fixing bolts and nuts to the specified torque.

Tighten:

Fixing bolts and nuts to 162 N·m (16.5 kg·m / 119 lb·ft).



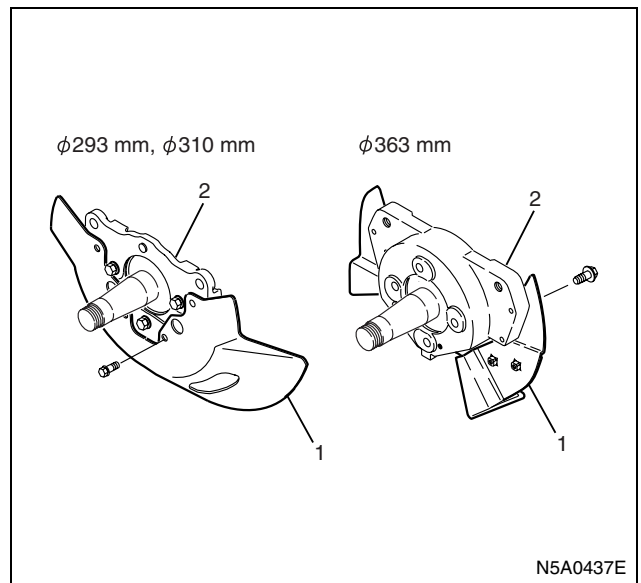
N5A0436E

Legend

1. Adapter
2. Wind Guide
 - Tighten the fixing bolts to the specified torque.

Tighten:

Fixing bolts to 13 N·m (1.3 kg·m / 113 lb·in).



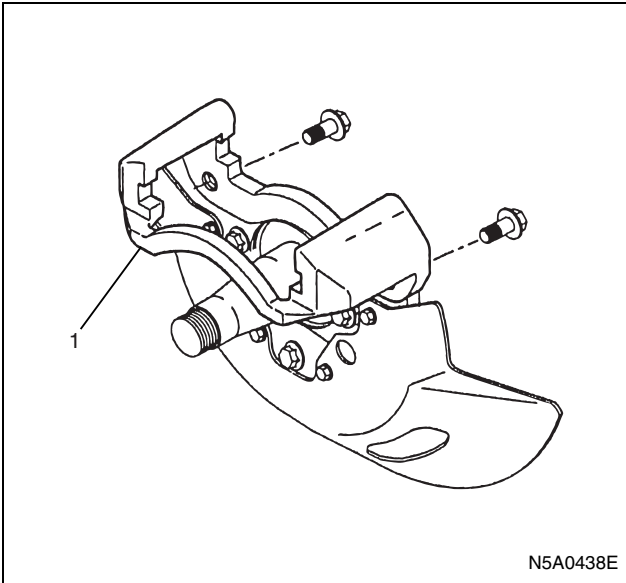
N5A0437E

Legend

1. Wind Guide
2. Adapter
3. Support Assembly
 - Tighten the fixing bolts to the specified torque.

Tighten:

Fixing nuts to 221 N·m (22.5 kg·m / 163 lb·ft).



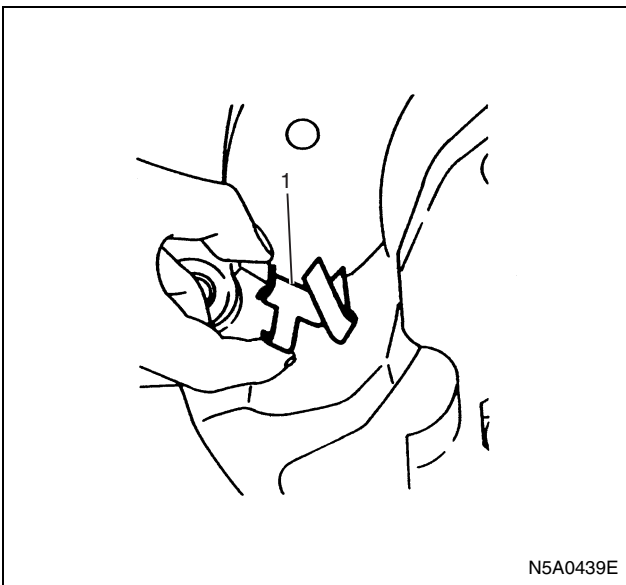
N5A0438E

Legend

- 1. Support Assembly

4. Pad Clips

- Be sure that the clips are completely installed to the support assembly.



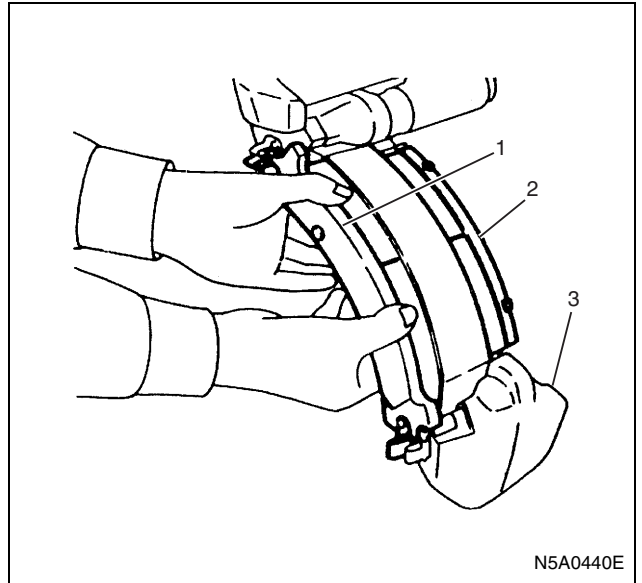
N5A0439E

Legend

- 1. Pad Clip

5. Pads

- Install the inner pad and the outer pad to the support assembly.



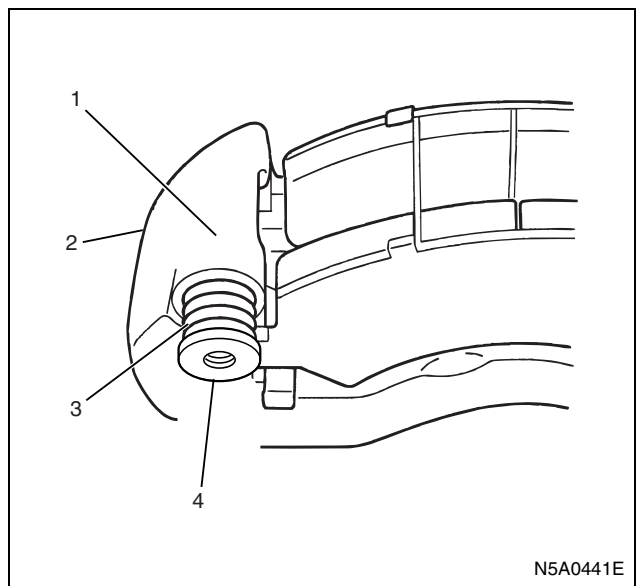
N5A0440E

Legend

- 1. Outer Pad (WEAR INDICATOR.... \varnothing 310 / \varnothing 363)
- 2. Inner Pad (WEAR INDICATOR.... \varnothing 293)
- 3. Support Assembly

6. Pin Boot

- Under normal conditions, there is no need to remove the pin boot.
- Apply approximately 1g (0.035 oz) of special grease to the pin boot bore and pin boss bore of support.
This will prevent pin corrosion.
The special grease is included in the seal kit.
- Install the pin boot to the support assembly.
- Check that the pin boot is securely inserted to the groove.



N5A0441E

Legend

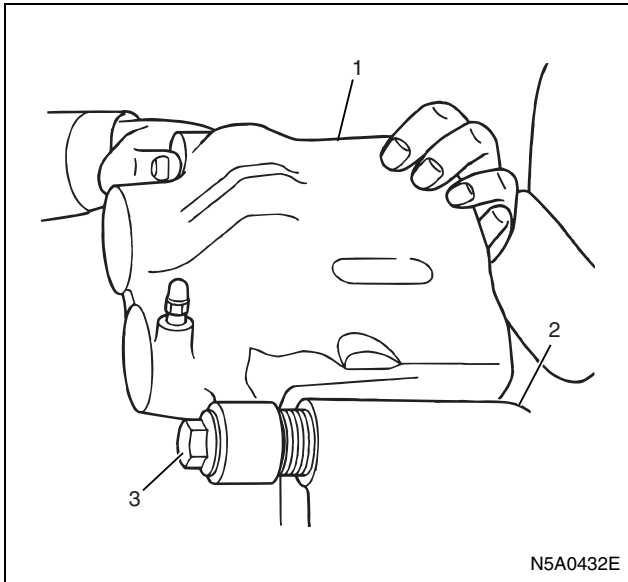
- 1. Pin Boss of Support
- 2. Support Assembly
- 3. Pin Boot
- 4. Pin

7. Caliper Assembly and Bolt (Lock pin side)

- Install the caliper assembly to the support assembly guide pin from the inside.
- Return the caliper assembly to its original position.
- Tighten the bolt (lock pin side) to the specified torque.

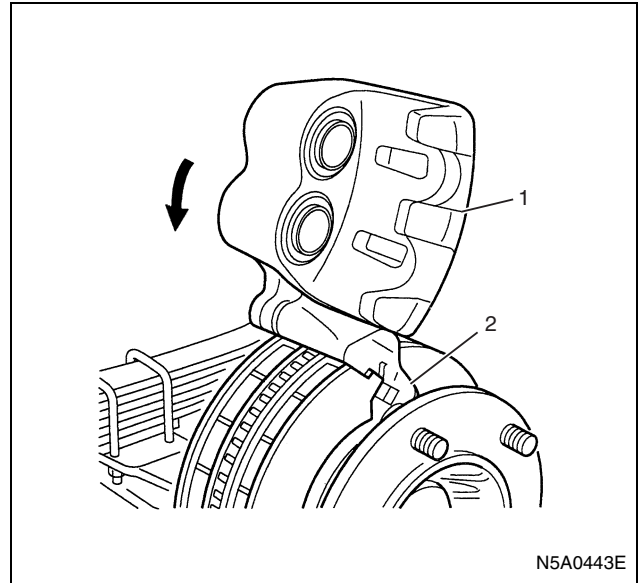
Tighten:

Bolt (Lock pin side) to 125 N·m (12.7 kg·m / 92 lb·ft).



Legend

- 1. Caliper Assembly
- 2. Support Assembly
- 3. Pin Bolt



Legend

- 1. Caliper Assembly
- 2. Support Assembly

8. Flexible Hose

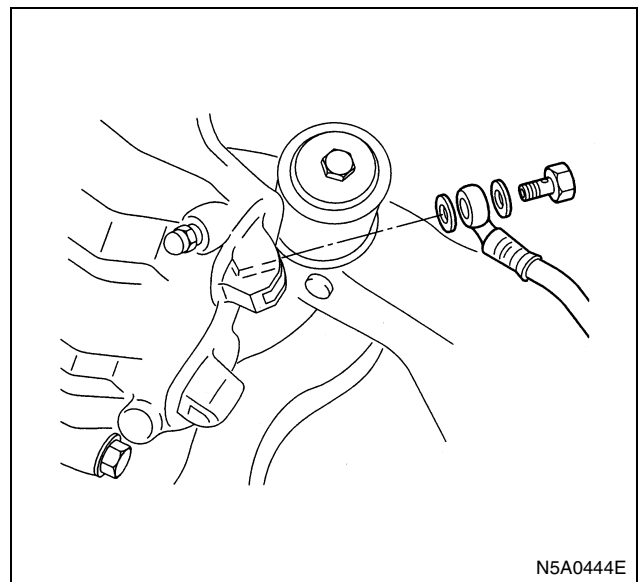
- Tighten the flexible hose bolt to the specified torque.

Tighten:

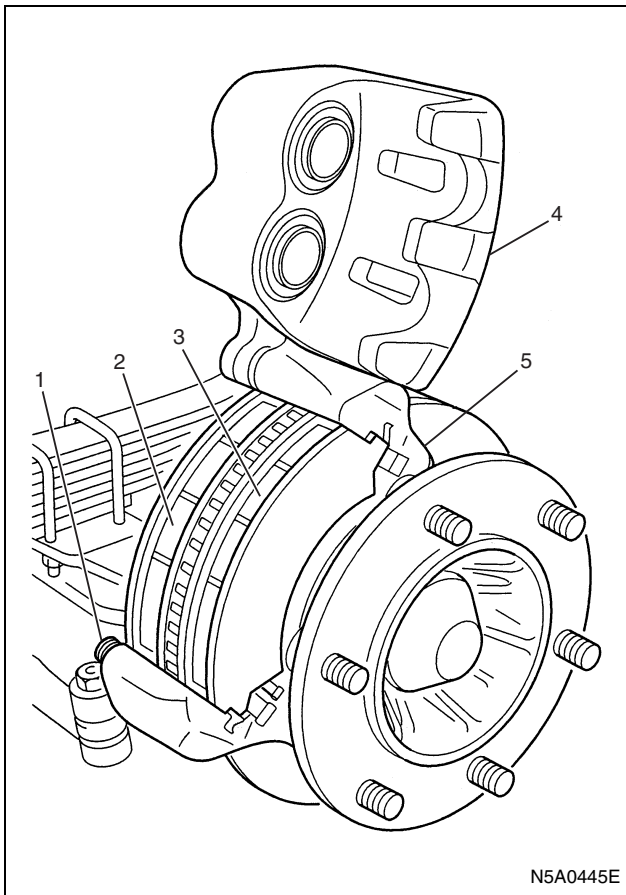
Hose bolt to 34 N·m (3.5 kg·m / 25 lb·ft).

Air Bleeding

Refer to “Brake Bleeding” in Section 00 of section.



Front Disc Brake Pad



Legend

1. Lock Pin
2. Inner Pad
3. Outer Pad
4. Caliper Assembly
5. Support Assembly

Removal

Notice:

- Block vehicle wheels and apply the parking brake.
- Rise the axle to clear the tire from the ground.

Position jack stands under vehicle.

- Remove the wheel.

1. Loosen and remove the lock pin bolt from the lower side of the caliper.
2. Turn the caliper assembly up and wire it to the frame firmly so that the hose is not stretched.

Notice:

- Do not disconnect the brake hose.
3. Remove the pad assembly with clips.
 4. Conduct disc wear check, and resurface or replace it as required.
 5. When removing brake disc, slide caliper assembly inside of the vehicle, and take out brake disc from support assembly.

Take care not to wipe the special grease from guide pin, and prevent from sticking dust or any foreign material to guide pin.

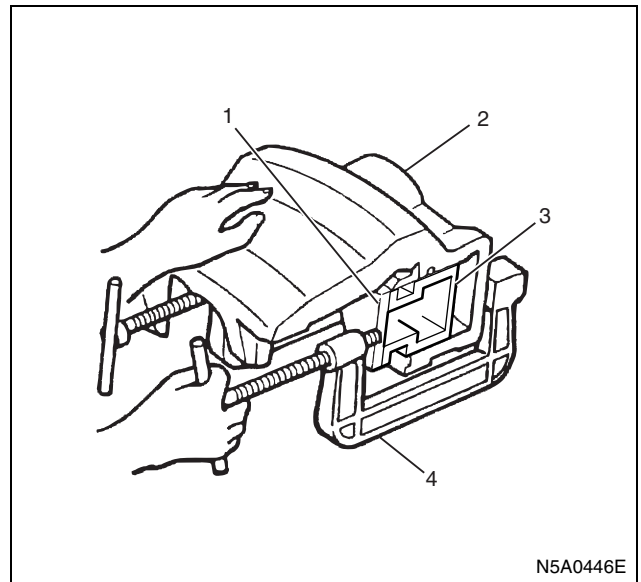
6. Refer to Section 4C FRONT AXLE and Section 3C FRONT SUSPENSION for disc wear check and replacement procedures.

Installation

1. Keep the rotor face away from the brake oil or grease.
2. Use a hand vise to push the piston backward until it reaches the cylinder bottom, as the piston was pushed forward by the distance where the pad worn.

Notice:

- When using a hand vise, push the piston at its center.



Legend

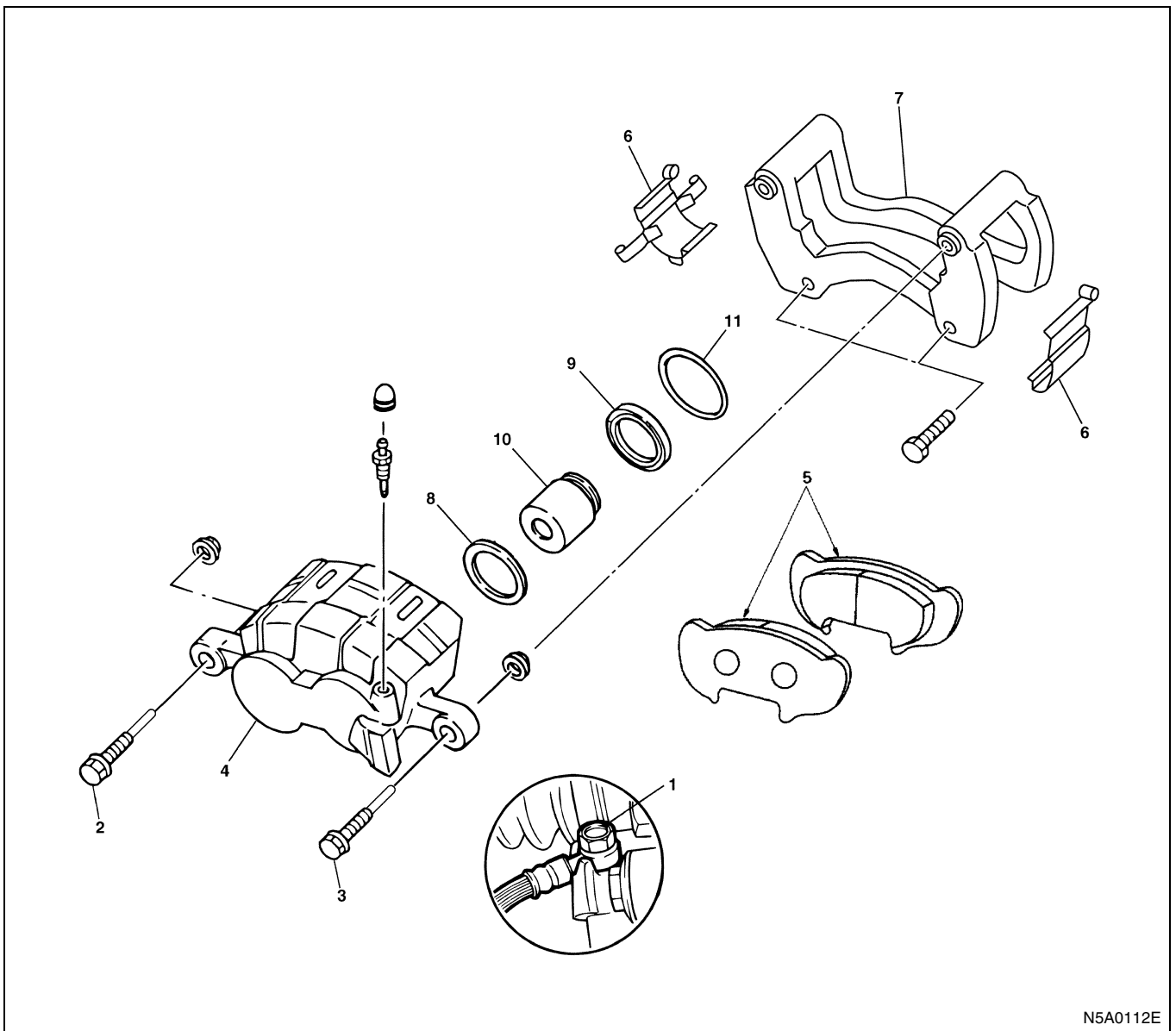
1. Steel Plate
2. Caliper Assembly
3. Piston
4. Hand Vise

3. Remove hand vise and install the new pads along with new clips.

Notice:

- Be careful not to assemble the inner and outer pad reversely.
4. Install the bolt (Lock pin side) into the lock pin by turning the caliper carefully so that the piston boot and pin boot may not be wedged. After assembling the caliper assembly, make sure that the piston boot and pin boot fitted correctly, and not damaged.

Independent Suspension Models (NKR)



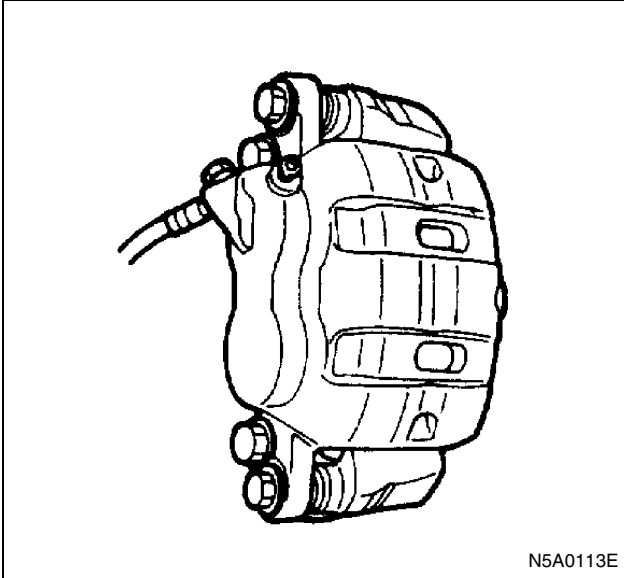
N5A0112E

Legend

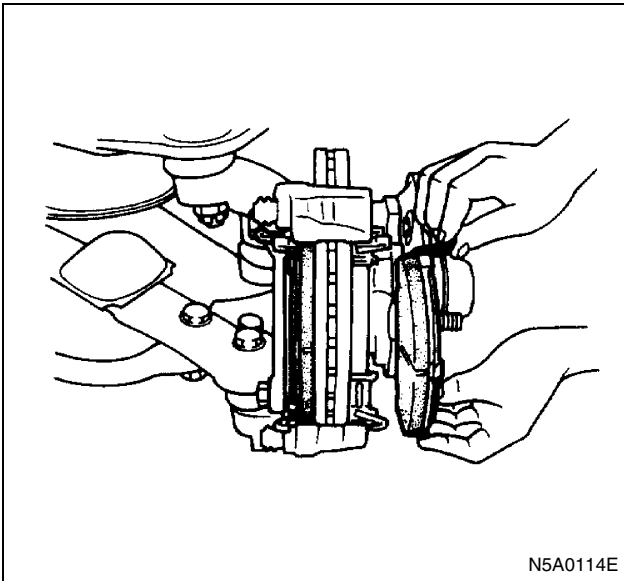
- | | |
|---------------------------------|---------------------|
| 1. Joint bolt and flexible hose | 7. Support assembly |
| 2. Lock pin bolt | 8. Boot ring |
| 3. Guide pin bolt | 9. Piston boot |
| 4. Caliper assembly | 10. Piston |
| 5. Pad | 11. Piston seal |
| 6. Pad clip | |

Removal

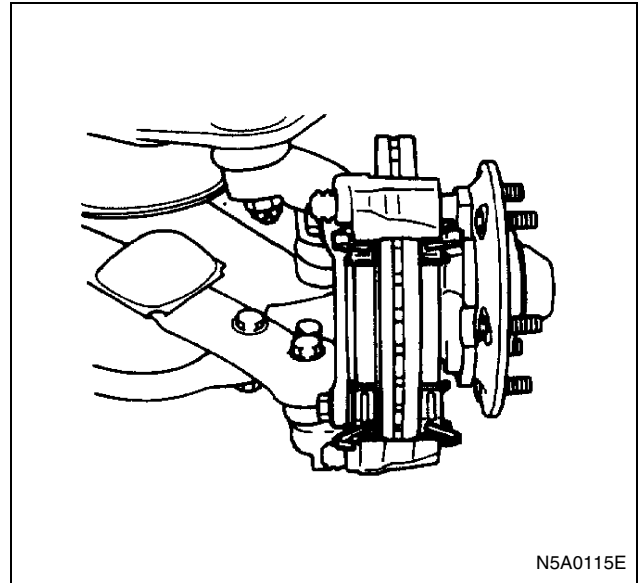
1. Joint bolt and Flexible Hose
2. Lock Pin Bolt
3. Guide Pin Bolt
4. Caliper Assembly



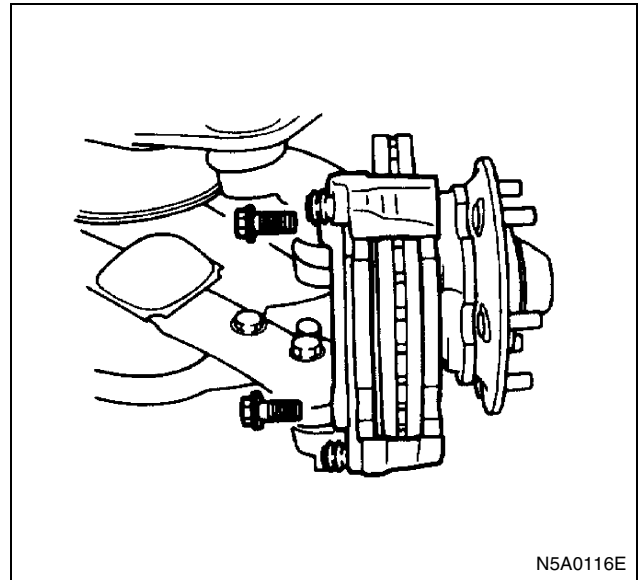
5. Pad



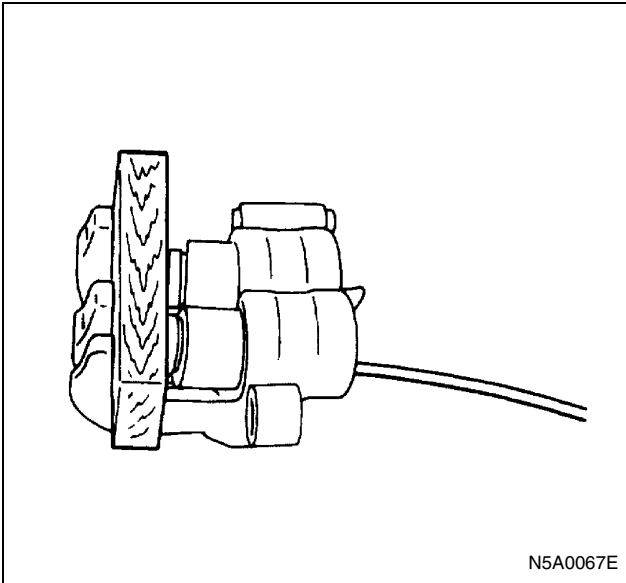
6. Pad Clip



7. Support Assembly



8. Boot Ring
9. Piston Boot
10. Piston
 - 1) Place a piece of wood across the body assembly to prevent piston damage.
 - 2) Apply approximately 196 kPa (2 kg/cm² / 28.4 psi) of compressed air to the body assembly oil port to remove the pistons.



N5A0067E

11. Piston Seal

Inspection and Repair

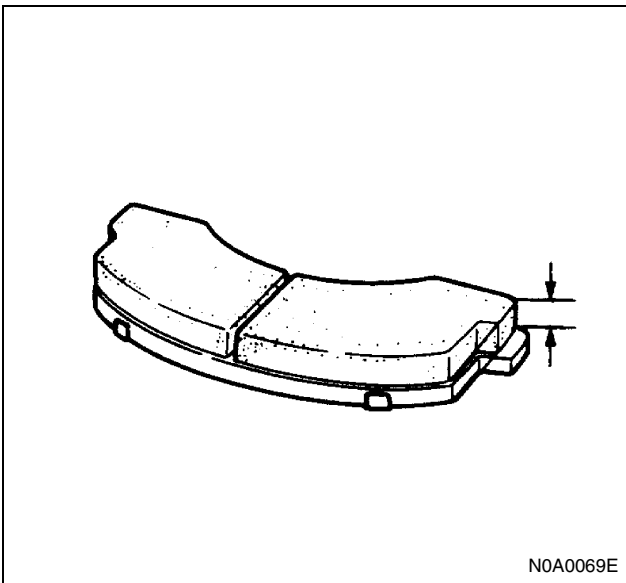
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Pad

Use a vernier caliper to measure the pad thickness.

Pad Thickness		mm (in)
Standard	Limit	
14 (0.551)	1 (0.039)	

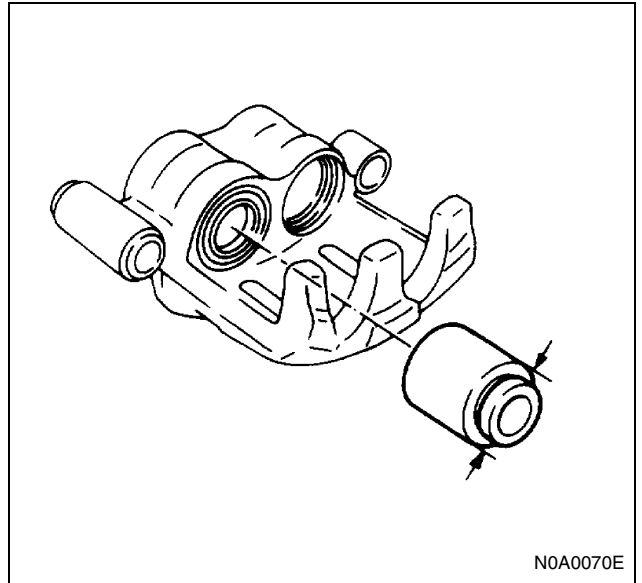
If the measured value is less than the specified limit, the pads must be replaced with the repair pad kit.



N0A0069E

Piston and Cylinder Clearance

1. Use a micrometer to measure the piston diameter.



N0A0070E

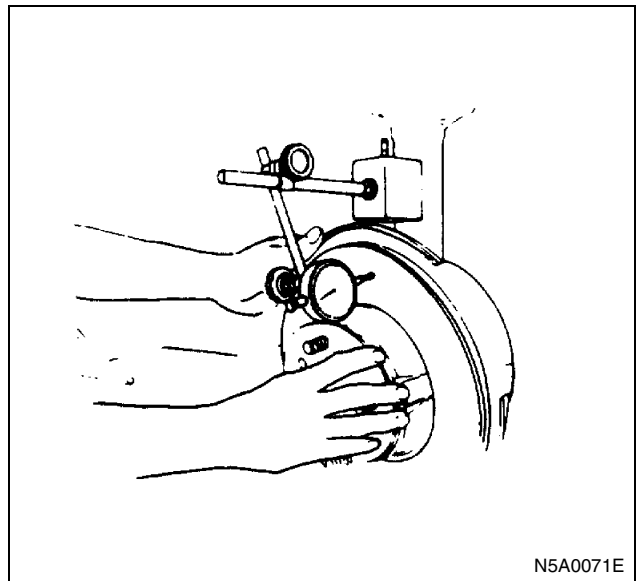
2. Use an inside dial indicator to measure the cylinder bore.
3. Calculate the piston and cylinder clearance.

Piston and cylinder Clearance		mm (in)
Standard	Limit	
0.08 — 0.18 (0.0031 — 0.0071)	0.23 (0.0091)	

If the clearance exceeds the specified limit, the piston and/or the body assembly must be replaced along with the repair seal kit.

Lateral Runout

1. Adjust the wheel bearing correctly. Refer to Section 4C FRONT AXLE.
2. Attach a dial indicator to some portion of the suspension so that the stem contacts the disc face about 29 mm (1.14 in) from the disc edge.



N5A0071E

3. Move the disc one complete rotation.
The lateral runout should not exceed 0.13 mm (0.005 in).

Maximum runout mm (in)	0.13 (0.005)
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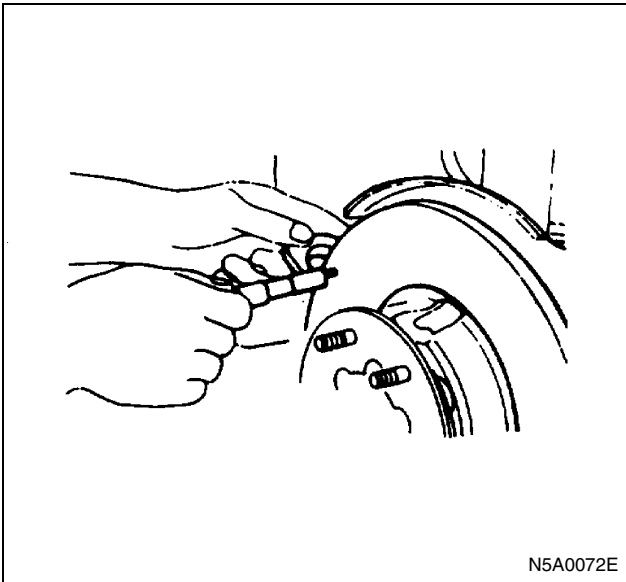
Parallelism and thickness

Parallelism is the measurement of the thickness of the disc at four or more points around the circumference of the disc. All measurement must be made at 29 mm (1.14 in) from the edge of the disc.

The disc thickness must not vary more than 0.010 mm (0.0004 in) from the point to point.

Maximum parallelism mm (in)	0.02 (0.0008)
-----------------------------	---------------

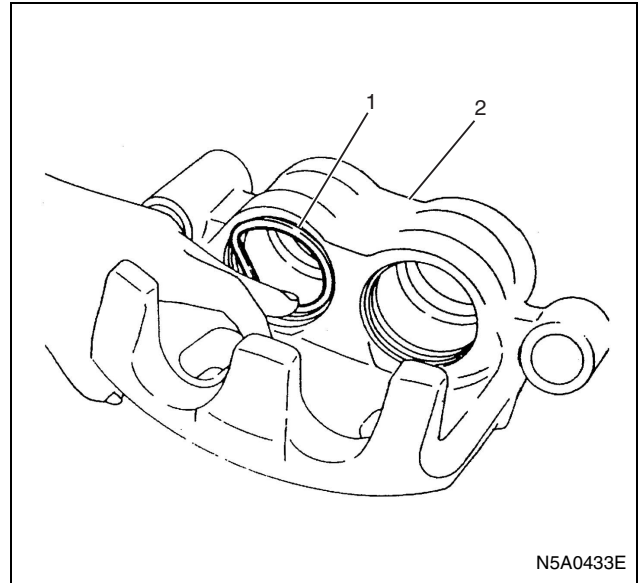
Disc Thickness		mm (in)
Standard	Limit	
35.0 (1.378)	32.0 (1.260)	



N5A0072E

Installation

1. Piston Seal
 - 1) Apply rubber grease to the piston seal.
The rubber grease is included in the seal kit.
 - 2) Install the piston seal to the cylinder bore groove.

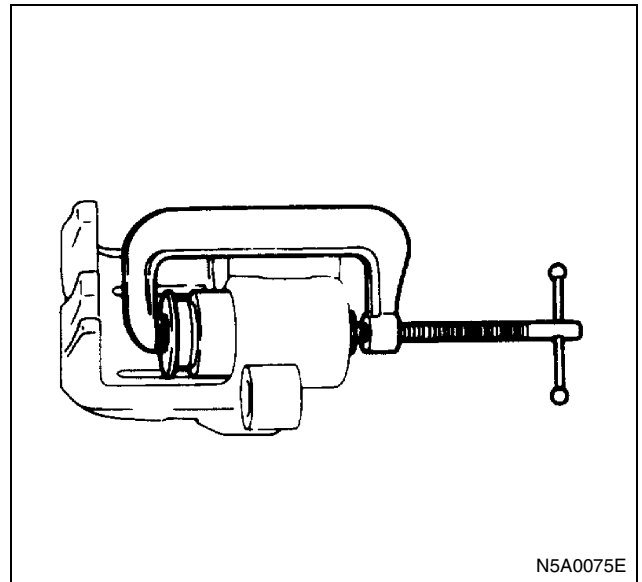


N5A0433E

Legend

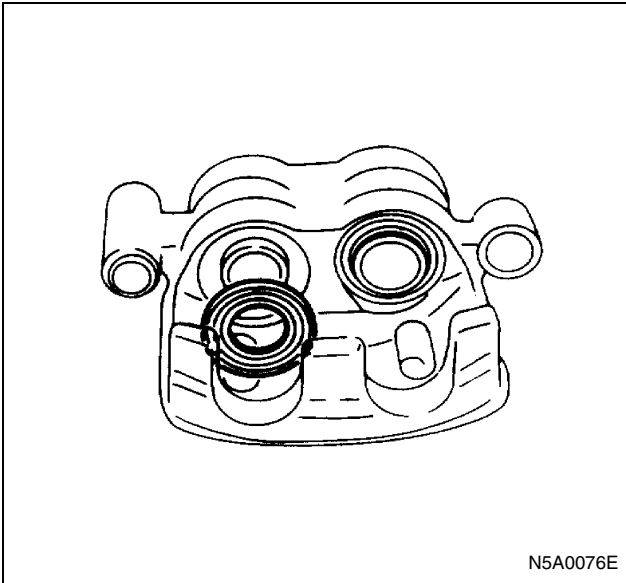
1. Piston Seal
2. Body Assembly

2. Piston
3. Piston Boot
4. Boot Ring
 - 1) Apply brake oil to the piston outer circumference.
 - 2) Use a hand vise to install the pistons to the cylinder.



N5A0075E

- 3) Apply special grease to the piston.
This will prevent cylinder and piston corrosion.
- 4) Install the piston boot outer lip to the cylinder bore groove.
Install the piston boot inner lip to the piston groove.
Handle the piston boot carefully.



- 5) Install the boot ring to the cylinder bore groove.
The boot ring must be completely installed to the groove.

5. Support Assembly

Tighten:

Support assembly bolt to 226 N·m (23.0 kg·m / 116 lb·ft)

6. Pad Clip
7. Pad
8. Caliper Assembly
9. Guide Pin Bolt
10. Lock Pin Bolt

Tighten:

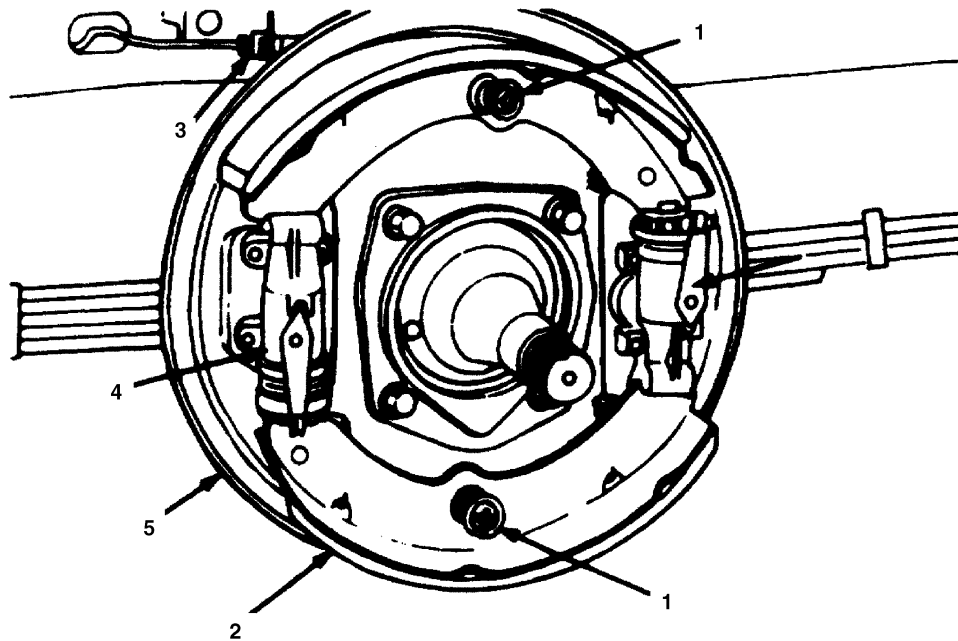
Guide pin and lock pin bolt to 137 N·m (14.0 kg·m / 101 lb·ft)

11. Joint Bolt and Flexible Hose

Tighten:

Joint bolt to 34 N·m (3.5 kg·m / 25 lb·ft)

Front Drum Brake Assembly (Two Leading and Dual Two Leading)
Two Leading Type (2L Type)

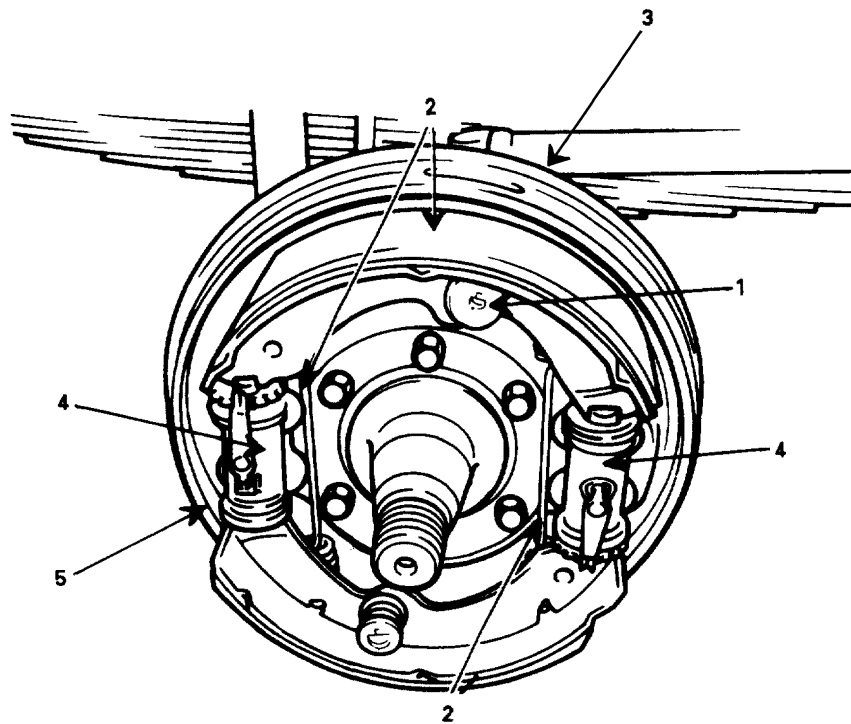


N5A0126E

Legend

- | | |
|-------------------------------------|------------------------------------|
| 1. Shoe holding spring, cup and pin | 4. Wheel cylinder assembly |
| 2. Brake shoe and return spring | 5. Back plate and oil shield cover |
| 3. Brake flexible hose and pipe | |

Dual Two Leading Type (D2L Type)



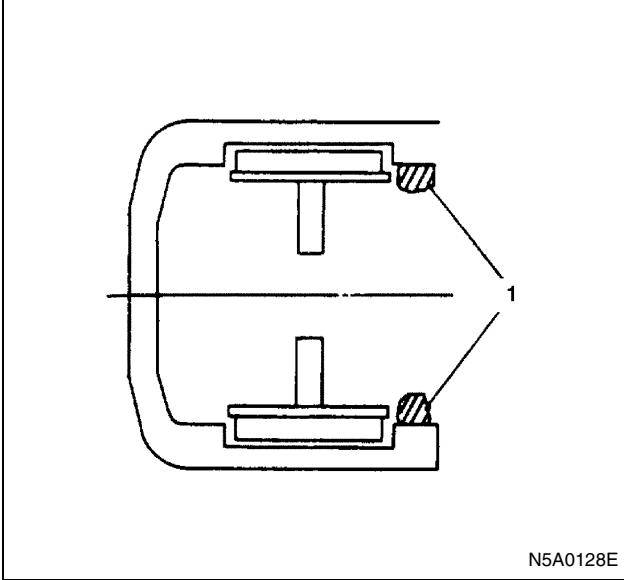
N5A0127E

Legend

- | | |
|-------------------------------------|------------------------------------|
| 1. Shoe holding spring, cup and pin | 4. Wheel cylinder assembly |
| 2. Brake shoe and return spring | 5. Back plate and oil shield cover |
| 3. Brake flexible hose and pipe | |

Removal

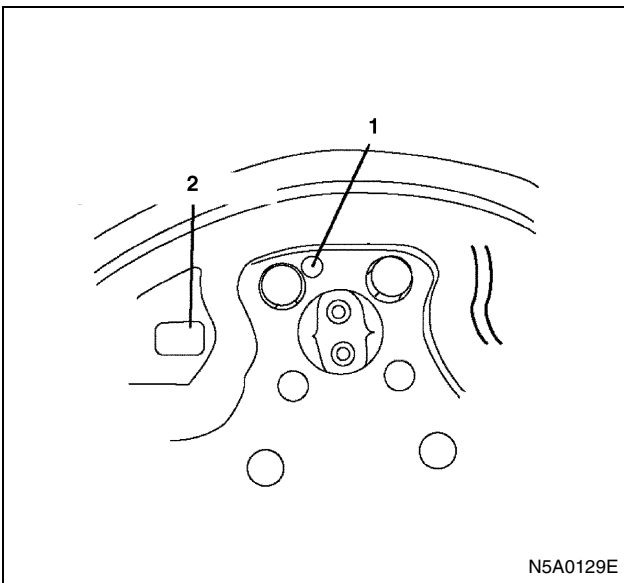
If the brake drum has step wear or the brake drum edge is corroded, it will be difficult to remove the brake drum. The following procedure will make brake drum removal easier.



Legend

1. Corroded portion

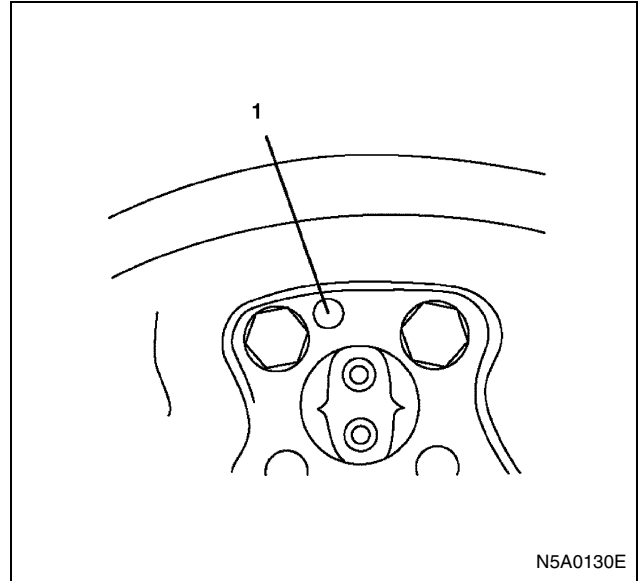
1. Remove the rubber cover from the brake lining clearance adjusting hole and auto-adjuster lever release hole.
2. Remove the adjust hole cover and adjuster lever release hole cover.



Legend

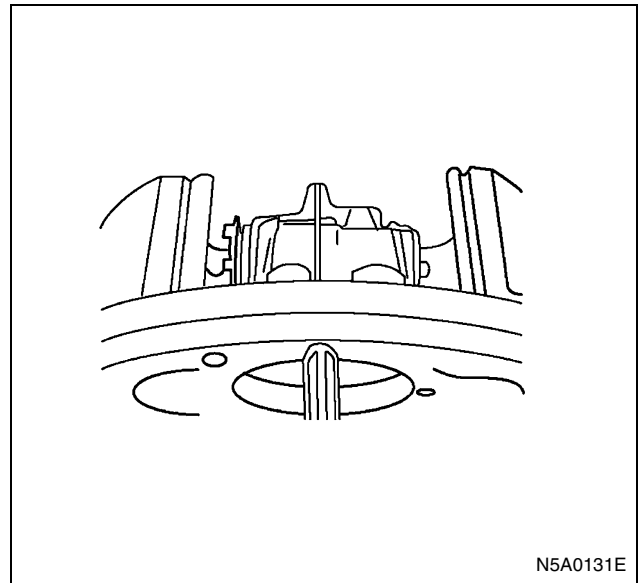
1. Adjuster lever release hole cover
2. Adjust hole cover

3. Using $\phi 5$ mm plus driver put it into the adjuster lever release hole and then push up the adjuster lever.

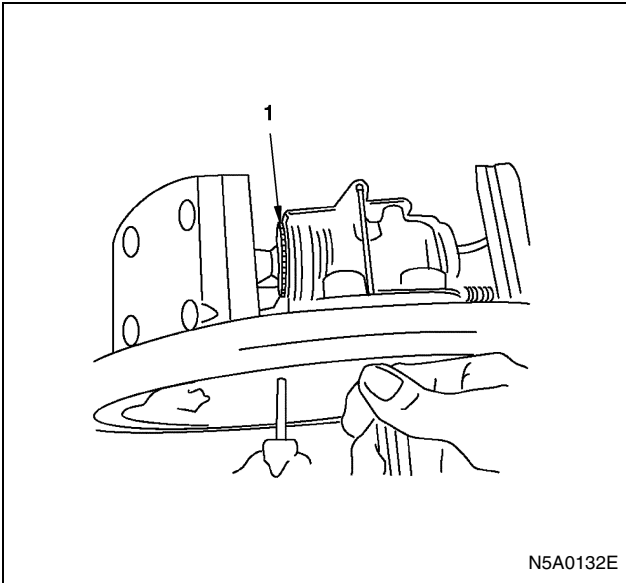


Legend

1. Adjuster lever release hole



4. Put the slotted screwdriver into the adjuster hole while push up the adjuster lever.

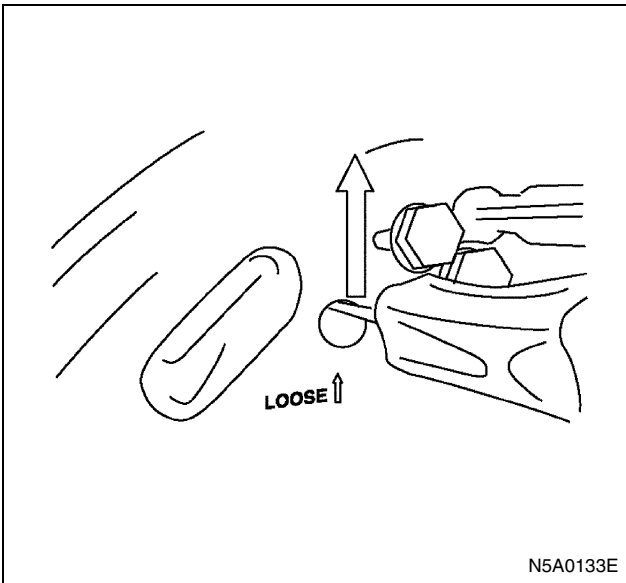


N5A0132E

Legend

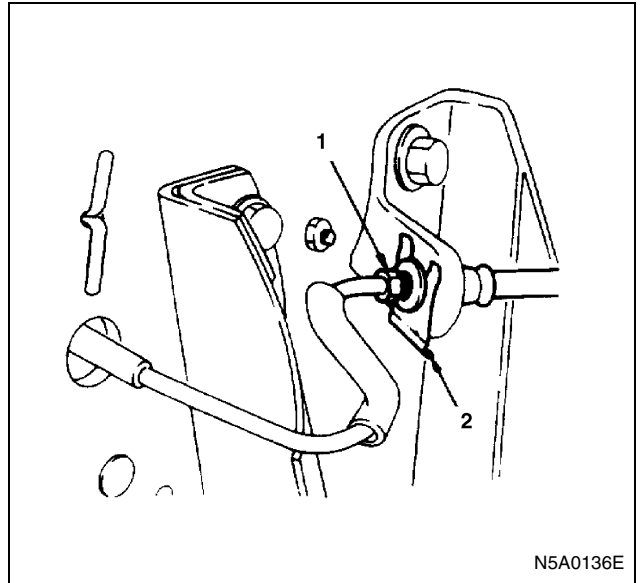
- 1. Adjuster gear

- 5. Turn the adjuster gear to the marked arrow "LOOSE" on the backing plate.



N5A0133E

- 6. Shoe Holding Spring, Cup and Pin
- 7. Brake Shoe and Return Spring
- 8. Brake flexible Hose and Pipe
 - 1) Place a tray beneath the flexible hose to receive the brake fluid.
 - 2) Loosen the union nut (1).

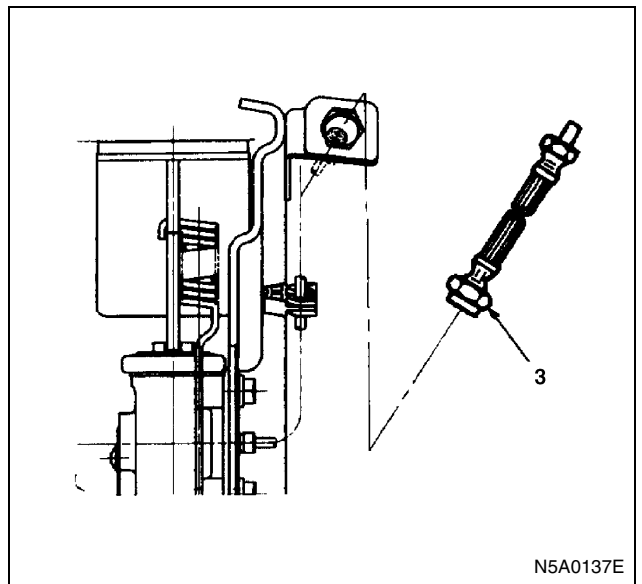


N5A0136E

- 3) Remove the clip (2) and loosen the hose end (3) from the pipe to remove the flexible hose.

Notice:

Take care not to twist the piping and the flexible hose.



N5A0137E

- 9. Wheel Cylinder Assembly
- 10. Back Plate and Oil Shield Cover
 - Store all of the removed parts in a clean part tray.

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Brake Drum Inside Diameter

Visually inspect the brake drum for excessive wear and scoring.

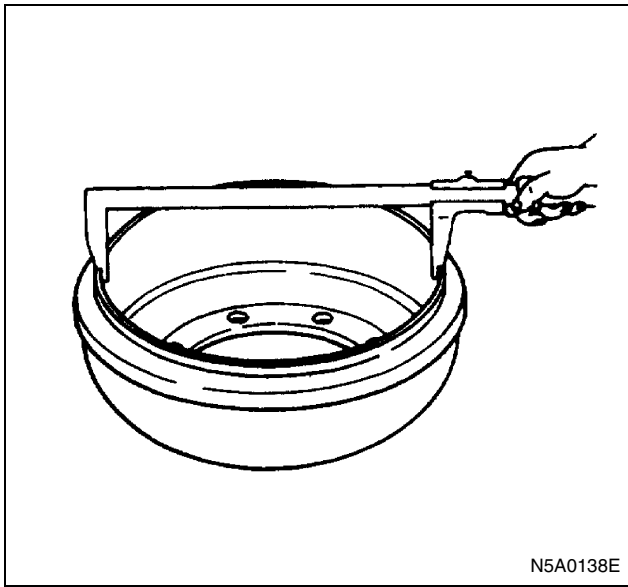
If the brake drum is scored or worn, lathed to the specified limit.

Use a vernier caliper to measure the brake drum inside diameter.

Brake Drum Inside Diameter		mm (in)
Drum size	Standard	Limit
279.4	279.4 (11.00)	281.0 (11.06)
300.0	300.0 (11.81)	301.5 (11.87)
320.0	320.0 (12.60)	321.5 (12.66)

Out of round:

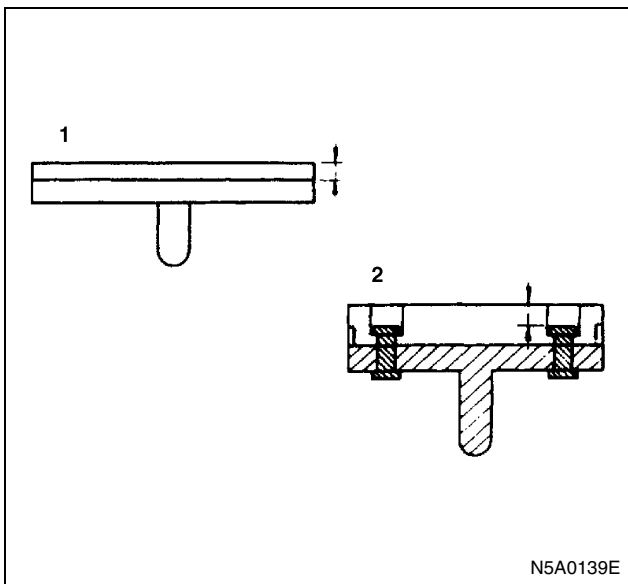
- Limit: 0.13 mm (0.005 in)



Brake Lining Thickness Measurement

Use a vernier caliper to measure the brake lining thickness or the rivet depth. If the measured value is less than the specified limit, the brake shoe assembly and/or the lining must be replaced.

Brake Lining Thickness or Rivet Depth		mm (in)
Limit		1.0 (0.039)

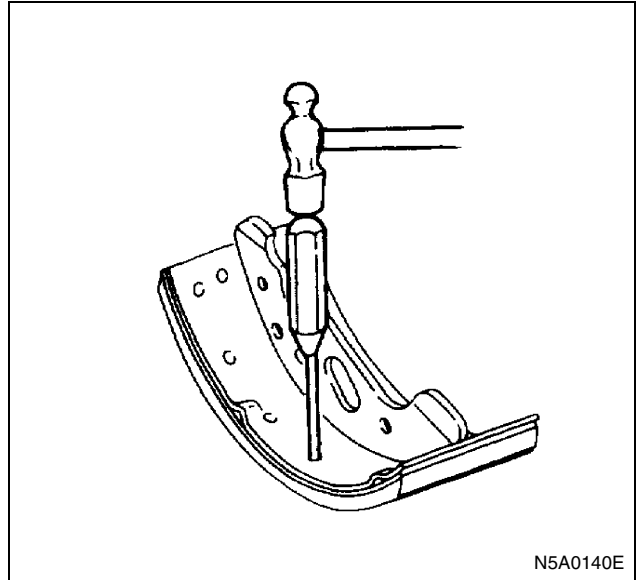


Legend

- Adhesion type
- Riveted type

Brake Lining Removal (Riveted Type Only)

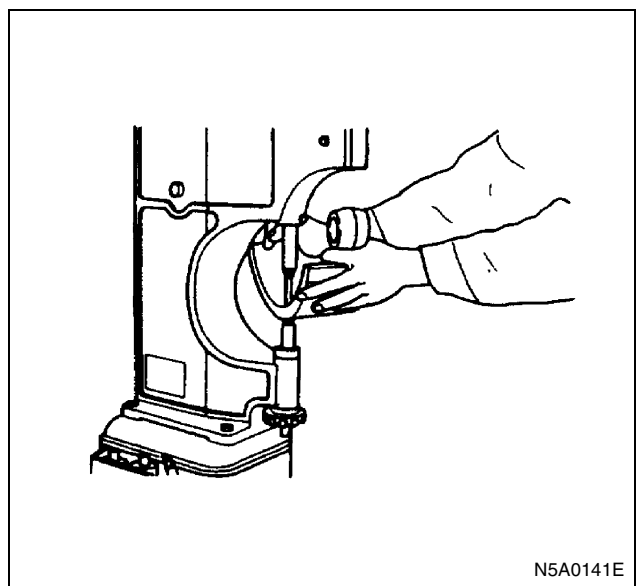
- Remove the rivet caulking portions with a hammer and chisel.
- Remove the rivets with a hammer and punch.



- Inspect the brake shoe for cracking.

Brake Lining Installation (Riveted Type Only)

- Install the brake lining the rivets to the brake shoe.
- Place the brake shoe assembly in the air hydraulic riveter.
- Use the air hydraulic riveter to set and caulk each of the rivets.

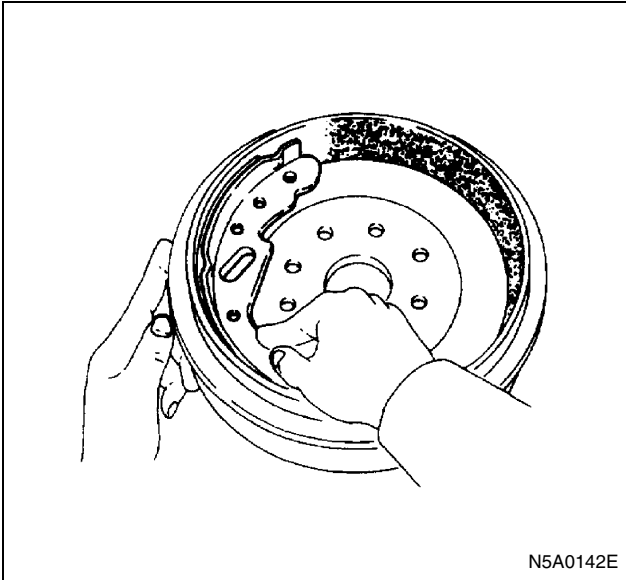


- Start riveting at the center of lining and work towards the ends.

Brake Lining and Drum Contact

- Apply chalk powder to the entire inside brake drum surface.

2. Place the brake shoe assembly in the inside brake drum.
3. Move the brake shoe assembly around the inside brake drum.
Check for uniform contact between the brake lining and the brake drum.



N5A0142E

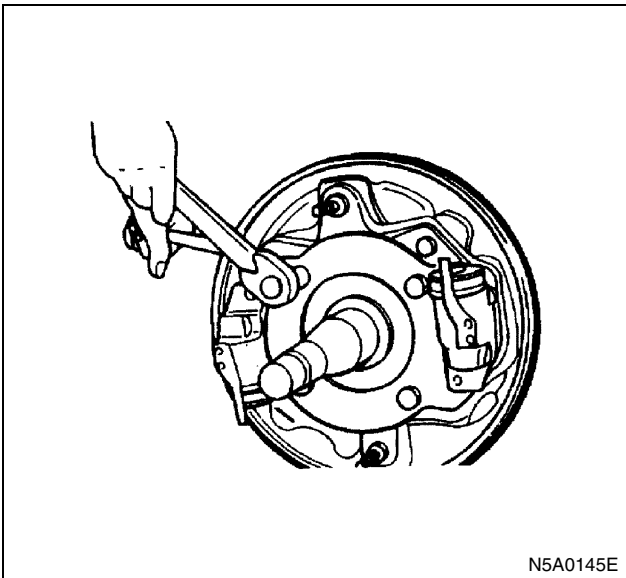
4. Correct any areas having poor contact with sandpaper.
5. Repeat Steps 1 through 4 until the contact between the brake lining and the brake drum is perfect.

Installation

1. Back Plate and Oil Shield cover
Tighten the back plate and oil shield cover bolts to the specified torque.

Tighten:

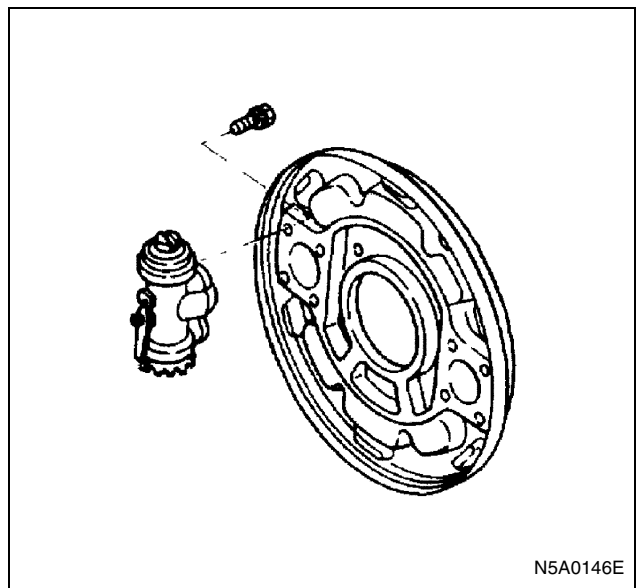
Back plate and oil shield cover bolts to
 NPS model: 98 N·m (10.0 kg·m / 72 lb·ft)
 NQR model: 157 N·m (16.0 kg·m / 116 lb·ft)
 Others: 88 N·m (9.0 kg·m / 65 lb·ft)



N5A0145E

2. Wheel Cylinder Assembly
Tighten the wheel cylinder assembly bolts to the specified torque.

Wheel Cylinder Assembly Bolt Torque		
		N·m (kg·m/lb·ft)
Drum Inside Dia. mm (in)	Lining Width mm (in)	—
279.4 (11.00)	60 (2.36)	27 (2.8/20)
300.0 (11.81)	75 (2.95)	34 (3.5/25)
320.0 (12.60)		43 (4.4/32)
320.0 (12.60)	100 (3.94)	74 (7.5/54)
320.0 (12.60)	120 (4.72)	94 (9.6/69)



N5A0146E

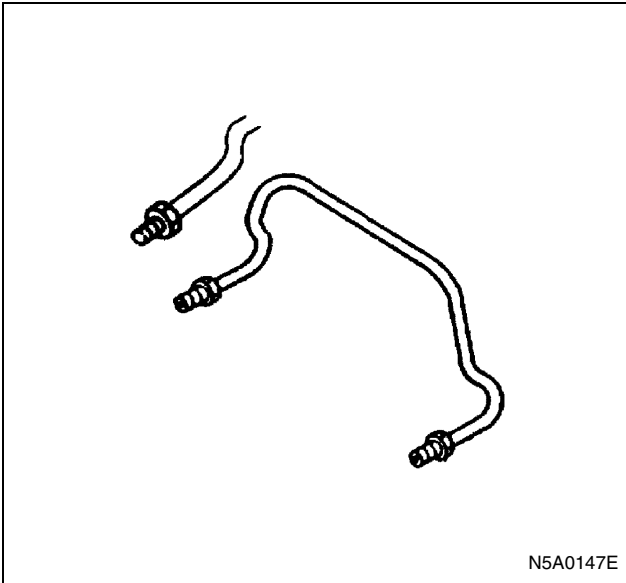
3. Brake Flexible Hose and Pipe
Tighten the brake pipe flare nuts to the specified torque.

Tighten:

Brake pipe flare nuts to 16 N·m (1.6 kg·m / 12 lb·ft)

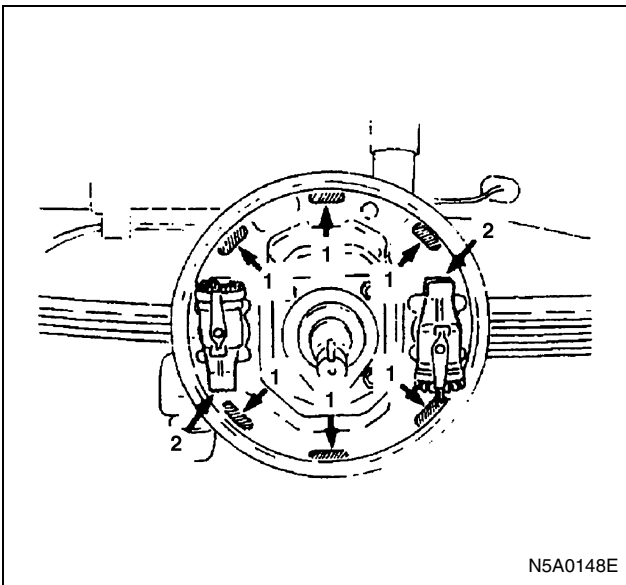
Notice:

Take care not to twist the piping and the flexible hose.

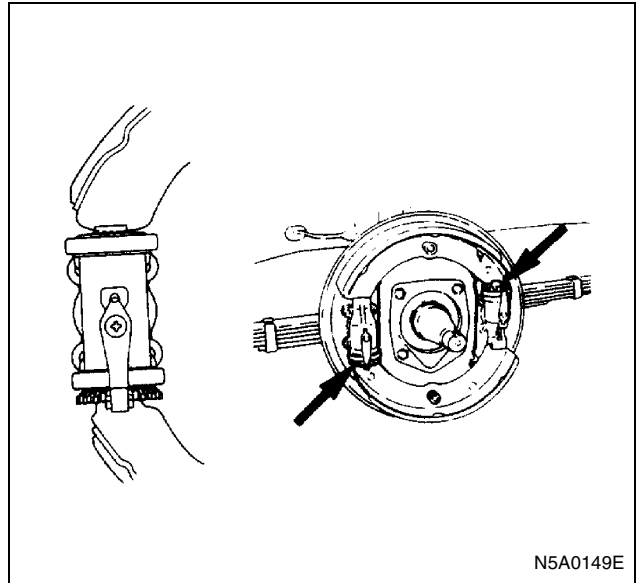


4. Brake Shoe and Return Spring (Two Leading Type)

- 1) Before setting the brake shoes, apply a thin coat of molybdenum disulfide grease to the back plate portions (1) contacting the brake shoe edge as shown in the illustrations.
- 2) Apply a coat of molybdenum disulfide grease to the wheel cylinder parts contacting the shoe (2).



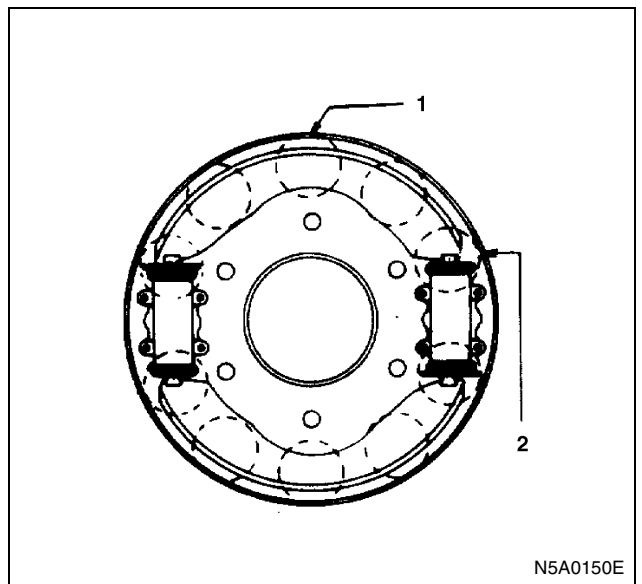
- 3) Set the brake shoe assembly to the cylinder adjusting screw at the brake shoe small angle end.
Do not install it at the round end to the adjusting screw.



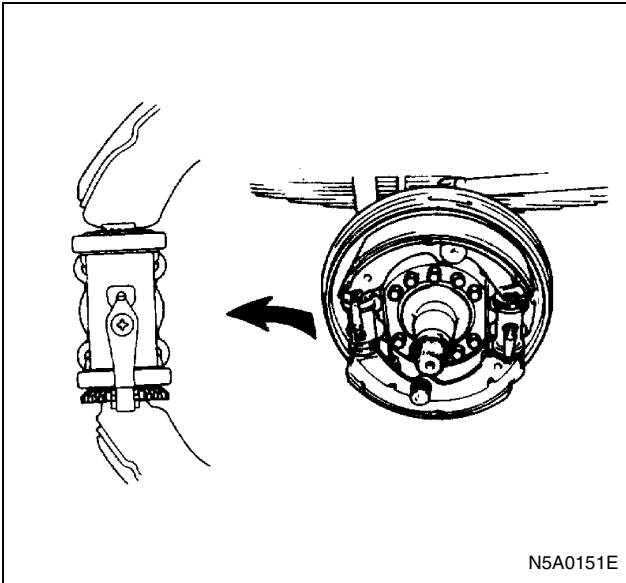
4) Install the brake shoes and the return springs to the wheel cylinders.
Keep the lining surface clean.

5. Brake Shoe and Return Spring (Dual Two Leading Type)

- 1) Before setting the brake shoes, apply a thin coat of molybdenum disulfide grease to the back plate portions (1) contacting the brake shoe edge as shown in the illustrations.
- 2) Apply a coat of molybdenum disulfide grease to the wheel cylinder parts contacting the brake shoe (2).



- 3) Set the brake shoe assembly to the cylinder adjusting screw at the brake shoe small angle end.
Do not install it at the round end to the adjusting screw.

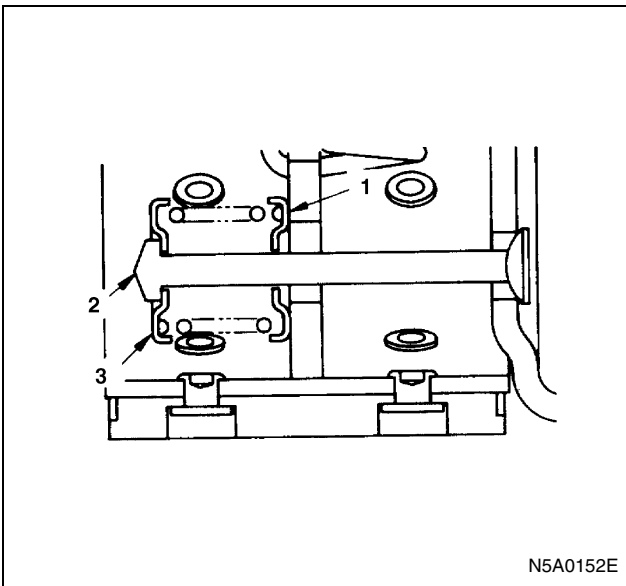


N5A0151E

- 4) Install the brake shoes and the return springs to the wheel cylinders.
Keep the brake lining clean.

6. Shoe Holding Spring, Cup and Pin

- 1) Before installing the holding pin, apply a coat of molybdenum disulfide grease to the holding cup seating faces (1) contacting the brake shoe.



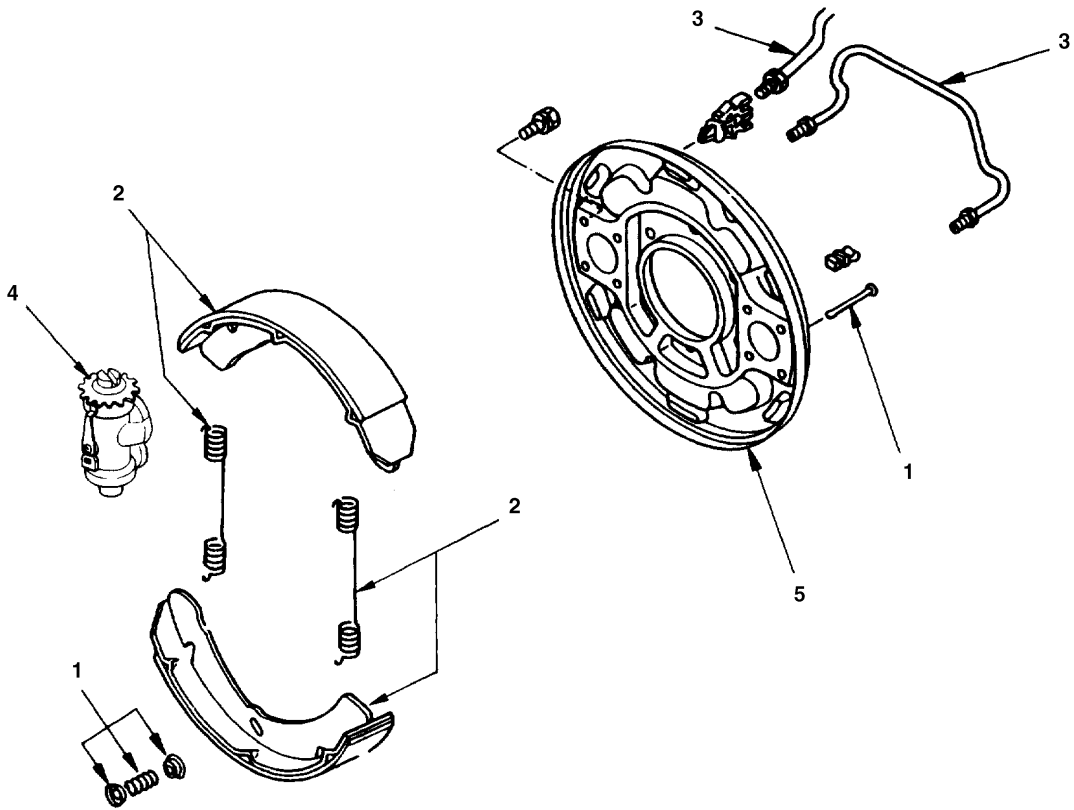
N5A0152E

- 2) After installation of the pins, cups and the springs, make sure the pin (2) seats to the cup (3) properly.

After assembly, adjust the lining clearance and air bleeding the brake, referring to "SERVING" in Section 00 of this section.

Rear Drum Brake Assembly (Except Drum Inside Diameter 370 mm)

These removal steps are based on the without auto-adjuster type brake.



N5A0153E

Legend

- | | |
|-------------------------------------|----------------------------|
| 1. Shoe holding spring, cup and pin | 4. Wheel cylinder assembly |
| 2. Brake shoe and return spring | 5. Back plate |
| 3. Brake pipe | |

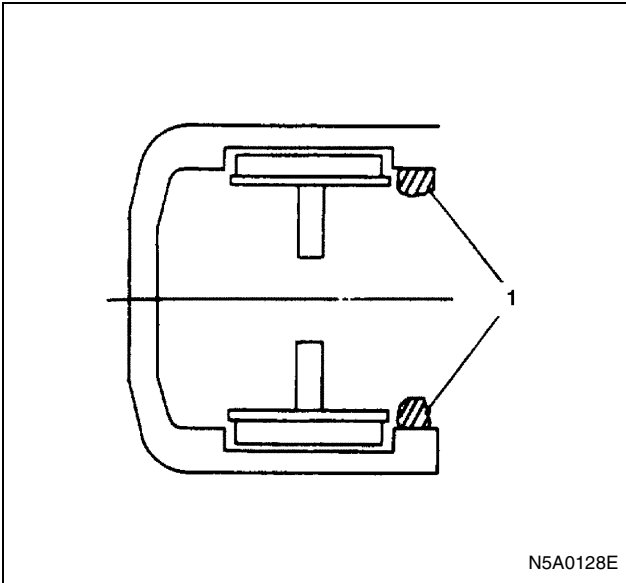
Removal

1. Shoe Holding Spring, Cup and Pin
2. Brake Shoe Return Spring
3. Brake Pipe
4. Wheel Cylinder Assembly
5. Back Plate

Store all of the removed parts in a clean part tray.

With Auto-adjuster

If the brake drum has step wear or the brake drum edge is corroded, it will be difficult to remove the brake drum. The following procedure will make brake drum removal easier.



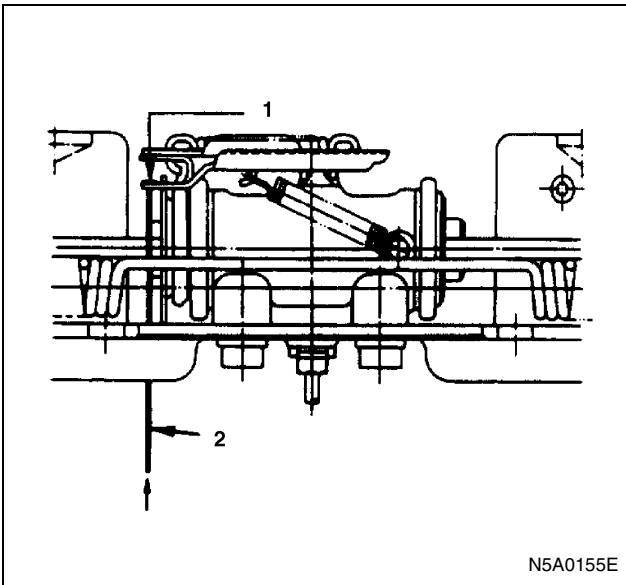
N5A0128E

Legend

- 1. Corroded portion

Drum Inside Diameter 260 mm

1. Remove the rubber covers from the brake lining clearance adjusting hole and auto-adjuster lever release hole.
2. Push up the auto-adjuster lever with a long drift or a suitable rod.
(Outside diameter: 4 mm (0.15 in) length: 80 mm (3.1 in))



N5A0155E

Legend

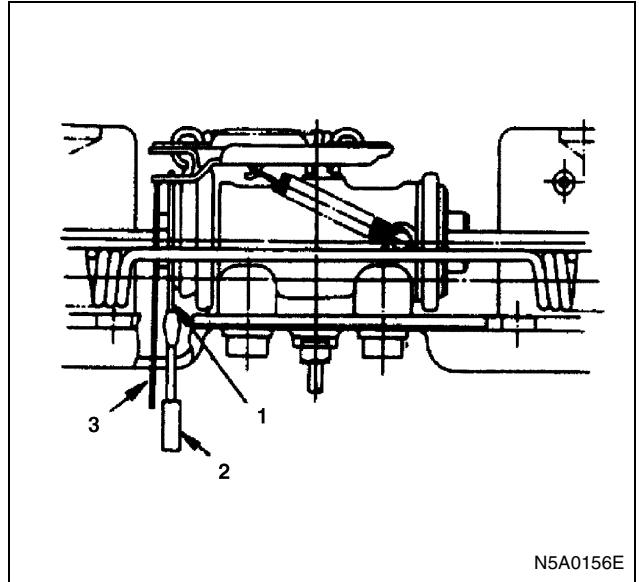
- 1. Auto-adjuster lever
- 2. Rod

3. Hold the auto-adjuster lever stationary. Use a screwdriver to rotate adjusters at back of the brake to provide clearance between lining and drum.

Notice:

Be sure to push up the auto-adjuster lever (Step 2). Failure to do so will result in damage to the teeth of the auto-adjuster lever.

Take care not to damage the rubber boot with the bar or the screwdriver.



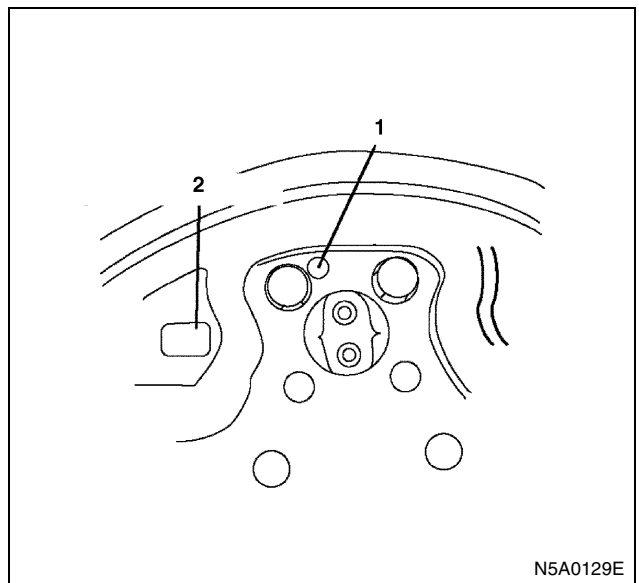
N5A0156E

Legend

- 1. Adjuster
- 2. Screw driver
- 3. Rod

Drum Inside Diameter 320 mm

1. Remove the rubber cover from the brake lining clearance adjusting hole and auto-adjuster lever release hole.
2. Remove the adjust hole cover and adjuster lever release hole cover.

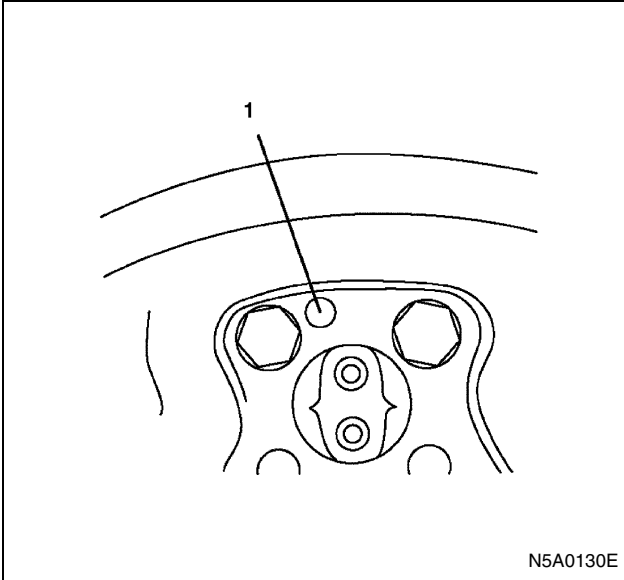


N5A0129E

Legend

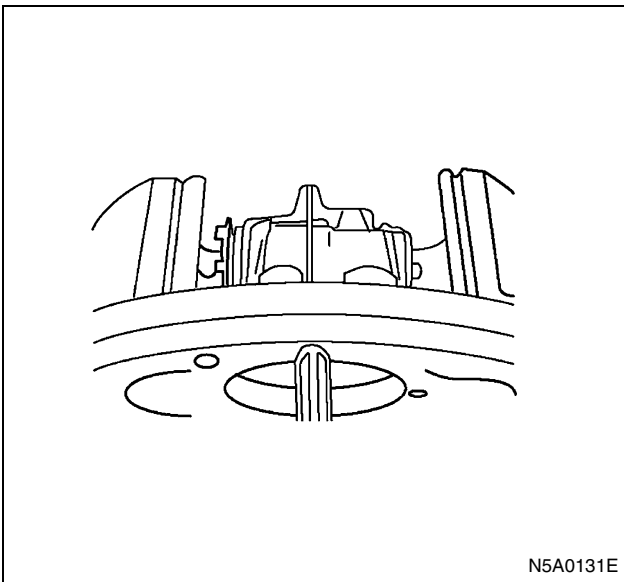
1. Adjuster lever release hole cover
2. Adjuster hole cover

3. Using $\phi 5$ mm Phillips screwdriver put it into the adjuster lever release hole and then push up the adjuster lever.

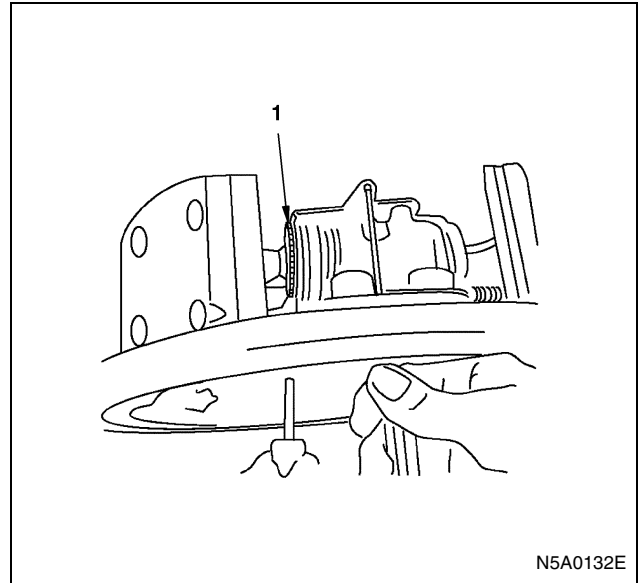


Legend

1. Adjuster lever release hole



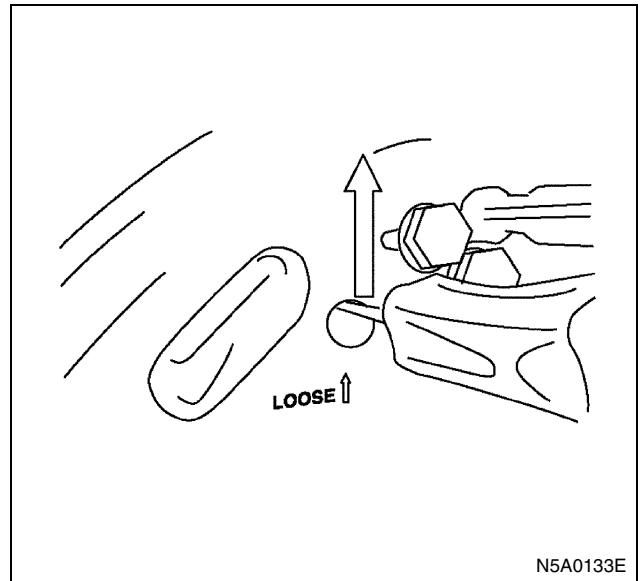
4. Put the flathead screwdriver into the adjuster hole while push up the adjuster lever.



Legend

1. Adjuster gear

5. Turn the adjuster gear to the marked arrow "LOOSE" on the backing plate.



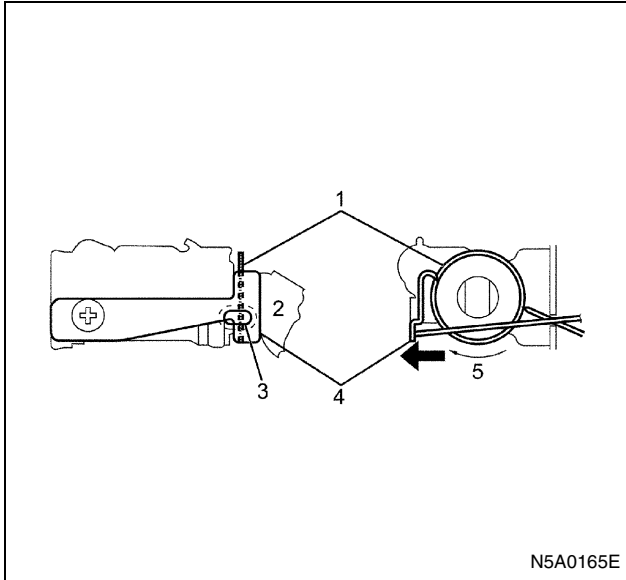
Drum Inside Diameter 240 mm

1. Remove the rubber cover from the brake lining clearance adjusting hole/auto-adjuster lever release hole in the back plate.
2. Insert a thin, suitable rod in the hole, and push up the auto-adjuster lever (4).
3. With the auto-adjuster lever (4) pushed up, insert a keystone tip screwdriver in the adjusting hole, and turn the adjuster gear (1) to increase the gap between the gear and the brake shoe (the outside diameter of the shoe will decrease).

Notice:

Do not fail to push up the auto-adjuster lever before turning the gear. Failure to do so will result in damage to the teeth of the gear because it is locked with the lever.

Exercise care not to damage the boot of the wheel cylinder and other parts when turning the gear and pushing up the lever.

**Legend**

1. Adjuster gear
2. Brake shoe
3. Plug hole
4. Auto-adjuster lever
5. Loosening direction

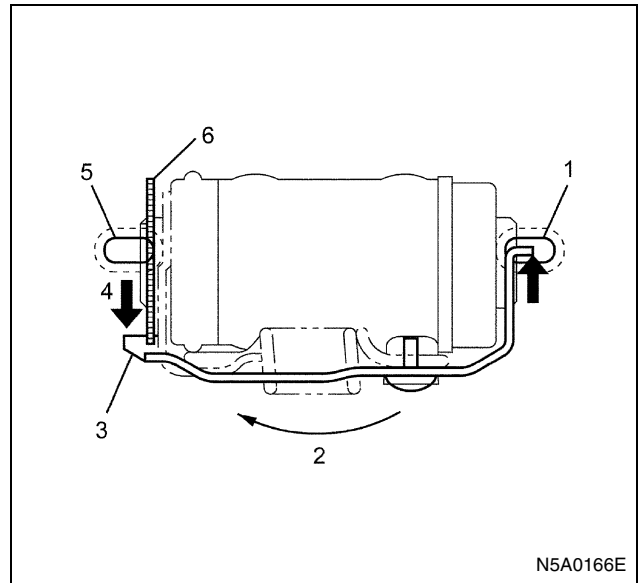
Drum Inside Diameter 290 mm

1. Remove the rubber cover from the brake lining clearance adjusting hole/auto-adjuster lever release hole in the back plate.
2. Insert a thin, suitable rod in the auto-adjuster lever release hole, and push the end of the auto-adjuster lever (3) in the direction of the arrow (4).
3. With the auto-adjuster lever (3) pushed up, insert a keystone tip screwdriver in the adjusting hole, and turn the adjuster gear (6) to increase the gap between the gear and the brake shoe (the outside diameter of the shoe will decrease).

Notice:

Do not fail to push up the auto-adjuster lever before turning the gear. Failure to do so will result in damage to the teeth of the gear because it is locked with the lever.

Exercise care not to damage the boot of the wheel cylinder and other parts when turning the gear and pushing up the lever.

**Legend**

1. Plug hole
2. Rotating direction of tire (forward)
3. Auto-adjuster lever
4. Loosening direction
5. Plug hole
6. Adjuster gear

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

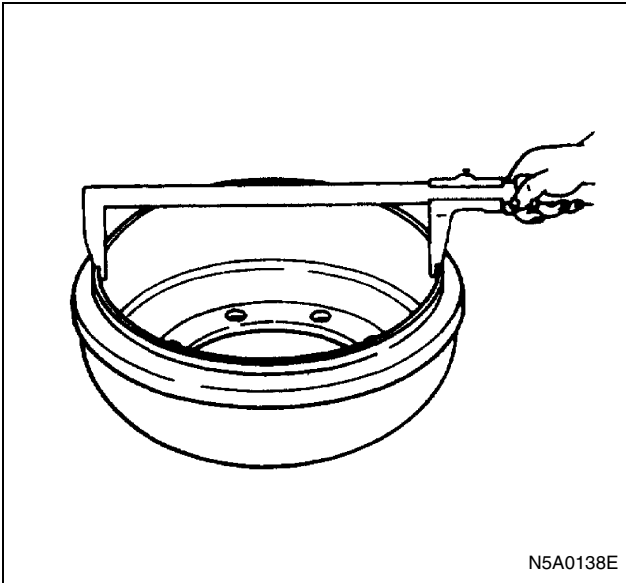
Brake Drum Inside Diameter

Visually inspect the brake drum for excessive wear and scoring.

If the brake drum is scored or worn, lathed to the specified limit.

Use a vernier caliper to measure the brake drum inside diameter.

Brake Drum Inside Diameter		mm (in)
Drum size	Standard	Limit
228.6	228.6 (9.00)	230.0 (9.06)
240	240.0 (9.45)	241.5 (9.51)
260	260.0 (10.24)	261.5 (10.30)
279.4	279.4 (11.00)	281.0 (11.06)
290	290.0 (11.42)	291.5 (11.48)
300	300.0 (11.81)	301.5 (11.87)
320	320.0 (12.60)	321.5 (12.66)
Out of round		
• Limit: 0.13 mm (0.005 in)		



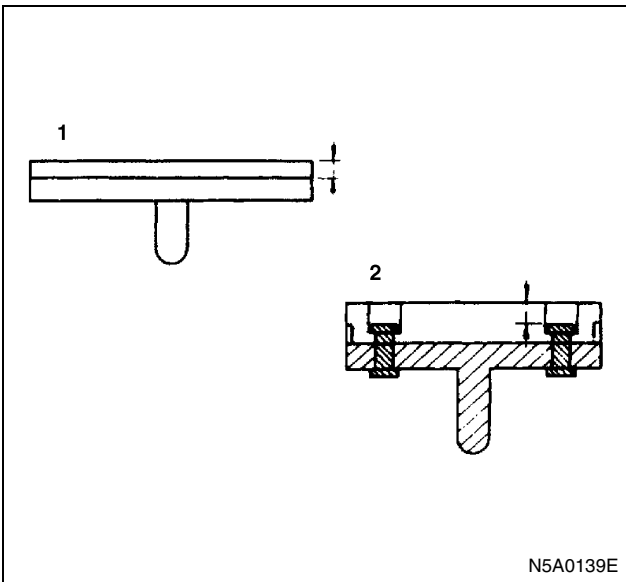
N5A0138E

Brake Lining Thickness Measurement

Use a vernier caliper to measure the brake lining thickness or the rivet depth.

If the measured value is less than the specified limit, the brake shoe assembly and/or the lining must be replaced.

Brake Lining Thickness or Rivet Depth		mm (in)
Limit		1.0 (0.039)



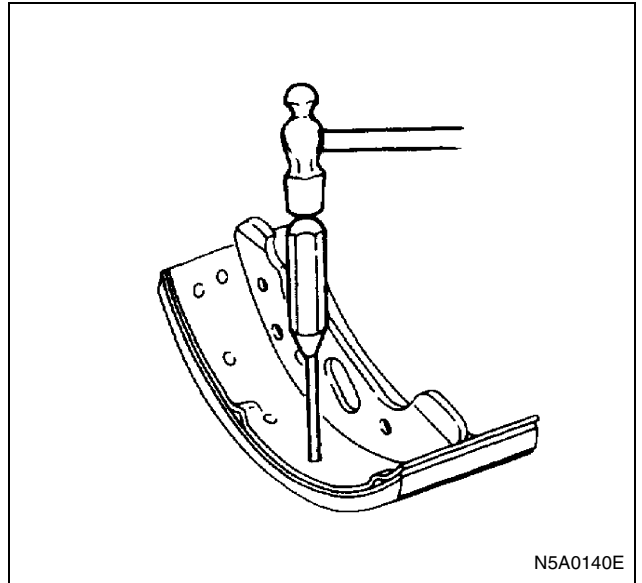
N5A0139E

Legend

- 1. Adhesion type
- 2. Riveted type

Brake Lining Removal (Riveted Type Only)

1. Remove the rivet caulking portions with a hammer and chisel.
2. Remove the rivets with a hammer and punch.

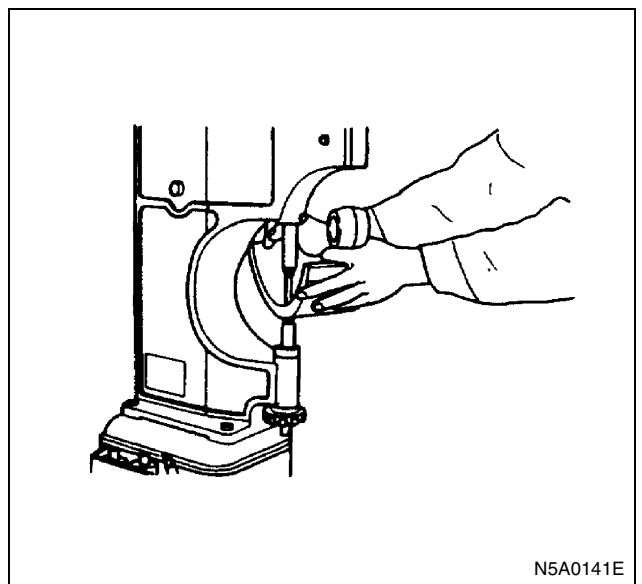


N5A0140E

3. Inspect the brake shoe for cracking.

Brake Lining Installation (Riveted Type Only)

1. Install the brake lining and the rivets to the brake shoe.
2. Place the brake shoe assembly in the air hydraulic riveter.
3. Use the air hydraulic riveter to set and caulk each of the rivets.

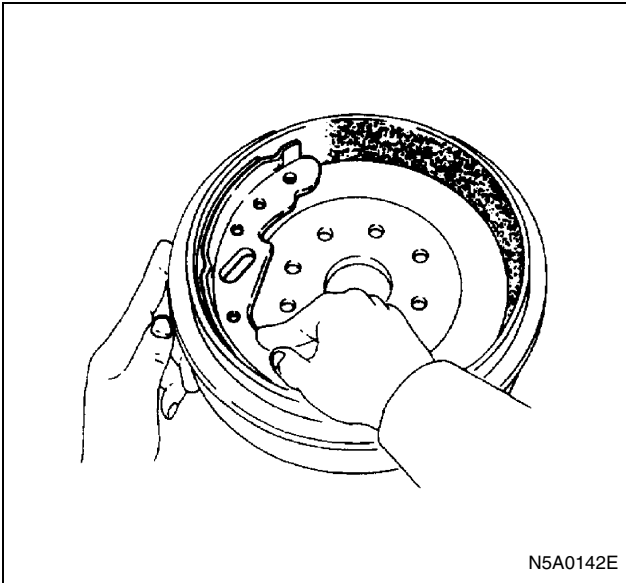


N5A0141E

4. Start riveting at the center of lining and work towards the ends.

Brake Lining and Drum Contact

1. Apply chalk powder to the entire inside brake drum surface.
2. Place the brake shoe assembly in the inside brake drum.
3. Move the brake shoe assembly around the inside brake drum. Check for uniform contact between the brake lining and the brake drum.



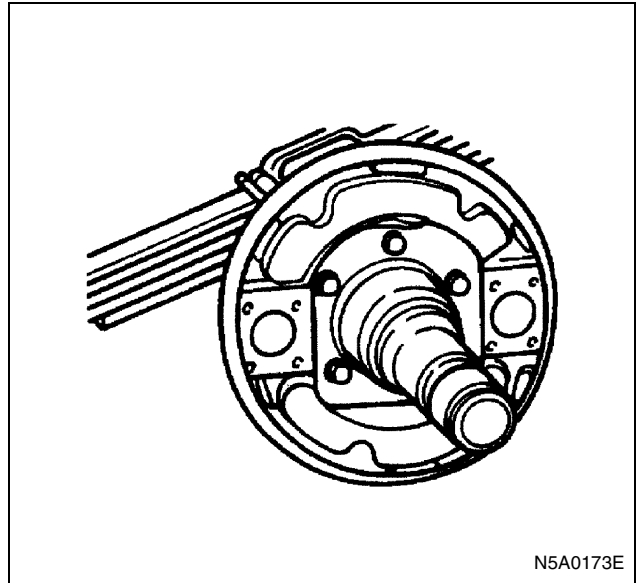
4. Correct any areas having poor contact with sandpaper.
5. Repeat Steps 1 through 4 until the contact between the brake lining and the brake drum is perfect.

Installation

1. Back Plate
Tighten the back plate bolts to the specified torque.

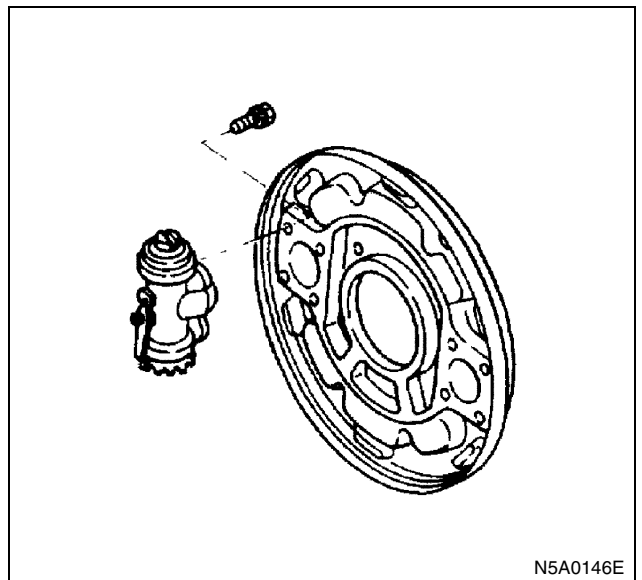
Back Plate Bolt Torque		N-m (kg-m/lb-ft)
Drum Inside Dia. mm (in)	Lining Width mm (in)	—
228.6 (9.00)	75 (2.95)	108 (11.0/80)
240.0 (9.45)	60 (2.36)	108 (11.0/80)
260.0 (10.24)	90 (3.54)	108 (11.0/80)
279.4 (11.00)	60 (2.36)	74 (7.5/54)
290.0 (11.42)	75 (2.95)	108 (11.0/80)
300.0 (11.81)	75 (2.95)	* 44 (4.5/33)
		** 108 (11.0/80)
320.0 (12.60)	75 (2.95)	108 (11.0/80)
	100 (3.94)	108 (11.0/80)
	120 (4.72)	157 (16.0/116)

* Single Tire models
** Dual Tire models



2. Wheel Cylinder Assembly
Tighten the wheel cylinder assembly bolts to the specified torque.

Wheel Cylinder Assembly Bolt Torque		
N-m (kg-m/lb-ft)		
Drum Inside Dia. mm (in)	Lining Width mm (in)	—
228.6 (9.00)	75 (2.95)	34 (3.5/25)
240.0 (9.45)	60 (2.36)	25 (2.5/18)
260.0 (10.24)	90 (3.54)	43 (4.4/32)
279.4 (11.00)	60 (2.36)	27 (2.8/20)
290.0 (11.42)	75 (2.95)	25 (2.5/18)
300.0 (11.81)	75 (2.95)	34 (3.5/25)
320.0 (12.60)	75 (2.95)	43 (4.4/32)
	100 (3.94)	74 (7.5/55)
	120 (4.72)	94 (9.6/69)



3. Brake Pipe

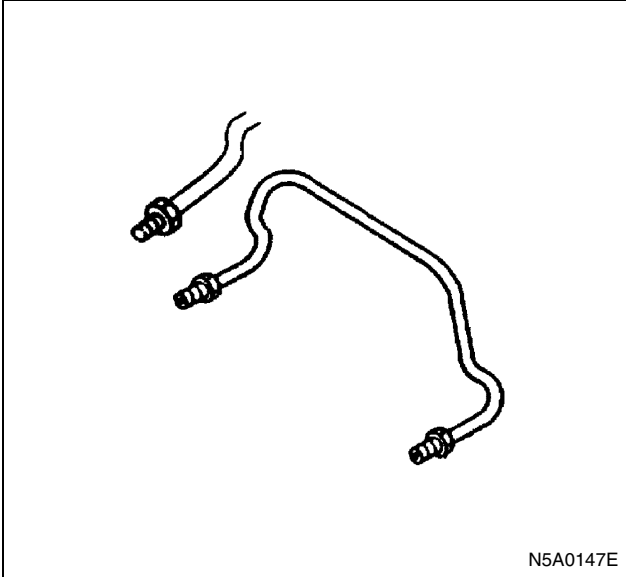
Tighten the brake pipe flare nuts to the specified torque.

Tighten:

Brake pipe flare nuts to 16 N-m (1.6 kg-m / 12 lb-ft)

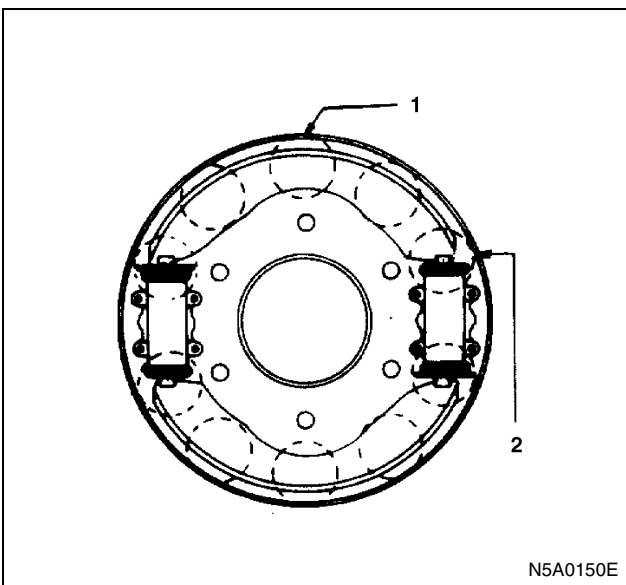
Notice:

Take care not to twist the piping.

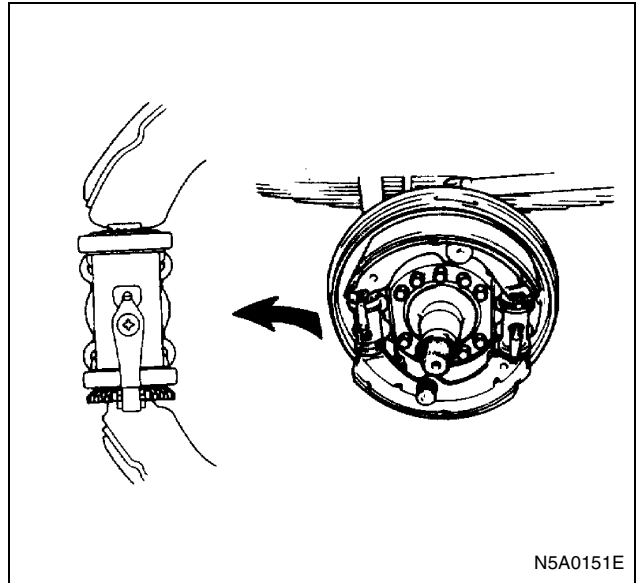


4. Brake Shoe and Return Spring

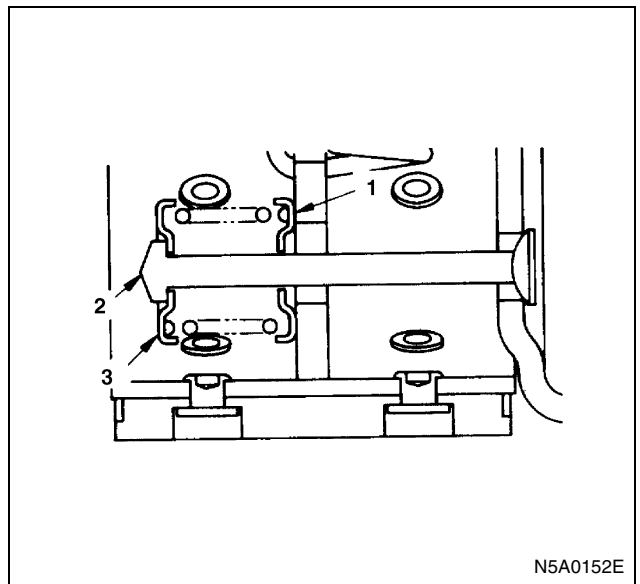
- 1) Before setting the brake shoes, apply a thin coat of molybdenum disulfide grease to the back plate portions (1) contacting the brake shoe edge as shown in the illustrations.
- 2) Apply a coat of molybdenum disulfide grease to the wheel cylinder parts contacting the brake shoe (2).



- 3) Set the brake shoe assembly to the cylinder adjusting screw at the brake shoe small angle end.
Do not install it at the round end.



- 4) Install the brake shoes and the return springs to the wheel cylinders.
Keep the brake lining clean.
5. Shoe Holding Spring, Cup and Pin
 - 1) Before installing the holding pin.
Apply a coat of molybdenum disulfide grease to the holding cup seating faces (1) contacting the brake shoe.
 - 2) After installation of the pins, cups and the springs, make sure the pin (2) seats to the cup (3) properly.

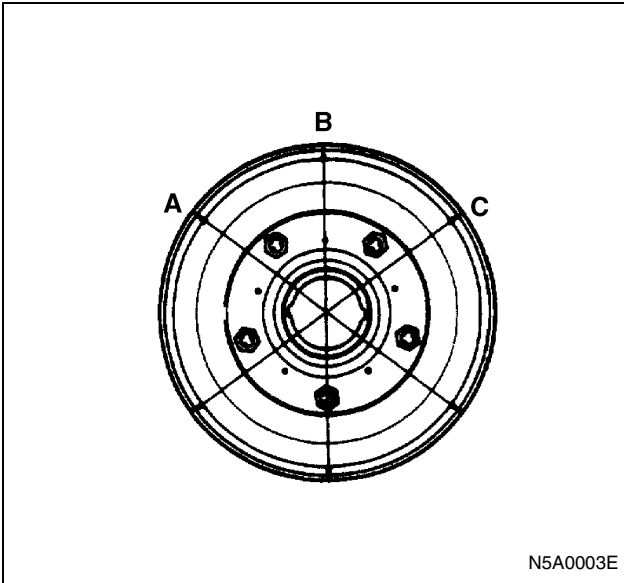


6. After installation of brake drum, be sure to perform the preload adjustment of hub bearing.
7. Bleed the air from brake.

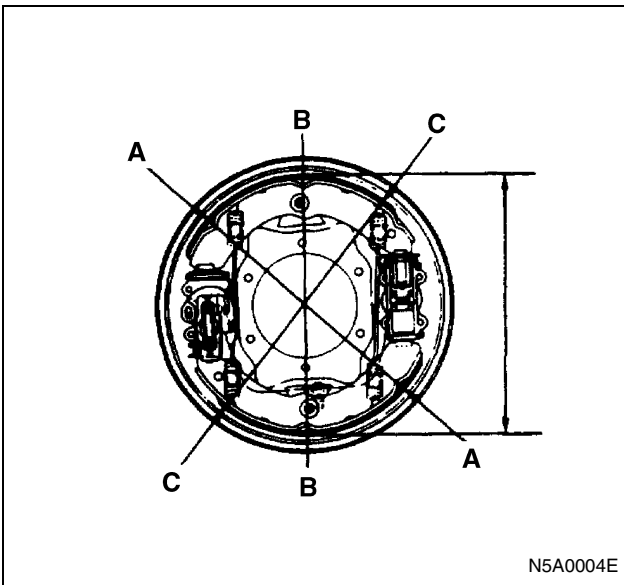
With Auto-adjuster

For the drum brake with auto-adjuster, perform the following procedure before Step 6 and 7.

1. Measure the internal diameter of the brake drum.
 - Take measurement of the distance at (A), (B) and (C) points.



2. Measure the external diameter of the brake shoe.
 - Take measurement of the distance at (A), (B) and (C) points.



3. Turn the adjuster gear so that the difference between the internal diameter of the brake drum and the internal diameter of the brake shoe becomes 0.6 mm (0.024 in).
4. Install the brake drum.

Adjustment

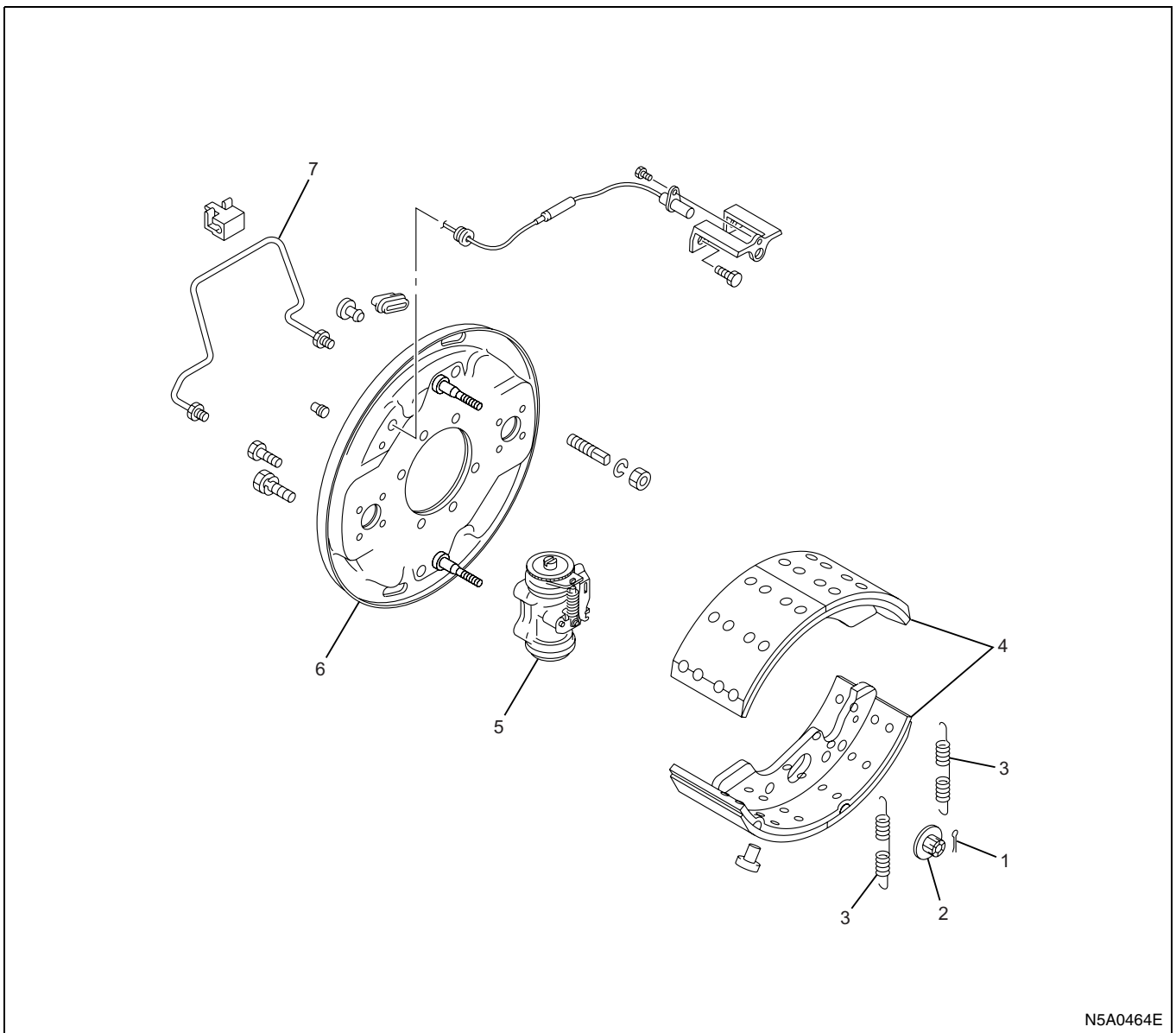
Without Auto-adjuster

Turn the adjuster until the brake drum stops rotating. Depress the brake pedal several times and turn the adjuster furthermore. When the brake drum stops rotating completely, turn the adjuster back for 5 to 6 notches.

With Auto-adjuster

Strongly depress the brake pedal several times while rotating the brake drum in the direction of moving forward or driving the vehicle forward. This adjusts the brake drum clearance automatically.

Rear Drum Brake Assembly (Drum Inside Diameter 370 mm)



N5A0464E

Legend

- | | |
|-----------------------------|----------------------------|
| 1. Cotter pin | 5. Wheel cylinder assembly |
| 2. Shoe hold nut | 6. Back plate |
| 3. Brake shoe return spring | 7. Brake pipe |
| 4. Brake shoe assembly | |

Removal

- Block vehicle wheels and apply the parking brake.
 - Raise the axle to clear the tire from the ground. Position jack stands under vehicle.
1. Wheel and tire assembly and brake drum and hub assembly.
 - Refer to Section 3E WHEELS AND TIRES.
 - Refer to Section 4C FRONT AXLE and Section 3C FRONT SUSPENSION.
 - Refer to Section 4B REAR AXLE.

2. Holder nuts.
3. Shoe return springs using a return spring plier. Return spring plier: 9-8522-0026-0
4. Shoe and lining assemblies.
5. Brake pipes.

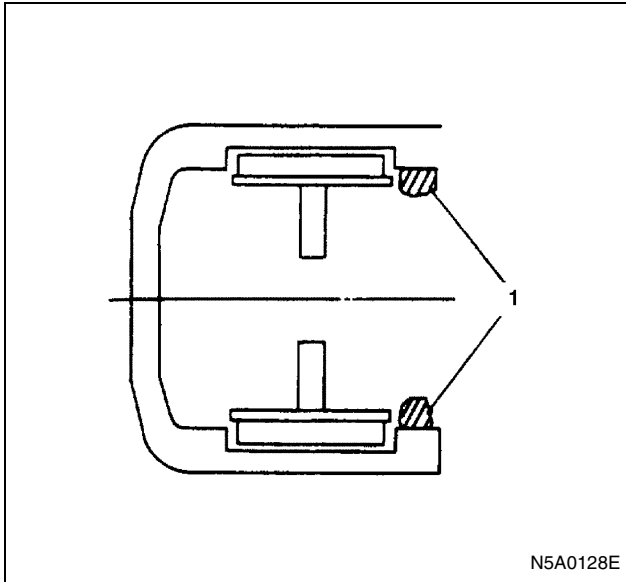
Notice:

The brake pipes to the wheel cylinders must be removed before the wheel cylinders can be removed.

6. Brake hose.
7. Back plate.
8. Wheel cylinders.

Drum Inside Diameter 370.0 mm (14.57 in)

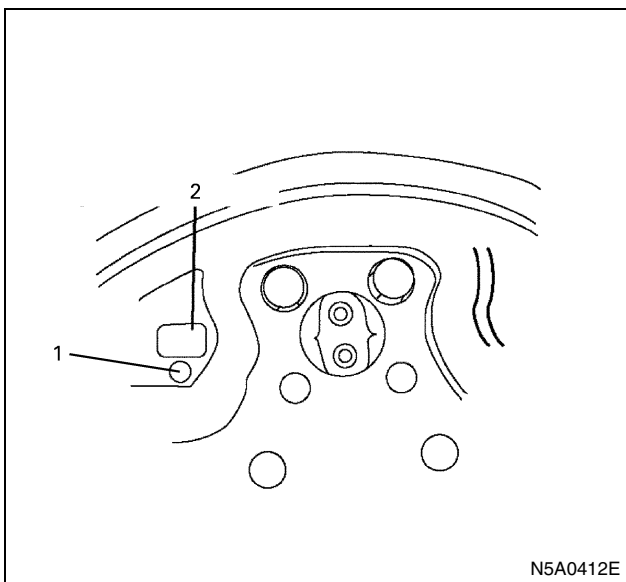
If the brake drum has step wear or the brake drum edge is corroded, it will be difficult to remove the brake drum. The following procedure will make brake drum removal easier.



Legend

1. Corroded portion

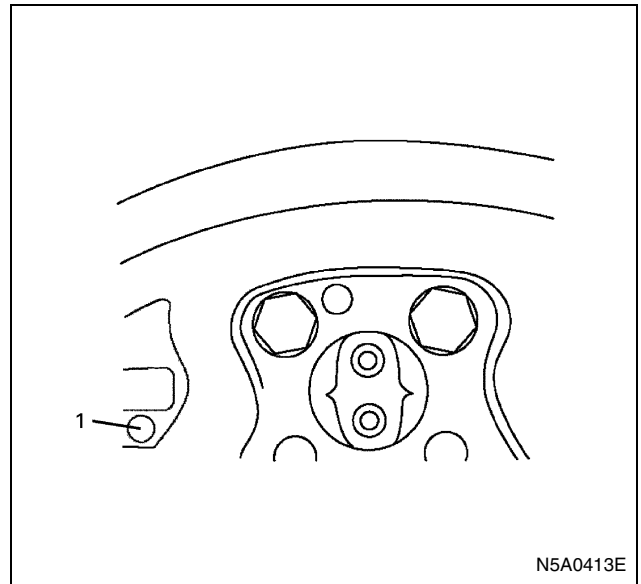
1. Remove the rubber cover from the brake lining clearance adjusting hole and auto-adjuster lever release hole.
2. Remove the adjust hole cover and adjuster lever release hole cover.



Legend

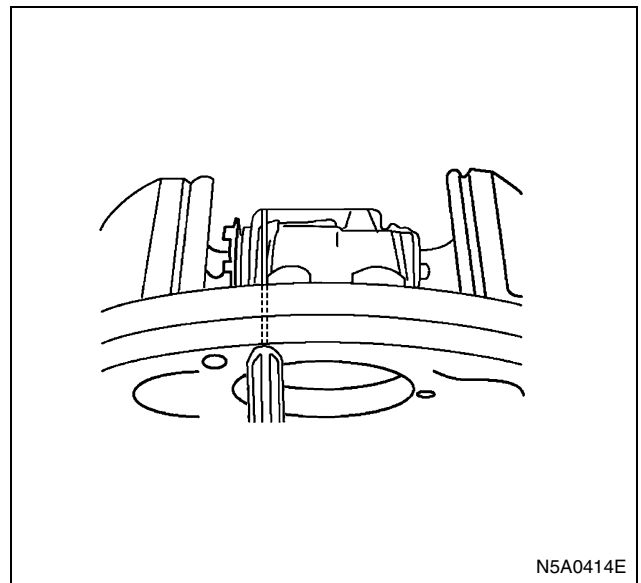
1. Adjuster lever release hole cover
2. Adjuster hole cover

3. Using $\phi 5$ mm Phillips screwdriver put it into the adjuster lever release hole and then push up the adjuster lever.

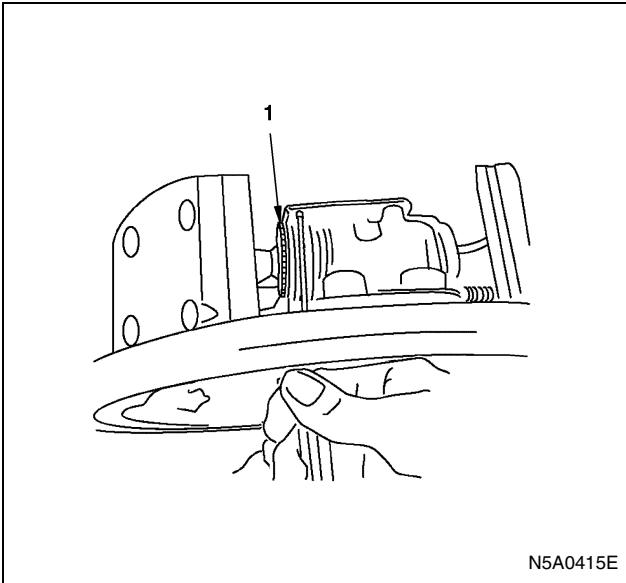


Legend

1. Adjuster lever release hole



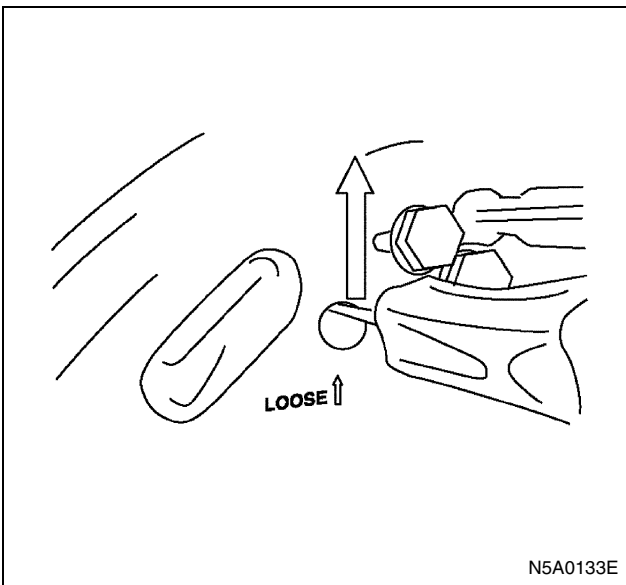
4. Put the flathead screwdriver into the adjuster hole while push up the adjuster lever.



Legend

- 1. Adjuster gear

- Turn the adjuster gear to the marked arrow "LOOSE" on the backing plate.

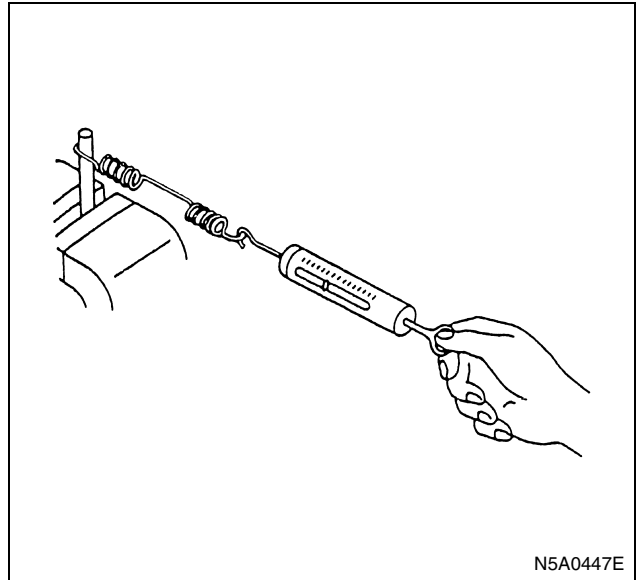


Inspection

- All components for wear or damage. Replace as necessary.

Measurement

Set the return spring as it is installed, and measure the tension.



- Return spring tension.

Free Length mm (in)	209.3 (8.24)
Set Length mm (in)	226 (8.90)
Set Load N (kg/lb)	292.2 — 357 (29.8 — 36.4 / 65.7 — 80.2)

Installation

- Wheel cylinder assemblies.

Tighten:

Wheel cylinder mounting bolts to 120 N-m (12.2 kg-m / 89 lb-ft)

- Back Plate.

Tighten:

Mounting plate bolts to 157 N-m (16.0 kg-m / 116 lb-ft)

- Brake pipes and hoses.

Tighten:

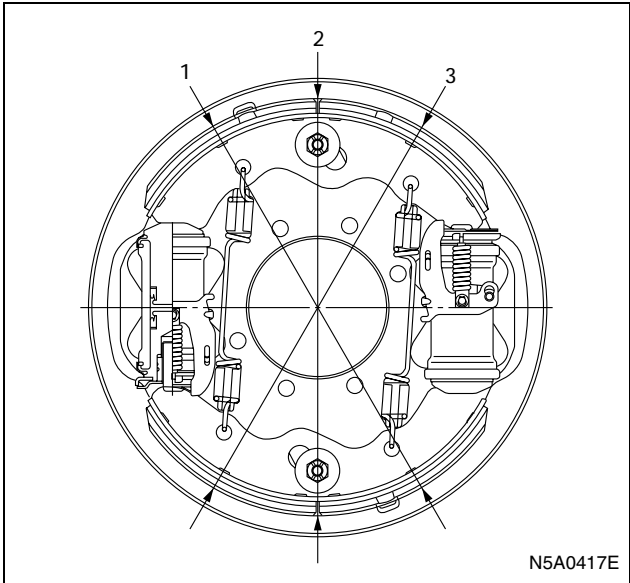
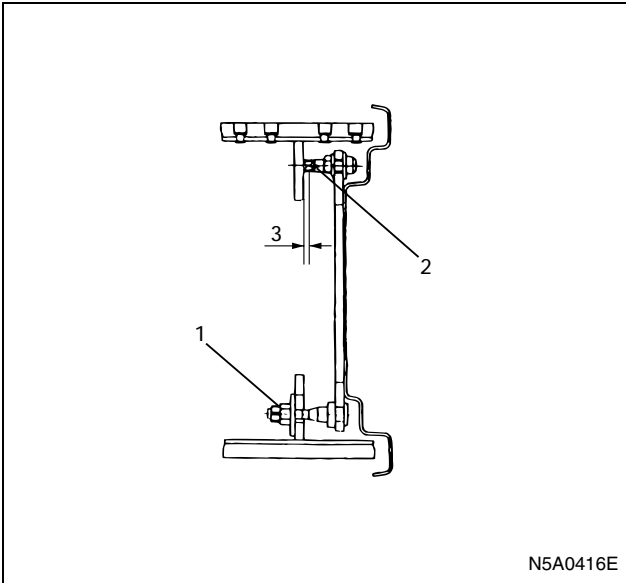
Brake pipe nuts to 15 N-m (1.5 kg-m / 11 lb-ft)

- Shoe and lining assemblies.
- Shoe return spring using a return spring plier.
Return spring plier: 9-8522-0026-0
- Holder nuts.
 - Brake holder nut clearance.
 - Turn nut (1) clockwise until shoe comes into contact with the bolts (2).
 - Turn nut (1) counterclockwise 1/3 turn. Back off the nut until the hole in the holding pin lines up with the nearest slot in the nut within 1/6 turn, and install split pin.
 - Check to see if clearance between bolt and shoe in 0.3 — 0.5 mm (0.012 — 0.020 in). If

clearance is not specified, it should be readjusted.

Caution:

Do not loosen the nuts on the shoe hold bolts during the operation.



2. Install the brake drum.
3. Rotate the brake drum and depress the brake pedal as far as possible.

Legend

1. Nut
2. Bolt
3. Clearance 0.3 — 0.5 mm (0.012 — 0.020 in)

7. Cotter pin.
Use a new cotter pin. Be sure to bend back the legs of the pin.
8. Hub and drum assembly and wheel and tire assembly. Adjust wheel bearings.
 - Refer to Section 3E WHEELS AND TIRES.
 - Refer to Section 4C FRONT AXLE and Section 3C FRONT SUSPENSION.
 - Refer to Section 4B REAR AXLE.

Adjustment

1. After reassembling the brake assembly, adjust the brake lining external diameter to 369.3 — 369.8 mm (14.54 — 14.56 in) by turning the wheel cylinder adjuster gear.
If the measurement at 1, 2 and 3 point are within the range of specified value, brake drum can be installed easily.

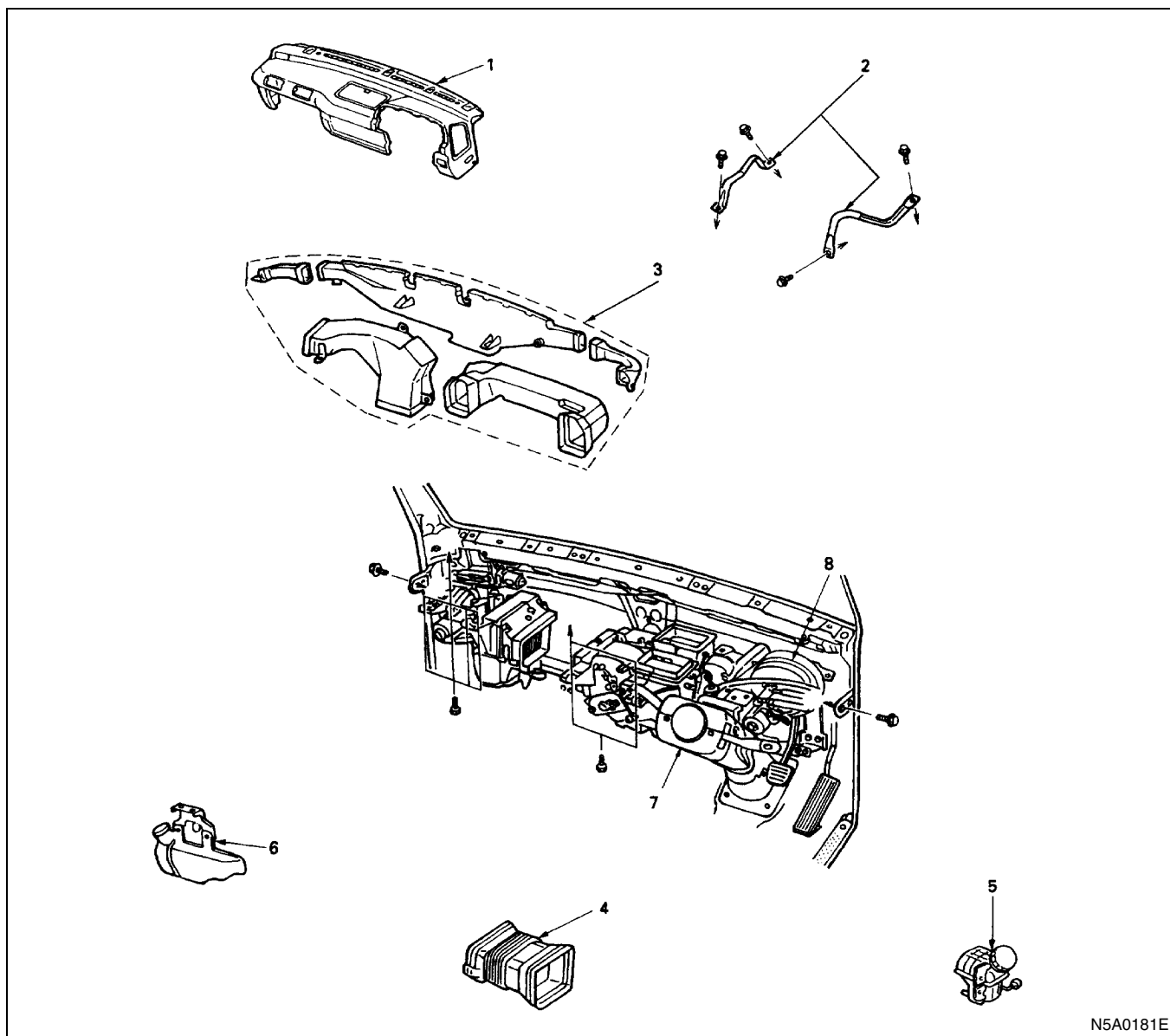
Notice:

Be sure to push up the auto-adjuster lever. Failure to do so will result in damage to the teeth of auto-adjuster-gear.

Take care not to damage the rubber boot with the screw driver.

Brake Pedal and Control

Brake Vacuum Booster and Brake Pedal Assembly



N5A0181E

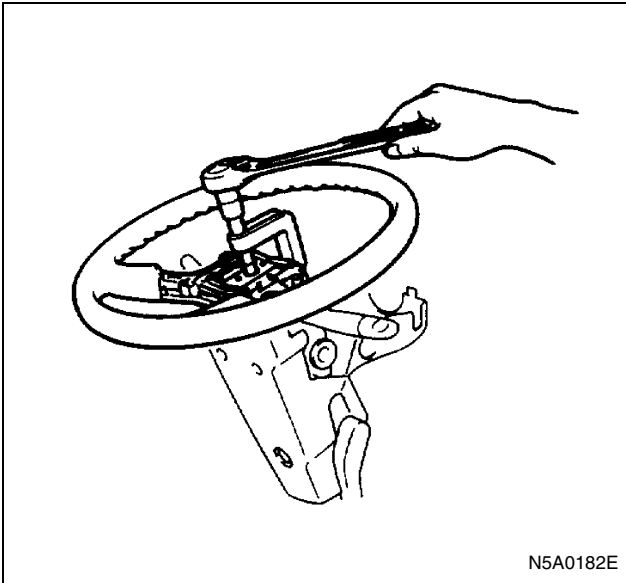
Legend

- | | |
|-----------------------------------|--|
| 1. Instrument panel | 5. Brake and clutch fluid reservoir |
| 2. Stay | 6. Windshield washer tank |
| 3. Defroster nozzle and vent duct | 7. Steering cowl assembly |
| 4. Center duct (NPR model only) | 8. Vacuum booster and brake pedal assembly |

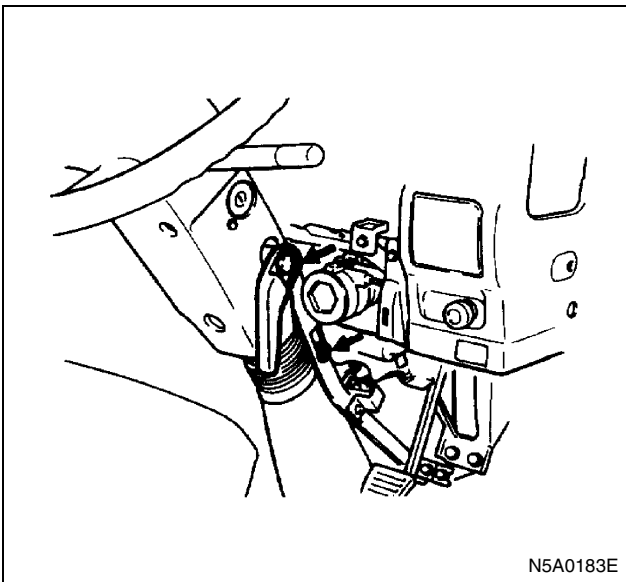
Removal

1. Instrument Panel
2. Stay
3. Defroster Nozzle and Vent Duct
4. Center Duct (NPR model only)
5. Brake and Clutch Fluid Reservoir
6. Windshield Washer Tank
7. Steering Cowl Assembly
Wheel remover: 5-8840-2215-0

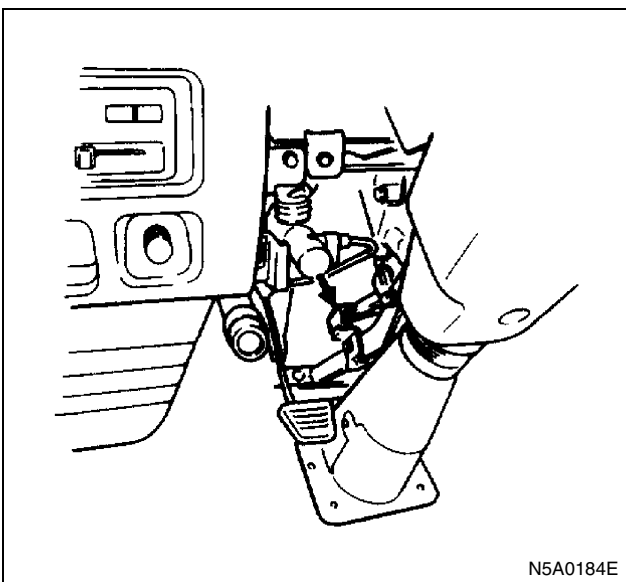
For the removal procedure for above, refer to Section 2 CAB AND FRAME.



Remove the tilt lever and steering cowl.

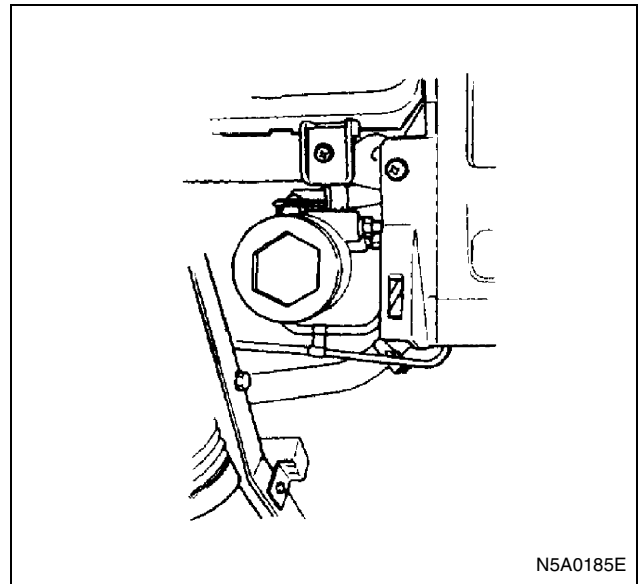


Disconnect the wire harness connectors.

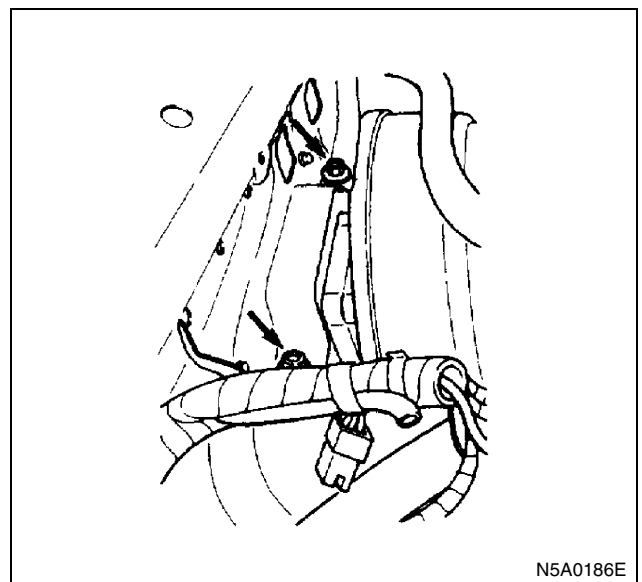


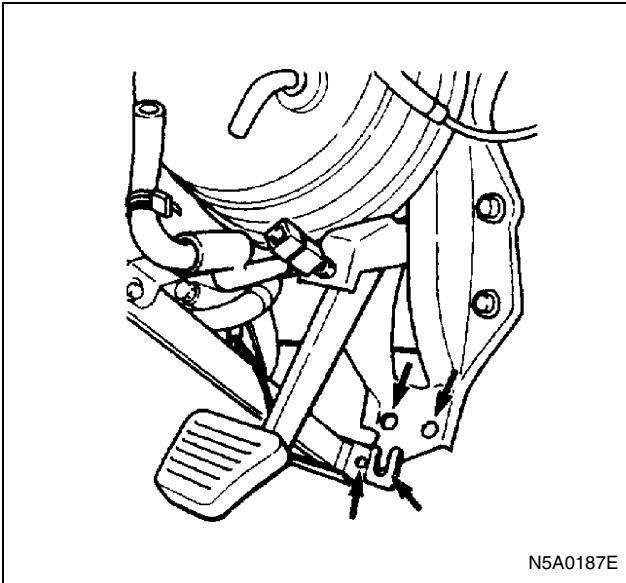
8. Vacuum Booster and Brake Pedal Assembly

- 1) Disconnect the brake pipes and hoses.



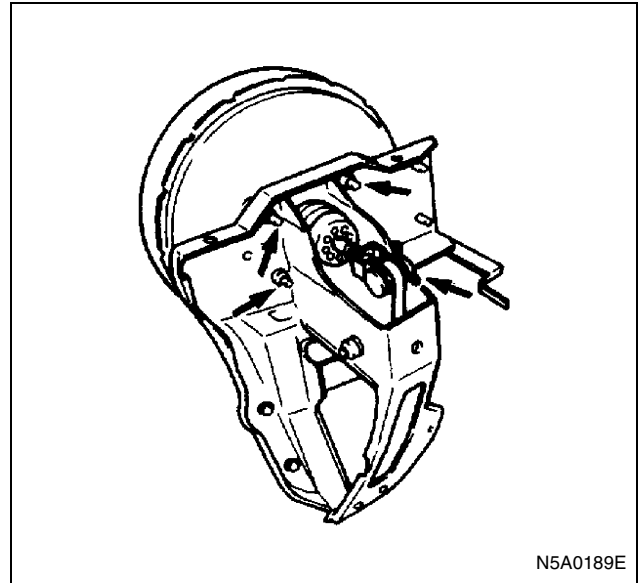
- 2) Plug or cover the brake rubber hoses, pipes and the master cylinder brake fluid ports to prevent brake fluid spillage. If brake fluid spillage occurs, wipe it up immediately.
- 3) Remove the brake pedal bracket fixing bolts and vacuum booster and brake pedal assembly.



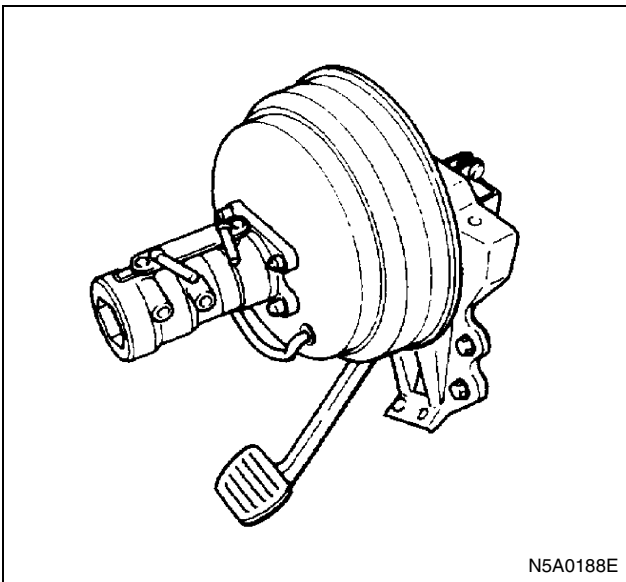


N5A0187E

4) Remove the brake pedal and master cylinder.



N5A0189E

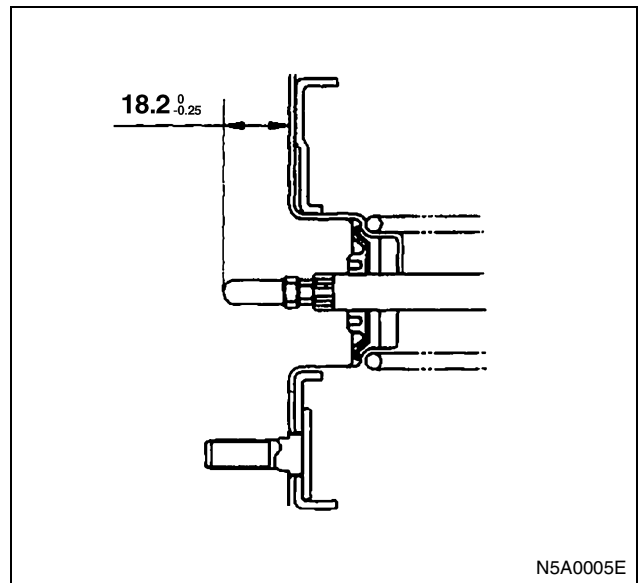


N5A0188E

5) Remove the vacuum booster assembly from brake pedal assembly.

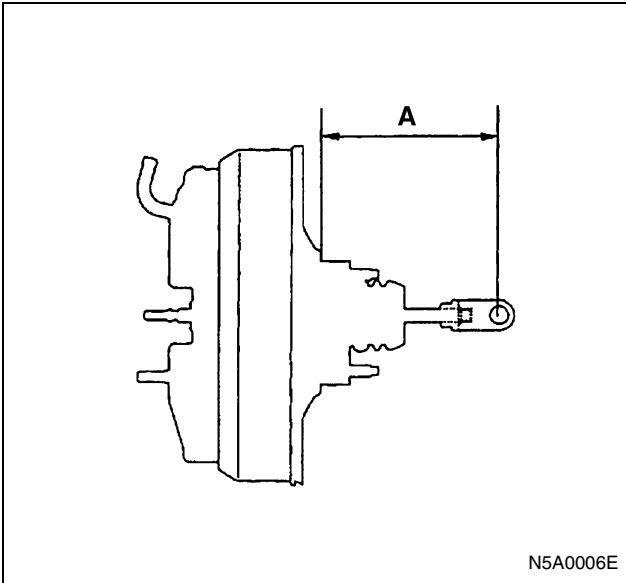
Installation

1. Vacuum Booster and Brake Pedal Assembly
 - 1) Vacuum booster cannot be overhauled. If it is found faulty, replace its assembly with a new one.
 - 2) Make necessary adjustment, so that distance between end of push rod and flange face is adjusted to 18.2 mm (0.717 in) in condition of vacuum applying.

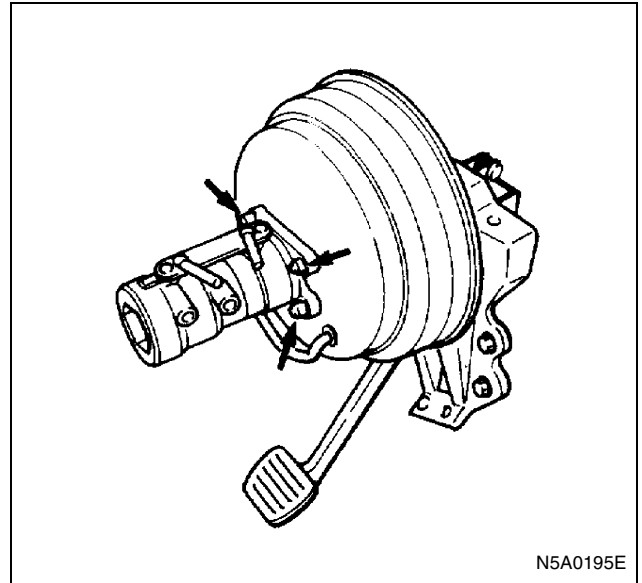


N5A0005E

- 3) Push rod length (A) is measured from the center of the clevis pin hole to the mounting surface of the brake pedal bracket. Adjusted to 109 mm (4.291 in); without spacer, 129 mm (5.079 in); with spacer and tighten the lock nut. When fixed under this condition, there is no need to adjust the height of brake pedal from floor and free play.



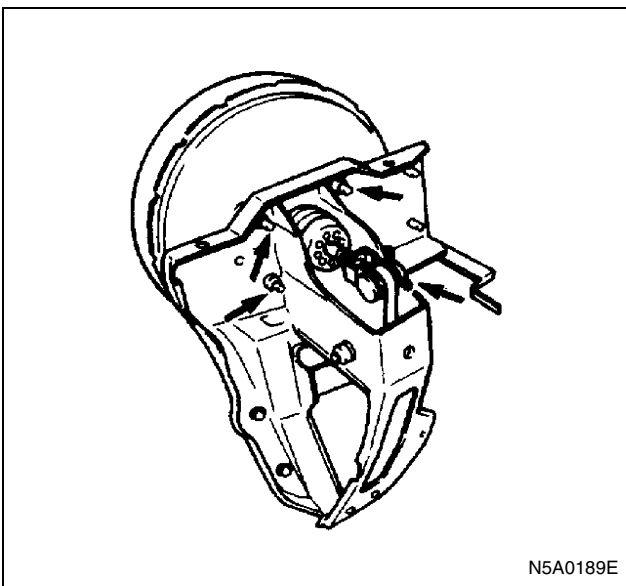
- 4) Install the vacuum booster to brake pedal assembly.
- Adjust the clearance between the tip of threaded portion of the stop light switch and the pedal arm to 0.5 — 1.0 mm (0.02 — 0.04 in).



- 8) Install the vacuum booster and brake pedal assembly.

Tighten:

Vacuum booster and brake pedal assembly bolts to 42 N·m (4.3 kg·m / 32 lb·ft)



- 5) Tighten the vacuum booster bolts to the specified torque.

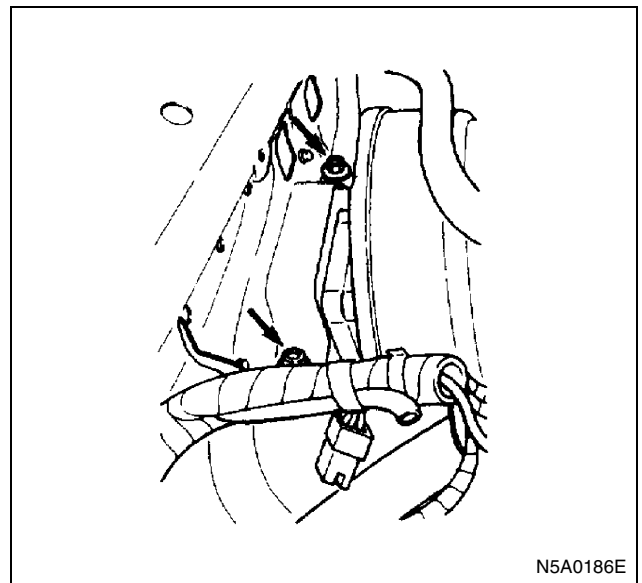
Tighten:

Vacuum booster bolts to 14 N·m (1.4 kg·m / 122 lb·in)

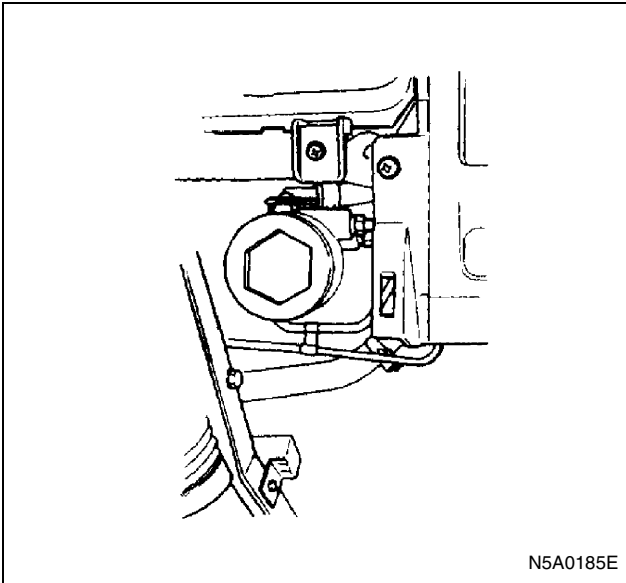
- 6) Install the master cylinder assembly to vacuum booster or brake pedal assembly.
- 7) Tighten the master cylinder nut to the specified torque.

Tighten:

Master cylinder nut to 14 N·m (1.4 kg·m / 122 lb·in)



- 9) Connect the brake hoses and pipes.

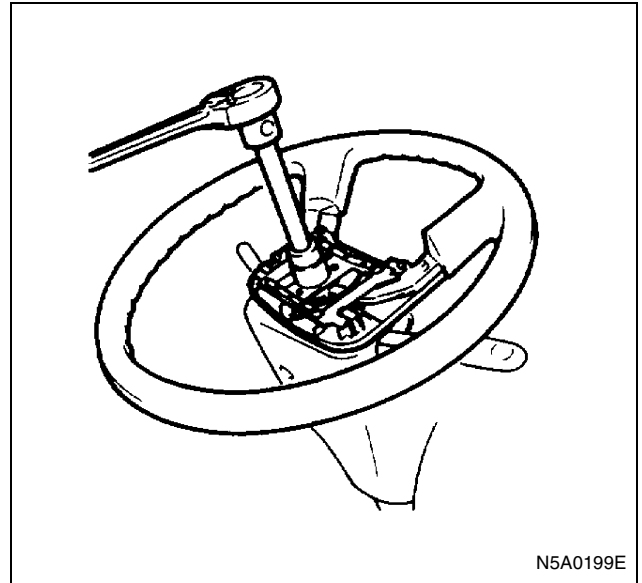


2. Steering Cowl Assembly

- 1) Connect the wire harness connectors.
- 2) Install the steering cowl.

Tighten:

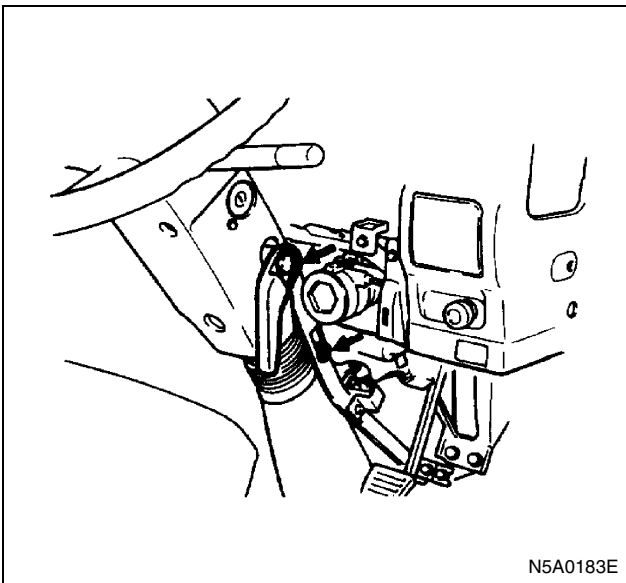
Steering cowl bolt to 14 N·m (1.4 kg·m / 122 lb-in)



3. Windshield Washer Tank

4. Brake and Clutch Fluid Reservoir
5. Center Duct (NPR model only)
6. Defroster Nozzle and Vent Duct
7. Stay
8. Instrument Panel

For the installation procedure for above, refer to Section 2 CAB AND FRAME.



- 3) Install the tilt lever.

Tighten:

Tilt lever bolt to 45 N·m (4.6 kg·m / 33 lb-ft)

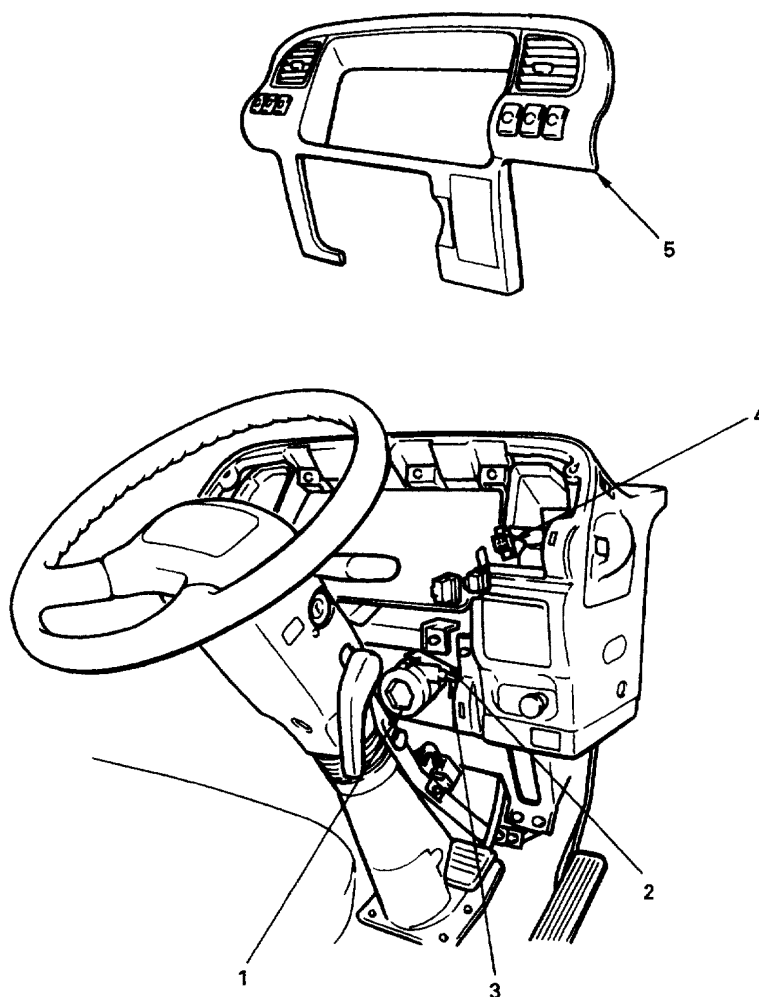
- 4) Install the steering wheel.

Tighten:

Steering wheel nut to 49 N·m (5.0 kg·m / 36 lb-ft)

Master Cylinder Assembly

This illustration is based on RHD.



N5A0200E

Legend

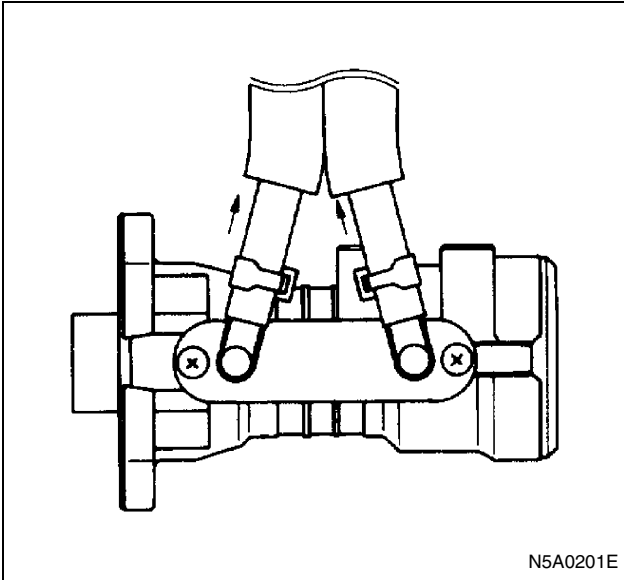
- | | |
|---------------------|--------------------|
| 1. Meter cluster | 4. Brake hose |
| 2. Switch connector | 5. Master cylinder |
| 3. Brake pipe | |

Removal

1. Meter Cluster
2. Switch connector

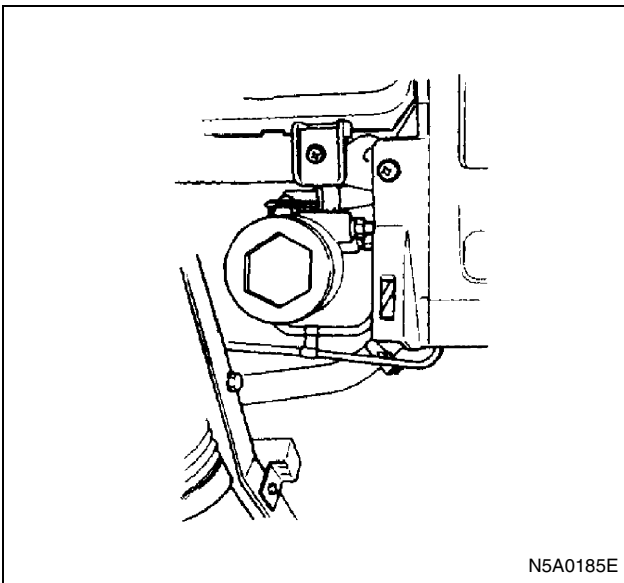
For the removal procedure for above, refer to Section 2 CAB AND FRAME.

3. Brake Pipe

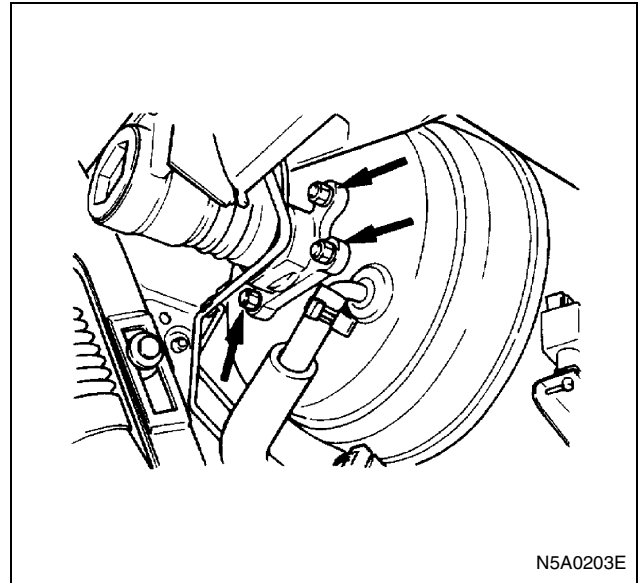


4. Brake Hose

- 1) Disconnect the brake pipes and hoses.
- 2) Plug or cover the brake rubber hoses, pipes and the master cylinder brake fluid ports to prevent brake fluid spillage.
If brake fluid spillage occurs, wipe it up immediately.



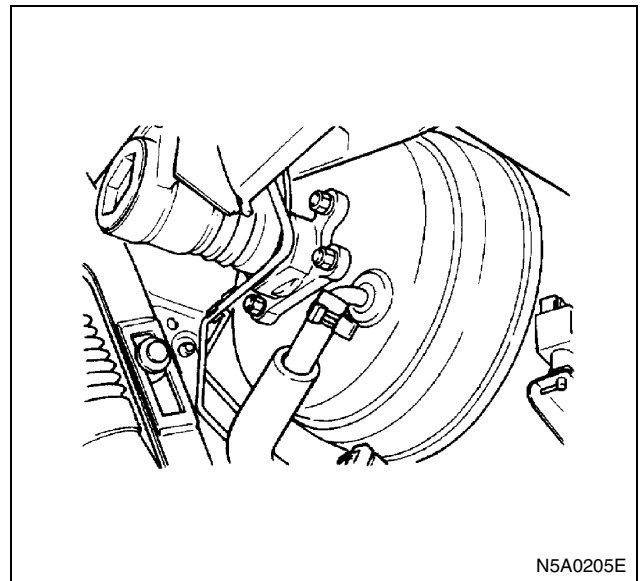
5. Master Cylinder



Installation

1. Master Cylinder

- 1) Install the master cylinder assembly to the vacuum booster or brake pedal assembly.



- 2) Tighten the nuts to the specified torque.

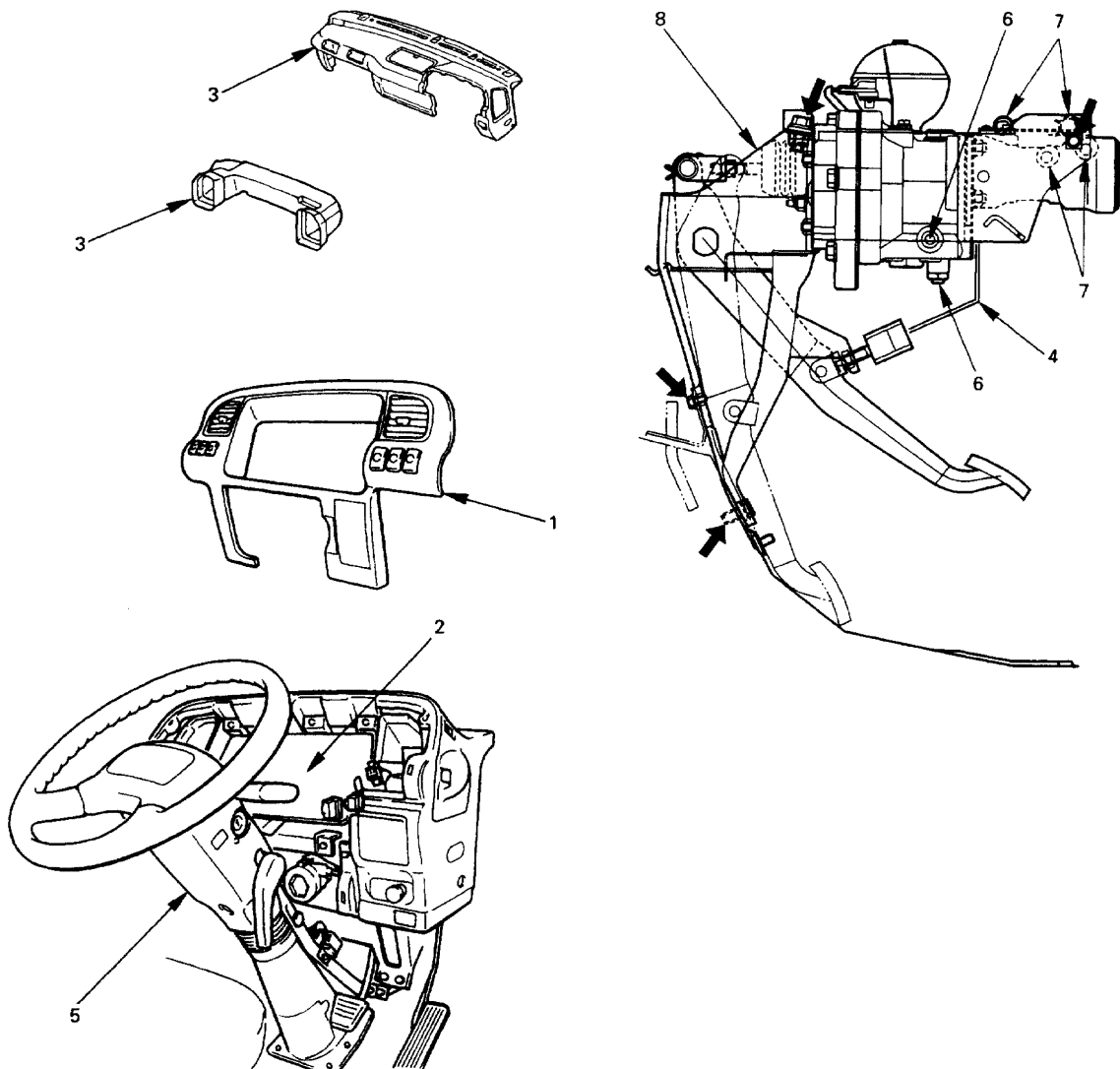
Tighten:

Master cylinder assembly nuts to 14 N·m (1.4 kg·m / 122 lb·in)

2. Brake Hose
3. Brake Pipe
4. Switch Connector
5. Meter Cluster

Hydraulic Booster and Brake Pedal Assembly

This illustration is based on RHD.



N5A0206E

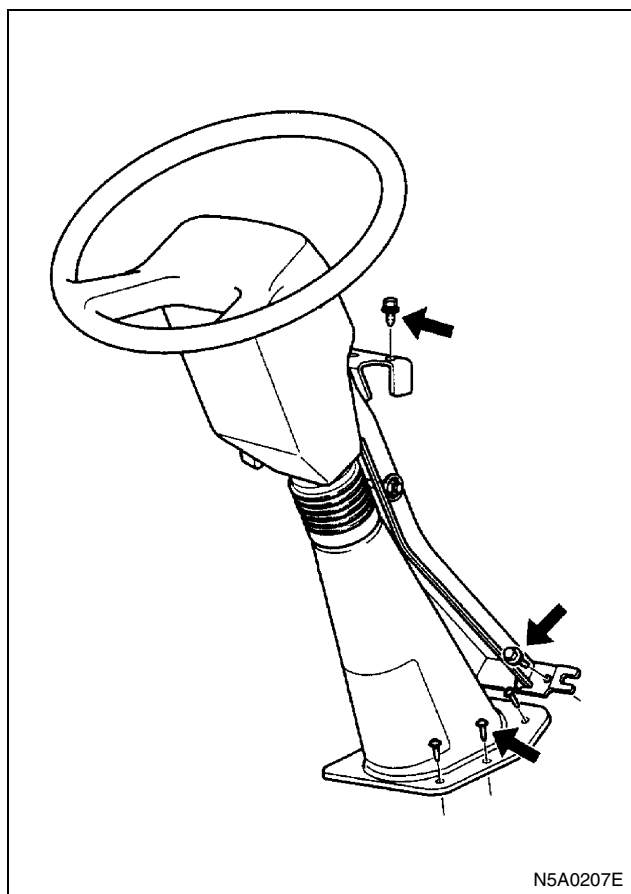
Legend

- | | |
|---------------------------------------|--|
| 1. Meter cluster | 6. ATF pipe |
| 2. Meter | 7. Brake pipe and hose |
| 3. Instrument panel and duct | 8. Brake pedal assembly with master cylinder and hydraulic booster |
| 4. Heat protector | |
| 5. Steering wheel and column assembly | |

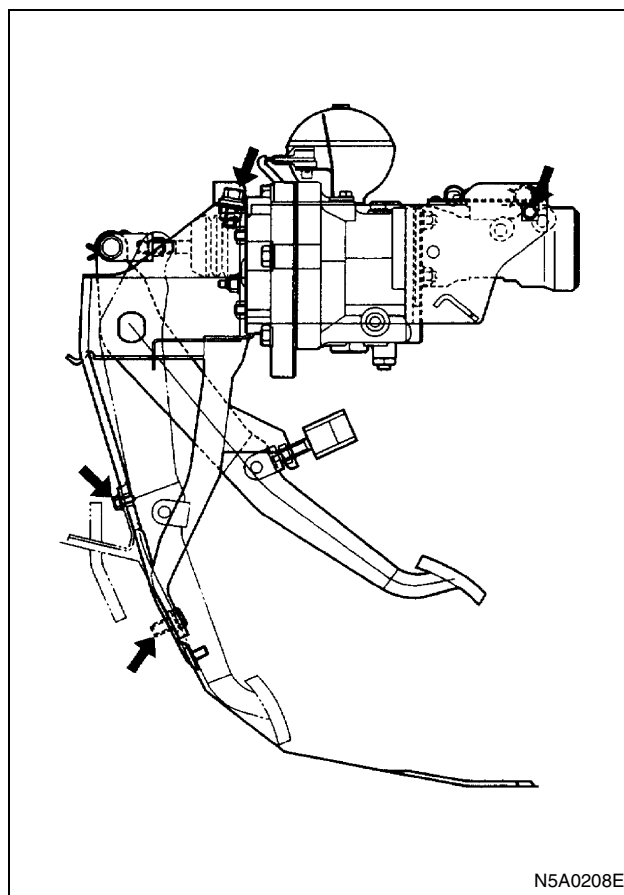
Removal

- Block the vehicle wheels and apply the parking brake.
 - Disconnect the battery ground cable.
 - By brake pedal operation with the engine off, reduce the pressure of the hydraulic oil in the accumulator, and after confirming that the temperature of the hydro boost assembly has been reduced, remove the hydro boost assembly from the vehicle.
1. Remove meter cluster.
 2. Remove meter assembly and harness connector.
 3. Remove instrument panel assembly and ventilation duct.
 4. Remove heat protector under the hydraulic booster.
 5. Steering wheel and column assembly.
 - Remove inspection window and mark steering worm shaft and U-joint yoke. Remove key bolt and nut.
 - Remove screws: boots to floor.

- Remove bolts and nuts: support bracket to floor.
- Remove bolts: steering column bracket to instrument reinforcement assembly.
- Remove bolts: steering column bracket to brake pedal bracket.



6. ATF pipe: inlet and outlet.
 - Disconnect pipes from the booster.
7. Brake pipe and hose: front and rear.
 - Disconnect pipes and hoses from the brake master cylinder.
8. Brake pedal assembly with master cylinder and hydraulic booster.
 - Remove accelerator pedal bracket.
 - Remove brake pedal assembly mounting bolts.
 - Remove radiator grille and disconnect ATF inlet pipe from flexible hose in front of the radiator.
Remove ATF inlet pipe.
 - Remove brake pedal assembly.



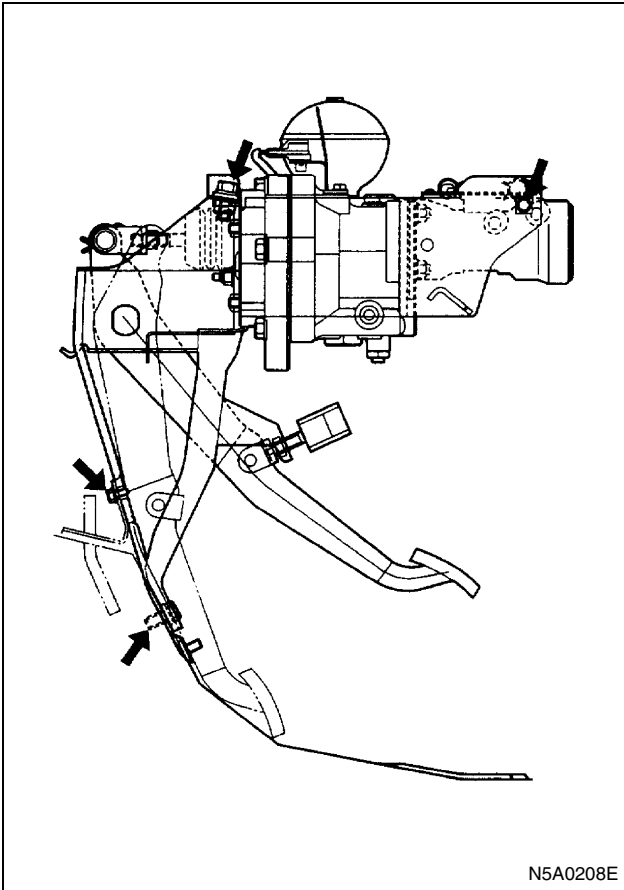
Installation

1. Brake Pedal Assembly with Master Cylinder and Hydraulic Booster
 - Set ATF inlet pipe and install brake pedal assembly.

Tighten:

M10 mounting bolts to 42 N·m (4.3 kg·m / 32 lb·ft)

- Connect ATF inlet pipe with flexible hose.
- Install accelerator pedal bracket.
- Install radiator grille.

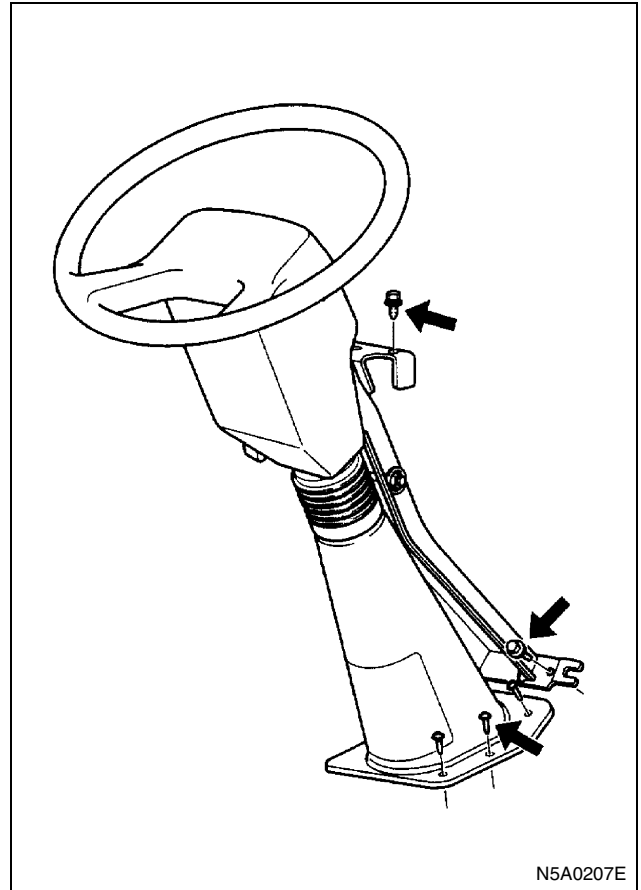


2. ATF Pipe
 - Install ATF pipes to hydraulic booster.
3. Brake Pipe and Hose
 - Install master cylinder hydraulic lines to master cylinder.
4. Steering Wheel and Column Assembly
 - Set steering wheel and column assembly.
 - Install mounting bolts, nuts and screws to body.
 - Install key bolt and nut.

Tighten:

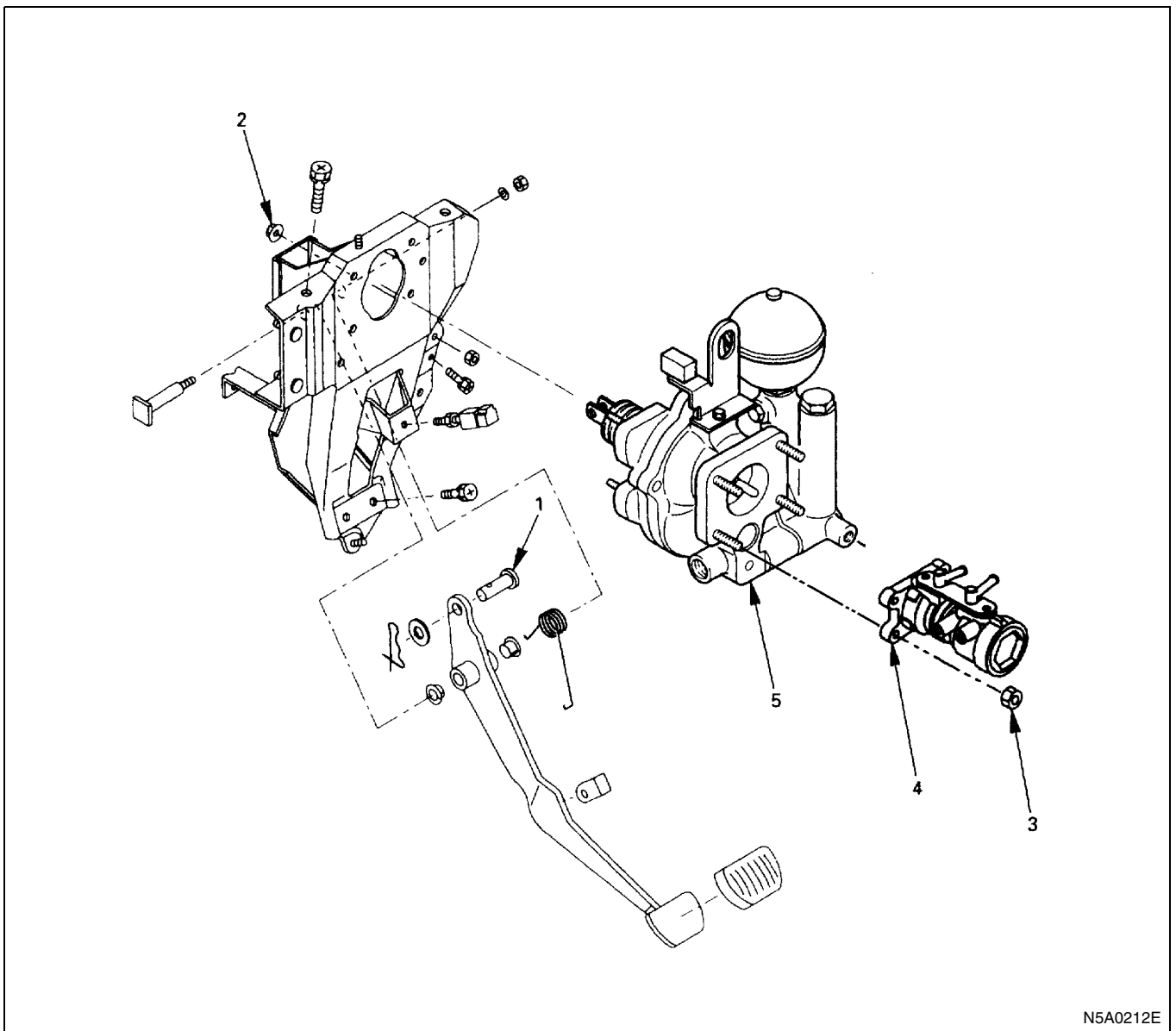
Key bolt to 38 N·m (3.9 kg·m / 28 lb·ft)

- Install inspection window.



5. Heat Protector
 - Install hydraulic booster heat protector.
6. Instrument Panel and Duct
 - Install ventilation duct and instrument panel assembly.
7. Meter
 - Install meter assembly and harness connector.
8. Meter Cluster
 - Install meter cluster.
9. Battery ground cable.
10. After attaching it to the vehicle, always replenish with new hydraulic oil (Besco ATF III), and completely release the air from the hydro boost.
11. Bleed brake lines.
12. Release the parking brake and remove the wheel blocks.

Hydraulic Booster



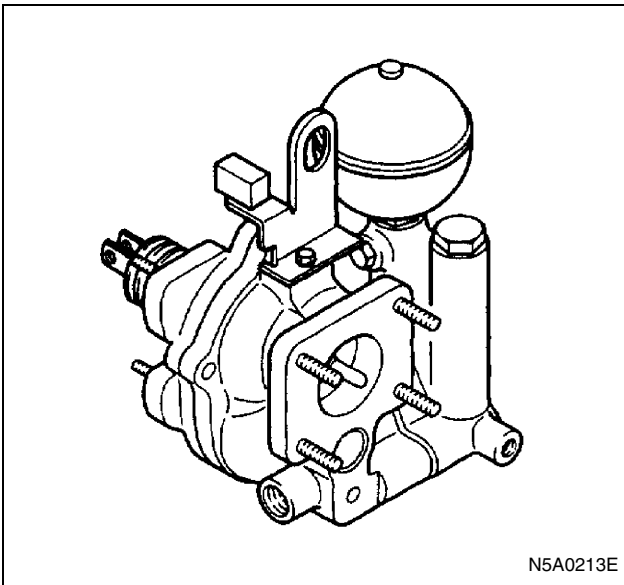
N5A0212E

Legend

- | | |
|--------------------------|----------------------|
| 1. Clevis pin | 4. Master cylinder |
| 2. Hydraulic booster nut | 5. Hydraulic booster |
| 3. Master cylinder nut | |

Removal

1. Clevis Pin
2. Hydraulic Booster Nut
 - Four hydraulic booster mounting nuts at pedal bracket.
 - Remove master cylinder with hydraulic booster.
3. Mastcr Cylinder Nut
 - Four nuts retaining master cylinder to hydraulic booster.
4. Master Cylinder
5. Hydraulic Booster



Installation

1. Hydraulic Booster
2. Master Cylinder Assembly
3. Master Cylinder Nut

Tighten:

Master cylinder nut to 14 N·m (1.4 kg·m / 122 lb·in)

4. Hydraulic Booster Nut
 - Four hydraulic booster mounting nuts to pedal bracket.

Tighten:

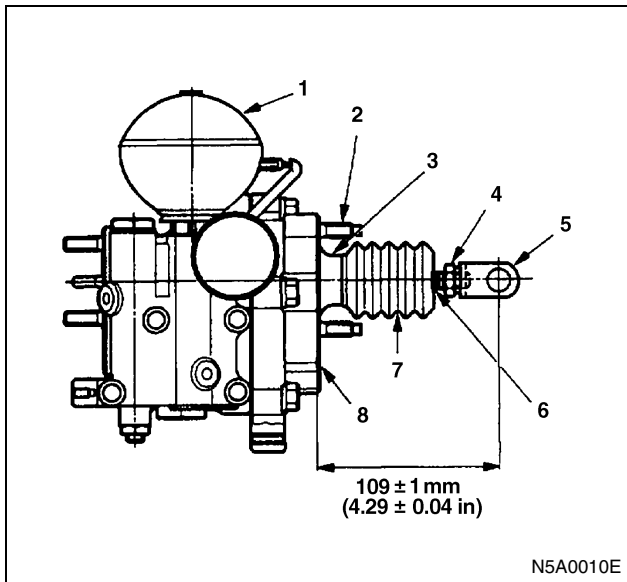
Hydraulic booster nut to 14 N·m (1.4 kg·m / 122 lb·in)

5. Clevis Pin
 - Connect hydraulic booster clevis to brake pedal and install clevis pin.

Accumulator and O-ring Replacement

Removal

- Block the vehicle and apply the parking brake.
- Disconnect the battery ground cable.
- Reduce the pressure of the hydraulic oil in the accumulator by brake pedal operation with the engine off, and after confirming that the temperature of the hydro boost assembly has been reduced, remove the hydro boost assembly from the vehicle.
 - 1) Remove meter cluster.
 - 2) Remove meter assembly and harness connector.
 - 3) Remove ventilation duct.
 - 4) Using an oil filter wrench, remove accumulator and O-ring.



Legend

1. Accumulator
2. Stud bolt
3. Cover boss
4. Lock nut
5. Clevis
6. Operating rod
7. Guard
8. Flange

Installation

1. Verify that there is no foreign matter adhering to the screw part of the accumulator or to the attachment part on the booster side.
2. Put an O-ring coated with new hydraulic oil (ATF DEXRON®-III) into the screw part of the accumulator, being careful not to damage it. Always use a new O-ring.
3. Using an oil filter wrench, hold the accumulator shell fixed, and tighten it via the wrench to the specified torque.

Tighten:

Accumulator to 29 N·m (3.0 kg·m / 22 lb·ft)

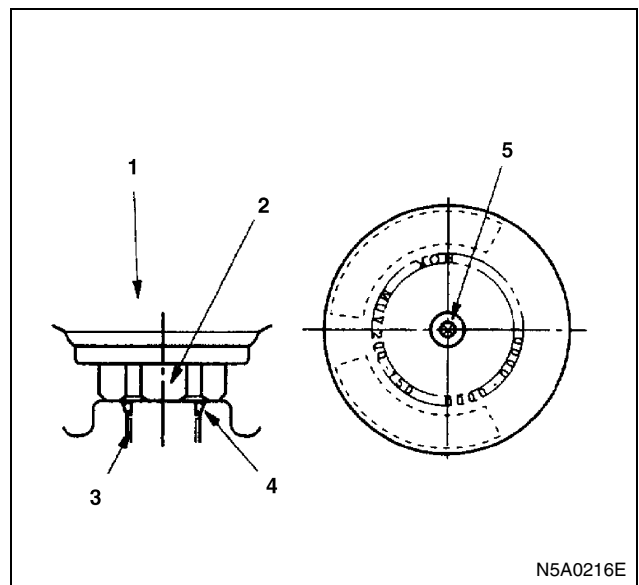
4. Install ventilation duct.
5. Connect harness connector and install meter assembly.
6. Install meter cluster.
7. Connect the battery ground cable.
8. After attaching it to the vehicle, always replenish with new hydraulic oil (ATF DEXRON®-III), and completely release the air from the hydro boost.
9. Release the parking brake and remove the wheel blocks.

Notice:

How to dispose of the accumulator

To dispose of the accumulator, drill a hole in the position shown in the diagram according to the indications printed on the accumulator, completely release the nitrogen gas scaled inside the accumulator, then dispose of the accumulator.

Concerning disposal with the hydro boost assembly as well, dispose of it after first letting out all the nitrogen gas inside the accumulator, by the above method.



Legend

1. Accumulator
2. HEX25
3. Thread
4. O-ring
5. Drilling point for gas releasing

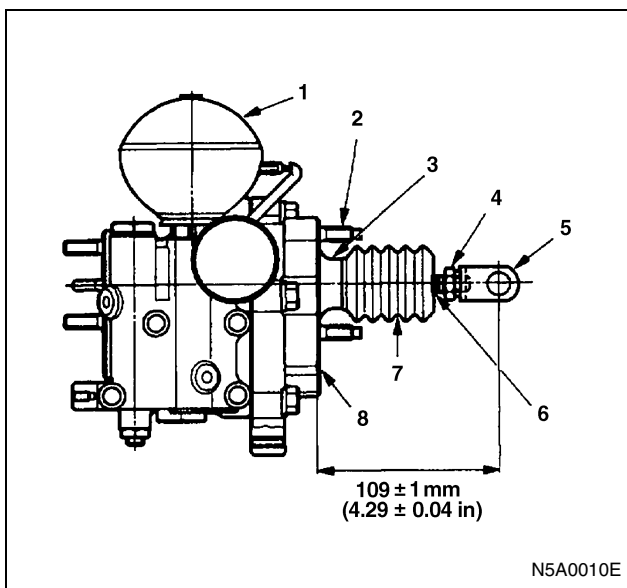
Clevis and Lock Nut Replacement

Removal

1. Remove hydraulic booster assembly.
Refer to "Removal" of Hydraulic Booster in this section.
2. Secure the hydro boost assembly to the jig using the four stud bolts on the surface of the flange for attachment to the vehicle.
3. Being careful not to exert any off-center load on the operating rod, loosen the lock nut and remove the clevis and lock nut.

Installation

1. Screw the lock nut and then the clevis onto the operating rod.



Legend

1. Accumulator
2. Stud bolt
3. Cover boss
4. Lock nut
5. Clevis
6. Operating rod
7. Guard
8. Flange

2. Adjust so that the booster clevis position dimension (the distance to the center of the clevis hole from the surface of the flange for attachment to the vehicle) is 109 ± 1 mm (4.29 ± 0.04 in), and tighten the lock nut with the prescribed torque.
When tightening the lock nut, be careful not to deform the clevis.

Tighten:

Lock nut to 20 N·m (2.0 kg·m / 14 lb·ft)

3. Attach the hydro boost assembly to the vehicle.
Refer to "Installation" of Hydraulic Booster in this section.

Guard Replacement

Removal

1. Remove hydraulic booster assembly.
Refer to "Removal" of Hydraulic Booster in this section.
2. Secure the hydro boost assembly to the jig using the four stud bolts on the surface of the flange for attachment to the vehicle.
3. Being careful not to exert any off-center load on the operating rod, loosen the lock nut and remove the clevis and lock nut.
4. Remove the guard from the cover boss anchoring groove and from the operating rod anchoring groove, and pull it out.

Installation

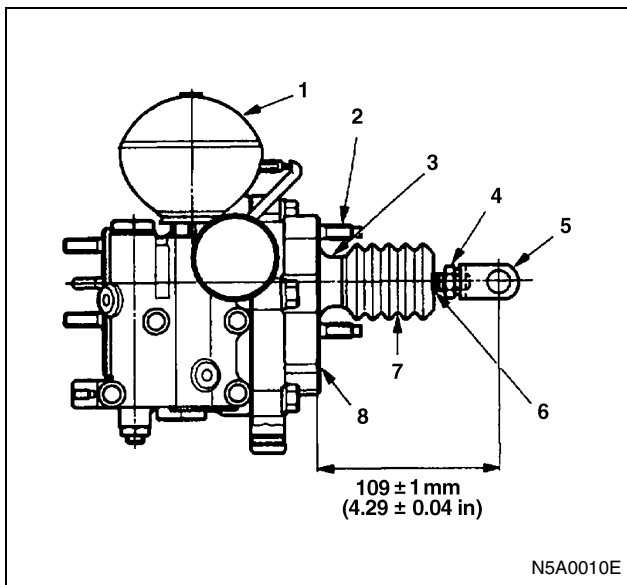
1. With a dry cloth, clean well the cover boss anchoring groove and the operating rod anchoring groove, and verify that no foreign matter is present.
2. Insert from the large diameter hole side of the guard end-face into the operating rod outside diameter part, assemble the small diameter hole part of the guard end-face into the anchoring groove of the operating rod, then assemble the large diameter hole part securely into the anchoring groove of the boss of the cover.
3. Screw the lock nut and then the clevis onto the operating rod.

4. Adjust so that the booster clevis position dimension (the distance to the center of the clevis hole from the surface of the flange for attachment to the vehicle) is 109 ± 1 mm (4.29 ± 0.04 in), and tighten the lock nut with the prescribed torque. When tightening the lock nut, be careful not to deform the clevis.

Tighten:

Lock nut to 20 N·m (2.0 kg·m / 14 lb·ft)

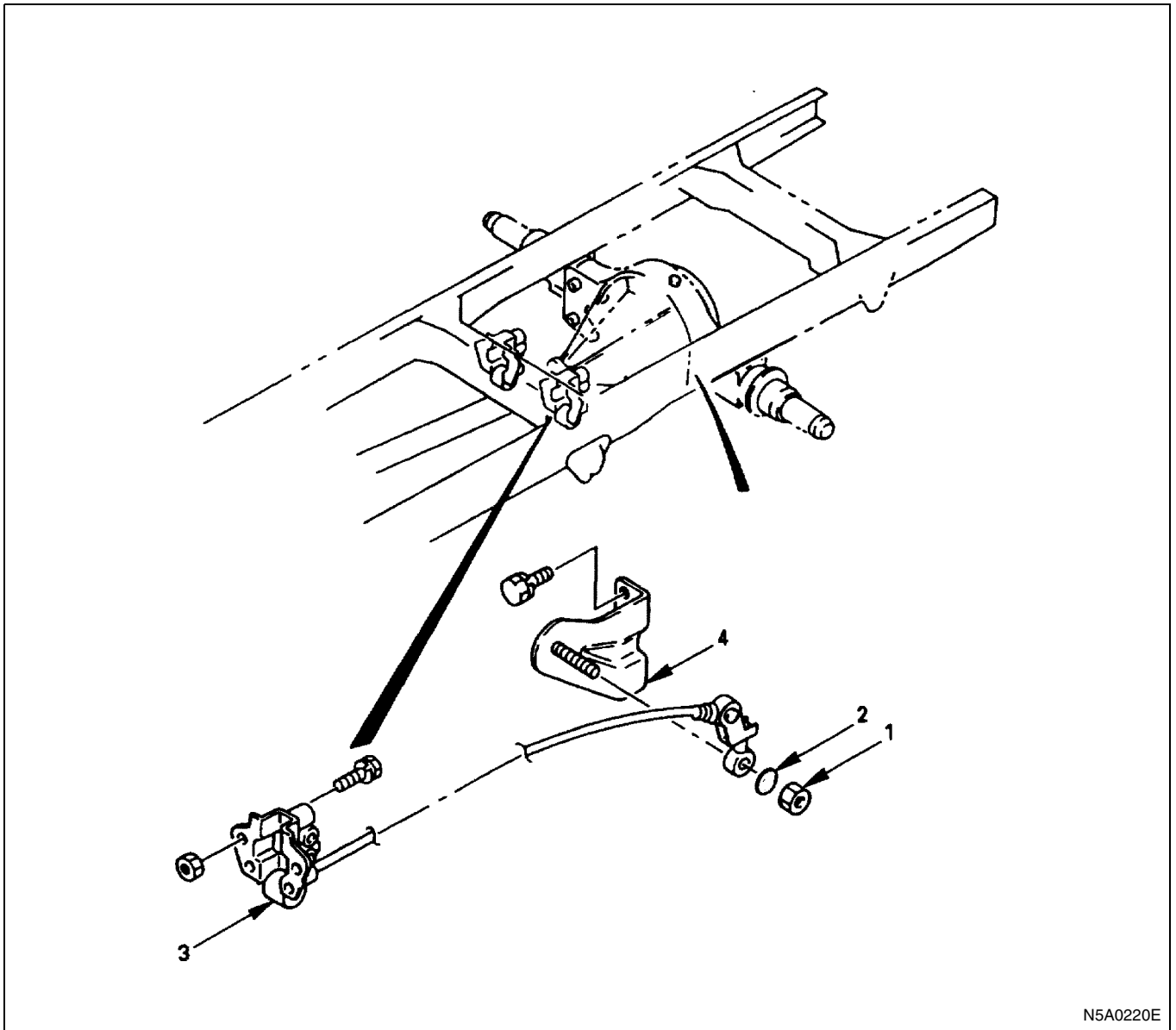
5. Attach the hydro boost assembly to the vehicle.
Refer to "Installation" of Hydraulic Booster in this section.



Legend

1. Accumulator
2. Stud bolt
3. Cover boss
4. Lock nut
5. Clevis
6. Operating rod
7. Guard
8. Flange

Load Sensing Proportioning Valve



N5A0220E

Legend

- | | |
|-----------|-------------------------------------|
| 1. Nut | 3. Load sensing proportioning valve |
| 2. Washer | 4. Bracket |

Removal

1. Nut
2. Washer
3. Load sensing Proportioning Valve
4. Bracket

Installation

To install, follow the removal steps in the reverse order.

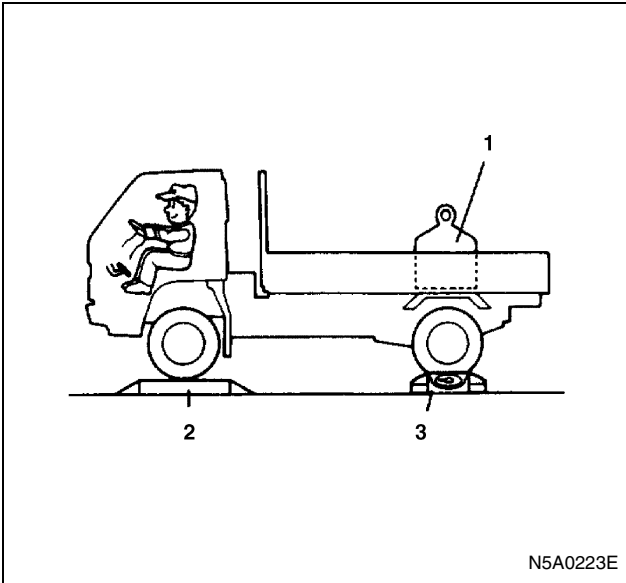
Adjustment

1. Fluid Pressure Measurement
 - 1) Rear axle weight adjustment

With an axle weight meter, adjust the rear axle weight with a person sitting in the driver's seat and a weight loaded in the rear body.

	N (kg/lb)
Adjustment value	(A)

For (A), refer to the adjustment standard table.



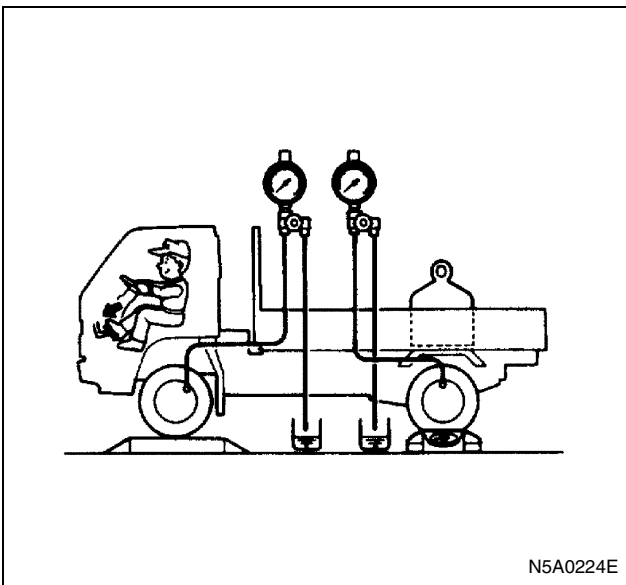
N5A0223E

Legend

- 1. Weight
- 2. Platform (which is the same height as the axle weight meter)
- 3. Axle weight meter

- 2) Installation of a fluid pressure gauge
Remove the air bleeder of the left hand wheel front and rear brakes. Bleed air out of the fluid pressure gauge with the measurement hose of the fluid pressure gauge installed.

Pressure Tester: Brake oil (Fluid pressure gauge)
5-8840-2190-0



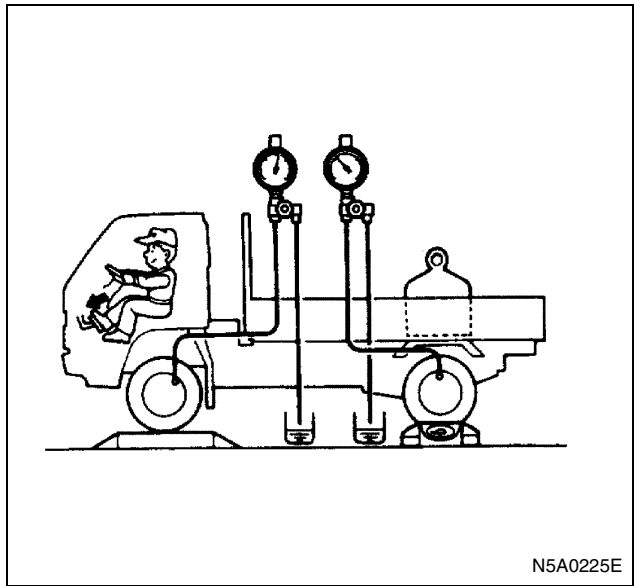
N5A0224E

- 3) Rear wheel cylinder fluid pressure measurement
Step on the brake pedal until the fluid pressure of the front wheel cylinder gets to 7845 kPa (80 kg/cm² / 1138 psi), and check the rear wheel cylinder fluid pressure. (Read the value of the front wheel cylinder fluid pressure 2 seconds

after the measurement. When measuring the L.S.V fluid pressure, keep the brake pedal pressed down without stepping it down twice or releasing it.)

Rear Wheel Cylinder Fluid Pressure	kPa (kg/cm ² / psi)
Standard	(B)

For (B), refer to the adjustment standard table.



N5A0225E

2. Oil Pressure Adjustment

- 1) L.S.V spring shackle adjustment
Loosen the adjust nut of the L.S.V spring shackle, and adjust the length of the L.S.V spring shackle.

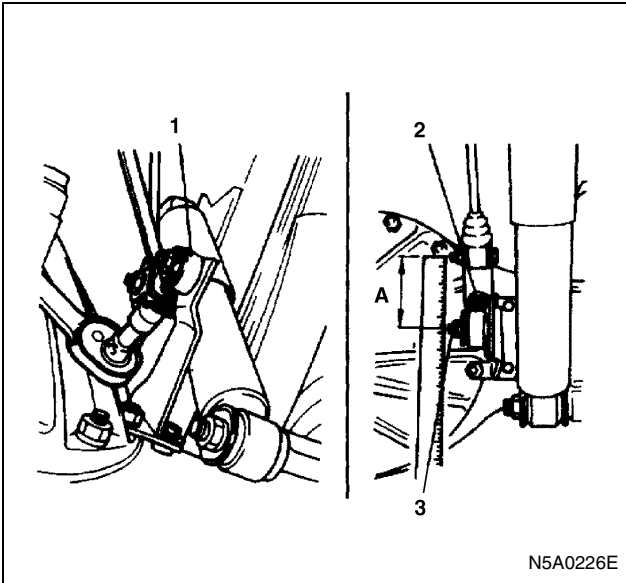
When the oil pressure is insufficient, turn the adjust nut clockwise to extend the span "A". When the oil pressure is too high, turn the adjust nut counterclockwise to reduce the span "A".

mm (in)	
Item	Span adjusted
Standard of span "A"	78 (3.07)
Range adjustable	72 — 84 (2.83 — 3.31)

After adjustment, tighten the lock nut securely and install the cotter pin.

Tighten:

Lock nut to Max. 10 N·m (1.0 kg·m / 87 lb·in)



Legend

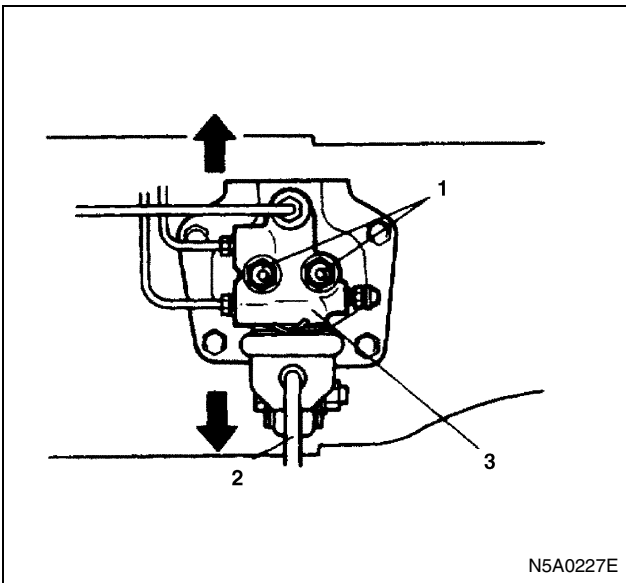
- 1. L.S.V spring shackle
- 2. Adjust nut
- 3. Lock nut

2) L.S.V adjustment

When the adjustment cannot be done with the L.S.V spring shackle, loosen the L.S.V adjust nut (2 pcs.) and adjust the oil pressure to the standard value by sliding the L.S.V up and down. After the L.S.V adjustment, readjust the length of the L.S.V spring shackle.

Tighten:

L.S.V adjust nut to 13 N·m (1.3 kg·m / 113 lb·in)

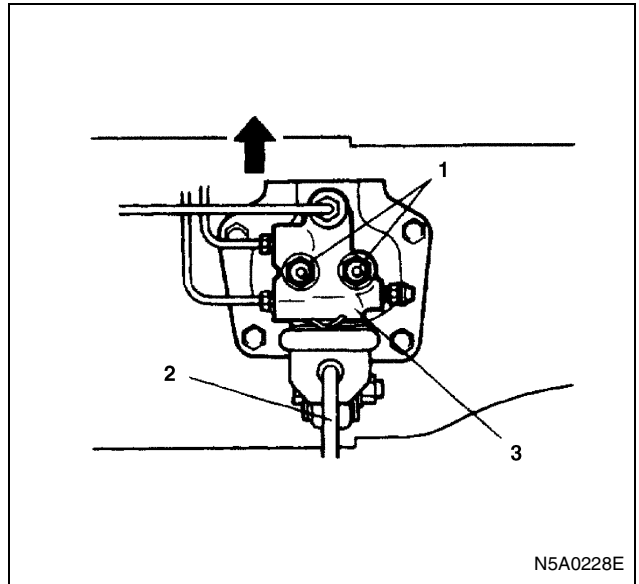


Legend

- 1. L.S.V adjust nut
- 2. L.S.V spring
- 3. L.S.V

3. Unit Inspection of L.S.V

- 1) Loosen the L.S.V adjust nut (2 pcs.). And then lift the L.S.V up fully and tighten it up tentatively so that the L.S.V spring will not move.



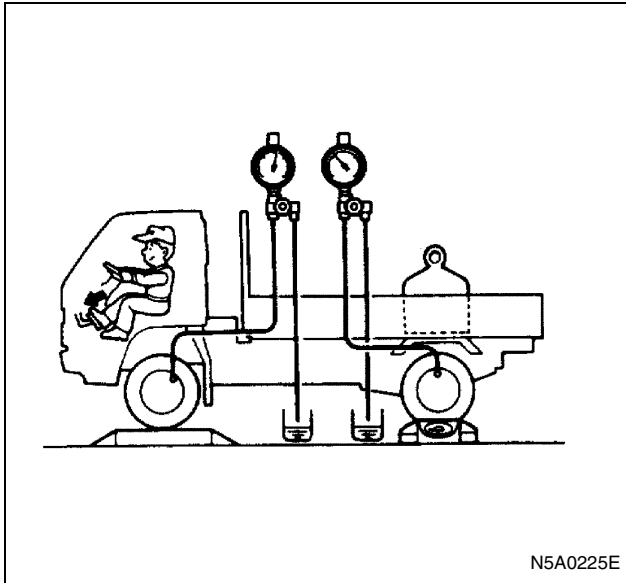
Legend

- 1. L.S.V adjust nut
- 2. L.S.V spring
- 3. L.S.V

- 2) Under the same conditions as 1) above, check the rear wheel cylinder fluid pressure.

Standard	
Master cylinder fluid pressure kPa (kg/cm ² /psi)	Rear fluid pressure kPa (kg/cm ² /psi)
2942 (30 / 427)	(C)
7845 (80 / 1138)	(D)

For (C) and (D), refer to the adjustment standard table.



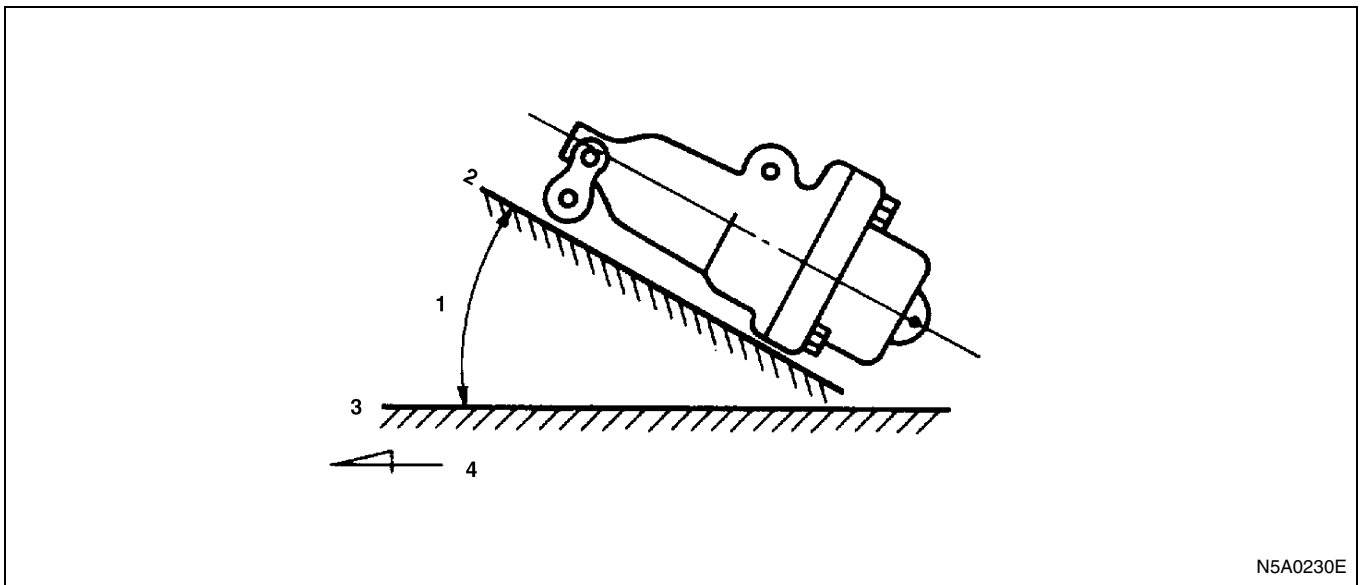
Adjustment Standard Table

Models	(A) N (kg/lb)	(B) kPa (kg/cm ² /psi)	(C) kPa (kg/cm ² /psi)	(D) kPa (kg/cm ² /psi)
NHR55-1C	5884(600/1323)	3687±588 (37.6±6/535±85)	1442±196 (14.7±2/209±28)	1932±343 (19.7±3.5/280±50)
NHR55-3C	8826(900/1984)			
NKR77-1D	12258(1250/2756)			
NKR77-5D	11768(1200/2646)			
NKR77-3E	6865(700/1543)			
NKR77-5E	8826(900/1984)			
NKR77-5H	8826(900/1984)			
NKR55-1E	6865(700/1543)			
NKR55-3E	6865(700/1543)			
NKR55-5H	9807(1000/2205)	5031±588 (51.3±6/730±85)	1697±196 (17.3±2/246±28)	2922±343 (29.8±3.5/424±50)
NKR77-3EXY (Taiwan)	6865(700/1543)	3687±588 (37.6±6/535±85)	1442±196 (14.7±2/209±28)	1932±343 (19.7±3.5/280±50)
NKR77-3EXA (Taiwan)	7845(800/1764)			
NKR77-5E (Taiwan)	9807(1000/2205)			
NKR77-5H (Taiwan)	9807(1000/2205)	5031±588 (51.3±6/730±85)	1697±196 (17.3±2/246±28)	2922±343 (29.8±3.5/424±50)
NPR77-5D/5CW	11768(1200/2646)	3687±588 (37.6±6/535±85)	1442±196 (14.7±2/209±28)	1932±343 (19.7±3.5/280±50)

Models	(A) N (kg/lb)	(B) kPa (kg/cm ² /psi)	(C) kPa (kg/cm ² /psi)	(D) kPa (kg/cm ² /psi)
NPR75-5E	8826(900/1984)	5031±588 (51.3±6/730±85)	1697±196 (17.3±2/246±28)	2922±343 (29.8±3.5/424±50)
NPR77-5H	8826(900/1984)			
NPR70/75-5J/5HW	14710(1500/3307)			
NPR75-5J/5HW	14710(1500/3307)			
NPR70/75-5L/5KW	16671(1700/3748)			
NQR75-5L/5KW	14710(1500/3307)			
NQR75-5N (Australia)	12749(1300/2866)			
NPR66-5J	8826(900/1984)			
NPR66-5E	15691(1600/3527)			
NPR66-5L (South Africa)	12749(1300/2866)			
NPR66-5L (GCC)	13729(1400/3086)			
NPR71 / NQR70-5L	13729(1400/3086)			
NQR71-5N	13729(1400/3086)			
NQR75-5N (South Africa)	14710(1500/3307)			
NPS71/75-5J	17652(1800/3968)			

Deceleration Sensing Proportioning Valve

DSPV Mounting Angle



Legend

- | | |
|---------------------|-------------------|
| 1. Mounting angle | 3. Ground surface |
| 2. Mounting surface | 4. Front |

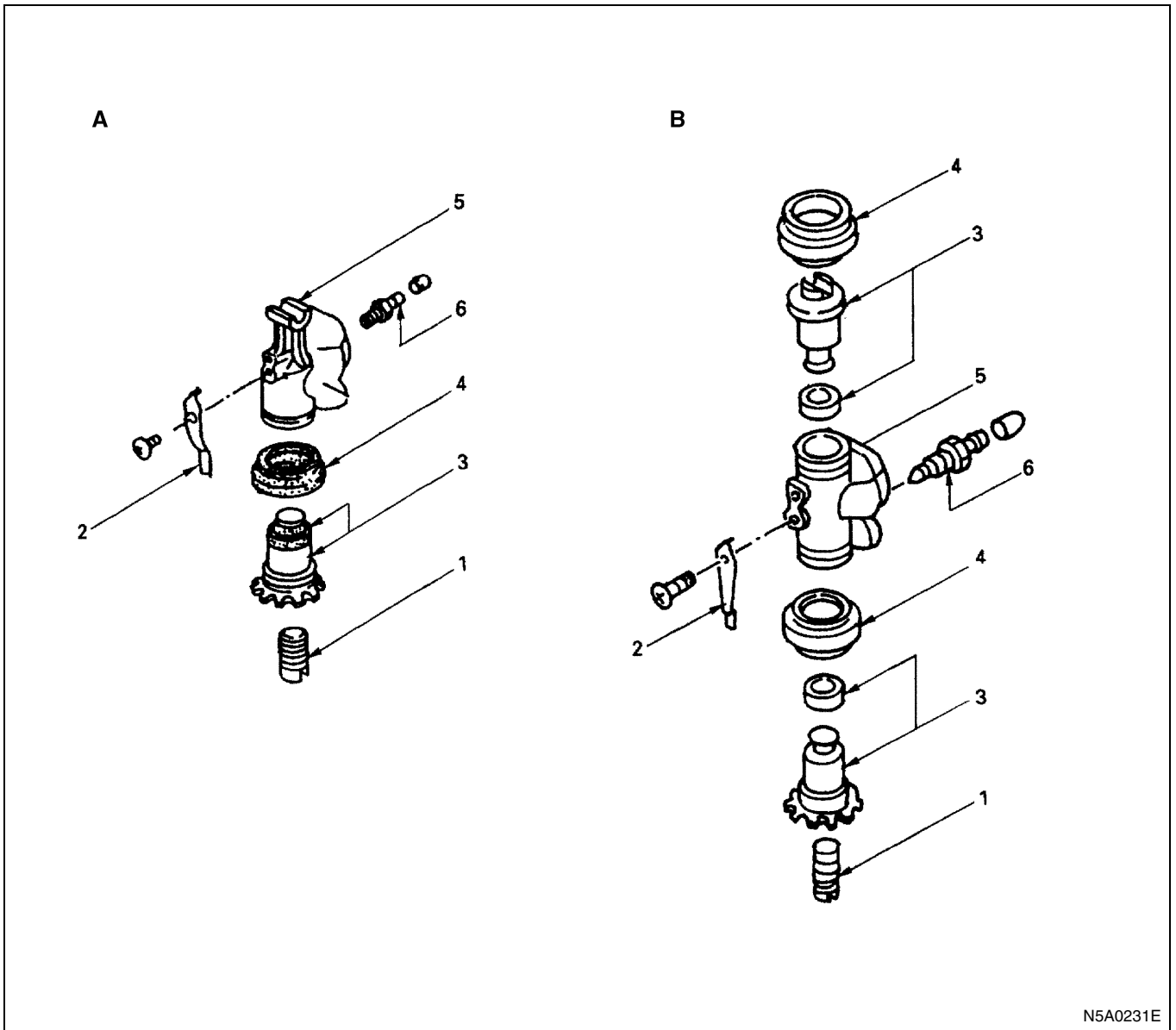
Models	Mounting Angle
NHR	12°00'±45'
NKR	12°30'±45'

Conduct the following inspections, and if any abnormality is found, replace.

Condition	Procedure	Judgement
As installed in the vehicle	Measure braking force to make sure of normality.	If no braking force, adherence of ball (deceleration sensing) to seal is suspected.
	Bleed air also from the DSPV side of breather.	If no brake fluid does not come out, the same trouble as above is suspected.
	Check fluid leakage.	No problem, if there is no leak.
	Check mounting angle. (Refer to the table.)	If installed at an abnormal angle, though rare, specified braking force is unobtainable or DSPV does not work.
As not installed in the vehicle	Incline DSPV back and forth to see if the ball moves insides.	No problem, if a ball sound is heard from within.

UNIT REPAIR

Wheel Cylinder Assembly (without Auto-adjuster)



N5A0231E

Legend

A. 2L type

B. D2L type

1. Adjusting screw

2. Lock plate

3. Piston and cup assembly

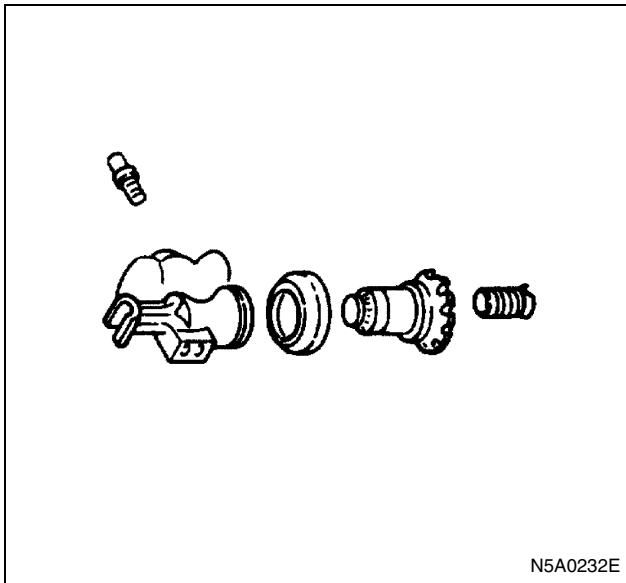
4. Boot

5. Wheel cylinder body

6. Bleeder screw

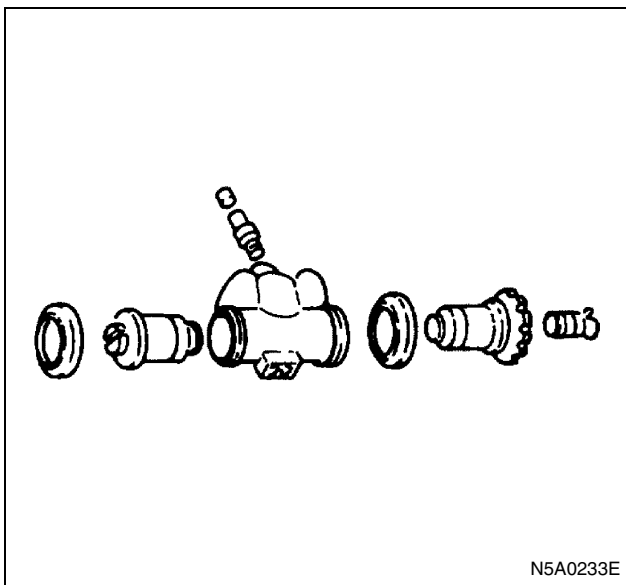
Disassembly

2L Type



N5A0232E

D2L Type



N5A0233E

1. Adjusting Screw
2. Lock Plate
3. Piston and cup Assembly
4. Boot
5. Wheel Cylinder Body
6. Bleeder Screw

Store all of the removed parts in a clean part tray.

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Wheel Cylinder Assembly

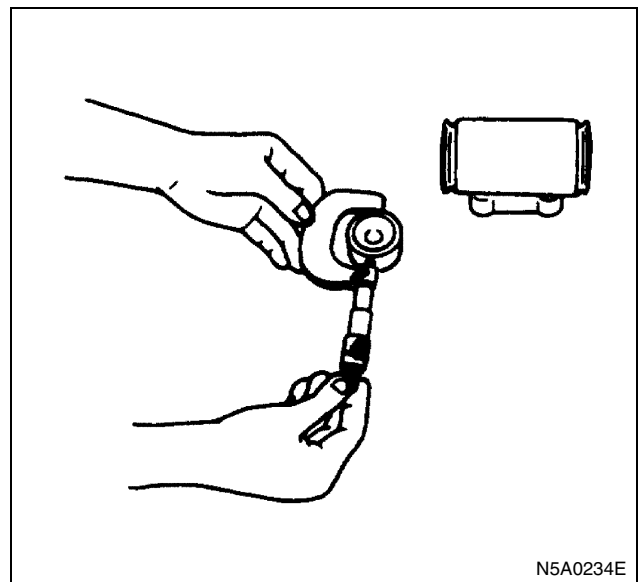
Wheel Cylinder and Piston Clearance

1. Use a micrometer to measure the piston diameter.
2. Use an inside dial indicator to measure the cylinder bore.

3. Calculate the clearance between the wheel cylinder and the piston.
If the clearance exceeds the specified limit, the piston and/or wheel cylinder body must be replaced.

Wheel Cylinder and Piston Clearance	
mm (in)	
Wheel Cylinder size	Limit
22.22 (0.875)	0.15 (0.006)
25.40 (1.000)	
28.57 (1.125)	
30.16 (1.188)	
33.33 (1.312)	
34.93 (1.375)	

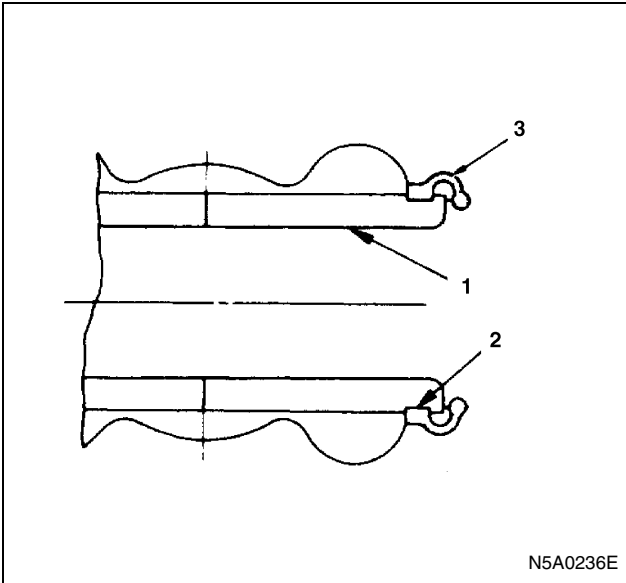
When the wheel cylinder disassembled, the repair kit (piston cup and boot) must be replaced.



N5A0234E

Reassembly

1. Bleeder Screw
2. Wheel Cylinder Body
 - 1) Apply a coat of rubber grease to the cylinder body bore (1) and the grooves for the boots (2).
 - 2) Fit the boot edge securely into the mating groove of the cylinder body.



Legend

- 1. Cylinder body bore
- 2. Groove
- 3. Boot

3. Boot

4. Piston Assembly

- 1) Apply a coat of rubber grease to the piston cups and the pistons.
Be sure to lubricate the entire cylinder body bore with the rubber grease.
- 2) Install the piston assembly to the cylinder.

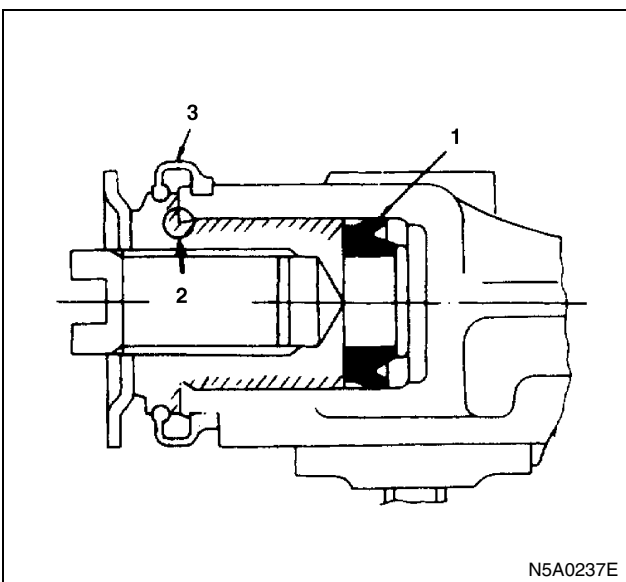
Notice:

After installation of the piston assembly into the cylinder body bore, fit the boot edge securely into the mating groove of the piston.

Make sure that the two boot edges firmly sealed into the grooves.

Be careful not to damage the piston cups and the boots.

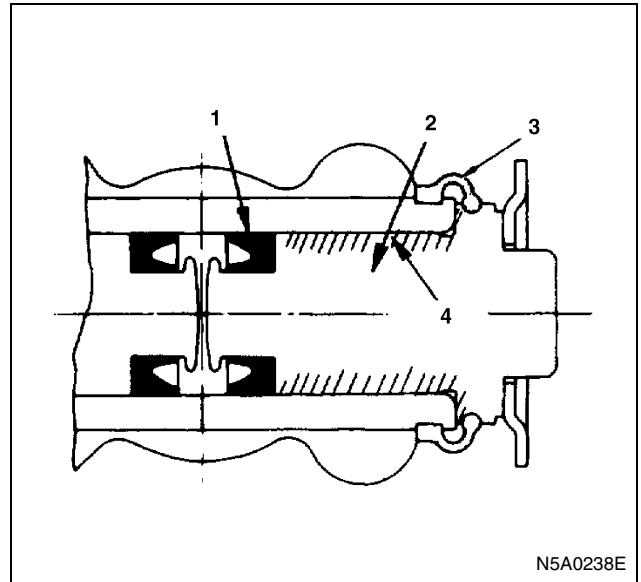
2L Type



Legend

- 1. Piston cup
- 2. Edge
- 3. Boot

D2L Type



Legend

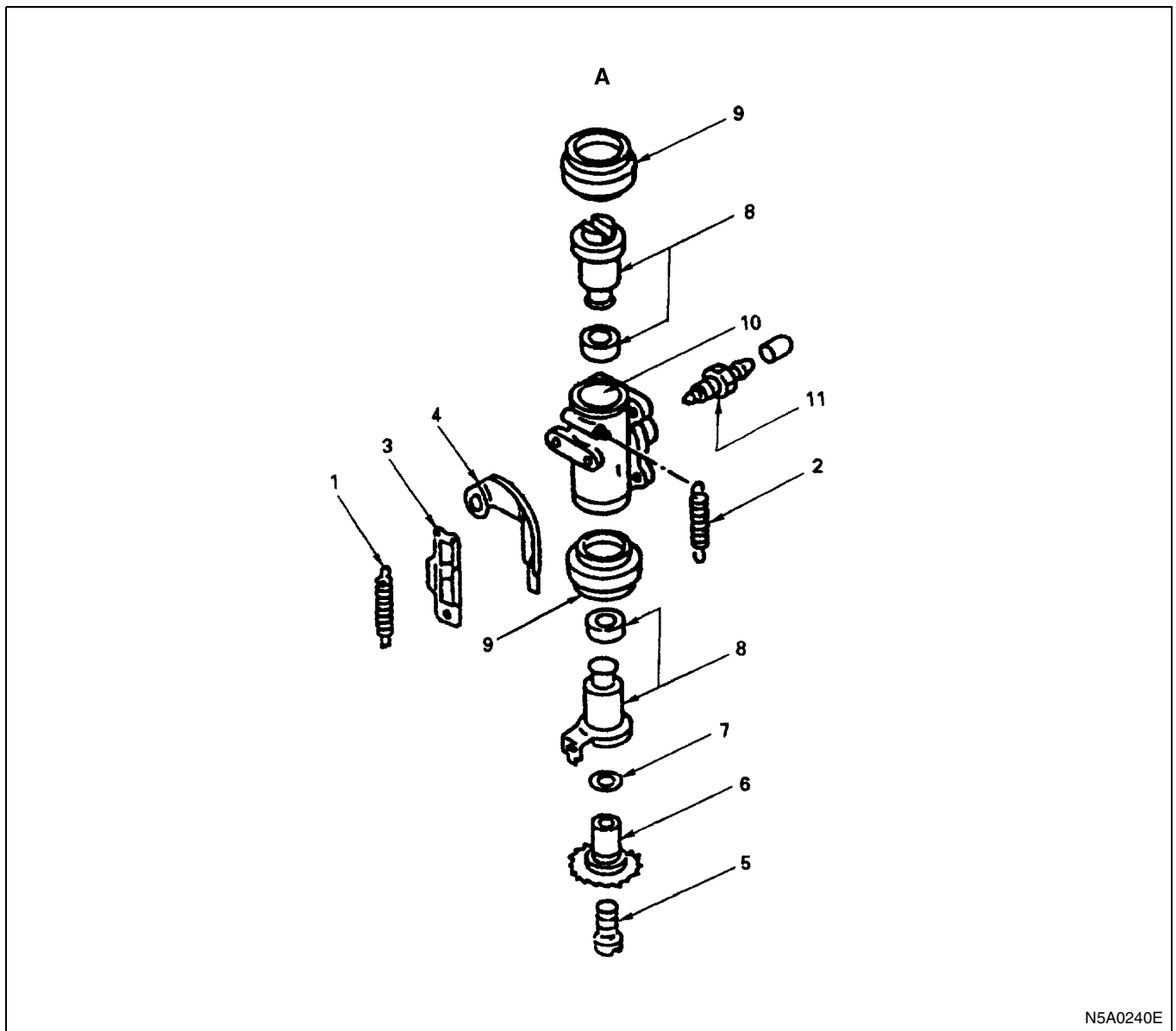
- 1. Piston cup
- 2. Piston
- 3. Boot
- 4. Grease

1. Lock Plate

2. Adjusting Screw

Apply a coat of molybdenum disulfide grease to the adjusting screw slit and threads.

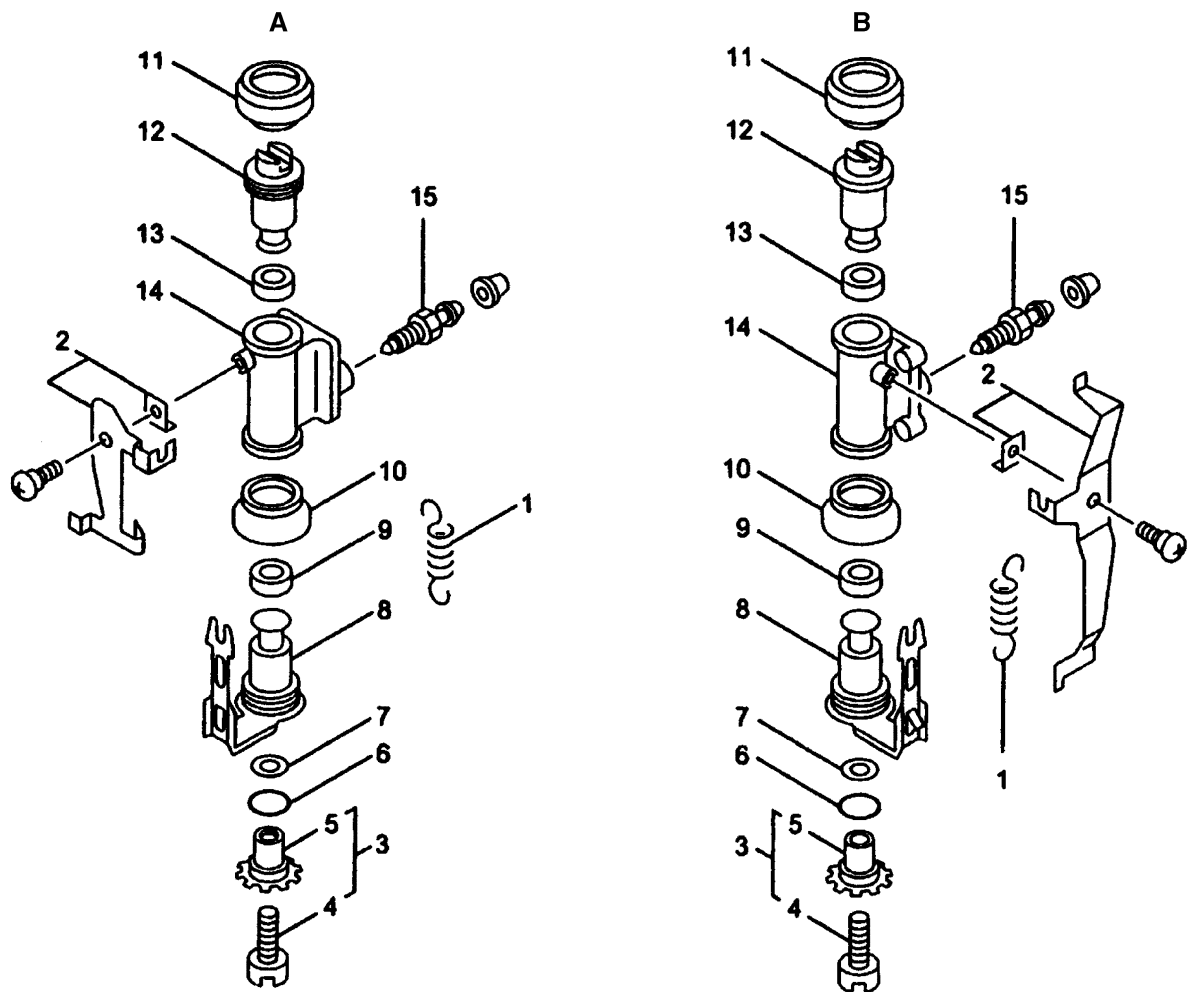
Wheel Cylinder Assembly (with Auto-adjuster)



N5A0240E

Legend

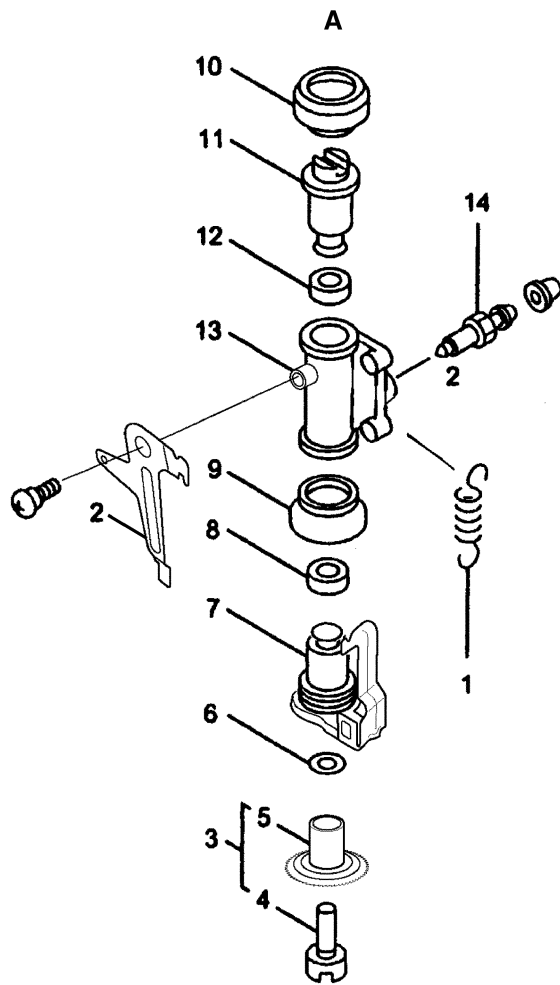
- | | |
|--------------------------------|-----------------------------------|
| A. Drum inside diameter 260 mm | 6. Adjuster gear and nut assembly |
| 1. Overtravel spring | 7. Washer |
| 2. Return spring | 8. Piston and cup assembly |
| 3. Fitting | 9. Boot |
| 4. Adjuster lever | 10. Wheel cylinder body |
| 5. Adjusting screw | 11. Bleeder screw |



N5A0241E

Legend

- | | |
|-----------------------------------|--------------------------------|
| A. Drum inside diameter 240 mm | 8. Piston and bracket assembly |
| B. Drum inside diameter 290 mm | 9. Piston cup |
| 1. Overtravel spring | 10. Boot |
| 2. Adjuster lever | 11. Boot |
| 3. Adjusting screw and gear | 12. Anchor piston |
| 4. Adjusting screw | 13. Piston cup |
| 5. Adjuster gear and nut assembly | 14. Cylinder body |
| 6. Seal | 15. Bleeder |
| 7. Seat (washer) | |

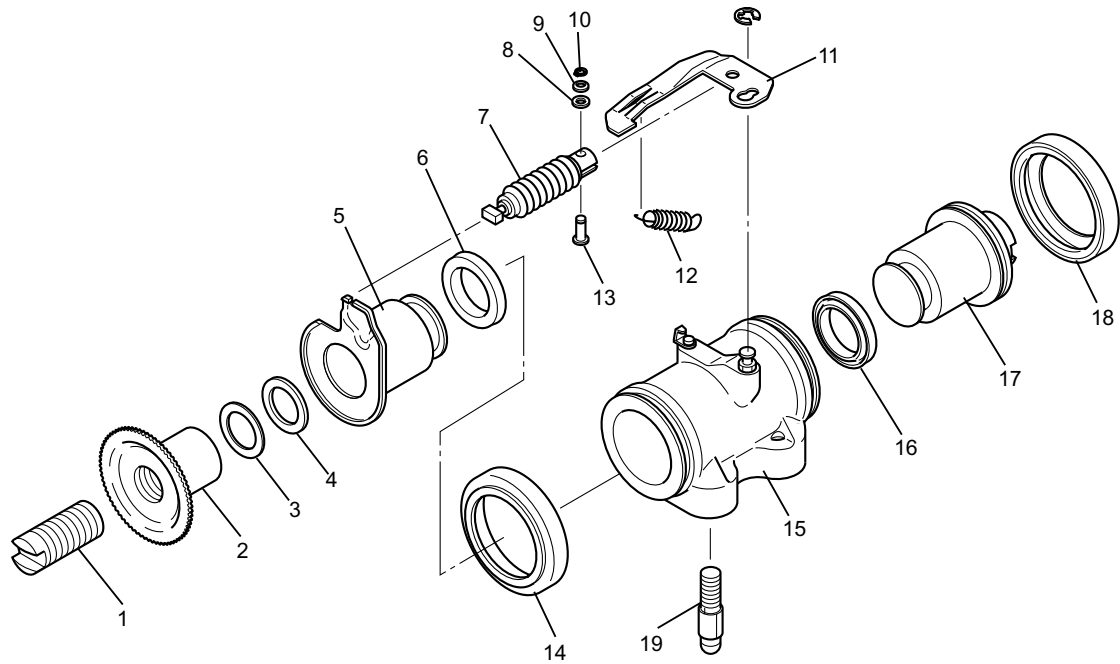


N5A0242E

Legend

- | | |
|--|-------------------|
| A. Drum inside diameter 300 mm, 320 mm | 8. Piston cup |
| 1. Overtravel spring | 9. Boot |
| 2. Adjuster lever | 10. Boot |
| 3. Adjusting screw and gear | 11. Anchor piston |
| 4. Adjusting screw | 12. Piston cup |
| 5. Adjuster gear and nut assembly | 13. Cylinder body |
| 6. Seat (Washer) | 14. Bleeder |
| 7. Piston | |

A



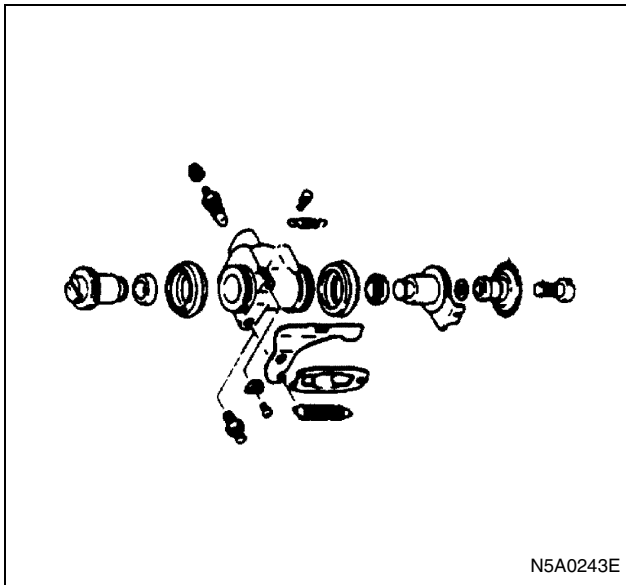
N5A0448E

Legend

- | | |
|-----------------------------------|-----------------------|
| A. Drum inside diameter 370 mm | 10. Snap ring |
| 1. Adjusting screw | 11. Lever |
| 2. Adjuster gear and nut assembly | 12. Return spring |
| 3. Washer (SUS) | 13. Pin |
| 4. Washer (OIL LESS) | 14. Boot |
| 5. Piston | 15. Cylinder assembly |
| 6. Piston cup | 16. Piston cup |
| 7. Spring assembly | 17. Piston |
| 8. Washer | 18. Boot |
| 9. Wave washer | 19. Bleeder |

Disassembly

Drum inside diameter 260 mm



1. Overtravel Spring
 2. Return Spring
 3. Fitting
 4. Adjuster Lever
 5. Adjusting Screw
 6. Adjuster Gear
 7. Piston and cup Assembly
 8. Boot
 9. Wheel Cylinder Body
 10. Bleeder Screw
- Store all of the removed parts in a clean part tray.

Drum inside diameter 240, 290 mm

Inspect the wheel cylinder.

Remove the parts of the brakes with a drum inside diameter of 240 mm and 290 mm in the order shown below.

1. Overtravel spring
2. Auto-adjuster lever
3. Adjusting screw and gear assembly
4. Adjusting screw
5. Adjuster gear
6. Seal
7. Seat (washer)
8. Piston
9. Piston cup
10. Boot
11. Boot
12. Piston
13. Piston cup
14. Cylinder
15. Bleeder

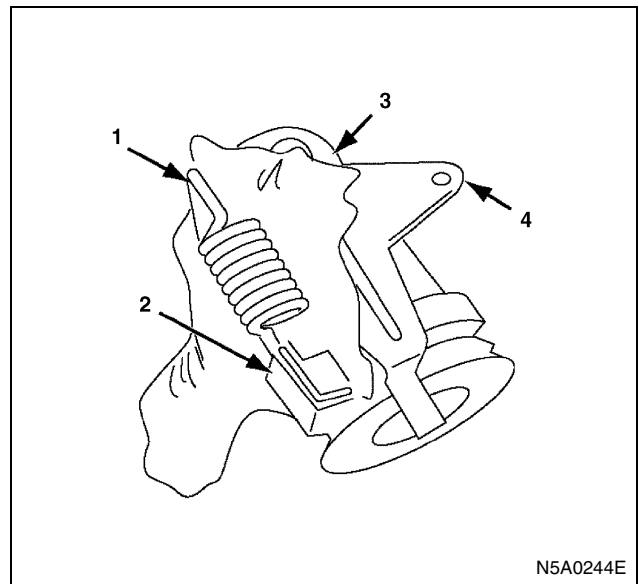
Drum inside diameter 300, 320 mm

1. Auto-adjuster
2. Boot

3. Piston
4. Adjusting screw
5. Adjuster gear
6. Washer
7. Piston cup
8. Piston
9. Bleeder screw and cap
10. Cylinder body

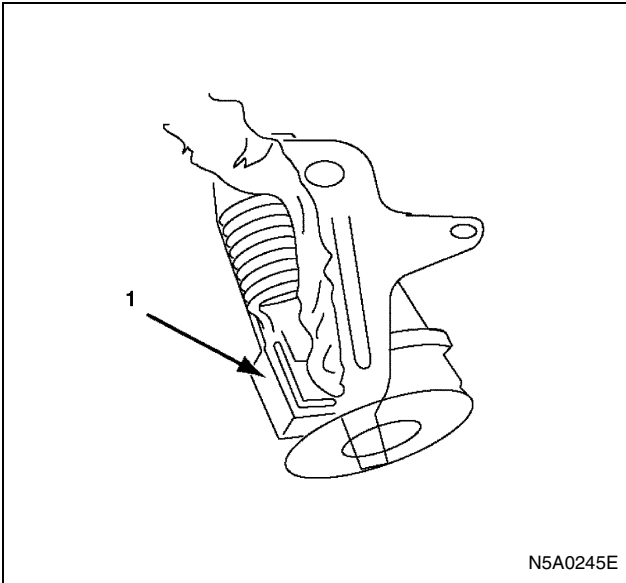
Disassembly of piston on adjust side (Drum inside diameter 300, 320 mm)

1. Fit the waste cloth between the lever and spring not to damage each parts.



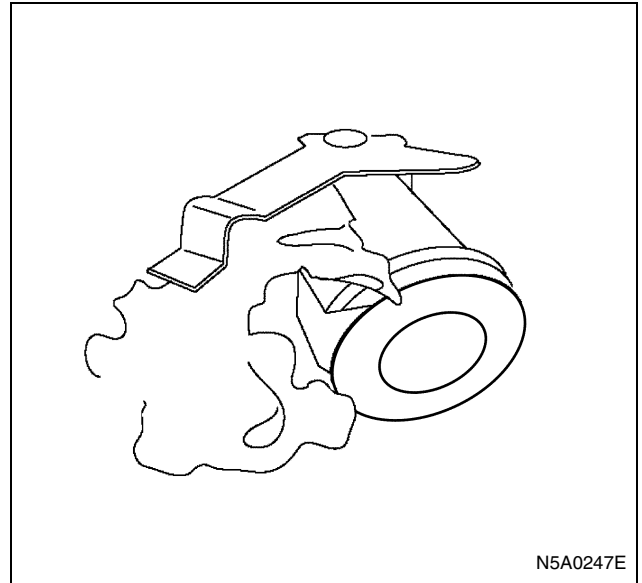
Legend

1. Spring
 2. Bracket
 3. Lever fixing bolt
 4. Lever
-
2. Disassemble the lever fixing bolt.
 3. Remove the piston assembly to hold the lever to fit the bracket.

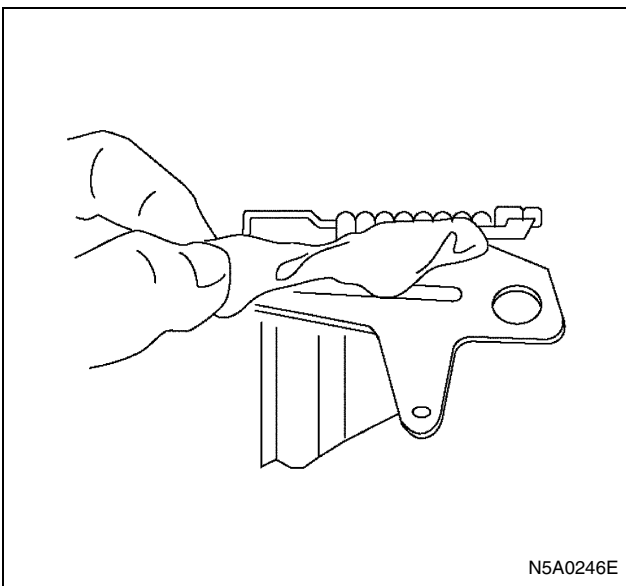


Legend

1. Attach the lever to the bracket

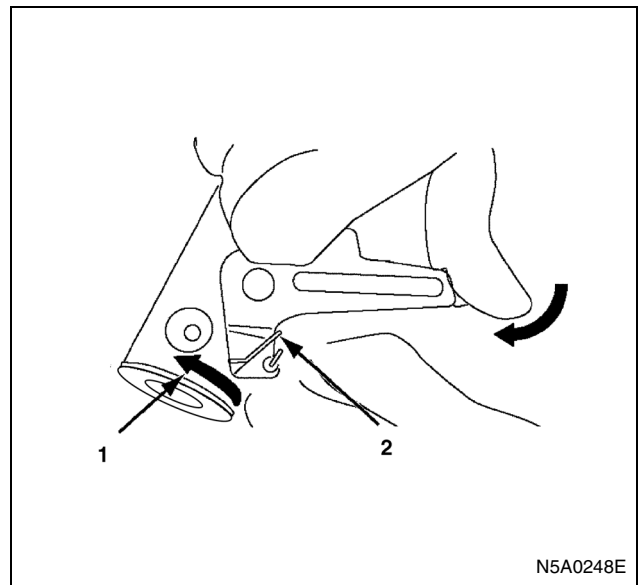


2. After running the lever up on the bracket, turn the lever to the direction at the connecting point of lever and spring.



Disassembly of lever spring

1. Fit the waste cloth between the lever and spring not to damage each parts.



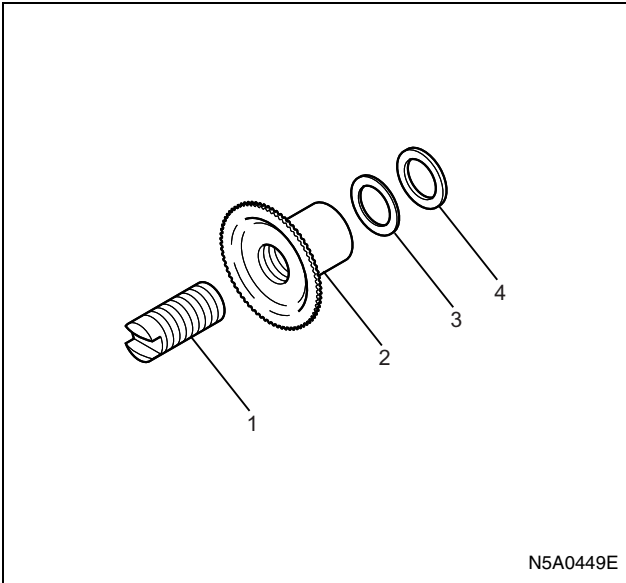
Legend

1. Reassemble the lever from the direction
2. Connecting point of lever and spring

3. Disassemble the lever from the bracket.

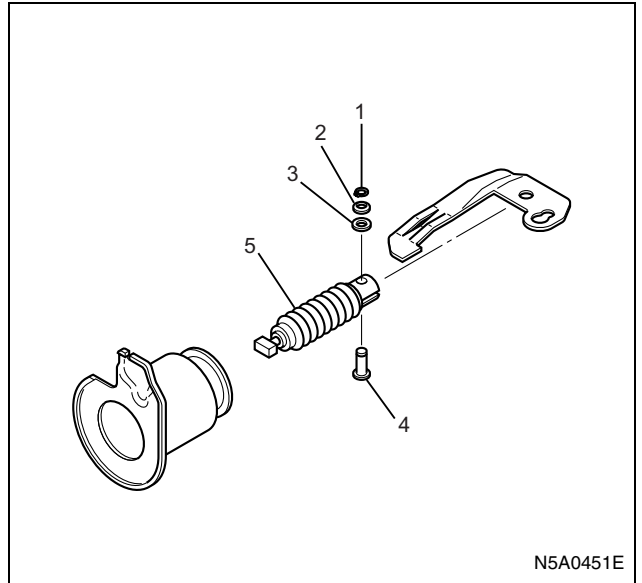
Drum inside diameter 370 mm

1. Remove the adjusting screw (1).
2. Remove the adjuster gear and nut assembly (2).
3. Remove the washer (SUS) (3).
4. Remove the washer (OIL LESS) (4).



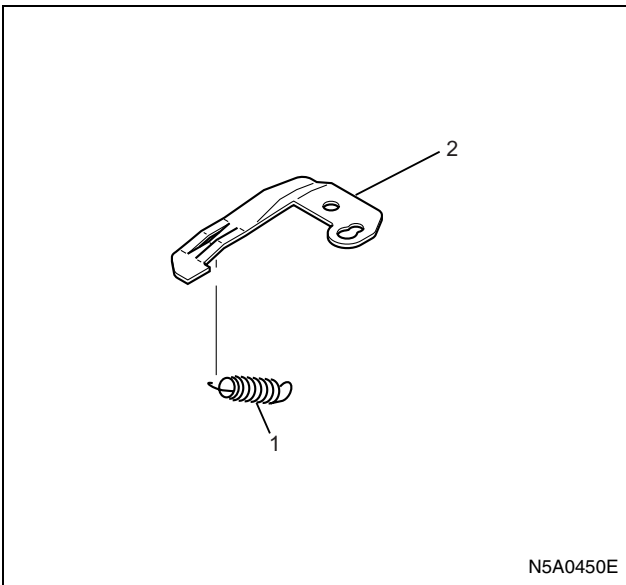
N5A0449E

5. Remove the return spring (1).
Remove the spring from lever side and cylinder side.
6. Remove the lever (2).



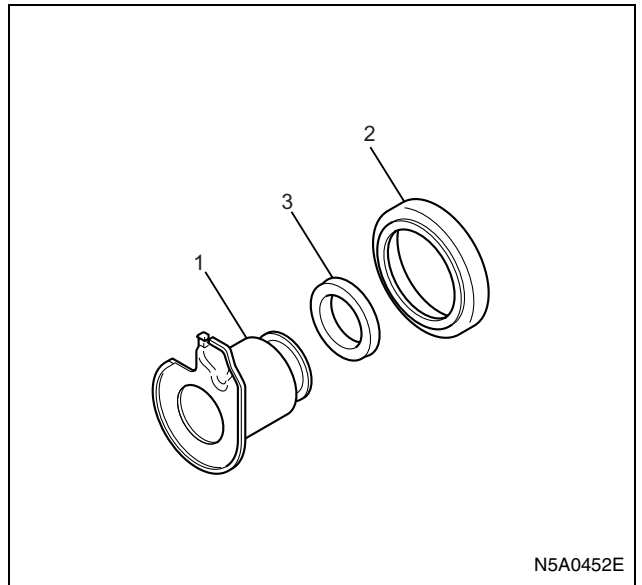
N5A0451E

12. Remove the piston (1).
Remove the boot from cylinder and pull out the piston.
13. Remove the boot (2).
14. Remove the piston cup (3).
15. Remove the cylinder assembly.



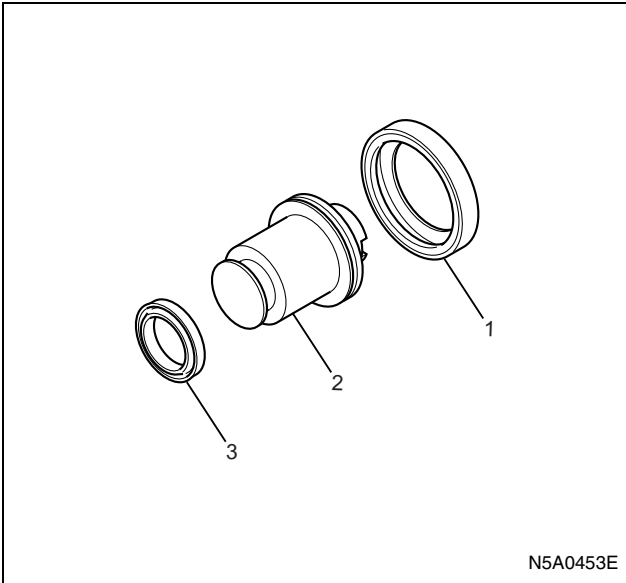
N5A0450E

7. Remove the snap ring (1).
8. Remove the wave washer (2).
9. Remove the washer (3).
10. Remove the pin (4).
11. Remove the spring assembly (5).
Pull out the pin from lever and separate the spring.
For piston side, remove it from flange groove of piston.



N5A0452E

16. Remove the boot (1).
17. Remove the piston (2).
18. Remove the piston cup (3).



N5A0453E

19. Remove the bleeder.

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

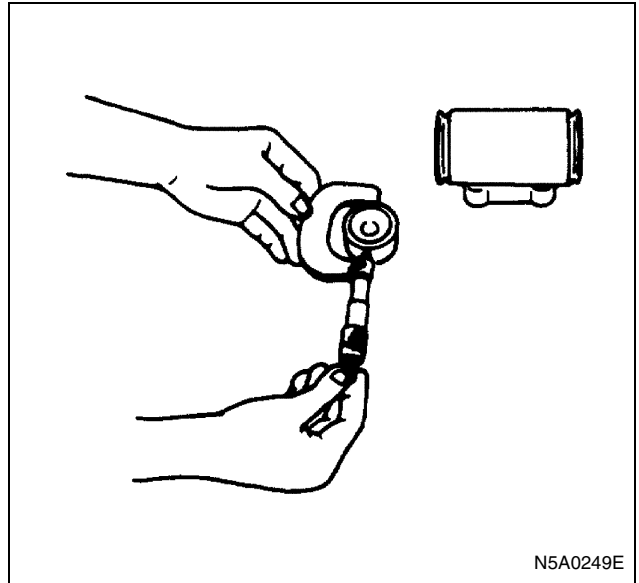
Wheel cylinder assembly

Wheel Cylinder and Piston Clearance

1. Use a micrometer to measure the piston diameter.
2. Use an inside dial indicator to measure the cylinder bore.
3. Calculate the clearance between the wheel cylinder and the piston.
If the clearance exceeds the specified limit, the piston and/or wheel cylinder body must be replaced.

Wheel Cylinder and Piston Clearance	
mm (in)	
Wheel Cylinder size	Limit
28.6 (1.125)	0.15 (0.006)
30.2 (1.188)	
25.4 (1.000)	
33.3 (1.313)	

When the wheel cylinder disassembled, the repair kit (piston cup and boot) must be replaced.

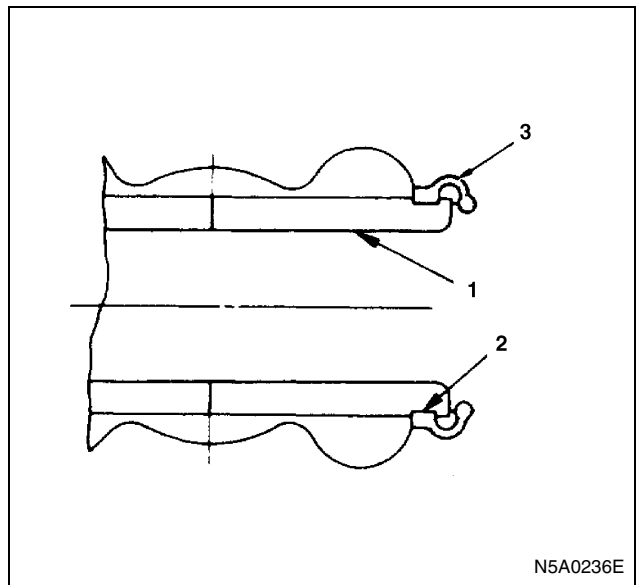


N5A0249E

Reassembly

Drum Inside Diameter 260 mm

1. Bleeder Screw
2. Wheel Cylinder Body
 - 1) Apply a coat of rubber grease to the cylinder body bore (1) and the grooves for the boots (2).

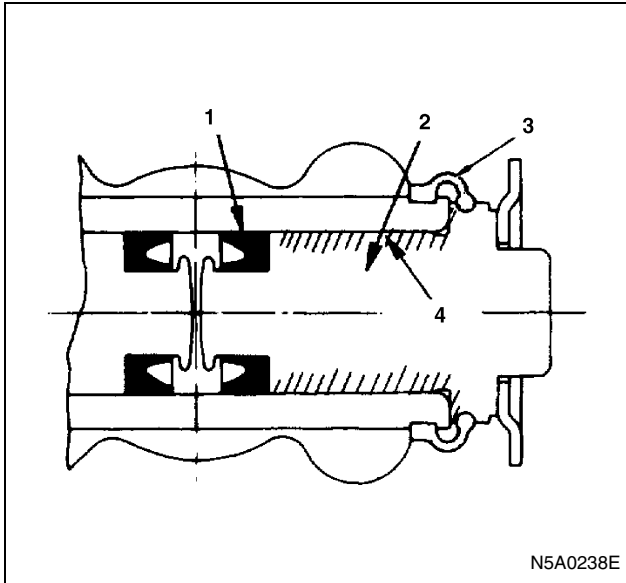


N5A0236E

Legend

1. Cylinder body bore
2. Groove
3. Boot

- 2) Fit the boot edge securely into the mating groove of the cylinder body.
3. Boot
4. Piston Assembly



N5A0238E

Legend

- 1. Piston cup
- 2. Piston
- 3. Boot
- 4. Grease

- 1) Apply a coat of rubber grease to the piston cups and the pistons.
Be sure to lubricate the entire cylinder body bore with the rubber grease.
- 2) Install the piston assembly to the cylinder.

Notice:

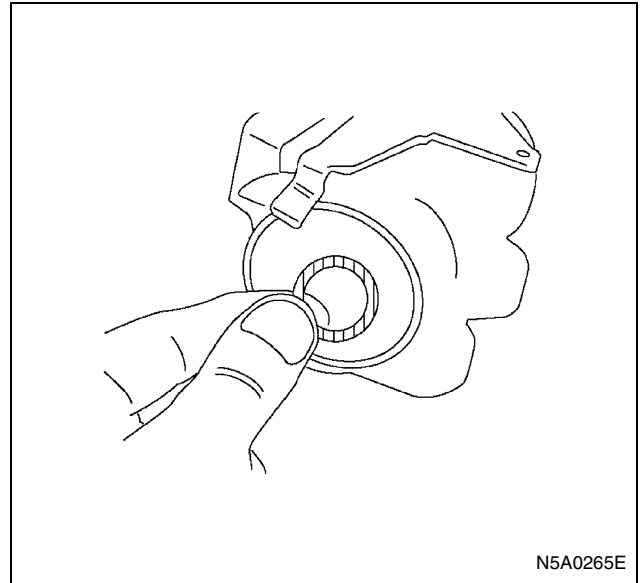
After installation of the piston assembly into the cylinder body bore, fit the boot edge securely into the mating groove of the piston.
Make sure that the two boot edges firmly sealed into the grooves.

Be careful not to damage the piston cups and the boots.

- 5. Adjuster Gear
- 6. Adjusting Screw
Apply a coat of molybdenum disulfide grease to the adjusting screw slit and threads.

Plain washer

Make sure to assemble the plain washer of coating side to the adjust side.



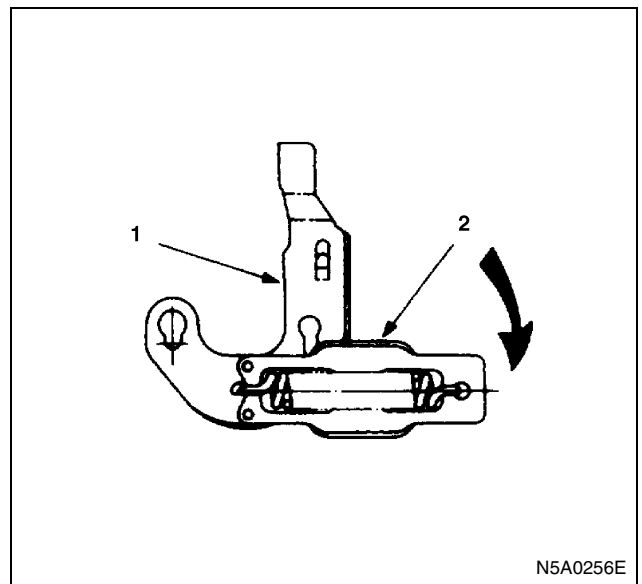
N5A0265E

Assemble the plain washer with the copper-colored surface facing inward and the coating (black) surface facing outward.

Notice:

Failure to assemble the plain washer or assembling it inside out causes auto adjuster not to operate properly. Be sure to assemble it correctly.

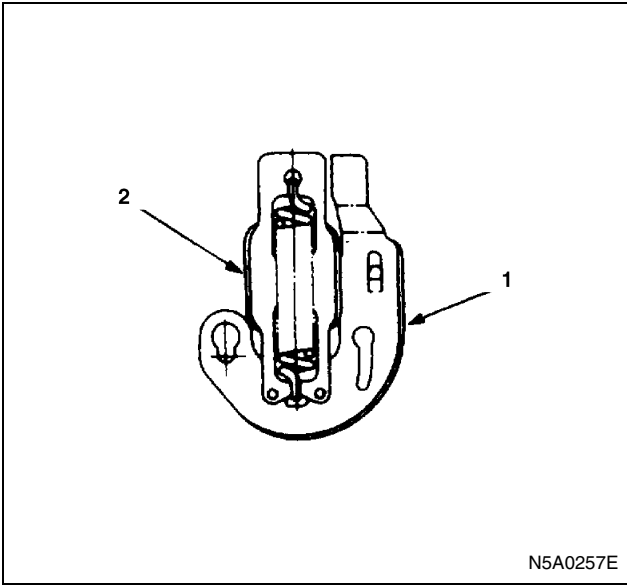
- 7. Adjuster Lever
- 8. Fitting
- 9. Overtravel Spring



N5A0256E

Legend

- 1. Adjuster lever
- 2. Overtravel spring

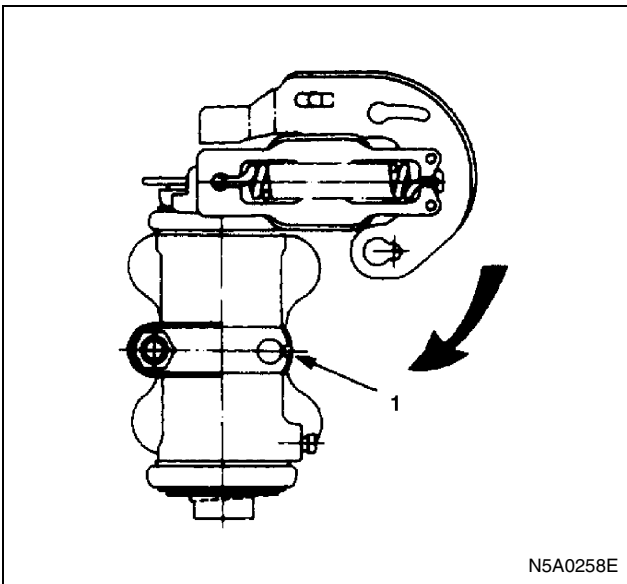


Legend

- 1. Adjuster lever
- 2. Overtravel spring

- 1) Hook one end of the overtravel spring to the adjuster lever hole as shown in the illustration.
- 2) Hook the other end of the overtravel spring to the fitting slot.
- 3) Turn the overtravel spring 90 degrees counter-clockwise as shown in the illustrations.

(Wheel Cylinder Body)



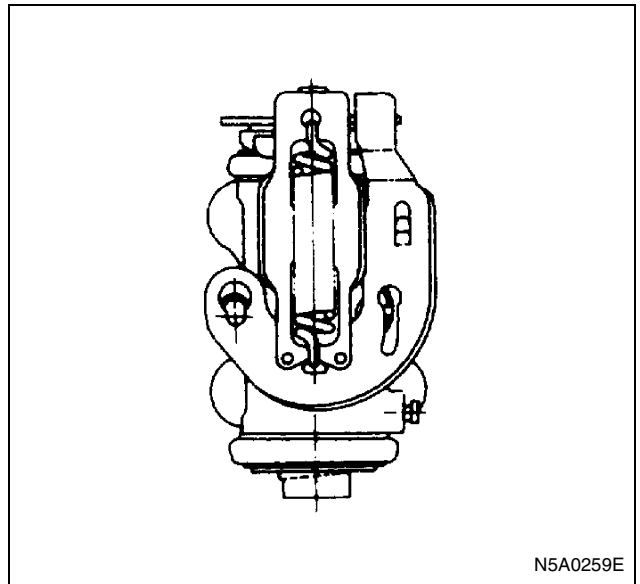
Legend

- 1. Wheel cylinder

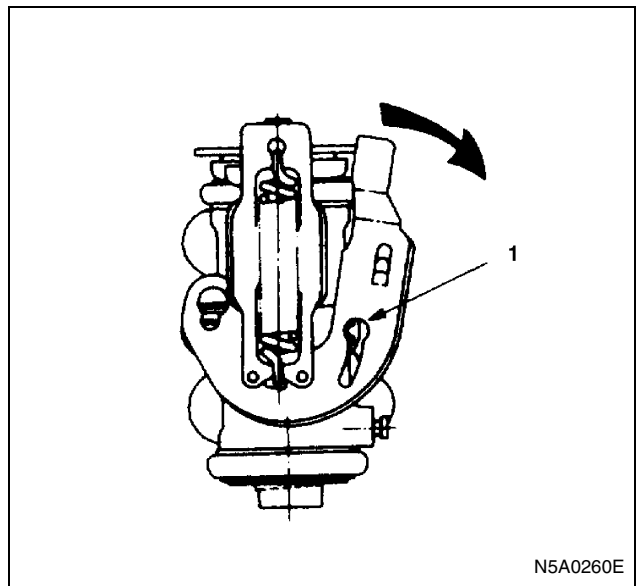
Install the adjuster lever and the overtravel spring to the wheel cylinder body.

- 1) Hook the overtravel spring fitting slot side to the wheel cylinder body bracket hole.

- 2) Turn the adjuster lever and the overtravel spring 90 degrees clockwise as shown in the illustration.



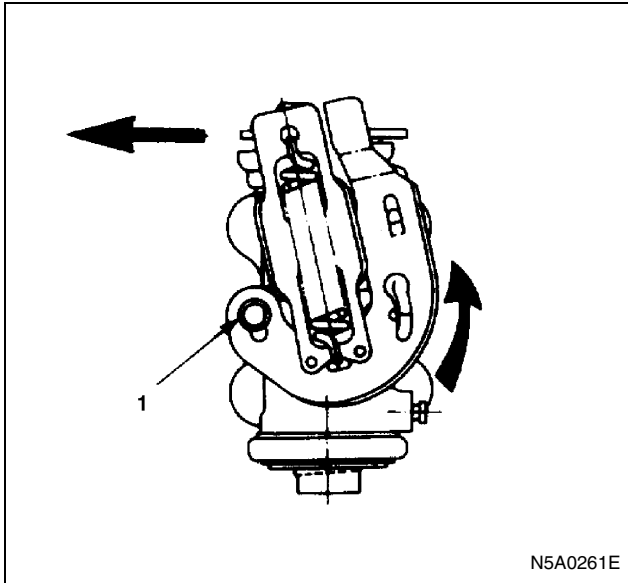
- 3) Turn the adjuster lever slightly clockwise to attach the adjuster lever hole to the wheel cylinder body hook.



Legend

- 1. Cylinder body hook

- 4) Push the wheel cylinder body and bracket to the left as shown in the illustration.



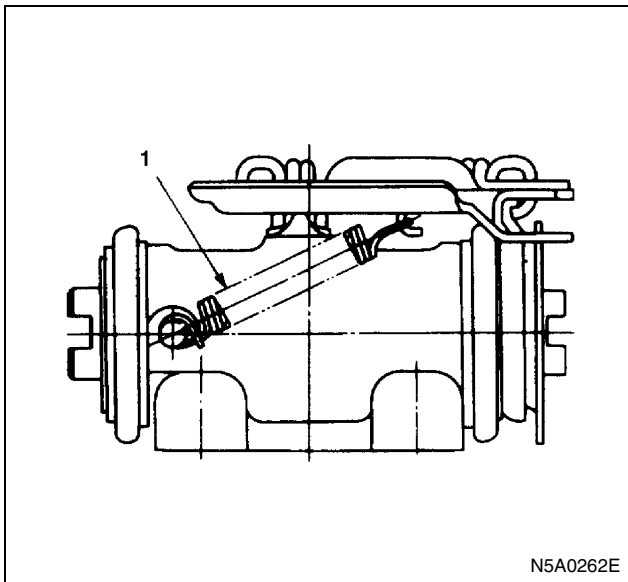
N5A0261E

Legend

1. Pin head

5) Turn the adjuster lever counterclockwise to install the pin head through the adjuster lever hole.

10. Return Spring
Hook the return spring to the wheel cylinder body pin.

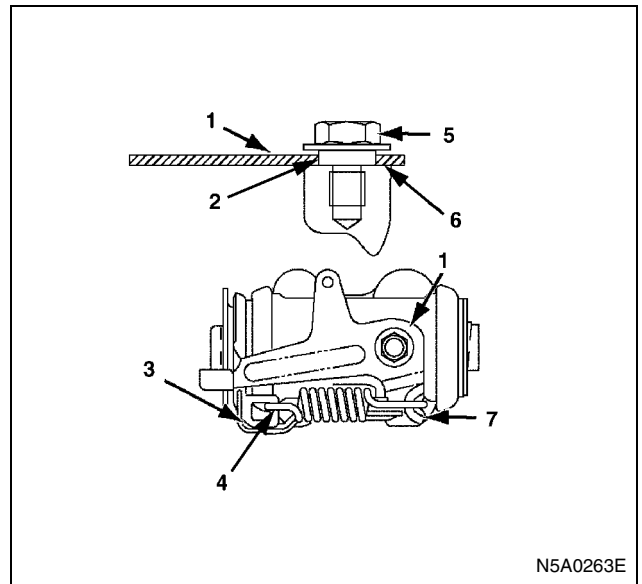


N5A0262E

Legend

1. Return spring

Drum Inside Diameter 300, 320 mm

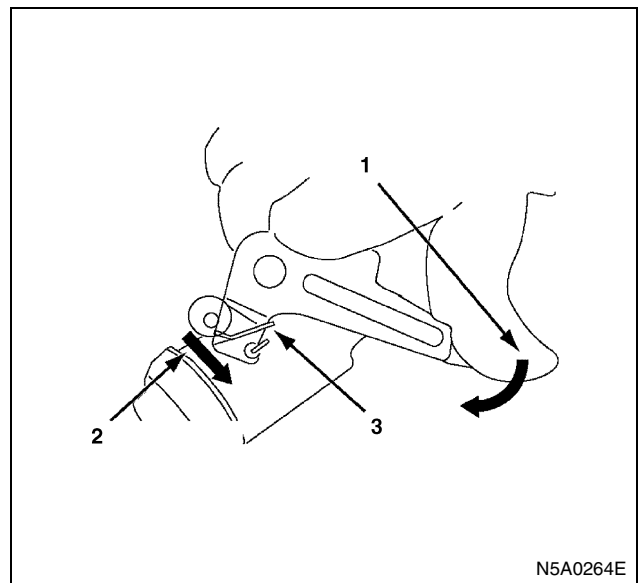


N5A0263E

Legend

- 1. Lever
- 2. Bolt sleeve
- 3. Bracket
- 4. Spring hook (short): Hook to the bracket square hole
- 5. Lever fixing bolt
Torque: 7.85 — 11.77 N·m (0.80 — 1.20 kg·m/
5.79 — 8.68 lb·ft)
- 6. Body surface
- 7. Spring hook (Long): Hook the lever

- 1. Reassemble the spring hook (short) to the bracket square hole and spring hook (long) to the lever.
- 2. Turn the lever to the direction at the connecting point of lever and spring and reassemble the lever to the bracket.



N5A0264E

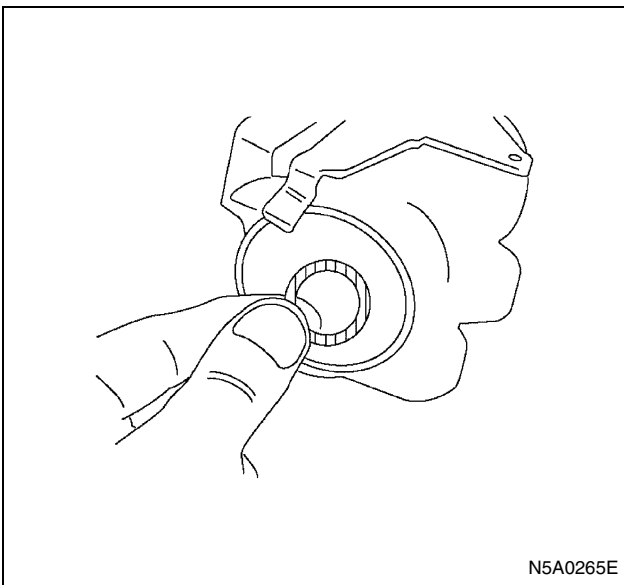
Legend

1. Turn the lever to the arrow, and extend the spring
2. Assemble the lever from the direction
3. Connecting point of lever and spring

3. Install the lever fixing bolt to the specified torque.
4. Make sure not to bite the lever between the bolt sleeve and body surface.
5. Make sure fit the lever to the gear properly after fixing the bolt.

Plain washer

Make sure to assemble the plain washer of coating side to the adjust side.



Assemble the plain washer with the copper-colored surface facing inward and the coating (black) surface facing outward.

Notice:

Failure to assemble the plain washer or assembling it inside out causes auto adjuster not to operate properly. Be sure to assemble it correctly.

Drum Inside Diameter 370 mm

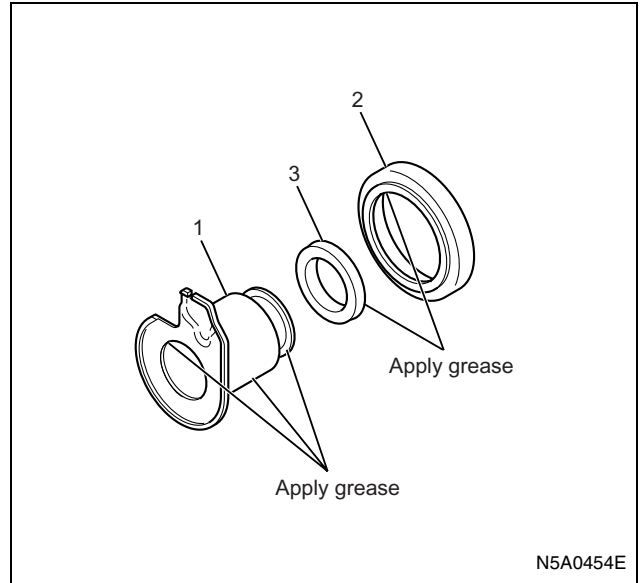
1. Assemble the piston.
 - 1) Apply grease to the outer circumference of piston (1) and installation groove of boot. Install the boot (2) and apply grease to the insertion groove of cup.

Notice:

After installation of boot, make sure that there are still enough grease in boot.

- 2) Assemble the grease-applied piston cup (3) to piston.

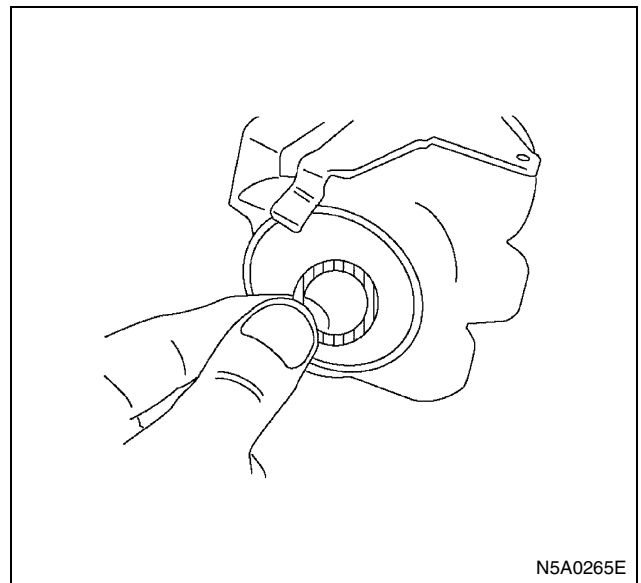
Grease: NIGLUBE RX-2



2. Install the washer (OIL LESS) (1).
Apply grease to both sides.

Plain washer

Make sure to assemble the plain washer of coating side to the adjust side.



Assemble the plain washer with the copper-colored surface facing inward and the coating (black) surface facing outward.

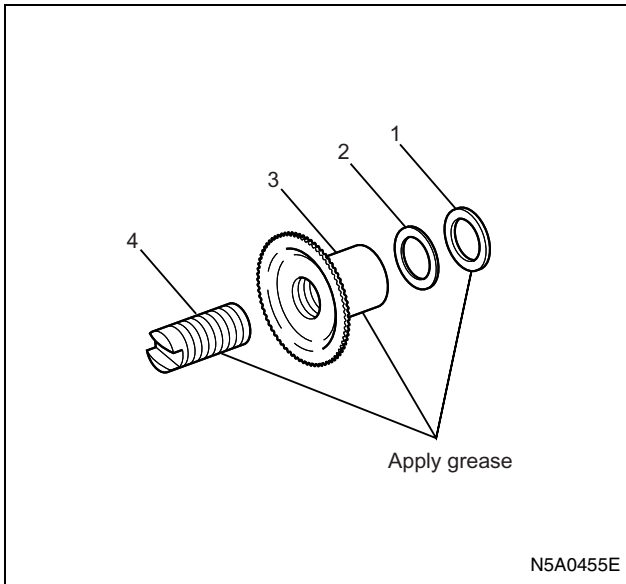
Notice:

Failure to assemble the plain washer or assembling it inside out causes auto adjuster not to operate properly. Be sure to assemble it correctly.

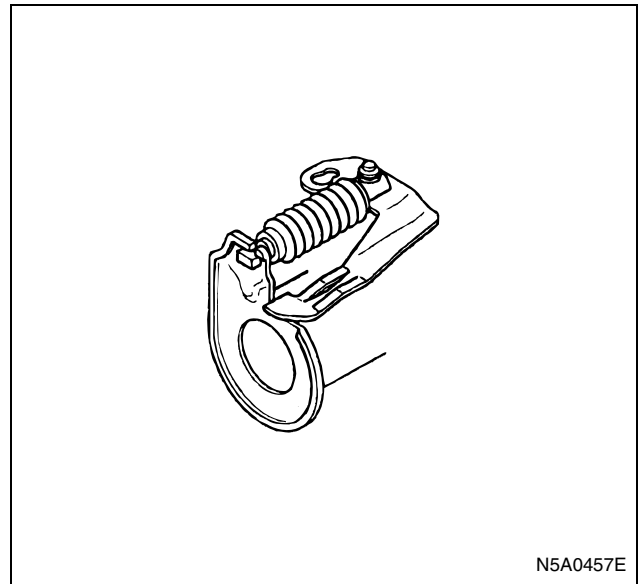
3. Install the washer (SUS) (2).
4. Install the adjuster gear and nut assembly (3).
Apply grease to the inner surface of piston and adjuster gear and nut assembly, and assemble it to piston.

Grease: NIGLUBE RX-2

5. Install the adjusting screw (4).
Apply grease and screw it in to adjuster gear and nut assembly.



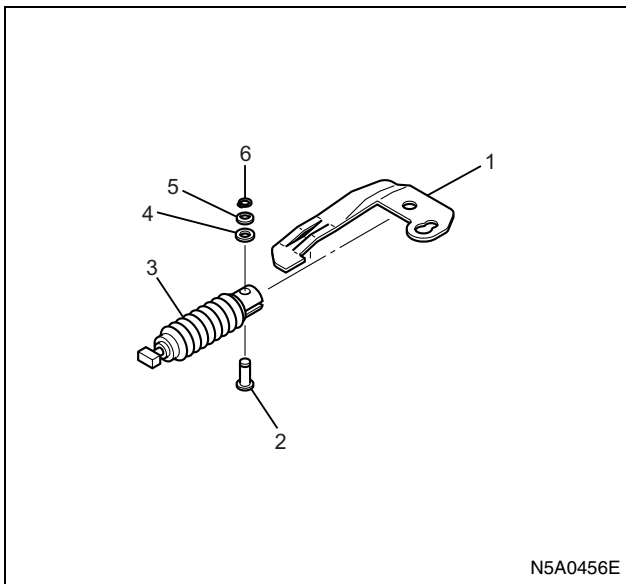
8. Fix the cylinder assembly in a vise and assemble the tip of spring assembly to cutout groove of piston flange.



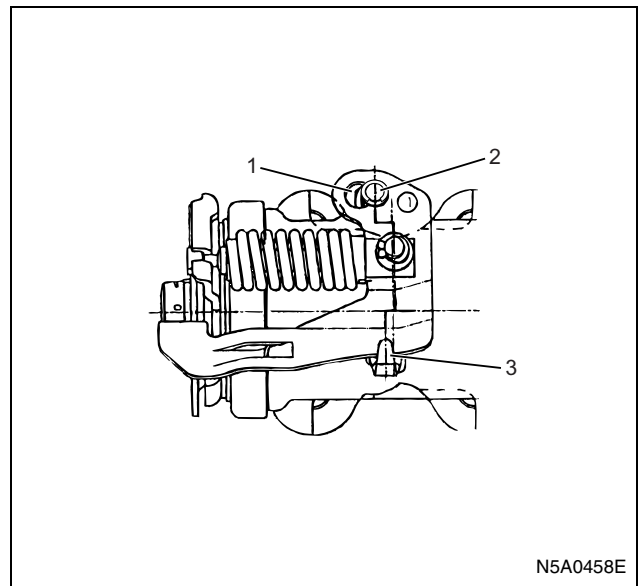
6. Install the cylinder assembly.
Apply grease to the sliding part of piston. Assemble the piston and install the boot.

Grease: NIGLUBE RX-2

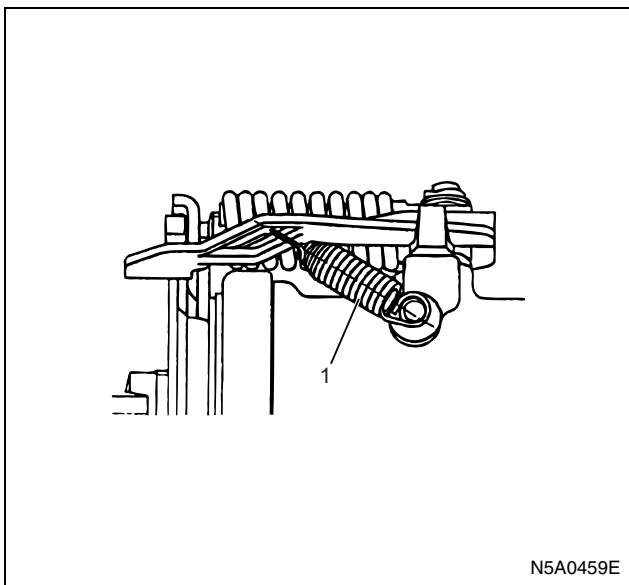
7. Assemble the lever assembly.
Install the pin (2), spring assembly (3), washer (4), wave washer (5) and snap ring (6) to lever (1).



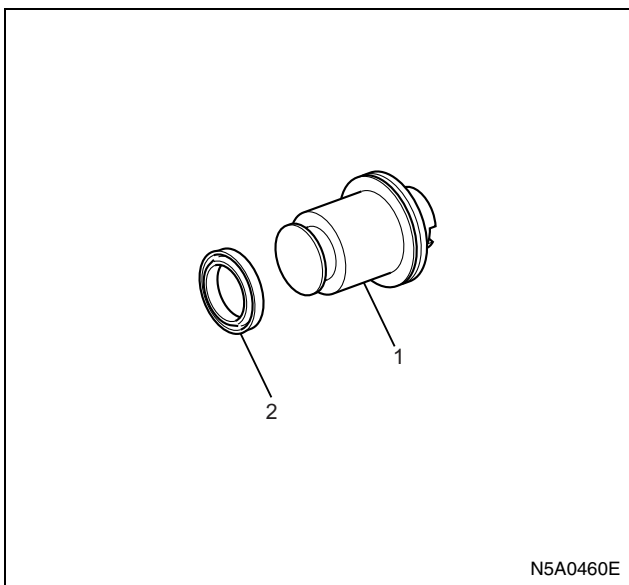
9. While matching the lever to cylinder's hook (3) and stretching the spring assembly, fix the lever to cylinder pin (2) through the double hole (1) of lever.



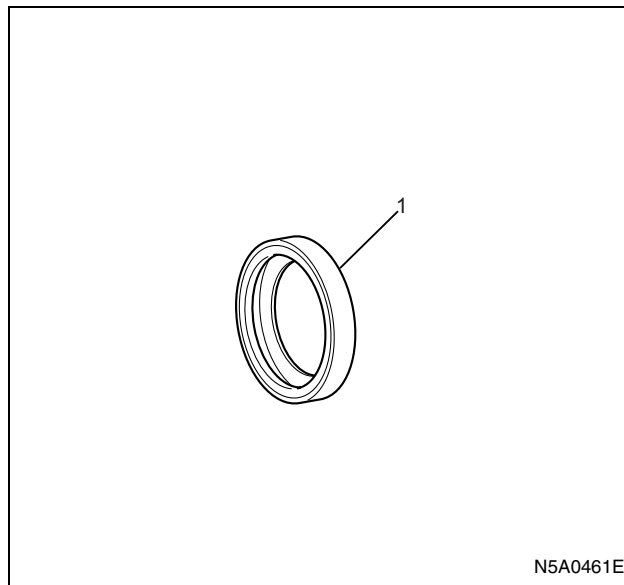
10. Install the return spring (1).
Install the closed hook of return spring to pin side.



11. Install the piston (1).
Apply grease to the outer circumference of piston and groove of piston cup (2), and install the grease-applied piston cup.



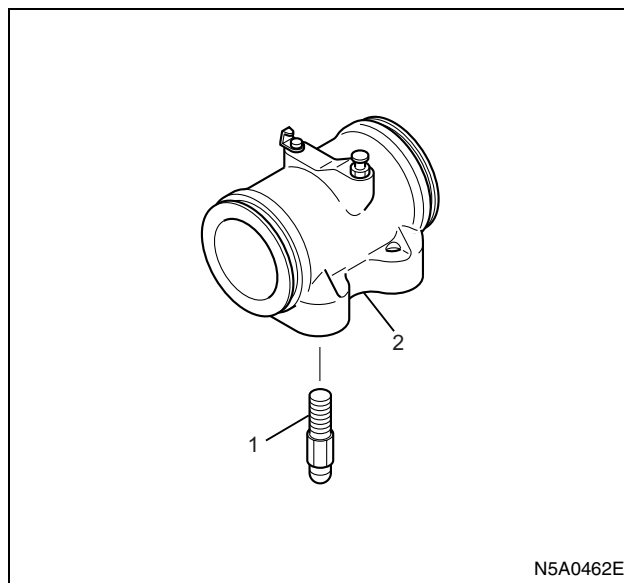
12. Install the boot (1).
Apply grease to the boot installation groove of cylinder, fill the grease to inside of boot and install it.
Grease: BESCO rubber grease



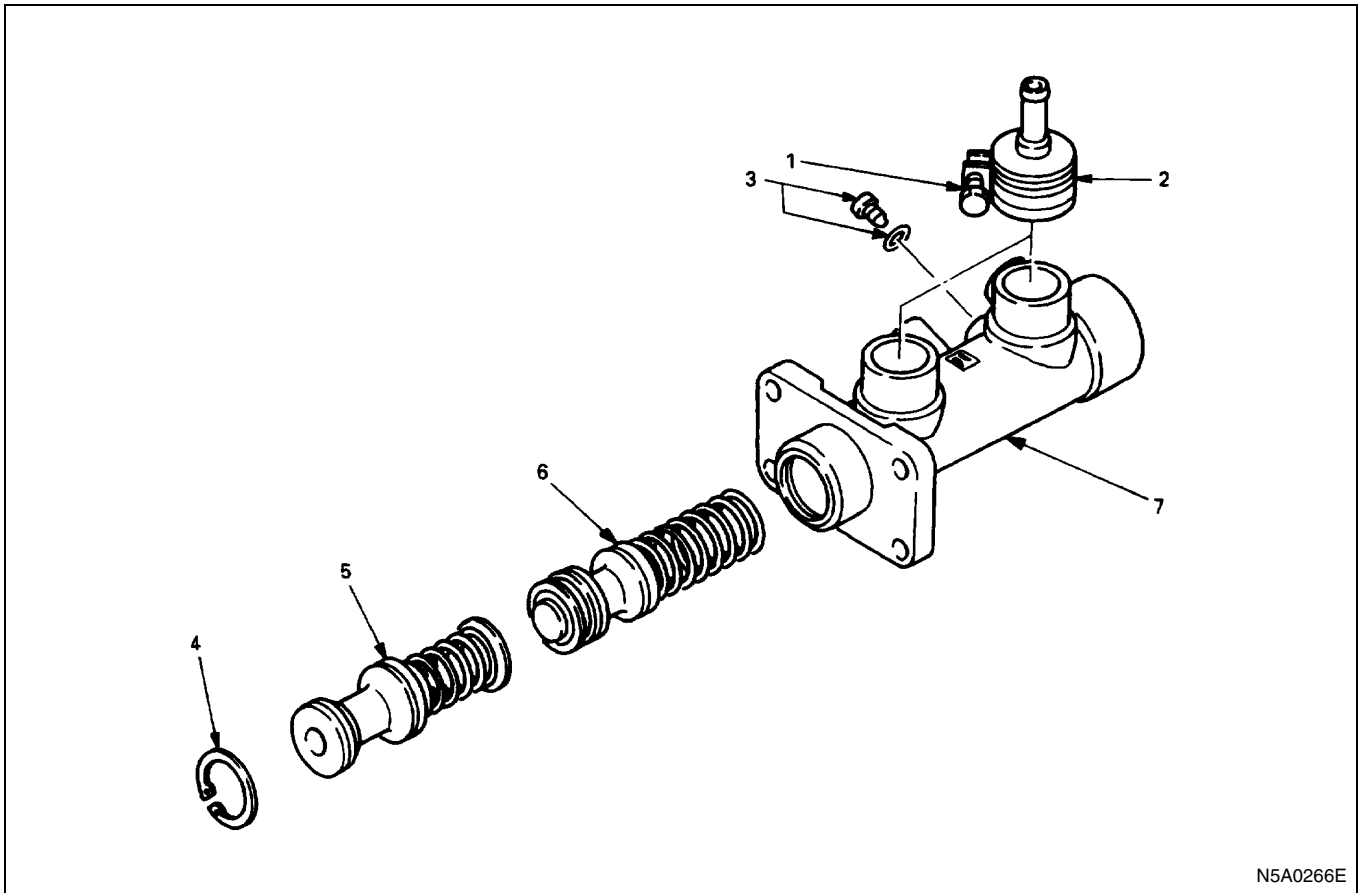
13. Install the bleeder (1) to cylinder assembly (2).

Tighten:

Bleeder to 6.9 — 11.8 N·m (0.7 — 1.2 kg·m / 5.1 — 8.7 lb·ft)



Master Cylinder Assembly (NHR)



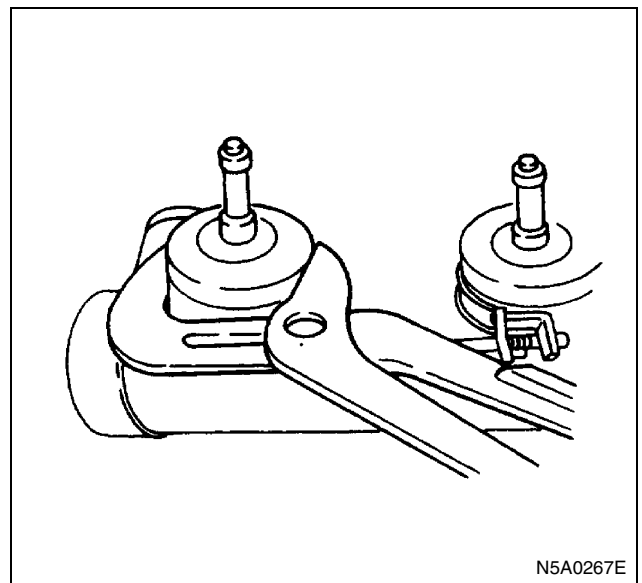
N5A0266E

Legend

- | | |
|-----------------------------|------------------------------|
| 1. Hose clamp | 5. Primary piston assembly |
| 2. Hose joint | 6. Secondary piston assembly |
| 3. Stopper screw and gasket | 7. Cylinder body |
| 4. Snap ring | |

Disassembly

1. Hose Clamp
2. Hose Joint
Use a pair of pliers to remove the hose joint.
Take care not to damage the hose joint and the cylinder body.



N5A0267E

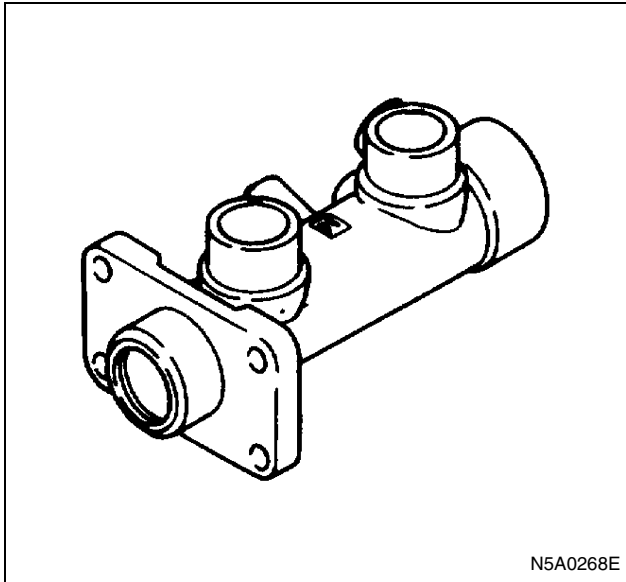
3. Stopper Screw and Gasket
4. Snap Ring
5. Primary Piston Assembly

- 6. Secondary Piston Assembly
- 7. Cylinder Body

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Cylinder Body

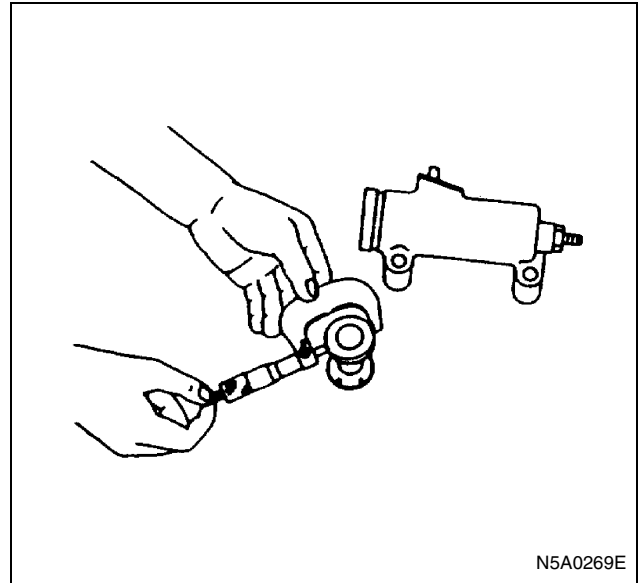


Visually check that the master cylinder bore, for scuff or scratch, if these conditions are presented, the cylinder body must be replaced.

Piston and Master Cylinder Clearance

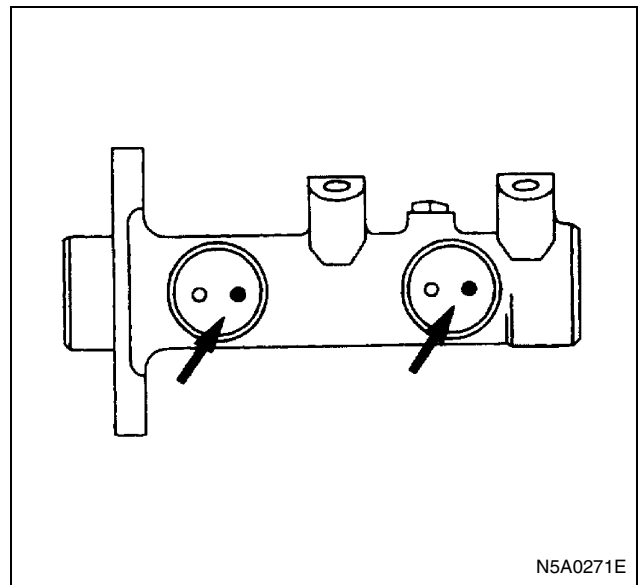
1. Use a micrometer to measure the piston diameter.
2. Use an inside dial indicator to measure the cylinder bore.
3. Calculate the clearance between the wheel cylinder and the piston.
If the clearance exceeds the specified limit, the piston assembly must be replaced.

Piston and Master Cylinder Clearance		mm (in)
Standard	Limit	
0.11 — 0.195 (0.004 — 0.008)	0.22 (0.009)	

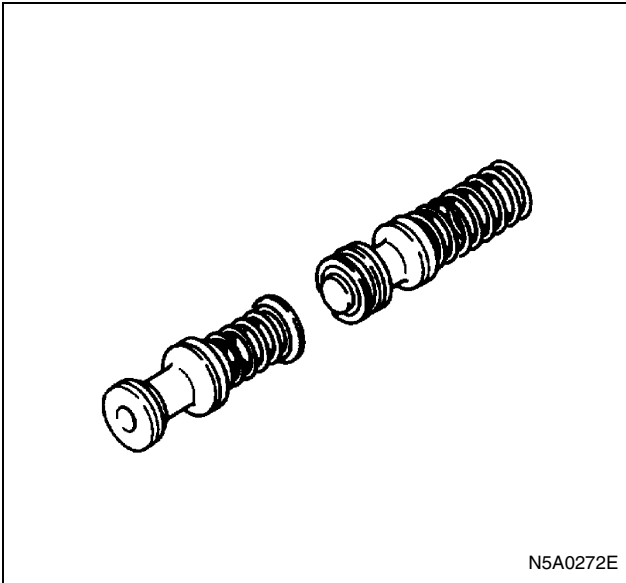


Reassembly

1. **Cylinder Body**
Clean the cylinder body and blow the return ports with compressed air.
Do not allow the return ports clogged with any foreign material.



2. **Secondary Piston Assembly**



3. Primary Piston Assembly

- 1) Rinse the piston assembly in clean brake fluid.
- 2) Install the piston assembly to the master cylinder.

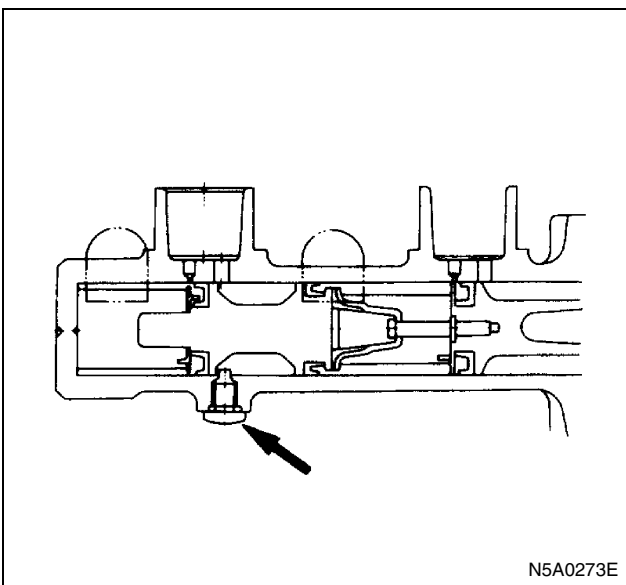
Notice:

Take care not to scratch the primary and secondary cups when installing the piston assembly.

4. Snap Ring
5. Stopper Screw and Gasket
 - 1) Slide the piston until the oil cavity of the secondary piston dears the stopper bolt hole.
 - 2) Install the stopper screw and tighten it to the specified torque.

Tighten:

Stopper screw to 27 N·m (2.8 kg·m / 20 lb·ft)

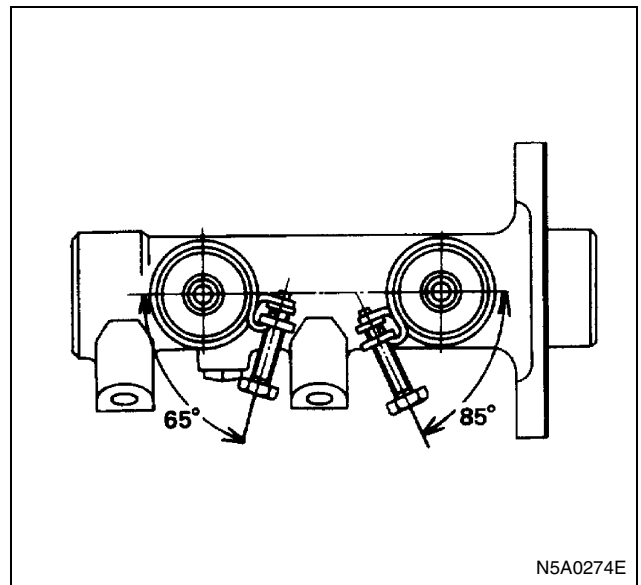


6. Hose Joint
7. Hose Clamp
 - 1) Set the clamp in position.

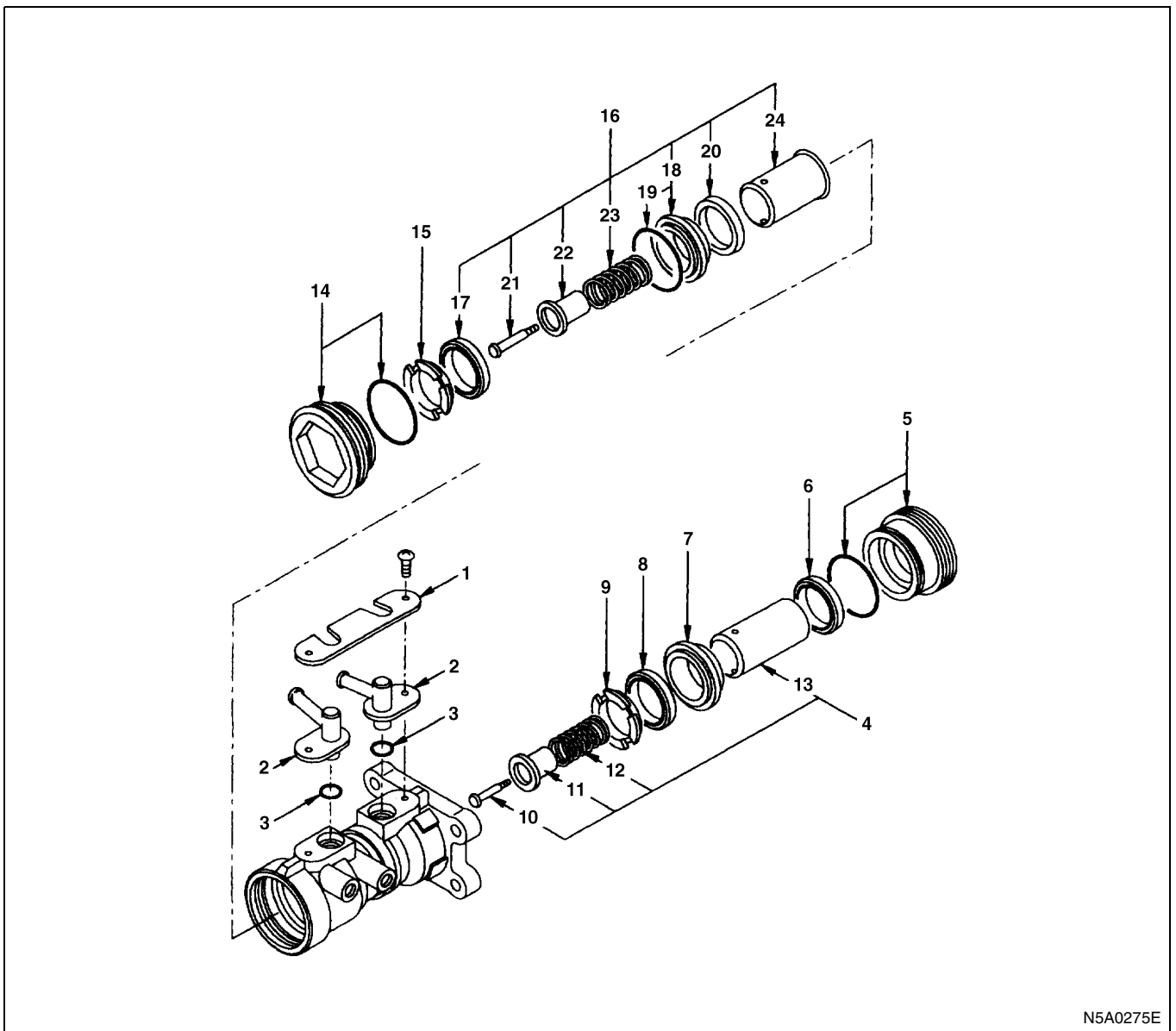
- 2) Dip the hose joint in hot water (60 — 80°C / 140 — 176°F) for several minutes.
- 3) Take out of the hose joint and blow off water immediately and completely.
- 4) Fit the hose joint to the cylinder body.
- 5) Align the position of the clamp screw as shown in the illustration.
- 6) Tighten the clamp screw to the specified torque.

Tighten:

Clamp screw to 2 N·m (0.2 kg·m / 17 lb·in)



Master Cylinder Assembly (NKR / NPR / NQR / NPS)



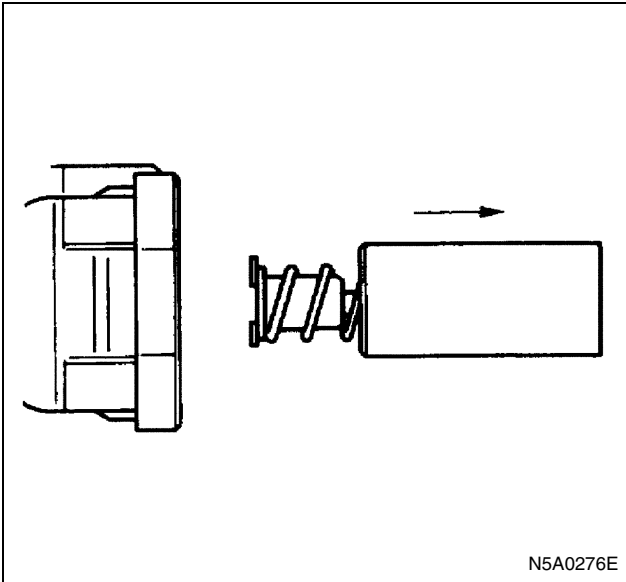
N5A0275E

Legend

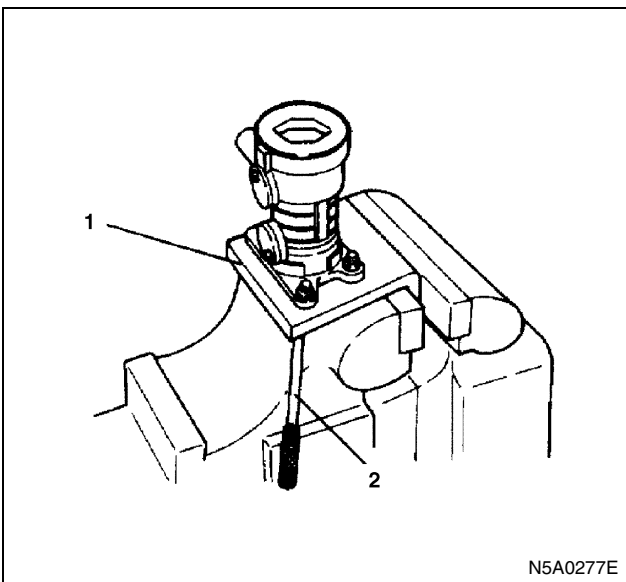
- | | |
|----------------------------|-------------------------------|
| 1. Holder plate | 13. Primary piston |
| 2. Hose joint | 14. Plug and O-ring |
| 3. O-ring | 15. Supporter |
| 4. Primary piston assembly | 16. Secondary piston assembly |
| 5. Plug and O-ring | 17. Primary cup |
| 6. Secondary cup | 18. Bushing |
| 7. Bushing | 19. O-ring |
| 8. Primary cup | 20. Secondary cup |
| 9. Supporter | 21. Screw |
| 10. Screw | 22. Spring retainer |
| 11. Spring retainer | 23. Secondary piston spring |
| 12. Primary piston spring | 24. Secondary piston |

Disassembly

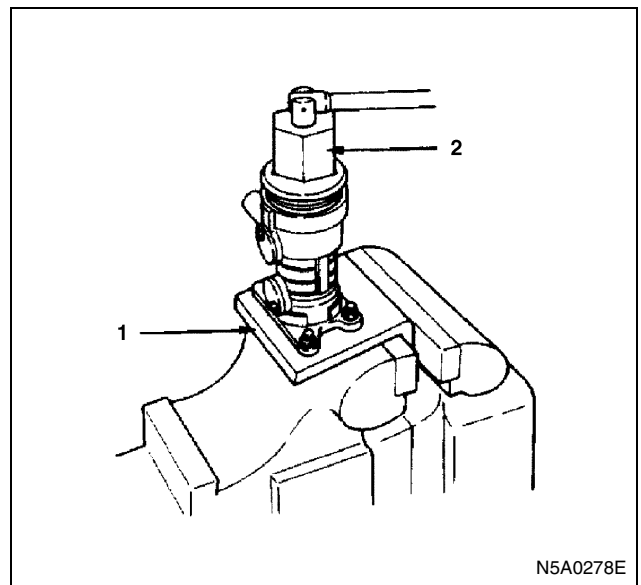
1. Holder Plate
2. Hose Joint
3. O-ring
4. Primary Piston Assembly
Draw out Piston by hand so that it may not be damaged.



5. Plug and O-ring
Install master cylinder on a support plate (1), fix the support in a vice, and loosen plug using a wrench (2).
- Support plate : 5-8840-2371-0
Wrench : 5-8840-2370-0
(Master cylinder inside diameter 31.7 mm, 30.1 mm)
Wrench : 5-8840-2369-0
(Master cylinder inside diameter 28.5 mm)
Wrench : 5-8840-2805-0
(Master cylinder inside diameter 34.9 mm)



6. Secondary Cup
 7. Bushing
 8. Primary Cup
 9. Supporter
 10. Screw
 11. Spring Retainer
 12. Primary Piston Spring
 13. Primary Piston
 14. Plug and O-ring
Install master cylinder on a support plate (1), fix the support in a vice, and loosen plug using a wrench (2).
- Support plate : 5-8840-2371-0
Wrench : 5-8840-2370-0
(Master cylinder inside diameter 31.7 mm, 30.1 mm)
Wrench : 5-8840-2369-0
(Master cylinder inside diameter 28.5 mm)
Wrench : 5-8840-2805-0
(Master cylinder inside diameter 34.9 mm)



15. Supporter
16. Secondary Piston Assembly
17. Primary Cup
18. Bushing
19. O-ring
20. Secondary Cup
21. Screw
22. Spring Retainer
23. Secondary Piston Spring
24. Secondary Piston

Inspection and Repair

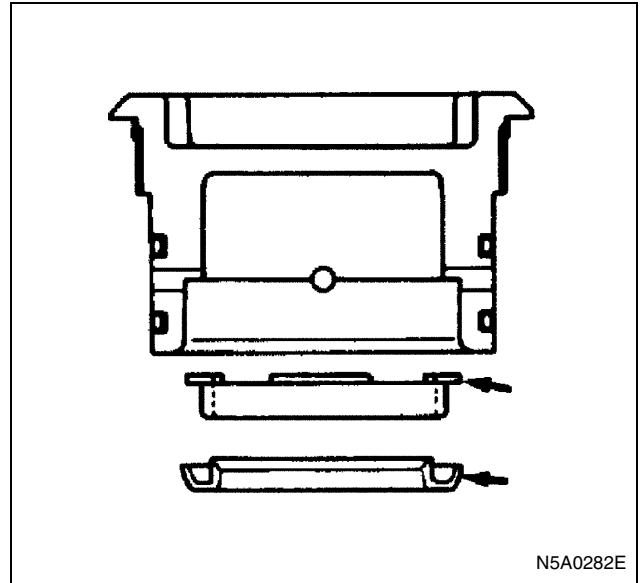
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Cup and O-ring

1. Wash each part with brake oil and check for wear, deterioration, and damage.
2. Replace the cups and O-rings.

Reassembly

1. Secondary Piston
2. Secondary Piston Spring
3. Spring Retainer
4. Screw
5. Secondary Cup
6. Bushing
Combine secondary cup and bushing with secondary piston as indicated as arrows, and push the assembly in until bushing comes into contact with cylinder body step.
7. O-ring
Install the O-ring to the bushing.



N5A0282E

Then tighten plug to specified tightening torque.

Plug Torque		N-m (kg·m/lb·ft)
Master Cylinder Inside diameter (mm)	28.5	40 (4.1/30)
	30.1	44 (4.5/33)
	31.7	
	34.9	49 (5.0/37)

Support plate : 5-8840-2371-0

Wrench : 5-8840-2370-0

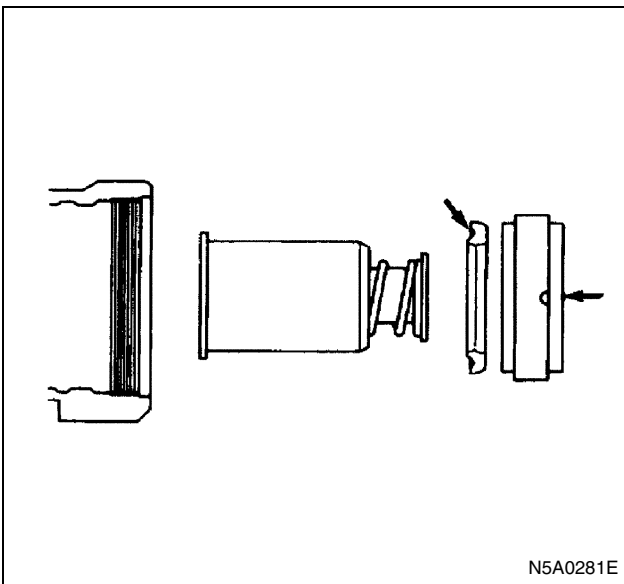
(Master cylinder inside diameter 31.7 mm, 30.1 mm)

Wrench : 5-8840-2369-0

(Master cylinder inside diameter 28.5 mm)

Wrench : 5-8840-2805-0

(Master cylinder inside diameter 34.9 mm)

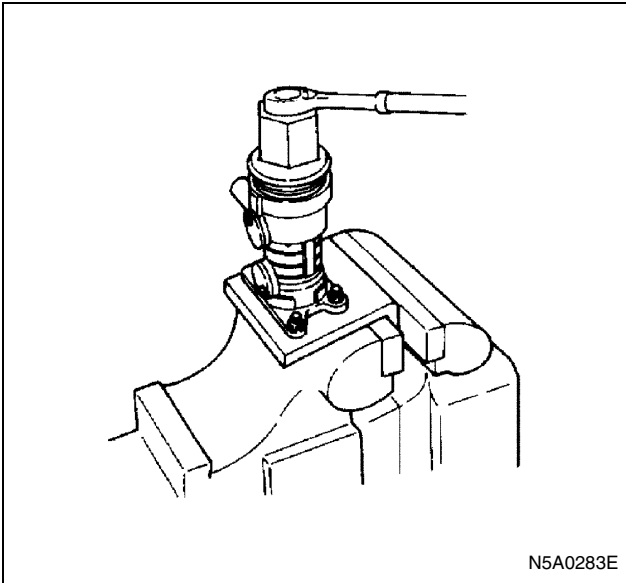


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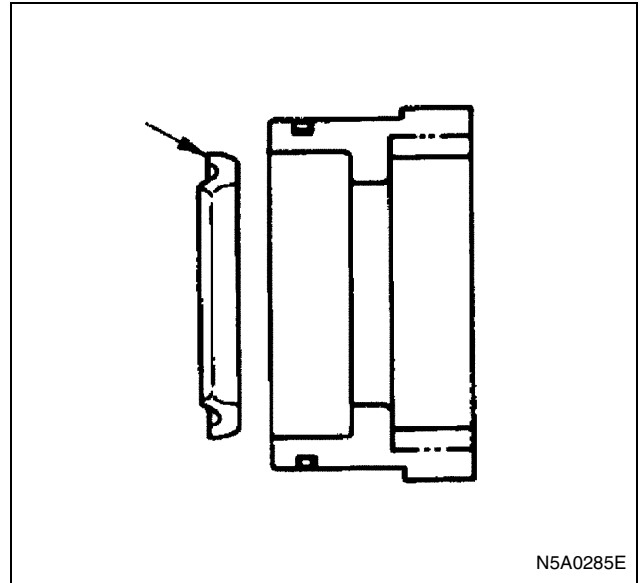
8. Primary Cup
9. Supporter
10. Plug and O-ring
Combine primary cup and supporter with plug as indicated by arrows.

Notice:

If plug tightened to specified torque is found floating from cylinder body, plug should be disassembled again and check for abnormal parts fitting. Then reassemble.



N5A0283E



N5A0285E

- 11. Primary Piston
- 12. Primary Piston Spring
- 13. Spring Retainer
- 14. Screw
- 15. Supporter
- 16. Primary Cup
- 17. Bushing

1) Combined the parts of primary piston as indicated by arrows.
Then push the assembly in until bushing comes into contact with the step in cylinder body.

Plug Torque		N-m (kg·m/lb·ft)
Master Cylinder Inside diameter (mm)	28.5	40 (4.1/30)
	30.1	44 (4.5/33)
	31.7	
	34.9	49 (5.0/37)

Support plate : 5-8840-2371-0

Wrench : 5-8840-2370-0

(Master cylinder inside diameter 31.7 mm, 30.1 mm)

Wrench : 5-8840-2369-0

(Master cylinder inside diameter 28.5 mm)

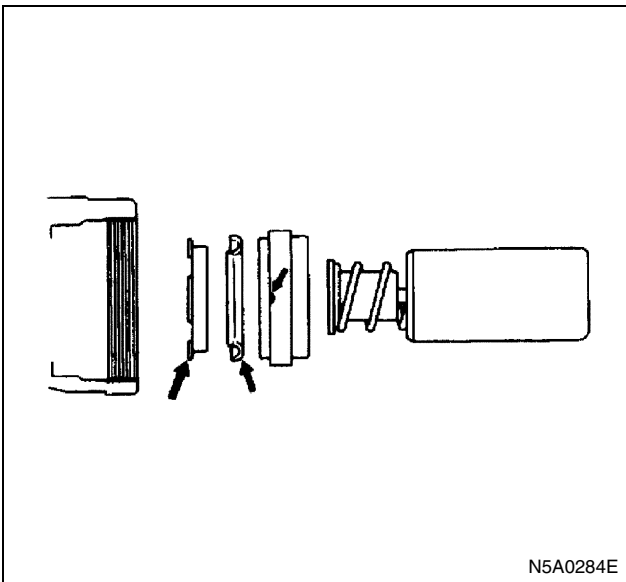
Wrench : 5-8840-2805-0

(Master cylinder inside diameter 34.9 mm)

Notice:

If plug tightened to specified torque is found floating from cylinder body, plug should be disassembled again and check for abnormal parts fitting. Then reassemble.

- 20. O-ring
- 21. Hose Joint
- 22. Holder Plate



N5A0284E

2) Draw out primary piston alone taking care not to be let bushing get out of the step.

- 18. Secondary Cup
 - 19. Plug and O-ring
- Combine secondary cup with plug as indicated by arrow, and tighten to specified tightening torque.

ANTI-LOCK BRAKE SYSTEM (ABS)

GENERAL DESCRIPTION

Service Precaution

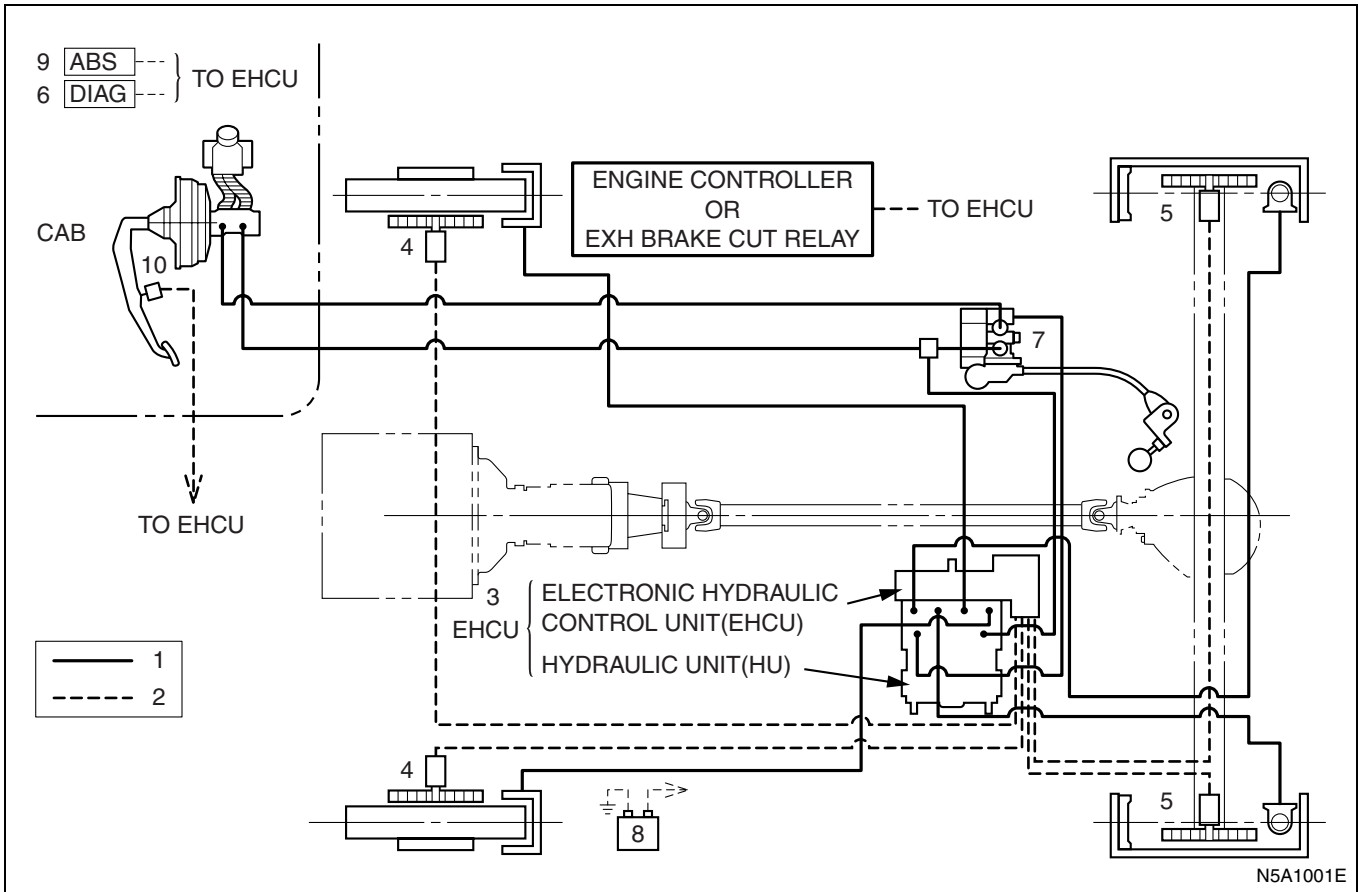
Caution:

Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The Anti-lock Brake System (ABS) works on all four wheels. A combination of wheel speed sensor and Electronic Hydraulic Control Unit (EHCUC) can determine when a wheel is about to stop turning and adjust brake pressure to maintain best braking.

This system helps the drive maintain greater control of the vehicle under heavy braking conditions.



Legend

- | | |
|--|--|
| 1. Hydraulic Line | 7. Load Sensing Proportioning Valve (LSPV) |
| 2. Electronic Line | 8. Battery |
| 3. Electronic Hydraulic Control Unit (EHCUC) | 9. ABS Warning Light |
| 4. Front Wheel Speed Sensor | 10. Brake Switch |
| 5. Rear Wheel Speed Sensor | |
| 6. Diagnosis Connector | |

System Components

The Anti-lock Brake System consists of a Electronic Hydraulic Control Unit (EHCUC), four Wheel Speed Sensors and Warning Light.

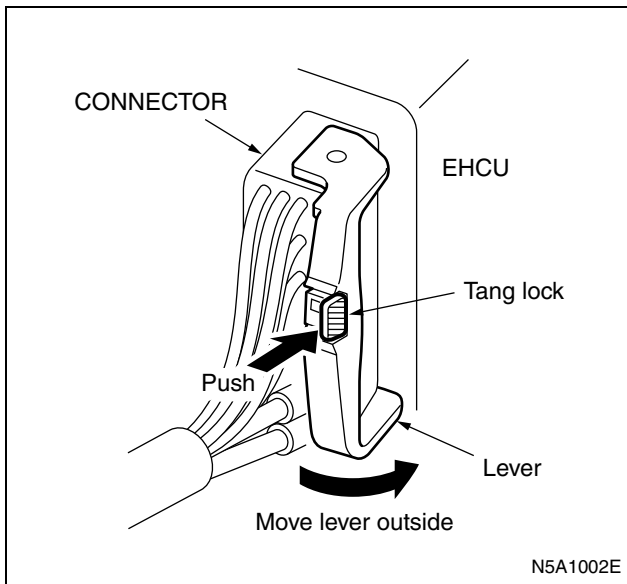
Electronic Hydraulic Control Unit (EHCUC)

The EHCUC consists of Electronic Brake Control Module (EBCM) and Hydraulic Unit (HU).

The EHCUC is located at the frame side, in front of rear spring bracket.

The EHCUC consists of ABS control circuits, fault detector, and a fail-safe. It drives the hydraulic unit according to the signal from each sensor, cancelling ABS to return to normal braking when a malfunction has occurred in the ABS.

The EHCUC is self-diagnosing function which can indicate faulty circuits during diagnosis.



Notice:

When disconnecting harness connector from EHCUC, push the tang lock of the connector and release the tang lock. Then move the lever.

Hydraulic Unit (HU)

It consists of a Motor, Plunger Pump, Solenoid Valves and Check Valve.

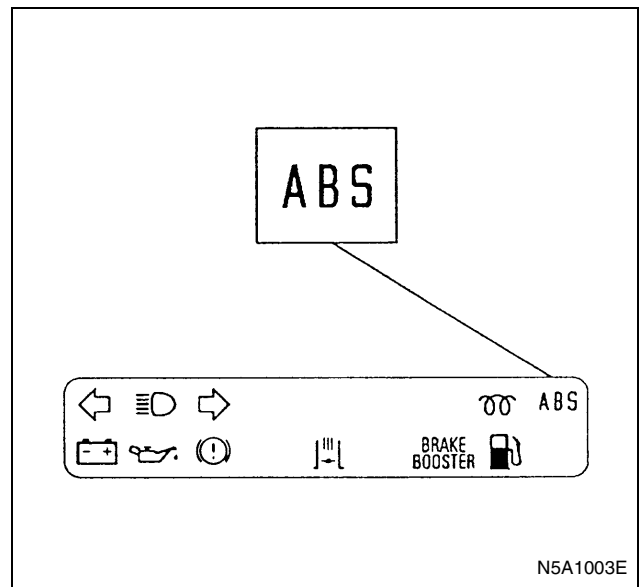
Solenoid Valves: Reduces or holds the caliper fluid pressure for each front brake or both rear brakes according to the signal sent from the EHCUC.

Reservoir: Temporarily holds the brake fluid that returns from the front and rear wheel brake so that pressure of front wheel brake can be reduced smoothly.

Plunger Pump: Feeds the brake fluid held in the reservoir to the master cylinder.

Motor: Drives the pump according to the signal from EHCUC. **Check Valve:** Controls the brake fluid flow.

ABS Warning Light



Vehicles equipped with the Anti-lock Brake System has an amber "ABS" warning light in the instrument panel. The "ABS" warning light will illuminate if a malfunction in the Anti-lock Brake System is detected by the Electronic Hydraulic Control Unit (EHCUC). In case of an electronic malfunction, the EHCUC will turn "ON" the "ABS" warning light and disable the Anti-lock braking function.

The "ABS" light will turn "ON" for 2 seconds after the ignition switch is to the "ON" position, and then will go out. If the "ABS" light comes "ON" and stays "ON" while driving, the Anti-lock Brake System should be inspected for a malfunction according to the diagnosis procedure.

Wheel Speed Sensor

It consists of a sensor and a rotor. The sensor is attached to the knuckle on the front wheels and to the bracket on the brake back plate on the rear wheels.

The front speed sensor is coil type and rear is Hall IC type.

The sensor rotors press-fitted to front and rear wheel hubs output pulse frequency depending on wheel rotation.

The speed sensors find vehicle speed from its frequency.

Normal and Anti-lock Braking

Under normal driving conditions, the Anti-lock Brake System functions the same as a standard power assisted brake system. However, with the detection of wheel lock-up, a slight bump or kick-back will be felt in the brake pedal. This pedal "bump" will be followed by a series of short pedal pulsations which occurs in rapid succession. The brake pedal pulsation will continue ANTI-LOCK BRAKE SYSTEM (ABS) 5A4-7 until there is no longer a need for the anti-lock function or until the vehicle is stopped. A slight ticking or popping noise may be heard during brake applications when the Anti-lock features is being used.

When the Anti-lock feature is being used, the brake pedal may rise even as the brakes are being applied. This is also normal. Maintaining a consist force on the pedal will provide the shortest stopping distance.

Brake Pedal Travel

Vehicles equipped with the Anti-lock Brake System may be stopped by applying normal force to the brake pedal. Although there is no need to push the pedal beyond the point where it stops or holds the vehicle, by applying more force the pedal will continue to travel toward the floor.

This extra brake pedal travel is normal.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

ABS

Anti-lock Brake System

CKT

Circuit

DLC

Data Link Connector

DTC

Diagnostic Trouble Code

DVM

Digital Volt Meter (High Impedance Multimeter)

EHC

Electronic Hydraulic Control Unit

FL

Front Left

FR

Front Right

GEN

Generator

HU

Hydraulic Unit

MV

Millivolts

RL

Rear Left

RR

Rear Right

RPS

Revolution per Second

SW

Switch

VDC

Volts DC

VAC

Volts AC

W/L

Warning Light

WSS

Wheel Speed Sensor

GENERAL DIAGNOSIS

General Information

ABS malfunction can be classified into two types, those which can be detected by the ABS warning light and those which can be detected as a vehicle abnormality by the driver.

In either case, locate the fault in accordance with the "BASIC DIAGNOSTIC FLOWCHART" and repair.

Please refer to Section 5A HYDRAULIC BRAKES for the diagnosis of mechanical troubles such as brake noise, brake judder (brake pedal or vehicle vibration felt when braking), uneven braking, and parking brake trouble.

ABS Service Precautions

Required Tools and Items:

- Box Wrench
- Brake Fluid
- Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

High Impedance Multimeter: 5-8840-0285-0 (J-39200)

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Anti-lock Brake System interfaces directly with the Electronic Hydraulic Control Unit (EHCUC) which is a control computer that is similar in some regards to the Engine Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However, care must be taken to avoid overloading any of the EHCUC circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter 5-8840-0285-0 (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the "ON" position. Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the "OFF" position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Anti-lock Brake System and/or other vehicle systems. Failure to observe these precautions may result in Anti-lock Brake System damage.

- If welding work is to be performed on the vehicle using an electric arc welder, the EHCUC connector should be disconnected before the welding operation begins.
- The EHCUC connector should never be connected or disconnected with the ignition "ON".

- The EHCUC is not separately serviceable and must be replaced as assemblies. Do not disassemble any component which is designated as non-serviceable in this Section.
- If only rear wheels are rotated using jacks or drum tester, the system will diagnose a speed sensor malfunction and the "ABS" warning light will illuminate. But actually no trouble exists. After inspection stop the engine once and re-start it, then make sure that the "ABS" warning light does not illuminate.

Note on Intermittents

As with virtually any electronic system, it is difficult to identify an intermittent failure. In such a case duplicating the system malfunction during a test drive or a good description of vehicle behavior from the customer may be helpful in locating a "most likely" failed component or circuit. The symptom diagnosis chart may also be useful in isolating the failure. Most intermittent problems are caused by faulty electrical connections or wiring. When an intermittent failure is encountered, check suspect circuits for:

- Suspected harness damage.
- Poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.

Test Driving ABS Complaint Vehicles

In case that there has been an malfunction in the lighting pattern of "ABS" warning light, the fault can be located in accordance with the "DIAGNOSIS BY "ABS" WARNING LIGHT ILLUMINATION PATTERN". In case of such trouble as can be detected by the driver as a vehicle symptom, however, it is necessary to give a test drive following the test procedure mentioned below, thereby reproducing the symptom for trouble diagnosis on a symptom basis:

1. Start the engine and make sure that the "ABS" W/L goes OFF. If the W/L remains ON, it means that the Diagnostic Trouble Code (DTC) is stored. Therefore, read the code and locate the fault.
2. Start the vehicle and accelerate to about 30 km/h (19 mph) or more.
3. Slowly brake and stop the vehicle completely.
4. Then restart the vehicle and accelerate to about 40 km/h (25 mph) or more.
5. Brake at a time so as to actuate the ABS and stop the vehicle.
6. Be cautious of abnormality during the test. If the W/L is actuated while driving, read the DTC and locate the fault.
7. If the abnormality is not reproduced by the test, make best efforts to reproduce the situation reported by the customer.

8. If the abnormality has been detected, repair in accordance with the "SYMPTOM DIAGNOSIS".

Notice:

- Be sure to give a test drive on a wide, even road with little traffic.
- If an abnormality is detected, be sure to suspend the test and start trouble diagnosis at once.

"ABS" Warning Light

When ABS trouble occurs and actuates when possible the "ABS" warning light, the trouble code corresponding to the trouble is stored in the EHCUC.

Only the ordinary brake system is available when the ABS is turned OFF. When the "ABS" warning light is actuated, if the starter switch is set ON after setting it OFF

once, the EHCUC checks up on the entire system and, if there is no abnormality, judges ABS to work currently and the warning light works normally even though the trouble code is stored.

Notice:

Illumination of the "ABS" warning light indicates that anti-lock braking is no longer available. Power assisted braking without anti-lock control is still available.

Normal Operation

"ABS" Warning Light

When the ignition is first moved from "OFF" to "ON", the amber "ABS" warning light will turn "ON" for 2 seconds and will turn "OFF".

Basic Diagnostic Flow Chart

Step	Action	Value(s)	YES	NO
1	1. Customer complaint. 2. Questioning to customer. 3. Basic inspection (Refer to "Basic inspection procedure"). Using Tech 2?	—	Go to Step 2	Go to Step 3
2	Make sure of DTC by TROUBLE CODE. Is EHCUC including DTC?	—	Go to Step 5	Go to Step 4
3	Check if the DTC is stored. Is EHCUC including DTC?	—	Go to Step 5	Go to Step 4
4	Test drive. Is W/L lit?	—	Go to Step 5	Trouble diagnosis based on symptom (Refer to "SYMPTOM DIAGNOSIS") Go to Step 5
5	1. Repair of faulty part. 2. Elimination of DTC. 3. Inspection of "ABS" W/L illumination pattern with ignition SW "ON". 4. Test drive. Does the DTC repeat?	—	Repeat the diagnosis of the symptom or DTC appears again Go to Step 1	Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Finished	—

Basic Inspection Procedure

1. Basic Inspection of Service Brake

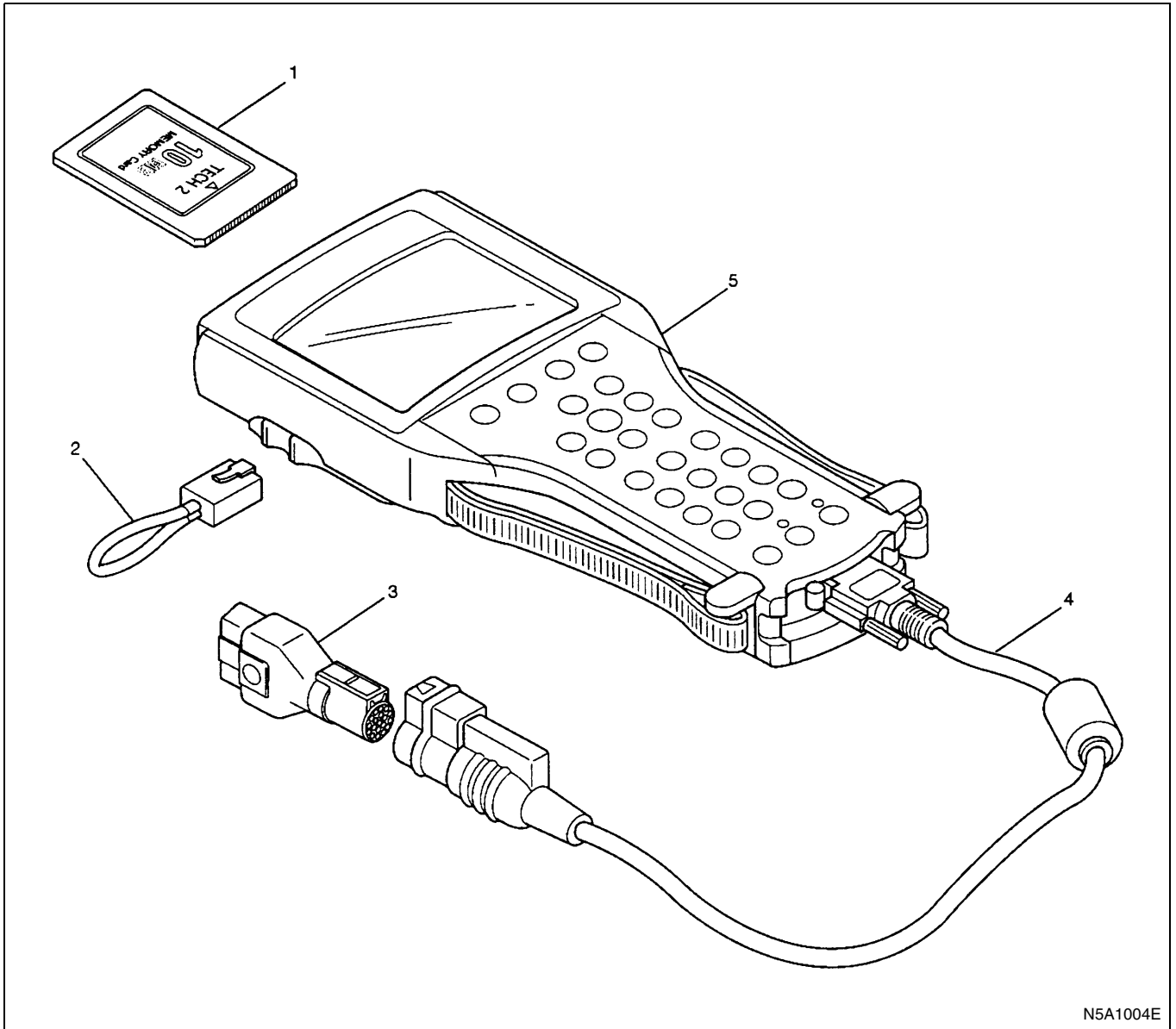
Step	Action	Value(s)	YES	NO
1	Is the fluid level normal?	—	Go to Step 2	Replenish with fluid. Go to Step 2
2	Does brake fluid leak from brake parts?	—	Repair. Go to Step 3	Go to Step 3
3	Is the booster functioning normal?	—	Go to Step 4	Repair. Go to Step 4
4	Is the pad and rotor normal?	—	Go to Step 5	Repair. Go to Step 5
5	Reconnect all components and ensure all components are properly mounted. Was this step finished?	—	Finished	—

2. Ground Inspection

Step	Action	Value(s)	YES	NO
1	Are ABS-related ground points ok?	—	Go to Step 2	Repair. Go to Step 2
2	Reconnect all components and ensure all components are properly mounted. Was this step finished?	—	Finished	—

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



Legend

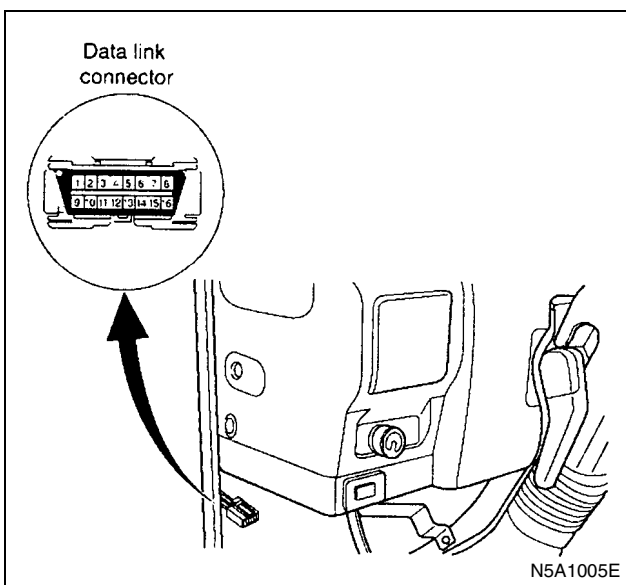
- | | |
|-------------------------------|--------------|
| 1. PCMCIA Card | 4. DLC Cable |
| 2. RS 232 Loop Back Connector | 5. Tech 2 |
| 3. SAE 16/19 Adapter | |

Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volt.
2. After connecting and/or installing the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge. (except 2003 year model)
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press "F1: Clear DTC Info".

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
1. The Isuzu System PCMCIA card (1) inserts into the Tech 2 (5).
 2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
 3. Connect the DLC cable to the Tech 2 (5).
 4. Make sure the vehicle ignition is off.
 5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and verify the Tech 2 power up display.

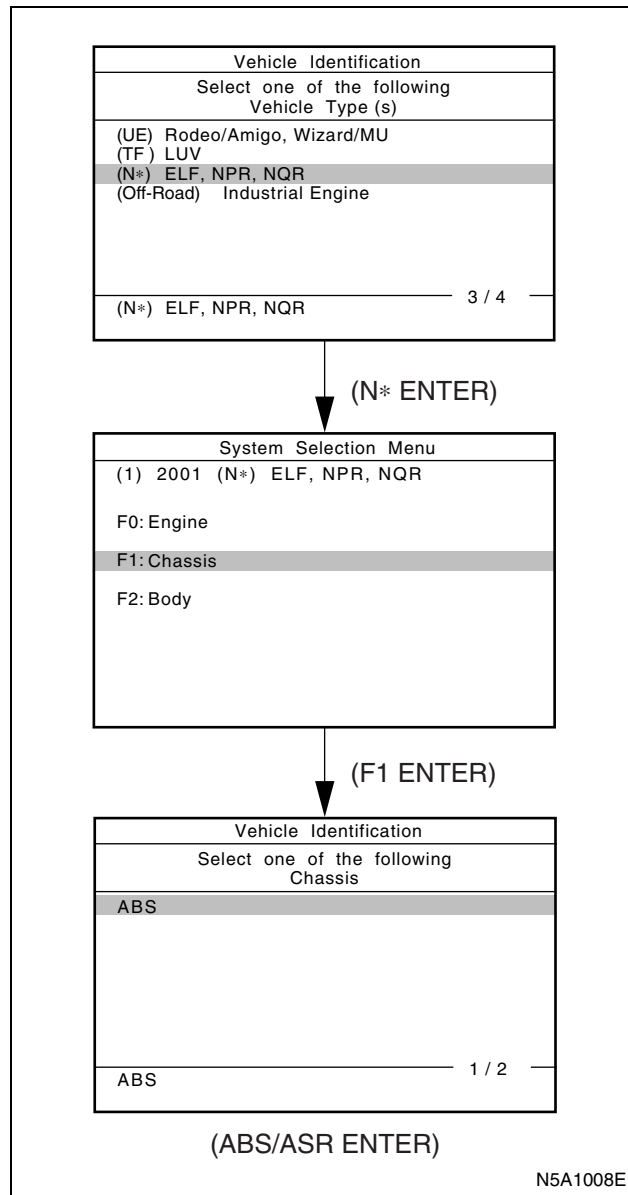
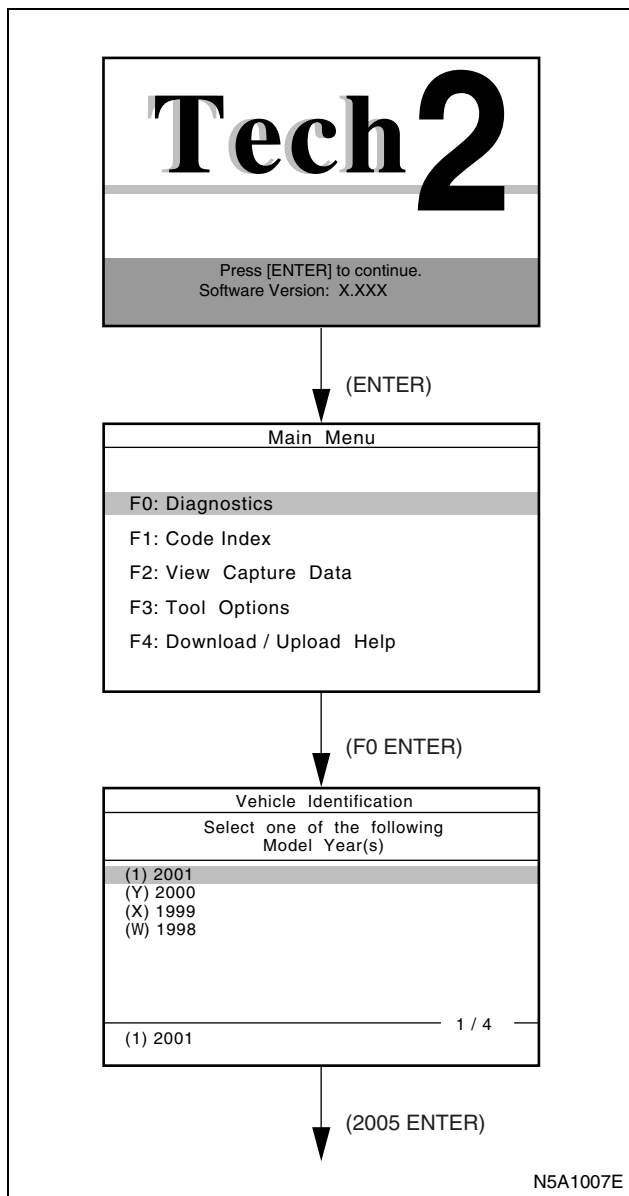


Notice:

The RS232 Loop back connector is only to use for diagnosis of Tech 2. Refer to user guide of the Tech 2.

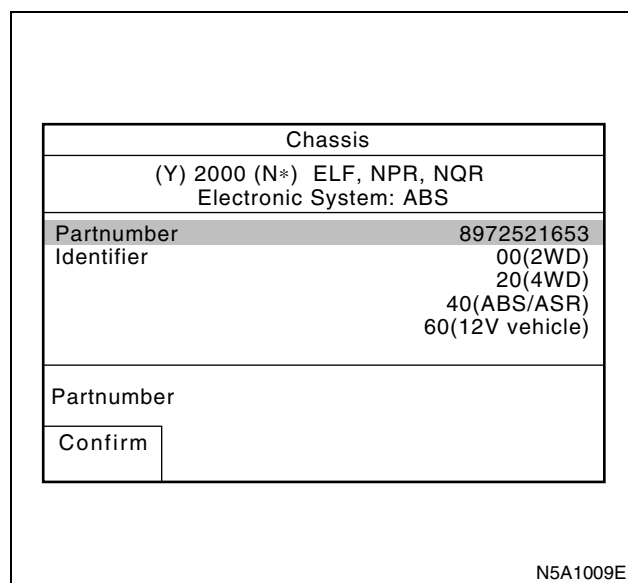
Operating Procedure (For Example)

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.

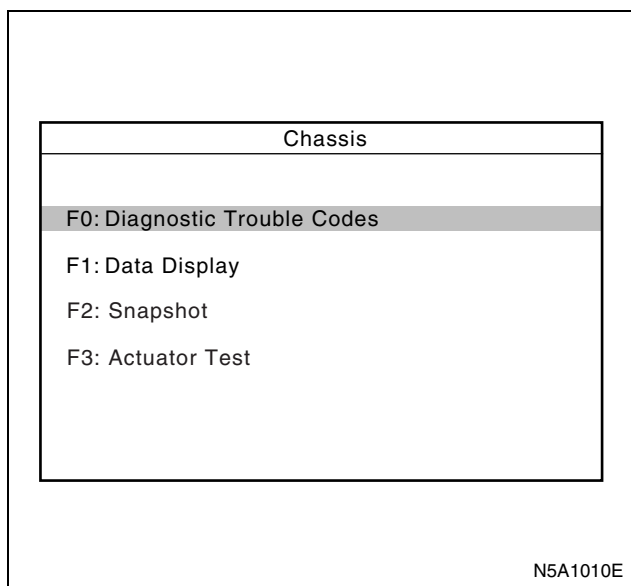


Menu

- The following table shows which functions are used for the available equipment versions.

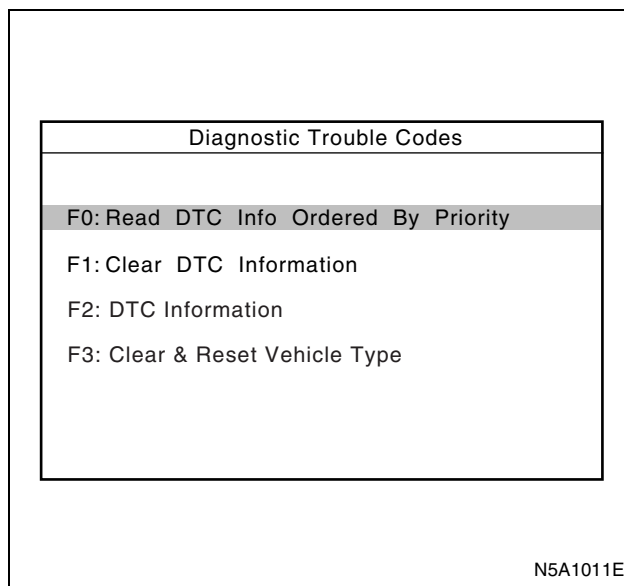


DTC Modes



There are two options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears.

- DTC Info
- Clear Info



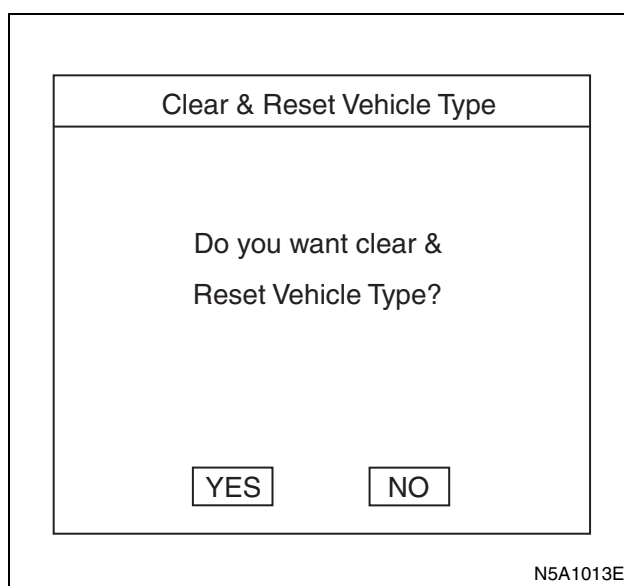
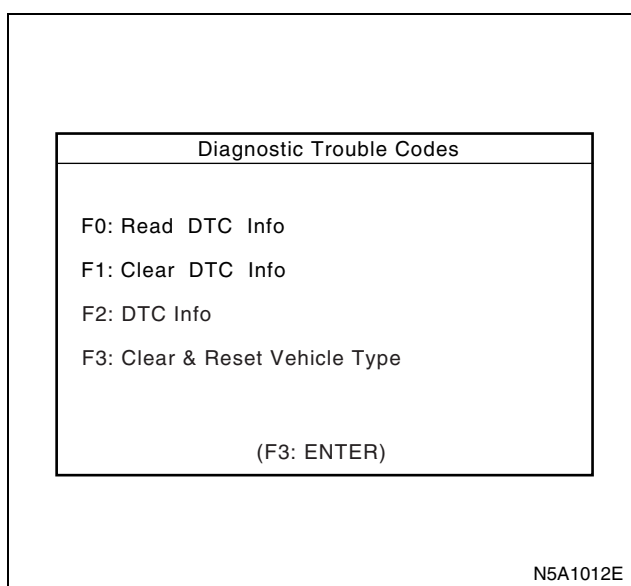
The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are two choices. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.

When CODE "13" is Displayed (Vehicle Type Error)

Step	Action	Value(s)	YES	NO
1	Check harness. Is it okay?	—	Erase vehicle type with Tech 2 and reread harness information.	Replace the harness.



YES: Clear vehicle type and reread vehicle harness information.

NO: Return

DTC Status

Current Diagnostic Trouble Codes

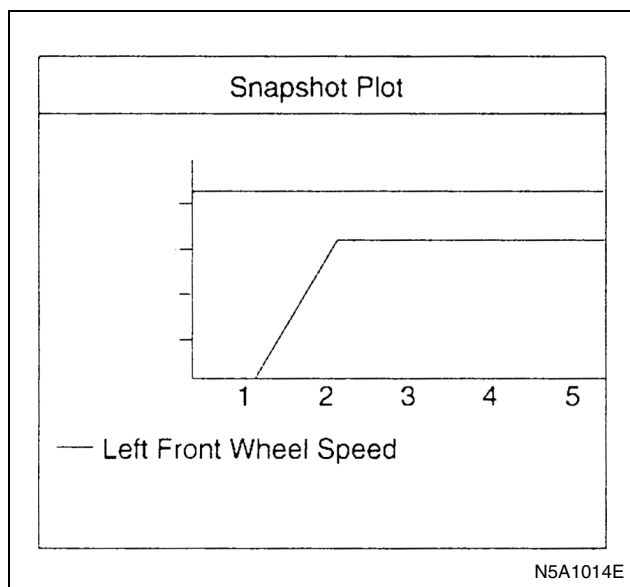
This selection will display all DTCs that have failed during the present ignition cycle.

History Diagnostic Trouble Codes

This selection will display only DTCs that are stored in the EHCU's history memory.

Plotting Snapshot Graph

This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. This test can check ABS performance and defect by graphing wheel speed differences between right and left sides, and front and rear sides obtained from the ABS data list menu.

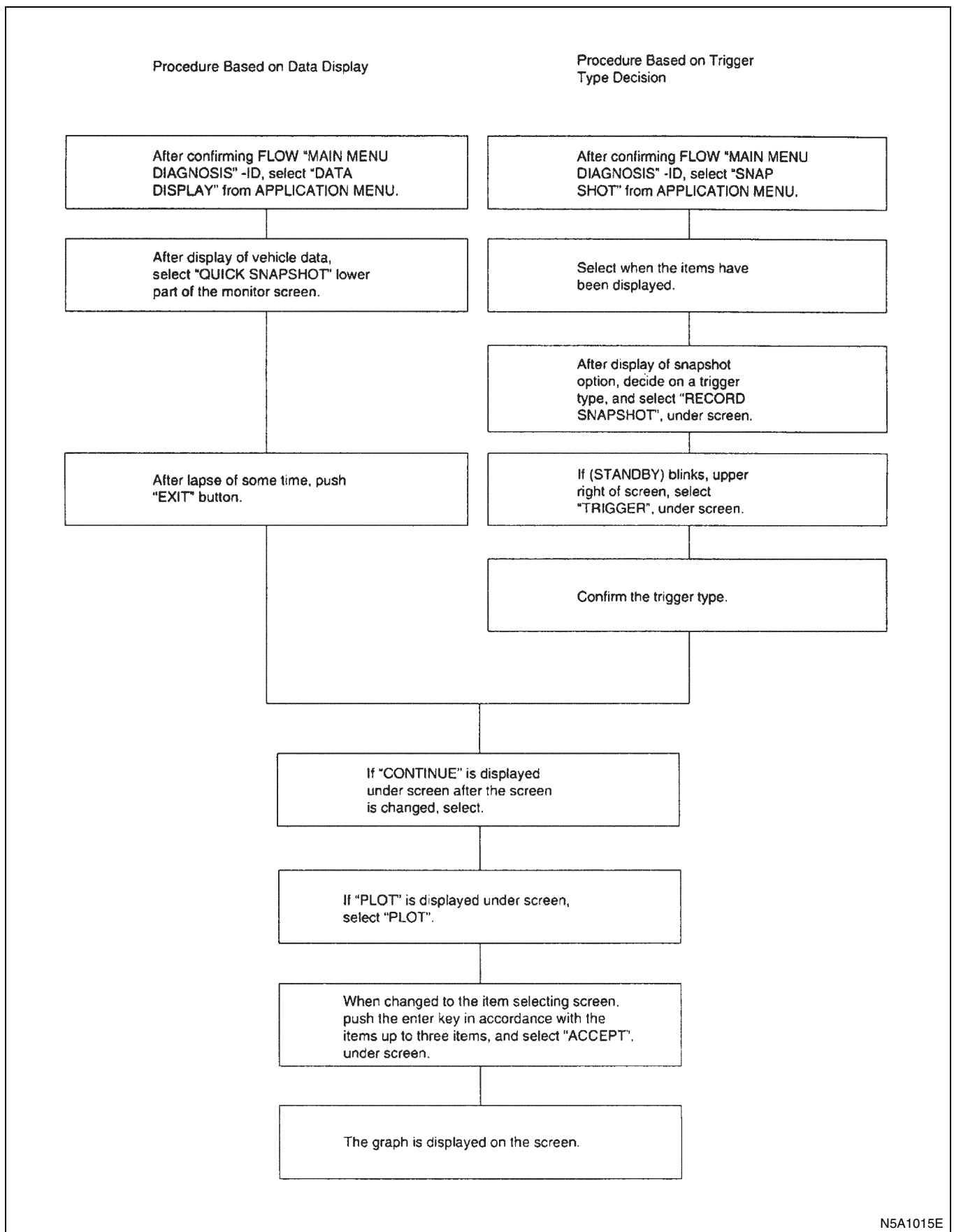


For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.

You can replay the snapshot data as needed.

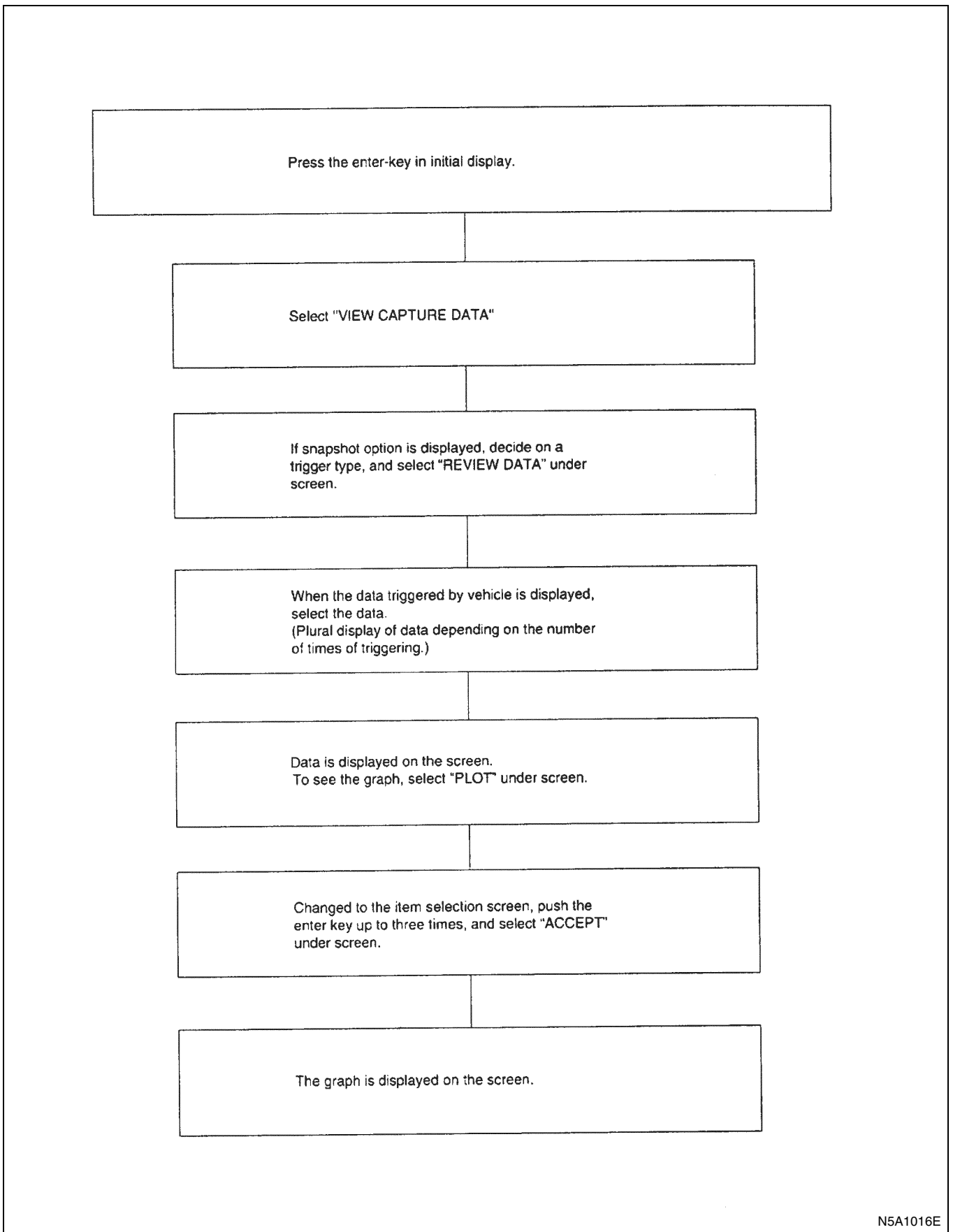
Therefore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting Graph after Obtaining Vehicle Information)



N5A1015E

Flow Chart for Snapshot Replay (Plotting Graph)



Tech 2 Data Display

Use the Tech 2 data Values only after the ABS Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing.

ABS Data

Ignition SW is "ON" position.

(For example)

F1: ABS DATA	
Left Front Wheel Speed	2 mph
Right Front Wheel Speed	2 mph
Left Rear Wheel Speed	2 mph
Right Rear Wheel Speed	2 mph
Brake Switch Status	OFF
ABS Lamp Command	OFF
ABS Pump Motor	OFF
LR Release Valve Command	OFF
LR Hold Valve Command	OFF
RR Release Valve Command	OFF
RR Hold Valve Command	OFF
LF Release Valve Command	OFF
LF Hold Valve Command	OFF
RF Release Valve Command	OFF
RF Hold Valve Command	OFF
LR Release Valve Feed back	OFF
LR Hold Valve Feed back	OFF
RR Release Valve Feed back	OFF
RR Hold Valve Feed back	OFF
LF Release Valve Feed back	OFF
LF Hold Valve Feed back	OFF
RF Hold Valve Feed back	OFF
RF Release Valve Feed back	OFF
Battery Voltage	12~16V

Select Items
DTC
Quick Snapshot
More

N5A1017E

Special Function

There are 12 different menus available for this test. The state of each circuit can be tested by using these menus. Especially when DTC cannot be detected, a faulty circuit can be diagnosed by testing each circuit by means of these menus.

Even when DTC has been detected, the circuit tests using these menus could help discriminate between a mechanical trouble and an electrical trouble.

In all cases test condition; Engine stops with the key turned to the "ON" position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.

- Engine: Stop
- Ignition SW: ON
- Brake Pedal: ON-OFF-ON

If the Ignition SW was turned OFF or communication was lost, make sure to apply the brake pedal ON-OFF-ON once again and then continue the test.

Actuator Test
F0: ABS Relay Test
F1: Return Pump Relay Test
F2: Front Left Solenoid Valve Test
F3: Front Right Solenoid Valve Test
F4: Rear Left Solenoid Valve Test
F5: Rear Right Solenoid Valve Test
F6: ABS Check Light Test
F7: Exhaust Brake Cut Test

N5A1018E

ABS Warning Lamp

Test condition: Engine stops with the key turned to the "ON" position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.

- The circuit is normal if the warning light in the meter panel comes on and goes out in accordance with Tech 2's instruction.

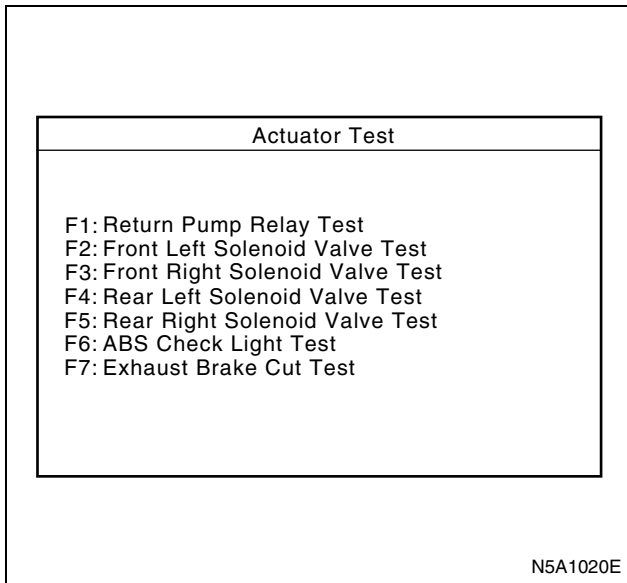
Actuator Test
F0: ABS Relay Test
F1: Return Pump Relay Test
F2: Front Left Solenoid Valve Test
F3: Front Right Solenoid Valve Test
F4: Rear Left Solenoid Valve Test
F5: Rear Right Solenoid Valve Test
F7: Exhaust Brake Cut Test

N5A1019E

ABS Relay

Test condition: Engine stops with the key turned to the "ON" position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.

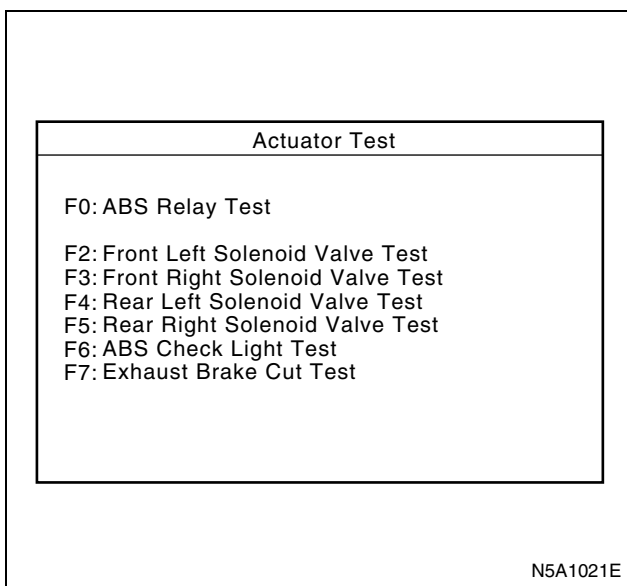
Make sure of the working sound of the ABS relay. The circuit is normal if the working sound of the ABS relay is made in accordance with Tech 2's instruction.



ABS Motor

Test condition: Engine stops with the key turned to the "ON" position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.

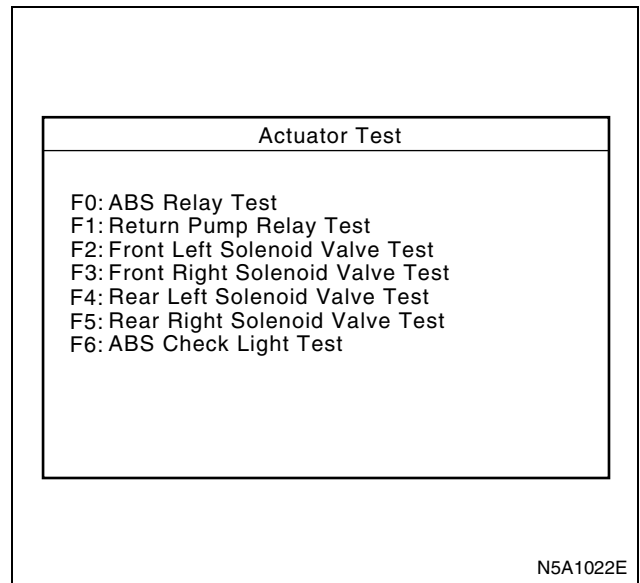
Make sure of the working sound of the ABS motor. The circuit is normal if the working sound of the ABS motor is made in accordance with Tech 2's instruction.



Exhaust Brake Cut Relay

Test condition: Engine stops with the key turned to the "ON" position. To be more specific, the test is conducted with the brake pedal stepped on after stepping once and releasing.

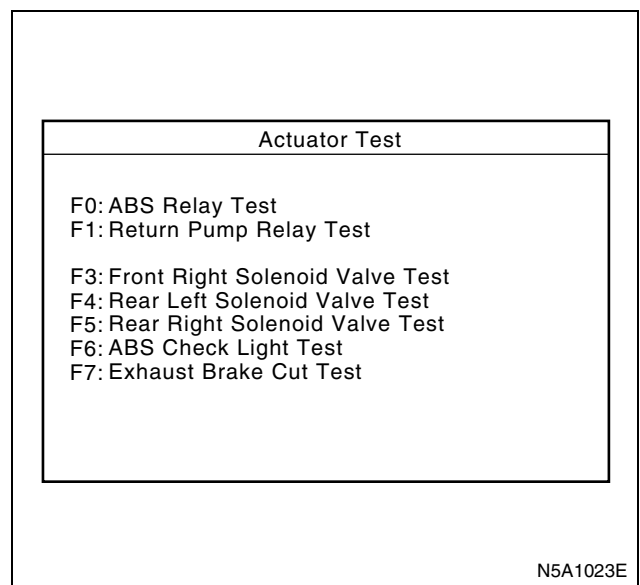
Make sure of the working sound of the exhaust brake cut relay. The circuit is normal if the working sound of the exhaust brake cut relay is made in accordance with Tech 2's instruction.



Hold Valve Test

Purpose: The purpose of this test is to detect brake pipe and valve line harness wire wrong connections and valve trouble.

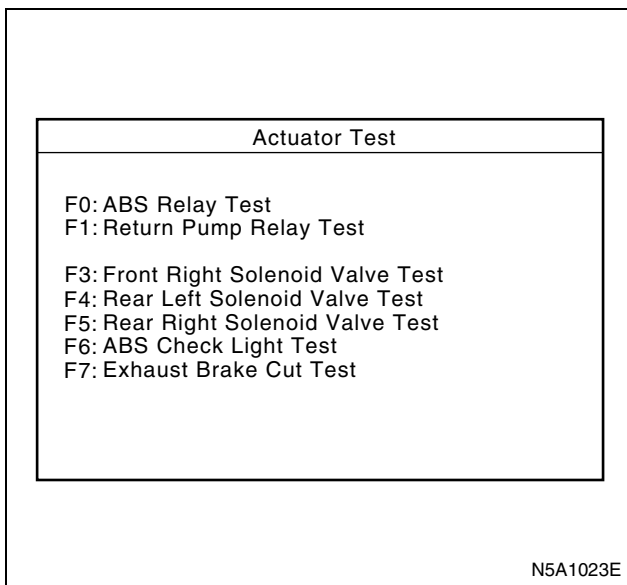
This test will help you confirm the result of your repair service including the removal/reinstallation of brake pipe, valve line harness and valve.



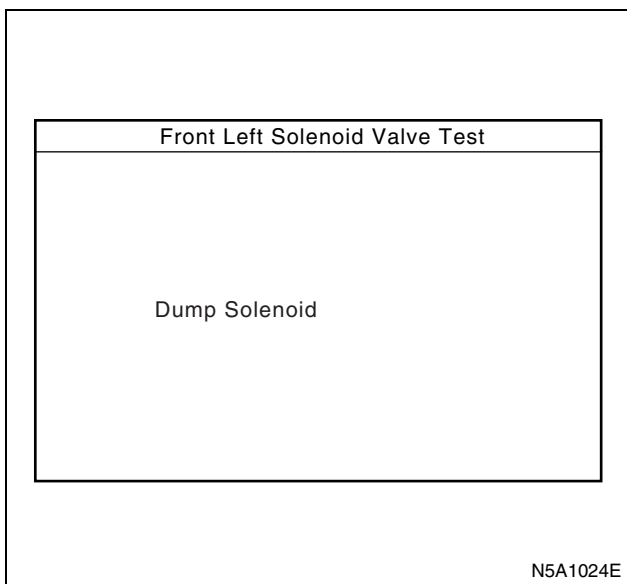
Test conditions: The ignition key is the "ON" position with the four wheels lifted up. The brake pedal is stepped on, released and stepped on again with the parking brake released.

Test procedure:

1. Connect Tech 2 with the vehicle, and select Special Function from the menus.
2. Select a Hold Valve Menu from the Special Function Menu.



Select a ISO Solenoid from the Front Left Solenoid Valve Test Function Menus.



3. Press the Hold Valve "ON" Soft Key with the brake pedal stepped on.
4. Release the brake pedal.
5. Make sure that the Hold Valve "ON" aimed at by Tech 2 and the wheel locked position are the same. If different, check brake pipe, valve line harness wiring and H/UNIT. Repair is needed if abnormality is found.

6. Conduct Step 2 through Step 5 above on all the four wheels.

Caution:

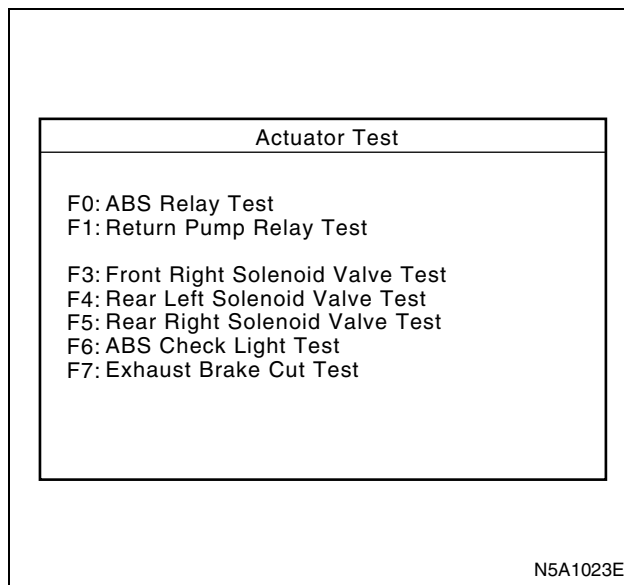
When conducting this test, please observe the following cautions.

1. Do not start the engine without fail.
2. Lift up the vehicle at the level floor.
 - Secure a clearance from the floor surface enough to allow the lifted tire to rotate.
3. Maintain the lift up.
4. Wipe the floor surface to remove water and oil so that the surface may become unslippery.
5. Do not load the vehicle.
 - When lifting up the vehicle, be sure to observe the lifting up points. Refer to vehicle lifting points in Section 0A GENERAL INFORMATION.

Release Valve Test

Purpose: The purpose of this test is to detect brake pipe and valve line harness wire wrong connections and valve trouble.

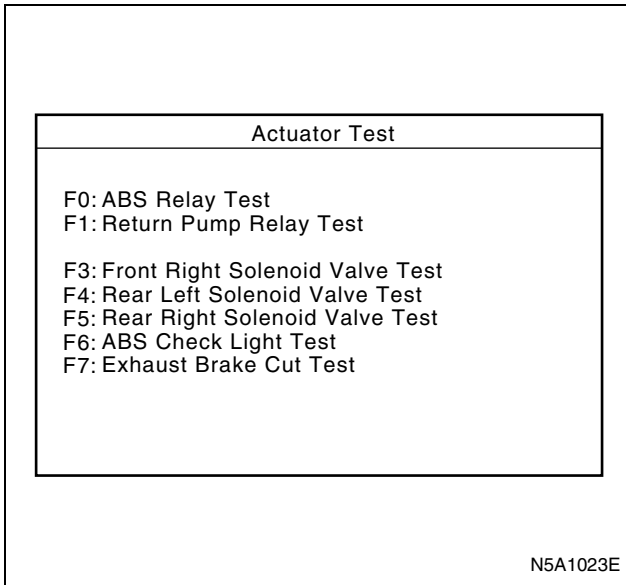
This test will help you confirm the result of your repair service including the removal/reinstallation of brake pipe, valve line harness and valve.



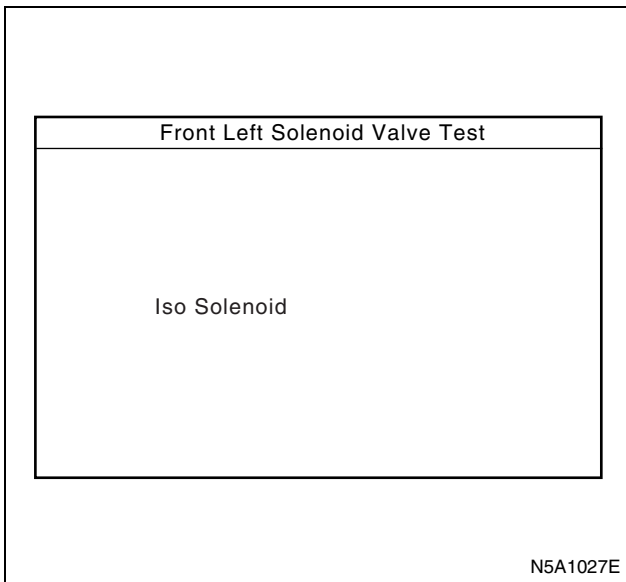
Test conditions: The ignition key is in the "ON" position with the four wheels lifted up. The brake pedal is stepped on, released and stepped on again with the parking brake released.

Test procedure:

1. Connect Tech 2 with the vehicle, and select Special Function from the menus.
2. Select a Release Valve Menu from the Special Function Menu.



Select a Dump Solenoid from the Front Left Solenoid Valve Test Function Menu.



4. Wipe the floor surface to remove water and oil so that the surface may become unslippery.
5. Do not load the vehicle.
 - When lifting up the vehicle, be sure to observe the lifting up points. Refer to vehicle lifting points in Section 0A GENERAL INFORMATION.

3. Press the Release Valve “ON” Soft Key with the brake pedal stepped on.
4. Make sure that the Release Valve “ON” aimed at by Tech 2 and the wheel released position are the same. If different, check brake pipe, valve line harness wiring and H/UNIT. Repair is needed if abnormality is found.
5. Conduct Step 2 through Step 4 above on all the four wheels.

Caution:

When conducting this test, please observe the following cautions.

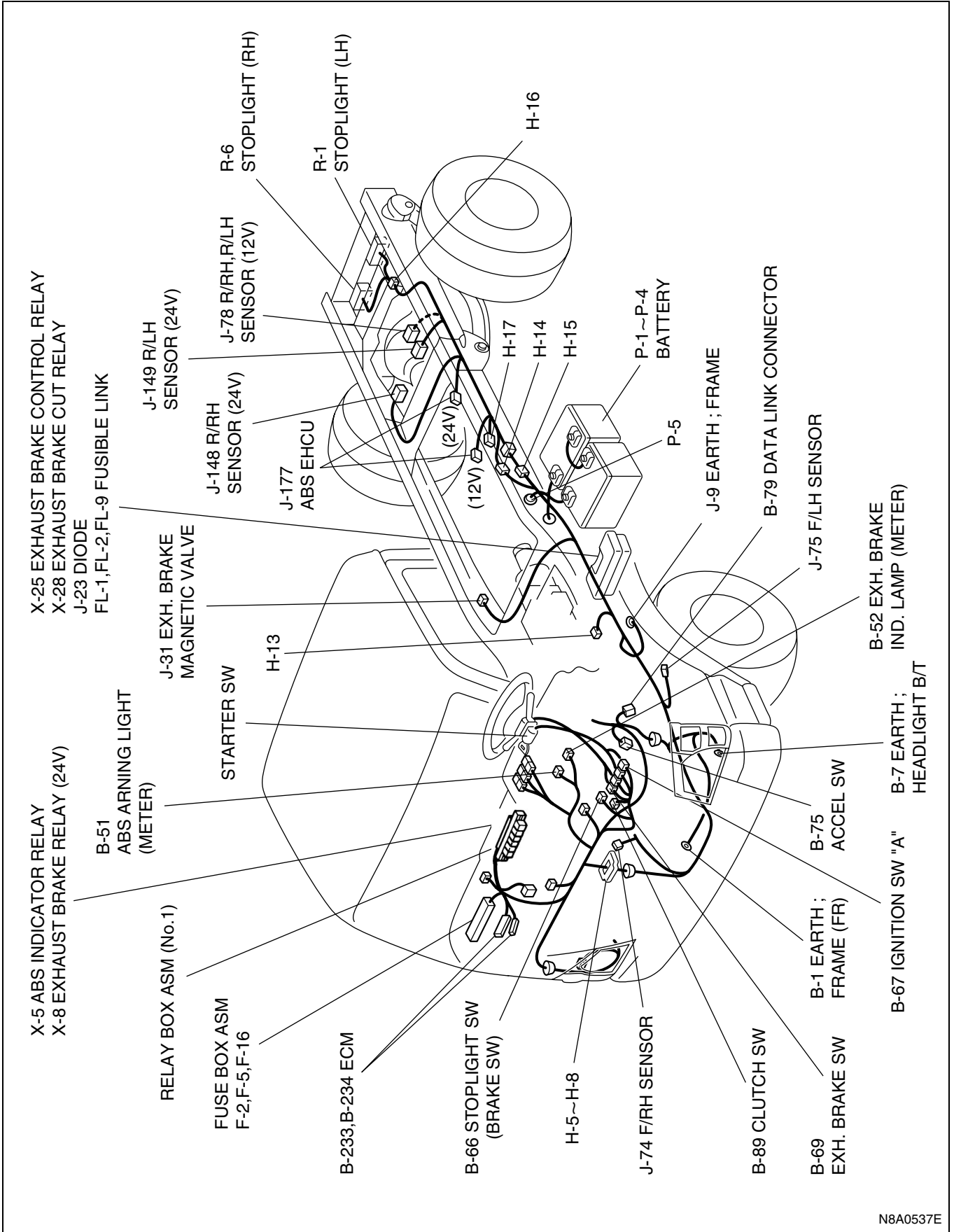
1. Do not start the engine without fail.
2. Lift up the vehicle at the level floor.
 - Secure a clearance from the floor surface enough to allow the lifted tire to rotate.
3. Maintain the lift up.

EHCU Connector Pin-out Checks

- Disconnect EHCU.
- Perform checks with high impedance digital multimeter 5-8840-0285-0 (J-39200) or equivalent.

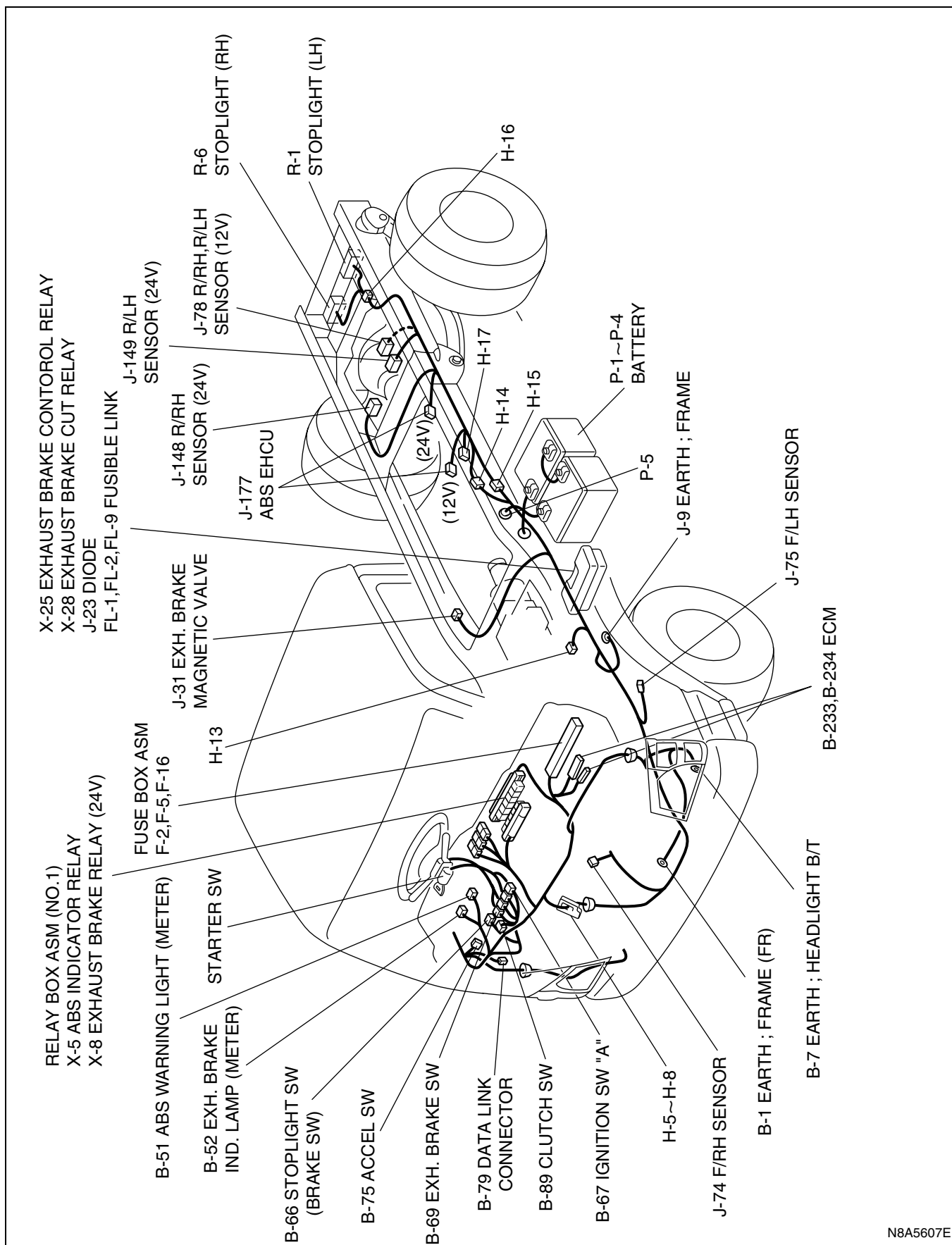
No.	Circuit to be Tested	Key Switch Position	Multimeter Scale/Range	Measure between Pin	Nominal Value (24 V Battery Vehicle)	Note
1	EHCU Power Circuit	OFF	VDC	3(+) — 1(-)	0 — 0.3 V	
		ON	VDC	3(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	2(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	24(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
2	EHCU Ground Circuit	OFF	Ω	1(+) — GND	Less than 0.01 Ω	
		OFF	Ω	23(+) — GND	Less than 0.01 Ω	
3	EXHIN Circuit	ON	VDC	7(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	Engine Run
4	EXHOUT Circuit	ON	VDC	8(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	8(+) — 1(-)	0 — 0.3 V	
5	Brake Switch Signal Circuit	OFF	VDC	16(+) — 1(-)	0 — 0.3 V	Apply Brake Pedal
		OFF	VDC	16(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
6	ABS W/L Circuit	ON	VDC	6(+) — 1(-)	9.5 — 16.5 V (16.5 — 34 V)	
		OFF	VDC	6(+) — 1(-)	0 — 0.3 V	
7	FL Speed Sensor	OFF	k Ω	10(+) — 11(-)	1 — 2 k Ω	Turn Wheel at 0.5 RPS
		OFF	k Ω	10(+) — 1(-)	More than 1000 k Ω	
		OFF	VDC	10(+) — 11(-)	More than 200 mV	
8	FR Speed Sensor	OFF	k Ω	32(+) — 33(-)	1 — 2 k Ω	Turn Wheel at 0.5 RPS
		OFF	k Ω	32(+) — 1(-)	More than 1000 k Ω	
		OFF	VDC	32(+) — 33(-)	More than 200 mV	

**Parts Location
For LHD Model**



N8A0537E

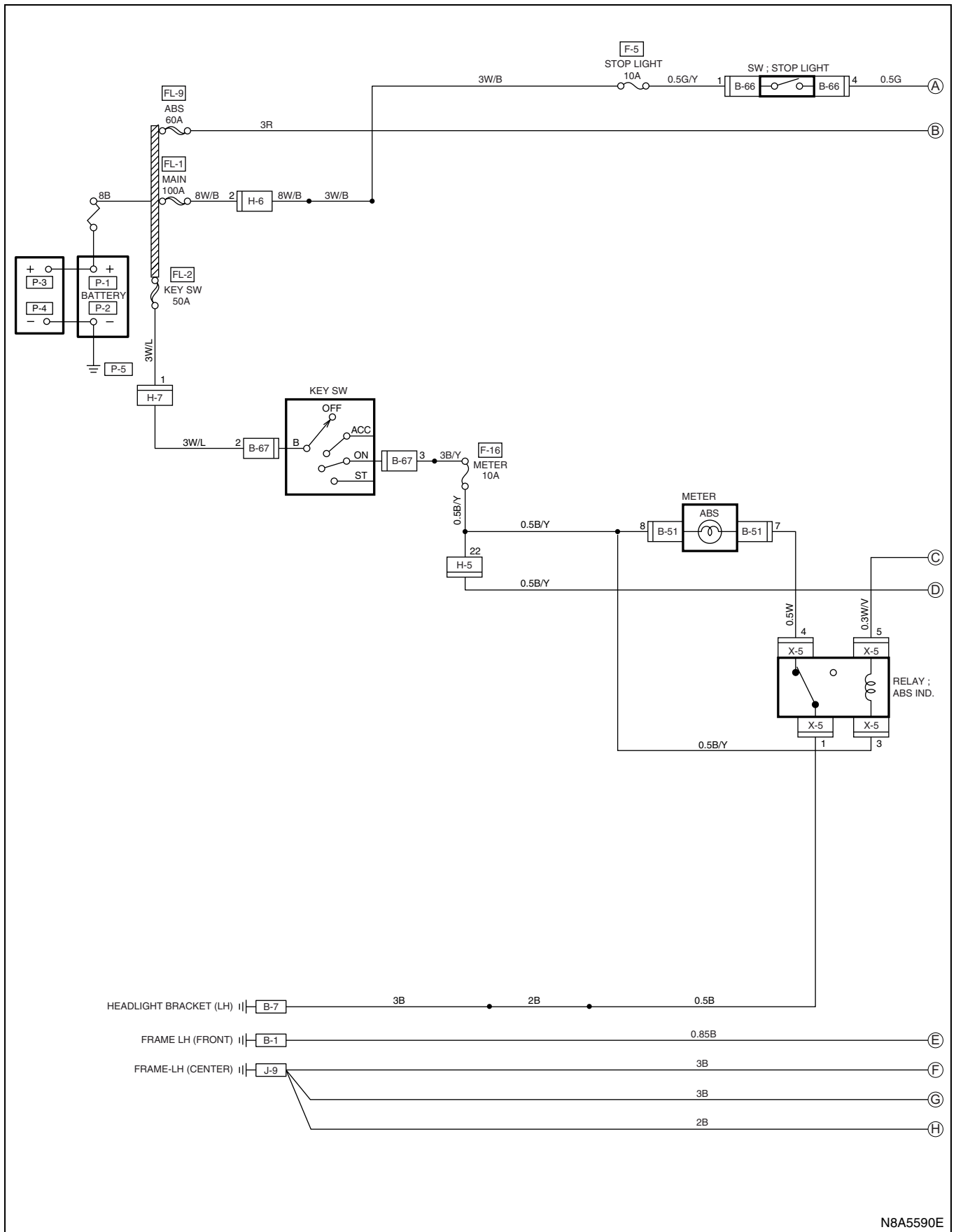
For RHD Model



N8A5607E

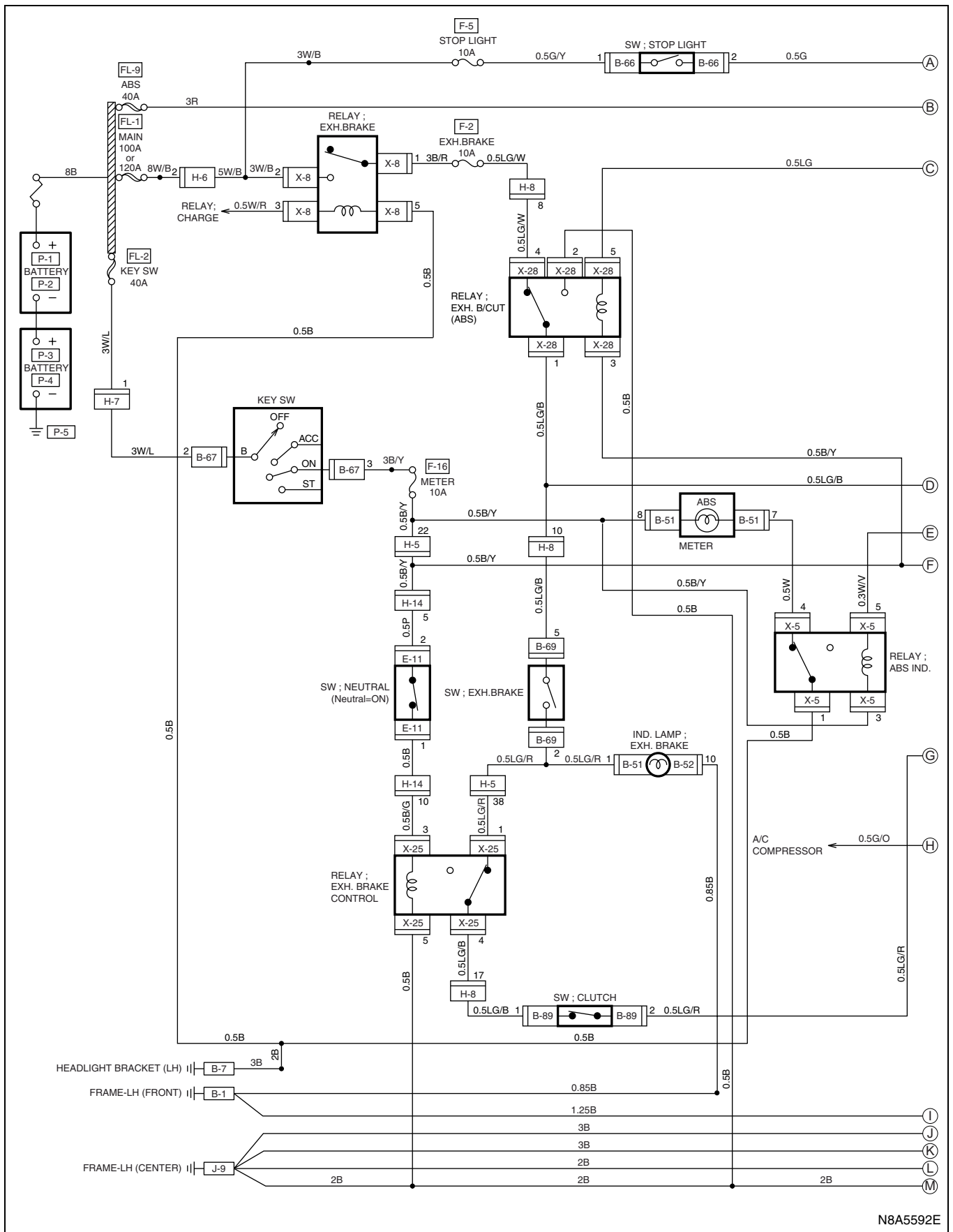
Circuit Diagram

12 Volt (4JH1 Engine)

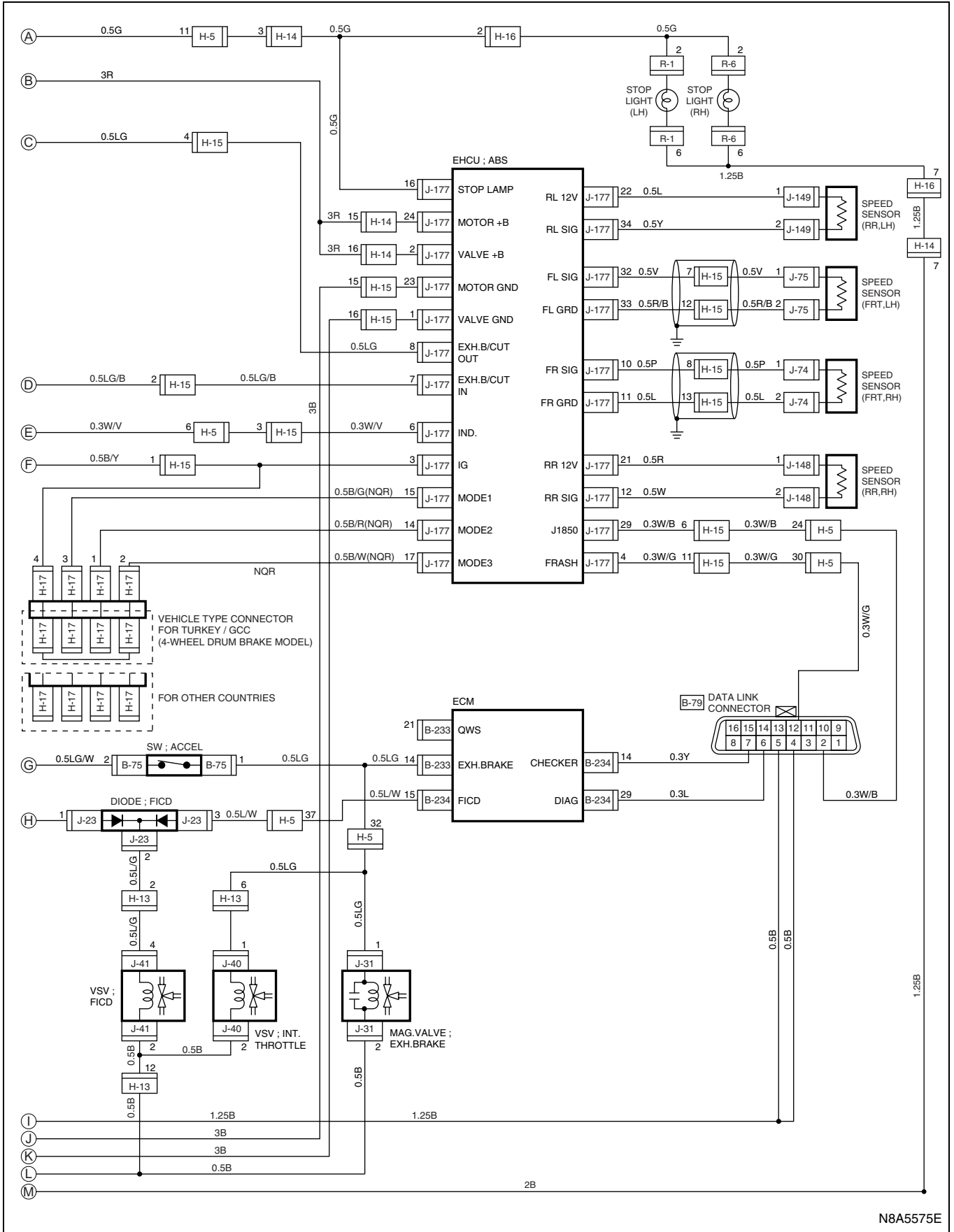


N8A5590E

24 Volt (4HE1 Engine, Single Cab Model)

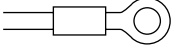
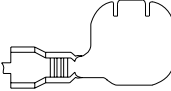
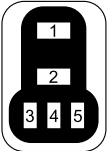

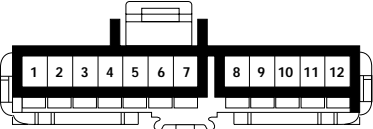


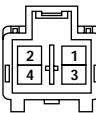


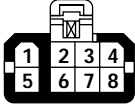
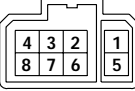

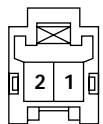
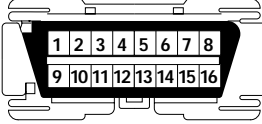

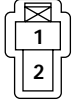
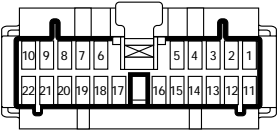
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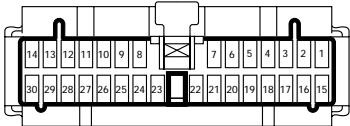





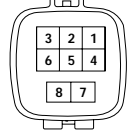
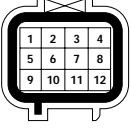

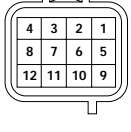
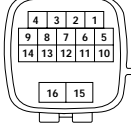


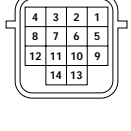
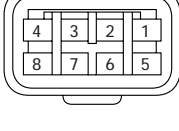



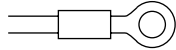
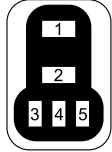
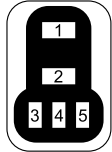
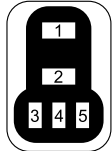
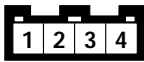


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Connector List





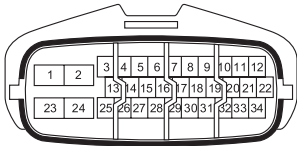
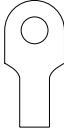
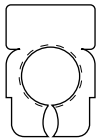
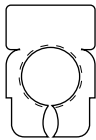
No.	Connector Face
B-1	 000-001
B-7	 000-012
X-5	 005-006
B-51	 014-001
B-52	 012-005
B-66	 004-010
B-67	 004-001
B-67	 004-002

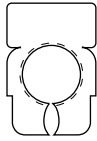
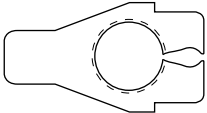
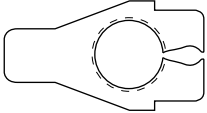
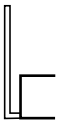
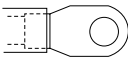

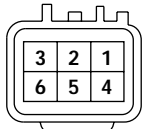

No.	Connector Face
B-69	 008-001
B-69	 008-002
B-75	 002-022
B-75	 002-023
B-79	 016-005
B-89	 002-009
B-89	 002-010
B-233 (24 V)	 022-002

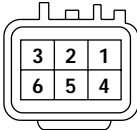
No.	Connector Face	No.	Connector Face																																																																																				
B-234 (24 V)	 030-002	H-14 (24 V)	 016-003																																																																																				
B-234 (12 V)	<table border="1"> <tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>5</td><td>4</td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td><td>41</td><td>42</td><td>43</td><td>3</td><td></td></tr> <tr><td>44</td><td>45</td><td>46</td><td>47</td><td>48</td><td>49</td><td>50</td><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>2</td><td>1</td></tr> <tr><td>63</td><td>64</td><td>65</td><td>66</td><td>67</td><td>68</td><td>69</td><td>70</td><td>71</td><td>72</td><td>73</td><td>74</td><td>75</td><td>76</td><td>77</td><td>78</td><td>79</td><td>80</td><td>81</td><td></td><td></td></tr> </table> 121-001	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	3		44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	2	1	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81			H-14 (24 V)	 016-004
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	5	4																																																																			
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63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81																																																																					
E-11	 002-001	H-15 (12 V)	 008-023																																																																																				
E-11	 002-002	H-15 (12 V)	 008-024																																																																																				
H-13	 012-001	H-15 (24 V)	 016-003																																																																																				
H-13	 012-002	H-15 (24 V)	 016-004																																																																																				
H-14 (12 V)	 014-004	H-16	 008-003																																																																																				
H-14 (12 V)	 014-005	H-16	 008-004																																																																																				

No.	Connector Face
H-17	 <p style="text-align: right;">004-011</p>
J-9	 <p style="text-align: right;">000-001</p>
X-8 (24 V)	 <p style="text-align: right;">005-006</p>
X-25 (24 V)	 <p style="text-align: right;">005-006</p>
X-28	 <p style="text-align: right;">005-006</p>
J-23	 <p style="text-align: right;">004-009</p>
J-31	 <p style="text-align: right;">002-011</p>
J-31	 <p style="text-align: right;">002-012</p>

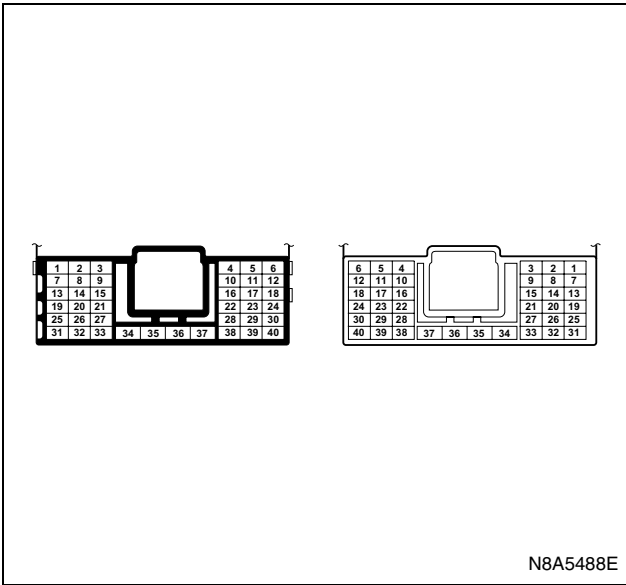
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J-40	 <p style="text-align: right;">002-015</p>
J-41	 <p style="text-align: right;">002-015</p>
J-74	 <p style="text-align: right;">002-011</p>
J-74	 <p style="text-align: right;">002-012</p>
J-75	 <p style="text-align: right;">002-011</p>
J-75	 <p style="text-align: right;">002-012</p>
J-148	 <p style="text-align: right;">002-011</p>
J-148	 <p style="text-align: right;">002-012</p>

No.	Connector Face
J-149 (24 V)	 002-011
J-149 (24 V)	 002-012
J-78 (12 V)	 004-018
J-78 (12 V)	 004-011
J-177	 034-001
P-1 (12 V)	 000-003
P-2	 000-004
P-1 (24 V)	 000-004

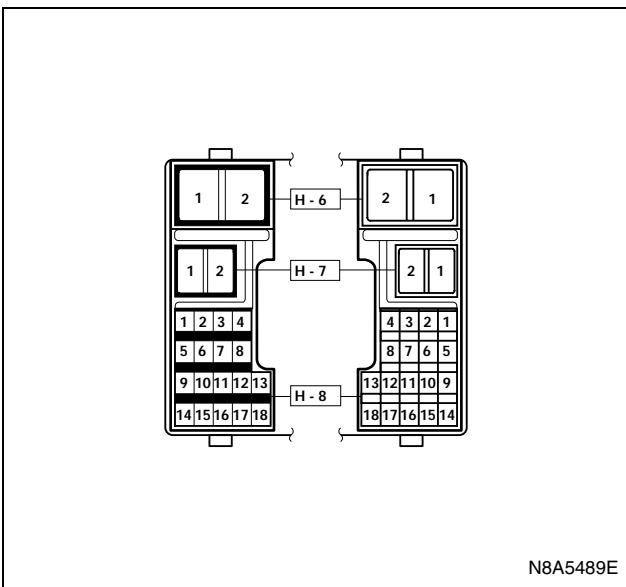
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P-4	 000-004
P-2 (24 V)	 000-006
P-3	 000-006
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002
R-1	 006-004
R-1	 006-005
R-6	 006-004

No.	Connector Face
R-6	 <p style="text-align: right;">006-005</p>

H-5



H-6, H-7, H-8



SYMPTOM DIAGNOSIS

Symptom Diagnosis

The symptoms that cannot be indicated by the warning light can be divided in the following five categories:

1. ABS works frequently but vehicle does not decelerate.
2. Uneven braking occurs while ABS works.
3. The wheels lock during braking.
4. Brake pedal feel is abnormal.
5. ABS operating sound (from Hydraulic Unit) is heard while not braking.

These are all attributable to problems which cannot be detected by EHCUC self-diagnosis. Use the customer complaint and a test to determine which symptom is present. Then follow the appropriate flow chart listed below.

No.	Symptom	Diagnostic Flow Charts	
		Without Tech 2	With Tech 2
1	ABS works frequently but vehicle does not decelerate.	Chart A-1	Chart TA-1
2	Uneven braking occurs while ABS works.	Chart A-2	Chart TA-2
3	The wheels are locked.	Chart A-3	Chart TA-3
4	ABS operating sound (from Hydraulic Unit) is heard while not braking.	Chart A-4	Chart TA-4

Chart A-1 ABS Works Frequently But Vehicle Does Not Decelerate

Step	Action	Value(s)	YES	NO
1	Inspect the tires. Are tire sizes as specified? Isn't there any abnormal wear?	—	Go to Step 2	Repair tires. Go to Step 2
2	Is braking force distribution normal between the front and rear of the vehicle?	—	Go to Step 3	Repair brake parts. Go to Step 7
3	Are axle parts installed normally?	—	Go to Step 4	Repair axle parts. Go to Step 7
4	Is there play in each wheel speed sensor?	—	Go to Step 5	Repair wheel speed sensor. Go to Step 7
5	Is there damage, or powdered iron sticking to each wheel speed sensor/sensor rotor?	—	Go to Step 6	Replace sensor or sensor rotor. Go to Step 7
6	Is the output of each wheel speed sensor normal? (Refer to chart C-1-1 to C-1-4 or TC-1)	—	Replace EHCUC. Go to Step 7	Replace wheel speed sensor or repair harness. Go to Step 7
7	Reconnect all components and ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

Chart TA-1 ABS Works Frequently But Vehicle Does Not Decelerate (Use Tech 2)

Step	Action	Value(s)	YES	NO
1	Return to Chart A-1. Was the Chart A-1 from Step 1 to Step 4 finished?	—	Go to Step 2	Repair tires. Go to Step 1
2	1. Connect Tech 2. 2. Confirm the output from each wheel sensor on DATA DISPLAY. Is the minimum vehicle speed output from each sensor stable at 4 km/h (3 mph) or less?	—	Go to Step 3	Replace wheel speed sensor. Go to Step 4
3	Return to Chart A-1. Was the Chart A-1 finished?	—	Go to Step 4	Go to Step 3
4	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the “Basic diagnostic flow chart”.	—

Chart A-2 Uneven Braking Occurs While ABS Works

Step	Action	Value(s)	YES	NO
1	Is there play in each sensor?	—	Go to Step 2	Repair. Go to Step 5
2	Damage or powdered iron sticking to each sensor/sensor rotor?	—	Go to Step 3	Repair. Go to Step 5
3	Is the output of each sensor normal? (Refer to chart C-1-1 to C-1-4 or TC-1)	—	Go to Step 4	Replace sensor or repair harness. Go to Step 5
4	Is brake pipe connecting order correct?	—	Replace EHCU. Go to Step 5	Reconnect brake pipe correctly. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the “Basic diagnostic flow chart”.	—

Chart TA-2 Uneven Braking Occurs While ABS Works (Use Tech 2)

Step	Action	Value(s)	YES	NO
1	1. Connect Tech 2. 2. WHEEL SENSORS make sure of the output conditions of each sensor. Is the output of each sensor normal?	—	Go to Step 2	Replace wheel speed sensor. Go to Step 3
2	Check the brake pipe connecting. Is brake pipe connecting order correct?	—	Replace EHCU. Go to Step 4	Repair brake pipe. Go to Step 4
3	Check the wheel speed sensor and repair if necessary (Refer to chart C-1-1 to C-1-4 or TC-1). Is each chart complete?	—	Go to Step 4	Go to Step 3
4	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

Chart A-3, TA-3 The Wheels Are Locked

Step	Action	Value(s)	YES	NO
1	Is ABS working?	—	Go to Step 2	Go to Step 4
2	Is vehicle speed under 10 km/h (6 mph)?	—	Go to Step 3	Normal.
3	Is sensor output normal? (Chart C-1-1 to C-1-4 or TC-1)	—	Go to Step 4	Replace sensor or repair harness. Go to Step 5
4	Is hydraulic unit grounded properly?	—	Replace hydraulic unit. Go to Step 5	Correct. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

Chart A-4, TA-4 Braking Sound (from Hydraulic Unit) Is Heard While Not Braking

Step	Action	Value(s)	YES	NO
1	Is this the first time the vehicle is being driven after starting the engine?	—	It is self checking sound. Normal.	Go to Step 2
2	Is vehicle speed under 10 km/h (6 mph)?	—	It is self checking sound. Normal.	Go to Step 3
3	Check for the following condition: <ul style="list-style-type: none"> • At the time of shift down or clutch operation. • At the time of low μ drive (ice or snow road) or rough road drive. • At the time of high-speed turn. • At the time of passing curb. • At the time of operating electrical equipment switches. • At the time of racing the engine. Did it occur under any one condition above?	—	ABS may sometime be actuated even when brake pedal is not applied.	Go to Step 4
4	Is there play in each sensor/wheel speed sensor rotor?	—	Go to Step 5	Repair. Go to Step 7
5	Damage or powdered iron sticking to each sensor/wheel speed sensor rotor?	—	Repair. Go to Step 7	Go to Step 6
6	Is each sensor output normal? (Refer to chart C-1-1 to C-1-4 or TC-1).	—	Check harness/connector for suspected disconnection. If no disconnection is found, replace EHCU. Go to Step 7	Repair. Go to Step 7
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

DIAGNOSTIC TROUBLE CODES

Diagnostic Trouble Codes

Choose and trace an appropriate flowchart by the numbers listed below to find fault and repair.

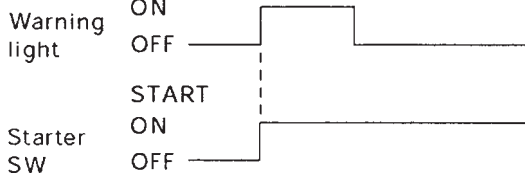
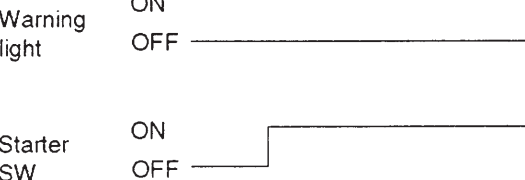
Code		Diagnosis	Item (except Wiring)	Chart No.
Flash out	Serial Communications			
12	—	Normal	—	—
13	C0213	Vehicle Type Error	EHCUC	1
14	C0214	EHCUC Abnormality	EHCUC	2
15	C0215	Low Power Voltage	EHCUC	3
25	C0225	Exhaust Brake Cut Circuit Abnormality	Relay or EHCUC	4
33	C0233	Motor Drive Circuit Abnormality	EHCUC	5
34	C0234	Abnormal Motor Rotation	EHCUC	6
41	C0241	Solenoid Valve Power Supply Abnormality	EHCUC	7
43	C0243	Solenoid Valve Circuit Abnormality	EHCUC	8
45	C0245	Solenoid Valve Circuit Abnormality		
51	C0251	FL Speed Sensor Circuit Abnormality	Sensor, EHCUC	9
52	C0252	FR Speed Sensor Circuit Abnormality		10
53	C0253	RL Speed Sensor Circuit Abnormality		11
54	C0254	RR Speed Sensor Circuit Abnormality		12
61	C0261	Abnormal FL Speed Sensor Signal		13
62	C0262	Abnormal FR Speed Sensor Signal		14
63	C0263	Abnormal RL Speed Sensor Signal		15
64	C0264	Abnormal RR Speed Sensor Signal		16

* Important: DTC 20 (Reference Voltage High) cannot be indicated by Tech 2. DTC 20 can be indicated and confirmed by flashing using Diagnosis Switch.

DIAGNOSIS BY “ABS” WARNING LIGHT ILLUMINATION PATTERN

Diagnosis by “ABS” Warning Light Illumination Pattern

In the event that there is abnormality in the “ABS” warning light illumination pattern while the key is in the ON position or if the warning light is actuated during driving, trouble should be diagnosed on a illumination pattern basis as follows:

No.	Condition	“ABS” Warning Light Illumination Pattern	Diagnostic
1	Warning light is actuated normally	 <p style="text-align: right; margin-right: 50px;">N5A1061E</p>	Normal
2	Warning light is not lit	 <p style="text-align: right; margin-right: 50px;">N5A1062E</p>	Warning light lighting circuit trouble → Go to Chart B-1

No.	Condition	"ABS" Warning Light Illumination Pattern	Diagnostic
3	Warning light is actuated while driving	<p>Warning light ON OFF</p> <p>Starter SW ON OFF</p> <p>During driving</p>	<p>Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.</p> <p>N5A1063E</p>

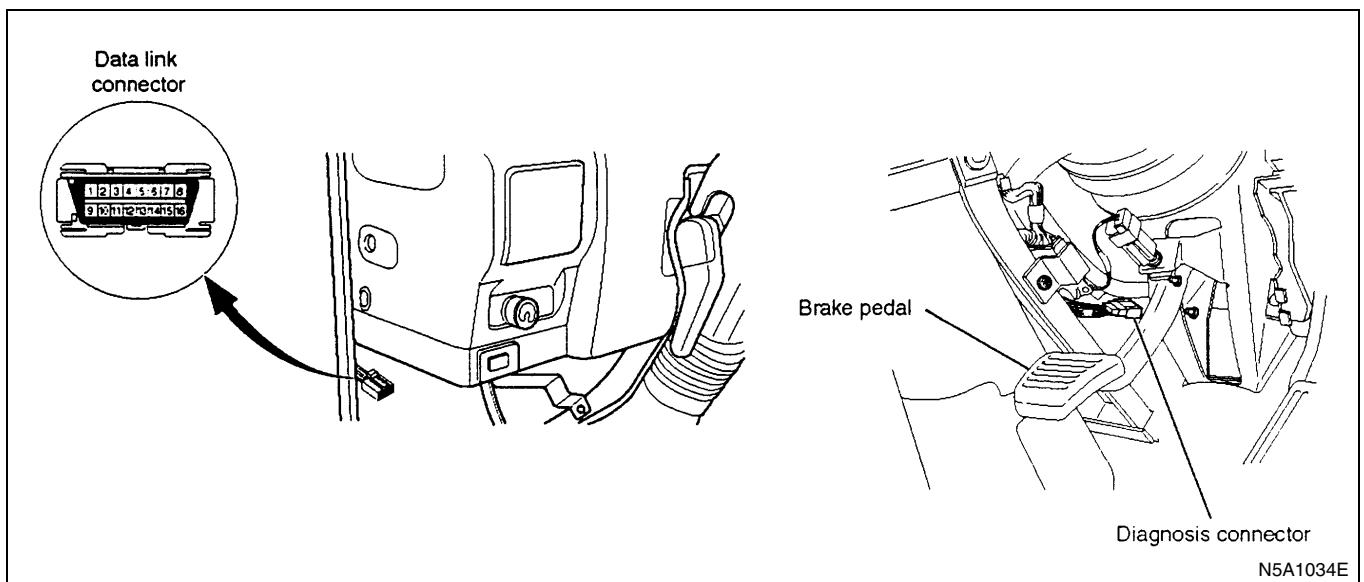
Diagnostic Trouble Codes (DTCs)

When the warning light in the meter remains ON, the EHCU stores the fault identification and disables the ABS.

1. How to start DTC display:

- Confirm that the vehicle has come to a complete stop (with the wheels standing still) and that the brake pedal is not depressed.
(Unless these two conditions are satisfied, DTC display cannot be started.)
- With the key switch OFF and short B-79 diagnosis connector terminal 12 to ground.
Then turn the key switch ON.
- DTCs can be displayed also by Tech 2.

The DLC (for Tech 2) Is Located Behind The Driver Side Lower Cluster Panel

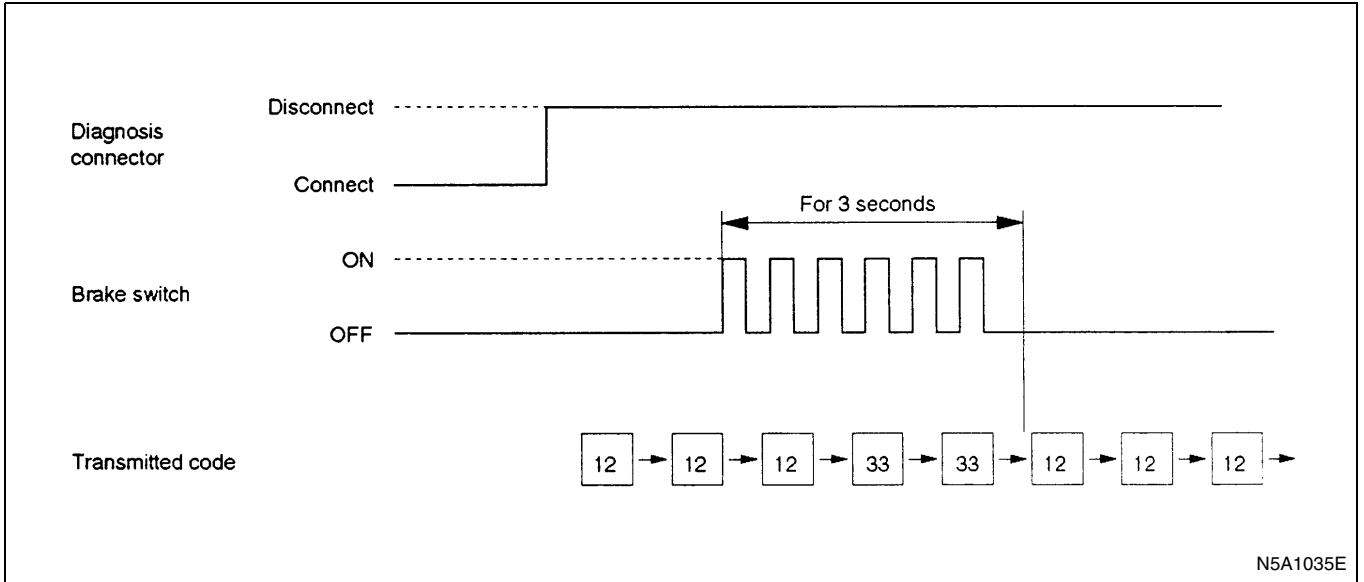


2. DTC display:

- DTC is displayed by blinking warning light.
- Double-digit display.
- First, normal DTC 12 is displayed three times and then any other DTCs are displayed three times. (If no other DTCs have been stored, the display of DTC 12 will be repeated.)

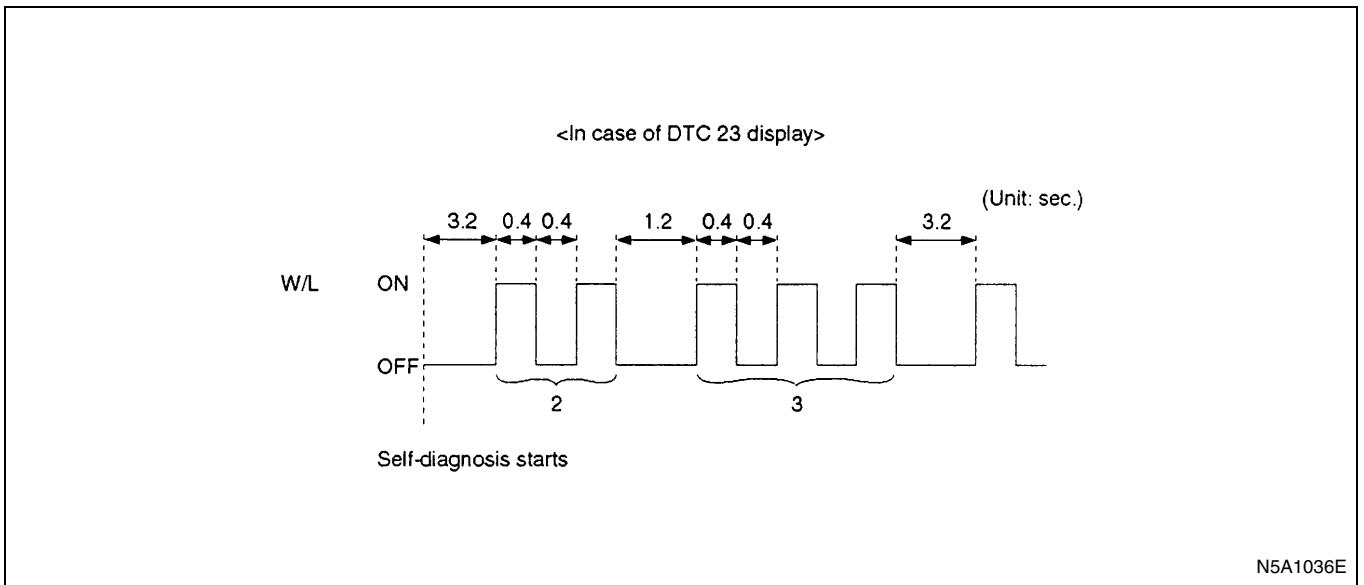
3. How to erase code:

- Conduct brake switch ON/OFF operation 6 or more times within 3 seconds of self-diagnosis startup.
- The code cannot be erased if more than 3 seconds have passed since self-diagnosis startup, or if self-diagnosis has started with brake switched on (brake pedal depressed).
- DTCs can be erased also by Tech 2.



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4. An example of DTC display
Display of DTC 23

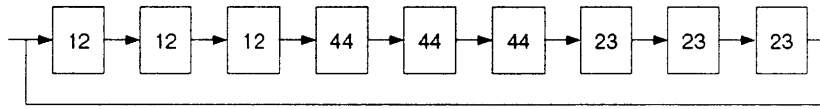


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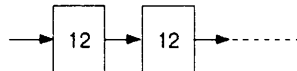
After displaying DTC 12 three times, one DTC after another is displayed, starting with the most recent one. (However, display is discontinued after about 5 minutes.)

The DTC 12 is displayed repeatedly. (display is discontinued after about 5 minutes)

<In case there are two or more DTCs: 44 & 23>



<In case no DTC has been stored>

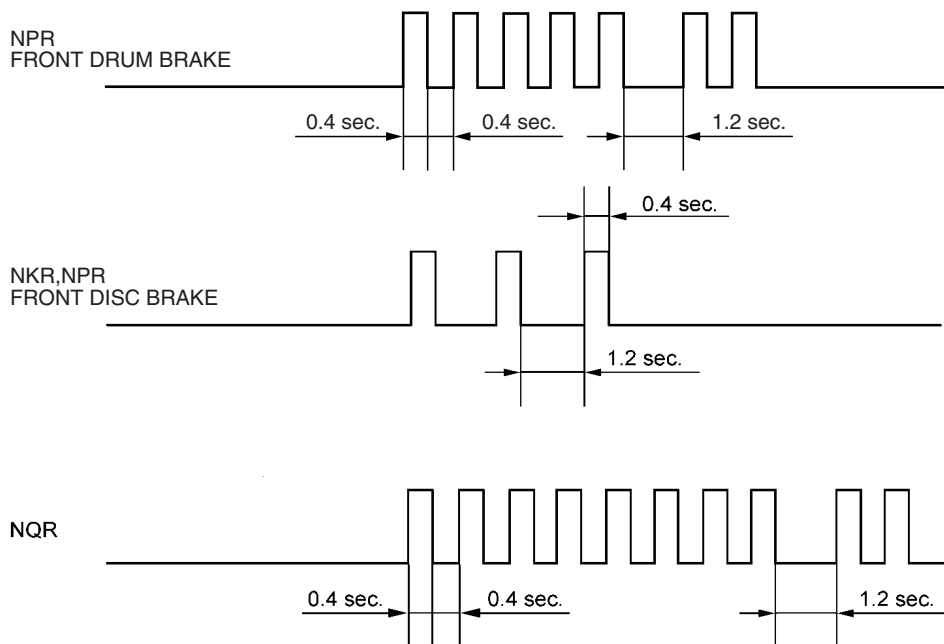


N5A1037E

5. How to display vehicle model:

- 1) Turn the key switch OFF.
- 2) Short the diagnosis connector terminal 12 to ground.
- 3) Slightly push the brake pedal.
- 4) Turn the key switch ON.
- 5) ABS warning light illuminates.
- 6) Illuminating number of times indicates the vehicle model.

Vehicle model	Illuminating number of times
NKR, NPR FRONT DISC BRAKE	1
NQR	8
NPR FRONT DRUM BRAKE	5



N5A1038E

Chart B-1-1 With the key in the ON position (Before starting the engine). Warning light (W/L) is not activated.

Step	Action	Value(s)	YES	NO
1	Is W/L fuse F-16 blown out?	—	Go to Step 5	Go to Step 2
2	Is W/L bulb burnt out?	—	Go to Step 6	Go to Step 3
3	<ol style="list-style-type: none"> 1. Turn the key off. 2. Disconnect EHCU connectors. 3. Turn the key on. 4. Using DVM, measure the voltage between J-177 EHCU connector terminals 6 and 1. <p>Does the DVM display a voltage within the specified value?</p>	<p>12V: 9.5 — 16.5 V</p> <p>24V: 16.5 — 34 V</p>	Go to Step 4	Go to Step 7
4	<p>Check the continuity between J-177 EHCU connector terminal 1 and body ground.</p> <p>Is there continuity?</p>	—	Go to Step 9	Go to Step 8
5	<p>Replace the fuse.</p> <p>Is action complete?</p>	—	Go to Step 10	—
6	<p>Replace the W/L bulb.</p> <p>Is action complete?</p>	—	Go to Step 10	—
7	<p>Locate and repair open circuit, poor connection or short circuit in the ignition feed circuit.</p> <p>Is action complete?</p>	—	Go to Step 10	—
8	<p>Locate and repair open circuit, poor connection or short circuit in the ground circuit.</p> <p>Is action complete?</p>	—	Go to Step 10	—
9	<ol style="list-style-type: none"> 1. Check the harness for suspected disconnection. 2. If no fault found, replace the EHCU. <p>Is action complete?</p>	—	Go to Step 10	—
10	<ol style="list-style-type: none"> 1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. <p>Was this step finished?</p>	—	Go to “Basic diagnostic flow chart”.	—

Chart 1 (DTC13/C0213) Vehicle Type Error

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCUC connector. 2. Turn the key on. 3. Measure the voltage at terminal 14, 15, and 17.	NQR: All terminal battery voltage NKR, NPR FRONT DISC BRAKE: All terminal 0 V NPR FRONT DRUM BRAKE: Terminal 14, 15: 0 V Terminal 17: battery voltage	Go to Step 2	Go to Step 5
2	1. Turn the key off and connect EHCUC. 2. Connect the Tech 2. 3. Clear the vehicle type. 4. Does the warning light turn off?	—	Go to Step 3	Replace the EHCUC. Go to Step 3
3	Confirm the vehicle type. Is the vehicle type okay?	—	Go to Step 4	Replace the EHCUC. Go to Step 3
4	Clear the DTC.	—	Troubleshooting completed.	—
5	Repair harness. Does the warning light turn off?	—	Go to Step 3	Replace the EHCUC. Go to Step 3

Chart 2 (DTC14/C0214) EHCUC Abnormality

Step	Action	Value(s)	YES	NO
1	1. Turn the key off. 2. Disconnect the EHCUC connector. 3. Measure continuity between the body ground and J-177 connector terminal 1, 23. Is there continuity?	—	Go to Step 2	Go to Step 3
2	1. Connect the EHCUC connector. 2. Clear DTC. 3. Turn the key from off to on and perform diagnosis procedure. Does the DTC repeat?	—	Go to Step 4	Go to Step 5
3	Repair the open/short circuit or malfunction at connection of connector. Is this step completed?	—	Go to Step 5	—
4	Replace the EHCUC. Is this step completed?	—	Go to Step 5	—
5	1. Install all parts. Verify each part is properly installed. 2. Clear DTC. Is this step completed?	—	Go to "Basic diagnostic flow chart".	—

Chart 3 (DTC15/C0215) EHCU Voltage Out of Range

Step	Action	Value(s)	YES	NO
1	Is the battery voltage okay?	—	Go to Step 2	Go to Step 5
2	1. Turn the key off. 2. Disconnect the EHCU connector. 3. Start the engine. 4. Measure voltage between J-177 connector terminal 2 and J-177 connector terminal 1, 23. Is the voltage within the specified value? 5. Measure voltage between J-177 connector terminal 24 and J-177 connector terminal 1, 23.	12 V vehicle: 10 — 16 V 24 V vehicle: 17 — 33.5 V	Go to Step 3	Go to Step 6
3	Locate the malfunction of connection in the circuit. Is the circuit malfunction specified?	—	Go to Step 4	Go to Step 8
4	Repair the malfunction and perform diagnosis procedure. Does the DTC repeat?	—	Go to Step 7	Go to Step 8
5	Charge or replace the battery. Is this step completed?	—	Go to Step 8	—
6	Repair open/short circuit or malfunction at connection of connector between J-177 connector terminal 2 or 24 and fusible link FL- 9. Is this step completed?	—	Go to Step 8	—
7	Replace the EHCU. Is this step completed?	—	Go to Step 8	—
8	1. Install all parts. Verify each part is properly installed. 2. Clear DTC. Is this step completed?	—	Go to “Basic diagnostic flow chart”.	—

Chart 4 (DTC25/C0225) Exhaust Brake Cut Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCUC connector. 2. Start the engine. 3. Measure voltage between EHCUC terminals 8 and 1. Is the voltage within the specified value?	12 V vehicle: More than 5 V 24 V vehicle: More than 10 V	Go to Step 2	Go to Step 4
2	Measure voltage between EHCUC terminals 7 and 1. Is the voltage within the specified value?	12 V vehicle: More than 5 V 24 V vehicle: More than 10 V	Go to Step 3	Go to Step 6
3	Short EHCUC terminal 8 to 1. Is the voltage at EHCUC terminal 7 less than 1.5 V?	—	Replace the EHCUC.	Replace the exhaust brake cut relay.
4	Measure resistance of the exhaust brake cut relay coil.	12 V vehicle: 60 — 120 ohms 24 V vehicle: 210 — 310 ohms	Go to Step 5	Replace the exhaust brake cut relay.
5	Measure voltage at coil power side of relay box connector. (key at on position) Is the voltage within the specified value?	12 V vehicle: 10 — 16 V 24 V vehicle: 20 — 32 V	Check harness between EHCUC terminal 8 and exhaust brake cut relay. Repair as necessary.	Repair harness and/or power line.
6	Turn the exhaust brake switch on. Does the exhaust brake indicator light turn on?	—	Repair harness of EHCUC terminal 7.	Go to exhaust brake diagnosis procedure.

Chart 5 (DTC33/C0233) Motor Drive Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCUC connector. 2. Measure voltage between EHCUC terminals 24 and 23. Is the voltage within the specified value?	12 V vehicle: 10 — 16 V 24 V vehicle: 20 — 32 V	Go to Step 2	Go to Step 3
2	Measure continuity between EHCUC terminals 23 and 1. Is there continuity?	—	Replace the EHCUC.	Repair the harness.
3	Check the ABS fusible link (12 V: 60 A, 24 V: 40 A). Is it okay?	—	Repair the harness.	Replace the ABS fusible link (12 V: 60 A, 24 V: 40 A)

Chart 6 (DTC 34/C0234) Abnormal Motor Rotation

- Replace EHCUC.

Chart 7 (DTC41/C0241) Solenoid Valve Power Supply Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCU connector. 2. Measure voltage between EHCU terminals 2 and 1. Is the voltage within the specified value?	12 V vehicle: 10 — 16 V 24 V vehicle: 20 — 32 V	Replace the EHCU.	Go to Step 2
2	Check the ABS fusible link (12 V: 60 A, 24 V: 40 A). Is it okay?	—	Repair the harness.	Replace the ABS fusible link (12 V: 60 A, 24 V: 40 A).

Chart 8 (DTC 43, 45/C0243, C0245) Solenoid Valve Circuit Abnormality

- Replace EHCU.

Chart 9 (DTC51/C0251) FL Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCU connector. 2. Measure resistance between EHCU terminals 32 and 33. Is the resistance within the specified value?	1 — 2 k ohms	Replace the EHCU.	Go to Step 2
2	1. Disconnect the FL speed sensor connector. 2. Measure the FL speed sensor resistance. Is the resistance within the specified value?	1 — 2 k ohms	Repair the harness.	Replace the FL speed sensor.

Chart 10 (DTC52/C0252) FR Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	1. Disconnect EHCU connector. 2. Measure resistance between EHCU terminals 10 and 11. Is the resistance within the specified value?	1 — 2 k ohms	Replace the EHCU.	Go to Step 2
2	1. Disconnect the FR speed sensor connector. 2. Measure the FR speed sensor resistance. Is the resistance within the specified value?	1 — 2 k ohms	Repair the harness.	Replace the FR speed sensor.

Chart 11 (DTC53/C0253) RL Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	<ol style="list-style-type: none"> Turn the key off. Disconnect EHCU connector J-177 and RL speed sensor connector J-149 (J-78). Check the continuity between connector J-177 terminal 34 and sensor connector J-149 (J-78) terminal 2 (1). <p>Is there continuity?</p>	—	Go to Step 2	Go to Step 7
2	<p>Check the continuity between connector J-177 terminal 34 and connector J-177 terminal 1.</p> <p>Is there continuity?</p>	—	Go to Step 7	Go to Step 3
3	<p>Check the continuity between connector J-177 terminal 22 and sensor connector J-149 (J-78) terminal 1 (2).</p> <p>Is there continuity?</p>	—	Go to Step 4	Go to Step 7
4	<p>Check the continuity between connector J-177 terminal 22 and connector J-177 terminal 1.</p> <p>Is there continuity?</p>	—	Go to Step 7	Go to Step 5
5	<ol style="list-style-type: none"> Connect the connector J-177 with EHCU. Turn the key on. Using DVM, measure the voltage between connector J-149 (J-78) terminal 1 (2) (vehicle side) and ground. <p>Does the DVM display a voltage within the specified value?</p>	9 — 16 V	Go to Step 6	Go to Step 7
6	<p>Check the RL sensor output. (Refer to Chart C-1-3)</p> <p>Does the DTC repeat?</p>	—	Go to Step 8	Go to Step 9
7	<p>Repair open circuit, poor connection and/or short circuit between the EHCU connectors and speed sensor connectors.</p> <p>Is this step complete?</p>	—	Go to Step 9	—
8	<p>Replace EHCU.</p> <p>Is this step complete?</p>	—	Go to Step 9	—
9	<ol style="list-style-type: none"> Reconnect all components, ensure all components are properly mounted. Clear diagnostic trouble code. <p>Was this step finished?</p>	—	Go to “Basic diagnostic flow chart”.	—

Chart 12 (DTC54/C0254) RR Speed Sensor Circuit Abnormality

Step	Action	Value(s)	YES	NO
1	<ol style="list-style-type: none"> Turn the key off. Disconnect EHCU connector J-177 and RL speed sensor connector J-148 (J-78). Check the continuity between connector J-177 terminal 12 and sensor connector J-148 (J-78) terminal 1 (3). <p>Is there continuity?</p>	—	Go to Step 2	Go to Step 7
2	<p>Check the continuity between connector J-177 terminal 12 and connector J-177 terminal 1.</p> <p>Is there continuity?</p>	—	Go to Step 7	Go to Step 3
3	<p>Check the continuity between connector J-177 terminal 21 and sensor connector J-148 (J-78) terminal 2 (4).</p> <p>Is there continuity?</p>	—	Go to Step 4	Go to Step 7
4	<p>Check the continuity between connector J-177 terminal 21 and connector J-177 terminal 1.</p> <p>Is there continuity?</p>	—	Go to Step 7	Go to Step 5
5	<ol style="list-style-type: none"> Connect the connector J-177 with EHCU. Turn the key on. Using DVM, measure the voltage between connector J-148 (J-78) terminal 2 (4) (vehicle side) and ground. <p>Does the DVM display a voltage within the specified value?</p>	9 — 16 V	Go to Step 6	Go to Step 7
6	<p>Check the RL sensor output. (Refer to Chart C-1-4)</p> <p>Does the DTC repeat?</p>	—	Go to Step 8	Go to Step 9
7	<p>Repair open circuit, poor connection and/or short circuit between the EHCU connectors and speed sensor connectors.</p> <p>Is this step complete?</p>	—	Go to Step 9	—
8	<p>Replace EHCU.</p> <p>Is this step complete?</p>	—	Go to Step 9	—
9	<ol style="list-style-type: none"> Reconnect all components, ensure all components are properly mounted. Clear diagnostic trouble code. <p>Was this step finished?</p>	—	Go to “Basic diagnostic flow chart”.	—

Chart 13 (DTC61/C0261) Abnormal FL Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the FL wheel bearing?	—	Go to Step 12	Go to Step 4
4	Is there play in the FL speed sensor/sensor rotor?	—	Go to Step 13	Go to Step 5
5	Is there powdered iron sticking to FL speed sensor/sensor rotor?	—	Go to Step 14	Go to Step 6
6	Check the FL speed sensor. (Refer to Chart C-1-1 or TC-1) Is the FL sensor output normal?	—	Go to Step 7	Go to Step 10
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 15	Go to Step 8
8	Using DVM, measure the resistance between J-177 EHCUC connector terminal 33 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 9	Go to Step 11
9	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 20	Go to Step 18
10	Is there damage or indentation in the speed sensor?	—	Go to Step 16	Go to Step 17
11	1. Disconnect FL sensor connector. 2. Using DVM, measure the resistance between J-75 sensor connector terminal 2 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 19	Go to Step 16
12	Adjust wheel bearing preload. Is action complete?	—	Go to Step 21	—
13	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
14	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
15	Replace sensor rotor. Is action complete?	—	Go to Step 21	—

Step	Action	Value(s)	YES	NO
16	Replace FL speed sensor. Is action complete?	—	Go to Step 21	—
17	Check the FL speed sensor circuit. Refer to Chart 9. Is action complete?	—	Verify repair	—
18	Check for a poor connection and an open circuit on the harness between EHCU and sensor connectors. Refer to “Note on Intermittents” described in earlier this section. Is action complete?	—	Go to Step 21	—
19	1. Locate open circuit, poor connection or short circuit on the harness between EHCU and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 21	Go to Step 21
20	Replace EHCU. Is action complete?	—	Go to Step 21	—
21	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to “Basic diagnostic flow chart”.	—

Chart 14 (DTC62/C0262) Abnormal FR Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the FR wheel bearing?	—	Go to Step 12	Go to Step 4
4	Is there play in the FR speed sensor/sensor rotor?	—	Go to Step 13	Go to Step 5
5	Is there powdered iron sticking to FR speed sensor/sensor rotor?	—	Go to Step 14	Go to Step 6
6	Check the FR speed sensor. (Refer to Chart C-1-2 or TC-1) Is the FR sensor output normal?	—	Go to Step 7	Go to Step 10
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 15	Go to Step 8

Step	Action	Value(s)	YES	NO
8	Using DVM, measure the resistance between J-177 EHCUC connector terminal 11 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 9	Go to Step 11
9	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 20	Go to Step 18
10	Is there damage or indentation in the speed sensor?	—	Go to Step 16	Go to Step 17
11	1. Disconnect FR sensor connector. 2. Using DVM, measure the resistance between J-74 sensor connector terminal 2 and ground. Does the DVM display a resistance within the specified value?	1000 k ohms or more	Go to Step 19	Go to Step 16
12	Adjust wheel bearing preload. Is action complete?	—	Go to Step 21	—
13	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
14	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 21	—
15	Replace sensor rotor. Is action complete?	—	Go to Step 21	—
16	Replace FR speed sensor. Is action complete?	—	Go to Step 21	—
17	Check the FR speed sensor circuit. Refer to Chart 10. Is action complete?	—	Verify repair	—
18	Check for a poor connection and an open circuit on the harness between EHCUC and sensor connectors. Refer to "Note on Intermittents" described in earlier this section. Is action complete?	—	Go to Step 21	—
19	1. Locate open circuit, poor connection or short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. Is action complete?	—	Go to Step 21	Go to Step 21
20	Replace EHCUC. Is action complete?	—	Go to Step 21	—

Step	Action	Value(s)	YES	NO
21	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to “Basic diagnostic flow chart”.	—

Chart 15 (DTC63/C0263) Abnormal RL Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the RL wheel bearing?	—	Go to Step 10	Go to Step 4
4	Is there play in the RL speed sensor/sensor rotor?	—	Go to Step 11	Go to Step 5
5	Is there powdered iron sticking to RL speed sensor/sensor rotor?	—	Go to Step 12	Go to Step 6
6	Check the RL speed sensor. (Refer to Chart C-1-3 or TC-1) Is the RL sensor output normal?	—	Go to Step 7	Go to Step 9
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 13	Go to Step 8
8	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 17	Go to Step 16
9	Is there damage or indentation in the speed sensor?	—	Go to Step 14	Go to Step 15
10	Adjust wheel bearing preload. Is action complete?	—	Go to Step 18	—
11	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—
12	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—
13	Replace sensor rotor. Is action complete?	—	Go to Step 18	—
14	Replace RL speed sensor. Is action complete?	—	Go to Step 18	—
15	Check the RL speed sensor circuit. Refer to Chart 11. Is action complete?	—	Verify repair	—

Step	Action	Value(s)	YES	NO
16	Check for a poor connection and an open circuit on the harness between EHCUC and sensor connectors. Refer to "Note on Intermittents" described in earlier this section. Is action complete?	—	Go to Step 18	—
17	Replace EHCUC. Is action complete?	—	Go to Step 18	—
18	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to "Basic diagnostic flow chart".	—

Chart 16 (DTC64/C0264) Abnormal RR Speed Sensor Signal

Step	Action	Value(s)	YES	NO
1	Have the vehicle been jacked up? Have two or three wheels been turned on the brake tester intentionally?	—	Be careful that the system may fail if two or three wheels are turned forcibly. The flow is now complete.	Repair tires. Go to Step 2
2	Are tire pressures, sizes and wear normal?	—	Go to Step 3	Repair tires. Go to Step 2
3	Is there play in the RR wheel bearing?	—	Go to Step 10	Go to Step 4
4	Is there play in the RR speed sensor/sensor rotor?	—	Go to Step 11	Go to Step 5
5	Is there powdered iron sticking to RR speed sensor/sensor rotor?	—	Go to Step 12	Go to Step 6
6	Check the RR speed sensor. (Refer to Chart C-1-4 or TC-1) Is the RR sensor output normal?	—	Go to Step 7	Go to Step 9
7	Is there a broken tooth or indentation in the sensor rotor?	—	Go to Step 13	Go to Step 8
8	1. Clear diagnostic trouble code. 2. Test drive and perform system self-check. Does the DTC repeat?	—	Go to Step 17	Go to Step 16
9	Is there damage or indentation in the speed sensor?	—	Go to Step 14	Go to Step 15
10	Adjust wheel bearing preload. Is action complete?	—	Go to Step 18	—
11	Repair or replace speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—
12	Repair speed sensor/sensor rotor. Is action complete?	—	Go to Step 18	—

Step	Action	Value(s)	YES	NO
13	Replace sensor rotor. Is action complete?	—	Go to Step 18	—
14	Replace RR speed sensor. Is action complete?	—	Go to Step 18	—
15	Check the RR speed sensor circuit. Refer to Chart 12. Is action complete?	—	Verify repair	—
16	Check for a poor connection and an open circuit on the harness between EHCU and sensor connectors. Refer to “Note on Intermittents” described in earlier this section. Is action complete?	—	Go to Step 18	—
17	Replace EHCU. Is action complete?	—	Go to Step 18	—
18	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	—	Go to “Basic diagnostic flow chart”.	—

UNIT INSPECTION PROCEDURE

Unit Inspection Procedure

This section describes the following inspection procedures referred to during “SYMPTOM DIAGNOSIS” and “DIAGNOSS BY ‘ABS’ WARNING LIGHT ILLUMINATION PATTERN”:

	without Tech 2	with Tech 2
Speed Sensor Output Inspection	Chart C-1-1 to C-1-4	Chart TC-1

Chart C-1-1 FL Speed Sensor Output Inspection Procedure

Step	Action	Value(s)	YES	NO
1	<ol style="list-style-type: none"> 1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Measure the AC voltage between J-177 EHCUC connector terminals 32 and 33 while turning FL wheel at a speed of 0.5 RPS. <p>Does the DVM display a voltage within the specified value?</p>	200 mV or more	Go to Step 5	Go to Step 2
2	<ol style="list-style-type: none"> 1. Disconnect FL sensor connector. 2. Using DVM, measure the resistance between J-75 sensor connector terminals 1 and 2. <p>Does the DVM display a resistance within the specified value?</p>	1.0 — 2.0 k ohms	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> 1. Locate open circuit, poor connection or short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. <p>Is action complete?</p>	—	Go to Step 5	—
4	<p>Replace FL sensor.</p> <p>Is action complete?</p>	—	Go to Step 5	—
5	<ol style="list-style-type: none"> 1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. <p>Was this step finished?</p>	—	Go to “Basic diagnostic flow chart”.	—

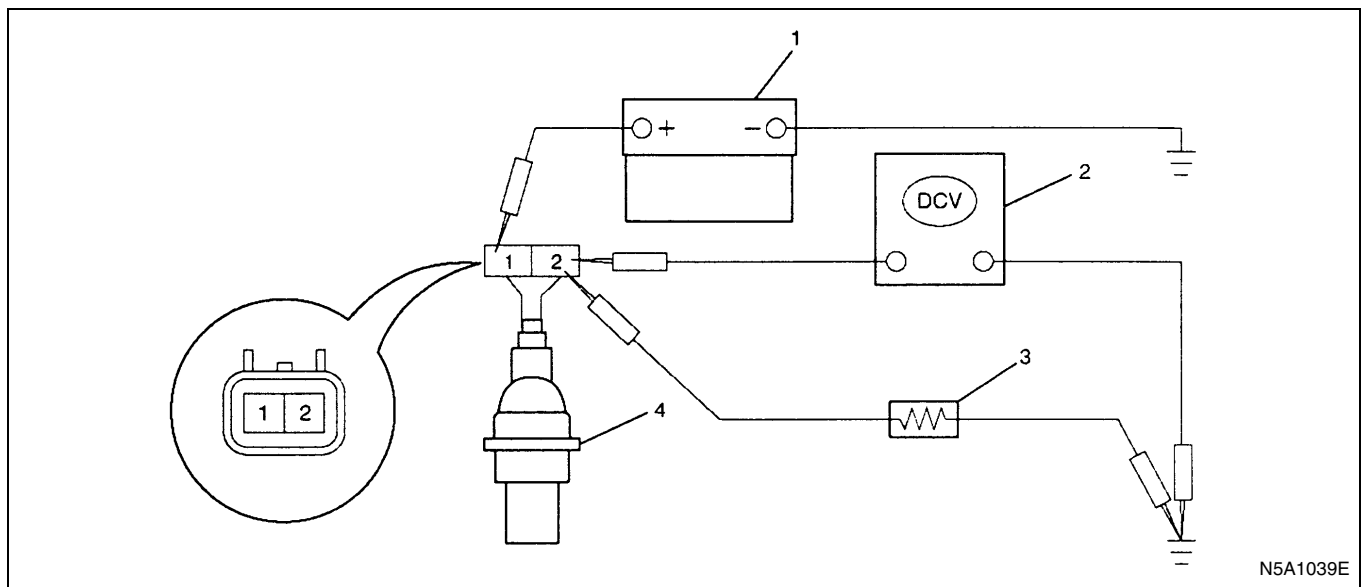
Chart C-1-2 FR Speed Sensor Output Inspection Procedure

Step	Action	Value(s)	YES	NO
1	<ol style="list-style-type: none"> 1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Measure the AC voltage between J-177 EHCUC connector terminals 10 and 11 while turning FR wheel at a speed of 0.5 RPS. <p>Does the DVM display a voltage within the specified value?</p>	200 mV or more	Go to Step 5	Go to Step 2
2	<ol style="list-style-type: none"> 1. Disconnect FR sensor connector. 2. Using DVM, measure the resistance between J-74 sensor connector terminals 1 and 2. <p>Does the DVM display a resistance within the specified value?</p>	1.0 — 2.0 k ohms	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> 1. Locate open circuit, poor connection or short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. <p>Is action complete?</p>	—	Go to Step 5	—
4	<p>Replace FR sensor.</p> <p>Is action complete?</p>	—	Go to Step 5	—
5	<ol style="list-style-type: none"> 1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. <p>Was this step finished?</p>	—	Go to "Basic diagnostic flow chart".	—

Chart C-1-3 RL Speed Sensor Output Inspection Procedure

Step	Action	Value(s)	YES	NO
1	<ol style="list-style-type: none"> 1. Turn the key off. 2. Disconnect EHCUC connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Connect a 120 ohms resistor between J-177 EHCUC connector terminal 22 and ground. Apply voltage of 12 V to EHCUC connector terminal 22. 5. Using DVM, measure the DC voltage between J-177 connector terminal 22 and ground while turning RL wheel at a speed of 0.5 RPS. <p>Does the DVM display a voltage within the specified value?</p>	0.2 — 4.5 V	Go to Step 5	Go to Step 2

Step	Action	Value(s)	YES	NO
2	<ol style="list-style-type: none"> 1. Turn the key off. 2. Disconnect RL sensor connector. 3. Connect a 120 ohms resistor between sensor connector terminal 2 (sensor side) and ground. 4. Apply 12 V voltage at sensor connector terminal 1 (sensor side). 5. Using DVM, measure the DC voltage between sensor connector terminal 2 (sensor side) and ground while turning RL wheel at a speed of 0.5 RPS. <p>Does the DVM display a voltage within the specified value?</p>	0.2 — 4.5 V	Go to Step 3	Go to Step 4
3	<ol style="list-style-type: none"> 1. Locate open circuit, poor connection short circuit on the harness between EHCUC and sensor connectors. 2. Repair the harness. <p>Is action complete?</p>	—	Go to Step 5	—
4	<p>Replace RL sensor.</p> <p>Is action complete?</p>	—	Go to Step 5	—
5	<ol style="list-style-type: none"> 1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. <p>Was this step finished?</p>	—	Go to "Basic diagnostic flow chart".	—



N5A1039E

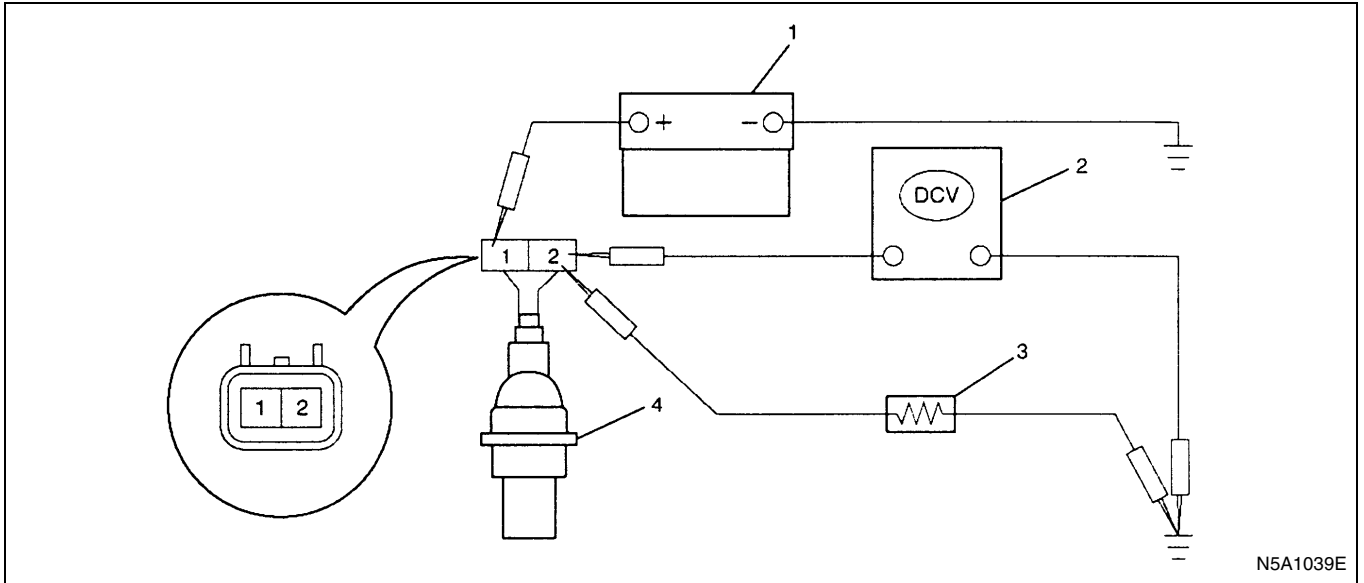
Legend

1. Battery
2. DVM

3. Resistor
4. Speed Sensor

Chart C-1-4 RR Speed Sensor Output Inspection Procedure

Step	Action	Value(s)	YES	NO
1	<ol style="list-style-type: none"> 1. Turn the key off. 2. Disconnect EHCU connector. 3. Jack up the vehicle, with all wheels off the ground. 4. Connect a 120 ohms resistor between J-177 EHCU connector terminal 21 and ground. 5. Using DVM, measure the DC voltage between J-177 connector terminal 21 and ground while turning RR wheel at a speed of 0.5 RPS. <p>Does the DVM display a voltage within the specified value?</p>	0.2 — 4.5 V	Go to Step 5	Go to Step 2
2	<ol style="list-style-type: none"> 1. Turn the key off. 2. Disconnect RR sensor connector. 3. Connect a 120 ohms resistor between sensor connector terminal 2 (sensor side) and ground. 4. Apply 12 V voltage at sensor connector terminal 1 (sensor side). 5. Using DVM, measure the DC voltage between sensor connector terminal 2 (sensor side) and ground while turning RR wheel at a speed of 0.5 RPS. <p>Does the DVM display a voltage within the specified value?</p>	0.2 — 4.5 V	Go to Step 3	Go to Step 4
3	<ol style="list-style-type: none"> 1. Locate open circuit, poor connection short circuit on the harness between EHCU and sensor connectors. 2. Repair the harness. <p>Is action complete?</p>	—	Go to Step 5	—
4	<p>Replace RR sensor.</p> <p>Is action complete?</p>	—	Go to Step 5	—
5	<ol style="list-style-type: none"> 1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. <p>Was this step finished?</p>	—	Go to "Basic diagnostic flow chart".	—



Legend

- 1. Battery
- 2. DVM
- 3. Resistor
- 4. Speed Sensor

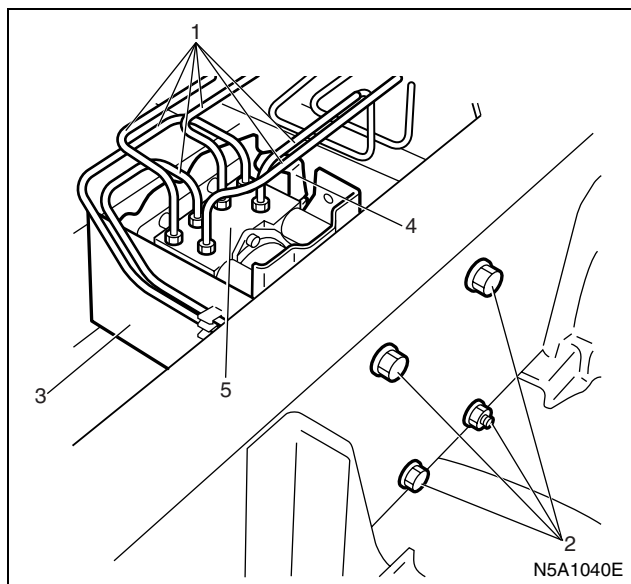
Chart TC-1 Sensor Output Inspection Procedure (Use Tech 2)

Step	Action	Value(s)	YES	NO
1	1. Connect Tech 2. 2. Check the minimum speed of each sensor by WHEEL SENSORS. Is sensor speed within the specified value?	More than 4 km/h (3 mph)	Go to Step 2	Go to Step 6
2	Check the sensor harness for suspected disconnection (check while shaking harness/connector). Is the sensor harness connection normal?	—	Replace speed sensor. Go to Step 3	Repair. Go to Step 2
3	Check the minimum speed of each sensor by WHEEL SENSORS. Is sensor speed within the specified value?	More than 4 km/h (3 mph)	Go to Step 4	Go to Step 6
4	Check the sensor rotor. Is the sensor rotor normal?	—	Go to Step 5	Replace sensor rotor. Go to Step 5
5	Check the minimum speed of each sensor by WHEEL SENSORS. Is sensor speed within the specified value?	More than 4 km/h (3 mph)	Repair harness or connector between EHCUC and speed sensor. Go to Step 6	Go to Step 6
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	—	Repeat the "Basic diagnostic flow chart".	—

ON-VEHICLE SERVICE

Electronic Hydraulic Control Unit (EHCUC)

Removal



Legend

1. Brake Pipe
2. EHCUC Bracket Fix Bolt & Nut
3. EHCUC Bracket
4. Harness Connector
5. EHCUC

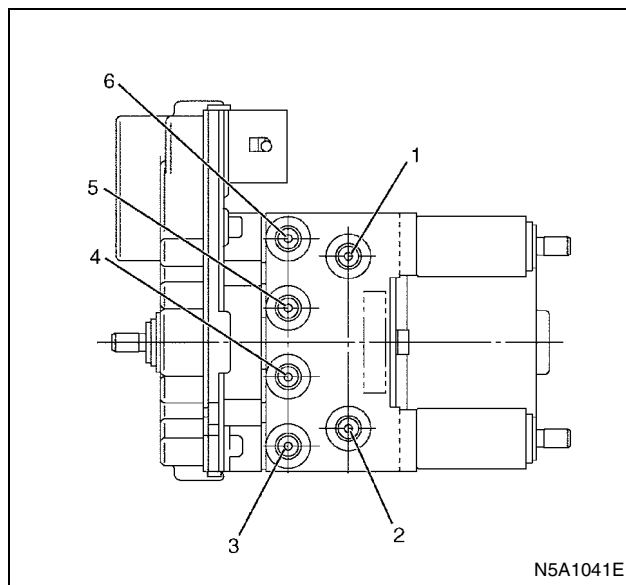
1. Disconnect battery ground cable.
2. Disconnect brake pipes.
3. Remove EHCUC bracket fix bolts & nut.
4. Remove EHCUC bracket.
5. Remove EHCUC.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

Notice:

- If welding work is to be performed on the vehicle using an electric arc welder, the EHCUC should be removed from the vehicle before the welding operation begins.
- Do not put a radio equipment etc, that emits strong radio wave near the EHCUC.
- Do not wet the control unit. If wetted, wipe off water immediately and dry it fully.
- Never loosen any screw on the control unit.
- Do not paint the control unit.
- Prevent possible electrostatic discharge damage.
- Do not touch the control unit pin type terminal with a metallic tip of a screwdriver or tester.
- Do not apply voltage to the terminal.

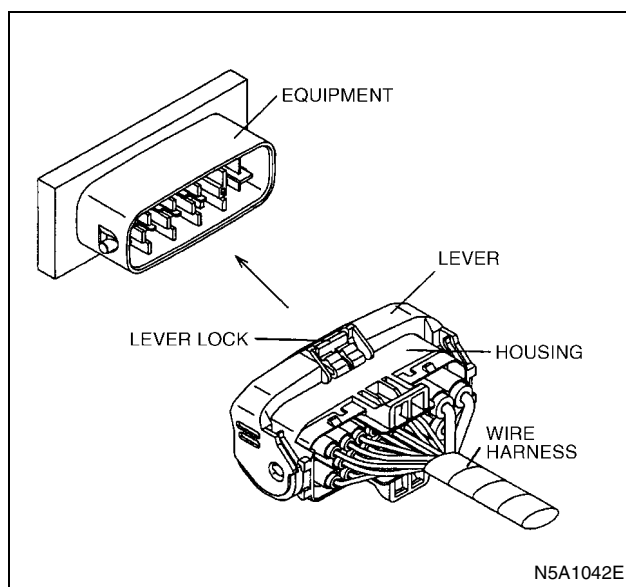


Legend

1. Master Cylinder (front)
2. Master Cylinder (rear)
3. Rear Right Wheel Cylinder
4. Rear Left Wheel Cylinder
5. Front Right Wheel Cylinder
6. Front Left Wheel Cylinder

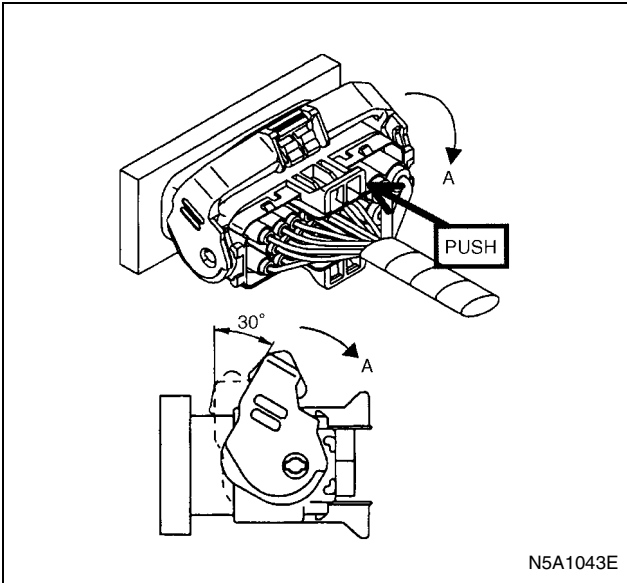
Methods of Matching and Taking Off Connectors

Before Matching



Semi Matching

Wire harness side connector should be inserted to equipment side, then lever folds up about 30°.

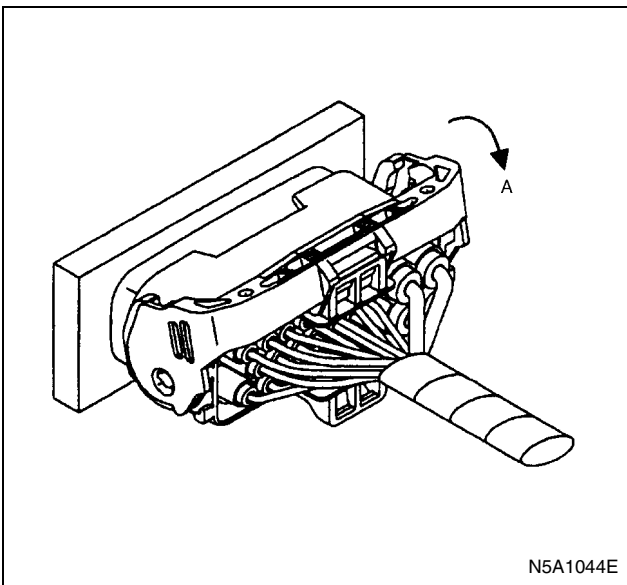


Notice:

Check the lever folding up.

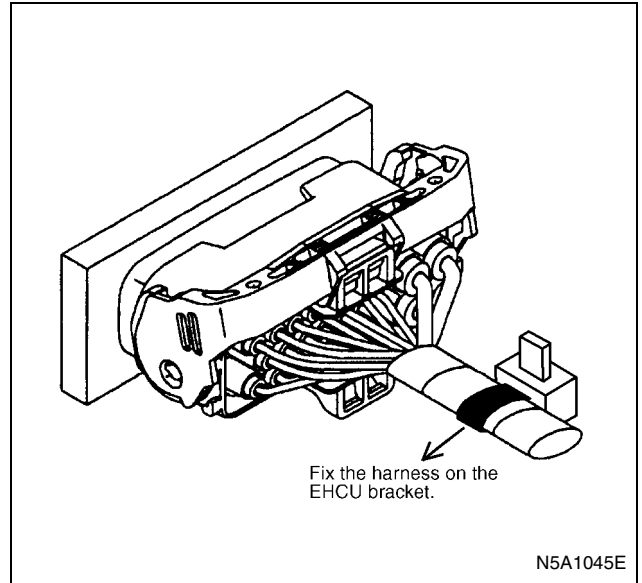
Matching

Turn the lever to direction A and fix the lever lock to the housing.



Finished Matching

On a vehicle in which the harness is clamped onto the EHCUC bracket, clamp the harness after matching the connectors.

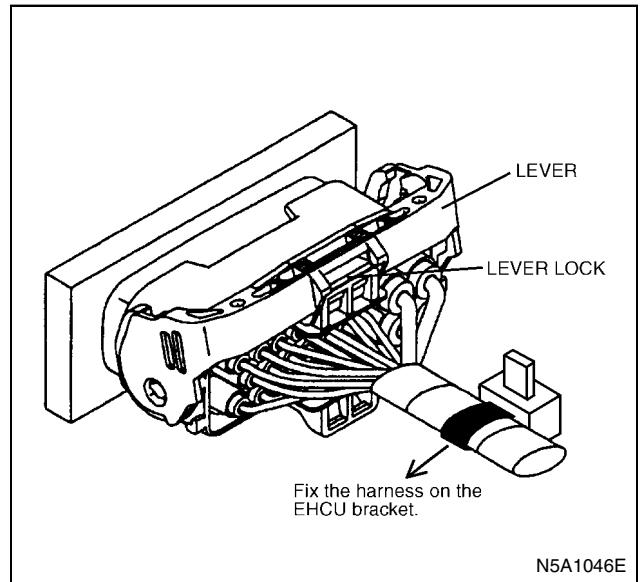


Notice:

Check the lever lock is fixed to housing certainly. The lever or housing can be broken by turned to direction A without the lever folding up (30°).

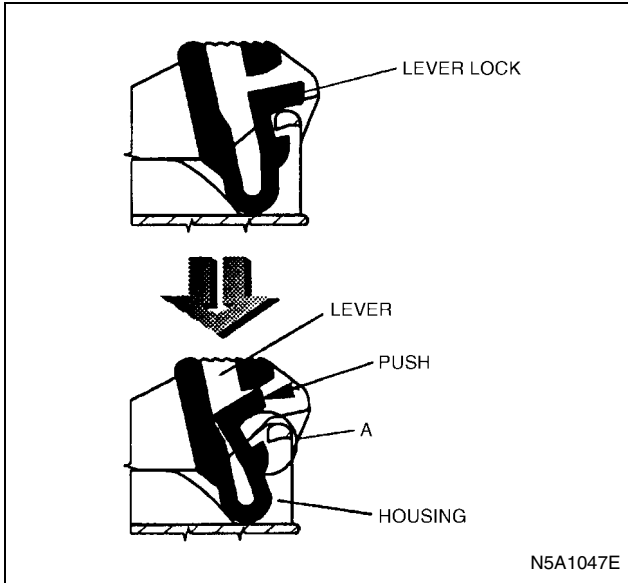
Condition of Matching

On a vehicle in which the harness is clamped onto the EHCUC bracket, loosen the before taking off the connectors.



Release of Lock

Push lever lock down until the condition it can be released.



Notice:

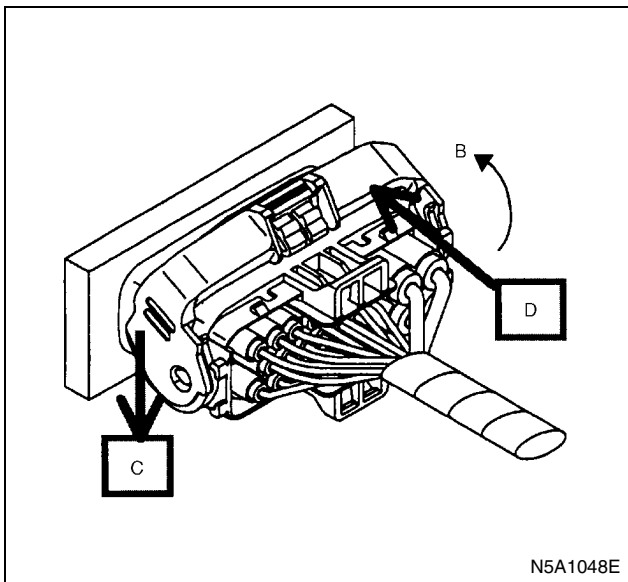
Check division A can be released.

Taking Off

Turn the lever to direction B.

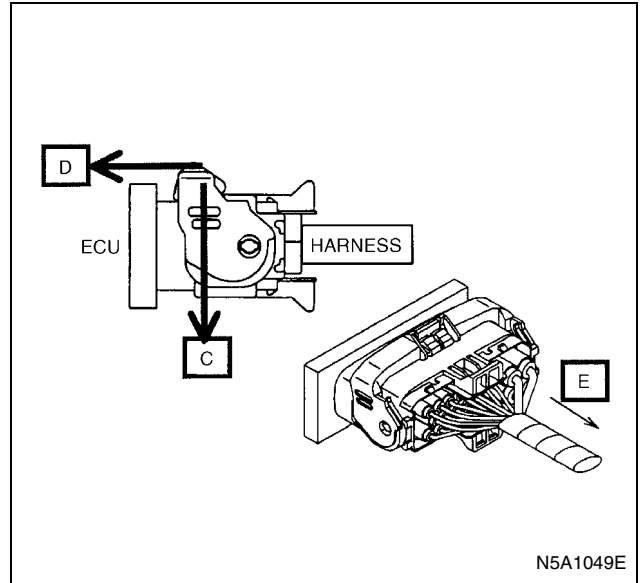
When you feel the lever heavy in your hand (after turning about 40 degrees), turn the lever in the direction of C.

The lever will not turn and the connector may fail if force is applied in the direction of D.



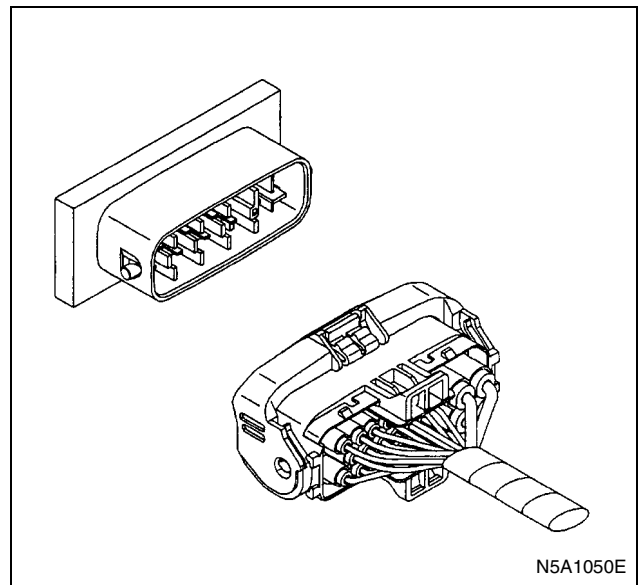
Notice:

The lockarm can be broken by being turned to direction B in case of incomplete locking.

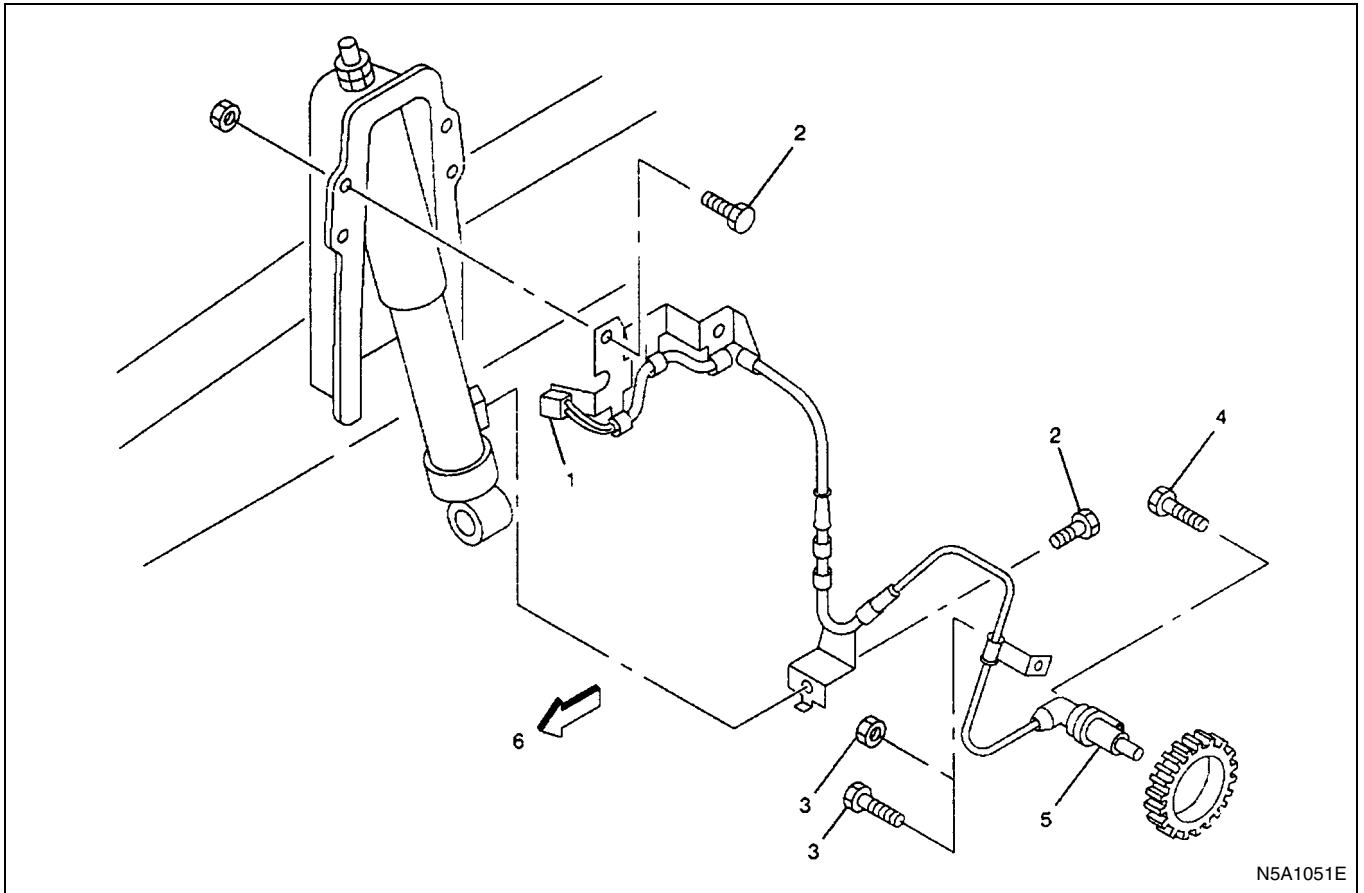


Check the lever is turned certainly and take connector off to direction E.

Finished Taking Off



Front Speed Sensor Components



N5A1051E

Legend

- | | |
|--|-----------------------|
| 1. Speed Sensor Connector | 4. Sensor Fixing Bolt |
| 2. Sensor Cable Fixing Bolt | 5. Speed Sensor |
| 3. Sensor Cable Fixing Bolt (Front Disc Brake model)
Sensor Cable Fixing Nut (Front Drum Brake model) | 6. Front |

Removal

1. Remove speed sensor connector.
2. Remove sensor cable fixing bolts and/or nut.
3. Remove the speed sensor fixing bolt.
4. Remove speed sensor.

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage; replace speed sensor if necessary.
3. Check the speed sensor cable for short or open circuit, and replace with a new one if necessary. To check for cable short or open, bend or stretch the cable while checking for continuity.

Installation

1. Install speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install speed sensor fixing bolt and tighten the fixing bolt to the specified torque.

Tighten:

Bolt to 22 N·m (2.2 kg·m/16 lb·ft)

3. Install speed sensor cable fixing bolts and tighten the fixing bolt to the specified torque.

Tighten:

Bolts (2) to 22 N·m (2.2 kg·m/16 lb·ft)

Bolts (3) to 45 N·m (4.6 kg·m/33 lb·ft)

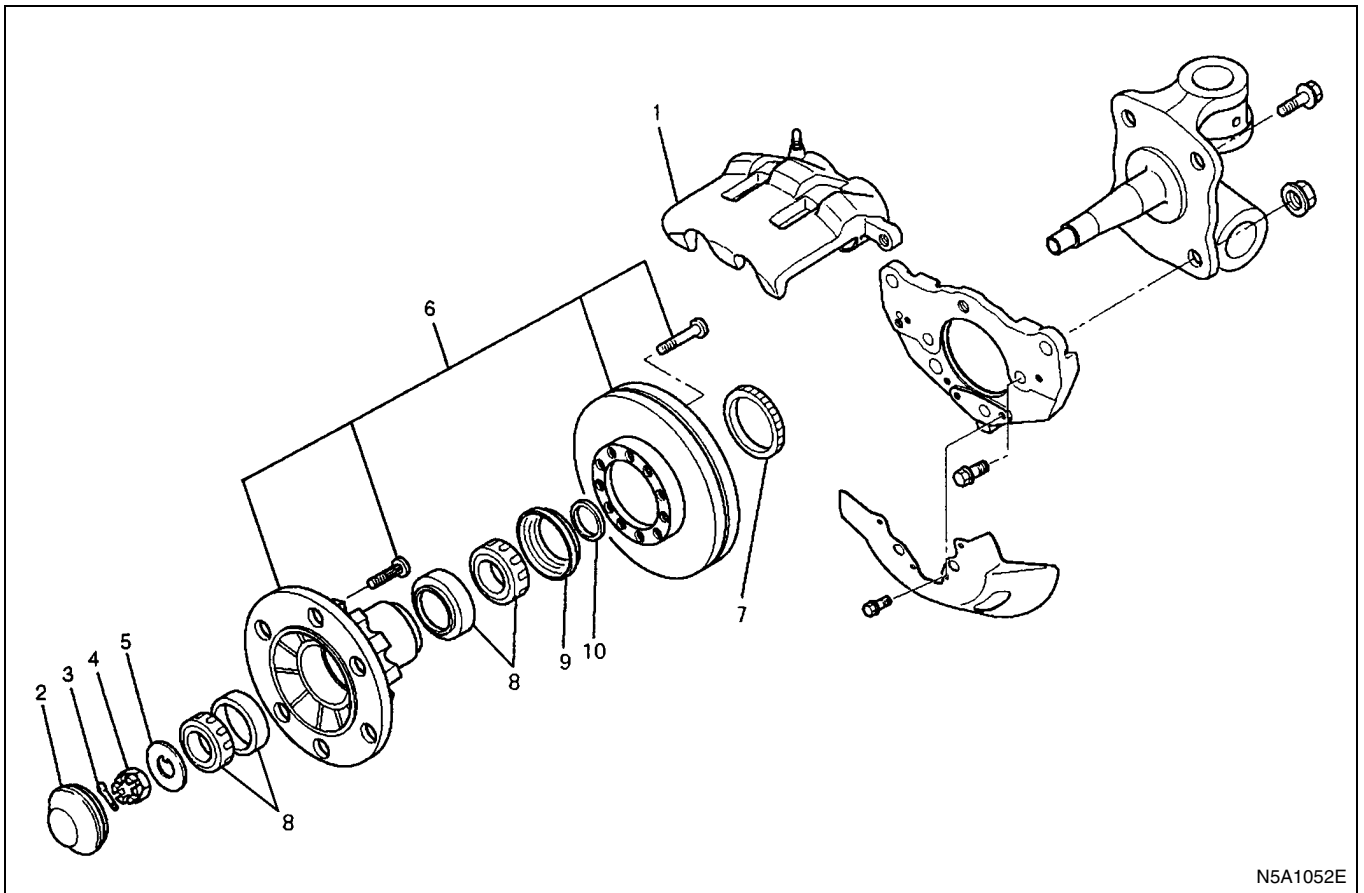
Nut (3) to 15 N·m (1.5 kg·m/11 lb·ft)

Notice:

Confirm that a white or yellow line marked on the cable is not twisted when connecting the speed sensor cable.

4. Connect speed sensor connector.

Front Speed Sensor Rotor Components



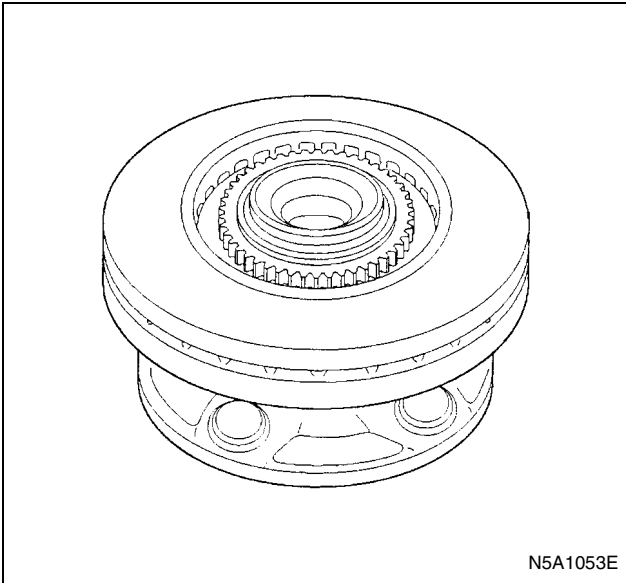
N5A1052E

Legend

- | | |
|------------------------|------------------------------------|
| 1. Disc Brake Assembly | 6. Hub and Disc Assembly |
| 2. Hub Cap | 7. Speed Sensor Rotor |
| 3. Cotter Pin | 8. Inner Bearing and Outer Bearing |
| 4. Hub Nut | 9. Oil Seal |
| 5. Washer | 10. Spacer |

Removal

1. Remove disc brake assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
2. Remove hub cap.
3. Remove cotter pin and hub nut.
4. Remove washer.
5. Remove hub and disc assembly.



6. Remove speed sensor rotor.
7. Remove inner bearing, oil seal spacer.

Inspection and Repair

1. Check the speed sensor rotor for damage including tooth chipping, and if damaged, replace the speed sensor rotor.

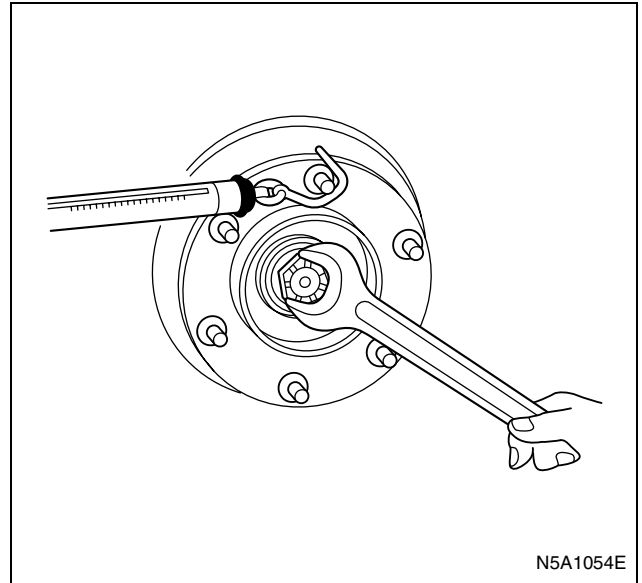
Installation

1. Using a bench press, install speed sensor rotor.
2. Install spacer onto the knuckle spindle.
3. Apply grease into the outer and inner bearings and install bearings in the hub.
4. Install oil seal into hub and disc assembly and install hub and disc assembly on to the knuckle spindle.

Preload Adjustment

Adjust the wheel bearing as follows:

1. Tighten the nut until you are unable to manually rotate the hub and disc assembly.
2. Loosen the nut.
3. Attach a spring balancer to one stud. Gradually re-tighten the nut until the hub and disc assembly bearing is adjusted to the specified preload.
 - Hub bearing preload
 New Hub Bearing: 9.8 — 24.5 N (1 — 2.5 kg/ 2.2 — 5.5 lb)
 Reused Hub Bearing: 4.9 — 19.6 N (0.5 — 2 kg/1.1 — 4.4 lb)

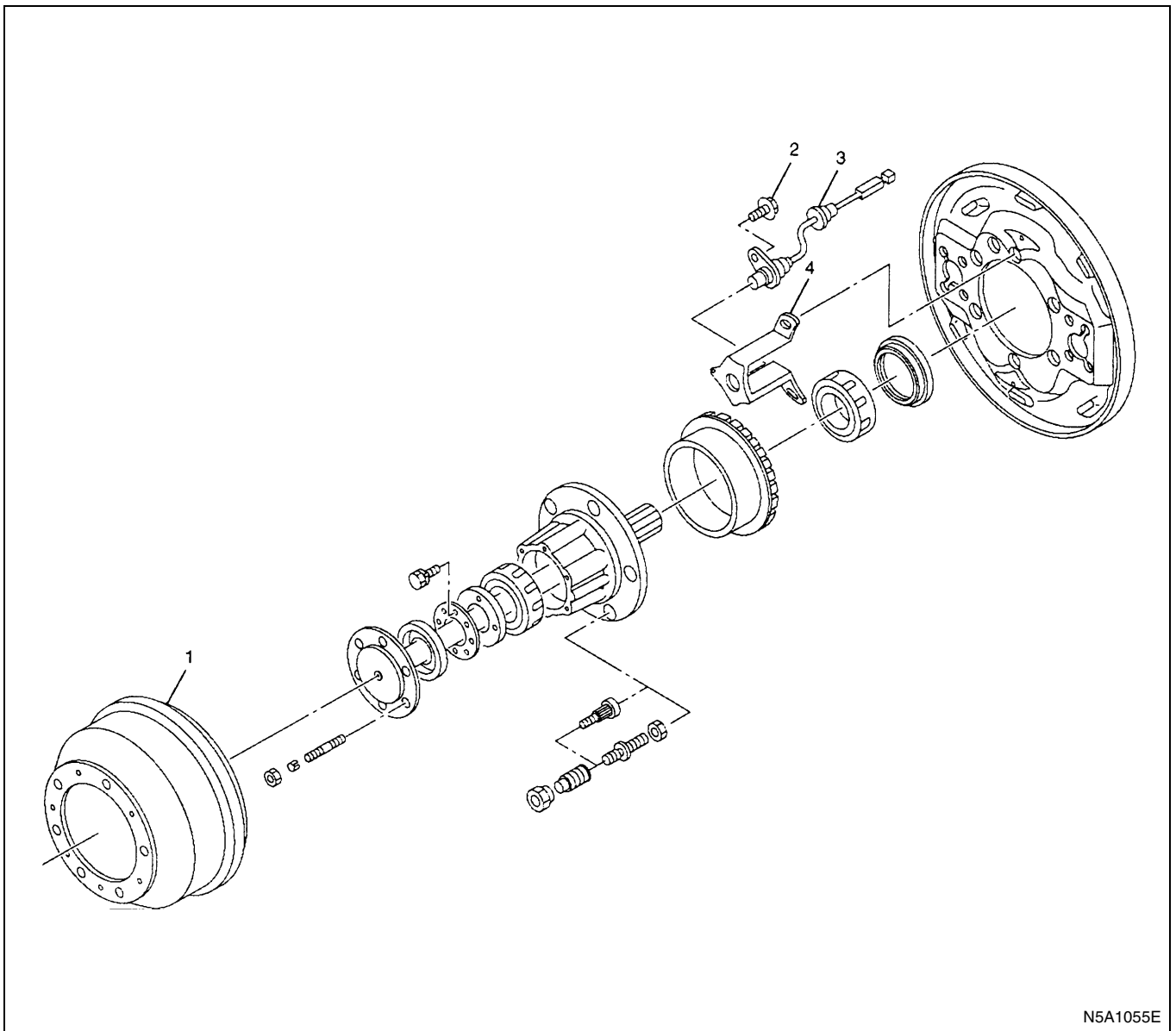


4. Install a cotter pin through the nut and knuckle and bend it over.
 - If the notch in the nut does not line up with the cotter pin hole in the knuckle, tighten the nut until it does. Do not loosen the nut to line up a notch and the knuckle hole.
5. Apply grease into the hub cap and install it.
 - 0.4 N (40 g/0.09 lb)
6. Install the disc brake assembly and tighten two bolts to the specified torque.

Tighten:

Bolts to 221 N·m (22.5 kg·m/163 lb·ft)

Rear Speed Sensor Components

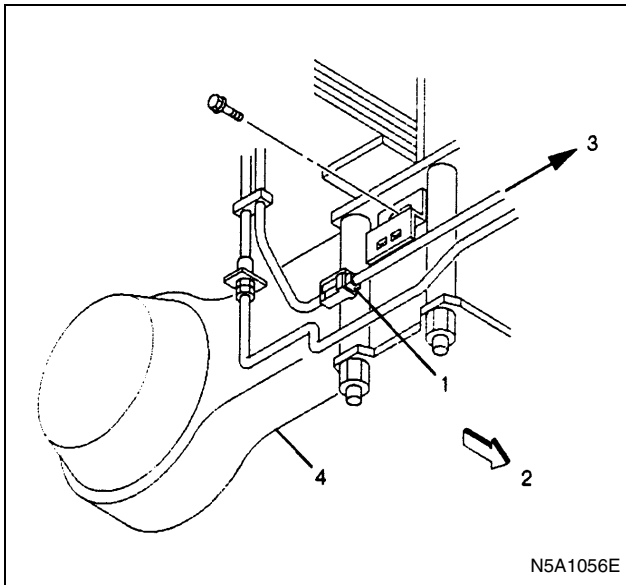


N5A1055E

Legend

- | | |
|-----------------------------|-------------------------|
| 1. Brake Drum | 3. Speed Sensor |
| 2. Speed Sensor Fixing Bolt | 4. Speed Sensor Bracket |

Removal



Legend

1. Speed Sensor Connector
2. Front
3. Speed Sensor
4. Rear Axle

Tighten:

Bolt to 18 N·m (1.8 kg·m/13 lb·ft)

4. Install brake drum and tighten bolts to the specified torque.

Tighten:

Bolts to 13 N·m (1.3 kg·m/9.5 lb·ft)

5. Connect speed sensor connector.

Notice:

Confirm that the harness is not twisted when connecting the speed sensor connector.

1. Disconnect speed sensor connector.
2. Remove brake drum.
3. Remove speed sensor fixing bolt.
4. Remove speed sensor.
5. Remove speed sensor bracket.

Inspection and Repair

1. Check the speed sensor for presence of foreign materials; remove any dirt, etc.
2. Check the speed sensor for damage, and replace the speed sensor if necessary.
3. Check the speed sensor harness for a short or an open, and replace with a new one if necessary. To check for harness short or open, bend or stretch the cable while checking for continuity.

Installation

1. Install speed sensor bracket and tighten the nut to the specified torque.

Tighten:

Nut to

GVW Range 12,000 lbs. and 14,500 lbs. model:

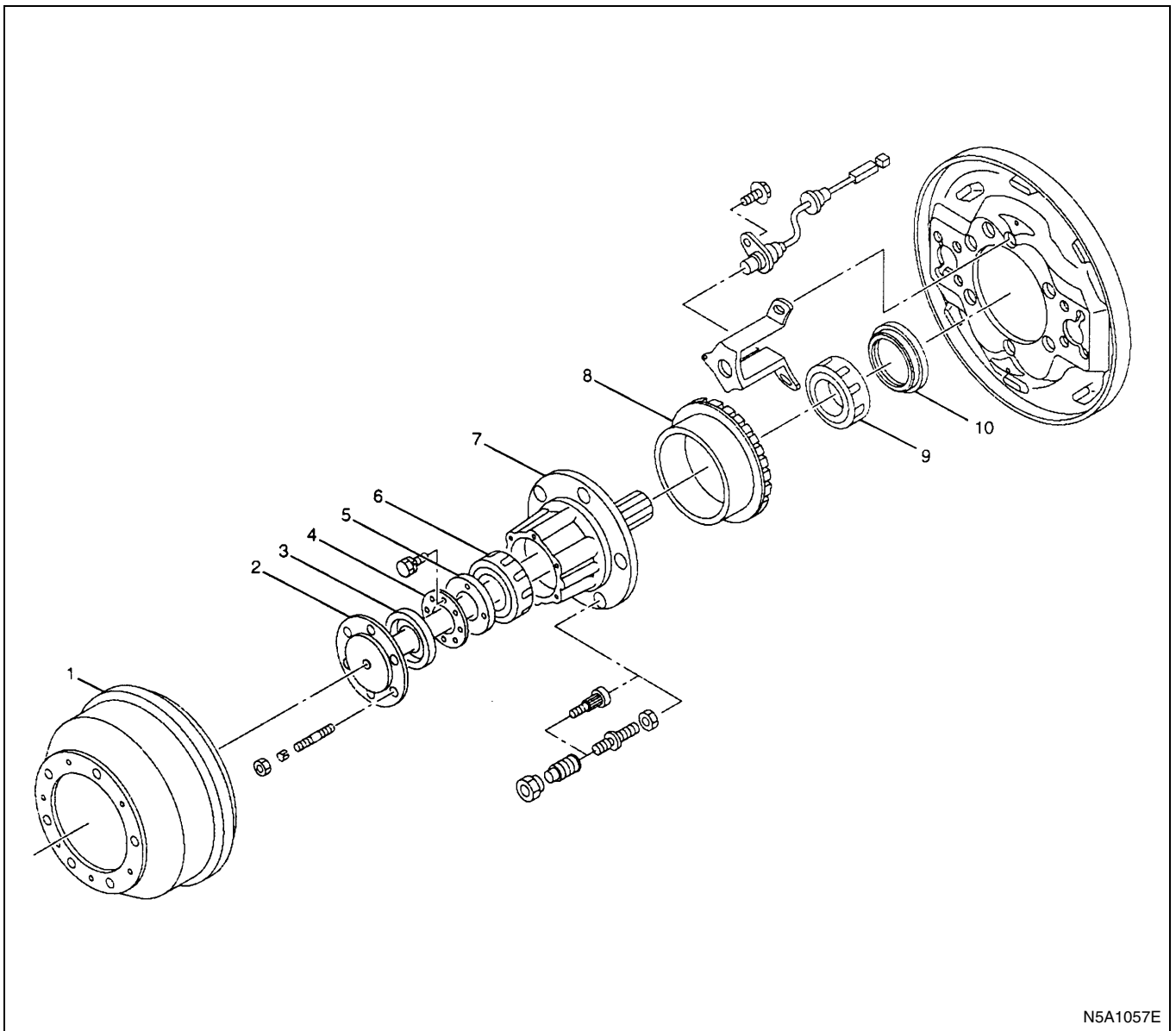
108 N·m (11 kg·m/80 lb·ft)

GVW Range 17,950 lbs. model:

157 N·m (16 kg·m/116 lb·ft)

2. Install the speed sensor and take care not to hit the speed sensor during installation.
3. Install the speed sensor fixing bolt and tighten it to the specified torque.

Rear Speed Sensor Rotor Components



N5A1057E

Legend

- | | |
|-------------------|-----------------------|
| 1. Brake Drum | 6. Outer Bearing |
| 2. Axle Shaft | 7. Rear Hub |
| 3. Outer Oil Seal | 8. Speed Sensor Rotor |
| 4. Lock Washer | 9. Inner Bearing |
| 5. Bearing Nut | 10. Inner Oil Seal |

Removal

1. Remove brake drum.
2. Remove axle shaft.
3. Remove outer oil seal, using a screwdriver.
4. Remove lock washer.
5. Remove bearing nut with a hub bearing nut wrench.
6. Remove hub assembly from axle case.
7. Remove outer bearing from hub assembly.

8. Remove speed sensor rotor from hub assembly.
9. Remove inner bearing and inner oil seal from axle case.

Inspection and Repair

1. Check the speed sensor rotor for damage including tooth chipping. If damaged, replace speed sensor rotor.

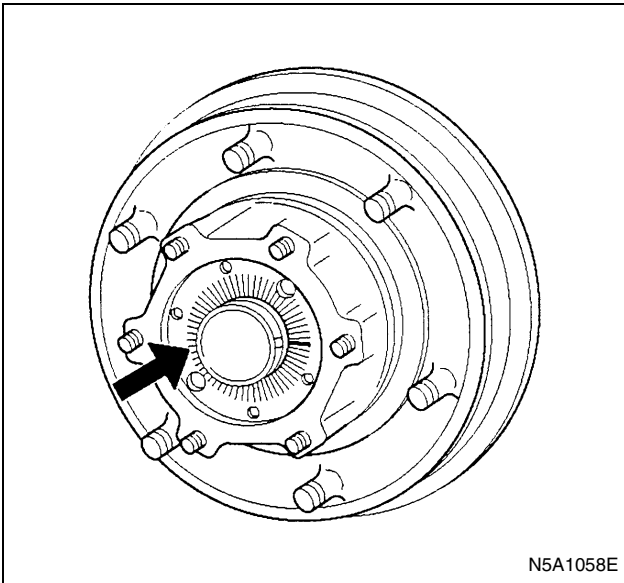
Installation

1. Using a bench press, install speed sensor rotor.

Notice:

Do not reuse the sensor rotor.

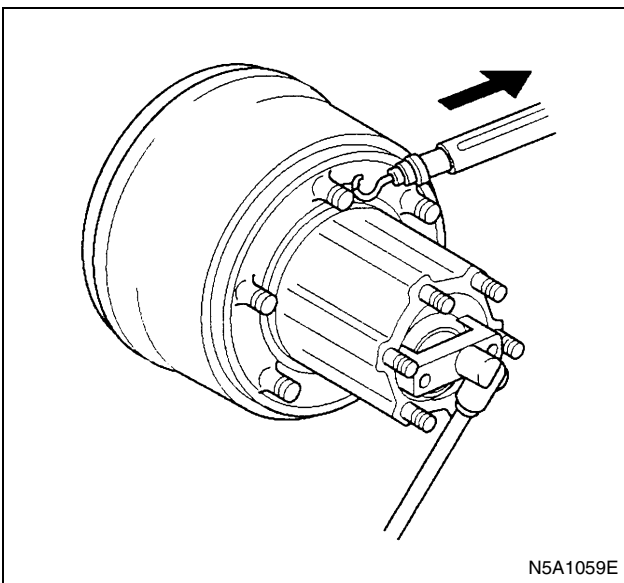
2. Install spacer on to the axle case.
3. Apply grease into the outer and inner bearings and install bearings in the hub.
4. Install outer oil seal into hub.
5. Install hub assembly onto the axle case.



6. Set the lock nut with the notched line facing out.

Preload Adjustment

- 1) Turn the hub to the left and right several times to establish bearing conformity.
- 2) Use the bearing nut wrench to tighten the bearing nut until the hub can not be manually rotated.
- 3) Loosen the bearing nut until hub rotates easily.



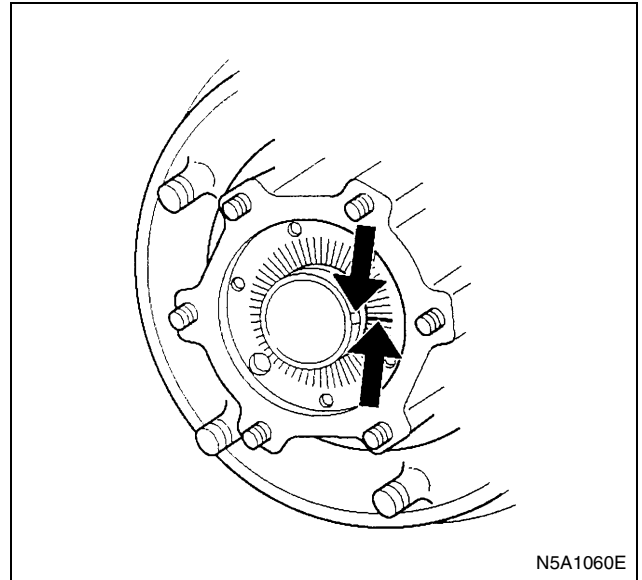
- 4) Set the spring balancer to the wheel pin in the position shown in the illustration.

- 5) Measure the hub bearing preload by carefully pulling on the spring balancer and noting the indicator reading.

Hub Bearing Preload (At Wheel Pin):

42 — 52 N (4.3 — 5.3 kg/9.4 — 11.6 lb)

- 6) Rotate the hub several times to the right and left.
- 7) Measure the bearing preload a second time.



- 8) Align the axle case groove with the closest bearing nut slit.

Notice:

If it is difficult to align the axle case and bearing nut, slightly tighten the bearing nut.

7. Install the lock washer with the lock washer tabs inserted to the axle case grooves. Install the lock bolts to prevent the bearing nut from loosening. Check that the lock washer tabs are inserted to the axle case grooves.
8. Apply grease to the outer oil seal lip inner and outer circumferences and install outer oil seal.
9. Clean the axle shaft. Apply gear oil to the axle shaft spline. Insert the axle shaft into the axle case. Take care not to damage the oil seal.
10. Tighten the axle shaft nuts to the specified torque a little at a time.

Tighten:

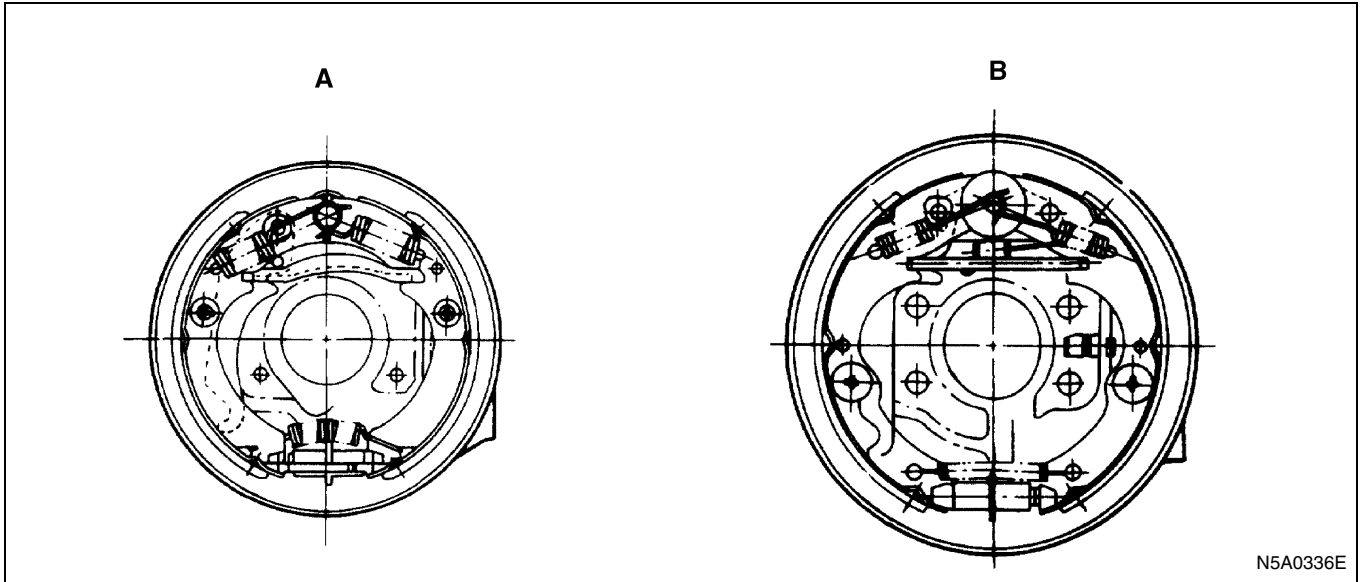
Nuts to 46 N·m (4.7 kg·m/34 lb·ft)

11. Install brake drum.

PARKING BRAKES

GENERAL DESCRIPTION

Parking Brake Assembly

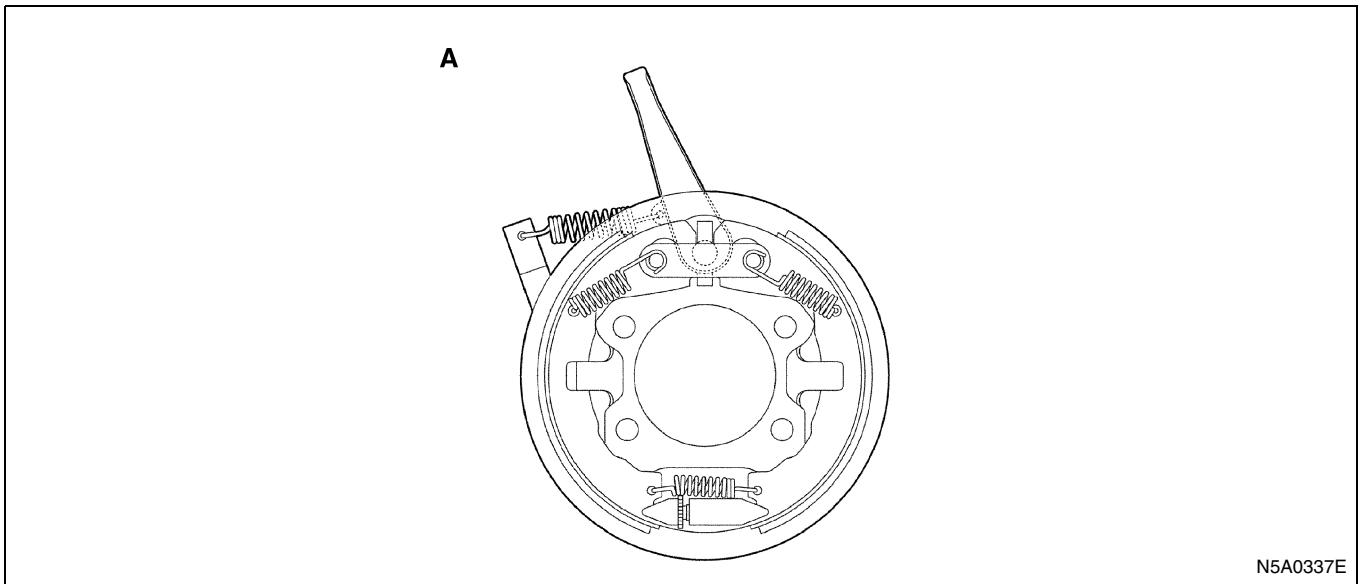


N5A0336E

Legend

A. 178 mm type

B. 190 mm type



N5A0337E

Legend

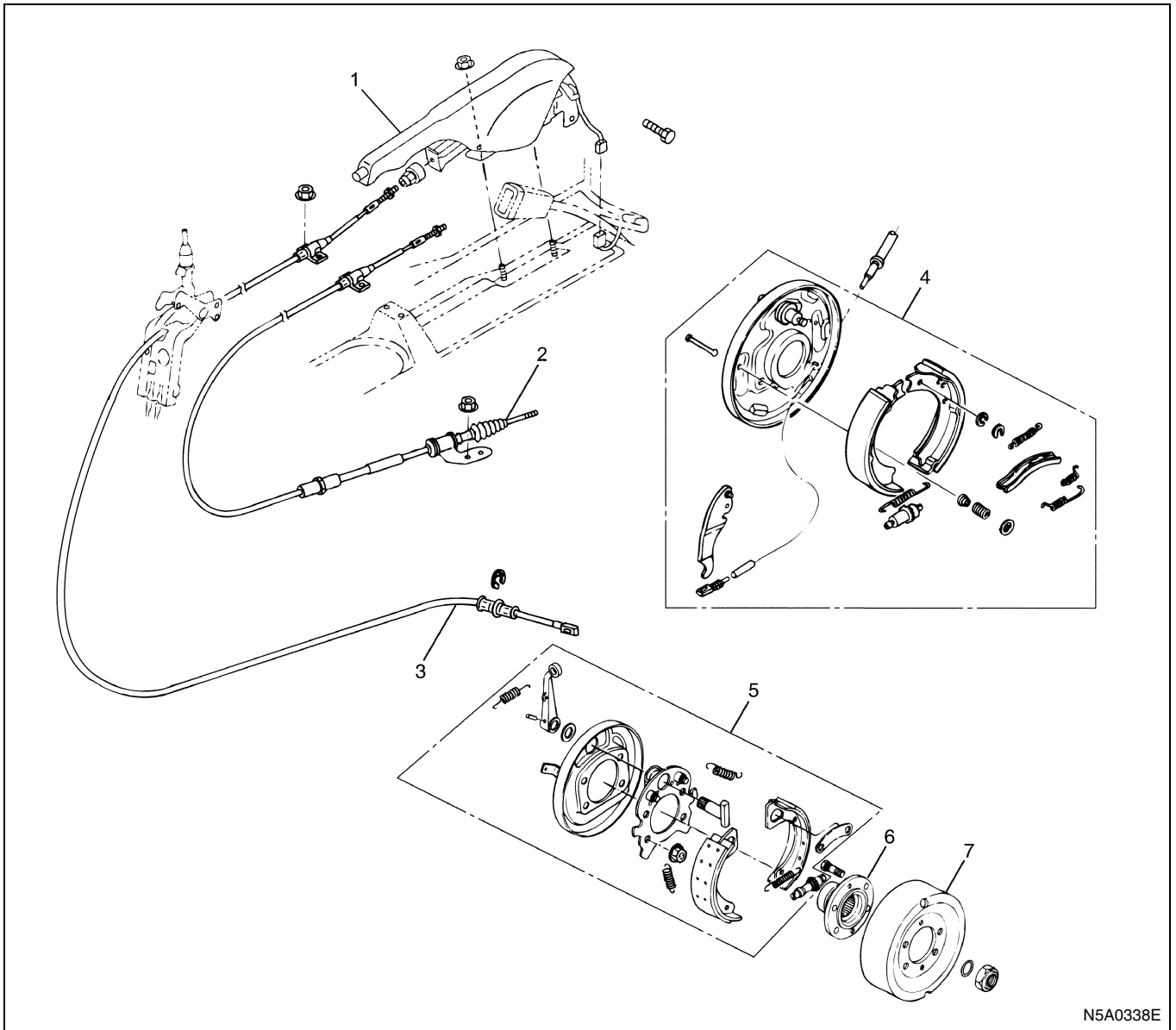
A. 203 mm type

The parking brake is a mechanically operated internal-expanding type drum brake. It is mounted on the rear of the transmission case.

The control cable is routed into the vehicle cab where it is connected to the parking brake lever.

PARKING BRAKE ASSEMBLY, PARKING BRAKE LEVER

Components



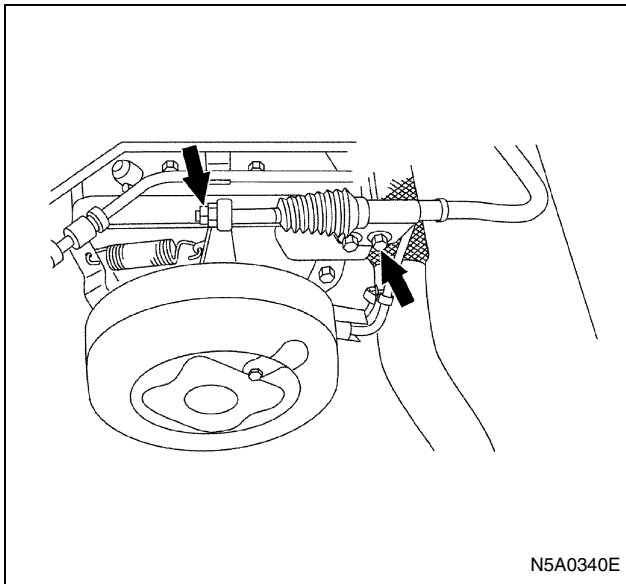
Legend

- | | |
|--|---|
| 1. Parking brake lever assembly | 5. Parking brake assembly (203 mm TYPE) |
| 2. Parking brake cable (203 mm TYPE) | 6. Coupling driver |
| 3. Parking brake cable (178, 190 mm TYPE) | 7. Parking brake drum |
| 4. Parking brake assembly (178, 190 mm TYPE) | |

Removal

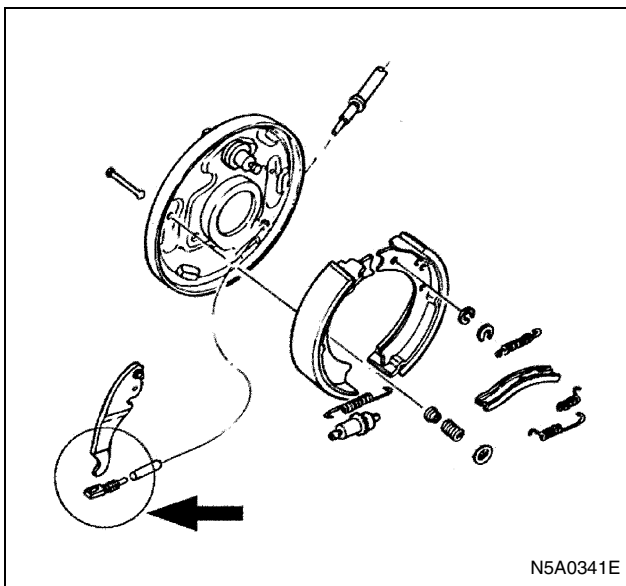
1. Jack up the body, and support the frame with the stand.
Refer to "LIFTING INSTRUCTION" in Section 0A GENERAL INFORMATION.
2. Remove the rear propeller shaft.
 - Disconnect the propeller shaft from the transmission.
 - Remove the center bearing bracket as well in the case of the long type.
3. Loosen the coupling driver lock nut.
 - Apply the parking brake, completely raise the latch of the lock nut for the coupling driver, and loosen the lock nut. Then, release the parking brake.
4. Disconnect the parking brake cable.
 - 203 mm TYPE
 - Remove the lock nut from the lever of the parking brake assembly.

- Remove the mounting bolt from the cable bracket, and disconnect the parking brake cable from the transmission.



N5A0340E

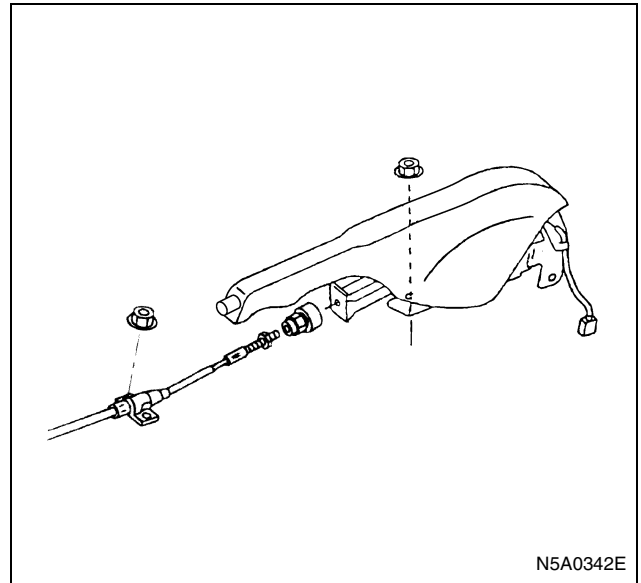
- 178, 190 mm TYPE
 - Remove the parking brake drum.
 - Disconnect the cable from the lever of the parking brake assembly.



N5A0341E

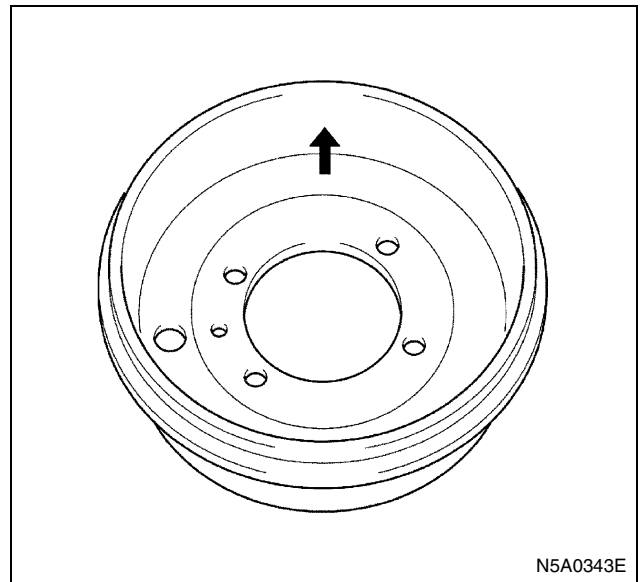
5. Remove the parking brake drum.
 - Remove the adjusting hole cover and the parking brake drum.
6. Remove the coupling driver.
 - Remove the lock nut that was loosened in step 3, and remove the coupling driver using a universal puller.
7. Remove the parking brake assembly.
8. Remove the parking brake lever assembly.
 - Loosen the adjusting nut, and disconnect the parking brake cable from the lever.
 - Disconnect the connector.

- Loosen the retaining nut, and remove the parking brake lever assembly.



N5A0342E

9. Inspect the parking brake drum.
 - Inspect the parking brake drum for damage, wear, step wear, or cracking. If any defect is found, correct or replace the parking brake drum with a new one.
 - Measure the inside diameter of the parking brake drum.



N5A0343E

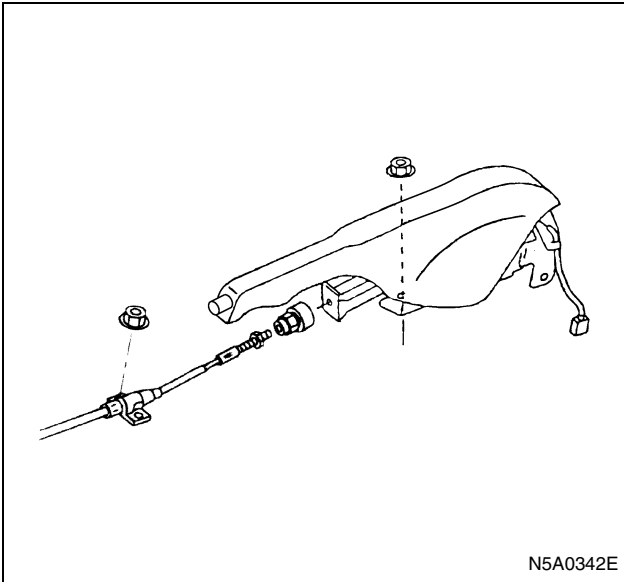
Drum inside diameter
 178 mm (7.00 in) type parking brake
 Standard value = 178 mm (7.00 in), limit = 179 mm (7.05 in)
 190 mm (7.48 in) type parking brake
 Standard value = 190 mm (7.48 in), limit = 191 mm (7.52 in)
 203 mm (7.99 in) type parking brake
 Standard value = 203 mm (7.99 in), limit = 204 mm (8.03 in)

Notice:

Correct the drum inside diameter by grinding to the appropriate limit.

Installation

1. Mount the parking brake lever assembly.
 - Mount the parking brake lever assembly, connect the parking brake cable, and properly tighten the adjusting nut.



2. Mount the parking brake assembly.
 - 178 mm type parking brake

Tighten:

M12 nut to 113 N·m (11.5 kg·m/83.3 lb-ft)

M8 bolt to 25 N·m (2.6 kg·m/18.4 lb-ft)

- 190 mm type parking brake
 - Wash the stud bolt and the bolt hole with volatile oil (thinner, alcohol, etc.).
 - Apply Loctite #638 to the embedded side (guide side) of the stud bolt and the bolt hole.
 - Attach the stud bolt (M12).

Tighten:

Stud bolt to 49 N·m (5.0 kg·m/36.1 lb-ft)

- Mount the parking brake assembly, and fasten it with the caulking nut (M12).

Tighten:

Caulking nut to 126.5 N·m (12.9 kg·m/93.3 lb-ft)

- 203 mm type parking brake

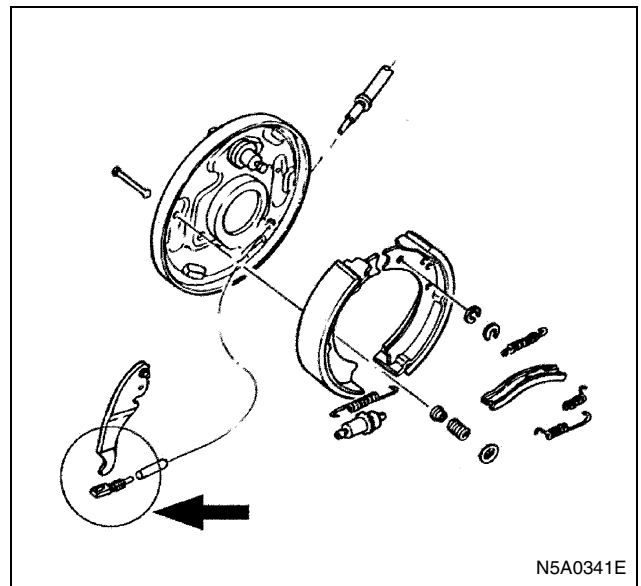
Tighten:

127 N·m (13.0 kg·m/93.7 lb-ft)

3. Connect the parking brake cable.
 - Connect the parking brake cable to the lever of the parking brake assembly (178, 190 mm TYPE).

Notice:

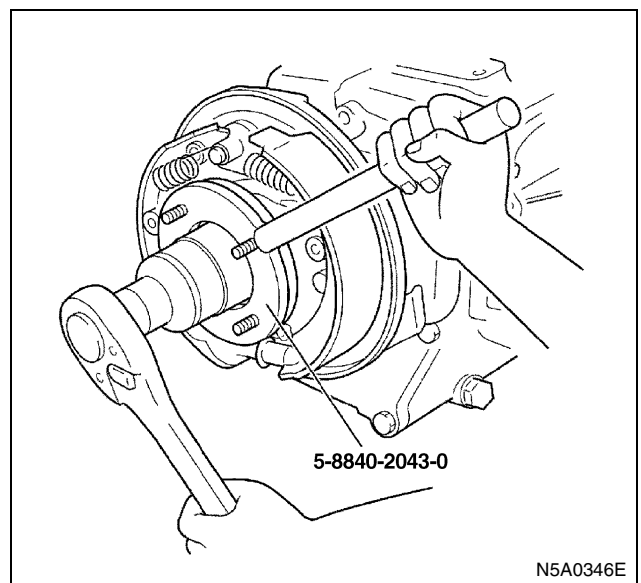
Confirm that the portion indicated by the arrow is properly connected.



4. Mount the coupling driver.
 - Attach the coupling driver to the main shaft, and fasten it with an O-ring, a conical washer (MSB only), and a lock nut.

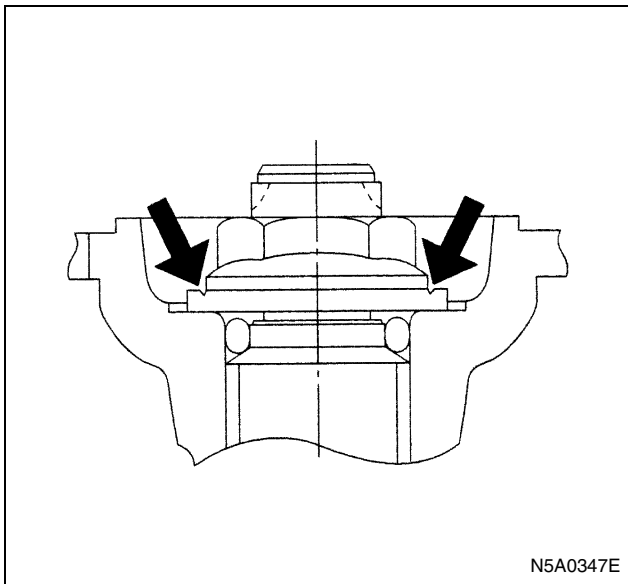
Tighten the lock nut while holding the coupling driver with a handle 5-8840-2043-0.

Tightening torque	N·m (kg·m/lb-ft)
MSB type transmission	226 (23.0/166.7)
MYY type transmission	289 (29.5/213.2)
MZZ type transmission	382 (39.0/281.8)

**Notice:**

- Use a new lock nut because it is a caulking type. Apply oil to the seating face before attaching the lock nut.

- Use a new O-ring. Apply a thin coat of lubricating oil to the O-ring before attaching it.
- Attach the conical washer (MSB only) with the identification groove facing the lock nut (rear side).

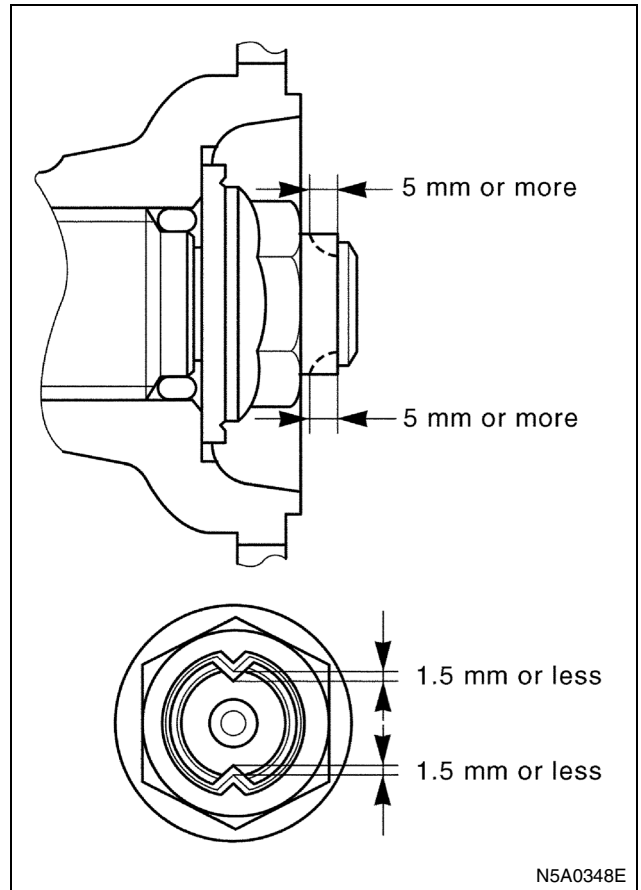


5. Caulk the lock nut.

- Align the lip of the lock nut with the V-grooves cut in the tip of the main shaft, and securely caulk the lock nut at two points so that the caulking length will be 5 mm (0.2 in) or more and the clearance between the lower V-groove in the main shaft and the lock nut lip will be 1.5 mm (0.06 in) or less.

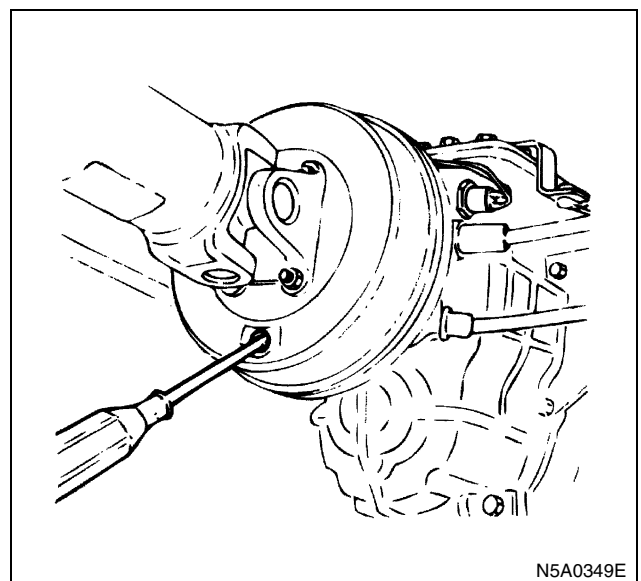
Notice:

After the caulking of the lock nut, check the caulked points for cracking. If there is any crack, replace the lock nut with a new one, and caulk it.



6. Mount the parking brake drum.

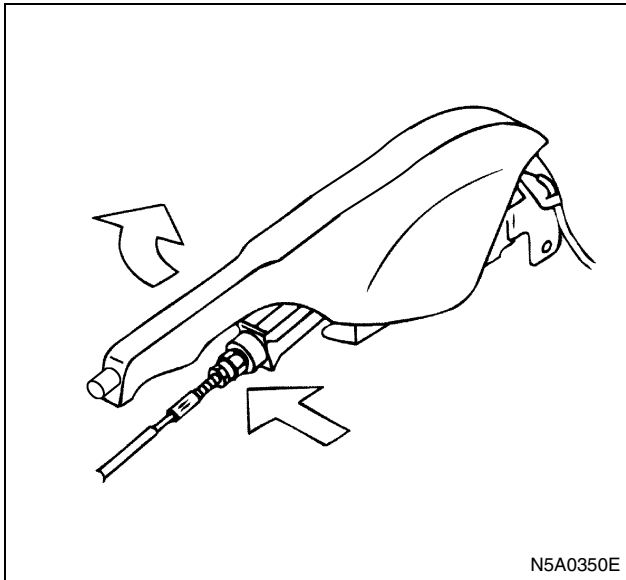
7. Adjust the pulling allowance of the parking brake.
- Turn the adjuster until the parking brake drum stops turning. (Turn the parking brake drum downward in the case of vehicles with a 203 mm type or upward in the case of vehicles other than 203 mm type.)
 - Turn back the adjuster by the specified number of notches.



Number of notches by which the adjuster must be turned back

All vehicles equipped with other than 203 mm type = 30 notches

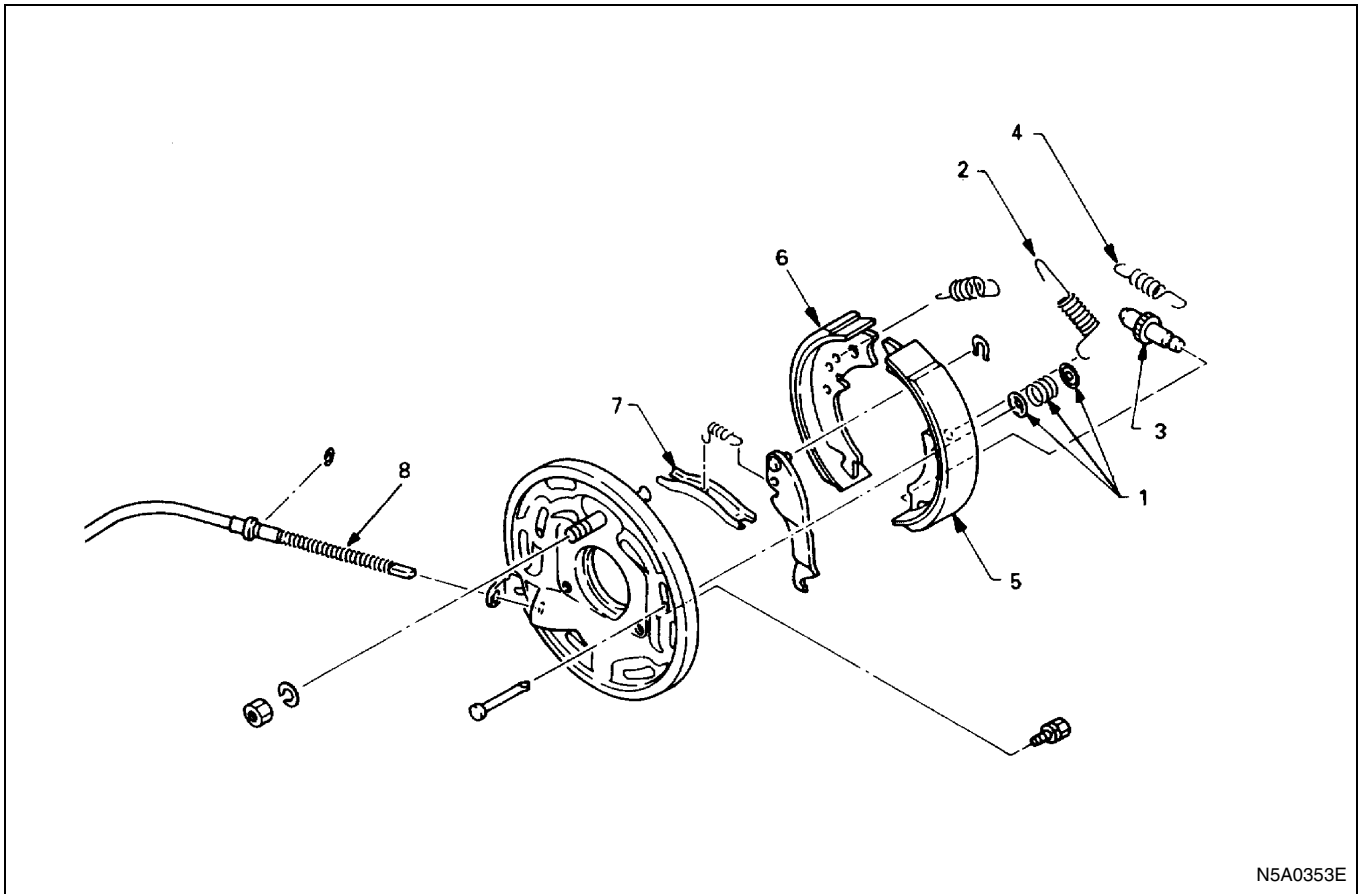
Vehicles equipped with a 203 mm type = 8 notches



- Adjust the pulling allowance of the parking brake lever by tightening the adjusting nut so that the allowance at a handle operating force of 147 N (15.0 kg / 33 lb) will be six to eight notches.
- Confirm that the brake does not drag.
- Mount the adjusting cover over the parking brake drum.

UNIT REPAIR [178 mm, 190 mm TYPE]

Parking Brake Assembly



N5A0353E

Legend

- | | |
|----------------------|---|
| 1. Holding spring | 5. Secondary brake shoe assembly with lever |
| 2. Return spring | 6. Primary brake shoe assembly |
| 3. Adjuster assembly | 7. Strut |
| 4. Spring; adjuster | 8. Parking cable |

Disassembly

1. Holding Spring
2. Return Spring
3. Adjuster Assembly
4. Spring; Adjuster
5. Secondary Brake Shoe Assembly
6. Primary Brake Shoe Assembly
7. Strut
8. Parking Cable

- Brake lining
- Return spring
- Parking brake lever assembly
- Parking brake inner cable

Brake Drum

Use a vernier caliper to measure the brake drum inside diameter.

If the measured value exceeds the specified limit, the brake drum must be replaced.

Brake Drum Inside Diameter	mm (in)	
	Standard	Limit
Inside diameter	178 (7.01)	179 (7.05)
	190 (7.48)	191 (7.52)
Out of round:		
• Limit: 0.05 mm (0.0020 in) or less		

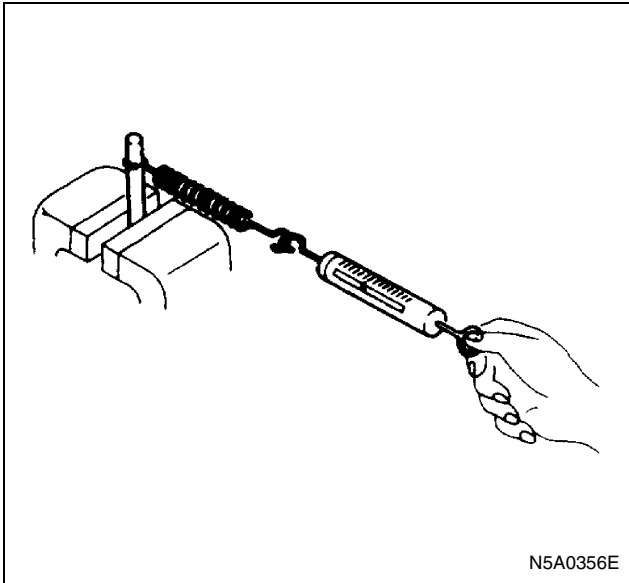
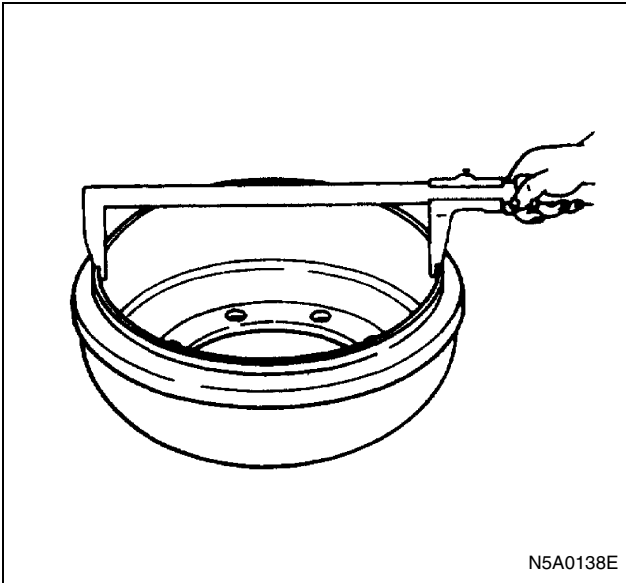
Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Visual Check

Inspect the following parts for wear, corrosion, scuffs, scratches, deterioration or other abnormal conditions.

- Brake drum

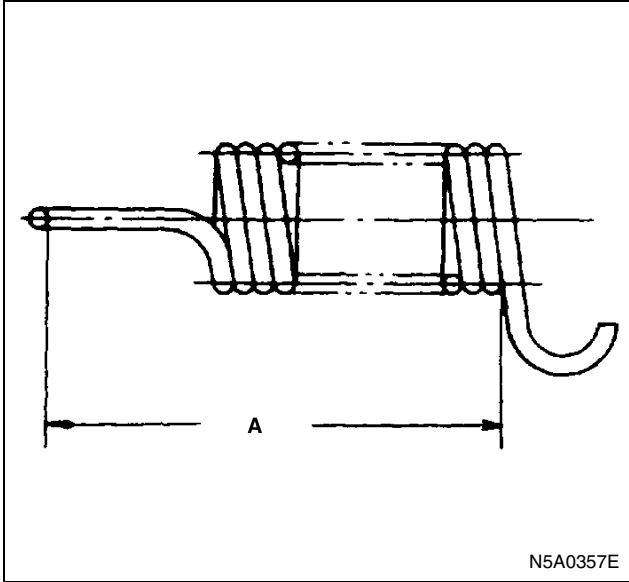


Return Spring

Use a spring balancer to measure the return spring set load.

If the variation exceeds 10% of the specified value, the return spring must be replaced.

		Drum inside dia. mm (in)	
		178 (7.01)	190 (7.48)
Free length: mm (in)	Primary	62 (2.44)	62.1 (2.44)
	Secondary	49 (1.93)	
Set length: mm (in)	Primary	70 (2.76)	67.1 (2.64)
	Secondary	57 (2.24)	
Set load; N (kg/lb)	Primary	105.9 — 129.5 (10.8 — 13.2/23.8 — 29.1)	53 — 65.7 (5.4 — 6.6/ 11.9 — 14.6)
	Secondary	88.3 — 107.8 (9.0 — 11.0/19.8 — 24.3)	



Legend

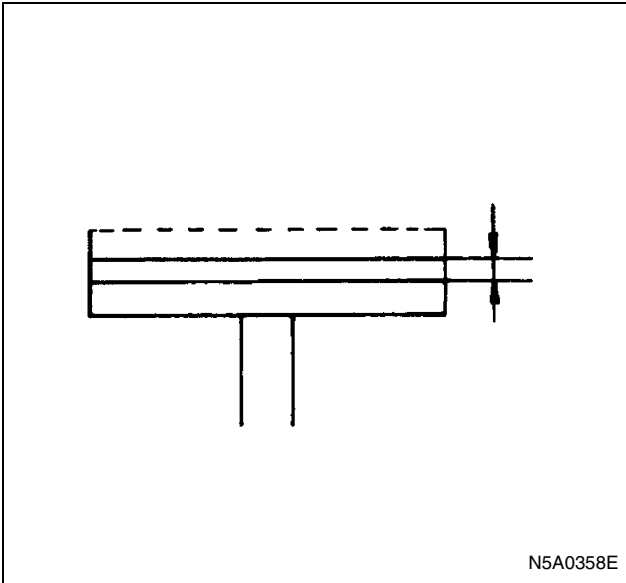
A. Length

Brake Lining Thickness

Use a vernier caliper to measure the brake lining thickness.

If the measured value is less than the specified limit, the brake shoe assembly must be replaced.

Brake Lining Thickness		mm (in)
Limit	1.0 (0.039)	

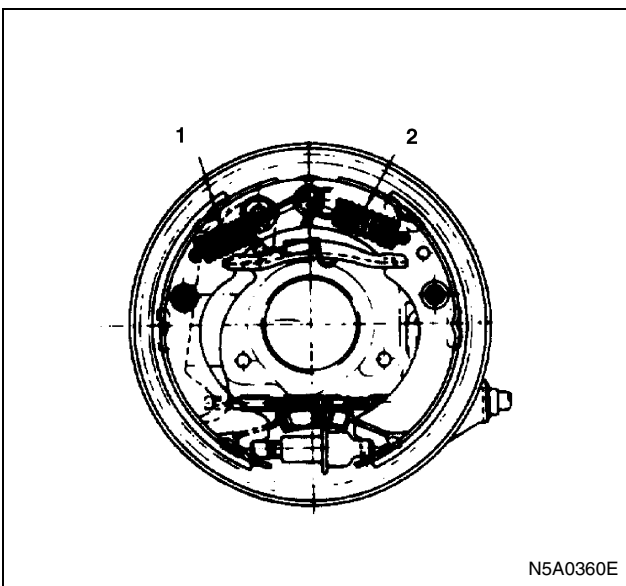


Reassembly

1. Parking Cable Rear
2. Strut
3. Primary Brake Shoe Assembly
4. Secondary Brake Shoe Assembly
Install the brake shoes by fitting them properly into slot in the adjuster and strut.
5. Spring; Adjuster
6. Adjuster Assembly
7. Return Spring

Drum inside diameter 178 mm only

Attach the return spring bawing fewer windings at the primary side as illustrated.



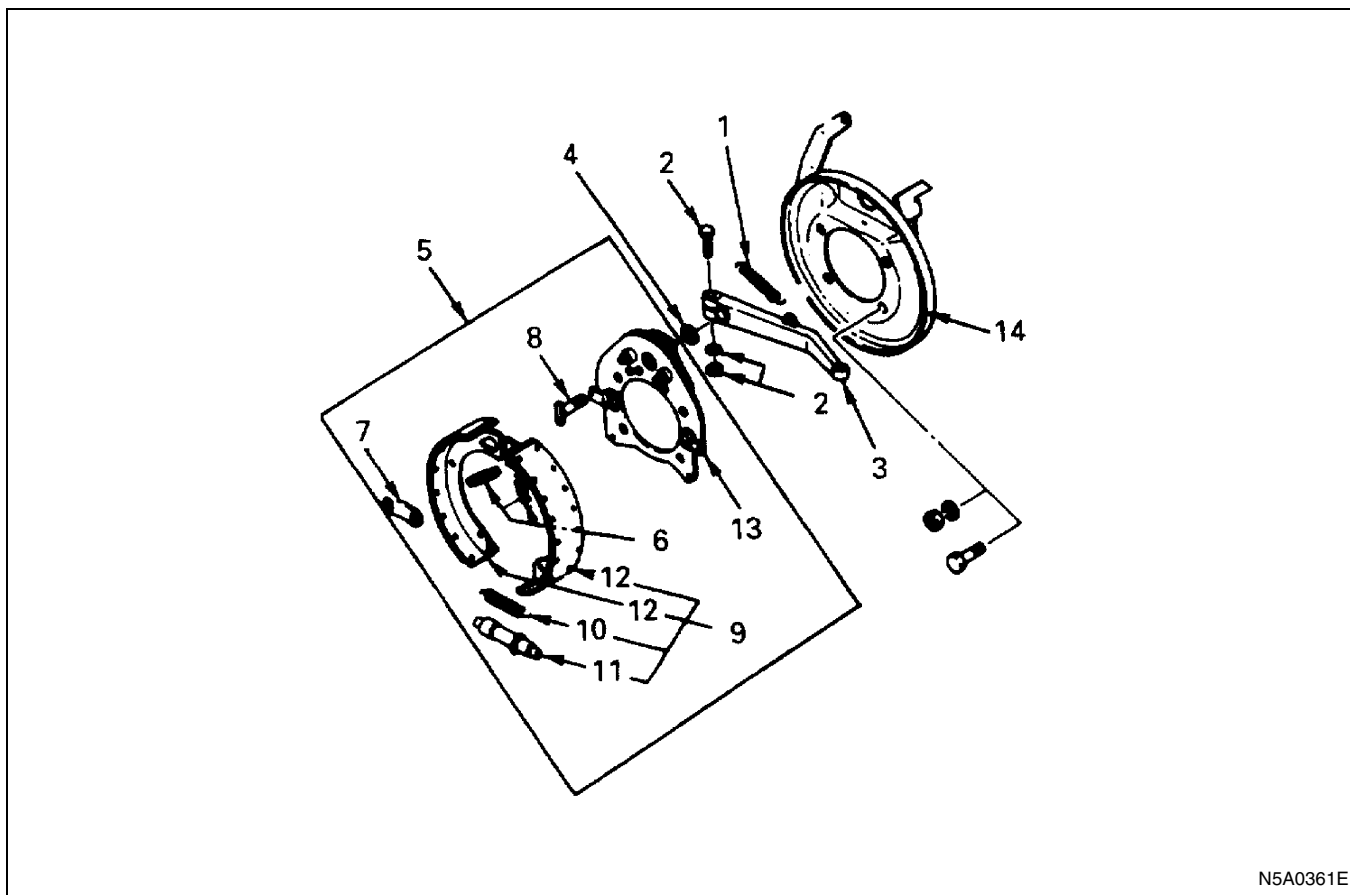
Legend

1. Fewer windings
2. Much windings

8. Holding Spring

UNIT REPAIR [203 mm TYPE]

Parking Brake Assembly



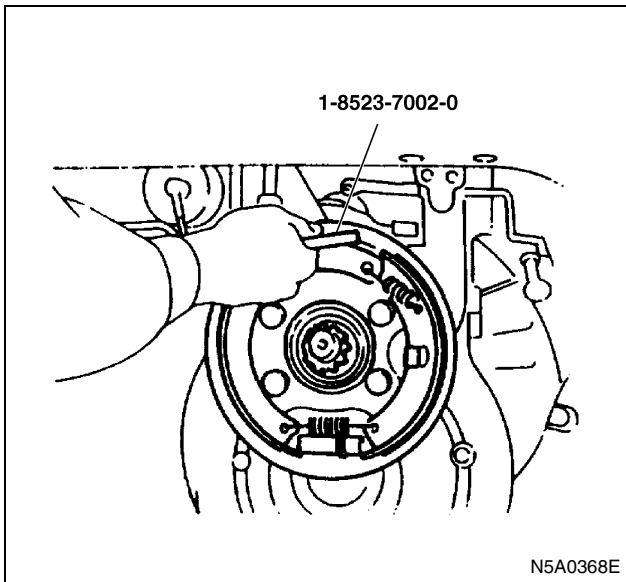
N5A0361E

Legend

- | | |
|---------------------------------|------------------------|
| 1. Spring | 8. Camshaft |
| 2. Nut, spring washer and bolt | 9. Brake shoe assembly |
| 3. Lever | 10. Spring: adjuster |
| 4. Washer | 11. Adjusting screw |
| 5. Brake shoe and support plate | 12. Brake shoe |
| 6. Return spring | 13. Support plate |
| 7. Anchor pin brace | 14. Dust cover |

Disassembly

1. Spring
2. Nut, Spring Washer and Bolt
3. Lever
4. Washer
5. Brake Shoe and Support Plate
6. Return Spring
Remover: 1-8523-7002-0



7. Anchor Pin Brace
8. Camshaft
9. Brake Shoe Assembly
10. Spring: adjuster
11. Adjusting Screw
12. Brake Shoe
13. Support Plate
14. Dust Cover

Inspection and Repair

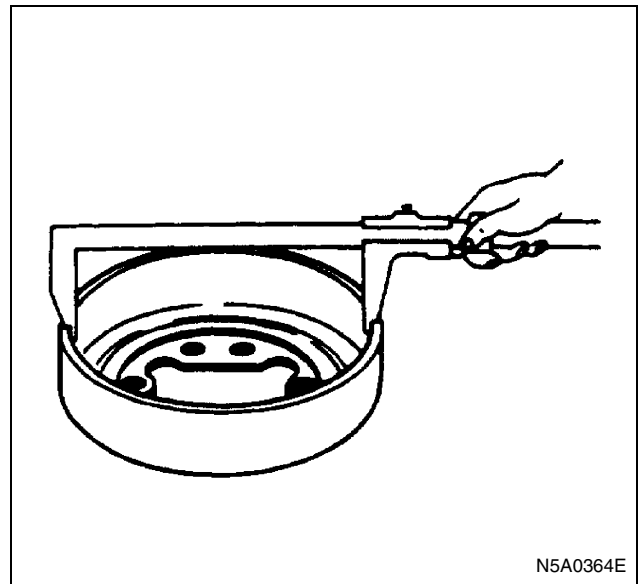
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Visual Check

Inspect the following parts for wear, corrosion, scuffs, scratches, deterioration or other abnormal conditions.

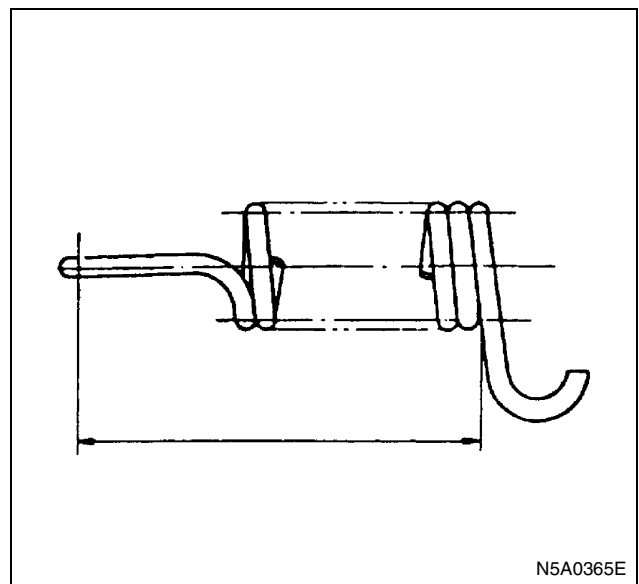
- Brake drum
- Brake lining
- Return spring
- Parking brake lever assembly
- Parking brake inner cable

Brake Drum



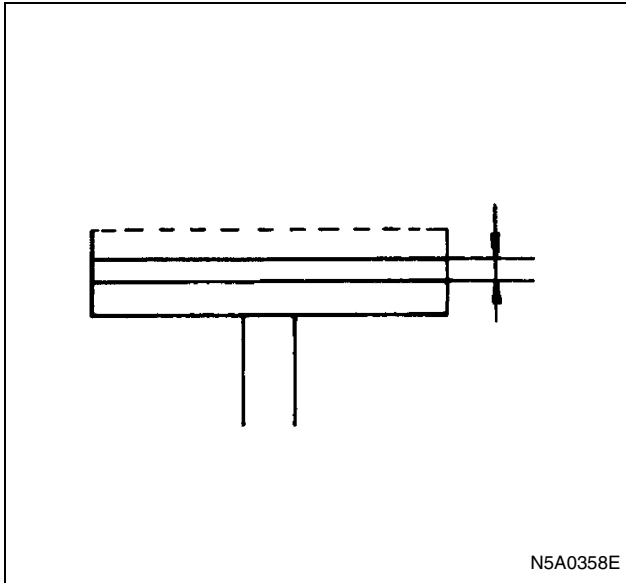
	mm (in)	
	Standard	Limit
Brake drum size inside diameter	203 (8.00)	205 (8.07)
Uneven wear and/or score	Run out 0.05 (0.002) or less	

Return Spring



	mm (in)	
Free length	49.9 (1.965)	
Set load	N (kg/lb)	147 (15/33.07)
Set length	57.5 (2.264)	

Brake Lining



10. Brake Shoe and Support Plate
11. Washer
12. Lever
13. Bolt, Spring Washer and Nut
14. Spring

Brake Lining Thickness	mm (in)
Limit	1.0 (0.039)

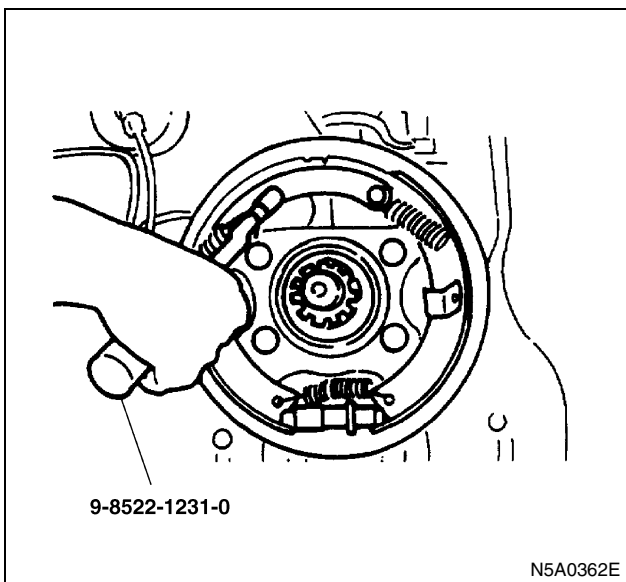
Reassembly

1. Duct Cover
2. Support Plate

Tighten:

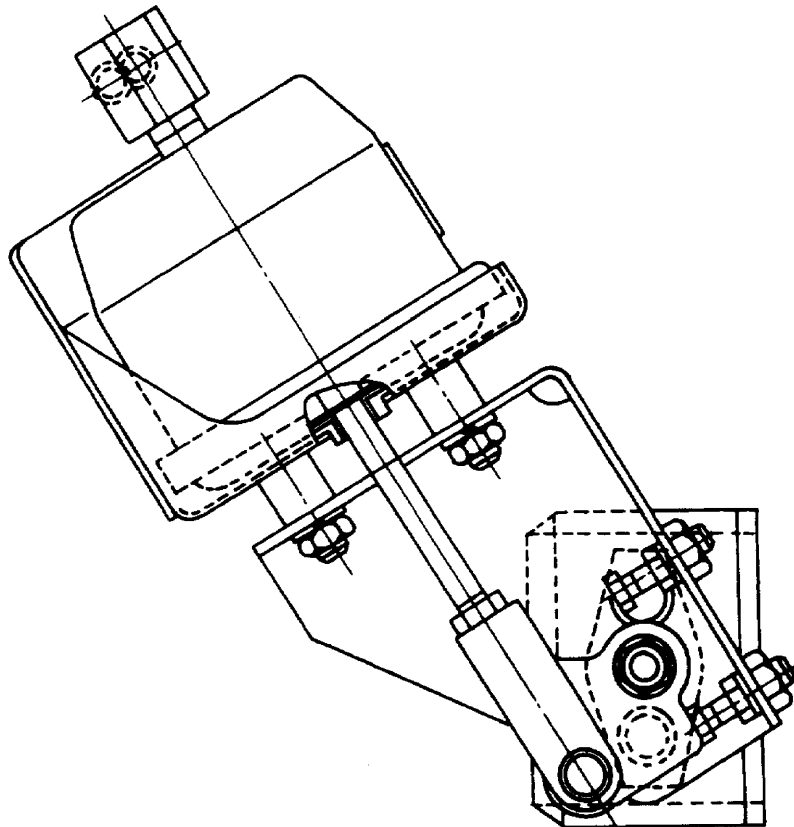
Bolt to 123 N·m (12.5kg·m / 90 lb·ft)

3. Brake Shoe
4. Adjusting Screw
5. Spring: adjuster
6. Brake Shoe Assembly
7. Camshaft
8. Anchor Pin Brace
9. Spring
Spring installer: 9-8522-1231-0



EXHAUST BRAKE

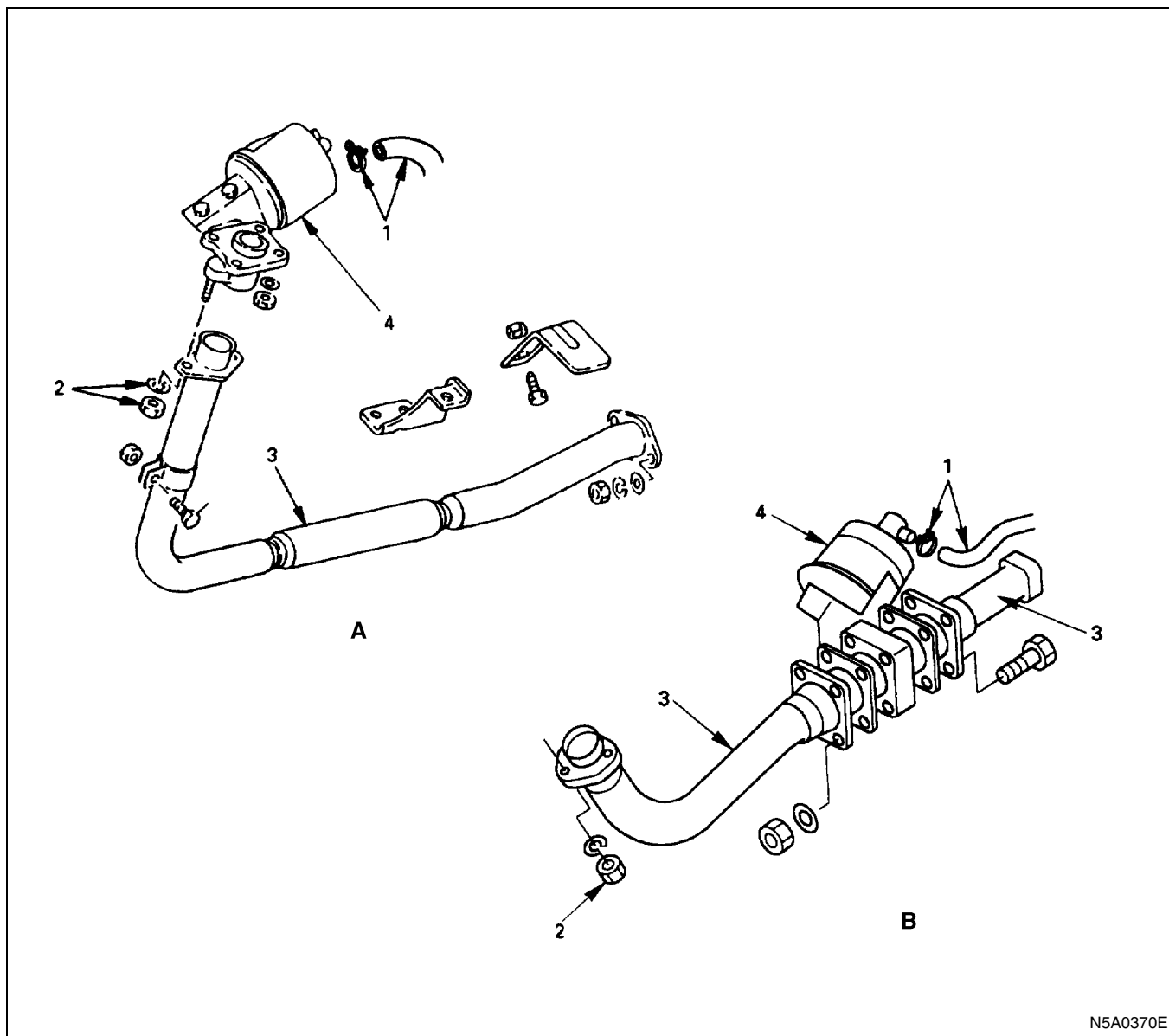
GENERAL DESCRIPTION



N5A0369E

ON-VEHICLE SERVICE

Exhaust Brake Assembly



N5A0370E

Legend

- | | |
|--|-----------------------|
| A. 4J engine without turbocharger | 2. Flange nut |
| B. 4J engine with turbocharger and 4H engine | 3. Exhaust pipe |
| 1. Vacuum hose and clip | 4. Exhaust brake unit |

Removal

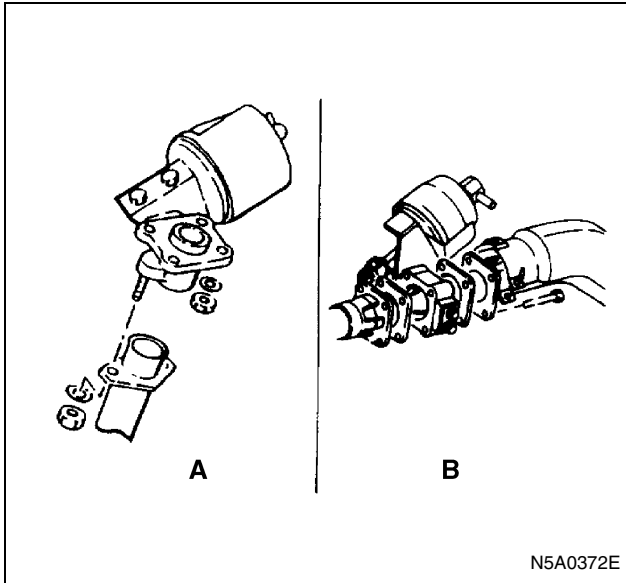
1. Vacuum Hose and Clip
2. Nut
3. Exhaust Pipe
4. Exhaust Brake Unit

Installation

1. Exhaust Brake Unit
Tighten the brake unit fixing nuts and/or bolts to the specified torque.

Tighten:

Exhaust brake unit fixing nuts and bolts to
4J engine without turbocharger: 37 N·m (3.8 kg·m / 27 lb·ft)
4J engine with turbocharger and 4H engine: 17 N·m (1.7 kg·m / 12 lb·ft)



Legend

- A. 4J engine without turbocharger
- B. 4J engine with turbocharger and 4H engine

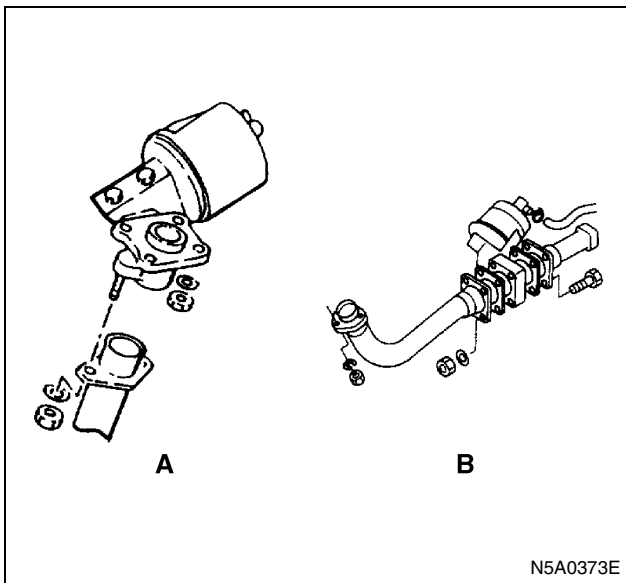
2. Exhaust Pipe
3. Flange Nut
Tighten the exhaust pipe flange nuts for the exhaust manifold to the specified torque.

Tighten:

Flange nuts to

4J engine without turbocharger: 37 N·m (3.8 kg·m / 27 lb·ft)

4J engine with turbocharger and 4H engine: 67 N·m (6.8 kg·m / 49 lb·ft)



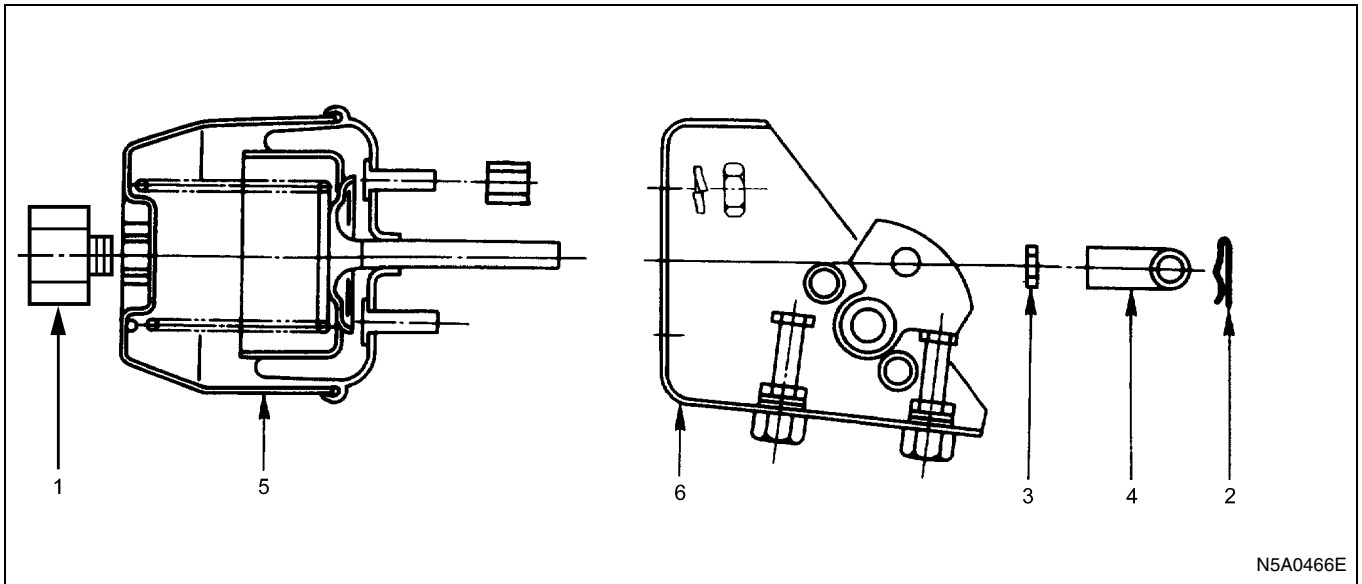
Legend

- A. 4J engine without turbocharger
- B. 4J engine with turbocharger and 4H engine

4. Vacuum Hose and Clip

UNIT REPAIR

Exhaust Brake Unit



Legend

- | | |
|----------------------------------|---------------------------|
| 1. Exhaust brake valve connector | 4. Clevis joint |
| 2. Cotter pin | 5. Power chamber |
| 3. Lock nut | 6. Exhaust valve assembly |

Disassembly

1. Exhaust Brake Valve Connector
2. Cotter Pin
3. Lock Nut
4. Clevis Joint
5. Power Chamber
6. Exhaust Valve Assembly

Inspection and Repair

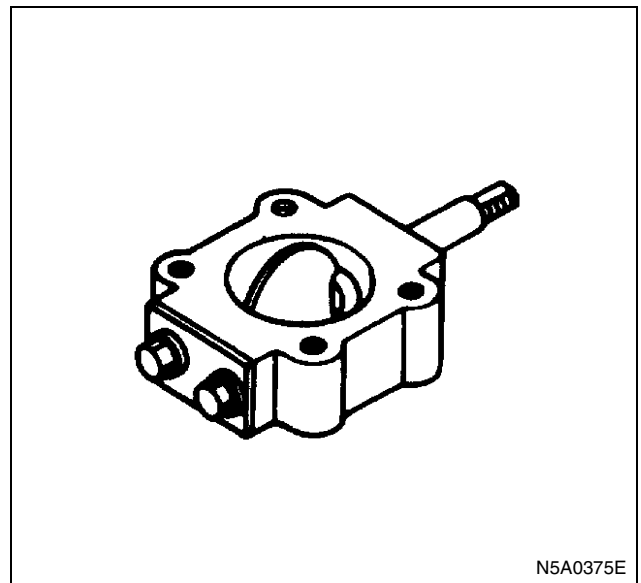
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Visual Inspection

Visually inspect the following parts for excessive wear and damage.

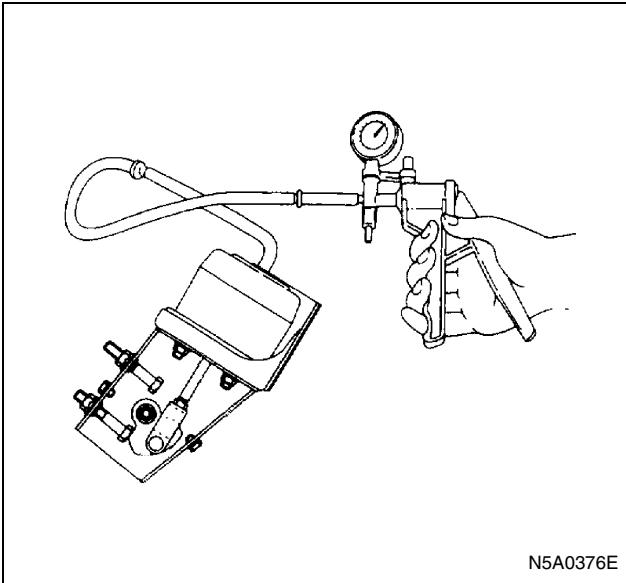
If excessive wear or damage is discovered during inspection, the part(s) must be replaced.

- Exhaust brake valve
- Exhaust brake shaft
- Butterfly valve
- Bushings
- Power chamber



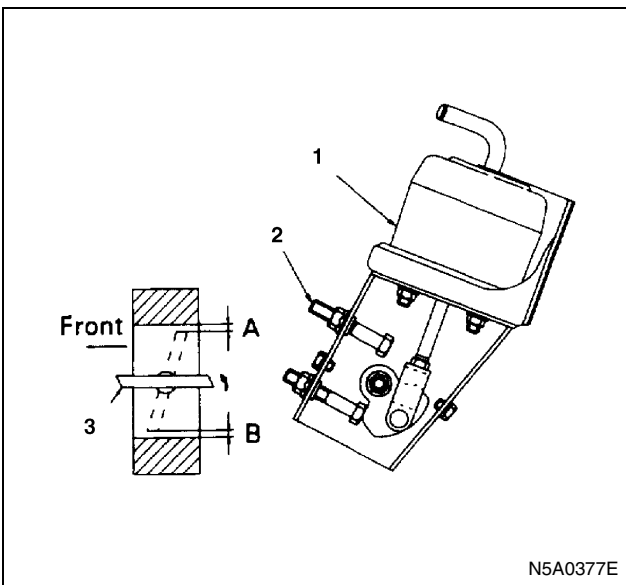
Power Chamber

(1) The exhaust brake valve should operate smoothly when the negative pressure (400 mmHg to 700 mmHg) is applied to the power chamber via the vacuum pump.



(2) At the points (A) and (B), the average clearance between the valve and the vehicle body should be as mentioned in the following table when the negative pressure (650 mmHg to 700 mmHg) is applied to the power chamber via the vacuum pump.

Clearance Between Valve And Body		mm (in)
		Standard
4HF1 Engine	0.4 — 0.6	(0.016 — 0.024)
Others	0.1 — 0.2	(0.004 — 0.008)



Legend

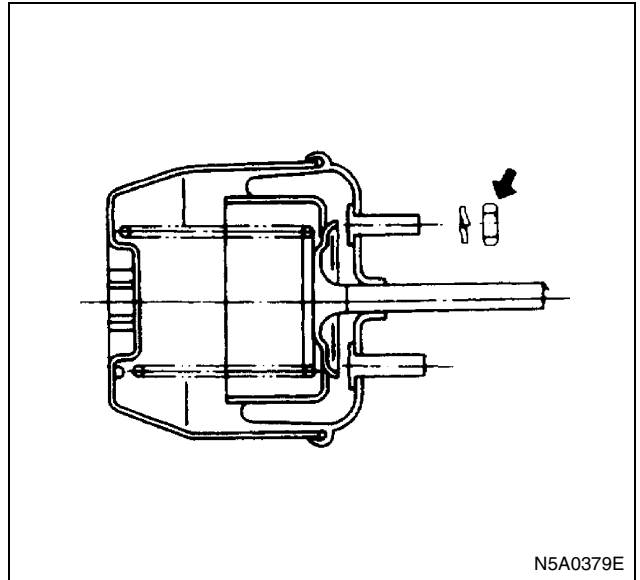
- 1. Power chamber
- 2. Adjust bolt
- 3. Valve

Reassembly

- 1. Exhaust Valve Assembly
- 2. Power Chamber

Tighten:

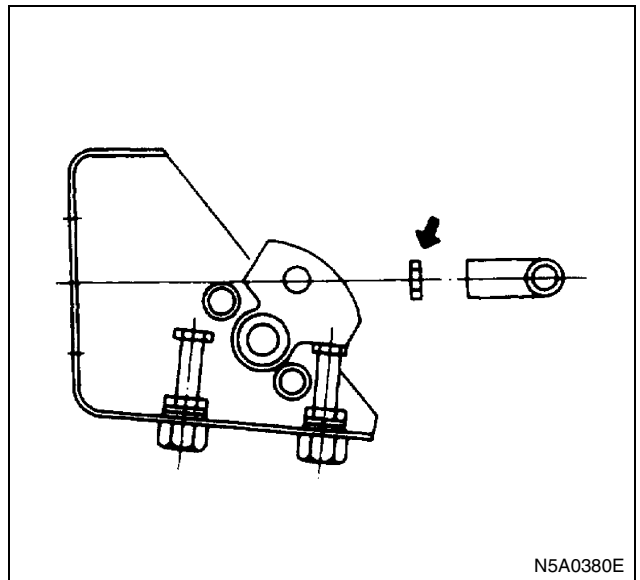
Power chamber fixing nut to 14 N·m (1.4 kg·m / 122 lb·in)



- 3. Lock Nut

Tighten:

Lock nut to 13 N·m (1.3 kg·m / 113 lb·in)



- 4. Clevis Joint
- 5. Cotter Pin
- 6. Exhaust Brake Valve Connector

Tighten:

More than 9.8 N·m (1.0 kg·m / 7.2 lb·ft)

MEMO

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MEMO

A series of horizontal dotted lines for writing a memo.

ABS/ASR

ABS/ASR

ABS/ASR System

Description of Function and Operation

Description of ABS/ASR

ABS (Anti-lock Brake System) and ASR (Anti-Slip Regulator) are the system to prevent the wheels from locking and wheel spin, and to assure stability and steering ability of the vehicle.

When a malfunction occurs in the system, fail-safe deactivate the ABS and ASR, and the warning lamp comes on. Also, the self-diagnosis function is equipped to improve serviceability.

Contents of ABS Control

The ABS controls the brake fluid pressure in the way that the electronic hydraulic control unit (EHCU) hold/decrease/increase the brake fluid pressure during brake operation, based on the signal transmitted from the wheel speed sensor.

The EHCU calculate the wheel speed, the wheel acceleration speed, and the vehicle speed based on the signal transmitted from the wheel speed sensor. When brake is applied while the vehicle is running, the wheel speed abruptly goes down, and the difference from the vehicle speed becomes more than specified; the EHCU judges that the wheel turns toward being locked, and it performs holding of the brake fluid pressure.

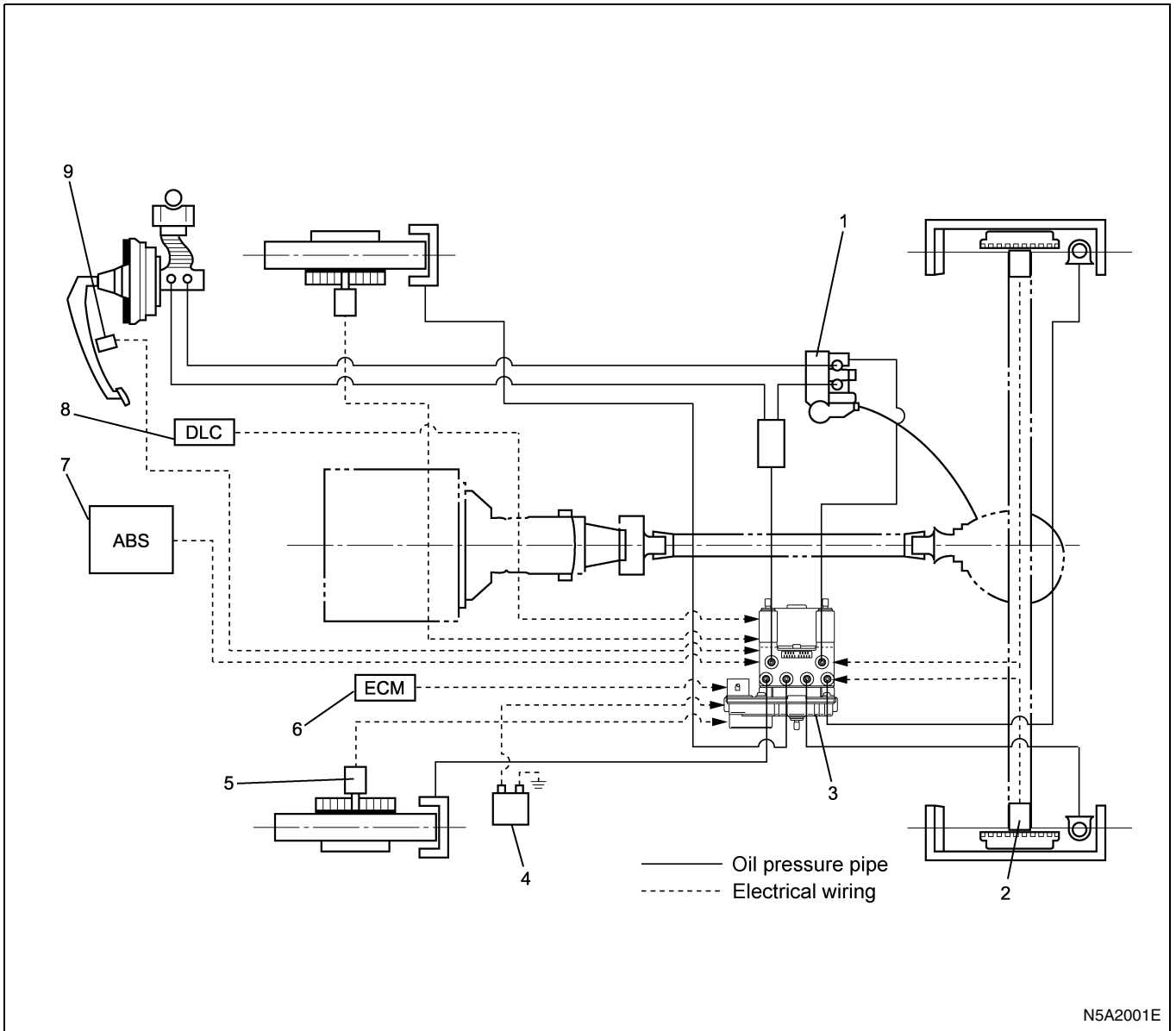
When the vehicle speed further goes down, the system judges that the wheel is about to be locked, and it performs decreasing of the brake fluid pressure. Consequently, when the system judges that wheel lock is avoided, it performs holding and increasing of the brake fluid pressure repeatedly.

Contents of ASR Control

The ASR controls the engine torque to prevent wheel spin of the drive wheel during sudden start/acceleration. The ABS/ASR control unit calculates the engine control speed (average of the drive wheel RH and LH speed) and the vehicle speed (driven wheel speed) based on the signal transmitted from each wheel speed sensor.

When the drive wheel spins and the speed difference between the engine control speed and the vehicle speed reaches the specified value, the ABS/ASR control unit send a signal to the engine control unit to operate the throttle closing direction to adjust the slip amount appropriately.

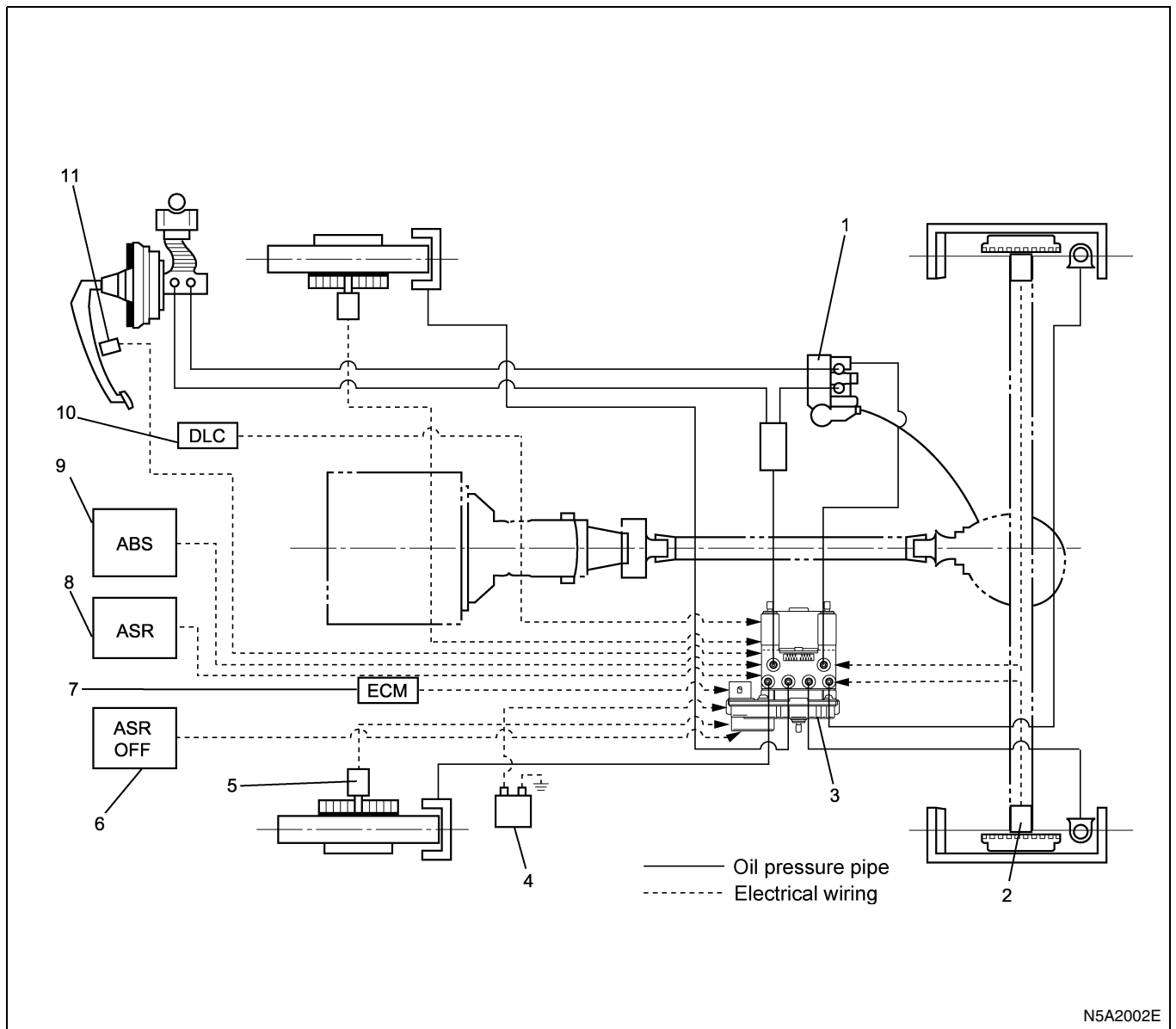
2WD ABS



Legend

- | | |
|---|-----------------------------|
| 1. LSPV | 6. Engine control unit |
| 2. Speed sensor (rear wheel) | 7. ABS warning lamp |
| 3. Electronic hydraulic control unit (EHCU) | 8. Self-diagnosis connector |
| 4. Battery | 9. Brake switch |
| 5. Speed sensor (front wheel) | |

ABS/ASR



Legend

- | | |
|---|------------------------------|
| 1. LSPV | 7. Engine control unit |
| 2. Speed sensor (rear wheel) | 8. ASR warning lamp |
| 3. Electronic hydraulic control unit (EHCU) | 9. ABS warning lamp |
| 4. Battery | 10. Self-diagnosis connector |
| 5. Speed sensor (front wheel) | 11. Brake switch |
| 6. ASR OFF switch | |

Symptom Specific to the Model with ABS

The vehicle equipped with ABS may develop the following symptoms, but those are inherent to the system and not malfunction.

- Kickback or vibration in the brake pedal, vibration in the steering wheel and vehicle are felt during abrupt braking or braking on a slippery surface.
- Noise is generated around the brake pedal or from the vehicle rearward while ABS is in operation.

- Motor operation noise is generated for short time immediately after engine starting.

Abbreviation

Abbreviations are used in this section. Followings are list of abbreviations for your convenience.

ABS

Anti-lock brake system

ASR

Anti-slip regulator

CKT

Circuit

DLC

Data link connector

DTC

Diagnostic trouble code

ECM

Engine control module

ECU

Electronic control unit

EHCU

Electronic hydraulic control unit

FL

Front left

FR

Front right

GEN

Generator

HU

Hydraulic unit

LSPV

Load sensing proportioning valve

MV

Millivolt

RR

Rear right

RPS

Revolution per second

VDC

Volts, direct current

VAC

Volts, alternating current

VIM

Vehicle interface module

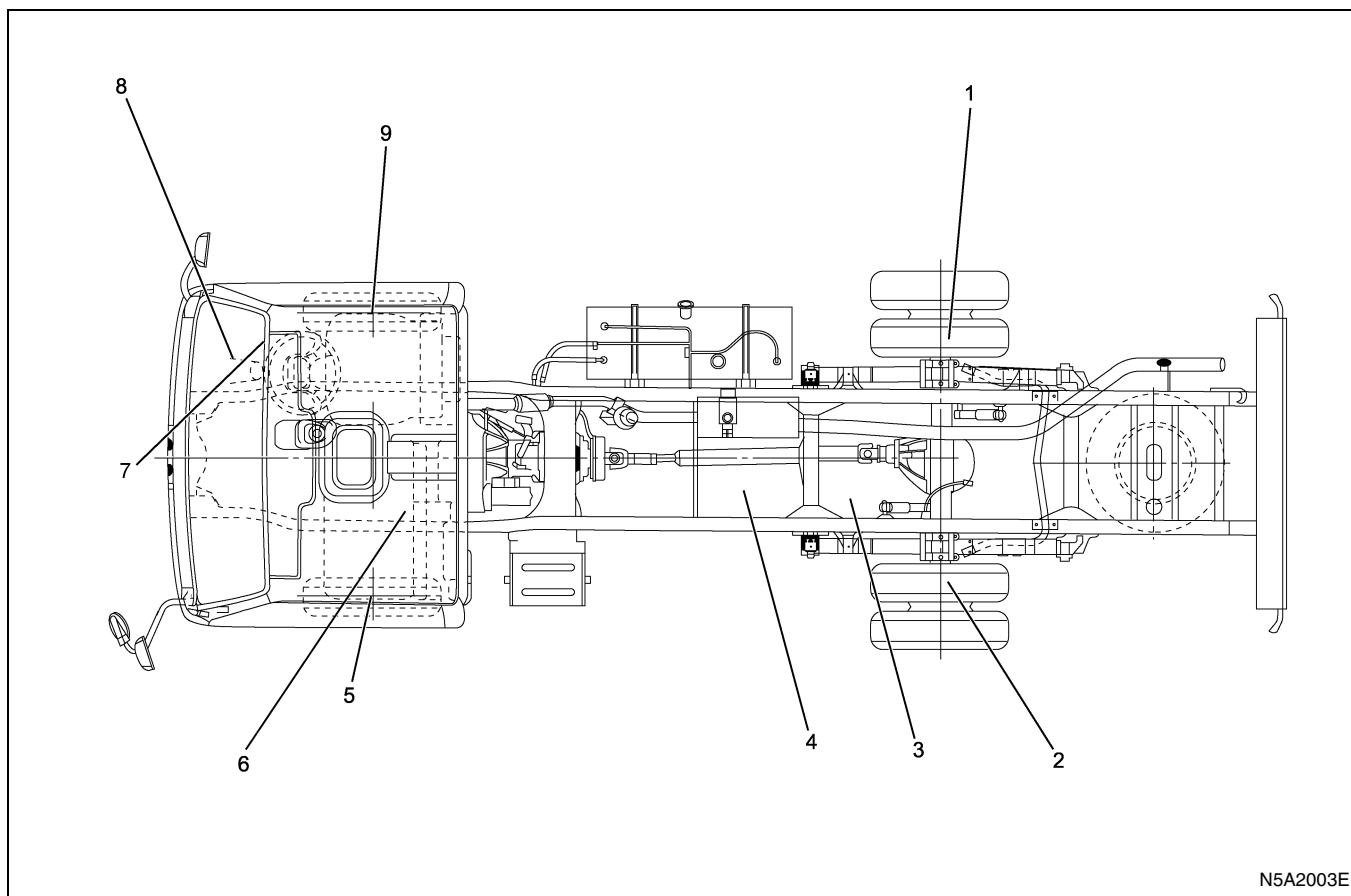
W/L

Warning light

WSS

Wheel speed sensor

System Component
Component location

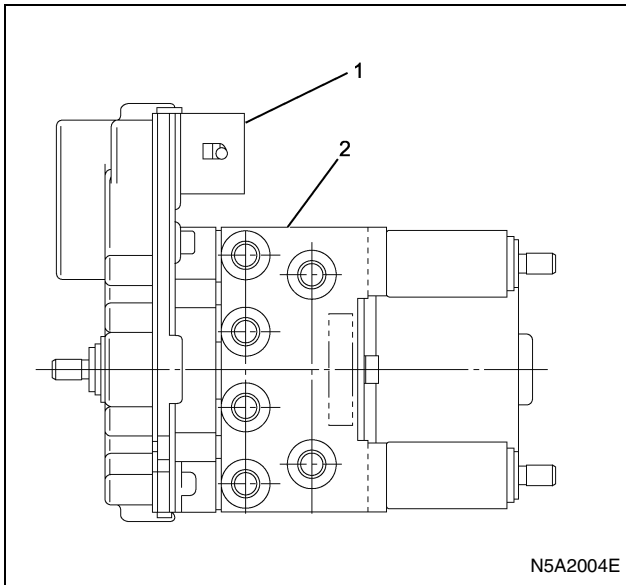


N5A2003E

Legend

- | | |
|--------------------------|-----------------------------|
| 1. Rear speed sensor RH | 6. Engine control unit |
| 2. Rear speed sensor LH | 7. Self-diagnosis connector |
| 3. LSPV | 8. ABS/ASR warning lamp |
| 4. EHCU | 9. Front speed sensor RH |
| 5. Front speed sensor LH | |

Electronic Hydraulic Control Unit (EHCU)



Legend

1. Electronic control unit part
2. Hydraulic control unit part

EHCU consists of ECU and HU. The ECU consists of the ABS/ASR control part, the fault detecting part, and the fail-safe part. It drives the hydraulic unit etc. based on the signal transmitted from each sensor. In case of system failure, it stops the fail-safe and returns to the normal brake. Also, the self-diagnosis function is equipped to indicate the trouble part during diagnosis.

The HU consists of the motor, the plunger pump, and the solenoid valve.

Solenoid valve: Decrease, hold, increase the brake fluid pressure based on the signal transmitted from the ECU.

Reservoir: Temporarily store the brake fluid from each caliper to lower the fluid pressure smoothly.

Plunger pump: Send the brake fluid stored in the reservoir to the master cylinder.

Motor: Drive the plunger pump based on the signal from ECU.

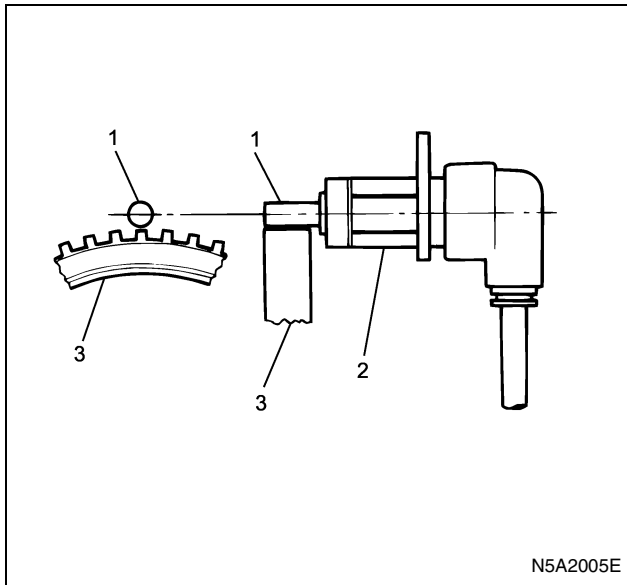
Check valve: Control the brake fluid flow.

CAUTION:

Turning the key ON with the harness disconnected from the EHCU means that the CAN communication line is not connected at this moment. Therefore, the systems which perform CAN communication such as engine and Smoother are judged as faulty. After replacing the EHCU, clear the DTCs of the systems which perform CAN communication. Also, do not drive the vehicle with the EHCU removed.

Wheel Speed Sensor

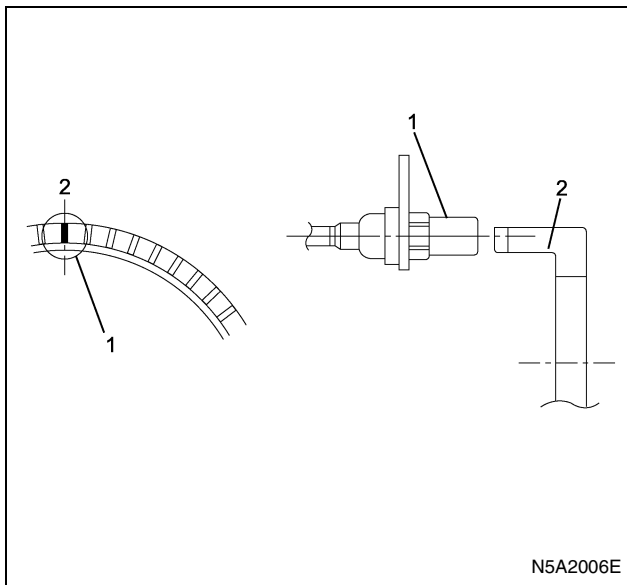
Front speed sensor



Legend

1. Electrode
2. Sensor
3. Sensor rotor

Rear speed sensor



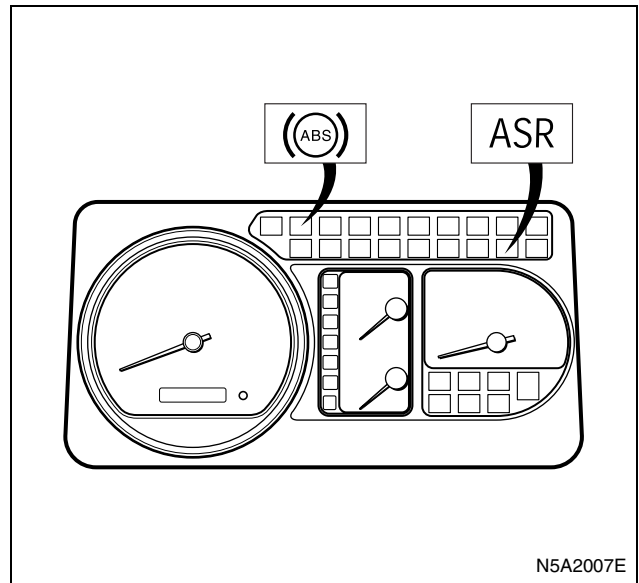
Legend

1. Sensor
2. Sensor rotor

The front speed sensor consists of permanent magnet and coil, and the rear speed sensor is the 2 wire system hall IC type and is installed to the knuckle for front wheels, and to the brake back plate for rear wheels. Sensor rotors inserted in front/rear wheel hubs rotate to generate voltage in the sensor. Frequency of this voltage varies in relation to the rotor revolution speed;

therefore this allows the sensor to detect the vehicle speed.

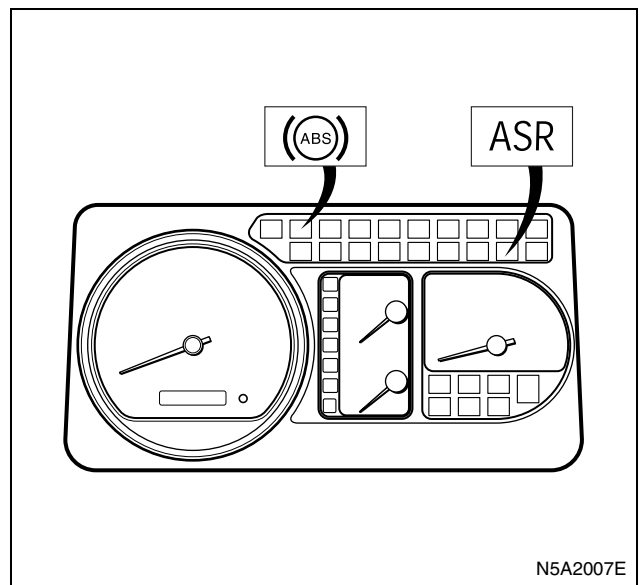
ABS Warning Lamp



The ABS warning lamp comes on with the starter switch ON, and then goes off if the ABS is normal.

It also comes on in case of ABS malfunction, and indicates the trouble code with blinking pattern upon change of the EHCU to diagnosis mode.

ASR Indicator/Off Lamp



The ASR warning lamp comes on with the starter switch ON, and then goes off if the ASR is normal.

It blinks while the ASR is in operation.

It comes on in case of ASR malfunction and when the ASR off switch is pressed to deactivate the system.

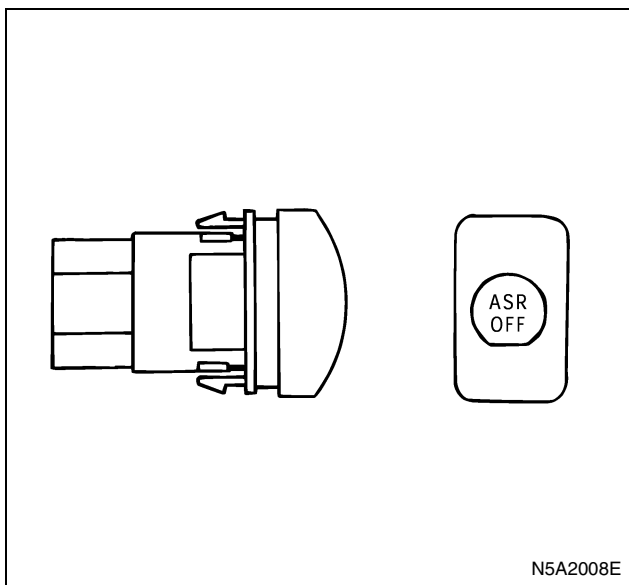
It indicates the trouble code with blinking pattern upon changing to the diagnosis mode.

CAUTION:

When either of the ABS or ASR is faulty (which does not affect the other), the warning lamp of the affected sys-

tem only comes on and prohibit the system operation.
In this case, the other system is still workable if normal.

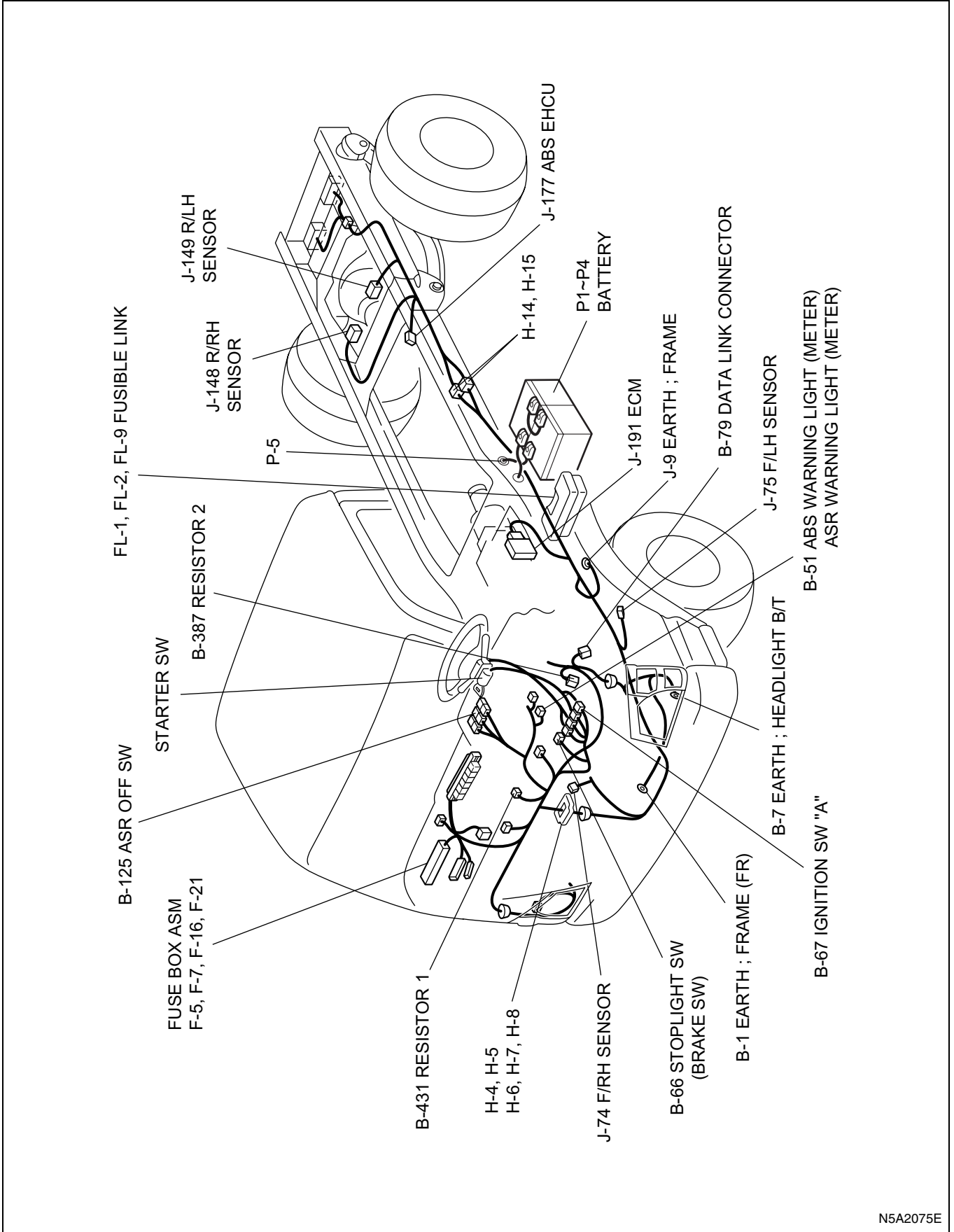
ASR Off Switch



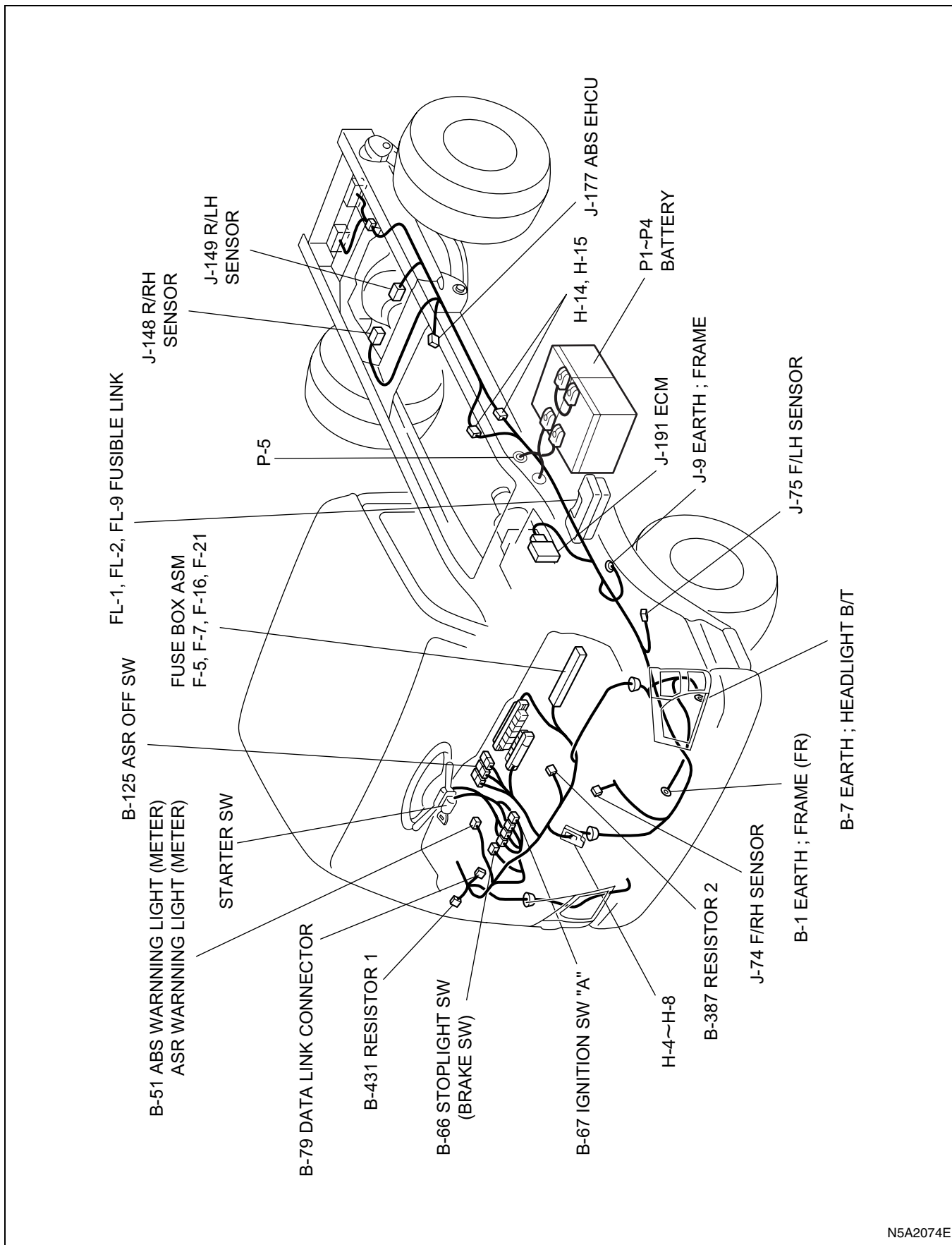
Pressing the ASR off switch after starting the engine deactivates the ASR, and pressing again bring the system to stand-by condition. The ASR is set stand-by condition whenever the engine is started regardless of switch condition.

Parts Location

LHD Model

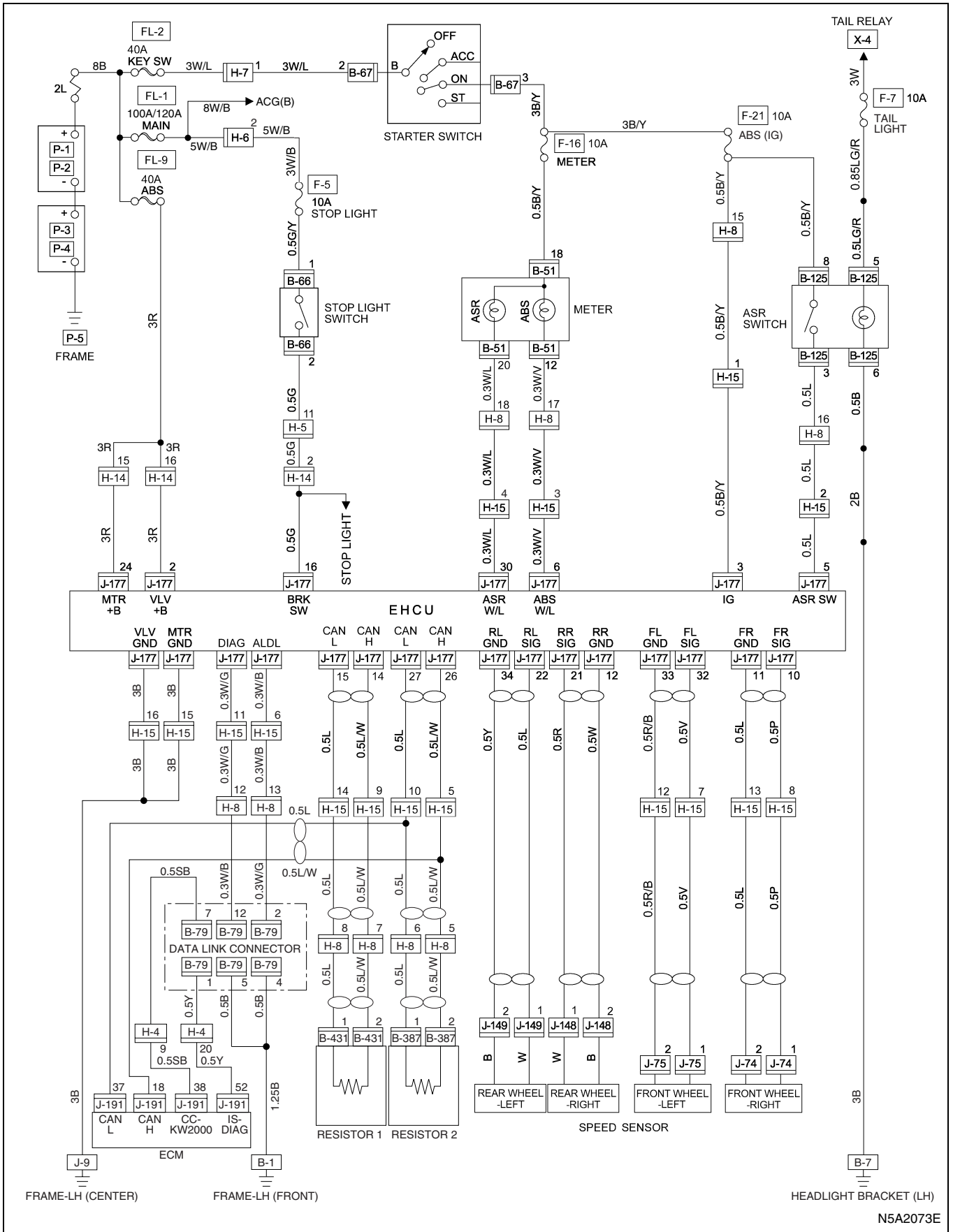


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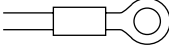
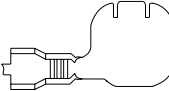
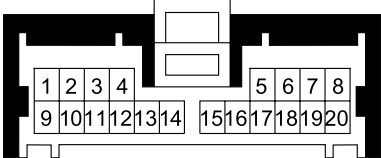
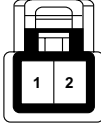
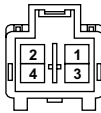

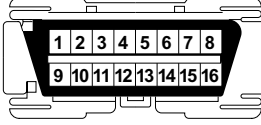
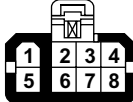
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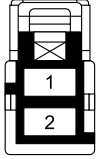
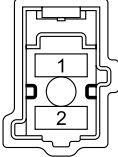
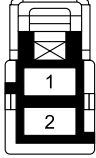
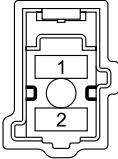



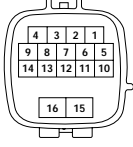
Circuit Diagram

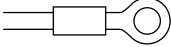










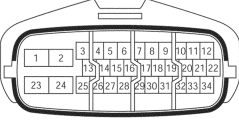
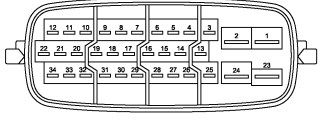
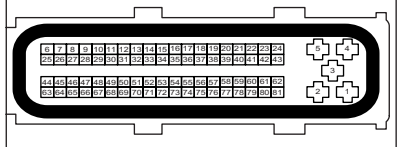
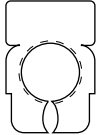
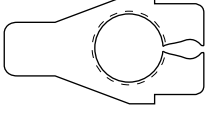
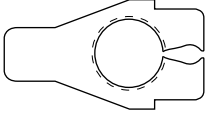
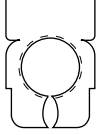
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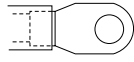
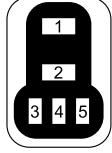
Connector List

No.	Connector Face
B-1	 000-001
B-7	 000-012
B-51	 020-004
B-66	 002-031
B-67	 004-002
B-67	 004-001
B-79	 016-005
B-125	 008-001

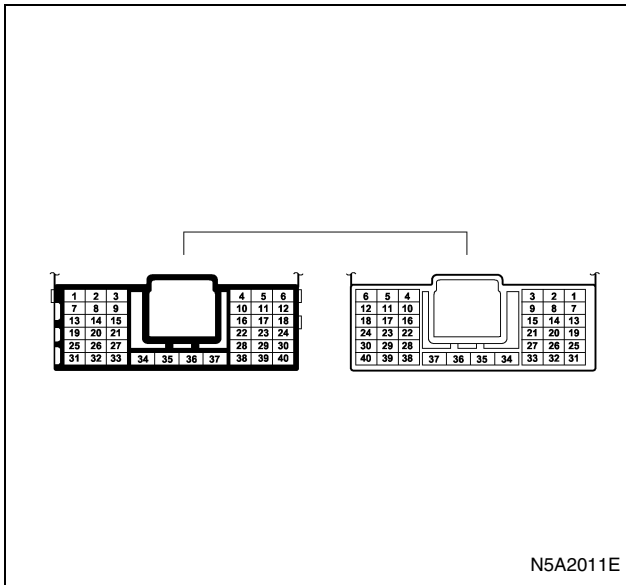
No.	Connector Face
B-387	 002-038
B-387	 002-039
B-431	 002-038
B-431	 002-039
H-14	 016-004
H-14	 016-003
H-15	 016-003
H-15	 016-004

No.	Connector Face
J-9	 000-001
J-74	 002-012
J-74	 002-011
J-75	 002-012
J-75	 002-011
J-148	 002-012
J-148	 002-011
J-149	 002-012

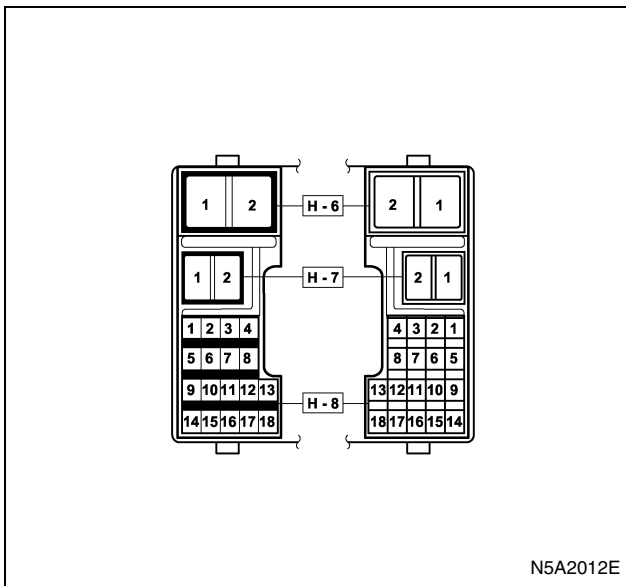
No.	Connector Face
J-149	 002-011
J-177	 034-001
J-177	 034-002
J-191	 081-001
P-1	 000-004
P-2	 000-006
P-3	 000-006
P-4	 000-004

No.	Connector Face
P-5	 000-002
X-4	 005-006

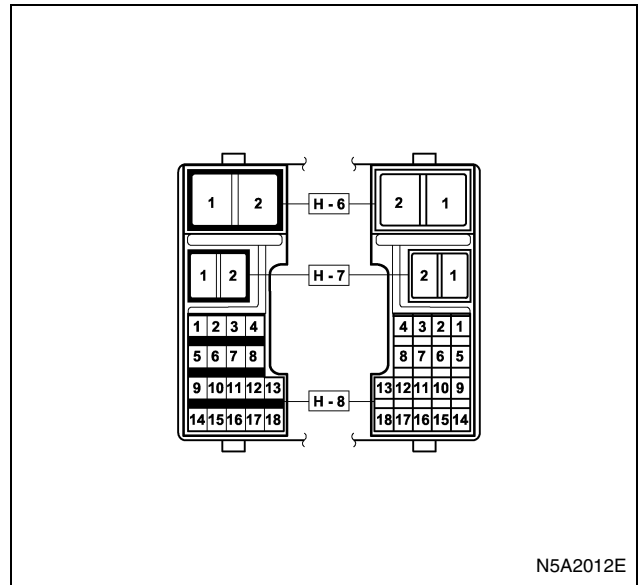
H-5



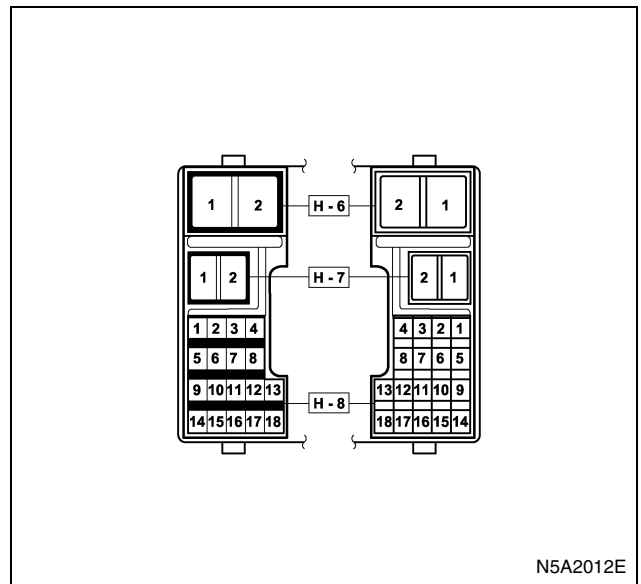
H-6



H-7



H-8



Procedure of Trouble Diagnosis

Description of Diagnosis

Trouble symptom related to ABS and ASR can be classified into two kinds; one is with ABS/ASR warning lamp illumination pattern, the other is from the trouble symptoms noticeable by the driver.

Refer to "Diagnosis with illumination pattern" in the first case, and "List of trouble symptoms" in the latter case for diagnostic procedures. Also, diagnostics with Tech 2 is available. Refer to sections 5A and 5C for the diagnosis of mechanical trouble, including brake noise, brake judder (vibration of pedal or vehicle body during normal brake operation), break pulling to one side, parking brake fault.

About Self-Diagnosis

Self-diagnosis function is equipped with the EHCUC, it performs the checks as shown in the illustration below to

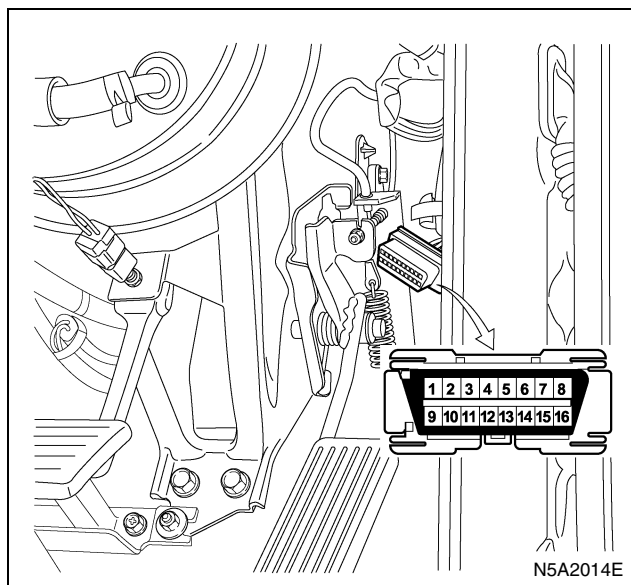
examine the system for fault and identify the trouble part every time the system starts. If it found to be faulty, the system illuminates the ABS/ASR warning lamp to notify the fault, and stores the diagnostic trouble code (DTC). Illumination pattern differ depending on the fault condition; refer to “Diagnostic procedure with illumination pattern” described in later, and check and repair according to the relevant flow chart.

CAUTION:

Lamp illumination is reset every time the starter switch is OFF (system OFF), however the diagnosis code will not be erased unless it is compulsory erased. In case of faults while driving and intermittent fault, the control unit may judge it as normal at the time of diagnosis and indicate the normal code. Therefore perform the check and repair according to the diagnosis flow.

How to Indicate Trouble Codes

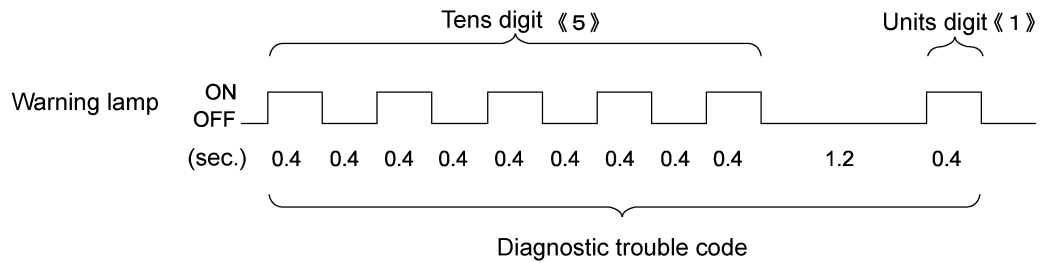
The vehicle must be parked (vehicle speed 3.3km/h (2 mph) or less). Short the terminal No. 12 with No. 4 or 5 (ground) of the self-diagnosis connector, and turn the starter switch to ON. The ABS/ASR warning lamp will blink to indicate the diagnosis trouble code.



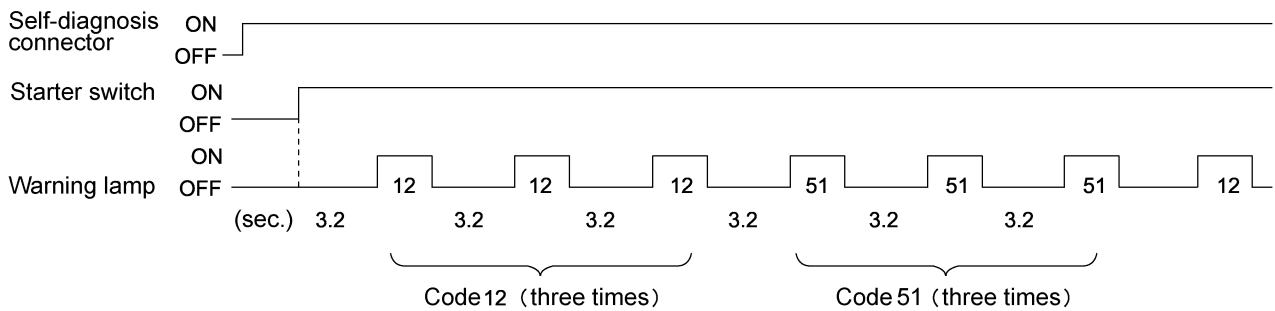
The normal code 12 is repeatedly displayed if normal. If faulty, after displaying the normal code 12 for three times, the stored diagnosis trouble code (DTC) is displayed for three times. Then back to the normal code again and repeats this display order. Maximum 6 codes are stored, and these are displayed in the reverse chronological order.

For details concerning DTCs, refer to “List of Diagnostic Trouble Code (DTC)” described later.

How to read diagnostic trouble code ; for code 51



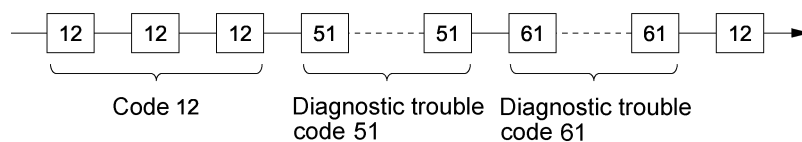
Indication sample of diagnostic trouble code ; for code 51



* Warning lamp : ABS/ASR warning lamp

N5A2015E

Indication sample of multiple diagnostic trouble code ; for code 51,61



N5A2016E

How to Clear Diagnosis Trouble Code (DTC)

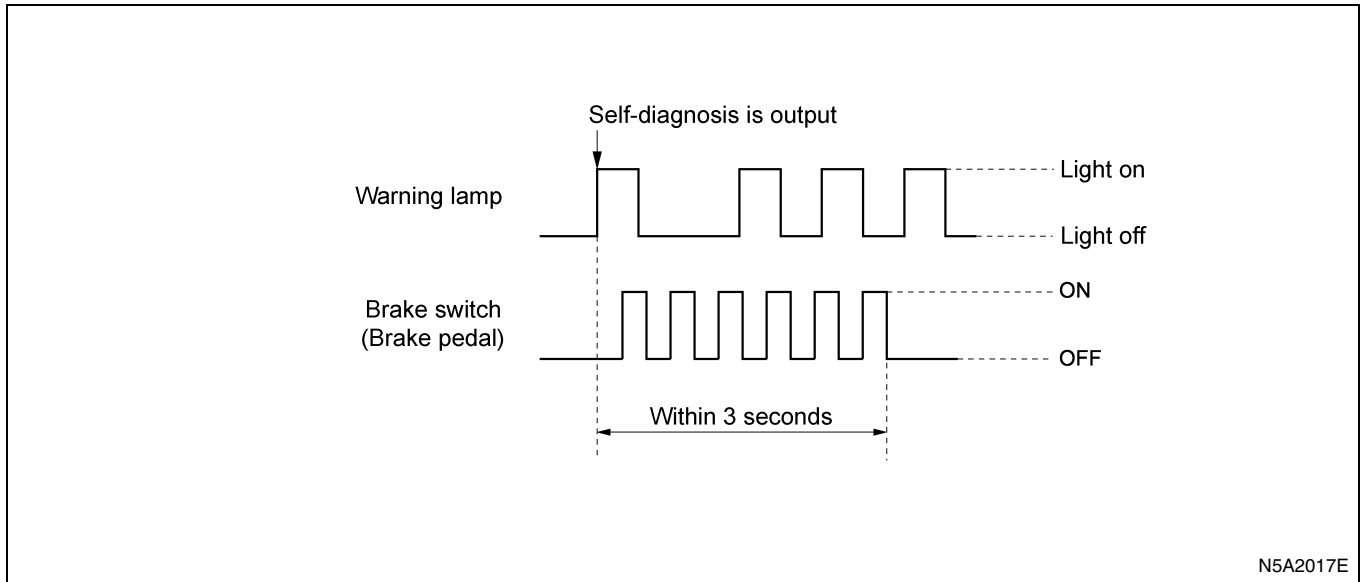
DTCs stored in the EHCU will not be erased automatically upon repair. Clear the DTCs using either of the following procedure:

1. Input the brake switch ON/OFF signal for six times within three seconds while self-diagnosis result is being output.

2. Use Tech 2 to clear.

CAUTION:

- After performing the DTC clear procedure, ensure that it is cleared.
- If the step 1 does not work, perform with the step2.



Precautions During Diagnosis

At general baintenance

Adhere the following precautions when servicing and diagnosing of the ABS/ASR and other vehicle control systems.

- When performing electric-arc welding on the vehicle, disconnect the EHCU connector before starting welding work.
- Do not connect/disconnect the EHCU connector when the starter switch is ON.
- The EHCU is a non-disassembled part. Do not loosen the bolts and plugs of the EHCU.
- Be especially careful not to allow dirt, dust or metallic powder to get into the hydraulic circuit during checking and servicing the brake components.
- When only rear wheels are rotated using dram tester or jack-upped for inspection, the ABS judges it as sensor fault and illuminates the ABS warning lamp. This indicates no fault in the system. Erase the ABS diagnosis code after repair. Turn the starter switch to ON again, to make sure that the ABS warning lamp does not come on.

When servicing computer system

Extreme care is required to avoid overcurrent to the EHCU circuit. Do not ground to or apply voltage to the EHCU without careful consideration while checking open/short circuit. Use only the circuit tester having high internal resistance or the special tool described in this section to check those circuit. Do not connect/disconnect the power supply to the EHCU when the starter

switch is ON. Be sure to turn the starter switch to OFF before disconnecting/connecting the battery cable, the fuse, or the connector.

When replacing EHCU

The EHCU body fault rarely occurs, but more cases are falsely identified as EHCU trouble, as it happened to be corrected when replacing the EHCU but the fact is mostly secondary failure caused by the harness-side trouble (such as short circuit) or undetectable cause due to intermittent trouble. Therefore, before replacing the EHCU, check if overcurrent is applied to the EHCU as well as improper connection of the connectors.

Intermittent trouble

Intermittent troubles are mostly caused by temporally disconnection of the harnesses and connectors. If a trouble occurs, check the related circuit in the following procedure.

1. Check for misconnection of the connector. Also check for improper connection of the connector terminal.
2. Check for deformation and damage of the terminal. If deformed or damaged, correct and reconnect it securely.
3. Simulated open circuit is also suspected. Check the circuit by shaking the harness in a degree that does not damage the harness.

Test run of vehicle with ABS problem

Trouble cause of the problem appeared as ABS warning lamp illumination, can be identified with "Diagnostic procedure with illumination pattern". However for the problem that can solely be identified by the driver as trouble

symptoms, the following procedure is necessary to identify the trouble cause by reproducing the trouble symptom with test run the vehicle.

1. Start the engine, and make sure that the ABS warning lamp goes off. (If the lamp does not go off, read the DTC and identify the trouble part.)
2. Slowly start the vehicle and run at 30 km/h (19 mph) or more for three minutes, then apply the brake to stop the vehicle completely. Start the vehicle again and accelerate to 30 km/h (19 mph) or more. Repeat this operation a least three times.
3. Next, start the vehicle and accelerate to 40 km/h (25 mph) or more, and then abruptly apply the brake to activate the ABS, till stop the vehicle.
4. If the warning lamp comes on during the test run, check the DTC and inspect the vehicle according to the DTC. If no DTC appeared, or the warning light does not come on, reproduce the condition of the trouble occurrence claimed by the customer as much as possible.
5. If DTC appeared or trouble symptom is found, perform the appropriate inspection according to the diagnostic procedure.

Check after repair

Upon completion of repair, turn the starter switch to OFF and then start the engine to make sure each lamp goes off. Next, run the vehicle at 30 km/h (19 mph) or more for 1 minute, and check that the lamp does not come on.

Brake basic inspection

Step	Action	Value	YES	NO
1	Is the brake fluid level correct?	—	Go to Step2	Replenish fluid. Go to Step2
2	Is fluid leaked?	—	Go to Step3	Repair. Go to Step3
3	Does the vacuum booster operate normally?	—	Go to Step4	Repair. Go to Step4
4	Is the brake pad and rotor normal?	—	Go to Step5	Repair. Go to Step5
5	Install all the components, and check that those are installed properly. Is this step completed?	—	End.	Go to Step5

Ground check

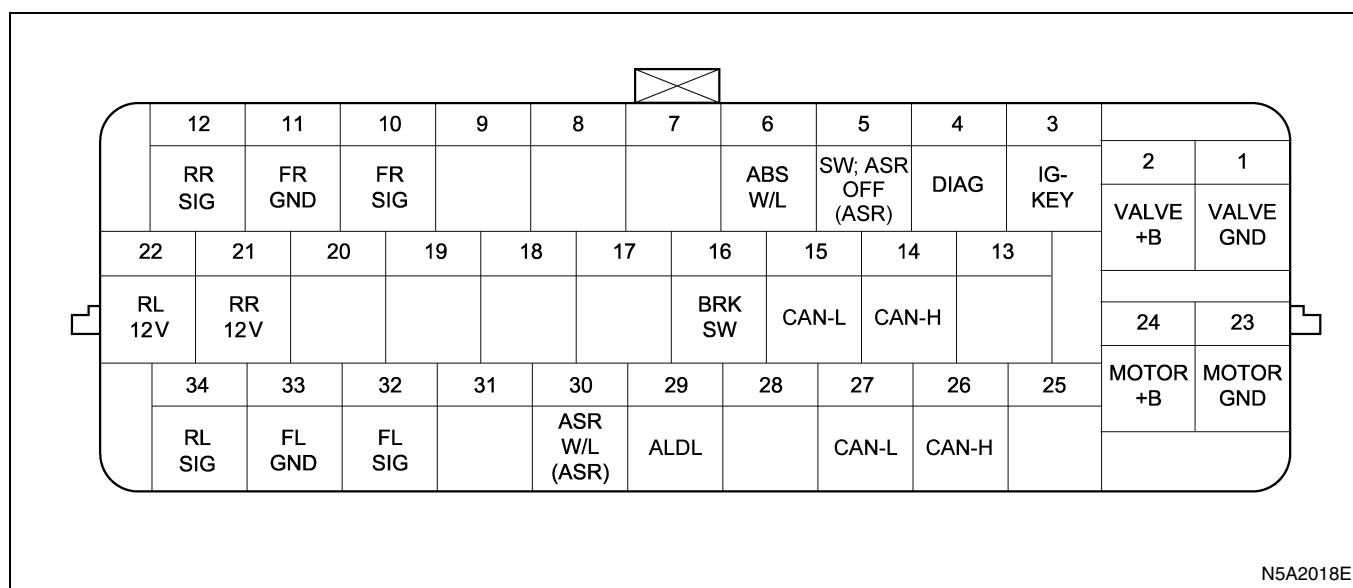
Step	Action	Value	YES	NO
1	Are all the ground point related to ABS OK?	—	Go to Step2	Repair. Go to Step2
2	Install all the components, and check that those are installed properly. Is this step completed?	—	End.	Go to Step2

Diagnostic basic flow

Step	Action	Value	YES	NO
1	1. Complaint from the customer 2. Interview to the customer. 3. Perform the basic inspection. (Refer to "Brake basic inspection".) Is Tech 2 required?	—	Go to Step2	Go to Step3
2	Check DTC. Is DTC appeared?	—	Go to Step5	Go to Step4
3	Check DTC (with warning lamp illumination pattern). Is DTC appeared?	—	Go to Step5	Go to Step4
4	Test run the vehicle. Does the warning lamp come on?	—	Go to Step5	Refer to "List of trouble symptom". Go to Step5
5	1. Repair the trouble part. 2. Clear the DTC. 3. Check the ABS warning lamp for illumination pattern with the ignition switch ON. 4. Test run the vehicle. Is the trouble appeared again?	—	Repeat the "Diagnostic basic flow" if the trouble appeared again (with trouble symptom or DTC). Go to Step1	Go to Step6
6	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	End.	Go to Step6

Function Check

EHCU Connector Pin Arrangement



Terminal	Mark	Signal name	Wire color
1	VALVE GND	ECU system ground (body ground 0V)	BLK
2	VALVE+B	Solenoid valve power supply	RED
3	IG-KEY	ECU system power supply	BLK/YEL
4	DIAG	Diagnosis entry	WHT/GRN
5	SW; ASR OFF	ASR cut switch (ASR only)	BLU
6	ABS W/L	ABS warning lamp output	WHT/VIOLET
7	NC	Not available	—
8	NC	Not available	—
9	NC	Not available	—
10	FR SIG	FR wheel speed signal (magnetic pickup sensor)	PNK
11	FR GND	FR wheel speed signal GND	BLU
12	RR GND	RR wheel speed signal GND	WHT
13	NC	Not available	—
14	CAN-H	CAN Hi input	BLU/WHT
15	CAN-L	CAN Lo input	BLU
16	BRK SW	Brake switch input signal	GRN
17	NC	Not available	—
18	NC	Not available	—
19	NC	Not available	—
20	NC	Not available	—
21	RR SIG	RR wheel speed signal	RED
22	RL SIG	RL wheel speed signal	BLU
23	MOTOR GND	Motor ground (body ground 0V)	BLK
24	MOTOR+B	Motor power supply	RED
25	NC	Not available	—
26	CAN-H	CAN Hi input	BLU/WHT
27	CAN-L	CAN Lo input	BLU
28	NC	Not available	—
29	ALDL	J1850 Class 2 communication	WHT/BLK
30	ASR W/L	ASR warning lamp output (ASR only)	WHT/BLU
31	NC	Not available	—
32	FL SIG	FL wheel speed signal (magnetic pickup sensor)	VIOLET
33	FL GND	FL wheel speed signal GND	RED/BLK
34	RL GND	RL wheel speed signal GND	YEL

Check List of EHCU Connector Terminal

1. EHCU power supply

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
OFF	VDC	J-177,3(+)-J-177,1(-)	0-0.3V	
ON	VDC	J-177,3(+)-J-177,1(-)	16.5-34V	
OFF	VDC	J-177,2(+)-J-177,1(-)	16.5-34V	
OFF	VDC	J-177,24(+)-J-177,1(-)	16.5-34V	

2. EHCU ground

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
OFF	Ω	J-177,1(+)-GND	0-1 Ω	
OFF	Ω	J-177,23(+)-GND	0-1 Ω	

3. Brake switch signal circuit

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
OFF	VDC	J-177,16(+)-J-177,1(-)	0-0.3V	
OFF	VDC	J-177,16(+)-J-177,1(-)	16.5-34V	Brake pedal depressed

4. ABS warning lamp

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
ON	VDC	J-177,6(+)-J-177,1(-)	16.5-34V	
OFF	VDC	J-177,6(+)-J-177,1(-)	0-0.3V	

5. Front LH speed sensor

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
OFF	k Ω	J-177,32(+)-J-177,33(-)	1-2k Ω	
OFF	k Ω	J-177,32(+)-J-177,1(-)	1000k Ω or more	
OFF	VDC	J-177,32(+)-J-177,33(-)	200mV or more	Tire half-turn/sec

6. Front RH speed sensor

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
OFF	k Ω	J-177,10(+)-J-177,11(-)	1-2k Ω	
OFF	k Ω	J-177,10(+)-J-177,1(-)	1000k Ω or more	
OFF	VDC	J-177,10(+)-J-177,11(-)	200mV or more	Tire half-turn/sec

7. Rear LH speed sensor

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
ON	VDC	J-177,22(+)-J-177,34(-)	0.2-4.5V	Tire half-turn/sec

8. Rear RH speed sensor

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
ON	VDC	J-177,21(+)-J-177,12(-)	0.2-4.5V	Tire half-turn/sec

9. ASR cut switch (ASR only)

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
ON	VDC	J-177,5(+)-J-177,1(-)	16.5-34V (switch pressed) 0-0.3V (switch released)	

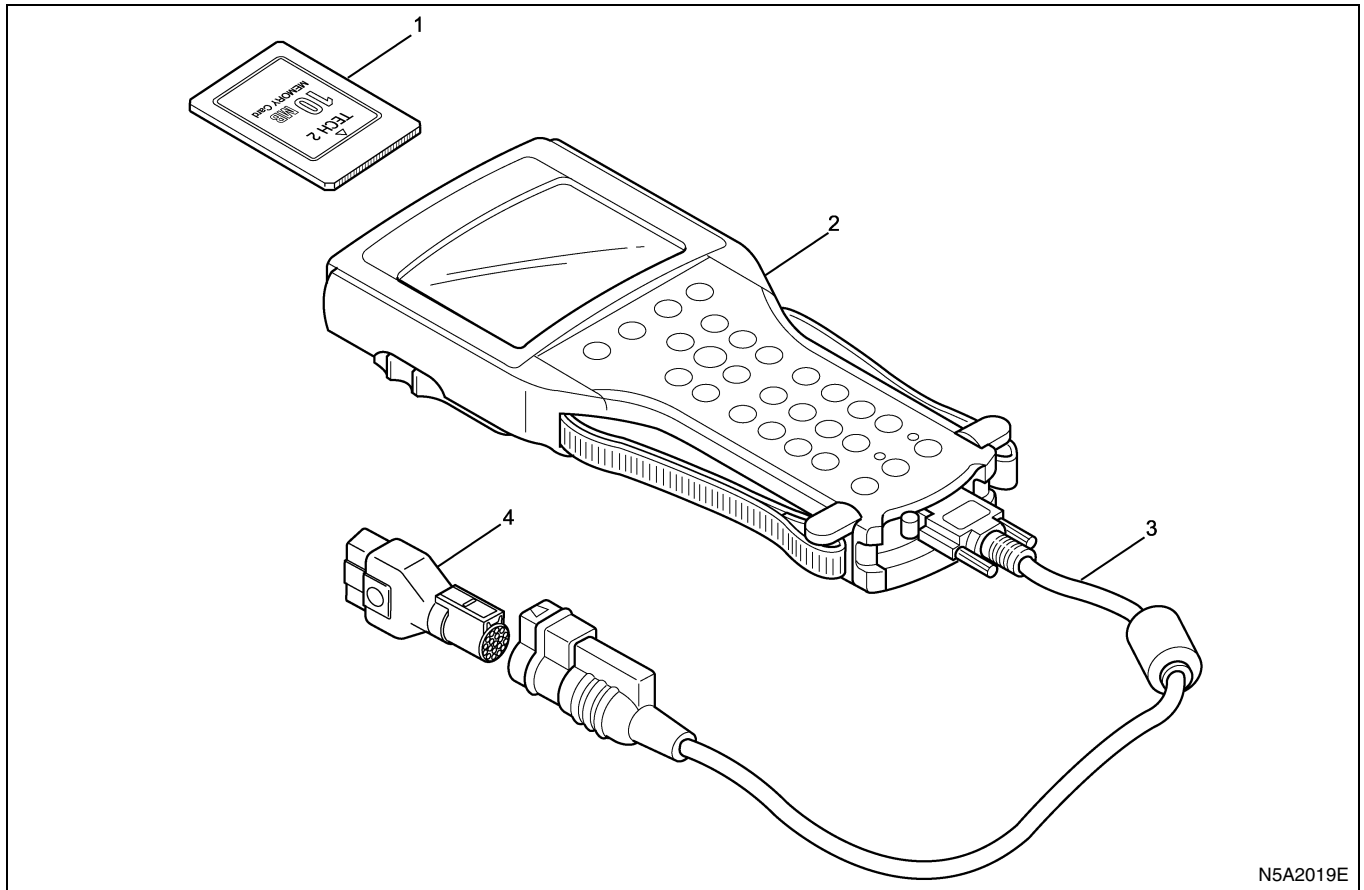
10. ASR warning lamp (ASR only)

Starter Switch	Tester scale/ range	Connector terminal No. to be measured	Standard value	Remarks
ON	VDC	J-177,30(+)-J-177,1(-)	16.5-34V	
OFF	VDC	J-177,30(+)-J-177,1(-)	0-0.3V	

Trouble Diagnosis with Scan Tool

Tech 2

Tech 2 is useful to diagnose the electric fault and the system check of the ABS control system. The Tech 2 is small and light tester. It can communicate with the ECM to perform various types of the diagnosis and the test by connecting the self-diagnosis connector equipped to the vehicle.



N5A2019E

Legend

- | | |
|----------------|-------------------------|
| 1. PCMCIA card | 3. DLC cable |
| 2. TECH 2 | 4. SAE16/19 pin adapter |

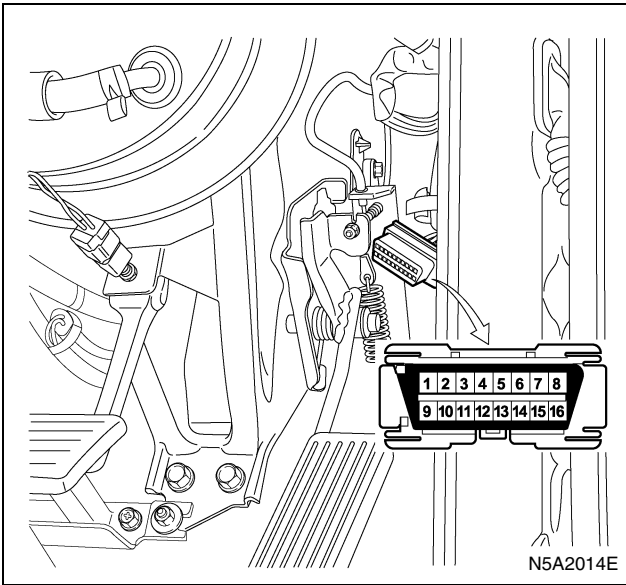
Feature of Tech 2

1. Tech 2 (2) is a 12-V power supply system. Do not use a 24-V power supply. If the vehicle system is equipped with a 24-V power supply, use a 12-V battery with an adapter for power distribution. Power distribution is not available from the cigar lighter.
2. Set the PCMCIA card (1) to the Tech 2 (2), and attach the VCI (Vehicle Communication Interface) (3)(4), and connect to the DLC in the vehicle.
3. Turn the power switch off before installing/removing the PCMCIA card.
4. The capacity of the PCMCIA card for Tech 2 is 10MB. It is ten times as large as Tech1 (1) mass storage.
5. Tech 2 has a capacity of equivalent to two snapshots.
6. The PCMCIA card is sensitive to magnetic and electrostatic. Please handle it with care.
7. Tech 2 can plot a graph of snapshots.
8. Pressing the EXIT key can bring back to the main menu anytime.
9. Open the application menu and press the "F1:Clear DTCInfo" or the DTC clear to erase the diagnosis trouble codes (DTCs).

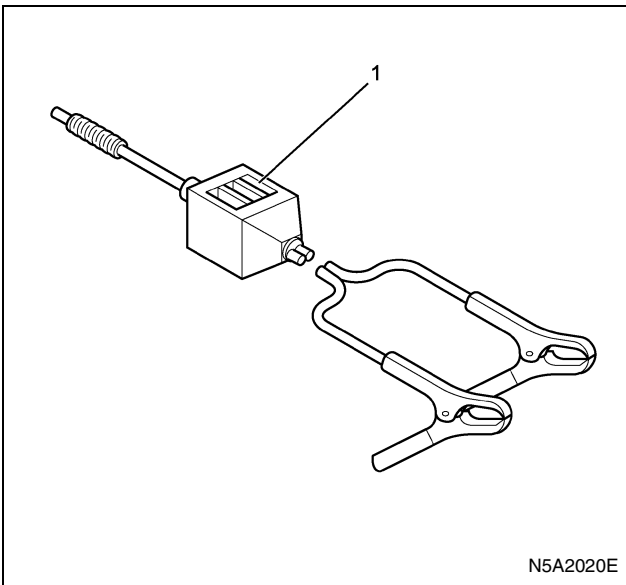
How to Connect Tech 2

1. Insert the PCMCIA card for ISUZU system to the Tech 2 body.
2. Install the SAE 16/19 adapter to the DLC cable.
3. Install the DLC cable to the Tech 2 body.
4. Make sure that the ignition is "OFF".

5. Connect the SAE-16/19 adapter of the Tech 2 to the self-diagnosis cord (black) in the body side.



Connect an adapter cable between the Tech 2 and 12-V battery. (When connecting the adapter cable, start with the negative side.)



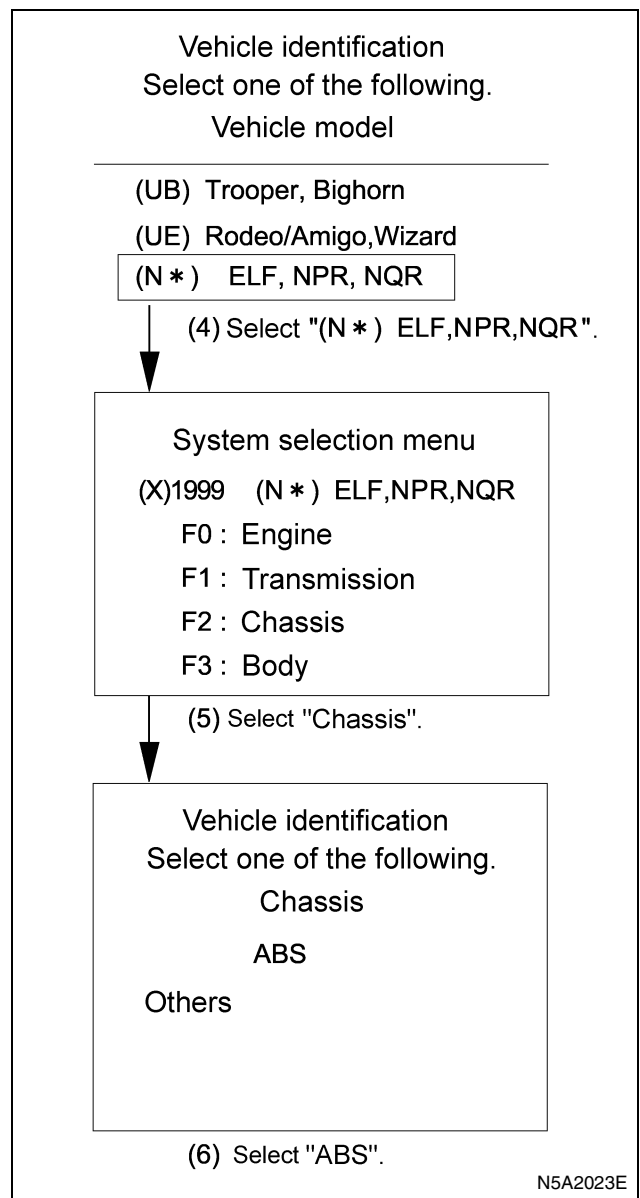
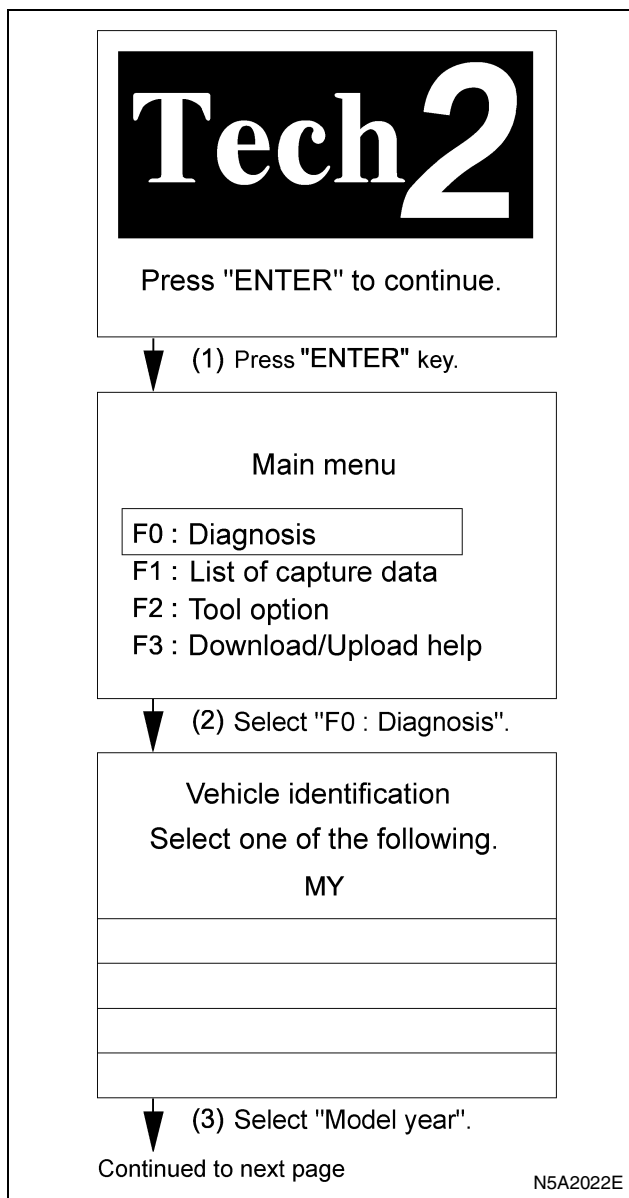
Legend

1. 3A-fuse
-
6. Turn the ignition switch to "ON" and press the "PWR" key of the Tech 2.
 7. Check the display of the Tech 2.



CAUTION:
Make sure that no power is supplied to the Tech 2 when installing/removing the PCMCIA card.

Tech 2 Operation Procedure



The following chart shows the functions used by the current Tech 2 software.

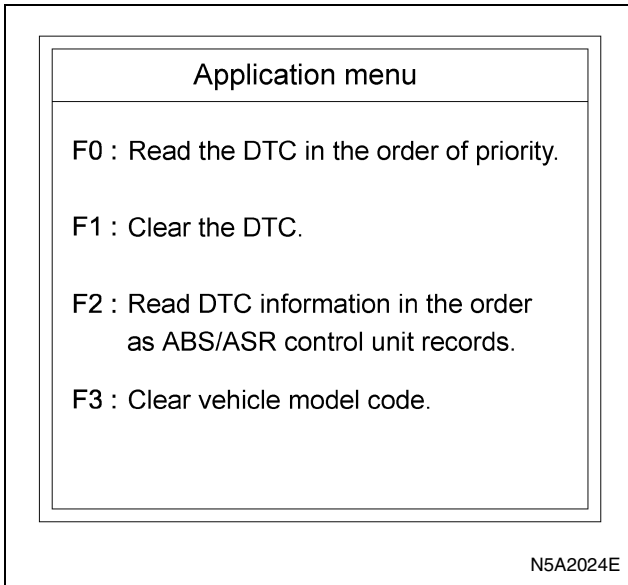
Menu

F0:	Diagnostic trouble code
	F0: Read the DTC in the order of priority. F1: Clear the DTC.
F1:	Data display
F2:	Snapshot
F3:	Actuator test

DTC (diagnostic trouble code) mode

Two options are available for Tech 2 DTC mode. After selecting the DTC, the following menu is displayed.

- DTC Info (DTC information)
- Clear Info (DTC clear)

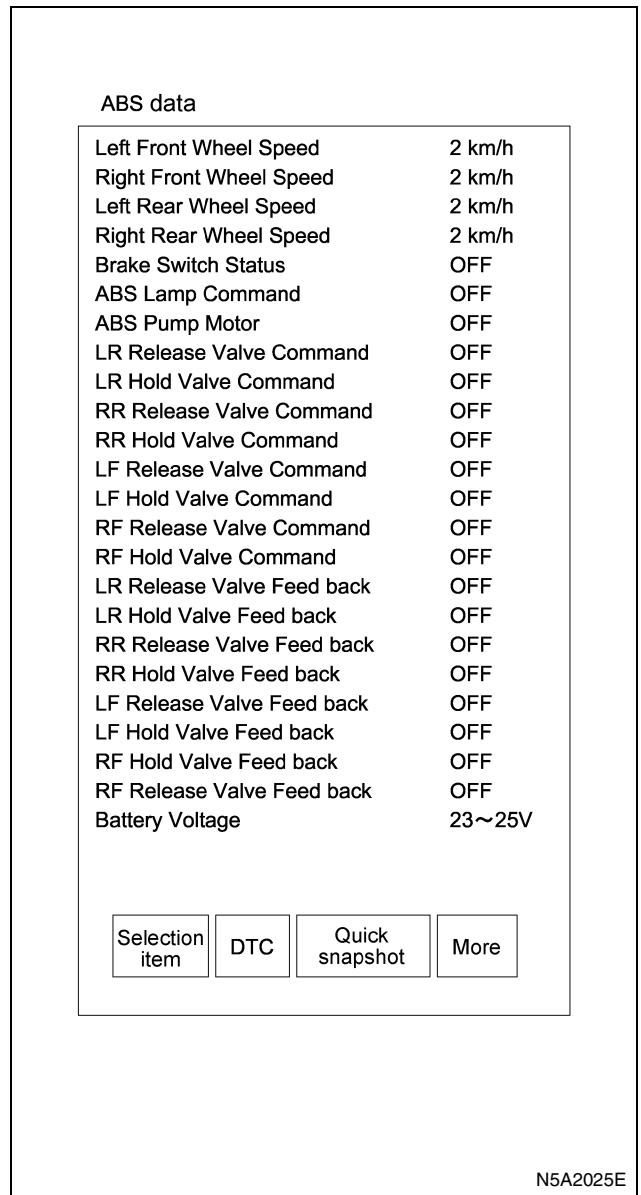


DTC is the language for technicians to communicate with the ECM on the vehicle. DTC can roughly be classified into past DTC and current DTC.

- Current DTC: Trouble (fault) occurred current ignition cycle
- Past DTC: Trouble (fault) occurred previous ignition cycle or that in the past
- Multiple DTC: More than one DTC may be displayed in a time. It is called as multiple DTC. This happens when multiple troubles (faults) occurred in a time. Further this happens to the sensors and switches sharing same power source or ground. When such power source or ground is open or shorted, the DTCs of relevant sensors or switches are displayed.
In this case, the power source or ground shared must be checked for open/short circuit.
Use of DTC clear mode can erase the DTC memory stored in the vehicle.

Data display

Example

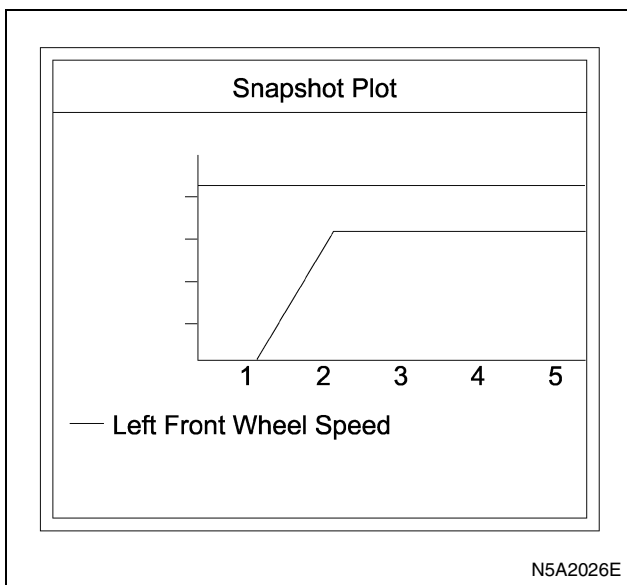


Use of this menu can display the current data. Note that menu is subject to change.

CAUTION:

On the vehicle that the rear tires have smaller diameter, the rear wheel speed may be indicated a little higher than the front wheel speed. Check the speed after driving a while at a constant speed.

Snapshot (graph plotting)



- The snapshot can record the data list menu and plot a graph.
- Utilizing this mode, reproduce and record the conditions claimed by the customer to identify the engine data fault.
- The stored data can be replayed with a domestic power supply.

Method to perform after data is displayed

Select "Data display" in application menu after confirming flow "Main menu diagnosis" -ID.

Select "Quick snapshot" in lower portion of display screen after vehicle data is displayed.

Wait for a while and press "EXIT" button.

Method to perform after trigger type is determined

Select "Snapshot" in application menu after confirming flow "Main menu diagnosis" -ID.

Select after items are displayed.

Determine trigger type after snapshot option screen is displayed, and select "Record snapshot" in lower portion of screen.

Select "Trigger" in lower portion of screen after (Standby)blinks in right lower portion of screen.

Confirm trigger type.

Select "Continue" in lower portion of screen after screen changes.

Select "Plot" after it is displayed.

In item selection screen, press enter key at items to select by three items, and select "Accept" in lower portion of screen.

Graph is displayed in screen.

N5A2027E

Confirm "Data display" in application menu after confirming flow "Main menu diagnosis" -ID.

Select item after it is displayed in screen.

Determine trigger type after snapshot option screen is displayed,
and select "Review data" in lower portion of screen.

Data which is triggered in vehicle is displayed, and select the data.
(Multiple data are displayed according to times of trigger.)

Data is displayed in screen. Select "Plot" to display graph.

In item selection screen, press enter key at items to select by three items,
and select "Accept" in lower portion of screen.

Graph is displayed in screen.

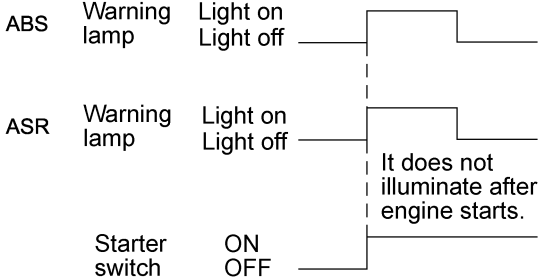
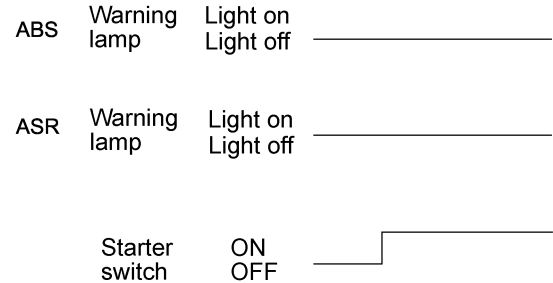
N5A2028E

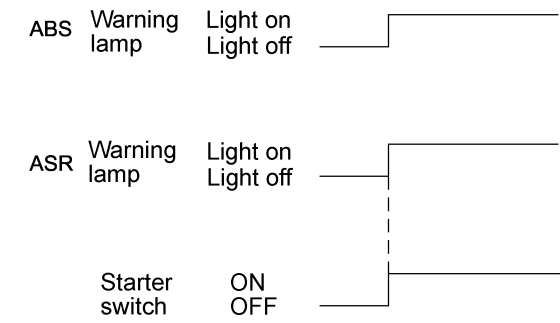
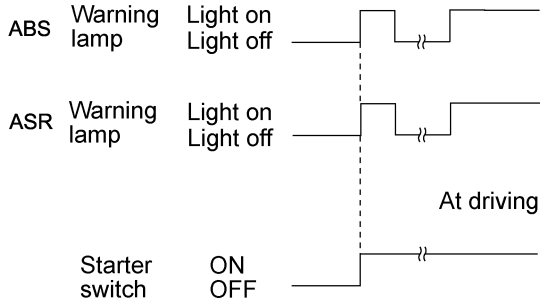
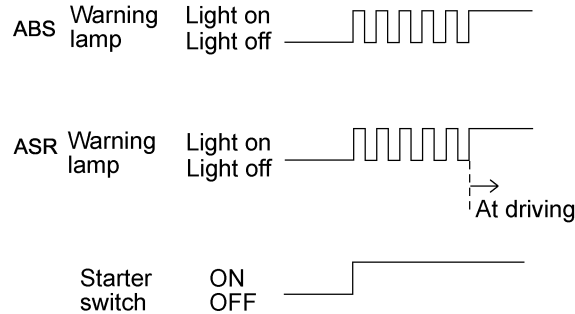
List of Diagnostic Trouble Code

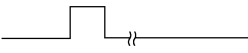
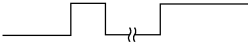
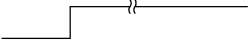

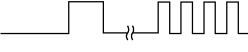
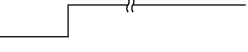
DTC		Description	Check flow
Flash out code (warning lamp blinking pattern)	Tech 2 code		
12	C0212	Normal	—
13	C0213	Model type identification fault due to wrong assembly of control unit	B-2
14	C0214	EHCUC fault	B-3
15	C0215	ECU power supply fault	B-4
16	C0216	CAN Communication fault	B-5
26	C0226	ECM Communication fault	B-6
33	C0233	Motor drive circuit fault	B-7
34	C0234	Motor rotation fault	B-8
35	C0235	ASR communication fault (ASR only) ASR continuous operation	B-9
41	C0241	Fail-safe relay fault	B-10
43	C0243	Solenoid drive circuit fault	B-11
45	C0245	Solenoid monitor circuit fault	B-12
51	C0251	Speed sensor open/short circuit; FL	B-13
52	C0252	Speed sensor open/short circuit; FR	B-14
53	C0253	Speed sensor open/short circuit; RL	B-15
54	C0254	Speed sensor open/short circuit; RR	B-16
61	C0261	Speed sensor signal fault/wrong tire size; FL	B-17
62	C0262	Speed sensor signal fault/wrong tire size; FR	B-18
63	C0263	Speed sensor signal fault/wrong tire size; RL	B-19
64	C0264	Speed sensor signal fault/wrong tire size; RR	B-20

Diagnosis with Blinking Pattern

If the ABS/ASR warning lamp blinking pattern is found to be faulty with the ignition switch ON, or when the warning lamp comes on during the test run, perform the diagnosis according to the chart shown below depending on the blinking pattern.

No.	Lamp condition	Warning lamp illumination pattern	Diagnostic flow
1	Warning lamp shows normal.	 <p style="text-align: right;">N5A2029E</p>	Normal
2	Warning lamp remains off.	 <p style="text-align: right;">N5A2030E</p>	<p>ABS ABS warning lamp illumination circuit is faulty. Go to check flow B-1-1.</p> <p>ASR ASR warning lamp illumination circuit is faulty.</p>

No.	Lamp condition	Warning lamp illumination pattern	Diagnostic flow
3	Warning lamp remains on.	 <p style="text-align: right;">N5A2031E</p>	<p>DTC is stored. Display the DTC and perform the diagnosis for each code according to the diagnostic flow.</p> <p>If DTC is not stored, warning lamp illumination circuit or meter may be faulty.</p> <p>Check the meter itself or harness between the meter and EHCU connector terminal 6.</p>
4	Warning lamp comes on when driving.	 <p style="text-align: center;">At driving</p> <p>※ Either "ABS" or "ASR" is faulty, one of two illuminates. System without faulty can operate.</p> <p style="text-align: right;">N5A2032E</p>	<p>DTC is stored. Display the DTC and perform the diagnosis for each code according to the diagnostic flow.</p>
5	Warning lamp repeats blinking after turning the starter switch ON, and then turns on when driving the vehicle.	 <p style="text-align: center;">At driving</p> <p style="text-align: right;">N5A2033E</p>	<p>Self-diagnosis circuit is faulty.</p> <p>Go to check flow B-1-2.</p>

No.	Lamp condition	Warning lamp illumination pattern	Diagnostic flow
6	ASR lamp only comes on when driving.	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">ABS</div> <div style="margin-right: 10px;">Warning lamp</div> <div style="margin-right: 10px;">Light on Light off</div>  </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">ASR</div> <div style="margin-right: 10px;">Warning lamp</div> <div style="margin-right: 10px;">Light on Light off</div>  </div> <div style="margin-left: 150px; margin-top: 5px;">At driving</div> <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="margin-right: 10px;">Starter switch</div> <div style="margin-right: 10px;">ON OFF</div>  </div> </div> <p style="text-align: right; margin-top: 20px;">N5A2034E</p>	<p>Normal if ASR off switch has been operated. If not, the ASR off switch circuit is faulty. Check the ASR off switch itself, and the harness between the ASR off switch and the EHCU connector terminal 5.</p>
7	ASR lamp only blinks when driving.	<div style="display: flex; flex-direction: column; align-items: flex-start;"> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">ABS</div> <div style="margin-right: 10px;">Warning lamp</div> <div style="margin-right: 10px;">Light on Light off</div>  </div> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="margin-right: 10px;">ASR</div> <div style="margin-right: 10px;">Warning lamp</div> <div style="margin-right: 10px;">Light on Light off</div>  </div> <div style="margin-left: 150px; margin-top: 5px;">At driving</div> <div style="display: flex; align-items: center; margin-top: 20px;"> <div style="margin-right: 10px;">Starter switch</div> <div style="margin-right: 10px;">ON OFF</div>  </div> </div> <p style="text-align: right; margin-top: 20px;">N5A2035E</p>	<p>ASR is in operation. It is normal.</p>

ABS Warning Lamp does not Come on with the Starter Switch ON.**Check flow B-1-1**

Step	Action	Value	YES	NO
1	Is the F-16 meter backup lamp fuse blown?	—	Go to Step5	Go to Step2
2	Is the warning lamp bulb blown?	—	Go to Step6	Go to Step3
3	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Turn the starter switch ON. 4. Measure the voltage between the B-51 connector terminal 18 and the J-177 connector terminal 1,2,3. Is the voltage within specified value?	16.5 — 34V	Go to Step4	Go to Step7
4	Check for continuity between the J-177 connector terminal 1,2,3 and the body ground. Is there continuity?	—	Go to Step9	Go to Step8
5	Replace the fuse. Is this step completed?	—	Go to Step10	—
6	Replace the warning lamp. Is this step completed?	—	Go to Step10	—
7	Repair the circuit for open/short circuit, and the connector for improper connection. Is this step completed?	—	Go to Step10	—
8	Repair the circuit for open/short circuit, and the connector for improper connection. Is this step completed?	—	Go to Step10	—
9	1. Check the suspicious circuit for improper connection. 2. If the connection is normal, replace the EHCU. Is this step completed?	—	Go to Step10	—
10	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	—

ABS Warning Lamp Repeats Blinking After Turning the Starter Switch to ON.**Check flow B-1-2**

Step	Action	Value	YES	NO
1	Is anything connected to the self-diagnosis connector?	—	Go to Step2	Go to Step3
2	Disconnect the connection. Is this step completed?	—	Go to Step7	—
3	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. Check for continuity between the J-177 connector terminal 4 and the J-177 connector terminal 1,2,3. Is there continuity?	—	Go to Step4	Go to Step5
4	Repair the circuit of the diagnosis connector J-177 terminal 4 and the B-79 connector terminal 12. Is this step completed?	—	Go to Step7	—
5	Is there any other trouble symptom?	—	Check according to the check flow of such symptom.	Go to Step6
6	Replace the EHCU. Is this step completed?	—	Go to Step7	—
7	Install all the components, and check that those are installed properly. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step7

ABS Warning Lamp Repeats Blinking After Turning the Starter Switch to ON.**Check flow B-1-3**

Step	Action	Value	YES	NO
1	Is anything connected to the self-diagnosis connector?	—	Go to Step2	Go to Step3
2	Disconnect the connection. Is this step completed?	—	Go to Step7	—
3	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. Is there continuity between the J-177 connector terminal 4 and the J-177 connector terminal 1, 23?	—	Go to Step4	Go to Step5
4	Repair the circuit between the diagnosis connector J-177 terminal 4 and the B-79 connector terminal 12. Is this step completed?	—	Go to Step7	—
5	Is there any other trouble symptom?	—	Check according to the check flow of such symptom.	Go to Step6
6	Replace the EHCU. Is this step completed?	—	Go to Step7	—
7	Install all the components, and check that those are installed properly. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step7

DTC:C0213 (Flash Code 13) Model Type Identification Fault Due to Wrong Assembly of Control Unit

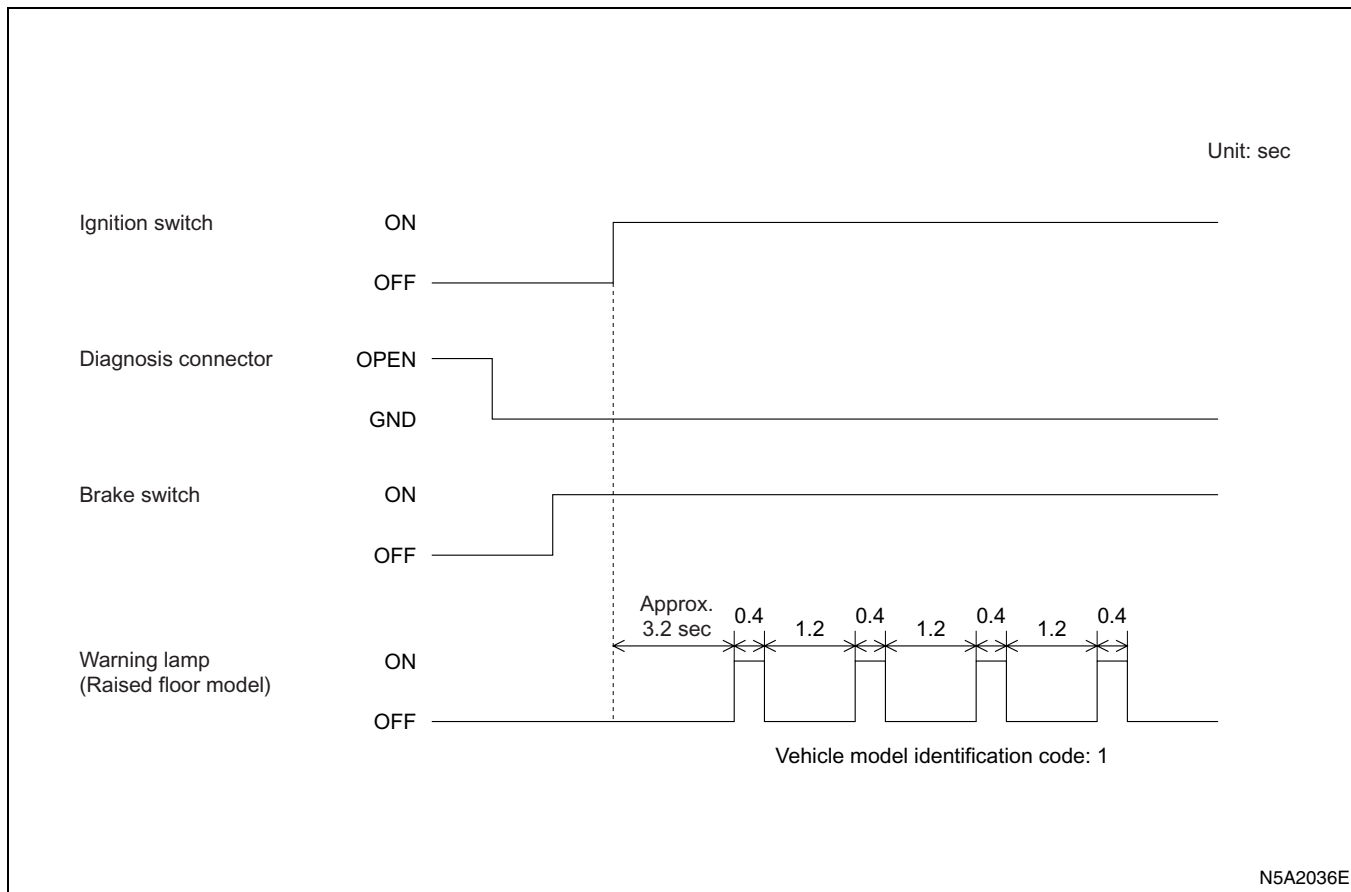
Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the J-177 connector of the EHCU. 3. Turn the starter switch ON. Measure the voltage between the J-177 connector terminal 18 and the 1,23. Is the voltage within the specified value?	0.5 — 4.5V	Go to Step2	Go to Step3
2	Repair the short circuit and improper connection in J-177 connector terminal 18. Measure the voltage between the J-177 connector terminal 18 and 1,23. Is the voltage within the specified value?	0.5 — 4.5V	Go to Step3	Go to Step4
3	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. 3. Does failure occur? Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step4
4	Replace the EHCU with a new one. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step3

Model Type Identification by Control Unit

EHCU (ABS control unit) is exclusively installed for each vehicle type, based the drive system, brake type, tire, etc. Also, you can use the warning lamp blinking pattern to identify the type of control unit (for which vehicle type).

How to Indicate Model Type Identification Result

With the ignition switch OFF, short the terminal 12 with the terminal 4 or 5 (ground) of the self-diagnosis connector, and depress the brake pedal and then turn the starter switch to ON. The ABS warning lamp will blink to indicate the result.



Model type identification code	2WD ABS
1	Raised floor model with front wheel disc brake
2	Flat low model with front wheel disc brake
3	Raised floor model with four wheel drum brake
7	NQR model for EC
8	NQR model for Australia

DTC:C0214 (Flash Code 14) EHCUC Fault**Check flow B-3**

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCUC. 3. Check for continuity between the J-177 connector terminal 1,23 and the body ground. Is there continuity?	—	Go to Step2	Go to Step3
2	1. Connect the connector of the EHCUC. 2. Clear the DTC. 3. Perform the self-diagnosis after turning the starter switch from OFF to ON. Is DTC displayed repeatedly?	—	Go to Step4	Go to Step5
3	Repair the circuit for open/short circuit, and the connector for improper connection. Is this step completed?	—	Go to Step5	—
4	Replace the EHCUC. Is this step completed?	—	Go to Step5	—
5	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step5

DTC:C0215 (Flash Code 15) ECU Power Supply Fault**Check flow B-4**

Step	Action	Value	YES	NO
1	Is the battery voltage normal?	—	Go to Step2	Go to Step5
2	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Start the engine. 4. Measure the voltage between the J-177 connector terminal 2 and the J-177 connector terminal 1,2,3. Is the value within specified value?	17 — 33.5V	Go to Step3	Go to Step6
3	Look for the circuit with improper connection. Is improper connection found?	—	Go to Step4	Go to Step8
4	Repair and perform the self-diagnosis. Is DTC displayed repeatedly?	—	Go to Step7	Go to Step8
5	Charge or replace the battery. Is this step completed?	—	Go to Step8	—
6	Repair the circuit for open/short circuit, and the connector for improper connection between the J-177 connector terminal 2 and the fusible link FL-9. Is this step completed?	—	Go to Step8	—
7	Replace the control unit. Is this step completed?	—	Go to Step8	—
8	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step8

DTC:C0216 (Flash Code 16) CAN Communication Fault**Check flow B-5**

Step	Action	Value	YES	NO
1	<ol style="list-style-type: none">1. Turn the starter switch OFF.2. Remove the harnesses from all the control units (engine, ABS, Smoother, etc.) connected to the CAN communication circuit.3. Check for short circuit (shorts with ground, power supply, lines, and circuits) in the CAN communication circuit harnesses. <p>Is the harness normal?</p>	—	Go to Step3	Go to Step2
2	<p>Repair the CAN communication circuit.</p> <p>Is the procedure completed?</p>	—	Go to Step3	—
3	<ol style="list-style-type: none">1. Turn the starter switch OFF.2. Remove the harness from the EHCU.3. Measure the circuit resistance between the terminals 14 and 15, and between terminals 26 and 27 in EHCU harness-side connector. <p>Is the resistance within specified value?</p>	100 —140Ω	Go to Step5	Go to Step4
4	<p>Inspect the CAN communication circuit, terminating resistor, and connectors for faulty contact, the pin terminals for looseness, etc., and repair as necessary.</p> <p>Is the procedure completed?</p>	—	Go to Step5	—
5	<ol style="list-style-type: none">1. Turn the starter switch OFF.2. Check the CAN communication (engine, ABS, Smoother, etc.) circuit harnesses for open circuit. <p>Is the harness normal?</p>	—	Go to Step7	Go to Step6
6	<p>Repair the CAN communication circuit.</p> <p>Is the procedure completed?</p>	—	Go to Step7	—
7	<ol style="list-style-type: none">1. Turn the starter switch OFF.2. Install the harnesses to all the control units connected to the CAN communication circuit.3. Turn the starter switch ON.4. Check each system (engine, Smoother, etc) for DTC.5. If any DTC is detected in any system, repair it. <p>Is the procedure completed?</p>	—	Go to Step8	—
8	<ol style="list-style-type: none">1. Clear the DTC.2. Perform the test drive.3. Check for DTC. <p>Was DTC C0216 detected?</p>	—	Go to Step9	Go to Step10

Step	Action	Value	YES	NO
9	Replace the EHCU. Is this step completed?	—	Go to Step10	—
10	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step10

DTC:C0226 (Flash Code 26) ECM Communication Fault**Check flow B-6**

Step	Action	Value	YES	NO
1	Inspect the engine control, and repair or replace any faulty parts. Is this step completed?	—	Go to Step2	Go to Step1
2	Perform the check flow B-5. Is this step completed?	—	Go to Step3	Go to Step2
3	1. Clear the DTC. 2. Perform the test drive. 3. Check for DTC. Was DTC C0226 detected?	—	Go to Step4	Go to Step5
4	Replace the EHCU. Is this step completed?	—	Go to Step5	—
5	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step5

DTC:C0233 (Flash Code 33) Motor Drive Circuit Fault**Check flow B-7**

Step	Action	Value	YES	NO
1	<ol style="list-style-type: none">1. Turn the starter switch OFF.2. Disconnect the connector of the EHCU.3. Turn the starter switch ON.4. Measure the voltage between the J-177 connector terminal 24 and the J-177 connector terminal 23. <p>Is the value within specified value?</p>	20 — 32V	Go to Step5	Go to Step2
2	<p>Repair the circuit between the J-177 connector terminal 24 and the FL-9, or replace the FL-9.</p> <p>Is this step completed?</p>	—	Go to Step3	Go to Step2
3	<p>Measure the voltage between the J-177 connector terminals 24 and 23.</p> <p>Is the value within specified value?</p>	20 — 32V	Go to Step6	Go to Step4
4	<p>Repair the harness between the J-177 connector terminal 23 and the chassis ground.</p> <p>Is this step completed?</p>	—	Go to Step6	Go to Step4
5	<p>Replace the EHCU.</p> <p>Is this step completed?</p>	—	Go to Step6	Go to Step5
6	<ol style="list-style-type: none">1. Install all the components, and check that those are installed properly.2. Clear the DTC.3. Test run the vehicle. <p>Is this step completed?</p>	—	Go to “Diagnostic basic flow”.	Go to Step6

DTC:C0234 (Flash Code 34) Motor Rotation Fault**Check flow B-8**

Step	Action	Value	YES	NO
1	Replace the EHCU. Is this step completed?	—	Go to Step2	Go to Step1
2	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. 3. Test run the vehicle. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step2

DTC:C0235 (Flash Code 35) ASR Communication Line Fault/ASR Continuous Operation
Check flow B-9

Step	Action	Value	YES	NO
1	1. Check the tire. 2. Check if specified tires are attached. 3. Check for abnormal wear on the tire outer surface. Are the tires normal?	—	Go to Step2	Replace with the specified tire, and Go to Step2
2	Check the speed sensor. (Check the sensor output by referring to the check flow C-1-1-C-1-4, or TC-1.) Is the sensor output normal?	100 — 140Ω	Go to Step3	Repair the faulty speed sensor, and Go to Step5
3	Check the engine control. Is the engine control normal?	“Diagnosis with Blinking Pattern” No.1	Go to Step4	Repair the engine control, and Go to Step5
4	Replace the EHCU. Is this step completed?	—	Go to Step5	Go to Step4
5	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step5

DTC:C0241 (Flash Code 41) Fail-Safe Relay Fault**Check flow B-10**

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Turn the starter switch ON. 4. Measure the voltage between the J-177 connector terminal 2 and the J-177 connector terminal 1. Is the value within specified value?	16.5 — 34V	Go to Step6	Go to Step2
2	Repair the circuit between the J-177 connector terminal 2 and the FL-9. Is this step completed?	—	Go to Step3	Go to Step2
3	Measure the voltage between the J-177 connector terminals 2 and 1. Is the value within specified value?	16.5 — 34V	Go to Step7	Go to Step4
4	Repair the harness between the J-177 connector terminal 1 and the chassis ground. Is this step completed?	—	Go to Step5	Go to Step4
5	Measure the voltage between the J-177 connector terminals 2 and 1. Is the value within specified value?	16.5 — 34V	Go to Step7	Go to Step5
6	Replace the EHCU. Is this step completed?	—	Go to Step7	Go to Step6
7	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. 3. Test run the vehicle. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step7

DTC:C0243 (Flash Code 43) Solenoid Drive Circuit Fault**Check flow B-11**

Step	Action	Value	YES	NO
1	Replace the EHCU. Is this step completed?	—	Go to Step2	Go to Step1
2	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. 3. Test run the vehicle. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step2

DTC:C0245 (Flash Code 45) Solenoid Monitor Circuit Fault**Check flow B-12**

Step	Action	Value	YES	NO
1	Replace the EHCU. Is this step completed?	—	Go to Step2	Go to Step1
2	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. 3. Test run the vehicle. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step2

DTC:C0251 (Flash Code 51) Speed Sensor Open/Short Circuit; FL**Check flow B-13**

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Measure the resistance between the J-177 connector terminals 32 and 33. Is the value within specified value?	1 — 2k Ω	Go to Step2	Go to Step3
2	Measure the resistance between the J-177 connector terminals 32 and the ground. Is the value within specified value?	1000k Ω or more	Go to Step7	Go to Step4
3	1. Disconnect the FL wheel speed sensor connector. 2. Measure the resistance between the J-75 connector terminals 1 and 2 (sensor side). Is the value within specified value?	1 — 2 Ω	Go to Step5	Go to Step6
4	1. Disconnect the FL wheel speed sensor connector. 2. Measure the resistance between the J-75 connector terminal 1 (sensor side) and the ground. Is the value within specified value?	1000k Ω or more	Go to Step5	Go to Step6
5	Repair the circuit for open/short circuit between the control unit connector and the sensor connector. Is this step completed?	—	Go to Step8	—
6	Replace the FL wheel speed sensor. Is this step completed?	—	Go to Step8	—
7	Replace the control unit. Is this step completed?	—	Go to Step8	—
8	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step8

DTC:C0252 (Flash Code 52) Speed Sensor Open/Short Circuit; FR**Check flow B-14**

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Measure the resistance between the J-177 connector terminals 10 and 11. Is the value within specified value?	1 — 2k Ω	Go to Step2	Go to Step3
2	Measure the resistance between the J-177 connector terminals 10 and the ground. Is the value within specified value?	1000k Ω or more	Go to Step7	Go to Step4
3	1. Disconnect the FR wheel speed sensor connector. 2. Measure the resistance between the J-74 connector terminals 1 and 2 (sensor side). Is the value within specified value?	1 — 2k Ω	Go to Step5	Go to Step6
4	1. Disconnect the FR wheel speed sensor connector. 2. Measure the resistance between the J-74 connector terminal 1 (sensor side) and the ground. Is the value within specified value?	1000k Ω or more	Go to Step5	Go to Step6
5	Repair the circuit for open/short circuit between the control unit connector and the sensor connector. Is this step completed?	—	Go to Step8	—
6	Replace the FR control unit. Is this step completed?	—	Go to Step8	—
7	Replace the control unit. Is this step completed?	—	Go to Step8	—
8	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step8

DTC:C0253 (Flash Code 53) Speed Sensor Open/Short Circuit; RL**Check flow B-15**

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCUC and the RL wheel speed sensor connector J-149. 3. Check for continuity between the J-177 connector terminal 34 and the J-149 sensor connector terminal 2. Is there continuity?	—	Go to Step2	Go to Step7
2	Check for continuity between the J-177 connector terminals 34 and 1. Is there continuity?	—	Go to Step7	Go to Step3
3	Check for continuity between the J-177 connector terminal 22 and the J-149 sensor connector terminal 1. Is there continuity?	—	Go to Step4	Go to Step7
4	Check for continuity between the J-177 connector terminals 22 and 1. Is there continuity?	—	Go to Step7	Go to Step5
5	1. Connect the connector of the EHCUC. 2. Turn the starter switch ON. 3. Measure the voltage between the J-149 sensor connector terminal 1 and the ground. Is the value within specified value?	9 — 16V	Go to Step6	Go to Step7
6	Check the RL wheel speed sensor output. (Refer to the check flow C-1-3.) Is the fail corrected?	—	Go to Step9	Go to Step8
7	Repair the circuit for open/short circuit, and the connector for improper connection between the connector of EHCUC and the speed sensor connector. Is this step completed?	—	Go to Step9	Go to Step7
8	Replace the control unit. Is this step completed?	—	Go to Step9	Go to Step8
9	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step9

DTC:C0254 (Flash Code 54) Speed Sensor Open/Short Circuit; RR**Check flow B-16**

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the connector of EHCU and the RR wheel speed sensor connector J-148. 3. Check for continuity between the J-177 connector terminal 12 and the J-148 sensor connector terminal 2. Is there continuity?	—	Go to Step2	Go to Step7
2	Check for continuity between the J-177 connector terminals 12 and 1. Is there continuity?	—	Go to Step7	Go to Step3
3	Check for continuity between the J-177 connector terminal 21 and the J-148 sensor connector terminal 1. Is there continuity?	—	Go to Step4	Go to Step7
4	Check for continuity between the J-177 connector terminals 21 and 1. Is there continuity?	—	Go to Step7	Go to Step5
5	1. Connect the connector of the EHCU. 2. Turn the starter switch ON. 3. Measure the voltage between the J-148 sensor connector terminal 1 and the ground. Is the value within specified value?	9 — 16V	Go to Step6	Go to Step7
6	Check the RR wheel speed sensor output. (Refer to the check flow C-1-4.) Is the fail corrected?	—	Go to Step8	Go to Step8
7	Repair the circuit for open/short circuit, and the connector for improper connection between the connector of EHCU and the speed sensor connector. Is this step completed?	—	Go to Step9	Go to Step7
8	Replace the control unit. Is this step completed?	—	Go to Step9	Go to Step8
9	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step9

DTC:C0261 (Flash Code 61) Speed Sensor Signal Fault/Wrong Tire Size; FL

Check flow B-17

Step	Action	Value	YES	NO
1	Check the tire. Is the tire specification correct? Is abnormal wear found in the outer surface?	—	Go to Step2	Replace with the specified tire without wear. Go to Step21
2	Has certain tire been rotated alone by performing for jack-up or roller tester?	—	DTC may be set if certain tire is rotated alone. Go to Step21	Go to Step3
3	Is the FL wheel bearing rattling?	—	Go to Step12	Go to Step4
4	Is the FL wheel speed sensor/sensor rotor rattling?	—	Go to Step13	Go to Step5
5	Is iron powder attached to the FL wheel speed sensor/sensor rotor?	—	Go to Step14	Go to Step6
6	Check the FL wheel speed sensor. (Refer to the check flow C-1-1 or TC-1.) Is the FL sensor output normal?	—	Go to Step7	Go to Step10
7	Does the sensor rotor have missing tooth or saw-toothed?	—	Go to Step15	Go to Step8
8	Measure the resistance between the B-177 connector terminals 33 and the ground. Is the value within specified value?	1000kΩ or more	Go to Step9	Go to Step11
9	1. Clear the DTC. 2. Test run the vehicle, and perform the self-diagnosis. Is DTC displayed repeatedly?	—	Go to Step20	Go to Step18
10	Is the speed sensor damaged or saw-toothed?	—	Go to Step16	Go to Step17
11	1. Disconnect the FL sensor connector. 2. Measure the resistance between the J-75 connector terminal 2 (sensor side) and the ground. Is the value within specified value?	1000kΩ or more	Go to Step19	Go to Step16
12	Adjust the preload of the wheel bearing. Is this step completed?	—	Go to Step21	—
13	Repair or replace the speed sensor/sensor rotor. Is this step completed?	—	Go to Step21	—
14	Repair the speed sensor/sensor rotor. Is this step completed?	—	Go to Step21	—
15	Replace the sensor rotor. Is this step completed?	—	Go to Step21	—
16	Replace the FL wheel speed sensor. Is this step completed?	—	Go to Step21	—

Step	Action	Value	YES	NO
17	Check the FL wheel speed sensor circuit. (Refer to the check flow B-13.) Is this step completed?	—	Check the repair.	—
18	Check the circuit for open circuit, and the connector for improper connection between the EHCUC and the speed sensor connector. Refer to "Intermittent trouble". Is this step completed?	—	Go to Step21	—
19	Repair the circuit for open/short circuit, and the connector for improper connection between the EHCUC connector and the speed sensor connector. Is this step completed?	—	Go to Step21	Go to Step21
20	Replace the EHCUC. Is this step completed?	—	Go to Step21	—
21	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step21

DTC:C0262 (Flash Code 62) Speed Sensor Signal Fault/Wrong Tire Size; FR**Check flow B-18**

Step	Action	Value	YES	NO
1	Check the tire. Is the tire specification correct? Is abnormal wear found in the outer surface?	—	Go to Step2	Replace with the specified tire without wear. Go to Step21
2	Has certain tire been rotated alone by performing for jack-up or roller tester?	—	DTC may be set if certain tire is rotated alone. Go to Step21	Go to Step3
3	Is the FR wheel bearing rattling?	—	Go to Step12	Go to Step4
4	Is the FR wheel speed sensor/sensor rotor rattling?	—	Go to Step13	Go to Step5
5	Is iron powder attached to the FR wheel speed sensor/sensor rotor?	—	Go to Step14	Go to Step6
6	Check the FR wheel speed sensor. (Refer to the check flow C-1-2 or TC-1.) Is the FR sensor output normal?	—	Go to Step7	Go to Step10
7	Does the sensor rotor have missing tooth or saw-toothed?	—	Go to Step15	Go to Step8
8	Measure the resistance between the B-177 connector terminal 11 and the ground. Is the value within specified value?	1000k Ω or more	Go to Step9	Go to Step11
9	1. Clear the DTC. 2. Test run the vehicle, and perform the self-diagnosis. Is DTC displayed repeatedly?	—	Go to Step20	Go to Step18
10	Is the speed sensor damaged or saw-toothed?	—	Go to Step16	Go to Step17
11	1. Disconnect the FR sensor connector. 2. Measure the resistance between the J-74 connector terminal 2 (sensor side) and the ground. Is the value within specified value?	1000k Ω or more	Go to Step19	Go to Step16
12	Adjust the preload of the wheel bearing. Is this step completed?	—	Go to Step21	—
13	Repair or replace the speed sensor/sensor rotor. Is this step completed?	—	Go to Step21	—
14	Repair the speed sensor/sensor rotor. Is this step completed?	—	Go to Step21	—
15	Replace the sensor rotor. Is this step completed?	—	Go to Step21	—
16	Replace the FR wheel speed sensor. Is this step completed?	—	Go to Step21	—

Step	Action	Value	YES	NO
17	Check the FR wheel speed sensor circuit. (Refer to the check flow B-14.) Is this step completed?	—	Check the repair.	—
18	Check the circuit for open circuit, and the connector for improper connection between the EHCUC and the speed sensor connector. Refer to "Intermittent trouble". Is this step completed?	—	Go to Step21	—
19	Repair the circuit for open/short circuit, and the connector for improper connection between the EHCUC connector and the speed sensor connector. Is this step completed?	—	Go to Step21	Go to Step21
20	Replace the EHCUC. Is this step completed?	—	Go to Step21	—
21	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to "Diagnostic basic flow".	Go to Step21

DTC:C0263 (Flash Code 63) Speed Sensor Signal Fault/Wrong Tire Size; RL**Check flow B-19**

Step	Action	Value	YES	NO
1	Check the tire. Is the tire specification correct? Is abnormal wear found in the outer surface?	—	Go to Step2	Replace with the specified tire without wear. Go to Step18
2	Has certain tire been rotated alone by performing for jack-up or roller tester?	—	DTC may be set if certain tire is rotated alone. Go to Step18	Go to Step3
3	Is the FL wheel bearing rattling?	—	Go to Step10	Go to Step4
4	Is the FL wheel speed sensor/sensor rotor rattling?	—	Go to Step11	Go to Step5
5	Is iron powder attached to the FL wheel speed sensor/sensor rotor?	—	Go to Step12	Go to Step6
6	Check the RL wheel speed sensor. (Refer to the check flow C-1-3.) Is the RL sensor output normal?	—	Go to Step7	Go to Step9
7	Does the sensor rotor have missing tooth or saw-toothed?	—	Go to Step13	Go to Step8
8	1. Clear the DTC. 2. Test run the vehicle, and perform the self-diagnosis. Is DTC displayed repeatedly?	—	Go to Step17	Go to Step16
9	Is the speed sensor damaged or saw-toothed?	—	Go to Step14	Go to Step15
10	Adjust the preload of the wheel bearing. Is this step completed?	—	Go to Step18	—
11	Repair or replace the speed sensor/sensor rotor. Is this step completed?	—	Go to Step18	—
12	Repair the speed sensor/sensor rotor. Is this step completed?	—	Go to Step18	—
13	Replace the sensor rotor. Is this step completed?	—	Go to Step18	—
14	Replace the RL wheel speed sensor. Is this step completed?	—	Go to Step18	—
15	Check the RL wheel speed sensor circuit. (Refer to the check flow B-15.) Is this step completed?	—	Check the repair.	—
16	Check the circuit for open circuit, and the connector for improper connection the EHCU connector and the speed sensor connector. Refer to "Intermittent trouble". Is this step completed?	—	Go to Step18	—

Step	Action	Value	YES	NO
17	Replace the EHCU. Is this step completed?	—	Go to Step18	—
18	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step18

DTC:C0264 (Flash Code 64) Speed Sensor Signal Fault/Wrong Tire Size; RR**Check flow B-20**

Step	Action	Value	YES	NO
1	Check the tire. Is the tire specification correct? Is abnormal wear found in the outer surface?	—	Go to Step2	Replace with the specified tire without wear. Go to Step18
2	Has certain tire been rotated alone by performing for jack-up or roller tester?		DTC may be set if certain tire is rotated alone. Go to Step18	Go to Step3
3	Is the RR wheel bearing rattling?	—	Go to Step10	Go to Step4
4	Is the RR wheel speed sensor/sensor rotor rattling?	—	Go to Step11	Go to Step5
5	Is iron powder attached to the RR wheel speed sensor/sensor rotor?	—	Go to Step12	Go to Step6
6	Check the RR wheel speed sensor. (Refer to the check flow C-1-4.) Is the RR sensor output normal?	—	Go to Step7	Go to Step9
7	Does the sensor rotor have missing tooth or saw-toothed?	—	Go to Step13	Go to Step8
8	1. Clear the DTC. 2. Test run the vehicle, and perform the self-diagnosis. Is DTC displayed repeatedly?	—	Go to Step17	Go to Step16
9	Is the speed sensor damaged or saw-toothed?	—	Go to Step14	Go to Step15
10	Adjust the preload of the wheel bearing. Is this step completed?	—	Go to Step18	—
11	Repair or replace the speed sensor/sensor rotor. Is this step completed?	—	Go to Step18	—
12	Repair the speed sensor/sensor rotor. Is this step completed?	—	Go to Step18	—
13	Replace the sensor rotor. Is this step completed?	—	Go to Step18	—
14	Replace the RR wheel speed sensor. Is this step completed?	—	Go to Step18	—
15	Check the RR wheel speed sensor circuit. (Refer to the check flow B-16.) Is this step completed?	—	Check the repair.	—
16	Check the circuit for open circuit, and the connector for improper connection the EHCU connector and the speed sensor connector. Refer to "Intermittent trouble". Is this step completed?	—	Go to Step18	—

Step	Action	Value	YES	NO
17	Replace the EHCUC. Is this step completed?	—	Go to Step18	—
18	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step18

List of Trouble Symptom

Troubles not appeared as warning lamp indication can be classified into the following five categories.

1. The ABS operates frequently but brake force is insufficient, or the ASR operates frequently.
2. The ABS operates but pulling to one side.
3. Wheels are locked during brake operation.
4. Feeling of brake pedal is faulty.

5. Brake operating noise comes from the EHCUC though the brake pedal is not depressed. Self-diagnosis function is unable to detect these symptoms.

Check the trouble symptom by reproducing the condition through interviewing customer with the test run, and perform the diagnosis according to each trouble symptom.

No.	Trouble symptom	Diagnostic check flow	
		Without Tech 2	With Tech 2
1	The ABS operates frequently but brake force is insufficient, or the ASR operates frequently.	Check flow A-1	Check flow TA-1
2	The ABS operates but pulling to one side.	Check flow A-2	Check flow TA-2
3	Wheels are locked during brake operation.	Check flow A-3	Check flow TA-3
4	Feeling of brake pedal is faulty.	Check flow A-4	—
5	Brake operating noise comes from the hydraulic unit though the brake pedal is not depressed.	Check flow A-5	Check flow TA-5

Symptom: [The ABS Operates Frequently but Brake Force is Insufficient, or the ASR Operates Frequently.] (Check Flow A-1)

Check flow A-1

Step	Action	Value	YES	NO
1	Check the tire. Is the tire specification correct? Is abnormal wear found in the outer surface?	—	Go to Step2	Replace with the specified tire without wear.Go to Step7
2	Is the brake balance between front and rear wheels correct?	—	Go to Step3	Repair the brake components.Go to Step7
3	Are the axle-related parts correctly assembled?	—	Go to Step4	Repair the parts.Go to Step7
4	Is the speed sensor installation normal?	—	Go to Step5	Repair the wheel speed sensor.Go to Step7
5	Is the speed sensor/sensor rotor damaged? Or iron powder attached?	—	Go to Step6	Replace the sensor or sensor rotor. Go to Step7
6	Are all the wheel speed sensor outputs normal?	—	Replace the control unit.Go to Step7	Replace the wheel speed sensor, or repair the circuit. Go to Step7
7	Install all the components, and check that those are installed properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step7

Symptom: [The ABS Operates Frequently but Brake Force is Insufficient, or the ASR Operates Frequently.] (Check Flow TA-1)

Check flow TA-1

Step	Action	Value	YES	NO
1	1. Connect the Tech 2. 2. Check each sensor output from the "Wheel sensor". Is the lowest value of each wheel sensor reading 4 km/h (2 mph) or less? And is the value stable?	—	Go to Step2	Replace the wheel speed sensor.Go to Step3
2	Go back to the check flow A-1. Is the check flow A-1 completed?	—	Go to Step3	Go to Step2
3	Assemble all the components, and check that those are installed properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step3

CAUTION:

On the vehicle that the rear tires have smaller diameter, the rear wheel speed may be indicated a little higher than the front wheel speed. Check the speed after driving a while at a constant speed.

Symptom: [The ABS Operates but Pulling to One Side.] (Check Flow A-2)**Check flow A-2**

Step	Action	Value	YES	NO
1	Is the speed sensor installation normal?	—	Go to Step2	Repair.Go to Step5
2	Is the wheel speed sensor/sensor rotor damaged? Or iron powder attached?	—	Go to Step3	Repair or replace it.Go to Step5
3	Are the wheel speed sensor outputs normal? (Refer to the check flow C-1 or TC-1)	—	Go to Step4	Replace the sensor or repair the circuit. Go to Step5
4	Is the brake pipe connection correct?	—	Replace the control unit.Go to Step5	Correct the connection.Go to Step5
5	Assemble all the components, and check that those are installed properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step5

Symptom: [The ABS Operates but Pulling to One Side.] (Check Flow TA-2)**Check flow TA-2**

Step	Action	Value	YES	NO
1	1. Connect the Tech 2. 2. Check each wheel speed sensor output. Is each sensor output normal?	—	Go to Step2	Go to Step3
2	Check the brake pipe. Is the pipe normal?	—	Replace the EHCU.Go to Step4	Repair the pipe.Go to Step4
3	Repair and check the wheel speed sensor. (Refer to the check flow C-1 or TC-1.) Is this step completed?	—	Go to Step4	Go to Step3
4	Assemble all the components, and check that those are installed properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step4

CAUTION:

On the vehicle that the rear tires have smaller diameter, the rear wheel speed may be indicated a little higher than the front wheel speed. Check the speed after driving a while at a constant speed.

Symptom: [Wheels are Locked During Brake Operation.] (Check Flow A-3, TA-3)**Check flow A-3, TA-3**

Step	Action	Value	YES	NO
1	Does the ABS operate?	—	Go to Step2	Go to Step4
2	Is the vehicle speed 10km/h (6 mph) or less?	—	Go to Step3	Normal
3	Are the wheel speed sensor outputs normal? (Refer to the check flow C-1 or TC-1)	—	Go to Step4	Replace the sensor or repair the circuit. Go to Step5
4	Is the EHCU grounded properly?	—	Replace the EHCU.Go to Step5	Repair.Go to Step5
5	Assemble all the components, and check that those are installed properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step5

Symptom: [Feeling of Brake Pedal is Faulty.] (Check Flow A-4)

Check flow A-4

Step	Action	Value	YES	NO
1	Does the stop lamp come on when depressing the brake pedal?	—	Go to Step2	Go to Step3
2	1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Measure the voltage between the J-177 connector terminal 16 and the J-177 connector terminal 1,23 with the brake pedal depressed. Is the power supply voltage supplied to it?	—	Go to Step4	Repair the circuit between the stop lamp switch and the control unit.Go to Step7
3	Is the stop lamp fuse F-5 normal?	—	Go to Step5	Replace the fuse.Go to Step7
4	Check for continuity between the J-177 connector terminal 1,23 and the body ground. Is there continuity?	—	Go to Step6	Repair the body ground circuit.Go to Step7
5	Is the stop lamp switch normal?	—	Repair the stop lamp circuit.Go to Step7	Replace the stop lamp switch.Go to Step7
6	Check the suspicious circuit/connector for improper connection. Is there improper connection?	—	Brake fluid line is leaked or air mixed. (Refer to Section 5A.)Go to Step7	Repair the circuit.Go to Step7
7	Assemble all the components, and check that those are assembled properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step7

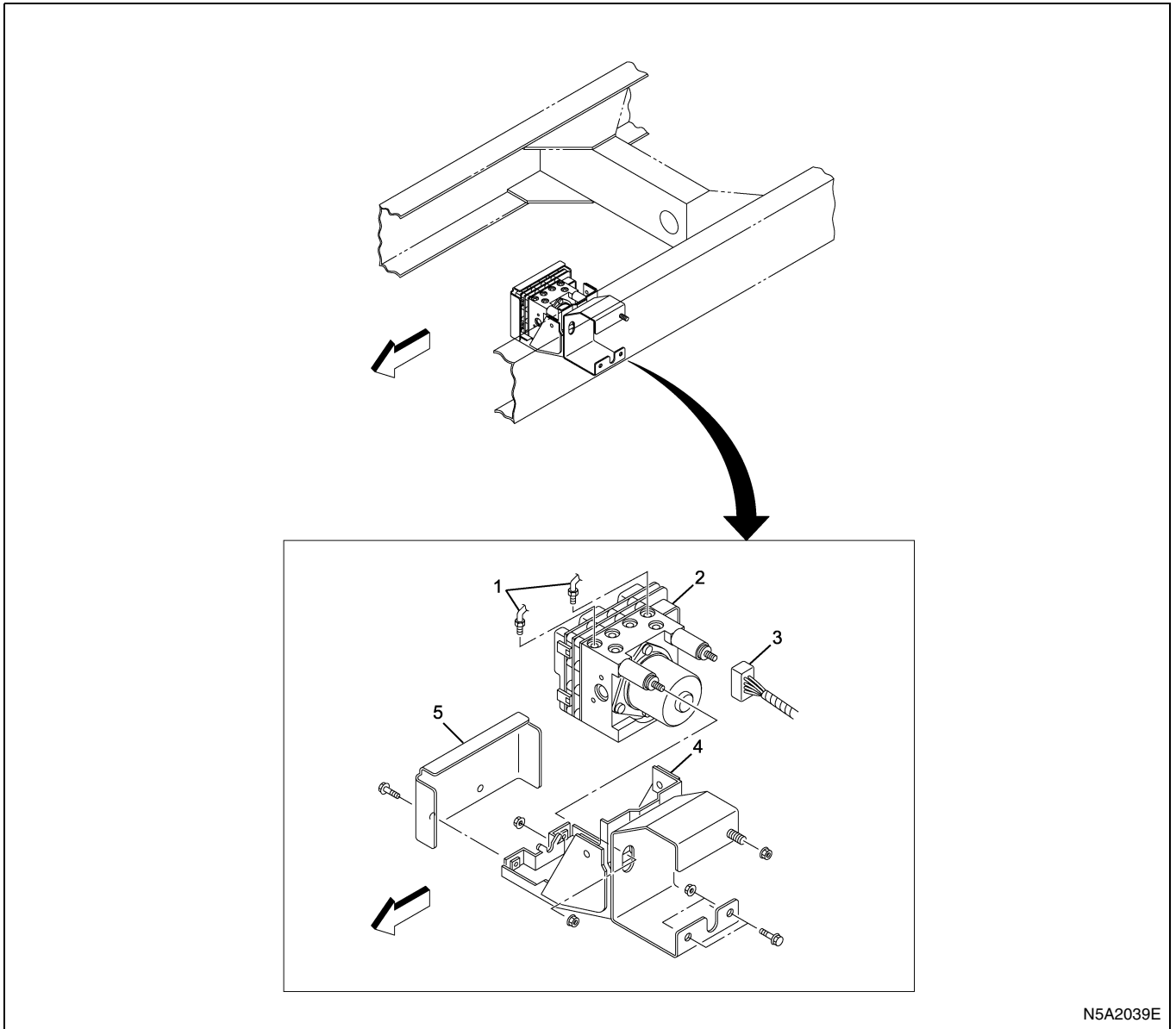
Symptom: [Brake Operating Noise Comes from the Hydraulic Unit Though the Brake Pedal is not Depressed.] (Check Flow A-5, TA-5)

Check flow A-5, TA-5

Step	Action	Value	YES	NO
1	Is this the first time operation since the engine is started?	—	Normal (It is a motor check operation noise of self-diagnosis function.)	Go to Step2
2	Is the vehicle speed 10km/h (6 mph) or less?	—	Normal (It is a motor check operation noise of self-diagnosis function.)	Go to Step3
3	<p>Check for noise in the following conditions:</p> <ul style="list-style-type: none"> • When shifting down, or when operating the clutch • When driving a slippery low-temperature road (iced or snow-covered), or when driving a rough road • While turning with high speed • When driving over a bump (such as curbstone) • When operating electrical switches • When running the engine high speed <p>Is noise generated in any of the above conditions?</p>	—	Normal (ABS may operate without depressing the brake pedal.)	Go to Step4
4	Do all the speed sensor/sensor rotor operate normally?	—	Go to Step5	Repair.Go to Step7
5	Is the wheel speed sensor/sensor rotor damaged? Or iron powder attached?	—	Go to Step7	Repair or replace it.Go to Step6
6	Are all the sensor outputs normal? (Refer to the check flow C-1 or TC-1)	—	Check the suspicious circuit/connector for improper connection. If the connection is normal, replace the EHCU.Go to Step7	Repair.Go to Step7
7	<p>Assemble all the components, and check that those are installed properly.</p> <p>Is this step completed?</p>	—	Repeat "Diagnostic basic flow".	Go to Step7

Electronic Hydraulic Control Unit (EHCU)

Components



N5A2039E

Legend

- | | |
|--------------|------------|
| 1. Pipe | 4. Bracket |
| 2. EHCU | 5. Cover |
| 3. Connector | |

Removal

CAUTION:

- When performing electric-arc welding on the vehicle, remove the EHCU before starting welding work.
- When removing the EHCU from the vehicle, disconnect the battery cable first, and then disconnect the connector. Connect in the reverse order of disconnection.
- Do not place intense radio emission equipment such as radio device near the EHCU.
- Do not pour water to the EHCU directly.
- Never loosen the screw of the EHCU body. Nor apply paint to the EHCU body.
- Do not let metal products directly contact with the connector pin terminals, including screwdriver and or tester probe.
- Use special care for electrostatic.
- Do not directly apply external voltage to the terminals.

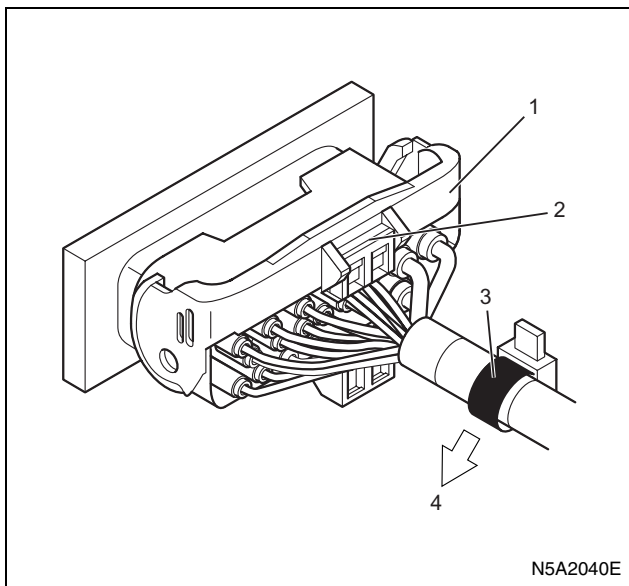
- When handling, do not hold the pipe of the upper EHCU.
- Never loosen the bolts and nuts of the EHCU body. If loosened, that EHCU must not be used anymore.

1. Cover

- Remove the cover.

2. Harness connector

- If the harness is fixed to the EHCU bracket, loosen the fixing clip.



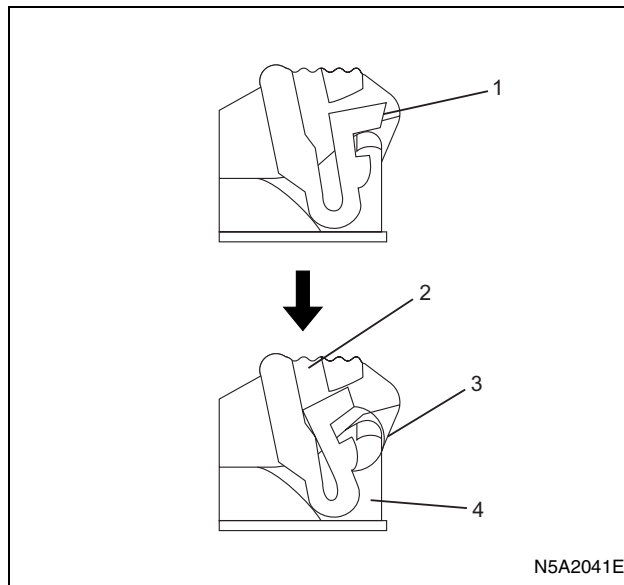
Legend

1. Lever
2. Lever lock
3. Clip
4. Fixed to EHCU bracket.

- Unlock the connector. Pull down the lever lock to the unlock position.

Notice:

Make sure the lock portion (A portion) is in the unlock position.



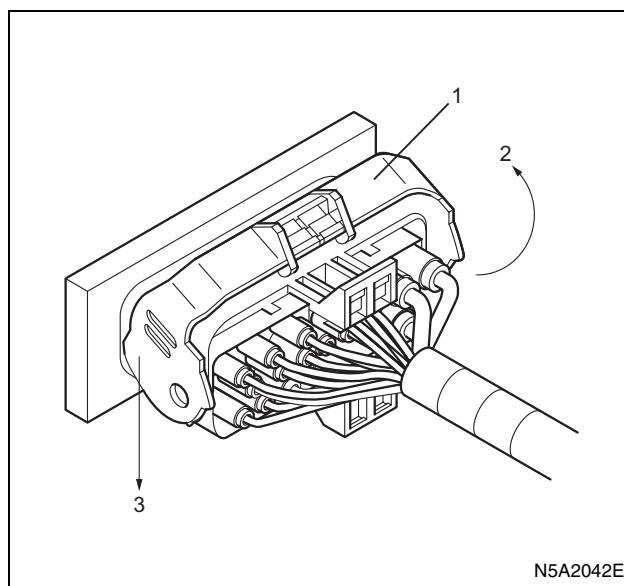
Legend

1. Lever lock
2. Lever
3. Lock portion (A portion)
4. Housing

- Operate the lever.

Notice:

Operate the lever till the lever becomes heavy. Then change the force direction to the downward of the connector. (See illustration.) Applying force to the EHCU-side may damage the connector.



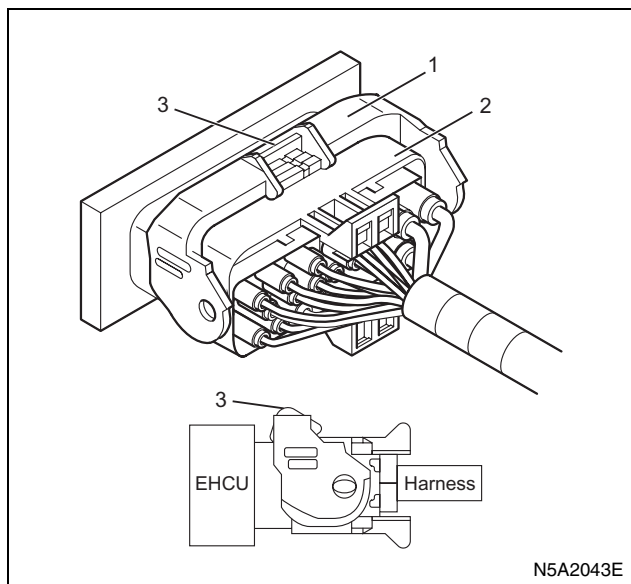
Legend

1. Lever
2. Lever operation (rotation direction)
3. Force applied direction when operating lever

- Move the connector to the opposite side of the EHCU to remove.

Notice:

With the lever in stop position, make sure that the lever surface (lock portion side) is almost perpendicular to the connector before removing the connector.



Legend

1. Lever
2. Connector
3. Lever lock

3. Brake pipe
 - Disconnect the six brake pipes.
4. EHCU fixing nut
 - Disconnect the three nuts fixing the EHCU.
5. EHCU
 - Remove the EHCU.
6. Bracket
 - Remove the bracket.

Installation

CAUTION:

- Be sure to use ground bolt to install the ground.
- Make sure there is no dust or foreign materials in and around the pipe connection.
- Be careful that the pipe is connect to correctly.
- After EHCU installation, bleed air from the brake system completely. Remove the fuse (FL-9 (40A)) of ABS to deactivate the ABS before air bleeding operation.
- Be sure to use fresh specified brake fluid.

1. Bracket
 - Install the bracket to the frame if it has been removed.
2. EHCU
 - Install the EHCU to the bracket.
3. EHCU fixing nut
 - Install the EHCU fixing nuts.

Tighten:

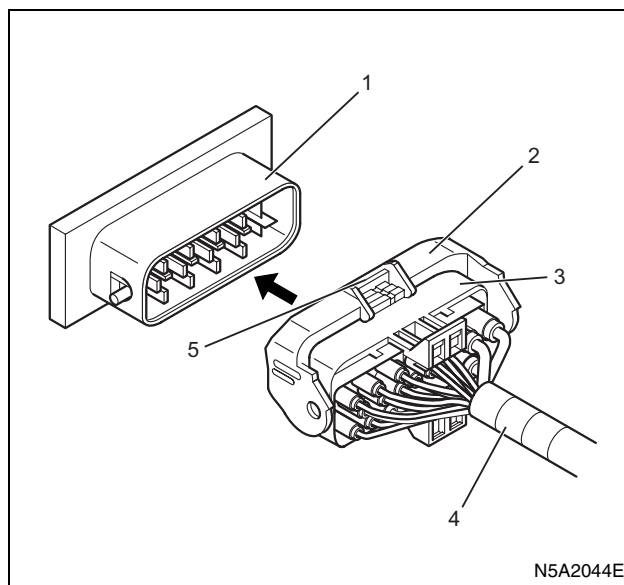
Nut to 22 N·m (2.2 kg·m / 16.2 lb·ft)

4. Brake pipe
 - Install the brake pipe.

Tighten:

Brake pipe to 16 N·m (1.6 kg·m / 11.8 lb·ft)

5. Harness connector
 - Align the harness-side connector with the EHCU-side connector.



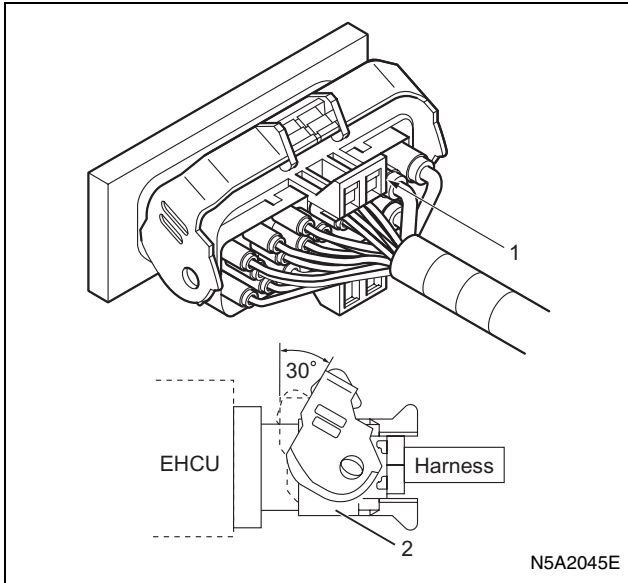
Legend

1. EHCU-side connector
2. Lever
3. Housing
4. Harness
5. Lever lock

- Insert the harness-side connector to the EHCU-side connector.

Notice:

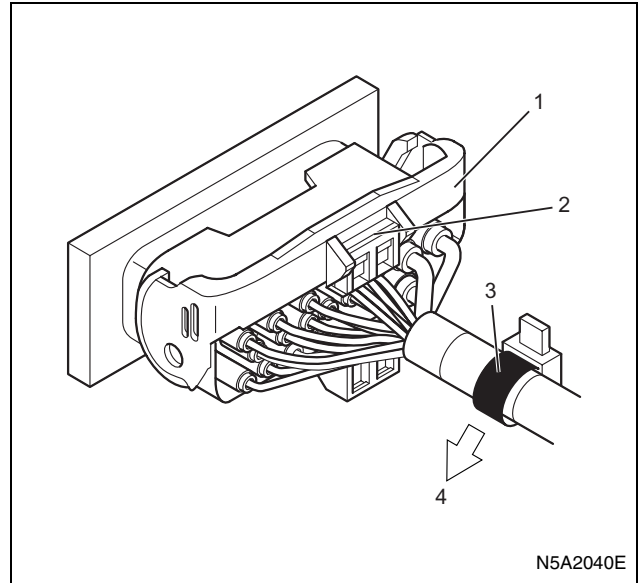
The lever moves approx. 30° when the connector is inserted.



Legend

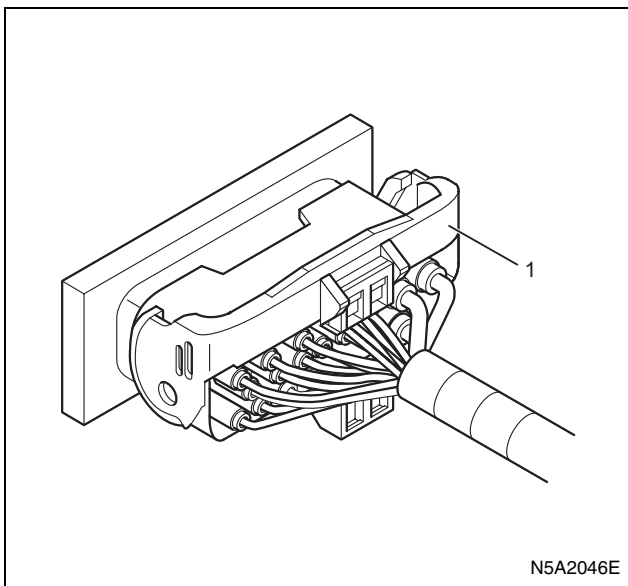
1. Pushing direction
2. Harness-side connector

- Operate the lever to lock the lever lock to the housing.



Legend

1. Lever
2. Lever lock
3. Clip
4. Fixed to EHCU bracket.

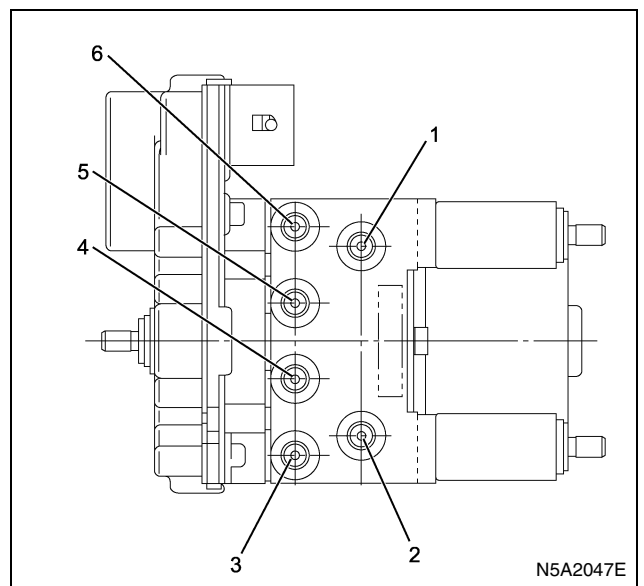


Legend

1. Lever

- If the harness was fixed to the EHCU bracket, fix the harness with the fixing clip.

6. Cover
- Install the cover.

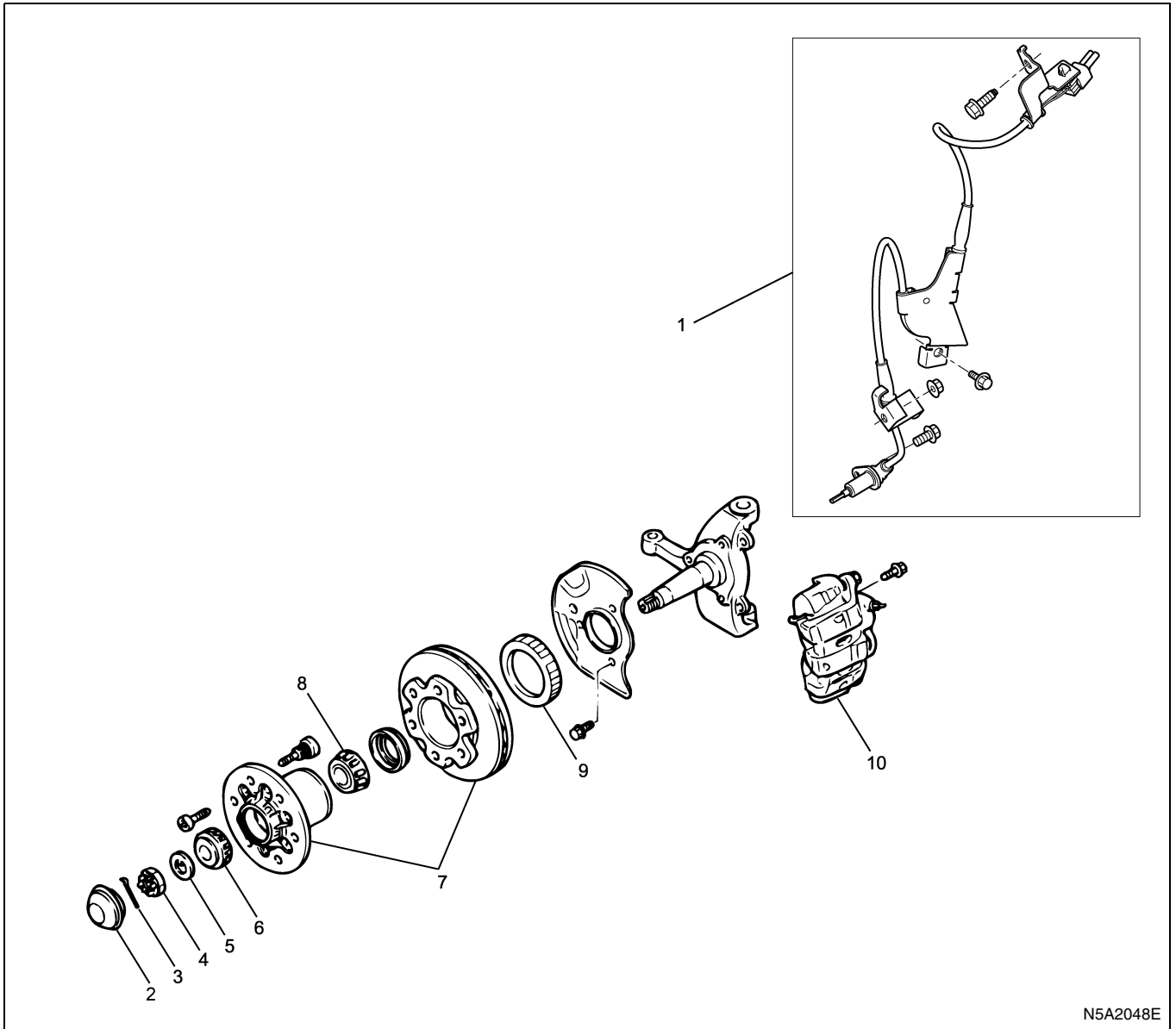


Legend

1. Master cylinder (front wheel)
2. Master cylinder (rear wheel)
3. RR wheel master cylinder
4. RL wheel master cylinder
5. FR wheel master cylinder
6. FL wheel master cylinder

Speed Sensor (Front)

Components



N5A2048E

Legend

- | | |
|---|---------------------------|
| 1. Speed sensor (model with rigid suspension) | 6. Outer bearing |
| 2. Hub cap | 7. Hub & rotor assembly |
| 3. Cotter pin | 8. Inner bearing |
| 4. Hub nut | 9. Sensor rotor |
| 5. Thrust washer | 10. Disc caliper assembly |

Removal

1. Harness connector
 - Disconnect the harness connector.
2. Harness fixing bolt
 - Remove the harness fixing bolt.
3. Sensor fixing bolt
 - Remove the sensor fixing bolt.
4. Speed sensor (front)

Installation

CAUTION:

- Do not let the speed sensor body contact with the sensor rotor during hub assembly. Otherwise the parts will be damaged.
- The speed sensor body has a built-in magnet. Be careful not to allow metallic materials attached to it.

- Remove the speed sensor before removing the hub & rotor assembly or the hub & drum assembly.
- Remove the speed sensor before hammering to remove the knuckle etc.
- Use the harness line as a reference to avoid the harness from twisting, when installing the sensor harness.
- To install the sensor, press-fit the sensor until the sensor flange contacts closely with the installing surface by your hand, and then tighten with the bolt.

1. Speed sensor (front)
 - Install the speed sensor.
2. Sensor fixing bolt
 - Install the sensor fixing bolt.

Tighten:
Bolt to 22 N·m (2.2 kg·m / 16.2 lb-ft)

3. Harness fixing bolt

- Install the harness fixing bolt.
Frame side

Tighten:
Bolt to 22 N·m (2.2 kg·m / 16.2 lb-ft)

Tighten together with the dust cover
(model with dram brake)

Tighten:
Bolt to 15 N·m (1.5 kg·m / 11.1 lb-ft)

Tighten together with the brake support
(model with rigid disc brake)

Tighten:
Bolt to 45 N·m (4.6 kg·m / 33.2 lb-ft)

4. Harness connector
 - Connect the harness connector.

Inspection

This section explores inspection procedures as the reference to perform “Diagnostics with symptom” and “Diagnosis with illumination pattern”.

	Without Tech 2	With Tech 2
Speed sensor output check	Check flow C-1-1 — C-1-4	Check flow TC-1

FL Wheel Speed Sensor Output Check Procedure

Check flow C-1-1

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the EHCU connector. 3. Jack-up the vehicle to lift the front wheels off the floor. 4. Measure the AC voltage between the J-177 connector terminals 32 and 33 while turning the FL wheel half turn/sec. Is the value within specified value?	200mV or more	Go to Step5	Go to Step2
2	1. Disconnect the FL sensor connector J-75. 2. Measure the resistance between the J-75 connector terminals 1 and 2 (sensor side). Is the value within specified value?	1 — 2kΩ	Go to Step4	Go to Step3
3	Replace the FL sensor. Is this step completed?	—	Go to Step5	—
4	Repair the circuit for open/short circuit, and the connector for improper connection between the connector of EHCU and the sensor connector. Is this step completed?	—	Go to Step5	—

Step	Action	Value	YES	NO
5	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step5

FR Wheel Speed Sensor Output Check Procedure
Check flow C-1-2

Step	Action	Value	YES	NO
1	1. Turn the starter switch OFF. 2. Disconnect the EHCU connector. 3. Jack-up the vehicle to lift the front wheels off the floor. 4. Measure the AC voltage between the J177 connector terminals 10 and 11 while turning the FR wheel half turn/sec. Is the value within specified value?	200mV or more	Go to Step5	Go to Step2
2	1. Disconnect the FR sensor connector J-74. 2. Measure the resistance between the J-74 connector terminals 1 and 2 (sensor side). Is the value within specified value?	1 — 2kΩ	Go to Step4	Go to Step3
3	Replace the FR sensor. Is this step completed?	—	Go to Step5	—
4	Repair the circuit for open/short circuit, and the connector for improper connection between the connector of EHCU and the sensor connector. Is this step completed?	—	Go to Step5	—
5	1. Install all the components, and check that those are installed properly. 2. Clear the DTC. Is this step completed?	—	Go to “Diagnostic basic flow”.	Go to Step5

Speed Sensor Output Check Procedure (With Tech 2)
Check flow TC-1

Step	Action	Value	YES	NO
1	1. Connect the Tech 2. 2. Check each sensor lowest speed from the “Wheel sensor”. Is the sensor speed 4km/h (2mph) or more?	—	Go to Step2	Go to Step6
2	Check the suspicious sensor circuit for open circuit. (Check with shaking the wire and the connector.) Is the sensor circuit connection normal?	—	Replace the speed sensor. Go to Step3	Repair. Go to Step3

Step	Action	Value	YES	NO
3	Check each sensor lowest speed from the "Wheel sensor". Is the sensor speed 4km/h (2mph) or more?	—	Go to Step4	Go to Step6
4	Check the sensor rotor. Is the sensor rotor normal?	—	Go to Step5	Replace the sensor rotor.Go to Step5
5	Check each sensor lowest speed from the "Wheel sensor". Is the sensor speed 4km/h (2mph) or more?	—	Repair the circuit or circuit between the EHCU and the speed sensor. Go to Step6	Go to Step6
6	Install all the components, and check that those are installed properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step6

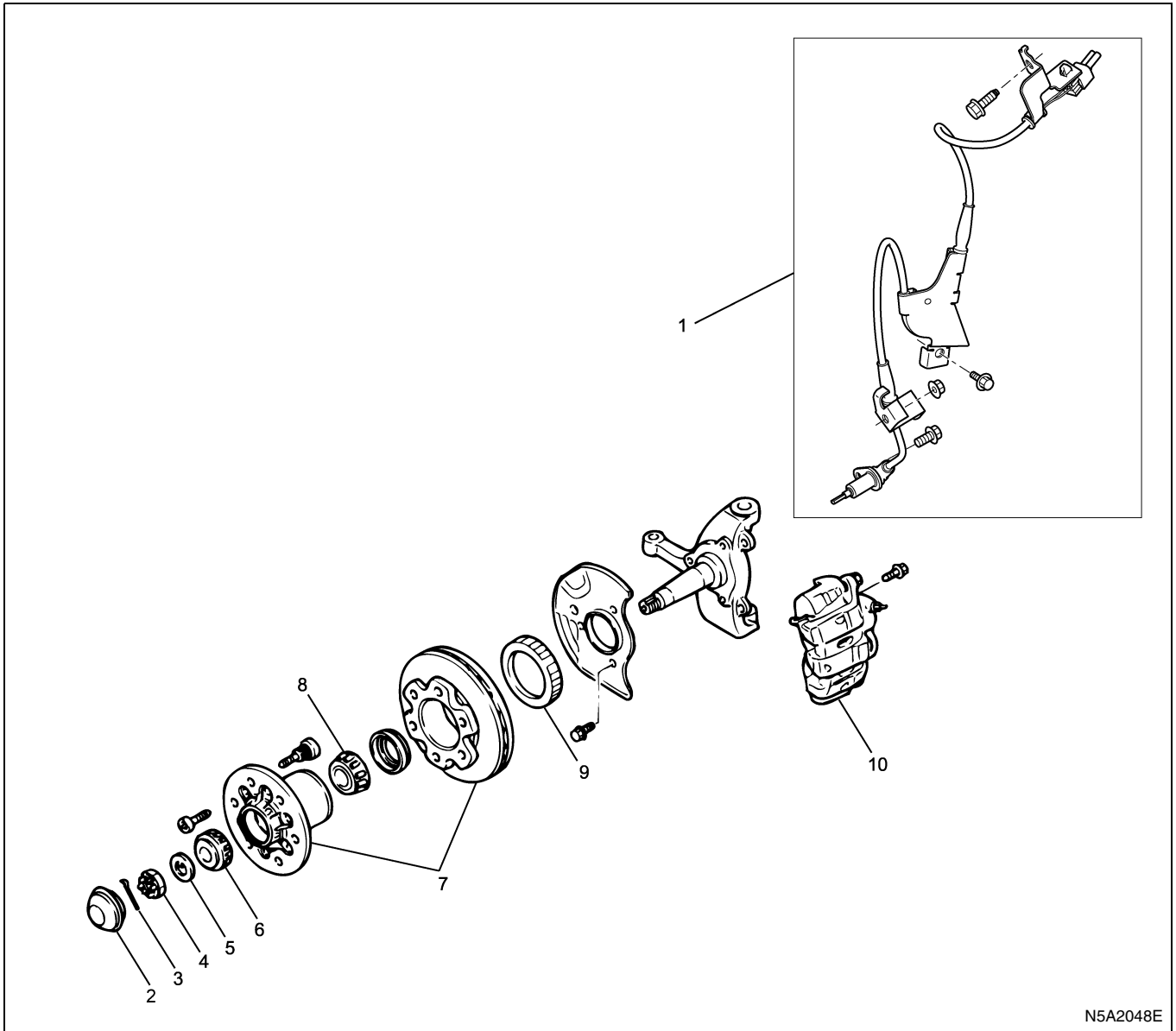
Used for checking the front speed sensor, or the rear speed sensor when no DTC is set.

CAUTION:

On the vehicle that the rear tires have smaller diameter, the rear wheel speed may be indicated a little higher than the front wheel speed. Check the speed after driving a while at a constant speed.

Sensor Rotor (Front Wheel)

Components



N5A2048E

Legend

- | | |
|---|---------------------------|
| 1. Speed sensor (model with rigid suspension) | 6. Outer bearing |
| 2. Hub cap | 7. Hub & rotor assembly |
| 3. Cotter pin | 8. Inner bearing |
| 4. Hub nut | 9. Sensor rotor |
| 5. Thrust washer | 10. Disc caliper assembly |

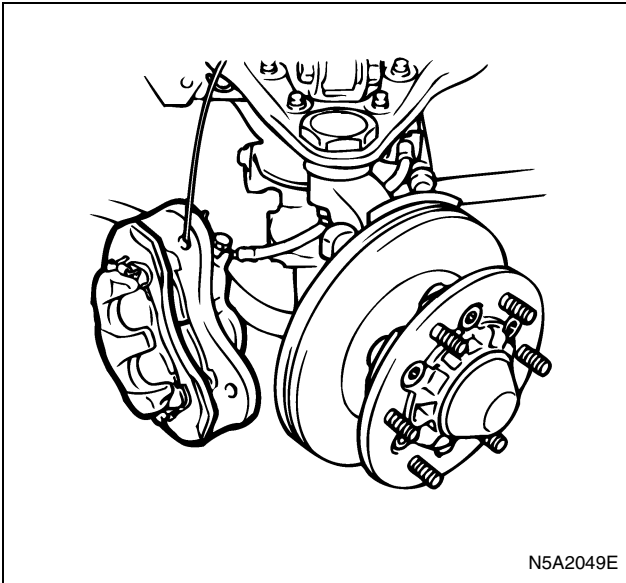
Removal

CAUTION:

- Hold the brake hose and the caliper assembly with wire or the like to prevent them from dropping, to stand clear from the service work. Do not bend the hose sharply or stretch it to the limit.
- Remove the brake hose if necessary. If to be removed, be careful to prevent the brake fluid from

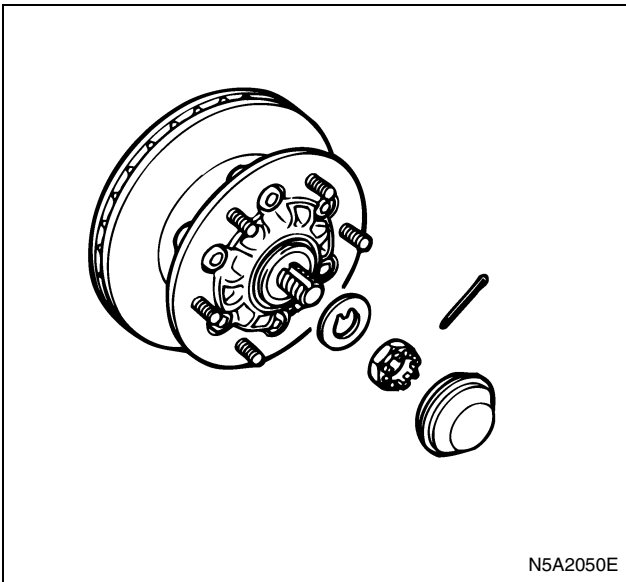
flowing out and protect it from intrusion of foreign materials.

1. Remove the disc brake caliper. (Model with disc brake)



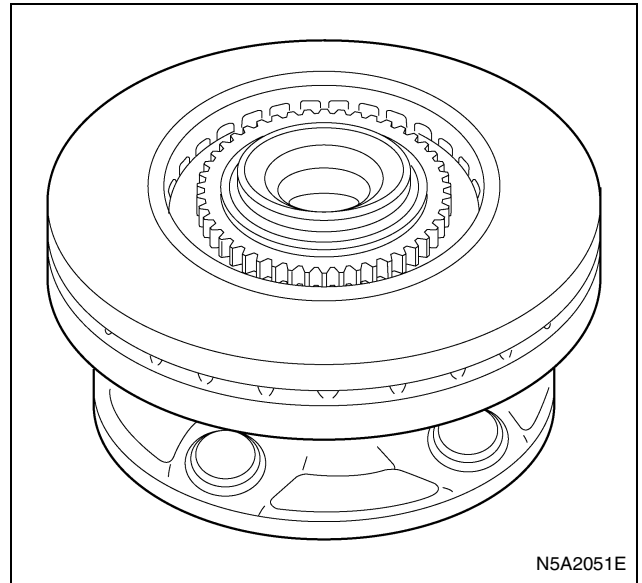
N5A2049E

2. Guard (NPR with disc brake)
 - Remove the guard.
3. Speed sensor (NPS)
 - Remove the head section of the speed sensor from the knuckle.
4. Hub cap (NPR)
 - Remove the hub cap.
5. Free wheel hub assembly (NPS)
 - Remove the free wheel hub assembly.
6. Cotter pin (NPR)
 - Remove the cotter pin.
7. Lock washer (NPS)
 - Remove the lock washer and the fixing screw.
8. Hub nut
 - Remove the hub nut.
9. Thrust washer (NPR)
 - Remove the thrust washer.
10. Hub & rotor assembly



N5A2050E

11. Outer bearing inner race
12. Sensor rotor (front wheel)
 - Use a puller to take out the sensor rotor.

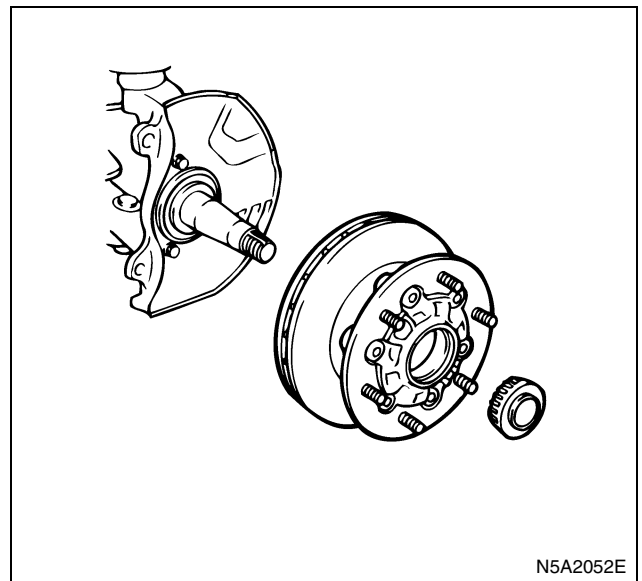


N5A2051E

Installation

1. Sensor rotor (front wheel)
 - Press-fit the new sensor rotor with a bench press around the circumference until it contacts.
2. Hub & rotor assembly
 - Fill the outer bearing with grease (Besco L-2), and install it to the hub.

CAUTION:
Use new oil seal.

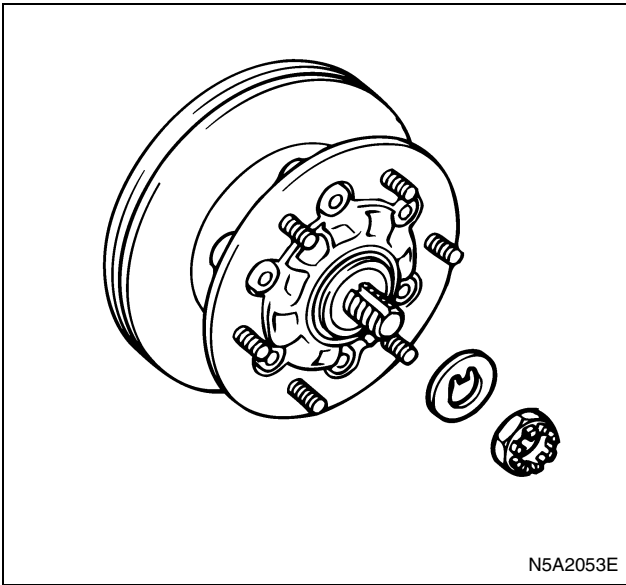


N5A2052E

3. Outer bearing inner race
4. Thrust washer (NPR)
 - Install the thrust washer.
5. Hub nut
 - Install the hub nut.

CAUTION:

After installing the thrust washer and the hub nut, adjust the hub bearing preload.

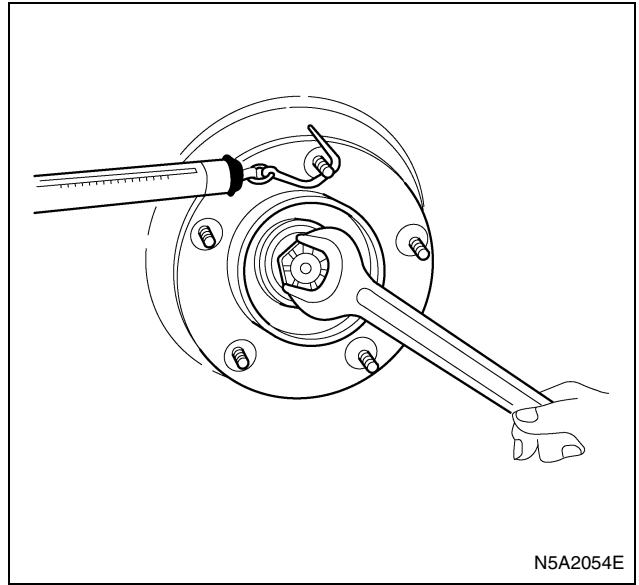


Hub bearing preload adjustment

- Tighten the hub nut till the hub no longer be turned, and then loosen it completely.
 - Turn the hub to make the bearing seated.
 - Attach a spring balance to the wheel pin. While pulling the it tangentially, tighten the hub nut so that the hub rotates with the specified value.
 - For hub bearing preload, refer to “FRONT AXLE” in Section 4C.
6. Cotter pin (NPR)
 - After preload adjustment, install the cotter pin. If the pin hole does not match the groove on the nut, adjust them by turning minimum to the tightening direction.
 7. Lock washer (NPS)
 - Install the pawl to the cutout of the spindle securely, and tighten with the screw.

Tighten:

Lock washer to 10 N·m (1.0 kg·m / 7.4 lb·ft)



8. Hub cap

- Fill the hub cap with grease (Besco L-2), and drive it in to the hub.

9. Free wheel hub assembly (NPS)

- Install the free wheel hub assembly.

CAUTION:

Be sure to adjust the drive shaft axial play.

10. Speed sensor (NPS)

- Install the head section of the speed sensor to the knuckle and tighten the bolt to the specified torque.

Tighten:

Speed sensor to 22 N·m (2.2 kg·m / 16.2 lb·ft)

11. Guard (NPR with disc brake)

- Install the guard.

Tighten:

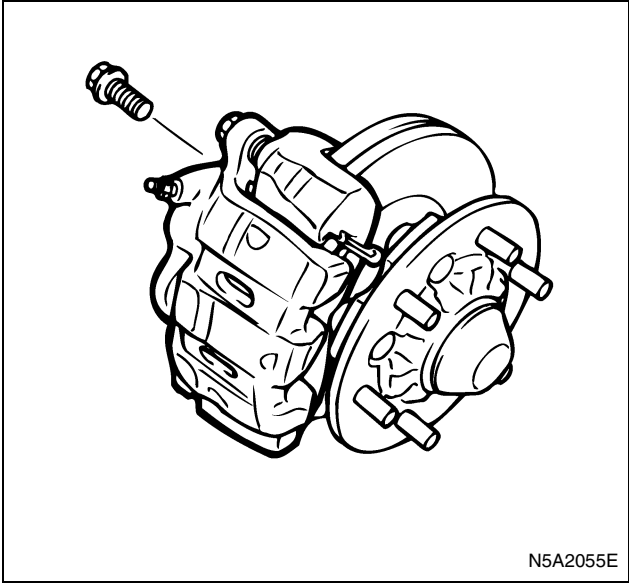
Guard to 37 N·m (3.7 kg·m / 27.3 lb·ft)

12. Disc brake caliper assembly (Model with disc brake)

- Install the disc brake caliper assembly.

Tighten:

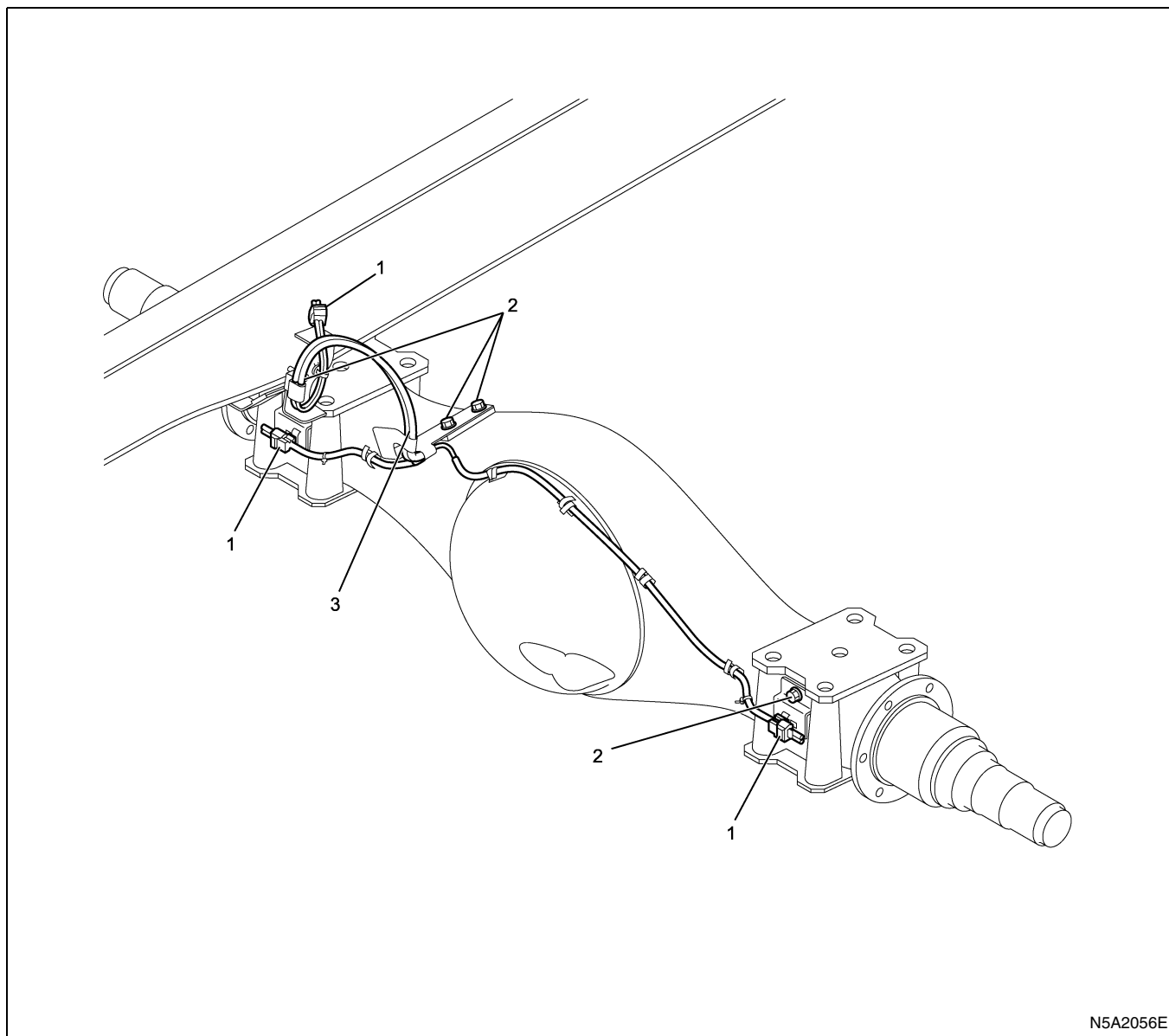
Disc brake calper to 220 N·m (22.5 kg·m / 162.3 lb·ft)



N5A2055E

Sensor Harness (Rear Axle)

Components



Legend

- | | |
|--------------------------------|-------------------|
| 1. Harness connector | 3. Sensor harness |
| 2. Harness bracket fixing bolt | |

Removal

1. Harness connector
 - Disconnect the harness connector.
2. Harness bracket fixing bolt
 - Remove the harness bracket fixing bolt.
3. Sensor harness
 - Remove the sensor harness.

Installation

CAUTION:
Take care not to twist the harness during installation.

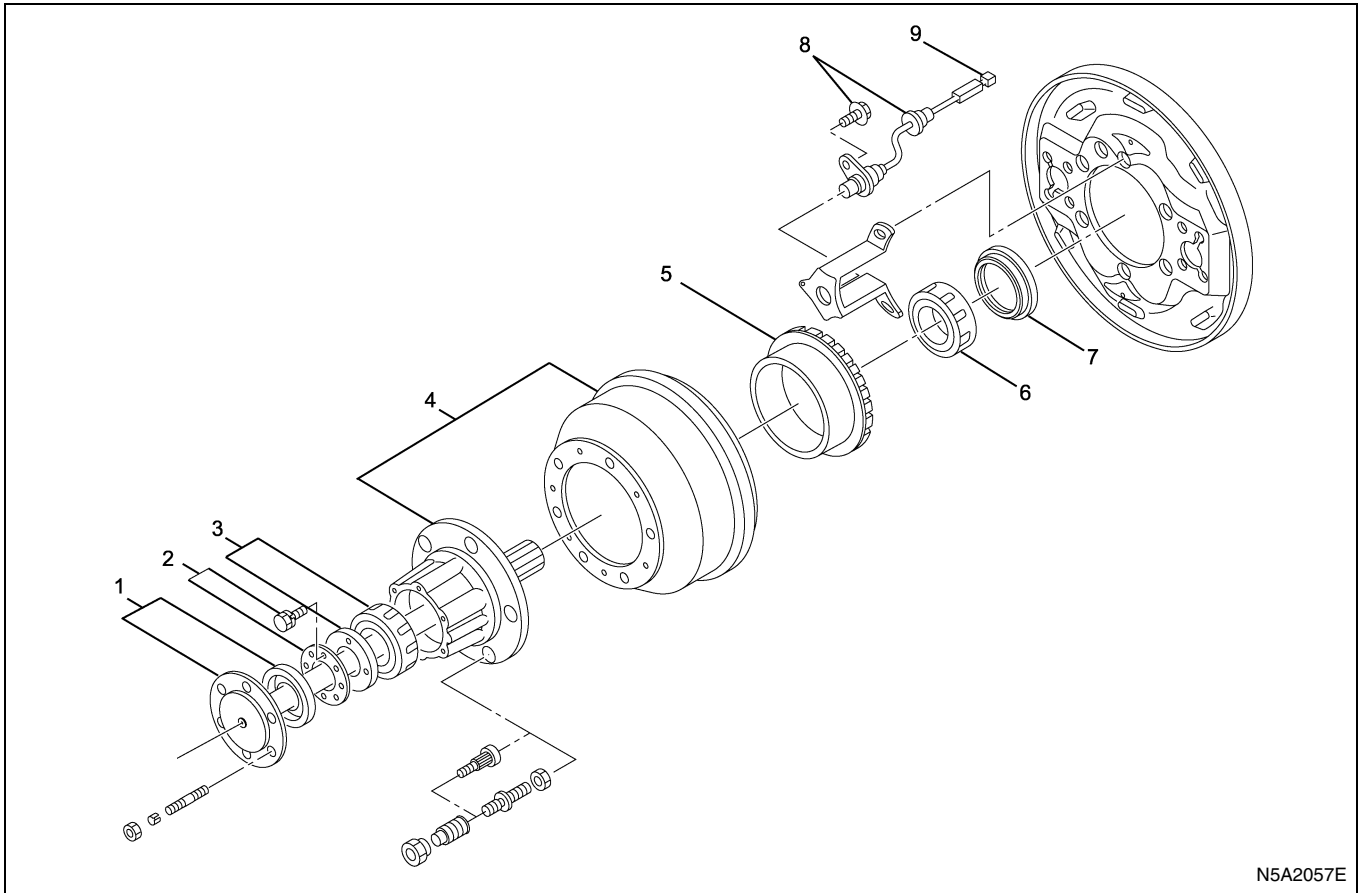
1. Sensor harness
 - Install the sensor harness.
2. Harness bracket fixing bolt
 - Install the harness bracket fixing bolt.

Tighten:

- Flange bolt (except below) to 22 N·m (2.2 kg·m / 16.2 lb·ft)
 - SEMS bolt (2 points on the axle case upper face) to 13 N·m (1.3 kg·m / 9.6 lb·ft)
3. Harness connector
- Connect the harness connector.

Rear Speed Sensor

Components



N5A2057E

Legend

- | | |
|------------------------------------|----------------------|
| 1. Axle shaft, outer oil seal | 6. Inner bearing |
| 2. Bearing lock washer, lock nut | 7. Inner oil seal |
| 3. Outer bearing, bearing lock nut | 8. Rear speed sensor |
| 4. Hub and drum | 9. Harness connector |
| 5. Sensor rotor | |

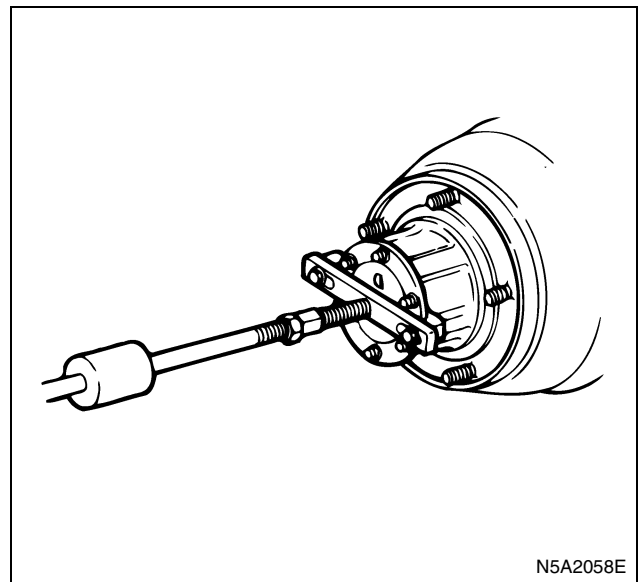
Removal

1. Rear axle shaft, outer oil seal, lock washer
 - Remove the axle shaft installing nut, and remove the rear axle shaft.

Special tool:

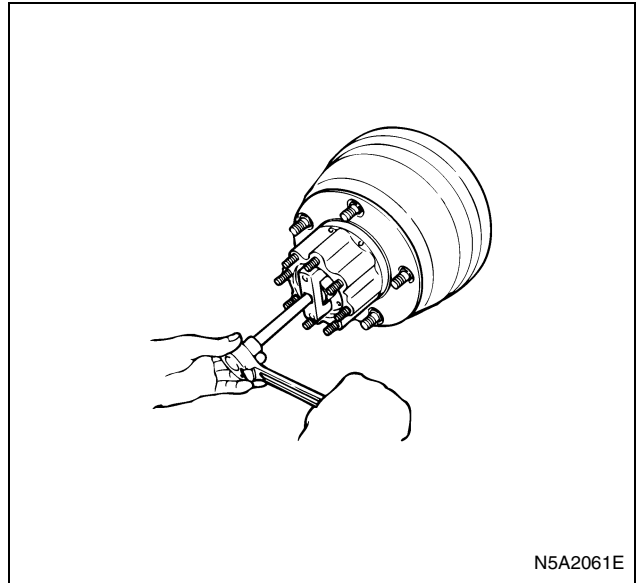
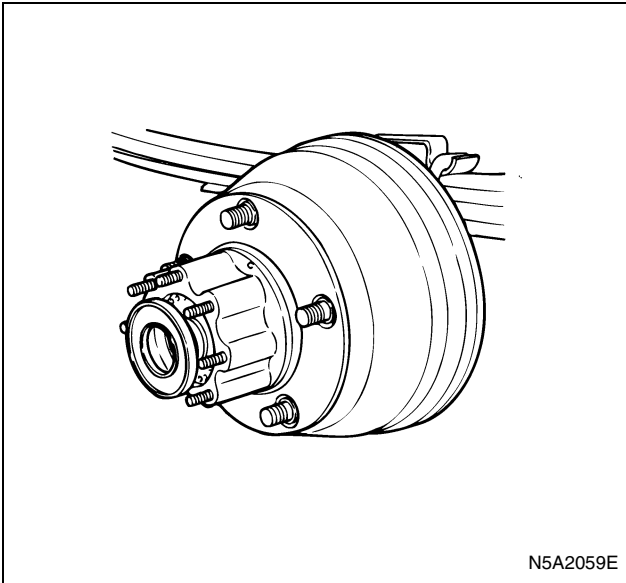
Universal puller: 5-8840-2027-0

Slide hammer: 5-8840-0084-0



N5A2058E

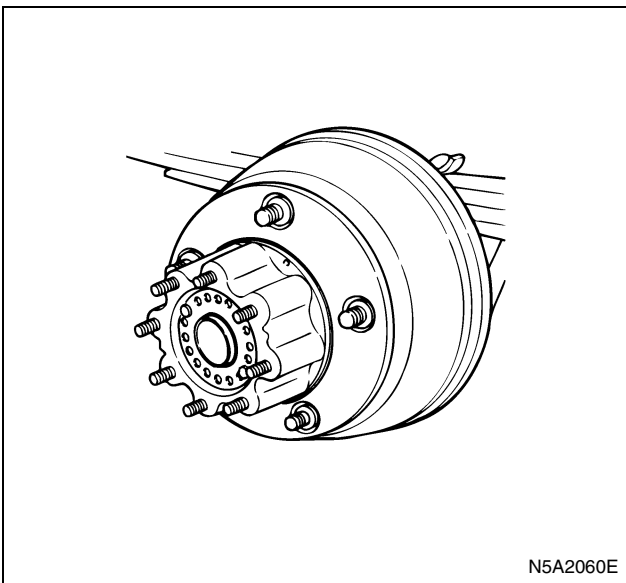
- Remove the outer oil seal.



3. Hub and drum assembly

- Remove the hub and drum assembly.

- Remove the lock washer installing bolt.



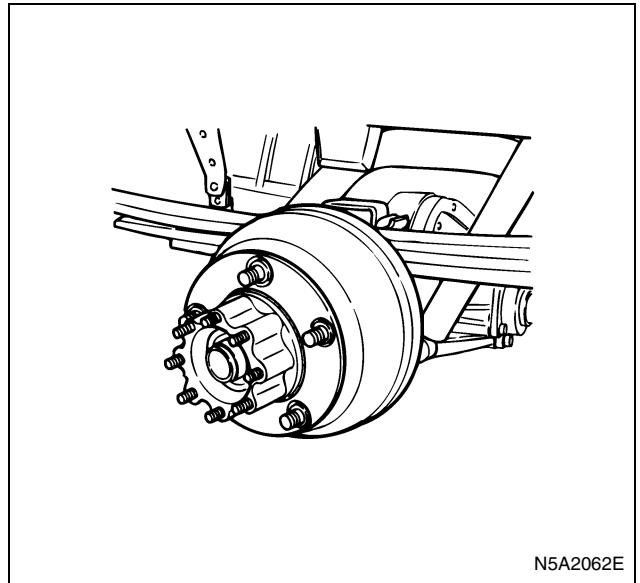
2. Bearing lock nut, outer bearing, hub

- Remove the bearing nut.

Special tool:

Wrench: 9-8522-1188-0

- Remove the outer bearing.



4. Inner oil seal

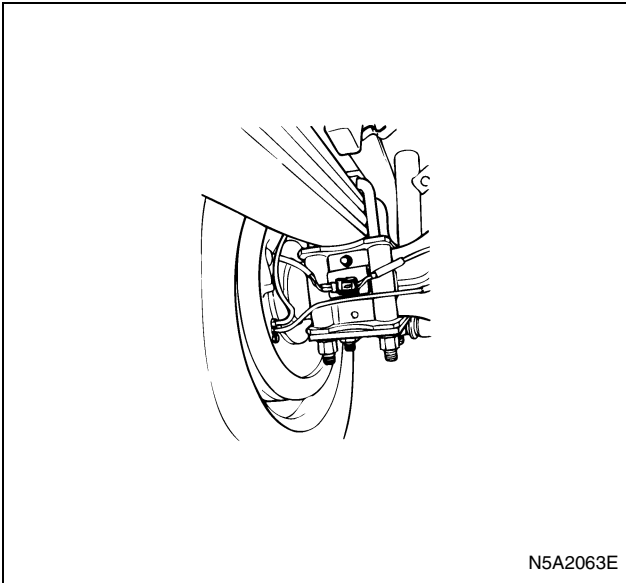
- Remove the inner oil seal.

5. Inner bearing

- Remove the inner bearing.

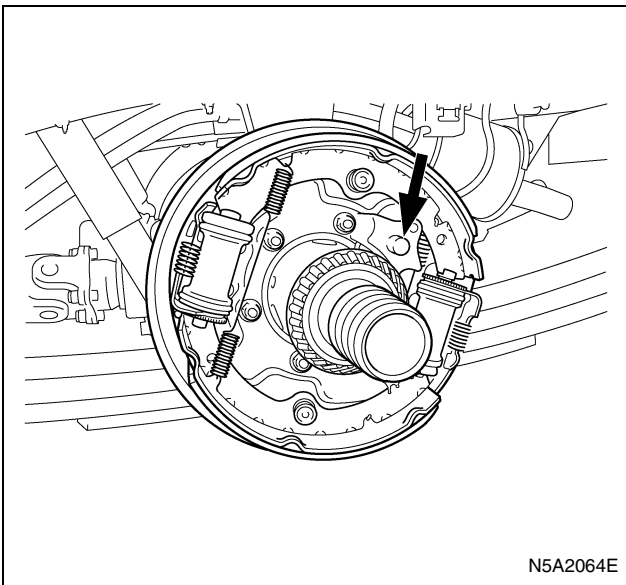
6. Harness connector

- Disconnect the connection of the harness connector.



7. Rear speed sensor

- Remove the speed sensor installing bolt, and take out from the sensor bracket.



Installation

CAUTION:

- Grommet in the back plate must be installed securely.
- Bearing lock nut must be installed with its slit surface facing outside.

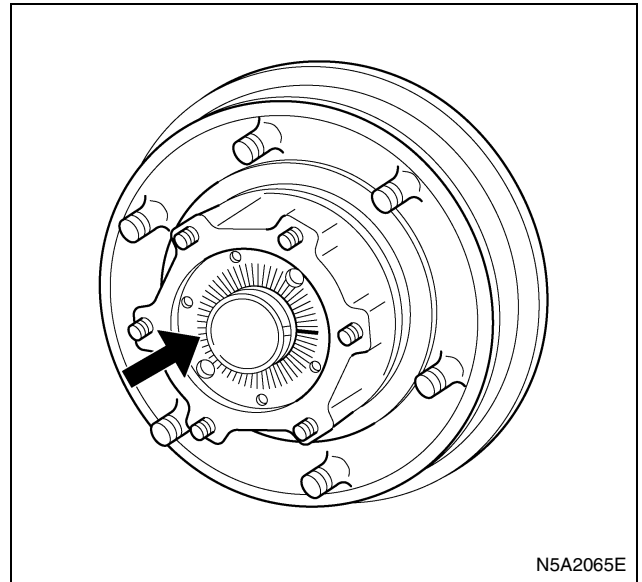
1. Rear speed sensor
 - Tighten the speed sensor installing bolt.

Tighten:

Bolt to 22 N·m (2.2 kg·m / 16.2 lb·ft)

2. Harness connector
 - Connect the harness connector.
3. Inner bearing
 - Install the inner bearing.

4. Inner oil seal
 - Install the inner oil seal.
5. Hub and drum assembly
 - Install the hub and drum assembly.
6. Outer bearing, hub, bearing lock nut
 - Install the outer bearing, hub, and bearing lock nut.

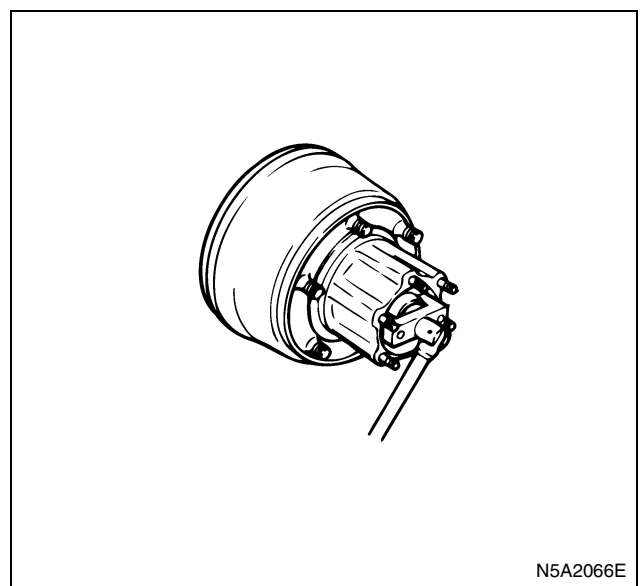


Rear hub bearing preload adjustment

- Rotate the hub to the left and right several times to make it seated.
- Tighten the bearing lock nut till the hub no longer be turned. Then, back off to a degree that the hub rotates easily.

Special tool:

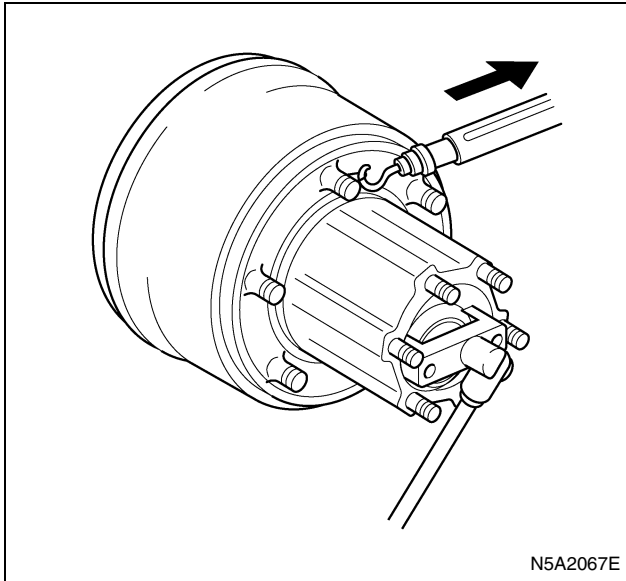
Wrench: 9-8522-1180-0



- Attach a spring balance to the wheel pin. While pulling it tangentially, tighten the bearing nut so that the spring balance reading shows the specified value when the hub starts rotation.

Tighten:

Starting to 42 — 52 N (4.3 — 5.3 kg / 9.4 — 11.7 lb)

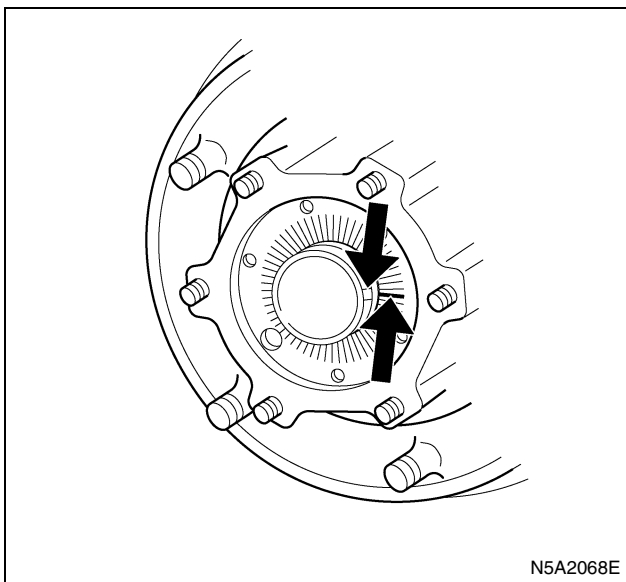
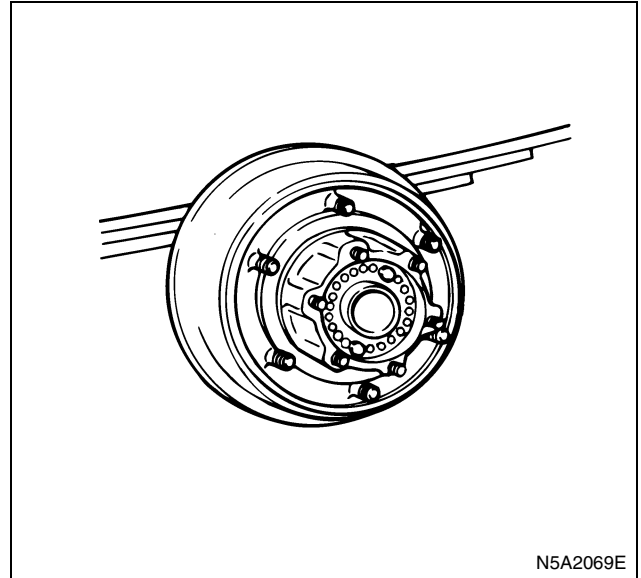


- After adjusting the starting torque, move the hub to the right and left side several times to make sure the value is correct.
- With the preload adjusted, match the lock cut-out center point of the axle case screw part with nearest ruling of the bearing lock nut. If it does not, rotate the nut in the tightening direction to match.

- Install the axle shaft.
Install to the rear hub stud part through the special washer with the flange nut.

Tighten:

Flange nut to 49 N·m (5.0 kg·m / 36.1 lb·ft)



7. Lock washer, outer oil seal, axle shaft

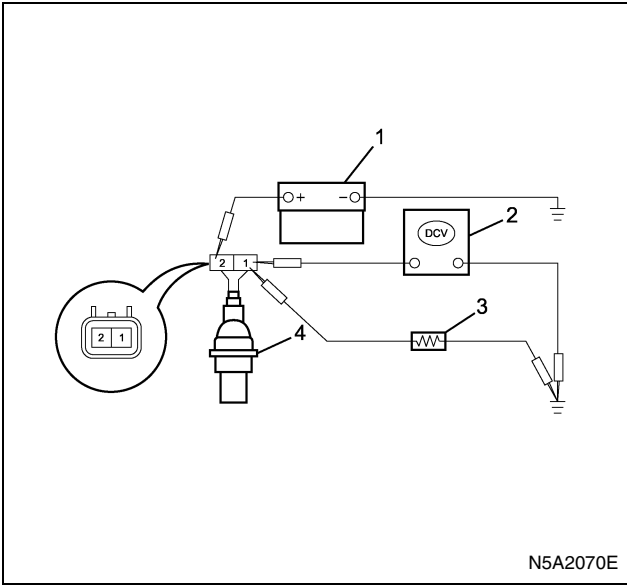
- Install the pawl of the lock washer to the lock cutout of the axle case screw part securely, and tighten the bearing nut and the lock washer with the lock bolt.
- Apply grease to the circumference of the outer oil seal inner lip, and install the outer oil seal.

Inspection

RL Wheel Speed Sensor Output Check Procedure

Check flow C-1-3

Step	Action	Value	YES	NO
1	<ol style="list-style-type: none"> 1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Jack-up the vehicle to lift the front wheels off the floor. 4. Connect a 120Ω resistance between the J-177 connector terminal 34 and the ground. 5. Apply a 9 — 16V voltage to the J-177 connector terminal 22. 6. Measure the DC voltage between the B-177 connector terminal 34 and the ground while turning the RL wheel half turn/sec. <p>Is the value within specified value?</p>	0.2 — 4.5V	Go to Step5	Go to Step2
2	<ol style="list-style-type: none"> 1. Turn the starter switch OFF. 2. Disconnect the RL wheel speed sensor connector J-149. 3. Connect a 120Ω resistance between the J-149 connector terminal 2 and the ground. 4. Apply a 9 — 16V voltage to the J-149 connector terminal 1 (sensor side). 5. Measure the DC voltage between the J-149 connector terminal 2 and the ground while turning the RL wheel half turn/sec. <p>Is the value within specified value?</p>	0.2 — 4.5V	Go to Step3	Go to Step4
3	<p>Repair the circuit for open/short circuit, and the connector for improper connection between the connector of EHCU and the sensor connector.</p> <p>Is this step completed?</p>	—	Go to Step5	—
4	<p>Replace the RL wheel speed sensor.</p> <p>Is this step completed?</p>	—	Go to Step5	—
5	<ol style="list-style-type: none"> 1. Install all the components, and check that those are installed properly. 2. Clear the DTC. <p>Is this step completed?</p>	—	Go to “Diagnostic basic flow”.	Go to Step5



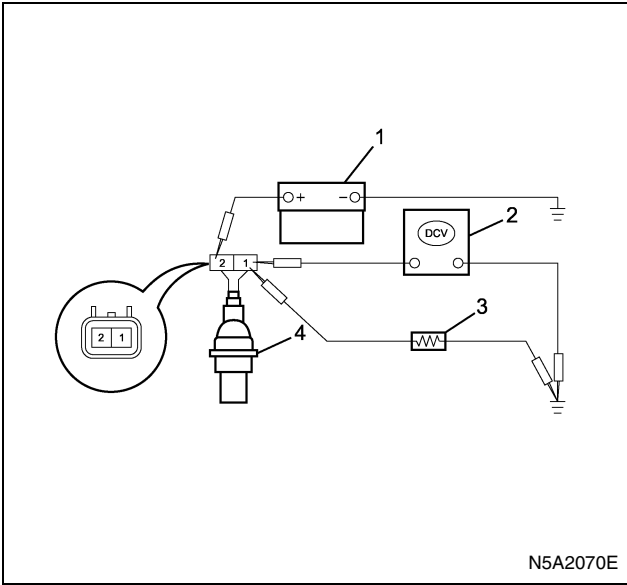
Legend

- 1. Battery (12V)
- 2. Tester
- 3. Resistance
- 4. Speed sensor

RR Wheel Speed Sensor Output Check Procedure

Check flow C-1-4

Step	Action	Value	YES	NO
1	<ol style="list-style-type: none"> 1. Turn the starter switch OFF. 2. Disconnect the connector of the EHCU. 3. Jack-up the vehicle to lift the front wheels off the floor. 4. Connect a 120Ω resistance between the J-177 connector terminal 12 and the ground. 5. Apply a 9 — 16V voltage to the J-177 connector terminal 21. 6. Measure the DC voltage between the J-177 connector terminal 1 and the ground while turning the RR wheel half turn/sec. <p>Is the value within specified value?</p>	0.2 — 4.5V	Go to Step5	Go to Step2
2	<ol style="list-style-type: none"> 1. Turn the starter switch OFF. 2. Disconnect the RR wheel speed sensor connector J-148. 3. Connect a 120Ω resistance between the J-148 connector terminal 2 and the ground. 4. Apply a 9 — 16V voltage to the J-148 connector terminal 1 (sensor side). 5. Measure the DC voltage between the J-148 connector terminal 2 and the ground while turning the RR wheel half turn/sec. <p>Is the value within specified value?</p>	0.2 — 4.5V	Go to Step3	Go to Step4
3	<p>Repair the circuit for open/short circuit, and the connector for improper connection between the connector of EHCU and the sensor connector.</p> <p>Is this step completed?</p>	—	Go to Step5	—
4	<p>Replace the RR wheel speed sensor.</p> <p>Is this step completed?</p>	—	Go to Step5	—
5	<ol style="list-style-type: none"> 1. Install all the components, and check that those are installed properly. 2. Clear the DTC. <p>Is this step completed?</p>	—	Go to "Diagnostic basic flow".	Go to Step5



N5A2070E

Legend

- 1. Battery (12V)
- 2. Tester
- 3. Resistance
- 4. Speed sensor

Speed Sensor Output Check Procedure

Check flow TC-1

Step	Action	Value	YES	NO
1	1. Connect the Tech 2. 2. Check each sensor lowest speed from the "Wheel sensor". Is the sensor speed 4km/h (2 mph) or more?	—	Go to Step2	Go to Step6
2	Check the suspicious sensor circuit for open circuit. (Check with shaking the wire and the connector.) Is the sensor circuit connection normal?	—	Replace the speed sensor.Go to Step3	Repair.Go to Step2
3	Check each sensor lowest speed from the "Wheel sensor". Is the sensor speed 4km/h (2 mph) or more?	—	Go to Step4	Go to Step6
4	Check the sensor rotor. Is the sensor rotor normal?	—	Go to Step5	Replace the sensor rotor. Go to Step5
5	Check each sensor lowest speed from the "Wheel sensor". Is the sensor speed 4km/h (2 mph) or more?	—	Repair the circuit or connector between the EHCU and the speed sensor. Go to Step6	Go to Step6
6	Install all the components, and check that those are installed properly. Is this step completed?	—	Repeat "Diagnostic basic flow".	Go to Step6

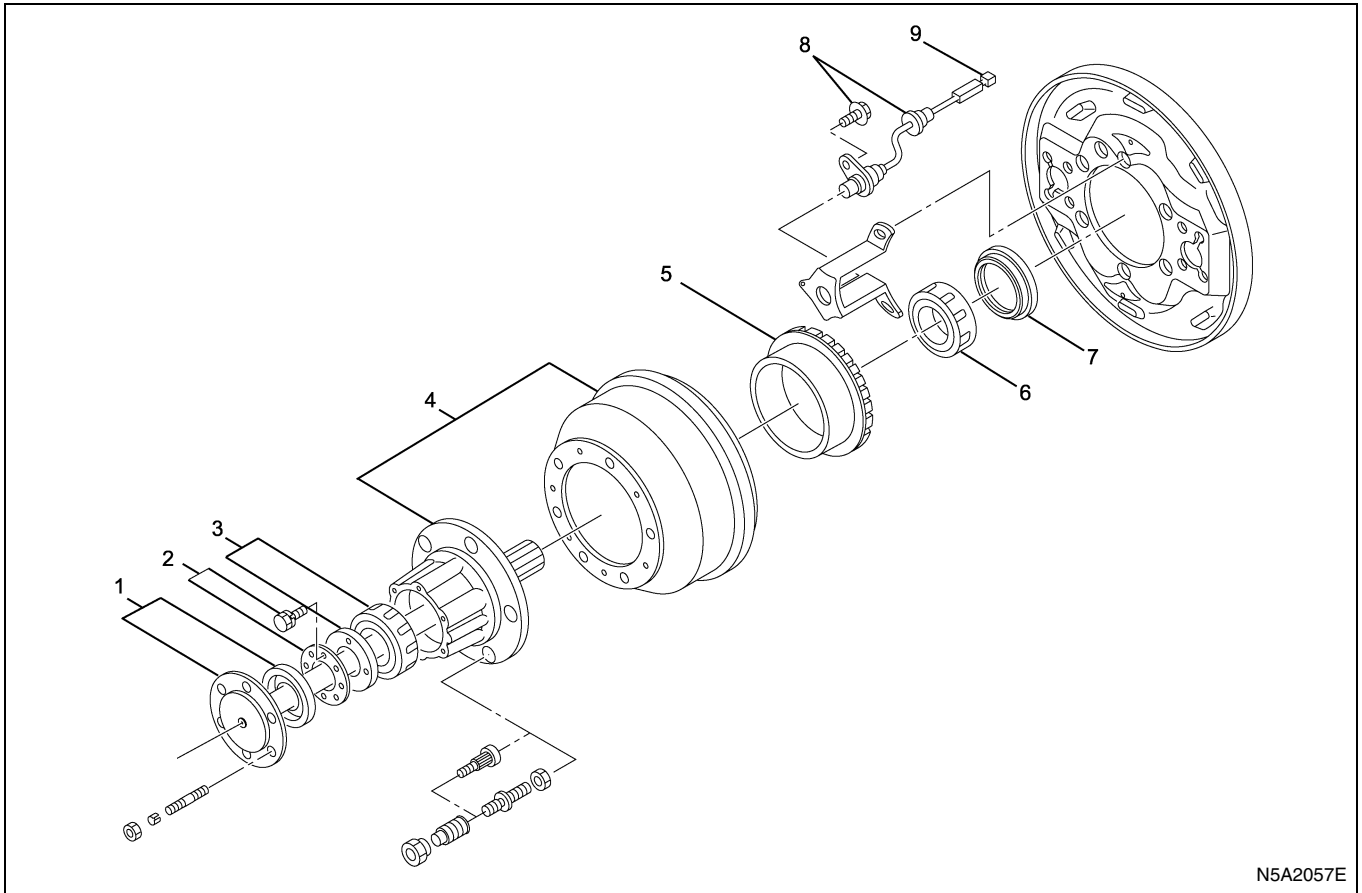
Used for checking the front speed sensor, or the rear speed sensor when no DTC is set.

CAUTION:

On the vehicle that the rear tires have smaller diameter, the rear wheel speed may be indicated a little higher than the front wheel speed. Check the speed after driving a while at a constant speed.

Rear Sensor Rotor

Components



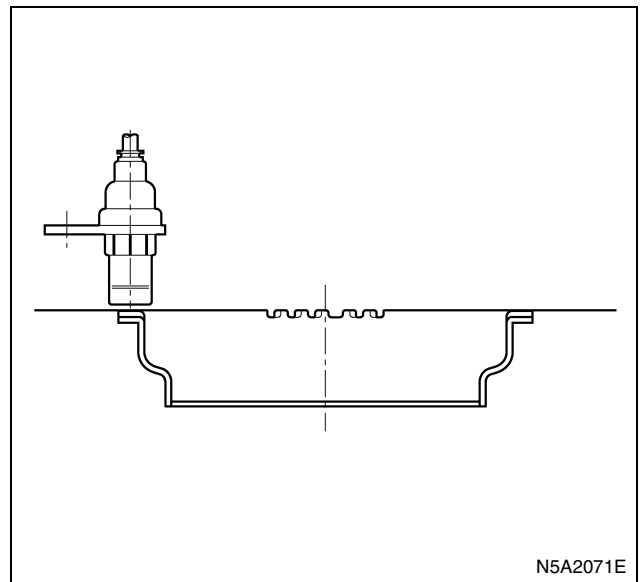
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Legend

- | | |
|------------------------------------|----------------------|
| 1. Axle shaft, outer oil seal | 6. Inner bearing |
| 2. Bearing lock washer, lock nut | 7. Inner oil seal |
| 3. Outer bearing, bearing lock nut | 8. Rear speed sensor |
| 4. Hub and drum | 9. Harness connector |
| 5. Sensor rotor | |

Removal

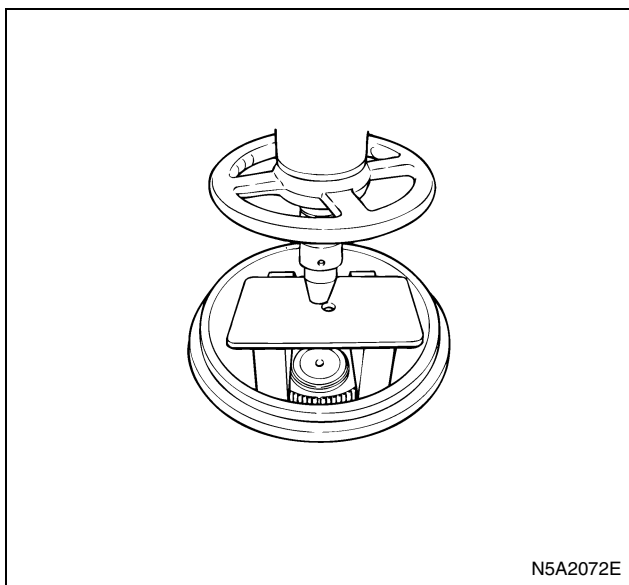
- Refer to the rear speed sensor removal procedure.
1. Rear sensor rotor
 - Use a puller to take out the sensor rotor.
 2. Inner oil seal
 - Remove the inner oil seal.
 3. Inner bearing
 - Remove the inner bearing.
 - Rotor runout must be ± 0.1 mm (0.004 in) or less with the rotor installed.



N5A2071E

Installation

1. Install the inner bearing to the hub.
2. Install the inner oil seal to the hub.
3. Install the new rear sensor rotor to the hub.
 - Press-fit with a bench press around the circumference until it contacts.
 - Refer to the rear speed sensor installation procedure step. 5 — 7.



MEMO

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MEMO

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MEMO

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ENGINE 4H SERIES

SERVICE INFORMATION

TROUBLESHOOTING

Hard Starting

1. Starter Inoperative

Checkpoint	Possible cause	Correction
Battery	Loose battery cable terminal Poor connections due to rusting	Clean and/or retighten the battery cable terminal
	Battery discharged or weak	Recharge or replace the battery
	Fan belt loose or broken	Adjust or replace the fan belt
Fusible link	Fusible link shorted	Replace the fusible link
Starter switch	Defective starter switch or starter relay	Replace the starter switch or the starter relay
Starter motor	Defective magnetic switch or starter relay	Repair or replace the magnetic switch
	Defective starter motor	Repair or replace the starter motor

2. Starter Motor Operates But Engine Does Not Turn Over

Checkpoint	Possible cause	Correction
Battery	Loose battery cable terminal Poor connections due to rusting	Clean and/or retighten the battery cable terminal
	Battery discharged or weak	Recharge or replace the battery
	Fan belt loose or broken	Adjust or replace the fan belt
Starter motor	Defective pinion gear	Replace the pinion gear
	Defective magnetic switch	Repair or replace the magnetic switch
	Brush wear, Weak brush spring	Replace the brush and/or the brush spring
Engine	Piston, crank bearing seizure, or other damage	Repair or replace the related parts

3. Engine Turns Over But Does Not Start

Checkpoint	Possible cause	Correction
Engine stop mechanism	Defective fuel cut solenoid valve	Replace the fuel cut solenoid valve

Fuel is Not Being Delivered to The Injection Pump

Fuel	Fuel tank is empty	Fill the fuel tank
Fuel piping	Clogged or damaged fuel lines Loose fuel line connection	Repair or replace the fuel lines Retighten the fuel line connection
Fuel filter	Fuel filter overflow valve does not close	Repair or replace the fuel filter overflow valve
	Clogged fuel filter element	Replace the fuel filter element or the filter cartridge
Fuel system	Air in the fuel system	Bleed the air from the fuel system
Fuel feed pump	Defective feed pump	Repair or replace the feed pump

Fuel is Being Delivered to The Injection Pump

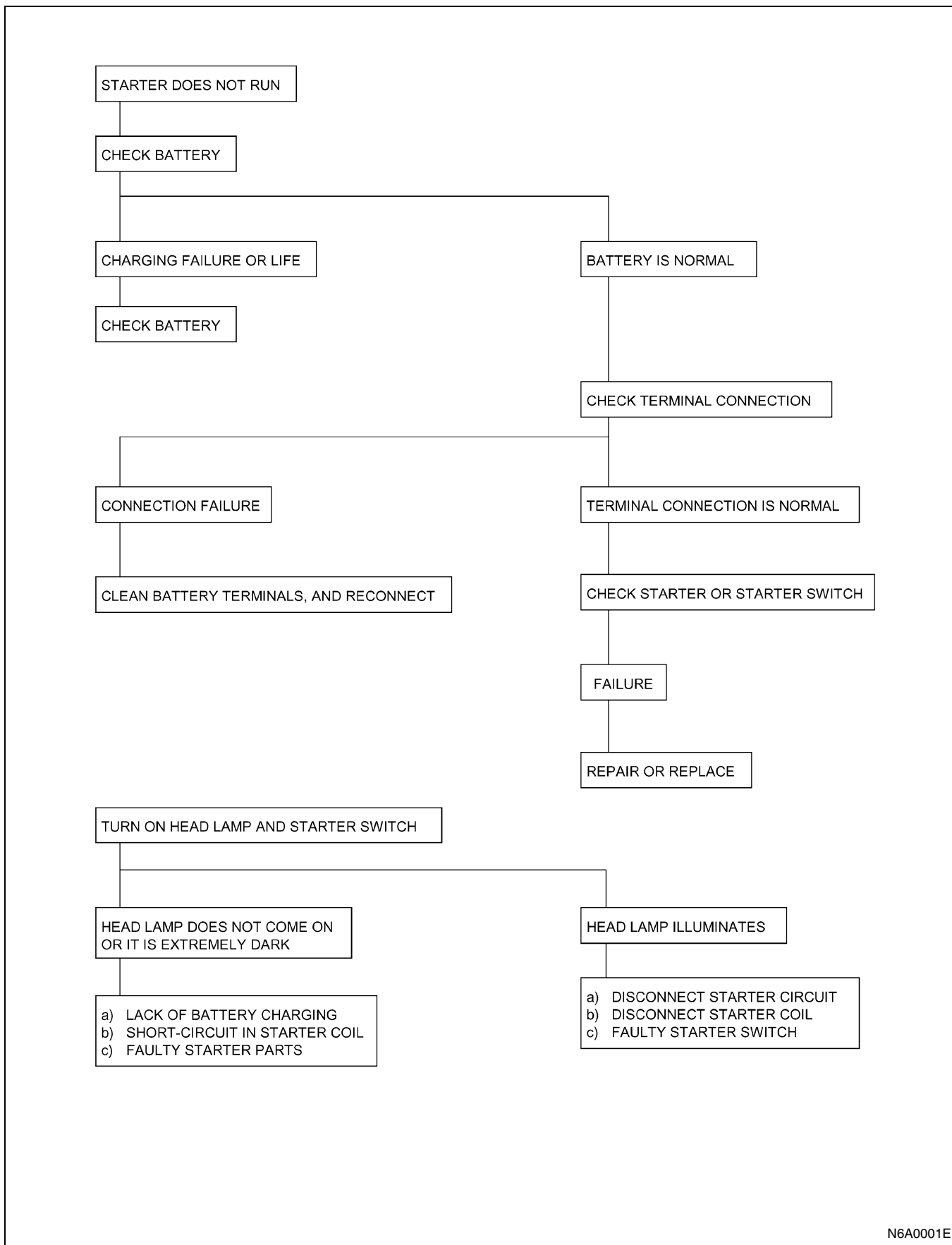
Fuel	Use of the wrong fuel	Use the correct fuel
	Water particles in the fuel	Change the fuel
Fuel system	Air in the injection pump	Bleed the air from the fuel system

Checkpoint	Possible cause	Correction
Injection nozzle	Injection nozzle sticking	Replace the injection nozzle
	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Injection pump	Defective fuel injection nozzle resulting in the fuel drippage after fuel injection	Replace the delivery valve
	Defective injection pump control rack operation	Repair or replace the injection pump control rack
	Injection pump plunger worn or stuck	Replace the injection pump plunger assembly
	Injection pump drive shaft seizure or other damage	Replace the injection drive shaft
	Injection pump governor spring seizure	Replace the injection pump governor spring

4. Quick-on Start System

Check point	Possible cause	Correction
Glow plug indicator light does not turn on	1. Defective Fusible link wire 2. Broken indicator light fuse 3. Defective indicator bulb	Replace the fusible link wire Replace the indicator light fuse Replace the indicator light bulb
Preheating system dose not work	1. Defective fusible link wire shorted 2. Defective glow plug relay connector 3. Defective glow plug connector 4. Defective quick-on start timer connector	Replace the fusible link wire Replace or Repair glow plug relay connector Replace or Repair glow plug connector Replace or Repair quick-on start timer connector
Preheating time to long or to short	1. Defective thermo switch include defective wiring harness 2. Defective glow plug 3. Defective timer unit	Replace thermo switch Replace glow plug Replace timer unit

Check if battery is normal, then perform the following diagnosis.



N6A0001E

FAULTY MESHING OF PINION AND RING GEAR

CHECK IF BATTERY VOLTAGE IS PRESENT AT MAGNETIC SWITCH TERMINAL "S" WHEN STARTER SWITCH IS TURNED TO "START (ST)"

YES

OR

EXTREME WEAR OF PINION AND RING GEAR

REPAIR OR REPLACE STARTER. REPLACE RING GEAR

STARTER SLIDING RESISTANCE IS LARGE

REPAIR OR REPLACE STARTER

NO

UNDER THIS CONDITION, CHECK IF VOLTAGE OF CONNECTOR 3BW ON MAGNETIC SWITCH OF RESTART RELAY IS NORMAL

YES

DISCONNECTION OR FAULTY CONNECTION BETWEEN STARTER SWITCH AND MAGNETIC SWITCH

REPAIR

NO

CHECK IF VOLTAGE IS PRESENT AT WIRING CONNECTOR 3BW ON STARTER SWITCH OF RESTART RELAY

YES

FAULTY CONNECTION OF STARTER SWITCH

REPLACE STARTER SWITCH

NO

DISCONNECTION OR FAULTY CONNECTION BETWEEN STARTER SWITCH AND BATTERY

REPAIR

MAGNETIC SWITCH DOES NOT OPERATE THOUGH STARTER SWITCH IS TURNED TO "START (ST)"

CHECK IF VOLTAGE IS PRESENT AT MAGNETIC SWITCH TERMINAL "S" WHEN STARTER SWITCH IS TURNED TO "START (ST)"

YES

CHECK GROUND CABLE

YES

PINION SLIDING PART DOES NOT MOVE

REPAIR OR REPLACE STARTER

NO

REPAIR

OR

MAGNETIC SWITCH OR COIL IS DISCONNECTED OR BURNED OUT

NO

CHECK IF INDICATOR LAMP ON METER COMES ON NORMALLY

YES

CHECK CONTINUITY STARTER SWITCH AND MAGNETIC SWITCH TERMINAL "S"

CHECK STARTER RELAY

CHECK CLUTCH START SWITCH

FAULTY CONNECTION OR STARTER SWITCH

REPLACE STARTER SWITCH

NO

DISCONNECTION OR FAULTY CONNECTION BETWEEN BATTERY AND STARTER SWITCH

REPAIR

PINION MESHES WITH RING GEAR BUT
ENGINE DOES NOT RUN

CHECK GROUND CABLE

YES

NO

REPAIR OR REPLACE
GROUND CABLE

FAULTY CONNECTION
OF BRUSH AND
COMMUTATOR

BURNED-OUT
MAGNETIC
STARTER SWITCH

DISCONNECTION
OR DAMAGE OF
FIELD COIL

DISCONNECTION
OR DAMAGE OF
ARMATURE COIL

SLIP OF
PINION
CLUTCH

REPAIR OR REPLACE STARTER

Unstable Idling

Check point	Possible cause	Correction
Idling system	Idling improperly adjusted	Adjust the idling
Fast idling speed control device	Defective fast idling speed control device	Repair or replace the fast idling speed control device
Accelerator control system	Accelerator control system improperly adjusted	Adjust the accelerator control system
Fuel system	Fuel system leakage or blockage	Repair or replace the fuel system
	Air in the fuel system	Bleed the air from the fuel system
	Water particles in the fuel system	Change the fuel
Fuel filter	Clogged fuel filter element	Replace the fuel filter element or the fuel filter cartridge
Fuel feed pump	Defective fuel feed pump	Repair or replace the fuel feed pump
Injection nozzle	Injection nozzle sticking	Replace the injection nozzle
	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Injection pump	Defective delivery valve resulting in fuel drippage after fuel injection	Replace the delivery valve
	Injection timing improperly adjusted	Adjust the injection timing
	Insufficient injection volume	Adjust the injection volume
	Defective idle spring	Replace the idle spring
	Defective governor lever operation	Repair or replace the governor lever
	Regulator valve improperly adjustment	Adjust or replace the regulator valve
	Broken plunger spring	Replace the plunger spring
	Worn plunger	Replace the plunger assembly
Worn cam disc	Replace the cam disc	
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Compression pressure	Blown out cylinder head gasket Worn cylinder liner Piston ring sticking between the valve and the valve seat	Replace the related parts

Insufficient Power

Check point	Possible cause	Correction
Air cleaner	Clogged air cleaner element	Clean or replace the air cleaner element
Fuel	Water particle in the fuel	Replace fuel
Fuel filter	Clogged fuel filter element	Replace the fuel filter element or the fuel filter cartridge
Fuel feed pump	Defective fuel feed pump	Repair or replace the fuel feed pump
Injection nozzle	Injection nozzle sticking	Replace the injection nozzle
	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Fuel injection pipes	Fuel injection pipes damaged or obstructed	Replace the fuel injection pipes
Injection pump	Defective regulating valve	Repair or replace the regulating valve
	Defective delivery valve	Replace the delivery valve
	Defective timer	Repair or replace the timer
	Worn cam disk	Replace the cam disk
	Improper control lever operation	Adjust or replace the control lever
	Defective injection timing	Adjust the injection timing Repair or replace the injection pump timer
	Weak governor spring	Replace the governor spring
Worn plunger	Replace the plunger assembly	
Compression pressure	Blown out cylinder head gasket Worn cylinder liner Piston ring sticking	Replace the related parts
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Valve spring	Valve spring weak or broken	Replace the valve spring
Exhaust system	Exhaust pipe clogged	Clean the exhaust pipe
Full load adjusting screw seal	Open and improperly set adjusting screw seal	Adjust and reseal the adjusting screw seal

Excessive Fuel Consumption

Check point	Possible cause	Correction
Fuel system	Fuel leakage	Repair or replace the fuel system related parts
Air cleaner	Clogged air cleaner element	Clean or replace the air cleaner element
Idling speed	Poorly adjusted idling speed	Adjust the idling speed
Injection nozzle	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Fuel injection timing	Fuel injection timing improperly	Adjust the fuel injection timing
Injection pump	Defective delivery valve resulting is fuel drippage after fuel injection	Replace the delivery valve
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Compression pressure	Blown out cylinder head gasket Worn cylinder liner Piston ring sticking	Replace the related parts
Valve spring	Valve spring weak or broken	Replace the valve spring

Excessive Oil Consumption

Check point	Possible cause	Correction
Engine oil	Engine oil unsuitable Too much engine oil	Replace the engine oil Correct the engine oil level
Oil seal and gasket	Oil leakage from the oil seal and/or the gasket	Replace the oil seal and/or the gasket
Air breather	Clogged air breather	Clean the air breather
Intake and exhaust valve	Worn valve stems and valve guides	Replace the intake and exhaust valves and the valve guides

Overheating

Check point	Possible cause	Correction
Cooling water	Insufficient cooling water	Replenish the cooling water
Fan clutch	Oil leakage from the fan clutch	Replace the fan clutch
Fan belt	Fan belt loose or cracked causing slippage	Replace the fan belt
Radiator	Defective radiator cap or clogged radiator core	Replace the radiator cap or clean the radiator core
Water pump	Defective water pump	Repair or replace the water pump
Cylinder head and cylinder body sealing cap	Defective sealing cap resulting in water leakage	Replace the sealing cap
Thermostat	Defective thermostat	Replace the thermostat
Cooling system	Cooling system clogged by foreign material	Clean the foreign material from the cooling system
Fuel injection timing	Fuel injection timing improperly adjusted	Adjust the fuel injection timing

White Exhaust Smoke

Check point	Possible cause	Correction
Fuel	Water particles in the fuel	Replace the fuel
Fuel injection timing	Delayed fuel injection timing	Adjust the fuel injection timing
Compression pressure	Blown out cylinder head gasket Worn cylinder liner Piston ring sticking	Replace the related parts
Inlet and exhaust valves Valves seals	Defective valve seales Worn valves stems and valve guides	Replace the valve seales, the valves, and the valve guides

Dark Exhaust Smoke

Check point	Possible cause	Correction
Air cleaner	Clogged air cleaner element	Clean or replace the air cleaner element
Injection nozzle	Injection nozzle injection starting pressure too low Improper spray condition	Adjust or replace the injection nozzle
Fuel injection timing	Fuel injection timing improperly adjusted	Adjust the fuel injection timing
Injection pump	Defective delivery valve resulting in fuel drippage after fuel injection	Replace the delivery valve
	Excessive injection volume	Adjust the injection volume

Oil Pressure Does Not Rise

Check point	Possible cause	Correction
Engine oil	Improper viscosity engine oil	Replace the engine oil
	Insufficient engine oil	Correct the engine oil volume
Oil pressure gauge or unit Oil pressure indicator light	Defective oil pressure gauge or unit Defective indicator light	Repair or replace the oil pressure gauge or unit Replace the indicator light
Oil filter	Clogged oil filter element	Replace the oil filter element or the oil filter cartridge
Relief valve and by-pass valve	Relief valve sticking and/or weak by-pass valve spring	Replace the relief valve and/or the by-pass valve spring
Oil pump	Clogged oil pump strainer	Clean the oil pump strainer
	Worn oil pump related parts	Replace the oil pump related parts
Rocker arm shaft	Worn rocker arm bushing	Replace the rocker arm bushing
Camshaft	Worn camshaft and camshaft bearing	Replace the camshaft and the camshaft bearing
Crankshaft and bearings	Worn crankshaft and bearings	Replace the crankshaft and/or the bearings

Abnormal Engine Noise

1. Engine Knocking

Check to see that the engine has been thoroughly warmed up before beginning the troubleshooting procedure.

Check point	Possible cause	Correction
Fuel	Fuel unsuitable	Replace the fuel
Fuel injection timing	Fuel injection timing improperly adjusted	Adjust the fuel injection timing
Injection nozzle	Improper injection nozzle starting pressure and spray condition	Adjust or replace the injection nozzle
Compression pressure	Blown out head gasket	Broken piston ring Replace the head gasket or the piston ring

2. Gas Leakage Noise

Check point	Possible cause	Correction
Exhaust pipes	Loosely connected exhaust pipes Broken exhaust pipes	Tighten the exhaust pipe connections Replace the exhaust pipes
Injection nozzles and/or glow plugs	Loose injection nozzles and /or glow plugs	Replace the washers Tighten the injection nozzles and/or the glow plugs
Exhaust manifold	Loosely connected exhaust manifold and/or glow plugs	Tighten the exhaust manifold connections
Cylinder head gasket	Damaged cylinder head gasket	Replace the cylinder head gasket

3. Continuous Noise

Check point	Possible cause	Correction
Fan belt	Loose fan belt	Readjust the fan belt tension
Cooling fan	Loose cooling fan	Retighten the cooling fan
Water pump bearing	Worn or damaged water pump bearing	Replace the water pump bearing
Alternator or vacuum pump	Defective alternator or vacuum pump	Repair or replace the alternator or the vacuum pump
Valve clearance	Clearance improperly adjust	Adjust the valve clearance

4. Slapping Noise

Check point	Possible cause	Correction
Valve clearance	Valve clearance improperly adjusted	Adjust the valve clearance
Rocker arm	Damaged rocker arm	Replace the rocker arm
Flywheel	Loose flywheel bolts	Retighten the flywheel bolts
Crankshaft and thrust bearings	Worn or damaged crankshaft and/or thrust bearings	Replace the crankshaft and/or the thrust bearings
Crankshaft and connecting rod bearings	Worn or damaged crankshaft and/or connecting rod bearings	Replace the crankshaft and/or the connecting rod bearings
Connecting rod bushing and piston pin	Worn or damaged connecting rod bushing and piston pin	Replace the connecting rod bushing and/or the piston pin
Piston and cylinder liner	Worn or damaged piston and cylinder liner Foreign material in the cylinder	Replace the piston and the cylinder liner

Engine Cooling Trouble

Condition	Possible cause	Correction
Engine overheating	Low coolant level	Replenish
	Thermo unit faulty	Replace
	Faulty thermostat	Replace
	Faulty coolant unit	Repair or replace
	Clogged radiator	Clean or replace
	Faulty radiator cap	Replace
	Low engine oil level or use of improper engine oil	Replenish or change oil Replenish
	Damaged cylinder head gasket	Replace
	Clogged exhaust system	Clean exhaust system or replace faulty parts
	Loose fan belt	Adjust
	Excessive fuel injected	Adjust
	Improper injection timing	Adjust
Engine overcooling	Faulty thermostat	Replace
Too long engine warm-up time	Faulty thermostat	Replace
	Thermo unit faulty	Replace

Starter Motor Does Not Stop

STARTER DOES NOT STOP THOUGH STARTER SWITCH IS RETURNED TO "ON"

DISCONNECTED STARTER SWITCH WIRING CONNECTOR, AND CHECK STARTER SWITCH OPERATION.

STARTER SWITCH KEY POSITION	Connector No.	B-67				B-68					
		Terminal No.	1	2	3	4	1	2	4	5	6
		Terminal No.	ACC	B	ON	ST	B ₁	P ₁	P ₂	W	W
OFF	LOCK					○	○				
ON	ACC	○	○							○	○
	ON	○	○	○		○	○	○			
	START		○	○	○	○	○	○			

THERE MUST BE NO CONTINUITY EXCEPT ABOVE LINES.

YES

MAGNETIC SWITCH CONTACTS ARE FUSED AND NOT MOVED, OR A RETURN SPRING IS BROKEN OR DETERIORATED

REPLACE MAGNETIC SWITCH

NO

REPLACE STARTER SWITCH

MAIN DATA AND SPECIFICATIONS

Main Data and Specifications

		Engine Model		
		4HF1	4HF1-2	
Item	Engine type	Four-cycle, overhead camshaft, water cooled		
	Combustion chamber type	Direct injection		
	Cylinder liner type	Dry liner, special compound metal		
	Timing drive system	Gear drive		
	No. of cylinders — Bore × stroke	4 — 112 × 110 (4 — 4.41 × 4.33)		
	No. of piston rings	Compression rings: 2, Oil ring: 1		
	Total piston displacement	4334 (264.5)		
	Compression ratio	19		
	Compression pressure	3,040 (31/441) — 200	3,226 (32.9/468) — 200	
		kPa (kg / cm ² / psi) — rpm		
	Fuel injection order	1 — 3 — 4 — 2		
	Fuel injection timing (BTDC)	8	12	
	Specified fuel type	SAE No. 2 diesel fuel		
	Idling speed rpm	550 — 600	575 — 625	
	Valve system			
	Valve clearances (At cold):	Intake	mm (in)	0.4 (0.016)
		Exhaust	mm (in)	0.4 (0.016)
	Valve timing (At valve clearances 0.4 mm (0.016 in))			
	Intake valves	Open at (BTDC)	deg	18
		Close at (ABDC)	deg	50
Exhaust valves	Open at (BBDC)	deg	51	
	Close at (ATDC)	deg	17	
Fuel system				
Injection pump type	Bosch in-line type with automatic timer		Bosch "VE" distributor with automatic timer	
Plunger outside diameter	mm (in)	9.5 (0.374)	12 (0.472)	
Plunger lift	mm (in)	11.0 (0.433)	2.8 (0.110)	
Governor type	RLD-F mechanical (Variable speed)		Half all speed governor	
Automatic timer type	SCDM, centrifugal, flyweight		Hydraulic speed sensing type	
Fuel feed pump type	Piston		Vane	

		Engine Model	
		4HF1	4HF1-2
Item	Injection nozzle type		
	Injection nozzle type	Hole type (with 5 orifices)	
	Pressure MPa (kg / cm ² / psi)	18.1 (185 / 2,631)	
	Pressure adjustment	Shim adjusted	
	Main fuel filter type	Disposal spin-on cartridge and remote mounted water separator	
	Lubricating system		
	Lubrication method	Full flow pressure circulation	
	Specified engine oil (API grade)	CD or above	
	Oil pressure kPa (kg /cm ² / psi) — rpm	147 (1.5 / 21) — 700 (SAE 10W-30 API CD grade engine oil at 80°C (176°F))	
	Oil pump type	Gear type	
	Oil filter type	Spin-on cartridge	
	Oil capacity lit (US / UK gal)	10.5 (2.77 / 2.31)	
	Oil cooler type	Water cooled	
	Cooling system		
	Radiator type	Corrugated fin with reserve tank	
	Coolant capacity lit (US / UK gal)	12 (3.17 / 2.64)	
	Water pump type	Centrifugal impeller, V-belt drive	
	Pump to crankshaft speed to : 1 ratio	1.16 (175 / 151)	
	Delivery volume lit (US / UK gal)/min	200 (52.8 / 44.0) (Pump speed at 3,300 rpm Water temperature at 82°C (180°F))	
	Pump bearing type	Double row shaft	
	Thermostat type	Wax pellet	
	Valve initial opening tem- perature °C (°F)	With jiggle valve: 85±1.5 (182 — 188) Without jiggle valve: 82±1.5 (177 — 182)	
	Valve lift mm (in)	With jiggle valve: 8 (0.3) or more at 100°C (212°F) Without jiggle valve: 8 (0.3) or more at 95°C (203°F)	
	Air cleaner type	Dry paper element	
	Battery type Volt-amp.hr.	55D23R / 12 — 60 : 2 pcs	
	Generator		
	Type	AC brush with IC regulator and vacuum pump	
	Voltage V	24	
Drive and rotation	V-belt, clockwise viewed from the drive pulley		
Ground polarity	Negative		
Maximum output A	50 at 5,000 rpm (For Indone- sian)		
Maximum speed rpm	60 at 5,000 rpm	80 at 5,000 rpm	
	7,500 — 10,000		

		Engine Model	
		4HF1	4HF1-2
Item	Regulator		
	Type		IC
	Regulating voltage	V	28 — 29
	Vacuum pump		
	-66.7 kPa (-500 mmHg / -9.67 psi) build-up time		13 seconds or less at 1,000 rpm 4 seconds or less at 5,000 rpm
	Maximum vacuum		-90.7 kPa (-680 mmHg / -13.1 psi) or more at 5,000 rpm
	Starter motor		
	Type		Magnetic solenoid-controlled
	Model		S25-168
	Rated voltage	V	24
	Rated output	kW	4.0
	Load characteristics		
	Terminal voltage	V	18.55
	Load current	A	250
	Torque	N·m (kg·m / lb·ft)	14.22 (1.45 / 10.49) at 1,500 rpm or more
	Preheating system		Quick-On-Start System II
	Exhaust system		
	Pipe outside diameter × thickness		
	Front pipe	mm (in)	60.5 × 2.0 (2.38 × 0.079)
	Middle pipe	mm (in)	60.5 × 2.0 (2.38 × 0.079)
	Rear pipe	mm (in)	60.5 × 1.6 (2.38 × 0.063)
	Silencer Type		Circular section-shell construction of triple skin and end plates, internal construction of baffles and perforated tubes
Inside diameter	mm (in)	Approximately 200 (7.87)	

		Engine Model		
		4HG1	4HG1-T	
Item	Engine type	Four-cycle, overhead camshaft, water cooled		
	Combustion chamber type	Direct injection		
	Cylinder liner type	Dry liner, special compound metal		
	Timing drive system	Gear drive		
	No. of cylinders — Bore × stroke	4 — 115 × 110 (4 — 4.53 × 4.33)		
	No. of piston rings	Compression rings: 2, Oil ring: 1		
	Total piston displacement	4570 (278.9)		
	Compression ratio	19		
	Compression pressure	3,226 (32.9/468) — 200		
	Fuel injection order	1 — 3 — 4 — 2		
	Fuel injection timing (BTDC)	9	7 (Except Colombia) 9 (For Colombia)	
	Specified fuel type	SAE No. 2 diesel fuel		
	Idling speed rpm	550 — 600	600 — 650	
	Valve system			
	Valve clearances (At cold):	Intake	mm (in)	0.4 (0.016)
		Exhaust	mm (in)	0.4 (0.016)
	Valve timing (At valve clearances 0.4 mm (0.016 in))			
	Intake valves	Open at (BTDC)	deg	18
		Close at (ABDC)	deg	50
	Exhaust valves	Open at (BBDC)	deg	51
		Close at (ATDC)	deg	17
	Fuel system			
	Injection pump type	Bosch in-line type with automatic timer		
Plunger outside diameter	mm (in)	9.5 (0.374)	10.5 (0.413)	
Plunger lift	mm (in)	11.0 (0.433)		
Governor type	RLD-F mechanical (Variable speed)			
Automatic timer type	SCDM, centrifugal, flyweight			
Fuel feed pump type	Piston			

		Engine Model	
		4HG1	4HG1-T
Item	Injection nozzle opening	Hole type (with 5 orifices)	
	Injection nozzle type	Hole type (with 5 orifices)	
	Pressure MPa (kg / cm ² / psi)	18.1 (185 / 2,631)	1st 18.1 (185 / 2,631) 2nd 21.1 (215 / 3,057)
	Pressure adjustment	Shim adjusted	
	Main fuel filter type	Disposal spin-on cartridge and remote mounted water separator	
	Lubricating system		
	Lubrication method	Full flow pressure circulation	
	Specified engine oil (API grade)	CD or above	
	Oil pressure kPa (kg /cm ² / psi) — rpm	147 (1.5 / 21) — 700 (SAE 10W-30 API CD grade engine oil at 80°C (176°F))	
	Oil pump type	Gear type	
	Oil filter type	Spin-on cartridge	
	Oil capacity lit (US / UK gal)	10.5 (2.77 / 2.31)	
	Oil cooler type	Water cooled	
	Cooling system		
	Radiator type	Corrugated fin with reserve tank	
	Coolant capacity lit (US / UK gal)	12 (3.17 / 2.64)	
	Water pump type	Centrifugal impeller, V-belt drive	
	Pump to crankshaft speed to : 1 ratio	1.19 (175 / 147)	
	Delivery volume lit (US / UK gal)/min	200 (52.8 / 44.0) (Pump speed at 3,300 rpm Water temperature at 82°C (180°F))	
	Pump bearing type	Double row shaft	
	Thermostat type	Wax pellet	
	Valve initial opening temperature °C (°F)	With jiggle valve: 85±1.5 (182 — 188) Without jiggle valve: 82±1.5 (177 — 182)	
	Valve lift mm (in)	With jiggle valve: 8 (0.3) or more at 100°C (212°F) Without jiggle valve: 8 (0.3) or more at 95°C (203°F)	
	Air cleaner type	Dry paper element or oil bath	
	Battery type Volt-amp.hr.	75D23R / 12-65 : 2 pcs	
	Generator		
	Type	AC brush with IC regulator and vacuum pump	
	Voltage V	24	12 or 24
Drive and rotation	V-belt, clockwise viewed from the drive pulley		
Ground polarity	Negative		
Maximum output A	35 at 5,000 rpm 60 at 5,000 rpm	50 at 5,000 rpm 80 (12V) at 5,000 rpm	
Maximum speed rpm	7,500 — 10,000		

		Engine Model			
		4HG1		4HG1-T	
Item	Regulator				
	Type	IC			
	Regulating voltage	V	28 — 29	14.4±0.3	28 — 29
	Vacuum pump				
	-66.7kPa (-500 mmHg / -9.67 psi) build-up time	13 seconds or less at 1,000 rpm 4 seconds or less at 5,000 rpm			
	Maximum vacuum	-90.7 kPa (-680 mmHg / -13.1 psi) or more at 5,000 rpm			
	Starter motor				
	Type	Magnetic solenoid-controlled			
	Model	S25-168	R3.0	S25-168	
	Rated voltage	V	24	12	24
	Rated output	kW	4	3	4
	Load characteristics				
	Terminal voltage	V	18.55	14	18.55
	Load current	A	250	890 (MAX)	250
	Torque	N·m (kg·m / lb·ft)	14.22 (1.45 / 10.49) at 1,500 rpm or more	29.4 (2.99 / 21.63) at 860 rpm or more	14.22 (1.45 / 10.49) at 1,500 rpm or more
	Preheating system	Quick-On-Start System II			
	Exhaust system				
	Pipe outside diameter × thickness				
	Front pipe	mm (in)	60.5 × 2.0 (2.38 × 0.079)		
	Middle pipe	mm (in)	60.5 × 2.0 (2.38 × 0.079)		
Rear pipe	mm (in)	60.5 × 1.6 (2.38 × 0.063)			
Silencer type	Circular section-shell construction of triple skin and end plates, internal construction of baffles and perforated tubes				
Inside diameter	mm (in)	Approximately 200 (7.87)			

		Engine Model		
		4HE1-TC (4HE1-XS, XN) 98EPA	4HE1-TC (4HE1-XS) SPEC. EURO3	
Item	Engine type	Four-cycle, overhead camshaft, water cooled		
	Combustion chamber type	Direct injection		
	Cylinder liner type	Dry liner, special compound metal		
	Timing drive system	Gear drive		
	No. of cylinders — Bore × stroke	4 — 110 × 125 (4 — 4.33 × 4.92)		
	No. of piston rings	Compression rings 3, oil ring 1		
	Total piston displacement	4751(289.9)		
	Compression ratio	17.3		
	Compression pressure	3,040 (31/441) — 200		
	Fuel injection order	1— 3 — 4 — 2		
	Fuel injection timing (BTDC)	8	9	
	Specified fuel type	SAE No. 2 diesel fuel		
	Idling speed	775 — 825		
	Valve system			
	Valve clearances (At cold):	Intake	mm (in)	0.4 (0.016)
		Exhaust	mm (in)	0.4 (0.016)
	Valve timing (At valve clearances 0.4 mm (0.016 in))			
	Intake valves	Open at (BTDC)	deg	14
		Close at (ABDC)	deg	51
	Exhaust valves	Open at (BBDC)	deg	49
Close at (ATDC)		deg	16	

		Engine Model	
		4HE1-TC (4HE1-XS, XN) 98EPA	4HE1-TC (4HE1-XS) SPEC. EURO3
Item	Fuel system		
	Injection pump type	Bosch in-line MI-TICS Different injection fuel quantity between 98EPA and EURO3, or XS and XN	
	Plunger outside diameter	mm (in)	11 (0.433)
	Plunger lift	mm (in)	12 (0.472)
	Governor type	RLD-M mechanical (Variable speed)	
	Automatic timer type	Electronic control	
	Fuel feed pump type	Piston	
	Injection nozzle opening		
	Injection nozzle type	Hole type	
		(with 6 × 0.22φ orifices)	(with 6 × 0.21φ orifices)
	Pressure	MPa (kg / cm ² / psi)	21.6 (220 / 3,128)
	Pressure adjustment	Shim adjusted	
	Main fuel filter type	Disposal spin-on cartridge and remote mounted water separator	
	Lubricating system		
	Lubrication method	Full flow pressure circulation	
	Specified engine oil (API grade)	CD or above	
	Oil pressure	kPa (kg /cm ² / psi) — rpm	147 (1.5 / 21) — 700 (SAE 10W-30 API CD grade engine oil at 80°C (176°F))
	Oil pump type	Gear type	
	Oil filter type	Spin-on cartridge	
	Oil capacity	lit (US / UK gal)	13 (3.43 / 2.86)
	Oil cooler type	Water cooled	
	Cooling system		
	Radiator type	Corrugated fin with reserve tank	
	Coolant capacity	lit (US / UK gal)	11 (3.70 / 3.08)
	Water pump type	Centrifugal impeller, V-belt drive	
	Pump to crankshaft speed	to : 1 ratio	1.19
	Delivery volume	lit (US / UK gal)/min	200 (52.8 / 44.0) (Pump speed at 3,300 rpm Water temperature at 82°C (180°F))
	Pump bearing type	Double row shaft	
Thermostat type	Wax pellet		
Valve initial opening temperature	°C (°F)	With jiggle valve: 85 ± 1.5 (182 — 188) Without jiggle valve Primary: 82 ± 2 (176 — 183) Secondary: 85 ± 2 (181 — 189)	
Valve lift	mm (in)	With jiggle valve: 8 (0.3) or more at 100°C (212°F) Without jiggle valve: 8 (0.3) or more at 95°C (203°F)	

		Engine Model	
		4HE1-TC (4HE1-XS, XN) 98EPA	4HE1-TC (4HE1-XS) SPEC. EURO3
Item	Air cleaner type	Dry paper element or wet paper element	
	Battery type Model / Volt-amp.hr.	80D26R / 12-65 : 2 pcs	
	Generator		
	Type	AC brush with IC regulator and vacuum pump	
	Voltage	12 (For Venezuela) 24 (Except Venezuela)	
	Drive and rotation	V-belt, clockwise viewed from the drive pulley	
	Ground polarity	Negative	
	Maximum output	12 / 80 at 5,000 (Hitachi) (For Venezuela) 24 / 50 at 5,000, 24 / 60 at 5,000 (Hitachi) 24 / 80 at 5,000 (Hitachi) (Except Venezuela)	
	Maximum speed	7,500 — 10,000	
	Regulator		
	Type	IC	
	Regulating voltage	28 — 29 (Except Venezuela)	
	Vacuum pump		
	-66.7 kPa (-500 mmHg / -9.67 psi) build-up time	13 seconds or less at 1,000 rpm 4 seconds or less at 5,000 rpm	
	Maximum vacuum	-90.7 (-680 / -13.1) or more at 5,000 rpm	
	Starter motor		
	Type	Magnetic solenoid-controlled	
	Model	R3.0 (For Venezuela) S25-505D (Except Venezuela)	
	Rated voltage	12 (For Venezuela) 24 (Except Venezuela)	
	Rated output	3 (For Venezuela) 4.5 (Except Venezuela)	
Load characteristics			
Terminal voltage	14.3 (Except Venezuela)		
Load current	890 (MAX) (For Venezuela) 400 (Except Venezuela)		
Torque	29.4 (2.99 / 21.63) at 860 rpm or more (For Venezuela) 25.0 (2.55 / 18.4) at 1,000 rpm or more (Except Venezuela)		

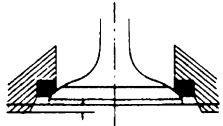
		Engine Model	
		4HE1-TC (4HE1-XS, XN) 98EPA	4HE1-TC (4HE1-XS) SPEC. EURO3
Item	Preheating system	Quick-On-Start System II	
	Exhaust system		
	Pipe outside diameter × Thickness		
	Front pipe mm (in)	60.5 × 2.0 (2.38 × 0.079)	
	Middle pipe mm (in)	60.5 × 2.0 (2.38 × 0.079)	
	Rear pipe mm (in)	60.5 × 1.6 (2.38 × 0.063)	
	Silencer type	Silencer with built-in catalytic converter (platinum)	Silencer with built-in catalytic converter (iron oxide)
	Inside diameter mm (in)	Approximately 200 (7.87)	
Exhaust gas recirculation system (EGR)	Equipped	Equipped (cooled)	

SERVICE STANDARD

Engine

Item	Service Standard	Service Limit
Compression Pressure KPa (kg / cm ² / psi) / rpm	3040 (31 / 441) or more Variance in pressure between the cylinders: less than 294 (3 / 43) / 200	2,157 (22 / 312)

Cylinder Head

Item	Service Standard	Service Limit
Inlet and Exhaust Valve Seat Depression mm (in)  N6A1400E	0.7 — 1.2 (0.028 — 0.047) Measurement should be taken by using a new valve.	2.5 (0.098)
Cylinder Head Lower Face Warp mm (in)	0.05 (0.002) or less Do not regrind the cylinder head lower face.	0.2 (0.008)
Manifold Fitting Face Warp mm (in)	0.05 (0.002) or less	0.2 (0.008)
Water Leak Test kPa (kg / cm ² / psi)	490 (5 / 71) — 3 minutes	Repair or replace those having water leak.




Cylinder Head Gasket Selection

Remarks:

The grade mark of the cylinder head gasket is shown by semicircular notches on the left side of the front portion of the gasket.

4HF1/4HF1-2/4HG1-T

Cylinder Head Gasket Selection


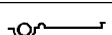
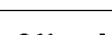
Gasket Grade		Ti max	Gasket Thickness (Reference)
A		0.579 - 0.659 (0.0228 - 0.0259)	1.70 (0.0669)
B		0.659 - 0.739 (0.0259 - 0.0291)	1.75 (0.0689)
C		0.739 - 0.819 (0.0291 - 0.0322)	1.80 (0.0708)

mm (in)

N6A1401E

4HE1-TC

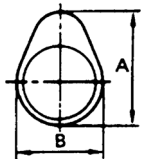
Cylinder Head Gasket Selection

Gasket Grade		Ti max	Gasket Thickness (Reference)
A		0.529 - 0.609 (0.0208 - 0.0240)	1.70 (0.0669)
B		0.609 - 0.679 (0.0240 - 0.0267)	1.75 (0.0689)
C		0.679 - 0.759 (0.0267 - 0.0300)	1.80 (0.0708)

mm (in)

N6A1404E

Camshaft

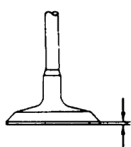
Item	Service Standard	Service Limit
Cam Height mm (in)	52.75 — 52.91 (2.076 — 2.083)	51.8 (2.039)
 N6A1407E		
Camshaft Journal Uneven Wear mm (in)	0.015 (0.0006) or less	0.05 (0.002)
Camshaft Journal Wear mm (in)	39.950 — 39.975 (1.5728 — 1.5738)	39.850 (1.569)
Camshaft Journal and Bearing Clearance mm (in)	0.025 — 0.087 (0.00098 — 0.00343)	0.15 (0.0059)
Camshaft Run-Out mm (in)	0.04 (0.0016) or less against the adjacent journal	0.05 (0.002)

Rocker Arm and Rocker Arm Shaft

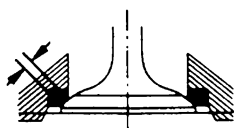
Item		Service Standard	Service Limit
Rocker Arm Shaft Wear	mm (in)	21.979 — 22.000 (0.8653 — 0.8661)	21.85 (0.860)
Rocker Arm Bushing Wear	mm (in)	22.010 — 22.035 (0.8665 — 0.8675)	22.15 (0.872)
Rocker Arm and Rocker Arm Shaft Clearance	mm (in)	0.010 — 0.056 (0.0004 — 0.0022)	0.2 (0.008)
Rocker Arm Shaft Run-Out	mm (in)		0.3 (0.012)
Rocker Arm Roller and Pin Clearance	mm (in)	0.040 — 0.084 (0.0016 — 0.0033)	0.5 (0.020)
Roller Surface			When there is an excessive wear or deformation found, replace it. When it is damaged only slightly, correct it with an oil stone.

Valve

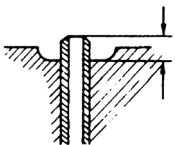
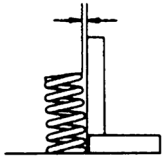
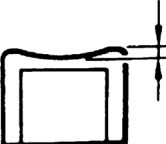
Item		Service Standard	Service Limit	
Valve Stem Wear	mm (in)	Inlet	8.946 — 8.961 (0.3522 — 0.3528)	8.88 (0.35)
		Exhaust	8.921 — 8.936 (0.3512 — 0.3529)	8.80 (0.34)
Valve Stem and Valve Guide Clearance	mm (in)	Inlet	0.038 — 0.071 (0.0015 — 0.0028)	0.20 (0.0079)
		Exhaust	0.064 — 0.096 (0.0025 — 0.0038)	0.25 (0.0098)
Valve Guide and Cylinder Head Interference	mm (in)	0.005 — 0.040 (0.0002 — 0.0016)		
Valve Thickness	mm (in)	Inlet	Nominal size 1.80 (0.071)	1.3 (0.051)
		Exhaust	Nominal size 1.75 (0.069)	1.3 (0.051)
Valve Contact Width	mm (in)	Inlet	Nominal size 2.5 (0.098)	3.0 (0.118)
		Exhaust	Nominal size 2.0 (0.079)	2.5 (0.098)



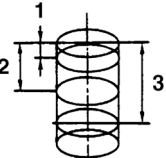
N6A1408E



N6A1409E

Item		Service Standard	Service Limit
Valve Guide Upper End Height	mm (in)	14.1±0.2 (0.555±0.008)	
	N6A1410E		
Valve Stem Seal Lip Wear	mm (in)	8.3 — 8.7 (0.3268 — 0.3425)	8.8 (0.346)
Valve Spring Tension	N (kg / lb)	414 — 477 (42.2 — 48.6 / 93 — 107) Set length 47.0 mm (1.85 in)	40.9 (98 / 401)
Valve Spring Free Height	mm (in)	Nominal size 62.5 (2.46)	59.4 (2.34)
Valve Spring Squareness	mm (in)		1.0 (0.04)
	N6A1411E		
Valve Clearance (At cold)	mm (in)	0.4 (0.016)	
Valve Stem Cap Wear	mm (in)		0.5 (0.02) Replace it when worn or deformed excessively.
	N6A1412E		

Cylinder Body

Item		Service Standard	Service Limit
Cylinder Liner Bore Wear	mm (in)	4HF1: 112.021 — 112.050 4HF12: (4.4103 — 4.4114) 4HG1: 115.021 — 115.050 4HG1-T: (4.5284 — 4.5295) 4HE1-TC: 110.041 — 110.080 (4.3323 — 4.3338)	112.20 (4.417) 115.20 (4.535) 115.20 (4.535)
	N6A1413E		
1. 20 mm (0.79 in) 2. 90 mm (3.54 in) 3. 160 mm (6.30 in)			
Cylinder Liner Projection	mm (in)	0.10 — 0.14 (0.0039 — 0.0055) The difference in the cylinder liner projection height between any two adjacent cylinders must not exceed 0.03 (0.0012)	There must be a projection on the cylinder liner.
Cylinder Body Upper Face Warpage	mm (in)	0.05 (0.002) or less Do not regrind the cylinder body upper face.	0.02 (0.008)

Item		Service Standard	Service Limit
Water Leak Test	kPa (kg / cm ² / psi)	490 (5 / 71) — 3 minutes	Repair or replace those having water leak.

Cylinder Liner Grade Selection

Remarks:

Cylinder Bore Grade Mark Position

The grade mark (1, 2 or 3) of the cylinder bore is stamped on the position just beside each cylinder on the upper left side (the upper portion of the oil cooler installation face) of the cylinder body.

Cylinder Liner Grade Mark Position

The outside diameter grade mark (1, 2 or 3) of the cylinder liner is stamped on the position approximately 160mm from the top face of the liner.

4HF1/4HF1-2

Line Grade	Cylinder Bore Diameter mm (in)	Service Grade	Liner Outside Diameter mm (in)
1	115.001 — 115.010 (4.5276 — 4.5279)	1X	114.991 — 115.000 (4.5272 — 4.5276)
2	115.011 — 115.020 (4.5280 — 4.5283)	3X	115.001 — 115.010 (4.5276 — 4.5279)
3	115.021 — 115.030 (4.5284 — 4.5287)		

4HG1 / 4HG1-T

Line Grade	Cylinder Bore Diameter mm (in)	Service Grade	Liner Outside Diameter mm (in)
1	118.001 — 118.010 (4.6457 — 4.6461)	1X	117.991 — 118.000 (4.6453 — 4.6457)
2	118.011 — 118.020 (4.6461 — 4.6464)	3X	118.001 — 118.010 (4.6457 — 4.6461)
3	118.021 — 118.030 (4.6465 — 4.6468)		

4HE1-TC

Line Grade	Cylinder Bore Diameter mm (in)	Service Grade	Liner Outside Diameter mm (in)
1	115.001 — 115.010 (4.5276 — 4.5279)	1X	115.021 — 115.030 (4.5284 — 4.5287)
2	115.011 — 115.020 (4.5280 — 4.5283)	3X	115.031 — 115.040 (4.5289 — 4.5291)
3	115.021 — 115.030 (4.5284 — 4.5287)		

Crankshaft

Item		Service Standard	Service Limit
Crankshaft Journal and Crankpin Uneven Wear		mm (in)	0.05 (0.002)
Crankshaft Journal Wear	No. 1, 2, 4 and 5	81.905 — 81.925 (3.2246 — 3.2254)	81.85 (3.2224)
	mm (in)	No. 3	81.890 — 81.910 (3.2240 — 3.2248)	81.85 (3.2224)
Crankshaft Journal and Bearing Clearance	No. 1, 2, 4 and 5	0.037 — 0.072 (0.0015 — 0.0028)	0.11 (0.0043)
	mm (in)	No. 3	0.051 — 0.086 (0.0020 — 0.0034)	0.11 (0.0043)
Crankpin Wear		4HF1, 4HG1, 4HG1-T: 65.902 — 65.992 (2.5946 — 2.5954)	65.85 (2.5925)
		4HE1-TC: 72.920 — 72.922 (2.8709 — 2.8433)	72.850 (2.8681)
Crankshaft Journal Bearing Spread	mm (in)		87 (3.43)
Crankshaft End Play	mm (in)	0.104 — 0.205 (0.0041 — 0.0081)	0.35 (0.014)
Crankshaft Run-Out	mm (in)	0.05 (0.002) or less	0.3 (0.012)
Crankshaft Front and Rear Oil Seal and Slinger Wear			When there is an oil leak found, the oil seal and slinger must be replaced as a set. Insert it securely with a special tool.

Crankshaft Journal Bearing Selection

Remarks:

Crankshaft Bearing Housing Grade Mark Position

The crankshaft bearing housing grade marks (1 or 2) are stamped collectively for all cylinders on the underside of the left front portion of the cylinder body.

Crankshaft Journal Grade Mark Position

The crankshaft journal grade marks (1 or 2) are stamped collectively for all cylinders on the front side of the crankshaft No. 1 balancer

Crankshaft Bearing Grade Mark Position

The identification color code (black, brown or blue) of the crankshaft journal bearing grade mark is applied on the side of each bearing.

Crankshaft Journal No. 1, 2, 4 and 5

Bearing Housing		Crankshaft Journal		Crankshaft Bearing Color Code
Grade Mark	(Reference) Inside Diameter mm (in)	Grade Mark	(Reference) Outside Diameter mm (in)	
1	87.000 — 87.009 (3.4252 — 3.4255)	1	81.905 — 81.915 (3.2246 — 3.2250)	Black
		2	81.916 — 81.925 (3.2250 — 3.2254)	Brown
2	87.010 — 87.019 (3.4256 — 3.4259)	1	81.905 — 81.915 (3.2246 — 3.2250)	Blue
		2	81.916 — 81.925 (3.2250 — 3.2254)	Black

Crankshaft Journal No. 3

Bearing Housing		Crankshaft Journal		Crankshaft Bearing Color Code
Grade Mark	(Reference) Inside Diameter mm (in)	Grade Mark	(Reference) Outside Diameter mm (in)	
1	87.000 — 87.009 (3.4252 — 3.4255)	1	81.890 — 81.900 (3.2240 — 3.2244)	Black
		2	81.901 — 81.910 (3.2244 — 3.2248)	Brown
2	87.010 — 87.019 (3.4256 — 3.4259)	1	81.890 — 81.900 (3.2240 — 3.2244)	Blue
		2	81.901 — 81.910 (3.2244 — 3.2248)	Black

Piston

Item	Service Standard	Service Limit
Piston and Cylinder Liner Clearance	4HG1: 0.081 — 0.116 (0.0032 — 0.0044)	
	4HF1: 0.081 — 0.113 (0.0032 — 0.0044)	
	4HE1-TC: 0.091 — 0.131 (0.0036 — 0.0052)	

Piston Grade Selection

Remarks:

Piston Grade Mark Position

The piston grade marks (i.e. A, B, C) are stamped on the piston upper face.

Piston Outside Diameter Measuring Position

Take measurement of the Piston at the position 82mm (3.23 in) from the top in the direction of the longer diameter.

Piston Grade

Engine model	Cylinder Liner Bore Diameter mm (in)	Piston Service Grade	Piston Outside Diameter mm (in)
4HF1 4HF1-2	112.041 — 112.060 (4.4111 — 4.4118)	—	111.947 — 111.960 (4.4074 — 4.4079)
4HG1 4HG1-T	115.040 — 115.060 (4.5291 — 4.5299)	—	114.944 — 114.959 (4.5253 — 4.5259)
4HE1-TC	110.066 — 110.075 (4.3333 — 4.3337)	AX	109.944 — 109.959 (4.3285 — 4.3291)
	110.076 — 110.085 (4.3337 — 4.3340)	CX	109.960 — 109.975 (4.3291 — 4.3297)

Piston Pin

Item	Service Standard	Service Limit
Piston Pin Wear	4HF1 4HF1-2 4HG1 4HG1-T	35.995 — 36.000 (1.4171 — 1.4173)
	4HE1-TC	39.995 — 40.000 (1.5746 — 1.5748)

Item	Service Standard	Service Limit
Piston and Piston Pin Clearance mm (in)	0.004 — 0.017 (0.0002 — 0.0007) Clearance should be wide enough for the piston pin to be inserted under the condition where the piston is heated to the temperature of 80°C to 100°C (176°F to 212°F).	0.04 (0.0016) When an abnormal striking sound is heard, replace the piston and the piston pin.

Piston Ring

Item		Service Standard	Service Limit		
Piston Ring Gap (Inside the cylinder) mm (in)	4HF1 4HF1-2	1st Compression Ring	0.24 — 0.39 (0.0094 — 0.0153)	1.50 (0.0591)	
		2nd Compression Ring	0.35 — 0.50 (0.0138 — 0.0197)	1.50 (0.0591)	
		Oil Ring	0.02 — 0.40 (0.0008 — 0.0157)	1.50 (0.0591)	
	4HG1 4HG1-T	1st Compression Ring	0.24 — 0.39 (0.0094 — 0.0153)	1.50 (0.0591)	
		2nd Compression Ring	0.35 — 0.50 (0.0138 — 0.0197)	1.50 (0.0591)	
		Oil Ring	0.15 — 0.35 (0.00591 — 0.0138)	1.50 (0.0591)	
	4HE1-TC	1st Compression Ring	0.24 — 0.40 (0.0094 — 0.0157)	1.50 (0.0591)	
		2nd Compression Ring	0.30 — 0.40 (0.0118 — 0.0157)	1.50 (0.0591)	
		3rd Compression Ring	0.30 — 0.40 (0.0118 — 0.0157)	1.50 (0.0591)	
		Oil Ring	0.02 — 0.40 (0.0008 — 0.0157)	1.50 (0.0591)	
	Piston Ring & Piston Ring Groove Clearance mm (in)	4HF1 4HF1-2	1st Compression Ring	0.062 — 0.092 (0.0024 — 0.0036)	0.2 (0.0078)
			2nd Compression Ring	0.04 — 0.08 (0.0015 — 0.0031)	0.15 (0.0059)
Oil Ring			0.02 — 0.06 (0.0008 — 0.0024)	0.15 (0.0059)	
4HG1 4HG1-T		1st Compression Ring	0.062 — 0.092 (0.0024 — 0.0036)	0.2 (0.0078)	
		2nd Compression Ring	0.04 — 0.08 (0.0015 — 0.0031)	0.15 (0.0059)	
		Oil Ring	0.02 — 0.06 (0.0008 — 0.0024)	0.15 (0.0059)	
4HE1-TC		1st Compression Ring	0.09 — 0.13 (0.0035 — 0.0051)	0.2 (0.0078)	
		2nd Compression Ring	0.09 — 0.13 (0.0035 — 0.0051)	0.2 (0.0078)	
		3rd Compression Ring	0.09 — 0.13 (0.0035 — 0.0051)	0.2 (0.0078)	
		Oil Ring	0.03 — 0.07 (0.0012 — 0.0028)	0.15 (0.0059)	
The direction of the piston ring connecting end		Alternately at 180°. Don't position the connecting end in the side pressure direction. Place the connecting end of the oil ring and that of the expander coil at 180° alternately.			

Connecting Rod

Item	Service Standard	Service Limit	
Connecting Rod Alignment mm (in)	Distortion	0.05 (0.002) or less	0.20 (0.008)
	Parallelism	0.05 (0.002) or less	0.20 (0.008)
Connecting Rod Small End Bushing and Piston Pin Clearance mm (in)	0.012 — 0.027 (0.0005 — 0.0011) There must be clearance enough to rotate the piston pin while holding it lightly with its large end fixed.	0.05 (0.002)	
Connecting Rod Bearing Spread mm (in)		70 (2.77) or more	

Item		Service Standard	Service Limit
Connecting Rod Bearing and Crankpin Clearance	mm (in)	0.036 — 0.077 (0.0014 — 0.0030)	0.10 (0.004)
The difference in weight between the connecting rod and the piston when assembled.	N (gr / lb)		0.2 (20 / 0.28)

Connecting Rod Bearing Selection

Remarks:

The connecting rod big end inside diameter grade marks (A or B) are stamped on top of the cylinder number align marks of the big end.

4HF1 / 4HF1-2 / 4HG1 / 4HG1-T

Connecting Rod Big End		Crankpin	Big End Bearing Color Code
Grade Mark	(Reference) Inside Diameter mm (in)	(Reference) Outside Diameter mm (in)	
A	69.985 — 69.992 (2.7553 — 2.7556)	65.902 — 65.922 (2.5946 — 2.5954)	Green
B	69.993 — 70.000 (2.7556 — 2.7559)	65.902 — 65.922 (2.5946 — 2.5954)	Yellow

4HE1-TC

Connecting Rod Big End		Crankpin	Big End Bearing Color Code
Grade Mark	(Reference) Inside Diameter mm (in)	(Reference) Outside Diameter mm (in)	
A	77.985 — 77.992 (3.0702 — 3.0705)	72.902 — 72.922 (2.8702 — 2.8709)	Green
B	77.993 — 78.000 (3.0706 — 3.0709)	72.902 — 72.922 (2.8702 — 2.8709)	Yellow

Flywheel

Item		Service Standard	Service Limit
Flywheel Thickness	mm (in)	31.4 — 31.6 (1.236 — 1.244) (Flywheel friction surface — crankshaft setting face)	31.0 (1.22)
Friction Surface Run-Out	mm (in)		0.2 (0.008)
Friction Surface Roughness	mm (in)	0.006 (0.0002) or less	
Ring Gear			The tooth face burr must be chamfered. Replace ones when damaged excessively.

Gear Train

Item		Service Standard	Service Limit
Timing Gear Backlash Gear to Gear (In the direction of a normal line)	mm (in)	0.10 — 0.17 (0.0039 — 0.0067) Hold both the gear to be checked and the adjoining gear stationary.	0.30 (0.012)
Crankshaft Gear and Crankshaft Interference	mm (in)	0.03 — 0.093 (0.0012 — 0.0037)	
Camshaft Gear and Camshaft Interference	mm (in)	0.015 — 0.023 (0.0006 — 0.0009)	
Idle Gear Shaft Wear	mm (in)	29.959 — 29.980 (1.1795 — 1.1803)	29.80 (1.1732)
Idle Gear Bushing Wear	mm (in)	30.000 — 30.021 (1.1811 — 1.1819)	30.1 (1.185)
Idle Gear Bushing and Idle Gear Shaft Clearance	mm (in)	0.020 — 0.062 (0.0008 — 0.0024)	0.2 (0.008)
Idle Gear End Play	mm (in)	0.058 — 0.115 (0.0002 — 0.005)	0.2 (0.008)

Lubrication System

Item		Service Standard	Service Limit	
Oil Pump	Gear Teeth and Inner Wall Clearance	mm (in)	0.125 — 0.220 (0.0049 — 0.0087)	0.3 (0.012)
	Gear and Pump Cover Clearance	mm (in)	0.064 — 0.109 (0.0018 — 0.0043)	0.2 (0.008)
	Gear Shaft Wear	mm (in)	15.989 — 16.000 (0.6295 — 0.6299)	15.9 (0.626)
	Gear Shaft and Bushing Clearance	mm (in)	0.04 — 0.07 (0.0016 — 0.0028)	0.2 (0.012)
	Delivery Volume	cc (cu-in)/rev	16.54 (1.0) Delivery Pressure: 392kPa (4 kg/cm ² / 56.9 psi) Oil Temperature: 50 ± 2°C (122 ± 3.6°F) Oil Viscosity: SAE 30	
Relief Valve Opening Pressure kPa (kg/cm ² / psi)	Oil Gallery		441.3 (4.5 / 64.0)	(Reference)
	Oil Pump		784.5 (8.0 / 113.8)	(Reference)

Cooling System

Item		Service Standard	Service Limit
Water Pump	External appearance	Check the following: <ul style="list-style-type: none"> • Cracks and damages of the pump body • Cracks and corrosion of the impeller • Water leak from the seal unit When an abnormal condition is found, replace the water pump as an assembly.	
	Seal Unit	Push the fan center in the radial direction while rotating it and check the seal unit for any excessive play or abnormal sound. When there is any abnormal condition found, replace the water pump as an assembly.	
	Delivery Volume lit (US / UK gal) / min	200 or more Water Pump Speed: 3,300 rpm Water Temperature: $80 \pm 2^{\circ}\text{C}$ $(176 \pm 3.6^{\circ}\text{F})$	
Fan Drive Belt Tension	mm (in)	8 — 12 (0.31 — 0.47) ... New belt 10 — 14 (0.39 — 0.55) ... Reuse belt Depress the drive belt mid-portion with a 98N (10kg / 22lb) force	
Thermostat With Jiggle Valve	Valve Initial Opening Temperature	$^{\circ}\text{C}$ ($^{\circ}\text{F}$)	85 ± 1.5 (185 ± 2.7)
	Valve Lift At 100°C (212°F)	mm (in)	8 (0.31) or more
Thermostat With-Out Jiggle Valve	Valve Initial Opening Temperature	$^{\circ}\text{C}$ ($^{\circ}\text{F}$)	82 ± 1.5 (177 — 182)
	Valve Lift At 95°C (203°F)	mm (in)	8 (0.31) or more
Radiator	External appearance	<ul style="list-style-type: none"> • Check the radiator for any corrosion, water leak, fin damage, or clogging. When there is any abnormal condition found, correct the radiator or replace it. • When deterioration, cracking or water leak is found in the rubber hose, replace the rubber hose. 	
	Pressure Valve Opening Pressure	kPa (kg/cm ² /psi)	103.0 ± 14.7 ($1.05 \pm 0.15 / 14.9 \pm 2.1$)
	Vacuum Valve Opening Pressure	kPa (kg/cm ² /psi)	1.0 — 4.9 (0.01 — 0.05 / 0.14 — 0.71)
Cooling Fan	Cooling Fan Pulley Speed	rpm	3,900
	Cold Condition (Bi-metal lower than 40°C (104°F))	rpm	900 or lower
	Hot Condition (Bi-metal higher than 70°C (158°F))	rpm	$3,300 \pm 150$
	Pulley Ratio (Crankshaft/Fan)		175 / 151

Fuel System

Item		Service Standard	Service Limit
Fuel Feed Pump	Suction capacity	The suction must be completed in 25 times or less. Priming Pump Speed: 60 — 100 times/minute Pipe Inside Diameter: 8mm (0.31in) Suction Pipe Length: 2,000mm (78.7 in) Suction Height: 1,000mm (39.4in)	
Injection Nozzle	Spray Condition	<ul style="list-style-type: none"> The spray must be fine and uniform. The injection must be directed in the center direction with no stray spray. The spray from each nozzle hole must be uniform 	

Engine Electrical

Item		Service Standard	Service Limit		
Generator	Ball bearing		When it doesn't rotate smoothly or is giving out an abnormal sound, or when there is an oil leak from the seal, replace it.		
	Slip Ring Diameter	mm (in)	Nominal size 31.6 (1.244)	30.6	
	Rotor	Coil Resistance	Ω	Nominal resistance 12.6	When the resistance differs largely from the standard value, or when a poor insulation is found, replace it.
		Coil Insulation Resistance	$M\Omega$	1 or more (500 volt megger tester)	
	Stator	Coil Resistance	Ω	Nominal resistance 0.17 (Between coil end and each coil end)	
		Coil Insulation Resistance	$M\Omega$	1 or more (500 volt megger tester)	
Brush Length	mm (in)	Nominal size 20 (0.79)	6 (0.24)		
IC Voltage Regulator	Rectifier		The rectifier is normal when there is continuity with the tester - terminal connected to "B" (battery) terminal and the + terminal to the rectifier holder, and when there is no continuity with their connections reversed.	When there is continuity in both directions, or when there is no continuity in both directions, replace the rectifier.	
	Battery Power	V	<4HF1 / 4HF1-2 / 4HG1 / 4HG1-T> LR 250 — 504 (24V - 60A) LR 250 — 508B (24V - 50A) DENSO (12V - 35A)	28 — 29 28 — 29 27.8 — 28.8	
			<4HE1-TC> LR 250 — 510 (24V - 50A) LR 180 — 510 (12V - 80A)	28 — 29 14.1 — 14.7	

Item		Service Standard	Service Limit																																
IC Voltage Regulator	Output Current A	<table border="1"> <thead> <tr> <th></th> <th>1300 rpm</th> <th>2000 rpm</th> <th>4000 rpm</th> </tr> </thead> <tbody> <tr> <td><4HF1 / 4HF1-2 / 4HG1 / 4HG1-T></td> <td></td> <td></td> <td></td> </tr> <tr> <td>LR 250 — 504</td> <td>18</td> <td>35</td> <td>53</td> </tr> <tr> <td>LR 250 — 508B</td> <td>15</td> <td>32</td> <td>46</td> </tr> <tr> <td>DENSO</td> <td>12</td> <td>18</td> <td>37</td> </tr> <tr> <td><4HE1-TC></td> <td></td> <td></td> <td></td> </tr> <tr> <td>LR 250 — 510</td> <td>15</td> <td>32</td> <td>43</td> </tr> <tr> <td>LR 180 — 510</td> <td>25</td> <td>58</td> <td>82</td> </tr> </tbody> </table>		1300 rpm	2000 rpm	4000 rpm	<4HF1 / 4HF1-2 / 4HG1 / 4HG1-T>				LR 250 — 504	18	35	53	LR 250 — 508B	15	32	46	DENSO	12	18	37	<4HE1-TC>				LR 250 — 510	15	32	43	LR 180 — 510	25	58	82	
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	Pulley Ratio (Crankshaft/Generator)	175 / 82																																	
Vacuum Pump	Pump Housing Inside Diameter mm (in)	60.0 — 60.1 (2.362)	(Reference)																																
	Vane Length mm (in)	14.2 — 15.2 (0.559 — 0.598)	(Reference)																																
	Performances Time required for the pressure to get to -66.7kPa (-500mmHg / -9.7psi).	1,000 rpm 13 sec or less 1,000 rpm 35 sec or less (LR 180 — 510 only) 5,000 rpm 4 sec or less 5,000 rpm 10 sec or less (LR 180 — 510 only) Oil Viscosity: SAE 30 Oil Temperature: 70 ± 5°C (158 ± 9°F) Oil Pressure: 441kPa (4.5 kg / cm ² / 64psi) Tank Capacity: 7,000cc (427 cu-in)																																	
	Check Valve	<ul style="list-style-type: none"> • Apply 98 — 490 kPa (1 — 5 kg/cm² 14-71 psi) compressed air to pump side of the check valve. • Check for air leakage from the check valve. • If there is air leakage, the check valve must be replaced. 																																	
Starter	Commutator Run-Out mm (in)	0.05 (0.002) or less	0.2 (0.008)																																
	Commutator Outside Diameter mm (in)	36.5 (1.437)	35.5 (1.398)																																
	Mica Segment Depth mm (in)	0.5 — 0.8 (0.020 — 0.031)	0.2 (0.008)																																
	Brush Length mm (in)	15.0 (0.591)	10.5 (0.413)																																
	Brush Spring Tension N (kg / lb)	24.5 — 34.3 (2.5 — 3.5 / 5.5 — 7.7)																																	

Item		Service Standard	Service Limit																																																												
Starter	Load Characteristics																																																														
	Terminal Voltage	V 18.55																																																													
	Load Current	A 250																																																													
	Torque	N·m (kg·m / lb·ft) 14.2 (1.45 / 10.5) or more																																																													
	Speed	rpm 860																																																													
		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2"></th> <th colspan="10">Terminal</th> </tr> <tr> <th>ACC</th> <th>B</th> <th>ON</th> <th>ST</th> <th>B1</th> <th>P1</th> <th>P2</th> <th>W</th> <th>W</th> </tr> </thead> <tbody> <tr> <td>LOCK</td> <td></td> <td></td> <td></td> <td></td> <td>○—○</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>ACC</td> <td>○—○</td> <td></td> <td></td> <td></td> <td>○—○</td> <td></td> <td></td> <td>○—○</td> <td></td> </tr> <tr> <td>ON</td> <td>○—○</td> <td>○—○</td> <td></td> <td></td> <td>○—○</td> <td>○—○</td> <td></td> <td></td> <td></td> </tr> <tr> <td>START</td> <td></td> <td>○—○</td> <td>○—○</td> <td></td> <td>○—○</td> <td>○—○</td> <td></td> <td></td> <td></td> </tr> </tbody> </table> <p style="text-align: right; margin-top: 10px;">N6A1414E</p>			Terminal										ACC	B	ON	ST	B1	P1	P2	W	W	LOCK					○—○					ACC	○—○				○—○			○—○		ON	○—○	○—○			○—○	○—○				START		○—○	○—○		○—○	○—○			
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START		○—○	○—○		○—○	○—○																																																									
Preheating system (QOSII)	Time required for the glow indicator to light up	sec 3.5	After the key switch is turned to ON position without engine turned.																																																												
	Time required for the source voltage to be supplied to the glow plug	sec 18	After the key switch is turned to ON position without engine turned.																																																												
	Glow Relay Coil Resistance	Ω Nominal resistance 51.5																																																													
	Thermo Switch Operating Temperature	°C (°F) OFF → ON: 7 — 13 (44.6 — 55.4) ON → OFF: Less 3 (37.4)																																																													
	Glow Plug Continuity		If no continuity exists, must be replaced.																																																												

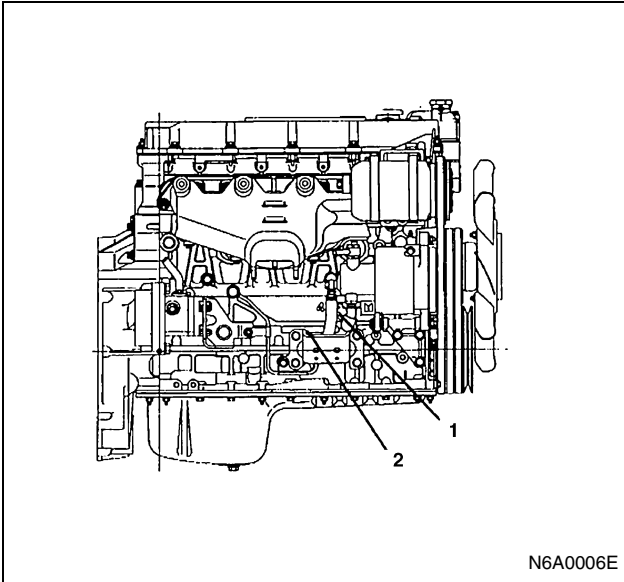
SERVICING

Servicing refers to general maintenance procedures to be performed by qualified service personnel.

Model Identification

Engine Serial Number

The engine number is stamped on the front left hand side of the cylinder body.



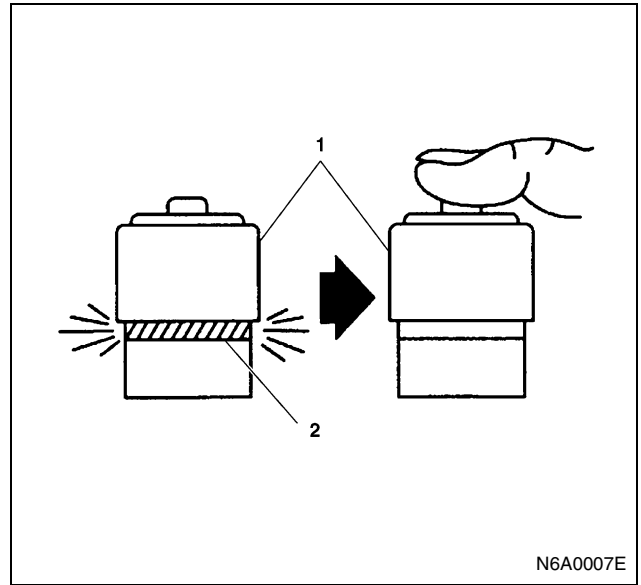
Legend

1. Engine type
2. Engine number

Air Cleaner

Dust Indicator

1. The dust indicator is installed to the air cleaner. (for Australia and GCC)
Inspect the dust indicator. If the indicator plate is red, the air cleaner element must be cleaned or replaced.
2. Clean the air cleaner element once and reinstall it. Press the dust indicator button to clear the dust indicator.

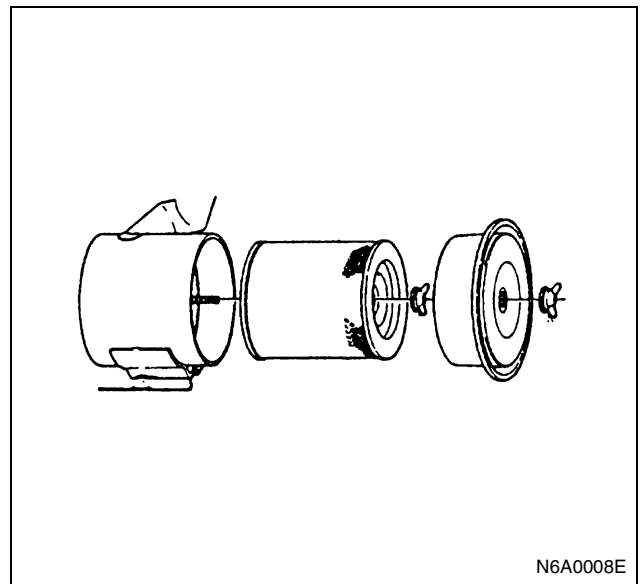


Legend

1. Dust indicator
2. Red color

Dry Type Washable Paper Element

Element cleaning procedures will vary according to the condition of the element.



Dust Fouled Element

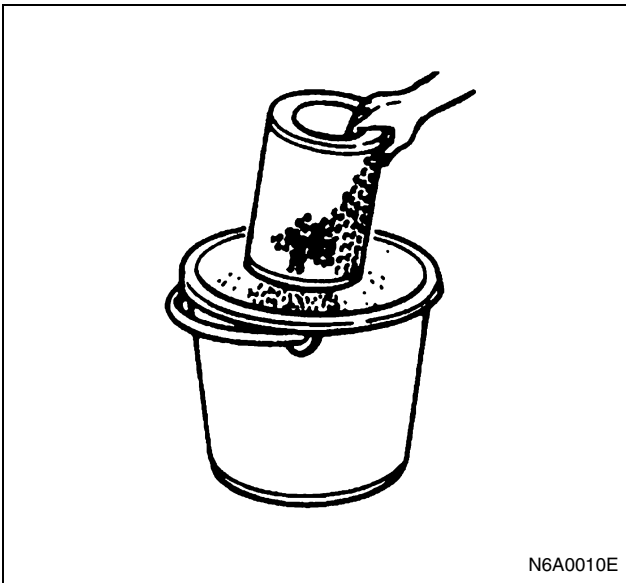
Rotate the element with your hand while applying compressed air to the inside of the element. This will blow the dust free.

Compressed air pressure must not exceed 686 kPa (7 kg/cm² / 99.6 psi).



Carbon and Dust Fouled Element

1. Prepare a cleaning solution of Isuzu Genuine Element Cleaner (Donaldson D1400) diluted with water.
2. Immerse the element in the solution for twenty minutes.



3. Remove the element from the solution and rinse it well with running water. Water pressure must not exceed 274 kPa (2.8 kg/cm² / 39.8 psi).

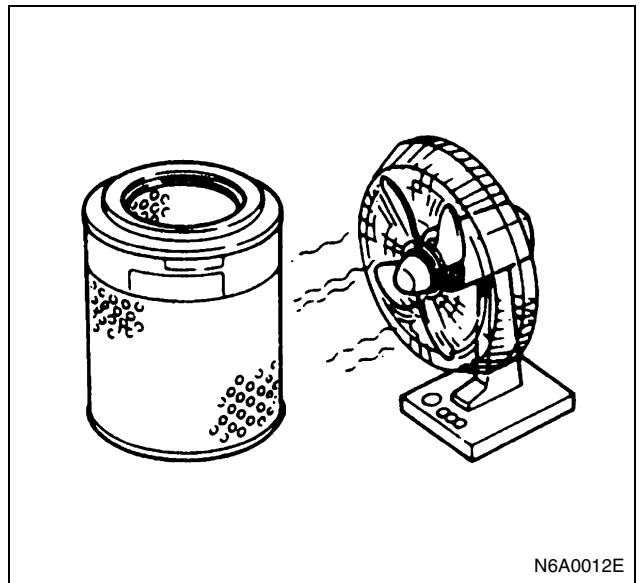


4. Dry the element in a well ventilated area. An electric fan will hasten drying.

Caution:

Do not use compressed air or an open flame to dry the element quickly. Damage to the element will result.

It will usually take two or three days for the element to dry completely. Therefore, it is a good idea to have a spare on hand to use in the interim.

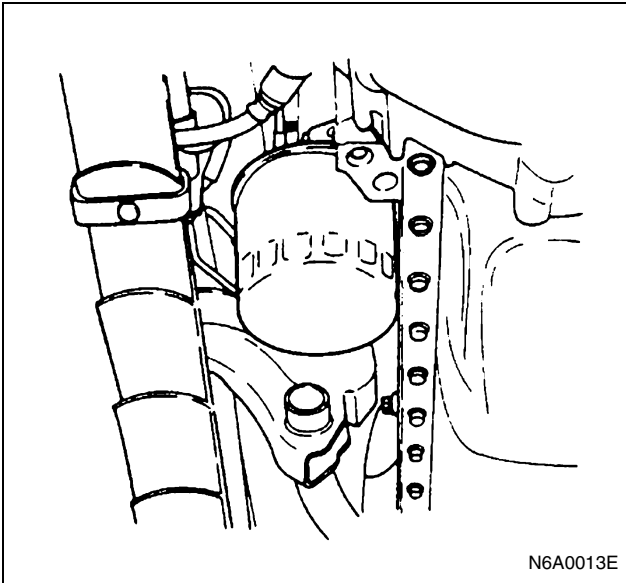


Lubricating System

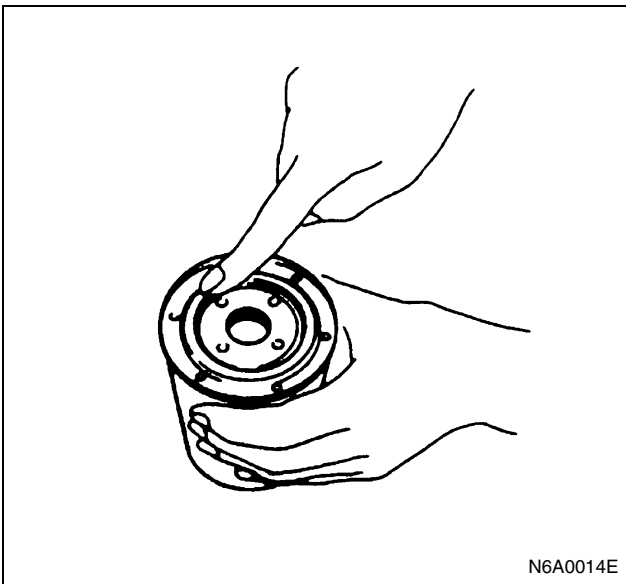
Main Oil Filter (Disposable Spin-On Cartridge Element)

Replacement Procedure

1. Loosen the used oil filter by turning it counterclockwise with the filter wrench.
Filter Wrench: 1-85221-097-0



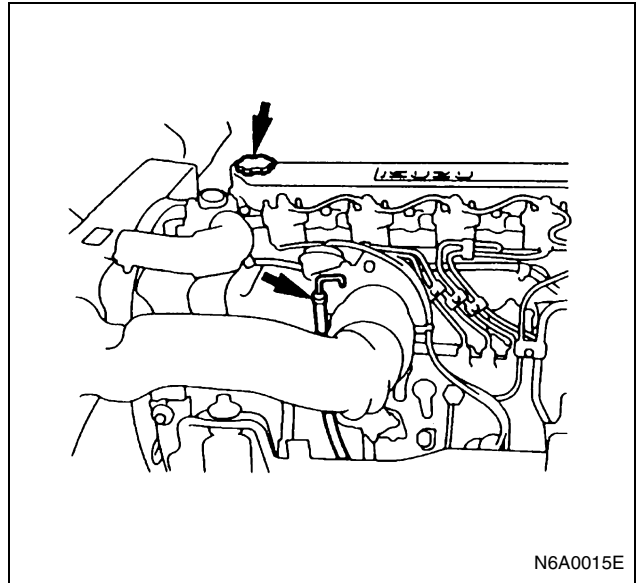
2. Clean the oil filter fitting face.
This will allow the new oil filter to seat properly.
3. Apply a light coat of engine oil to the O-ring.



4. Turn in the new oil filter until the filter O-ring is fitted against the sealing face.
5. Use the filter wrench to turn in the filter an additional one full turn.
6. Check the engine oil level and replenish to the specified level if required.

Engine Oil Replenishment	lit (US/UK gal)
	0.7 (0.19/0.15)

7. Start the engine and check for oil leakage from the main oil filter.



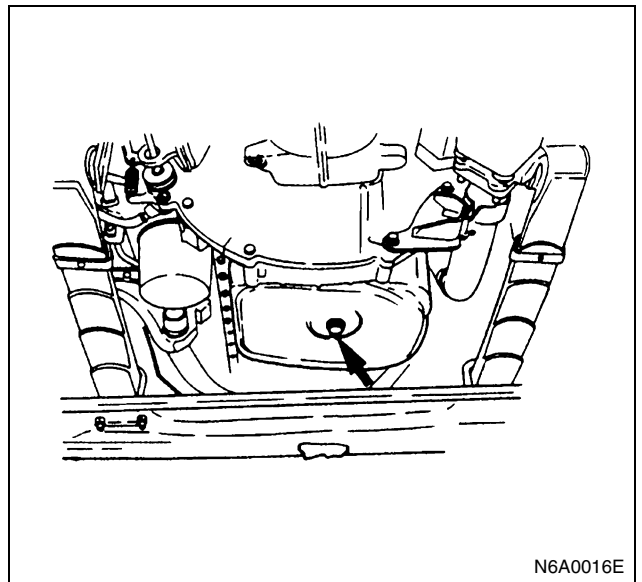
Engine Oil Replacement

Draining

1. Remove the drain plug to completely drain the engine oil.
Do this while the engine is hot.
2. Replace the drain plug.
3. Tighten the drain plug to the specified torque.

Tighten:

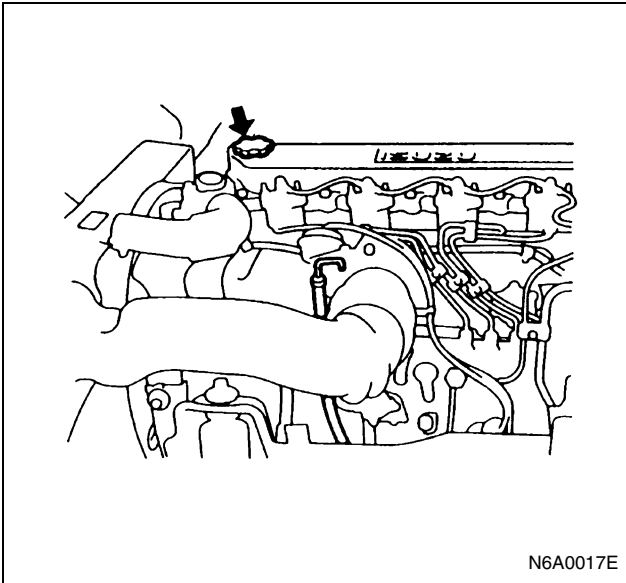
Drain plug to 78 N·m (8.0 kg·m/58 lb·ft)



Replenishment

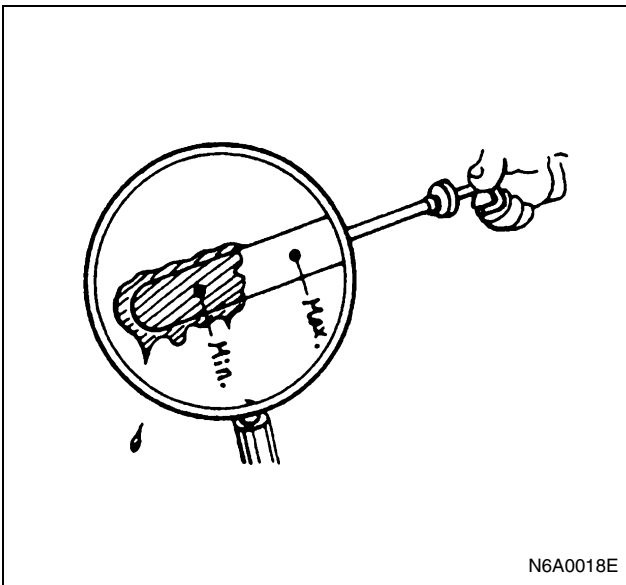
1. Remove the filler cap.
2. Pour the specified engine oil into the crankcase through the oil filler.
3. Replace the filler cap.

Crankcase and Filter Oil Capacity	lit (US/UK gal)
	10.5 (2.8/2.3)



N6A0017E

4. Start the engine and allow it to idle for a few minutes.
5. Stop the engine.
6. Use the dipstick to check the oil level.
 If the oil level is below the "MIN" line, add oil through the oil filler.
 If the oil level is above the "MAX" line, drain off the excess oil through the drain plug.



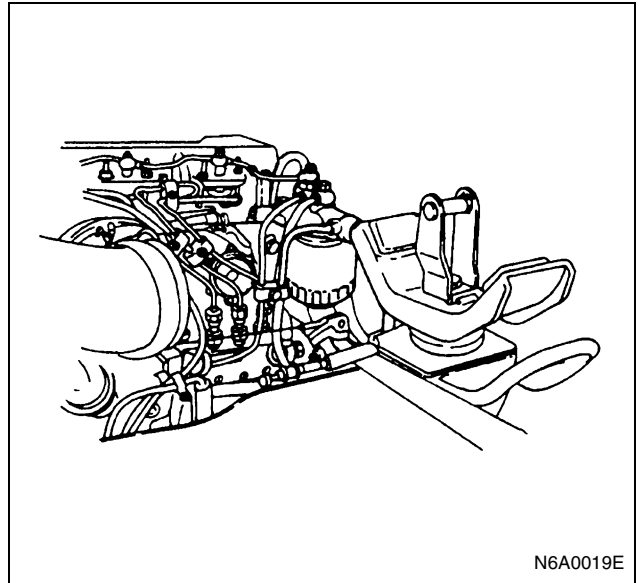
N6A0018E

Fuel System

Fuel Filter

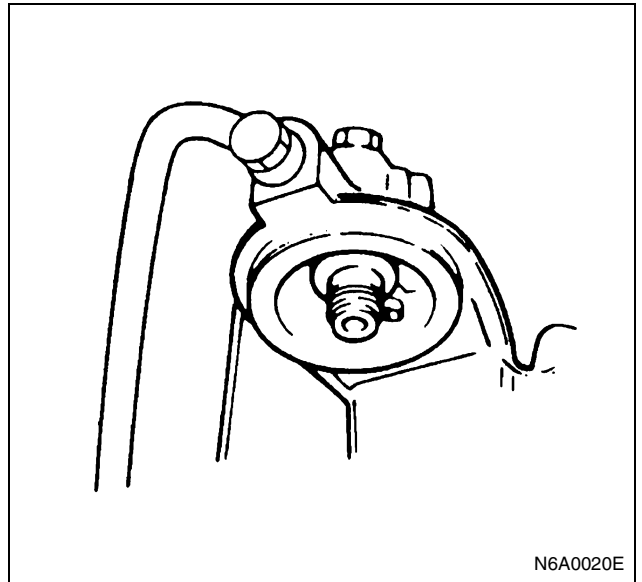
Replacement Procedure

1. Loosen the used fuel filter by turning it counter-clockwise with the universal filter wrench.



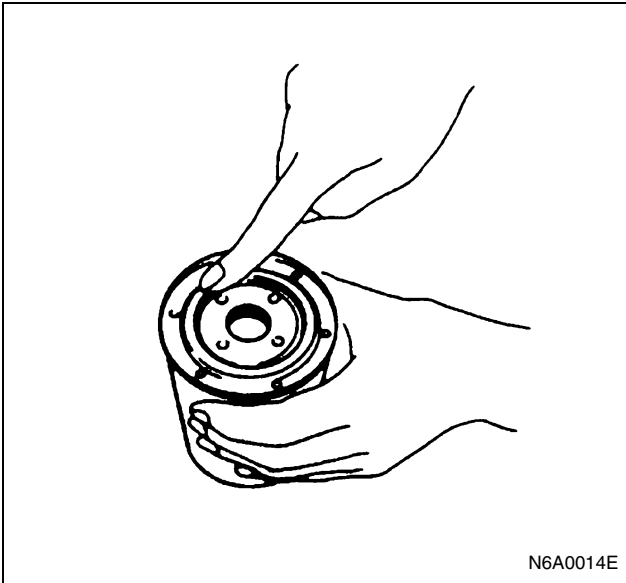
N6A0019E

2. Clean the upper cover fitting face.
 This will allow the new fuel filter to seat properly.



N6A0020E

3. Apply a light coat of engine oil to the O-ring.

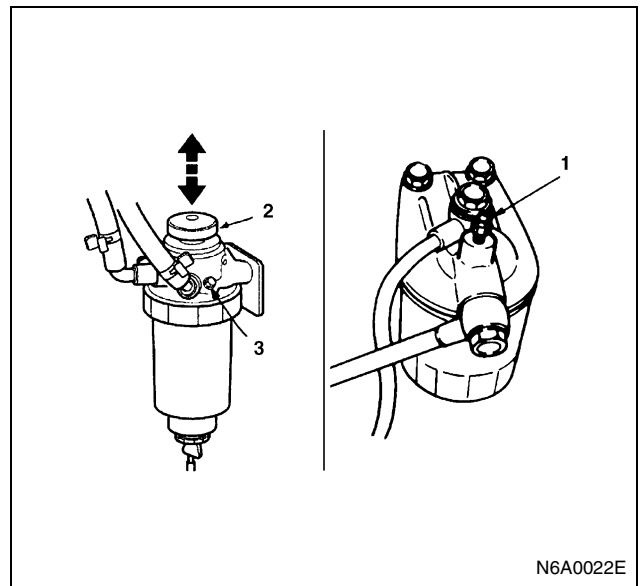


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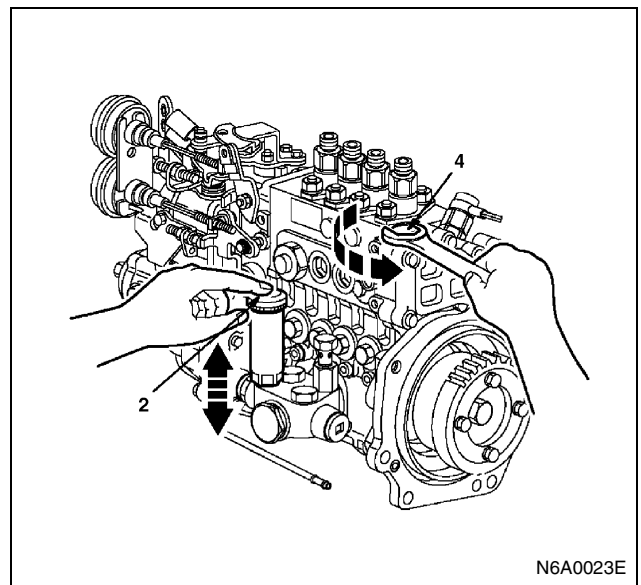
4. Supply fuel to the new fuel filter to facilitate bleeding.
5. Turn in the new fuel filter until the filter O-ring is fitted against the sealing face. Be very careful to avoid fuel spillage.
6. Use the filter wrench to turn in the fuel filter an additional 1/3 to 2/3 of a turn.
7. Operate the priming pump to bleed the air from the fuel line in the following procedures.
 - Loosen the priming pump cap (2).
 - Loosen the air bleeding plug (3). (4HG1-T model only)
 - Operate the priming pump. Pump the primer pump until fuel flow is free of air bubbles. (Except 4HG1-T model)
 - Tighten the air bleeding plug (3). (4HG1-T model only)
 - Loosen the bleeding plug (1).
 - Operate the priming pump. Pump the primer pump until fuel flow is free of air bubbles.
 - Tighten the bleeder plug (1).
 - Operate the priming pump. Pump the primer pump until fuel flow is free of air bubbles. (Except 4HE1-TC model)
 - Loosen the bleeding plug on the injection pump (4). (4HE1-TC model only)
 - Operate the priming pump. Pump the primer pump until fuel flow is free of air bubbles. (4HE1-TC model only)
 - Tighten the bleeding plug on the injection pump (4). (4HE1-TC model only)
 - Lock the priming pump cap (2).

Notice:

Check for fuel leakage from around the injection pump and the fuel filter.



N6A0022E



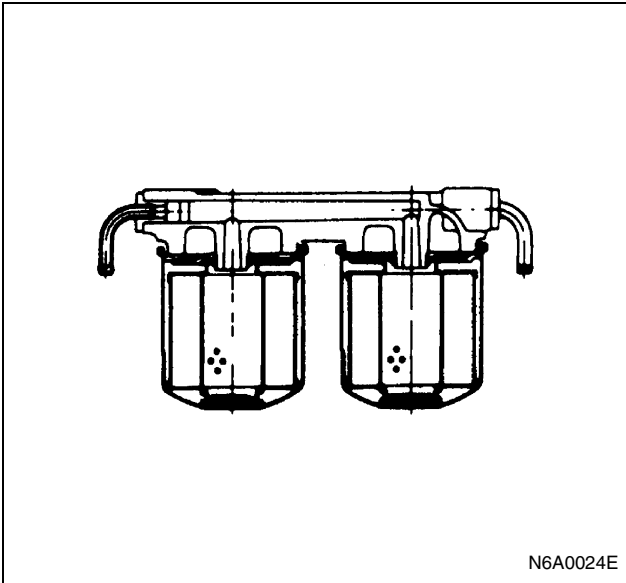
N6A0023E

8. Start the engine. Crank the engine for ten seconds or until it starts. If the engine does not start after ten seconds, repeat Step 7.

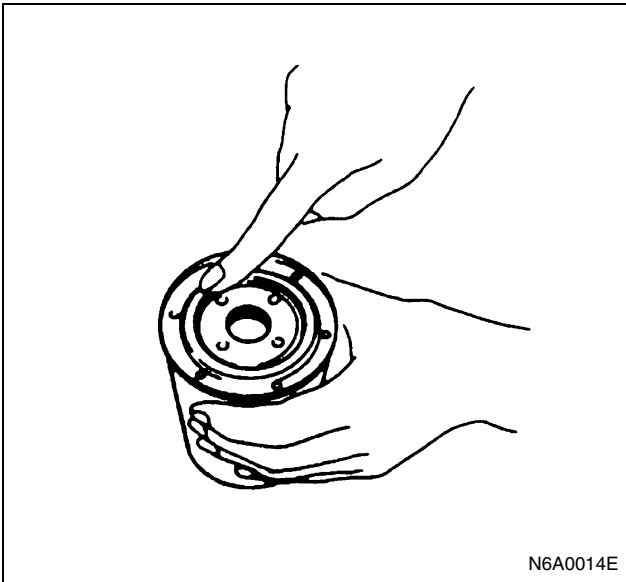
Sub Fuel Filter (Dual Type)

Replacement Procedure

1. Loosen the fuel filters by turning them counterclockwise with the universal filter wrench.
2. Clean the upper cover fitting faces. This will allow the new fuel filters to seat properly.



3. Apply a thin coat of engine oil to the O-rings.

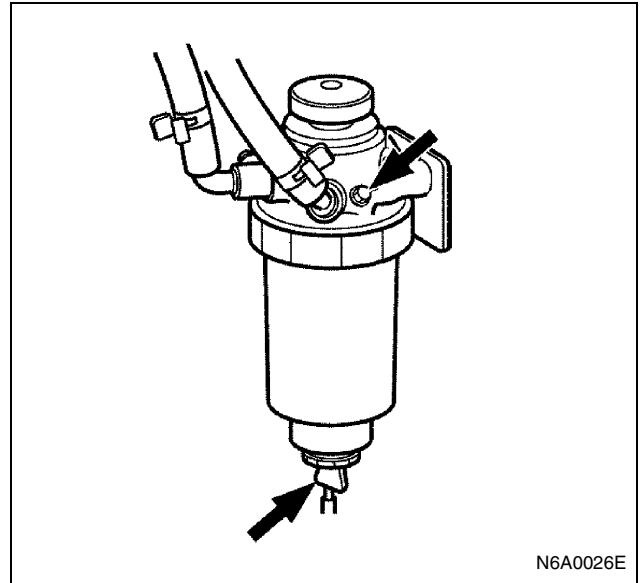


4. Install the filter assemblies.
Carefully turn each assembly clockwise until the O-ring is fitted against the filter cover sealing face.
5. Use the filter wrench to turn in each filter assembly an additional 1/3 to 2/3 of turn.
6. Operate the priming pump on the fuel filter to bleed the fuel system.
Refer to "AIR BLEEDING" for more detailed information.

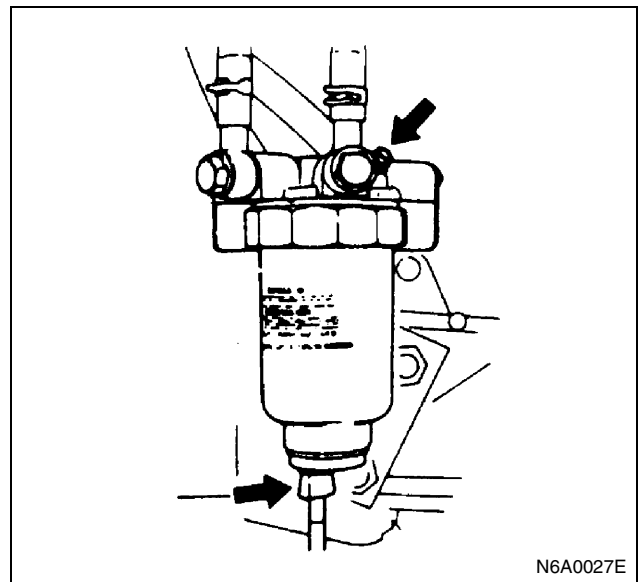
Pre-fuel Filter Water Draining Procedure

The indicator light will come on when the water level in the water separator exceeds the specified level. Drain the water and foreign material from the water separator with the following procedure.

1. Place the end of a vinyl hose (beneath the drain plug) in a container.
2. Loosen the air intake plug and drain plug, then drain water.



3. After draining, securely tighten the drain plug and air intake plug.



4. Then, operate the priming pump on the injection pump to bleed the fuel system.
5. After starting the engine, check to see that no fuel leaks from the drain plug.

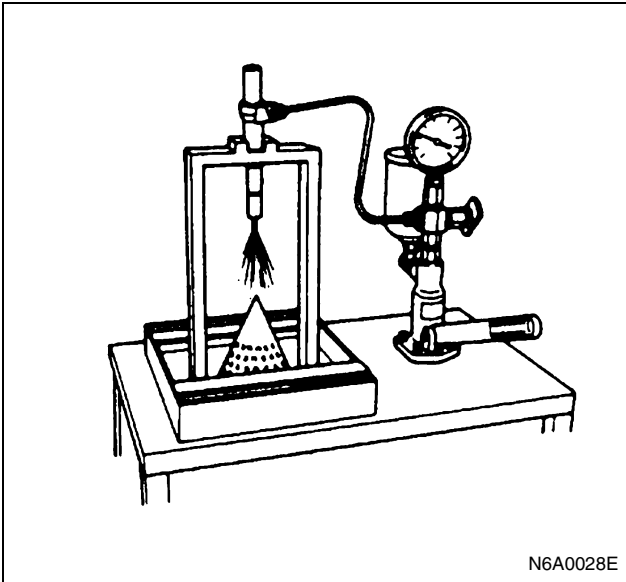
Injection Nozzle

Pressure and Spray Condition Check

1. Use a nozzle tester to check the injection nozzle opening pressure.
If the opening pressure is above or below the specified value, the injection nozzle must be replaced or adjusted.
Refer to "Adjustment."

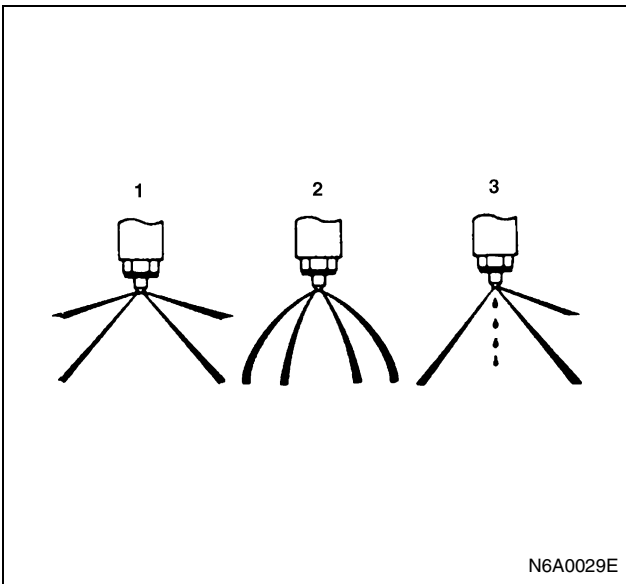
Injection Nozzle Opening Pressure

	Mpa (kg/cm ² /psi)
4HF1/4HF1-2/4HG1	18.14 (185/2,631)
4HE1-TC	21.57 (220/3,128)
4HG1-T	1st: 18.1 (185/2,631) 2nd: 21.1 (215/3,057)



N6A0028E

2. Check the spray condition.
Refer to the illustration.
Spray Condition



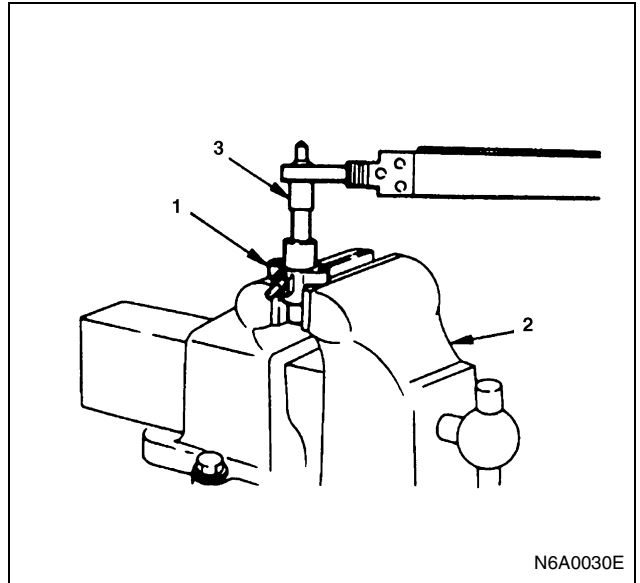
N6A0029E

- 1) Correct
- 2) Incorrect (Restrictions in orifice)
- 3) Incorrect (Dripping)

If the spray condition is bad, the injection nozzle must be replaced or adjusted.
Refer to "6C FUEL SYSTEM".

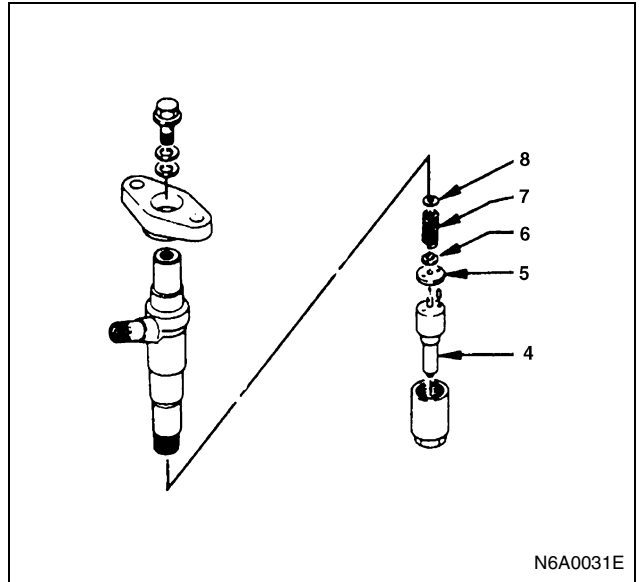
Adjustment

1. Clamp the injection nozzle holder (1) in a vise (2).
2. Use a wrench to remove the injection nozzle retaining nut (3).



N6A0030E

3. Remove the injection nozzle holder from the vise.
4. Remove the injection nozzle (4), the spacer (5), the spring seat (6) the spring (7) and the adjusting shim (8).



N6A0031E

5. Install the new adjusting shim, the spring, the spring seat, the spacer, the injection nozzle, and the retaining nut.
6. Clamp the injection nozzle holder in the vise.
7. Tighten the injection nozzle holder retaining nut to the specified torque.

Tighten:

Injection nozzle holder retaining nut to 34 N·m (3.5 kg·m/ 25 lb·ft)

8. Remove the injection nozzle holder from the vise.

9. Attach the injection nozzle holder to the injection nozzle tester.
10. Apply pressure to the nozzle tester to check that the injection nozzle opens at the specified pressure.

If the injection nozzle does not open at the specified pressure, install or remove the appropriate number or adjusting shims to adjust it.

Removing or installing one shim will increase or decrease the nozzle opening pressure approximately 370 kPa (3.77 kg/cm² / 53.6 psi).

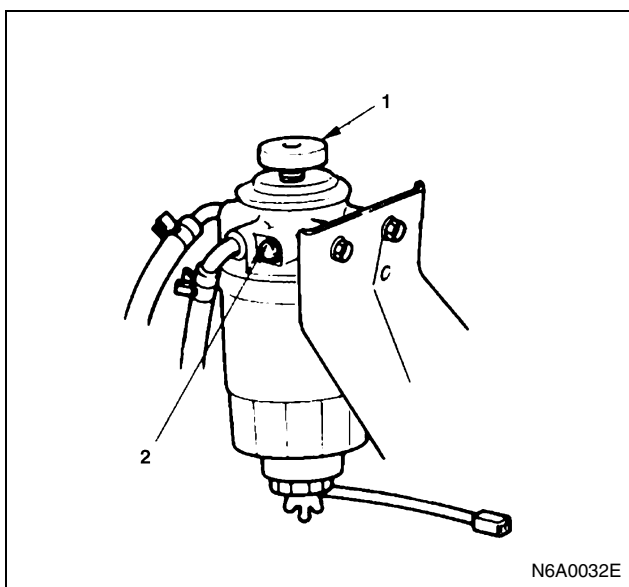
Adjust Shim Availability	mm (in)
Range	0.5 — 1.5 (0.02 — 0.06)
Increment	0.025 (0.001)
Total Number of Shims	41

Air Bleeding (Except 4HF1-2 model only)

Above works refer to "FUEL SYSTEM" in this section.

Air Bleeding (4HF1-2 model only)

1. Actuate the priming pump (1) to send the air in the fuel system to the injection pump.
2. Loosen the sedimenter air bleeding plug (2) and operate the priming pump until no bubbles appear.
3. Tighten the air bleeding plug (2) completely.



4. Try to start the engine. If the engine is not started within 10 seconds, air bleeding should be conducted once again.
5. Check that there is no fuel leak, and then tighten the priming pump completely.

Water Drain

If more water than specified has collected, the warning light is lit. Under this condition, follow the following water drain procedure:

1. Place a container (Approximately 0.2 liters capacity) beneath the drain plug on the separator.
2. Loosen the drain plug and air bleeding plug.
3. After draining, tighten the drain plug.

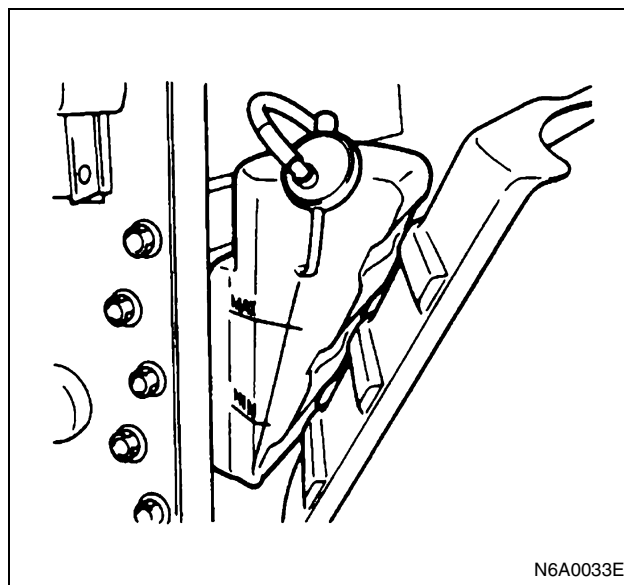
4. Operate the priming pump several times again and check for fuel leak.
5. Tighten the air bleeding plug.
6. Make sure that the warning light in the instrument panel is off. (Except 4HE1-TC model)

Cooling System

Coolant Level

Check the coolant level and replenish the radiator reserve tank if necessary.

If the coolant level falls below the "MIN" line, carefully check the cooling system for leakage. Then add enough coolant to bring the level up to the "MAX" line.

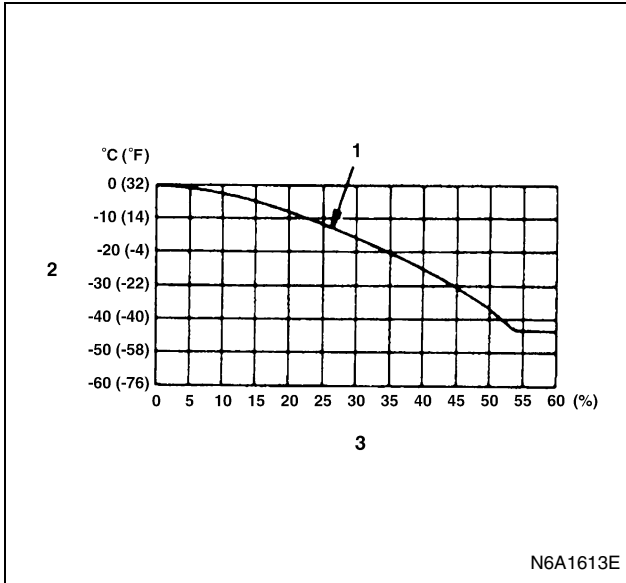


Notice:

Do not overfill the reserve tank.

Remove the radiator filler cap only when absolutely necessary.

Always check the coolant level when the engine is cold. Always refer to the chart at the left to determine the correct cooling water to antifreeze solution mixing ratio.



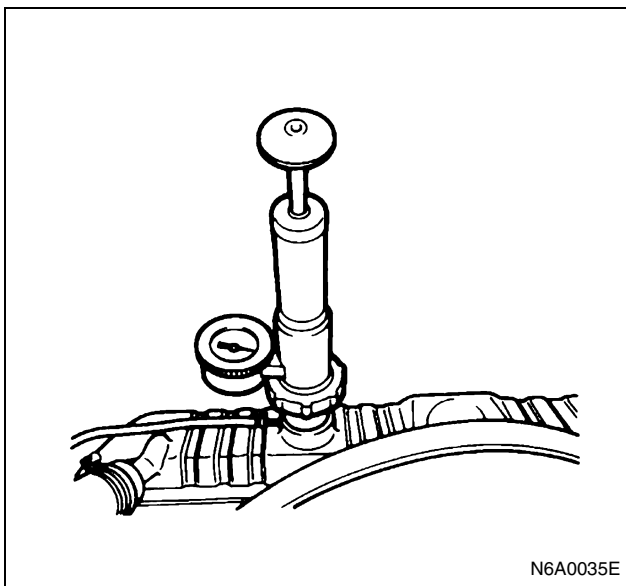
Legend

- 1. Good quality ethylene glycol anti-freeze
- 2. Freezing point
- 3. Mixing ratio

Cooling System Leakage Inspection

Clog up the reservoir tank hose carefully and check the cooling system for leakage with a radiator cap tester by applying an air pressure of 196 kPa (2 kg/cm²/28 psi) from filler neck to inside the radiator.

As the radiator upper tank is provided with a valve, the pressure fails to rise higher than the valve opening pressure unless the hose is clogged up.



Radiator Valve Inspection

Apply air pressure from filler neck using radiator cap tester and check the opening pressure of radiator valve. If the valve opening pressure is out of the standard value range, replace with a new radiator valve.

Radiator valve opening pressure	kPa (kg/cm ² /psi)
93 — 123	(0.95 — 1.25/13.5 — 17.8)

Remove the radiator valve and check a negative pressure valve as the center of the valve seat side. If the negative pressure valve does not work smoothly, clean or replace the radiator valve.

Tighten:

Radiator valve fixing to 6 N·m (0.6 kg·m/4 lb·ft)

Conduct cooling system leakage check after reinstalling the radiator valve.

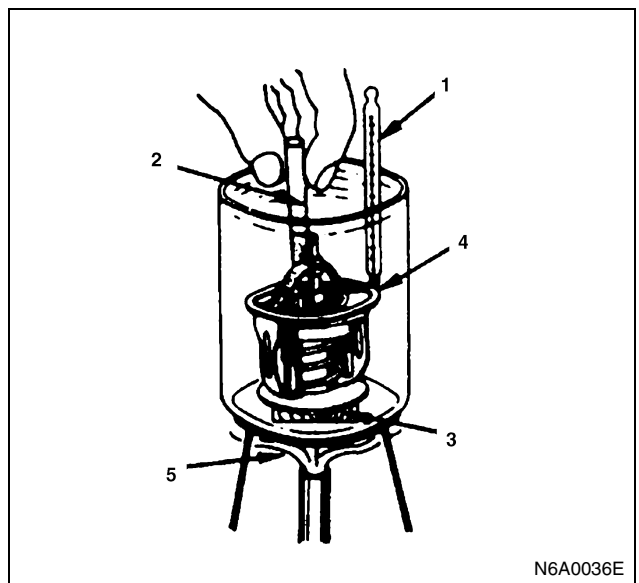
Thermostat Operating Test

1. Completely submerge the thermostat in water.
 2. Heat the water.
- Stir the water constantly to avoid direct heat being applied to the thermostat.
3. Check the valve initial opening temperature.

Valve Initial Opening Temperature		°C (°F)
		Standard
without jiggle valve	Primary valve	83 — 87 (181 — 189)
	Secondary valve	80 — 84 (176 — 183)
with jiggle valve		83.5 — 86.5 (182 — 188)

4. Check the valve lift full opening temperature.

Valve Lift Full Opening Temperature		°C (°F)
		Standard
without jiggle valve		95 (203)
with jiggle valve		100 (212)



Legend

- 1. Thermometer
- 2. Aditating rod
- 3. Wooden piece
- 4. Thermostat
- 5. Heat

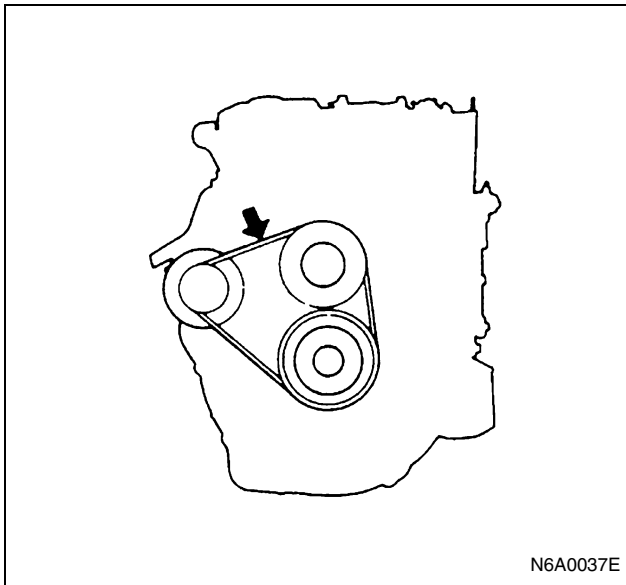
Fan Belt

Check the drive belt tension.
Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 — 12 (0.31 — 0.47) ... New belt	
10 — 14 (0.39 — 0.55) ... Reuse belt	

Check the drive belt for cracking and other damage.

- Crankshaft damper pulley
- Generator pulley
- Cooling fan pulley

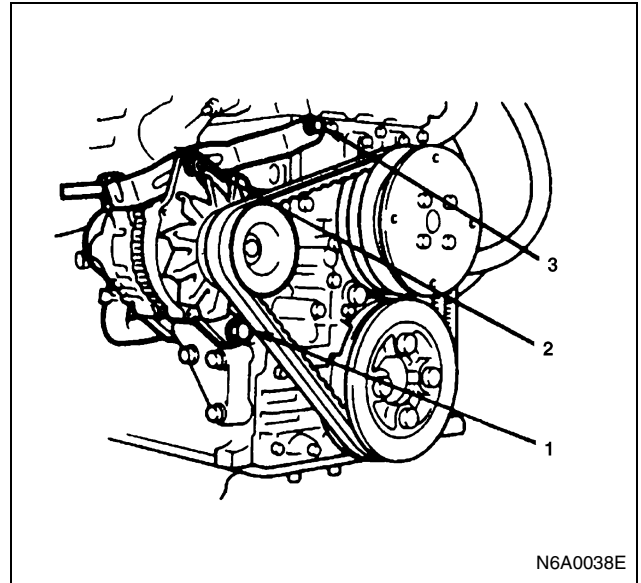


Fan Belt Adjustment

Fan belt tension is adjusted by moving the generator.

Tighten:

- Bolt 1 to 40 N·m (4.1 kg·m/30 lb·ft)
- Bolt 2 to 24 N·m (2.4 kg·m/17 lb·ft)
- Bolt 3 to 46 N·m (4.7 kg·m/34 lb·ft)



If equipped with A/C compressor, loosen the A/C drive belt tension pulley adjust bolt and lock nut. Then free the A/C drive belt. When finishing the fan belt adjustment, adjust the A/C drive belt and check the belt tension.

Air Conditioning (A/C) Compressor Drive Belt

Check the drive belt tension.

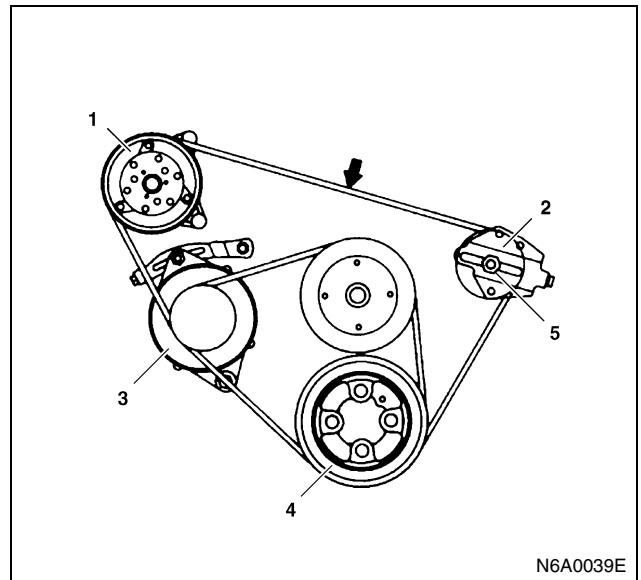
- Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	

Check the drive belt for cracking and other damage. A/C compressor drive belt tension is adjusted by moving the tension pulley. When finishing the fan drive belt, then adjust the A/C drive belt.

Tighten:

Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)



Legend

1. A/C compressor pulley
2. Tension pulley
3. Generator pulley
4. Crankshaft damper pulley
5. Tension pulley lock nut

Engine Control

Idling Speed Inspection

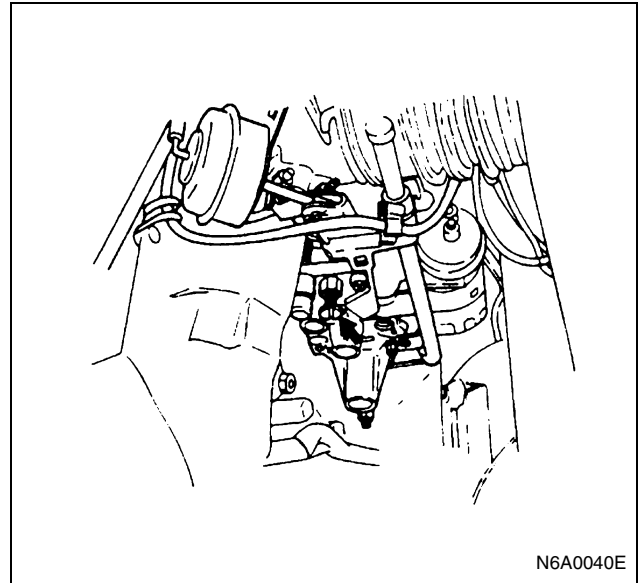
1. Set the vehicle parking brake and chock the drive wheels.
2. Place the transmission in neutral.
3. Start the engine and allow it to warm up.
4. Check that the idling control knob is in the engine idling position.
5. Set a tachometer to the engine.
6. Check the engine idling speed.
Engine idling speed should be as below.

Engine Idling Speed		rpm
4HF1	M/T	550 — 625
4HF1-2	M/T	575 — 625
4HG1	M/T	550 — 600
4HG1-T	M/T	600 — 650
4HE1-TC (4HE1-TC-XS, XN) 98EPA	M/T	775 — 825
4HE1-TC (4HE1-TC-XS, XN) SPEC. EURO3	M/T	775 — 825

If the engine idling speed is outside the specified range, it must be adjusted.

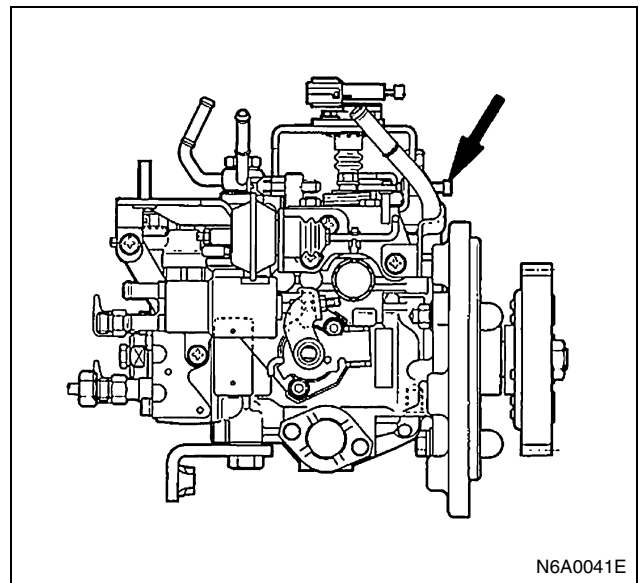
Idling Speed Adjustment

1. Loosen the idling set bolt lock nut on the injection pump.
2. Adjust the idling speed with the idling set bolt.
3. Tighten the lock nut.



Idling Speed Check & Adjustment (4HF1-2 model only)

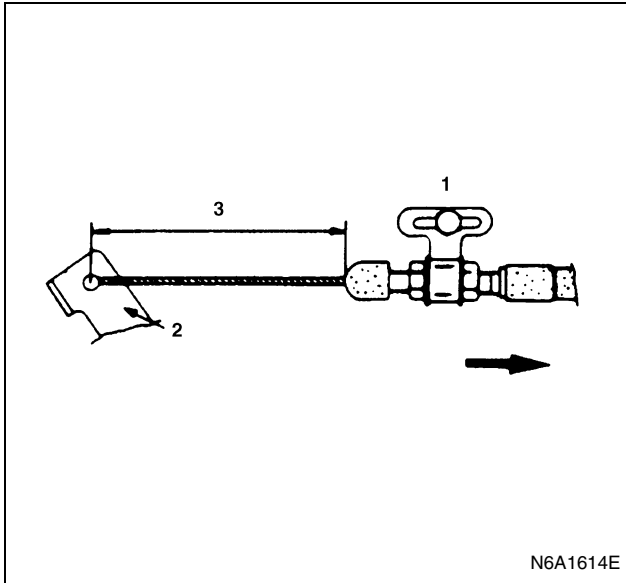
1. Warm up the engine.
2. Measure idling speed by means of tachometer.
3. If idling speed is out of the standard, adjust with an idling adjust bolt (indicated by an arrow mark).
Idling speed: 575 — 625 rpm



Accelerator Control

Accelerator Control Cable Adjustment

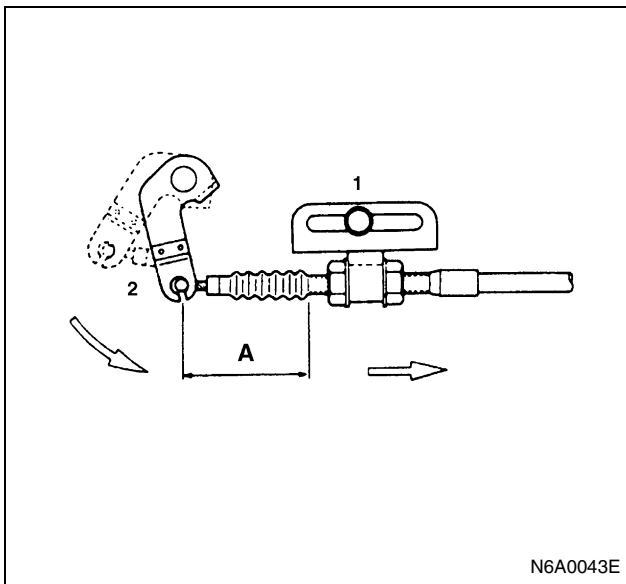
1. Loosen the accelerator cable clamp bolt (1).
2. Check that the idling control knob is in the engine idling position.
3. Hold the accelerator lever (2) in the fully closed position and stretch the control cable (3) in the direction indicated by the arrow to remove any slack.



Engine Stop Control

Adjustment

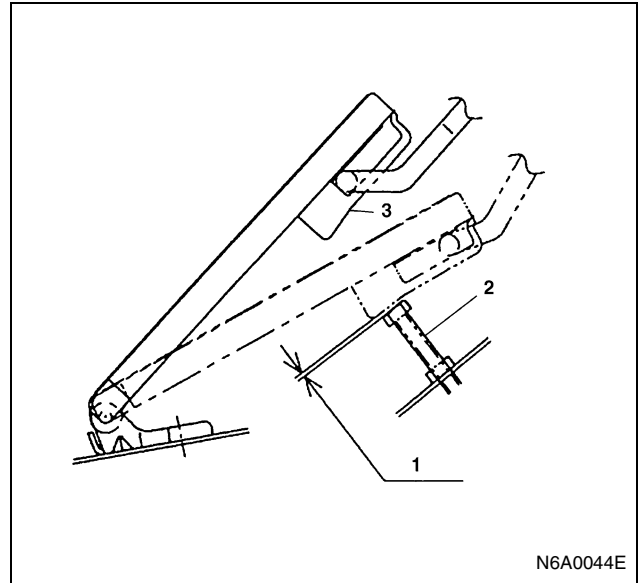
1. Check that the key switch is either in the "LOCK" position or removed from the engine.
2. Loosen the bolt (1).
3. Pull the fuel cut lever (2) as far as possible and hold it.
4. Remove cable slackness (A) by pulling the cable in the direction of the arrow in the illustration.
5. Tighten the bolt (1).



Accelerator Pedal Adjustment

1. Press the accelerator pedal to the floorboard and hold it.
2. Use the stopper bolt (2) to adjust the clearance between the stopper bolt end and the accelerator pedal (3) lower face.

Accelerator Pedal Clearance	mm (in)
0 — 2 (0 — 0.079)	



Legend

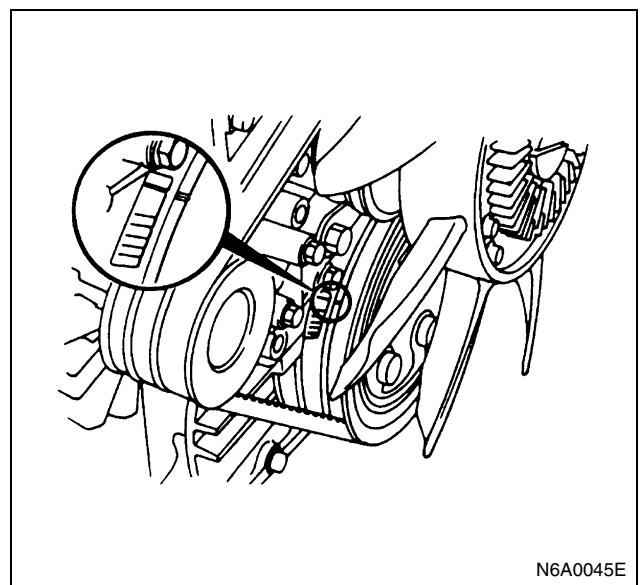
1. Full stroke 0 — 2 mm (0 — 0.079 in)
2. Stopper bolt
3. Accelerator pedal

Valve Clearance Adjustment

1. Bring the piston in either the No.1 cylinder or the No.4 cylinder to TDC on the compression stroke by turning the crankshaft until the crankshaft damper pulley timing mark is aligned with the TDC notched line.

Notice:

If there are two marks on the crank pulley, the front side of mark is for setting BTDC 49° and the rear side of mark is for setting TDC.

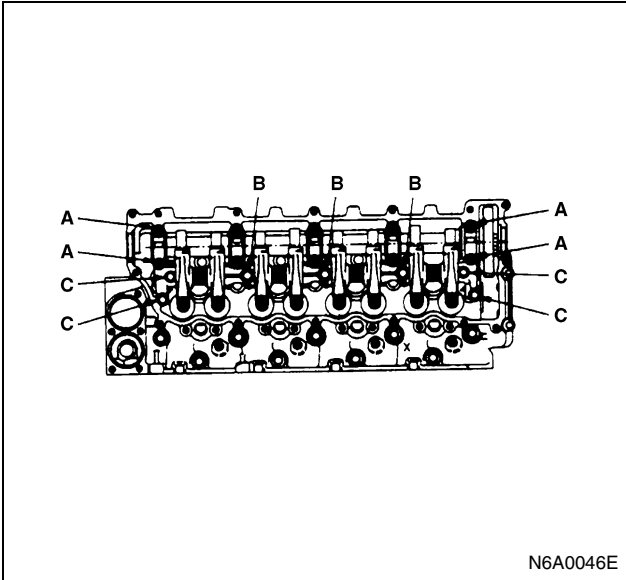


2. Tighten the rocker arm shaft bracket nuts and bolts to the specified torque in numerical order a little at a time as shown in the illustration.

Tighten:

Rocker arm shaft bracket nut and bolt to

- Nut (A) 27 N·m (2.8 kg·m/20 lb·ft)
- Bolt (B) 56 N·m (5.7 kg·m/41 lb·ft)
- Bolt (C) 27 N·m (2.8 kg·m/20 lb·ft)

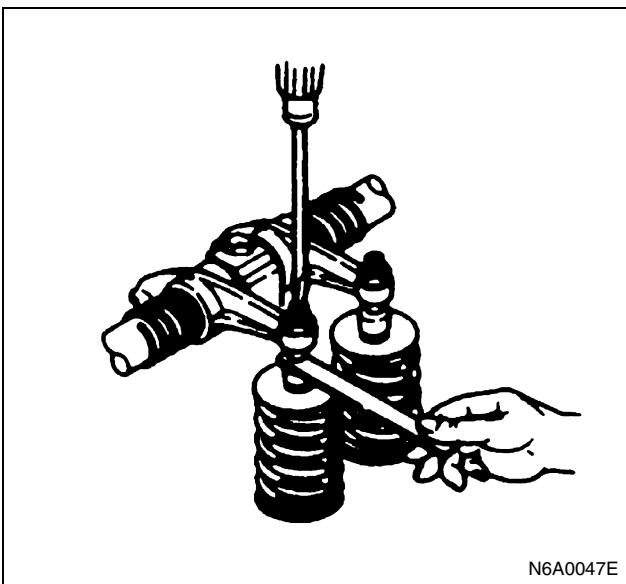


- Apply engine oil to the threaded portion of the nuts marked with "A" and the bolts with "B" shown in the illustration, and then tighten them to the specified torque.

3. Check for play in the No.1 intake and exhaust valve rocker arms.

If the No.1 cylinder intake and exhaust valve rocker arms have play, the No.1 piston is at TDC on the compression stroke.

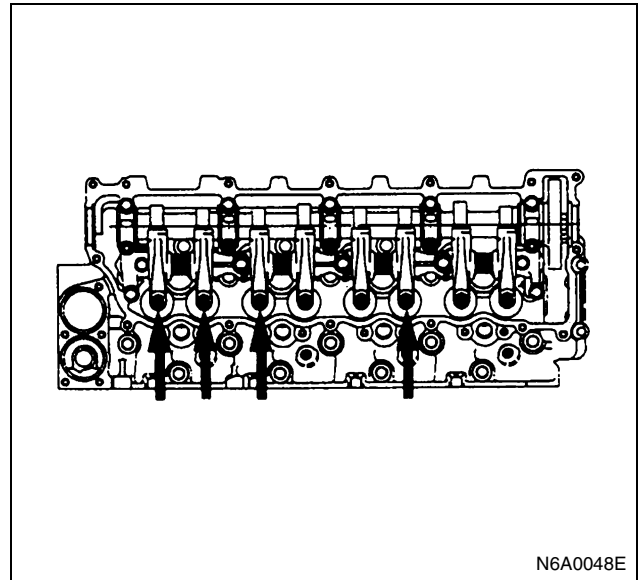
If the No.1 cylinder intake and exhaust valve rocker arms are depressed, the No.4 piston is at TDC on the compression stroke.



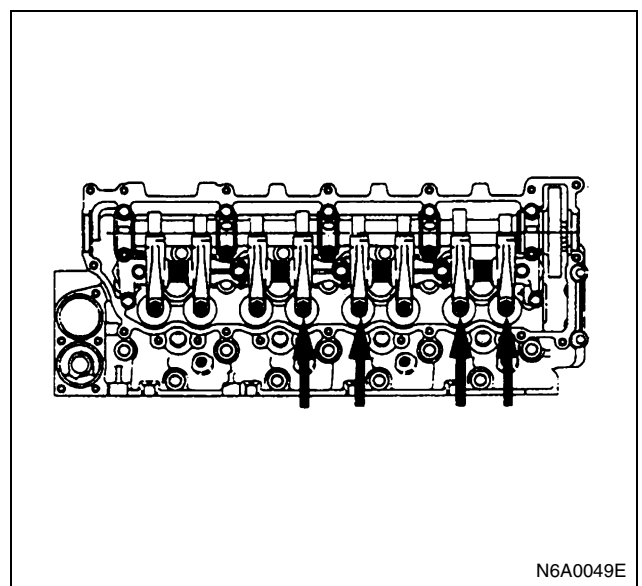
Adjust the No.1 or the No.4 cylinder valve clearance while their respective cylinders are at TDC on the compression stroke.

Valve Clearance		mm (in)
At cold		0.40 (0.016)

4. Loosen each valve clearance adjusting screw as shown in the illustration.



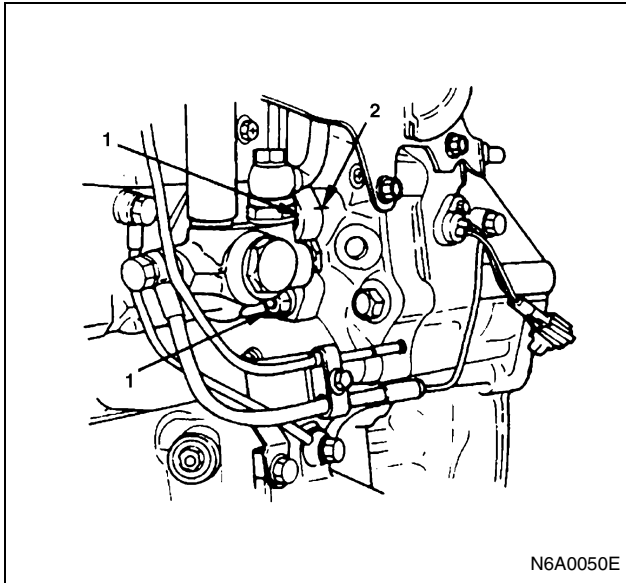
5. Insert a feeler gauge of the appropriate thickness between the rocker arm and the valve stem end.
6. Turn the valve clearance adjusting screw until a slight drag can be felt on the feeler gauge.
7. Tighten the lock nut securely.
8. Rotate the crankshaft 360 degrees.
9. Realign the crankshaft damper pulley timing mark with the TDC notched line.
10. Adjust the clearance for the remaining valves as shown in the illustration.



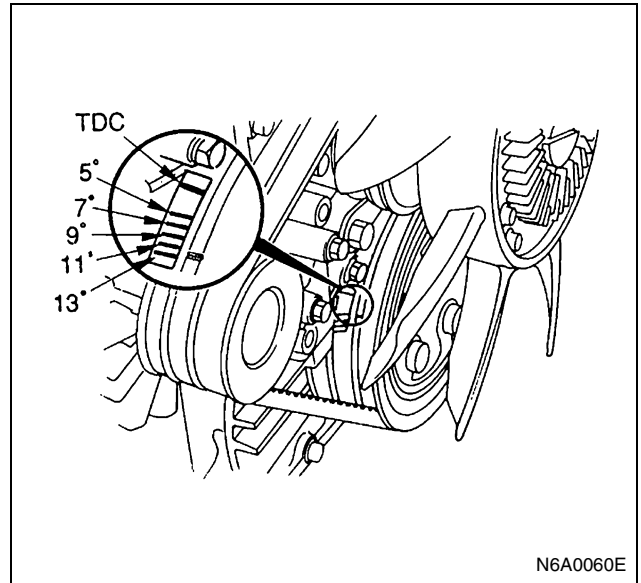
Injection Timing Adjustment

Injection Pump Notched Line Inspection

1. Check the injection pump bracket nuts (1) for looseness.
Tighten as required.
2. Check that the notched lines (2) on the injection pump bracket and the timing gear case are aligned.
If the notched lines are not aligned, the injection timing must be checked.



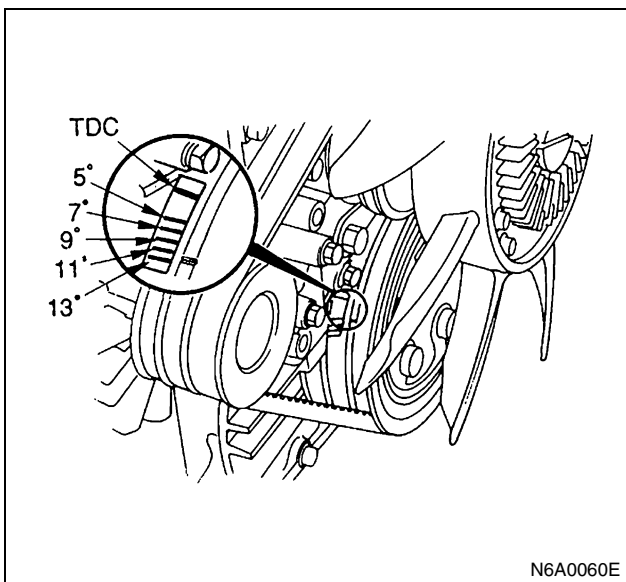
Injection Timing	deg
4HF1 4HE1-TC (4HE1-XS, XN)	BTDC 8
4HG1	BTDC 9
4HEI-T	BTDC 7
4HE1-TC (4HE1-XS)	BTDC 9 (Spec EURO3)



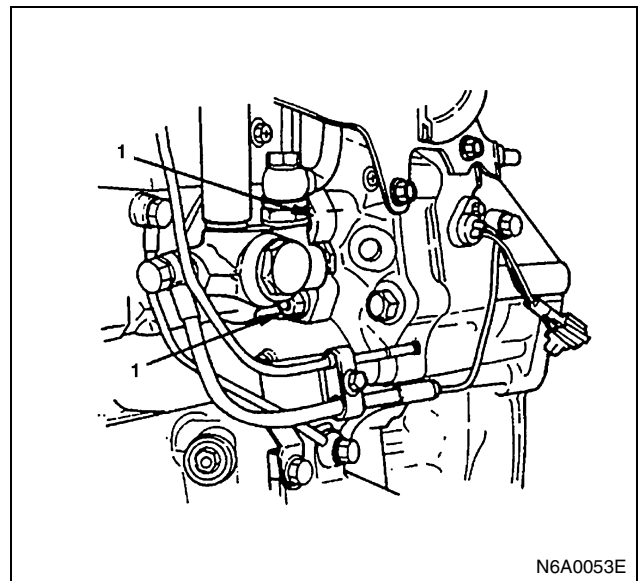
3. Some time, check injection timing on the crank damper pulley.
If the injection timing aligned with in correct, the injection timing must be readjusted.

Injection Timing Adjustment

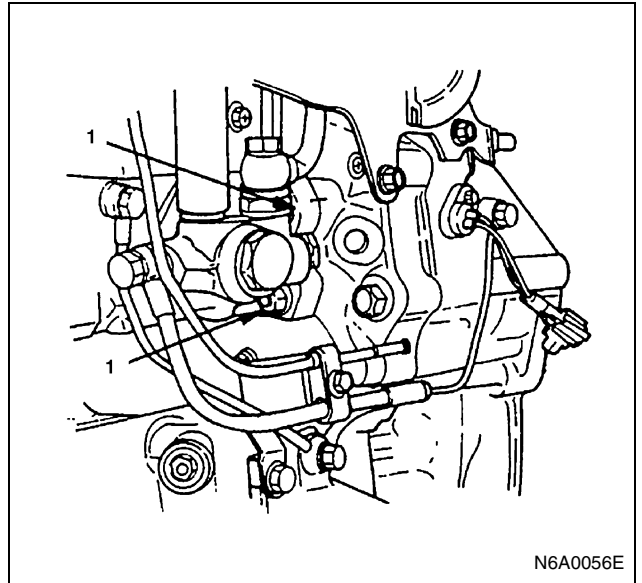
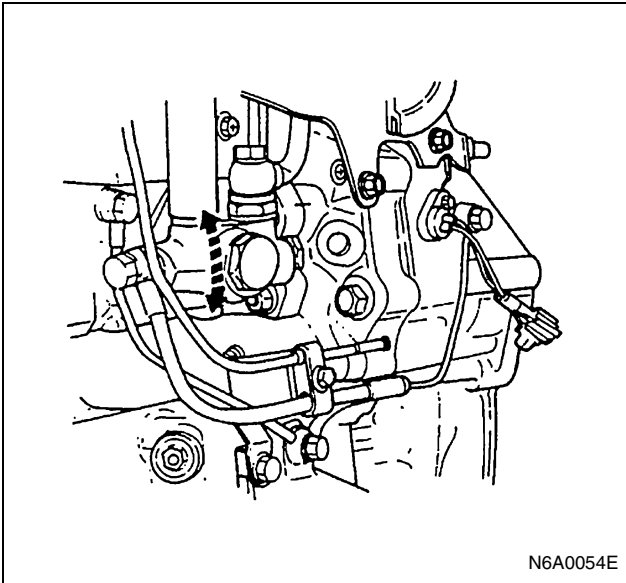
1. Turn the crankshaft until the timing mark on the crankshaft damper pulley is aligned with the BTDC (injection timing of each engine model) mark in the illustration.



2. Remove the two foam rubbers.
3. Loosen the four injection pump fixing nuts (1).
This will allow the pump to pivot.
Do not bend or scratch the fuel pipe.



4. Align the notched line between the injection pump bracket and the timing gear case.
Make sure that the timing mark on the crank damper pulley is aligned with correct injection timing.



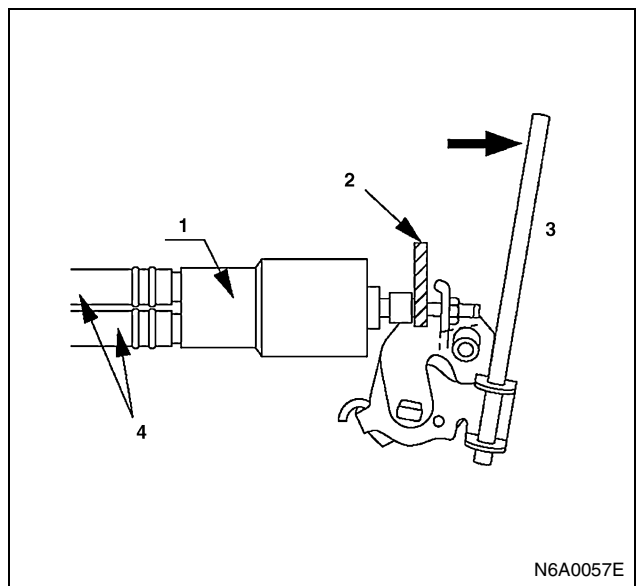
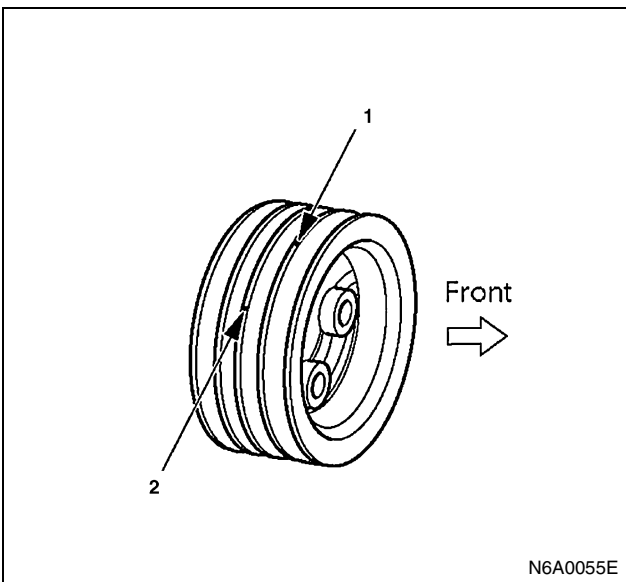
Notice:

In case the crank pulley has two marks as illustrated, (1) BTDC 49° mark on the second crest and (2) TDC mark on the third crest (as viewed from the front side), be sure to set at the mark (2). (If there are two different marks on one and same crest, set at the mark which comes second when rotated in the normal direction.)

The mark (1) is used when installing the injection pump for 4HF1-2.

Injection Timing Check (4HF1-2 model only)

1. Set No. 1 Cylinder to the TDC in the compression stroke.
2. Disconnect Injection Pipe.
3. Put down Wax CSD lever, insert a spacer 10 — 20 mm (0.39 — 0.47 in) thick between the plunger and adjust bolt, and cancel the Wax CSD.



5. Tighten the injection pump fixing nuts (1) to the specified torque.

Tighten:

Injection pump fixing nut to 25 N·m (2.6 kg·m/19 lb·ft)

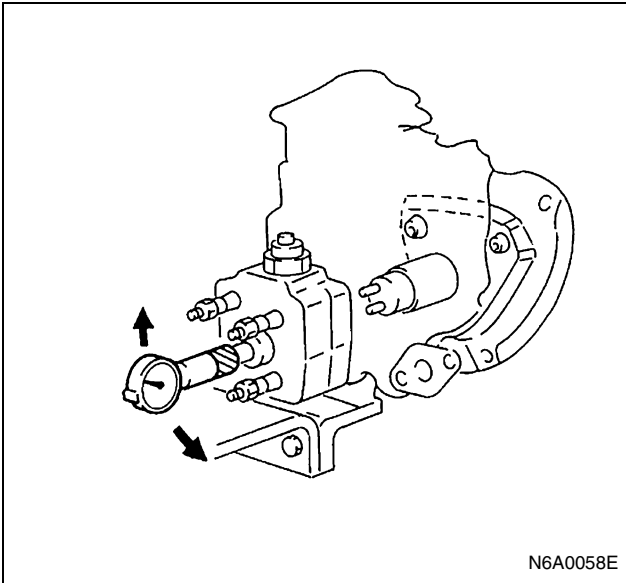
Legend

1. Wax CSD
2. Spacer
3. Lever
4. Water hose

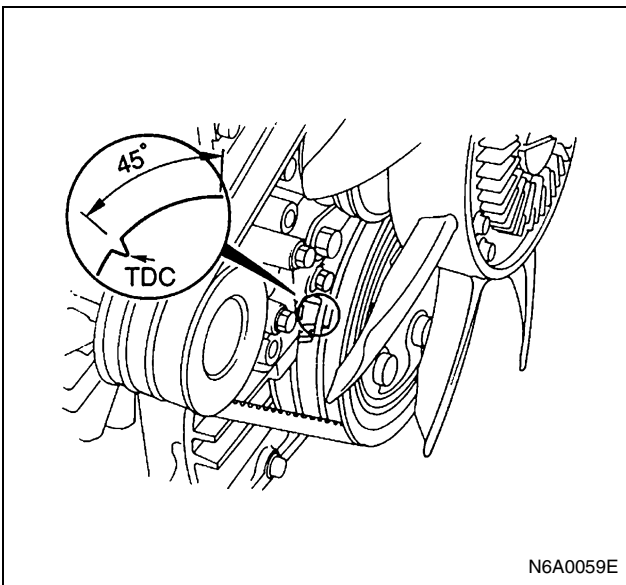
4. Remove the pump rear plug, connect a dial gage and set the lift at 1 mm (0.039 in).

Special Tool

Measuring device: 5-8840-0145-0



5. Set the crankshaft damper pulley TDC mark to the pointer or 45° before TDC.

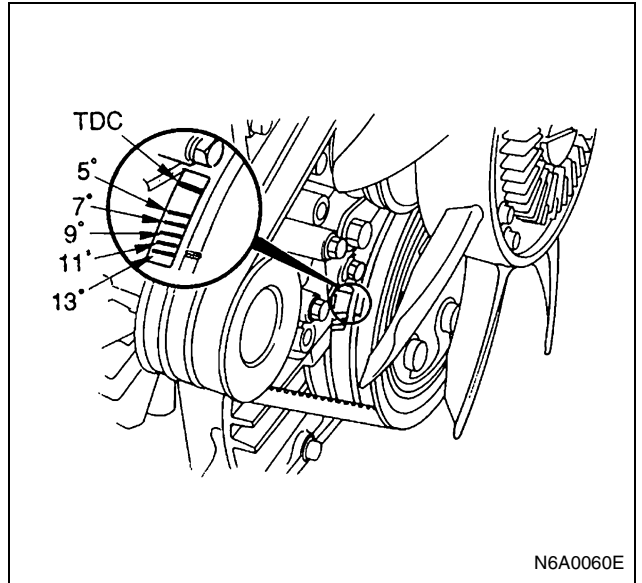


6. Set the dial gage to the "0" position.
7. Turn the crankshaft leftwise and rightwise a little and make sure that the needle stays in the "0" position.
8. Turn the crankshaft in the normal direction and read the measuring device's indication at the 12° before TDC position.

Notice:

As there is no 12° mark, set midway between the 11° and 13° marks.

Standard value: 0.5 mm (0.0197 in)



Injection Timing Adjustment (4HF1-2 model only)

If injection timing is out of the specified range, follow the following procedure for adjustment:

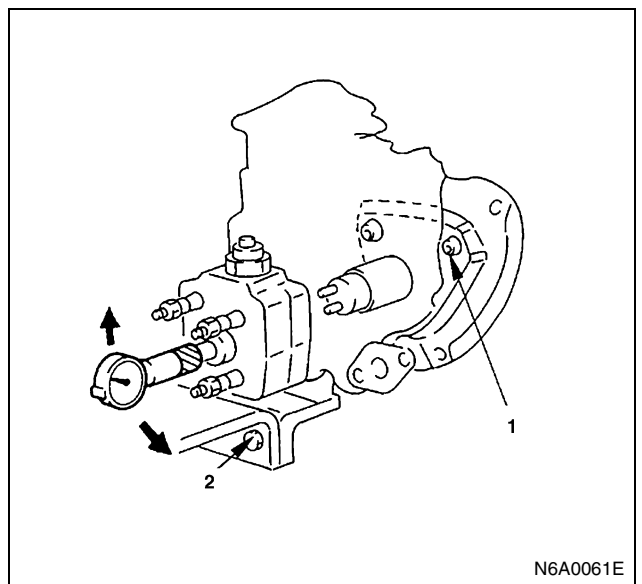
1. Loosen injection pump fixing nuts (1) and bracket bolt (2).
2. Adjust the mounting angle of injection pump:
 - If injection timing is too fast, bring the injection pump closer to the engine.
 - If injection timing is too slow, put the injection pump more distant from the engine.
3. When the dial gage has indicated the specified value, tighten the fixing nuts (1) and bolt (2) to specified torque:

Tighten:

Fixing nut to 24 N·m (2.4 kg·m/17 lb·ft)

Tighten:

Bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



4. Disconnect the dial gage, install and tighten the plug to specified torque. (Make sure of a copper washer being attached to the plug)

Tighten:

Pump rear plug to 17 N·m (1.7 kg·m/12 lb·ft)

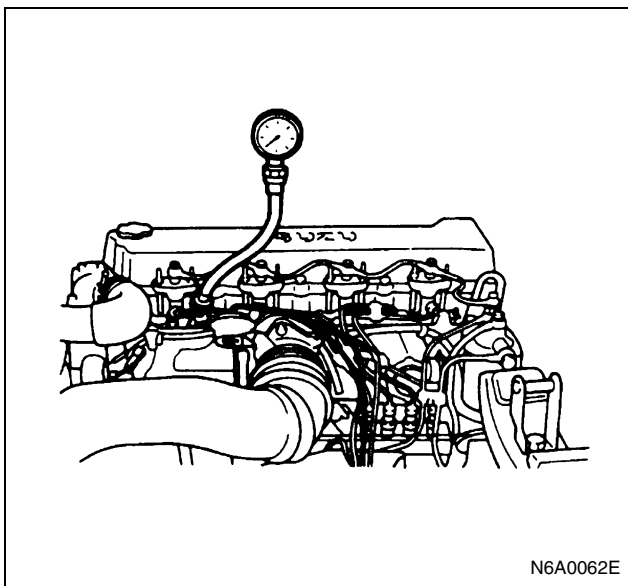
5. Release the wax CSD and connect the injection pipe.

Tighten:

Pipe sleeve nut to 29 N·m (3.0 kg·m/22 lb·ft)

Compression Pressure Measurement

1. Start the engine and allow it to warm up.
Engine Coolant Temperature: Above 80°C (176°F)
2. Stop the engine.
3. Remove the following parts.
 - Glow plugs.
 - In case VE pump;
Fuel cut solenoid connector.
 - In case line pump;
F-9 fuse in fuse box.
4. Set the adapter and the compression gauge to the No.1 cylinder glow plug hole.
Compression Gauge: 5-8840-2675-0
Adapter; Compression Gauge: 5-8531-7001-0



5. Connect a tachometer and check that engine cranking speed is 200 rpm or higher.
6. Turn the engine over with the starter motor and take the compression gauge reading.
7. Repeat the procedure (steps 4,5 and 6) for the remaining cylinders.

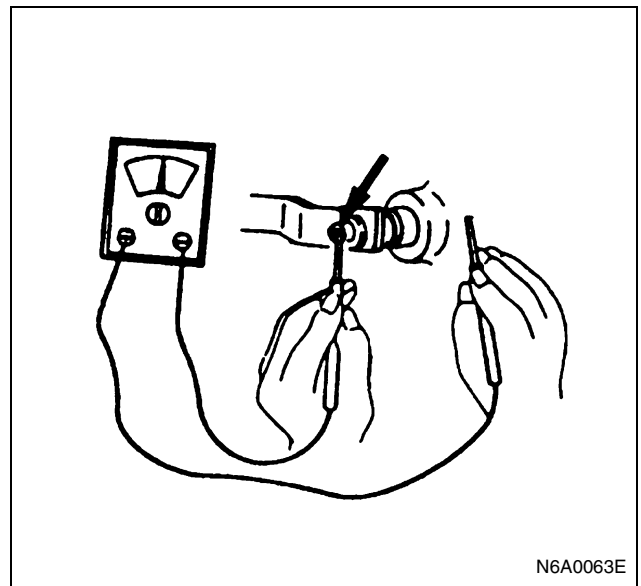
Compression Pressure	
kPa (kg/cm ² /psi) at 200 rpm	
Standard	More than 2,942 (30/426)
Limit for use	2,157(22/312)
Variance in pressure between cylinders	Less than 294 (3/43)

If the measured value is less than the specified limit, above works refer to "TROUBLESHOOTING" Section in this manual.

Quick-On-Start II System

Inspection Procedure

1. Disconnect the thermostatic connection on the thermostat outlet pipe.
2. Turn the key switch to the "ON" position.
If the Quick-ON-Start II system is operating properly, the flow relay will make a clicking sound within three seconds.
3. Measure the glow plug terminal voltage with a circuit tester as soon as possible after turning the key switch to the "ON" position.



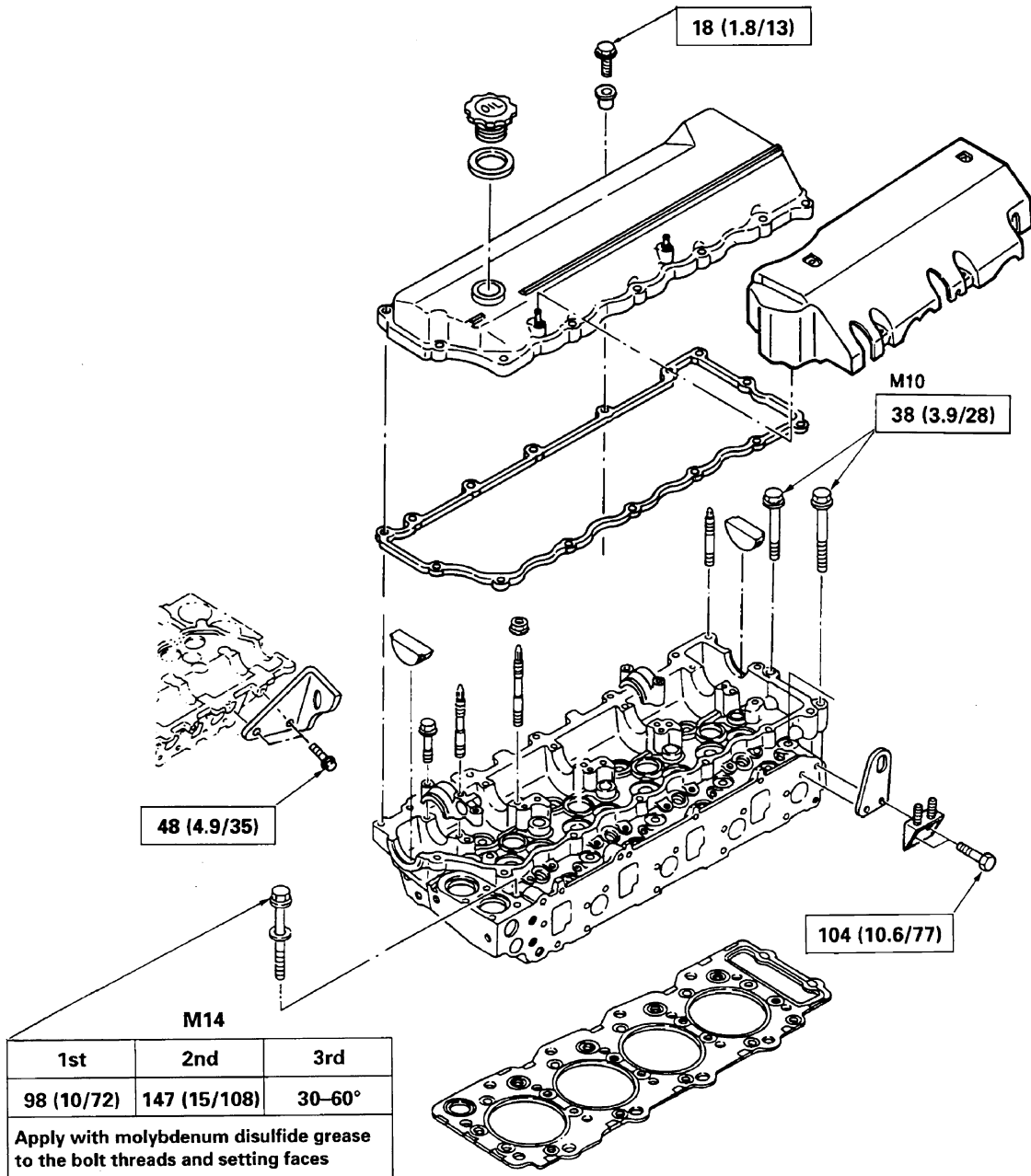
4. Check the glow plug heating time.

Approximate Glow Plug Heating Time	sec
	18

FIXING TORQUE

Cylinder Head, Head Gasket and Head Cover Except for 4HE1-TC (Engine)

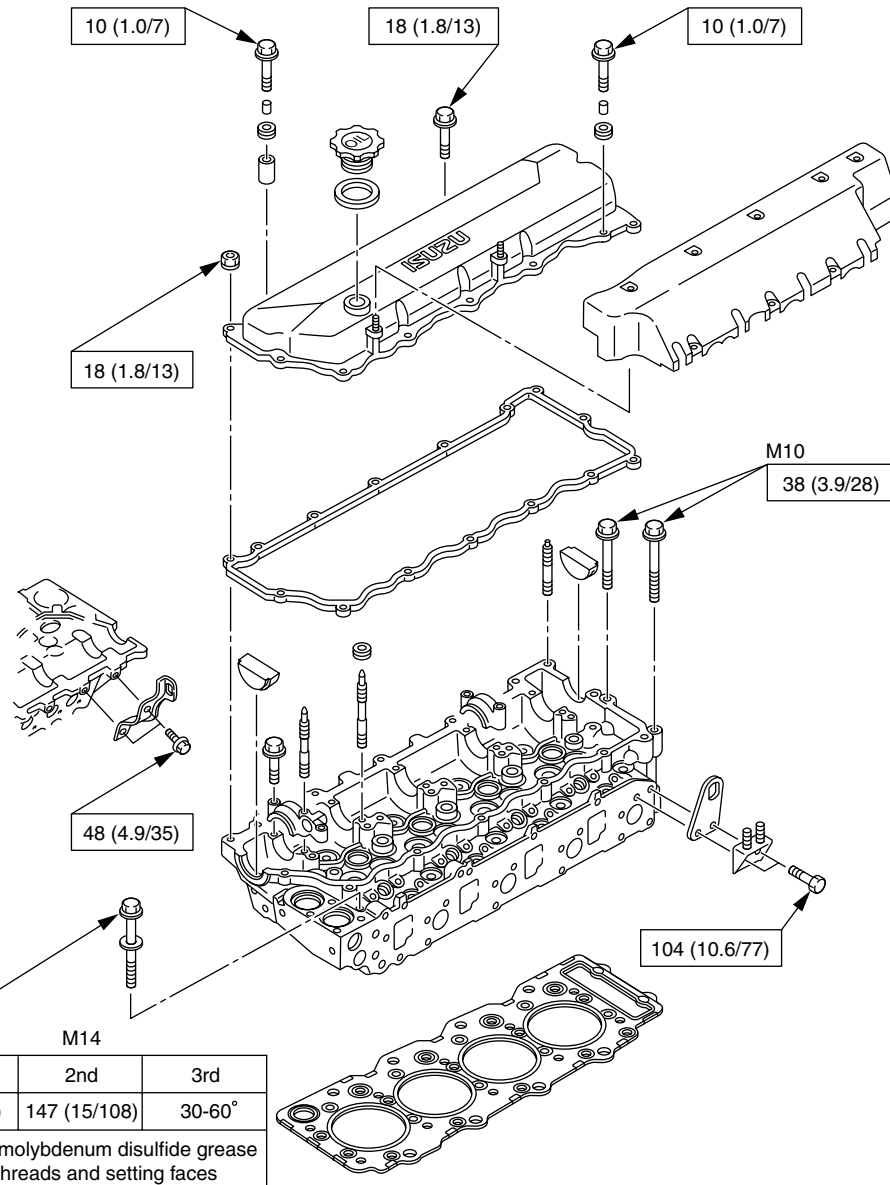
N·m (kg·m / lb·ft)



N6A0064E

4HE1-TC (Engine)

N·m (kg·m / lb·ft)



M14		
1st	2nd	3rd
90 (10/72)	147 (15/108)	30-60°
Apply with molybdenum disulfide grease to the bolt threads and setting faces		

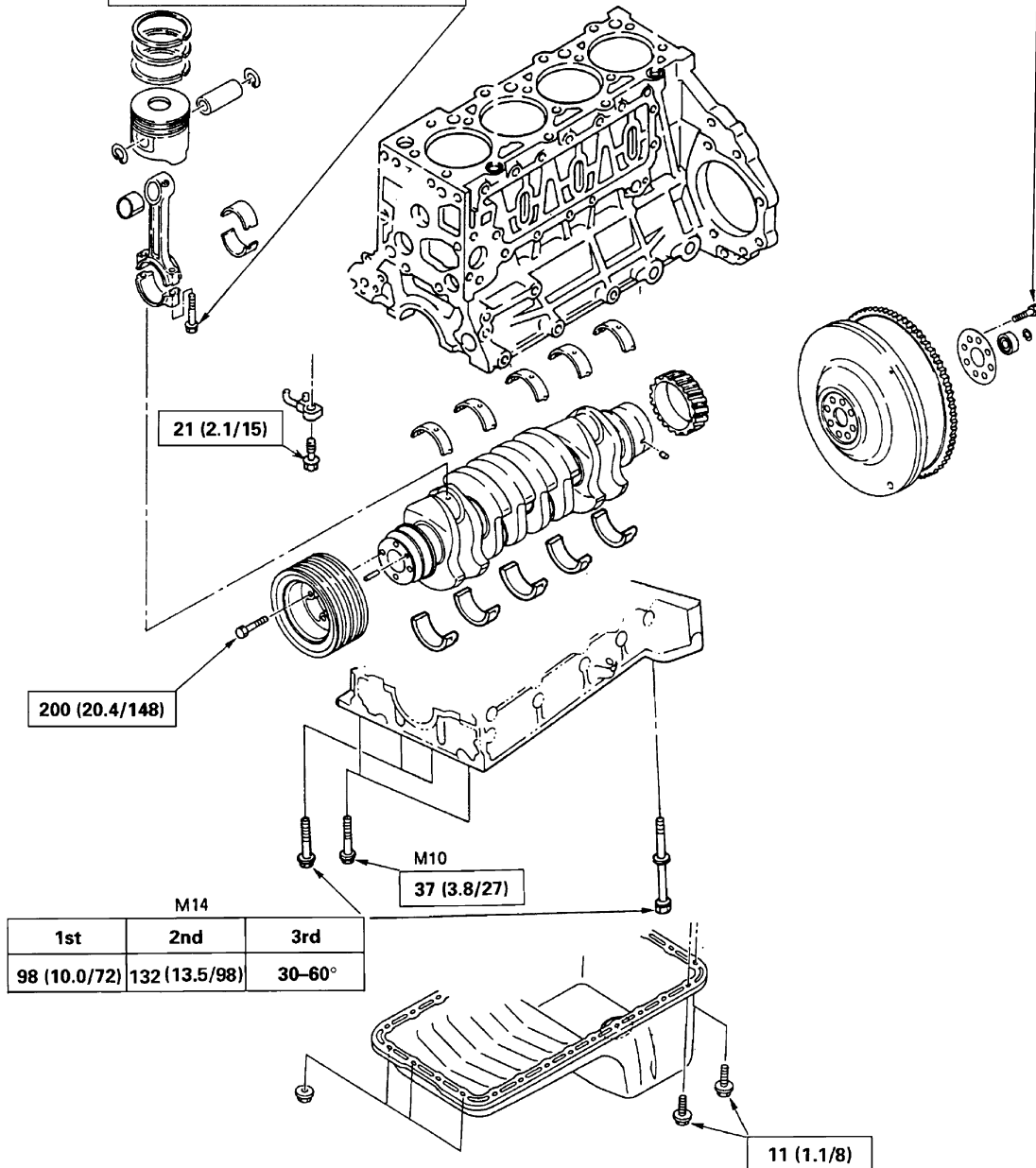
N6A1615E

Crankshaft, Flywheel, Damper Pulley, Connecting Rod and Oil Pan

N·m (kg·m / lb·ft)

1st	2nd	3rd
39 (4.0/29)	60°	30°
Apply with molybdenum disulfide grease to the bolt threads and setting faces		

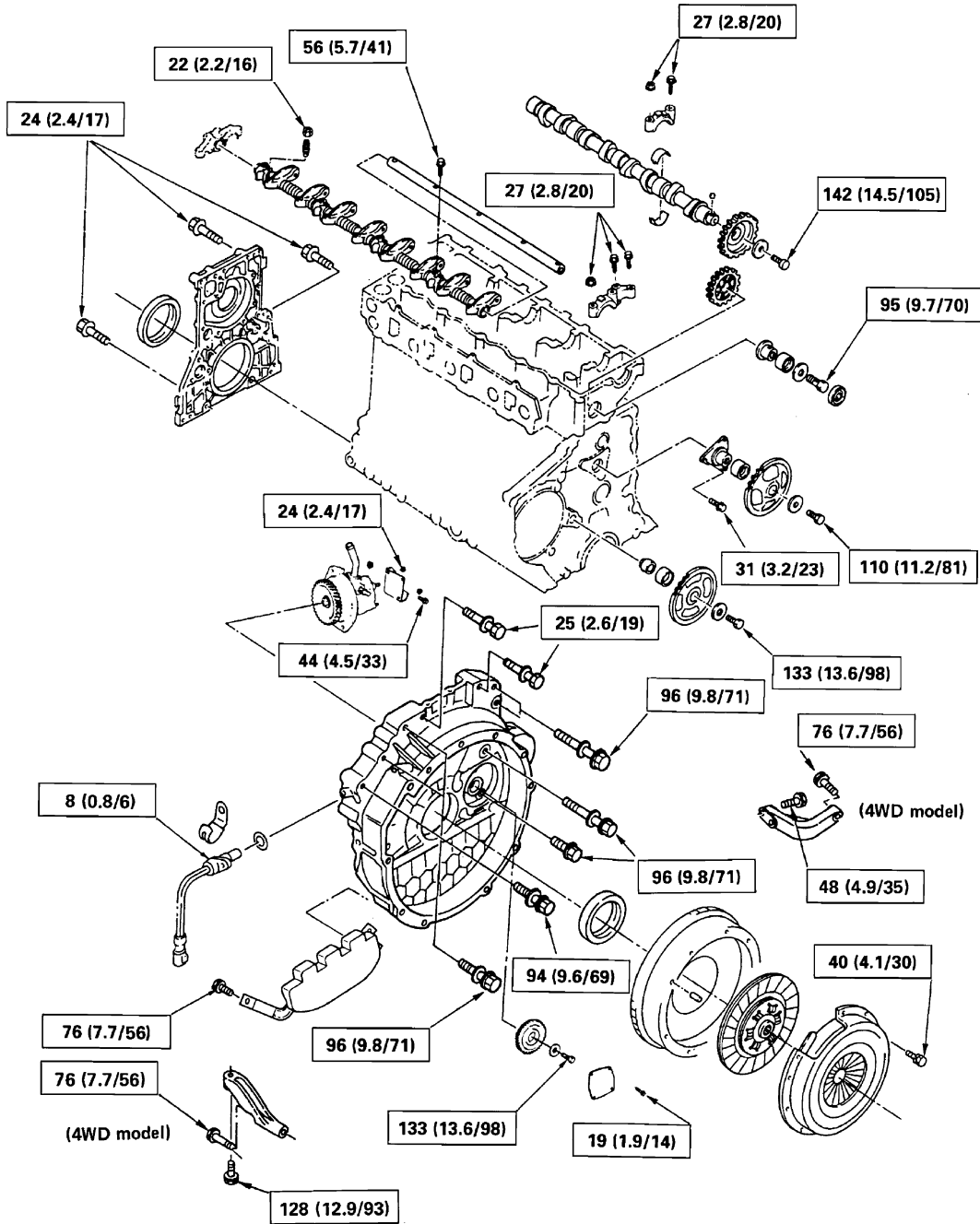
1st	2nd
78 (8.0/58)	90 – 120°



N6A1616E

Gear Train, Camshaft, Rocker Arm Shaft, Front Retainer, Flywheel Housing

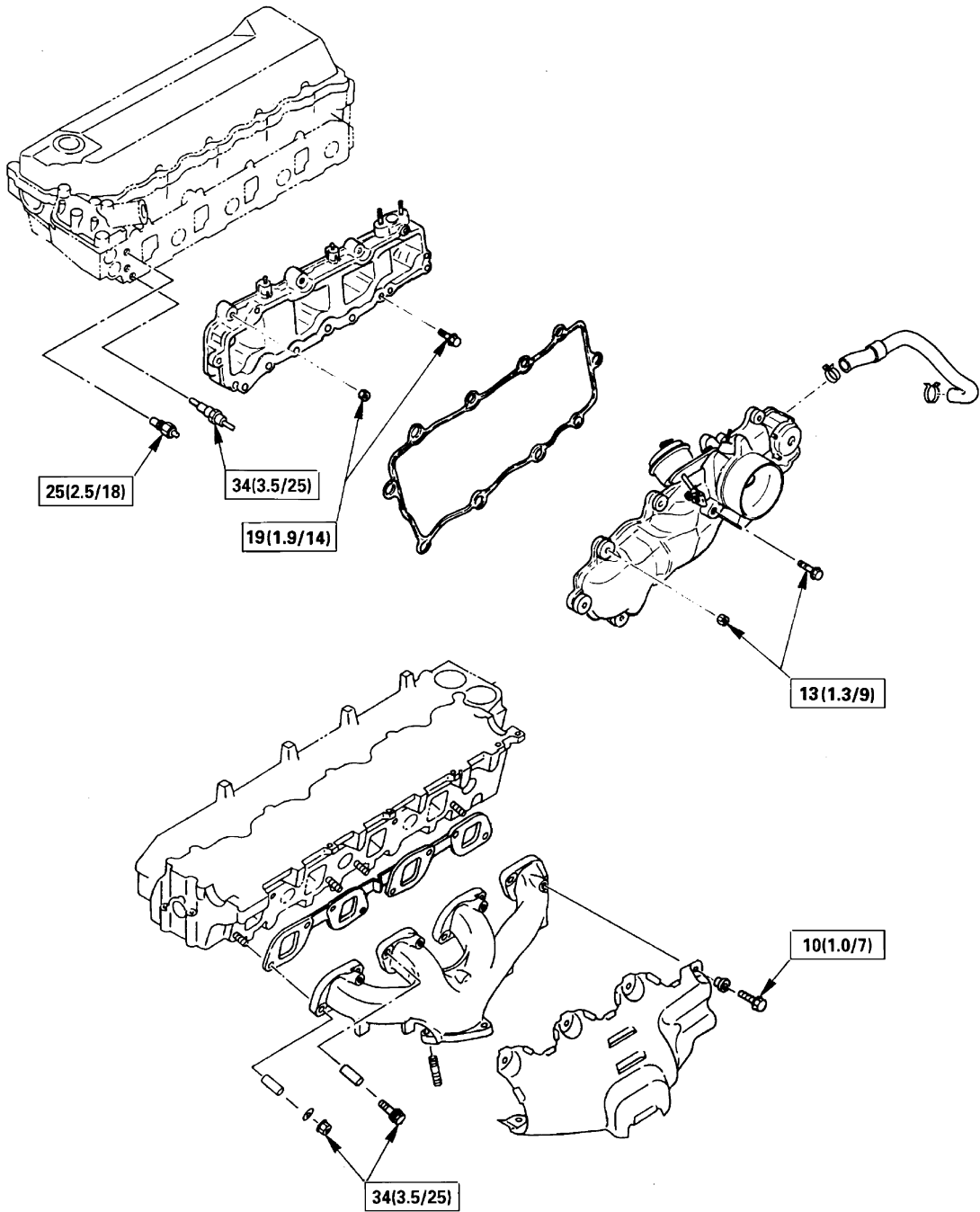
N-m (kg-m / lb-ft)



N6A0067E

Inlet Cover and Exhaust Manifold

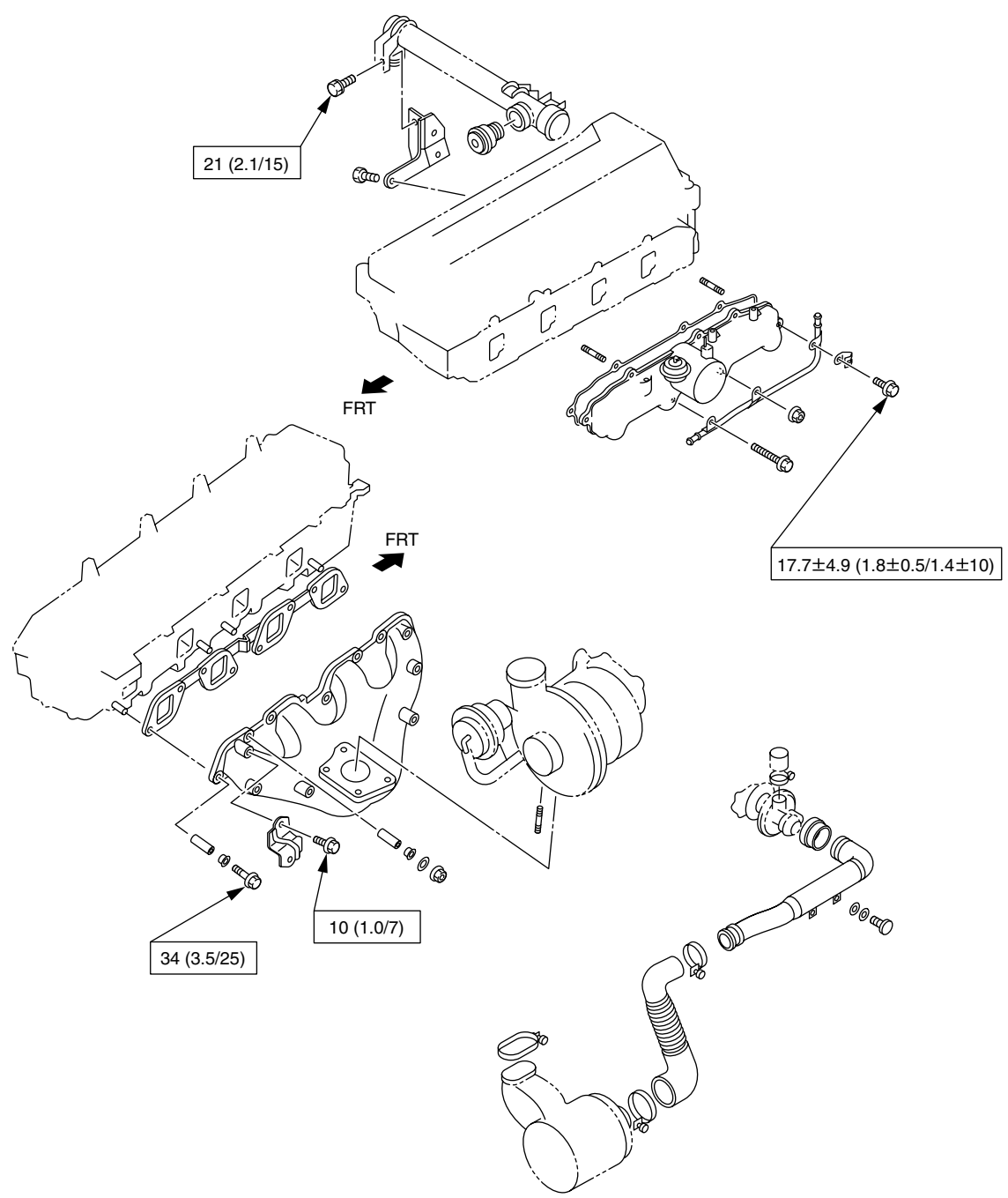
N·m (kg·m / lb-ft)



N6A1617E

4HE1-TC Engine

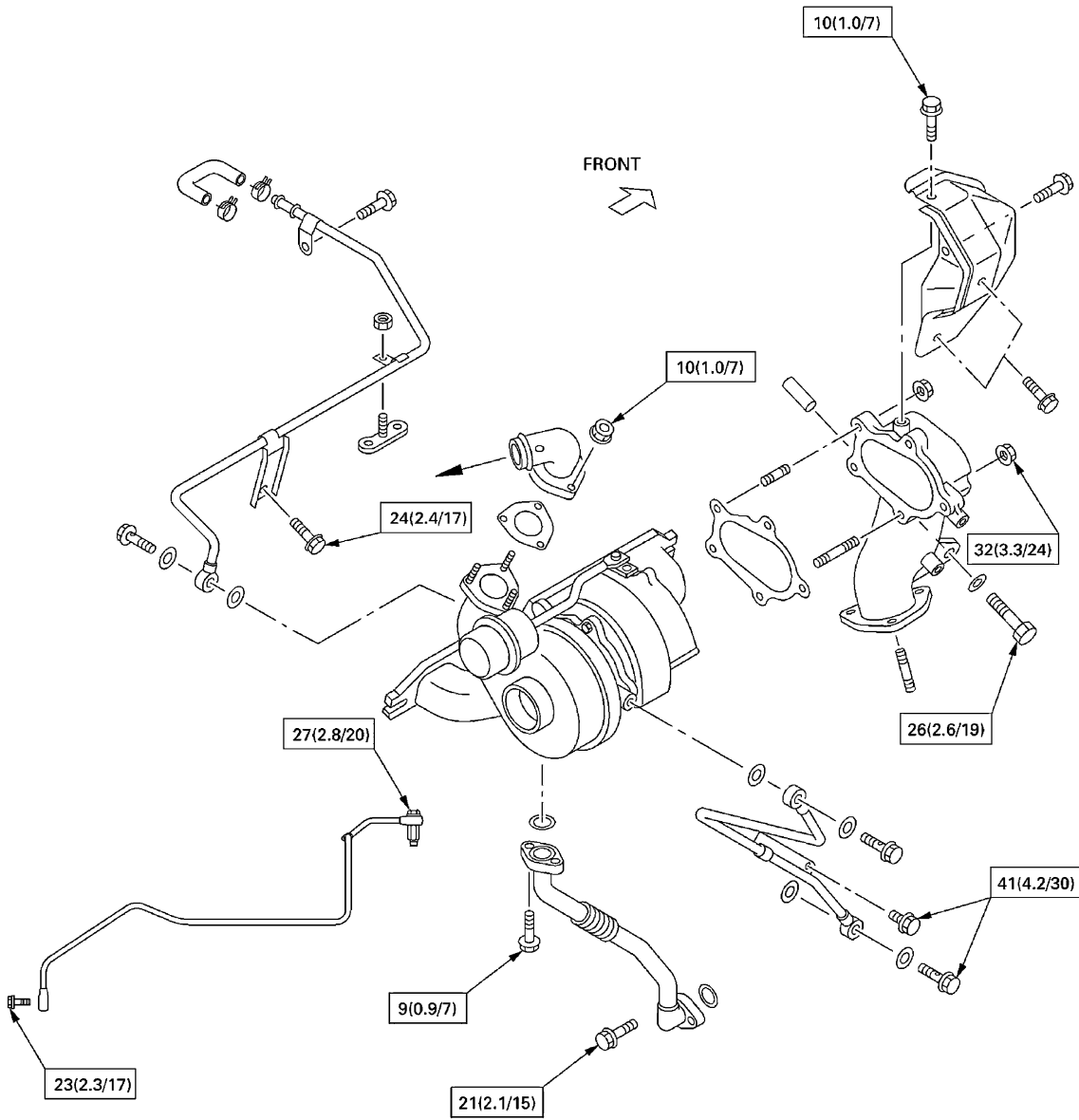
N·m (kg·m / lb·ft)



N6A0070E

Turbocharger, Water Pipe and Oil Pipe

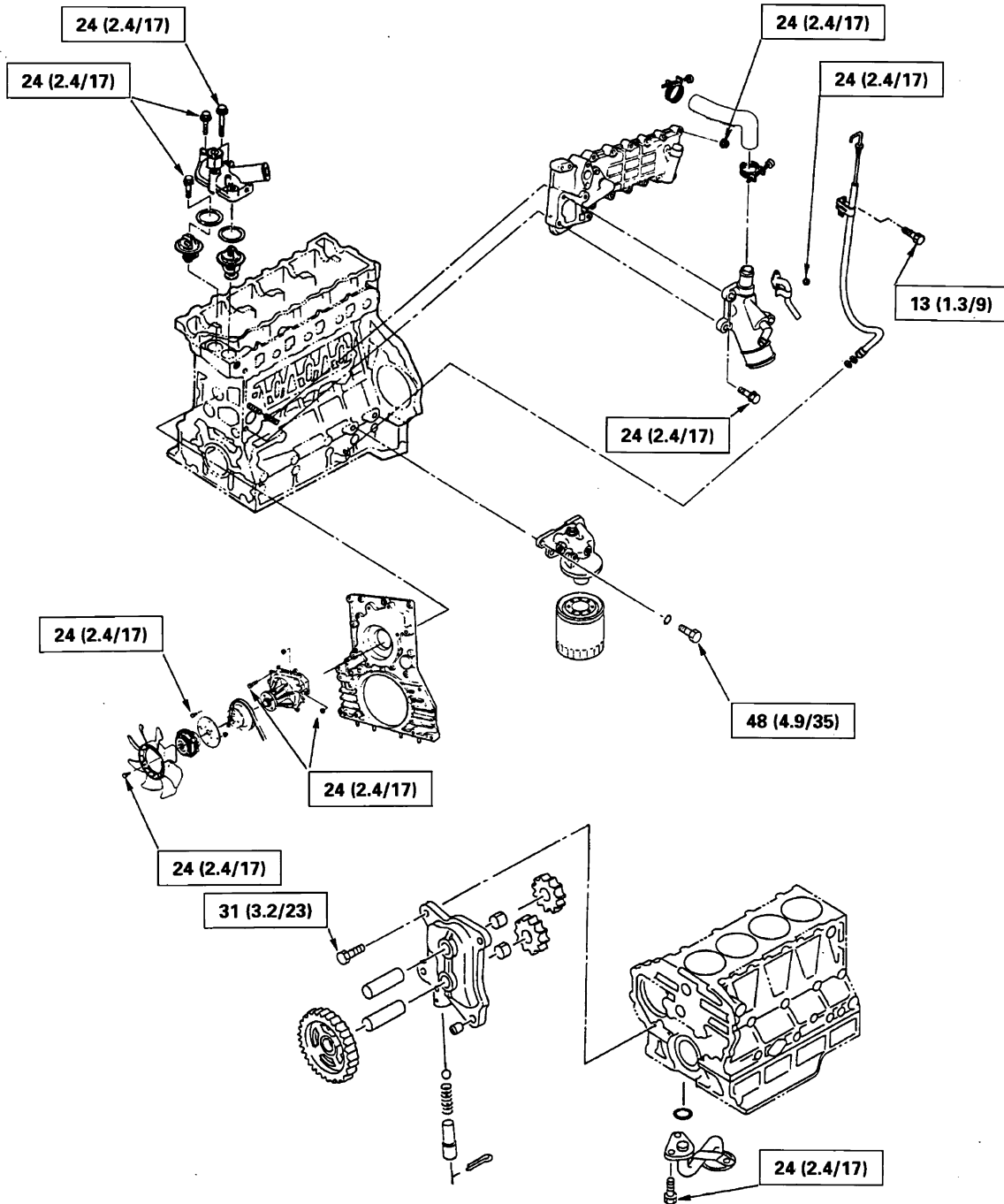
N·m (kg·m / lb·ft)



N6A0071E

Water Pump, Water Outlet Pipe, Oil Pump, Oil Cooler and Oil Filter

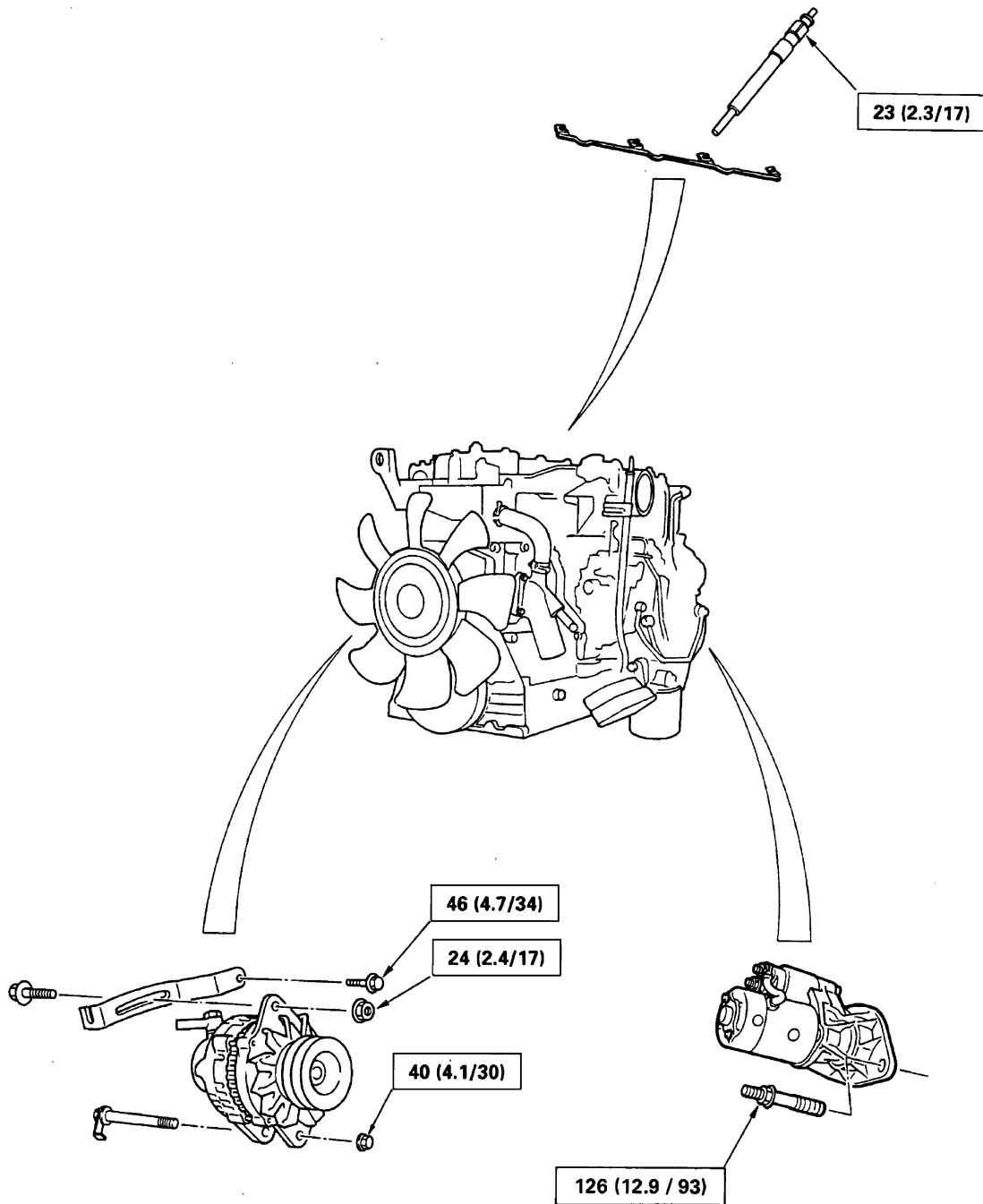
N·m (kg·m / lb·ft)



N6A0072E

Generator, Starter and Glow Plug

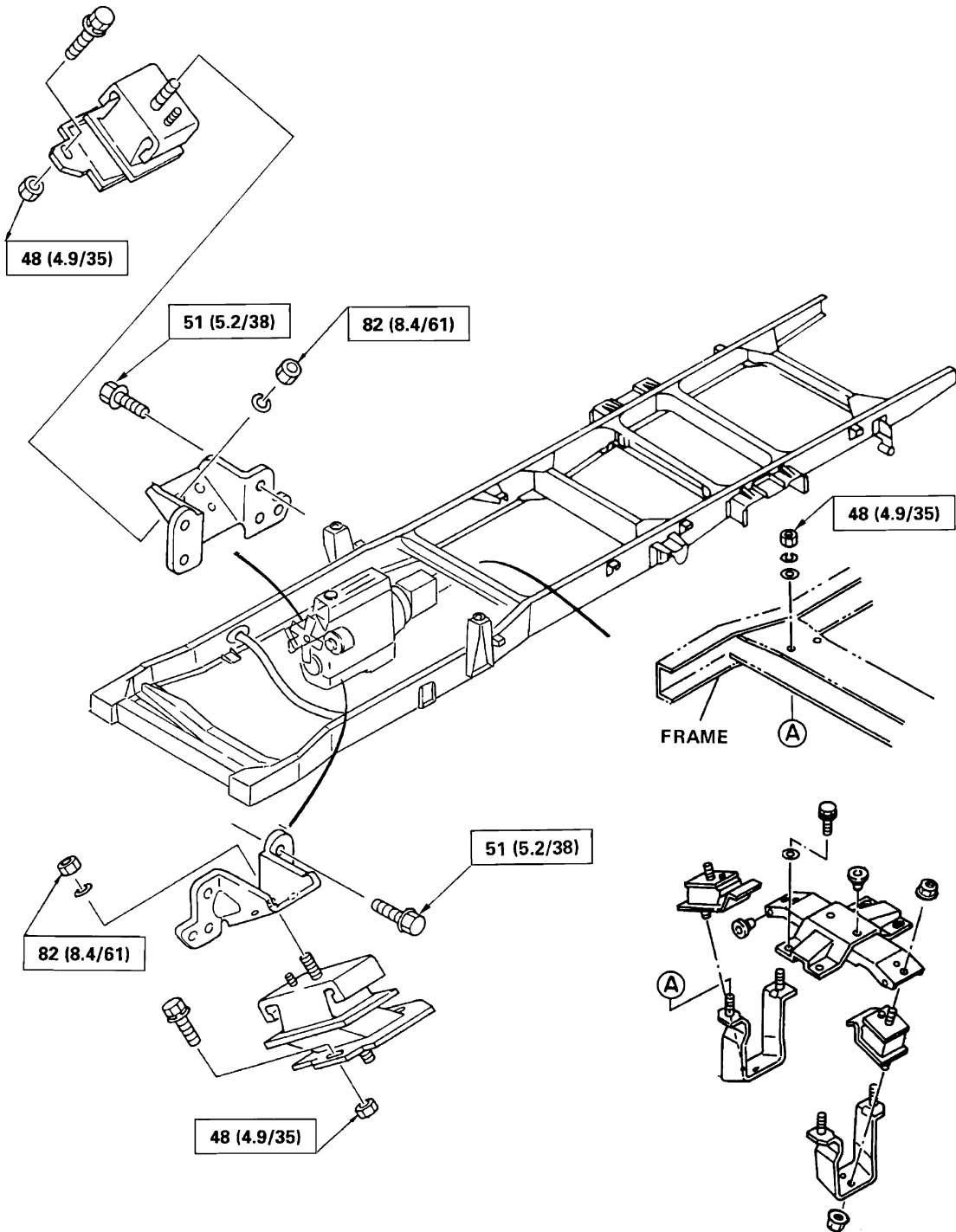
N·m (kg·m / lb·ft)



N6A0073E

Engine Mounting

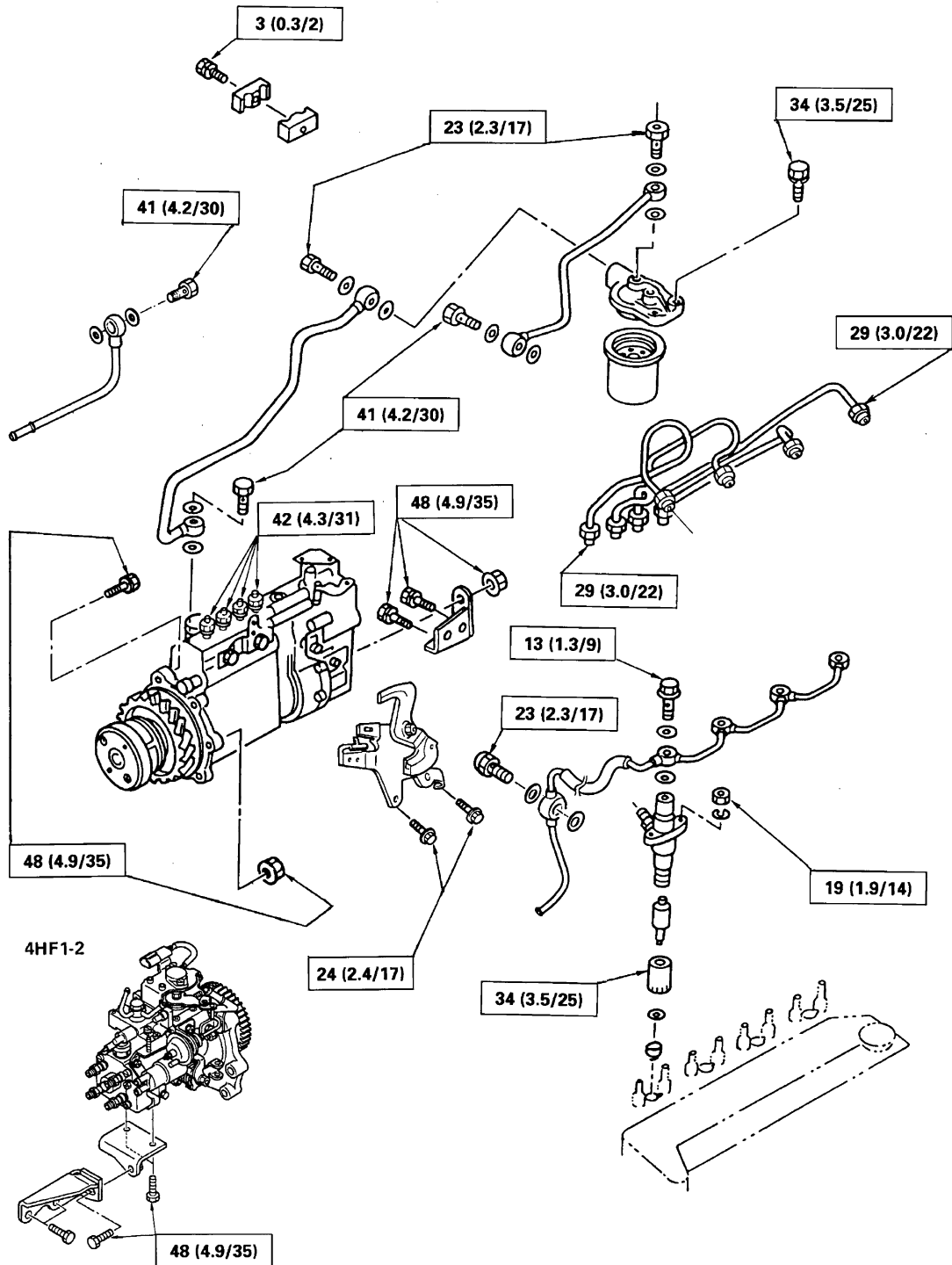
N·m (kg·m / lb·ft)



N6A1618E

Injection Pump, Injection Pipe and Fuel Pipe

N·m (kg·m / lb·ft)



N6A0075E

SPECIAL TOOLS

Special Tools

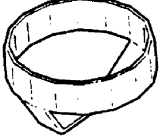
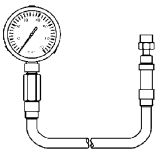

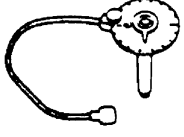
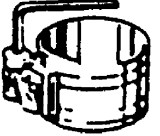
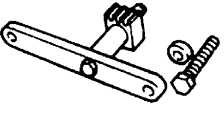
Illustration	Tool Number / Description / Remarks
 1852210970	1-8522-1097-0 / Oil filter wrench
 5884026750	5-8840-2675-0 / Compression gauge
 5853170010	5-8531-7001-0 / Adapter; Compression gauge
 5884002660	5-8840-0266-0 / Angle gauge / For angular bolt and nut tightening
 5884090180	5-8840-9018-0 / Piston installer
 5884022300	5-8840-2230-0 / Crankshaft stopper


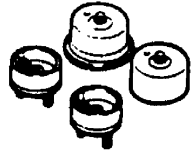

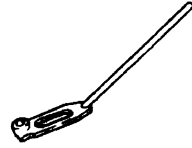
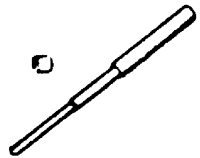

Illustration	Tool Number / Description / Remarks
 5884023600	5-8840-2360-0 / Slinger puller / For crankshaft front and rear slinger remove
 5884024310	5-8840-2431-0 / Oil seal setting tool kit / For crankshaft front and rear oil seal and slinger install
 5884022400	5-8840-2240-0 / Clutch pilot aligner
 5884022280	5-8840-2228-0 / Valve spring compressor
 5884022270	5-8840-2227-0 / Valve guide replacer
 8943968150	8-9439-6815-0 / Valve guide seal installer

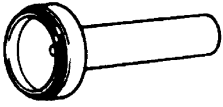


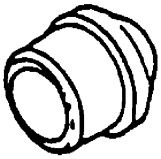
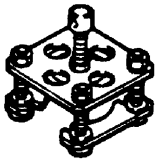

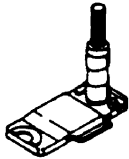
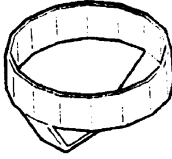
Illustration	Tool Number / Description / Remarks
 <p>5884022220</p>	5-8840-2222-0 / Sealing cup installer
 <p>9852311690</p>	9-8523-1169-0 / Cylinder liner remover
 <p>5884022200 5884023970</p>	5-8840-2220-0 5-8840-2397-0 (4HG1) / Cylinder liner remover ankle
 <p>5884023370</p>	5-8840-2337-0 / Cylin- der Liner Installer (4HE1- TC only)
 <p>8943968180</p>	8-9439-6818-0 / Crank- shaft gear remover
 <p>8943968190</p>	8-9439-6819-0 / Crank- shaft gear installer
 <p>5884023400</p>	5-8840-2340-0 / Conrod bush replacer

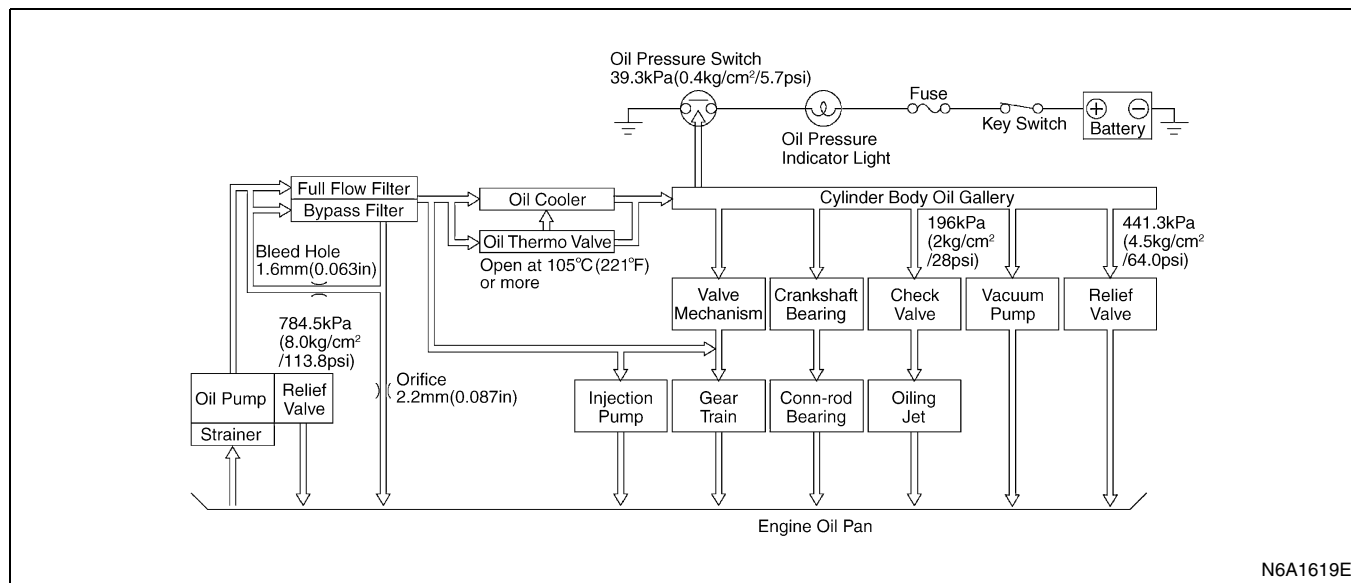
Illustration	Tool Number / Description / Remarks
 <p>5884020940</p>	5-8840-2094-0 / Oil filter wrench / 4WD model

LUBRICATING SYSTEM

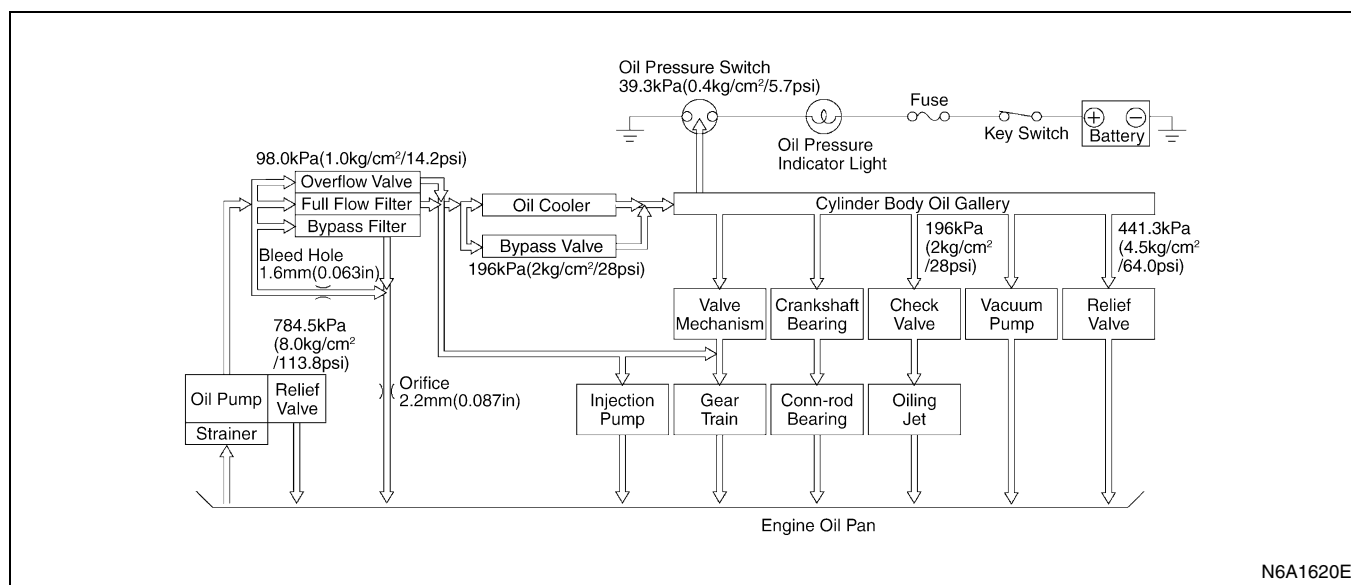
General Description

Lubricating Oil Flow

4HF1, 4HF1-2, 4HG1-T Model



4HE1-TC Model



The engine lubricating system is a full flow type.

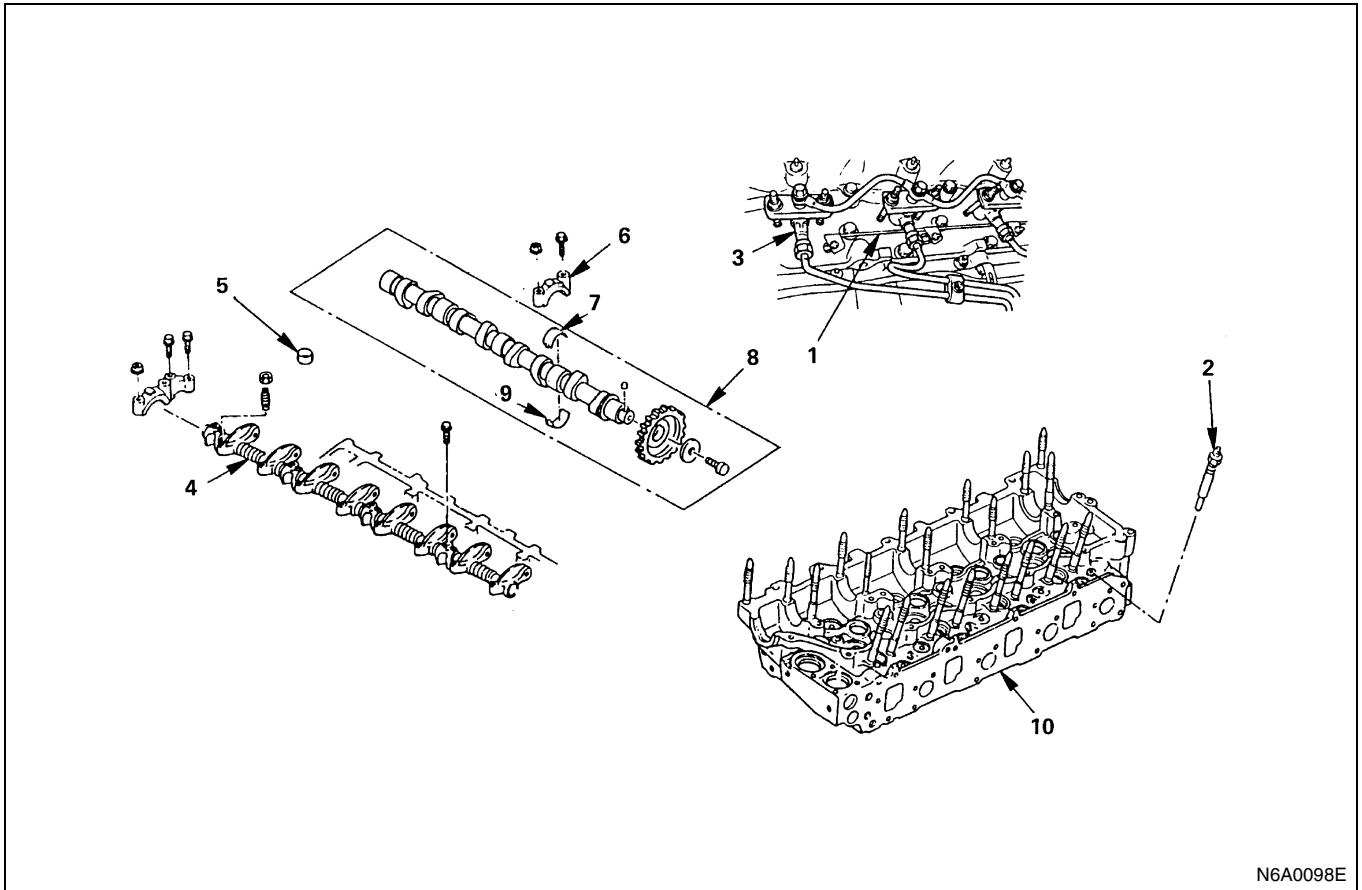
Lubricating oil is pumped from the oil pump to the cylinder body oil gallery through the oil filter and the oil cooler. It is then delivered to the vital parts of the engine from the cylinder body oil gallery.

Oil jets installed on the cylinder body spray engine oil to the piston inside faces to achieve maximum cooling effect.

ENGINE MECHANICAL

CYLINDER HEAD

Component



N6A0098E

Legend

- | | |
|-------------------------------------|---------------------------|
| 1. Glow plug connector | 6. Camshaft bearing cap |
| 2. Glow plug | 7. Camshaft bearing upper |
| 3. Injection nozzle holder assembly | 8. Camshaft assembly |
| 4. Rocker arm shaft assembly | 9. Camshaft bearing lower |
| 5. Valve cap | 10. Cylinder head |

Notice:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be re-installed in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, make a compression test and note the results.

Disassembly

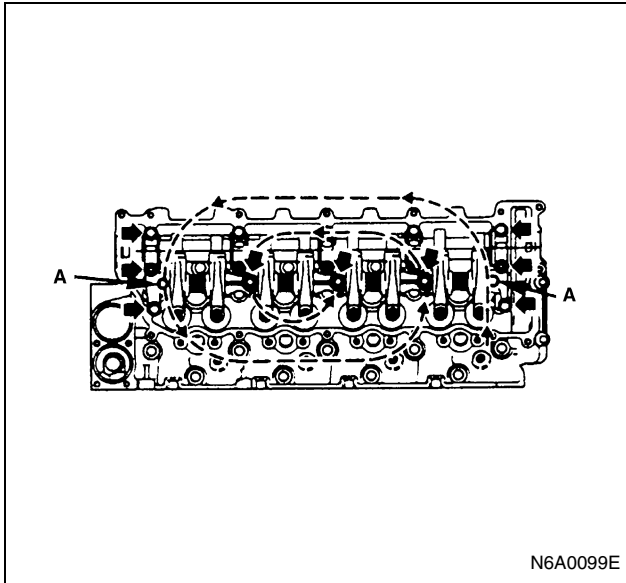
1. Glow Plug Connector
2. Glow Plug
3. Injection Nozzle Holder Assembly
Mark the nozzle holder assemblies fitting positions by tagging each nozzle holder assembly with the cylinder number from which it was removed.
4. Rocker Arm Shaft Assembly

1) Loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time and remove the rocker arm shaft assembly with the camshaft brackets.

2) Leave the (A) indicated bolt unremoved on this occasion, since it is the rocker arm fixing bolt.

Caution:

Failure to loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time will adversely affect the rocker arm shaft.



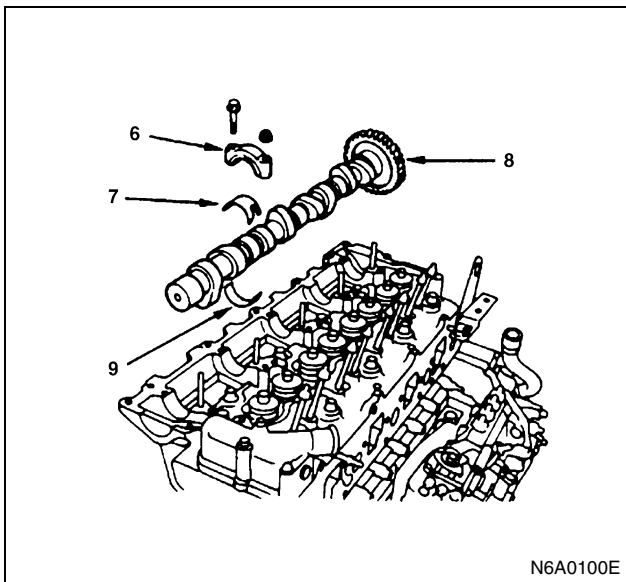
5. Valve Cap

Caution:

Take sufficient care not to let valve caps fall into the gear case or oil return hole.

- 6. Camshaft Bearing Cap
- 7. Camshaft Bearing Upper
- 8. Camshaft Assembly
- 9. Camshaft Bearing Lower

If the camshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



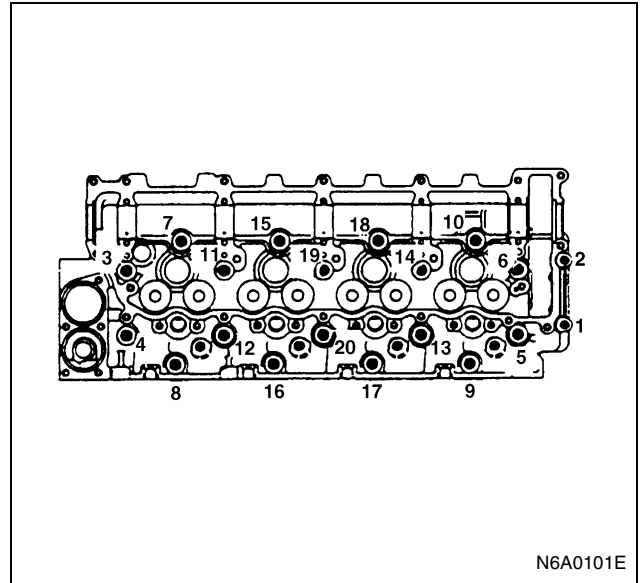
10. Cylinder Head

Loosen the cylinder head bolts in numerical order a little at a time.

Caution:

Failure to loosen the cylinder head bolts in numerical order a little at a time will adversely affect the cylinder head lower surface.

- Refer to Section 6A3 "CYLINDER HEAD".



Clean

- Cylinder head bolts
- Cylinder head

Carefully remove all varnish, soot and carbon to the bare metal. Do not use a motorized wire brush on any gasket sealing surface.

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

- Cylinder head gasket and mating surfaces for leaks, corrosion and blow-by. If the gasket has failed, determine the cause;
 - Improper installation
 - Loose or warped cylinder head
 - Insufficient torque on head bolts
 - Warped case surface

1. Cylinder head bolts for damaged threads or stretching and damaged heads caused by improper use of tools.

Caution:

Suspected bolts must be replaced.

2. Cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Cylinder head deck for corrosion, sand particles in head and porosity.

Caution:

Do not attempt to weld the cylinder head. Replace it.

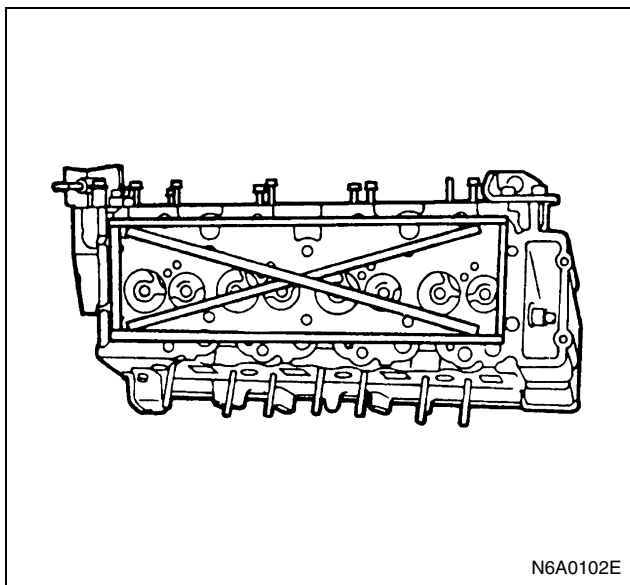
Cylinder Head Lower Face Warpage

1. Use a straight edge and a feeler gauge to measure the four sides and the two diagonals of the cylinder head face.
2. If the measured values exceed the specified limit, the cylinder head must be replaced.

Notice:

Do not regrind the cylinder head lower face.

Cylinder Head Lower Face Warpage		mm (in)
Standard	Limit	
0.05 (0.002) or less	0.2 (0.008)	

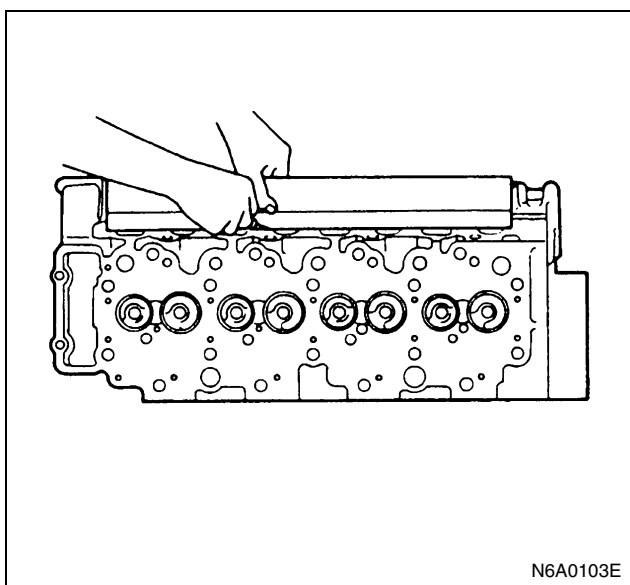


Manifold Fitting Face Warpage

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

Regrind the manifold cylinder head fitting faces if the measured value is greater than the specified limit.

Manifold Fitting Face Warpage		mm (in)
Standard	Limit	
0.05 (0.002) or less	0.2 (0.008)	

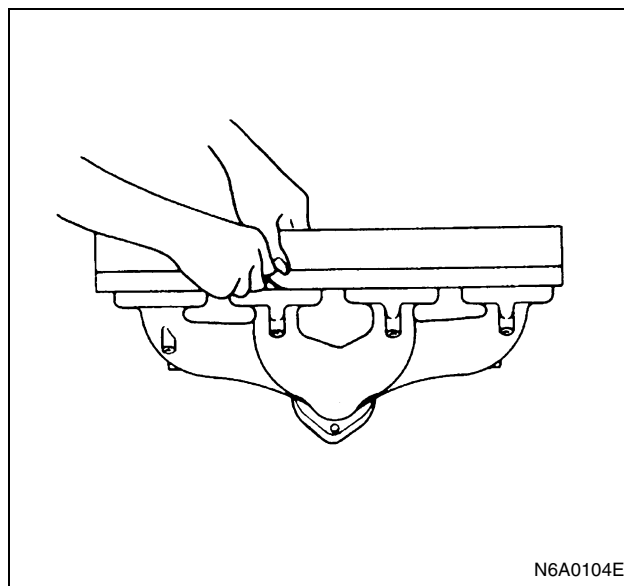


Exhaust Manifold Warpage

Use a straight edge and a feeler gauge to measure the manifold cylinder head fitting face warpage.

If the measured values exceed the specified limit, the manifold must be replaced.

Exhaust Manifold Warpage		mm (in)
Standard	Limit	
0.05 (0.002) or less	0.24 (0.008)	



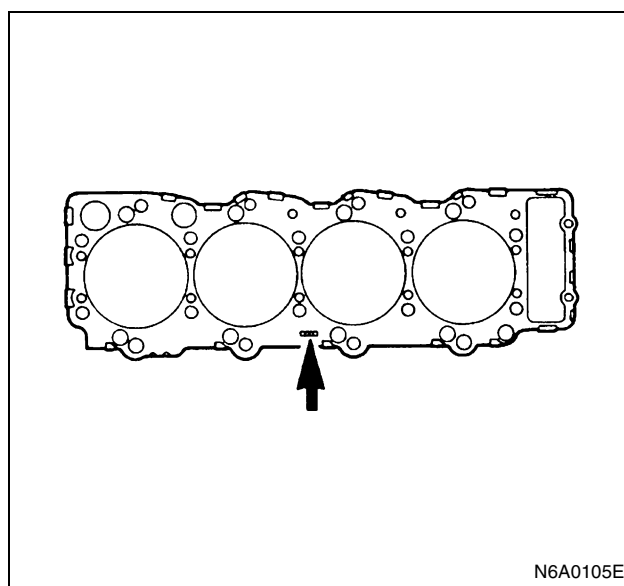
Reassembly

Install the cylinder head gasket with its "PART NUMBER" mark facing up and toward the left of the engine.

Caution:

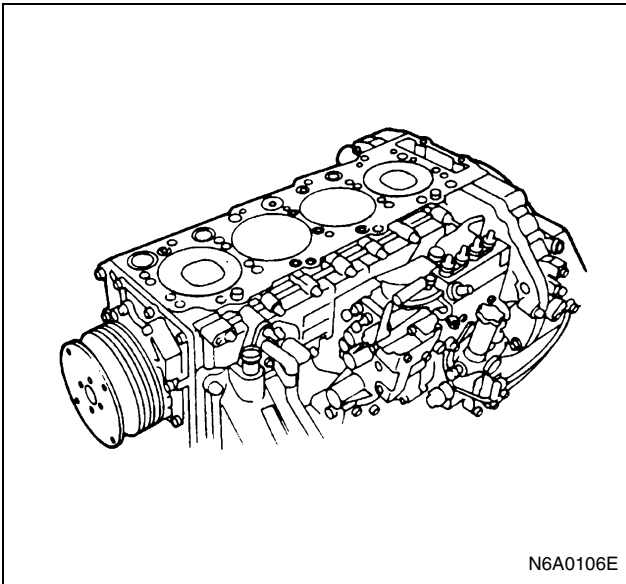
Do not reuse the cylinder head gasket.

Above works refer to "CYLINDER BLOCK" section in this manual.



1. Cylinder Head

- 1) Align the cylinder body dowels and the cylinder head dowel holes.
- 2) Carefully place the cylinder head on the cylinder head gasket.



- 3) Apply a coat of molybdenum disulfide grease to the M14 cylinder head bolt threads and setting faces and apply a coat of engine oil to the M10 cylinder head bolt threads and setting faces.
- 4) Use the angular tightening method to tighten the bolts (M14) to the specified torque in three steps following the numerical order shown in the illustration.

Tighten:

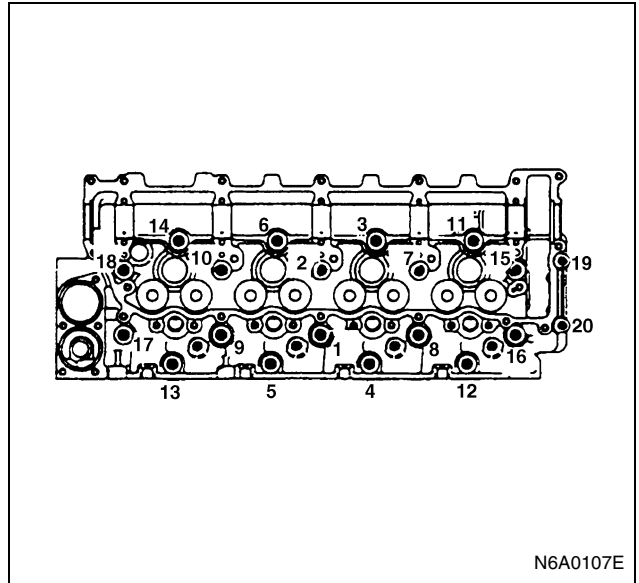
Cylinder head bolt (M14: (1) — (18)) to

- 1st step: 98 N·m (10 kg·m / 72 lb-ft)
- 2nd step: 147 N·m (15 kg·m / 108 lb-ft)
- 3rd step: 30 — 60°

- 5) Tighten the cylinder head to the flywheel housing bolts (M10) to the specified torque.

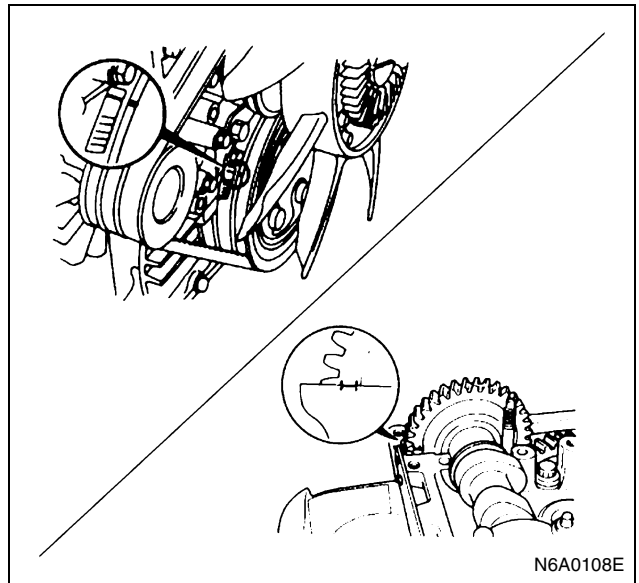
Tighten:

Cylinder head bolt to (M10: (19) — (20)) to 38 N·m (3.9 kg·m / 28 lb-ft)

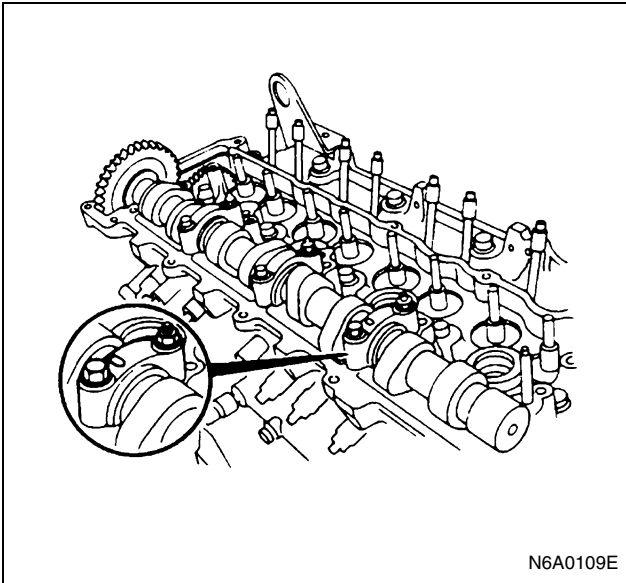


2. Camshaft Bearing Lower
3. Camshaft Assembly

- 1) Turn the crankshaft in the direction of normal rotation until the timing mark on the crankshaft damper pulley is aligned with the TDC notched line. (Confirm that the No. 1 cylinder piston comes to the compression top dead center.)



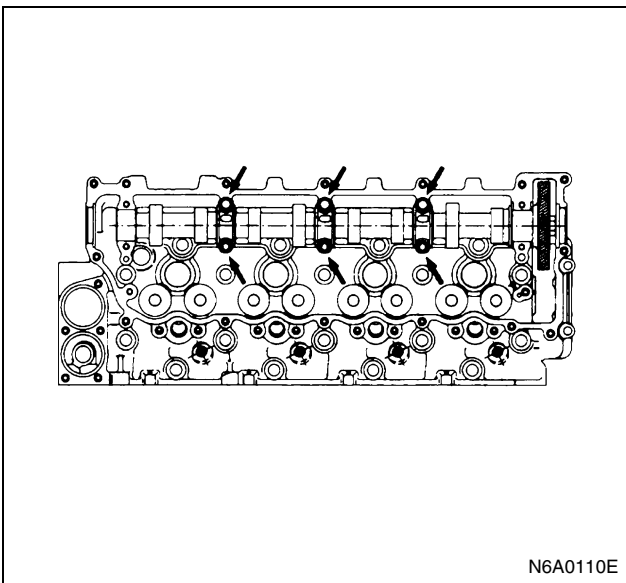
- 2) Apply engine oil to the camshaft journal and the camshaft bearing surfaces before installation.
- 3) Carefully align the camshaft gear "I" mark and the cylinder head upper face shown in the illustration.
4. Camshaft Bearing Upper
5. Camshaft Bearing Cap
 - 1) Install the bearing caps with the bearing cap head mark (arrow) facing forward.



- 2) Apply a coat of engine oil to the bearing cap bolt and stud threads.
- 3) Tighten the bearing cap bolts and studs to the specified torque.

Tighten:

Camshaft bearing cap nut and bolt to 27 N·m (2.8 kg·m / 20 lb·ft)

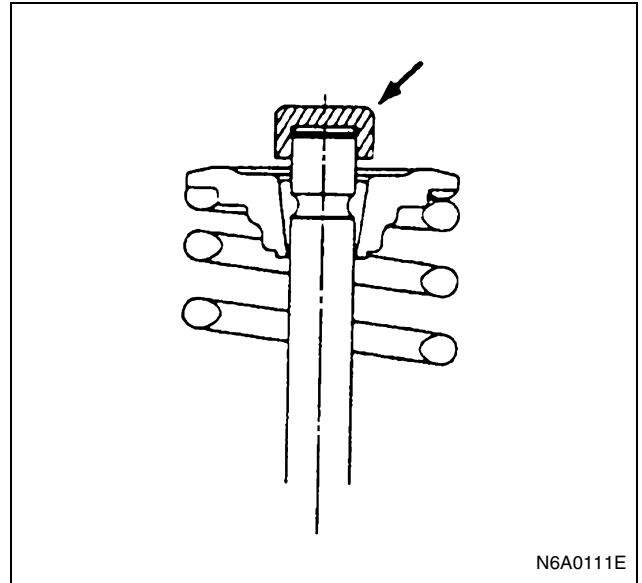


6. Valve Cap

Apply engine oil to the inside of the valve caps and install them to the valve stem end.

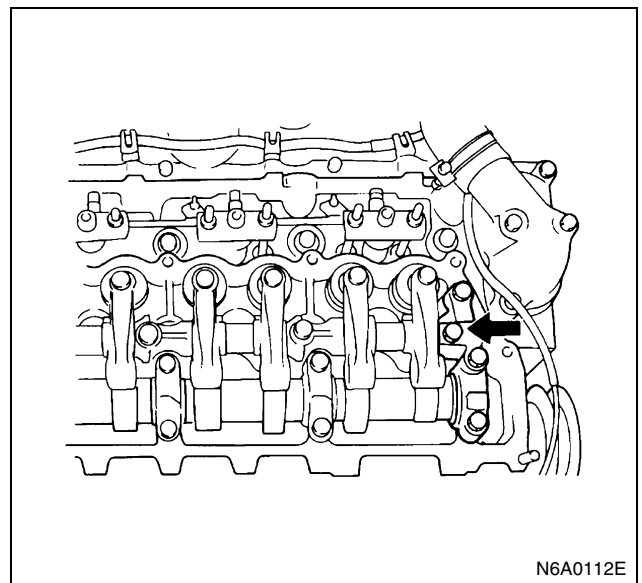
Caution:

Take sufficient care not to let valve caps fall into the gear.



7. Rocker Arm Shaft Assembly

- 1) Temporarily tighten the bolts marked with the arrow in the illustration.

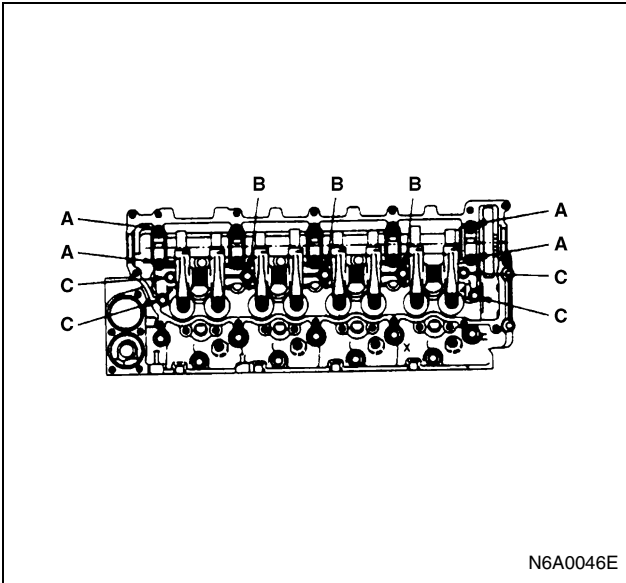


- 2) Loosen the rocker arm adjust screws and apply engine oil to the rocker arm roller portions.
- 3) Install the rocker arm assembly on the cylinder head.
- 4) Tighten the rocker arm shaft bracket nuts and bolts to the specified torque in numerical order a little at a time as shown in the illustration.

Tighten:

Rocker arm shaft bracket nut and bolt to

- Nut (A): 27 N·m (2.8 kg·m / 20 lb·ft)
- Bolt (B): 56 N·m (5.7 kg·m / 41 lb·ft)
- Bolt (C): 27 N·m (2.8 kg·m / 20 lb·ft)

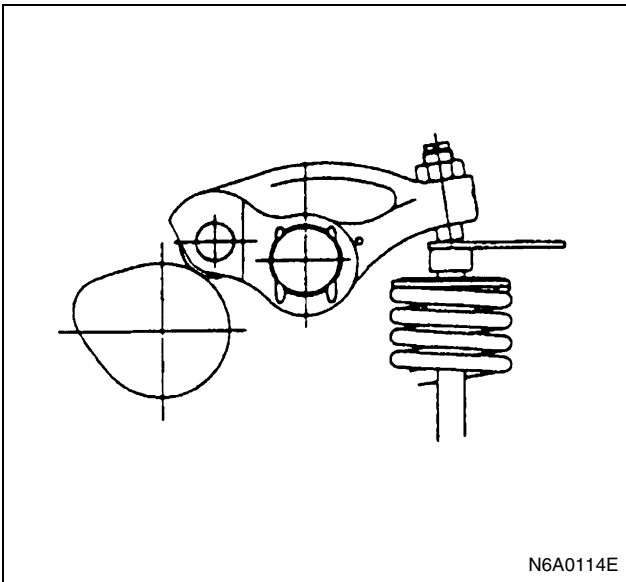


N6A0046E

5) Apply engine oil to the threaded portion of the nuts marked with "A" and the bolts with "B" shown in the illustration left, and tighten them to the specified torque.
Adjust the valve clearance.

Valve Clearance	mm (in)
At cold	0.4 (0.016)

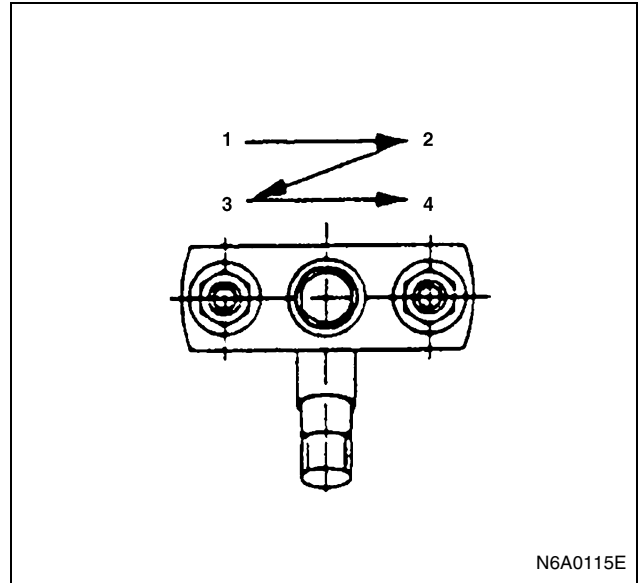
Above works refer to "SERVICING" "VALVE CLEARANCE ADJUSTMENT" previously section in this manual.



N6A0114E

8. Injection Nozzle Holder Assembly
Tighten the nozzle holder flange nuts to the specified torque in the numerical order shown in the illustration.

Tighten:
Nozzle holder flange nut to 19 N·m (1.9 kg·m / 14 lb·ft)

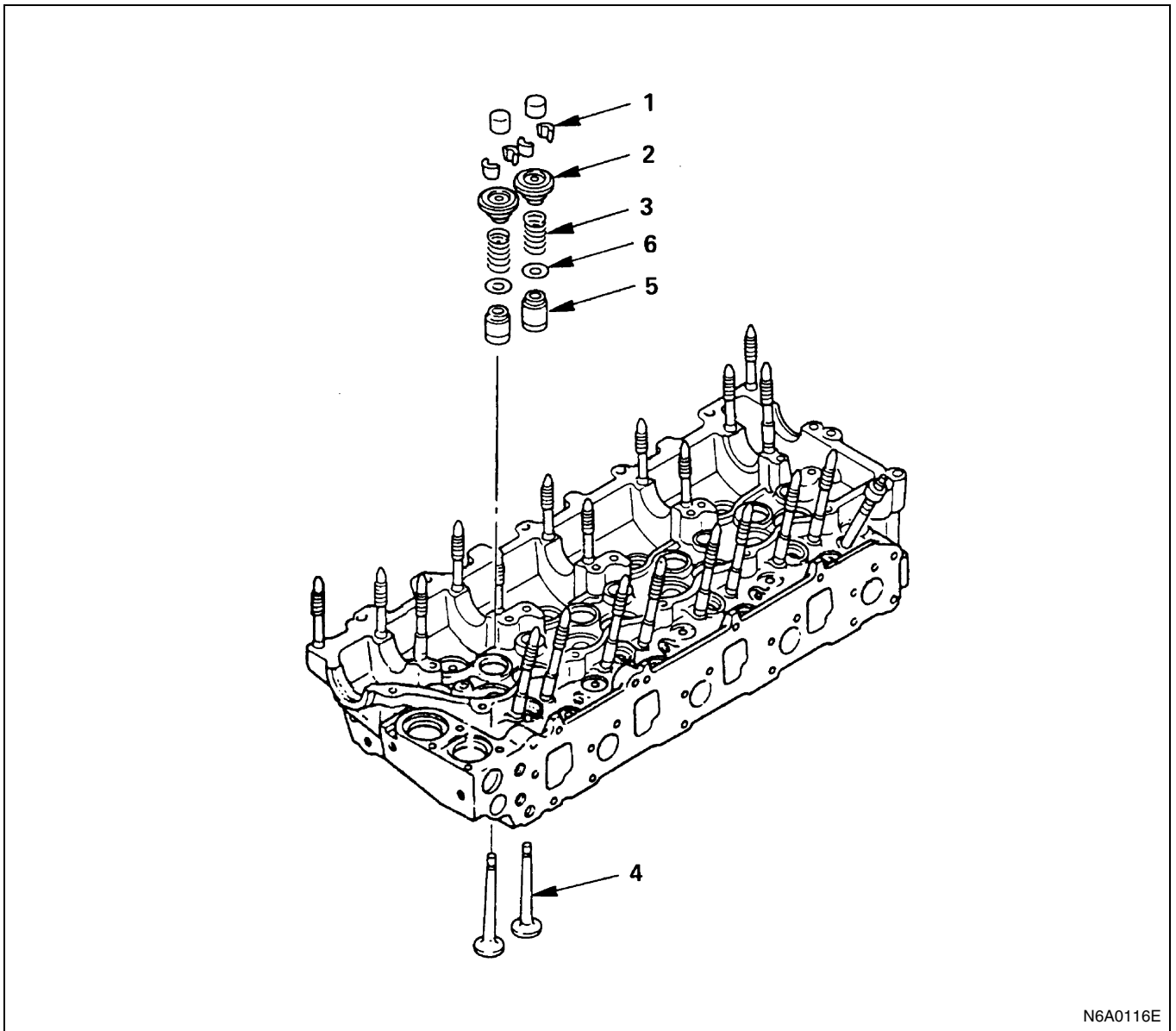


N6A0115E

9. Glow Plug
Tighten:
Glow Plug to 23 N·m (2.3 kg·m / 17 lb·ft)
10. Glow Plug Connector

VALVE SPRING, VALVE GUIDE OIL SEAL, VALVE, VALVE GUIDE

Component



N6A0116E

Legend

- | | |
|----------------------|-----------------------------|
| 1. Split collar | 4. Intake and exhaust valve |
| 2. Spring upper seat | 5. Valve guide seal |
| 3. Valve spring | 6. Spring lower seat |

Disassembly

Preparation

- Remove all the parts only with the cylinder head assembly left.
(Above works refer to "CYLINDER HEAD GASKET" section 6A3 in this manual.)

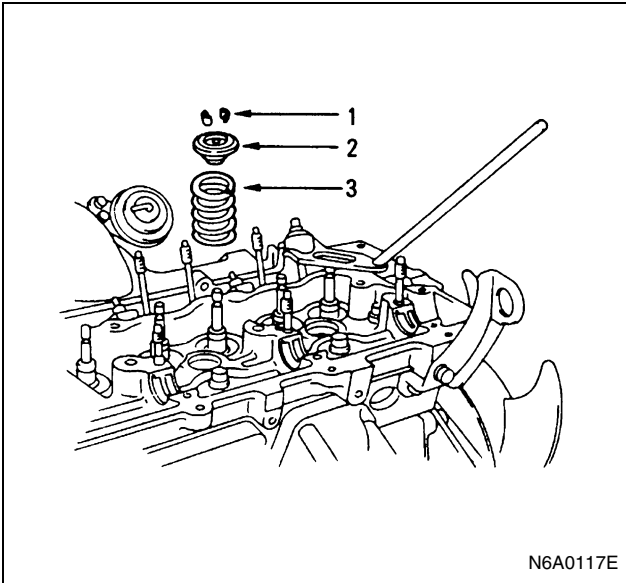
1. Cotter Collar

- Place the cylinder head on a flat wooden surface.
- Use the valve spring compressor to remove the cotter collar.

Do not allow the valve to fall from the cylinder head.

Valve Spring Compressor: 5-8840-2228-0

- Spring Upper Seat
- Valve Spring

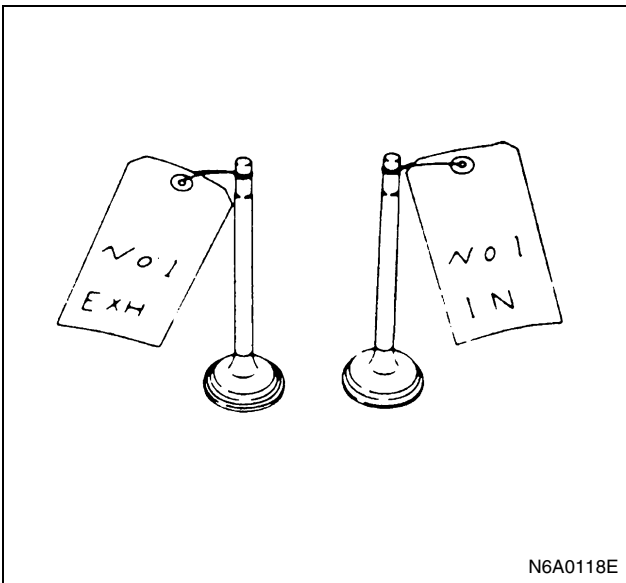


N6A0117E

4. Intake and Exhaust Valve

If the intake and exhaust valves are to be reinstalled, mark their installation positions by tagging each valve with the cylinder number from which it was removed.

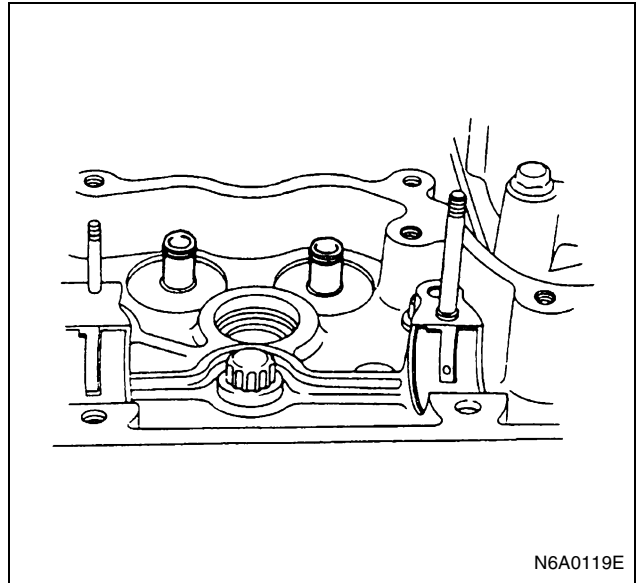
If the intake and exhaust valves are to be replaced, the valve guides must also be replaced.



N6A0118E

5. Valve Guide Seal

6. Spring Lower Seat



N6A0119E

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

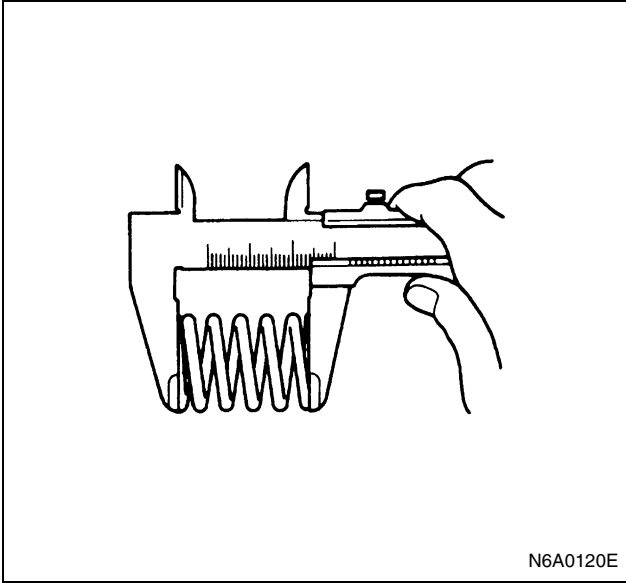
Valve Spring Free Height

Use a vernier caliper to measure the valve spring free height.

If the measured valve is less than the specified limit, the valve spring must be replaced.

Valve Spring Free Height		mm (in)
4HF1: 4HF1-2: 4HG1: 4HG1-T		
Nominal Size	Limit	
62.5 (2.46)	59.4 (2.34)	

4HE1-TC:			mm (in)
	Nominal size	Limit	
Intake Inner	53.2 (2.094)	50.1 (1.972)	
Intake Outer	55.6 (2.189)	52.5 (2.067)	
Exhaust Inner	58.6 (2.307)	55.5 (2.185)	
Exhaust Outer	62.0 (2.441)	58.9 (2.319)	



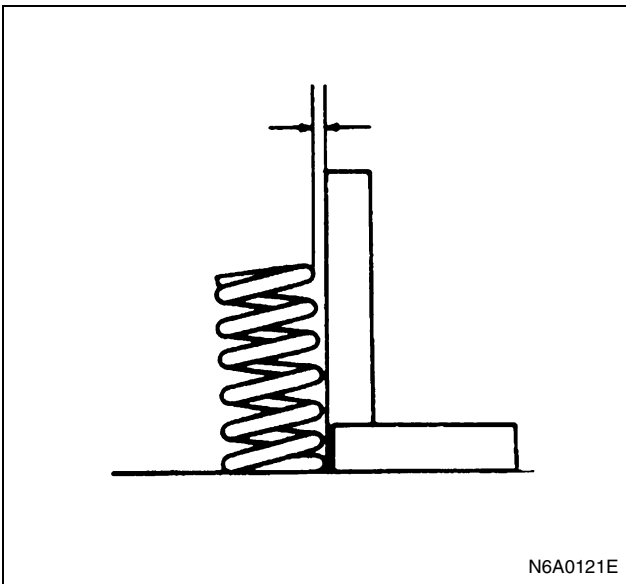
N6A0120E

Valve Spring Squareness

Use a surface plate and a square to measure the valve spring squareness.

If the measured value exceeds the specified limit, the valve spring must be replaced.

Valve Spring Squareness		mm (in)
Limit		1.0 (0.04)

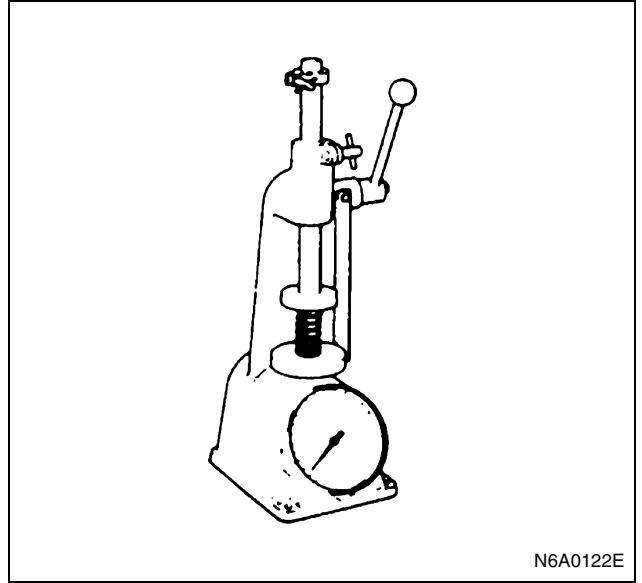


N6A0121E

Valve Spring Tension

Use spring tester to measure the valve spring tension. If the measured valve is less than the specified limit, the valve spring must be replaced.

Valve Spring Tension		N (kg/lb)
Set Length mm (in)	Standard	Limit
47.0 (1.85)	414 — 477 (42.2 — 48.6/93 — 107)	401 (40.9/98)



N6A0122E

Valve Guide

Caution:

Taking care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratching or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

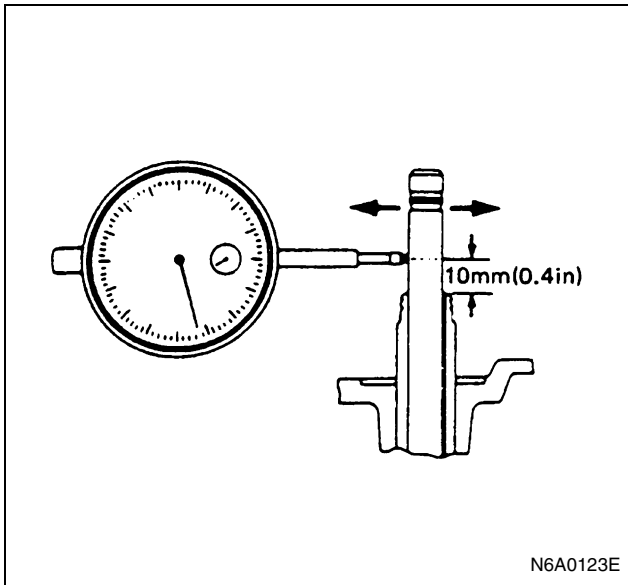
Valve Stem and Valve Guide Clearance

(Measuring Method-I)

1. Set the dial indicator to the valve stem measuring point.
2. Move the valve stem end from side to side. Read the dial indicator. Note the total indicator reading.

If the measured values exceed the specified limit, the valve and the valve guide must be replaced as a set.

Total Dial Indicator Reading (Valve Stem and Valve Guide Clearance)		mm (in)
Valve	Standard	Limit
Intake Valve	0.038 — 0.071 (0.0015 — 0.0028)	0.20 (0.0079)
Exhaust Valve	0.064 — 0.096 (0.0025 — 0.0038)	0.25 (0.0098)

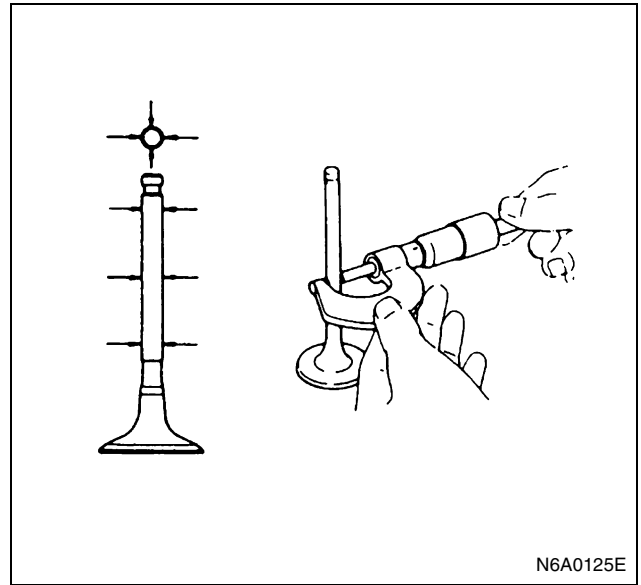


N6A0123E

(Measuring Method-II)

1. Measure the valve stem outside diameter. Refer to the "Valve Stem Outside Diameter".
2. Use a caliper calibrator or a telescoping gauge to measure the valve guide inside diameter.
3. Calculate the clearance between the valve guide inside diameter and the valve stem outside diameter. If the clearance exceeds the specified limit, the valve and the valve guide must be replaced as a set.

Valve Stem Outside Diameter		mm (in)
Valve	Standard	Limit
Intake Valve	8.946 — 8.962 (0.3522 — 0.3528)	8.88 (0.350)
Exhaust Valve	8.921 — 8.936 (0.3512 — 0.3529)	8.80 (0.346)

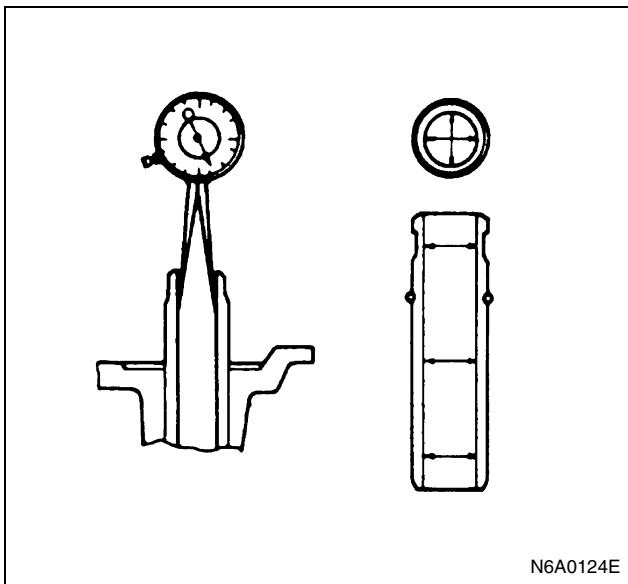


N6A0125E

Valve Guide Replacement

Valve Guide Removal

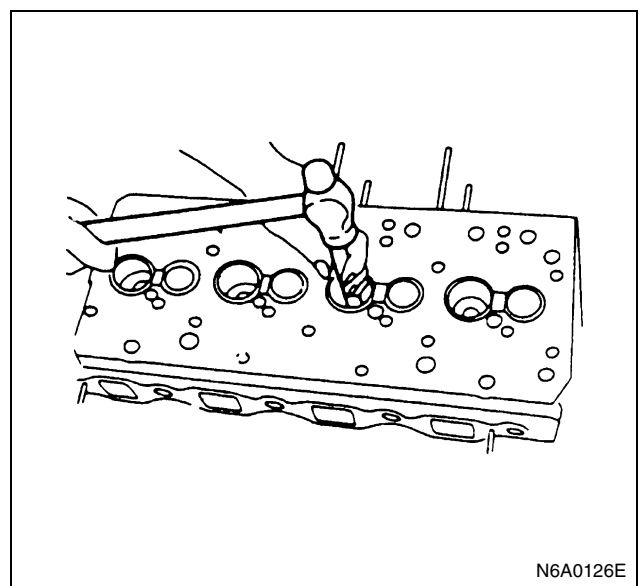
Use a hammer and the valve guide replacer to drive out the valve guide from the cylinder head lower face. Valve Guide Replacer: 5-8840-2227-0



N6A0124E

Valve Stem Outside Diameter

Measure the valve stem diameter at three points. If the measured valve is less than the specified limit, the valve and the valve guide must be replaced as a set.

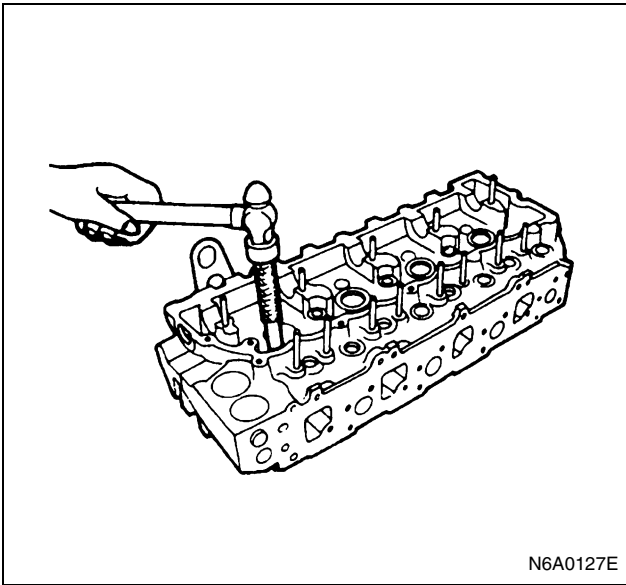


N6A0126E

Valve Guide Installation

1. Apply engine oil to the valve guide outer circumference.
2. Attach the valve guide installer to the valve guide. Valve Guide Replacer: 5-8840-2227-0

- Use a hammer to drive the valve guide into position from the cylinder head upper face.

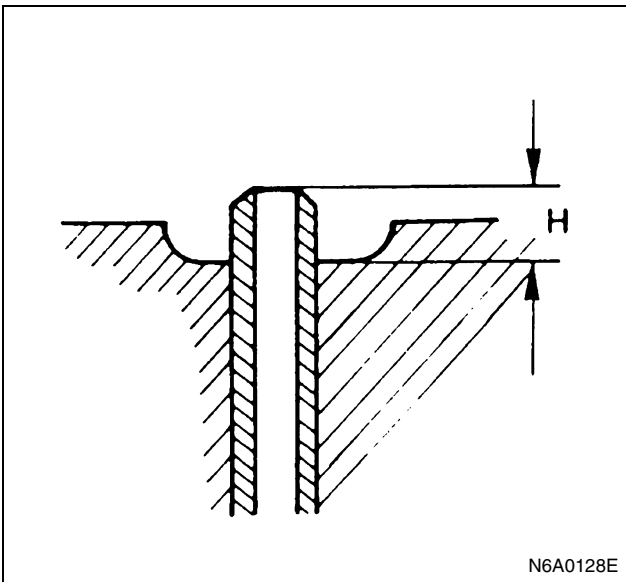


- Measure the height (H) of the valve guide upper end from the cylinder head upper face.

Valve Guide Upper End Height (H)	mm (in)
14.1 ± 0.2 (0.555 ± 0.008)	

Notice:

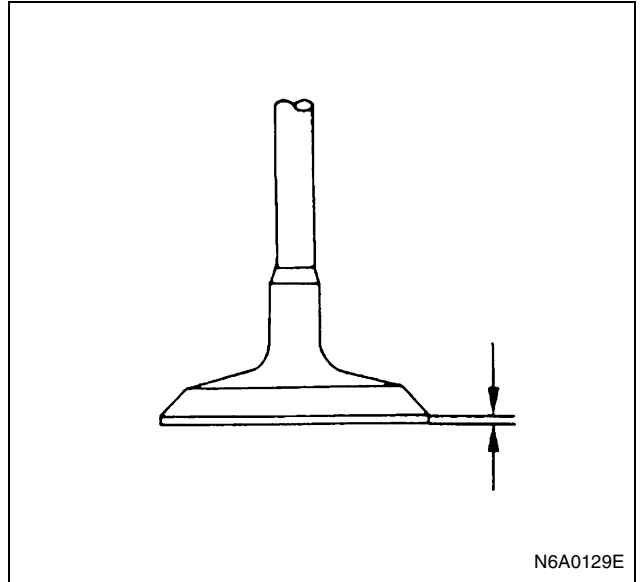
If the valve guide has been removed, both the valve and the valve guide must be replaced as a set.



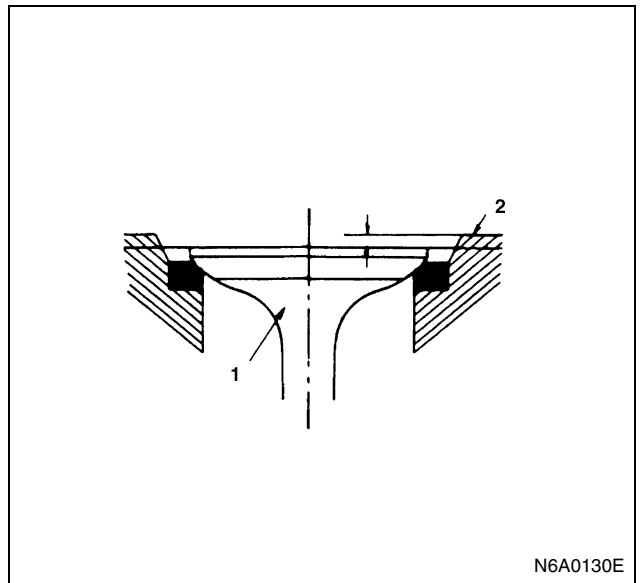
**Valve and Valve Seat Insert
Valve Thickness and Depression**

- Measure the valve thickness.
If the measured value is less than the specified limit, the valve and the valve seat insert must be replaced as a set.

Intake and Exhaust Valve Thickness		mm (in)
Valve	Nominal Size	Limit
Inlet	1.8 (0.071)	1.3 (0.051)
Exhaust	1.75 (0.069)	1.3 (0.051)



- Install the new valve (1) to the cylinder head (2).



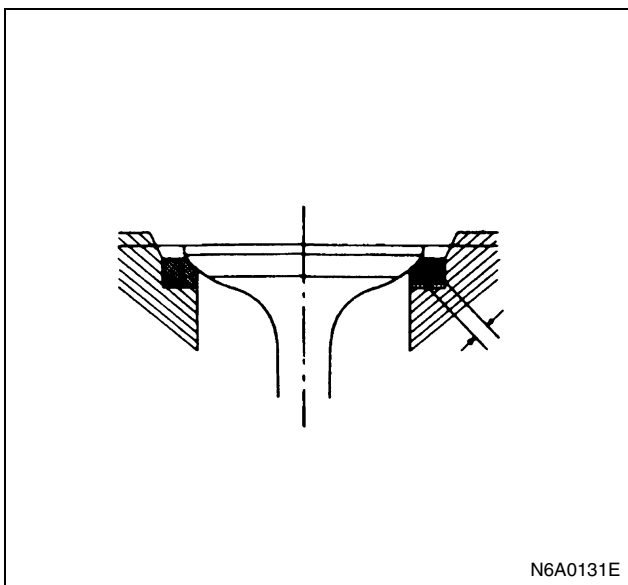
- Use a depth gauge or a straight edge with steel rule to measure the valve depression from the cylinder head lower surface.
If the measured value exceeds the specified limit, the valve seat insert and/or the valve must be replaced.

Intake and Exhaust Valve Depression		mm (in)
Standard	Limit	
0.7 — 1.2 (0.028 — 0.047)	2.5 (0.098)	

Valve Contact Width

1. Check the valve contact faces for roughness and unevenness.
Make smooth the valve contact surfaces.
2. Measure the valve contact width.
If the measured value exceeds the specified limit, the valve seat insert must be corrected or replaced.

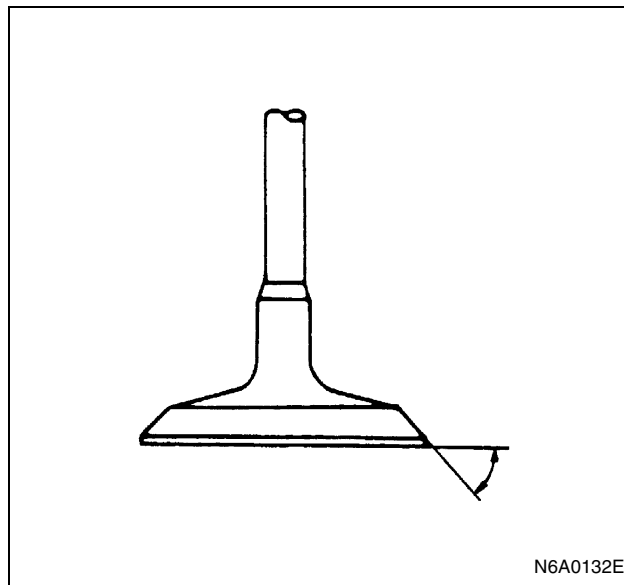
Valve Contact Width		mm (in)
Valve	Nominal Size	Limit
Intake	2.5 (0.098)	3.0 (0.118)
Exhaust	2.0 (0.079)	2.5 (0.098)



Contact Surface Angle on Valve Seat on Valve

1. Measure contact surface angle on valve seat.
2. If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

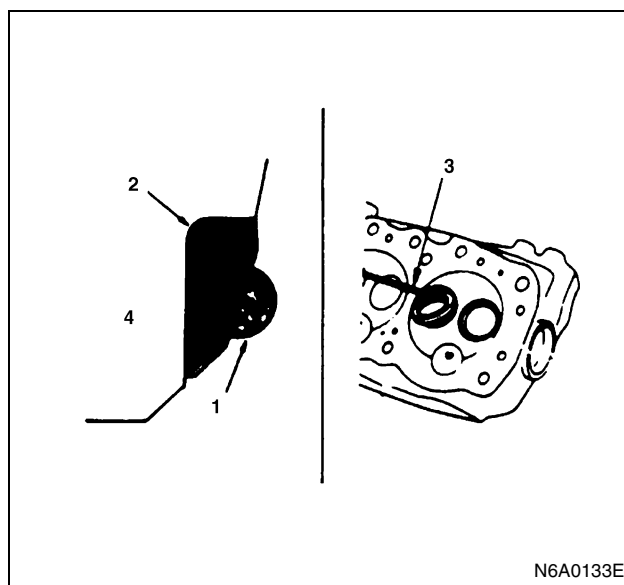
Standard	Degrees
	45°



Valve Seat Insert Replacement

Valve Seat Insert Removal

1. Arc weld the entire inside circumference (1) of the valve seat insert (2).
2. Allow the valve seat insert to cool for a few minutes. This will invite contraction and make removal of the valve seat insert easier.
3. Use a screwdriver (3) to pry the valve seat insert free. Take care not to damage the cylinder head (4).
4. Carefully remove carbon and other foreign material from the cylinder head insert bore.



Valve Seat Insert Installation

1. Carefully place the attachment (1) (having a smaller outside diameter than the valve seat insert) on the valve seat insert (2).

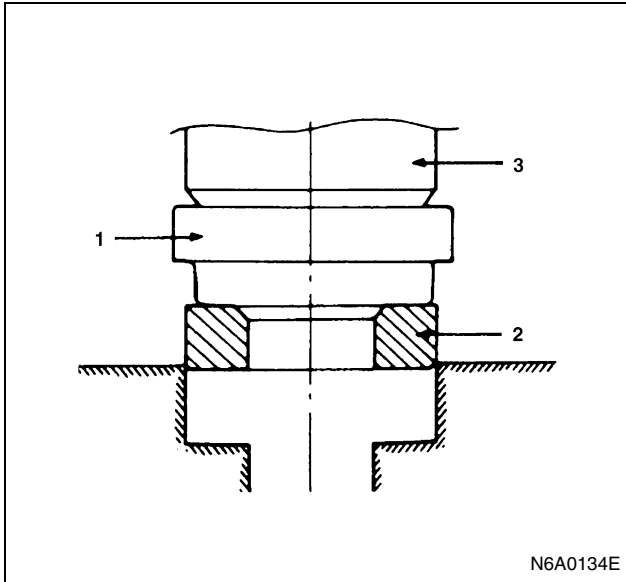
Notice:

The smooth side of the attachment must contact the valve seat insert.

- Use a bench press (3) to gradually apply pressure to the attachment and press the valve seat insert into place.

Caution:

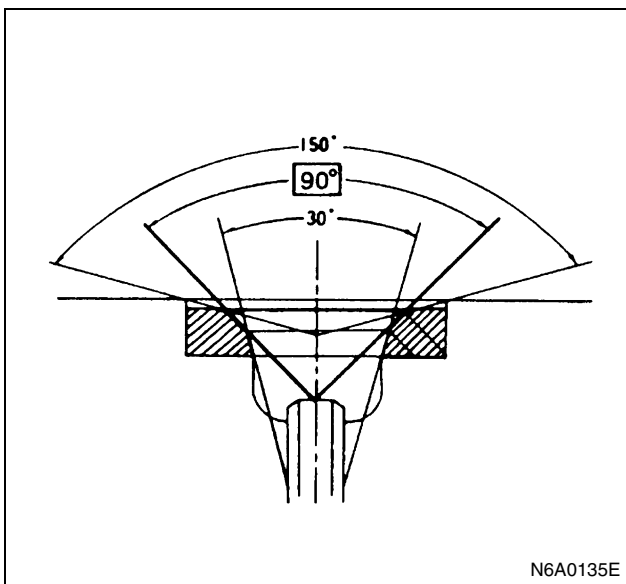
Do not apply an excessive amount of pressure with the bench press. Damage to the valve seat insert will result.



- The valve should be lapped before final assembly to ensure a good valve seal. Above works refer to "Valve Seat Insert Correction" section in this manual.

Valve Seat Insert Correction

- Remove the carbon from the valve seat insert surface.
- Use a valve cutter (15°, 45°, and 75° blades) to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

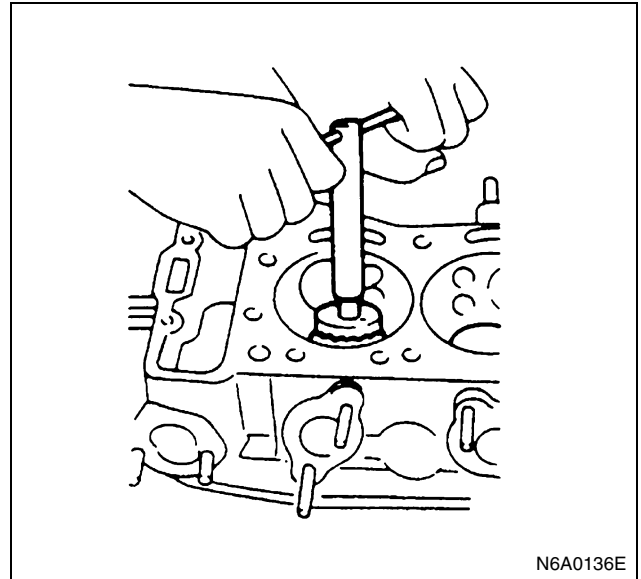


Valve Seat Angle	Degrees
	45°

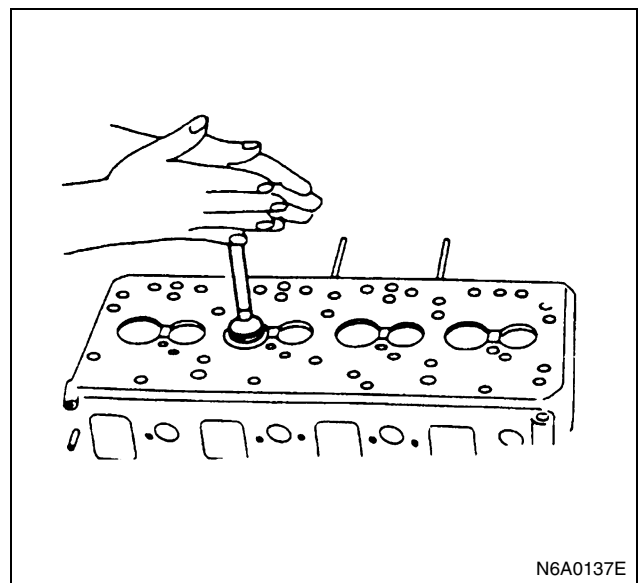
Notice:

Use an adjustable valve cutter pilot.

Do not allow the valve cutter pilot to wobble inside the valve guide.



- Apply abrasive compound to the valve seat insert surface.
- Insert the valve into the valve guide.
- Turn the valve while tapping it to fit the valve seat insert.



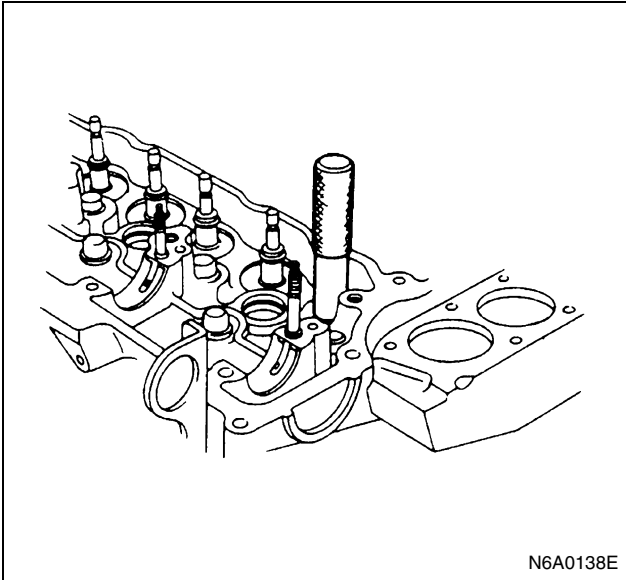
- Check to see if the valve contact width is correct.
- Check to see if the valve seat insert surface is in contact with the entire circumference of the valve.

Reassembly

- Spring Lower Seat

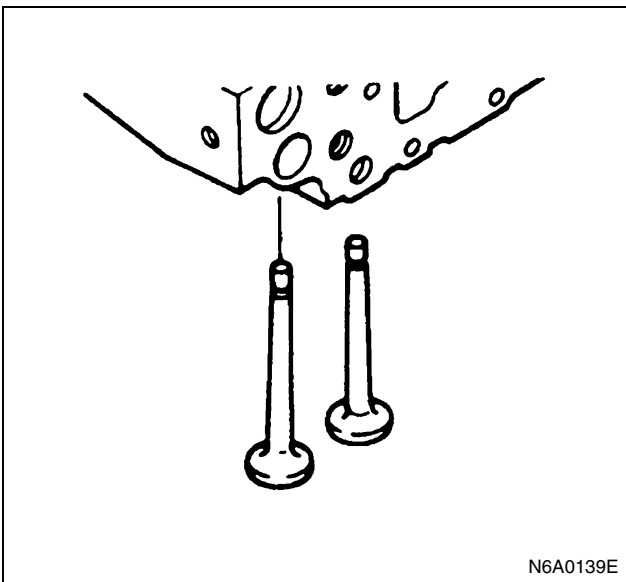
2. Valve Guide Seal

- 1) Apply a coat of engine oil to the valve guide seal inner face.
- 2) Use a valve guide seal installer to install the valve guide seal to the valve guide
Valve Guide Seal Installer: 8-9439-6815-0



3. Intake and Exhaust Valve

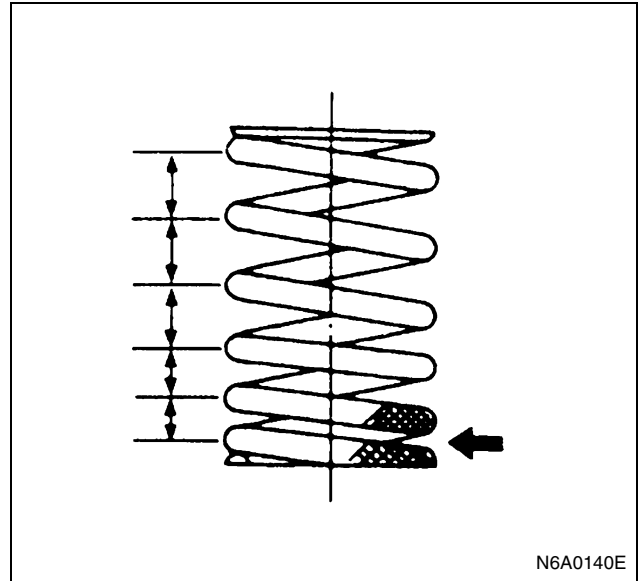
- 1) Apply a coat of engine oil to each valve stem before installation.
- 2) Install the intake and exhaust valve.



- 3) Turn the cylinder head up to install the valve spring. Take care not to allow the installed valves to fall free.

4. Valve Spring

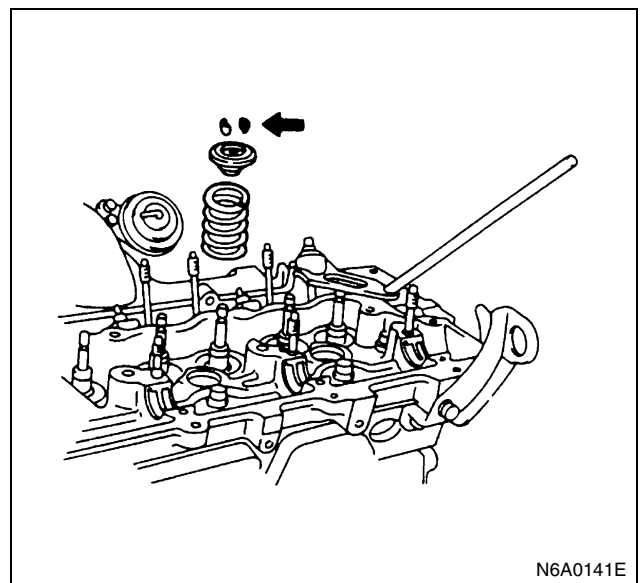
Install the valve spring with its fine pitched (or painted) end side down.



5. Spring Upper Seat

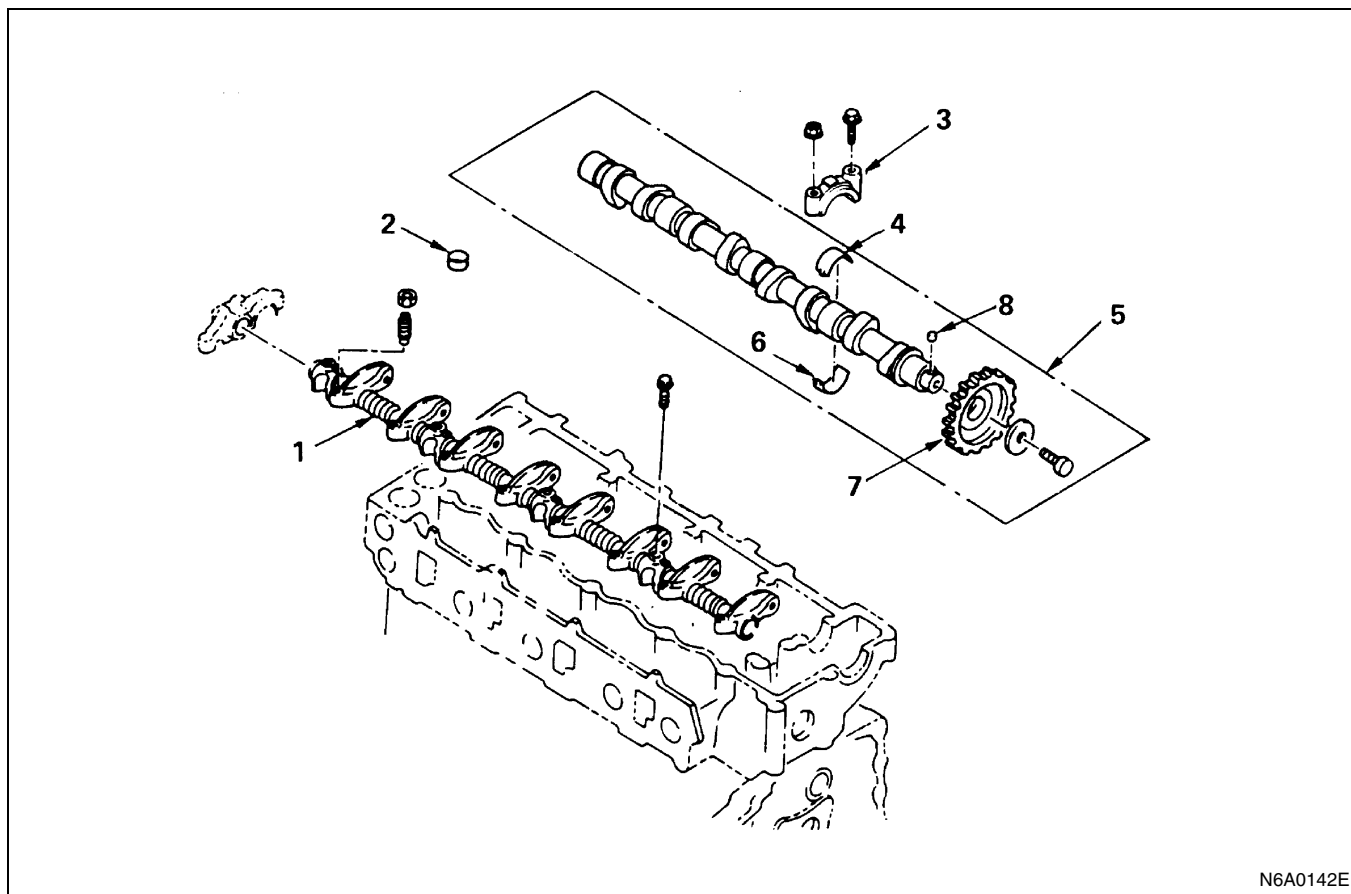
6. Cotter Collar

- 1) Use the valve spring compressor to push the valve spring into position.
Valve Spring Compressor: 5-8840-2228-0
- 2) Install the cotter collar to the valve stem.
- 3) Set the cotter collar by tapping around the head of the collar with a rubber hammer.



CAMSHAFT

Component

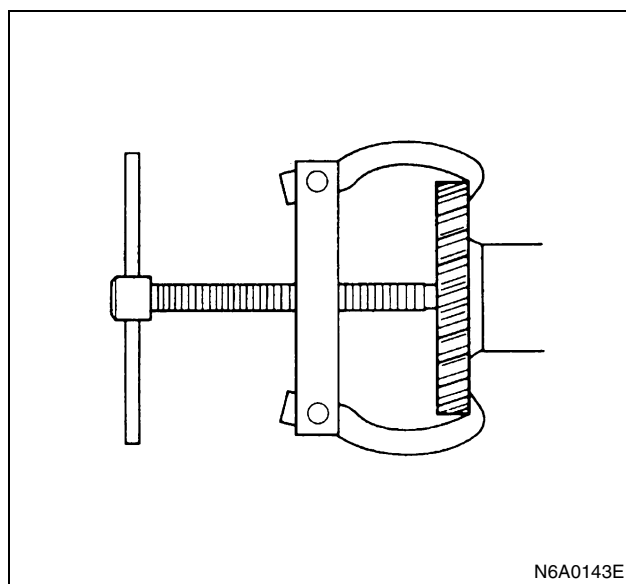


Legend

- | | |
|------------------------------|---------------------------|
| 1. Rocker arm shaft assembly | 5. Camshaft assembly |
| 2. Valve cap | 6. Camshaft bearing lower |
| 3. Camshaft bearing cap | 7. Camshaft gear |
| 4. Camshaft bearing upper | 8. Key |

Disassembly

1. Rocker Arm Shaft Assembly
2. Valve Cap
3. Camshaft Bearing Cap
4. Camshaft Bearing Upper
5. Camshaft Assembly
6. Camshaft Bearing Lower
Above works refer to "CYLINDER HEAD" section in this manual.
7. Camshaft Gear
Use the universal puller to pull out the camshaft gear.
Universal puller: 5-8840-2027-0/5-8840-0086-0
8. Key



Inspection and Repair

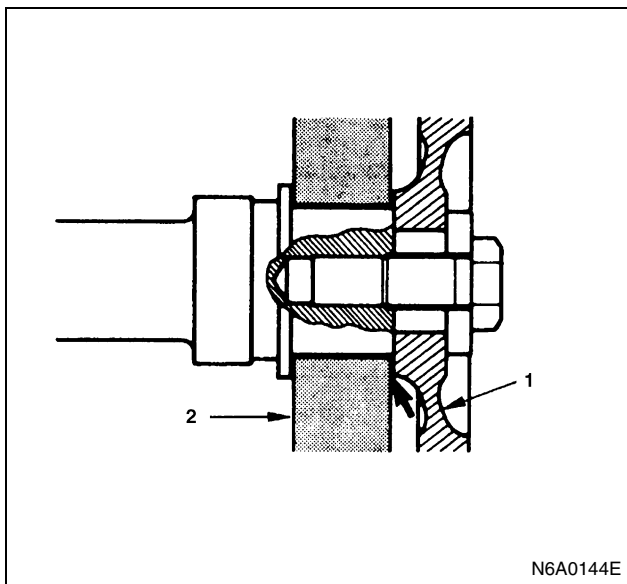
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Camshaft End Play

Use a thickness gauge to measure the clearance between the camshaft gear (1) and the camshaft bracket (2).

If the measured value exceeds the specified limit, the camshaft gear or the camshaft must be replaced.

Camshaft End Play		mm (in)
Standard	Limit	
0.085 — 0.205 (0.0033 — 0.0081)	0.25 (0.0098)	

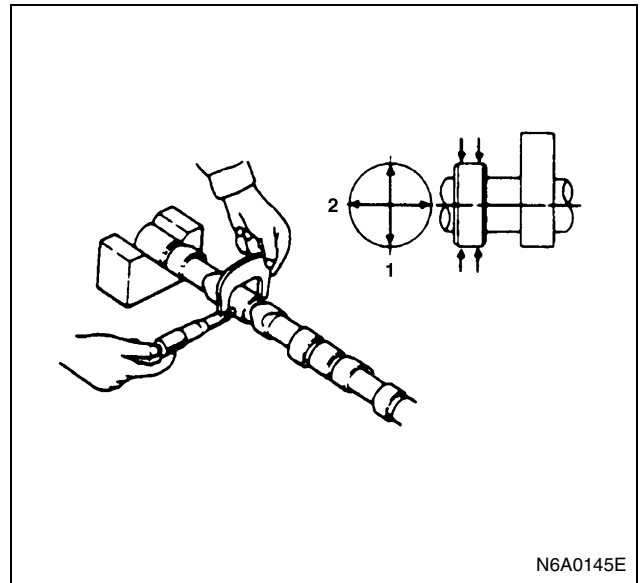


N6A0144E

Camshaft Journal Diameter

Use a micrometer to measure each camshaft journal diameter in two directions ((1) and (2)). If the measured value is less than the specified limit, the camshaft must be replaced.

Camshaft Journal Diameter		mm (in)
Standard	Limit	
39.950 — 39.975 (1.5728 — 1.5738)	39.850 (1.569)	

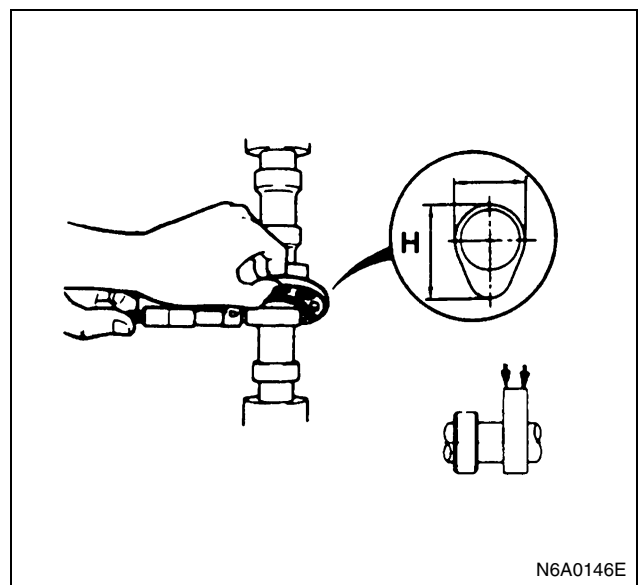


N6A0145E

Cam Height

Measure the cam height "H" with a micrometer. If the measured value is less than the specified limit, the camshaft must be replaced.

Cam Height "H"			mm (in)
Engine model	Standard	Limit	
Except 4HE1-TC	52.8 (2.078)	51.8 (2.039)	
4HE1-TC	53.6 (2.110)	52.6 (2.071)	

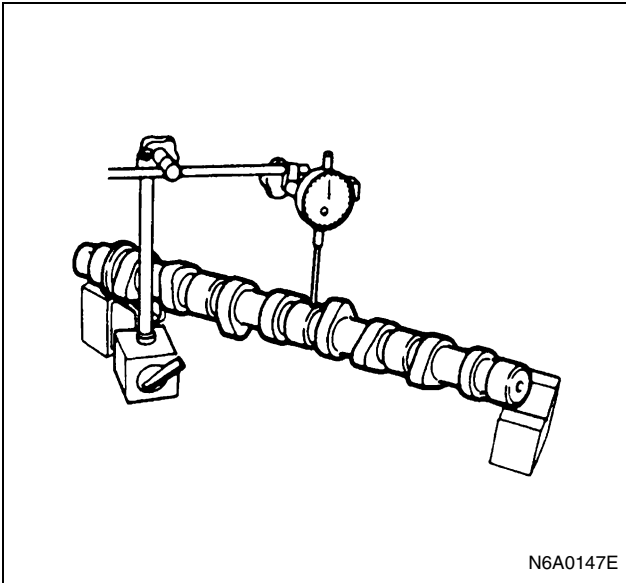


N6A0146E

Camshaft Run-Out

1. Mount the camshaft on V-blocks.
2. Measure the run-out with a dial indicator. If the measured value exceeds the specified limit, the camshaft must be replaced.

Camshaft Run-Out		mm (in)
Limit	0.05 (0.002)	



N6A0147E

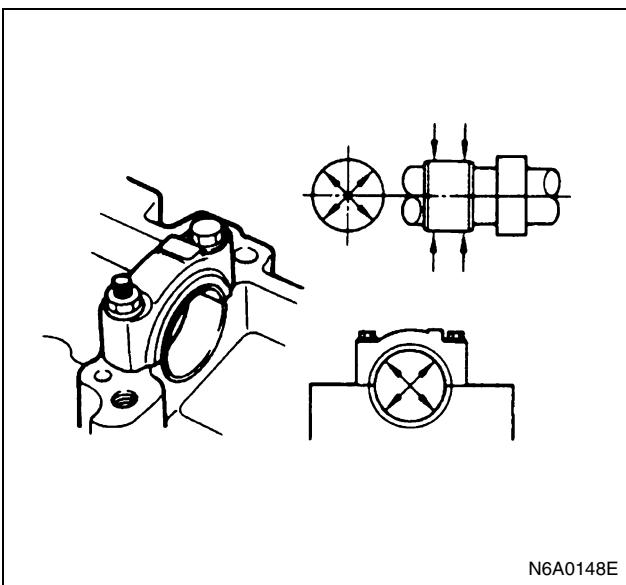
Camshaft and Camshaft Bearing Clearance

Use an inside dial indicator to measure the camshaft bearing inside diameter.

Camshaft Bearing Inside Diameter		mm (in)
Standard	40.000 — 40.037 (1.5748 — 1.5763)	

If the clearance between the camshaft bearing inside diameter and the journal exceeds the specified limit, the camshaft bearing must be replaced.

Camshaft Bearing Clearance		mm (in)
Standard	Limit	
0.025 — 0.087 (0.00098 — 0.00343)	0.15 (0.0059)	



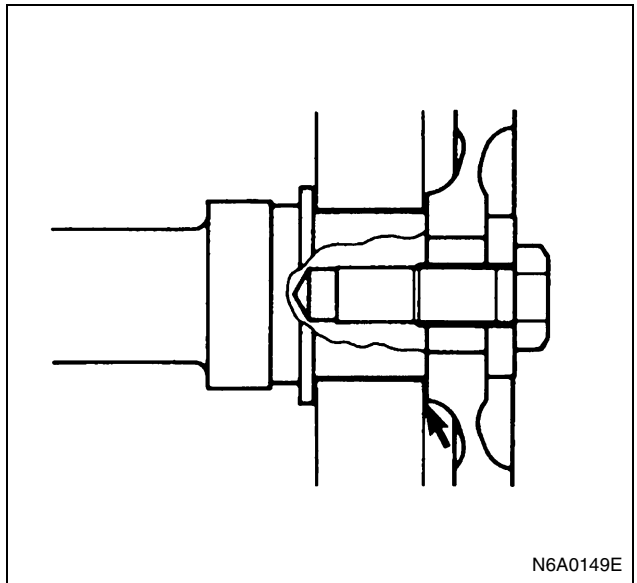
N6A0148E

Reassembly

1. Key
2. Camshaft Gear
 - With the projection of the camshaft gear center boss turned to the camshaft side, set it to the knock pin and install the camshaft gear.

Tighten:

Camshaft gear bolt to 142 N·m (14.5 kg·m / 105 lb·ft)

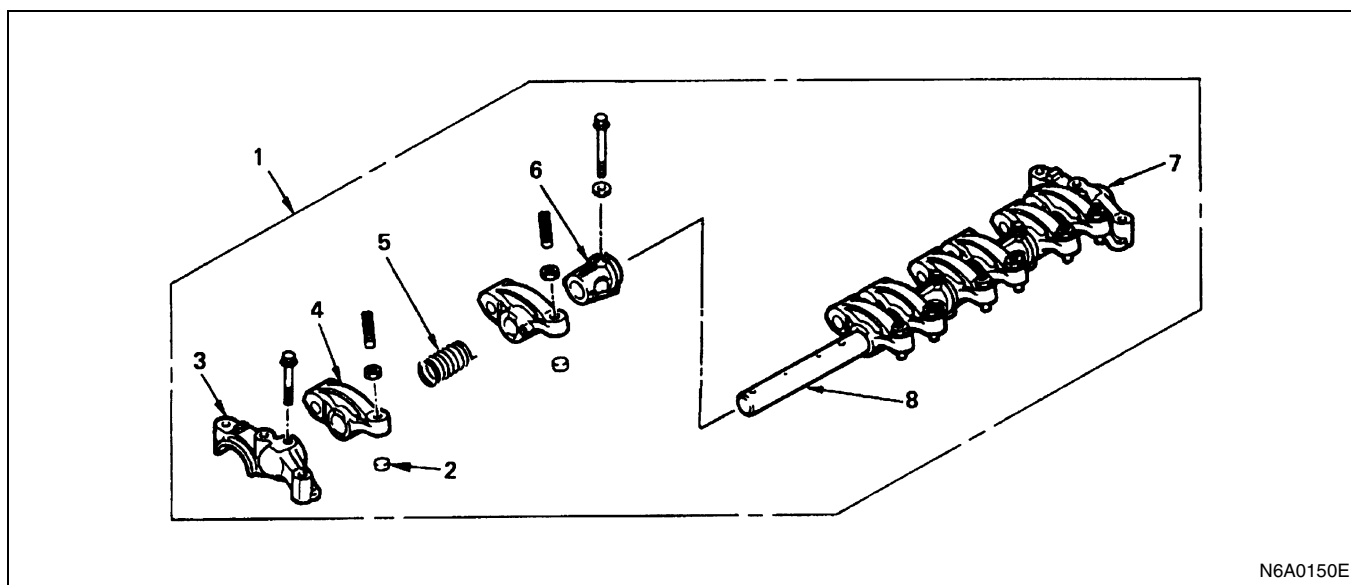


N6A0149E

3. Camshaft Bearing Lower
 4. Camshaft Assembly
 5. Camshaft Bearing Upper
 6. Camshaft Bearing Cap
 7. Valve Cap
 8. Rocker Arm Shaft Assembly
- Above works refer to "CYLINDER HEAD" section in this manual.

ROCKER ARM ASSEMBLY

Component



N6A0150E

Legend

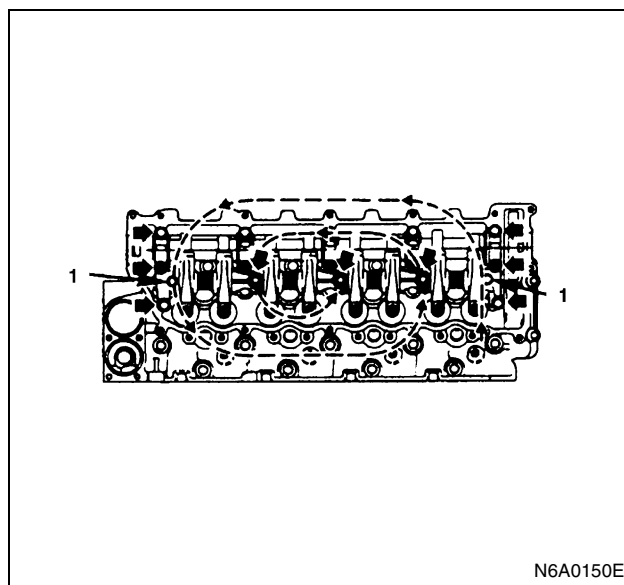
- | | |
|------------------------------|-----------------------|
| 1. Rocker arm shaft assembly | 5. Spring |
| 2. Valve cap | 6. Rocker arm bracket |
| 3. Camshaft bracket | 7. Camshaft bracket |
| 4. Rocker arm | 8. Rocker arm shaft |

Disassembly

1. Rocker Arm Shaft Assembly
 - 1) Loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time and remove the rocker arm shaft assembly with the camshaft brackets.
 - 2) Leave the (1) indicated bolt unremoved on this occasion, since it is the rocker arm fixing bolt.

Caution:

Failure to loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time will adversely affect the rocker arm shaft.



N6A0150E

2. Valve Cap

Caution:

Take sufficient care not to let the valve caps fall into the gear case or oil return hole.

3. Camshaft Bracket
4. Rocker Arm
5. Spring
6. Rocker Arm Bracket
7. Camshaft Bracket

8. Rocker Arm Shaft

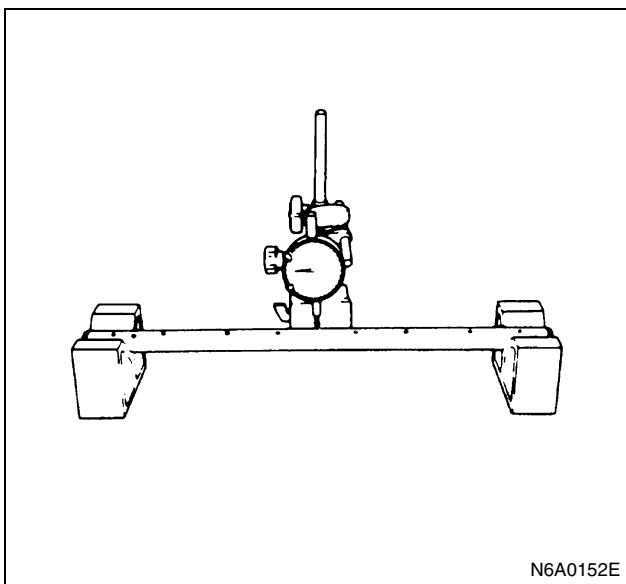
Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Rocker Arm Shaft Run-Out

- 1) Place the rocker arm shaft on V-blocks.
- 2) Use a dial indicator to measure the rocker arm shaft central portion run-out.
If the run-out is very slight, correct the rocker arm shaft run-out with a bench press. The rocker arm must be at cold condition.
If the measured rocker arm shaft run-out exceeds the specified limit, the rocker arm shaft must be replaced.

Rocker Arm Shaft Run-Out		mm (in)
Limit		0.3 (0.012)



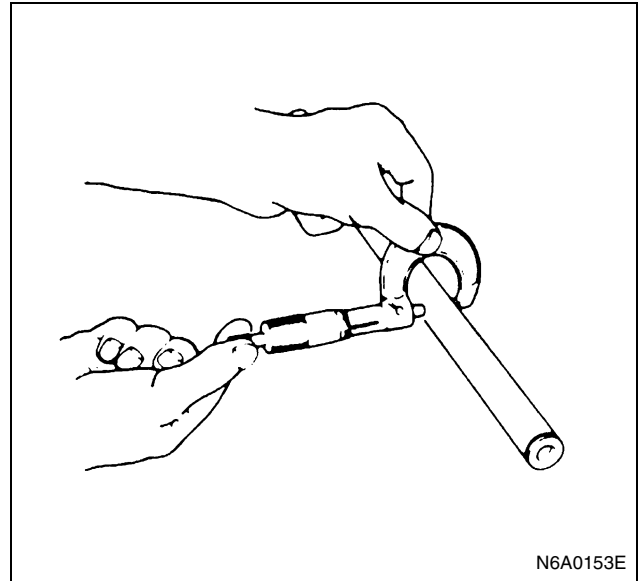
N6A0152E

Rocker Arm Shaft Outside Diameter

Use a micrometer to measure the rocker arm fitting portion outside diameter.

If the measured value is less than the specified limit, the rocker arm shaft must be replaced.

Rocker Arm Shaft Outside Diameter		mm (in)
Standard	Limit	
21.979 — 22.000 (0.8653 — 0.8661)	21.85 (0.8602)	



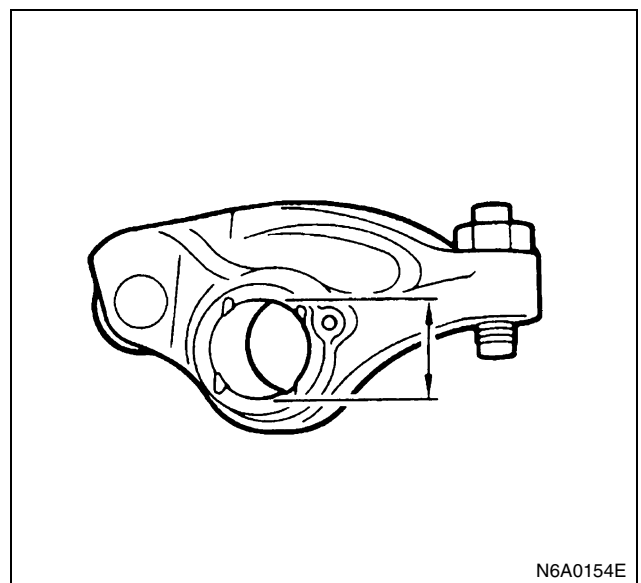
N6A0153E

Rocker Arm Bushing Inside Diameter

Use either a vernier caliper or a dial indicator to measure the rocker arm bushing inside diameter.

Rocker Arm Bushing Inside Diameter		mm (in)
Standard	Limit	
22.010 — 22.035 (0.8665 — 0.8675)	22.15 (0.8720)	

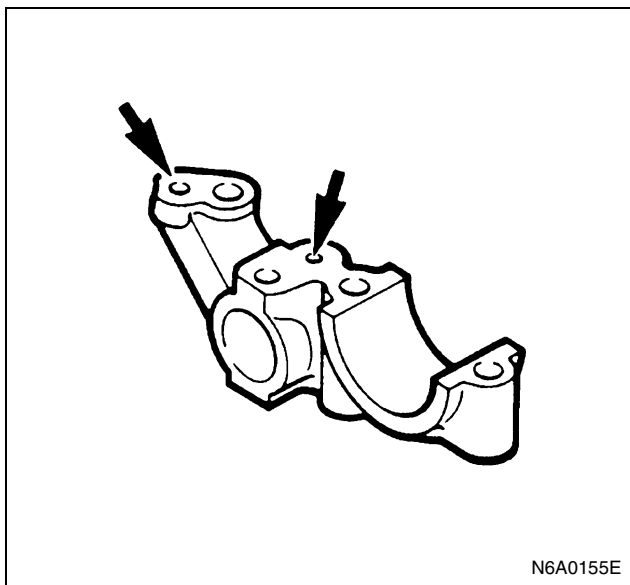
Rocker Arm and Rocker Arm Shaft Clearance		mm (in)
Standard	Limit	
0.010 — 0.056 (0.0004 — 0.0022)	0.2 (0.0079)	



N6A0154E

Check to see if the rocker arm oil port is free of obstructions.

If necessary, use compressed air to clean the rocker arm oil port.



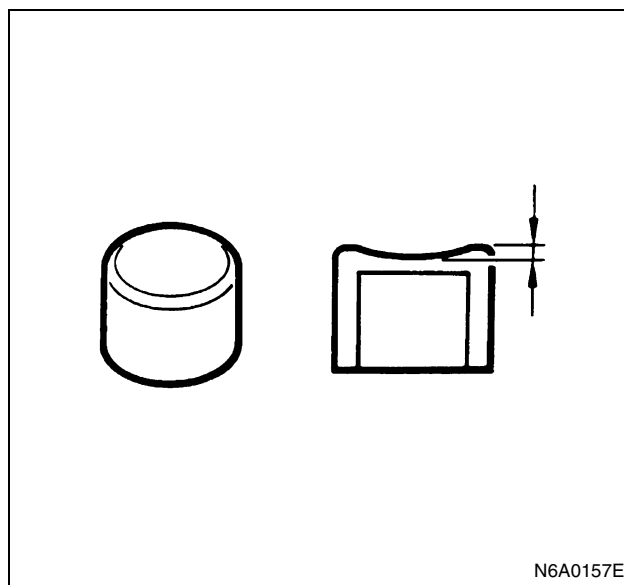
Legend

- 1. Roller
- 2. Depth gauge

Valve Cap Wear

Inspect the valve cap surface contacting the rocker arm using a dial gauge. If wear exceeds the limit, replace the valve cap with a new one.

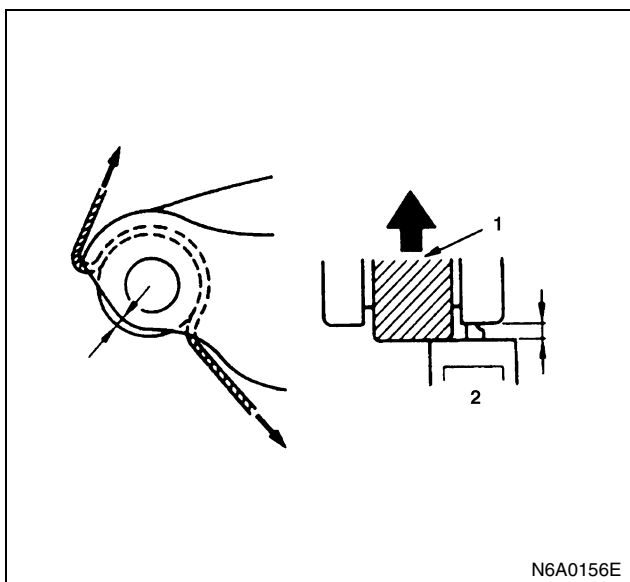
Valve Cap Worn		mm (in)
Limit		0.1 (0.004)



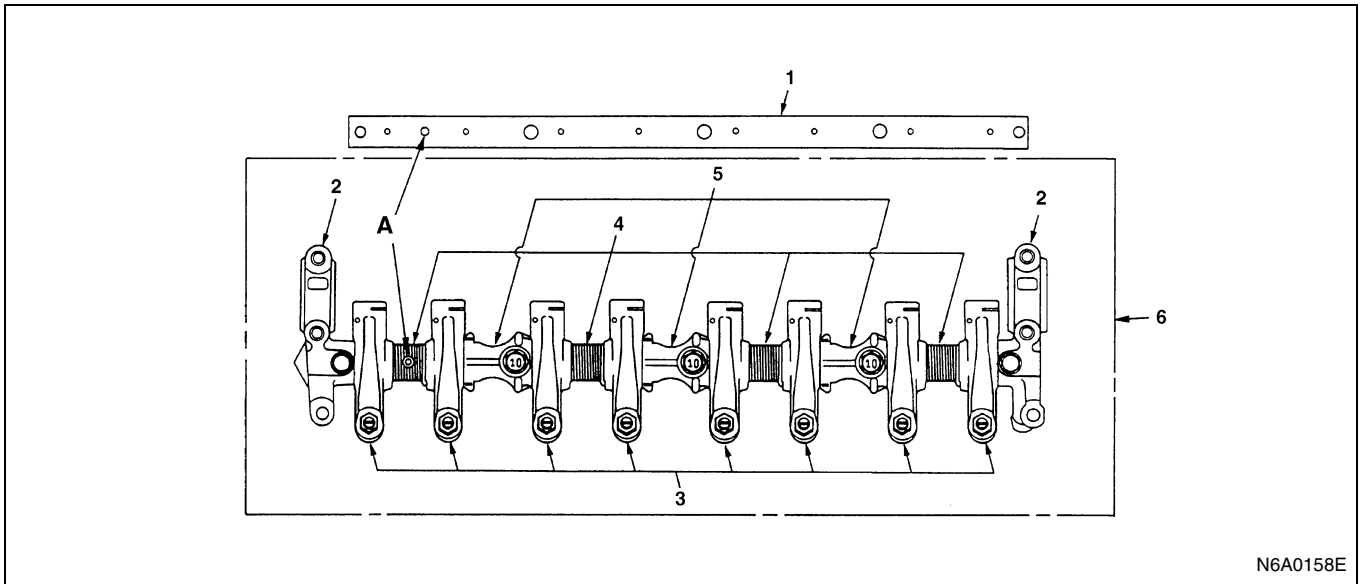
Rocker Arm Roller and Rocker Arm Pin

1. Pass a string through the rocker arm-roller clearance and measure the roller protrusion while pulling both ends of the string in the arrow-indicated directions to push out the roller.
2. Mark the measuring point and draw out the string. Measure the roller protrusion again while the roller is pushed in.
3. Note the difference in the above measurements is the standard roller-rocker arm pin clearance. Should the clearance exceed the limit, replace the rocker arm.

Rocker Arm Roller and Pin Clearance		mm (in)
Standard		Limit
0.040 — 0.084 (0.0016 — 0.0033)		0.5 (0.02)



Reassembly



Legend

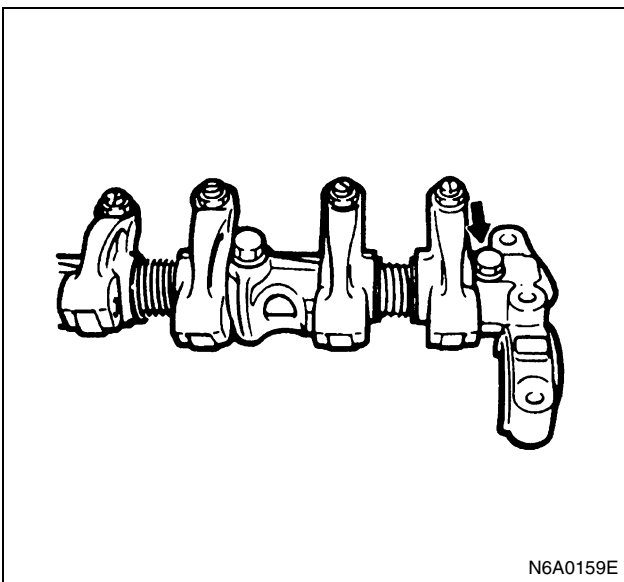
- | | |
|---------------------|-----------------------|
| A. Front mark | 4. Spring |
| 1. Rocker arm shaft | 5. Rocker arm bracket |
| 2. Camshaft bracket | 6. Valve cap |
| 3. Rocker arm | |

1. Rocker Arm Shaft

- 1) Use compressed air to thoroughly clean the rocker arm shaft oil holes.
- 2) Apply a coat of engine oil to the rocker arm shaft.
- 3) Install the rocker arm shaft with the "Front" mark facing up and toward the front of the engine.

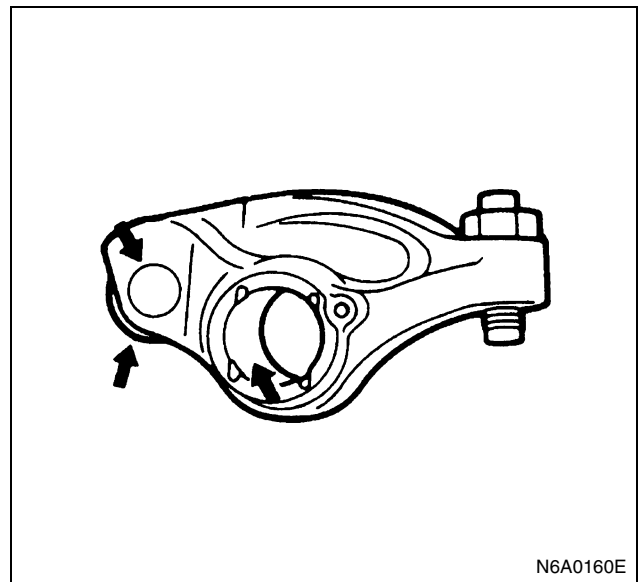
2. Camshaft Bracket

Install the camshaft bracket to the rocker arm shaft and temporarily tighten the camshaft bracket fixing bolt as shown in the illustration.



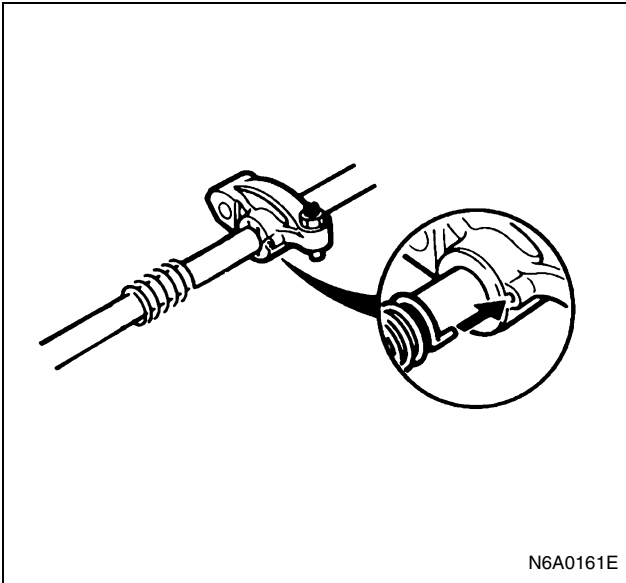
3. Rocker Arm

Apply engine oil to the rocker arm bushing and the roller pin and then install it to the rocker arm shaft.

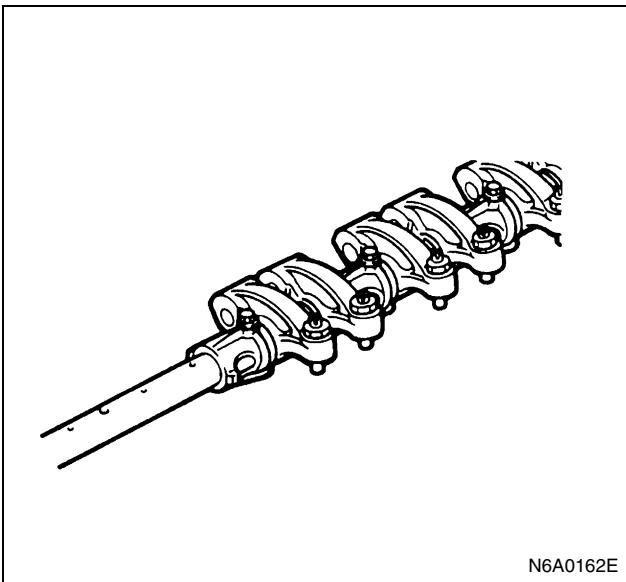


4. Spring

Insert the spring end into the rocker arm.



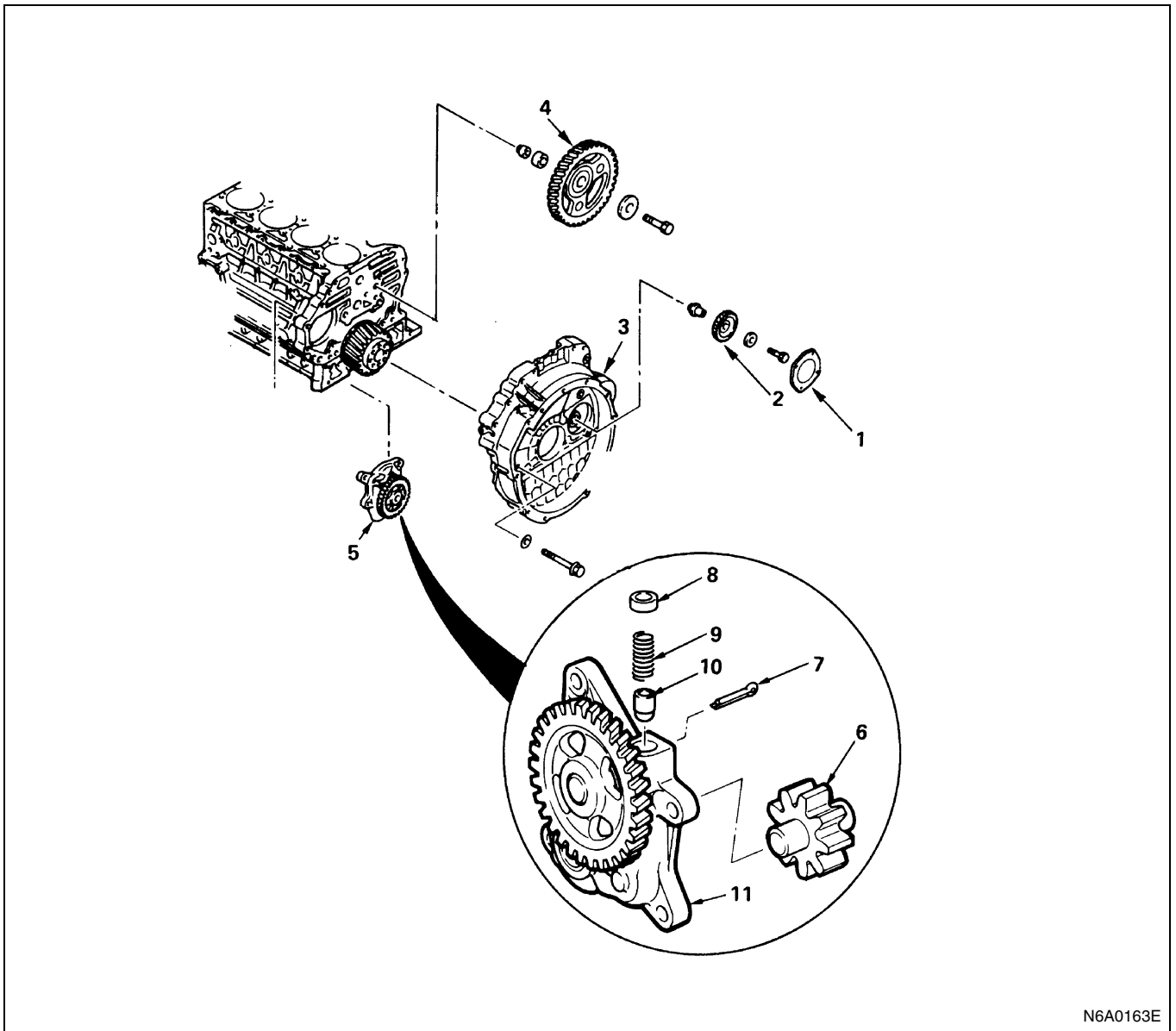
5. Rocker Arm Bracket



6. Camshaft Bracket
Temporarily tighten the camshaft bracket fixing bolt.
7. Valve Cap
8. Rocker Arm Shaft Assembly
Above works refer to "CYLINDER HEAD" section in this manual.

OIL PUMP

Component



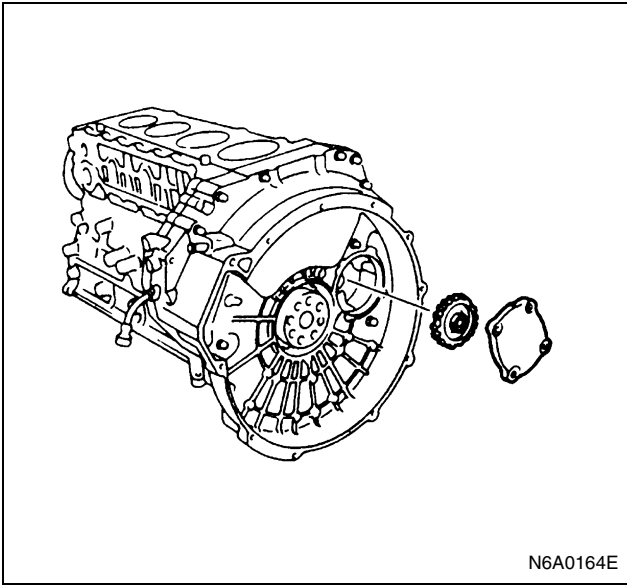
N6A0163E

Legend

- | | |
|--|----------------------------|
| 1. Power steering pump idle gear cover | 7. Cotter pin |
| 2. Power steering pump idle gear | 8. Spring seat |
| 3. Flywheel housing | 9. Oil relief valve spring |
| 4. Idle gear A | 10. Oil relief valve |
| 5. Oil pump assembly | 11. Pump cover |
| 6. Driven gear and shaft | |

Disassembly

1. Power Steering Pump Idle Gear Cover
2. Power Steering Pump Idle Gear

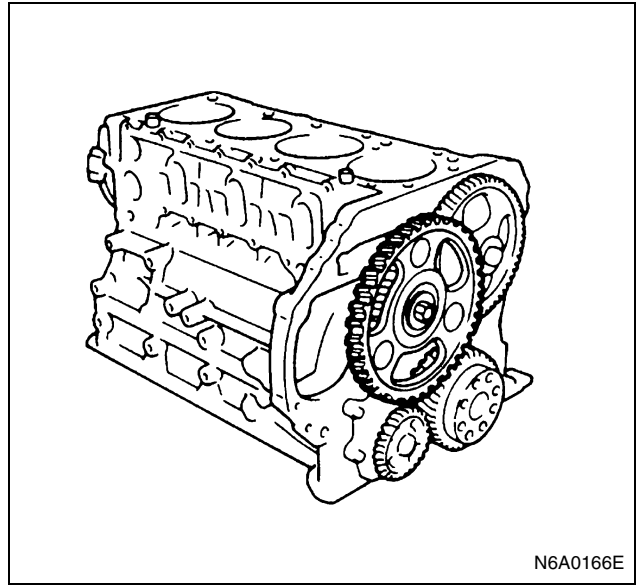


N6A0164E

3. Flywheel Housing

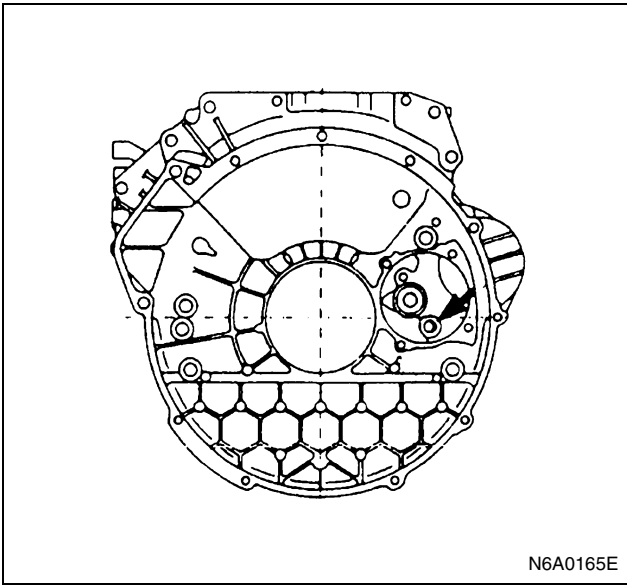
Notice:

Be careful not to fail to remove the bolts shown in the illustration.



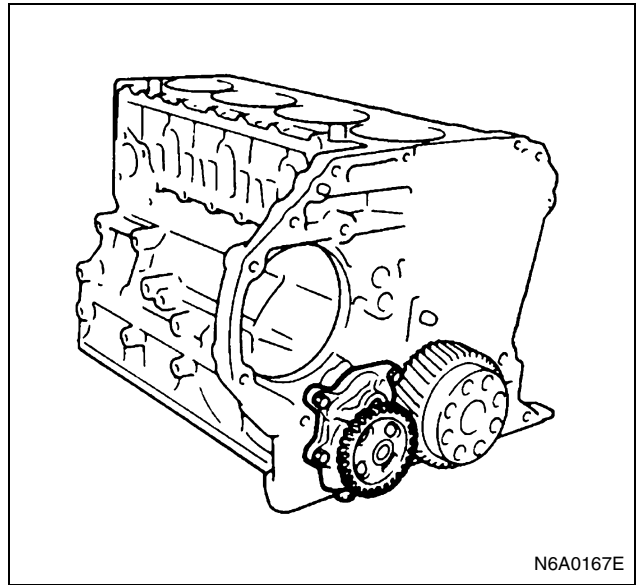
N6A0166E

5. Oil Pump Assembly



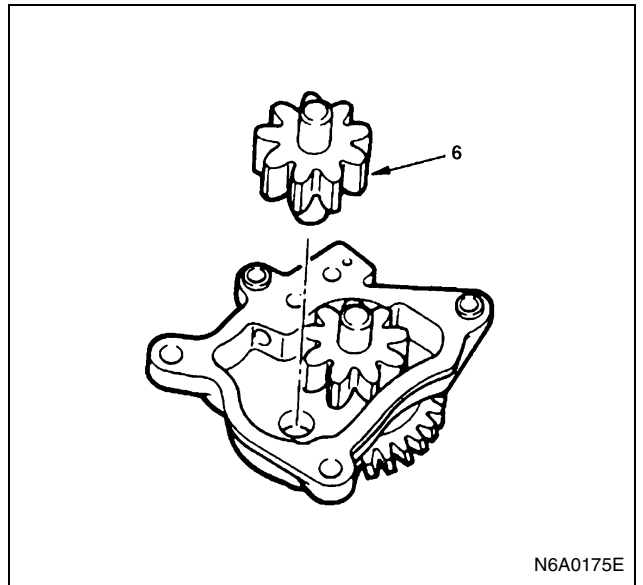
N6A0165E

4. Idle Gear A



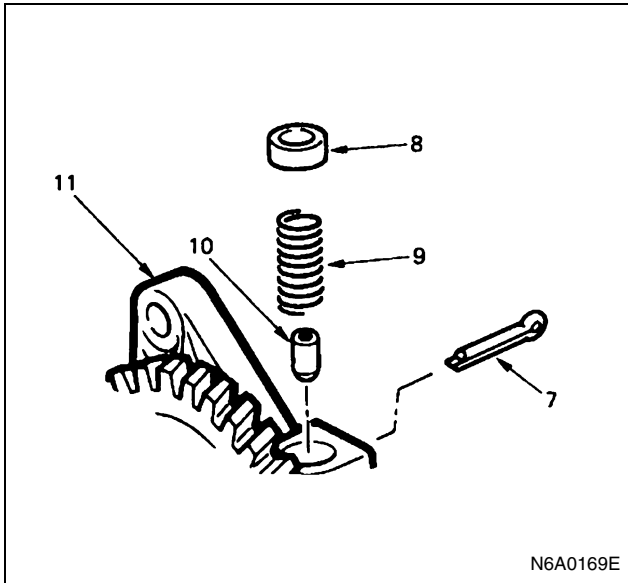
N6A0167E

6. Driven Gear and Shaft



N6A0175E

- 7. Cotter Pin
- 8. Spring Seat
- 9. Oil Relief Valve Spring
- 10. Oil Relief Valve
- 11. Pump Cover



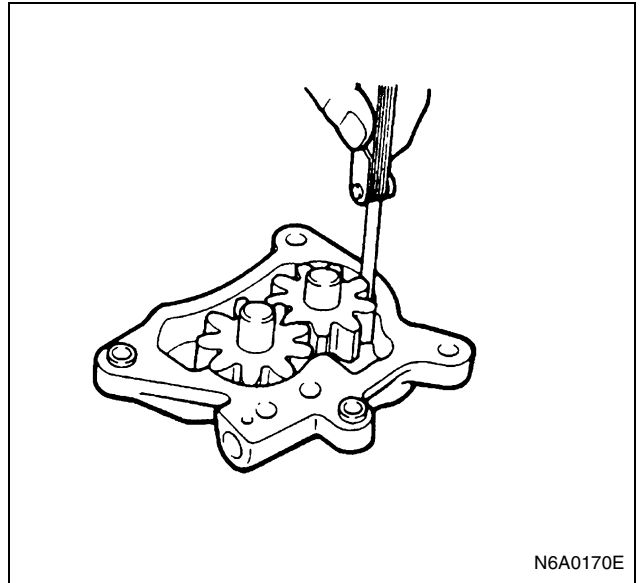
Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Gear Teeth and Cover Inner Wall Clearance

Use a feeler gauge to measure the clearance between the gear teeth and the cover inner wall. If the clearance between the gear teeth and the cover inner wall exceeds the specified limit, the oil pump assembly must be replaced.

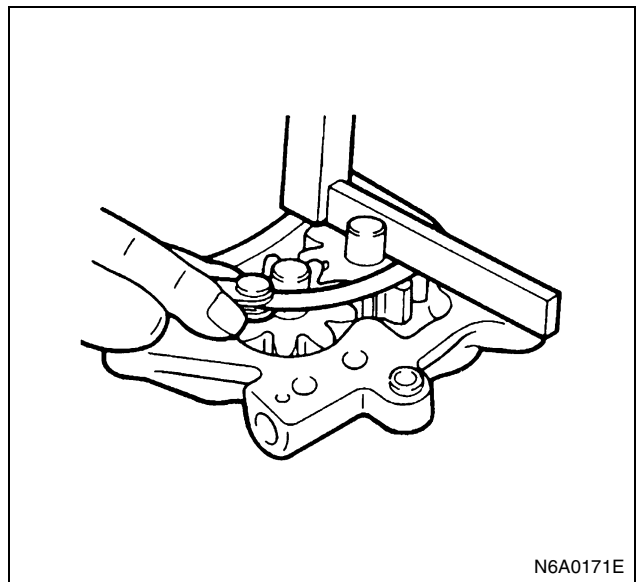
Gear Teeth and Cover Inner Wall Clearance		mm (in)
Standard	Limit	
0.125 — 0.220 (0.0049 — 0.0087)	0.3 (0.012)	



Gear and Cover Clearance

Use a feeler gauge to measure the clearance between the cover and the gear. If the clearance between the gear and the cover exceeds the specified limit, the oil pump assembly must be replaced.

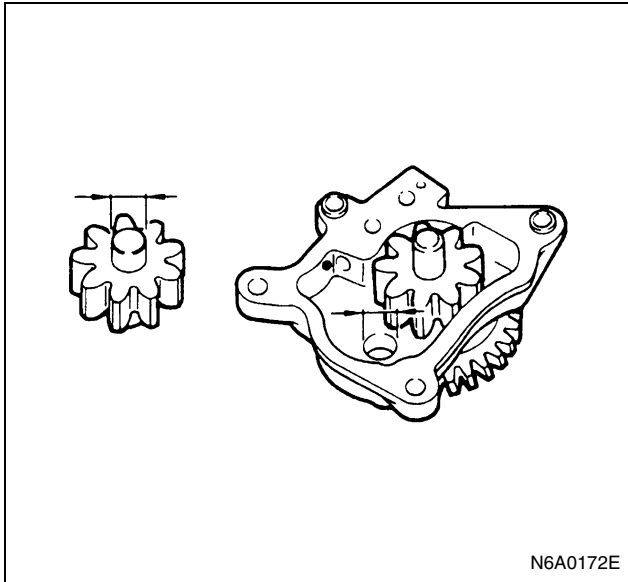
Gear and Cover Clearance		mm (in)
Standard	Limit	
0.064 — 0.109 (0.0025 — 0.0043)	0.2 (0.008)	



Driven Gear Shaft and Bushing Clearance

1. Use a micrometer to measure the gear shafts outside diameter.

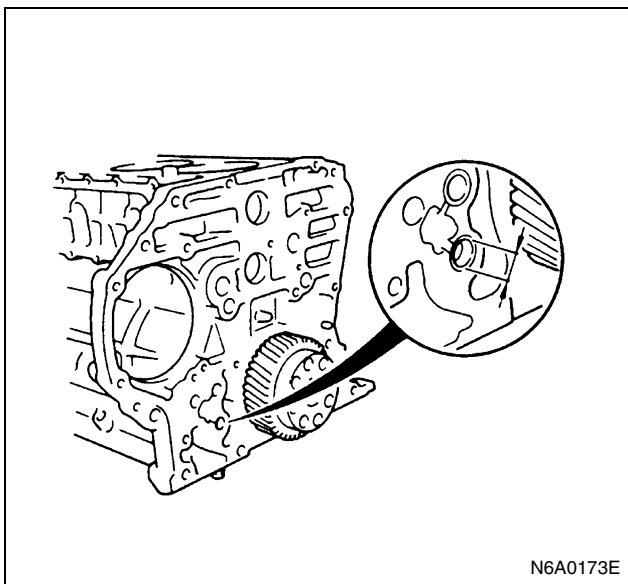
Gear Shaft Outside Diameter		mm (in)
Standard	Limit	
15.989 — 16.000 (0.6295 — 0.6299)	15.9 (0.626)	



N6A0172E

- Use an inside dial indicator or inside micrometer to measure the pump cover bushing inside diameter and the cylinder body inside diameter. If clearance between the gear shaft and the bushing exceeds the specified limit, the oil pump assembly must be replaced.

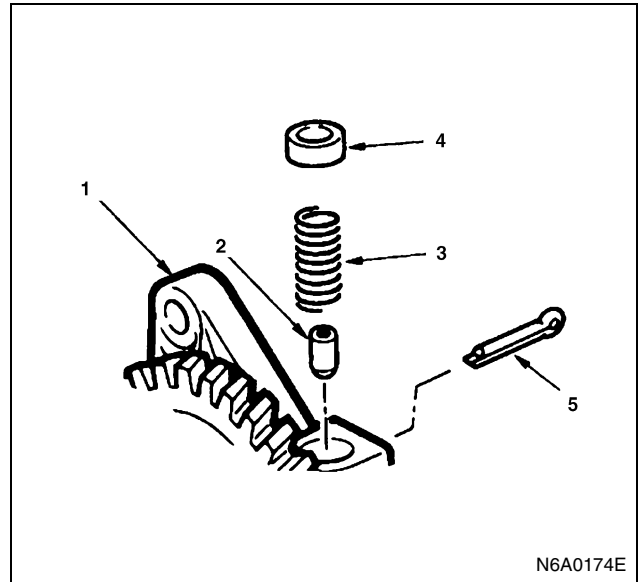
Gear Shaft and Bushing Clearance		mm (in)
Standard	Limit	
0.04 — 0.07 (0.0016 — 0.0028)	0.2 (0.012)	



N6A0173E

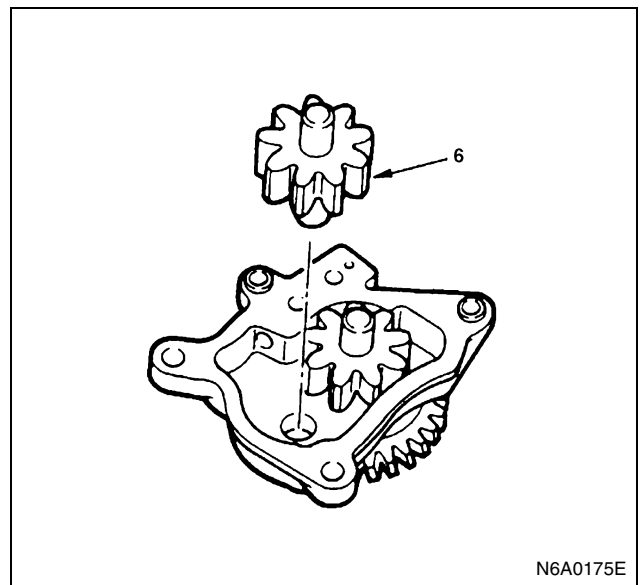
Reassembly

- Pump Cover
- Oil Relief Valve
- Oil Relief Valve Spring
- Sprig Seat
- Cotter Pin



N6A0174E

- Driven Gear and Shaft
Apply the engine oil to the driven gear shaft.

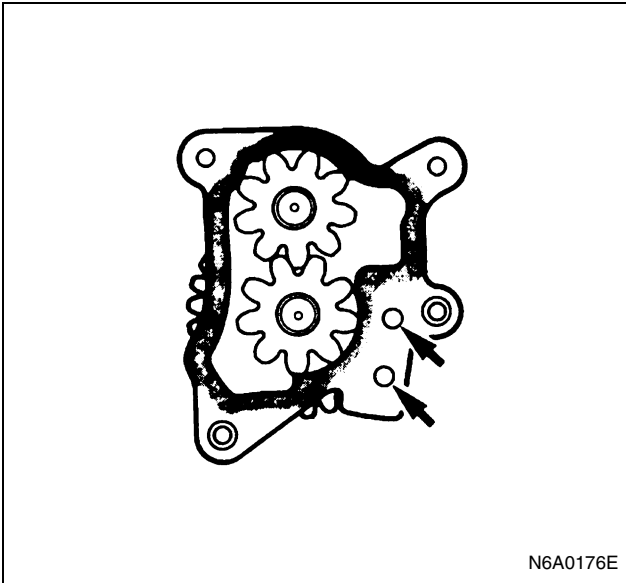


N6A0175E

- Oil Pump Assembly
 - Carefully wipe any foreign material from cylinder body rear surface.
 - Apply the recommended liquid gasket (Three Bond 1141E) or its equivalent to the shaded areas shown in the illustration.

Caution:

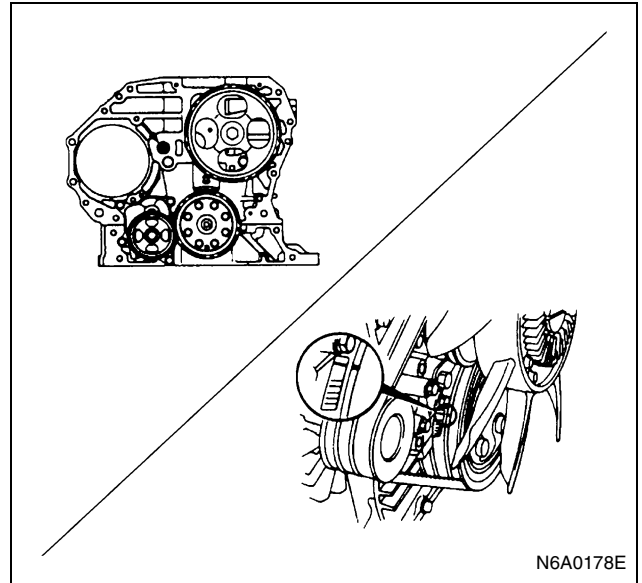
Be careful that no liquid gasket gets into the holes in the arrow-marked portion in the illustration and the inside of the oil pump cover.



- 3) Install the oil pump to the cylinder body.
- 4) Tighten the oil pump to the specified torque.

Tighten:

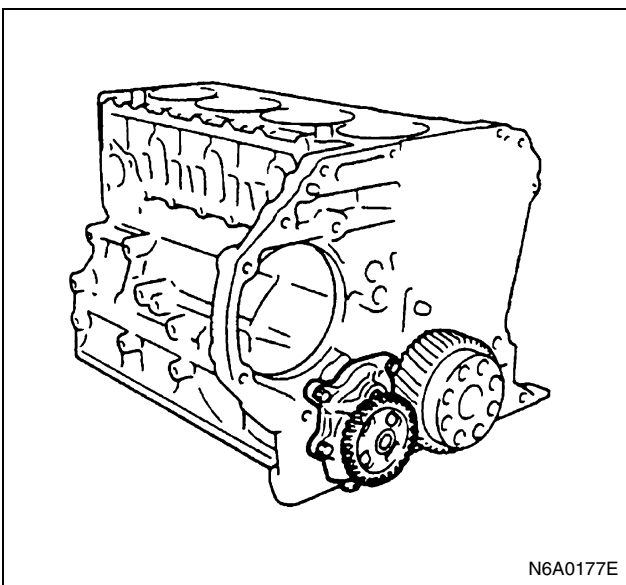
Oil pump bolt to 31 N·m (3.2 kg·m / 23 lb·ft)



- 2) Align the crankshaft gear with the engagement mark of the idle gear and install the idle gear A.

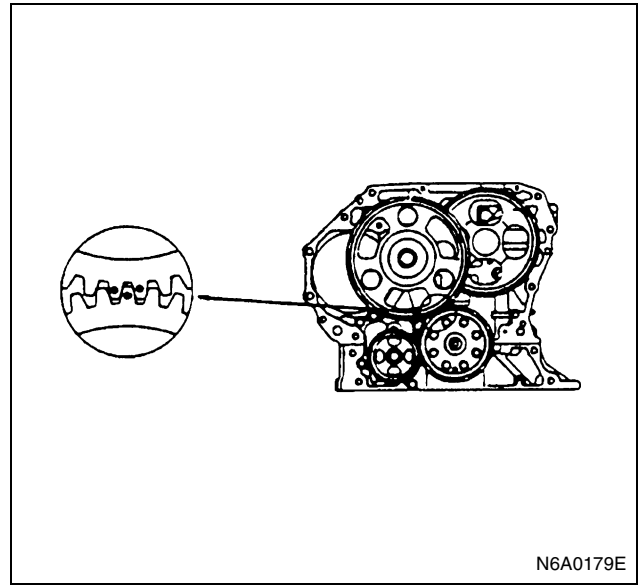
Tighten:

Idle gear A bolt to 133 N·m (13.6 kg·m / 98 lb·ft)



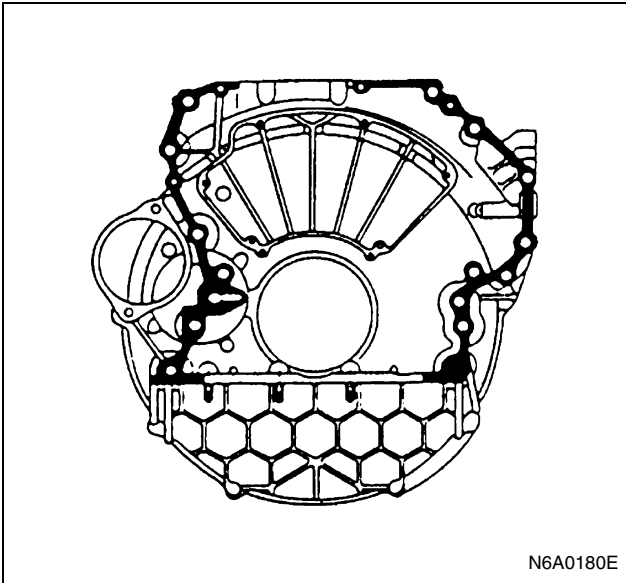
8. Idle Gear A

- 1) Turn the crankshaft clockwise so that the engagement mark of the crankshaft gear faces to the shaft center of the idle gear A and the No.1 cylinder piston comes to the top dead center.



9. Flywheel Housing

- 1) Carefully wipe any foreign material from the cylinder body rear face.
- 2) Apply the recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.

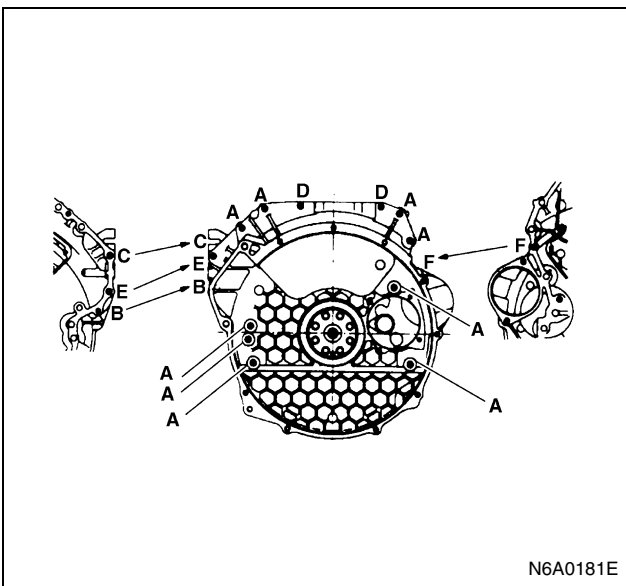


- 3) Align the cylinder body knock pins with the flywheel housing knock pin holes.
- 4) Tighten the flywheel housing bolts to the specified torque shown in the illustration.

Tighten:

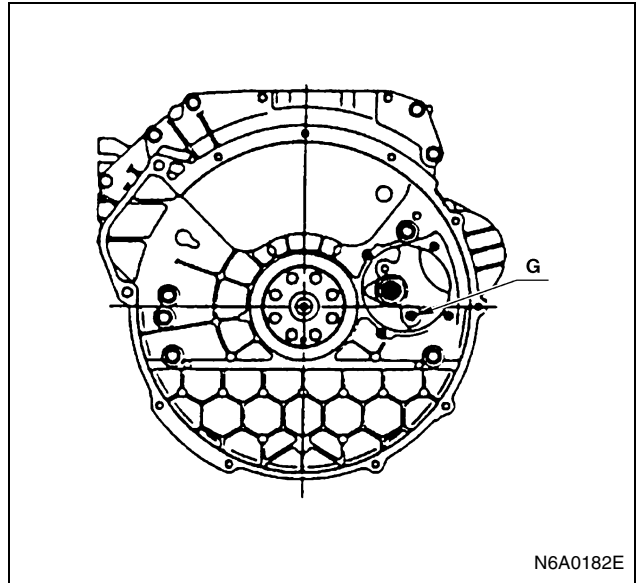
Flywheel housing bolt to

- A: 96 N·m (9.8 kg·m / 71 lb·ft)
- B: 48 N·m (4.9 kg·m / 35 lb·ft)
- C: 94 N·m (9.6 kg·m / 69 lb·ft)
- D: 25 N·m (2.6 kg·m / 19 lb·ft)
- E: 76 N·m (7.7 kg·m / 56 lb·ft)
- F: 38 N·m (3.9 kg·m / 28 lb·ft)
- Tighten the bolts marked with "E" or "B" from the injection pump side, and those with "F" from the cylinder body side.



Tighten:

Flywheel housing bolt (G) to 96 N·m (9.8 kg·m / 71 lb·ft)

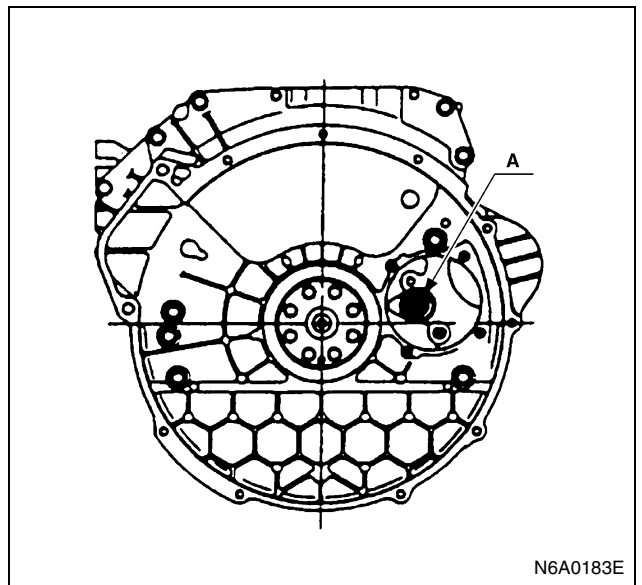


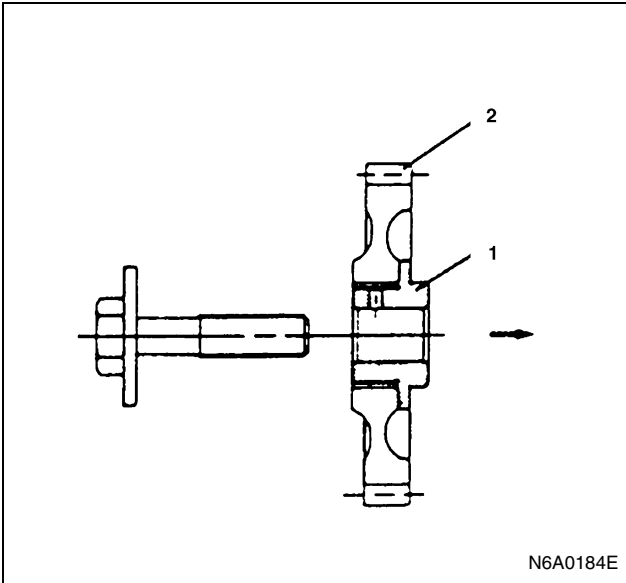
10. Power Steering Pump Idle Gear

- 1) Apply the engine oil to the idle gear shaft.
- 2) Install the idle gear shaft (1) with the idle gear (2) to the cylinder body "A" portion as shown in the illustration.

Tighten:

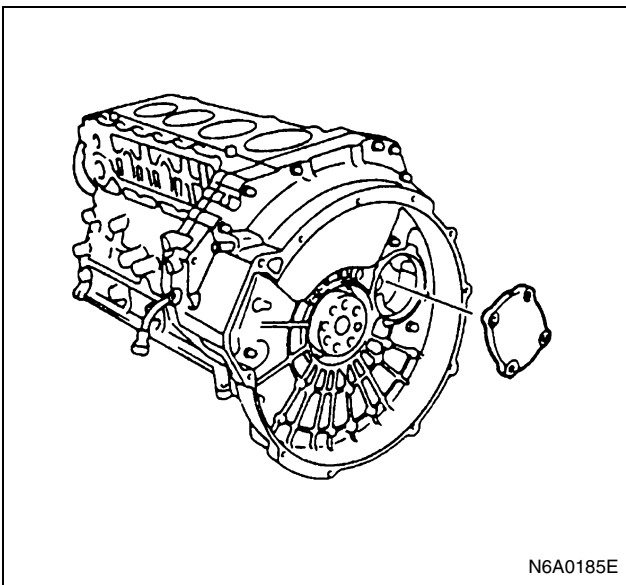
Idle gear shaft bolt to 133 N·m (13.6 kg·m / 98 lb·ft)





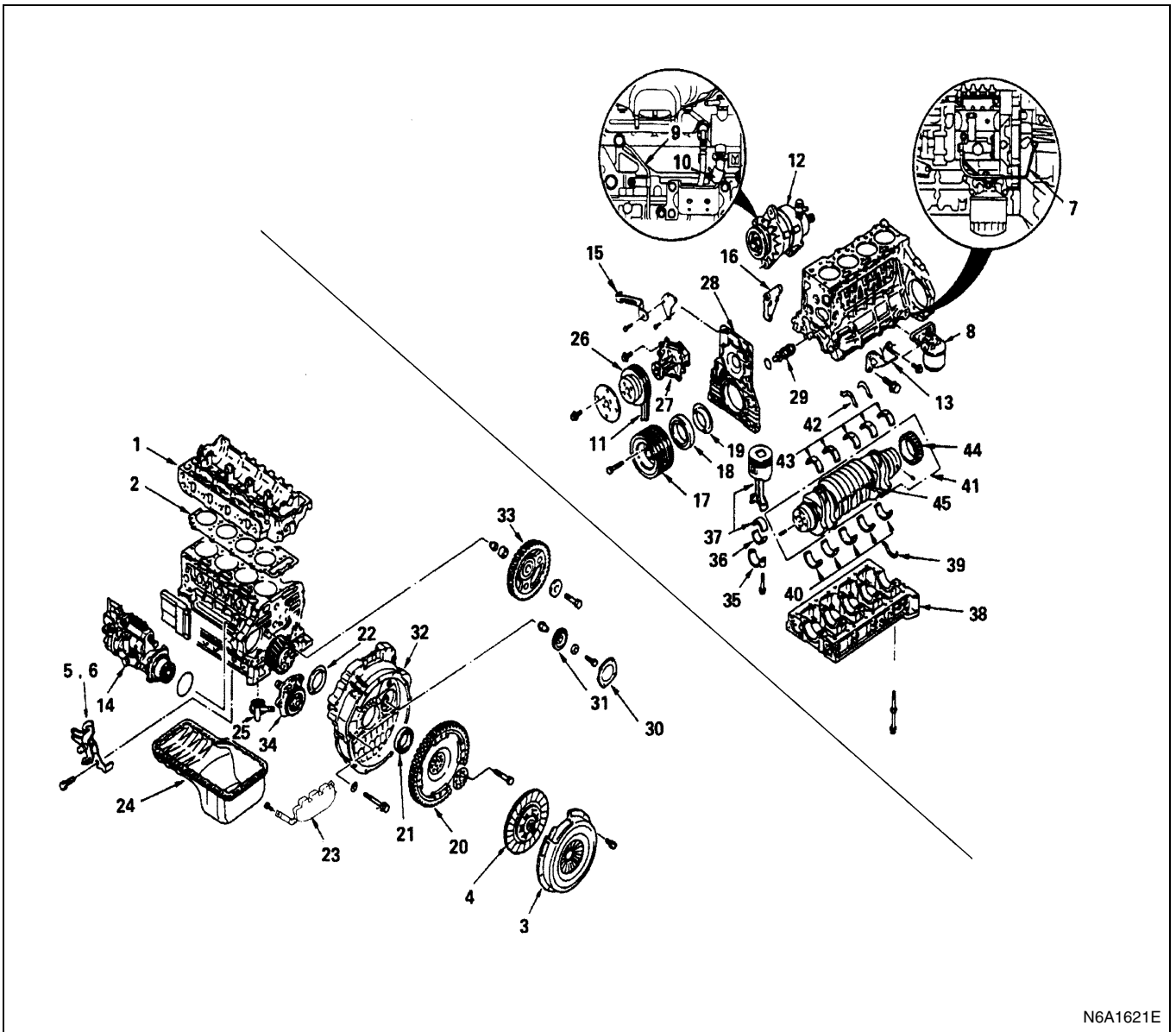
11. Power Steering Pump Idle Gear Cover
Install the gear cover with the O-ring.

Tighten:
Gear cover bolt to 19 N·m (1.9 kg·m / 14 lb·ft)



CRANKSHAFT

Component



N6A1621E

Legend

1. Cylinder head assembly
2. Cylinder head gasket
3. Clutch pressure plate assembly
4. Driven plate
5. Engine control wire
6. Engine control lever assembly
7. Oil pipe
8. Oil filter assembly
9. Vacuum pump oil pipe
10. Vacuum pump rubber hose
11. Fan belt
12. Generator
13. Engine foot
14. Injection pump assembly
15. Fan belt adjust plate
16. Generator bracket
17. Crankshaft damper pulley
18. Crankshaft front oil seal
19. Crankshaft front slinger
20. Flywheel
21. Crankshaft rear oil seal
22. Crankshaft rear slinger
23. Spacer rubber
24. Oil pan
25. Oil pump strainer
26. Water pump pulley
27. Water pump
28. Front retainer
29. Oil thermo valve
30. Power steering pump idle gear cover
31. Power steering pump idle gear
32. Flywheel housing
33. Idle gear A
34. Oil pump assembly
35. Connecting rod cap assembly
36. Connecting rod lower bearing
37. Piston and connecting rod assembly
38. Crankcase
39. Thrust bearing lower
40. Crankshaft bearing lower
41. Crankshaft assembly
42. Thrust bearing upper
43. Crankshaft bearing upper
44. Crankshaft gear
45. Crankshaft

Disassembly

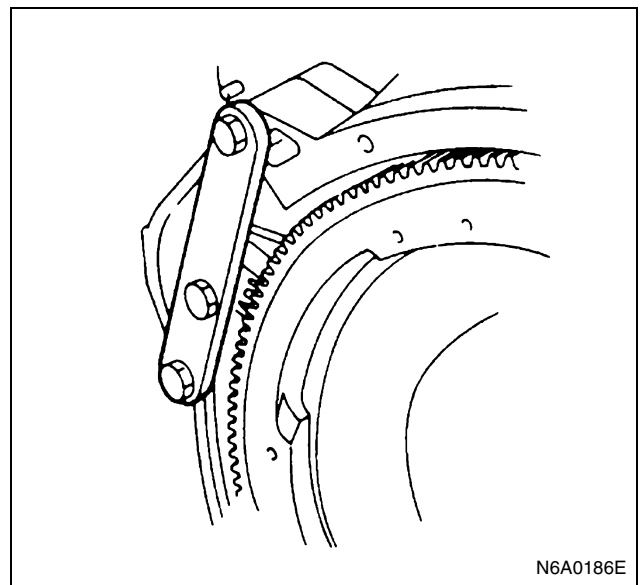
1. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
2. Cylinder Head Gasket

Caution:

Do not reuse the cylinder head gasket.

3. Clutch Pressure Plate Assembly
4. Driven Plate
5. Engine Control Wire
6. Engine Control Lever Assembly
7. Oil Pipe
8. Oil Filter Assembly
9. Vacuum Pump Oil Pipe
10. Vacuum Pump Rubber Hose
11. Fan Belt
12. Generator
13. Engine Foot
14. Injection Pump Assembly
15. Fan Belt Adjust Plate
16. Generator Bracket
Above works refer to "CYLINDER BLOCK" section in this manual.
17. Crankshaft Damper Pulley
 - 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0

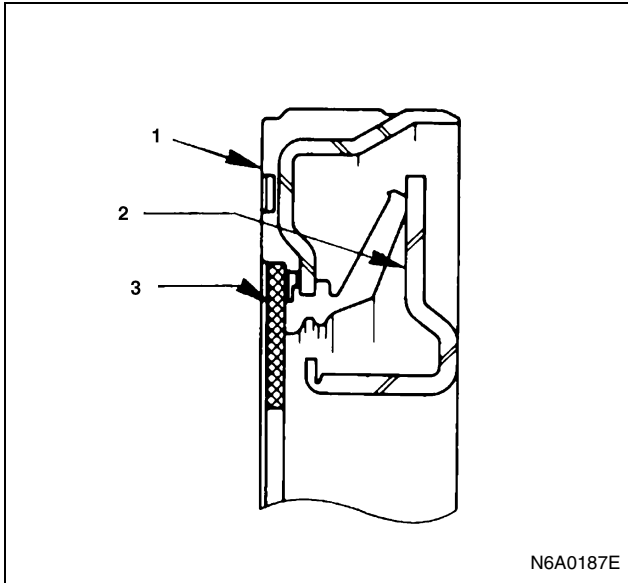
- 2) Loosen the damper pulley bolts and remove the damper pulley.



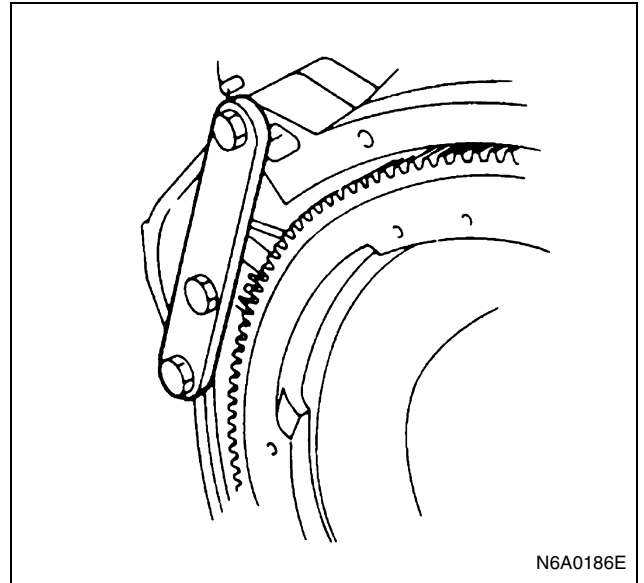
18. Crankshaft Front Oil Seal

Caution:

Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.



N6A0187E



N6A0186E

Legend

- 1. Oil seal
- 2. Slinger
- 3. Felt

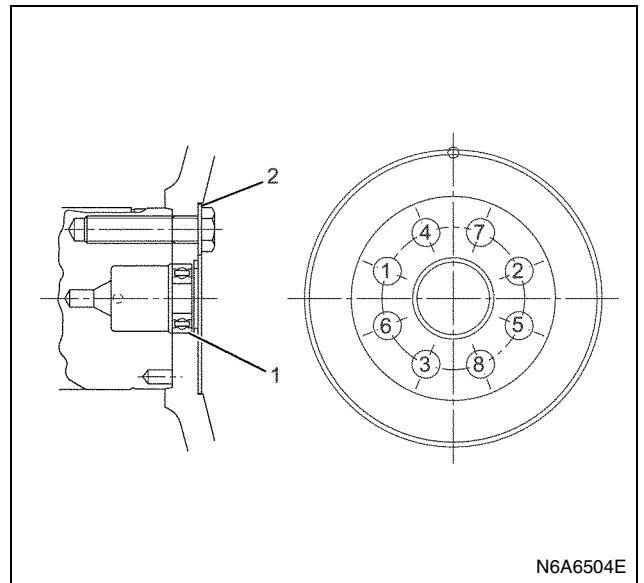
19. Crankshaft Front Slinger

Use the slinger puller to pull out the slinger.

Slinger Puller: 5-8840-2360-0

Notice:

If the oil seal has been removed, both the oil seal and slinger must be replaced as a set.



N6A6504E

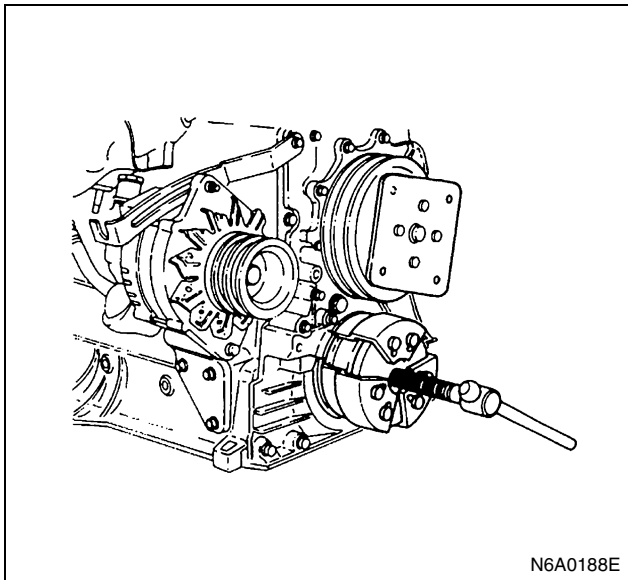
Legend

- 1. Washer
- 2. Pilot bearing

21. Crankshaft Rear Oil Seal

Caution:

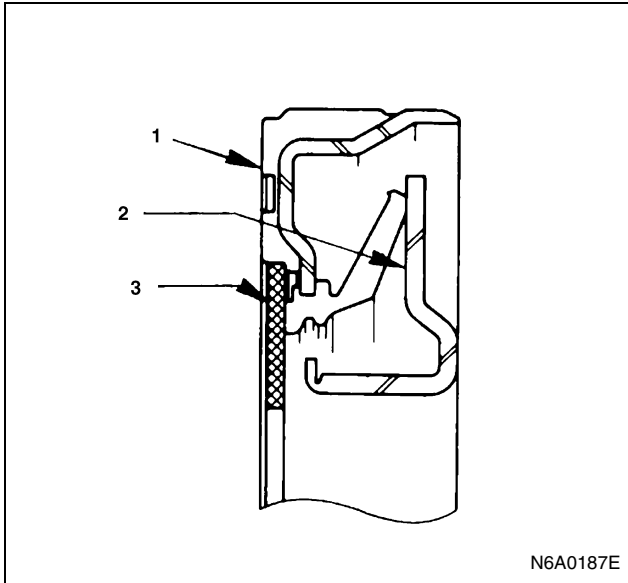
Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.



N6A0188E

20. Flywheel Assembly

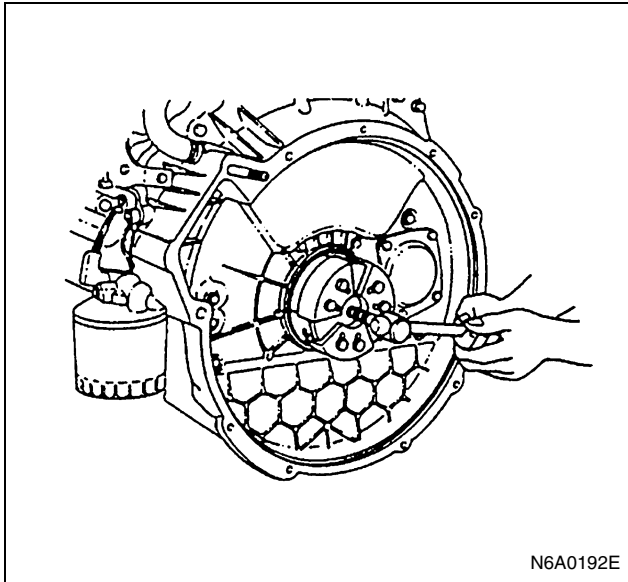
- 1) Use the crankshaft stopper to prevent the crankshaft from turning
Crankshaft Stopper: 5-8840-2230-0
- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.
- 3) Remove the flywheel stopper and the flywheel assembly.



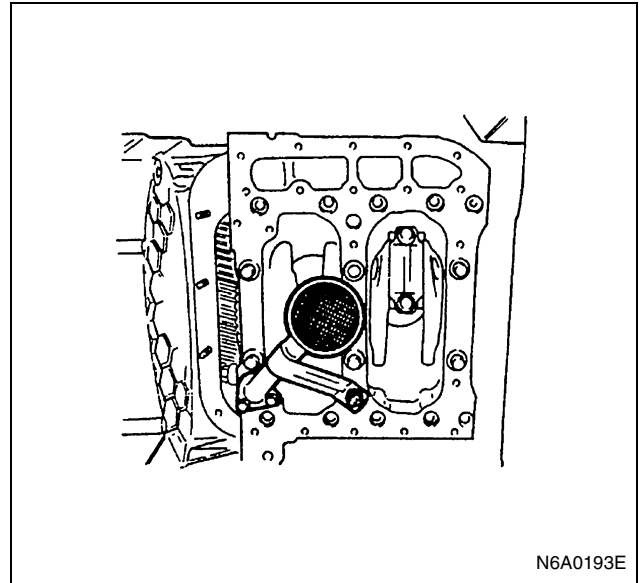
Legend

- 1. Oil seal
- 2. Slinger
- 3. Felt

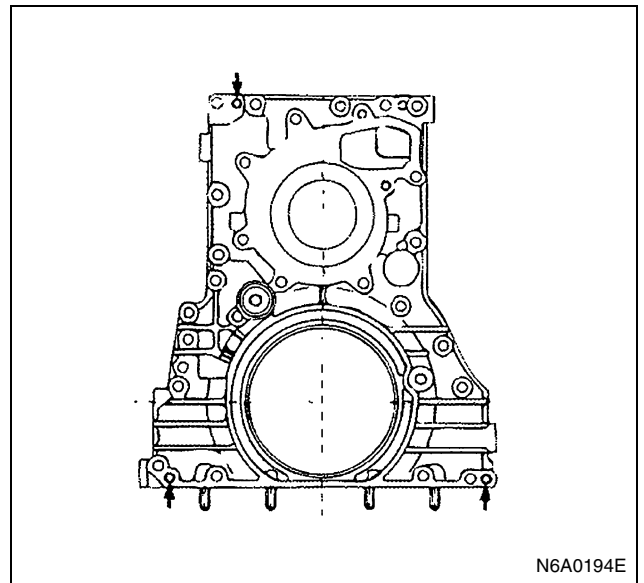
- 22. Crankshaft Rear Slinger
Use the slinger puller to pull out the slinger.
Slinger Puller: 5-8840-2360-0



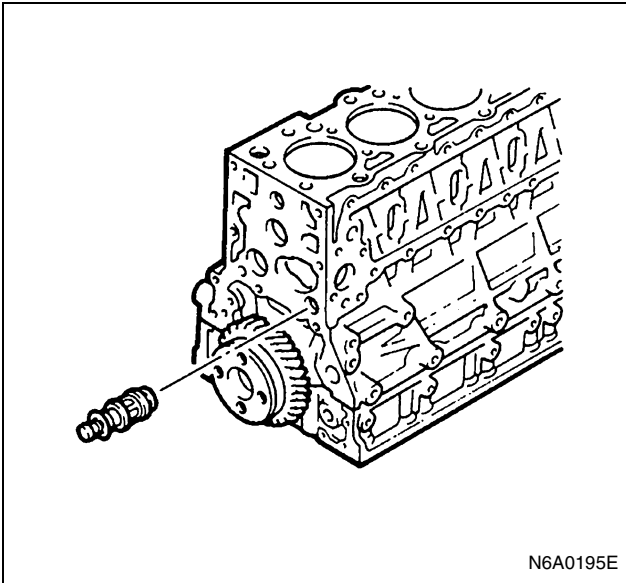
- 23. Spacer Rubber
- 24. Oil Pan
- 25. Oil Pump Strainer
- 26. Water Pump Pulley
- 27. Water Pump



- 28. Front Retainer
Install the three front retainer fixing bolts to the front retainer replacer holes as shown in the illustration, and tighten the bolts alternately a little at a time.

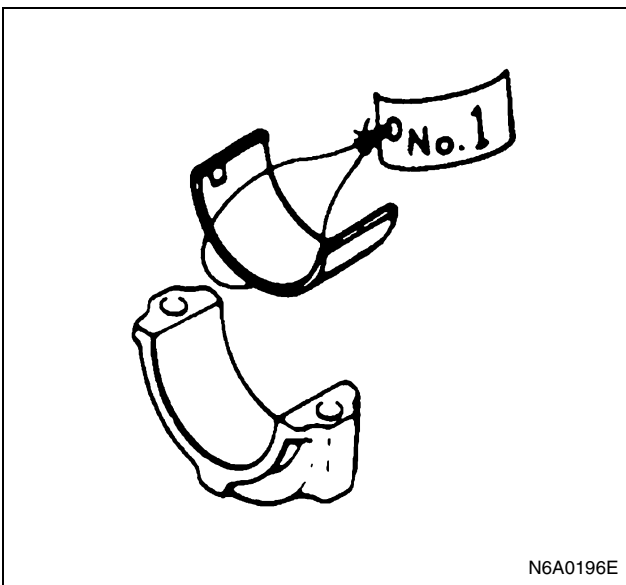


- 29. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Pull out the thermo valve from the cylinder body.



N6A0195E

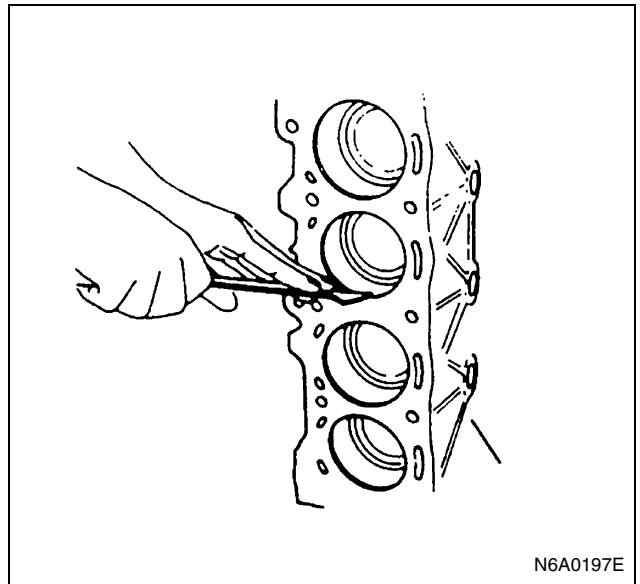
- 30. Bypass Valve (4HE1-TC)
Pull out the bypass valve from the cylinder body.
- 31. Power Steering Pump Idle Gear Cover
- 32. Power Steering Pump Idle Gear
- 33. Flywheel Housing
- 34. Idle Gear A
- 35. Oil Pump Assembly
Above works refer to "OIL PUMP" section in this manual.
- 36. Connecting Rod Cap Assembly
- 37. Connecting Rod Lower Bearing
 - 1) Take out the connecting rod bearing cap bolts and remove the bearing cap with the lower bearing.
 - 2) If the connecting rod lower bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



N6A0196E

38. Piston and Connecting Rod Assembly

- 1) To facilitate smooth removal of piston, remove carbon from the upper part of the cylinder wall using a scraper or equivalent.



N6A0197E

- 2) Remove the piston and connecting rod assembly upward by pushing on the edge of the connecting rod with a hammer handle or equivalent.
- 3) If the connecting rod bearing are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

Caution:

Do not bend or damage the oiling jet.

Notice:

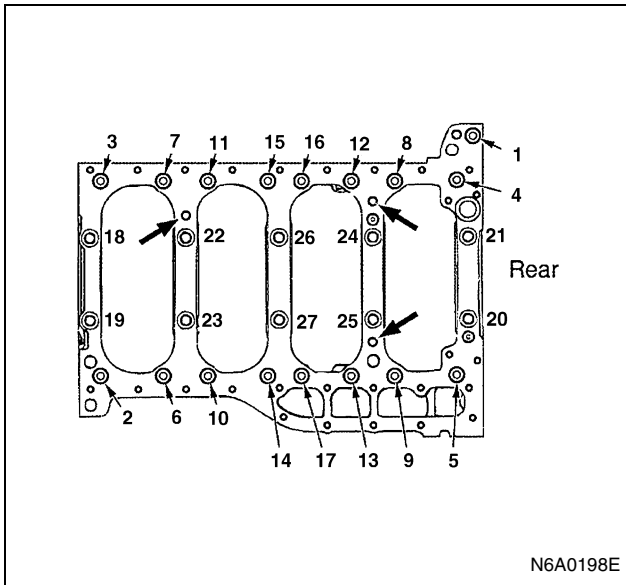
When removing the piston and connecting rod assembly, pull the connecting rod in parallel with the cylinder bore.

39. Crankcase

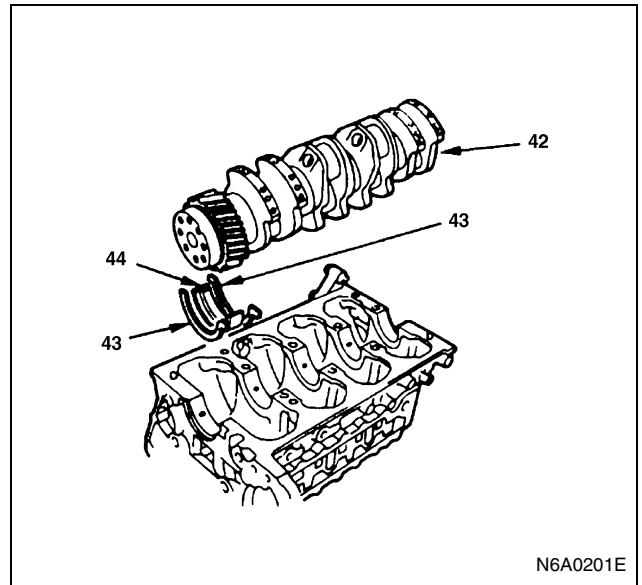
- 1) Loosen the crankcase bolts in numerical order a little at a time.
- 2) Install the three crankcase fixing bolts (See left arrow marks) to the crankcase replacer holes as shown in the illustration, and tighten the bolts alternate a little at a time.

Notice:

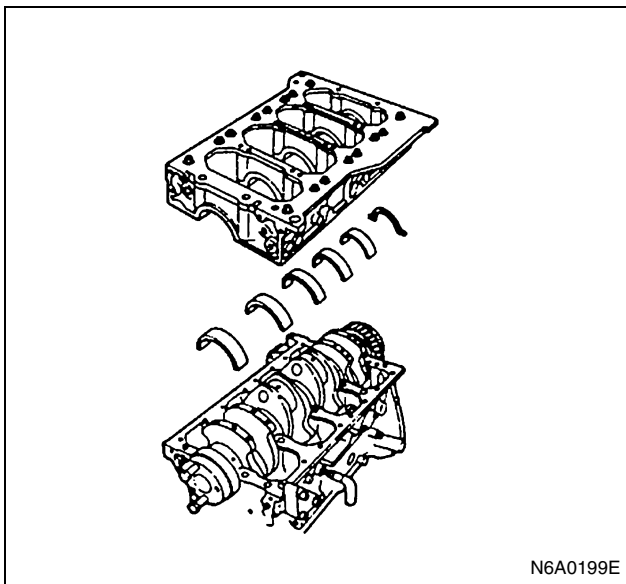
When removing the crankcase, be sure to remove the oil pump and the generator bracket before that.



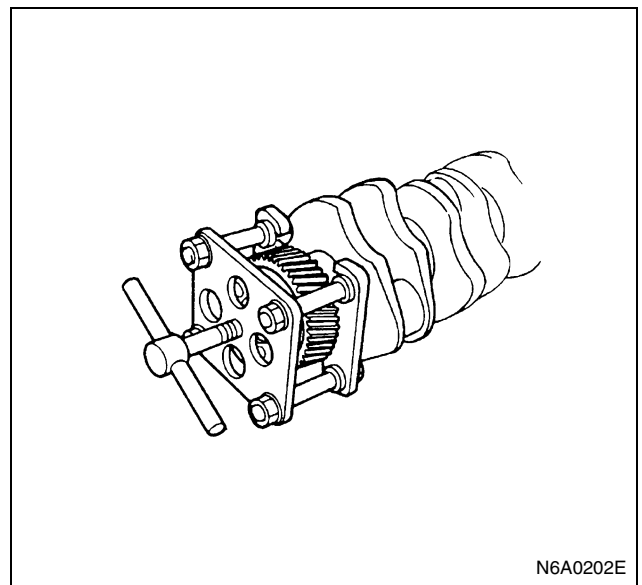
- 40. Thrust Bearing Lower
- 41. Crankshaft Bearing Lower



- 45. Crankshaft Gear
 - 1) Use the crankshaft gear remover to remove the crankshaft gear.
Crankshaft Gear Remover: 8-9439-6818-0
 - 2) Remove the crankshaft feather key.



- 42. Crankshaft Assembly
- 43. Thrust Bearing Upper
- 44. Crankshaft Bearing Upper



- 46. Crankshaft

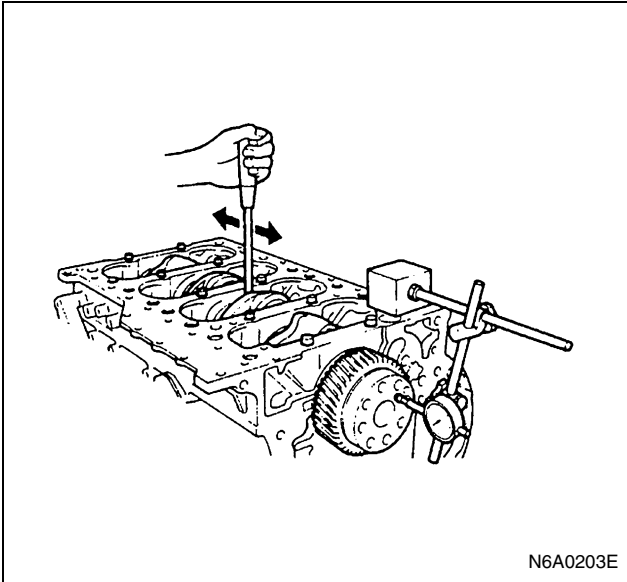
Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Crankshaft End Play

1. Set the dial indicator to the crankshaft end and measure the end play.
2. If the measured value exceeds the specified limit, the thrust bearings must be replaced.

Crankshaft End Play		mm (in)
Standard	Limit	
0.104 — 0.205 (0.0041 — 0.0081)	0.35 (0.014)	



Crankshaft and Bearing

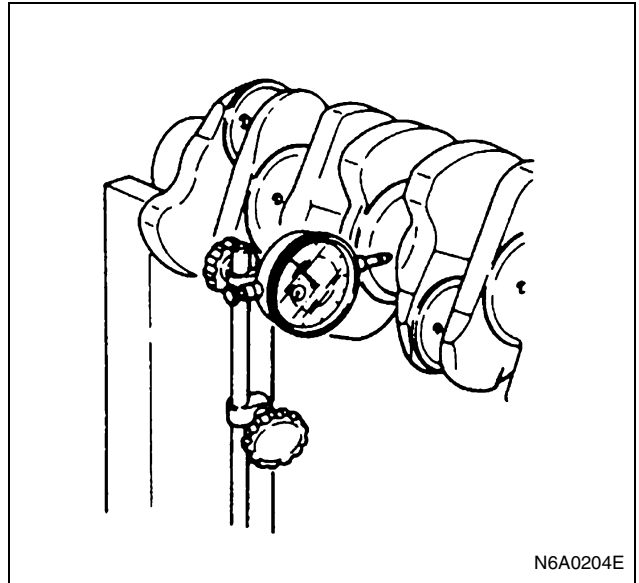
Inspect the surface of the crankshaft journals and crankpins for excessive wear and damage.
 Inspect the oil seal fitting surfaces for excessive wear and damage.
 Inspect the oil ports for obstructions.

Crankshaft Run-Out

1. Set a dial indicator to the center of the crankshaft journal.
2. Gently turn the crankshaft in the normal direction of rotation.

Read the dial indicator as you turn the crankshaft.
 If the measured value exceeds the specified limit, the crankshaft must be replaced.

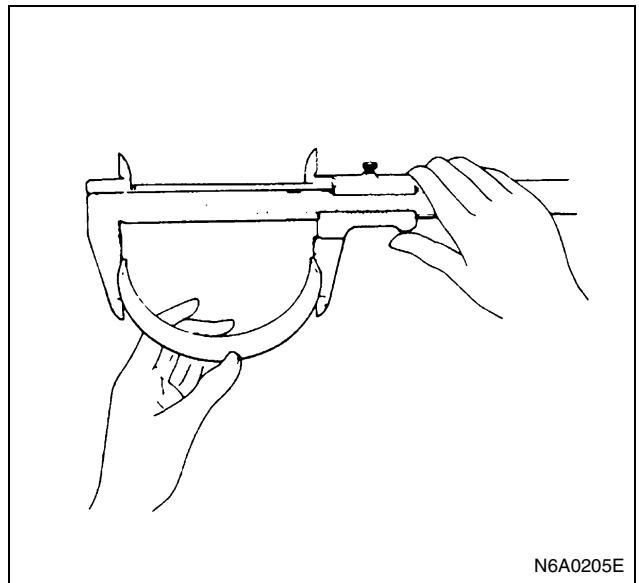
Crankshaft Run-Out		mm (in)
Standard	Limit	
0.05 (0.002) or less	0.30 (0.012)	



Bearing Spread

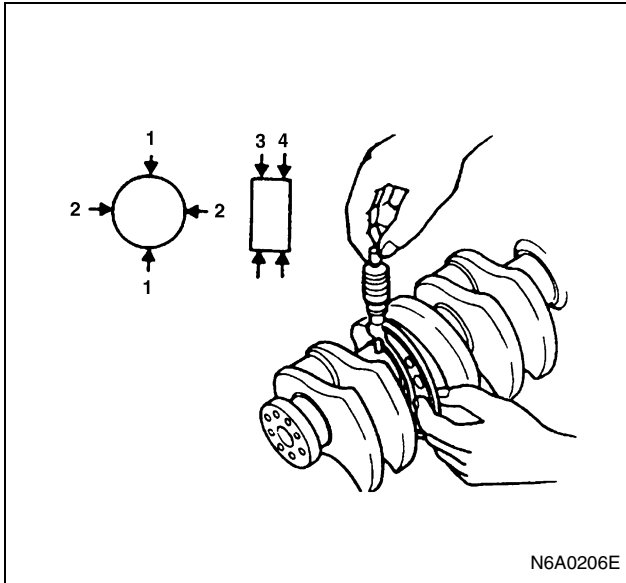
Use a vernier caliper to measure the bearing spread.
 If the measured value is less than the specified limit, the bearing must be replaced.

Bearing Spread		mm (in)
Limit	87 (3.43)	



Crankshaft Journal and Crankpin Diameter

1. Use a micrometer to measure the crankshaft journal diameter across points (1) — (1) and (2) — (2).
2. Use the micrometer to measure the crankshaft journal diameter at the two points (3) and (4).



N6A0206E

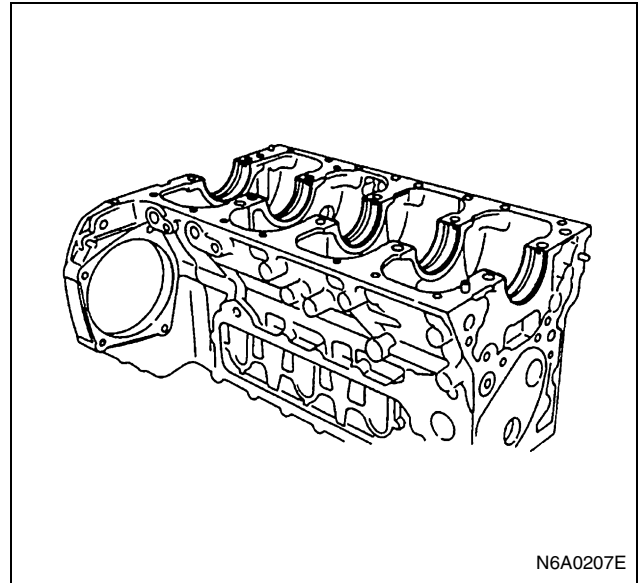
- Repeat Steps 1 and 2 to measure the crankpin diameter.
If the measured values are less than the limit, the crankshaft must be reground or replaced.

Crankshaft Journal and Crankpin Diameter		mm (in)	
Engine model		Standard	Limit
ALL	No.1,2,4 and 5 Journal	81.905 — 81.925 (3.2246 — 3.2254)	81.85 (3.2224)
ALL	No.3 Journal	81.891 — 81.911 (3.2240 — 3.2248)	81.85 (3.2224)
Except 4HE1-TC	Crankpin	65.902 — 65.922 (2.5946 — 2.5954)	65.85 (2.5925)
4HE1-TC	Crankpin	72.902 — 72.922 (2.8702 — 2.8433)	72.85 (2.8681)

Crankshaft Journal and Crankpin Diameter Uneven Wear		mm (in)
Except 4HE1-TC	Limit	0.050 (0.002)
4HE1-TC		0.0050 (0.0002)

Crankshaft Journal and Bearing Clearance

- Clean the cylinder body and crankcase, the journal bearing fitting surface, and the journal bearings.
- Install the bearings to the cylinder body and crankcase.
- Install the crankcase to the cylinder body.



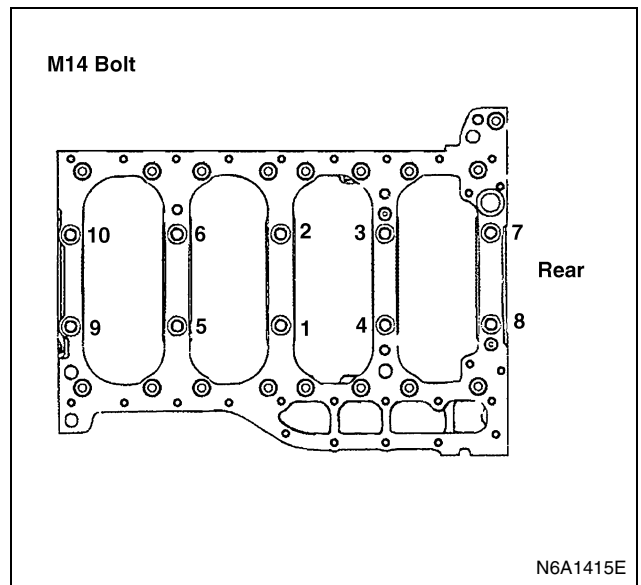
N6A0207E

- Tighten the crankcase to the specified torque in the numerical order shown in the illustration.

Tighten:

Crankcase bolt (M14: (1) — (10)) to

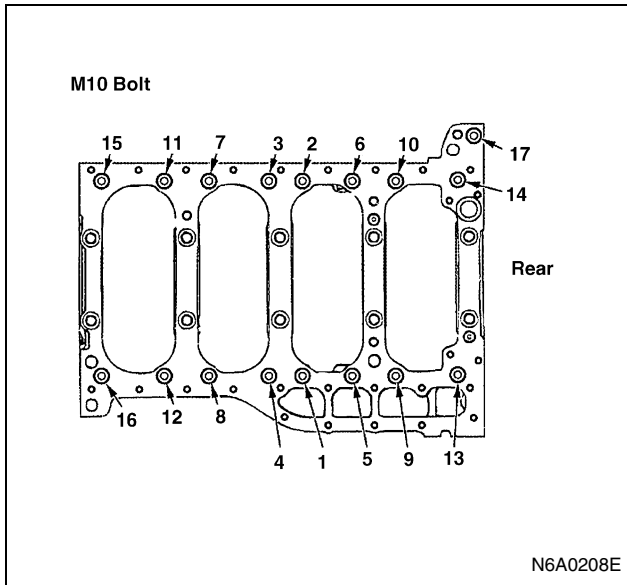
- 1st step: 98 N·m (10 kg·m / 72 lb·ft)
- 2nd step: 132 N·m (13.5 kg·m / 98 lb·ft)
- 3rd step: 30 — 60°



N6A1415E

Tighten:

Crankcase bolt (M10: (1) — (17)) to 37 N·m (3.8 kg·m / 27 lb·ft)



5. Use a dial indicator to measure the crankshaft journal inside diameter.
6. If the clearance between the crankshaft journal and the bearing exceeds the specified limit, the crankshaft must be either reground or replaced.

Crankshaft Journal and Bearing Clearance		mm (in)
	Standard	Limit
No.1, 2, 4 and 5 Journal	0.037 — 0.072 (0.0015 — 0.0028)	0.11 (0.0043)
No.3 Journal	0.051 — 0.086 (0.0020 — 0.0034)	0.11 (0.0043)

7. Remove the crankcase and the bearings.

Undersized Crankshaft Journal Bearing Availability (Except 4HE1-TC)	mm (in)
0.25 (0.01)	0.50 (0.02)

Crankshaft Bearing Selection

Refer to the following table when replacing the crankshaft and/or the crankshaft bearings.

Crankshaft bearing selection is based on the measured diameters of the crankshaft journals and the bearing housing.

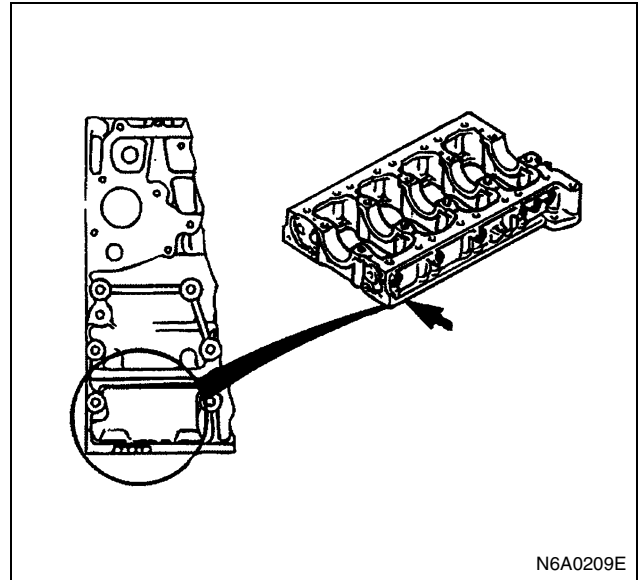
Match the crankshaft bearing housing grade marks and the crankshaft journal grade marks in the table below to determine the correct crankshaft bearing size.

Crankshaft Bearing Insert Grade Mark Position

The crankshaft bearing housing grade marks (1 or 2) are stamped collectively for all cylinders on the underside of the left front portion of the crankcase.

Example:

1	2	1	1	2
↑	↑	↑	↑	↑
No.1 Bearing Housing	No. 2 Bearing Housing	No. 3 Bearing Housing	No. 4 Bearing Housing	No. 5 Bearing Housing



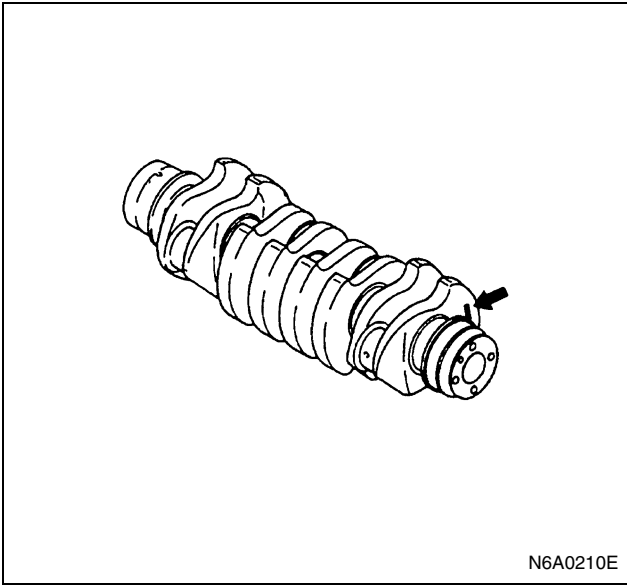
Crankshaft Journal Grade Mark Position

The crankshaft journal grade marks (1 or 2) are stamped collectively for all cylinders on the front side of the crankshaft No.1 balancer.

The clearance between the crankshaft journal and the bearing must be the same for each position after installation of the crankshaft and the crankshaft bearings.

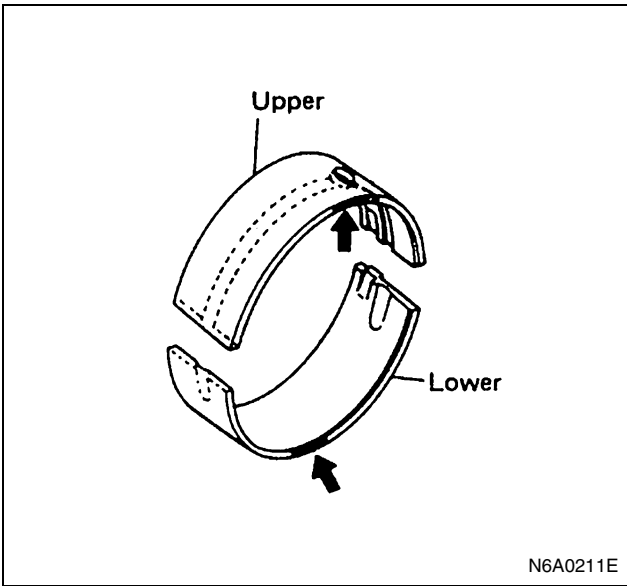
Example:

2	1	2	2	1
↑	↑	↑	↑	↑
No.1 Journal	No.2 Journal	No.3 Journal	No.4 Journal	No.5 Journal



Crankshaft Bearing Combination (Reference) mm (in)

Bearing Housing		Crankshaft Journal No.1, 2, 4, 5		Crankshaft Bearing	Oil Clearance
Grade Mark	Diameter	Grade Mark	Diameter	Color Code	
1	87.000 — 87.009 (3.4252 — 3.4255)	1	81.905 — 81.915 (3.2246 — 3.2250)	Black	0.039 — 0.070 (0.0015 — 0.0028)
		2	81.916 — 81.925 (3.2250 — 3.2254)	Brown	0.037 — 0.068 (0.0015 — 0.0027)
2	87.010 — 87.019 (3.4256 — 3.4259)	1	81.905 — 81.915 (3.2246 — 3.2250)	Blue	0.041 — 0.072 (0.0016 — 0.0028)
		2	81.916 — 81.925 (3.2250 — 3.2254)	Black	0.039 — 0.070 (0.0015 — 0.0028)



Crankshaft Bearing Combination (Reference)					mm (in)
Bearing Housing		Crankshaft Journal No.3		Crankshaft Bearing	Oil Clearance
Grade Mark	Diameter	Grade Mark	Diameter	Color Code	
1	87.000 — 87.009 (3.4252 — 3.4255)	1	81.890 — 81.900 (3.2240 — 3.2244)	Black	0.053 — 0.084 (0.0021 — 0.0033)
		2	81.901 — 81.910 (3.2244 — 3.2248)	Brown	0.051 — 0.082 (0.0020 — 0.0032)
2	87.010 — 87.019 (3.4256 — 3.4259)	1	81.890 — 81.900 (3.2240 — 3.2244)	Blue	0.055 — 0.086 (0.0022 — 0.0034)
		2	81.901 — 81.910 (3.2244 — 3.2248)	Black	0.053 — 0.084 (0.0021 — 0.0033)

Crankpin and Connecting Rod Bearing Clearance

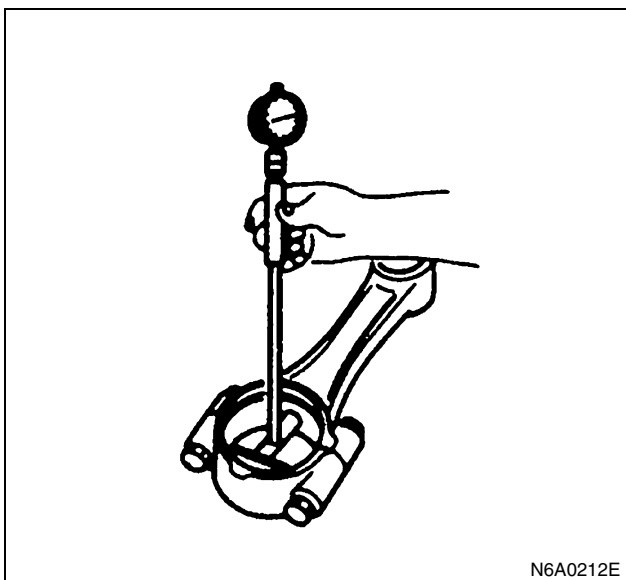
1. Clean the crankshaft, the connecting rod, the bearing cap, and the bearings.
2. Install the bearing to the connecting rod and the bearing cap.
3. Apply a coat of molybdenum disulfide grease to the bearing cap bolt threads and setting faces.
4. Prevent the connecting rod from moving.
5. Tighten the bearing cap to the specified torque.

Tighten:

Connecting rod bearing cap bolt to

- 1st step: 39 N·m (4.0 kg·m / 29 lb·ft)
 - 2nd step: 60°
 - 3rd step: 30°
6. Use the dial indicator to measure the connecting rod bearing inside diameter.

Crankpin and Connecting Rod Bearing Clearance		mm (in)
Standard	Limit	
0.036 — 0.077 (0.0014 — 0.0030)	0.10 (0.004)	



7. If the clearance between the measured bearing inside diameter and the crankpin exceeds the specified limit, the bearing and/or the crankshaft must be replaced or reground. (Except 4HE1-TC)
8. Remove the bearing cap and the bearings.

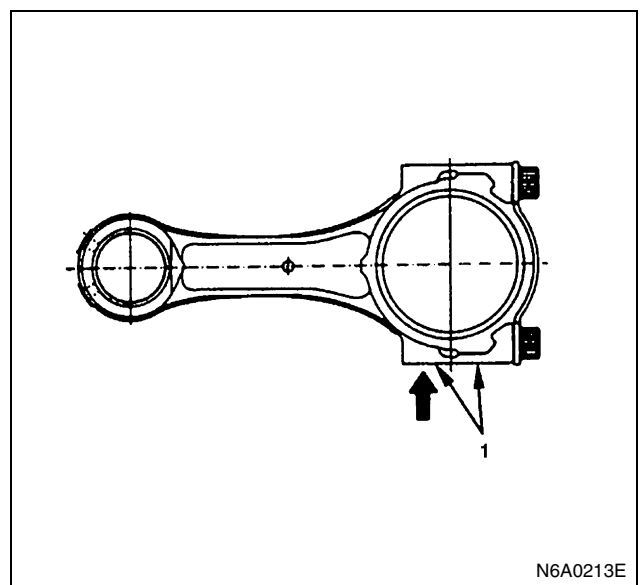
Undersized Connecting Rod Bearing Availability		mm (in)
0.25 (0.01)	0.50 (0.02)	

Connecting Rod Bearing Selection

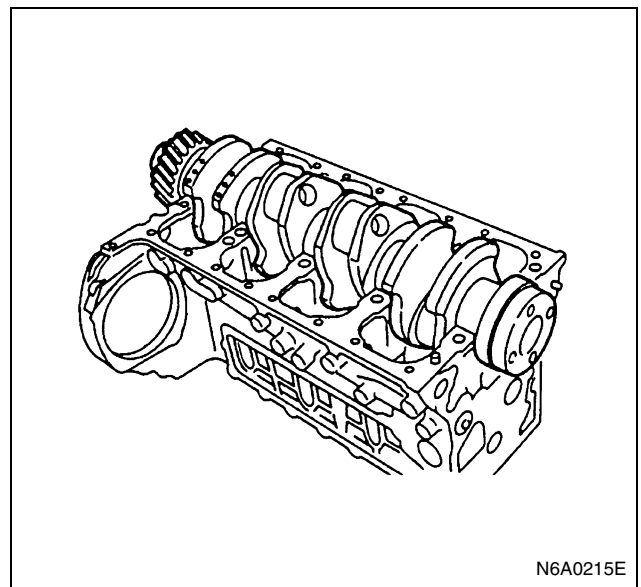
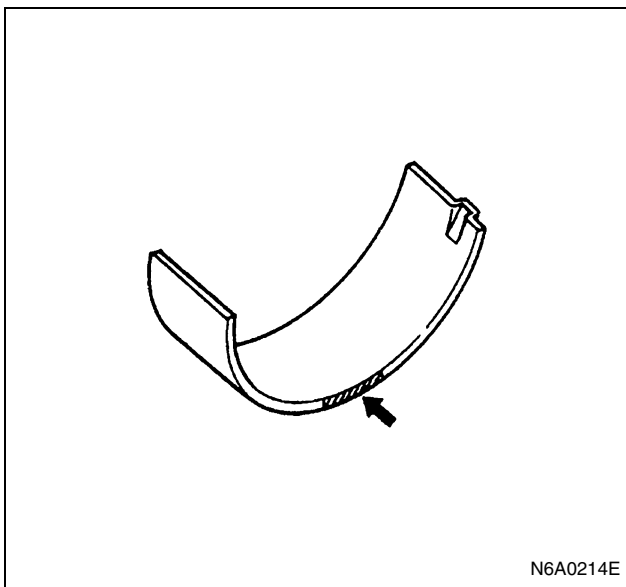
Refer to the following table when installing or replacing the connecting rod bearings.

Pay close attention to the size mark on the big end of the connecting rod.

Do not confuse the size mark on the big end of connecting rod with the alignment cylinder No. (1) mark.



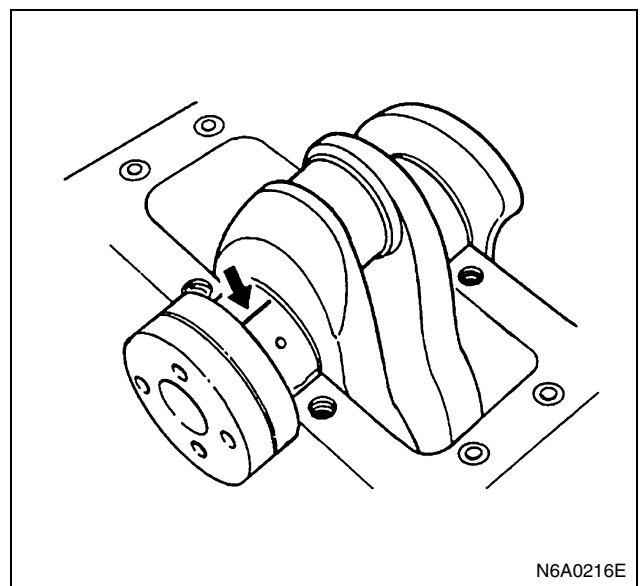
Connecting Rod Bearing Combination					mm (in)
Engine Model	Connecting Rod Big End		Crankpin	Connecting Rod Bearing	Oil Clearance
	Grade Mark	Diameter	Diameter	Color Code	
4HF1 4HF1-2 4HG1 4HG1-T	A	69.985 — 69.992 (2.7553 — 2.7556)	65.902 — 65.992 (2.5946 — 2.5954)	Green	0.036 — 0.077 (0.0014 — 0.0030)
	B	69.993 — 70.000 (2.7556 — 2.7559)	65.902 — 65.922 (2.5946 — 2.5954)	Yellow	0.036 — 0.070 (0.0014 - 0.0030)
4HE1-TC	A	77.985 — 77.992 (3.0703 — 3.0705)	72.902 — 72.922 (2.8702 — 2.8709)	Green	0.037 — 0.077 (0.0015 — 0.0030)
	B	77.993 — 78.000 (3.0706 — 3.0709)		Yellow	



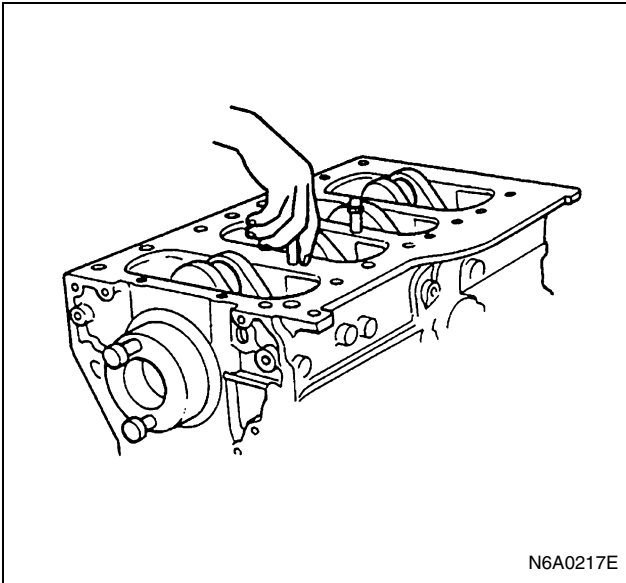
Clearance Measurements (With Plastigage) Crankshaft Journal and Bearing Clearance

1. Clean the cylinder body and crankcase, the journal bearing fitting surface, and the journal bearings.
2. Install the bearings to the cylinder body and crankcase.
3. Carefully place the crankshaft on the bearings.
4. Rotate the crankshaft approximately 30 degrees to seat the bearing.

5. Place the Plastigage (arrow) over the crankshaft journal across the full width of the bearing.



6. Install the crankcase to the cylinder body.



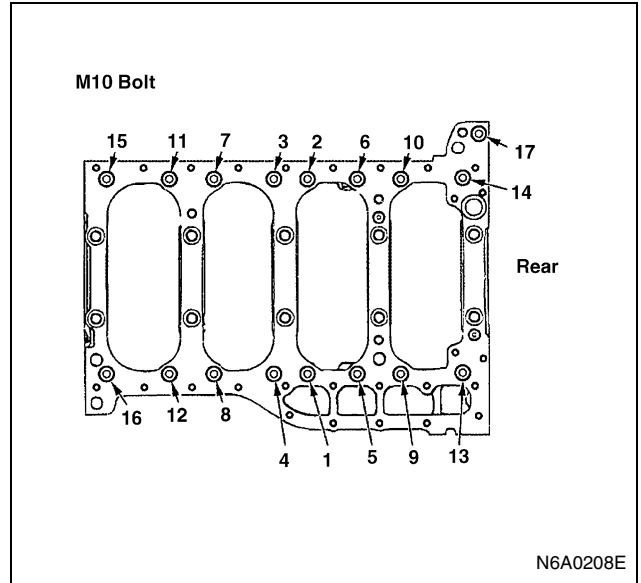
N6A0217E

7. Tighten the crankcase to the specified torque in the numerical order shown in the illustration.

Tighten:

Crankcase bolt (M14: (1) — (10)) to

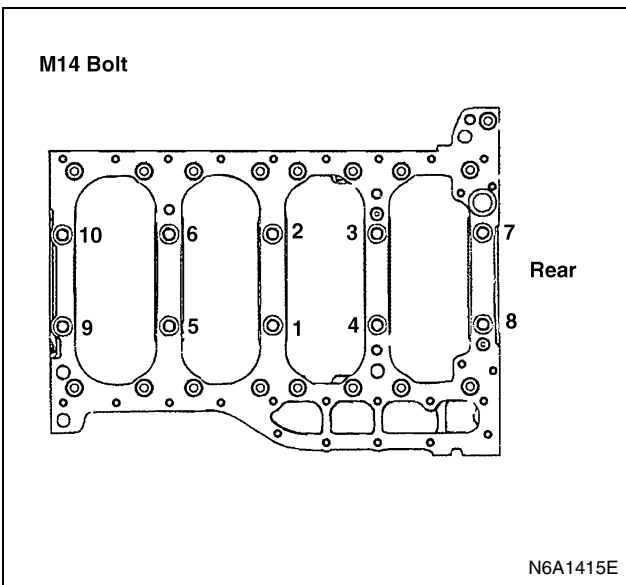
- 1st step: 98 N·m (10 kg·m / 72 lb-ft)
- 2nd step: 132 N·m (13.5 kg·m / 98 lb-ft)
- 3rd step: 30 — 60°



N6A0208E

Do not allow the crankshaft to turn during bearing cap installation and tightening.

8. Remove the bearing beam and the crankcase with bearings.
9. Compare the width of the Plastigage attached to either the crankshaft or the bearing with the scale printed on the Plastigage container.

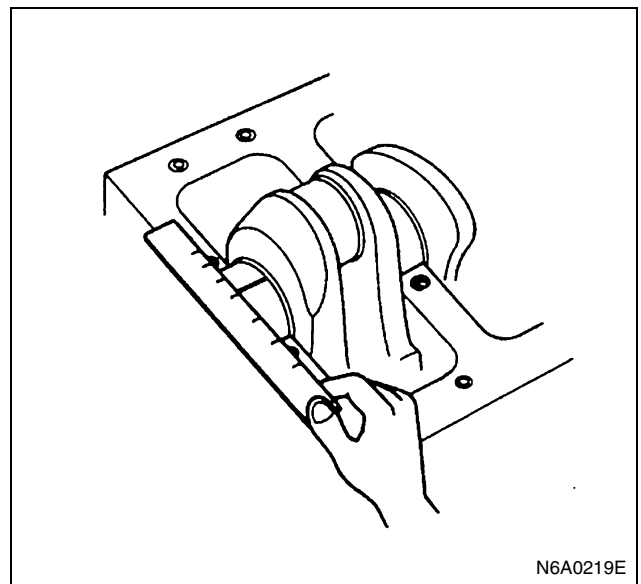


N6A1415E

Tighten:

Crankcase bolt (M10: (1) — (17)) to 3.9±0.7 N·m (28±5 kg·m / 38±7 lb-ft)

Crankshaft Journal and Bearing Clearance	mm (in)	
	Standard	Limit
No.1, 2, 4 and 5 Journal	0.037 — 0.072 (0.0015 — 0.0028)	0.11 (0.0043)
No.3 Journal	0.051 — 0.086 (0.0020 — 0.0034)	0.11 (0.0043)



N6A0219E

10. If the measured value exceeds the limit, perform the following additional steps.

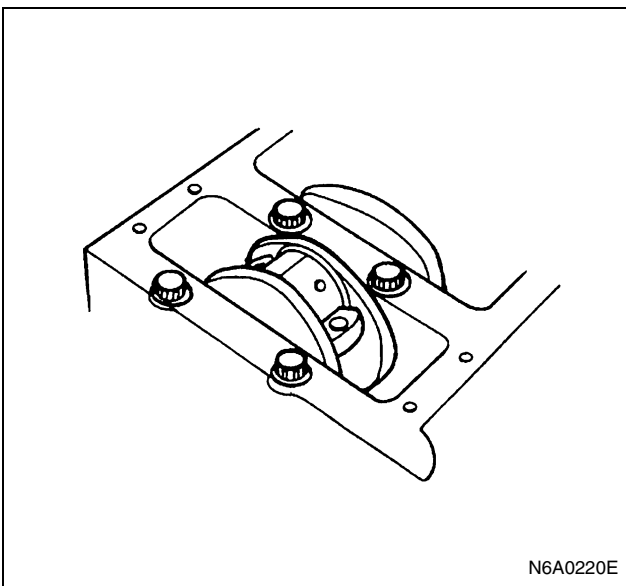
- Use a micrometer to measure the crankshaft outside diameter.
- Use an inside dial indicator to measure the bearing inside diameter.
If the crankshaft journal and bearing clearance exceeds the limit, the crankshaft and/or the bearing must be reground (Except 4HE1-TC) or replaced.

Undersized Crankshaft Journal Bearing Availability (Except 4HE1-TC)		mm (in)
0.25 (0.01)	0.50 (0.02)	

11. Remove the crankshaft and bearings.

Crankpin and Connecting Rod Bearing Clearance

1. Clean the crankshaft, the connecting rod, the bearing cap, and the bearings.
2. Install the bearing to the connecting rod and the bearing cap.
Do not allow the crankshaft to move when installing the bearing cap.
3. Prevent the connecting rod from moving.
4. Attach the Plastigage to the crankpin.
Apply engine oil to the Plastigage to keep it from falling.



5. Apply a coat of molybdenum disulfide grease to the bearing cap bolt threads and setting faces.
6. Install the bearing cap and tighten it to the specified torque.
Do not allow the connecting rod to move when installing and tightening the bearing cap.

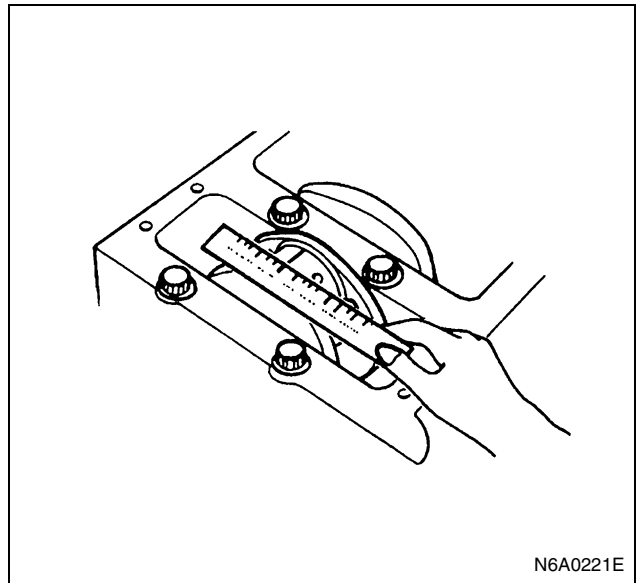
Tighten:

Connecting rod bearing cap bolt to

- 1st step: 39 N·m (4.0 kg·m / 29 lb·ft)
 - 2nd step: 60°
 - 3rd step: 30°
7. Remove the bearing cap.

8. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

Crankpin and Connecting Rod Bearing Clearance		mm (in)
Standard	Limit	
0.036 — 0.077 (0.0014 — 0.0030)	0.10 (0.004)	



9. If the measured value exceeds the specified limit, perform the following additional steps.

- Use a micrometer to measure the crankpin outside diameter.
- Use an inside dial indicator to measure the bearing inside diameter.
If the clearance between the crankpin and the bearing exceeds the specified limit, the crankshaft and / or the bearing must be reground (except 4HE1-TC) or replaced.

Undersized Connecting Rod Bearing Availability (Except 4HE1-TC)		mm (in)
0.25 (0.01)	0.50 (0.02)	

Crankshaft Regrinding (Except 4HE1-TC)

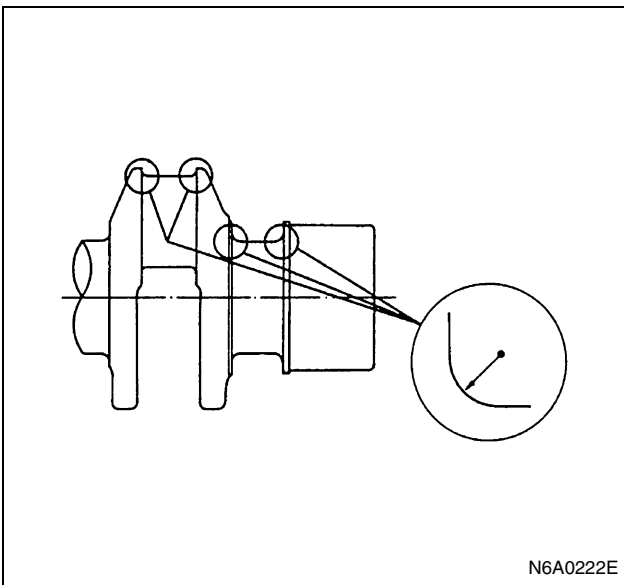
To ensure crankshaft reliability, pay close attention to the following items during and after the crankshaft journal and crankpin regrinding procedure.

Undersized Bearing Availability		mm (in)
0.25 (0.01)	0.50 (0.02)	

Crankshaft Journal and Crankpin Grinding Limit (Reference)		mm (in)
Journal	No.1, 2, 4, 5	81.405 (3.2049)
	No.3	81.390 (3.2043)
Crankpin		65.402 (2.5749)

Crankshaft Regrinding Procedure (Except 4HE1-TC)

1. Regrind the crankshaft journals and the crankpins.
2. Fillet the crankshaft journals and the crankpin radiuses to a minimum of R 4.8±0.2 mm (0.189±0.0078 in). There must be no stepping around the fillet area.



3. Finish the crankshaft journals, the crankpins, and the oil port corners to a smooth surface having a chamfer radius of 1 mm (0.04 in).

Crankshaft Journal and Crankpin Roughness
0.4 μm or less

4. Check the crankshaft journal and crankpin clearance. Refer to the "Crankshaft Journal and Bearing Clearance" and "Crankpin and Connecting Rod Bearing Clearance".
5. Check the crankshaft run-out. Refer to the "Crankshaft Run-Out".

Caution:

The crankshaft for 4HE1-TC is applied soft nitrided surface (Taftriding). Therefore, the crankshaft for 4HE1-TC not could be ground.

Inspection Procedure for Soft Nitrided (Taftriding) Crankshaft (For 4HE1-TC)

1. Inspect the crankshaft following points.
 - Excessive wear and damage on the surface of crankshaft journals.

- Excessive wear and damage on the surface of crankpin.
 - Excessive wear and damage on the oil seal fitting surface.
 - Inspect the oil ports for obstructions.
2. Inspect the crankshaft soft nitrided surface (Taftriding). The soft nitrided crankshaft has been applied to increase crankshaft strength. Because of this, it is not possible to regrind the crankshaft surfaces.

1) Inspection conditions.

- Remove the oil and other material on the crankshaft inspection area.
- The portion to be tested must be held horizontally so as not let the test solution flow.
- Test liquid should not be applied to the approximately 10 mm (0.39 in) area around the oil port (2).

2) Inspection method

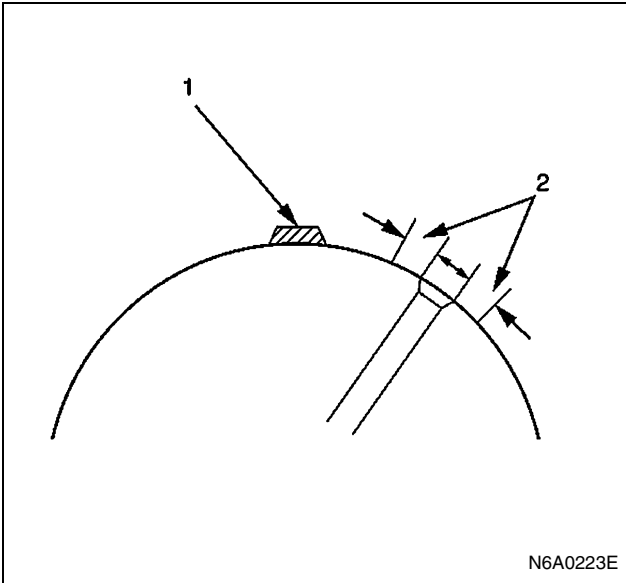
- Use an organic cleaner to thoroughly clean the crankshaft. There must be no traces of oil the surfaces to be inspected.
- Prepare a 5 — 10 percent solution of ammonium cupric chloride (dissolved in distilled water).
- Use a syringe to apply the solution (1) to the surface to be inspected. Hold the surface to be inspected perfectly horizontal to prevent the solution from running.

3) Judgement

- Wait for thirty to forty seconds. If there is no discoloration after thirty to forty seconds, the crankshaft is usable. If discoloration appears (the surface being tested will become the color copper), the crankshaft must be replaced.
- Steam clean the crankshaft surface immediately after completing the inspection.

Notice:

The ammonium cupric chloride solution is highly corrosive. Because of this, it is imperative that the surfaces being inspected be cleaned immediately after completing the inspection.



N6A0223E

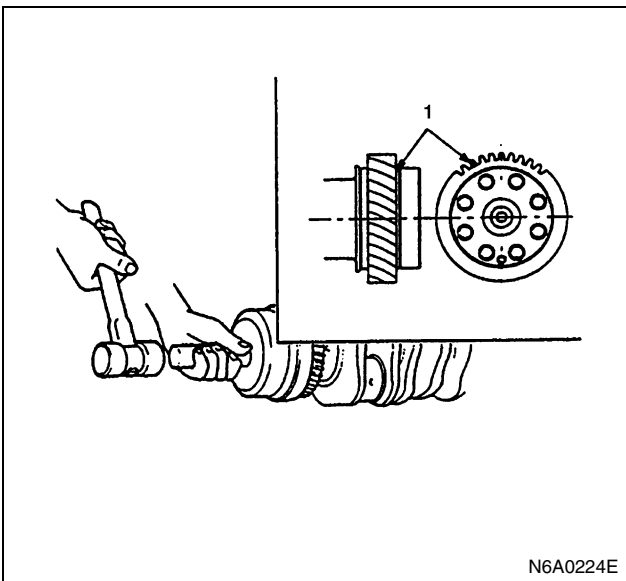
Reassembly

1. Crankshaft
2. Crankshaft Gear
 - 1) Use a piston heater to heat the crankshaft gear to 170 — 250°C (338 — 482°F).
 - 2) With the alignment mark “S” on the side of the crankshaft gear turned outward, align the groove on the gear side with the crankshaft pin position and hammer it in with a crankshaft gear installer until it hits the bottom.

Caution:

When hammered in with the gear slanted, the crankshaft gear may be caught in the middle and cannot be hammered in fully. Hammer it in quickly enough not to allow a shaft line along the gear and the crankshaft to slant.

Crankshaft Gear Installer: 8-9439-6819-0



N6A0224E

Legend

1. Alignment mark

3. Crankshaft Bearing Upper

When replacing the crankshaft or the crankshaft bearing with a new one, select the crankshaft bearing according to the respective grades stamped on the crankshaft and the cylinder body.

Above works refer to “CRANKSHAFT” section in this manual.

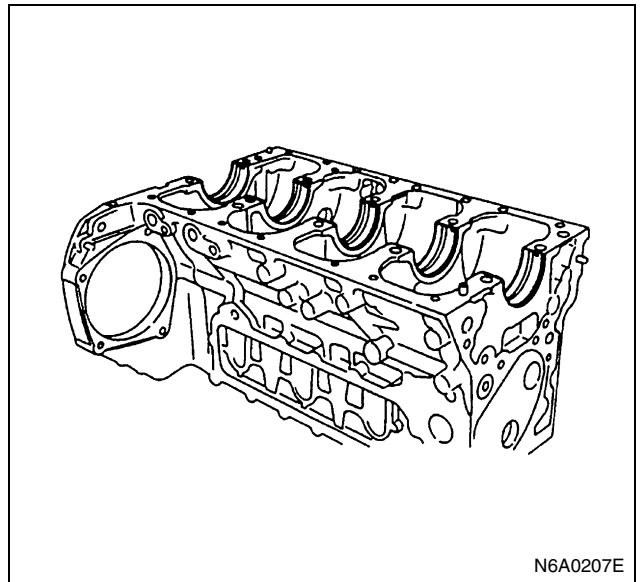
All upper bearings have oil grooves.

- 1) Carefully wipe any foreign material from the upper bearing.

Caution:

Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surfaces.

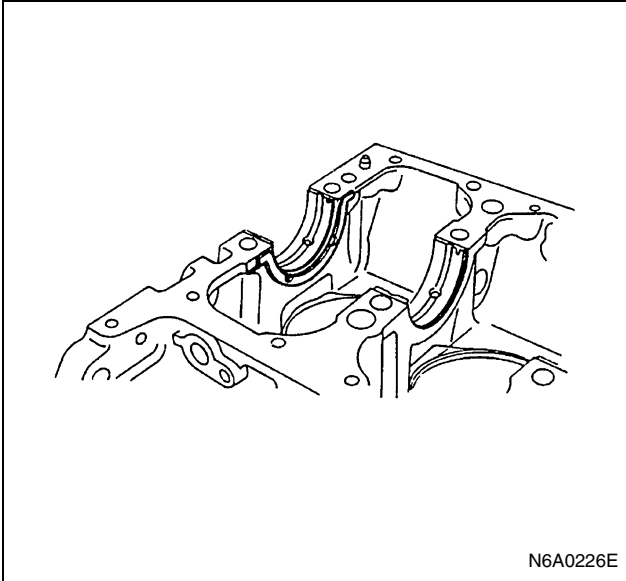
- 2) Locate the position mark applied at disassembly if the removed upper bearings are to be reused.



N6A0207E

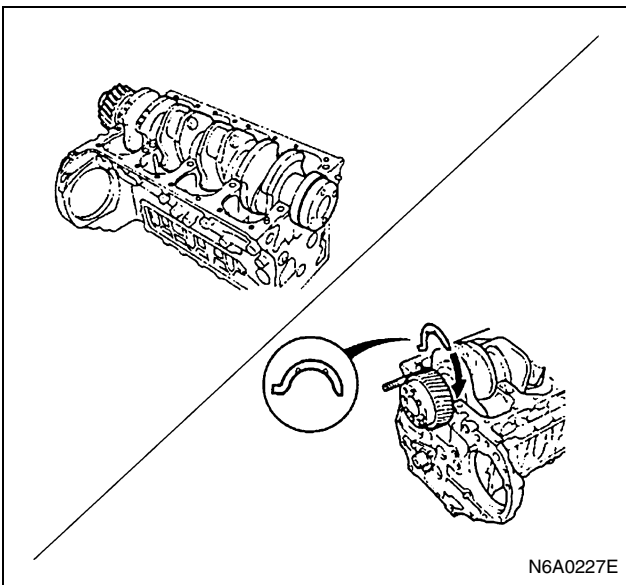
4. Thrust Bearing Upper

- 1) Install the thrust bearing upper to the front side of the cylinder body No.5 journal. At this time, the thrust bearing upper may be pasted to the cylinder body with grease. However, wipe off any excessive grease clean.
- 2) The thrust bearing oil grooves must be facing the sliding faces.



5. Crankshaft Assembly

- 1) Apply an ample coat of the engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft with timing gear.
- 2) With the installed crankshaft pressed on to the rear side, install the thrust bearing upper to the rear side of the cylinder body No.5 journal.
- 3) The thrust bearing oil grooves must be facing the sliding faces.



6. Crankshaft Bearing Lower

All lower bearings does not have oil grooves.

- 1) Carefully wipe any foreign material from the lower bearing.

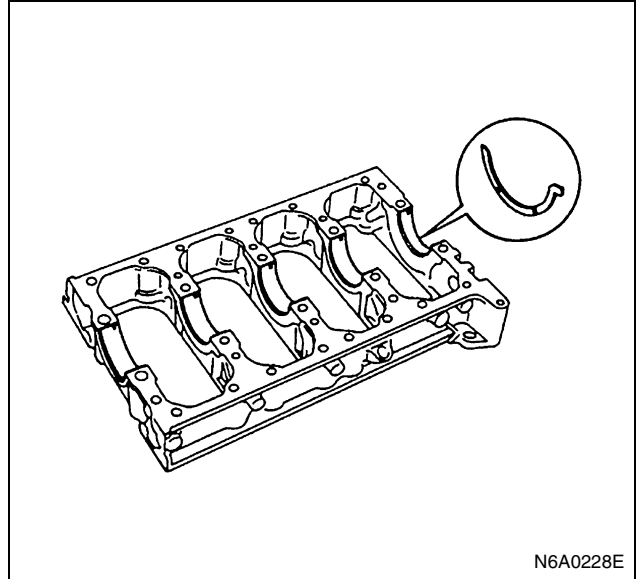
Caution:

Do not apply engine oil to the bearing back faces and the crankcase bearing fitting surfaces.

- 2) Locate the position mark applied at disassembly if the removed lower bearings are to be re-used.

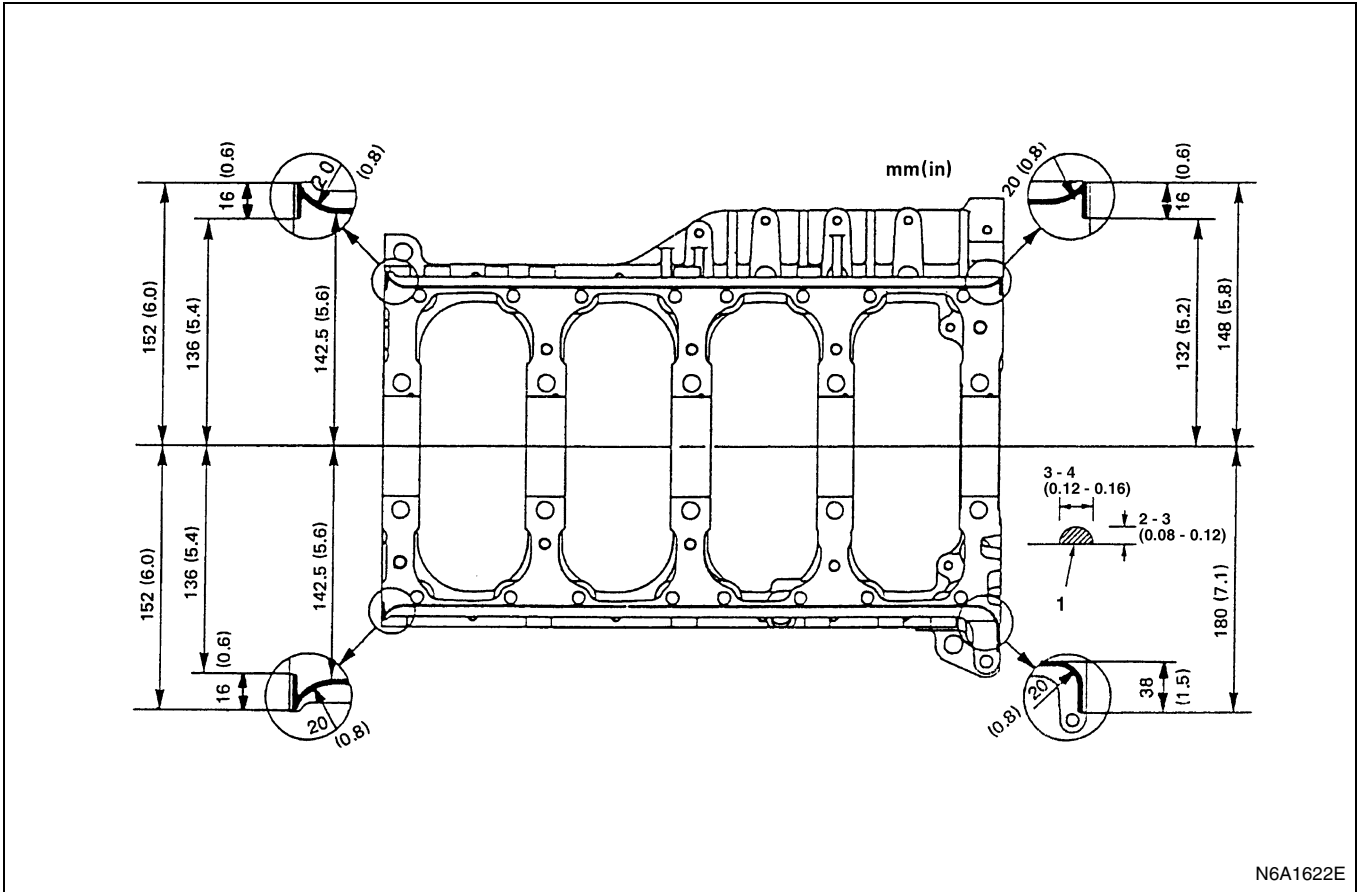
7. Thrust Bearing Lower

- 1) Install the thrust bearing lower to the rear side of the crankcase No.5 journal.
- 2) The thrust bearing oil grooves must be facing the sliding faces.



8. Crankcase

- 1) Apply a 3 mm (0.12 in) bead of recommended liquid gasket (Three Bond 1207C) or its equivalent to the crankcase upper surface as shown in the illustration.
- 2) Carefully place the crankcase on the cylinder body.
 - Install the crankcase within 20 minutes after application of liquid gasket.



Legend

- 1. Liquid gasket

3) Tighten the crankcase to the specified torque in the numerical order shown in the illustration.

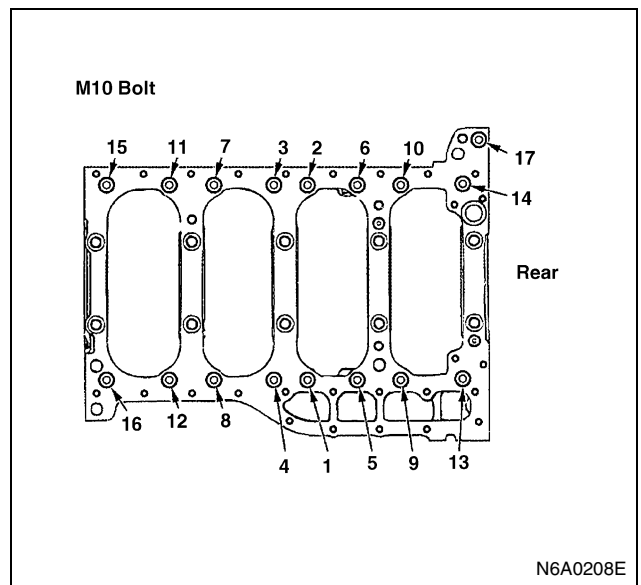
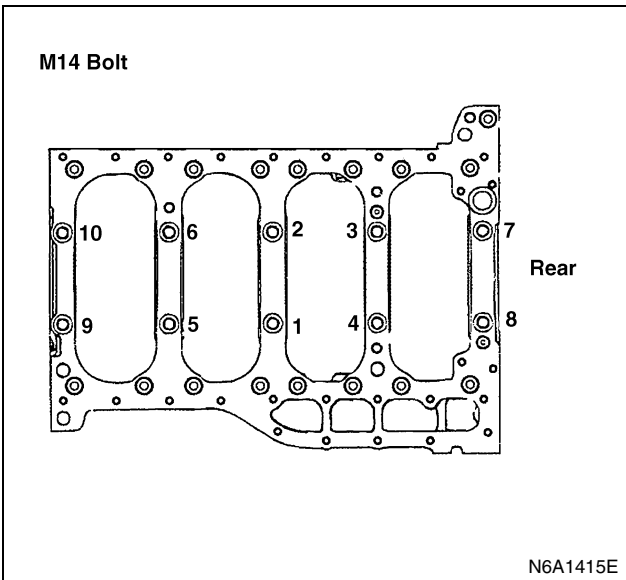
Tighten:

Crankcase bolt (M14: (1) — (10)) to

- 1st step: 98 N·m (10 kg·m / 72 lb·ft)
- 2nd step: 132 N·m (13.5 kg·m / 98 lb·ft)
- 3rd step: 30 — 60°

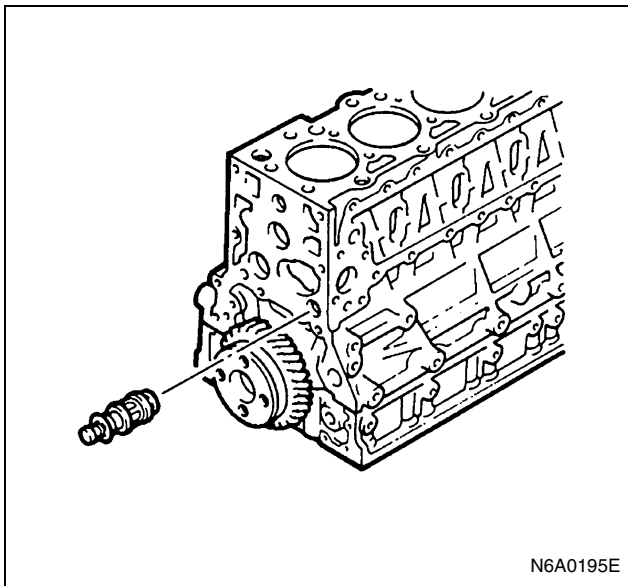
Tighten:

Crankcase bolt (M10: (1) — (17)) to 37 N·m (3.8 kg·m / 27 lb·ft)

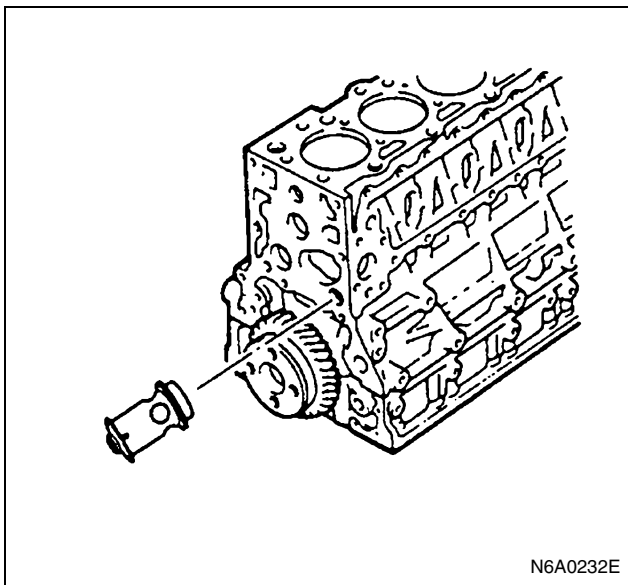


- Angle gauge: 5-8840-0266-0
- 9. Piston and Connecting Rod Assembly
 - 10. Connecting Rod Lower Bearing

11. Connecting Rod Cap Assembly
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
12. Oil Pump Assembly
13. Idle Gear A
14. Flywheel Housing
15. Power Steering Pump Idle Gear
16. Power Steering Pump Idle Gear Cover
Above works refer to O"IL PUMP" section in this manual.
17. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Insert the oil thermo valve into the cylinder body.



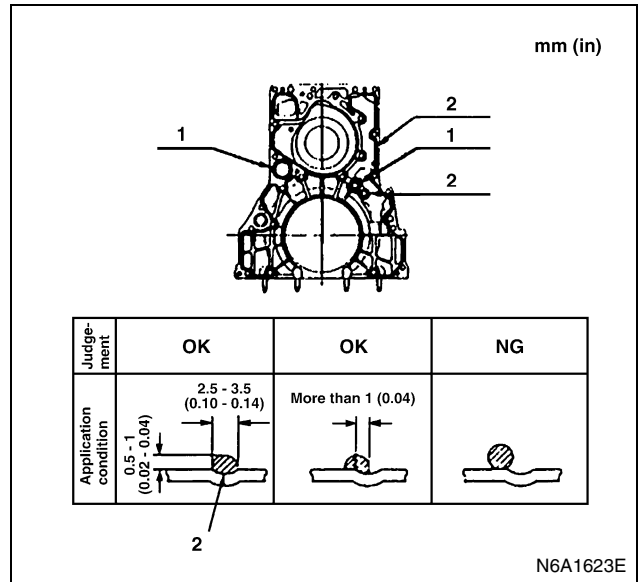
18. Bypass Valve (4HE1-TC)
Insert the bypass valve into the cylinder body.



19. Front Retainer
 - 1) Carefully wipe any foreign material from the cylinder body front face.
 - 2) Apply 2.5 — 3.5 mm (0.10 — 0.14 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove of the

front retainer fitting surface shown in the illustration.

- 3) Install the O-rings (2 pieces) to the front retainer.
 - Install the front retainer within 7 minutes after application of liquid gasket.
 - For the dislocation of liquid gasket, refer to the illustration.



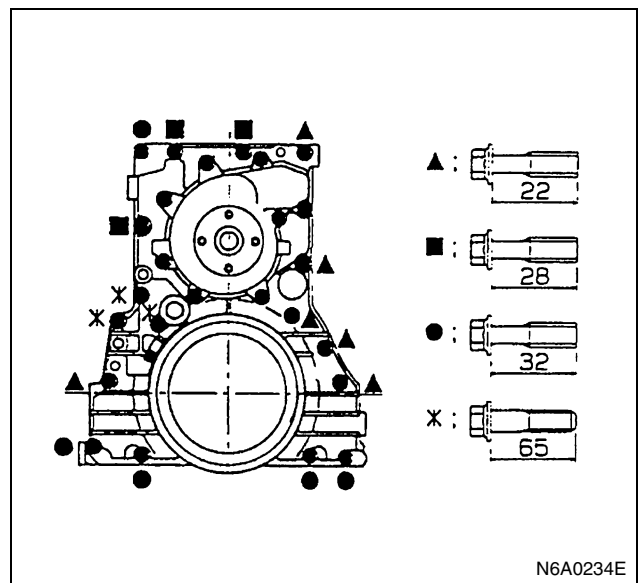
Legend

1. O-ring
2. Liquid gasket

- 4) Align the cylinder body knock pins with the front retainer knock pin holes.

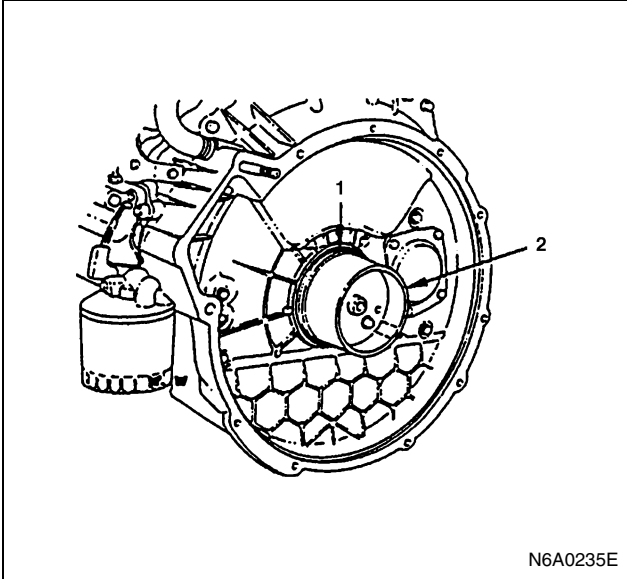
Tighten:

Front retainer bolt to 24 N·m (2.4 kg·m / 17 lb-ft)

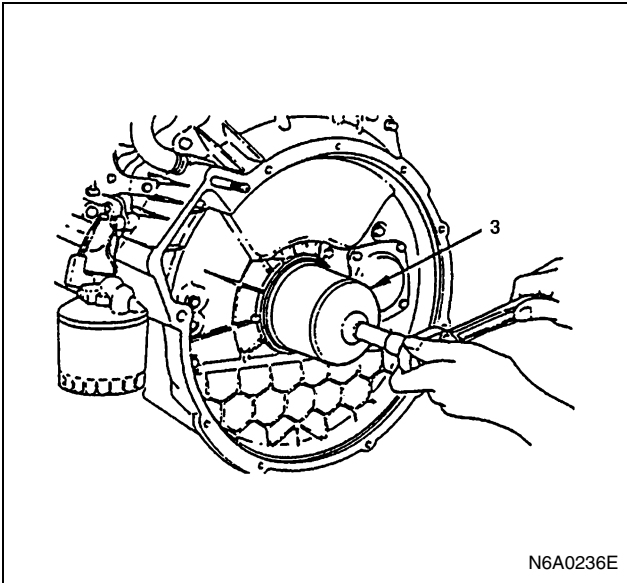


20. Water Pump Assembly
21. Water Pump Pulley
22. Oil Pump Strainer

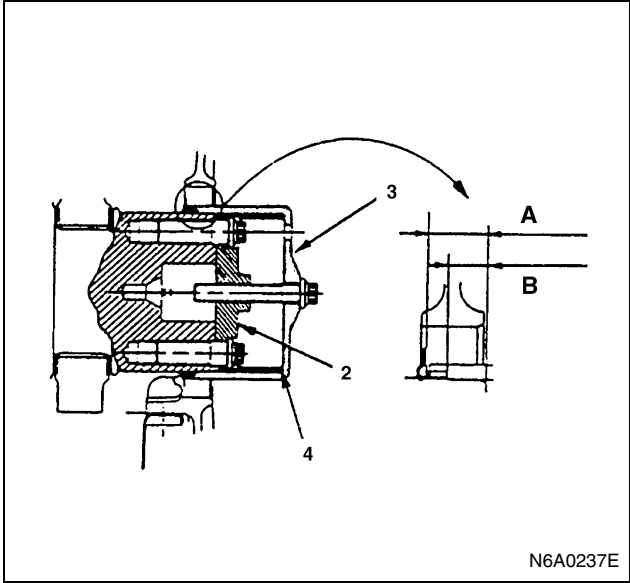
- 23. Oil Pan
 - 24. Spacer Rubber
Above works refer to "CYLINDER BLOCK" section in this manual.
 - 25. Crankshaft Rear Slinger
Press in the slinger using oil seal setting tool kit.
- 1) Insert the slinger (1) into the end of the adapter (2) and install the adapter on the crankshaft.



- 2) Cover the sleeve (3) and tighten the bolt until the sleeve comes to contact the adapter stopper (4).

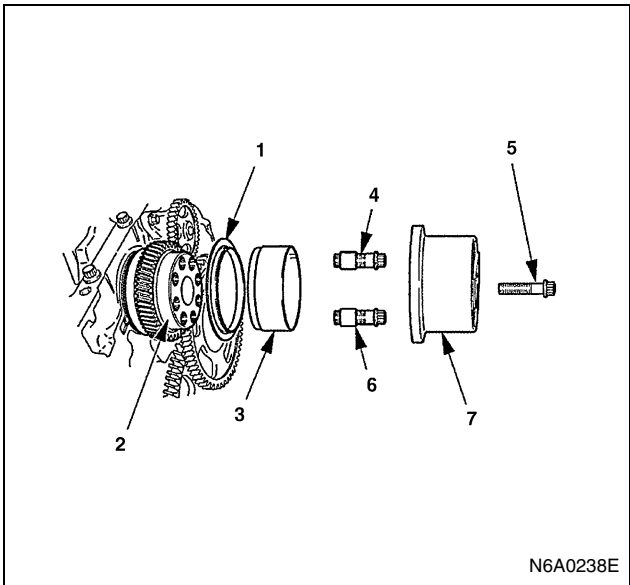


- 3) Make sure of measurements specified in the illustration as well as of slinger deflection.
(A): 17.3 ± 0.3 mm (0.681 ± 0.012 in)
(B): 10.8 ± 0.1 mm (0.425 ± 0.004 in)



Notice:
Be sure to replace the slinger and oil seal as a set.
Oil Seal Setting Tool Kit: 5-8840-2431-0

Rear slinger and oil seal setting tools			
Part Name	Stamp	Slinger	Oil Seal
Adapter	RR	○	○
Sleeve	RR	○	○
Oil seal adapter ring	RR		○
Center bolt	—	○	○
Adapter bolt	—	○	○
Adapter bolt collar	RR	○	○

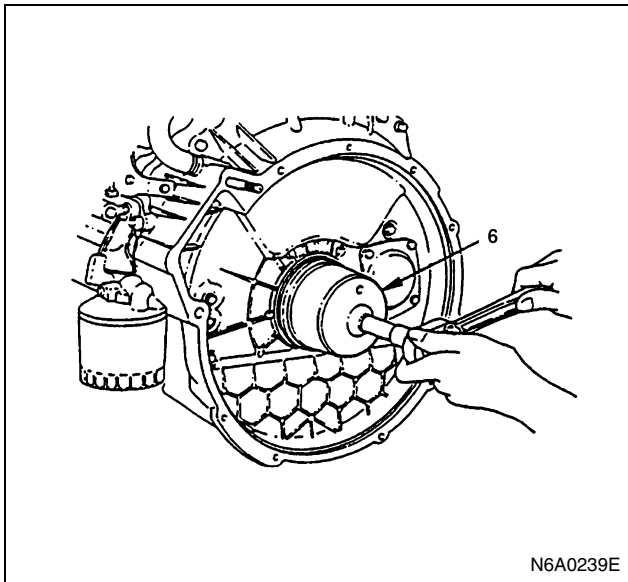


Legend

1. Slinger
2. Crankshaft
3. Adapter
4. Adapter bolt
5. Center bolt
6. Collar
7. Sleeve

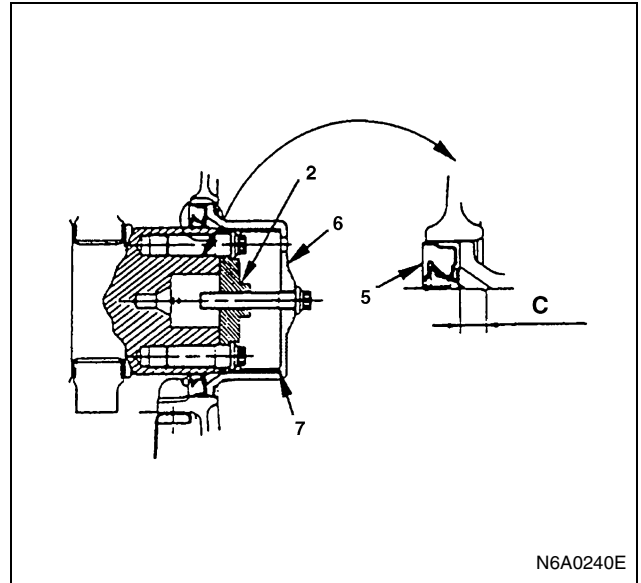
26. Crankshaft Rear Oil Seal

- 1) Apply engine oil to the lip of the oil seal.
- 2) Press in the oil seal using rear oil seal setting tool kit.
- 3) Remove the slinger sleeve and insert the oil seal (5) into the adapter (2).
- 4) Install the adapter ring into the sleeve.
- 5) Install the oil seal sleeve (6) to the adapter (2) and tighten the center bolt until the sleeve comes to contact the adapter stopper (7).

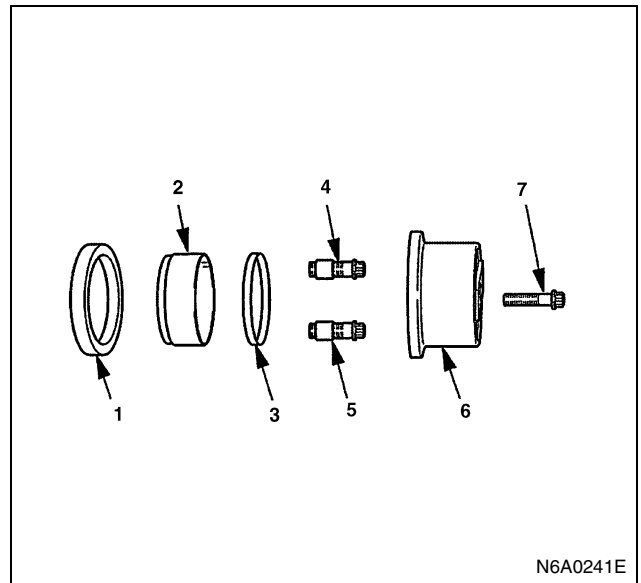


N6A0239E

- 6) With the oil seal pressed in, make sure of the measurements specified in the illustration.
(C): 7.8 ± 0.3 mm (0.307 ± 0.012 in)



N6A0240E



N6A0241E

Legend

1. Oil seal
2. Adapter
3. Ring
4. Adapter bolt
5. Collar
6. Sleeve
7. Center bolt

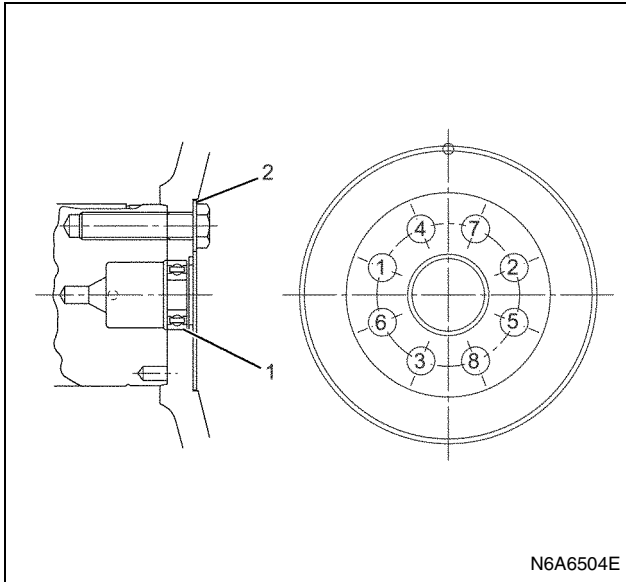
27. Flywheel Assembly

- 1) Apply molybdenum disulfide grease to the flywheel bolt threads and setting faces.
- 2) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
- 3) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0
- 4) Install the washer and the flywheel bolts and tighten to the specified torque in numerical order show in the illustration.

Tighten:

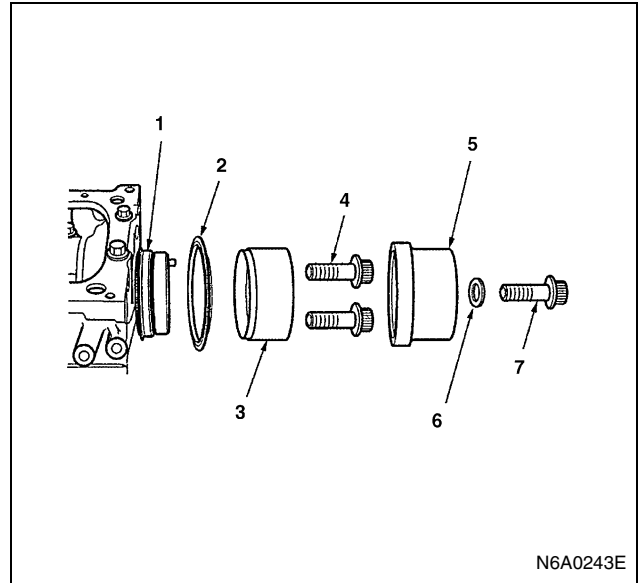
Flywheel bolt to

- 1st step: 78 N·m (8.0 kg·m / 58 lb·ft)
- 2nd step: 90 — 120°



Legend

- 1. Washer
- 2. Pilot bearing



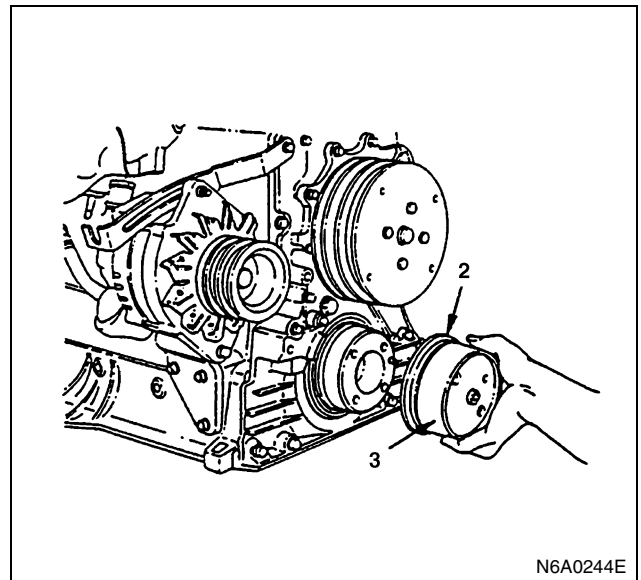
Legend

- 1. Crankshaft
- 2. Slinger
- 3. Adapter
- 4. Adapter bolt
- 5. Sleeve
- 6. Washer (5 mm (0.20 in))
- 7. Center bolt

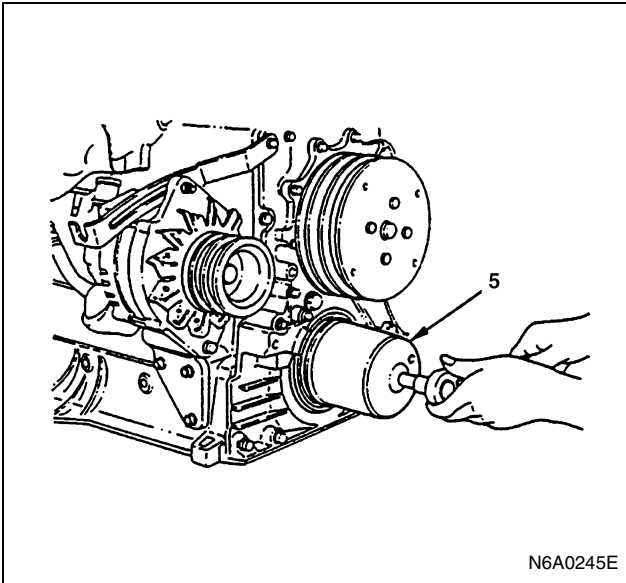
- 5) Remove the crankshaft stopper.
- 28. Crankshaft Front Slinger
Press in the slinger using the oil seal setting tool kit.
Oil Seal Setting Tool Kit: 5-8840-2431-0

- 1) Insert the slinger (2) into the end of the adapter (3) and install the adapter on the crankshaft.

Front slinger and oil seal setting tools			
Part Name	Stamp	Slinger	Oil Seal
Adapter	FT	○	○
Sleeve	FT	○	○
Oil seal adapter ring	FT		○
Center bolt	—	○	○
Adapter bolt	—	○	○



- 2) Cover the sleeve (5) and tighten the bolt until the sleeve comes to contact the adapter stopper (8).

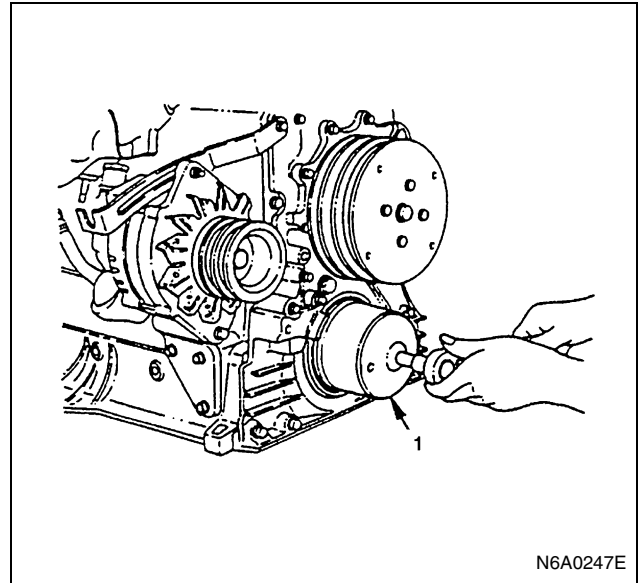


N6A0245E

- 3) Make sure of measurements specified in the illustration as well as of slinger deflection.
 - (A): 40.5 ± 0.3 mm (1.594 ± 0.012 in)
 - (B): 34.0 ± 0.1 mm (1.339 ± 0.004 in)

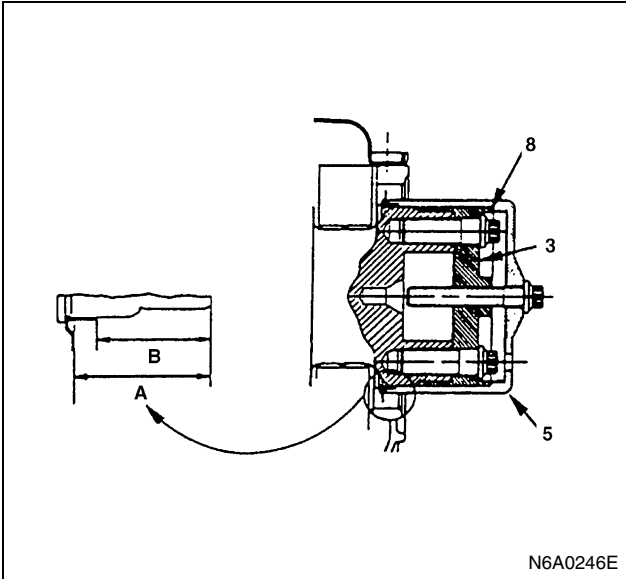
Notice:

Be sure to replace the slinger and the oil seal as a set. Use about 5mm (0.20 in) thickness plain washer on the center bolt.



N6A0247E

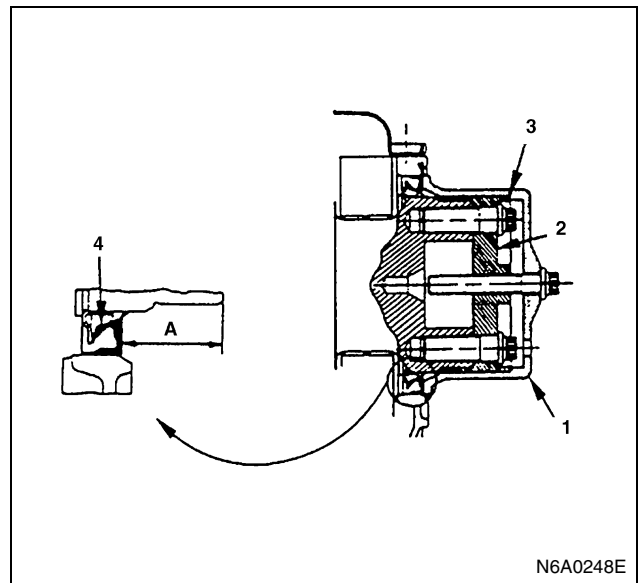
- 6) Make sure of the measurements specified in the illustration.
 - (A): 31 ± 0.3 mm (1.220 ± 0.012 in)



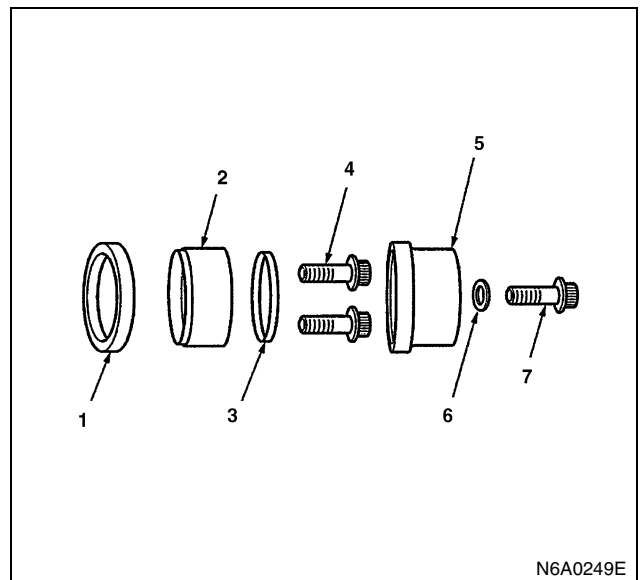
N6A0246E

29. Crankshaft Front Oil Seal

- 1) Apply engine oil to the lip of the oil seal.
- 2) Press in the oil seal using the front oil seal setting tool kit.
- 3) Remove the slinger sleeve and insert the oil seal (4) into the adapter (2).
- 4) Install the adapter ring into the sleeve.
- 5) Install the oil seal sleeve (1) to the adapter (2) and tighten the center bolt until the sleeve comes to contact the adapter stopper (3).



N6A0248E



N6A0249E

Above works refer to "CYLINDER HEAD" section in this manual.

Legend

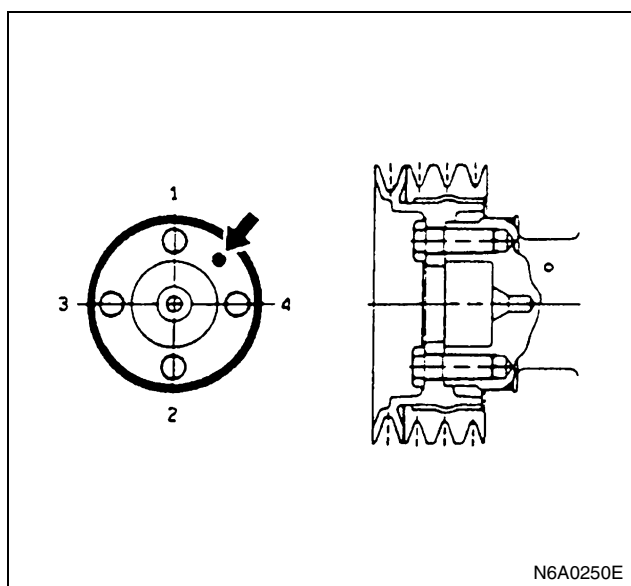
1. Oil seal
2. Adapter
3. Ring
4. Adapter bolt
5. Sleeve
6. Washer (5 mm (0.20 in))
7. Center bolt

30. Crankshaft Damper Pulley

- 1) Apply a coat of engine oil to the threads of the bolts.
- 2) Align the damper pulley with the crankshaft knock pin and tighten the bolts to the specified torque in numerical order.

Tighten:

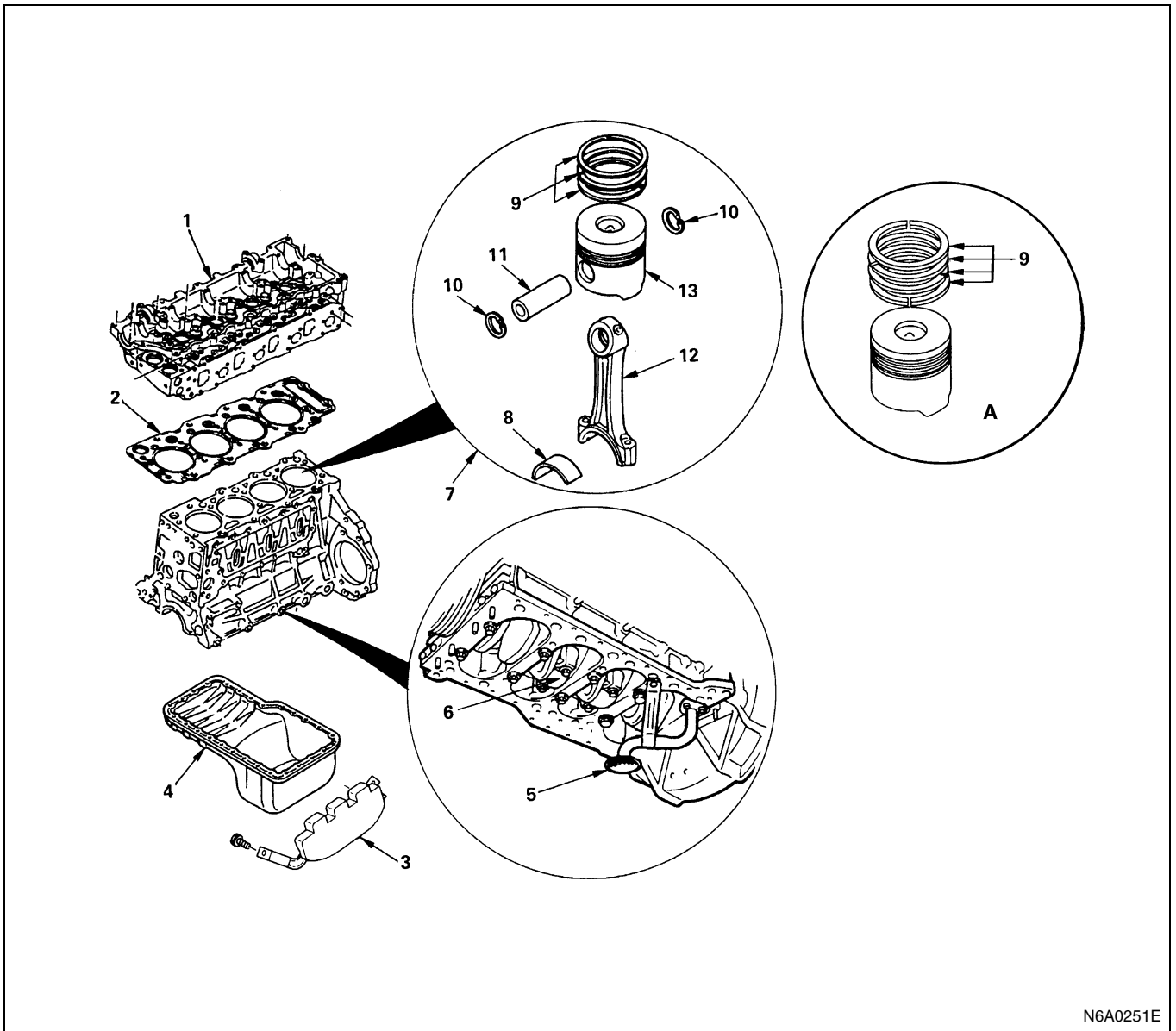
Damper pulley bolt to 200 N·m (20.4 kg·m / 147 lb·ft)



31. Generator Bracket
 32. Fan Belt Adjust Plate
 33. Injection Pump Assembly
 34. Engine Foot
 35. Generator
 36. Fan Belt
 37. Fan Belt Adjustment
 38. Vacuum Pump Rubber Hose
 39. Vacuum Pump Oil Pipe
 40. Oil Filter Assembly
 41. Oil Pipe
 42. Engine Control Lever Assembly
 43. Engine Control Wire
 44. Driven Plate
 45. Clutch Pressure Plate Assembly
 46. Cylinder Head Gasket
- Above works refer to "CYLINDER BLOCK" section in this manual.
47. Cylinder Head Assembly

PISTON AND CONNECTING ROD

Component



N6A0251E

Legend

- | | |
|---------------------------|------------------------------|
| A. For 4HE1-TC | 7. Piston and connecting rod |
| 1. Cylinder head assembly | 8. Connecting rod bearing |
| 2. Cylinder head gasket | 9. Piston ring |
| 3. Spacer rubber | 10. Piston pin snap ring |
| 4. Oil pan | 11. Piston pin |
| 5. Oil pump strainer | 12. Connecting rod |
| 6. Connecting rod cap | 13. Piston |

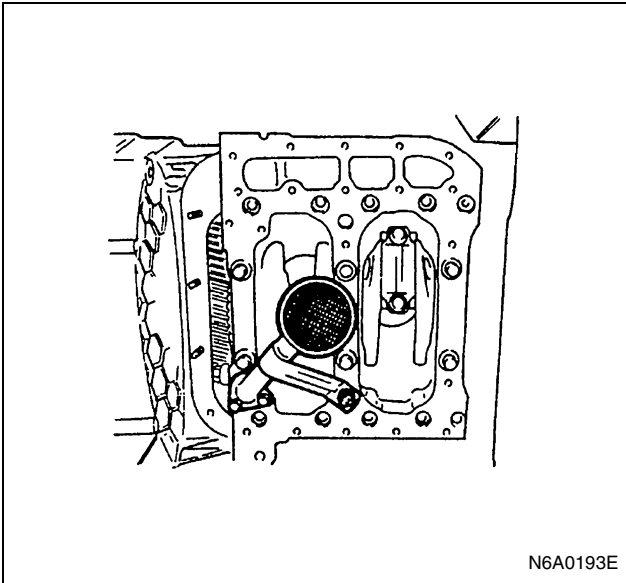
Disassembly

1. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
2. Cylinder Head Gasket

Caution:

Do not reuse the cylinder head gasket.

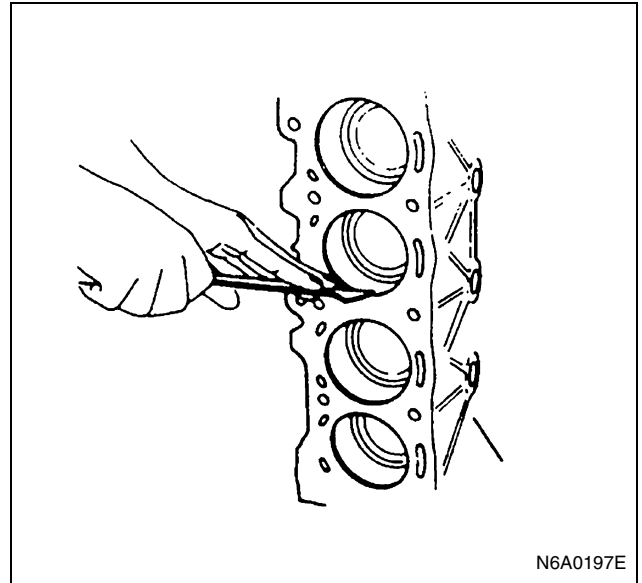
3. Spacer Rubber
4. Oil Pan
5. Oil Pump Strainer



N6A0193E

6. Connecting Rod Cap

- 1) Take out the connecting rod bearing cap bolts and remove the bearing cap with the lower bearing.
- 2) If the connecting rod lower bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



N6A0197E

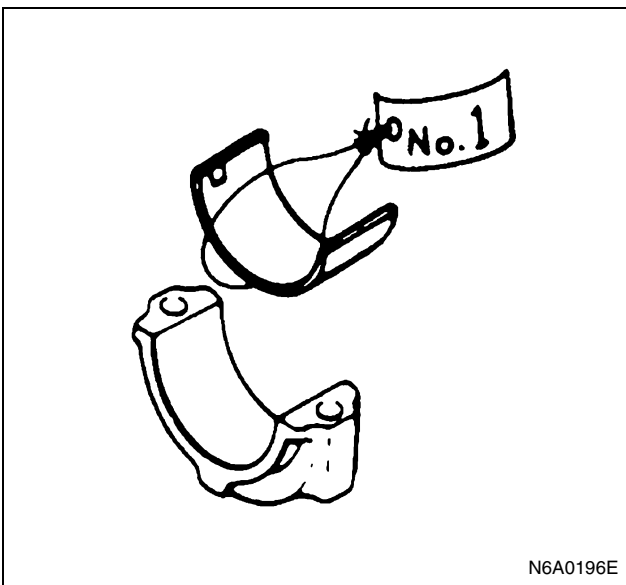
- 2) Remove the piston and connecting rod assembly upward by pushing on the edge of the connecting rod with a hammer handle or equivalent.
- 3) If the connecting rod bearing are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

Caution:

Do not bend or damage the oiling jet.

Notice:

When removing the piston and connecting rod assembly, pull the connecting rod in parallel with the cylinder bore.



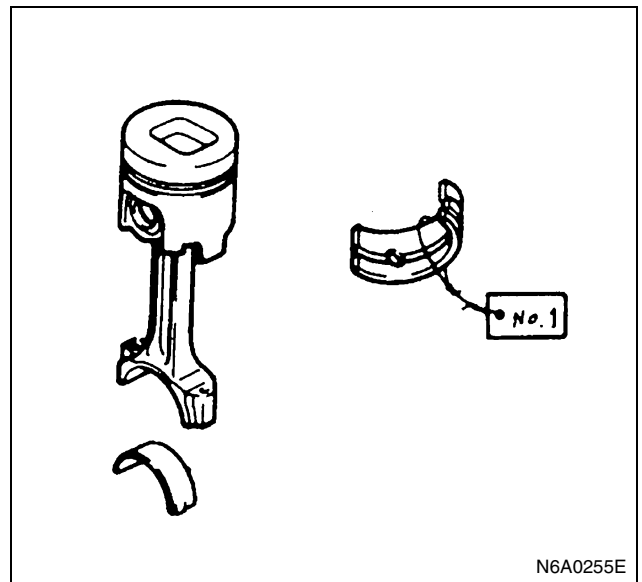
N6A0196E

8. Connecting Rod Bearing

If the connecting rod bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

7. Piston and Connecting Rod Assembly

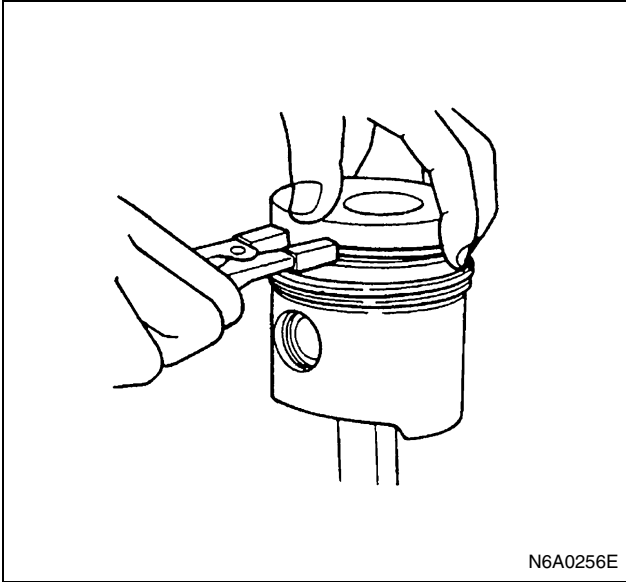
- 1) To facilitate smooth removal of piston, remove carbon from the upper part of the cylinder wall using a scraper or equivalent.



N6A0255E

9. Piston Ring

- 1) Clamp the connecting rod in a vise.
Take care not to damage the connecting rod.
- 2) Use piston ring replacer to remove the piston rings.
Do not attempt to use some other tool to remove the piston rings. Piston ring stretching will result in reduced piston ring tension.



10. Piston Pin Snap Ring

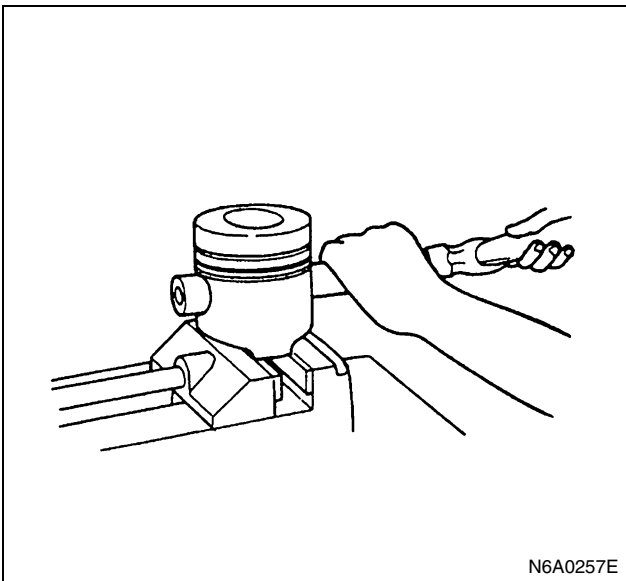
Use a pair of snap ring pliers to remove the piston pin snap rings.

11. Piston Pin

12. Connecting Rod

13. Piston

Tap the piston pin out with a hammer and a brass bar. If the pistons are to be reinstalled, mark their installation positions by tagging each piston with the cylinder number from which it was removed.



Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

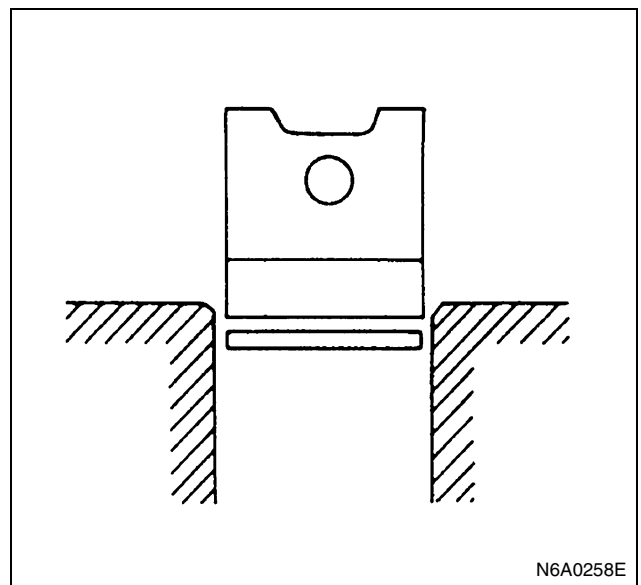
Piston Grade Selection and Cylinder Bore Measurement

Refer to the Section "CYLINDER BLOCK", Item "Cylinder Liner Bore Measurement" for details on piston grade selection and cylinder liner bore measurement.

Piston Ring

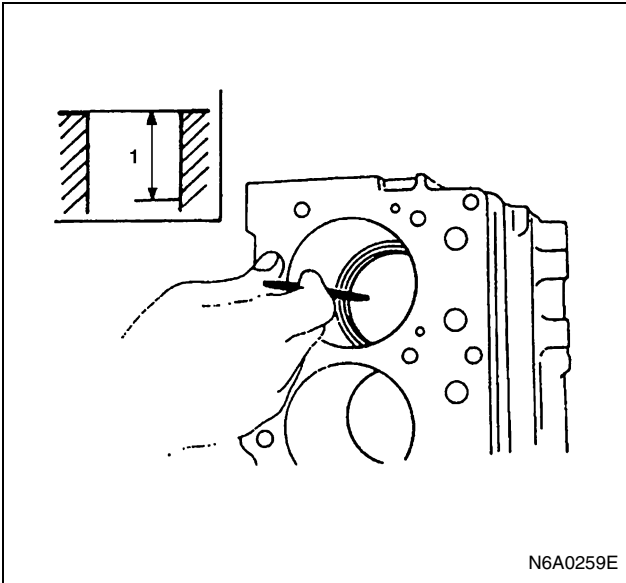
Piston Ring Gap

1. Insert the piston ring horizontally (in the position it would assume if it were installed to the piston) into the cylinder liner bore.



2. Push the piston ring into the cylinder liner bore until it reaches the point (1) where the cylinder liner bore is the smallest.
Do not allow the piston ring to slant to one side or the other. It must be perfectly horizontal.

Measuring Point	mm (in)
	Approx. 150 (6)



N6A0259E

- Use a feeler gauge to measure the piston ring gap. If the measured value exceeds the specified limit, the piston ring must be replaced.

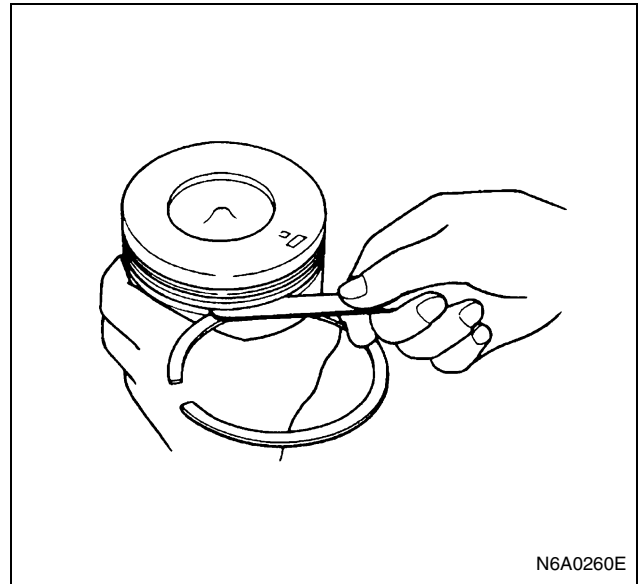
Piston Ring Gap / 4HF1 / 4HF1-2		mm (in)
	Standard	Limit
1st compression ring gap	0.24 — 0.39 (0.0094 — 0.0153)	1.50 (0.0591)
2nd compression ring gap	0.35 — 0.50 (0.0138 — 0.0197)	
Oil ring gap	0.02 — 0.40 (0.0008 — 0.0157)	

Piston Ring Gap / 4HG1 / 4HG1-T		mm (in)
	Standard	Limit
1st compression ring gap	0.24 — 0.39 (0.0094 — 0.0153)	1.50 (0.0591)
2nd compression ring gap	0.35 — 0.50 (0.0138 — 0.0197)	
Oil ring gap	0.15 — 0.35 (0.00591 — 0.0138)	

Piston Ring Gap / 4HE1-TC		mm (in)
	Standard	Limit
1st compression ring gap	0.24 — 0.40 (0.0094 — 0.0157)	1.50 (0.0591)
2nd and 3rd compression ring gap	0.30 — 0.450 (0.0118 — 0.0177)	
Oil ring gap	0.20 — 0.40 (0.0078 — 0.0157)	

Piston Ring and Piston Ring Groove Clearance

- Use a feeler gauge to measure the clearance between the piston ring and the piston ring groove at several points around the piston.



N6A0260E

Piston Ring and Piston Ring Groove Clearance / 4HF1, 4HF1-2, 4HG1, 4HG1-T		mm (in)
	Standard	Limit
1st Compression Ring	0.062 — 0.092 (0.0024 — 0.0036)	0.20 (0.0079)
2nd Compression Ring	0.04 — 0.08 (0.0015 — 0.0031)	0.15 (0.0059)
Oil ring gap	0.02 — 0.06 (0.0008 — 0.0024)	

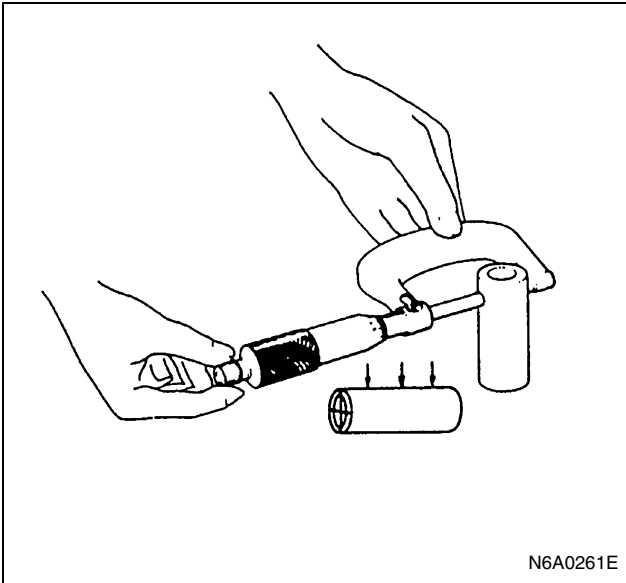
Groove Clearance / 4HE1-TC		mm (in)
	Standard	Limit
1st Compression Ring	0.09 — 0.13 (0.0035 — 0.0051)	0.20 (0.0078)
2nd and 3rd Compression Ring	0.09 — 0.13 (0.0035 — 0.0051)	
Oil ring gap	0.03 — 0.07 (0.0012 — 0.0028)	0.15 (0.0059)

- Visually inspect the piston ring grooves. If a piston ring groove is damaged or distorted, the piston must be replaced.

Piston Pin

Piston Pin Diameter

Use a micrometer to measure the piston pin outside diameter at several points. If the measured value is less than the specified limit, the piston pin must be replaced.



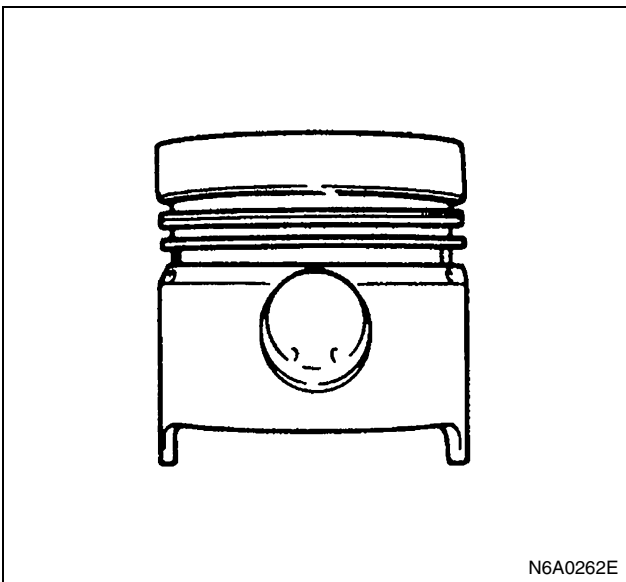
N6A0261E

Piston Pin Diameter		mm (in)
Engine model	Standard	Limit
Except 4HE1-TC	35.995 — 36.000 (1.4171 — 1.4173)	35.970 (1.4161)
4HE1-TC	39.995 — 40.000 (1.5746 — 1.5748)	39.970 (1.5736)

Piston Pin Hole and Piston Pin Clearance

Use an inside dial indicator to measure the piston pin hole (in the piston).

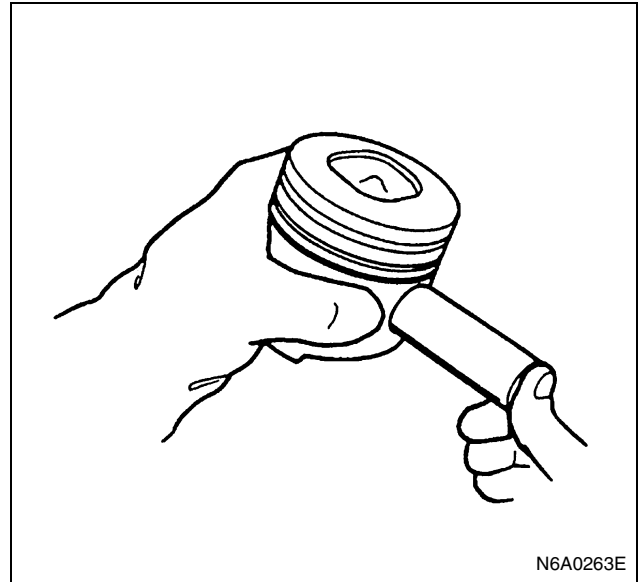
Piston Pin Hole and Piston Pin Clearance		mm (in)
Standard	Limit	
0.004 — 0.017 (0.00016 — 0.00067)	0.04 (0.0016)	



N6A0262E

If an inside dial indicator is not available, use the following procedure to check the piston pin clearance.

1. Use a piston heater to heat the piston to approximately 80 — 100°C (176 — 212°F)
2. Push strongly against the piston pin with your thumbs. The piston pin should move smoothly with little or no resistance.



N6A0263E

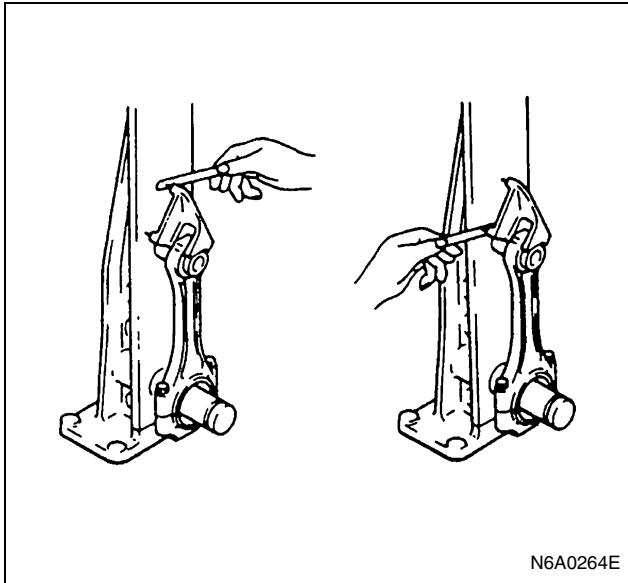
Connecting Rod

Connecting Rod Alignment

Use a connecting rod aligner to measure the distortion and the parallelism between the connecting rod big end hole and the connecting rod small end hole.

If either the measured distortion or parallelism exceeds the specified limit, the connecting rod must be replaced.

Connecting Rod Alignment		mm (in)
Per Length of 100 (3.94)		
	Standard	Limit
Distortion	0.05 (0.002) or less	0.20 (0.008)
Parallelism		



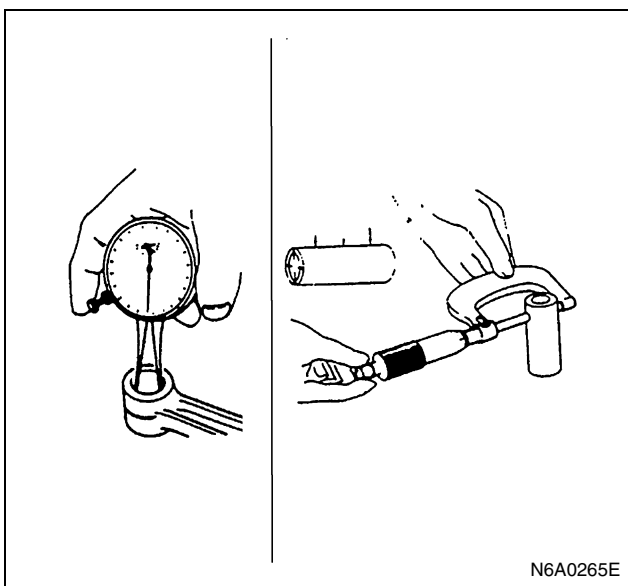
N6A0264E

Piston Pin and Connecting rod Small End Bushing Clearance

Use a caliper calibrator and a dial indicator to measure the clearance between the piston pin and connecting rod small end bushing.

If the clearance between the piston pin and the connecting rod small end bushing exceeds the specified limit, replace the piston pin and/or the connecting rod bushing.

Piston Pin and Connecting Rod Small End Bushing Clearance		mm (in)
Standard	Limit	
0.012 — 0.027 (0.0005 — 0.0011)	0.05 (0.002)	



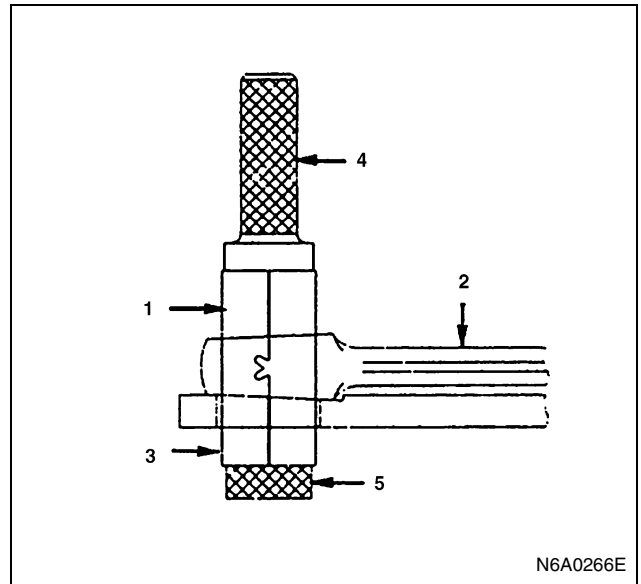
N6A0265E

Connecting Rod Bushing Replacement

Connecting Rod Bushing Removal

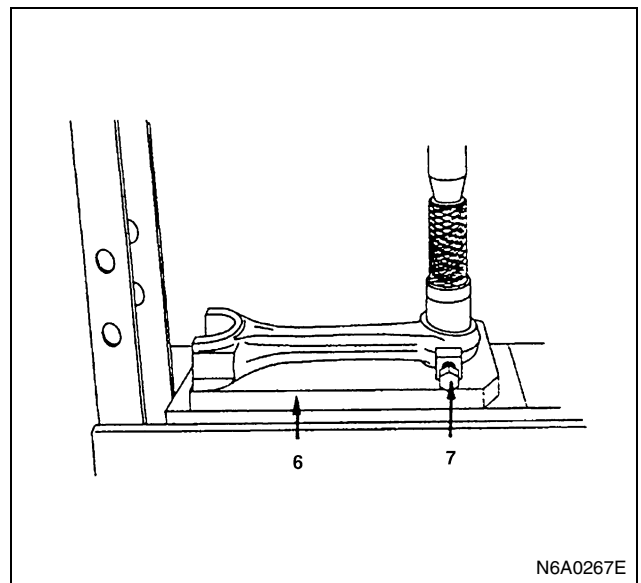
1. Set the collar (1), the connecting rod (2), and the collar (3) to the setting bar (4).

- Connecting Rod Bushing Replacer: 5-8840-2340-0
2. Hand-tighten the nut (5) until there is no more gap.



N6A0266E

3. Set the connecting rod bushing replacer base (6) to the bench press.
4. Set the connecting rod to the connecting rod bushing replacer base.
5. Tighten the bolt (7).

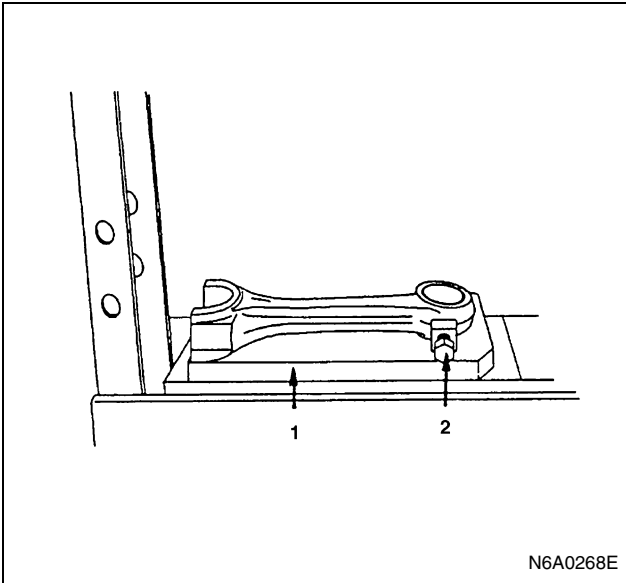


N6A0267E

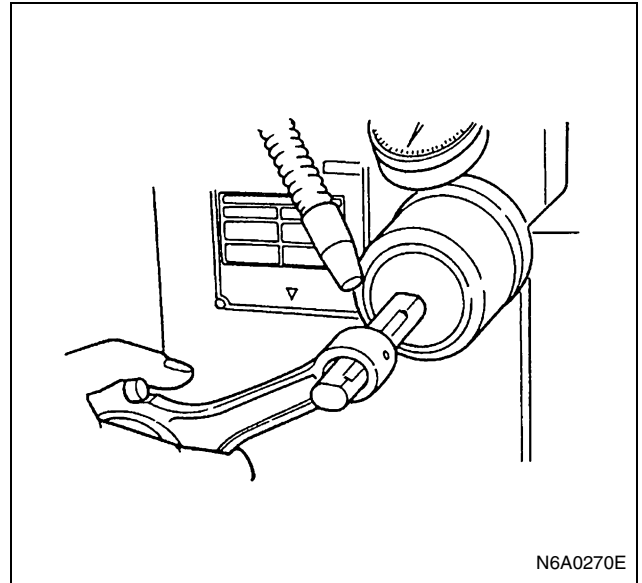
6. Use the bench press to force the bushing from the connecting rod.

Connecting Rod Bushing Installation

1. Set the connecting rod bushing replacer base (1) to the bench press.
Connecting Rod Bushing Replacer: 5-8840-2340-0
2. Set the connecting rod to the connecting rod replacer base.
The connecting rod must be perfectly horizontal.
3. Tighten the bolt (2) to hold the connecting rod small end in place.

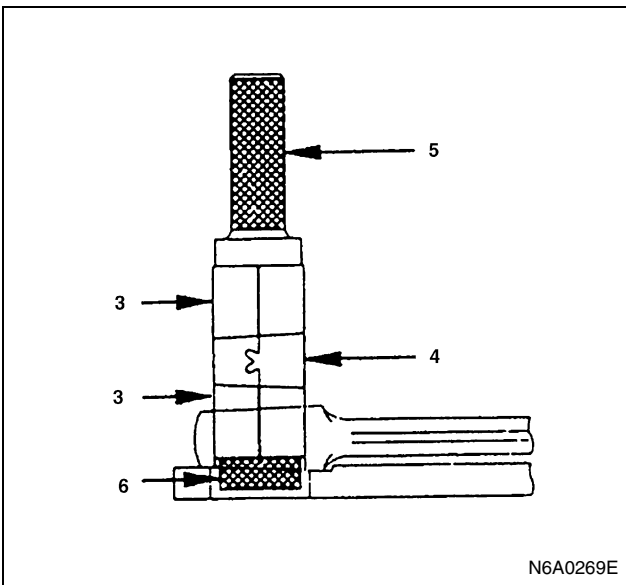


4. Install the two collars (3) and the new bushing (4) to the setting bar (5). Align the bushing clinch line and the collar setting marks. Tighten the nut (6).

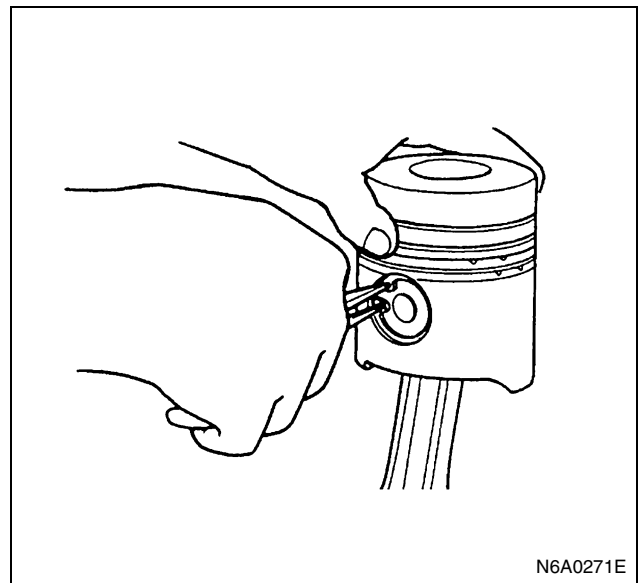


Reassembly

1. Piston
2. Piston Pin Snap Ring
Use a pair of snap ring pliers to install the piston pin snap ring to the piston.

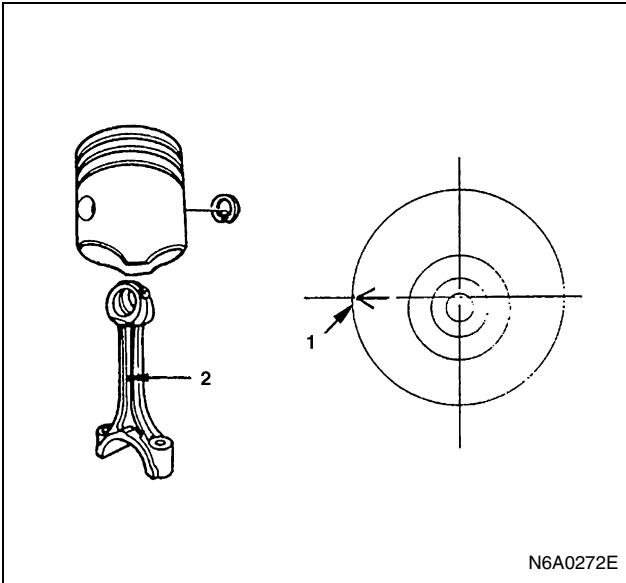


5. Use the bench press to press the new bushing into position inside the connecting rod. Check that the bushing oil holes and the connecting rod oil holes are aligned.
6. Use a pinhole grinder to finish the new bushing.



3. Connecting Rod
 - 1) Clamp the connecting rod in a vise. Take care not to damage the connecting rod.
 - 2) Install the connecting rod so that the piston head front mark (1) and the connecting rod forging mark (projecting) (2) are set in the same direction.

Connecting Rod Small End Bushing Inside Diameter	mm (in)
Except 4HE1-TC	36.012 — 36.022 (1.4178 — 1.4182)
4HE1-TC	40.012 — 40.022 (1.5753 — 1.5767)

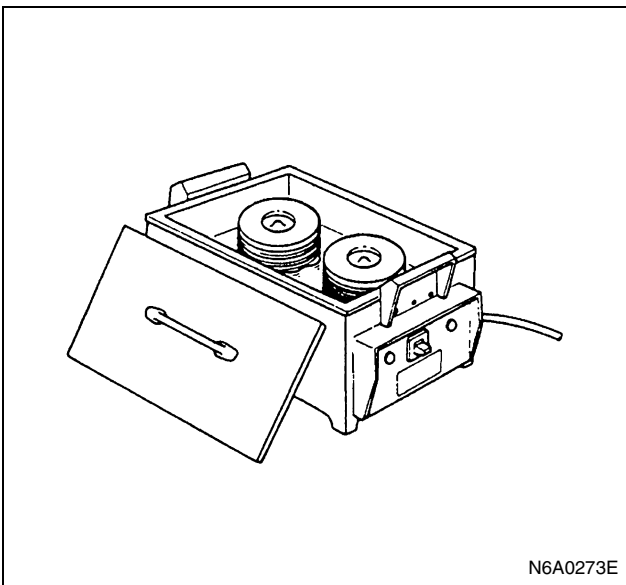


N6A0272E

4. Piston Pin

If could not be installed piston pin, it is recommended to remove it by following procedure.

- 1) Use a piston heater to heat the piston to 80 — 100°C (176 — 212°F).



N6A0273E

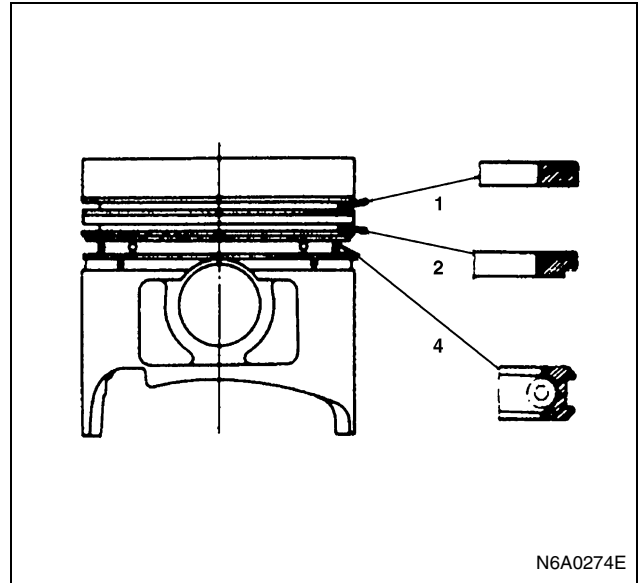
- 2) Apply a coat of the engine oil to the piston pin.
- 3) Use your fingers to force the piston pin into the piston until it makes contact with the snap ring.
- 4) Check to see if the connecting rod moves smoothly on the piston pin.

5. Snap Ring

6. Piston Ring

- 1) Use a piston ring replacer to install the three piston rings.

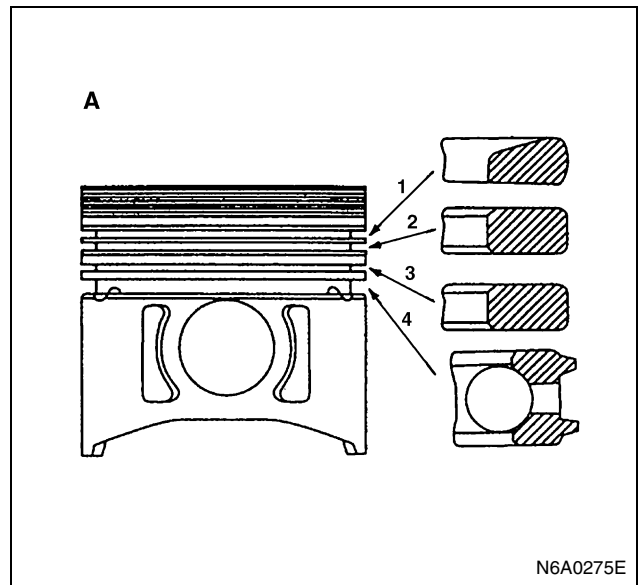
Install the piston rings in the order shown in the illustration.



N6A0274E

Legend

1. 1st compression ring
2. 2nd compression ring
4. Oil ring



N6A0275E

Legend

- A. For 4HE1-TC
1. 1st compression ring
 2. 2nd compression ring
 3. 3rd compression ring (For 4HE1-TC)
 4. Oil ring

Notice:

Insert the expander coil into the oil ring groove so that there is no gap on either side of the expander coil before installing the oil ring.

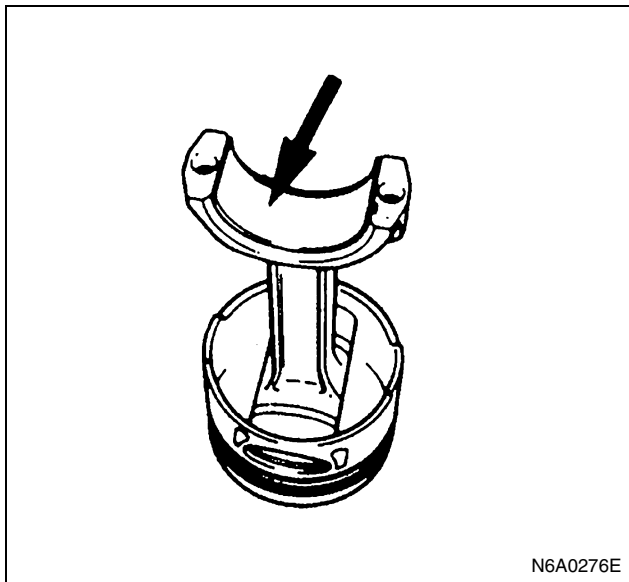
Install the compression rings with the stamped side facing up.

- 2) Apply engine oil to the piston ring surfaces.

3) Check to see if the piston rings rotate smoothly in the piston ring grooves.

7. Connecting Rod Bearing

Carefully wipe any oil or other foreign material from the connecting rod bearing back face and the connecting rod bearing fitting surface.

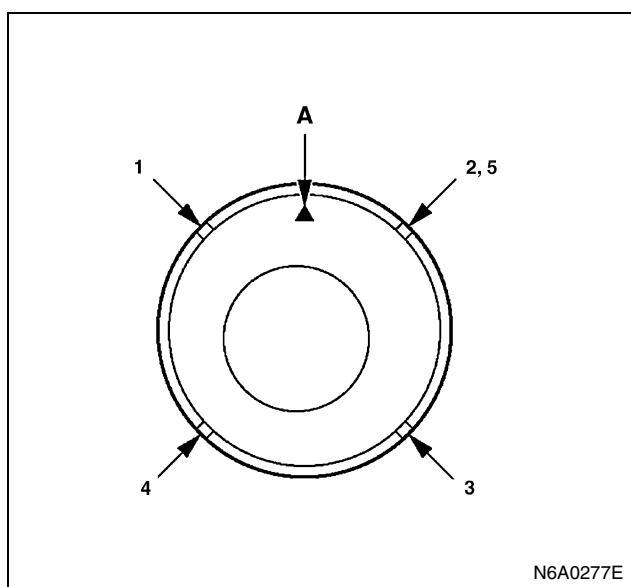


8. Piston and Connecting Rod Assembly

Notice:

When installing new connecting rod and/or connecting rod bearings, refer to the selection table. Above works refer to "CRANKSHAFT" section in this manual.

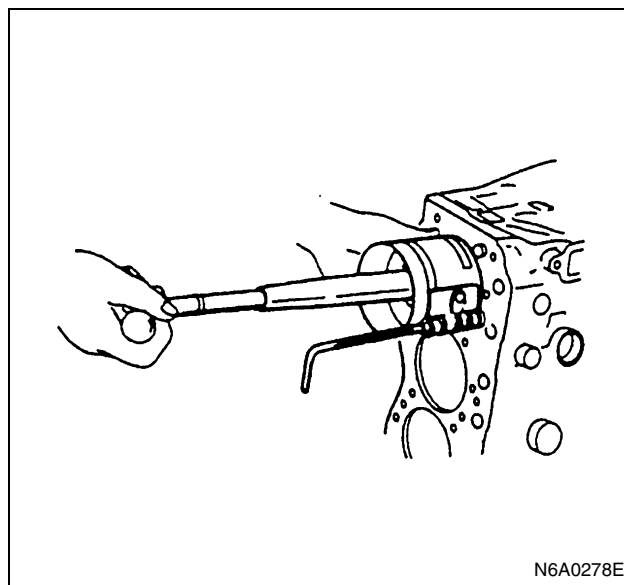
- 1) Apply a coat of the engine oil to the circumference of each piston ring and piston.
- 2) Position the piston ring gaps as shown in the illustration.



Legend

- A. Front mark
- 1. 1st compression ring
- 2. 2nd compression ring
- 3. 3rd compression ring (For 4HE1-TC only)
- 4. Oil ring
- 5. Coil expander

- 3) Apply a coat of molybdenum disulfide grease to the two piston skirts.
This will facilitate smooth break-in when the engine is first started after reassembly.
- 4) Apply a coat of the engine oil to the upper bearing surfaces.
- 5) Apply a coat of the engine oil to the cylinder wall.
- 6) Position the piston head front mark so that it is facing the front of the engine.
- 7) Use the piston ring compressor to compress the piston rings.
Piston Ring Compressor: 5-8840-9018-0
- 8) Use a hammer grip to push the piston in until the connecting rod makes contact with the crankpin.
At the same time, rotate the crankshaft until the crankpin is at bottom dead center.

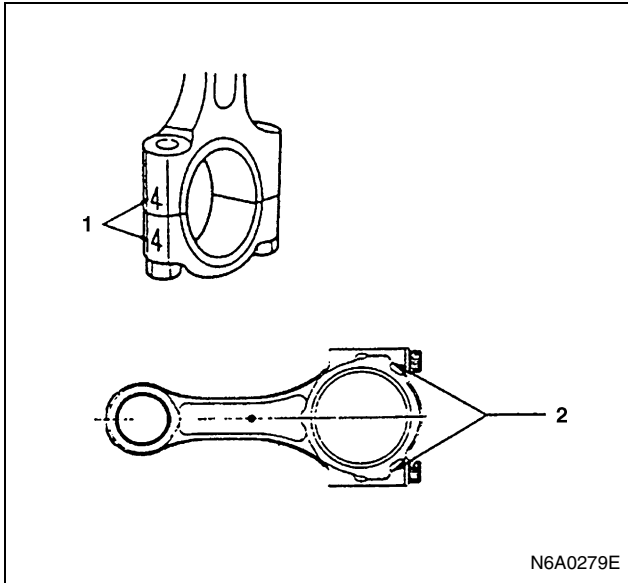


Caution:

Do not bend or damage the oiling jet.

9. Connecting Rod Cap

- 1) Install the connecting rod bearing caps.
- 2) Align the bearing cap cylinder number marks (1) and the connecting rod cylinder number marks (1).
- 3) Apply a coat of molybdenum disulfide grease to the threads and setting faces of each connecting rod cap bolts.



14. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.

Legend

1. Alignment
2. Boss discriminating the front from the rear

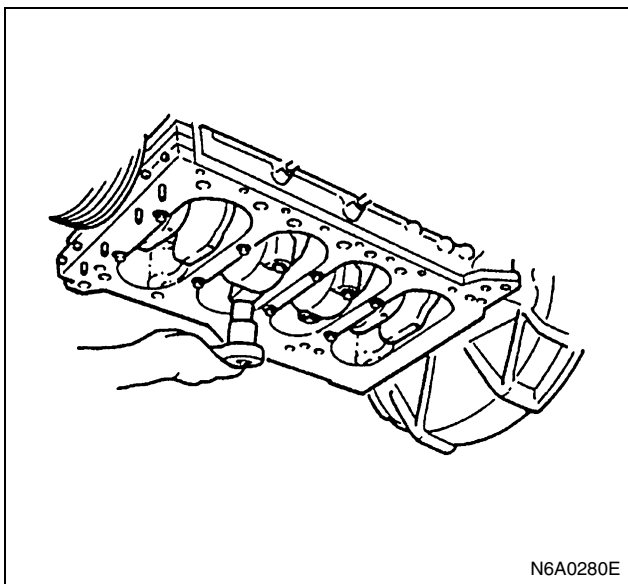
- 4) Tighten the connecting rod caps to the specified torque.

Tighten:

Connecting rod bearing cap bolt to

- 1st step: 39 N·m (4.0 kg·m / 29 lb·ft)
- 2nd step: 60°
- 3rd step: 30°

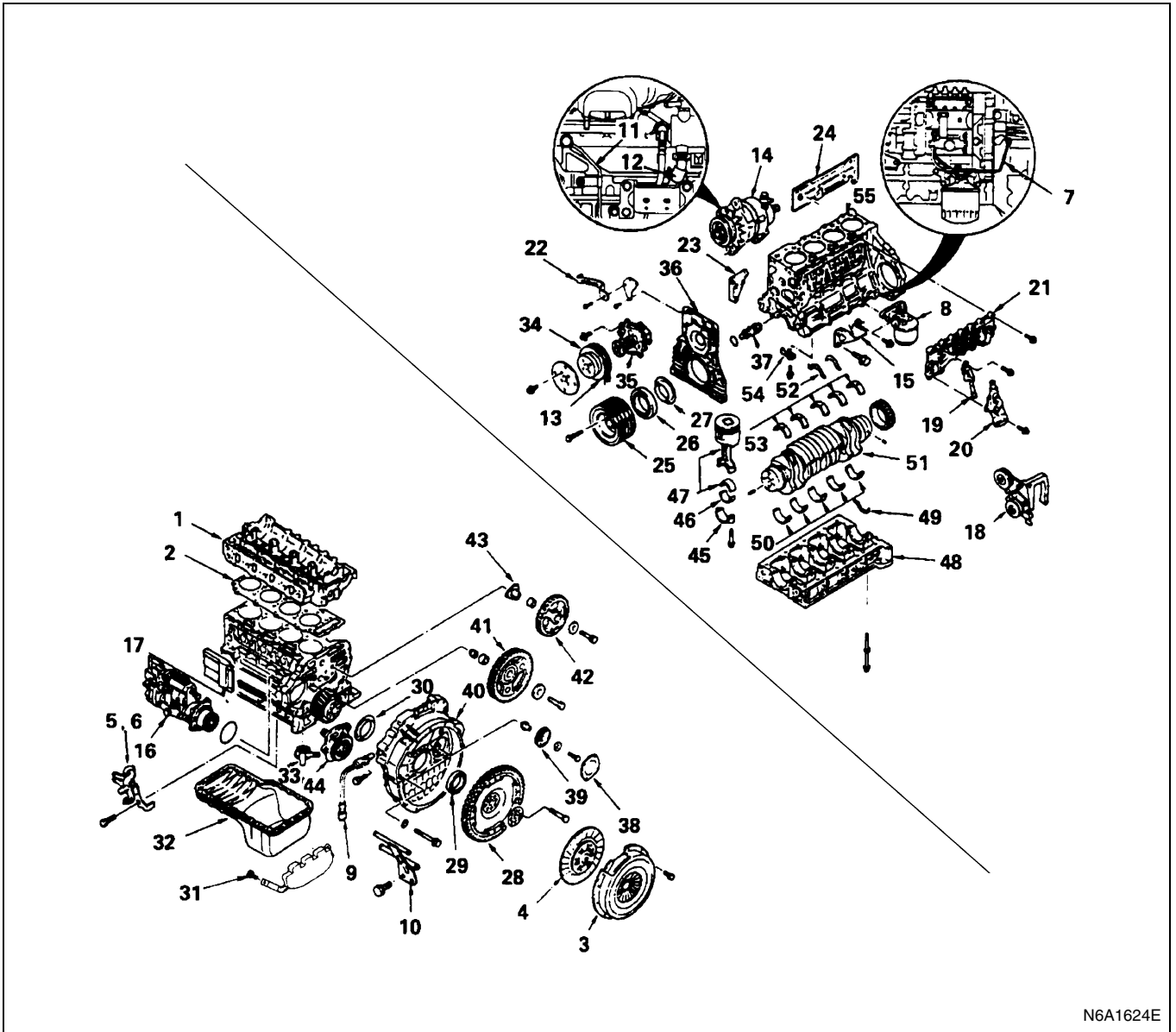
Angle gauge: 5-8840-0266-0



10. Oil Pump Strainer
11. Oil Pan
12. Spacer Rubber
13. Cylinder Head Gasket
Above works refer to "CYLINDER BLOCK" section in this manual.

CYLINDER BLOCK

Component



N6A1624E

Legend

- | | |
|-----------------------------------|---|
| 1. Cylinder head assembly | 29. Crankshaft rear oil seal |
| 2. Cylinder head gasket | 30. Crankshaft rear slinger |
| 3. Clutch pressure plate assembly | 31. Spacer rubber |
| 4. Driven plate | 32. Oil pan |
| 5. Engine control wire | 33. Oil pump strainer |
| 6. Engine control lever assembly | 34. Water pump pulley |
| 7. Oil pipe | 35. Water pump |
| 8. Oil filter assembly | 36. Front retainer |
| 9. Tachometer sensor | 37. Oil thermo valve |
| 10. Fuel pipe bracket | 38. Power steering pump idle gear cover |
| 11. Vacuum pump oil pipe | 39. Power steering pump idle gear |
| 12. Vacuum pump rubber hose | 40. Flywheel housing |
| 13. Fan belt | 41. Idle gear A |
| 14. Generator | 42. Idle gear B |
| 15. Engine foot | 43. Idle gear B shaft |
| 16. Injection pump assembly | 44. Oil pump assembly |
| 17. Injection pump rubber spacer | 45. Connecting rod cap |
| 18. Idle pulley bracket | 46. Connecting rod lower bearing |
| 19. Heater pipe | 47. Piston and connecting |
| 20. Water suction pipe | 48. Crankcase |
| 21. Oil cooler assembly | 49. Thrust bearing lower |
| 22. Fan belt adjust plate | 50. Crankshaft bearing lower |
| 23. Generator bracket | 51. Crankshaft assembly |
| 24. Cover | 52. Thrust bearing upper |
| 25. Crankshaft pulley | 53. Crankshaft bearing upper |
| 26. Crankshaft front oil seal | 54. Piston oil jet |
| 27. Crankshaft front slinger | 55. Cylinder block |
| 28. Flywheel assembly | |

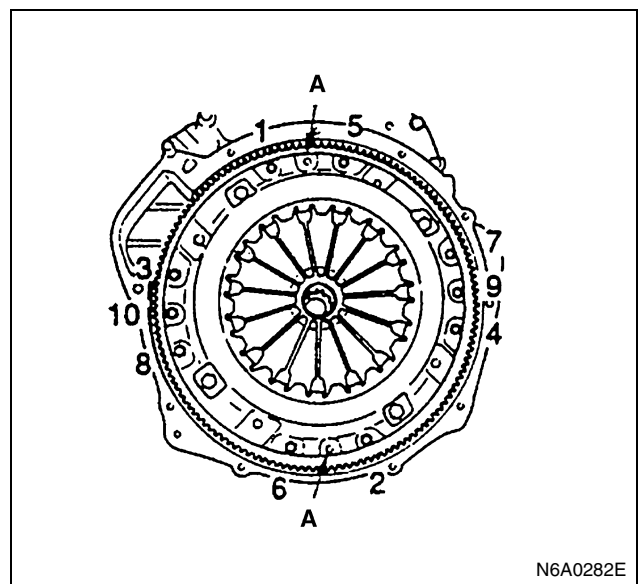
Disassembly

1. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
2. Cylinder Head Gasket

Caution:

Do not reuse the cylinder head gasket.

3. Clutch Pressure Plate Assembly
 - 1) Insert the clutch pilot a slinger to the clutch assembly.
Clutch Pilot Aligner: 5-8840-2240-0
 - 2) Loosen the pressure plate bolts in numerical order a little at a time as shown in the illustration.

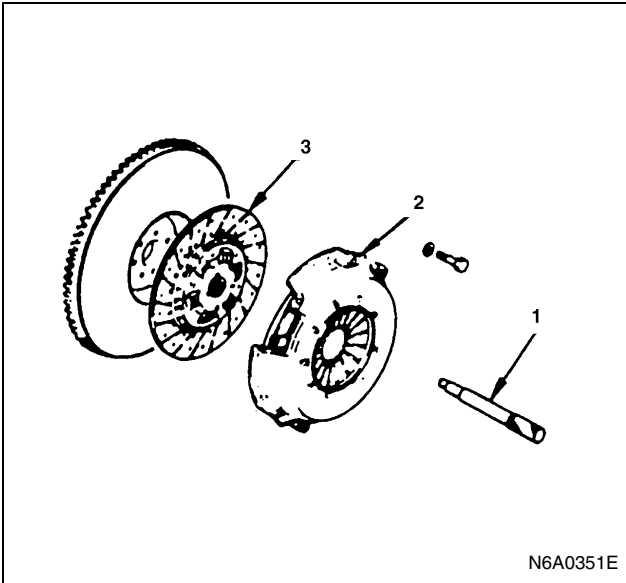


N6A0282E

Legend

- A. Knock pin

- 3) Remove the pressure plate assembly.
4. Driven Plate
Remove the driven plate with the clutch pilot aligner.

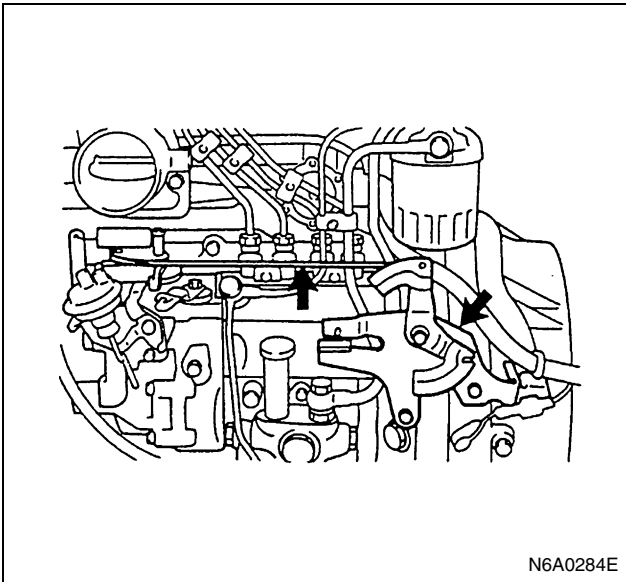


N6A0351E

Legend

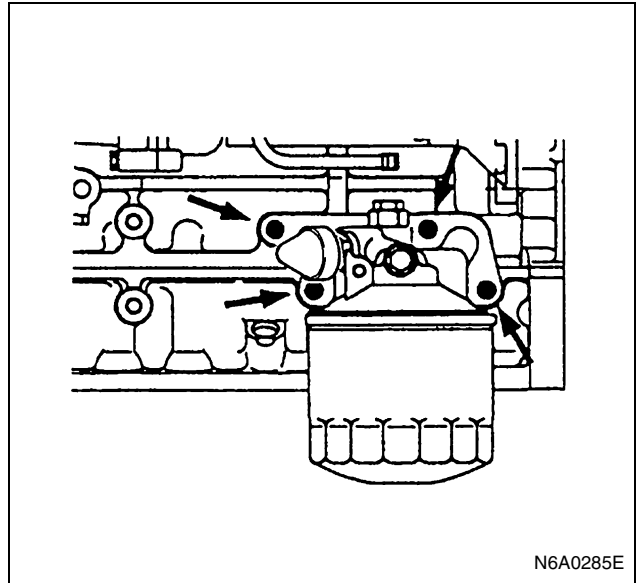
- 1. Clutch pilot aligner
- 2. Clutch pressure plate assembly
- 3. Driven plate

- 5. Engine Control Wire
- 6. Engine Control Lever Assembly
- 7. Oil Pipe



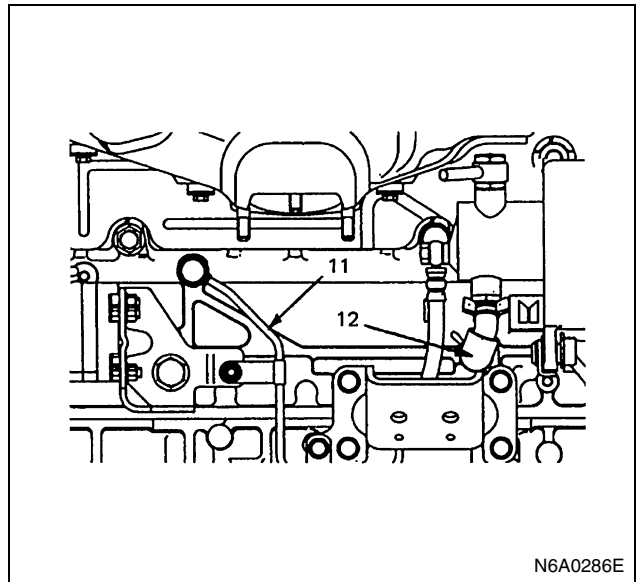
N6A0284E

- 8. Oil Filter Assembly
- 9. Tachometer Sensor
- 10. Fuel Pipe Bracket



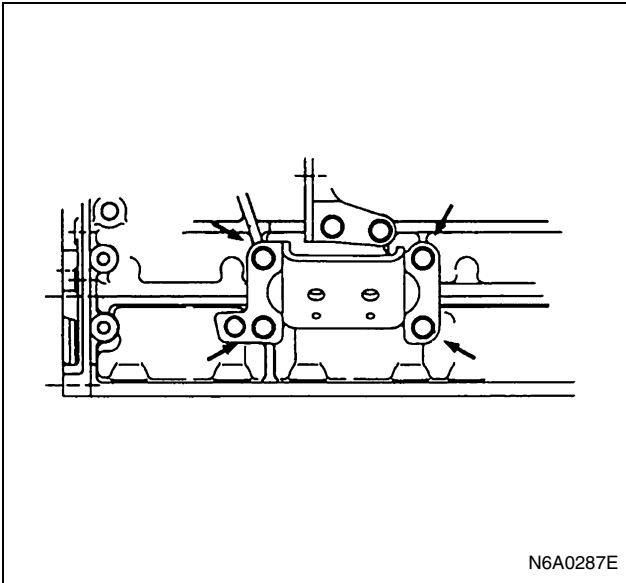
N6A0285E

- 11. Vacuum Pump Oil Pipe (11)
- 12. Vacuum Pump Rubber Hose (12)



N6A0286E

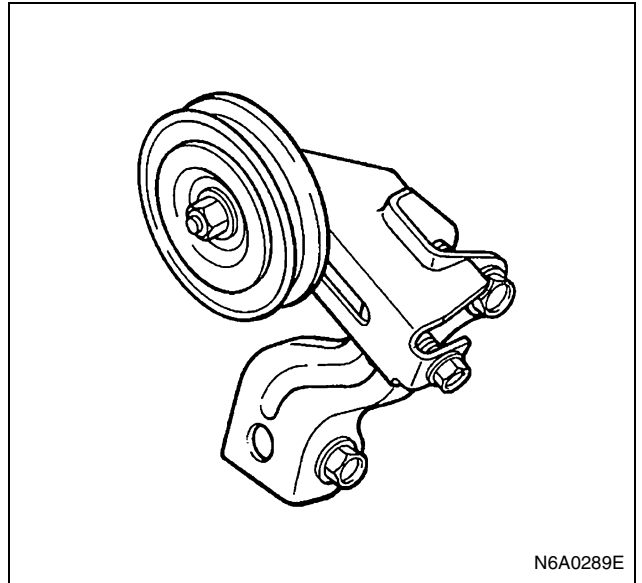
- 13. Fan Belt
- 14. Generator
- 15. Engine Foot



N6A0287E

16. Injection Pump Assembly

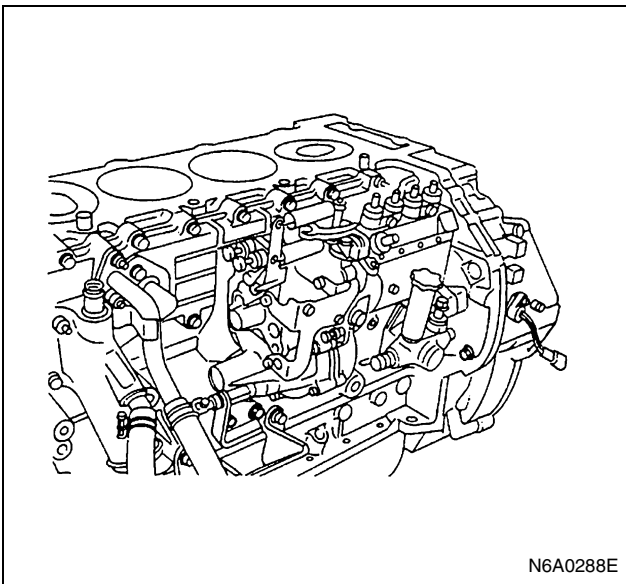
- 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
- 2) Then remove the injection pump assembly.



N6A0289E

19. Heater Pipe

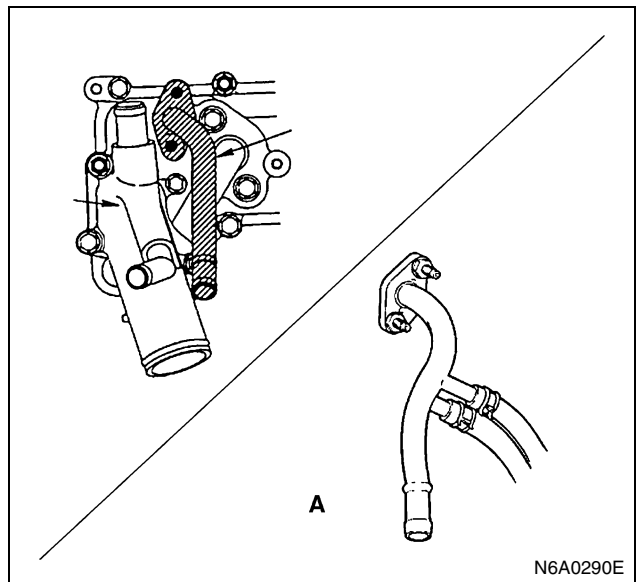
20. Water Suction Pipe



N6A0288E

17. Injection Pump Rubber Spacer

18. Idle Pulley Bracket (If equipped with A/C)



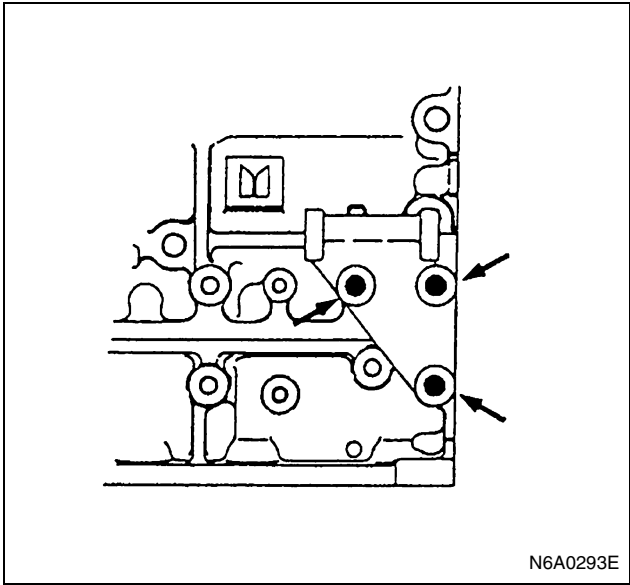
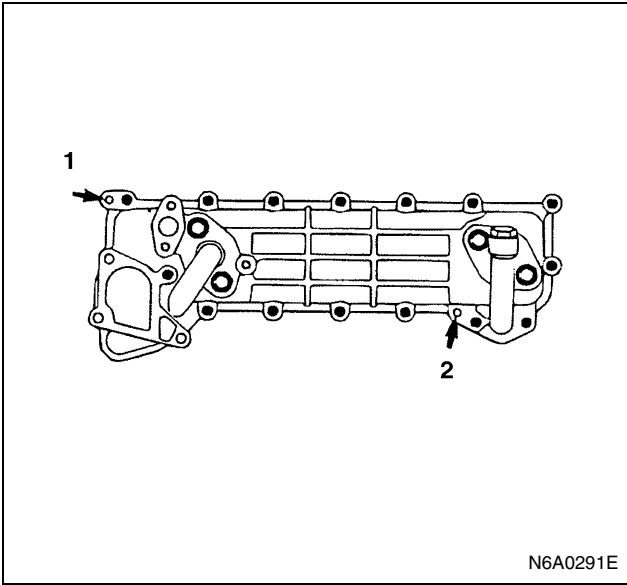
N6A0290E

Legend

A. 4HF1-2

21. Oil Cooler Assembly

- 1) Remove the oil cooler bolts.
- 2) Install a oil cooler fixing bolt to the oil cooler re-placer hole as shown in the illustration, and tighten the bolt alternately a little at a time.

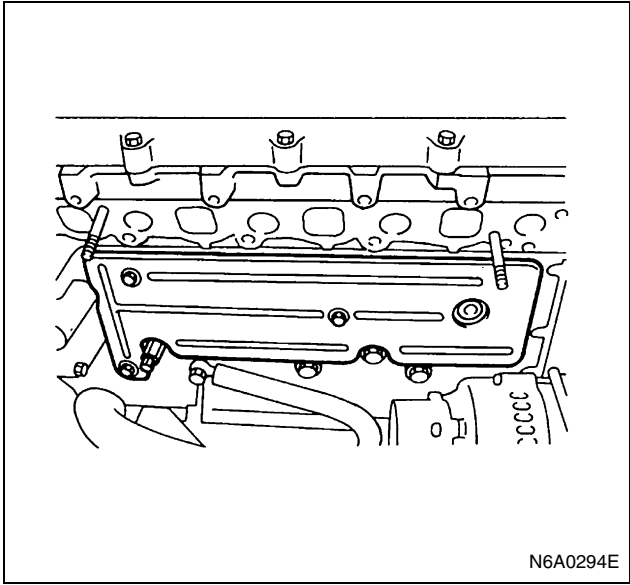
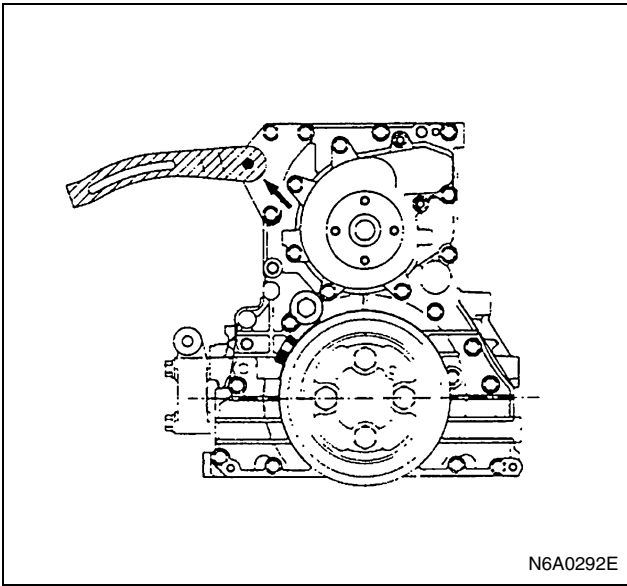


Legend

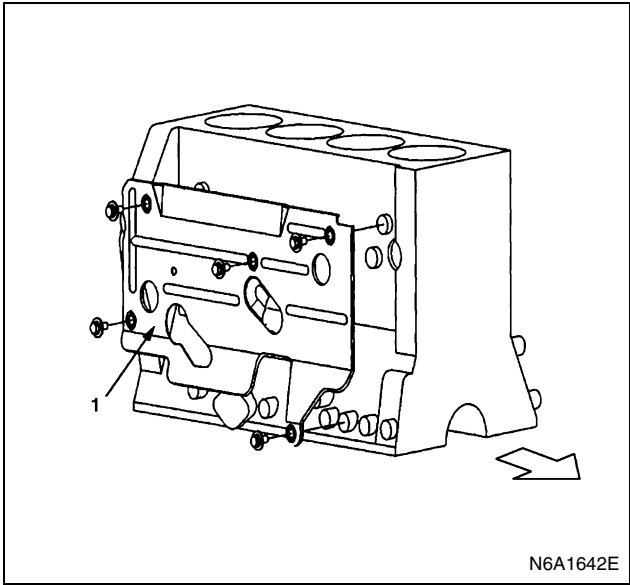
- 1. 4HE1-TC
- 2. 4HF1, 4HG1-T

22. Fan Belt Adjust Plate

24. Cover

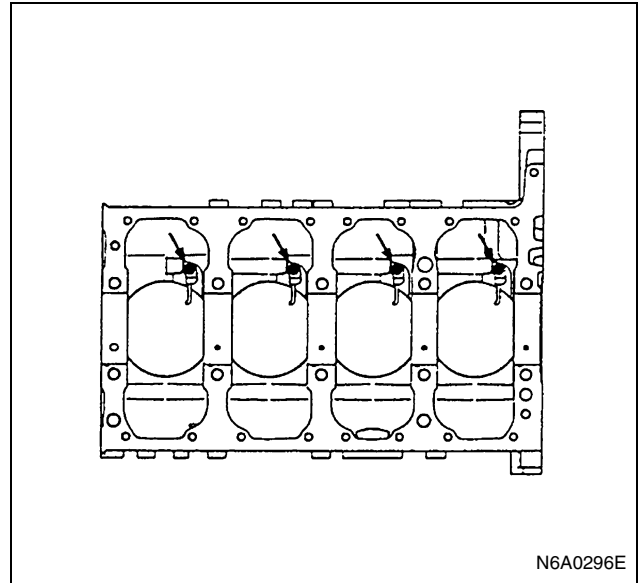


23. Generator Bracket



Legend

1. Cover
-
25. Crankshaft Damper Pulley
 26. Crankshaft Front Oil Seal
 27. Crankshaft Front Slinger
 28. Flywheel Assembly
 29. Crankshaft Rear Oil Seal
 30. Crankshaft Rear Slinger
 31. Space Rubber (NKR model only)
 32. Oil Pan
 33. Oil Pump Strainer
 34. Water Pump Pulley
 35. Water Pump
 36. Front Retainer
 37. Oil Thermo Valve
 38. Power Steering Pump Idle Gear Cover
 39. Power Steering Pump Idle Gear
 40. Flywheel Housing
 41. Idle Gear A
 42. Idle Gear B
 43. Idle Gear B Shaft
 44. Oil Pump Assembly
 45. Connecting Rod Cap
 46. Connecting Rod Lower Bearing
 47. Piston and Connecting Rod Assembly
 48. Crankcase
 49. Thrust Bearing Lower
 50. Crankshaft Bearing Lower
 51. Crankshaft Assembly
 52. Thrust Bearing Upper
 53. Crankshaft Bearing Upper
Above works refer to "CRANKSHAFT" section in this manual.
 54. Piston Oiling Jet
Loosen the check valves to remove both the check valves and the oiling jets.
Take care not to bend or damage the oiling jets.



55. Cylinder Block

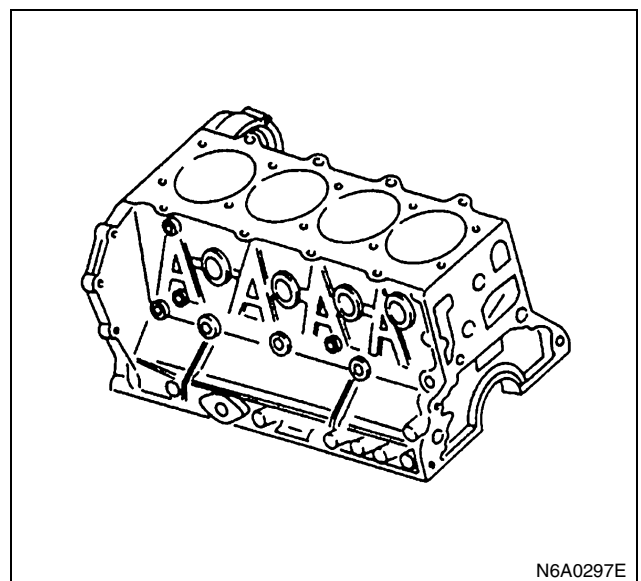
Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

1. Remove the gasket and any other material adhering to the upper surface of the cylinder block.
Be very careful not to allow any material to accidentally drop into the cylinder block.
Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, rear oil seal, and oil pan installation surface seal.
3. Wipe the cylinder block clean.

Cylinder Body Upper Face Warpage

1. Remove the cylinder body dowel.
2. Remove the cylinder liner.
Refer to "Cylinder Liner Replacement".



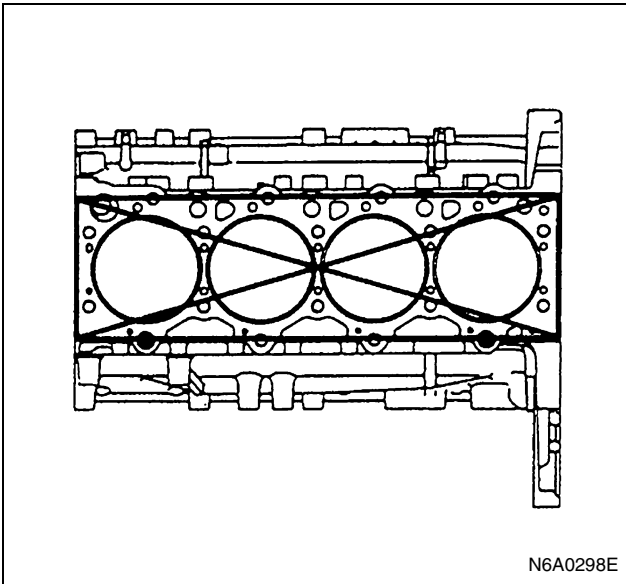
- Use a straight edge and a feeler gauge to measure the four sides and the two diagonals of the cylinder body upper face.
- If the measured values exceed the specified limit, the cylinder body must be replaced.

Caution:

Do not regrind the cylinder body upper face.

Cylinder Body Upper Face Warpage		mm (in)
Standard	Limit	
0.05 (0.002) or less	0.20(0.008)	

Cylinder Body Height (H) (Reference)	mm (in)
Standard	
279.965 — 280.035 (11.022 — 11.025)	



- Reinstall the cylinder liner. Refer to the "Cylinder Body Bore Measurement".
- Reinstall the cylinder body dowel.

Cylinder Liner Bore Measurement

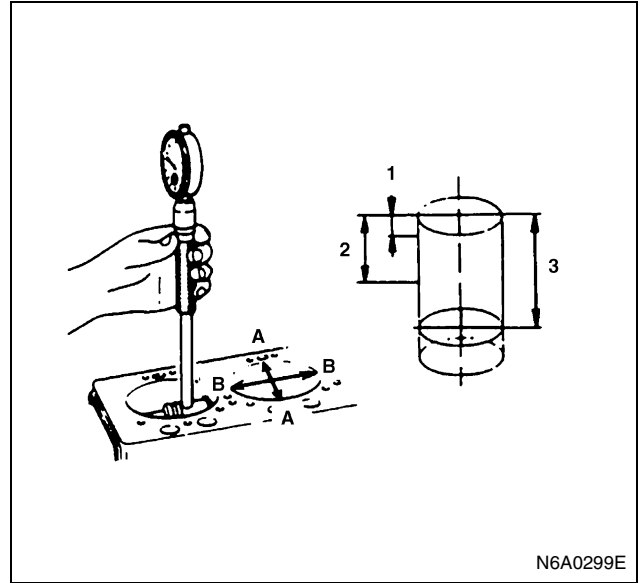
Use a cylinder indicator to measure the cylinder bore at measuring points (1), (2) and (3) in the A — A and B — B directions of the crankshaft.

Measuring points:

- 20 mm (0.79 in)
- 90 mm (3.54 in)
- 160 mm (6.30 in)

If the measured value exceeds the specified limit, the cylinder liner must be replaced.

Cylinder Liner Bore		mm (in)
	Standard	Limit
4HF1 4HF1-2	112.021 — 112.050 (4.4103 — 4.4114)	112.20 (4.417)
4HG1 4HG1-T	115.021 — 115.050 (4.5284 — 4.5295)	115.20 (4.535)
4HE1-TC	110.041 — 110.080 (4.3323 — 4.3338)	110.23 (4.340)



Notice:

The inside of the dry type cylinder liner is made of thin cast iron. It cannot be rebored or honed.

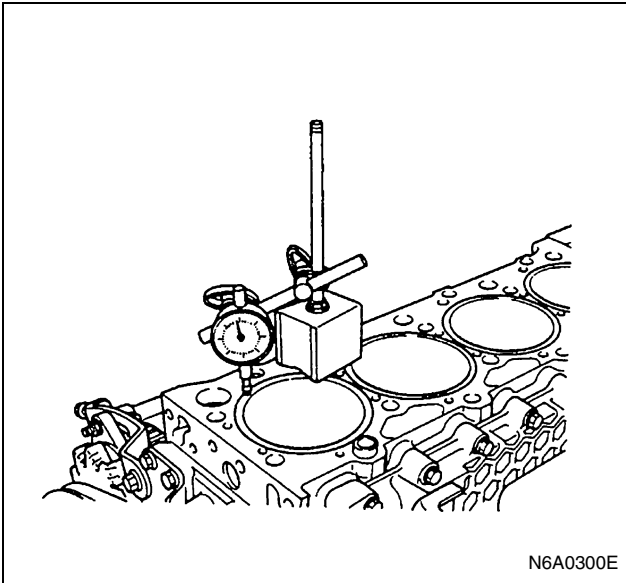
If the inside of the cylinder liner is scored or scorched, the cylinder liner must be replaced.

Cylinder Liner Projection Inspection

Use a dial gauge to measure the projection of each cylinder.

Cylinder Liner Projection	mm (in)
Standard	
0.09 — 0.14 (0.0035 — 0.0055)	

The difference in the cylinder liner projection height between any two adjacent cylinders must not exceed 0.03 mm (0.0012 in).



Cylinder Liner Grade Selection and Standard Fitting Interference

Accurately measured fitting interference and proper cylinder liner grade selection are extremely important. If the cylinder liner fitting interference is too small, engine cooling efficiency will be adversely affected. If the cylinder liner fitting interference is too large, it will be difficult to insert the cylinder liner into the cylinder body.

A mark was stamped on the left side of the cylinder block during production to indicate the correct liner. The liner grade (i.e. 1, 2, 3) is indicated in metal stamp.

Cylinder Liner Replacement

Cylinder Liner Removal

If could not be removed cylinder liner, it is recommended to remove it by following procedure.

1. Set the cylinder liner remover (1) to the cylinder liner (3).
2. Check to see if the remover shaft ankle (2) is firmly gripping the cylinder liner bottom edge.
3. Slowly turn the remover shaft handle (4) clockwise to pull the cylinder liner free.

Cylinder Liner Remover:

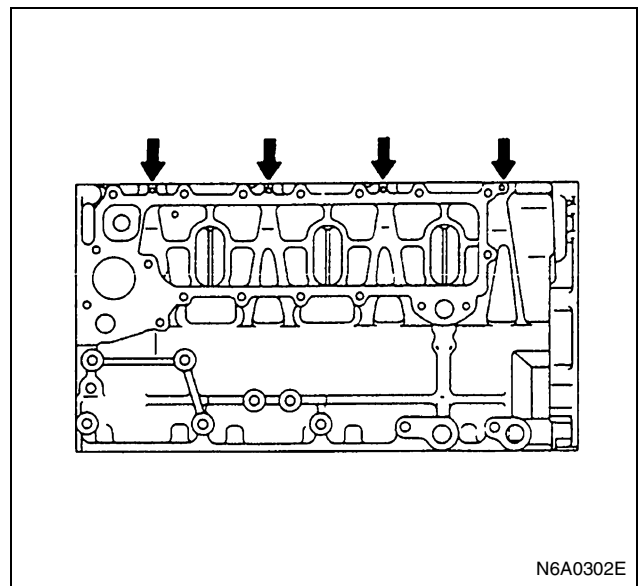
9-8523-1169-0

Cylinder Liner Remover Ankle:

5-8840-2220-0

Ankle:

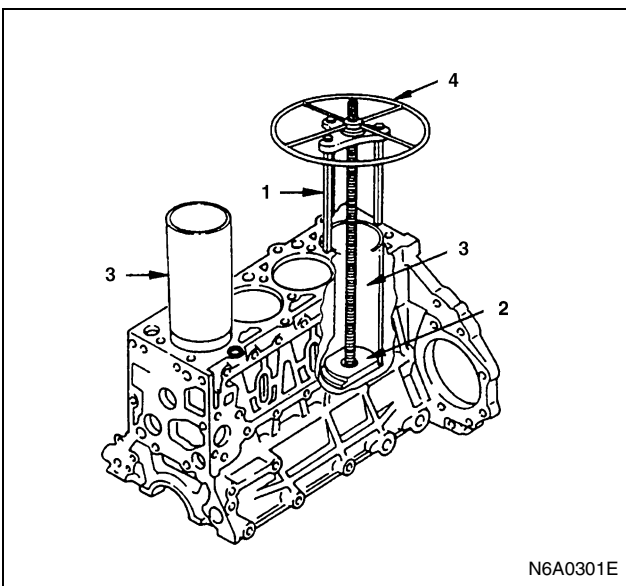
5-8840-2397-0 (4HG1)



Cylinder Liner Grade

- 4HF1 / 4HF1-2

Line Grade	Cylinder Bore Diameter mm (in.)	Service Grade	Liner Outside Diameter mm (in.)
1	115.001 — 115.010 (4.5276 — 4.5279)	1X	114.991 — 115.000 (4.5272 — 4.5276)
2	115.011 — 115.020 (4.5280 — 4.5283)	3X	115.001 — 115.010 (4.5276 — 4.5279)
3	115.021 — 115.030 (4.5284 — 4.5287)		



Caution:

Take care not to damage the cylinder body upper face during the cylinder liner removal procedure.

• 4HG1 / 4HG1-T

Line Grade	Cylinder Bore Diameter mm (in.)	Service Grade	Liner Outside Diameter mm (in.)
1	118.001 — 118.010 (4.6457 — 4.6461)	1X	117.991 — 118.000 (4.6453 — 4.6457)
2	118.011 — 118.020 (4.6461 — 4.6464)	3X	118.001 — 118.010 (4.6457 — 4.6461)
3	118.021 — 118.030 (4.6465 — 4.6468)		

• 4HE1-TC

Line Grade	Cylinder Bore Diameter mm (in.)	Service Grade	Liner Outside Diameter mm (in.)
1	115.001 — 115.010 (4.5276 — 4.5279)	1X	115.021 — 115.030 (4.5284 — 4.5287)
2	115.011 — 115.020 (4.5280 — 4.5283)	3X	115.031 — 115.040 (4.5289 — 4.5291)
3	115.021 — 115.030 (4.5284 — 4.5287)		

The cylinder liner grade is stamped on the outside of the cylinder liner.

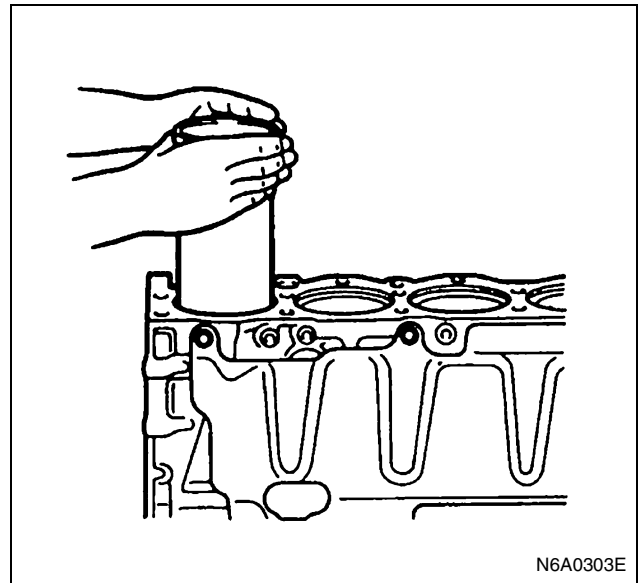
Cylinder Liner Installation (For 4HF1, 4HF1-2, 4HG1 and 4HG1-T Engine)

1. Use new kerosene or diesel oil to thoroughly clean the cylinder liners and bores.
2. Use compressed air to blow dry the cylinder liner and bore surfaces.

Caution:

All foreign material must be carefully removed from the cylinder liner and the cylinder bore before installation.

3. Install the cylinder liner perpendicularly to the cylinder bore. Do not give any excessive force such as knocking while inserting cylinder liner into the cylinder bore.



Cylinder Liner Installation (For 4HE1-TC Engine)

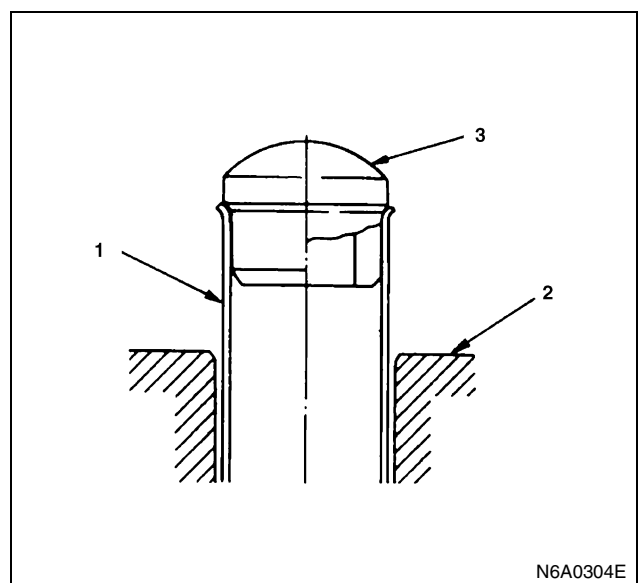
1. Cylinder Liner Installation Using The Special Tool
 - Use new kerosene or diesel oil to thoroughly clean the cylinder liners and bores.
 - Use compressed air to blow-dry the cylinder liner and bore surfaces.

Caution:

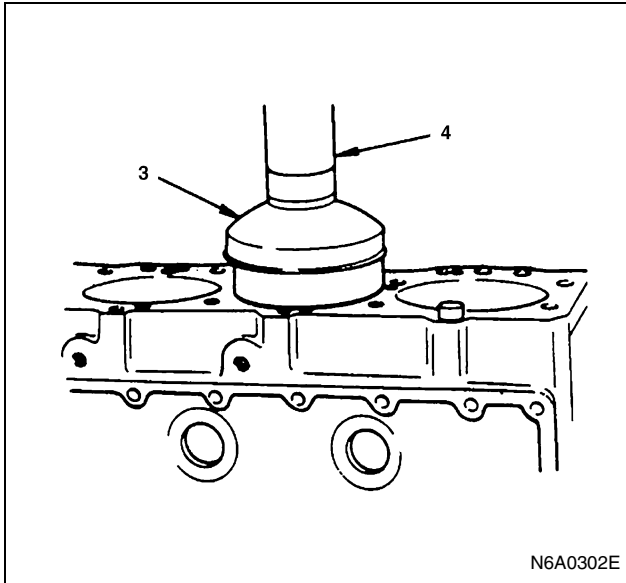
All foreign material must be carefully removed from the cylinder liner and the cylinder bore before installation.

- Insert the cylinder liner (1) into the cylinder body (2) from the top of the cylinder body.
- Set the cylinder liner installer (3) to the top of the cylinder liner.

Cylinder Liner Installer: 5-8840-2337-0



- (3) is directly beneath the bench press shaft (4).



N6A0302E

Caution:

Check that the cylinder liner is set perpendicular to the bench press and that there is no wobble.

- Use the bench press to apply a seating force of 4,900 N (500 kg / 1,102.5 lb) to the cylinder liner.
- Apply a force of 24,500 N (2,500 kg / 5,512.5 lb) to fully seat the cylinder liner.
- After installing the cylinder liner, measure the cylinder liner projection. Refer to "Cylinder Liner Projection Inspection".

2. Cylinder Liner Installation Using Dry Ice

If the cylinder liner is a chrome plated dry type, it is advisable to use dry ice during the installation procedure.

Cooling the cylinder liner with dry ice will cause the cylinder liner to contract, thus making installation easier.

Caution:

It is important that the cylinder liner be inserted to the cylinder body immediately after it has been cooled.

WARNING:

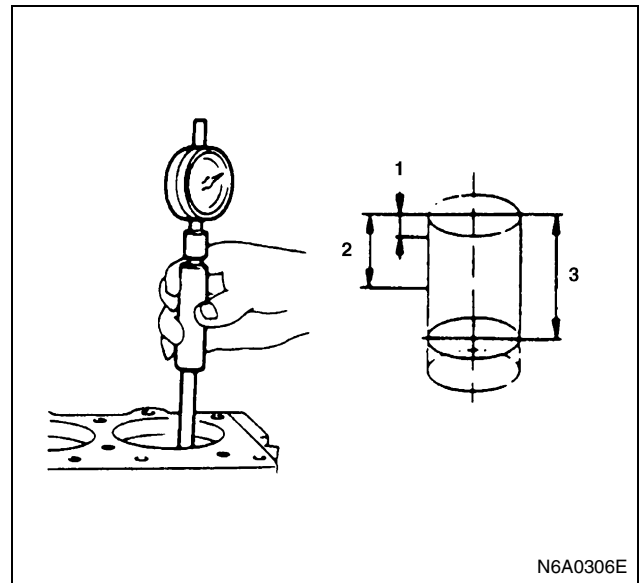
DRY ICE MUST BE USED WITH GREAT CARE. CARELESS HANDLING OF DRY ICE CAN RESULT IN SEVERE FROSTBITE.

Piston Grade Selection

Measure the cylinder liner bore after installing the cylinder liner. Then select the appropriate piston grade for the installed cylinder liner.

1. Measure the cylinder liner bore. Refer to the "Cylinder Liner Bore Measurement".
 Measuring Point (1) 20 mm (0.79 in)
 Measuring Point (2) 90 mm (3.54 in)
 Measuring Point (3) 160 mm (6.30 in)

Cylinder Liner Bore		mm (in)
	Standard	Limit
4HF1 4HF1-2	112.021 — 112.050 (4.4103 — 4.4114)	112.20 (4.417)
4HG1 4HG1-T	115.021 — 115.050 (4.5284 — 4.5295)	115.20 (4.535)
4HE1-TC	110.041 — 110.080 (4.3323 — 4.3338)	110.23 (4.340)



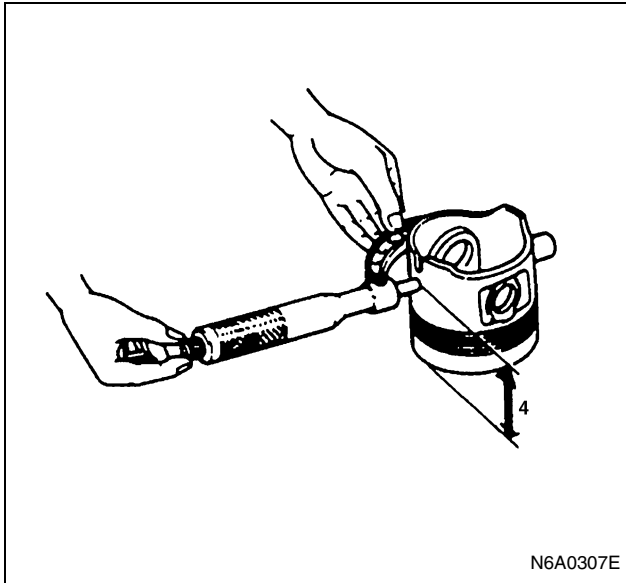
N6A0306E

Caution:

It is most important that the correct piston grade be used. Failure to select the correct piston grade will result in engine failure. Always measure the cylinder bore and select the correct piston grade.

2. Measure the piston outside diameter (Reference).
 Piston Measuring Point (4): 82 mm (3.23 in)

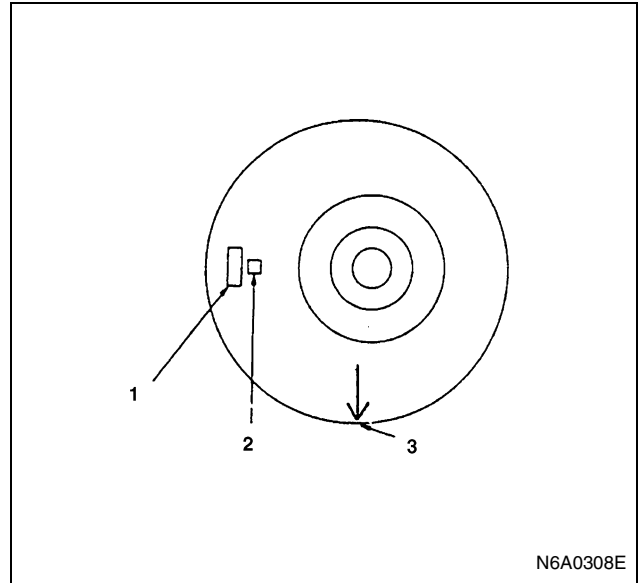
Cylinder Liner and Piston Clearance	mm (in)
4HF1 / 4HF1-2	0.081 — 0.113 (0.0032 — 0.0044)
4HG1 / 4HG1-T	0.081 — 0.116 (0.0032 — 0.0046)
4HE1-TC	0.091 — 0.131 (0.0036 — 0.0052)



N6A0307E

The piston grade (i.e. A, B, C) is indicated in metal stamp on the piston upper face.

Piston Grade			
Engine Model	Cylinder Liner Bore Diameter mm (in)	Piston Service Grade	Piston Outside Diameter mm (in)
4HF1 4HF1-2	112.041 — 112.060 (4.4111 — 4.4118)	—	111.944 — 111.959 (4.4072 — 4.4078)
4HG1 4HG1-T	115.041 — 115.060 (4.5292 — 4.5299)	—	114.944 — 114.959 (4.5253 — 4.5259)
4HE1- TC	110.066 — 110.075 (4.3333 — 4.3337)	AX	109.944 — 109.959 (4.3285 — 4.3291)
	110.076 — 110.085 (4.3337 — 4.3340)	CX	109.960 — 109.975 (4.3291 — 4.3297)



N6A0308E

Legend

1. Part No.
2. Grade
3. Front mark

Caution:

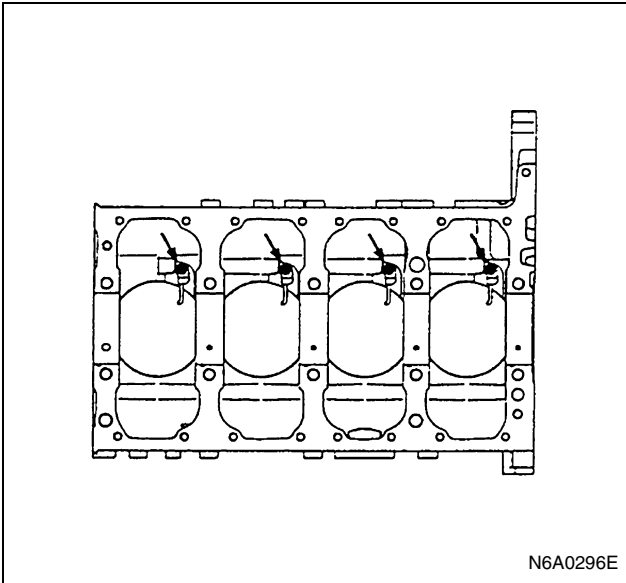
Cylinder liner kit clearances are preset. However, the cylinder liner installation procedure may result in slight decreases in cylinder liner clearances. Always measure the cylinder liner clearance after installation to be sure that it is correct.

Reassembly

1. Cylinder Block
Use compressed air to thoroughly clean the inside and outside surfaces of the cylinder body, the oil holes, and the water jackets.
2. Piston Oiling Jet
 - 1) Install the oiling jets together with the check valves. Take care not to damage the oiling jet nozzles.
 - 2) Tighten the check valves and oiling jets to the specified torque.

Tighten:

Check valve and oiling jet to 21 N·m (2.1 kg·m / 15 lb·ft)

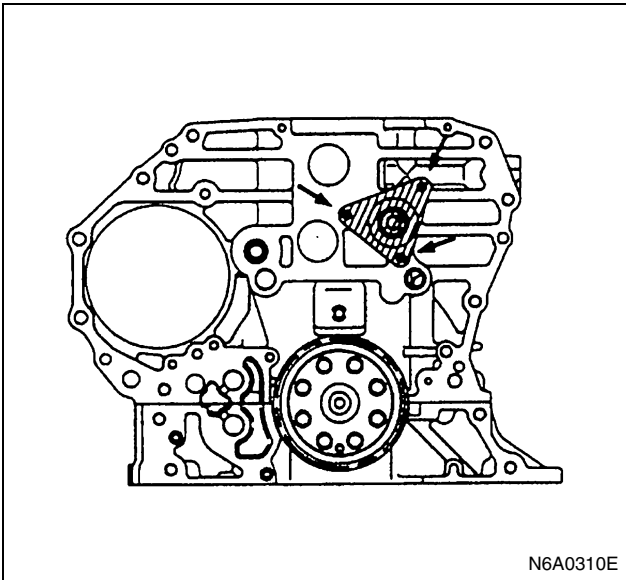


3. Crankshaft Bearing Upper
4. Thrust Bearing Upper
5. Crankshaft Assembly
6. Crankshaft Bearing Lower
7. Thrust Bearing Lower
8. Crankcase
Above works refer to "CRANKSHAFT" section in this manual.
9. Piston and Connecting Rod Assembly
10. Connecting Rod Lower Bearing
11. Connecting Rod Cap
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
12. Oil Pump Assembly
13. Idle Gear B Shaft

Tighten:

Idle gear B shaft bolt to 31 N·m (3.2 kg·m / 23 lb·ft)

Apply the engine oil to the idle gear shaft after installation.

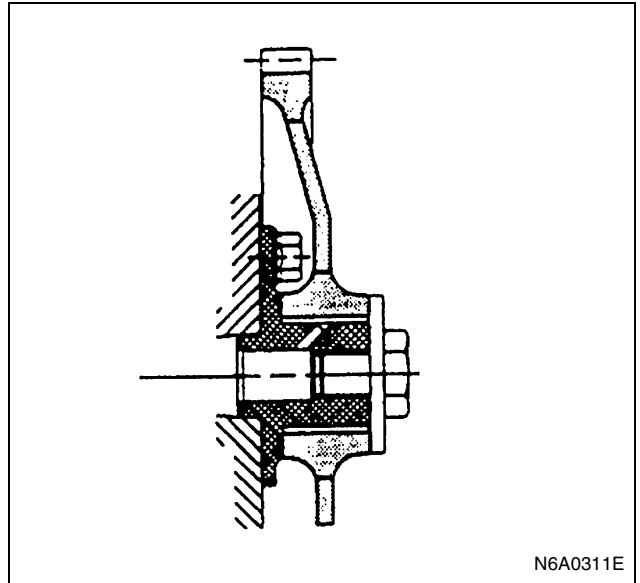


14. Idle Gear B

The face of the idle gear B with longer boss should be positioned toward the rear side shown in the illustration.

Tighten:

Idle gear B bolt to 110 N·m (11.2 kg·m / 81 lb·ft)

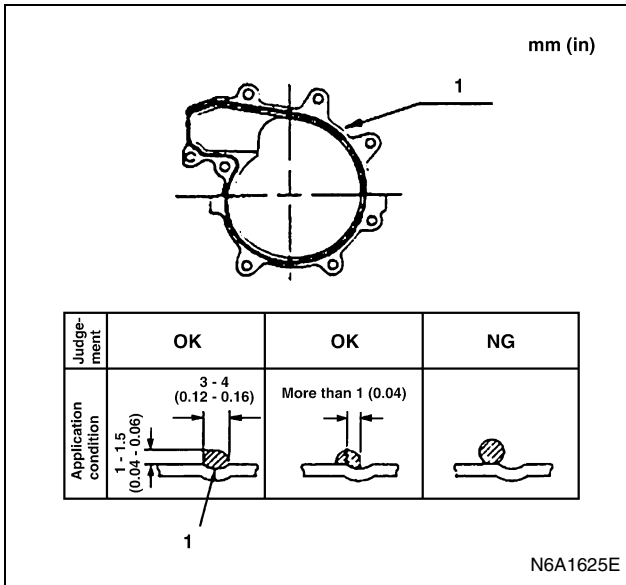


15. Idle Gear A
16. Flywheel Housing
17. Power Steering Pump Idle Gear
18. Power Steering Pump Idle Gear Cover
Above works refer to "OIL PUMP" section in this manual.
19. Oil Thermo Valve
20. Front Retainer
Above works refer to "CRANKSHAFT" section in this manual.
21. Water Pump Assembly
 - 1) Apply 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the water pump fitting surface.
 - 2) Install the water pump to the front retainer.

Tighten:

Water pump bolt to 24 N·m (2.4 kg·m / 17 lb·ft)

- Install the water pump within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.



Legend

- 1. Liquid gasket

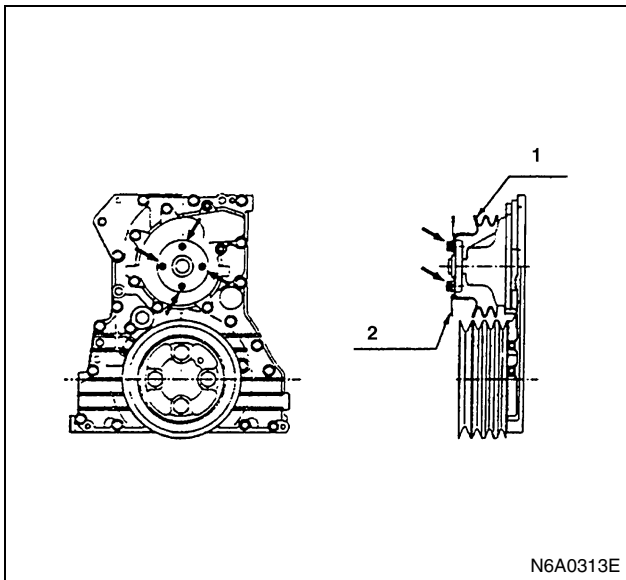
Caution:

The water pump clamping bolt is also used to tighten the front retainer. So, install the water pump before liquid gasket gets dry immediately after installation of the front retainer.

22. Water Pump Pulley

Tighten:

Water pump pulley bolt to 24 N·m (2.4 kg·m / 17 lb·ft)



Legend

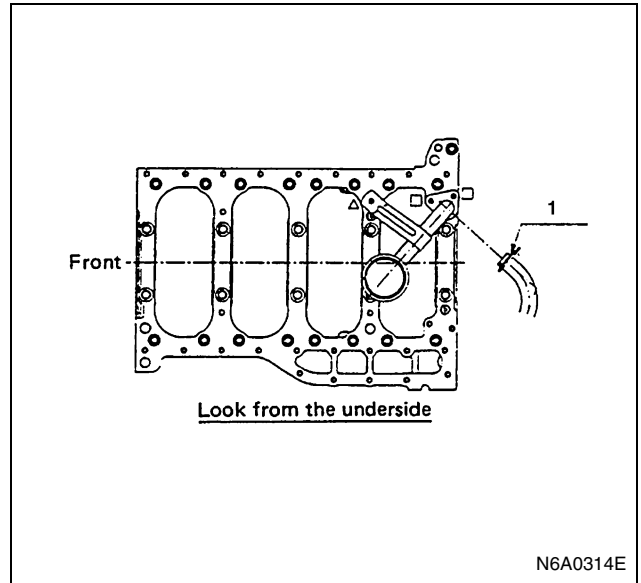
- 1. Pulley
- 2. Set plate

23. Oil Pump Strainer

Install the O-ring (1) to the oil pump strainer pipe and install the oil pump strainer to the cylinder body shown in the illustration.

Tighten:

Oil pump strainer bolt to 24 N·m (2.4 kg·m / 17 lb·ft)



24. Oil Pan

Above works refer to "OIL PAN" section in this manual.

25. Spacer Rubber

Tighten:

Spacer rubber bolt to 76 N·m (7.7 kg·m / 56 lb·ft)

26. Crankshaft Rear Slinger

27. Crankshaft Rear Oil Seal

28. Flywheel Assembly

29. Crankshaft Front Slinger

30. Crankshaft Front Oil Seal

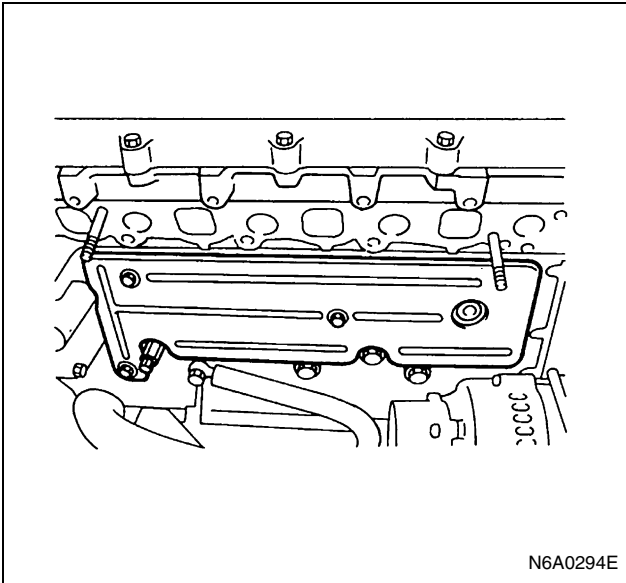
31. Crankshaft Damper Pulley

Above works refer to "CRANKSHAFT" section in this manual.

32. Cover

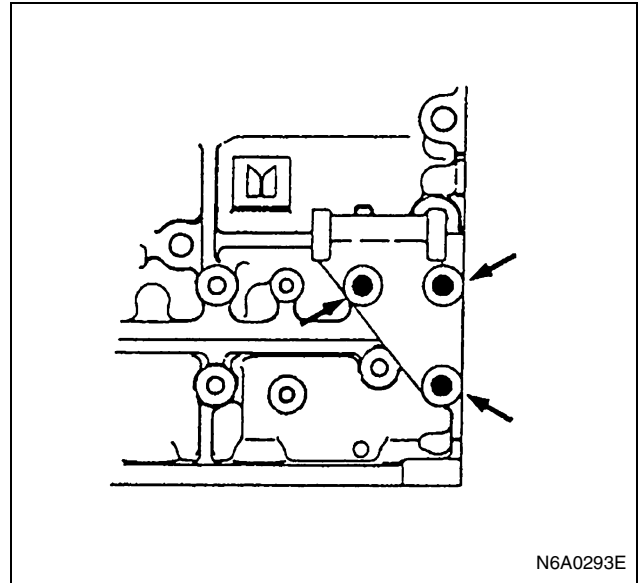
Tighten:

Cover Bolt to 13 N·m (1.3 kg·m / 9 lb·ft)



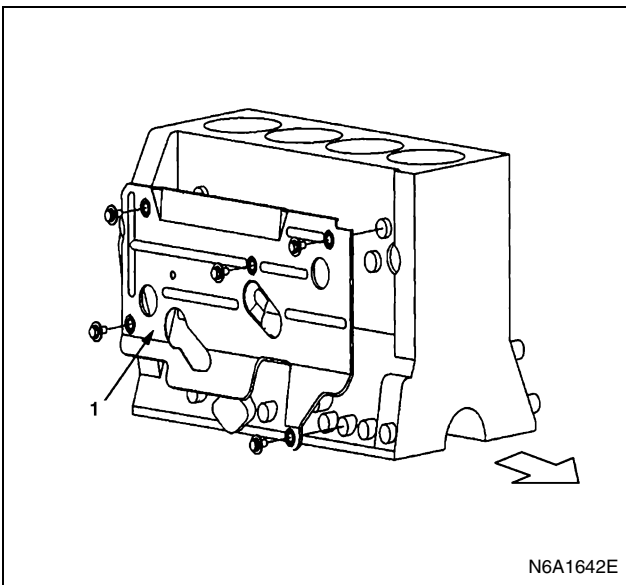
4HE1-TC

4HE1-TC engines use a larger rubber spacer than other engines.



34. Fan Belt Adjust Plate

Install the adjust plate and temporarily tighten the adjust plate bolt.



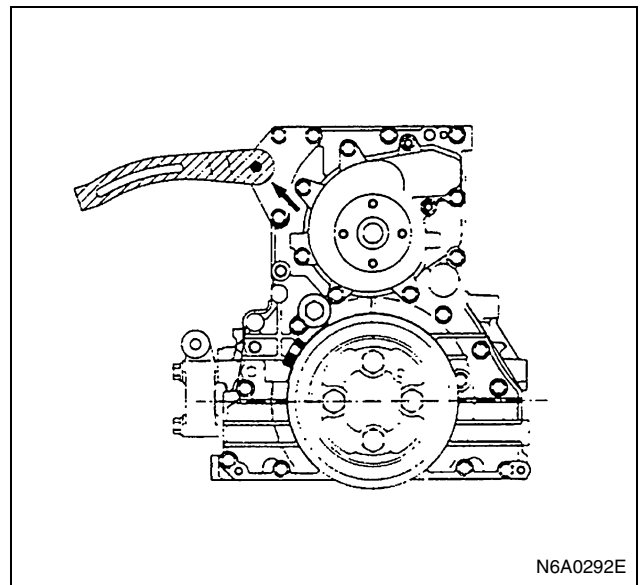
Legend

1. Cover

33. Generator Bracket

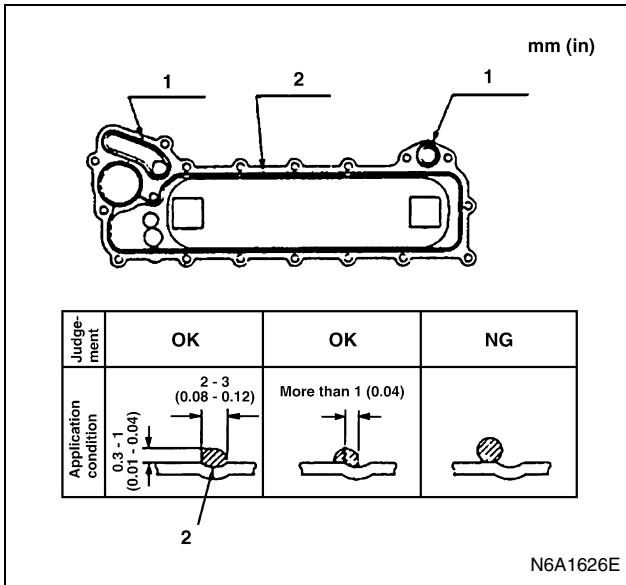
Tighten:

Generator bracket bolt to 48 N·m (4.9 kg·m / 35 lb·ft)



35. Oil Cooler Assembly

- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the oil cooler fitting surface.
- 2) Apply a coat of engine oil to the O-rings (2 pieces) and install the O-rings to the oil cooler.



Legend

- 1. O-ring
- 2. Liquid gasket

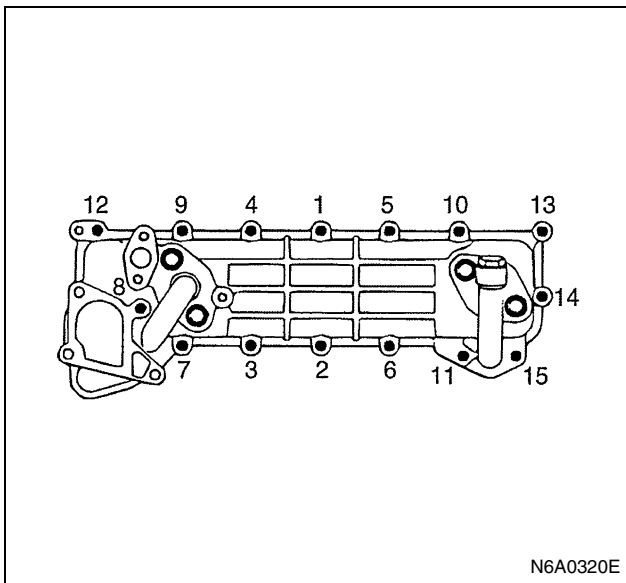
Notice:

Take care that the O-ring is not smeared with liquid gasket.

- Install it within 7 minutes after application of liquid gasket.
 - For the dislocation of liquid gasket, refer to the illustration.
- 3) Tighten the oil cooler bolts and nut to the specified torque a little at a time in the sequence shown in the illustration.

Tighten:

Oil cooler bolt and nut to 24 N·m (2.4 kg·m / 17 lb·ft)

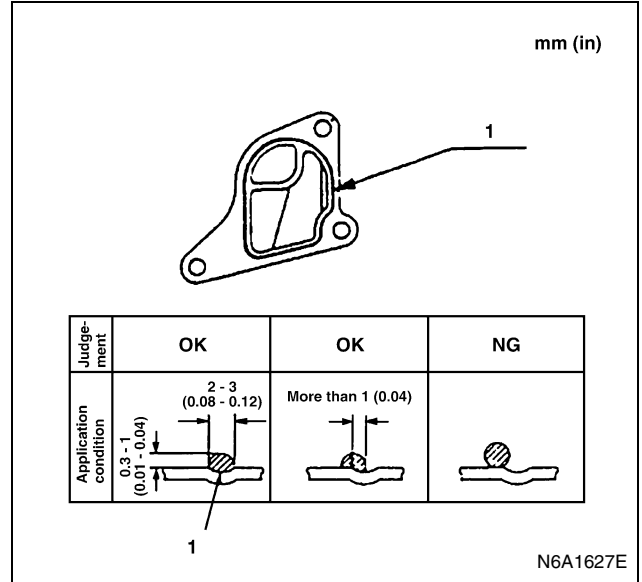


36. Water Suction Pipe

- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond

1207C) or its equivalent on the groove of the water suction pipe fitting surface.

- 2) Install the water suction pipe to the oil cooler.
 - For the dislocation of liquid gasket, refer to the illustration.



Legend

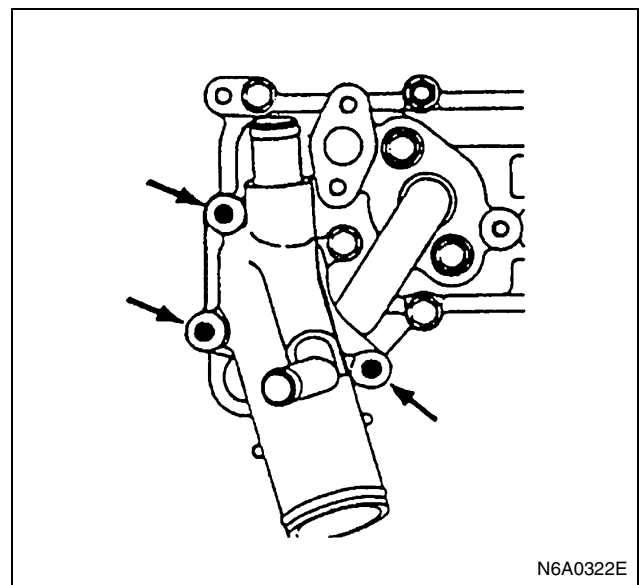
- 1. Liquid gasket

Tighten:

Water suction pipe bolt and nuts to 24 N·m (2.4 kg·m / 17 lb·ft)

Notice:

Install the water suction pipe immediately after the installation of the oil cooler.

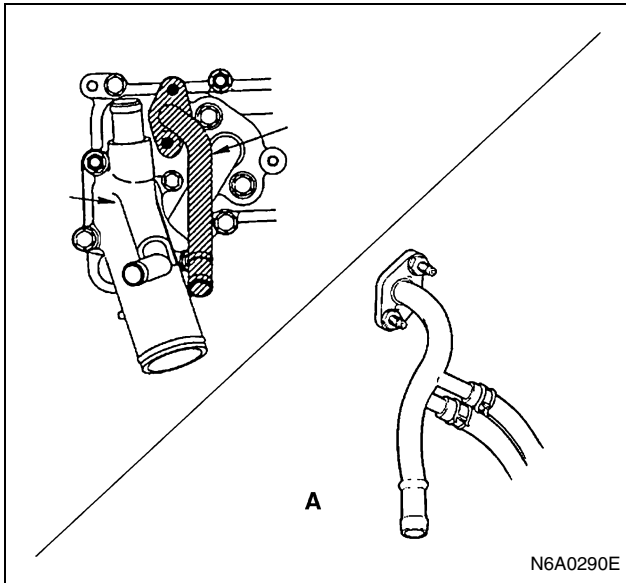


37. Heater Pipe

- 1) Install the O-ring to the heater pipe.
- 2) Install the heater pipe to the oil cooler.

Tighten:

Heater pipe bolt to 24 N·m (2.4 kg·m / 17 lb·ft)



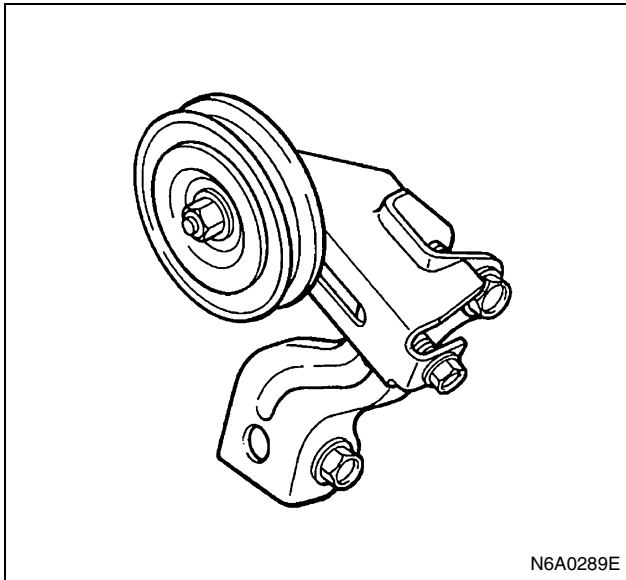
Legend

A. 4HF1-2

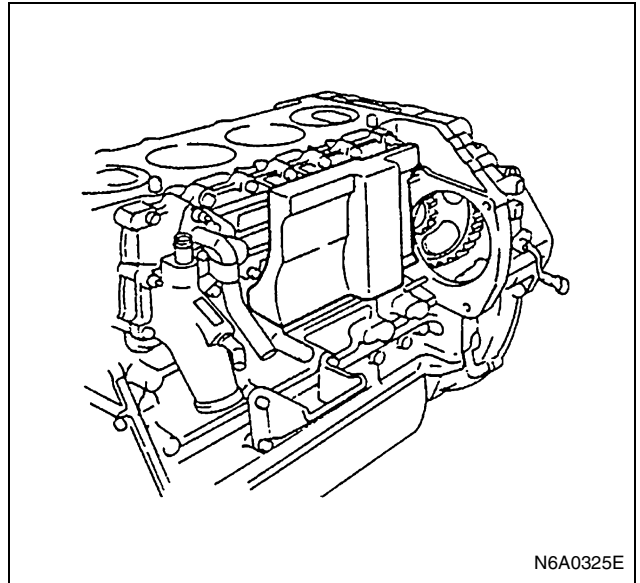
38. Idle Pulley Bracket (If equipped with A/C)

Tighten:

Idle pulley bracket bolt to 48 N·m (4.9 kg·m / 35 lb·ft)



39. Injection Pump Rubber Spacer
Stick the rubber spacer to the location indicated in the illustration with pressure sensitive adhesive double coated tape.

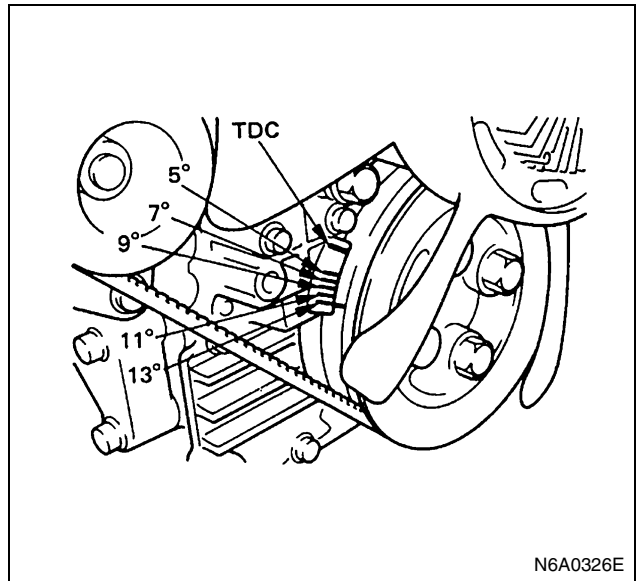


40. Injection Pump Assembly (Except 4HF1-2)

- 1) Turn the crankshaft until the timing mark on the crankshaft damper pulley is aligned with "13" line.

Notice:

BTDC 13° to be aligned with here is an angle at which the injection pump is installed, and has nothing to do with the injection timing.

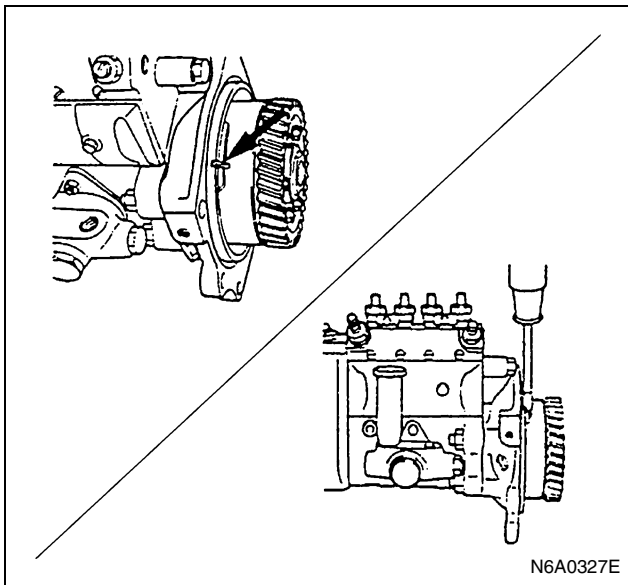


- 2) Remove the inspection hole plug from the cylinder body.
- 3) Install the O-ring to the injection pump bracket.
- 4) Align the injection pump bracket slit with the timer slit.
- 5) Install the injection pump assembly to the cylinder body.

Notice:

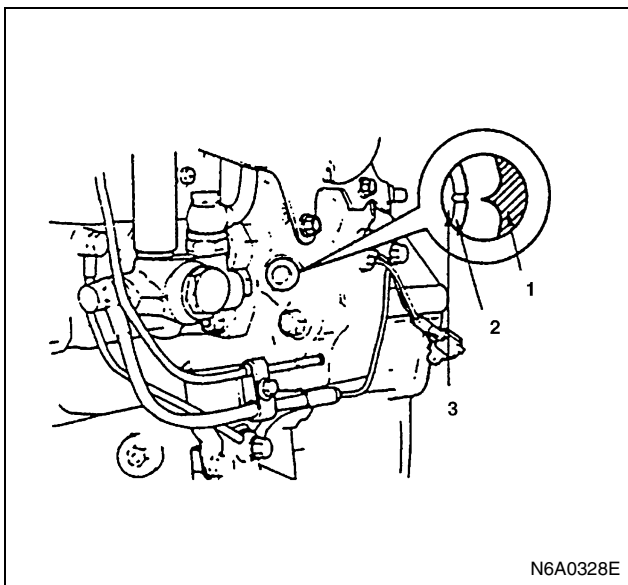
When the injection pump has a poor gear engagement while installing the assembly to the cylinder body, insert a screwdriver into the slit on the timer peripheral with the

pump bracket slit used as a guide, and move it up and down to get it into forcibly.



6) After installation of the injection pump, the injection timing can be checked through the timing check hole provided to the injection pump bracket.

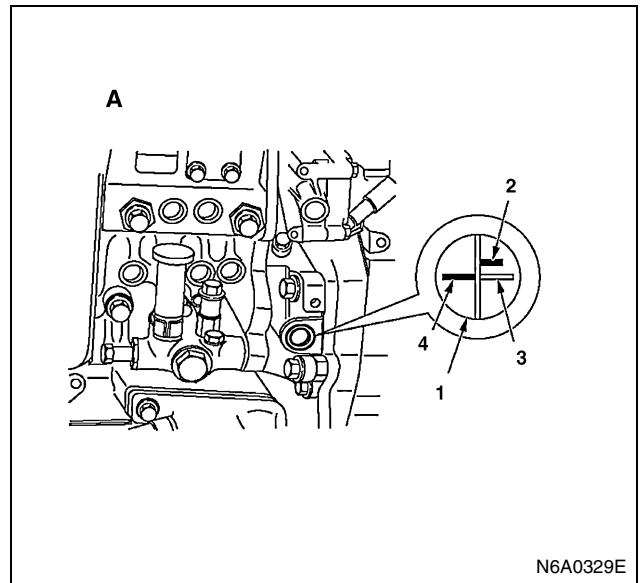
Set the No.1 cylinder to BTDC (Injection timing of each engine model) on the compression stroke. When the pointer of the timing check hole comes in line with the mark on the timer periphery of the injection pump as shown in the illustration, the injection timing is normal. After completion of the injection timing check, tighten the check hole plug to the specified torque.



Legend

- 1. Pointer
- 2. Timer outside mark
- 3. Timing check hole

Injection Timing	deg
4HF1 4HE1-TC (4HE1-XS, XN)	BTDC 8
4HG1	BTDC 9
4HG1-T	BTDC 7 (Except Colombia) BTDC 9 (For Colombia)
4HE1-TC (4HE1-XS)	BTDC 9 (Spec EURO3)



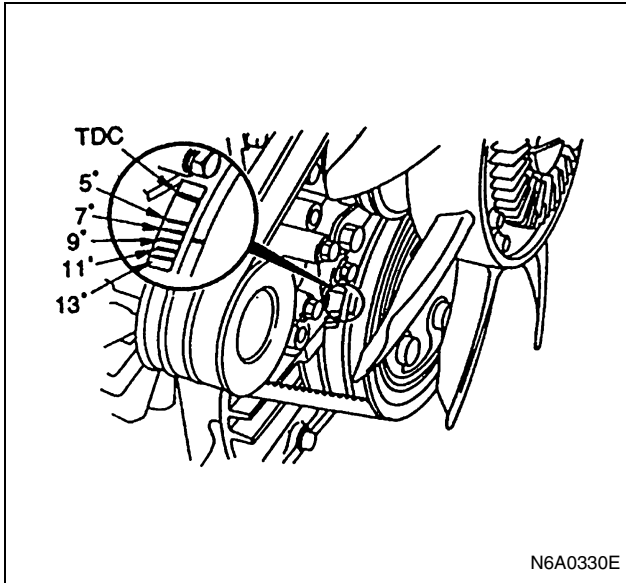
Legend

- A. For 4HF1-TC
- 1. Timing check hole
- 2. 8° Mark
- 3. 13° Mark
- 4. Pointer

7) Turn the crankshaft until the timing mark on the crankshaft damper pulley is aligned with "8°" (98EPA) or "9°" (Spec EURO3) line.

Notice:

Position in its normal rotating direction. (for 4HE1-TC only)

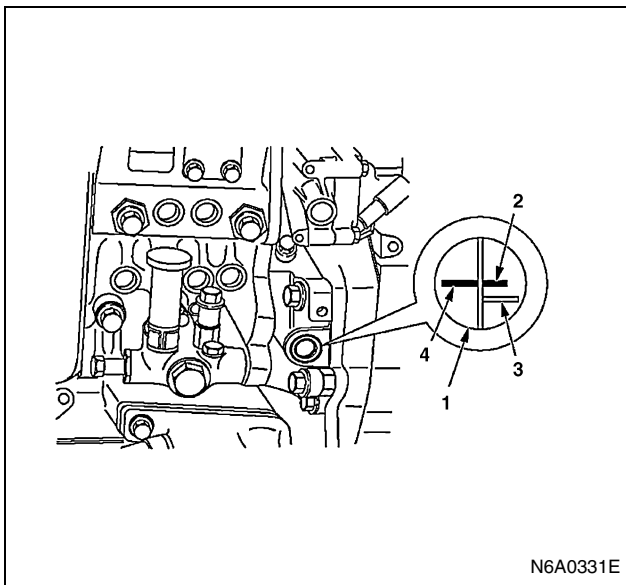


N6A0330E

8) Adjust injection pump downward so that the "8°" (98EPA) or "9°" (Spec EURO3) comes to position in the timing check hole. (for 4HE1-TC only)

Notice:

When ever the injection pump is replaced, be sure to adjust the injection timing for the details of the adjustment, refer to the "SECTION 00 SERVICING: INJECTION TIMING INSPECTION AND ADJUSTMENT."



N6A0331E

Legend

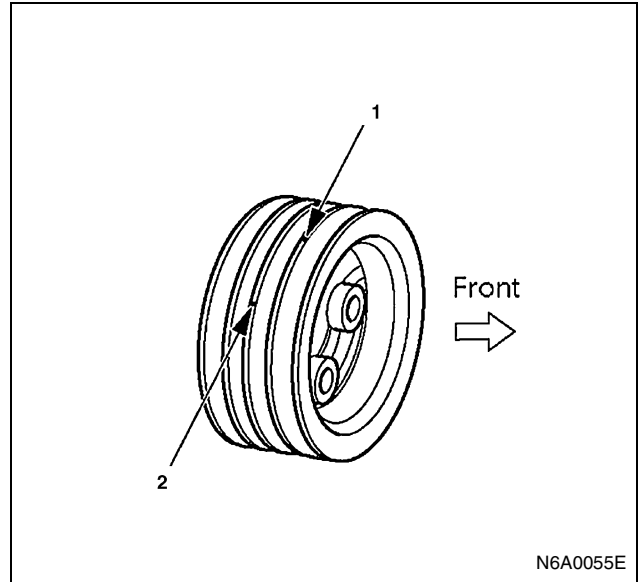
- 1. Timing check hole
- 2. 8° Mark
- 3. 13° Mark
- 4. Pointer

Notice:

In case the crank pulley has two marks as illustrated, (1) BTDC 49° mark on the second crest and (2) TDC mark on the third crest (as viewed from the front side), be sure

to set at the mark (2). (If there are two different marks on one and same crest, set at the mark which comes second when rotated in the normal direction.)

The mark (1) is used when installing the injection pump for 4HF1-2.

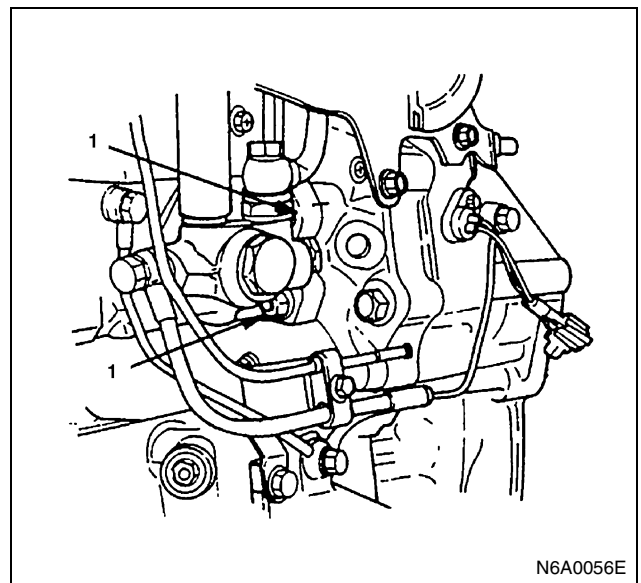


N6A0055E

9) Tighten the injection pump bracket nuts and bolts to the specified torque.

Tighten:

Injection pump bracket nut and bolt (1) to 48 N·m (4.9 kg·m / 35 lb·ft)



N6A0056E

10) Install the injection pump rear bracket.

Tighten:

Injection pump rear bracket bolt to 48 N·m (4.9 kg·m / 35 lb·ft)

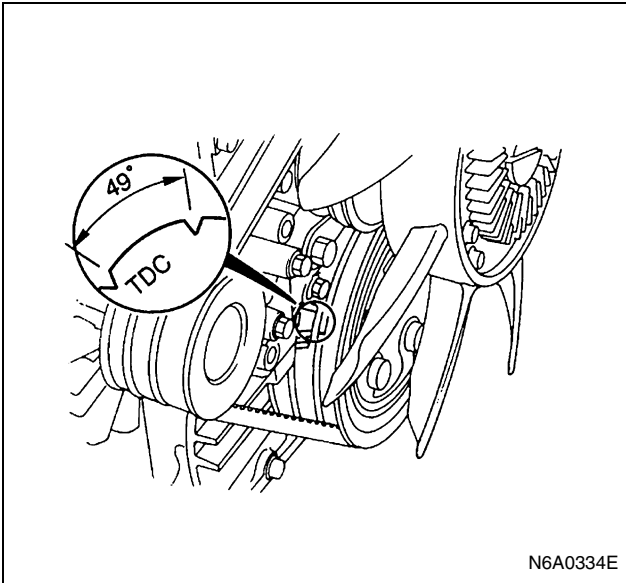
11) Install the inspection hole plug.

Tighten:

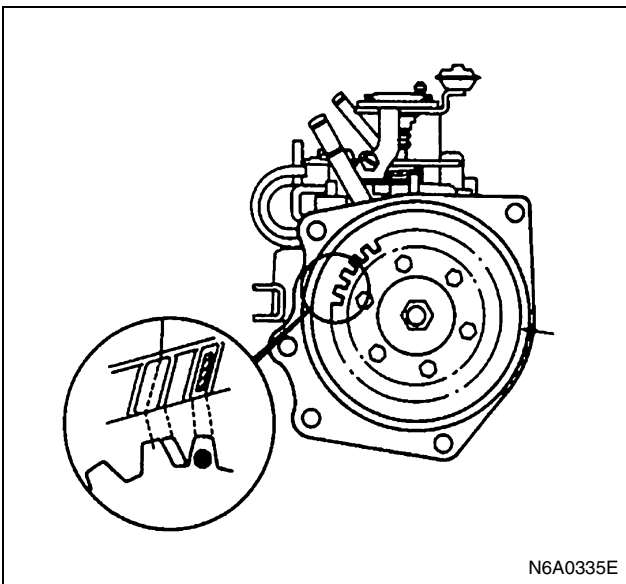
Inspection hole plug to 48 N·m (4.9 kg·m / 35 lb·ft)

41. Injection Pump Assembly (4HF1-2 model only)

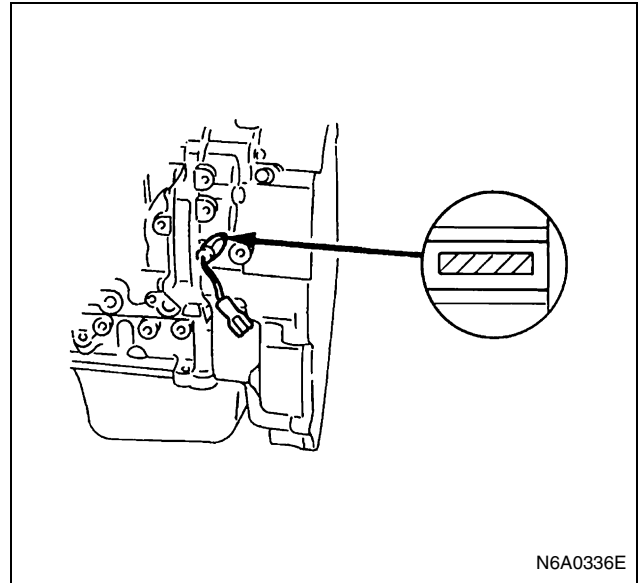
- 1) Turn the crankshaft to set No.1 cylinder to 49° before TDC in its compression stroke. (49° is a pump installing alignment angle, not related to injection timing.)



- 2) Install O-ring to the injection pump.
- 3) Apply paint on the • (Z) marked side of the injection pump gear.
- 4) Align the pump bracket mark with the tooth (under side of the pump) just before the • (Z) marked tooth.



- 5) Insert the pump using the block side of stud bolt as a guide.
- 6) After installing the injection pump, remove the tachometer sensor from the housing, and make sure that the painted gear is at the center of the sensor mounting hole.



- 7) Tighten injection pump clamping bolt and nut to specified torque:

Tighten:

Bolt to 48 N·m (4.9 kg·m / 35 lb-ft)

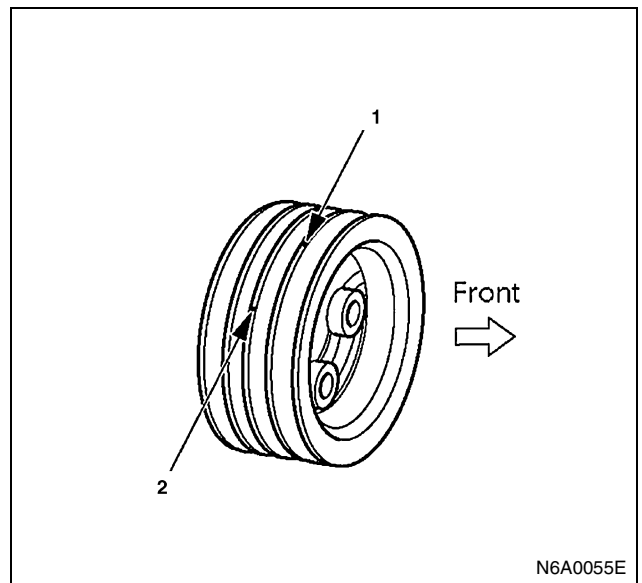
Tighten:

Nut to 24 N·m (2.4 kg·m / 17 lb-ft)

- 8) With reference to Injection Timing Check & Adjustment, set No. 1 Cylinder to 12° before its TDC.

Notice:

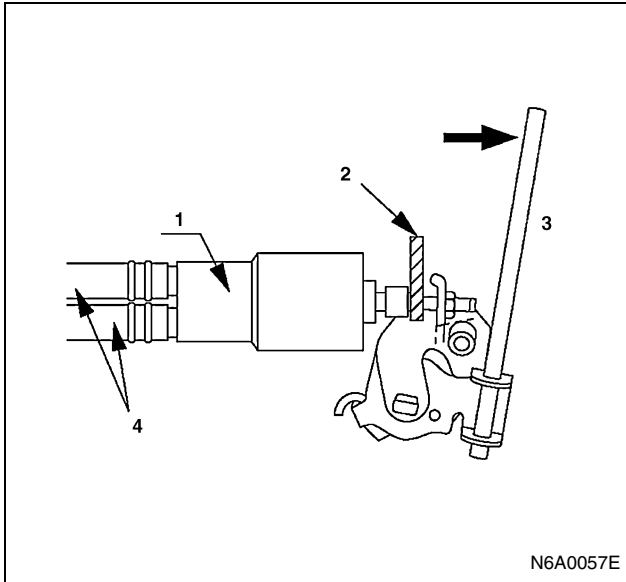
In case the crank pulley has two marks as illustrated (1), BTDC 49° mark on the second crest and (2) TDC mark on the third crest (as viewed from the front side), be sure to set at the mark (2). (If there are two different marks on one and same crest, set at the mark which comes second when rotated in the normal direction.)



42. Injection Timing Check (4HF1-2 model only)

- 1) Set No. 1 Cylinder to the TDC in the compression stroke.

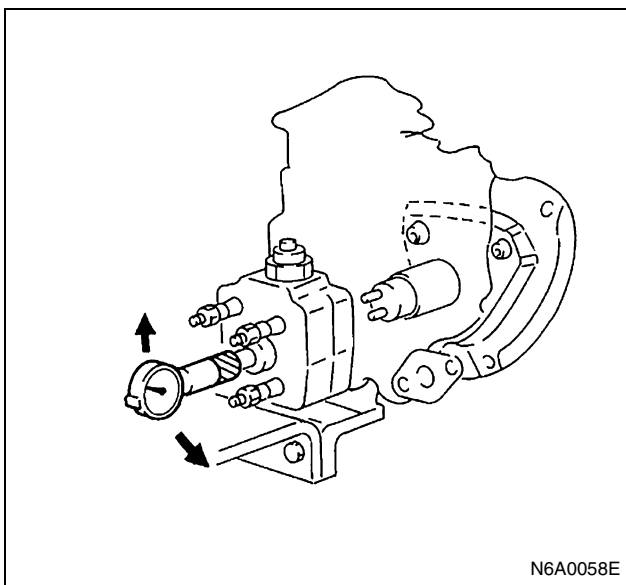
- 2) Disconnect Injection Pipe.
- 3) Put down Wax CSD lever, insert a spacer 10 — 20 mm (0.39 — 0.47 in) thick between the plunger and adjust bolt, and cancel the Wax CSD.



Legend

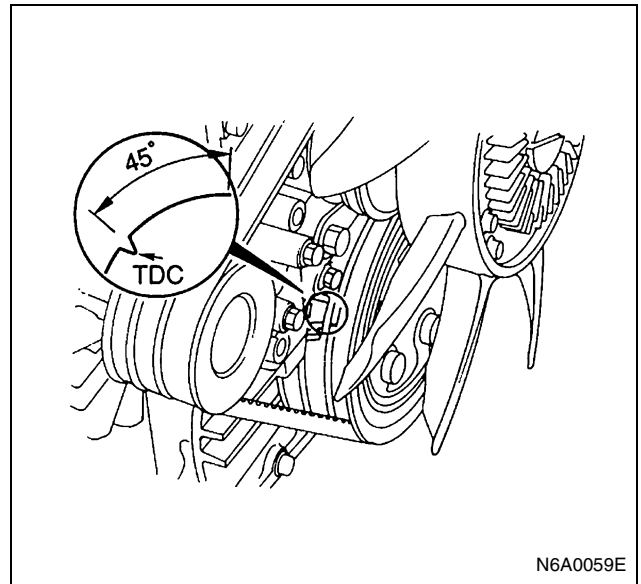
1. Water house
2. Wax CSD
3. Spacer
4. Lever

- 4) Remove the pump rear plug, connect a dial gage and set the lift at 1 mm (0.039 in).
Special Tool
Measuring device: 5-8840-0145-0



- 5) Set the crankshaft damper pulley TDC mark to the pointer or 45° before TDC.
- 6) Set the dial gage to the "0" position.

- 7) Turn the crankshaft leftwise and rightwise a little and make sure that the needle stays in the "0" position.

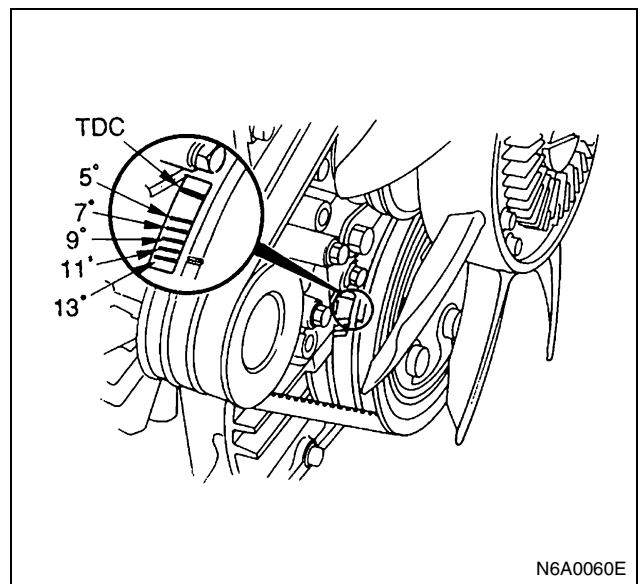


- 8) Turn the crankshaft in the normal direction and read the measuring device's indication at the 12° before TDC position.

Notice:

As there is no 12° mark, set midway between the 11° and 13 marks.

Standard value: 0.5 mm (0.0197 in)



43. Injection Timing Adjustment (4HF1-2 model only)
If injection timing is out of the specified range, follow the following procedure for adjustment:

- 1) Loosen injection pump fixing nuts and bracket bolt.
- 2) Adjust the mounting angle of injection pump:
 - If injection timing is too fast, bring the injection pump closer to the engine.
 - If injection timing is too slow, put the injection pump more distant from the engine.

- 3) When the dial gage has indicated the specified value, tighten the fixing nuts and bolt to specified torque:

Tighten:

Nut to 24 N·m (2.4 kg·m / 17 lb·ft)

Tighten:

Bolt to 48 N·m (4.9 kg·m / 35 lb·ft)

- 4) Disconnect the dial gage, install and tighten the plug to specified torque. (Make sure of a copper washer being attached to the plug)

Tighten:

Pump rear plug to 17 N·m (1.7 kg·m / 12 lb·ft)

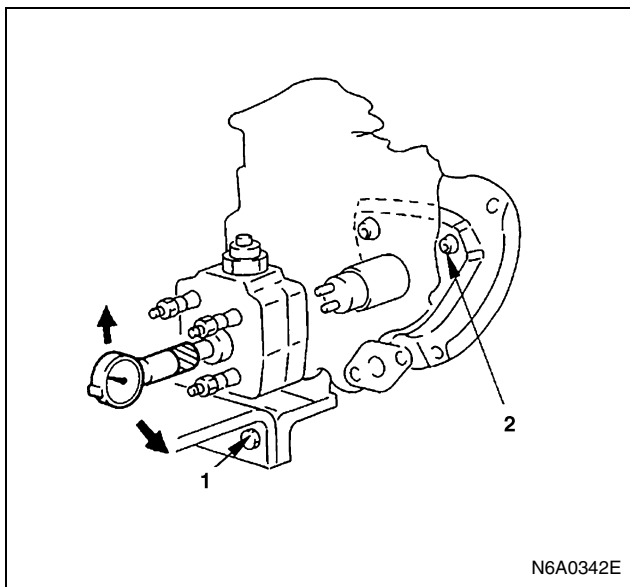
- 5) Release the wax CSD and connect the injection pipe.

Tighten:

Pipe sleeve to 29 N·m (3.0 kg·m / 22 lb·ft)

Notice:

If there are two marks on the crank pulley, the front side of mark is for setting BTDC 49° and the rear side of mark is for setting TDC.



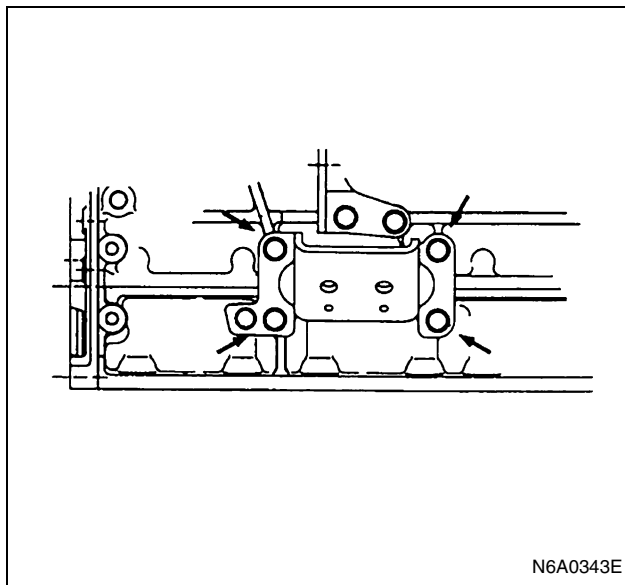
Legend

- 1. Bolts
- 2. Nuts

44. Engine Foot

Tighten:

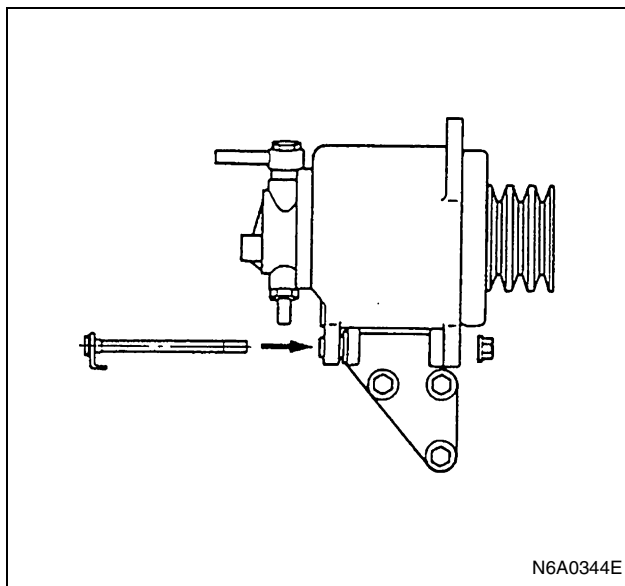
Engine foot bolt to 51 N·m (5.2 kg·m / 38 lb·ft)



45. Generator

Notice:

Before tightening the generator securely, tighten it temporarily in advance after adjusting the fan belt. Put the lower fixing bolt through from the rear side and tighten it with the nut on the front side as shown in the illustration.



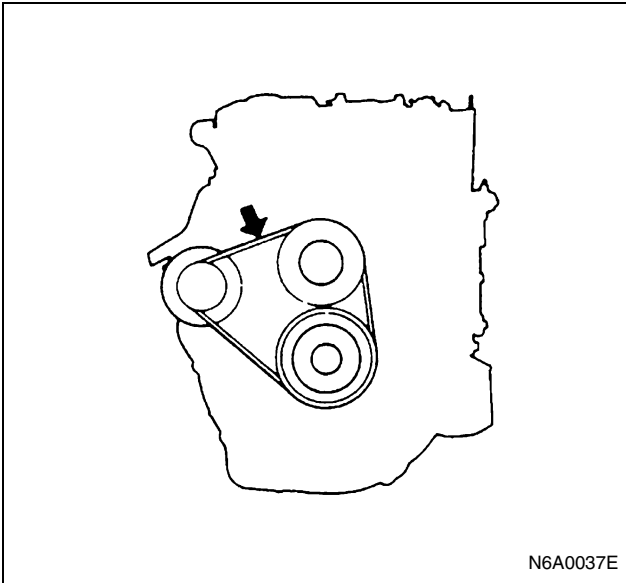
46. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 10 kg (22 lb / 98 N) force.

Drive Belt Deflection		mm (in)
New belt	8 — 12	(0.31 — 0.47)
Reuse belt	10 — 14	(0.39 — 0.55)

Check the drive belt for cranking and other damage.

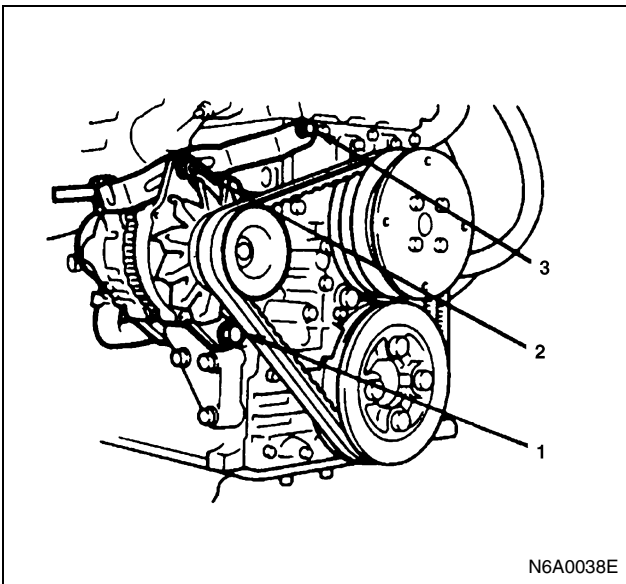


47. Fan Belt Adjustment
Fan belt tension is adjusted by moving the alternator.

Tighten:

Bolt to

- (1): 40 N·m (4.1 kg·m / 30 lb·ft)
- (2): 24 N·m (2.4 kg·m / 17 lb·ft)
- (3): 46 N·m (4.7 kg·m / 34 lb·ft)



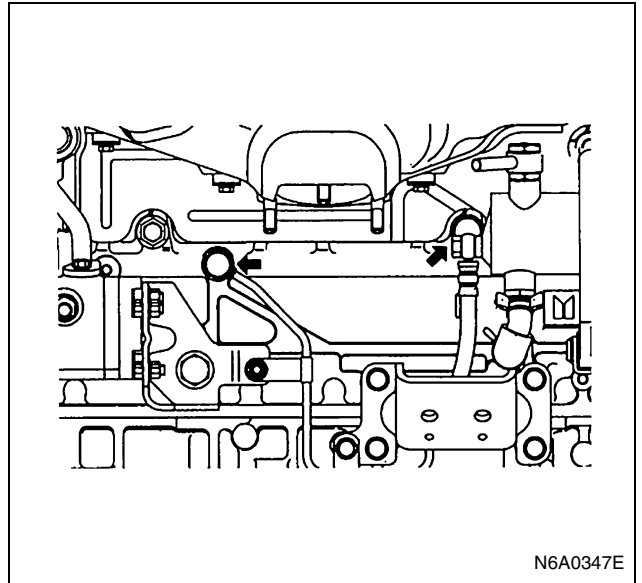
48. Vacuum Pump Rubber Hose
49. Vacuum Pump Oil Pipe

Tighten:

Cylinder body side pipe to 41 N·m (4.2 kg·m / 30 lb·ft)

Tighten:

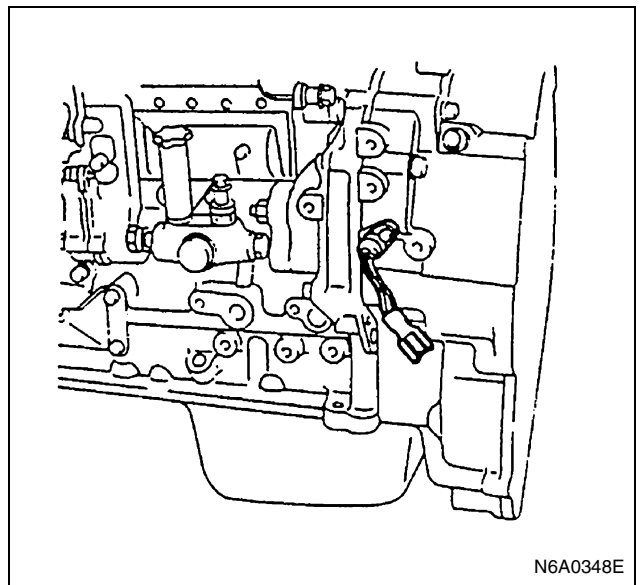
Generator side pipe to 23 N·m (2.3 kg·m / 17 lb·ft)



50. Fuel Pipe Bracket
51. Tachometer Sensor

Tighten:

Tachometer bolt to 8 N·m (0.8 kg·m / 6 lb·ft)



52. Oil Filter Assembly

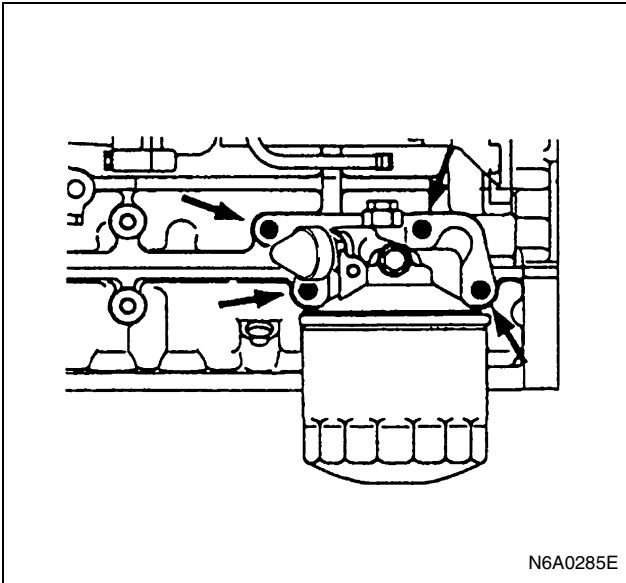
Tighten:

Oil filter bolt to 48 N·m (4.9 kg·m / 35 lb·ft)

53. Oil Pipe

Tighten:

Oil pipe joint bolt to 17 N·m (1.7 kg·m / 12 lb·ft)



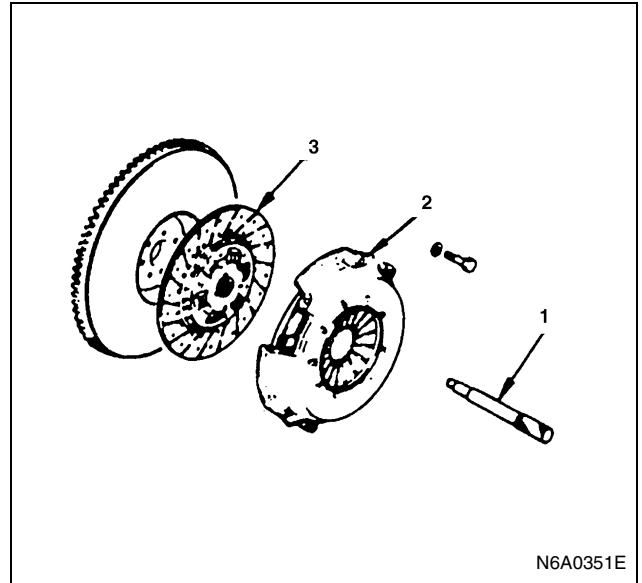
N6A0285E

54. Engine Control Lever Assembly

Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m / 17 lb·ft)

55. Engine Control Wire



N6A0351E

Legend

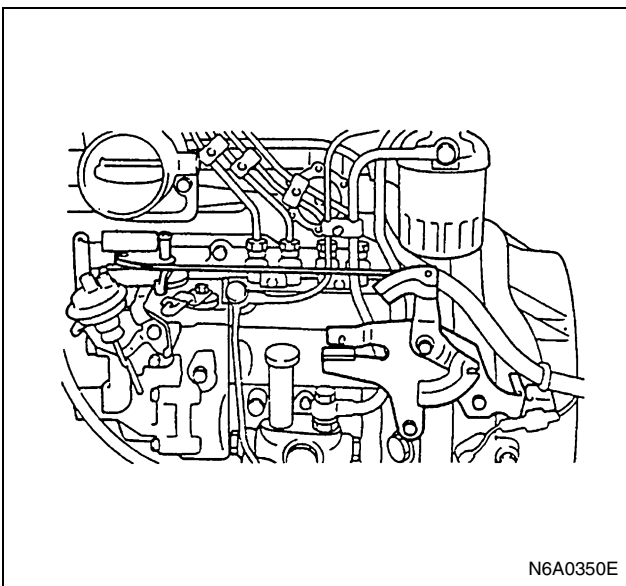
- 1. Clutch pilot aligner
- 2. Clutch pressure plate assembly
- 3. Driven plate

57. Clutch Pressure Plate Assembly

- 1) Align the clutch pressure plate with the flywheel knock pin.
- 2) Tighten the pressure plate bolts to the specified torque in numerical order.

Tighten:

Clutch pressure plate bolt to 40 N·m (4.1 kg·m / 30 lb·ft)

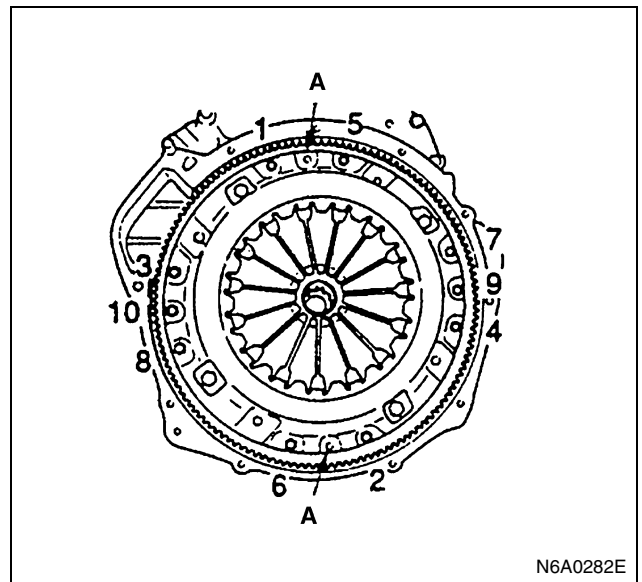


N6A0350E

56. Driven Plate

Use the clutch pilot aligner to install the driven plate.

Clutch Pilot Aligner: 5-8840-2240-0



N6A0282E

Legend

- A. Knock pin

58. Cylinder Head Gasket

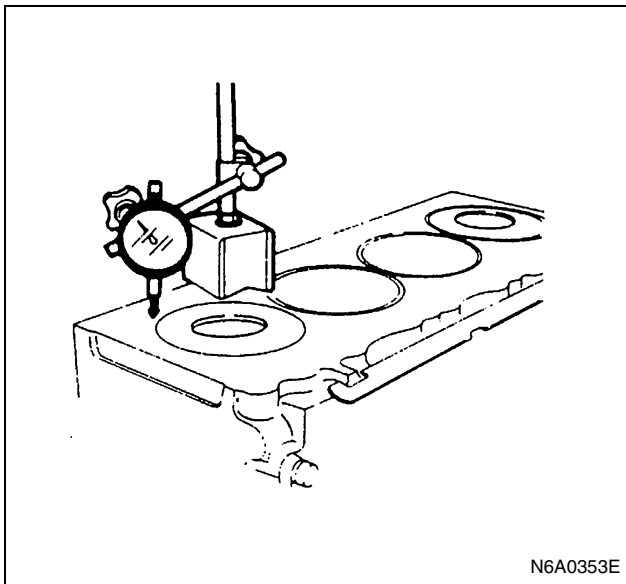
- 1) When any of the cylinder block, crankshaft, crankshaft bearing, connecting rod, connecting rod bearing, and piston is replaced with a new one, cylinder head gasket thickness should be determined newly.
- 2) When replacing the cylinder head gasket alone without replacing any of the parts mentioned in 1) above, the gasket to be used should be the same grade as the one used before.
- 3) Correct the cylinder head gasket thickness is important. Installing the wrong thickness gasket can result in greatly reduced engine performance.
- 4) There are three cylinder head gaskets available.

59. Piston Head Projection Measurement

- Select a cylinder head gasket.
- Clean thoroughly the top faces of the piston head and the cylinder body.
- Use the dial gauge to measure the piston head projection. Take measurements at two locations for each cylinder.
- The measurement points of the piston head and the reference point of the cylinder body are shown in the illustration.

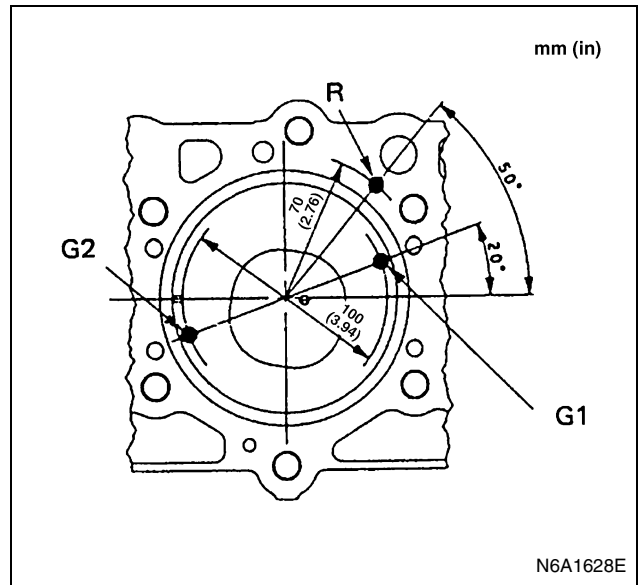
Measurement points: Points G1 and G2 of the piston head

Reference point: Point R on the top face of the cylinder body



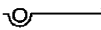
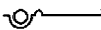

N6A0353E

- Based on the Timax obtained, select a gasket of the appropriate grade.



N6A1628E

4HF1/4HF1-2/4HG1-T
Cylinder Head Gasket Selection

mm (in)		
Gasket Grade	Ti max	Gasket Thickness (Reference)
A 	0.579 - 0.659 (0.0228 - 0.0259)	1.70 (0.0669)
B 	0.659 - 0.739 (0.0259 - 0.0291)	1.75 (0.0689)
C 	0.739 - 0.819 (0.0291 - 0.0322)	1.80 (0.0708)

N6A1396E


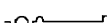

Notice:

Note that there are three types of a cylinder head gasket available as shown in the table following, according to the piston projection.

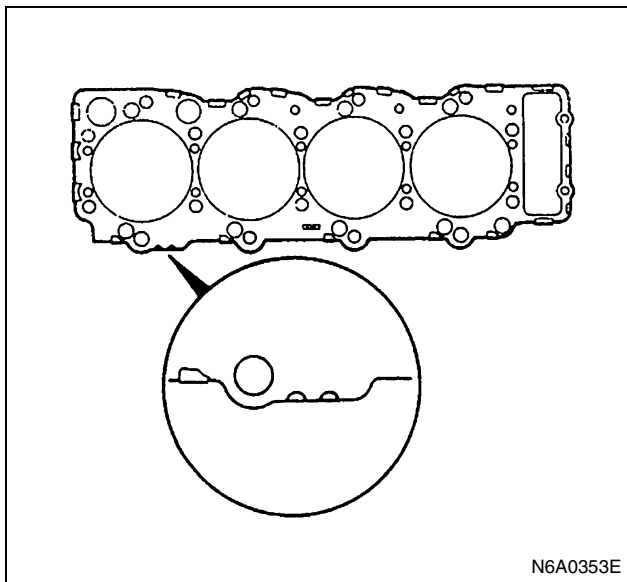
- For each cylinder, calculate the average value (Ti) of the piston projection.
- Find the maximum value (Timax) of the average value (Ti) of each cylinder.

4HE1-TC

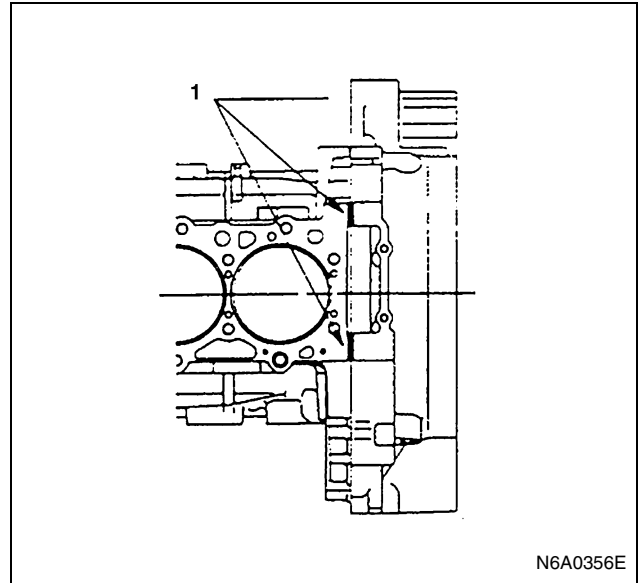
Cylinder Head Gasket Selection

mm (in)		
Gasket Grade	Ti max	Gasket Thickness (Reference)
A 	0.529 - 0.609 (0.0208 - 0.0240)	1.70 (0.0669)
B 	0.609 - 0.679 (0.0240 - 0.0267)	1.75 (0.0689)
C 	0.679 - 0.759 (0.0267 - 0.0300)	1.80 (0.0708)

N6A1397E



- Apply a 3 mm (0.12 in) bead or recommended liquid gasket or its equivalent to the shaded areas shown in the illustration.



Legend

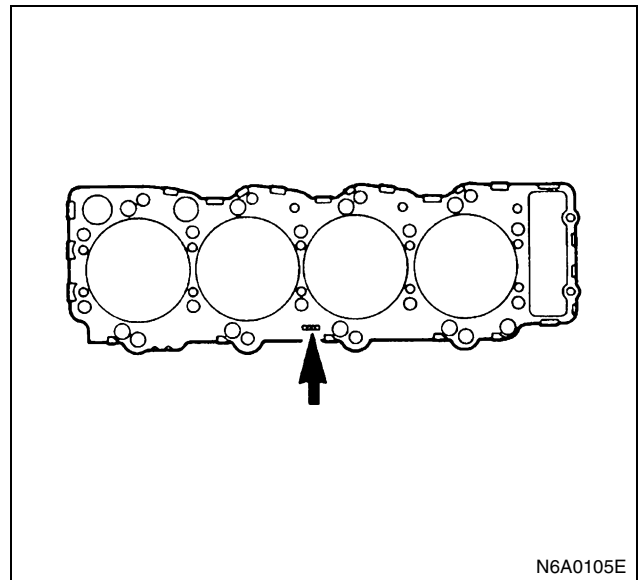
1. Bead width $\phi 3$

- Install the cylinder head gasket with its "PART NUMBER" mark facing up and toward the left of the engine.

Caution:

Do not reuse the cylinder head gasket.

60. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section 6A3 in this manual.



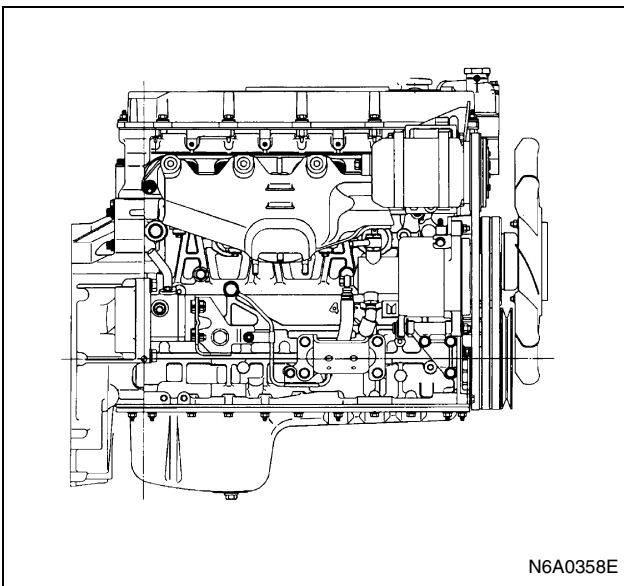
ENGINE

(4HF1 / 4HF1-2 / 4HE1-TC / 4HG1 / 4HG1-T)

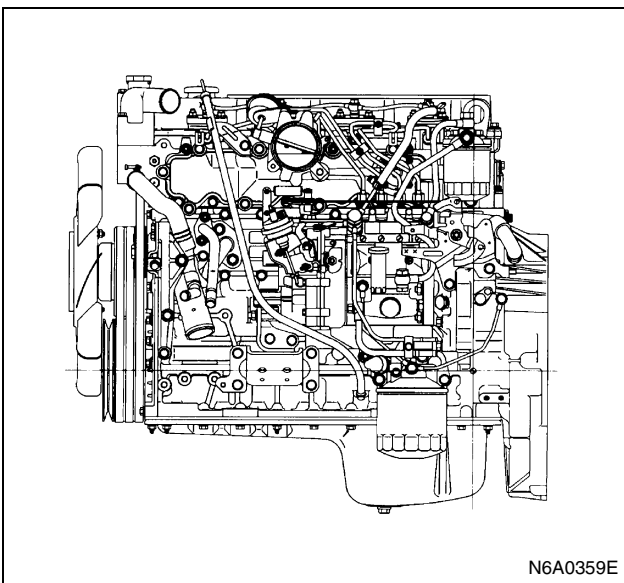
GENERAL DESCRIPTION

The engine is a four-cycle, four-cylinder, in-line, direct fuel injection type diesel engine with the piston displacement of 4,334 cc. It features a gear driven OHC (overhead camshaft) timing train and the unique mechanisms and systems designed for outstanding cleanness, economy and durability. Its torque characteristics promise dynamic ride at high speed, high power at low speed, and smooth and continuous torque at medium to high ranges.

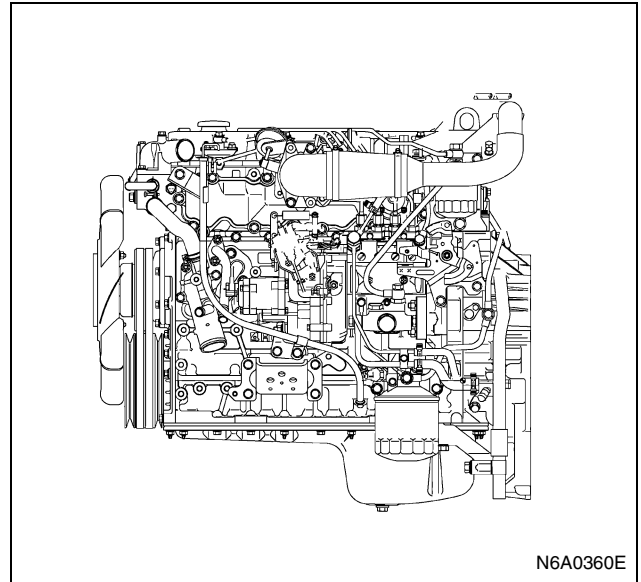
For 4HF1



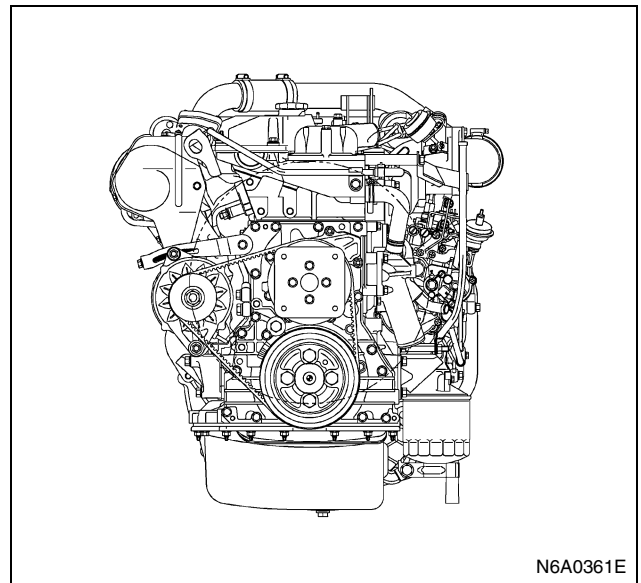
For 4HF1



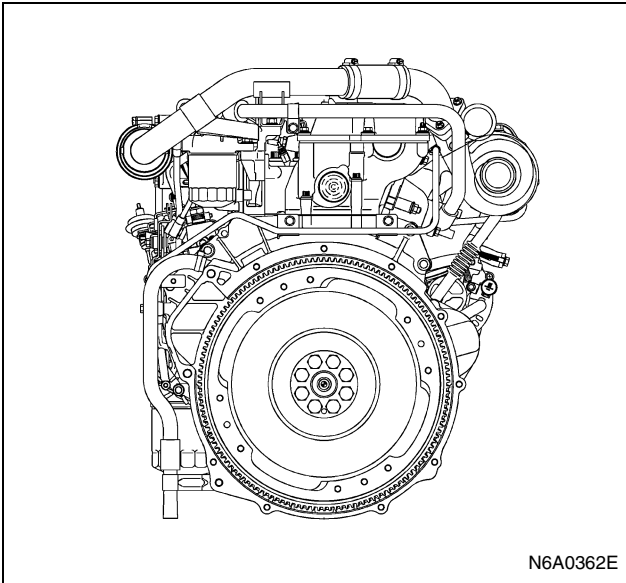
For 4HG1-T



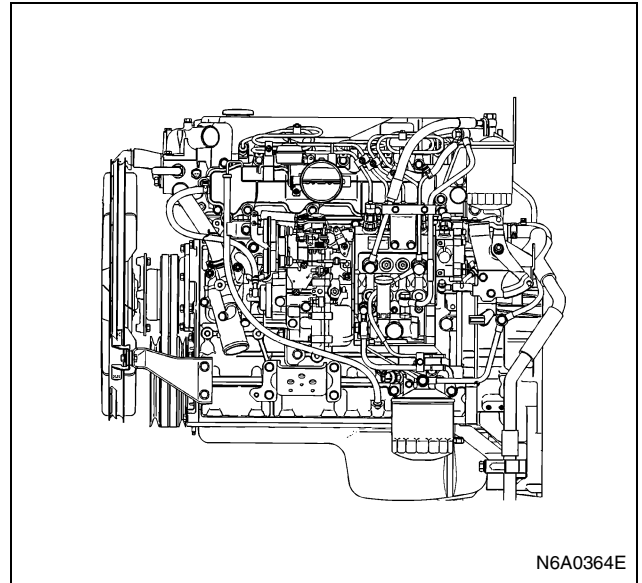
For 4HG1-T



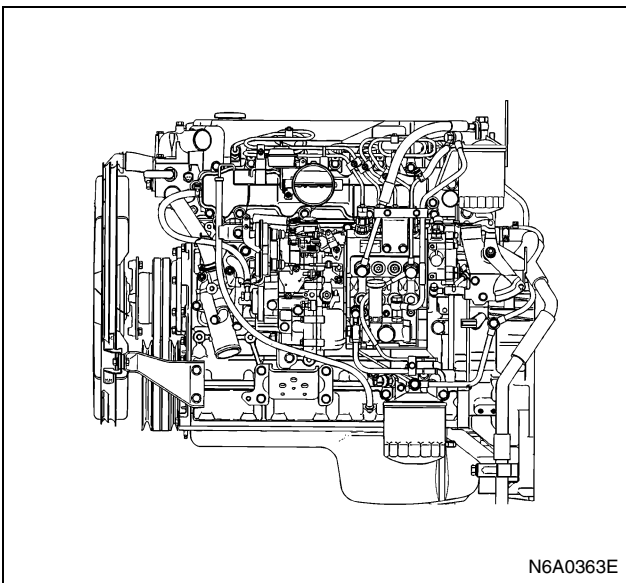
For 4HG1-T



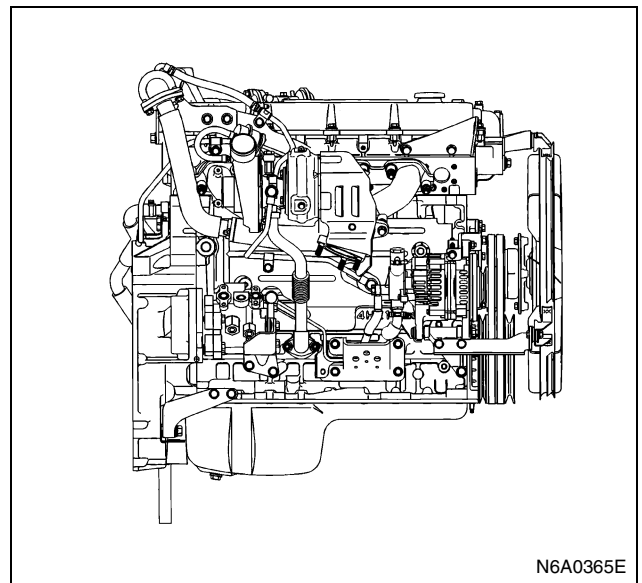
For 4HE1-TC (4HE1-XS) 98EPA



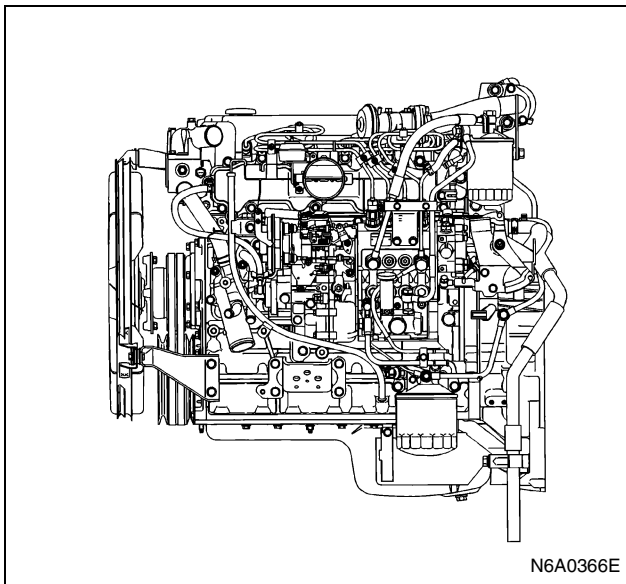
For 4HE1-TC (4HE1-XS) 98EPA



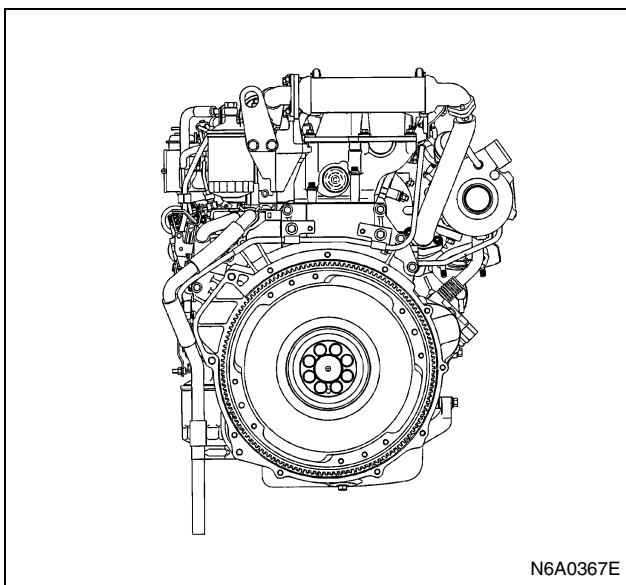
For 4HE1-TC (4HE1-XS) SPEC. EURO3



For 4HE1-TC (4HE1-XS) SPEC. EURO3



For 4HE1-TC (4HE1-XS) SPEC. EURO3

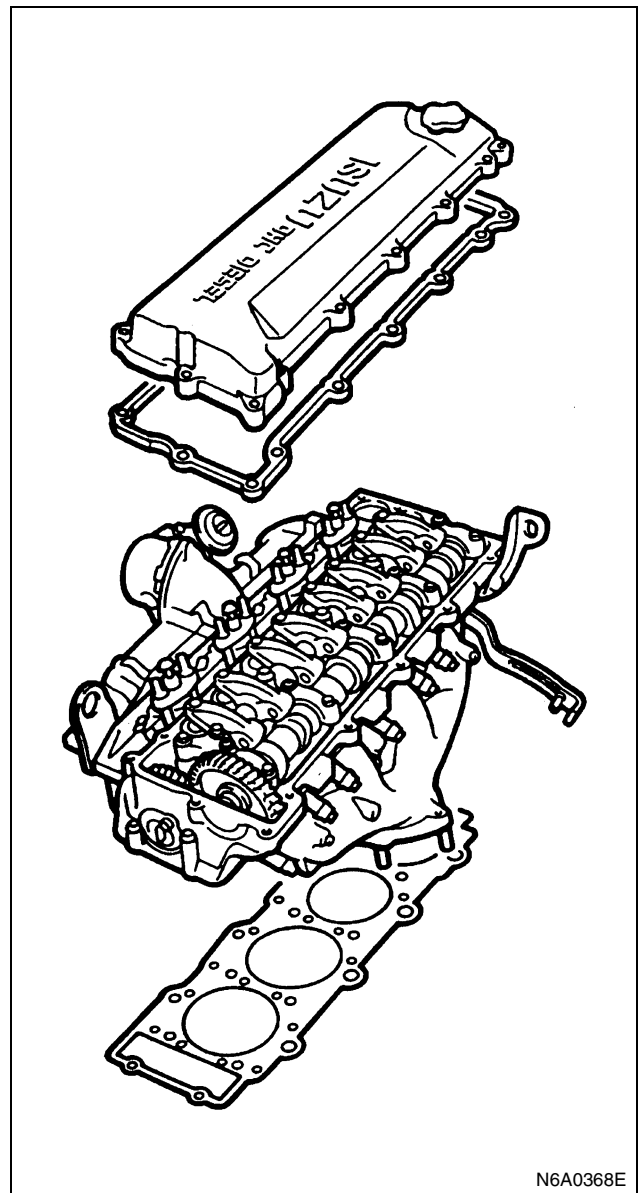


Cylinder Head

- The cylinder head is made of cast iron and has a crossflow layout with the intake system in the left side and the exhaust system in the right side, designed to reduce resistance in the intake and exhaust systems.
- The valve diameter is increased to offset the mass of the valve operating system reduced by the introduction of the OHC mechanism. In addition, the intake and exhaust ports are put in a smoother and less resistant layout to enhance intake and exhaust efficiency.
- The cylinder head gasket is of the laminated steel of least fatigue in combination with the angular cylinder head bolt tightening method, equally designed to increase reliability against gas and water leakage, in addition, selective assembly of gaskets of various thicknesses minimizes the wasted

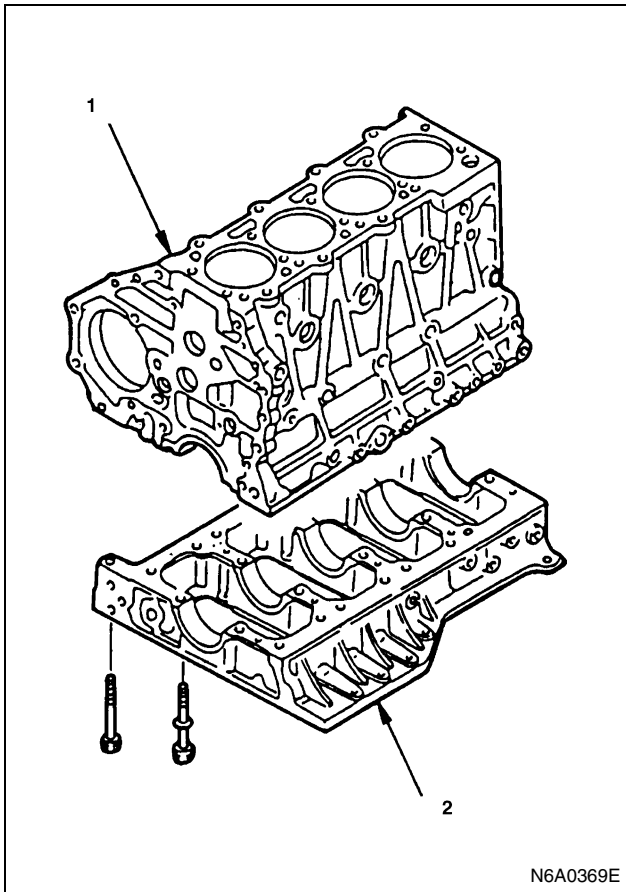
space between the piston and the cylinder head to maintain performance at a high level.

- The cylinder head cover is made of aluminum to reduce noise.



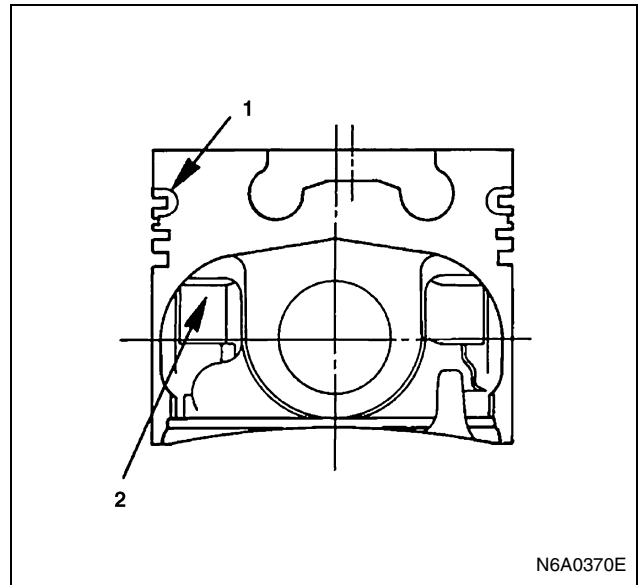
Cylinder Block

- The cylinder block (1) is made of cast iron having dry cylinder liner and five bearings. The bearing cap has a ladder frame (2) construction integrating the crankcase to increase rigidity.
- The cylinder liner is made of thin iron plus special alloys and is combined with the chrome-plated piston ring to ensure good resistance against wear.
- The oil pan is made of vibration-damping steel to reduce noise.



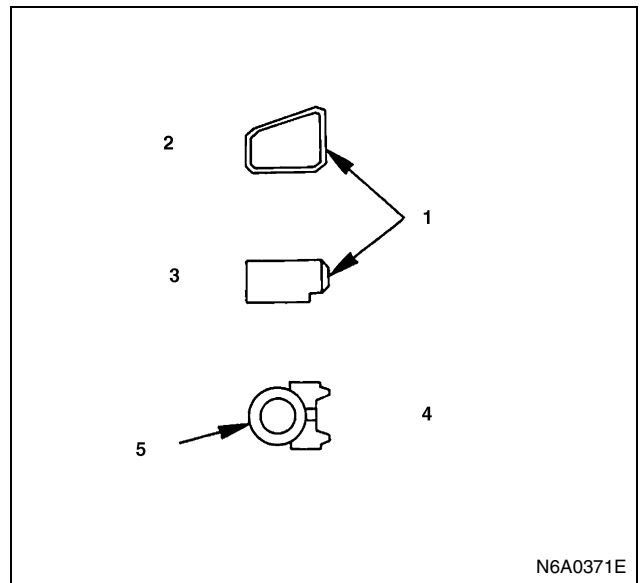
Piston, Connecting Rod and Crankshaft

- The piston is made of aluminum alloy. A ring trigger is cast into the top ring groove and chrome plating is applied to four sides of the top ring to ensure sufficient strength and wear resistance of the ring and the ring groove. The piston bottom has a thermal flow shape to increase cooling efficiency of the oiling jet. This design reduces thermal load while increasing rigidity (see figure).
- The combustion chamber has a square shelf of proven performance to ensure outstanding stability in exhaust gas control (see figure).
- The autothermic piston and offset piston pin reduces piston flapping and other noise.



Legend

1. Ring trigger
2. Strut

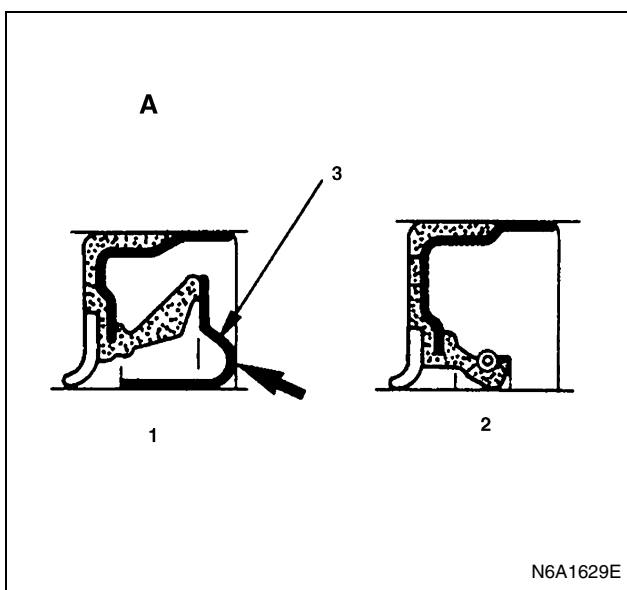


Legend

1. Chrome plated
2. Top ring
3. 2nd ring
4. Nitriding
5. Oil ring expander

- The crankshaft is made of cast carbon steel with five bearings and eight counterweights to reduce revolution load to the bearing. The ladder frame design that integrates the bearing cap and the crankcase increases bearing rigidity. The angular tightening method of the bearing bolt further increases reliability and durability.

- The connecting rod is made of cast carbon steel and the cap is bolted by angular tightening method to maintain reliability.
- The bearing, as well as the crank journal and crank pin bearings, are made of Kelmet metal. Oil clearance is controlled accurately through selective assembly by thickness to reduce noise and increase reliability.
- The crankshaft has the axial type oil seal that drastically improves durability and reliability. Compared with the conventional radial type (lips in a radial orientation), the axial type oil seal has lips in an axial orientation to minimize lip wear. It also precludes lip peeling and damage, spring dislocation and other problems associated with the radial type oil seal (see figure).

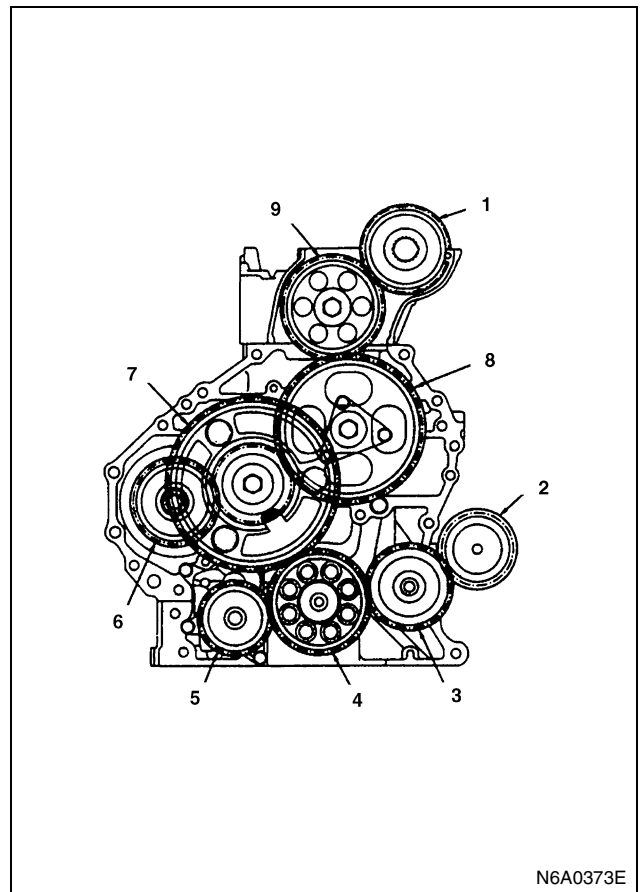


Legend

- A. Crankshaft oil seal
- 1. Axial type
- 2. Radial type
- 3. Slinger

Valve Train

- The gear train is located at the end of the cylinder block to minimize influence of the torsional vibration of the crankshaft and the radiant sound. Noise is further reduced, to the same level as a timing belt driven system, by integrating the crank gear with the crankshaft by shrink fit and by careful turning of the gear precision, teeth contact ratio of gear, backlash, bearing rigidity, neutral frequency, etc. (See figure).

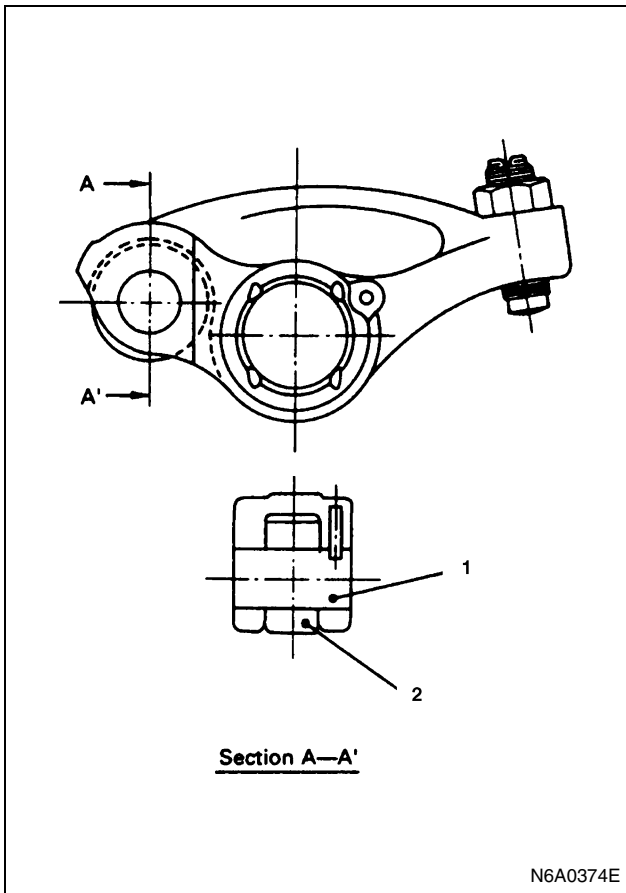


Legend

- 1. Camshaft gear
- 2. Power steering pump gear
- 3. Power steering pump idle gear
- 4. Crankshaft gear
- 5. Oil pump drive gear
- 6. Injection pump gear
- 7. Idle gear A
- 8. Idle gear B
- 9. Idle gear C

- Gears are of the forged type. Gears are tufftrided to secure sufficient durability.
- The camshaft is made of carbon steel with five bearings. The cam's nose and the journal are induction-hardened to secure sufficient durability.
- The cam has a Fourier-dyne profile to maximize the intake and exhaust valve lifts and the valve opening and closing timing is optimized to increase intake and exhaust efficiency.
- The valve spring is a single spring having an egg-shaped cross section to reduce weight while reducing stress. Coupled with the unique cam profile, the spring increases the jump-and bounce-free limit at high-speed operation to provide reserve characteristics.
- The rocker arm is made of diecast aluminum and is of the center pivot type having a roller. This increases reliability while reducing friction and con-

tributes to increased power output and fuel efficiency (See figure).



Legend

1. Pin
2. Roller

- The rocker shaft is chrome plated to secure sufficient durability.

Fuel System

LINE Pump

- The injection pump is of Bosch A type with the plunger outside diameter of 9.5 mm (0.37 in) and cam lift of 9 mm (0.35 in). The plunger has a special notch for advancing the timing at starting.
- The governor is of a mechanical RLD type to ensure sustained power at high speed.
- The timer is of the SCDM (eccentric) type.

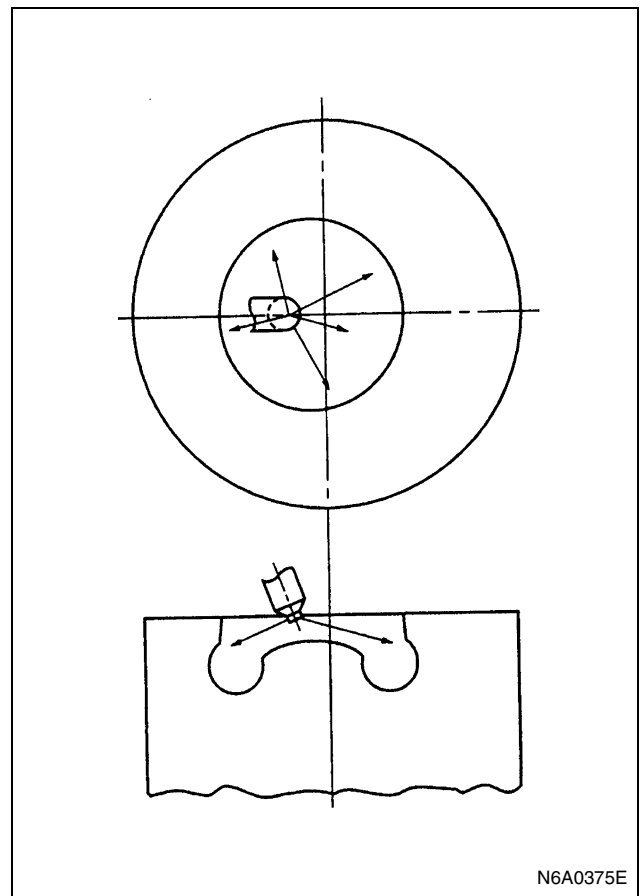
VE Pump

- A Bosch Distributor Type injection Pump is used. A single reciprocating / revolving plunger delivers the fuel uniformly to the injection nozzles, regardless of the number of cylinders.
- The governor, the injection timer, and the feed pump are all contained in the injection pump housing. The injection pump is compact, light weight, and provides reliable high-speed operation.

An android compensator is available as an option for vehicles to be operated at high altitudes. It adjusts the fuel and air mixing ratio.

Injection Nozzle

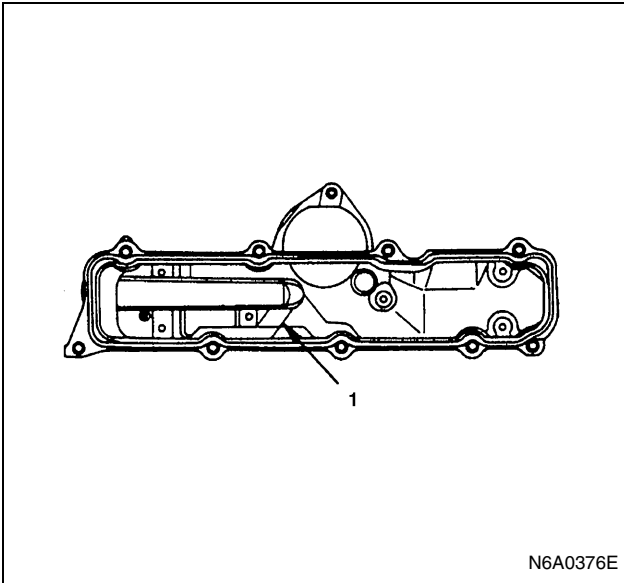
- The injection nozzle is of the P type to bring it as technically close as possible to the center of the combustion chamber. The nozzle inclination is also reduced to minimum to increase combustion efficiency. The nozzle has five jets and the valve opening pressure is set at 185 kg/cm² (2,630 psi, 18,142 kPa) (See figure).



- The injection pipe is laid in such a way that the overall length is minimized to enhance performance.

Intake and Exhaust Systems

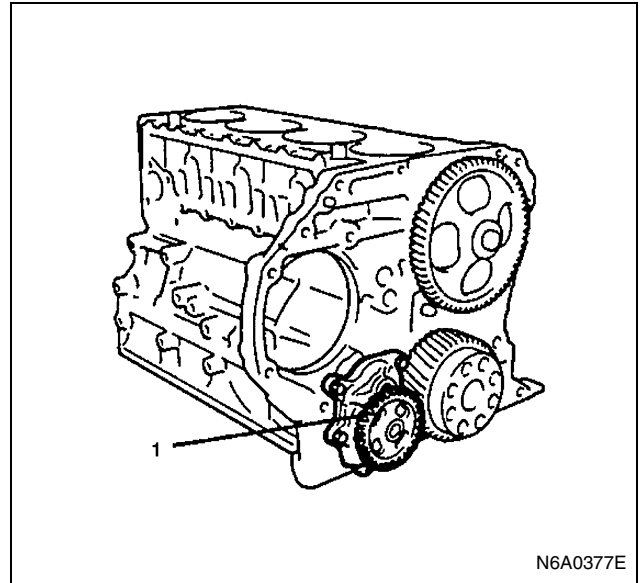
- The resin-made intake manifold is of the cover type having an inner cover made of rubber and steel. This design effectively reduces radiant sound and transmitted sound.
- The intake manifold has a straightening vane inside to stabilize swirl and improve performance. It also contains a built-in Positive Crankcase Ventilation (PCV) valve to minimize the overall size (See figure).
- The exhaust manifold is made of cast iron and heat-resisting alloys. Ports are shaped carefully to minimize exhaust resistance.



N6A0376E

Legend

- 1. Straightening wall



N6A0377E

Legend

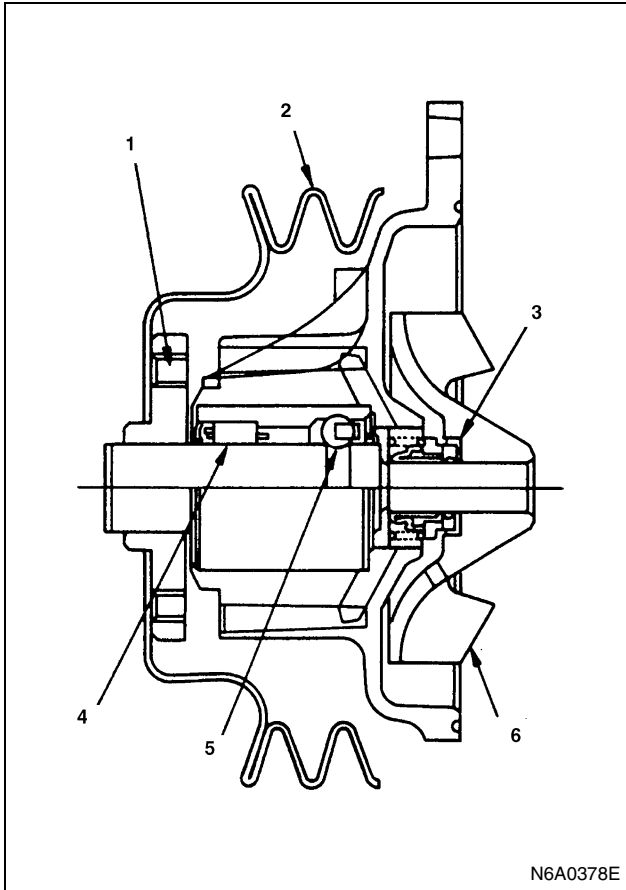
- 1. Oil pump gear

Lubrication System

- The oil pump is driven by the crank gear directly to increase durability while maintaining sufficient delivery. The pump body is partially integrated with the cylinder block to reduce the overall size and weight (See figure)
- The oil filter is of the cartridge type integrating the full flow filter and bypass filter as a single unit. This presents several advantages such as an extended interval between oil exchanges and greater ease of maintenance resulting in cost reduction. The bypass valve is fitted to the body itself to avoid flow of foreign matter due to bypassing of oil thereby maintaining sufficient reliability.
- The oil cooler is of a large-capacity, water-cooled and multiple-partition type built into the side of the cylinder block. This design maintains necessary stability in oil temperature. It also has a bypass valve to minimize delay of the oil gallery pressure build-up for cold starting.

Cooling System

- The water pump is driven by a V-belt and the pump body is made of diecast aluminum. Part of the swirl chamber is built into the engine front cover to reduce the overall size and weight. A sintered carbon type seal unit is chosen to secure reliability. The shaft bearing combines roller bearing and ball bearing to maintain necessary durability. The outlet for draining is located behind the pulley to prevent dust from entering the system as much as possible. (See figure)
- The cooling fan operation is regulated by a temperature-sensitive clutch to enhance fuel efficiency while reducing noise.



Legend

1. Fan center
2. Fan pulley
3. Seal unit
4. Roller bearing
5. Ball bearing
6. Impeller

Important Operations

1. Axial Type Oil Seal

- As crankshaft front and rear oil seals are both axial type, attention must be paid to the following: when replacing, replace oil seal and slinger as a set.
- Be sure to use the special tool correctly since oil seal and slinger must be set accurately in their longitudinal direction.

2. Valve Cap

- As intake and exhaust valves have caps, take sufficient care not to let them fall into the gear case or oil return hole during disassembly or reassembly.

3. Application of Liquid Gasket

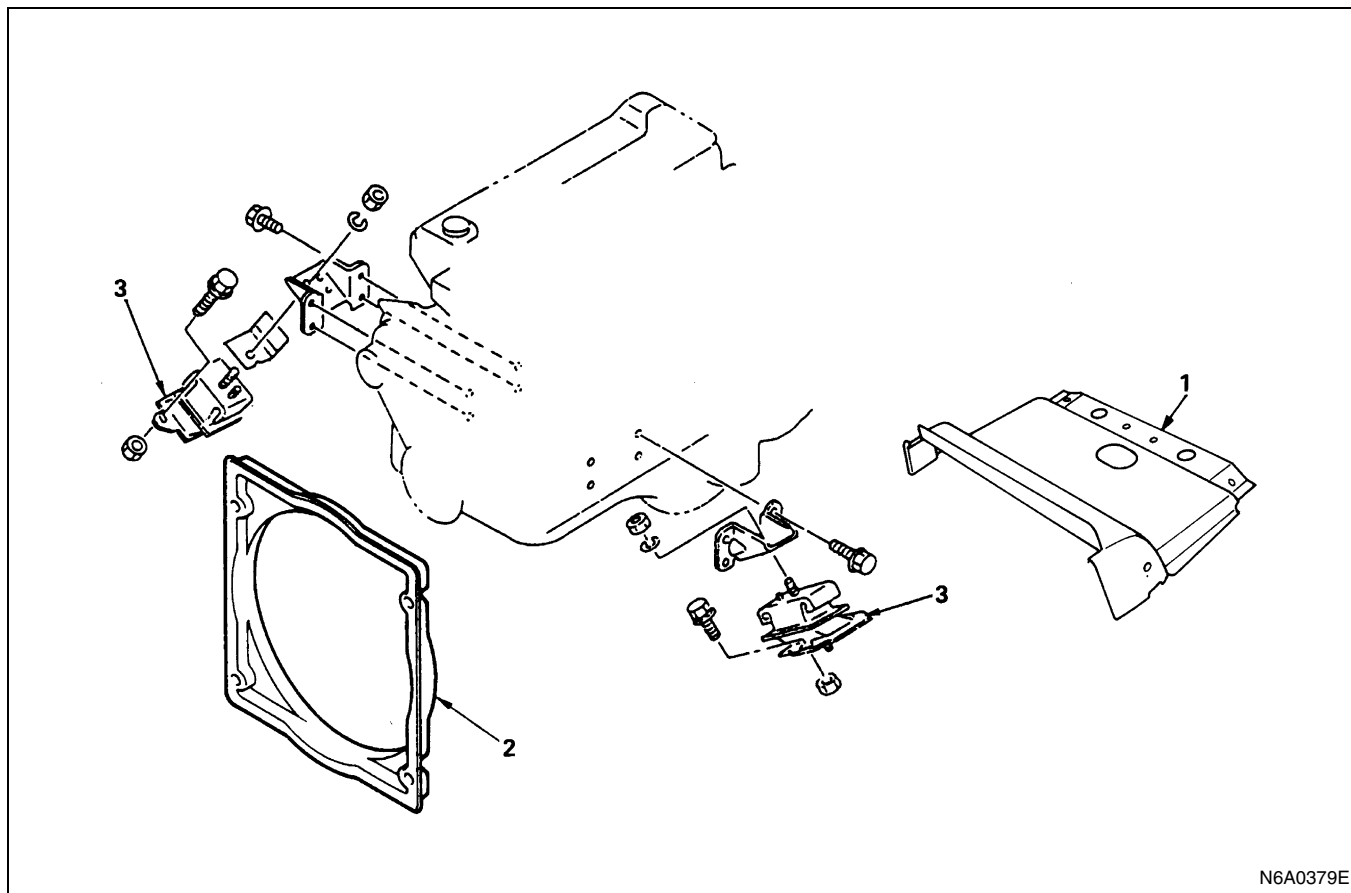
- Oil pan, crankcase, oil cooler, retainer front, and water pump are not sealed with sheet gasket but with liquid gasket only.
- Prior to application, be sure to remove old hardened liquid gasket or oil from those surfaces to which new gasket will be applied. Further, if the old gasket can hardly be removed, mask such surfaces with gasket remover (Three Bond PANDO-391D; ISUZU Genuine Parts No. 1-8844-0542-0) or equivalent in accordance with the instructions manual.
- Liquid gasket should be applied evenly so that no breaks and omissions may be made. Further, were O-ring is used should not be exposed to liquid gasket.

4. Plastic-Region Angular Bolt Tightening Method

- Clamping bolts of connecting rod and cylinder head (M14 only) are tightened by plastic region angular bolt tightening method. This method is applied with bolt threads and setting faces coated with molybdenum disulfide grease.

ENGINE MOUNT (RH,LH)

Component



Legend

1. Transmission panel
2. Fan guide

3. Engine mount

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab.

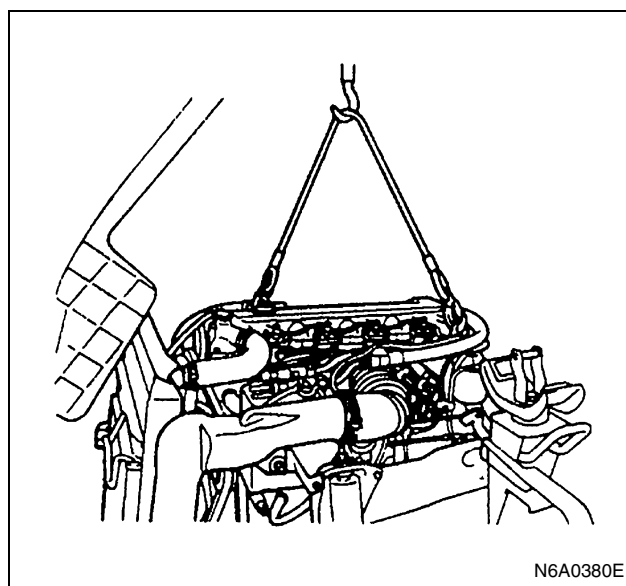
1. Transmission Panel

2. Fan Guide

Remove the fan guide and hang it on the fan side.

3. Engine Mount

- 1) Hang the engine by the hoist before dismantling the engine mount.
- 2) Remove the nuts that fix the engine foot and the engine mount.
- 3) Remove the fixing bolts on the chassis frame side of the engine mount.
- 4) Hoist the engine assembly a little, and dismount the engine mount.



Installation

1. Engine Mount
Tighten the fixing bolts to the specified torque.

Tighten:

Chassis frame side bolt to 48 N·m (4.9 kg·m/35 lb·ft)

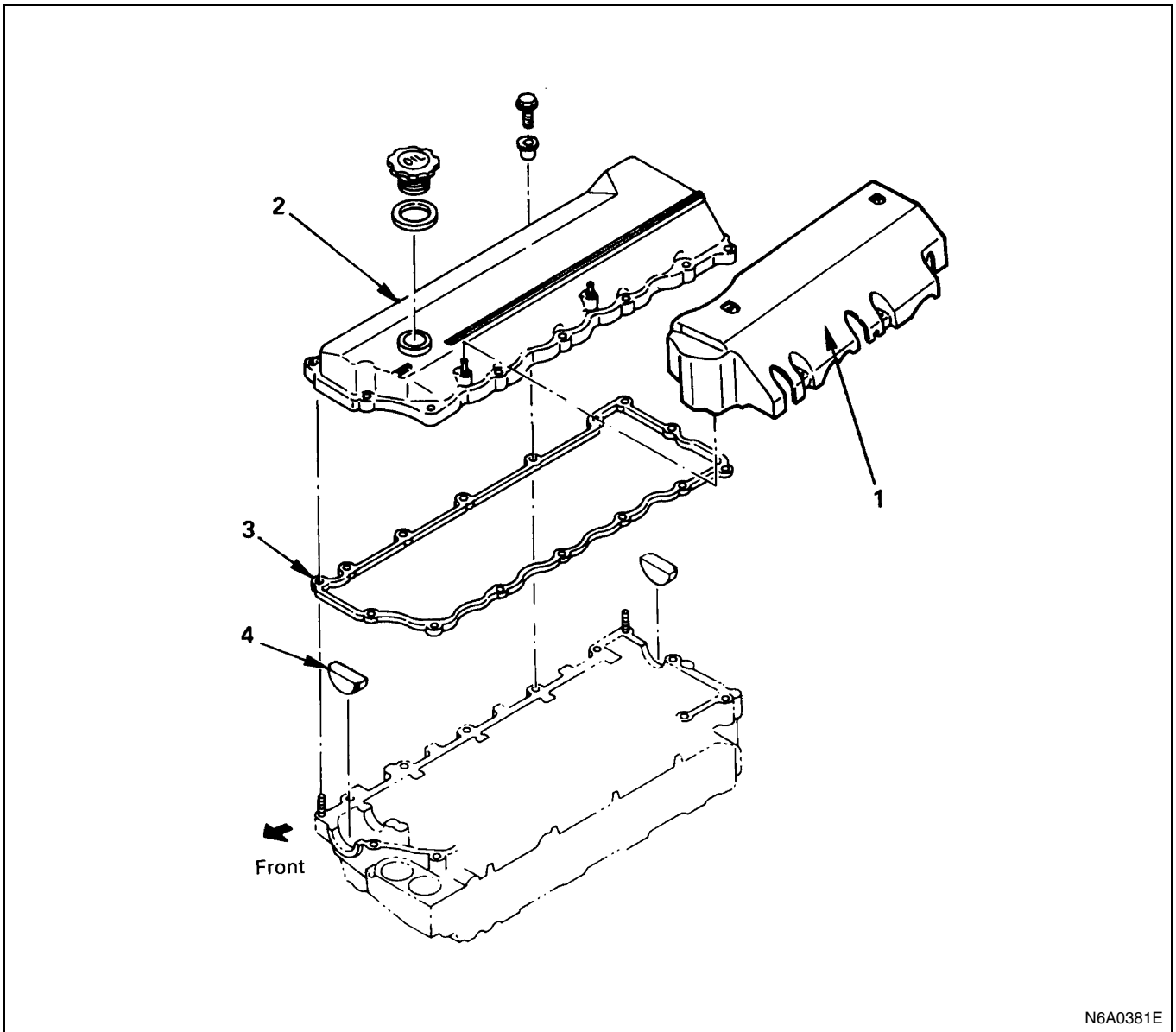
Tighten:

Engine foot side nut to 82 N·m (8.4 kg·m/61 lb·ft)

2. Fan Guide
3. Transmission Panel
 - 1) Connect the negative battery cable.
 - 2) Lower the cab
 - 3) Start the engine, and check for any abnormal conditions with the engine mount.

CYLINDER HEAD COVER

Component



Legend

- | | |
|------------------------|-------------------------------|
| 1. Nozzle cover | 3. Cylinder head cover gasket |
| 2. Cylinder head cover | 4. Rubber plug |

Removal

Preparation

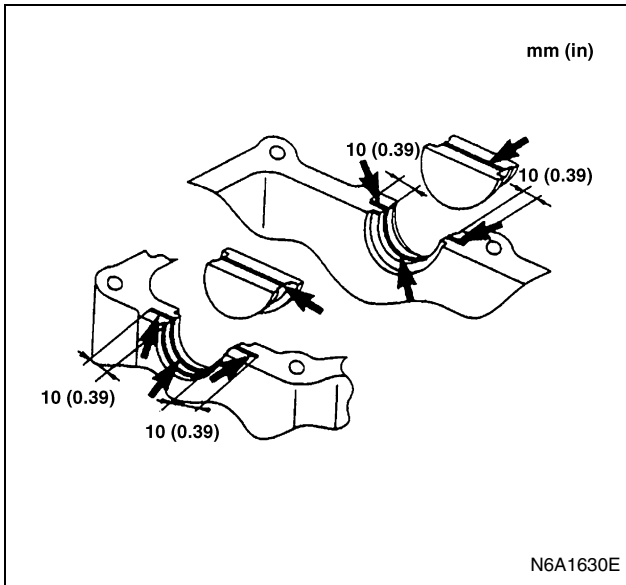
- Disconnect battery ground cable.
- Tilt the cab.

1. Nozzle Cover
2. Cylinder Head Cover
3. Cylinder Head Cover Gasket
4. Rubber Plug

Installation

1. Rubber Plug

- 1) Apply a 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207B) or its equivalent to the cylinder head front and rear plug arch.
- 2) Install the rubber plugs to the cylinder head upper faces.
- 3) Apply a 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207B) or its equivalent to the rubber plugs and cylinder head upper faces. Refer to arrows in the illustration.

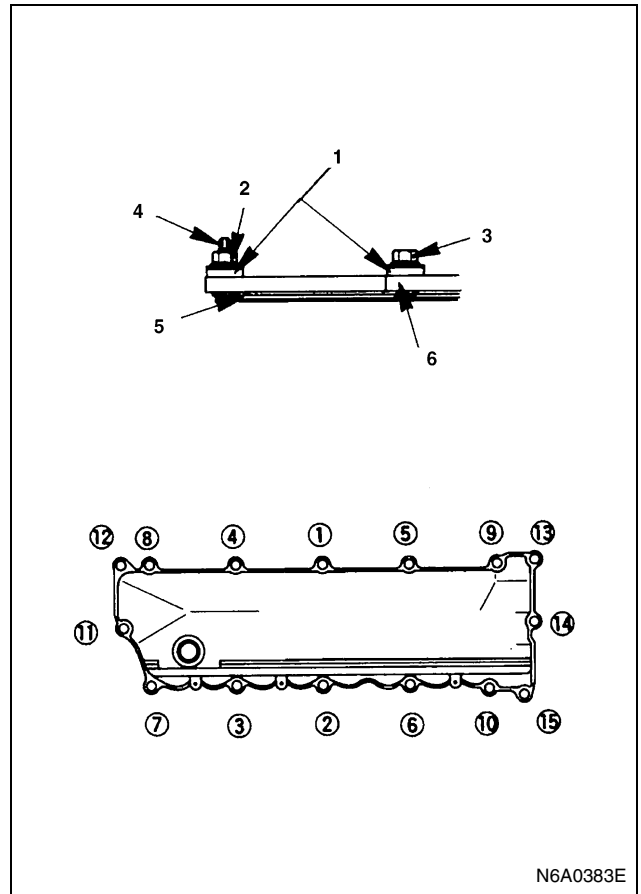


Install the cylinder head cover within 7 minutes after application of liquid gasket.

2. Cylinder Head Cover Gasket
Install the gasket to the cylinder head cover.
3. Cylinder Head Cover
 - 1) Install the cylinder head cover.
 - 2) Tighten the cylinder head cover nuts and bolts to the specified torque in the numerical order shown in the illustration.

Tighten:

Cylinder head cover nut and bolt to 18 N·m (1.8 kg·m/13 lb·ft)



Legend

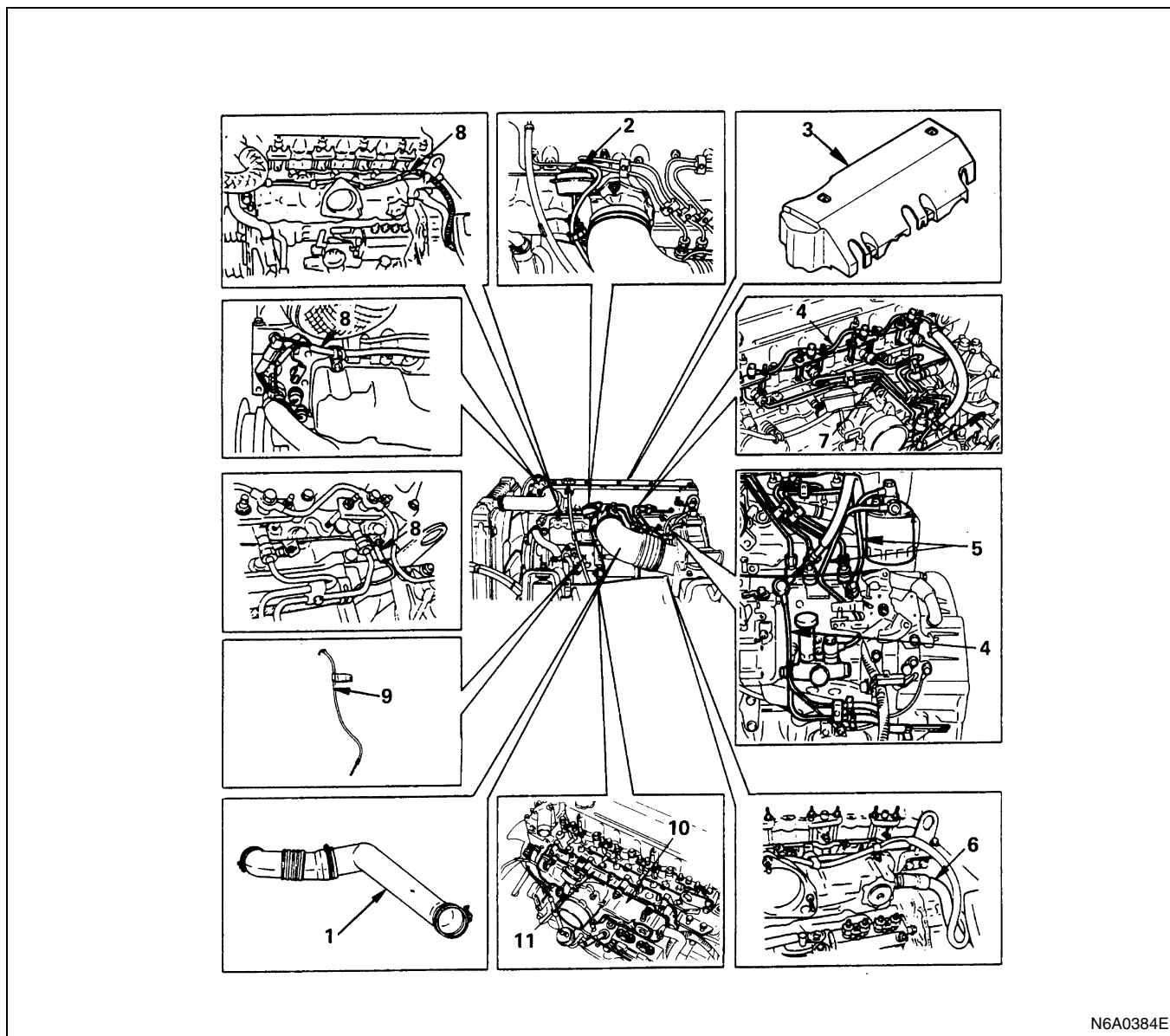
1. Mounting rubber
2. Nut
3. Bolt
4. Stud
5. Gasket
6. Head cover

4. Nozzle Cover

- Connect the negative battery cable.
- Lower the cab.
- Start engine and check for oil leakage carefully.

INLET COVER / INLET CASE

Component
For 4HF1



N6A0384E

Legend

- | | |
|--------------------|-------------------------|
| 1. Intake air duct | 7. Injection pipe |
| 2. Vacuum hose | 8. Engine harness |
| 3. Nozzle cover | 9. Oil level guide tube |
| 4. Leak off pipe | 10. Inlet cover |
| 5. Fuel pipe | 11. Inlet case |
| 6. PCV hose | |

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab.

1. Intake Air Duct

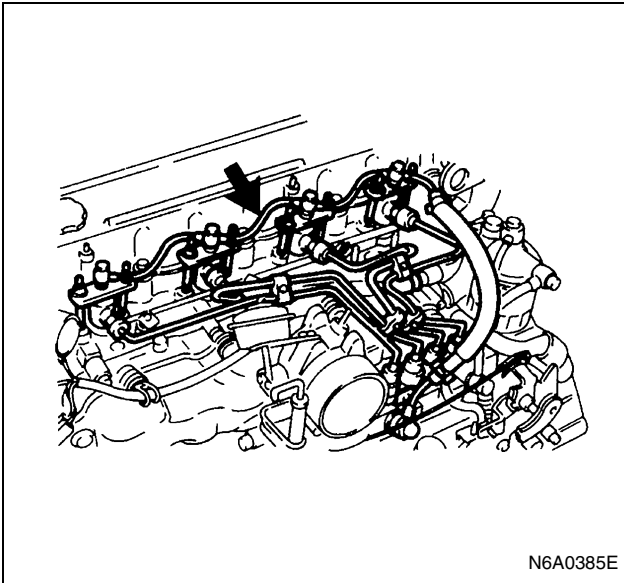
1) Remove the clips at the connections with the inlet cover and with the air cleaner.

2) Remove the intake air duct with the connector hose attached.

2. Vacuum Hose

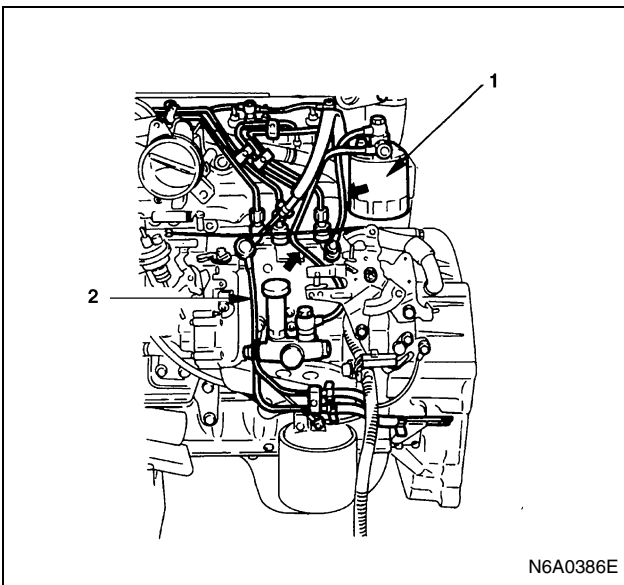
3. Nozzle Cover

4. Leak off Pipe



5. Fuel Pipe

Do not apply excessive force to the fuel pipes.

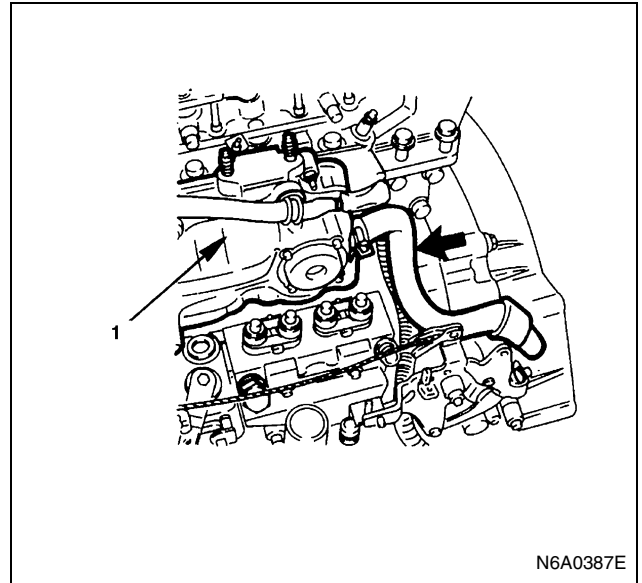


Legend

- 1. Fuel filter
- 2. Leak off

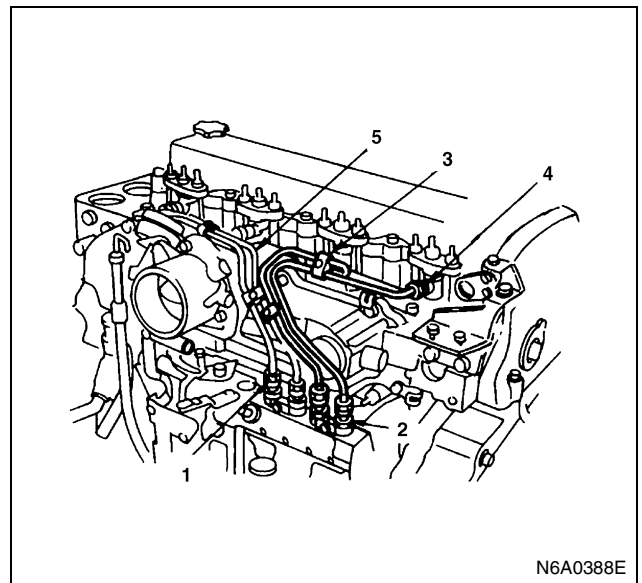
6. Positive Crankcase Ventilation (PCV) Hose

Disconnect the PCV hose from inlet cover (1).



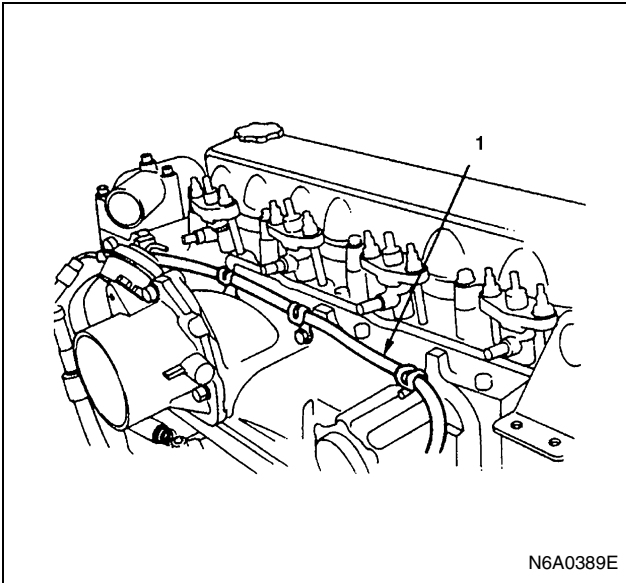
7. Fuel Injection Pipe

- 1) Loosen the injection pipe sleeve nuts (1).
- 2) Do not apply excessive force to the injection pipes (5).
- 3) Loosen the injection pipes clips (3).
- 4) Remove the injection pipe assembly. Plug the delivery valve holder (2) ports and nozzle holder (4) ports with caps to prevent the entry of foreign material.



8. Engine Harness

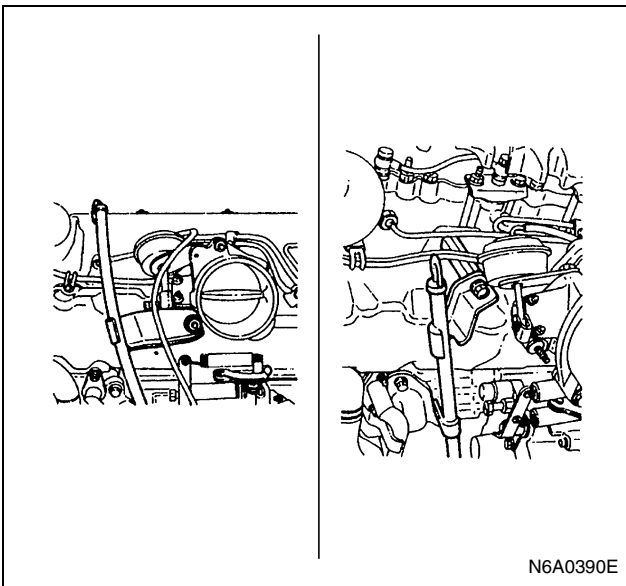
Disconnect thermometer unit, thermo switch, tachometer sensor and glow plug harness connectors and separate harness from clips.



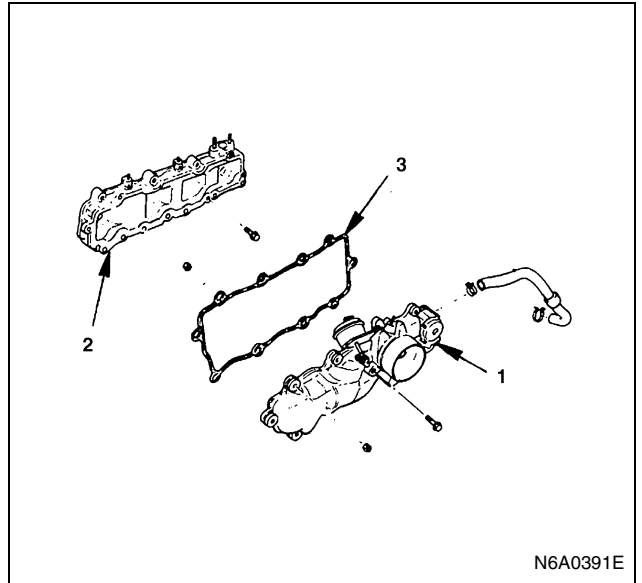
Legend

- 1. Engine harness

- 9. Oil Level Guide Tube
Remove the guide tube fixing bolt and pull out the guide tube.



- 10. Inlet Cover
- 11. Inlet Case
Remove the inlet case while removing the liquid gasket.

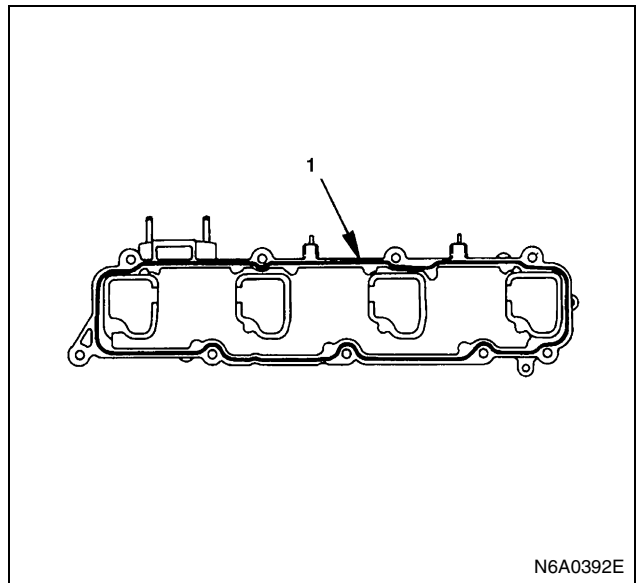


Legend

- 1. Inlet cover
- 2. Inlet case
- 3. Gasket

Installation

- 1. Inlet Case
 - 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove (1) of the inlet case fitting surfaces shown in the illustration.
 - Clean the inlet case fitting surface of the cylinder head.



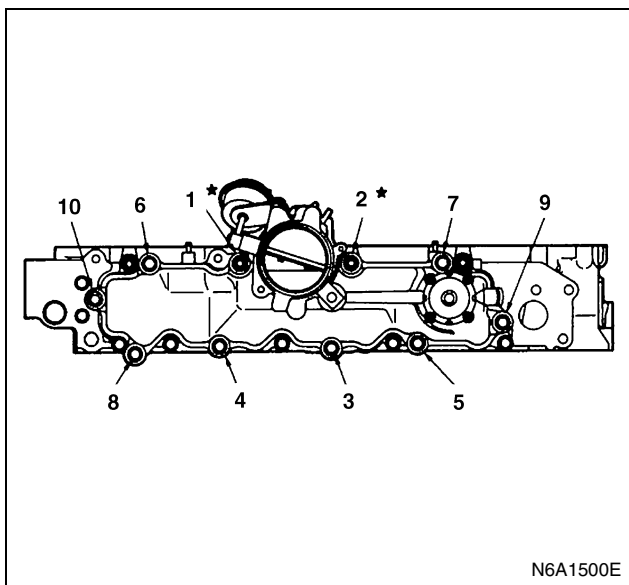
- 2) Install the inlet case to the cylinder head.
 - Install the inlet case within 7 minutes after application of liquid gasket.
- 3) Tighten the inlet case to the specified torque.

Tighten:

Inlet case nuts and bolts to 19 N·m (1.9 kg·m/ 14 lb·ft)

2. Inlet Cover

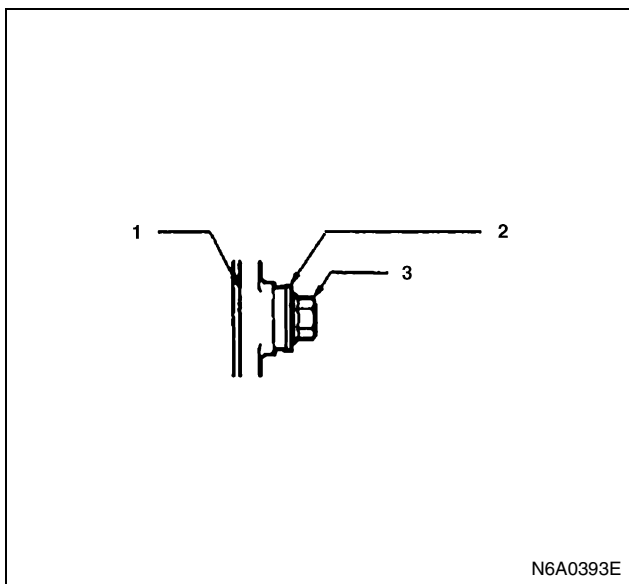
- 1) Attach harness clips ((1), (6) and (7)) and tighten the inlet cover bolts and nuts to the specified torque in the numerical order shown in the illustration.



2) ★ marks are located on the nut positions.

Tighten:

Inlet cover bolt and nut to 13 N·m (1.3 kg·m/9 lb·ft)



Legend

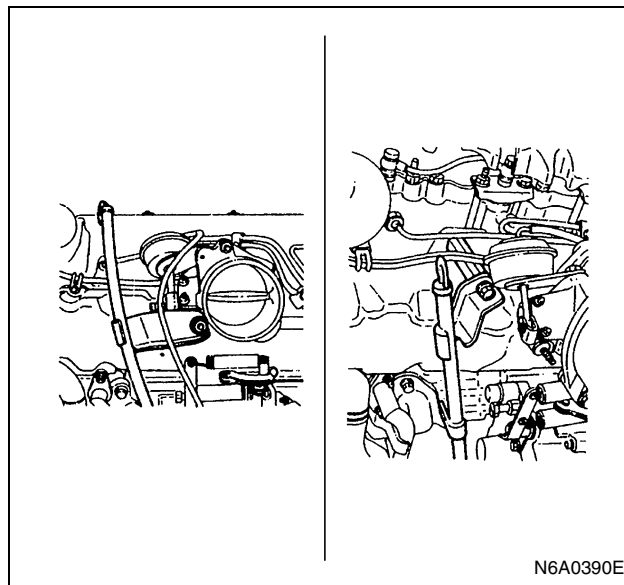
1. Inlet cover
2. Mounting rubber
3. Bolt

3. Oil Level Guide Tube

- 1) Install the O-rings to the guide tube lower portion and insert the guide tube completely to the cylinder body.
- 2) Tighten the guide tube bolt to the specified torque.

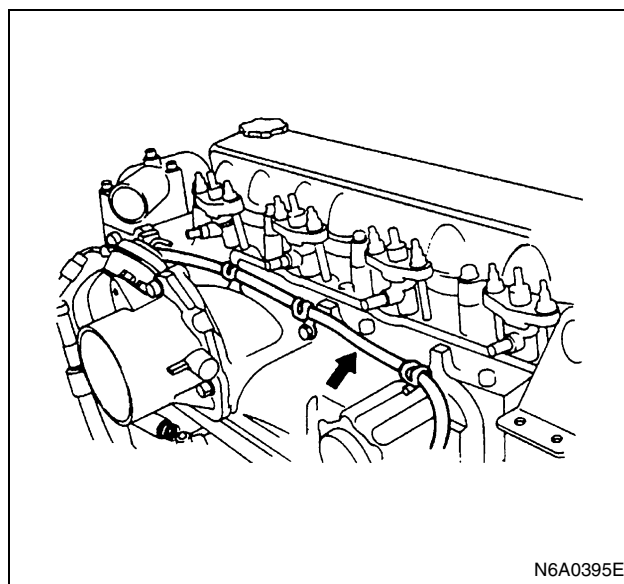
Tighten:

Guide tube bolt to 13 N·m (1.3 kg·m/9.4 lb·ft)



4. Engine Harness

Connect thermometer unit, thermo switch, tachometer sensor and glow plug harness connector and fasten the engine harness with clips.



5. Injection Pipe

- 1) Install the injection pipe assembly and temporarily tighten the injection pipe sleeve nuts.
- 2) Set the clips in the prescribed position shown in the illustration.

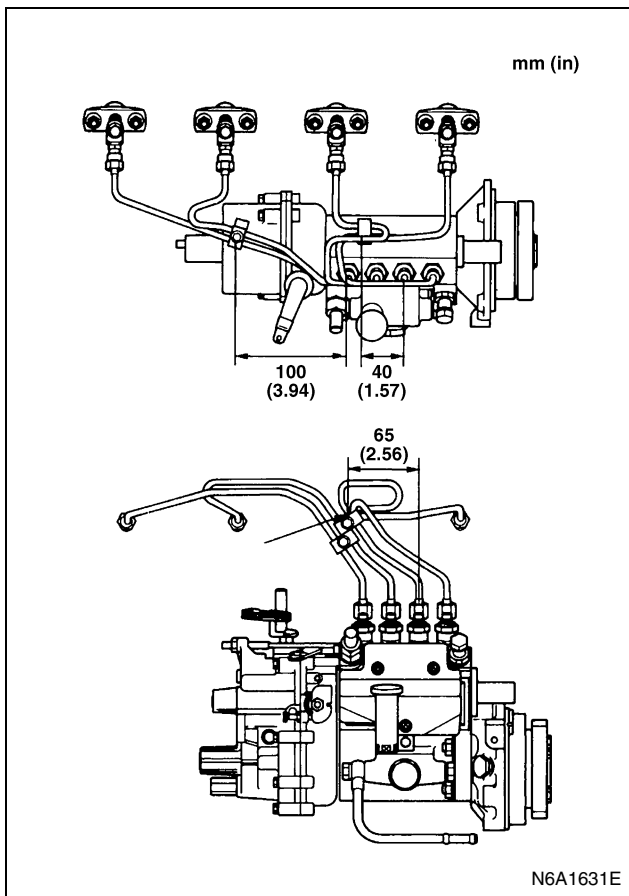
Caution:

Make absolutely sure that the clip is correctly positioned.

An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.

Tighten:

Clip screw to 3 N·m (0.3 kg·m/26 lb·in)



3) Tighten the injection pipe sleeve nuts to the specified torque.

Tighten:

Injection pipe sleeve nut to 29 N·m (3 kg·m/22 lb·ft)

Injection Pipe (4HF1-2 model only)

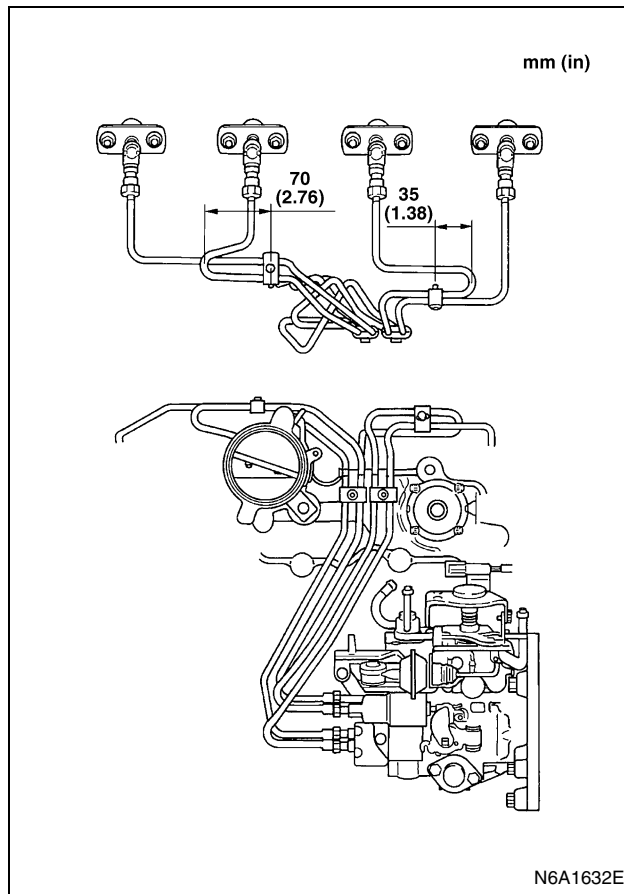
- 1) Install the injection pipe assembly and temporarily tighten the injection pipe sleeve nuts.
- 2) Set the clips in the prescribed position shown in the illustration.

Caution:

Make absolutely sure that the clip is correctly positioned. An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.

Tighten:

Clip screw to 3 N·m (0.3 kg·m/26 lb·in)

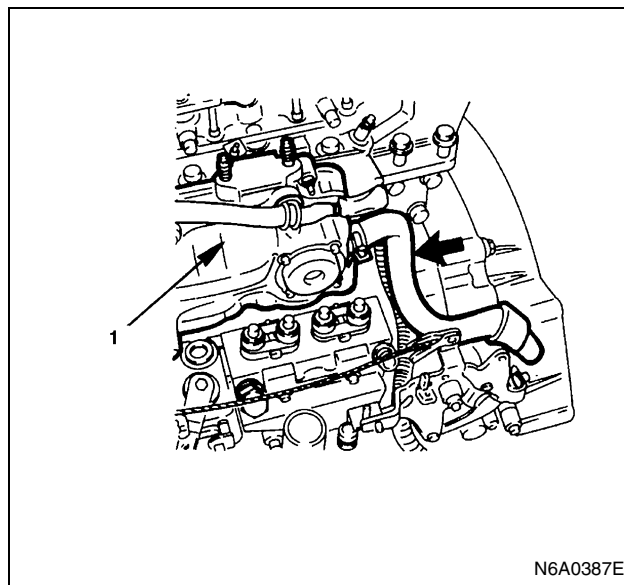


3) Tighten the injection pipe sleeve nuts to the specified torque.

Tighten:

Injection pipe sleeve nut to 29 N·m (3 kg·m/22 lb·ft)

6. Positive Crankcase Ventilation (PCV) Hose



Legend

1. Inlet cover

7. Fuel Pipe

Do not apply excessive force to the fuel pipe.

Tighten:

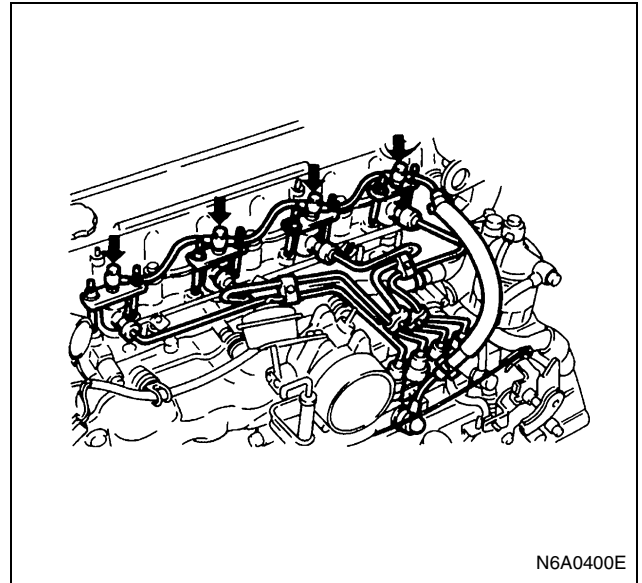
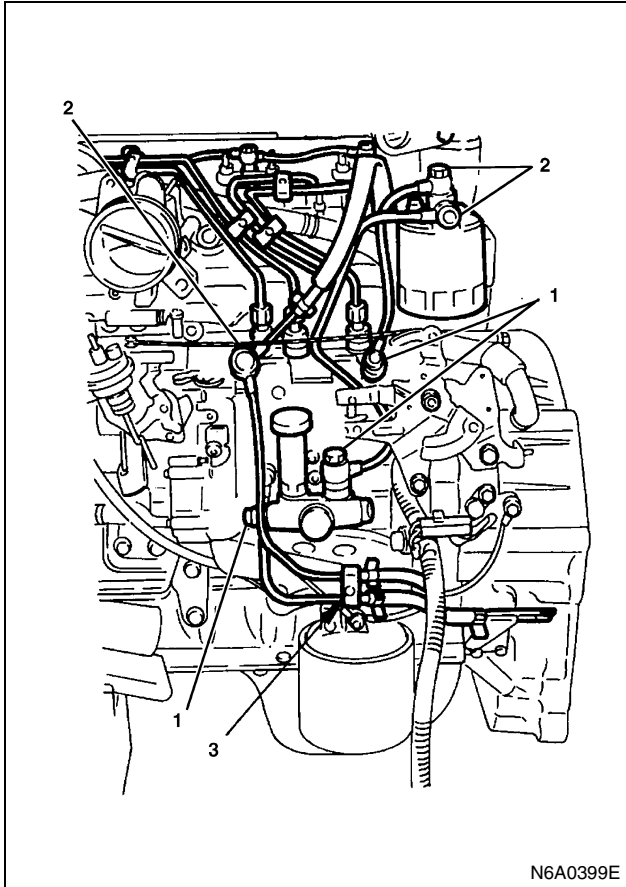
Fuel pipe joint bolt (1) to 41 N·m (4.2 kg·m/30 lb·ft)

Tighten:

Fuel pipe joint bolt (2) to 23 N·m (2.3 kg·m/17 lb·ft)

Tighten:

Clip screw to 4 N·m (0.4 kg·m/35 lb·in)



9. Nozzle Cover

10. Vacuum Hose

11. Intake Air Duct

- Connect the negative battery cable.
- Lower the cab.
- Start engine and check for fuel leakage carefully.

Legend

1. Fuel pipe joint bolt

2. Fuel pipe joint bolt

3. Clip

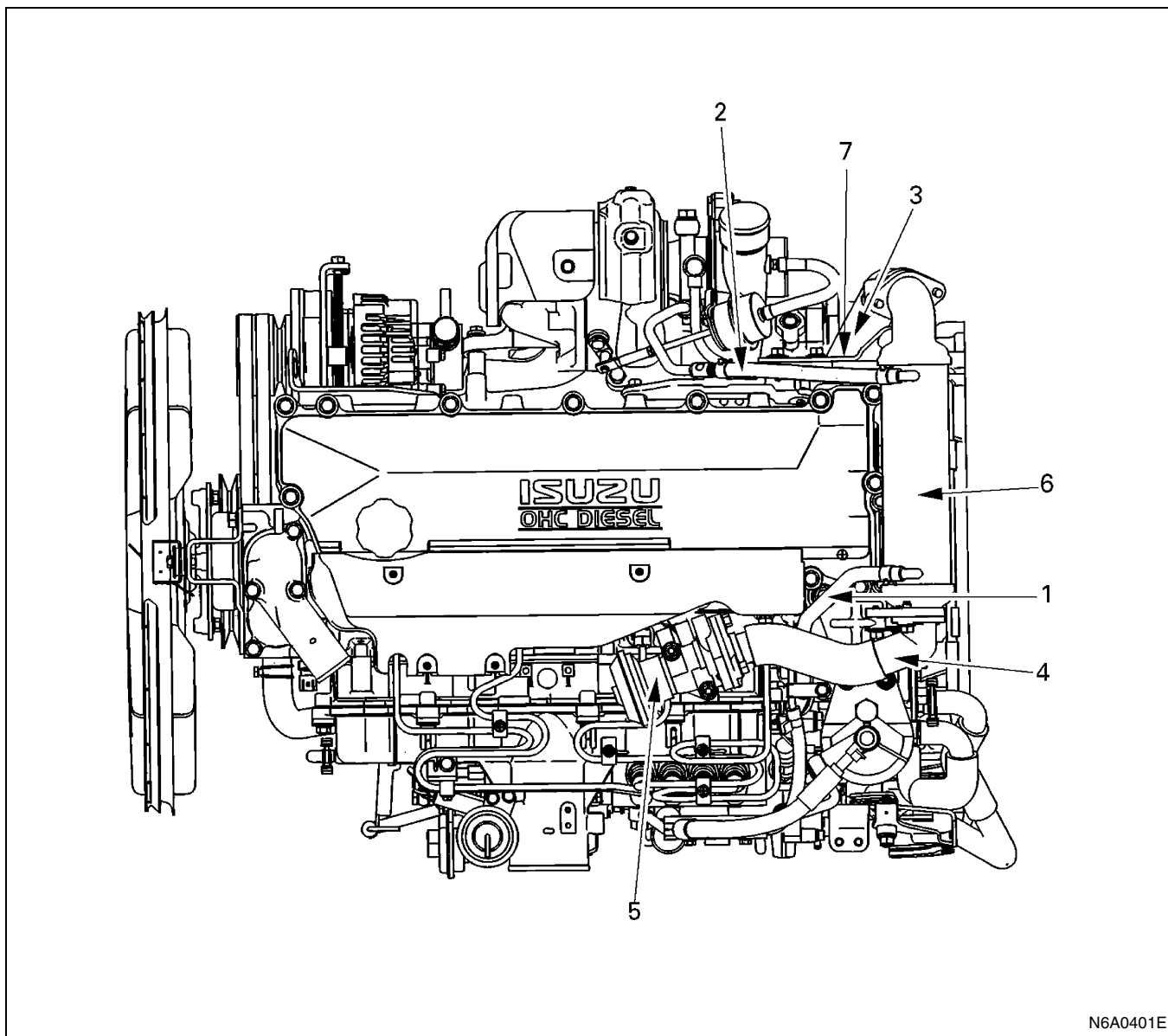
8. Leak Off Pipe

Tighten:

Leak-Off pipe joint bolt to 13 N·m (1.3 kg·m/113 lb·in)

4HE1-TC (4HE1-XS) for EURO3
EXHAUST GAS RECIRCULATION SYSTEM (EGR)

Component



Legend

- | | |
|--------------------------|-----------------------|
| 1. Water hose (out) | 5. EGR valve |
| 2. Water hose (in) | 6. EGR cooler |
| 3. EGR pipe (right side) | 7. EGR cooler bracket |
| 4. EGR pipe (left side) | |

Removal

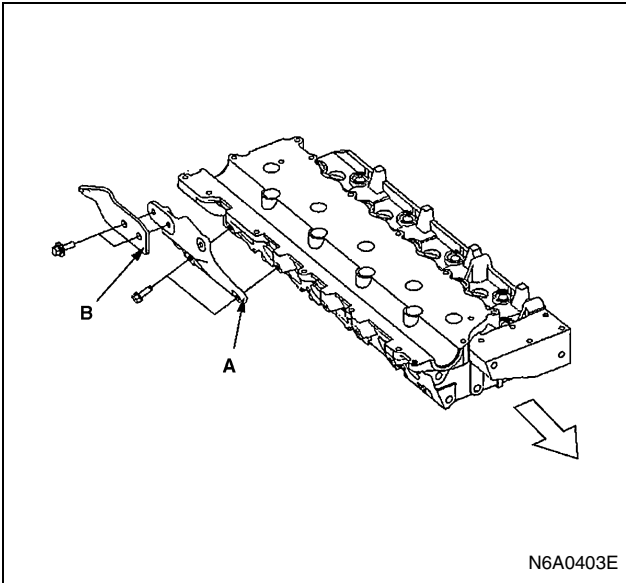
1. Water hose (out)
2. Water hose (in)
3. EGR pipe (right side)
4. EGR pipe (left side)
5. EGR valve
6. EGR cooler
7. EGR cooler bracket

Installation

1. EGR Cooler Bracket
Temporarily tighten the EGR cooler bracket (B) to the EGR cooler bracket (A).

Tighten:

EGR cooler bracket bolt (A) to 31 N·m (3.2 kg·m/23 lb·ft)

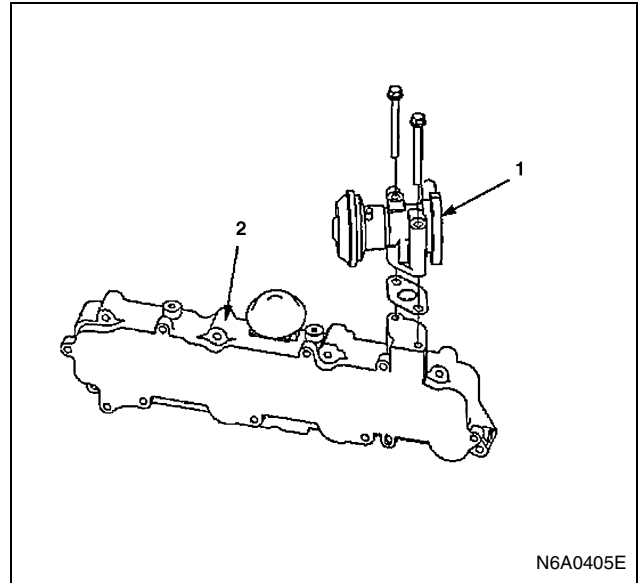


2. EGR Cooler

- 1) Temporarily tighten the EGR cooler bolts left side.
- 2) Tighten the EGR cooler bolt right side.

Tighten:

EGR cooler bracket bolt (right side) to 33 N·m (3.4 kg·m/ 25 lb·ft)



Legend

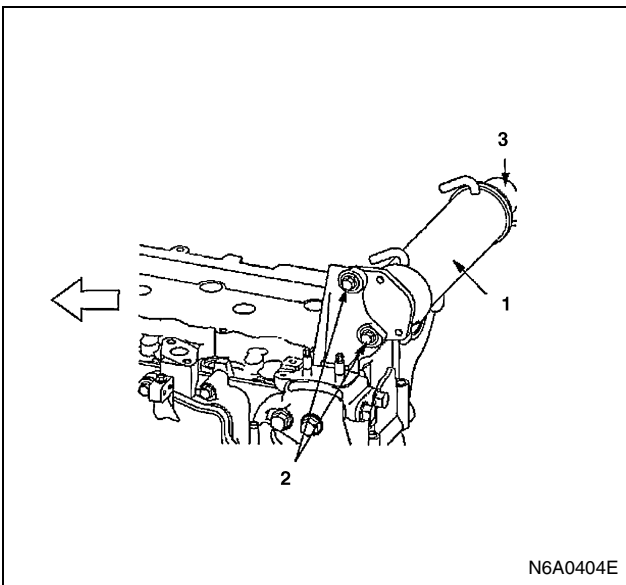
1. EGR valve
2. Inlet case

4. EGR Pipe (left side)

Insert the gasket into the left-hand EGR pipe (1). Install the pipe between the EGR valve (2) and the EGR cooler (3).

Tighten:

EGR pipe (left side) bolt to 24 N·m (2.4 kg·m/17 lb·ft)



Legend

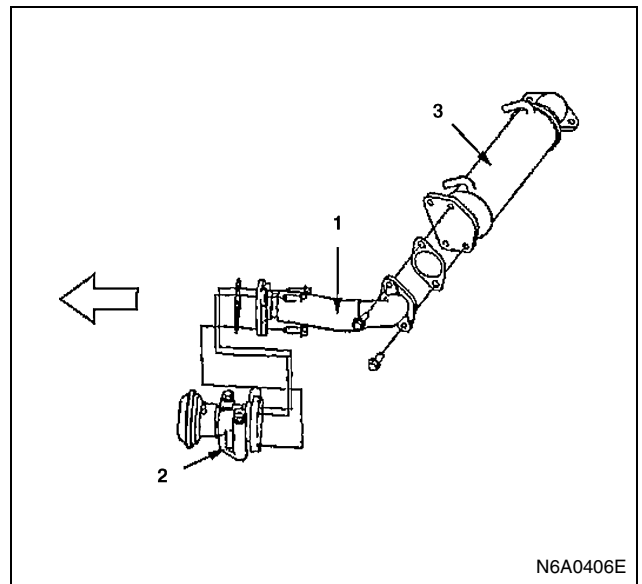
1. EGR cooler
2. Left side
3. Right side

3. EGR Valve

Insert the gasket and install the EGR valve to the intake manifold.

Tighten:

EGR valve bolt to 24 N·m (2.4 kg·m/17 lb·ft)

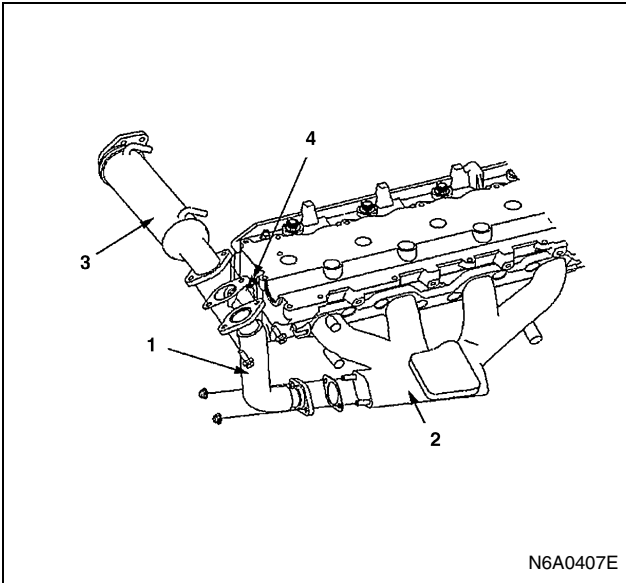


5. EGR Pipe (right side)

1) Insert the gasket into the right-hand EGR pipe (refer to the illustration). Install the pipe between the exhaust manifold and the EGR cooler.

Tighten:

EGR pipe nut and bolt to 28 N·m (2.9 kg·m/21 lb·ft)



N6A0407E

Legend

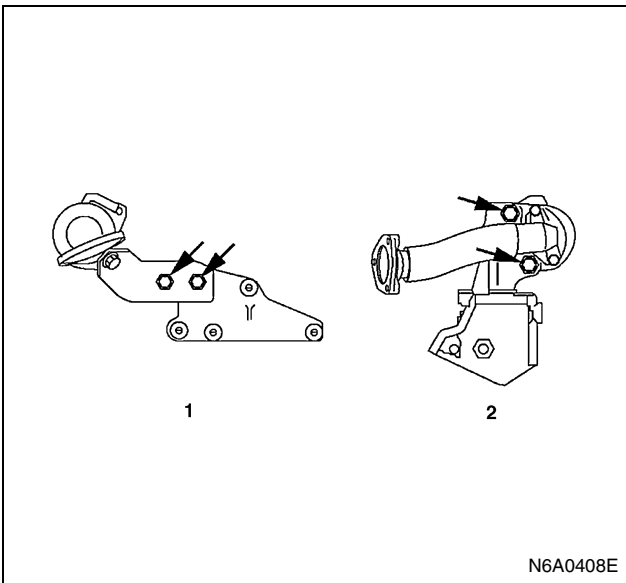
- 1. EGR pipe
- 2. Exhaust manifold
- 3. EGR cooler
- 4. TAB

2) Adjust bracket position to eliminate any play using the bracket adjustment holes. Tighten the bolts as shown by the arrows in the illustration.

Tighten:

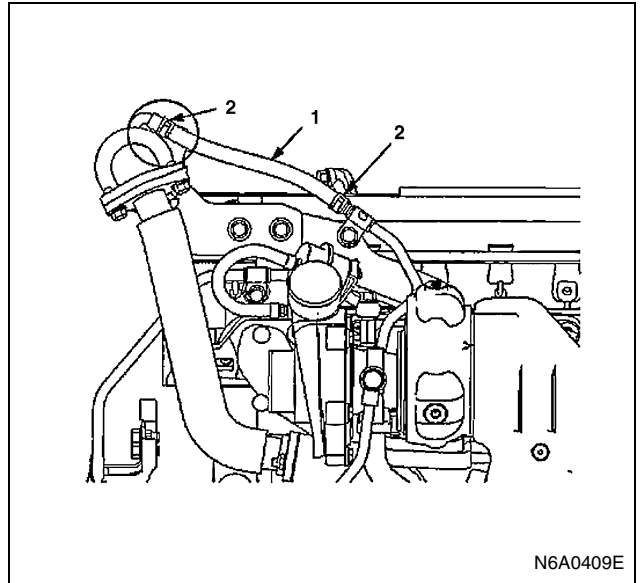
EGR cooler bracket bolt to

- Right side (1): 26 N·m (2.7 kg·m/20 lb·ft)
- Left side (2): 24 N·m (2.4 kg·m/17 lb·ft)



N6A0408E

6. Water Hose (in)
Arrange the clips so that the jaws face the side of the engine.

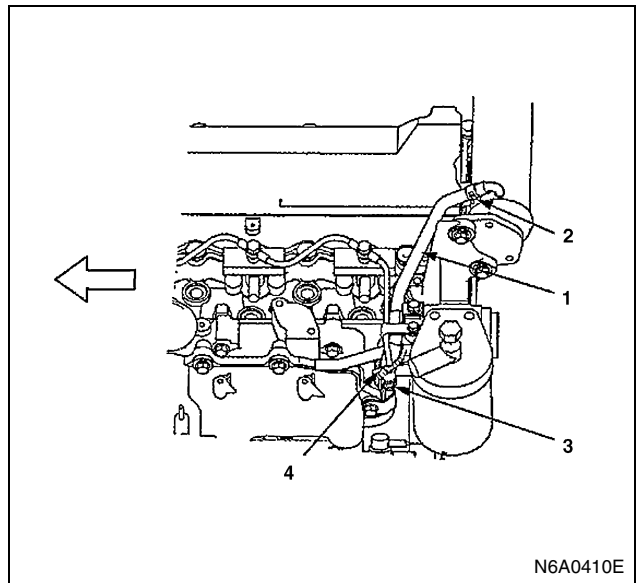


N6A0409E

Legend

- 1. Water hose (in)
- 2. Clip

7. Water Hose (out)
Insert clip (2) so that the jaws face the side of the engine.
Install clip (3) so that the jaws face away from the engine.



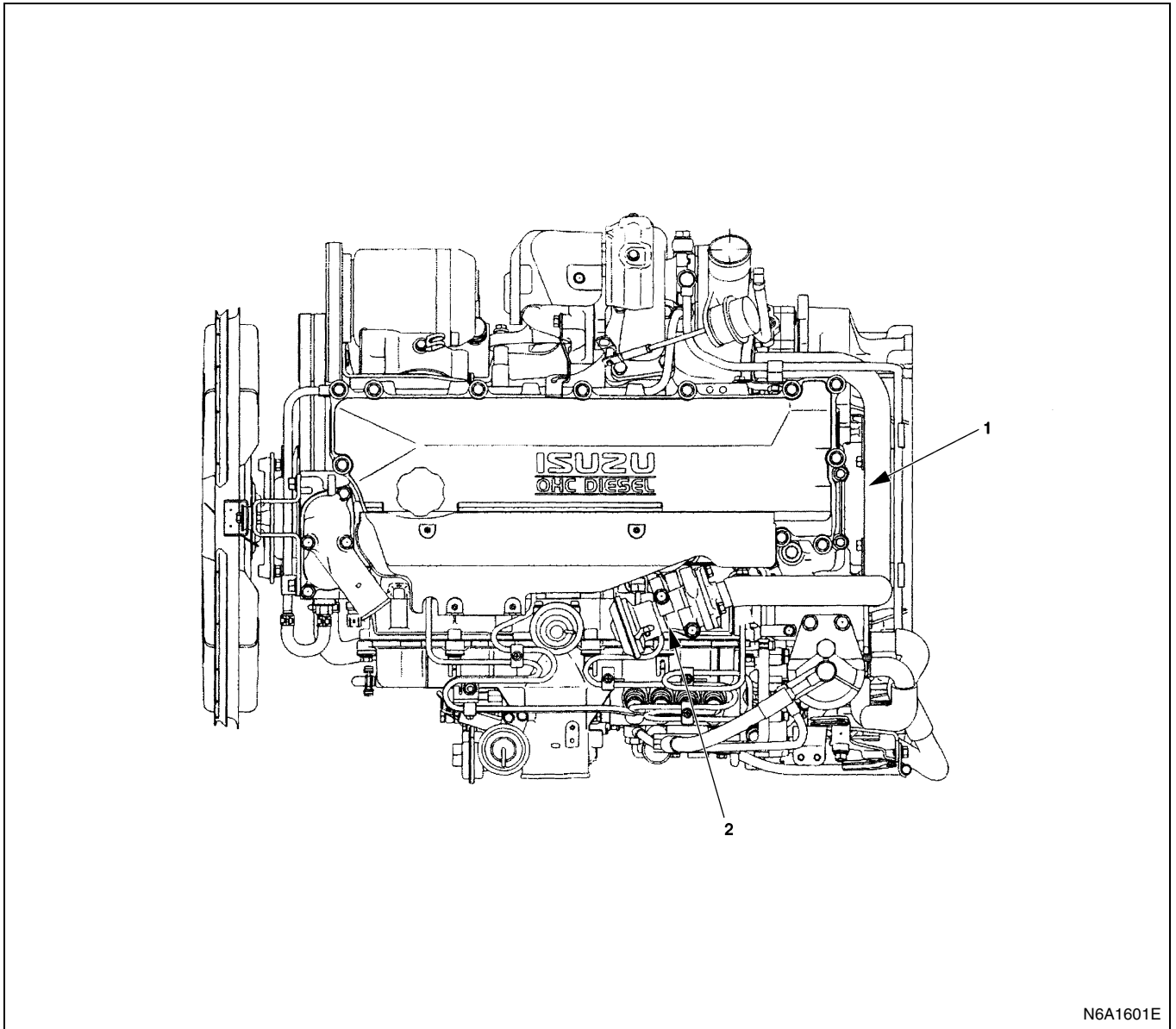
N6A0410E

Legend

- 1. Water hose (out)
- 2. Clip
- 3. Clip
- 4. Band clip

4HE1-TC (98EPA)
EXHAUST GAS RECIRCULATION SYSTEM (EGR)

Component



N6A1601E

Legend

1. EGR pipe assembly

2. EGR valve

Removal

1. EGR pipe assembly
2. EGR valve

Tighten:

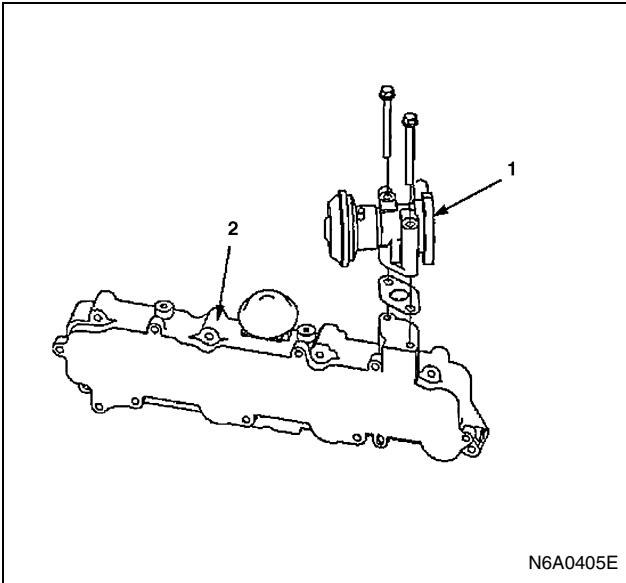
EGR valve bolt to 23.5 ± 5 N·m (2.4 ± 0.5 kg·m/ 17 ± 3.7 lb·ft)

Installation

1. EGR valve
Insert the gasket and install the EGR valve to the intake manifold.

Notice:

The gasket of 4HE1-XS and 4HE1-XN are different.



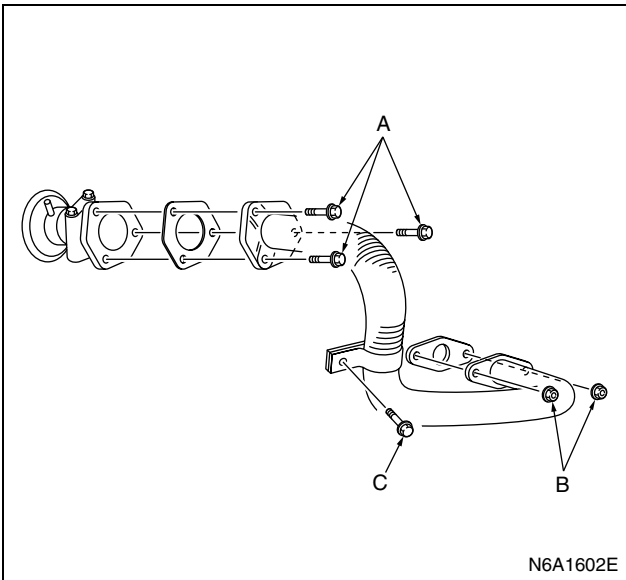
Legend

- 1. EGR valve
- 2. Inlet case

- 2. EGR Pipe assembly
Install the EGR pipe assembly to the exhaust manifold and the EGR valve with gasket.

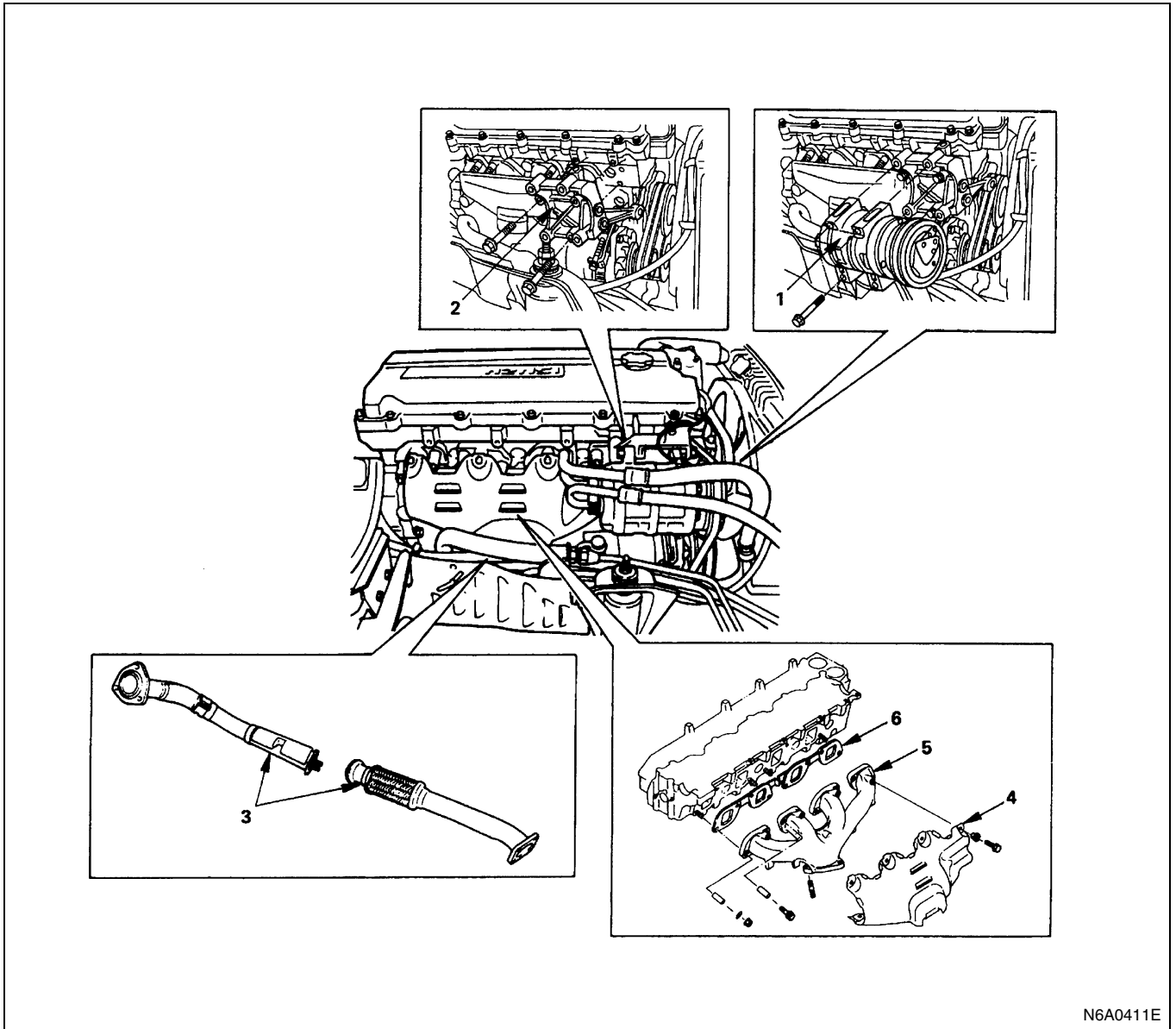
Tighten:

- A: Bolt to 23.5 ± 5 N·m (2.4 ± 0.5 kg·m/ 17 ± 3.7 lb·ft)
- B: Nut to 28.4 ± 4 N·m (2.9 ± 0.4 kg·m/ 21 ± 3.1 lb·ft)
- C: Bolt to 23.5 ± 5 N·m (2.4 ± 0.5 kg·m/ 17 ± 3.7 lb·ft)



EXHAUST MANIFOLD

Component



Legend

- | | |
|--|---------------------|
| 1. A/C compressor (If equipped with A/C) | 4. Heat protector |
| 2. A/C compressor bracket (If equipped with A/C) | 5. Exhaust manifold |
| 3. Front exhaust Pipe | 6. Exhaust gasket |

Removal

Preparation

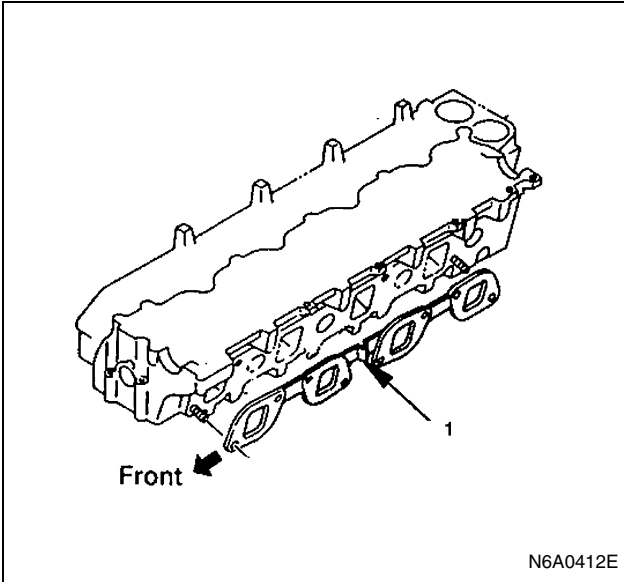
- Disconnect battery ground cable.
 - Tilt the cab.
1. Air Conditioning (A/C) Compressor (If equipped with A/C)
 - 1) Disconnect magnetic clutch harness connector.

- 2) Dismount the compressor together with the hoses from the A/C compressor bracket, and fasten it to the appropriate location with a wire.
2. A/C Compressor Bracket (If equipped with A/C)
3. Front Exhaust Pipe
4. Heat Protector
5. Exhaust Manifold
6. Exhaust Gasket

Installation

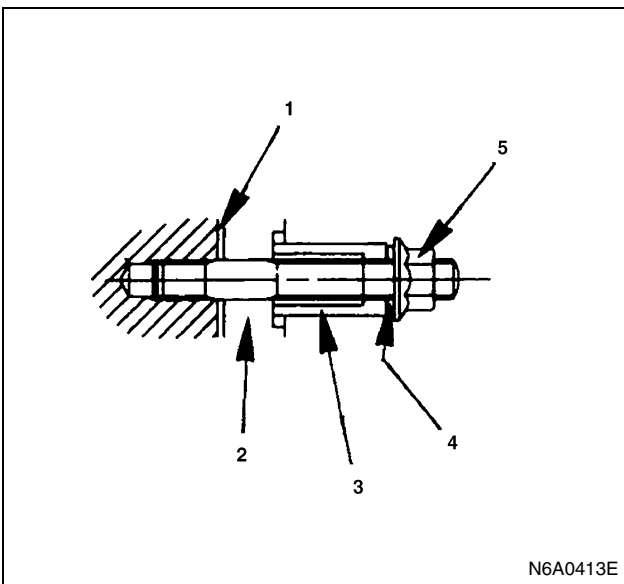
1. Exhaust Gasket

Insert the gasket into the stud provided to the cylinder head (with the projection (1) of the gasket on this side).



2. Exhaust Manifold

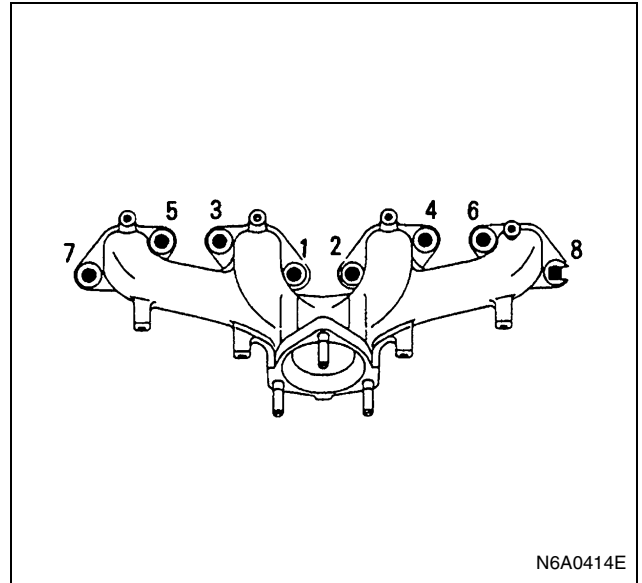
1) Install exhaust manifold gaskets (1), exhaust manifold (2), distance pieces (3), dish washers (4) and nuts (5) to the stud bolts shown in the illustration.



2) Tighten the nuts to the specified torque in the numerical order shown in the illustration.

Tighten:

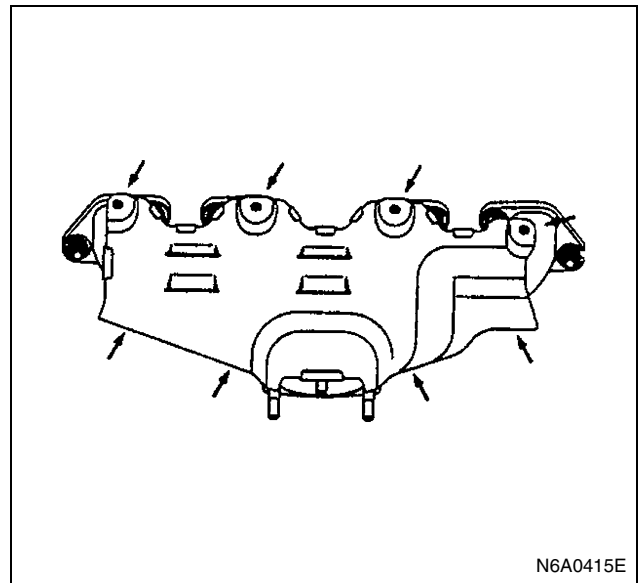
Exhaust manifold nut to 34 N·m (3.5 kg·m/25 lb·ft)



3. Heat Protector

Tighten:

Heat protector bolt to 10 N·m (1.0 kg·m/7 lb·ft)



4. Front Exhaust Pipe

Tighten:

Front exhaust pipe to

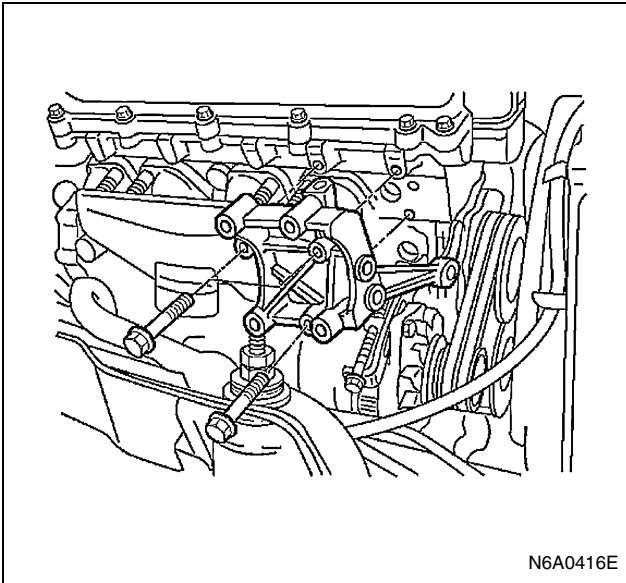
- Exhaust manifold side: 67 N·m (6.8 kg·m/49 lb·ft)
- Exhaust brake side: 17 N·m (1.7 kg·m/12 lb·ft)

5. Air Conditioning (A/C) Compressor Bracket (If equipped with A/C)

Tighten fixing bolts to the specified torque.

Tighten:

A/C compressor bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



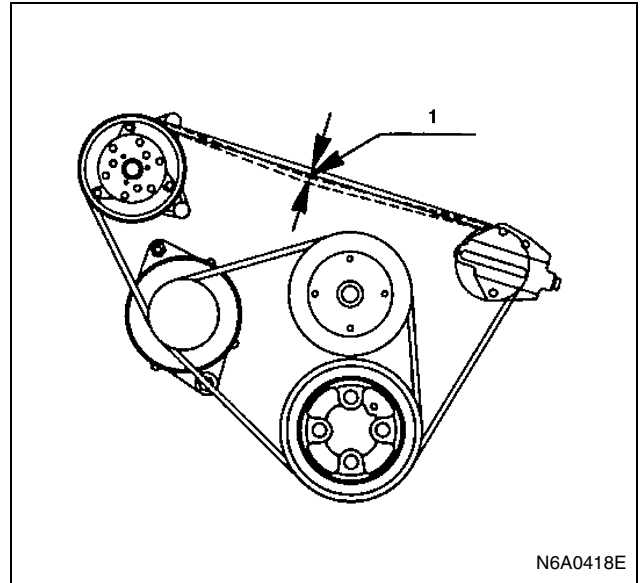
6. A/C Compressor (If equipped with A/C)
 1) Tighten fixing bolts to the specified torque.

Tighten:

A/C compressor bolt to 48 N·m (4.9 kg·m/35 lb·ft)

Notice:

When tightening the compressor fixing bolts, tighten first the 2 bolts on the rear side, and then the remaining 2 on the front.



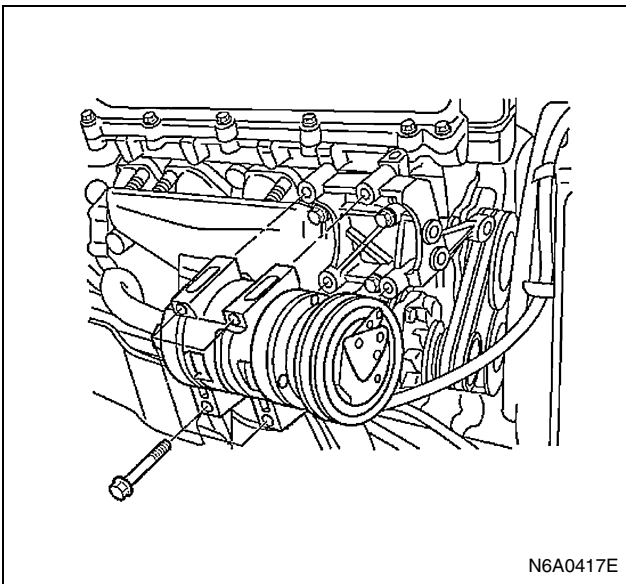
Legend

1. Belt deflection

Tighten:

Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

- Connect the negative battery cable.
- Lower the cab.
- Start engine and check for gas leakage carefully.

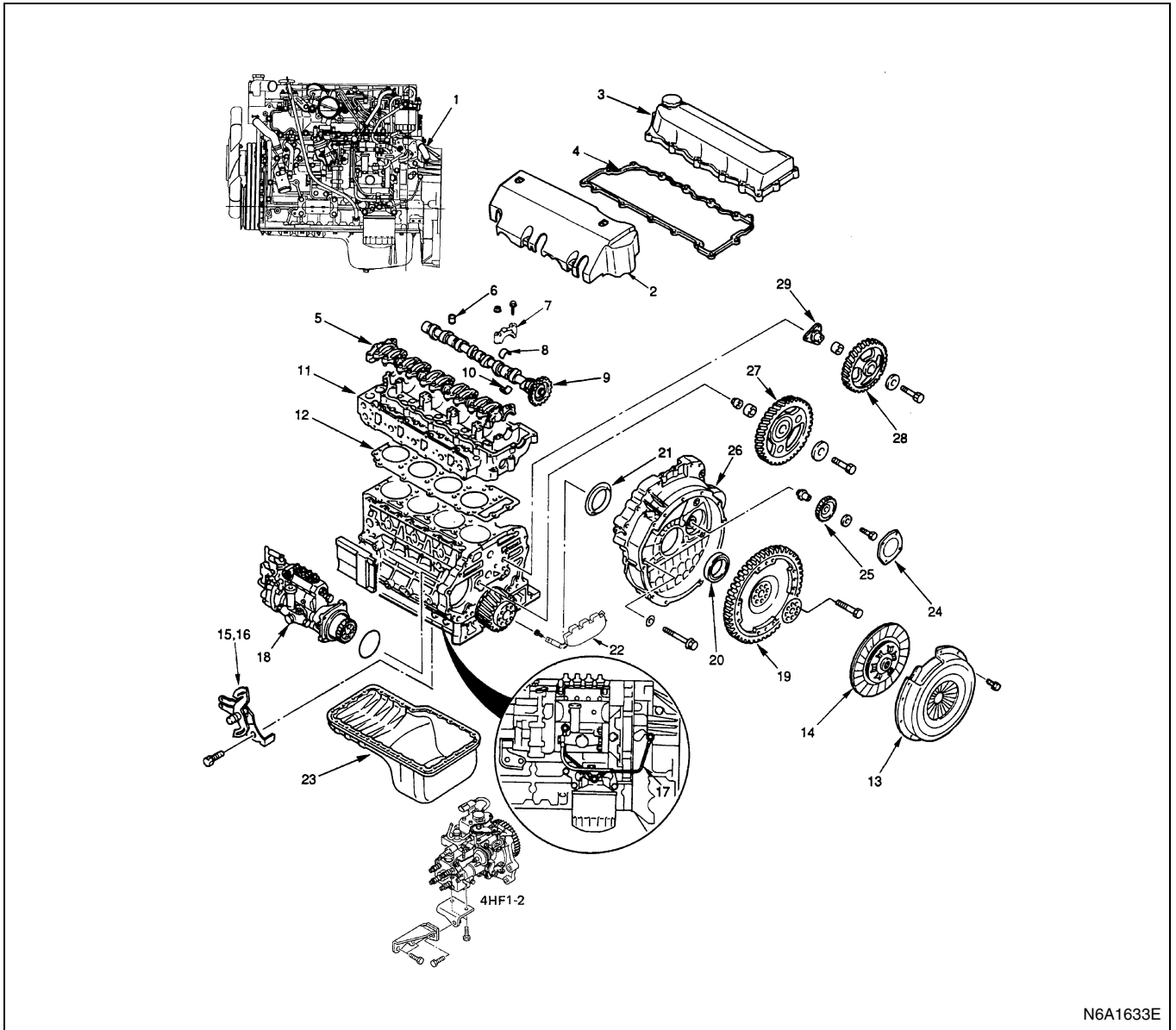


- 2) Install drive belt adjust belt tension by adjusting bolt and tighten locking nut to the specified torque.
 3) Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	

TIMING GEAR REPLACEMENT

Component



N6A1633E

Legend

- | | |
|------------------------------------|---|
| 1. Engine assembly | 16. Engine control lever assembly |
| 2. Nozzle cover | 17. Oil pipe |
| 3. Cylinder head cover | 18. Injection pump assembly |
| 4. Head cover gasket | 19. Flywheel |
| 5. Rocker arm shaft assembly | 20. Rear oil seal |
| 6. Valve cap | 21. Slinger |
| 7. Camshaft bearing cap | 22. Spacer rubber |
| 8. Camshaft bearing upper | 23. Oil pan |
| 9. Camshaft assembly | 24. Power steering pump idle gear cover |
| 10. Camshaft bearing lower | 25. Power steering pump idle gear |
| 11. Cylinder head assembly | 26. Flywheel housing |
| 12. Cylinder head gasket | 27. Idle gear A |
| 13. Clutch pressure plate assembly | 28. Idle gear B |
| 14. Driven plate | 29. Idle gear B shaft |
| 15. Engine control wire | |

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab.
- Drain coolant and engine oil.

1. Engine Assembly

Above works refer to "ENGINE ASSEMBLY" section in this manual.

2. Nozzle Cover

3. Cylinder Head Cover

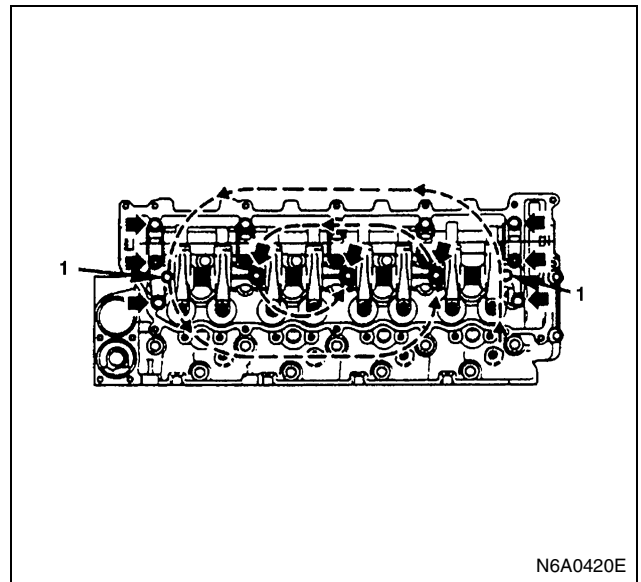
4. Head Cover Gasket

5. Rocker Arm Shaft Assembly

- 1) Loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time and remove the rocker arm shaft assembly with the camshaft brackets.
- 2) Leave the (1) indicated bolt unremoved on this occasion, since it is the rocker arm fixing bolt.

Caution:

Failure to loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time will adversely affect the rocker arm shaft.



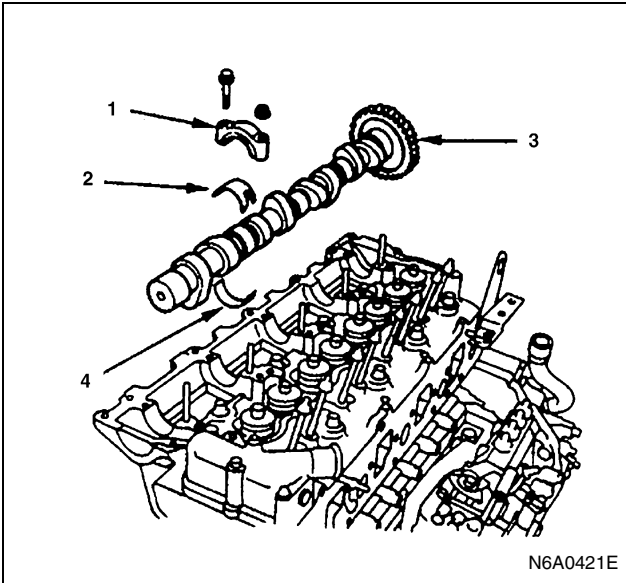
6. Valve Cap

Caution:

Take sufficient care not to let valve caps fall into the gear case or oil return hole.

7. Camshaft Bearing Cap
8. Camshaft Bearing Upper
9. Camshaft Assembly
10. Camshaft Bearing Lower

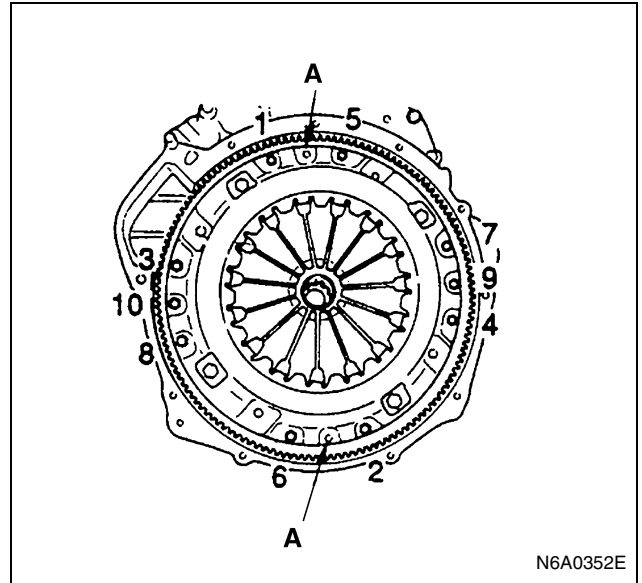
If the camshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



N6A0421E

Legend

- 1. Camshaft bearing cap
- 2. Camshaft bearing upper
- 3. Camshaft assembly
- 4. Camshaft bearing lower



N6A0352E

Legend

- A. Knock pin

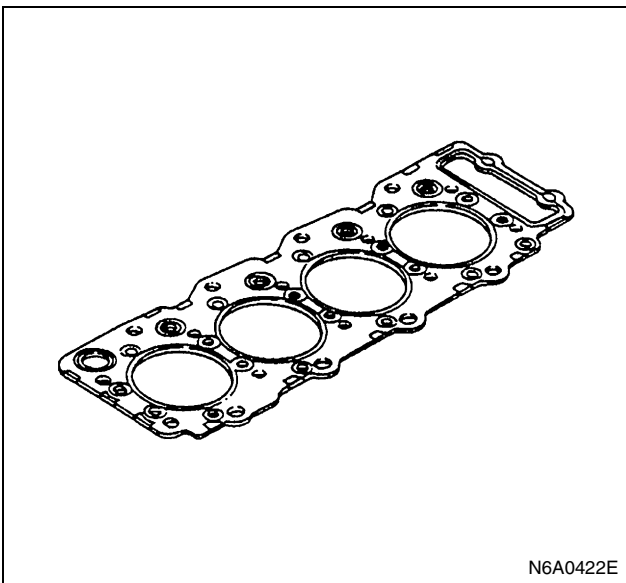
- 3) Remove the pressure plate assembly.
- 14. Driven Plate
Remove the driven plate with the clutch pilot aligner.

- 11. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.

- 12. Cylinder Head Gasket

Caution:

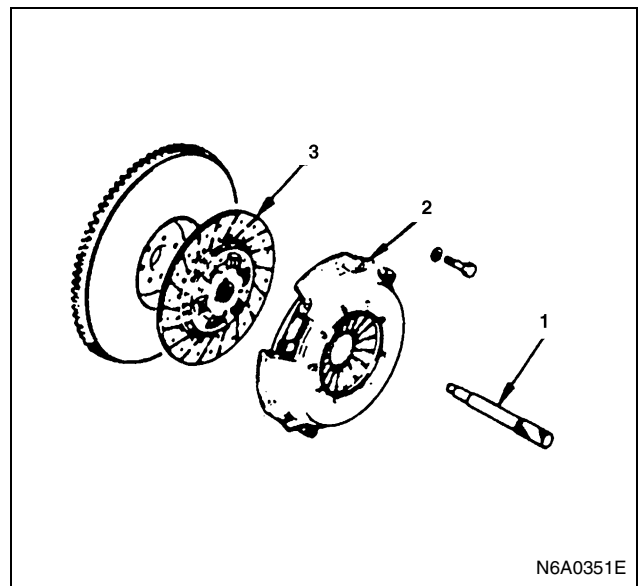
Do not reuse the cylinder head gasket.



N6A0422E

- 13. Clutch Pressure Plate Assembly

- 1) Insert the clutch pilot aligner to the clutch assembly.
Clutch Pilot Aligner: 5-8840-2240-0
- 2) Loosen the pressure plate bolts in numerical order a little at a time as shown in the illustration.

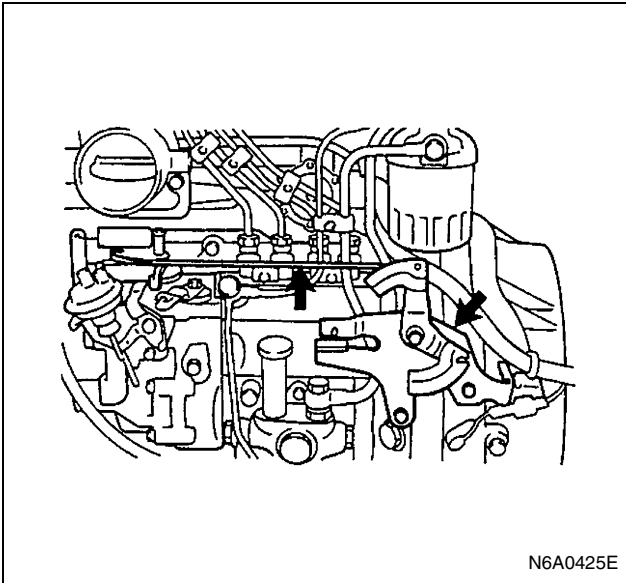


N6A0351E

Legend

- 1. Clutch pilot aligner
- 2. Clutch pressure plate assembly
- 3. Driven plate

- 15. Engine Control Wire
- 16. Engine Control Lever Assembly

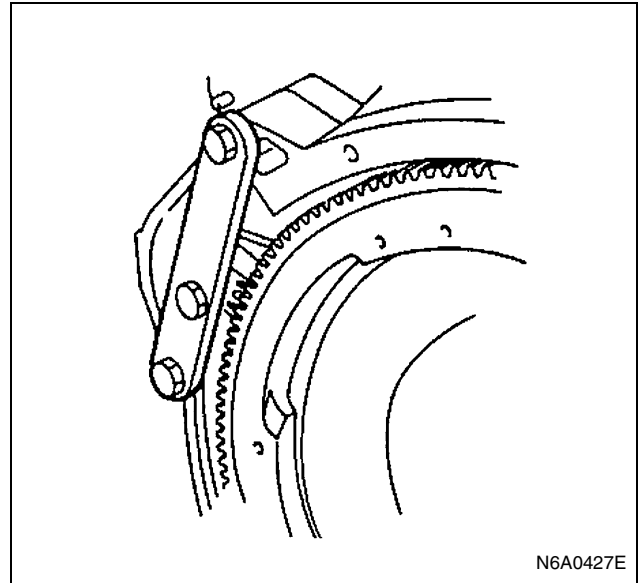


N6A0425E

17. Oil Pipe

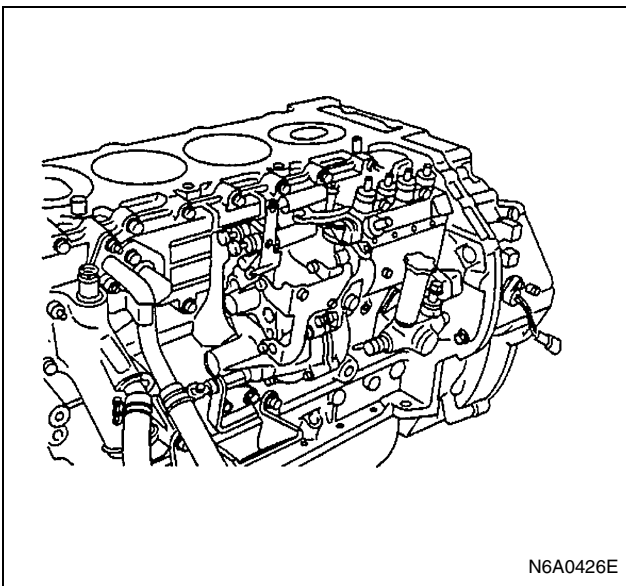
18. Injection Pump Assembly

- 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
- 2) Then remove the injection pump assembly.



N6A0427E

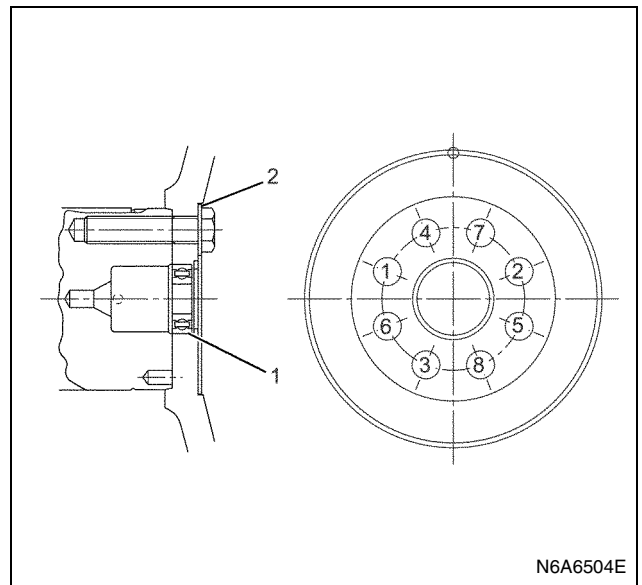
- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.



N6A0426E

19. Flywheel

- 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



N6A6504E

Legend

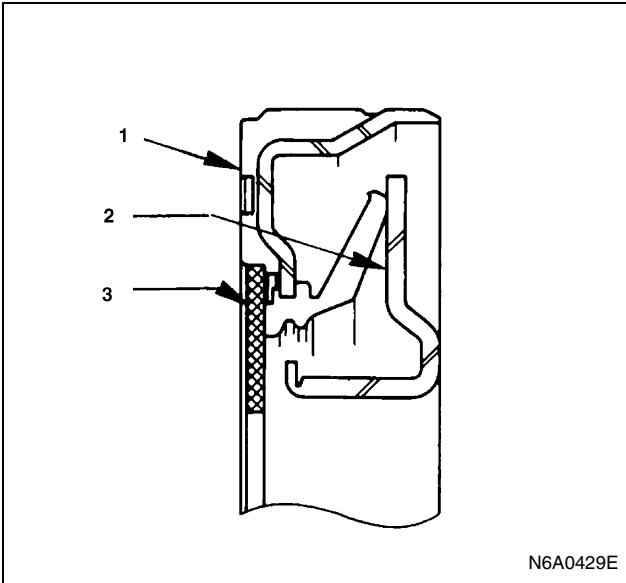
1. Washer
2. Pilot bearing

- 3) Remove the flywheel stopper and the flywheel assembly.

20. Crankshaft Rear Oil Seal

Caution:

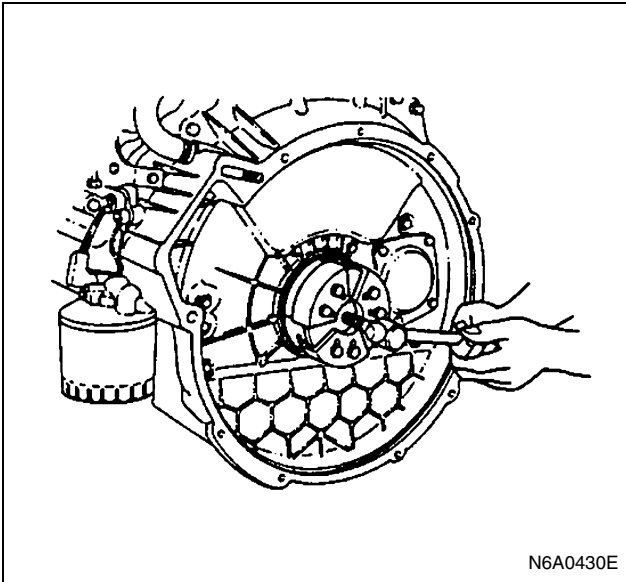
Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.



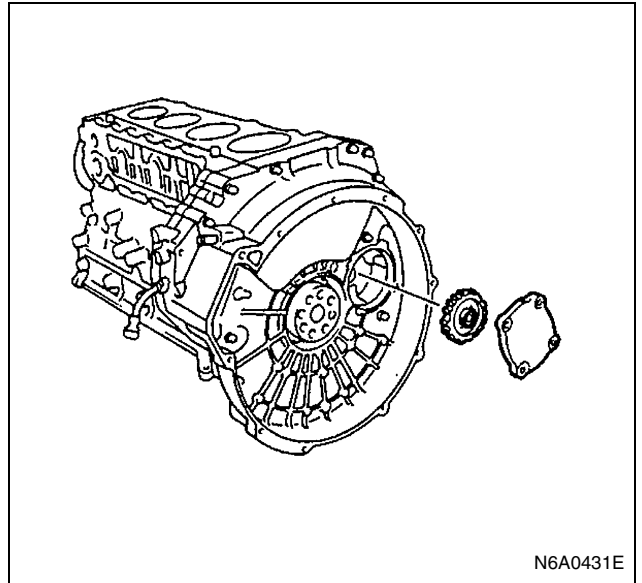
Legend

- 1. Oil seal
- 2. Slinger
- 3. Felt

- 21. Crankshaft Rear Slinger
Use the slinger puller to pull out the slinger.
Slinger Puller: 5-8840-2360-0



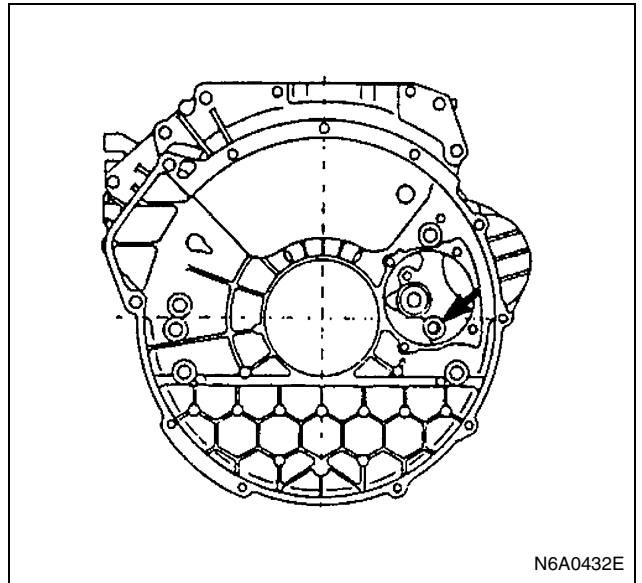
- 22. Spacer Rubber
(Remove the stiffener before removing the spacer rubber.)
- 23. Oil Pan
- 24. Power Steering Pump Idle Gear Cover
- 25. Power Steering Pump Idle Gear



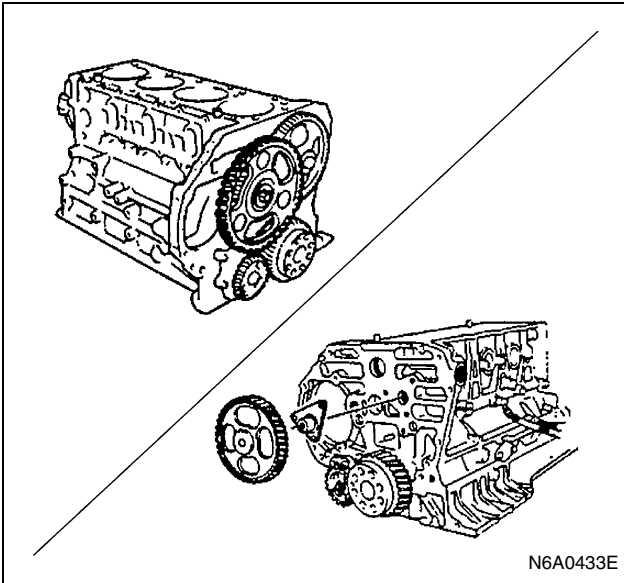
- 26. Flywheel Housing

Notice:

Be careful not to fail to remove the bolts shown in the illustration.



- 27. Idle Gear A
- 28. Idle Gear B
- 29. Idle Gear B shaft



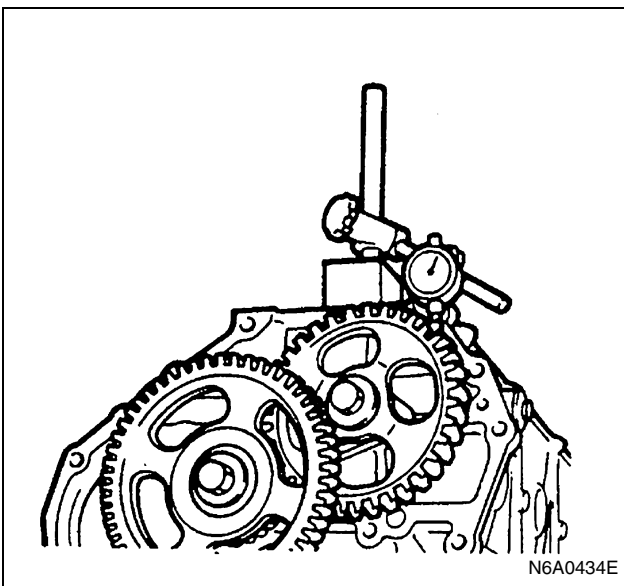
N6A0433E

Inspection

Idle Gear Backlash Measurement

1. Set a dial indicator to the timing gear to be measured.
Hold both the gear to be checked and the adjoining gear stationary.
2. Move the gear to be checked right and left as far as possible. Take the dial indicator reading.

Timing Gear Backlash	Gear to Gear	mm (in)
Standard		Limit
0.10 — 0.17 (0.0039 — 0.0067)		0.30 (0.012)

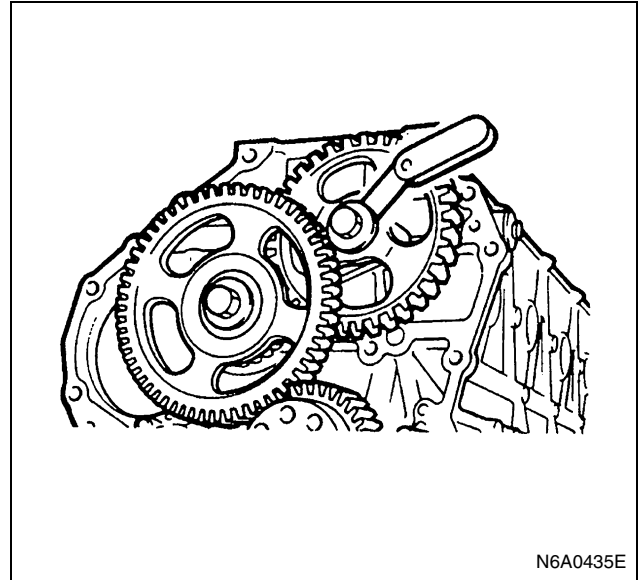


N6A0434E

Idle Gear End Play Measurement

Insert a feeler gauge between the idler gear and the thrust collar to measure the gap and determine the idler gear end play.
If the measured value exceeds the specified limit, the thrust collar must be replaced.

Idle Gear End Play		mm (in)
Standard		Limit
0.058 — 0.115 (0.002 — 0.005)		0.2 (0.008)

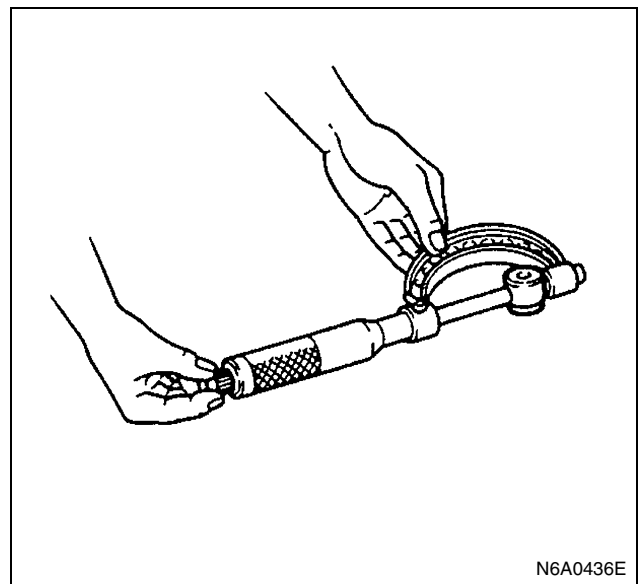


N6A0435E

Idle Gear Shaft Outside Diameter

Use a micrometer to measure the idler gear shaft outside diameter.
If the measured value is less than the specified limit, the idler gear must be replaced.

Idle Gear Shaft Outside Diameter		mm (in)
Standard		Limit
29.959 — 29.980 (1.1795 — 1.1803)		29.80 (1.1732)

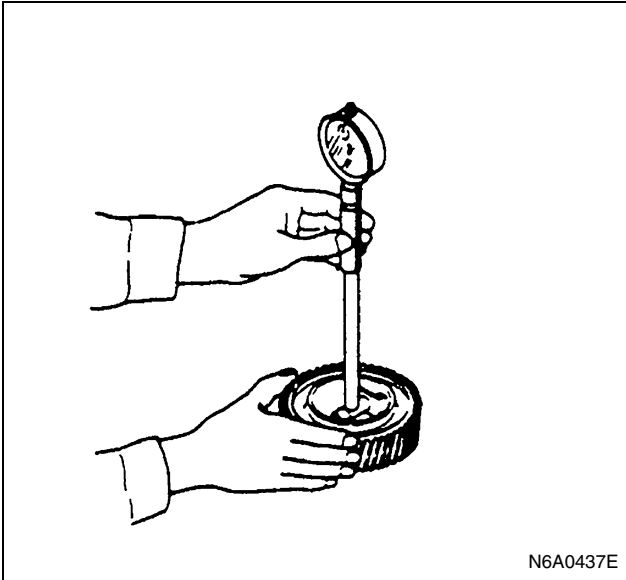


N6A0436E

Idle Gear Inside Diameter

Use an inside dial indicator or an inside micrometer to measure the idler gear inside diameter.

Idler Gear Inside diameter		mm (in)
Standard	Limit	
30.000 — 30.021 (1.1811 — 1.1819)	30.100 (1.1850)	



N6A0437E

If the clearance between the idler gear shaft outside diameter and the idler gear inside diameter exceeds the limit, the idler gear must be replaced.

Idler Gear Shaft and Idler Gear clearance		mm (in)
Standard	Limit	
0.020 — 0.062 (0.0008 — 0.0024)	0.200 (0.0079)	

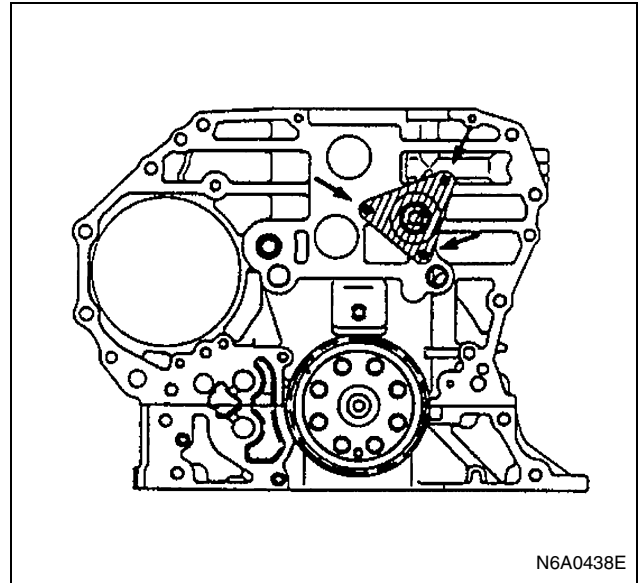
Installation

1. Idler Gear B Shaft

Tighten:

Idle gear B shaft bolt to 31 N·m (3.2 kg·m/23 lb·ft)

Apply the engine oil to the idle gear shaft after installation.



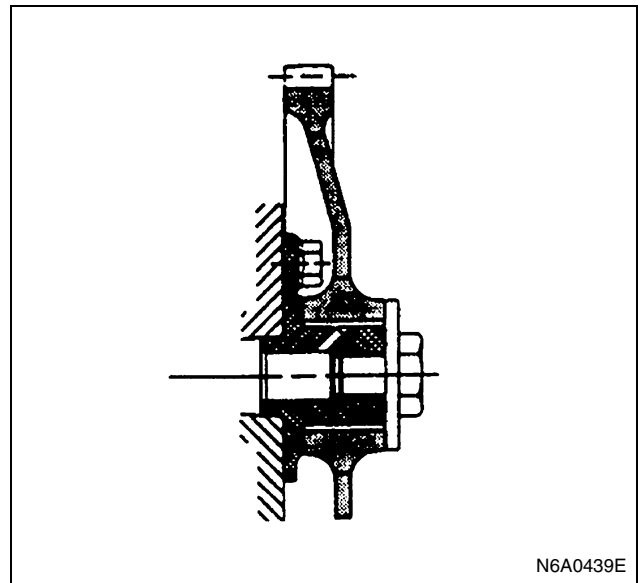
N6A0438E

2. Idle Gear B

The face of the idle gear B with longer boss should be positioned toward the rear side shown in the illustration.

Tighten:

Idle gear B bolt to 110 N·m (11.2 kg·m/81 lb·ft)



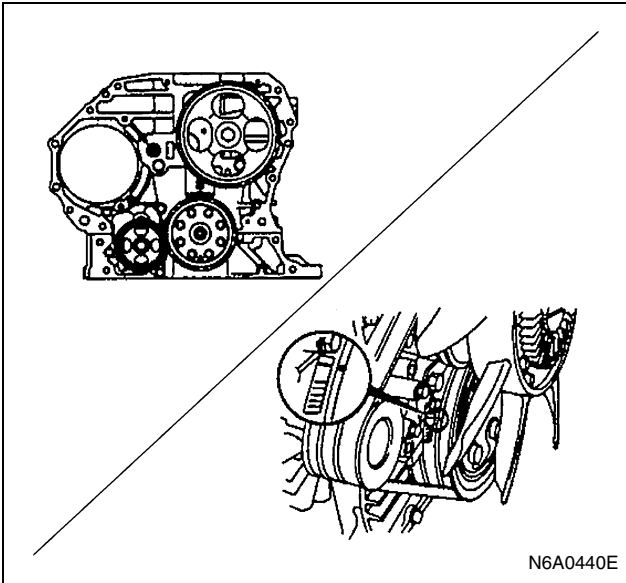
N6A0439E

3. Idle Gear A

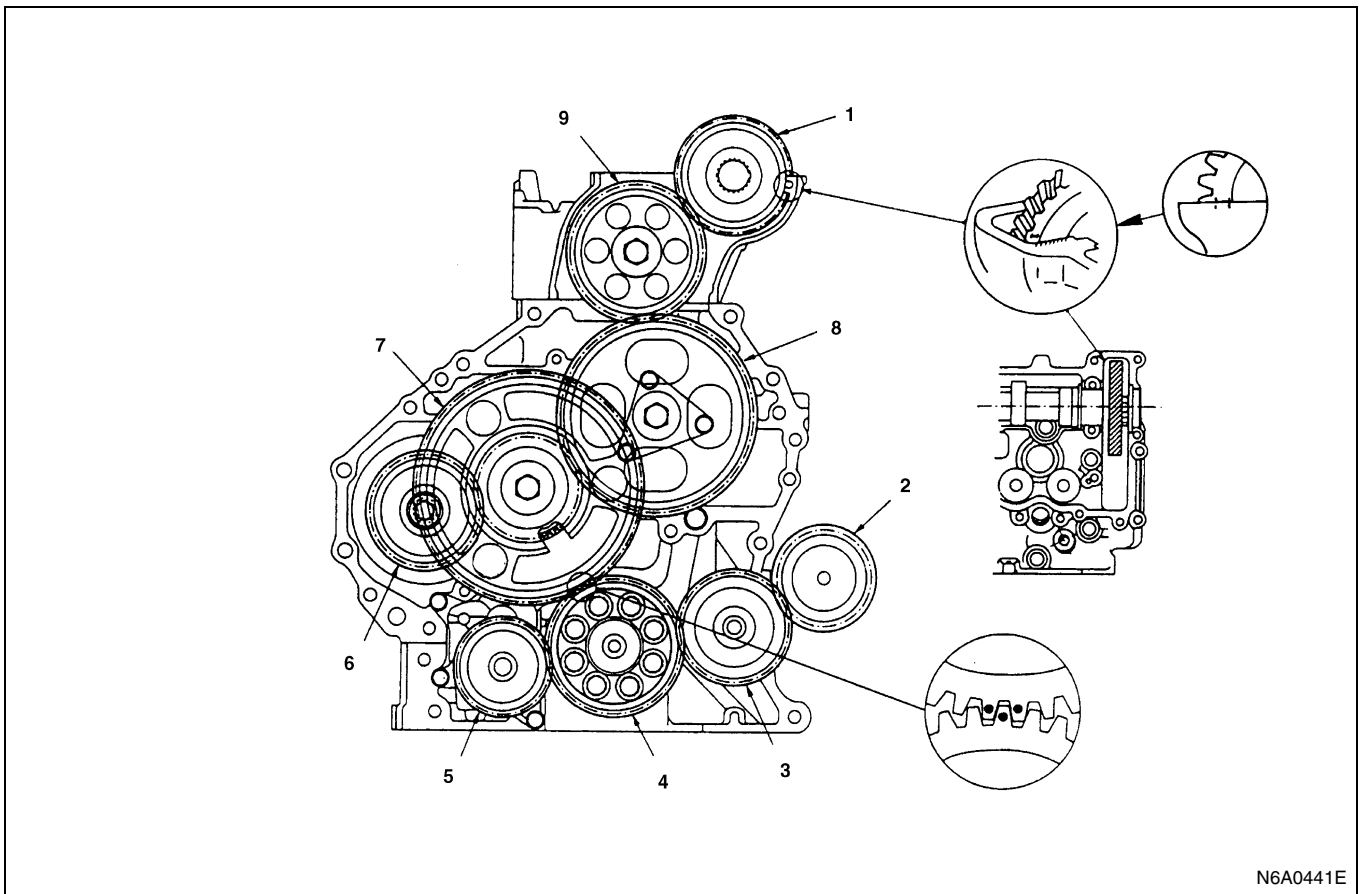
- 1) Turn the crankshaft clockwise so that the engagement mark of the crankshaft gear faces to the shaft center of the idle gear A and the No. 1 cylinder piston comes to the top dead center.
- 2) Align the crankshaft gear with the engagement mark of the idle gear and install the idle gear A.

Tighten:

Idle gear A bolt to 133 N·m (13.6 kg·m/98 lb·ft)



Alignment Mark Position for Each Gear



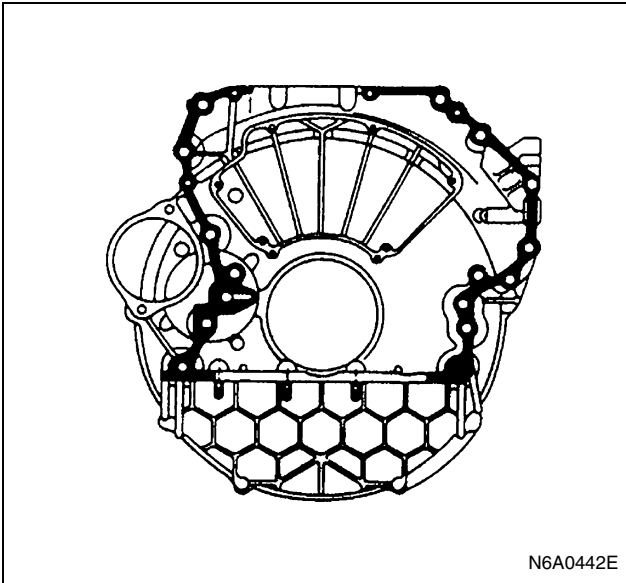
Legend

- | | |
|----------------------------------|------------------------|
| 1. Camshaft gear | 6. Injection pump gear |
| 2. Power steering pump gear | 7. Idle gear A |
| 3. Power steering pump idle gear | 8. Idle gear B |
| 4. Crankshaft gear | 9. Idle gear C |
| 5. Oil pump drive | |

4. Flywheel Housing

- 1) Carefully wipe any foreign material from the cylinder body rear face.

- 2) Apply the recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.

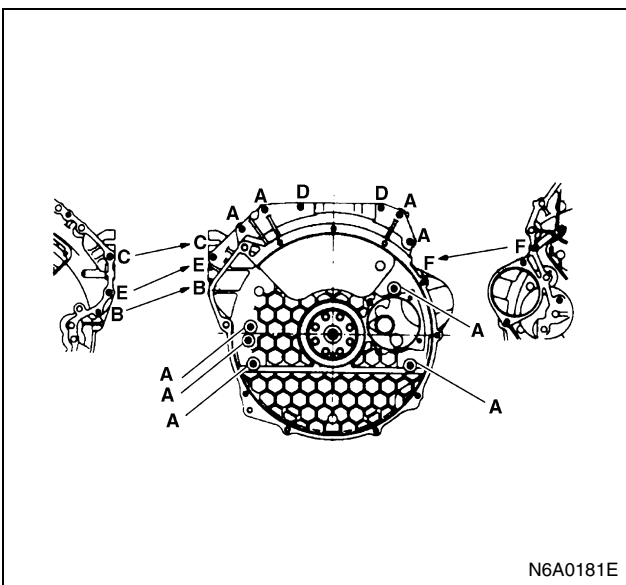


- 3) Align the cylinder body knock pins with the flywheel housing knock pin holes.
- 4) Tighten the flywheel housing bolts to the specified torque shown in the illustration.

Tighten:

Flywheel housing bolt to

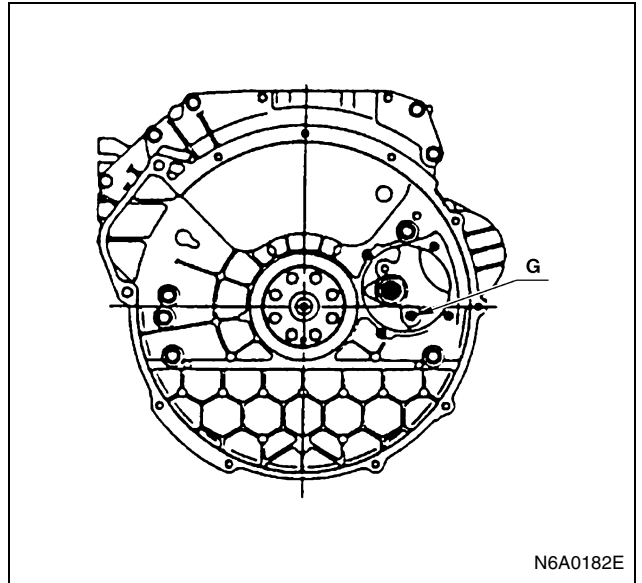
- (A): 96 N·m (9.8 kg·m/71 lb·ft)
- (B): 48 N·m (4.9 kg·m/35 lb·ft)
- (C): 94 N·m (9.6 kg·m/69 lb·ft)
- (D): 25 N·m (2.6 kg·m/19 lb·ft)
- (E): 76 N·m (7.7 kg·m/56 lb·ft)
- (F): 48 N·m (4.9 kg·m/35 lb·ft)



- Tighten the bolts marked with "E" or "B" from the injection pump side, and those with "F" from the cylinder body side.

Tighten:

Flywheel housing bolt (G) to 96 N·m (9.8 kg·m/71 lb·ft)

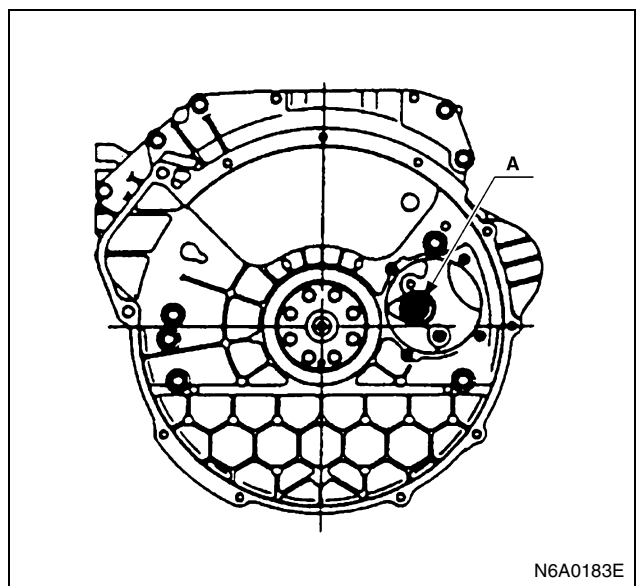


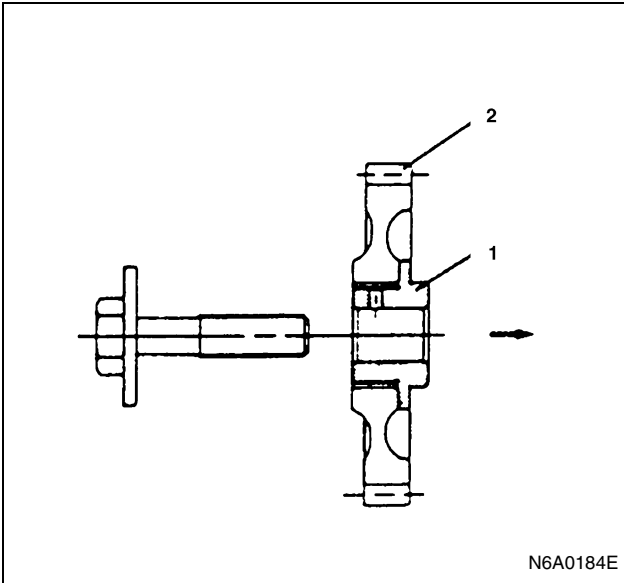
5. Power Steering Pump Idle Gear

- 1) Apply the engine oil to the idle gear shaft.
- 2) Install the idle gear shaft (1) with the idle gear (2) to the cylinder body A portion as shown in the illustration.

Tighten:

Idle gear shaft bolt to 135 N·m (13.6 kg·m/98 lb·ft)

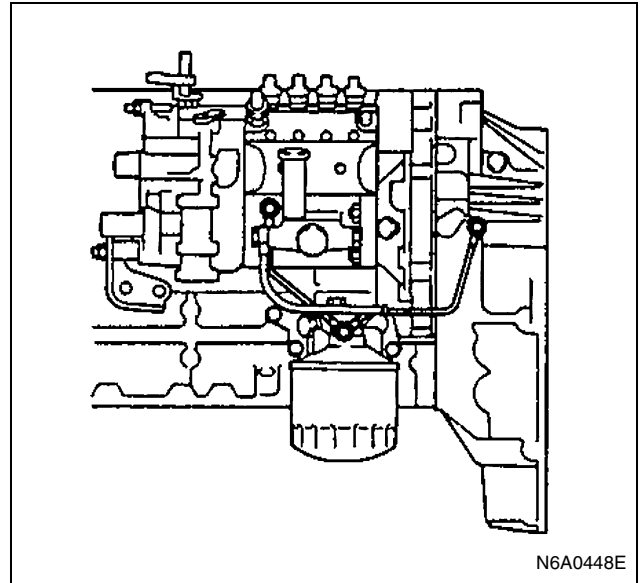




6. Power steering Pump Idle Gear Cover
Install the gear cover with the O-ring.

Tighten:

Gear cover bolt to 19 N·m (1.9 kg·m/14 lb·ft)

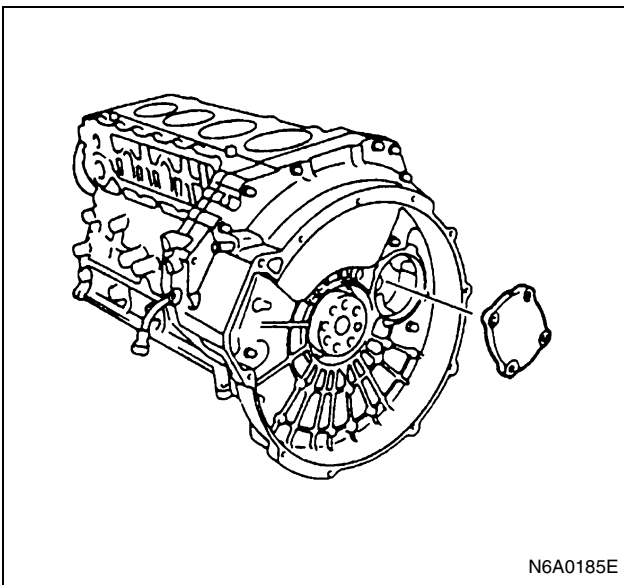


14. Engine Control Lever Assembly

Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)

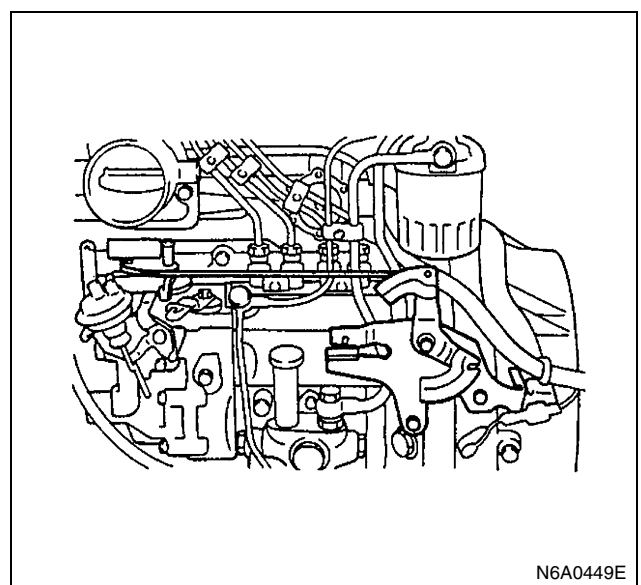
15. Engine Control Wire



7. Oil Pan
8. Spacer Rubber
Above works refer to "OIL PAN" section in this manual.
9. Crankshaft Rear Slinger
10. Crankshaft Rear Oil Seal
11. Flywheel
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
12. Injection Pump Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
13. Oil Pipe

Tighten:

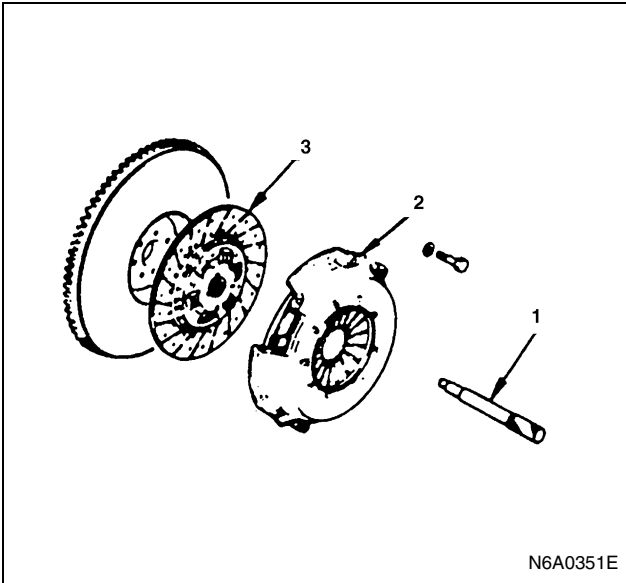
Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)



16. Driven Plate

Use the clutch pilot aligner to install the driven plate.

Clutch Pilot Aligner: 5-8840-2240-0



N6A0351E

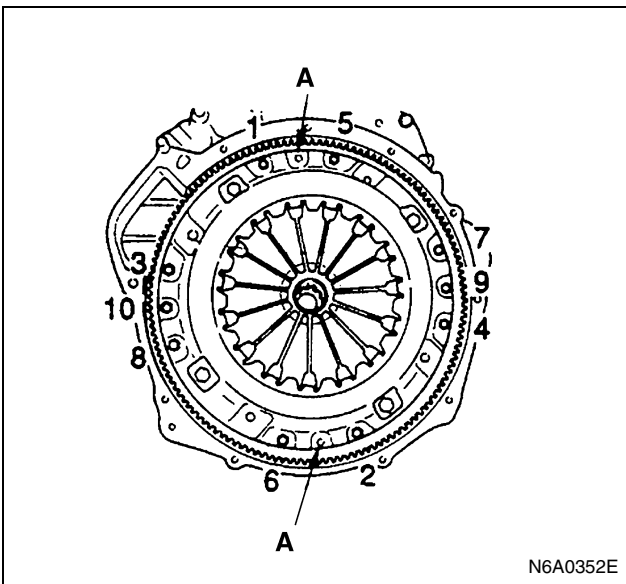
Legend

- 1. Clutch pilot aligner
- 2. Clutch pressure plate assembly
- 3. Driven plate

- 17. Clutch Pressure Plate Assembly
 - 1) Align the clutch pressure plate with the flywheel knock pin.
 - 2) Tighten the pressure plate bolts to the specified torque in numerical order.

Tighten:

Clutch pressure plate bolt to 40 N·m (4.1 kg·m/30 lb·ft)



N6A0352E

Legend

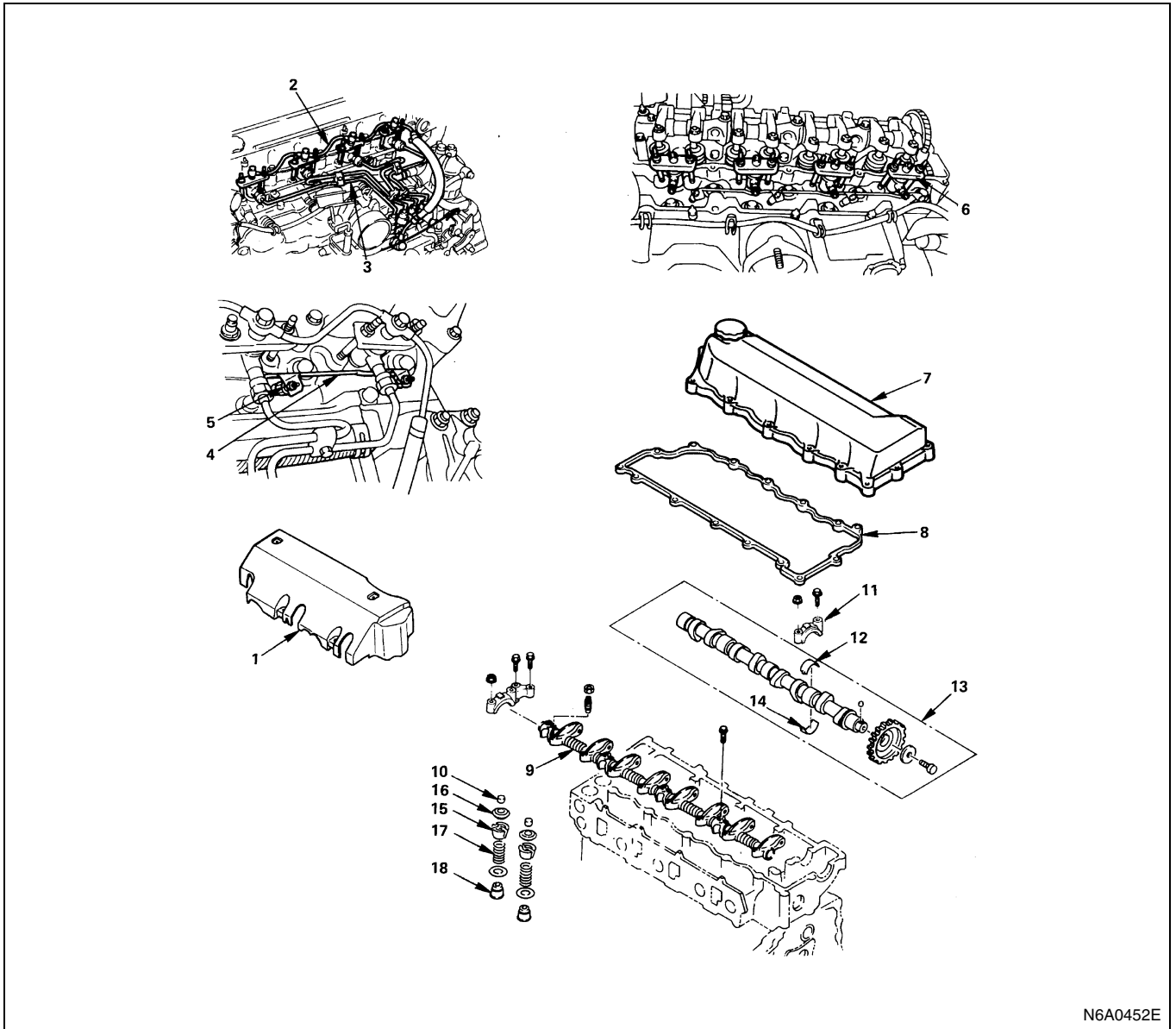
- A. Knock pin

- 18. Cylinder Head Gasket
 - Above works refer to "CYLINDER HEAD GASKET" section in this manual.

- 19. Cylinder Head Assembly
 - Above works refer to "CYLINDER HEAD GASKET" section in this manual.
- 20. Camshaft Bearing Lower
- 21. Camshaft Assembly
- 22. Camshaft Bearing Upper
- 23. Camshaft Bearing Cap
- 24. Valve Cap
- 25. Rocker Arm Shaft Assembly
 - Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
- 26. Head Cover Gasket
- 27. Cylinder Head Cover
 - Above works refer to "CYLINDER HEAD COVER" section in this manual.
- 28. Nozzle Cover
- 29. Engine Assembly
 - Above works refer to "ENGINE ASSEMBLY" section in this manual.

VALVE GUIDE SEAL & VALVE SPRING

Component



N6A0452E

Legend

- | | |
|-------------------------------------|----------------------------|
| 1. Nozzle cover | 10. Valve cap |
| 2. Leak off pipe | 11. Camshaft bearing cap |
| 3. Injection pipe | 12. Camshaft bearing upper |
| 4. Glow plug connector | 13. Camshaft assembly |
| 5. Glow plug | 14. Camshaft bearing lower |
| 6. Injection nozzle holder assembly | 15. Cotter collar |
| 7. Cylinder head cover | 16. Spring upper seat |
| 8. Cylinder head cover gasket | 17. Valve spring |
| 9. Rocker arm shaft assembly | 18. Valve guide seal |

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab.

1. Nozzle Cover

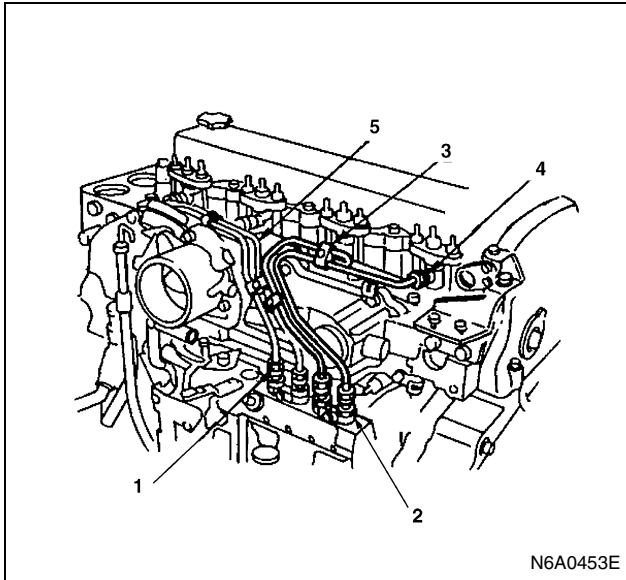
2. Leak Off Pipe

3. Injection Pipe

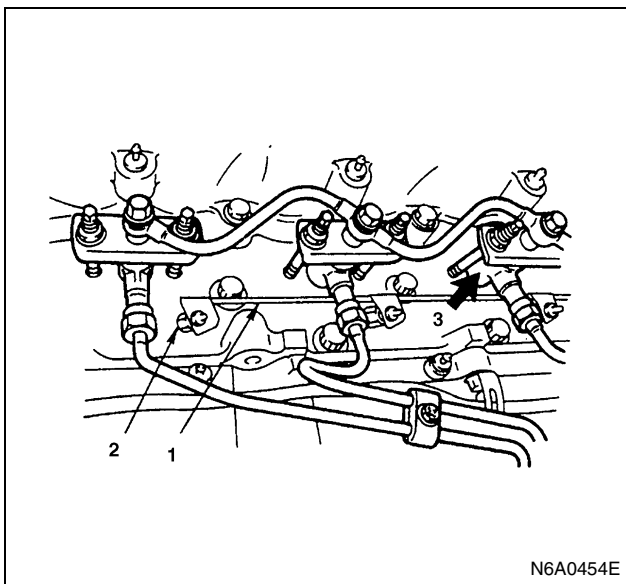
- Loosen the injection pipe sleeve nuts (1).

Do not apply excessive force to the injection pipes (5).

- Loosen the injection pipes clips (3). Remove the injection pipe assembly. Plug the delivery valve holder (2) ports and nozzle holder (4) ports with caps to prevent the entry of foreign material.



- Glow Plug Connector
- Glow Plug
- Injection Nozzle Holder Assembly
Mark the nozzle holder assemblies fitting positions by tagging each nozzle holder assembly with the cylinder number from which it was removed.

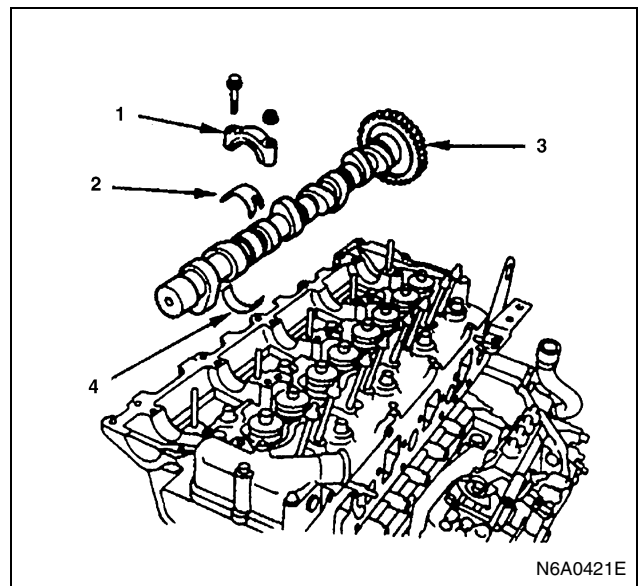


Legend

- Glow plug connector
- Glow plug
- Injection nozzle holder assembly

- Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
- Valve Cap
- Camshaft Bearing Cap
- Camshaft Bearing Upper
- Camshaft Assembly
- Camshaft Bearing Lower

- If the camshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

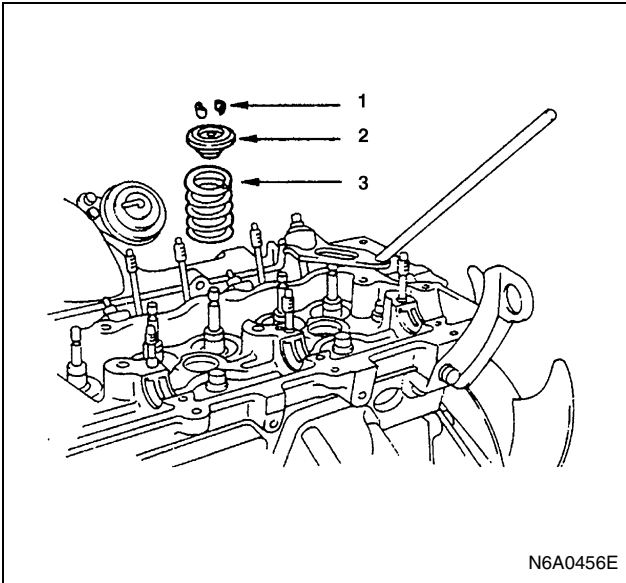


Legend

- Camshaft bearing cap
- Camshaft bearing upper
- Camshaft assembly
- Camshaft bearing lower

- Cotter Collar
 - Spring Upper Seat
 - Valve Spring
 - Apply compressed air to cylinder from the glow plug hole to hold the valve in place.
 - Using special tool, compress valve spring and remove cotter collar.
- Valve Spring Compressor: 5-8840-2228-0

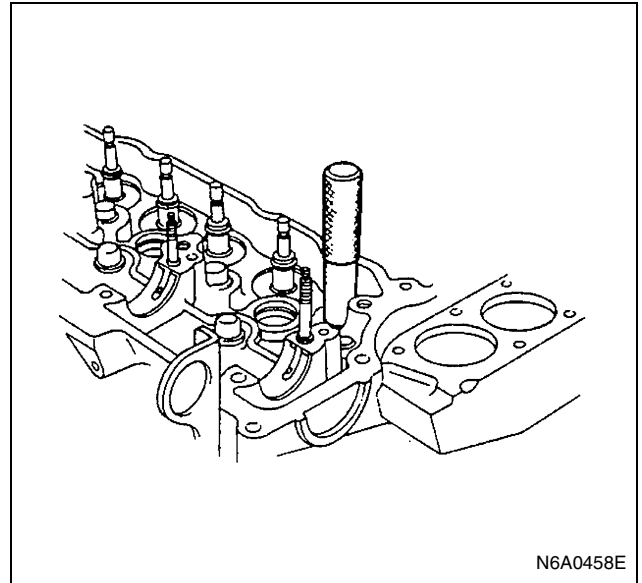
- Cylinder Head Cover
- Cylinder Head Cover Gasket



N6A0456E

Legend

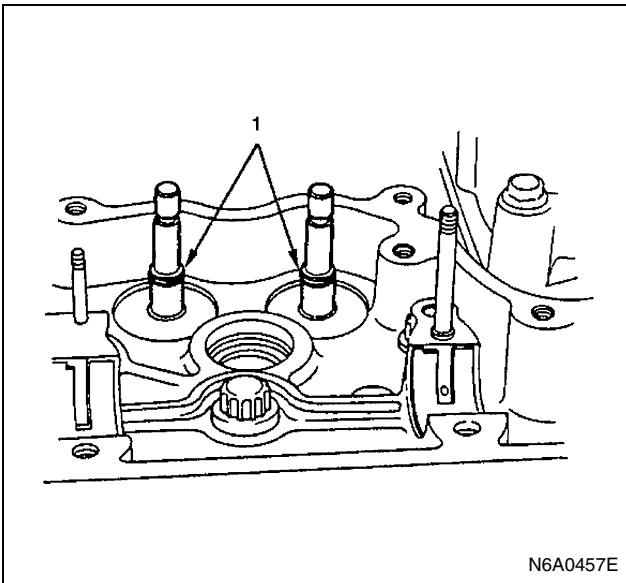
1. Cotter collar
2. Spring upper seat
3. Valve spring



N6A0458E

2. Valve Spring
Install the valve spring with its fine pitched (or painted) end side down.

18. Valve Guide Seal



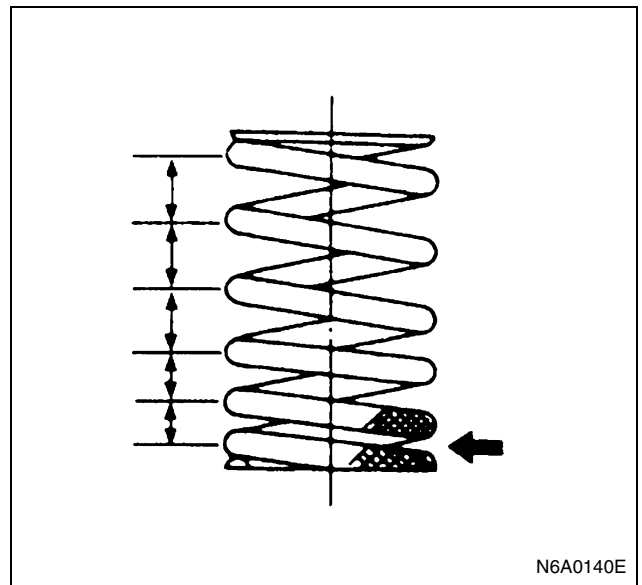
N6A0457E

Legend

1. Oil seal

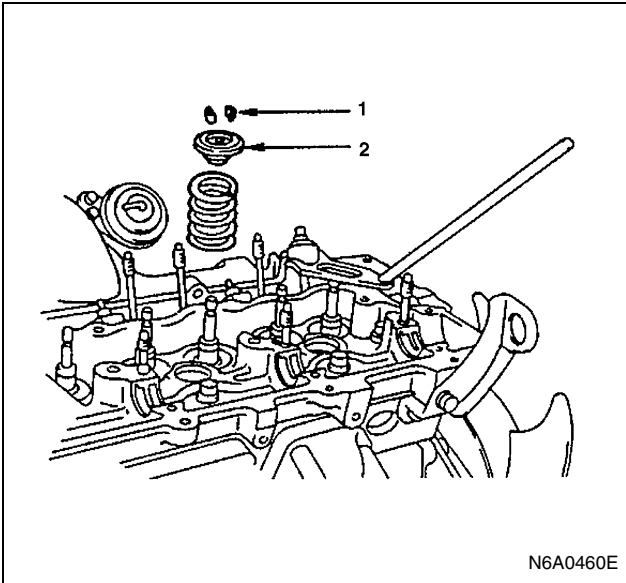
Installation

1. Valve Guide Seal
 - Apply a coat of engine oil to the valve guide seal inner face.
 - Use a valve guide seal installer to install the valve guide seal to the valve guide
Valve Guide Seal Installer: 8-9439-6815-0



N6A0140E

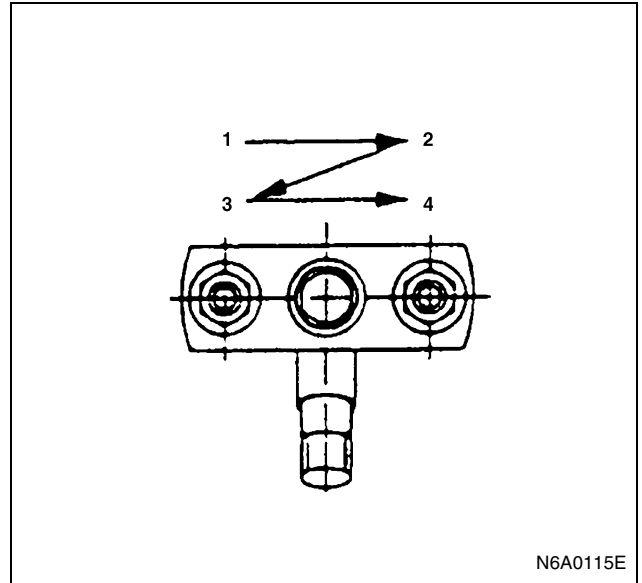
3. Spring Upper Seat
4. Cotter Collar
 - 1) Use the valve spring compressor to push the valve spring into position.
Valve Spring Compressor: 5-8840-2228-0
 - 2) Install the cotter collar to the valve stem.
 - 3) Set the cotter collar by tapping around the head of the collar with a rubber hammer.



N6A0460E

Legend

- 1. Cotter collar
- 2. Spring upper seat



N6A0115E

14. Glow Plug

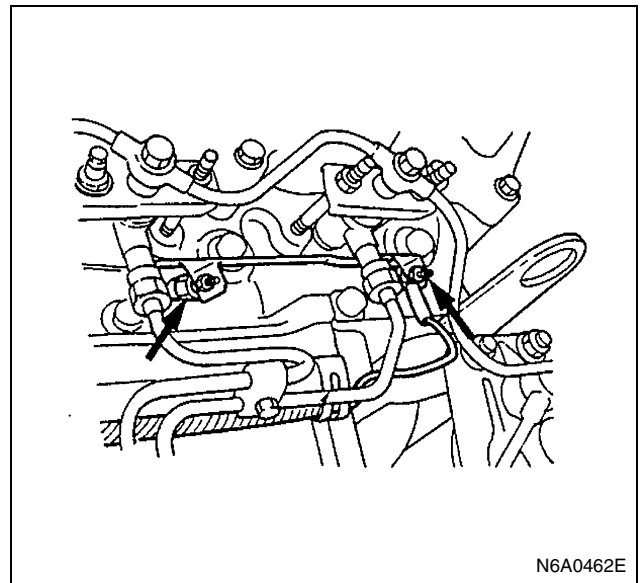
Tighten:

Glow plug to 23 N·m (2.3 kg·m/17 lb·ft)

- 5. Camshaft Bearing Lower
- 6. Camshaft Assembly
- 7. Camshaft Bearing Upper
- 8. Camshaft Bearing Cap
- 9. Valve Cap
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
- 10. Rocker Arm shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
- 11. Cylinder Head Cover Gasket
- 12. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
- 13. Injection Nozzle Holder Assembly
Tighten the nozzle holder flange nuts to the specified torque in the numerical order shown in the illustration.

Tighten:

Nozzle holder flange nut to 19 N·m (1.9 kg·m/14 lb·ft)



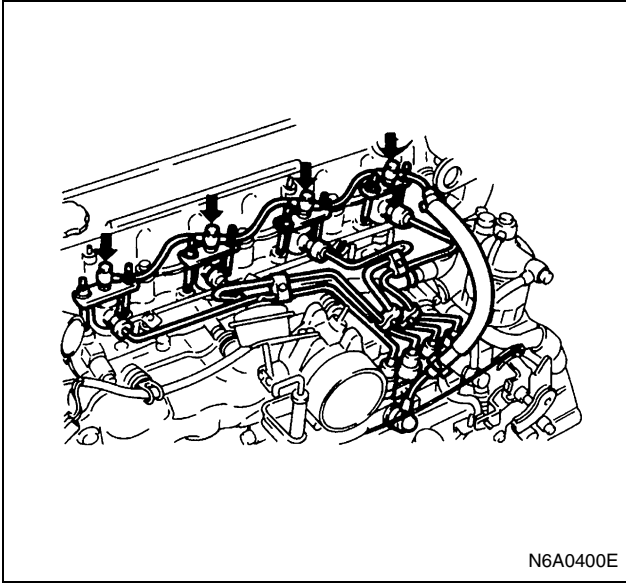
N6A0462E

15. Glow Plug Connector

16. Injection Pipe

17. Leak Off Pipe

Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.

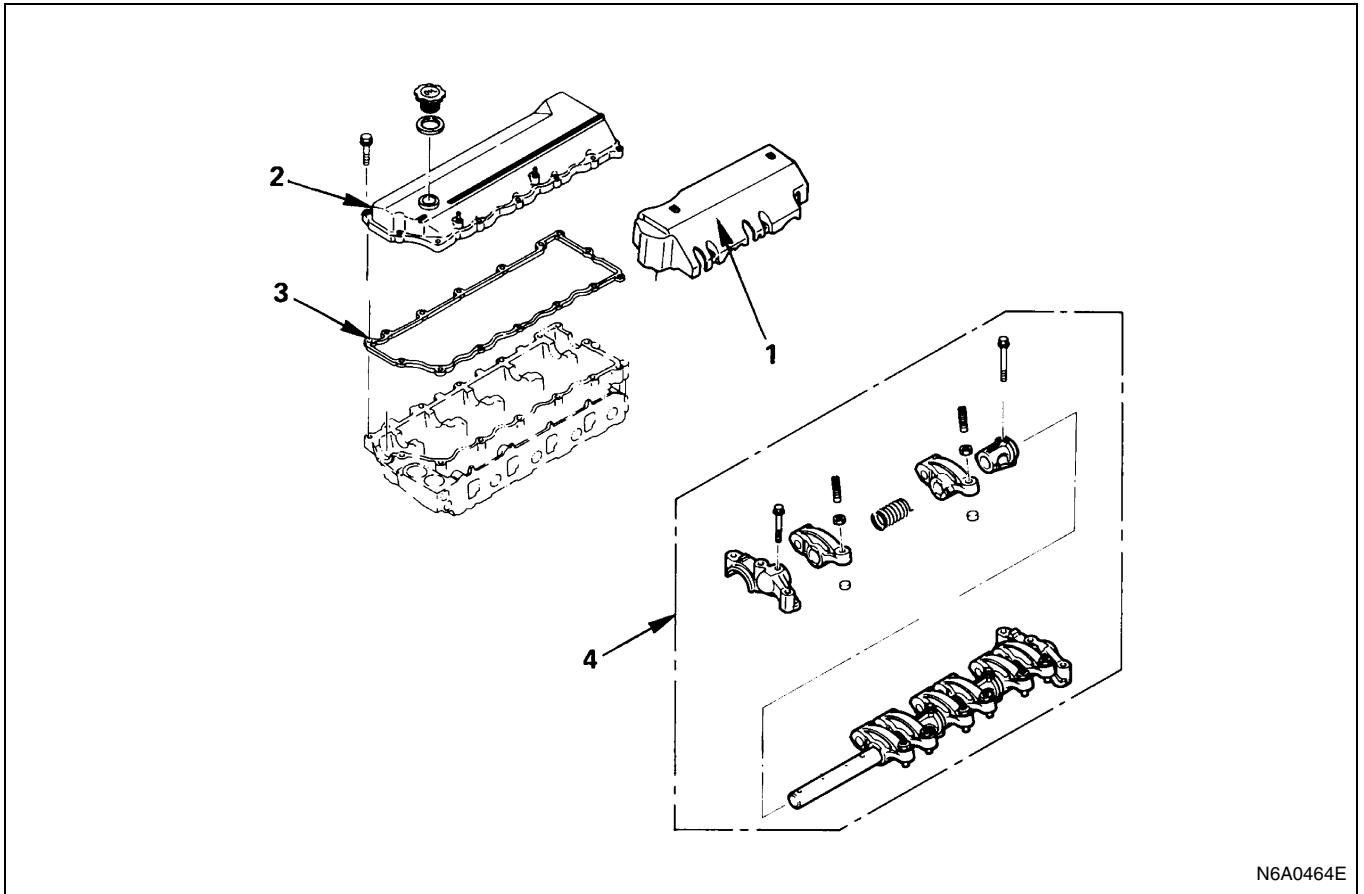


18. Nozzle Cover

- Connect the negative battery cable
- Lower the cab
- Start engine and check for fuel leakage carefully.

ROCKER ARM SHAFT ASSEMBLY

Component



N6A0464E

Legend

- | | |
|------------------------|-------------------------------|
| 1. Nozzle cover | 3. Cylinder head cover gasket |
| 2. Cylinder head cover | 4. Rocker arm shaft assembly |

Removal

Preparation

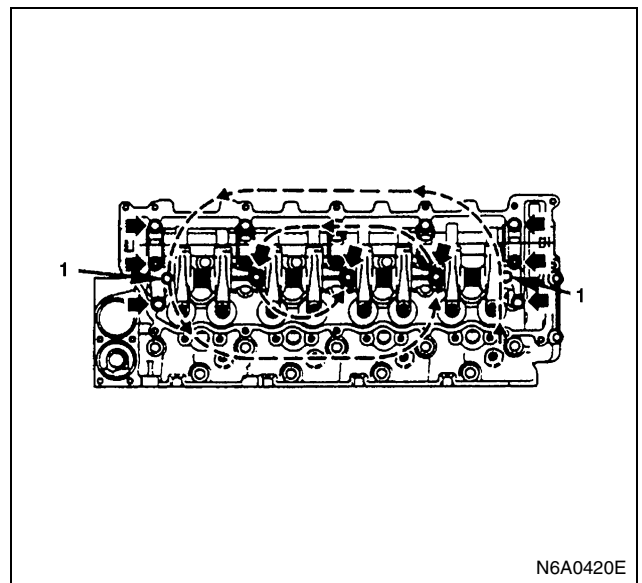
- Disconnect battery ground cable.
- Tilt the cab.

1. Nozzle Cover
2. Cylinder Head Cover
3. Cylinder Head Cover Gasket
4. Rocker Arm Shaft Assembly

- 1) Loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time and remove the rocker arm shaft assembly with the camshaft brackets.
- 2) Leave the (1) indicated bolt unremoved on this occasion, since it is the rocker arm fixing bolt.

Caution:

Failure to loosen the rocker arm shaft bracket nuts and bolts in numerical order a little at a time will adversely affect the rocker arm shaft.

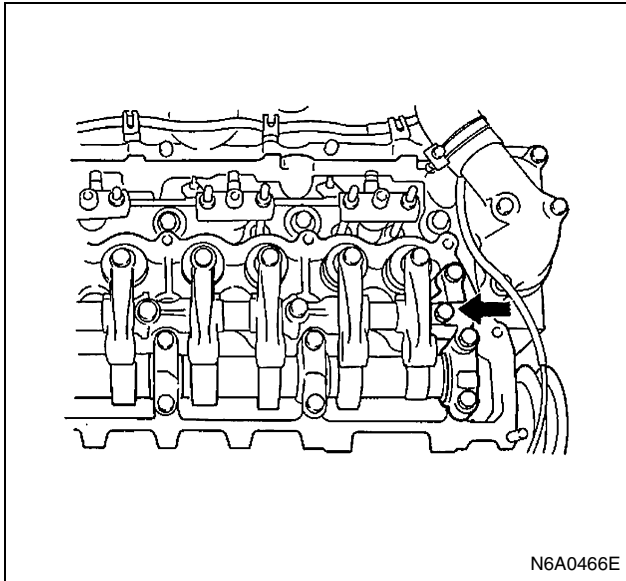


N6A0420E

Installation

1. Rocker Arm Shaft Assembly

- 1) Slightly loosen the bolts marked with the arrow in the illustration.



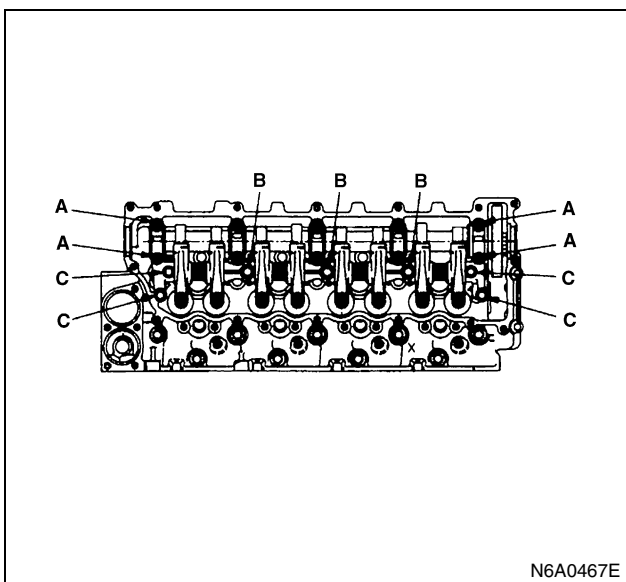
- 2) Loosen the rocker arm adjust screws and apply engine oil to the rocker arm roller portions.
- 3) Install the rocker arm assembly on the cylinder head.
- 4) Tighten the rocker arm shaft breaker nuts and bolts to the specified torque in numerical order a little at a time as shown in the illustration.

Tighten:

Rocker arm shaft bracket nut and bolt to

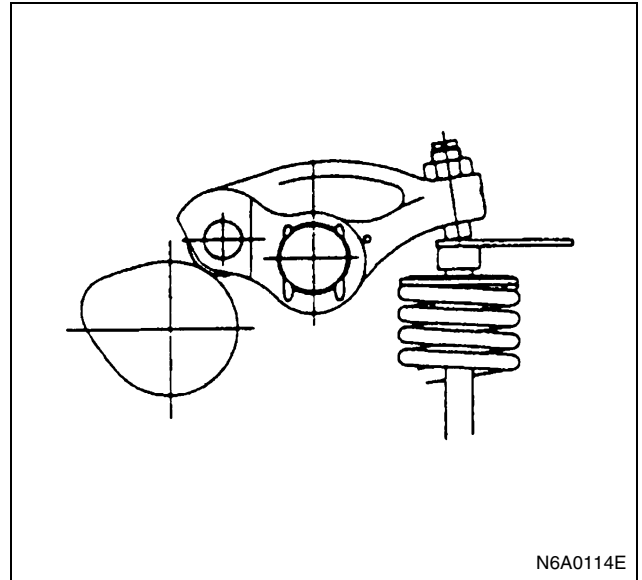
- Nut (A): 27 N·m (2.8 kg·m/20 lb·ft)
- Bolt (B): 56 N·m (5.7 kg·m/41 lb·ft)
- Bolt (C): 27 N·m (2.8 kg·m/20 lb·ft)

- 5) Apply engine oil to the threaded portion of the nuts marked with "A" and the bolts with "B" shown in the illustration left, and then tighten them to the specified torque.



Adjust the valve clearance.

Valve Clearance		mm (in)
At cold		0.4 (0.016)

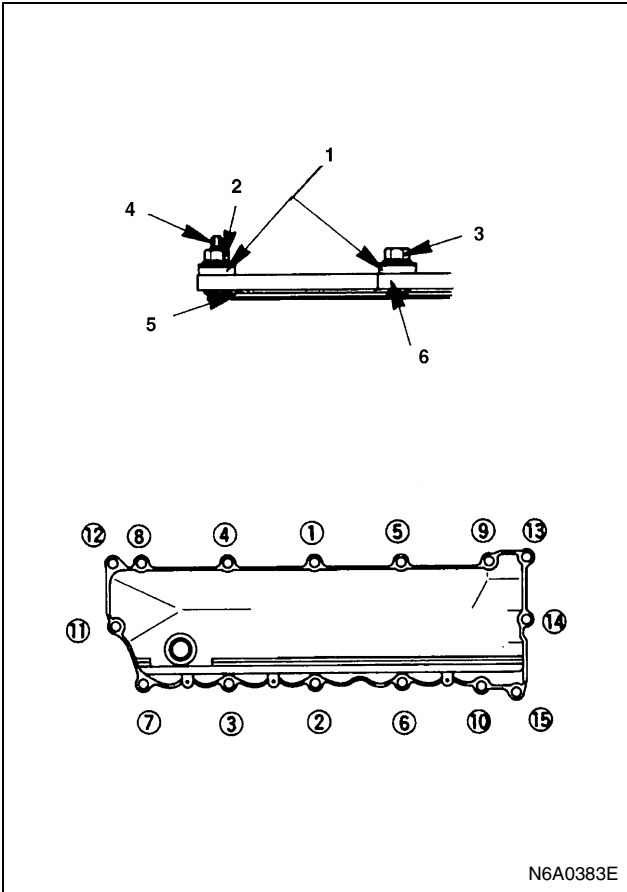


Above works refer to "SERVICING" VALVE CLEARANCE ADJUSTMENT" previously section in this manual.

2. Cylinder Head Cover Gasket
Install the gasket to the cylinder head cover.
3. Cylinder Head Cover
 - 1) Install the cylinder head cover.
 - 2) Tighten the cylinder head cover nuts and bolts to the specified torque in the numerical order shown in the illustration.

Tighten:

Cylinder head cover nut and bolt to 18 N·m (1.8 kg·m/13 lb·ft)



N6A0383E

Legend

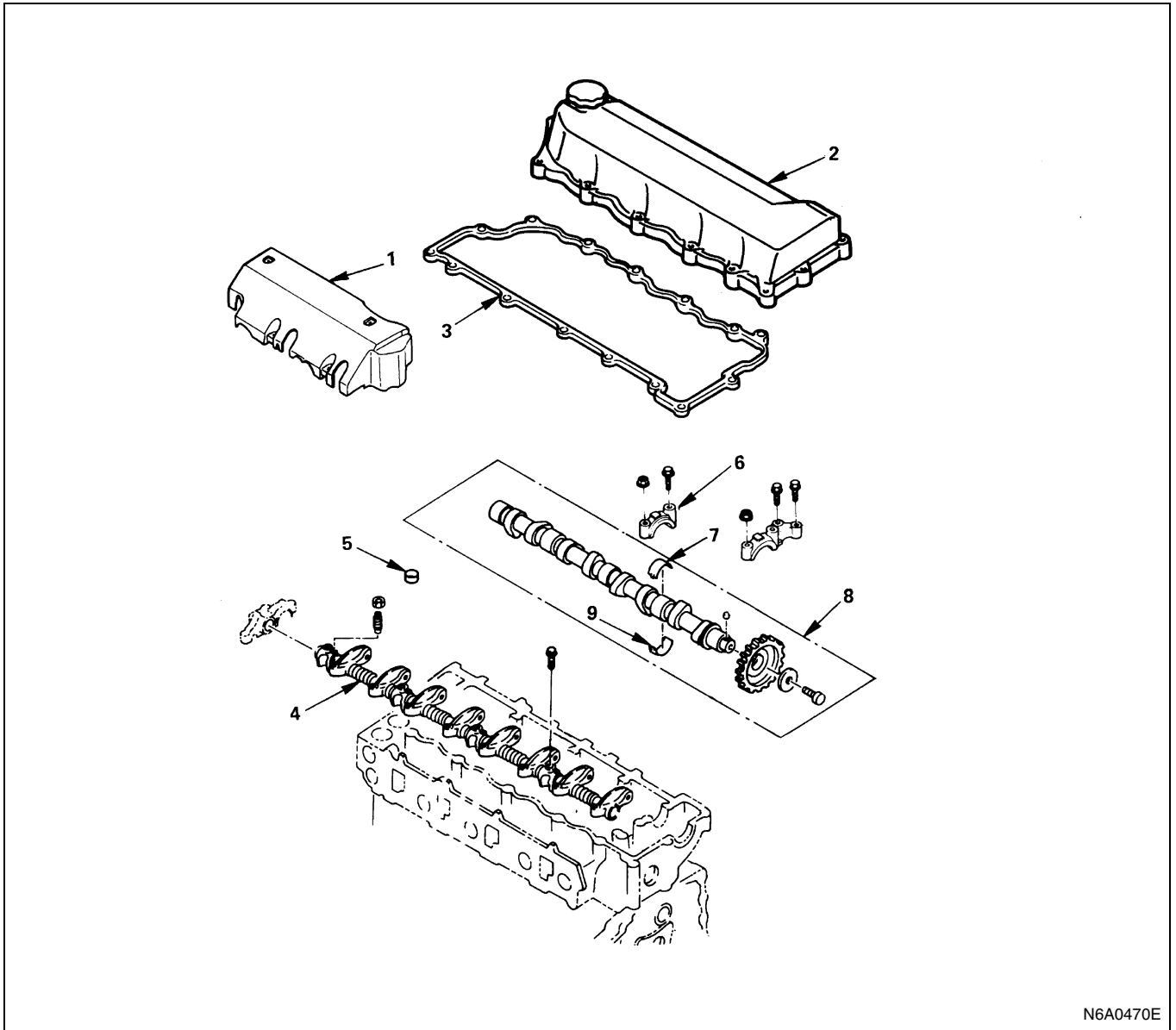
- 1. Mounting rubber
- 2. Nut
- 3. Bolt
- 4. Stud
- 5. Gasket
- 6. Head cover

4. Nozzle Cover

- Connect the battery ground cable.
- Lower the cab.
- Start the engine and check for the oil leakage carefully.

CAMSHAFT ASSEMBLY

Component



N6A0470E

Legend

- | | |
|-------------------------------|---------------------------|
| 1. Nozzle cover | 6. Camshaft bearing cap |
| 2. Cylinder head cover | 7. Camshaft bearing upper |
| 3. Cylinder head cover gasket | 8. Camshaft assembly |
| 4. Rocker arm shaft assembly | 9. Camshaft bearing lower |
| 5. Valve cap | |

Removal

Preparation

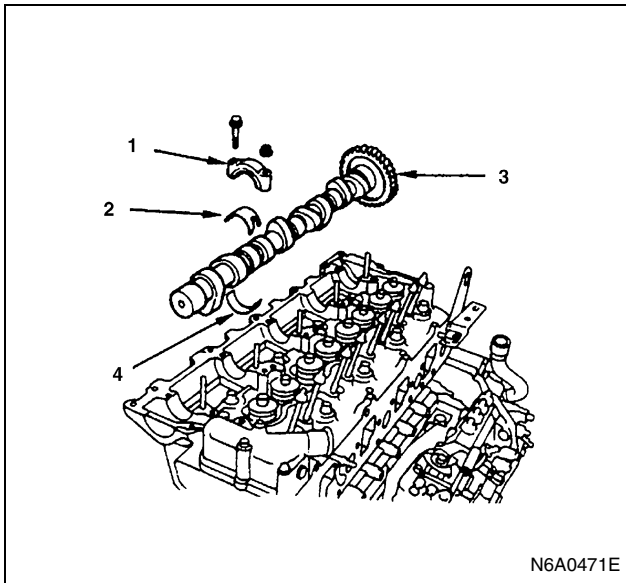
- Disconnect battery ground cable.
- Tilt the cab.

1. Nozzle Cover
2. Cylinder Head Cover
3. Cylinder Head Cover Gasket
4. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

5. Valve Cap
6. Camshaft Bearing Cap
7. Camshaft Bearing Upper
8. Camshaft Assembly
9. Camshaft Bearing Lower

- If the camshaft bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

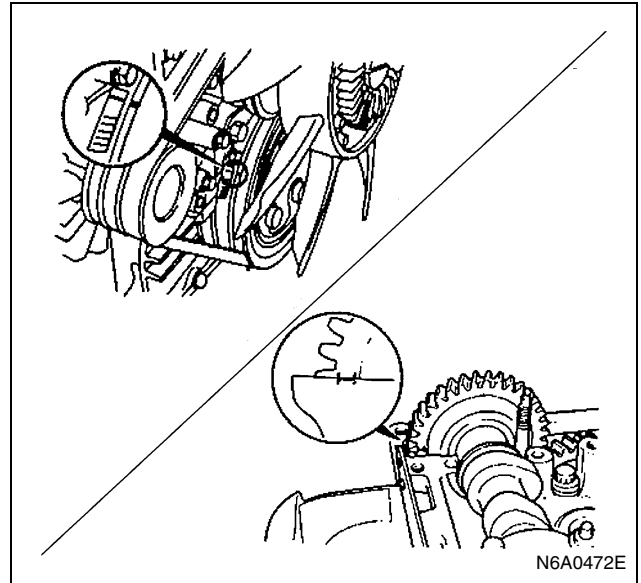


Legend

1. Camshaft bearing cap
2. Camshaft bearing upper
3. Camshaft assembly
4. Camshaft bearing lower

Installation

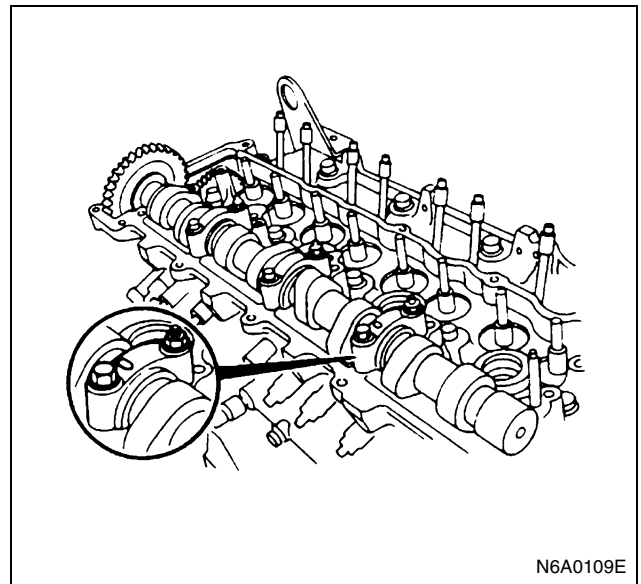
1. Camshaft Bearing Lower
2. Camshaft Assembly
 - 1) Turn the crankshaft in the direction of normal rotation until the timing mark on the crankshaft damper pulley is aligned with the TDC notched line.
 - 2) Apply engine oil to the camshaft journal and the camshaft bearing surfaces before installation.
 - 3) Carefully align the camshaft gear "I" mark and the cylinder head upper face shown in the illustration.



3. Camshaft Bearing Upper

4. Camshaft Bearing Cap

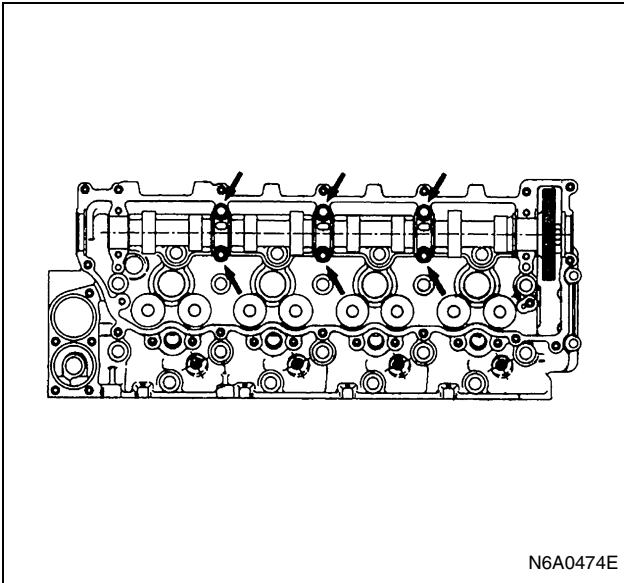
- Install the bearing caps with the bearing cap head mark (arrow) facing forward.
- Apply a coat of engine oil to the bearing cap bolt and stud threads.



- Tighten the bearing cap bolts and studs to the specified torque.

Tighten:

Camshaft bearing cap nut and bolt to 27 N·m (2.8 kg·m/20 lb·ft)

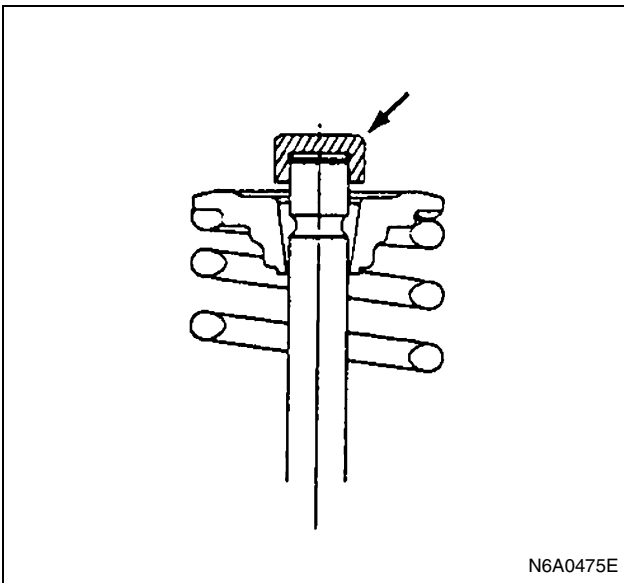


5. Valve Cap

Apply engine oil to the inside of the valve caps and install them to the valve stem end.

Caution:

Take sufficient care not to let the valve caps fall into the gear.



6. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

7. Cylinder Head Cover Gasket

8. Cylinder Head Cover

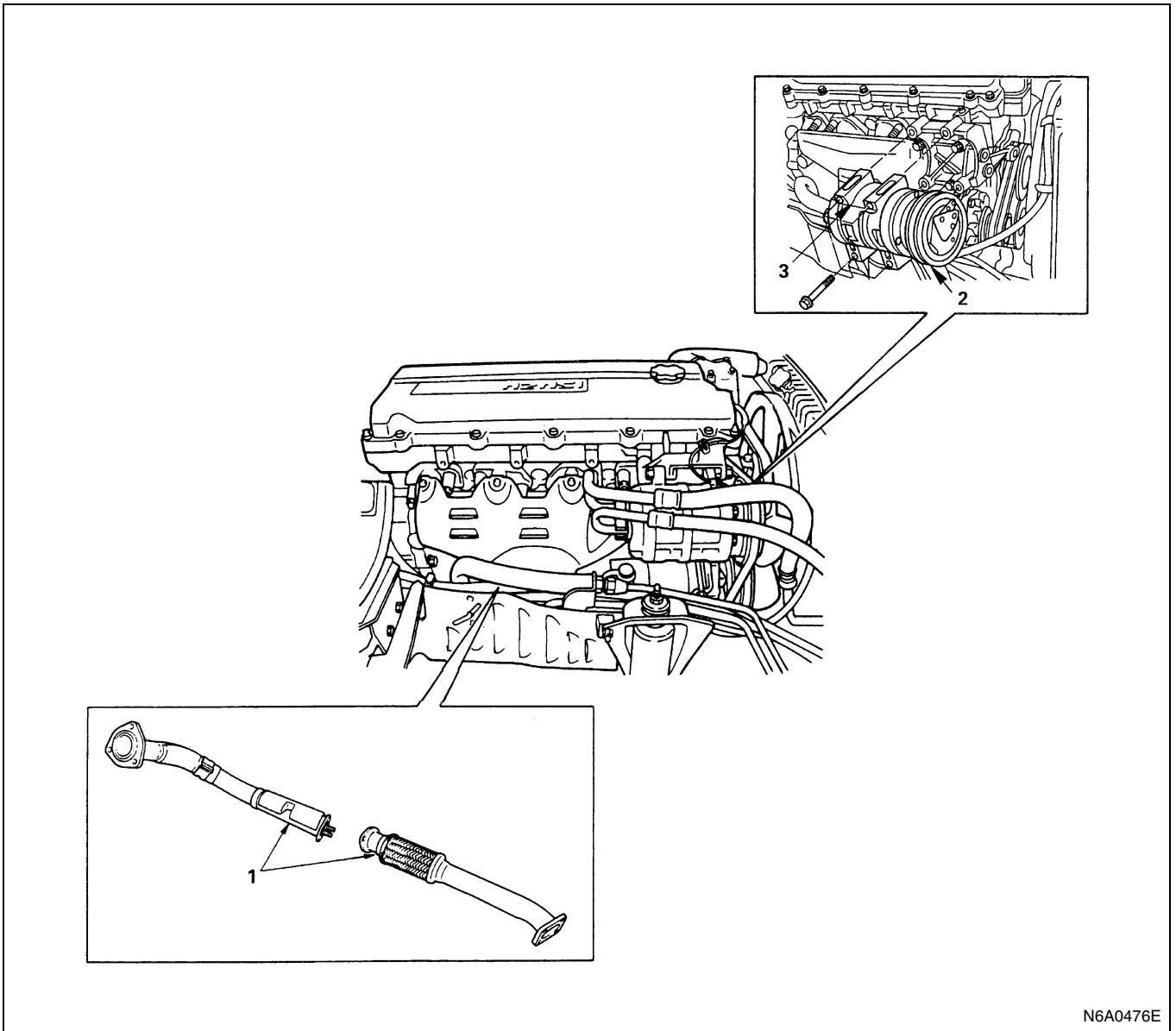
Above works refer to "CYLINDER HEAD COVER" section in this manual.

9. Nozzle Cover

- Connect the battery ground cable.
- Lower the cab.
- Start engine and check for oil leakage carefully.

CYLINDER HEAD

Component
Engine Right Side

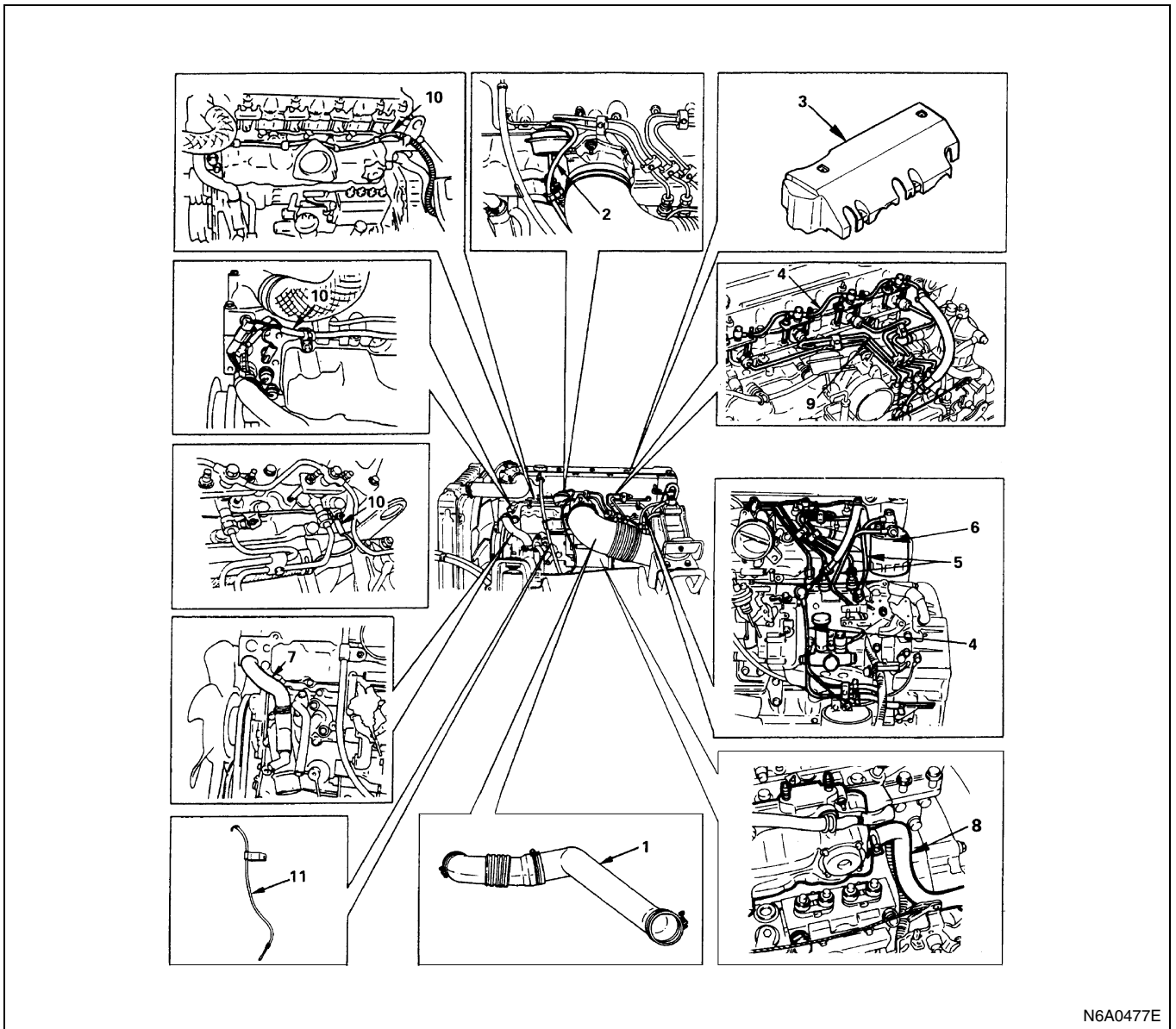


N6A0476E

Legend

- 1. Front exhaust pipe
- 2. A/C compressor drive belt (If equipped with A/C)
- 3. A/C compressor (If equipped with A/C)

Engine Left Side

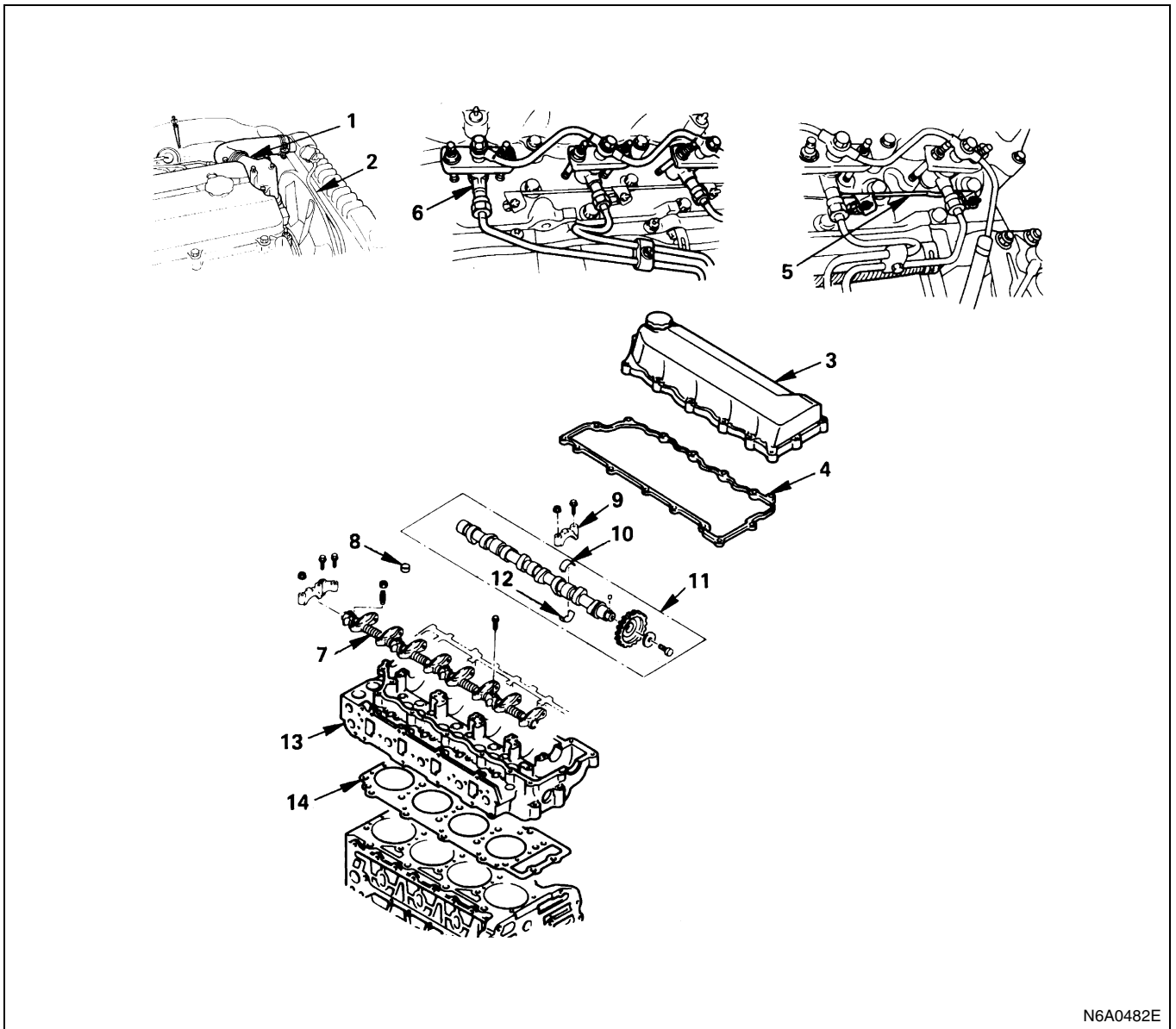


N6A0477E

Legend

- | | |
|----------------------------|--------------------------------|
| 1. Intake air duct | 7. Water bypass hose |
| 2. Vacuum hose | 8. PCV hose |
| 3. Nozzle cover | 9. Injection pipe |
| 4. Leak off pipe | 10. Engine harness |
| 5. Fuel pipe | 11. Oil level gauge guide tube |
| 6. Fuel filter and bracket | |

Cylinder Head Side



N6A0482E

Legend

- | | |
|--|----------------------------|
| 1. Radiator upper hose | 8. Valve cap |
| 2. Coolant reserve tank hose/bypass hose | 9. Camshaft bearing cap |
| 3. Cylinder head cover | 10. Camshaft bearing upper |
| 4. Cylinder head cover gasket | 11. Camshaft assembly |
| 5. Glow plug connector | 12. Camshaft bearing lower |
| 6. Injection nozzle holder assembly | 13. Cylinder head assembly |
| 7. Rocker arm shaft assembly | 14. Cylinder head gasket |

Removal

Preparation

- Disconnect battery ground cable
- Tilt the cab.
- Drain coolant

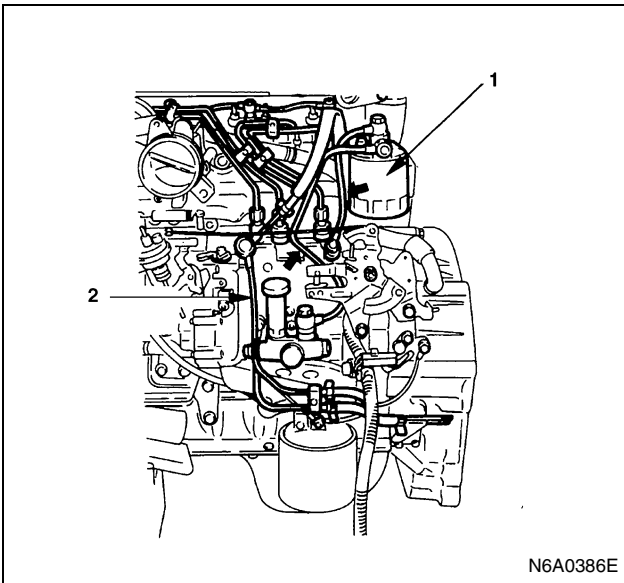
Engine Right Side

1. Front Exhaust Pipe

2. Air Conditioning (A/C) Compressor Drive Belt (If equipped with A/C)
3. A/C Compressor (If equipped with A/C)
 - 1) Disconnect magnetic clutch harness connector.
 - 2) Dismount the compressor together with the hoses from the A/C compressor bracket, and fasten it with a wire to the appropriate location.

Engine Left Side

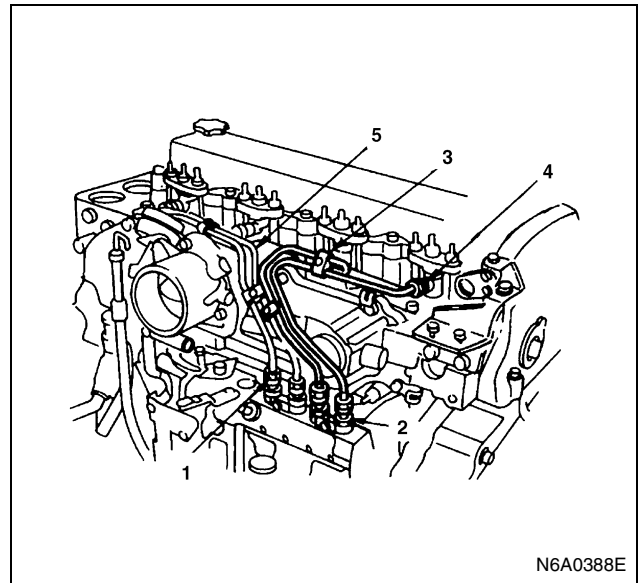
1. Intake Air Duct
 - 1) Remove the clips at the connections with the inlet cover and with the air cleaner.
 - 2) Remove the intake air duct with the connecting hoses attached.
2. Vacuum Hose
3. Nozzle Cover
4. Leak Off Pipe
5. Fuel Pipe



Legend

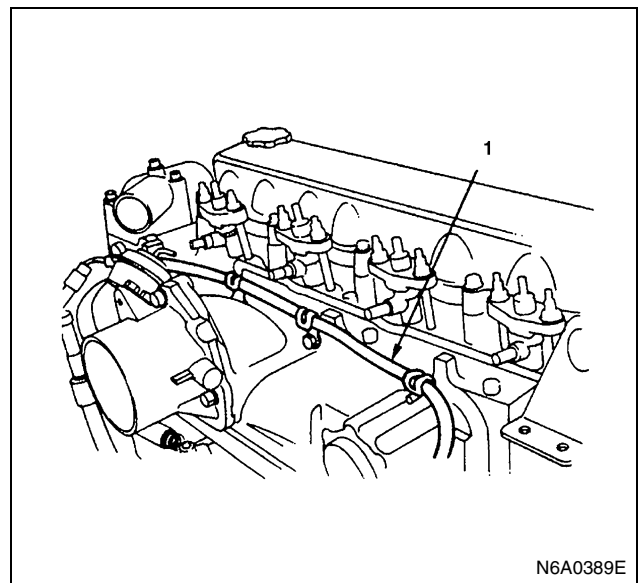
1. Fuel filter
2. Leak off

6. Fuel filter & Bracket
7. Water Bypass Hose
8. Positive Crankcase Ventilation (PCV) Hose
9. Injection Pipe
 - 1) Loosen the injection pipe sleeve nuts (1). Do not apply excessive force to the injection pipes (5).
 - 2) Loosen the injection pipes clips (3).
 - 3) Remove the injection pipe assembly. Plug the delivery valve holder (2) ports and nozzle holder (4) ports with caps to prevent the entry of foreign material.



10. Engine Harness

Disconnect thermometer unit, thermo switch, tachometer sensor and glow plug harness connectors an separate harness from clips.

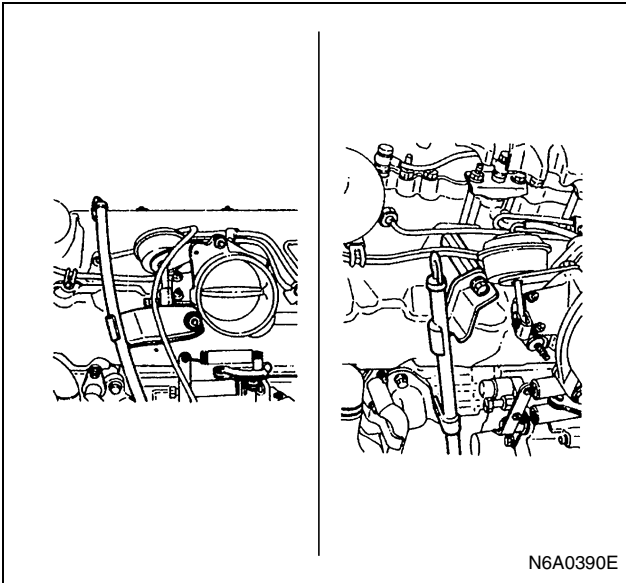


Legend

1. Engine harness

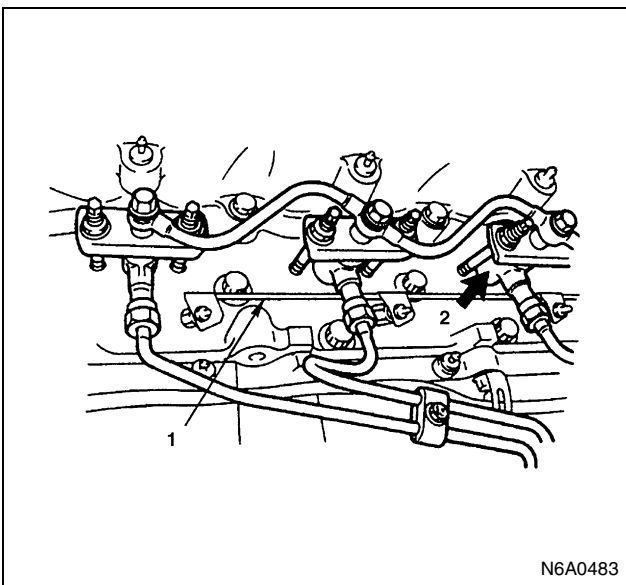
11. Oil Level Gauge Guide Tube

Remove the guide tube fixing bolt and pull out the guide tube.



Cylinder Head Side

1. Radiator Upper Hose
2. Coolant Reserve Tank Hose/Bypass Hose
3. Cylinder Head Cover
4. Cylinder Head Cover Gasket
5. Glow Plug Connector
6. Injection Nozzle Holder Assembly
Mark the nozzle holder assemblies fitting positions by tagging each nozzle holder assembly with the cylinder number from which it was removed.



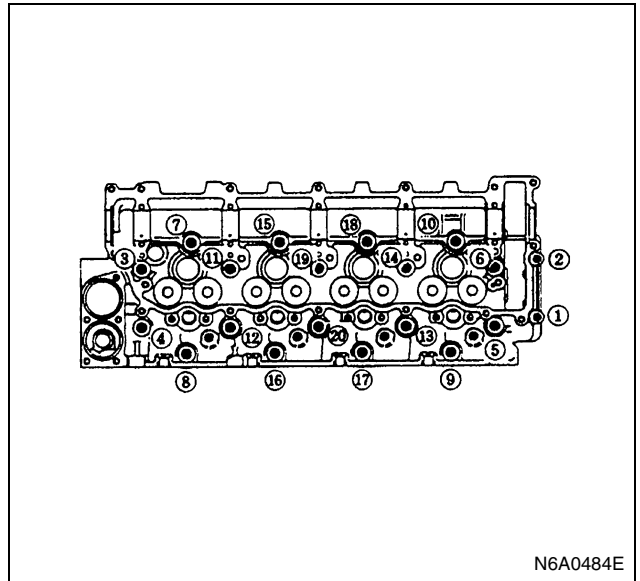
Legend

1. Glow plug connector
 2. Injection nozzle holder assembly
-
7. Rocker Arm Shaft Assembly
 8. Valve Cap
 9. Camshaft Bearing Cap
 10. Camshaft Bearing Upper
 11. Camshaft Assembly

12. Camshaft Bearing Lower
Above works refer to "ROCKER ARM SHAFT ASSEMBLY AND CAMSHAFT ASSEMBLY" section in this manual.
13. Cylinder Head Assembly
Loosen the cylinder head bolts in numerical order a little at a time.

Caution:

Failure to loosen the cylinder head bolts in numerical order a little at a time will adversely affect the cylinder head lower surface.



14. Cylinder Head Gasket

Caution:

Do not reuse the cylinder head gasket.

Installation

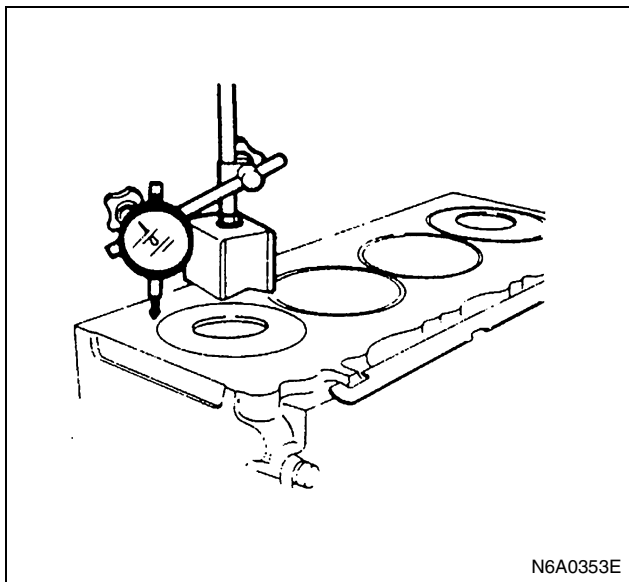
Cylinder Head Side

1. Cylinder Head Gasket
 - 1) When any of the cylinder block, crankshaft, crankshaft bearing, connecting rod, connecting rod bearing, and piston is replaced with a new one, cylinder head gasket thickness should be determined newly.
 - 2) When replacing the cylinder head gasket alone without replacing any of the parts mentioned in 1) above, the gasket to be used should be the same grade as the one used before.
 - 3) Correct cylinder head gasket thickness is important. Installing the wrong thickness gasket can result in greatly reduced engine performance.
 - 4) There are three cylinder head gaskets available.

Piston Head Projection Measurement

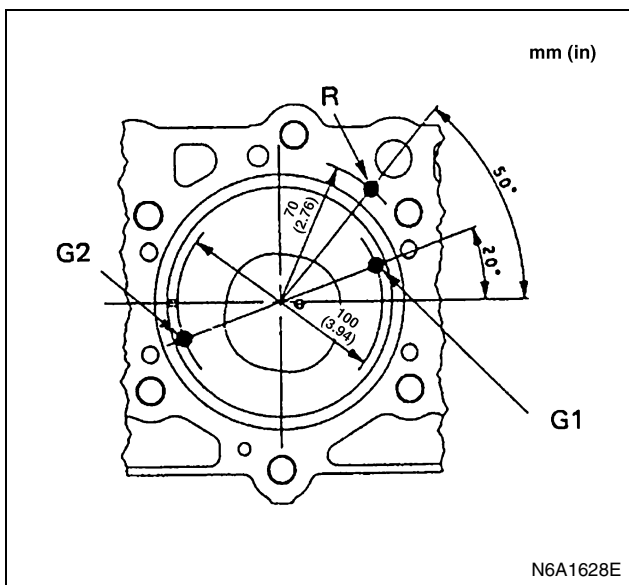
- Select a cylinder head gasket.
- Clean thoroughly the top faces of the piston head and the cylinder body.

- Use the dial gauge to measure the piston head projection. Take measurements at two location for each cylinder.
- The measurement points of the piston head and the reference point of the cylinder body are shown in the illustration.



N6A0353E

Measurement points: Points G1 and G2 of the piston head
 Reference point: Point R on the top face of the cylinder body






N6A1628E

Notice:

Note that there are three types of a cylinder head gasket available as below, according to the piston projection.

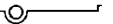


- For each cylinder, calculate the average value (Ti) of the piston projection.
- Find the maximum value (Ti max) of the average of each cylinder.
- Based on the Timax obtained, select a gasket of the appropriate grade.

4HF1/4HF1-2/4HG1-T
 Cylinder Head Gasket Selection

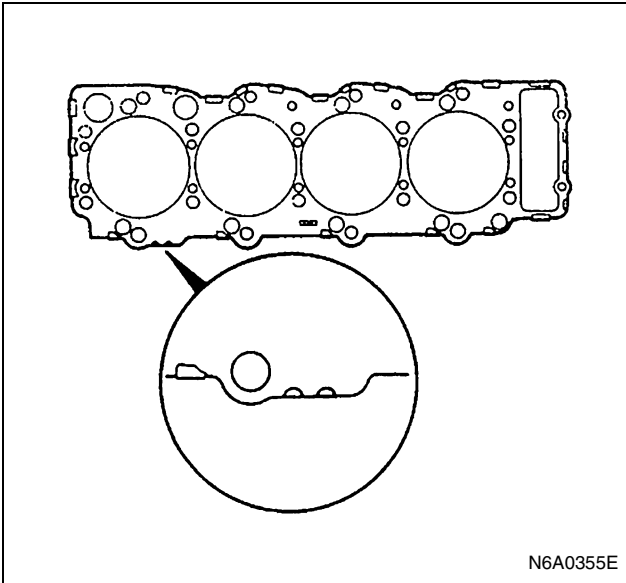
mm (in)		
Gasket Grade	Ti max	Gasket Thickness (Reference)
A 	0.579 - 0.659 (0.0228 - 0.0259)	1.70 (0.0669)
B 	0.659 - 0.739 (0.0259 - 0.0291)	1.75 (0.0689)
C 	0.739 - 0.819 (0.0291 - 0.0322)	1.80 (0.0708)

N6A1396E

4HE1-TC
 Cylinder Head Gasket Selection

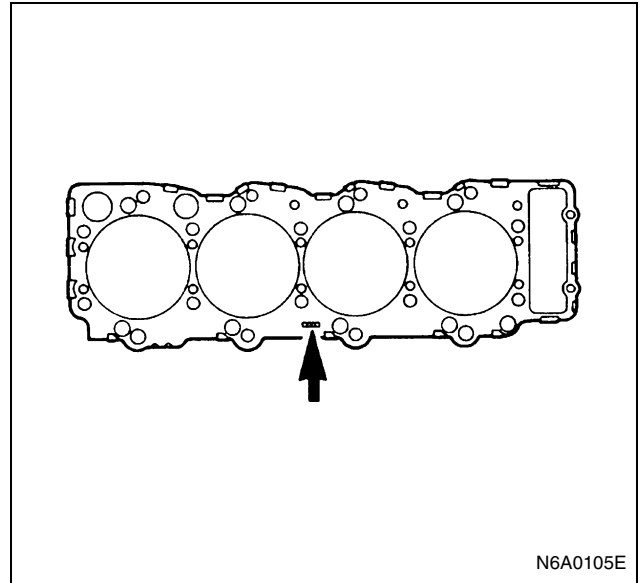
mm (in)		
Gasket Grade	Ti max	Gasket Thickness (Reference)
A 	0.529 - 0.609 (0.0208 - 0.0240)	1.70 (0.0669)
B 	0.609 - 0.679 (0.0240 - 0.0267)	1.75 (0.0689)
C 	0.679 - 0.759 (0.0267 - 0.0300)	1.80 (0.0708)

N6A1397E



N6A0355E

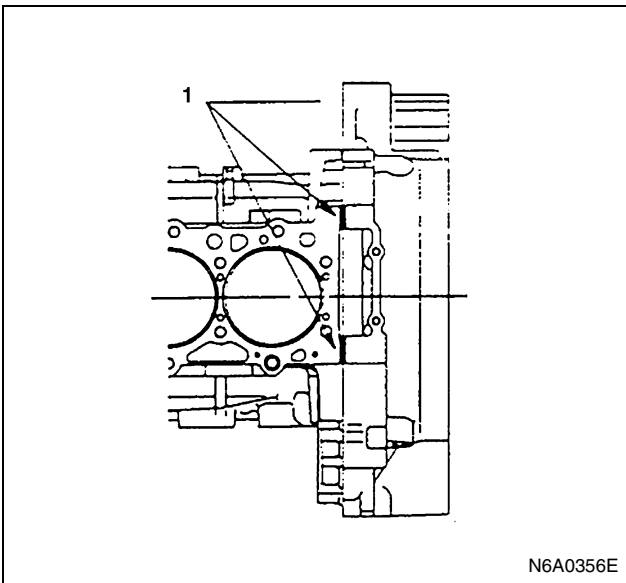
- 5) Apply a 3 mm (0.12 in) bead or recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.



N6A0105E

2. Cylinder Head Assembly

- 1) Align the cylinder body dowels and the cylinder head dowel holes.
- 2) Carefully place the cylinder head on the cylinder head gasket.



N6A0356E

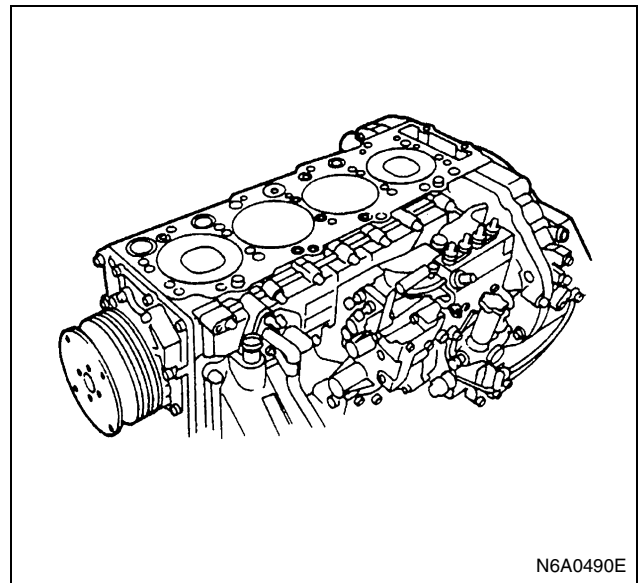
Legend

1. Bead width $\phi 3$

- 6) Install the cylinder head gasket with its "PART NUMBER" mark facing up and toward the left of the engine.

Caution:

Do not reuse the cylinder head gasket.



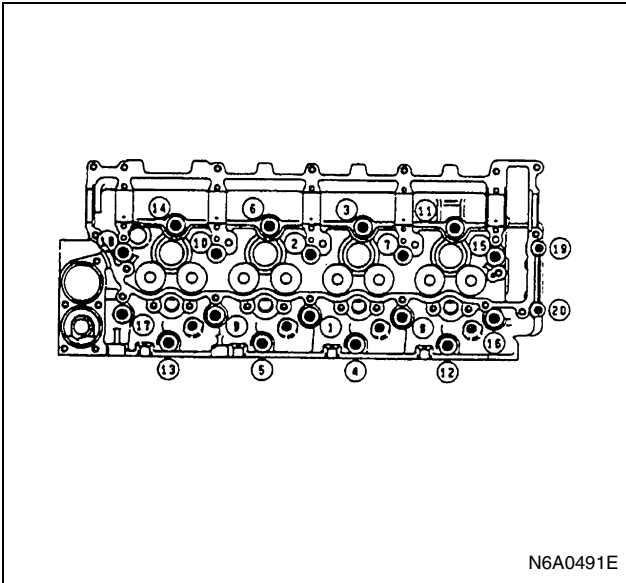
N6A0490E

- 3) Apply a coat of molybdenum disulfide grease to the M14 cylinder head bolt threads and setting faces and apply a coat of engine oil to the M10 cylinder head bolt threads and setting faces.
- 4) Use the angular tightening method to tighten the bolts (M14) to the specified torque in three steps following the numerical order shown in the illustration.

Tighten:

Cylinder head bolt (M14: (1) — (18)) to

- 1st step: 98 N·m (10 kg·m/72 lb·ft)
- 2nd step: 147 N·m (15 kg·m/108 lb·ft)
- 3rd step: 30 — 60°



N6A0491E

5) Tighten the cylinder head to the flywheel housing bolts (M10) to the specified torque.

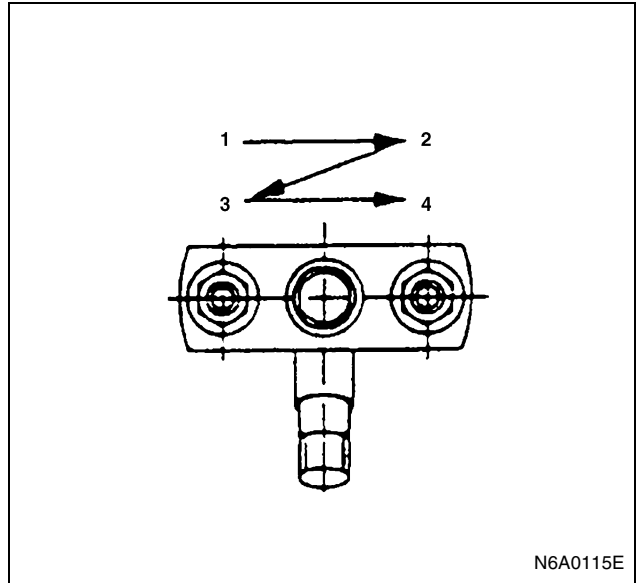
Tighten:

Cylinder head bolt (M10: (19), (20)) to 38 N·m (3.9 kg·m/28 lb·ft)

- 3. Camshaft Bearing Lower
- 4. Camshaft Assembly
- 5. Camshaft Bearing Upper
- 6. Camshaft Bearing Cap
- 7. Valve Cap
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
- 8. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
- 9. Injection Nozzle Holder Assembly
Tighten the nozzle holder flange nuts to the specified torque in the numerical order shown in the illustration.

Tighten:

Nozzle holder flange nut to 19 N·m (1.9 kg·m/14 lb·ft)



N6A0115E

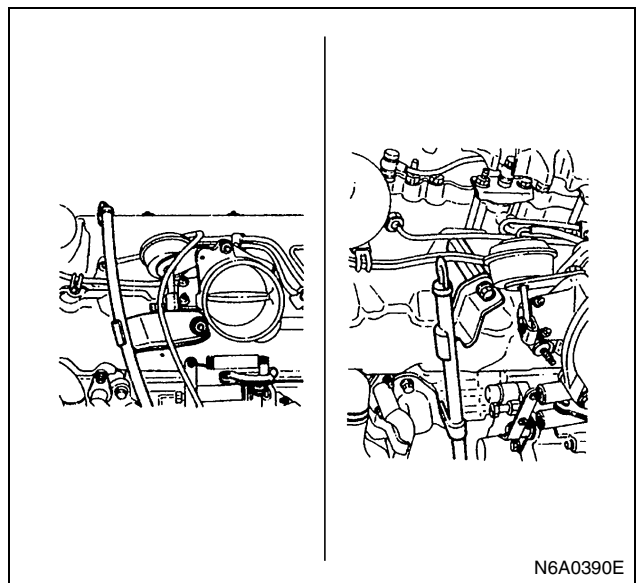
- 10. Glow Plug Connector
- 11. Head Cover Gasket
Install the gasket to the cylinder head cover.
- 12. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
- 13. Coolant Reserve Tank Hose/Bypass Hose
- 14. Radiator Upper Hose

Engine Left Side

- 1. Oil Level Gauge Guide Tube
 - 1) Install the O-rings to the guide tube lower portion and insert the guide tube completely to the cylinder body.
 - 2) Tighten the guide tube bolt to the specified torque.

Tighten:

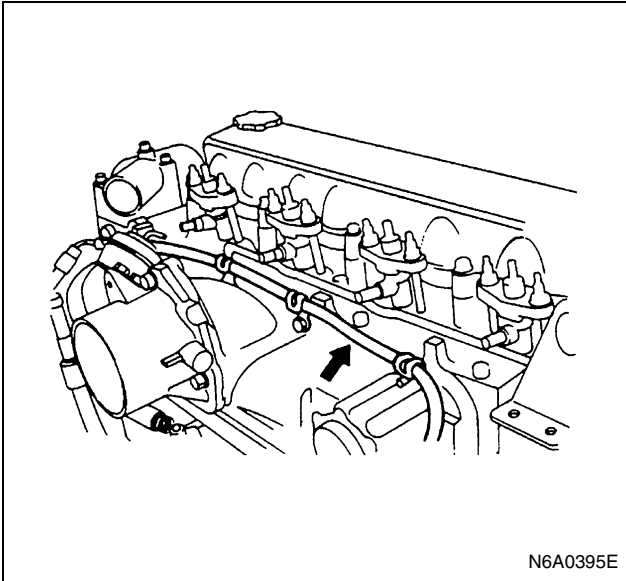
Guide tube bolt to 13 N·m (1.3 kg·m/113 lb·in)



N6A0390E

- 2. Engine Harness

Connect thermometer unit, thermo switch, tachometer sensor and glow plug harness connector and fasten the engine harness with clips.



3. Fuel Injection Pipe Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
4. Positive Crankcase Ventilation (PCV) Hose
5. Water Bypass Hose
6. Fuel Filter & Bracket

Tighten:

Fuel filter bracket to 34 N·m (3.5 kg·m/25 lb·ft)

7. Fuel Pipe
Do not apply excessive force to the fuel pipe.

Tighten:

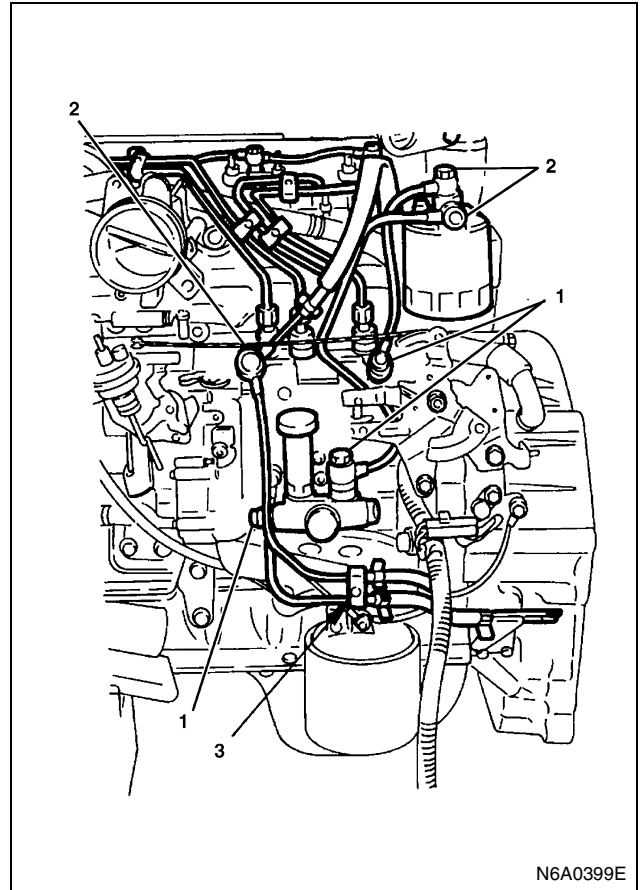
Fuel pipe joint bolt (1) to 41 N·m (4.2 kg·m/30 lb·ft)

Tighten:

Fuel pipe joint bolt (2) to 23 N·m (2.3 kg·m/17 lb·ft)

Tighten:

Clip screw to 4 N·m (0.4 kg·m/35 lb·in)



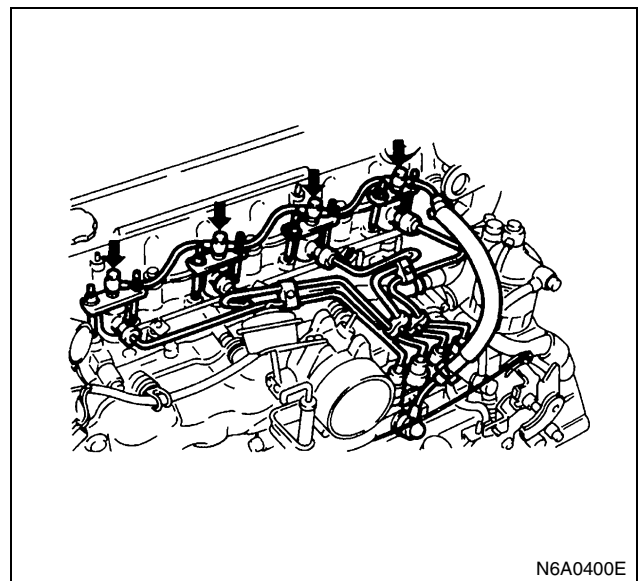
Legend

1. Fuel pipe joint bolt
2. Fuel pipe joint bolt
3. Clip

8. Leak Off Pipe

Tighten:

Leak-off pipe joint bolt to 13 N·m (1.3 kg·m/113 lb·in)



9. Nozzle Cover
10. Vacuum Hose

11. Intake Air Duct

Engine Right Side

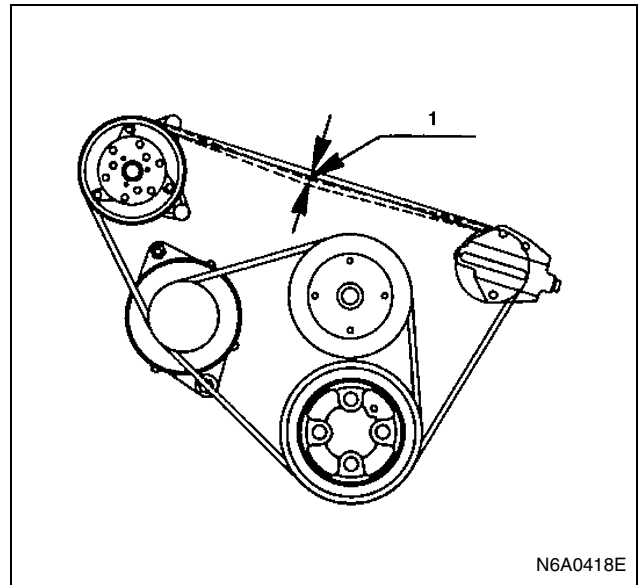
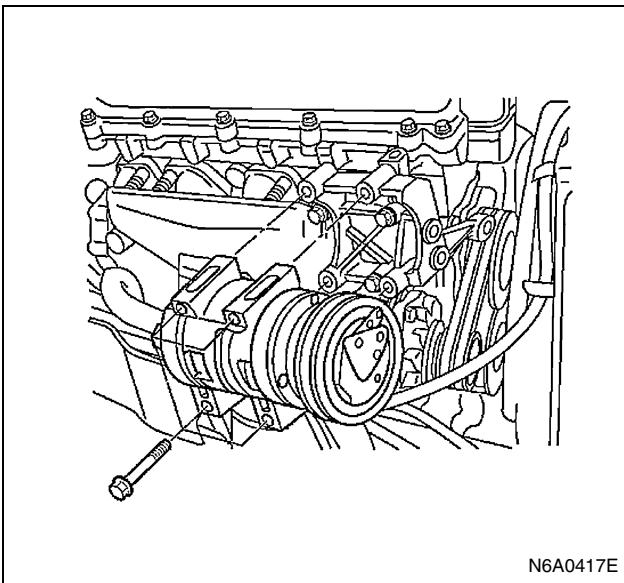
1. Air Conditioning (A/C) Compressor (If equipped with A/C)
Tighten fixing bolts to the specified to torque.

Tighten:

A/C compressor bolt to 48 N·m (4.9 kg·m/35 lb·ft)

Notice:

When tightening the compressor fixing bolts, tighten first the 2 bolts on the rear side, and then the remaining 2 on the front side.



Legend

1. Belt deflection

Tighten:

Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

3. Front Exhaust Pipe

Tighten:

Front exhaust pipe to

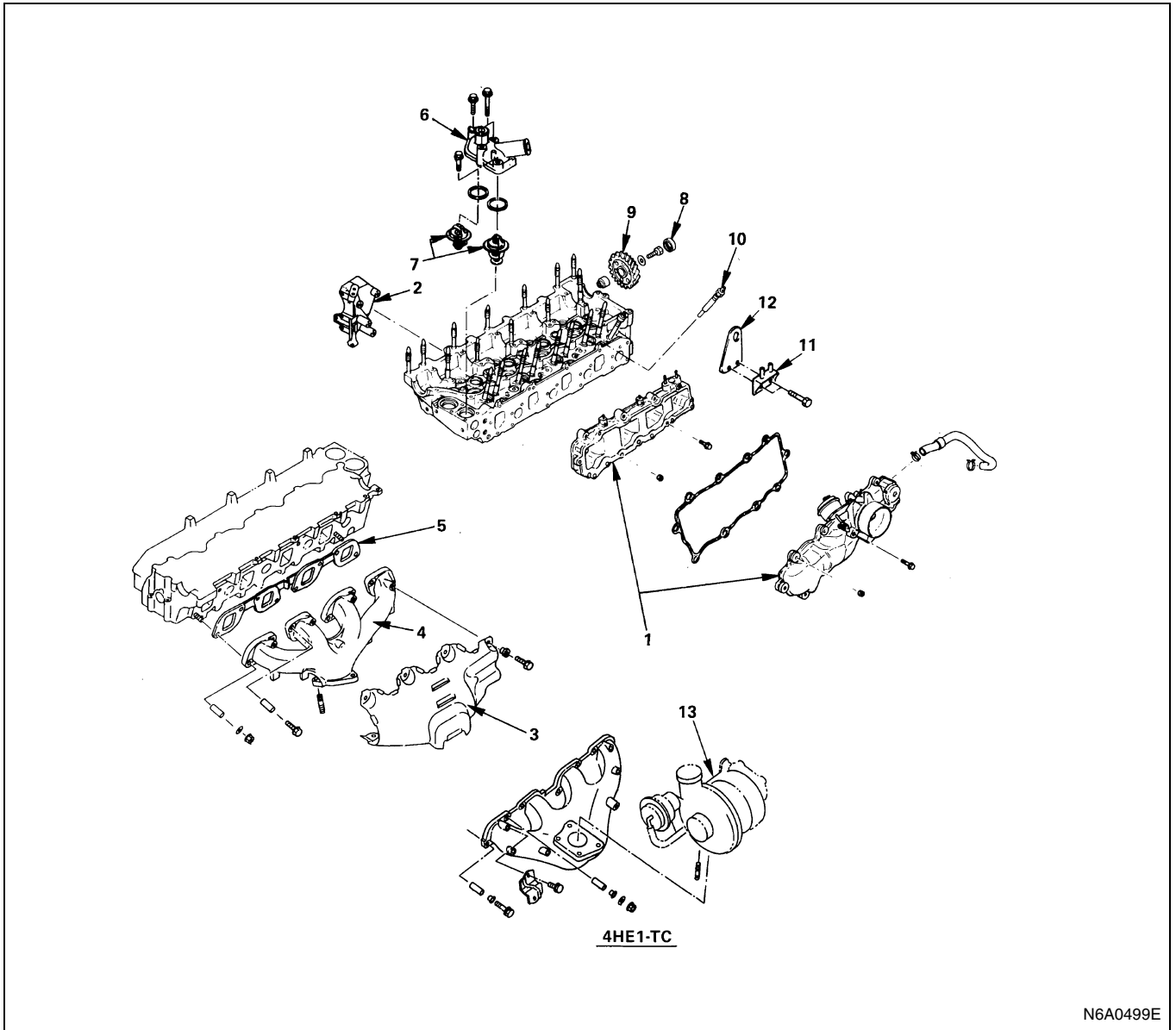
- Exhaust manifold side: 67 N·m (6.8 kg·m/49 lb·ft)
- Exhaust brake side: 17 N·m (1.7 kg·m/12 lb·ft)
 - Connect the negative battery cable.
 - Lower the cab.
 - Start engine and check for oil, fuel and water leakage carefully.

2. A/C Compressor Drive Belt (If equipped with A/C)
 - 1) Install drive belt adjust belt tension by adjusting bolt and tighten locking nut to the specified torque.
 - 2) Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	

CIRCUMFERENCE PARTS OF CYLINDER HEAD

Component



N6A0499E

Legend

- | | |
|--|-------------------------|
| 1. Inlet cover/inlet case | 8. Idle gear C cover |
| 2. A/C compressor bracket (If equipped with A/C) | 9. Idle gear C |
| 3. Heat protector | 10. Glow plug |
| 4. Exhaust manifold | 11. Fuel filter bracket |
| 5. Exhaust gasket | 12. Engine hanger |
| 6. Water outlet pipe | 13. Turbocharger |
| 7. Idle gear C cover | |

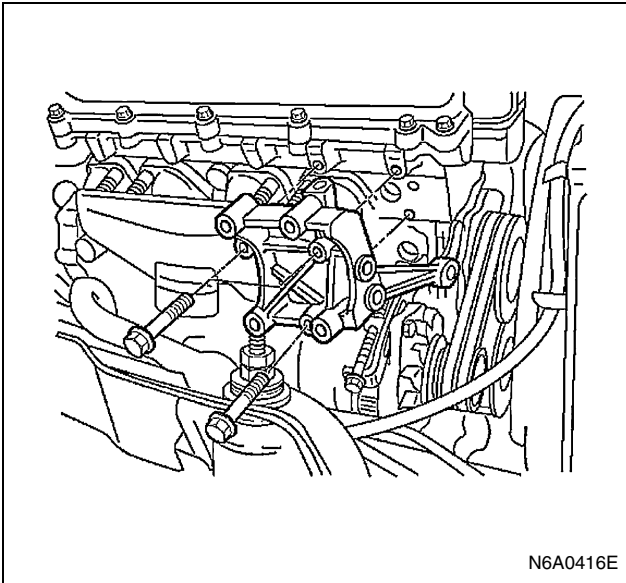
Removal

Preparation

- Disconnect battery ground cable
- Tilt the cab
- Drain coolant

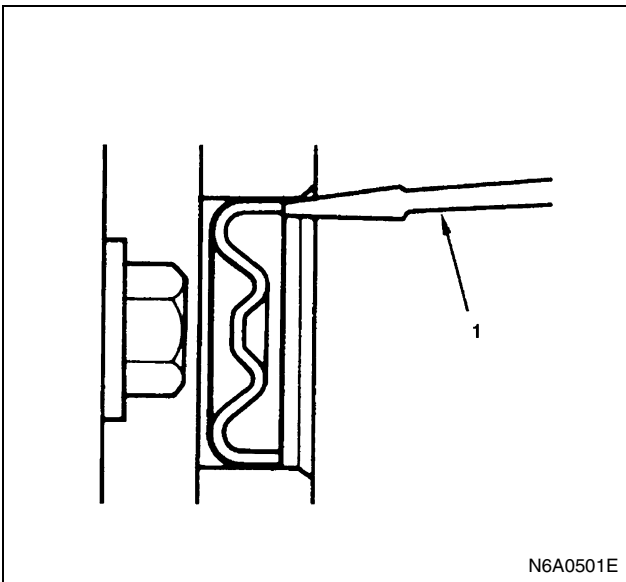
- Remove each part from the cylinder head assembly.
For details, refer to the "CYLINDER HEAD" in this section.

1. Inlet Cover/Inlet Case
2. Air Conditioning (A/C) Compressor Bracket (If equipped with A/C)

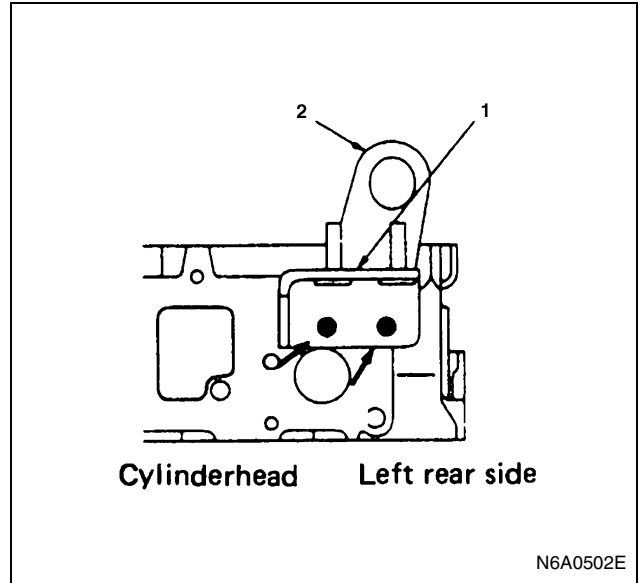


- 3. Heat Protector
- 4. Exhaust Manifold
- 5. Exhaust Gasket
- 6. Water Outlet Pipe
- 7. Thermostat
- 8. Idle Gear C Cover

Tap the outside of the sealing cup with a screwdriver (1) to deform one end of it and draw it out with pliers.



- 9. Idle Gear C
- 10. Glow Plug
- 11. Fuel Filter Bracket
- 12. Engine Hanger



Legend

- 1. Fuel filter bracket
- 2. Engine hanger

Installation

- 1. Engine Hanger
- 2. Fuel Filter Bracket

Tighten:

Fuel filter bracket bolt to 104 N·m (10.6 kg·m/77 lb·ft)

- 3. Glow Plug

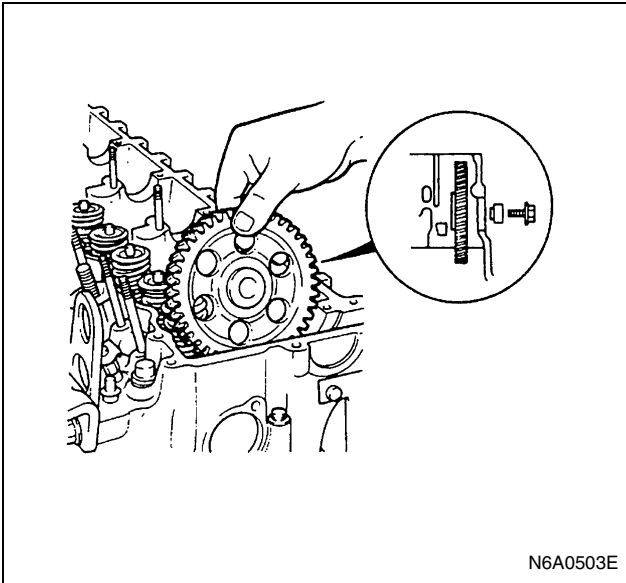
Tighten:

Glow plug to 23 N·m (2.3 kg·m/17 lb·ft)

- 4. Idle Gear C
 - 1) Apply engine oil to the idle gear shaft, bushing and idle gear before installation.
 - 2) Install the idle gear with the boss side facing to the camshaft as shown in the illustration.

Tighten:

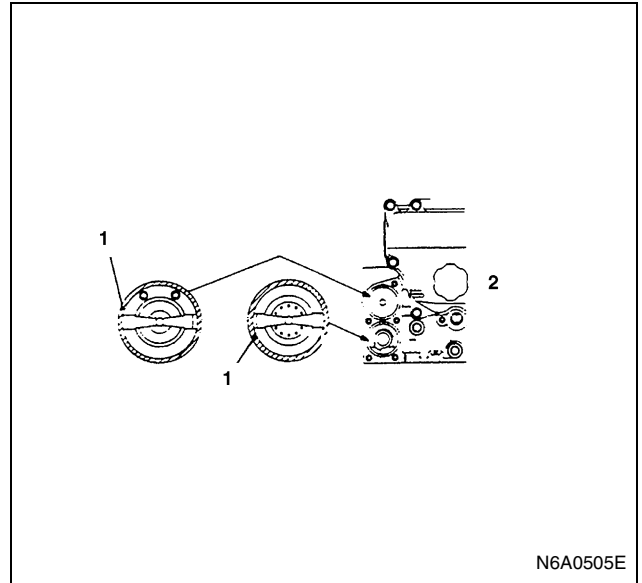
Idle gear C bolt to 95 N·m (9.7 kg·m/70 lb·ft)



N6A0503E

5. Idle Gear C Cover

- 1) Apply the recommended liquid gasket (LOCTITE 262) or its equivalent to the outside of the sealing cup and install it to the cylinder head.
- 2) Use the sealing cup installer and a hammer to drive the sealing cup into position from the cylinder head side as shown in the illustration.
Sealing Cup Installer: 5-8840-2222-0



N6A0505E

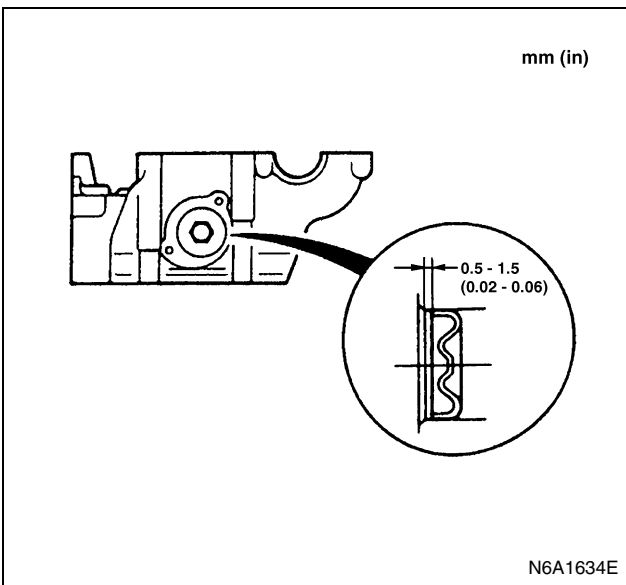
Legend

1. Gasket
2. Top face of the head

7. Water Outlet Pipe

Tighten:

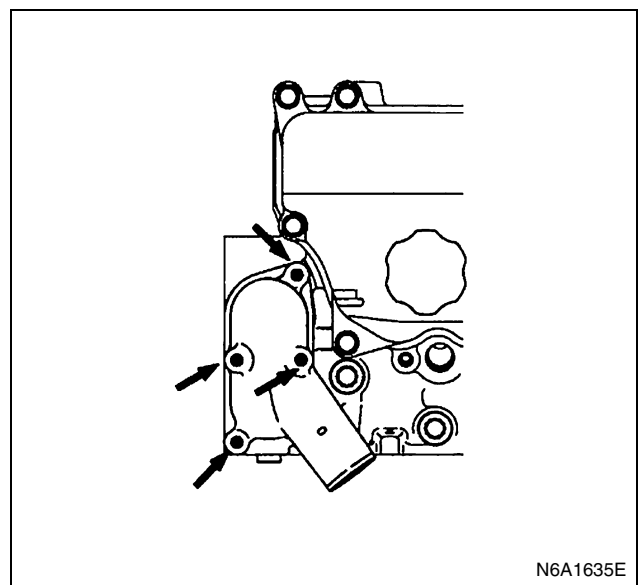
Water outlet pipe bolt to 24 N·m (2.4 kg·m/17 lb·ft)



N6A1634E

6. Thermostat

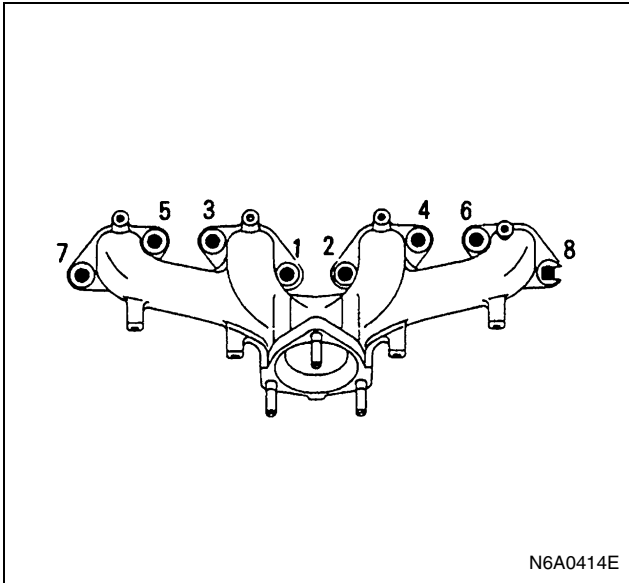
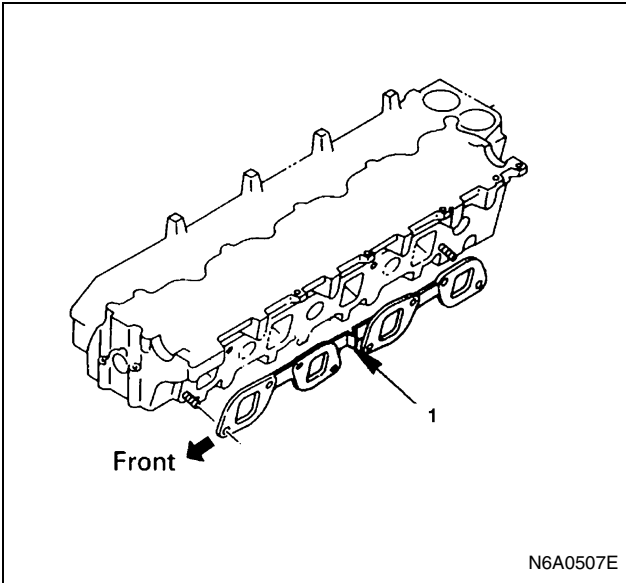
Install the gaskets to the thermostat and install them to the cylinder head as shown in the illustration.



N6A1635E

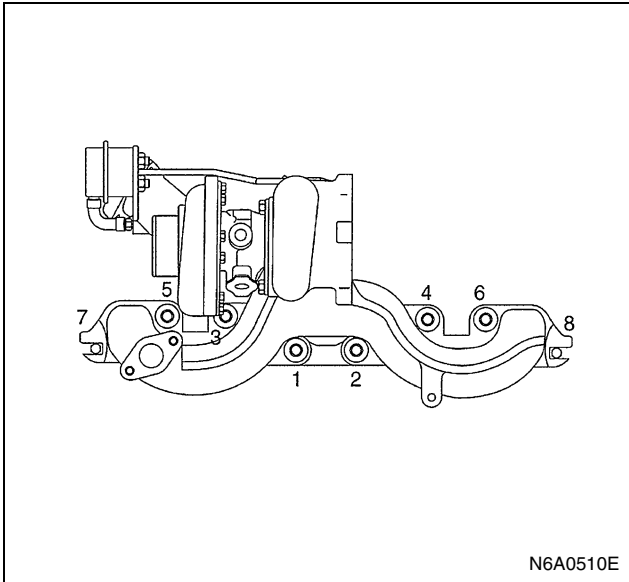
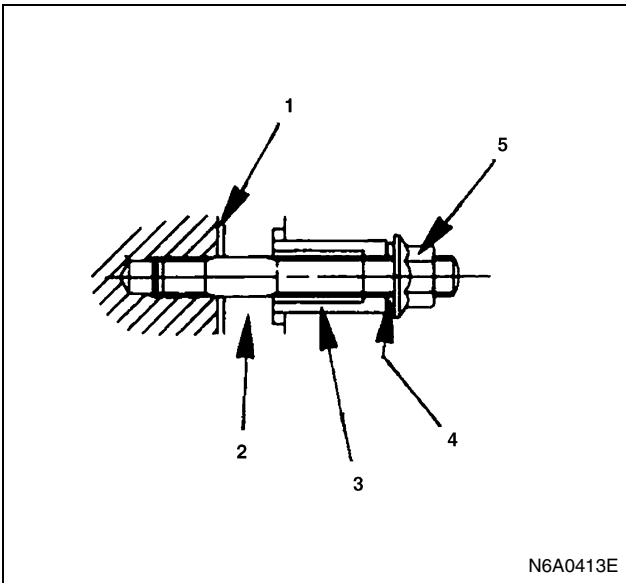
8. Exhaust Gasket

Insert the gasket into the stud provided to the cylinder head (with the projection (1) of the gasket on this side).



9. Exhaust Manifold

1) Install exhaust manifold gaskets (1), exhaust manifold (2), distance pieces (3), dish washers (4) and nuts (5) to the stud bolts shown in the illustration.

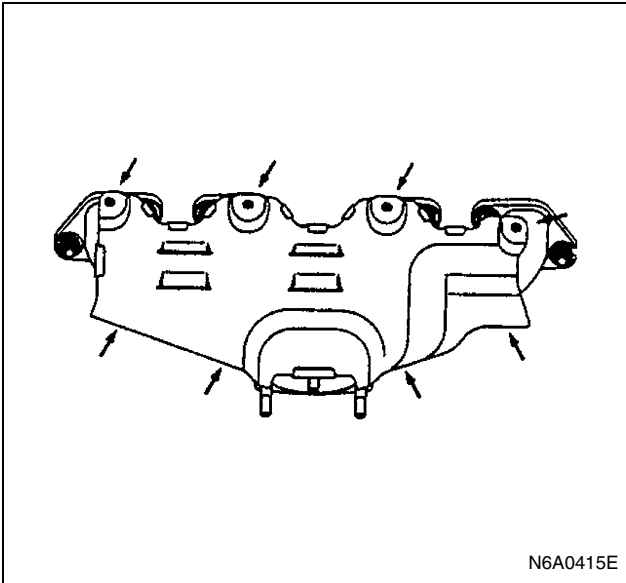


10. Heat Protector

Tighten:
Heat protector bolt to 10 N·m (1.0 kg·m/87 lb·in)

2) Tighten the nuts to the specified torque in the numerical order shown in the illustration.

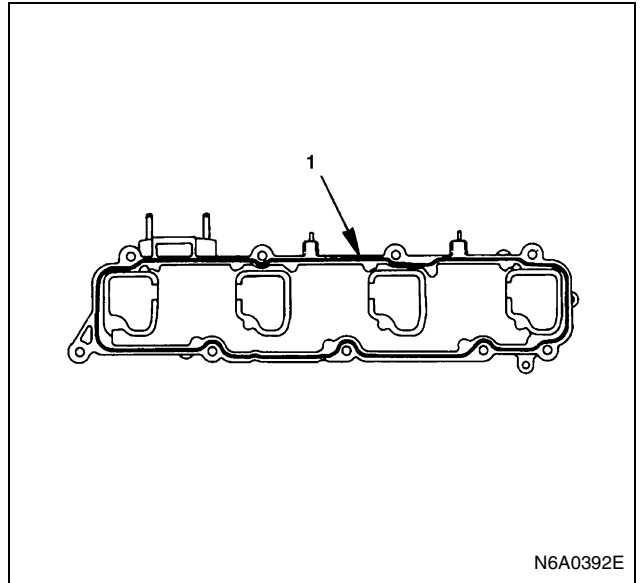
Tighten:
Exhaust manifold nut to 34 N·m (3.5 kg·m/25 lb·ft)



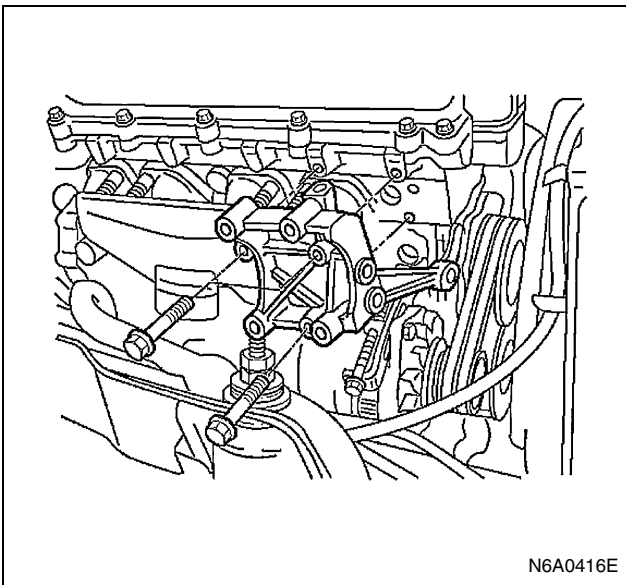
11. Air Conditioning (A/C) Compressor Bracket (If equipped with A/C)
Tighten fixing bolts to the specified torque.

Tighten:

A/C compressor bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)

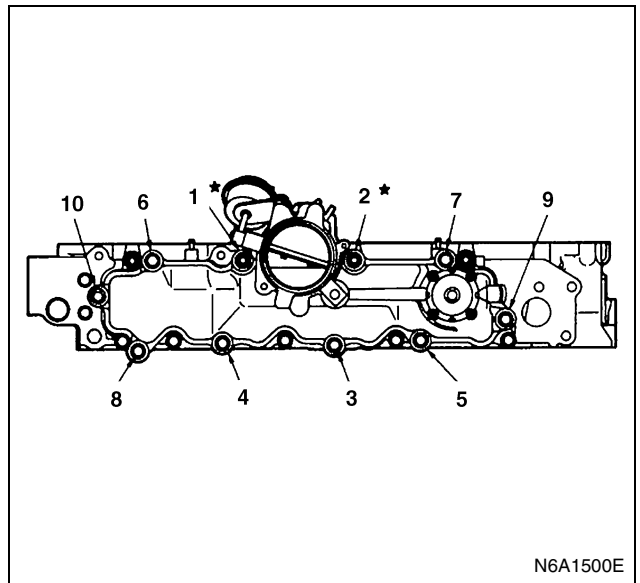


- 2) Install the inlet case to the cylinder head.
- Install the inlet case within 7 minutes after application of liquid gasket.
 - Attach harness clips ((1), (6) and (7)) and tighten the inlet cover bolts and nuts to the specified torque in the numerical order shown in the illustration.



12. Inlet Cover/Inlet Case

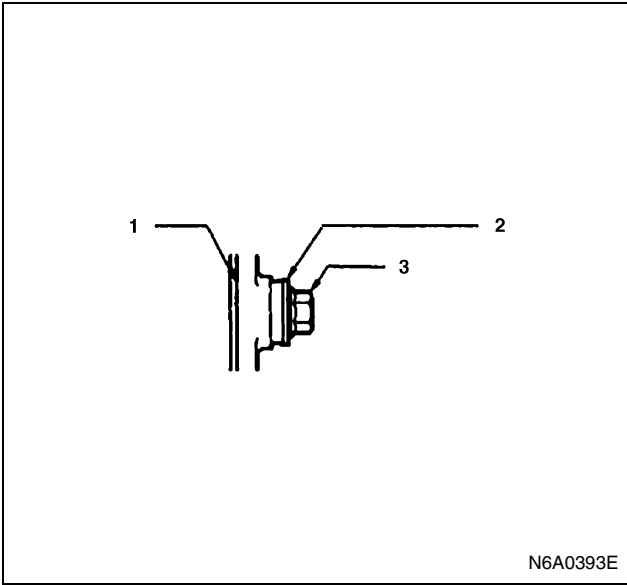
- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove (1) of the inlet case fitting surfaces shown in the illustration.
- Clean the inlet case fitting surface of the cylinder head.



- ★ marks are located on nut positions.

Tighten:

Inlet cover bolt and nut to 13 N·m (1.3 kg·m/9 lb·ft)



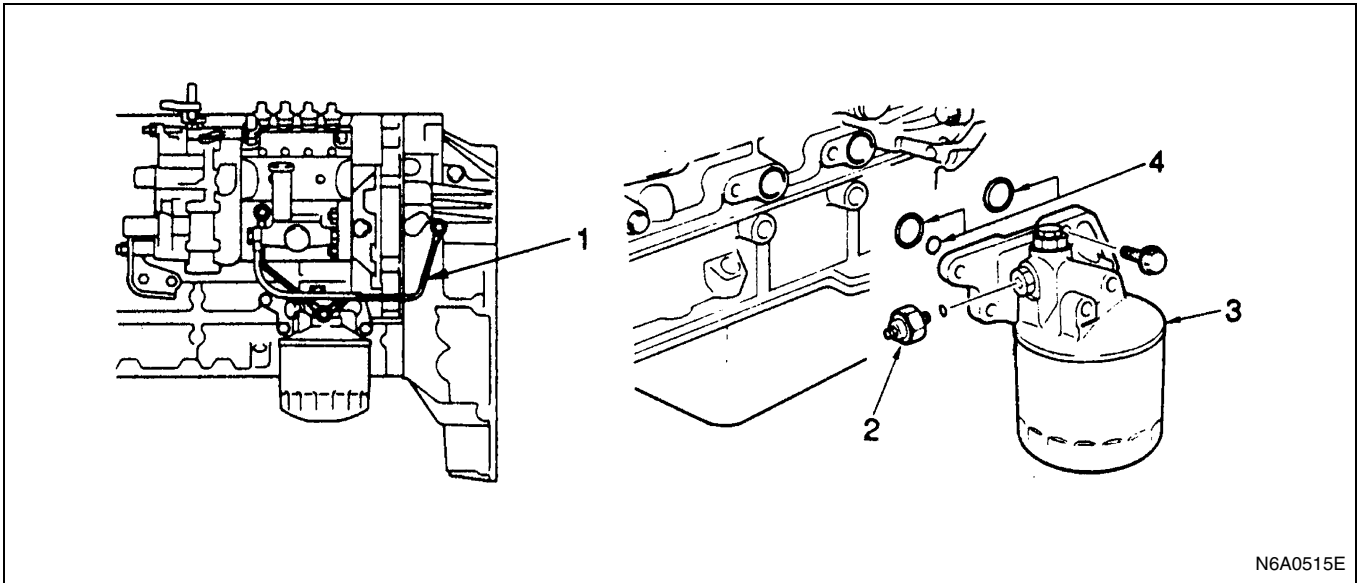
Legend

- 1. Inlet cover
- 2. Mounting rubber
- 3. Bolt

Refer to "CYLINDER HEAD" in this section, install the remaining parts.

OIL FILTER ASSEMBLY

Component



N6A0515E

Legend

- | | |
|------------------------|---------------|
| 1. Oil pipe | 3. Oil filter |
| 2. Oil pressure switch | 4. O-ring |

Removal

Preparation

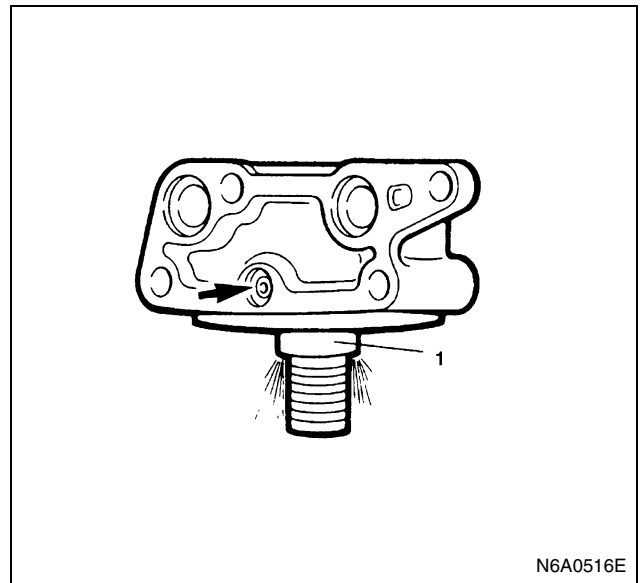
- Disconnect battery ground cable.
- Place a receptacle beneath the oil filter to contain the drained oil.

1. Oil Pipe
2. Oil Pressure Switch
3. Oil Filter
4. O-ring

Inspection

Oil Filter Cover

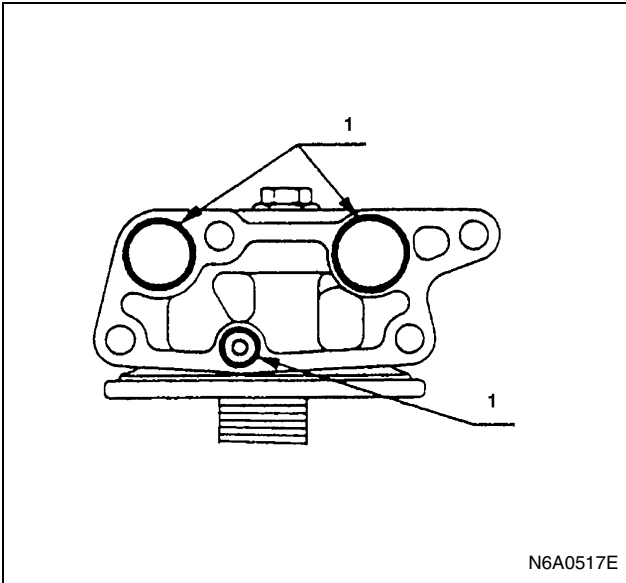
1. Check the partial filter orifice for any clogging.
2. Send air into the arrow-marked hole in the illustration, and check to see if the air blows out from the small holes in the center sleeve (1).



N6A0516E

Installation

1. O-Ring
Apply a coat of engine oil to the O-rings (1) and install them to the cylinder body.

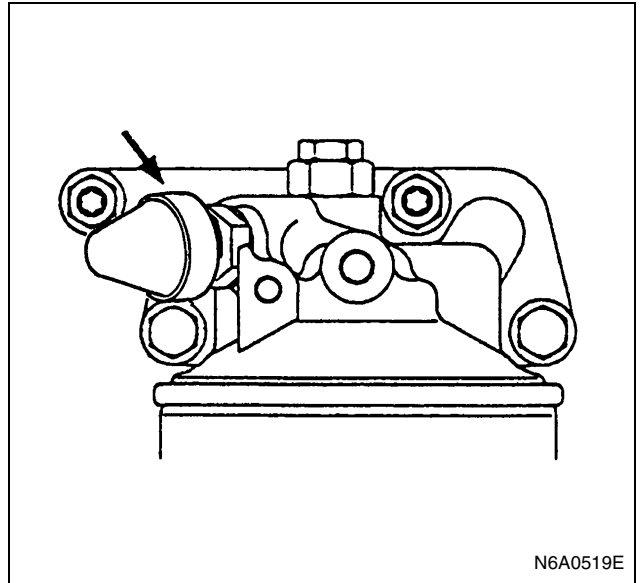


N6A0517E

2. Oil Filter

Tighten:

Oil filter cover bolt to 48 N·m (4.9 kg·m/35 lb·ft)



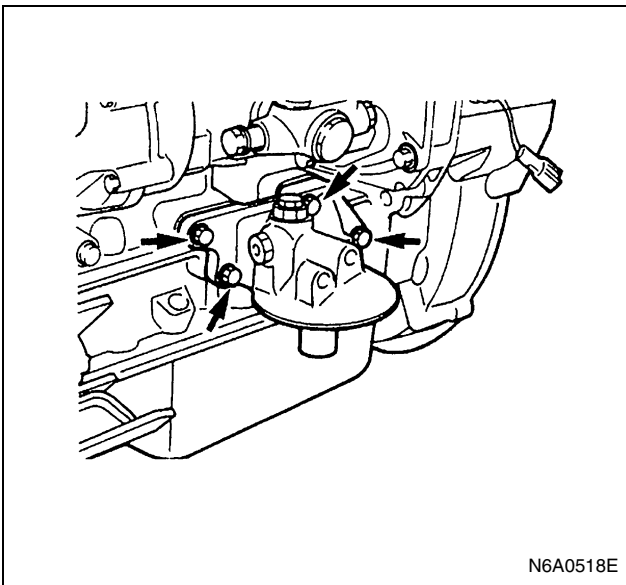
N6A0519E

4. Oil Pipe

Tighten:

Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)

- Connect battery ground cable.
- Start engine and check for oil leakage carefully.



N6A0518E

3. Oil Pressure Switch

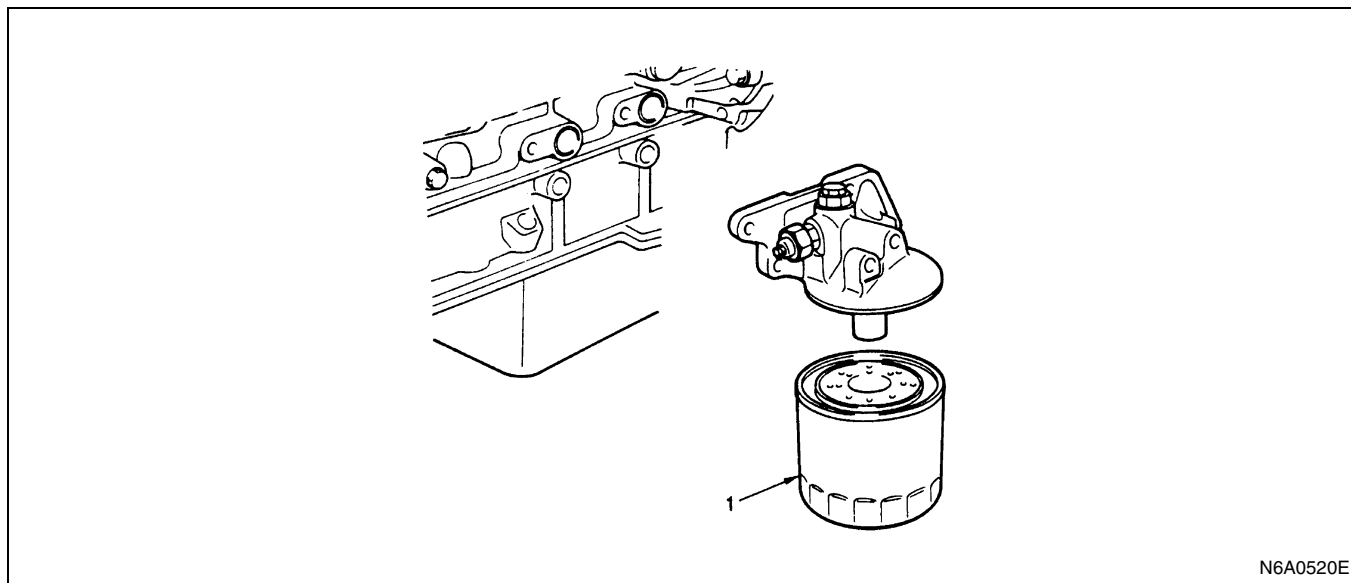
- 1) Apply the recommended liquid gasket (LOCTITE 262) or its equivalent to at least 2 — 3 of the oil pressure switch threaded areas.
- 2) Install the oil pressure switch to the oil filter cover.

Tighten:

Oil pressure switch to 13 N·m (1.3 kg·m/113 lb·in)

OIL FILTER CARTRIDGE

Component



Legend

1. Oil filter cartridge

Removal

Preparation

- Disconnect battery ground cable.
- Place a receptacle beneath the oil filter to contain the drained oil.

1. Oil Filter Cartridge

Use an oil filter wrench to remove the oil filter cartridge.

Oil Filter Wrench: 1-8522-1097-0

5-8840-2094-0 (4WD model)

Installation

1. Oil Filter Cartridge

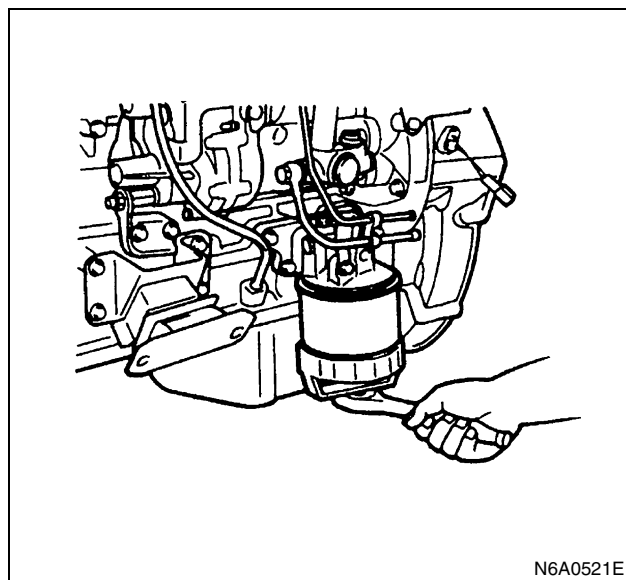
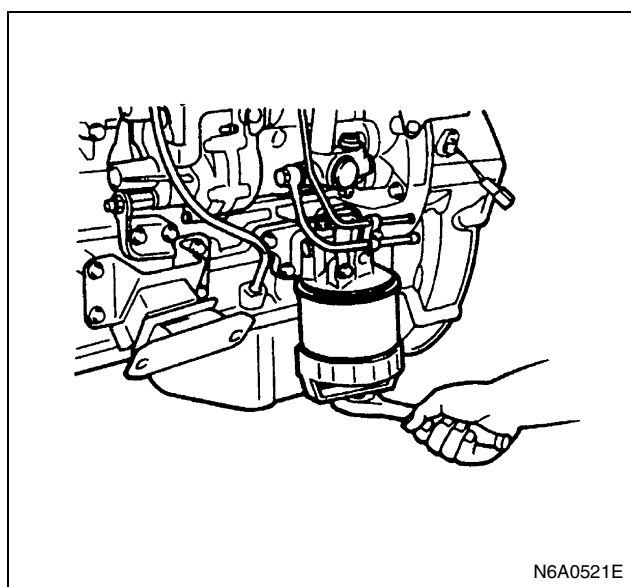
- 1) Clean the oil filter fitting face.
- 2) Apply a light coat of engine oil to the O-ring.
- 3) Turn in the new oil filter until the filter O-ring is fitted against the sealing face.
- 4) Use an oil filter wrench to install the new oil filter cartridge.

Oil Filter Wrench: 1-8522-1097-0

5-8840-2094-0 (4WD model)

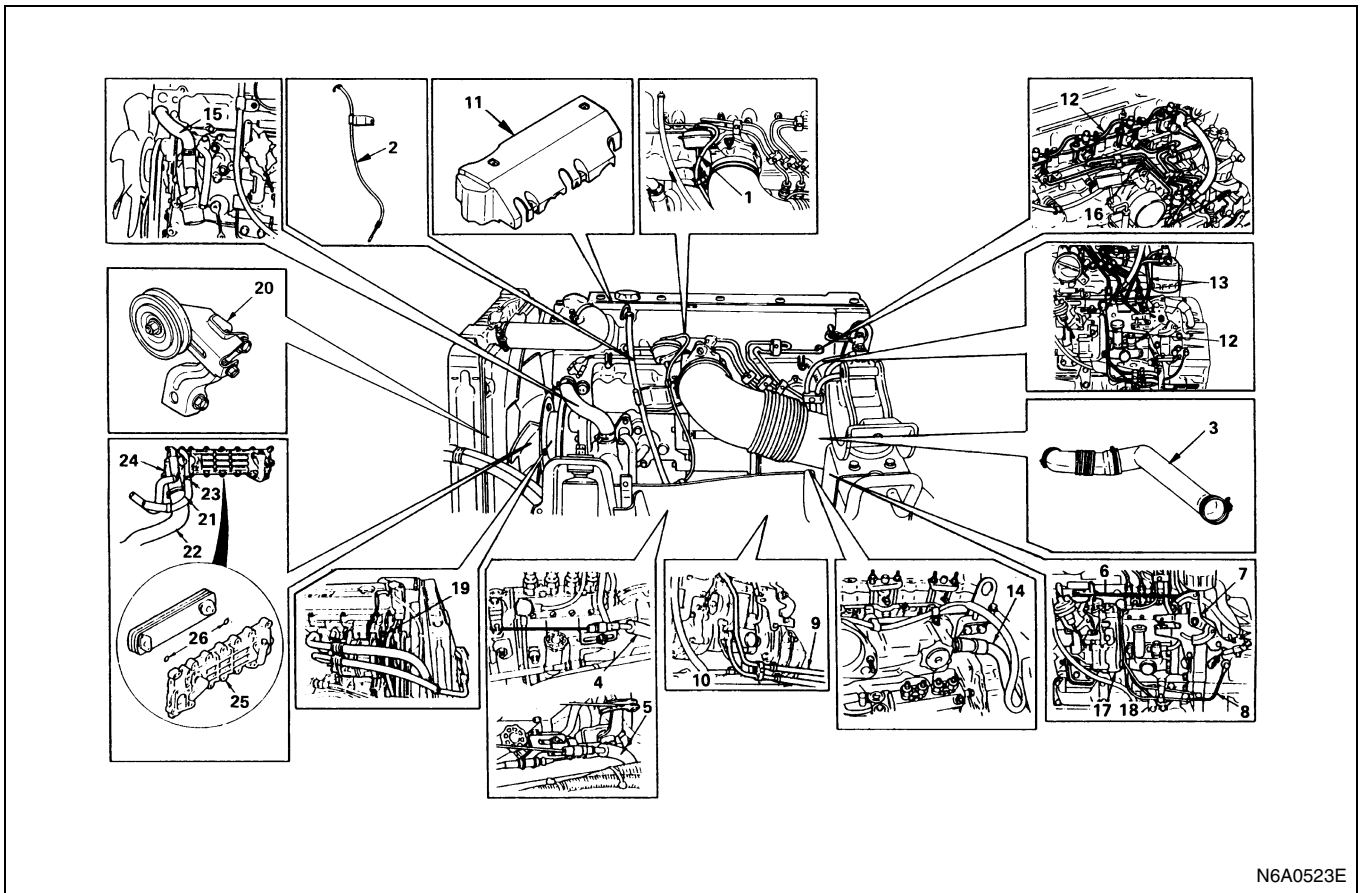
Tighten:

Oil filter to 64 N·m (6.5 kg·m/47 lb·ft)



OIL COOLER

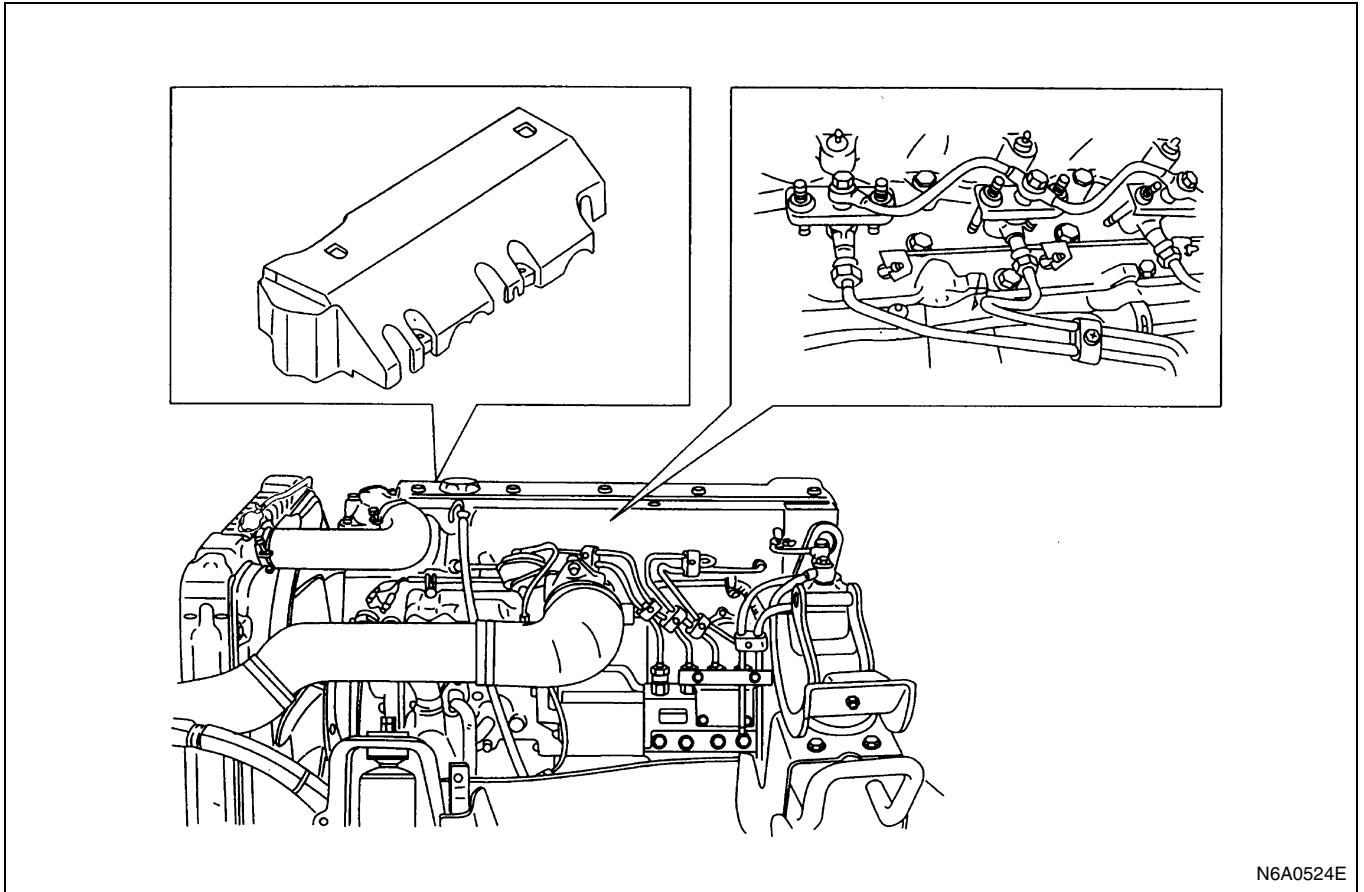
Component



N6A0523E

Legend

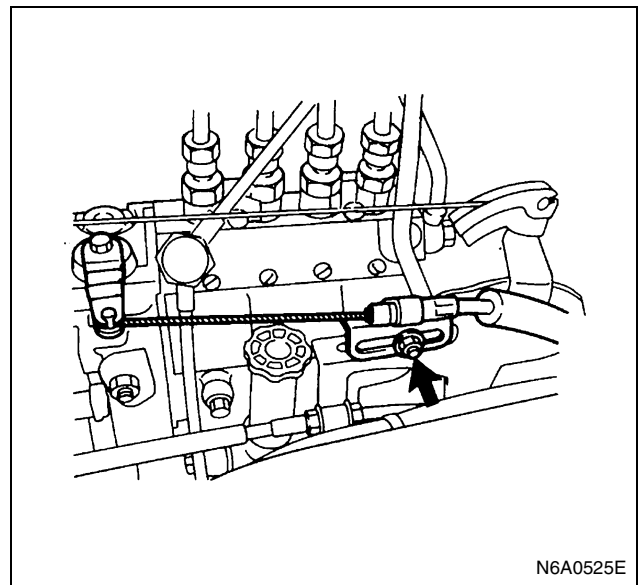
- | | |
|----------------------------------|--|
| 1. Vacuum hose | 14. PCV hose |
| 2. Oil level guide tube | 15. Water bypass hose |
| 3. Intake air duct | 16. Injection pipe |
| 4. Engine stop cable | 17. Injection pump assembly |
| 5. Accelerator control cable | 18. Injection pump rubber spacer |
| 6. Engine control cable | 19. A/C drive belt (If equipped with A/C) |
| 7. Engine control lever assembly | 20. Idle pulley bracket (If equipped with A/C) |
| 8. Oil pipe | 21. Heater hose |
| 9. Fuel return hose | 22. Radiator lower hose |
| 10. Fuel feed hose | 23. Heater pipe |
| 11. Nozzle cover | 24. Water suction pipe |
| 12. Leak off pipe | 25. Oil cooler assembly |
| 13. Fuel pipe | 26. O-ring |



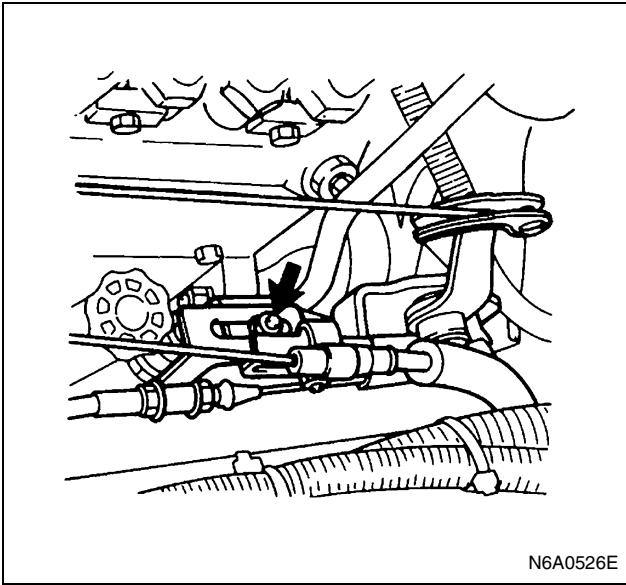
Removal

Preparation

- Disconnect the battery ground cable
 - Drain coolant
1. Vacuum Hose
 2. Oil Level Guide Tube
Remove the guide tube fixing bolt and pull out the guide tube.
 3. Intake Air Duct
 4. Engine Stop Cable
Loosen the locking nut at the bracket and disconnect engine stop cable from injection pump stop lever.

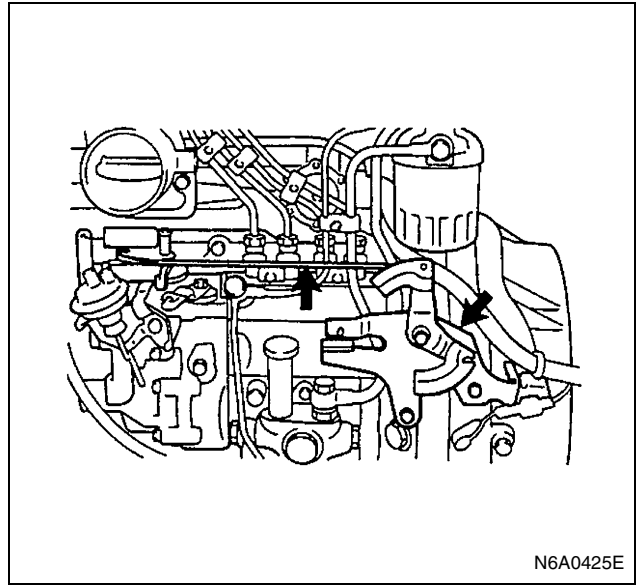


5. Accelerator Control Cable
Loosen the locking nut at the bracket and disconnect accelerator control cable from injection pump control lever.



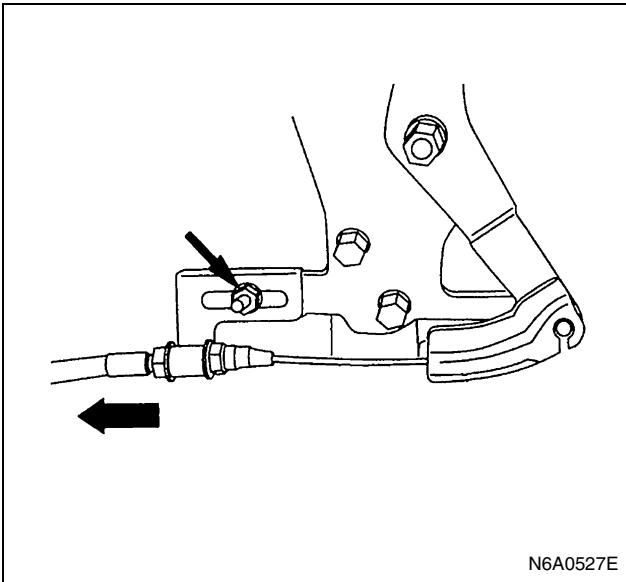
N6A0526E

For 4HE1-TC



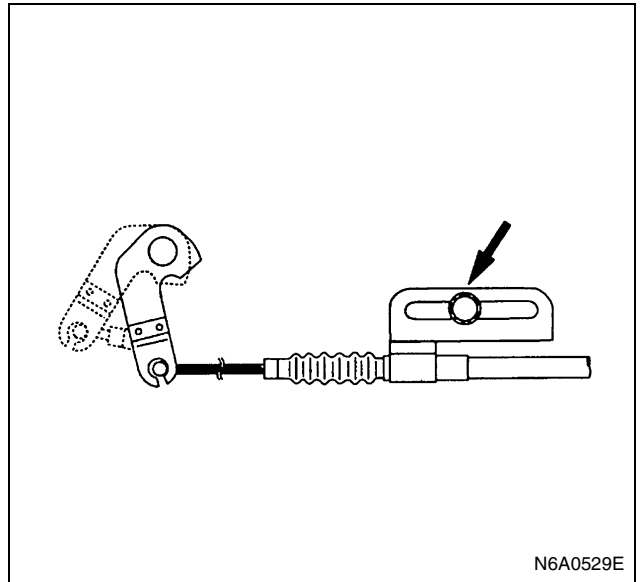
N6A0425E

For 4HE1-TC



N6A0527E

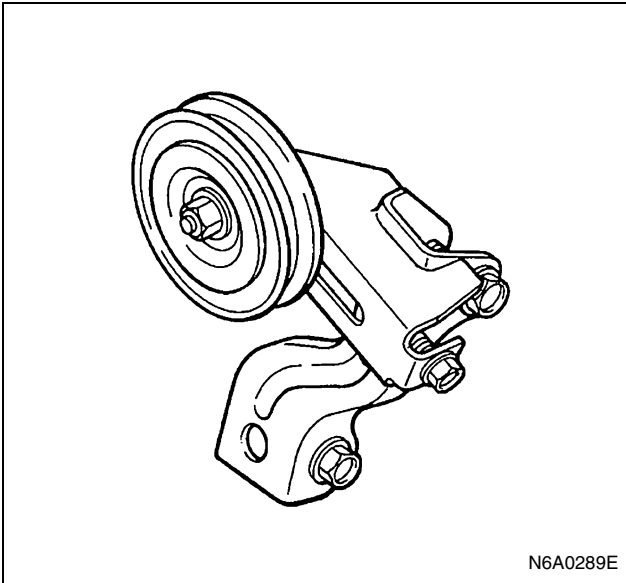
- 6. Engine Control Cable
- 7. Engine Control Lever Assembly



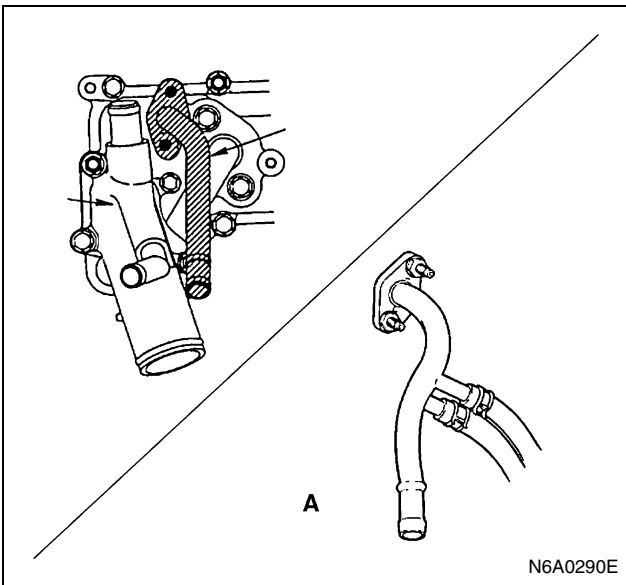
N6A0529E

- 8. Oil Pipe
- 9. Fuel Return Hose
- 10. Fuel Feed Hose
Disconnect fuel hose from injection pump side and take care not to spill and enter dust.
- 11. Nozzle Cover
- 12. Leak Off Pipe
- 13. Fuel Pipe
- 14. Positive Crankcase Ventilation (PCV) Hose
- 15. Water Bypass Hose
- 16. Injection Pipe
- 17. Injection Pump Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
- 18. Injection Pump Rubber Spacer (for 4HF1/4HG1-T)
- 19. Air Conditioning (A/C) Drive Belt (If equipped with A/C)

20. Idle Pulley Bracket (If equipped with A/C)
After removal of the A/C drive belt, remove the 3 bracket fixing bolts. Then, remove the bracket with the tensioner and the idler attached.



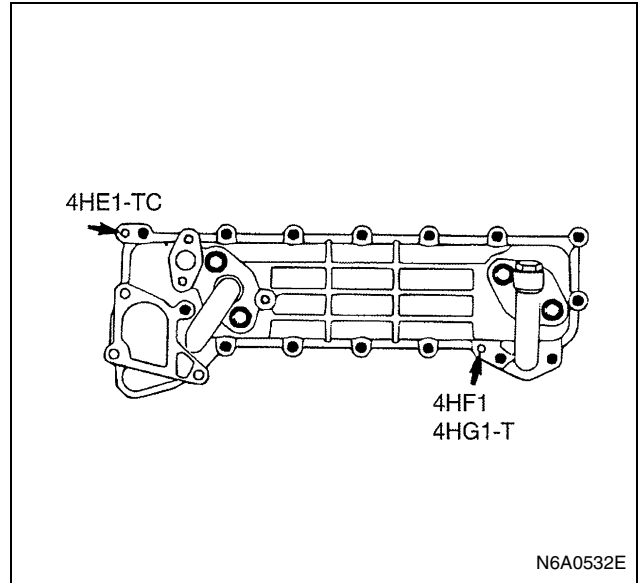
21. Heater Hose
22. Radiator Lower Hose
23. Heater Pipe



Legend

A. 4HF1-2

24. Water Suction Pipe
25. Oil Cooler Assembly
1) Remove the oil cooler bolts.
2) Install a oil cooler fixing bolt to the oil cooler replace hole as shown in the illustration, and tighten the bolt alternately a little at a time.

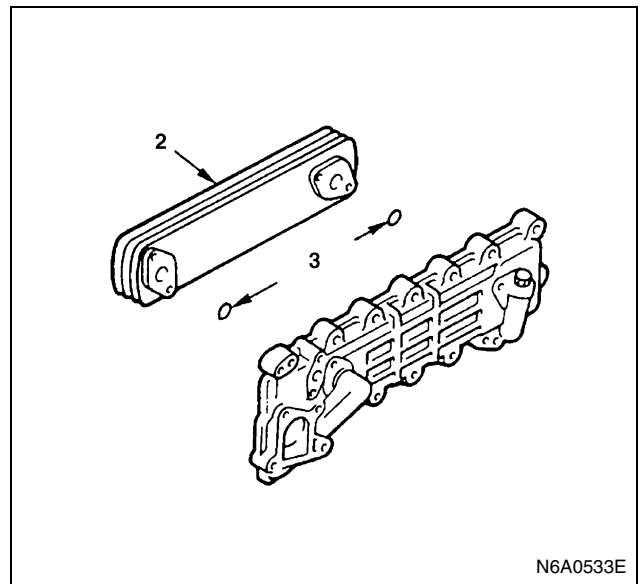


26. O-Ring

Disassembly

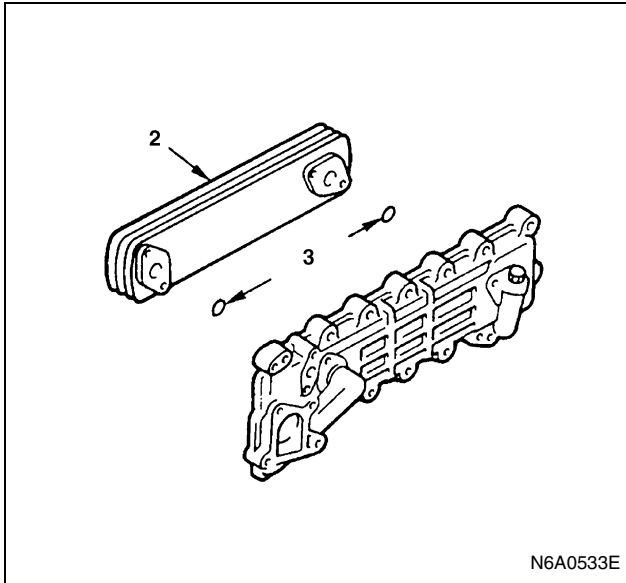
(Oil Cooler Assembly)

1. Element fixing bolts
2. Element
3. O-Ring



Reassembly

1. O-Ring
Apply a coat of engine oil to the O-rings and install the O-rings the oil cooler.
2. Element



Legend

- 2. Element
- 3. O-ring

- 3. Element fixing bolts

Tighten:

Element fixing bolts to 20 N·m (2.0 kg·m/14 lb·ft)

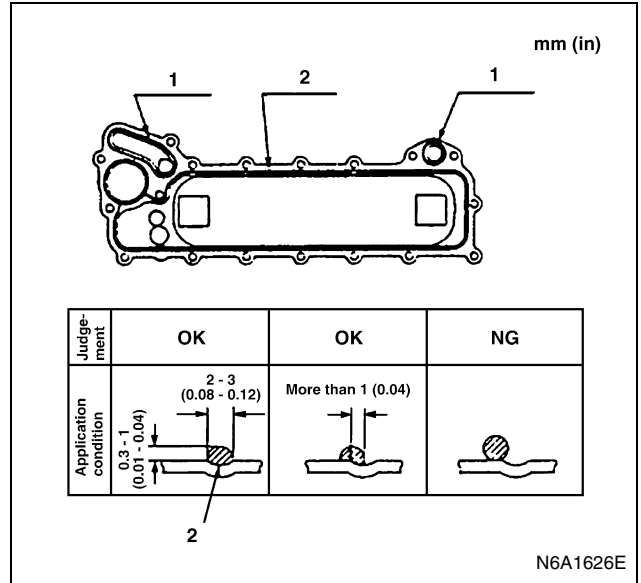
Installation

1. O-Ring
2. Oil Cooler Assembly
 - 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the oil cooler fitting surface.
 - 2) Apply a coat of engine oil to the O-rings (2 pieces) and install the O-rings to the oil cooler.

Notice:

Take care that the O-ring is not smeared with liquid gasket.

- Install the oil cooler within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.



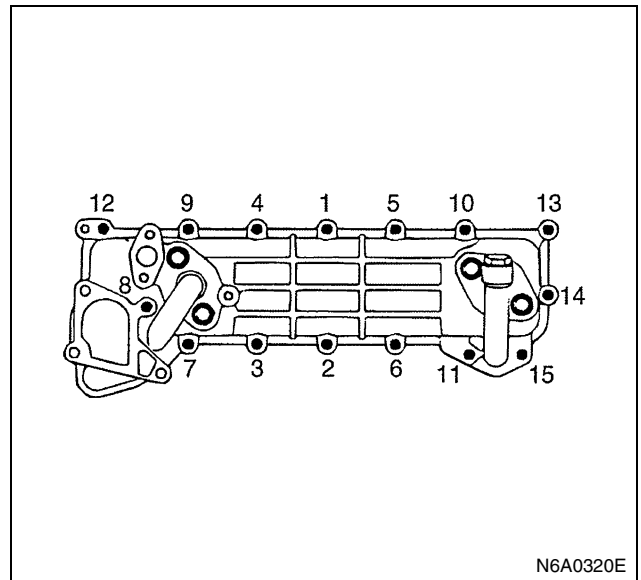
Legend

- 1. O-ring
- 2. Liquid gasket

- 3) Tighten the oil cooler bolts and nut to the specified torque a little at a time in the sequence shown in the illustration.

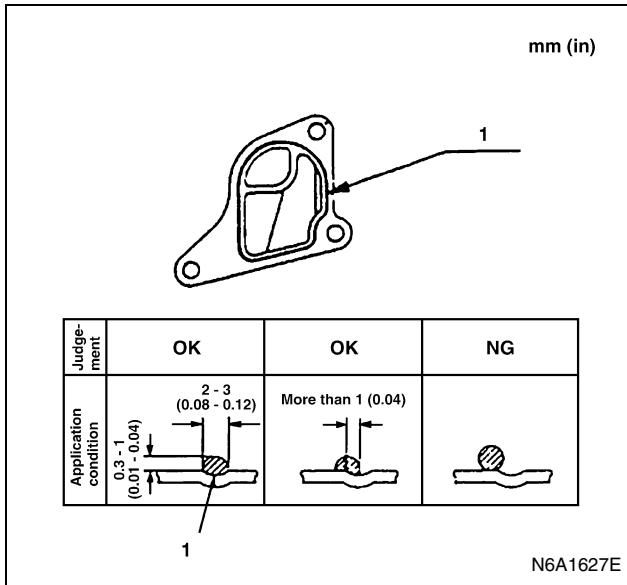
Tighten:

Oil cooler bolt and nut to 24 N·m (2.4 kg·m/17 lb·ft)



- 3. Water Suction Pipe

- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove of the water suction pipe fitting surface.
- 2) Install the water suction pipe to the oil cooler.
 - For the dislocation of liquid gasket, refer to the illustration.



Legend

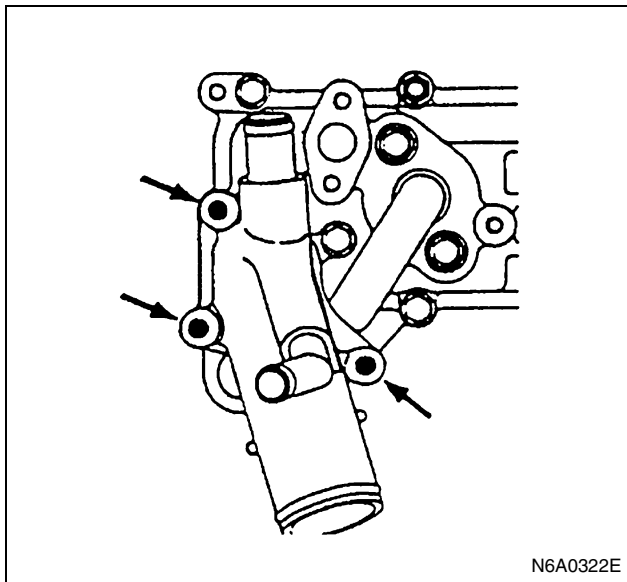
1. Liquid gasket

Tighten:

Water suction pipe bolt to 24 N·m (2.4 kg·m/17 lb-ft)

Notice:

Install the water suction pipe immediately after the installation of the oil cooler.

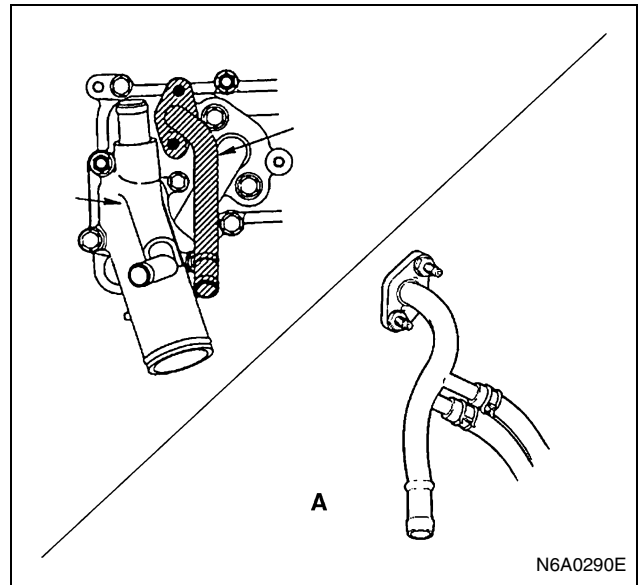


4. Heater Pipe

- 1) Install the O-ring to the heater pipe.
- 2) Install the heater pipe to the oil cooler.

Tighten:

Heater pipe bolt to 24 N·m (2.4 kg·m/17 lb-ft)

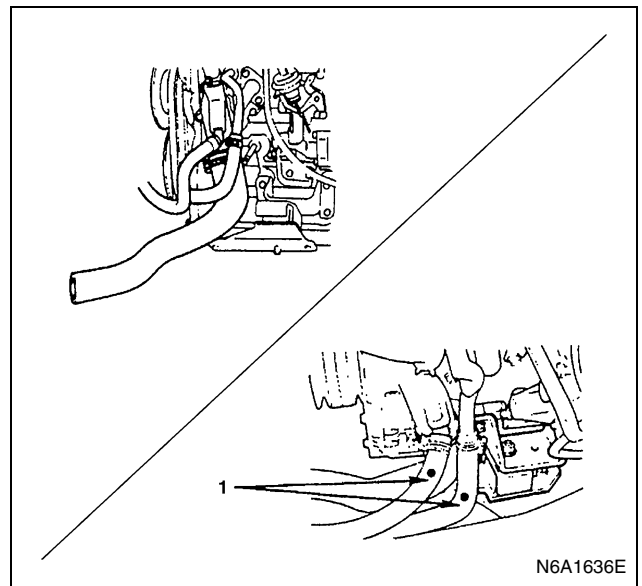


Legend

- A. 4HF1-2

5. Radiator Lower Hose

6. Heater Hose



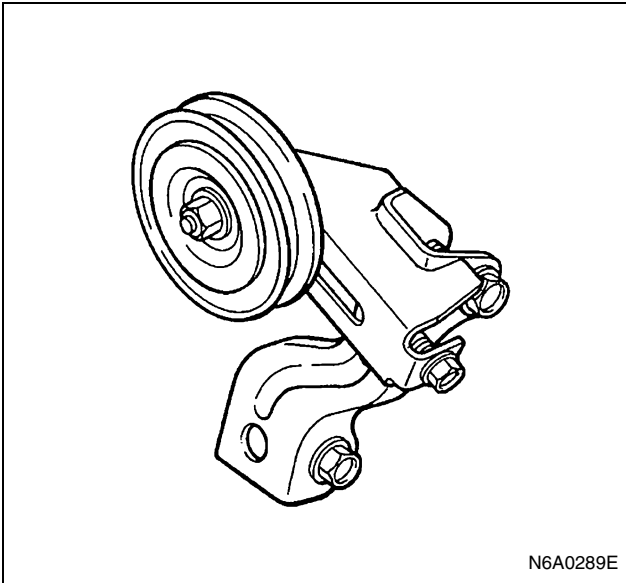
Legend

1. Mark

7. Idle Pulley Bracket (If equipped with A/C)

Tighten:

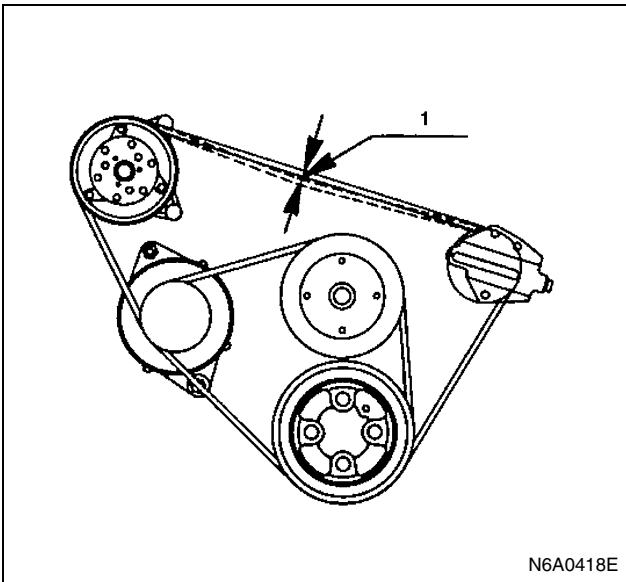
Idle pulley bracket bolt to 48 N·m (4.9 kg·m/35 lb-ft)



8. Air Conditioning (A/C) Drive Belt (If equipped with A/C)

- Install drive belt adjust belt tension by adjusting bolt and tighten locking nut to the specified torque.
- Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ... New belt	
18 — 22 (0.71 — 0.87) ... Reuse belt	



Legend

1. Belt deflection

Tighten:

Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

9. Injection Pump Rubber Spacer (4HF1/4HG1-T)
10. Injection Pump Assembly

11. Injection Pipe
12. Water Bypass Hose
13. Positive Crankcase Ventilation (PCV) Hose
14. Fuel Pipe
15. Leak Off Pipe
16. Nozzle Cover
17. Fuel Feed Hose
18. Fuel Return Hose

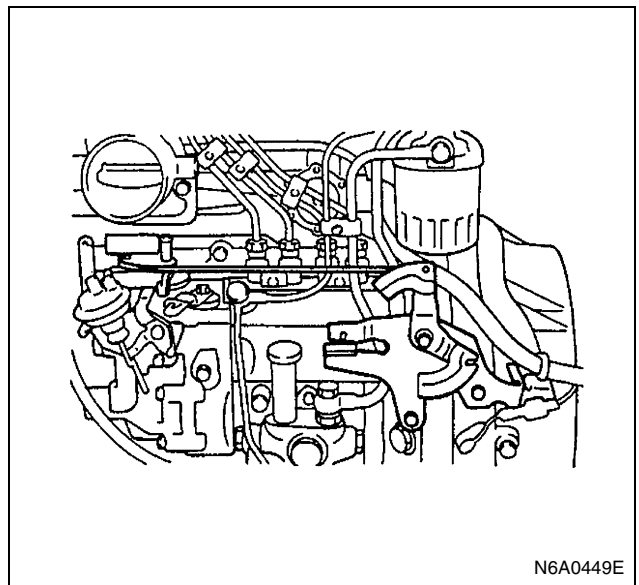
Air Bleeding

Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.

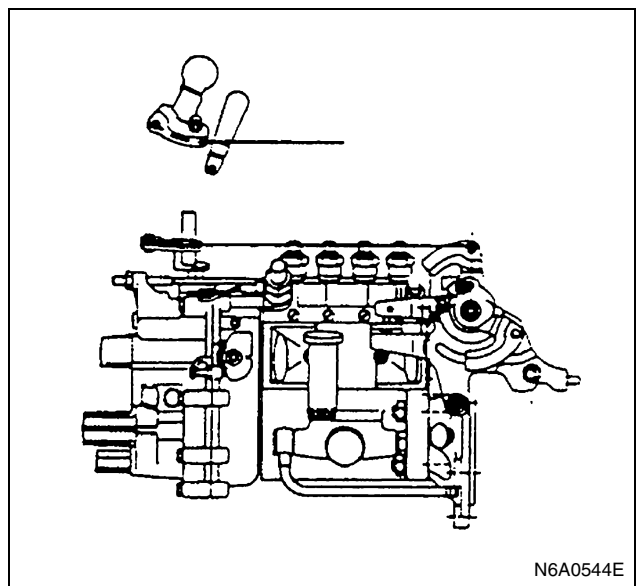
19. Oil Pipe
20. Engine Control Lever Assembly

Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)



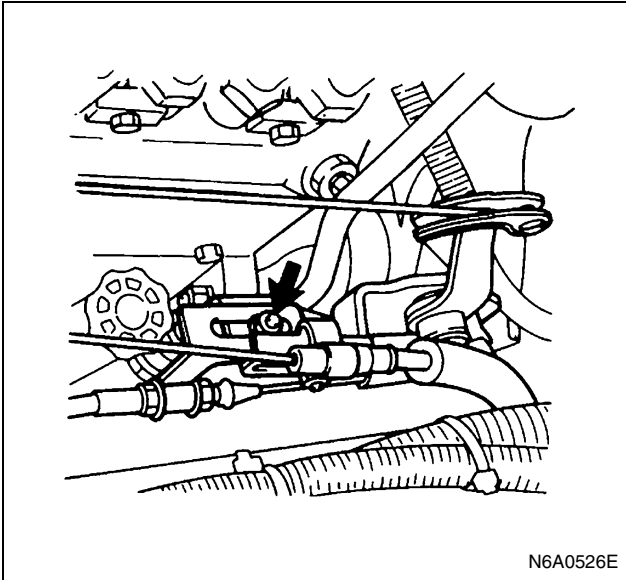
21. Engine Control Cable



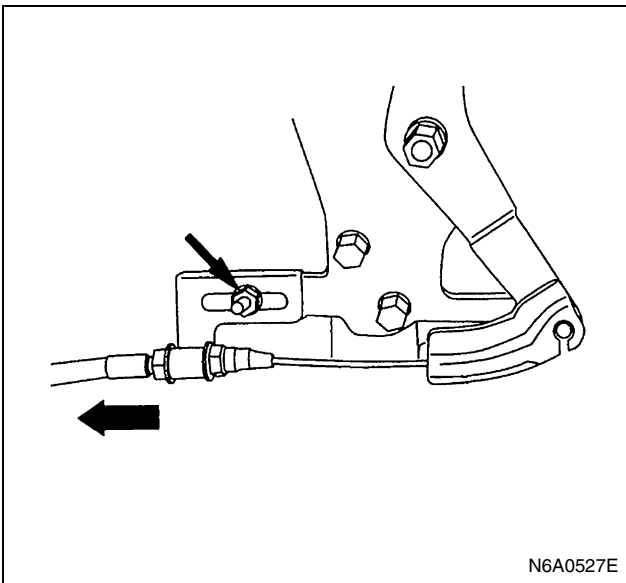
22. Accelerator Control Cable

- 1) Check to see if the idling control knob is turned to the utmost limit to the left.

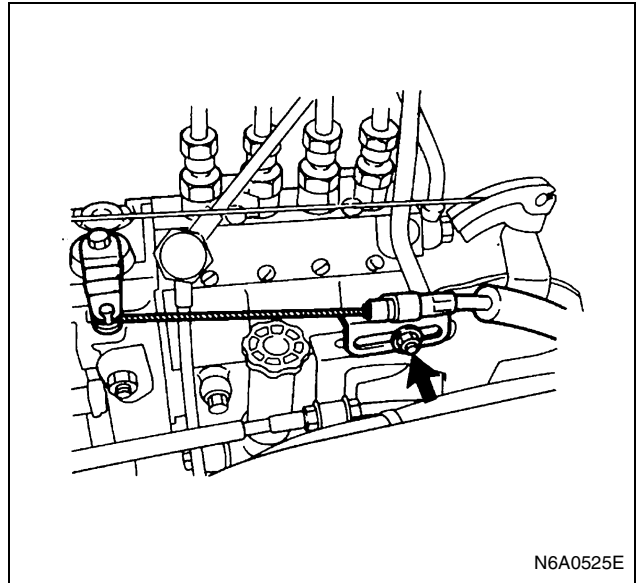
- 2) Install the end tip of the cable to the engine control lever.
- 3) With the outer cable pulled toward the front of the vehicle, provide the engine control wire and the inner cable with the appropriate play. Then, fasten the clamp with a nut.



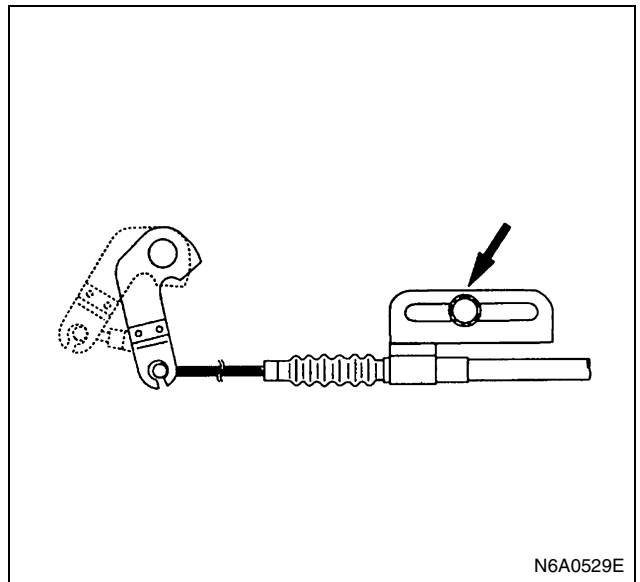
For 4HE1-TC



- 4) Check to see if the control lever of the injection pump is set at the idling position (with the lever attached to the stopper bolt).
23. Engine Stop Cable
- 1) Install the end tip of the cable to the engine stop lever.
 - 2) Pull the cable toward the rear of the vehicle, and fasten the clamp with a nut at the position where the lever stops.

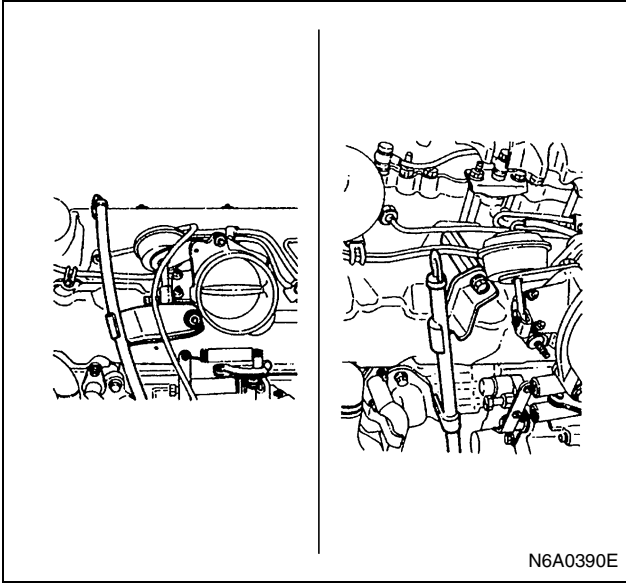


For 4HE1-TC



24. Intake Air Duct
25. Oil Level Gauge Guide Tube
 - 1) Install the O-rings to the guide tube lower portion and insert the guide tube completely to the cylinder body.
 - 2) Tighten the guide tube bolt to the specified torque.

Tighten:
Guide tube bolt to 13 N·m (1.3 kg·m/113 lb-in)

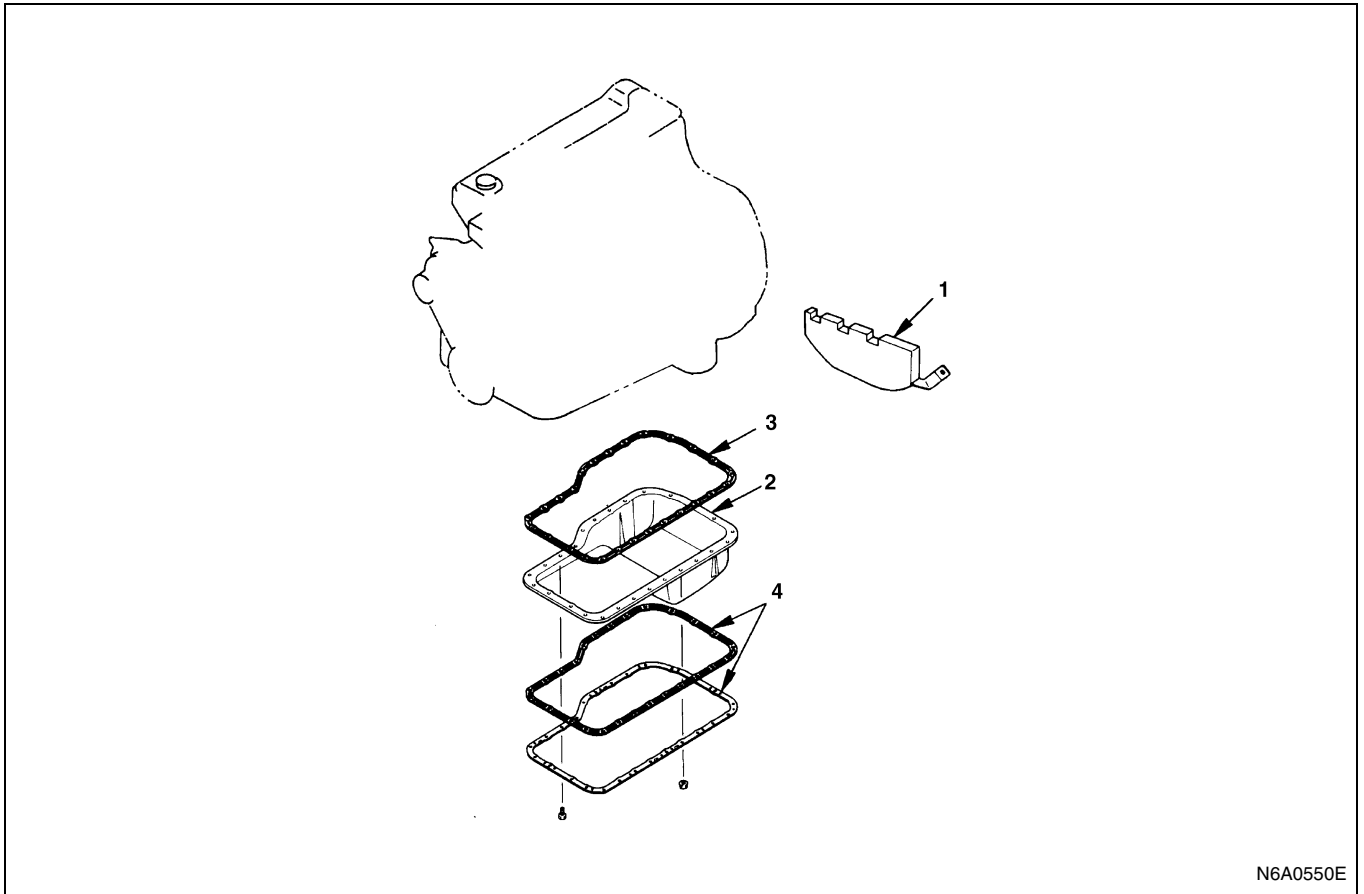


26. Vacuum Hose

- Pour coolant into radiator.
- Connect battery ground cable.
- Start engine and check for oil and water leakage carefully.

OIL PAN

Component



Legend

- | | |
|------------------|--------------------|
| 1. Spacer rubber | 3. Gasket |
| 2. Oil pan | 4. Rubber assembly |

Removal

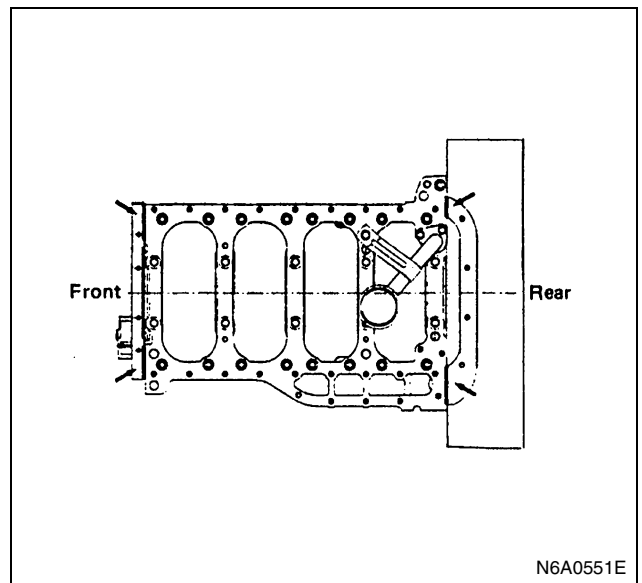
Preparation

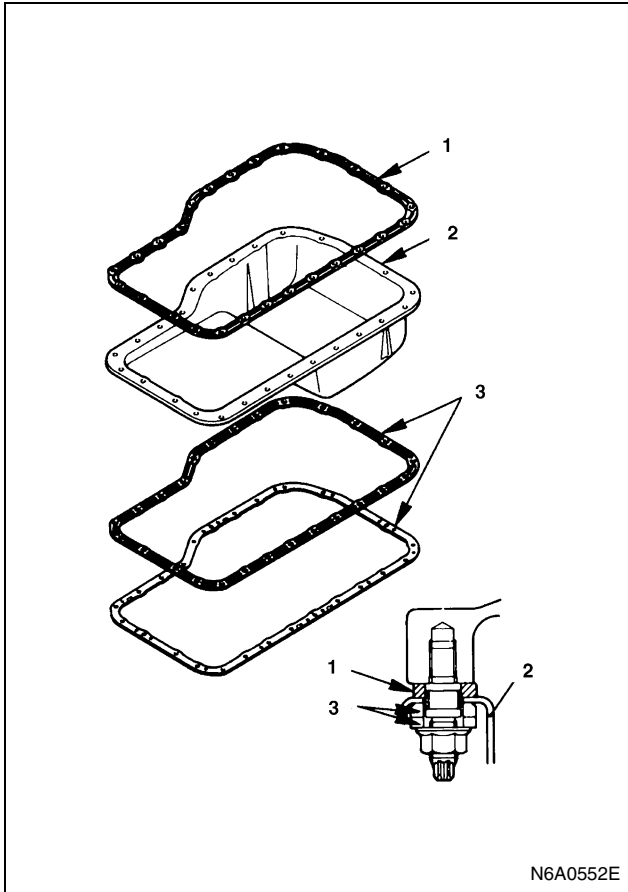
- Disconnect battery ground cable
- Lift up car
- Drain engine oil

1. Spacer Rubber
 - Remove the stiffener before removing the spacer rubber.
2. Oil Pan

Installation

1. Oil Pan
 - 1) Apply a 3 mm (0.12 in) bead of recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.





N6A0552E

Legend

- 1. Gasket
- 2. Oil pan
- 3. Rubber assembly

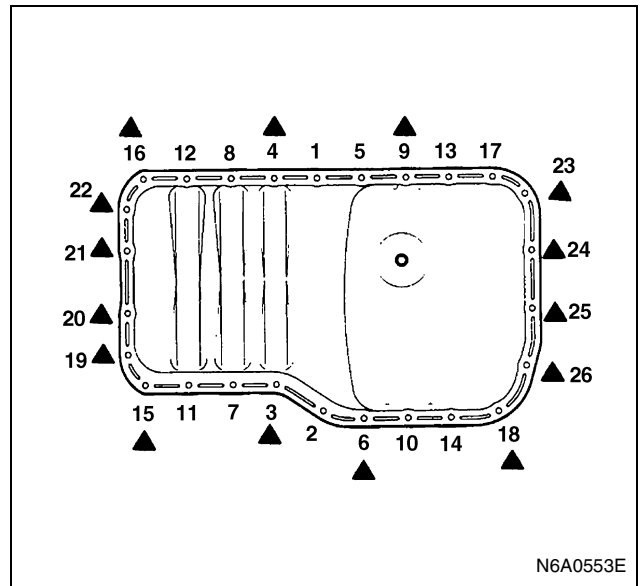
2) Tighten the oil pan nuts and bolts to the specified torque in the numerical order as shown in the illustration.

▲ marks are located on nut positions.

Tighten:

Oil Pan nuts and bolts to 11 N·m (1.1 kg·m/8 lb·ft)

Except 4HE1-TC



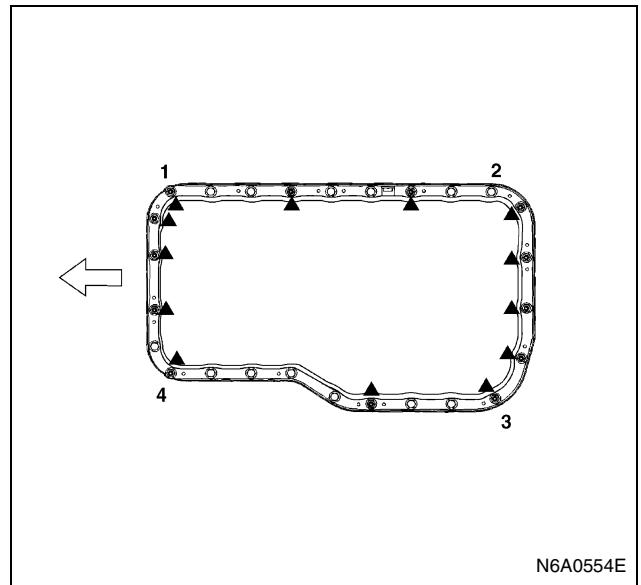
N6A0553E

- Tighten bolts (1), (2), (3), and (4) in numerical order.
- Tighten the remaining bolts (numerical order is not required).

Tighten:

Oil pan nuts and bolts to 11 N·m (1.1 kg·m/8 lb·ft)

For 4HE1-TC



N6A0554E

2. Spacer Rubber

Tighten:

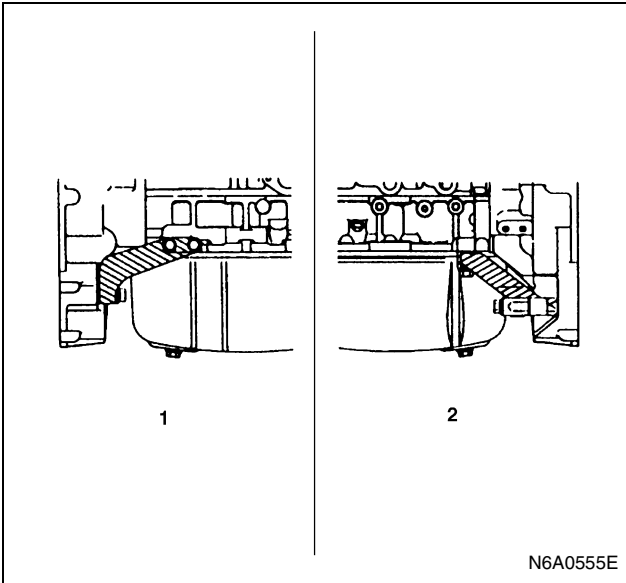
Spacer rubber bolts to 76 N·m (7.7 kg·m/56 lb·ft)

- Tighten the spacer rubber together with the stiffener.

Tighten:

Spacer rubber bolts to

- Cylinder body RH side: 48 N·m (4.9 kg·m/35 lb·ft)
- Cylinder body LH side: 128 N·m (12.9 kg·m/93 lb·ft)
- Flywheel housing side: 76 N·m (7.7 kg·m/56 lb·ft)



Legend

- 1. Right side
- 2. Left side

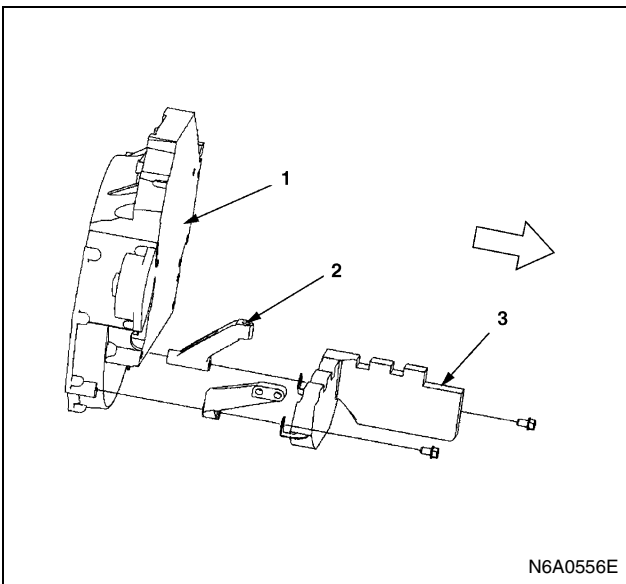
- 4HE1-TC engines use a larger rubber spacer than other engines.

Tighten:

Space rubber bolts to 76 N·m (7.7 kg·m/56 lb·ft)

- Install the rubber spacer to the bracket from the outside of the spacer. Tighten the stiffener together with the rubber spacer.

For 4HE1-TC

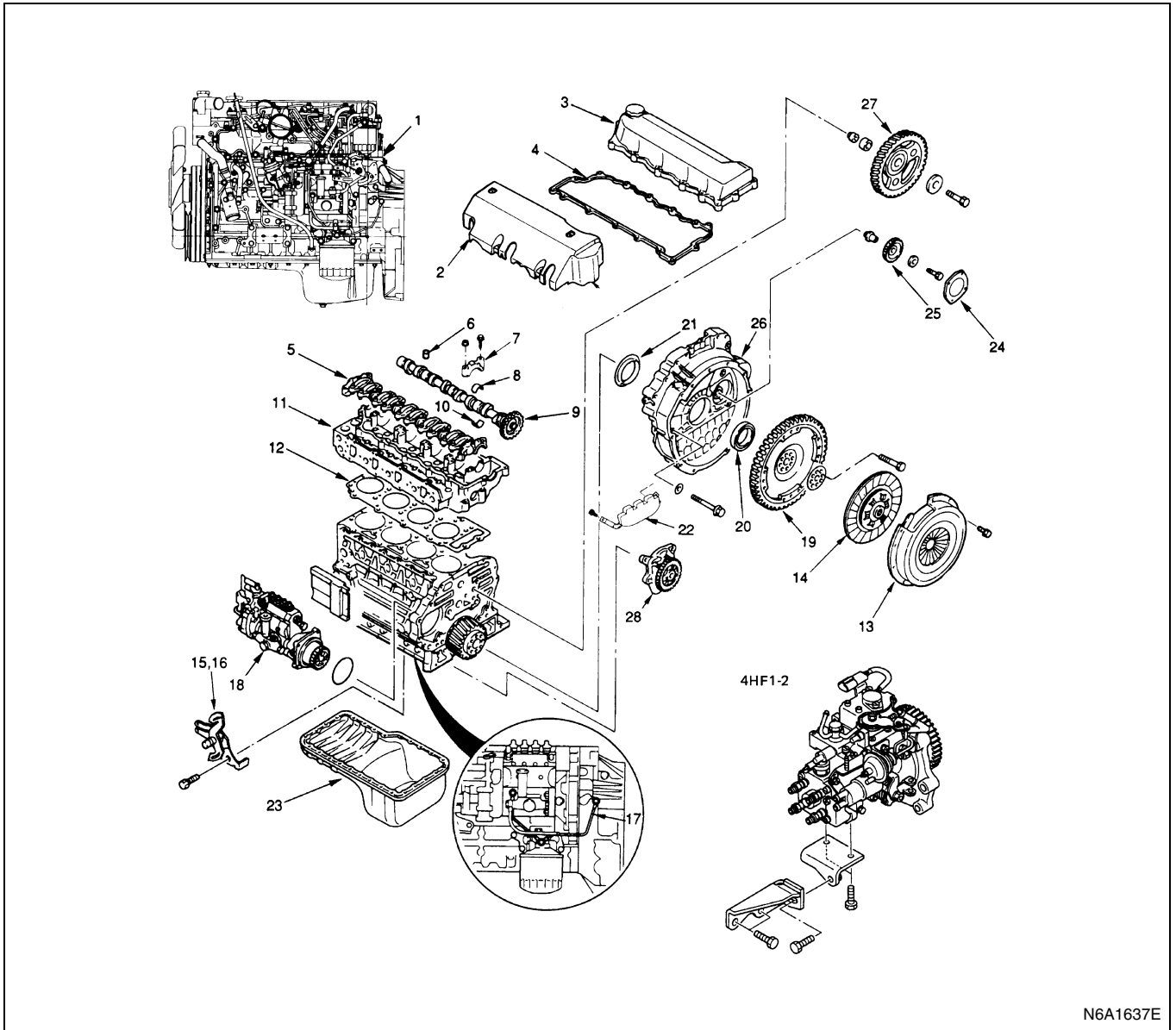


Legend

- 1. Flywheel housing
- 2. Stiffener
- 3. Space rubber

OIL PUMP ASSEMBLY

Component



N6A1637E

Legend

- | | |
|------------------------------------|---|
| 1. Engine assembly | 15. Engine control wire |
| 2. Nozzle cover | 16. Engine control lever assembly |
| 3. Cylinder head cover | 17. Oil pipe |
| 4. Head cover gasket | 18. Injection pump assembly |
| 5. Rocker arm shaft assembly | 19. Flywheel |
| 6. Valve cap | 20. Rear oil seal |
| 7. Camshaft bearing cap | 21. Slinger |
| 8. Camshaft bearing upper | 22. Spacer rubber |
| 9. Camshaft assembly | 23. Oil pan |
| 10. Camshaft bearing lower | 24. Power steering pump idle gear cover |
| 11. Cylinder head assembly | 25. Power steering pump idle gear |
| 12. Cylinder head gasket | 26. Flywheel housing |
| 13. Clutch pressure plate assembly | 27. Idle gear A |
| 14. Driven plate | 28. Oil pump assembly |

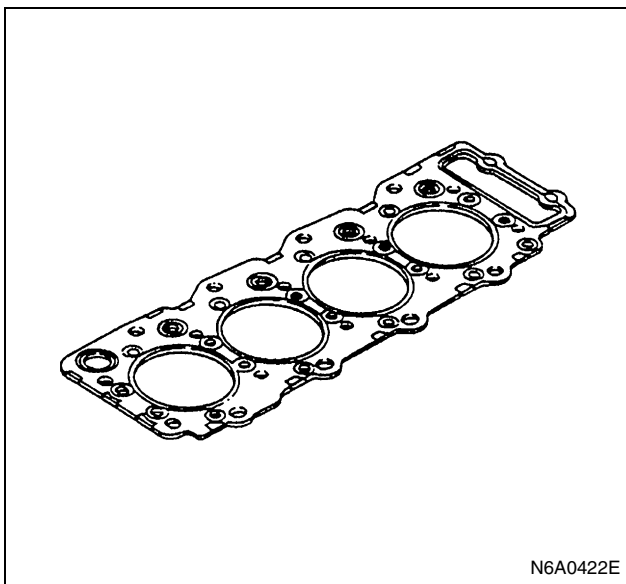
Removal

Preparation

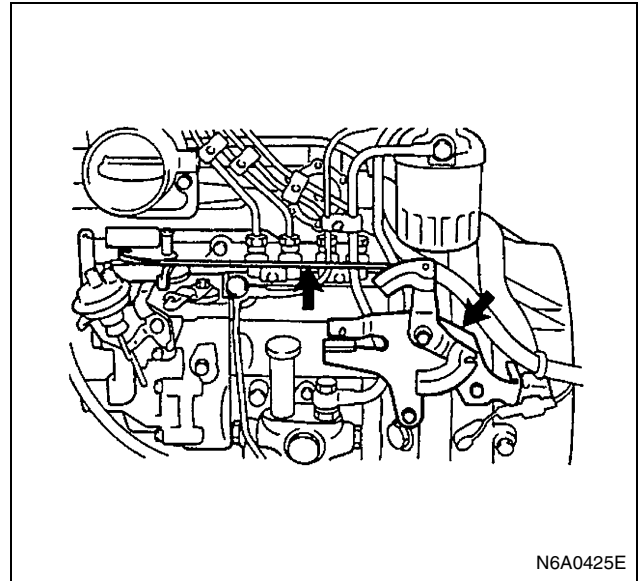
- Disconnect battery ground cable.
 - Tilt the cab.
 - Drain coolant and engine oil
1. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
 2. Nozzle Cover
 3. Cylinder Head Cover
 4. Head Cover Gasket
 5. Rocker Arm Shaft Assembly
 6. Valve Cap
 7. Camshaft Bearing Cap
 8. Camshaft Bearing Upper
 9. Camshaft Assembly
 10. Camshaft Bearing Lower
Above works refer to "ROCKER ARM SHAFT ASSEMBLY AND CAMSHAFT ASSEMBLY" section in this manual.
 11. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
 12. Cylinder Head Gasket

Caution:

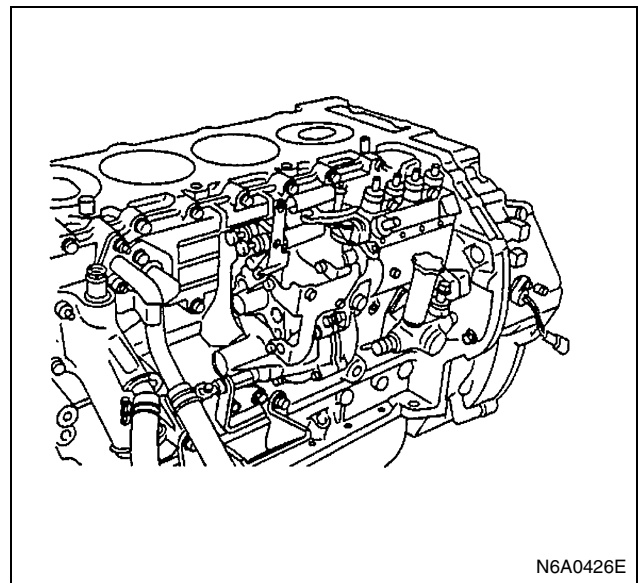
Do not reuse the cylinder head gasket.



13. Clutch Pressure Plate Assembly
14. Driven Plate
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
15. Engine Control Wire
16. Engine Control Lever Assembly



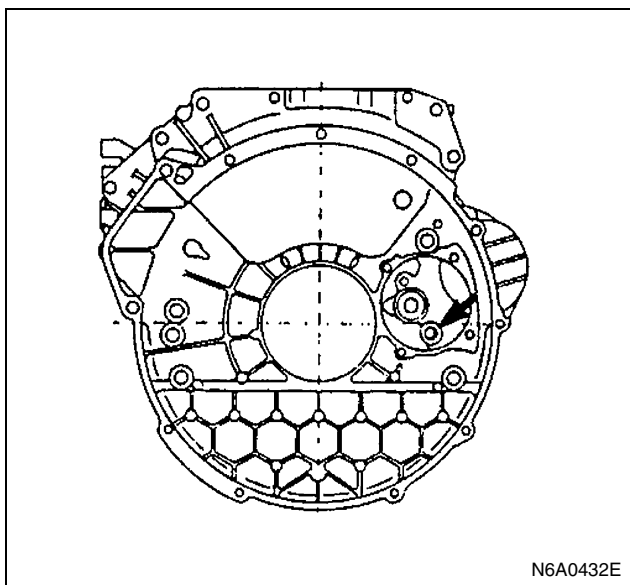
17. Oil Pipe
18. Injection Pump Assembly
 - 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
 - 2) Then remove the injection pump assembly.



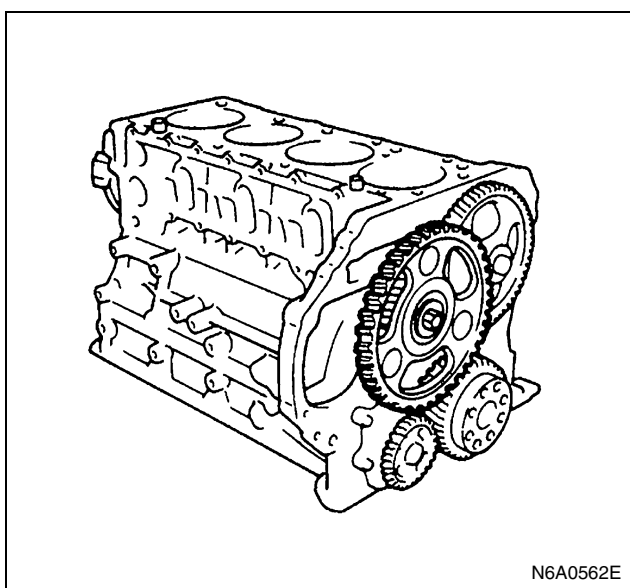
19. Flywheel
20. Crankshaft Rear Oil Seal
21. Crankshaft Rear Slinger
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
22. Spacer Rubber
Remove the stiffener before removing the spacer rubber.
23. Oil Pan
24. Power Steering Pump Idle Gear Cover
25. Power Steering Pump Idle Gear
26. Flywheel Housing

Notice:

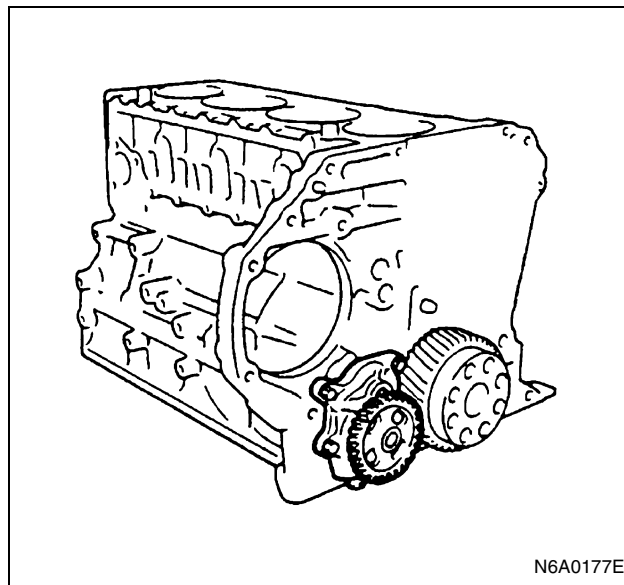
Be careful not to fail to remove the bolts shown in the illustration.



27. Idle Gear A



28. Oil Pump Assembly

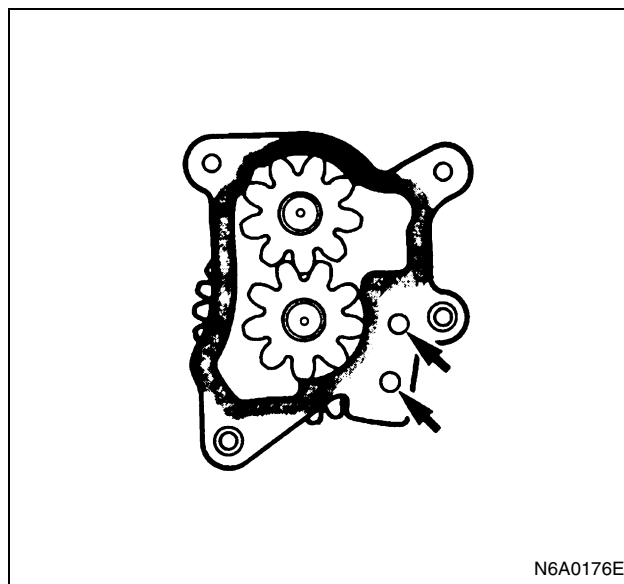


Installation

1. Oil Pump Assembly
 - 1) Carefully wipe any foreign material from the cylinder body rear surface.
 - 2) Apply the recommended liquid gasket (Three Bond 1141E) or its equivalent to the shaded areas shown in the illustration.

Caution:

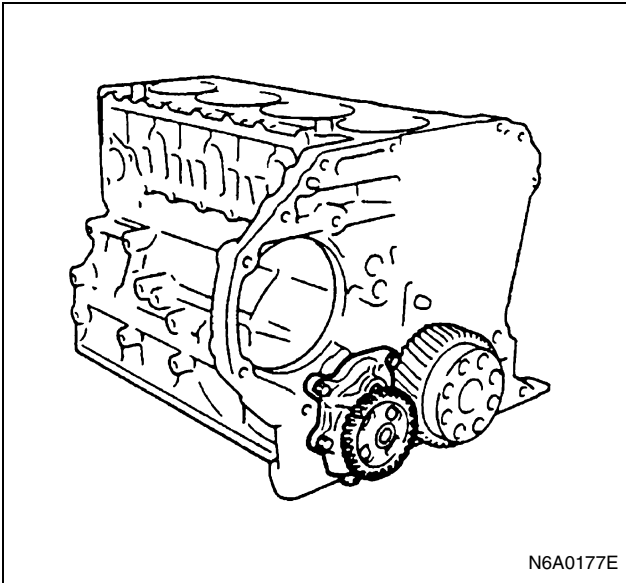
Be careful that no liquid gasket gets into the holes in the arrow-marked portion in the illustration and the inside of the oil pump cover.



- 3) Install the oil pump to the cylinder body.
- 4) Tighten the oil pump to the specified torque.

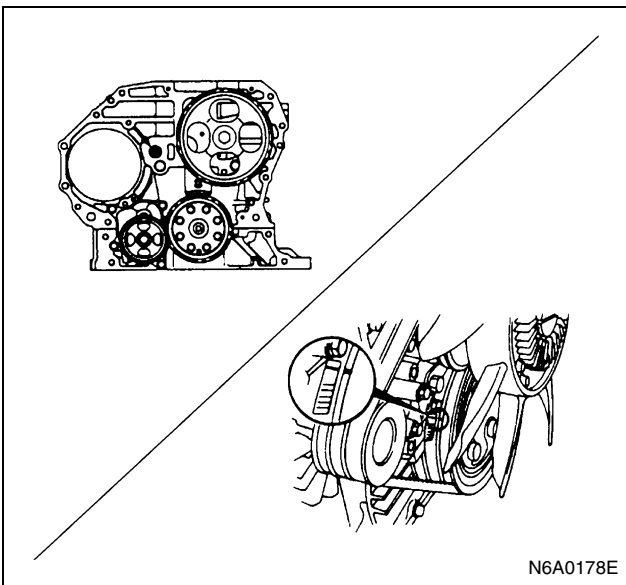
Tighten:

Oil pump bolt to 31 N·m (3.2 kg·m/23 lb·ft)



2. Idle Gear A

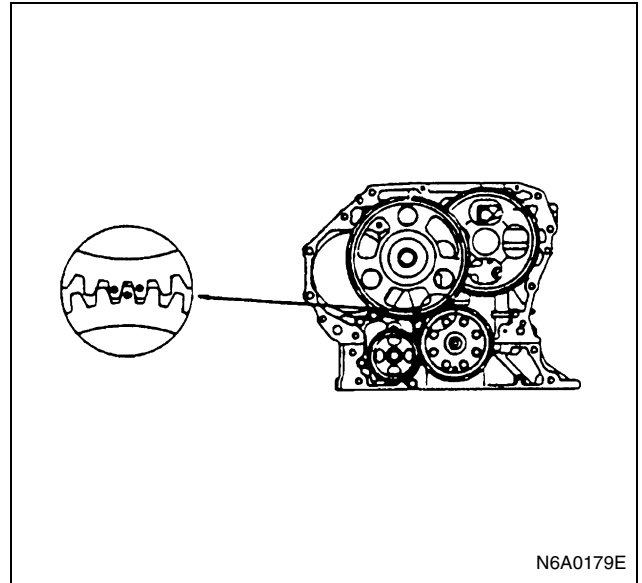
- 1) Turn the crankshaft clockwise so that the engagement mark of the crankshaft gear faces to the shaft center of the idle gear A and the No.1 cylinder piston comes to the top dead center.



- 2) Align the crankshaft gear with the engagement mark of the idle gear and install the idle gear A.

Tighten:

Idle gear A bolt to 133 N·m (13.6 kg·m/98 lb·ft)



3. Flywheel Housing
4. Power Steering Pump Idle Gear
5. Power Steering Pump Idle Gear Cover
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
6. Oil Pan
7. Spacer Rubber
Above works refer to "OIL PAN" section in this manual.
8. Crankshaft Rear Slinger
9. Crankshaft Rear Oil Seal
10. Flywheel
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
11. Injection Pump Assembly
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
12. Oil Pipe
13. Engine Control Lever Assembly
14. Engine Control Wire
Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.
15. Driven Plate
16. Clutch Pressure Plate Assembly
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
17. Cylinder Head Gasket
Above works refer to "CYLINDER HEAD" section in this manual.
18. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
19. Camshaft Bearing Lower
20. Camshaft Assembly
21. Camshaft Bearing Upper
22. Camshaft Bearing Cap
23. Valve Cap

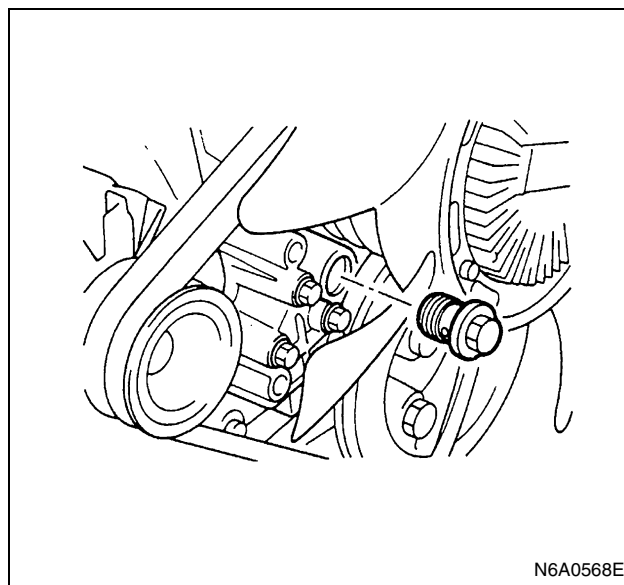
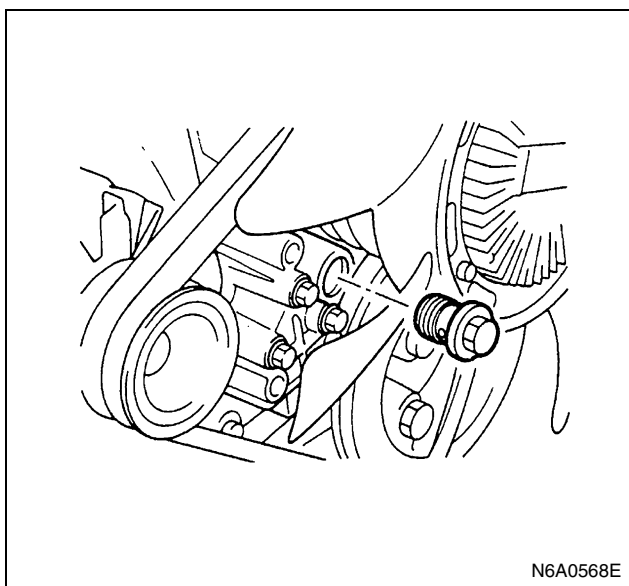
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.

24. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
25. Head Cover Gasket
26. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
27. Nozzle Cover
28. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.

OIL RELIEF VALVE

Removal

1. Oil Relief Valve



Inspection and Repair

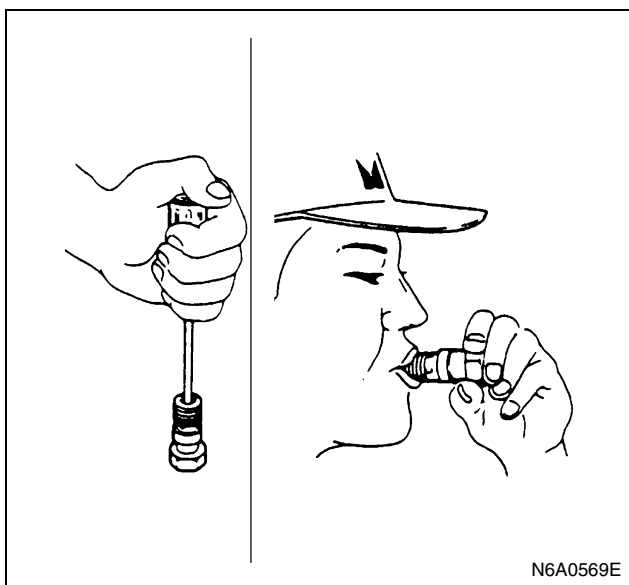
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Valve

Push the valve with a screwdriver to check it for binding. When the valve is binding, replace the relief valve with a new one.

Spring

Blow the valve and check it for air leak. When there is any air leak in the valve, replace it with a new one.



Installation

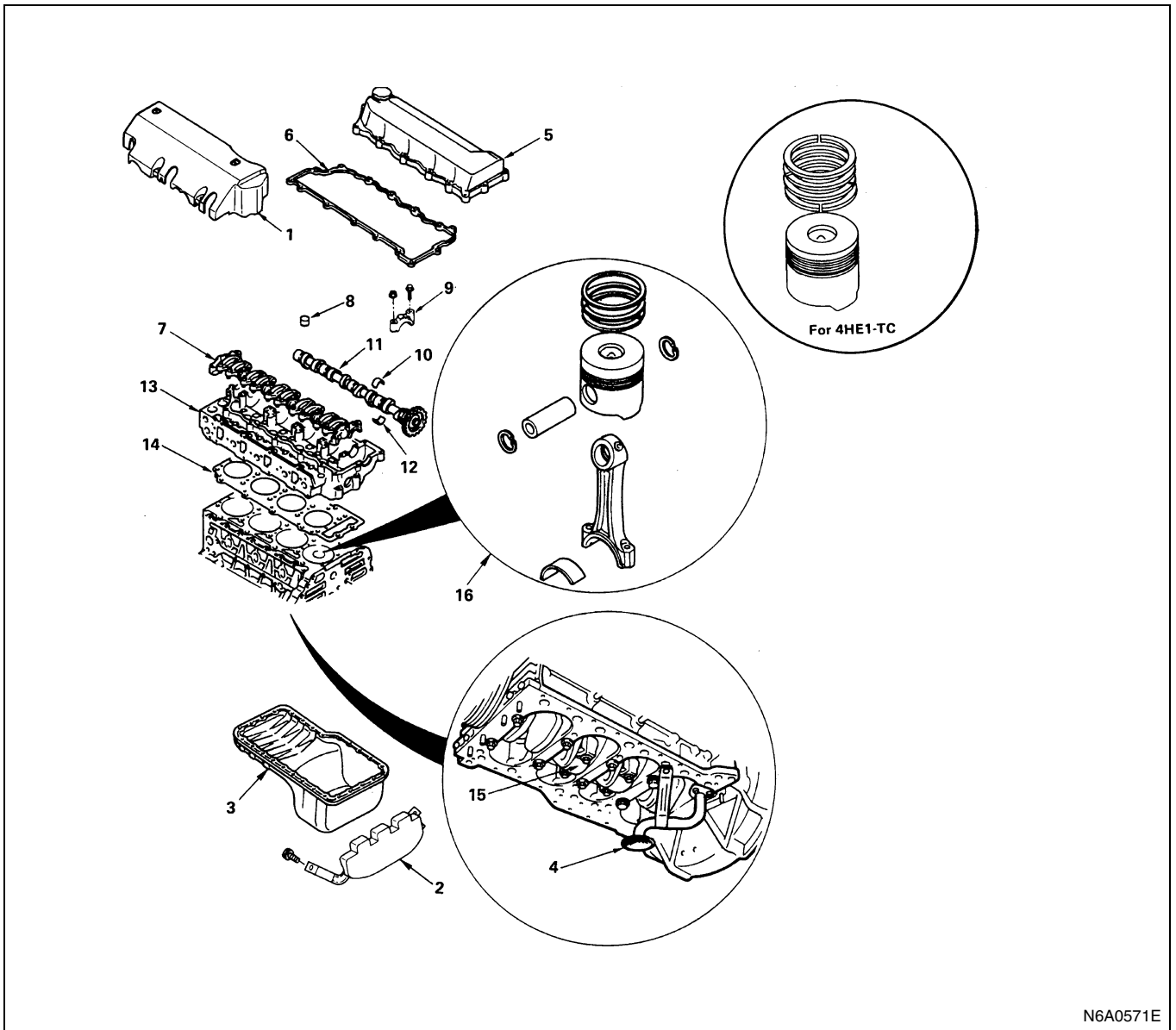
1. Oil Relief Valve

Tighten:

Oil relief valve to 39 N·m (4.0 kg·m/29 lb·ft)

PISTON, PISTON RING, PISTON PIN AND CONNECTING ROD

Component



N6A0571E

Legend

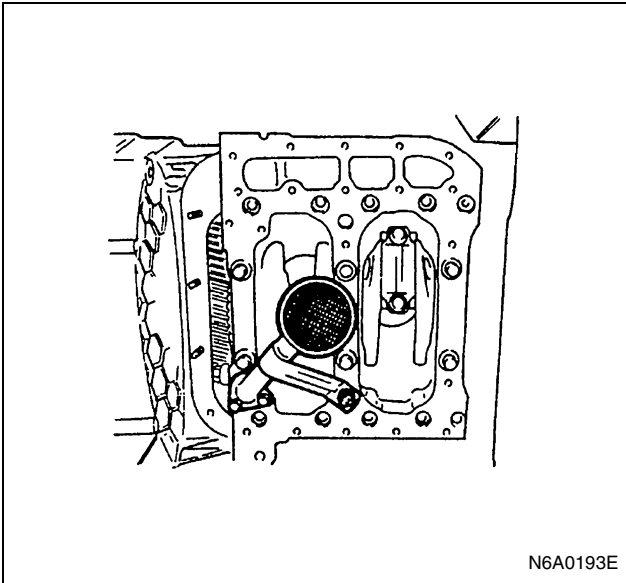
- | | |
|-------------------------------|--|
| 1. Nozzle cover | 9. Camshaft bearing cap |
| 2. Spacer rubber | 10. Camshaft bearing upper |
| 3. Oil pan | 11. Camshaft assembly |
| 4. Oil pump strainer | 12. Camshaft bearing lower |
| 5. Cylinder head cover | 13. Cylinder head assembly |
| 6. Cylinder head cover gasket | 14. Cylinder head gasket |
| 7. Rocker arm shaft assembly | 15. Connecting rod cap |
| 8. Valve cap | 16. Piston and connecting rod assembly |

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab.
- Drain coolant and engine oil.

1. Nozzle Cover
2. Spacer Rubber
Remove the stiffener before removing the spacer rubber.
3. Oil Pan
4. Oil Pump Strainer



N6A0193E

5. Cylinder Head Cover
6. Cylinder Head Cover Gasket
7. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
8. Valve Cap

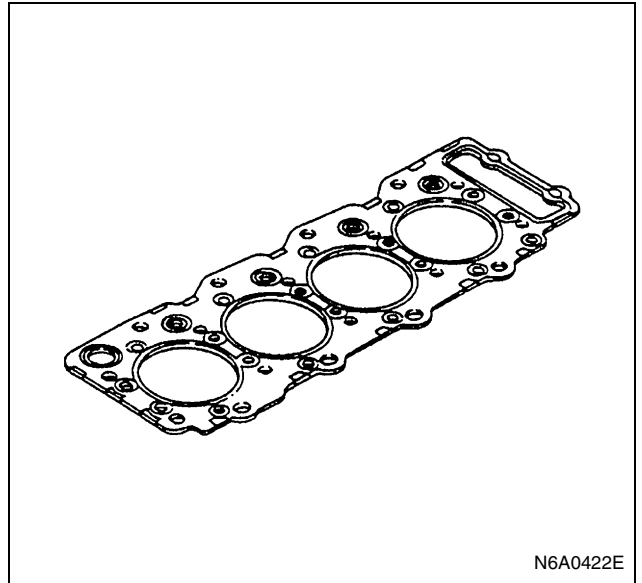
Caution:

Take sufficient care not to let valve caps fall into the gear case or oil return hole.

9. Camshaft Bearing Cap
10. Camshaft Bearing Upper
11. Camshaft Assembly
12. Camshaft Bearing Lower
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
13. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
14. Cylinder Head Gasket

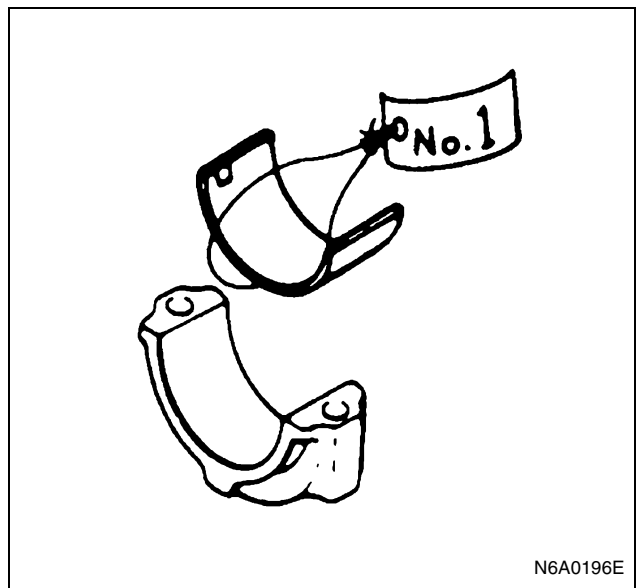
Caution:

Do not reuse the cylinder head gasket.



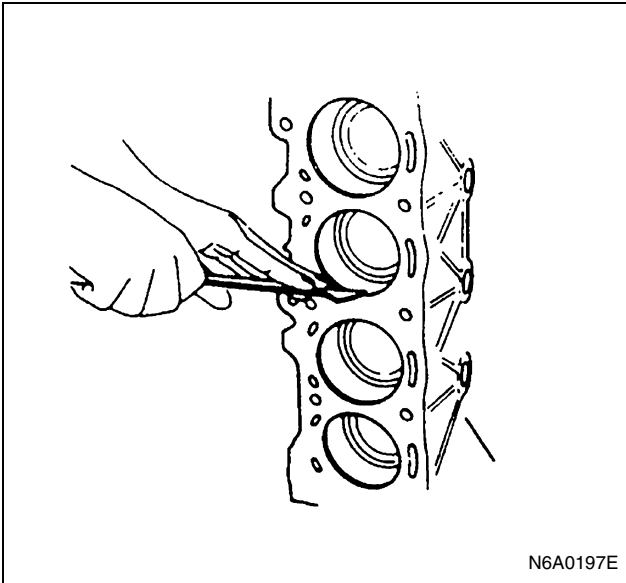
N6A0422E

15. Connecting Rod Cap
 - 1) Take out the connecting rod bearing cap bolts and remove the bearing cap with the lower bearing.
 - 2) If the connecting rod lower bearings are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.



N6A0196E

16. Piston and Connecting Rod Assembly
 - 1) To facilitate smooth removal of piston, remove carbon from the upper part of the cylinder wall using a scraper or equivalent.



- 2) Remove the piston and connecting rod assembly upward by pushing on the edge of the connecting rod with a hammer handle or equivalent.
- 3) If the connecting rod bearing are to be reinstalled, mark their fitting positions by tagging each bearing with the cylinder number from which it was removed.

Caution:

Do not bend or damage the oiling jet.

Notice:

When removing the piston and connecting rod assembly, pull the connecting rod in parallel with the cylinder bore.

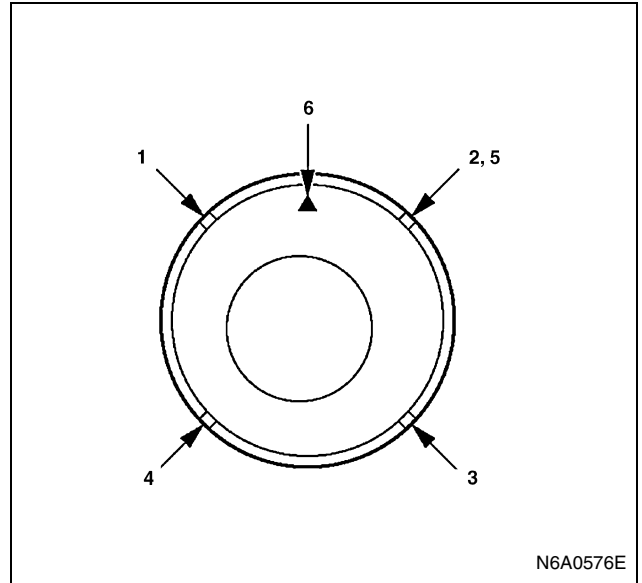
Installation

1. Piston and Connecting Rod Assembly

Notice:

When installing new connecting rod and/or connecting rod bearings, refer to the selection table. Above works refer to "CRANKSHAFT" section 6A in this manual.

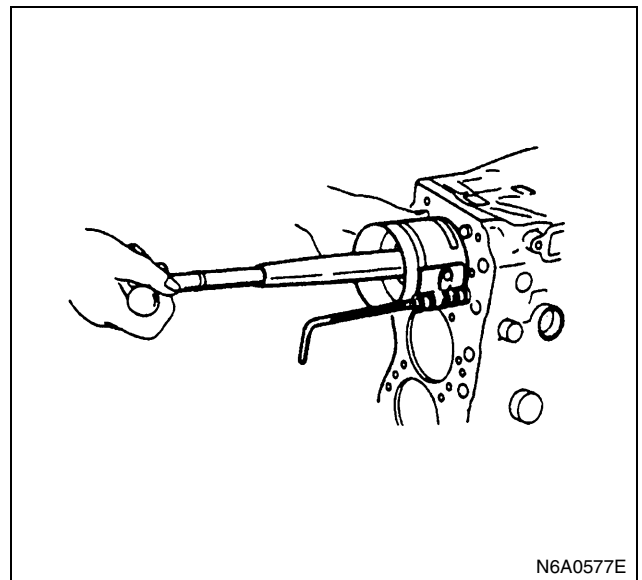
- 1) Apply a coat of engine oil to the circumference of each piston ring and piston.
- 2) Position the piston ring gaps as shown in the illustration.



Legend

1. 1st compression ring
2. 2nd compression ring
3. 3rd compression ring (4HE1-TC only)
4. Oil ring
5. Coil expander
6. Front mark

- 3) Apply a coat of molybdenum disulfide grease to the two piston skirts.
This will facilitate smooth break-in when the engine is first started after reassembly.
- 4) Apply a coat of engine oil to the upper bearing surfaces.
- 5) Apply a coat of engine oil to the cylinder wall.
- 6) Position the piston head front mark so that it is facing the front of the engine.
- 7) Use the piston ring compressor to compress the piston rings.
Piston Ring Compressor: 5-8840-9018-0



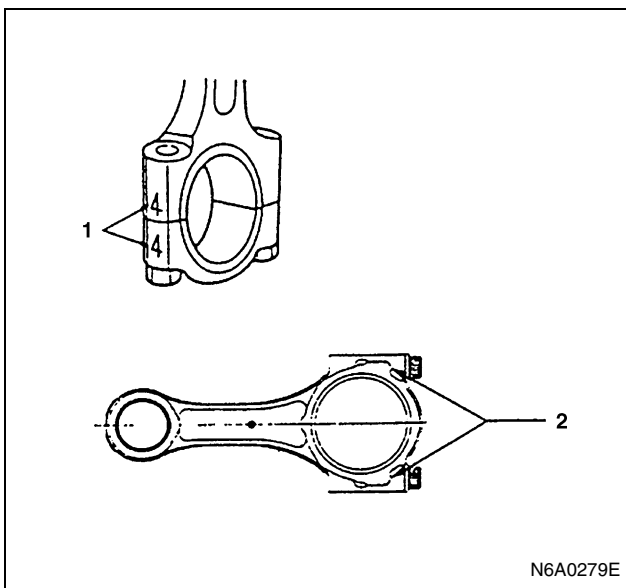
- 8) Use a hammer grip to push the piston in until the connecting rod makes contact with the crankpin.
At the same time, rotate the crankshaft until the crankpin is at bottom dead center.

Caution:

Do not bend or damage the oiling jet.

2. Connecting Rod Cap

- 1) Install the connecting rod bearing caps.
- 2) Align the bearing cap cylinder number marks and the connecting rod cylinder number marks.
- 3) Apply a coat of molybdenum disulfide grease to the threads and setting faces of each connecting rod cap bolts.



Legend

1. Alignment
2. Boss discriminating the front from rear

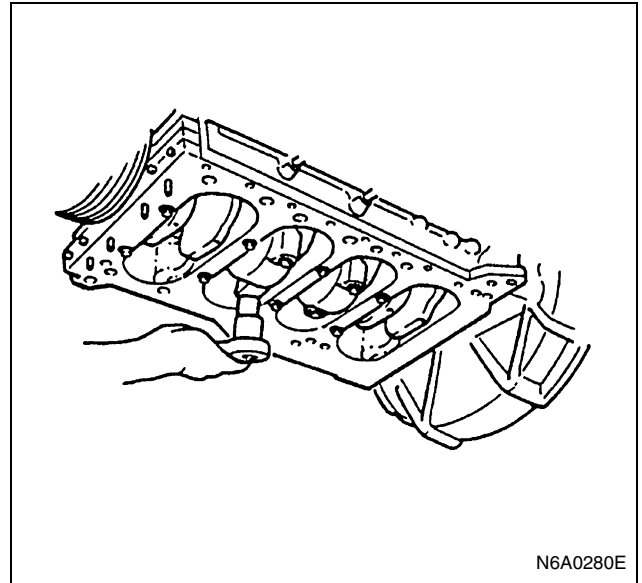
- 4) Tighten the connecting rod caps to the specified torque.

Tighten:

Connecting rod bearing cap bolt to

- 1st step: 39 N·m (4.0 kg·m/29 lb·ft)
- 2nd step: 60°
- 3rd step: 30°

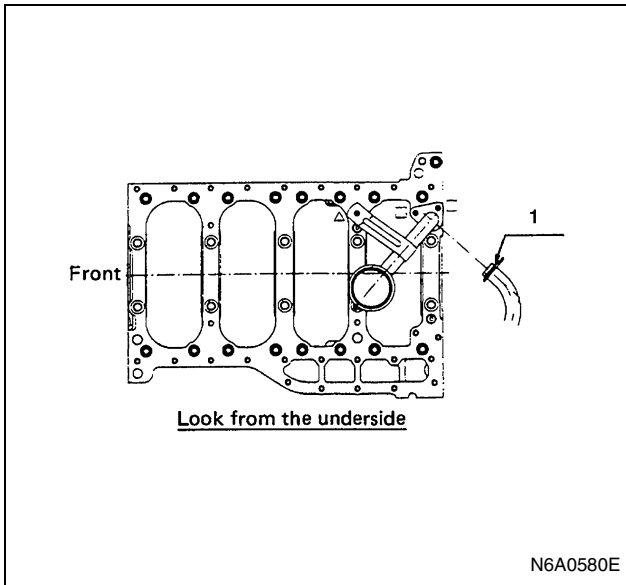
Angle gauge: 5-8840-0266-0



3. Cylinder Head Gasket
Above works refer to "CYLINDER HEAD" section in this manual.
4. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
5. Camshaft Bearing Lower
6. Camshaft Assembly
7. Camshaft Bearing Upper
8. Camshaft Bearing Cap
9. Valve Cap
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
10. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
11. Cylinder Head Cover Gasket
Above works refer to "CYLINDER HEAD" section in this manual.
12. Cylinder Head Cover
Above works refer to "CYLINDER HEAD COVER" section in this manual.
13. Oil Pump Strainer
Install the O-ring (1) to the oil pump strainer pipe and install the oil pump strainer to the cylinder body shown in the illustration.

Tighten:

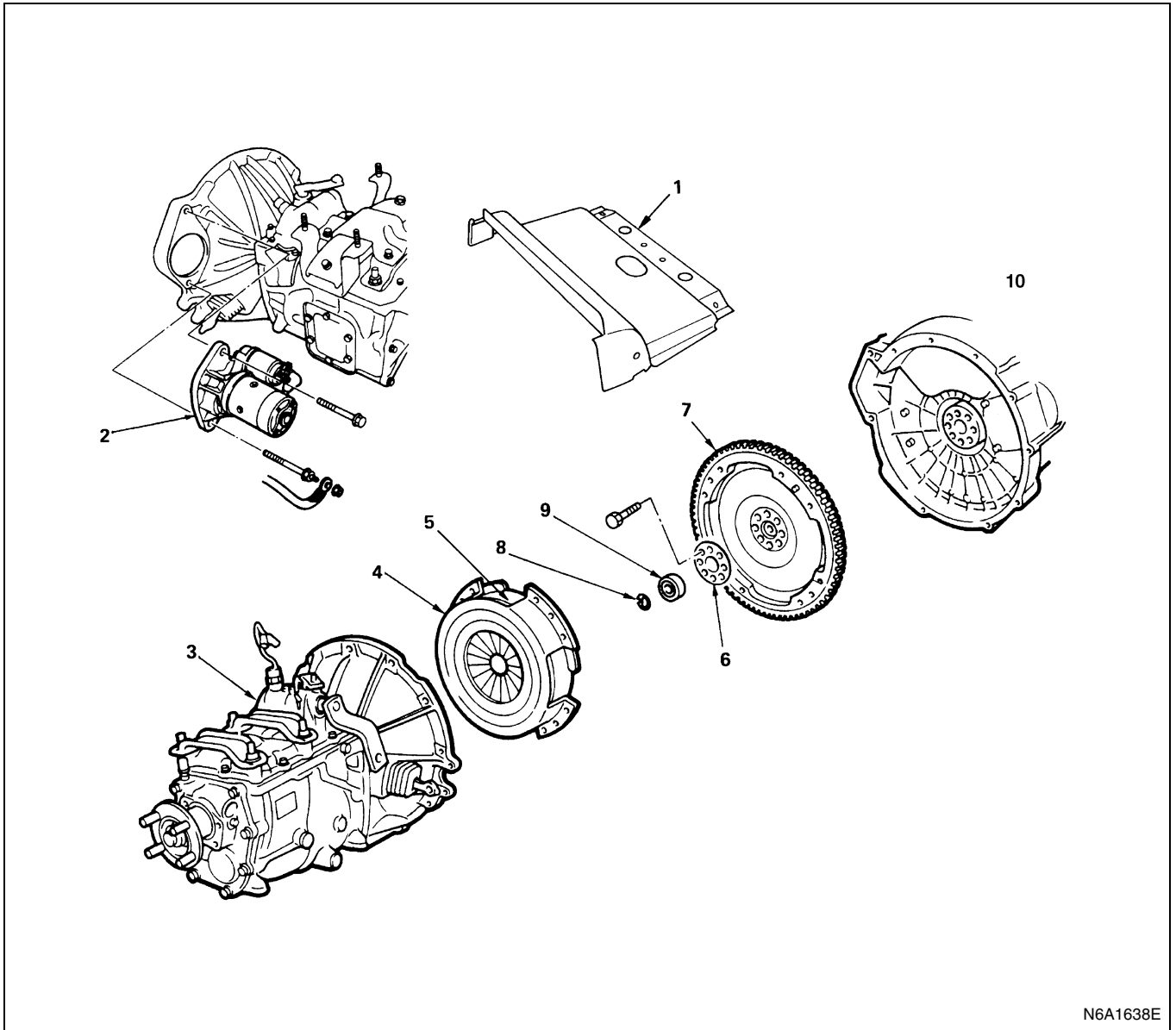
Oil pump strainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



14. Oil Pan
15. Spacer Rubber
Above works refer to "OIL PAN" section in this manual.
16. Nozzle Cover
 - Pour engine oil and coolant into the engine
 - Connect battery ground cable
 - Start the engine and check for coolant and oil leakage

FLYWHEEL AND PILOT BEARING

Component



Legend

- | | |
|-----------------------------------|----------------------|
| 1. Transmission panel | 6. Washer |
| 2. Starter | 7. Flywheel assembly |
| 3. Transmission assembly | 8. Snap ring |
| 4. Clutch pressure plate assembly | 9. Pilot bearing |
| 5. Driven plate | 10. Engine side |

Removal

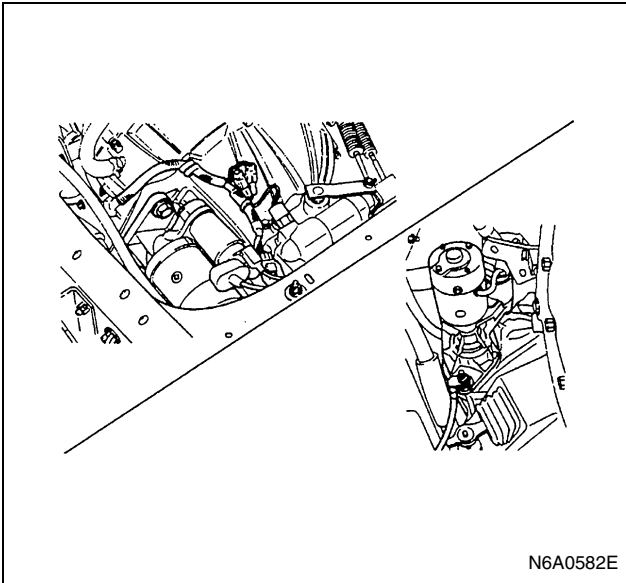
Preparation

- Disconnect battery ground cable.

1. Transmission Panel
2. Starter

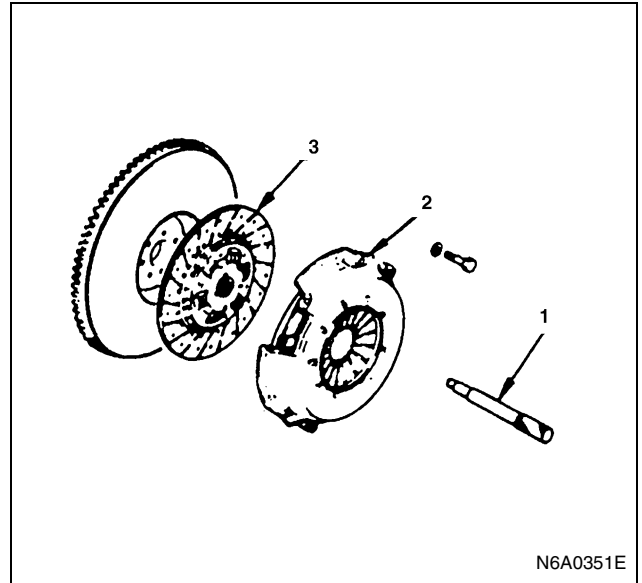
- 1) Disconnect the battery cable at the starter motor.

- 2) Remove the starter assembly from flywheel housing.



N6A0582E

3. Transmission Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
4. Clutch Pressure Plate Assembly
 - 1) Insert the clutch pilot aligner to the clutch assembly.
Clutch Pilot Aligner: 5-8840-2240-0
 - 2) Loosen the pressure plate bolts in numerical order a little at a time as shown in the illustration.

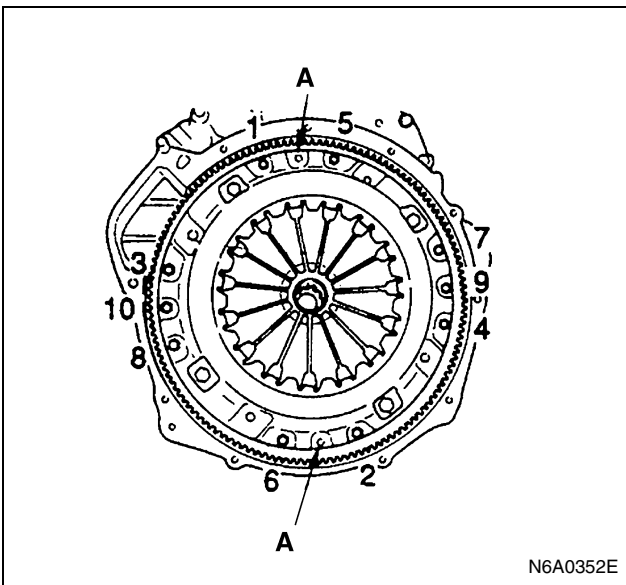


N6A0351E

Legend

1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

6. Washer
7. Flywheel Assembly
 - 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0

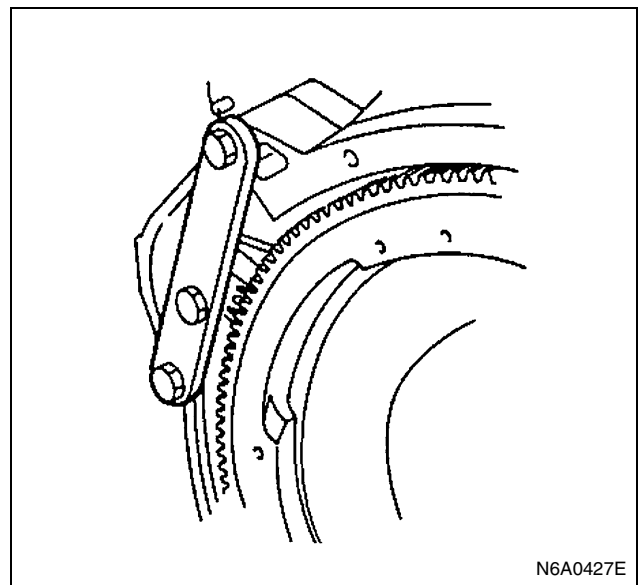


N6A0352E

Legend

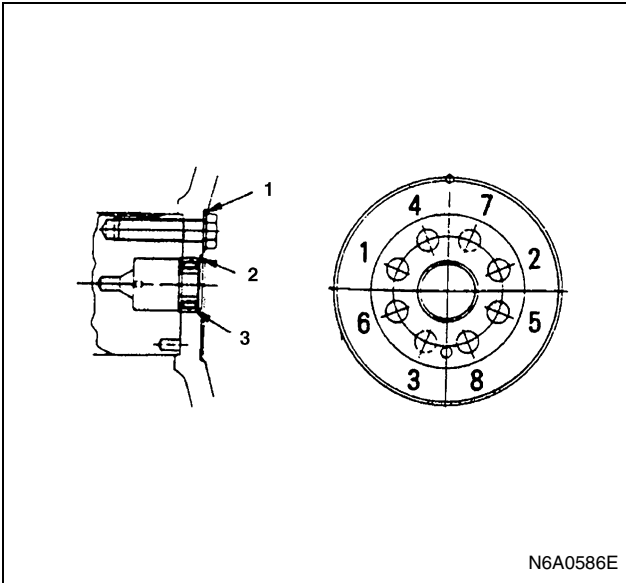
- A. Knock pin

- 3) Remove the pressure plate assembly.
5. Driven Plate
Remove the driven plate with the clutch pilot aligner.



N6A0427E

- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.



N6A0586E

Legend

- 1. Washer
- 2. Snap ring
- 3. Pilot bearing

- 3) Remove the flywheel stopper and the flywheel assembly.
- 8. Snap Ring
Use a snap ring pliers to remove the snap ring from the flywheel.
- 9. Pilot Bearing

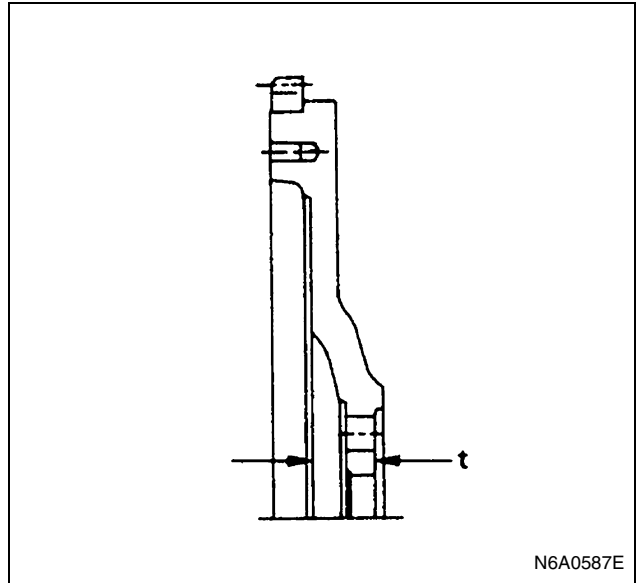
Inspection and Repair

Flywheel

- 1. Inspect the flywheel friction surface for excessive wear and heat cracks.
- 2. Measure the flywheel thickness (t) between the flywheel friction surface and crankshaft setting face. If the measured value is between the standard and the specified limit, the flywheel may be reground. If the measured value exceeds the specified limit, the flywheel must be replaced.

Flywheel Thickness (t)		mm (in)
Engine model	Standard	Limit
Others	31.4 — 31.6 (1.236 — 1.244)	31.0 (1.220)
4HG1-TC	37.4 — 37.6 (1.472 — 1.480)	37.0 (1.457)

Flywheel Friction Surface Roughness	mm (in)
Less than 0.006 (0.00024)	



N6A0587E

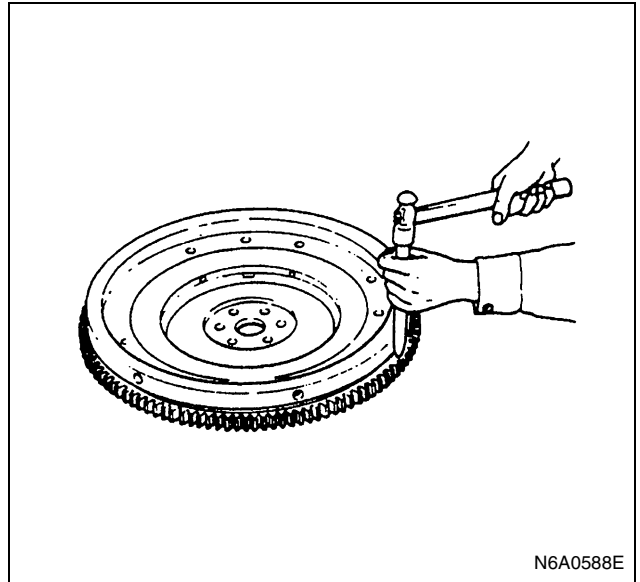
Ring Gear

Inspect the ring gear
If the ring gear teeth are broken or excessively worn, the ring gear must be replaced.

Ring Gear Replacement

REMOVAL

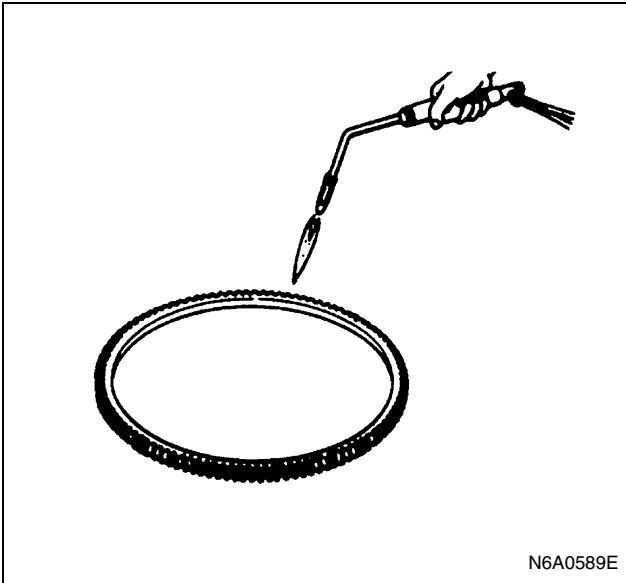
Strike around the edges of the ring gear with a hammer and chisel to remove it.



N6A0588E

INSTALLATION

- 1. Heat the ring gear evenly with a gas burner to invite thermal expansion.



2. Install the ring gear when it is sufficiently heated. The ring gear must be installed with the chamfer facing the clutch.

Pilot Bearing

Check the pilot bearing for wear or damage and replace with a new one if any abnormal condition is noticeable.

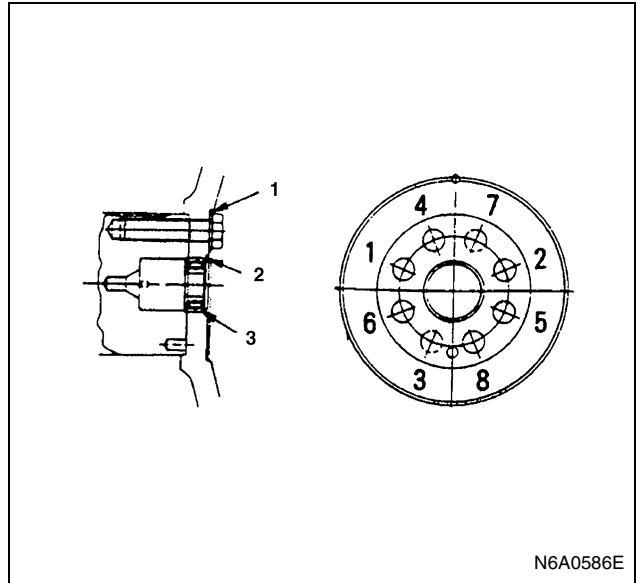
Installation

1. Pilot Bearing
2. Snap Ring
3. Flywheel Assembly
4. Washer
 - 1) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
 - 2) Use the crankshaft stopper to prevent the crankshaft from turning. Crankshaft stopper: 5-8840-2230-0
 - 3) Install the washer and the flywheel bolts and tighten to the specified torque in numerical order show in the illustration.

Tighten:

Flywheel bolt to

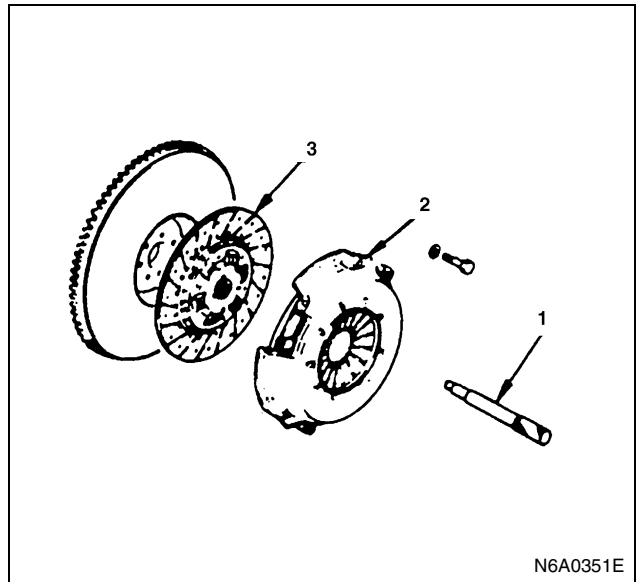
- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°



Legend

1. Washer
2. Snap ring
3. Pilot bearing

- 4) Remove the crankshaft stopper.
5. Driven Plate
Use the clutch pilot aligner to install the driven plate.
Clutch Pilot Aligner: 5-8840-2240-0



Legend

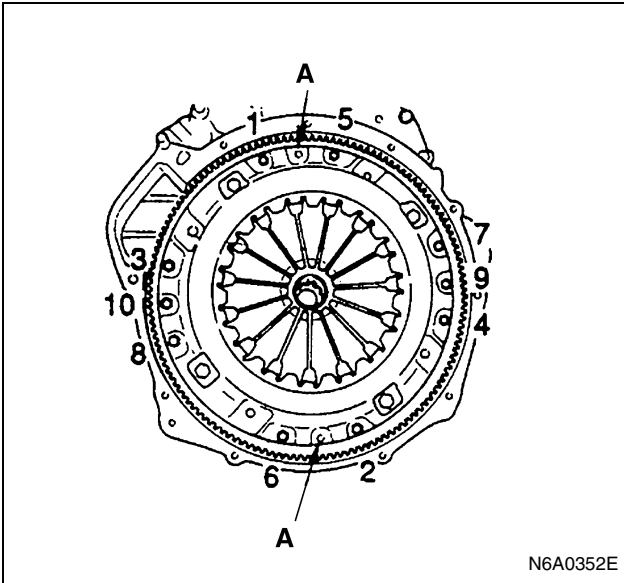
1. Clutch pilot aligner
2. Clutch pressure plate assembly
3. Driven plate

6. Clutch Pressure Plate Assembly
 - 1) Align the clutch pressure plate with the flywheel knock pin.

-
- 2) Tighten the pressure plate bolts to the specified torque in numerical order.

Tighten:

Clutch pressure plate bolt to 40 N·m (4.1 kg·m/30 lb·ft)



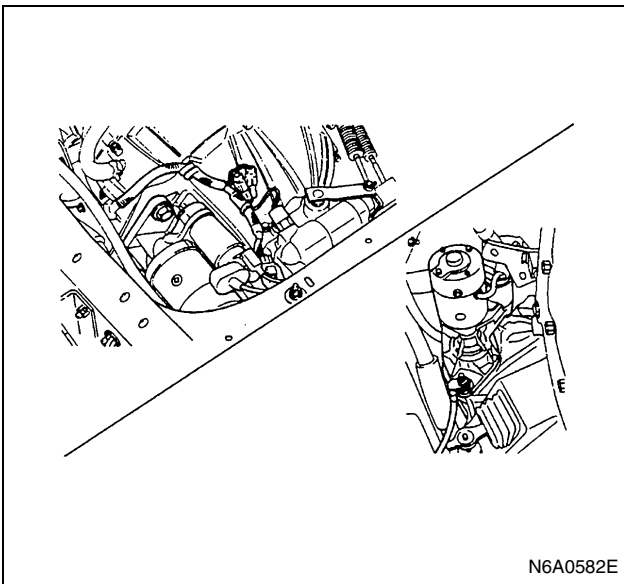
Legend

A. Knock pin

-
7. Transmission Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
 8. Starter

Tighten:

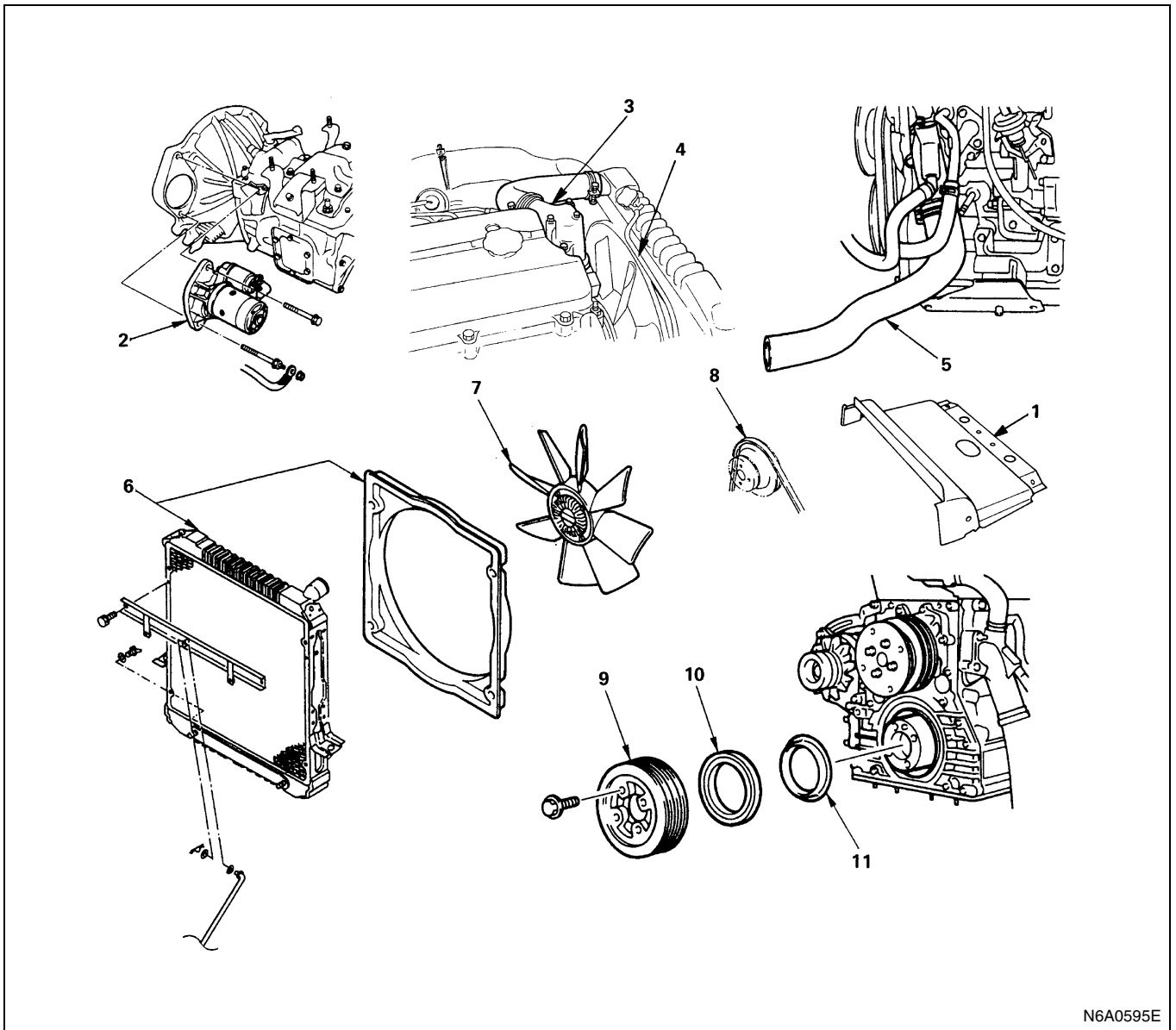
Starter bolt to 76 N·m (7.7 kg·m/56 lb·ft)



9. Transmission Panel
 - Connect the battery ground cable.

CRANKSHAFT FRONT OIL SEAL

Component



N6A0595E

Legend

- | | |
|--|-------------------------------|
| 1. Transmission panel (Australia only) | 7. Fan assembly |
| 2. Starter | 8. Fan belt |
| 3. Radiator upper hose | 9. Crankshaft damper pulley |
| 4. Coolant reserve tank hose/Bypass hose | 10. Crankshaft front oil seal |
| 5. Radiator lower hose | 11. Crankshaft front slinger |
| 6. Radiator (with guide) | |

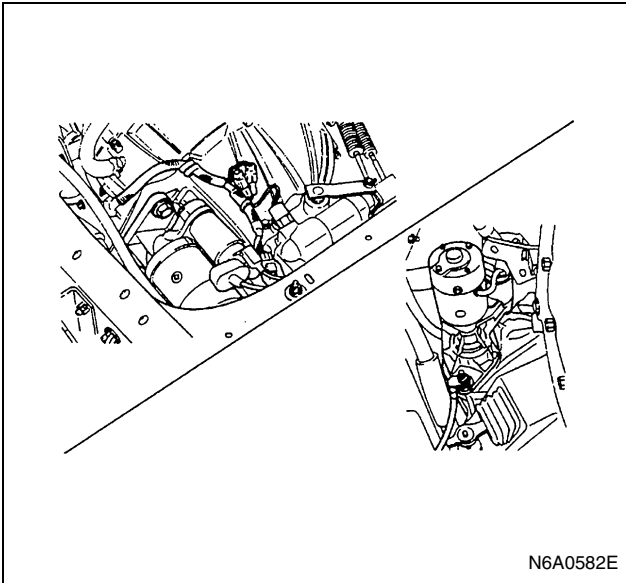
Removal

Preparation

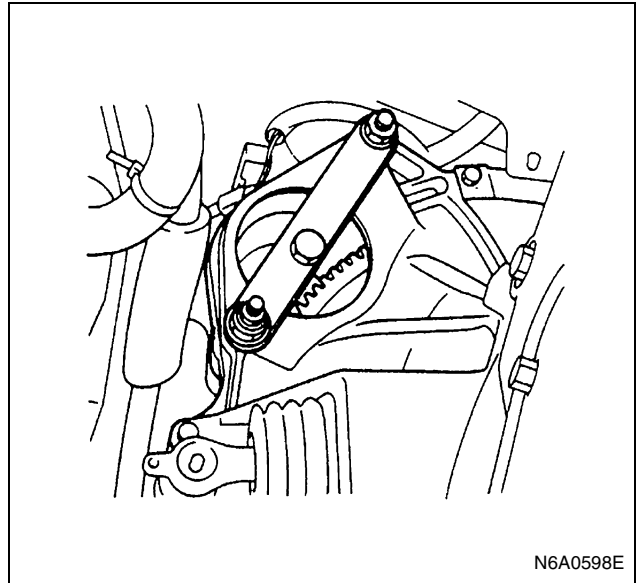
- Disconnect battery ground cable.
- Tilt the cab.
- Drain coolant

1. Transmission Panel
2. Starter

- Disconnect the battery cable at the starter motor.
- Remove the starter assembly from flywheel housing.



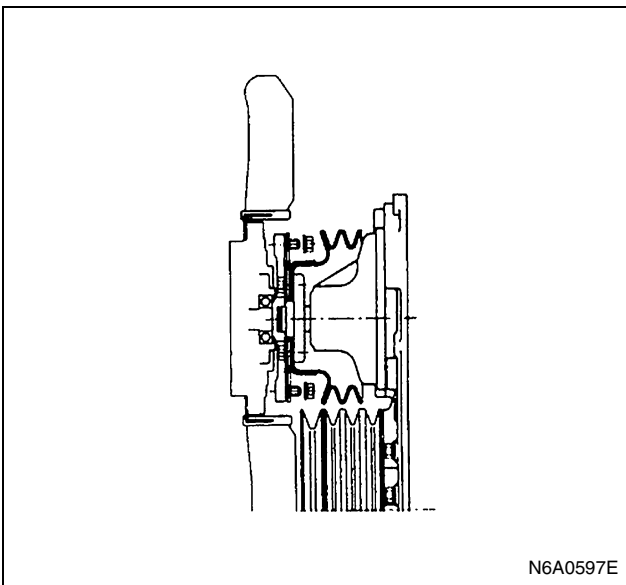
3. Radiator Upper Hose
4. Coolant Reserve Tank Hose/Bypass Hose
5. Radiator Lower Hose
6. Radiator (with Guide)
7. Fan Assembly



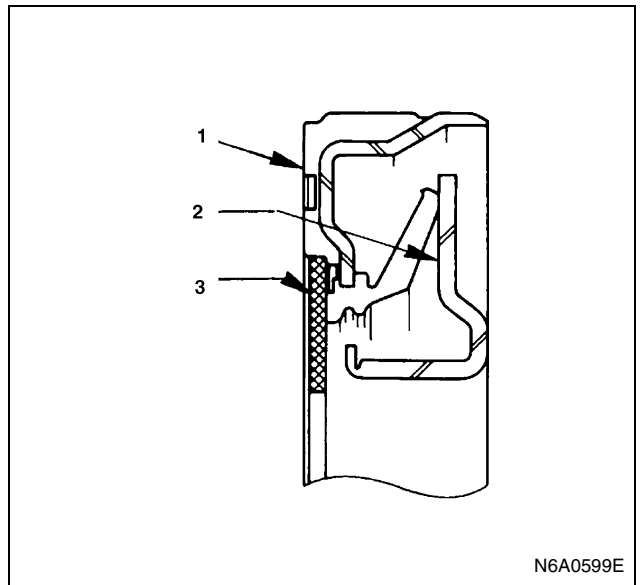
- 2) Loosen the damper pulley bolts and remove the damper pulley.
10. Crankshaft Front Oil Seal

Caution:

Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.



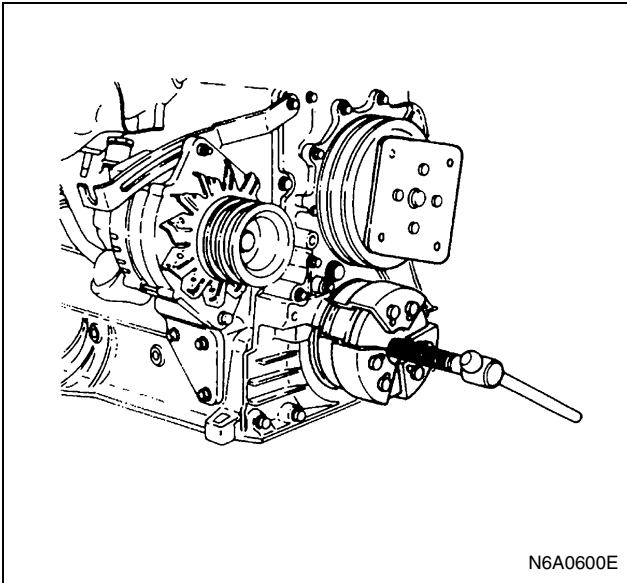
8. Fan Belt
9. Crankshaft Damper Pulley
 - 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



Legend

1. Oil seal
2. Slinger
3. Felt

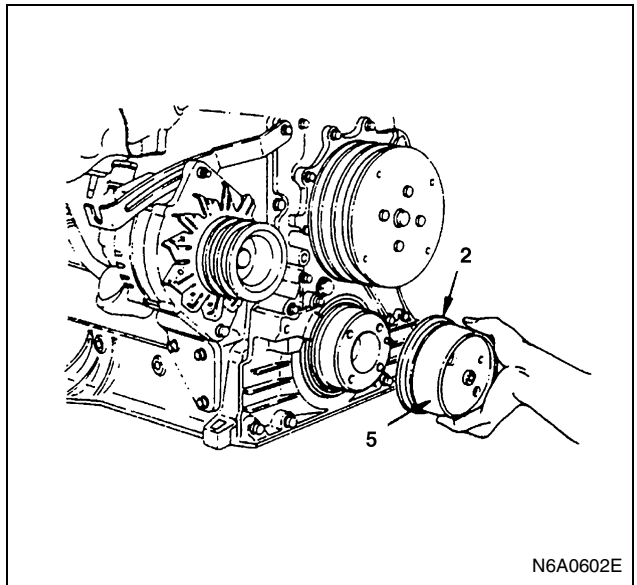
11. Crankshaft Front Slinger
Use the slinger puller to pull out the slinger.
Slinger Puller: 5-8840-2360-0



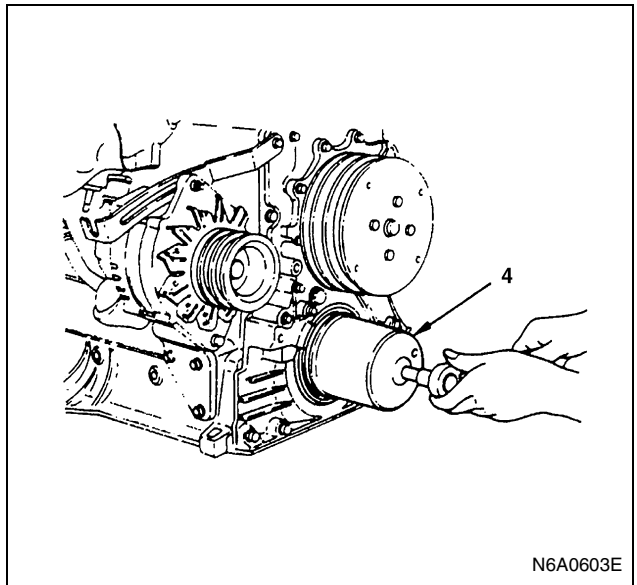
Legend

- 1. Crankshaft
- 2. Slinger
- 3. Adapter bolt
- 4. Sleeve
- 5. Adapter
- 6. Washer (5 mm (0.20 in))
- 7. Center bolt

1) Insert the slinger (2) into the end of adapter (5) and install the adapter on the crankshaft.



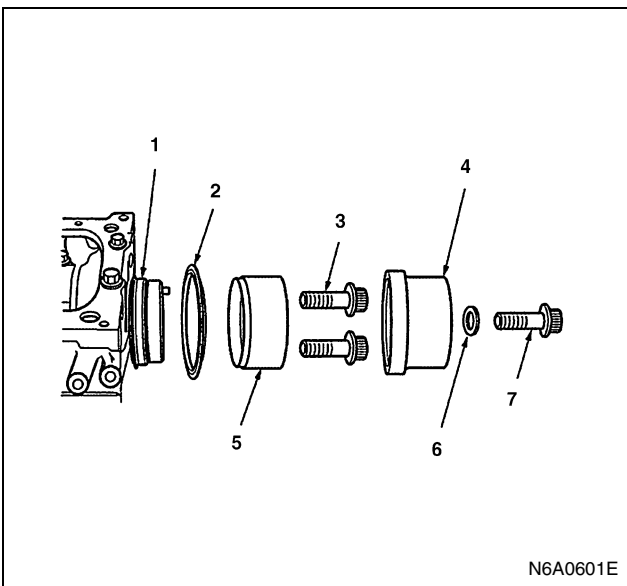
2) Cover the sleeve (4) and tighten the bolt until the sleeve comes to contact the adapter stopper (8).

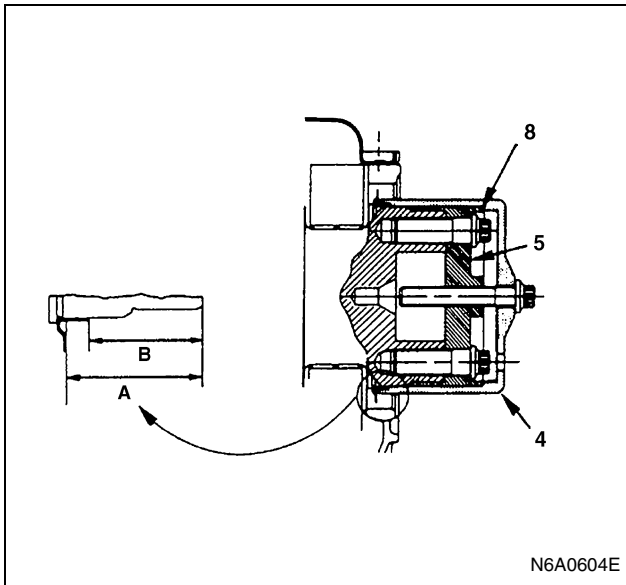


Installation

1. Crankshaft Front Slinger
Press in the slinger using the oil seal setting tool.
Oil Seal Setting Tool Kit: 5-8840-2431-0
Front slinger and oil seal setting tools

Part Name	Stamp	Slinger	Oil Seal
Adapter	FT	○	○
Sleeve	FT	○	○
Oil seal adapter ring	FT		○
Center bolt	—	○	○
Adapter bolt	—	○	○





3) With the slinger pressed in, make sure of measurements specified in the illustration as well as of slinger deflection.

(A): 40.5 ± 0.3 mm (1.594 ± 0.012 in)

(B): 34.0 ± 0.1 mm (1.339 ± 0.004 in)

Notice:

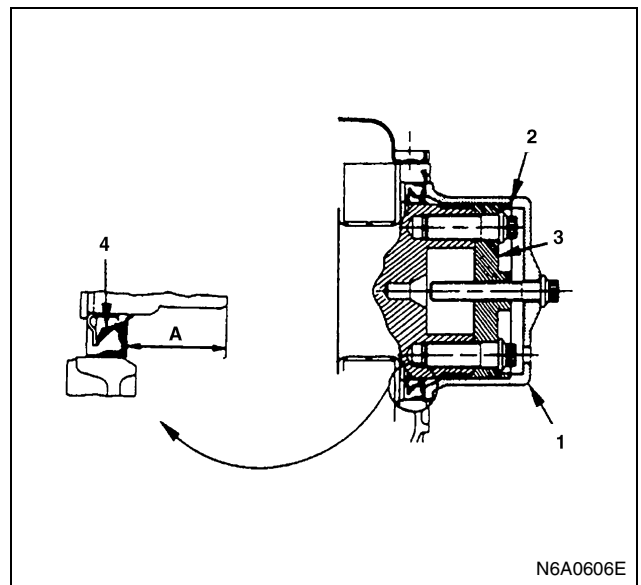
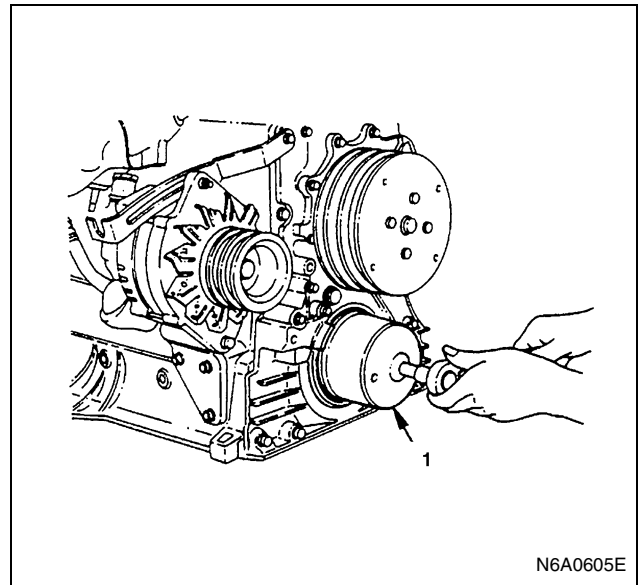
Be sure to replace the slinger and oil seal as a set. Use about 5 mm (0.20 in) thickness plain washer on the center bolt.

2. Crankshaft Front Oil Seal

- 1) Apply engine oil to the lip of the oil seal.
 - 2) Press in the oil seal using the front oil seal setting tool.
 - Remove the slinger sleeve and insert the oil seal (4) into the adapter (3).
 - Install the oil seal sleeve (1) to the adapter (3) and tighten the center bolt until the sleeve comes to contact the adapter stopper (2).
 - With the oil seal pressed in, make sure of the measurements specified in the illustration.
- (A): 31 ± 0.3 mm (1.220 ± 0.012 in)

Notice:

Be sure to replace the slinger and oil seal as a set. Use about 5 mm (0.20 in) thickness plain washer on the center bolt.

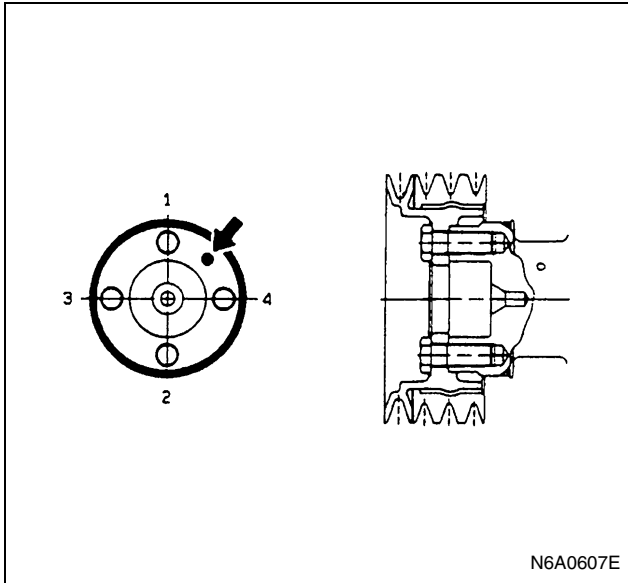


3. Crankshaft Damper Pulley

- 1) Apply a coat of engine oil to the threads of the bolts.
- 2) Align the damper pulley with the crankshaft knock pin and tighten the bolts to the specified torque in numerical order.

Tighten:

Damper pulley bolt to 200 N·m (20.4 kg·m/147 lb·ft)



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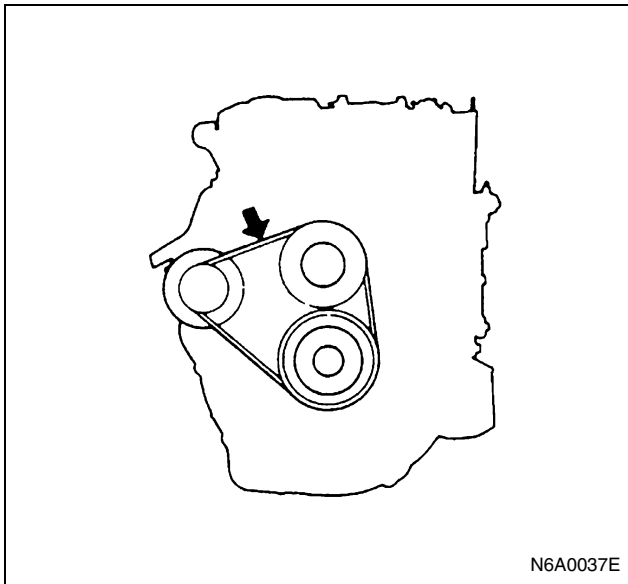
4. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 — 12 (0.31 — 0.47) ... New belt	
10 — 14 (0.39 — 0.55) ... Reuse belt	

Check the drive belt for cranking and other damage.



N6A0037E

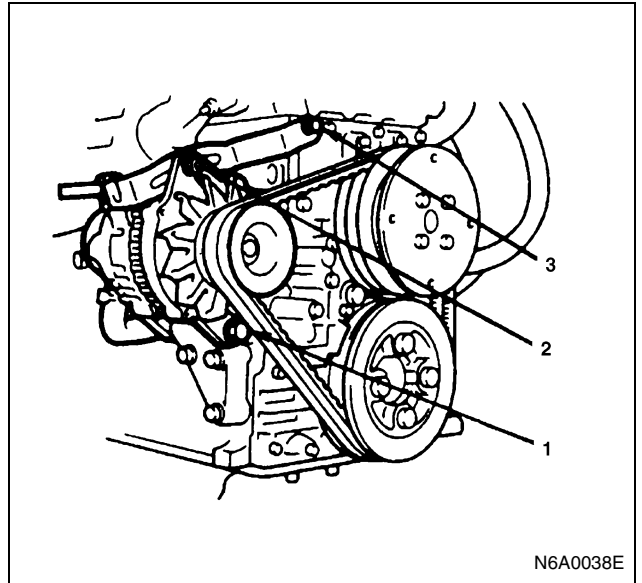
Fan Belt Adjustment

Fan belt tension is adjusted by moving the generator.

Tighten:

Belt to

- (1): 40 N·m (4.1 kg·m/30 lb·ft)
- (2): 24 N·m (2.4 kg·m/17 lb·ft)
- (3): 46 N·m (4.7 kg·m/34 lb·ft)

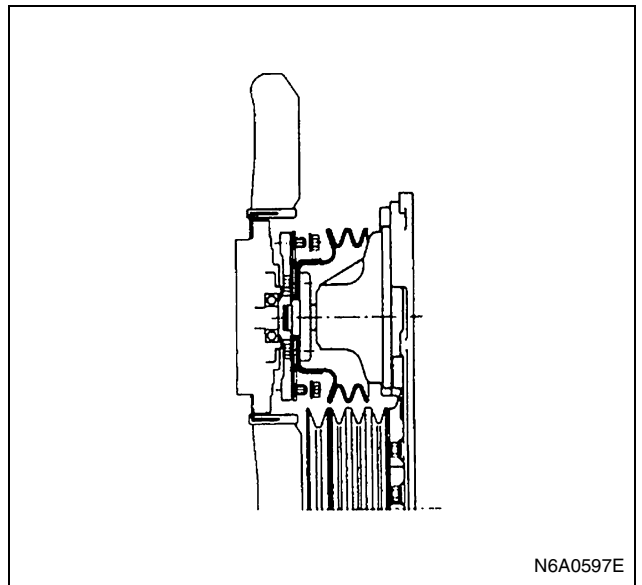


N6A0038E

5. Fan Assembly

Tighten:

Fan bolt to 24 N·m (2.4 kg·m/17 lb·ft)

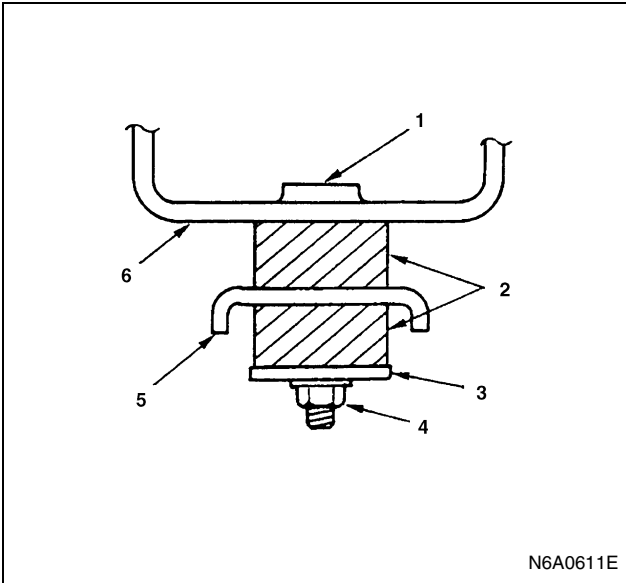


N6A0597E

6. Radiator (with Guide)

Tighten:

Radiator bolt to 55 N·m (5.6 kg·m/41 lb·ft)



N6A0611E

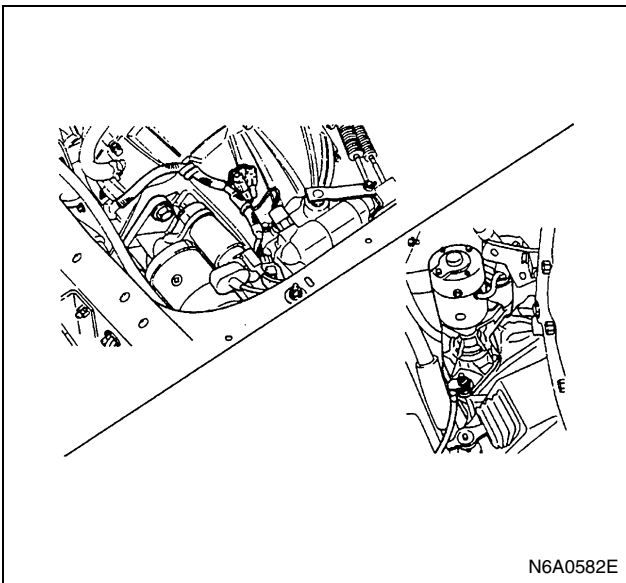
Legend

- 1. Stud bolt
- 2. Rubber
- 3. Washer
- 4. Flange nut
- 5. Flame side bracket
- 6. Radiator side bracket

- 7. Radiator Lower Hose
- 8. Coolant reserve Tank Hose/Bypass Hose
- 9. Radiator Upper Hose
- 10. Starter

Tighten:

Starter bolt to 76 N·m (7.7 kg·m/56 lb·ft)

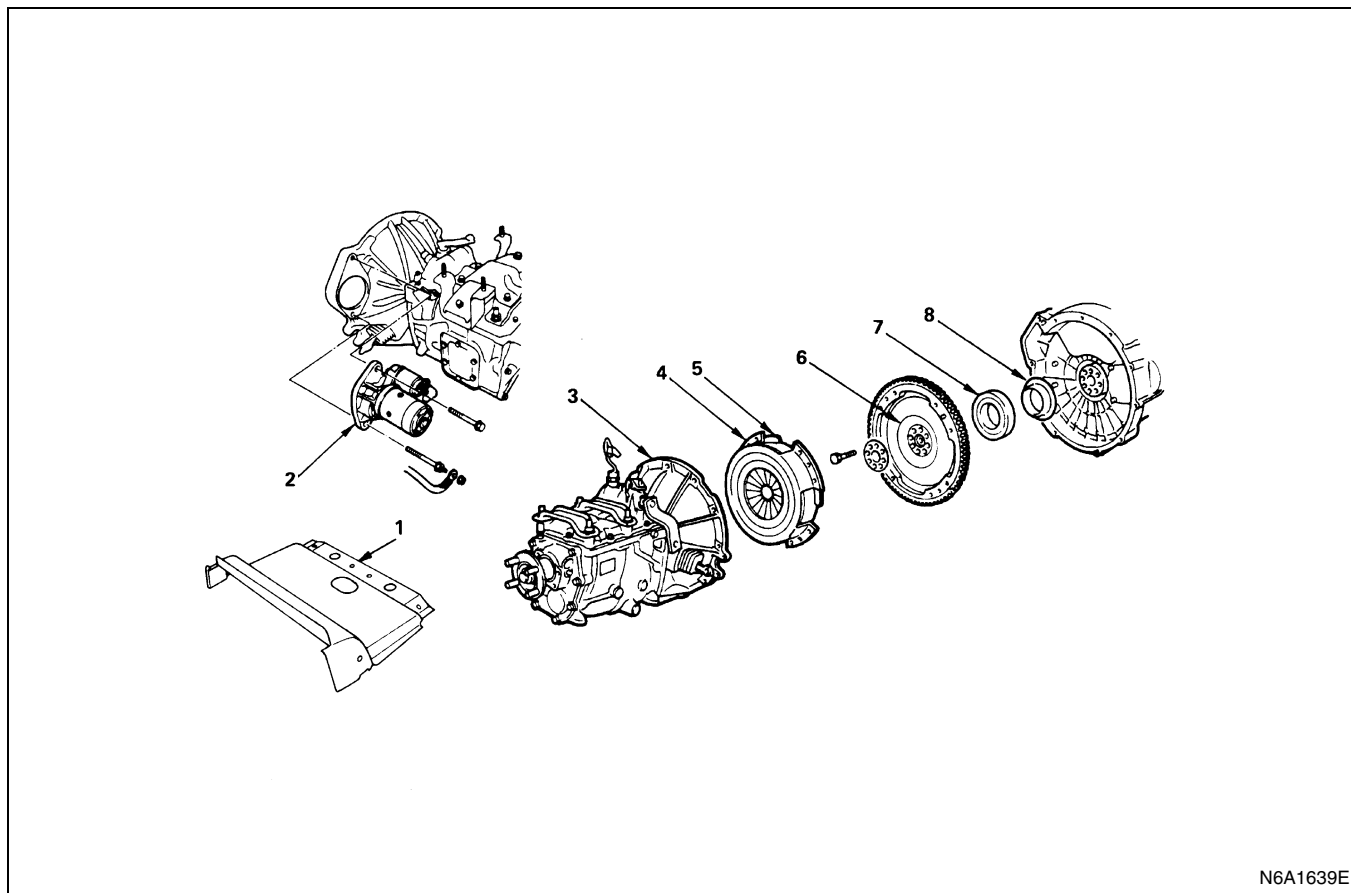


N6A0582E

- 11. Transmission Panel
 - Connect battery ground cable.
 - Pour engine coolant into engine.

CRANKSHAFT REAR OIL SEAL

Component



N6A1639E

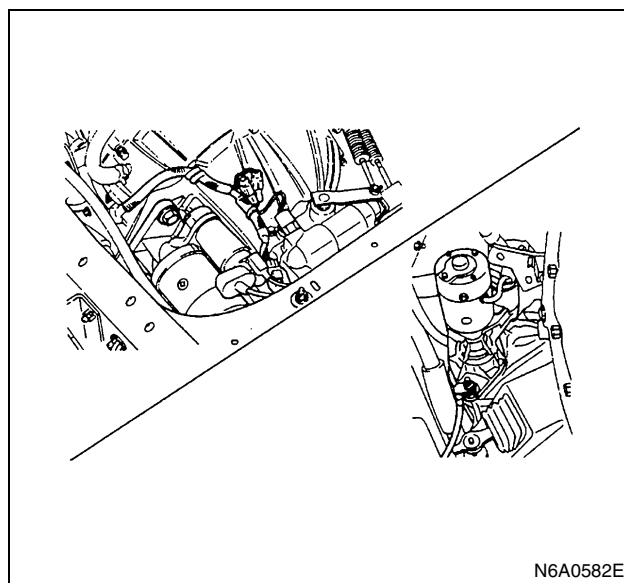
Legend

- | | |
|-----------------------------------|-----------------------------|
| 1. Transmission panel | 5. Driven plate |
| 2. Starter | 6. Flywheel assembly |
| 3. Transmission assembly | 7. Crankshaft rear oil seal |
| 4. Clutch pressure plate assembly | 8. Crankshaft rear slinger |

Removal

Preparation

- Disconnect battery ground cable.
1. Transmission Panel
 2. Starter
 - 1) Disconnect the battery cable at the starter motor.
 - 2) Remove the starter assembly from flywheel housing.



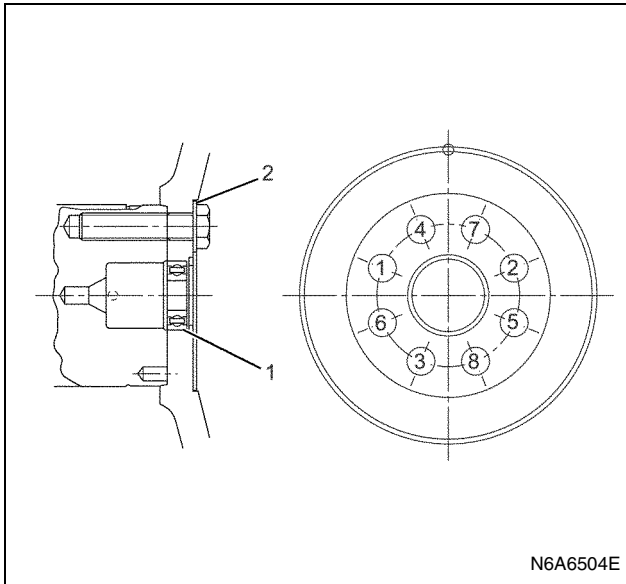
N6A0582E

3. Transmission Assembly

Above works refer to "ENGINE ASSEMBLY" section in this manual.

4. Clutch Pressure Plate Assembly
5. Driven Plate
6. Flywheel Assembly

Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.



N6A6504E

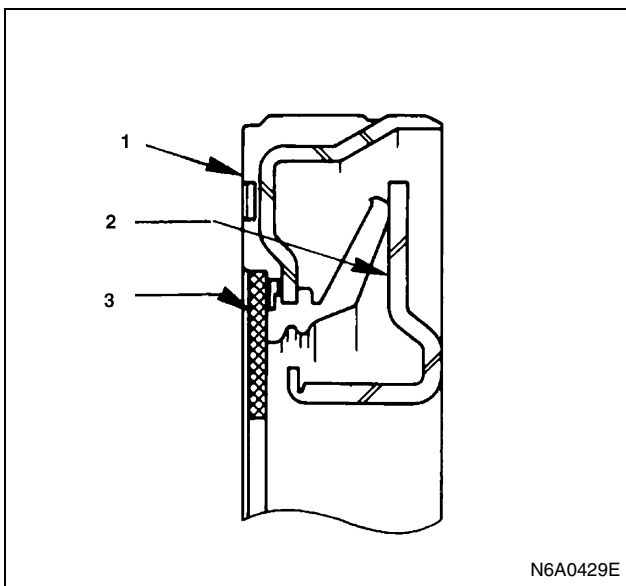
Legend

1. Washer
2. Pilot bearing

7. Crankshaft Rear Oil Seal

Caution:

Be careful not to damage the crankshaft oil seal contact surface during the removal procedure.

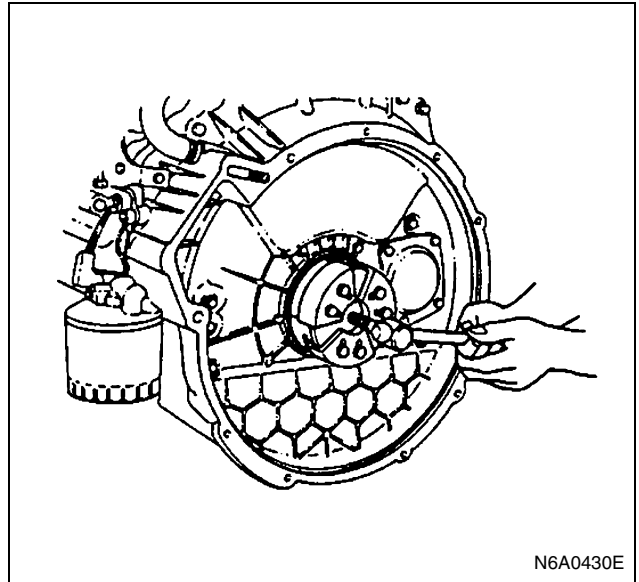


N6A0429E

Legend

1. Oil seal
2. Slinger
3. Felt

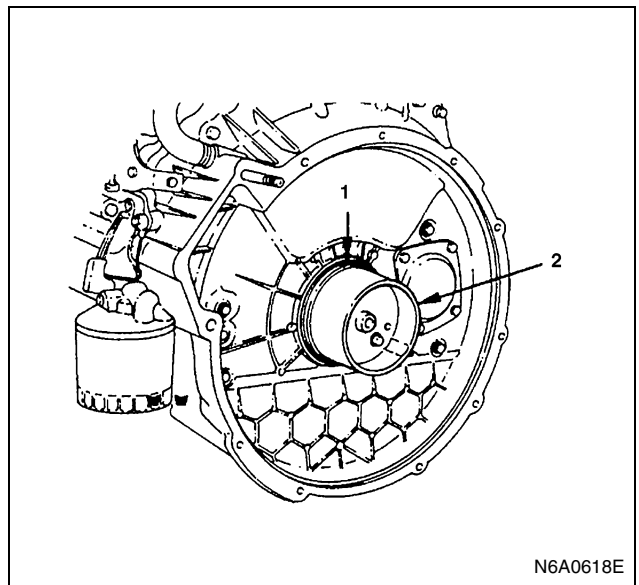
8. Crankshaft Rear Slinger
Use the slinger puller to pull out the slinger.
Slinger Puller: 5-8840-2360-0



N6A0430E

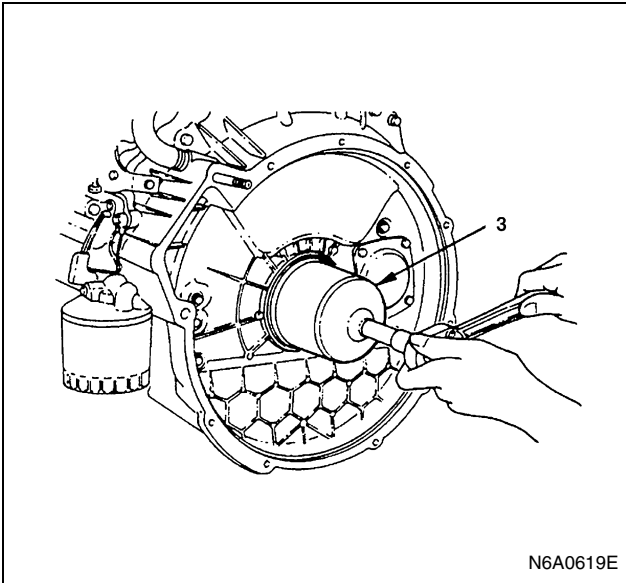
Installation

1. Crankshaft Rear Slinger
Press in the slinger using oil seal setting tool kit.
 - Insert the slinger (1) into the end of adapter (2) and install the adapter on the crankshaft.

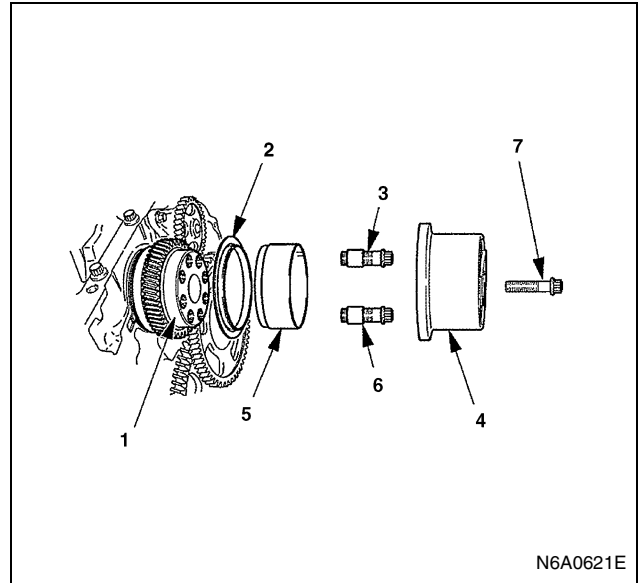


N6A0618E

- Cover the sleeve (3) and tighten the bolt until the sleeve comes to contact the adapter stopper (4).



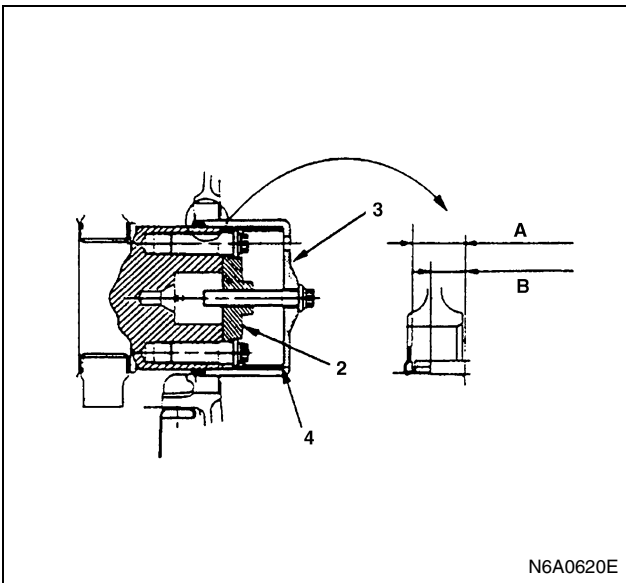
N6A0619E



N6A0621E

Legend

- 1. Crankshaft
- 2. Slinger
- 3. Adapter bolt
- 4. Sleeve
- 5. Adapter
- 6. Collar
- 7. Center bolt



N6A0620E

- Make sure of measurements specified in the illustration as well as of slinger deflection.
 (A): 17.3 ± 0.3 mm (0.681 ± 0.012 in)
 (B): 10.8 ± 0.1 mm (0.425 ± 0.004 in)

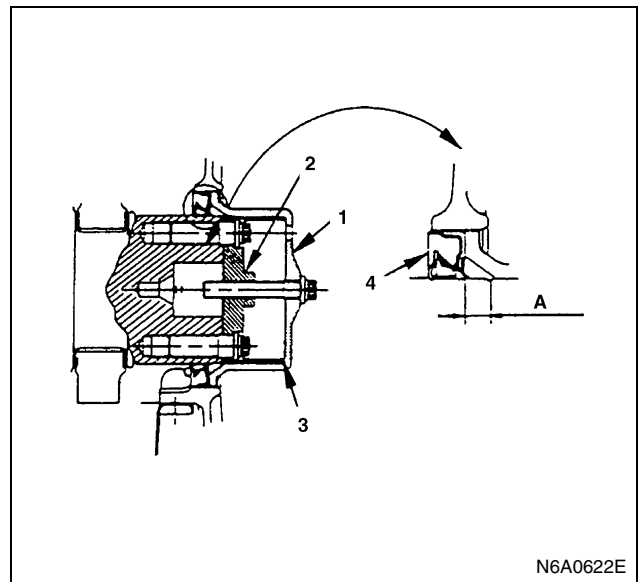
Notice:

Be sure to replace the slinger and oil seal as a set.

Oil Seal Setting Tool Kit: 5-8840-2431-0

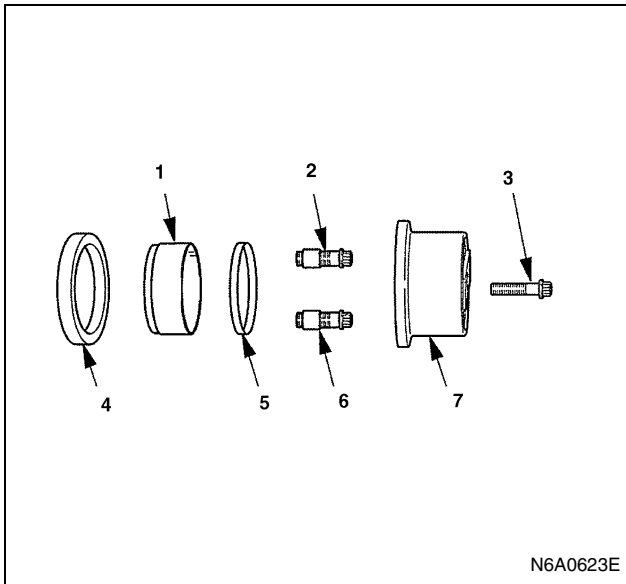
Rear slinger and oil seal setting tools

Part Name	Stamp	Slinger	Oil Seal
Adapter	RR	○	○
Sleeve	RR	○	○
Oil seal adapter ring	RR		○
Center bolt	—	○	○
Adapter bolt	—	○	○
Adapter bolt collar	RR	○	○



N6A0622E

- Make sure of the measurements specified in the illustration.
(A): 7.8 ± 0.3 mm (0.307 ± 0.012 in)



N6A0623E

Legend

1. Adapter
2. Adapter bolt
3. Center bolt
4. Oil seal
5. Ring
6. Collar
7. Sleeve

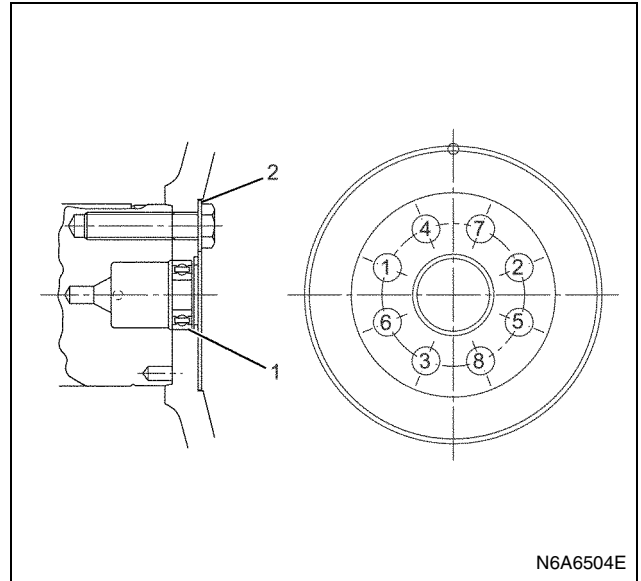
3. Flywheel Assembly

- 1) Apply a coat of molybdenum disulfide grease to the flywheel bolt threads and setting faces.
- 2) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
- 3) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0
- 4) Install the washer and the flywheel bolts and tighten to the specified torque in numerical order show in the illustration.

Tighten:

Flywheel bolt to

- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°



N6A6504E

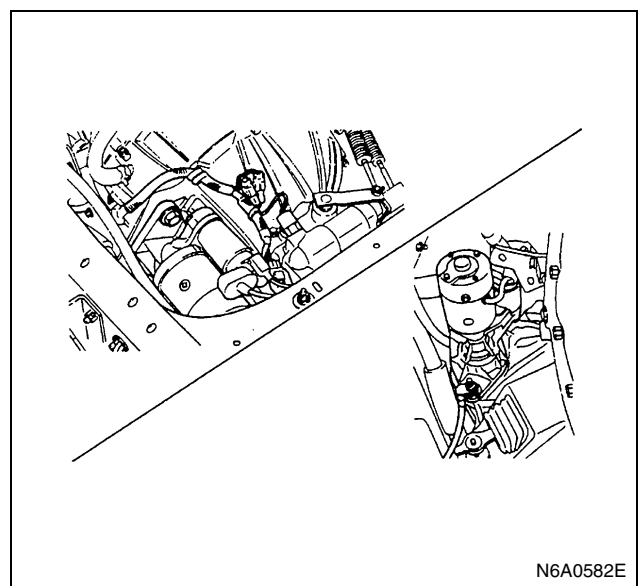
Legend

1. Washer
2. Pilot bearing

- 5) Remove the crankshaft stopper.
4. Driven Plate
5. Clutch Pressure Plate Assembly
Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.
6. Transmission Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
7. Starter

Tighten:

Starter bolt to 76 N·m (7.7 kg·m/56 lb·ft)



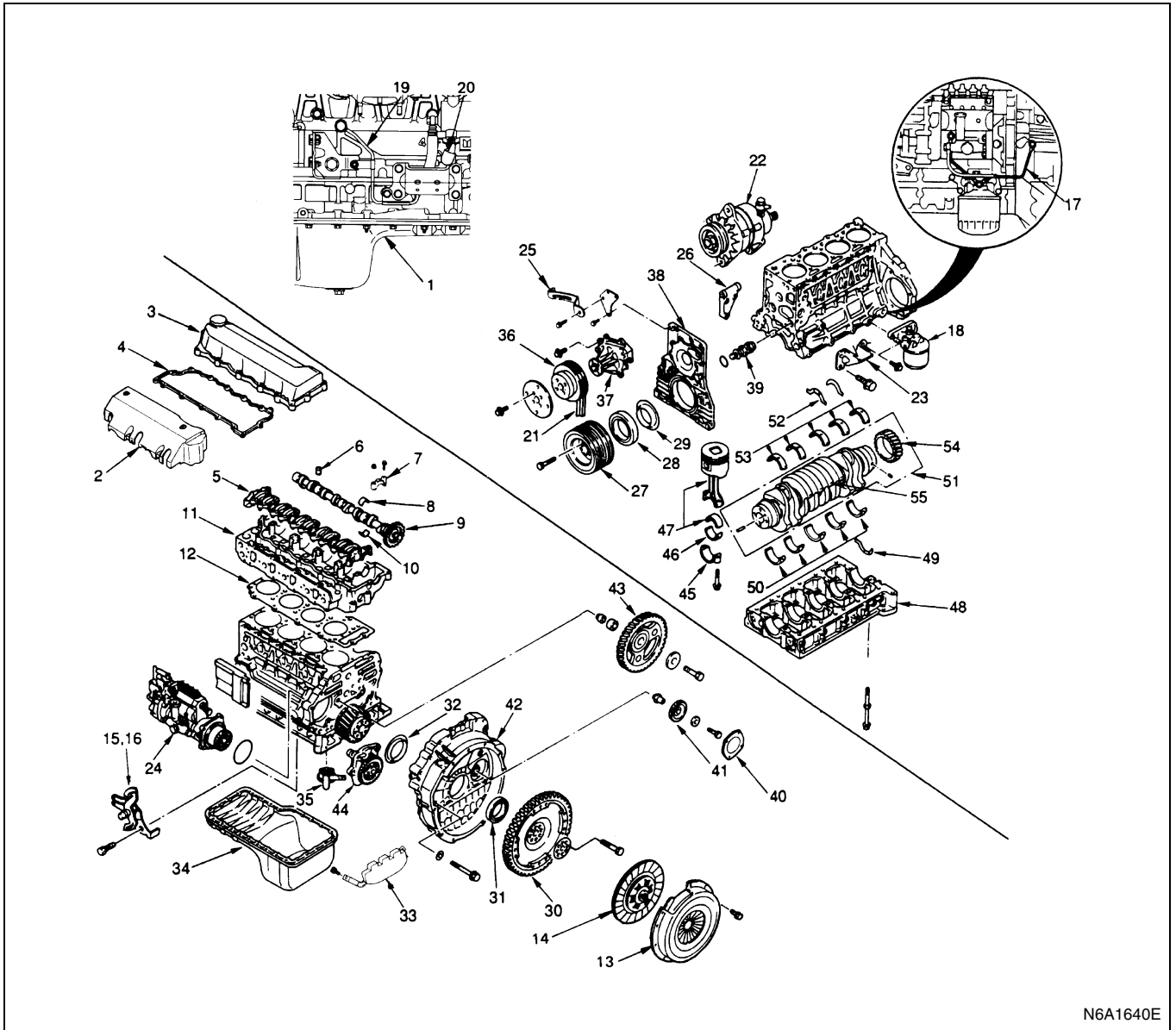
N6A0582E

8. Transmission Panel

- Connect the battery ground cable.

CRANKSHAFT

Component



N6A1640E

Legend

- | | |
|------------------------------------|---|
| 1. Engine cover | 29. Crankshaft front slinger |
| 2. Nozzle cover | 30. Flywheel |
| 3. Cylinder head cover | 31. Crankshaft rear oil seal |
| 4. Cylinder head cover gasket | 32. Crankshaft rear slinger |
| 5. Rocker arm shaft assembly | 33. Spacer rubber |
| 6. Valve cap | 34. Oil pan |
| 7. Camshaft bearing cap | 35. Oil pump strainer |
| 8. Camshaft bearing upper | 36. Water pump pulley |
| 9. Camshaft assembly | 37. Water pump |
| 10. Camshaft bearing lower | 38. Front retainer |
| 11. Cylinder head assembly | 39. Oil thermo valve |
| 12. Cylinder head gasket | 40. Power steering pump idle gear cover |
| 13. Clutch pressure plate assembly | 41. Power steering pump idle gear |
| 14. Driven plate | 42. Flywheel housing |
| 15. Engine control wire | 43. Idle gear A |
| 16. Engine control lever assembly | 44. Oil pump assembly |
| 17. Oil pipe | 45. Connecting rod cap assembly |
| 18. Oil filter assembly | 46. Connecting rod lower bearing |
| 19. Vacuum pump oil pipe | 47. Piston and connecting rod assembly |
| 20. Vacuum pump rubber hose | 48. Crankcase |
| 21. Fan belt | 49. Thrust bearing lower |
| 22. Generator | 50. Crankshaft bearing lower |
| 23. Engine foot | 51. Crankshaft assembly |
| 24. Injection pump assembly | 52. Thrust bearing upper |
| 25. Fan belt adjust plate | 53. Crankshaft bearing upper |
| 26. Generator bracket | 54. Crankshaft gear |
| 27. Crankshaft pulley | 55. Crankshaft |
| 28. Crankshaft front oil seal | |
-

Removal

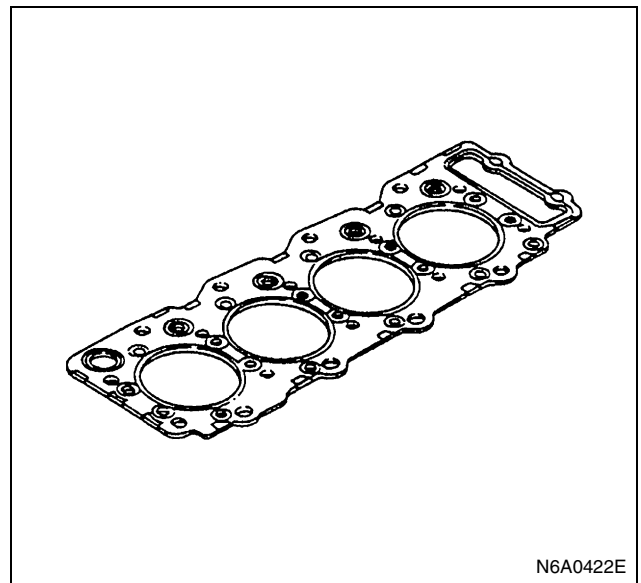
Preparation

- Disconnect battery ground cable.
 - Tilt the cab
 - Drain coolant and engine oil
1. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
 2. Nozzle Cover
 3. Cylinder Head Cover
 4. Cylinder Head Cover Gasket
 5. Rocker Arm Shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
 6. Valve Cap
 7. Camshaft Bearing Cap
 8. Camshaft Bearing Upper
 9. Camshaft Assembly
 10. Camshaft Bearing Lower
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
 11. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.

12. Cylinder Head Gasket

Caution:

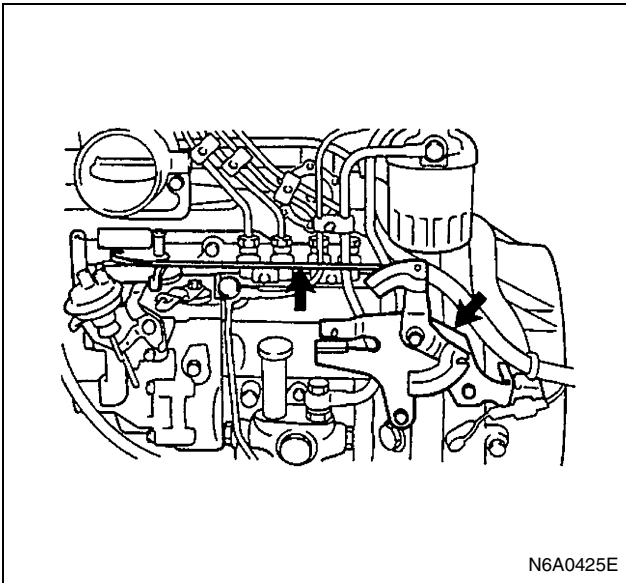
Do not reuse the cylinder head gasket.



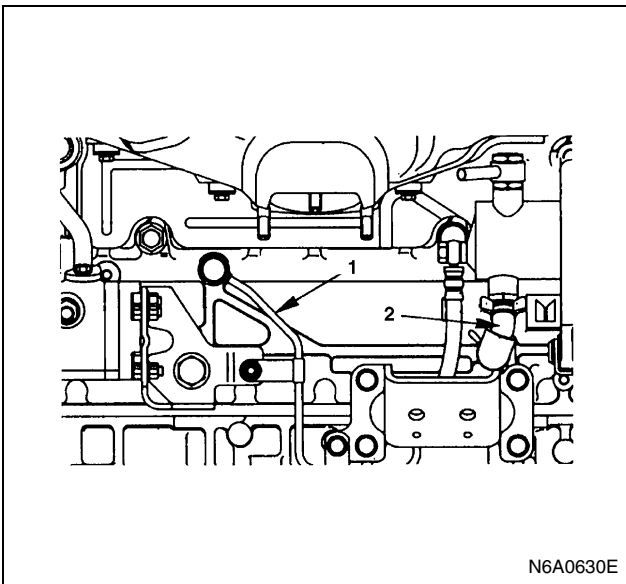
13. Clutch Pressure Plate Assembly
14. Driven Plate

Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.

- 15. Engine Control Wire
- 16. Engine Control Lever Assembly



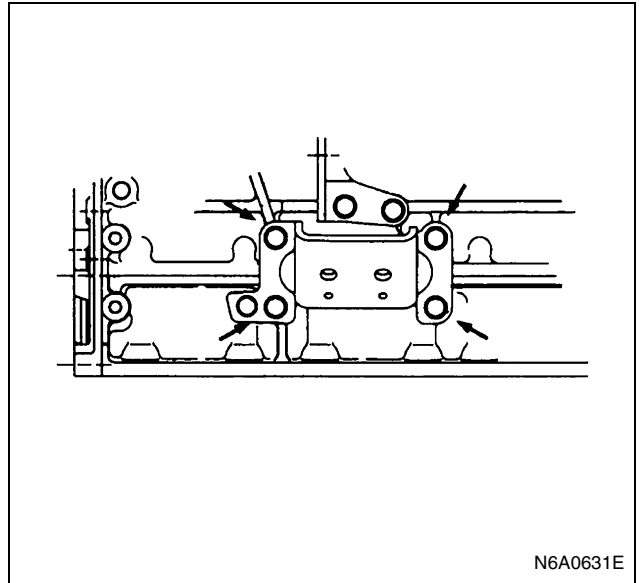
- 17. Oil Pipe
- 18. Oil Filter Assembly
- 19. Vacuum Pump Oil Pipe
- 20. Vacuum Pump Rubber Hose



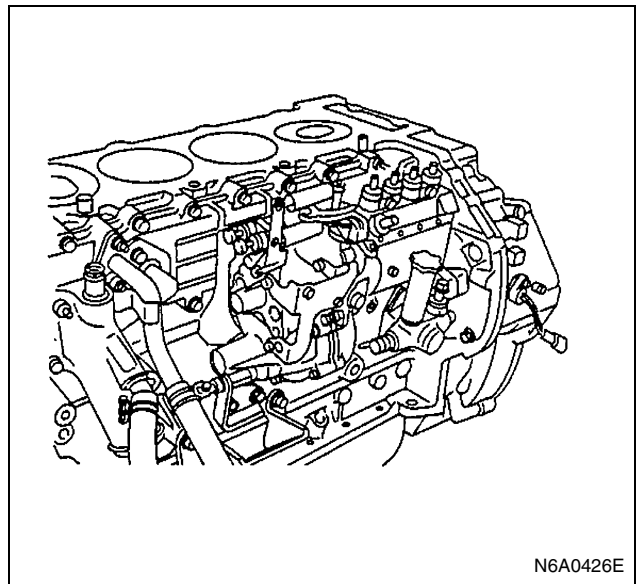
Legend

- 1. Vacuum pump oil pipe
- 2. Vacuum pump rubber hose

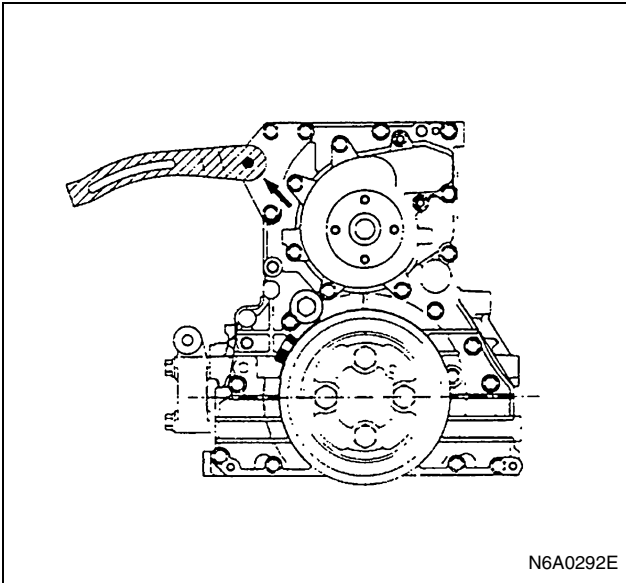
- 21. Fan Belt
- 22. Generator
- 23. Engine Foot



- 24. Injection Pump Assembly
 - 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
 - 2) Then remove the injection pump assembly.

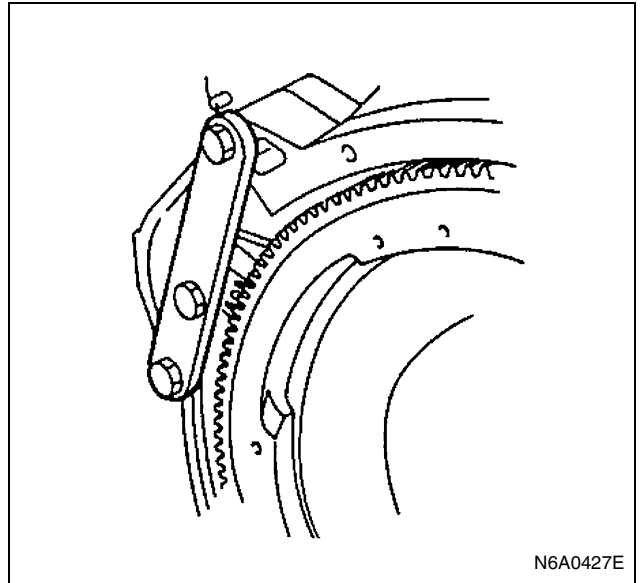


- 25. Fan Belt Adjust Plate



N6A0292E

26. Generator Bracket



N6A0427E

2) Loosen the damper pulley bolts and remove the damper pulley.

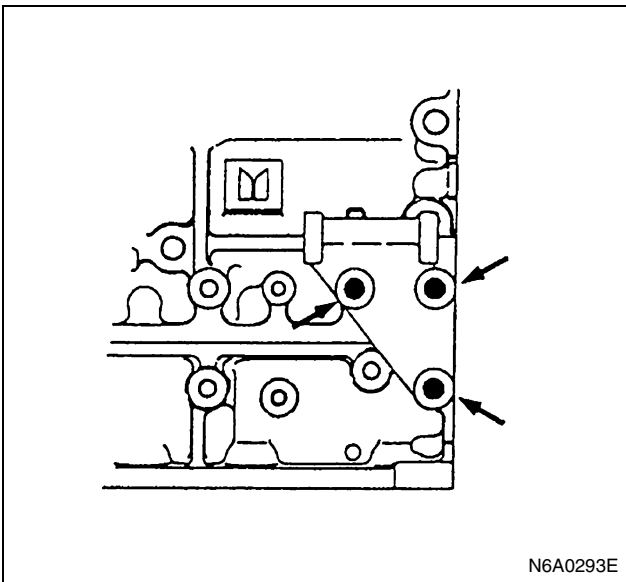
28. Crankshaft Front Oil Seal

29. Crankshaft Front Slinger

Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.

30. Flywheel

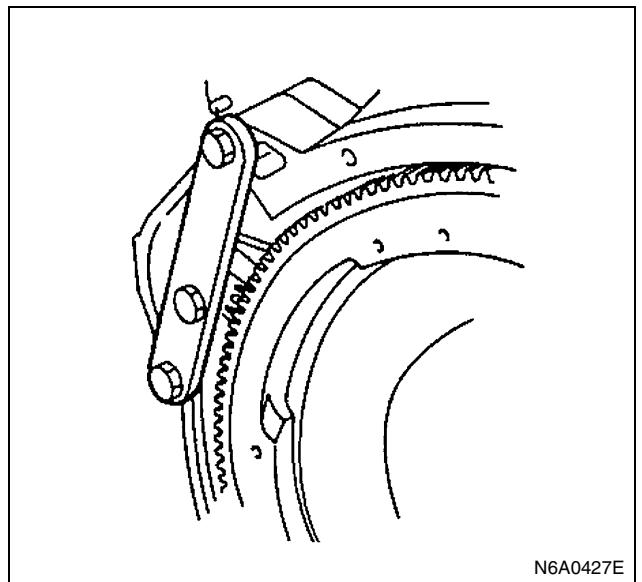
1) Use the crankshaft stopper to prevent the crankshaft from turning
Crankshaft Stopper: 5-8840-2230-0



N6A0293E

27. Crankshaft Damper Pulley

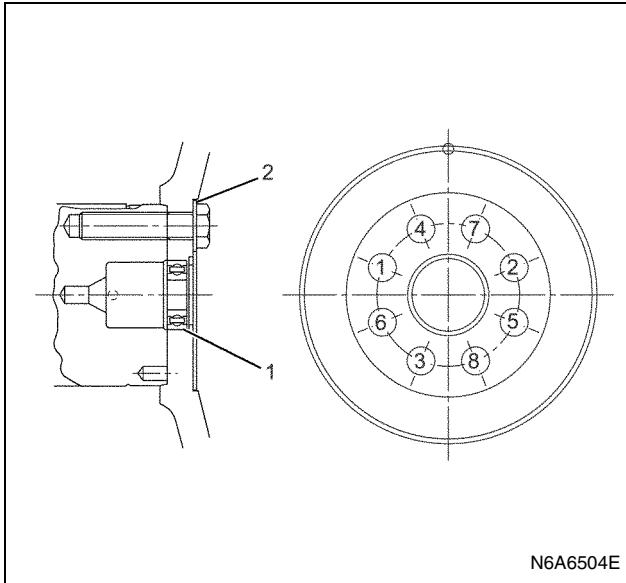
1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



N6A0427E

2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.

3) Remove the flywheel stopper and the flywheel assembly.

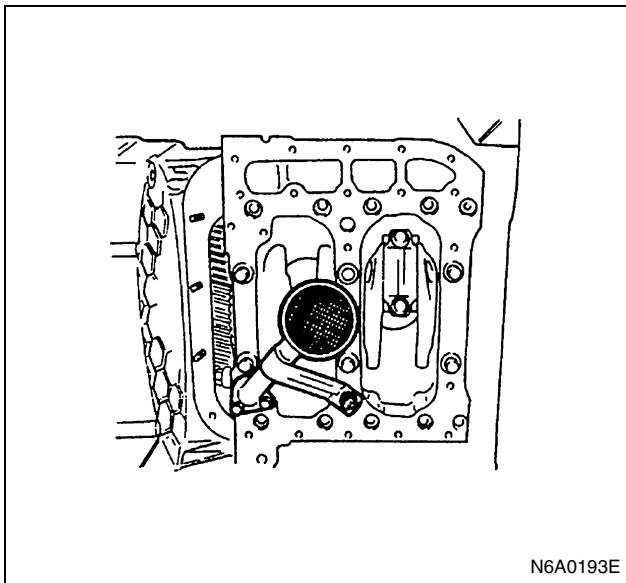


N6A6504E

Legend

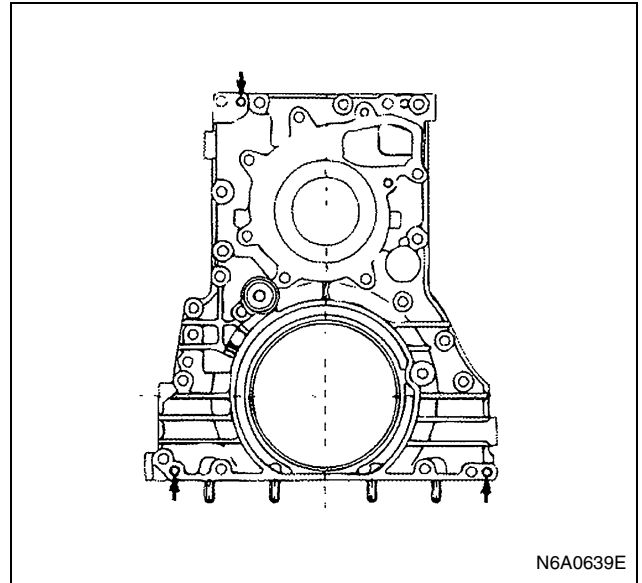
- 1. Washer
- 2. Pilot bearing

- 31. Crankshaft Rear Oil Seal
- 32. Crankshaft Rear Slinger
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.
- 33. Spacer Rubber
Remove the stiffener before removing the spacer rubber.
- 34. Oil Pan
- 35. Oil Pump Strainer



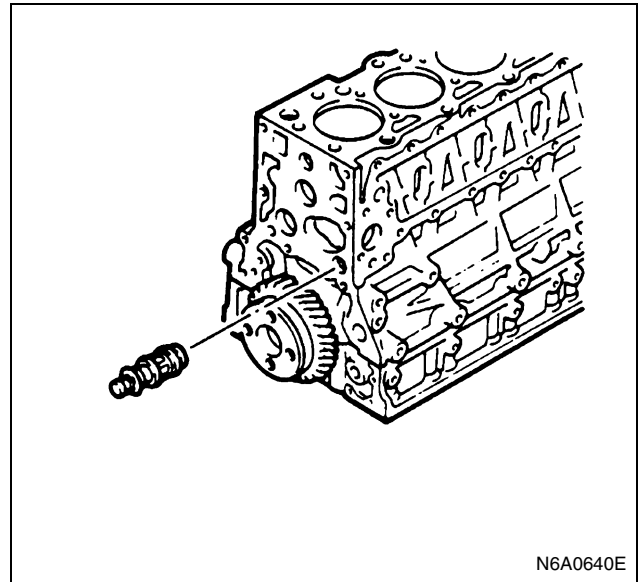
N6A0193E

- 36. Water Pump Pulley
- 37. Water Pump
- 38. Front Retainer
Install the three front retainer fixing bolts to the front retainer replacer holes as shown in the illustration, and tighten the bolts alternately a little at a time.



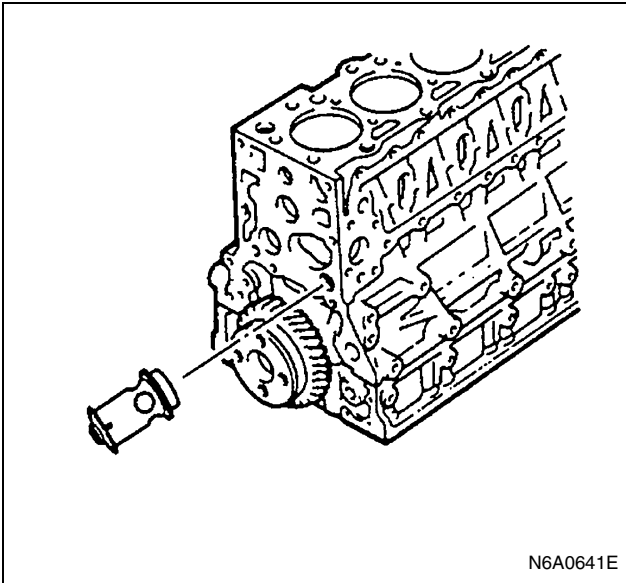
N6A0639E

- 39. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Pull out the thermo valve from the cylinder body.



N6A0640E

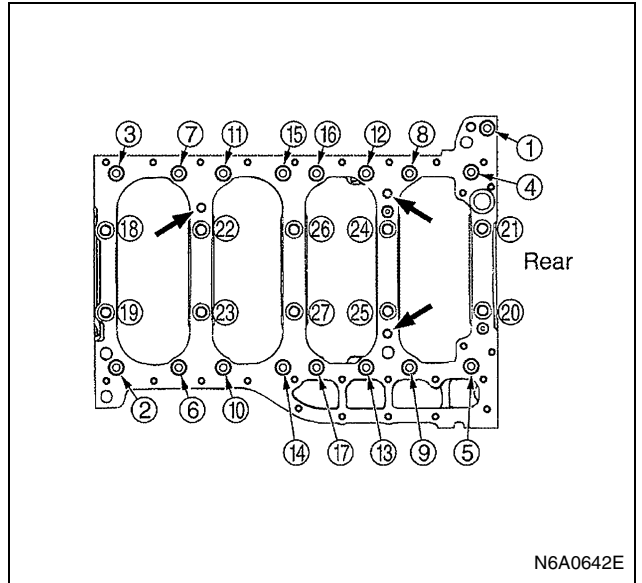
- 40. Bypass Valve (4HE1-TC)
Pull out the bypass valve from the cylinder body.



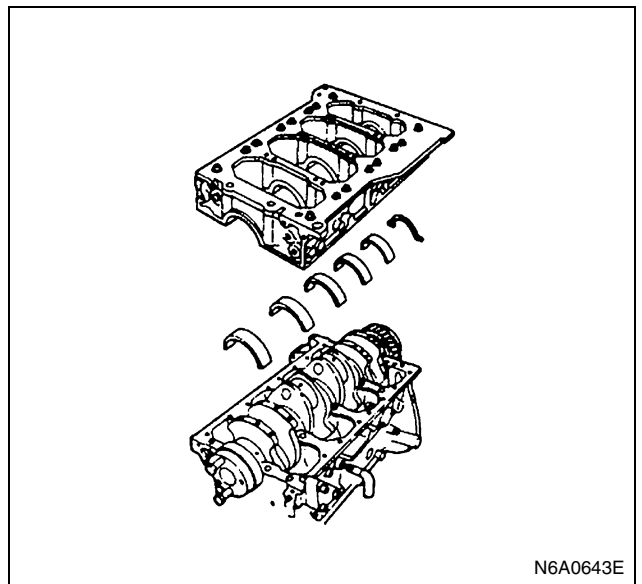
- 41. Power Steering Pump Idle Gear Cover
- 42. Power Steering Pump Idle Gear
- 43. Flywheel Housing
- 44. Idle Gear A
- 45. Oil Pump Assembly
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
- 46. Connecting Rod Cap Assembly
- 47. Connecting Rod Lower Bearing
- 48. Piston and Connecting Rod Assembly
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
- 49. Crankcase
 - 1) Loosen the crankcase bolts in numerical order a little at a time.
 - 2) Install the three crankcase fixing bolts (See arrow marks) to the crankcase replacer holes as shown in the illustration, and tighten the bolts alternate a little at a time.

Notice:

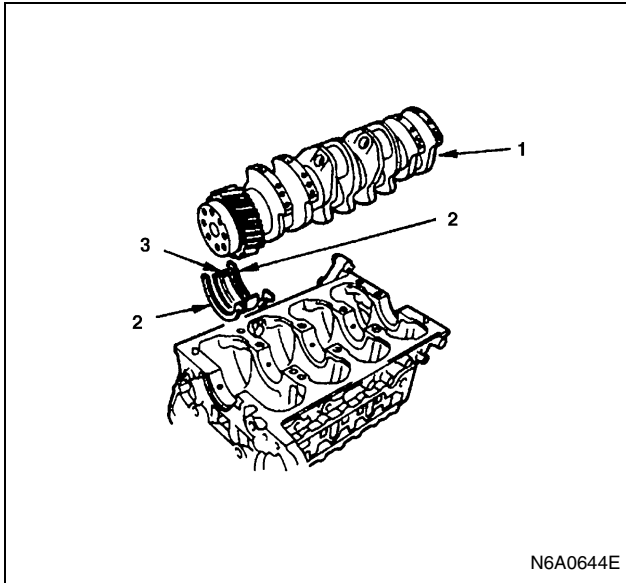
When removing the crankcase, be sure to remove the oil pump and the generator bracket before that.



- 50. Thrust Bearing Lower
- 51. Crankshaft Bearing Lower



- 52. Crankshaft Assembly
- 53. Thrust Bearing Upper
- 54. Crankshaft Bearing Upper



N6A0644E

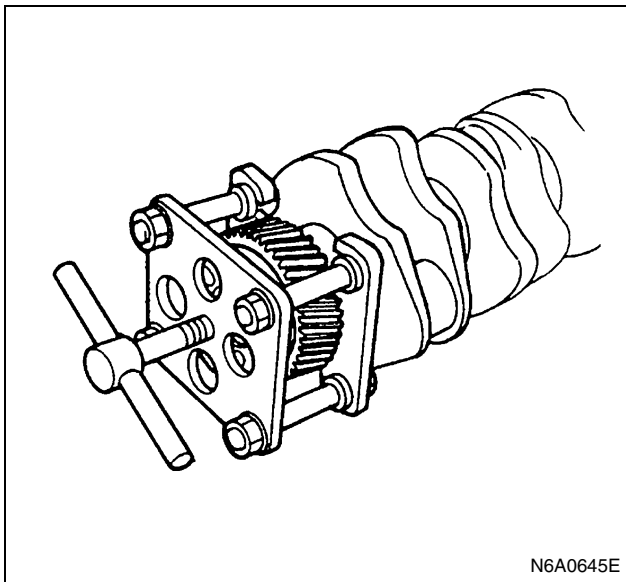
Legend

1. Crankshaft assembly
2. Thrust bearing upper
3. Crankshaft bearing upper

55. Crankshaft Gear

- 1) Use the crankshaft gear remover to remove the crankshaft gear.

Crankshaft Gear Remover: 8-9439-6818-0



N6A0645E

- 2) Remove the crankshaft feather key.

56. Crankshaft

Installation

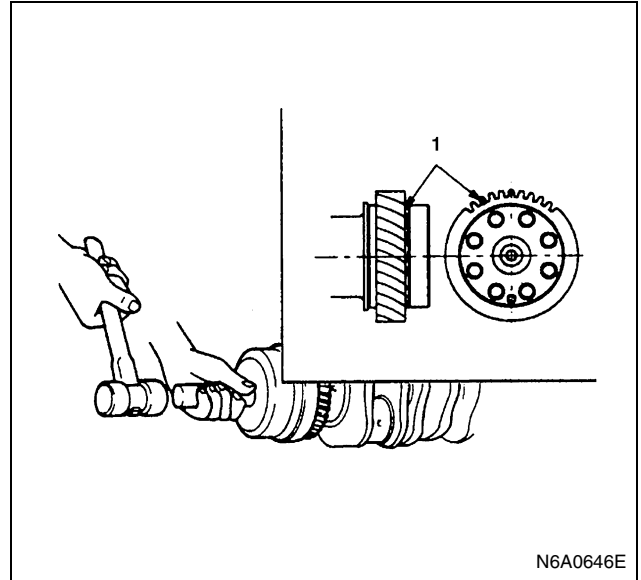
1. Crankshaft
2. Crankshaft Gear
 - 1) Use a piston heater to heat the crankshaft gear to 170 — 250°C (338 — 482°F).
 - 2) With the alignment mark “S” on the side of the crankshaft gear turned outward, align the groove on the gear side with the crankshaft pin

position and hammer it in with a crankshaft gear installer until it hits the bottom.

Caution:

When hammered in with the gear slanted, the crankshaft gear may be caught in the middle and cannot be hammered in fully. Gear it in quickly enough not to allow a shaft line along the gear and the crankshaft to slant.

Crankshaft Gear Installer: 8-9439-6819-0



N6A0646E

Legend

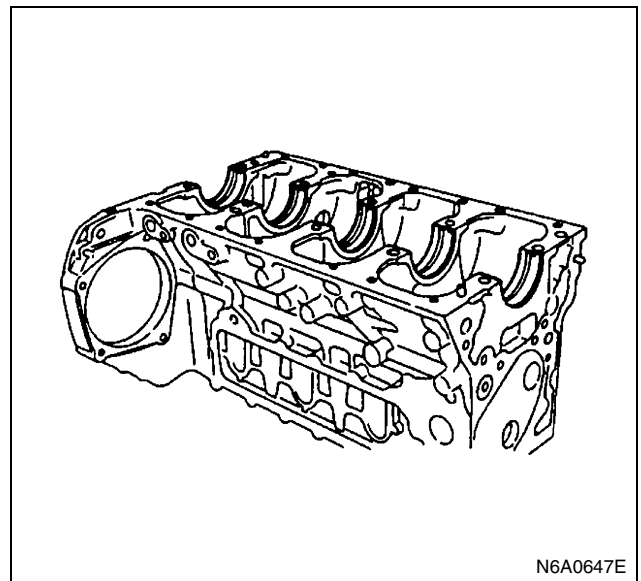
1. Alignment mark

3. Crankshaft Bearing Upper

When replacing the crankshaft or the crankshaft bearing with a new one, select the crankshaft bearing according to the respective grades stamped on the crankshaft and the cylinder body.

Refer to the “CRANKSHAFT”.

All upper bearings have oil grooves.



N6A0647E

- 1) Carefully wipe any foreign material from the upper bearing.

Caution:

Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surfaces.

- 2) Locate the position mark applied at disassembly if the removed upper bearings are to be re-used.

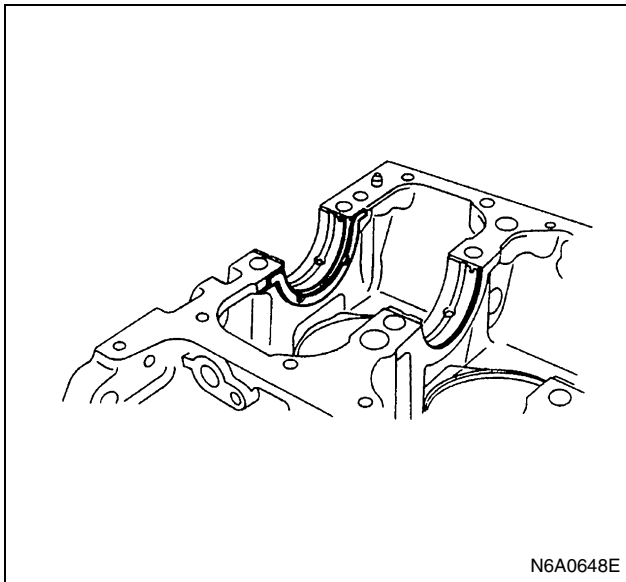
4. Thrust Bearing Upper

Install the thrust bearing upper to the front side of the cylinder body No.5 journal. At this time, the thrust bearing upper may be pasted to the cylinder body with grease.

However, be sure to wipe off any excessive grease.

Caution:

The thrust bearing oil grooves must be facing the sliding faces.



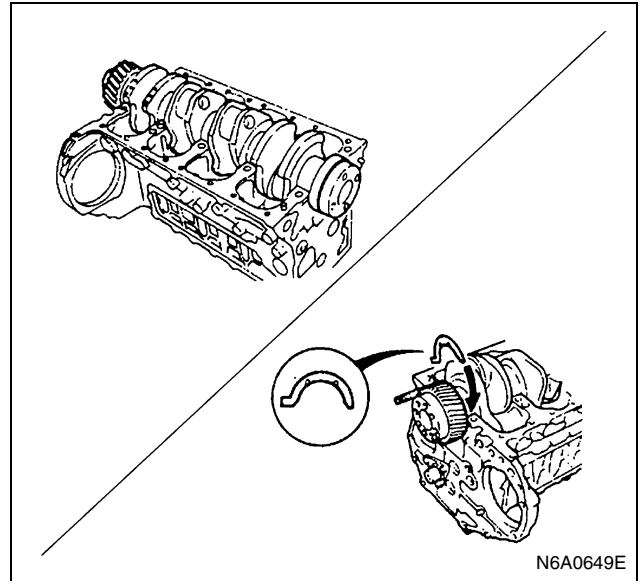
5. Crankshaft Assembly

Apply an ample coat of engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft with timing gear.

- While pressing on the installed crankshaft toward the rear side, insert the thrust bearing upper into the rear side of the cylinder body No.5 journal.

Caution:

The thrust bearing oil grooves must be facing the sliding faces.



6. Crankshaft Bearing Lower

All lower bearings does not have oil grooves.

- 1) Carefully wipe any foreign material from the lower bearing.

Caution:

Do not apply engine oil to the bearing back faces and the crankcase bearing fitting surfaces.

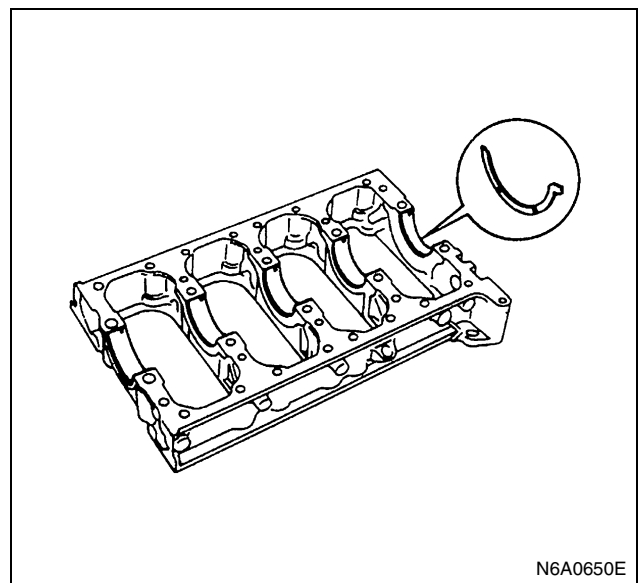
- 2) Locate the position mark applied at disassembly if the removed lower bearings are to be re-used.

7. Thrust Bearing Lower

Install the thrust bearing lower to the rear side of the crankcase No.5 journal.

Caution:

The thrust bearing oil grooves must be facing the sliding faces.

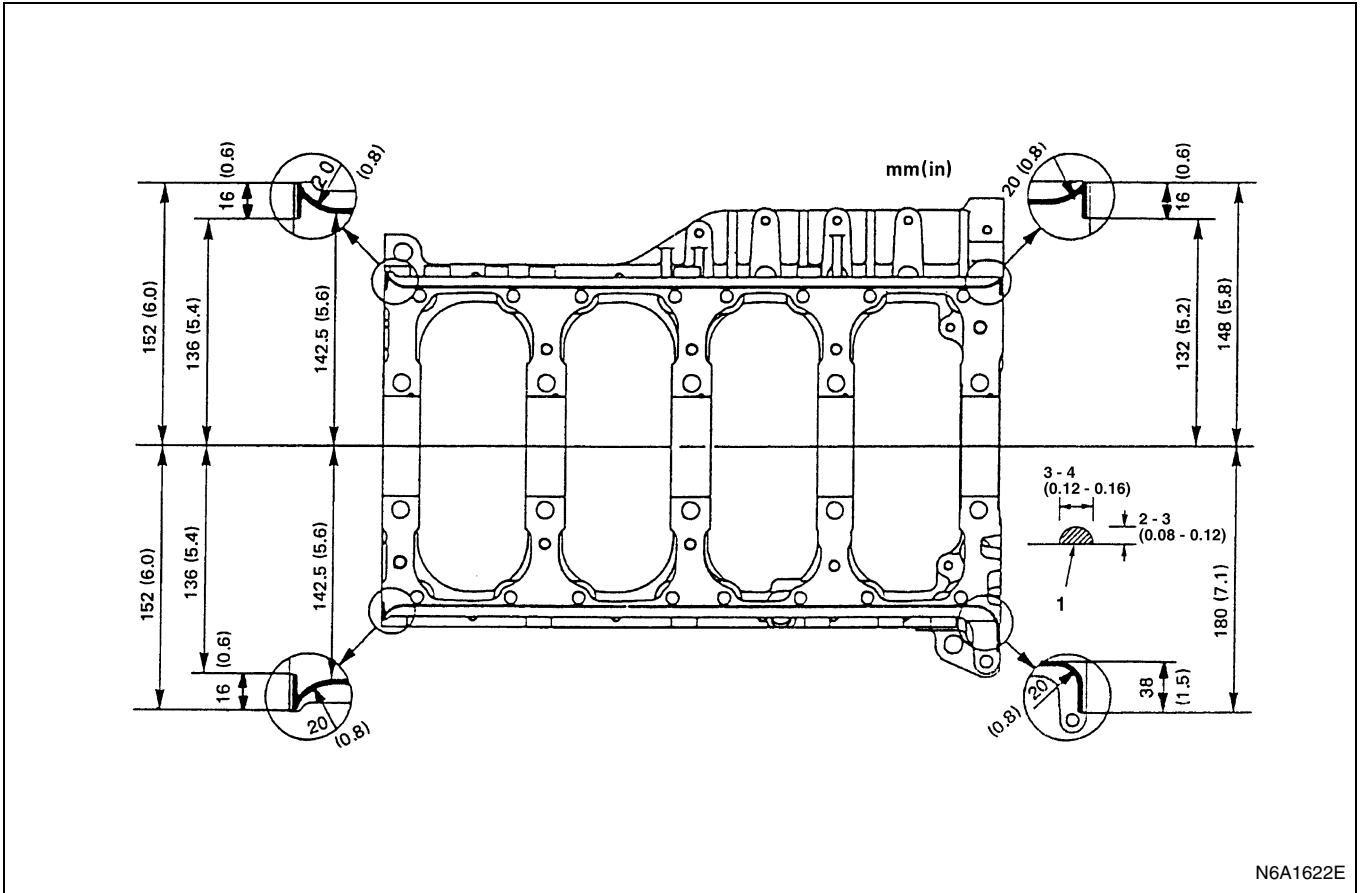


8. Crankcase

- 1) Apply a 3 mm (0.12 in) bead of recommended liquid gasket (Three Bond 1207C) or its equivalent to the crankcase upper surface as shown in the illustration.

- 2) Carefully place the crankcase on the cylinder body.

- Install the crankcase within 20 minutes after application of liquid gasket.



Legend

1. Liquid gasket

- 3) Tighten the crankcase to the specified torque in the numerical order shown in the illustration.

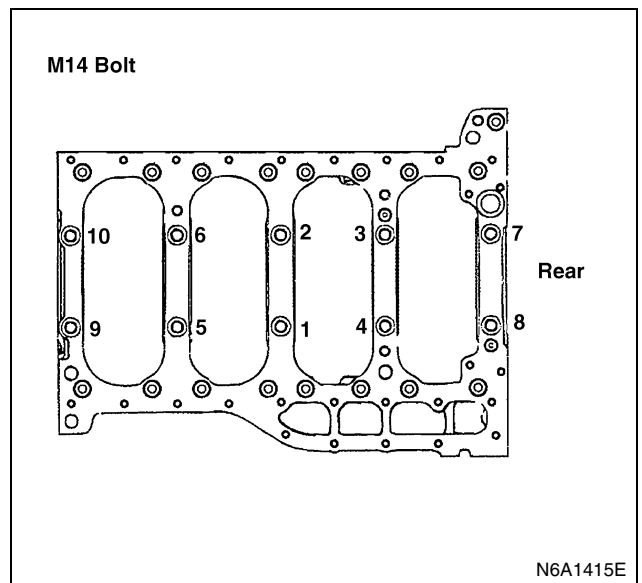
Tighten:

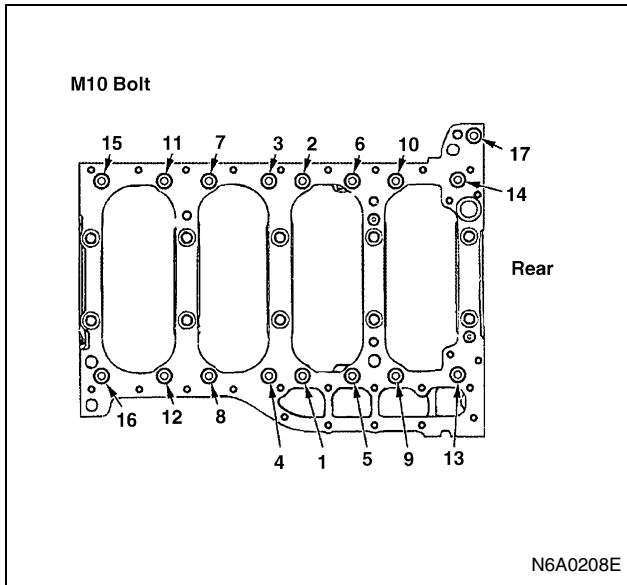
Crankcase bolt (M14: (1) — (10)) to

- 1st step: 98 N·m (10 kg·m/72 lb·ft)
- 2nd step: 132 N·m (13.5 kg·m/98 lb·ft)
- 3rd step: 30 — 60°

Crankcase bolt (M10:(1) — (17)) to 37 N·m (3.8 kg·m/27 lb·ft)

Angle gauge: 5-8840-0266-0





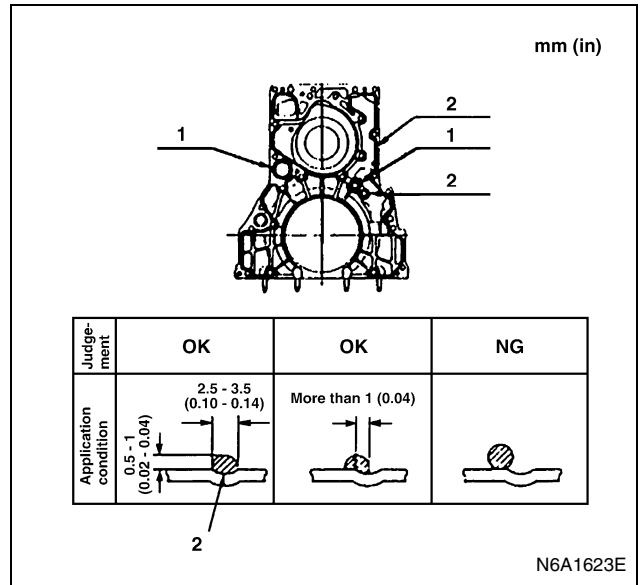
N6A0208E

9. Piston and Connecting Rod Assembly
10. Connecting Rod Lower Bearing
11. Connecting Rod Cap Assembly
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
12. Oil Pump Assembly
13. Idle Gear A
Above works refer to "OIL PUMP ASSEMBLY" section in this manual.
14. Flywheel Housing
15. Power Steering Pump Idle Gear
16. Power Steering Pump Idle Gear Cover
17. Oil Thermo Valve
Above works refer to "TIMING GEAR REPLACEMENT" section in this manual.
18. Front Retainer

- 1) Carefully wipe any foreign material from the cylinder body front face.
- 2) Apply 2.5 — 3.5 mm (0.10 — 0.14 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove of the front retainer fitting surface shown in the illustration.
- 3) Install the O-rings (2 pieces) to the front retainer.
 - Install the front retainer within 7 minutes after application of liquid gasket.
 - For the dislocation of liquid gasket, refer to the illustration.
- 4) Align the cylinder body knock pins with the front retainer knock pin holes.

Tighten:

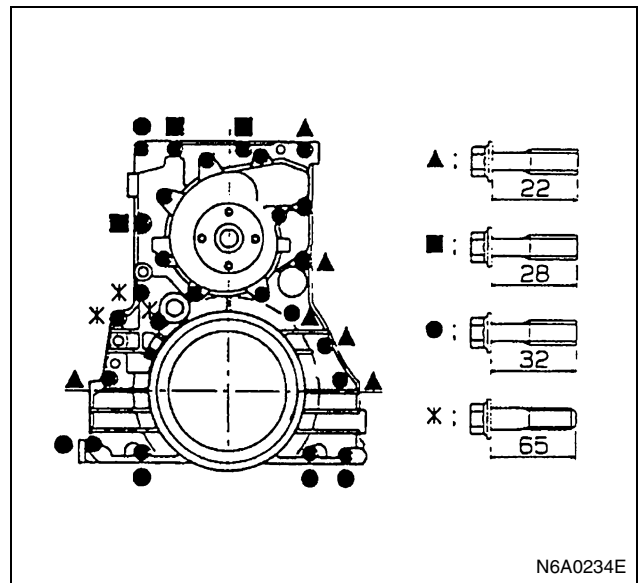
Front retainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



N6A1623E

Legend

1. O-ring
2. Liquid gasket



N6A0234E

19. Water Pump Assembly

- 1) Apply 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the water pump fitting surface.
- 2) Install the water pump to the front retainer.

Tighten:

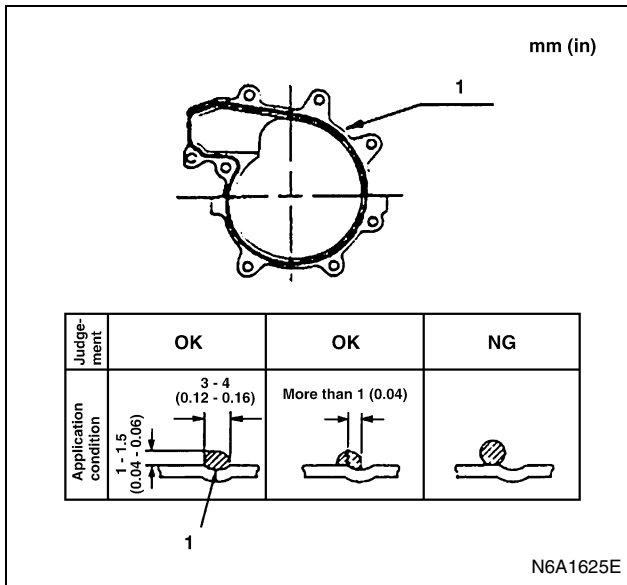
Water pump bolt to 24 N·m (2.4 kg·m/17 lb·ft)

- Install the water pump within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.

Caution:

The water pump clamping bolt is also used to tighten the front retainer. So, install the water pump before liquid

gasket gets dry immediately after installation of the front retainer.



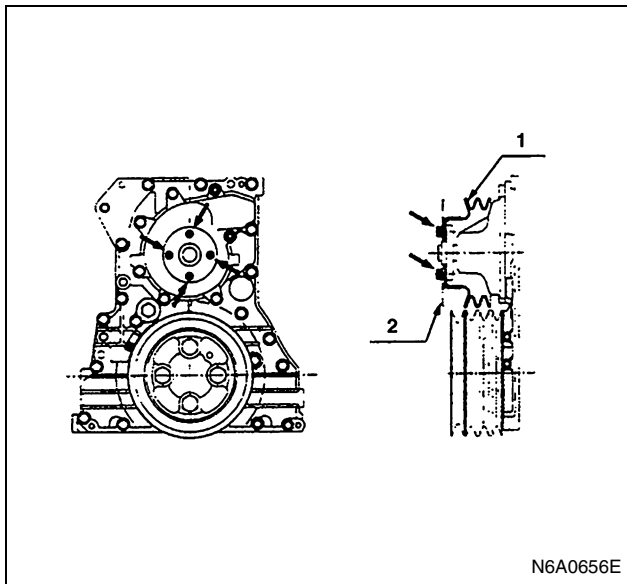
Legend

1. Liquid gasket

20. Water Pump Pulley

Tighten:

Water pump pulley bolt to 24 N·m (2.4 kg·m/17 lb·ft)



Legend

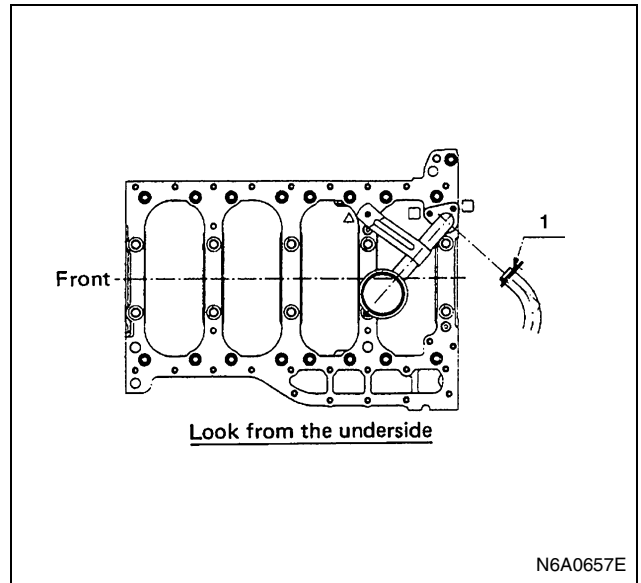
1. Pulley
2. Set plate

21. Oil Pump Strainer

Install the O-ring (1) to the oil pump strainer pipe and install the oil pump strainer to the cylinder body shown in the illustration.

Tighten:

Oil pump strainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



22. Oil Pan

23. Spacer Rubber

Above works refer to "OIL PAN" section in this manual.

24. Crankshaft Rear Slinger

25. Crankshaft Rear Oil Seal

Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.

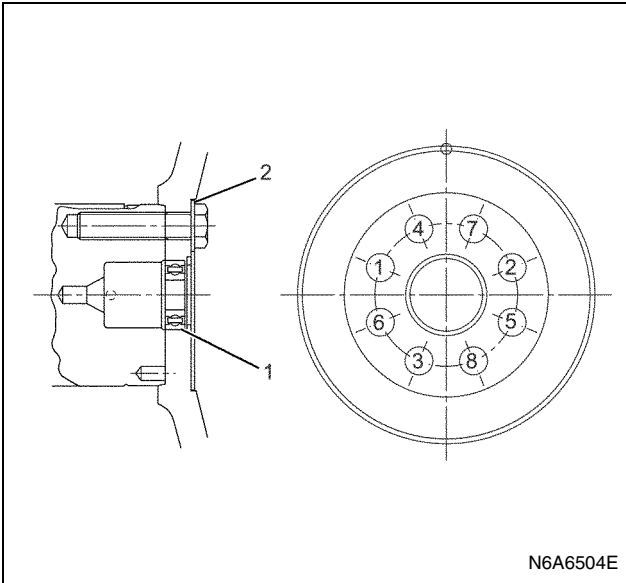
26. Flywheel

- 1) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
- 2) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0
- 3) Install the washer and the flywheel bolts and tighten to the specified torque in numerical order show in the illustration.

Tighten:

Flywheel bolt to

- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°



N6A6504E

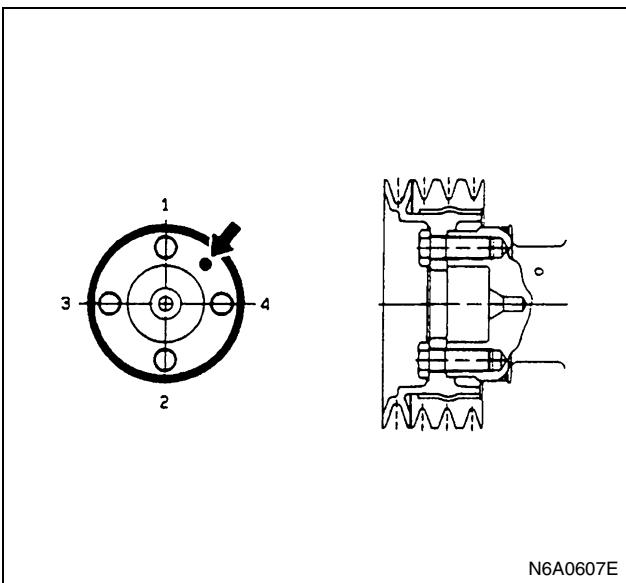
Legend

- 1. Washer
- 2. Pilot bearing

- 4) Remove the crankshaft stopper.
- 27. Crankshaft Front Slinger
- 28. Crankshaft Front Oil Seal
Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.
- 29. Crankshaft Damper Pulley
 - 1) Apply a coat of engine oil to the threads of the bolts.
 - 2) Align the damper pulley with the crankshaft knock pin and tighten the bolts to the specified torque in numerical order.

Tighten:

Damper pulley bolt to 200 N·m (20.4 kg·m/147 lb·ft)

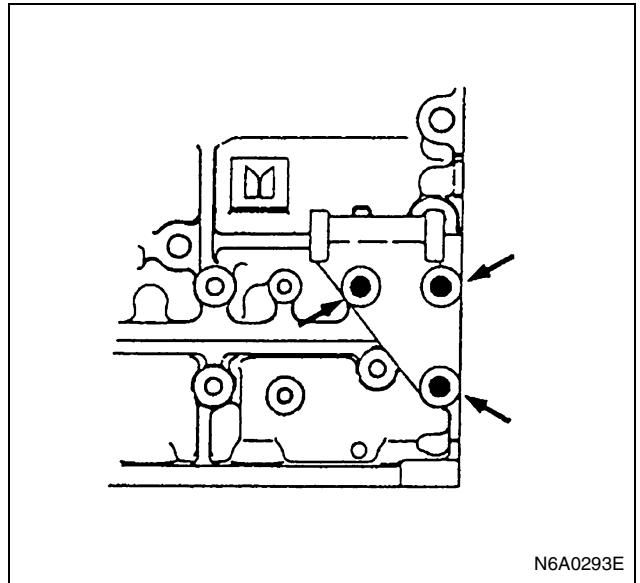


N6A0607E

30. Generator Bracket

Tighten:

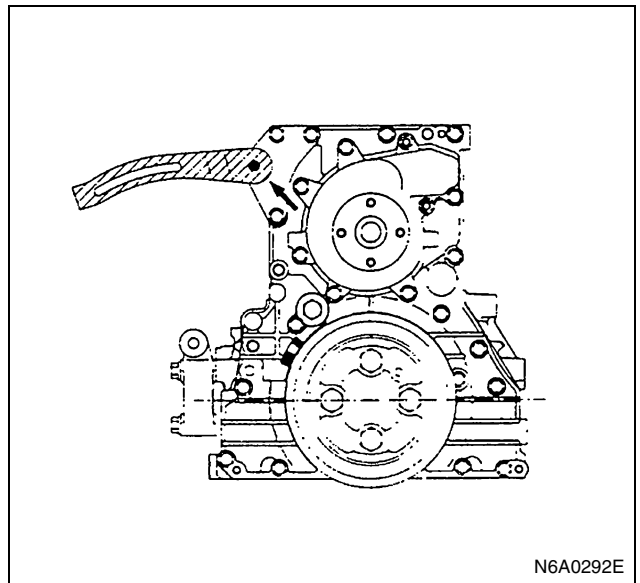
Generator bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



N6A0293E

31. Fan Belt Adjust Plate

Install the adjust plate and temporarily tighten the adjust plate bolt.



N6A0292E

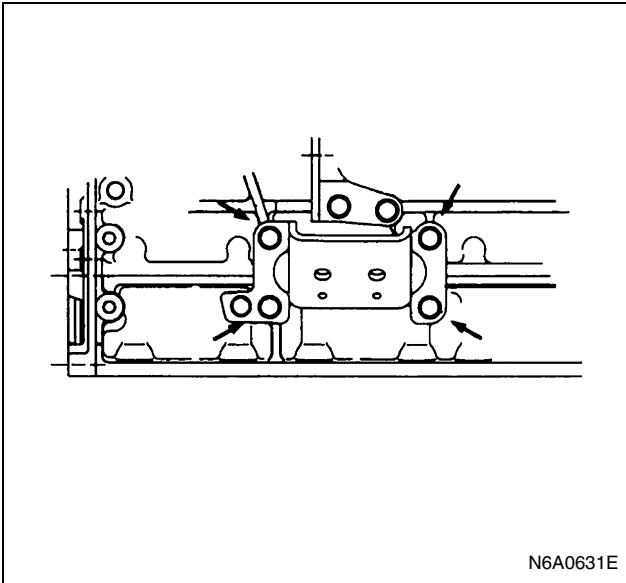
32. Injection Pump Assembly

Above works refer to "INJECTION PUMP ASSEMBLY" section 6C in this manual.

33. Engine Foot

Tighten:

Engine foot bolt to 51 N·m (5.2 kg·m/38 lb·ft)



N6A0631E

34. Generator

Notice:

When tightening the generator, tighten in advance the fan belt temporarily after its adjustment.

- Insert through the lower fixing bolt from the rear side as shown in the illustration, and tighten it with a nut on the front side.

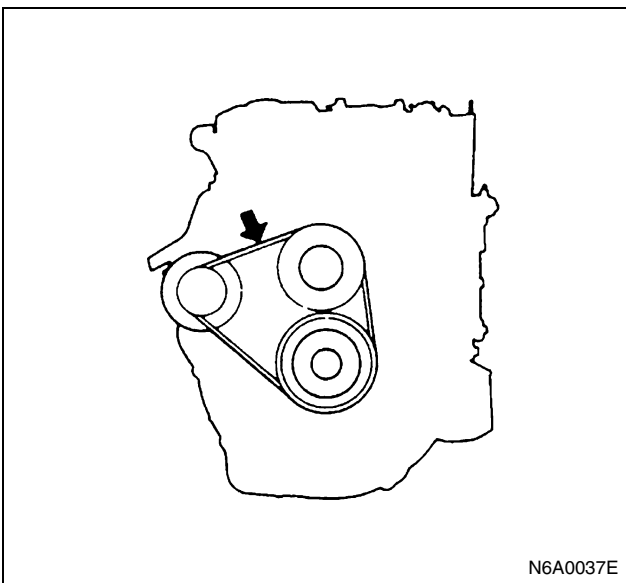
35. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 — 12 (0.31 — 0.47) ... New belt	
10 — 14 (0.39 — 0.55) ... Reuse belt	

Check the drive belt for cranking and other damage.



N6A0037E

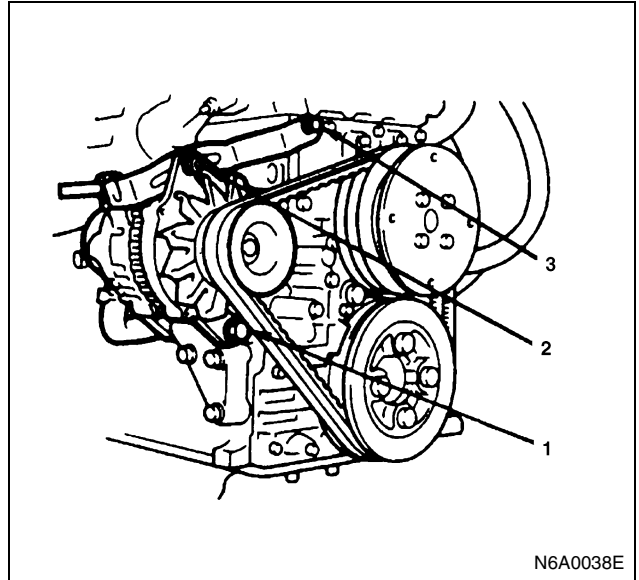
Fan Belt Adjustment

Fan belt tension is adjusted by moving the generator.

Tighten:

Bolt to

- (1): 40 N·m (4.1 kg·m/30 lb·ft)
- (2): 24 N·m (2.4 kg·m/17 lb·ft)
- (3): 46 N·m (4.7 kg·m/34 lb·ft)



N6A0038E

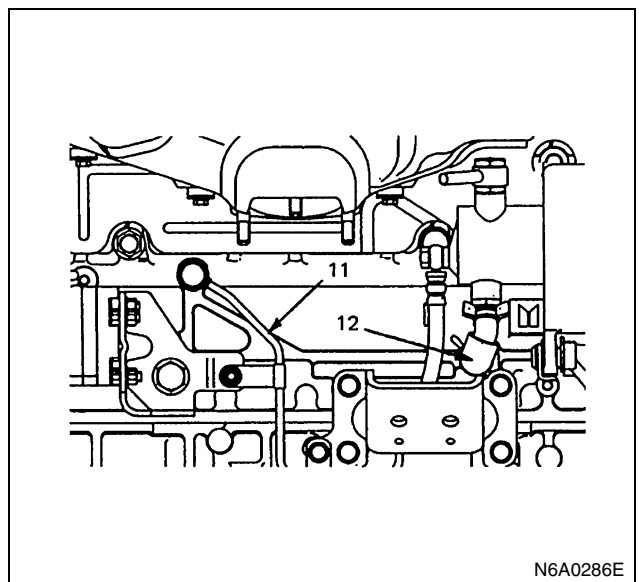
36. Vacuum Pump Rubber Hose (12)

37. Vacuum Pump Oil Pipe (11)

Tighten:

Vacuum pump oil pipe to

- Cylinder body side: 41 N·m (4.2 kg·m/30 lb·ft)
- Generator side: 23 N·m (2.3 kg·m/17 lb·ft)

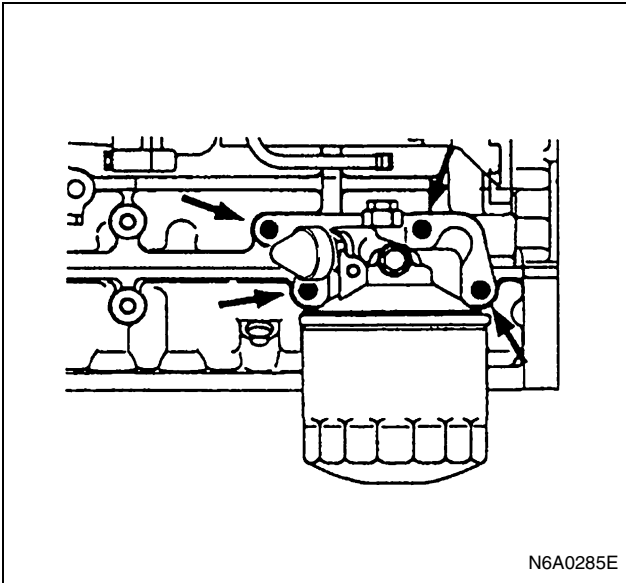


N6A0286E

38. Oil Filter Assembly

Tighten:

Oil filter bolt to 48 N·m (4.9 kg·m/35 lb·ft)

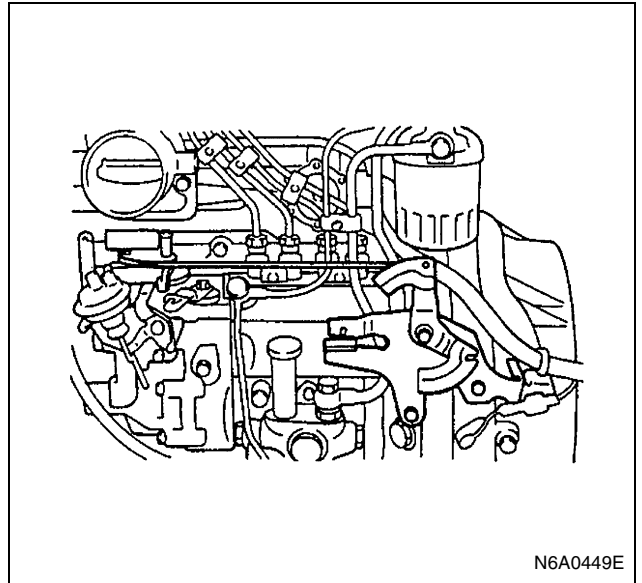


N6A0285E

39. Oil Pipe

Tighten:

Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)



N6A0449E

42. Driven Plate

43. Clutch Pressure Plate Assembly
Above works refer to "FLYWHEEL AND PILOT BEARING" section in this manual.

44. Cylinder Head Gasket
Above works refer to "CYLINDER HEAD" section in this manual.

45. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.

46. Camshaft Bearing Lower

47. Camshaft Assembly

48. Camshaft Bearing Upper

49. Camshaft Bearing Cap

50. Valve Cap

Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.

51. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

52. Cylinder Head Cover Gasket

Above works refer to "CYLINDER HEAD" section in this manual.

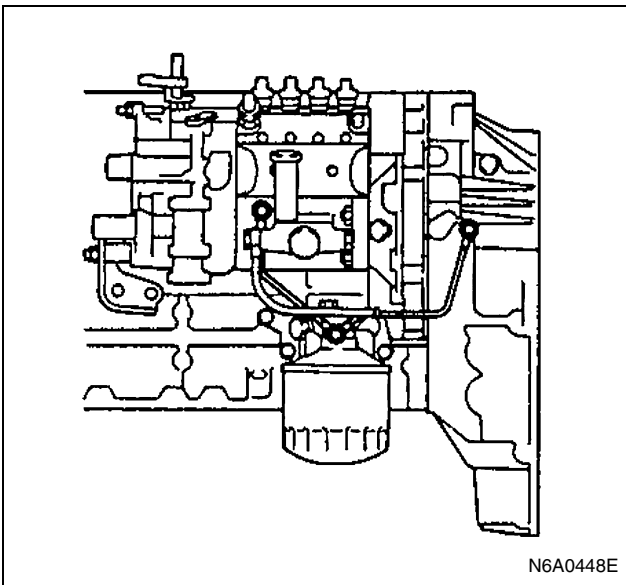
53. Cylinder Head Cover

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

54. Nozzle Cover

55. Engine Assembly

Above works refer to "ENGINE ASSEMBLY" section in this manual.



N6A0448E

40. Engine Control Lever Assembly

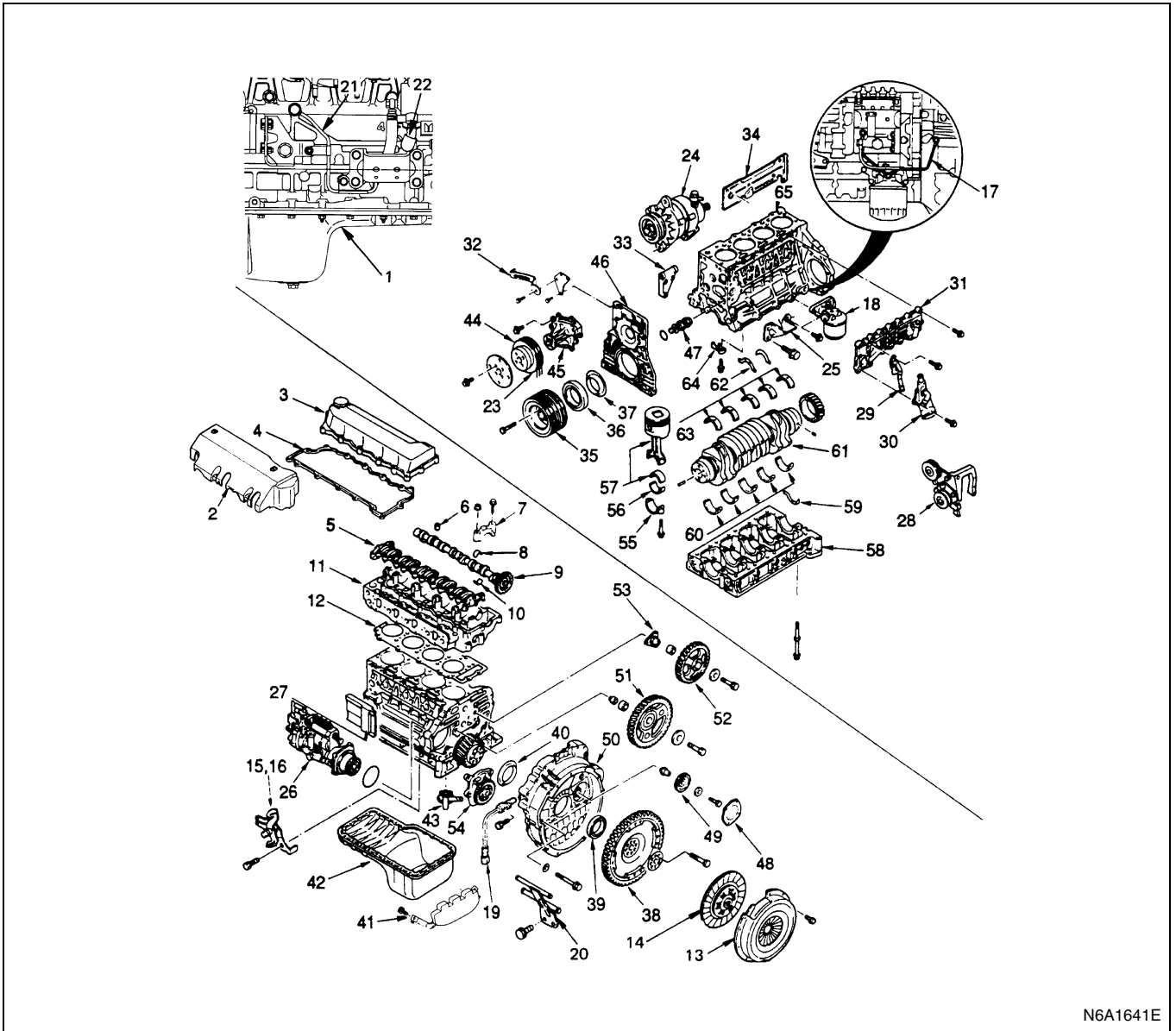
Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)

41. Engine Control Wire

CYLINDER BLOCK

Component



N6A1641E

Legend

- | | |
|------------------------------------|---|
| 1. Engine assembly | 34. Cover |
| 2. Nozzle cover | 35. Crankshaft pulley |
| 3. Cylinder head cover | 36. Crankshaft front oil seal |
| 4. Cylinder head cover gasket | 37. Crankshaft front slinger |
| 5. Rocker arm shaft assembly | 38. Flywheel assembly |
| 6. Valve cap | 39. Crankshaft rear oil seal |
| 7. Camshaft bearing cap | 40. Crankshaft rear slinger |
| 8. Camshaft bearing upper | 41. Spacer rubber |
| 9. Camshaft assembly | 42. Oil pan |
| 10. Camshaft bearing lower | 43. Oil pump strainer |
| 11. Cylinder head assembly | 44. Water pump pulley |
| 12. Cylinder head gasket | 45. Water pump |
| 13. Clutch pressure plate assembly | 46. Front retainer |
| 14. Driven plate | 47. Oil thermo valve |
| 15. Engine control wire | 48. Power steering pump idle gear cover |
| 16. Engine control lever assembly | 49. Power steering pump idle gear |
| 17. Oil pipe | 50. Flywheel housing |
| 18. Oil filter assembly | 51. Idle gear A |
| 19. Tachometer sensor | 52. Idle gear B |
| 20. Fuel pipe bracket | 53. Idle gear B shaft |
| 21. Vacuum pump oil pipe | 54. Oil pump assembly |
| 22. Vacuum pump rubber hose | 55. Connecting rod cap |
| 23. Fan belt | 56. Connecting rod lower bearing |
| 24. Generator | 57. Piston and connecting |
| 25. Engine foot | 58. Crankcase |
| 26. Injection pump assembly | 59. Thrust bearing lower |
| 27. Injection pump rubber spacer | 60. Crankshaft bearing lower |
| 28. Idle pulley bracket | 61. Crankshaft assembly |
| 29. Heater pipe | 62. Thrust bearing upper |
| 30. Water suction pipe | 63. Crankshaft bearing upper |
| 31. Oil cooler assembly | 64. Piston oil jet |
| 32. Fan belt adjust plate | 65. Cylinder block |
| 33. Generator bracket | |

Removal

Preparation

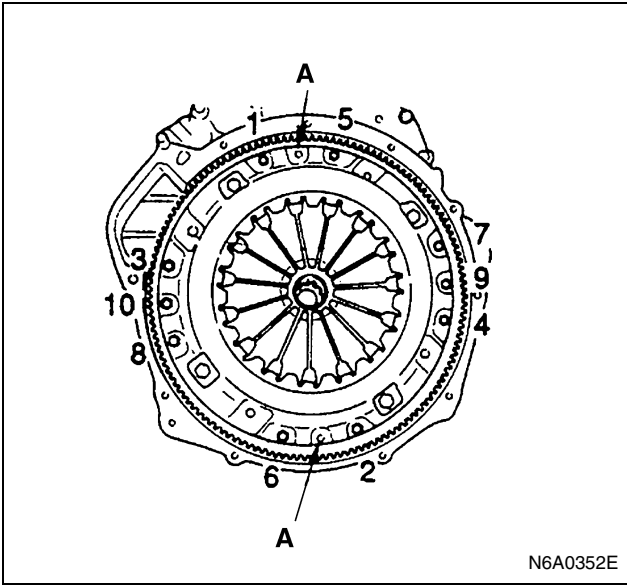
- Disconnect battery ground cable.
- Tilt the cab
- Drain coolant and engine oil

1. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.
2. Nozzle Cover
3. Cylinder Head Cover
4. Cylinder Head Cover Gasket
5. Rocker Arm shaft Assembly
Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.
6. Valve Cap

Caution:

Take sufficient care not to let valve caps fall into the gear case or oil return hole.

7. Camshaft Bearing Cap
8. Camshaft Bearing Upper
9. Camshaft Assembly
10. Camshaft Bearing Lower
Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.
11. Cylinder Head Assembly
Above works refer to "CYLINDER HEAD" section in this manual.
12. Cylinder Head Gasket
13. Clutch Pressure Plate Assembly
 - 1) Insert the clutch pilot aligner to the clutch assembly.
Clutch Pilot Aligner: 5-8840-2240-0
 - 2) Loosen the pressure plate bolts in numerical order a little at a time as shown in the illustration.



N6A0352E

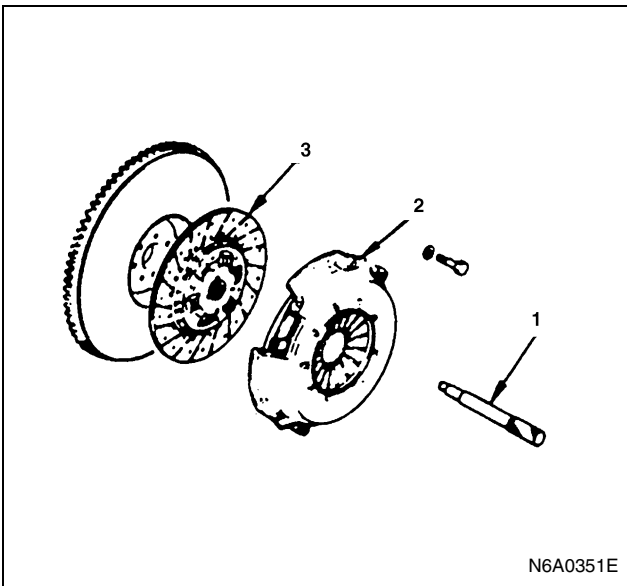
Legend

A. Knock pin

3) Remove the pressure plate assembly.

14. Driven Plate

Remove the driven plate with the clutch pilot aligner.



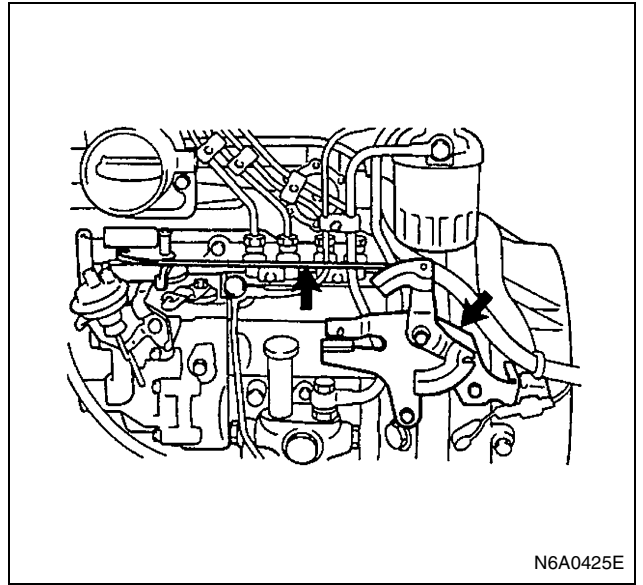
N6A0351E

Legend

- 1. Clutch pilot aligner
- 2. Clutch pressure plate assembly
- 3. Driven plate

15. Engine Control Wire

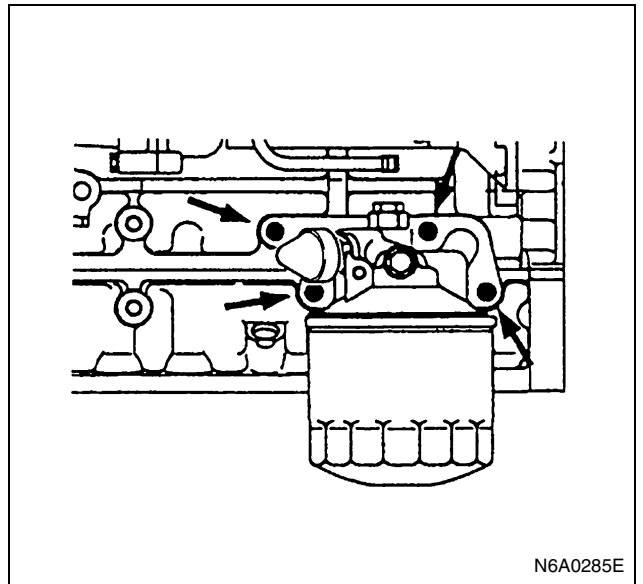
16. Engine Control Lever Assembly



N6A0425E

17. Oil Pipe

18. Oil Filter Assembly



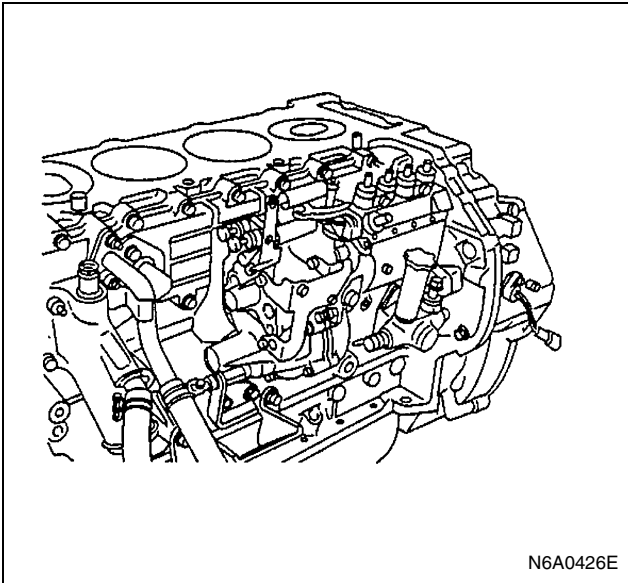
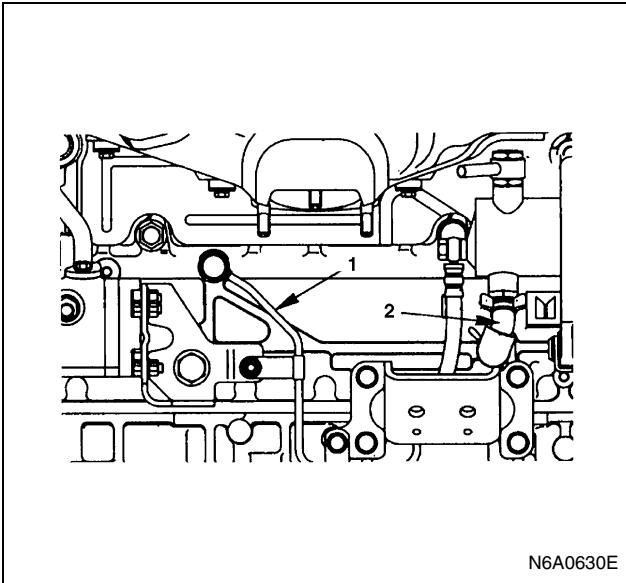
N6A0285E

19. Tachometer Sensor

20. Fuel Pipe Bracket

21. Vacuum Pump Oil Pipe

22. Vacuum Pump Rubber Hose

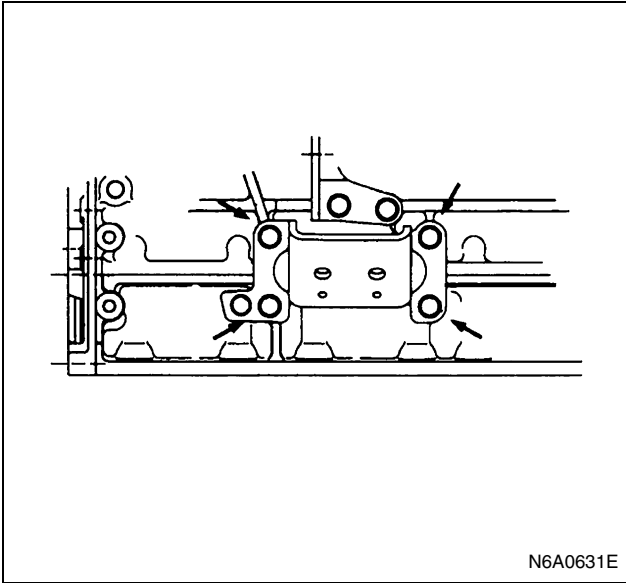
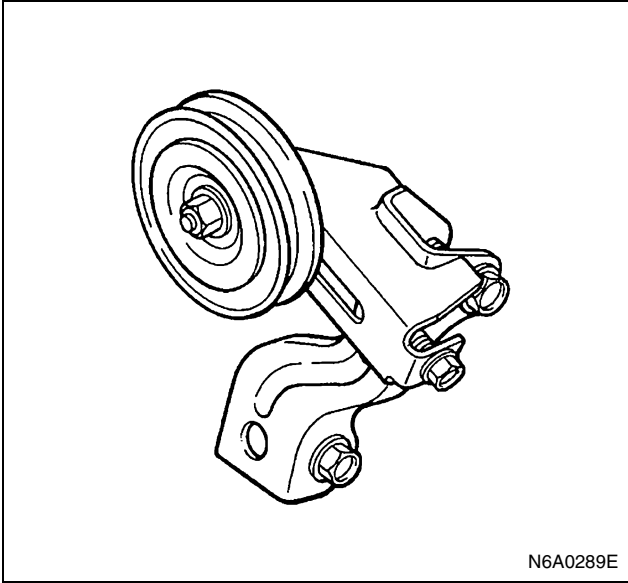


Legend

- 1. Vacuum pump oil pipe
- 2. Vacuum pump rubber hose

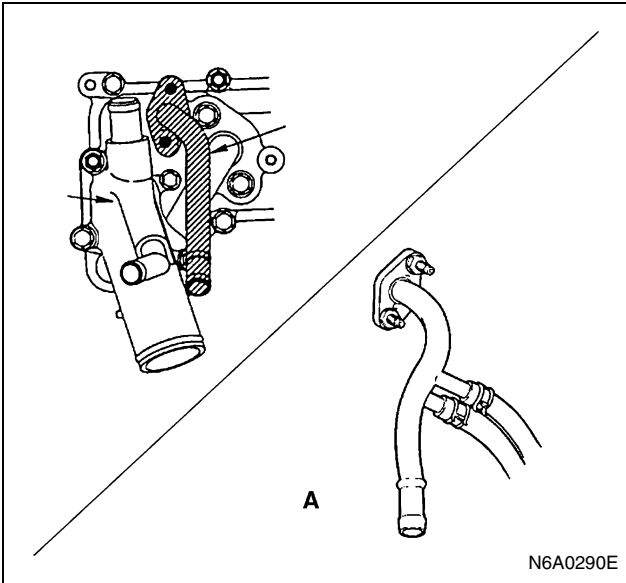
- 27. Injection Pump Rubber Spacer
- 28. Idle Pulley Bracket (If equipped with A/C)

- 23. Fan Belt
- 24. Generator
- 25. Engine Foot



- 29. Heater Pipe

- 26. Injection Pump Assembly
 - 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
 - 2) Then remove the injection pump assembly.



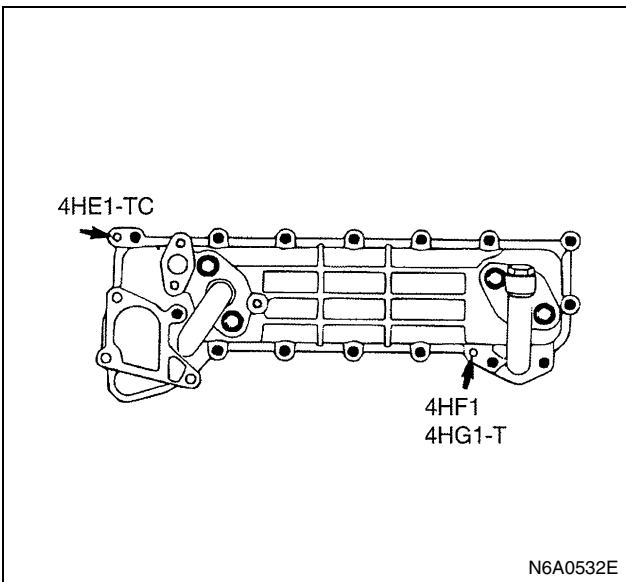
Legend

A. 4HF1-2

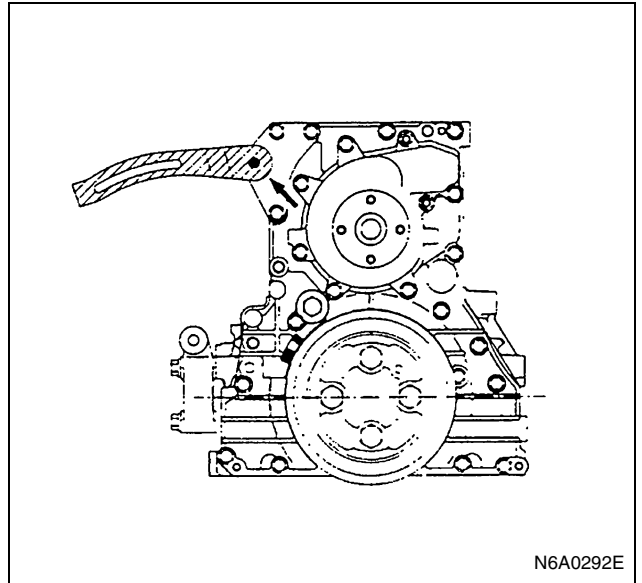
30. Water Suction Pipe

31. Oil Cooler Assembly

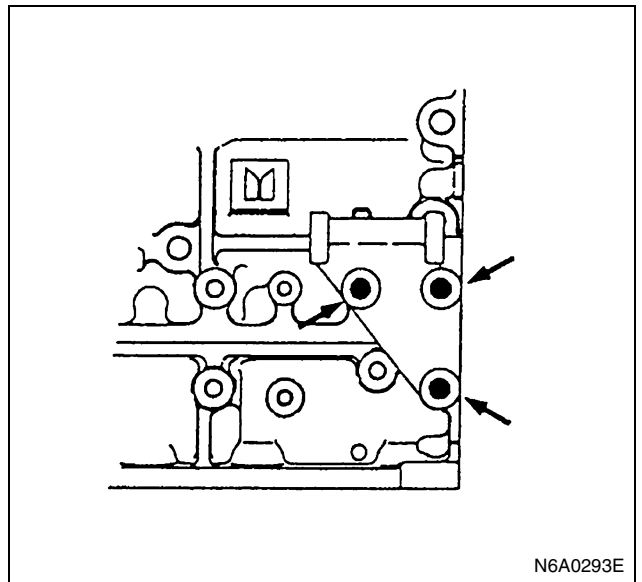
- 1) Remove the oil cooler bolts.
- 2) Install a oil cooler fixing bolt to the oil cooler replacer hole as shown in the illustration, and tighten the bolt alternately a little at a time.



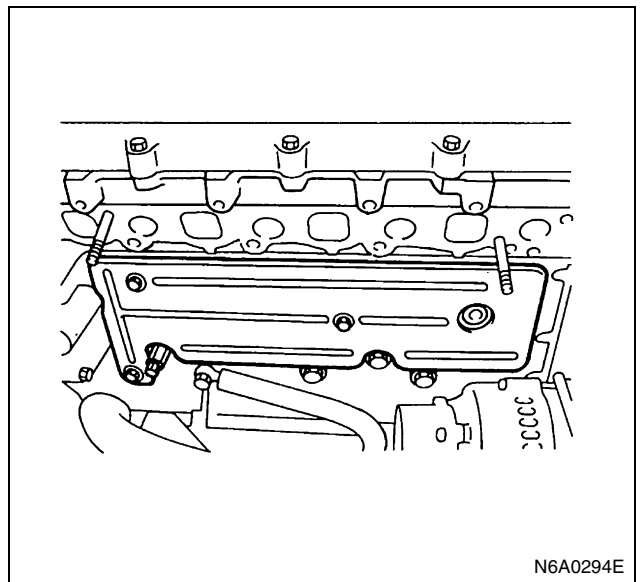
32. Fan Belt Adjust Plate



33. Generator Bracket

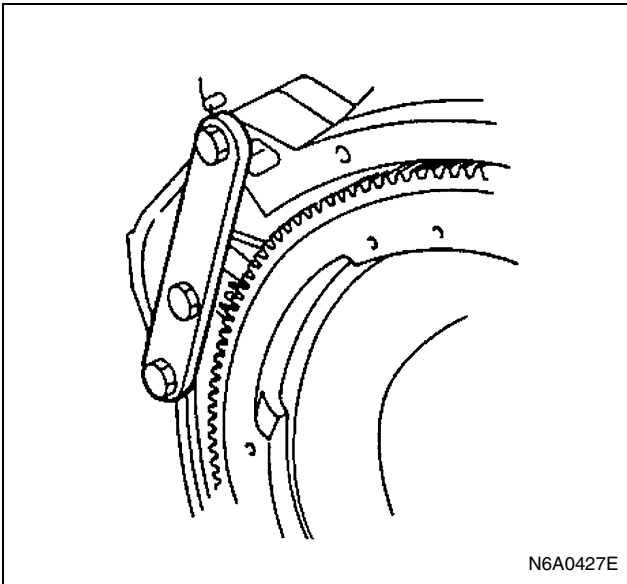


34. Cover



35. Crankshaft Damper Pulley

- 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



- 2) Loosen the damper pulley bolts and remove the damper pulley.

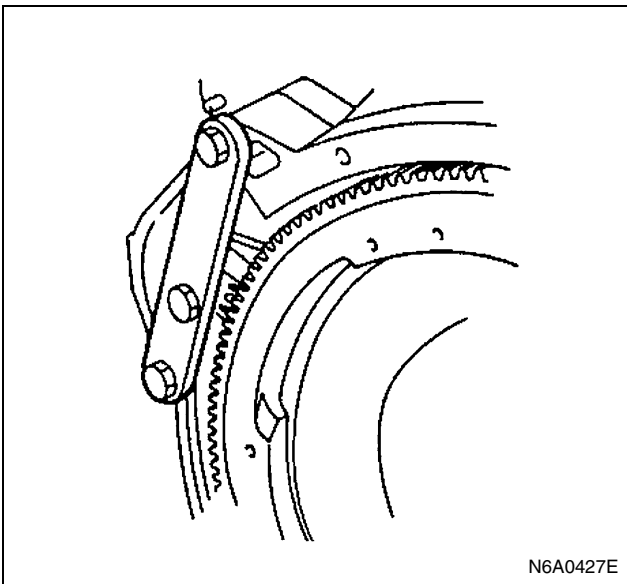
36. Crankshaft Front Oil Seal

37. Crankshaft Front Slinger

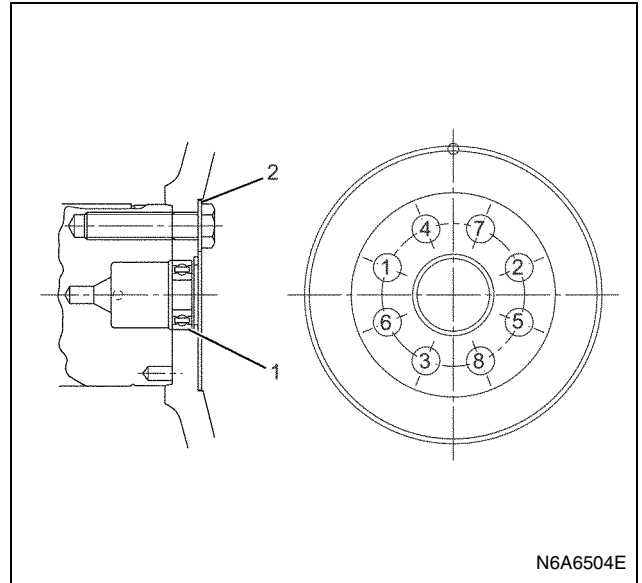
Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.

38. Flywheel Assembly

- 1) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0



- 2) Loosen the flywheel bolts in numerical order a little at a time as shown in the illustration.
- 3) Remove the flywheel stopper and the flywheel assembly.



Legend

1. Washer
2. Pilot bearing

39. Crankshaft Rear Seal

40. Crankshaft Rear Slinger

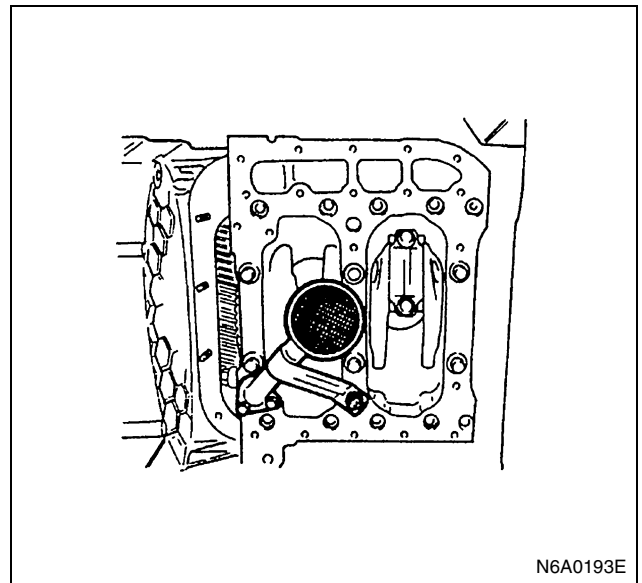
Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.

41. Spacer Rubber

Remove the stiffener before removing the spacer rubber.

42. Oil Pan

43. Oil Pump Strainer

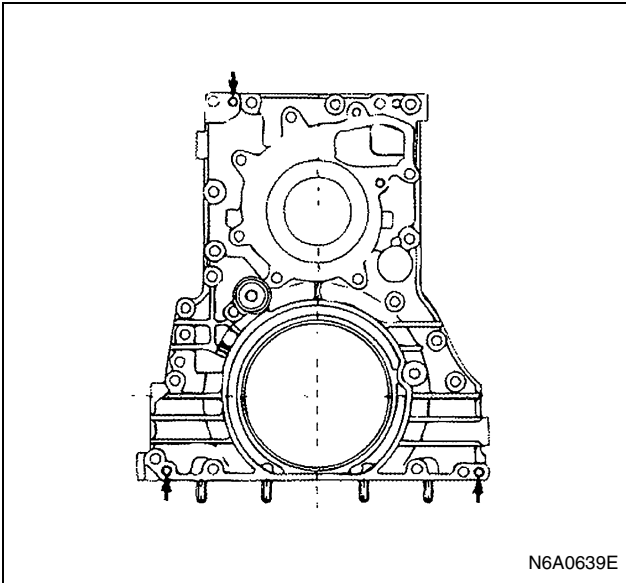


44. Water Pump Pulley

45. Water Pump

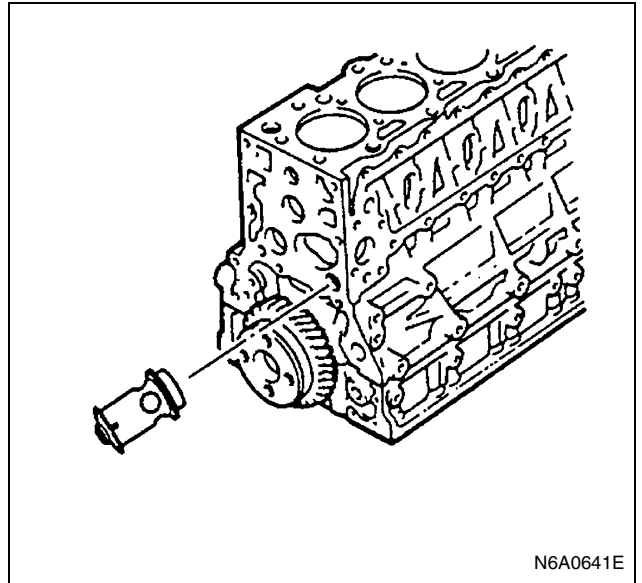
46. Front Retainer

Install the three front retainer fixing bolts to the front retainer replacer holes as shown in the illustration, and tighten the bolts alternately a little at a time.



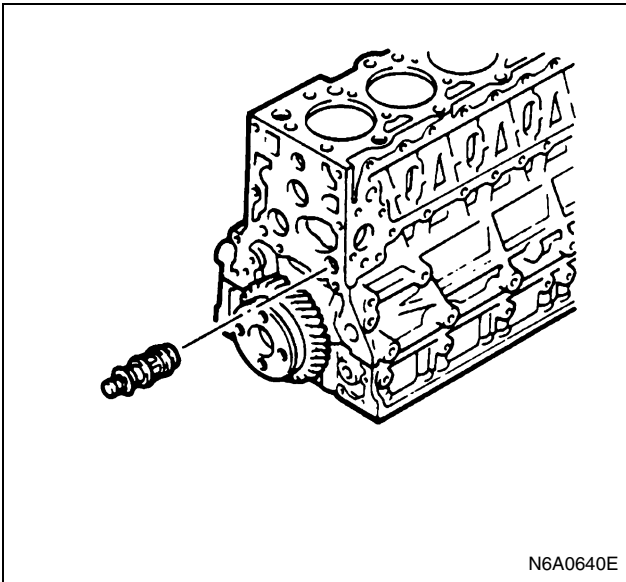
N6A0639E

47. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Pull out the thermo valve from the cylinder body.



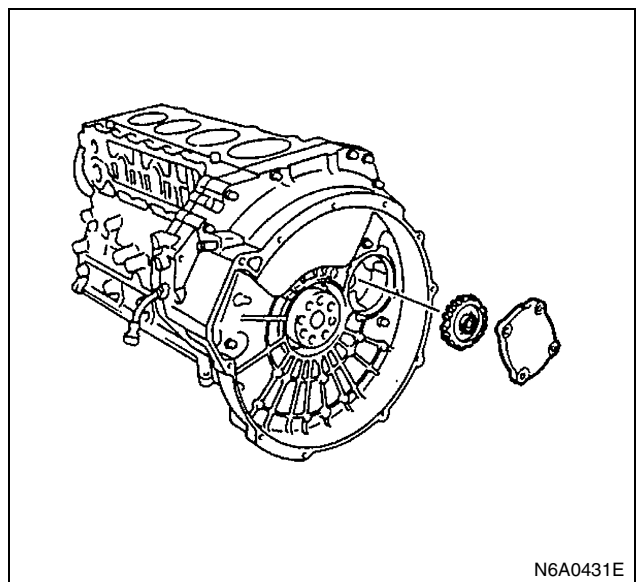
N6A0641E

49. Power Steering Pump Idle Gear Cover
50. Power Steering Pump Idle Gear



N6A0640E

48. Bypass Valve (4HE1-TC)
Pull out the bypass valve from the cylinder body.

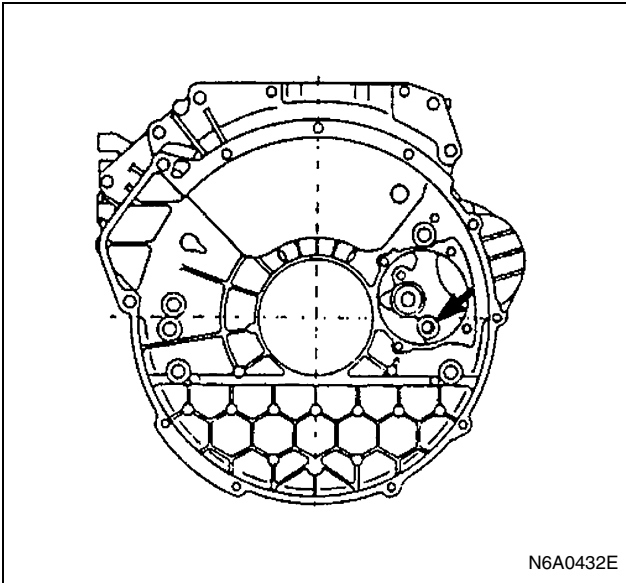


N6A0431E

51. Flywheel Housing

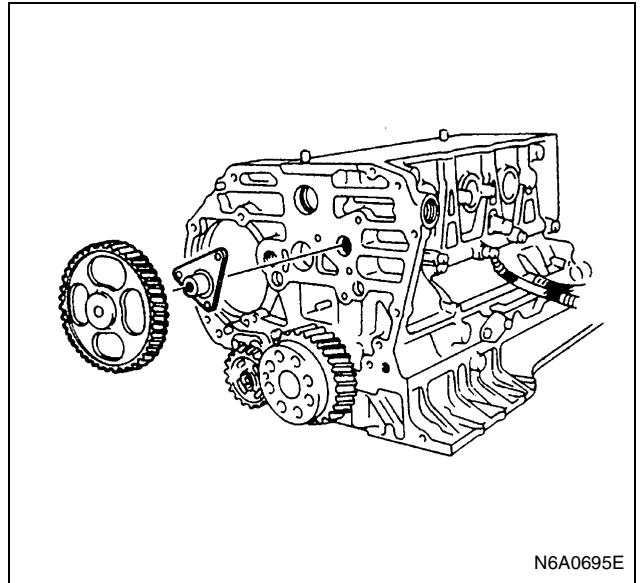
Notice:

Be careful not to fail to remove the bolts shown in the illustration.



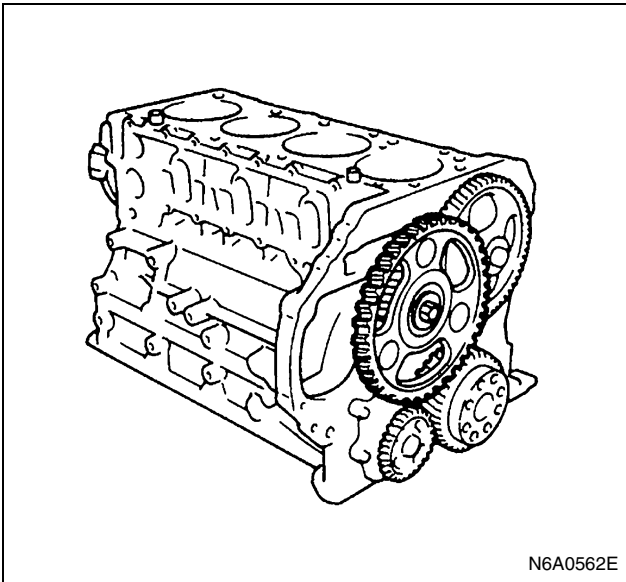
N6A0432E

52. Idle Gear A



N6A0695E

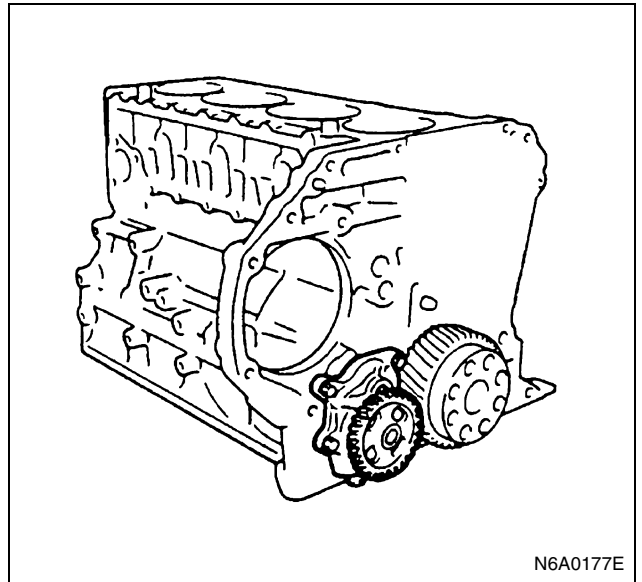
55. Oil Pump Assembly



N6A0562E

53. Idle Gear B

54. Idle Gear B Shaft



N6A0177E

56. Connecting Rod Cap

57. Connecting Rod Lower Bearing

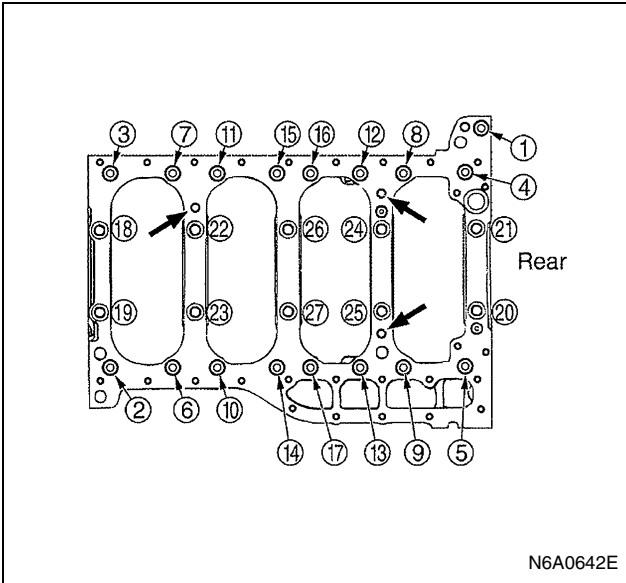
58. Piston and Connecting Rod Assembly
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.

59. Crankcase

- 1) Loosen the crankcase bolts in numerical order a little at a time.
- 2) Install the three crankcase fixing bolts (See arrow marks) to the crankcase replacer holes as shown in the illustration, and tighten the bolts alternate a little at a time.

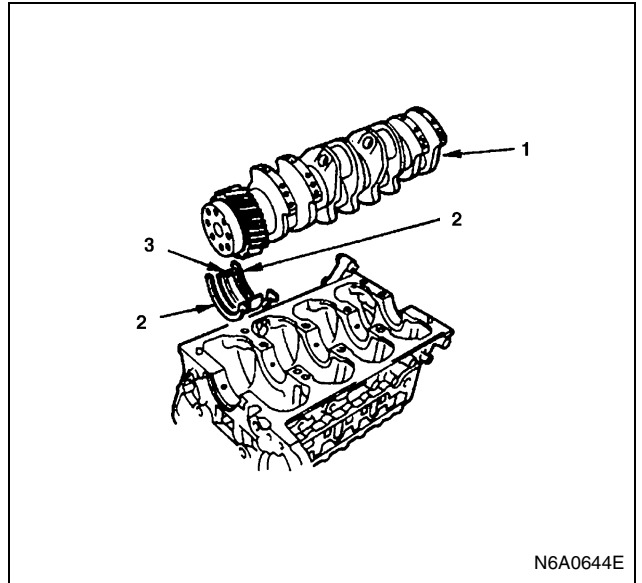
Notice:

When removing the crankcase, be sure to remove the oil pump and the generator bracket before that.



N6A0642E

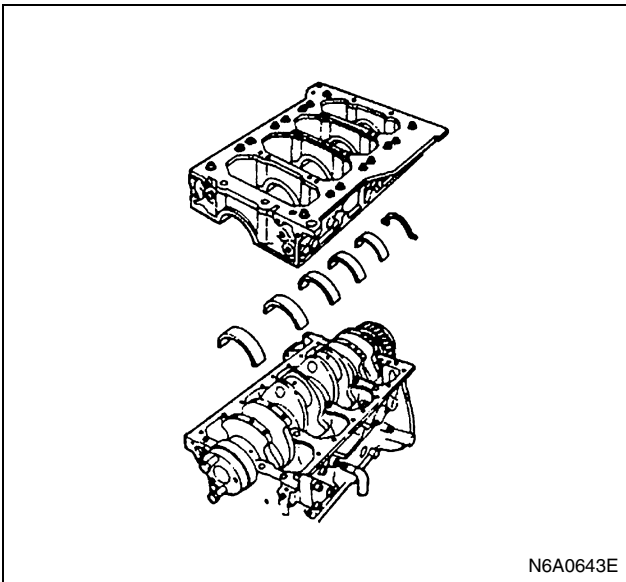
- 60. Thrust Bearing Lower
- 61. Crankshaft Bearing Lower



N6A0644E

Legend

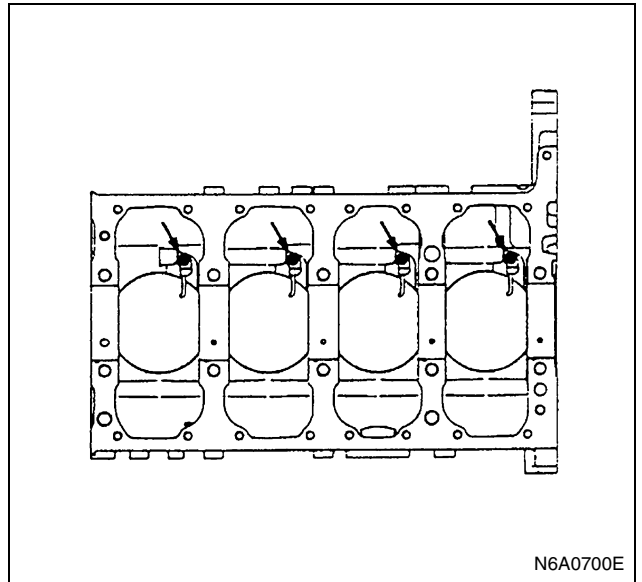
- 1. Crankshaft assembly
- 2. Thrust bearing upper
- 3. Crankshaft bearing upper



N6A0643E

- 62. Crankshaft Assembly
- 63. Thrust Bearing Upper
- 64. Crankshaft Bearing Upper

- 65. Oiling Jet
Loosen the check valves to remove both the check valves and the oiling jets.
Take care not to bend or damage the oiling jets.



N6A0700E

- 66. Cylinder Block

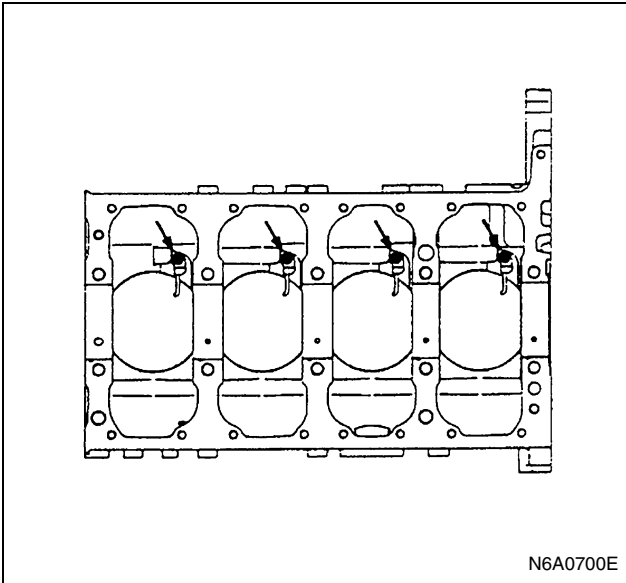
Installation

- 1. Cylinder Block
Use compressed air to thoroughly clean the inside and outside surfaces of the cylinder body, the oil holes, and the water jackets.
- 2. Oiling Jet
1) Install the oiling jets together with the check valves.
Take care not to damage the oiling jet nozzles.

- 2) Tighten the check valves and oiling jets to the specified torque.

Tighten:

Check valve and oiling jet to 21 N·m (2.1 kg·m/15 lb·ft)



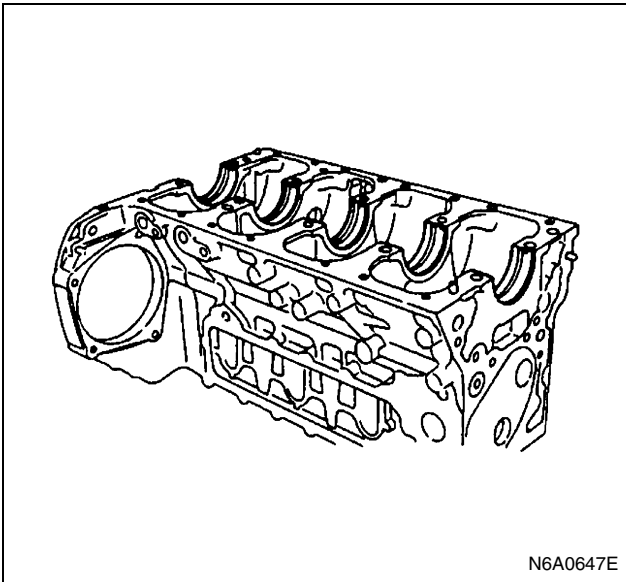
N6A0700E

3. Crankshaft Bearing Upper

When replacing the crankshaft or the crankshaft bearing with a new one, select the crankshaft bearing according to the respective grades stamped on the crankshaft and the cylinder body.

Refer to the "CRANKSHAFT" in section 6A.

All upper bearings have oil grooves.



N6A0647E

- 1) Carefully wipe any foreign material from the upper bearing.

Caution:

Do not apply engine oil to the bearing back faces and the cylinder body bearing fitting surface.

- 2) Locate the position mark applied at disassembly if the removed upper bearings are to be re-used.

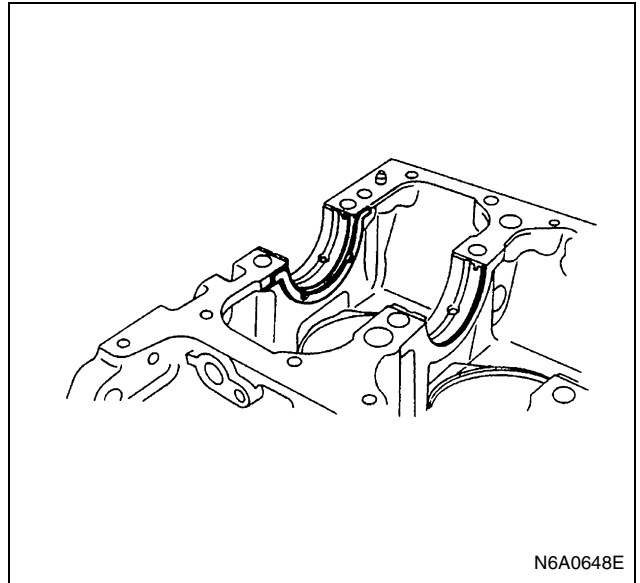
4. Thrust Bearing Upper

Install the thrust bearing upper to the front side of the cylinder body No.5 journal. At this time, the thrust bearing upper may be pasted to the cylinder body with grease.

However, be sure to wipe off any excessive grease.

Caution:

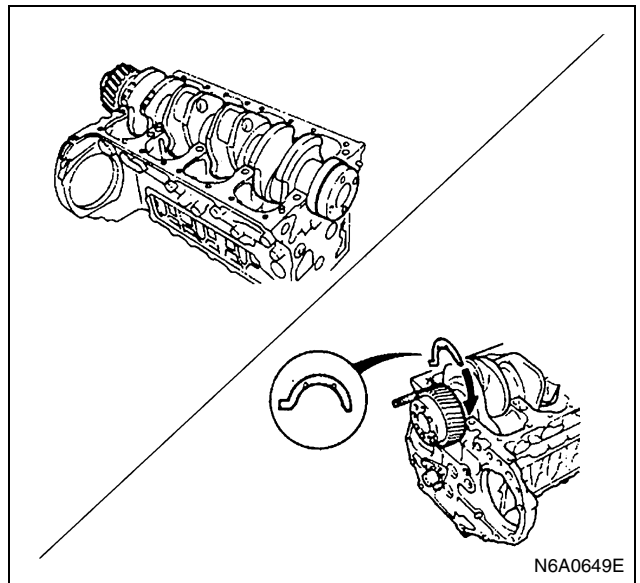
The thrust bearing oil grooves must be facing the sliding faces.



N6A0648E

5. Crankshaft Assembly

Apply an ample coat of engine oil to the crankshaft journals and the crankshaft bearing surfaces before installing the crankshaft with timing gear.



N6A0649E

6. Crankshaft Bearing Lower

All lower bearings do not have oil grooves.

- 1) Carefully wipe any foreign material from the lower bearing.

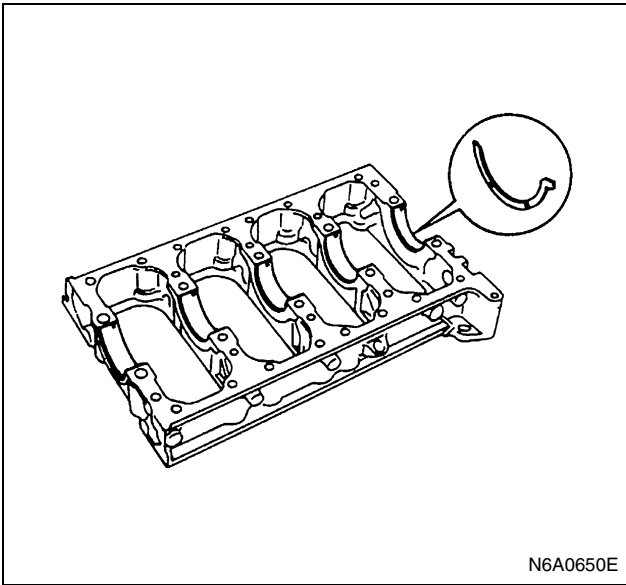
Caution:

Do not apply engine oil to the bearing back faces and the crankcase bearing fitting surfaces.

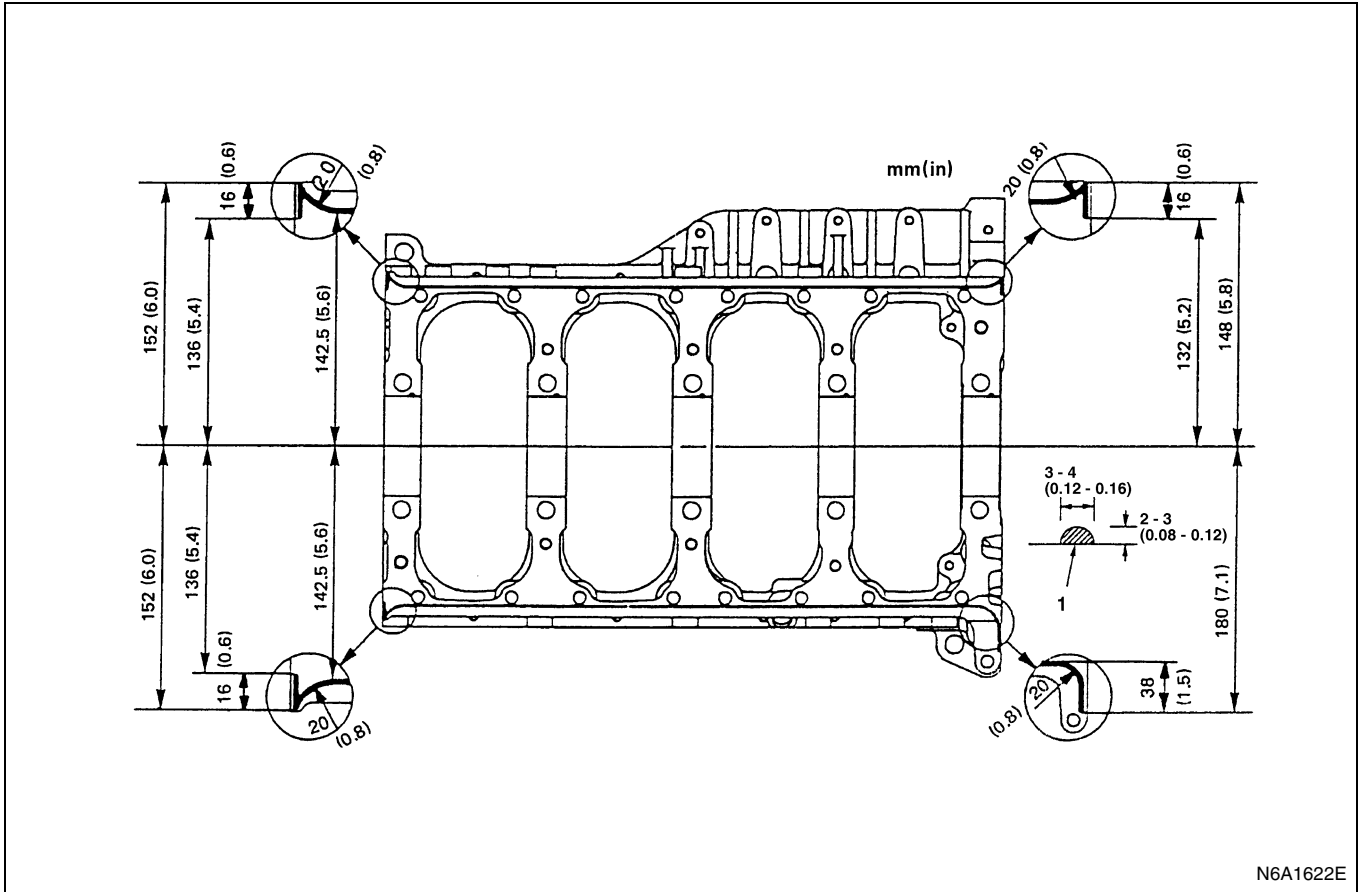
- 2) Locate the position mark applied at disassembly if the removed lower bearings are to be re-used.
7. Thrust Bearing Lower
Install the thrust bearing lower to the rear side of the crankcase No.5 journal.

Caution:

The thrust bearing oil grooves must be facing the sliding faces.

**8. Crankcase**

- 1) Apply a 3 mm (0.12 in) bead of recommended liquid gasket (Three Bond 1207C) or its equivalent to the crankcase upper surface as shown in the illustration.
- 2) Carefully place the crankcase on the cylinder body.
 - Install the crankcase within 20 minutes after application of liquid gasket.



Legend

- 1. Liquid gasket

3) Tighten the crankcase to the specified torque in the numerical order shown in the illustration.

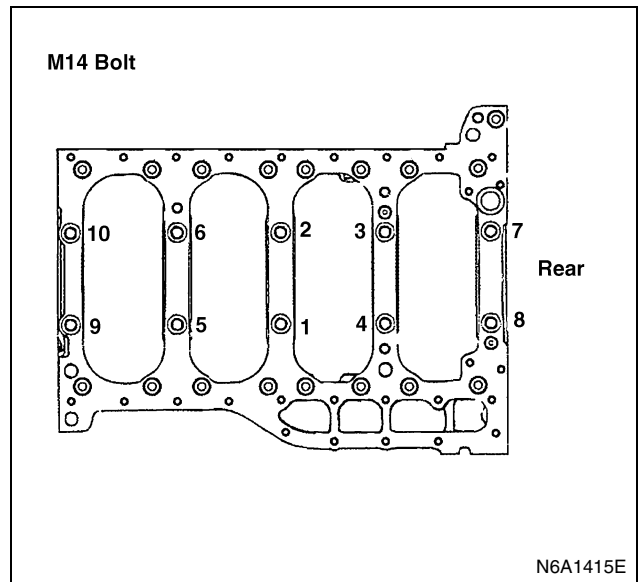
Tighten:

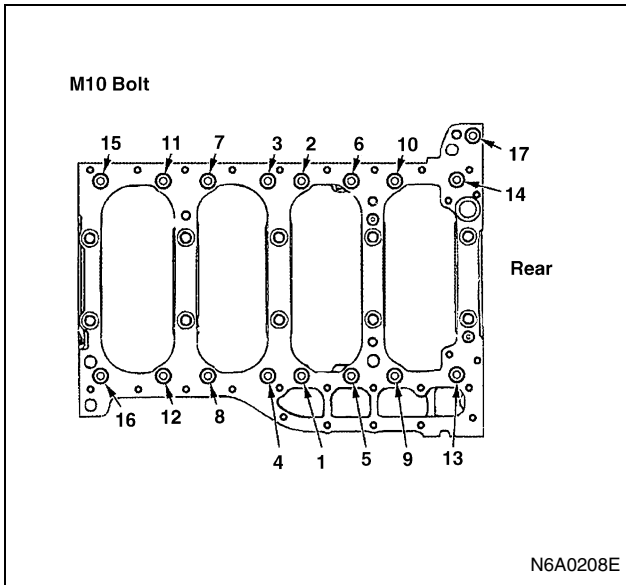
Crankcase bolt (M14: (1) — (10)) to

- 1st step: 98 N·m (10 kg·m/72 lb·ft)
- 2nd step: 132 N·m (13.5 kg·m/98 lb·ft)
- 3rd step: 30 — 60°

Crankcase bolt (M10: (1) — (17)) to 37 N·m (3.8 kg·m/ 27 lb·ft)

Angle gauge: 5-8840-0266-0



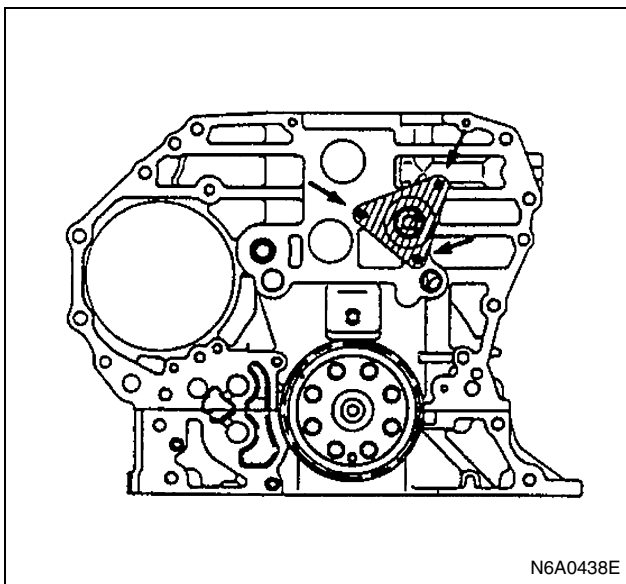


- 9. Piston and Connecting Rod Assembly
- 10. Connecting Rod Bearing
- 11. Connecting Rod Cap
Above works refer to "PISTON AND CONNECTING ROD" section in this manual.
- 12. Oil Pump Assembly
Above works refer to "OIL PUMP ASSEMBLY" section in this manual.
- 13. Idle Gear B Shaft

Tighten:

Idle gear B shaft bolt to 31 N·m (3.2 kg·m/23 lb·ft)

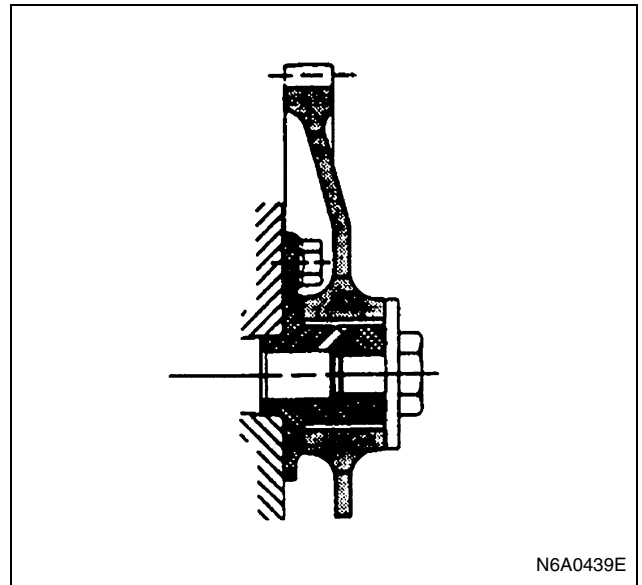
Apply the engine oil to the idle gear shaft after installation.



- 14. Idle Gear B
The face of the idle gear B with longer boss should be positioned toward the rear side shown in the illustration

Tighten:

Idle gear B bolt to 110 N·m (11.2 kg·m/81 lb·ft)

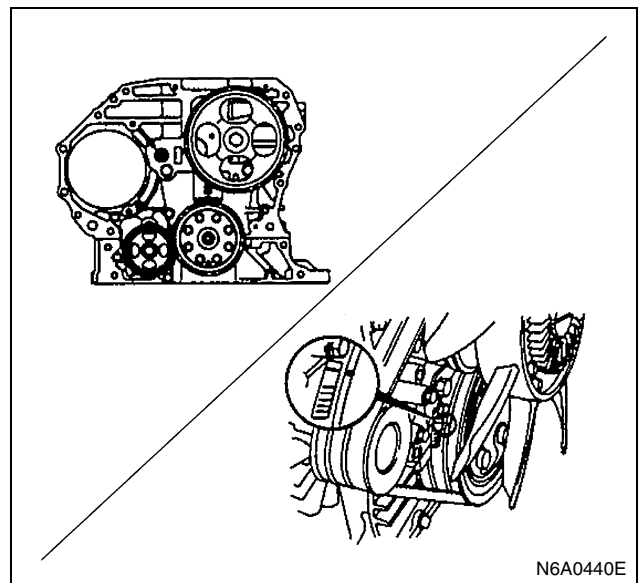


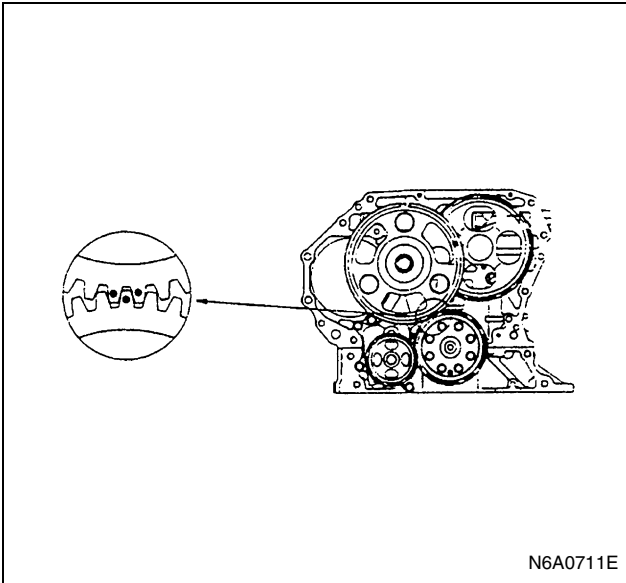
- 15. Idle Gear A

- 1) Turn the crankshaft clockwise so that the engagement mark of the crankshaft gear faces to the shaft center of the idle gear A and the No.1 cylinder piston comes to the top dead center.
- 2) Align the crankshaft gear with the engagement mark of the idle gear and install the idle gear A.

Tighten:

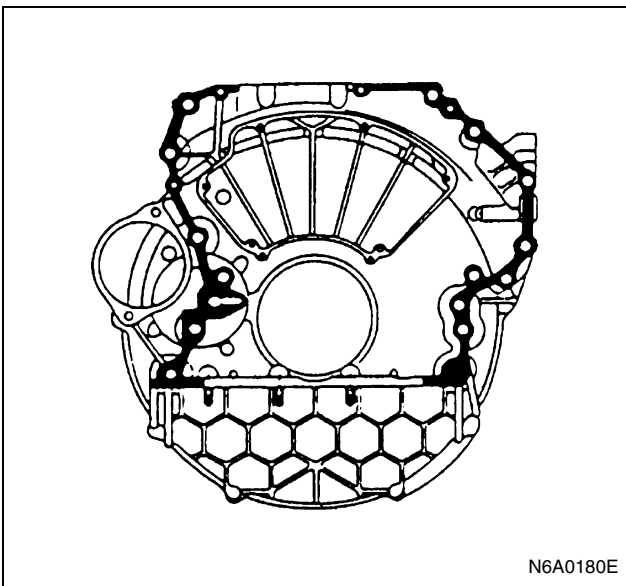
Idle gear A bolt to 133 N·m (13.6 kg·m/98 lb·ft)





16. Flywheel Housing

- 1) Carefully wipe any foreign material from the cylinder body rear face.
- 2) Apply the recommended liquid gasket (Three Bond 1207C) or its equivalent to the shaded areas shown in the illustration.

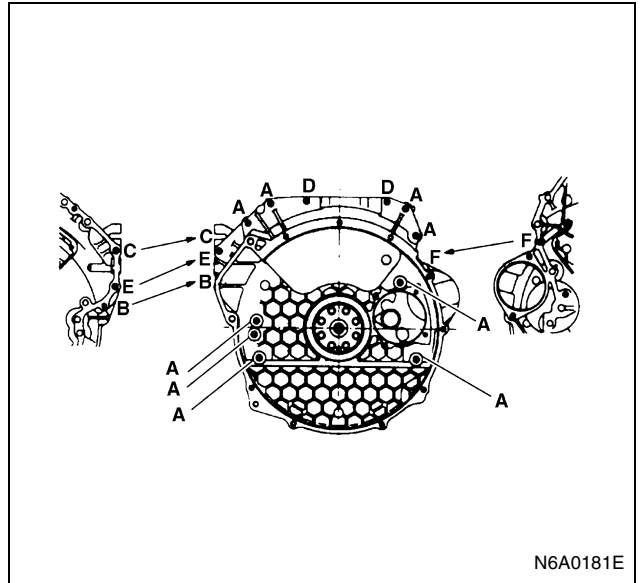


- 3) Align the cylinder body knock pins with the flywheel housing knock pin holes.
- 4) Tighten the flywheel housing bolts to the specified torque shown in the illustration.

Tighten:

Flywheel housing bolt to

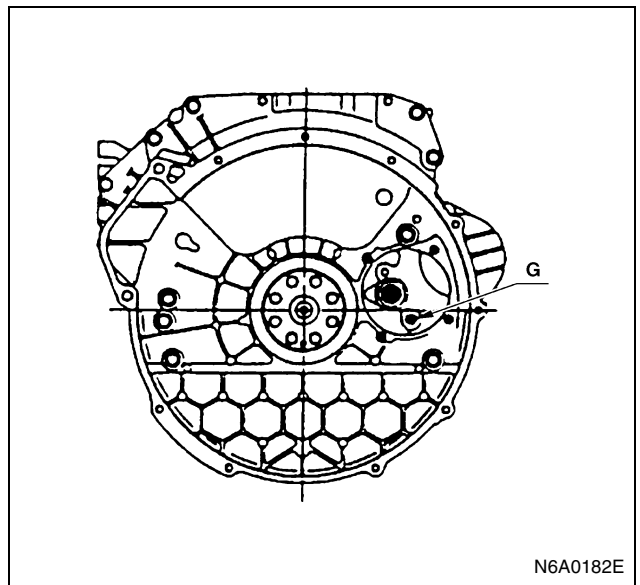
- (A): 96 N·m (9.8 kg·m/71 lb·ft)
- (B): 48 N·m (4.9 kg·m/35 lb·ft)
- (C): 94 N·m (9.6 kg·m/69 lb·ft)
- (D): 25 N·m (2.6 kg·m/19 lb·ft)
- (E): 76 N·m (7.7 kg·m/56 lb·ft)
- (F): 48 N·m (4.9 kg·m/35 lb·ft)



- Tighten the bolts marked with "E" or "B" from the injection pump side, and those with "F" from the cylinder body side.

Tighten:

Flywheel housing bolt (G) to 96 N·m (9.8 kg·m/71 lb·ft)

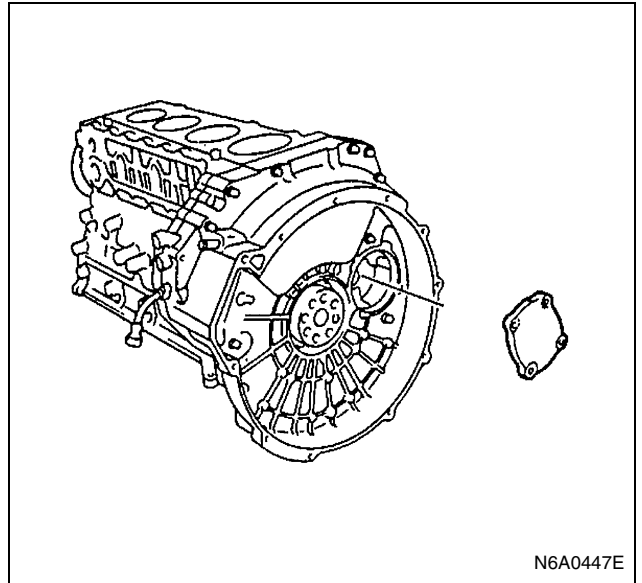
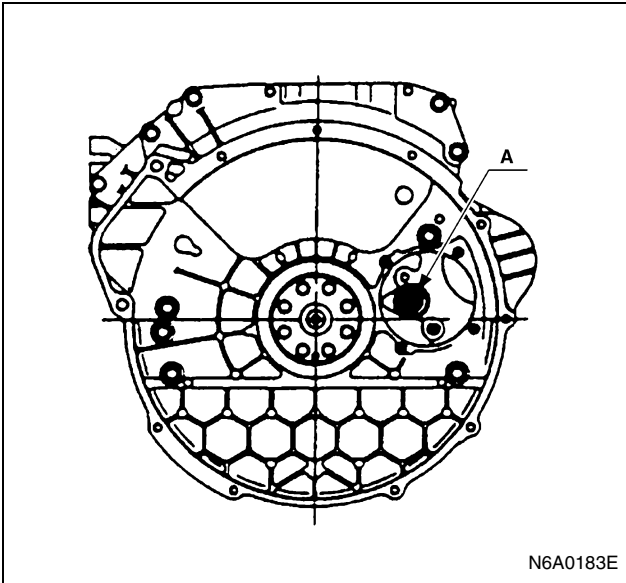


17. Power Steering Pump Idle Gear

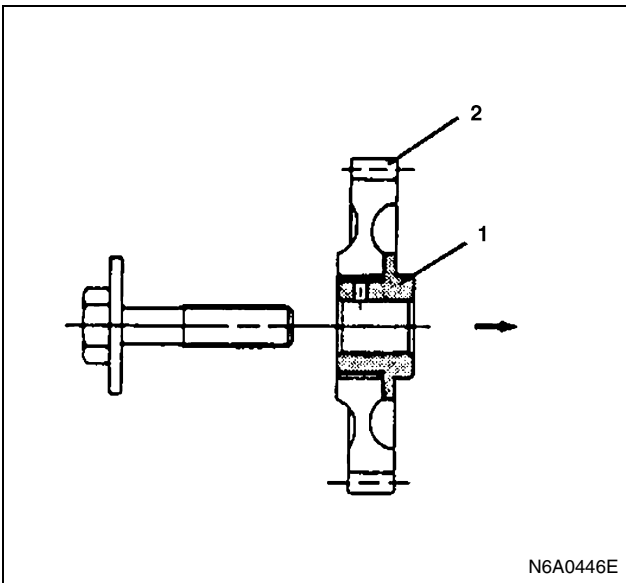
- 1) Apply the engine oil to the idle gear shaft.
- 2) Install the idle gear shaft (1) with the idle gear (2) to the cylinder body A portion as shown in the illustration.

Tighten:

Idle gear shaft bolt to 133 N·m (13.6 kg·m/98 lb·ft)



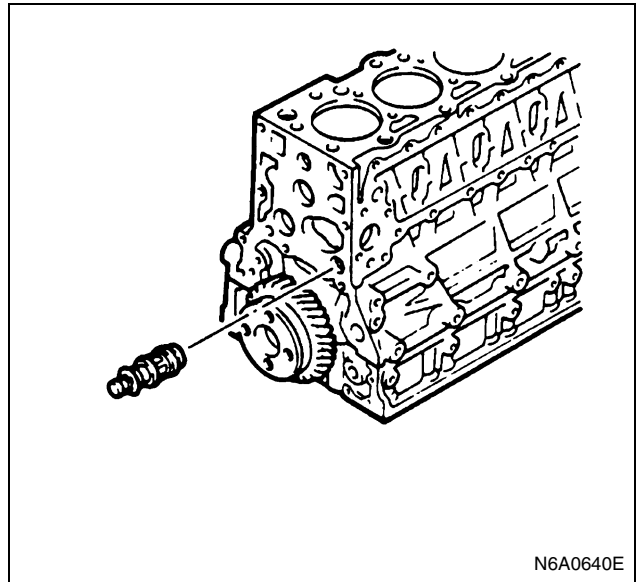
19. Oil Thermo Valve (4HF1, 4HF1-2, 4HG1, 4HG1-T)
Insert the oil thermo valve into the cylinder body.



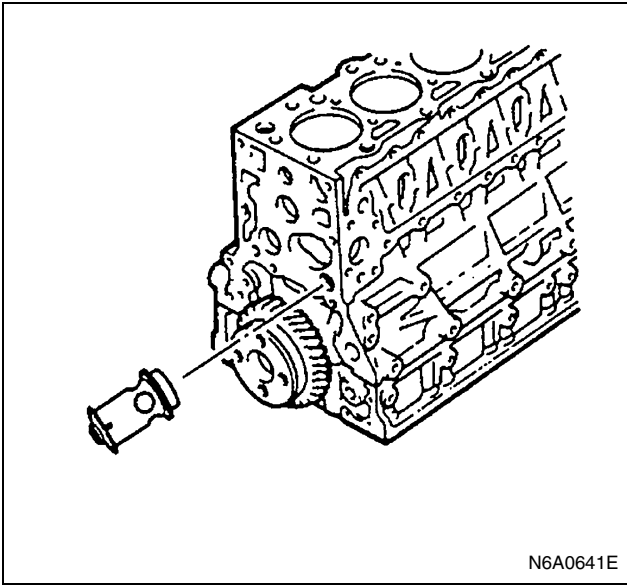
18. Power Steering Pump Idle Gear Cover
Install the gear cover with the O-ring.

Tighten:

Gear cover bolt to 19 N·m (1.9 kg·m/14 lb·ft)



20. Bypass Valve (4HE1-TC)
Insert the bypass valve into the cylinder body.

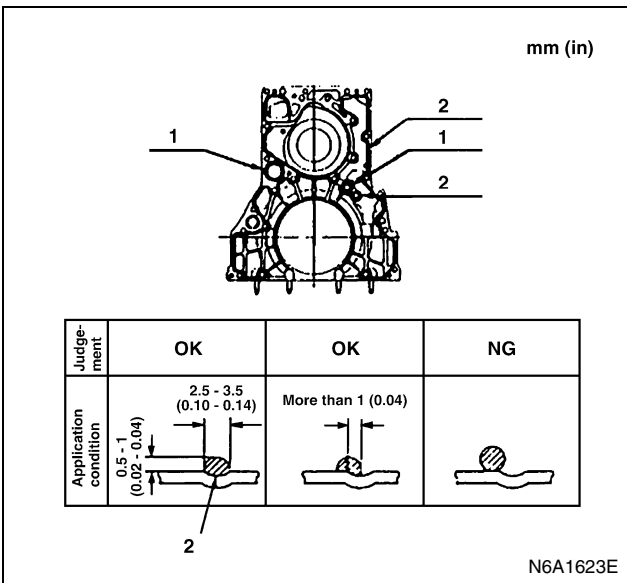


21. Front Retainer

- 1) Carefully wipe any foreign material from the cylinder body front face.
- 2) Apply a 2.5 — 3.5 mm (0.10 — 0.14 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the groove of the front retainer fitting surface shown in the illustration.
- 3) Install the O-rings (2 pieces) to the front retainer.
 - Install the front retainer within 7 minutes after application of the liquid gasket.
 - For the dislocation of liquid gasket, refer to the illustration.
- 4) Align the cylinder body knock pins with the front retainer knock pin holes.

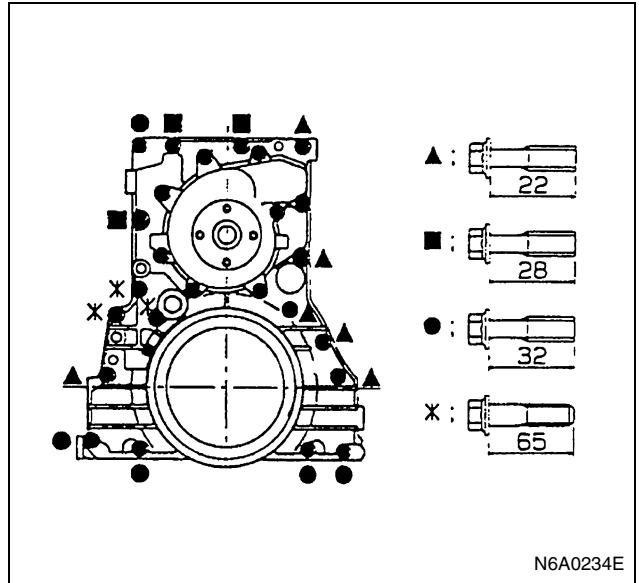
Tighten:

Front retainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



Legend

1. O-ring
2. Liquid gasket



22. Water Pump Assembly

- 1) Apply 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the water pump fitting surface.
- 2) Install the water pump to the front retainer.

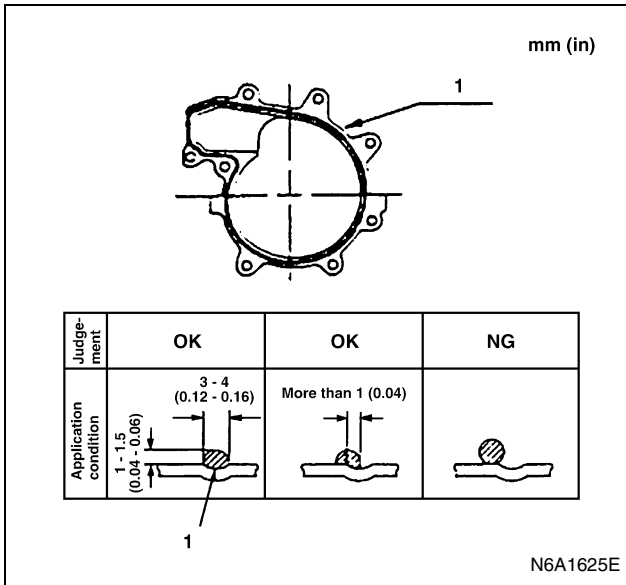
Tighten:

Water pump bolt to 24 N·m (2.4 kg·m/17 lb·ft)

- Install the water pump within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.

Caution:

The water pump clamping bolt is also used to tighten the front retainer. So, install the water pump before liquid gasket gets dry immediately after installation of the front retainer.



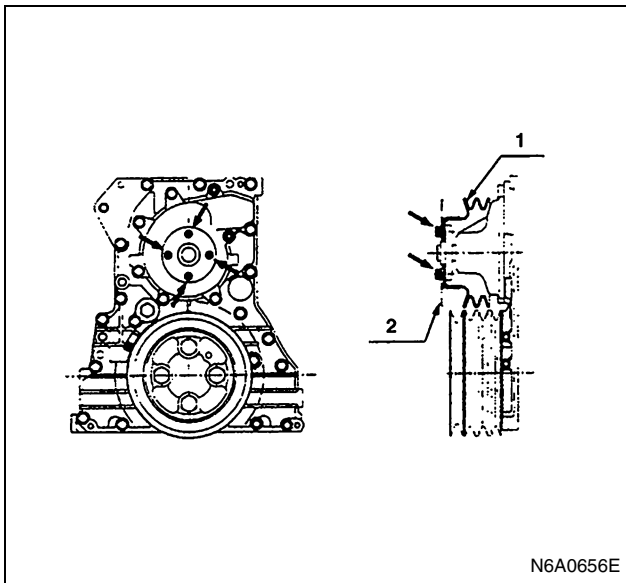
Legend

1. Liquid gasket

23. Water Pump Pulley

Tighten:

Water pump pulley bolt to 24 N·m (2.4 kg·m/17 lb·ft)



Legend

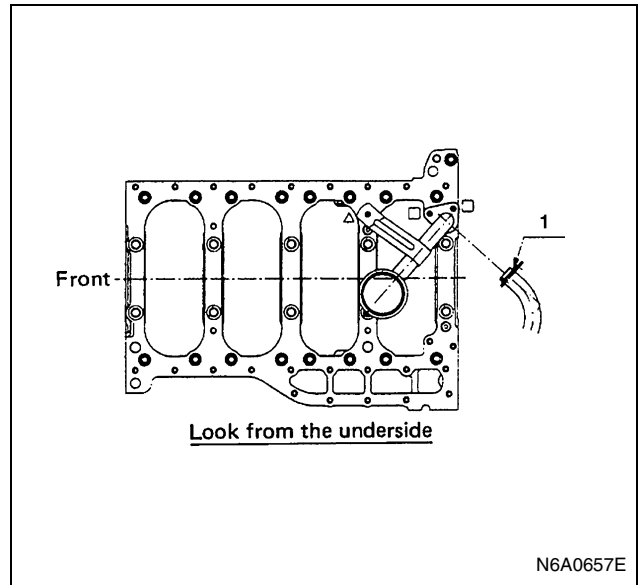
1. Pulley
2. Set plate

24. Oil Pump Strainer

Install the O-ring (1) to the oil pump strainer pipe and install the oil pump strainer to the cylinder body shown in the illustration.

Tighten:

Oil pump strainer bolt to 24 N·m (2.4 kg·m/17 lb·ft)



25. Oil Pan

Above works refer to "OIL PAN" section in this manual.

26. Spacer Rubber

Above works refer to "OIL PAN" section in this manual.

27. Crankshaft Rear Slinger

28. Crankshaft Rear Oil Seal

Above works refer to "CRANKSHAFT REAR OIL SEAL" section in this manual.

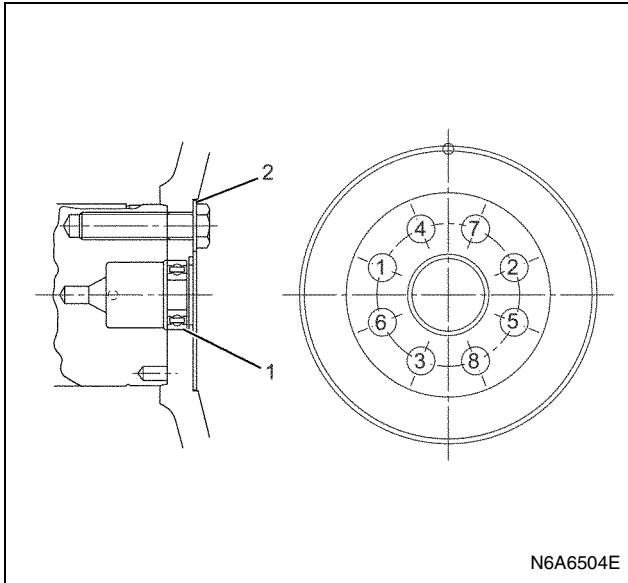
29. Flywheel Assembly

- 1) Align the flywheel with the crankshaft knock pin and temporarily tighten the flywheel bolts.
- 2) Use the crankshaft stopper to prevent the crankshaft from turning.
Crankshaft Stopper: 5-8840-2230-0
- 3) Install the washer and the flywheel bolts and tighten to the specified torque in the numerical order show in the illustration.

Tighten:

Flywheel bolt to

- 1st step: 78 N·m (8.0 kg·m/58 lb·ft)
- 2nd step: 90 — 120°



N6A6504E

Legend

- 1. Washer
- 2. Pilot bearing

4) Remove the crankshaft stopper.

30. Crankshaft Front Slinger

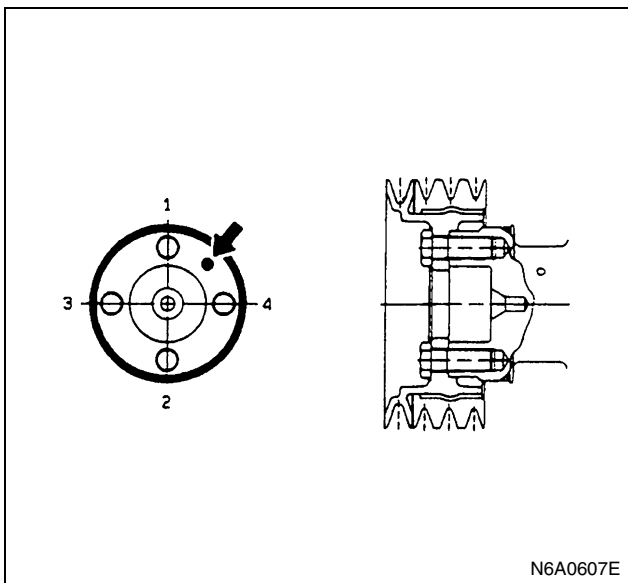
31. Crankshaft Front Oil Seal
Above works refer to "CRANKSHAFT FRONT OIL SEAL" section in this manual.

32. Crankshaft Damper Pulley

- 1) Apply a coat of the engine oil to the threads of the bolts.
- 2) Align the damper pulley with the crankshaft knock pin and tighten the bolts to the specified torque in the numerical order.

Tighten:

Damper pulley bolt to 200 N·m (20.4 kg·m/147 lb·ft)

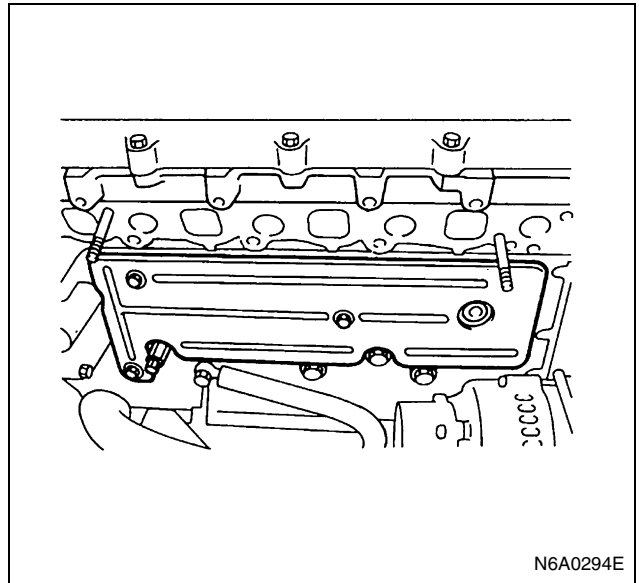


N6A0607E

33. Cover

Tighten:

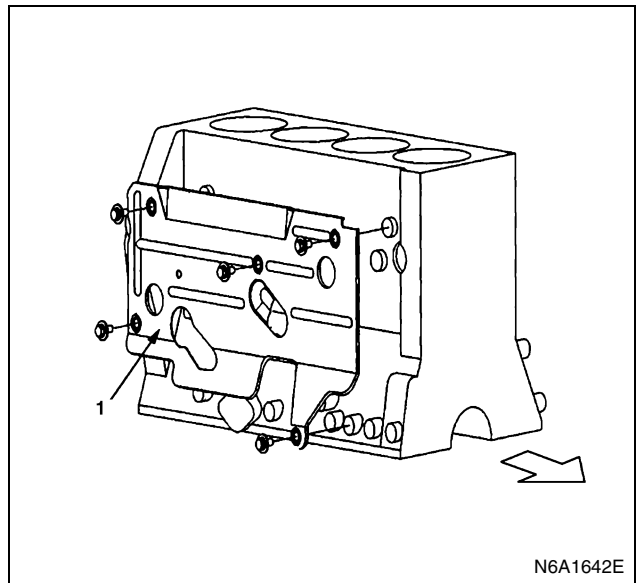
Cover Bolt to 13 N·m (1.3 kg·m/113 lb·in)



N6A0294E

4HE1-TC

4HE1-TC engines use a larger rubber spacer than other engines.



N6A1642E

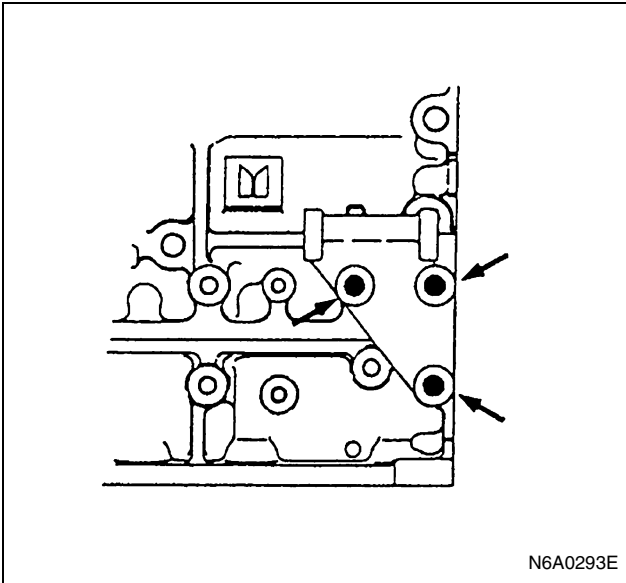
Legend

- 1. Cover

34. Generator Bracket

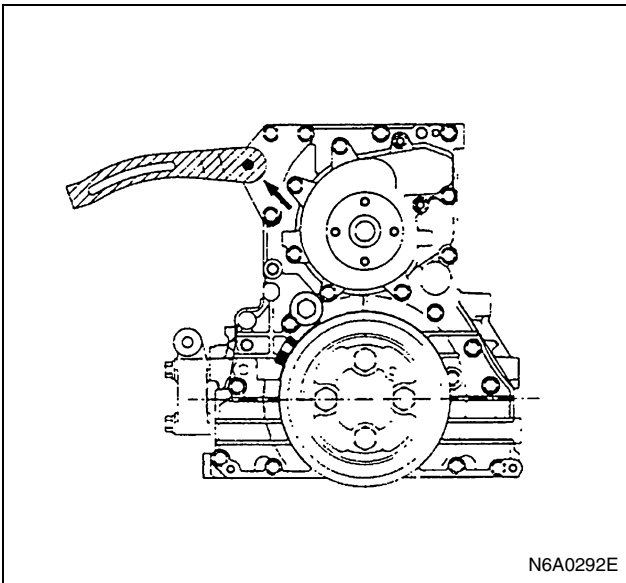
Tighten:

Generator bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



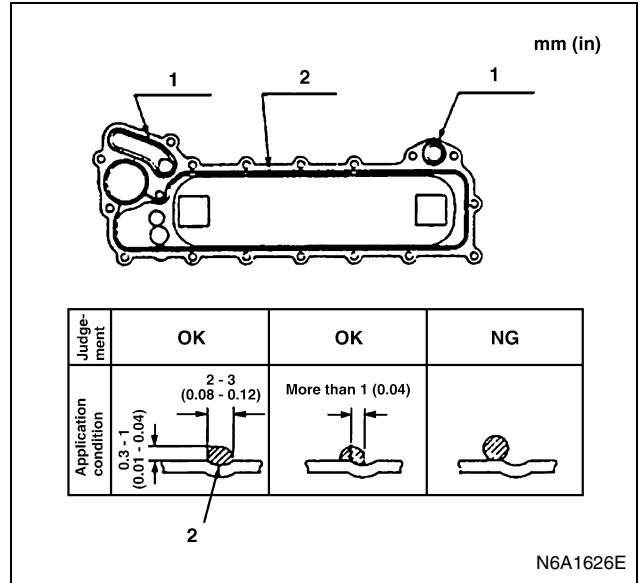
N6A0293E

35. Fan Belt Adjust Plate
Install the adjust plate and temporarily tighten the adjust plate bolt.



N6A0292E

36. Oil Cooler Assembly
- 1) Apply 2 — 3 mm (0.08 — 0.12 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the oil cooler fitting surface.
 - 2) Apply a coat of engine oil to the O-rings (2 pieces) and install the O-rings to the oil cooler.



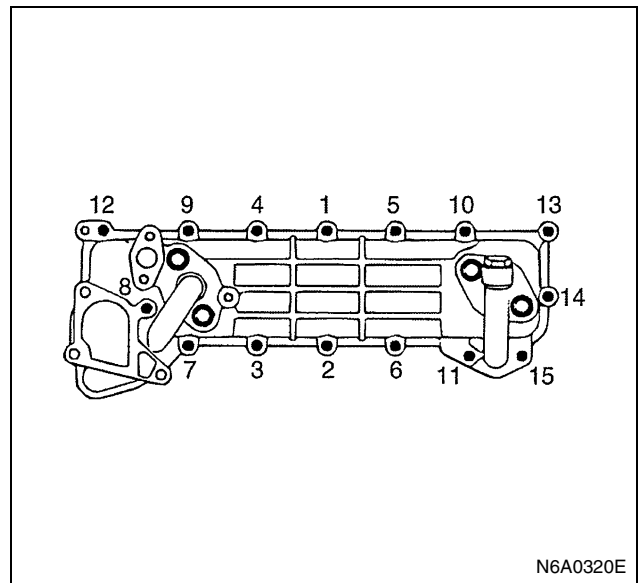
N6A1626E

- Legend**
1. O-ring
 2. Liquid gasket

Notice:
Take care that the O-ring does not get smeared with liquid gasket.

- Install the oil cooler within 7 minutes after application of the liquid gasket.
 - For the dislocation of the liquid gasket, refer to the illustration.
- 3) Tighten the oil cooler bolts and nut to the specified torque a little at a time in the sequence shown in the illustration.

Tighten:
Oil cooler bolt and nut to 24 N·m (2.4 kg·m/17 lb·ft)

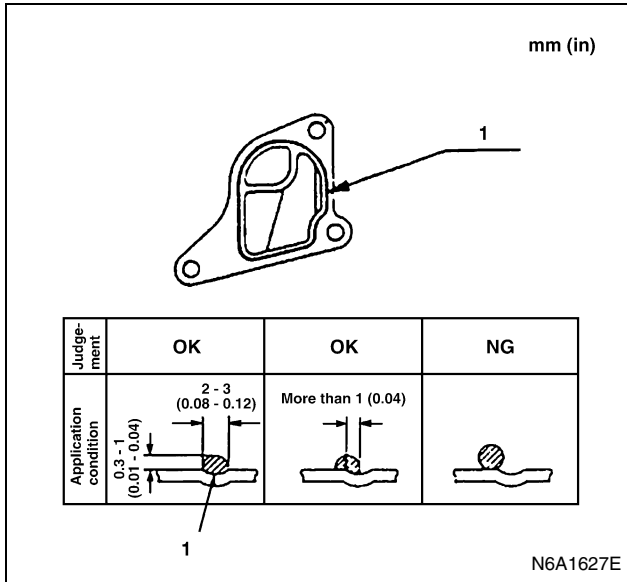


N6A0320E

37. Water Suction Pipe
- 1) Apply a 2 — 3 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond

1207C) or its equivalent on the groove of the water suction pipe fitting surface.

- 2) Install the water suction pipe to the oil cooler.
 - For the dislocation of liquid gasket, refer to the illustration.



Legend

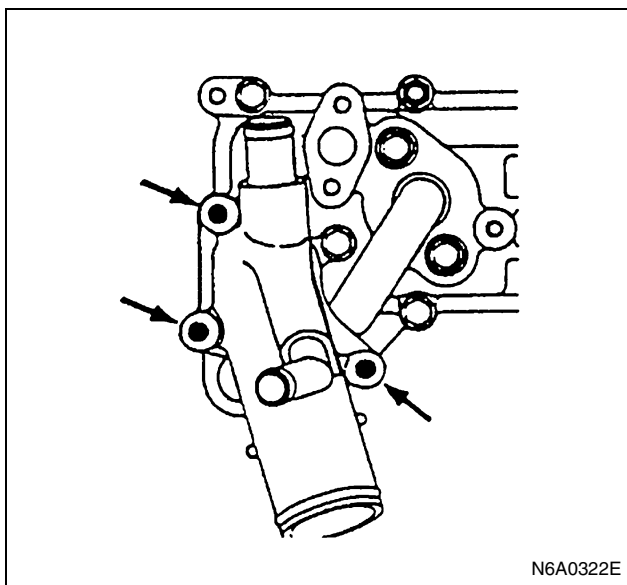
1. Liquid gasket

Tighten:

Water suction pipe bolt and nuts to 24 N·m (2.4 kg·m/17 lb·ft)

Notice:

Install the water suction pipe immediately after the installation of the oil cooler.

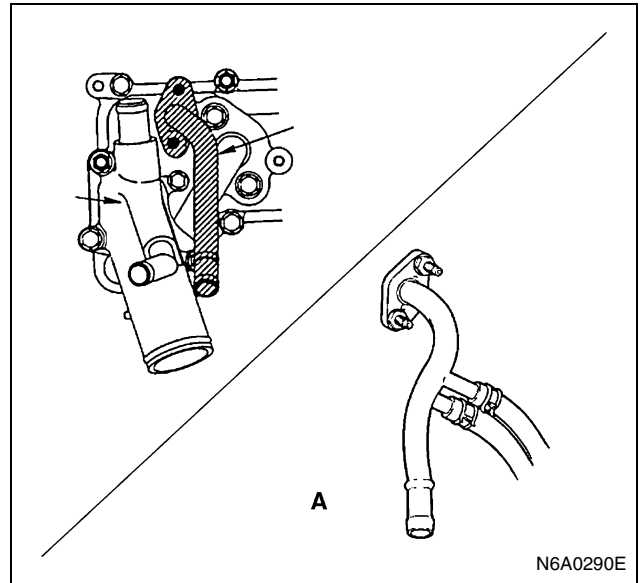


38. Heater Pipe

- 1) Install the O-ring to the heater pipe.
- 2) Install the heater pipe to the oil cooler.

Tighten:

Heater pipe bolt to 24 N·m (2.4 kg·m/17 lb·ft)



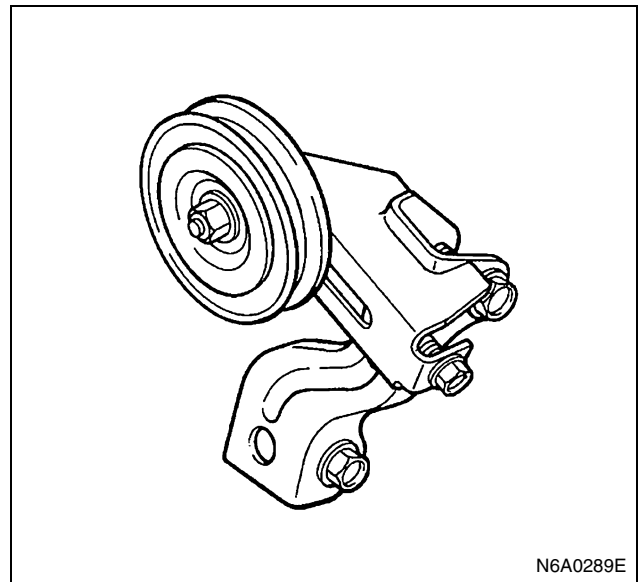
Legend

- A. 4HF1-2

39. Idle Pulley Bracket (If equipped with A/C)

Tighten:

Idle pulley bracket bolt to 48 N·m (4.9 kg·m/35 lb·ft)



40. Injection Pump Rubber Spacer

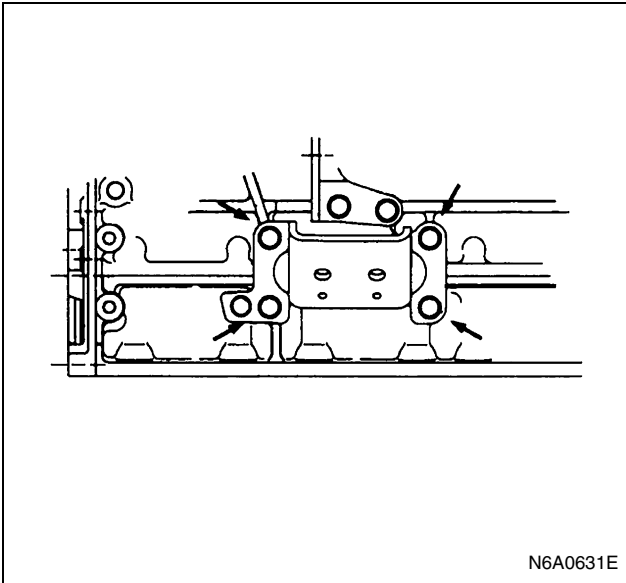
41. Injection Pump Assembly

Above works refer to "INJECTION PUMP ASSEMBLY" section in this manual.

42. Engine Foot

Tighten:

Engine foot bolt to 51 N·m (5.2 kg·m/38 lb·ft)



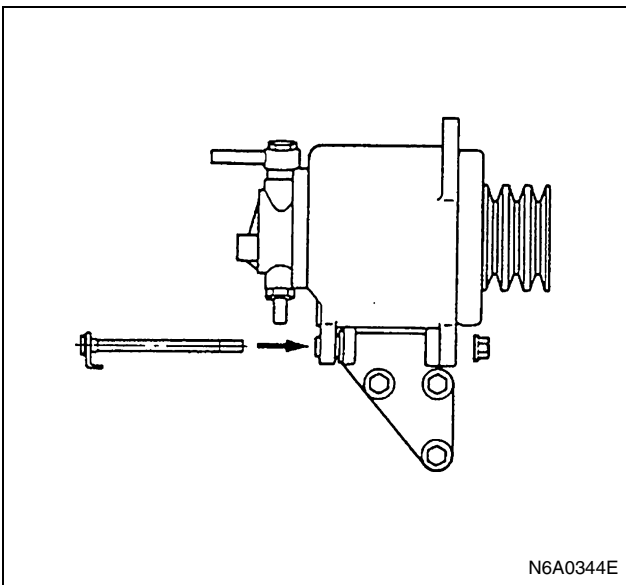
N6A0631E

43. Generator

Notice:

When tightening the generator, tighten in advance the fan belt temporarily after its adjustment.

- Insert through the lower fixing bolt from the rear side as shown in the illustration, and tighten it with a nut on the front side.



N6A0344E

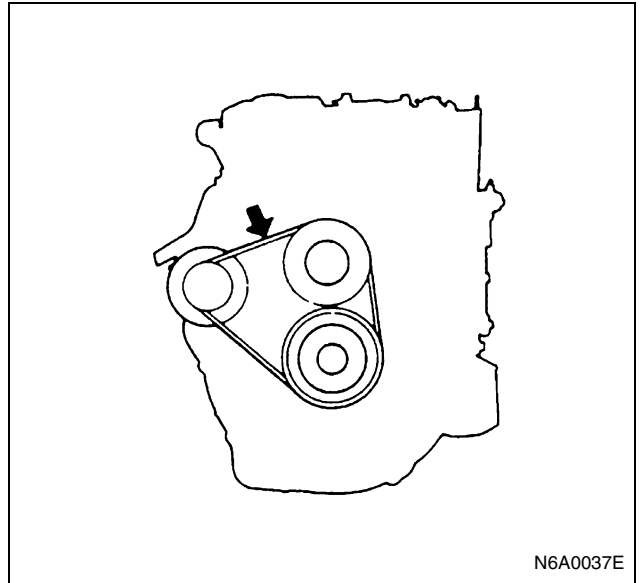
44. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
8 — 12 (0.31 — 0.47) ... New belt	
10 — 14 (0.39 — 0.55) ... Reuse belt	

Check the drive belt for cranking and other damage.



N6A0037E

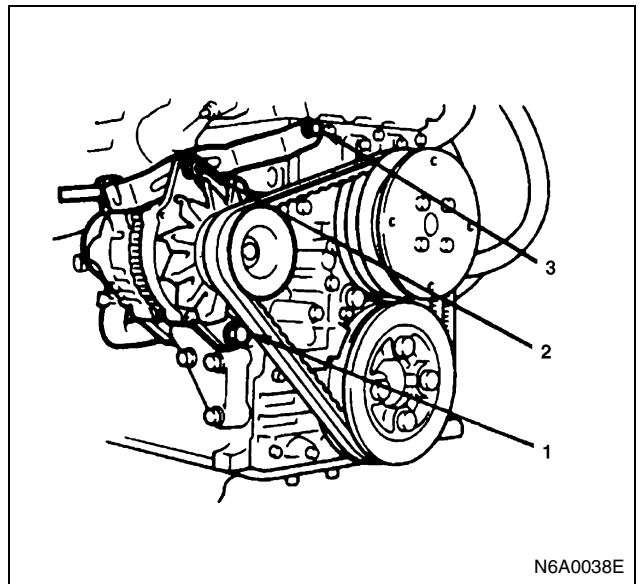
Fan Belt Adjustment

Fan belt tension is adjusted by moving the generator.

Tighten:

Bolt to

- (1): 40 N·m (4.1 kg·m/30 lb-ft)
- (2): 24 N·m (2.4 kg·m/17 lb-ft)
- (3): 46 N·m (4.7 kg·m/34 lb-ft)



N6A0038E

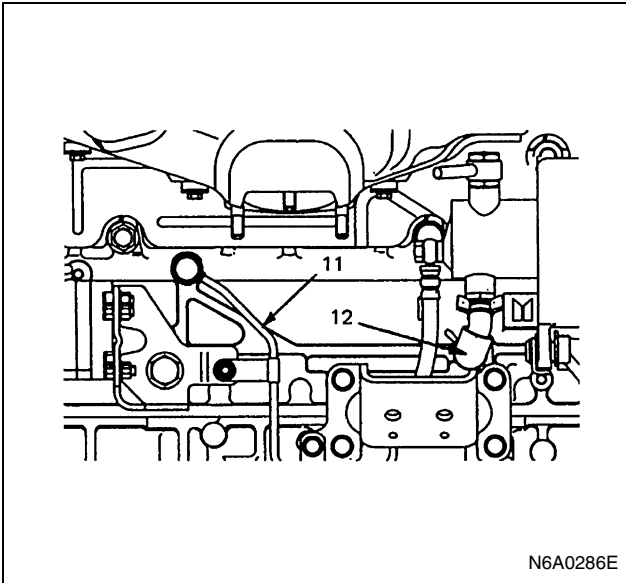
45. Vacuum Pump Rubber Hose (12)

46. Vacuum Pump Oil Pipe (11)

Tighten:

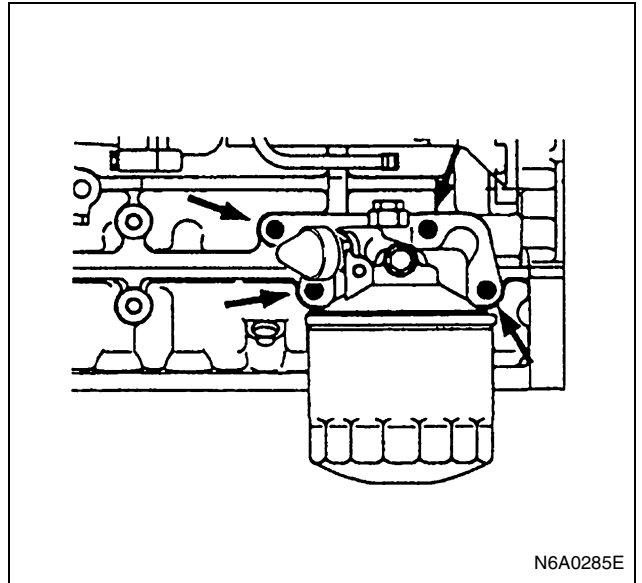
Vacuum pump oil pipe to

- Cylinder body side: 41 N·m (4.2 kg·m/30 lb-ft)
- Generator side: 23 N·m (2.3 kg·m/17 lb-ft)



- 47. Fuel Pipe Bracket
- 48. Tachometer Sensor

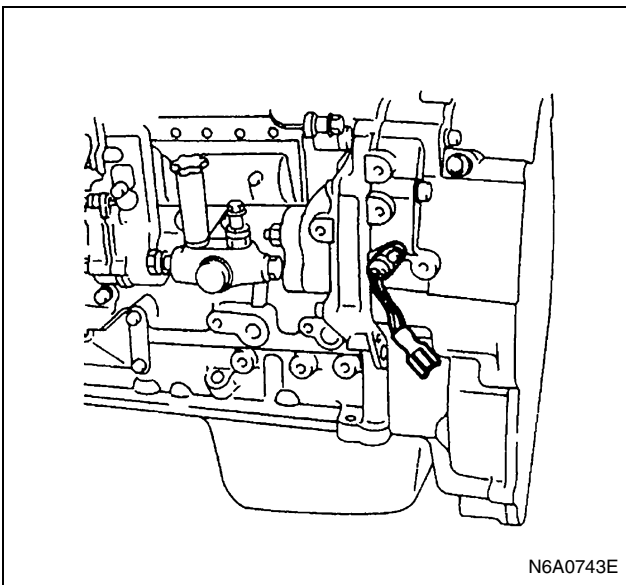
Tighten:
Tachometer bolt to 8 N·m (0.8 kg·m/69 lb·in)



- 50. Oil Pipe
- Tighten:**
Oil pipe joint bolt to 17 N·m (1.7 kg·m/12 lb·ft)
- 51. Engine Control Lever Assembly

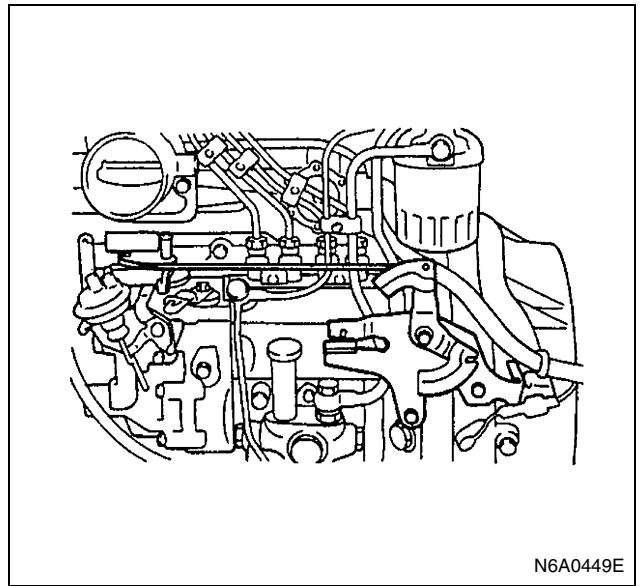
Tighten:
Engine control lever bolt to 24 N·m (2.4 kg·m/17 lb·ft)

52. Engine Control Wire

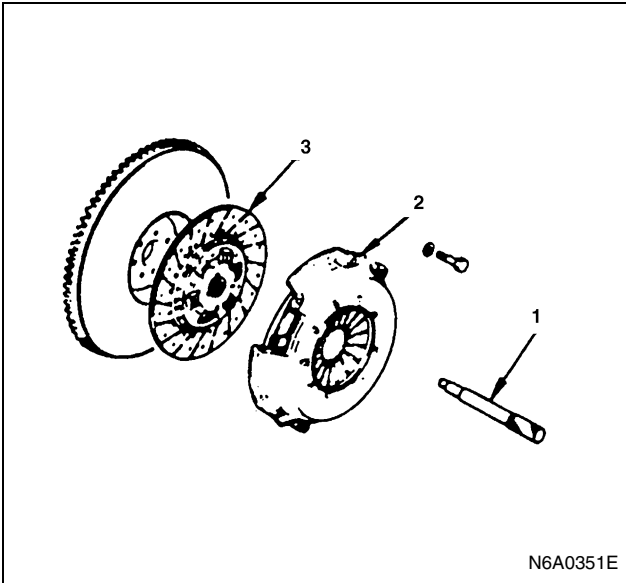


- 49. Oil Filter Assembly

Tighten:
Oil filter bolt to 8 N·m (4.9 kg·m/35 lb·ft)



- 53. Driven Plate
Use the clutch pilot aligner to install the driven plate.
Clutch Pilot Aligner: 5-8840-2240-0



N6A0351E

Legend

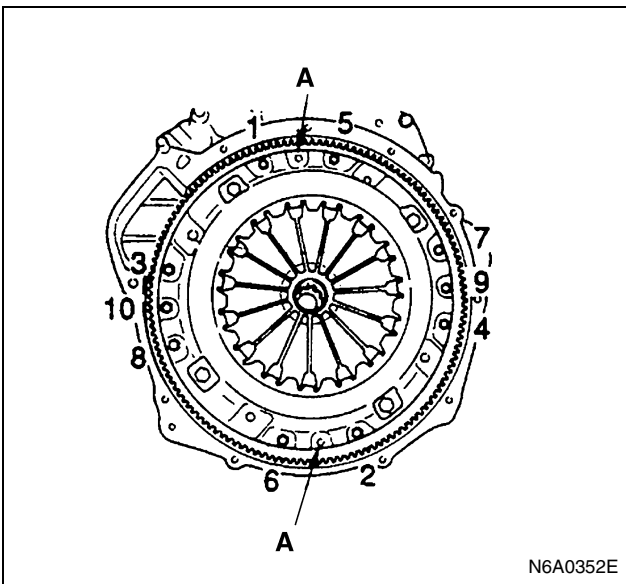
- 1. Clutch pilot aligner
- 2. Clutch pressure plate assembly
- 3. Driven plate

54. Clutch Pressure Plate Assembly

- 1) Align the clutch pressure plate with the flywheel knock pin.
- 2) Tighten the pressure plate bolts to the specified torque in numerical order.

Tighten:

Clutch pressure plate bolt to 40 N·m (4.1 kg·m/30 lb-ft)



N6A0352E

Legend

- A. Knock pin

55. Cylinder Head Gasket

56. Cylinder Head Assembly

Above works refer to "CYLINDER HEAD" section in this manual.

57. Camshaft Bearing Lower

58. Camshaft Assembly

59. Camshaft Bearing Upper

60. Camshaft Bearing Cap

61. Valve Cap

Above works refer to "CAMSHAFT ASSEMBLY" section in this manual.

62. Rocker Arm Shaft Assembly

Above works refer to "ROCKER ARM SHAFT ASSEMBLY" section in this manual.

63. Head Cover Gasket

Above works refer to "CYLINDER HEAD" section in this manual.

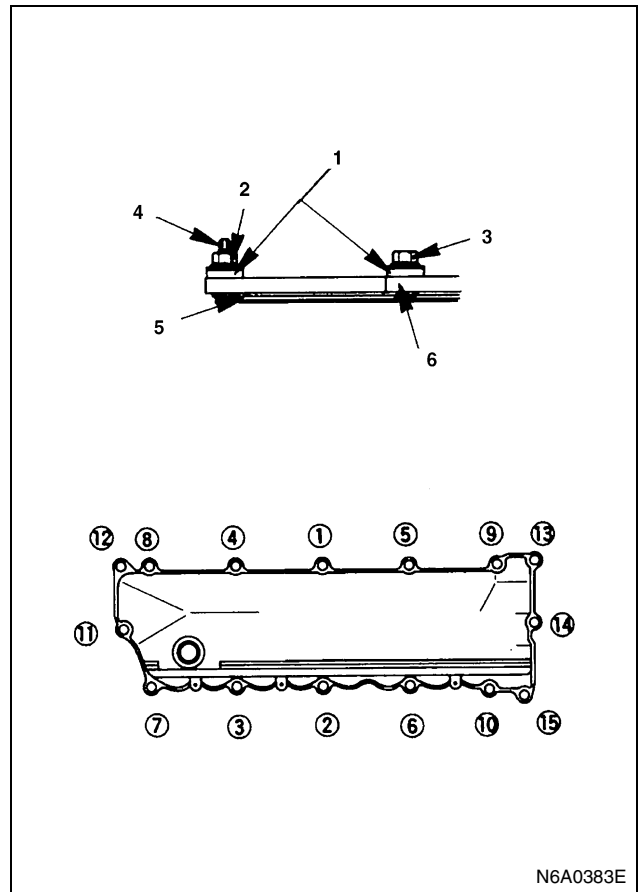
64. Cylinder Head Cover

1) Install the cylinder head cover.

2) Tighten the cylinder head cover nuts and bolts to the specified torque in the numerical order shown in the illustration.

Tighten:

Cylinder head cover nut and bolt to 18 N·m (1.8 kg·m/13 lb-ft)



N6A0383E

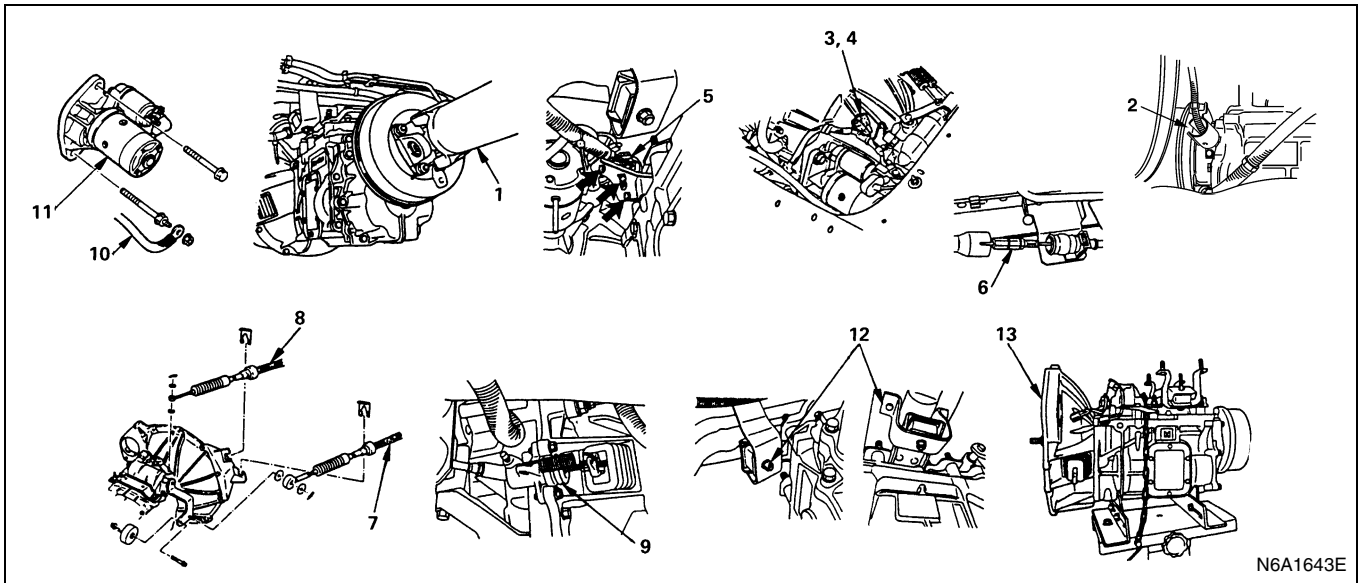
Legend

1. Mounting rubber
 2. Nut
 3. Bolt
 4. Stud bolt
 5. Gasket
 6. Head cover
-

65. Nozzle Cover
66. Engine Assembly
Above works refer to "ENGINE ASSEMBLY" section in this manual.

ENGINE ASSEMBLY

Component Transmission Side

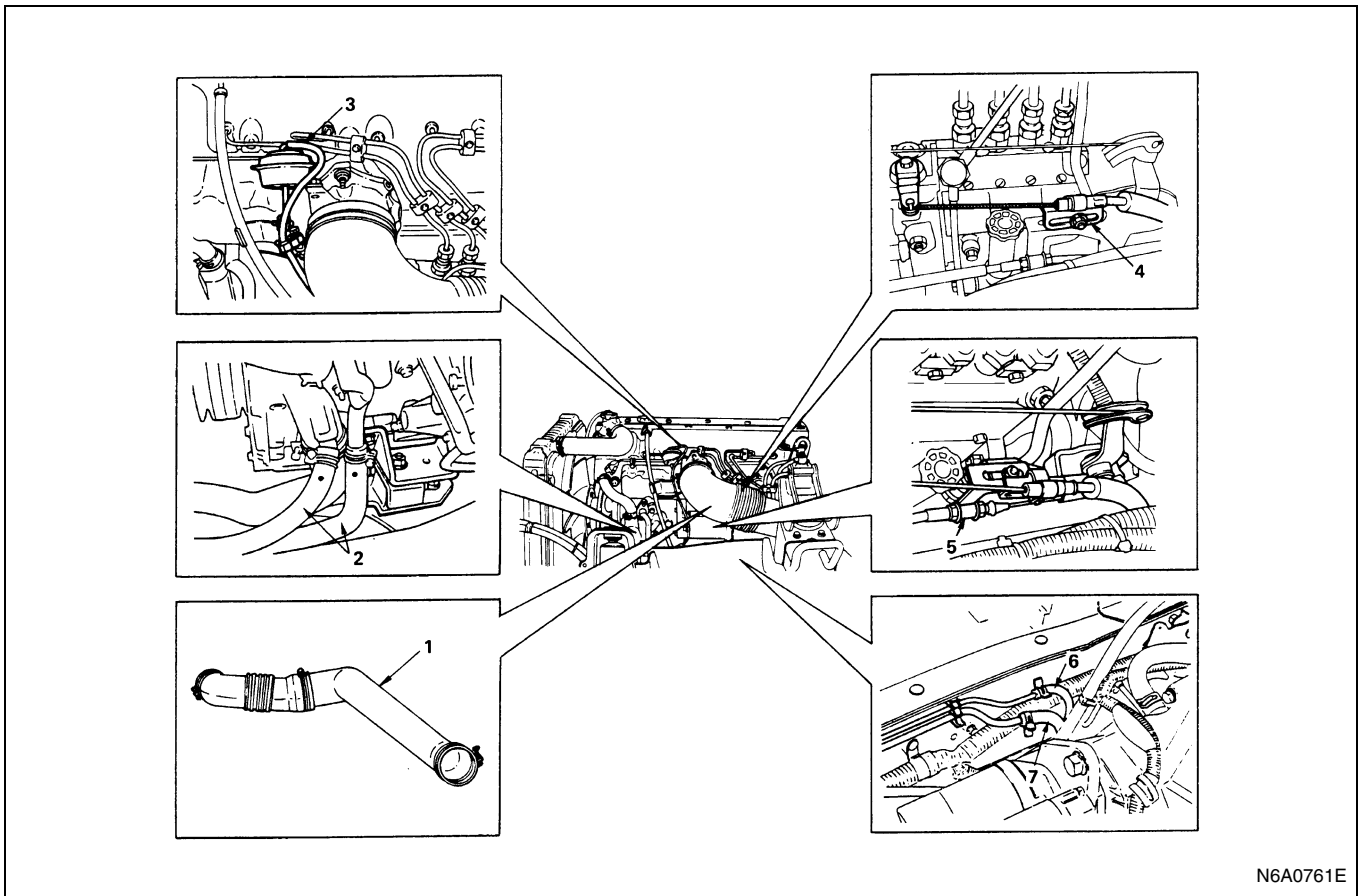


N6A1643E

Legend

- | | |
|-------------------------------|-------------------------------|
| 1. Propeller shaft assembly | 8. Select cable |
| 2. Car speed sensor connector | 9. Clutch slave cylinder |
| 3. Neutral switch connector | 10. Starter earth cable |
| 4. Back-up lamp connector | 11. Starter |
| 5. Harness connector | 12. Transmission mounting nut |
| 6. Parking brake cable | 13. Transmission assembly |
| 7. Shift cable | |

Engine Left Side

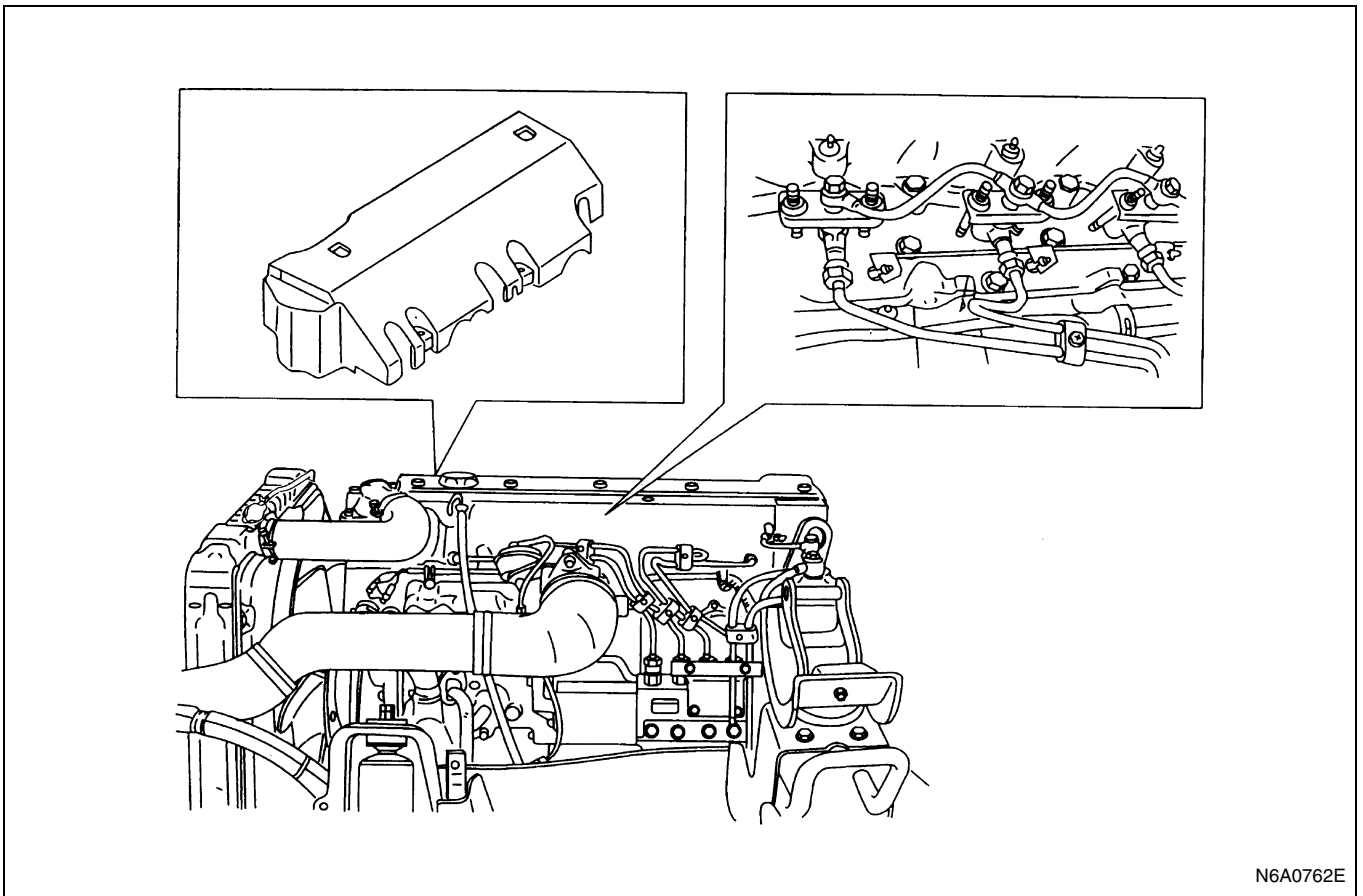


N6A0761E

Legend

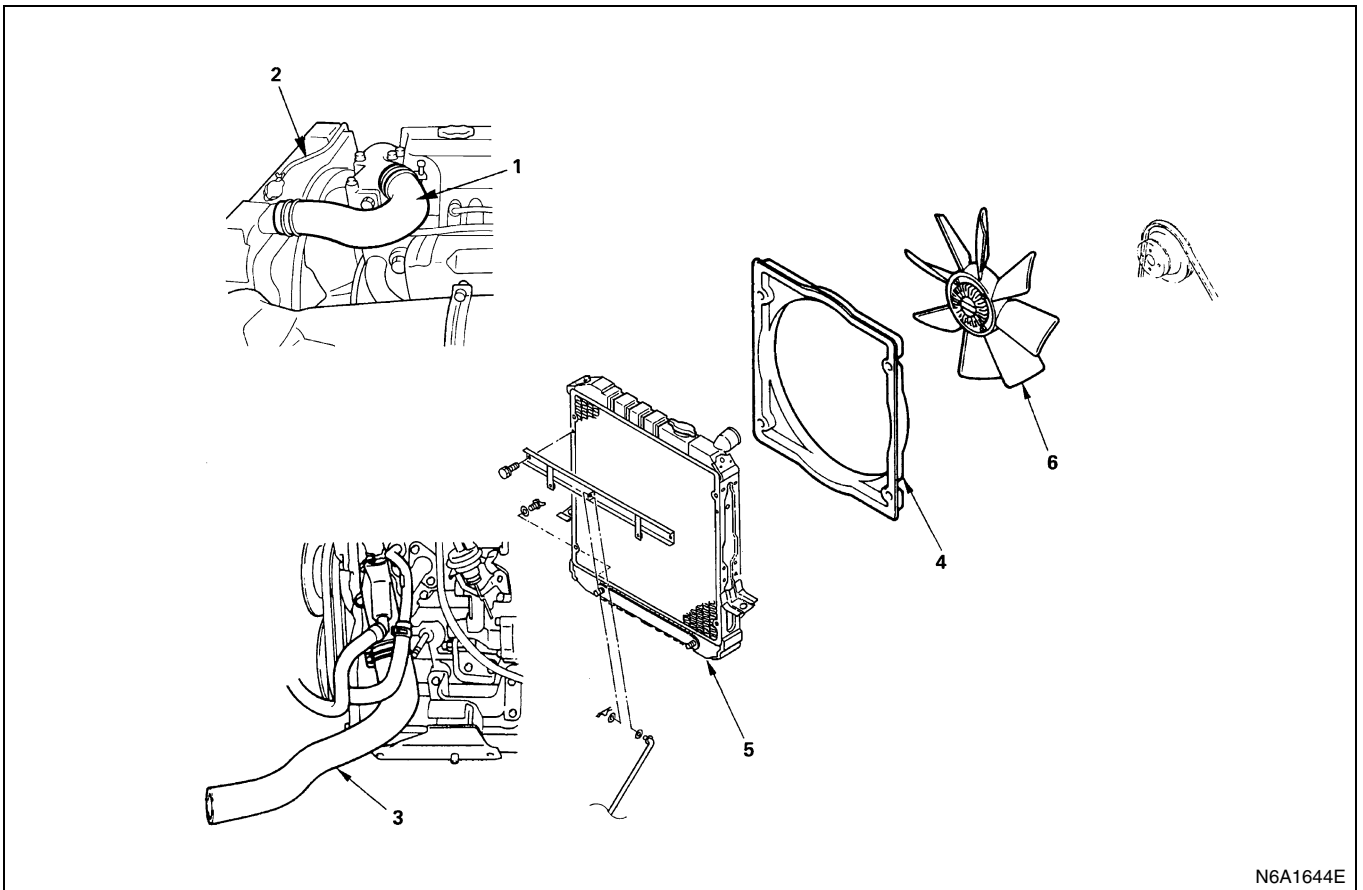
- | | |
|----------------------|------------------------------|
| 1. Intake air duct | 5. Accelerator control cable |
| 2. Heater hose | 6. Fuel return hose |
| 3. Vacuum hose | 7. Fuel feed hose |
| 4. Engine stop cable | |

Engine Upper Side



N6A0762E

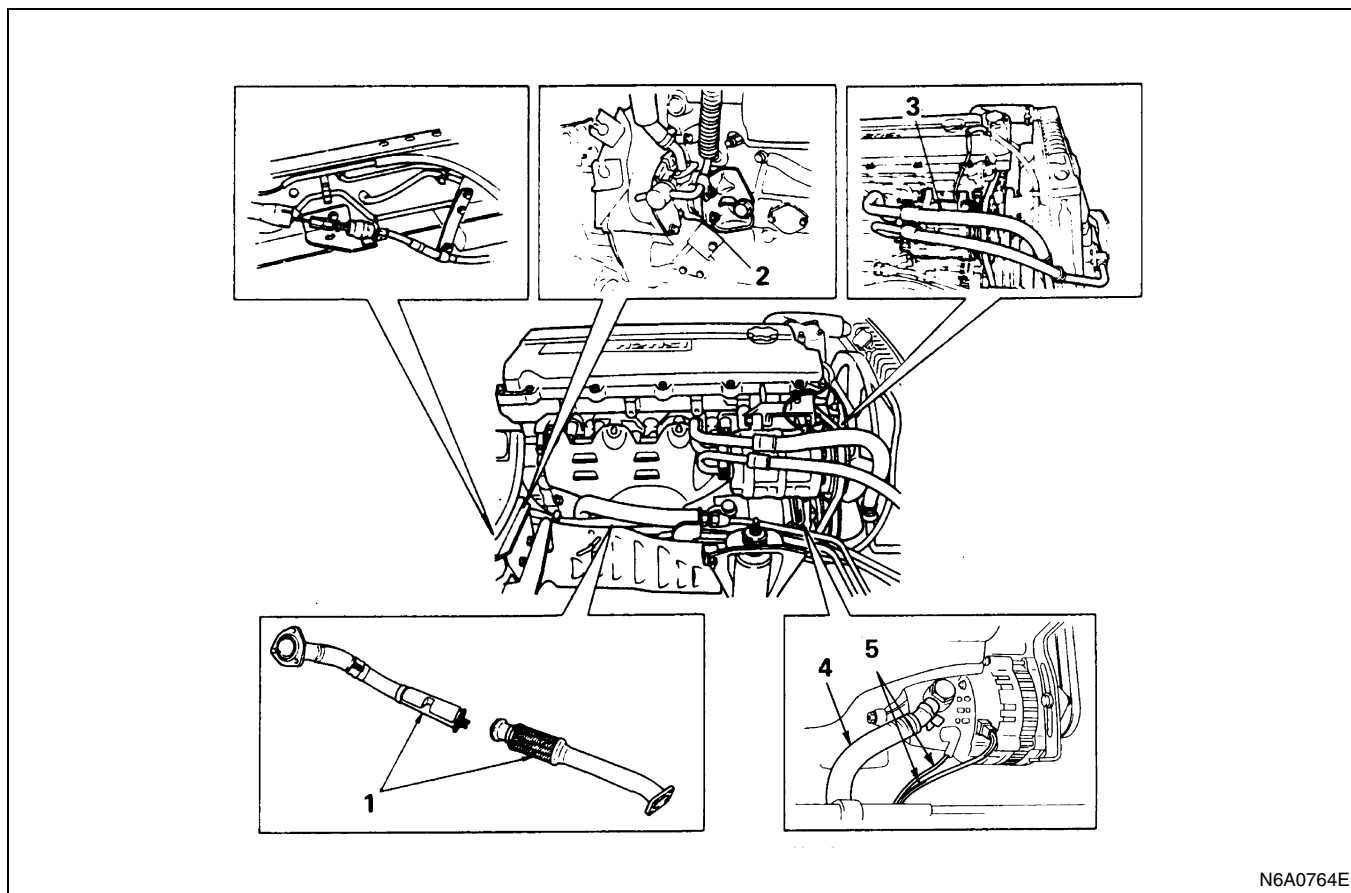
Engine Front Side



N6A1644E

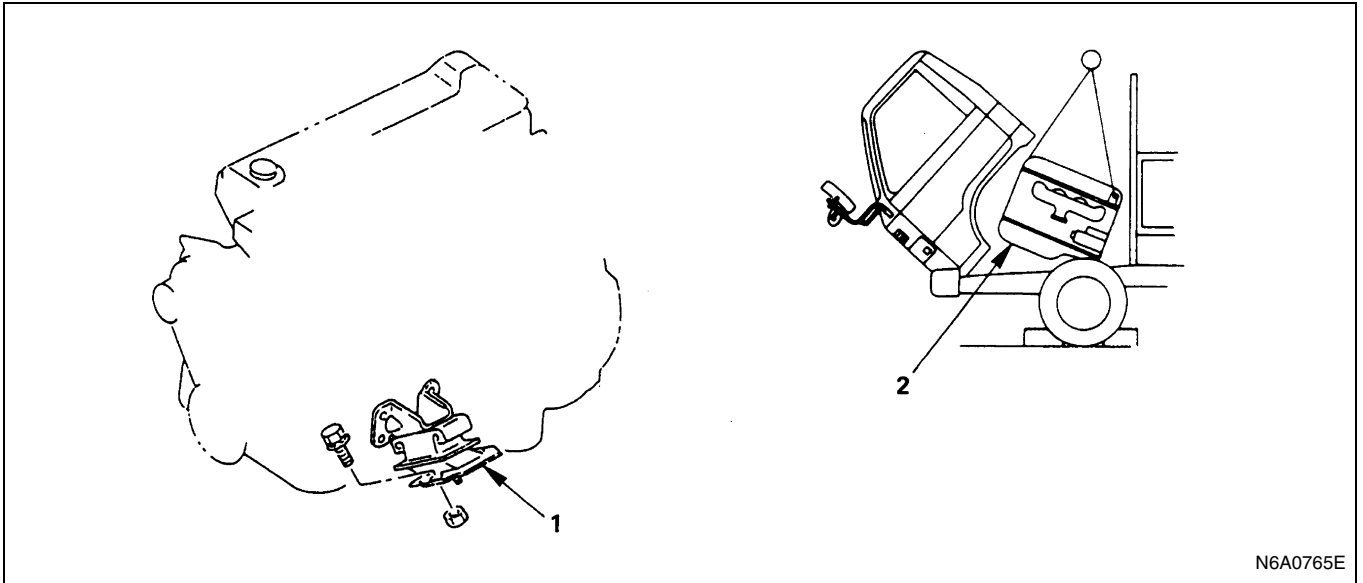
Legend

- | | |
|--|--------------|
| 1. Radiator upper hose | 4. Fan guide |
| 2. Coolant reserve tank hose/Bypass hose | 5. Radiator |
| 3. Radiator lower hose | 6. Fan |
-

Engine Right Side**Legend**

- | | |
|------------------------|--------------------|
| 1. Front exhaust pipe | 4. ACG vacuum hose |
| 2. Power steering pump | 5. ACG harness |
| 3. A/C compressor | |
-

Engine Mounting Side



Legend

1. Engine mount

2. Engine assembly

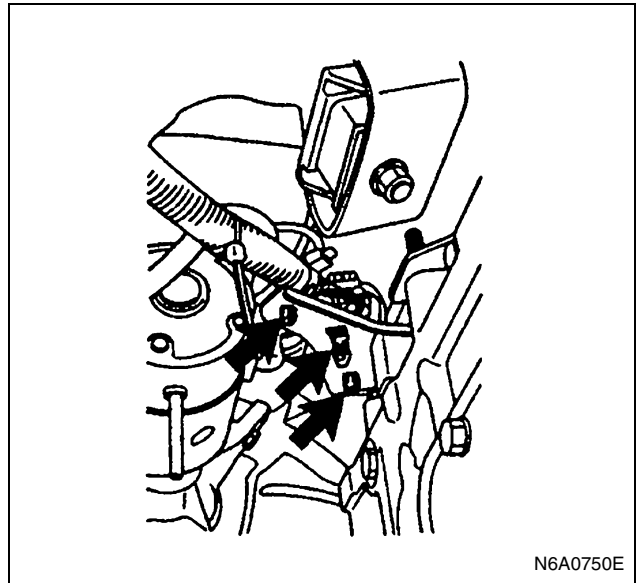
Removal

Preparation

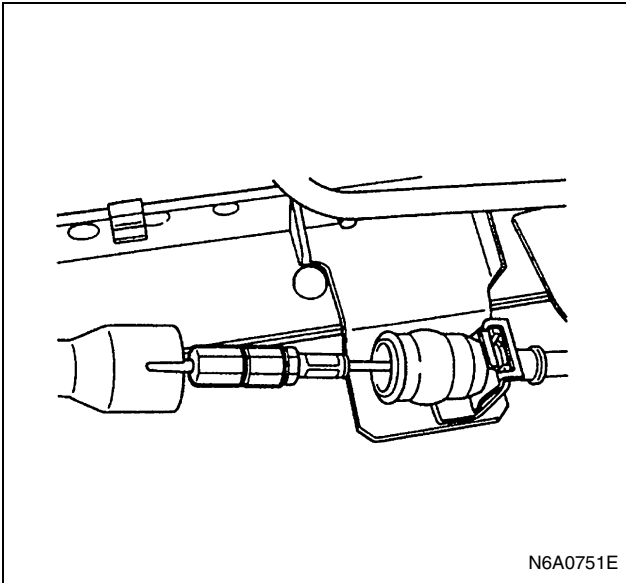
- Disconnect battery ground cable
- Tilt the cab
- Remove the transmission panel
- Drain coolant

Transmission Side

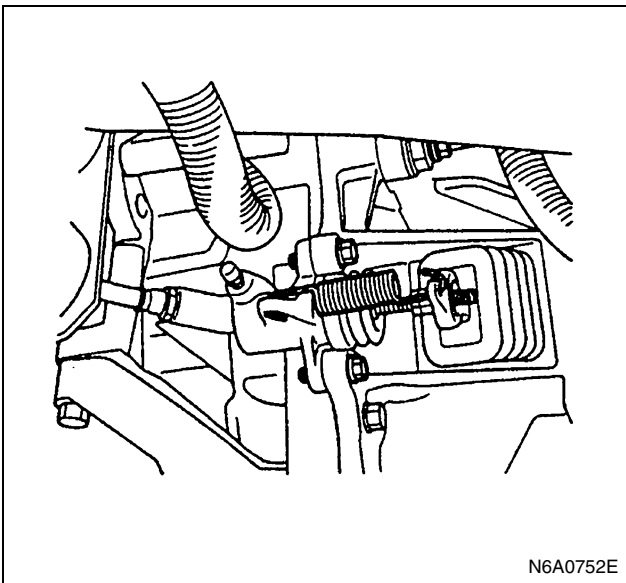
1. Propeller shaft Assembly
 - 1) Put in advance an alignment mark to the drum and the flange yoke.
 - 2) Put the drum and the flange yoke aside and hang them with a wire so that they do not interfere with servicing work.
2. Car Speed Sensor Connector
3. Neutral Switch Connector
4. Back-up Lamp Connector
5. Harness Connector
Remove the connectors from the harness bracket. At that time, take care not to cause any damages to the clips.



6. Parking Brake Cable
Remove the clip and slide the cover provided in the middle of the cable. Then, loosen the longer nut on the front side of the vehicle to disconnect the parking brake cable.



7. Shift Cable
8. Select Cable
9. Clutch Slave Cylinder
 - 1) Disconnect the clutch return spring from the clutch slave cylinder.
 - 2) Remove the slave cylinder from the clutch shift fork.



10. Starter Earth Cable
11. Starter
 - 1) Disconnect the battery cable at the starter motor.
 - 2) Remove the starter assembly from flywheel housing.
12. Transmission Mounting Nut
 - 1) Check that the engine lifting is securely supporting the engine.
 - 2) Remove the engine rear mounting bracket nuts from the No.3 crossmember.
13. Transmission Assembly

Remove the transmission nuts and bolts from the flywheel housing.

- Remove the transmission by pulling it toward the rear of the vehicle while slowly lowering the transmission jack.

Engine Left Side

1. Intake Air Duct
2. Heater Hose
3. Vacuum Hose
4. Engine Stop Cable

Loosen locking nut at bracket and disconnect engine stop cable from injection pump stop lever.
5. Accelerator Control Cable

Loosen locking nut at bracket and disconnect accelerator control cable from injection pump control lever.
6. Fuel Return Hose
7. Fuel Feed Hose

Disconnect fuel hose from injection pump side and take care not to spill and enter dust.

Engine Front Side

1. Radiator Upper Hose
2. Coolant Reserve Tank Hose/Bypass Hose
3. Radiator Lower Hose
4. Fan Guide
5. Radiator
6. Fan

Engine Right Side

1. Front Exhaust Pipe
2. Power Steering Pump

Remove the power steering pump from the engine side with the bracket attached, and fasten it with a wire to the appropriate location, together with the hoses.
3. Air Conditioning (A/C) Compressor (If equipped with A/C)
 - 1) Remove the A/C compressor drive belt.
 - 2) Dismount the compressor from the A/C compressor bracket, and fasten it with a wire to the appropriate location, together with the hoses.
4. ACG Vacuum Hose

Disconnect the vacuum hoses from vacuum pump side.
5. ACG Harness

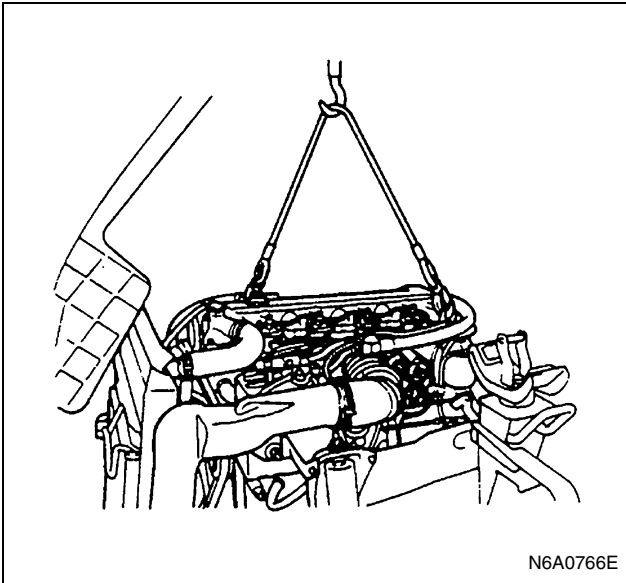
Disconnect the B terminal cable and harness connector from generator.

Engine Mounting Side

1. Engine Mount

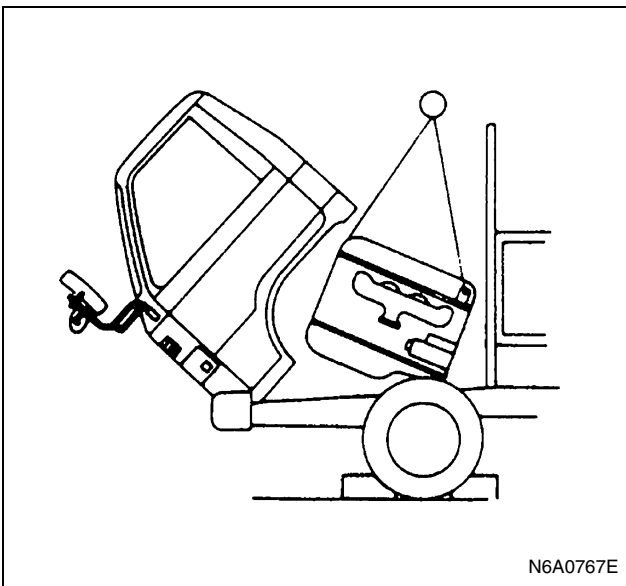
Attach lifting wires to the engine lifting hangers and slightly raise the engine.

Remove the engine mounting rubber nuts attaching the engine mounting crossmembers.

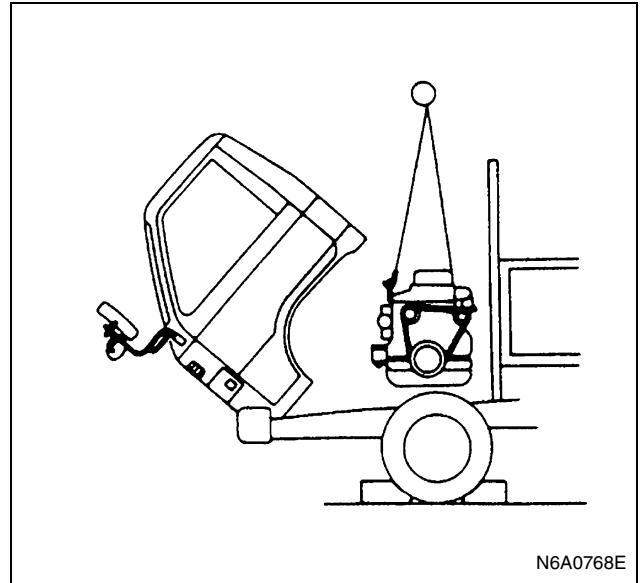


2. Engine Assembly

- 1) Make sure that the connecting pipes, hoses, and cables have all been removed from the engine.
- 2) Operate the hoist to slowly raise the engine until it is clear of the chassis frame.



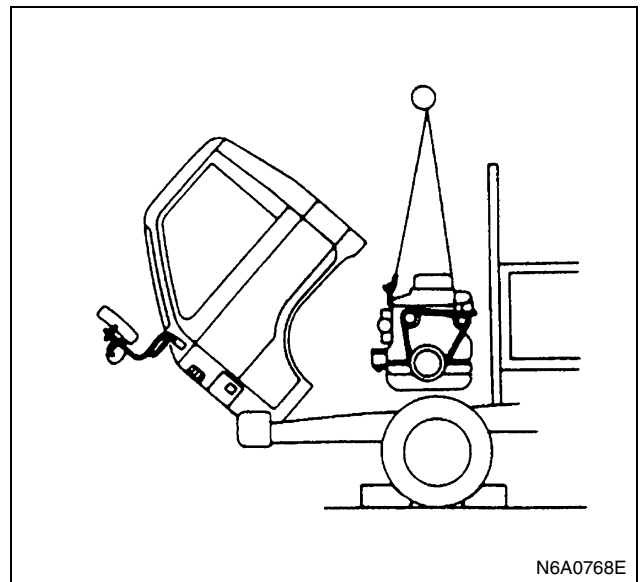
- 3) Rotate the engine 90 degrees.
- 4) Continue to lift the engine from the chassis.
- 5) Carefully move the hoist and engine.
- 6) Set the engine on an engine stand.



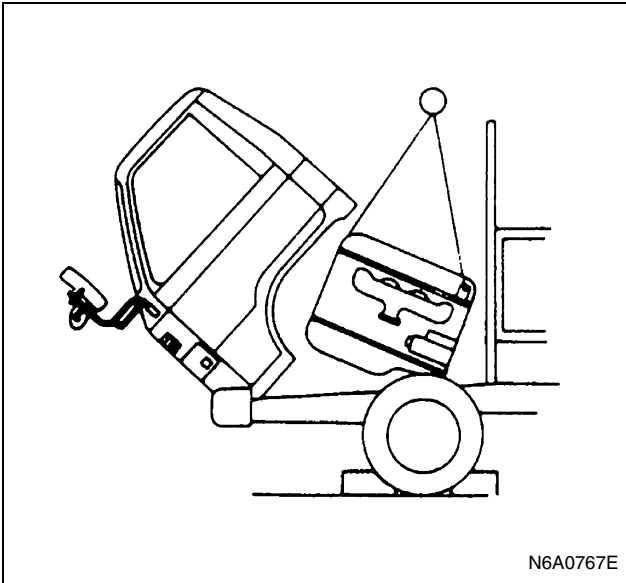
Installation

Engine Mounting Side

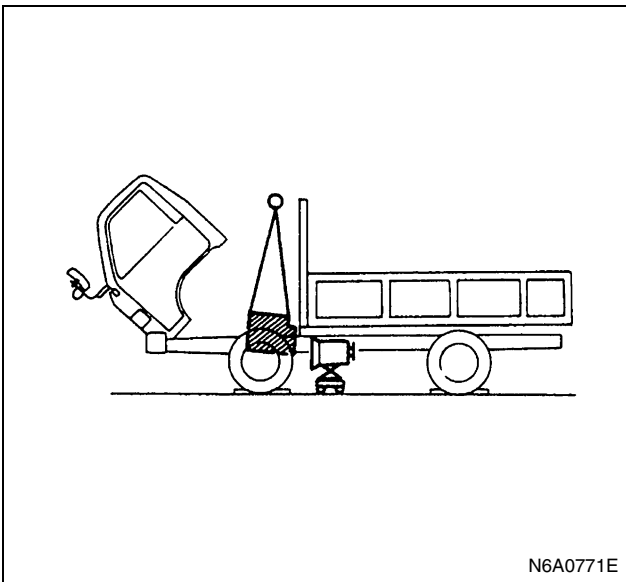
1. Engine Assembly
 - 1) Attach a lifting wire to the engine lifting hangers.
 - 2) Operate the hoist to position the engine above the chassis frame.
 - 3) Carefully lower the engine until it is just above the chassis frame.



- 4) Rotate the engine 90° to position it for final installation.
- 5) Carefully set the engine to the chassis. The front of the engine should be held higher than the rear at this time. Be careful not to damage the exposed parts.



- 6) Lower the engine until it contacts the engine mounting crossmember.
- 7) Set the engine mounting rubbers to the engine mounting crossmember.
- 8) Temporarily tighten the engine mounting rubber bolts.
The bolts will be finally tightened after the transmission has been installed to the engine and the engine rear mounting bracket and the No.3 crossmember connected.



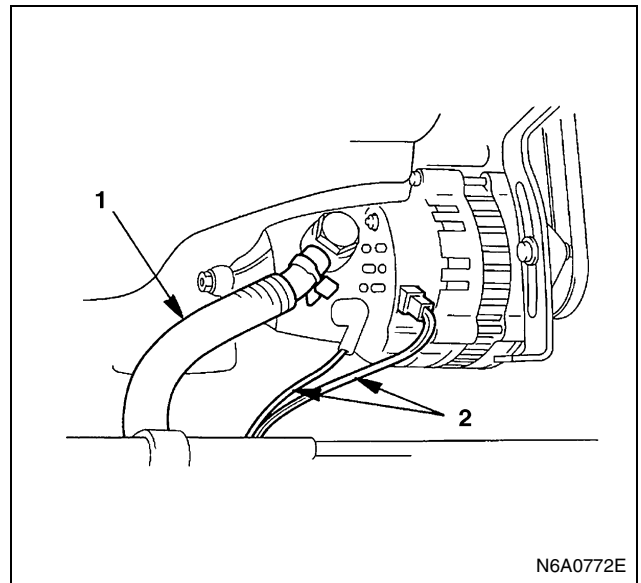
2. Engine Mount
Install the engine mount with it set to the holes of the engine mount crossmember. Then tighten it to the specified torque.

Tighten:
Mounting rubber nut to 48 N·m (4.9 kg·m/35 lb·ft)

Engine Right Side

1. ACG Harness
2. ACG Vacuum Hose

- 1) Connect the B terminal cable and the harness connector.
- 2) Connect the vacuum hoses to the vacuum pump.



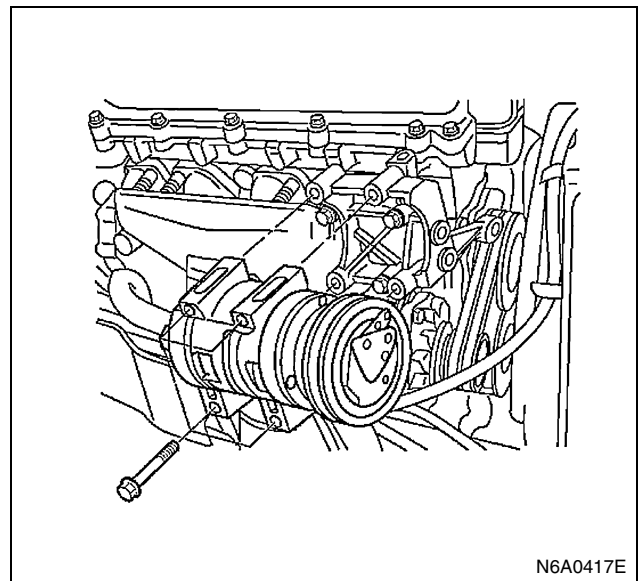
Legend

1. ACG vacuum hose
2. ACG harness

3. Air Conditioning (A/C) Compressor
 - Tighten the fixing bolts to the specified torque.

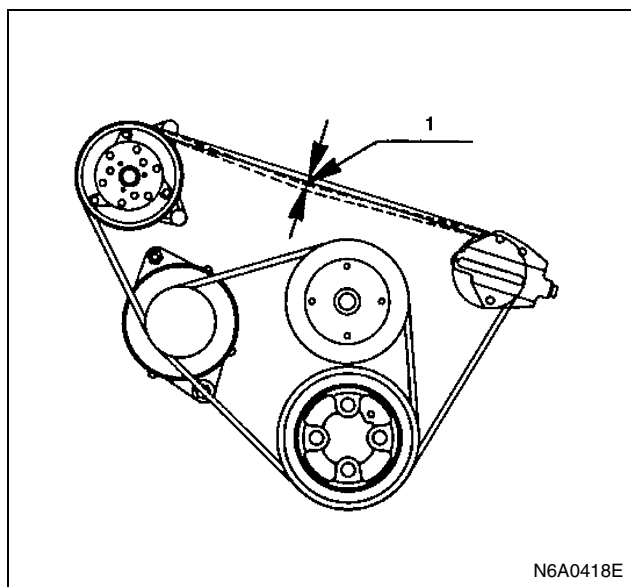
Tighten:
A/C compressor bolt to 48 N·m (4.9 kg·m/35 lb·ft)

Notice:
When tightening the compressor fixing bolts, tighten the first 2 bolts on the rear side, and then the remaining 2 on the front.



- Install the drive belt adjust belt tension by adjusting bolt and tighten the locking nut to the specified torque.
- Depress the drive belt mid-portion with a 98 N (10 kg/22 lb) force.

Drive Belt Deflection	mm (in)
16 — 20 (0.63 — 0.79) ...	New belt
18 — 22 (0.71 — 0.87) ...	Reuse belt



N6A0418E

Legend

1. Belt deflection

Tighten:

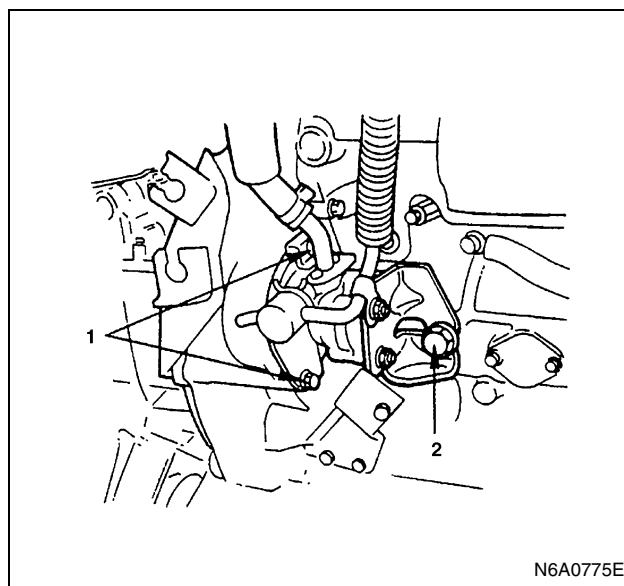
Locking nut to 27 N·m (2.8 kg·m/20 lb·ft)

4. Power Steering Pump

Tighten:

Bolt to

- (1): 43 N·m (4.4 kg·m/32 lb·ft)
- (2): 44 N·m (4.5 kg·m/33 lb·ft)



N6A0775E

5. Front Exhaust Pipe

Tighten:

Front exhaust pipe to

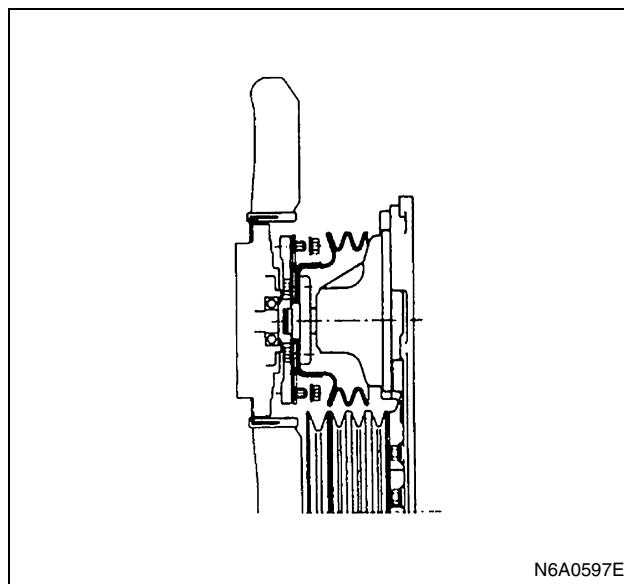
- Exhaust manifold side: 67 N·m (6.8 kg·m/49 lb·ft)
- Exhaust brake side: 17 N·m (1.7 kg·m/12 lb·ft)
- Cylinder body side: 17 N·m (1.7 kg·m/12 lb·ft)

Engine Front Side

1. Fan

Tighten:

Fan bolt to 24 N·m (2.4 kg·m/17 lb·ft)

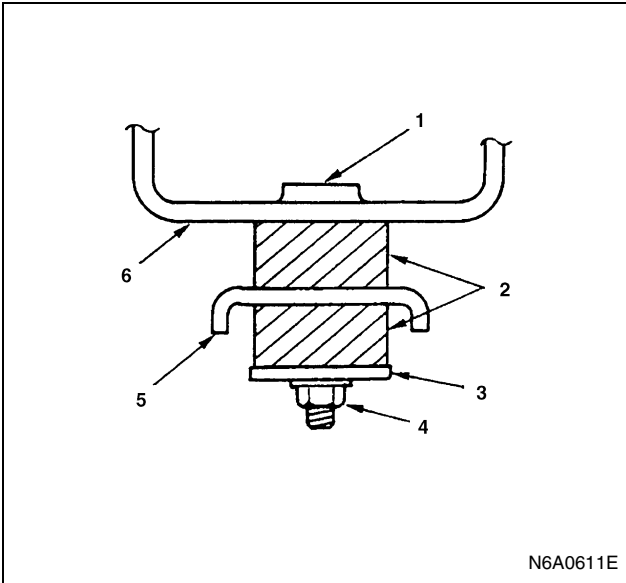


N6A0597E

2. Radiator

Tighten:

Radiator bracket bolt to 55 N·m (5.6 kg·m/41 lb·ft)



N6A0611E

Legend

- 1. Stud bolt
- 2. Rubber
- 3. Washer
- 4. Flange nut
- 5. Flame side bracket
- 6. Radiator side bracket

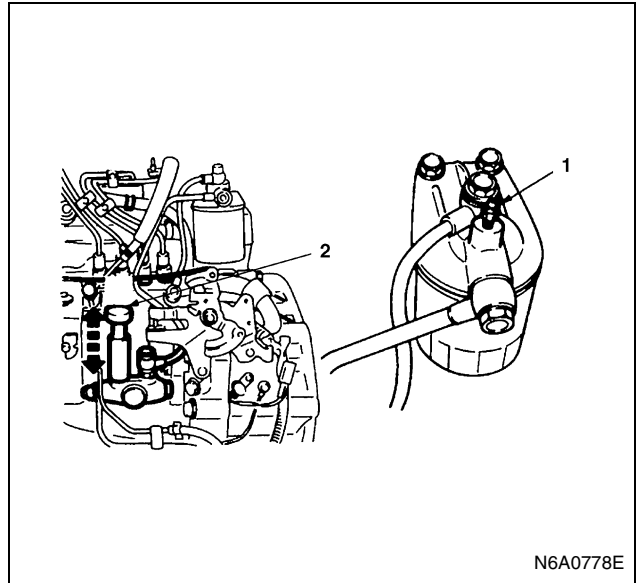
- 3. Fan Guide
- 4. Radiator Lower Hose
- 5. Coolant Reserve Tank Hose/Bypass Hose
- 6. Radiator Upper Hose

Engine Left Side

- 1. Fuel Feed Hose
- 2. Fuel Return Hose

Air Bleeding

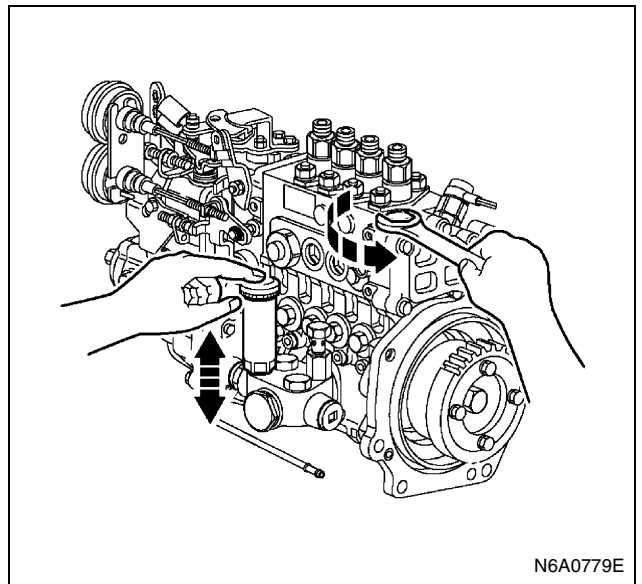
- 1) Loosen the priming pump cap (2) at the side of the injection pump.
- 2) Loosen the bleeder valve (1) (4HF1) at the top of the fuel filter.



N6A0778E

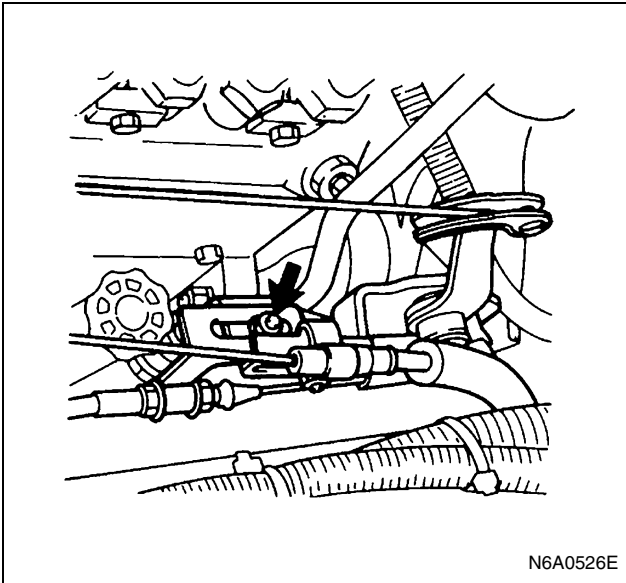
- 3) Operate the priming pump to bleed the air from the injection pump.
- 4) Retighten the bleeder valve.
- 5) Operate the priming pump. Check for fuel leakage from around the injection pump and the fuel filter.
- 6) Lock the priming pump cap to the injection pump.

For 4HE1-TC



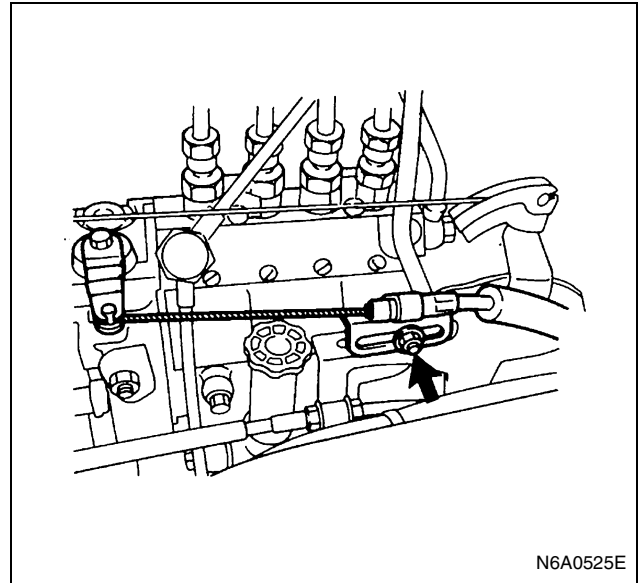
N6A0779E

- 3. Accelerator Control Cable
 - 1) Check to see if the idling control knob is turned to the extreme left.
 - 2) Attach the end tip of the cable to the engine control lever.
 - 3) Pull the outer cable toward the front of the vehicle, and provide the engine control wire and the inner cable with an appropriate play before fastening the clamp with a nut.



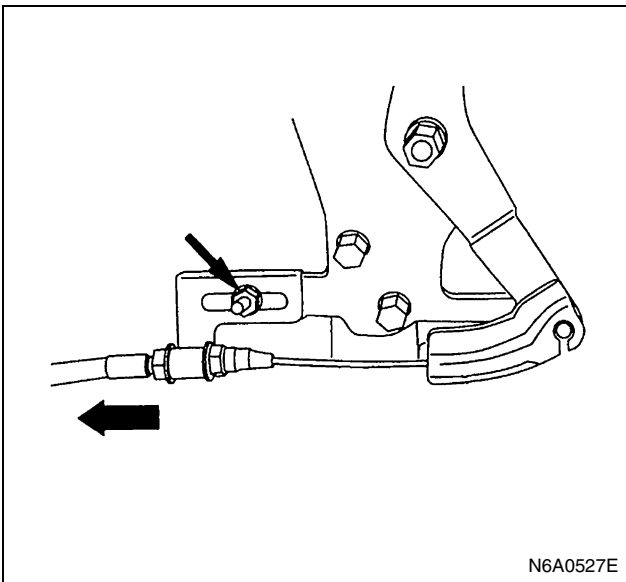
N6A0526E

For 4HE1-TC

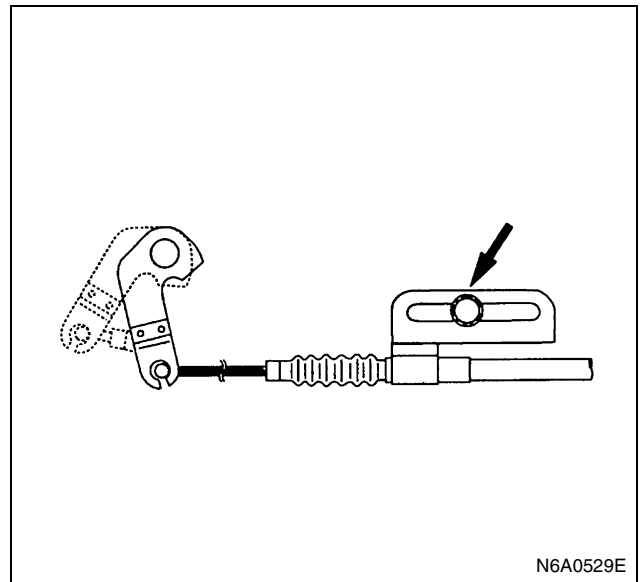


N6A0525E

For 4HE1-TC



N6A0527E



N6A0529E

4) Check to see if the control lever of the injection pump is at the idle position (with the lever in touch with the stopper bolt).

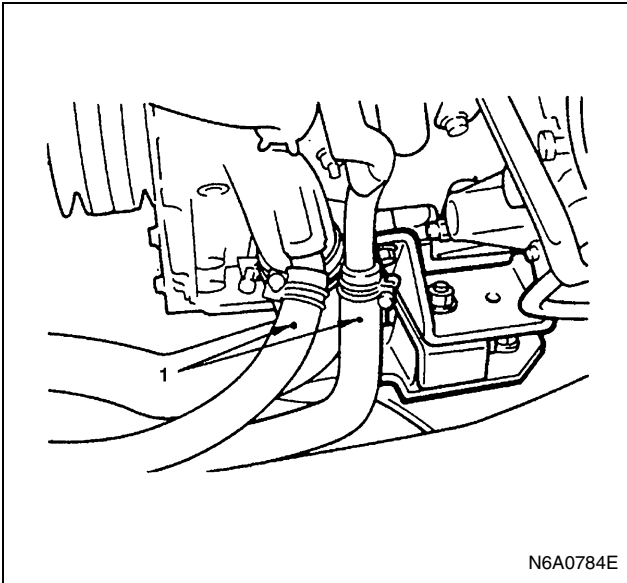
4. Engine Stop Cable

- 1) Attach the end tip of the cable to the engine stopper lever.
- 2) Pull the cable toward the rear side of the vehicle, and fasten the clamp with a nut at the position where the lever stops.

5. Vacuum Hose

6. Heater Hose

Install the hose with its mark (1) turned up.



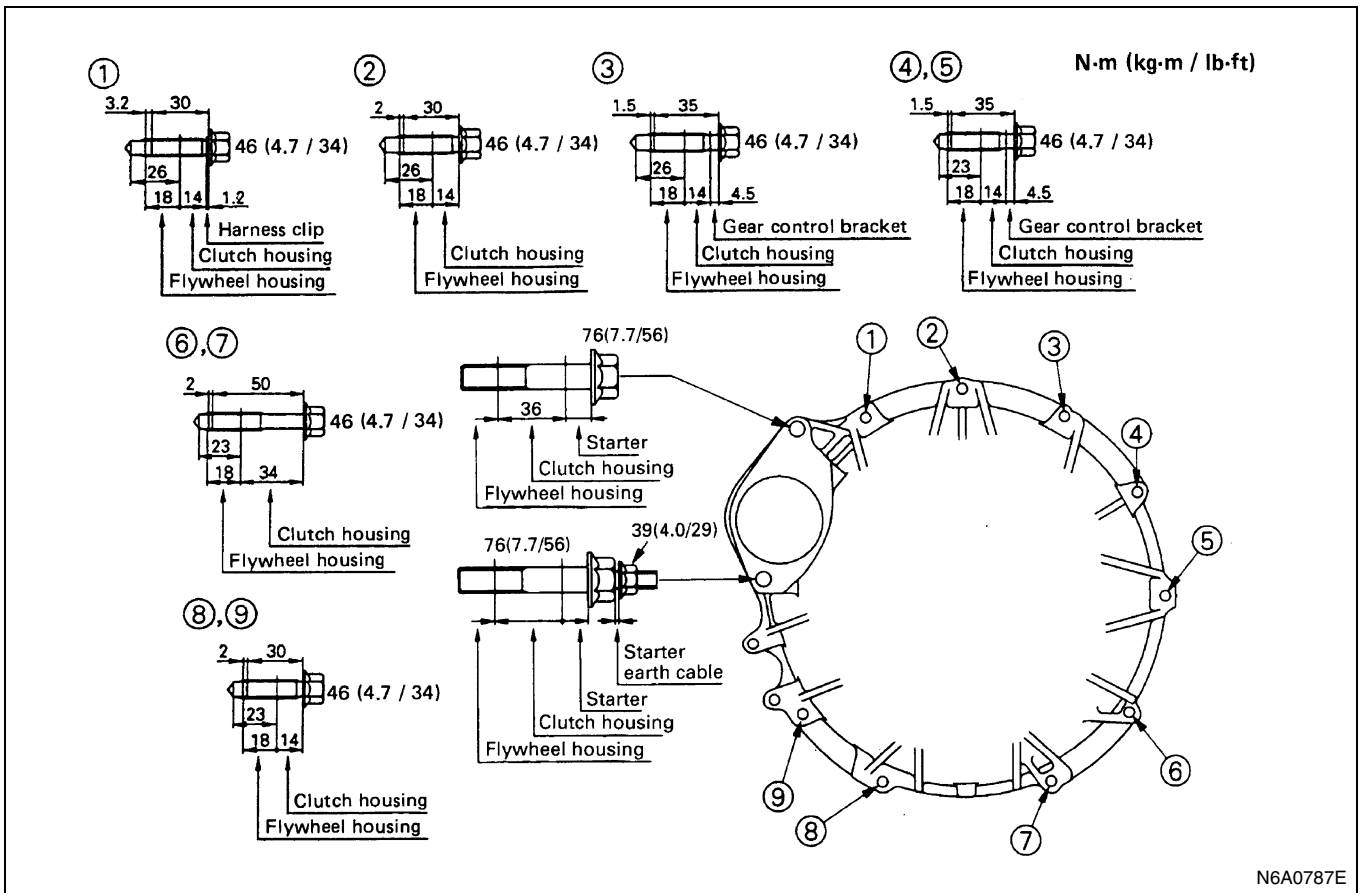
7. Intake Air Duct

Transmission Side

1. Transmission Assembly

Fasten the transmission to the transmission jack with a chain in the same manner as when dismounting it, and tighten the clutch housing clamping bolt to the specified torque.

(Refer to the illustration below.)



2. Transmission Mounting Nut

Tighten:

Transmission mounting nut to 40 N·m (4.1 kg·m/30 lb·ft)

3. Starter

4. Starter Earth Cable

Refer to the preceding page.

5. Clutch Slave Cylinder

1) Install the clutch slave cylinder.

Tighten:

Slave cylinder bolts to 16 N·m (1.6 kg·m/12 lb·ft)

2) Install the clutch return spring to the clutch shift fork.

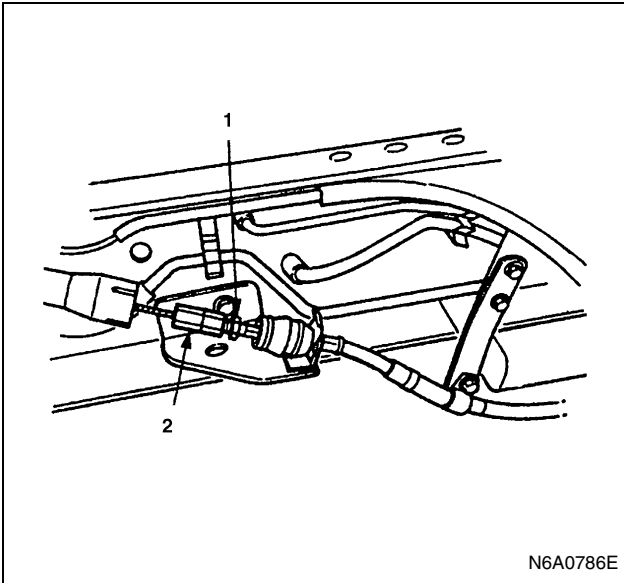
6. Select Cable

7. Shift Cable

8. Parking Brake Cable

1) With the lock nut (1) of the parking brake side cable tightened to the limit, rotate the nut (2) to connect it with the front side cable.

2) After tightening the front side nut (2) to the limit, fasten the parking brake cable with the lock nut (1).



- 3) Pull the parking brake lever to the limit (with the operating force of about 147 N (15 kg/33 lb) at the hand), adjust the lever with the lever adjusting nut so that the number of notches becomes 6 to 8 notches.

9. Harness Connector
10. Back-up Lamp Connector
11. Neutral Switch Connector
12. Car Speed Sensor Connector
13. Propeller Shaft Assembly

Tighten:

Propeller shaft bolt to 103 N·m (10.5 kg·m/76 lb·ft)

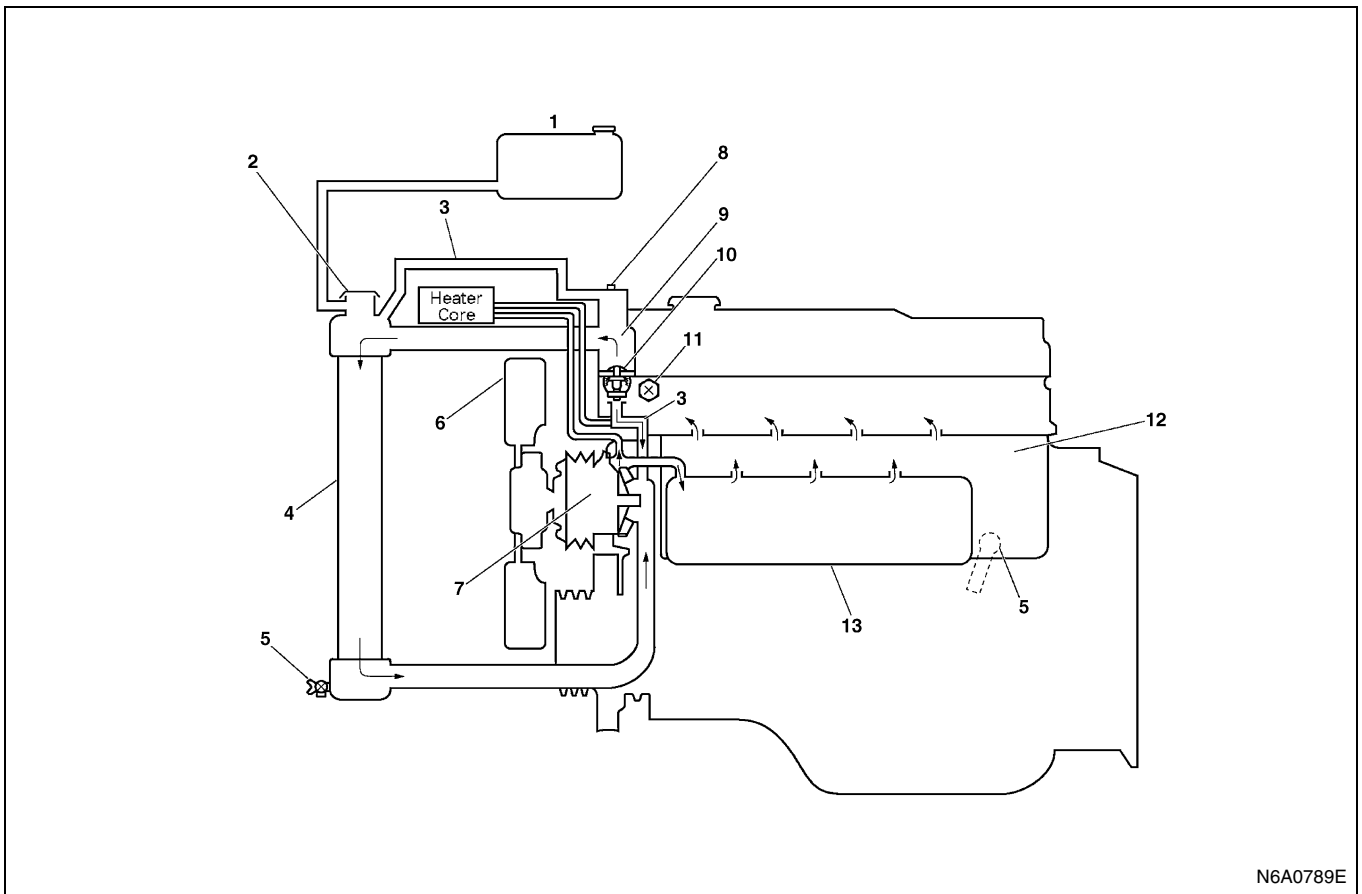
Engine Warm-Up

After completing the required maintenance procedures, start the engine and allow it to warm up. Then check the following:

- 1) Engine idling speed
Refer to "Servicing" for the idling speed adjustment procedure.
- 2) Engine noise level
- 3) Engine oil, coolant and fuel leakage
- 4) Engine control cable operation
- 5) Clutch engagement
- 6) Indicator warning light operation

ENGINE COOLING

GENERAL DESCRIPTION



N6A0789E

Legend

- | | |
|-------------------|----------------------|
| 1. Reservoir tank | 8. Air bleeding |
| 2. Radiator cap | 9. Water outlet pipe |
| 3. Bypass hose | 10. Thermostat |
| 4. Radiator | 11. Thermometer unit |
| 5. Drain cock | 12. Water jacket |
| 6. Cooling fan | 13. Oil cooler |
| 7. Water pump | |

The engine cooling system consists of the radiator, the water pump, the cooling fan, and the thermostats.

To quickly increase cold engine coolant temperature for smooth engine operation, the coolant is circulated by the water pump and thermostats through the by-pass hose and back to the cylinder body. The coolant does not circulate through the radiator.

When the coolant temperature reaches 82°C (180°F), the thermostat will begin to open and a gradually increasing amount of coolant will circulate through the radiator.

The thermostats will be fully open when the coolant temperature reaches 100°C (212°F). All of the coolant is now circulating through the radiator for effective engine cooling.

Engine coolant change procedure.

1. To change engine coolant, make sure that the engine is cool.

WARNING:

WHEN THE COOLANT IS HEATED TO A HIGH TEMPERATURE, BE SURE NOT TO LOOSEN OR REMOVE THE RADIATOR CAP. OTHERWISE YOU MIGHT GET SCALDED BY HOT VAPOR OR BOILING WATER. TO OPEN THE RADIATOR CAP, PUT A PIECE OF THICK CLOTH ON THE CAP AND LOOSEN THE CAP SLOWLY TO REDUCE THE PRESSURE WHEN THE COOLANT HAS BECOME COOLER.

2. Open radiator cap and drain the cooling system by loosening the drain valve on the radiator and on the cylinder body.

Notice:

For best result it is suggested that the engine cooling system be flushed at least once a year.

It is advisable to flash the interior of the cooling system including the radiator before using anti-freeze (ethylene-glycol based).

Replace damaged rubber hoses as the engine anti-freeze coolant is liable to leak out even minor cracks.

Isuzu recommends to use Isuzu genuine anti-freeze (ethylene-glycol based) or equivalent, for the cooling system and not add any inhibitors or additives.

Caution:

A failure to correctly fill the engine cooling system in changing or topping up coolant may sometimes cause the coolant to overflow from the filler neck even before the engine and radiator are completely full.

If the engine runs under this condition, shortage of coolant may possibly result in engine overheating. To avoid such trouble, the following precautions should be taken in filling the system.

3. To refill engine coolant, pour coolant up to filler neck using a filling hose which is smaller in outside diameter of the filler neck. Otherwise air between the filler neck and the filling hose will block entry, preventing the system from completely filling up.
4. Keep a filling rate of 9 liter/min or less. Filling over this maximum rate may force air inside the engine and radiator.
And also, the coolant overflow will increase, making it difficult to determine, whether or not the system is completely full.
5. After filling the system to the full, pull out the filling hose and check to see if air trapped in the system is dislodged and the coolant level goes down. Should the coolant level go down, repeat topping-up until there is no more drop in the coolant level.
6. After directly filling the radiator, fill the reservoir to the maximum level.
7. Install and tighten radiator cap and start the engine. After idling for 2 to 3 minutes, stop the engine and reopen radiator cap. If the water level is lower, replenish.

WARNING:

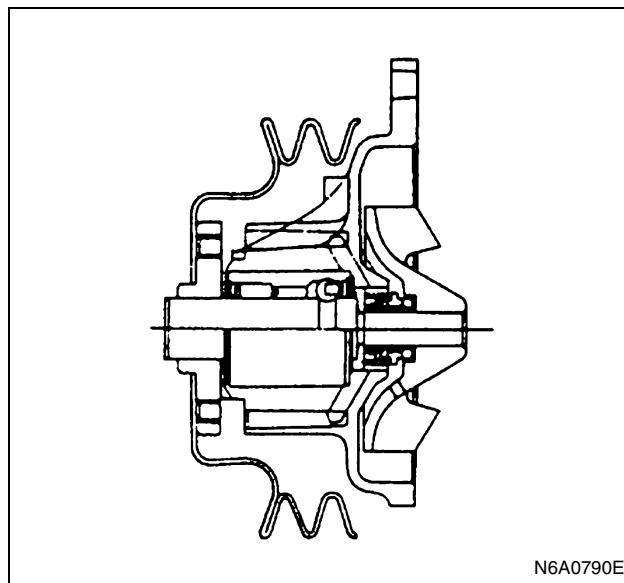
WHEN THE COOLANT IS HEATED TO A HIGH TEMPERATURE, BE SURE NOT TO LOOSEN OR REMOVE THE RADIATOR CAP. OTHERWISE YOU MIGHT GET SCALDED BY HOT VAPOR OR BOILING WATER. TO OPEN THE RADIATOR CAP, PUT A PIECE OF THICK CLOTH ON THE CAP AND LOOSEN THE CAP SLOWLY TO REDUCE THE PRESSURE WHEN THE COOLANT HAS BECOME COOLER.

8. After tightening radiator cap, warm up the engine at about 2,000 rpm.
Set heater adjustment to the highest temperature position, and let the coolant circulate also into heater water system.
9. Check to see the thermostat has opened through the needle position of water thermometer, conduct a 5-minute idling again and stop the engine.

10. When the engine has been cooled, check filler neck for water level and replenish if required. Should extreme shortage of coolant is found, check the coolant system and reservoir tank hose for leakage.
11. Fill the coolant into the reservoir tank up to "MAX" line.

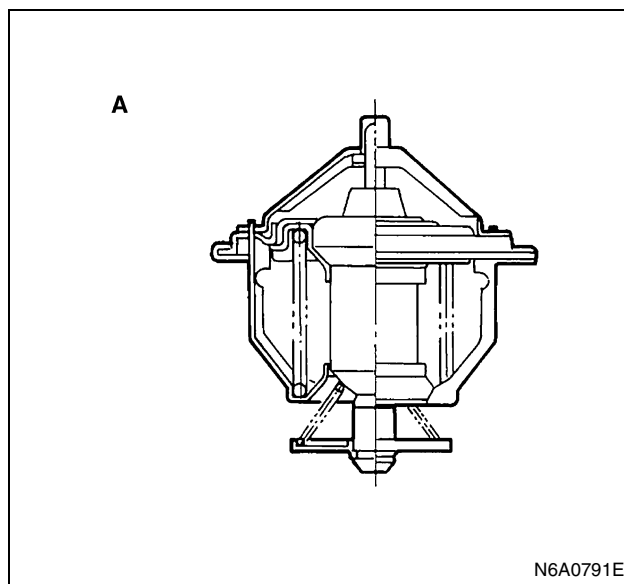
Water Pump

The coolant pump is a centrifugal impeller type and is driven by V type drive belt.



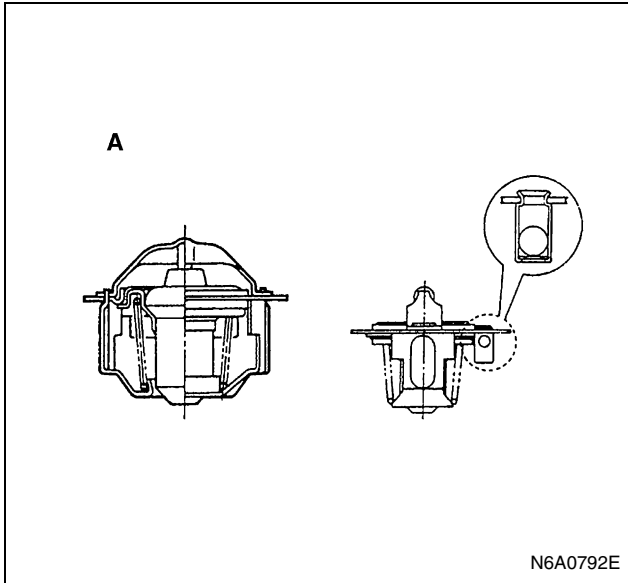
Thermostat

The thermostat is a wax pellet type with a jiggle valve and is installed in the outlet pipe.



Legend

- A. Without jiggle valve

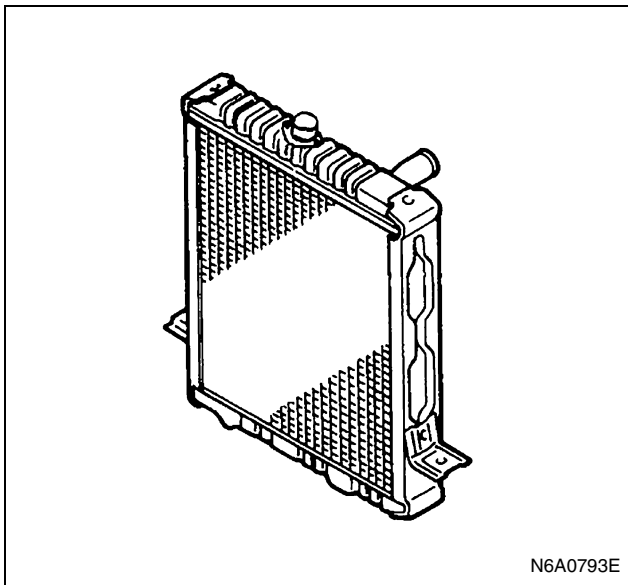


Legend

A. With jiggle valve

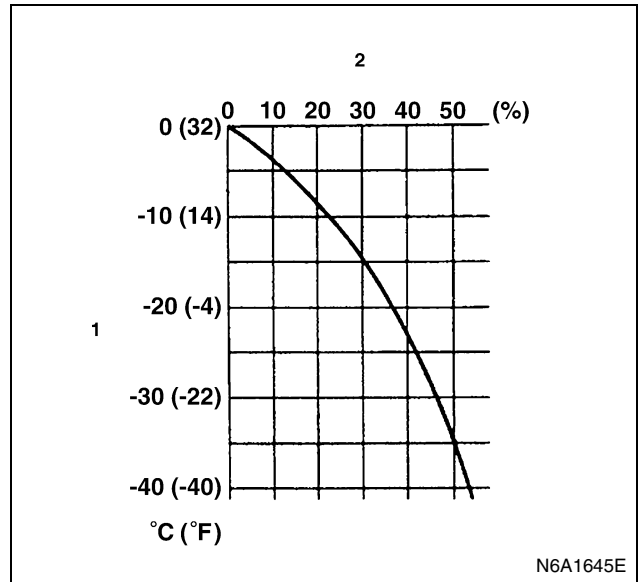
Radiator

The radiator is a tube type with corrugated fins. In order to raise the boiling point of coolant, the radiator is adjusted through a valve fitted to the upper tank to a pressure range of 93 — 123 kPa (0.95 — 1.25 kg/cm²). The cap fitted to the cylinder head thermostat housing has only a water supply function.



Anti-freeze Solution

- Relation between Mixing ratio and Freezing point
Freezing temperature of the engine coolant varies with the ratio of anti-freeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.



Legend

1. Freezing point
2. Mixing ratio

- Calculation of mixing ratio

Mixing ratio

$$= \frac{\text{Anti-freeze solution (Lit/qt.)}}{\text{Anti-freeze solution (Lit/qt.)} + \text{water (Lit/qt.)}}$$

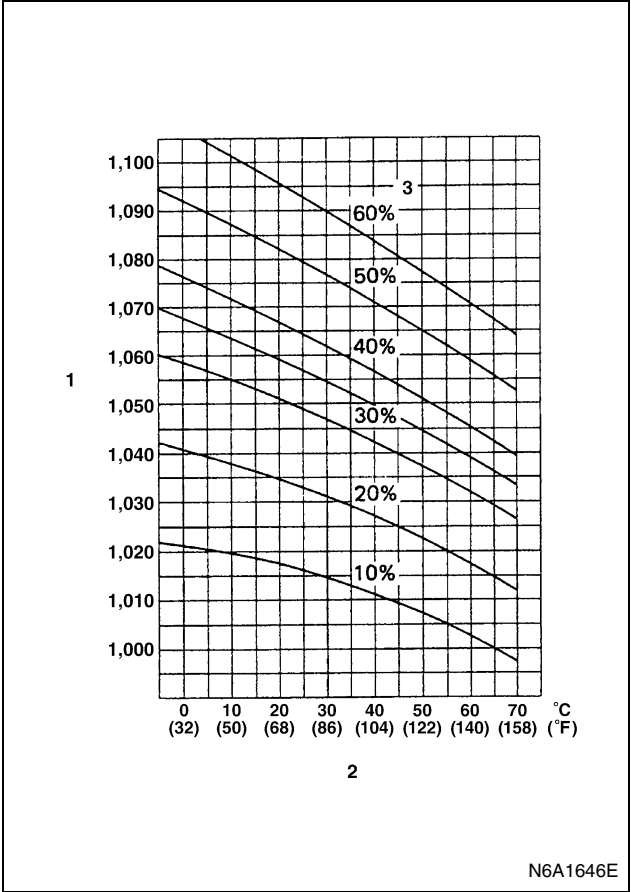
Notice:

Anti-freeze solution + Water = Total cooling system capacity.

In case of 12 lit (3.17 US gal/2.64 UK gal) total cooling system capacity

Freezing point: °C (°F)	Mixing ratio: %	Anti-freeze solution: L (Imp.qt./U.S.qt)	Water: L (Imp.qt./U.S. qt)
-18 (4)	35	4.2 (4.44/3.70)	7.8 (8.24/6.86)
-25 (-13)	42	5.0 (5.29/4.40)	7.0 (7.40/6.16)
-35 (-31)	50	6.0 (6.34/5.28)	6.0 (6.34/5.28)
-40 (-40)	53	6.4 (6.76/5.63)	5.6 (5.92/4.93)

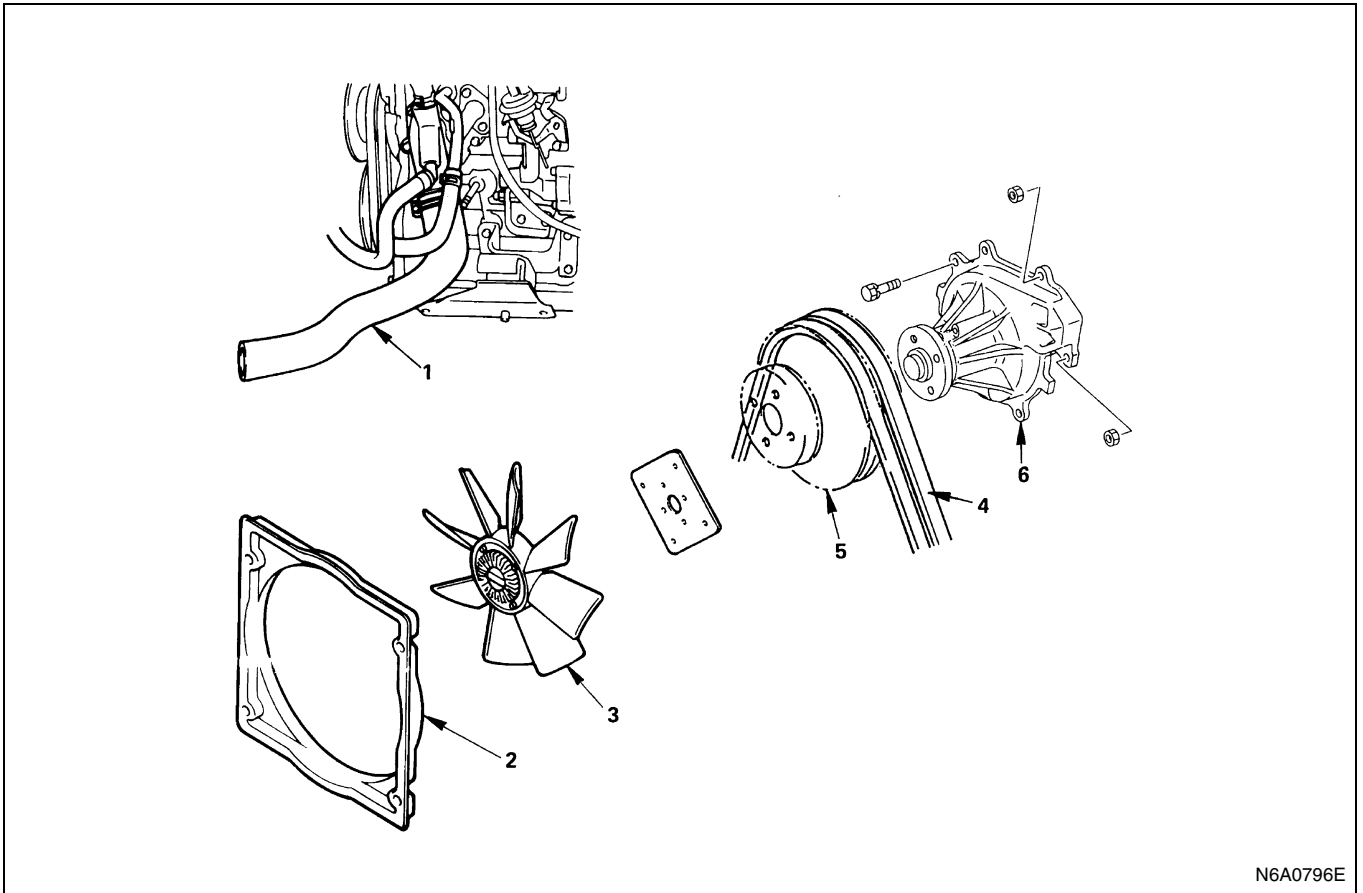
- **Mixing ratio**
Check the specific gravity of engine coolant in the cooling system in temperature ranges from 0 — 50°C (32 — 122°F) using a suction type hydrometer, then determine the mixing ratio of the coolant by referring to the table.



- Legend**
1. Specific gravity
 2. Coolant temperature
 3. Mixing ratio

WATER PUMP

Component



N6A0796E

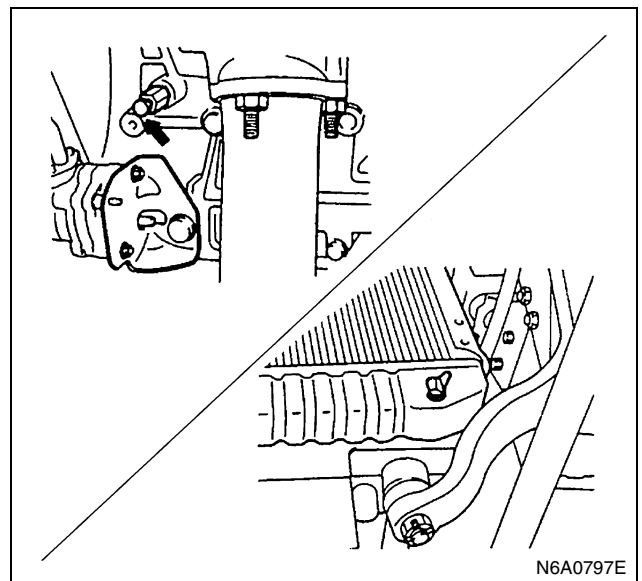
Legend

- | | |
|------------------------|------------------------|
| 1. Radiator lower hose | 4. Fan belt |
| 2. Fan guide | 5. Water pump pulley |
| 3. Fan | 6. Water pump assembly |

Removal

Preparation

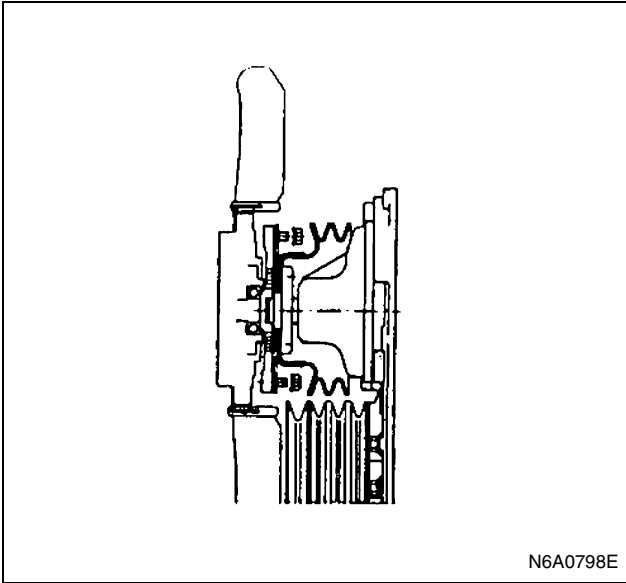
- Disconnect battery ground cable.
- Drain coolant.
- Tilt the cab.



N6A0797E

1. Radiator Lower Hose
Disconnect radiator Lower hose from radiator.

2. Fan Guide
3. Fan



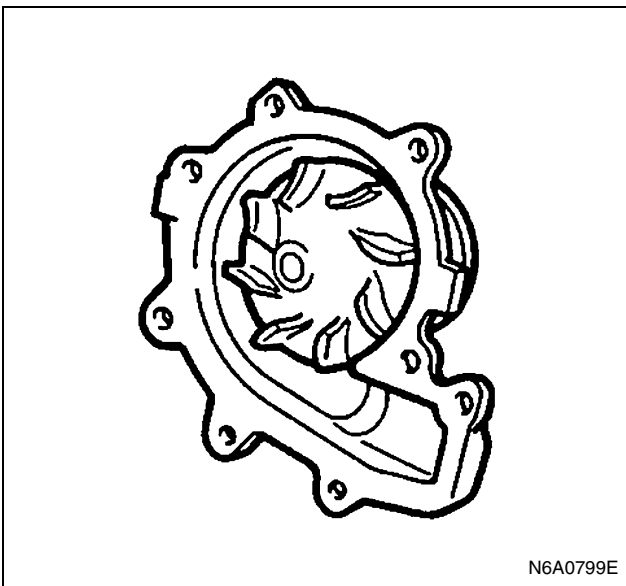
4. Fan Belt
5. Water Pump Pulley
6. Water Pump Assembly

Inspection

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

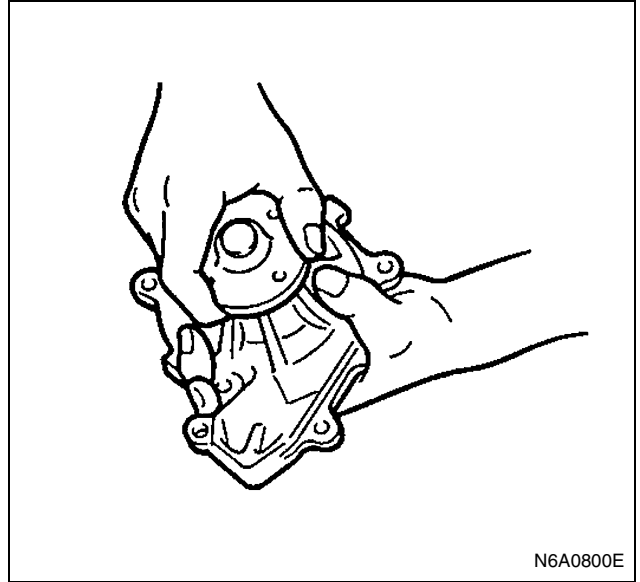
Water Pump Assembly

1. Check the pump body for crack and damage.
2. Check the impeller for crack and corrosion.
3. Check the seal unit leakage.
4. If there is any abnormal condition, replace the water pump as an assembly.



Bearing Unit

1. Rotate the fan center while pushing it toward the radius, and check to see if there is any excessive play or noise.
2. When there is any excessive play or noise found, replace it as a water pump assembly.



Installation

1. Water Pump Assembly
 - 1) Apply 3 — 4 mm (0.12 — 0.16 in) bead of the recommended liquid gasket (Three Bond 1207C) or its equivalent on the water pump fitting surface.
 - 2) Install the water pump to the front retainer.

Tighten:

Water pump bolt to 24 N·m (2.4 kg·m / 17 lb·ft)

- Install the water pump within 7 minutes after application of liquid gasket.
- For the dislocation of liquid gasket, refer to the illustration.

mm (in)

Judgment	OK	OK	NG
Application condition	$3 - 4$ $(0.12 - 0.16)$	More than 1 (0.04)	
Application condition	$1 - 1.5$ $(0.04 - 0.06)$		

1

N6A1625E

Legend

- 1. Liquid gasket

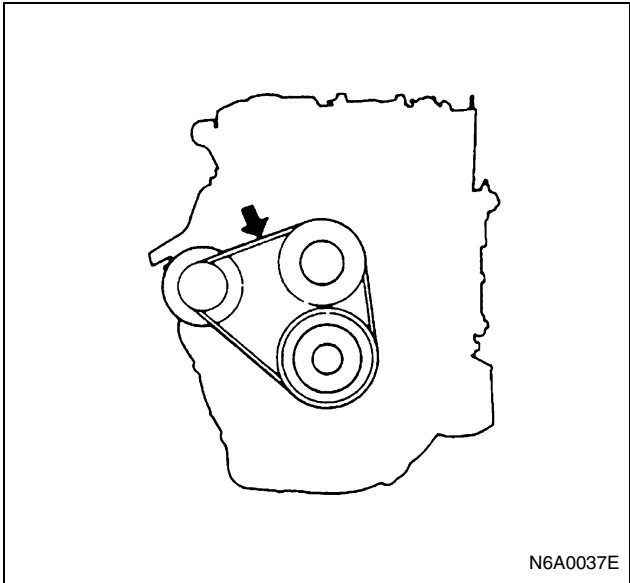
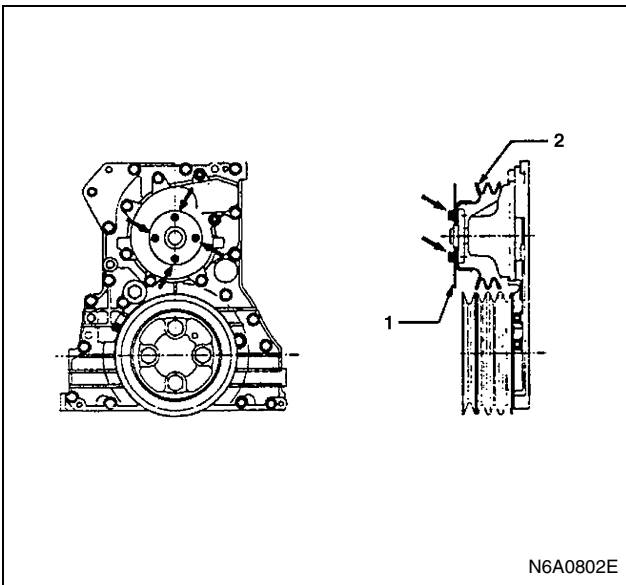
Caution:

The water pump clamping bolt is also used to tighten the front retainer. So, install the water pump before liquid gasket gets dry immediately after installation of the front retainer.

- 2. Water Pump Pulley

Tighten:

Water pump pulley bolt to 24 N·m (2.4 kg·m / 17 lb·ft)



Fan Belt Adjustment

Fan belt tension is adjusted by moving the generator.

Tighten:

Bolt to

- (1): 40 N·m (4.1 kg·m / 30 lb·ft)
- (2): 24 N·m (2.4 kg·m / 17 lb·ft)
- (3): 46 N·m (4.7 kg·m / 34 lb·ft)

Legend

- 1. Set plate
- 2. Pulley

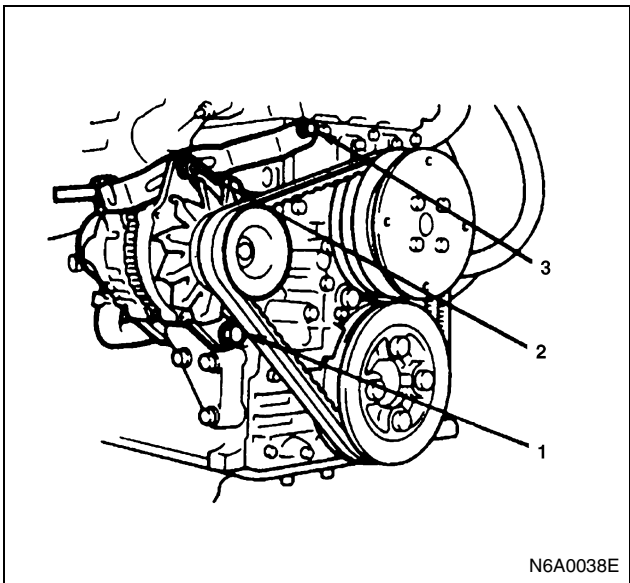
3. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg / 22 lb) force.

Drive Belt Deflection	mm (in)
New belt	8 — 12 (0.31 — 0.47)
Reuse belt	10 — 14 (0.39 — 0.55)

Check the drive belt for cranking and other damage.



- 4. Fan

Tighten:

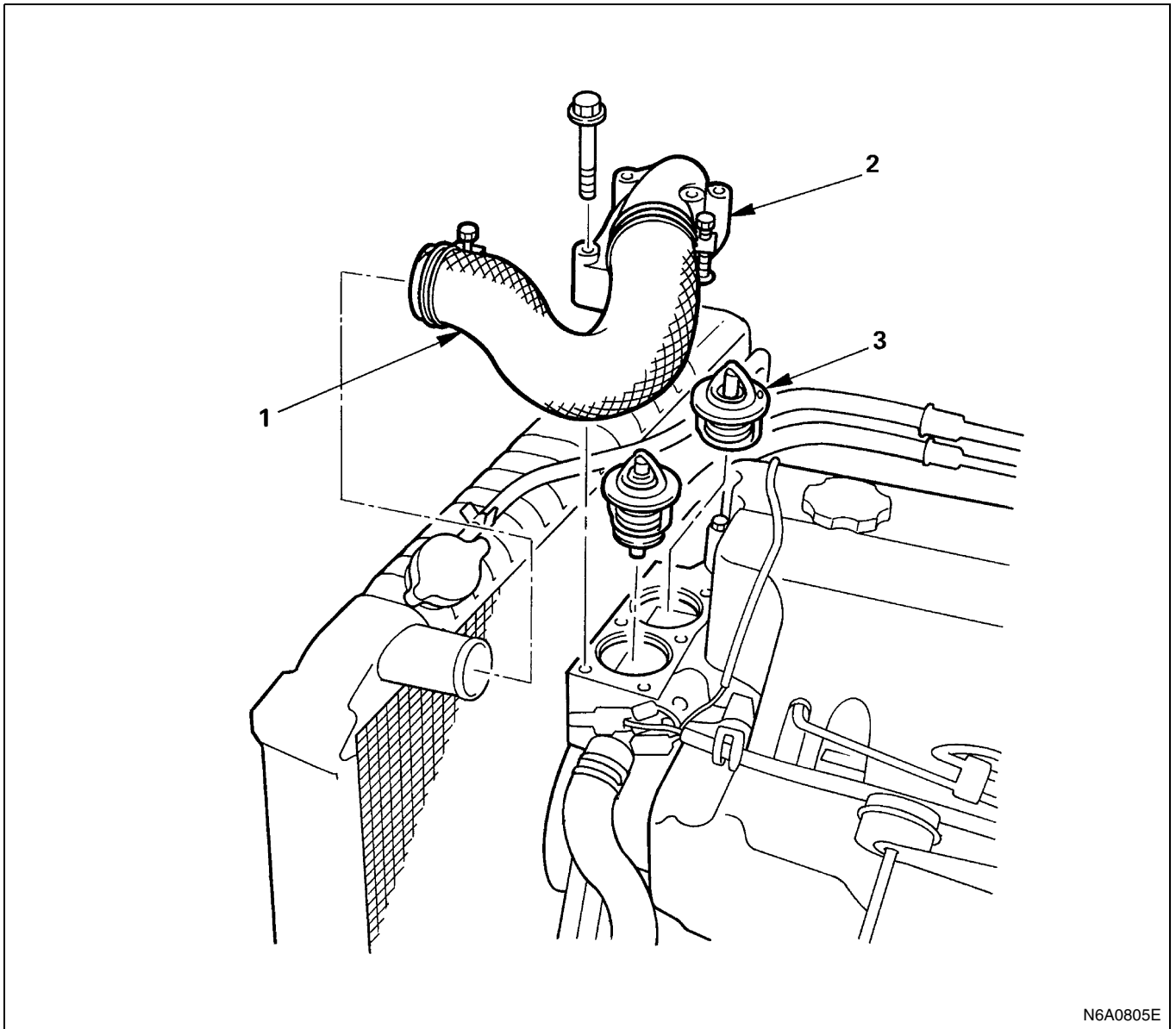
Fan bolt to 24 N·m (2.4 kg·m / 17 lb·ft)

- 5. Fan Guide
- 6. Radiator Lower Hose

- Pour coolant into radiator.
- Connect battery ground cable.
- Start engine and check for water leakage carefully.

THERMOSTAT

Component



N6A0805E

Legend

- | | |
|------------------------|---------------|
| 1. Radiator upper hose | 3. Thermostat |
| 2. Water outlet pipe | |

Removal

Preparation

- Disconnect battery ground cable
 - Drain coolant
1. Radiator Upper Hose
Disconnect radiator upper hose from radiator.
 2. Water Outlet Pipe
Remove mounting bolt and remove outlet pipe together with radiator upper hose.
 3. Thermostat

Inspection

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

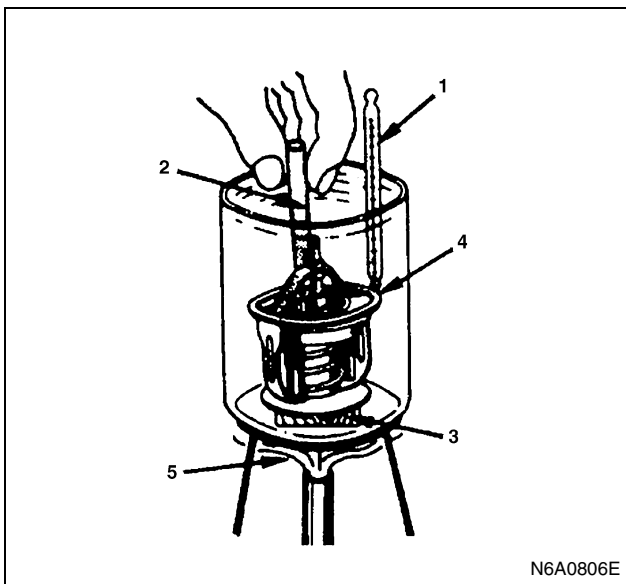
Operating Test

1. Completely submerge the thermostat in water.
2. Heat the water.
Stir the water constantly to avoid direct heat being applied to the thermostat.
3. Check the valve initial opening temperature.

Valve Initial Opening Temperature		°C (°F)
		Standard
without jiggle valve	Primary valve	80 — 84 (176 — 183)
	Secondary valve	83 — 87 (181 — 189)
with jiggle valve		83.5 — 86.5 (182 — 188)

4. Check the valve lift full opening temperature.

Valve Lift Full Opening Temperature		°C (°F)
		Standard
without jiggle valve		95 (203)
with jiggle valve		100 (212)



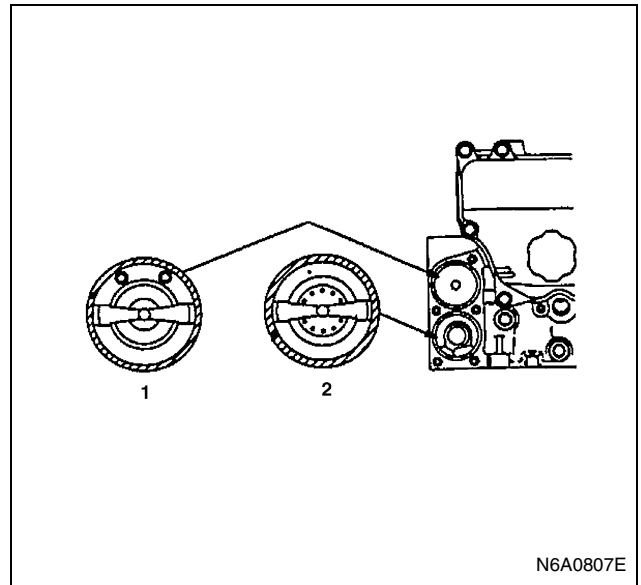
N6A0806E

Legend

- 1. Thermometer
- 2. Agitating rod
- 3. Wooden piece
- 4. Thermostat
- 5. Heat

Installation

1. Thermostat
Install the gaskets to the thermostats and the thermostats to the cylinder head as shown in the illustration.



N6A0807E

Legend

- 1. With jiggle valve
- 2. Without jiggle valve

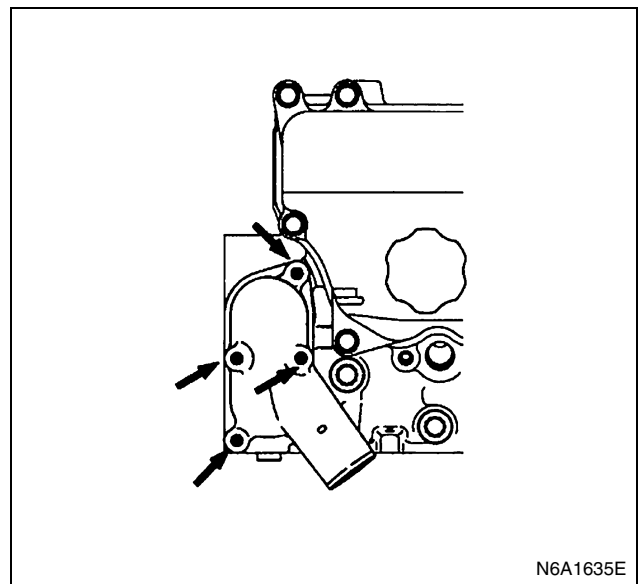
2. Water Outlet Pipe

Install the water outlet pipe with thermostat to the cylinder head.

Tighten the water outlet pipe bolts to the specified torque.

Tighten:

Water outlet pipe bolt to 24 N·m (2.4 kg·m / 17 lb·ft)



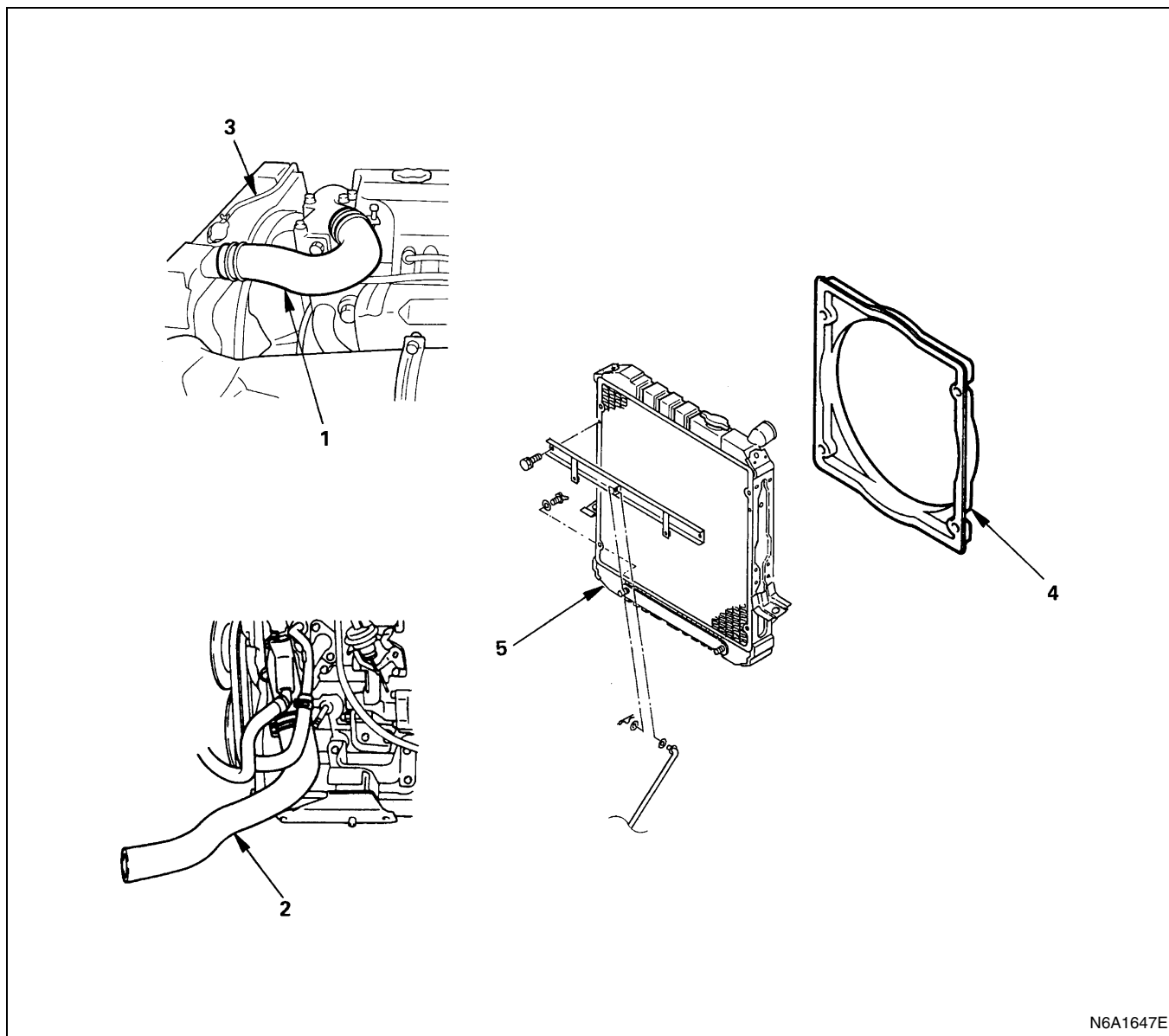
N6A1635E

3. Radiator Upper

- Connect battery ground cable.
- Pour coolant
- Start the engine and check coolant leakage.

RADIATOR

Component

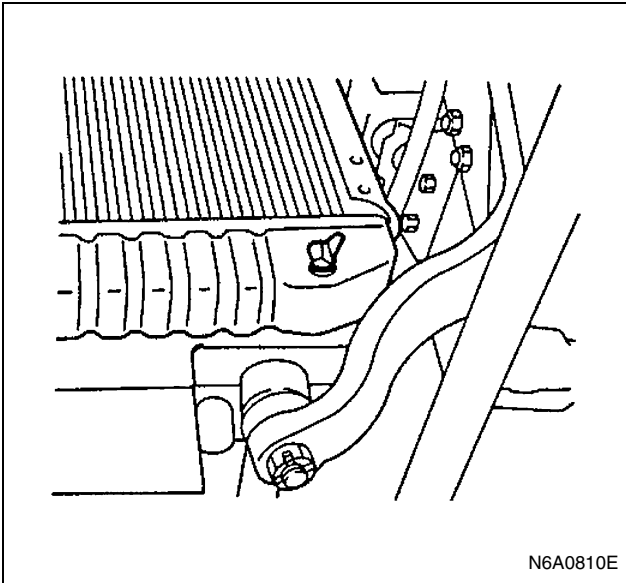


Legend

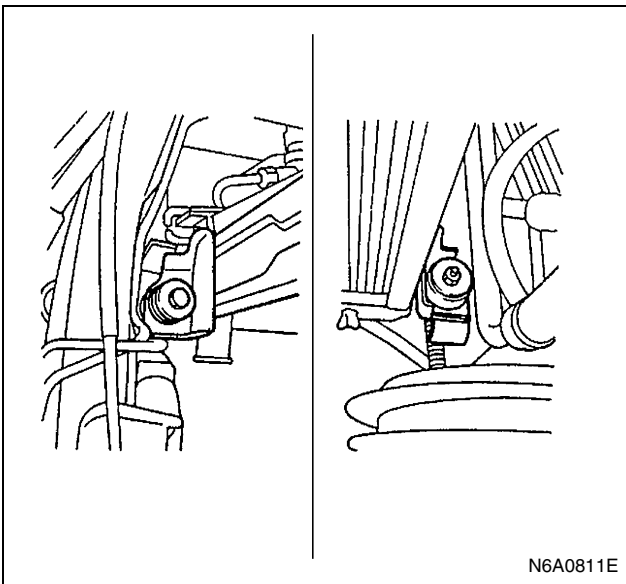
- | | |
|------------------------------|--------------|
| 1. Radiator upper hose | 4. Fan guide |
| 2. Radiator lower hose | 5. Radiator |
| 3. Coolant reserve tank hose | |

Removal

- Disconnect battery ground cable.
- Tilt the cab.
- Loosen drain plug to drain coolant.



1. Radiator Upper Hose
2. Radiator Lower Hose
Disconnect upper hose and lower hose from the radiator.
3. Coolant Reserve Tank Hose
4. Fan Guide
5. Radiator
 - 1) Remove upward the radiator assembly with hose, taking care not to damage the radiator core by fan blade.



Inspection

Radiator Valve Check

1. Apply air pressure from filler neck using radiator cap tester and check the opening pressure of radiator valve. If the valve opening pressure is out of the standard value range, replace with a new radiator valve.

Radiator Valve Opening Pressure	kPa (kg/cm ² /psi)
93 — 123	(0.95 — 1.25/13.5 — 17.8)

2. Remove the radiator valve and check a negative pressure valve as the center of the valve seat side. If the negative pressure valve does not work smoothly, clean or replace the radiator valve.

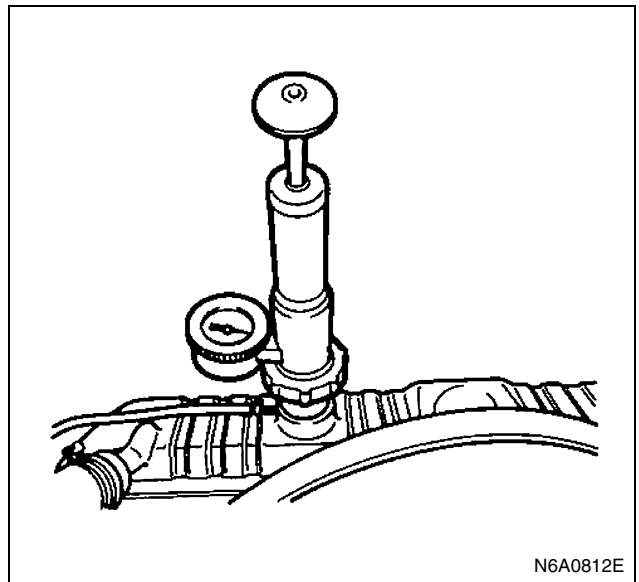
Tighten:

Radiator valve fixing to 6 N·m (0.6 kg·m / 4 lb·ft)

3. Conduct cooling system leakage check after re-installing the radiator valve.

Cooling System Leakage Check

1. Clog up the reservoir tank hose carefully and check the cooling system for leakage with a radiator cap tester by applying an air pressure of 196 kPa (2 kg/cm²/28 psi) from filler neck to inside the radiator.
2. As the radiator upper tank is provided with a valve, the pressure fails to rise higher than the valve opening pressure unless the hose is clogged up.



Radiator Core

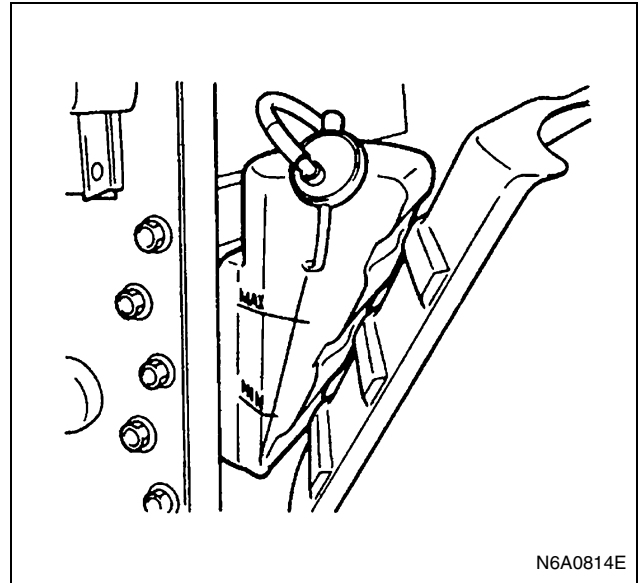
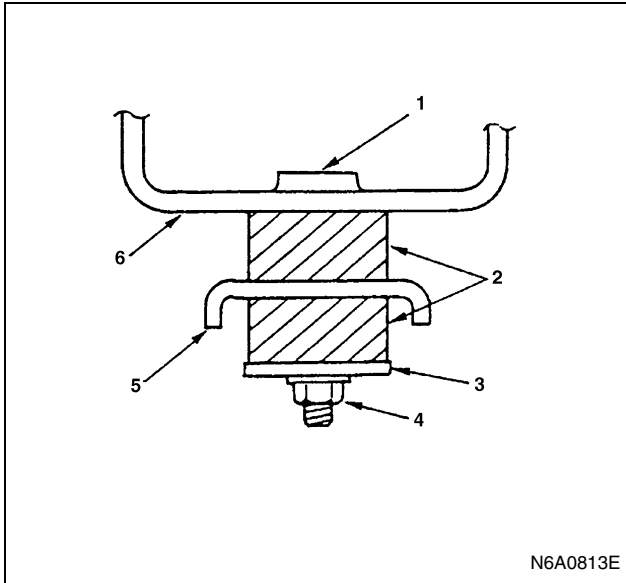
1. Deformed radiator fins could reduce radiation effects, resulting in overheat. Straighten the fins. In such a case, take care not to damage the fin roots.
2. Remove dust and other foreign materials.

Flushing the Radiator

Wash the inside of radiator and the coolant passage with water and neutral detergent. Remove all scales and rust.

Installation

1. Radiator
With due attention paid not to damage the radiator core by the fan blades, install the both brackets of the radiator to the brackets on the frame as shown in the illustration.



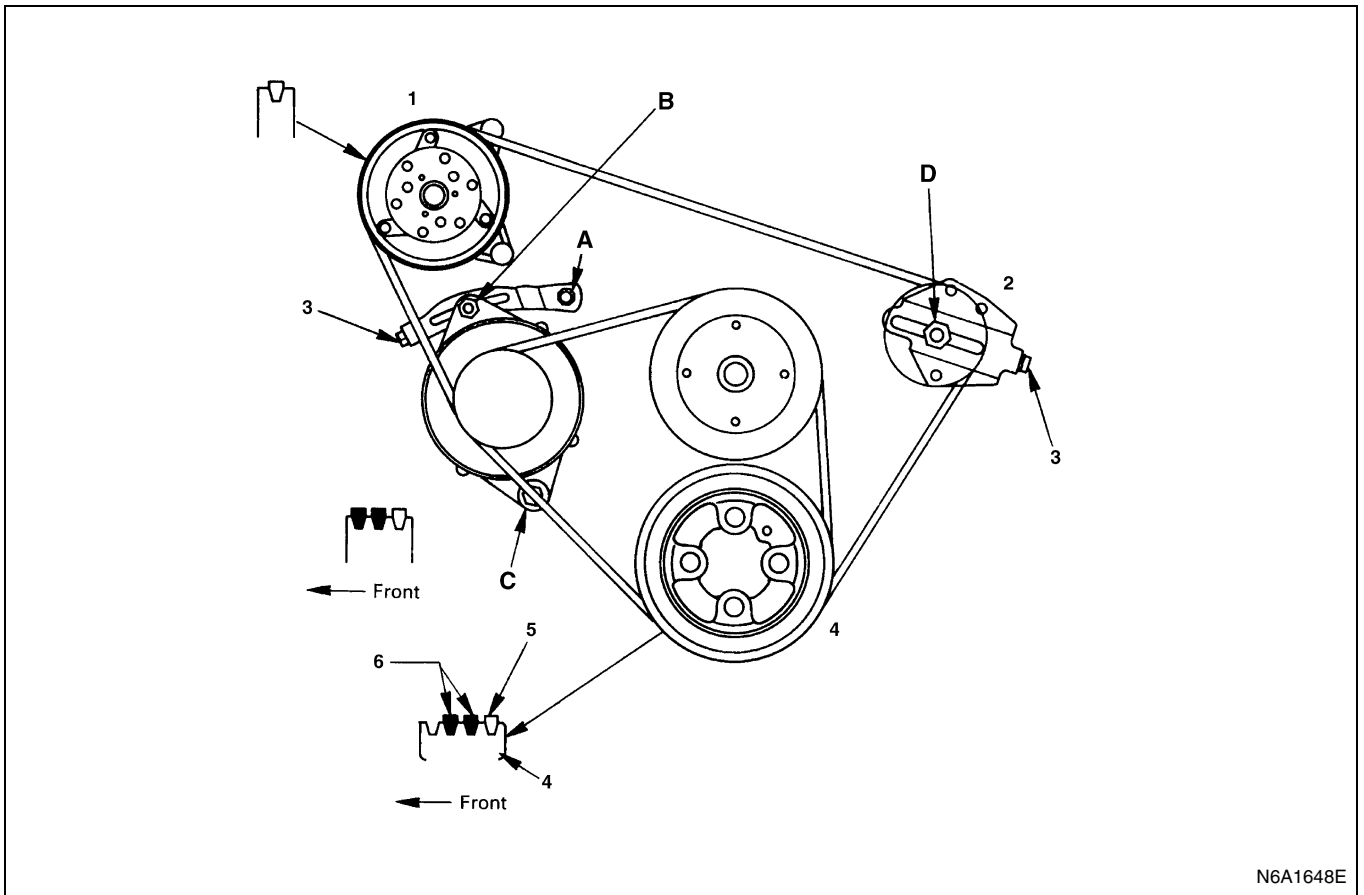
Legend

1. Stud bolt
2. Rubber
3. Washer
4. Flange nut
5. Flame side bracket
6. Radiator side bracket

2. Fan Guide
3. Coolant Reserve Tank Hose
4. Radiator Lower Hose
5. Radiator Upper Hose
 - Connect battery ground cable.
 - Pour coolant
 - Pour coolant up to filler neck of outlet pipe, and up to MAX mark of reserve tank.
 - Start engine to warm up, and check for coolant level.
Replenish coolant if it does not reach the outlet pipe filler neck, and tighten the cap completely.

DRIVE BELT ADJUSTMENT

Component



N6A1648E

Legend

- | | |
|-------------------|--------------------------|
| 1. A/C compressor | 4. Crank pulley |
| 2. Tension pulley | 5. Compressor drive belt |
| 3. Adjust bolt | 6. Generator drive belt |

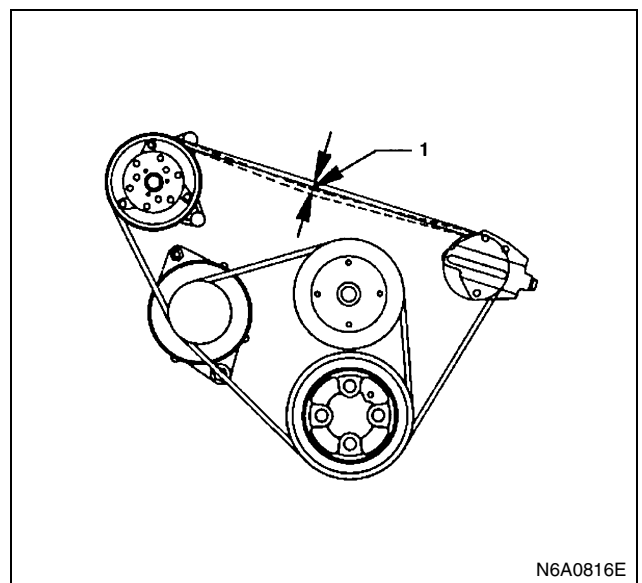
Inspection

Check drive belts for wear or damage, and replace with new ones as necessary. Check belts for tension, and adjust as necessary.

1. Check drive belts tension
2. Push the middle of belts with a force of 98 N (10 kg / 22 lb) and check each belt for deflection.
3. Standard deflection

Fan Drive Belt Deflection		mm (in)
New belt	8 — 12	(0.31 — 0.47)
Reuse belt	10 — 14	(0.39 — 0.55)

A/C Drive Belt Deflection		mm (in)
New belt	16 — 20	(0.63 — 0.79)
Reuse belt	18 — 22	(0.71 — 0.87)



N6A0816E

Legend

1. Belt deflection
-

Tension Adjustment

(Refer to the illustration on the previous page.)

1. Generator & Water Pump Pulley Drive Belt
 - 1) Loosen the Air Conditioning (A/C) drive belt tension pulley adjust bolt and lock nut (D). Then free the A/C drive belt.
 - 2) Loosen the adjust plate lock nut (B), the fixing bolt (A), and the fixing bolts (C) on the lower side of the generator.
 - 3) Rotate the adjust bolt to adjust the belt.
 - 4) After adjustment, tighten each section to the specified torque.

Tighten:

Bolt and nut to

- (A): 46 N·m (4.7 kg·m / 34 lb·ft)
 - (B): 24 N·m (2.4 kg·m / 17 lb·ft)
 - (C): 40 N·m (4.1 kg·m / 30 lb·ft)
- 5) Adjust the A/C drive belt tension.

2. A/C Compressor Drive Belt

- 1) Loosen the tension pulley lock nut (D), and rotate the adjust bolt to adjust the belt.
When finishing the fan drive belt adjustment, then adjust the A/C drive belt.
After adjustment, tighten the lock nut (D) to the specified torque.

Tighten:

Lock nut (D) to 27 N·m (2.8 kg·m / 20 lb·ft).

FUEL SYSTEM

GENERAL DESCRIPTION

Caution

When working on the fuel system, there are several things to keep in mind:

- Any time the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Replace all pipes with the same pipe and fittings that were removed.
- Clean and inspect "O" rings. Replace where required.
- Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.

Description

Fuel Filters

The Purpose of the fuel filters is to clean the fuel of any dirt particles that can cause wear on the fuel injection nozzle's sliding surface; and to separate any water from the fuel, which is ever-present from the condensation in the fuel tank. The pre-fuel filter (water separator) is located between the fuel tank and the injection pump. The secondary fuel filter is located between the fuel pump and the injection pump.

Pre-Fuel Filter

When the condensed water in the pre-fuel filter (water separator) comes to the warning level indicated on its plastic body, drain the fluid immediately from the drain plug located bottom of water separator.

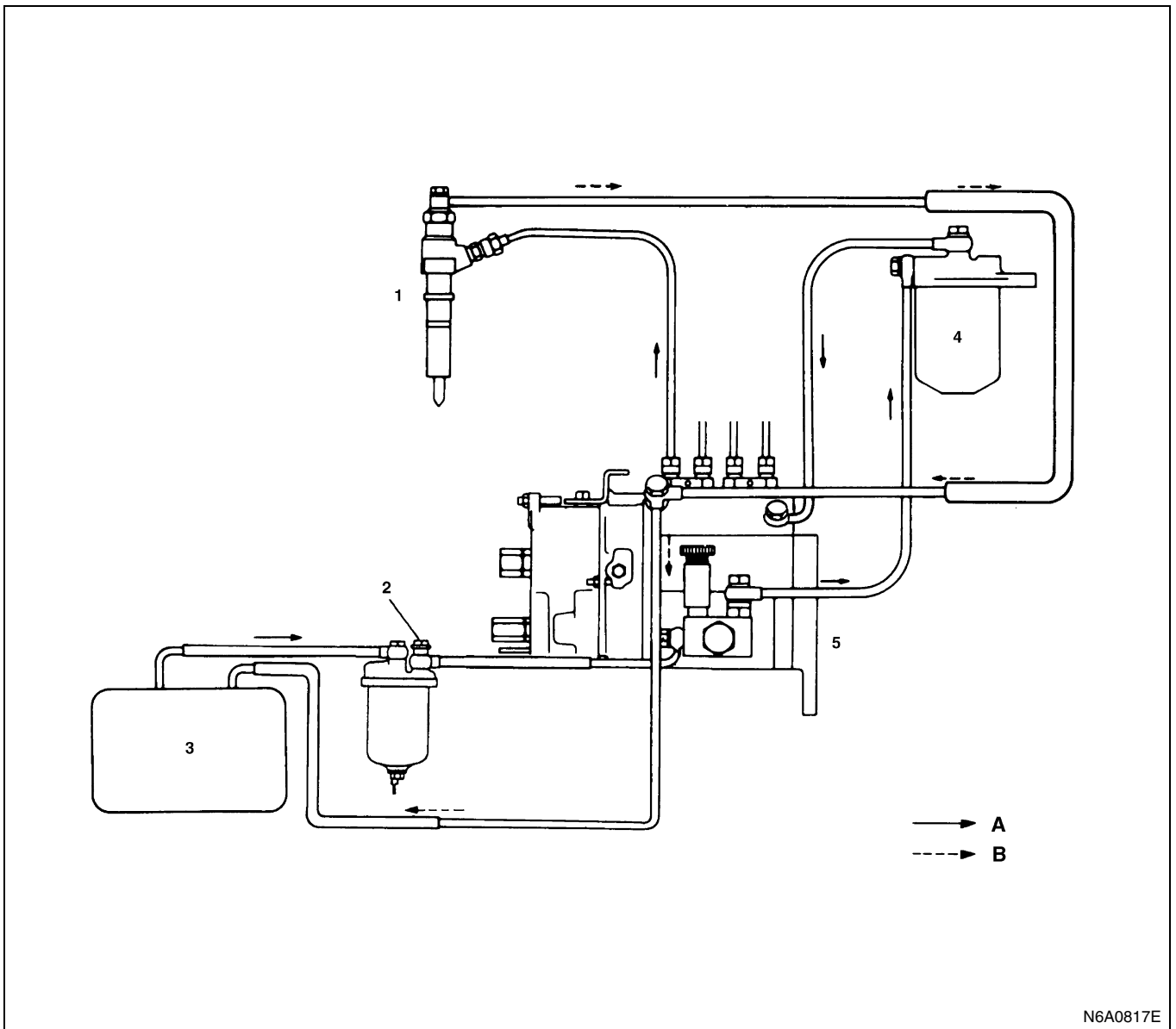
Injection Pump

The fuel injection system includes a fuel tank, fuel hoses and lines, a fuel/water separator, fuel filters, a fuel pump, a Bosch-type in-line fuel injection pump with an internal governor, delivery valves, fuel injection lines and for fuel injection nozzles.

The fuel pump, injection pump and the nozzle are manufactured by Bosch AS corporation, but serviced by Bosch.

Remove the injection pump and governor assembly as a unit to have it serviced. Do not open or break any seals on the pump or the warranty is void. The injection pump has an identification plate attached to the pump body.

Fuel Flow

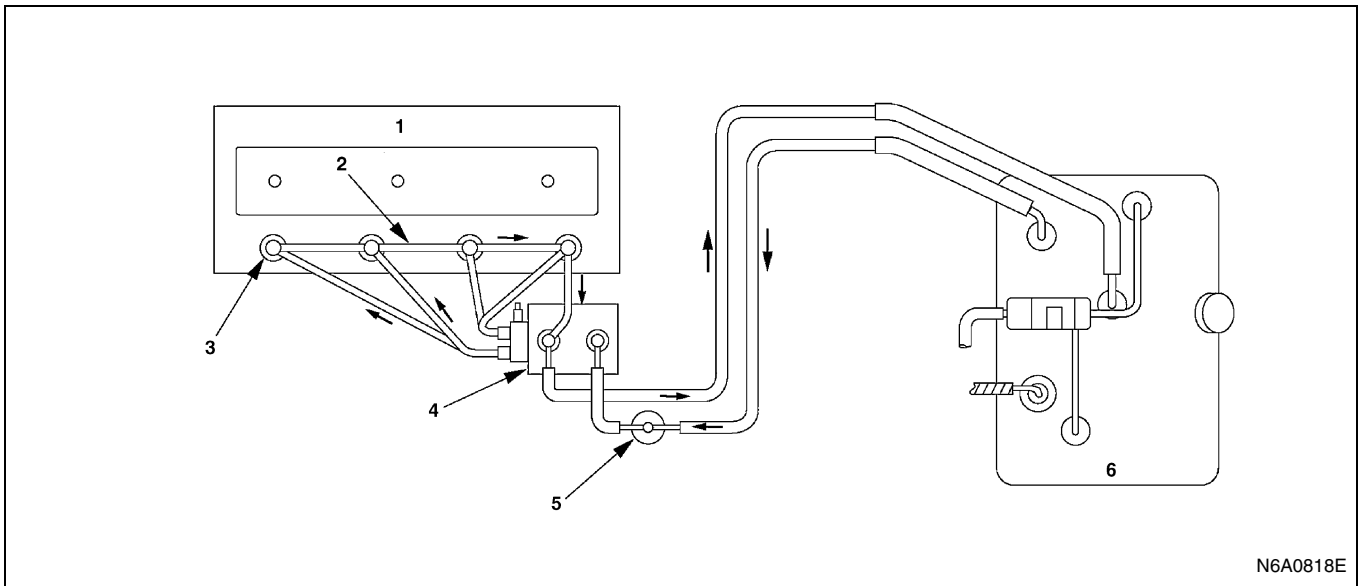


N6A0817E

Legend

- | | |
|--------------------|-------------------|
| A. Feed | 3. Fuel tank |
| B. Return | 4. Fuel filter |
| 1. Nozzle | 5. Injection pump |
| 2. Water separator | |

4HF1-2



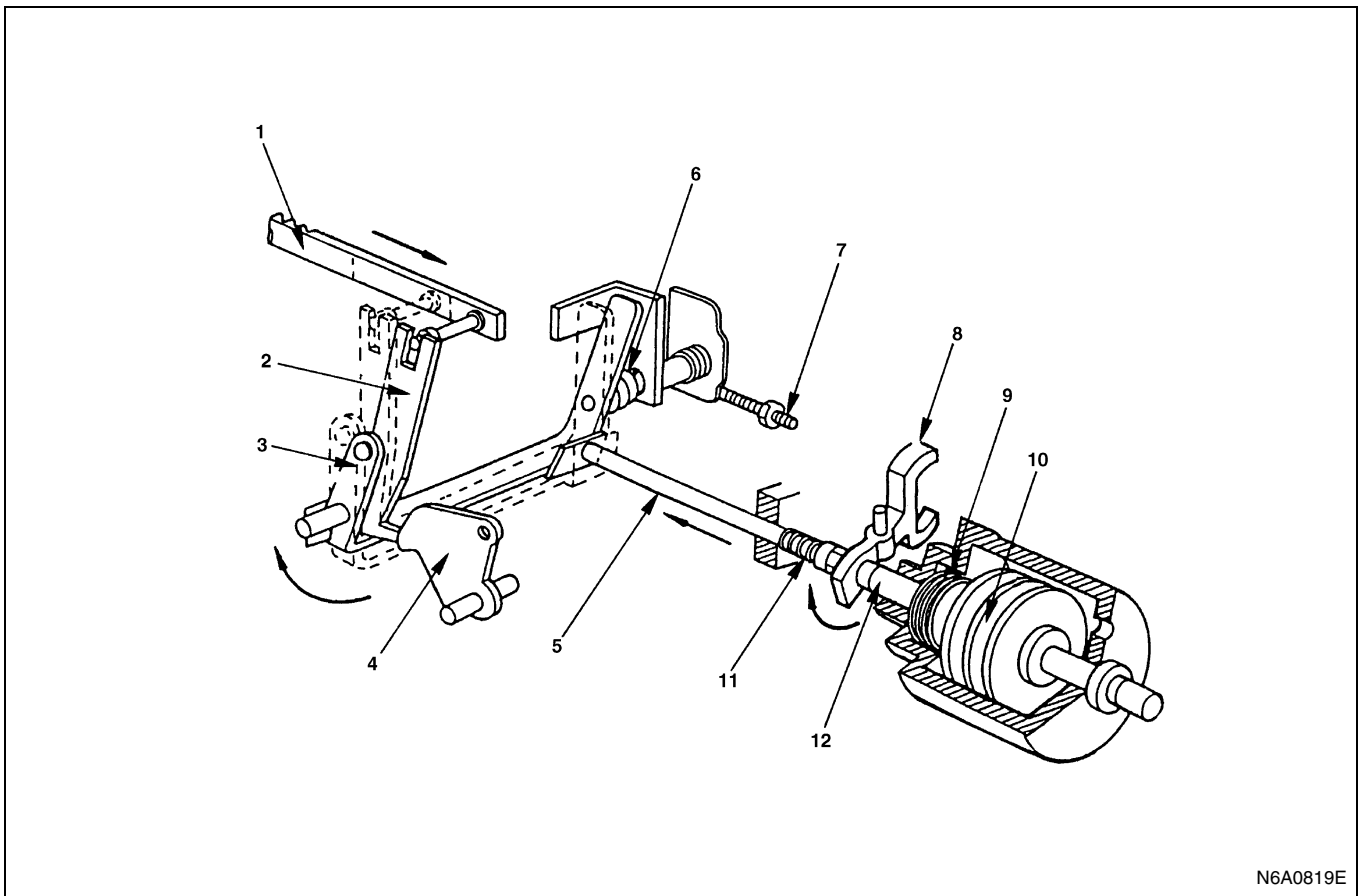
Legend

- | | |
|------------------|-----------------------------|
| 1. Engine | 4. Injection pump |
| 2. Leak off pipe | 5. Fuel filter (sedimeater) |
| 3. Nozzle | 6. Fuel tank |

Aneroid Compensator Function

The bellows in the aneroid compensator is provided with an initial set force by the aneroid compensator spring and is compressed by the push rod C. As the atmospheric pressure drops, the bellows begins to expand against the force of the aneroid compensator spring, which in turn causes the push rod B, through the push rod C and the boost compensator lever F, to move to the left.

Then the push rod B comes into contact with the U-shaped lever and, as the expanding bellows overcome the force of the cancel spring installed on the U-shaped lever, causes the U-shaped lever to turn clockwise. Because the bottom of the sensor lever is in touch with the torque cam, the torque cam then works as a pivot on which the top of the sensor lever moves to the right together with the U-shaped lever. At the same time, the control rack, which is hooked on the sensor lever, moves toward the governor to reduce fuel injection.



N6A0819E

Legend

- | | |
|-------------------|-------------------------------|
| 1. Control rack | 7. Full load set screw |
| 2. Sensor lever | 8. Boost compensator lever |
| 3. U-shaped lever | 9. Aneroid compensator spring |
| 4. Torque cam | 10. Bellows |
| 5. Push rod B | 11. Return spring |
| 6. Cancel spring | 12. Push rod C |

Brief Explanation of Emission and Electrical Control System

MITICS (Mechanically Integrated Timing and Injection Control System)

4HE1-TC

The Mechanically Integrated Timing and Injection rate Control System (MITICS) utilizes mechanical control, in comparison with TICS systems, which utilize electronic control.

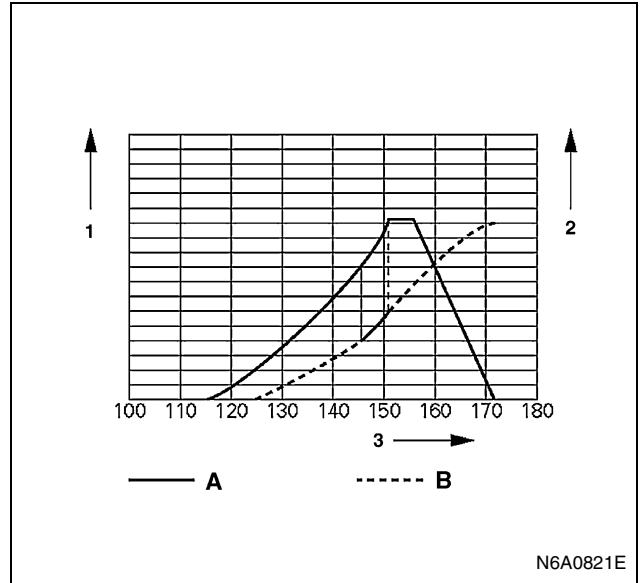
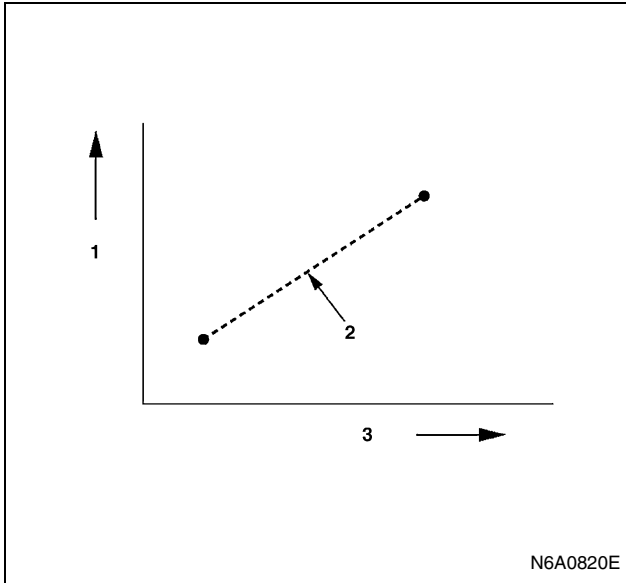
MITICS is equipped with the RLD-M type governor, which contains a pre-stroke control mechanism. With this, pre-stroke position (i.e., beginning of static injection) can be varied to control injection timing and injection rate (i.e., the fuel injection quantity injected from the nozzle per cam angle degree).

This enables high injection rates¹ in the low and medium speed ranges through a short injection interval, thus contributing to higher engine torque and cleaner exhaust.

MITICS was developed in response to the demands of medium sized diesel engines for low cost, low fuel consumption, high output and cleaner emissions.

High injection rates using a short injection interval.

- The speed at which the injection pump plunger rises slows as engine speed decreases and the pressure inside the injection pipe decreases. Because of this, the nozzle spray deteriorates and makes it impossible to obtain the proper fuel - air mixture. To obtain the proper mixture at low and medium speeds, it is necessary to increase the pressure inside the injection pipes using a short injection interval.



Legend

- 1. Injection pipe pressure
- 2. PE-AD type injection pump
- 3. Engine speed

Legend

- A. Plunger speed
- B. Cam lift
- 1. Plunger speed (m/sec)
- 2. Cam lift (mm)
- 3. Cam angle (degrees)

- The following figure shows plunger speed and cam lift in relation to cam angle. It can be seen from the graph that plunger speed increases together with cam lift.

MITICS varies the beginning of injection position at low and medium speeds so that injection occurs when the plunger speed increases during the latter half of cam lift (shown by the bold line). At high speeds, injection is performed when the plunger speed decreases during the first half of cam lift to prevent an excessive increase in injection pipe pressure.

This enables high pressures at low and medium speeds with a fast plunger speed. Thus, a fine fuel oil spray is injected into the cylinder from the nozzles within a short time to provide the proper mixture for combustion, helping to increase torque and keep exhaust emissions clean.

Governor (Model RLD-M)

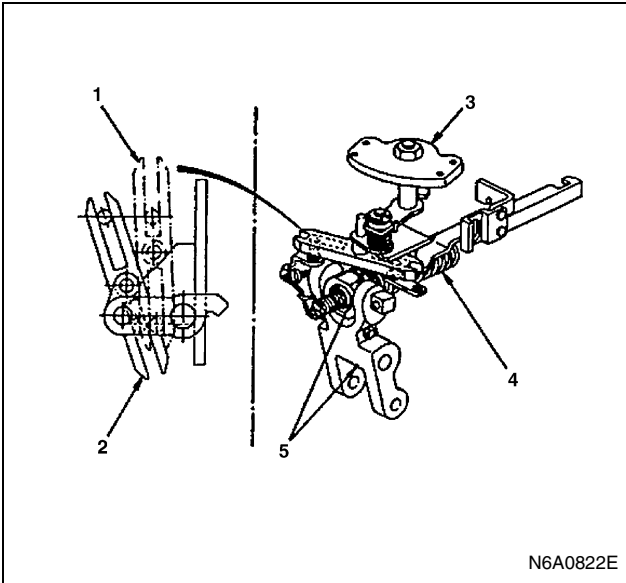
4HE1-TC

The RLD-J type governor can be used with the MI, MITICS injection pumps, and was designed to have better control and endurance than the previous RLD type governor.

Although the basic construction is identical to that of the RLD type governor, the RLD-M type is larger to match the applicable pumps' larger size.

Features

- 1. Variable speed control governor with decreased lever reaction force
As with the previous RLD type governor, RLD-M governor control is accomplished using the speed control lever to change the fulcrum of the internal link mechanism.
Consequently, as the reaction force of the governor spring does not act directly on the speed control lever, only a very small lever reaction force is exerted on the accelerator pedal.



Legend

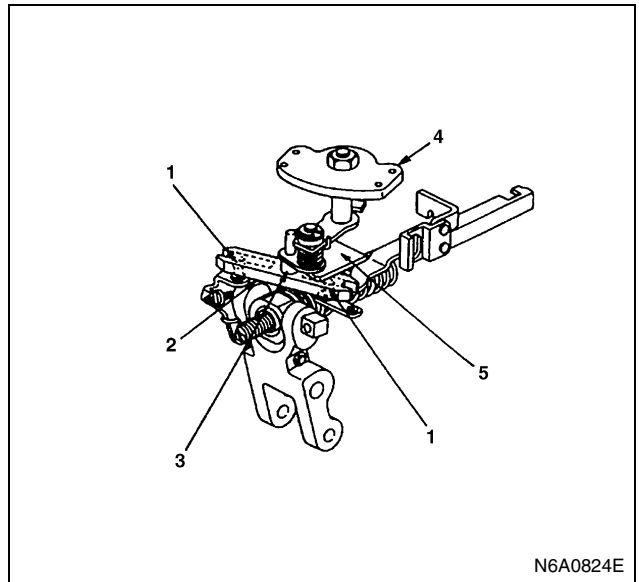
- 1. Sensor lever
- 2. Torque cam
- 3. Control rack position (mm)
- 4. Pump speed (r/min)

- 3. Improved control through internal guide plate
When the speed control lever is operated, the 2nd supporting lever's pin moves along the guide plate. The floating lever connected to the pin thus moves to change the ball joint fulcrum positions. In the intermediate to high speed ranges, the guide plate causes the floating lever to move to increase the lever ratio continuously from 1.1 (idling) — 6 (full speed). This increase in the lever ratio in the intermediate to high speed range improves speed droop.

Legend

- 1. At maximum speed control
- 2. At idle speed control
- 3. Speed control lever
- 4. Governor spring
- 5. Link mechanism

- 2. Set torque characteristics through internal torque cam
At full load, the tip of the sensor lever traces the face of the torque cam to determine the full load rack position and control the full load injection quantity.
Consequently, the torque characteristics demanded by the engine can be freely set by changing the shape of the torque cam face.

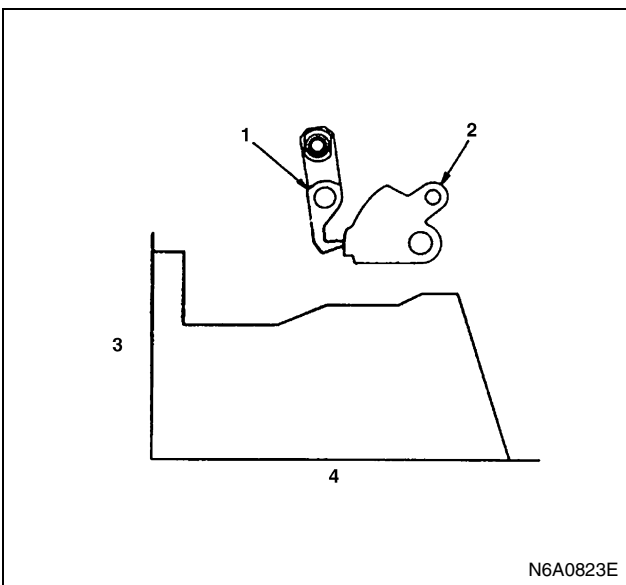


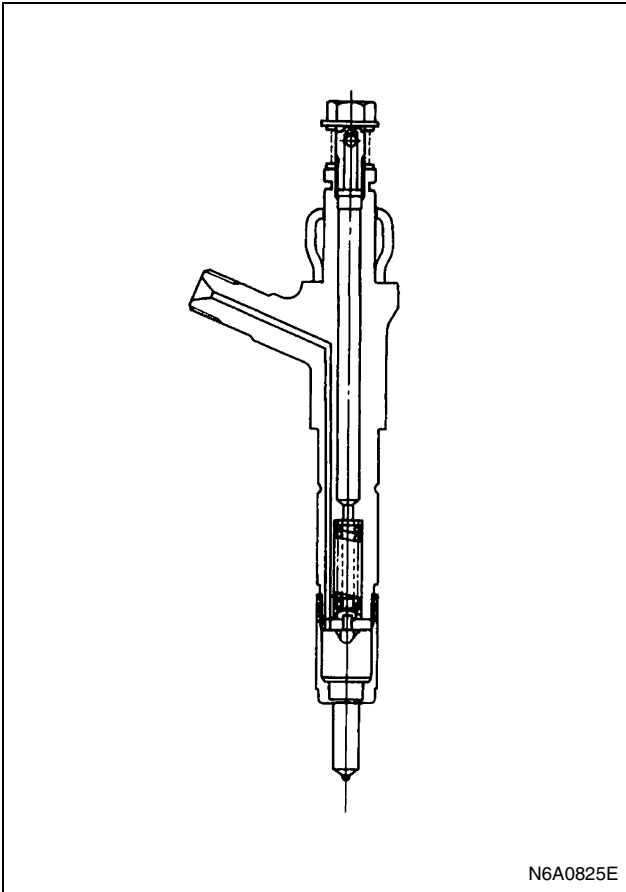
Legend

- 1. Ball joint
- 2. Floating lever
- 3. 2nd supporting lever pin
- 4. Speed control lever
- 5. Guide plate

Injection Nozzle

A Bosch hole type injection nozzle is used. It consists of the nozzle body and the needle valve assembly. The injection nozzle assembly sprays pressurized fuel from the injection pump into the combustion chamber through the nozzle body injection orifice.





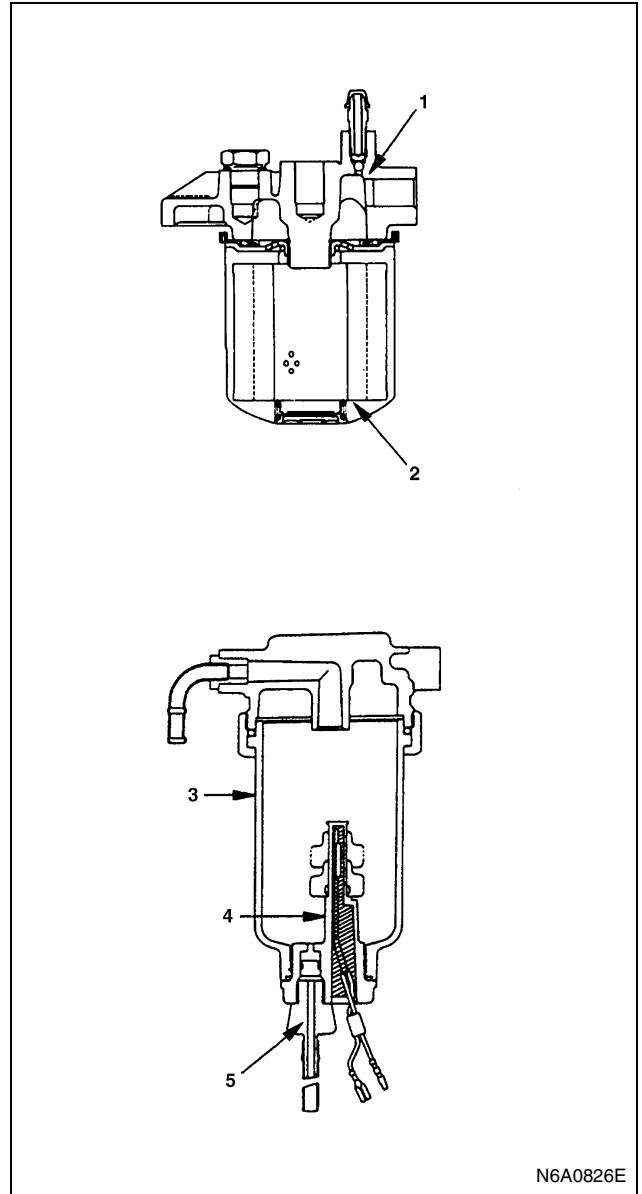
N6A0825E

Fuel Filter and Water Separator

A cartridge type fuel filter and a water separator are used along with the in-line type injection pump.

As the inside of the injection pump is lubricated by the fuel which it is pumping, the fuel must be perfectly clean. The fuel filter and the water separator remove water particles and other foreign material from the fuel before it reaches the injection pump.

The water separator has an internal float. When the float reaches the specified level, a warning light comes on to remind you to drain the water from the separator.



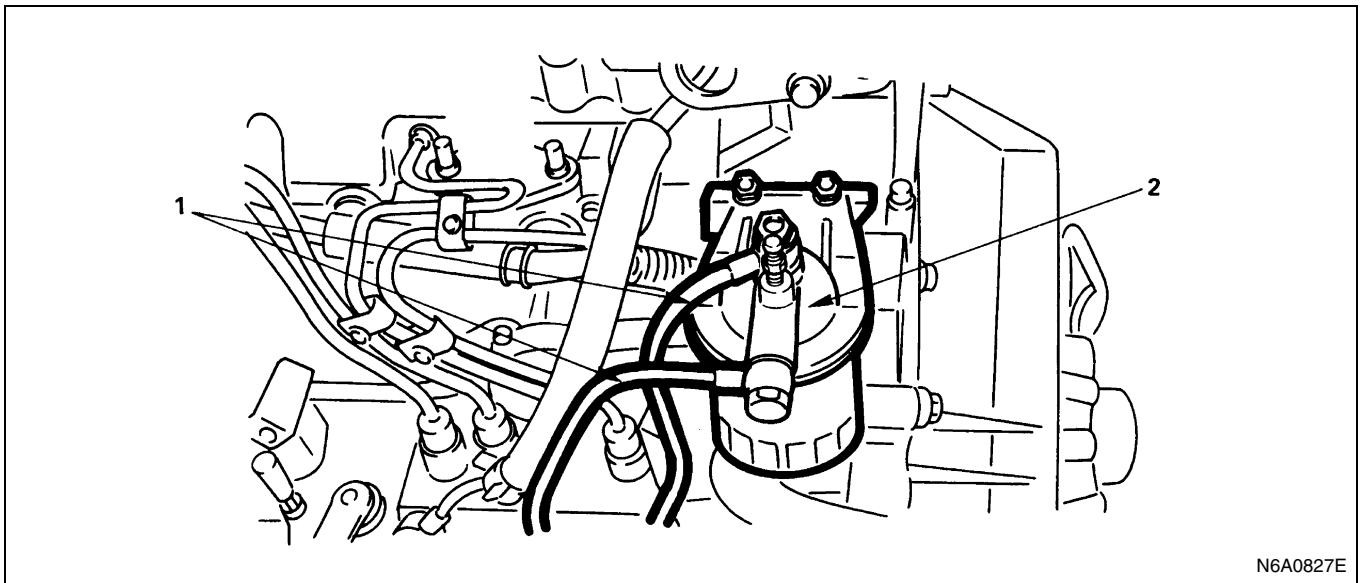
N6A0826E

Legend

1. Body assembly
2. Filter cartridge
3. Case
4. Lever sensor
5. Drain plug

FUEL FILTER ASSEMBLY (Except 4HF1-2 model)

Component



Legend

1. Fuel pipe

2. Fuel filter

Removal

Preparation

- Disconnect battery ground cable.
- Tilt the cab

1. Fuel Pipe
2. Fuel Filter Assembly

Installation

1. Fuel Filter Assembly

Tighten:

Fuel filter bracket to 34 N·m (3.5 kg·m / 25 lb·ft)

2. Fuel Pipe

Tighten:

Fuel pipe joint bolt to 23 N·m (2.4 kg·m / 17 lb·ft)

Air Bleeding

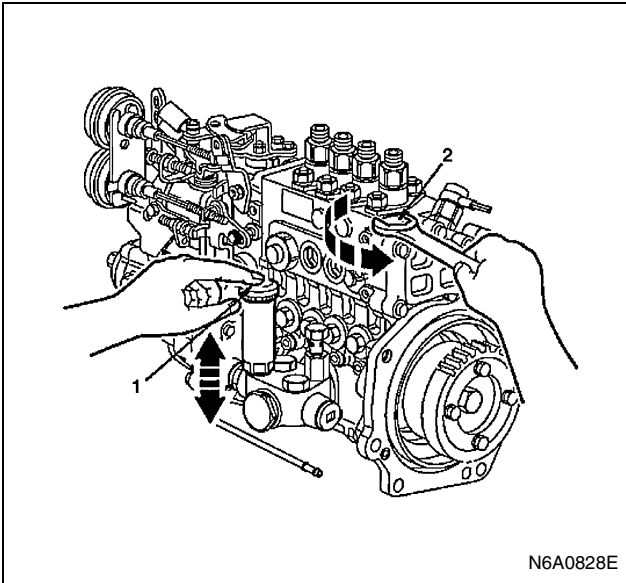
- Loosen the priming pump cap (1).
- Loosen the air bleeding plug. (4HG1-T model only)
- Operate the priming pump.
Pump the primer pump until fuel flow is free of air bubbles. (Except 4HG1-T model)
- Tighten the air bleeding plug. (4HG1-T model only)
- Loosen the bleeding plug.
- Operate the priming pump.
Pump the primer pump until fuel flow is free of air bubbles.
- Tighten the bleeder plug.
- Operate the priming pump.

Pump the primer pump until fuel flow is free of air bubbles. (Except 4HE1-TC model)

- Loosen the bleeding plug on the injection pump (2). (4HE1-TC model only)
- Operate the priming pump.
Pump the primer pump until fuel flow is free of air bubbles. (4HE1-TC model only)
- Tighten the bleeding plug on the injection pump (2). (4HE1-TC model only)
- Lock the priming pump cap (1).

Notice:

Check for fuel leakage from around the injection pump and the fuel filter.

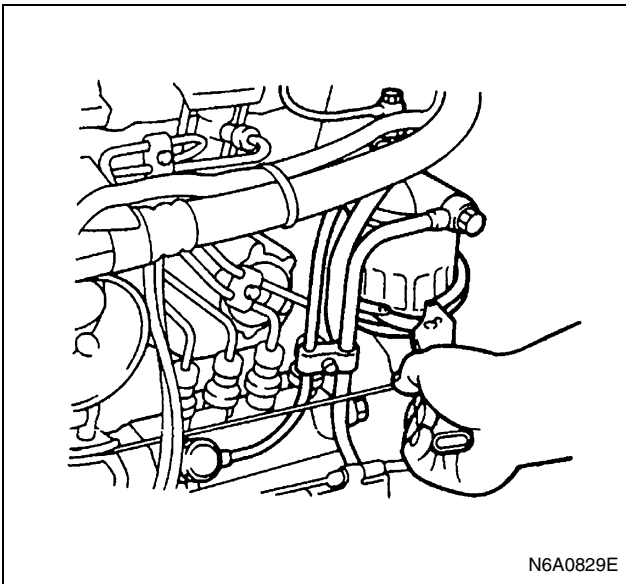


Cartridge Replacement

Removal

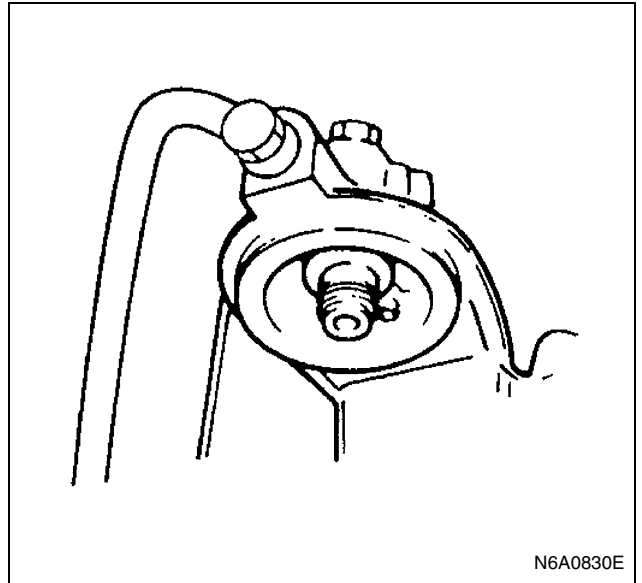
Replacement Procedure

1. Loosen the used fuel filter by turning it counter-clockwise with the filter wrench.

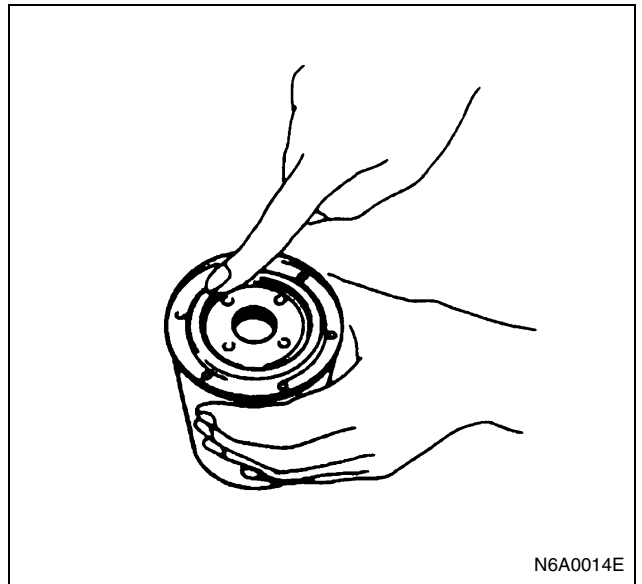


Installation

1. Clean the upper cover fitting face.
This will allow the new fuel filter to seat properly.



2. Apply a light coat of engine oil to the O-ring.
3. Supply fuel to the new fuel filter to facilitate bleeding.
4. Turn in the new fuel filter until the filter O-ring is fitted against the sealing face.
Be very careful to avoid fuel spillage.

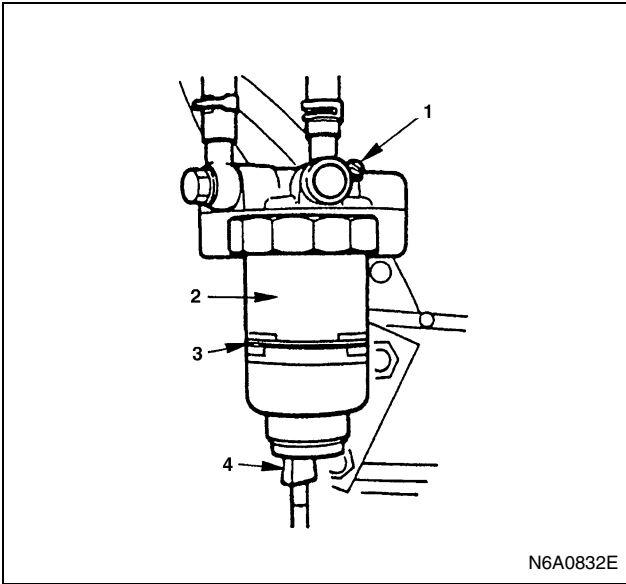


5. Use the filter wrench to turn in the fuel filter an additional 1/3 to 2/3 of a turn.
6. Operate the priming pump to bleed the air from the fuel line.
Refer to "FUEL FILTER ASSEMBLY" for more detailed information.
7. Start the engine.
Crank the engine for ten seconds or until it starts.
If the engine does not start after ten seconds, repeat Step 6.

Draining the Pre-fuel Filter

1. Loosen the air bleeding plug and drain plug by turning them counterclockwise.

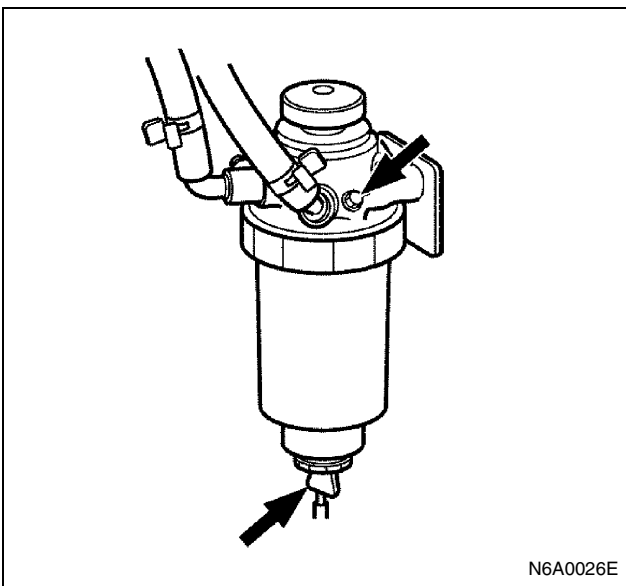
2. Drain approximately 0.1 liters (3.4 oz) of water.
3. Securely tighten the drain plug.
4. Operate the primer pump on the fuel pump to bleed the fuel system.
5. Tighten the air bleeding plug.



Legend

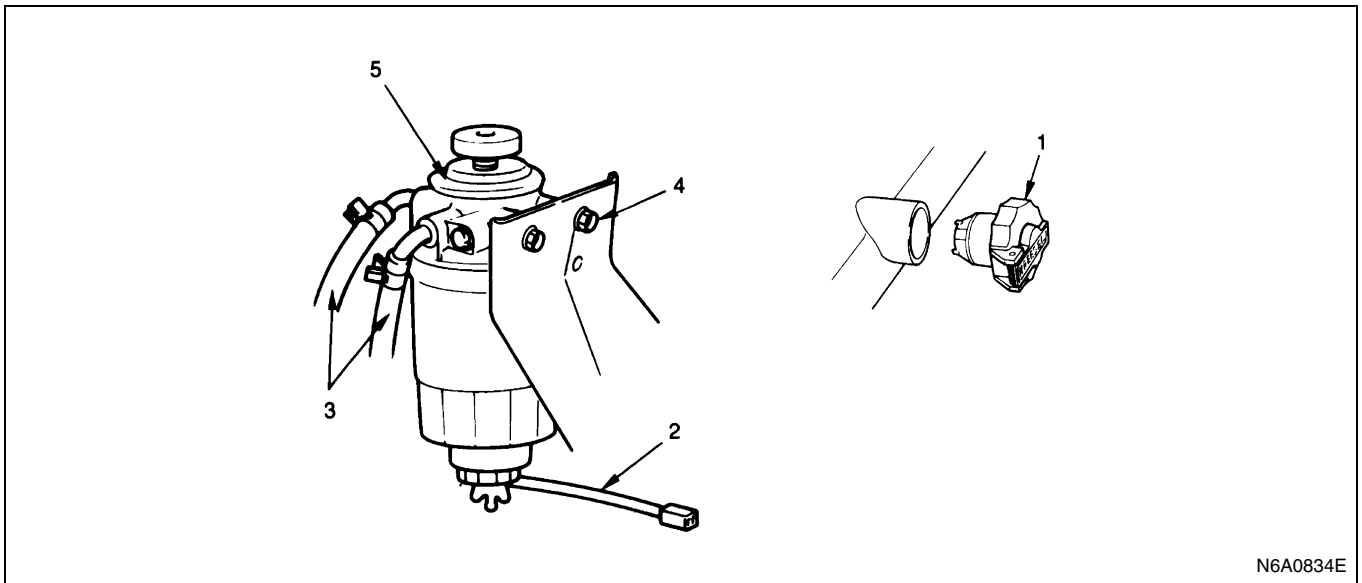
1. Air bleeding plug
2. Pre-fuel filter
3. Drain level
4. Drain plug

6. Start the engine and check to be sure no fuel is leaking from the drain plug.
7. Make sure that the warning light in the instrument panel is off. (Except 4HE1-TC)



FUEL FILTER ASSEMBLY (4HF1-2 model only)

Component



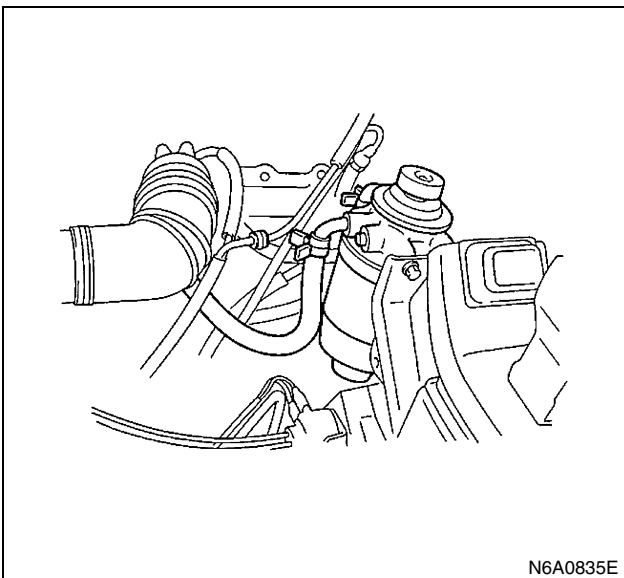
Legend

- | | |
|---------------------------------|--------------------------------|
| 1. Filter cap | 4. Fuel filter installing bolt |
| 2. Lead switch wiring connector | 5. Fuel filter assembly |
| 3. Fuel hoses | |

Removal

Preparation

- Disconnect battery ground cable.
1. Filler cap
 2. Lead switch wiring connector
 3. Fuel hose
 - Draw out inlet and outlet hoses from the fuel filter and cork the hoses to prevent fuel outflow.
 4. Fuel filter installing bolt
 5. Fuel filter assembly



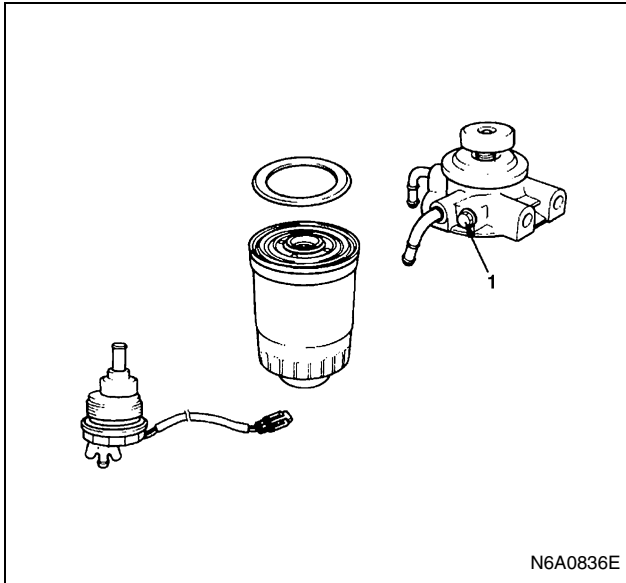
Installation

1. Fuel filter assembly
2. Fuel filter installing bolt
3. Fuel hose
 - Connect the inlet hose and outlet hose.
4. Lead switch wiring connector
5. Filler cap

Cartridge Replacement

Removal

1. Remove the cartridge using a filter wrench.
Special Tool
Filter wrench: 5-8840-0253-0
2. Remove the sedimenter/center.



Legend

1. Air bleeding plug

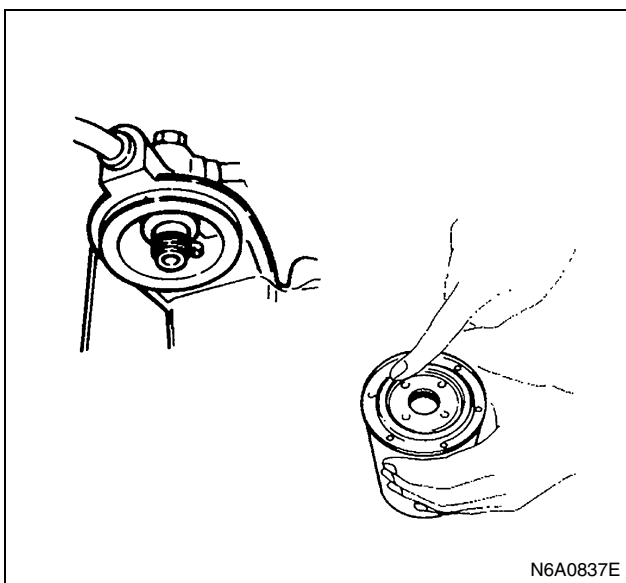
Reassembly

1. Fit the sedimenter/center in a new cartridge.
2. Clean the cartridge mounting surface of the filter body so that the new cartridge can be seated completely.
3. Apply engine oil thinly to the new cartridge O-ring.
4. Fill the new cartridge with light oil to facilitate air bleeding.
5. Tighten the cartridge until the O-ring comes into contact with the sealing surface. Sufficient care should be taken not to spill the light oil.

Give 1/3 to 2/3 of a turn using a filter wrench.

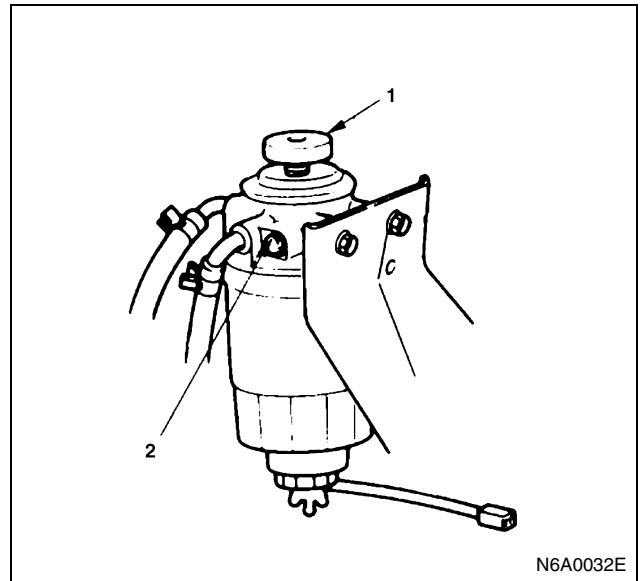
Special Tool

Filter wrench: 5-8840-0253-0



Air Bleeding

1. Actuate the priming pump (1) to send the air in the fuel system to the injection pump.
2. Loosen the sedimenter air bleeding plug (2) and operate the priming pump until no bubbles appear.
3. Tighten the air bleeding plug completely.
4. Try to start the engine. If the engine is not started within 10 seconds, air bleeding should be conducted once again.
5. Check that there is no fuel leak, and then tighten the priming pump completely.



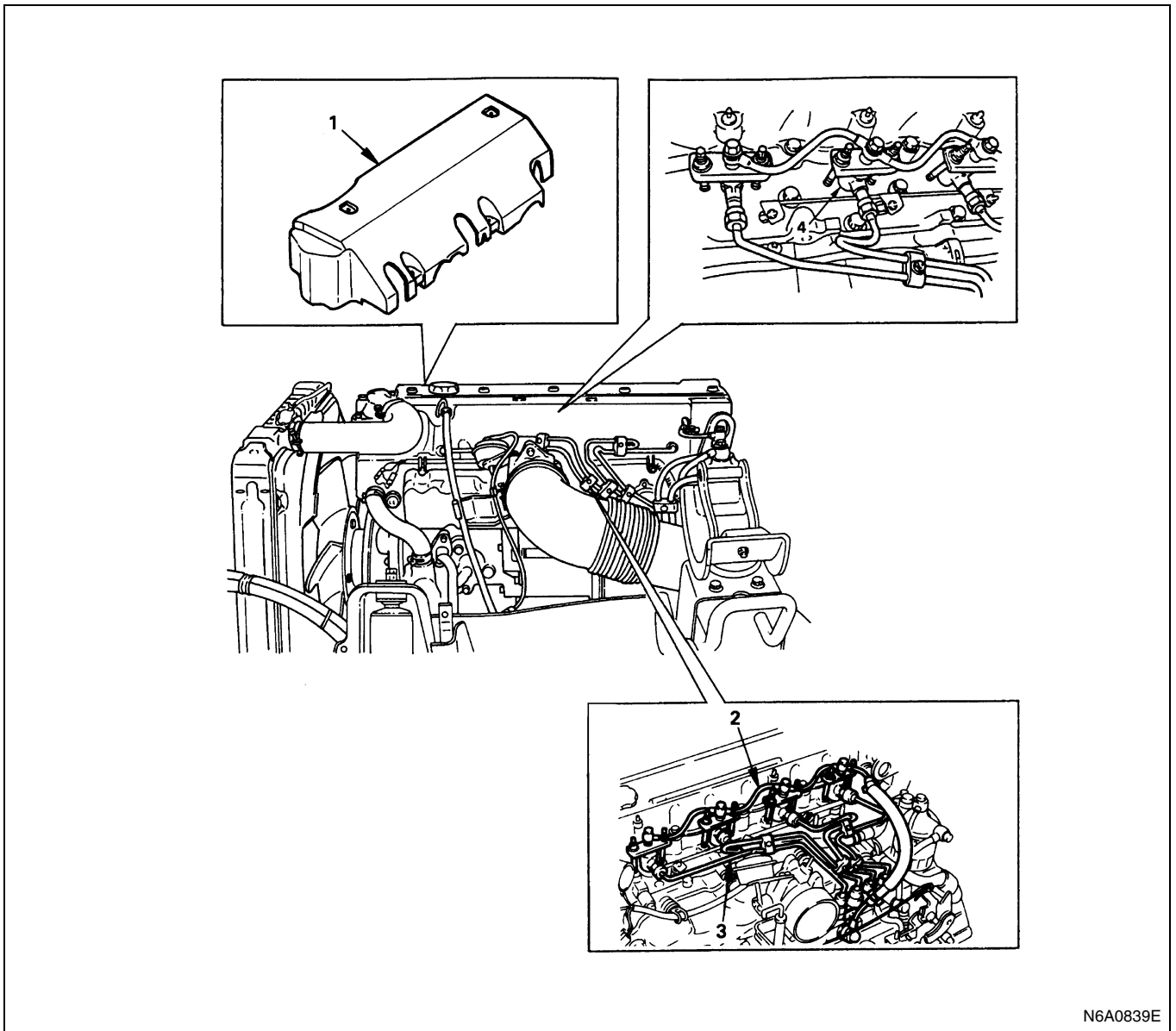
Water Drain

If more than specified has collected, the warning light is lit. Under this condition, follow the following water drain procedure:

1. Place a container (Approximately 0.2 lit (0.18 Imp qt/0.21 US qt) capacity) beneath the drain plug on the separator.
2. Loosen the drain plug and air bleeding plug.
3. After draining, tighten the drain plug.
4. Operate the priming pump several times again and check for fuel leak.
5. Tighten the air bleeding plug.
6. Make sure that the warning light in the instrument panel is off.

INJECTION NOZZLE ASSEMBLY

Component



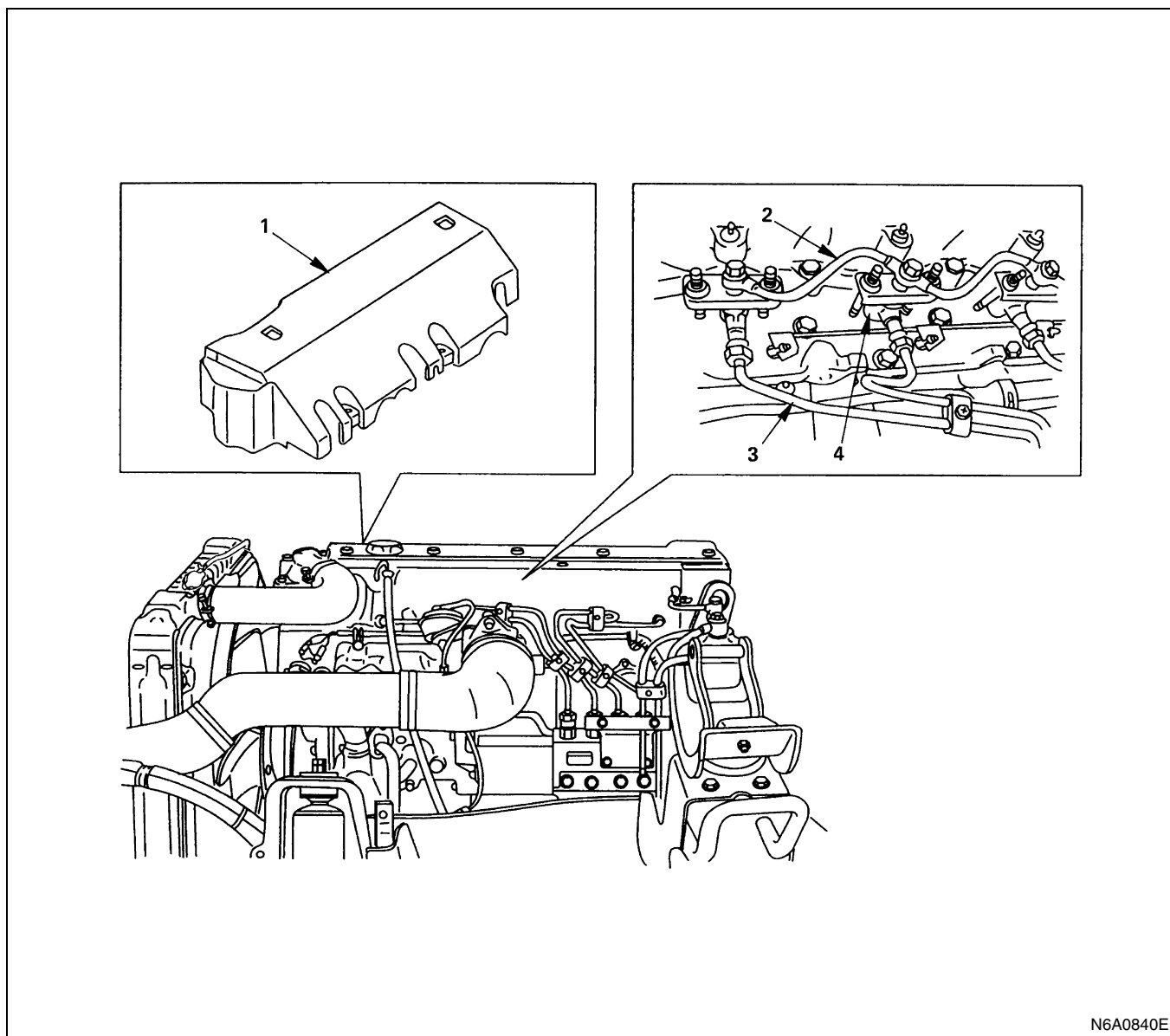
N6A0839E

Legend

- 1. Nozzle cover
- 2. Leak off pipe

- 3. Injection pipe
- 4. Injection nozzle assembly

4HE1-TC (Engine)



N6A0840E

Legend

- | | |
|------------------|------------------------------|
| 1. Nozzle cover | 3. Injection pipe |
| 2. Leak off pipe | 4. Injection nozzle assembly |

Removal

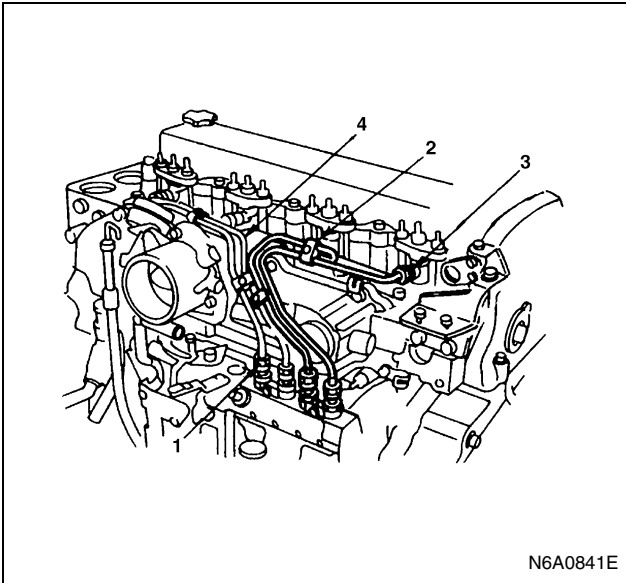
Preparation

- Disconnect battery ground cable.
- Tilt the cab.

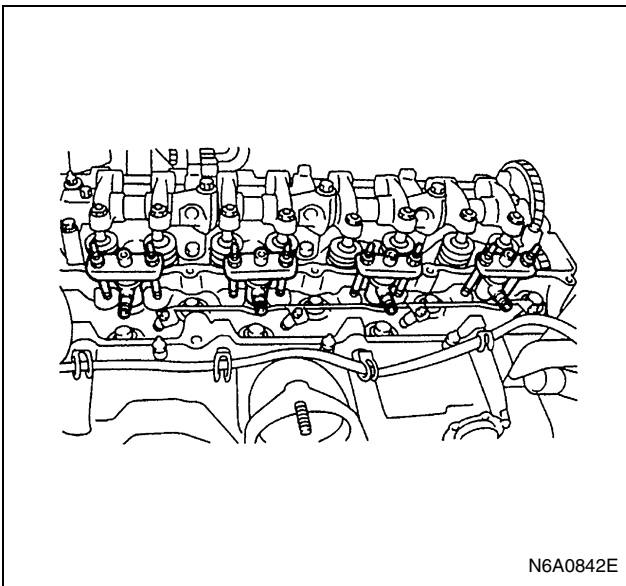
1. Nozzle Cover
2. Leak-Off Pipe
3. Fuel Injection

- 1) Loosen the injection pipe sleeve nuts (1).
Do not apply excessive force to the injection pipes (4).
- 2) Loosen the injection pipes clips (2).
- 3) Remove the injection pipe assembly.

Plug the delivery valve holder ports and nozzle holder (3) ports with caps to prevent the entry of foreign material.



4. Injection Nozzle Assembly
Mark the nozzle holder assemblies fitting positions by tagging each nozzle holder assembly with the cylinder number from which it was removed.



Inspection

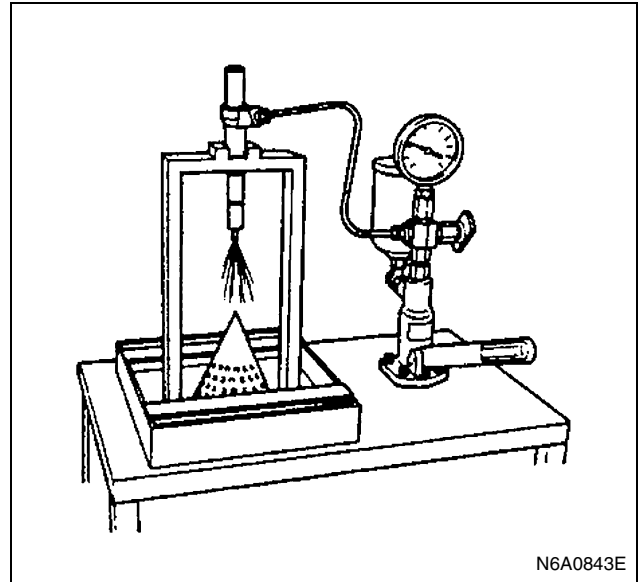
Before disassembling the injection nozzle assembly, check nozzle opening pressure, spray pattern, chatter and oil leakage.

Opening Pressure

Use a nozzle tester to check the injection nozzle opening pressure.

If the opening pressure is above or below the specified value, the injection nozzle must be replaced or adjusted.

Injection Nozzle Opening Pressure	MPa (kg/cm ² /psi)
4HF1/4HF1-2/4HG1	18.1 (185/2,631)
4HE1-TC	21.6 (220/3,128)
4HG1-T	1st 18.1 (185/2,631)
	2nd 21.1 (215/3,057)



Spray Pattern

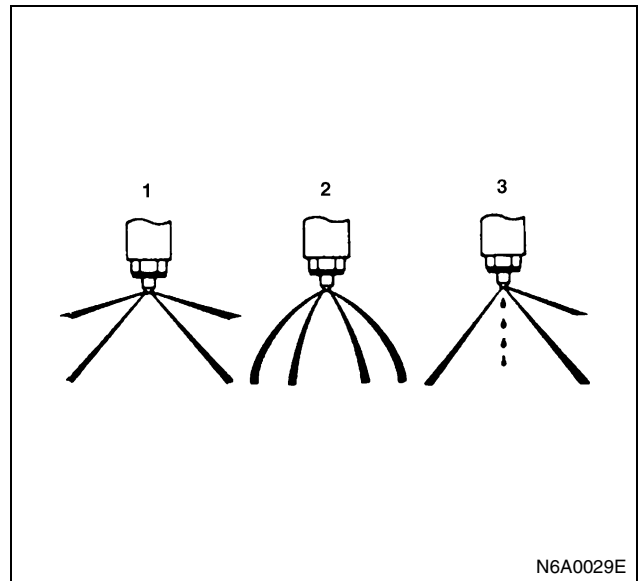
Check the spray pattern

Refer to the illustration.

Spray Condition

- Correct (1)
- Incorrect (Restrictions in orifice) (2)
- Incorrect (Dripping) (3)

If the spray condition is bad, the injection nozzle must be replaced or adjusted.



Leakage

Hold the tester handle to about 2,070 kPa (21 kg/cm²/ 300 psi) below the opening pressure. If no drops of fuel fall from the nozzle tip within 10 seconds, the nozzle is not leaking.

Chatter

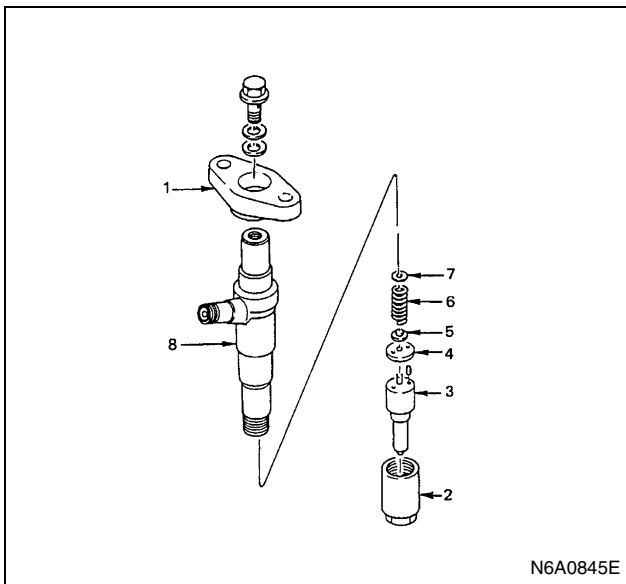
An easily audible chatter at all pump lever speeds should be heard.

WARNING:

TEST FLUID FROM THE INJECTION NOZZLE WILL SPRAY OUT UNDER GREAT PRESSURE. IT CAN EASILY PUNCTURE A PERSON'S SKIN. KEEP YOUR HANDS AWAY FROM THE INJECTION NOZZLE TESTER AT ALL TIMES.

Disassembly

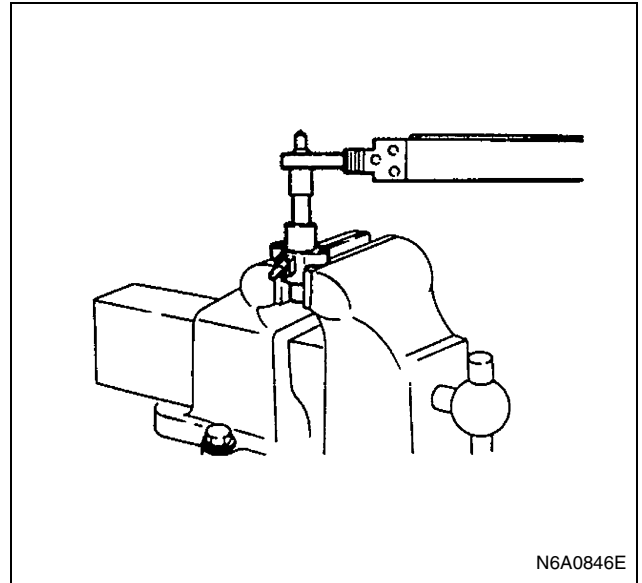
Clamp the injection nozzle holder in a vice.



Legend

1. Flange
2. Retaining nut
3. Injection nozzle
4. Spacer
5. Spring seat
6. Nozzle spring
7. Adjusting shim
8. Nozzle holder body

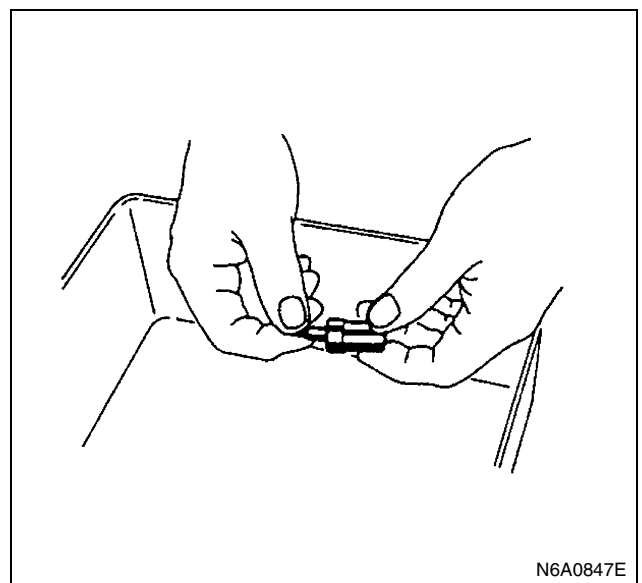
1. Flange
2. Retaining Nut
Use a wrench to remove the injection nozzle retaining nut.



3. Injection Nozzle
Keep the nozzle along with the needle valve separately to maintain the original nozzle to needle valve combination.
4. Spacer
5. Spring Seat
6. Nozzle Spring
7. Adjusting Shim
Keep the adjusting shims in the original groups to hold the initial shim to nozzle spring combination.
8. Nozzle Holder Body

Caution:

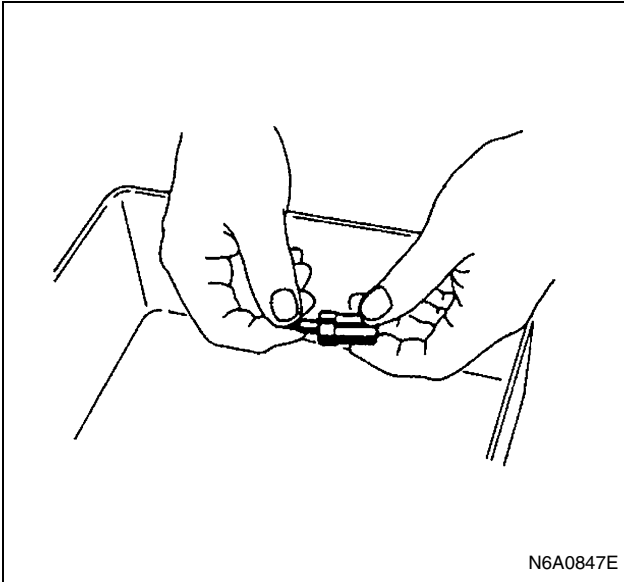
- Wash all the parts removed and arrange them on a cylinder basis, care should be taken not to miss any parts.
- Soak the nozzle assembly in a parts receptacle filled with light oil.
- Care should be taken not to miss shim, if used.



Inspection

Injection Nozzle Needle

1. Remove the nozzle from the nozzle body.
2. Carefully wash the nozzle needle and the nozzle body in clean diesel fuel.
3. Check that the nozzle needle moves smoothly inside the injection nozzle body.
If the nozzle does not move smoothly, it must be repaired (See "Nozzle Lapping Procedure" below).

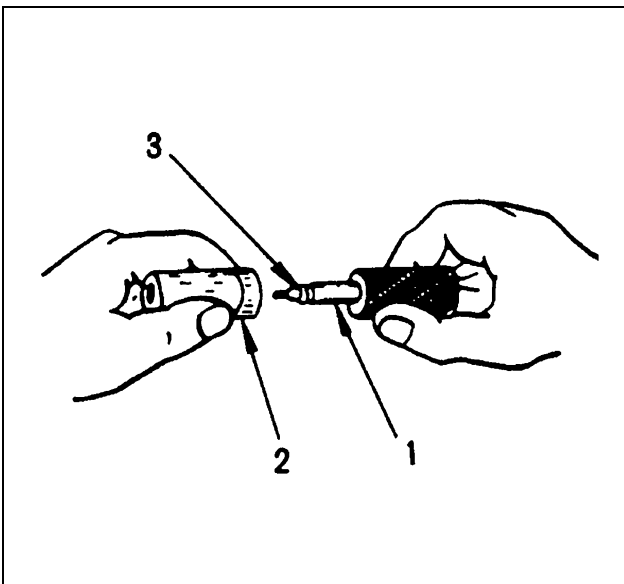


Nozzle Lapping Procedure

1. Lap the nozzle needle (1) and the nozzle body (2) by applying a compound of oxidized chrome and animal oil (3).

Notice:

Do not apply an excessive amount of the oxidized chrome and animal oil compound to the injection needle valve seat area.



2. Carefully wash the needle valve and the nozzle body in clean diesel fuel after lapping.

Nozzle Body and Needle Valve

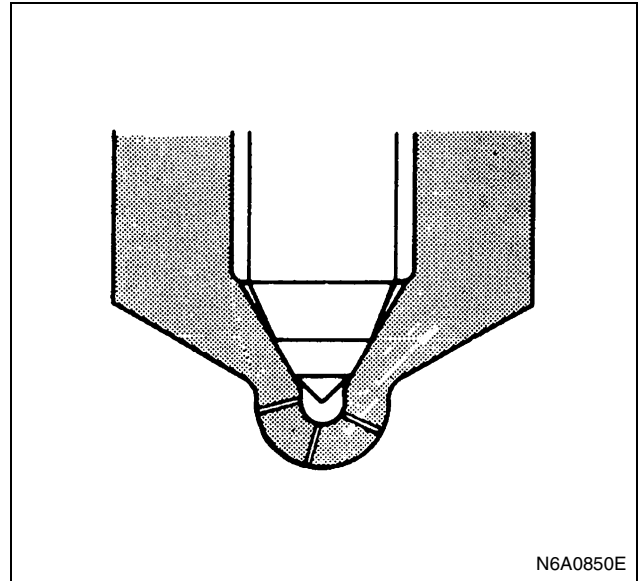
Check the nozzle body and the needle valve for damage and deformation.

The nozzle and body assembly must be replaced if either of these two conditions are discovered during inspection.

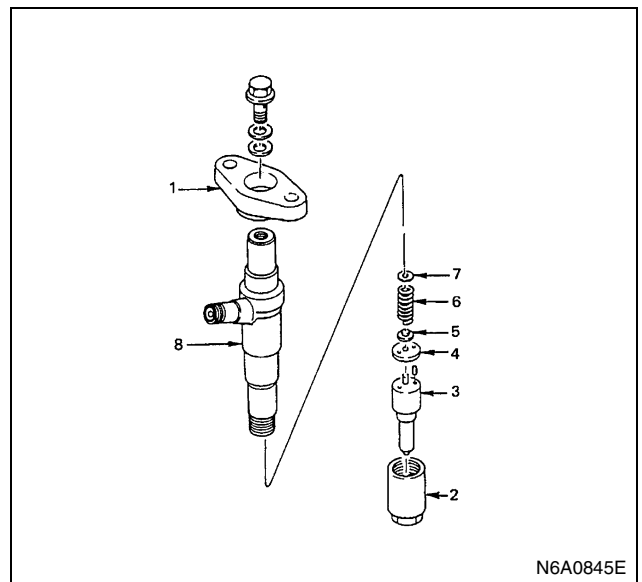
Notice:

New nozzles must be cleaned in a solvent to remove protective coating.

The nozzle body and needle must always be replaced as an assembly.



Reassembly

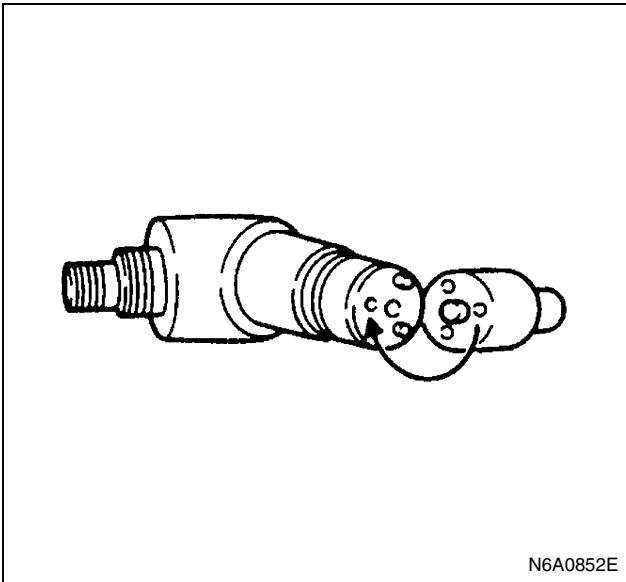


Legend

1. Flange
2. Retaining nut
3. Injection nozzle
4. Spacer
5. Spring seat
6. Nozzle spring
7. Adjusting shim
8. Nozzle holder body

1. Nozzle Holder Body
2. Adjusting Shim
3. Nozzle Spring
4. Spring Seat
5. Spacer
6. Injection Nozzle

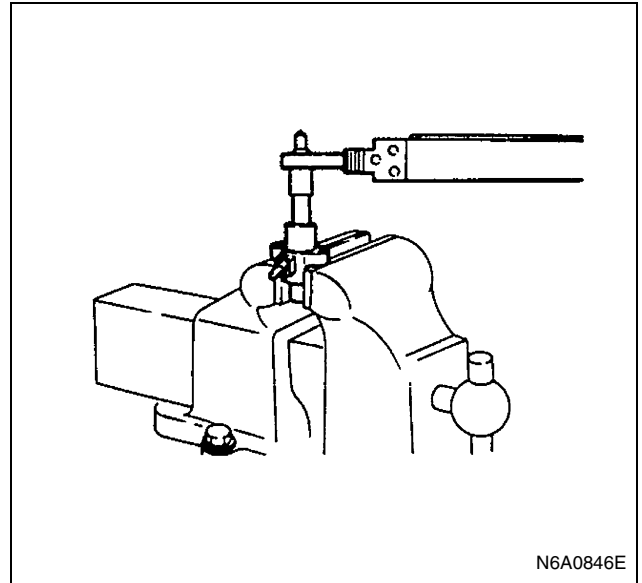
Install the nozzle dowel pin with it set to the dowel hose of the nozzle holder body.



7. Retaining Nut
Clamp the injection nozzle holder in a vice.
Tighten the injection nozzle holder retaining nut to the specified torque.

Tighten:

Injection nozzle holder retaining nut to 34 N·m (3.5 kg·m / 25 lb·ft)



- Remove the injection nozzle holder from the vice.
8. Flange

Adjustment of Injection Starting Pressure

After reassemble of the injection nozzle, recheck the opening pressure and spray condition.

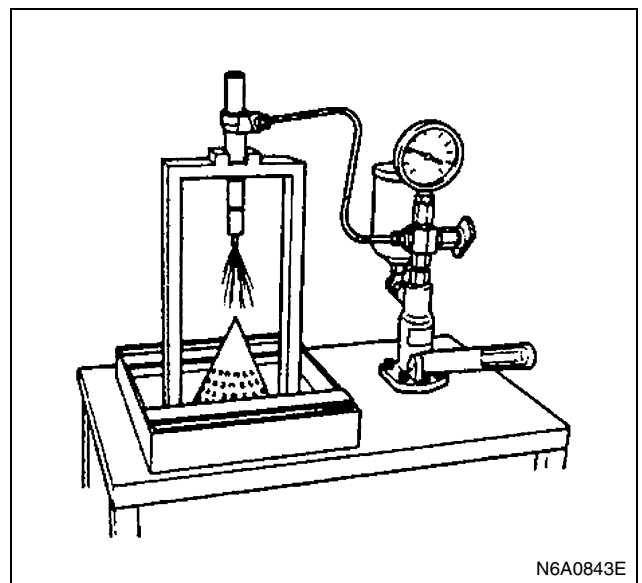
Opening Pressure

Attach the injection nozzle holder to the injection nozzle tester.

Apply pressure to the nozzle tester to check that the injection nozzle opens at the specified pressure.

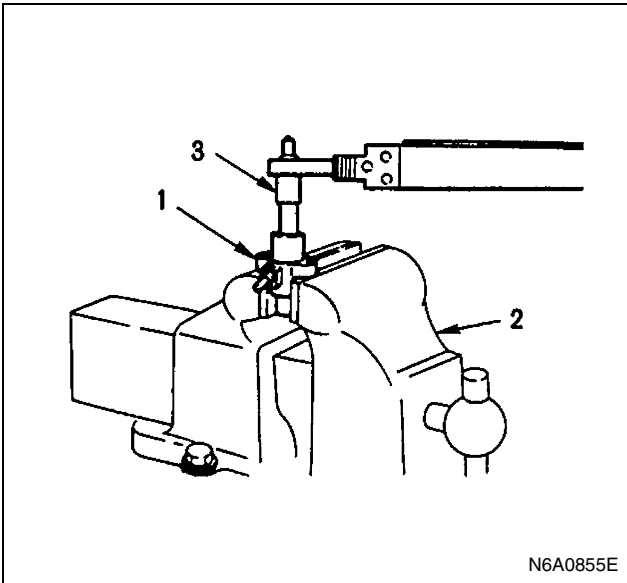
If the injection nozzle does not open at the specified pressure, install or remove the appropriate number of adjusting shims to adjust it.

Injection Nozzle Opening Pressure	MPa (kg/cm ² /psi)
4HF1/4HF1-2/4HG1	18.1 (185/2,631)
4HE1-TC	21.6 (220/3,128)

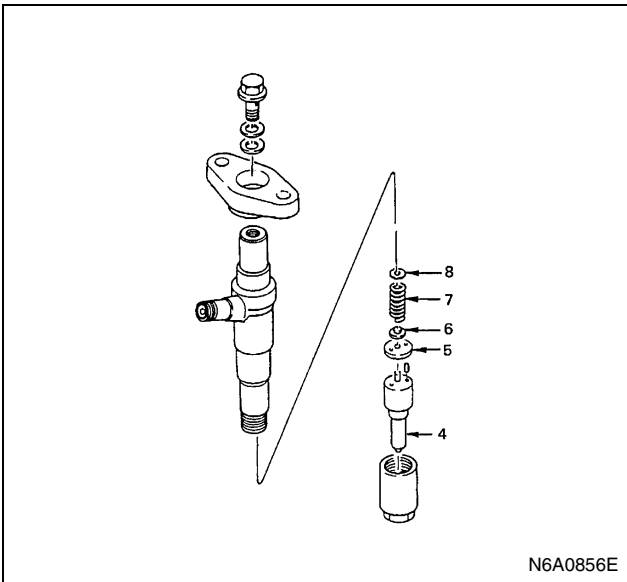


Opening Pressure Adjustment

1. Clamp the injection nozzle holder (1) in a vise (2).
2. Use a wrench to remove the injection nozzle retaining nut (3).



3. Remove the injection nozzle holder from the vise.
4. Remove the injection nozzle (4), the spacer (5), the spring seat (6) the spring (7) and the adjusting shim (8).
5. Install the new adjusting shim, the spring, the sprig seat, the spacer, the injection nozzle, and the retaining nut.



6. Clamp the injection nozzle holder in the vise.
7. Tighten the injection nozzle holder retaining nut to the specified torque.

Tighten:

Injection nozzle holder retaining nut to 34 N·m (3.5 kg·m / 25 lb·ft)

8. Remove the injection nozzle holder from the vise.

9. Attach the injection nozzle holder to the injection nozzle tester.
10. Apply pressure to the nozzle tester to check that the injection nozzle opens at the specified pressure.

If the injection nozzle does not open at the specified pressure, install or remove the appropriate number or adjusting shims to adjust it.

Removing or installing one shim will increase or decrease the nozzle opening pressure approximately 370 kPa (3.77 kg/cm² / 53.6 psi).

Adjusting Shim Availability		mm (in)
Range	0.5 — 1.5	(0.02 — 0.06)
Increment	0.025 (0.001)	
Total Number of Shims	41	

Spray Pattern

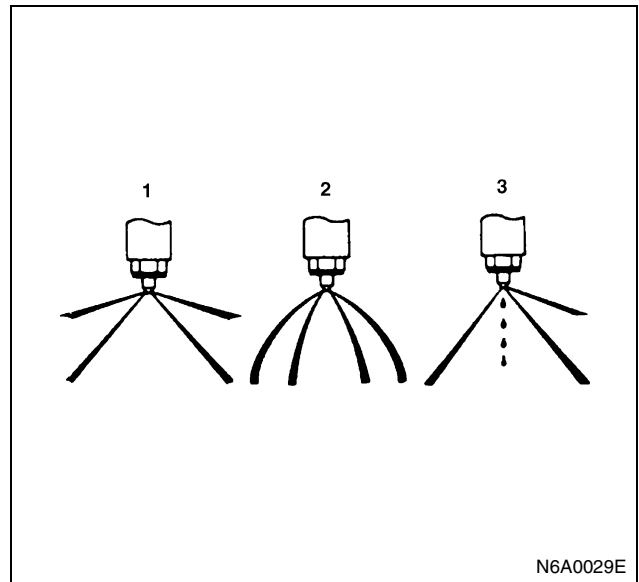
Check the spray condition.

Refer to the illustration.

Spray Condition

- Correct (1)
- Incorrect (Restrictions in orifice) (2)
- Incorrect (Dripping) (3)

If the spray condition is bad, the injection nozzle must be replaced or adjusted.



Refer to "Adjustment".

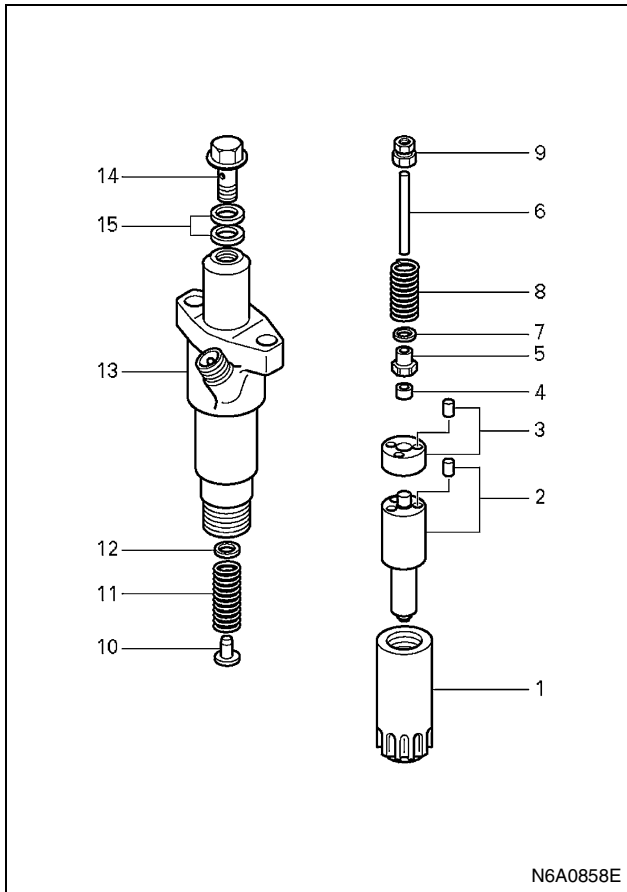
Notice:

Adjust the nozzle in a well ventilated area. Do not inhale oil or spray injected from the nozzle.

Disassembly

4-1 Injection Nozzle (Two spring nozzle holder) (4HG1-T only)

The two-spring nozzle holder has been developed to reduce NOx (Nitrogen Oxides) and particulates from direct injection diesel engine exhaust.



N6A0858E

Legend

1. Retaining nut
2. Nozzle & pin
3. Spacer & pin
4. Lift piece
5. Spring seat
6. Push rod
7. Shim (Second nozzle opening pressure adjustment)
8. Second spring
9. Collar
10. Spring seat
11. First spring
12. Shim (First nozzle opening pressure adjustment)
13. Nozzle holder body
14. Eye bolt
15. Gasket

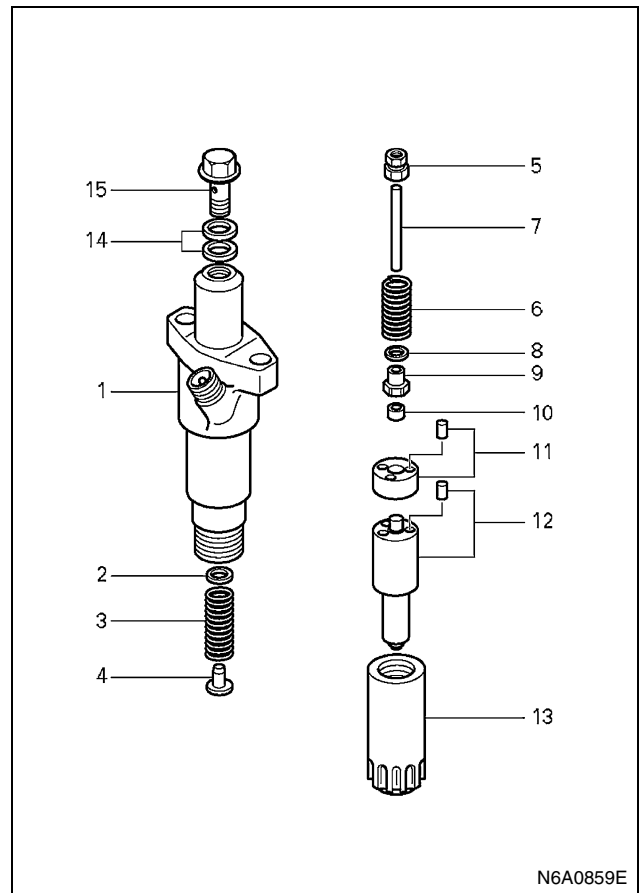
1. Before disassembly remove carbon deposit from nozzle and nozzle holder using a wire brush and wash the outside nozzle holder assembly.

Caution:

Do not touch nozzle holes with the wire brush during cleaning it.

2. Disassemble the nozzle holder assembly to numerical order.

Reassembly and Opening Pressure Adjustment



N6A0859E

Legend

1. Nozzle holder body
2. Shim (First opening pressure adjustment)
3. First spring
4. Spring seat
5. Collar
6. Second spring
7. Push rod
8. Shim (Second opening pressure adjustment)
9. Spring seat
10. Lift piece
11. Spacer & pin
12. Nozzle & pin
13. Retaining nut
14. Gasket
15. Eye bolt

The nozzle holder is adjusted as the components are reassembled in the sequence above.

As adjustment of the two-spring nozzle holder is made in hundredths of a millimeter, clean the parts thoroughly in light oil to completely remove any dirt or foreign matter.

Reassembly and Adjustment Procedure

1. First nozzle opening pressure adjustment
 - Adjust the first nozzle opening pressure using the shim.

2. Full needle valve lift confirmation
 - Confirm the full needle valve lift in accordance with the closed method.
3. Pre-lift confirmation
 - Confirm pre-lift in accordance with the closed method.

Caution:

If not as specified, replace the nozzle assembly, lift piece, pins and spacer using the nozzle service kit.

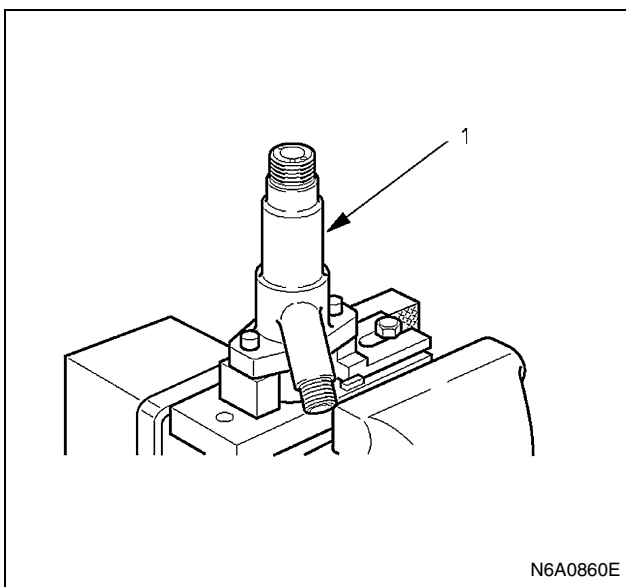
Adjustment Service Data (4HG1-T only)

Nozzle needle valve full-lift		0.30 mm (0.0118 in)
Nozzle needle valve pre-lift		0.04 mm (0.0016 in) at 19.1 MPa (195 kg/cm ² , 2,770 psi)
Nozzle pressure	1st Stage	18.1 MPa (185 kg/cm ² , 2,630 psi)
	2nd Stage	22.1 — 23.0 MPa (225 — 235 kg/cm ² , 3,200 — 3,342 psi) at lift 0.09 mm (0.0035 in) = pre lift + 0.05 mm (0.0020 in)

4. Second nozzle opening pressure confirmation
 - Confirm the second nozzle opening pressure in accordance with the closed method.
5. Second nozzle opening pressure adjustment
 - Adjust the second nozzle opening pressure using the shim.
6. Final inspection
 - Confirm the condition of the fuel spray with the nozzle and nozzle holder assembled.

First nozzle opening pressure adjustment

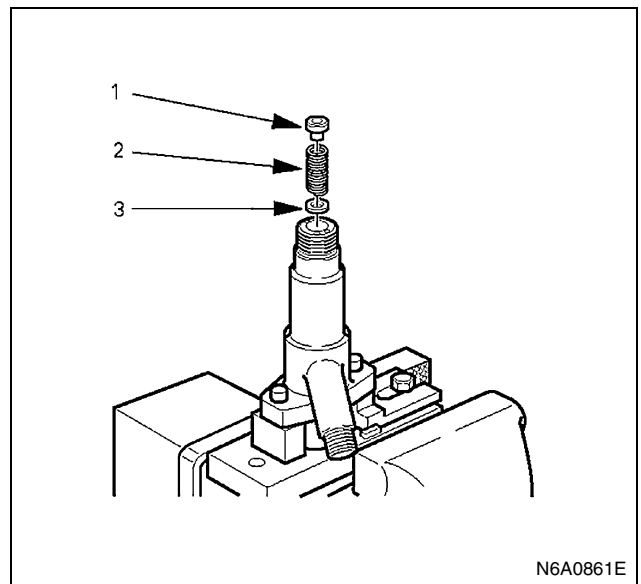
1. Clamp the nozzle holder in a vise.



Legend

1. Nozzle holder body

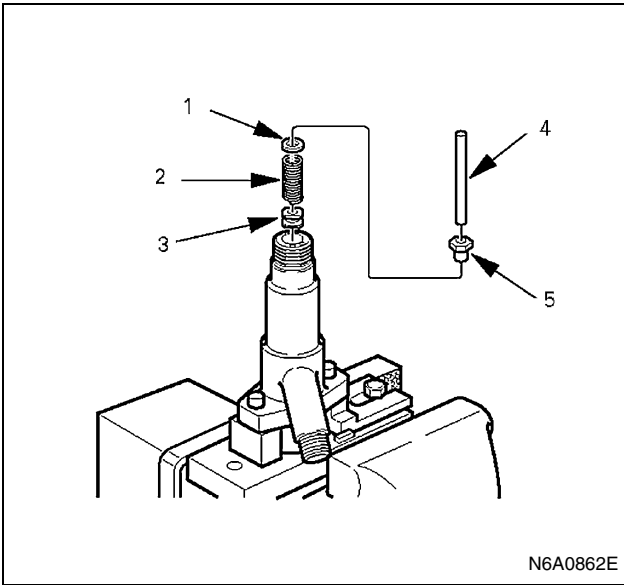
2. Install the shim, first spring and spring seat in the nozzle holder.



Legend

1. Spring seat
2. First spring
3. First nozzle opening pressure adjusting shim

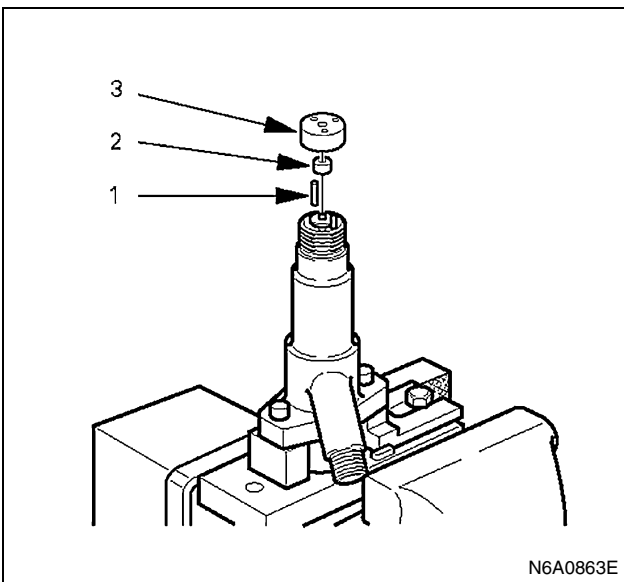
3. Install the collar, second spring, shim, spring seat and push rod in the nozzle holder.



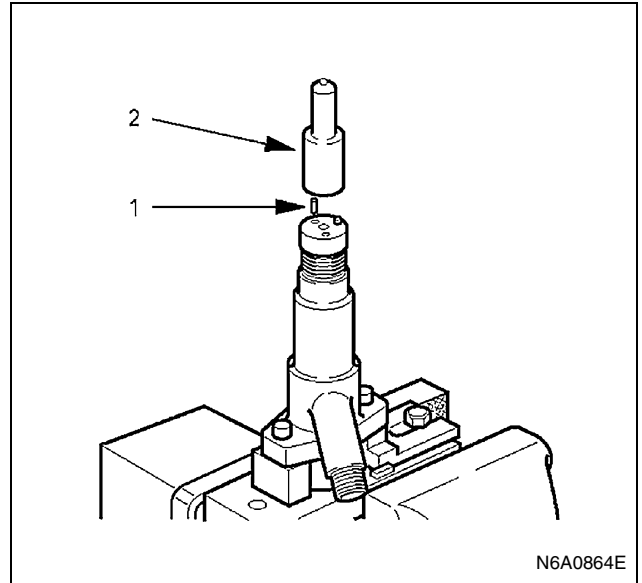
Legend

1. Second nozzle opening pressure adjusting shim
2. Second spring
3. Collar
4. Push rod
5. Spring seat

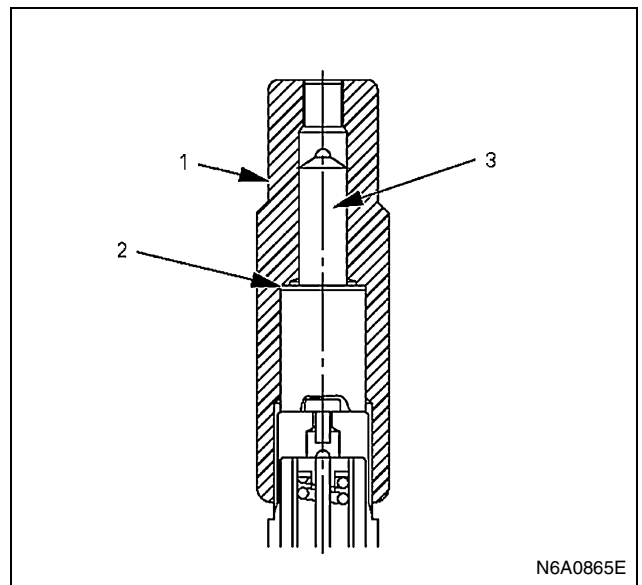
4. Install the pins (1), lift piece (2) and spacer (3) in the nozzle holder.



5. Install the pins (1) in the spacer.
6. Install the nozzle (2) on the spacer.



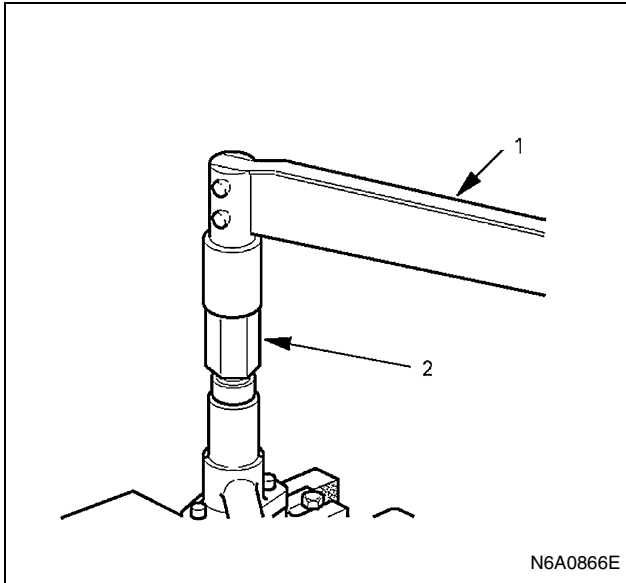
7. Hand-tighten the adjustment retaining nut together with the gasket to the nozzle holder.
Retaining nut: 157892-3200 (* Bosch AS)
Gasket: 157892-5100 (* Bosch AS)
(* Bosch Automotive System Corporation)



Legend

1. Retaining nut (special tool)
2. Gasket
3. Nozzle

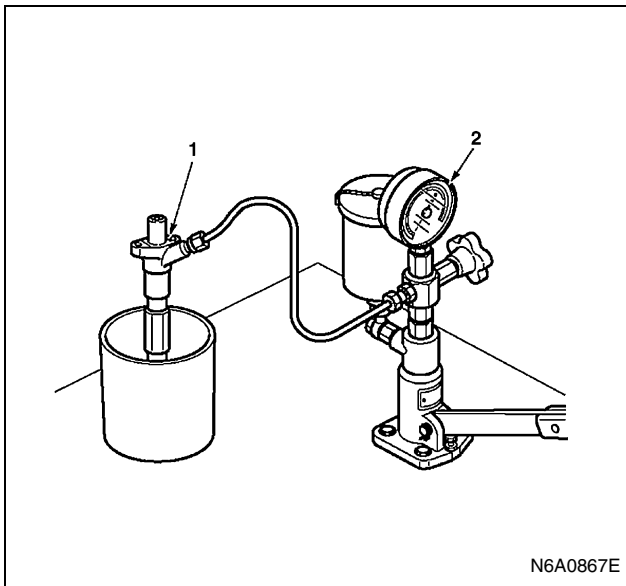
8. Tighten the adjustment retaining nut to the specified torque.
Torque: 29 — 39 N·m (3.0 — 4.0 kg·m/257 — 345 lb·in)



Legend

- 1. Torque wrench
- 2. Retaining nut (special tool)

9. Set the nozzle holder (1) to the nozzle tester (2).



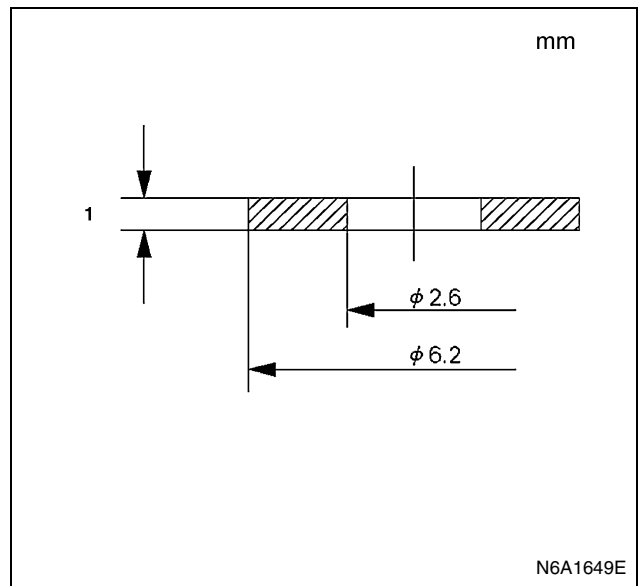
- 10. Operate the nozzle tester and measure the first nozzle opening pressure.
- 11. If the first nozzle opening pressure is not as specified, disassemble the nozzle holder and replace the shim until the pressure is as specified.

Caution:

- Use a micrometer to measure shim thickness.
- Use some combination of 3 adjusting shims to adjust the pressure.

- First nozzle opening pressure adjusting shims

Part No. (ISUZU)	Thickness mm (in)
115349-0420	0.40 (0.0157)
115349-0430	0.50 (0.0197)
115349-0440	0.52 (0.0205)
115349-0450	0.54 (0.0213)
115349-0460	0.56 (0.0220)
115349-0470	0.58 (0.0228)
115349-0480	0.60 (0.0236)
115349-0490	0.70 (0.0276)



Legend

- 1. Thickness

Full Needle Valve Lift Confirmation

- 1. Install the gasket (1) and plug (2) on the adjustment retaining nut.

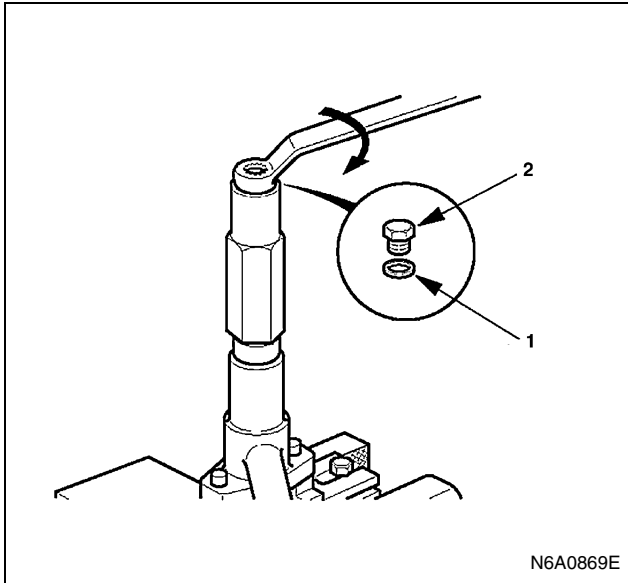
Gasket:

026508-1140 (Bosch AS)

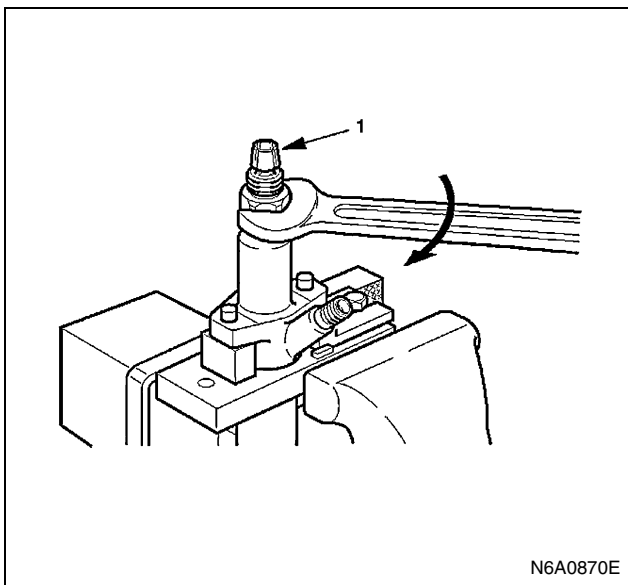
894227-6020 (ISUZU)

Plug:

157892-1600 (Bosch AS)



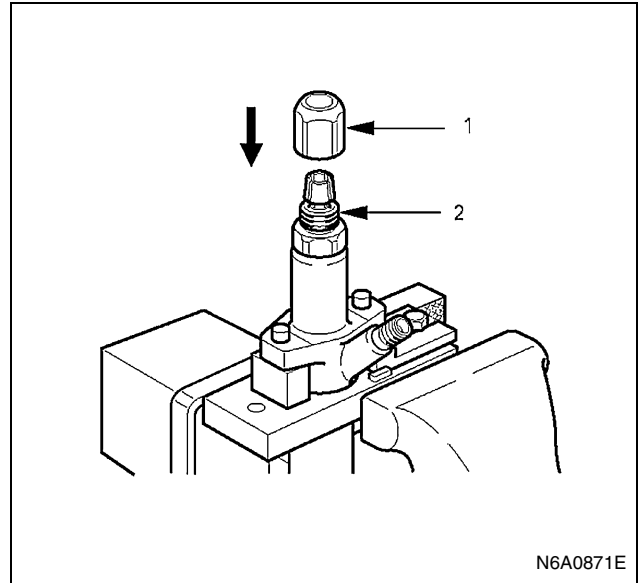
2. Position the nozzle holder with the nozzle facing down and install the dial gauge holder on the nozzle holder.
Dial gauge holder: 157892-5000 (Bosch AS)



Legend

1. Holder (special tool)

3. Install the nut on the dial gauge holder.
Nut: 157892-1000 (Bosch AS)



Legend

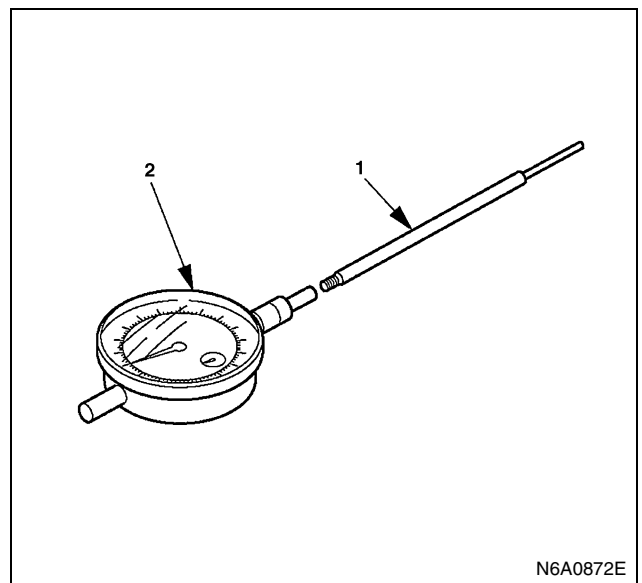
1. Nut (special tool)
2. Holder (special tool)

4. Install the pin (1) to the dial gauge (2).

Notice:

The lengths of the pins do not include the threaded portions.

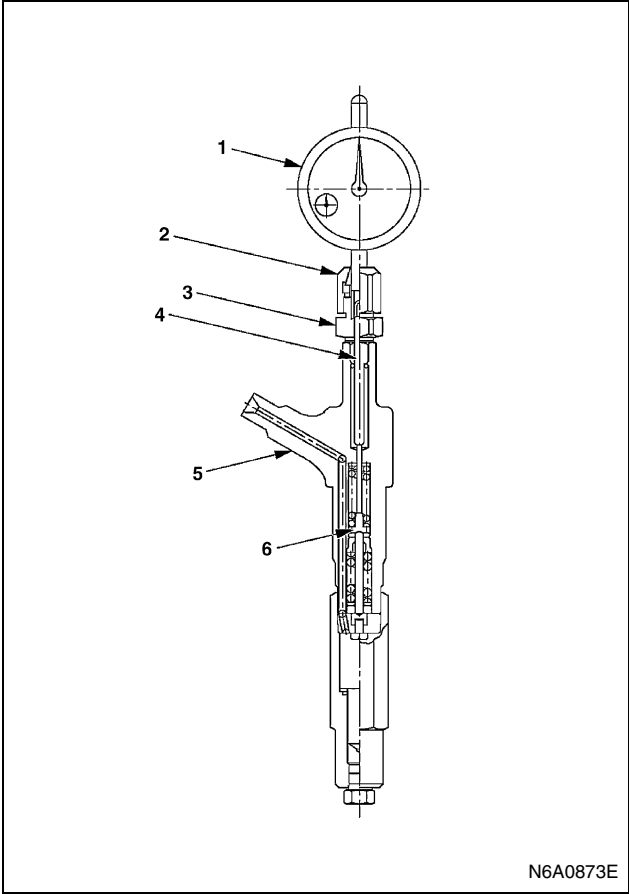
- Pin (l=100 mm (3.94 in)):
157892-5200 (Bosch AS)
Dial gauge:
157954-3800 (Bosch AS)
185317-0150 (ISUZU)



5. Secure the dial gauge to the nozzle holder using the nut so that the pin contacts the tip of the first spring seat.

Caution:

- Secure the dial gauge so that a stroke of 2 mm (0.08 in) can be measured.
- Do not over-tighten the nut as the dial gauge shaft may jam. (Confirm from the dial gauge that the shaft moves smoothly.)

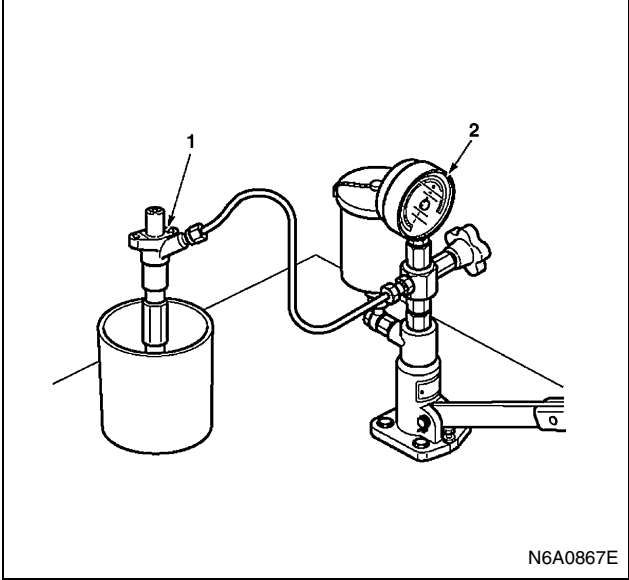


N6A0873E

Legend

- 1. Dial gauge
- 2. Nut
- 3. Holder
- 4. Pin
- 5. Nozzle holder
- 6. First spring seat

6. Set the nozzle holder (1) to the nozzle tester (2) and put needle to zero on the dial gauge.
7. Operate the nozzle tester to bleed any air from inside the retaining nut and to confirm that no fuel leaks.



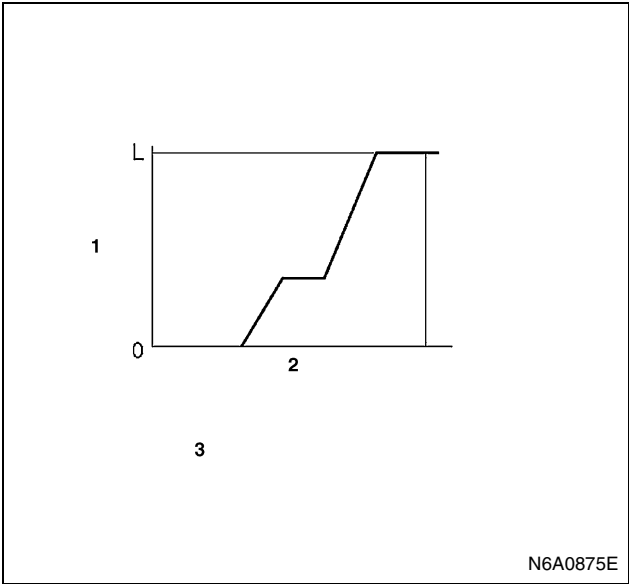
N6A0867E

8. Operate the nozzle tester and increase the in-line pressure to 34.3 — 44.1 MPa (350 — 450 kg/cm² / 4,975 — 6,396 psi) so that the nozzle's needle valve moves through its full lift. Record full lift 'L'. (Read dial gauge)

Nozzle Full Lift	mm (in)
	0.30 (0.0118)

Notice:

The above operation is used to determine whether the nozzle seat is worn and whether the nozzle assembly is in good condition.



N6A0875E

Legend

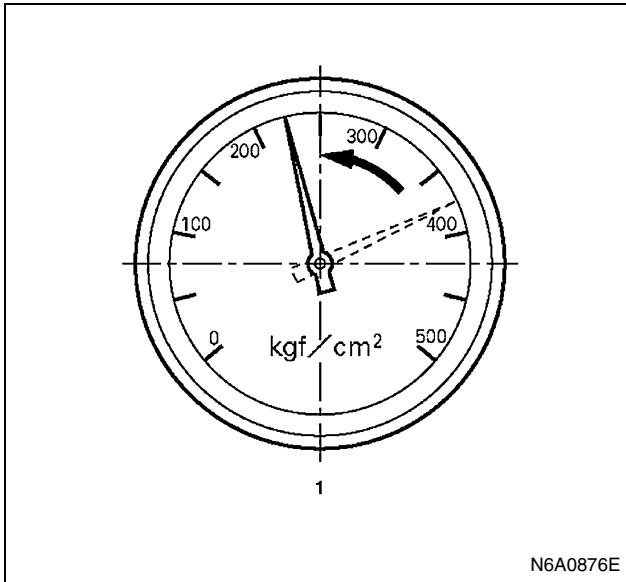
- 1. Needle valve
- 2. First nozzle opening pressure 34.3 — 44.1 MPa (350 — 450 kg/cm² / 4,975 — 6,396 psi)
- 3. In line pressure

Pre-lift Confirmation

1. With the needle valve at full lift, release the nozzle tester handle.

Notice:

The in-line pressure will decrease and needle valve lift (as indicated on the dial gauge) will also decrease a little.



Legend

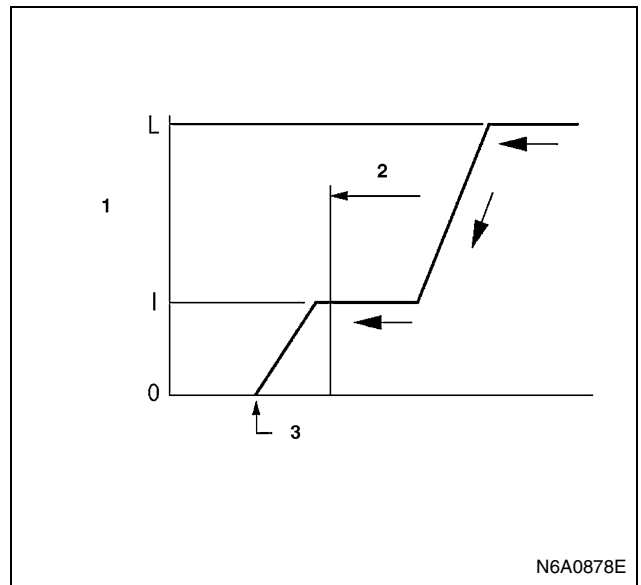
1. Pressure gauge

Read the dial gauge at **first nozzle opening pressure + approx 1 MPa (10 kg/cm² / 145 psi)**.

Pre-lift		
Engine	Pressure MPa (kg/cm ² / psi)	Lift mm (in)
4HG1-T	19.1 (195/2,770)	0.04 (0.0016)

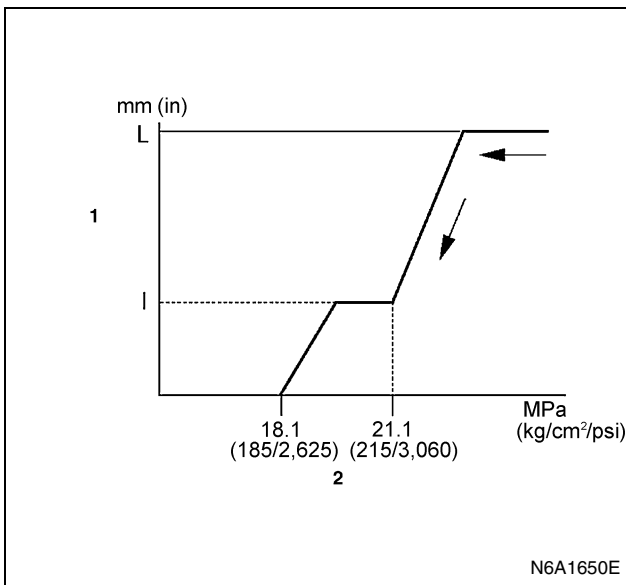
Notice:

This point can be found while the pressure is decreasing.



Legend

1. Needle valve lift
2. Measuring point of prelift
3. First nozzle opening pressure

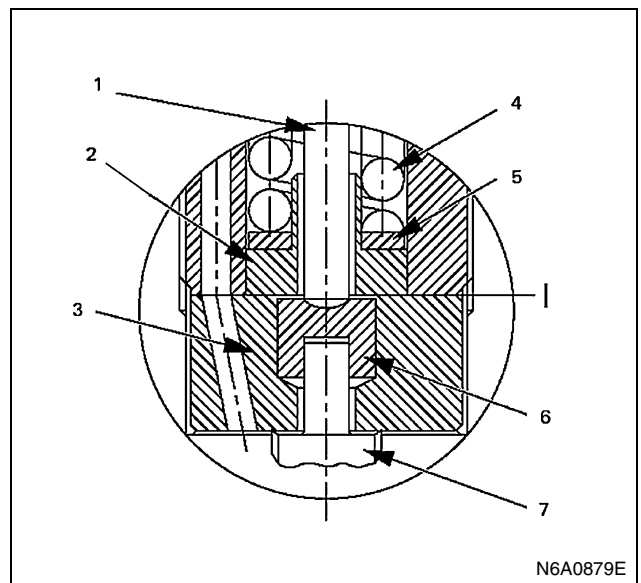


Legend

1. Needle valve lift
2. In line pressure

2. Read the needle valve lift 'l' from the dial gauge indication (once the needle valve has descended when the second spring has stopped operating). Refer to the pre-lift measuring point for 'l'.

Pre-lift measuring point:



N6A0879E

Legend

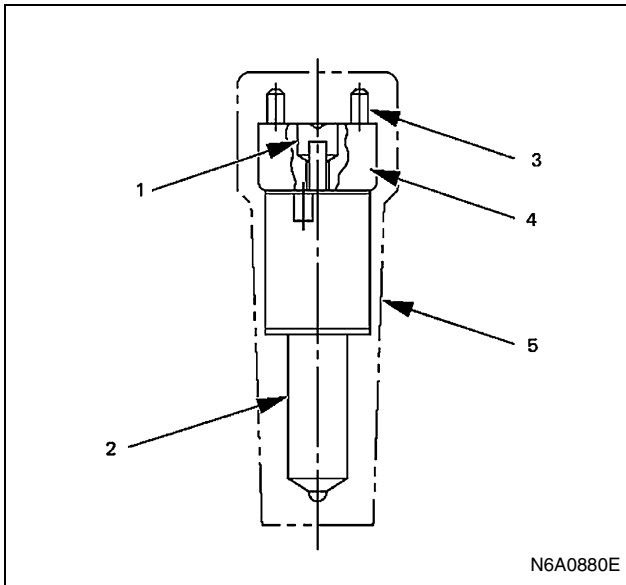
- 1. Push rod
- 2. Spring seat
- 3. Spacer
- 4. Second spring
- 5. Adjusting shim
- 6. Lift piece
- 7. Needle valve

4. If pre-lift is not as specified, replace the pins, lift piece, spacer and nozzle assembly as a set with the service kit.

Service kit:

4HG1-T

897313-8970



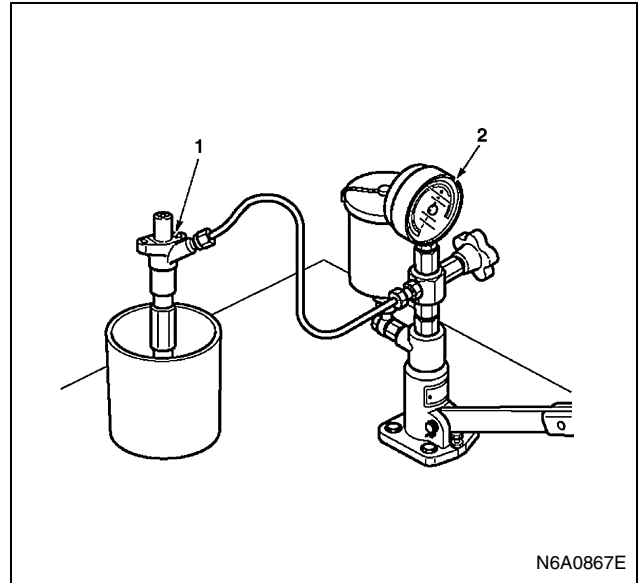
N6A0880E

Legend

- 1. Lift piece
- 2. Nozzle assembly
- 3. Pin
- 4. Spacer
- 5. Capsule

Second Nozzle Opening Pressure Confirmation

1. After pre-lift confirmation, operate the nozzle tester to increase in-line pressure to 34.3 — 44.1 MPa (350 — 450 kg/cm² / 4,975 — 6,396 psi) so that the nozzle's needle valve moves through its full lift.



N6A0867E

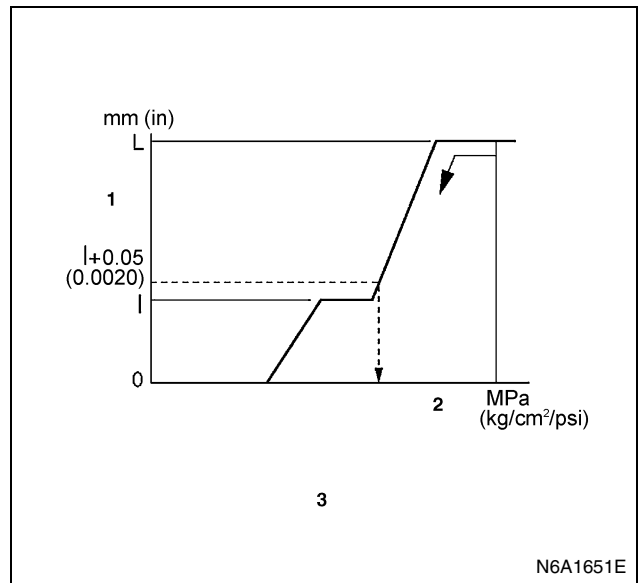
Legend

- 1. Nozzle holder
- 2. Nozzle tester

2. Release the nozzle tester handle so that in-line pressure decreases.

Notice:

The in-line pressure will decrease and needle valve lift (as indicated on the dial gauge) will also decrease a little.



N6A1651E

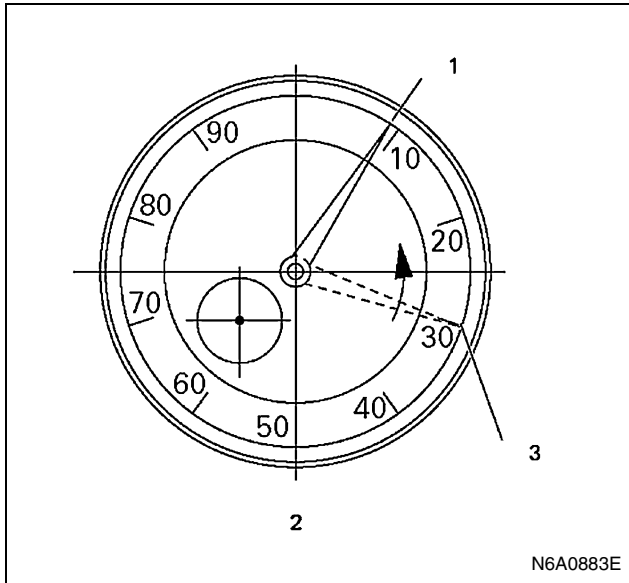
Legend

- 1. Needle valve lift
- 2. Second nozzle opening pressure 34.3 — 44.1 MPa (350 — 450 kg/cm² / 4,975 — 6,396 psi)
- 3. In line pressure

3. Then, read the pressure gauge indication (second nozzle opening pressure) the instant that the dial

gauge indicates the specified needle valve lift (usually pre-lift $l + 0.05$ mm (0.0020 in)).

Second Nozzle Opening Pressure		
	Lift mm (in)	Pressure MPa (kg/cm ² /psi)
4HG1-T	0.09 (0.0035)	22.1 — 23.0 (225 — 235/ 3,200 — 3,342)



Legend

1. When needle valve lift is $l + 0.05$ mm (0.0020 in)
2. Dial gauge
3. Full needle valve lift

Second Nozzle Opening Pressure Adjustment

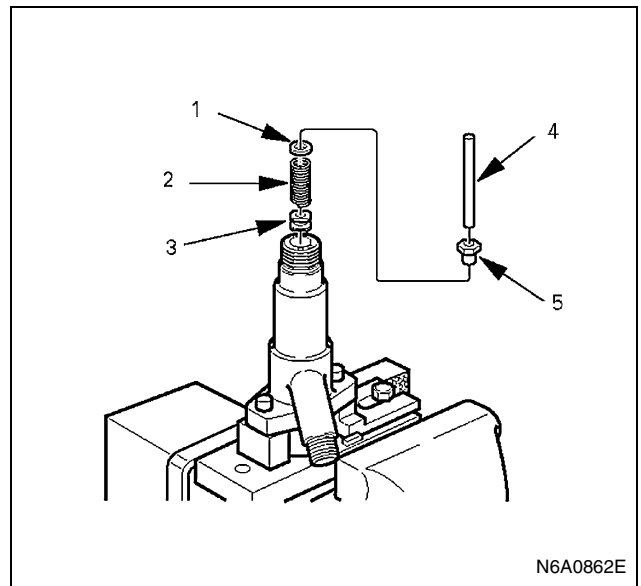
If the second nozzle opening pressure is not as specified, disassemble the nozzle from the nozzle holder and replace the shim until the pressure is as specified.

Caution:

- Because the second opening pressure changes when the first opening pressure changes, the second opening pressure must be adjusted when the first opening pressure changes.
- Use a micrometer to measure shim thickness.
- Use some combination of 3 adjusting shims to adjust the pressure.
- Second nozzle opening pressure adjusting shims

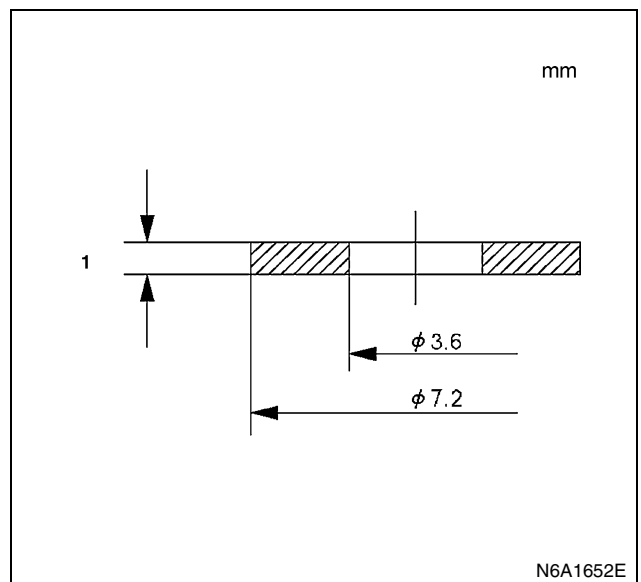
Part No. (ISUZU)	Thickness mm (in)
897116-0290	0.10 (0.0039)
897116-0320	0.20 (0.0079)
897116-0330	0.30 (0.0118)
897116-0340	0.40 (0.0157)
897116-0350	0.50 (0.0197)
897116-0360	0.51 (0.0201)

Part No. (ISUZU)	Thickness mm (in)
897116-0370	0.52 (0.0205)
897116-0380	0.53 (0.0209)
897116-0390	0.54 (0.0213)
897116-0400	0.55 (0.0217)
897116-0410	0.56 (0.0220)
897116-0420	0.57 (0.0224)
897116-0430	0.58 (0.0228)
897116-0440	0.59 (0.0232)



Legend

1. Second nozzle opening pressure adjusting shim
2. Second spring
3. Collar
4. Push rod
5. Spring seat

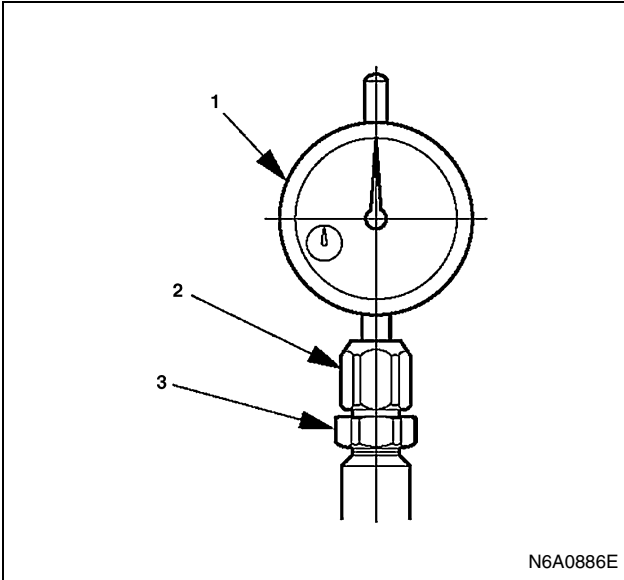


Legend

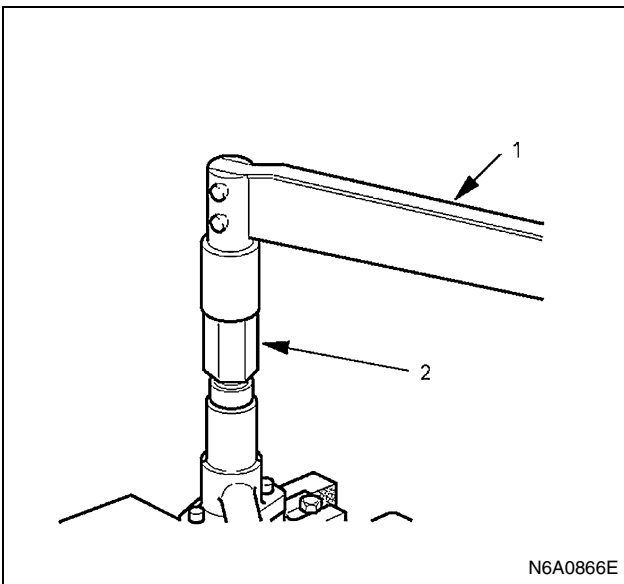
1. Thickness

Final Inspection

1. Remove the dial gauge (1), nut (2) and dial gauge holder (3).



2. Remove the adjustment retaining nut and gasket.
3. Install the original retaining nut, confirm that the pins are inserted fully into the nozzle, and then hand-tighten the retaining nut. Then, tighten the original retaining nut to the specified torque.
Torque: 29 — 39 N·m (3.0 — 4.0 kg·m / 22 — 29 lb·ft)



Legend

1. Torque wrench
2. Retaining nut (special tool)

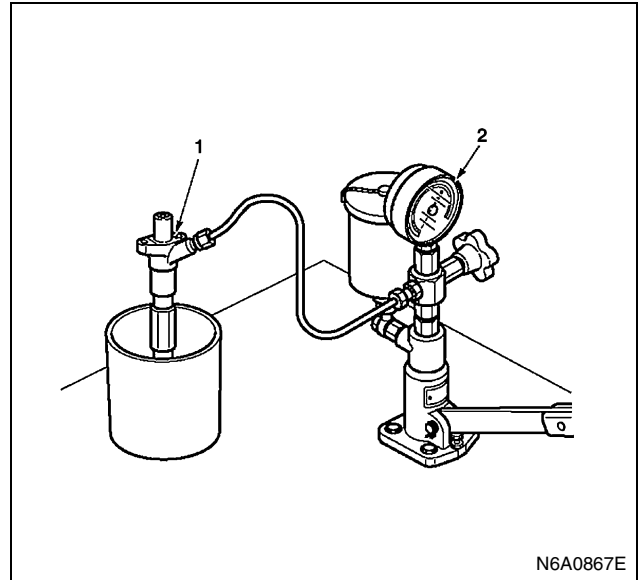
4. Set the nozzle holder (1) to the nozzle tester (2) and check first nozzle opening pressure, spray

condition, seat oil tightness and each part for oil leaks.

5. When replacing the nozzle, replace the nozzle, lift piece, pins and spacer as a set with the nozzle service kit.

Caution:

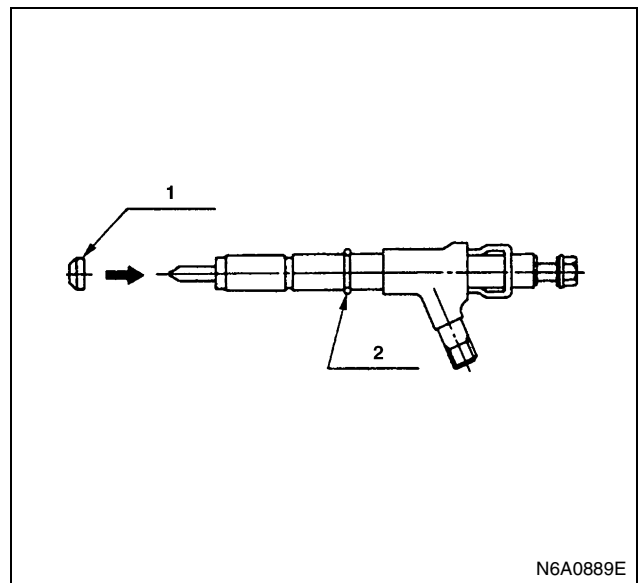
Pre-lift will not be as specified if only the nozzle is replaced.



Installation

1. Injection Nozzle Assembly

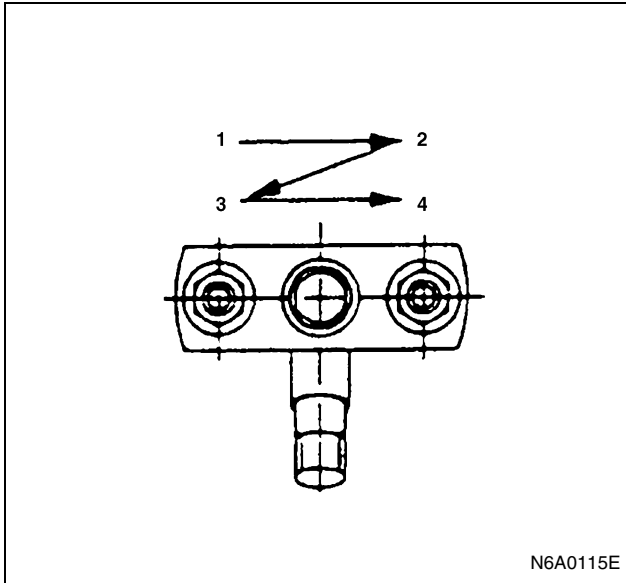
- 1) Install a new injection nozzle (1) gasket and O-ring (2) to the nozzle holder, and then install the nozzle holder to the cylinder head as shown in the illustration.



- 2) Tighten the nozzle holder flange nuts to the specified torque in the numerical order.

Tighten:

Nozzle holder flange nuts to 19 N·m (1.9 kg·m / 14 lb·ft)



2. Fuel Injection Pipe

- 1) Install the injection pipe assembly and temporarily tighten the injection pipe sleeve nuts.
- 2) Set the clips in the prescribed position shown in the illustration.

Caution:

Make absolutely sure that the clip is correctly positioned. An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.

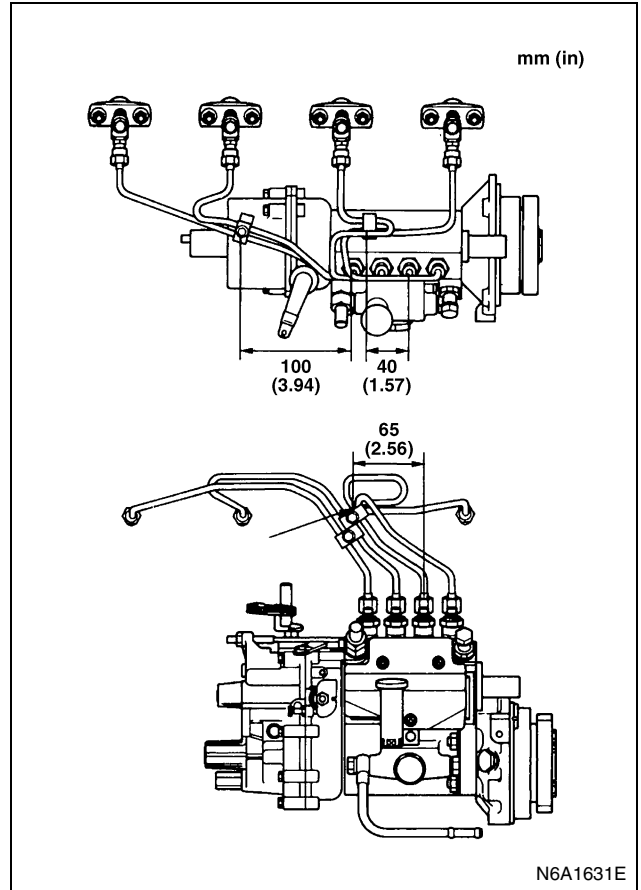
Tighten:

Clip screw to 3 N·m (0.3 kg·m / 26 lb·in)

- 3) Tighten the injection pipe sleeve nuts to the specified torque.

Tighten:

Injection pipe sleeve nut to 29 N·m (3 kg·m / 22 lb·ft)

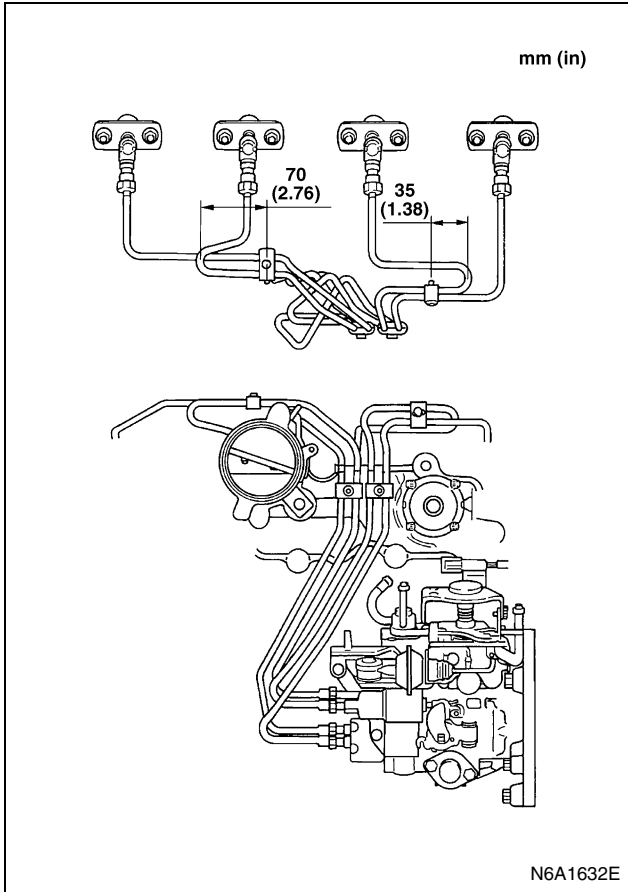


3. Fuel Injection Pipe (4HF1-2 model only)

- 1) Connect Injection Pipe and fix with clips as illustrated.

Tighten:

- Injection pipe to 29 N·m (3.0 kg·m / 22 lb·ft)
- Clip to 3 N·m (0.3 kg·m / 26 lb·in)

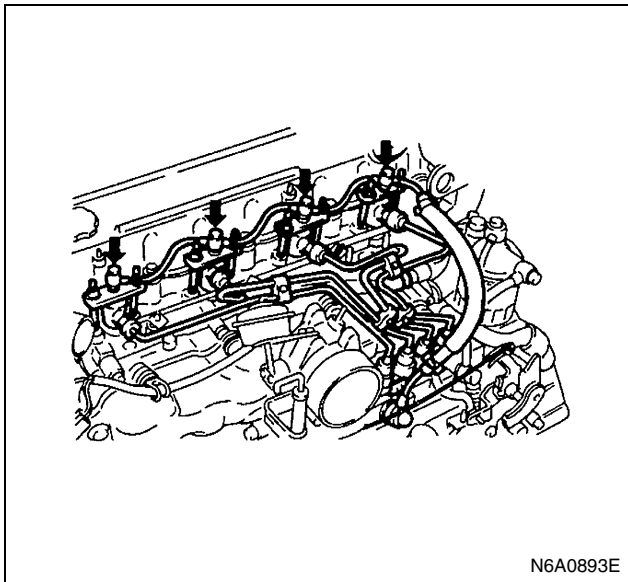


4. Leak Off Pipe

Leak-off pipe joint bolt 13 N·m (1.3 kg·m / 113 lb·in)

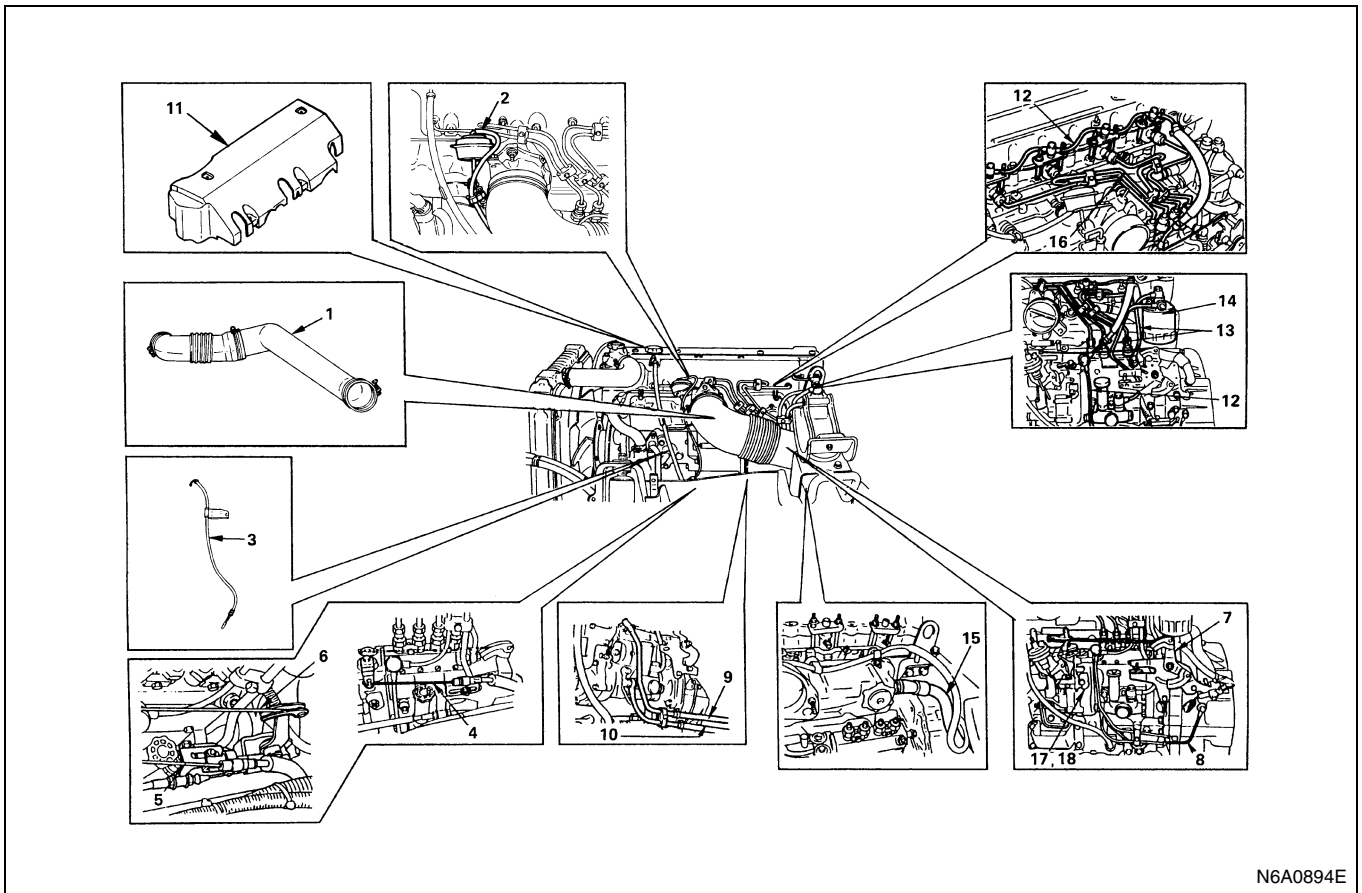
5. Nozzle Cover

- Connect battery ground cable.



INJECTION PUMP ASSEMBLY (Except 4HF1-2 model)

Component



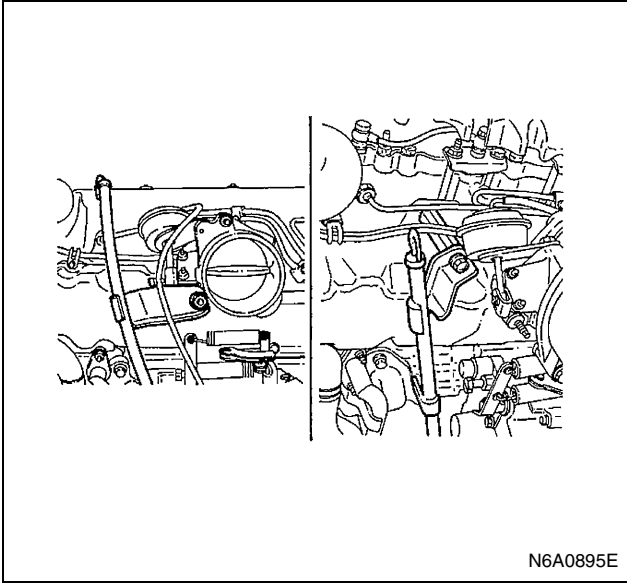
Legend

- | | |
|------------------------------|-----------------------------|
| 1. Intake air duct | 10. Fuel feed hose |
| 2. Vacuum hose | 11. Nozzle cover |
| 3. Oil level guide tube | 12. Leak off pipe |
| 4. Engine stop cable | 13. Fuel pipe |
| 5. Accelerator control cable | 14. Fuel filter assembly |
| 6. Engine control wire | 15. PCV hose |
| 7. Engine control lever | 16. Injection pipe |
| 8. Oil pipe | 17. Injection pump assembly |
| 9. Fuel return hose | 18. Injection rubber spacer |

Removal

Preparation

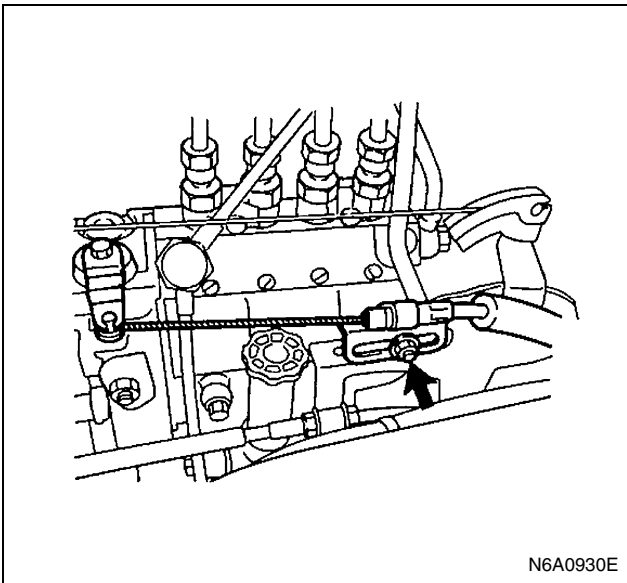
- Disconnect the battery ground cable
 - Drain coolant
1. Intake Air Duct
 2. Vacuum Hose
 3. Oil Level Guide Tube
 - Remove the guide tube fixing bolt and pull out the guide tube.



N6A0895E

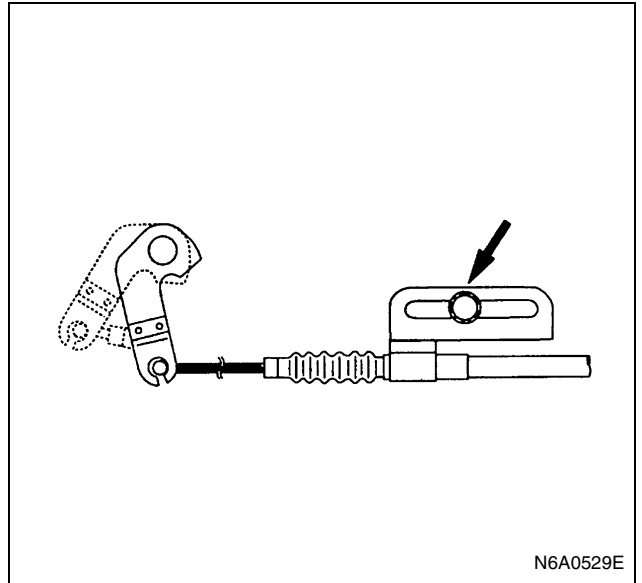
4. Engine Stop Cable

- Loosen the locking nut at bracket and disconnect engine stop cable from the injection pump stop lever.



N6A0930E

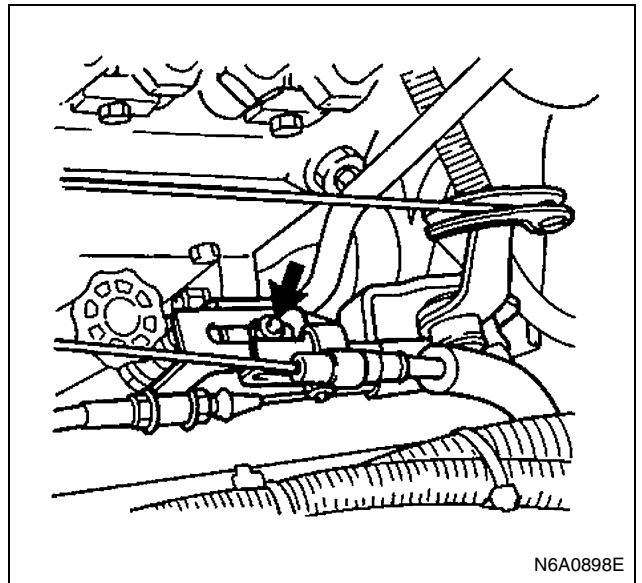
For 4HE1-TC



N6A0529E

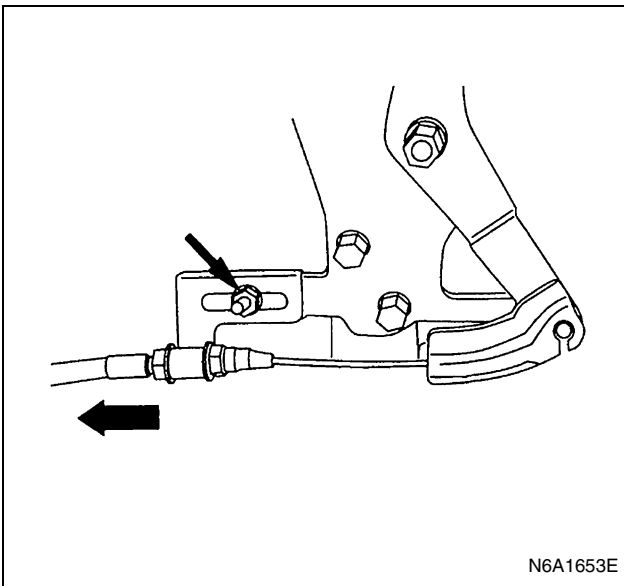
5. Accelerator Control Cable

- Loosen the locking nut at bracket and disconnect the accelerator control cable from the injection pump control lever.



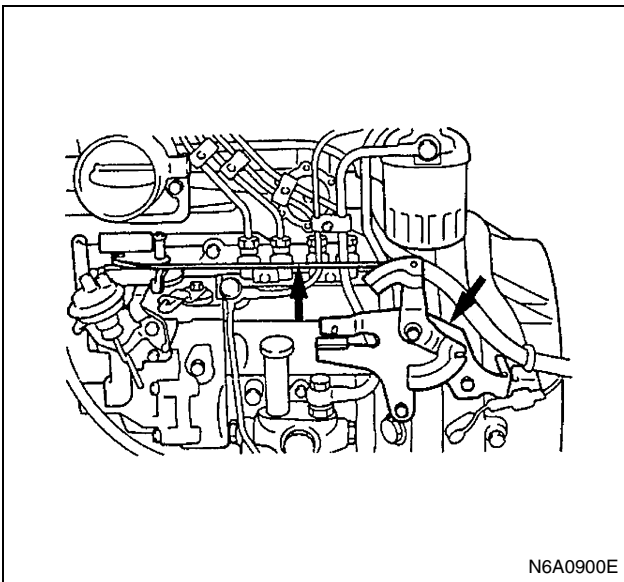
N6A0898E

For 4HE1-TC



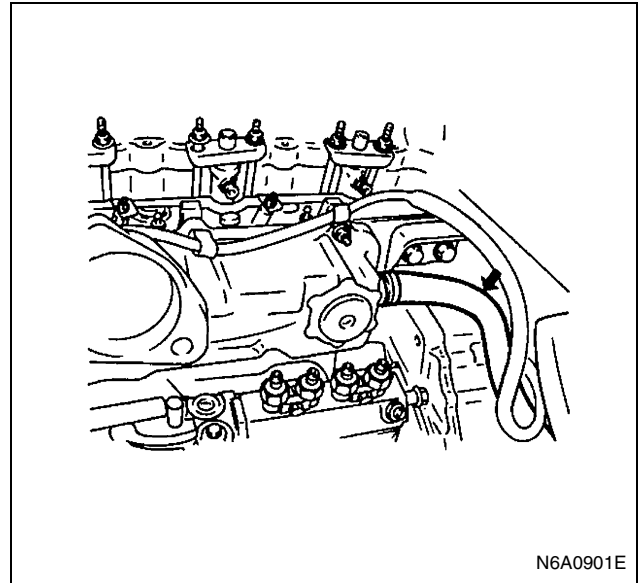
N6A1653E

6. Engine Control Wire
7. Engine Control Lever
8. Oil Pipe
9. Fuel Return Hose
10. Fuel Feed Hose
 - Disconnect fuel hose from injection pump side and take care not to spill and enter dust.
11. Nozzle Cover



N6A0900E

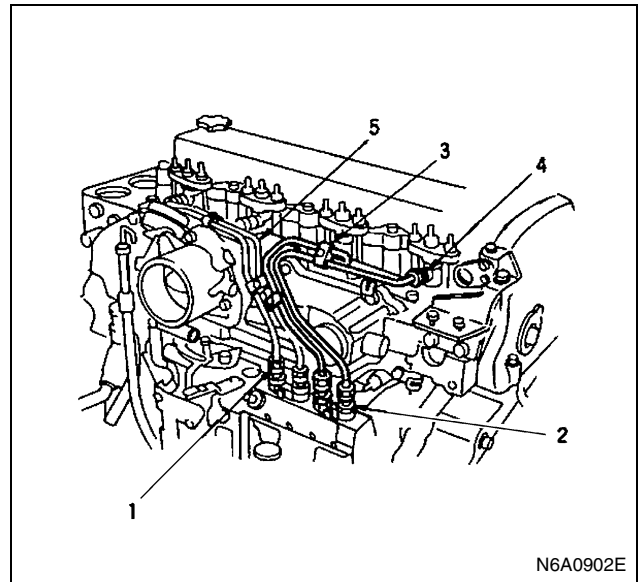
12. Leak-Off Pipe
13. Fuel Pipe
14. Fuel Filter Assembly
15. PCV Hose



N6A0901E

16. Injection Pipe

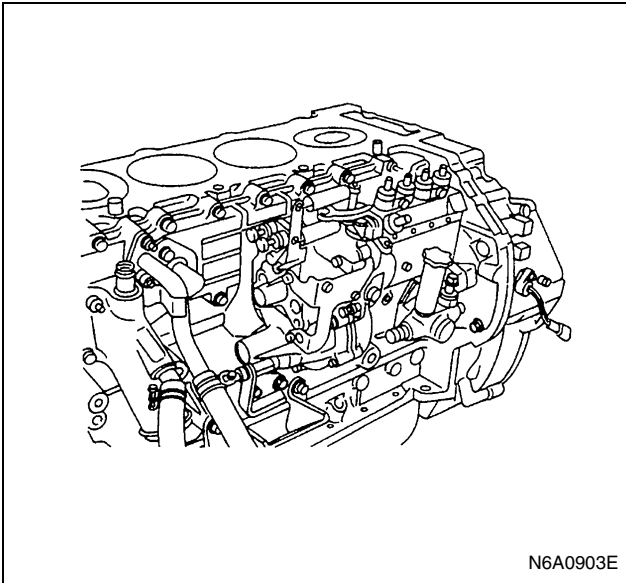
- Loosen the injection pipe sleeve nuts (1). Do not apply excessive force to the injection pipes (5).
- Loosen the injection pipes clips (3).
- Remove the injection pipe assembly. Plug the delivery valve holder (2) ports and nozzle holder (4) ports with caps to prevent the entry of foreign material.



N6A0902E

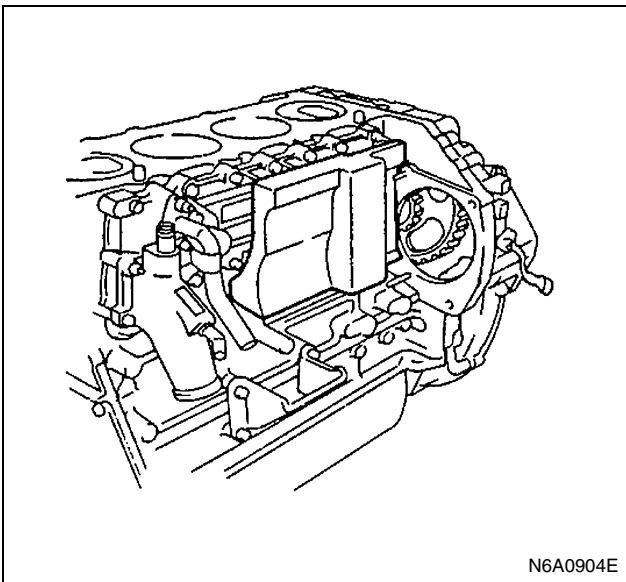
17. Injection Pump Assembly

- 1) Remove the injection pump bracket bolts and the injection pump rear bracket bolts.
- 2) Then remove the injection pump assembly.



N6A0903E

18. Injection Pump Rubber Spacer (For 4HF1/4HG1)

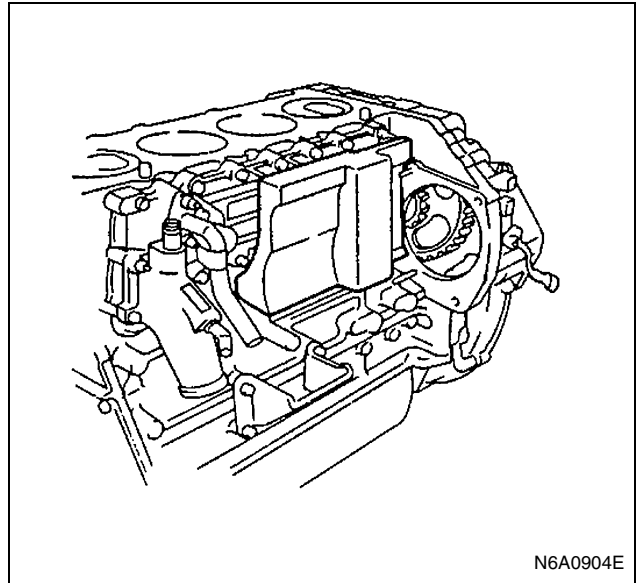


N6A0904E

Installation

1. Injection Pump Rubber Spacer

- 1) Stick the rubber spacer to the location indicated in the illustration with pressure sensitive adhesive double coated tape. (4HF1/4HG1 Engine)
- 2) 4HE1-TC (4HE1-XS) EURO-3 engines use a larger rubber spacer than other engines. However, engines destined for Hong Kong do not have a rubber spacer.



N6A0904E

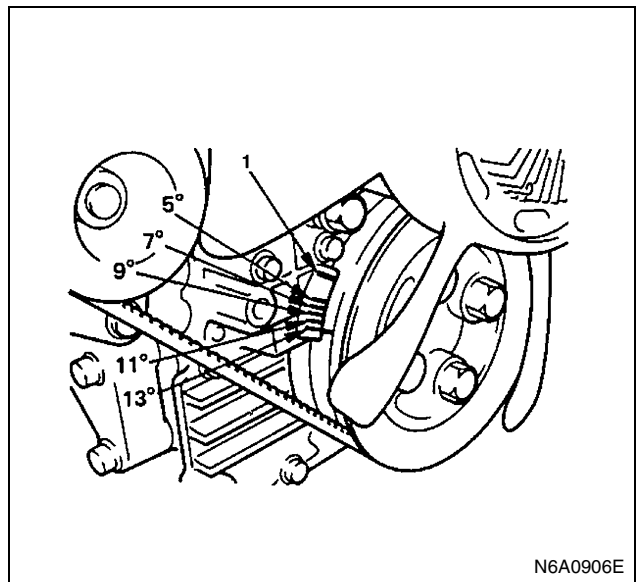
2. Injection Pump Assembly

- 1) Turn the crankshaft until the timing mark on the crankshaft damper pulley is aligned with "13°" line.
- 2) Check the No.1 cylinder intake and exhaust valve rocker arms for any play.
If the No.1 cylinder intake and exhaust valve rocker arms are depressed the No.4 piston is at on the compression stroke.
Rotate the crankshaft one full turn (360 degrees) and realign the crankshaft damper pulley timing mark with the "13°" line.

Notice:

BTDC 13° to be aligned with here is an angle at which the injection pump is installed, and has nothing to do with the injection timing.

- Remove the inspection hole plug from the cylinder body.
- Install the O-ring to the injection pump bracket.



N6A0906E

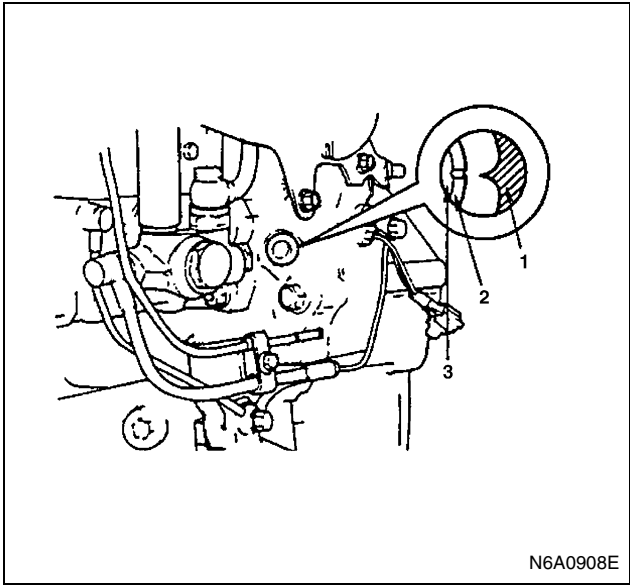
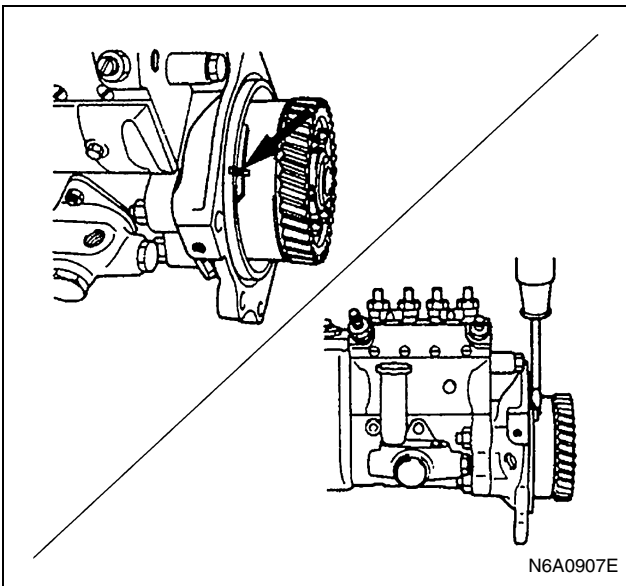
Legend

- 1. TDC

- 3) Align the injection pump bracket slit with the timer slit.
- 4) Install the injection pump assembly to the cylinder body.

Notice:

When the injection pump has a poor gear engagement while installing the assembly to the cylinder body, insert a screwdriver into the slit on the time peripheral with the pump bracket slit used as a guide, and move it up and down to get it into forcibly.



Legend

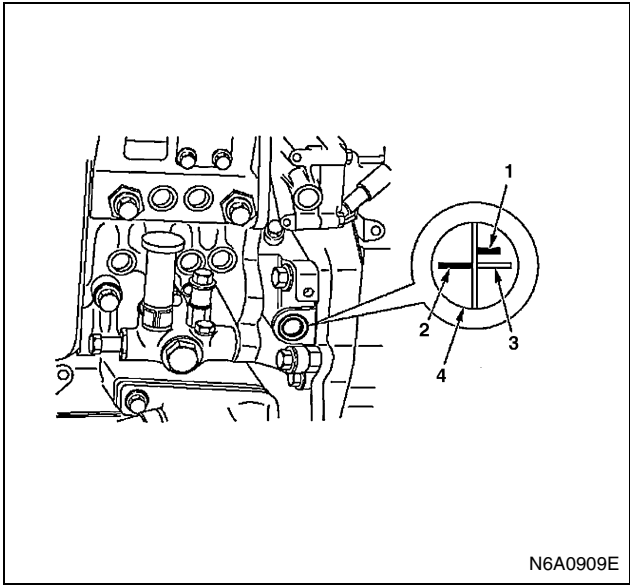
- 1. Pointer
- 2. Timer outside mark
- 3. Timing check hole

For 4HE1-TC

- 5) After installing the injection pump, the injection timing can be checked through the timing check hole provided at the injection pump bracket.

Set the No.1 cylinder to the BTDC (injection timing of engine mode) on the compression stroke. When the pointer of the timing check hole comes in line with the mark on the timer periphery of the injection pump as shown in the illustration, the injection timing is normal.

After completion of the injection timing check, tighten the check hole plug to the specified torque.



Legend

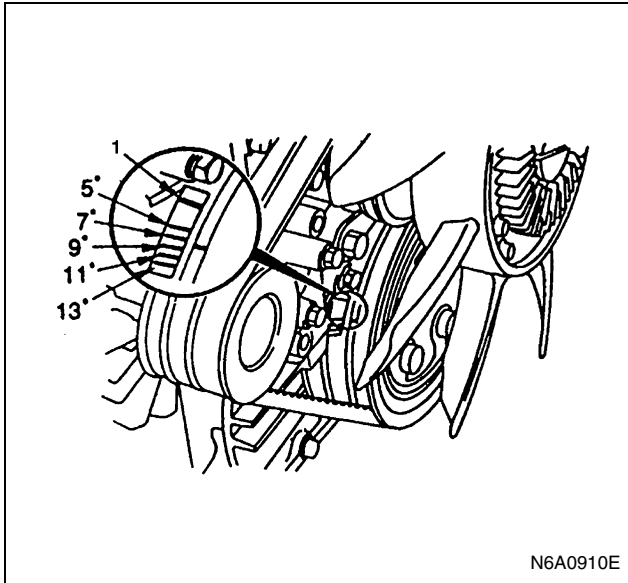
- 1. 8° mark
- 2. Pointer
- 3. 13° mark
- 4. Timing check hole

- 6) Turn the crankshaft until the timing mark on the crankshaft damper pulley is aligned with "8°" (98EPA) or "9°" (Spec EURO3) line.

Notice:

Position in its normal rotating direction. (for 4HE1-TC only)

Injection Timing	deg
4HF1: 4HE1-TC (4HE1-XS, XN)	BTDC 8
4HG1	BTDC 9
4HG1-T	BTDC 7 BTDC 9 (For Colombia)
4HE1-TC (4HE1-XS)	BTDC 9 (Spec EURO3)



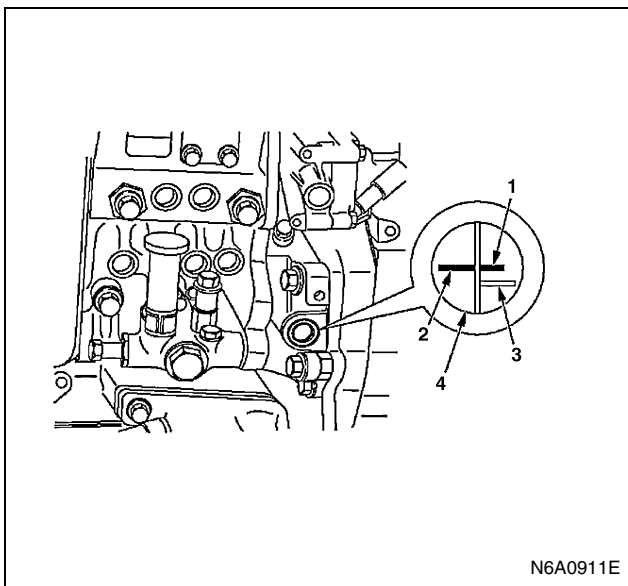
Legend

- 1. TDC

- 7) Adjust injection pump downward so that the "8°" (98EPA) or "9°" (Spec EURO3) comes to position in the timing check hole. (for 4HE1-TC only)

Notice:

Whenever the injection pump is replaced, be sure to adjust the injection timing. For the details of the adjustment, refer to the "SECTION 00 SERVICING: INJECTION TIMING INSPECTION AND ADJUSTMENT".



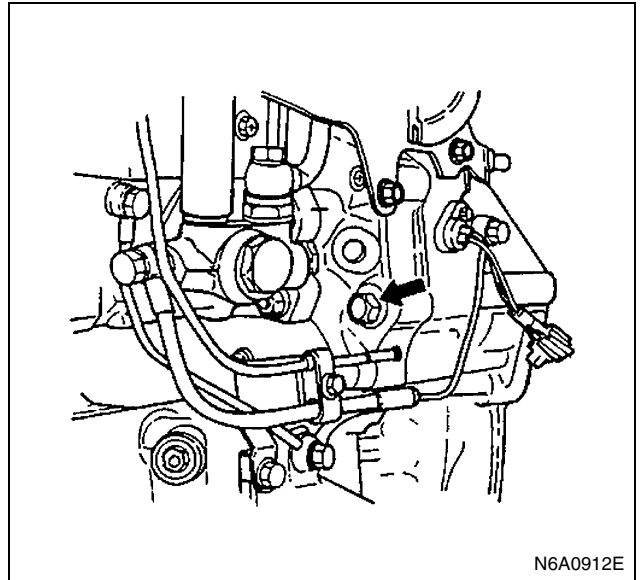
Legend

- 1. 8° mark
- 2. Pointer
- 3. 13° mark
- 4. Timing check hole

- 8) Tighten the injection pump bracket nuts and bolts to the specified torque.

Tighten:

Injection pump bracket nut and bolt to 48 N·m (4.9 kg·m / 35 lb·ft)



- 9) Install the injection pump rear bracket.

Tighten:

Injection pump rear bracket bolt to 48 N·m (4.9 kg·m / 35 lb·ft)

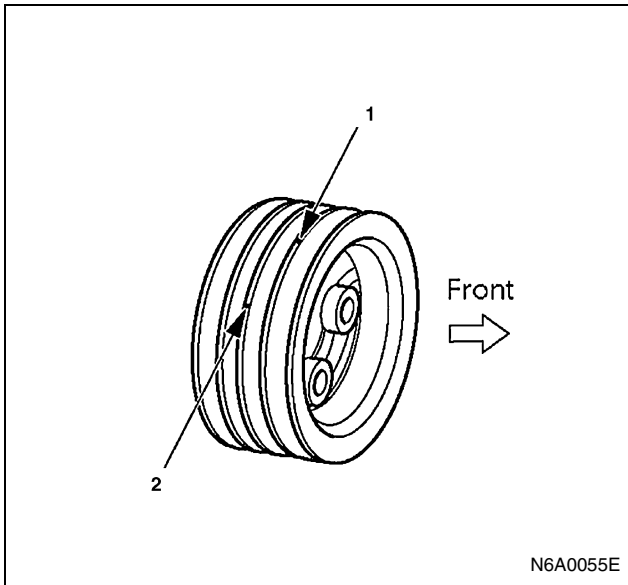
- 10) Install the inspection hole plug.

Tighten:

Inspection hole plug to 48 N·m (4.9 kg·m / 35 lb·ft)

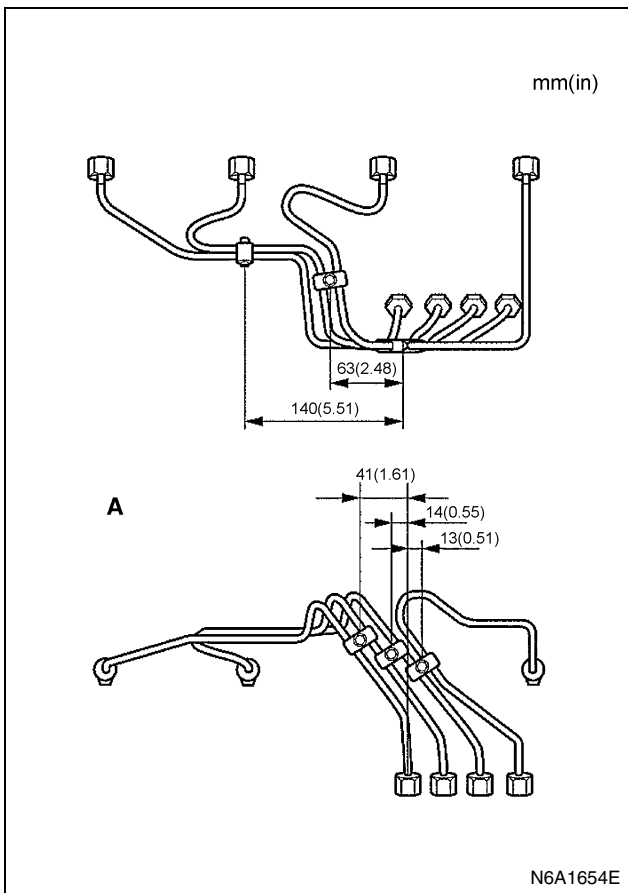
Notice:

In case the crank pulley has two marks as illustrated, (1) BTDC 49° mark on the second crest and (2) TDC mark on the third crest (as viewed from the front side), be sure to set at the mark (2). (If there are two different marks on one and same crest, set at the mark which comes second when rotated in the normal direction.) The mark (1) is used when installing the injection pump for 4HF1-2.



3. Fuel Injection Pipe

- 1) Install the injection pipe assembly and temporarily tighten the injection pipe sleeve nuts.
- 2) Set the clips in the prescribed position shown in the illustration.



Legend

A. 4HG1-T

An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.

Tighten:

Clip screw to 3 N·m (0.3 kg·m / 26 lb·in)

- 3) Tighten the injection pipe sleeve nuts to the specified torque.

Tighten:

Injection pipe sleeve nut to 29 N·m (3 kg·m / 22 lb·ft)

4. PCV Hose
5. Fuel Filter

Tighten:

Fuel filter bracket bolt to 34 N·m (3.5 kg·m / 25 lb·ft)

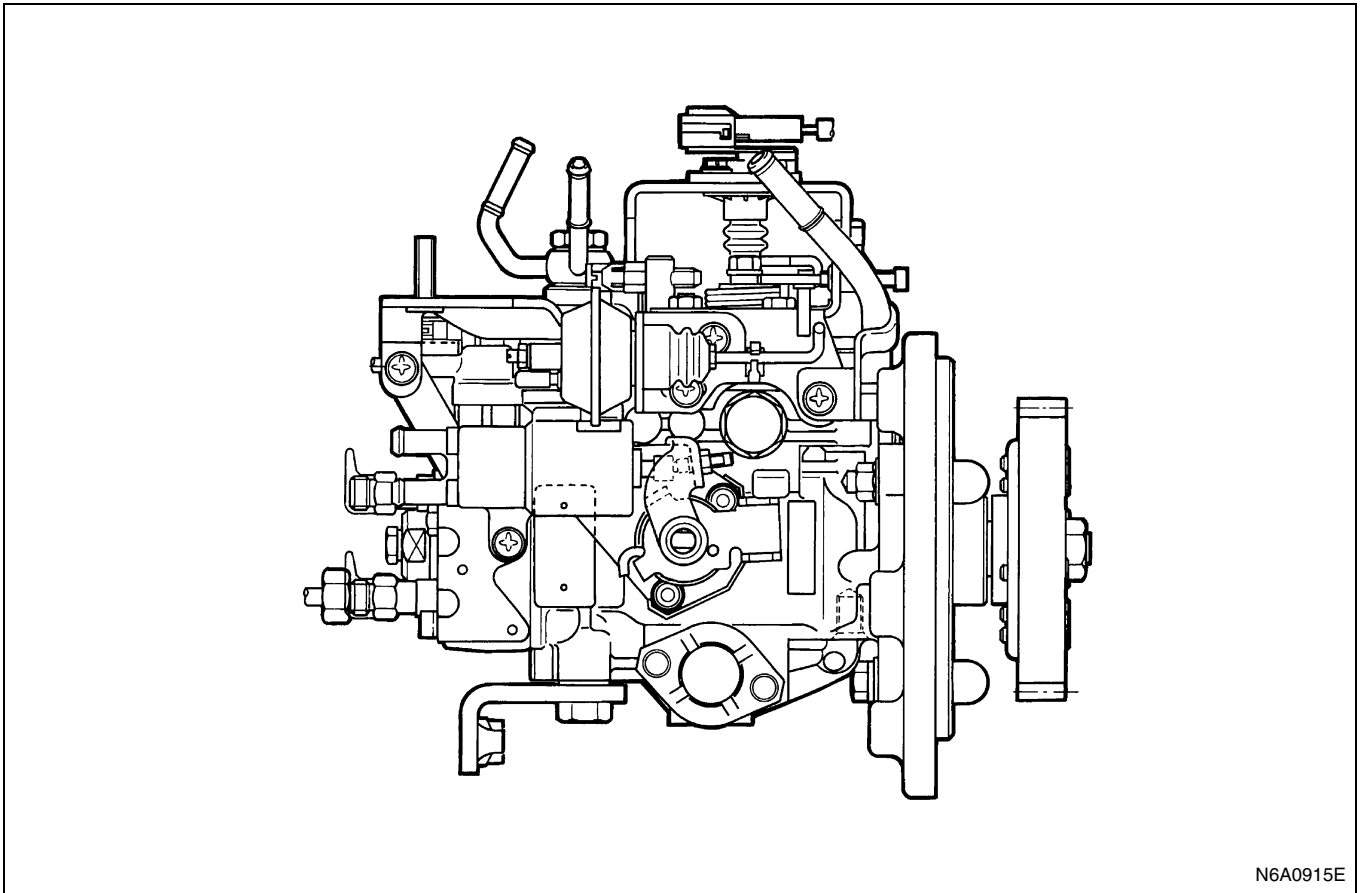
6. Fuel Pipe
7. Leak Off Pipe
8. Nozzle Cover
9. Fuel Feed Hose
10. Fuel Return Hose
11. Oil Pipe
12. Engine Control Lever
13. Engine Control Wire
14. Accelerator Control Cable
15. Engine Stop Cable
16. Oil Level Guide Tube
17. Vacuum Hose
18. Intake Air Duct

Caution:

Make absolutely sure that the clip is correctly positioned.

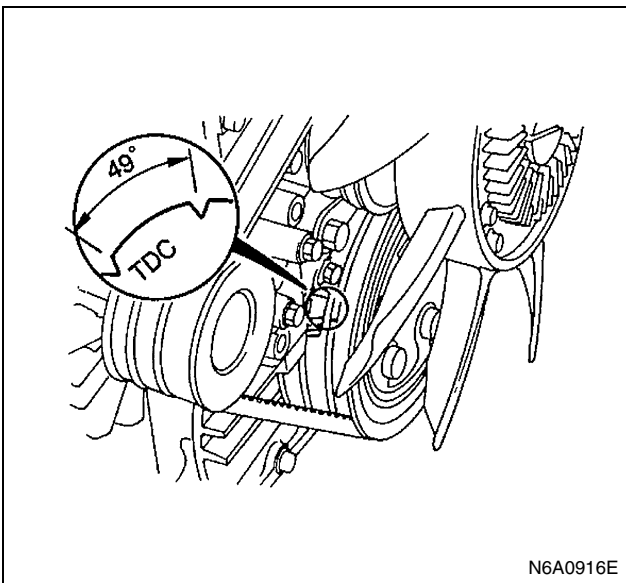
INJECTION PUMP ASSEMBLY (4HF1-2 model only)

Component

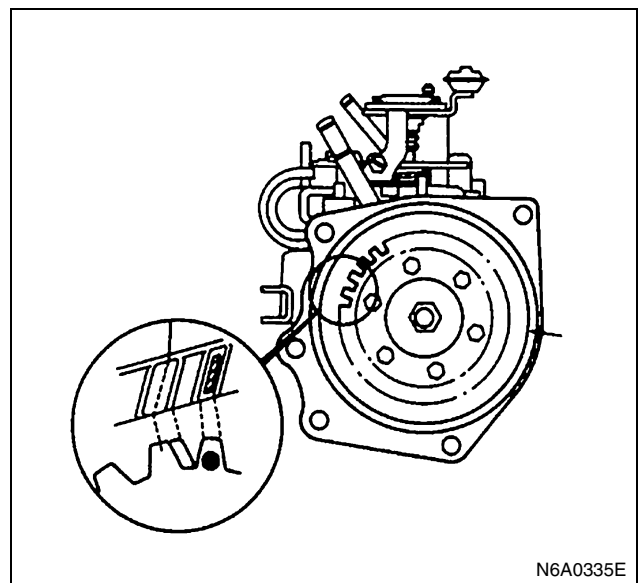


Installation

1. Turn the crankshaft to set No. 1 cylinder to 49° before TDC in its compression stroke. (49° is a pump assembling angle, not related to injection timing.)
4. Align the pump bracket mark with the tooth (under side of the pump) just before the • (Z) marked tooth.
5. Insert the pump using the block side of stud bolt as a guide.

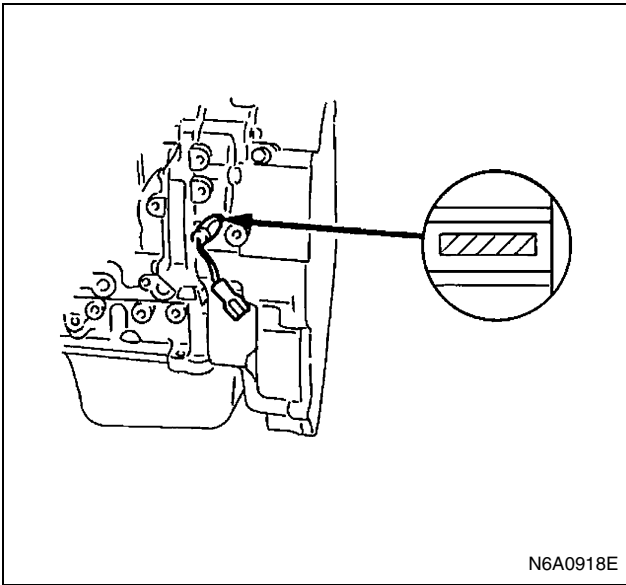


2. Install O-ring to the injection pump.
3. Apply paint on the • (Z) marked side of the injection pump gear.



6. After installing the injection pump, remove the tachometer sensor from the housing, and make sure

that the painted gear is at the center of the sensor mounting hole.



7. Tighten injection pump clamping bolt and nut to specified torque:

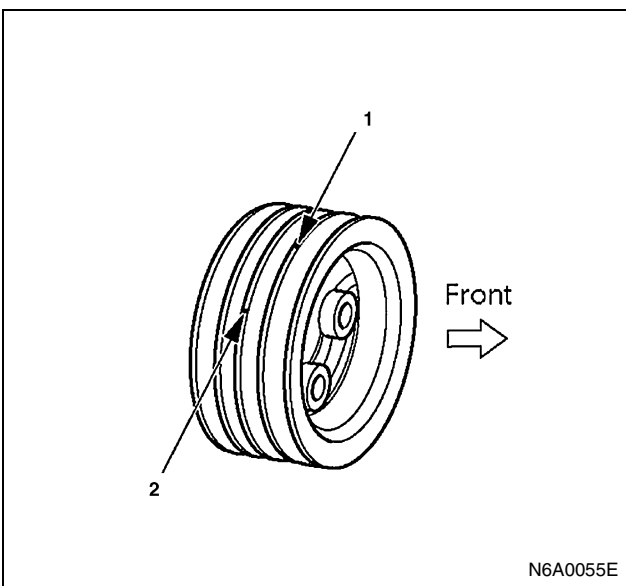
Tighten:

- Bolt to 48 N·m (4.9 kg·m / 35 lb·ft)
- Nut to 24 N·m (2.4 kg·m / 17 lb·ft)

8. With reference to Injection Timing Check & Adjustment, set No. 1 Cylinder to 12° before its TDC.

Notice:

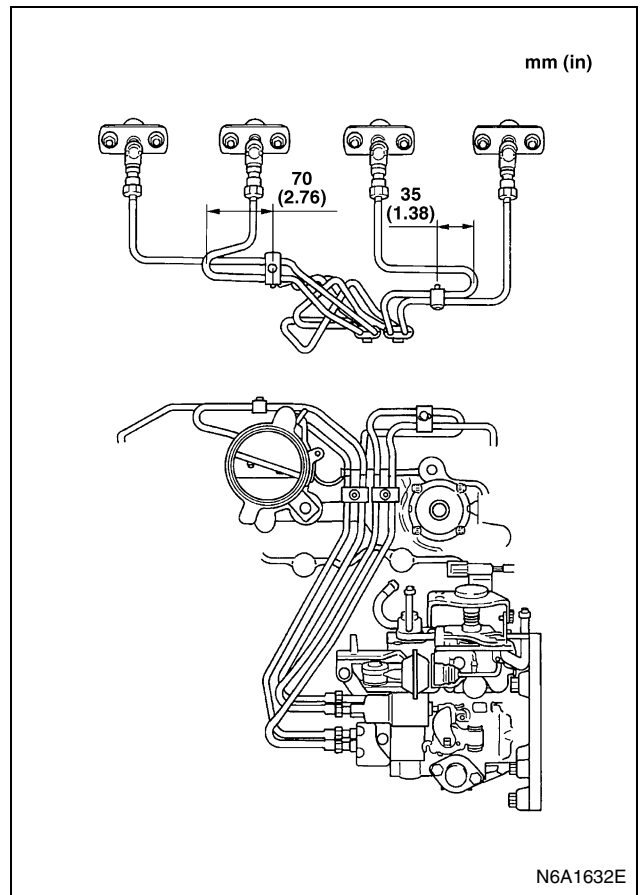
In case the crank pulley has two marks as illustrated, (1) BTDC 49° mark on the second crest and TDC mark on the third crest (as viewed from the front side), be sure to set at the mark (2). (If there are two different marks on one and same crest, set at the mark which comes second when rotated in the normal direction.)



9. Injection Pipe (4HF1-2 model only)
1) Connect Injection Pipe and fix with clips as illustrated.

Tighten:

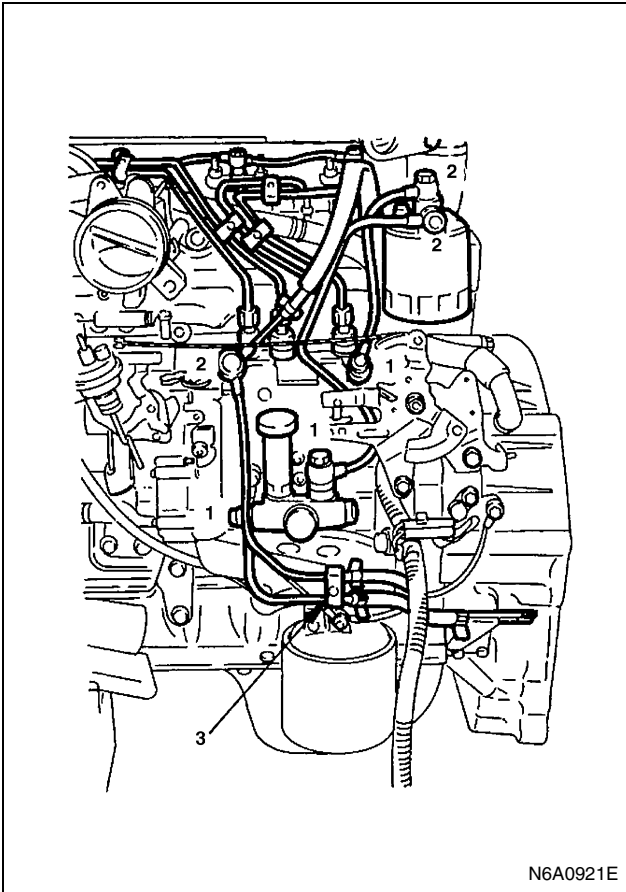
- Injection pipe to 29 N·m (3.0 kg·m / 22 lb·ft)
- Clip to 3 N·m (0.3 kg·m / 26 lb·in)



10. Fuel Pipe
Do not apply excessive force to the fuel pipe.

Tighten:

- Fuel pipe joint bolt (1) to 41 N·m (4.2 kg·m / 30 lb·ft)
- Fuel pipe joint bolt (2) to 23 N·m (2.3 kg·m / 17 lb·ft)
- Clip screw to 4 N·m (0.4 kg·m / 35 lb·in)



N6A0921E

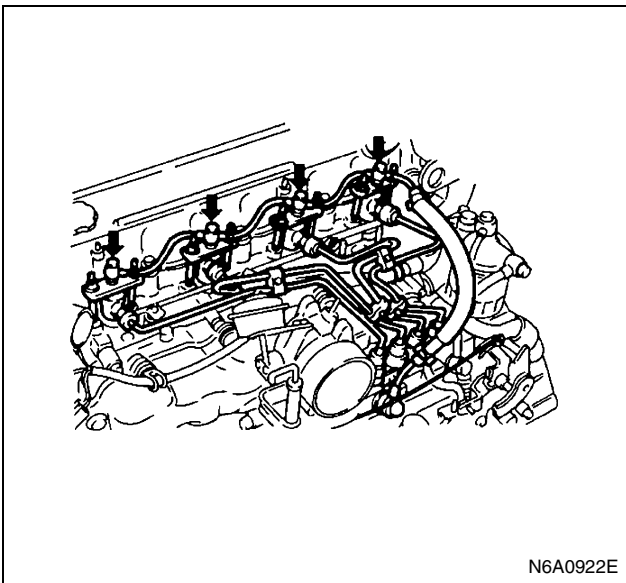
Legend

- 1. Fuel pipe joint bolt
- 2. Fuel pipe joint bolt
- 3. Clip

11. Leak Off Pipe

Tighten:

Leak-off pipe joint bolt to 13 N·m (1.3 kg·m / 9.6 lb·ft)



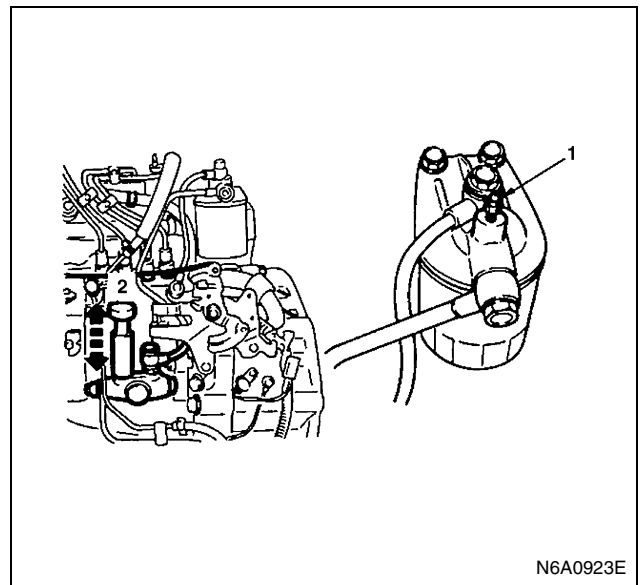
N6A0922E

- 12. Nozzle Cover
- 13. Fuel Feed Hose

14. Fuel Return Hose

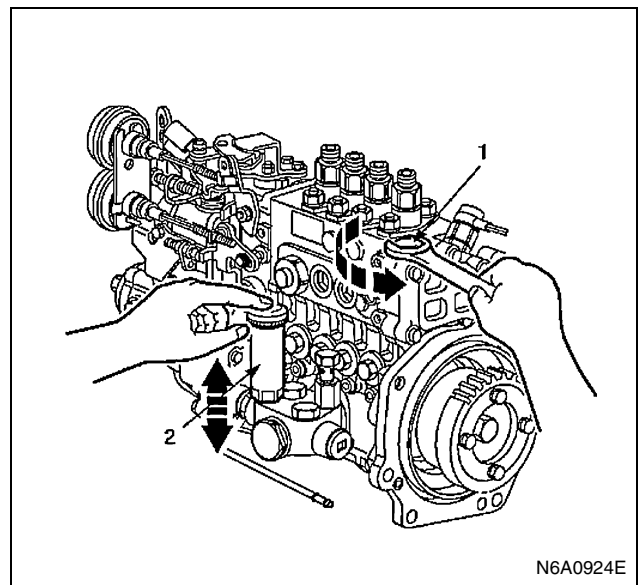
15. Air Bleeding

- 1) Loosen the priming pump cap (2) at the side of the injection pump.
- 2) Loosen the bleeder valve (1) at the top of the fuel filter.
- 3) Operate the priming pump to bleed the air from the injection pump.
- 4) Retighten the bleeder valve (1).
- 5) Operate the priming pump.
Check for fuel leakage from around the injection pump and the fuel filter.
- 6) Lock the priming pump cap (2) to the injection pump.



N6A0923E

For 4HE1-TC

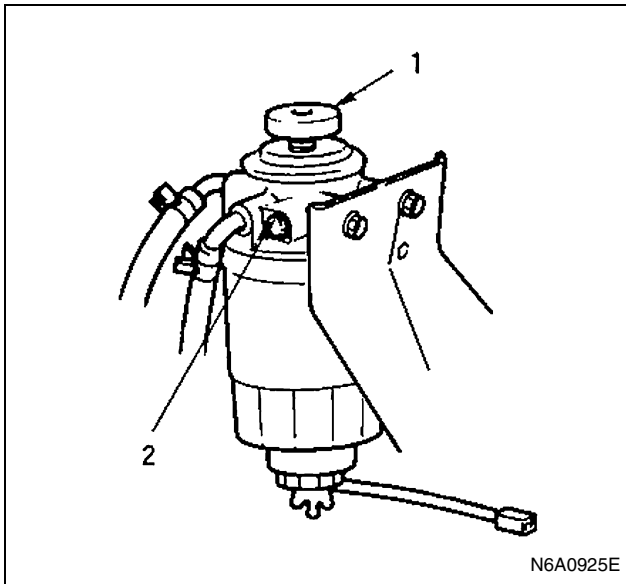


N6A0924E

16. Air Bleeding (4HF1-2 model only)

- 1) Actuate the priming pump (1) to send the air in the fuel system to the injection pump.

- 2) Loosen the sedimenter air bleeding plug (2) and operate the priming pump until no bubbles appear.

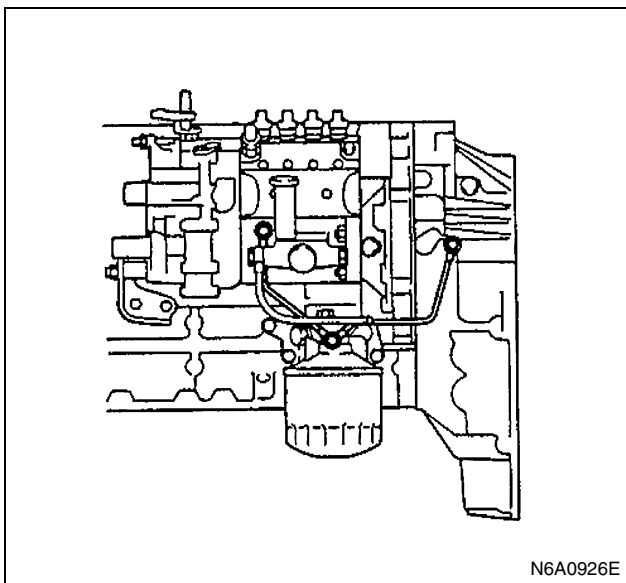


- 3) Tighten the air bleeding plug completely.
- 4) Try to start the engine. If the engine is not started within 10 seconds, air bleeding should be conducted once again.
- 5) Check that there is not fuel leak, and then tighten the priming pump completely.

17. Oil Pipe

Tighten:

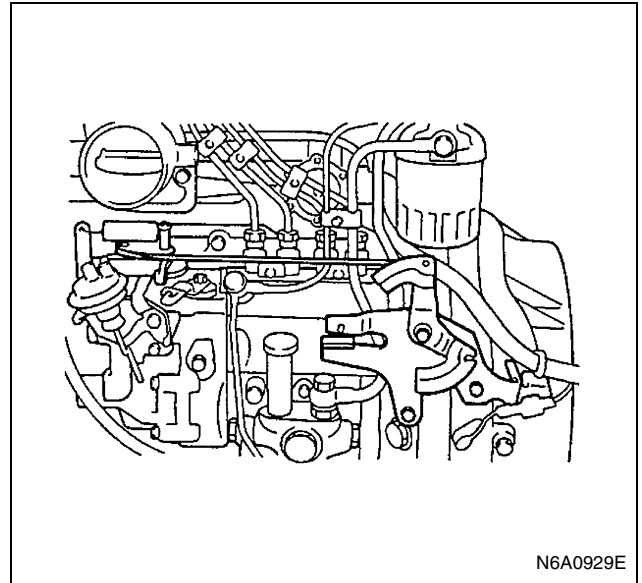
Oil pipe joint bolt to 17 N·m (1.7 kg·m / 12 lb·ft)



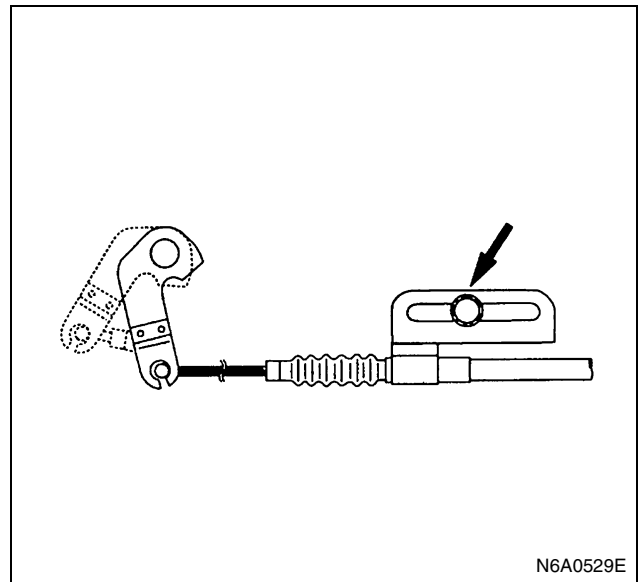
18. Engine Control Lever Assembly

Tighten:

Engine control lever bolt to 24 N·m (2.4 kg·m / 17 lb·ft)



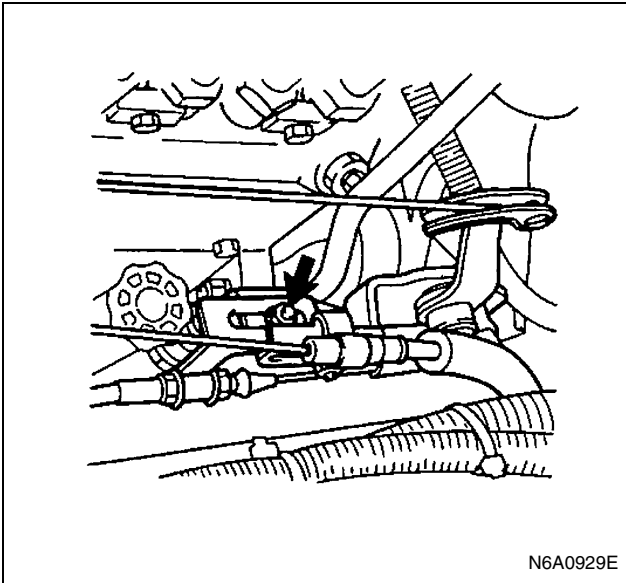
For 4HE1-TC



19. Engine Control Wire

20. Accelerator Control Cable

- 1) Check to see if the idling control knob is turned to the extreme left.
- 2) Attach the tip end of the cable to the engine control lever.
- 3) Pull the outer cable toward the front side of the vehicle, and provide the engine control wire and the inner cable with an appropriate play before fastening the clamp with a nut.

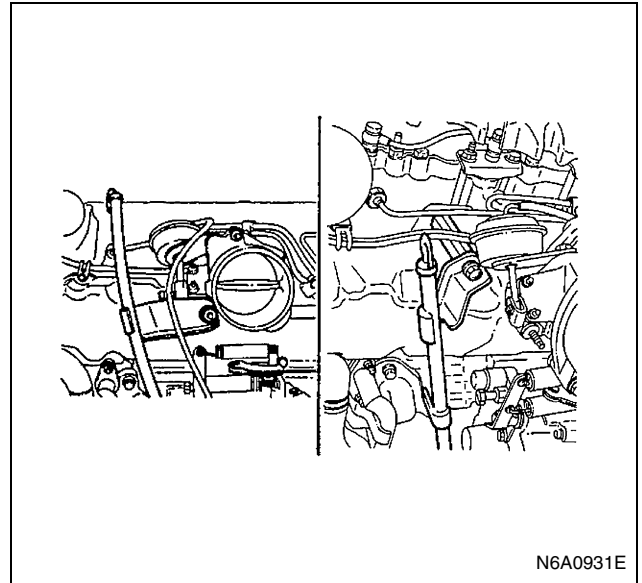


N6A0929E

- 4) Check to see if the injection pump control lever is at the idling position (with the lever in touch with the stopper bolt).

21. Engine Stop Cable

- 1) Attach the end tip of the cable to the engine stop lever.
- 2) Pull the cable toward the rear side of the vehicle, and fasten the clamp with a nut at the position where the lever stops.

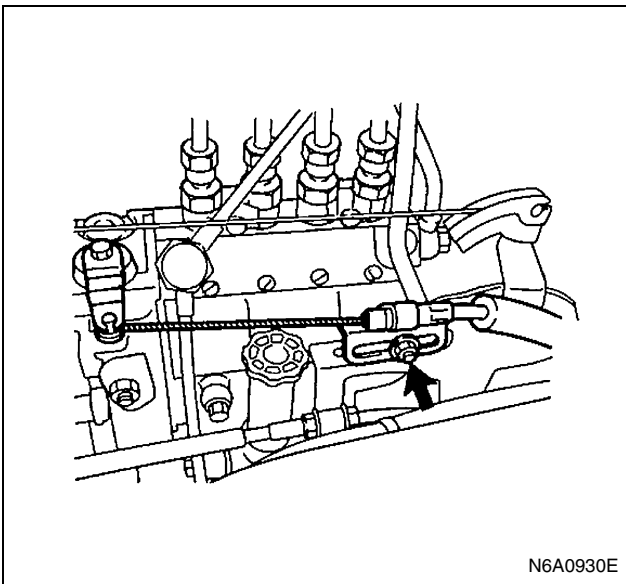


N6A0931E

23. Vacuum Hose

24. Intake Air Duct

- Pour coolant into radiator.
- Connect battery ground cable.
- Start engine and check for oil and fuel leakage carefully.



N6A0930E

22. Oil Level Gauge Guide Tube

- 1) Install the O-rings to the guide tube lower portion and insert the guide tube completely to the cylinder body.
- 2) Tighten the guide tube bolt to the specified torque.

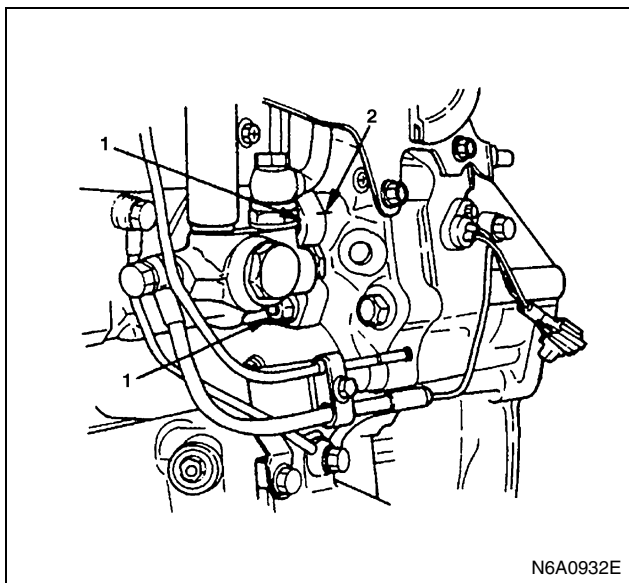
Tighten:

Guide tube bolt to 13 N·m (1.3 kg·m / 9.6 lb·ft)

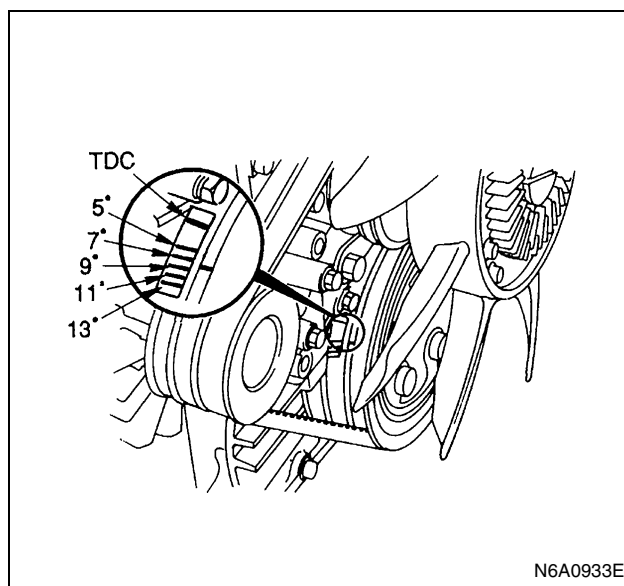
INJECTION TIMING ADJUSTMENT

Injection Pump Notched Line Inspection

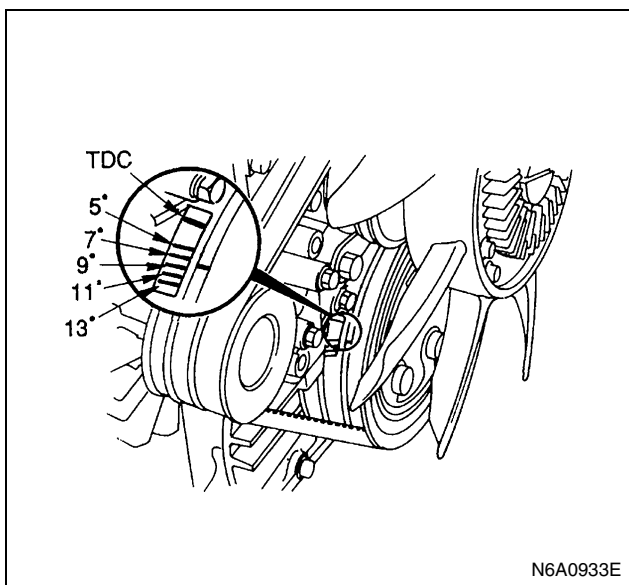
1. Check the injection pump bracket nuts (1) for looseness.
Tighten as required.
2. Check that the notched lines (2) on the injection pump bracket and the timing gear case are aligned.
If the notched lines are not aligned, the injection timing must be checked.



Injection Timing		deg
4HF1 4HE1-TC (4HE1-XS)	BTDC 8	
4HG1	BTDC 9	
4HG1-T	BTDC 7 BTDC 9 (For Colombia)	
4HE1-TC (4HE1-XS)	BTDC 9 (Spec EURO3)	



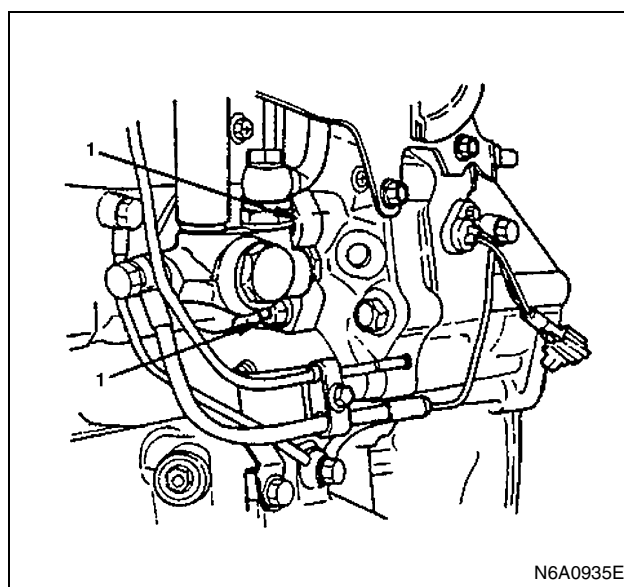
3. Same time, check injection timing on the crank damper pulley. If the injection timing aligned with incorrect, the injection timing must be readjusted.



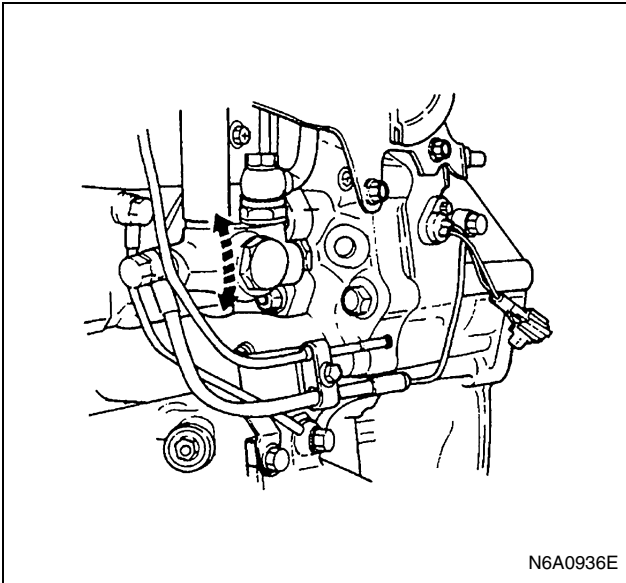
Injection Timing Adjustment (Except 4HF1-2 model)

1. Turn the crankshaft until the timing mark on the crankshaft damper pulley is aligned with the injection timing of each engine mode mark in the illustration.

2. Remove the two foam rubbers.
3. Loosen the four injection pump fixing nuts (1).
This will allow the pump to pivot.
Do not bend or scratch the fuel pipe.



4. Align the notched line between the injection pump bracket and the timing gear case.
Make sure that the timing mark on the crank damper pulley is aligned with correct injection timing.



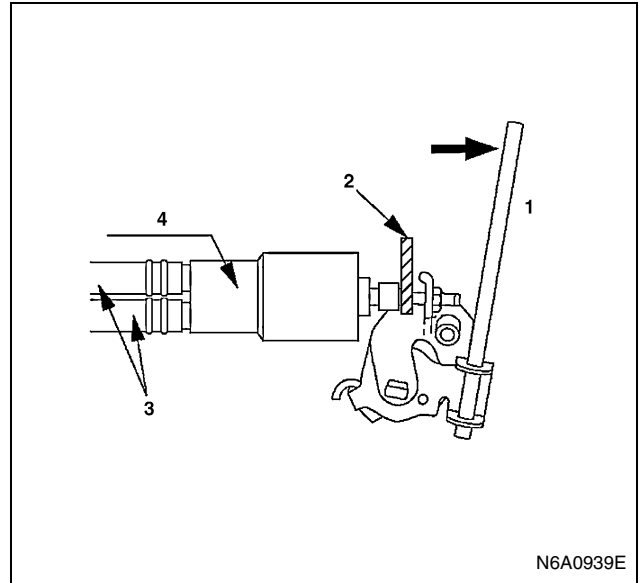
5. Tighten the injection pump fixing nuts (1) to the specified torque.

Tighten:

Injection pump fixing nut to 25 N·m (2.6 kg·m / 19 lb·ft)

Notice:

If there are two marks on the crank pulley, the front side of mark is for setting BTDC 49° and the rear side of mark is for setting TDC.



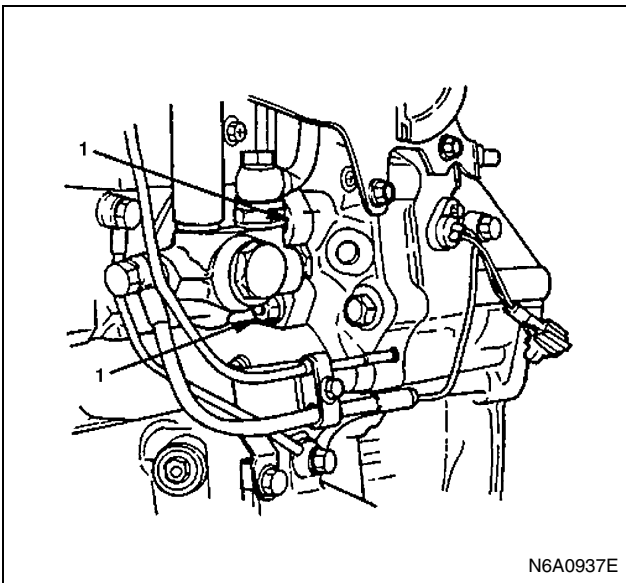
Legend

- 1. Lever
- 2. Spacer
- 3. Water hose
- 4. Wax CSD

4. Remove the pump rear plug, connect a dial gage and set the lift at 1 mm (0.039 in).

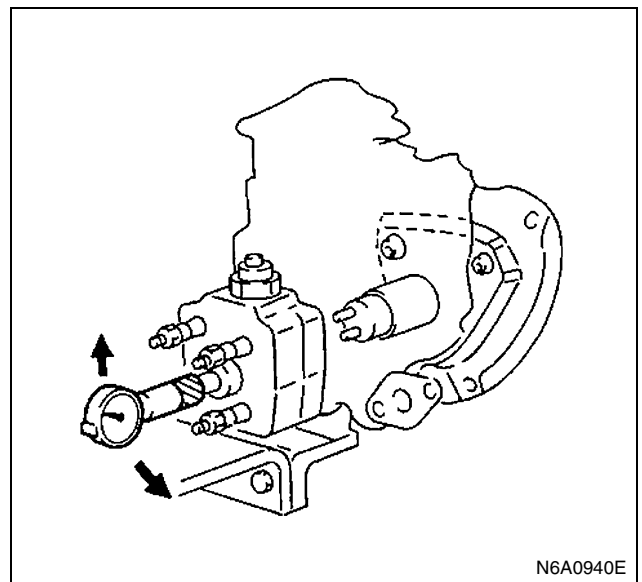
Special Tool

Measuring device: 5-9940-0145-0

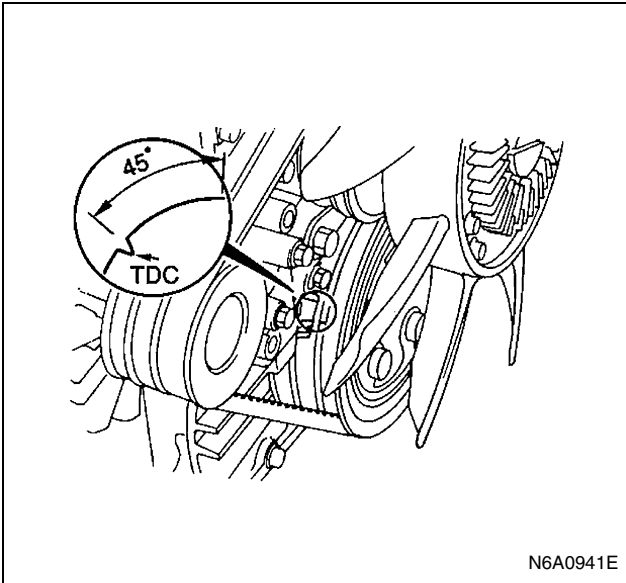


Injection Timing Check (4HF1-2 model only)

1. Set No. 1 Cylinder to the TDC in the compression stroke.
2. Disconnect Injection Pipe.
3. Put down Wax CSD lever, insert a spacer 10 — 12 mm (0.39 — 0.47 in) thick between the plunger and adjust bolt, and cancel the Wax CSD.



5. Set the crankshaft damper pulley TDC mark to the pointer or 45° before TDC.

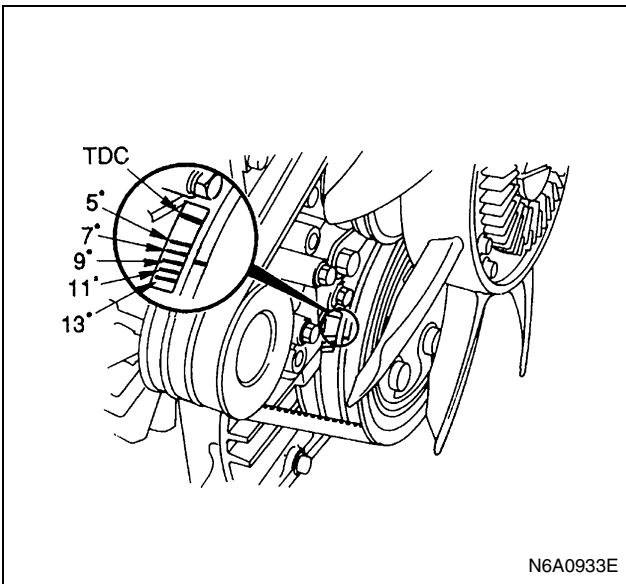


6. Set the dial gage to the "0" position.
7. Turn the crankshaft leftwise and rightwise a little and make sure that the needle stays in the "0" position.
8. Turn the crankshaft in the normal direction and read the measuring device's indication at the 12° before TDC position.

Notice:

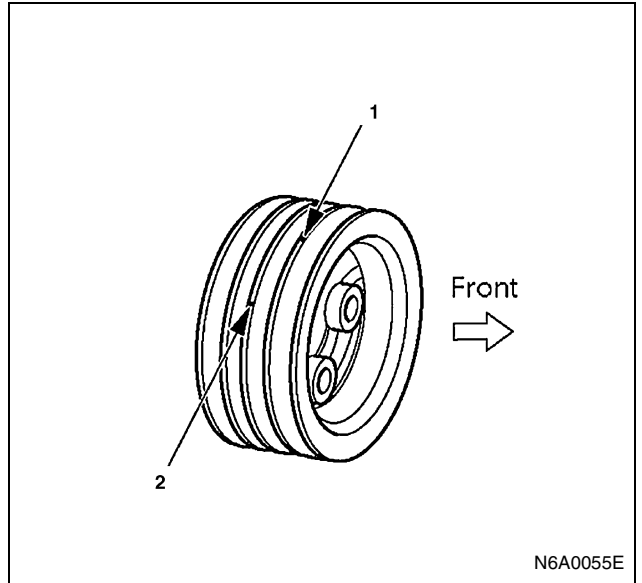
As there is no 12° mark, set midway between the 11° and 13° marks.

Standard value: 0.5 mm (0.0197 in)



Notice:

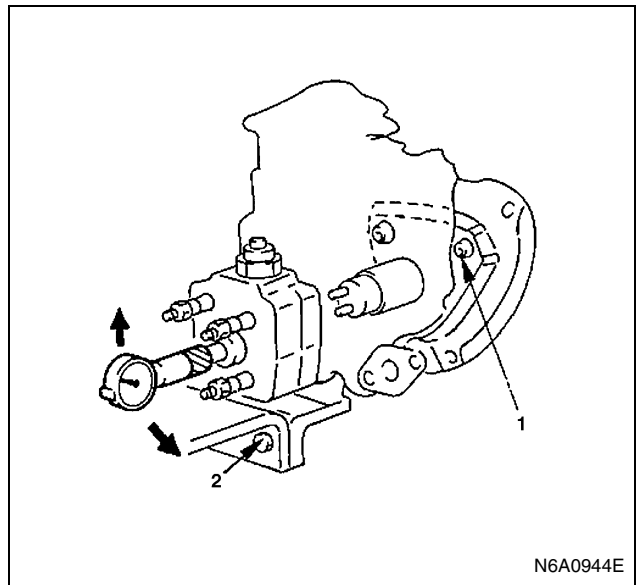
In case the crank pulley has two marks as illustrated, (1) BTDC 49° mark on the second crest and (2) TDC mark on the third crest (as viewed from the front side), be sure to set at the mark (2). (If there are two different marks on one and same crest, set at the mark which comes second when rotated in the normal direction.) The mark (1) is used when installing the injection pump for 4HF1-2.



Injection Timing Adjustment (4HF1-2 model only)

If injection timing is out of the specified range, follow the following procedure for adjustment:

1. Loosen injection pump fixing nuts (1) and bracket bolt (2).



2. Adjust the mounting angle of injection pump:
 - If injection timing is too fast, bring the injection pump closer to the engine.
 - If injection timing is too slow, put the injection pump more distant from the engine.
3. When the dial gage has indicated the specified value, tighten the fixing nuts and bolt to specified torque.

Tighten:

- Nut to 24 N·m (2.4 kg·m / 17 lb·ft)
- Bolt to 48 N·m (4.9 kg·m / 35 lb·ft)

4. Disconnect the dial gage, install and tighten the plug to specified torque. (Make sure of a cover washer being attached to the plug)

Tighten:

Plug to 17 N·m (1.7 kg·m / 12 lb·ft)

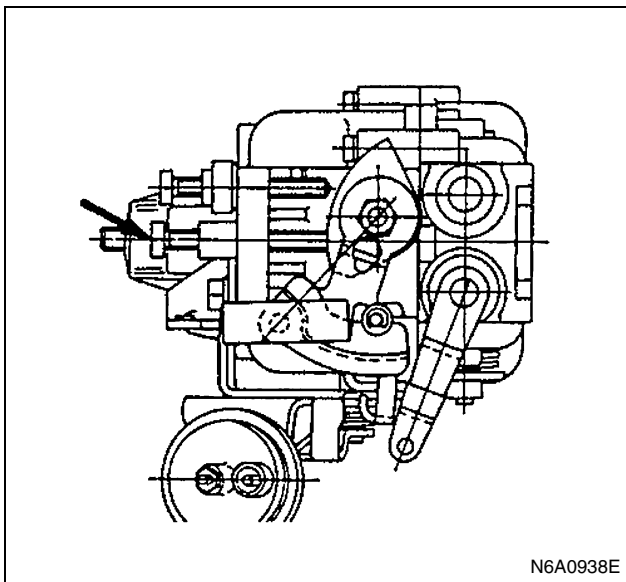
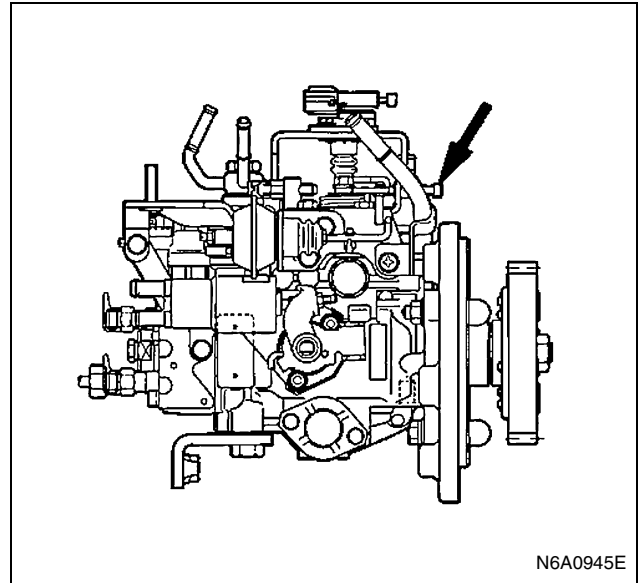
5. Release the wax CSD and connect the injection pipe.

Tighten:

Pipe sleeve nut to 29 N·m (3.0 kg·m / 22 lb·ft)

Idling Speed Adjustment (Except 4HF1-2 model)

1. Idling Rotation Check
 - 1) Idle the engine.
 - 2) Measure the number of the idling rotations with a tachometer.
 - 3) When the number of the idling rotations is outside the specified value, adjust it with the idling adjust bolt (arrow-marked).



Number of idling rotations:

550 — 600 rpm

(4HE1-TC)

775 — 825 rpm

Idling Speed Check & Adjustment (4HF1-2 model only)

1. Warm up the engine.
2. Measure idling speed by means of tachometer.
3. If idling speed is out of the standard, adjust with an idling adjust bolt (indicated by arrow mark).
Idling speed: 575 — 625 rpm

Injection Volume and Governor Performance Diagram

Identification Numbers : 101401-7070/101401-7060

[4HF1 Engine]

Pre-stroke : No. 1 plunger 4.1±0.05 mm (0.1614±0.0020 in)

Injection order : 1 — 3 — 4 — 2 (interval 90°±30') Plungers are numbered from the Governor side

Tapet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.

: Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

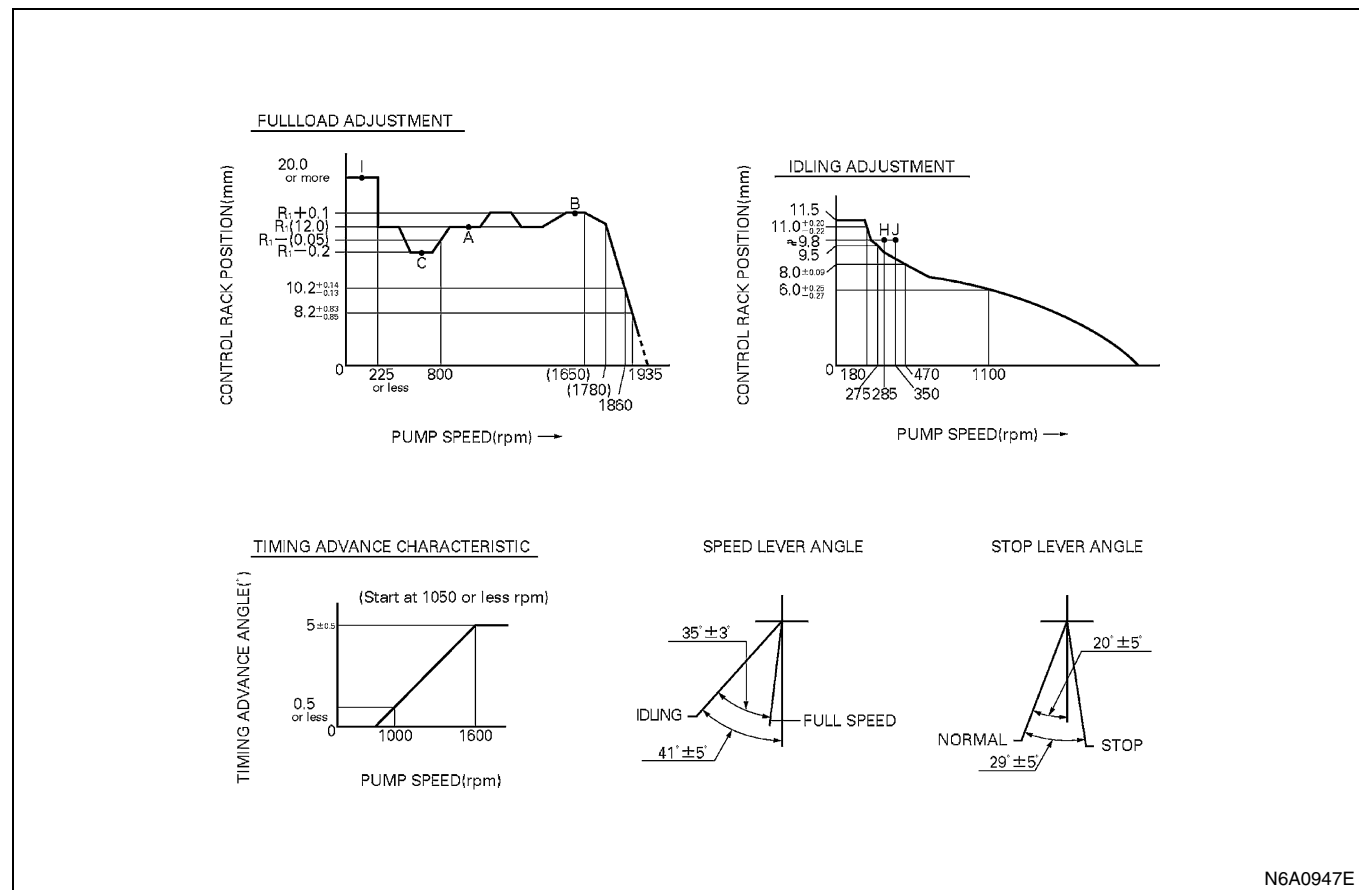
Injection Volume

Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/1000 strokes)	Variance (%)	Remarks
	960	61±1.6	±4	Basic
H	285	16±1.3	±10.0	
A	960	61±1	—	Basic
B	1,600	(62)±2	—	
C	500	(60.5)±2	—	
I	150	(82) ⁺¹⁶ ₋₀	—	

Timing Advance Specification

Pump Speed (r.p.m.)	1,050 or less	1,000	1,600 or more
Degree for Angle of Lead (deg.)	Start	0.5 or less	Finish 5±0.5

Governor Adjustment



N6A0947E

Injection Volume and Governor Performance Diagram

Identification Numbers : 101401-7090

[4HF1 Engine]

Pre-stroke : No. 1 plunger 4.1 ± 0.05 mm (0.1614 ± 0.0020 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 30'$) Plungers are numbered from the Governor side

Tappet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.
 : Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

Injection Volume

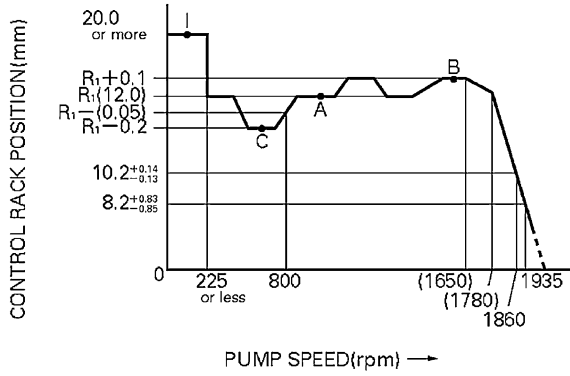
Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/1000 strokes)	Variance (%)	Remarks
	960	61 ± 1.6	± 4	Basic
H	285	16 ± 1.3	± 10.0	
A	960	61 ± 1	—	Basic
B	1,600	$(62) \pm 2$	—	
C	500	$(60.5) \pm 2$	—	
I	150	$(82)^{+16}_{-0}$	—	

Timing Advance Specification

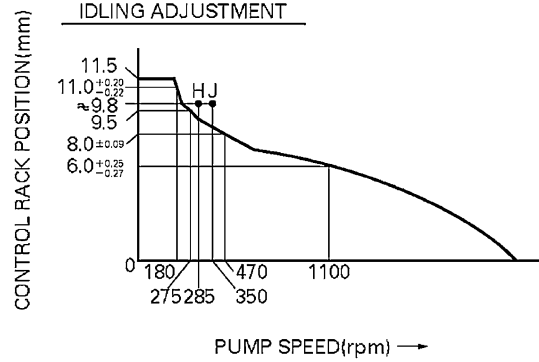
Pump Speed (r.p.m.)	1,050 or less	1,000	1,600 or more
Degree for Angle of Lead (deg.)	Start	0.5 or less	Finish 5 ± 0.5

Governor Adjustment

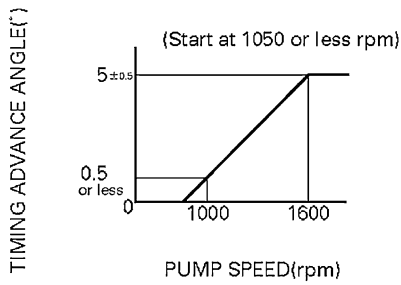
FULLLOAD ADJUSTMENT



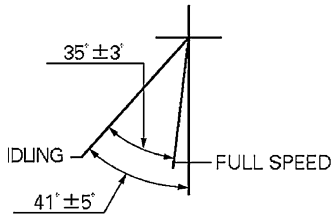
IDLING ADJUSTMENT



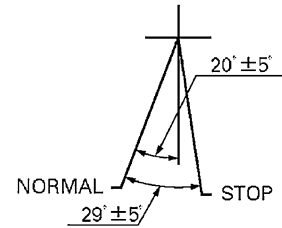
TIMING ADVANCE CHARACTERISTIC



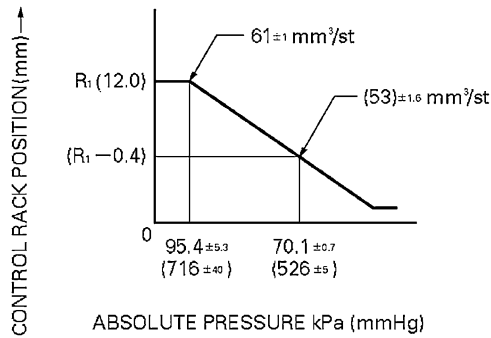
SPEED LEVER ANGLE



STOP LEVER ANGLE



ANEROID COMPENSATOR PERFORMANCE (CONTROL LEVER FULL SET POSITION 960 r/min)



Injection Volume and Governor Performance Diagram

Identification Numbers : 101401-7311

[4HF1 Engine]

Pre-stroke : No. 1 plunger 4.1 ± 0.05 mm (0.1614 ± 0.0020 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 30'$) Plungers are numbered from the Governor side

Tappet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.

: Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

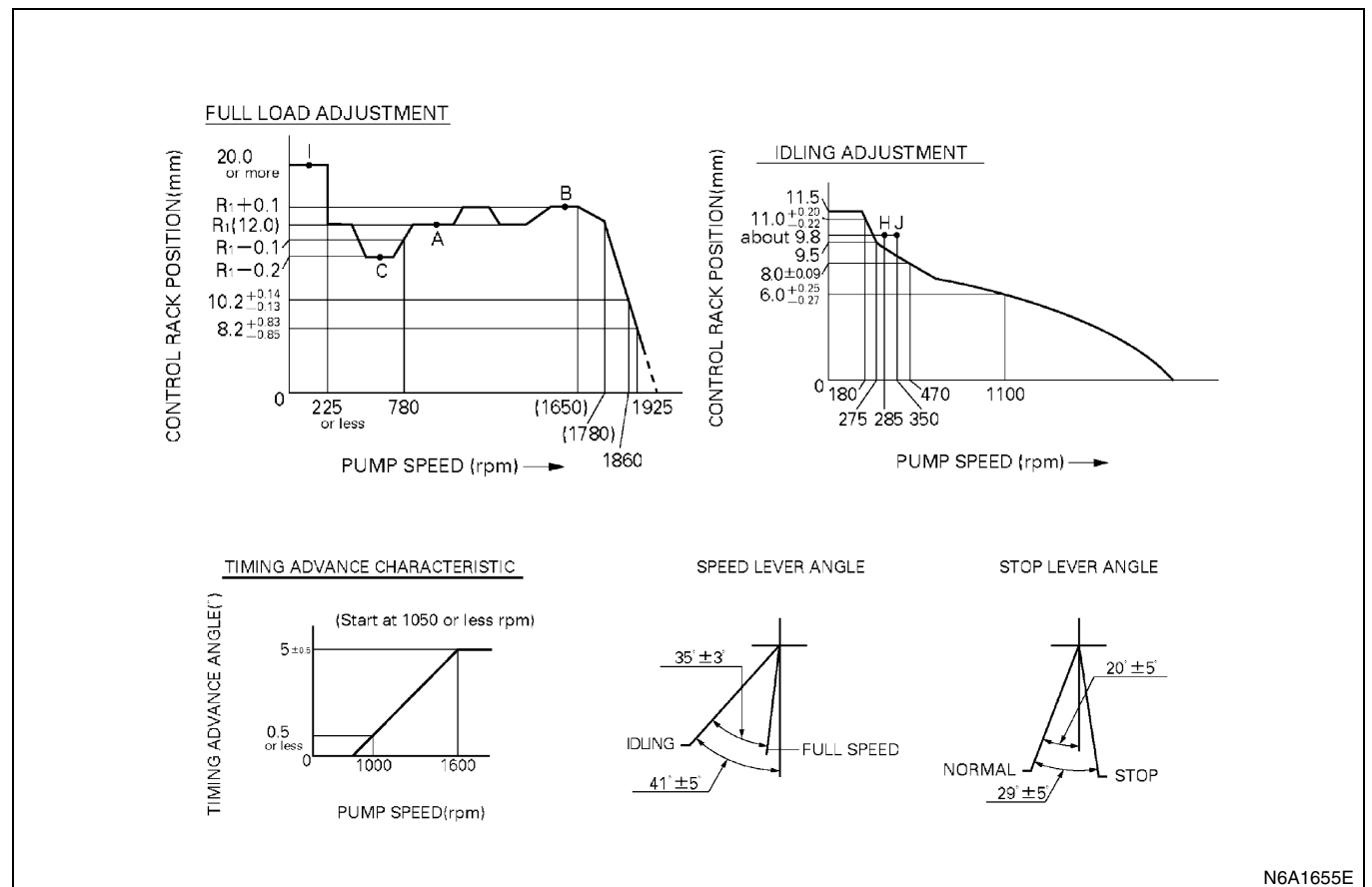
Injection Volume

Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/1000 strokes)	Variance (%)	Remarks
	960	61 ± 1.6	± 4	Basic
H	285	16 ± 1.3	± 10.0	
A	960	65 ± 1	—	Basic
B	1,600	$(62) \pm 2$	—	
C	500	$(63.5) \pm 2$	—	
I	150	$(82)^{+16}_{-0}$	—	

Timing Advance Specification

Pump Speed (r.p.m.)	1,000	1,600 or more
Degree for Angle of Lead (deg.)	0.5 or less	Finish 5 ± 0.5

Governor Adjustment



Injection Volume and Governor Performance Diagram

Identification Numbers : 104742-1630

[4HF1-2 Engine]

Pre-stroke : No. 1 plunger 0.45±0.05 mm (0.0177±0.0020 in)

Injection order : 1 — 3 — 4 — 2 (interval 90°±30') Plungers are numbered from the Governor side

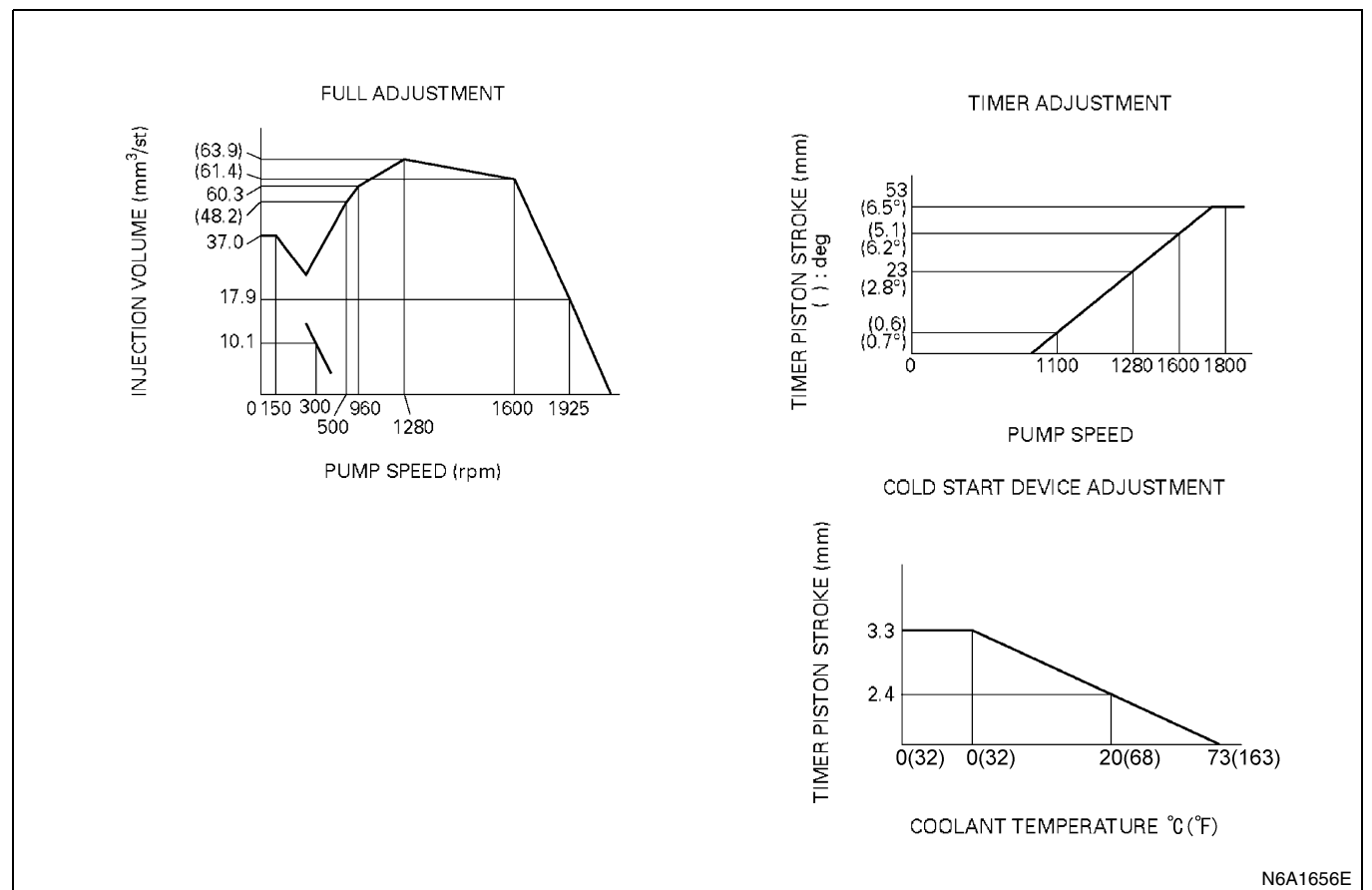
Injection volume

Pump speed (rpm)	Injection volume (mm ³ /strokes)	Uneven amplitude (mm ³ /strokes)	Oil temperature (°C (°F))	Remarks
500	48.2 ± 4.5	—	48±2 (118±36)	
960	60.3±1.0	5.0	50±2 (122±36)	Basic
1280	63.9±3.5	—	50±2 (122±36)	
1600	61.4±4.5	—	50±2 (122±36)	
1925	17.9±3.0	5.5	50±2 (122±36)	Basic
300	10.1±2.0	2.0	48±2 (118±36)	Basic
150	37.0±10	—	48±2 (118±36)	

Timing Advance Specification

Pump Speed (r.p.m.)	1,100	1,280	1,600	1,800
Degree for Angle of Lead (deg.)	0.7	2.8	6.2	Finish 6.5

Governor Adjustment (4HF1-2)



Injection Volume and Governor Performance Diagram

Identification Numbers : 101401-7430/101401-7440

[4HG1 Engine]

Pre-stroke : No. 1 plunger 4.1 ± 0.05 mm (0.1614 ± 0.0020 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 30'$) Plungers are numbered from the Governor side

Tappet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.
 : Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

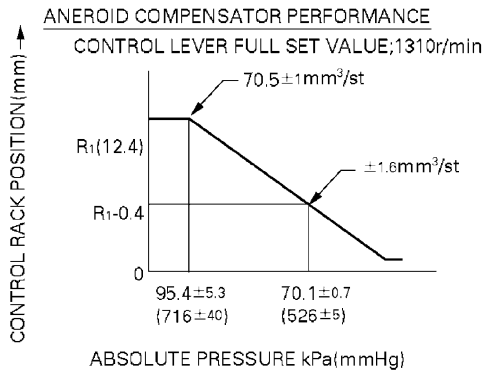
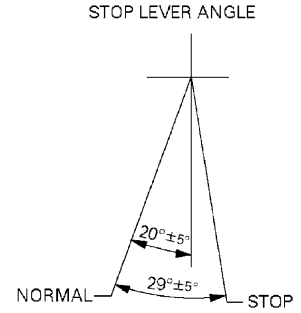
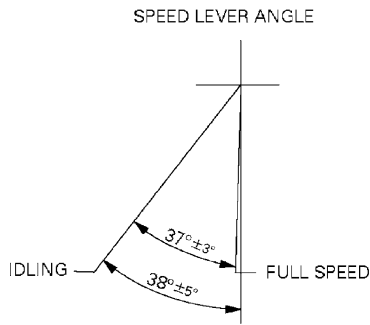
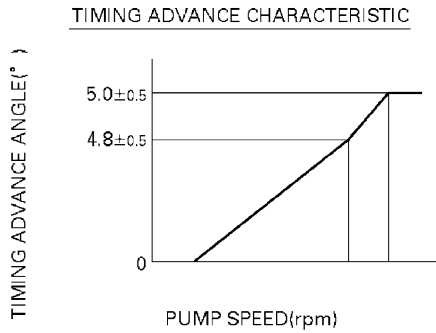
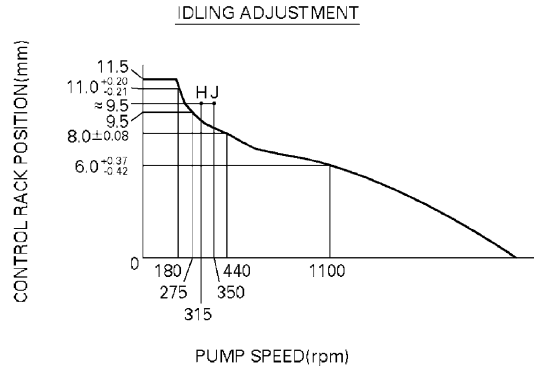
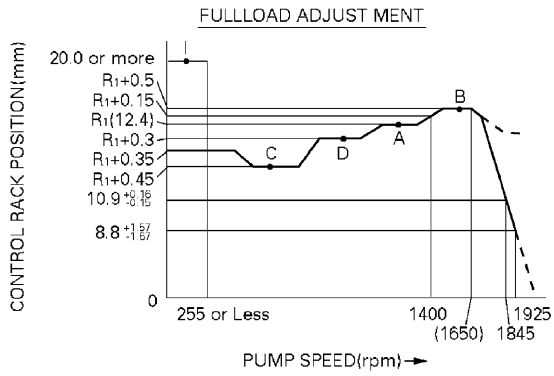
Injection Volume

Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/1000 strokes)	Variance (%)	Remarks
	1,310	70.5 ± 1.6	± 4	Basic
H	315	10 ± 1.3	± 10.0	
A	1,310	70.5 ± 1	—	Basic
B	1,600	$(75.5) \pm 2$	—	
C	520	$(64) \pm 2$	—	
D	960	$(70.5)^{+2}_{-0}$	—	
I	150	$(95)^{+16}_{-0}$	—	

Timing Advance Specification

Pump Speed (r.p.m.)	1,050 or less	1,000	1,600 or more
Degree for Angle of Lead (deg.)	Start	0.5 or less	Finish 5 ± 0.5

Governor Adjustment



Injection Volume and Governor Performance Diagram

Identification Numbers : 101401-7452

[4HG1-T Engine]

Pre-stroke : No. 1 plunger 3.8 ± 0.05 mm (0.1496 ± 0.0020 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 30'$) Plungers are numbered from the Governor side

Tappet clearance : Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

: Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.

Injection Volume

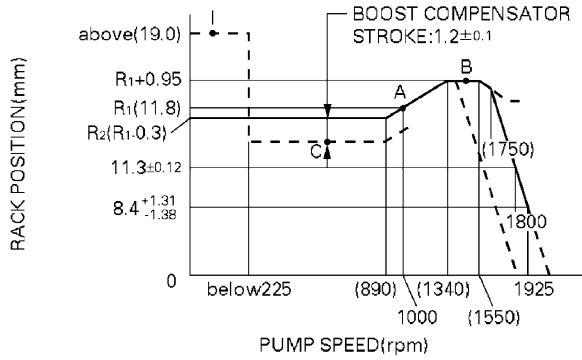
Adjusting point	Rack Position (mm (in))	Pump Speed (rpm)	Injection q'ty (cm ³ /1000strokes)	Max var bet. cyl. (%)	Fixed	Remarks
	11.5 (0.4528)	1000	73.5 ± 1.6	± 4	Rack	Basic
H	Approx. 8.9 (0.3504)	315	(Measure) ± 1.3	± 10	Rack	
A	R1 (11.5 (0.4528))	1000	73.5 ± 1	—	Lever	Basic Boost press. kPa (mmHg/psi) Above 62.0 (465/8.99)
B	R1 +1.0 (0.0394)	1500	(78.5) ± 2	—	Lever	Lever Boost press. kPa (mmHg/psi) Above 62.0 (465/8.99)
C	R2 -0.8 (0.0315)	500	(66.5) ± 2	—	Lever	Boost press. 0
I	—	150	(Measure) ± 16	—	Lever	Boost press. 0 Confirm that the timing of is advanced $1^\circ \pm 30'$ from A.

Timing Advance Specification

Pump speed (rpm)	Below (N1 + 50)	N1	N3
Advance angle (°)	Start	Below 0.5	Finish 4.0 ± 0.5

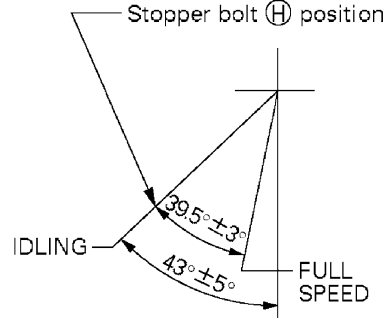
Governor Adjustment (4HG1-T)

FULL LOAD ADJUSTMENT

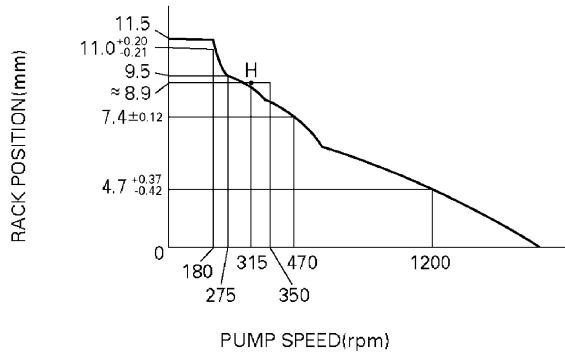


Confirm that $V_{ist} = 2.97 \pm 0.28$ at $N = 1500$, $R = R + 0.95$ at rack sensor voltage 5 ± 0.01 V.

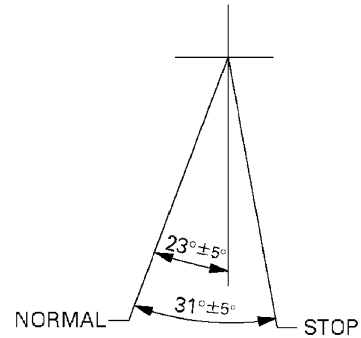
SPEED LEVER ANGLE



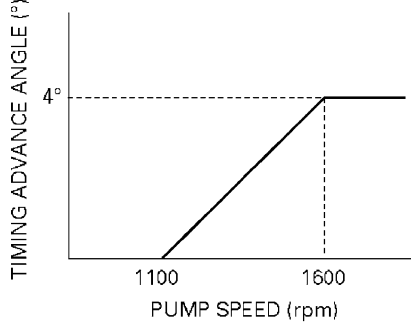
IDLING ADJUSTMENT



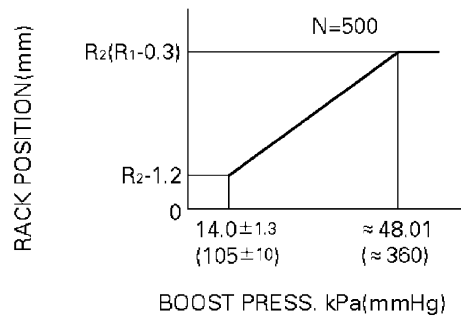
STOP LEVER ANGLE



TIMING ADVANCE CHARACTERISTIC



BOOST COMPENSATOR ADJUSTMENT



N6A0955E

Injection Volume Adjustment (4HE1-TC Engine)

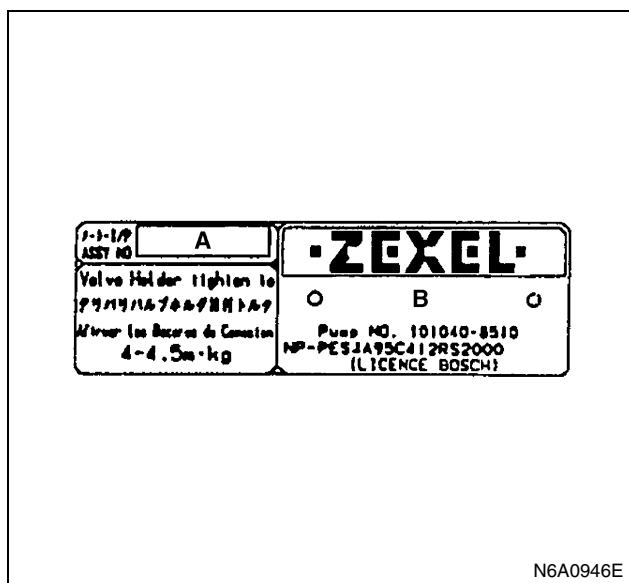
Test Conditions

4HE1-TC Engine

Item	Condition
Injection nozzle and holder assembly	Bosch AS Part No.: 105118-6462
Injection nozzle	Bosch AS Part No.: 105017-2181
Nozzle holder	Bosch AS Part No.: 105048-4510
Injection nozzle opening pressure kPa (kg/cm ² / psi)	18,142 (185 / 2,631)
Injection line dimensions	
Inside diameter mm (in)	3.0 (0.118)
Outside diameter mm (in)	8.0 (0.315)
Length mm (in)	600 (23.6)
Fuel delivery pressure kPa (kg/cm ² / psi)	254.9 (2.6 / 36.97)
Test fuel	SAE Standard Test Diesel Fuel (SAE J967d) ISO Standard Test Diesel Fuel (ISO 4113)
Test fuel temperature °C (°F)	40 — 45 (104 — 113)
Identification numbers	107492-1023 107492-1062 107492-1032 107492-1100 107492-1110 107492-1120 107492-1130 897212-9351 (ISUZU NO.)

Identification Plate and Number

Use the data following the injection pump identification number to adjust the injection volume.



Legend

- A. Isuzu part No. (Pump assembly No.)
- B. Bosch pump assembly No.

Injection Volume and Governor Performance Diagram

Identification Numbers : 107492-1110

[4HE1-TC Engine]

Pre-stroke : No. 1 plunger 4.0 ± 0.03 mm (0.1575 ± 0.0012 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 15'$) Plungers are numbered from the Governor side

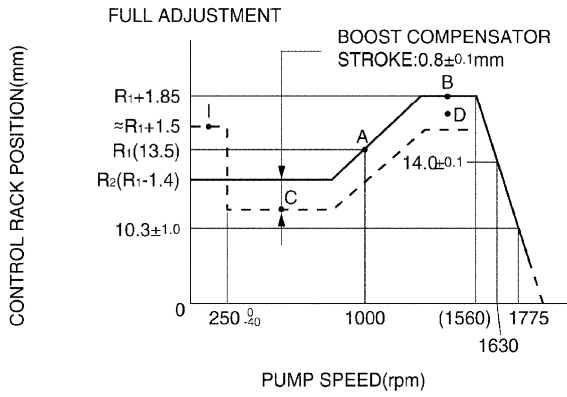
Tappet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.
 : Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

Injection Volume

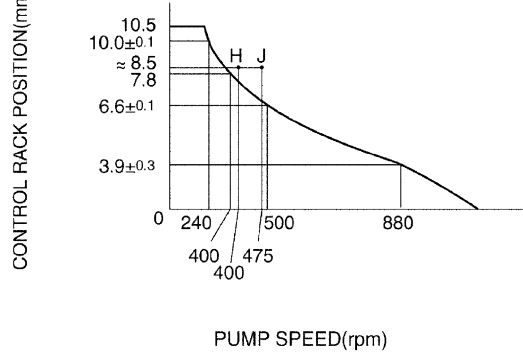
Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/ 1000 strokes)	Variance (%)	Remarks
	1,000	82.5 ± 1.6	± 4	Basic
H	400	19 ± 1.5	± 14	
Z	500	—	—	
A	1,000	82.5 ± 1	—	Basic
B	1,450	92.5 ± 2	—	
C	500	67	—	
D	1,450	89.5	—	
I	150	220	—	

Governor Adjustment

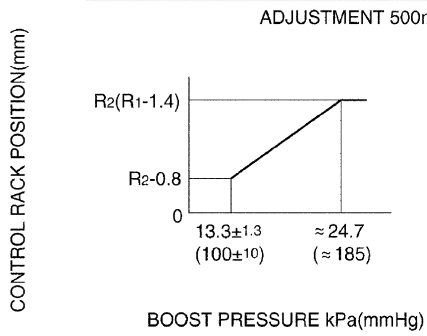
GOVERNOR PERFORMANCE



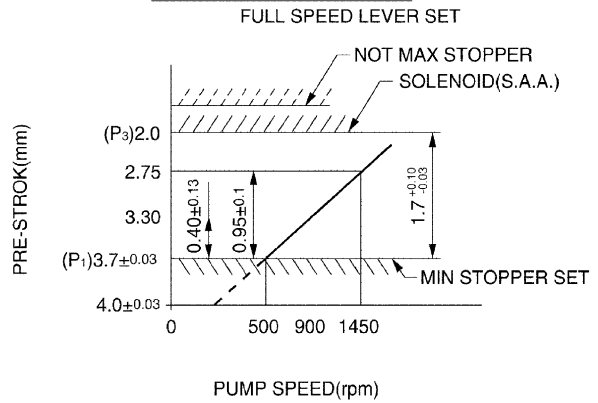
IDLING ADJUSTMENT



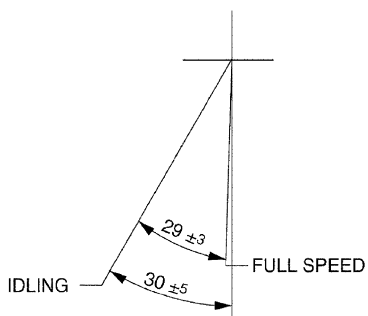
BOOST COMPENSATOR PERFORMANCE



PRE-STROK PERFORMANCE



SPEED LEVER ANGLE



N6A1658E

Injection Volume and Governor Performance Diagram

Identification Numbers : 107492-1023 / 107492-1100

[4HE1-TC Engine]

Pre-stroke : No. 1 plunger 4.0 ± 0.03 mm (0.1575 ± 0.0012 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 15'$) Plungers are numbered from the Governor side

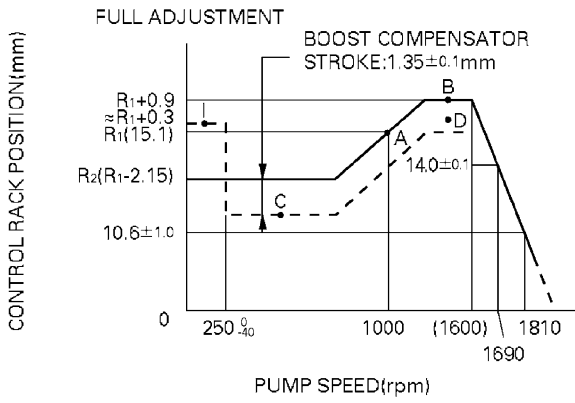
Tappet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.
: Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

Injection Volume

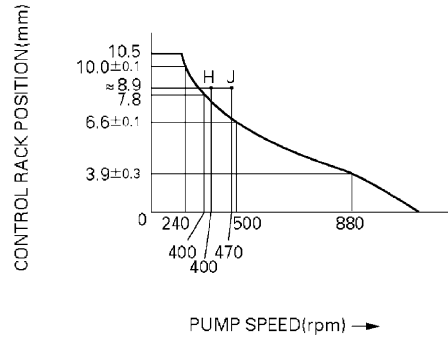
Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/ 1000 strokes)	Variance (%)	Remarks
	1,000	107.5 ± 1.6	± 4	Basic
H	400	22 ± 1.5	± 10.0	
Z	510	—	—	Basic
A	1,000	107.5 ± 1	—	
B	1,200	112.5 ± 2	—	
C	500	(78)	—	
D	1,200	(103)	—	
I	150	(235)	—	

Governor Adjustment

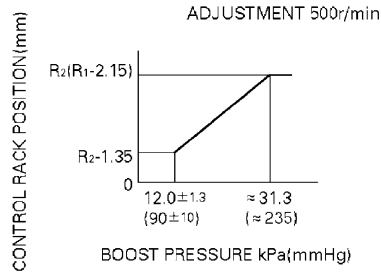
GOVERNOR PERFORMANCE



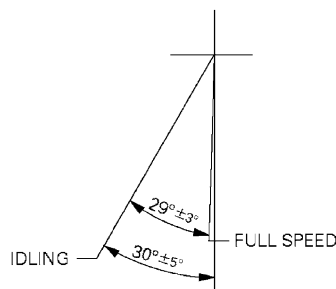
IDLING ADJUSTMENT



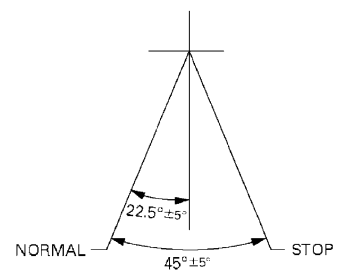
BOOST COMPENSATOR PERFORMANCE



SPEED LEVER ANGLE

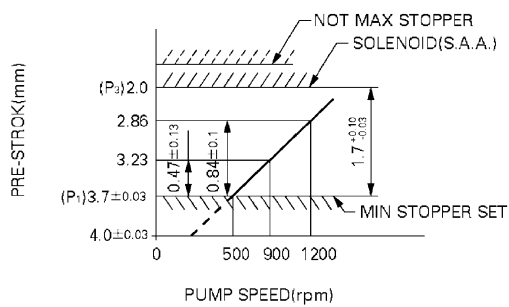


STOP LEVER ANGLE



PRE-STROKE PERFORMANCE

FULL SPEED



Injection Volume and Governor Performance Diagram

Identification Numbers : 107492-1062 / 107492-1120 / 897212-9350 (ISUZU NO.)

[4HE1-TC Engine]

Pre-stroke : No. 1 plunger 4.0 ± 0.03 mm (0.1575 ± 0.0012 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 15'$) Plungers are numbered from the Governor side

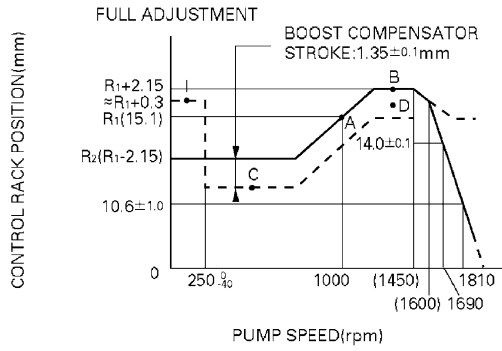
Tappet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.
: Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

Injection Volume

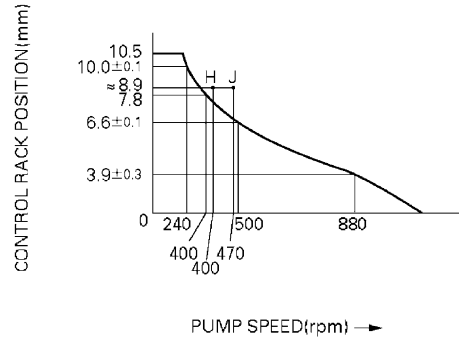
Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/ 1000 strokes)	Variance (%)	Remarks
	1,000	107.5 ± 1.6	± 4	Basic
H	400	22 ± 1.5	± 14	
Z	510	—	—	Basic
A	1,000	107.5 ± 1	—	
B	1,400	121.5 ± 2	—	
C	500	78	—	
D	1,400	103	—	
I	150	235	—	

Governor Adjustment

GOVERNOR PERFORMANCE

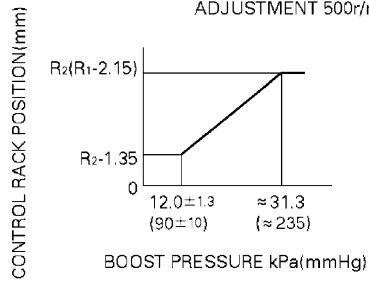


IDLING ADJUSTMENT



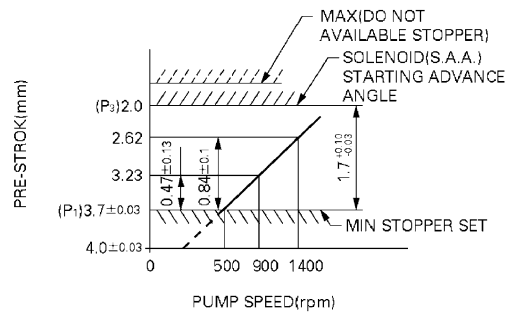
BOOST COMPENSATOR PERFORMANCE

ADJUSTMENT 500r/min

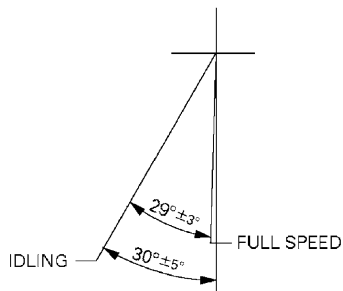


PRE-STROK PERFORMANCE

AT SPEED LEVER FULL POSITION



SPEED LEVER ANGLE



Injection Volume and Governor Performance Diagram

Identification Numbers : 10749-1032 / 107492-1130

[4HE1-TC Engine]

Pre-stroke : No. 1 plunger 4.0 ± 0.03 mm (0.1575 ± 0.0012 in)

Injection order : 1 — 3 — 4 — 2 (interval $90^\circ \pm 15'$) Plungers are numbered from the Governor side

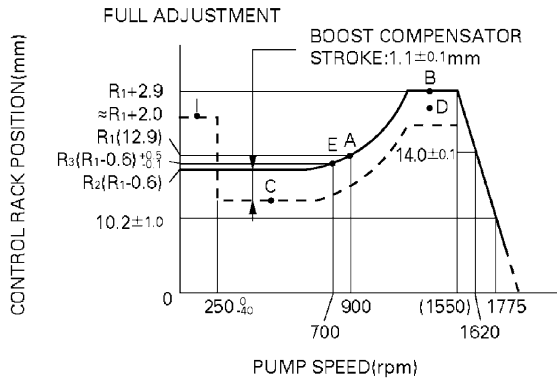
Tappet clearance : Bolt adjustment type : More than 0.3 mm (0.0118 in) for all cylinders.
: Shim adjustment type : Manually rotate the camshaft 2 — 3 times and confirm that it rotates smoothly.

Injection Volume

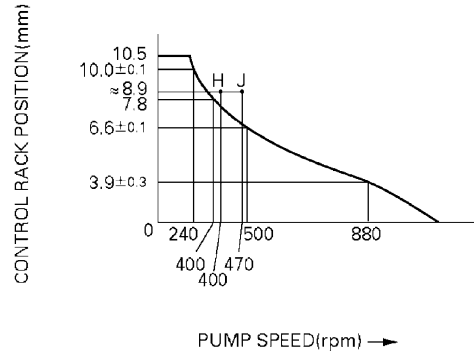
Adjusting point	Pump speed (r.p.m.)	Injection volume (cc/ 1000 strokes)	Variance (%)	Remarks
	900	78 ± 1.6	± 4	Basic
H	400	19 ± 1.5	± 14	
Z	500	—	—	Basic
A	900	78 ± 1	—	
B	1,450	89.5 ± 2	—	
C	500	67.5	—	
D	1,450	91.5	—	
E	700	78	—	
I	150	220	—	

Governor Adjustment

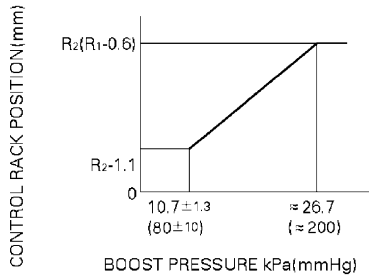
GOVERNOR PERFORMANCE



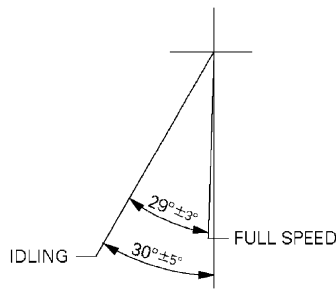
IDLING ADJUSTMENT



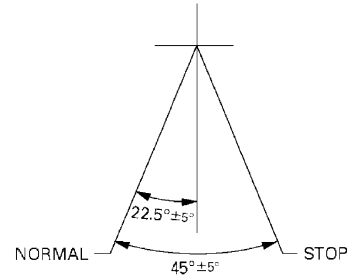
BOOST COMPENSATOR PERFORMANCE ADJUSTMENT 500r/min



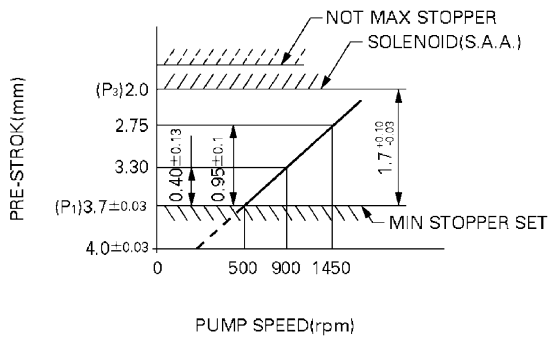
SPEED LEVER ANGLE



STOP LEVER ANGLE



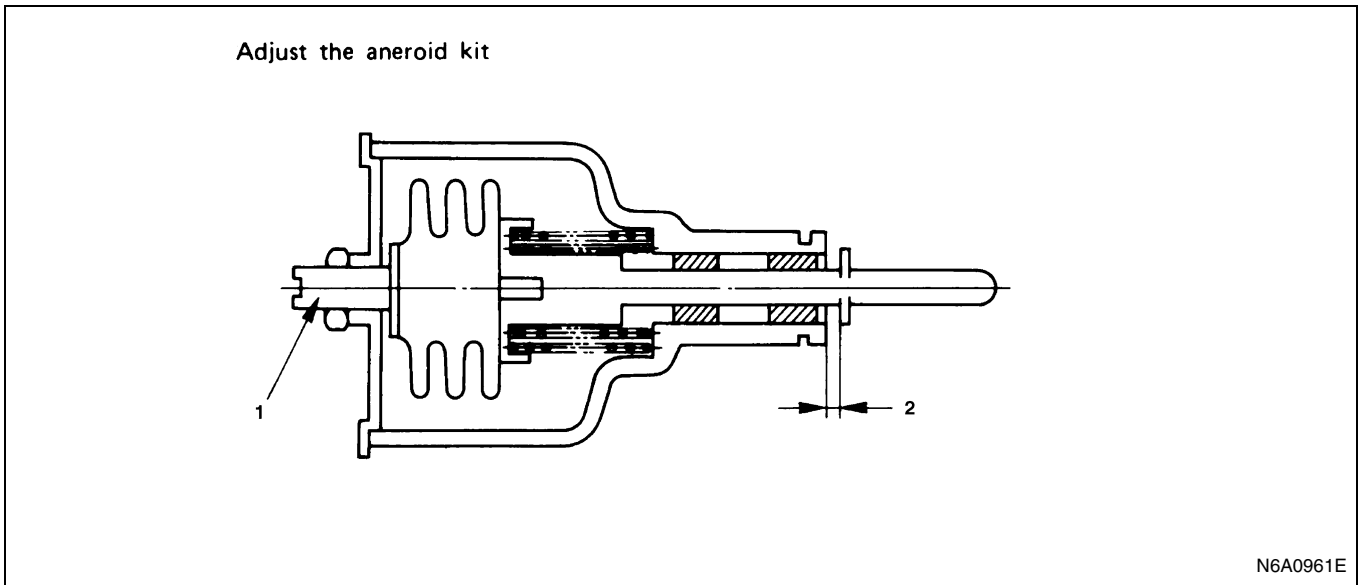
PRE-STROKE PERFORMANCE FULL SPEED LEVER SET



N6A0960E

ANEROID COMPENSATOR ADJUSTMENT

Component



Legend

1. Setting screw

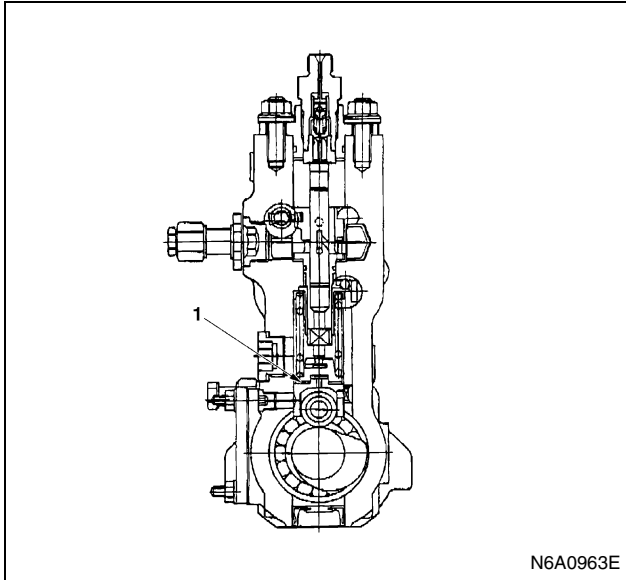
2. Between 1.4 — 1.7 mm (0.055 — 0.067 in) at sea level (adjust by setting screw)

Pre-stroke adjustment

Adjust No.1 cylinder's start of static injection using the shim (1).

Individual cylinder's injection order adjustment

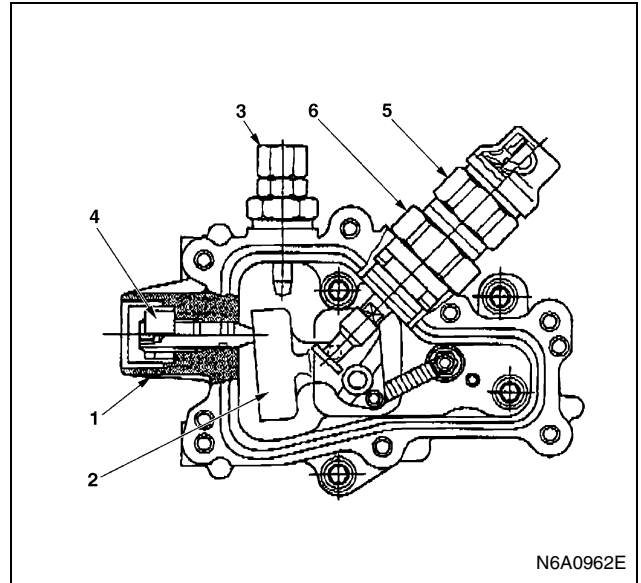
Adjust difference between each cylinder's injection angle based on that of the No.1 cylinder using the shim (1).



Measuring pre-stroke output voltage

1. Install the measuring device (P/N 105782-6420).
2. Remove the setscrew (3) (P/N 157927-2820) and install the air bleeder bolt.
3. Screw in screw (4) (P/N 157927-3321) and measure the No 1 cylinder's output voltage for pre-stroke lift values in the table below.

Adjusting point confirmation point	Pre-stroke (mm (in))	Output voltage (actual)	Remarks
a	3.70 (0.1457)	a1	+ tolerance
	3.44 (0.1354)	a2	- tolerance
b	3.24 (0.1276)	b1	+ tolerance
	3.04 (0.1197)	b2	- tolerance
(calculate form each specification)			



Advice

If measuring device (P/N 105782-6420) is removed, the output voltage (a1, a2) should be remeasured.

Minimum advance angle adjustment stopper adjustment

1. Remove the screw (4) (P/N 157927-3321) and install minimum advance angle adjustment stopper.
2. Screw in minimum advance angle adjustment stopper until No 1 cylinder's pre-stroke is 3.84 — 3.90 mm (0.1512 — 0.1535 in). Then, tighten locknut to specified torque.
3. Measure the output voltage (c) at this time.

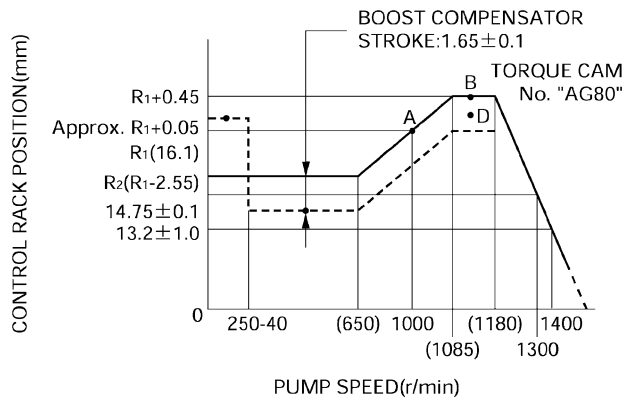
Solenoid switch adjustment

1. Apply 24 V voltage to solenoid switch (5).
2. Loosen solenoid switch (5) until No 1 cylinder's pre-stroke is 1.90 — 2.03 mm (0.0748 — 0.0799 in), then tighten the locknut to the specified torque.
3. Confirm solenoid switch operates at 14.5 — 0.1 V.

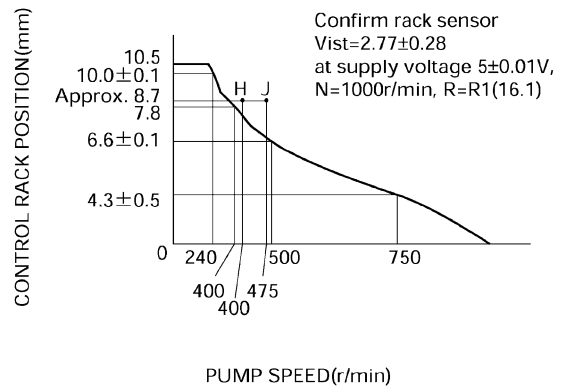
Governor Adjustment

Governor adjustment

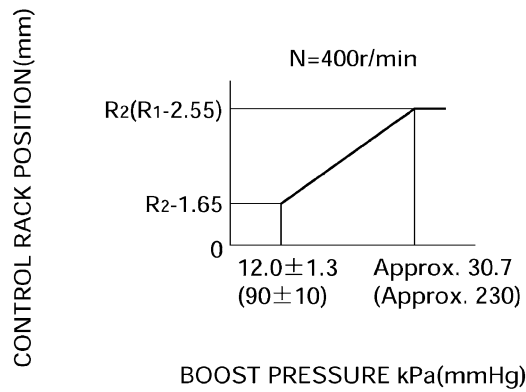
FULL ROAD ADJUSTMENT



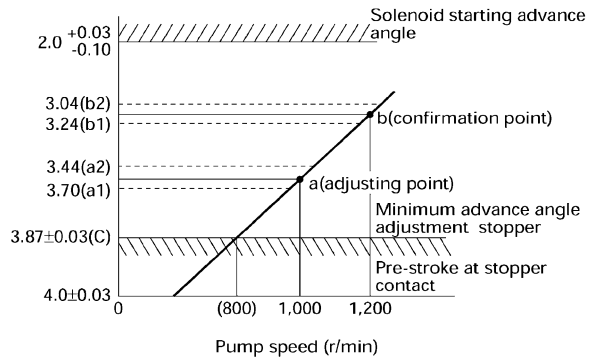
IDLING ADJUSTMENT



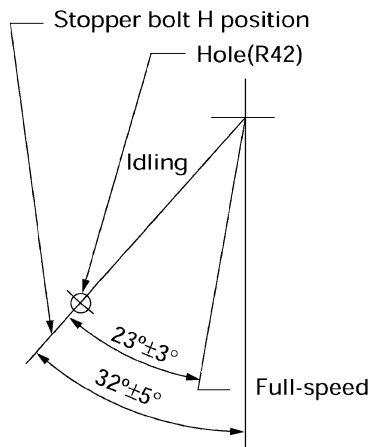
BOOST COMPENSATOR PERFORMANCE



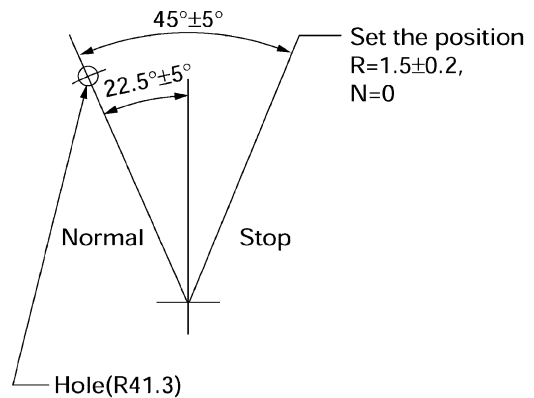
Pre-stroke(Pre-stroke output voltage)



Speed control lever angle



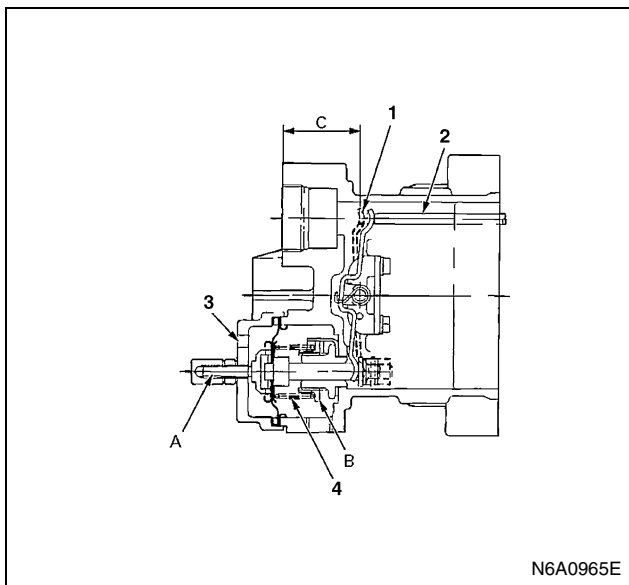
Stop lever angle



N6A0964E

Boost compensator adjustment

1. Select a push rod so (C) = 37.5 ± 0.5 mm (1.48 \pm 0.02 in) at full boost pressure. ((C) is the distance from the end face of the housing to top of the lever.)
2. Adjust the boost compensator stroke using screw (A). (0 boost pressure position adjustment)
Adjust the beginning of boost compensator operation by adjusting the notch adjusting nut (B).



N6A0965E

Legend

1. Top of lever
2. Push rod
3. Boost pressure inlet
4. Boost compensator spring

Timing cam adjustment (Timing cam No: 510)

1. Hold speed control lever against full speed stopper bolt.
2. Supply boost pressure of at least 44.0 kPa (330 mmHg/6.38 psi)
3. Operate pump at the timing cam adjusting point (point a table below: $N_p = 1,000$ r/min).
4. Perform timing cam adjustment so output voltage is within range of a1 — a2 actually measured for pore-stroke output voltage during injection timing adjustment in 3 — 4.

Adjusting point	Pre-stroke (mm (in))	Output voltage (actual)	Remarks
a	3.70 (0.1457)	a1	+ tolerance
	3.44 (0.1354)	a2	- tolerance

5. Operate the pump at the timing cam confirmation point.
(point b in table below: $N_p = 1,200$ r/min)

6. Confirm that the pre-stroke output voltage is within the range b1 — b2.

Confirmation point	Pre-stroke (mm (in))	Output voltage (actual)	Remarks
b	3.24 (0.1276)	b1	+ tolerance
	3.04 (0.1197)	b2	- tolerance

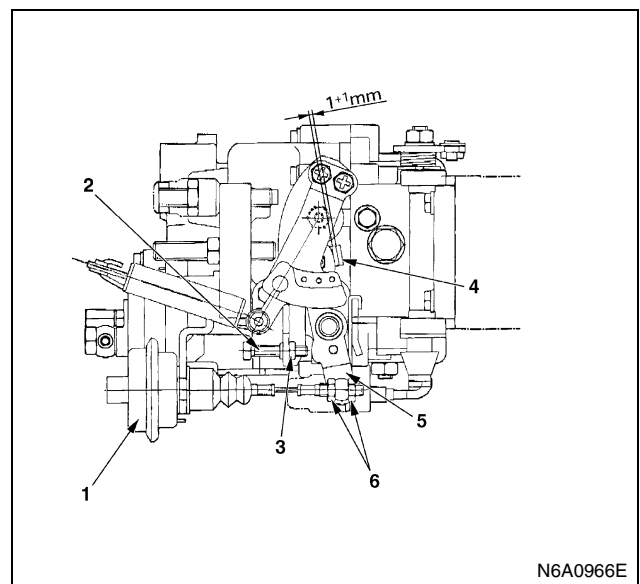
Injection Quantity

Adjusting point	Rack position (mm (in))	Pump speed (r/min)	Injection q'ty (cm ³ /1,000 strokes)	Max. variation between cylinders	Fixed	Pre-stroke at adjustment	Remarks	
—	16.1 (0.6339)	1,000	124±1.6	±4	Rack	a1 — a2 (v)	Basic	Cylinder variation adjustment standard
Z	8.7±0.5 (0.3425± 0.0197)	585	14±1.5	±14	Rack	c (v)		Cylinder variation adjustment standard
A	R1 (16.1 (0.6339))	1,000	124±1	—	Lever	a1 — a2 (v)	Basic	Boost press. kPa (mmHg/ psi) Above 44.0 (330/6.38)
B	R1+0.45 (0.0177)	1,150	123.5±2	—	Lever	Measure		Boost press. kPa (mmHg/ psi) Above 44.0 (330/6.38)
D*	16.15±0.1 (0.6358± 0.0039)	1,150	—	—	Lever	Measure		Boost press. kPa (mmHg/ psi) Above 44.0 (330/6.38) Negative press. kPa (mmHg/psi) 53.3 (400/7.73)

D*: Aneroid compensator actuator adjustment point

FICD Adjustment

1. Stop the injection pump.
2. Hold speed control lever against idling stopper bolt.
3. Adjust clearance between FICD actuator lever and speed control lever to approx. 1+1 mm (0.0394+0.0394 in).
4. Loosen nut (3) and fully tighten FICD set bolt (2).
5. Apply 53.3 kPa (400 mmHg/7.73 psi) negative pressure to the actuator (1) and set the pump speed at 450 r/min.
6. Gradually loosen set bolt (2) then fix bolt using nut when the rack position is 8.1±0.1 mm (0.3189±0.0039 in).
7. Apply above negative pressure several times and confirm FICD actuator is operating properly and clearance between FICD actuator lever and speed control lever.



Legend

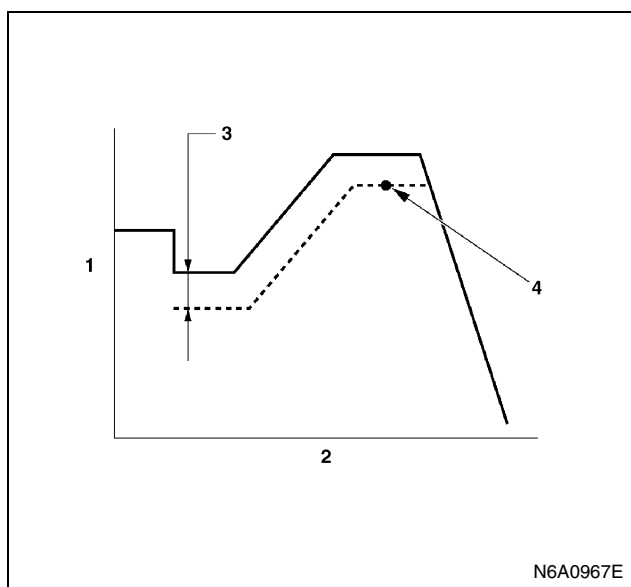
1. Actuator
2. Set bolt
3. Nut
4. Speed control lever
5. FICD actuator lever
6. Tightening torque 5 — 7 N·m (0.5 — 0.7 kg·m/
3.7 — 5.2 lb·ft)

Aneroid Compensator Actuator Adjustment (Injection Quantity Decrease)

Notice:

Set this actuator after adjusting the full rack position.

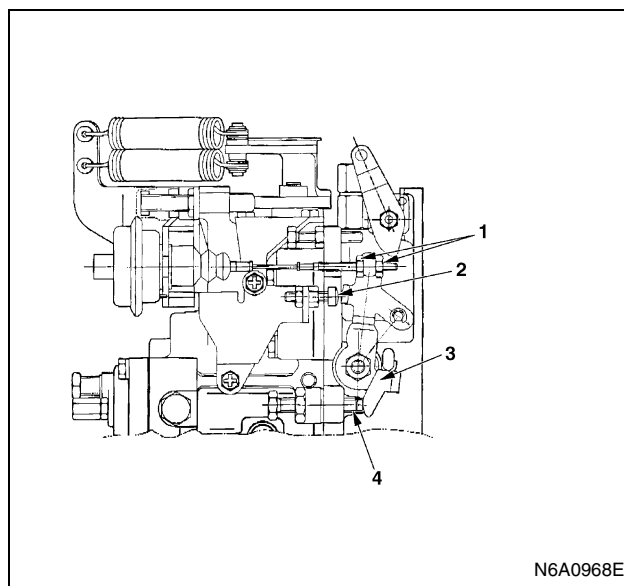
1. Stop injection pump.
2. Adjust wire nut so full load set lever contacts full load set bolt and aneroid compensator actuator wire is not loose. Then, fix the nut.
3. Apply 53.3 kPa (400 mmHg/7.73 psi) negative pressure to aneroid compensator, set pump speed at 1,150 r/min.



Legend

1. Rack position (mm)
2. Pump speed (r/min)
3. Stroke
4. Injection quantity decrease adjustment point

4. Apply at least 44.0 kPa (330 mmHg/6.38 psi) boost pressure to the boost compensator.
5. After operating full load set lever, adjust aneroid compensator set bolt so control rack position is 16.15 ± 0.1 mm (0.6358 ± 0.0039 in) and fuel injection quantity is as specified. Then, fix the set bolt.

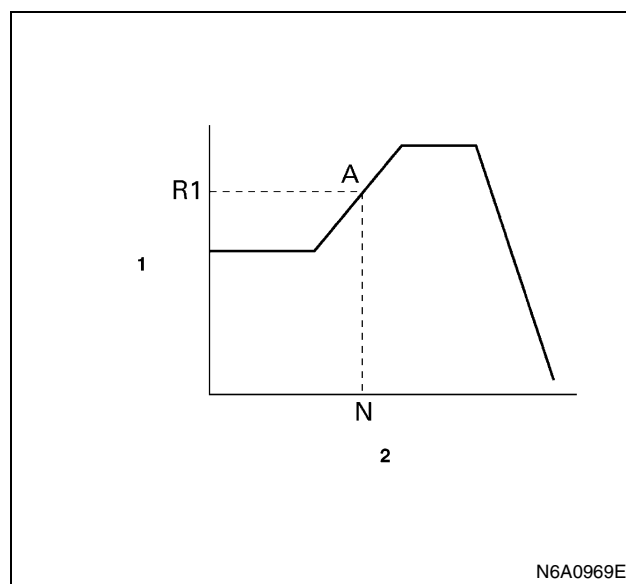


Legend

1. Nut
2. Set bolt
3. Full load set lever
4. Full load set bolt

Rack Sensor Adjustment

1. Before removing rack position measuring device, apply at least 44.0 kPa (330 mmHg/6.38 psi) boost pressure and confirm rack position is $R1 = 16.1$ mm and fuel injection quantity is 124 ± 1 mm³/st at $N = 1,000$ r/min.



Legend

1. Rack position (mm)
2. Pump speed (r/min)

2. Remove the rack position measuring device.
3. Attach the rack sensor core to the control rack.

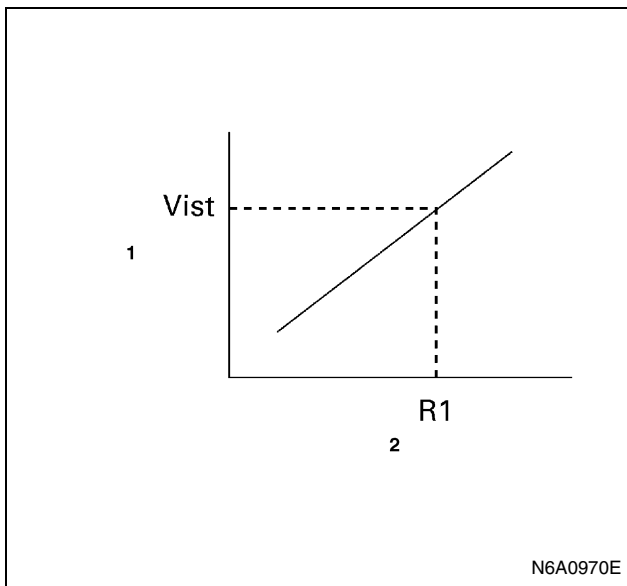
At this time, hold control rack using a spanner (to prevent the rack from bending).

Specified torque: 3.4 — 4.9 N·m (0.35 — 0.5 kg·m/2.5 — 3.6 lb·ft)

4. While pulling stop lever, install rack sensor to rack sensor core.
5. Tighten the two flange fixing screws.

Specified torque: 6.9 — 8.8 N·m (0.7 — 0.9 kg·m/5.1 — 6.5 lb·ft)

6. Connect the rack sensor wire harness to constant voltage power supply and digital voltmeter.
7. Turn constant voltage power supply power switch ON and set it to DC $5 \pm 0.01V$.
8. Apply at least 44.0 kPa (330 mmHg/6.38 psi) boost pressure, set pump speed at $N = 1,000$ r/min, and hold speed control lever against the full speed stopper bolt.
9. Confirm the rack sensor output voltage from the digital voltmeter. ($V_{ist} = 2.77 \pm 0.28V$)
10. Confirm that the voltage changes when the speed control lever is moved to the idle and full sides.

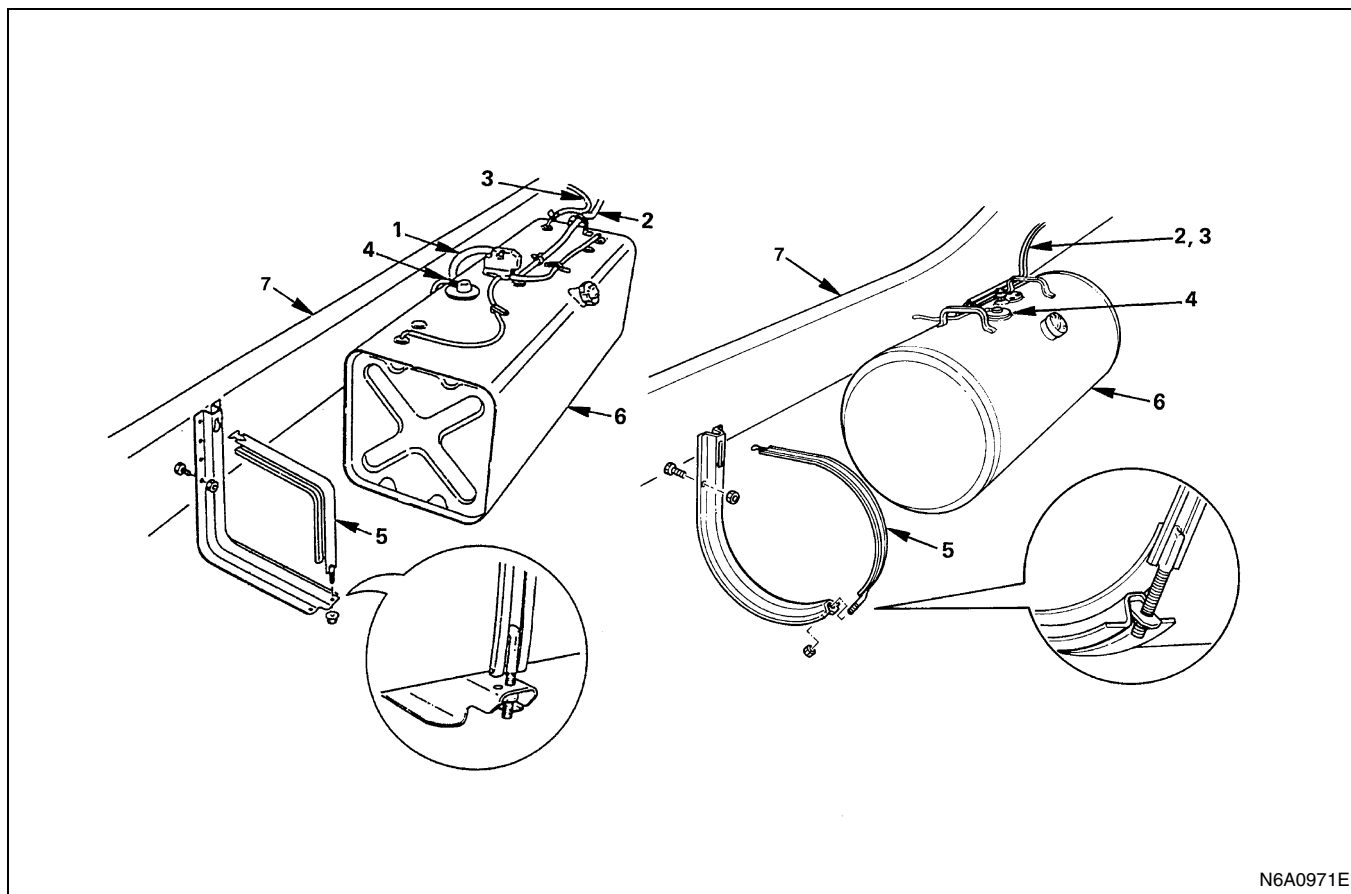


Legend

1. Sensor output voltage (V)
 2. Rack position (mm)
-

FUEL TANK

Component



Legend

- | | |
|------------------------------|--------------|
| 1. Evapo fuel hose | 5. Band |
| 2. Fuel feed hose | 6. Fuel tank |
| 3. Fuel return hose | 7. Frame |
| 4. Fuel gauge unit connector | |

Removal

Preparation

- Disconnect the battery ground cable.
- Loosen the fuel filler cap.
- Drain fuel from drain plug.
- After the drain fuel, tighten the drain plug to the specified torque.

Tighten:

Drain plug to 29 N·m (3 kg·m / 22 lb·ft)

1. Evapo Fuel Hose
2. Fuel Feed Hose
3. Fuel Return Hose
 - Plugging the return hose to prevent fuel from getting spilled, tie it to the frame with the plugged end up.
4. Fuel Gauge Unit Connector

- Remove the fuel gauge unit connector.
5. Band
 - Remove the nut of the fuel tank fixing band, and then remove the band end on the frame side.
 6. Fuel Tank
 - Pull out the fuel tank to the outside.

Notice:

When it is not possible to pull out the fuel tank, remove the bracket and then draw out the fuel tank downward.

Installation

1. Fuel Tank

Notice:

When the bracket was removed to take off the fuel tank, install the bracket to the frame and tighten it to the specified torque.

Tighten:

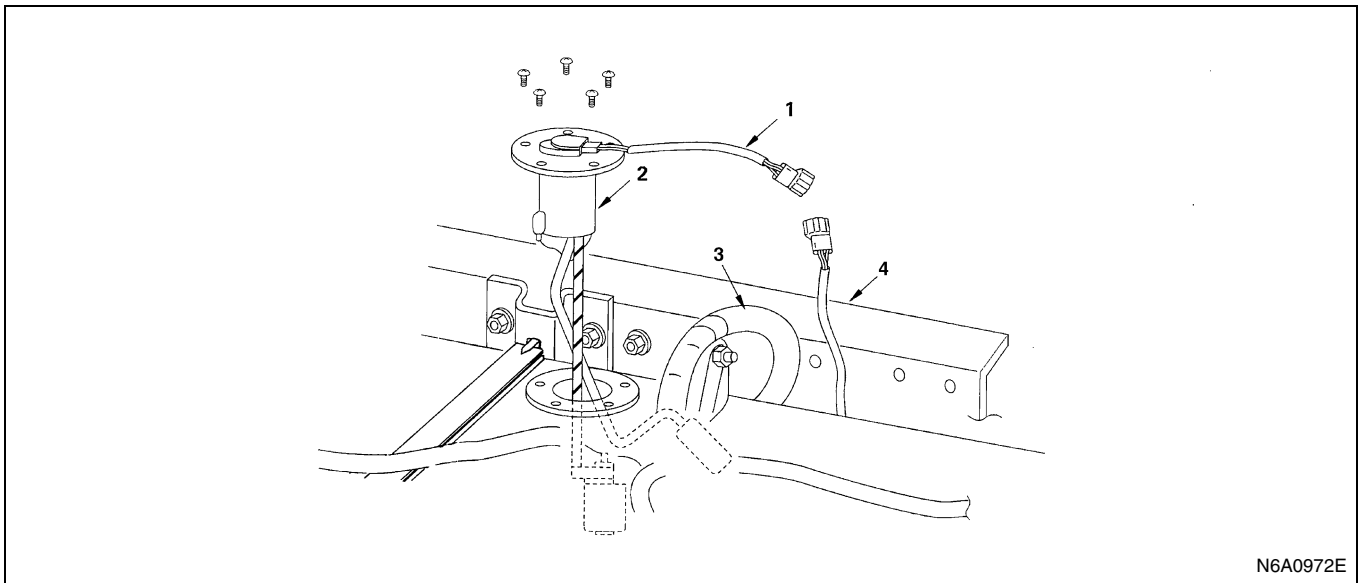
Fuel tank bracket to 55 N·m (5.6 kg·m / 41 lb·ft)

Also, when mounting the fuel tank to the bracket, place the packing section attached to the fuel tank securely on the bracket.

2. Band
 - Tighten the band to 12 N·m (1.2 kg·m / 104 lb·in)
3. Fuel Gauge Unit Connector
 - Connect the fuel gauge unit connector.
4. Fuel Return Hose
5. Fuel Feed Hose
 - Set the hose to the pipe more than 25 mm (0.98 in) deep.
6. Evapo Fuel Hose
 - Fill the fuel to the fuel tank.
 - Connect battery ground cable.

FUEL GAUGE UNIT

Component



Legend

- | | |
|------------------------------|--------------------|
| 1. Fuel gauge unit connector | 3. Evapo fuel hose |
| 2. Fuel gauge unit | 4. Frame |

Removal

Preparation

Disconnect the Battery ground cable.

1. Fuel Gauge Unit Connector
 - Disconnect the fuel gauge unit connector from the fuel gauge unit.
2. Fuel Gauge Unit
 - Remove the fuel gauge unit fixing screw and fuel gauge unit.

Notice:

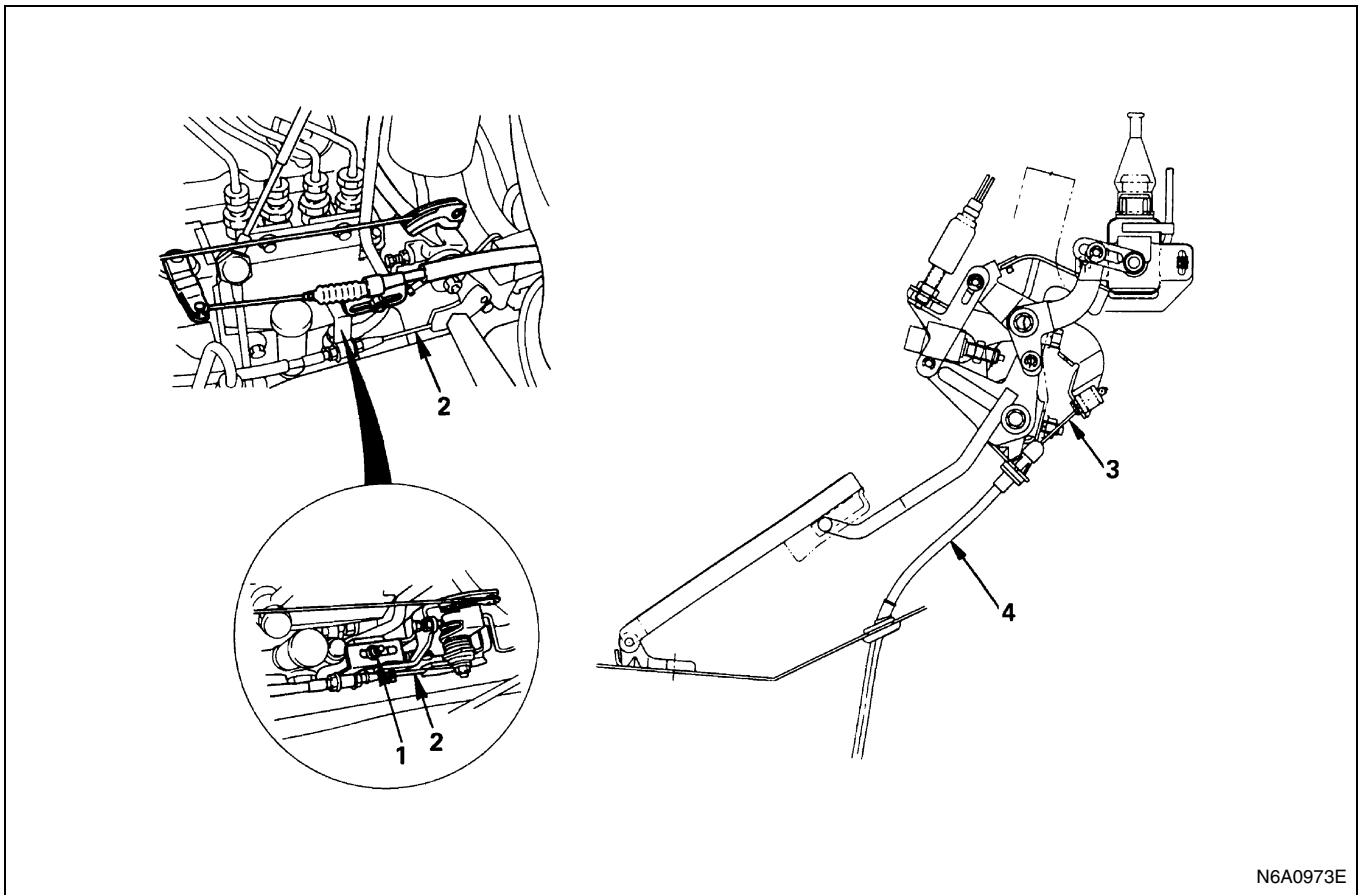
After removing fuel gauge unit, cover fuel tank with waste to prevent any dust entering

Installation

1. Fuel Gauge Unit
2. Fuel Gauge Unit Connector
 - Connect the wiring connector to the fuel gauge unit.

ACCELERATOR CONTROL CABLE

Component



Legend

- | | |
|---|--|
| 1. Adjust nut | 3. Accelerator control wire (Accelerator pedal side) |
| 2. Accelerator control wire (Injection pump side) | 4. Accelerator control cable |

Removal

1. Adjust Nut
 - Loosen the adjust nut on the cable bracket mounted.
2. Accelerator Control Wire (Injection pump side)
 - Remove the control wire from injection pump control lever.
3. Accelerator Control Wire (Accelerator pedal side)
 - Remove the Accelerator control wire from accelerator pedal.
4. Accelerator Control Cable
 - Pull out the wire to the chassis side through the grommet hole of the floor board, and remove the control cable.

Inspection

Check the following items, and replace the control cable if any abnormality is found.

- The control cable should move smoothly.

- The control cable should not be bent or kinked.
- The control cable should be free of damage and corrosion.

Installation

1. Accelerator Control Cable
 - Take care that the core wire of the cable does not get damaged or indented.
 - Put the cable through the grommet hole from under the floor.
 - Set the groove of the grommet securely into the floor panel.
2. Accelerator Control Wire (Accelerator Pedal side)
 - Connect the accelerator control wire to Accelerator pedal.
3. Cable Clips
 - Install the cable clip to chassis frame.
 - Tighten the cable clips to 16 N·m (1.6 kg·m / 12 lb·ft)
4. Accelerator Control Wire

5. Adjust Nut

- Attach the end tip of the wire to the engine control lever.
- Pull the outer cable gently toward the front of the vehicle, and provide the engine control wire and the accelerator control wire an appropriate play before fastening the clamp with a nut.

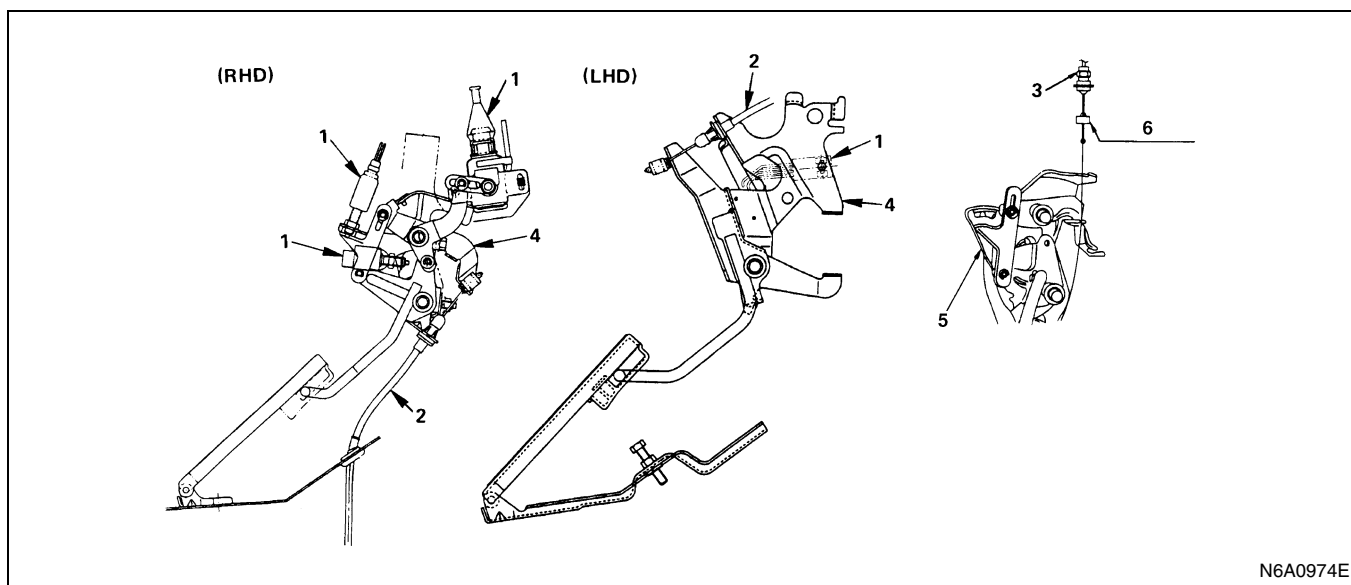
Tighten:

Nut to 8 N·m (0.8 kg·m /69 lb·in)

- Check to see if the injection pump lever is at the idle position (with the lever in touch with the stopper bolt).
- Connect the battery ground cable.
- Check to see if the accelerator pedal fully is in the range of 5 — 10 mm (0.2 — 0.4 in) above the pedal pad.
- Press down on the accelerator pedal fully, and check to see if the engine rotates at the maximum speed with the linkage in the smooth operation.
- In the operating range of the accelerator pedal, check to see if the accelerator pedal and the injection pump lever return without fail to the original positions.

ACCELERATOR PEDAL

Component



Legend

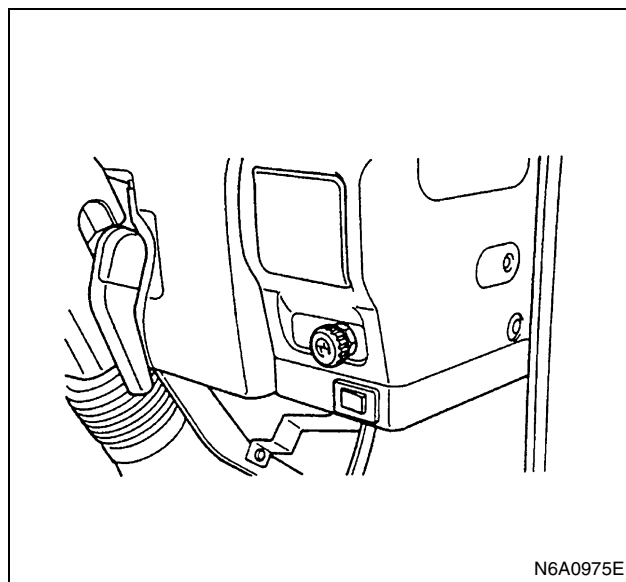
- | | |
|------------------------------|-------------------------------|
| 1. Switch connector | 4. Accelerator pedal assembly |
| 2. Accelerator control cable | 5. Accelerator pedal bracket |
| 3. Idling control cable | 6. Wire guide |

Removal

1. Switch Connector
2. Accelerator Control Cable.
 - Remove control cable from Accelerator pedal bracket.
3. Idling Control Cable
 - Remove control cable from accelerator pedal bracket.
4. Accelerator Pedal Assembly
 - Remove accelerator pedal assembly from brake pedal bracket.

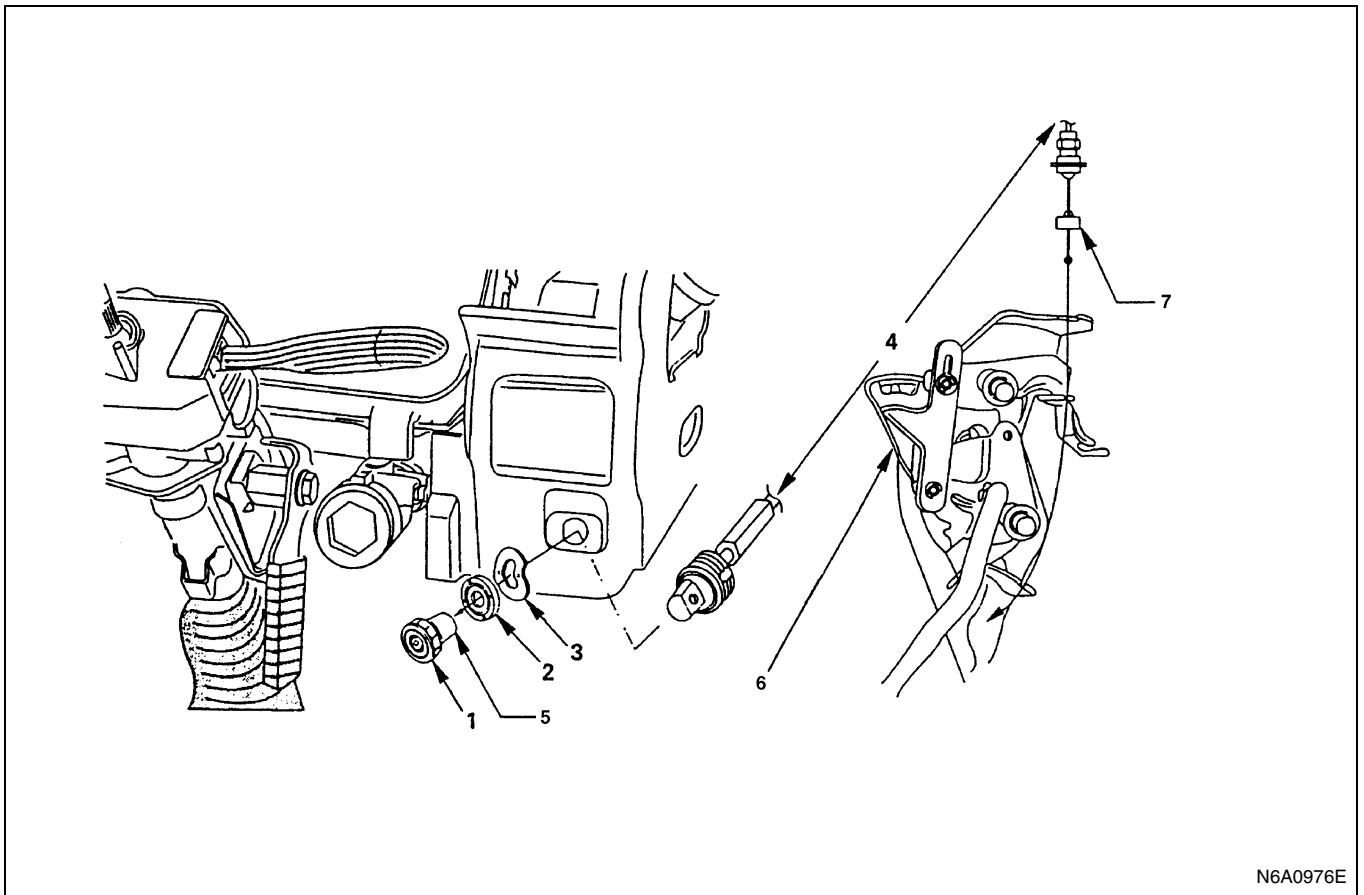
Installation

1. Accelerator Pedal Assembly
 - Apply grease to the sliding portion, and install it to the brake pedal bracket.
2. Idling Control Cable
 - Install the idling control cable to the lever of the accelerator pedal bracket.
3. Accelerator Control Cable
 - After confirming that the idling control knob is turned fully to the left, install the accelerator control cable.
4. Switch Connector



IDLING CONTROL CABLE

Component



Legend

- | | |
|-----------------------------|------------------------------|
| 1. Idling control knob | 5. Screw |
| 2. Idling control cable nut | 6. Accelerator pedal bracket |
| 3. Wave washer | 7. Wire guide |
| 4. Idling control cable | |

Removal

1. Idling Control Knob
 - Loosen the idling control knob screw and remove the knob from cable.
2. Idling Control Cable Nut
3. Wave Washer
4. Idling Control Cable
 - Remove control cable from accelerator pedal bracket.

Installation

1. Idling Control Cable
 - Install control cable to Accelerator pedal bracket.
2. Wave Washer
3. Idling Control Cable Nut

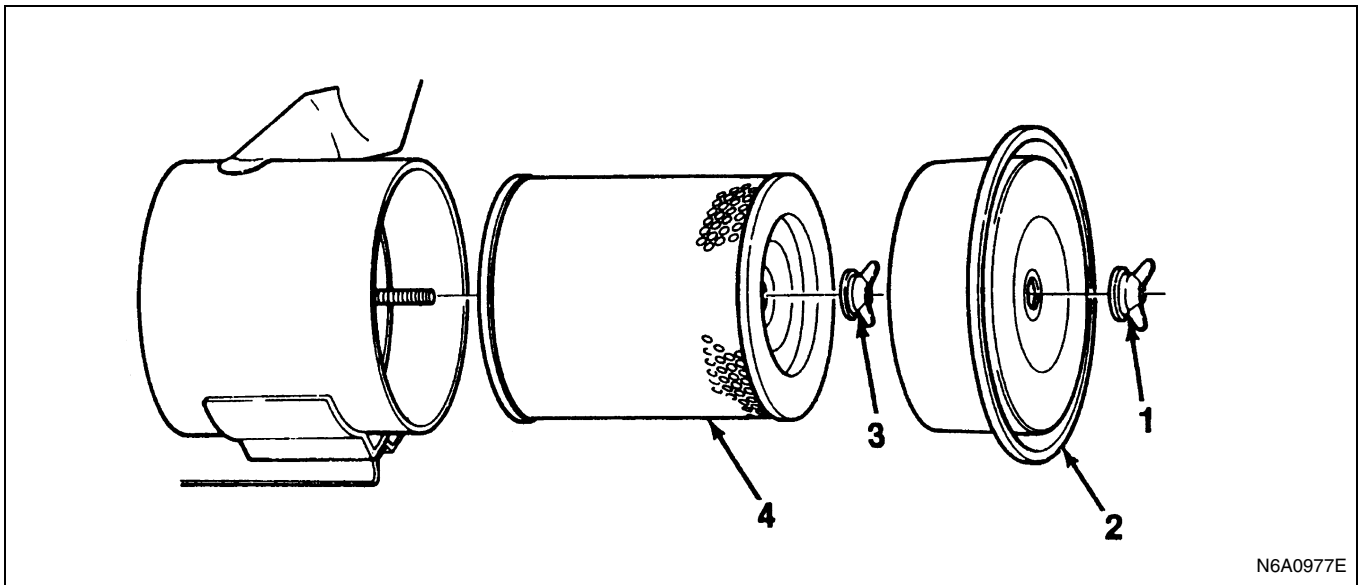
- Insert the idling control cable into the specified hole of the instrument panel.
 - Install the washer to the cable, and tighten it with a nut.
4. Idling Control Knob
 - Insert the idling control knob into the cable, and tighten the screw.

Inspection:

- With the idling control knob not in use, check to see if the injection pump lever is at the idle position (with the lever in contact with the stopper bolt).
- With the idling control knob turned fully to the right, check to see if the number of the engine idling rotations gets to 1,500 rpm or more.

AIR CLEANER ELEMENT

Component



Legend

- | | |
|-------------------|------------------------|
| 1. Cover wing nut | 3. Filter wing nut |
| 2. End cover | 4. Air cleaner element |

Removal

1. Cover Wing Nut
2. End Cover
3. Filter Wing Nut
4. Air Cleaner Element

Clean

- Wipe out the inside of the Air cleaner assembly
- Wipe off the Cover

Inspection

- The air filter with a light for fears or holes.

Cleaning Method

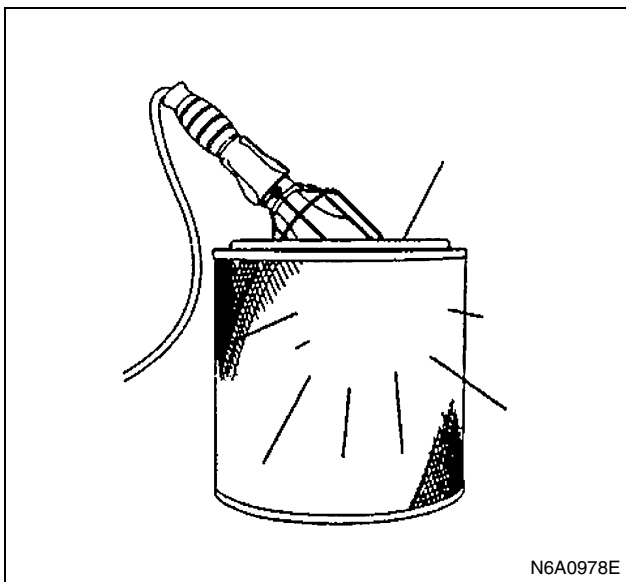
Dust Fouled Element

Rotate the element with your hand while applying compressed air to the inside of the element. This will blow the dust free.

Compressed air pressure	kPa (kg/cm ² /psi)
392 — 490	(4 — 5/57 — 71)

Caution:

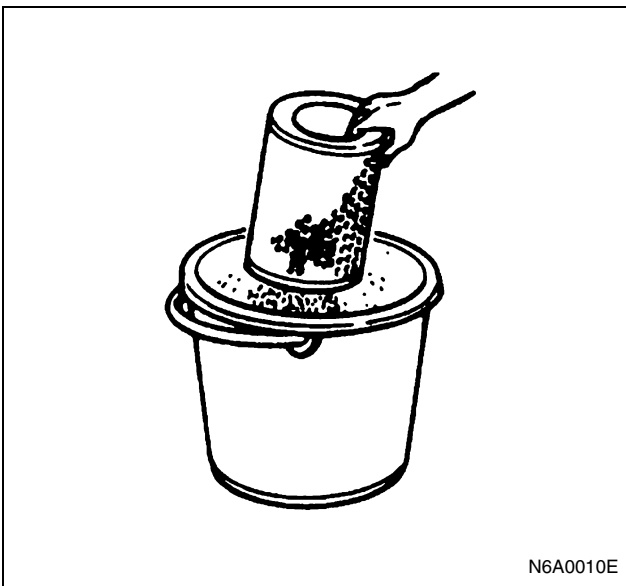
Do not bang the element against another object in an attempt to clean it. Damage to the element will result.





Carbon and Dust Fouled Element

1. Prepare a cleaning solution of Isuzu Genuine Element Cleaner (Donaldson D1400) diluted with water.
2. Submerge the element in the solution for twenty minutes.



3. Remove the element from the solution and rinse it well with running water.
Water pressure must not exceed 274 kPa (2.8 kg/cm²/40 psi)

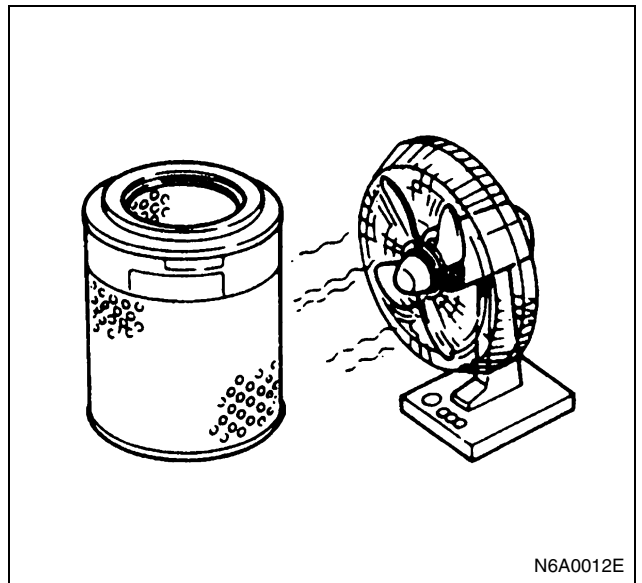


4. Dry the element in a well ventilated area.
An electric fan will hasten drying.

Notice:

Do not use compressed air or an open flame to dry the element quickly. Damage to the element will result.

It will usually take two or three days for the element to dry completely. Therefore, it is a good idea to have a spare on hand to use in the interim.



Installation

1. Air Cleaner Element
2. Filter Wing Nut
3. End Cover
4. Cover Wing Nut

ENGINE ELECTRICAL

BATTERY

General Description

There are six battery fluid caps at the top of the battery. The battery is completely sealed except for the six small vent holes at the side. These vent holes permit the escape of small amounts of gas generated by the battery. This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging. The battery will refuse to accept an excessive charge. (A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self-discharge than a conventional type battery.

Diagnosis

Visual Inspection

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.

Replace the battery if obvious physical damage is discovered during inspection.

Check for any other physical damage and correct it as necessary. If not, proceed to "Hydrometer check".

Hydrometer Check

There is a built-in hydrometer (Charge test indicator) at the top of the battery. It is designed to be used during diagnostic procedures.

Before trying to read the hydrometer, carefully clean the upper battery surface.

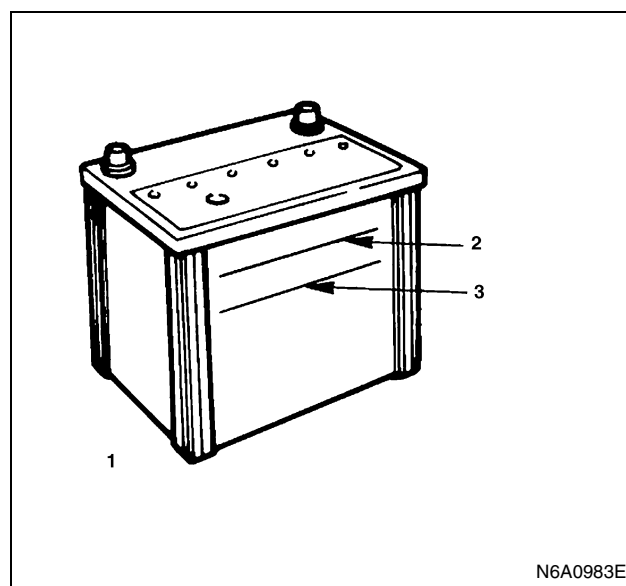
If your work area is poorly lit, additional light may be necessary to read the hydrometer.

- a. BLUE RING OR DOT VISIBLE - Go to "Voltage check".
- b. BLUE RING OR DOT NOT VISIBLE - Go to "Fluid level check".

Fluid Level Check

The fluid level should be between the upper level line and lower level line on side of the battery.

- a. CORRECT FLUID LEVEL - Charge the battery.
- b. BELOW LOWER LEVEL - Replace battery.



Legend

1. Battery
2. Upper level
3. Lower level

Voltage Check

1. Put voltmeter test leads to battery terminals.
 - a. VOLTAGE IS 12.4V OR ABOVE - Go to "Load test".
 - b. VOLTAGE IS UNDER 12.4V - Go to procedure 2 below.
2. Determine fast charge amperage from specification. (See Main Data and Specifications in this section). Fast charge battery for 30 minutes at amperage rate no higher than specified value. Take voltage and amperage readings after charge.
 - a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE - Replace battery.
 - b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE - Drop charging voltage to 15V and charge for 10 — 15 hours. Then go to "Load test".
 - c. VOLTAGE IS BETWEEN 12V AND 16V - Continue charging at the same rate for an additional 3-1/2 hours. Then go to "Load test".
 - d. VOLTAGE IS BELOW 12V - Replace battery.

Load Test

1. Connect a voltmeter and a battery load tester across the battery terminals.
2. Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.

3. Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).

Read voltage after 15 seconds, then remove load.

- 1) VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN FOLLOWING TABLE - The battery is good and should be returned to service.
- 2) VOLTAGE IS LESS THAN MINIMUM LISTED -Replace battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
°F	°C	
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	-1	9.1
20	-7	8.9
10	-12	8.7
0	-18	8.5

The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.

On-vehicle Service

Battery Charging

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery.
In this case, the battery must be replaced.
2. Pay close attention to the battery during the charging procedure.
Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick-charged or slow-charged in the same manner as other batteries.
Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

Jump Starting

Jump Starting With An Auxiliary (Booster) Battery

Caution:

Never push or to the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables.

Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING:

FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:

1. **SERIOUS PERSONAL INJURY, PARTICULARLY TO YOUR EYES.**
2. **PROPERTY DAMAGE FROM A BATTERY EXPLOSION, BATTERY ACID, OR AN ELECTRICAL FIRE.**
3. **DAMAGE TO THE ELECTRONIC COMPONENTS OF ONE OR BOTH VEHICLES PARTICULARLY.**

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.

Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.

Never allow battery fluid to come in contact with your eyes or skin.

Never allow battery fluid to come in contact with fabrics or painted surfaces.

Battery fluid is a highly corrosive acid.

Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.

Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.

Always keep batteries out of the reach of young children.

Jump Starting Procedure

1. Set the vehicle parking brake.
If the vehicle is equipped with an automatic transmission, place the selector lever in the "PARK" position.
If the vehicle is equipped with a manual transmission, place the shift lever in the "NEUTRAL" position.
Turn "OFF" the ignition.
Turn "OFF" all lights and any other accessory requiring electrical power.
2. Look at the built-in hydrometer.
If the indication area of the built-in hydrometer is completely clear, do not try to jump start.

3. Attach the end of one jumper cable to the positive terminal of the booster battery.
Attach the other end of the same cable to the positive terminal of the discharged battery.
Do not allow the vehicles to touch each other.
This will cause a ground connection, effectively neutralizing the charging procedure.
Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.
Attach the other end of the same cable to a solid engine ground (such as the A/C compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.
This ground connection must be at least 450 mm (18 in) from the battery of the vehicle whose battery is being charged.

WARNING:

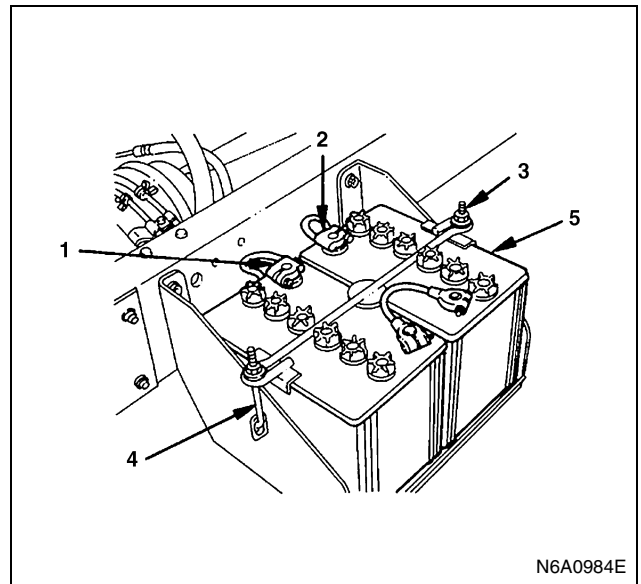
NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.

5. Start the engine of the vehicle with the good battery.
Make sure that all unnecessary electrical accessories have been turned "OFF".
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in the reverse order.

Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

Removal

1. Negative cable
2. Positive cable
3. Retainer screw and rods
4. Retainer
5. Battery



N6A0984E

Installation

To install the battery, follow the removal procedure in the reverse order, noting the following points:

1. Make sure that the rod is hooked on the body side.

Main Data and Specifications

Model	(JIS)	65D23R	75D23R	80D26R	115E41R	DELCO 31-750
Voltage	(V)	12	12	12	12	12
Cold-Cranking Performance	(Amp)		520	356		750
Reserve Capacity	(Min.)		180	133		160

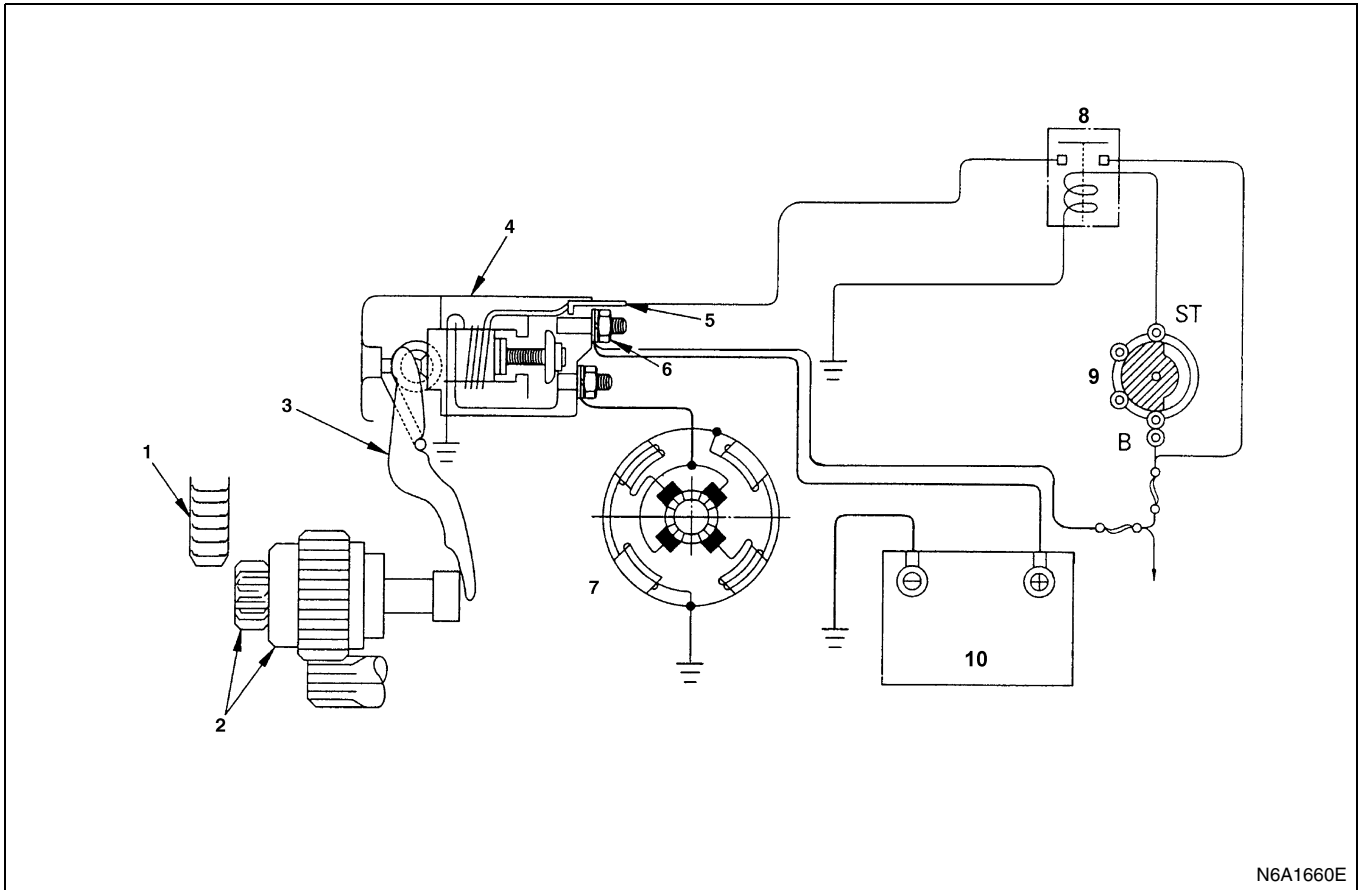
STARTING SYSTEM

GENERAL DESCRIPTION

Component

Starting Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. and these main components are connected as shown in figure. For details of the starting circuit.



Legend

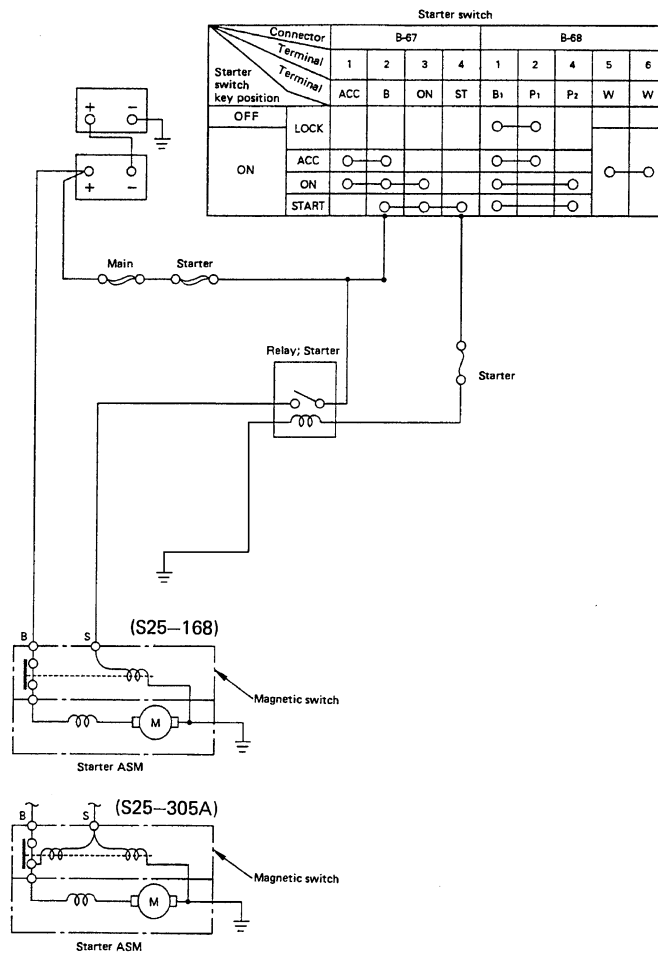
- | | |
|--------------------|-------------------|
| 1. Ring gear | 6. "B" terminal |
| 2. Pinion clutch | 7. Starter |
| 3. Shift lever | 8. Relay; starter |
| 4. Magnetic switch | 9. Starter switch |
| 5. "S" terminal | 10. Battery |

Starter

The starting system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.

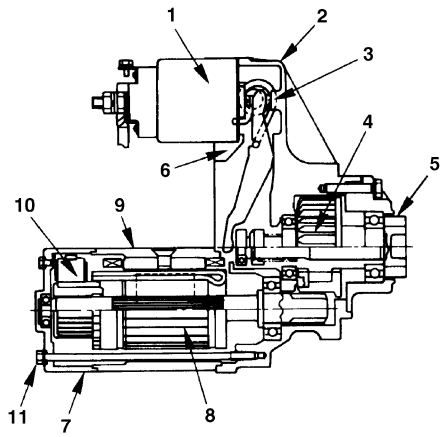
Starting Circuit



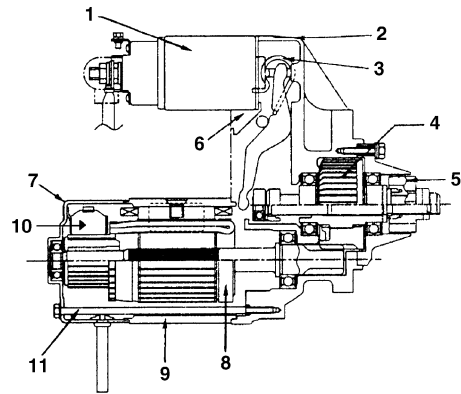
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Starting Motor

S25—168



S25—305A



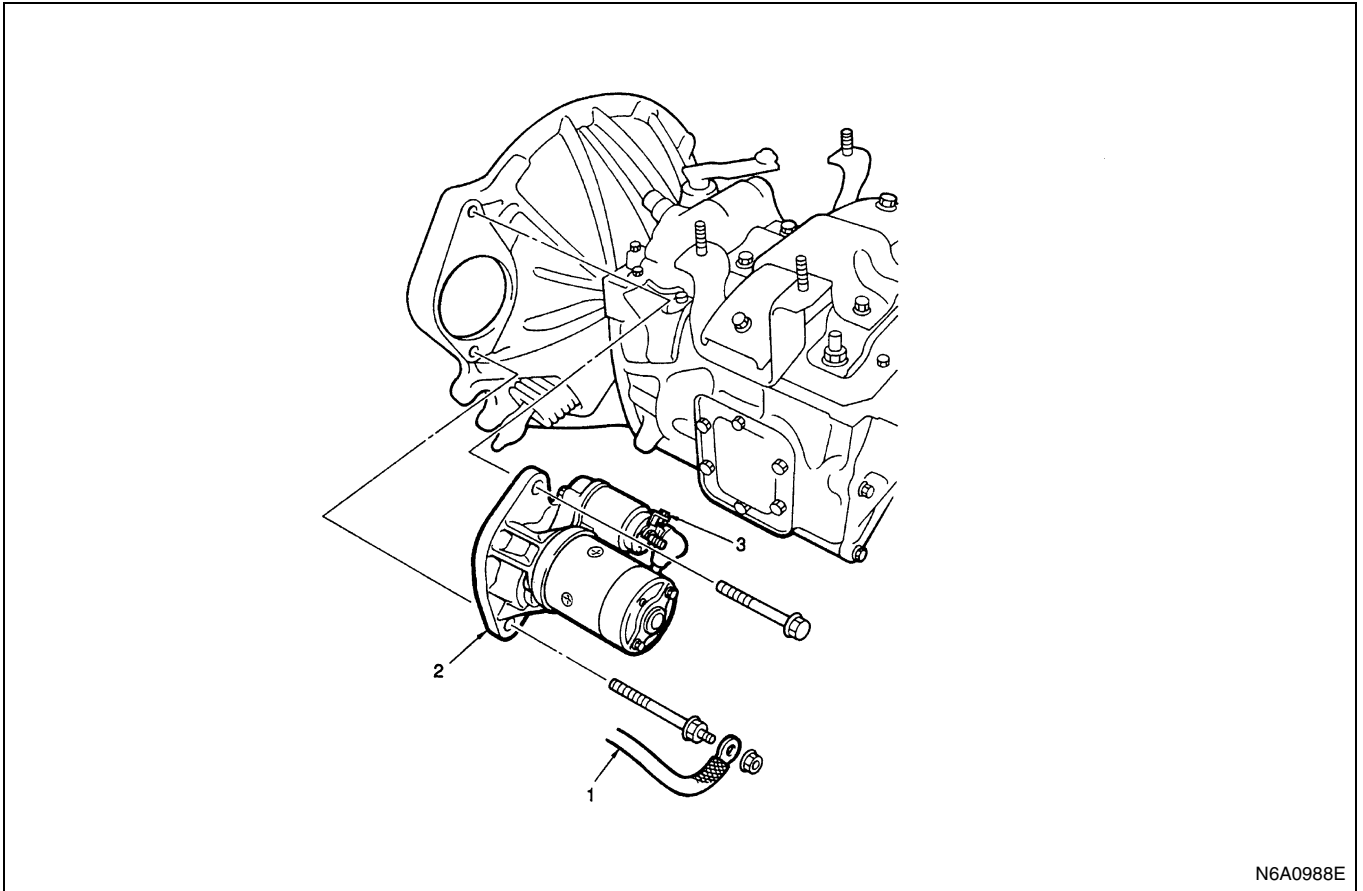
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Legend

- | | |
|--------------------|------------------|
| 1. Magnetic switch | 7. Rear cover |
| 2. Gear case | 8. Armature |
| 3. Torsion spring | 9. Yoke |
| 4. Clutch | 10. Brush |
| 5. Pinion | 11. Through bolt |
| 6. Dust cover | |

ON-VEHICLE SERVICE

Component Starter



N6A0988E

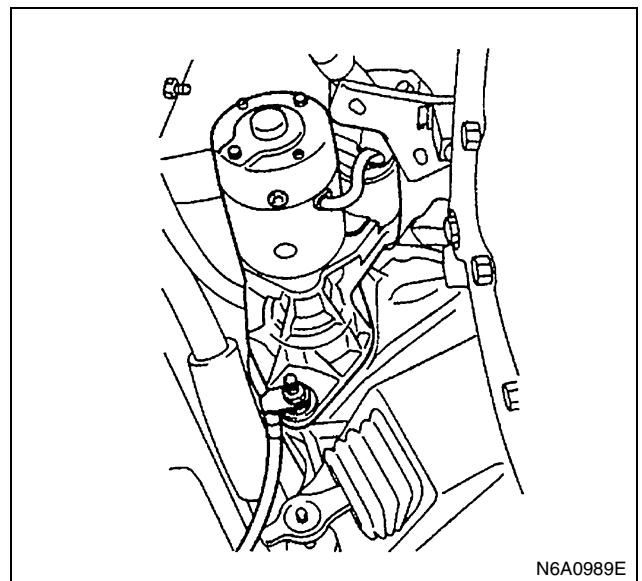
Legend

- | | |
|------------------------|-----------------------------|
| 1. Starter earth cable | 3. Starter wiring connector |
| 2. Starter assembly | |

Removal

Preparation

- Disconnect the battery ground cable (both batteries).
1. Starter Earth Cable

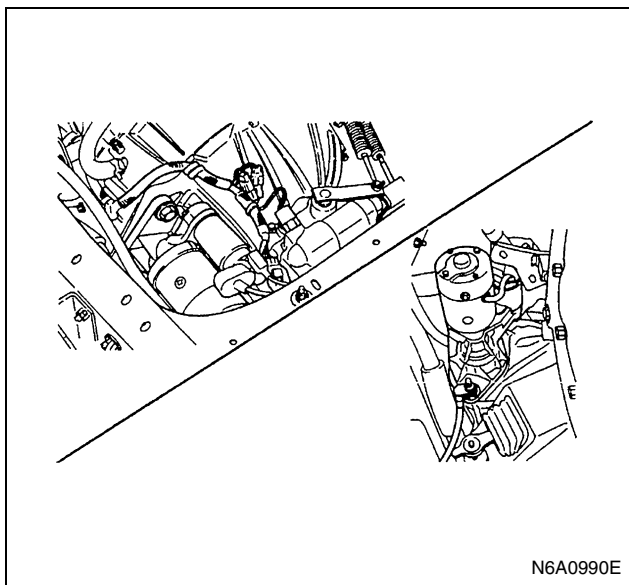


N6A0989E

- Disconnect the starter earth cable at the starter motor.

- Disconnect the front frame harness connector somewhere near the control box of the transmission, remove each clip that fastens the harness.

2. Starter Assembly

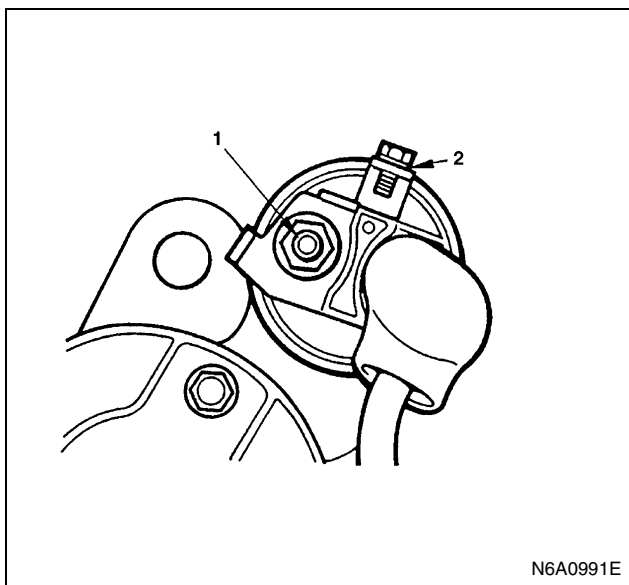


- Remove the starter assembly from flywheel housing.

3. Starter Wiring Connector

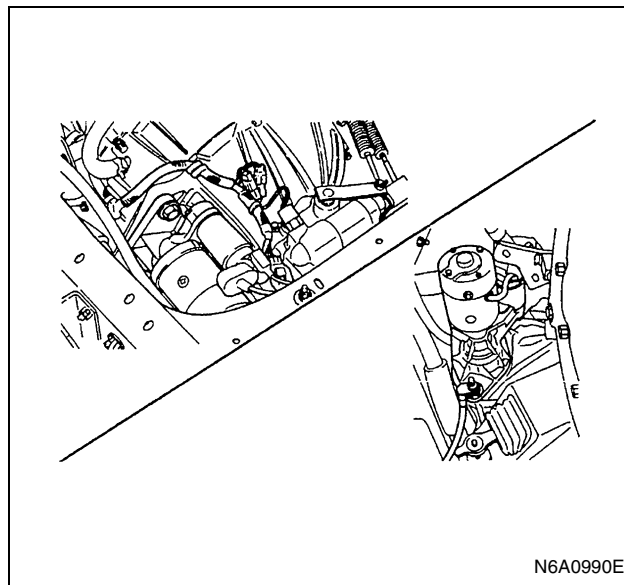
Installation

1. Starter Wiring Connector



Legend

1. Terminal B
2. Terminal S



- Install the starter to the flywheel housing.

Tighten:

Starter bolt to 126 N·m (12.9 kg·m / 93 lb·ft)

3. Starter Earth Cable

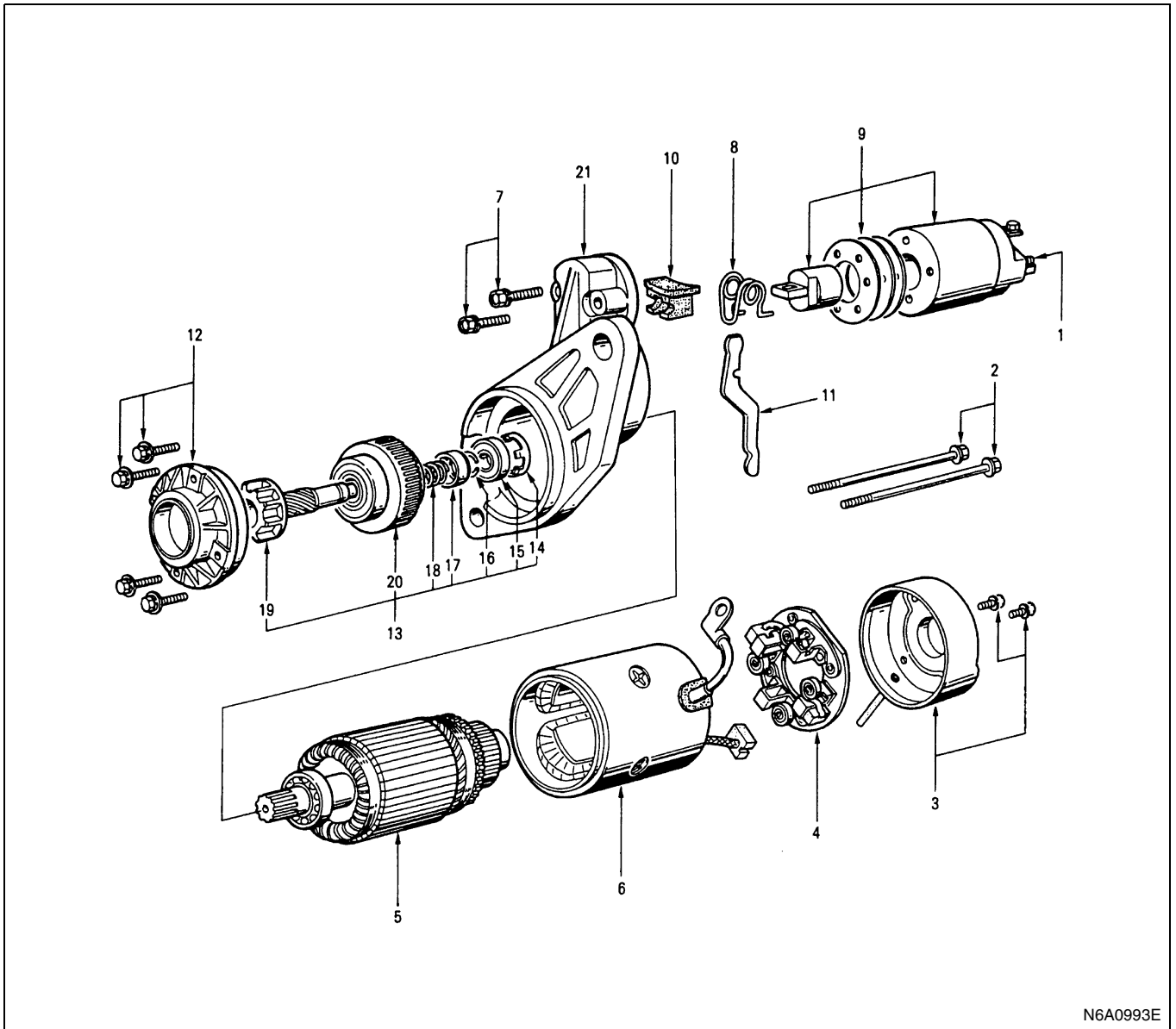
- Connect the earth cable to the starter motor.
- Connect the battery ground cable.

2. Starter Assembly

UNIT REPAIR

Component

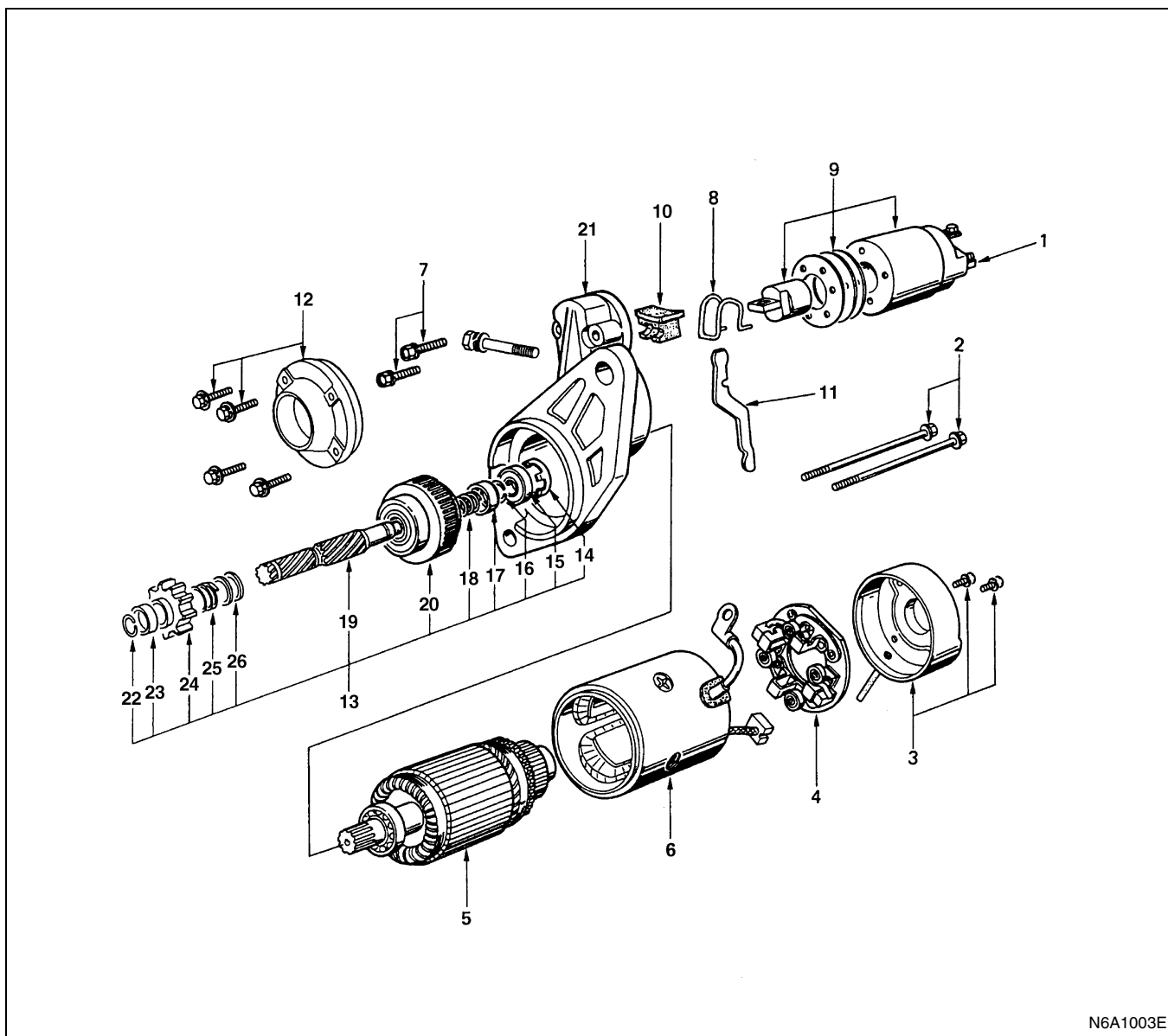
S25-168



N6A0993E

Legend

- | | |
|-----------------------------|-------------------------|
| 1. Lead wire nut | 12. Bearing retainer |
| 2. Through bolt | 13. Clutch assembly |
| 3. Rear cover | 14. Bearing holder |
| 4. Brush holder | 15. Ball bearing |
| 5. Armature | 16. Pinion stopper clip |
| 6. Yoke | 17. Pinion stopper |
| 7. Bolt | 18. Return spring |
| 8. Torsion spring | 19. Pinion shaft |
| 9. Magnetic switch assembly | 20. Pinion clutch |
| 10. Dust cover | 21. Gear case |
| 11. Shift lever | |

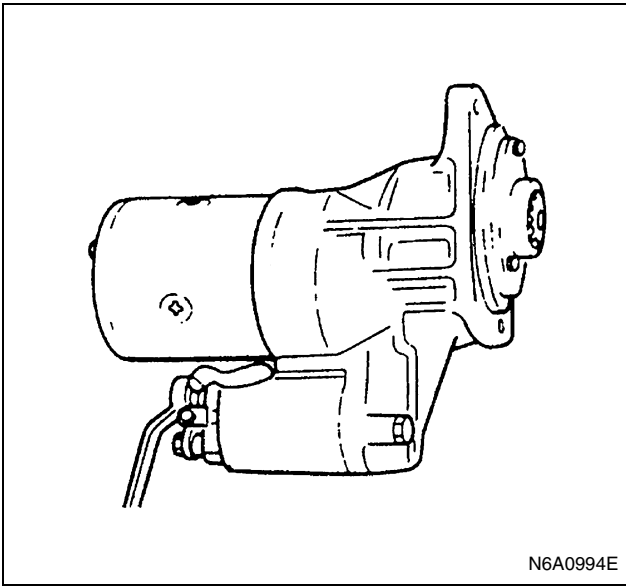


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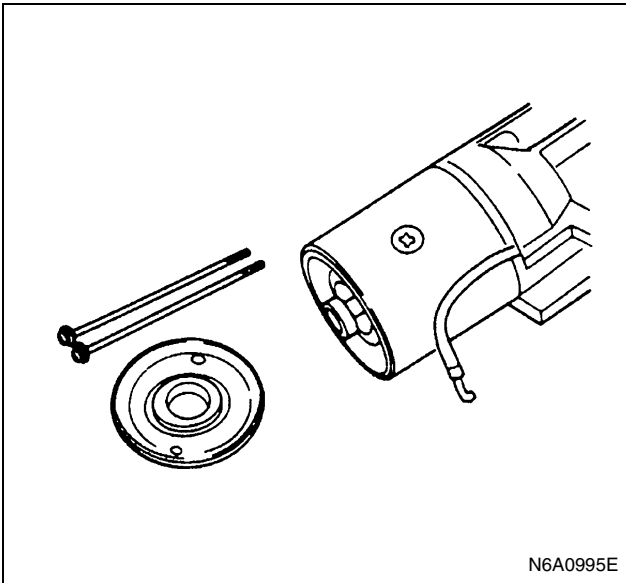
Legend

- | | |
|-----------------------------|-------------------------|
| 1. Lead wire nut | 14. Bearing holder |
| 2. Through bolt | 15. Ball bearing |
| 3. Rear cover | 16. Pinion stopper clip |
| 4. Brush holder | 17. Pinion stopper |
| 5. Armature | 18. Return spring |
| 6. Yoke | 19. Pinion shaft |
| 7. Bolt | 20. Pinion clutch |
| 8. Torsion spring | 21. Gear case |
| 9. Magnetic switch assembly | 22. Clip |
| 10. Dust cover | 23. Pinion stopper |
| 11. Shift lever | 24. Pinion |
| 12. Bearing retainer | 25. Cushion spring |
| 13. Clutch assembly | 26. Washer |

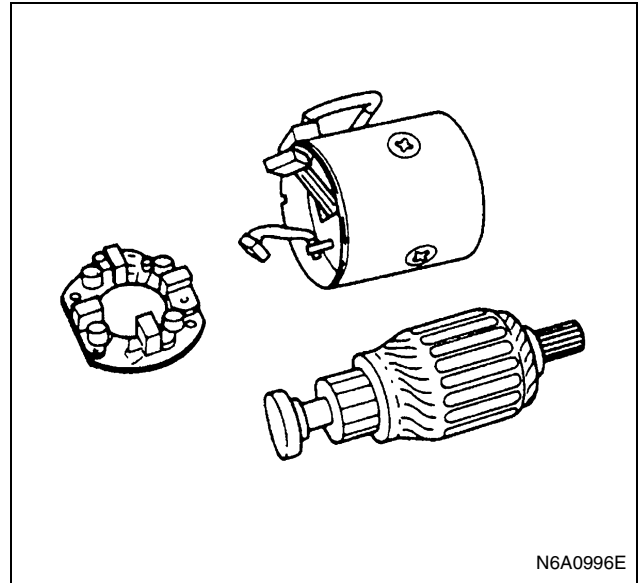
Disassembly



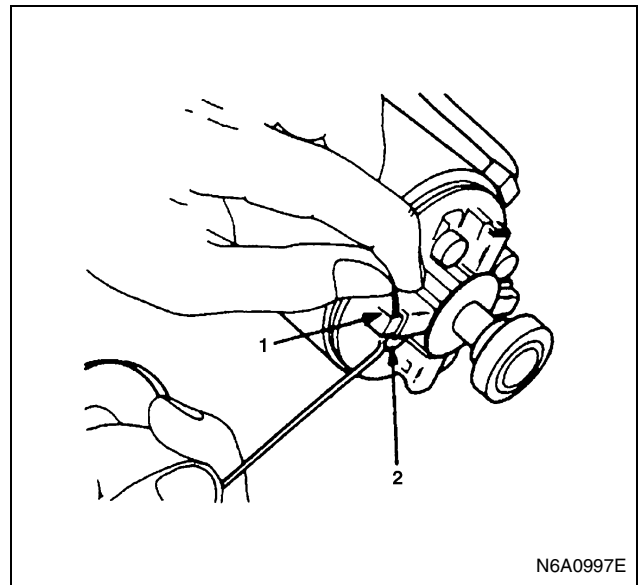
1. Lead Wire Nut
Disconnect the lead wire at the magnetic switch.
2. Through Bolt



3. Rear Cover
Remove the through bolts, then remove the rear cover.
4. Brush Holder



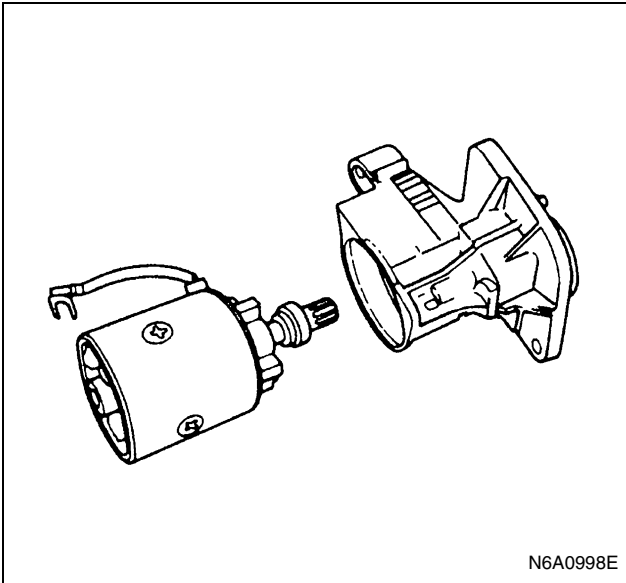
5. Armature
6. Yoke
Remove the brush holder and pull the armature assembly from the yoke.
Remove the four brushes from the brush holders.



Legend

1. Brush
2. Brush spring

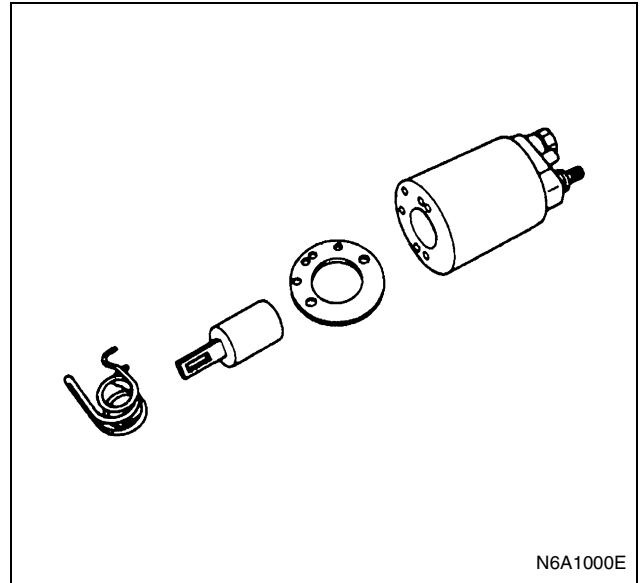
Remove the yoke along with the armature and the brush holder from the drive housing.



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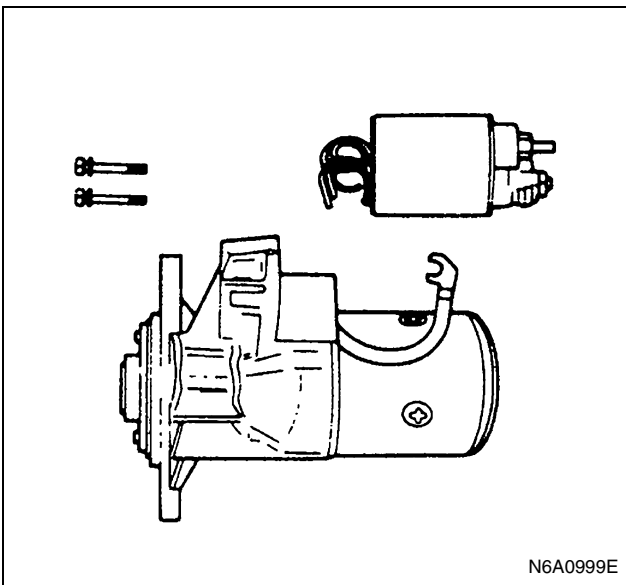
Remove the brushes and commutator carefully so as not to allow them in contact with the adjacent parts.

- 7. Bolt
- 8. Torsion Spring
- 9. Magnetic Switch Assembly



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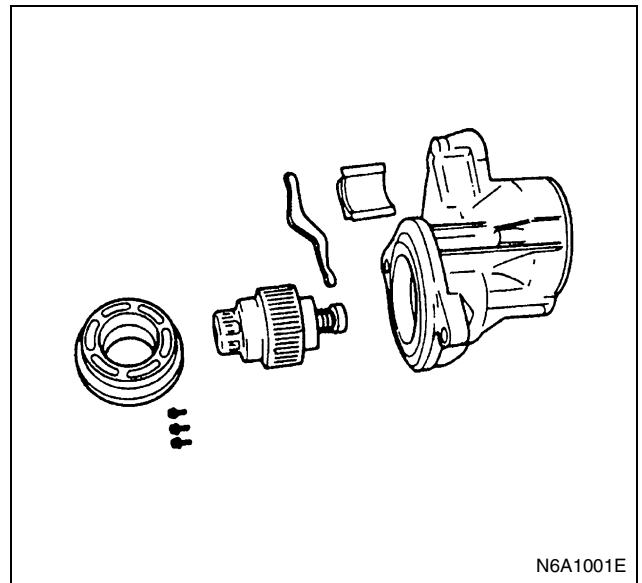
- 10. Dust Cover
- 11. Shift Lever
- 12. Bearing Retainer
- 13. Clutch Assembly



N6A0999E

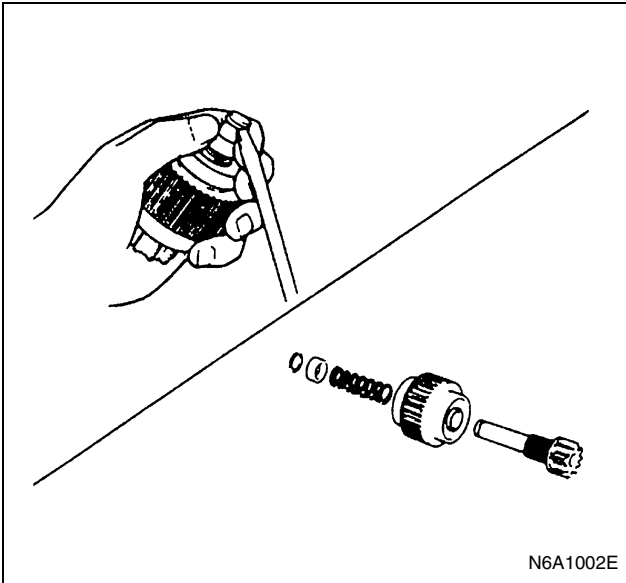
Remove the magnetic switch bolts, then remove the switch from the shift lever.

Remove the torsion spring from the magnetic switch.



N6A1001E

- 1) Remove the bearing retainer.
 - 2) Remove the clutch assembly from the gear case.
 - 14. Bearing Holder
 - 15. Ball Bearing
 - 16. Pinion Stopper Clip
 - 17. Pinion Stopper
 - 18. Return Spring
 - 19. Pinion Shaft
 - 20. Pinion Clutch
- Use a screwdriver to remove the stopper clip. Then disassemble the clutch assembly.



N6A1002E

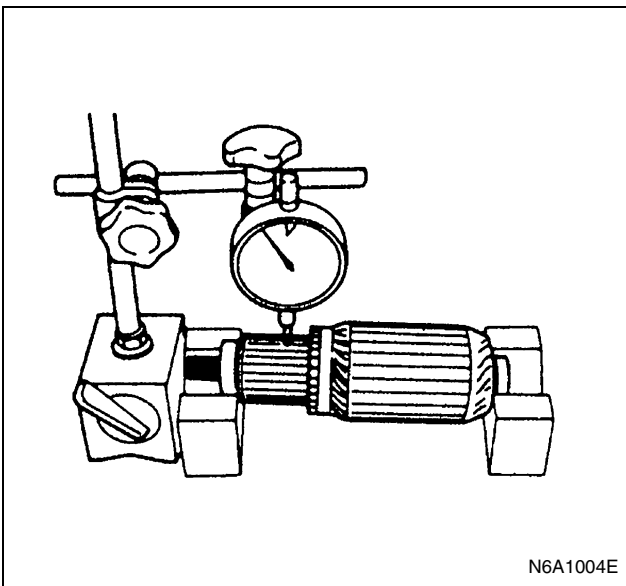
Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Armature

1. Measure the commutator run-out.
Replace the commutator if the measured run-out exceeds the specified limit.

Commutator Run-Out		mm (in)
Standard	Limit	
0.05 (0.002) or less	0.2 (0.008)	



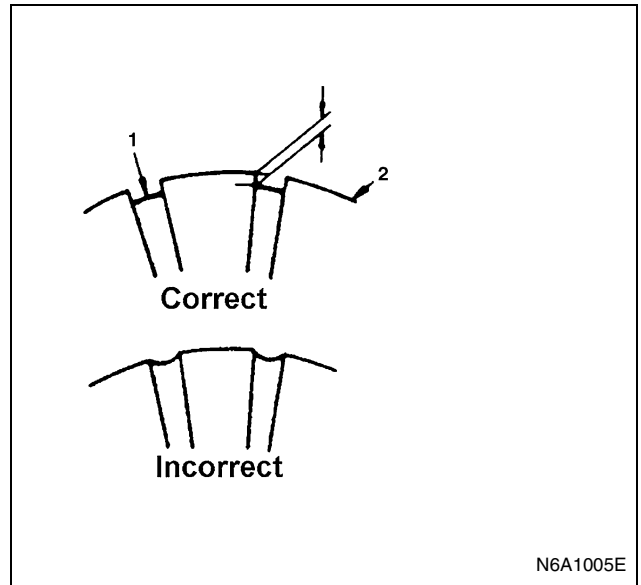
N6A1004E

2. Check the commutator mica segments for excessive wear.
3. Measure the mica segment depth.

Mica Segment Depth		mm (in)
Standard	Limit	
0.5 — 0.8 (0.020 — 0.031)	0.2 (0.008)	

If the mica segment depth is less than the standard but more than the limit, the commutator may be re-ground.

If the mica segment depth is less than the limit, the commutator must be replaced.

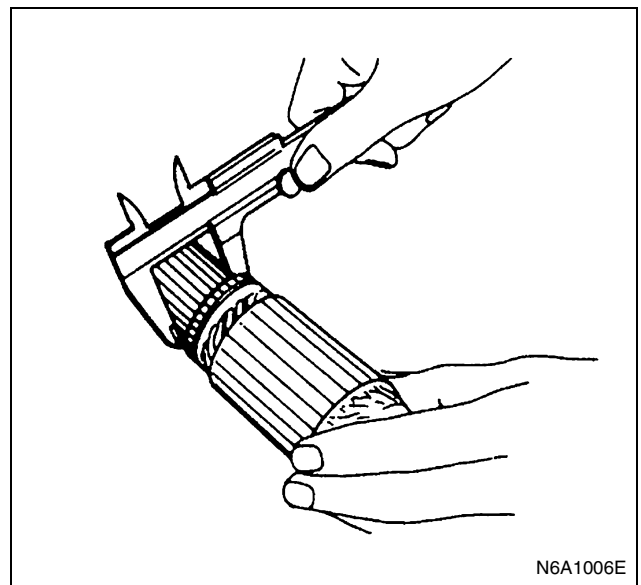


N6A1005E

Legend

1. Insulator
2. Commutator segments

4. Measure the commutator outside diameter.

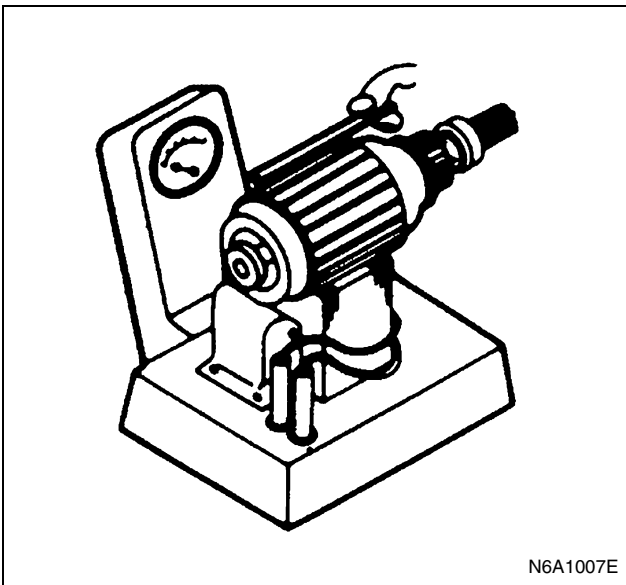


N6A1006E

Commutator Outside Diameter			mm (in)
Model	Yoke Diameter	Standard	Limit
S25-163C	φ80	36.5 (1.437)	35.5 (1.398)
S25-305C	φ90	38.0 (1.496)	36.6 (1.441)

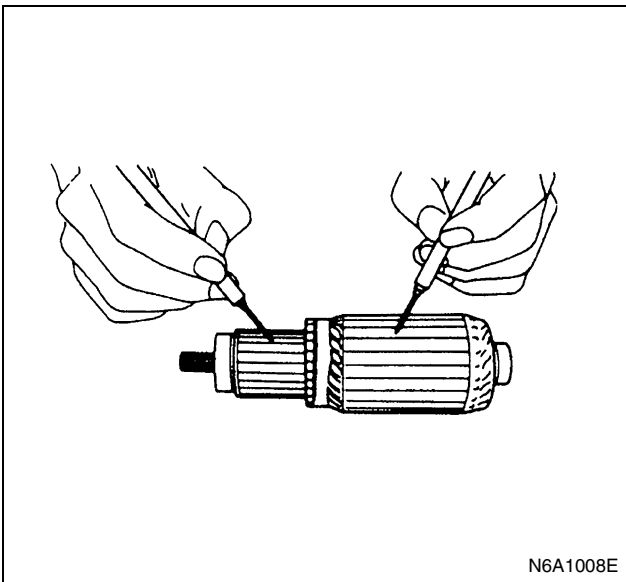
If the measured outside diameter is less than the specified limit, the commutator must be replaced.

5. Test the armature for short circuiting.

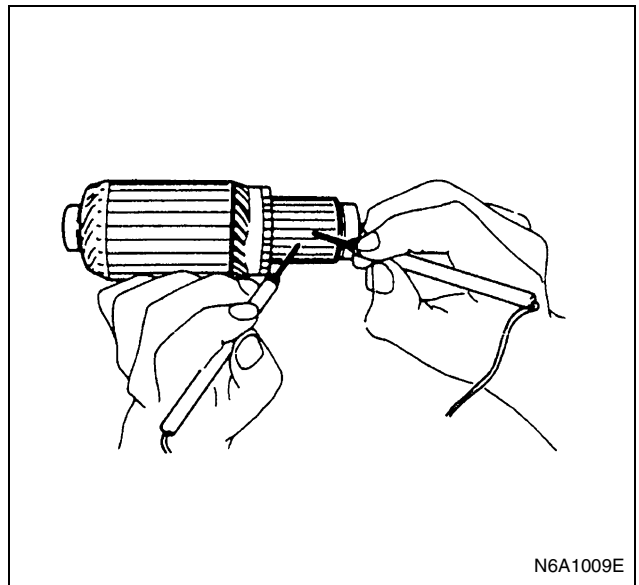


- Place the armature in a growler tester.
- Hold a hacksaw blade against the armature core.
If the armature has a short circuit, the hacksaw blade will vibrate.
Replace the armature if there is a short circuit.

6. Use a circuit tester to check the armature for grounding.



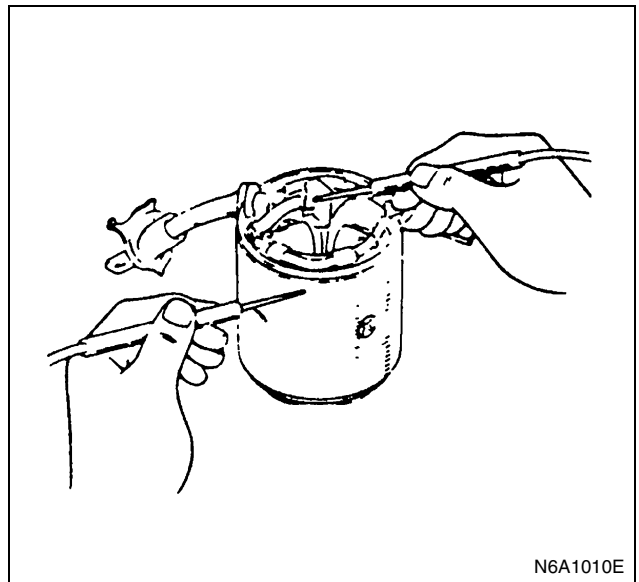
- Hold one probe of the circuit tester against the commutator segment.
 - Hold the other circuit tester probe against the armature core.
If the circuit tester indicates continuity, the armature is grounded.
The armature must be replaced.
7. Use the circuit tester to check the armature for continuity.



- Hold the circuit tester probes against two armature core segments.
- Repeat Step 1 at different segments of the armature core.
There should be continuity between all segments of the armature core.
If there is not, the armature must be replaced.

Yoke

- Use a circuit tester to check the field winding ground.



1) Hold one circuit tester probe against the field winding end or brush.

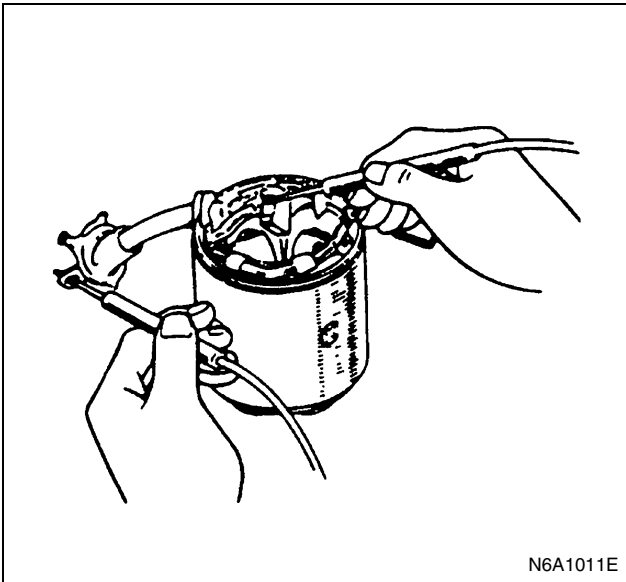
2) Hold the other circuit tester probe against the bare surface of the yoke body.

There should be no continuity.

If there is continuity, the field coil is grounded.

The yoke must be replaced.

2. Use the circuit tester to check the field winding continuity.



1) Hold one circuit tester probe against the "C" terminal lead wire.

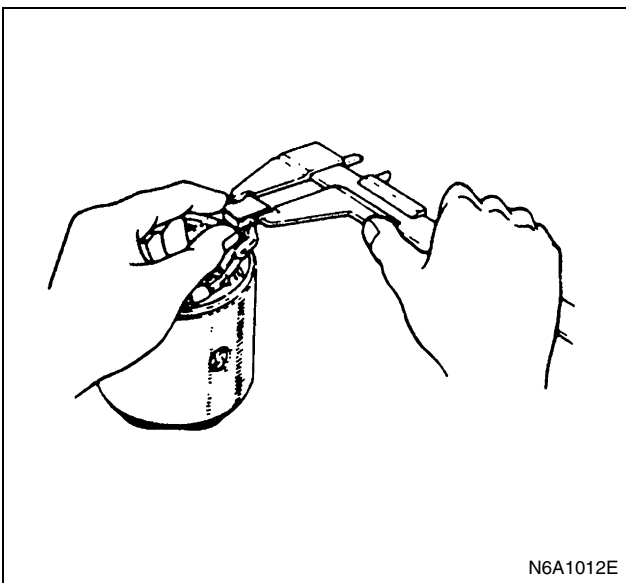
2) Hold the other circuit tester probe against the field winding brush.

There should be continuity.

If there is no continuity, the yoke must be replaced.

Brush and Brush Holder

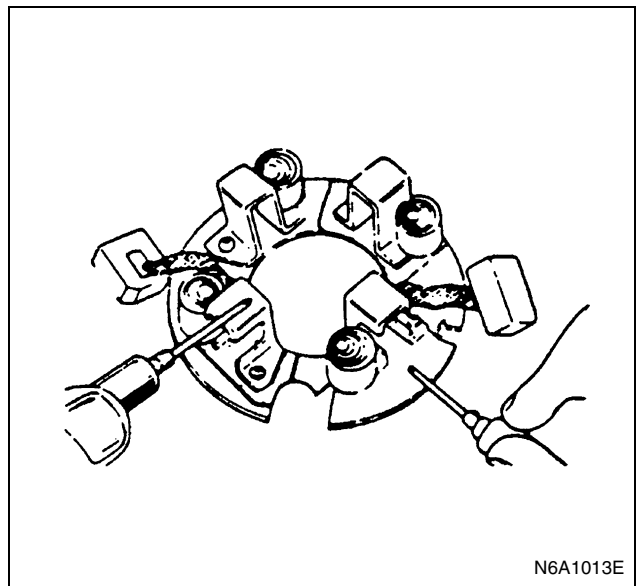
1. Use a vernier caliper to measure the brush length (four brushes).



Replace the brushes as a set if one or more of the brush length is less than the specified limit.

Brush Length			mm (in)
Model	Yoke Diameter	Standard	Limit
S25-168	φ80	15.0 (0.591)	10.5 (0.413)
S25-305	φ90	18.0 (0.709)	11.0 (0.433)

2. Use a circuit tester to check the brush holder insulation.



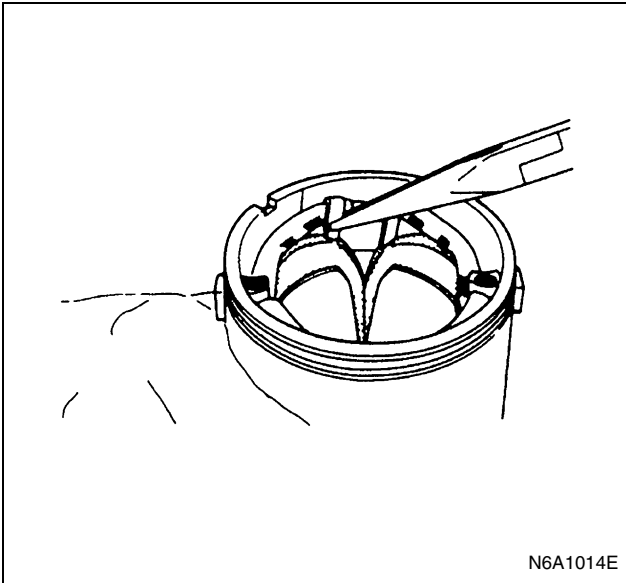
Touch one probe to the holder plate and the other probe to the positive brush holder.

There should be no continuity.

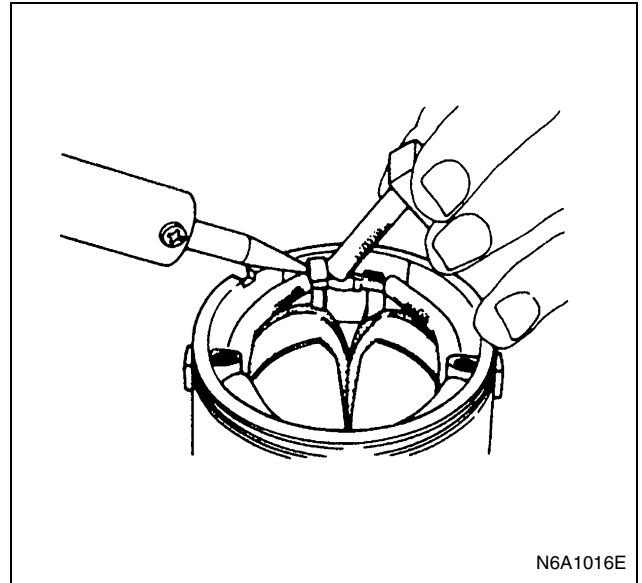
3. Inspect the brushes for excessive wear. If the negative brushes have excessive wear, the entire brush holder assembly must be replaced.

If the positive brushes have excessive wear, only the brushes must be replaced.

1) Use a pair of side cutters to cut the lead wire from the brush.



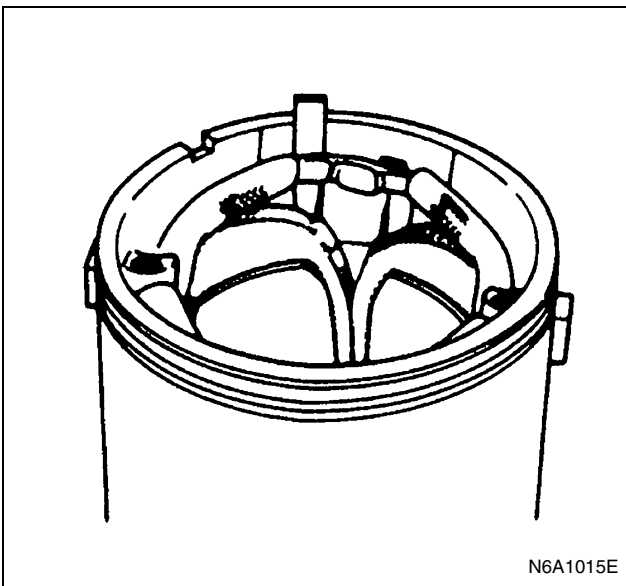
- 2) File away any foreign material clinging to the edge of the lead wire.
- 3) Remove the brushes from the brush holder.
- 4) Install the new brushes.
- 5) Straighten the bent portion of the clip.



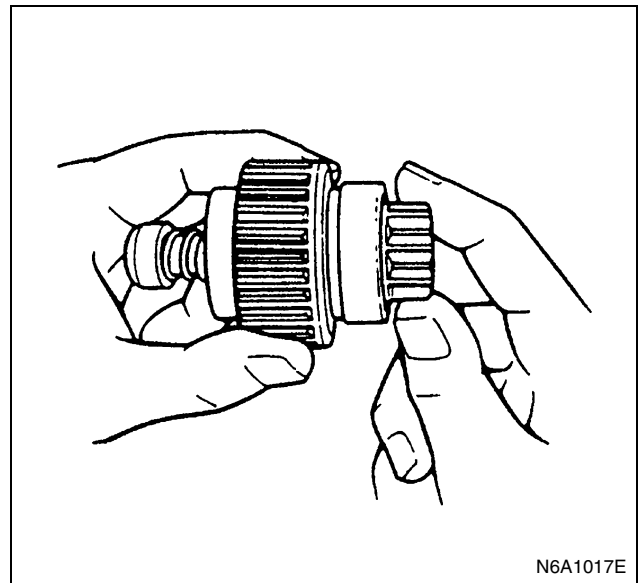
- 10) Repeat the procedure for each of the brushes.

Overrunning Clutch

1. Inspect the overrunning clutch gear teeth for excessive wear and damage. Replace the overrunning clutch if necessary.
2. Rotate the pinion clockwise.



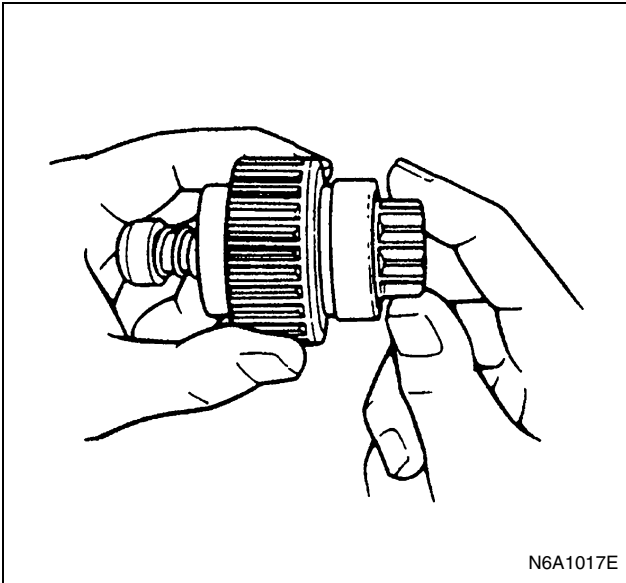
- 6) File away any foreign material clinging to the clip surface.
- 7) Place the lead wire in the clip.
- 8) Bend the clip shut.
- 9) Solder the brush lead.



- It should turn smoothly.
3. Try to rotate the pinion in the opposite direction. The pinion should lock.

Ball Bearing

Inspect the bearings for excessive wear and damage. Replace the bearings if necessary.



N6A1017E

Magnetic Switch

The following tests must be performed with the starter motor fully assembled.

The yoke lead wire must be disconnected from the "C" terminal.

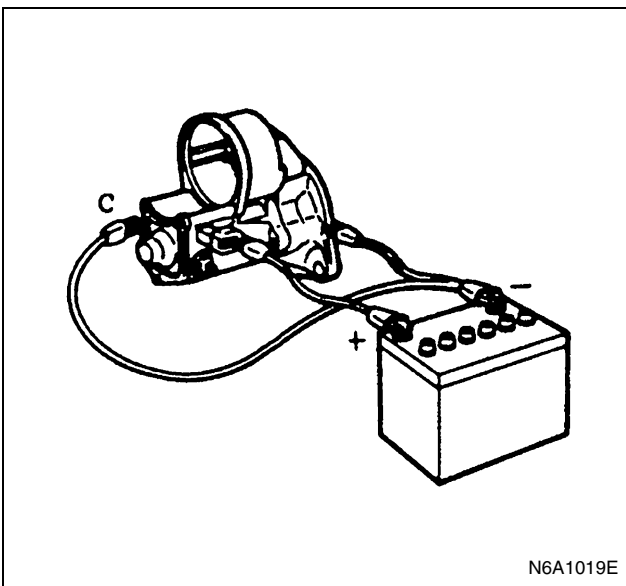
To prevent coil burning, complete each test as quickly as possible (within three to five seconds).

Temporarily connect the magnetic switch between the clutch and the housing and run the following test.

Complete each test within three to five seconds.

1. Pull-Out Test

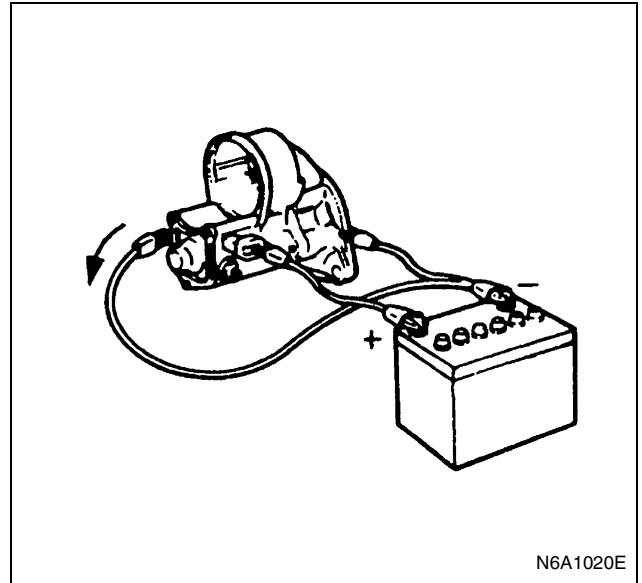
Connect the battery negative terminal with the magnetic switch body and the C terminal. When current is applied to the 50 terminal from the battery positive terminal, the pinion should flutter.



N6A1019E

2. Hold-in Maintenance Test

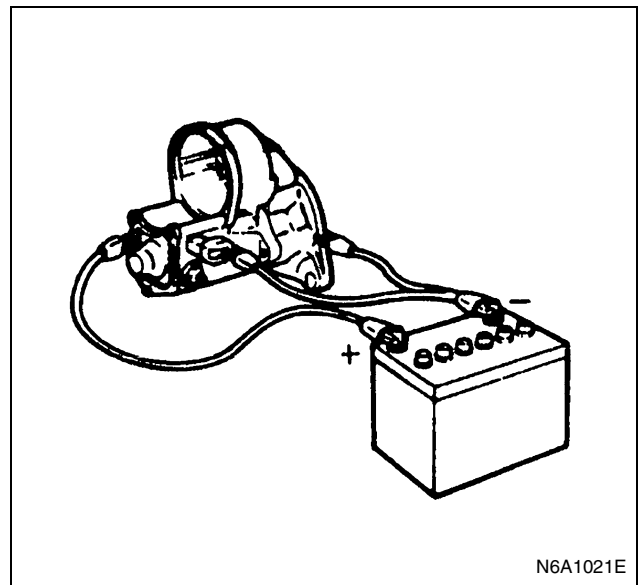
Disconnect the lead at the C terminal. The pinion should continue to flutter.



N6A1020E

3. Return Test

Connect the battery negative leads to the starter body and the 50 terminal.

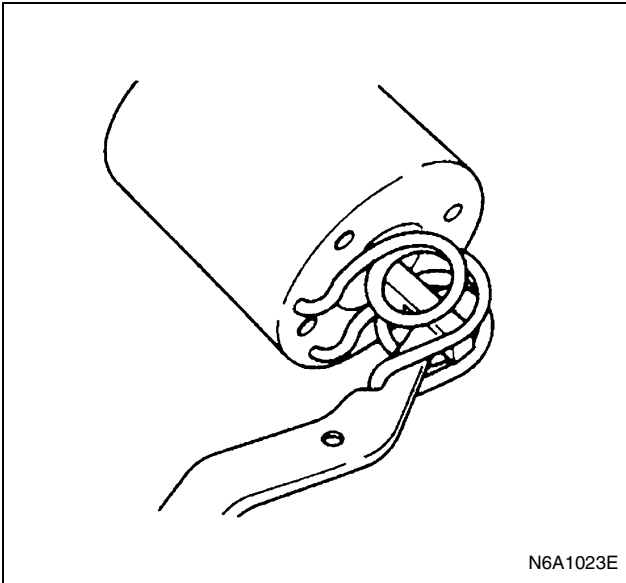


N6A1021E

Connect the battery positive lead at the C terminal. The pinion should return to its home position.

Reassembly

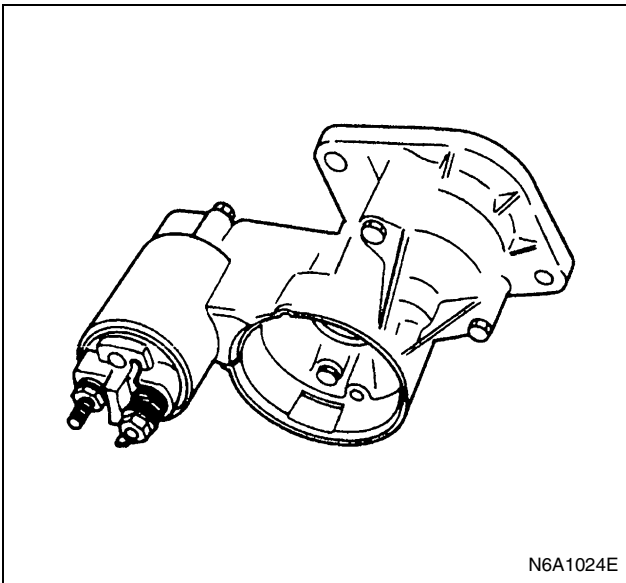
1. Gear Case
2. Magnetic Switch Assembly
3. Torsion Spring
4. Shift Lever
 - 1) Attach the torsion spring to the hole in the magnetic switch as illustrated.



N6A1023E

2) Insert the shift lever into the plunger hole of the magnetic switch.

5. Dust Cover
Install the dust cover.
6. Bolt
Install the magnetic switch assembly in the gear case and tighten the bolt to the specified torque.

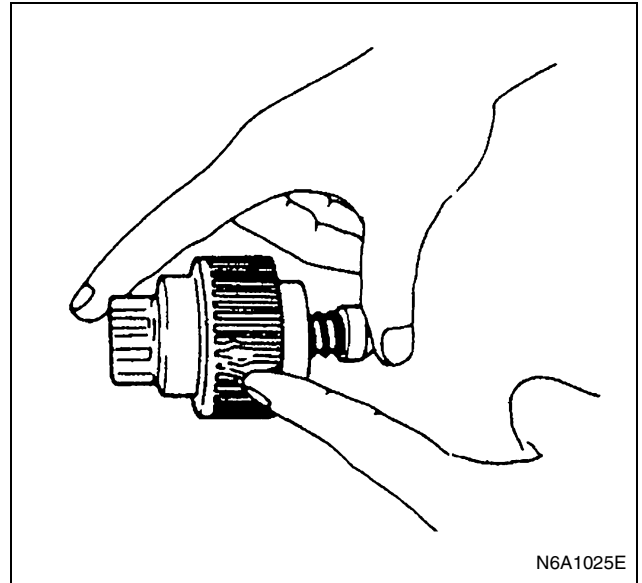


N6A1024E

Tighten:

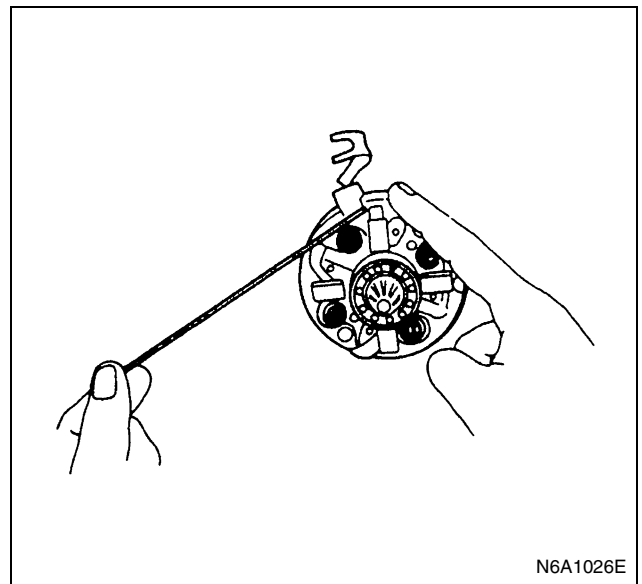
Gear case bolt to 8 N·m (0.8 kg·m / 69 lb·in)

7. Pinion Clutch
8. Pinion Shaft
Apply a coat of grease to the pinion clutch gear and install the pinion assembly to the armature shaft.



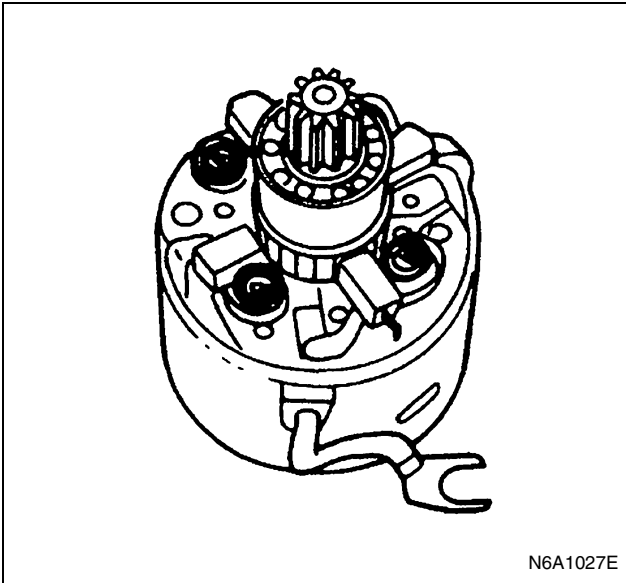
N6A1025E

9. Return Spring
10. Pinion Stopper
11. Pinion Stopper Clip
12. Ball Bearing
13. Bearing Holder
14. Clutch Assembly
15. Bearing Retainer
16. Armature
17. Yoke
18. Brush Holder



N6A1026E

- 1) Twist the holder spring and hold it.
- 2) Install the brush to the brush holder.
- 3) Repeat step 1 and 2 for the remaining holders.
- 4) Install the brush holder assembly to the yoke.

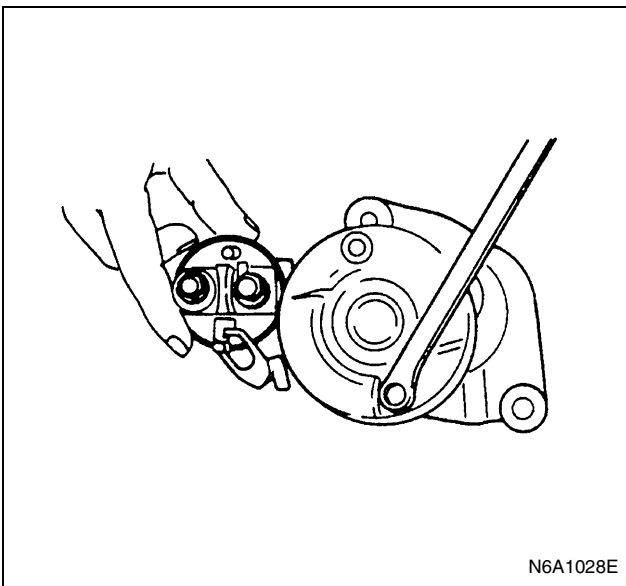


N6A1027E

Take care not to damage the commutator face and the brushes.

19. Rear Cover
20. Through Bolt

Install the through bolts in the rear cover and tighten them to the specified torque.



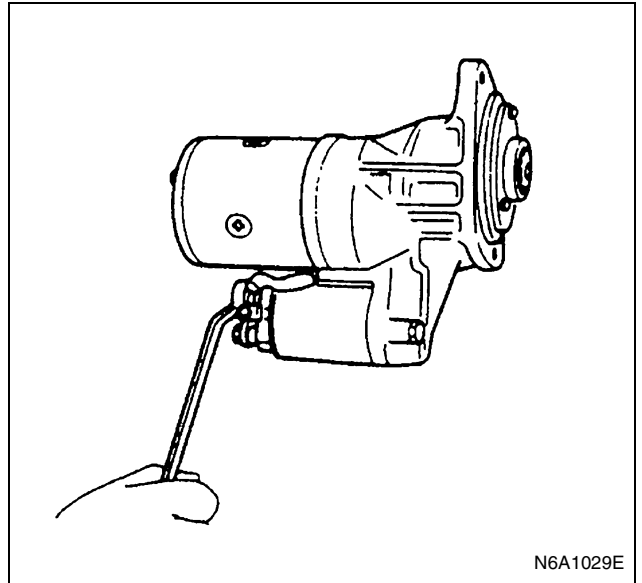
N6A1028E

Tighten:

Through bolt to 6 N·m (0.6 kg·m / 52 lb·in)

21. Lead Wire Nut

Connect the lead wire in the magnetic switch and tighten the terminal nut to the specified torque.



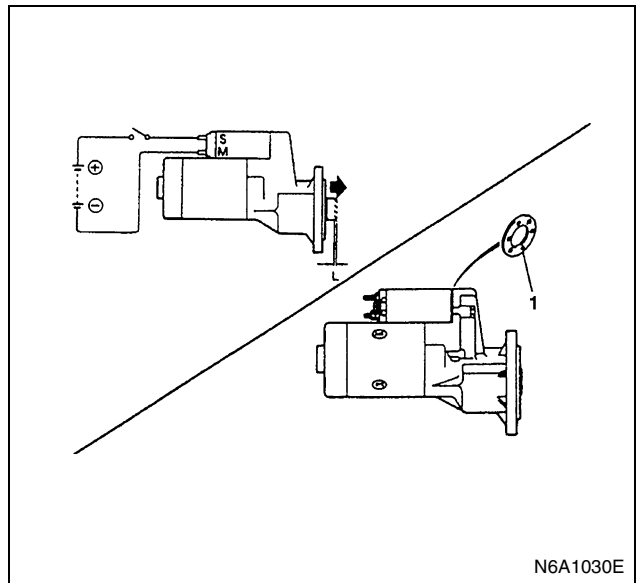
N6A1029E

Tighten:

Lead wire terminal nut to 10 N·m (1.0 kg·m / 87 lb·in)

Pinion Jump-out dimension

- Connect the (+) cable of battery to terminal S and the (-) cable to terminal M. Turn the switch on, and measure pinion travel dimension "L" in thrust direction from the jump-out position.



N6A1030E

Legend

1. Spacer

In measuring the dimension, pull the pinion out a little in the arrow direction.

		mm (in)
Dimension		Standard
L		0.3 — 0.1 (0.01 — 0.004)

If the measured value is out of standard, adjust the of shims.

CHARGING SYSTEM

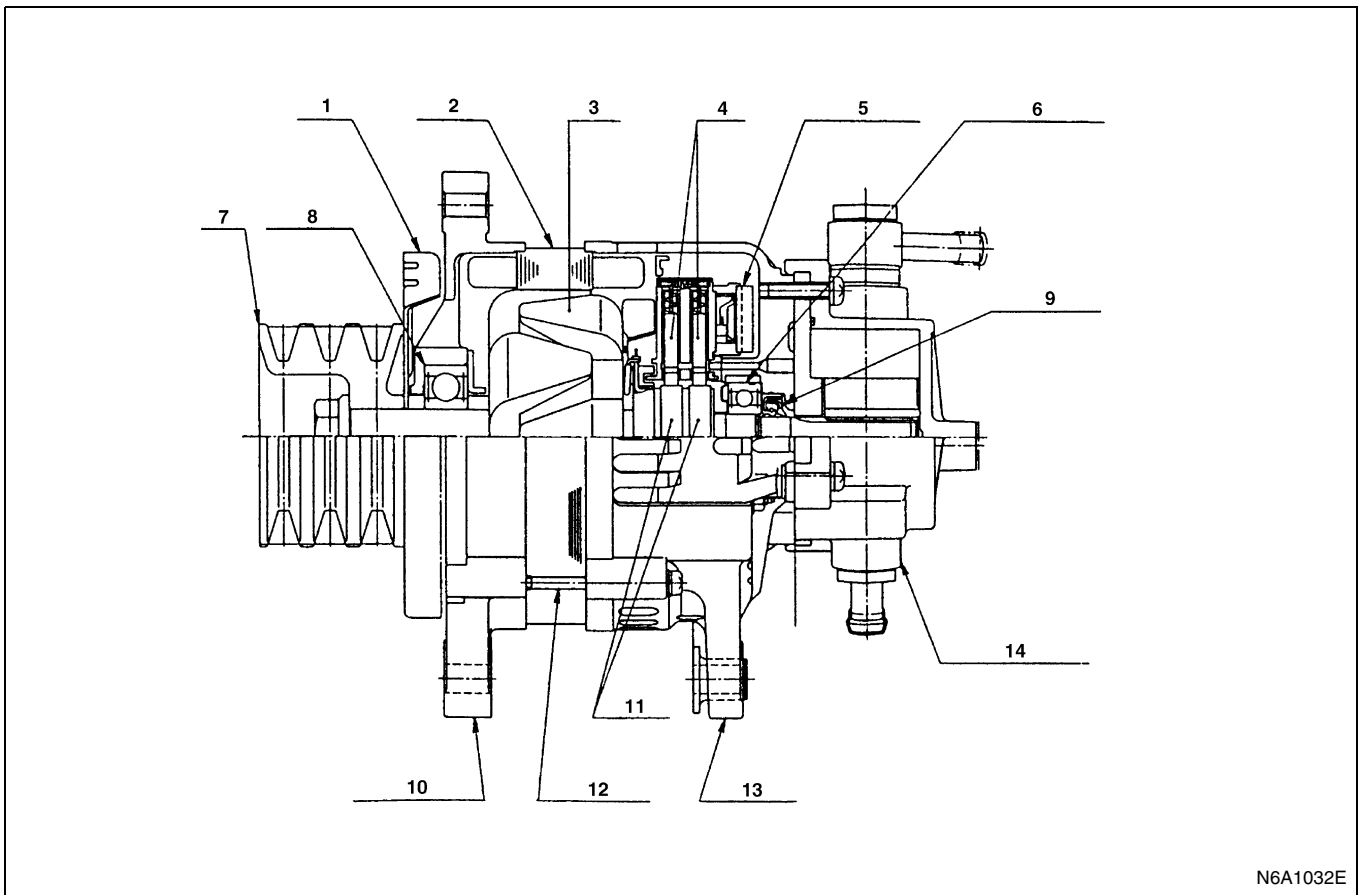
GENERAL DESCRIPTION

The charging system is the IC integral regulator charging system and its main components are connected as shown in figure.

The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.

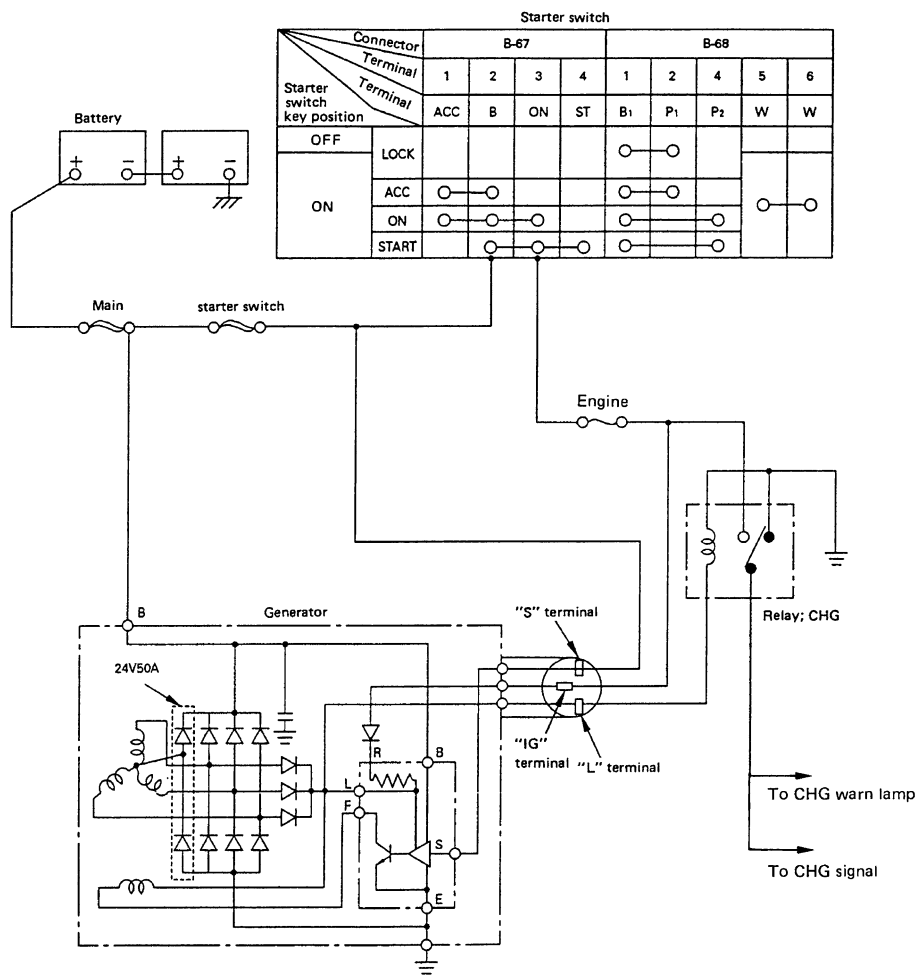
The generator does not require particular maintenance such as voltage adjustment. The rectifier connected to the stator coil has nine diodes to transform A.C. voltage into D.C. voltage. This D.C. voltage is connected to the output terminal of generator.

Component



Legend

- | | |
|-----------------|------------------|
| 1. Fan | 8. Ball bearing |
| 2. Stator | 9. Oil seal |
| 3. Rotor | 10. Front cover |
| 4. Brush | 11. Slip ring |
| 5. IC regulator | 12. Through bolt |
| 6. Ball bearing | 13. Rear cover |
| 7. Pulley | 14. Vacuum pump |

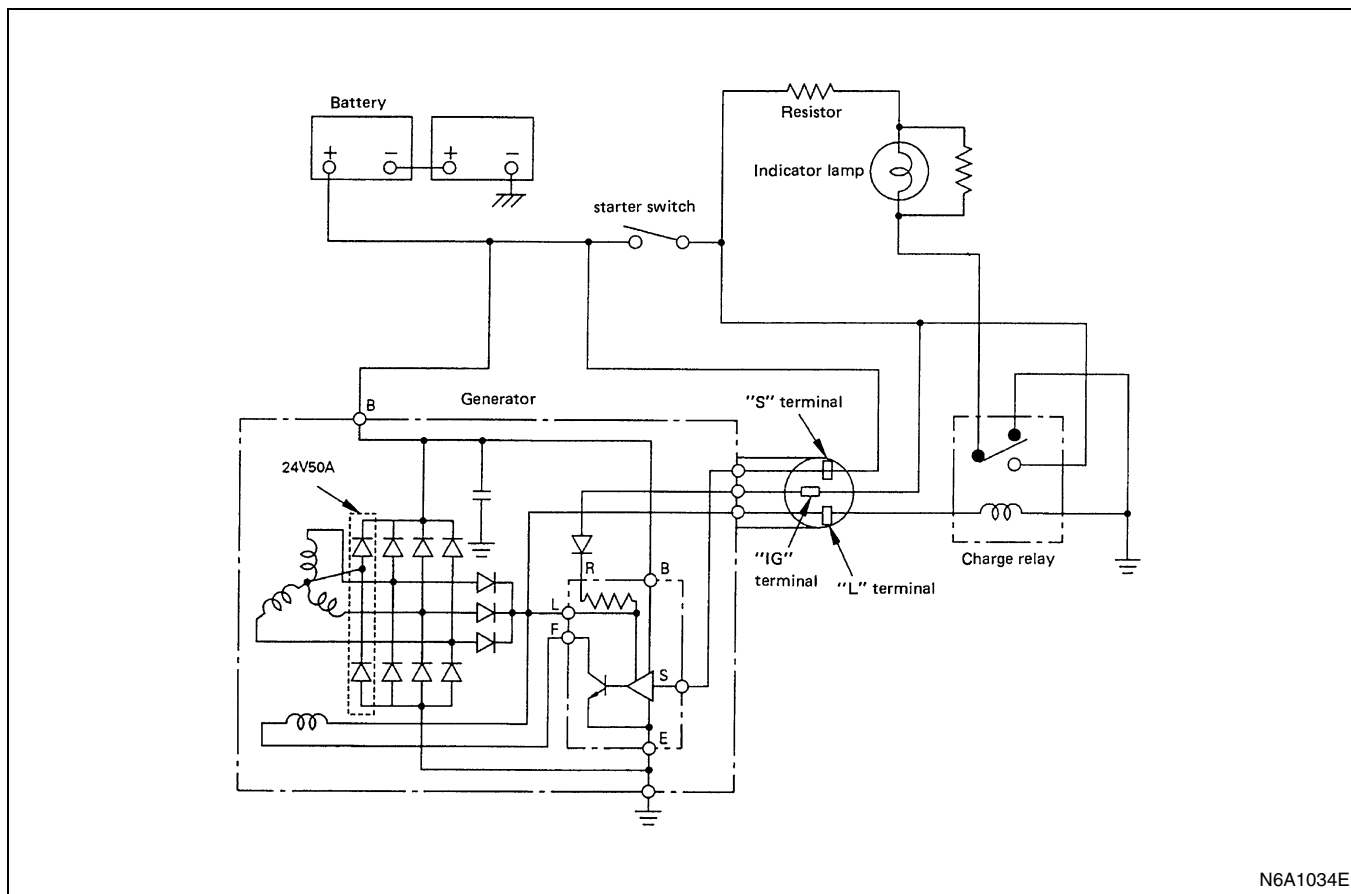


N6A1033E

DIAGNOSIS

General On-Vehicle Inspection

The operating condition of charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned to "ON" position. The charging system operates normally if the lamp goes off when the engine starts. If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:



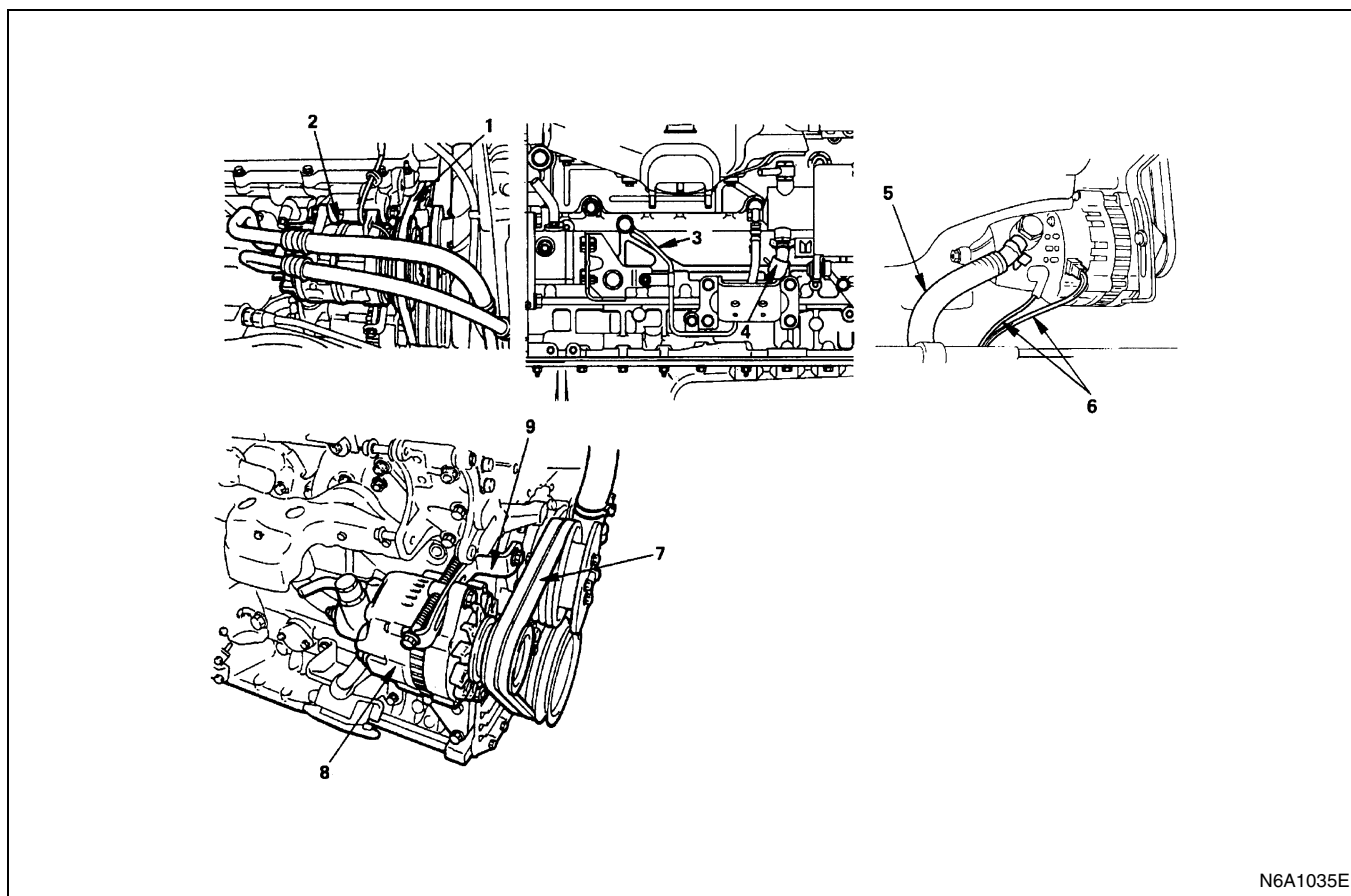
N6A1034E

1. Check visually the belt and wiring connector.
2. With the engine in stop status, turn the starter switch to "ON" position and observe the warning lamp.
 - If lamp does not come on:
Disconnect wiring connector from generator, and ground the terminal "L" on connector side.
 - If lamp comes on:
Repair or replace the generator.

ON-VEHICLE SERVICE

Component

Generator



N6A1035E

Legend

- | | |
|------------------------------|-----------------|
| 1. A/C compressor drive belt | 6. ACG harness |
| 2. A/C compressor | 7. Fan belt |
| 3. Vacuum pump oil pipe | 8. Generator |
| 4. Vacuum pump rubber hose | 9. Adjust plate |
| 5. Vacuum hose | |

Removal

Preparation

- Disconnect the battery ground cable.
 - Tilt the cab.
1. A/C Compressor Drive Belt (If equipped with A/C)
 2. A/C Compressor (If equipped with A/C)
 - After disconnecting the A/C compressor harness connector, demount the compressor from the A/C compressor bracket and fasten it with a wire to an appropriate location together with the hoses.

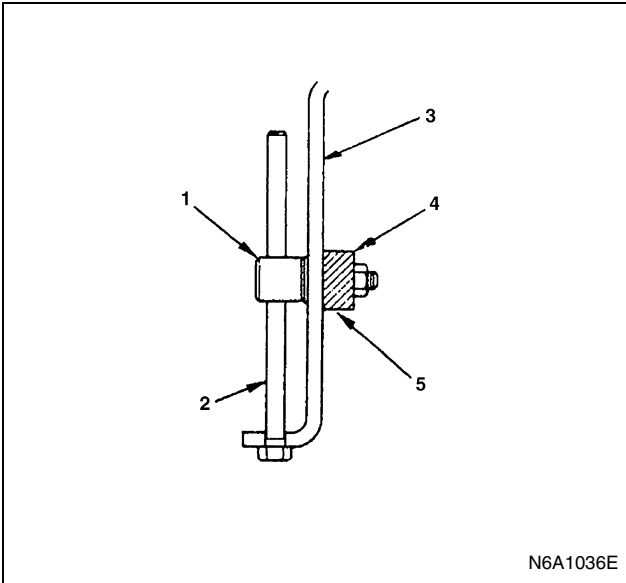
3. Vacuum Pump Oil Pipe
4. Vacuum Pump Rubber Hose
5. Vacuum Hose
6. ACG Harness

Disconnect the B terminal cable and harness connector from generator.

7. Fan Belt
8. Generator
9. Adjust Plate

Installation

1. Adjust Plate
Install the adjust plate as shown in the illustration.



N6A1036E

Legend

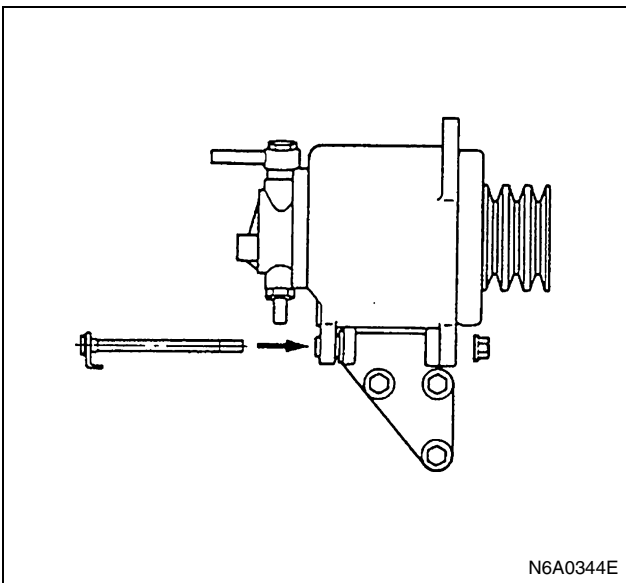
- 1. Sliding piece
- 2. Adjust bolt
- 3. Adjust plate
- 4. Nut
- 5. Generator

2. Generator

Notice:

Before tightening the generator, tighten in advance the fan belt temporarily after its adjustment.

- Insert the lower fixing bolt from the rear side as shown in the illustration, and tighten it with a nut on the front side.

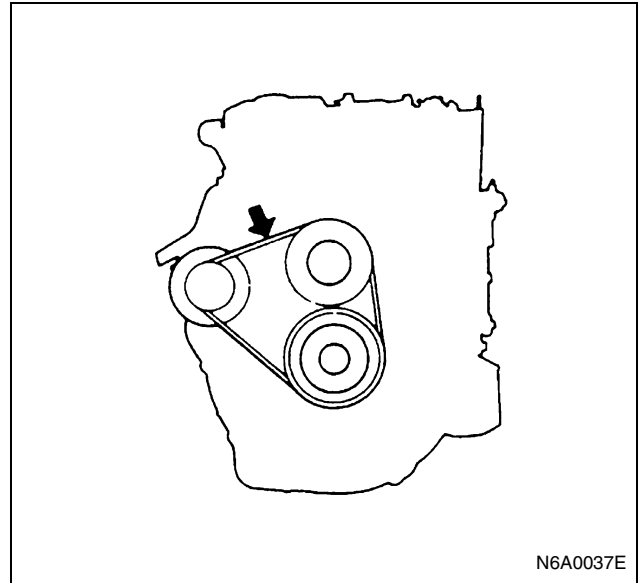


N6A0344E

3. Fan Belt

Check the drive belt tension.

Depress the drive belt mid-portion with a 98 N (10 kg / 22 lb) force.



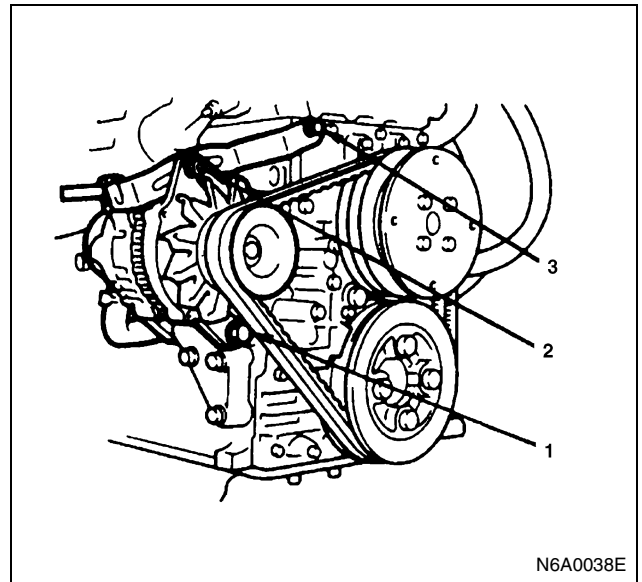
N6A0037E

Drive Belt Deflection		mm (in)
New belt	8 — 12	(0.31 — 0.47)
Reuse belt	10 — 14	(0.39 — 0.55)

Check the drive belt for cranking and other damage.

Fan Belt Adjustment

Fan belt tension is adjusted by moving the generator.

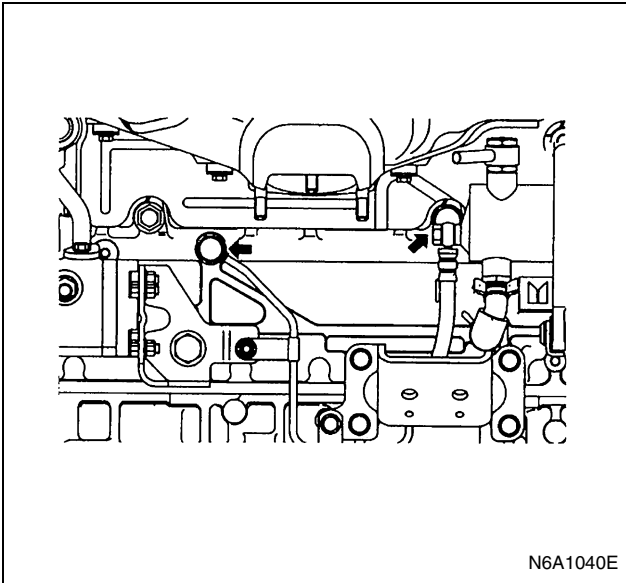


N6A0038E

Tighten:

Bolt to

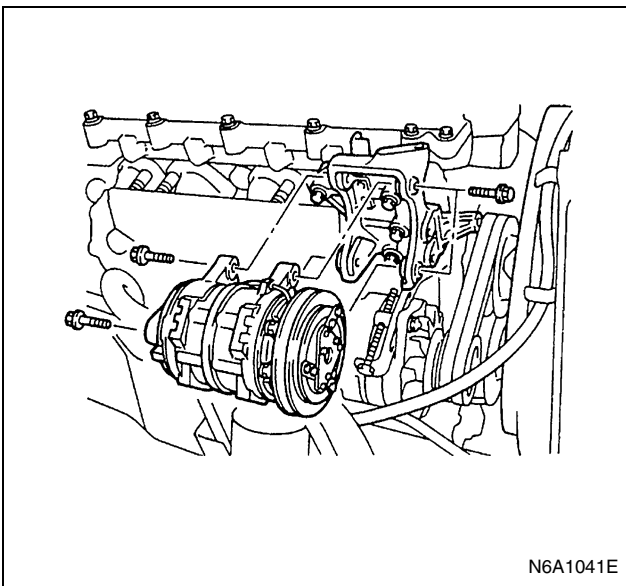
- (1): 40 N·m (4.1 kg·m / 30 lb·ft)
- (2): 24 N·m (2.4 kg·m / 17 lb·ft)
- (3): 46 N·m (4.7 kg·m / 34 lb·ft)
- 4. ACG Harness
- 5. Vacuum Hose
- 6. Vacuum Pump Rubber Hose
- 7. Vacuum Pump Oil Pipe



Tighten:

Vacuum pump oil pipe to

- Cylinder body side: 41 N·m (4.2 kg·m / 30 lb·ft)
 - Generator side: 23 N·m (2.3 kg·m / 17 lb·ft)
8. A/C Compressor (If equipped with A/C)



- Tighten the fixing bolts to the specified torque.

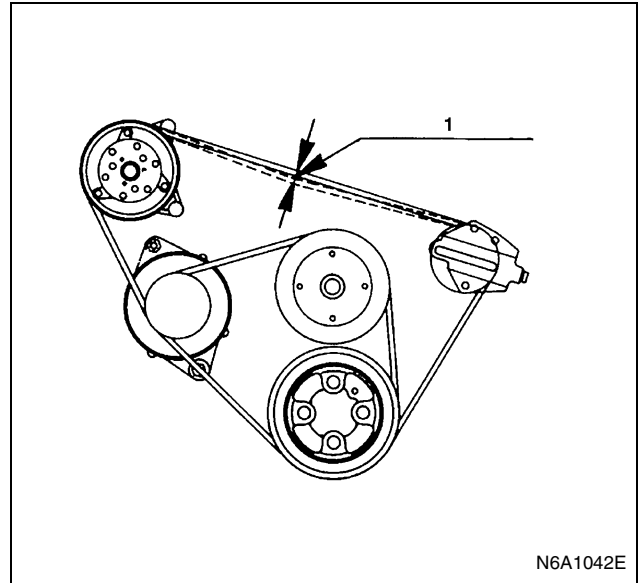
Tighten:

A/C compressor bolt to 48 N·m (4.9 kg·m / 35 lb·ft)

Notice:

When installing the compressor fixing bolts, tighten first the 2 bolts on the rear side, and then the remaining 2 on the front side.

9. A/C Compressor Drive Belt (If equipped with A/C)
- Install the drive belt adjust belt tension by adjusting bolt and tighten the locking nut to the specified torque.
 - Depress the drive belt mid-portion with a 98 N (10 kg / 22 lb) force.



Legend

1. Belt deflection

Drive Belt Deflection		mm (in)
New belt	16 — 20	(0.63 — 0.79)
Reuse belt	18 — 22	(0.71 — 0.87)

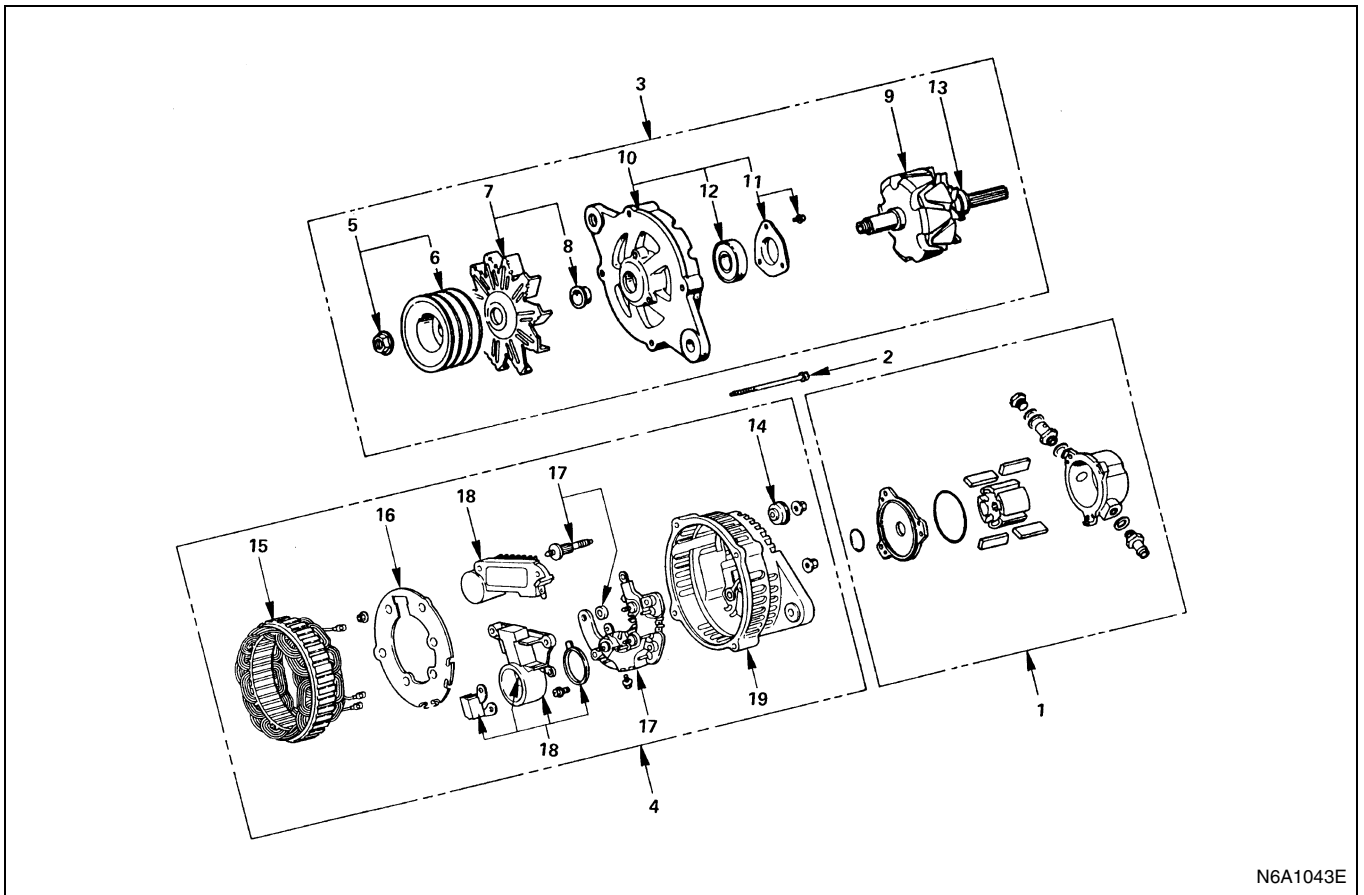
Tighten:

Locking nut to 27 N·m (2.8 kg·m / 20 lb·ft)

- Connect the negative battery cable.
- Lower the cab.

UNIT REPAIR

Component



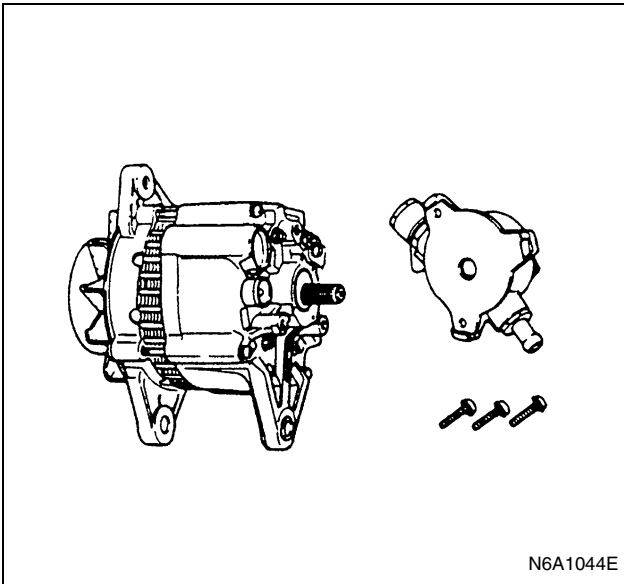
N6A1043E

Legend

- | | |
|-----------------------------------|----------------------------|
| 1. Vacuum pump assembly | 11. Bearing retainer |
| 2. Through bolt | 12. Front ball bearing |
| 3. Rotor and front cover assembly | 13. Rear ball bearing |
| 4. Stator and rear cover assembly | 14. Terminal nut and bolt |
| 5. Pulley nut | 15. Stator |
| 6. Pulley | 16. Fan guide |
| 7. Fan | 17. Rectifier |
| 8. Spacer | 18. Brush and IC regulator |
| 9. Rotor | 19. Rear cover |
| 10. Front cover | |

Disassembly

1. Vacuum Pump Assembly



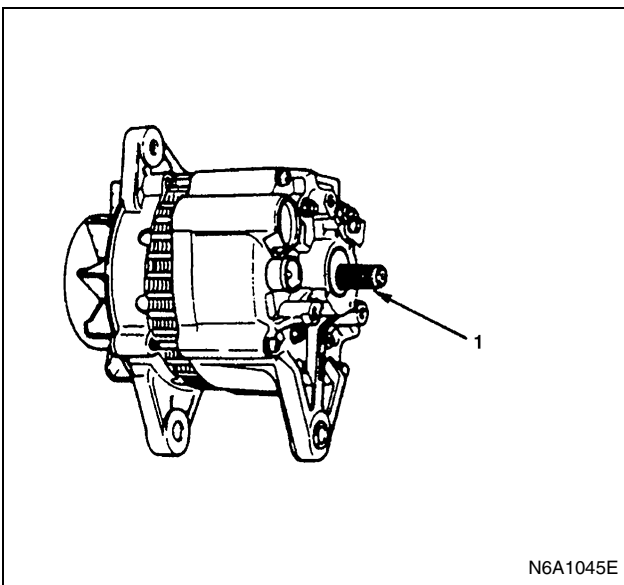
- 1) Loosen the vacuum pump fixing bolts.
- 2) Support the vacuum pump center plate.
- 3) Carefully remove the vacuum pump.

2. Through Bolt

3. Rotor and Front Cover Assembly

4. Stator and Rear Cover Assembly

- 1) Loosen the through bolts.
- 2) Remove the rotor and front cover assembly from the stator and rear cover assembly. Do not allow the stator to separate from the rear cover. Take care not to damage the oil seal. Tape the rotor splines to protect them from damage.



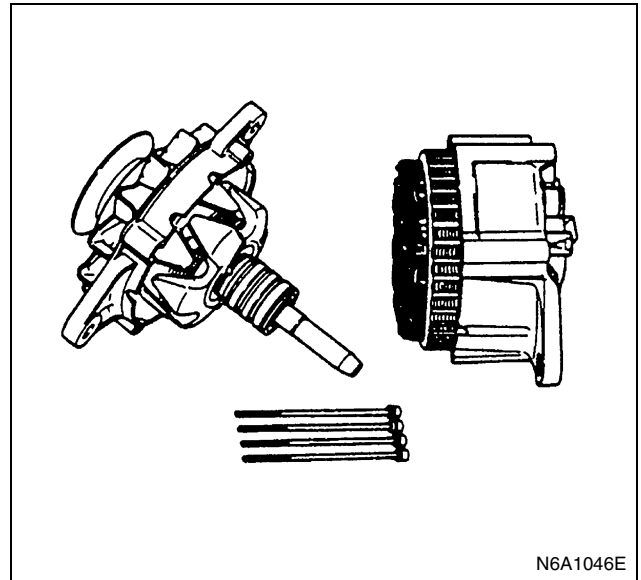
5. Pulley Nut

6. Pulley

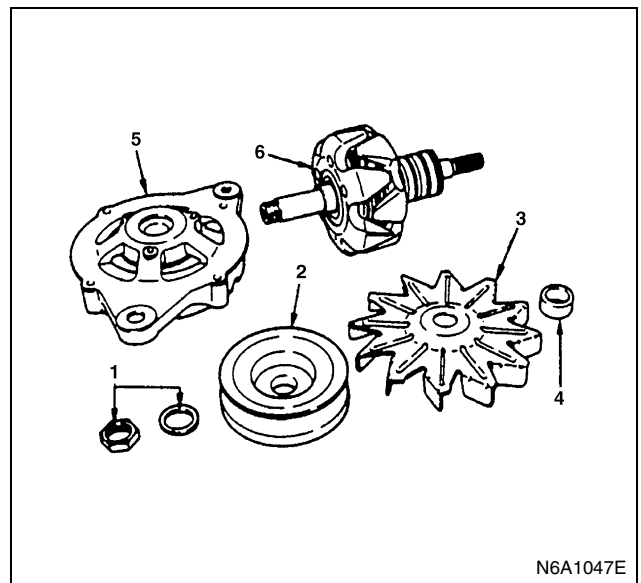
7. Fan

8. Spacer

9. Rotor



- 1) Carefully clamp the rotor assembly in a vice.



- 2) Loosen the pulley nut (1).
- 3) Remove the pulley (2), the fan (3), the spacer (4), the front cover (5) and the rotor (6).

10. Front Cover

11. Bearing Retainer

12. Front Ball Bearing

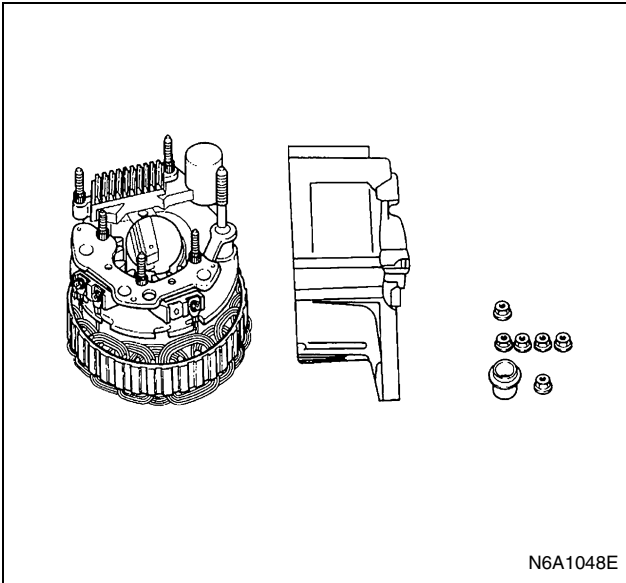
13. Rear Ball Bearing

14. Terminal Nut and Bolt

15. Stator

Legend

1. Taping



N6A1048E

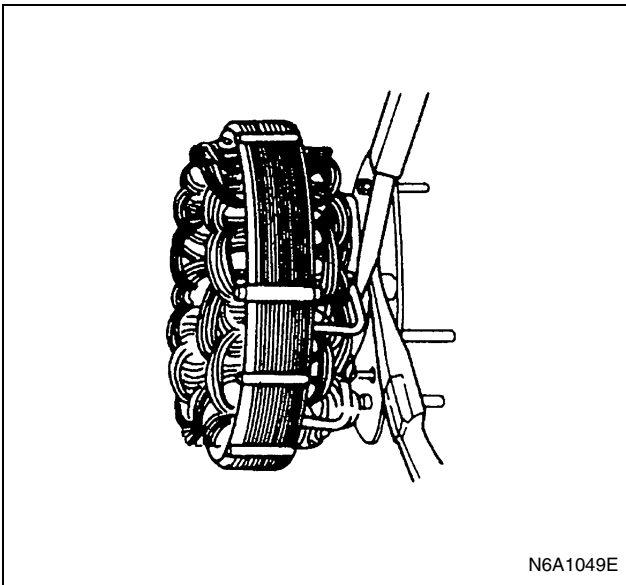
- 1) Loosen the terminal nuts and bolts.
- 2) Remove the lead wire, the insulators, and the washers.
- 3) Remove the stator and the IC regulator assembly from the rear cover.

16. Fan guide

17. Rectifier

18. Brush and IC Regulator

Disconnect the stator coil leads between each rectifier and the N-terminal by melting the solder connection.



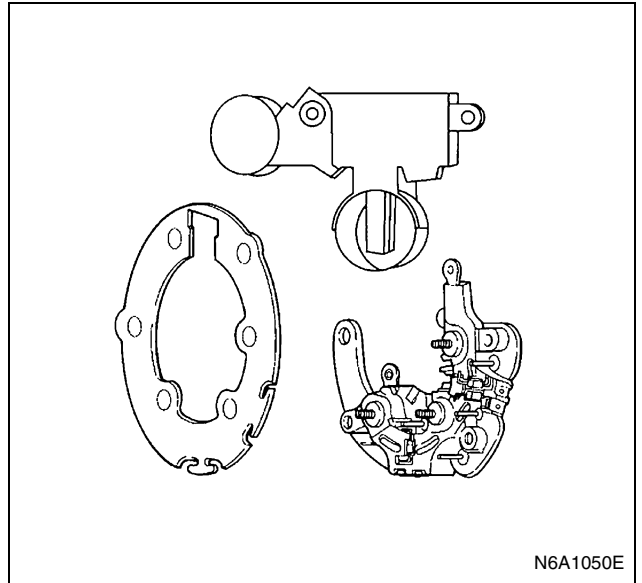
N6A1049E

Notice:

Hold the lead wire between the solder and the rectifier with a pair of long nose pliers.

This will prevent heat transfer and resultant damage to the rectifier.

Refer to "INSPECTION AND REPAIR" for the IC regulator, the rectifier, the brush holder, and the condenser replacement procedures.



N6A1050E

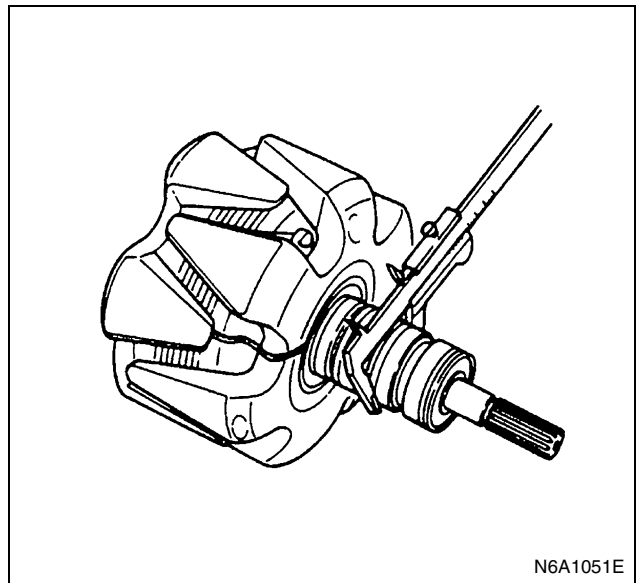
19. Rear Cover

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Rotor

1. Inspect the slip ring faces for dirt and pitting. Wipe away any dirt with a clean cloth soaked in alcohol. Use a hand grinder to remove pitting.
2. Measure the slip ring diameter.

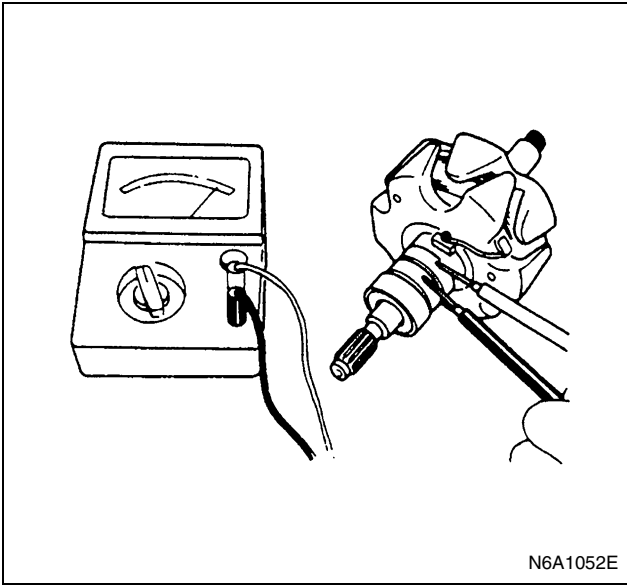


N6A1051E

Slip Ring Diameter		mm (in)
Standard		Limit
37.6 (1.480)		36.6 (1.441)

If the slip ring diameter is less than the specified limit, the slip ring must be replaced.

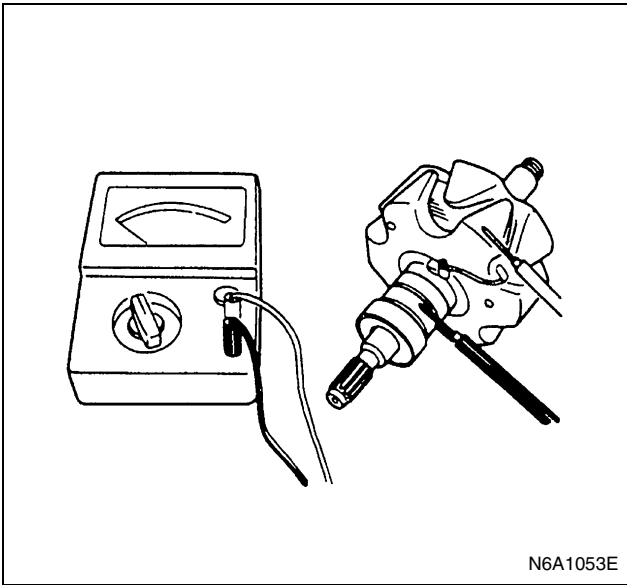
3. Measure the rotor coil resistance.



Rotor Coil Resistance at 20°C (68°F) ohms

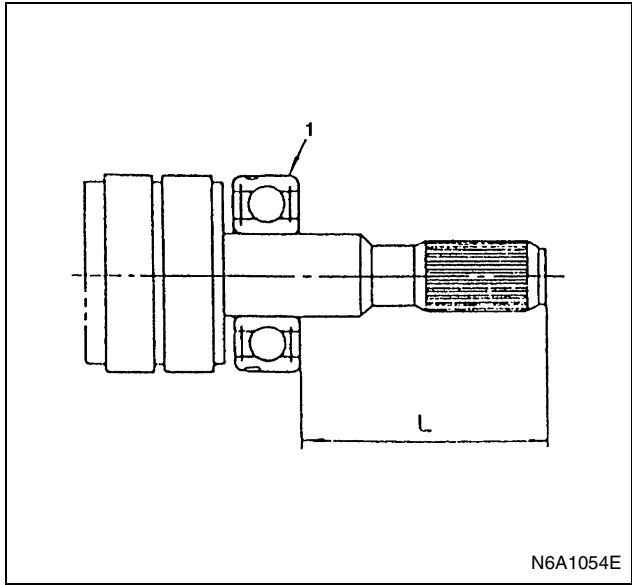
Standard	12.6
----------	------

4. Check for continuity between the slip rings and the rotor core or shaft.



If there is continuity, the entire rotor assembly must be replaced.

5. Rear ball bearing



Legend

- 1. Ball bearing

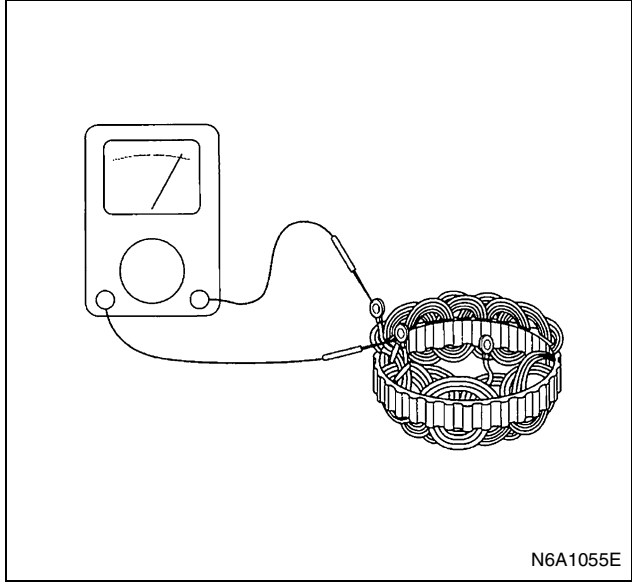
- Check to see if the ball bearings rotate lightly with no noise heard.
- As the result of inspection, it is found that the ball bearing do not rotate lightly or any noises are heard, replace them with new ones.

Press-in measurement (L) mm (in)

Standard	58.0 — 58.2 (2.283 — 2.291)
----------	-----------------------------

Stator

- 1. Check for continuity across the stator coils.



If there is no continuity, the stator coils must be replaced.

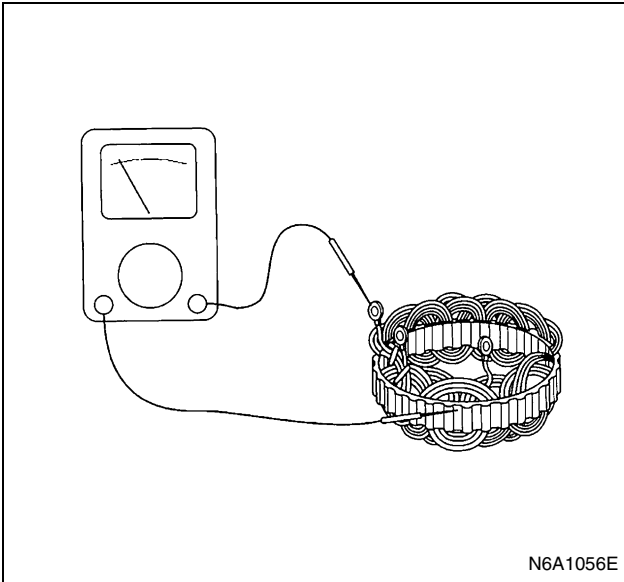
Resistance Between The
Coil End "N" And The Each
Coil Ends (Reference)

ohms

Standard

0.17

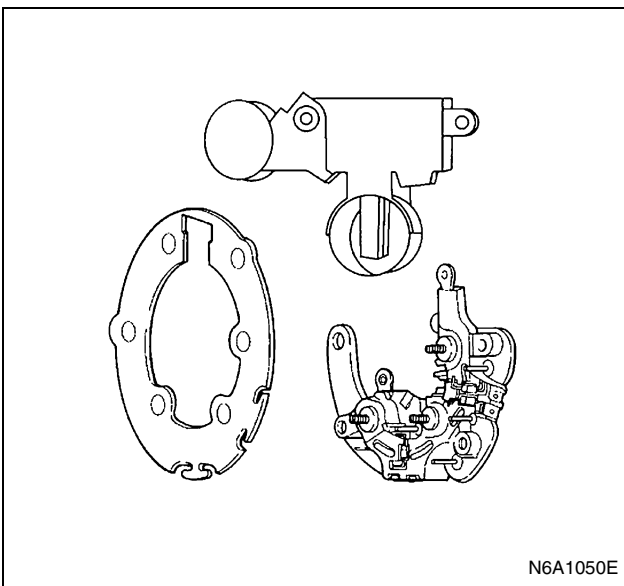
2. Check for continuity between each stator coil and the stator core.



If there is continuity, the stator coils must be replaced.

Rectifier, IC Regulator, and Brush Holder Assembly

Disassembly



1. Disconnect the IC regulator and the rectifier by melting the solder connections.
2. Loosen the terminal bolt to remove the rectifier.
3. Disconnect the IC regulator, the brush holder, and the condenser by melting the solder connections.
4. Remove the IC regulator from the terminal plates.

5. Remove the stud bolts from the terminal plate.

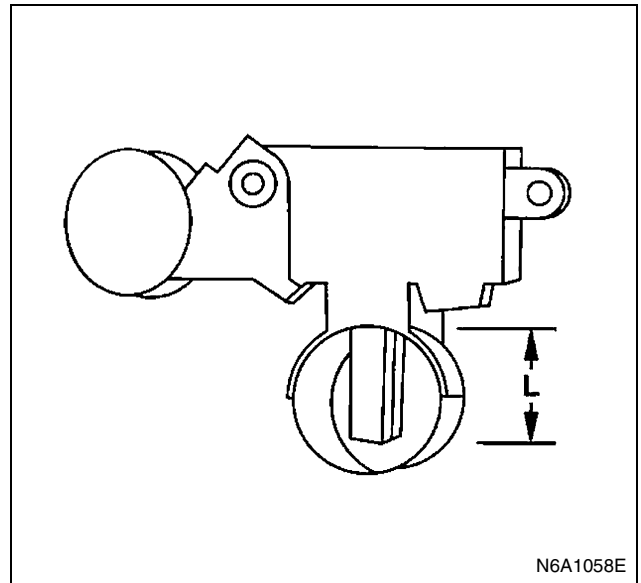
Notice:

If the brushed, brush holder, and the condenser to be re-used, do not remove the stud bolts.

6. Remove the brush holder from the terminal plate.

Inspection

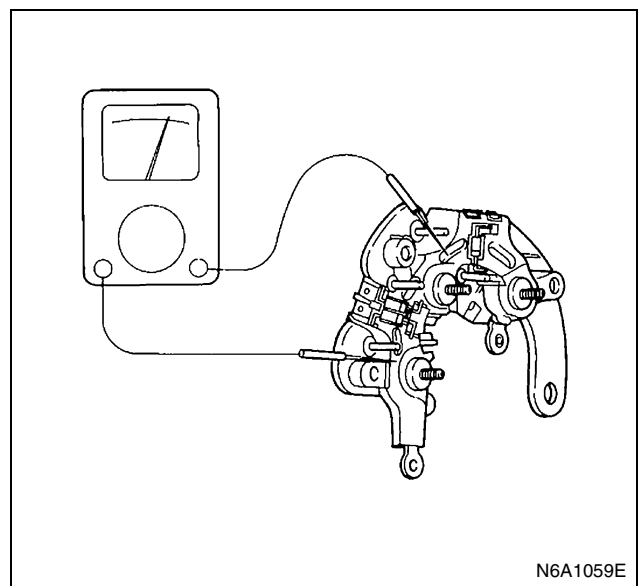
1. Brush
Each brush has a line to indicate whether or not the brush is serviceable.

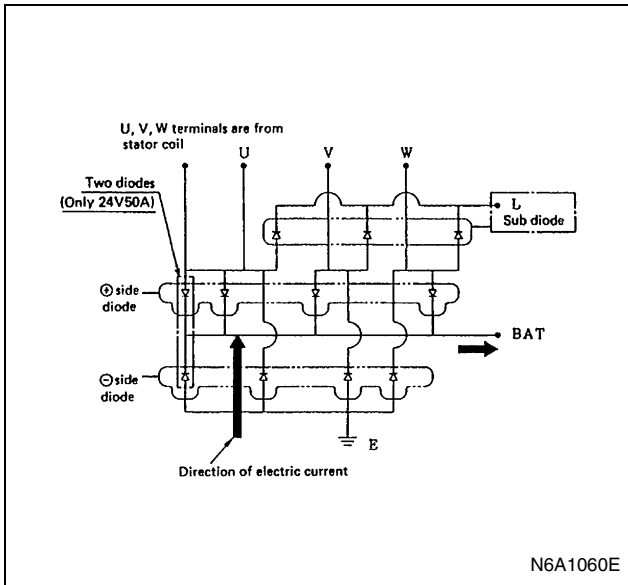


If the line is not visible, the brush must be replaced.

Brush Length (Reference)		mm (in)
Standard		Limit
25 (0.984)		6 (0.236)

2. Rectifier





1) Check for continuity with a circuit tester between the battery and each of the three stator coil lead terminals.

If there is continuity from battery to each of the three stator coil lead terminals, the rectifier is normal.

If there is no continuity, the rectifier must be replaced.

Check for continuity with a circuit tester between the earth and each of the three stator coil lead terminals.

If there is continuity from each of the three stator coil lead terminals to earth, the rectifier is normal.

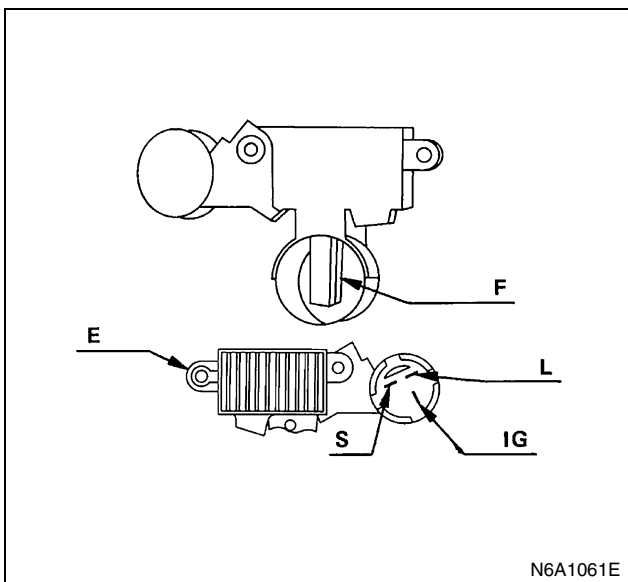
If there is no continuity, the rectifier must be replaced.

2) Reverse the polarity of the test probes.

If there is no continuity, the rectifier is normal.

If there is continuity, the rectifier must be replaced.

3. IC Regulator



The IC regulator may be tested with either a circuit tester or pair of standard voltmeters.

Refer to the illustration.

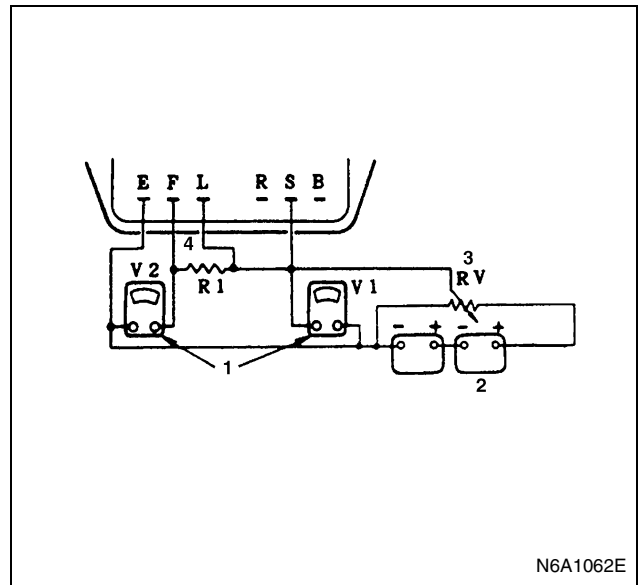
1) Circuit tester (or voltmeter) range is from 0 — 50 volts in 0.5 volt increments.

2) Two twelve volt batteries are required.

3) Note the variable resistor.

4) This resistor is rated at 100 watts/3 ohms.

4. Testing the IC Regulator



Refer to the wiring diagram when testing the IC regulator.

1) Connect the batteries in series.

2) Measure the battery power (voltage).

Battery Power	V
28 — 29	

3) Connect the circuit tester (1) (or voltmeter V2) as shown in the illustration.

4) Set the variable resistor (3) to zero.

5) Slowly increase the resistance of the variable resistor toward the build-up point.

Measure the voltage between E and F.

As long as the resistance is below the build-up point, the voltage reading should be stable and less than two volts.

When the resistance exceeds the build-up point, the voltage reading should be two volts or greater.

If the voltage does not exceed two volts after reaching the build-up point, the IC regulator must be replaced.

6) Return the variable resistor (3) to zero.

7) Connect the circuit tester (or voltmeter V1) as shown in the illustration.

8) Measure the voltage at terminals S, L, and E.

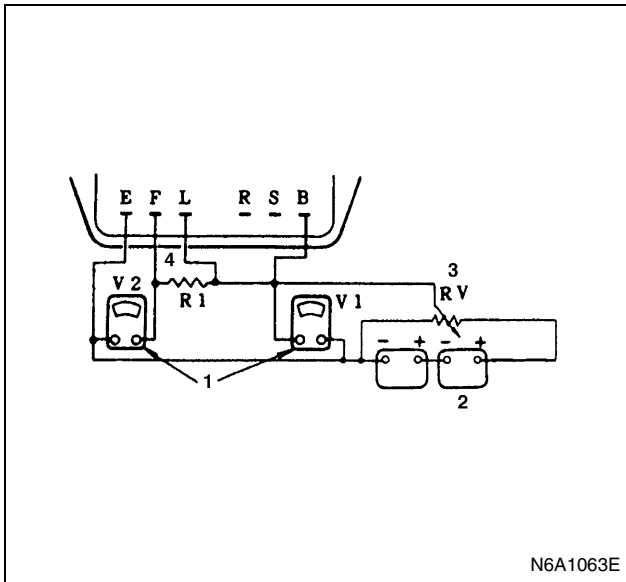
9) Slowly increase the resistance of the variable resistor.

Note the point at which the voltage quickly builds up to between 2 and 6 volts.

This will indicate the point at which the voltage regulator begins to function.

If the measured voltage is outside the specified range, the voltage regulator must be replaced.

10) Repeat Steps 3 through 5 to measure the voltage between terminals B, L, and E.

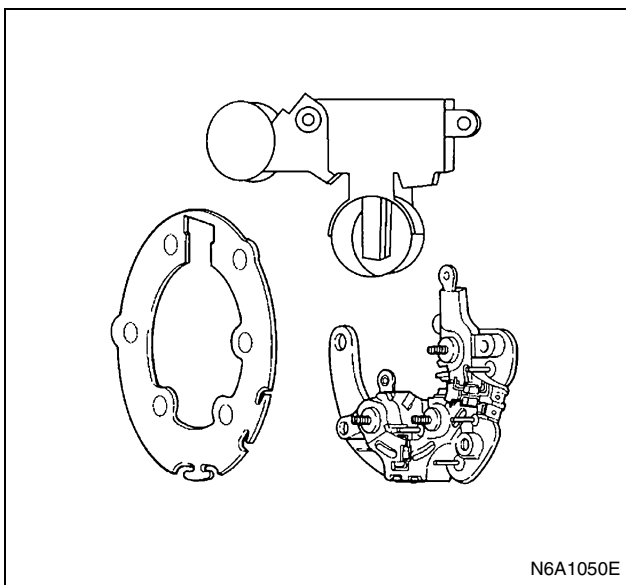


Refer to the wiring diagram.

The regulator voltage should be between 0.5 and 3 volts higher than the measured voltage.

If the regulator voltage is outside this range, the voltage regulator must be replaced.

Reassembly



1. Install the brush holder and the stud bolts to the terminal plate.
Check that the stud bolts fit properly.
2. Attach the IC regulator to the terminal plate.
3. Solder the IC regulator, the brush holder and the condenser.

Take care not to heat the IC regulator.

Over-heating will resulting damage to the IC regulator.

4. Set the rectifier to the IC regulator assembly.

5. Solder rectifier and IC regulator.

Take care not to heat the IC regulator.

Over-heating will resulting damage to the rectifiers and the IC regulator.

6. Tighten the rectifier terminal bolt.

Oil Seal

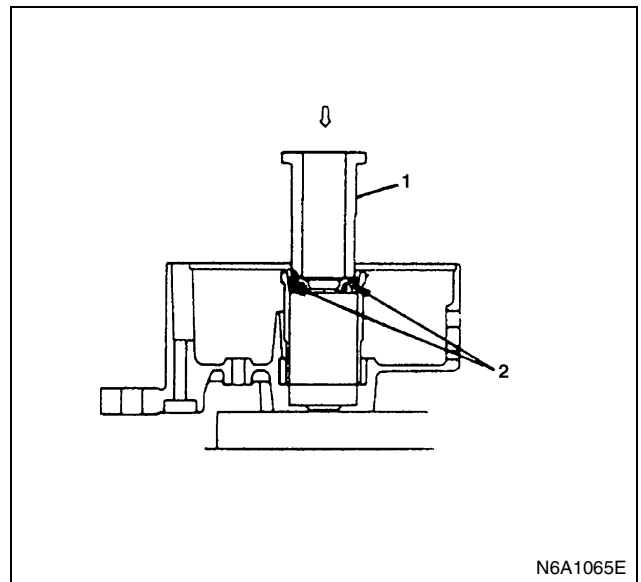
Check the rear cover oil seal bore for oil leakage.

Oil Seal Replacement

1. Use a screwdriver to remove the oil seal from the rear cover side.
Take care not to damage the oil seal bore.

2. Discard the used oil seal.

3. Use the oil seal installer to install the new oil seal.

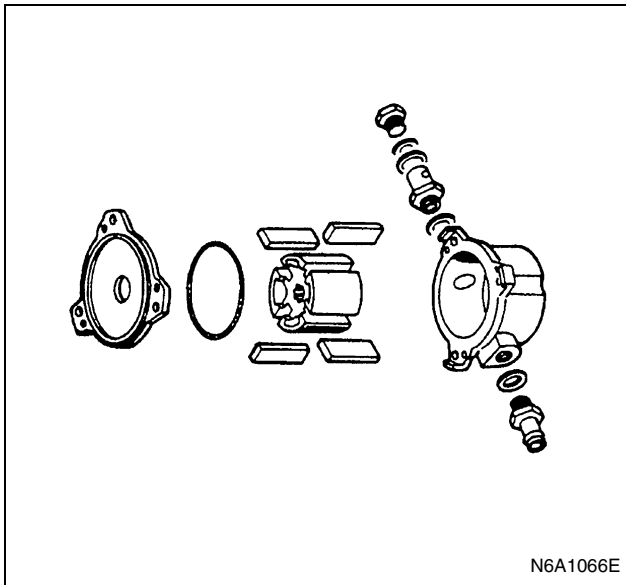


Legend

1. Oil seal installer
2. Oil seal

Vacuum Pump

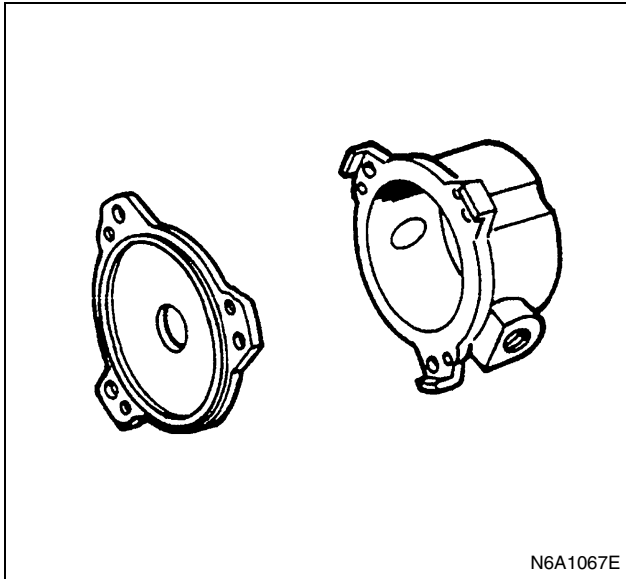
Disassembly



1. Remove the center plate from the vacuum pump housing.
2. Remove the vacuum pump rotor and the vanes from the housing.

Inspection and Repair

1. Vacuum Pump Housing and Center Plate



Inspect the vacuum pump housing and the center plate for excessive wear, abrasion, and scoring.

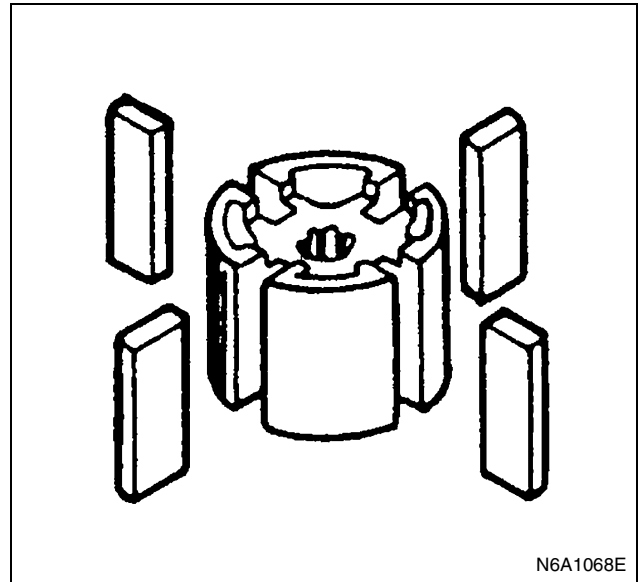
If any of these conditions are present, the vacuum pump housing and center plate must be replaced.

Inspect the vacuum pump housing inside for wear and damage.

If the measured inside diameter is outside the specified range, replace the vacuum pump housing.

Vacuum Pump Housing Inside Diameter (Reference)		mm (in)
Standard	69.5 — 69.6 (2.736 — 2.740)	

2. Vane



Inspect the vanes for excessive wear and damage. Replace all four vanes if either of these conditions are present.

Never replace only one vane.

Vane Length (Reference)		mm (in)
Standard	18.0 (0.709)	

3. Rotor

- 1) Inspect the rotor for excessive wear, abrasion, and scoring.

Pay particular attention to the internal spline.

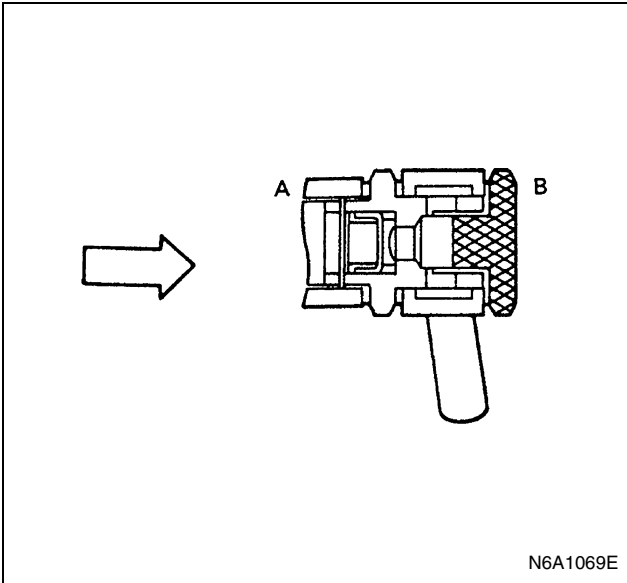
Replace the rotor if any of these conditions are present.

- 2) Inspect the generator rotor shaft splines for backlash.

Replace the rotor if backlash is present.

4. Check Valve

- 1) Carefully force the valve from the "B" side as shown in the illustration.



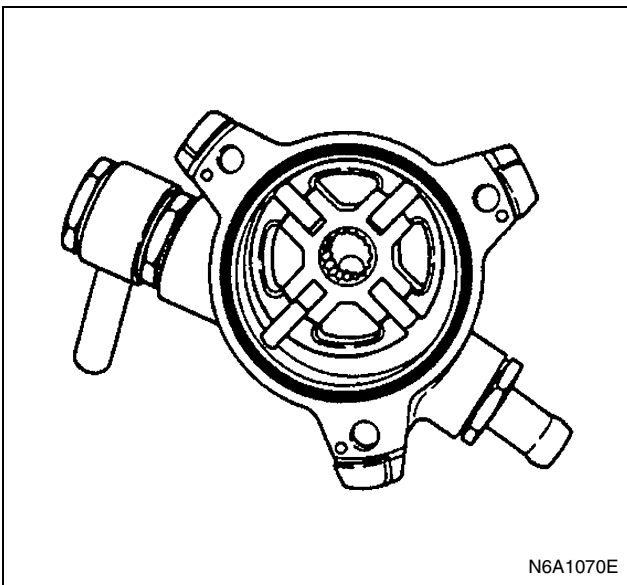
- The valve must move smoothly.
 If it does not, the check valve must be replaced.
 2) Apply compressed air to the "A" side.

Air Pressure	kPa (kg/cm ² /psi)
98 — 490 (1 — 5/14.22 — 71.10)	

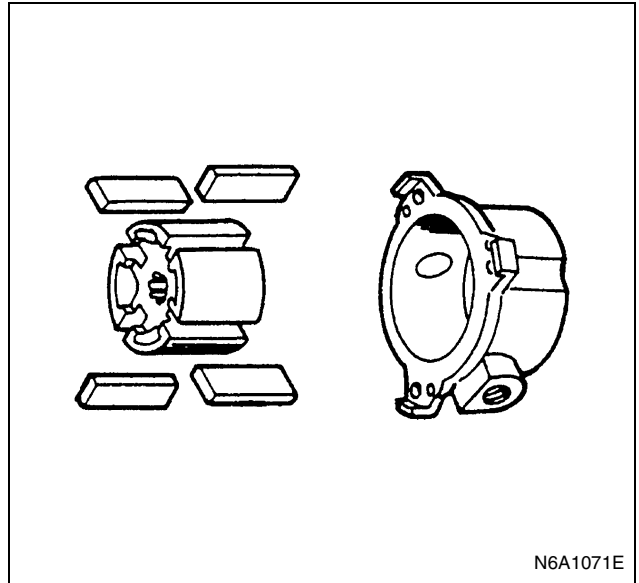
Check for air leakage from the check valve.
 If there is air leakage, the valve must be replaced.

Reassembly

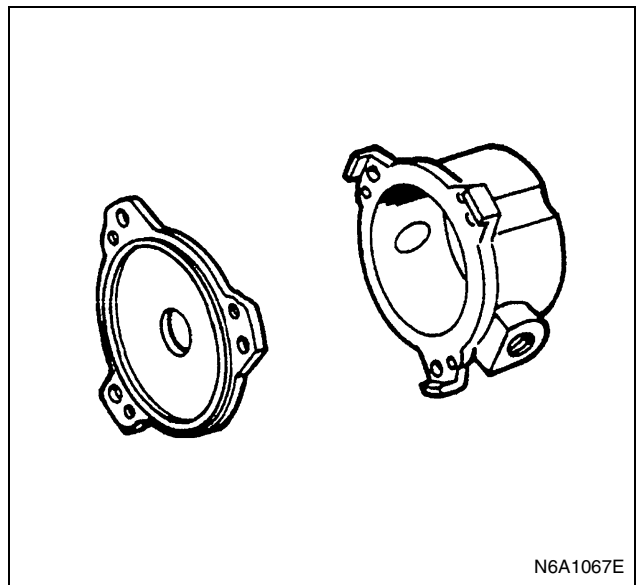
1. Install the vanes to the rotor slits.
 The rounded side of the vanes must be facing the rotor housing.



2. Install the rotor with the concave side facing the center plate.

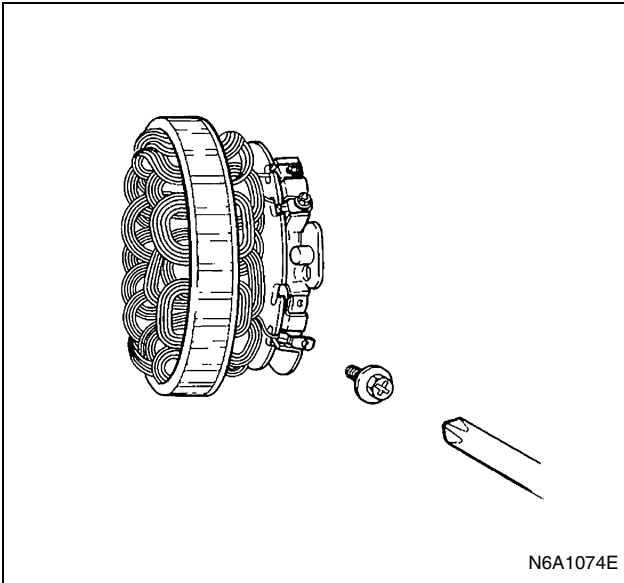


3. Install the center plate to the rotor housing.
 Be sure to use a new O-rings.



Reassembly

1. Rear Cover
2. Brush and IC Regulator
3. Rectifier
4. Fan Guide
5. Stator



- 1) Solder together the rectifier and stator leads. Hold the rectifier lead near the rectifier with a pair of long-nose pliers to protect the rectifier from heat.

Complete the soldering procedure as quickly as possible.

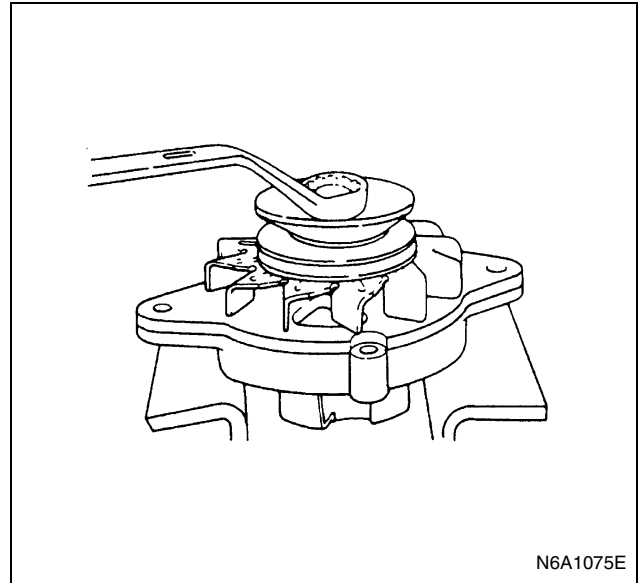
- 2) Install the IC regulator/stator assemblies to the rear cover.

Be absolutely sure that the washers and the insulators are reinstalled to their original positions.

Hold the stator coil against the rear cover.

6. Terminal Nut and Bolt
7. Rotor
8. Rear Ball Bearing
9. Front Cover
10. Front Ball Bearing
11. Bearing Retainer
12. Spacer
13. Fan
14. Pulley
15. Pulley Nut

- 1) Carefully clamp the rotor and cover assembly in a vise.
- 2) Install the pulley and the pulley nut.



- 3) Tighten the pulley to the specified torque.

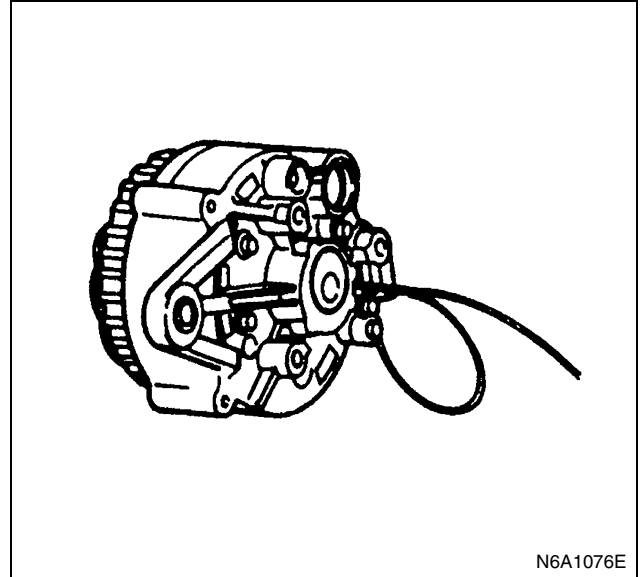
Tighten:

Pulley nut to 98 N·m (10.0 kg·m / 72 lb-ft)

Notice:

Take care not to damage the rotor when clamping it in a vise.

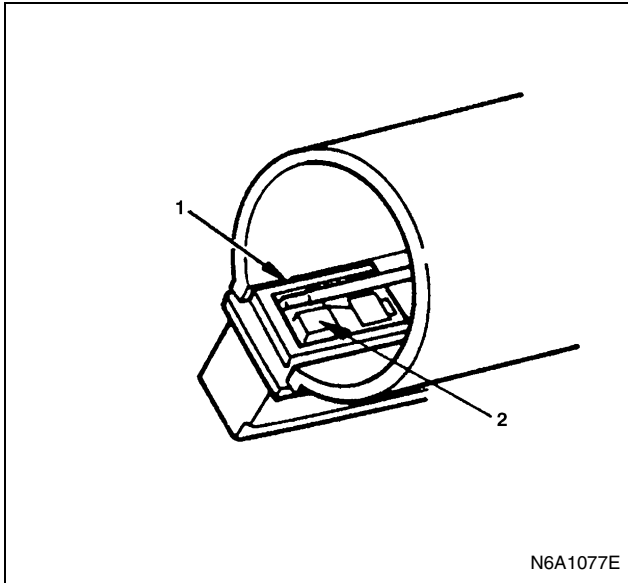
16. Stator and Rear Cover Assembly



17. Rotor and Front Cover Assembly

18. Through Bolt

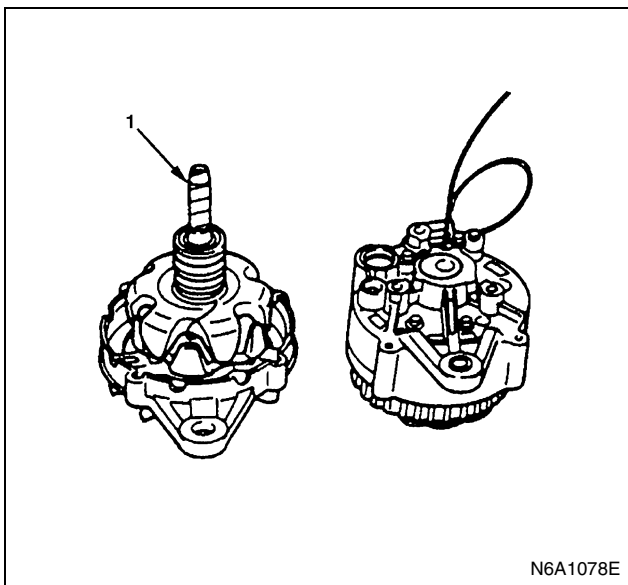
- 1) Prepare a brush holding wire or a pin.
- 2) Set the holding wire or the pin to the brushes from the vacuum pump side.
- 3) Push the brushes into the holder.



Legend

- 1. Brush holding wire or pin
- 2. Brush

- 4) Bend the wire end to hold the brushes. If the holding wire does not hold the brushes properly, the brushes will be damaged.
- 5) Tape the rotor shaft spline.

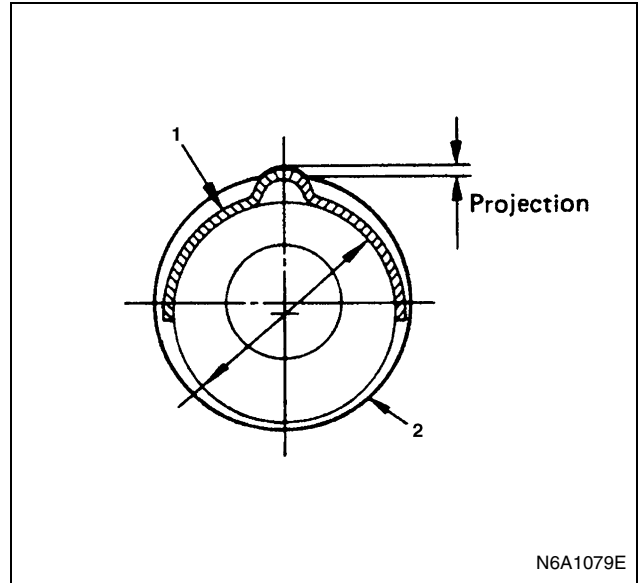


Legend

- 1. Taping

This will prevent oil seal damaged.

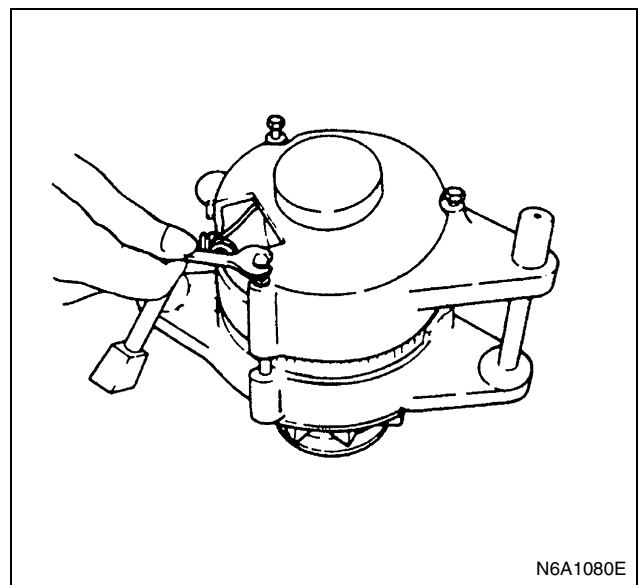
- 6) Place the bearing retainer ring. Ring projection must be less than 0.65 mm (0.025 in)



Legend

- 1. Retainer ring
- 2. Bearing outer race

- 7) Install the front cover and rotor assembly to the rear cover. Take care not to damage the rotor, the coil leads, the oil seal lip, and the splines.
- 8) Place the guide bar into the rear cover bracket hole. Align the front cover bracket hole with the guide bar.
- 9) Install the through bolts.
- 10) Tighten the through bolts to the specified torque.



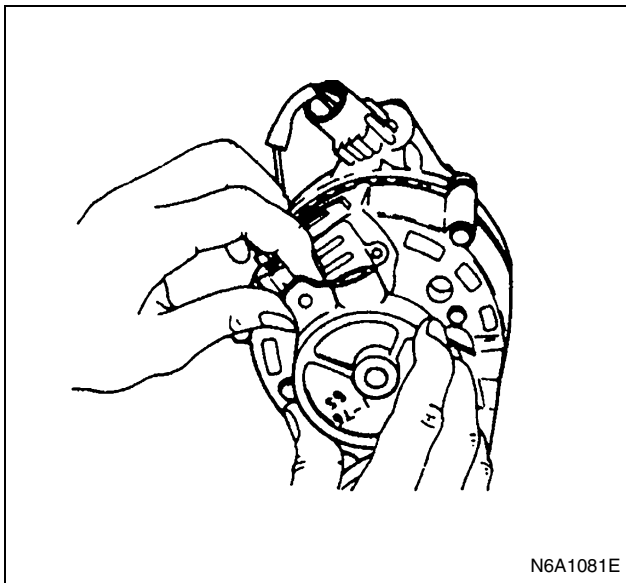
Tighten:

Through bolt to 4 N-m (0.4 kg-m / 35 lb-in)

- 11) Carefully remove the holding wire from the rear cover.

19. Vacuum Pump Assembly

- 1) Position the pump rotor together with the pump housing on the center plate.
The rotor serrated side must be facing up.



- 2) Rotate the rotor to align the rotor bore with the center plate bore.
- 3) Install the housing, the rotor, and the center plate.
The O-ring must not be projecting beyond the center plate slot.
Take care not to scratch the vanes.
- 4) Turn the housing to align it with the center plate.
- 5) Tighten the vacuum pump fixing bolts.

Tighten:

Vacuum pump fixing bolt to 7 N·m (0.7 kg·m / 61 lb·in)

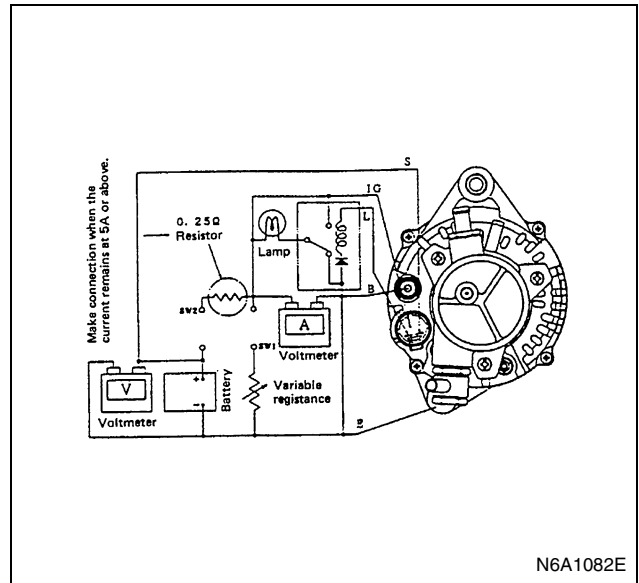
- 6) Add 5cc of engine oil through the filler port.
- 7) Check that the generator spins smoothly by turning it with your hand.

Inspection

Performance Test

1. Generator

- Connect the generator as shown in the illustration.



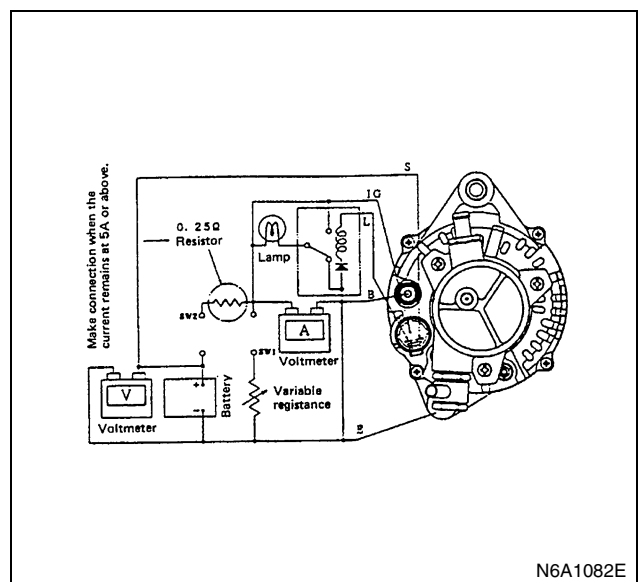
- Use a fully charged battery to conduct the measurement with the current outputted from the battery terminals at 5A or less.

Notice:

When conducting the performance test:

For the connection between the generator B terminal and the battery (+) terminal and between the E terminal and the battery (-) terminal, use a lead wire with a cross section of 8 mm² and the length of 2.5 m or less.

2. Adjusting voltage measurement



- Open SW1 and close SW2.
- With the number of the generator rotations raised up to its rated rotations of 5,000 rpm, measure the adjusting voltage.

Adjusting voltage = 28 - 29V

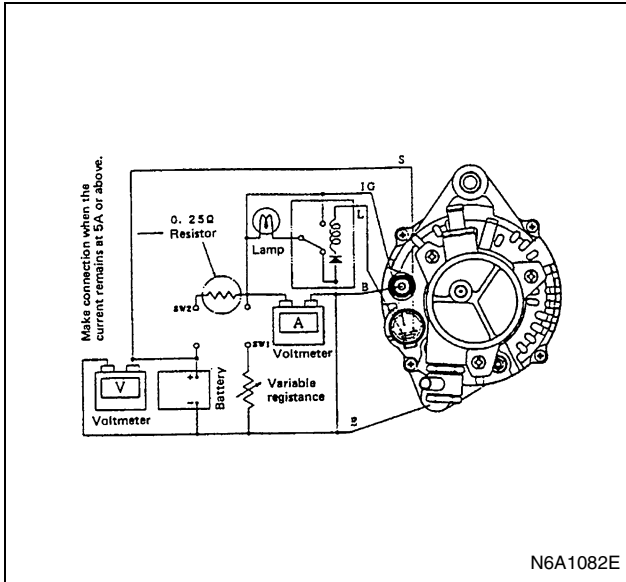
- Check to see if the fluctuation in the adjusting voltage is not caused by the increased number of rotations.

3. Measurement of the number of rotations at 27V

- Open SW1 and close SW2.

- Increase the number of the generator rotations gradually until the reading of the voltmeter indicates 27V. Measure the number of rotations at this time.

4. Output current measurement



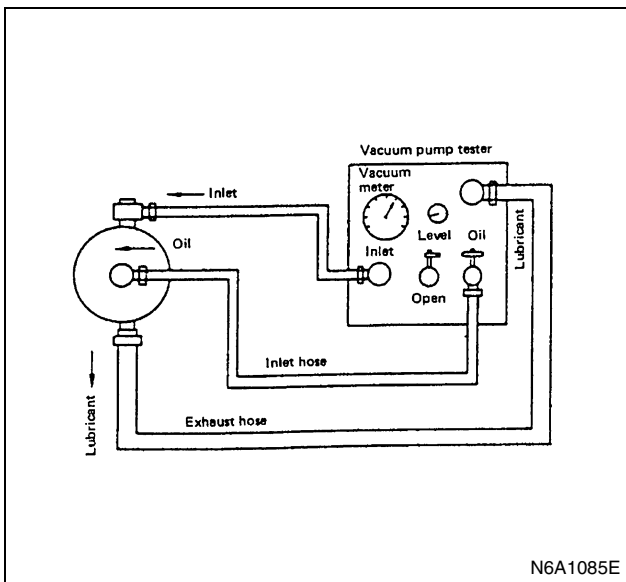
- Set the resistance of the variable resistor at the minimum, and rotate the generator with SW1 and SW2 closed.
- While keeping the voltage steady at 27V after adjusting the variable resistor, read the indicated value of the ammeter at the generator rotation of 5,000 rpm.

Current at 27V with 5,000 rpm = 35A or more (for 35A specification)

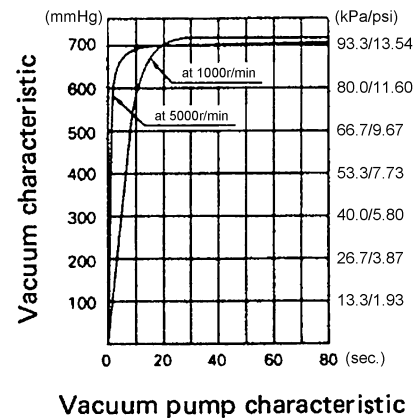
Current at 27V with 5,000 rpm = 45A or more (for 50A specification)

5. Unit test of vacuum pump

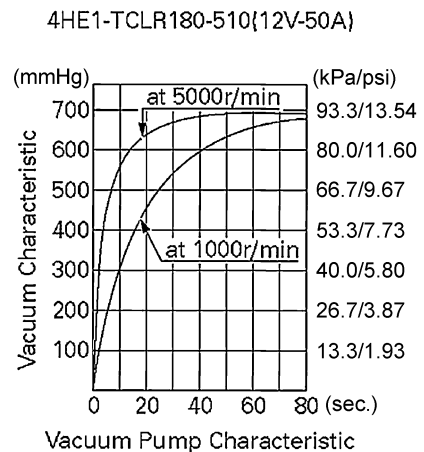
- With a pipe arrangement as shown in the illustration, use the vacuum pump tester to conduct the measurement.



- Pour about 20 liter (5.28 US gal/4.40 UK gal) of engine oil into the vacuum pump tester.
- Increase the generator rotations gradually, and check to see if the engine oil is fully circulated by discharging oil from the exhaust side of the vacuum pump.
- Close the release valve and measure the “vacuum characteristic” and the “vacuum drop characteristic (air tight characteristic)”. Then check the obtained values based on the following table.



N6A1662E



N6A1663E

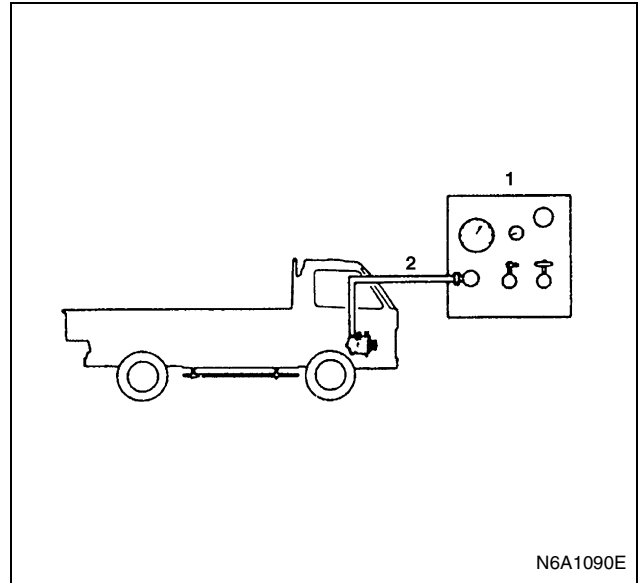
Item	Performance	Specifications
Vacuum characteristic	5000 rpm — 66.7 kPa (500 mmHg / 9.67 psi)	Less than 4 sec.
	Max. 5000 rpm	More than 90.7 kPa (680 mmHg / 13.15 psi)
Vacuum-down performance	Valve of vacuum-down 15 sec. after the vacuum pump is stopped at 53.3 kPa (400 mmHg / 7.73 psi).	Less than 2.67 kPa (20 mmHg / 0.39 psi)
Test condition	Oil used	Mobil oil #30
	Oil temperature	75±5°C (167±41°F)
	Oil pressure	441 kPa (4.5 kg/cm ² / 63.96 psi)

- 4HE1-TC LR180-510 (12-50A)

Item	Performance	Specifications
Vacuum characteristic	5000 rpm — 66.7 kPa (500 mmHg / 9.67 psi)	Less than 10 sec.
	Max. 5000 rpm	More than 90.7 kPa (680 mmHg / 13.15 psi)
Vacuum-down performance	Valve of vacuum-down 15 sec. after the vacuum pump is stopped at 53.3 kPa (400 mmHg / 7.73 psi).	Less than 2.67 kPa (20 mmHg / 0.39 psi)
Test condition	Oil used	Mobil oil #30
	Oil temperature	75±5°C (167±41°F)
	Oil pressure	441 kPa (4.5 kg/cm ² / 63.96 psi)

6. On-vehicle test of the vacuum pump

- Install the generator to the engine.
- With the engine idling, check to see if oil is being discharged sufficiently from the exhaust side of the vacuum pump.
- Idle the engine until the engine oil temperature gets to the range of 70 — 80°C (158 — 176°F).
- Connect the pipe only to the suction side of the vacuum pump tester, and conduct the test in the same manner as in the unit test. When the resulting value is outside the specified range, re-check the vacuum pump.



N6A1090E

Legend

1. Vacuum pump tester
2. Intake

QOS II PREHEATING SYSTEM

GENERAL DESCRIPTION

QOS II preheating system features a quick-on glow plug with thermometer control of the glowing time and the after-glow time function.

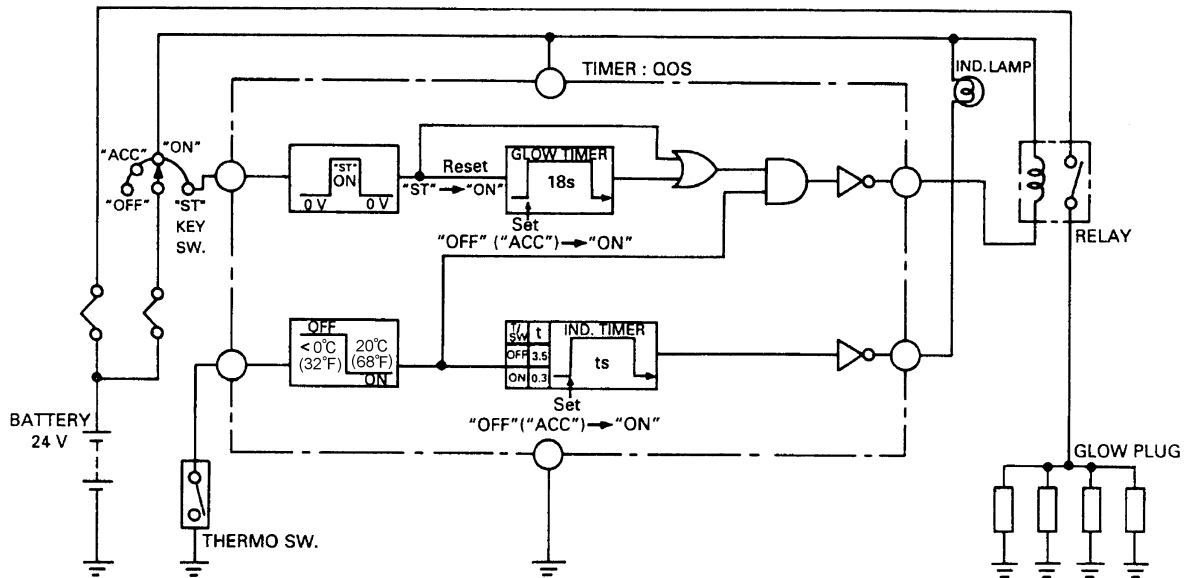
The system consists of a timer, indicator lamp, thermosensor, relay and temperature self-control type glow plug (4 pcs).

With the employment of the thermosensor, the glow time changes according to the engine coolant temperature, thus allowing optimum starting conditions to be obtained.

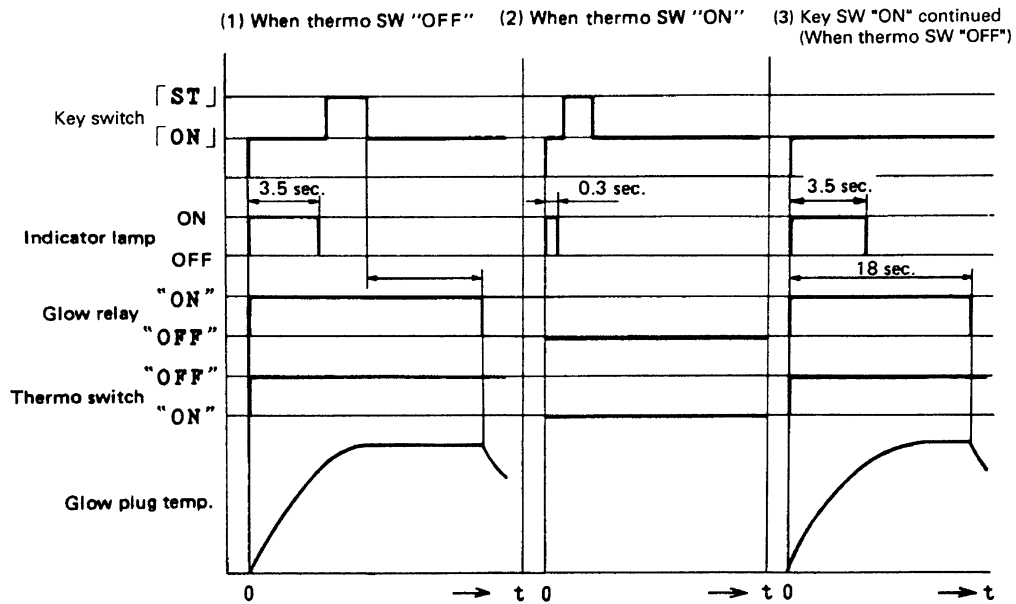
The afterglow time function is controlled by thermosensor.

Component
Quick-On-Start II (QOS II)

SYSTEM DIAGRAM



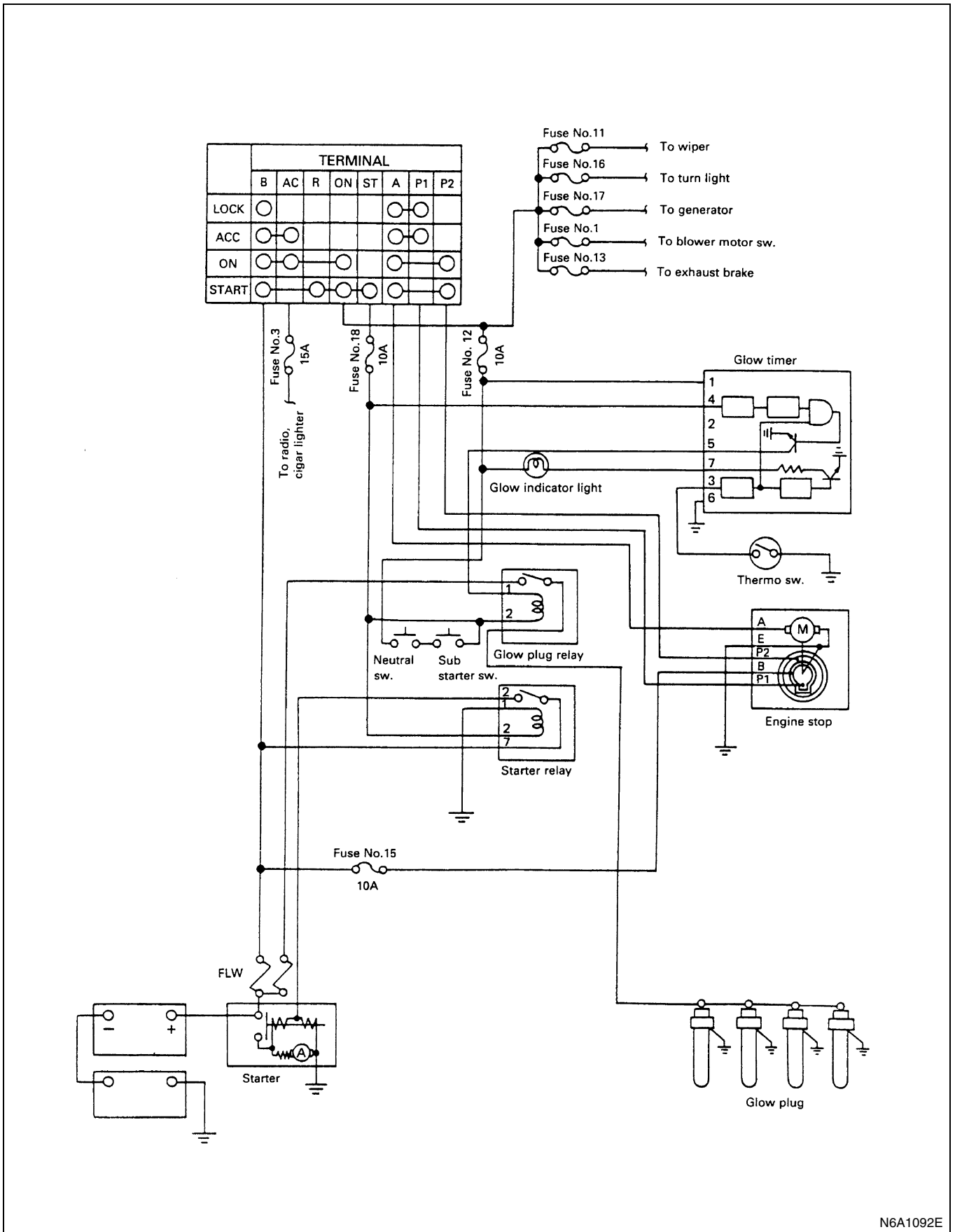
TIMING CHART



N6A1664E

STARTING CIRCUIT DIAGRAM (REFERENCE)

Component



N6A1092E

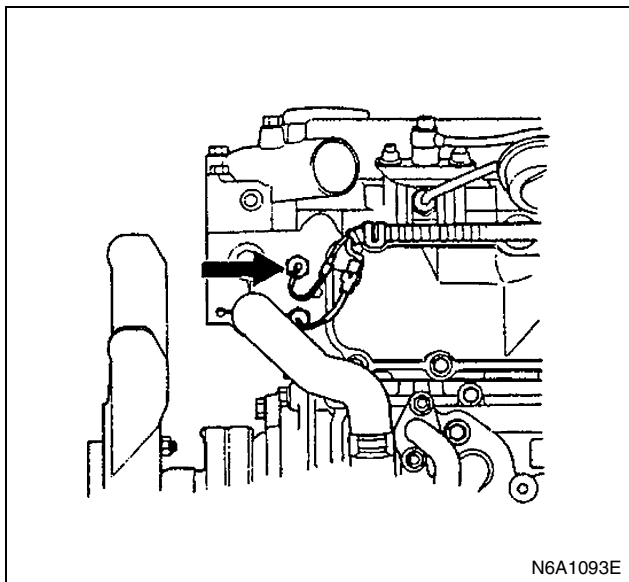
Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

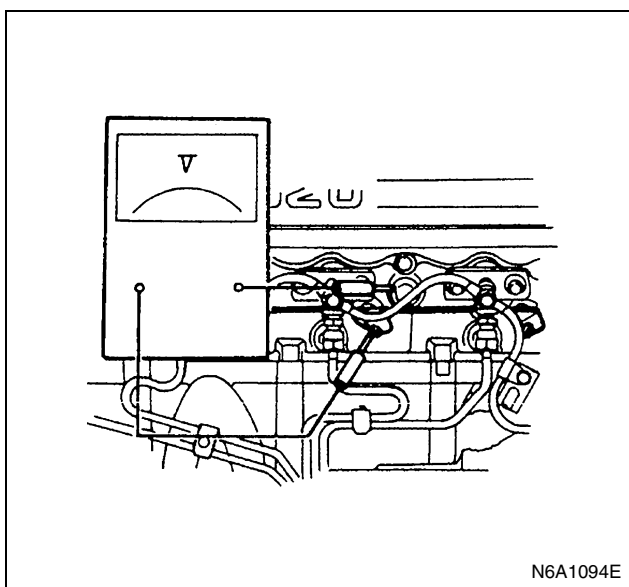
Quick-On-Start II (QOS II)

System

1. Disconnect the connector of the thermo switch.



2. Set the voltage meter in connection as shown in the illustration.



3. Turn the key switch to "ON" position without engine turned and check the following items.

Glow Indicator Lighting Time	Seconds
Standard	3.5

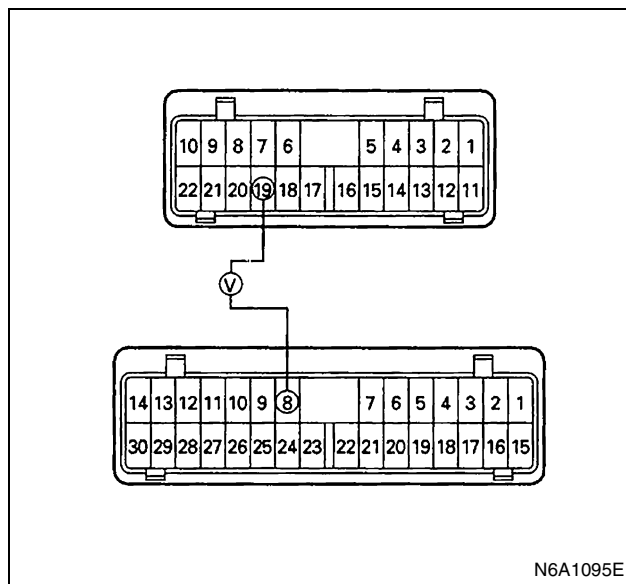
Power Source Voltage Indicating Time	Seconds
Standard	18

When abnormal, check the QOS timer, the glow relay and the thermo switch.

When normal, check the glow plug.

Timer

1. Disconnect the connector of the thermo switch.
2. Set the voltage meter in connection as shown the illustration with connector connected.

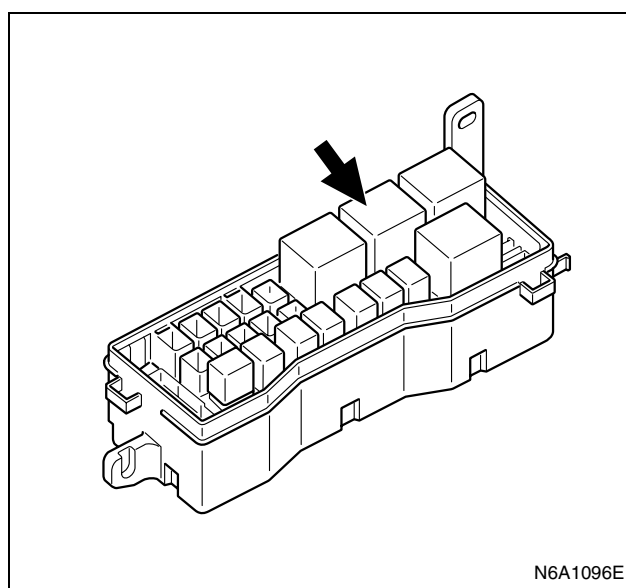


3. Turn the key switch to "ON" position without engine turned, and check the following.

0 Volts Indicating Time	Seconds
Standard	18

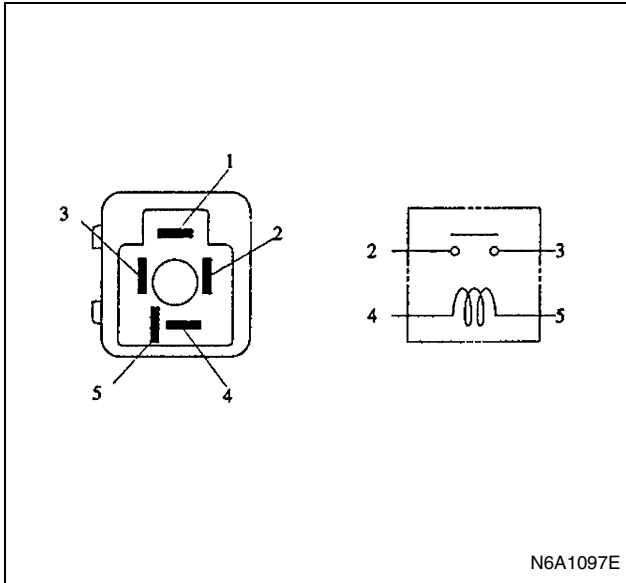
Glow Plug Relay

Location



Specification

Measure the glow relay resistance between the terminal (4) and the (5) with a circuit tester.

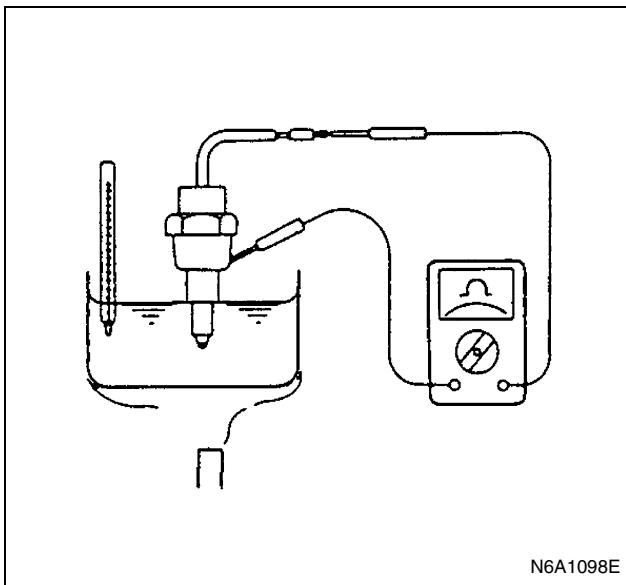


N6A1097E

If the measured resistance is outside the specified range, the glow relay must be replaced.

Glow Relay Resistance (Reference)	ohms
Standard	100

Thermo-Switch

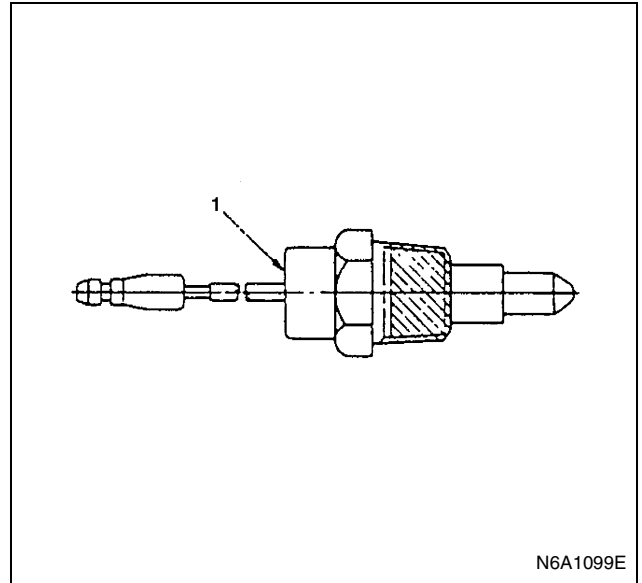


N6A1098E

Specification

Operating Temperature	°C (°F)
OFF → ON	7 — 13 (44.6 — 55.4)
ON → OFF	Over 3 (37.4)

- Before installing the thermo-switch, apply LOC-TITE 262 or its equivalent to the portion shown in the illustration.



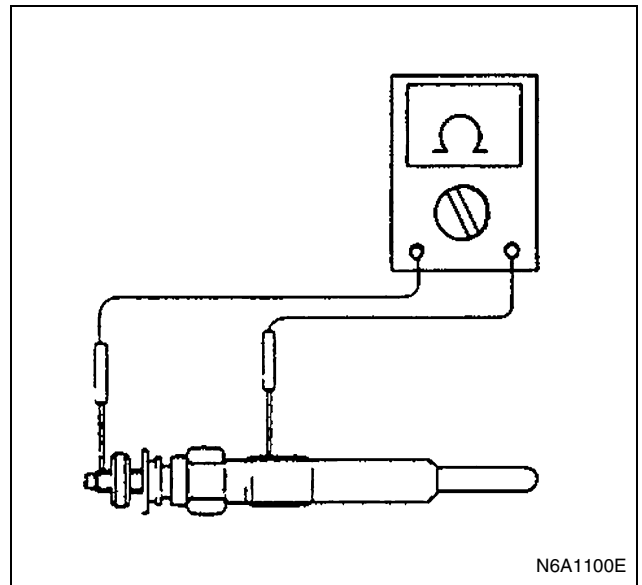
N6A1099E

Legend

- 1. Pink (resin)

Glow plug check

- Use the circuit tester to measure the continuity of the glow plug.

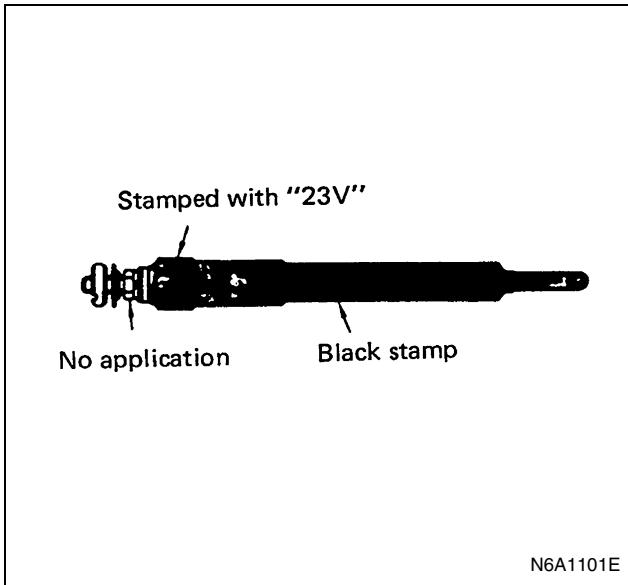


N6A1100E

- When the obtained value is outside the specified range, replace the glow plug with a new one.
Glow plug resistance = About 4Ω (at room temperature)

Notice:

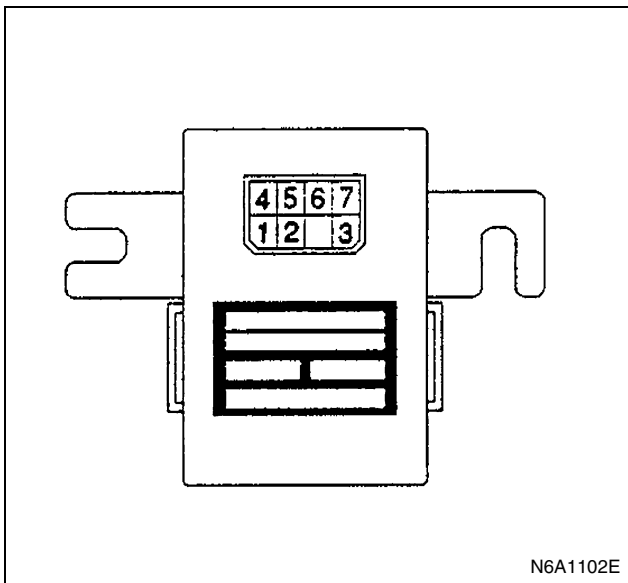
When changing glow plugs, use a set of 4 glow plugs of the same manufacture.



- Note that an identification mark is provided to prevent any possible faulty assembly.

Type	Rated Voltage (V)	Total length mm (in)
Standard	23	141 (5.55)

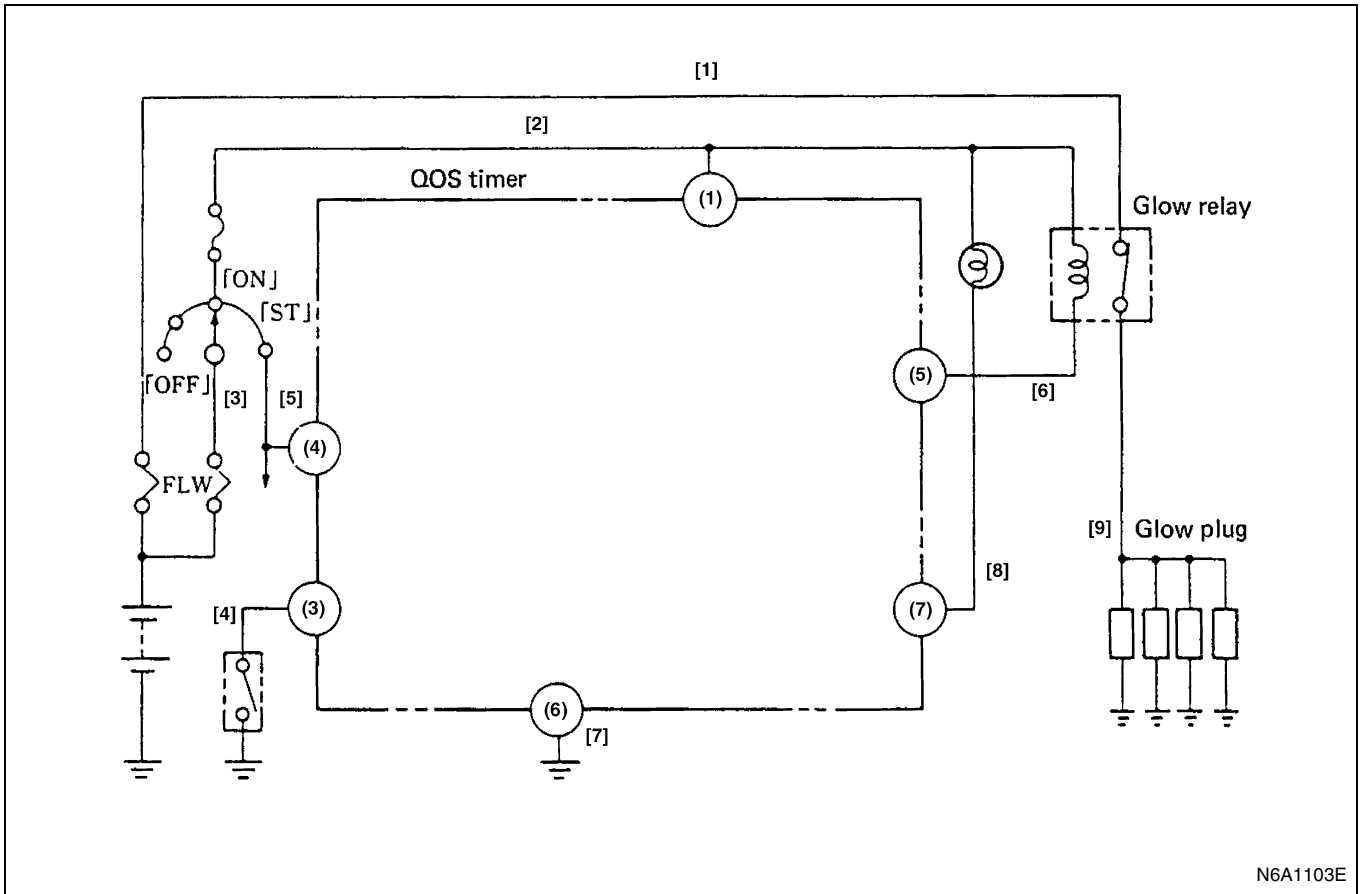
QOS Timer



Timer Specification	
No.	Connection to
1	Starter SW "ON"
2	—
3	Thermo SW
4	Starter SW "ST"
5	Glow relay
6	Earth (ground)
7	Indicator lamp

TROUBLESHOOTING

Circuit diagram



N6A1103E

Notice:

A figure in a circle "()" shows a terminal No.

A figure in a square "[]" shows a circuit No.

When the Cooling Water Temperature is Below 0°C (32°F).

Condition	Possible cause	Circuit
The glow relay does not turn on.	1. Defective connection in fusible link between battery and starter switch	[3]
	2. Defective connection or broken wire in starter switch circuit	[2]
	3. Defective connection or broken wire in fuse No.3	
	4. Defective starter switch * Items 3 and 4 above coincide with troubles in other circuits.	[1]
	5. Defective connection of glow relay terminal	[6]
	6. Broken wire in glow relay excitation coil	
	7. Broken wire in the circuit between glow relay and timer	
	8. Defective glow relay (There is no continuity in main connection.)	[7]
	9. Defective connection in QOS timer Defective QOS timer	
	10. Defective ground circuit in QOS timer	[7]
	11. Defective thermo-switch (The thermo-switch does not turn off even when water temperature is below zero.)	[7]
	12. Defective ground circuit in thermo-switch	
Glow relay turns on, but does not get preheated.	1. Defective connection of fusible link between battery and start switch	[1]
	2. Defective connection of glow relay main link terminal connector, or broken wire in preheating circuit	[9]
	3. Defective connection of plug connector with preheating circuit	
Glow relay remains on, and does not turn off.	1. Defective QOS timer	[6]
	2. Circuit is shorted to ground between QOS timer terminal (5) and glow relay	
	3. Defective glow relay	
Indicator lamp does not light on.	1. Defective QOS timer	[8]
	2. Broken wire in bulb	
	3. Broken wire in indicator lamp harness	

When the Cooling Water Temperature is Over 0°C (32°F).

Condition	Possible cause	Circuit
Indicator lamp does not light on.	1. Defective QOS timer	[8]
	2. Broken wire in bulb	
Indicator lamp lights on for a long time.	1. Defective thermo-switch, or broken wire in thermo-switch circuit (Indicator lights on for about 3.5 sec.)	[4]
	2. Defective QOS timer	
Glow relay is ready to turn on, or remains on.	1. Circuit is shorted to ground between terminal (5) and glow relay.	[6]

EMISSION AND ELECTRICAL DIAGNOSIS

GENERAL DESCRIPTION

The emission and electrical control system operates on a 12 or 24 volt power supply with negative ground polarity. Each wire in the vehicle is of a specific size and has an identifying colored insulation.

These colors are indicated in wiring diagrams and will help in tracing circuits and making proper connections. Wire size is determined by load capacity and circuit length. Some wires are grouped together and taped. Such a grouping of wires is called a harness.

The harness use a split corrugated tube to protect the wires from the elements. Each circuit consists of the following:

- Power source - the battery and the alternator.
- Wires - To carry electrical current through the circuit.
- Fuses - To protect the circuit against current overload.
- Relays - To protect voltage drop between the battery and the circuit parts and to protect the switch points against burning.
- Switches - To open and close the circuit.
- Load - Any device, such as a light or a motor, which converts the electrical current into useful work.
- Ground - To allow the current to flow back to the power source.

In this manual, such electrical device is classified by system. For major parts shown on the circuit based on the circuit diagram for each system, inspection and removal and installation procedures are detailed.

Notes for Working on Electrical Items

Battery Cable

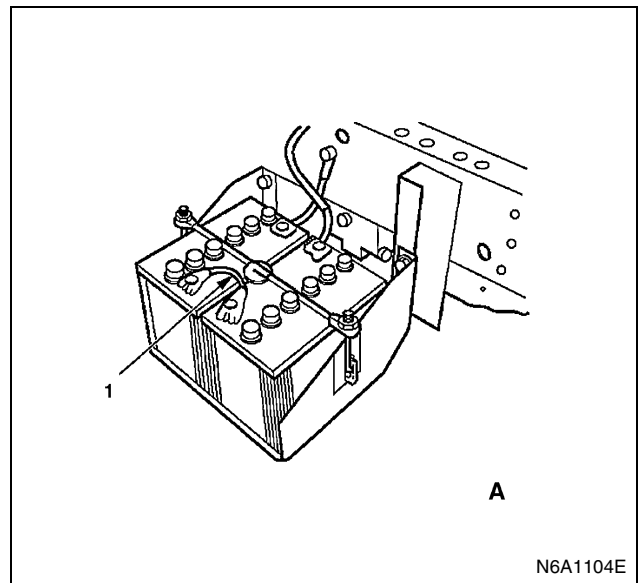
Disconnecting the Battery Cable

1. All switches should be in the "OFF" position.
2. Disconnect the battery ground cable.
3. Disconnect the battery positive cable
4. Disconnect the battery cable (1).

Caution:

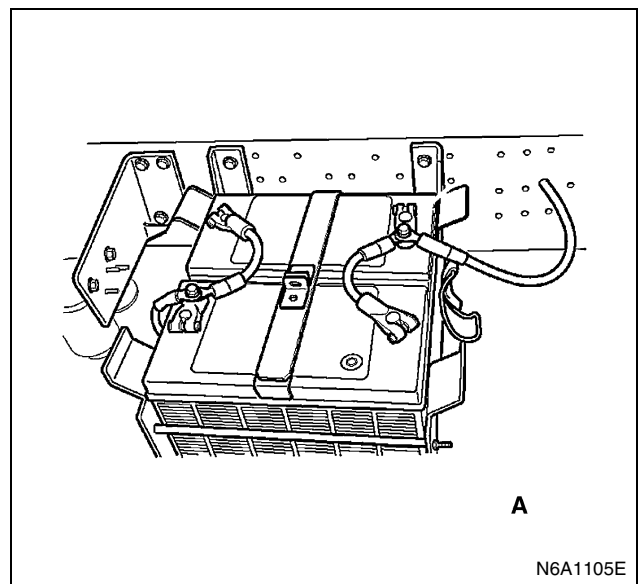
It is important that the battery ground cable be disconnected first.

Disconnecting the battery positive cable first can result in a short circuit.



Legend

- A. For 24 volt
- 1. Cable



Legend

- A. For 12 volt

Connecting the Battery Cable

Follow the disconnecting procedure in the reverse order.

Caution:

Clean the battery terminal and apply a light coat of grease to prevent terminal corrosion.

Connecting Handling

Disconnecting the Connectors

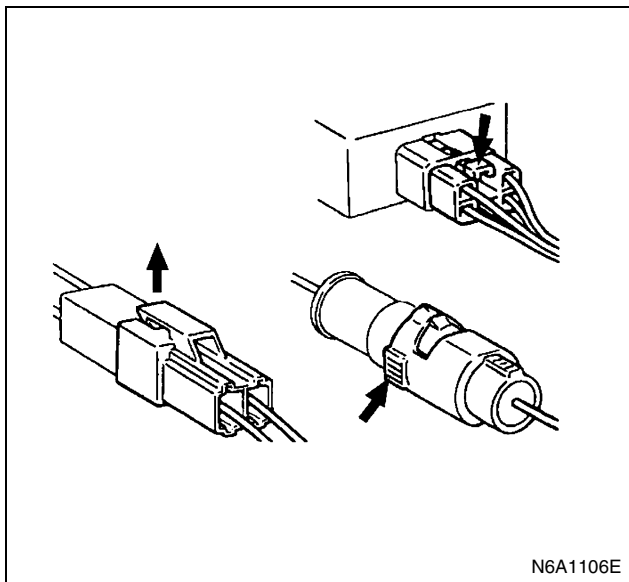
Some connectors have a tang lock to hold the connectors together during vehicle operation.

Some tang locks are released by pulling them towards you.

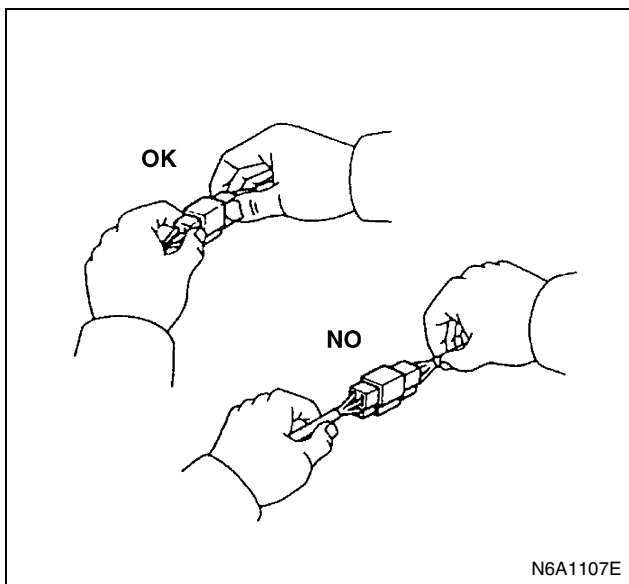
Other tang locks are released by pressing them forward. Determine which type of tang lock is on the connector being handled.

Firmly grasp both sides (male and female) of the connector.

Release the tang lock and carefully pull the two halves of the connector apart.

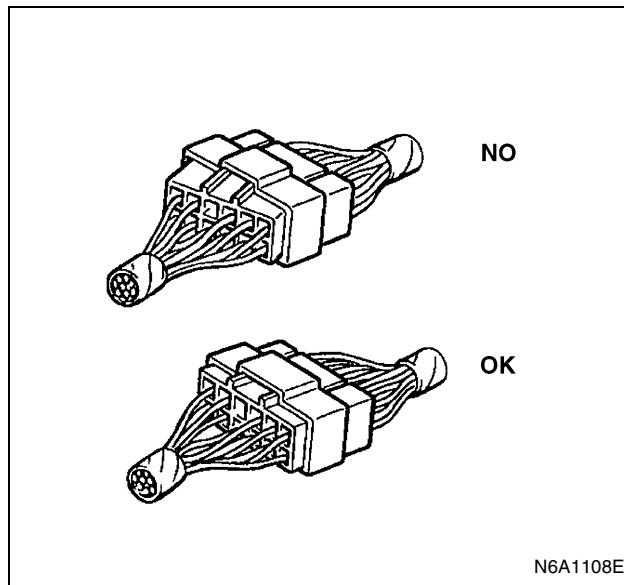


Never pull on the wires to separate the connectors. This will result in wire breakage.



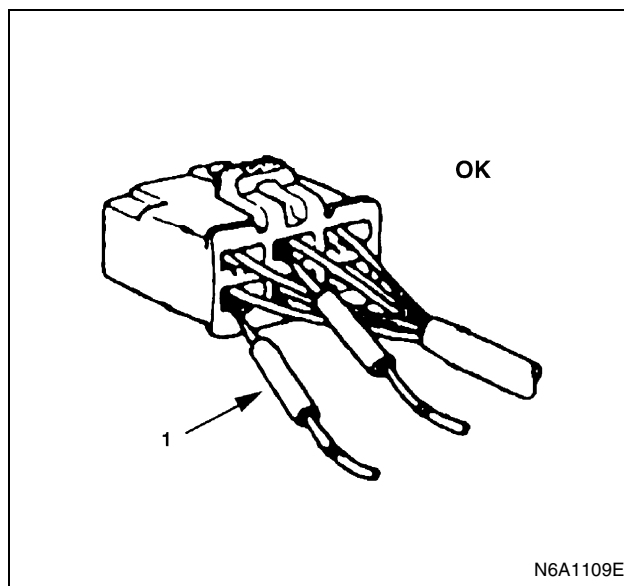
Connecting the Connector

Firmly grasp both sides (male and female) of the connector. Be sure that the connector pins and pin holes match. Be sure that both sides of the connector are aligned with each other. Firmly but carefully push the two sides of the connector together until a distinct click is heard.



Connector Inspection

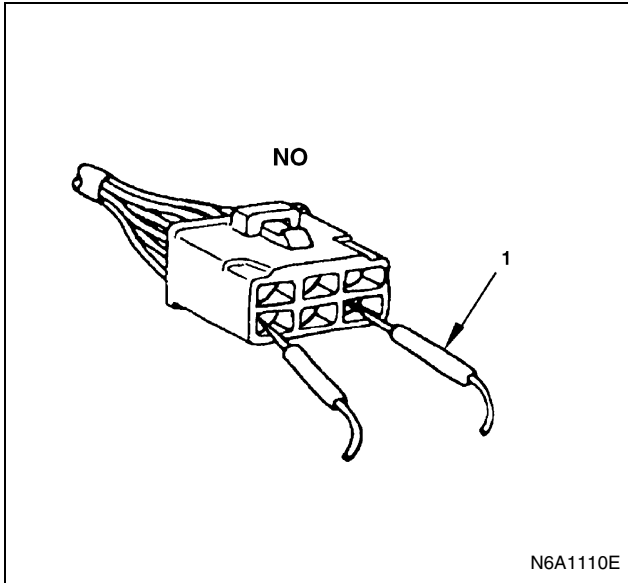
Use a circuit tester to check the connector for continuity. Insert the test probes from the connector wire side.



Legend

- 1. Test probe

Never insert the circuit tester test probes into the connector open end to test the continuity. Broken or open connector terminals will result.



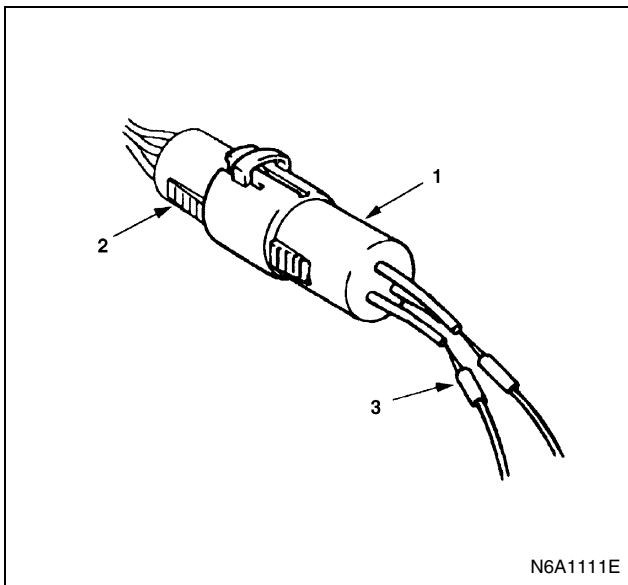
N6A1110E

Legend

- 1. Test probe

Waterproof Connector Inspection

It is not possible to insert the test probes into the connector wire side of a waterproof connector. Use one side of a connector (1) with its wires cut to make the test. Connect the test connector (2) to the connector to be tested. Connect the test probes to the cut wires to check the connector continuity.



N6A1111E

Legend

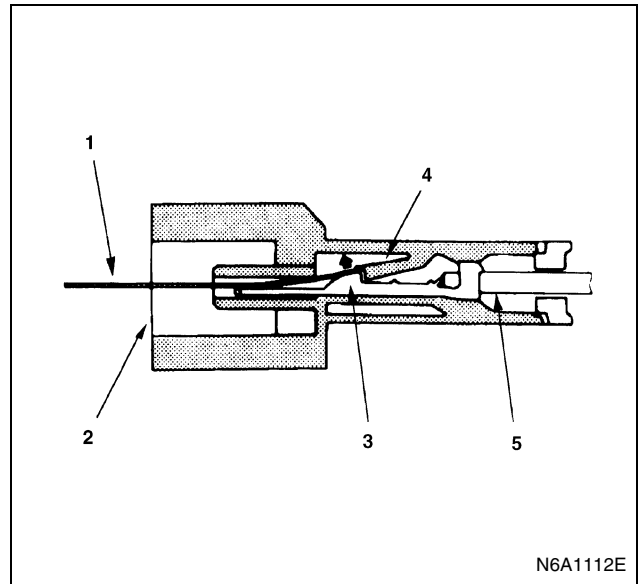
- 1. Connector
- 2. Test connector
- 3. Test probe

Connector Pin Removal

Connector Housing Tang Lock Type

- 1. Insert a slender shaft into the connector housing open end.

- 2. Push the tang lock up (in the direction of the arrow in the illustration). Pull the wire with pin free from the wire side of the connector.



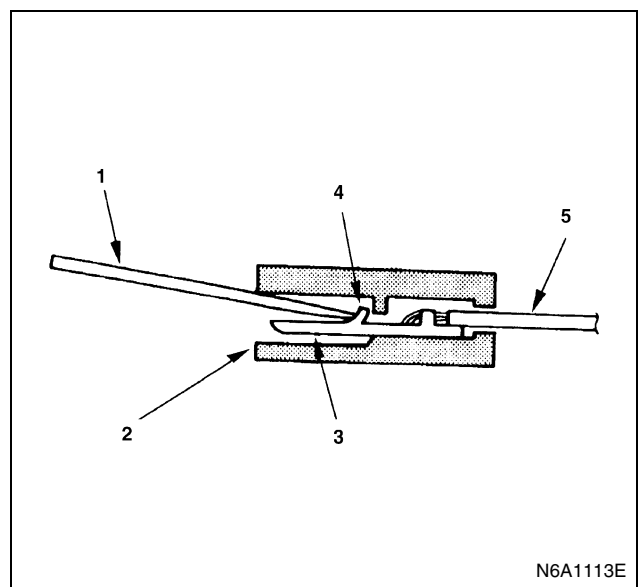
N6A1112E

Legend

- 1. Slender shaft
- 2. Housing open pad
- 3. Pin
- 4. Tang lock
- 5. Wire

Pin Tang Lock Type

- 1. Insert a slender shaft into the Connector housing open end.
- 2. Push the tang lock flat (toward the wire side of the connector). Pull the wire with pin free from the wire side of the connector.



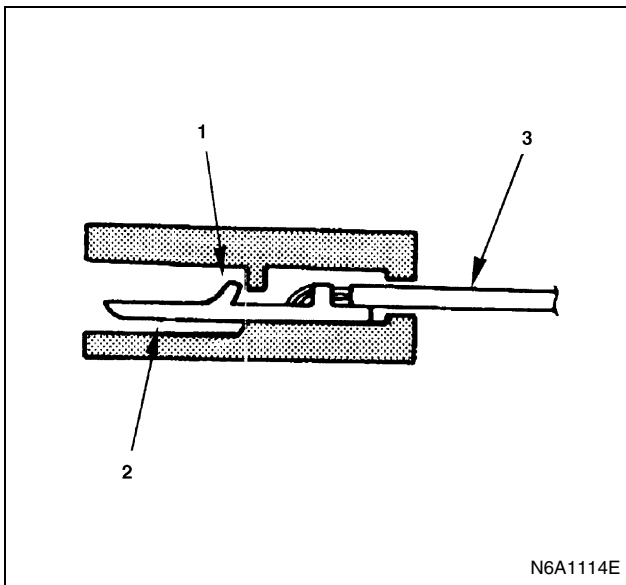
N6A1113E

Legend

1. Slender shaft
2. Housing open pad
3. Pin
4. Tang lock
5. Wire

Connector Pin Insertion

1. Check that the tang lock is fully up.
2. Insert the pin from the connector wire side. Push the pin in until the tang lock closes firmly.
3. Gently pull on the wires to make sure that the connector pin is firmly set in place.

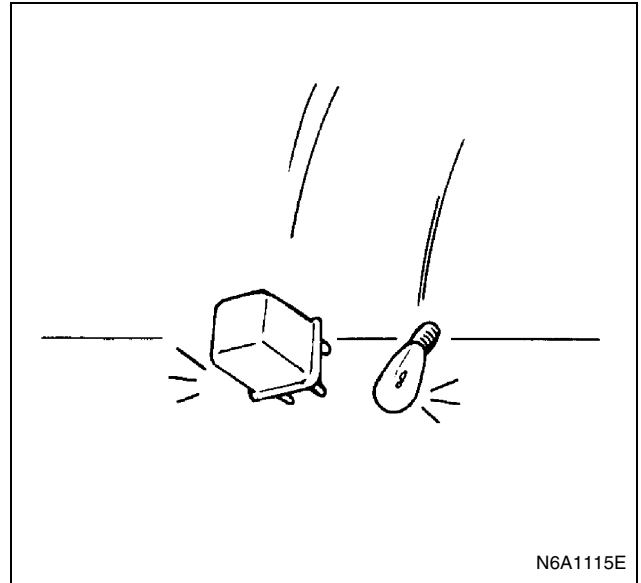


Legend

1. Tang lock
2. Pin
3. Wire

Parts Handling

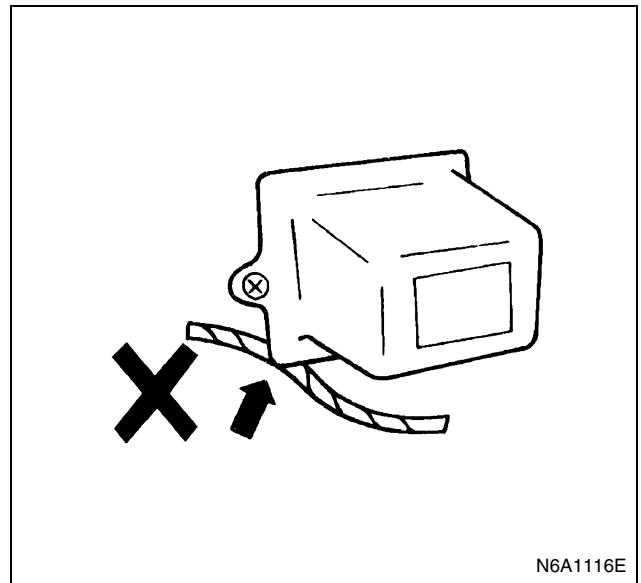
Be careful when handling electrical parts. They should not be dropped or thrown, because short circuit or other damage may result.



Cable Harness

When installing the parts, be careful not to pinch or wedge the wiring harness.

All electrical connections must be kept clean and tight.



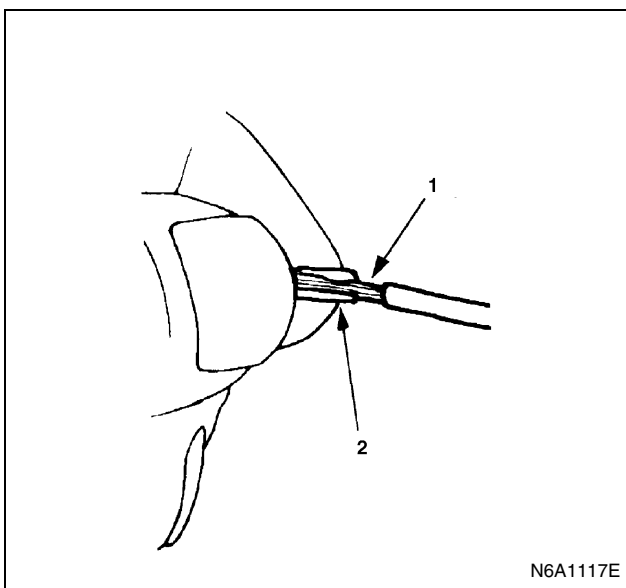
Splicing Wire

1. Open the Harness
If the harness is taped, remove the tape. To avoid wire insulation damage, use a sewing "seam ripper" (available from sewing supply stores) to cut open the harness.
If the harness has a block plastic conduit, simply pull out the desired wire.
2. Cut the wire
Begin by cutting as little wire off the harness as possible. You may need the extra length of wire later if you decide to cut more wire off to change the location of a splice. You may have to adjust splice locations to make certain that each splice is at least 1.5 in (40 mm) away from other splices, harness branches, or connectors.
3. Strip the insulation

When replacing a wire, use a wire of the same size as the original wire. Check the stripped wire for nicks or cut stands. If the wire is damaged, repeat the procedure on a new section of wire. The two stripped wire ends should be equal in length.

4. Crimp the Wires

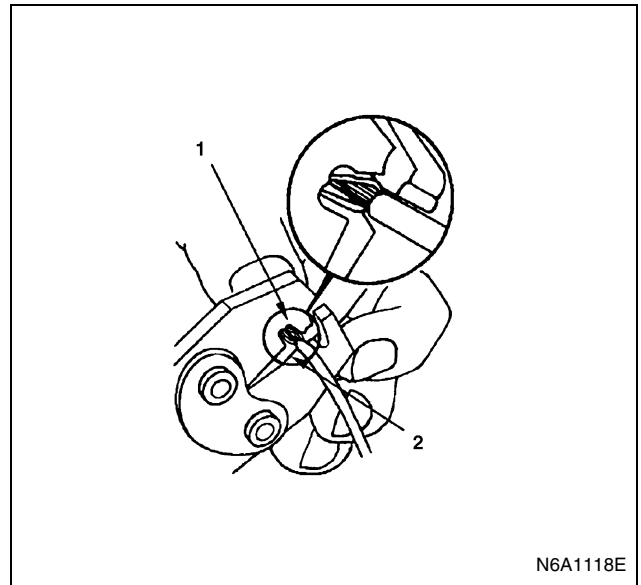
Select the proper clip to secure the splice. To determine the proper clip size for the wire being spliced, follow the directions included with your clips. Select the correct anvil on the crimper. (On most crimpers your choice is limited to either a small or large anvil.) Overlap the two stripped wire ends and hold them between your thumb and forefinger. Then, center the splice clip under the stripped wires and hold it in place.



Legend

1. Over lap bare wires
2. Splice clip

- Open the crimping tool to its full width and rest one handle on a firm flat surface.
- Center the back of the splice clip on the proper anvil and close the crimping tool to the point where the back of the splice clip touches the wings of the clip.
- Make sure that the clip and wires are still in the correct position. then, apply steady pressure until the crimping tool closes.



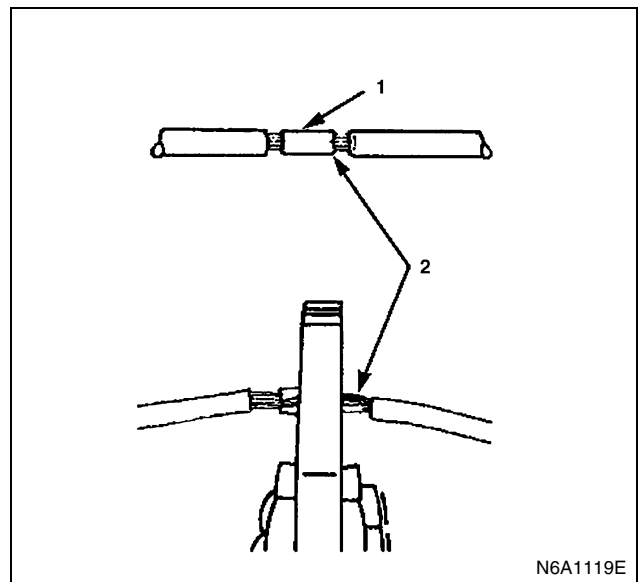
Legend

1. Wings of clip touching former
2. Back of clip centered on anvil

Before crimping the ends of the clip, be sure that:

- The wires extend beyond the clip in each direction.
- No stands of wire are cut loose, and
- No insulation is caught under the clip.

Crimp the splice again, once on each end. Do not let the crimping tool extend beyond the edge of the clip or you may damage or nick the wires.

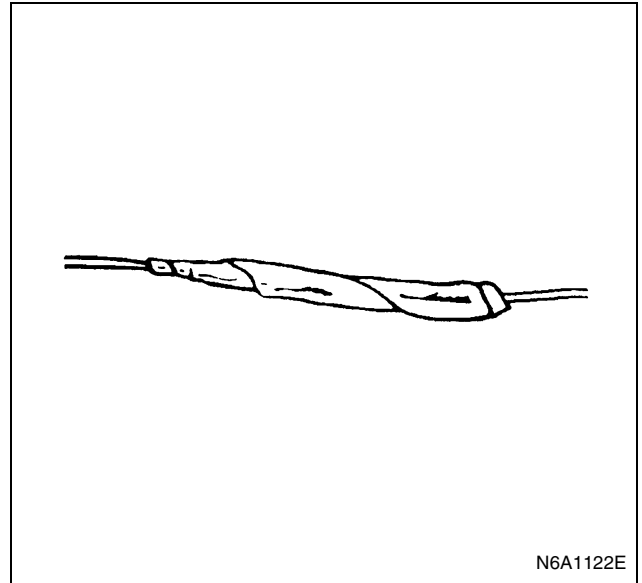
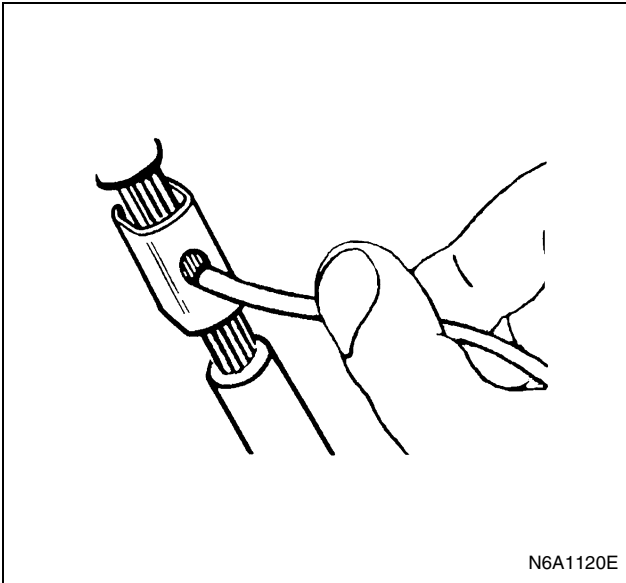


Legend

1. Splice clip
2. Align tool with edge of clip to crimp ends of splice

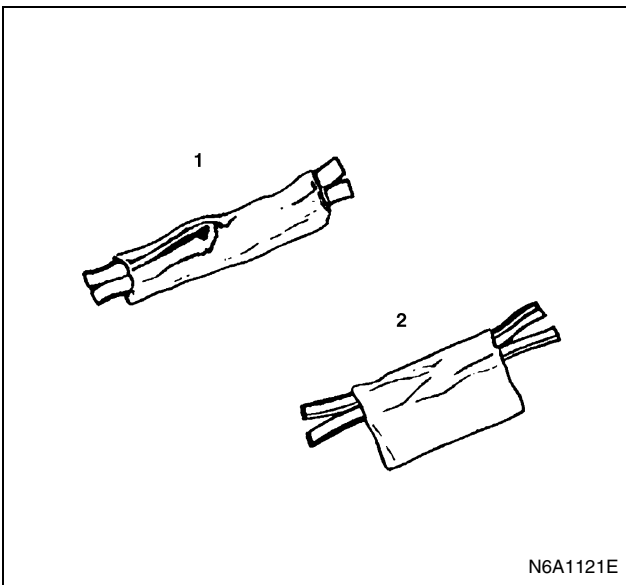
5. Solder

Apply 60/40 rosin core solder to the opening in the back of the clip. Follow the manufacturer's instructions for the solder equipment you are using.



6. Tape the Splice

Center and roll the splicing tape. The tape should cover the entire splice. Roll on enough tape to duplicate the thickness of the insulation on the existing wires. Do not flag the tape. Flagged tape may not provide enough insulation, and the flagged ends will tangle with the other wires in the harness.




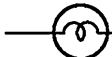
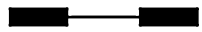


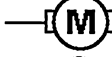


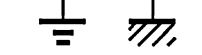


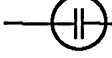

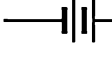



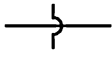

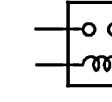
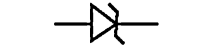



Legend

- 1. Good (Rolled)
- 2. Bad (Flagged)

If the wire does not belong in a conduit or other harness covering, tape the wire again. Use a winding motion to cover the first piece of tape.

Symbols and Abbreviations

Symbols

	Fuse		Single filament light
	Fusible link		Double filament light
	Fusible link wire		Motor
	Switch		Buzzer
	Ground		Meter
	Condenser		Consent
	Resistor		Battery
	Variable resistance		Connected portion
	Coil		Crossed portion
	Diode		Relay
	Zener diode		Circuit breaker
	NPN type transistor		
	PNP type transistor		

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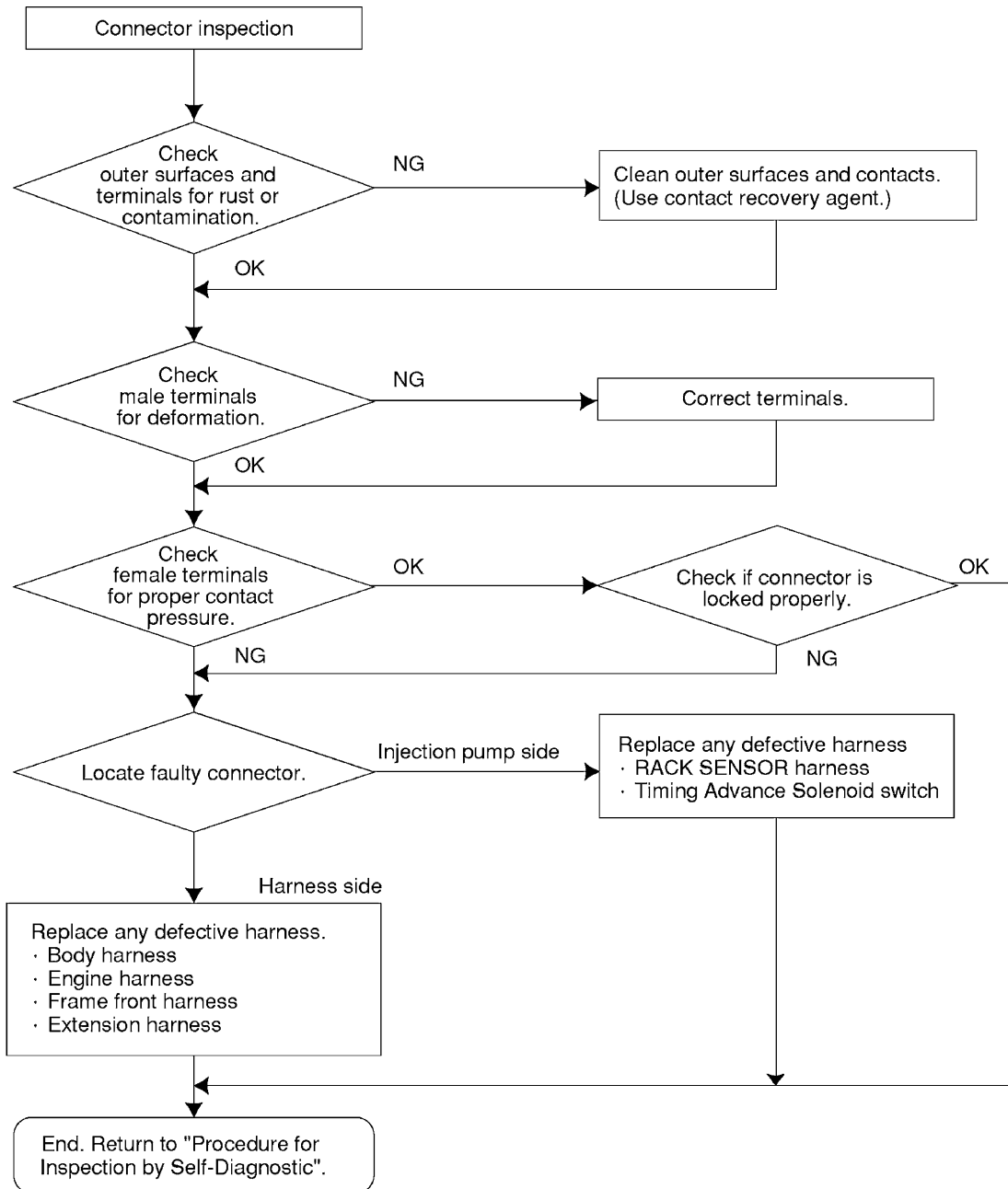
Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
A/C	Air Conditioner	OBD	BOARD Diagnostic
ACC	Accessory	OFF	Turn Off (Switch/Lamp)
ACT	Actuator	ON	Turn On (Switch/Lamp)
ASSIT	Assistant	OPT	Option
BATT	Battery	P/BRAKE	Parking Brake
CAS	Cab Air Suspension	PGND	Power Ground (To Body Earth)
CAS C/U	Cab Air Suspension Control Unit	PIN	Pin or Terminal
CCS	Combined Charging System	P/L	Pilot (Warning) Lamp
CONN	Connector	PRESS	Pressure
		P/T	Power Train

Abbreviation	Meaning	Abbreviation	Meaning
C/U	Control Unit	PTO	Power Take Off
DC	Direct Current	Q ADJUST- MENT	Injection Quantity Adjustment
D/CONN	Diagnosis Connector	QOS	Quick On Start
DTC	Diagnostic Trouble Code	QWS	Quick Warm System
EC	Electrical Control Governor	RH	Right Hand (Side)
ECM	Engine Control Module	RHD	Right Hand Drive
ECT	Engine Coolant Temperature	R/L	Relay
EGR	Exhaust Gas Recirculation	RR	Rear
EH	Electrical and Hydraulic Timer	S/ASB	Shock Absorber
EXH	Exhaust	SIG	Signal
EVRV	Electronic Vacuum Regulating Valve	SS	Speed Sensor
FICD	Fast Idle Control Device	SS C/U	Speed Sensor Control Unit
FRT	Front	STD	Standard
GND	Ground (Body Earth)	SUSP	Suspension
IE	ISUZU Economy System	SW	Switch
IN	Inlet, Intake	TCV	Trailer Cock Valve
IVES	ISUZU Variable Electric and Economy Swirl	TICS	Timing and Injection Rate Control System
LH	Left Hand (Side)	VGS	Variable Geometry Turbocharging System
LHD	Left Hand Drive	VSS	Variable Swirl System
MAG	Magnetic	VSV	Vacuum Switching Valve
ME/CONN	Memory Eraser Connector	W/L	Warning Lamp
MIL	Malfunction Indicator Lamp	W/	With
M/V	Magnetic Valve	W/O	Without
N	Neutral (Transmission Gear)		
N-TDC	Numbers Top Dead Center		
NR	Noise Reducer		

Connector Inspecting Procedure

Connector Inspecting Procedure



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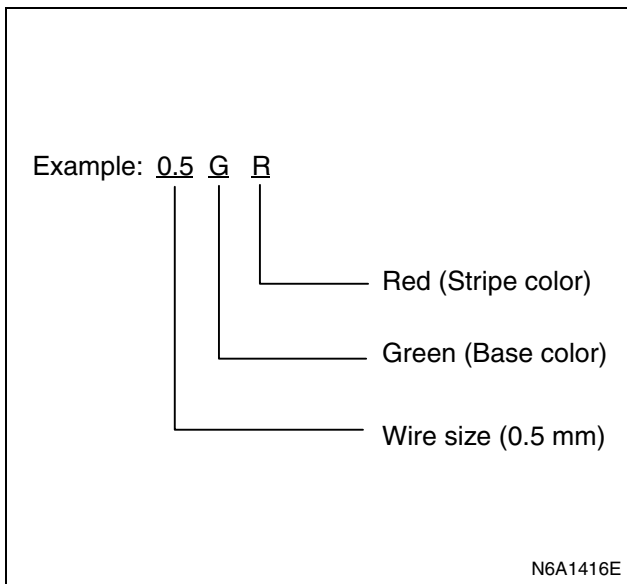
Parts for Electrical Circuit

Wiring

Wire Color

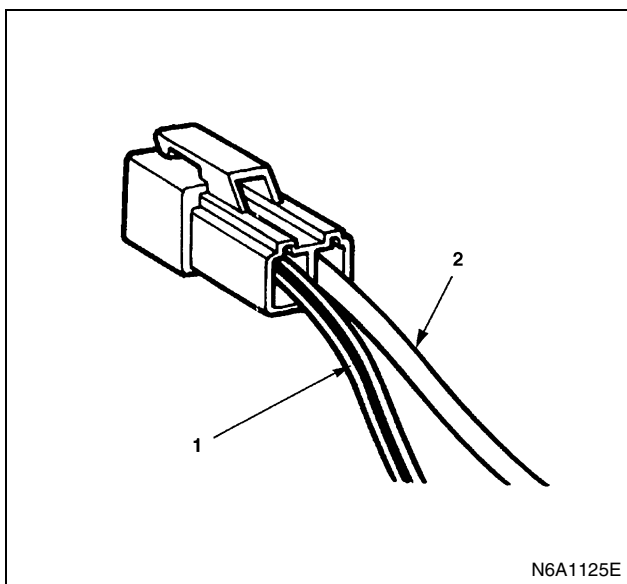
All wires have color-coded insulation.

Wires belonging to a system's main harness will have a single color. Wires belonging to a system's sub circuits will have a colored stripe. Striped wires use the following code to show wire size and colors.



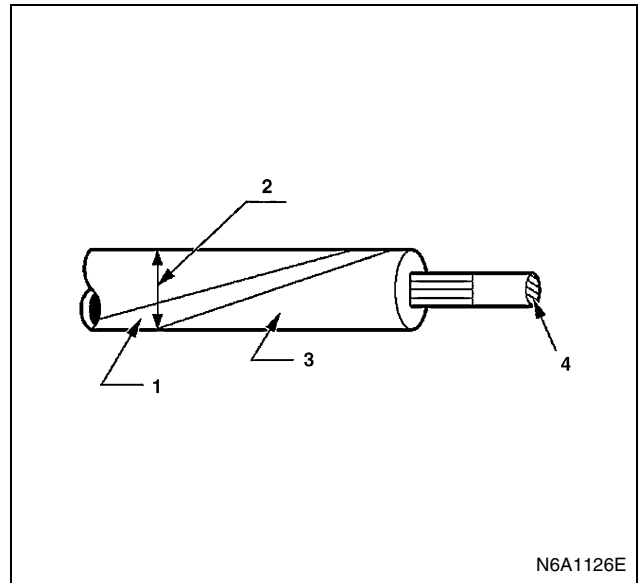
Abbreviations are used to indicate wire color within a circuit diagram.

Refer to the following table.



Legend

1. Colored stripe
2. Single color



Legend

1. Stripe color
2. Outside diameter
3. Base color
4. Cross sectional area

Wire Color Coding

Color-coding	Meaning	Color-coding	Meaning
B	Black	Br	Brown
W	White	Lg	Light green
R	Red	Gr	Gray
G	Green	P	Pink
Y	Yellow	Sb	Sky blue
L	Blue	V	Violet
O	Orange		

Stripe Color Coding

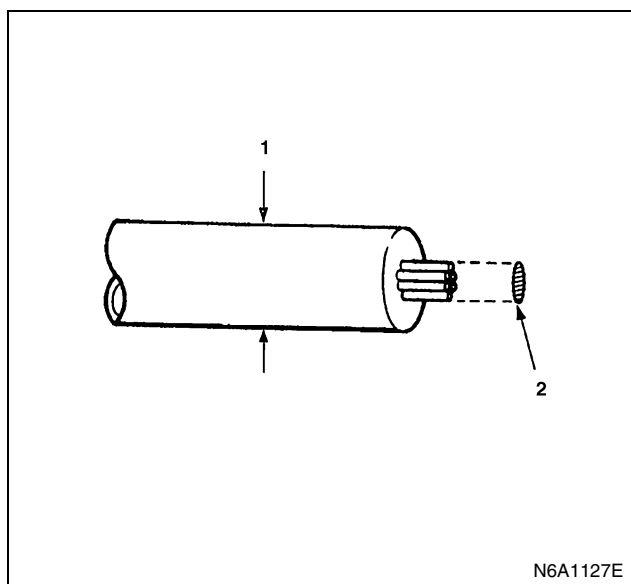
Color-code	Base Color	Stripe Color
LB	Blue	Black
OB	Orange	Black
PB	Pink	Black
PG	Pink	Green
PL	Pink	Blue
RY	Red	Yellow
VR	Violet	Red
VW	Violet	White
YB	Yellow	Black
YB	Yellow	Green
YV	Yellow	Violet

Wire Size

The size of wire, used in a circuit is determined by the amount of current (amperage), the length of the circuit, and the voltage drop allowed. The following wire size and load capacity, shown below, are specified by JIS (Japanese Industrial Standard) (Nominal size means approximate cross sectional area)

Legend

1. Outside diameter
2. Cross sectional area



Nominal size (mm)	Cross sectional area (mm ²)	Outside diameter (mm)	Allowable current (A)
0.3	0.372	1.8	9
0.5	0.563	2	12
0.85	0.885	2.2	16
1.25	1.287	2.5	21
2	2.091	2.9	28
3	3.296	3.6	37.5
5	5.227	4.4	53
8	7.952	5.5	67
15	13.36	7	75
20	20.61	8.2	97

DIAGNOSIS (4HE1-TC Only)

Strategy-based Diagnostics

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
 - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
 - Conduct a thorough visual inspection.
 - Review the service history.
 - Detect unusual sounds or odors.
 - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
 - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check (s).
 - “System checks” contain information on a system that may not be supported by one or more DTCs.
System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

Diagnostic Trouble Code (DTC) Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables.

Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matchig Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Call technical assistance for similar cases where repair history may be available. Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes.
2. Evaluate the symptoms and the conditions described by the customer.

3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most scan tool, such as the Tech II have data-capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re-examine the complaint
When the Complaint cannot be successfully found or isolated, a re-evaluation is necessary.
The complaint should be re-verified and could be intermittent as defined in Intermittents, or could be normal.
2. Repair and verify.
After isolating the cause, the repairs should be made.

Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:

- Conditions noted by the customer.
- If a DTC was diagnosed, verify a repair by duplicating conditions present according to customer complaint.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD system diagnostics. Following a repair, the technician should perform the following steps:

Important:

Follow the steps below when you verify repairs on board diagnostic systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records for the DTC which has been diagnosed.
2. Clear the DTC (S).
3. Operate the vehicle within conditions according to customer complaint.
4. Monitor the Diagnostic Trouble Code (DTC) status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

General Service Information

On Board Diagnostic (OBD) Serviceability Issues

The list of non-vehicle faults that could affect the performance of the OBD system has been compiled. These non-vehicle faults vary from environmental conditions to the quality of fuel used.

The illumination of the Malfunction Indicator Lamp (MIL) (“Check Engine” lamp) due to a non-vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non-vehicle faults does not include every possible fault and may not apply equally to all product lines.

Poor Vehicle Maintenance

The sensitivity of OBD diagnostics will cause the MIL to turn on if the vehicle is not maintained properly. Restricted air filters, fuel filters, oil filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD. Poor vehicle maintenance can not be classified as a “non-vehicle fault”, but with the sensitivity of OBD diagnostics, vehicle maintenance schedules must be more closely followed.

Maintenance Schedule

Refer to the maintenance Schedule.

Visual/Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspection all vacuum hoses for punches, cuts, disconnects, and correct routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in a engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge of Tools Required

Notice:

Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

On-Board Diagnostic (OBD)

On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Common OBD Terms

Diagnostic

When used as a noun, the word diagnostic refers to any on-board test run by the vehicle’s Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification.

Enable Criteria

The term “enable criteria” is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. “Enable criteria” is another way of saying “conditions required”.

Trip

Technically, a trip is a key on-run-key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostic are run when the vehicle is at operating temperature, some when the vehicle first start up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is idle.

Some run only immediately following a cold engine start-up.

A trip then, is defined as a key on-run-key off cycle in which the vehicle was operated in such a way as to satisfy the enables criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are not multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) is illuminated.

Data Link Connector (DLC)

The provision for communication with the control module is the Data Link Connector (DLC). It is located at near the A post of driver side. The DLC is used to connect to a scan tool. Some common uses of the scan tool are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs).
- Clearing DTCs.
- Reading serial data.

Decimal/Binary/Hexadecimal Conversions

All scan tool manufacture will display a variety of vehicle information which will aid in repairing the vehicle. Some scan tools will display encoded messages which will aid in determining the nature of the concern. The method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digits is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

A hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for scan tool manufactures to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicle with OBD system diagnostic. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records for the DTC which has been diagnosed.
2. Clear DTC (s).
3. Operate the vehicle within conditions noted in the Fail Records.
4. Monitor the DTC status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD systems. Failure to follow these steps could result in unnecessary repairs.

On-Board Diagnostic (OBD) System Check

OBD System should be checked as follows:

1. When Ignition key is turned from the "OFF" to the "ON" position, make sure that MIL is lit for 0.3 — 0.8 sec.
2. Connect Scan Tool and check to see if MIL is always lit.

If so, OBD System is normal.

Reading Diagnostic Trouble Codes Using a Tech 2 or Other Scan Tool

The procedure for reading diagnostic trouble codes is to be used a diagnostic scan tool. When reading DTCs, follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

Important:

Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the "warm-up" cycles with no further faults detected, the DTC will automatically be cleared from the Engine Control Module (ECM) memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic scan tool "clear DTCs" or "clear Information" function. When clearing DTCs follow instructions supplied by the tool manufacturer.

When a scan tool is not available, DTCs can also be cleared by disconnecting one of the following sources for at least thirty (30) seconds.

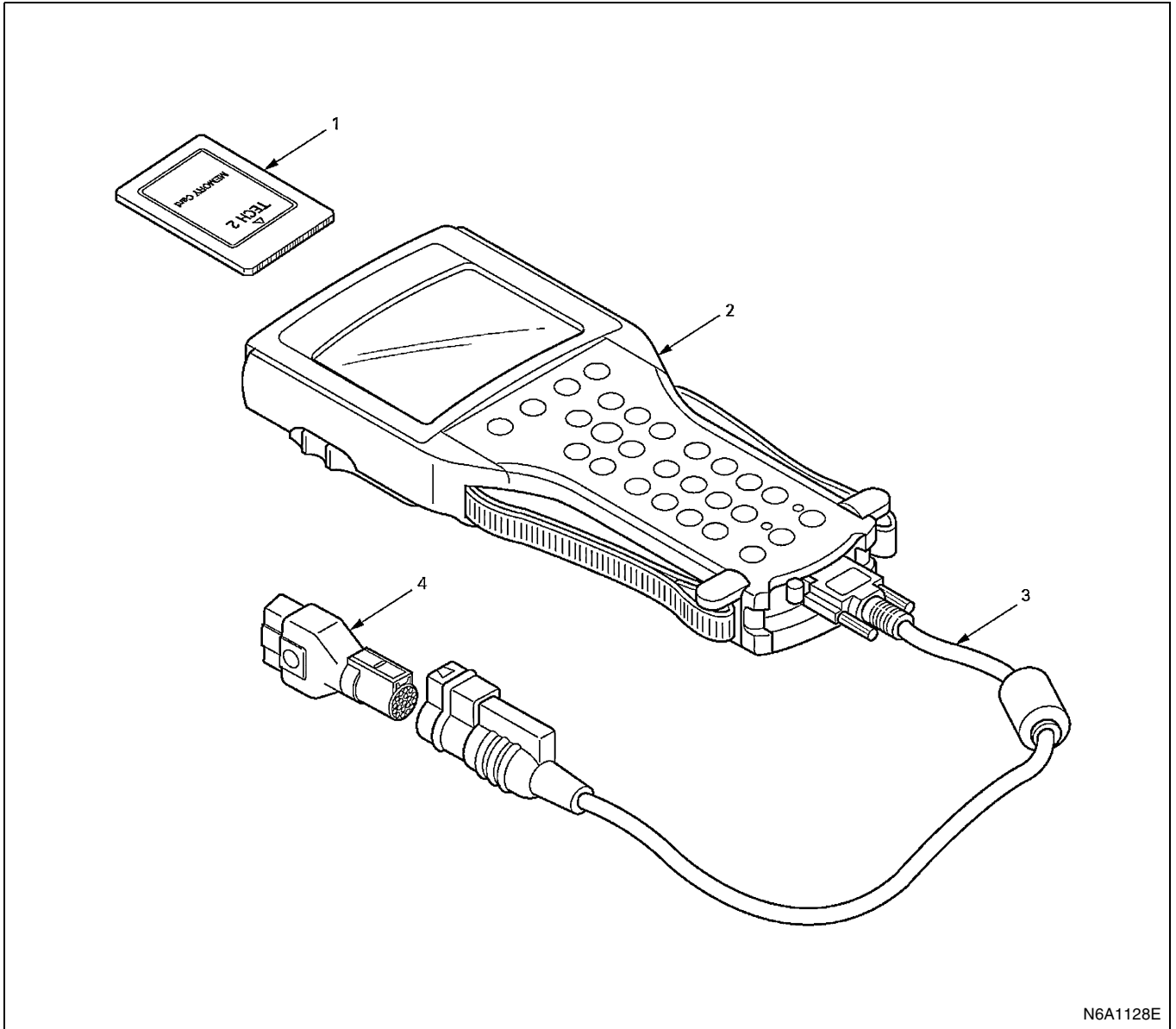
Notice:

To prevent system damage, the ignition key must be "OFF" when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery ECM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).

Tech 2 Scan Tool

From 98 MY, Isuzu Dealer service departments are recommended to use Tech 2. Refer to Tech 2 scan tool user guide.



N6A1128E

Legend

- | | |
|----------------------|--------------|
| 1. PCMCIA card | 3. DLC cable |
| 2. SAE 16/19 adapter | 4. Tech-2 |

Getting Started

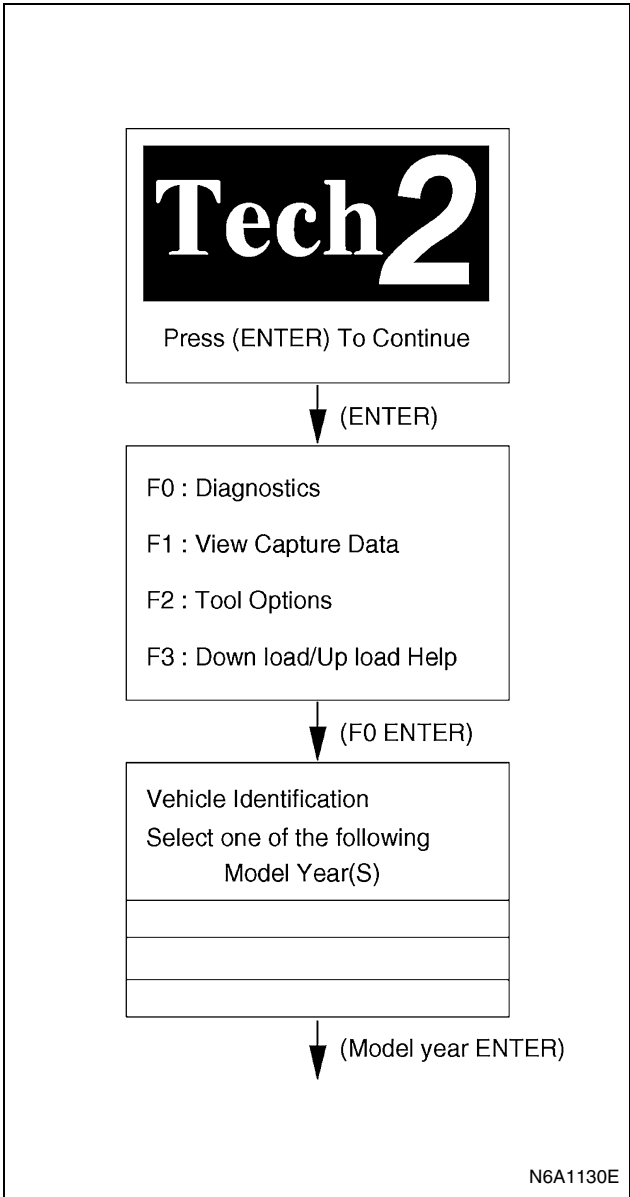
- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:
 1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (2).
 2. Connect the SAE 16/19 adapter (4) to the DLC cable (3).
 3. Connect the DLC cable to the Tech 2 (2).
 4. Make sure the vehicle ignition key is off.
 5. Connect the Tech 2 SAE 16/19 adapter to the vehicle ALDL/DLC.
 6. The vehicle ignition turns on.
 7. Verify the Tech 2 power up display.

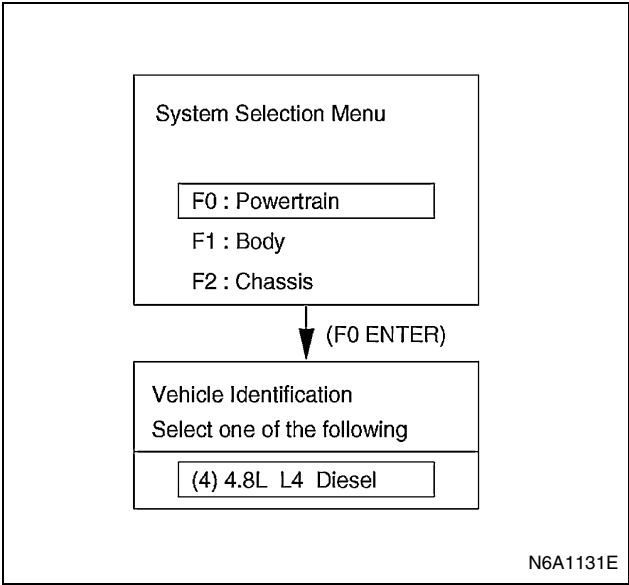


Notice:
 The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

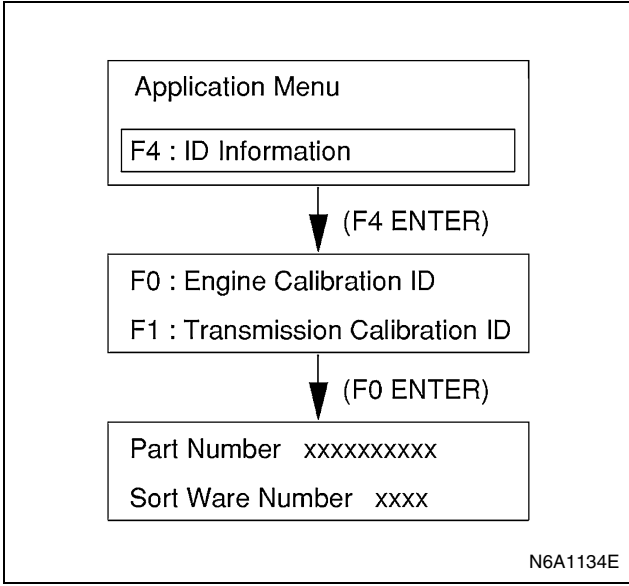
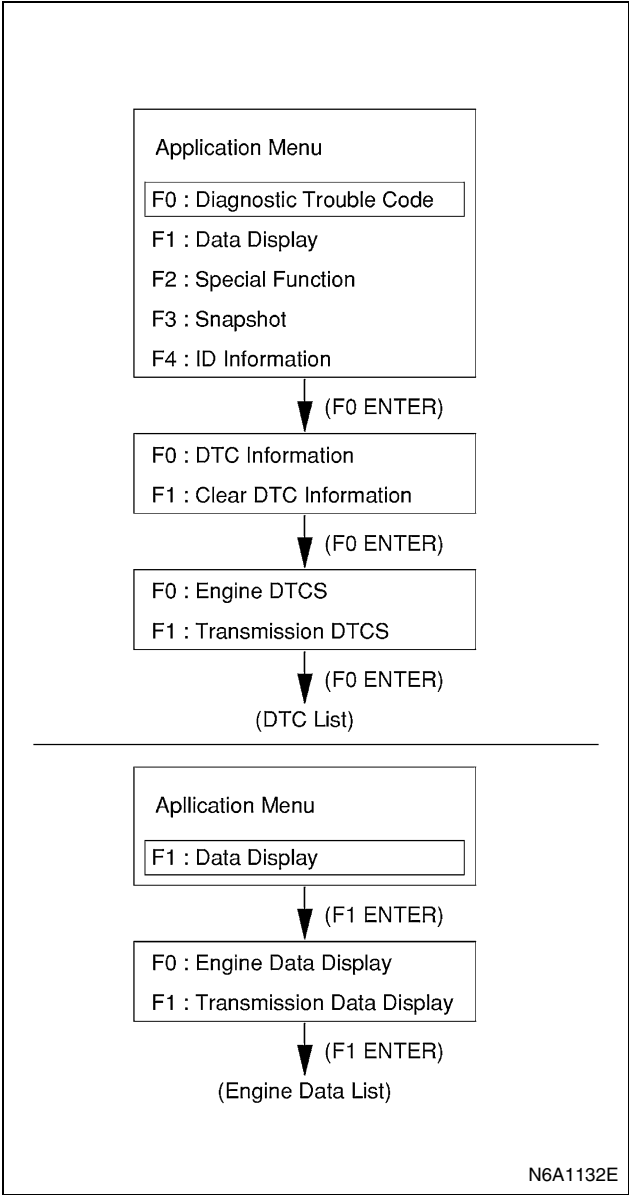
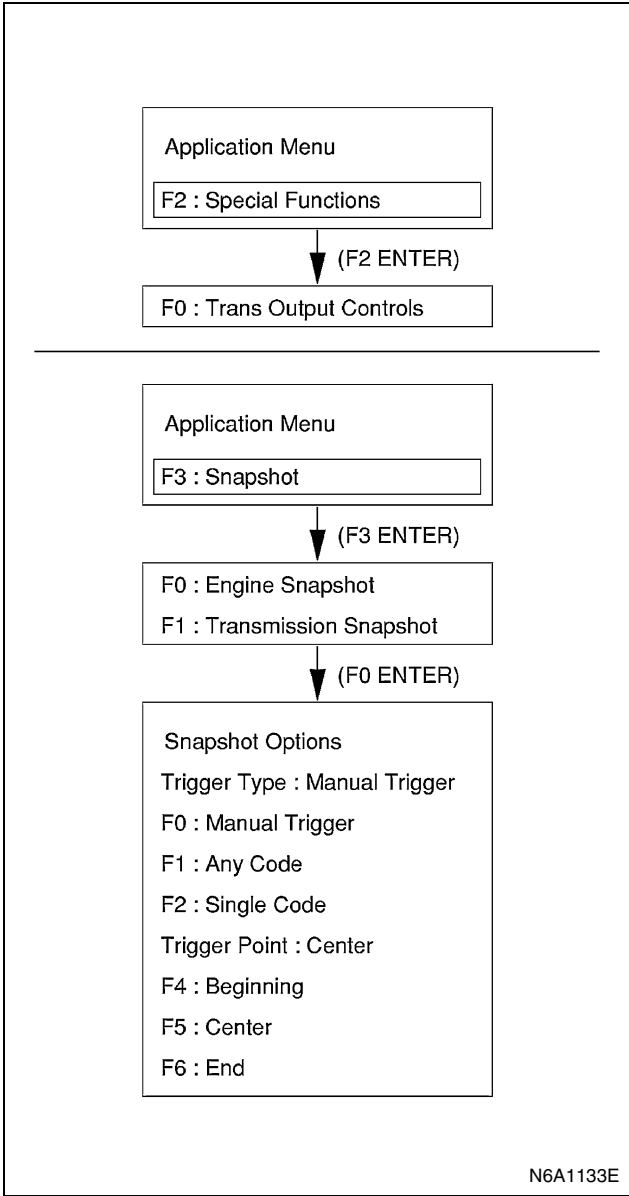
Operating Procedure (For example)

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.





- The following table shows, which functions are used the available equipment versions.



Typical Scan Data Values

Use the Typical Scan Data Values Table only after the On-Board Diagnostic System Check has been completed, no diagnostic trouble codes were noted, and you have determined that the on-board diagnostics are functioning properly. Scan tool values from a properly-running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally-running engine.

Notice:

A scan tool that displays faulty data should not be used, and the problem should be reported to the scan tool

manufacturer. Use of a faulty scan tool can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the scan tool to diagnose the engine control module and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, refer to the symptoms section for diagnosis.

Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, closed loop, accessories off, brake not applied and air conditioning off.

Data List (Typical Data)

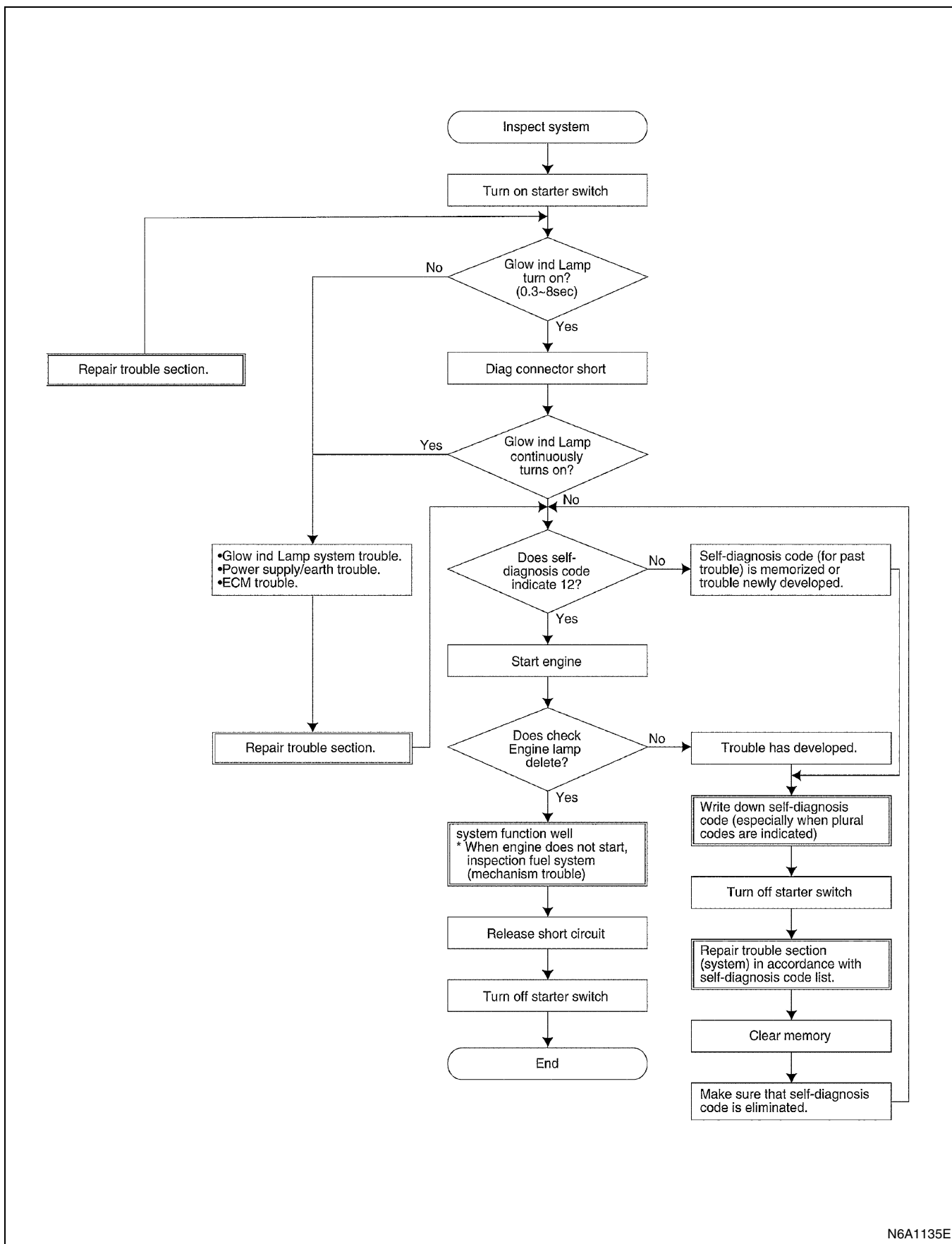
TECH 2 STRING		TYPICAL DATA VALUES (IDLE)
Ignition Switch	(On/Off)	On
Starter Switch	(On/Off)	Off
Exhaust Break Switch	(On/Off)	Off
Transmission Gear Position Switch		N.2.3.4.5.6
Transmission Spec. Select Switch	(AT/MT)	Automatic Trans
Engine Spec. Select Switch	(S/N)	S/N
IAT Switch	(Yes/No and High/Low)	High
EGR/VSS System	(Yes/No)	Yes
Rack Sensor Voltage	(V)	1
Engine Coolant Temperature Sensor Voltage	(V)	1.7 —1.9
Engine Coolant Temperature	°F(°C)	176 (80)
Engine Speed	(rpm)	800
Barometric Voltage	(V)	2.9
Barometric Pressure	(mmHg)	761

Troubleshooting

Caution taken in inspecting

1. In inspecting system, write down self-diagnosis code to be indicated. (especially, when plural self-diagnosis codes are indicated.)
2. Before eliminating the indicated self-diagnosis codes by a memory clear switch, doubly inspect abnormal place as indicated in self-diagnosis code. (Self-diagnosis code means 'Warning.' Make sure to inspect abnormal section.)

Inspection Procedure Flowchart



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Notice:

Please note that some items of self-diagnosis code may not be generated unless the engine is warmed up or unless the vehicle is driven under load.

Self-diagnosis Functions**Memorization of self-diagnosis code**

The self-diagnosis code indicated will be memorized in Electronically Erasable Programmable Read Only Memory (EEPROM) with in the Engine Control Module (ECM). Accordingly even if the starter switch turns off or the ECM is removed from the vehicle, the memorized self-diagnosis code will not be eliminated.

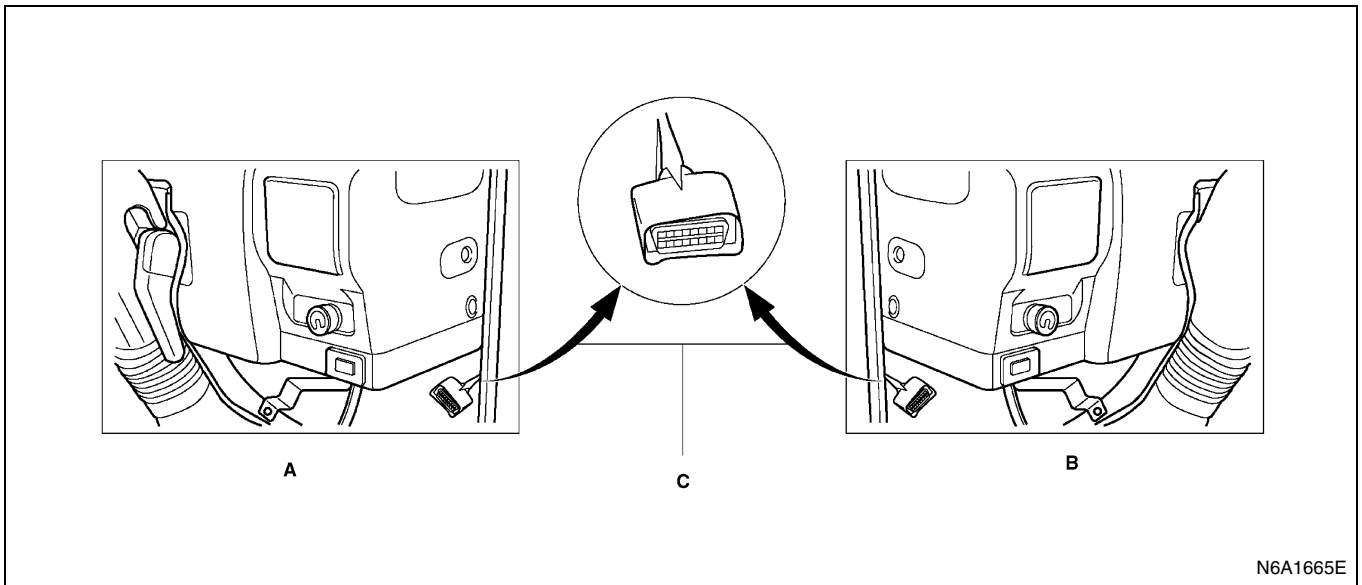
* Unless an elimination procedure is taken, the self-diagnosis code will remain in memory. (The memory will be eliminated only by a memory clear switch.)

Elimination of self-diagnosis code

The self-diagnosis code memorized in the EEPROM with in the ECM can be eliminated only by Scan Tool or the operation of the memory clear switch.

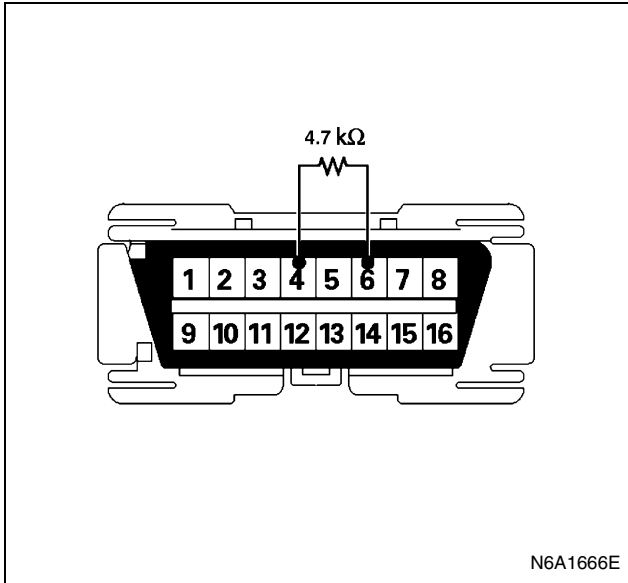
The elimination method memory clear switch will be described below:

1. Turn OFF ignition switch.
2. Use 4.7kΩ resistance and make short circuit on memory clear switch.
3. Turn ON ignition switch. The indication lamp turn on (lighting) continuously after three seconds flashing the indication lamp.
4. Turn OFF ignition switch.
5. Remove shortage resistance from memory clear switch.

Location of the Memory Clear Switch**Location of the memory clear switch (DATA LINK CONNECTOR)****Legend**

- A. Right-hand drive
- B. Left-hand drive

- C. Terminal assignment of data link connector (DLC)



NO	TERMINAL NAME
6	DIAG CONTROL
7	CHECKER SIG
4, 5	CHECKER GND

How to read flashing of the indicator lamp:

The two-digit self-diagnosis code flashes starting from ten's figure to indicate the self-diagnosis code.

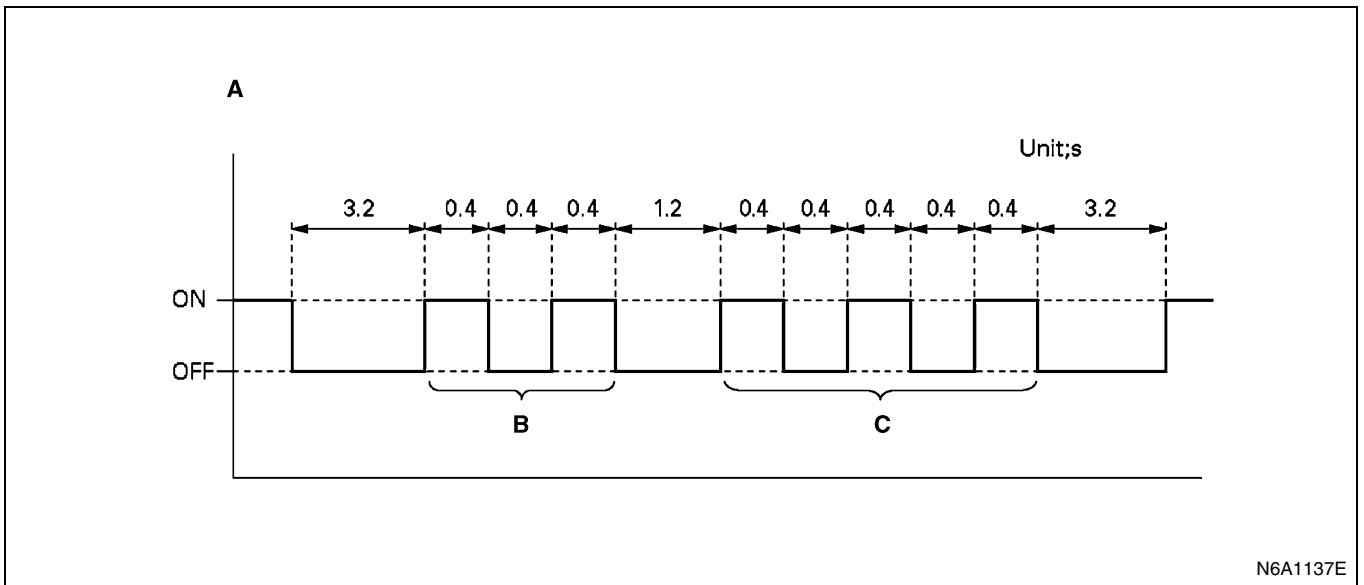
Please read the self-diagnosis code from the flashing.

If the plural self-diagnosis codes are indicated, the same self-diagnosis code is flashed repeatedly in steps of three times.

Please read it correctly.

- Diagnostic Trouble Code (DTC) outputting is done in decreasingly order of DTC number.
- Indication is changed over on completion of output DTC indication.
- DTC indicator is stopped with diagnostic switch being off.
- When there is no DTC output, "1" is outputted in normal DTC code.
- After indicating 3 times per 1 DTC, shift is conducted to the next DTC. (After making a round, the indications are repeated again.)
- In case of the same diagnostic code, it is used 1 DTC (3 times indication.)

Example Diagnosis Trouble Code Output



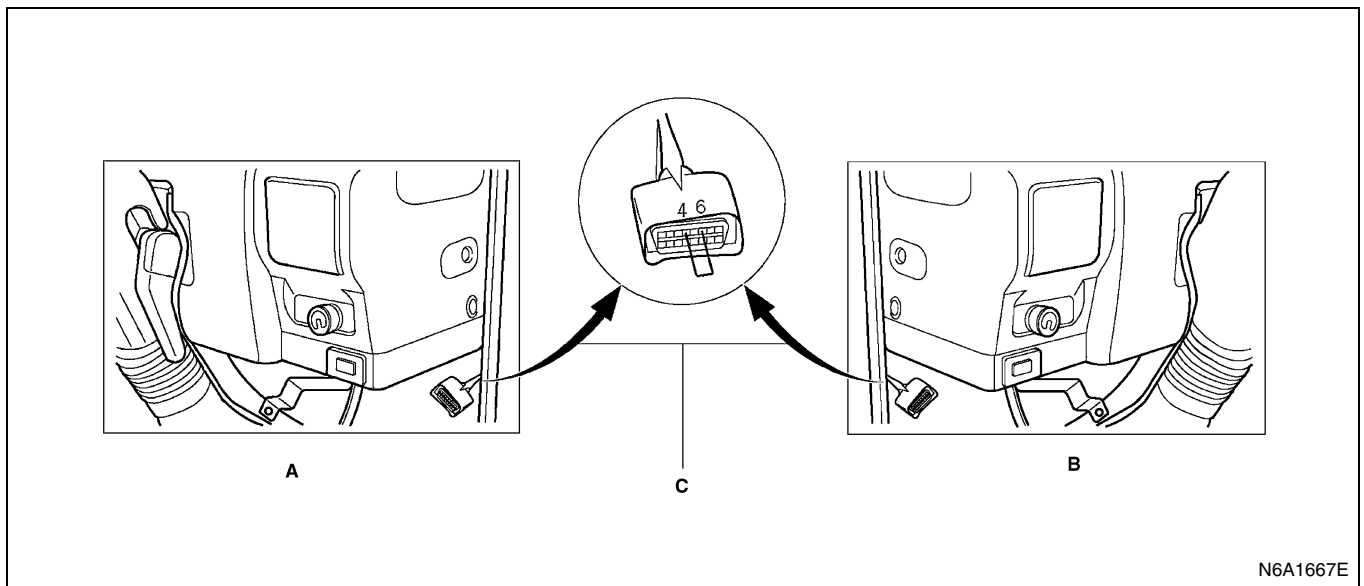
Legend

A. (For example) In case of indicate two digits figure "DTC23"

B. Figure of ten

C. Figure of one

Flashing of Indicator Lamp



N6A1667E

Legend

- A. Right-hand drive
- B. Left-hand drive

C. Terminal assignment of data link connector (DLC)

Diagnosis Trouble Code List

DTC#	TECH 2 STRING
P21	Rack Sensor Circuit Low
P22	Rack Sensor Circuit High
P13	Engine Coolant Temperature (ECT) Sensor Circuit High
P14	ECT Sensor Circuit Low
P31 *	Exhaust Gas Recirculation (EGR) Electronic Vacuum Regulating Valve (EVRV) Solenoid Circuit Low
P32 *	EGR EVRV Solenoid Circuit High
P41	Quick On Start (QOS) Relay Control Circuit Low
P42	QOS Relay Control Circuit High
P23	Magnetic Switch Control Circuit Low
P24	Magnetic Switch Control Circuit High
P26	Quick Warm System (QWS) Relay Control Circuit High
P33 *	Variable Swirl System (VSS) Control Circuit Low
P34 *	VSS Control Circuit High
P43	Aneroid Compensator Vacuum Switching Valve (VSV) Control Circuit Low
P35 *	EGR Quick Cut VSV Control Circuit Low
P36 *	EGR Quick Cut VSV Control Circuit High
P44	Aneroid Compensator VSV Control Circuit High
P45	Engine Speed Sensor Circuit Low
P61	Barometric Sensor Circuit Error
P52	Electronically Erasable Programmable Read Only Memory (EEPROM) Error

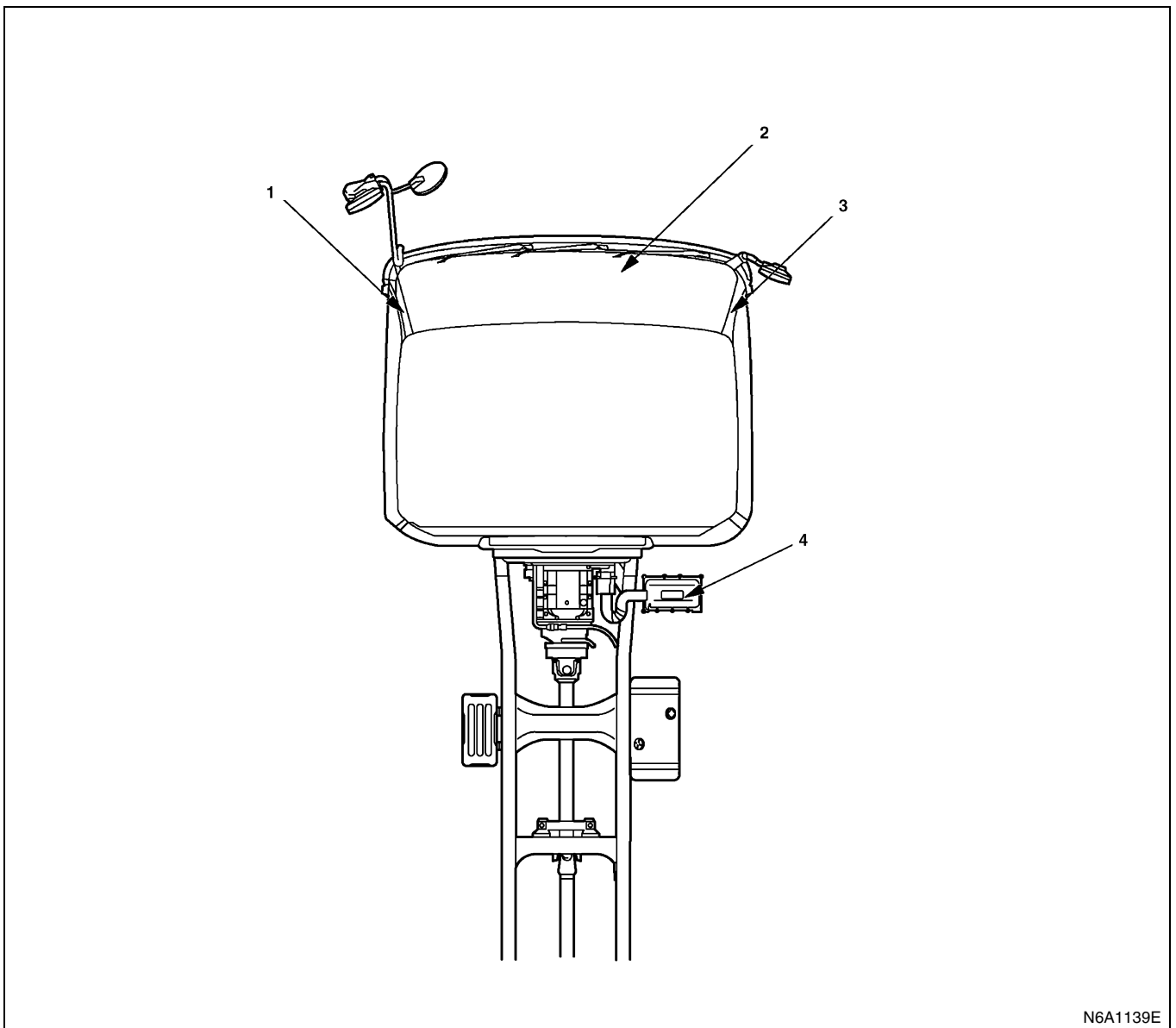
* Equipped with EGR and VSS

Error Classified		Trouble Code	Diagnostic Condition	Return Condition	Back Up	Judging Time
Relay: QWS	+B short	P26	Output TR Monitor	When forward normal	QWS: R/L Non-Continuity.	0.52 sec
VSV: VSS	Harness Open GND short	*P33	Output TR Monitor	When forward normal	VSS: VSV Output stop.	0.52 sec
	+B short	*P34				
VSV: ANECON	Harness Open GND short	P43	Output TR Monitor	When forward normal	ANECON: VSV Output stop.	0.52 sec
	+B short	P44				
VSV: EGR Quick	Harness Open GND short	*P35	Output TR Monitor	When forward normal	EVRV: EGR VSV: EGR Quick Cut The above output stops.	0.52 sec
	+B short	*P36				
Atmospheric Pressure Sensor	Output Abnormal	P61	1.5V (49.9 kPa / 374 mmHg / 7.23 psi) or lower, or 4.5V (160 kPa / 1200 mmHg / 23.2 psi) or higher detected.	When forward normal	EVRV: EGR VSV: EGR Quick Cut The above output stops. ANECON: VSV is actuated.	0.52 sec
	ECM EEPROM error	P52	Check when ECM is started and when Trouble Code is written.	When forward normal	Trouble Code other than 52 (EEPROM error) not indicated.	
Normal		P12	No other trouble code.		No history of this diagnosis recorded	—
Rack Sensor	Harness Open GND short	P21	Rack Voltage 0.3V or lower, Engine speed 600 — 900rpm, and water Temp. 0°C (32°F) or higher are detected for 3 seconds running.	When forward normal	EVRV: EGR VSV: EGR Quick Cut VSV: VSS The above outputs stop. R/L: QWS Non-continuity Idle position output stop. The above outputs stop. Rack Learning valve: 0	3.52 sec
	+5V short Rack Sensor Power Voltage	P22	5V or higher Rack Voltage detected.			
Water Temp Sensor	Harness Open +B short	P13	-79°C/-110°F (390kΩ) or lower, or 120°C/248°F (115kΩ) or higher detected.	When forward normal	EVRV: EGR VSV: EGR Quick Cut VSV: VSS MV: Timing Advance The above outputs stop. VSV: ANECON is actuated QOS: 0°C or lower control	0.52 sec
	GND short	P14				
EVRV: EGR	Harness Open GND short	*P31	Output TR Monitor	When forward normal	EVRV: EGR VSV: EGR Quick Cut The above outputs stop.	1.57 sec
	+B short	*P32				
Relay QOS	Harness Open GND short	P41	Output TR Monitor	When forward normal	QOS: RL Non-continuity	0.52 sec
	+B short	P42				

Error Classified		Trouble Code	Diagnostic Condition	Return Condition	Back Up	Judging Time
Magnetic Volume Timing	Harness Open	P23	Output TR Monitor	When forward normal	Timing Advance: MV output stop.	0.52 sec
	GND short +B short	P24				
	Harness Open GND short	P45	Engine speed 0, Rack Voltage $\geq 0.3V \leq 0.57$ is detected.	When forward normal	EVRV: EGR VSV: EGR Quick Cut VSV: VSS R/L: QWS The above outputs Idling position output stop when T/M POS SW outputted. VSV: ANECON is actuated	1.52 sec

* Equipped with EGR and VSS

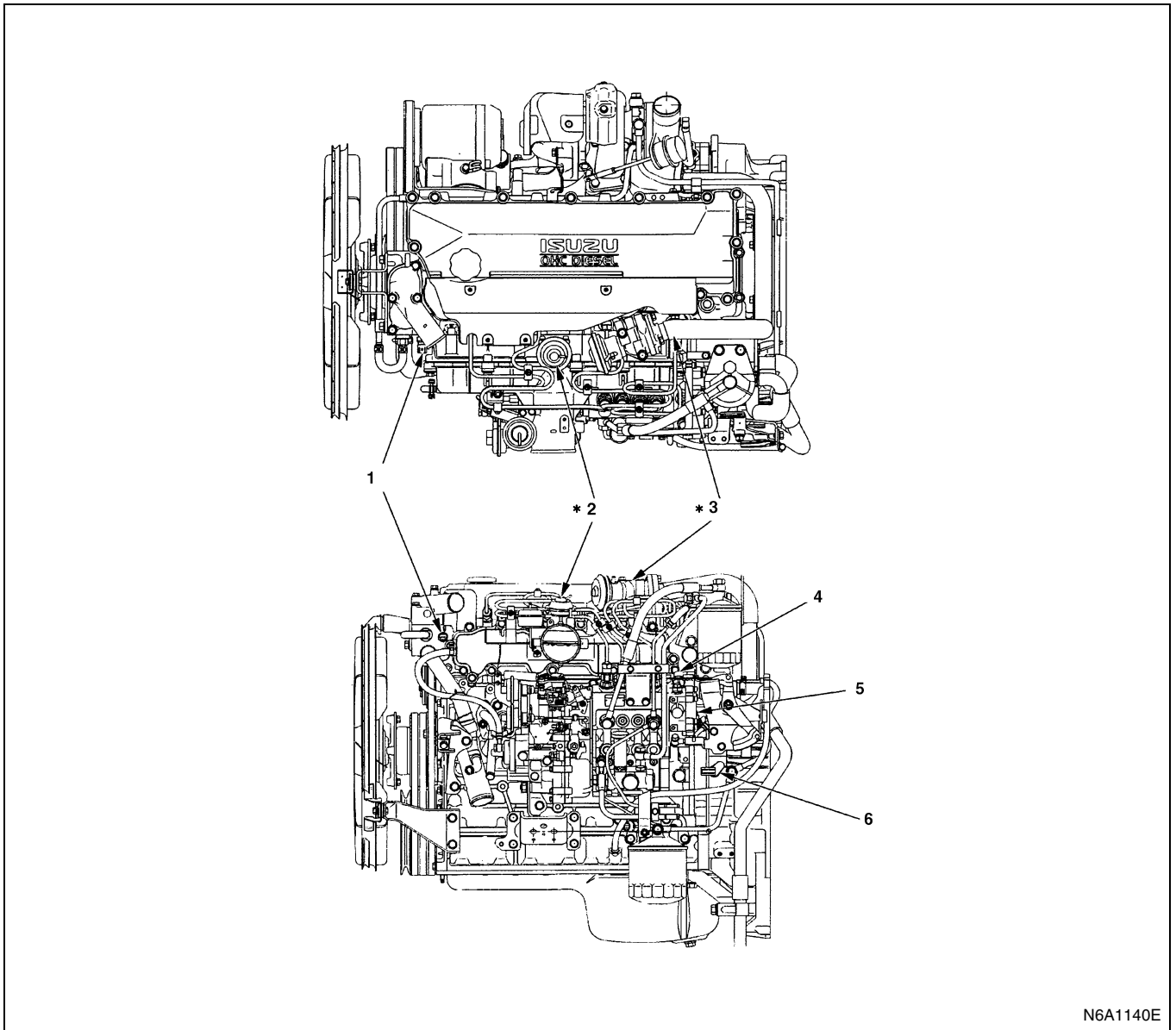
Location of Sensor and Switch



N6A1139E

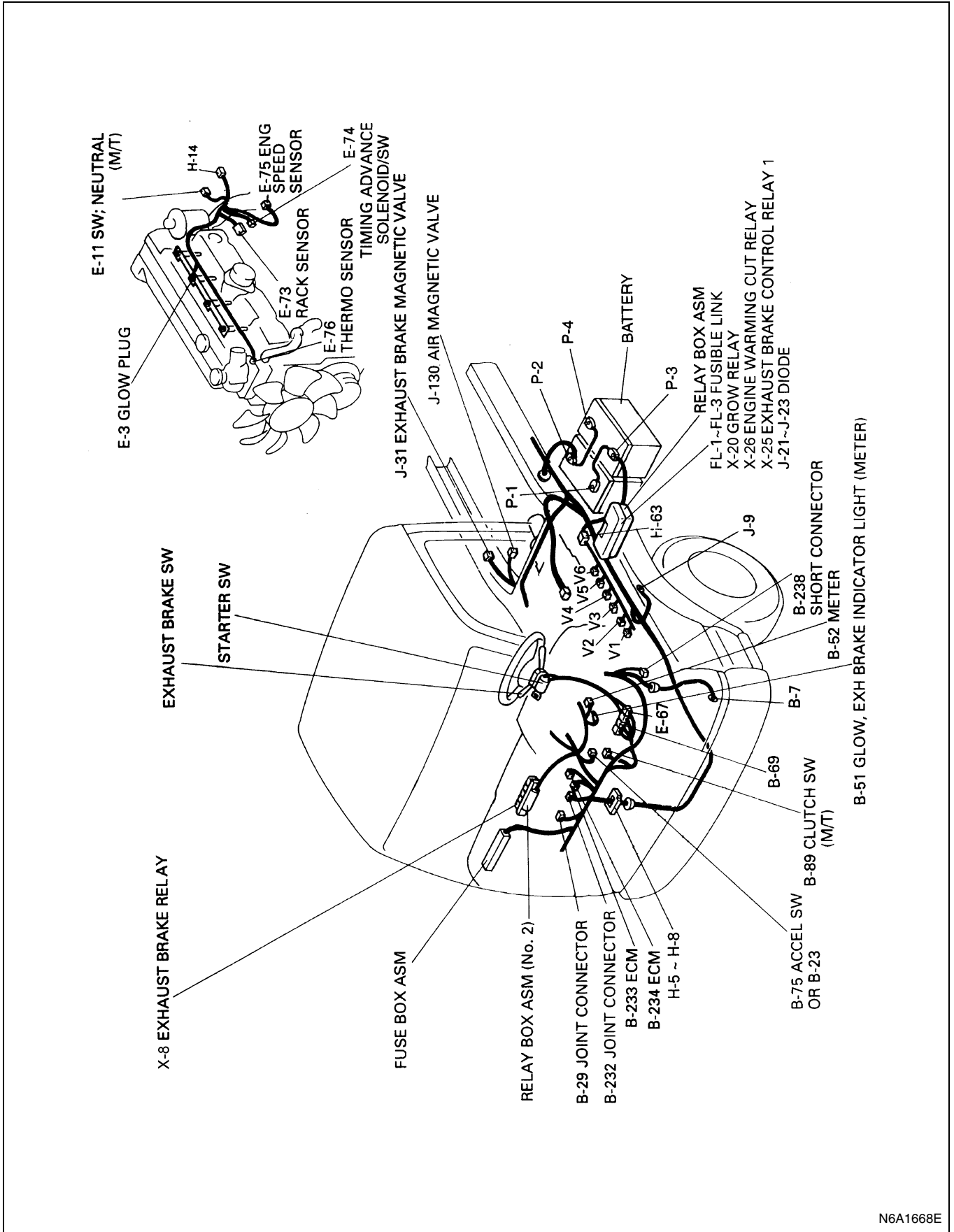
Legend

- | | |
|--|---|
| 1. Data link connector (Left-hand drive) | 3. Data link connector (Right-hand drive) |
| 2. ECM including atmospheric | 4. Intake air temp switch equipped with EGR and VSS |
-

**Legend**

- | | |
|--------------------------------------|-----------------------------|
| 1. Engine coolant temperature sensor | 5. Rock sensor |
| 2. VSS | 6. Engine speed sensor |
| 3. EGR | * Equipped with EGR and VSS |
| 4. Timing advance solenoid switch | |
-

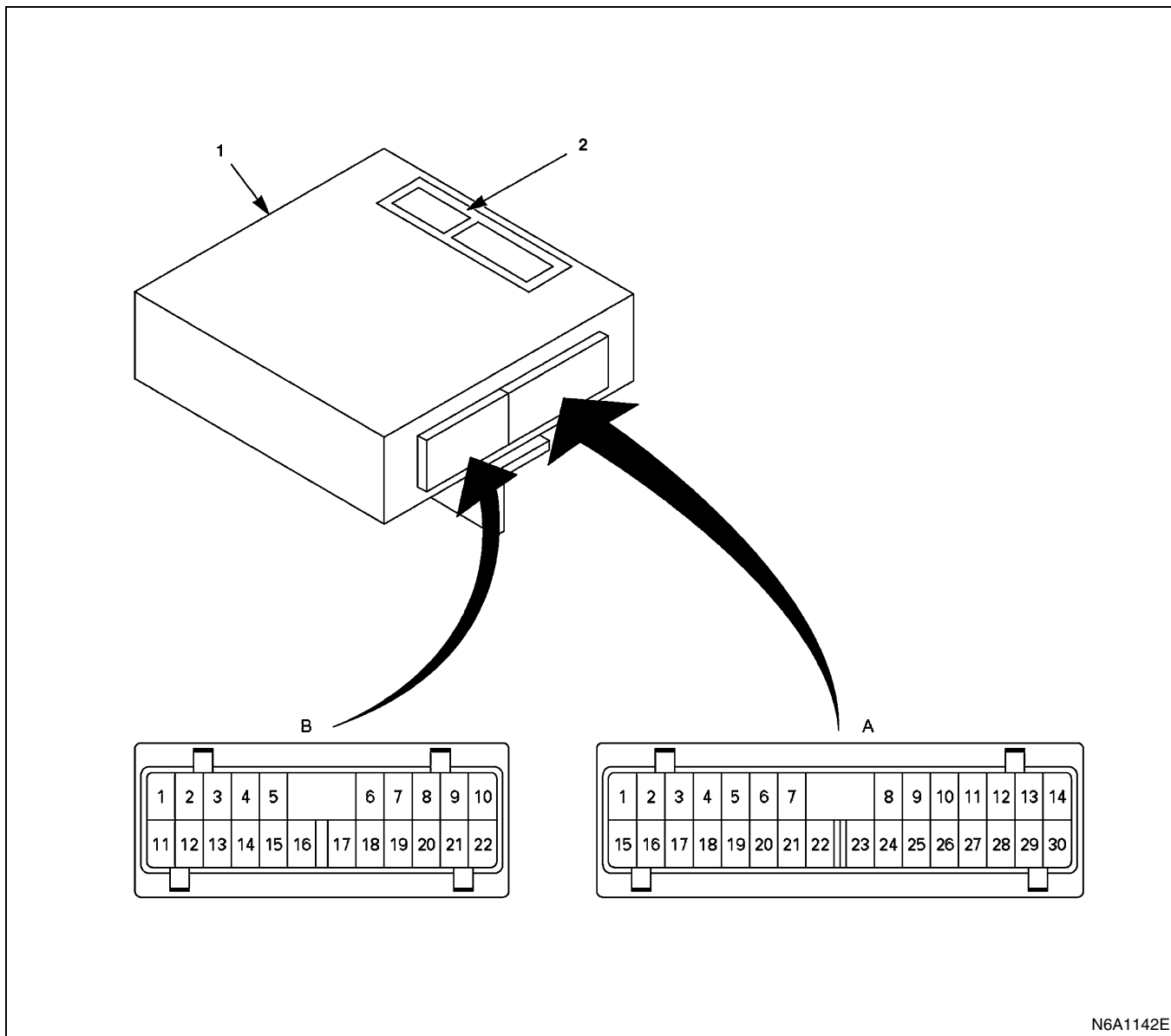
Parts Location



N6A1668E

Engine Control Module (ECM)

Appearance of ECM



N6A1142E

Legend

1. ECM

2. Name plate

A. Detail of 30 pins connector

B. Detail of 22 pins connector

Chart of Engine Control Module (ECM) Input/Output

			Equipped without EGR and VSS	Equipped with EGR and VSS	
Connector	Connector number	Connector name	4HE1-XS	4HE1-XN	4HE1-XS
Connector 30 pin	1	Checker SIG (Serial Communication)	○	○	○
	2	Intake Temperature Switch		○	○
	3	Engine Type		○	
	4	Not be used	—	—	—
	5	Transmission Type			
	6	Rack Sensor (+5V)	○	○	○
	7	Rack Sensor SIG	○	○	○
	8	Battery (+)	○	○	○
	9	Ignition Key	○	○	○
	10	Not be used	—	—	—
	11	Timing Advance Solenoid Switch Relay	○	○	○
	12	Not be used	—	—	—
	13	Electric Vacuum Regulating Valve Power Supply	×	○	○
	14	Electric Vacuum Regulating Valve GND	×	○	○
	15	Checker GND	○	○	○
	16	Diag Control	○	○	○
	17	Not be used	—	—	—
	18	Not be used	—	—	—
	19	Not be used	—	—	—
	20	Not be used	—	—	—
	21	Rack Sensor GND	○	○	○
	22	ECM GND	○	○	○
	23	Not be used	—	—	—
	24	Not be used	—	—	—
	25	Not be used	—	—	—
	26	Not be used	—	—	—
	27	Transmission Position Switch		○	
	28	Not be used	—	—	—
	29	Not be used	—	—	—
	30	FICD Magnetic Valve Power Supply	○	○	○

			Equipped without EGR and VSS	Equipped with EGR and VSS	
Connector	Connector number	Connector name	4HE1-XS	4HE1-XN	4HE1-XS
Connector 22 pin	1	EGR Cut Magnetic Valve Power Supply	×	○	○
	2	Glow Relay	○	○	○
	3	Glow Indicator Lamp	○	○	○
	4	Rack Idle Position Out Put			
	5	Not be used	—	—	—
	6	Not be used	—	—	—
	7	Engine Coolant Temperature Sensor GND	○	○	○
	8	Engine Coolant Temperature Sensor SIG	○	○	○
	9	Engine Revolution Sensor GND	○	○	○
	10	Engine Revolution Sensor SIG	○	○	○
	11	VSS Magnetic Valve Power Supply	×	○	○
	12	QWS Relay	○	○	○
	13	Aneroid Compensator Magnetic Valve	○	○	○
	14	Not be used	—	—	—
	15	Not be used	—	—	—
	16	Not be used	—	—	—
	17	Not be used	—	—	—
	18	Starter Switch	○	○	○
	19	Exhaust Brake Status Switch	○	○	○
	20	Not be used	—	—	—
	21	Not be used	—	—	—
	22	Not be used	—	—	—

Notice:

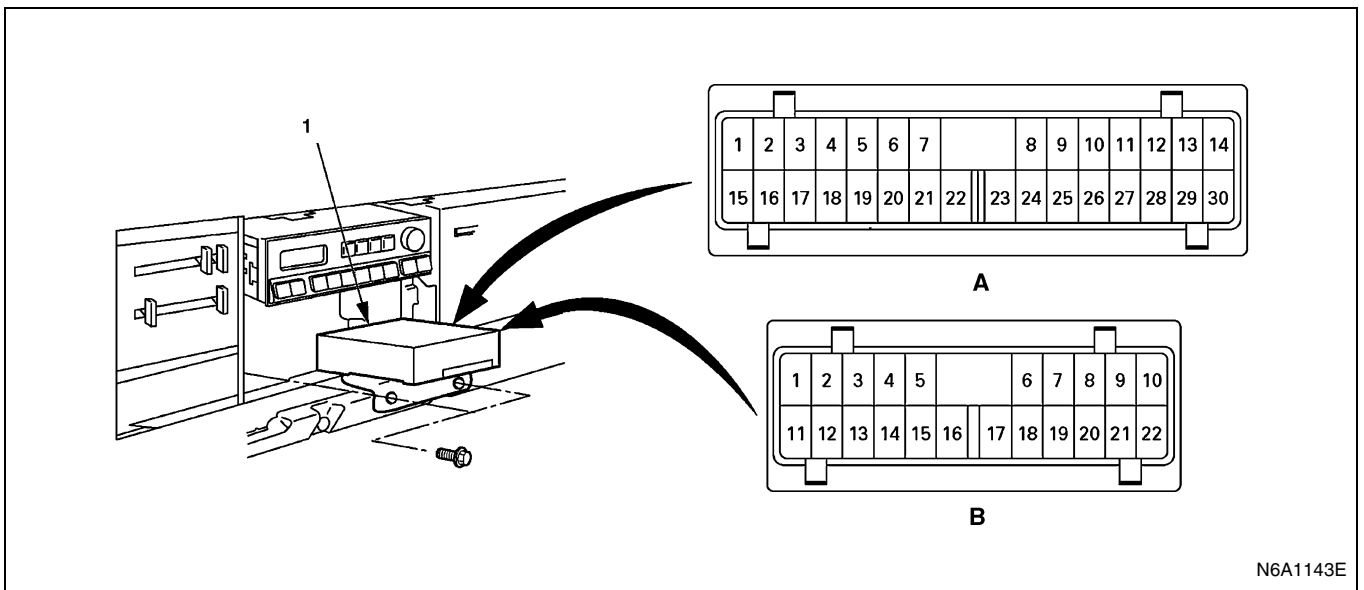
The meaning of symbol marks are:

○: Connect

BLANK: Not

×: Not Connect

Location of the Engine Control Module (ECM) Connector

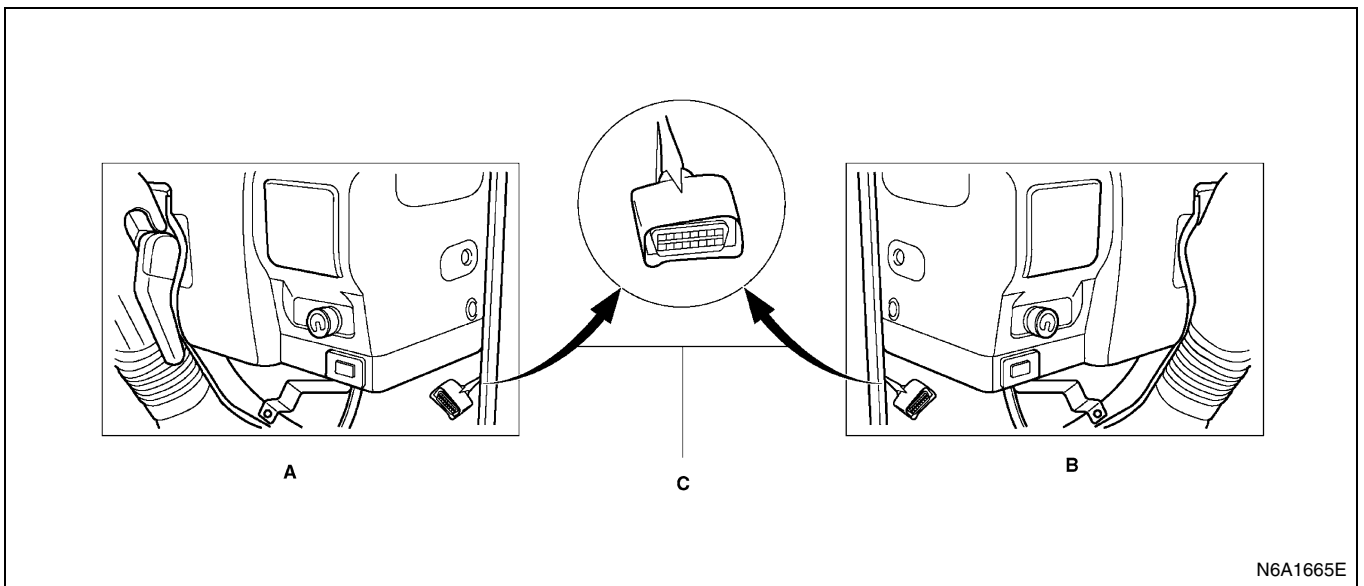


Legend

- A. 30 pins connector (green)
- B. 22 pins connector (green)

1. Engine control module (ECM)

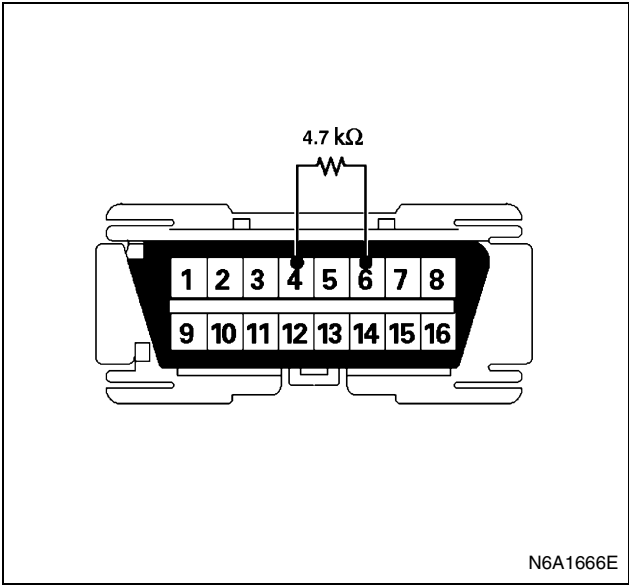
Location of Data Link Connector (DLC)



Legend

- A. Right-hand drive
- B. Left-hand drive

C. Terminal assignment of data link connector (DLC)



N6A1666E

NO	TERMINAL NAME
6	DIAG CONTROL
7	CHECKER SIG
4, 5	CHECKER GND

BRIEF EXPLANATION OF EMISSION AND ELECTRICAL CONTROL SYSTEM

MITICS (Mechanically Integrated Timing and Injection Control System)

The Mechanically Integrated Timing and Injection rate Control System (MITICS) utilizes mechanical control, in comparison with TICS systems, which utilize electronic control.

MITICS is equipped with the RLD-M type governor, which contains a pre-stroke control mechanism.

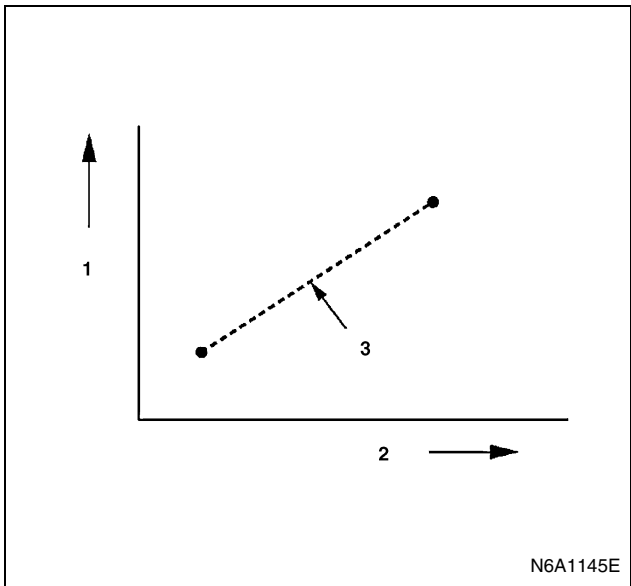
With this, pre-stroke position (i.e., beginning of static injection) can be varied to control injection timing and injection rate (i.e., the fuel injection quantity injected from the nozzle per cam angle degree).

This enables high injection rates¹ in the low and medium speed ranges through a short Injection interval, thus contributing to higher engine torque and cleaner exhaust.

MITICS was developed in response to the demands of medium sized diesel engines for low cost, low fuel consumption, high output and cleaner emissions.

High injection rates using a short injection interval.

- The speed at which the injection pump plunger rises slows as engine speed decreases and the pressure inside the injection pipe decreases. Because of this, the nozzle spray deteriorates and makes it impossible to obtain the proper fuel - air mixture. To obtain the proper mixture at low and medium speeds, it is necessary to increase the pressure inside the injection pipes using a short injection interval.



Legend

1. Injection pipe pressure
2. Engine speed
3. PE-AD type injection pump

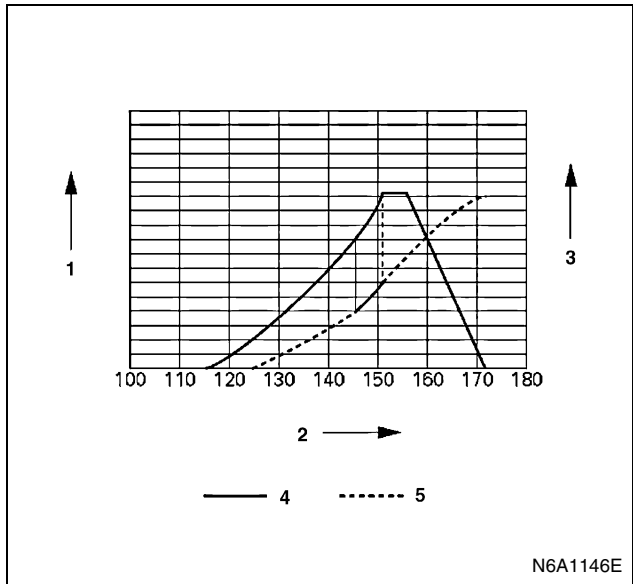
- The left hand figure shows plunger speed and cam lift in relation to cam angle. It can be seen from the graph that plunger speed increases together with cam lift.

MITICS varies the beginning of injection position at low and medium speeds so that injection occurs when the plunger speed increases during the latter half of cam lift (shown by the bold line).

At high speeds, injection is performed when the plunger speed decreases during the first half of cam lift to prevent an excessive increase in injection pipe pressure.

This enables high pressures at low and medium speeds with a fast plunger speed.

Thus, a fine fuel oil spray is injected into the cylinder from the nozzles within a short time to provide the proper mixture for combustion, helping to increase torque and keep exhaust emissions clean.



Legend

1. Plunger speed (m/sec)
2. Cam angle (degrees)
3. Cam lift (mm)
4. Plunger speed
5. Cam lift

Governor (Model RLD-M)

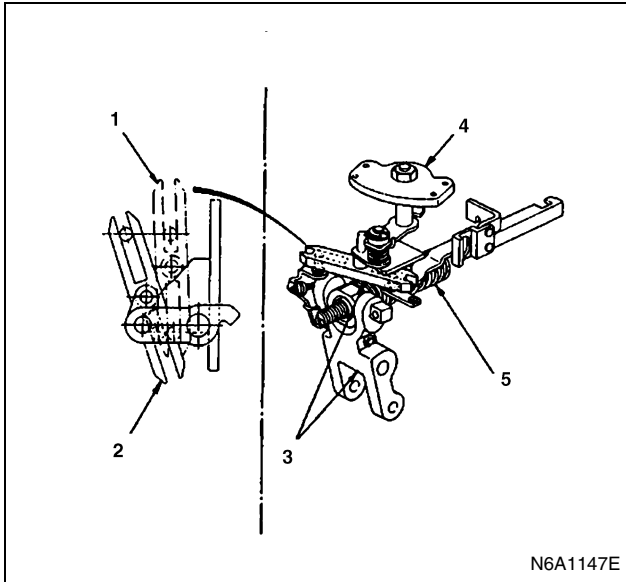
The RLD-J type governor can be used with the MI, MITICS injection pumps, and was designed to have better control and endurance than the previous RLD type governor.

Although the basic construction is identical to that of the RLD type governor, the RLD-M type is larger to match the applicable pumps' larger size.

Features

Variable speed control governor with decreased lever reaction force

As with the previous RLD type governor, RLD-M governor control is accomplished using the speed control lever to change the fulcrum of the internal link mechanism. Consequently, as the reaction force of the governor spring does not act directly on the speed control lever, only a very small lever reaction force is exerted on the accelerator pedal.



N6A1147E

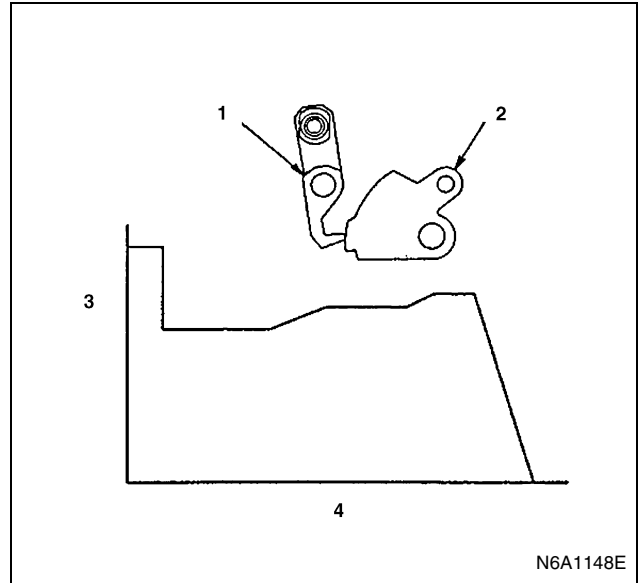
Legend

1. At maximum speed control
2. At idle speed control
3. Link mechanism
4. Speed control lever
5. Governor spring

Set torque characteristics through internal torque cam

At full load, the tip of the sensor lever traces the face of the torque cam to determine the full load rack position and control the full load injection quantity.

Consequently, the torque characteristics demanded by the engine can be freely set by changing the shape of the torque cam face.



N6A1148E

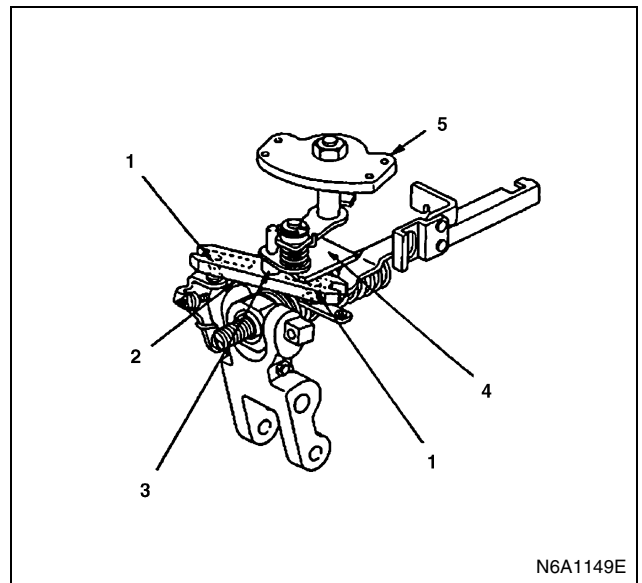
Legend

1. Sensor lever
2. Torque cam
3. Control rack position (mm)
4. Pump speed (r/min)

Improved control through internal guide plate

When the speed control lever is operated, the 2nd supporting lever's pin moves along the guide plate. The floating lever connected to the pin thus moves to change the ball joint fulcrum positions.

In the intermediate to high speed ranges, the guide plate causes the floating lever to move to increase the lever ratio continuously from 1.1 (idling) — 6 (full speed). This increase in the lever ratio in the intermediate to high speed range improves speed droop.



N6A1149E

Legend

1. Ball joint
2. Floating lever
3. 2nd supporting lever pin
4. Guide plate
5. Speed control lever

Timing Advance Control

Timing advance control is measuring the ECT to calculate drive current of the solenoid switch for the injection timing advance.

The injection timing is controlled by according to the ECT when engine is started.

Solenoid Switch

The solenoid switch is installed on the top of the injection pump to push the advance lever in the injection pump when 12 or 24 volts is supplied.

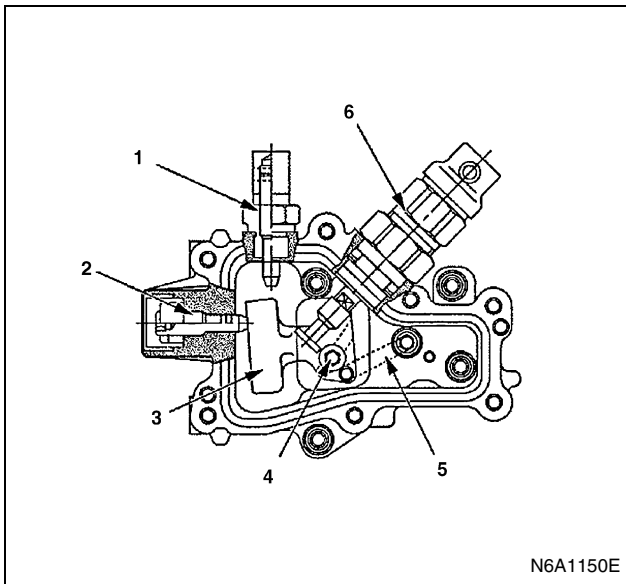
In this condition the injection timing is an additional.

10 degree (BTDC) from normal injection timing.

If there is some trouble for electricity current, it will set the DTC-P23 or P24.

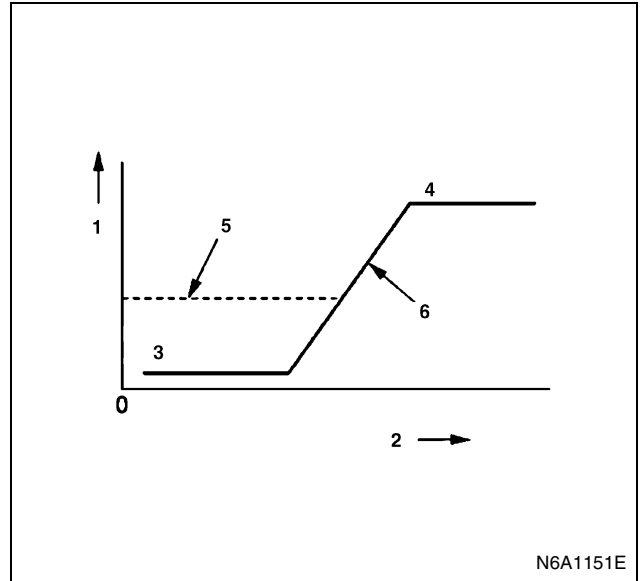
Refer to the DTC chart.

If remove the solenoid switch, it can not be reinstalled because it is necessary to readjust advance value on the injection pump tester.



Legend

1. Adjust screw for maximum advance angle
2. Adjust screw for minimum advance angle
3. Counter weight
4. Timing rod center
5. Return spring
6. Solenoid switch



Legend

1. Advance angle
2. Pump speed
3. Minimum advance angle
4. Maximum advance angle
5. Advance angle by solenoid switch
6. Control character by flyweight

EGR (Exhaust Gas Recirculation) System

EGR Purpose

The exhaust gas recirculation (EGR) system is used to reduce emission levels of the oxides of nitrogen (NOx). The NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.

EGR Control

The main element of the system is the EGR valve. The EGR valve feeds small amounts of the exhaust gas back into the intake manifold. The EGR valve is controlled by the ECM and the ECM uses information from the following sensors to control the EGR valve.

- Engine coolant temperature (ECT) sensor.
- Engine speed sensor.
- Rack sensor
- Exhaust brake switch condition.
- Atmospheric pressure sensor.

EGR Valve Operation and Results of Incorrect Operation

The EGR valve is designed to accurately supply EGR to the engine independent of the intake manifold.

The EGR valve controls EGR flow from the exhaust manifold to the intake manifold through the VSV (Vacu-

um Switching Valve) with a ECM controlled EVRV (Electronic Vacuum Regulating Valve).

The ECM monitors related sensor or switch condition, if EVRV solenoid has incorrect operation, DTC P31 or P32 will be set.

If DTCs P13, P14, P21, P22, P35, P36, P45 or P61 are set, refer to the DTC charts.

Rack Sensor

The rack sensor is engaged with tip of injection pump rack.

The rack sensor signal will send during vehicle operating to the ECM, the ECM calculate together with other sensor's signal, the ECM output activation signal for EVRV.

Atmospheric Pressure Sensor

The atmospheric pressure sensor is built-in the ECM.

The EVRV activity will be stopped, when the atmospheric pressure will comes below the setting pressure.

Exhaust Brake Switch

The exhaust brake switch is equipped on the steering column.

The exhaust brake switch is controlled by vehicle operator, when during the vehicle operating the vehicle operator will demand to apply the exhaust brake for assist the main brake system.

EGR Quick Cut Control

During the VSV action, when the EVRV drive current will comes over the setting valve (the drive current will decide relation of the engine load and speed) immediate stop the VSV.

Result of this action will reduce the PM (Particulate Matter).

EV RV Control

The EGR is controlled under normal temperature with separate stage by the ECT of engine condition.

ECM refer to EGR action map to demand the EVRV drive current, also ECM controls agree EVRV drive current and EVRV actual drive current each other.

Otherwise the ECM transitional stage controls for current of EVRV when EGR is controlled moving OFF area to ON area on the EGR action map.

Also stop the EVRV drive for stop the EGR system under following conditions.

When under low temperature of the ECT.

When acting the QWS system.

When acting the exhaust brake

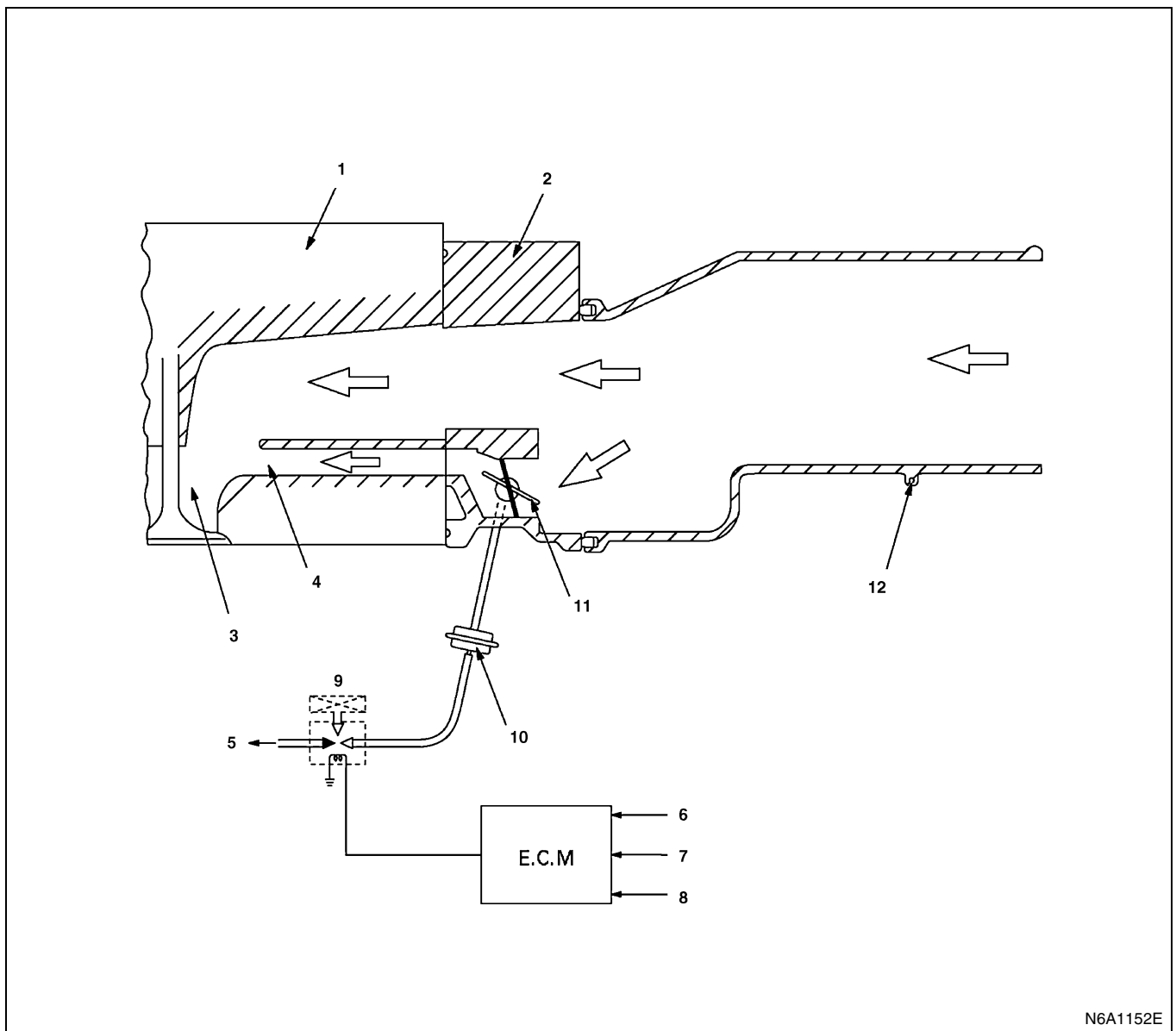
When the atmospheric pressure comes under setting the pressure valve.

VSS (Variable Swirl System)

The Variable Swirl System (VSS) is designed to adjust the intensity of swirl by allowing or not allowing air to flow through a sub-port (or bypass) that runs in parallel with the intake port for each cylinder. The swirl intensifies when there is no air flow through the sub-port, and vice versa.

The air flow is controlled by the on-off valve at the inlet to the sub-port and the valve in turn is turned on and off by computer signals which are dependent on engine speed, load and coolant temperature. Basically, the air is cut off at low speeds to maintain high swirl and is allowed to flow at high speeds to maintain low swirl.

Variable Swirl System (Equipped with EGR and VSS)

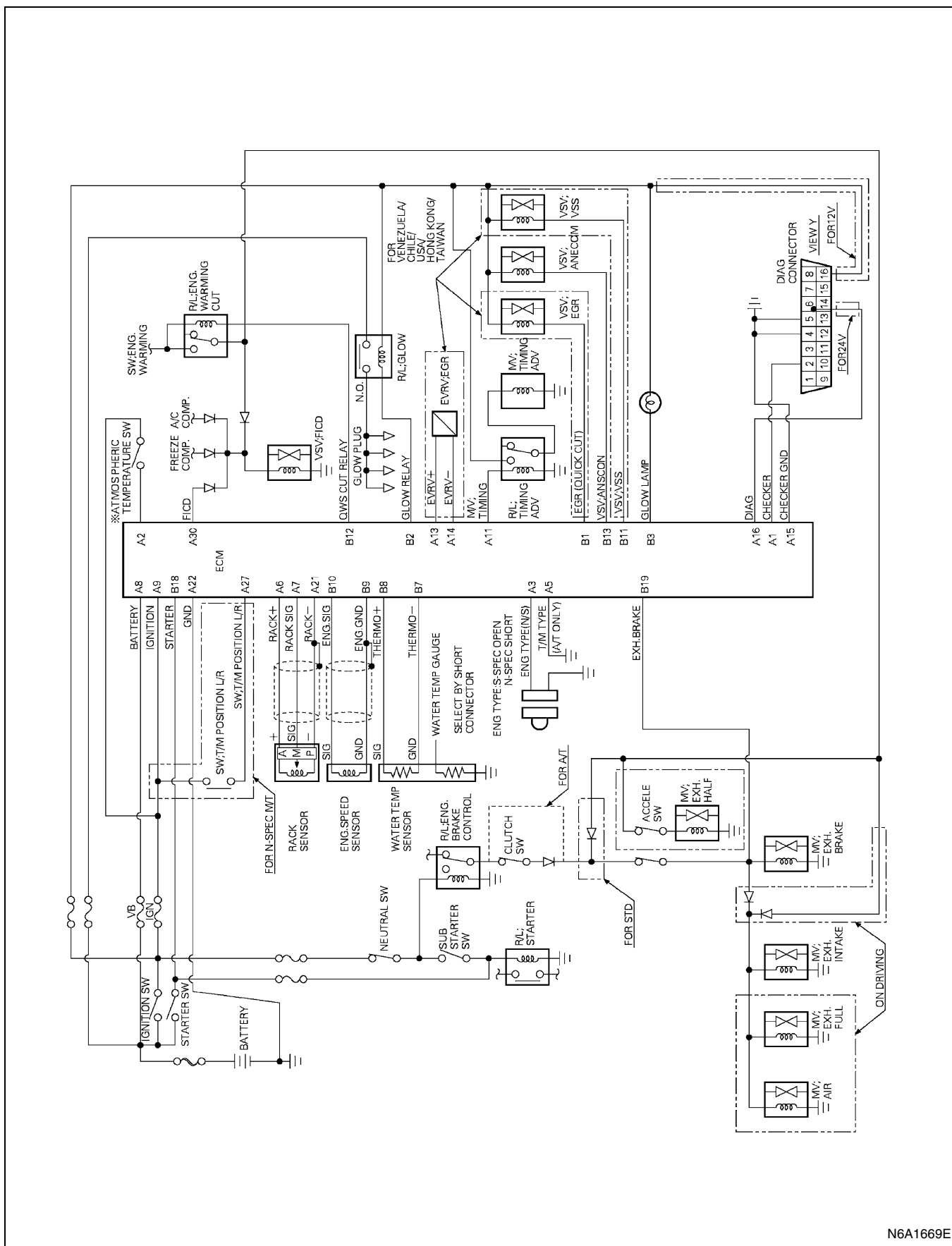


N6A1152E

Legend

- | | |
|------------------|------------------------|
| 1. Cylinder head | 7. Engine speed sensor |
| 2. VSS case | 8. Rack sensor |
| 3. Inlet port | 9. VSV; VSS |
| 4. Sub-port | 10. Actuator |
| 5. Vacuum | 11. Control valve |
| 6. Thermo sensor | 12. Inlet manifold |

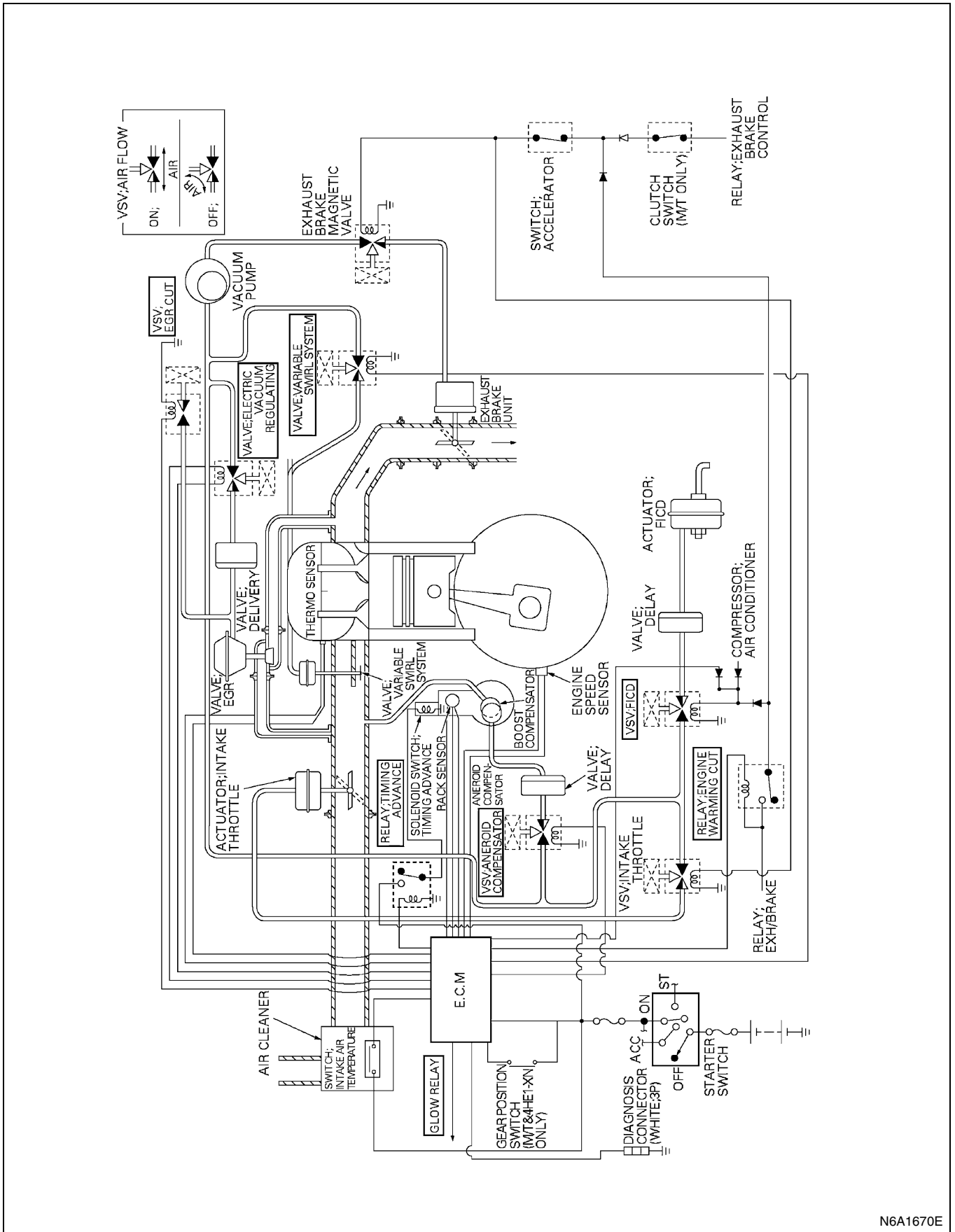
Engine Control Module (ECM) System Wiring Diagram



N6A1669E

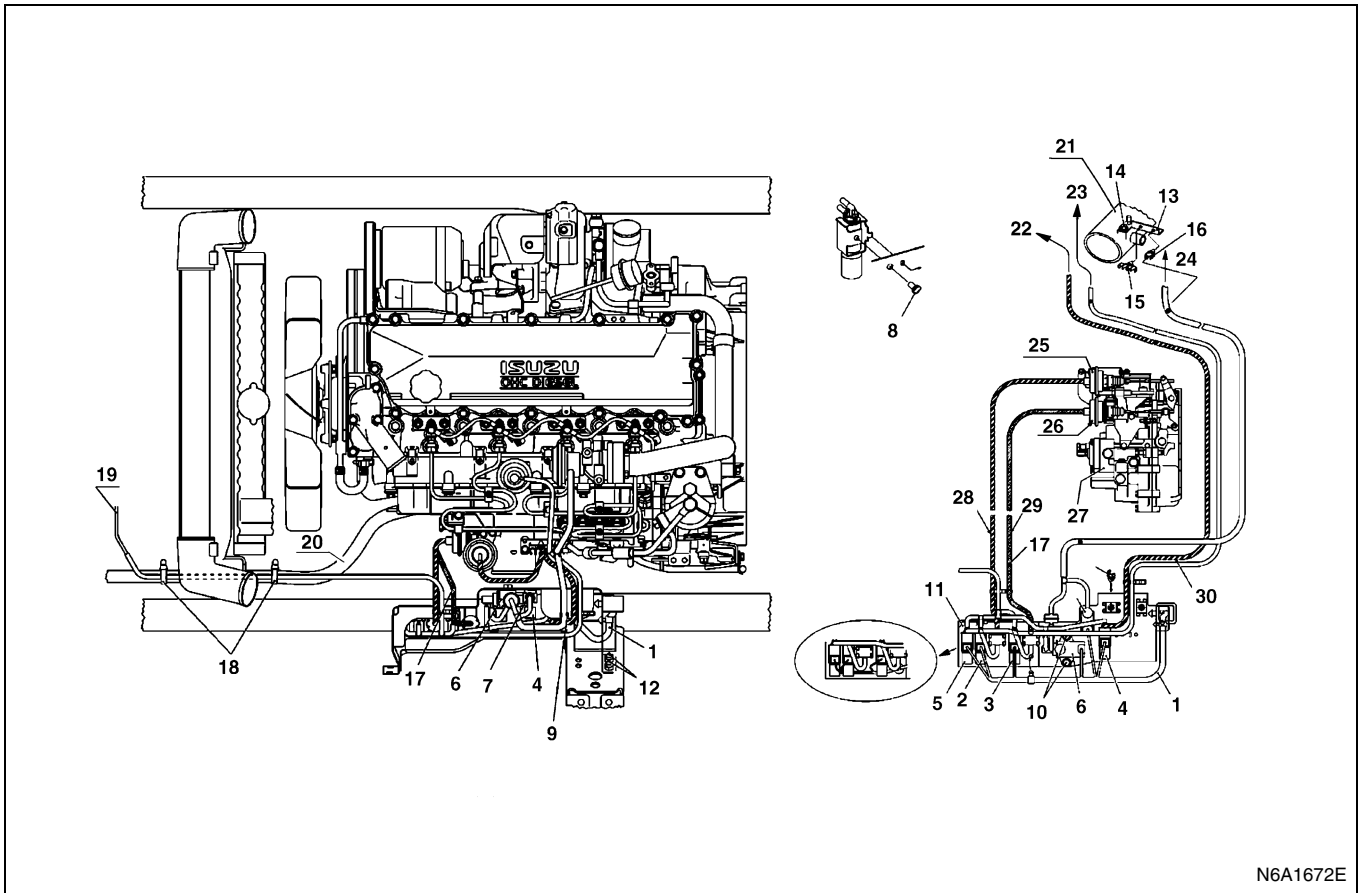
Auxiliary Engine Control System

Equipped with Exhaust Gas Recirculation and Variable Swirl System



N6A1670E

Vacuum Switching Valve (VSV) Circuit Equipped with Exhaust Gas Recirculation and Variable Swirl System

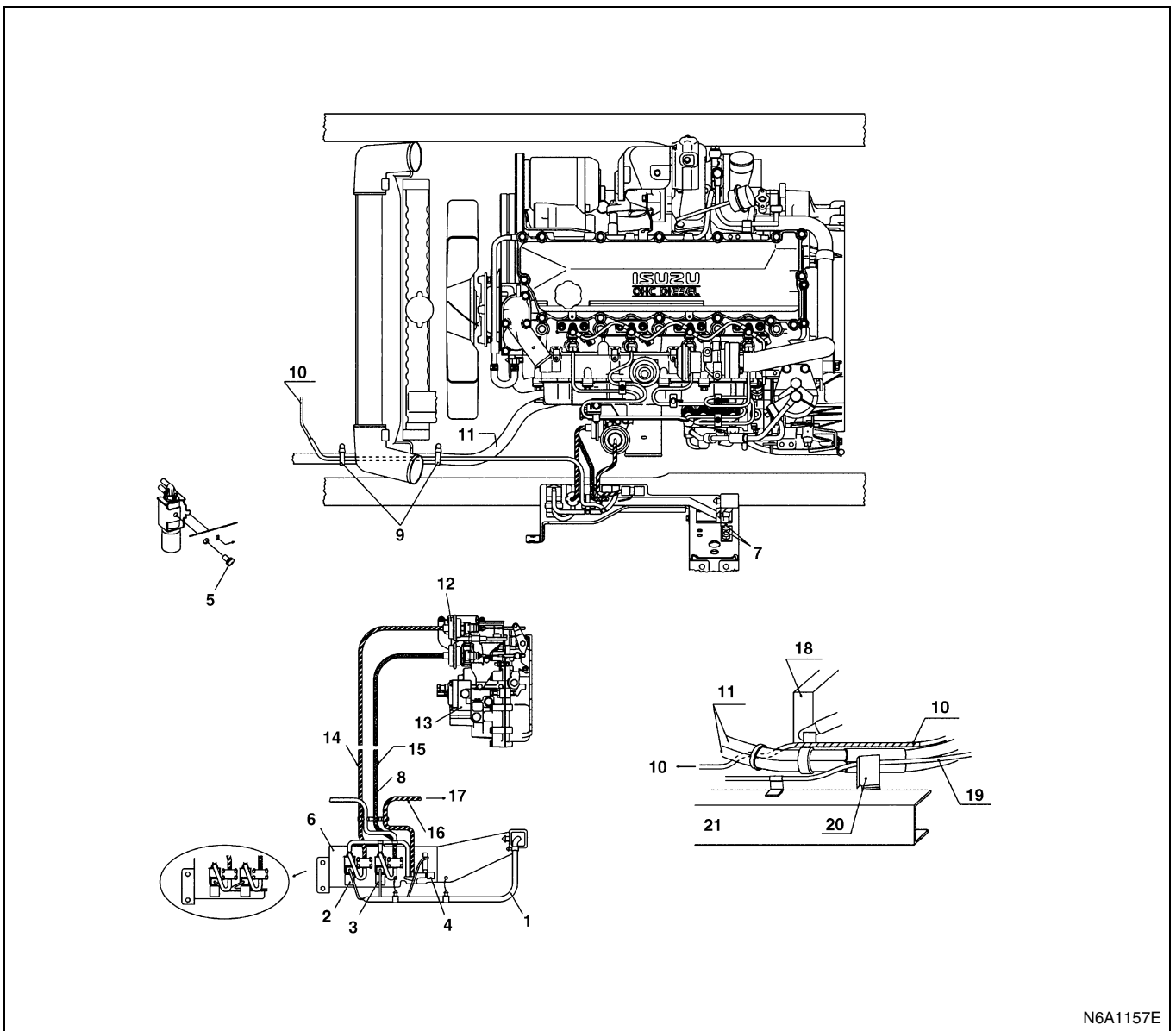


N6A1672E

Legend

- | | |
|---------------------------------------|-----------------------------------|
| 1. Extension harness | 16. EGR hose, injection pipe clip |
| 2. FICD vacuum S/W valve | 17. Vacuum hose assembly |
| 3. ANECOM vacuum S/W valve | 18. Vacuum hose clip |
| 4. I/T throttle vacuum S/W valve | 19. Vacuum pipe |
| 5. VSS vacuum S/W valve | 20. Heater hose |
| 6. Electronic vacuum regulating valve | 21. Inlet cover |
| 7. EGR cut vacuum S/W valve | 22. Inlet throttle |
| 8. VSV fix bolt | 23. VSS |
| 9. EGR hose, injection pump clip | 24. EGR valve |
| 10. Valve fix | 25. FICD diaphragm |
| 11. VSV bracket | 26. Aneroid diaphragm |
| 12. Case fix bolt | 27. Injection pump |
| 13. Rubber hose bracket | 28. White stripe |
| 14. Bracket fix bolt | 29. Yellow stripe |
| 15. VSS hose, injection pipe clip | 30. Green stripe |

Equipped Without Exhaust Gas Recirculation and Variable Swirl System

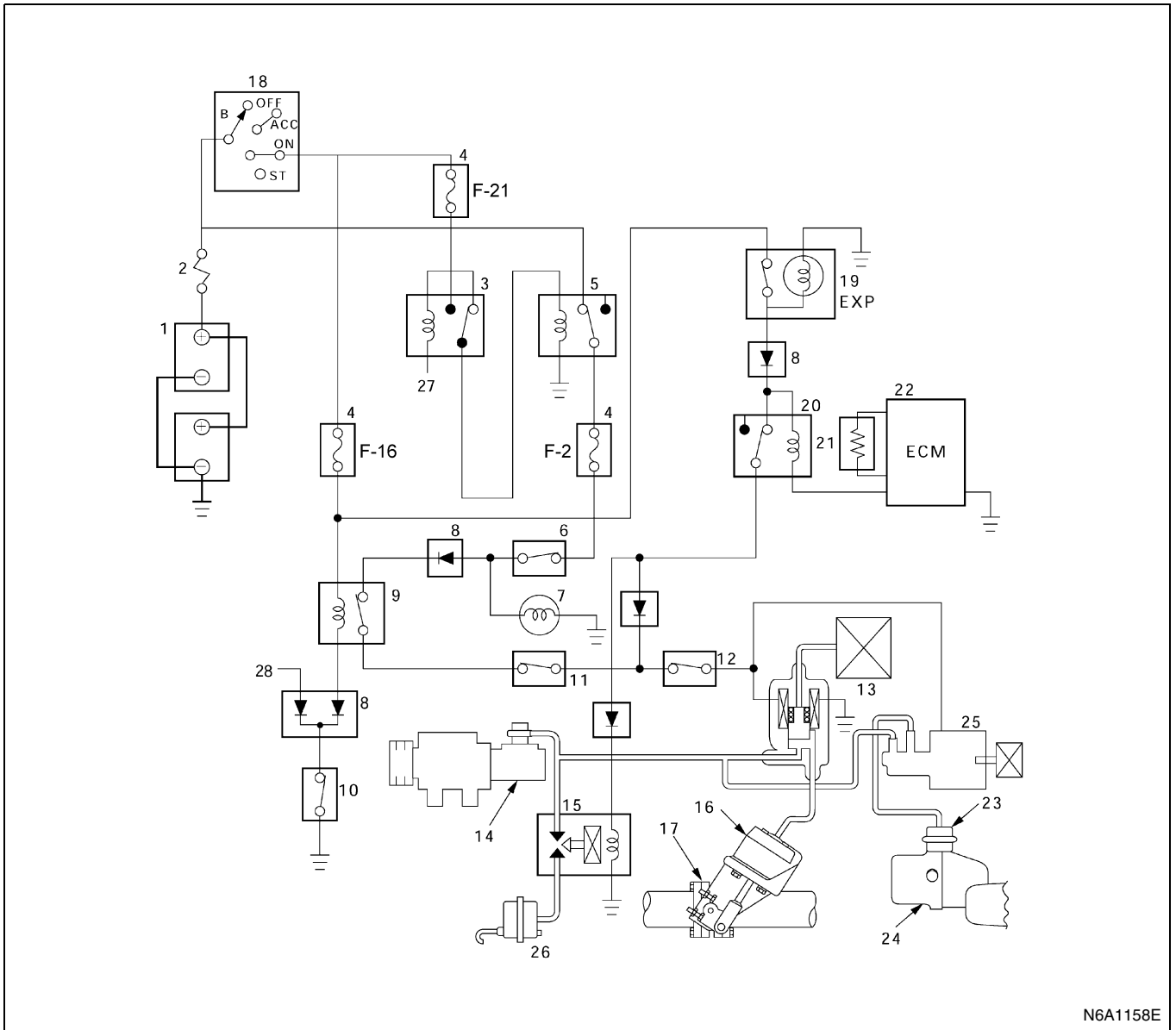


N6A1157E

Legend

- | | |
|----------------------------------|-------------------------------|
| 1. Extension harness | 12. FICD diaphragm |
| 2. FICD vacuum S/W valve | 13. Injection pump |
| 3. ANECOM vacuum S/W valve | 14. White stripe |
| 4. I/T throttle vacuum S/W valve | 15. Yellow stripe |
| 5. VSV fix bolt | 16. Green stripe |
| 6. VSV bracket | 17. Intake throttle diaphragm |
| 7. Case fix bolt | 18. Inter cooler |
| 8. Vacuum hose assembly | 19. Accelerator cable |
| 9. Vacuum hose clip | 20. Guide plate |
| 10. Vacuum pipe | 21. Frame |
| 11. Heater hose | |

Exhaust Brake and Engine Warm-up Control



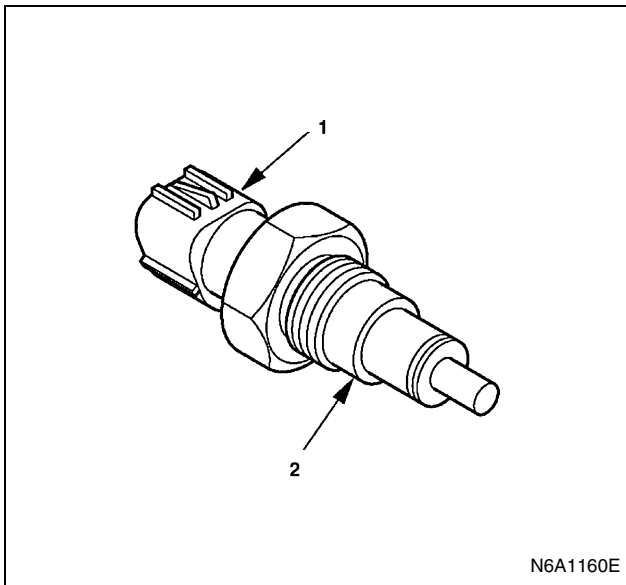
N6A1158E

Legend

- | | |
|-----------------------------------|---------------------------------------|
| 1. Batteries | 15. Vacuum switch valve |
| 2. Fusible link wire | 16. Vacuum chamber: Exhaust brake |
| 3. Charge relay | 17. Exhaust brake valve |
| 4. Fuse | 18. Key switch |
| 5. Exhaust brake relay | 19. Engine warming-up switch |
| 6. Exhaust brake switch | 20. Engine warming cut relay |
| 7. Indicator light | 21. Engine coolant temperature sensor |
| 8. Diode | 22. ECM |
| 9. Exhaust brake control relay | 23. Vacuum chamber: Intake throttle |
| 10. Neutral switch | 24. Intake throttle |
| 11. Clutch switch | 25. Magnetic valve intake throttle |
| 12. Accelerator switch | 26. Actuator FICD |
| 13. Magnetic valve: Exhaust brake | 27. Generator (L) |
| 14. Vacuum pump | 28. Starter relay coil |

Appearance of Water Temperature Sensor and Connector Pin Assignment

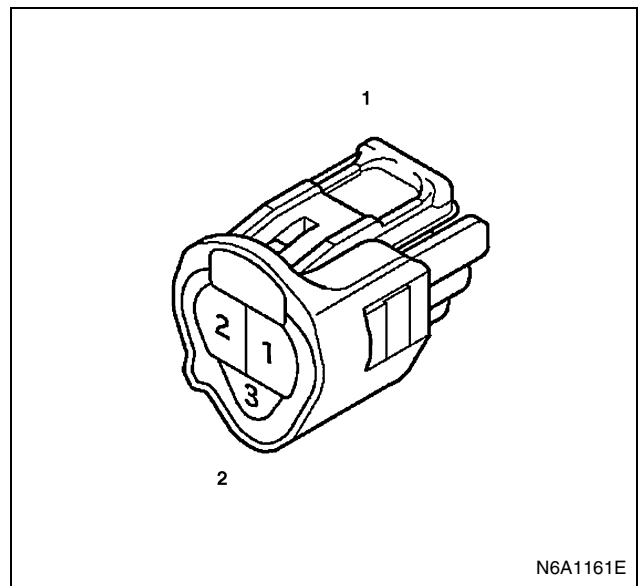
Temperature Sensor



Legend

1. 3 pin connector
2. Engine coolant temperature sensor

Connector Pin Assignment

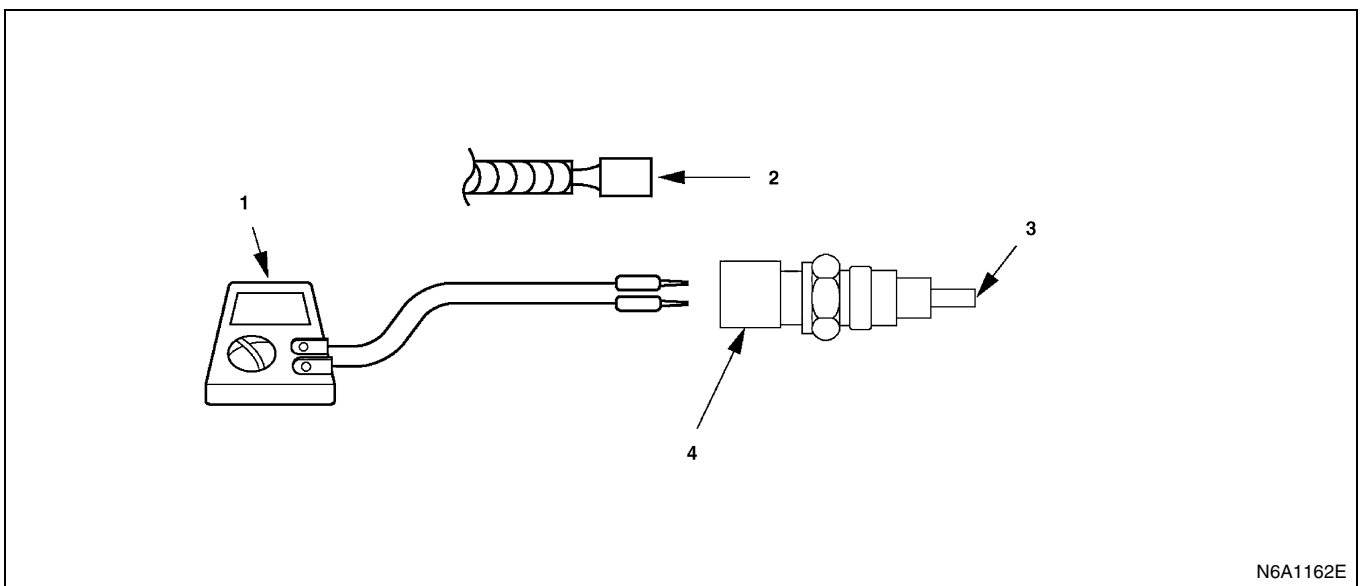


Legend

1. To ECT sensor
2. 3 pin gray

Connector No	Signal
1	Thermistor for engine
2	Thermistor for engine
3	Thermistor for meter

Measure Resistance at Engine Coolant Temperature (ECT) Sensor



Legend

1. Circuit tester
2. Remove engine wire harness
3. Engine coolant temperature sensor
4. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value	Temperature on sensor	Reference
Connector	Pin No.			
3 pin Black	1 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	1 ↔ 2	2.5 (kΩ)	20°C (68°F)	Thermistor for ENGINE
		247 (Ω)	90°C (194°F)	
	1 ↔ Body	∞	—	Thermistor for ENGINE ↔ Body
	2 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	3 ↔ Body	146.6 (Ω)	60°C (140°F)	Thermistor for meter ENGINE
	2 ↔ Body	∞	—	Thermistor for ECM ↔ Body

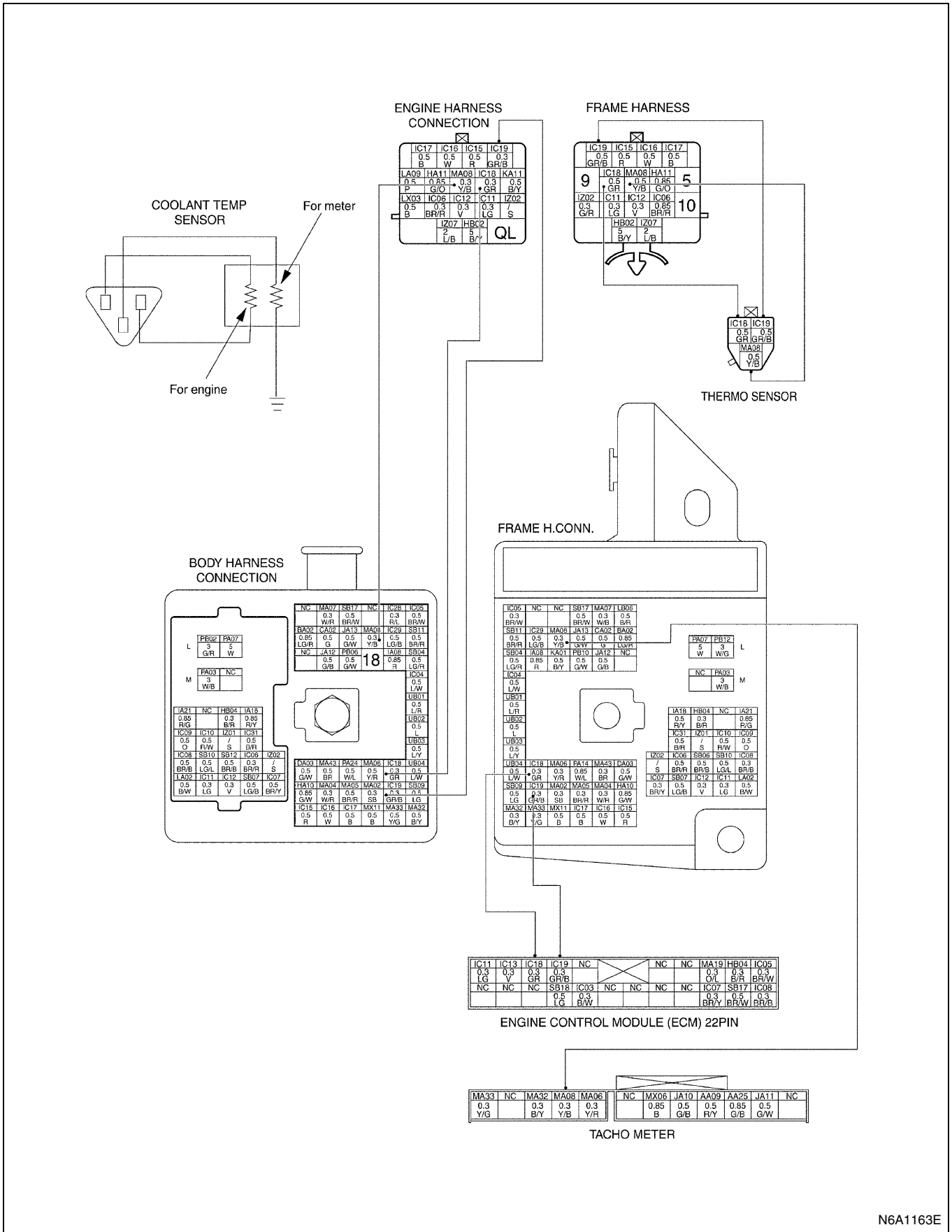
Notice:

Resistance value is difference according to the temperature of temperature sensor.

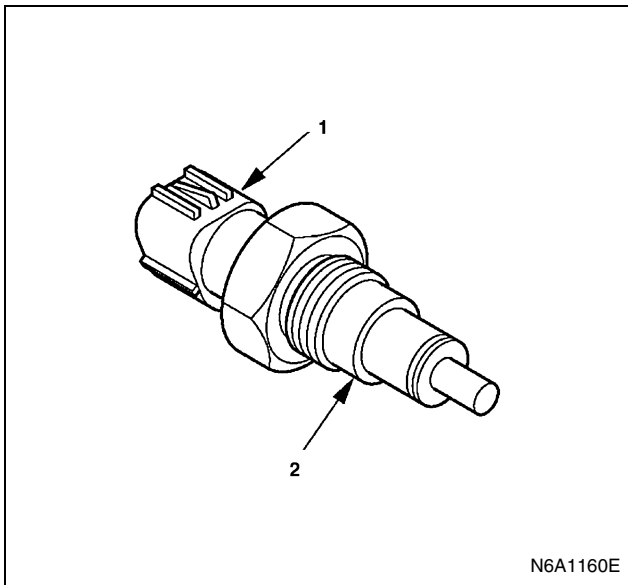
Step	Action	Value	YES	NO
1	Was the “on-board diagnostic (OBD) system check” performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition “OFF” 2. Disconnect the ECT sensor electrical connector. 3. Jumper the ECT sensor signal circuit and the ECT sensor ground circuit together at the ECT sensor harness connector. 4. Observe the “Engine cool temp” display on the scan tool. <p>Is the “Engine cool temp” at the specified value?</p>	120°C (248°F)	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> 1. Ignition “OFF” 2. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 3. Observe the “Engine cool temp” display on the scan tool. <p>Is the “Engine cool temp” at the specified value?</p>	120°C (248°F)	Go to Step 5	Go to Step 6
4	<p>Check for poor connection at the ECT sensor and replace terminals if necessary.</p> <p>Did any terminals require replacement?</p>	—	Go to Step 8	Go to Step 10
5	<ol style="list-style-type: none"> 1. Ignition “OFF”. 2. Disconnect the ECM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. <p>Was the ECT sensor ground circuit open?</p>	—	Go to Step 7	Go to Step 10

Step	Action	Value	YES	NO
6	1. Ignition "OFF". 2. Disconnect the ECM, and check the ECT sensor signal circuit for an open. 3. If the ECT signal circuit is open, repair it as necessary. Was the ECT sensor signal circuit open?	—	Go to Step 7	Go to Step 10
7	Check for poor sensor ground or ECT sensor signal circuit terminal connection at the ECU and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Go to Step 9	Go to Step 10
8	1. Ignition "OFF" 2. Replace the ECT Sensor. Is the action complete?	—	Go to Step 10	—
9	1. Replace the ECM. Is the action complete?	—	Go to Step 10	—
10	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 13 all right under Scan Tool Check?	—	Go to Step 11	Go to Step 2
11	Is any current trouble other than DTC 13 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P14 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage



Appearance of Water Temperature Sensor and Connector Pin Assignment
Temperature Sensor

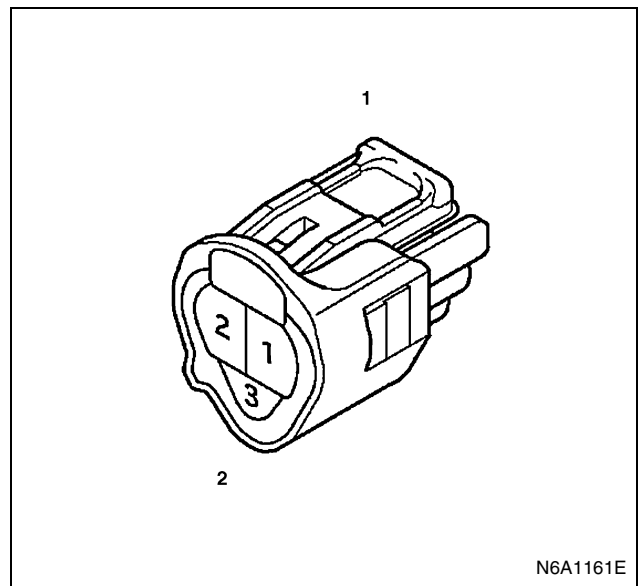


N6A1160E

Legend

- 1. 3 pin connector
- 2. Engine coolant temperature sensor

Connector Pin Assignment



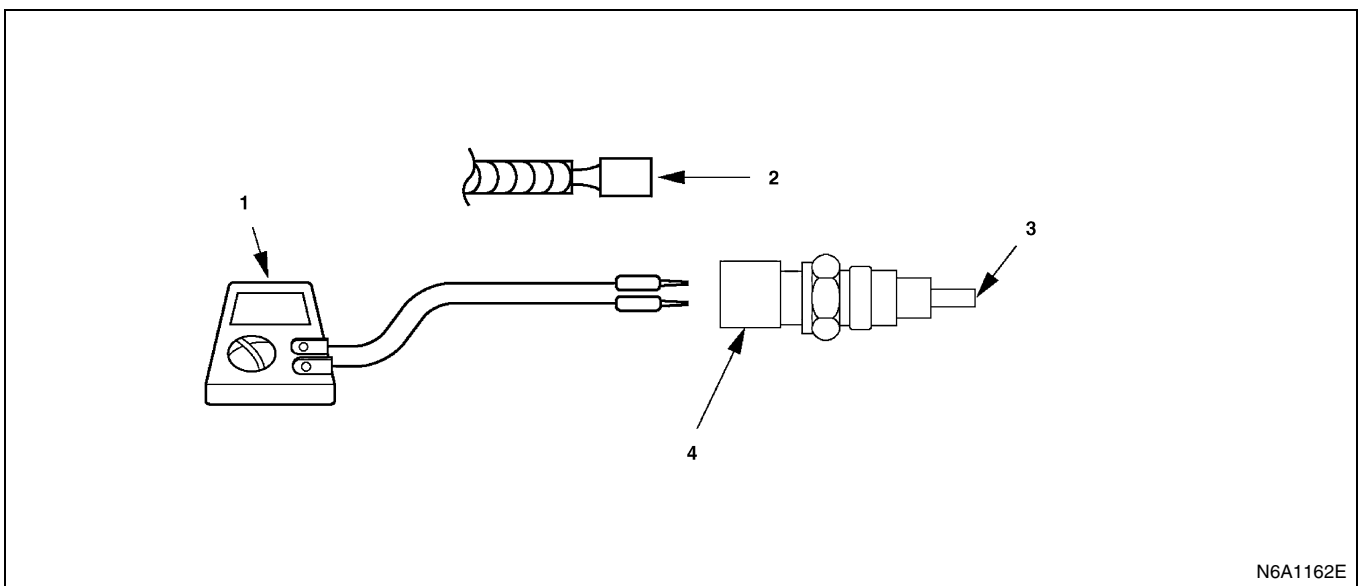
N6A1161E

Legend

- 1. To ECT sensor
- 2. 3 pin gray

Connector No	Signal
1	Thermistor for engine
2	Thermistor for engine
3	Thermistor for meter

Measure Resistance at Engine Coolant Temperature (ECT) Sensor



N6A1162E

Legend

- 1. Circuit tester
- 2. Remove engine wire harness
- 3. Engine coolant temperature sensor
- 4. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value	Temperature on sensor	Reference
Connector	Pin No.			
3 pin Black	1 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	1 ↔ 2	2.5 (kΩ)	20°C (68°F)	Thermistor for ENGINE
		247 (Ω)	90°C (194°F)	
	1 ↔ Body	∞	—	Thermistor for ENGINE ↔ Body
	2 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	3 ↔ Body	146.6 (Ω)	60°C (140°F)	Thermistor for meter ENGINE
	2 ↔ Body	∞	—	Thermistor for ECM ↔ Body

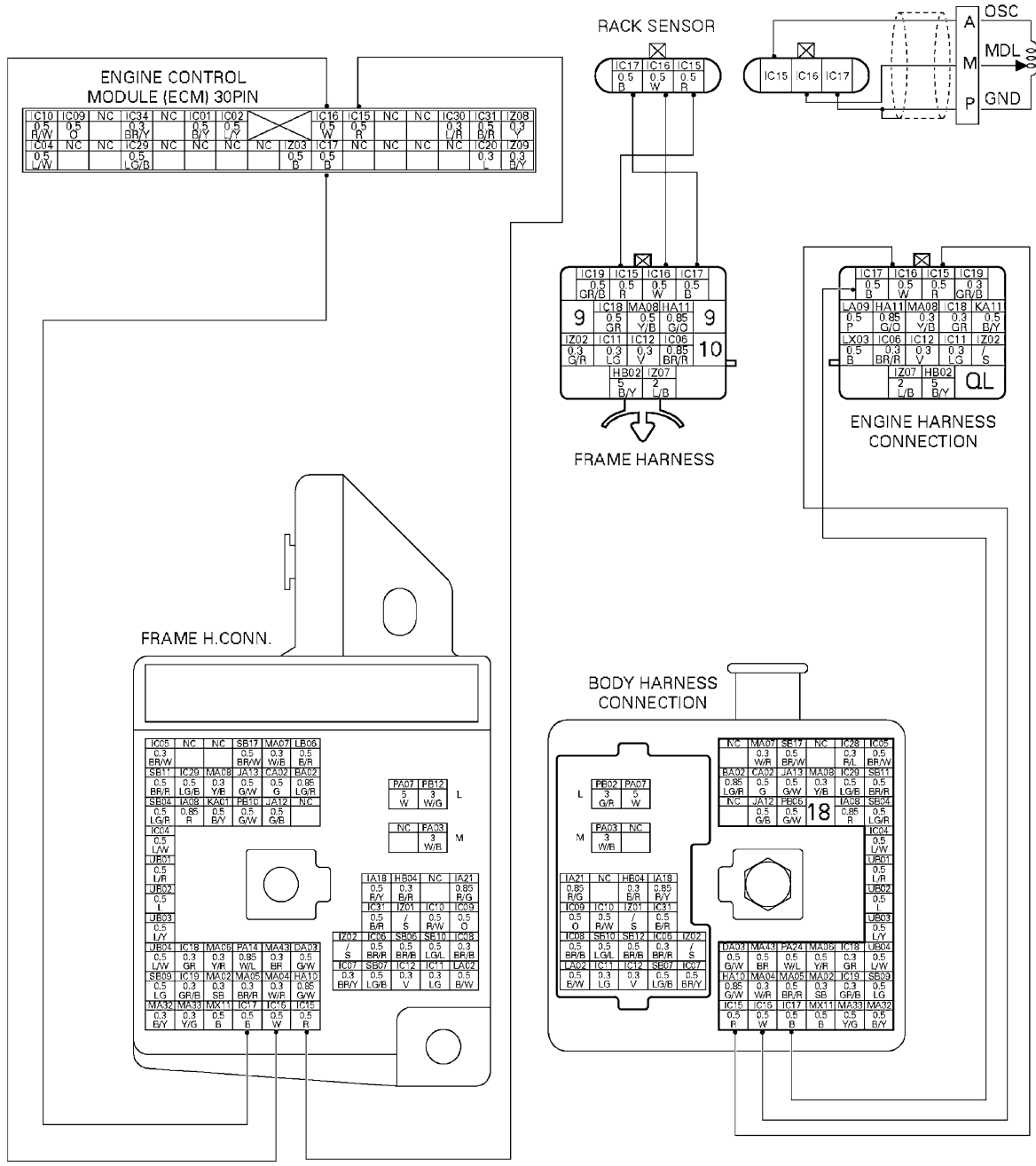
Notice:

Resistance value is difference according to the temperature of temperature sensor.

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	1. Ignition "OFF" 2. Disconnect the ECT sensor. 3. Ignition "ON", Engine "OFF" 4. See scan Tool Display and Ignore trouble code 13. Does code 14 still remain faulty?	—	Go to Step 3	Go to Step 6
3	1. Ignition "OFF" 2. Check Connector ECT Sensor Harness for interterminal short. 3. Repair if necessary. Was ECT Sensor connector shorted?	—	Go to Step 4	Go to Step 8
4	1. Ignition "OFF" 2. Check the ECM connector terminal short. 3. Repair if necessary. Was ECM terminal shorted?	—	Go to Step 5	Go to Step 8
5	1. Disconnect the ECM. 2. Check if ECT sensor signal circuit for a short to ground or a short to ground circuit. 3. Repair if necessary. Is ECT sensor signal circuit shorted to ground?	—	Go to Step 7	Go to Step 8
6	1. Ignition "OFF" 2. Replace the ECT Sensor. Is the action complete?	—	Go to Step 8	—
7	1. Replace the ECM. Is the action complete?	—	Go to Step 8	—

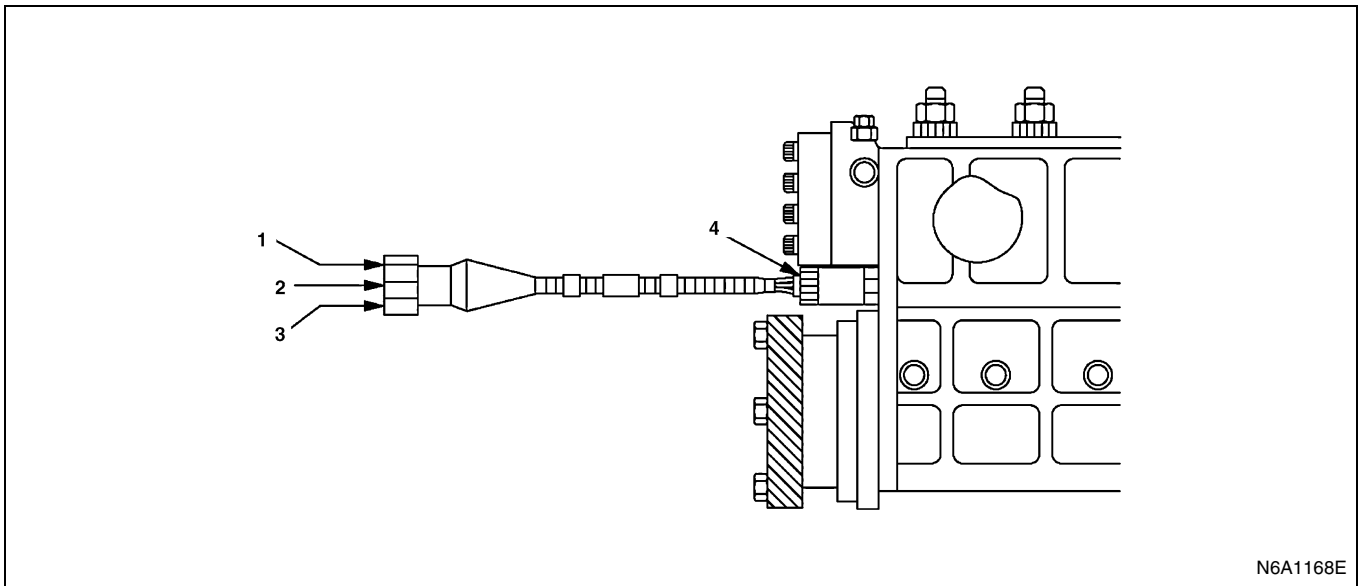
Step	Action	Value	YES	NO
8	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 14 all right under Scan Tool Check?	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 14 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P21 Rack Sensor Circuit Low Voltage



N6A1167E

Location of Rack Sensor Connector

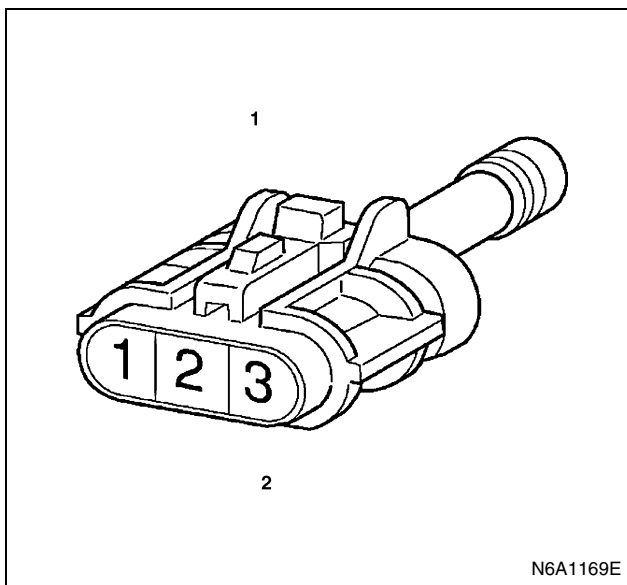


N6A1168E

Legend

- | | |
|----------------|----------------|
| 1. OSC (red) | 3. GND (black) |
| 2. MDL (white) | 4. Rack sensor |

Connector Name of Rack Sensor



N6A1169E

Legend

- | |
|--------------------------|
| 1. Rack sensor connector |
| 2. Natural 3 pin |

Relation Between Connector Number and Signal Name

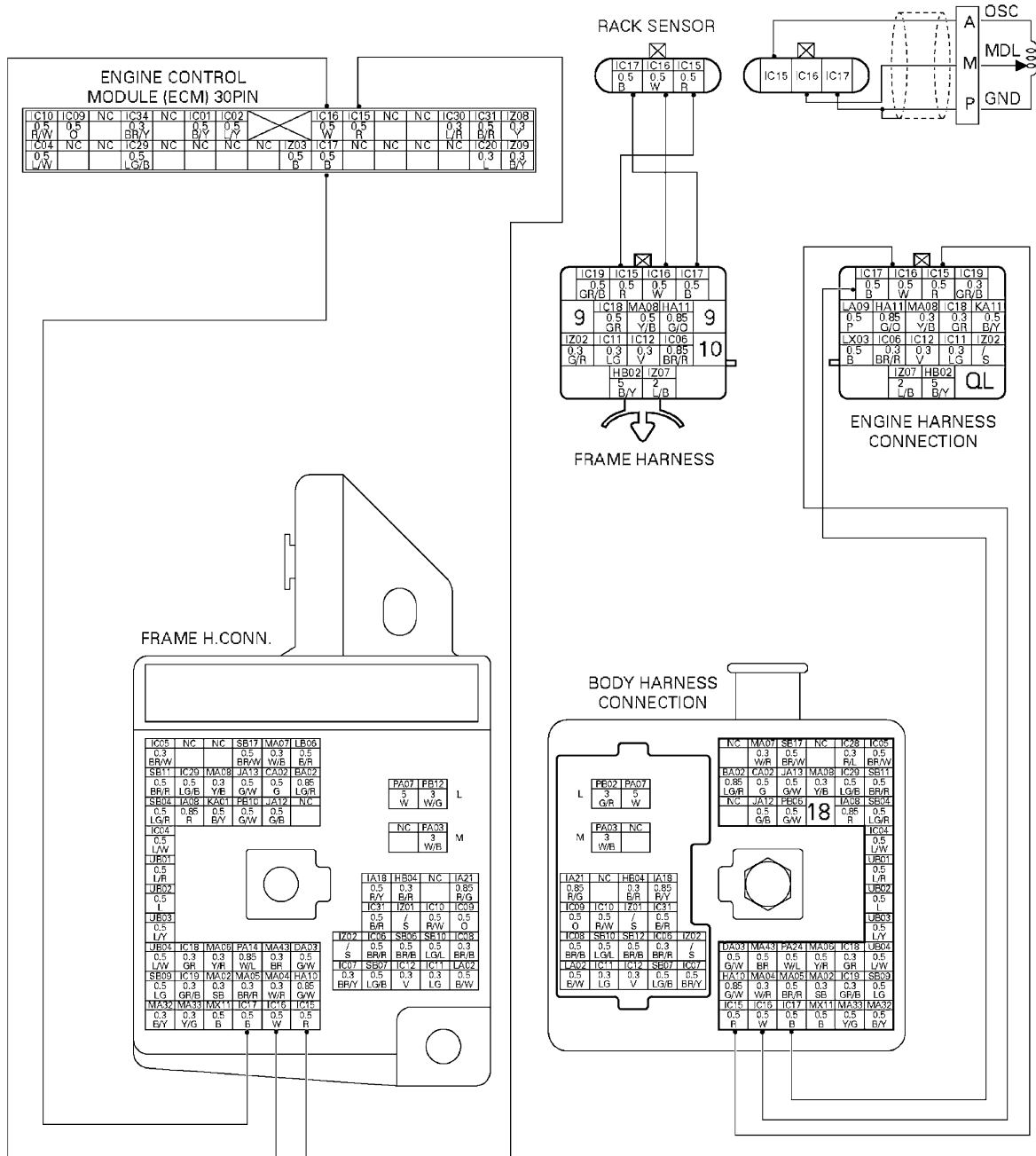
Connector No	Signal	Wire color
1	Rack sensor (OSC)	R
2	Rack sensor (MDL)	W
3	Rack sensor (GND)	B

Notice:

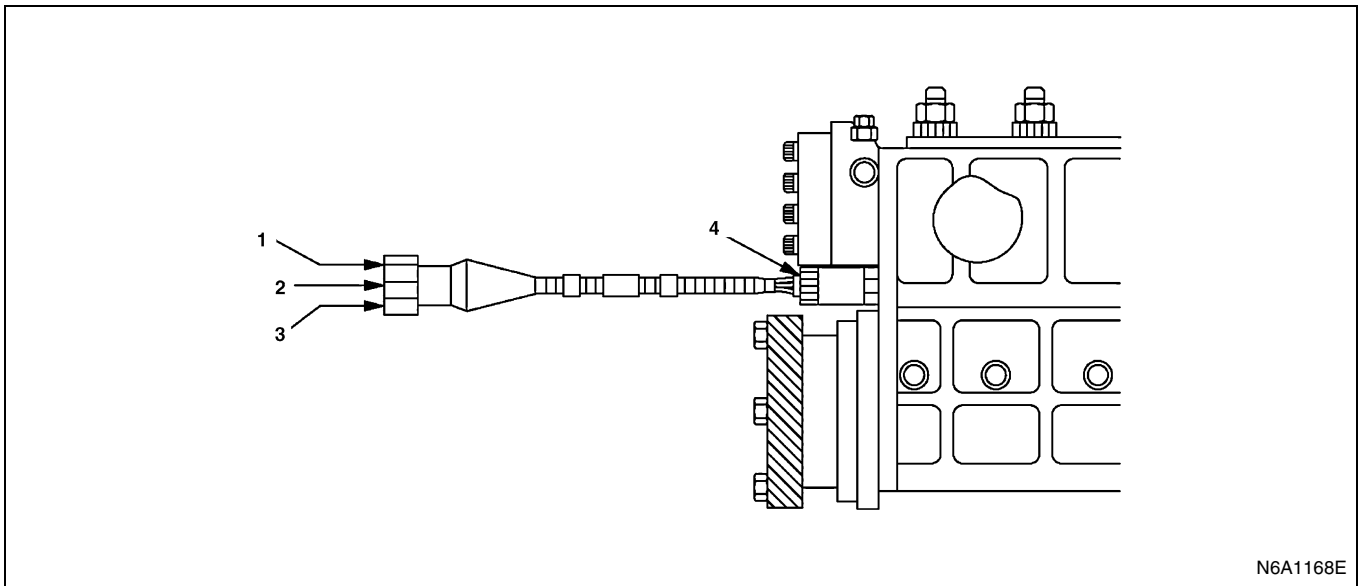
Mark “___” on connector which is plugged, therefore, should be confirmed to be played.

Step	Action	Value	YES	NO
1	Was the on-board diagnostic (OBD) system check performed?	—	Go to Step 2	Go to self diag system check
2	1. Check harness side power source circuit and signal circuit for GND short. 2. Repair if necessary. Has DTC21 been corrected?	—	Go to Step 10	Go to Step 3
3	Disconnect the Sensor Connector. Jumper RACK+ and RACK signal. Free from trouble now? Ignore code 22.	—	Go to Step 4	Go to Step 6
4	1. Apply 5V to RACK+ TERMINAL. Measure RACK SIG Voltage. Is RACK SIG VOLTAGE as specified?	0.9 — 2.0V (Idling speed)	Go to Step 7	Go to Step 5
5	1. Check Rack Sensor Harness Signal Circuit and power source for GND short. Check signal circuit for disconnect. 2. Repair if necessary. Free from trouble now?	—	Go to Step 10	Go to Step 7
6	1. Check harness signal circuit and power source circuit for disconnect. 2. Repair if necessary. Free from trouble now?	—	Go to Step 10	Go to Step 8
7	1. Check the iron core of RACK Sensor for damage, seizure, and wear. 2. After check, repair if necessary. Was there any trouble in the iron core (RACK end) inside RACK Sensor?	—	Go to Step 10	Go to Step 9
8	1. Replace the RACK Sensor. Is the action complete?	—	Go to Step 10	—
9	1. Replace the ECM. Is the action complete?	—	Go to Step 10	—
10	1. Reconnect all the connectors removed. 2. Ignition -ON+, Engine "OFF" Is DTC 21 all right under Scan Tool Check?	—	Go to Step 10	Go to Step 2
11	Is any current trouble other than DTC 21 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P22 Rack Sensor Circuit High Voltage



Location of Rack Sensor Connector

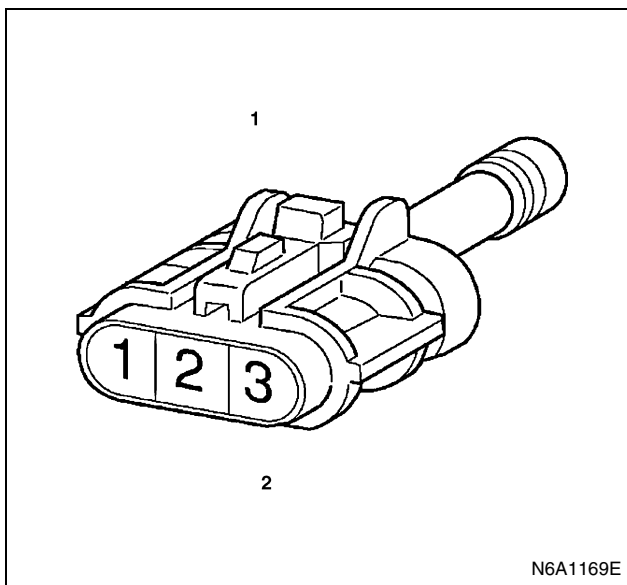


N6A1168E

Legend

- | | |
|----------------|----------------|
| 1. OSC (red) | 3. GND (black) |
| 2. MDL (white) | 4. Rack sensor |

Connector Name of Rack Sensor



N6A1169E

Legend

- | |
|--------------------------|
| 1. Rack sensor connector |
| 2. Natural 3 pin |

Relation Between Connector Number and Signal Name

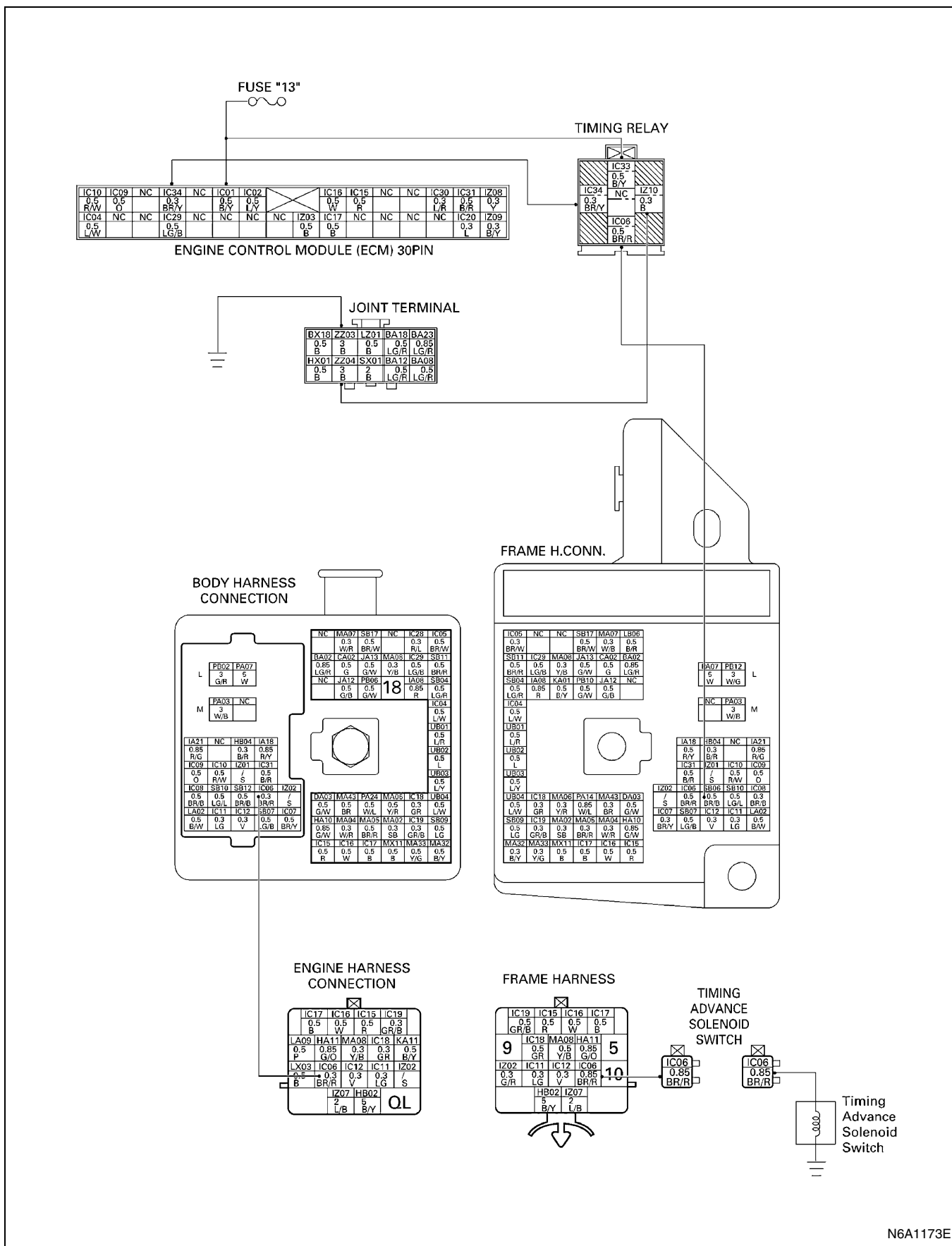
Connector No	Signal	Wire color
1	Rack sensor (OSC)	R
2	Rack sensor (MDL)	W
3	Rack sensor (GND)	B

Notice:

Mark “___” on connector which is plugged, therefore, should be confirmed to be played.

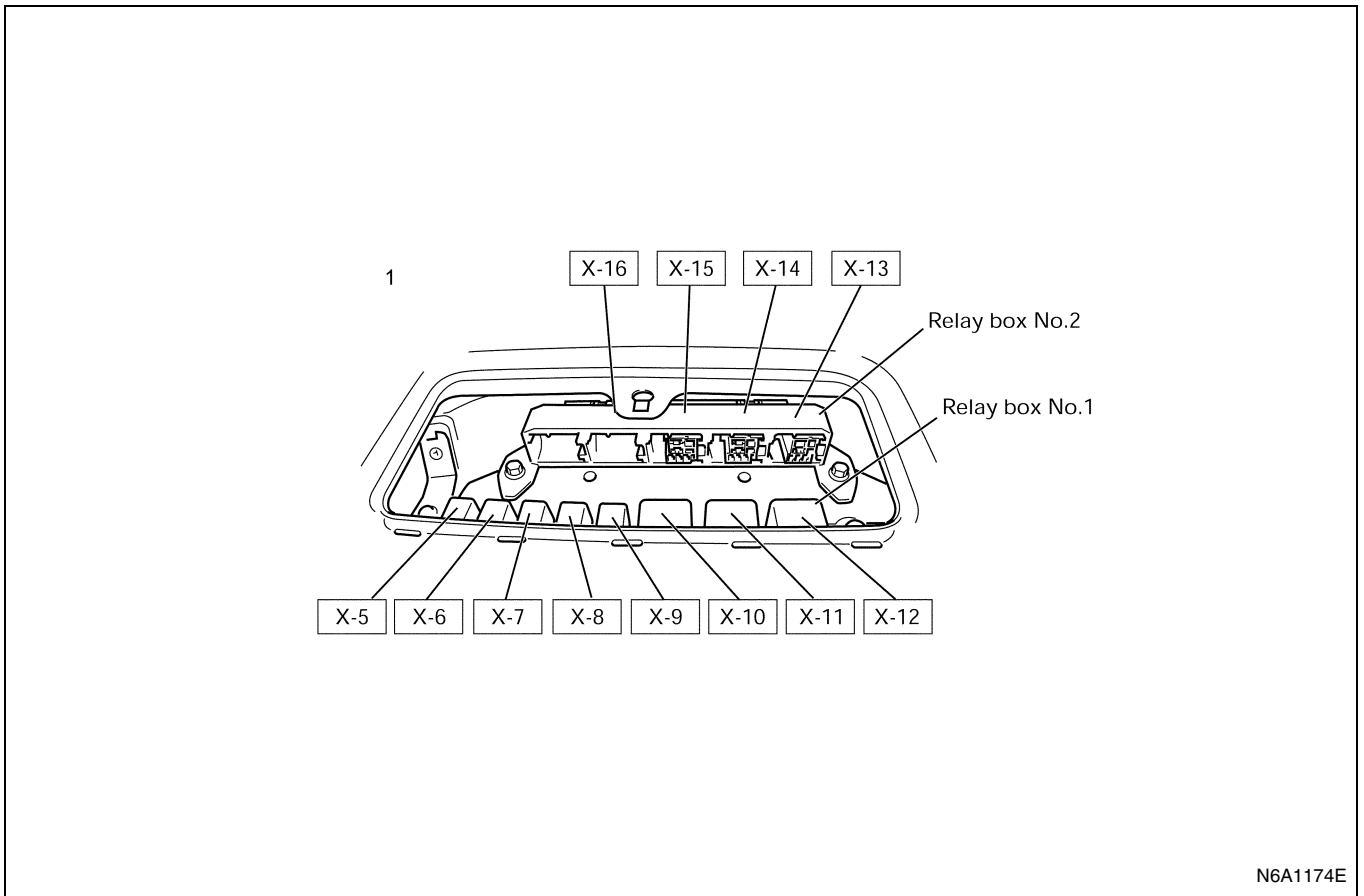
Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	Remove Sensor Connector. Has DTC22 been corrected? (Ignore DTC21)	—	Go to Step 3	Go to Step 7
3	1. Jump between Harness signal Terminal and GND terminal at the Sensor side of Connector. 2. Ignition "ON" Has DTC22 been corrected?	—	Go to Step 4	Go to Step 5
4	1. Check the Sensor Connector for inter terminal short. After check, repair if necessary. Was Connector Terminal shorted?	—	Go to Step 12	Go to Step 6
5	1. Check GND Circuit for disconnect. After check, repair if necessary. Is GND circuit disconnect?	—	Go to Step 12	Go to Step 11
6	1. Check Sensor Harness signal circuit and power source circuit for short. After check, repair if necessary. Was Harness shorted?	—	Go to Step 12	Go to Step 8
7	1. Check Harness signal circuit and power source for short. After check, repair if necessary. Was Harness shorted?	—	Go to Step 12	Go to Step 11
8	1. Apply 5V to RACK+ TERMINAL. 2. Measure RACK SIG Voltage. Is RACK SIG VOLTAGE as specified?	0.9 — 2.0V (Idling speed)	Go to Step 9	Go to Step 10
9	1. Check the iron core of RACK Sensor for damage, seizure, and wear. 2. After check, repair if necessary. Was there any trouble in the iron core(RACK end) inside RACK Sensor?	—	Go to Step 12	Go to Step 11
10	Replace the RACK Sensor. Is the action complete?	—	Go to Step 12	—
11	Replace the ECM. Is the action complete?	—	Go to Step 12	—
12	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC22 all right under Scan Tool Check?	—	Go to Step 13	Go to Step 2
13	Is any current trouble other than DTC 22 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P23 Solenoid Switch Control Circuit Low Voltage



N6A1173E

Location of Relay

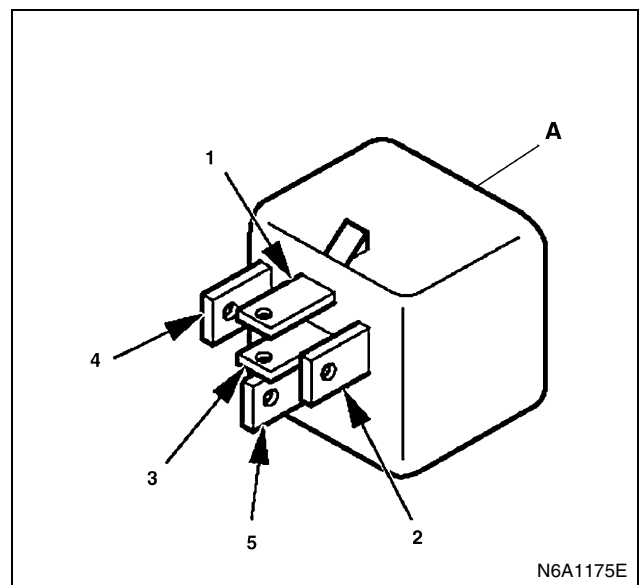


Legend

1. Relay box (Installed on the instrument panel)

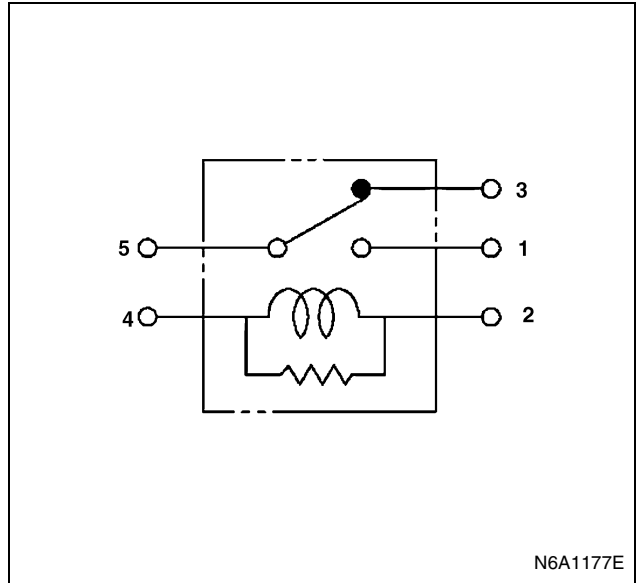
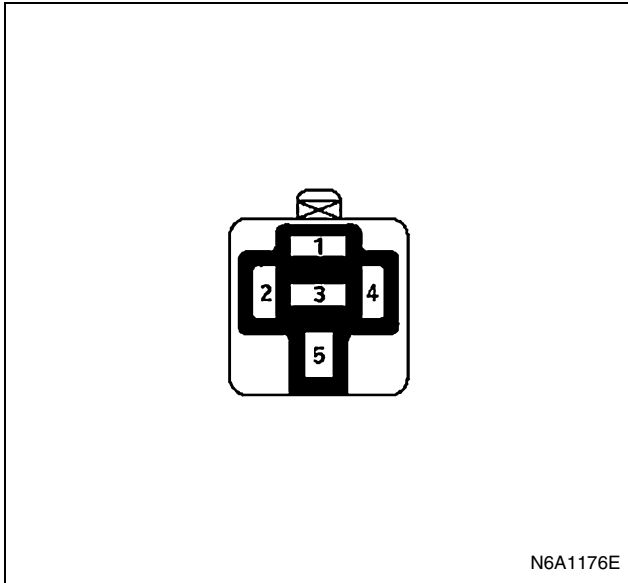
NO	RELAY NAME
X-5	ABS IND.
X-6	Dimmer
X-7	Power window
X-8	Exh. brake
X-9	Cornering lamp
X-10	Thermo A/C
X-11	Exh. Brake, Charge warning, Key ON
X-12	Heater & A/C
X-13	Buzzer cancel, Heater
X-14	ECU, PTO main, Timing
X-15	Tail, PTO solenoid, M/T
X-16	PTO cut

Inspection for Timing Advance Solenoid Switch cut relay



Legend

A. Timing advance solenoid



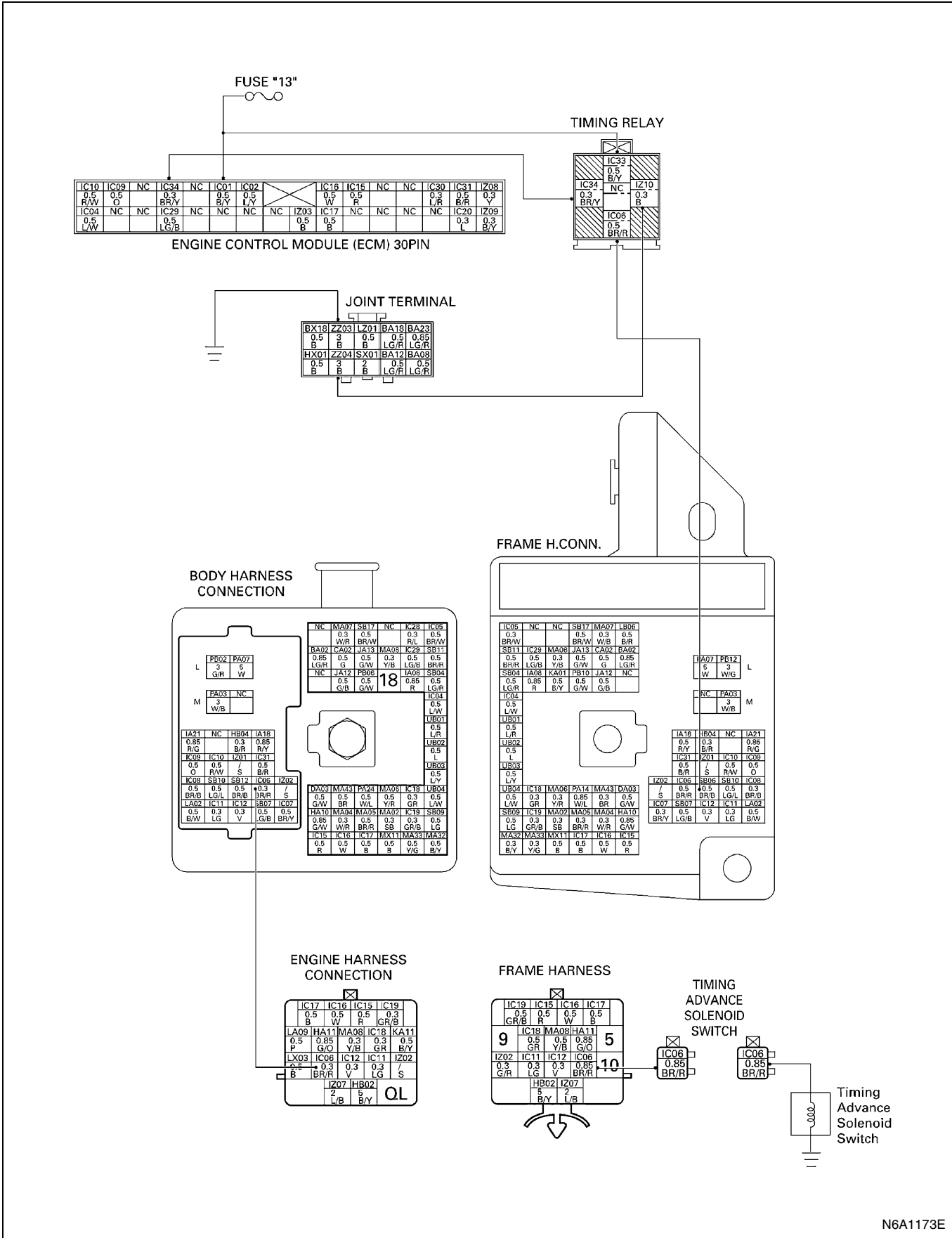
Resistance value

Inspection Point		Resistance	Reference
Inspection relay unit	2 ↔ 4	240 to 290 (Ω) (for 12 volt) 256 to 276 (Ω) (for 24 volt)	
	1 ↔ 5	∞	Not be supplied electricity
		Below 0.5 (Ω)	Be supplied electricity
	3 ↔ 5	Below 0.5 (Ω)	Be supplied electricity
		∞	Not be supplied electricity

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	1. Ignition "OFF", Engine "ON". 2. Jumper the magnetic switch Relay ground circuit at the Relay connector to chassis ground. 3. Observe the "Relay; solenoid switch" circuit open status on the scan tool. Has DTC23 been corrected?	—	Go to Step 4	Go to Step 3
3	1. Check for poor connector at the Relay connector and replace the terminals if necessary. Did any terminals require replacement?	—	Go to Step 11	Go to Step 5
4	1. Check the Relay ground circuit for an open. 2. If the Relay ground circuit is open, repair it as necessary. Was the Relay ground circuit open?	—	Go to Step 11	Go to Step 2

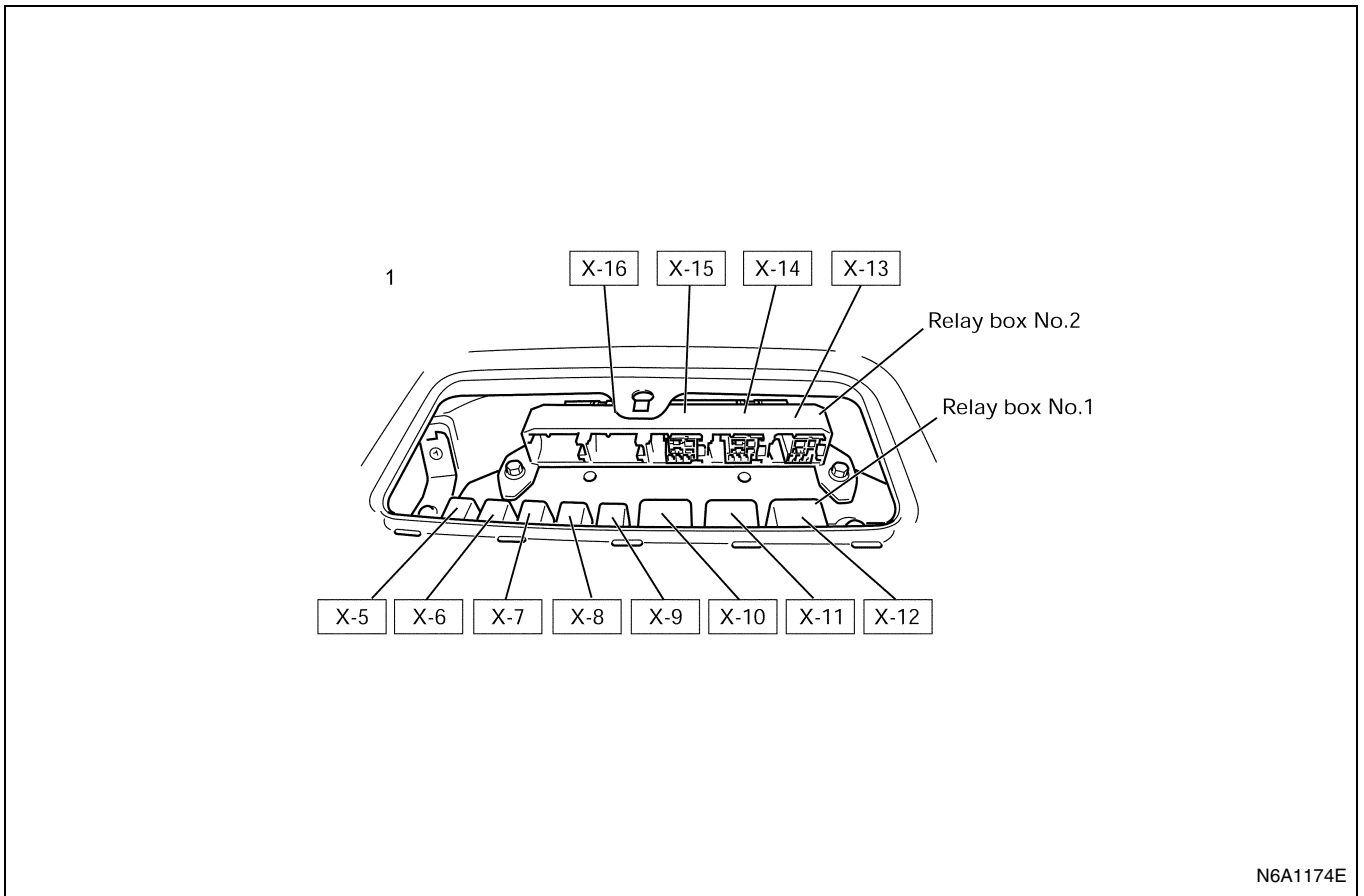
Step	Action	Value	YES	NO
5	<ol style="list-style-type: none"> Ignition "OFF", with scan tool disconnected. Disconnect the Solenoid switch Relay connector. Apply a circuit tester with voltage range or a test light to the output line for the Relay. Ignition "ON", Measure the voltage or check the test light "ON". Ignition "OFF" 	<p>≥8V or light "ON" (for 12 Volt)</p> <p>≥16V or light "ON" (for 24 Volt)</p>	Go to Step 8	Go to Step 6
6	<ol style="list-style-type: none"> Ignition "ON". Disconnect ECM, and check for the Relay signal circuit terminal connector at the ECM and clean or replace terminal if necessary. <p>Did any terminals need to be repaired?</p>	—	Go to Step 11	Go to Step 7
7	<ol style="list-style-type: none"> Check the Relay signal circuit for an open. If the Relay signal circuit is open, repair it as necessary. <p>Was the Relay signal circuit open?</p>	—	Go to Step 11	Go to Step 8
8	<ol style="list-style-type: none"> Disconnect the Relay. Measure the resistance between the coil circuit terminals of the Relay. <p>Is the resistance within specific value?</p>	<p>240 — 290Ω (for 12 Volt)</p> <p>256 — 276Ω (for 24 Volt)</p>	Go to Step 10	Go to Step 9
9	<ol style="list-style-type: none"> Replace the Relay. <p>Is the action complete?</p>	—	Go to Step 11	—
10	<ol style="list-style-type: none"> Replace the ECM <p>Is the action complete?</p>	—	Go to Step 11	—
11	<ol style="list-style-type: none"> Reconnect all the connectors removed. Ignition "ON", Engine "OFF". Ignition "OFF" after 30 seconds. Install Scan tool. <p>Is DTC 23 all right under Scan Tool Check?</p>	—	Go to Step 12	Go to Step 2
12	<p>Is any current trouble other than DTC 23 displayed by scan tool?</p>	—	Go to trouble code section	Trouble code clear

DTC-P24 Solenoid Switch Control Circuit High Voltage



N6A1173E

Location of Relay

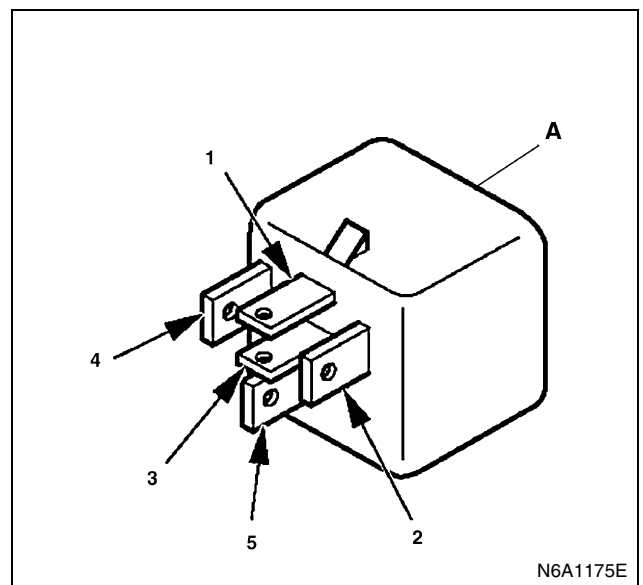


Legend

1. Relay box (Installed on the instrument panel)

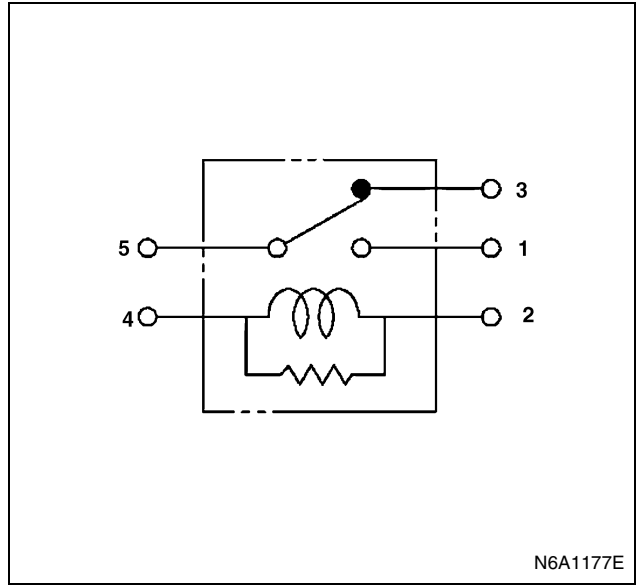
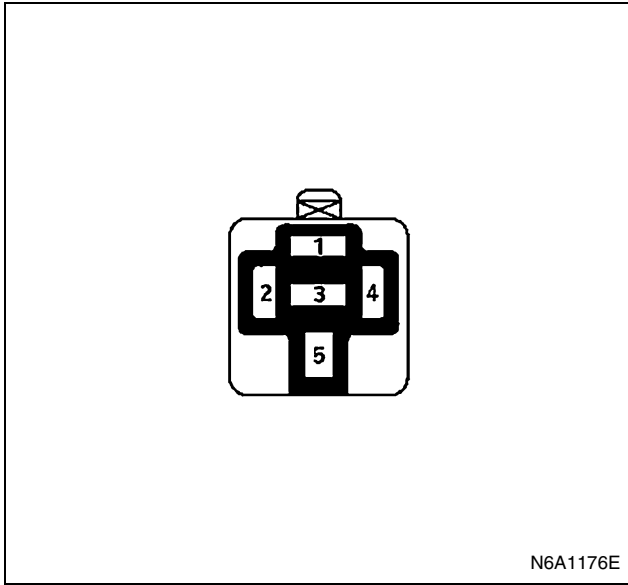
NO	RELAY NAME
X-5	ABS IND.
X-6	Dimmer
X-7	Power window
X-8	Exh. brake
X-9	Cornering lamp
X-10	Thermo A/C
X-11	Exh. Brake, Charge warning, Key ON
X-12	Heater & A/C
X-13	Buzzer cancel, Heater
X-14	ECU, PTO main, Timing
X-15	Tail, PTO solenoid, M/T
X-16	PTO cut

Inspection for Timing Advance Solenoid Switch cut relay



Legend

A. Timing advance solenoid



Resistance value

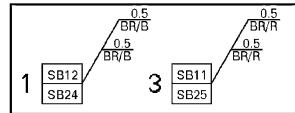
Inspection Point		Resistance	Reference
Inspection relay unit	2 ↔ 4	240 to 290 (Ω) (for 12 volt) 256 to 276 (Ω) (for 24 volt)	
	1 ↔ 5	∞	Not be supplied electricity
		Below 0.5 (Ω)	Be supplied electricity
	3 ↔ 5	Below 0.5 (Ω)	Be supplied electricity
		∞	Not be supplied electricity

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition "OFF", with scan tool disconnected. 2. Disconnect the Relay solenoid switch from the Relay box. 3. Apply a circuit tester with the voltage range or a test light to the output circuit for the Relay. 4. Ignition "ON", Engine "OFF". Is voltage as prescribed, or is test Light lit until 18 seconds?	$\geq 8V$ or light "ON" (for 12 Volt) $\geq 16V$ or light "ON" (for 24 Volt)	Go to Step 6	Go to Step 3
3	<ol style="list-style-type: none"> 1. Ignition "OFF". 2. Check if there is no short between Relay Box Terminals. 3. Repair if necessary. Was the circuit shorted between Relay Box Terminals?	—	Go to Step 8	Go to Step 4
4	<ol style="list-style-type: none"> 1. Disconnect the ECM. 2. Check if Relay Sig Circuit for a short to Chassis/GND or short to voltage. 3. Repair if necessary. Was Relay signal circuit shorted?	—	Go to Step 8	Go to Step 5
5	<ol style="list-style-type: none"> 1. Disconnect the Relay. 2. Measure the resistance between the coil circuit terminal of the Relay. Is the resistance with in specific valve?	$240 - 290\Omega$ (for 12 Volt) $256 - 276\Omega$ (for 24 Volt)	Go to Step 8	Go to Step 6
6	<ol style="list-style-type: none"> 1. Ignition "OFF". 2. Replace the Relay. Is the action complete?	—	Go to Step 8	—
7	<ol style="list-style-type: none"> 1. Ignition "ON". 2. Replace the ECM. Is the action complete?	—	Go to Step 8	—
8	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine OFF, and Ignition off after 30sec. 3. Install Scan tool. 4. Ignition "ON", Engine "OFF". Is DTC 24 all right under Scan Tool Check?	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 24 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P26 Quick Warm System (QWS) Relay Control Circuit High Voltage

ENGINE CONTROL MODULE (ECM) 22PIN

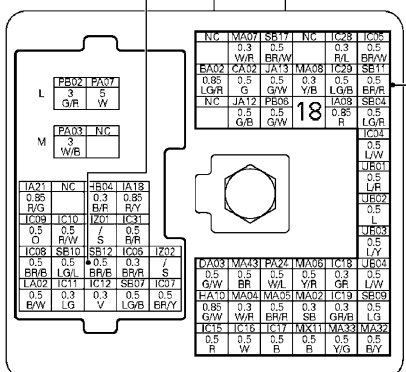
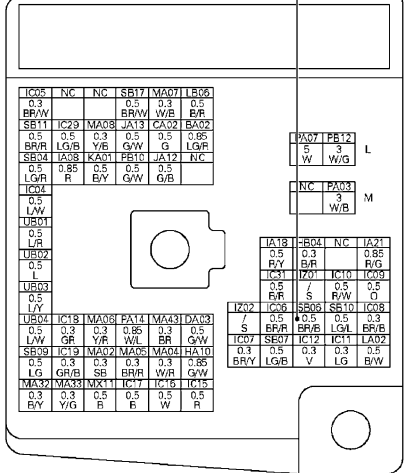
IC11	IC13	IC18	IC19	NC	NC	NC	NC	MA19	HB04	IC05
0.3 LG	0.3 V	0.3 GR	0.3 GR/B					0.3 O/L	0.3 B/R	0.3 BR/W
NC	NC	NC	SB18	IC03	NC	NC	NC	IC07	SB17	IC08
			0.3 LG	0.3 B/W				0.3 BR/Y	0.5 BR/W	0.5 BR/B



RELAY; ENG. WARM. CUT

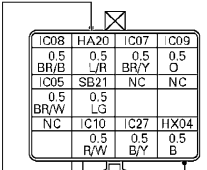
FUSE BOX "15"

FRAME H.CONN.



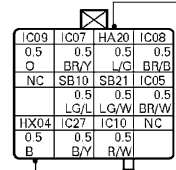
BODY HARNESS CONNECTION

FRAME HARNESS



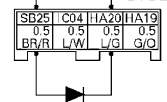
VSV;FICD

VSV.H.CONN.



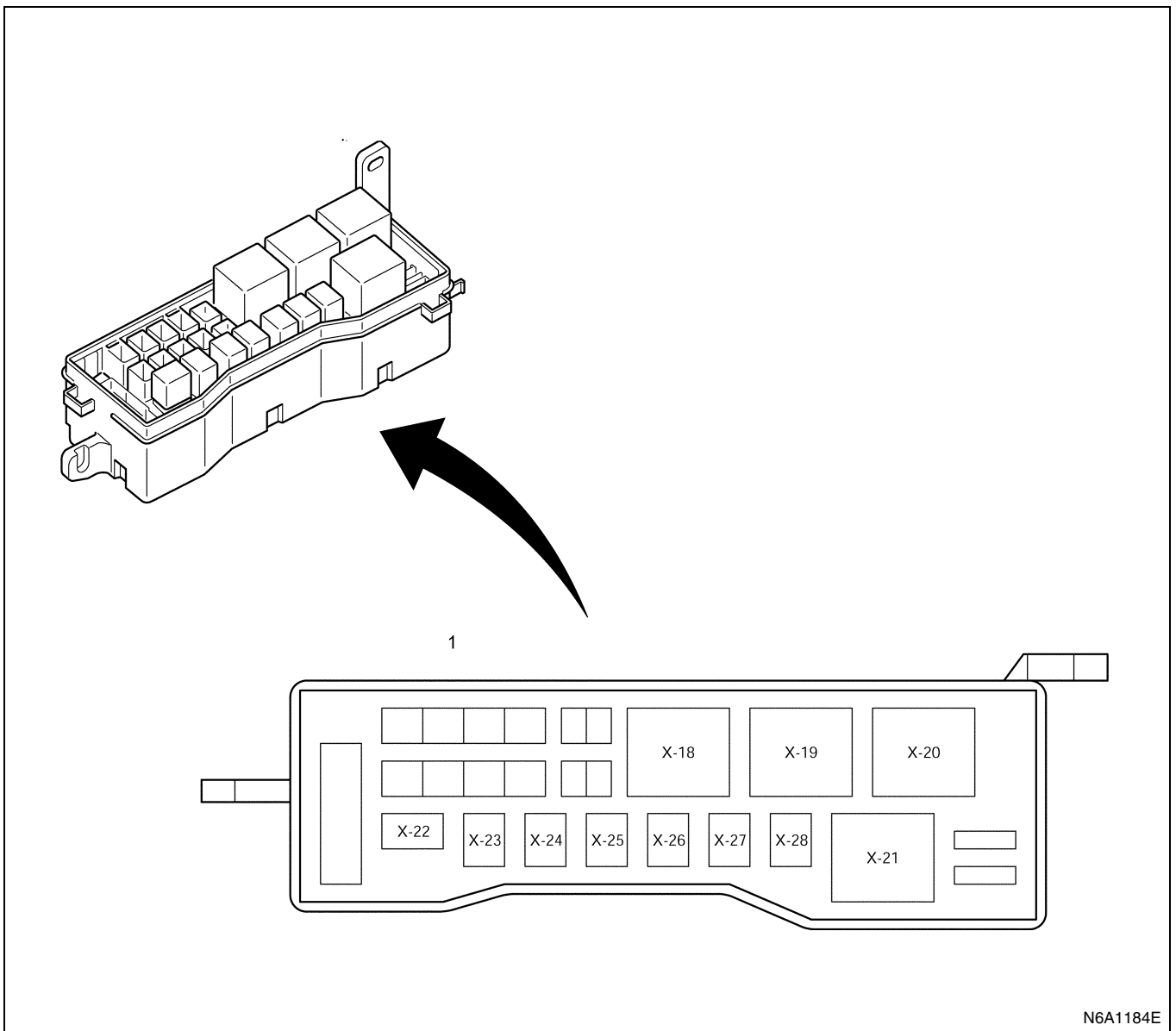
FRAME HARNESS CONNECTION

DIODE;FICD



FRAME HARNESS CONNECTION

Location of Relay

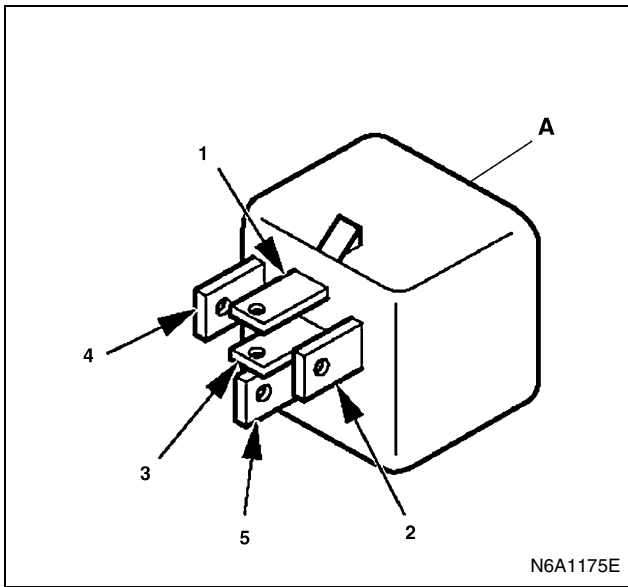


Legend

1. Relay box (Installed on the left side rear of the cab)

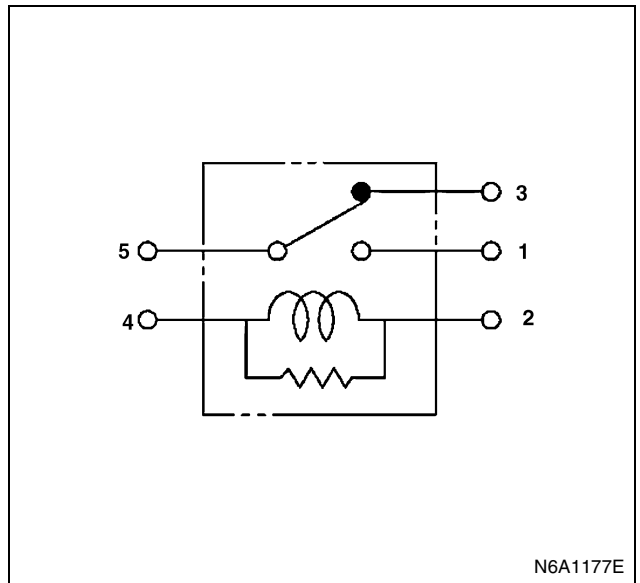
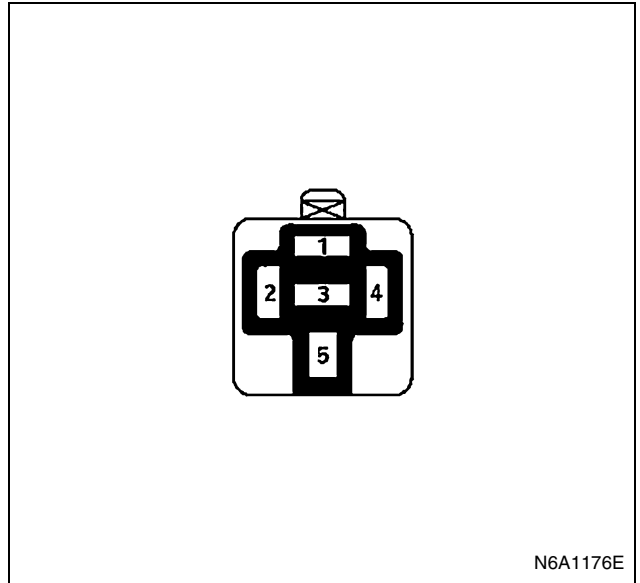
NO	RELAY NAME
X-20	Glow plug
X-21	Starter
X-22	Marker lamp
X-23	Rear fog
X-24	A/C COMP, 4WD ind. lamp
X-25	Exh, Brake control
X-26	CSD, A/C ON SIGNAL
X-27	Condenser fan
X-28	Exh. Brake cut

Inspection for Timing Advance Solenoid Switch cut relay



Legend

A. Timing advance solenoid



Resistance value

Inspection Point		Resistance	Reference
Inspection relay unit	2 ↔ 4	240 to 290 (Ω) (for 12 volt) 256 to 276 (Ω) (for 24 volt)	
	1 ↔ 5	∞	Not be supplied electricity
		Below 0.5 (Ω)	Be supplied electricity
	3 ↔ 5	Below 0.5 (Ω)	Be supplied electricity
		∞	Not be supplied electricity

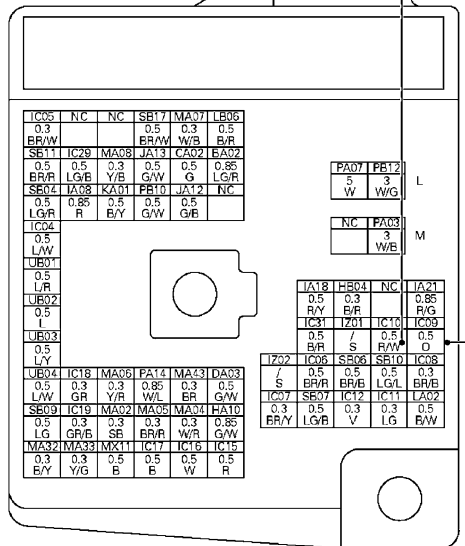
Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition "OFF", with scan tool disconnected. 2. Disconnect the Relay solenoid switch from the Relay box. 3. Apply a circuit tester with the voltage range or a test light to the output circuit for the Relay. 4. Ignition "ON", Engine "OFF". Is voltage as prescribed, or is test Light lit until 18 seconds?	≥ 8 V or light "ON" (for 12 Volt) ≥ 16 V or light "ON" (for 24 Volt)	Go to Step 3	Go to Step 4
3	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of Relay circuit between the ECM and Relay connector. 4. Repair if necessary. Has DTC 26 been corrected?	—	Go to Step 6	Go to Step 5
4	Replace the Relay. Is the action complete?	—	Go to Step 6	—
5	Replace the ECM. Is the action complete?	—	Go to Step 6	—
6	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 26 all right under Scan Tool Check?	—	Go to Step 7	Go to Step 2
7	Is any current trouble other than DTC 26 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P31 Exhaust Gas Recirculation (EGR) Electronic Vacuum Regulating Valve (EVRV) Solenoid Control Low Voltage

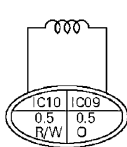
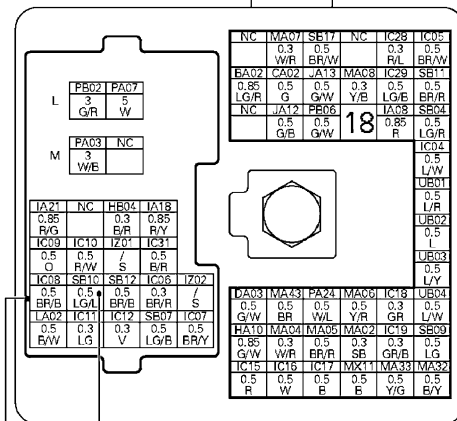
ENGINE CONTROL MODULE (ECM) 30PIN

IC10	IC09	NC	IC34	NC	IC01	IC02	IC16	IC15	NC	NC	IC30	IC31	IZ08
0.5 R/W	0.5 O		0.3 BR/Y		0.5 B/Y	0.5 L/Y	0.5 W	0.5 R			0.3 L/R	0.5 B/B	0.3 Y
IC04	NC	NC	IC29	NC	NC	NC	IZ03	IC17	NC	NC	NC	IC20	IZ09
0.5 L/W			0.5 LG/B				0.5 B	0.5 B				0.3 L	0.3 B/Y

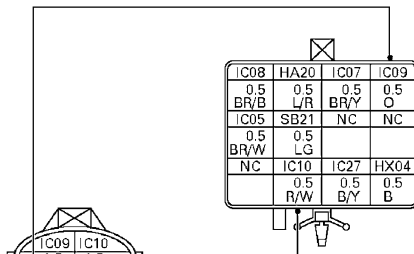
FRAME H.CONN.



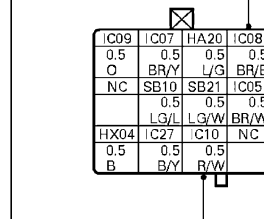
BODY HARNESS CONNECTION



EVRV;EGR



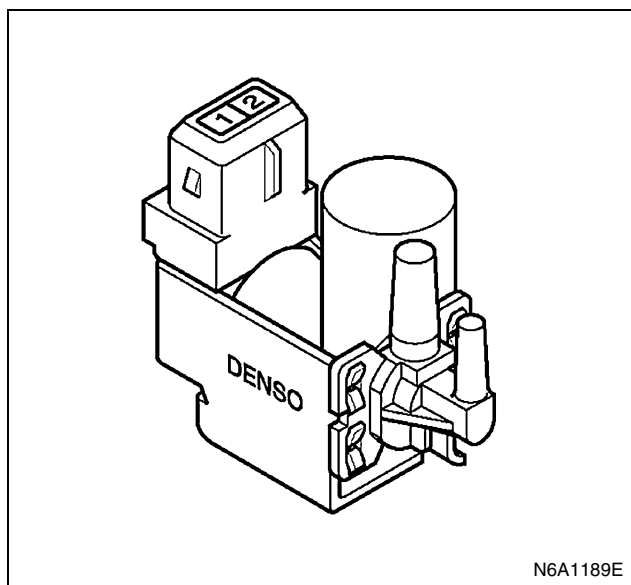
FRAME HARNESS



VSV.H.CONN.

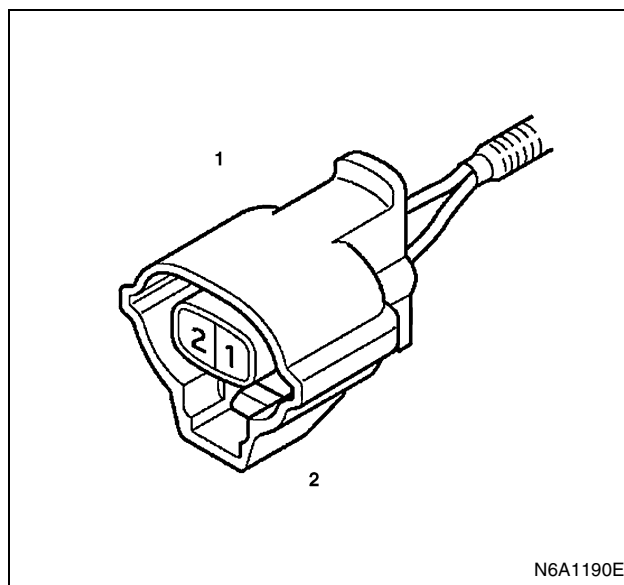
Appearance of Electronic Vacuum Regulating Valve (EVRV): Exhaust Gas Recirculation (EGR) Sensor and Connector Name

EVRV: EGR



N6A1189E

EVRV: EGR Connector



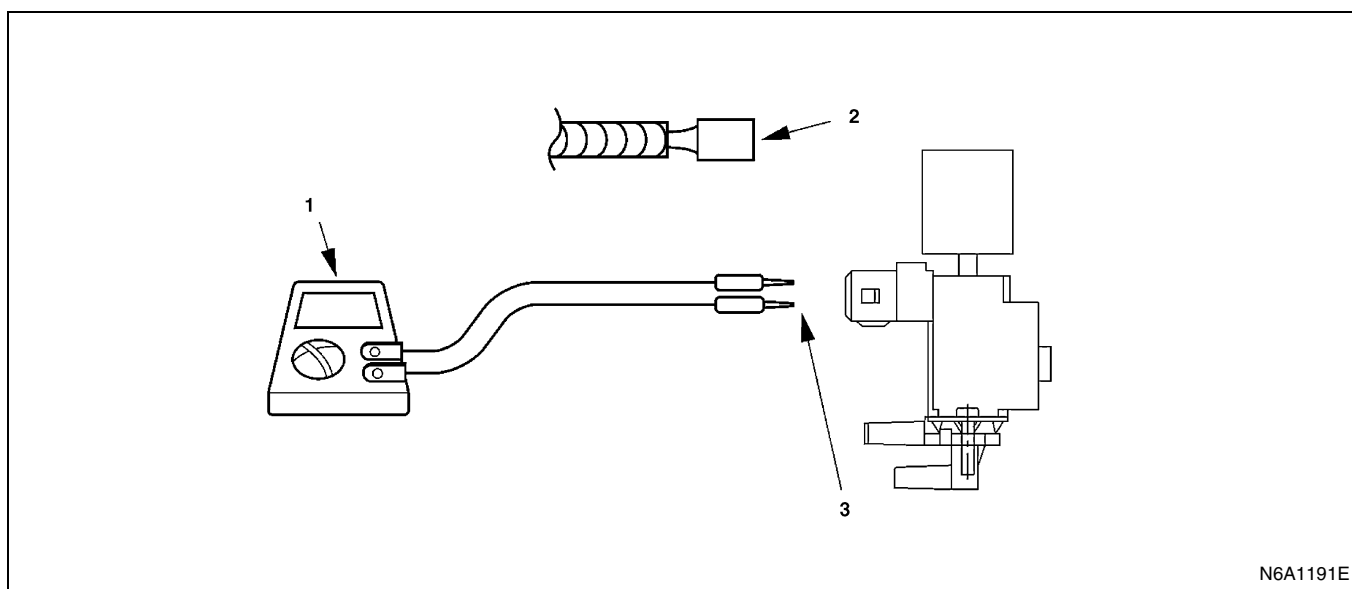
N6A1190E

Legend

- 1. To EVRV: EGR
- 2. 2 pin

Connector No	Signal
1	GND
2	SIG

Measure Resistance at EVRV: EGR



N6A1191E

Legend

- 1. Circuit tester
- 2. Remove EVRV wire harness
- 3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Black	2 ↔ 1	12±1 (for 12 volt) 48±2 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

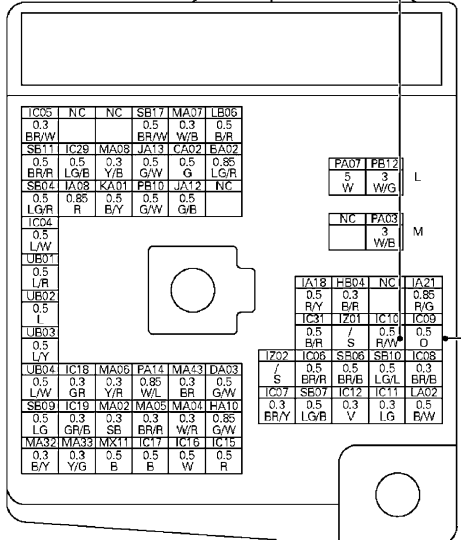
Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	1. Ignition "OFF" 2. Disconnect the EVRV from the wiring harness connector. 3. Check the EVRV signal circuit between the EVRV connector and the ECM for the following condition. <ul style="list-style-type: none"> • A short to ground • An open circuit 4. Repair if necessary. Has DTC31 been corrected?	—	Go to Step 7	Go to Step 3
3	Using the DVM, check the resistance of the EVRV. Does the DVM read the following Value?	12Ω (for 12 Volt) 48Ω (for 24 Volt)	Go to Step 4	Go to Step 5
4	1. Ignition "OFF" 2. Check an open circuit of the EVRV ground circuit between the ECM and EVRV connector. 3. Repair if necessary. Has DTC31 been corrected?	—	Go to Step 7	Go to Step 6
5	Replace the EVRV. Is the action complete?	—	Go to Step 7	Go to Step 6
6	Replace the ECM. Is the action complete?	—	Go to Step 7	—
7	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC31 all right under Scan Tool Check?	—	Go to Step 8	Go to Step 2
8	Is any current trouble other than DTC31 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P32 Exhaust Gas Recirculation (EGR) Electronic Vacuum Regulating Valve (EVRV) Solenoid Control High Voltage

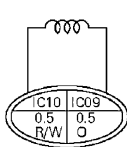
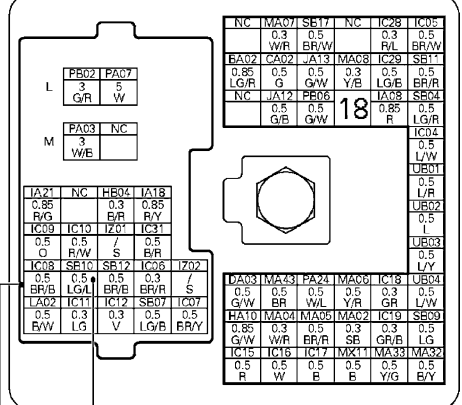
ENGINE CONTROL MODULE (ECM) 30PIN

IC10	IC09	NC	IC34	NC	IC01	IC02	IC16	IC15	NC	NC	IC30	IC31	IZ08
0.5 R/W	0.5 O		0.3 BR/Y		0.5 B/Y	0.5 L/Y	0.5 W	0.5 R			0.3 L/R	0.5 B/B	0.3 Y
IC04	NC	NC	IC29	NC	NC	NC	IC17	NC	NC	NC	IC20	IZ09	
0.5 L/W			0.5 LG/B				0.5 B				0.3 L	0.3 B/Y	

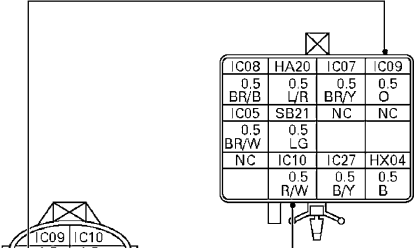
FRAME H.CONN.



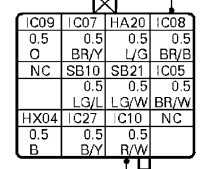
BODY HARNESS CONNECTION



EVRV;EGR



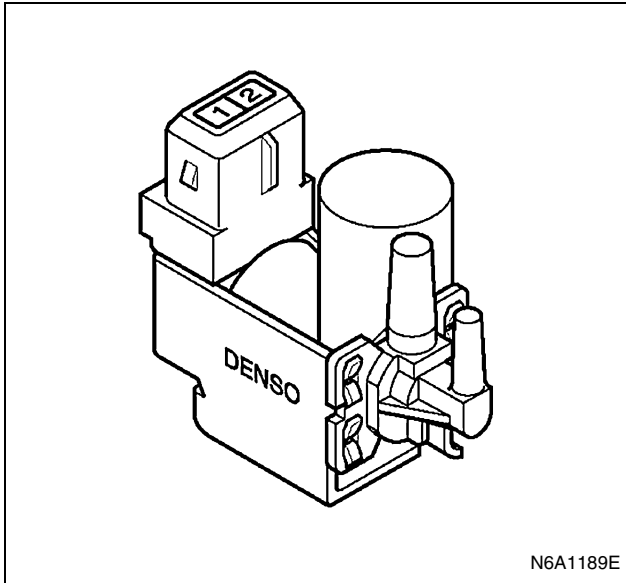
FRAME HARNESS



VSV.H.CONN.

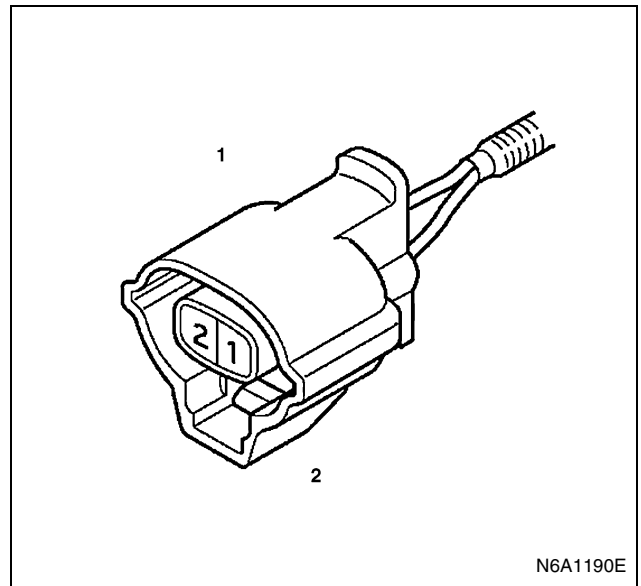
Appearance of Electronic Vacuum Regulating Valve (EVRV): Exhaust Gas Recirculation (EGR) Sensor and Connector Name

EVRV: EGR



N6A1189E

EVRV: EGR Connector



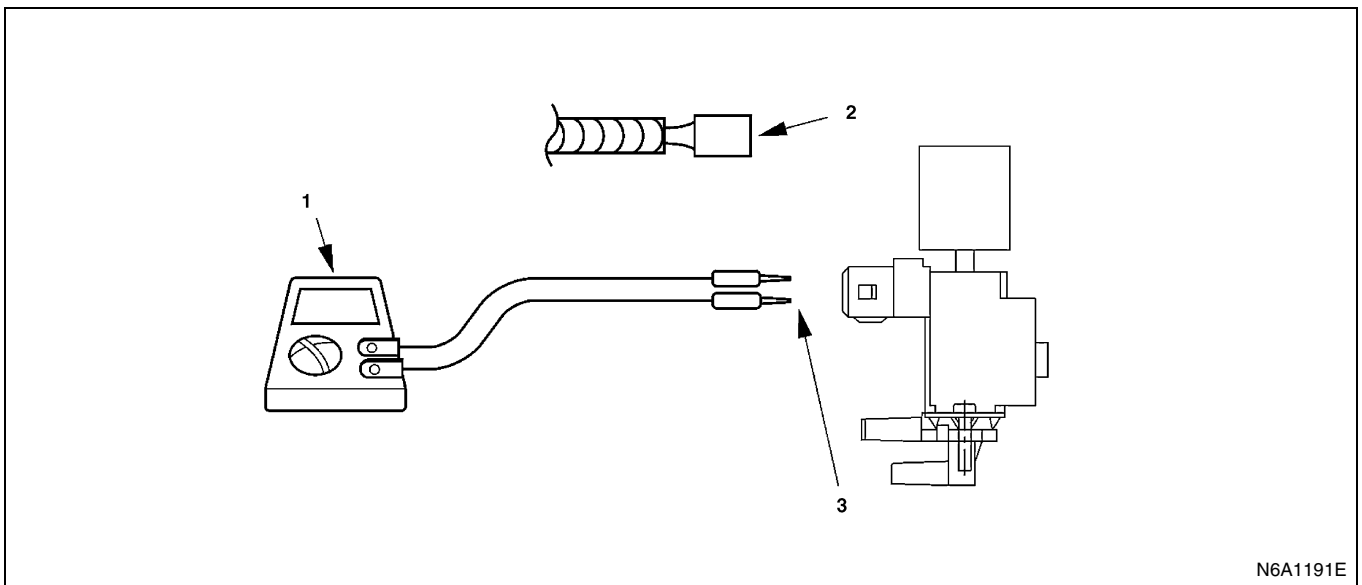
N6A1190E

Legend

- 1. To EVRV: EGR
- 2. 2 pin

Connector No	Signal
1	GND
2	SIG

Measure Resistance at EVRV: EGR



N6A1191E

Legend

- 1. Circuit tester
- 2. Remove EVRV wire harness
- 3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Black	2 ↔ 1	12±1 (for 12 volt) 48±2 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

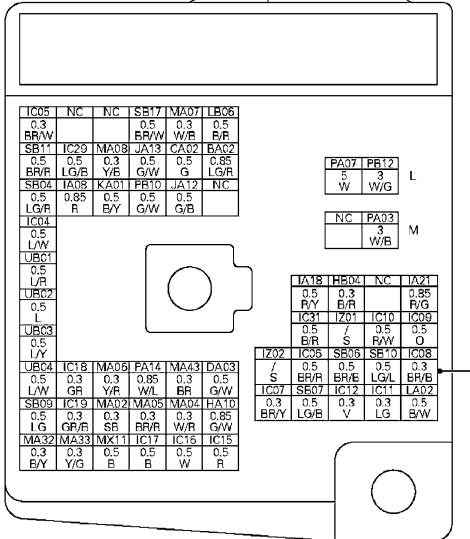
Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check performed?	—	Go to Step 2	Go to self diag system check
2	1. Ignition "OFF" 2. Disconnect the EVRV from the wiring harness connector. 3. Check a short to voltage of the EVRV signal circuit and GND circuit between the EVRV connector and the ECM. 4. Repair if necessary. Has DTC32 been corrected?	—	Go to Step 5	Go to Step 3
3	1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of EVRV circuit between the ECM and EVRV connector 4. Repair if necessary. Has DTC32 been corrected?	—	Go to Step 5	Go to Step 4
4	Replace the ECM. Is the action complete?		Go to Step 5	—
5	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC32 all right under Scan Tool Check?	—	Go to Step 6	Go to Step 2
6	Is any current trouble other than DTC32 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P33 Variable Swirl System (VSS) Control Circuit Low Voltage

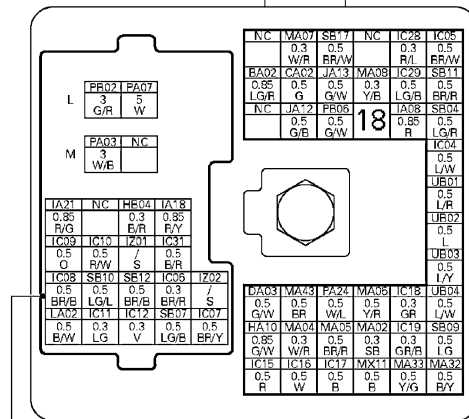
ENGINE CONTROL MODULE (ECM) 22PIN

IC11	IC13	IC18	IC19	NC			NC	NC	NC	MA19	HB04	IC05
0.3 LG	0.3 V	0.3 GR	0.3 GR/B							0.3 O/L	0.3 B/R	0.3 BR/W
NC	NC	NC	SB18	IC03	NC	NC	NC	NC	NC	IC07	SB17	IC08
			0.5 LG	0.3 B/W						0.3 BR/Y	0.5 BR/W	0.3 BR/B

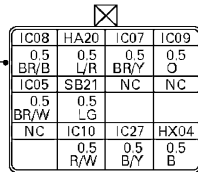
FRAME H.CONN.



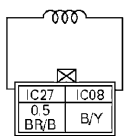
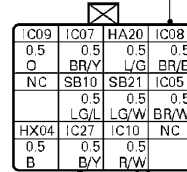
BODY HARNESS CONNECTION



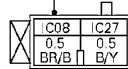
FRAME HARNESS



VSV.H.CONN.



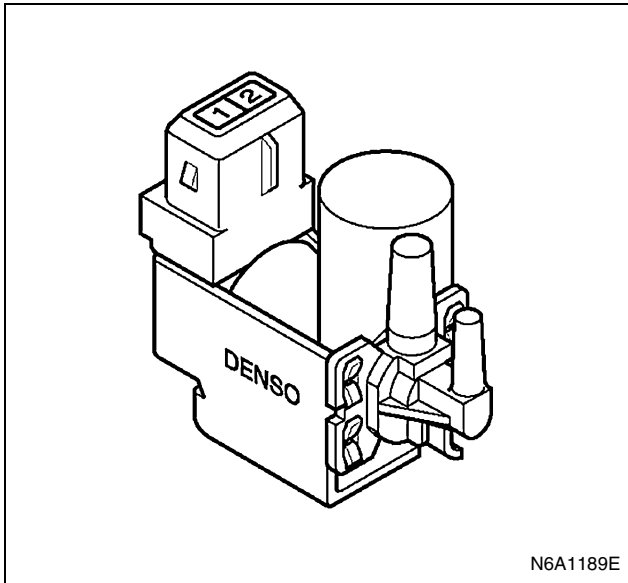
VSV;VSS



FUSE

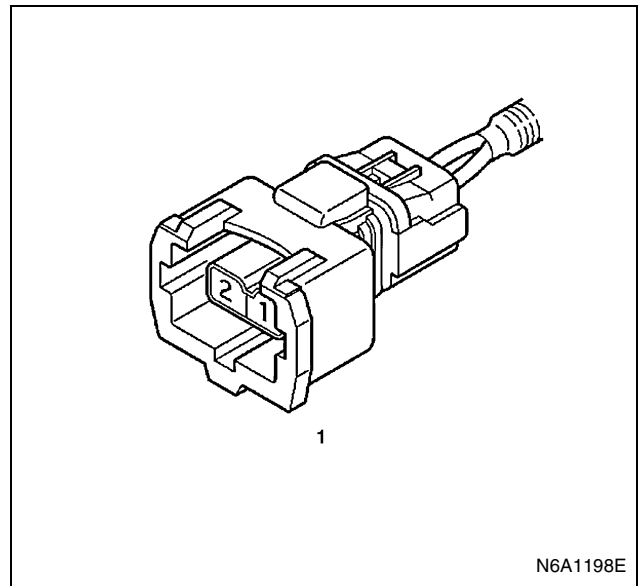
Appearance of VSV for VSS and Connector Name

VSV for VSS



N6A1189E

VSV Connector



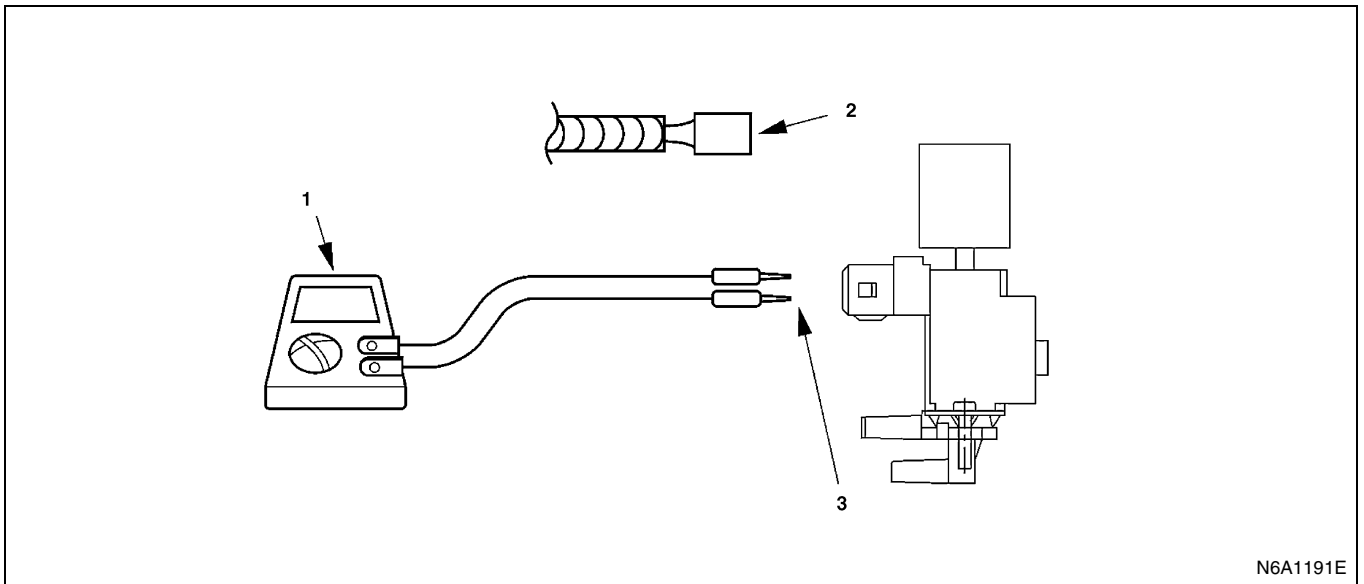
N6A1198E

Legend

- 1. 2 pin

Connector No	Signal
1	SIG
2	GND

Measure Resistance at VSV for VSS



N6A1191E

Legend

- 1. Circuit tester
- 2. Remove VSV wire harness
- 3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Gray	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

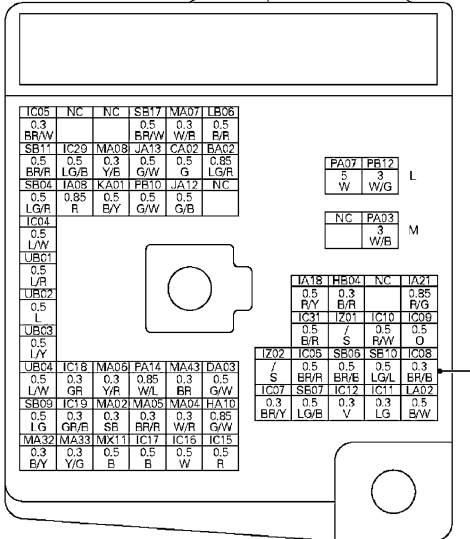
Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the VSV from the wiring harness connector. 3. Ignition "ON" Engine "OFF" 4. Using the Digital Voltmeter (DVM), check for voltage on the "IC27" of the VSV harness connector. <p>Does the DVM read the following value?</p>	12 Volt or 24 Volt	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> 1. Check the suspect circuit between the VSV connector and "Engine Ignition." Fuse for the following condition. <ul style="list-style-type: none"> • A short to ground • An open circuit 2. Repair if necessary. <p>Has DTC 33 been corrected?</p>	—	Go to Step 8	—
4	<p>Using the DVM, check the resistance of the VSV.</p> <p>Does the DVM read the following Value?</p>	37 — 44Ω (for 12 Volt) 159 — 169Ω (for 24 Volt)	Go to Step 5	Go to Step 6
5	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the VSV circuit between the ECU and VSV connector. <ul style="list-style-type: none"> • A short to ground • An open circuit 4. Repair if necessary. <p>Has DTC 33 been corrected?</p>	—	Go to Step 8	Go to Step 7
6	<p>Replace the VSV.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
7	<p>Replace the ECM.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
8	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" <p>Is DTC 33 all right under Scan Tool Check?</p>	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 33 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P34 Variable Swirl System (VSS) Control Circuit High Voltage

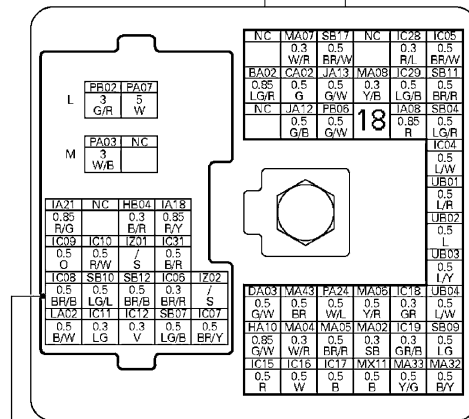
ENGINE CONTROL MODULE (ECM) 22PIN

IC11	IC13	IC18	IC19	NC			NC	NC	NC	MA19	HB04	IC05
0.3 LG	0.3 V	0.3 GR	0.3 GR/B							0.3 O/L	0.3 B/R	0.3 BR/W
NC	NC	NC	SB18	IC03	NC	NC	NC	NC	NC	IC07	SB17	IC08
			0.5 LG	0.3 B/W						0.3 BR/Y	0.5 BR/W	0.3 BR/B

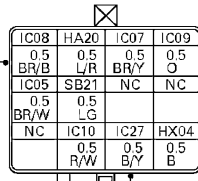
FRAME H.CONN.



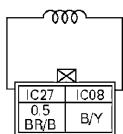
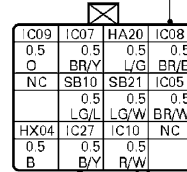
BODY HARNESS CONNECTION



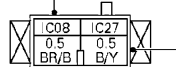
FRAME HARNESS



VSV.H.CONN.



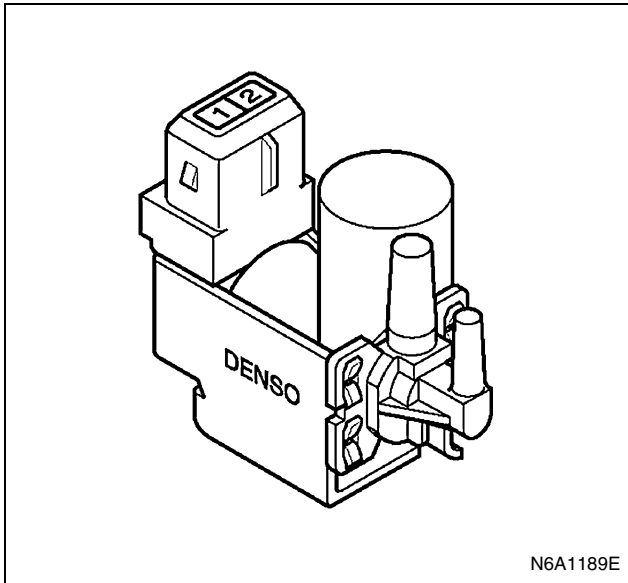
VSV;VSS



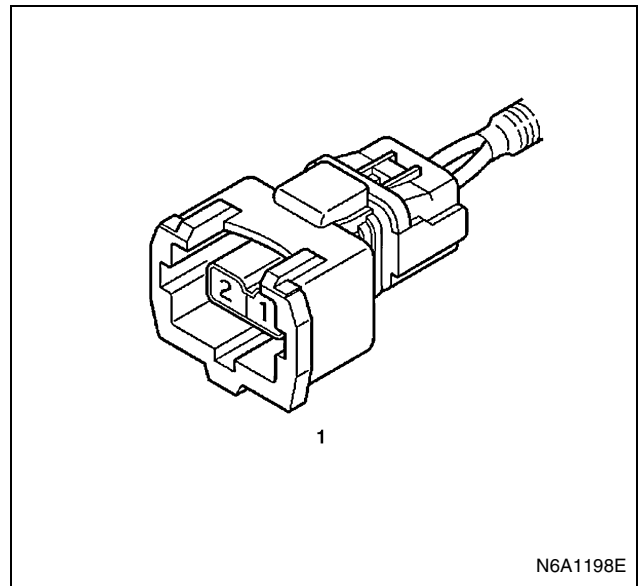
FUSE

Appearance of VSV for VSS and Connector Name

VSV for VSS



VSV Connector

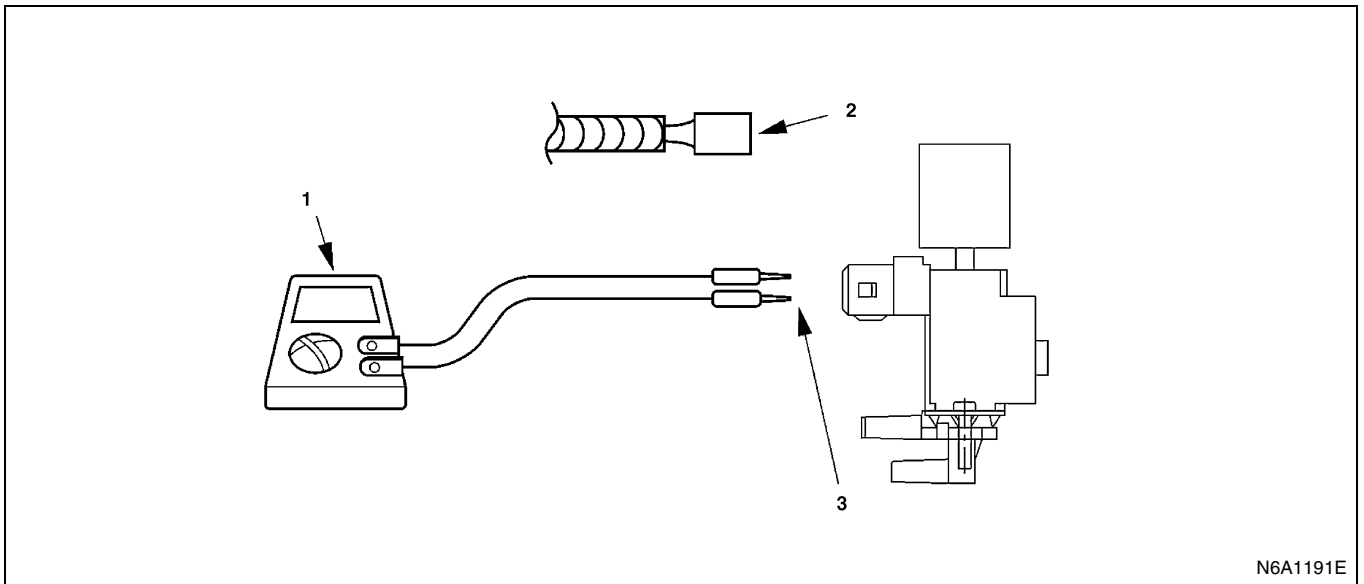


Legend

1. 2 pin

Connector No	Signal
1	SIG
2	GND

Measure Resistance at VSV for VSS



Legend

1. Circuit tester
 2. Remove VSV wire harness
 3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Gray	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

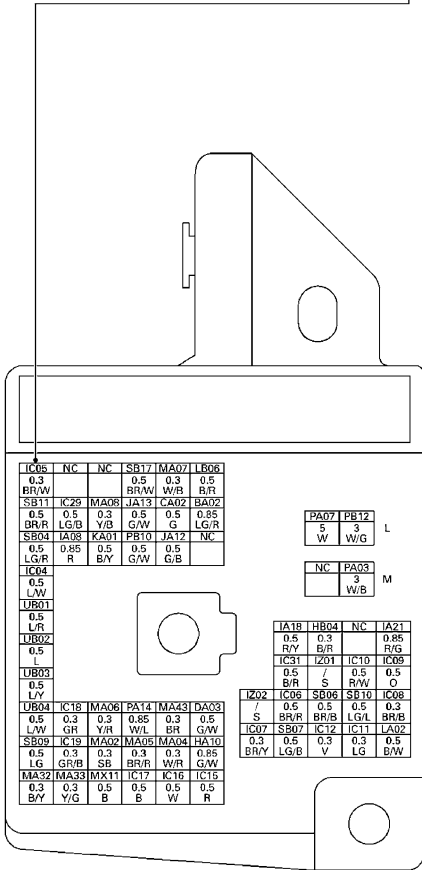
Resistance value is difference according to the engine temperature (condition of engine warming up).

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	Using the DVM, check the resistance of the VSV. Does the DVM read the following Value?	37 — 44Ω (for 12 Volt) 159 — 169Ω (for 24 Volt)	Go to Step 3	Go to Step 4
3	1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of VSV circuit between the ECM and VSV connector 4. Repair if necessary. Has DTC 34 been corrected?	—	Go to Step 6	Go to Step 5
4	Replace the VSV. Is the action complete?	—	Go to Step 6	—
5	Replace the ECM. Is the action complete?	—	Go to Step 6	—
6	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 34 all right under Scan Tool Check?	—	Go to Step 7	Go to Step 2
7	Is any current trouble other than DTC 34 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

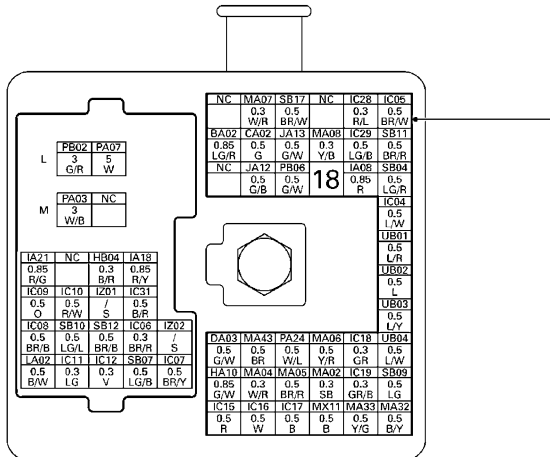
DTC-P35 Exhaust Gas Recirculation (EGR) Quick Cut Vacuum Switching Valve (VSV) Control Circuit Low Voltage

ENGINE CONTROL MODULE (ECM) 22PIN

IC11	IC13	IC18	IC19	NC	NC	NC	NC	MA19	HB04	IC05
0.3 LG	0.3 V	0.3 GR	0.3 GR/B					0.3 O/L	0.3 B/R	0.3 BR/W
NC	NC	NC	SB18	IC03	NC	NC	NC	IC07	SB17	IC08
			0.5 LG	0.3 B/W				0.3 B/Y	0.5 BR/W	0.3 BR/B

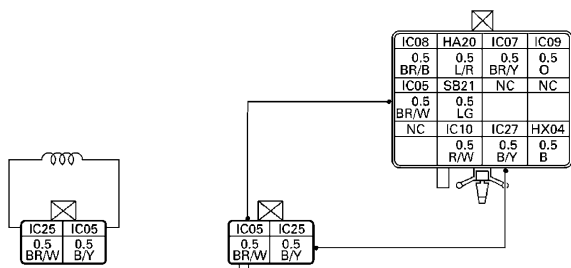


FRAME H.CONN.



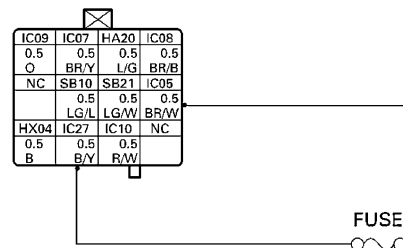
BODY HARNESS CONNECTION

FRAME HARNESS



VSV:EGR CUT

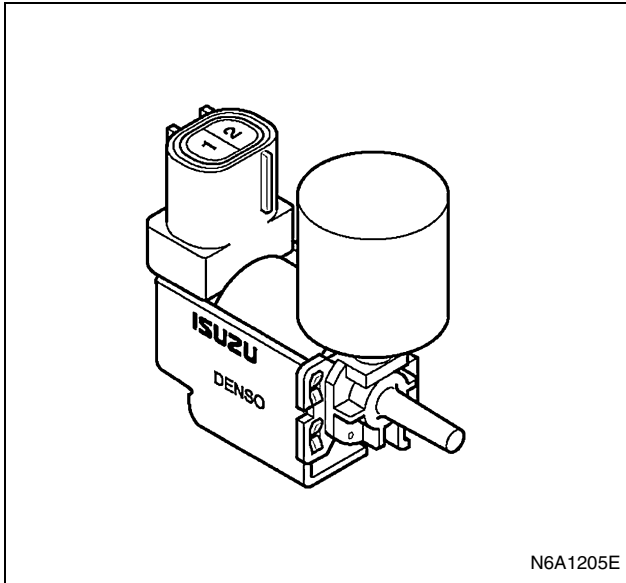
VSV.H.CONN.



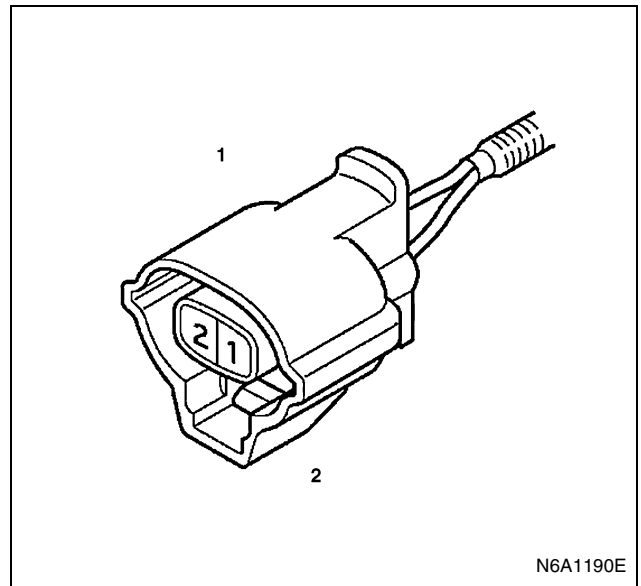
FUSE

Appearance of Vacuum Switching Valve (VSV): Exhaust Gas Recirculation (EGR) CUT and Connector Name

VSV: EGR CUT



VSV: EGR CUT Connector

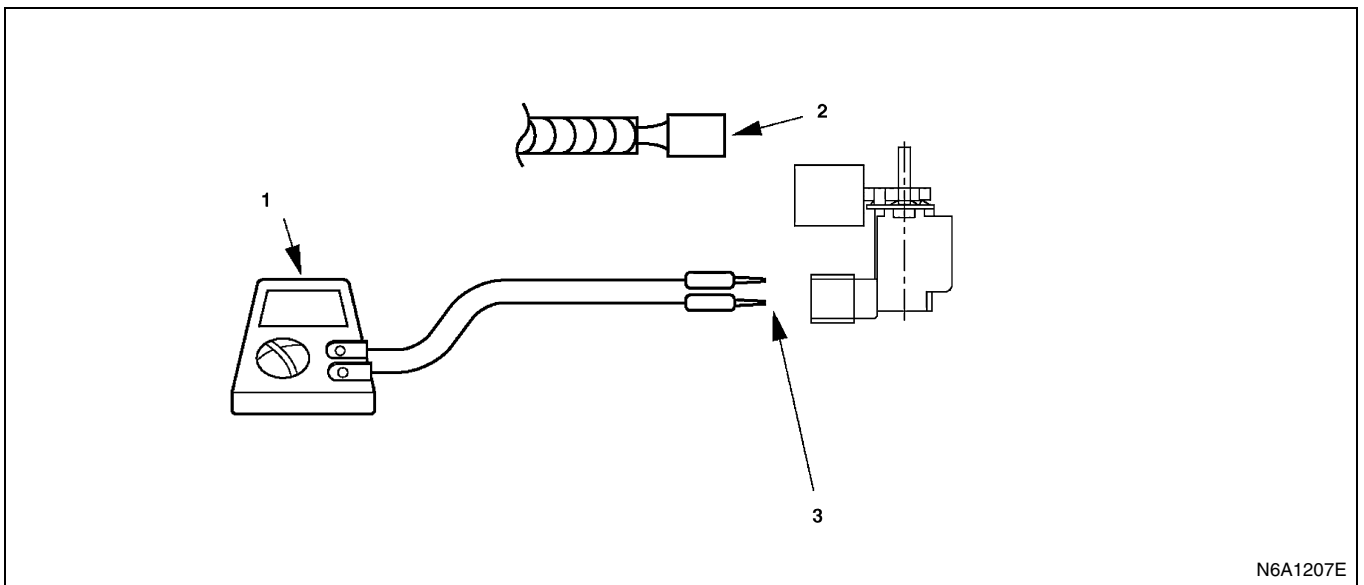


Legend

- 1. To VSV: EGR
- 2. 2 pin

Connector No	Signal
1	SIG
2	GND

Measure Resistance at VSV: EGR CUT



Legend

- 1. Circuit tester
- 2. Remove VSV wire harness
- 3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Black	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

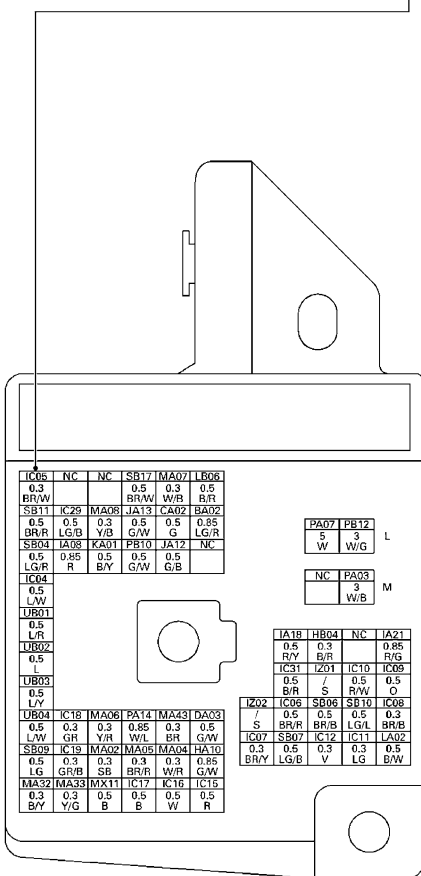
Resistance value is difference according to the engine temperature (condition of engine warming up).

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the VSV from the wiring harness connector. 3. Ignition "ON" Engine "OFF" 4. Using the Digital Voltmeter (DVM), check for voltage on the "IC25" of the VSV harness connector. <p>Does the DVM read the following value?</p>	12 Volt or 24 Volt	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> 1. Check the suspect circuit between the VSV connector and "Engine Ignition." Fuse for the following condition. <ul style="list-style-type: none"> • A short to ground • An open circuit 2. Repair if necessary. <p>Has DTC 35 been corrected?</p>	—	Go to Step 8	—
4	<p>Using the DVM, check the resistance of the VSV.</p> <p>Does the DVM read the following Value?</p>	37 — 44Ω (for 12 Volt) 159 — 169Ω (for 24 Volt)	Go to Step 5	Go to Step 6
5	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the VSV circuit between the ECM and VSV connector. <ul style="list-style-type: none"> • A short to ground • An open circuit 4. Repair if necessary. <p>Has DTC 35 been corrected?</p>	—	Go to Step 8	Go to Step 7
6	<p>Replace the VSV.</p> <p>Is the action complete?</p>		Go to Step 8	—
7	<p>Replace the ECM.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
8	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" <p>Is DTC 35 all right under Scan Tool Check?</p>	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 35 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

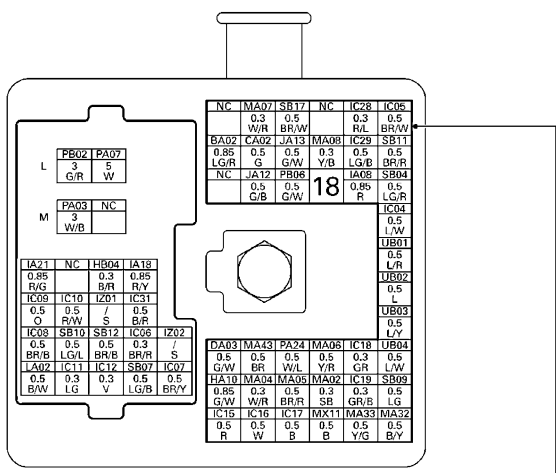
DTC-P36 Exhaust Gas Recirculation (EGR) Quick Cut Vacuum Switching Valve (VSV) Control Circuit High Voltage

ENGINE CONTROL MODULE (ECM) 22PIN

IC11	IC13	IC18	IC19	NC			NC	NC	MA19	HB04	IC05
0.3 LG	0.3 V	0.3 GR	0.3 GR/B						0.3 O/L	0.3 B/R	0.3 BR/W
NC	NC	NC	SB18	IC03	NC	NC	NC	NC	IC07	SB17	IC08
			0.5 LG	0.3 B/W					0.3 B.5	0.3 BR/Y	0.3 BR/B

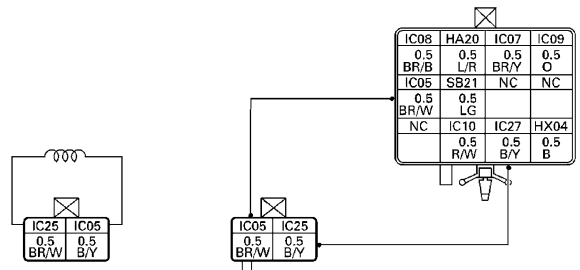


FRAME H.CONN.



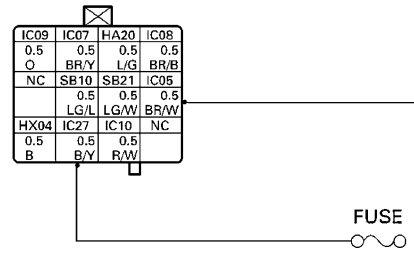
BODY HARNESS CONNECTION

FRAME HARNESS



VSV:EGR CUT

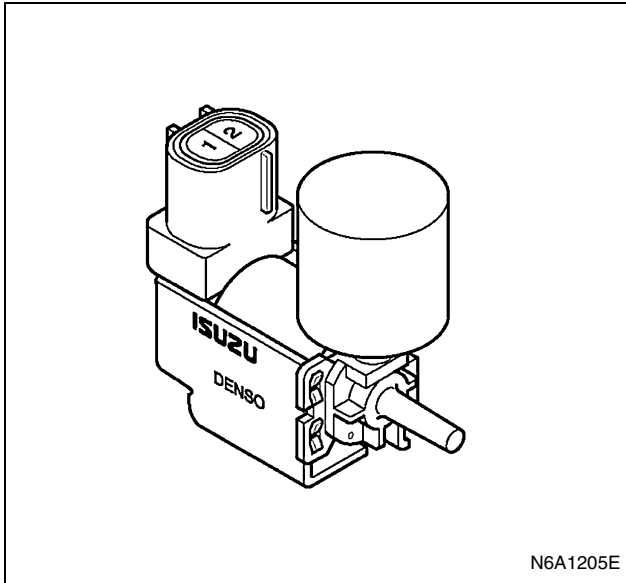
VSV.H.CONN.



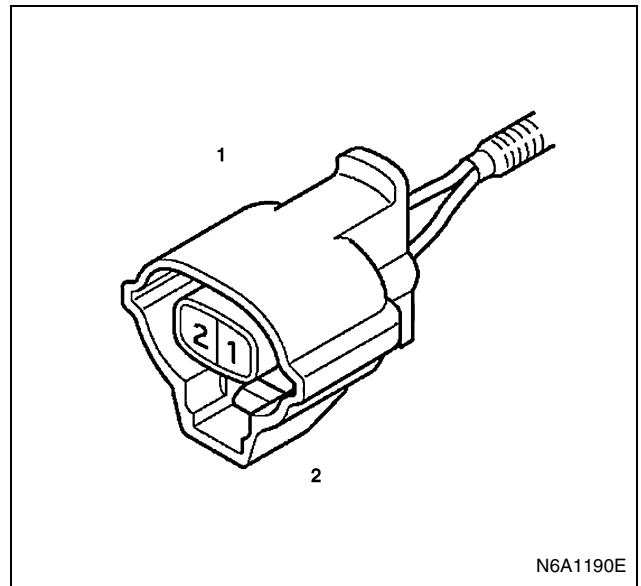
FUSE

Appearance of Vacuum Switching Valve (VSV): Exhaust Gas Recirculation (EGR) CUT Sensor and Connector Name

VSV: EGR CUT



VSV: EGR CUT Connector

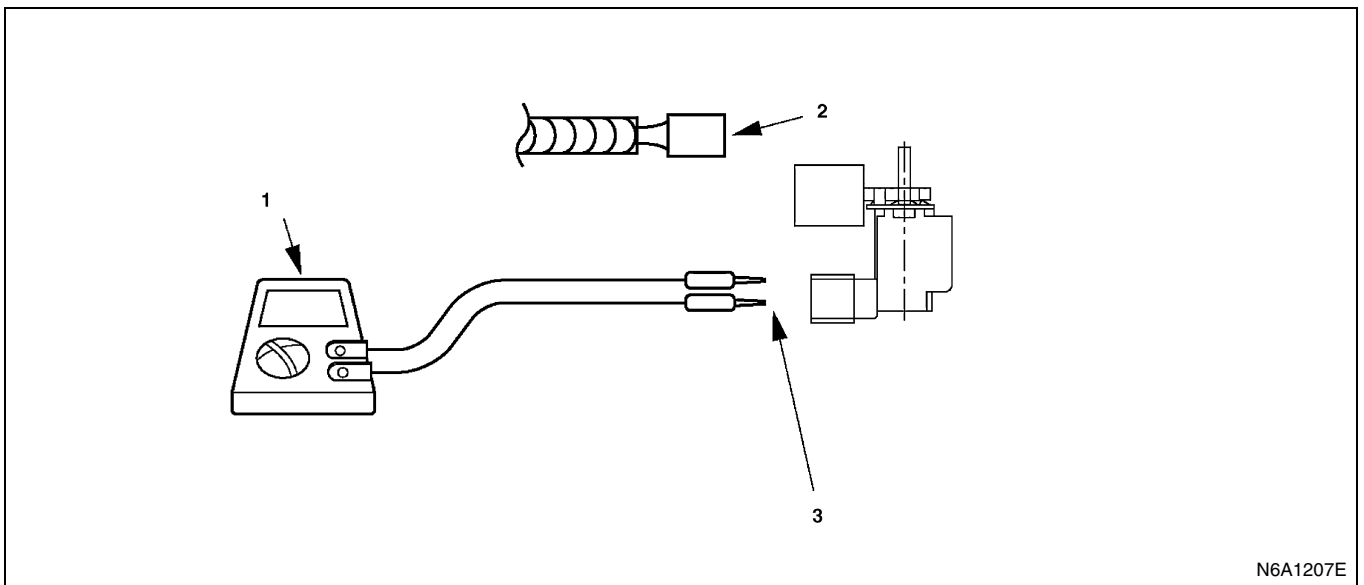


Legend

- 1. To VSV: EGR
- 2. 2 pin

Connector No	Signal
1	SIG
2	GND

Measure Resistance at VSV: EGR CUT



Legend

- 1. Circuit tester
- 2. Remove VSV wire harness
- 3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

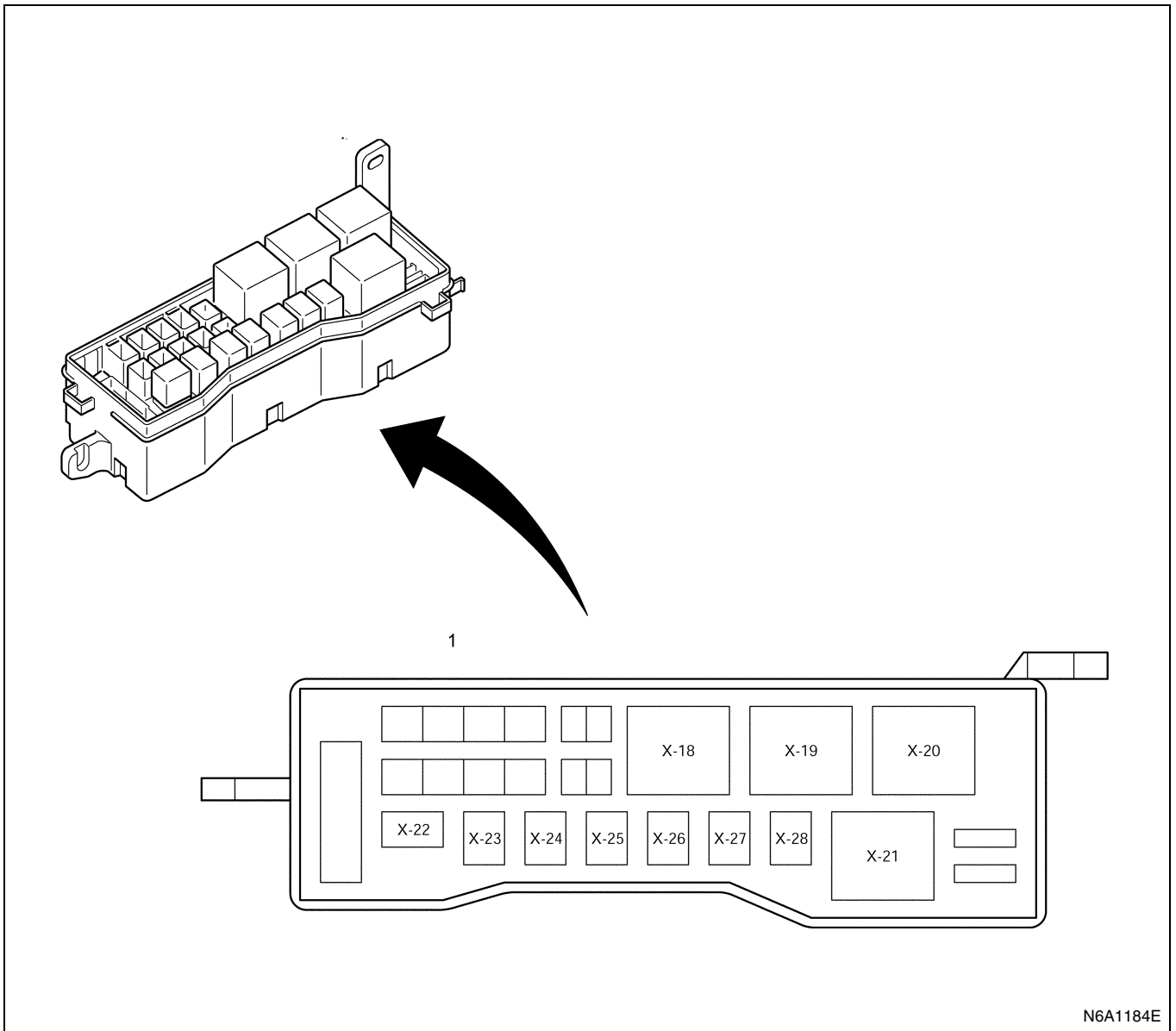
Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Black	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	Using the DVM, check the resistance of the VSV. Does the DVM read the following Value?	37 — 44Ω (for 12 Volt) 159 — 169Ω (for 24 Volt)	Go to Step 3	Go to Step 4
3	1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of VSV circuit between the ECM and VSV connector. 4. Repair if necessary. Has DTC 36 been corrected?	—	Go to Step 6	Go to Step 5
4	Replace the VSV. Is the action complete?	—	Go to Step 6	—
5	Replace the ECM. Is the action complete?	—	Go to Step 6	—
6	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 36 all right under Scan Tool Check?	—	Go to Step 7	Go to Step 2
7	Is any current trouble other than DTC 36 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

Location of Relay

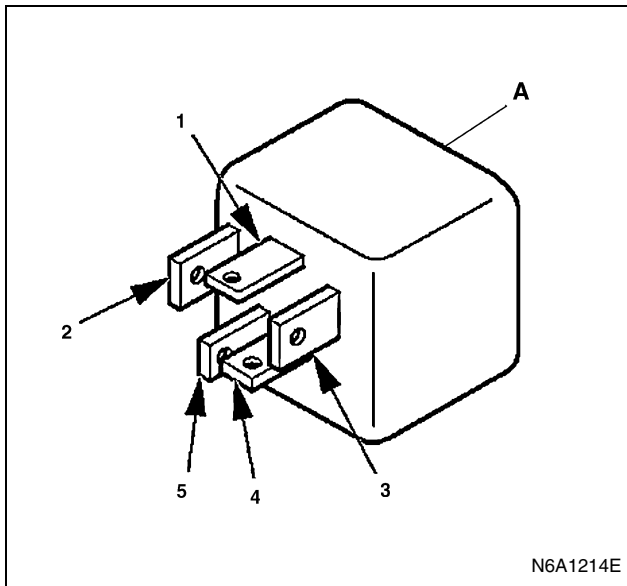


Legend

1. Relay box (Installed on the left side rear of the cab)

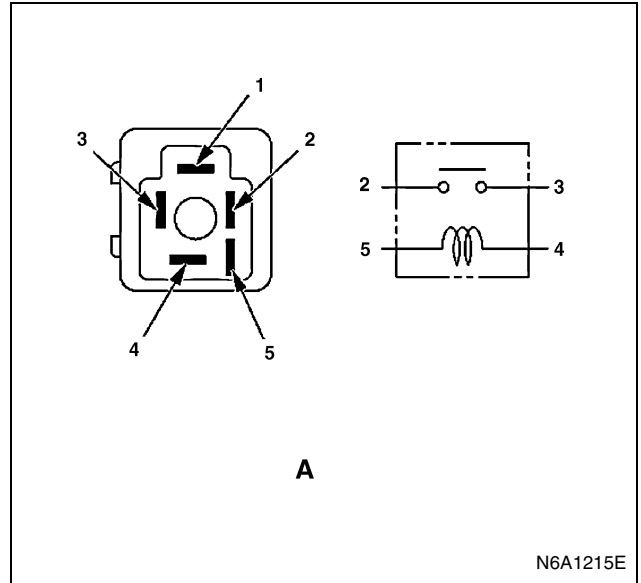
NO	RELAY NAME
X-20	Glow plug
X-21	Starter
X-22	Marker lamp
X-23	Rear fog
X-24	A/C COMP, 4WD ind. lamp
X-25	Exh, Brake control
X-26	CSD, A/C ON SIGNAL
X-27	Condenser fan
X-28	Exh. Brake cut

Inspection for quick on start (QOS) power cut relay



Legend

A. QOS relay



Legend

A. QOS relay

Resistance value

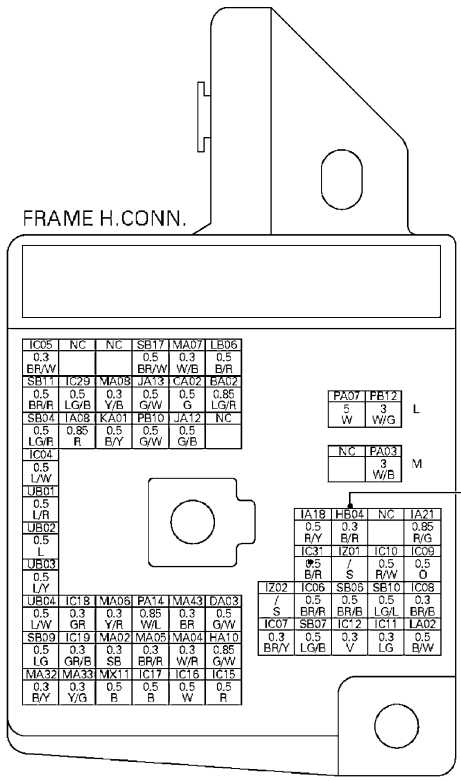
Inspection Point		Resistance	Reference
Inspection relay unit	4 ↔ 5	23 (Ω) (for 12 volt) 100 (Ω) (for 24 volt)	
	2 ↔ 3	∞	Not be supplied electricity to coil
		Below 0.5 (Ω)	Be supplied electricity to coil

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the Relay from the Relay box connector. 3. Ignition "ON" Engine "OFF" 4. Using the Digital Voltmeter (DVM), check for voltage on the "HBOL" terminal of the Relay Box Connector. <p>Does the DVM read the following value?</p>	12 Volt or 24 Volt	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> 1. Check the suspect circuit between the Relay connector. Fuse for the following condition. <ul style="list-style-type: none"> • A short to ground • An open circuit 2. Repair if necessary. <p>Has DTC 41 been corrected?</p>	—	Go to Step 8	Go to Step 4
4	<p>Using the DVM, check the resistance of inter "4" "5" Relay terminal.</p> <p>Does the DVM read the following Value?</p>	23Ω (for 12 Volt) 100Ω (for 24 Volt)	Go to Step 5	Go to Step 6
5	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the VSV circuit between the ECU and Relay connector. <ul style="list-style-type: none"> • A short to ground • An open circuit 4. Repair if necessary. <p>Has DTC 41 been corrected?</p>	—	Go to Step 8	Go to Step 7
6	<p>Replace the Relay.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
7	<p>Replace the ECM.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
8	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" <p>Is DTC 41 all right under Scan Tool Check?</p>	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 41 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

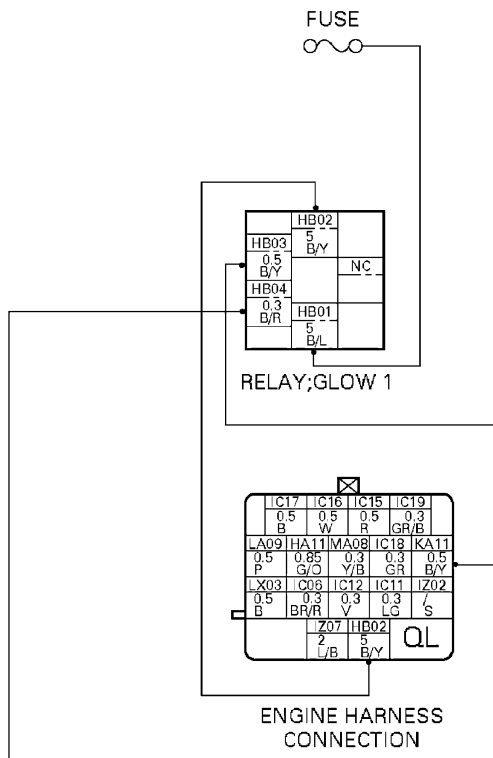
DTC-P42 Quick On Start (QOS) Relay Control Circuit High Voltage

IC11	IC13	IC18	IC19	NC	NC	NC	MA19	HB04	IC05
0.3 LG	0.3 V	0.3 CR	0.3 GR/B				0.3 O/L	0.3 B/R	0.3 BR/W
NC	NC	NC	SB18	IC03	NC	NC	IC07	SB17	IC08
			0.3 LG	0.3 B/W			0.3 BR/Y	0.5 BR/W	0.3 BR/B

ENGINE CONTROL MODULE (ECM) 22PIN

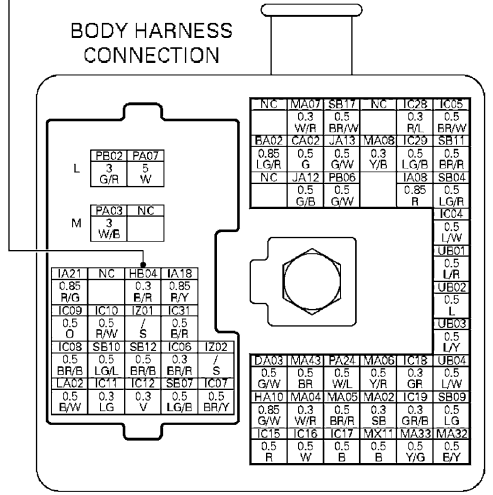


FRAME H.CONN.



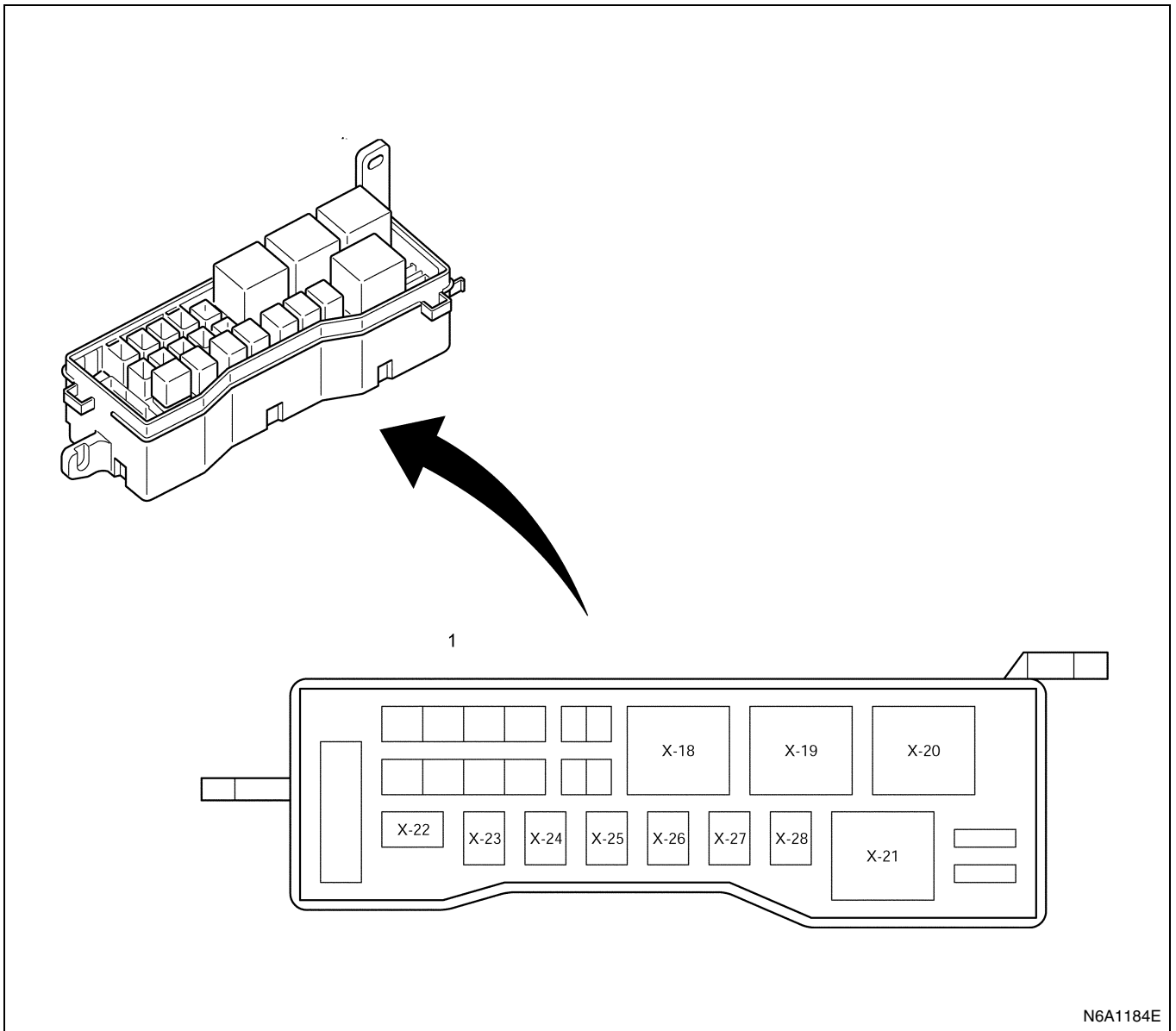
RELAY; GLOW 1

ENGINE HARNESS CONNECTION



BODY HARNESS CONNECTION

Location of Relay



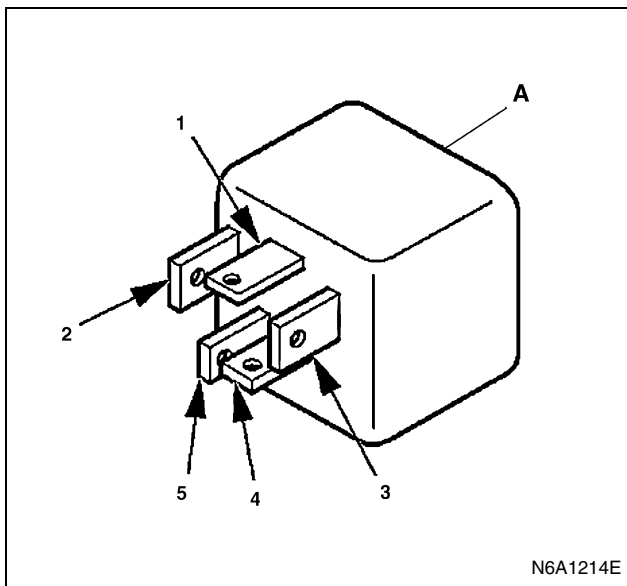
N6A1184E

Legend

1. Relay box (Installed on the left side rear of the cab)

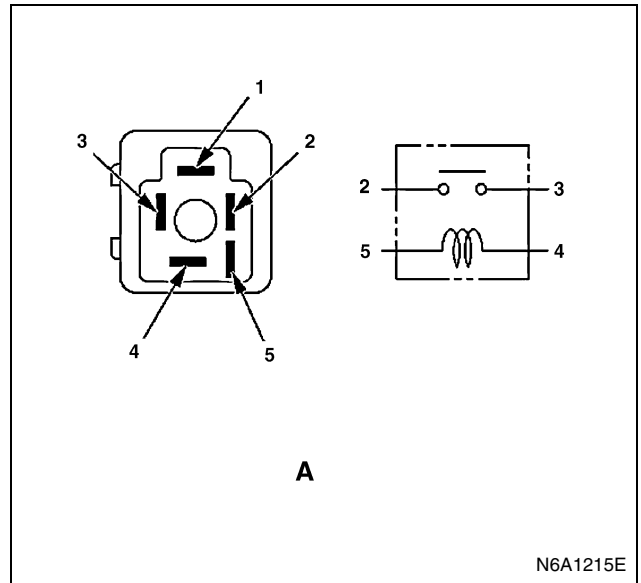
NO	RELAY NAME
X-20	Glow plug
X-21	Starter
X-22	Marker lamp
X-23	Rear fog
X-24	A/C COMP, 4WD ind. lamp
X-25	Exh, Brake control
X-26	CSD, A/C ON SIGNAL
X-27	Condenser fan
X-28	Exh. Brake cut

Inspection for quick on start (QOS) power cut relay



Legend

A. QOS relay



Legend

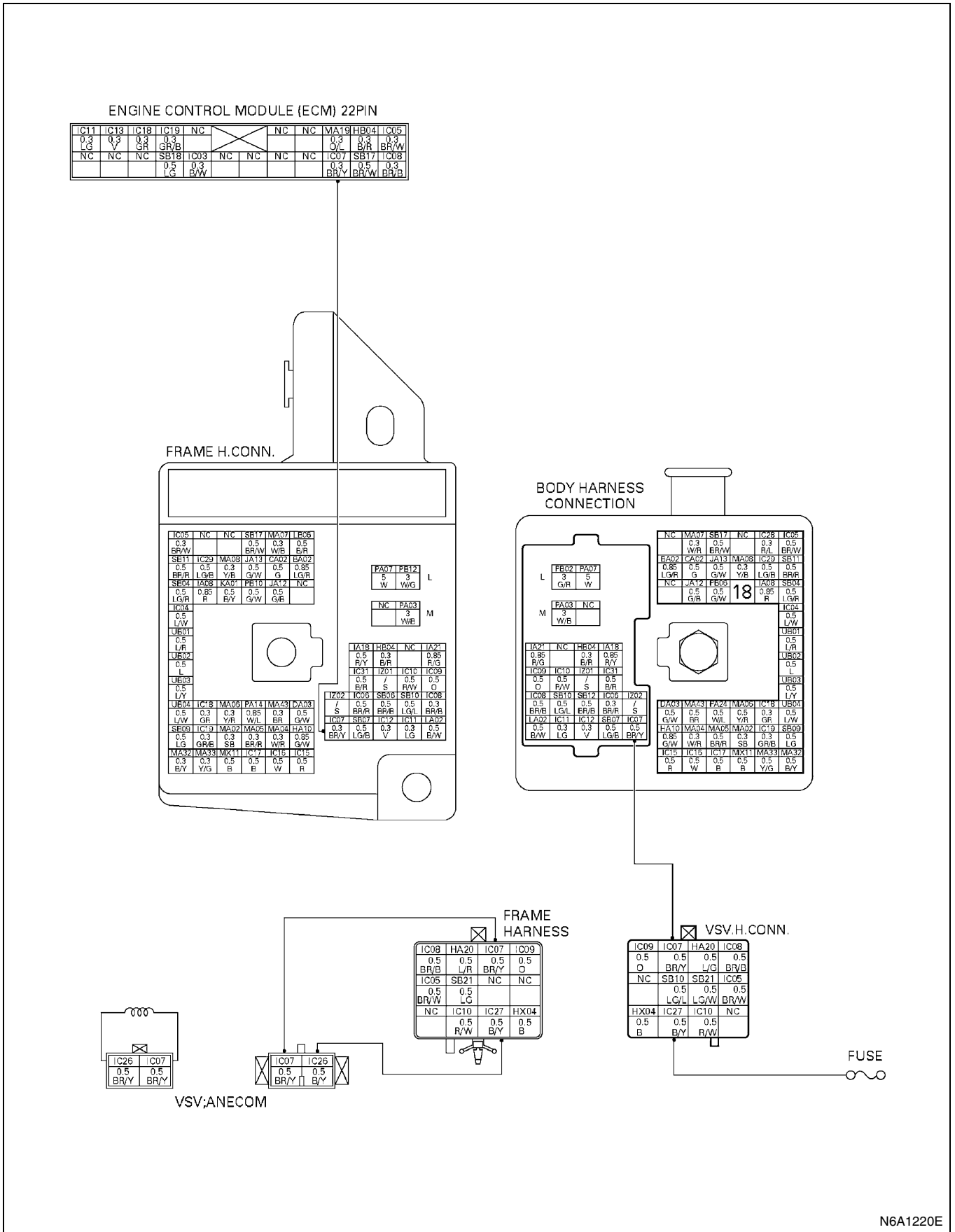
A. QOS relay

Resistance value

Inspection Point		Resistance	Reference
Inspection relay unit	4 ↔ 5	23 (Ω) (for 12 volt) 100 (Ω) (for 24 volt)	
	2 ↔ 3	∞	Not be supplied electricity to coil
		Below 0.5 (Ω)	Be supplied electricity to coil

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition "OFF", with scan tool disconnected. 2. Disconnect the Relay solenoid switch from the Relay box. 3. Apply a circuit tester with the voltage range or a test light to the output circuit for the Relay. 4. Ignition "ON", Engine "OFF". Is voltage as prescribed, or is test Light lit until 18 seconds?	$\geq 8V$ or light "ON" (for 12 Volt) $\geq 16V$ or light "ON" (for 24 Volt)	Go to Step 3	Go to Step 4
3	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of Relay circuit between the ECM and Relay connector. 4. Repair if necessary. Has DTC 42 been corrected?	—	Go to Step 6	Go to Step 5
4	Replace the VSV. Is the action complete?	—	Go to Step 6	—
5	Replace the ECM. Is the action complete?	—	Go to Step 6	—
6	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 42 all right under Scan Tool Check?	—	Go to Step 7	Go to Step 2
7	Is any current trouble other than DTC 42 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

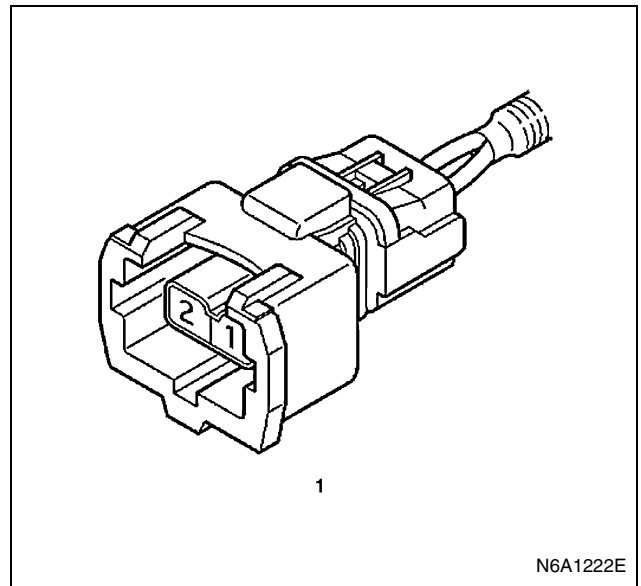
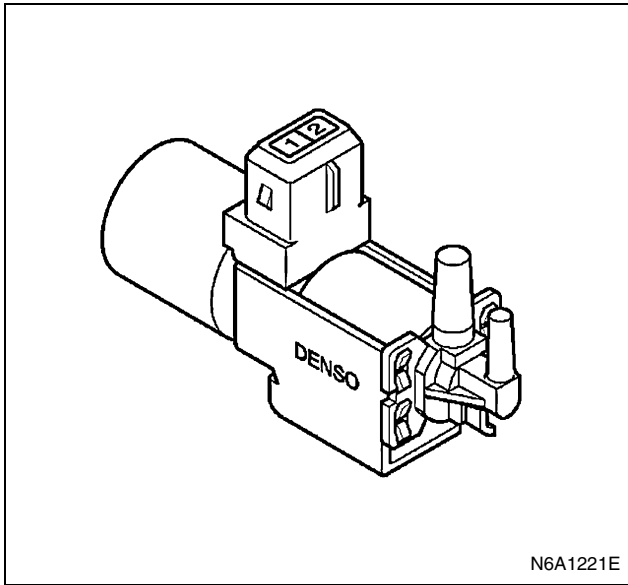
DTC-P43 Aneroid Compensator Vacuum Switching Valve (VSV) Control Circuit Low Voltage



N6A1220E

**Appearance of Vacuum Switching Valve (VSV):
Aneroid Compensator and Connector Name**
VSV: Aneroid Compensator

VSV: Aneroid Compensator

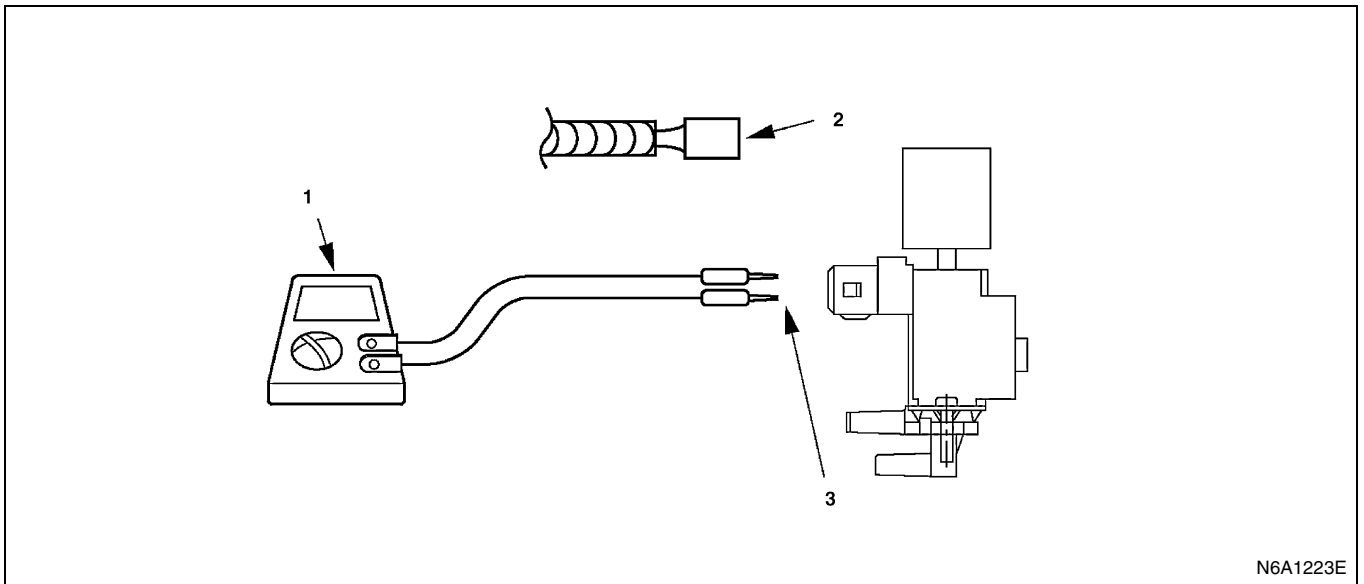


Legend

1. 2 pin

Connector No	Signal
1	SIG
2	GND

Measure Resistance at VSV Aneroid Compensator



Legend

- 1. Circuit tester
- 2. Remove VSV wire harness
- 3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

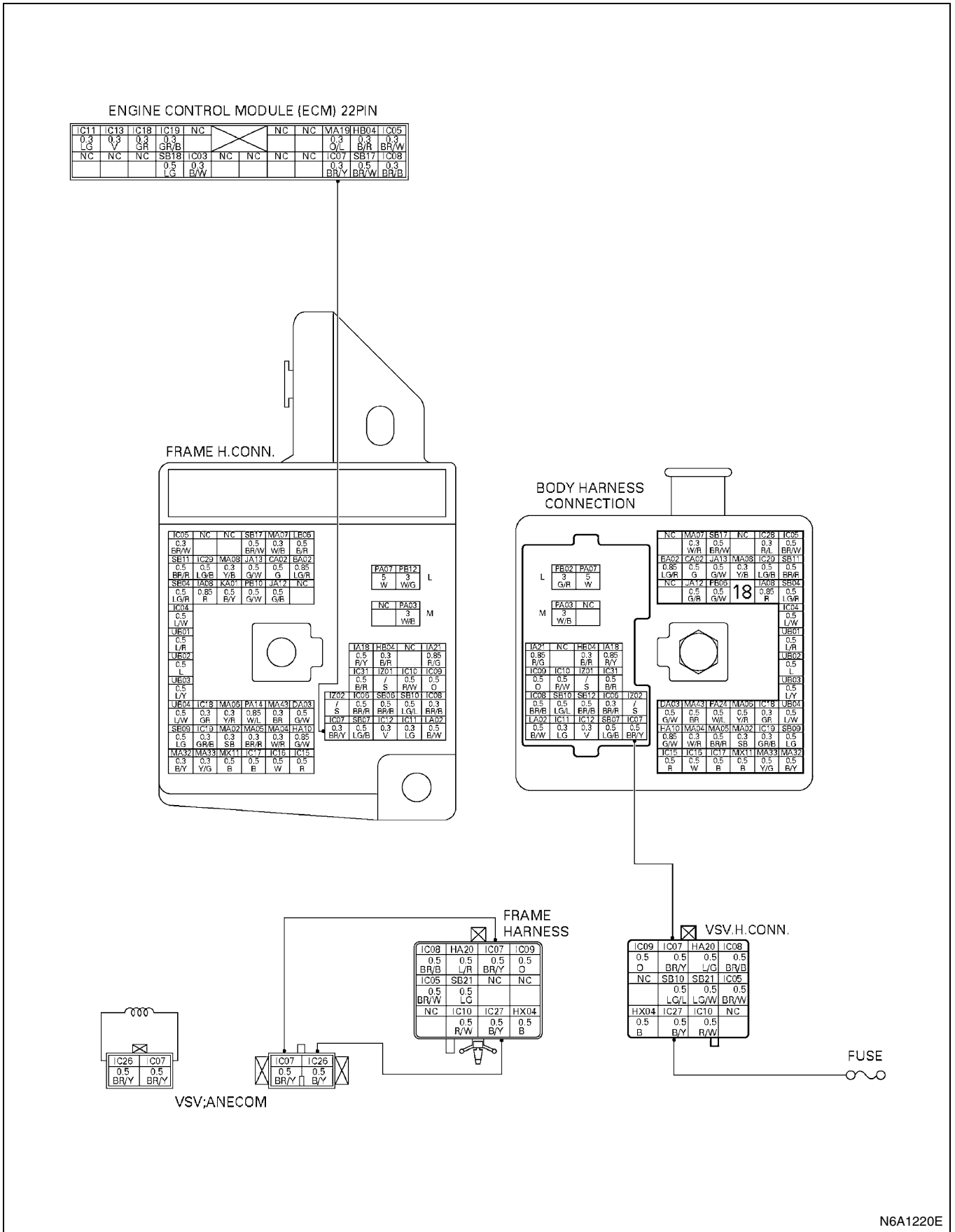
Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Gray	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the VSV from the wiring harness connector. 3. Ignition "ON" Engine "OFF" 4. Using the Digital Voltmeter (DVM), check for voltage on the "IC26" of the VSV harness connector. <p>Does the DVM read the following value?</p>	12 Volt or 24 Volt	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> 1. Check the suspect circuit between the VSV connector and "Engine Ignition." Fuse for the following condition. <ul style="list-style-type: none"> • A short to ground • An open circuit 2. Repair if necessary. <p>Has DTC 43 been corrected?</p>	—	Go to Step 8	Go to Step 4
4	<p>Using the DVM, check the resistance of the VSV.</p> <p>Does the DVM read the following Value?</p>	37 — 44Ω (for 12 Volt) 159 — 169Ω (for 24 Volt)	Go to Step 5	Go to Step 6
5	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the VSV circuit between the ECM and VSV connector. <ul style="list-style-type: none"> • A short to ground • An open circuit 4. Repair if necessary. <p>Has DTC 43 been corrected?</p>	—	Go to Step 8	Go to Step 7
6	<p>Replace the VSV.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
7	<p>Replace the ECM.</p> <p>Is the action complete?</p>	—	Go to Step 9	—
8	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" <p>Is DTC 43 all right under Scan Tool Check?</p>	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 43 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

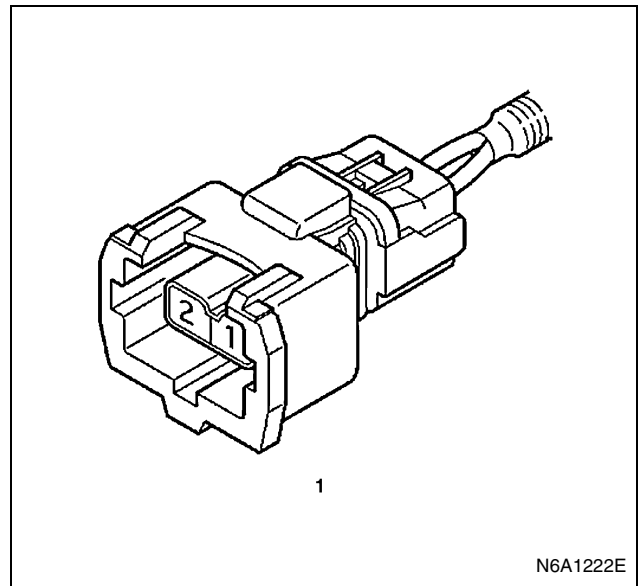
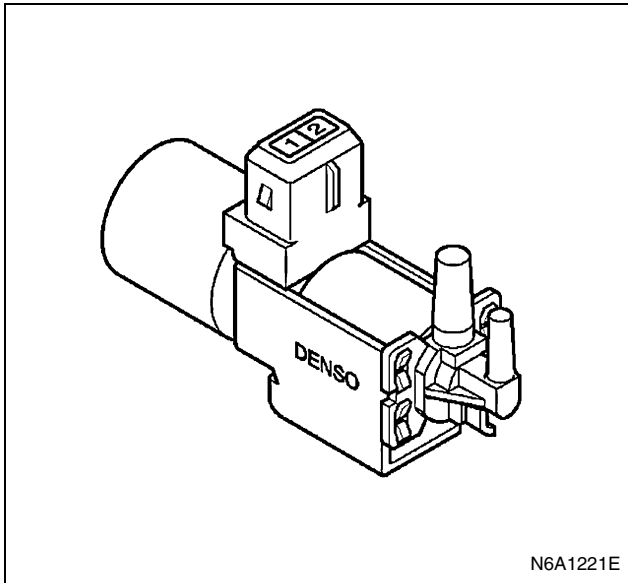
DTC-P44 Aneroid Compensator Vacuum Switching Valve (VSV) Control Circuit High Voltage



N6A1220E

**Appearance of Vacuum Switching Valve (VSV):
Aneroid Compensator and Connector Name**
VSV: Aneroid Compensator

VSV: Aneroid Compensator

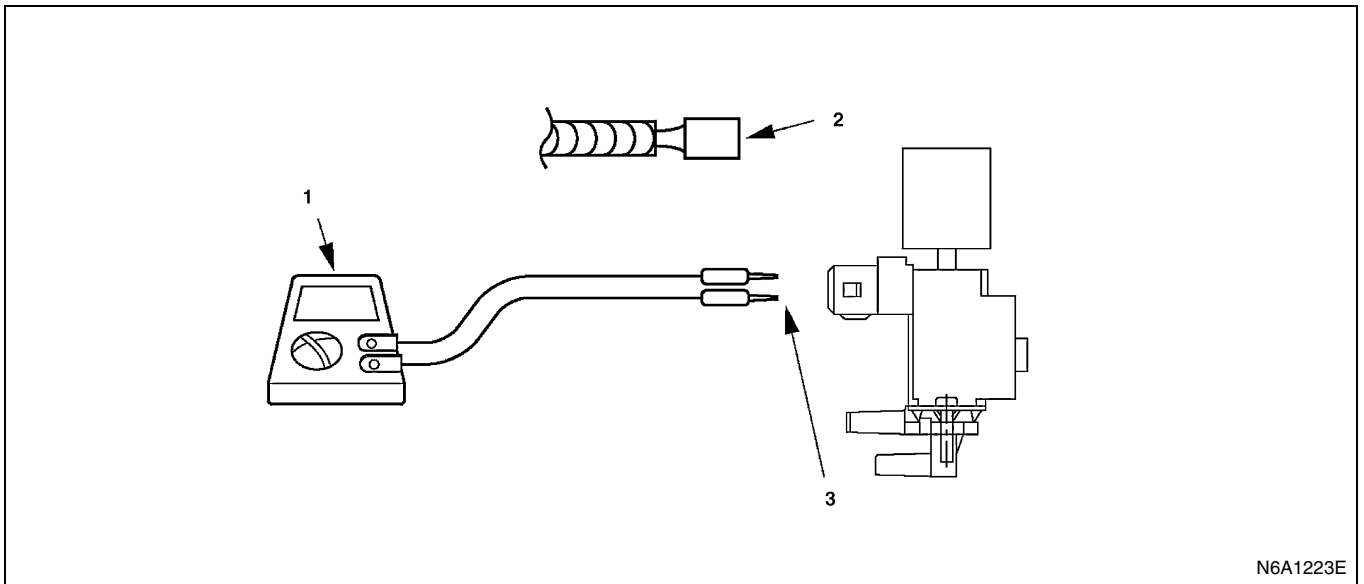


Legend

1. 2 pin

Connector No	Signal
1	SIG
2	GND

Measure Resistance at VSV Aneroid Compensator



Legend

1. Circuit tester
2. Remove VSV wire harness
3. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Green	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

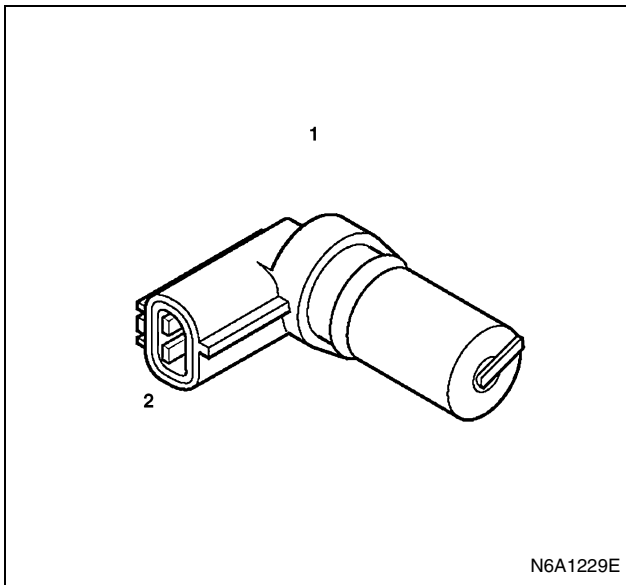
Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	Using the DVM, check the resistance of the VSV. Does the DVM read the following Value?	37 — 44Ω (for 12 Volt) 159 — 169Ω (for 24 Volt)	Go to Step 3	Go to Step 4
3	1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of VSV circuit between the ECM and VSV connector. 4. Repair if necessary. 5. Clear trouble code by Scan Tool. 6. Ignition "ON" Engine "ON". Does the MIL blink?	—	Go to Step 6	Go to Step 5
4	Replace the VSV. Is the action complete?	—	Go to Step 6	—
5	Replace the ECM. Is the action complete?	—	Go to Step 7	—
6	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF". Clear trouble code by Scan Tool. 3. Ignition "ON" Engine "ON". Does the MIL blink?	—	Go to Step 7	Go to Step 2
7	Connect Scan Tool. Is any current trouble other than DTC 44 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

Appearance of Engine Speed Sensor and Connector Name

Engine Speed Sensor

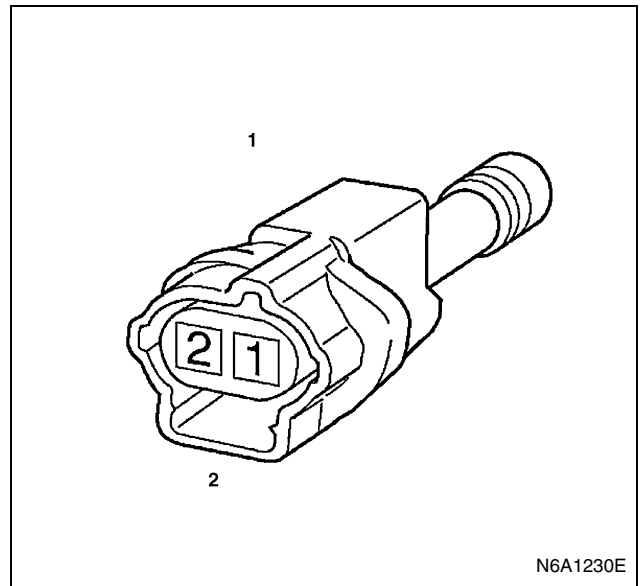


N6A1229E

Legend

1. To engine speed sensor
2. 2 pin

Engine Speed Sensor Connector



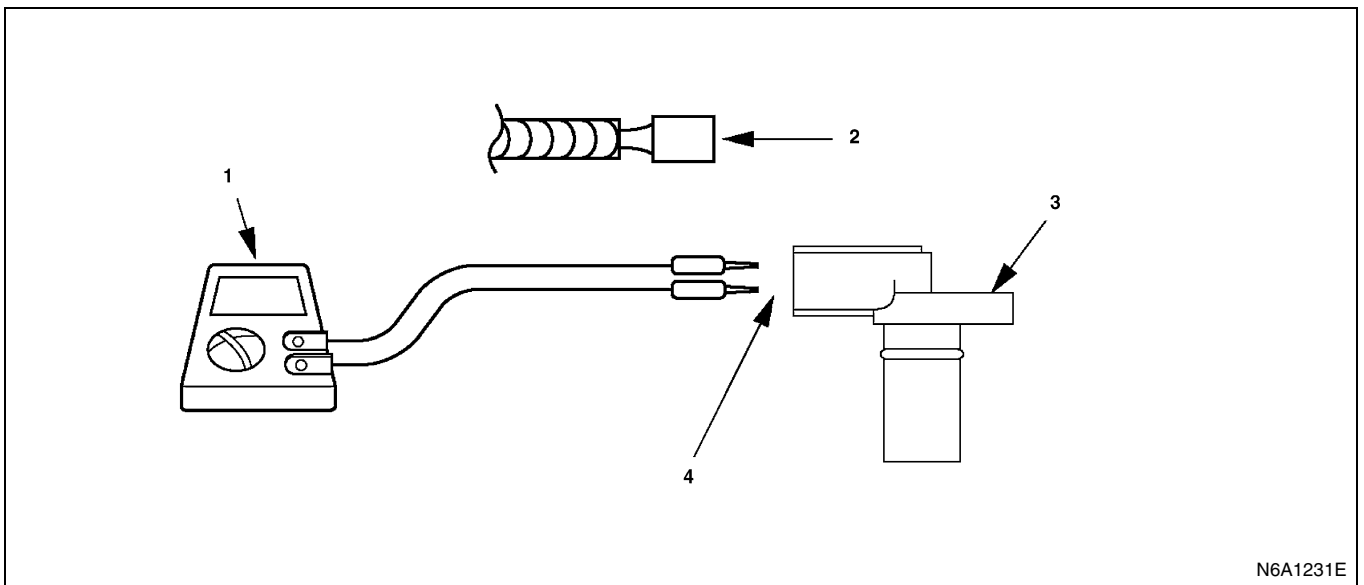
N6A1230E

Legend

1. To engine speed sensor
2. 2 pin

Connector No	Signal
1	GND
2	SIG

Measure Resistance at Engine Speed Sensor



N6A1231E

Legend

1. Circuit tester
2. Remove engine wire harness
3. Engine speed sensor
4. Measure resistance between connector pin

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

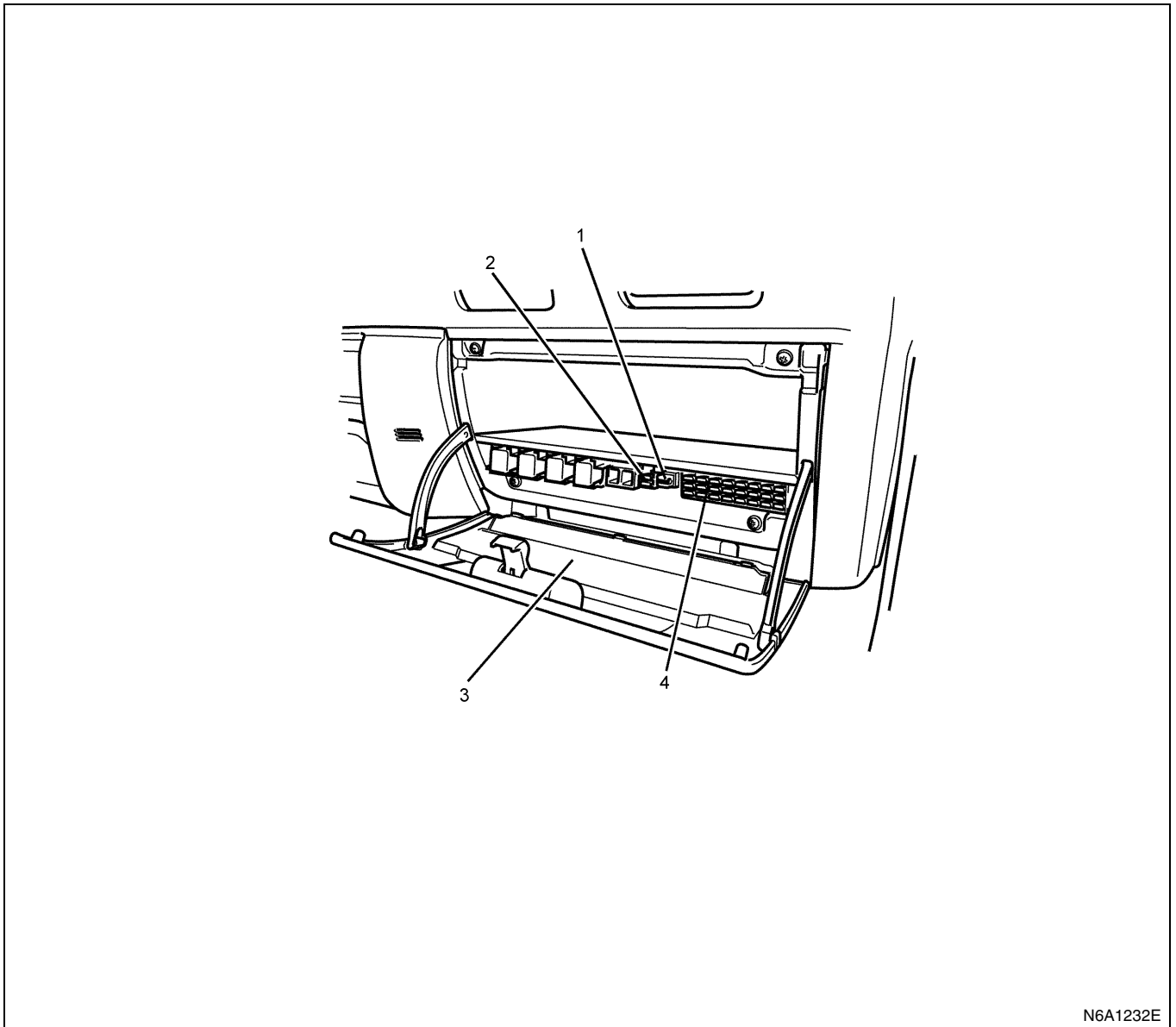
Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Black	2 ↔ 1	840±20%	SIG ↔ GND
	2 ↔ Body	∞	SIG ↔ Body

Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

Location of Fuse



N6A1232E

Legend

- | | |
|----------------|-----------------------|
| 1. Fuse puller | 3. Label |
| 2. Spare fuses | 4. Fuses (F-1 — F-24) |

Step	Action	Value	YES	NO
1	1. Ignition "ON", Engine "OFF" 2. Connect a voltmeter to the ECM connector terminals (ENGINE+) and (ENGINE-) Is the voltage 0V?	—	Go to Step 3	Go to Step 5
2	1. Ignition "ON", Engine "ON" 2. Connect a voltmeter to the ECM connector terminals (ENGINE+) and (ENGINE-). Is the voltage under the range of 0 — 1V (AC intermittently) when the engine speed is about 2000RPM? Does the Voltage increase as the engine speed is increased?	—	Go to Step 4	Go to Step 6
3	Check for poor sensor ground or sensor signal circuit terminal connection and terminal shorted at the ECM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Go to Step 8	Go to Step 4
4	1. Check sensor signal circuit for disconnection and power source for short. 2. Check sensor GND circuit for disconnection and power source for short. 3. Repair if necessary. Was repair needed?	—	Go to Step 8	Go to Step 5
5	1. Check signal circuit for GND short. 2. Repair if necessary. Was repair needed?	—	Go to Step 8	Go to Step 7
6	Replace the sensor. Is the action complete?	—	Go to Step 8	—
7	Replace the ECM. Is the action complete?	—	Go to Step 8	—
8	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" 3. Connect the Scan Tool. 4. Ignition "ON" Engine "OFF" 5. Make Scan Tool indicate engine speed. Is a speed range of 700 rpm to 900 rpm indicated with the engine idling (accel. off)? And as engine speed rises with accel. on, does the indicated value rise?	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 45 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P52 Electronically Erasable Programmable Read Only Memory (EEPROM) Error

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	Replace the ECM. Is the action complete?	—	Go to Step 3	—
3	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 52 all right under Scan Tool Check?	—	Go to Step 4	Go to Step 2
4	Is any current trouble other than DTC 52 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-P61 Barometric Pressure Sensor Circuit Error

Step	Action	Value	YES	NO
1	Was the "on-board diagnostic (OBD) system check" performed?	—	Go to Step 2	Go to self diag system check
2	Replace the ECM. Is the action complete?	—	Go to Step 3	—
3	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 61 all right under Scan Tool Check?	—	Go to Step 4	Go to Step 2
4	Is any current trouble other than DTC 61 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

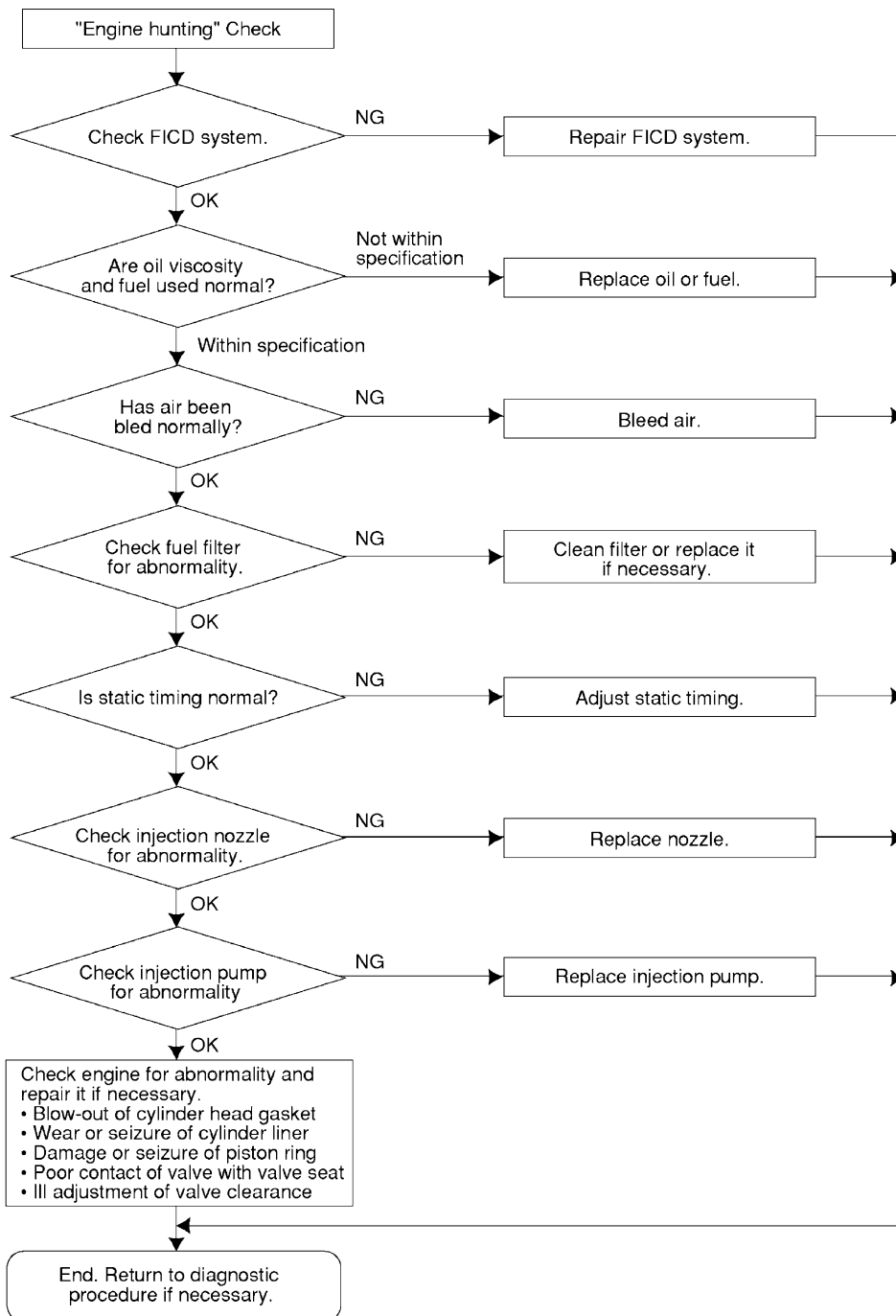
WITHOUT DIAGNOSIS TROUBLE CODE

Introduction

If there occurs a malfunction although no Diagnostic Trouble Code (DTC) is generated, then inspect and repair the system in accordance with the flowcharts given on the following pages.

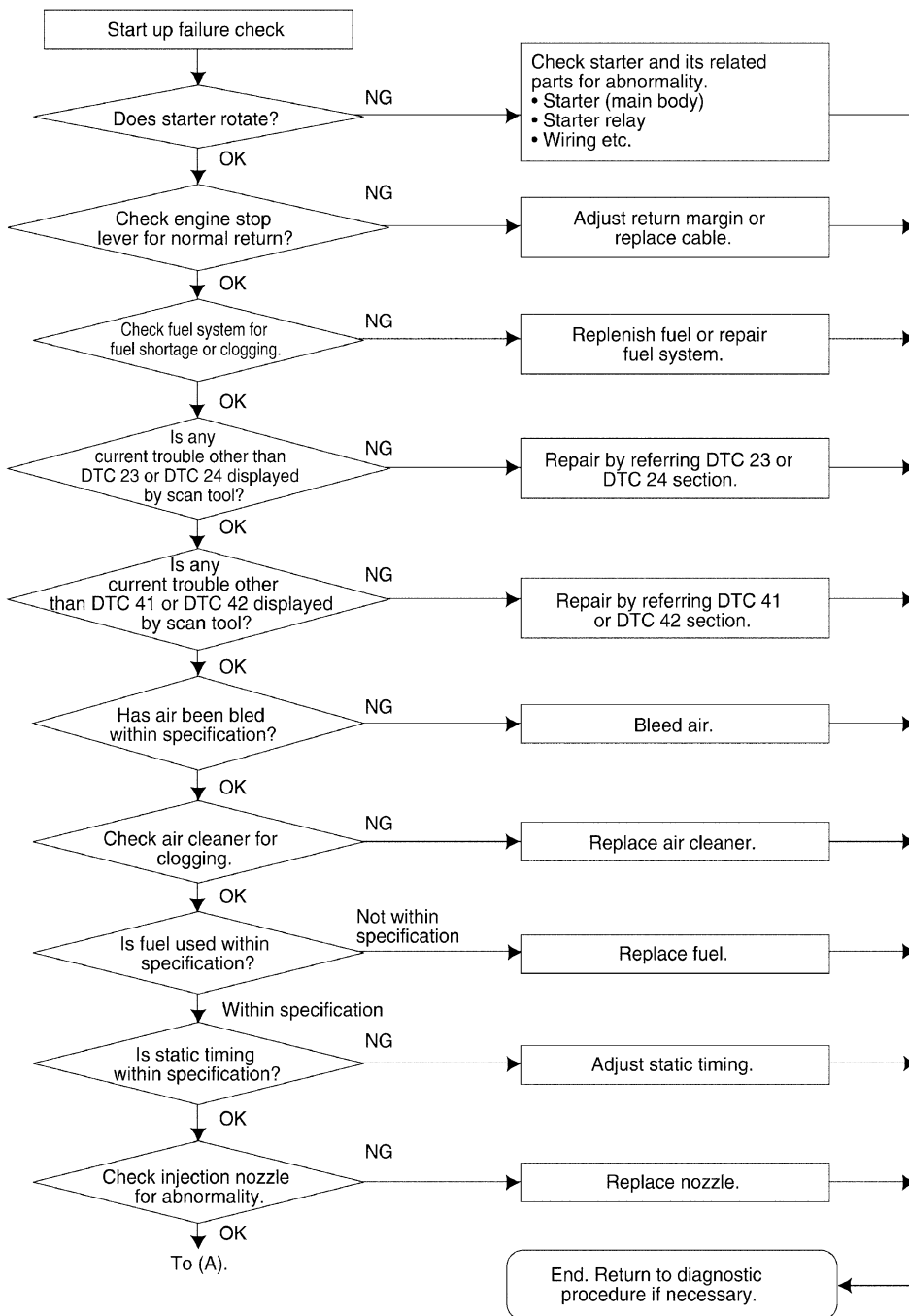
When a Diagnostic Trouble Code (DTC) is produced, inspect and repair system with reference to "EMISSION AND ELECTRICAL DIAGNOSIS".

Engine Hunting

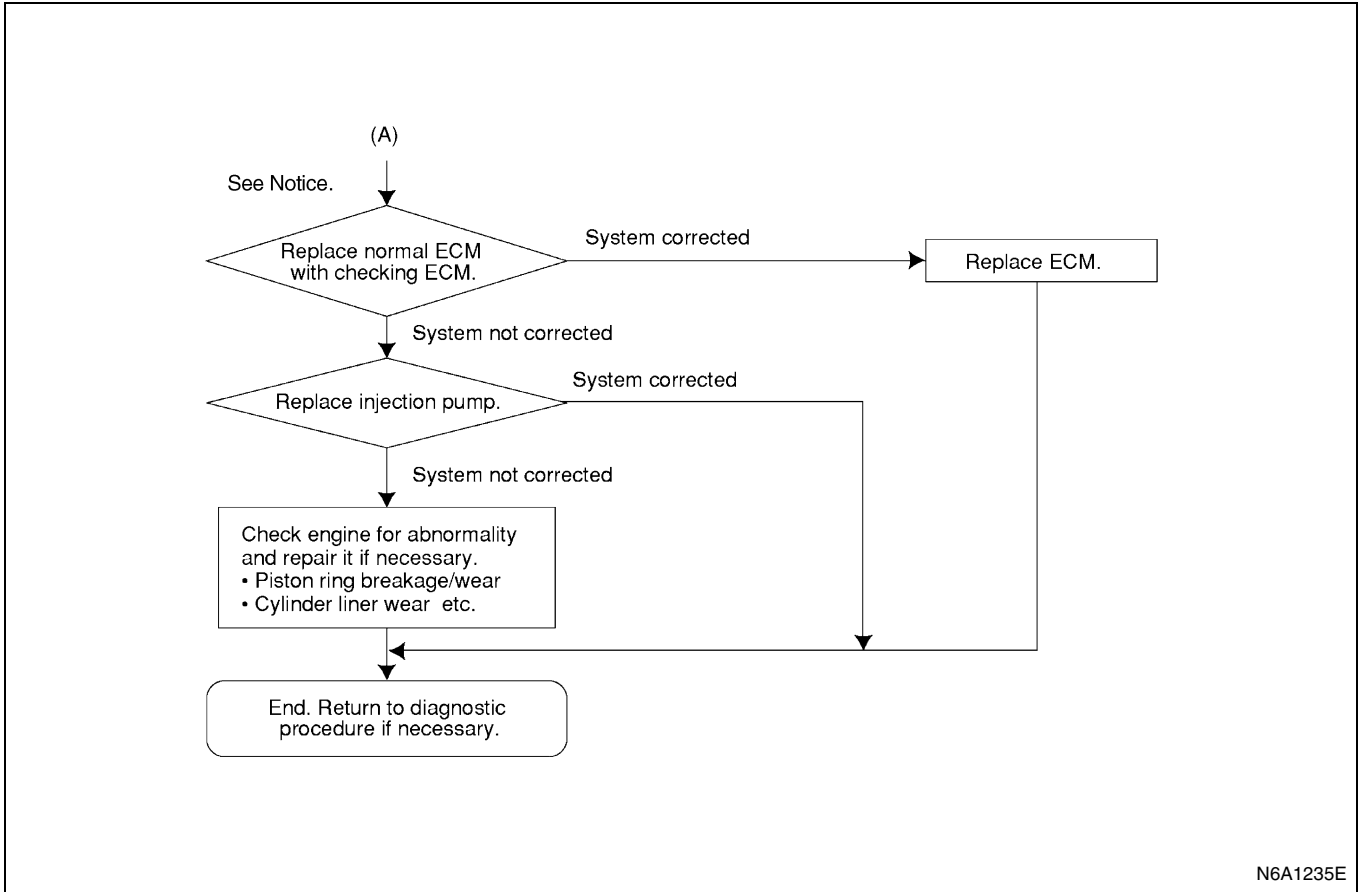


N6A1233E

Startup Failure



N6A1234E

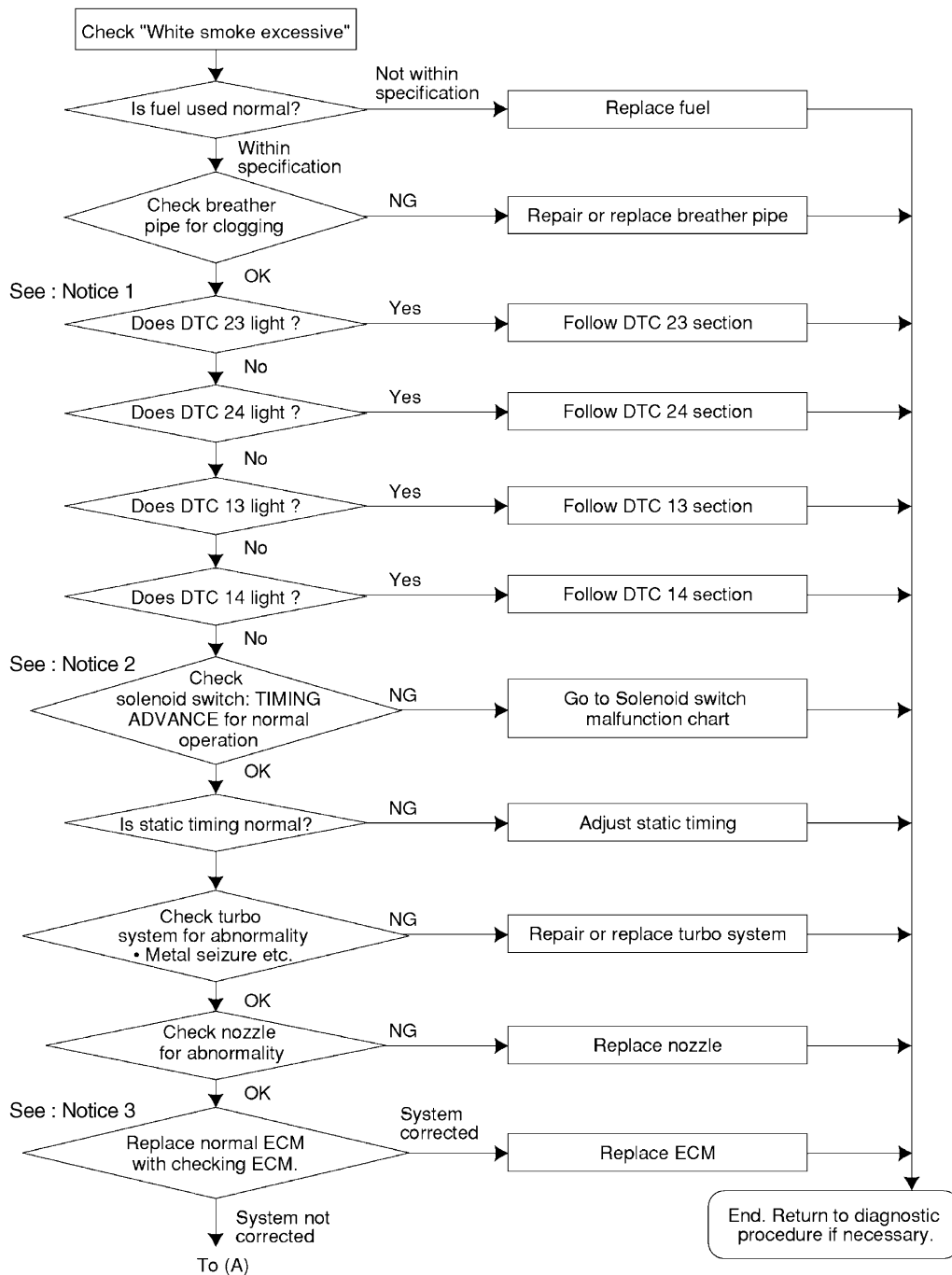


N6A1235E

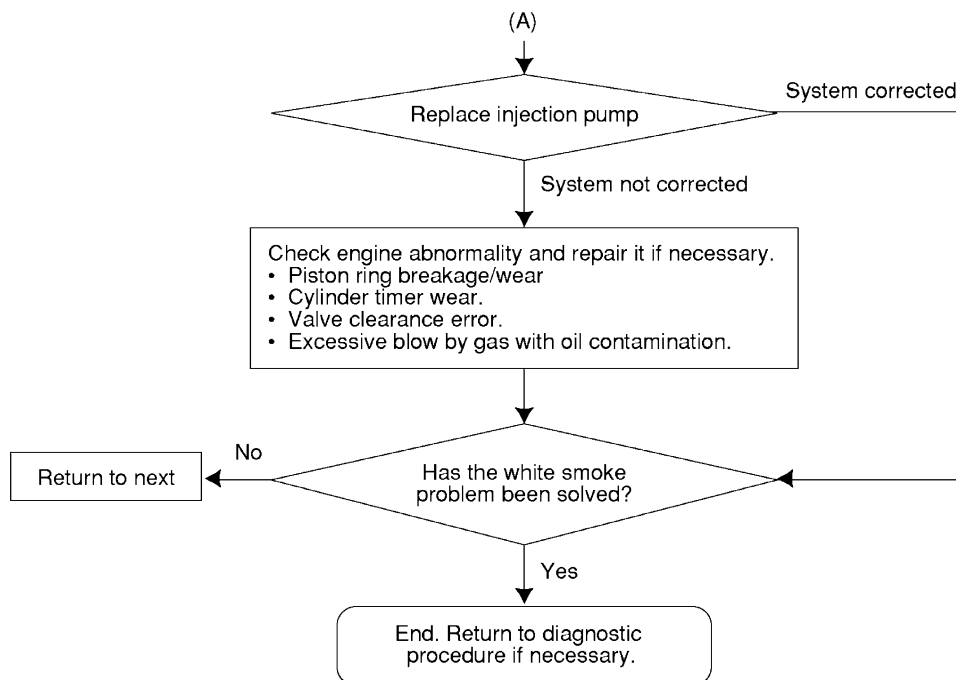
Notice:

The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle Engine Control Module (ECM) and the checking ECM.

White Smoke (Excessive)



N6A1236E

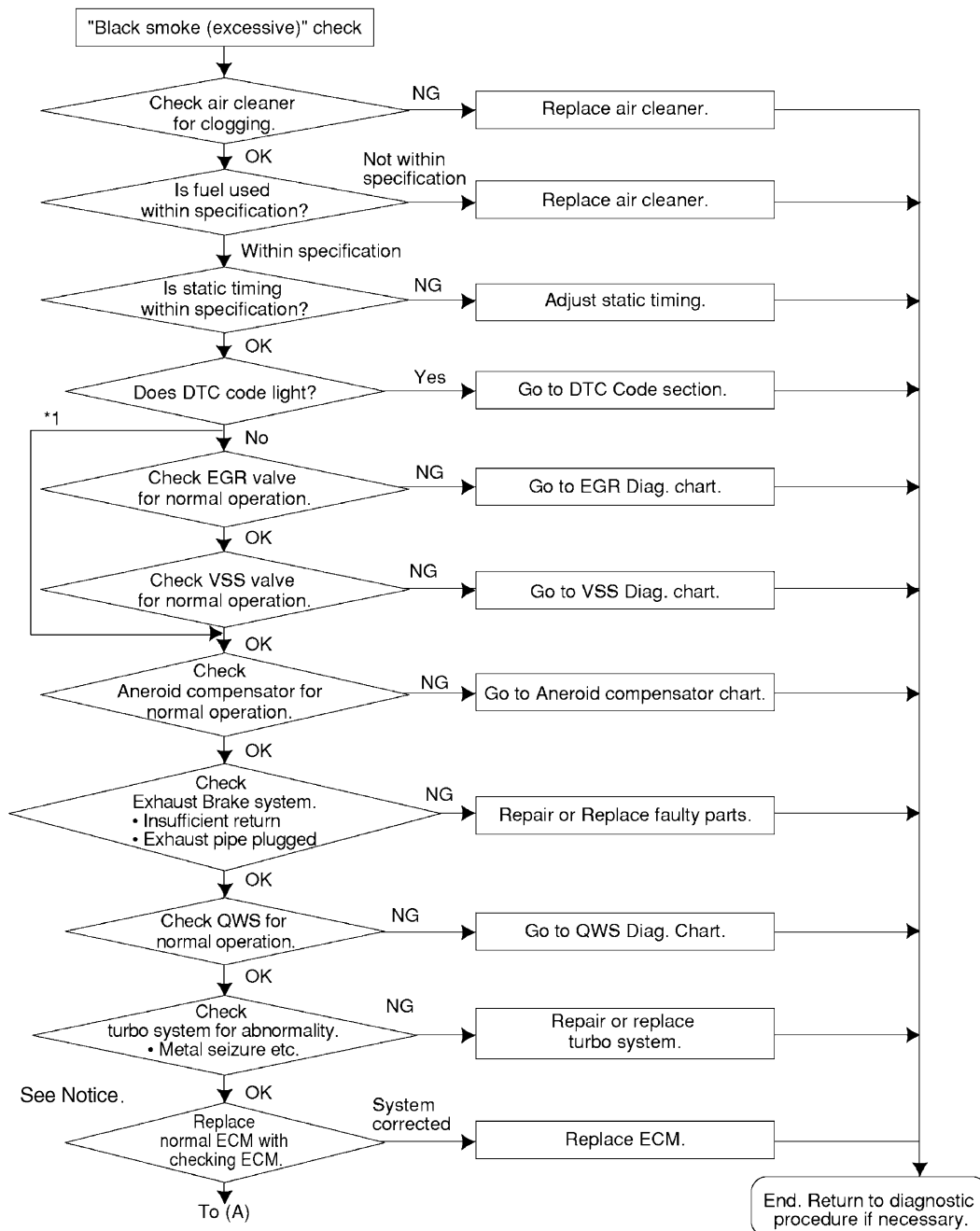


N6A1237E

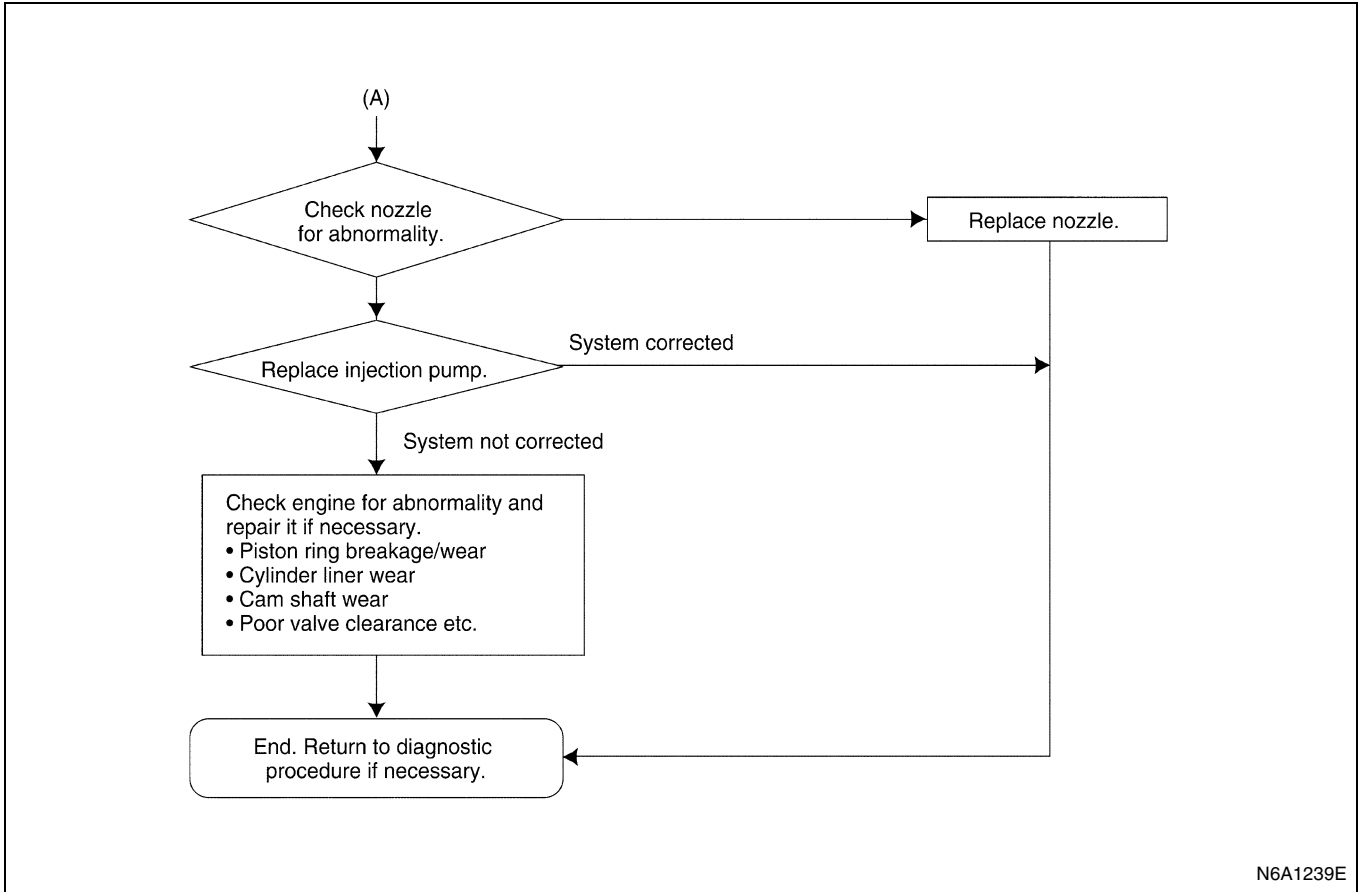
Notice:

1. "Follow (DTC-13, 14, 23, 24)" means to refer "Workshop Manual EMISSION AND ELECTRICAL DIAGNOSIS 4HE1 6E Section of Diagnosis Trouble Code (DTC-13, 14, 23, 24)" for other DTC code, follow concerned DTC sections.
2. Turn the ignition key from the "OFF" position to the "ON" position to put on the solenoid switch attached to the injection pump. After the solenoid switch being on for 18 consecutive seconds, check from the outside of the vehicle if the release sound of the solenoid switch is heard.
3. The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle Engine Control Module (ECM) and the checking ECM.

Black Smoke (Excessive)



N6A1238E



N6A1239E

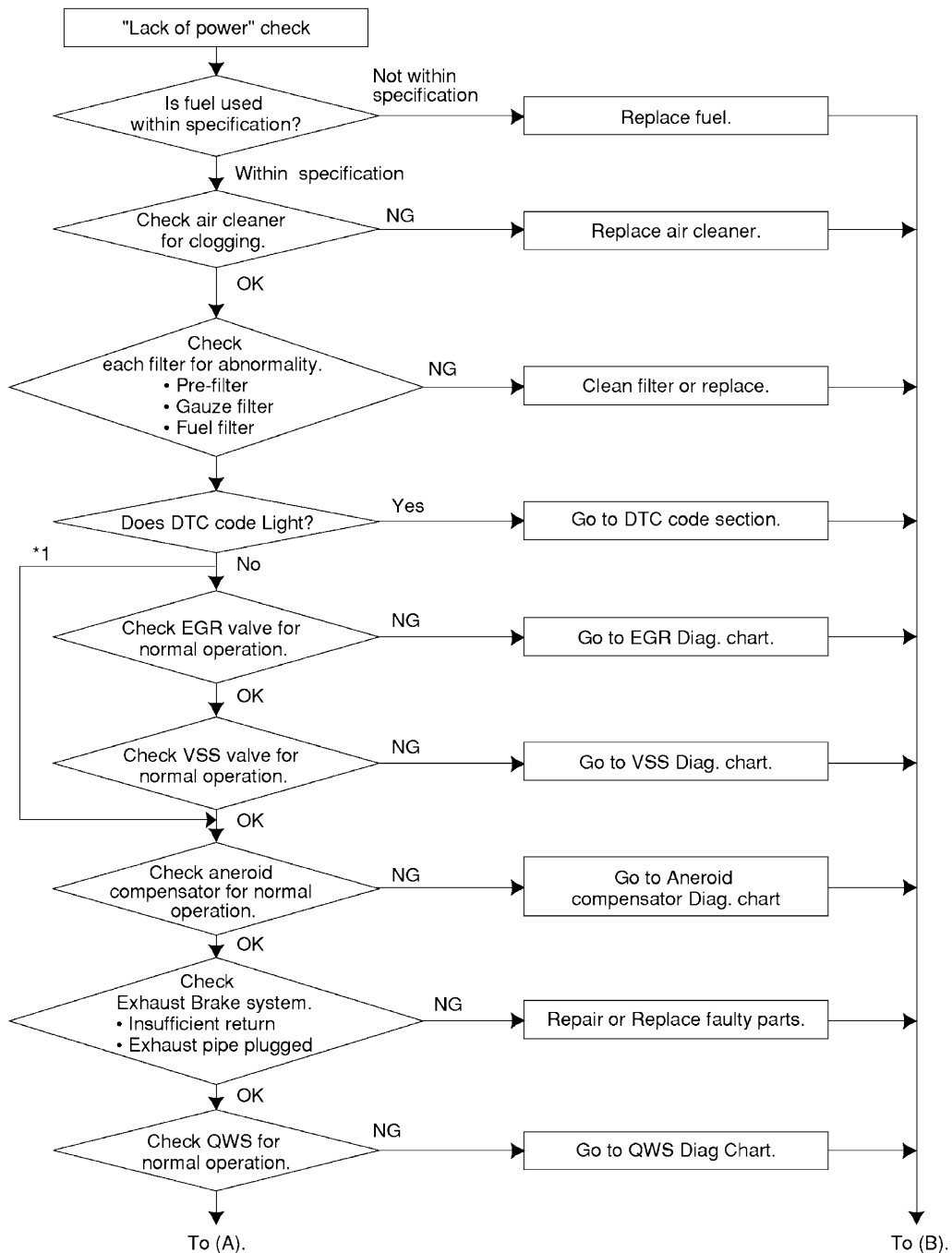
Notice:

The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle Engine Control Module (ECM) and the checking ECM.

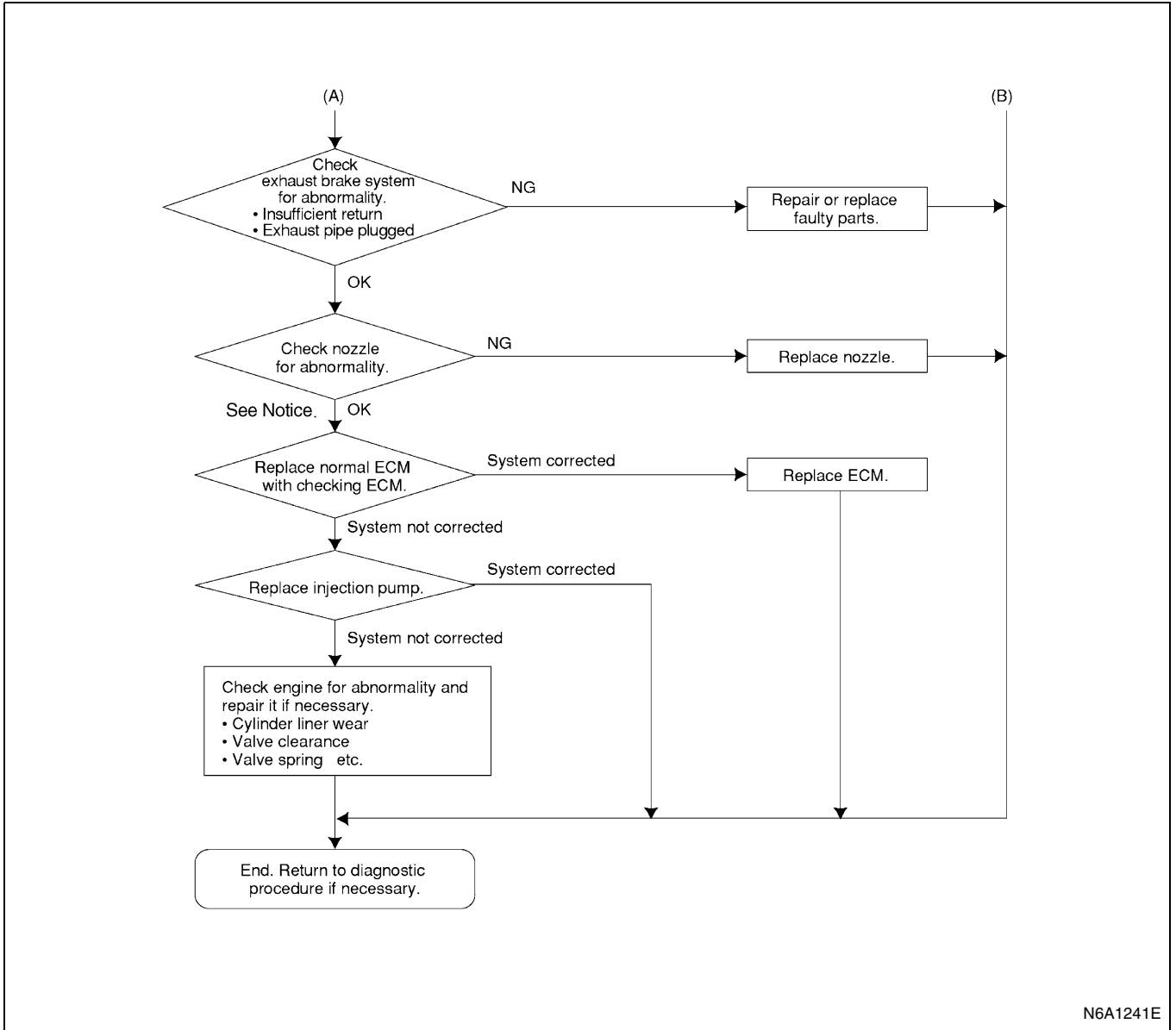
Refer to a trouble code for a supplier's check, if available.

*1. Equipped without Exhaust Gas Recirculation (EGR) and Variable Swirl System (VSS).

Lack of Power



N6A1240E



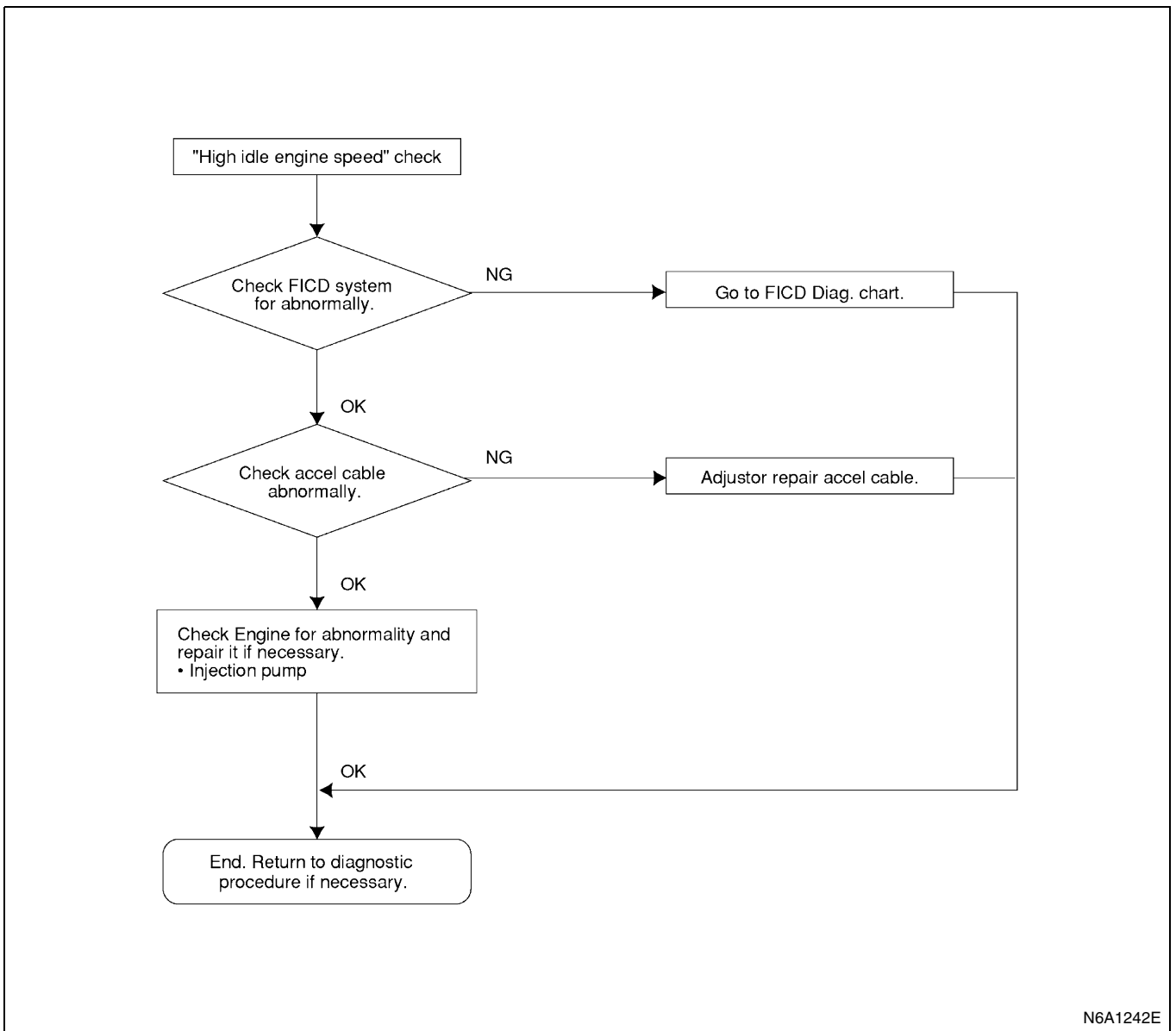
N6A1241E

Notice:

The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle Engine Control Module (ECM) and the checking ECM.

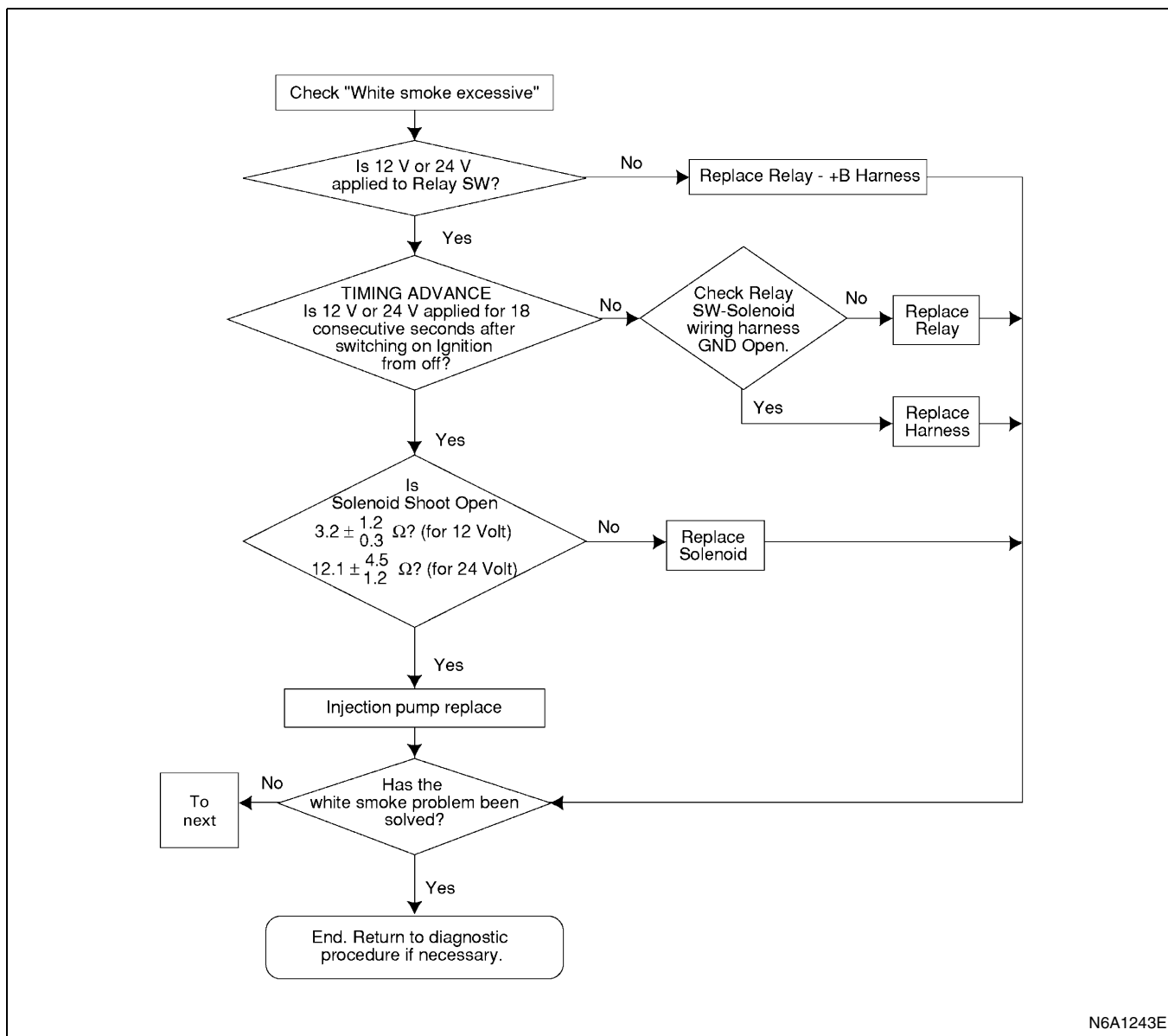
*1. Equipped without Exhaust Gas Recirculation (EGR) and Variable Swirl System (VSS).

High Idle Engine Speed



N6A1242E

Solenoid Switch Malfunction



N6A1243E

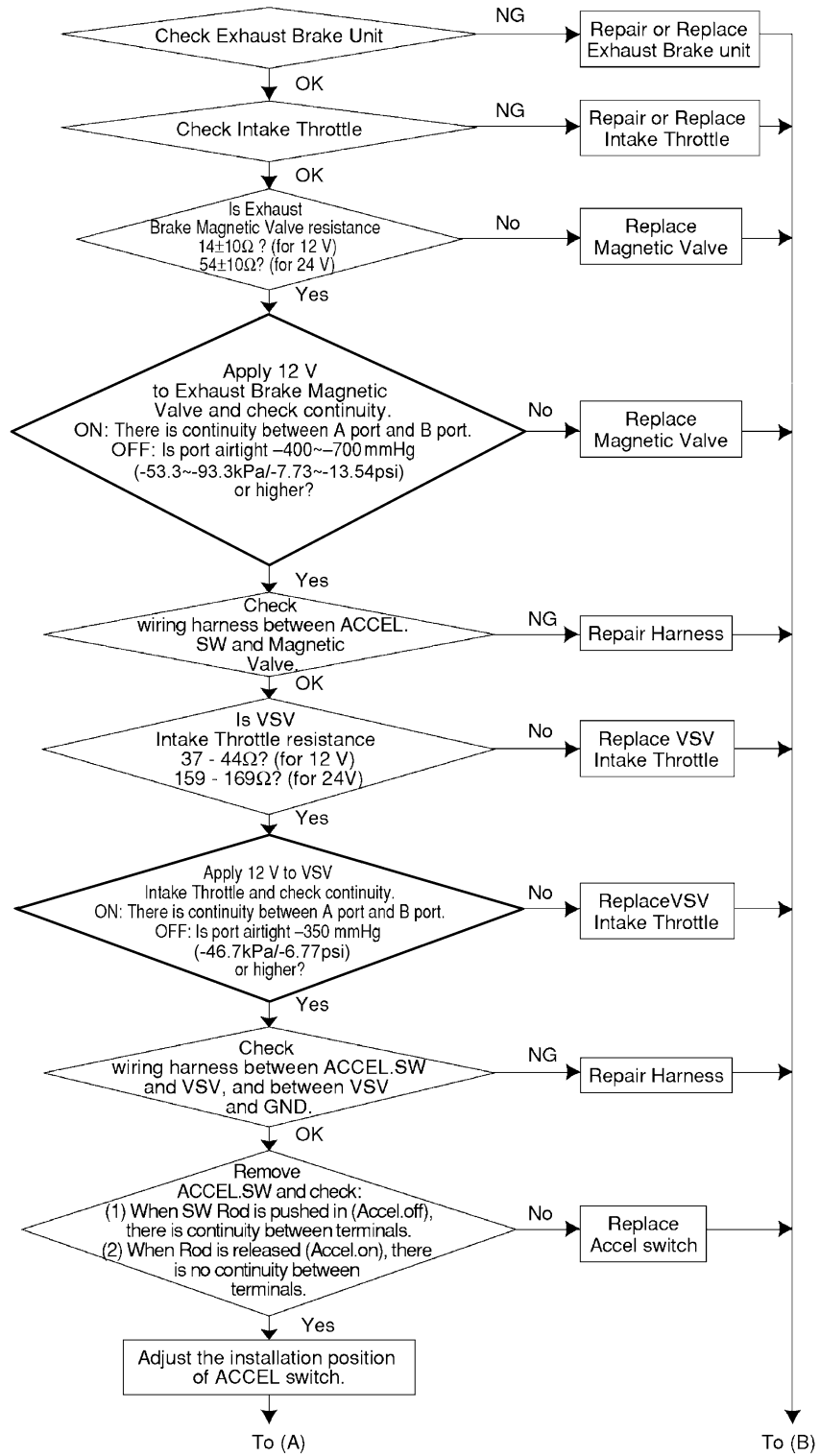
Inspection Solenoid Switch

Disconnect the connector on the solenoid switch.

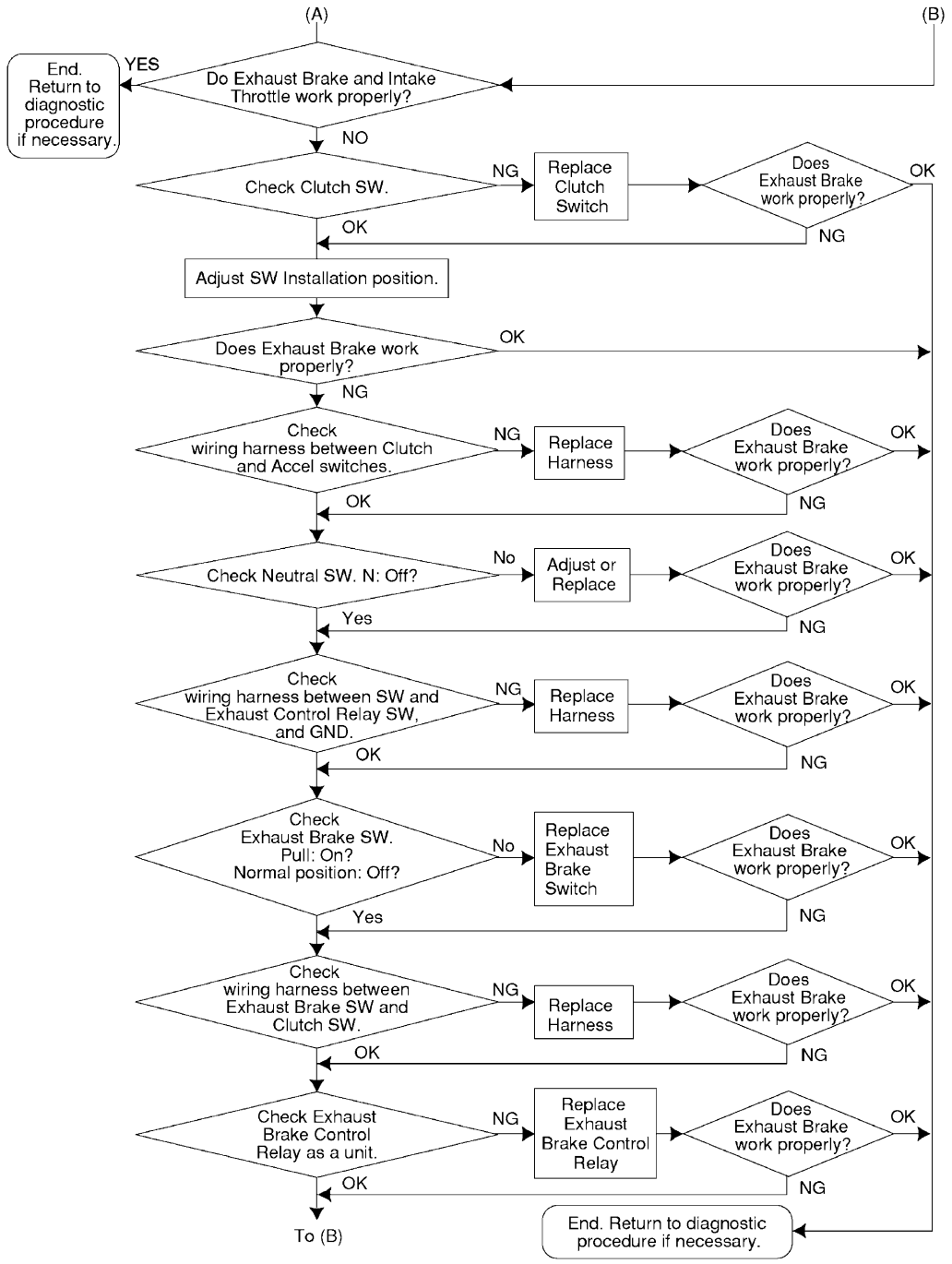
Apply 12 volts or 24 volts DC to the solenoid switch and hear the touching noise between solenoid switch and advance lever in the injection pump.

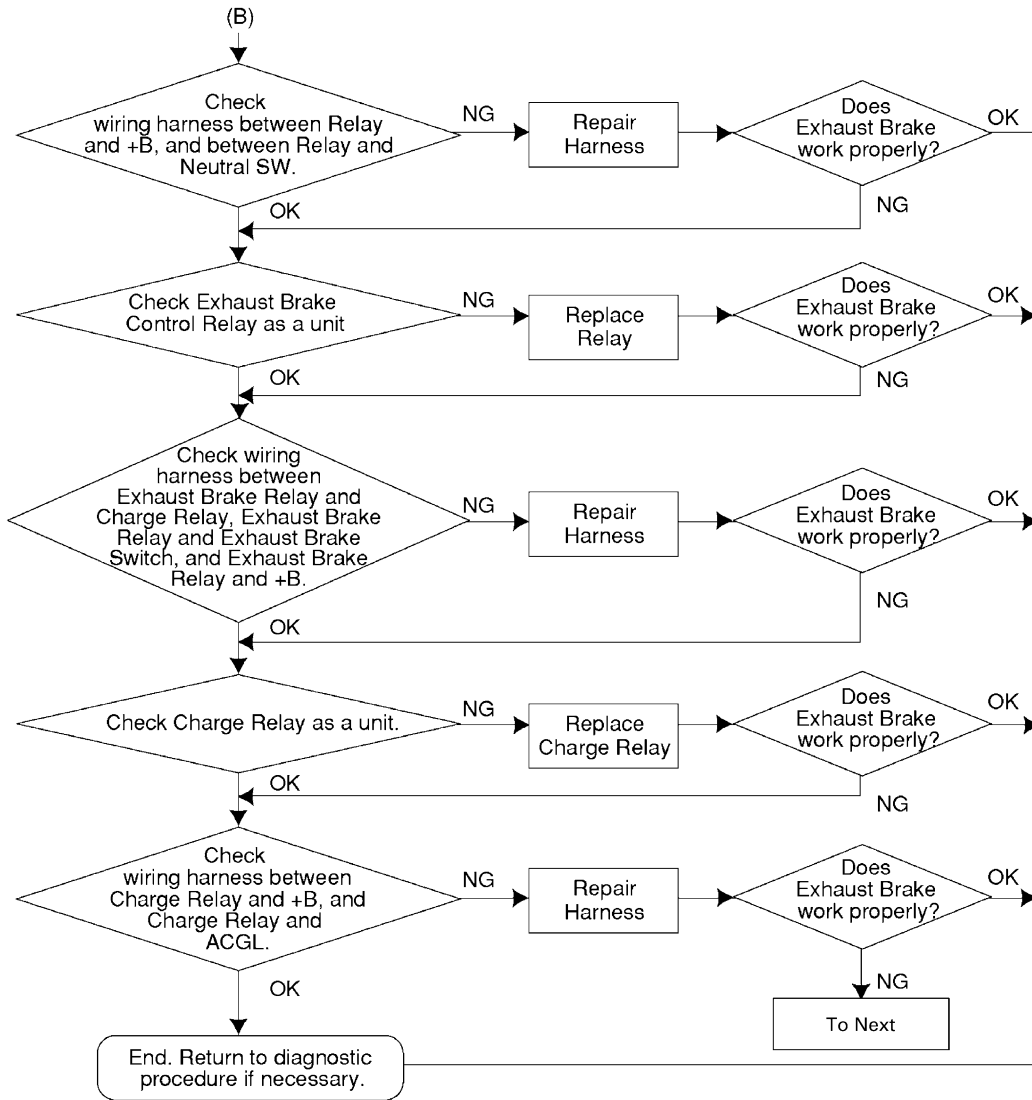
If can not hear the touching noise, do not remove the solenoids switch and contact injection pump service shop to repair it.

Exhaust Brake Malfunction



N6A1673E





* Repair of wiring harness includes diode check.

Inspection

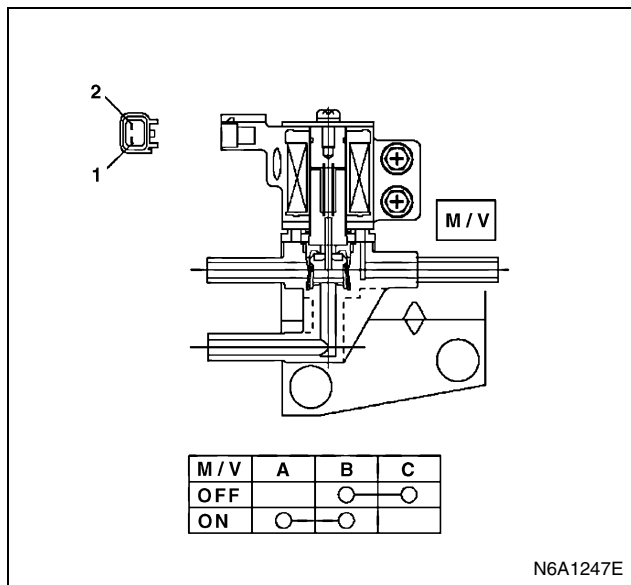
1. Exhaust Brake Magnetic Valve

Inspection

Connect the magnetic valve connector terminal No.1 and No.2 to (+) terminal and (-) terminal of battery, respectively, and check the continuity between the ports.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



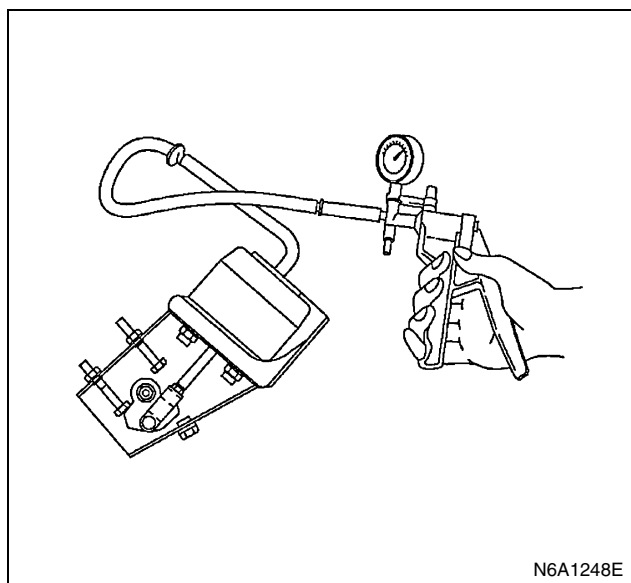
Legend

- A. Inlet (Vacuum pump)
- B. Outlet (unit)
- C. Exhaust (air filter)

2. Exhaust Throttle Valve

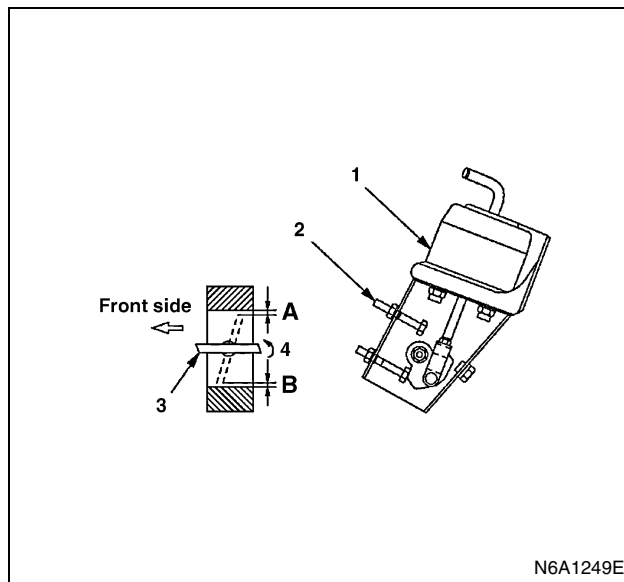
Working Check

Actuate the exhaust brake with the engine idling and make sure that you hear the valve strike on the stopper.



Airtight Check

Apply a negative pressure of 53.3 — 93.3 kPa (400 — 700 mmHg/7.73 — 13.54 psi) to the power chamber by means of a vacuum pump and make sure of the smooth opening/closing of the exhaust brake valve.

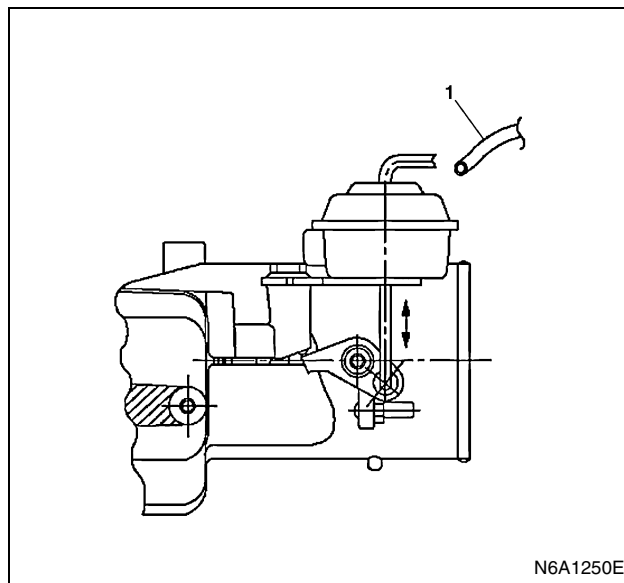


Legend

- 1. Power chamber
- 2. Adjust bolt
- 3. Valve
- 4. Close

Apply a negative pressure of 86.7 — 93.3 kPa (650 — 700 mmHg/12.57 — 13.54 psi) to the power chamber using a vacuum pump and make sure the average of measurements at Point A and Point B of the clearance between valve and body is as follows: 0.4 — 0.6 mm (0.016 — 0.024 in) (Minimum: 0.4 mm/0.016 in)

If the clearance is out of this range, adjust with the adjusting bolt.



Legend

- 1. Vacuum hose

3. Intake Throttle Valve

Working Check

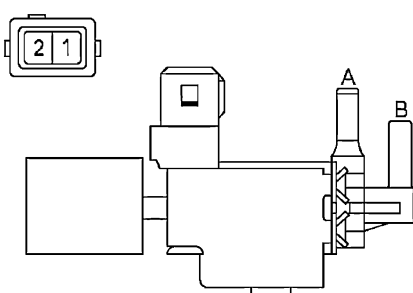
Disconnect the vacuum hose from the actuator and try to move the rod by hand, making sure of the smooth move of the rod.

4. Vacuum Switching Valve; Intake Throttle

Inspection

Connect the vacuum switching valve connector terminals No.1 and No.2 to (+) terminal and (-) terminals of battery, respectively, and check the continuity between the ports.

If the check result is abnormal, repair or replace the valve.



Port	A	B
Volume Condition		
Operation	○	○
Not Operation		

N6A1251E

5. Accelerator Switch (2-pole connector type)

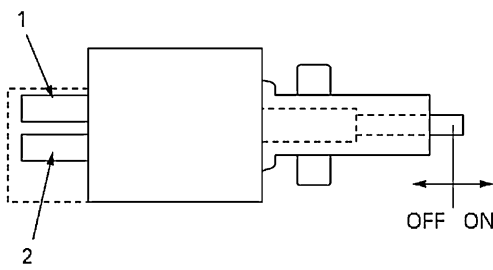
Inspection

- 1) Check the continuity between the switch connector terminals.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

- 2) Check the smooth move of the pushrod. If the check result is abnormal, repair or replace the push rod.



Connection pin	1	2
Switch position		
Release push rod	○	○
Push in Push rod		

N6A1252E

Removal

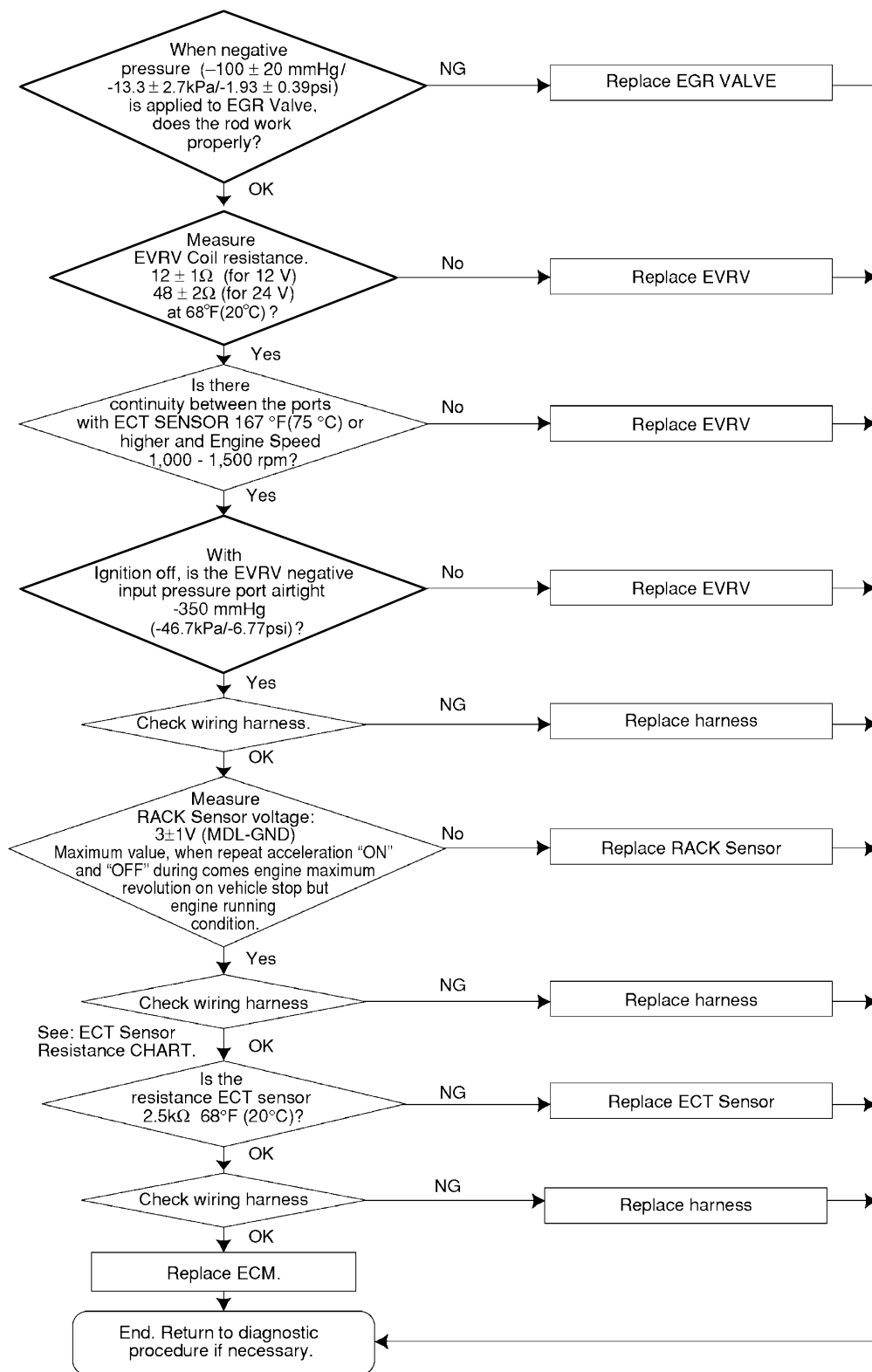
- 1) Accelerator Switch
- 2) Disconnect the connector.
Loosen the lock nut.
Turn the switch to remove.

Reinstallation

To install, follow the removal procedure in reverse order:

- 1) Drive the threaded part of the switch until its end surface becomes flush with that of the bracket side of nut.
- 2) Tighten the lock nut.
Tightening torque: 1.3 N·m (0.13 kg·m/11.5 lb·in)

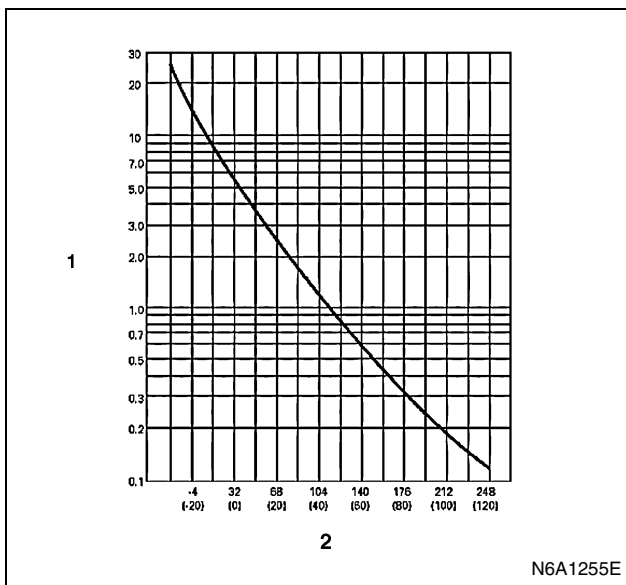
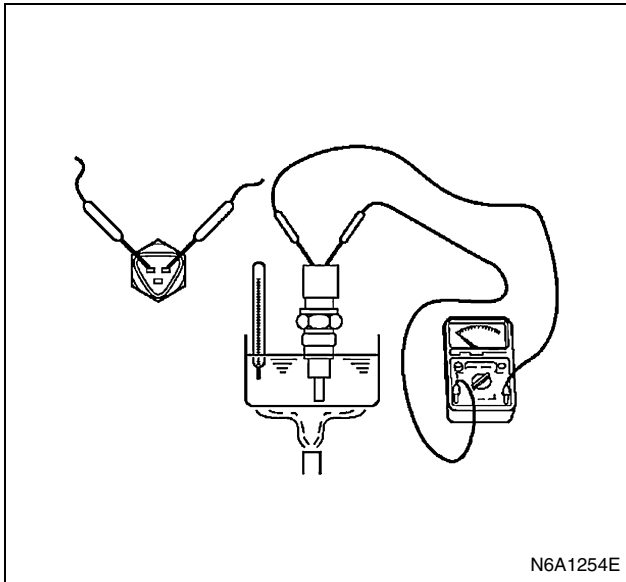
EGR System Malfunction



N6A1674E

Inspection

1. Thermosensor (Engine Coolant Temperature)
Soak the temperature sensitive part of a thermosensor in the water, and while changing the water temperature, make sure the resistance is changed as the following graph shows:



Legend

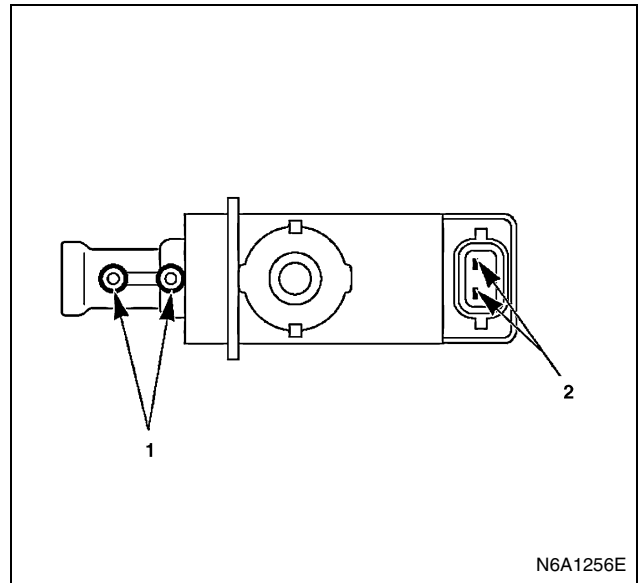
1. Resistance (kΩ)
2. ECT °F (°C)

2. Electronic Vacuum Regulating Valve (EVRV) (Equipped with Exhaust Gas Recirculation (EGR) and Variable Swirl System (VSS))

Resistance Check

Check the resistance between the EVRV connector terminals using a circuit tester.

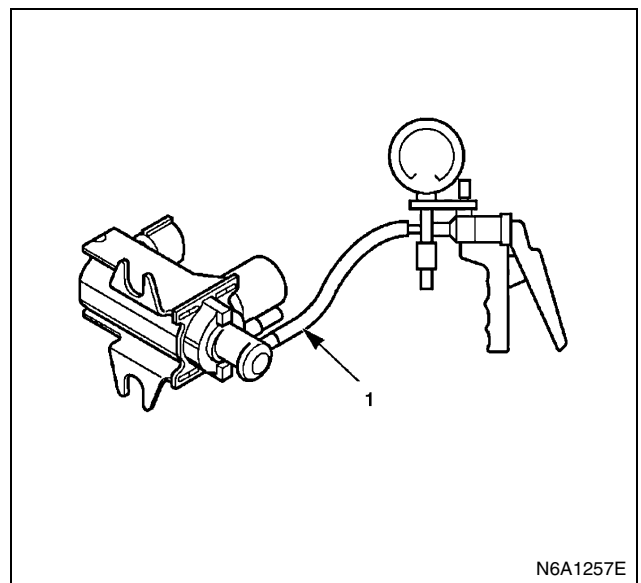
Cold Resistance: 12 ± 1 (Ω)



Legend

1. Port
2. Pin

Connect battery voltage between EVRV connector terminals and make sure of the continuity between the ports.



Legend

1. Vacuum port

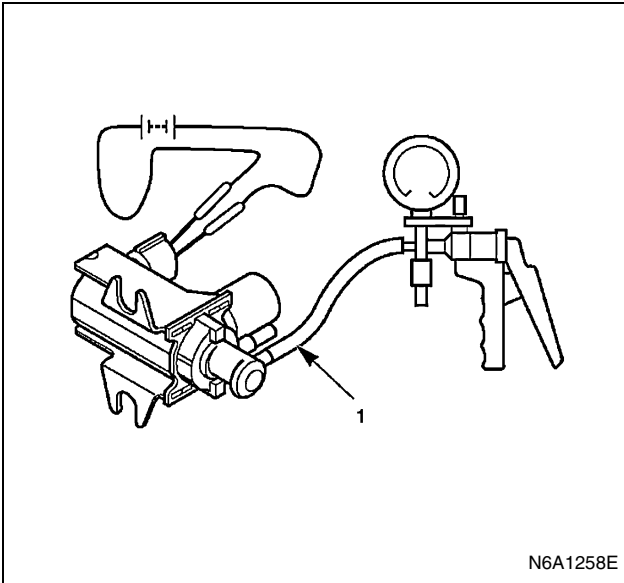
Airtight Check

Apply negative pressure to the negative pressure input port as illustrated on the left.

Although there is leakage, it is no problem if the negative pressure rises to -46.7 kPa (-350 mmHg / -6.77 psi) or more.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



Legend

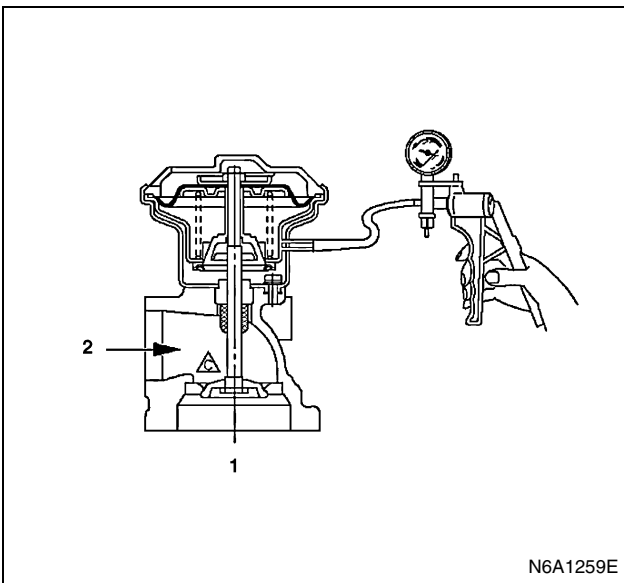
- 1. Vacuum port

Working Check

Apply power voltage between the terminals, there is no problem if the negative pressure does not rise when applied to the input port.

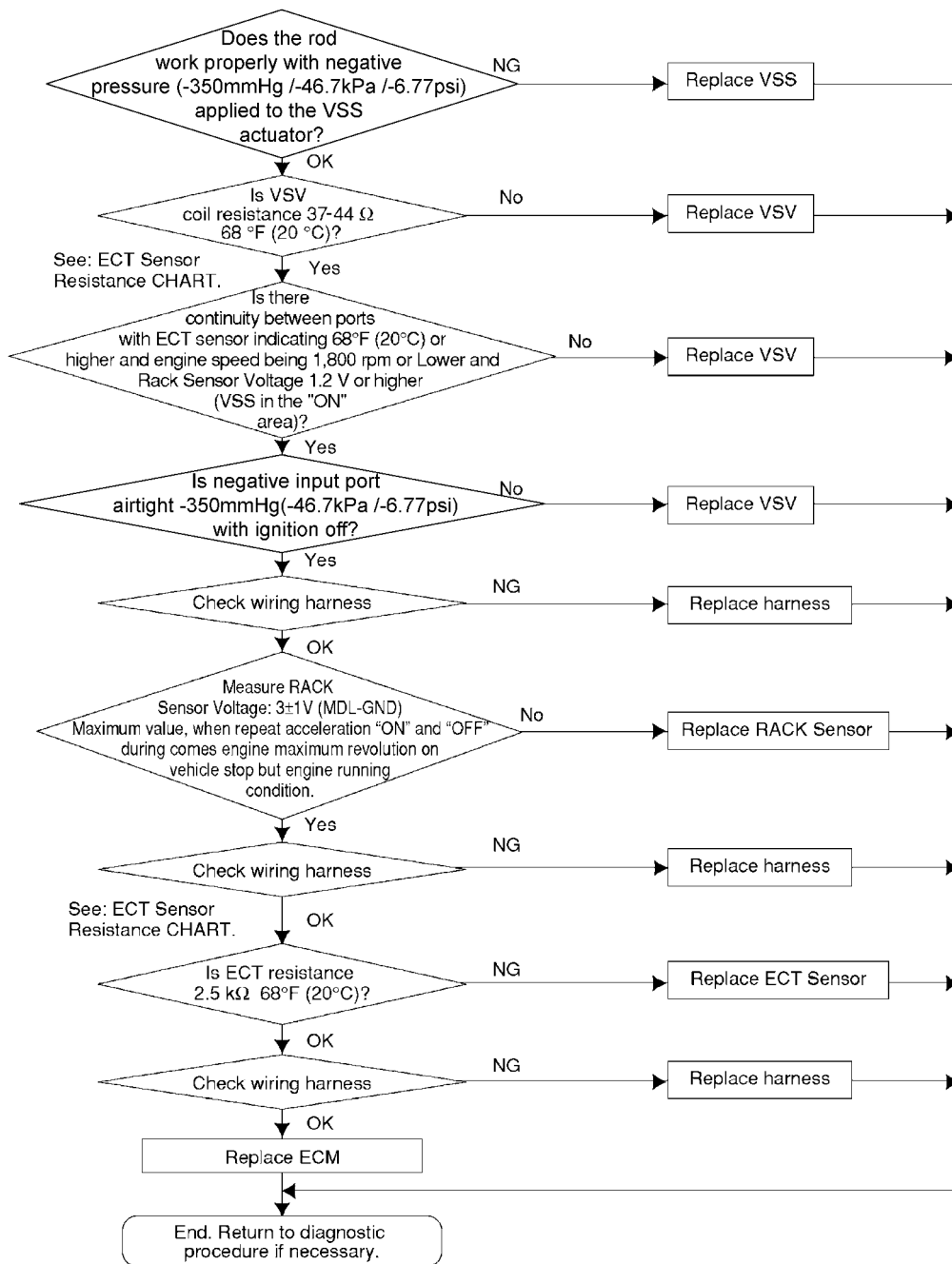
- 3. Exhaust Gas Recirculation (EGR) Valve (Equipped with EGR and Variable Swirl System (VSS))
 With negative pressure applied to the diaphragm chamber, make sure that the valve is smoothly actuated to make the area between (1) and (2) ventilated.

Startup: About -13.3 ± 2.7 kPa (-100 ± 20 mmHg / -1.93 ± 0.39 psi)



Check to see if EGR valve is normally actuated under the following conditions:
 QWS off (After warming up)
 Engine coolant temp.: 80°C (176°F) or higher

Variable Swirl System (VSS) System Malfunction (Equipped with Exhaust gas recirculation and VSS)



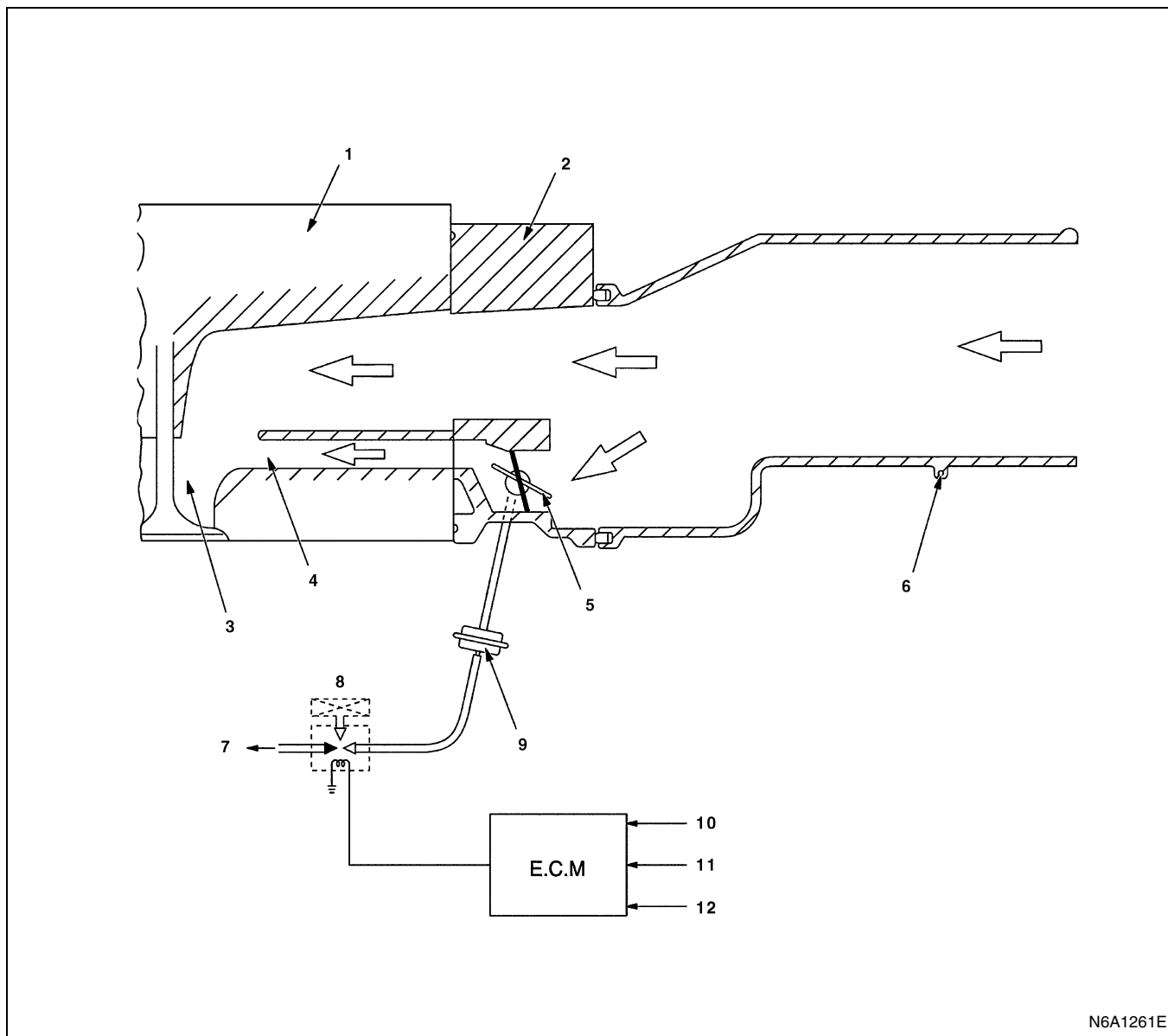
N6A1675E

VSS (Variable Swirl System)

The Variable Swirl System (VSS) is designed to adjust the intensity of swirl by allowing or not allowing air to flow through a sub-port (or bypass) that runs in parallel with the intake port for each cylinder. The swirl intensifies when there is no air flow through the sub-port, and vice versa.

The air flow is controlled by the on-off valve at the inlet to the sub-port and the valve in turn is turned on and off by computer signals which are dependent on engine speed, load and coolant temperature. Basically, the air is cut off at low speeds to maintain high swirl and is allowed to flow at high speeds to maintain low swirl.

Variable Swirl System (Equipped with Exhaust gas recirculation (EGR) and VSS)



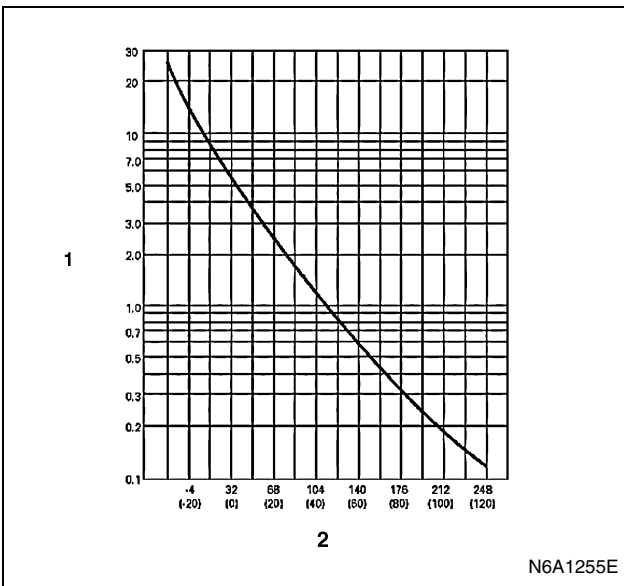
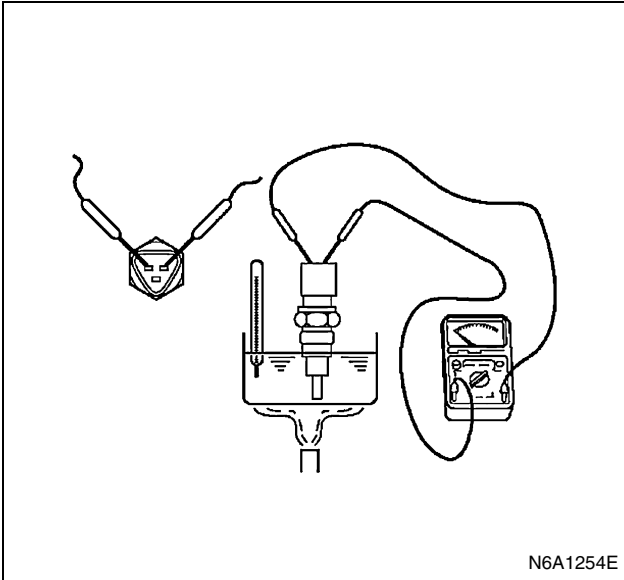
N6A1261E

Legend

- | | |
|-------------------|-------------------------|
| 1. Cylinder head | 7. Vacuum |
| 2. VSS case | 8. VSV; VSS |
| 3. Inlet port | 9. Actuator |
| 4. Sub-port | 10. Thermo sensor |
| 5. Control valve | 11. Engine speed sensor |
| 6. Inlet manifold | 12. Rack sensor |

Inspection

1. Thermosensor (Engine coolant temperature)
Soak the temperature sensitive part of a thermosensor in the water, and while changing the water temperature, make sure the resistance is changed as the following graph shows:



Legend

1. Resistance (kΩ)
2. ECT °F (°C)

2. Vacuum Switching Valve (VSV)

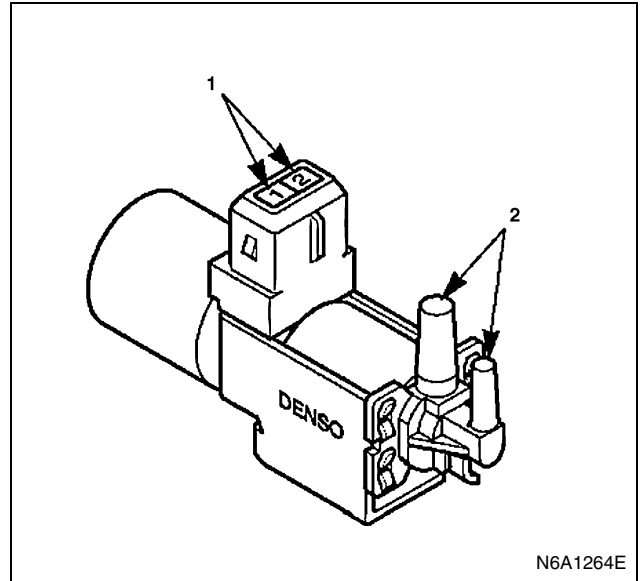
Resistance Check

Check the resistance between the VSV connector terminals using a circuit tester.

Cold Resistance

: 37 — 44 (Ω) (for 12 volt)

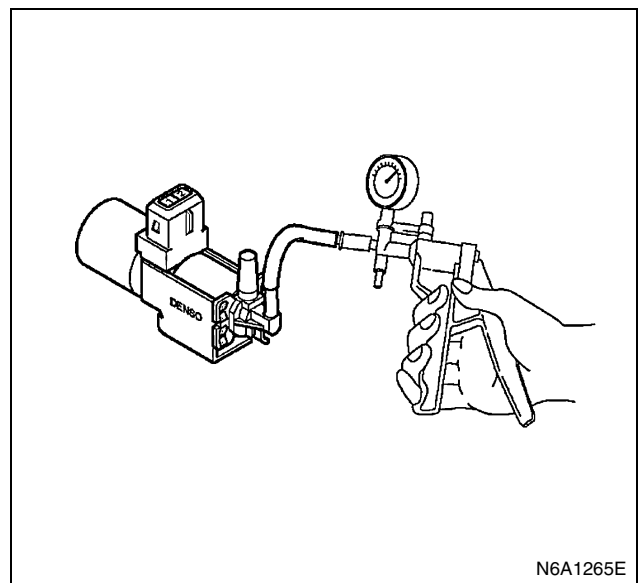
: 159 — 169 (Ω) (for 24 volt)



Legend

1. 2 Pin
2. Port

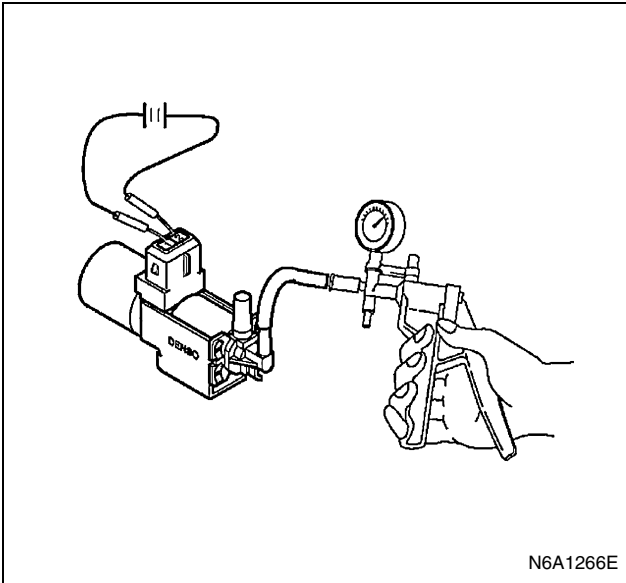
Connect battery voltage between VSV connector terminals and make sure of the continuity between the ports.



Airtight Check

Apply negative pressure to the negative pressure input port as illustrated on the left.

Although there is leakage, it is no problem if the negative pressure rises to -46.7 kPa (-350 mmHg / -6.77 psi) or more.



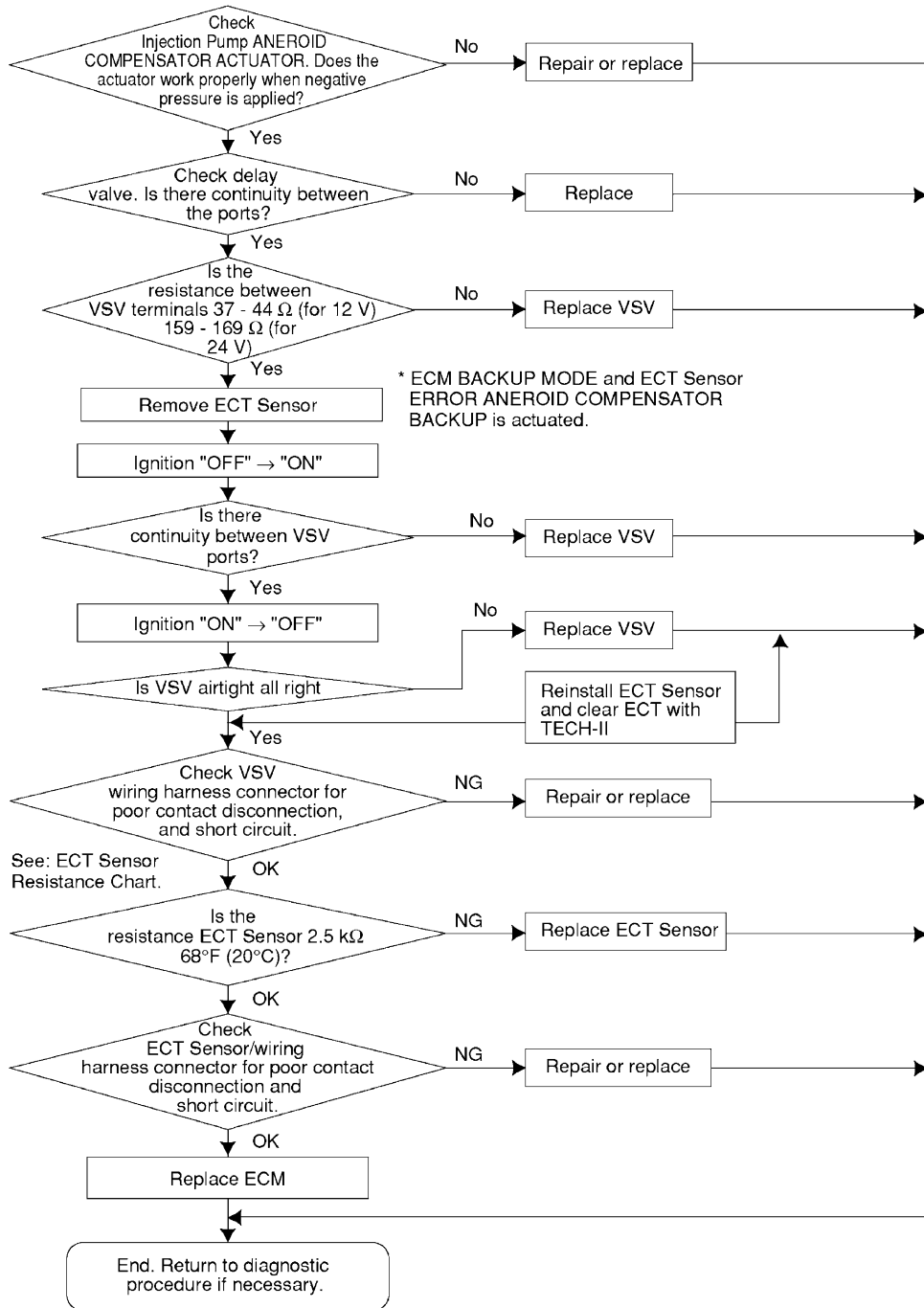
Working Check

Apply power voltage between the terminals, there is no problem if the negative pressure does not rise when applied to the input port.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Aneroid Compensator Malfunction

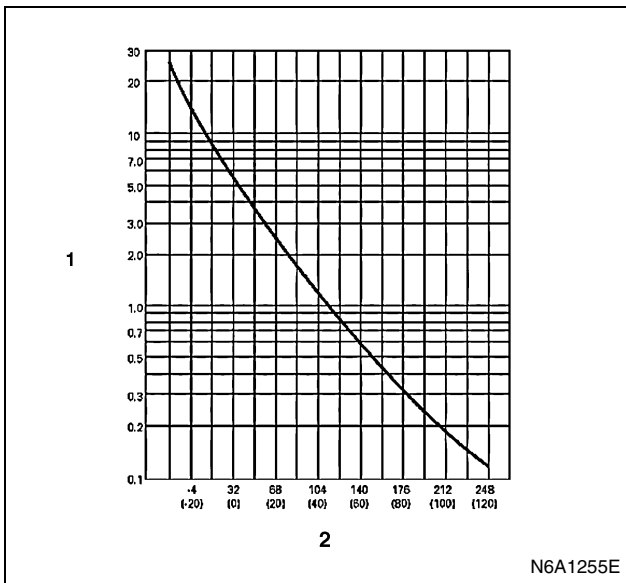
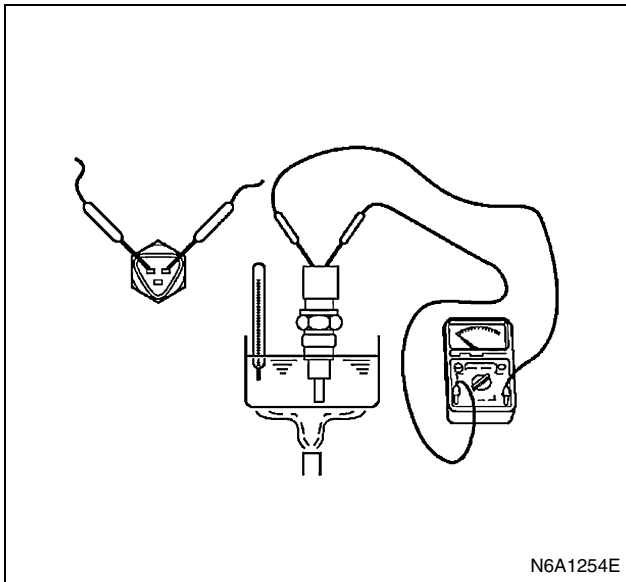


N6A1267E

Inspection

1. Thermosensor (Engine coolant temperature (ECT))

Soak the temperature sensitive part of a thermosensor in the water, and while changing the water temperature, make sure the resistance is changed as the following graph shows:



Legend

1. Resistance (kΩ)
2. ECT °F (°C)

2. Vacuum Switching Valve (VSV)

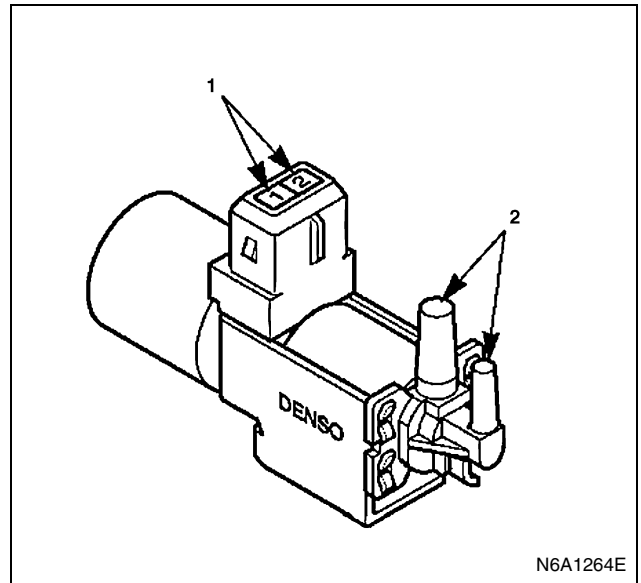
Resistance Check

Check the resistance between the VSV connector terminals using a circuit tester.

Cold Resistance

: 37 — 44 (Ω) (for 12 Volt)

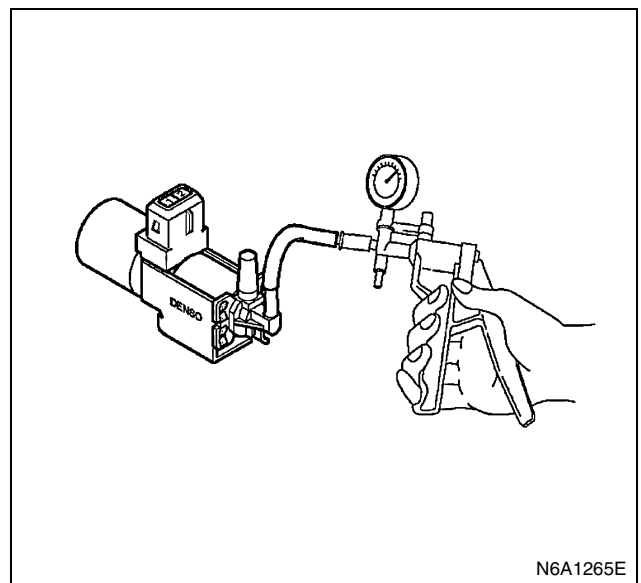
: 159 — 169 (Ω) (for 24 Volt)



Legend

1. 2 Pin
2. Port

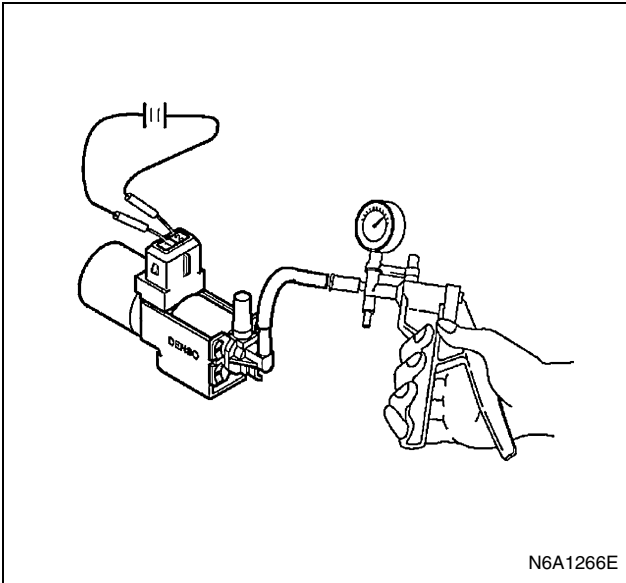
Connect battery voltage between VSV connector terminals and make sure of the continuity between the pots.



Airtight Check

Apply negative pressure to the negative pressure input port as illustrated on the left.

Although there is leakage, it is no problem if the negative pressure rises to -46.7 kPa (-350 mmHg / -6.77 psi) or more.



Working Check

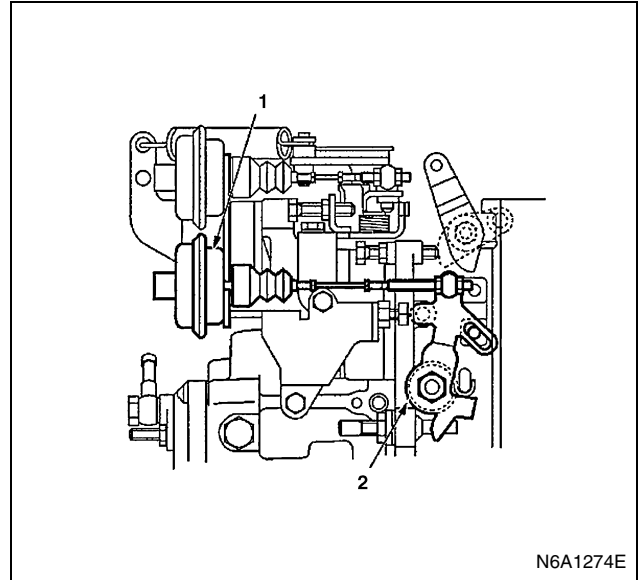
Apply power voltage between the terminals, there is no problem if the negative pressure does not rise when applied to the input port.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

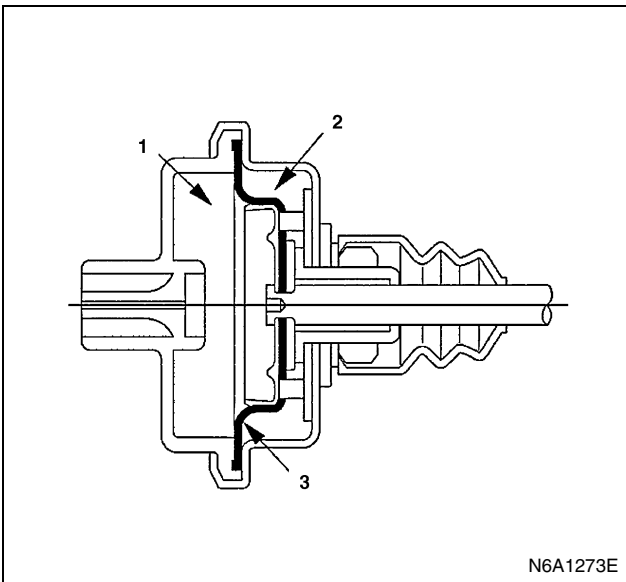
- 3. Actuator
Diaphragm is built in the actuator, by which the inside of the actuator is divided into two, atmospheric room and negative pressure room.

The full load set lever is connected to a U-lever. When the atmospheric sensor built in Engine Control Module (ECM) makes the actuator work, the full load set lever and U-lever are rotated to a specified position so that the control rack is drawn in the direction of reducing fuel injection amount.



Legend

- 1. Aneroid compensator actuator
- 2. Full load set lever

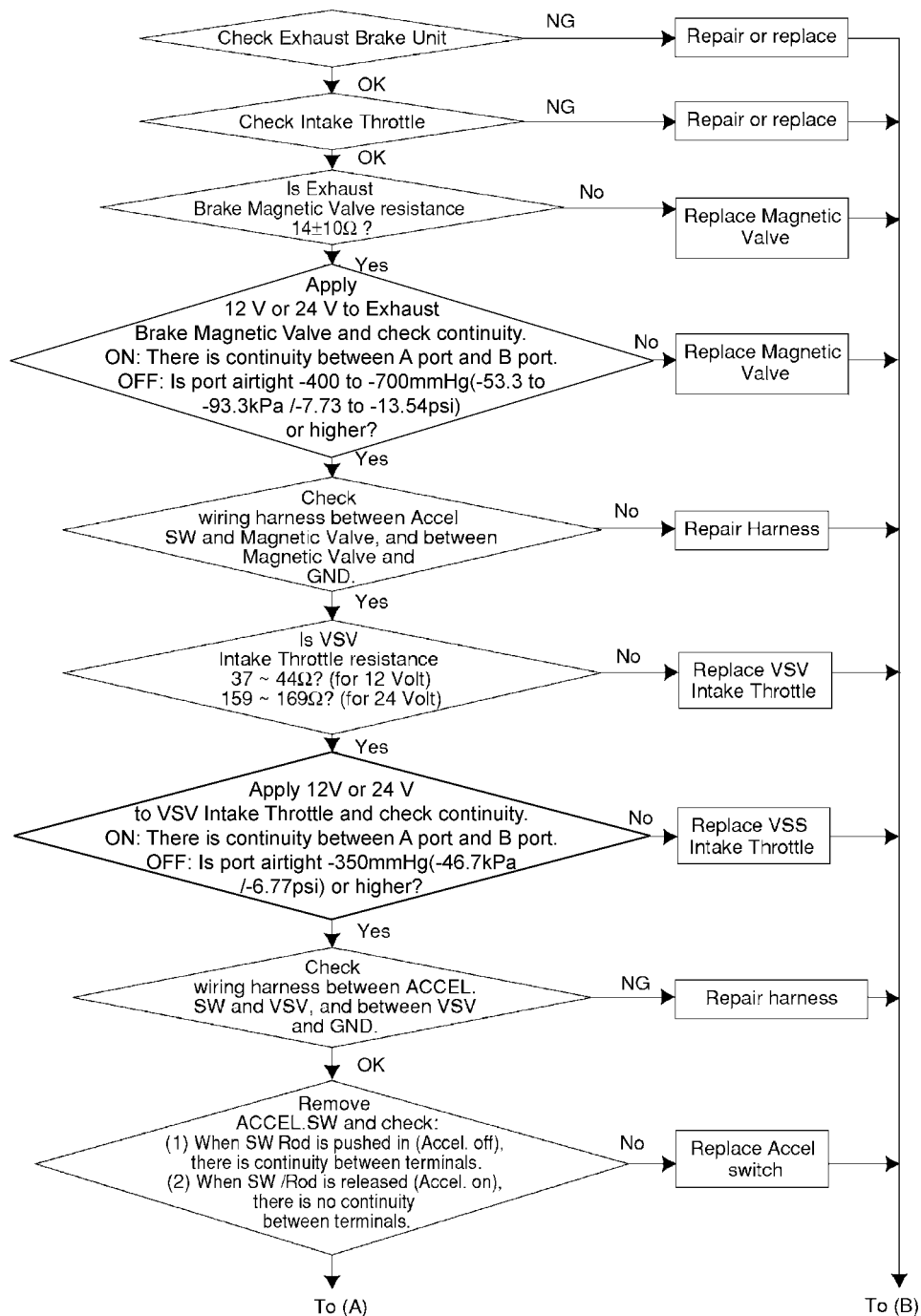


Legend

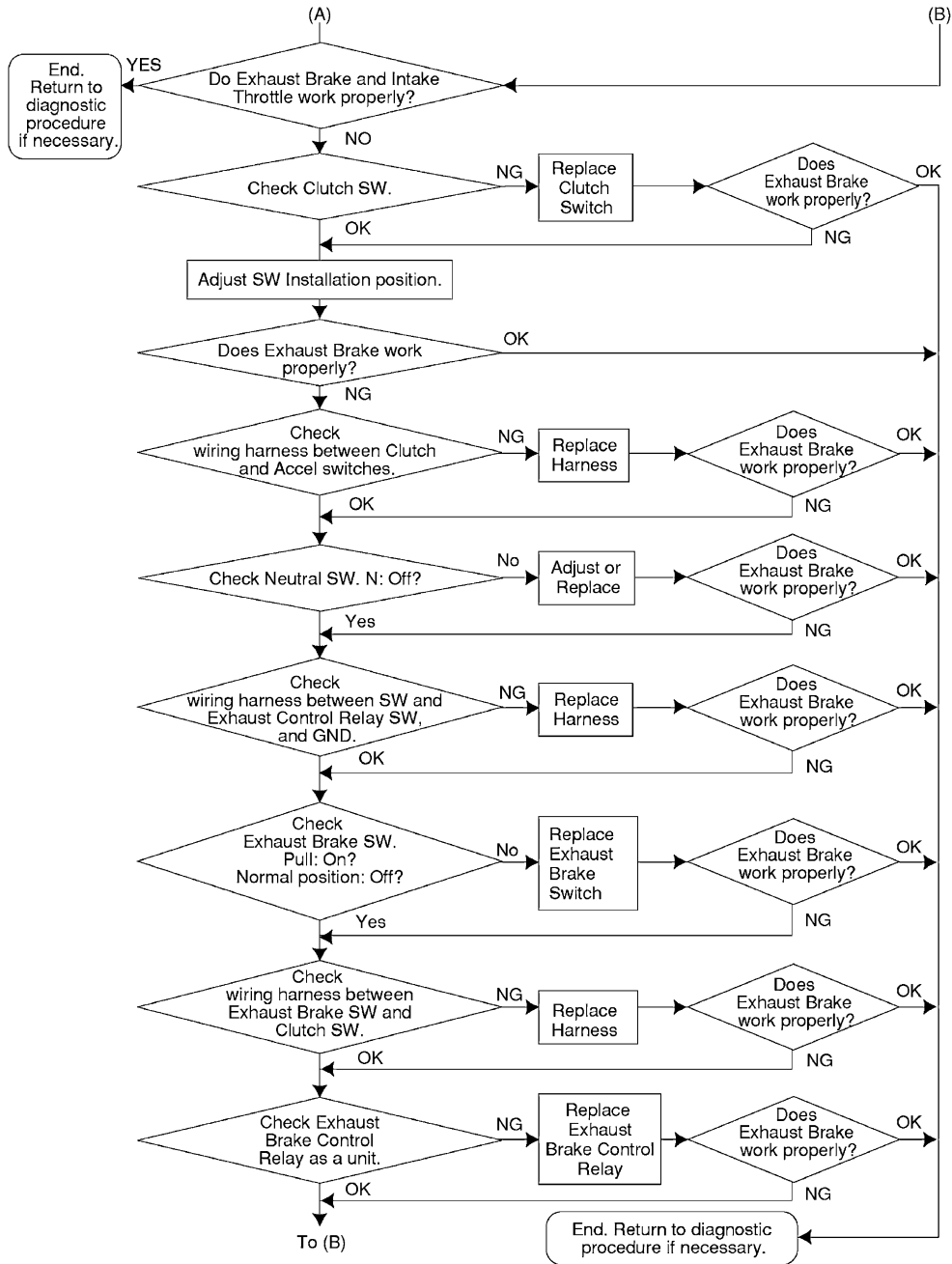
- 1. Vacuum chamber
- 2. Atmospheric chamber
- 3. Diaphragm

- 4. Aneroid compensator Actuator
The link of the actuator for the aneroid compensator is connected to full load set lever.

Quick Warm System (QWS) Malfunction



N6A1676E



Inspection

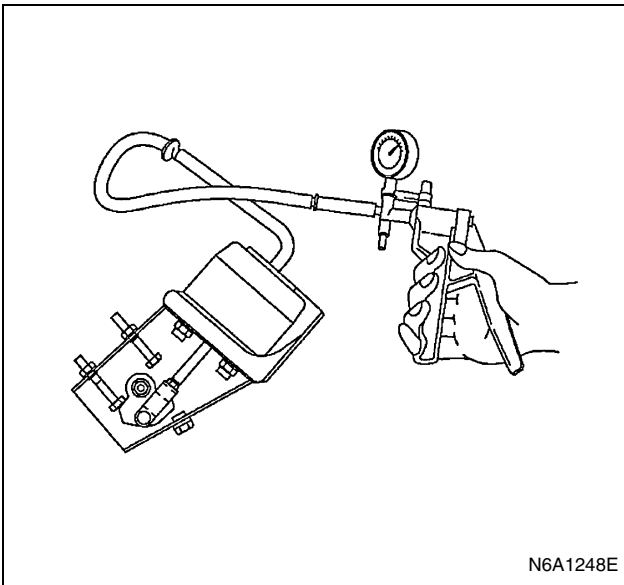
1. Exhaust Throttle Valve

Working Check

Actuate the exhaust brake with the engine idling and make sure that you hear the valve strike on the stopper.

Airtight Check

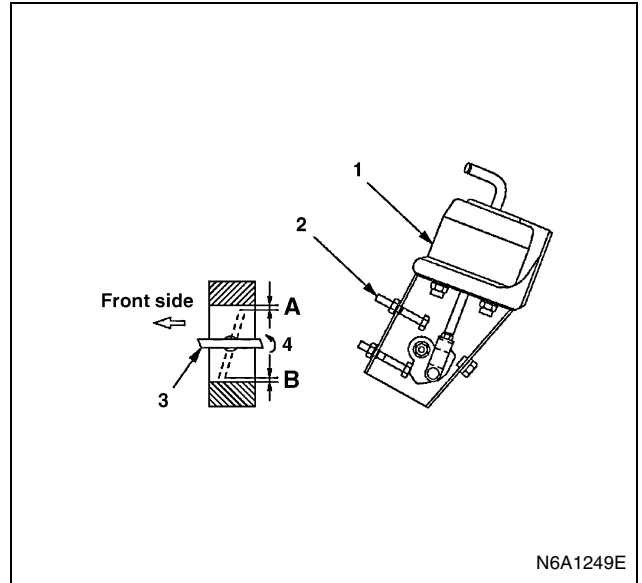
Apply a negative pressure of -53.3 — -93.3 kPa (-400 — -700 mmHg/ -7.73 — -13.54 psi) to the power chamber by means of a vacuum pump and make sure of the smooth opening/closing of the exhaust brake valve.



Apply a negative pressure of -86.7 — -93.3 kPa (-650 — -700 mmHg/ -12.57 — -13.54 psi) to the power chamber using a vacuum pump and make sure the average of measurements at Point A and Point B of the clearance between valve and body is as follows:

0.4 — 0.6 mm (0.016 — 0.024 in) (Minimum: 0.4 mm/ 0.016 in)

If the clearance is out of this range adjust with the adjusting bolt.



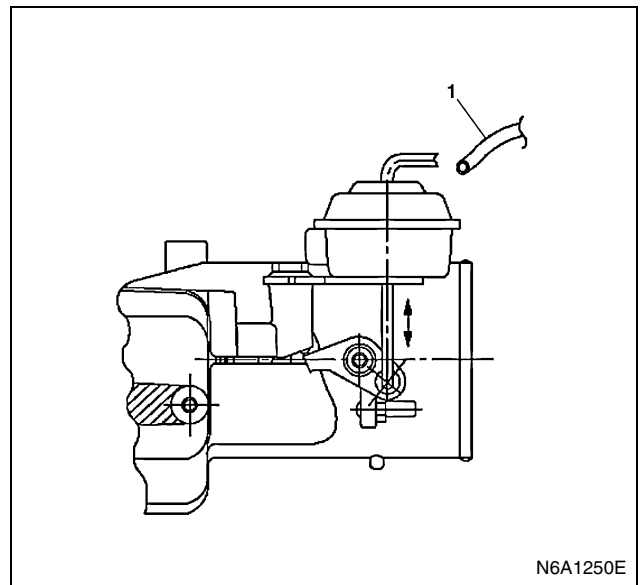
Legend

1. Power chamber
2. Adjust bolt
3. Valve
4. Close

2. Intake Throttle Valve

Working Check

Disconnect the vacuum hose from the actuator and try to move the rod by hand, making sure of the smooth move of the rod.



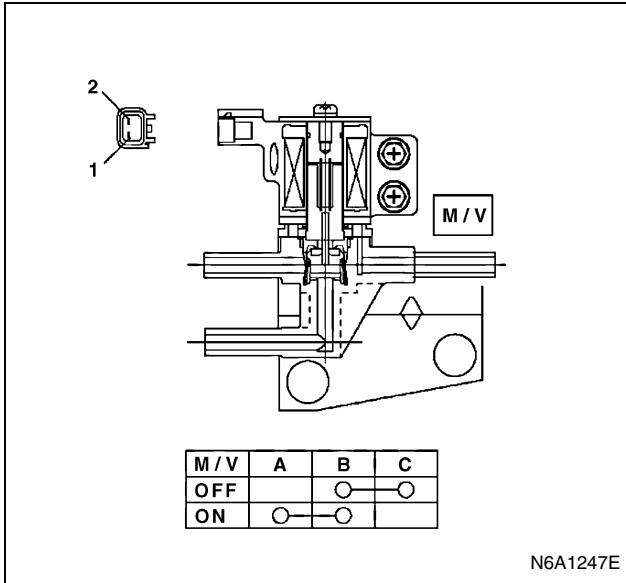
Legend

1. Vacuum hose

3. Exhaust Brake Magnetic Valve

Inspection

Connect the magnetic valve connector terminal No.1 and No.2 to (+) terminal and (-) terminal of battery respectively, and check the continuity between the ports.



Legend

- A. Inlet (vacuum pump)
- B. Outlet (unit)
- C. EXH (air filter)

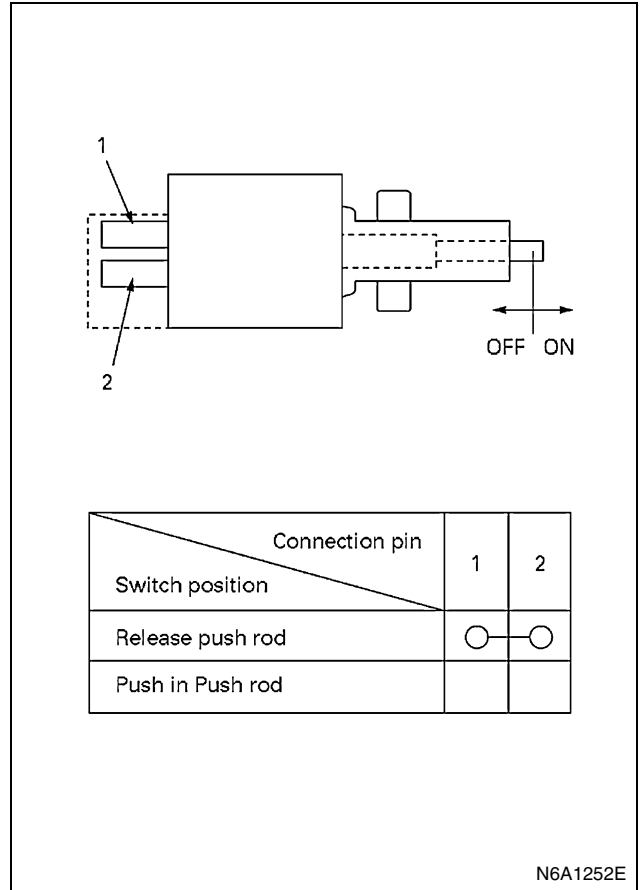
4. Accelerator Switch (2-pole connector type)

Inspection

- 1) Check the continuity between the switch connector terminals.
- 2) Check the smooth move of the pushrod. If the check result is abnormal, repair or replace the pushrod.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



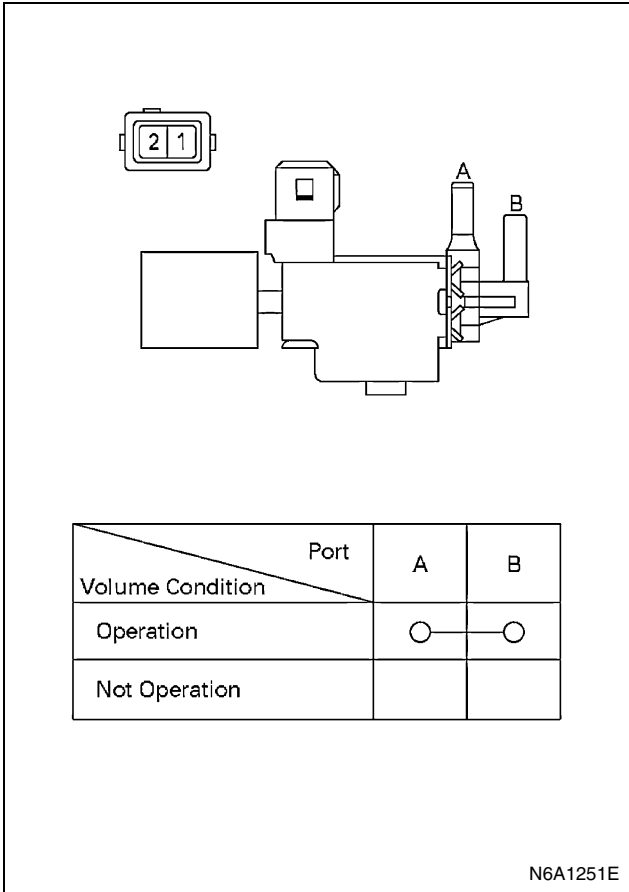
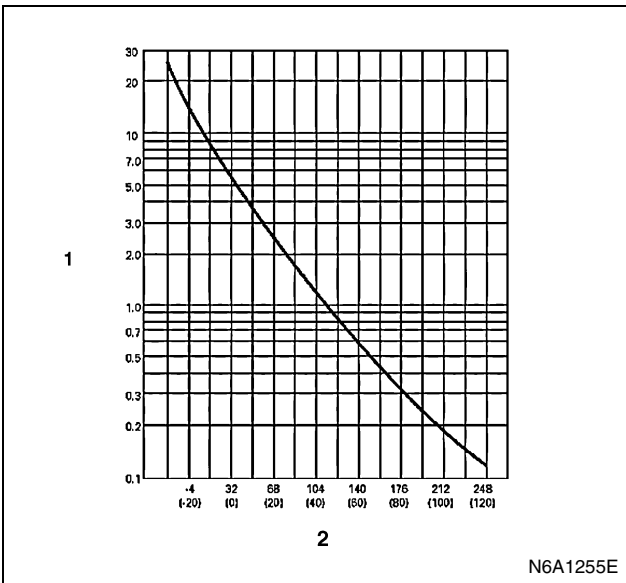
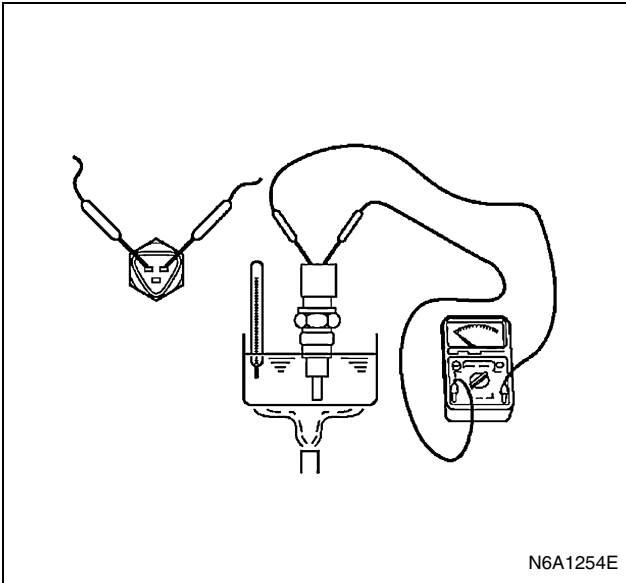
Removal

- 1) Accelerator Switch
Disconnect the connector.
Loosen the lock nut.
Turn the switch to remove.

Reinstallation

To install, follow the removal procedure in reverse order:

- 1) Drive the threaded part of the switch until its end surface becomes flush with that of the bracket side of nut.
- 2) Tighten the lock nut.
Tightening torque: 1.3 N·m (0.13 kg·m/11.5 lb·in)
5. Thermosensor (Engine coolant temperature)
Soak the temperature sensitive part of a thermosensor in the water, and while changing the water temperature, make sure the resistance is changed as the following graph shows:



Legend

- 1. Resistance (kΩ)
- 2. ECT °F (°C)

6. Vacuum Switching Valve; Intake Throttle Inspection

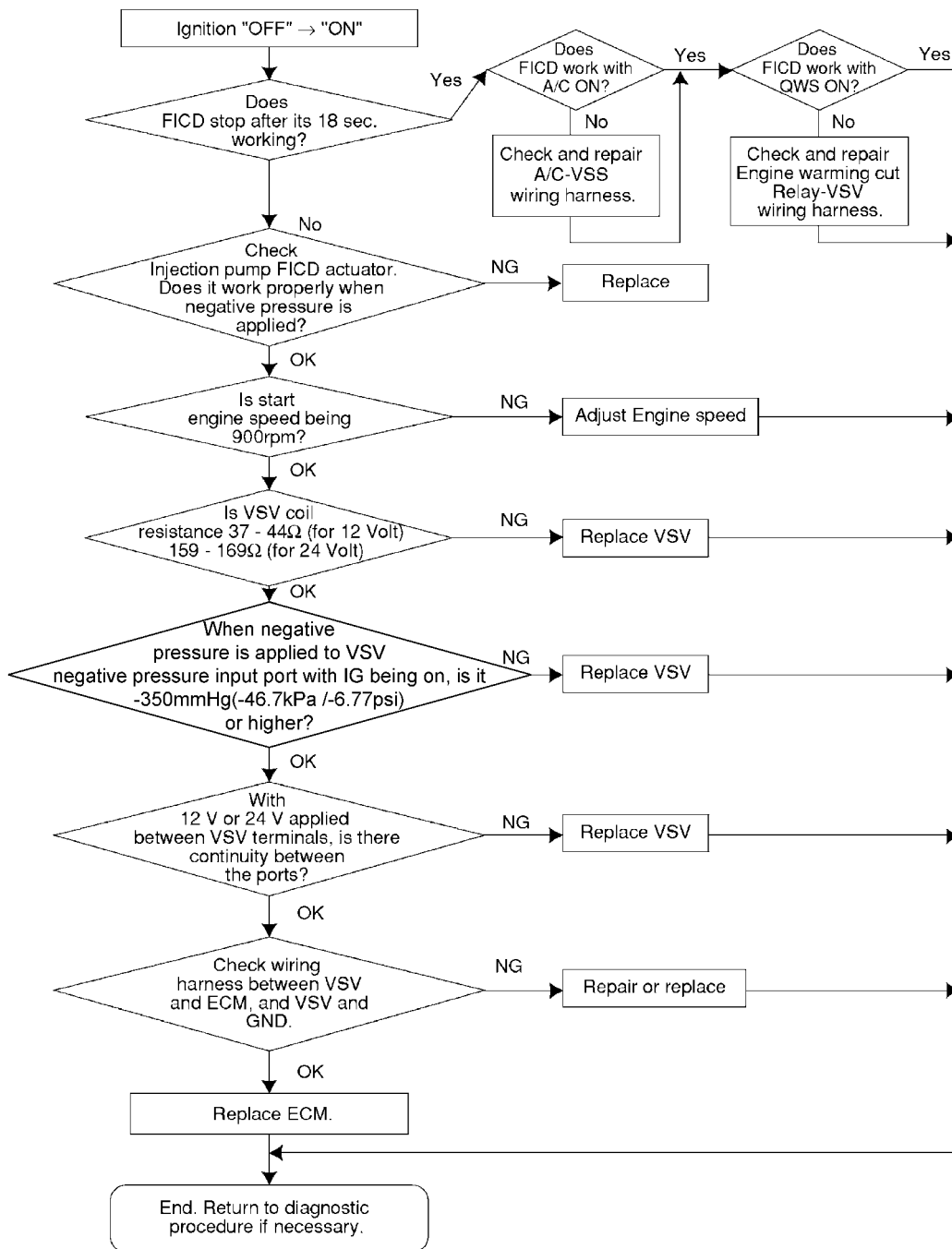
Connect the vacuum switching valve connector terminals No.1 and No.2 to (+) terminal and (-) terminals of battery respectively, and check the continuity between the ports.

If the check result is abnormal, repair or replace the valve.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Fast Idle Control Device (FICD) System Malfunction



N6A1677E

Inspection

Vacuum Switching Valve (VSV)

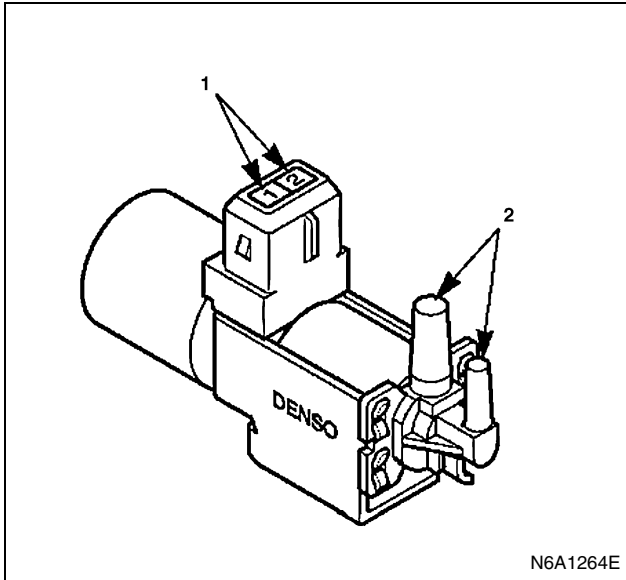
Resistance Check

Check the resistance between the VSV connector terminals using a circuit tester.

Cold Resistance

: 37 — 44 (Ω) (for 12 Volt)

: 159 — 169 (Ω) (for 24 Volt)

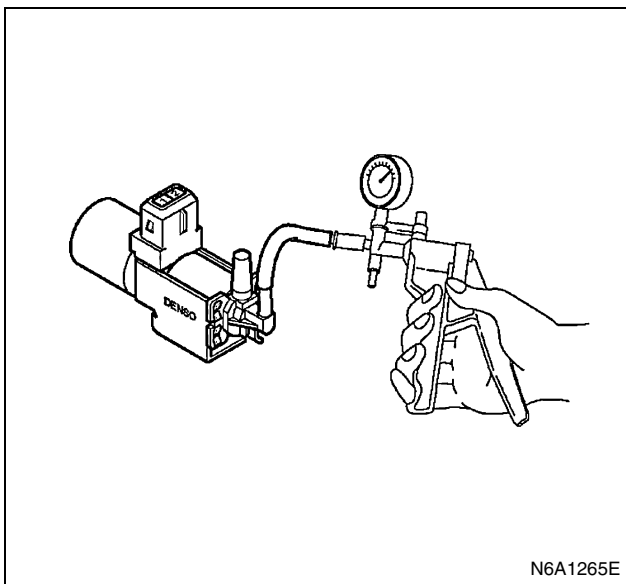


N6A1264E

Legend

1. 2 Pin
2. Port

Connect the battery voltage between VSV connector terminals and make sure of the continuity between the ports.

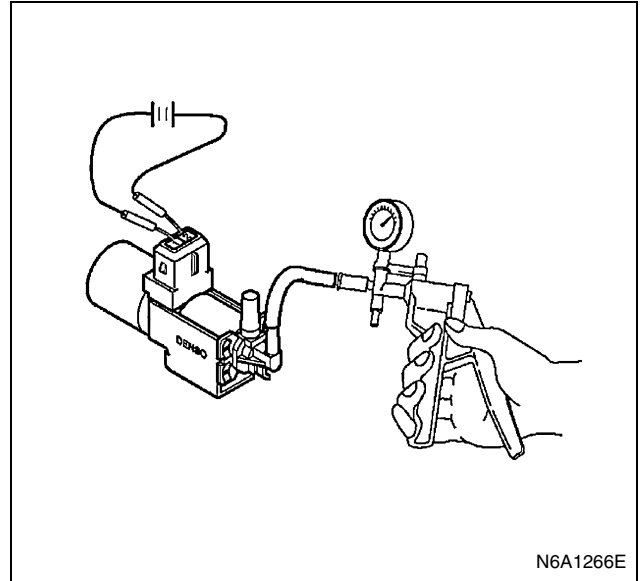


N6A1265E

Airtight Check

Apply negative pressure to the negative pressure input port as illustrated on the left.

Although there is leakage, it is no problem if the negative pressure rises to -46.7 kPa (-350 mmHg / -6.77 psi) or more.



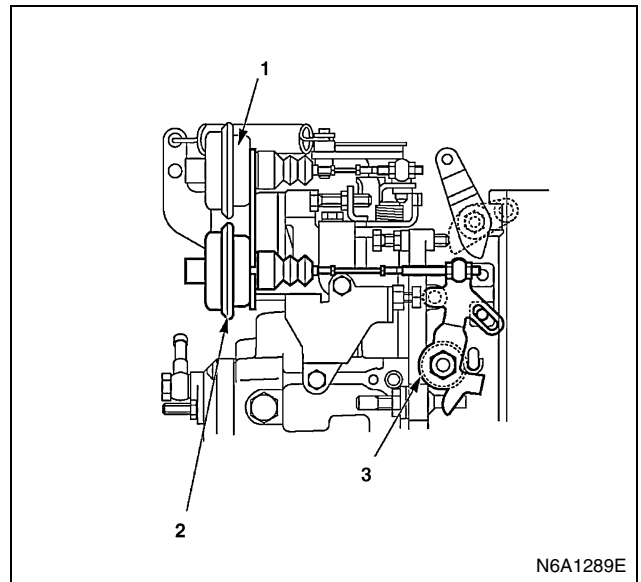
N6A1266E

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

Working Check

Apply power voltage between the terminals, there is no problem if the negative pressure does not rise when applied to the input port.

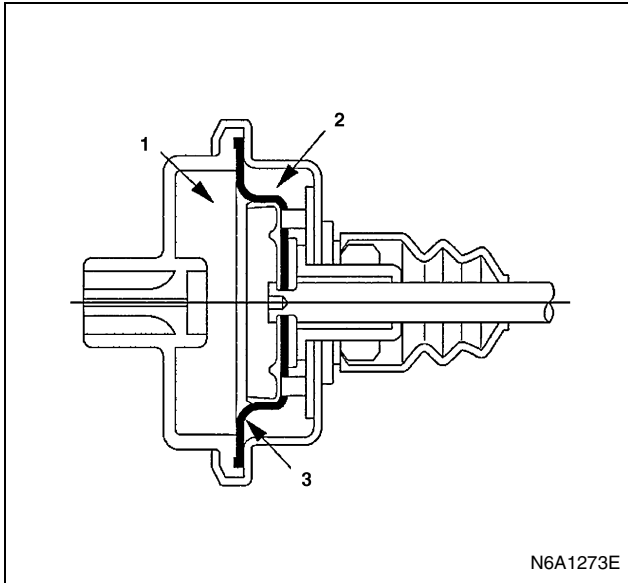


N6A1289E

Legend

1. FICD actuator
2. Aneroid compensator actuator
3. Full rod set lever

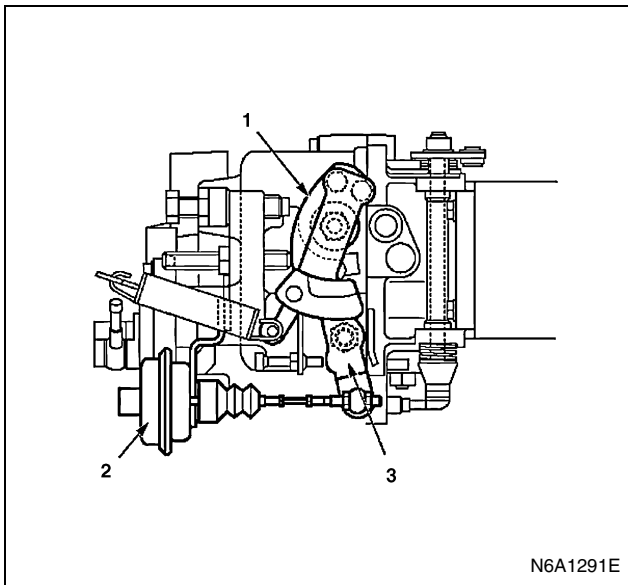
1. Diaphragm is built in the actuator, by which the inside of the actuator is divided into two, atmospheric room and negative pressure room.



Legend

- 1. Vacuum chamber
- 2. Atmospheric chamber
- 3. Diaphragm

- 2. Fast Idle Control Device (FICD) actuator link is connected to FICD lever, setting speed control lever at a specified speed when FICD is at work at the time of idling.

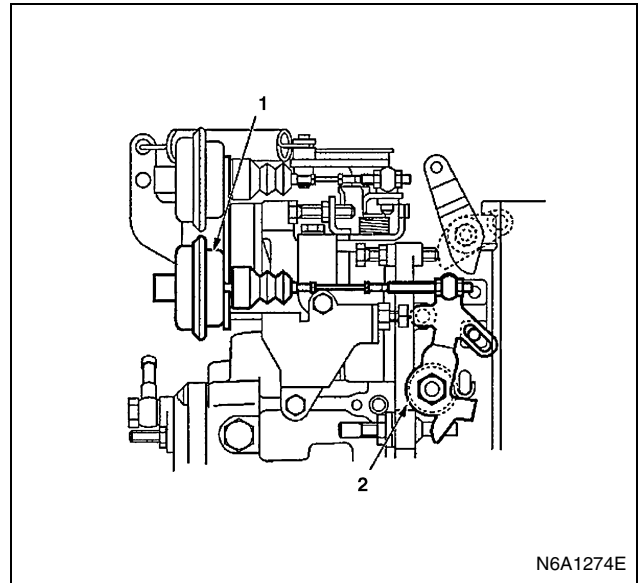


Legend

- 1. Speed control lever
- 2. FICD actuator
- 3. FICD lever

- 3. The link of the actuator for the aneroid compensator is connected to full load set lever. The full load set lever is connected to a U-lever. When the atmospheric sensor built in Engine Control Module (ECM) makes the actuator work, the full load set lever and U-lever are rotated to a specified position

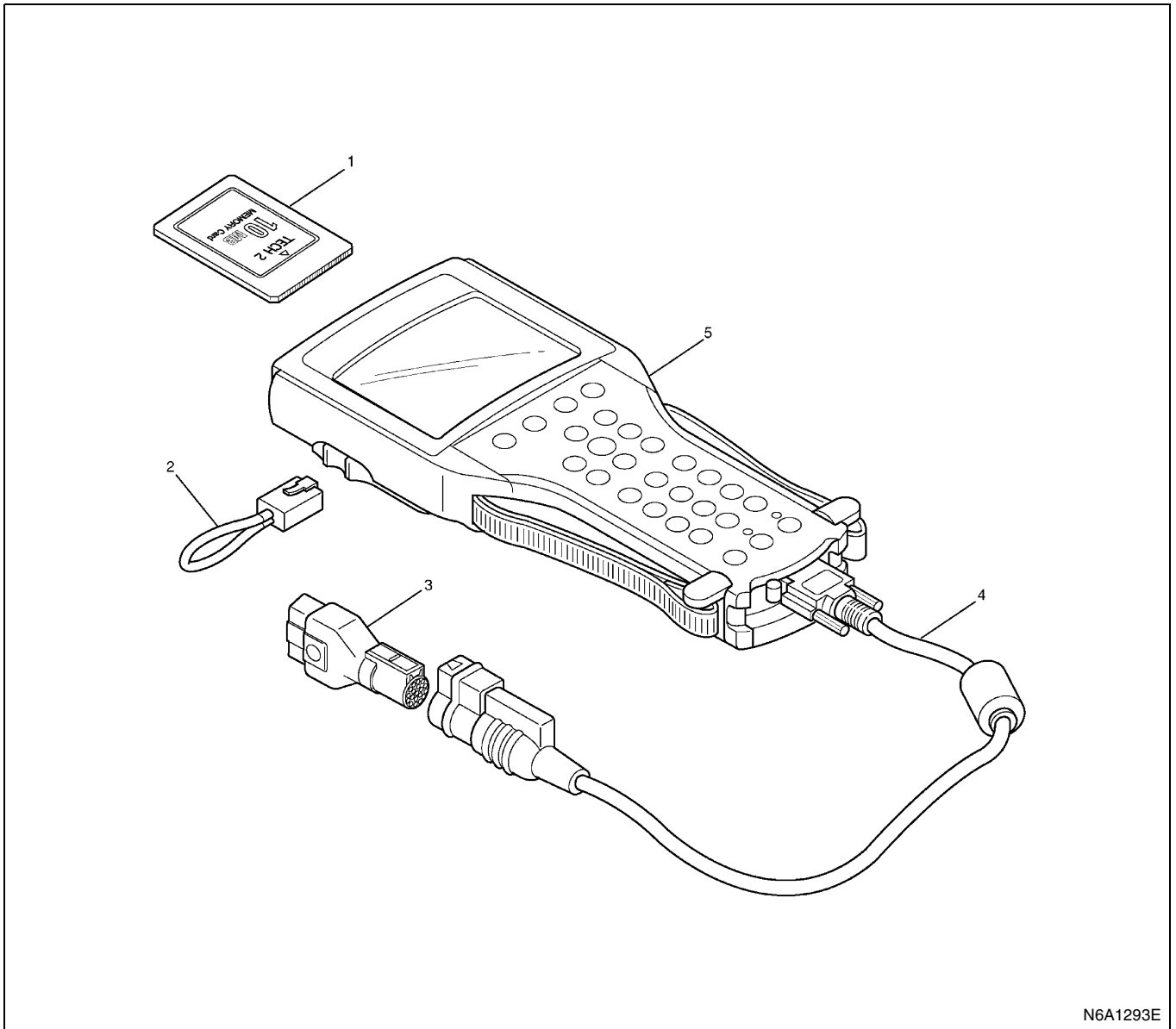
so that the control rack is drawn in the direction of reducing fuel injection amount.



Legend

- 1. Aneroid compensator actuator
- 2. Full load set lever

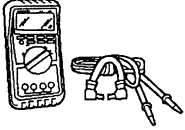
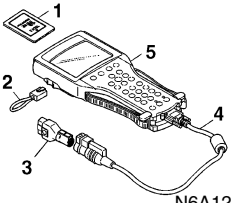
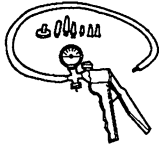
SPECIAL TOOLS



N6A1293E

Legend

- | | |
|------------------------------|--------------|
| 1. PCMCIA card | 4. DLC cable |
| 2. RS232 loop back connector | 5. TECH-2 |
| 3. SAE 16/19 adapter | |

Illustration	Tool Number / Description / Remarks
 <p>5884003660</p>	<p>5-8840-0366-0 (J 39200) / High Impedance Multi-meter (Digital Voltmeter-DVM)</p>
 <p>N6A1295E</p>	<p>1. PCMCIA Card 2. RS232 Loop Back 3. SAE 16/19 Adapter 4. DLC Cable 5. TECH-2</p>
 <p>5884002790</p>	<p>5-8840-0279-0 (J 23738-A) / Vacuum Pump with Gauge</p>

DIAGNOSIS (4HG1-T Only)

Strategy-Based Diagnostics

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
 - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
 - Conduct a thorough visual inspection.
 - Review the service history.
 - Detect unusual sounds or odors.
 - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
 - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check (s).
 - “System checks” contain information on a system that may not be supported by one or more DTCs.
System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

Diagnostic Trouble Code (DTC) Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matchig Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Call technical assistance for similar cases where repair history may be available. Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Evaluate the symptoms and the conditions described by the customer.
2. Use a check sheet or other method to identify the circuit or electrical system component.

3. Follow the suggestions for intermittent diagnosis found in the service documentation.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re-examine the complaint. When the Complaint cannot be successfully found or isolated, a re-evaluation is necessary.

The complaint should be re-verified and could be intermittent as defined in Intermittents, or could be normal.

2. Repair and verify.

After isolating the cause, the repairs should be made.

Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:

- Conditions noted by the customer.
- If a DTC was diagnosed, verify a repair by duplicating conditions present according to customer complaint.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with self diagnostic system diagnostics. Following a repair, the technician should perform the following steps:

Important:

Follow the steps below when you verify repairs on self diagnostic systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records for the DTC which has been diagnosed.
2. Clear the DTCs.
3. Operate the vehicle within conditions according to customer complaint.
4. Monitor the Diagnostic Trouble Code (DTC) status information for the specific DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

GENERAL SERVICE INFORMATION

Visual/Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspection all vacuum hoses for punches, cuts, disconnects, and correct routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in a engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge of Tools Required

Notice:

Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual

Self Diagnostic System Check

Self Diagnostic System should be checked as follows:

1. When Ignition key is turned from the "OFF" to the "ON" position, make sure that Malfunction Indicator Lamp (MIL) is lit for 0.3 — 0.8 sec.
2. Connect Scan Tool and check to see if MIL is always lit.

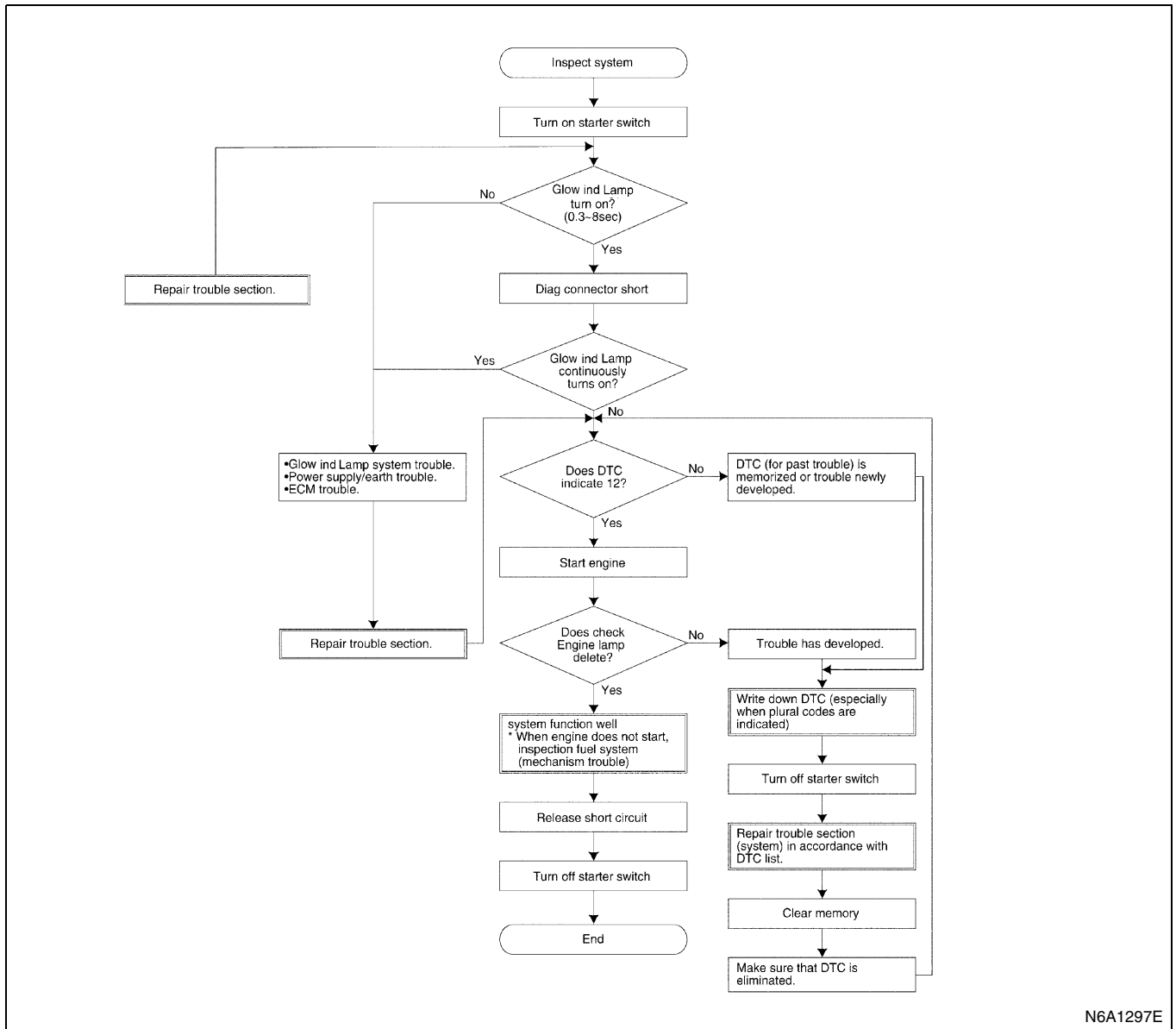
If so, Self Diagnostic System is normal.

Troubleshooting

Caution taken in inspecting

1. In inspecting system, write down Diagnostic Trouble Code (DTC) to be indicated. (especially, when plural self-diagnosis codes are indicated.)
2. Before eliminating the indicated DTC by a memory clear switch, doubly inspect abnormal place as indicated in DTC.

Inspection Procedure Flowchart (Diagnostic System Check)



N6A1297E

Notice:

Please note that some items of DTC may not be generated unless the engine is warmed up or unless the vehicle is driven under load.

Self-diagnosis Functions

Memorization of diagnostic trouble code

The self-diagnosis code indicated will be memorized in Electronically Erasable Programmable Read Only Memory (EEPROM) with in the Engine Control Module (ECM).

Accordingly even if the starter switch turns off or the ECM is removed from the vehicle, the memorized self-diagnosis code will not be eliminated.

* Unless an elimination procedure is taken, the diagnostic trouble code (DTC) will remain in memory. (The memory will be eliminated only by a memory clear switch.)

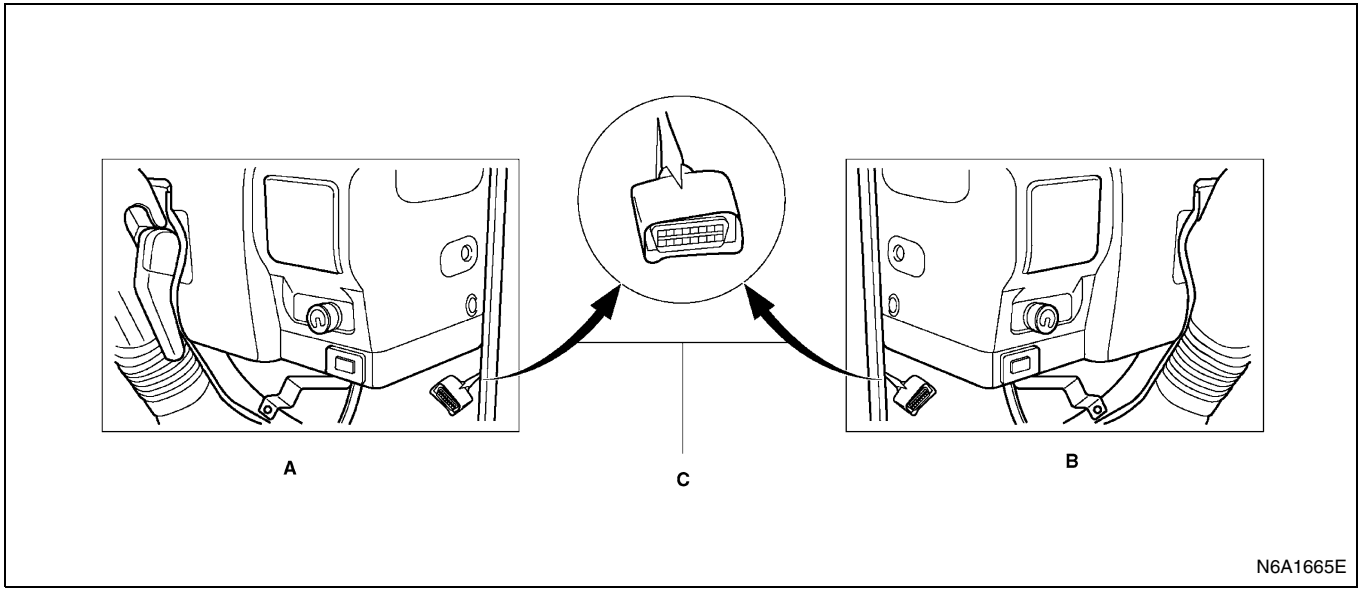
Elimination of diagnostic trouble code

The DTC memorized in the EEPROM with in the ECM can be eliminated only by the operation of the memory clear switch. The elimination method memory clear switch will be described below:

1. Turn OFF ignition switch.
2. Use 4.7kΩ resistance and make short circuit on memory clear switch.
3. Turn ON ignition switch. The indication lamp turn on (lighting) continuously after three seconds flashing the indication lamp.
4. Turn OFF ignition switch.
5. Remove shortage resistance from memory clear switch.

Location of the Memory Clear Switch

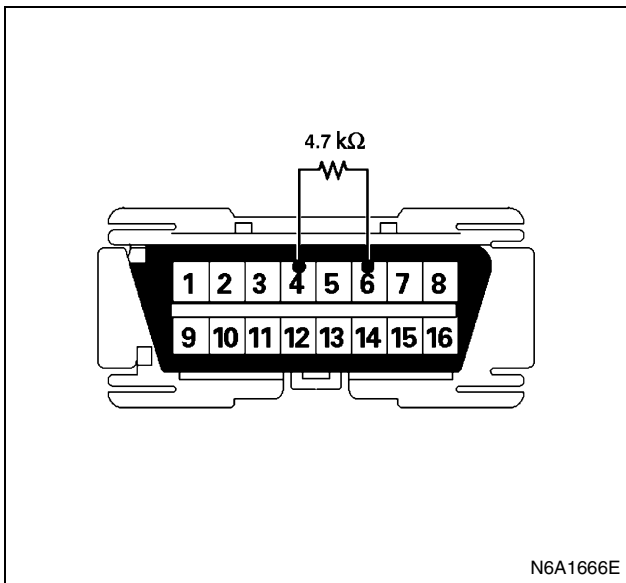
Location of the Memory Clear Switch (Diagnosis Connector)



N6A1665E

Legend

- A. Right-hand drive
- B. Left-hand drive
- C. Terminal assignment of diagnosis connector



N6A1666E

NO	TERMINAL NAME
6	DIAG CONTROL
7	CHECKER SIG
4, 5	CHECKER GND

How to read flashing of the indicator lamp:

The two-digit diagnosis code flashes starting from ten's figure to indicate the diagnosis code.

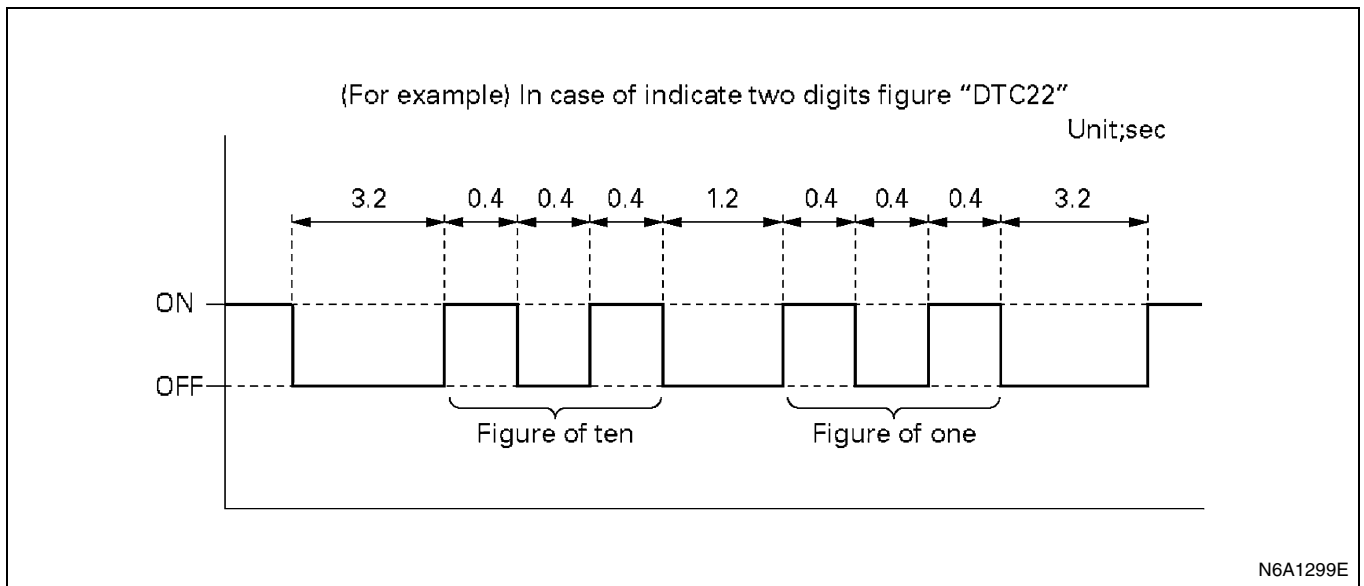
Please read the diagnosis code from the flashing.

If the plural diagnosis codes are indicated, the same diagnosis code is flashed repeatedly in steps of three times.

Please read it correctly.

- Diagnostic Trouble Code (DTC) outputting is done in decreasingly order of DTC number.
- Indication is changed over on completion of output DTC indication.
- DTC indicator is stopped with diagnostic switch being off.
- When there is no DTC output, -12+ is outputted in normal DTC code.
- After indicating 3 times per 1 DTC, shift is conducted to the next DTC. (After making a round, the indications are repeated again.)
- In case of the same diagnostic code, it is used 1 DTC (3 times indication.)

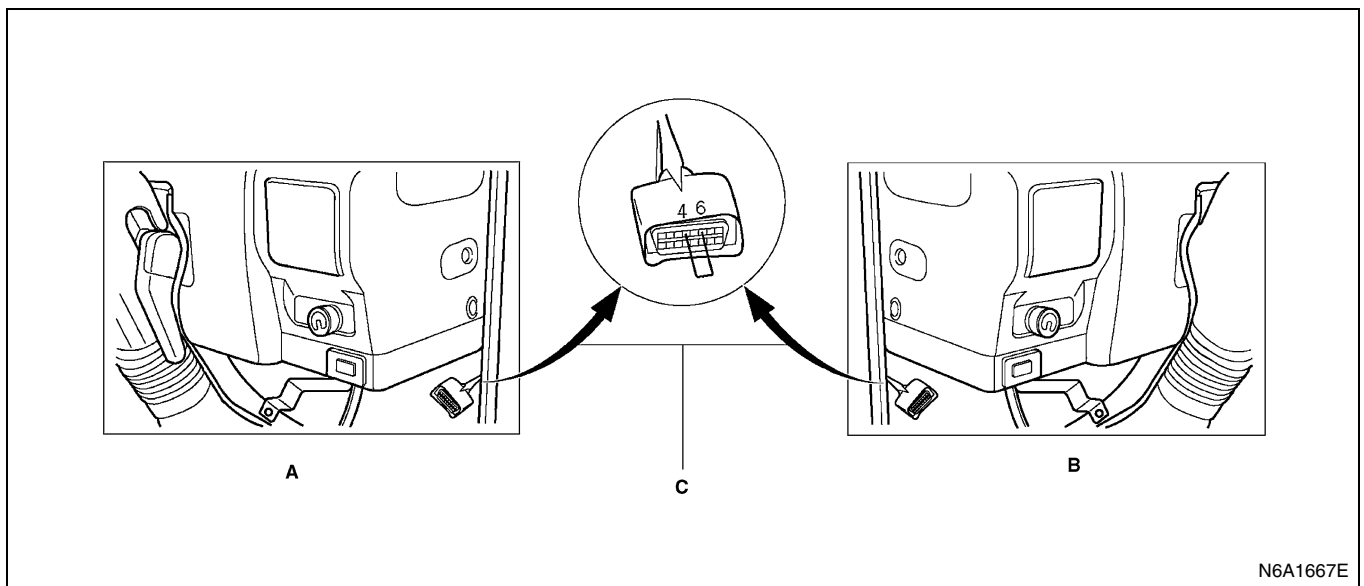
Example Diagnosis Trouble Code Output



Legend

- | | |
|--|------------------|
| 1. (For example) In case of indicate two digits figure "DTC22" | 2. Figure of ten |
| | 3. Figure of one |

Flashing of Indicator Lamp



Legend

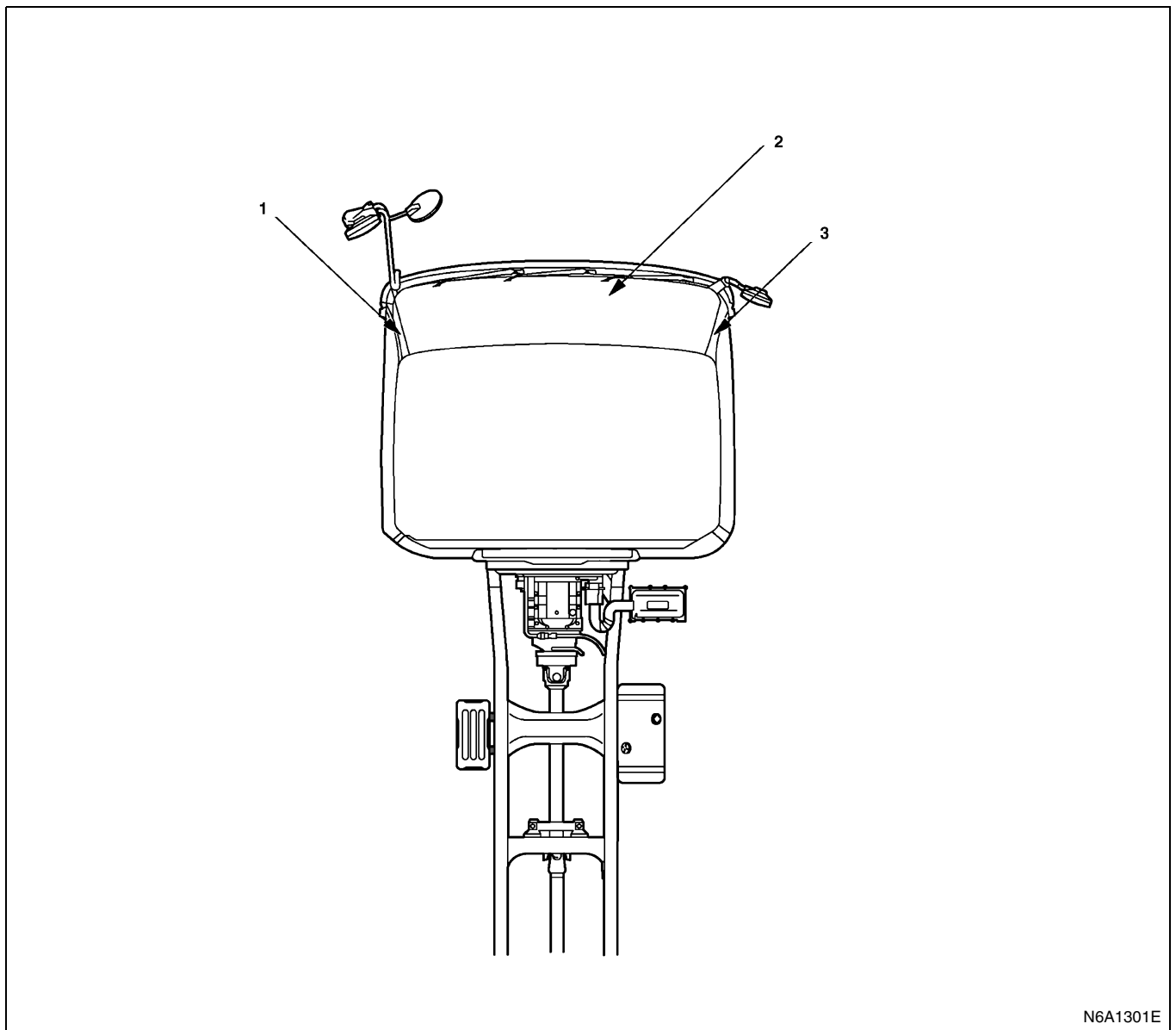
- | | |
|---------------------|---|
| A. Right-hand drive | C. Terminal assignment of diagnosis connector |
| B. Left-hand drive | |

Diagnosis Trouble Code (DTC) List

DTC#	TECH 2 STRING
21	Rack Sensor Circuit Low Voltage
22	Rack Sensor Circuit High Voltage
13	Engine Coolant Temperature (ECT) Sensor Circuit High Voltage
14	ECT Sensor Circuit Low Voltage
31	Exhaust Gas Recirculation (EGR) Vacuum Switching Valve (VSV) Solenoid Circuit Low Voltage
32	EGR VSV Solenoid Circuit High Voltage
52	Electronically Erasable Programmable Read Only Memory (EEPROM) Error

Error Classified		Trouble Code	Diagnostic Condition	Return Condition	Back Up	Judging Time
Normal		12	No other trouble code.		No history of this diagnosis recorded	—
Rack Sensor	Harness Open GND short	21	Rack Voltage 0.3V or lower, Engine speed 600 — 900rpm, and water Temp. 0°C (32°F) or higher are detected for 3 seconds running.	When forward normal	VSV: EGR Output stop. Rack Learning valve: 0	3.52 sec
	+5V short Rack Sensor Power Voltage	22	5V or higher Rack Voltage detected.			0.52 sec
Water Temp Sensor	Harness Open +B short	13	-79°C/-110°F (390kΩ) or lower, or 120°C/248°F (115kΩ) or higher detected.	When forward normal	VSV: EGR Output stop.	0.52 sec
	GND short	14				
VSV: EGR	Harness Open GND short	*31	Output TR Monitor	When forward normal	VSV: EGR Output stop.	1.57 sec
	+B short	*32				
	ECM EEPROM error	52	Check when ECM is started and when Trouble Code is written.	When forward normal	Trouble Code other than 52 (EEPROM error) not indicated.	

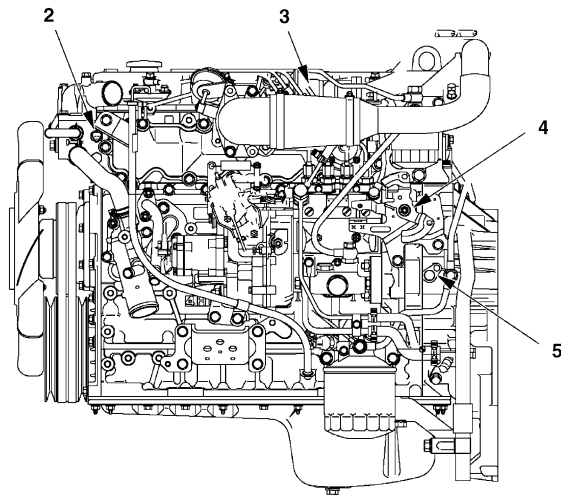
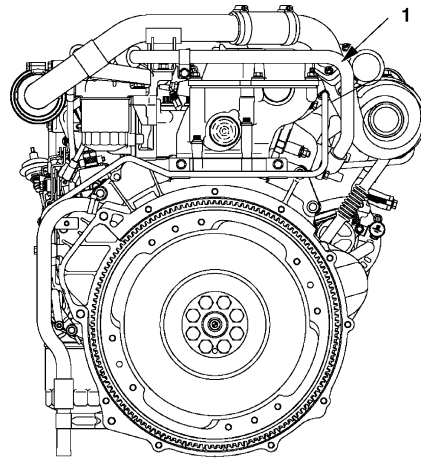
Location of Sensor and Switch



N6A1301E

Legend

- | | |
|--|---|
| 1. Diagnosis connector (Left-hand drive) | 3. Diagnosis connector (Right-hand drive) |
| 2. ECM including atmospheric | |

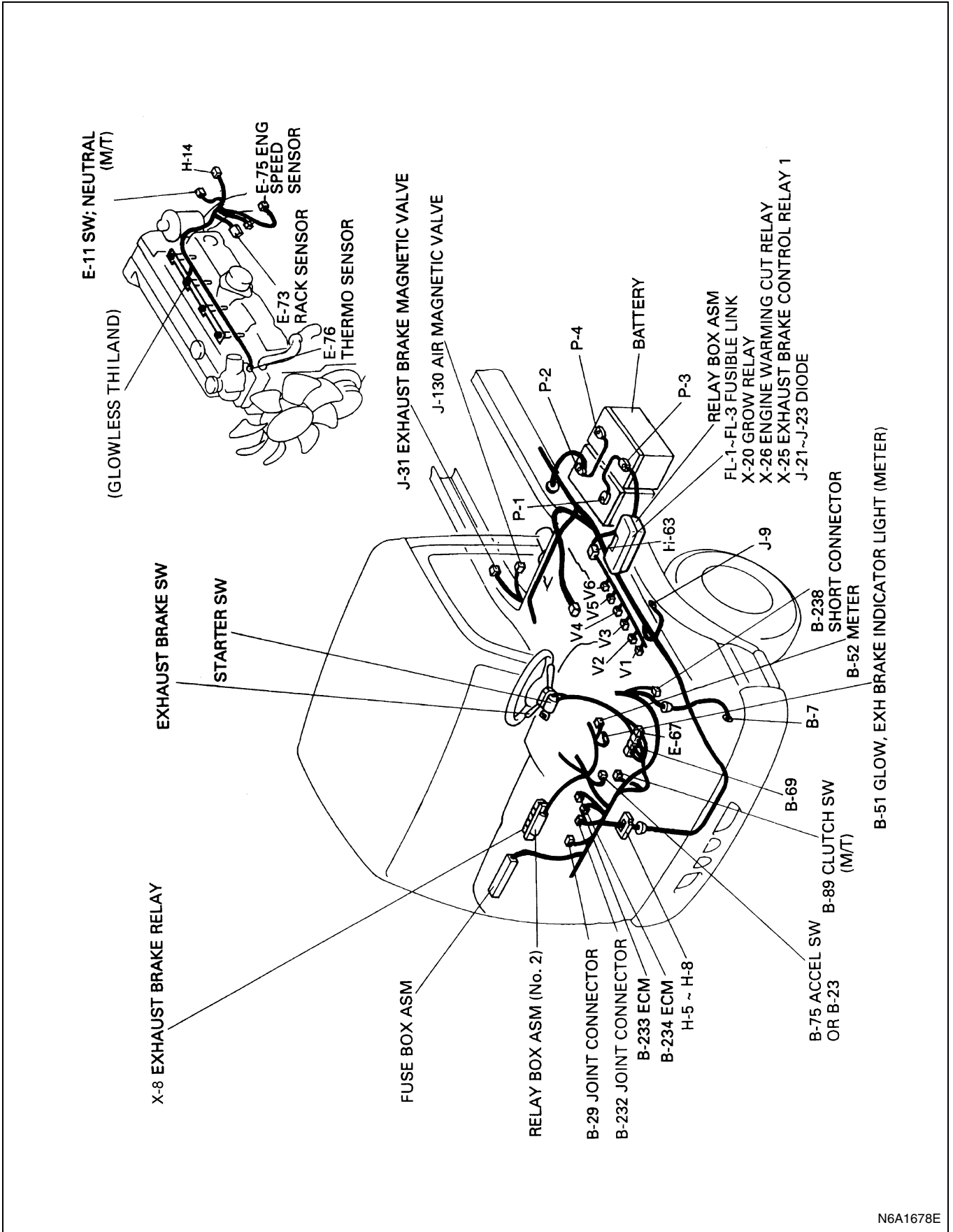


N6A1302E

Legend

- | | |
|------------------------|-----------------|
| 1. EGR pipe | 4. Rack sensor |
| 2. Coolant temp sensor | 5. Speed sensor |
| 3. EGR valve | |

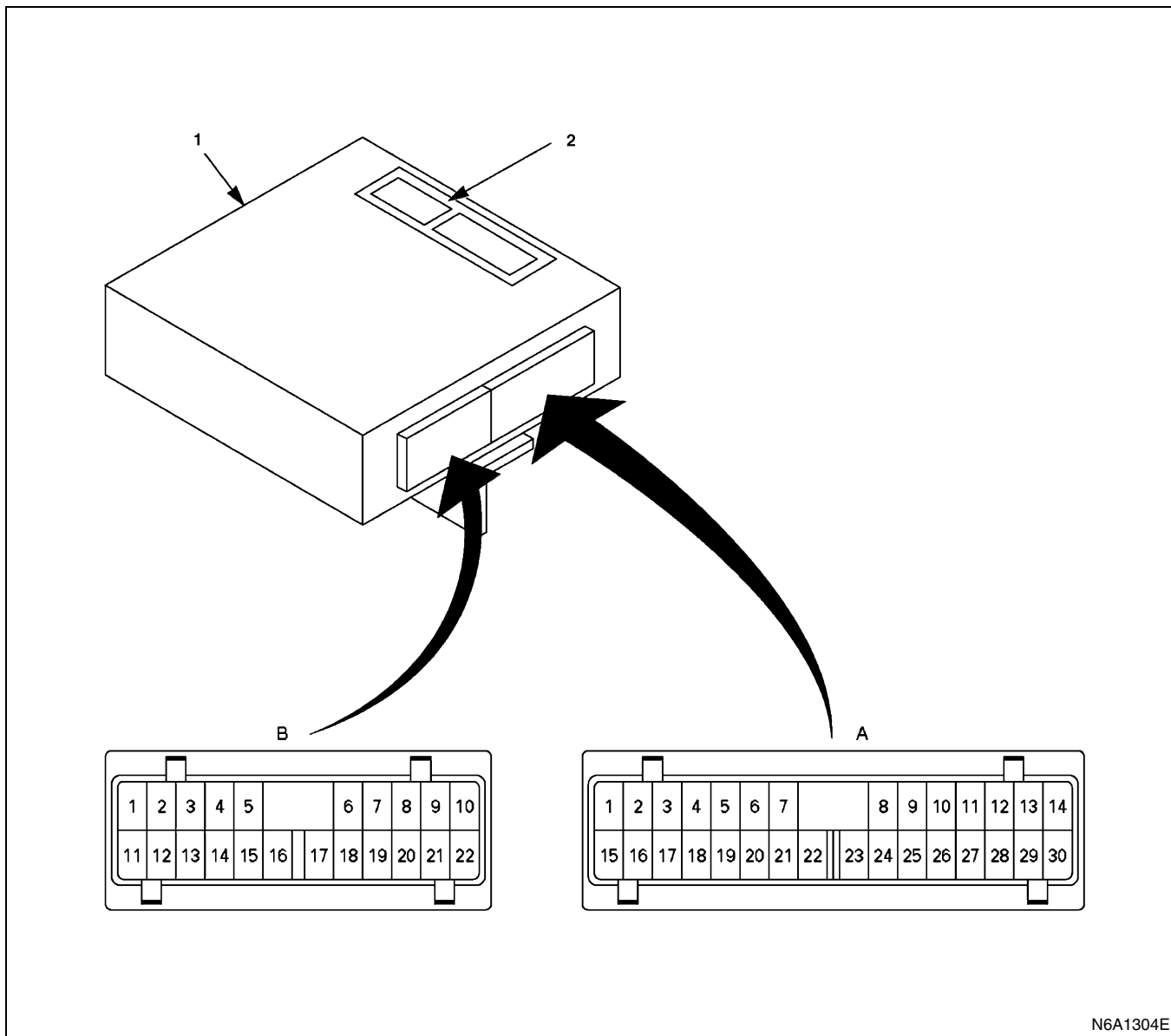
Parts Location



N6A1678E

Engine Control Module (ECM)

Appearance of ECM



Legend

- A. Detail of 30 pins connector
- B. Detail of 22 pins connector

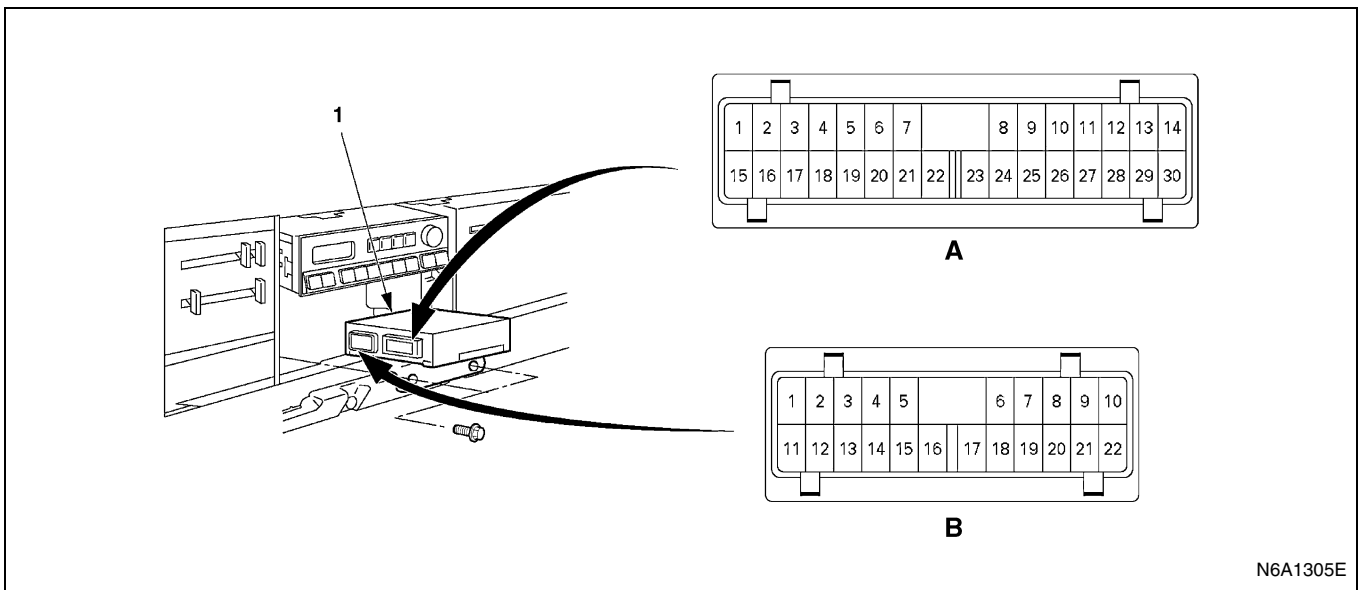
- 1. ECM
- 2. Name plate

Chart of Engine Control Module (ECM) Input/Output

Connector number	Connector name
A-1	CHECKER
A-2	Not used
A-3	QOS (W/Glow only)
A-4	Not used
A-5	Not used
A-6	RACK+
A-7	RACK SIG
A-8	BATTERY
A-9	IGKBY
A-10	Not used
A-11	Not used
A-12	Not used
A-13	Not used
A-14	Not used
A-15	CHECKER GND
A-16	DIAG
A-17	Not used
A-18	Not used
A-19	Not used
A-20	Not used
A-21	RACK-
A-22	GND
A-23	Not used
A-24	Not used
A-25	Not used
A-26	Not used
A-27	Not used
A-28	Not used
A-29	Not used
A-30	Not used

Connector number	Connector name
B-1	VSV: EGR
B-2	GLOW RELAY
B-3	GLOW IND LAMP
B-4	Not used
B-5	Not used
B-6	Not used
B-7	THERMO -
B-8	THERMO +
B-9	ENGINE -
B-10	ENGINE +
B-11	Not used
B-12	Not used
B-13	Not used
B-14	Not used
B-15	Not used
B-16	Not used
B-17	Not used
B-18	STARTER
B-19	EXH BRAKE
B-20	Not used
B-21	Not used
B-22	Not used

Location of the Engine Control Module (ECM) Connector

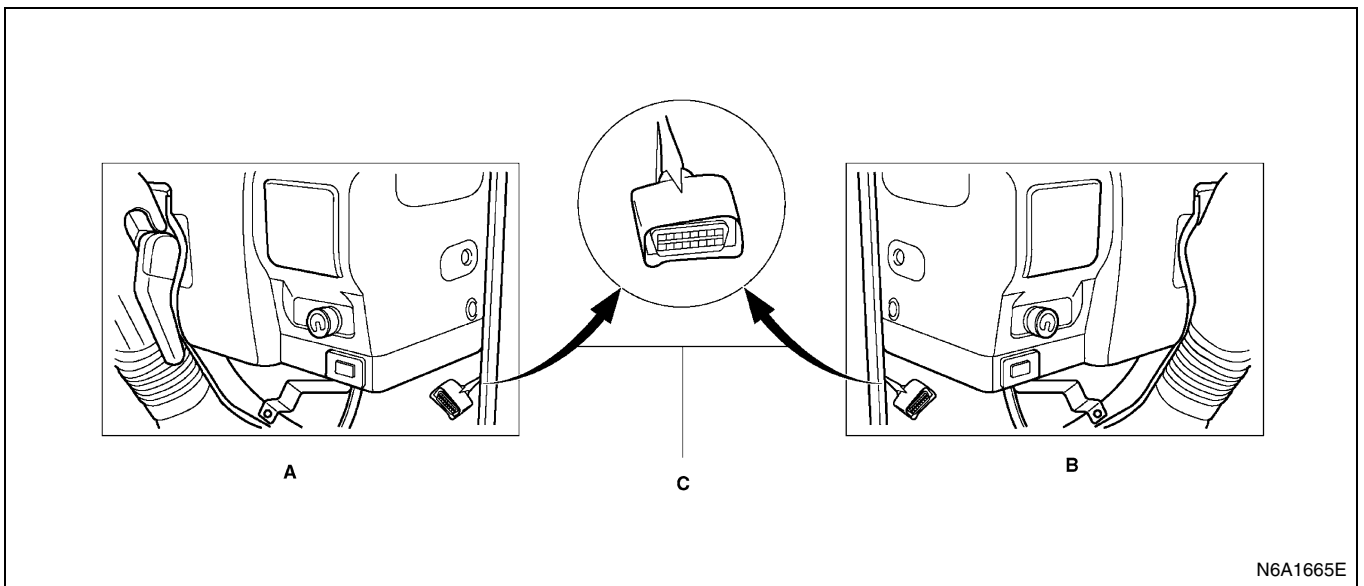


Legend

- A. 30 pins connector (green)
- B. 22 pins connector (green)

1. Engine control module (ECM)

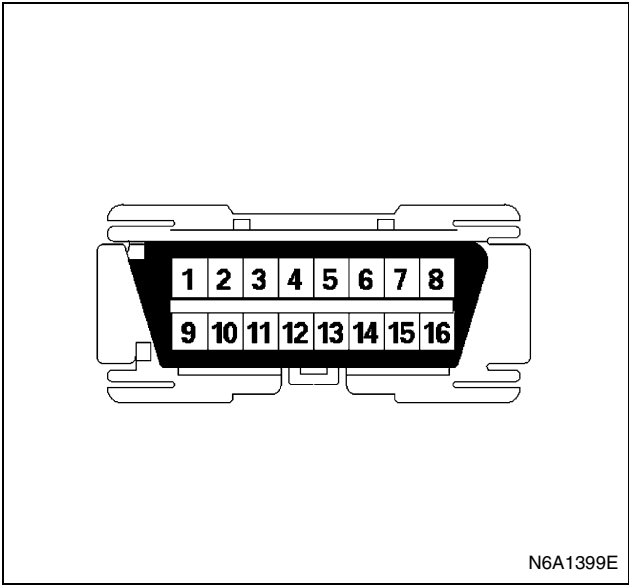
Location of Data Link Connector (DLC)



Legend

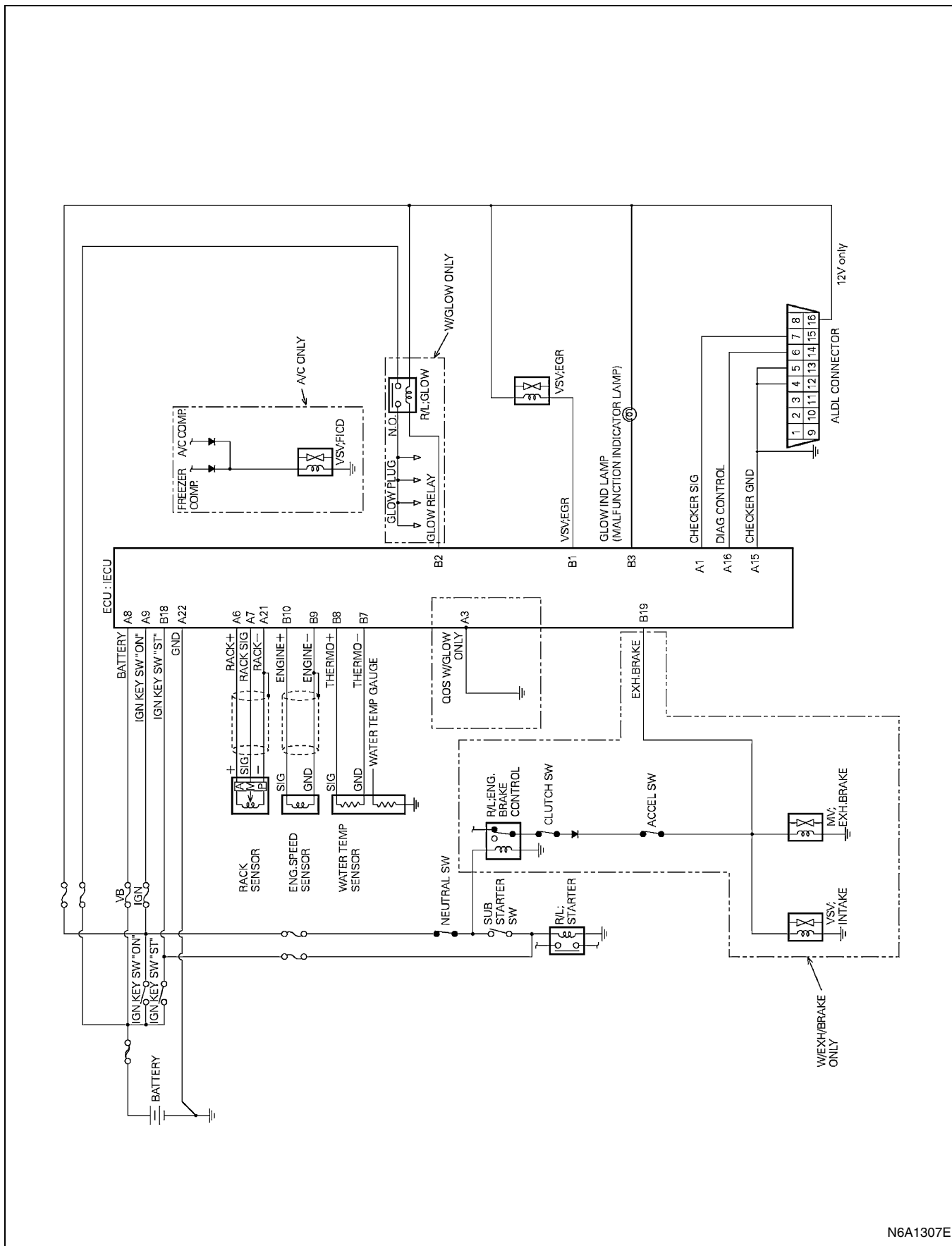
- A. Right-hand drive
- B. Left-hand drive

C. Terminal assignment of diagnosis connector



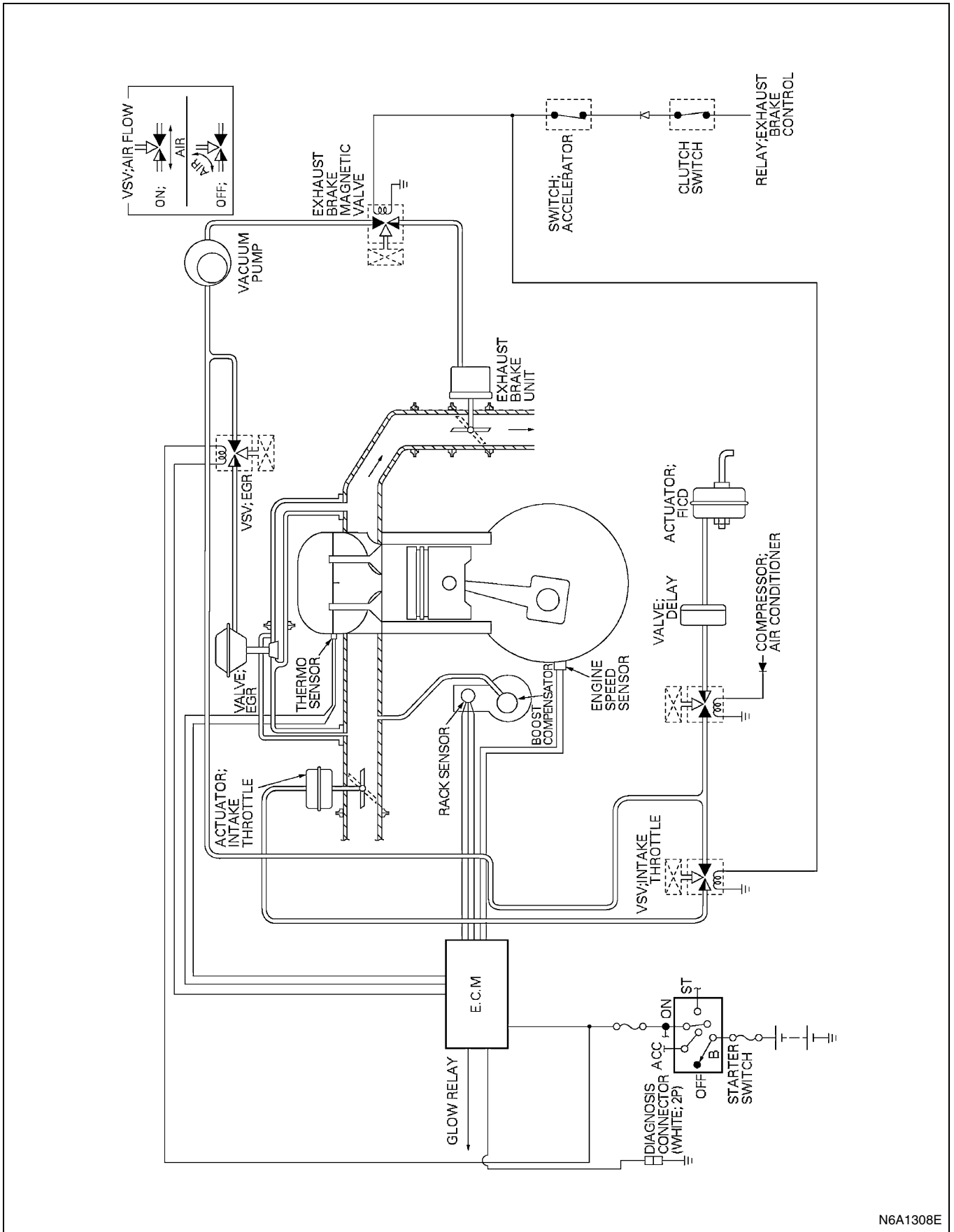
NO	TERMINAL NAME
6	DIAG CONTROL
7	CHECKER SIG
4, 5	CHECKER GND

Engine Control Module (ECM) System Wiring Diagram



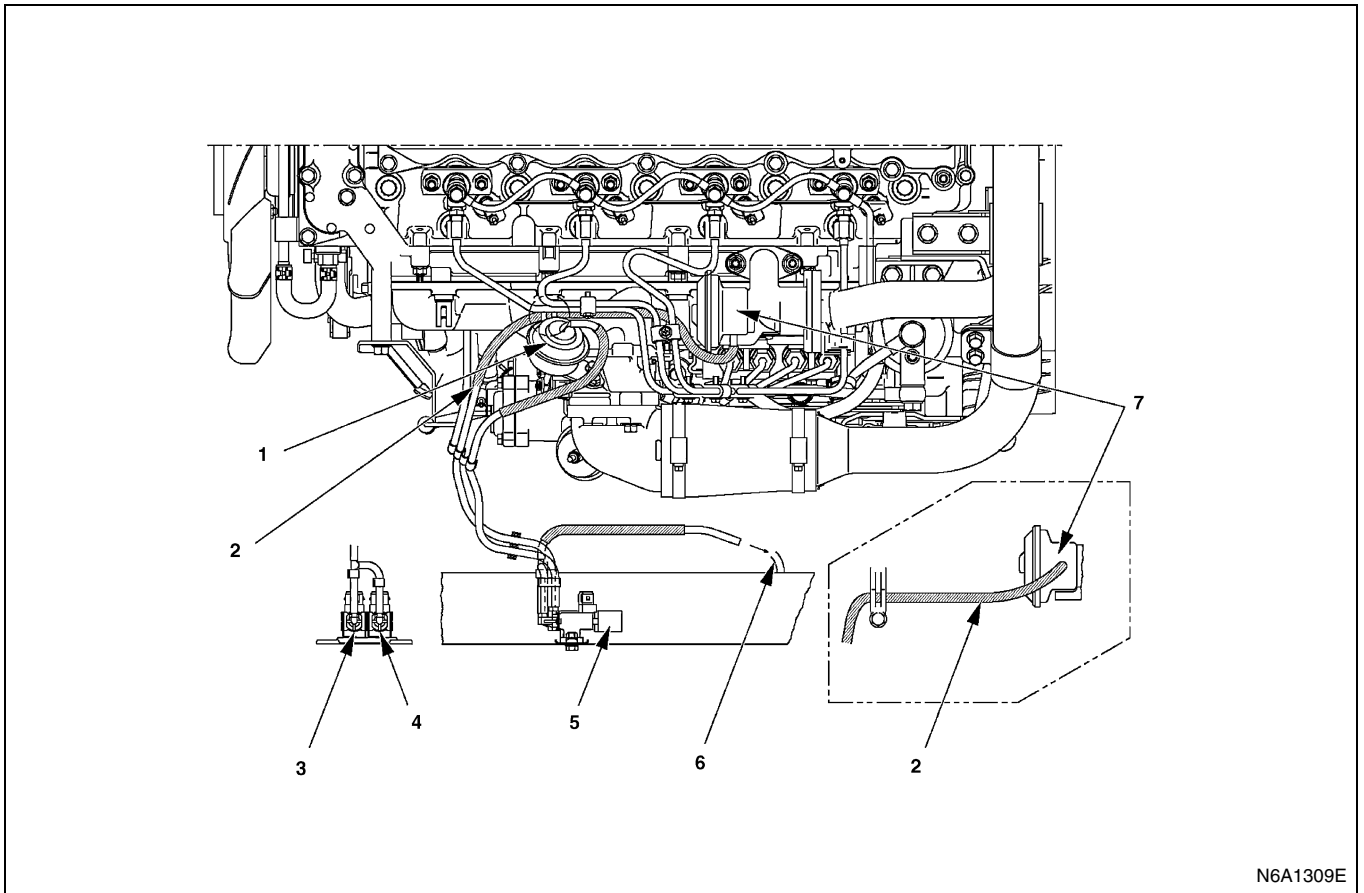
N6A1307E

Auxiliary Engine Control System (Equipped with Exhaust gas recirculation (EGR))



N6A1308E

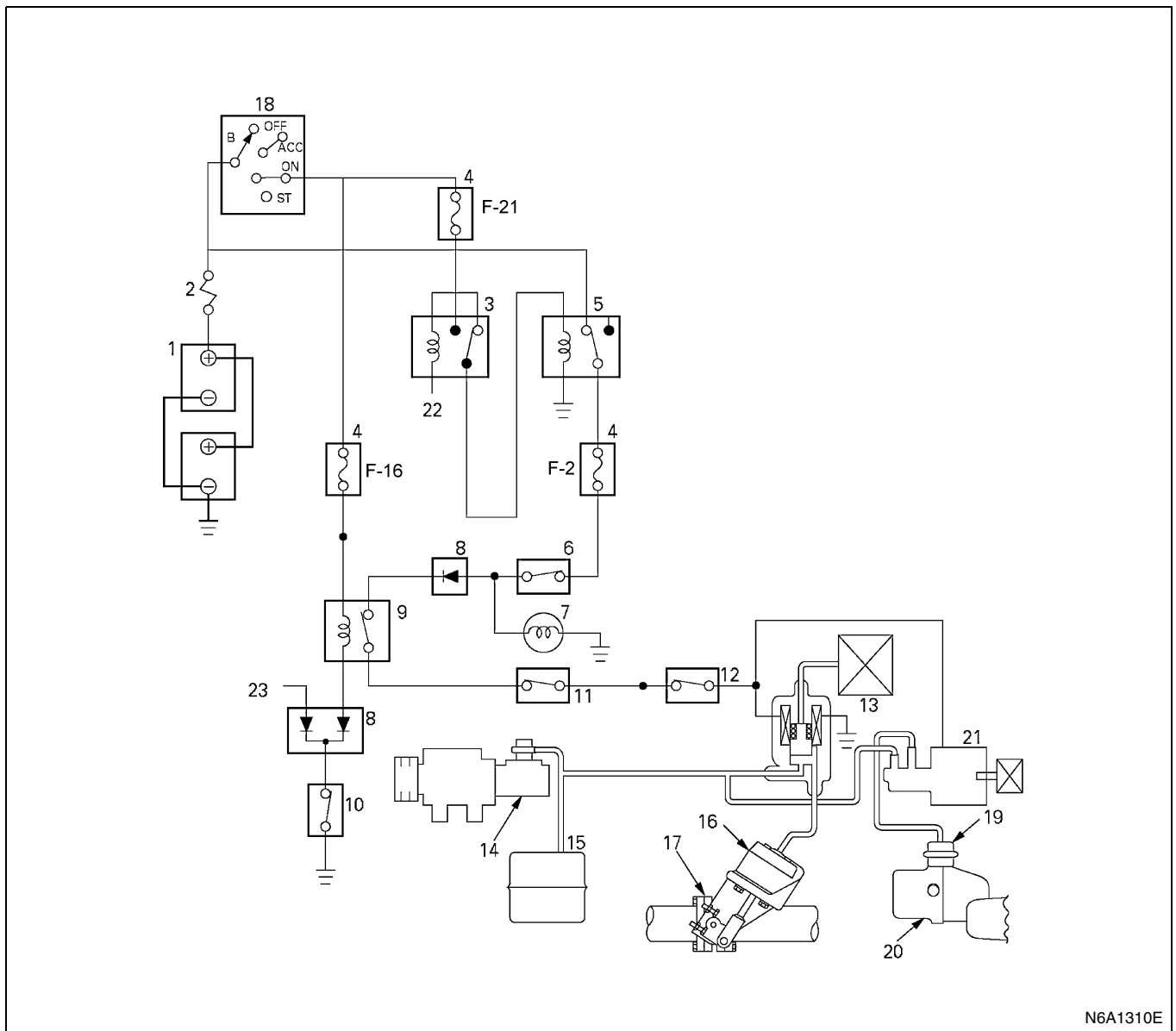
Vacuum Switching Valve (VSV) Circuit (Equipped with Exhaust gas recirculation (EGR))



Legend

- | | |
|----------------------------|---------------------------|
| 1. Intake throttle chamber | 5. Vacuum Switching Valve |
| 2. Vacuum hose | 6. Vacuum source |
| 3. Intake throttle valve | 7. EGR valve |
| 4. FICD valve | |

Exhaust Brake Control

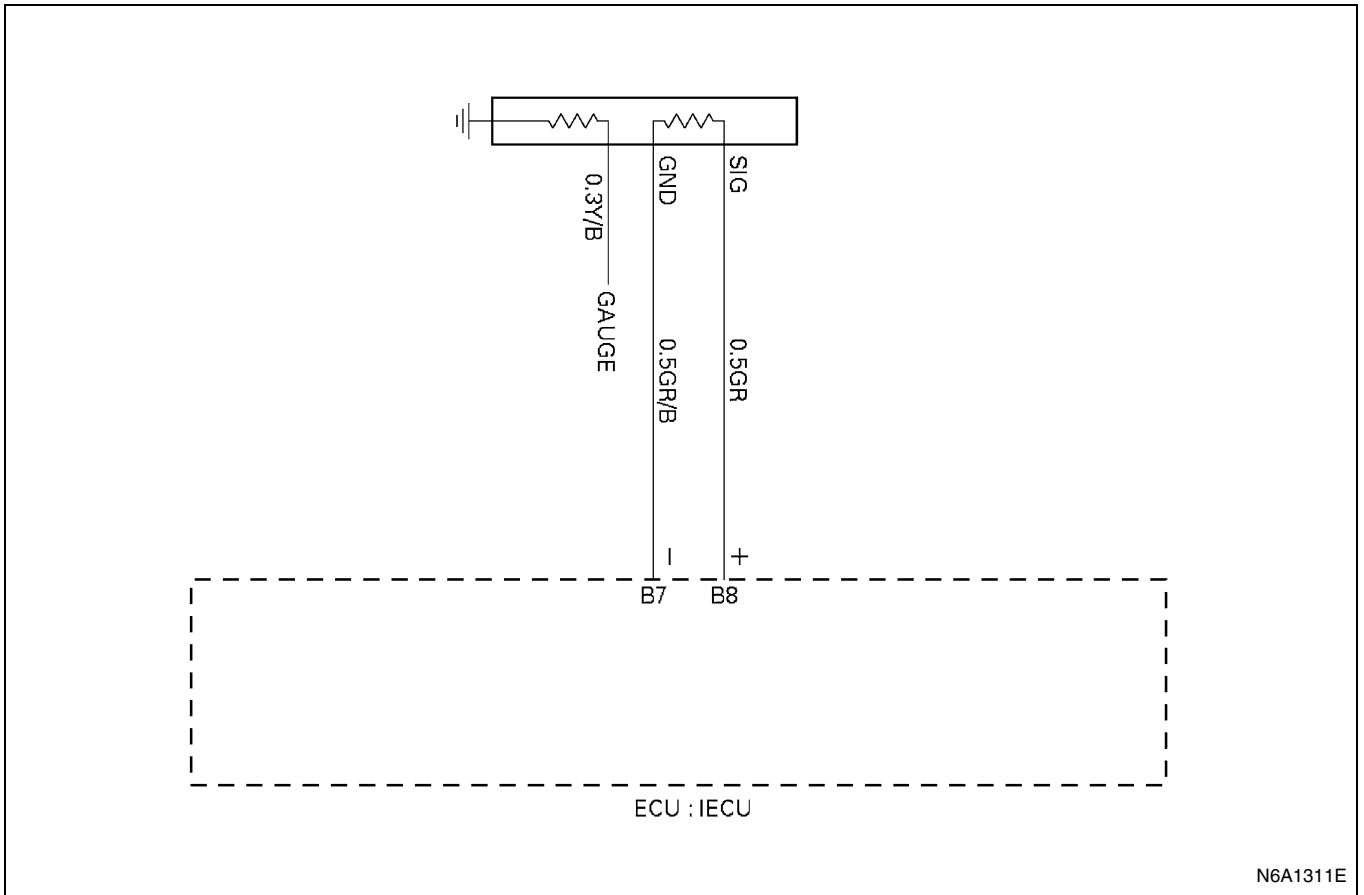


N6A1310E

Legend

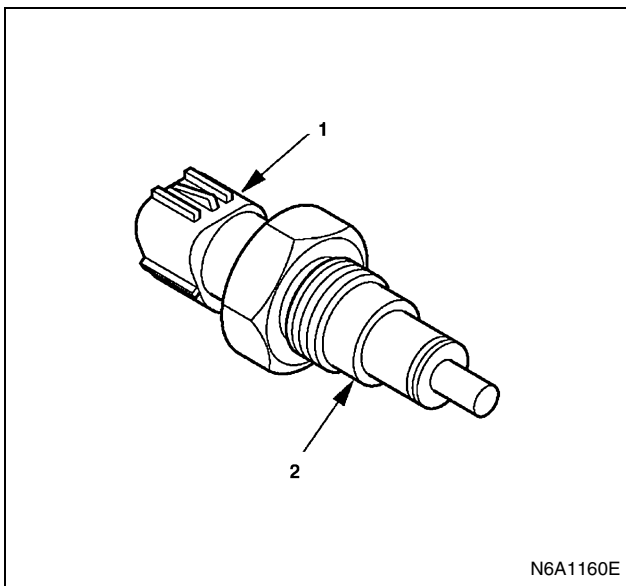
- | | |
|--------------------------------|-------------------------------------|
| 1. Batteries | 13. Magnetic valve: Exhaust brake |
| 2. Fusible link wire | 14. Vacuum pump |
| 3. Charge relay | 15. Vacuum tank |
| 4. Fuse | 16. Vacuum chamber: Exhaust brake |
| 5. Exhaust brake relay | 17. Exhaust brake valve |
| 6. Exhaust brake switch | 18. Key switch |
| 7. Indicator light | 19. Vacuum chamber: Intake throttle |
| 8. Diode | 20. Intake throttle |
| 9. Exhaust brake control relay | 21. Magnetic valve intake throttle |
| 10. Neutral switch | 22. Generator (L) |
| 11. Clutch switch | 23. Starter relay coil |
| 12. Accelerator switch | |

DTC-13 Engine Coolant Temperature (ECT) Sensor Circuit High Voltage



Appearance of Water Temperature Sensor and Connector Pin Assignment

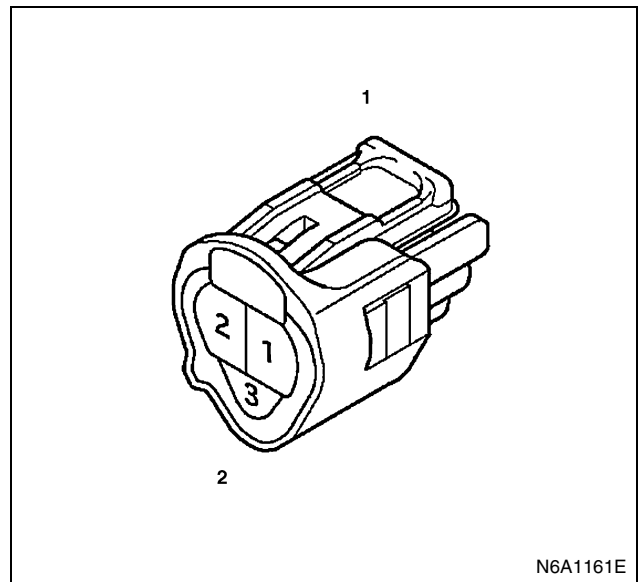
Temperature Sensor



Legend

1. 3 pin connector
2. Engine coolant temperature sensor

Connector Pin Assignment



Legend

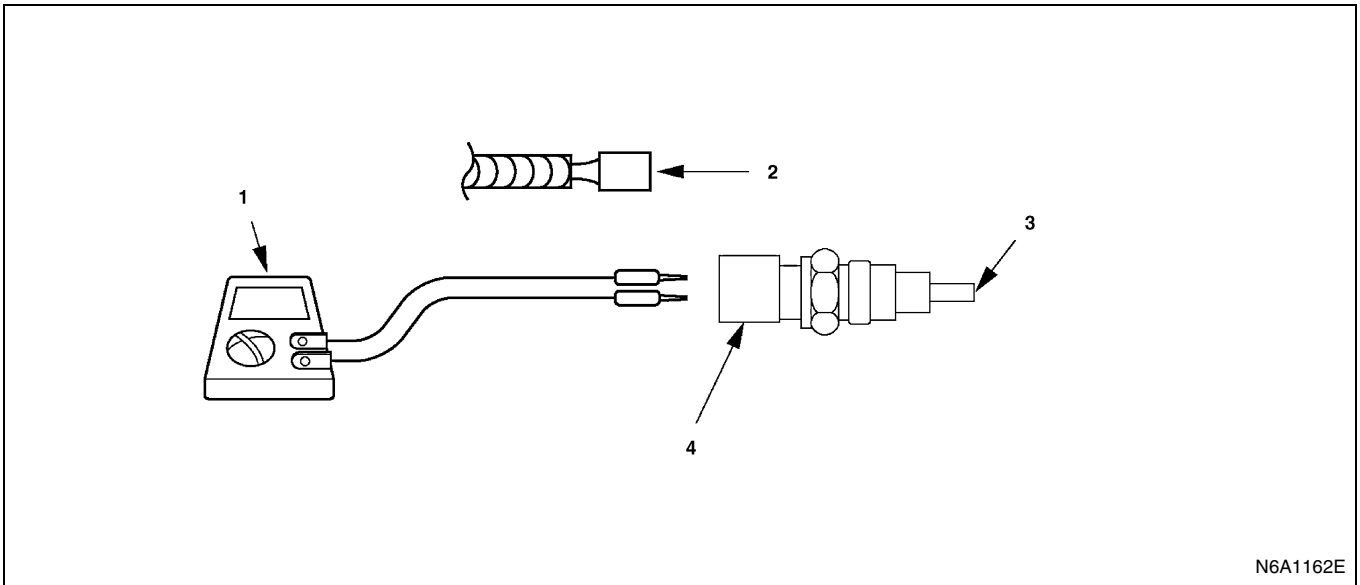
1. To ECT sensor
2. 3 pin gray

Connector No	Signal
1	Thermistor for engine
2	Thermistor for engine
3	Thermistor for meter

Measure Resistance at Engine Coolant Temperature (ECT) Sensor

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



N6A1162E

Legend

- 1. Circuit tester
- 2. Remove engine wire harness
- 3. Engine coolant temperature sensor
- 4. Measure resistance between connector pin

Resistance value

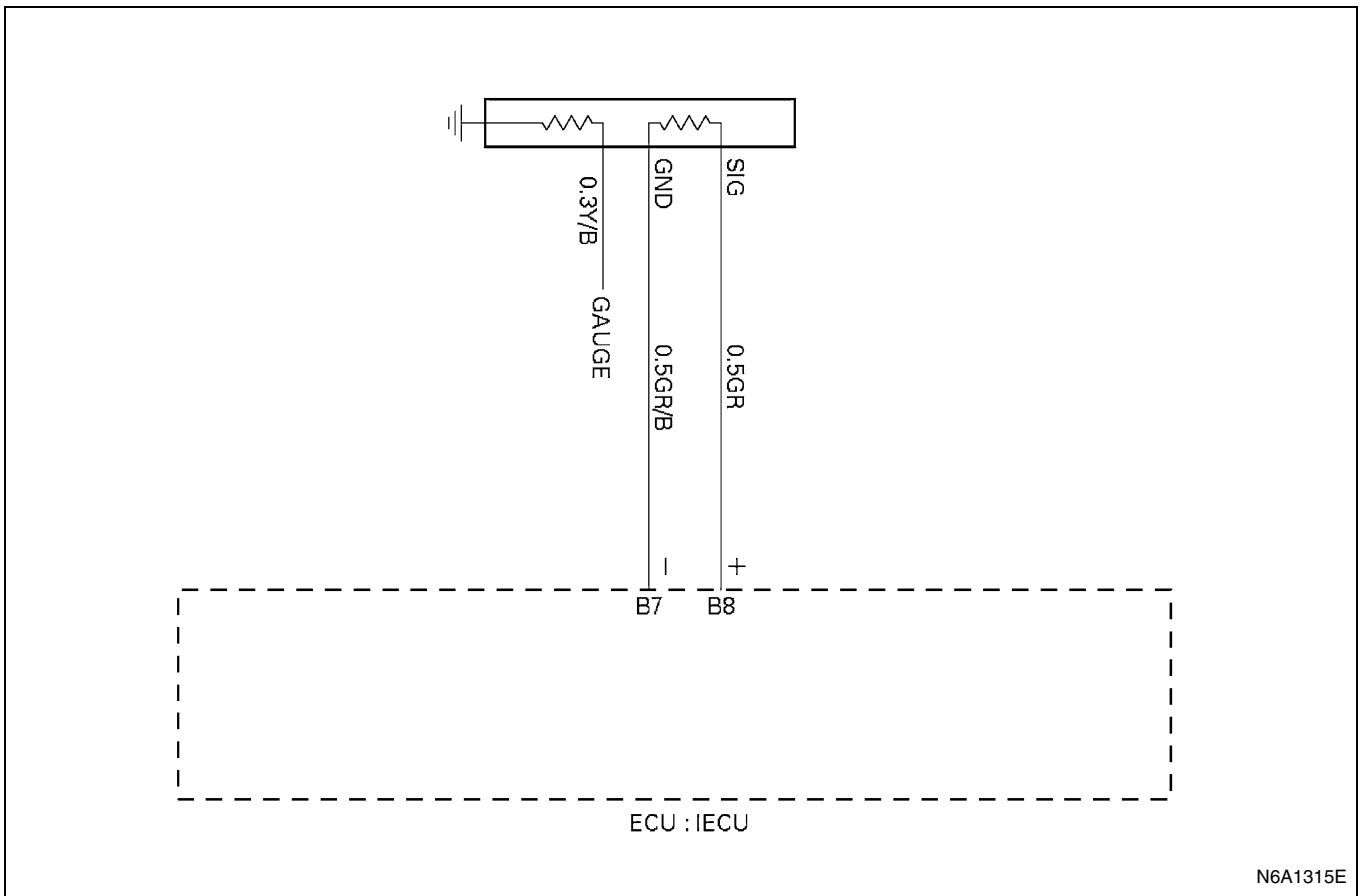
Inspection Point		Resistance Value	Temperature on sensor	Reference
Connector	Pin No.			
3 pin Black	1 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	1 ↔ 2	2.5 (kΩ)	20°C (68°F)	Thermistor for ENGINE
		247 (Ω)	90°C (194°F)	
	1 ↔ Body	∞	—	Thermistor for ENGINE ↔ Body
	2 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	3 ↔ Body	146.6 (Ω)	60°C (140°F)	Thermistor for meter ENGINE
	2 ↔ Body	∞	—	Thermistor for ECM ↔ Body

Notice:

Resistance value is difference according to the temperature of temperature sensor.

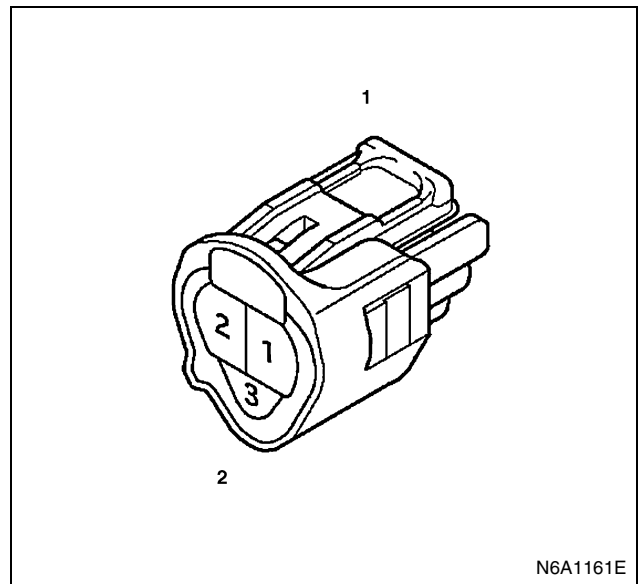
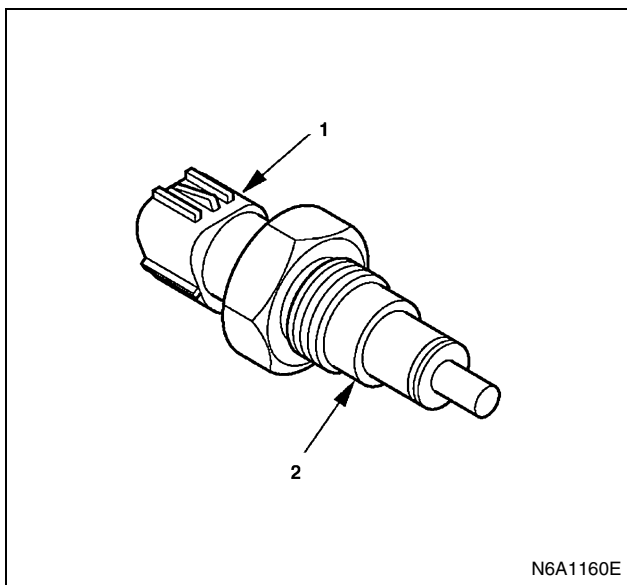
Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to self diagnostic system check
2	1. Ignition "OFF" 2. Disconnect the ECT sensor electrical connector. 3. Jumper the ECT sensor signal circuit and the ECT sensor ground circuit together at the ECT sensor harness connector. Does indicate DTC 13?	—	Go to Step 4	Go to Step 3
3	1. Ignition "OFF" 2. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. Does indicate DTC 13?	—	Go to Step 5	Go to Step 6
4	Check for poor connection at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Go to Step 10	Go to Step 8
5	1. Ignition "OFF". 2. Disconnect the ECM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Go to Step 10	Go to Step 7
6	1. Ignition "OFF". 2. Disconnect the ECM, and check the ECT sensor signal circuit for an open. 3. If the ECT signal circuit is open, repair it as necessary. Was the ECT sensor signal circuit open?	—	Go to Step 10	Go to Step 7
7	Check for poor sensor ground or ECT sensor signal circuit terminal connection at the ECU and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Go to Step 10	Go to Step 9
8	1. Ignition "OFF" 2. Replace the ECT Sensor. Is the action complete?	—	Go to Step 10	—
9	1. Replace the ECM. Is the action complete?	—	Go to Step 10	—
10	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Does DTC 13 come normal condition?	—	Go to Step 11	Go to Step 2
11	Is any current trouble other than DTC 13 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

DTC-14 Engine Coolant Temperature (ECT) Sensor Circuit Low Voltage



Appearance of Water Temperature Sensor and Connector Pin Assignment

Connector Pin Assignment



Legend

1. 3 pin connector
2. Engine coolant temperature sensor

Legend

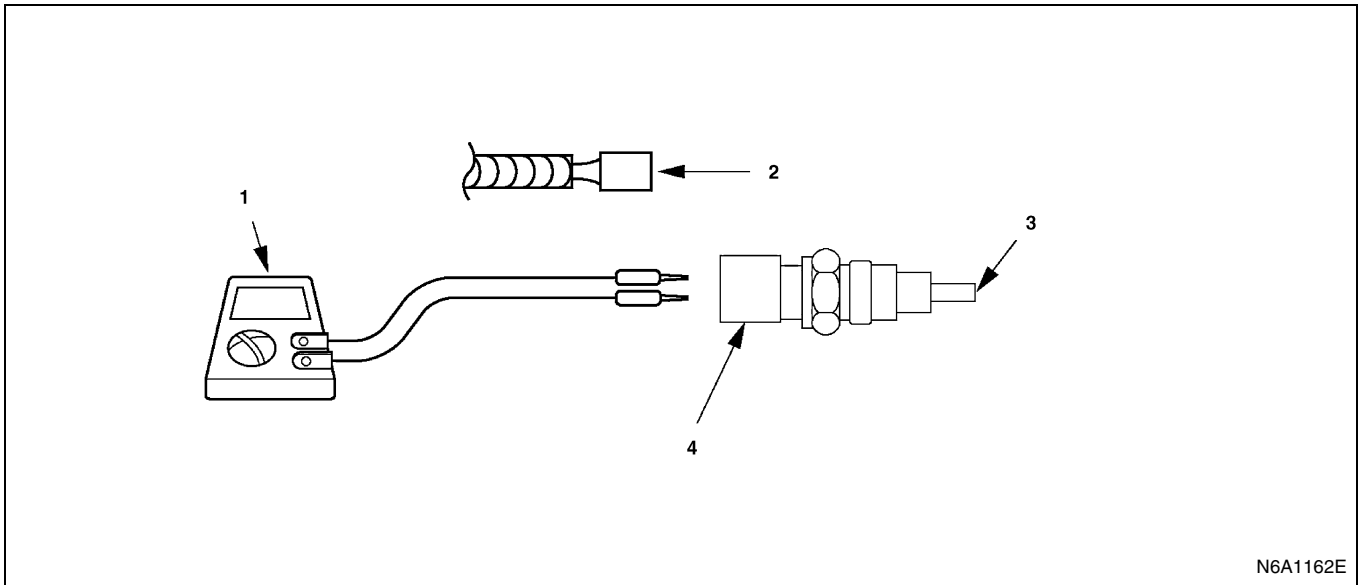
1. To ECT sensor
2. 3 pin gray

Connector No	Signal
1	Thermistor for engine
2	Thermistor for engine
3	Thermistor for meter

Measure Resistance at Engine Coolant Temperature (ECT) Sensor

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



N6A1162E

Legend

- 1. Circuit tester
- 2. Remove engine wire harness
- 3. Engine coolant temperature sensor
- 4. Measure resistance between connector pin

Resistance value

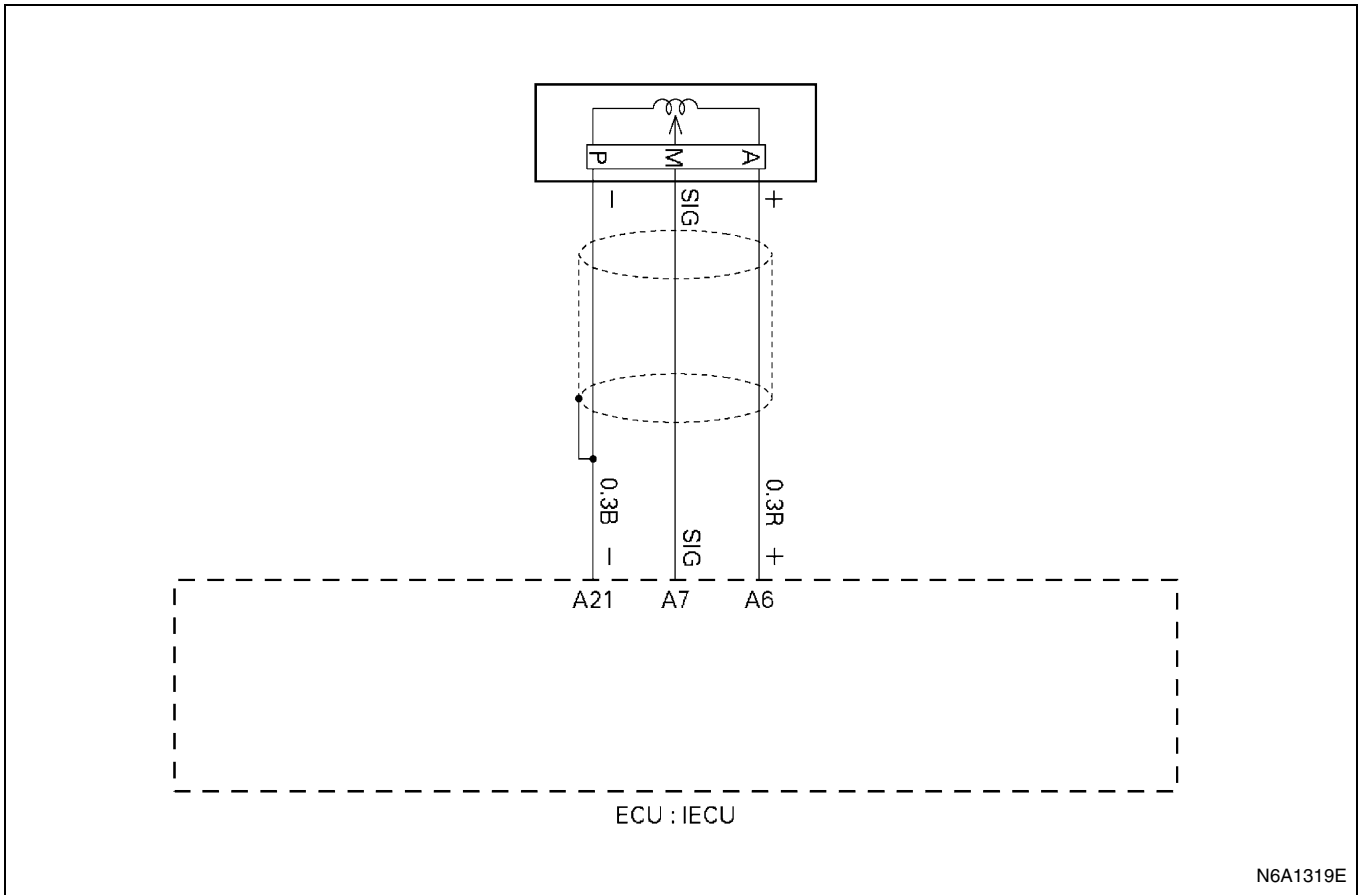
Inspection Point		Resistance Value	Temperature on sensor	Reference
Connector	Pin No.			
3 pin Black	1 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	1 ↔ 2	2.5 (kΩ)	20°C (68°F)	Thermistor for ENGINE
		247 (Ω)	90°C (194°F)	
	1 ↔ Body	∞	—	Thermistor for ENGINE ↔ Body
	2 ↔ 3	∞	—	Thermistor for ENGINE ↔ Thermistor for meter
	3 ↔ Body	146.6 (Ω)	60°C (140°F)	Thermistor for meter ENGINE
	2 ↔ Body	∞	—	Thermistor for ECM ↔ Body

Notice:

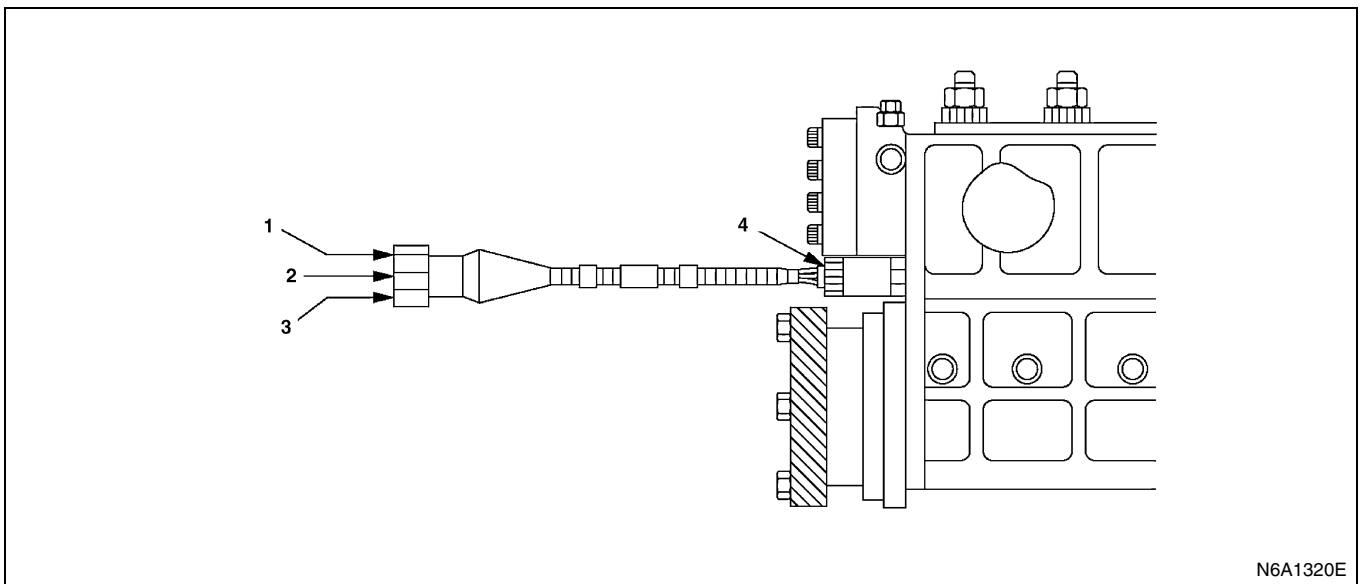
Resistance value is difference according to the temperature of temperature sensor.

Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to self diagnostic system check
2	<ol style="list-style-type: none"> 1. Memory DTC to ECM. 2. Clear DTC. 3. Ignition "OFF" 4. Disconnect the ECT sensor. 5. Ignition "ON", Engine "OFF" Does indicate DTC 14? (Ignore DTC 13)	—	Go to Step 3	Go to Step 6
3	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Check Connector ECT Sensor Harness for interterminal short. 3. Repair if necessary. Was ECT Sensor connector shorted?	—	Go to Step 8	Go to Step 4
4	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Check the ECM connector terminal short. 3. Repair if necessary. Was ECM terminal shorted?	—	Go to Step 8	Go to Step 5
5	<ol style="list-style-type: none"> 1. Disconnect the ECM. 2. Check if ECT sensor signal circuit for a short to ground or a short to ground circuit. 3. Repair if necessary. Is ECT sensor signal circuit shorted to ground?	—	Go to Step 8	Go to Step 7
6	<ol style="list-style-type: none"> 1. Ignition "OFF" 2. Replace the ECT Sensor. Is the action complete?	—	Go to Step 8	—
7	<ol style="list-style-type: none"> 1. Replace the ECM. Is the action complete?	—	Go to Step 8	—
8	<ol style="list-style-type: none"> 1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Does DTC 14 come normal condition?	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 14 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

DTC-21 Rack Sensor Circuit Low Voltage



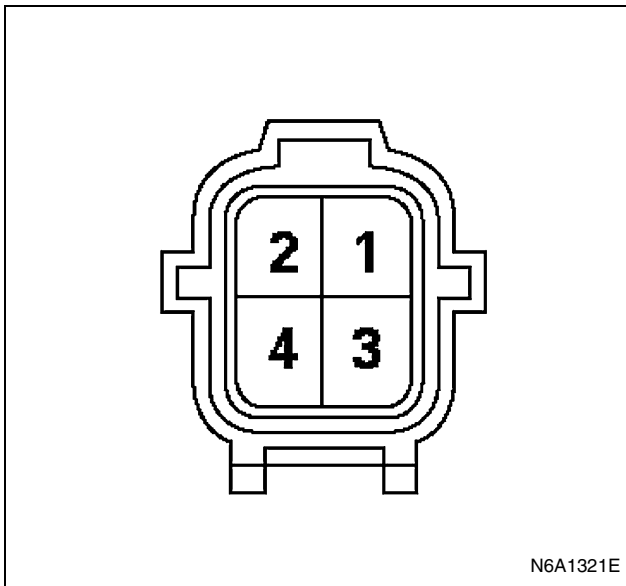
Location of Rack Sensor Connector



Legend

- | | |
|----------------|----------------|
| 1. OSC (red) | 3. GND (black) |
| 2. MDL (white) | 4. Rack sensor |

Connector Name of Rack Sensor



Notice:

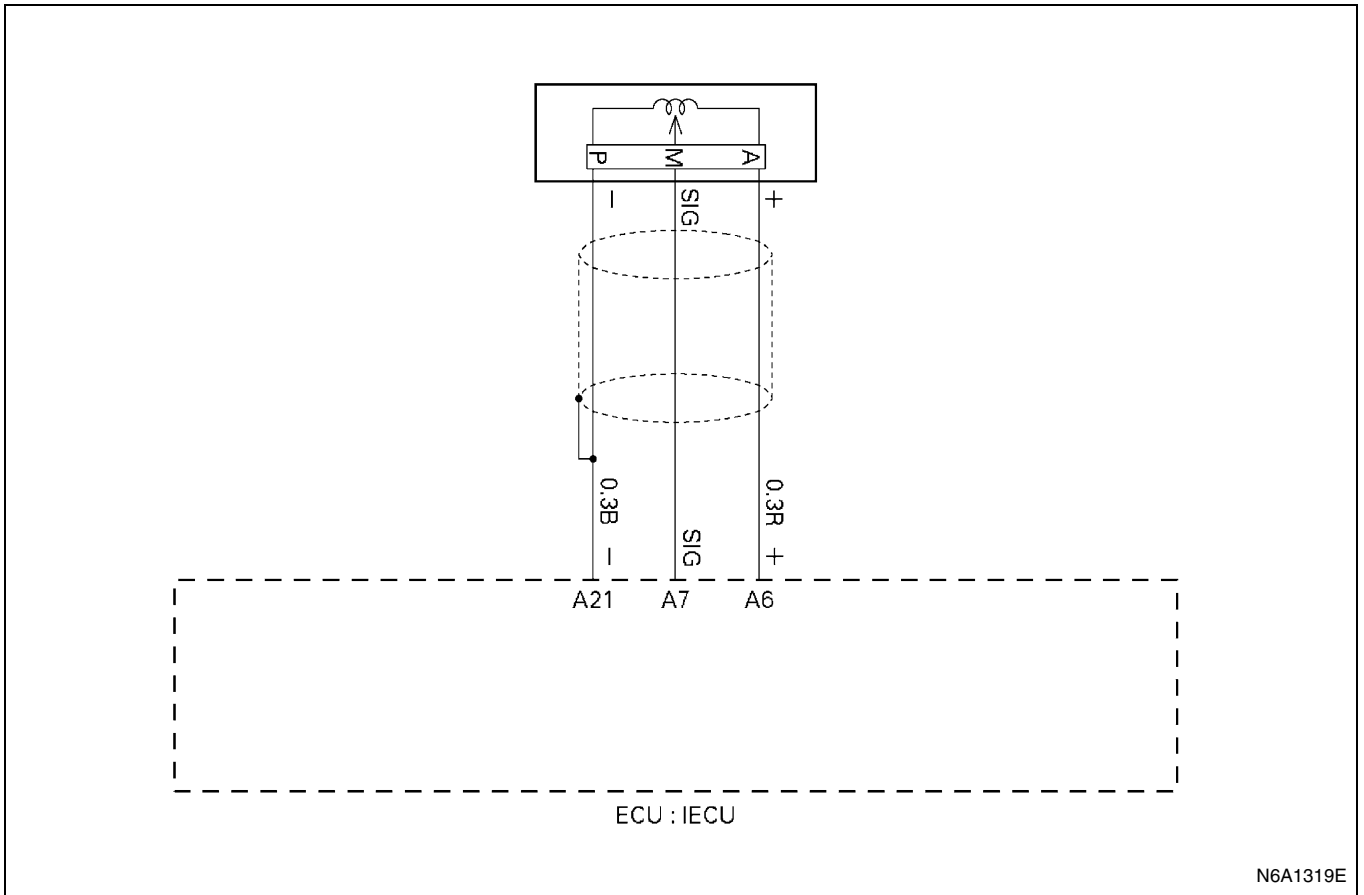
Mark “___” on connector which is plugged, therefore, should be confirmed to be played.

Relation Between Connector Number and Signal Name

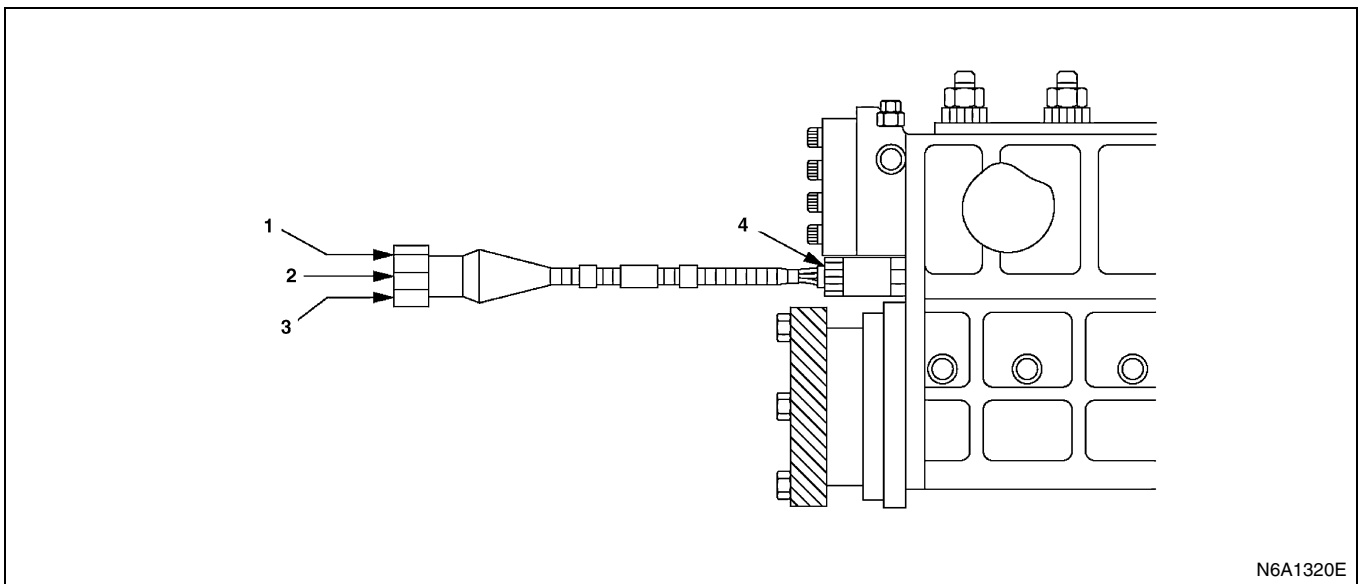
Connector No	Signal name	Wire color
1	Rack sensor (OSC)	R
2	Rack sensor (GND)	W
4	Rack sensor (MDL)	B

Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to diagnostic system check
2	1. Check harness side power source circuit and signal circuit for GND short. 2. Repair if necessary. Has DTC21 been corrected?	—	Go to Step 10	Go to Step 3
3	Disconnect Sensor Connector. Jumper RACK+ and RACK signal. Free from trouble now? Ignore code 22.	—	Go to Step 4	Go to Step 6
4	1. Apply 5V to RACK+ TERMINAL. Measure RACK SIG Voltage. Is RACK SIG VOLTAGE as specified?	0.9 — 2.0V (Idling speed)	Go to Step 7	Go to Step 5
5	1. Check Rack Sensor Harness Signal Circuit and power source for GND short. Check signal circuit for disconnect. 2. Repair if necessary. Free from trouble now?	—	Go to Step 10	Go to Step 7
6	1. Check harness signal circuit and power source circuit for disconnect. 2. Repair if necessary. Free from trouble now?	—	Go to Step 10	Go to Step 9
7	1. Check the iron core of RACK Sensor for damage, seizure, and wear. 2. After check, repair if necessary. Was there any trouble in the iron core (RACK end) inside RACK Sensor?	—	Go to Step 10	Go to Step 8
8	1. Replace the RACK Sensor. Is the action complete?	—	Go to Step 10	—
9	1. Replace the ECM. Is the action complete?	—	Go to Step 10	—
10	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 21 all right under Scan Tool Check?	—	Go to Step 11	Go to Step 2
11	Is any current trouble other than DTC 21 displayed by scan tool?	—	Go to trouble code section	Trouble code clear

DTC-22 Rack Sensor Circuit High Voltage



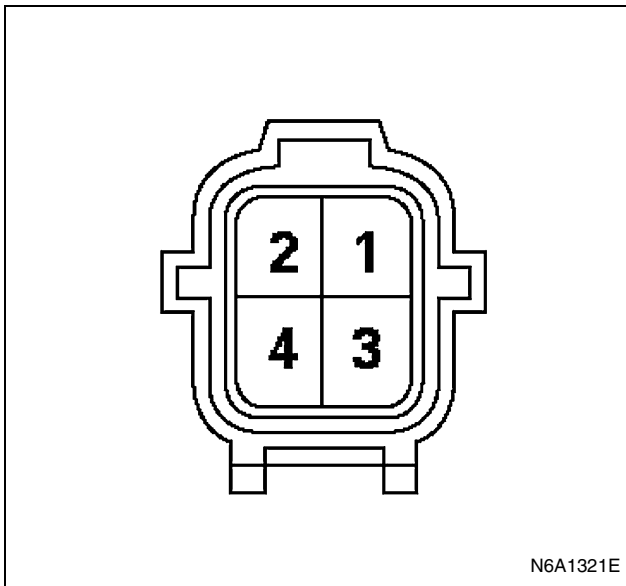
Location of Rack Sensor Connector



Legend

- | | |
|----------------|----------------|
| 1. OSC (red) | 3. GND (black) |
| 2. MDL (white) | 4. Rack sensor |

Connector Name of Rack Sensor



Notice:

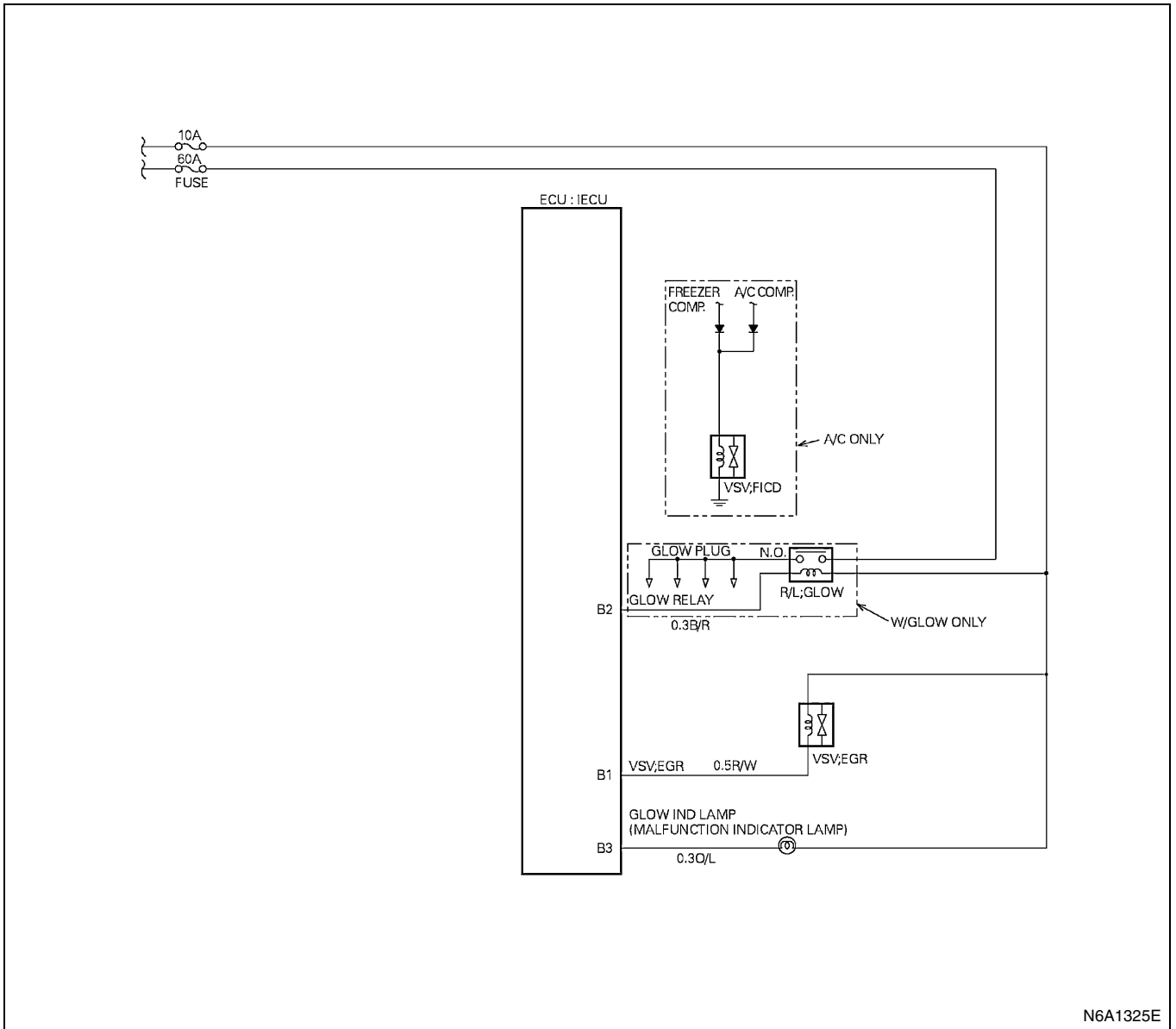
Mark “___” on connector which is plugged, therefore, should be confirmed to be played.

Relation Between Connector Number and Signal Name

Connector No	Signal name	Wire color
1	Rack sensor (OSC)	R
2	Rack sensor (GND)	B
4	Rack sensor (MDL)	W

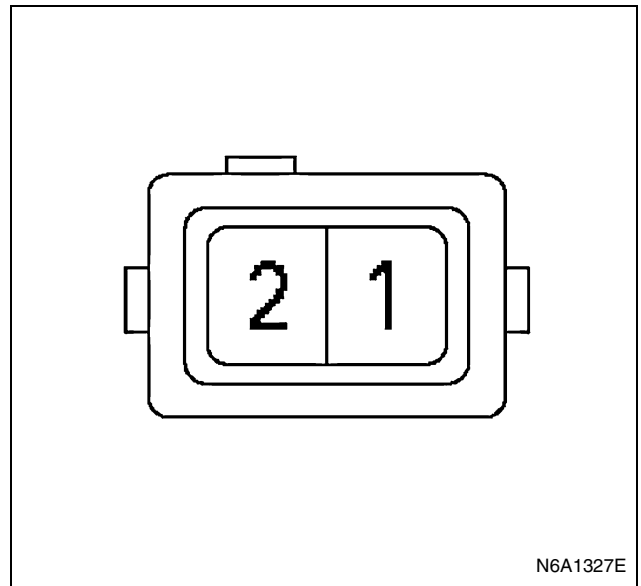
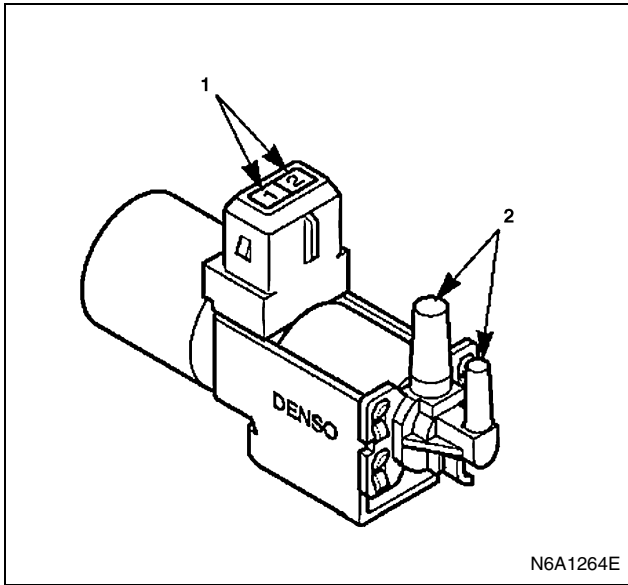
Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to diagnostic system check
2	Remove Sensor Connector. Has DTC22 been corrected? (Ignore DTC 21)	—	Go to Step 3	Go to Step 7
3	1. Jumper Harness signal Terminal and GND terminal at the Sensor side of Connector. 2. Ignition "ON" Has DTC22 been corrected?	—	Go to Step 4	Go to Step 5
4	1. Check the Sensor Connector for inter terminal short. After check, repair if necessary. Was Connector Terminal shorted?	—	Go to Step 12	Go to Step 6
5	1. Check the GND Circuit for disconnect. After check, repair if necessary. Is GND circuit disconnect?	—	Go to Step 12	Go to Step 11
6	1. Check the Sensor Harness signal circuit and power source circuit for short. After check, repair if necessary. Was Harness shorted?	—	Go to Step 12	Go to Step 8
7	1. Check the Harness signal circuit and power source for short. After check, repair if necessary. Was Harness shorted?	—	Go to Step 12	Go to Step 11
8	1. Apply 5V to RACK+ TERMINAL. 2. Measure RACK SIG Voltage. Is RACK SIG VOLTAGE as specified?	0.9 — 2.0V (Idling speed)	Go to Step 9	Go to Step 10
9	1. Check the iron core of RACK Sensor for damage, seizure, and wear. 2. After check, repair if necessary. Was there any trouble in the iron core(RACK end) inside RACK Sensor?	—	Go to Step 12	Go to Step 11
10	Replace the RACK Sensor. Is the action complete?	—	Go to Step 12	—
11	Replace the ECM. Is the action complete?	—	Go to Step 12	—
12	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC22 all right under Scan Tool Check?	—	Go to Step 13	Go to Step 2
13	Is any current trouble other than DTC 22 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

DTC-31 Exhaust Gas Recirculation (EGR) Vacuum Switching Valve (VSV) Solenoid Control Low Voltage



**Appearance of Vacuum Switching Valve (VSV):
Exhaust Gas Recirculation (EGR) Connector
VSV: EGR**

VSV: EGR Connector



Connector No	Signal
1	GND
2	SIG

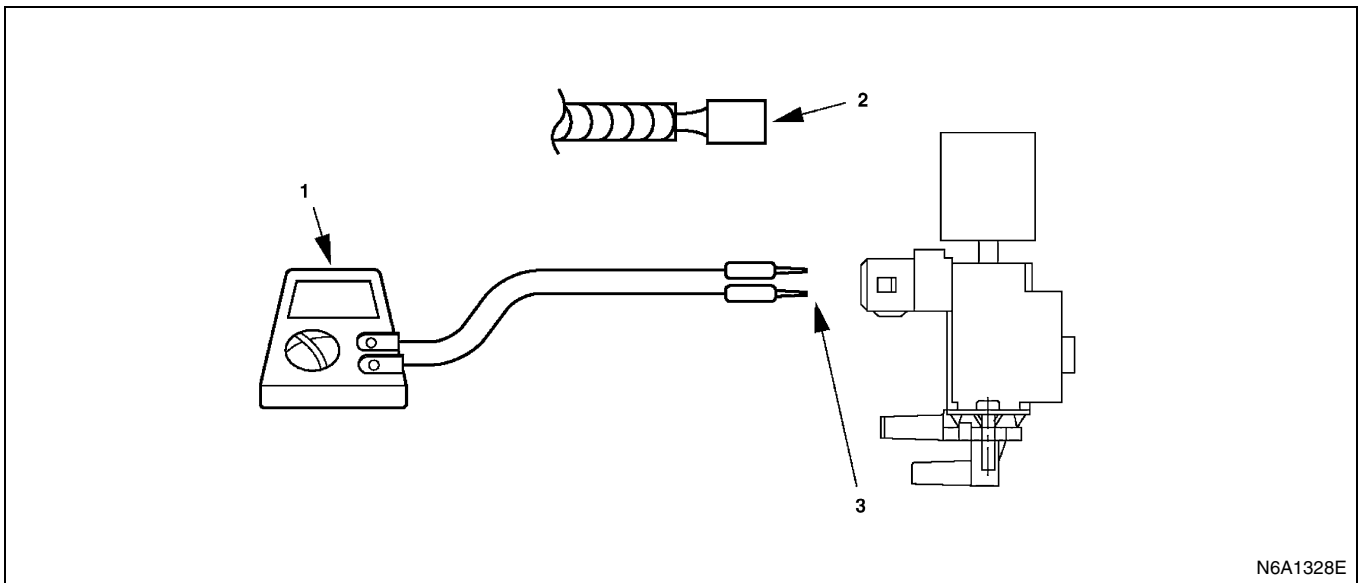
Legend

- 1. 2 pin
- 2. Port

Measure Resistance at VSV: EGR

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



Legend

- 1. Circuit tester
- 2. Remove VSV wire harness
- 3. Measure resistance between connector pin

Resistance value

Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Black	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

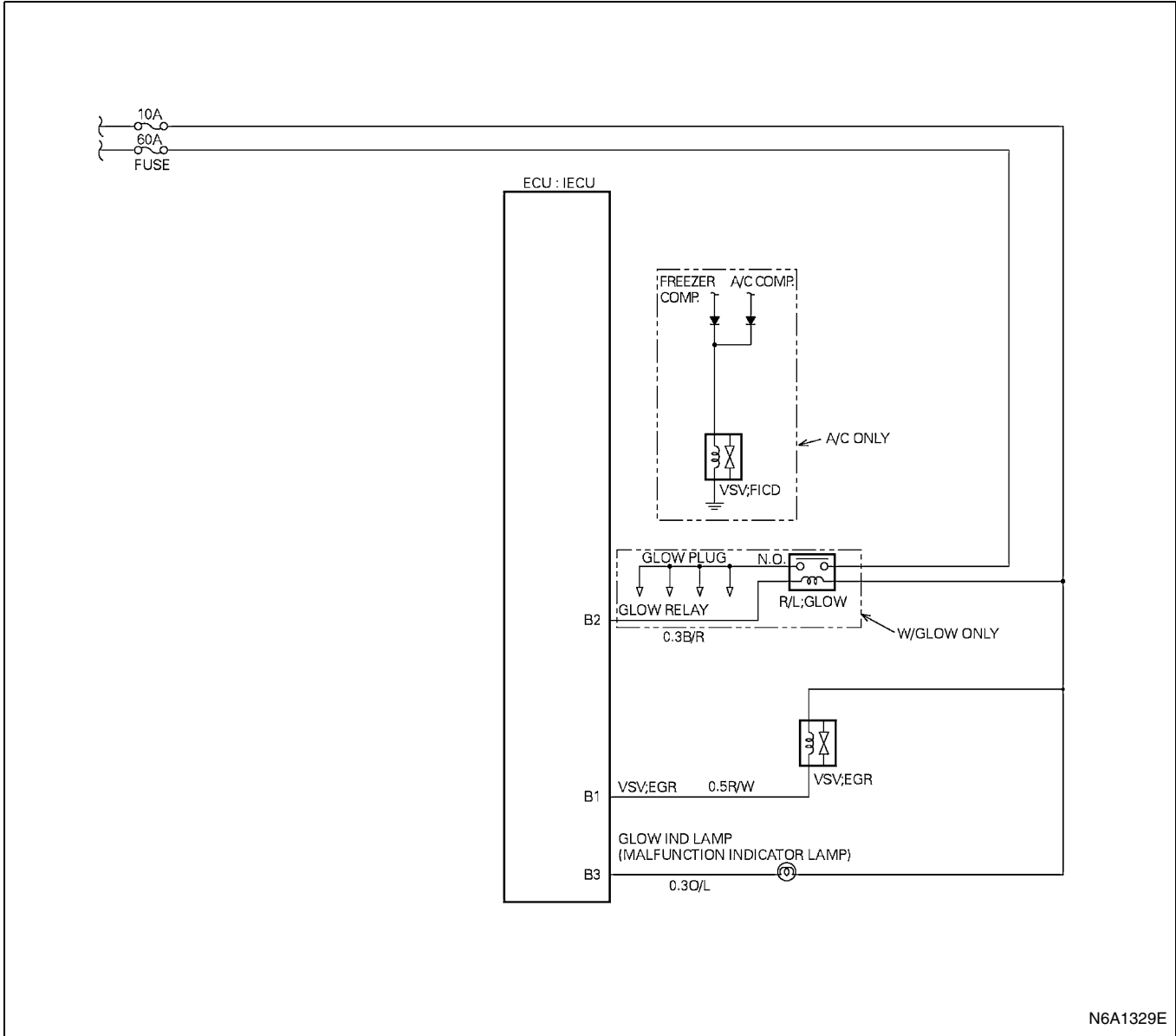
Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to diagnostic system check
2	<ol style="list-style-type: none"> Ignition "OFF". Disconnect the VSV from the wiring harness connector. Ignition "ON" Engine "OFF". Using the Digital Voltmeter (DVM), check for voltage on the "Power supply side terminal" of the VSV harness connector. <p>Does the DVM read the following value?</p>	12 Volt or 24 Volt	Go to Step 4	Go to Step 3
3	<ol style="list-style-type: none"> Check the suspect circuit between the VSV connector and "Engine Ignition". Fuse for the following condition. <ul style="list-style-type: none"> A short to ground An open circuit Repair if necessary. <p>Has DTC 31 been corrected?</p>	—	Go to Step 8	—
4	<p>Using the DVM, check the resistance of the VSV.</p> <p>Does the DVM read the following Value?</p>	37 — 44Ω 159 — 169Ω	Go to Step 5	Go to Step 6
5	<ol style="list-style-type: none"> Ignition "OFF" Disconnect the ECM connector from ECM. Check the VSV circuit between the ECU and VSV connector. <ul style="list-style-type: none"> A short to ground An open circuit Repair if necessary. <p>Has DTC 31 been corrected?</p>	—	Go to Step 8	Go to Step 7
6	<p>Replace the VSV.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
7	<p>Replace the ECM.</p> <p>Is the action complete?</p>	—	Go to Step 8	—
8	<ol style="list-style-type: none"> Reconnect all the connectors removed. Ignition "ON", Engine "OFF". <p>Does DTC 31 come normal condition?</p>	—	Go to Step 9	Go to Step 2

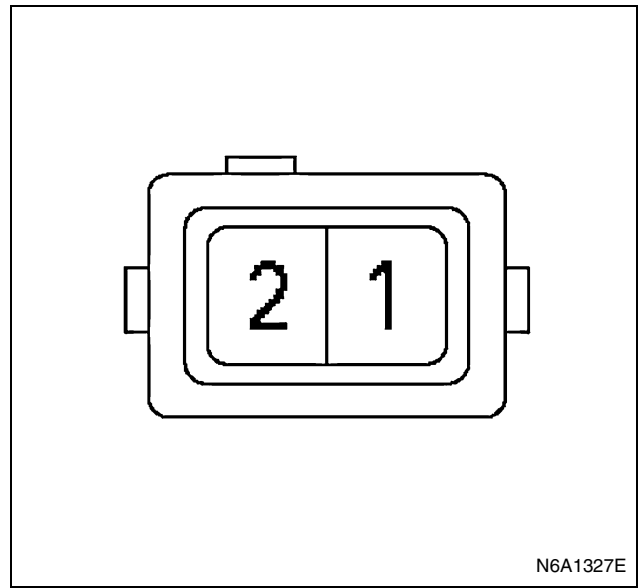
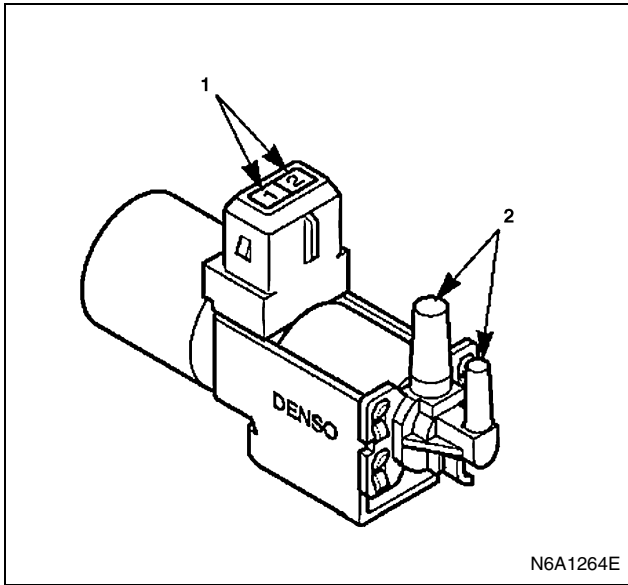
Step	Action	Value	YES	NO
9	Is any current trouble other than DTC 31 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

DTC-32 Exhaust Gas Recirculation (EGR) Vacuum Switching Valve (VSV) Solenoid Control High Voltage



**Appearance of Vacuum Switching Valve (VSV):
Exhaust Gas Recirculation (EGR) Connector
VSV: EGR**

VSV: EGR Connector



Connector No	Signal
1	GND
2	SIG

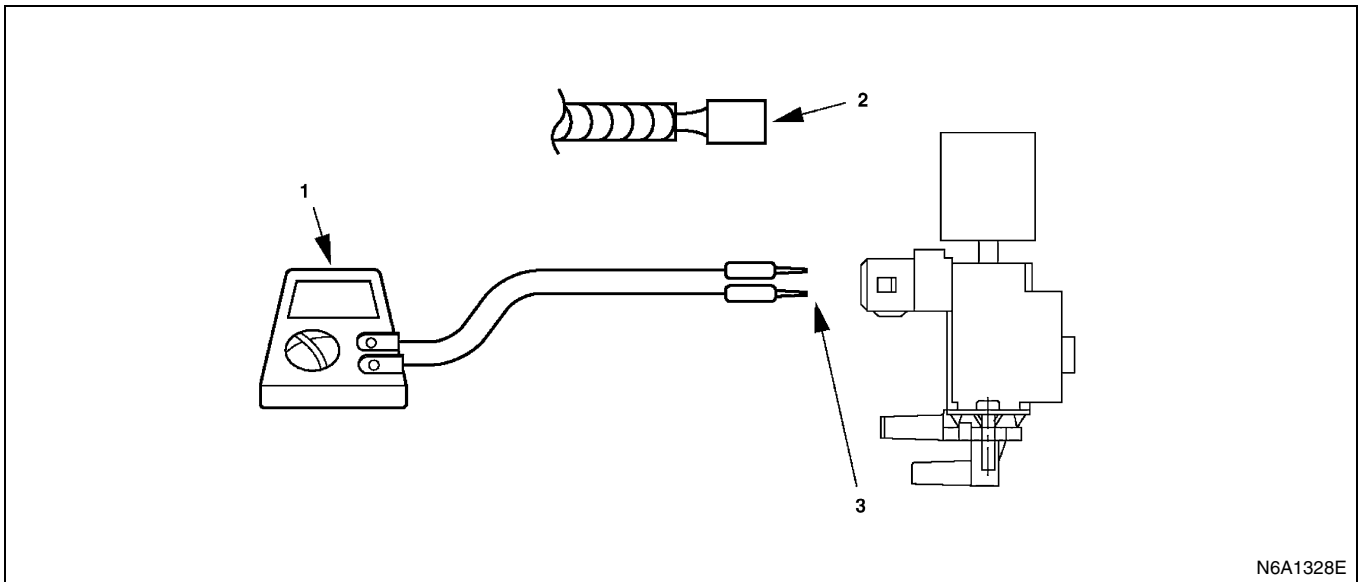
Legend

- 1. 2 pin
- 2. Port

Measure Resistance at VSV: EGR

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



Legend

- 1. Circuit tester
- 2. Remove VSV wire harness
- 3. Measure resistance between connector pin

Resistance value

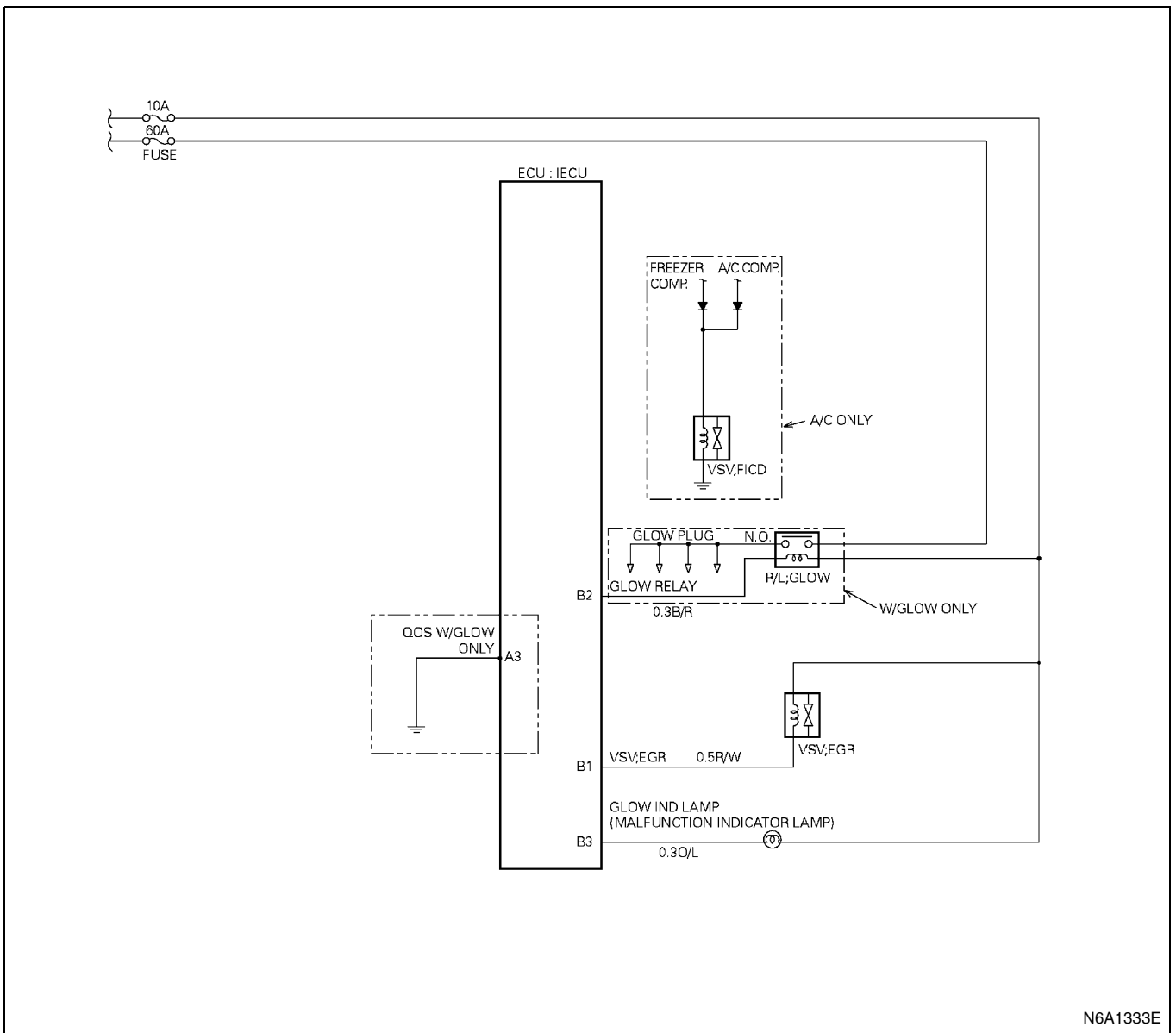
Inspection Point		Resistance Value (kΩ)	Reference
Connector	Pin No.		
2 pin Black	2 ↔ 1	37 to 44 (for 12 volt) 159 to 169 (for 24 volt)	SIG ↔ GND
	1 ↔ Body	∞	SIG ↔ Body

Notice:

Resistance value is difference according to the engine temperature (condition of engine warming up).

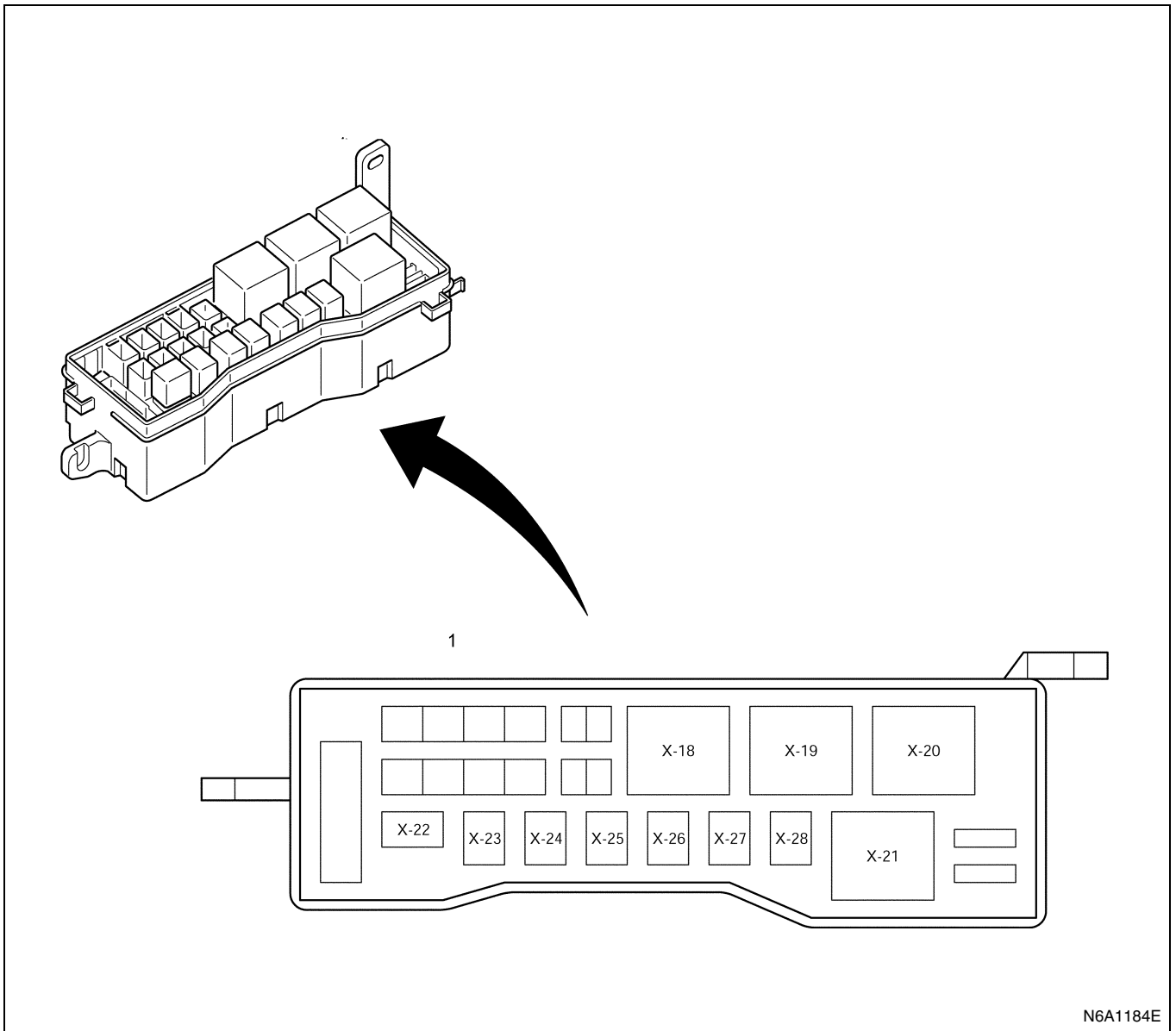
Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to diagnostic system check
2	Using the DVM, check the resistance of the VSV. Does the DVM read the following Value?	37 — 44Ω 159 — 169Ω	Go to Step 3	Go to Step 4
3	1. Ignition "OFF". 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of VSV circuit between the ECM and VSV connector. 4. Repair if necessary. Has DTC 32 been corrected?	—	Go to Step 6	Go to Step 5
4	Replace the VSV. Is the action complete?	—	Go to Step 6	—
5	Replace the ECM. Is the action complete?	—	Go to Step 6	—
6	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF". Does DTC 32 come normal condition?	—	Go to Step 7	Go to Step 2
7	Is any current trouble other than DTC 32 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

DTC-41 Quick On Start (QOS) Relay Control Circuit Low Voltage



N6A1333E

Location of Relay



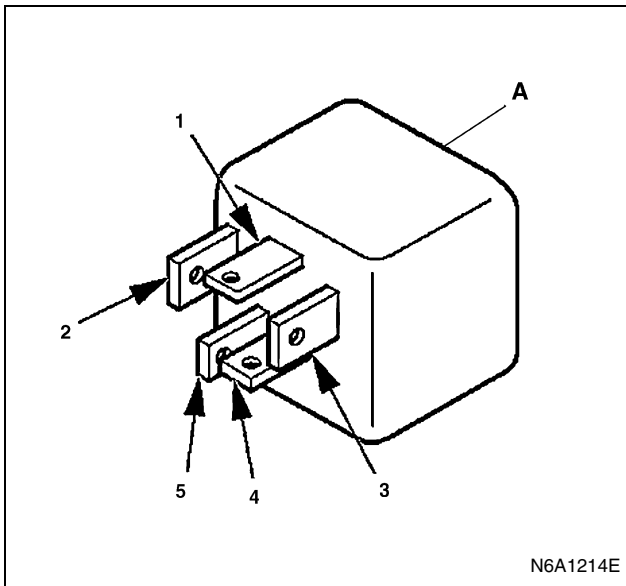
N6A1184E

Legend

1. Relay box (Installed on the left side rear of the cab)

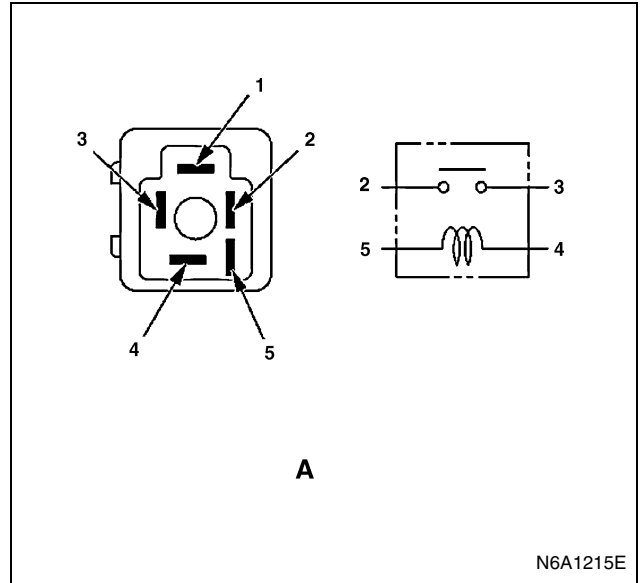
NO	RELAY NAME
X-20	Glow plug
X-21	Starter
X-22	Marker lamp
X-23	Rear fog
X-24	A/C COMP, 4WD ind. lamp
X-25	Exh, Brake control
X-26	CSD, A/C ON SIGNAL
X-27	Condenser fan
X-28	Exh. Brake cut

Inspection for prestroke power cut relay



Legend

A. QOS relay



Legend

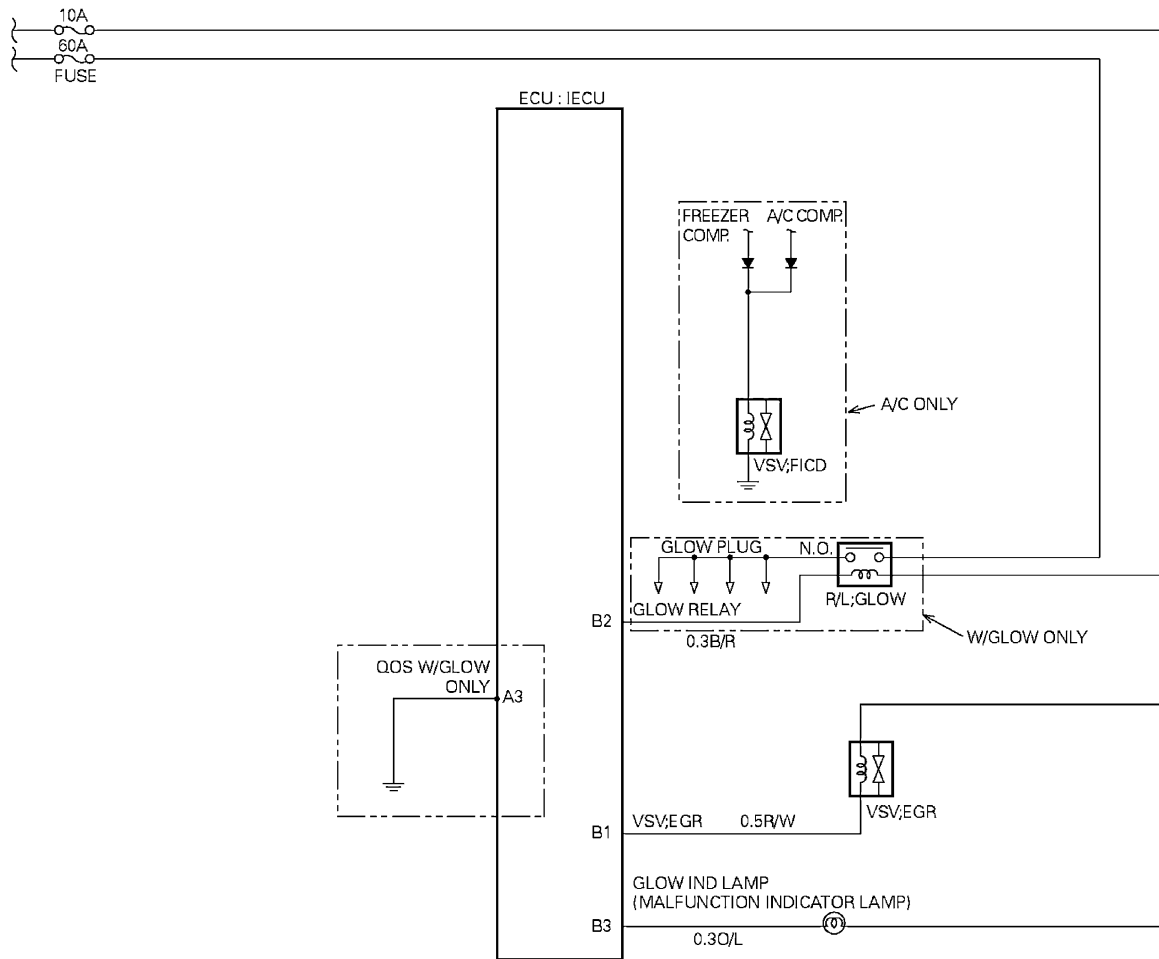
A. QOS relay

Resistance value

Inspection Point		Resistance	Reference
Inspection relay unit	4 ↔ 5	23 (Ω) (for 12 volt) 100 (Ω) (for 24 volt)	
	2 ↔ 3	∞	Not be supplied electricity to coil
		Below 0.5 (Ω)	Be supplied electricity to coil

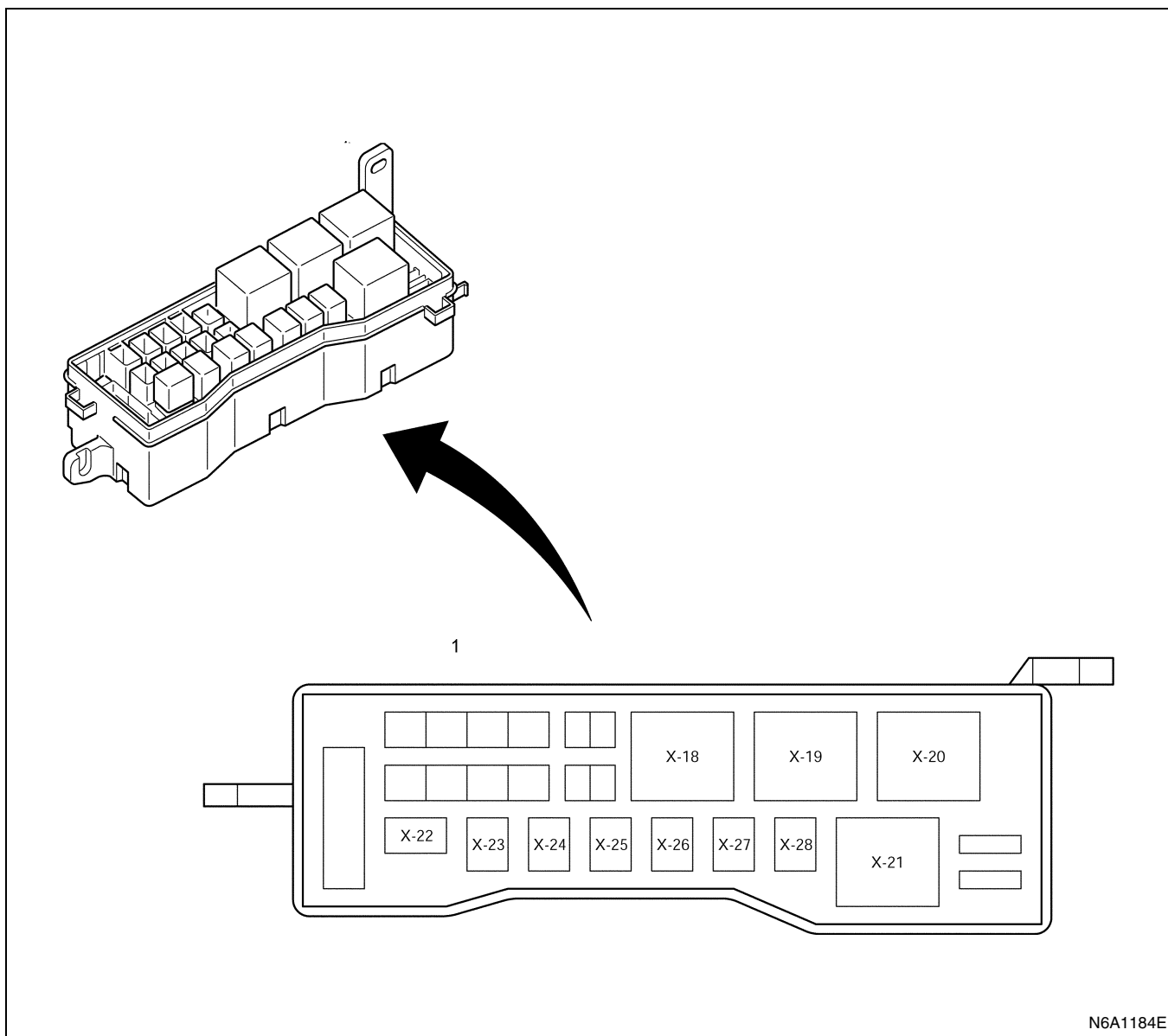
Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to diagnostic system check
2	1. Ignition "OFF" 2. Disconnect the Relay from the Relay box connector. 3. Ignition "ON" Engine "OFF" 4. Using the Digital Voltmeter (DVM), check for voltage on the "Power supply side terminal" terminal of the Relay Box Connector. Does the DVM read the following value?	12 Volt or 24 Volt	Go to Step 4	Go to Step 3
3	1. Check the suspect circuit between the Relay connector. Fuse for the following condition. <ul style="list-style-type: none"> • A short to ground • An open circuit 2. Repair if necessary. Has DTC 41 been corrected?	—	Go to Step 8	—
4	Using the DVM, check the resistance of inter "4" "5" Relay terminal. Does the DVM read the following Value?	23Ω (for 12 Volt) 100Ω (for 24 Volt)	Go to Step 5	Go to Step 6
5	1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the Relay circuit between the ECU and Relay connector. <ul style="list-style-type: none"> • A short to ground • An open circuit 4. Repair if necessary. Has DTC 41 been corrected?	—	Go to Step 8	Go to Step 7
6	Replace the Relay. Is the action complete?	—	Go to Step 8	—
7	Replace the ECM. Is the action complete?	—	Go to Step 8	—
8	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Does DTC 41 come normal condition?	—	Go to Step 9	Go to Step 2
9	Is any current trouble other than DTC 41 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

DTC-42 Quick On Start (QOS) Relay Control Circuit High Voltage



N6A1337E

Location of Relay

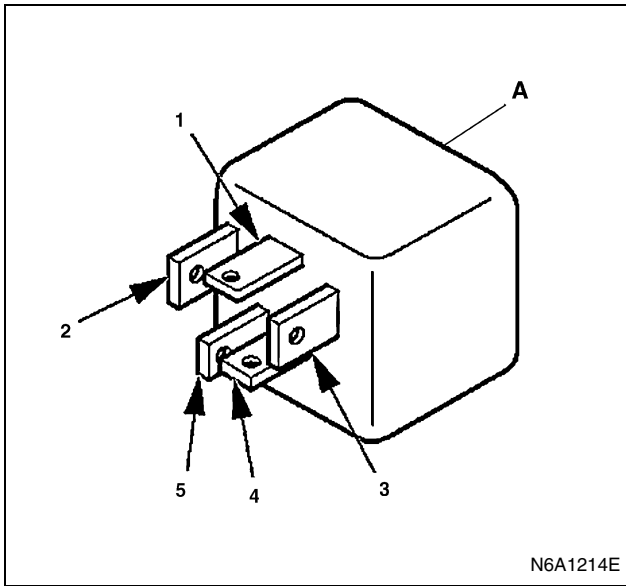


Legend

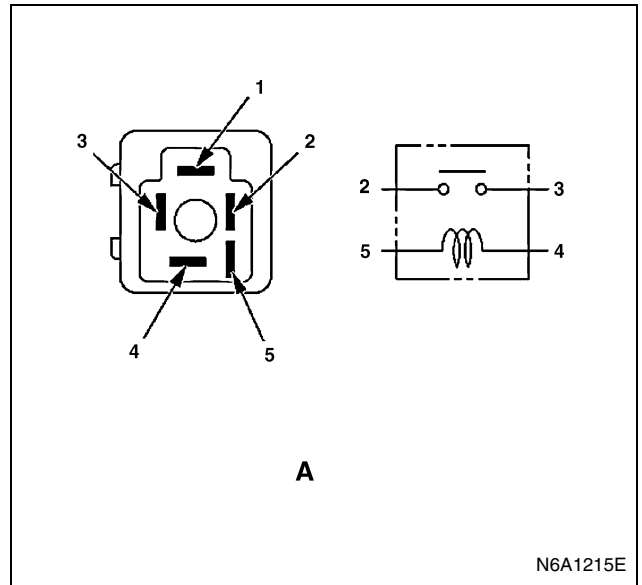
1. Relay box (Installed on the left side rear of the cab)

NO	RELAY NAME
X-20	Glow plug
X-21	Starter
X-22	Marker lamp
X-23	Rear fog
X-24	A/C COMP, 4WD ind. lamp
X-25	Exh, Brake control
X-26	CSD, A/C ON SIGNAL
X-27	Condenser fan
X-28	Exh. Brake cut

Inspection for Quick On Start (QOS) power cut relay



Legend
A. QOS relay



Legend
A. QOS relay

Resistance value

Inspection Point	Resistance	Reference
Inspection relay unit	4 ↔ 5	23 (Ω) (for 12 volt) 100 (Ω) (for 24 volt)
	2 ↔ 3	∞	Not be supplied electricity to coil
Below 0.5 (Ω)		Be supplied electricity to coil

Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to diagnostic system check
2	Using the DVM, check the resistance between terminal number 4 and 5 of the Relay. Does the DVM read the following Value?	23Ω (for 12 Volt) 100Ω (for 24 Volt)	Go to Step 3	Go to Step 4
3	1. Ignition "OFF" 2. Disconnect the ECM connector from ECM. 3. Check the short to voltage of Relay circuit between the ECM and Relay connector 4. Repair if necessary. Has DTC 42 been corrected?	—	Go to Step 6	Go to Step 5
4	Replace the Relay. Is the action complete?	—	Go to Step 6	—
5	Replace the ECM. Is the action complete?	—	Go to Step 6	—
6	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Does DTC 42 come normal condition?	—	Go to Step 7	Go to Step 2
7	Is any current trouble other than DTC 42 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

DTC-52 Electronically Erasable Programmable Read Only Memory (EEPROM) Error

Step	Action	Value	YES	NO
1	Was the "Diagnostic system check" performed?	—	Go to Step 2	Go to diagnostic system check
2	Replace the ECM. Is the action complete?	—	Go to Step 3	—
3	1. Reconnect all the connectors removed. 2. Ignition "ON", Engine "OFF" Is DTC 52 all right under Scan Tool Check?	—	Go to Step 4	Go to Step 2
4	Is any current trouble other than DTC 52 displayed by indicator light?	—	Go to trouble code section	Trouble code clear

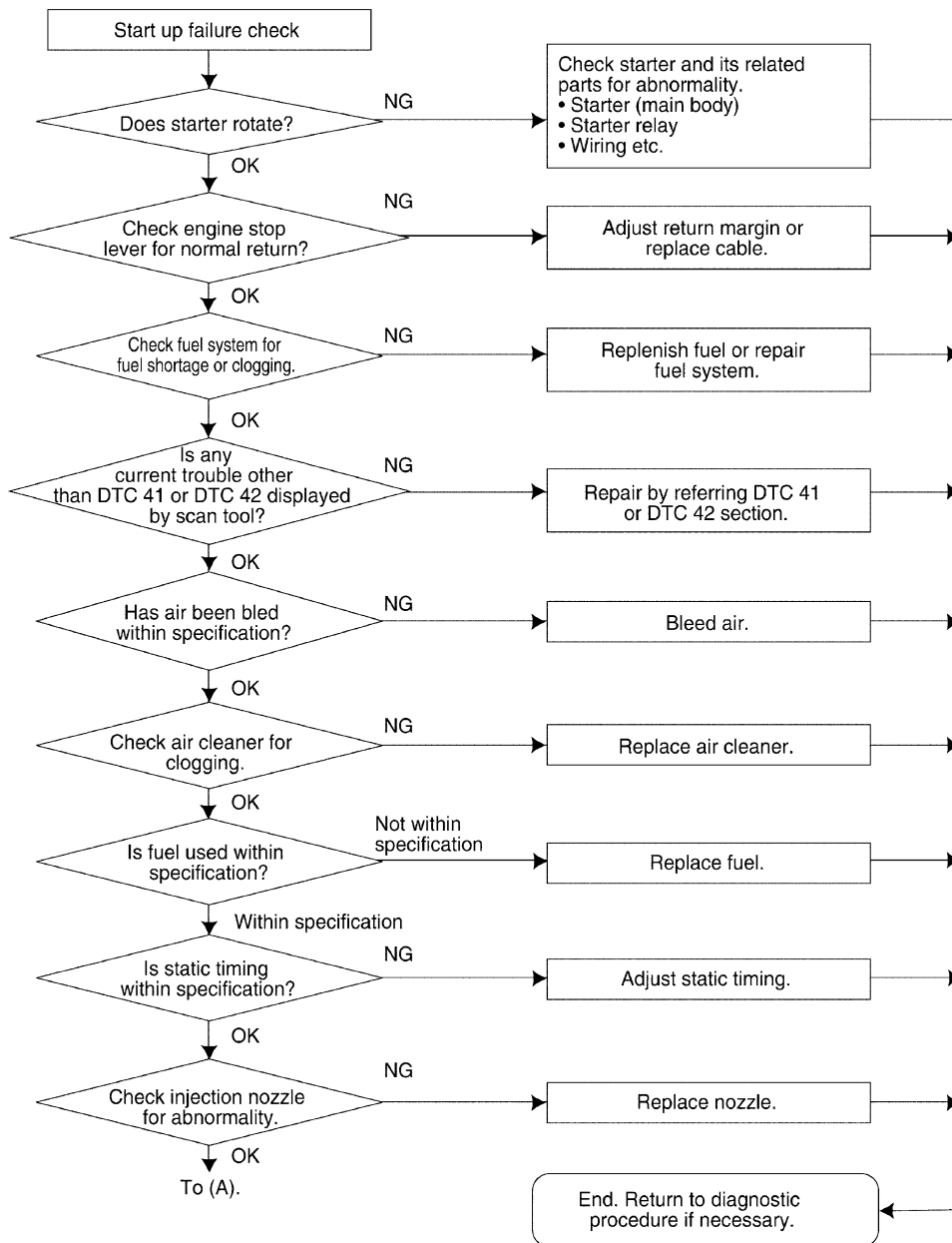
WITHOUT DIAGNOSIS TROUBLE CODE

Introduction

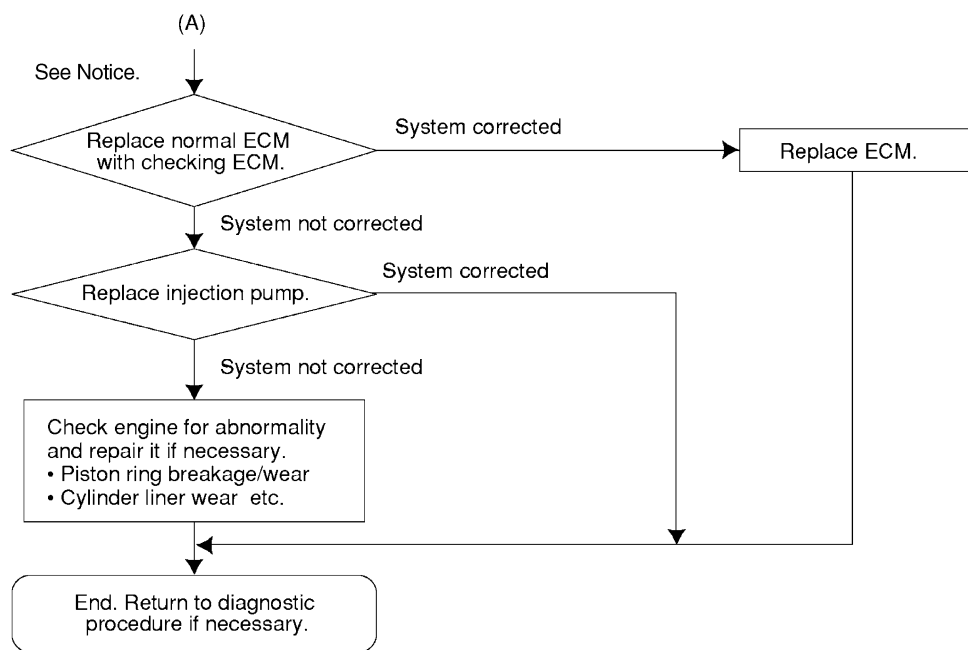
If there occurs a malfunction although no Diagnostic Trouble Code (DTC) is generated, then inspect and repair the system in accordance with the flowcharts given on the following pages.

When a Diagnostic Trouble Code (DTC) is produced, inspect and repair system with reference to "EMISSION AND ELECTRICAL DIAGNOSIS"

Startup Failure (Quick On Start (QOS) only)



N6A1341E

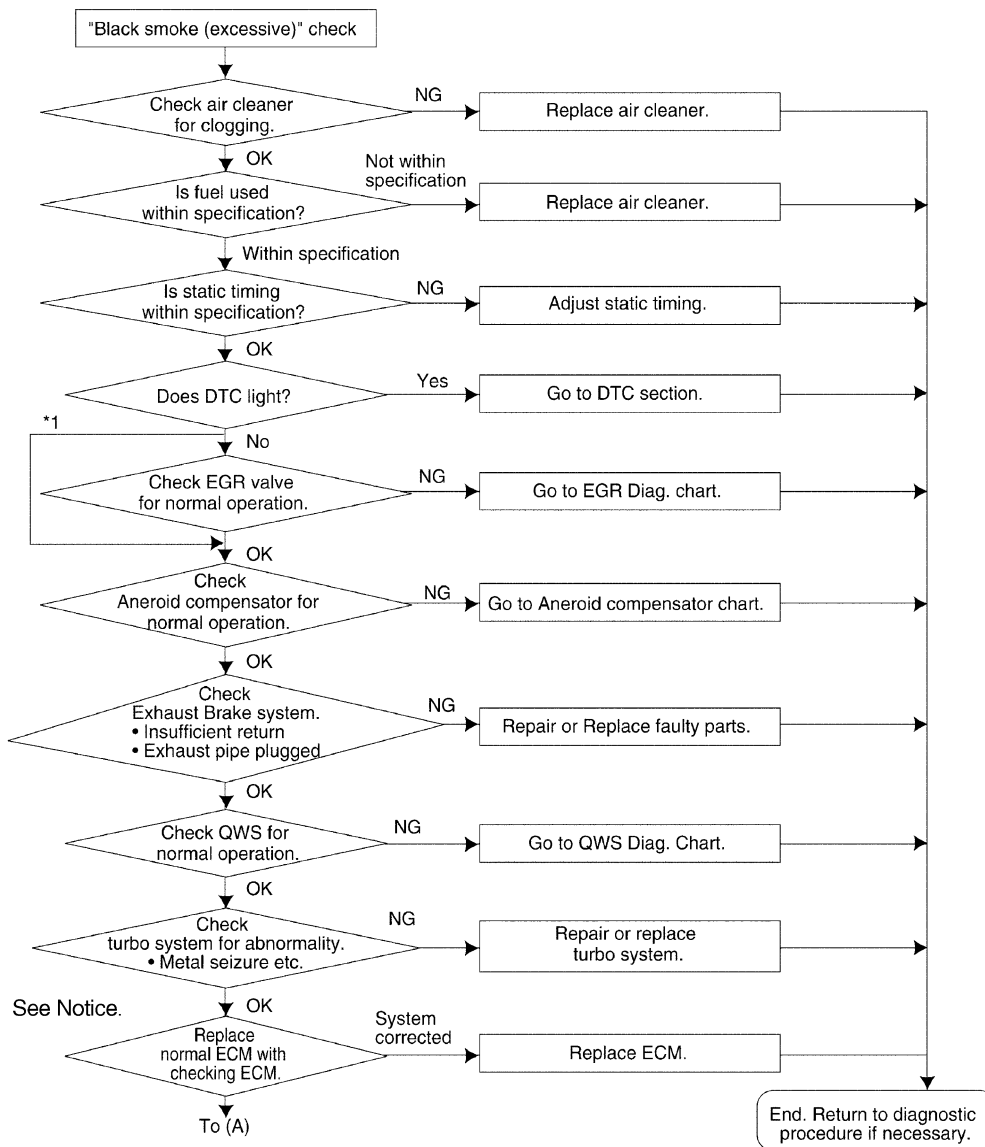


N6A1342E

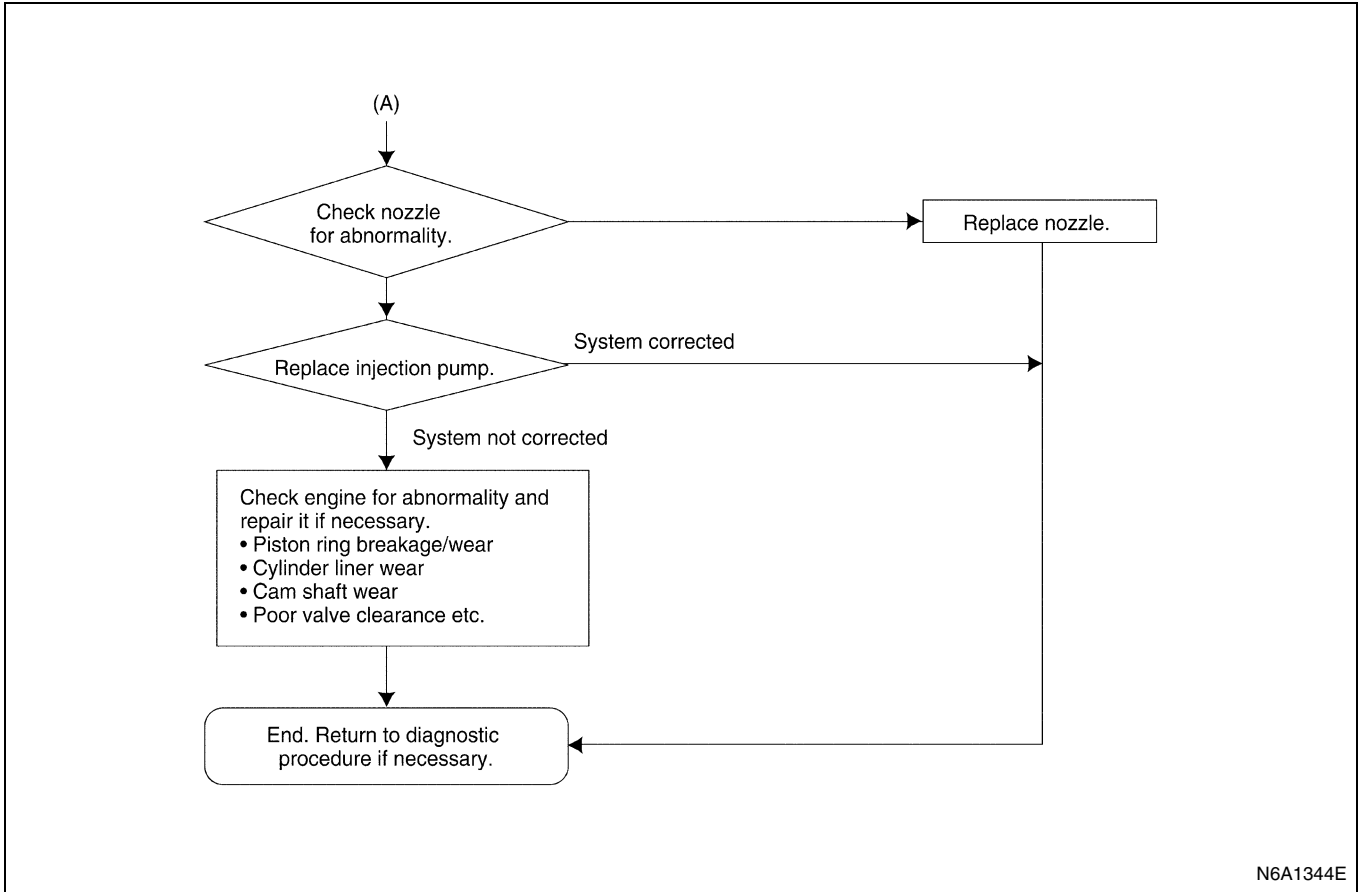
Notice:

The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle Engine Control Module (ECM) and the checking ECM.

Black Smoke (Excessive)



N6A1343E



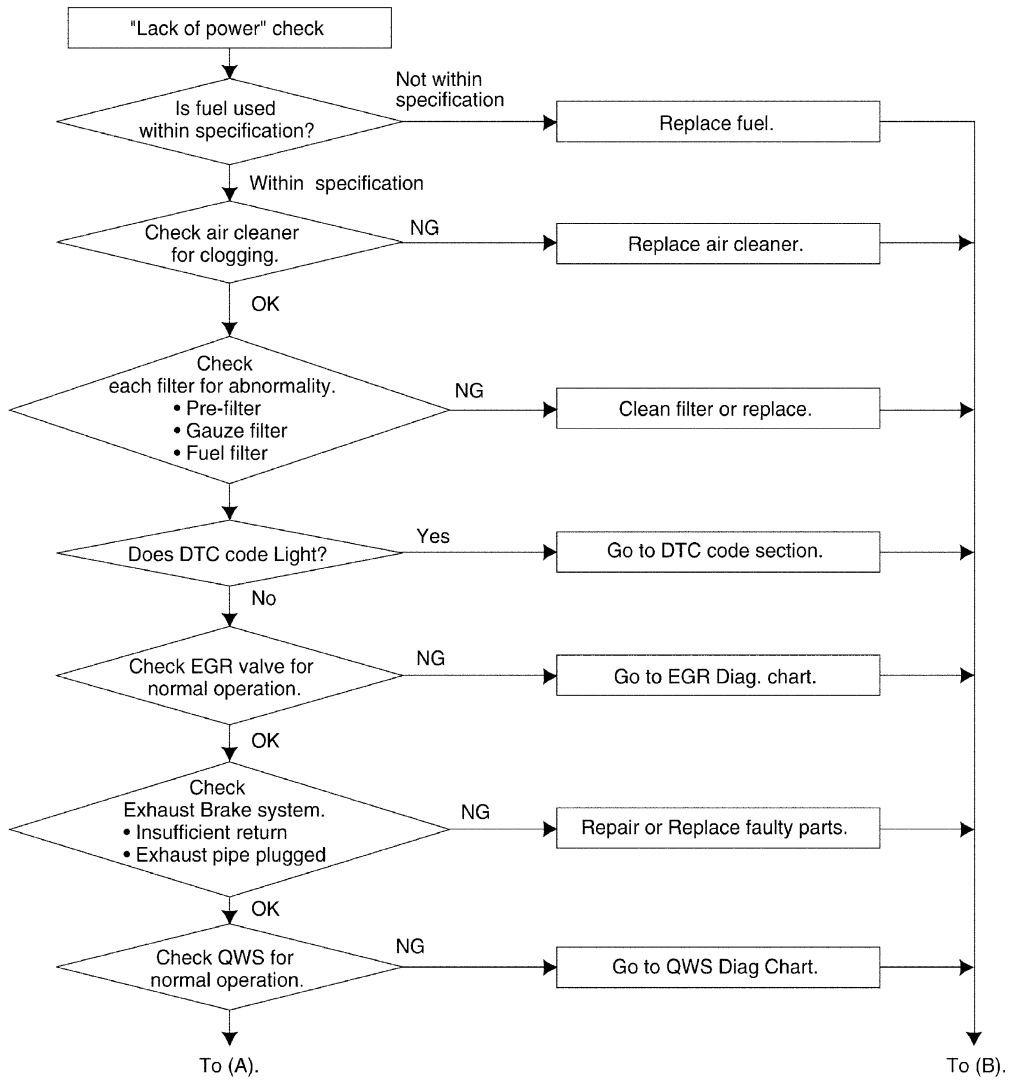
N6A1344E

Notice:

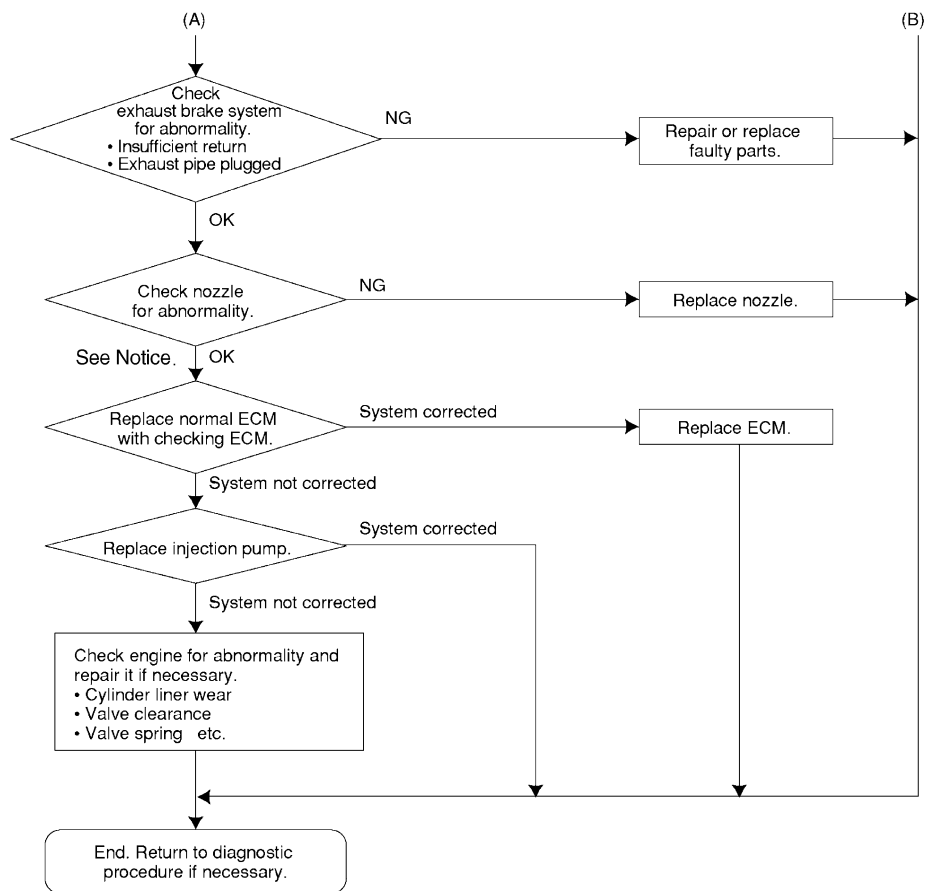
The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle Engine Control Module (ECM) and the checking ECM.

Refer to a trouble code for a supplier's check, if available.

Lack of Power



N6A1345E

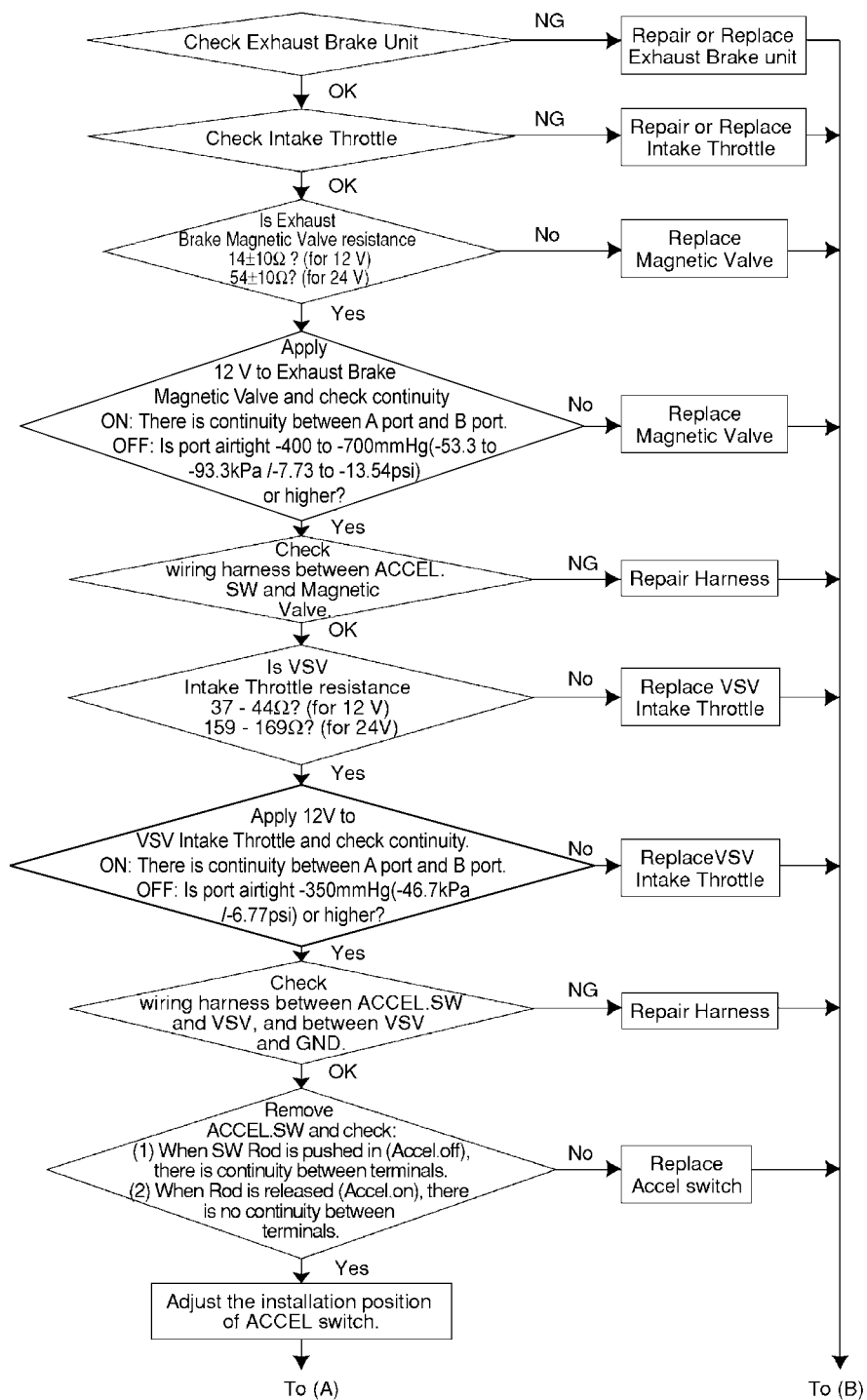


N6A1346E

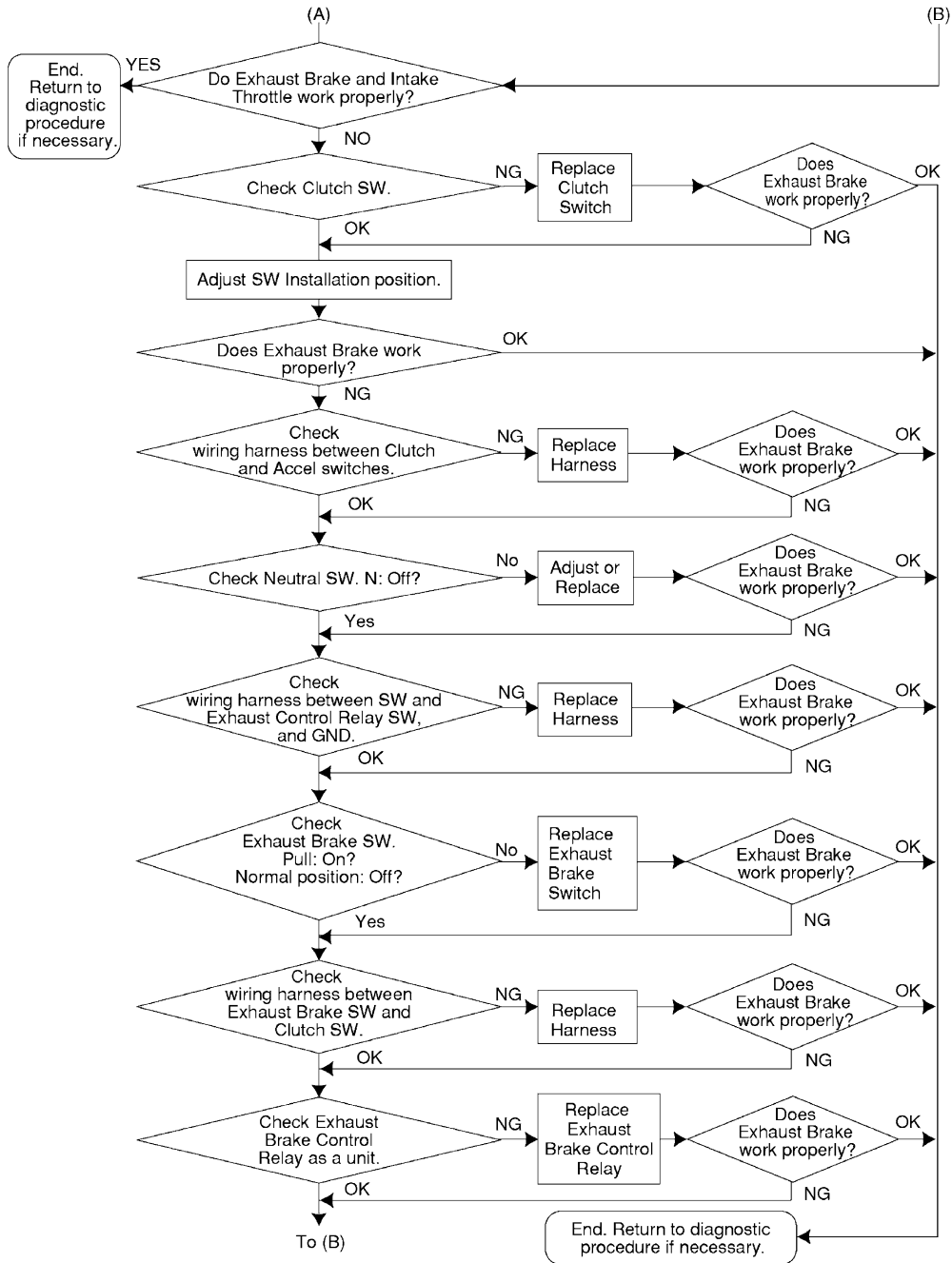
Notice:

The condition of the system in which the malfunction has occurred should be checked by making comparisons between the vehicle Engine Control Module (ECM) and the checking ECM.

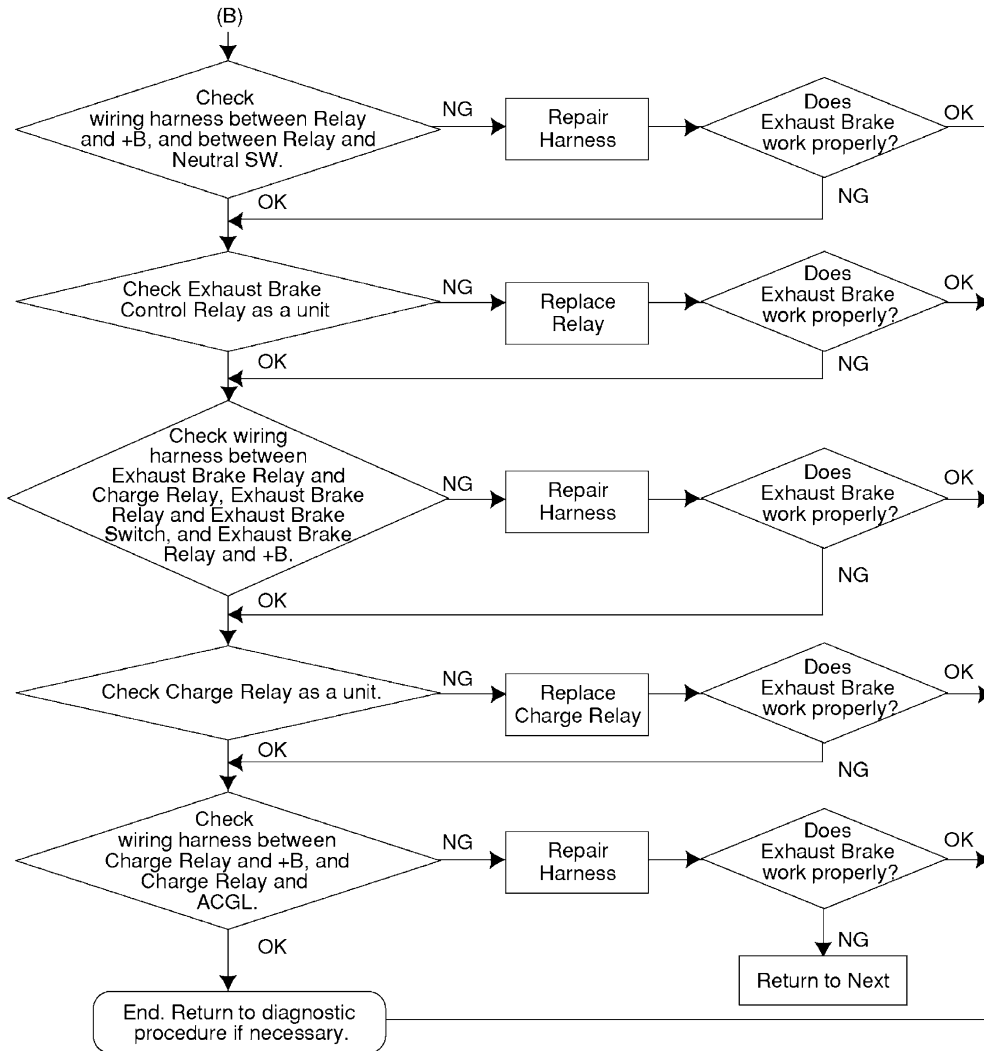
Exhaust Brake Malfunction (Exhaust Brake only)



N6A1679E



N6A1348E



* Repair of wiring harness includes diode check.

Inspection

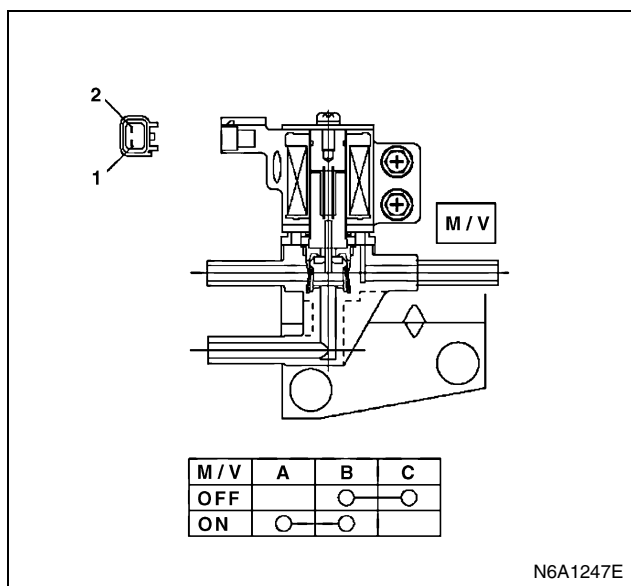
1. Exhaust Brake Magnetic Valve

Inspection

Connect the magnetic valve connector terminal No.1 and No.2 to (+) terminal and (-) terminal of battery, respectively, and check the continuity between the ports.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.



N6A1247E

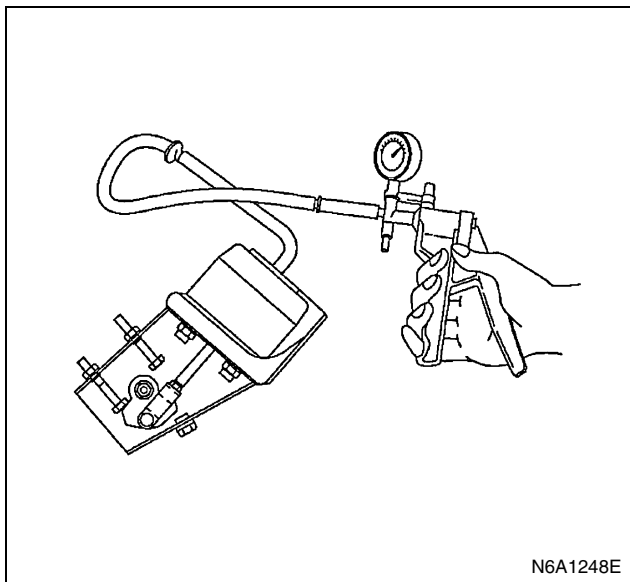
Legend

- A. Inlet (Vacuum pump)
- B. Outlet (unit)
- C. EXH (air filter)

2. Exhaust Throttle Valve

Working Check

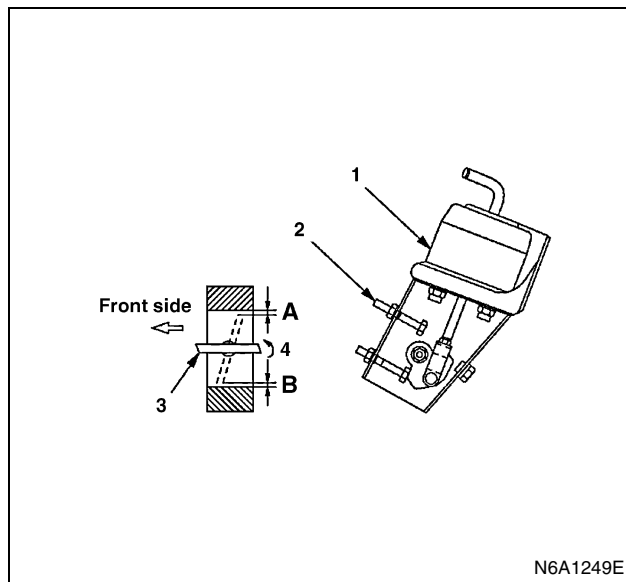
Actuate the exhaust brake with the engine idling and make sure that you hear the valve strike on the stopper.



N6A1248E

Airtight Check

Apply a negative pressure of 53.3 — 93.3 kPa (400 — 700 mmHg/7.73 — 13.54 psi) to the power chamber by means of a vacuum pump and make sure of the smooth opening/closing of the exhaust brake valve.



N6A1249E

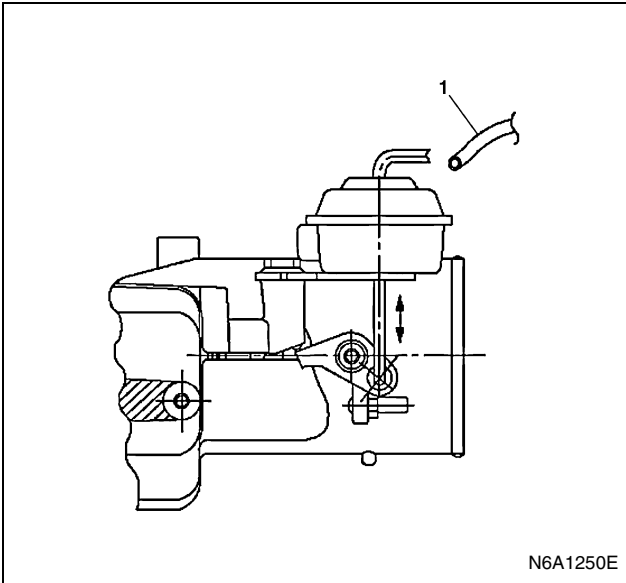
Legend

- 1. Power chamber
- 2. Adjust bolt
- 3. Valve
- 4. Close

Apply a negative pressure of 86.7 — 93.3 kPa (650 — 700 mmHg/12.57 — 13.54 psi) to the power chamber using a vacuum pump and make sure the average of measurements at Point A and Point B of the clearance between valve and body is as follows:

0.4 — 0.6 mm (0.016 — 0.024 in) (Minimum: 0.4 mm/0.016 in)

If the clearance is out of this range, adjust with the adjusting bolt.



Legend

- 1. Vacuum hose

- 3. Intake Throttle Valve

Working Check

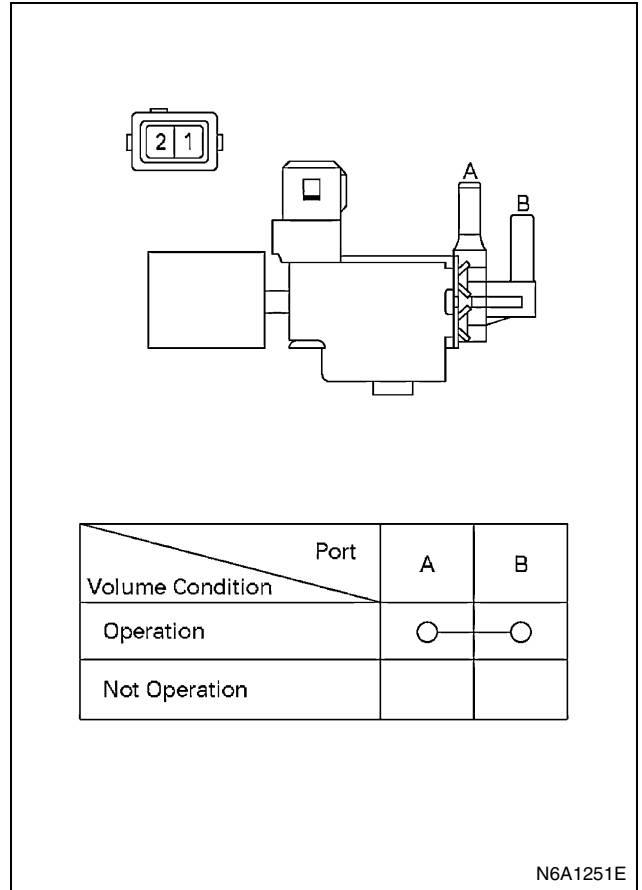
Disconnect the vacuum hose from the actuator and try to move the rod by hand, making sure of the smooth move of the rod.

- 4. EXHAUST GAS RECIRCULATION (EGR) SYSTEM MALFUNCTION4. Vacuum Switching Valve; Intake Throttle

Inspection

Connect the vacuum switching valve connector terminals No.1 and No.2 to (+) terminal and (-) terminals of battery, respectively, and check the continuity between the ports.

If the check result is abnormal, repair or replace the valve.



- 5. Accelerator Switch (2-pole connector type)

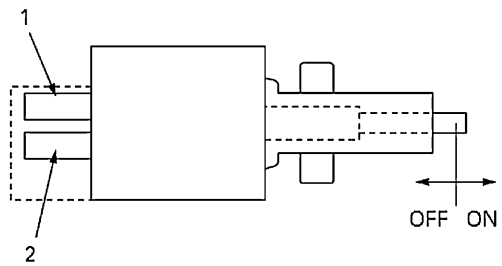
Inspection

- 1) Check the continuity between the switch connector terminals.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

- 2) Check the smooth move of the pushrod. If the check result is abnormal, repair or replace the pushrod.



	Connection pin	
Switch position	1	2
Release push rod	○	○
Push in Push rod		

N6A1252E

Removal

- 1) Accelerator Switch
 Disconnect the connector.
 Loosen the lock nut.
 Turn the switch to remove.

Reinstallation

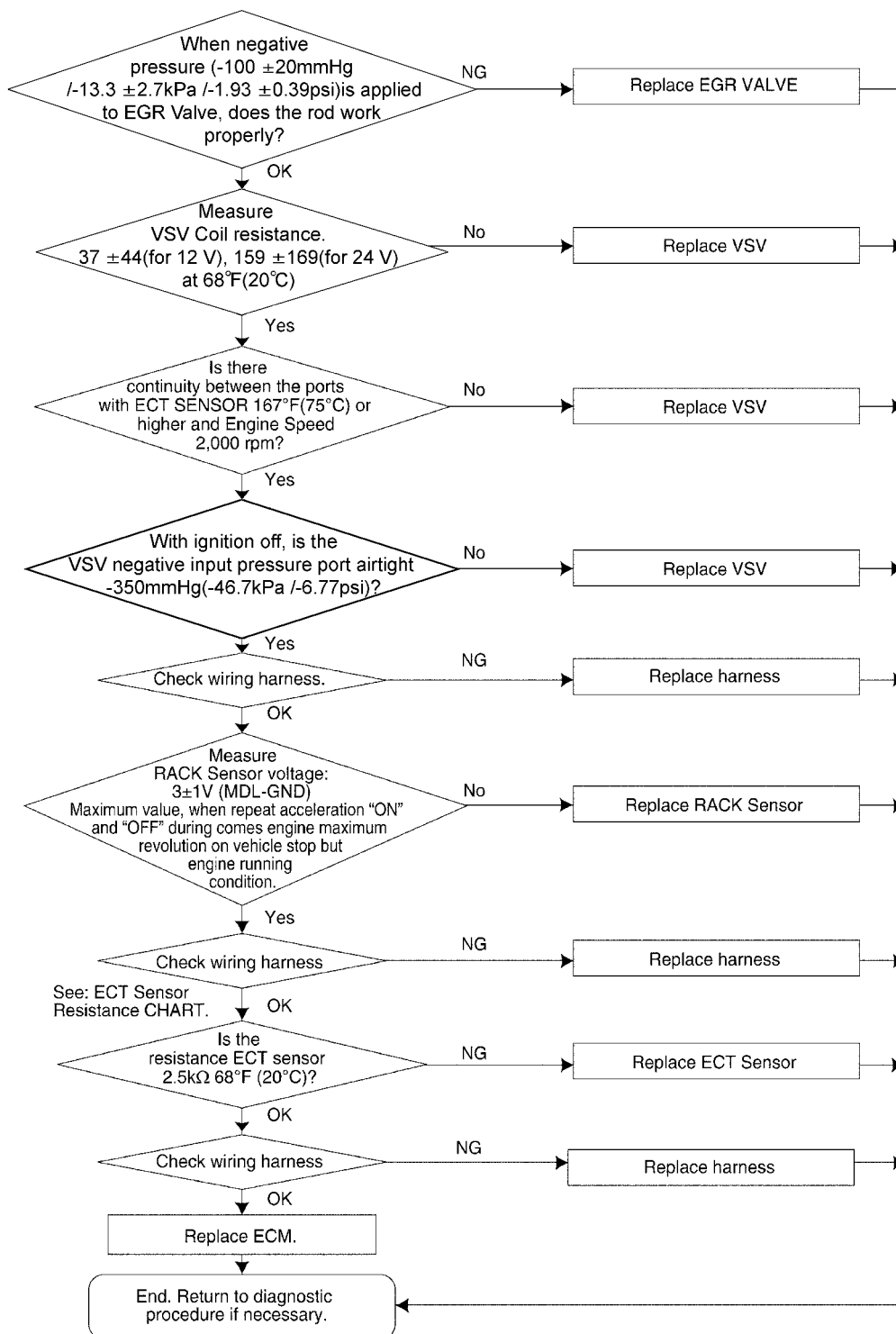
To install, follow the removal procedure in reverse order:

- 1) Drive the threaded part of the switch until its end surface becomes flush with that of the bracket side of nut.
- 2) Tighten the lock nut.

Tighten:

- Lock nut to 1.3 N·m (0.13 kg·m/11.5 lb-in)

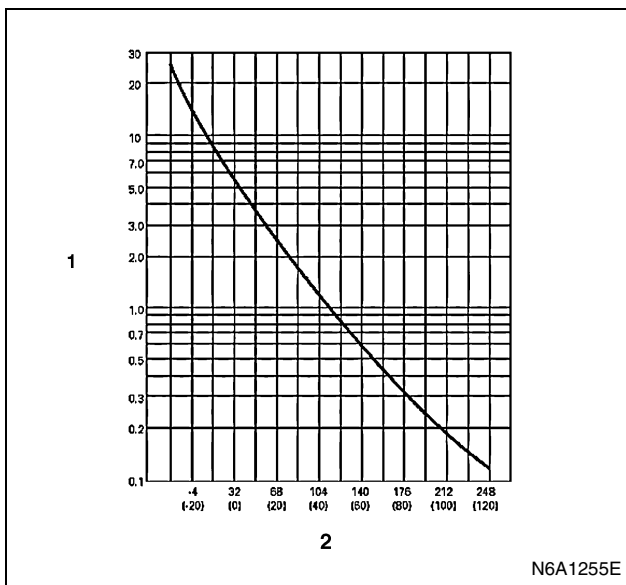
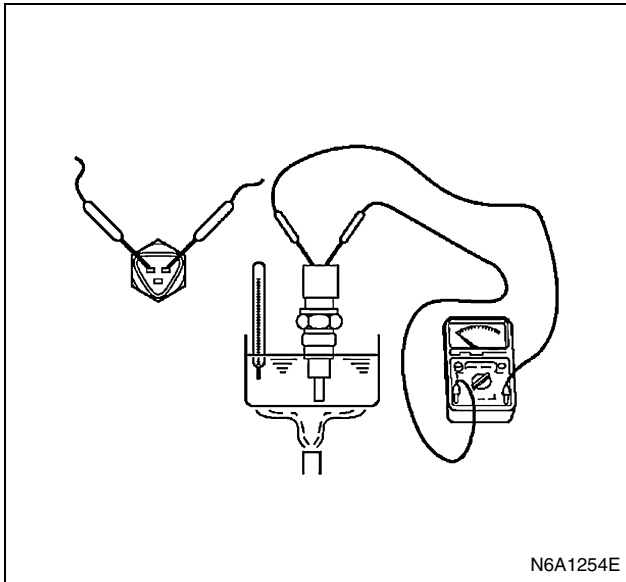
Exhaust Gas Recirculation (EGR) System Malfunction



N6A1680E

Inspection

1. Thermosensor (Engine coolant temperature)
Soak the temperature sensitive part of a thermosensor in the water, and while changing the water temperature, make sure the resistance is changed as the following graph shows:



Legend

1. Resistance (kΩ)
2. ECT °F (°C)

2. Vacuum Switching Valve (VSV)

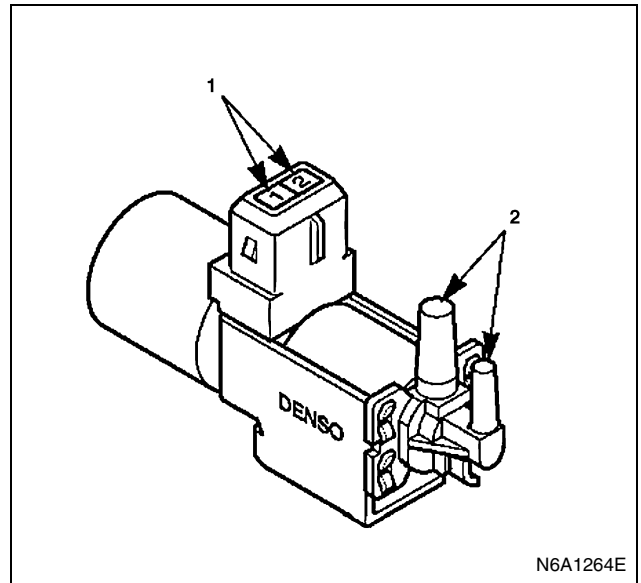
Resistance Check

Check the resistance between the VSV connector terminals using a circuit tester.

Cold Resistance

: 37 — 44 (Ω) (for 12 volt model)

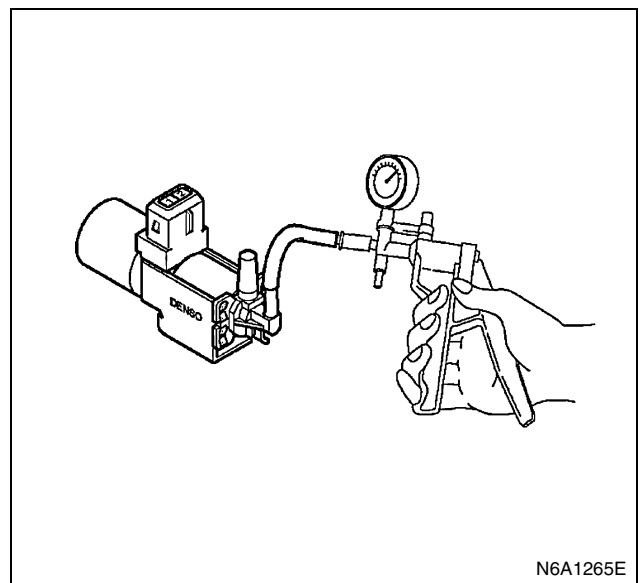
: 159 — 169 (Ω) (for 24 volt model)



Legend

1. 2 Pin
2. Port

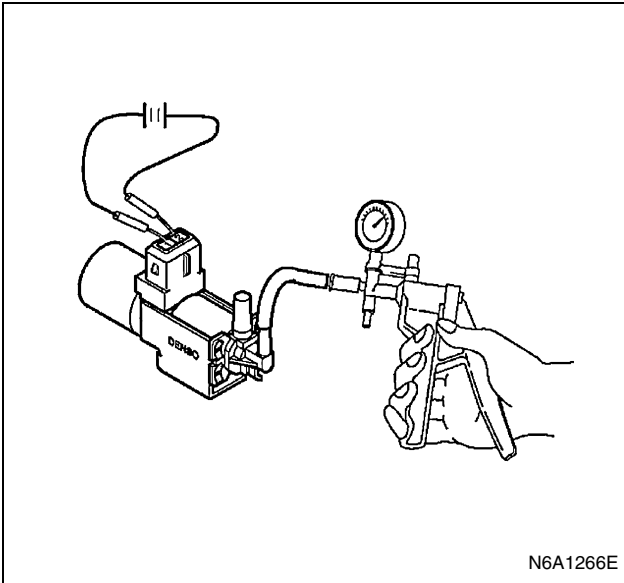
Connect battery voltage between VSV connector terminals and make sure of the continuity between the ports.



Airtight Check

Apply negative pressure to the negative pressure input port as illustrated on the left.

Although there is leakage, it is no problem if the negative pressure rises to -46.7 kPa (-350 mmHg / -6.77 psi) or more.



Working Check

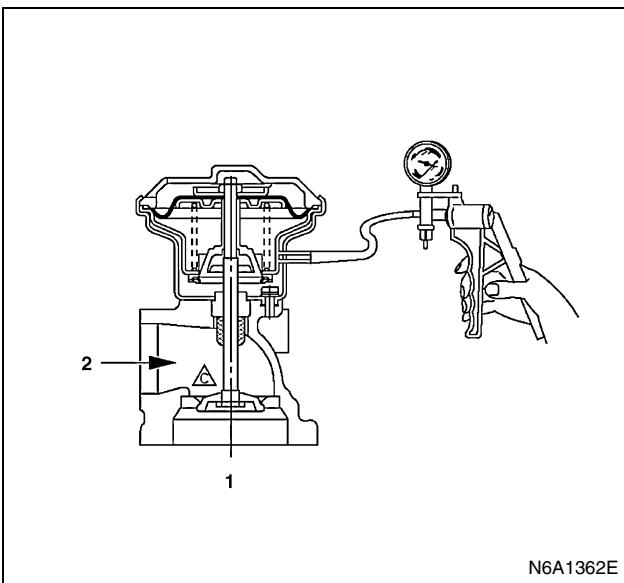
Apply power voltage between the terminals, there is no problem if the negative pressure does not rise when applied to the input port.

Caution:

When measuring resistance with a circuit tester, be careful not to damage or deform the terminals.

- 3. Exhaust Gas Recirculation (EGR) Valve
 With negative pressure applied to the diaphragm chamber, make sure that the valve is smoothly actuated to make the area between (1) and (2) ventilated.

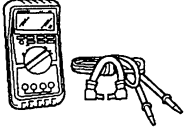

Startup: About -13.3 ± 2.7 kPa (-100 ± 20 mmHg / -1.93 ± 0.39 psi)



Check to see if EGR valve is normally actuated under the following conditions:

Engine coolant temp.: 80°C (176°F) or higher

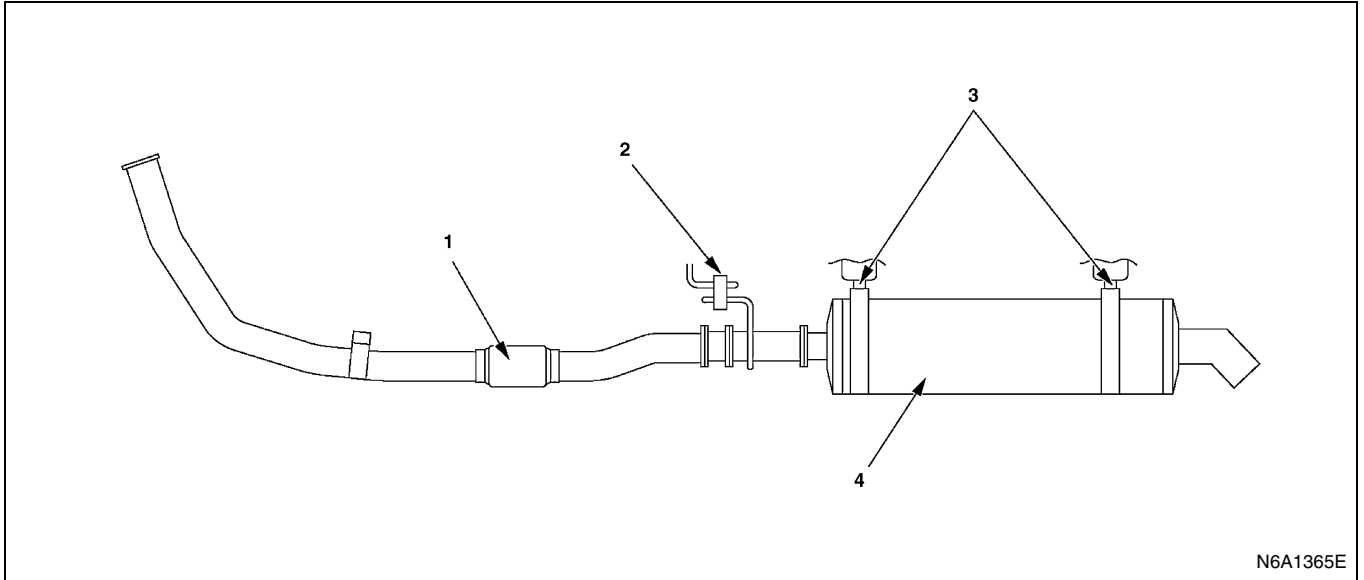
SPECIAL TOOLS

Illustration	Tool Number / Description / Remarks
 <p>5884003660</p>	5-8840-0366-0 (J 39200) / High Impedance Multi- meter (Digital Voltmeter- DVM)
 <p>5884002790</p>	5-8840-0279-0 (J 23738- A) / Vacuum Pump with Gauge

EXHAUST

GENERAL DESCRIPTION

Component



N6A1365E

Legend

- | | |
|-------------------|----------------------------|
| 1. Flexible tube | 3. Rubber mount |
| 2. Rubber support | 4. Silencer with converter |

The vehicle is equipped with a single horizontal exhaust system which consists of a front exhaust pipe with a heat shield attached, a main exhaust pipe, a silencer with catalytic converter and a tail pipe.

An engine exhaust brake is attached between the front exhaust pipe and the exhaust manifold.

The exhaust brake, when turned on, restricts the flow of exhaust gases and thereby slows the engine.

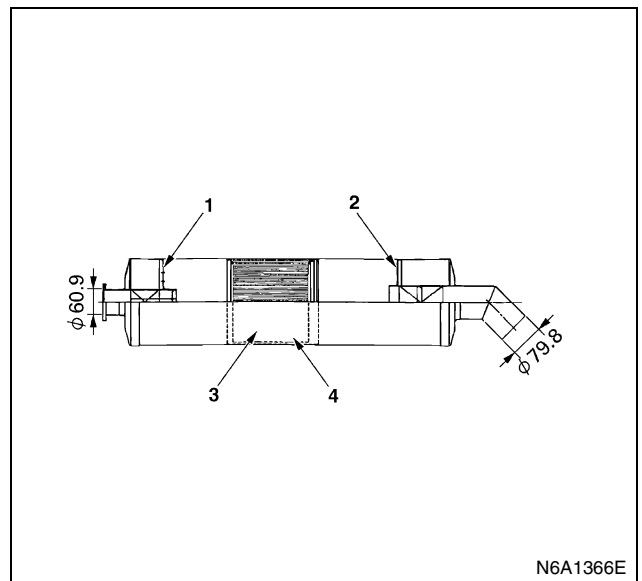
Be sure the exhaust brake system is turned off before performing any exhaust system diagnosis.

Gasket

The gasket must be replaced whenever a new exhaust pipe, muffler or exhaust throttle is installed.

Catalytic Converter

For Taiwan

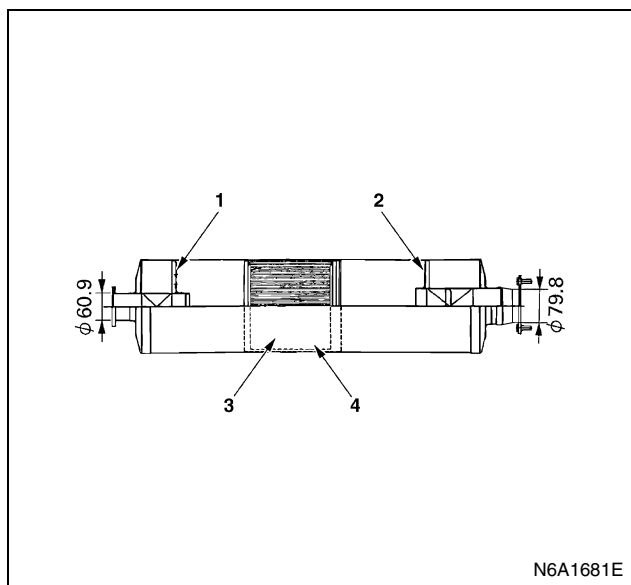


N6A1366E

Legend

1. Inlet assembly
2. Outlet assembly
3. Catalyst assembly
4. P.NO.

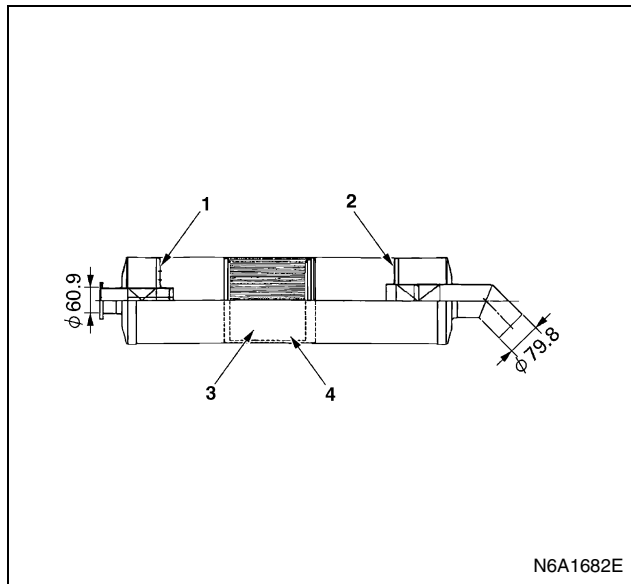
For Venezuela



Legend

- 1. Inlet assembly
- 2. Outlet assembly
- 3. Catalyst assembly
- 4. P.NO.

For Hongkong



Legend

- 1. Inlet assembly
- 2. Outlet assembly
- 3. Catalyst assembly
- 4. P.NO.

ON-VEHICLE SERVICE

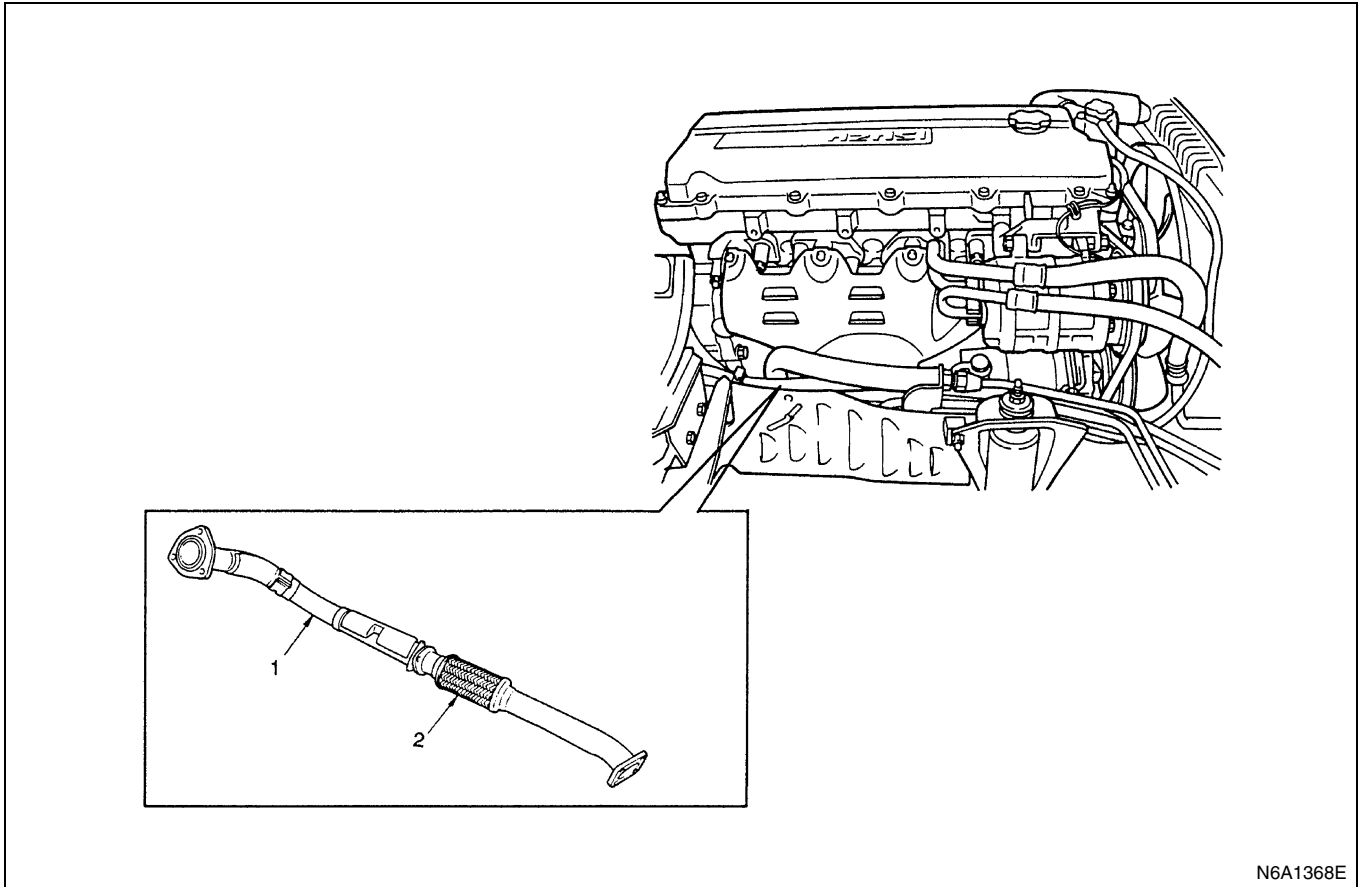
Rattles and noise vibrations in the exhaust system are usually caused by misalignment of parts. When aligning the system, leave all bolts or nuts loose until all parts are properly aligned; then tighten, working from front to rear.

1. Check connections for looseness or damage, especially for exhaust gas leakage.

2. Check clamps and rubbers for weakness, cracks or damage.
3. Check for dents or damage and for any holes or cracks caused by corrosion.

Component

Front Exhaust Pipe



Legend

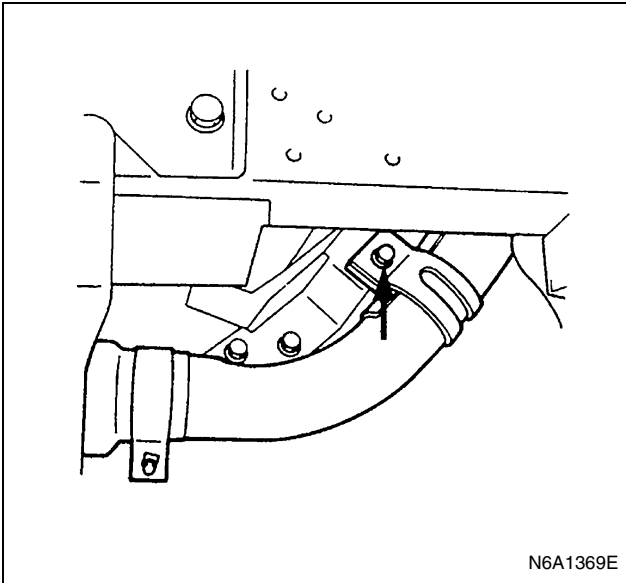
1. Front exhaust pipe I (Exhaust manifold side)

2. Front exhaust pipe II (Exhaust brake side)

Removal

Preparation

- Disconnect battery negative cable.
1. Front Exhaust Pipe I (Exhaust manifold side)
 - Remove the three nuts from front exhaust pipe I (exhaust manifold side)
 - Remove the bolt from mounting bracket (engine right side)



- Remove the four bolts and nuts from front exhaust pipe II (exhaust brake side)
2. Front Exhaust Pipe II (exhaust brake side)

Installation

1. Front Exhaust Pipe II (exhaust brake side)

Tighten:

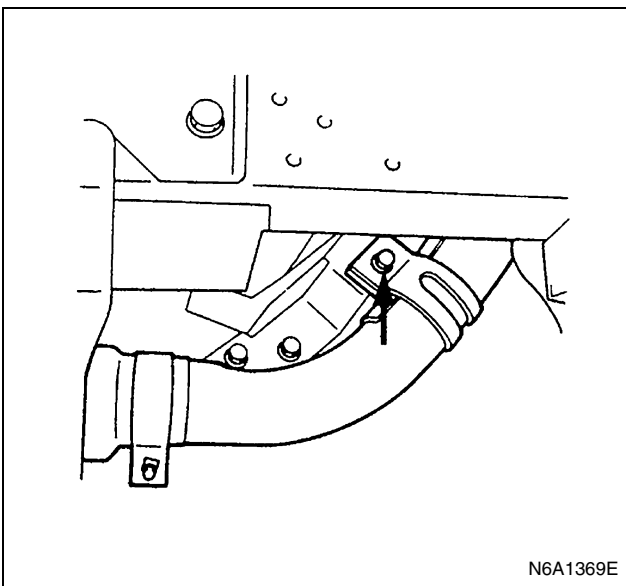
Exhaust brake unit fixing bolt to 17 N·m (1.7 kg·m/12 lb·ft)

2. Front Exhaust Pipe I (exhaust manifold side)

Tighten:

Exhaust Pipe II side to 17 N·m (1.7 kg·m/12 lb·ft)

Mounting Bracket Bolt to 18 N·m (1.8 kg·m/13 lb·ft)



Tighten:

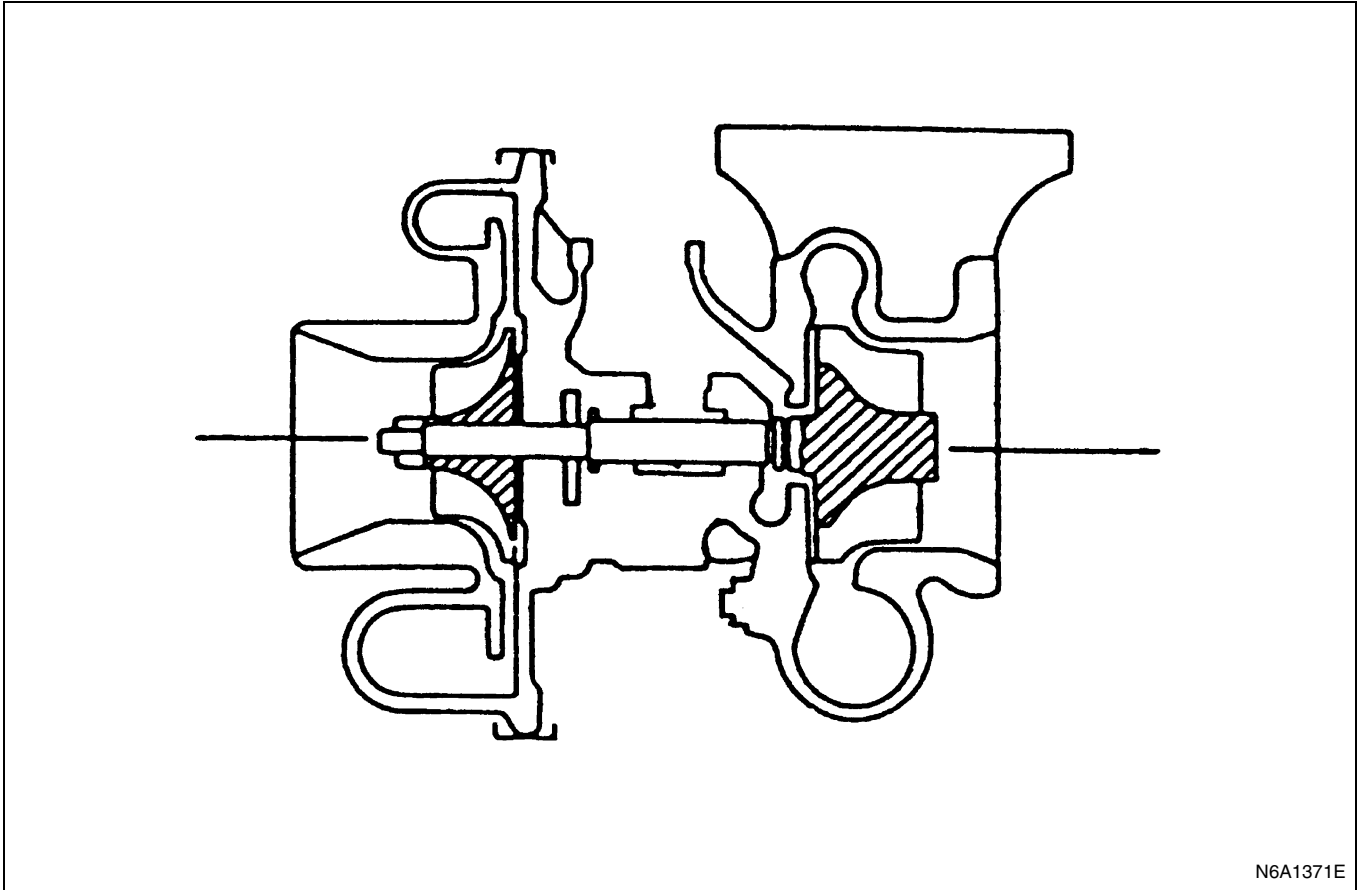
Manifold Fixing Nut to 67 N·m (6.8 kg·m /49 ft·lb)

- Connect battery ground cable.
- Start engine and check for exhaust gas leakage from exhaust pipes.

TURBOCHARGER

GENERAL DESCRIPTION

Turbocharger



N6A1371E

Garrett turbocharger components are constituted the Center Housing and Rotating Assembly (CHRA), the compressor housing, and the turbine housing.

Rotating parts include the turbine shaft, the compressor wheel, the shaft bearings, the thrust bearings and the oil seal rings. These parts are supported by the center housing.

The turbocharger bearing and turbine shaft are lubricated with engine oil and at the same time are cooled with engine coolant to improve their durability.

The turbocharger increase air intake efficiency, the results in increased engine power, reduced fuel consumption and minimal engine noise.

Turbocharger rotating parts operate at very high speeds and temperatures. The parts materials have been carefully selected and machined to extremely high precision. The turbocharger for 4HG1-T Engine has a unit construction of turbine housing and exhaust manifold.

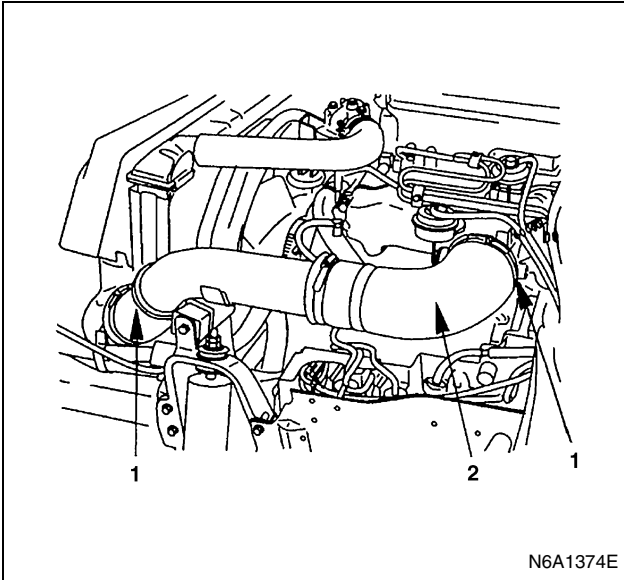
Color for caution plate on the 4HE1-TC turbocharger are, EURO3 vehicles have a blue caution plate. All other vehicles have a silver caution plate.

ON-VEHICLE SERVICE

Charge Air Pipe

Removal

1. Connecting hose clamps.
2. Connecting hoses.



3. Bracket bolts and washers and charge air pipe.

4. Clamps.
5. Connecting hose.
6. Bracket accelerator cable.
7. Bracket engine stop cable and vacuum hose.
8. Engine harness connector.
9. Charge air pipe.
10. Gasket.

Caution:

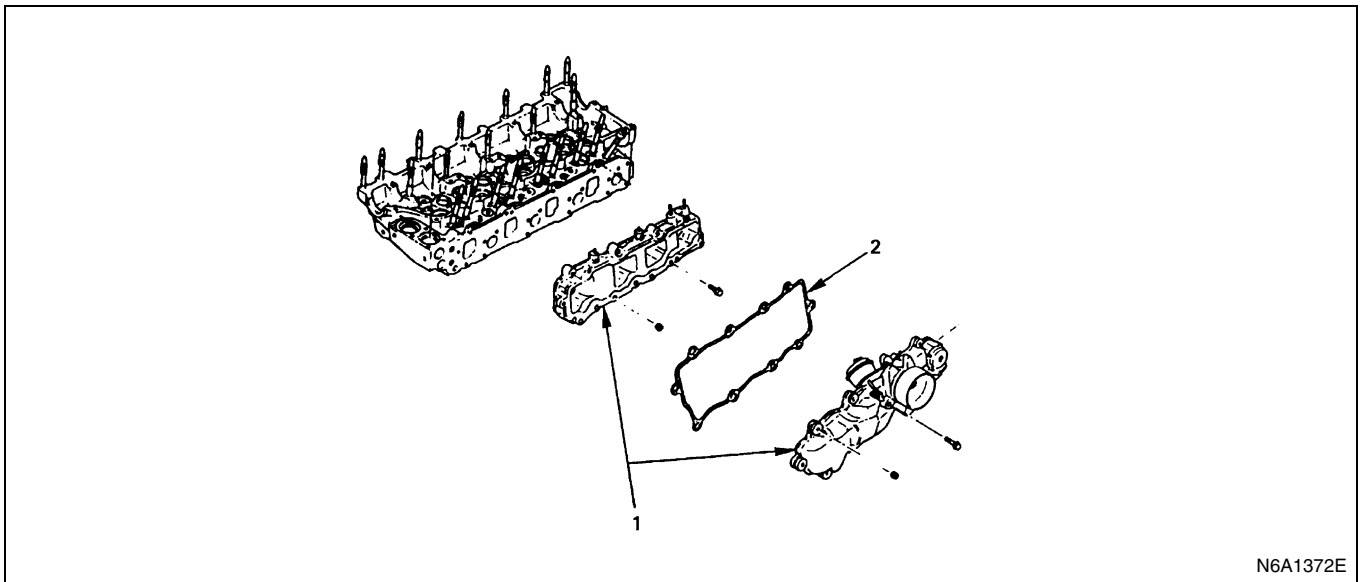
- Check hoses for deterioration, or damage.
- Charge air pipes for damage.

Installation

1. Gasket to the intake manifold.
2. Charge air pipe.
3. Engine harness connector.
4. Bracket engine stop cable and vacuum hose.
5. Bracket accelerator cable.
6. Connecting hose.
7. Clamps.
8. Charge air pipe and bracket bolts.
9. Connecting hoses.
10. Clamps.

Intake Manifold

Component



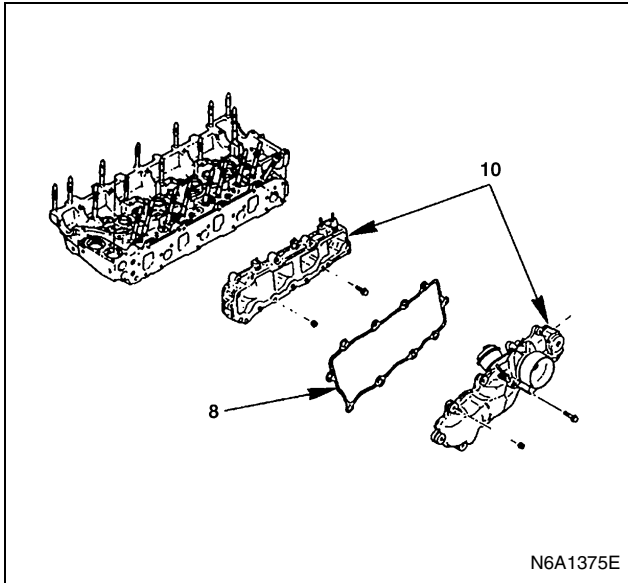
Legend

1. Intake manifold
2. Intake manifold gasket

Removal

1. PCV hose.
2. Accelerator cable injection pump side.
3. Connecting hose.
4. Bracket accelerator cable.
5. Bracket engine stop cable and vacuum hose.
6. Engine harness connector.
7. Charge air pipe.

- 8. Gasket.
- 9. Injection pipe.
- 10. Intake manifold.
- 11. Gasket and discard.



Installation

- 1. Intake manifold.

Tighten:

Intake manifold to 19 N·m(1.9 kg·m/ 14 lb·ft)

- 2. Injection pipe

Tighten:

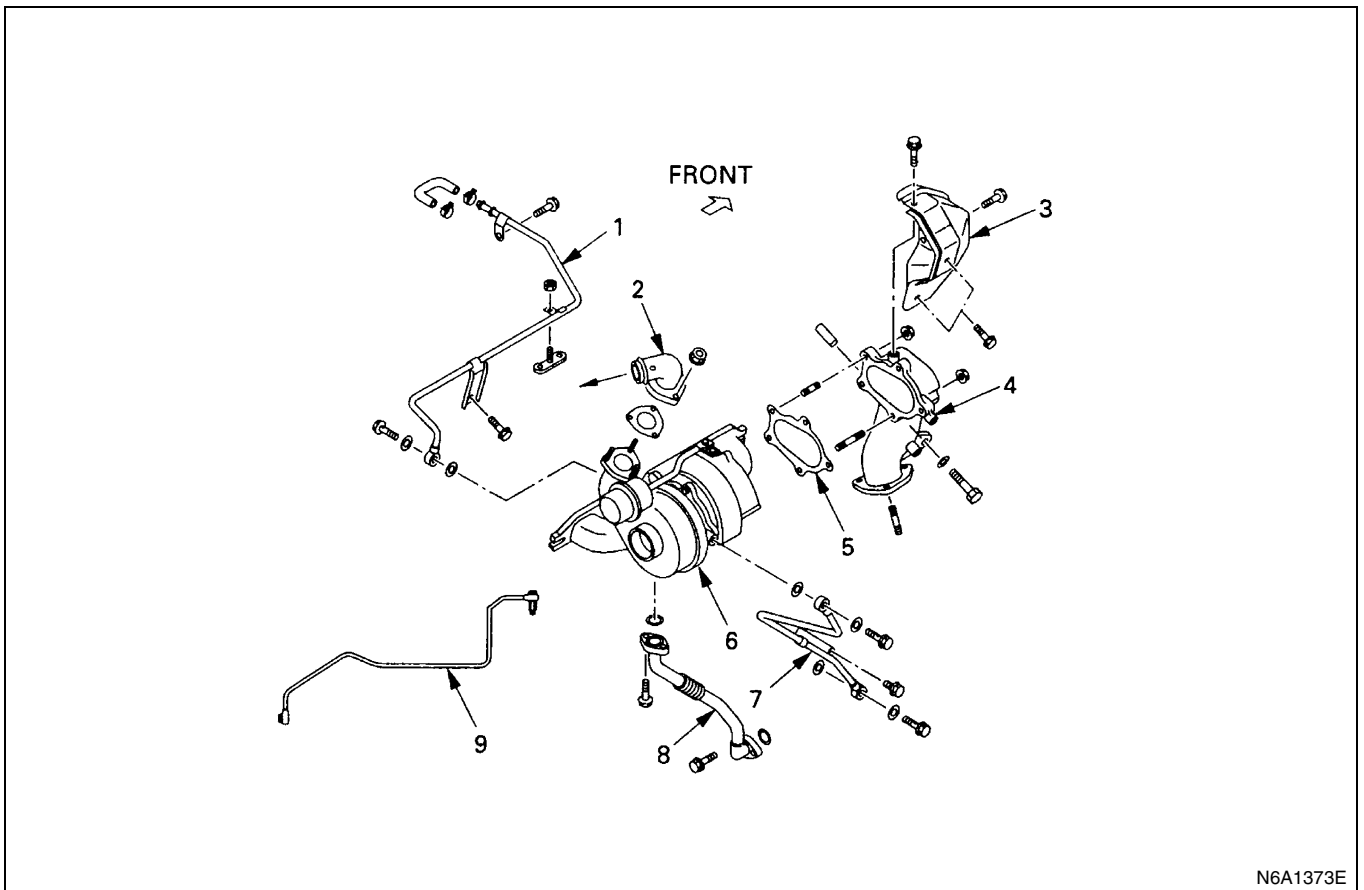
Fuel injector line nuts to 26 N·m(2.7 kg·m/ 20 lb·ft)

- 3. Gasket
- 4. Charge air pipe.
- 5. Engine harness connector.
- 6. Bracket engine stop cable and vacuum hose.
- 7. Bracket accelerator cable.
- 8. Connecting hose.
- 9. Accelerator cable injection pump side.
- 10. PCV hose.

Turbocharger

Refer to "Statement on Cleanliness and Care" previously in this section.

Component

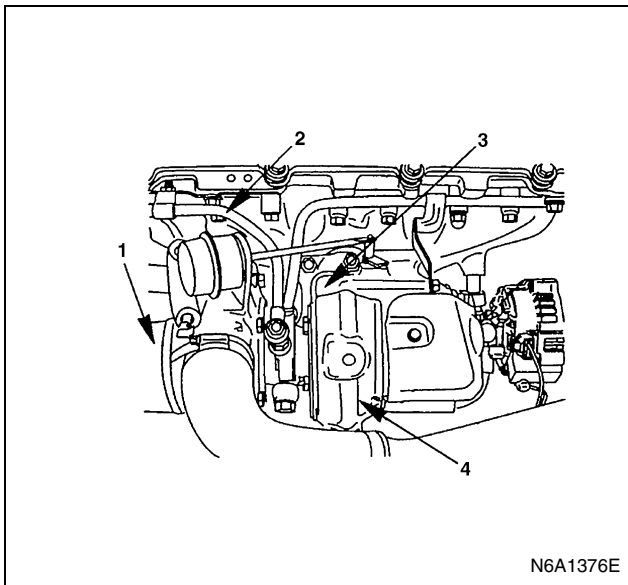


Legend

- 1. Water return pipe
- 2. Turbocharger intake pipe
- 3. Heat shield
- 4. Exhaust adapter
- 5. Gasket
- 6. Turbocharger assembly
- 7. Water feed pipe
- 8. Oil return pipe
- 9. Oil feed pipe

Removal

- 1. Turbocharger air inlet pipe.
- 2. Turbocharger intake pipe.
- 3. Connecting hose.
- 4. Exhaust gas recirculation (EGR) pipe.
- 5. Heat shield bolt.
- 6. Water feed and drain lines.
- 7. Oil feed line.
- 8. Oil drain line.
- 9. Exhaust pipe to exhaust adapter nuts.
- 10. Exhaust adapter to turbocharger nuts.
- 11. Turbocharger to exhaust manifold nuts.



Legend

- 1. Air inlet pipe
- 2. Oil supply line
- 3. Turbo charger
- 4. Heat shield

Caution:

The turbocharger for 4HG1-T Engine has a unit construction of turbin housing and exhaust manifold.

Inspection and Repair

Caution:

- Turbocharger housing for cracks or damage.
- Gasket surfaces for damage.
- Seals and gaskets for damage.

- Turbine and compressor blades for damage or carbon buildup.
- Air and exhaust exit openings for oil or wetness.
- For grinding or roughness when spinning turbine and compressor wheels by hand.
- For evidence of turbine or compressor blades contacting the shroud or housing. If any of the above conditions exist, the turbocharger must be replaced or repaired by an authorized repair facility.

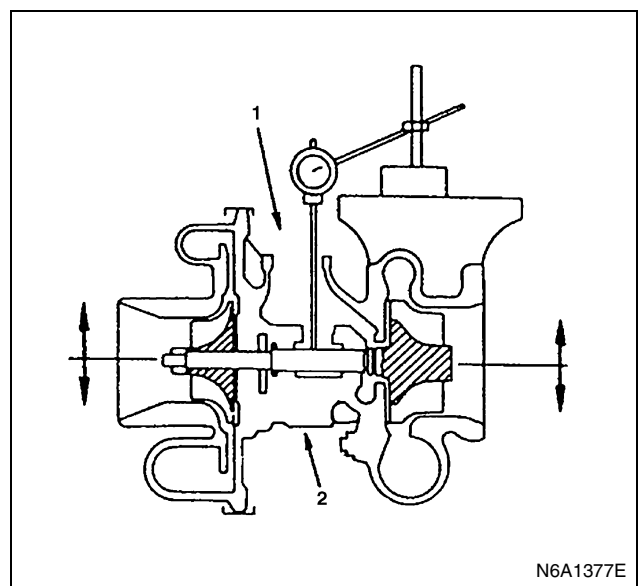
Play in Radial Clearance

Moving the rotor in the radial clearance, measure the play by a dial gage.

- Measure the play at several points while letting the rotor revolve.
- Use only the flat dial gage attachment. Do not use the pointed one.
- Attach the turbocharger and dial gage firmly.

Play in radial clearance		mm (in)
Standard	Limit	
0.056 — 0.127 (0.0022 — 0.0050)	0.140 (0.0055)	

If excessive, replace the turbocharger.



Legend

- 1. Oil outlet
- 2. Oil inlet

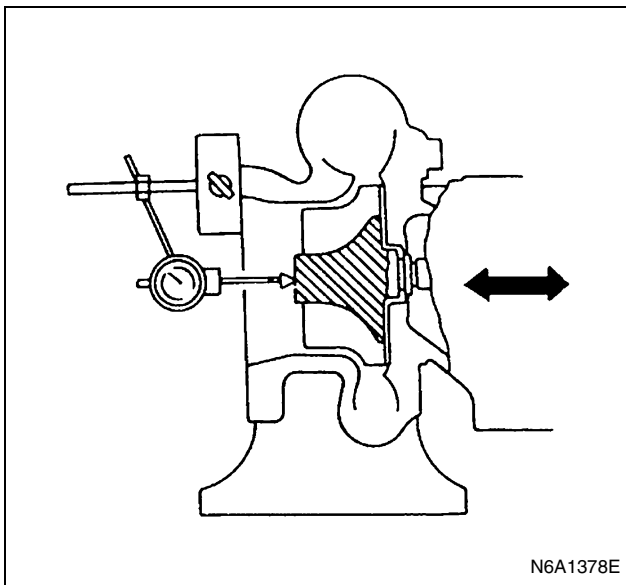
Play in Axial Clearance

Moving the rotor in the axial clearance, measure the play by a dial gage.

- Measure the play at several points while letting the rotor revolve.
- Attach the turbocharger and dial gage firmly.

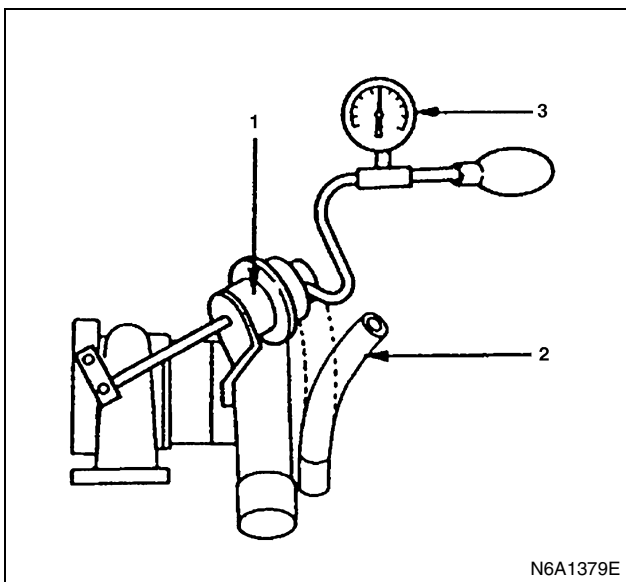
Play in axial clearance		mm (in)
Standard	Limit	
0.013 — 0.097 (0.0005 — 0.0038)	0.097 (0.0038)	

If excessive, replace the turbocharger.



Operation of Waste Gate

- Disconnect hose (2) from waste gate (1), and install pressure gauge (3) as shown in the figure.
- With the engine stopped, operate the pressure gauge pump to apply pressure to the waste gate for check the waste gate function.



Oil Leakage Check

1. Remove the charge air pipe connecting hose to the compressor side of the turbocharger.
2. Clean the area around the compressor wheel.
3. Remove the blow-by hose.
4. Start the engine and let idle. Rev the engine and hold at wide open throttle (WOT) for five seconds, then release and let idle for five seconds. Repeat this cycle for a total of five times then let the engine idle steady for five minutes.
5. Shut off the engine.
6. Check the compressor area for an oil stream.

Caution:

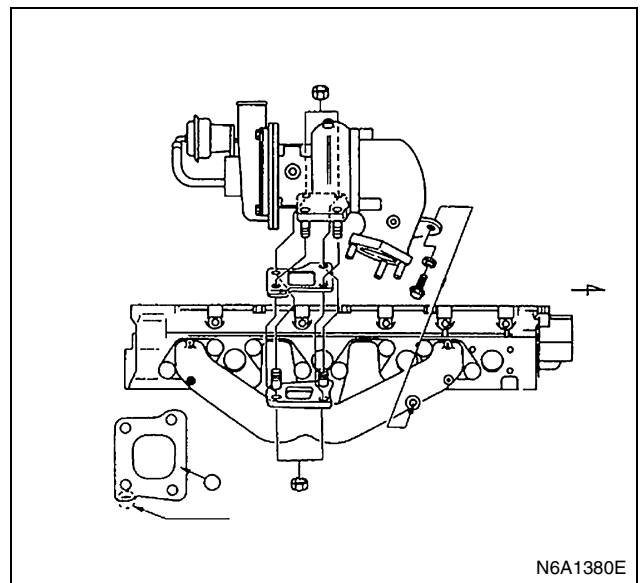
- A stream of oil indicates a possible defective turbocharger. If mist or spray is present, however, this is normal and is NOT indicative of a turbocharger problem.
- 7. If the turbocharger is suspect, refer to the on-vehicle service procedures in this section.

Installation

1. Exhaust manifold to turbocharger.
2. New gasket and turbocharger to exhaust manifold.

Tighten:

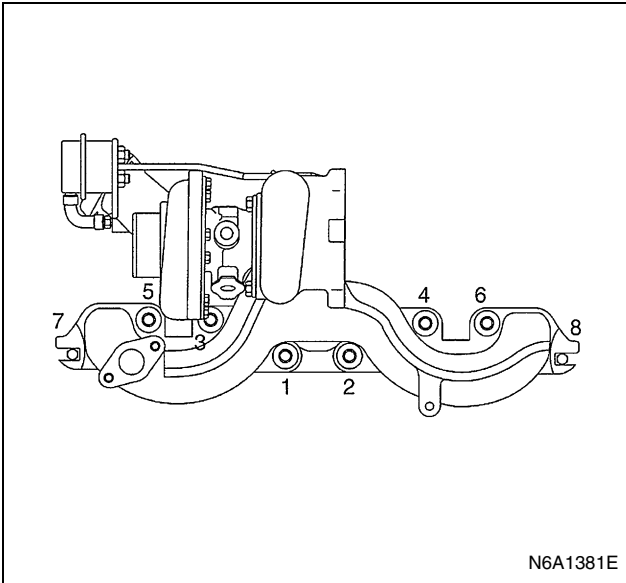
Turbo charger to 52 N·m (5.3 kg·m/ 38 lb·ft)



3. Tighten the cylinder head to turbinhousing and exhaust manifold to the specified torque in the numerical order shown in the illustration. (4HG1-T)

Tighten:

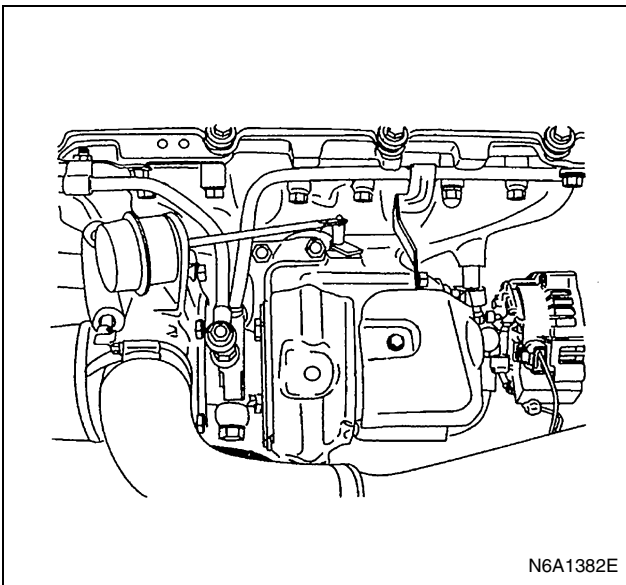
Exhaust manifold to 34 N·m (3.5 kg·m/ 25 lb·ft)



4. Turbocharger to exhaust adapter.

Tighten:

Exhaust adapter to 32 N·m (3.3 kg·m/ 24 lb·ft)



5. Exhaust pipe to exhaust adapter.

Tighten:

Exhaust pipe to 67 N·m (6.8 kg·m/ 49 lb·ft)

6. Turbocharger oil drain line.

Tighten:

Oil drain line to

- Turbocharger 9 N·m (0.9 kg·m/ 6 lb·ft)
- Cylinder body 21 N·m (2.1 kg·m/ 15 lb·ft)

7. Turbocharger oil supply line to turbocharger.

Tighten:

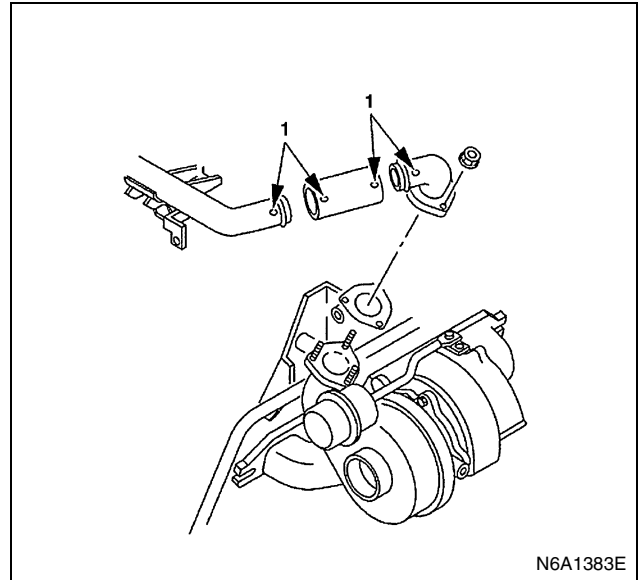
Oil supply line to 27 N·m (2.8 kg·m/ 20 lb·ft)

8. Water supply and drain lines.

Tighten:

Water supply to 41 N·m (4.2 kg·m/ 30 lb·ft)

9. Heat shield to exhaust adapter
10. Charge air pipe connecting hoses and clamps to turbocharger.
11. Air inlet pipe to turbocharger.
12. Fit the connecting hose over the pipe to its projecting part. (4HG1-T)
13. Align connecting hose and pipe marks with each other (4HG1-T)

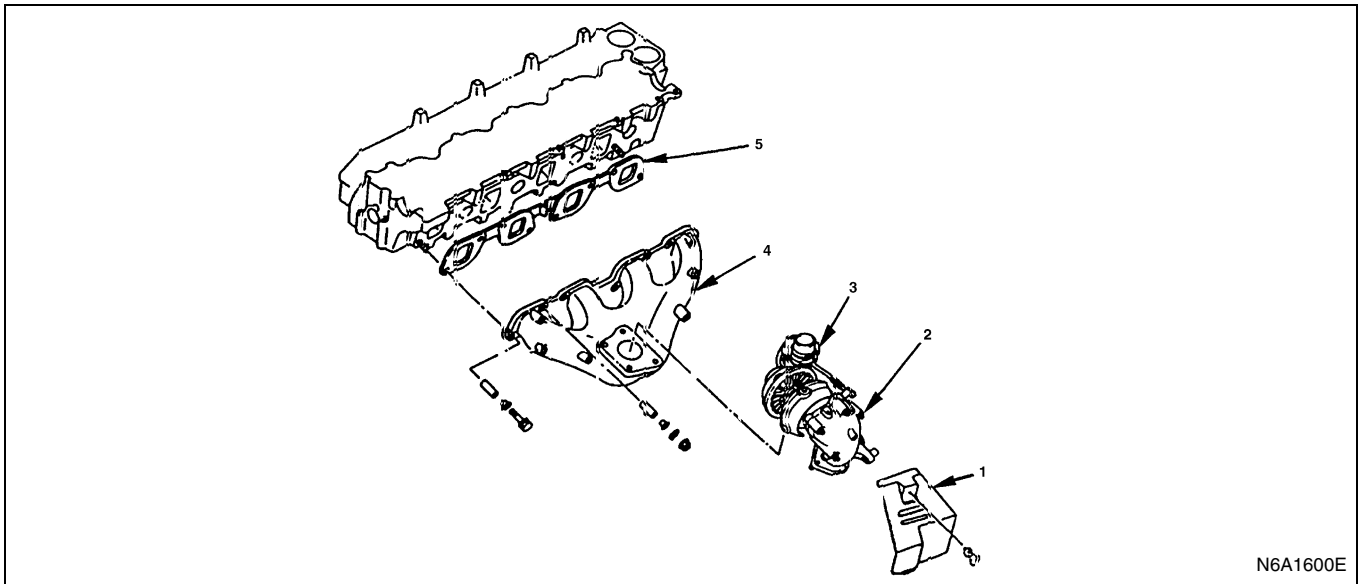


Legend

1. Mark

Exhaust Manifold

Component

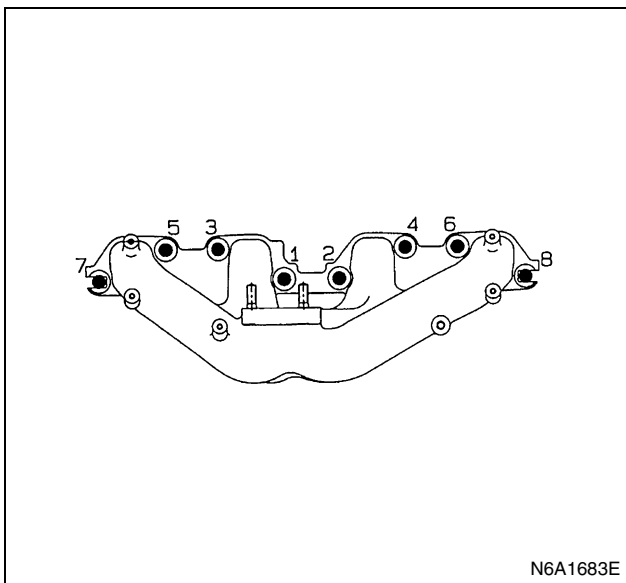


Legend

- | | |
|--------------------|----------------------------|
| 1. Heat shield | 4. Exhaust manifold |
| 2. Exhaust adapter | 5. Exhaust manifold gasket |
| 3. Turbocharger | |

Removal

1. Turbocharger as outlined previously in this section.
2. Heat shield
3. Loosen the exhaust manifold bolts, nuts and washers in numerical order shown in the illustration.



4. Exhaust manifold
5. Gaskets

Caution:

- Exhaust manifold and cylinder head for cracks or damage to gasket surfaces.

Installation

1. Gaskets.
2. Exhaust manifold.
3. Washers nuts and bolts.

Tighten:

Exhaust manifold to 34 N·m (3.5 kg·m/ 25 lb·ft)

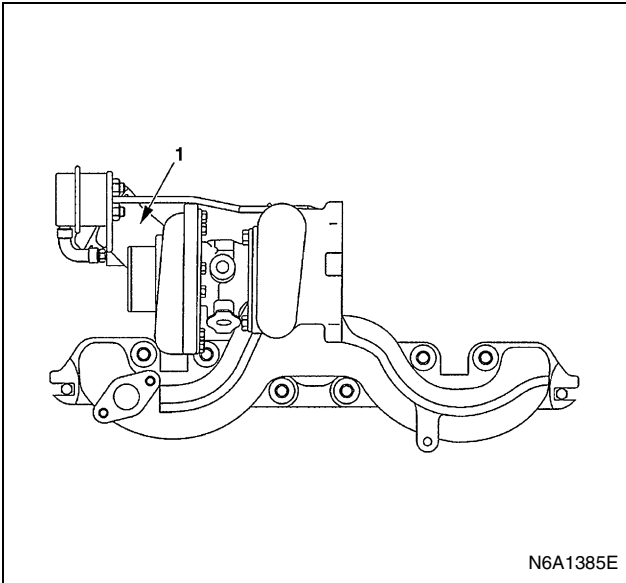
4. Heat shield
5. Turbocharger as outlined previously in this section.

Turbocharger Turbine Housing Replacement (For 4HG1-T Model)

Changing the turbine housing of the turbocharger (integrated with the exhaust manifold)

Inspection

Before replacing the turbine housing, make sure there are no abnormalities in other parts.



N6A1385E

Legend

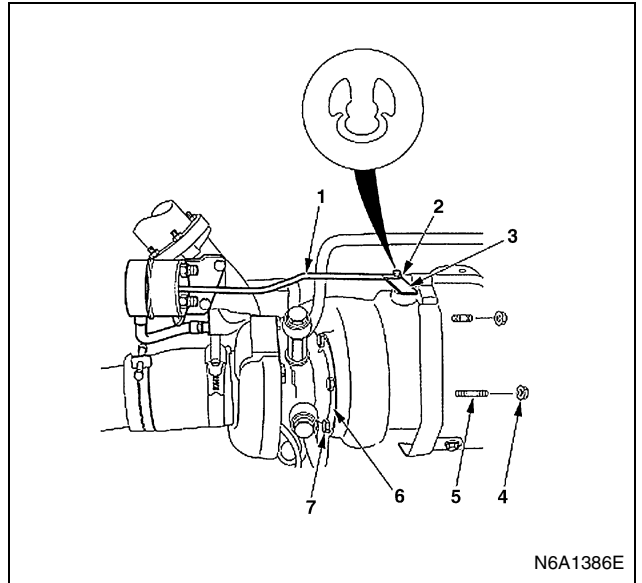
- 1. Compressor port

Notice:

- It is normal to find some oil inside the compressed-air duct. The oil is to lubricate the turbine shaft, and as long as the exhaust is not abnormally white in color, this does not indicate a problem.
- 1. Make sure the parts have no cracks, impeded movement, damage, or distortion of shape, that there is no oil leakage from the seal, and that there is no gas leakage.
- 2. Turn the rotor to see if it rotates smoothly, also checking the rotation direction as well as the amount of slack.
Refer to the separate reference sheet for the proper amount of slack.
If there is an abnormality in any of the above, you will have to change the turbocharger as a unit.

Disassembly

1. Separate the end of the actuator rod (1) from the E Ring (2), then remove the crank (3) from the end of the rod (1).
2. Remove the turbine housing tie-down bolts (7).



N6A1386E

3. Separate the turbine housing from the sensor housing.

Notice:

- Be careful not to scratch the turbine blades when removing parts.

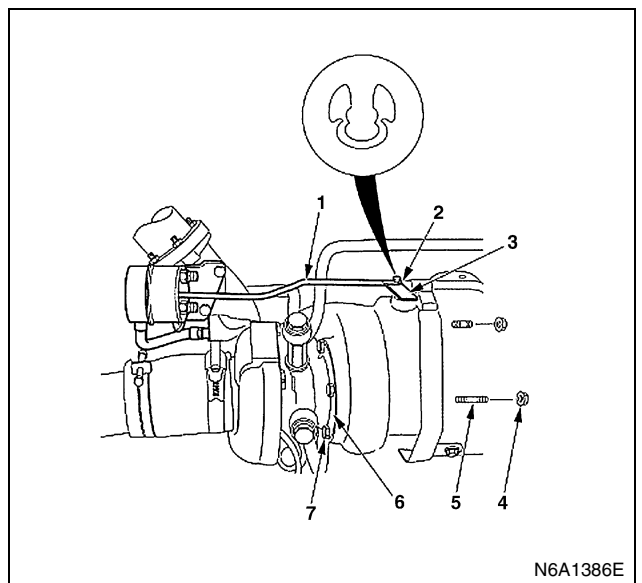
Inspecting the center housing assembly:

Check that none of the blades is bent, cracked, or scratched. Make sure there are no obstructions that would interfere with the movement of the blades or with mounting the new housing. Remove any excess carbon or oil.

Replacing Parts

When reassembling, be sure to replace the following parts. (Use only genuine Isuzu parts.)

1. E Ring (2)
2. Turbine housing tie-down bolts (7)
3. Turbine housing clamp (6)
4. Adapter nut (4)
5. Adapter stud (5)



N6A1386E

Cleaning

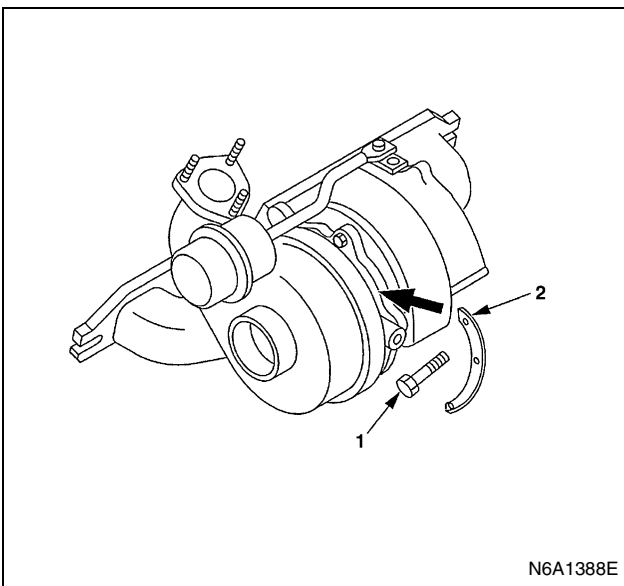
Thoroughly clean off the oil and carbon from abutting surfaces, the oil passages, flange surfaces, air and exhaust ducts, etc. Always air-dry the parts after cleaning.

Assembly

1. Insert the sensor housing into the turbine housing.

Notice:

- When inserting the sensor housing, make sure it will not impede the movement of the turbine blades.
2. Apply molybdenum disulfide to the thread and underside of the head of each bolt (1).
 3. Temporarily secure the sensor housing in place with the clamp (2).



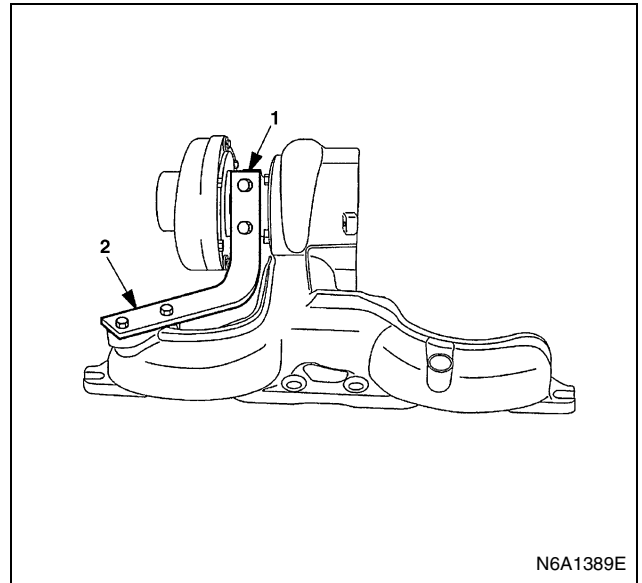
4. Connect the oil side of the sensor housing (1) and the EGR-connection side of the exhaust manifold (2) to the angle setting gauge, then tighten the bolt to secure the gauge in place. (The angle of the sensor housing and turbine housing will be set with the use of this gauge).

Turbocharger housing setting gauge: 5-8840-2673-0

(1) M6 × P = 1.00

(2) M8 × P = 1.25

5. To give the sensor housing some slack, loosen the bolt on side (1) by half a turn.

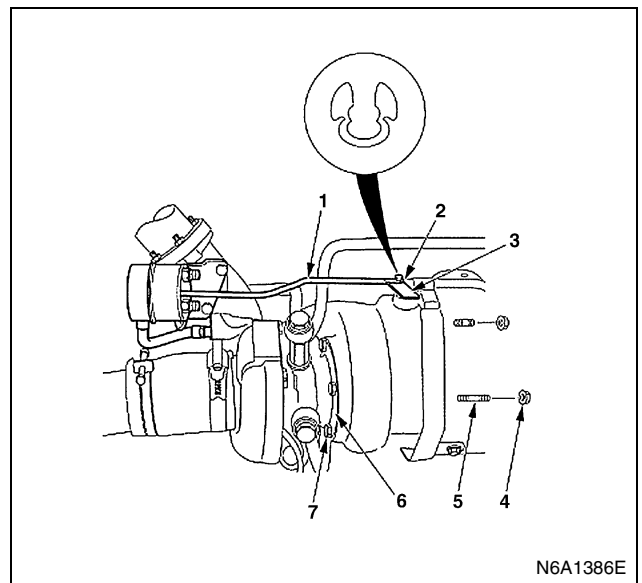


6. Tighten the turbine housing tie-down bolts to the specified torque.

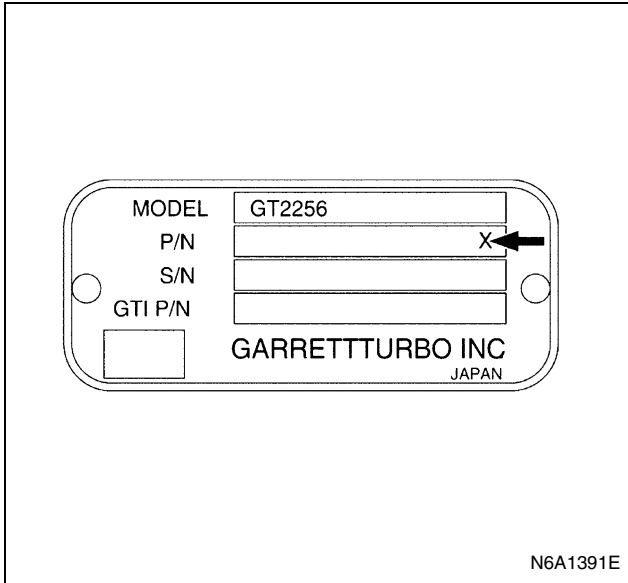
Tighten:

Housing tie-down bolts to 22 N·m (2.2 kg·m/ 16 lb·ft)

7. Remove the bolt that secures the pressure gauge, then remove the gauge.
8. Manually turn the rotor clockwise to be sure it rotates smoothly. Check for abnormal noise, drag, etc.
9. Attach the end of the actuator rod (1) to the crank at the waste gate (3), and secure with the E Ring (2).



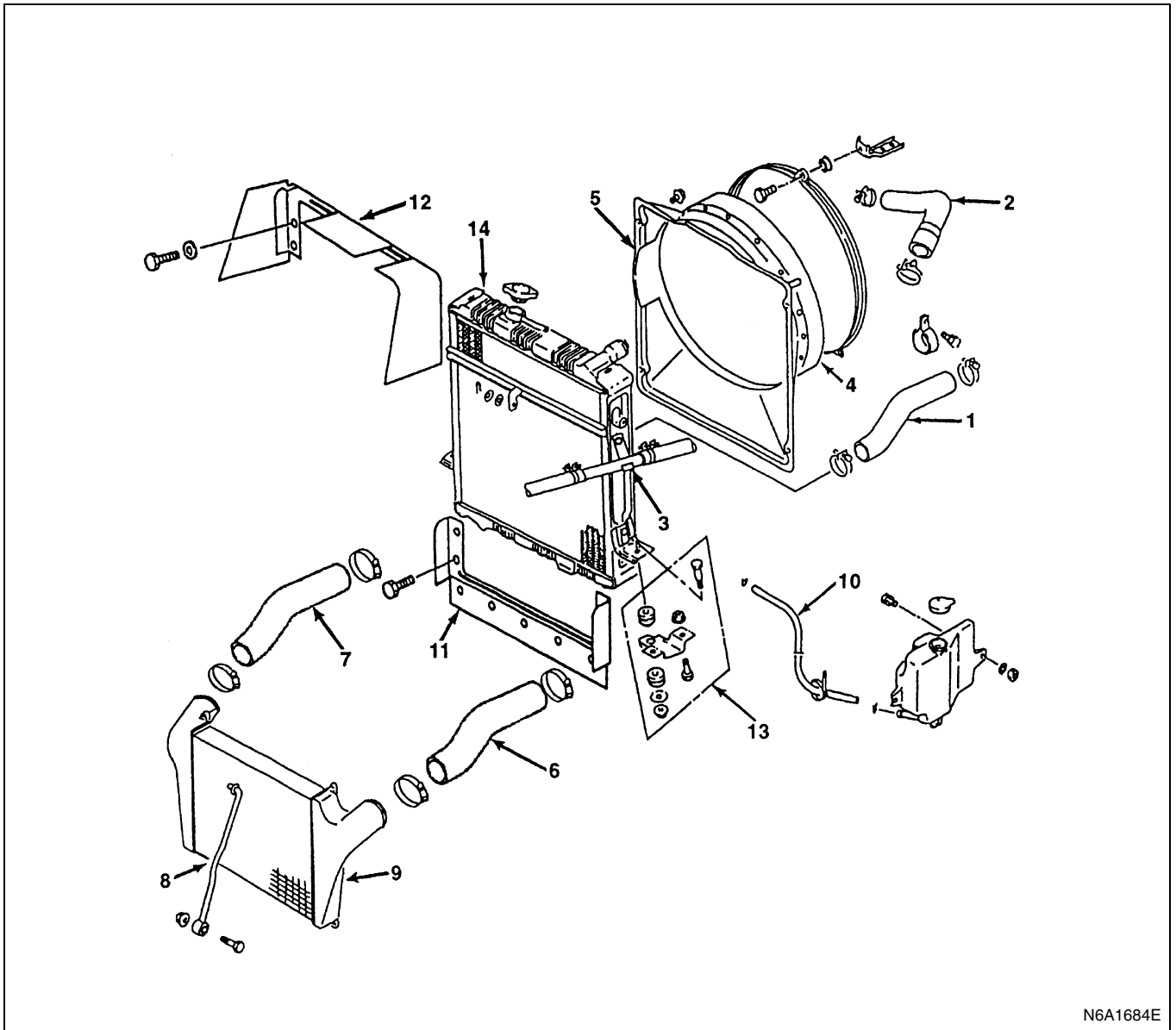
10. (Indicate on the nameplate that parts were replaced.)



11. Pour clean oil through the oil filler port to prevent corrosion.
 12. Seal the air and exhaust ducts of the turbocharger, as well as the water and oil filler ports to prevent foreign matter from entering.
- Follow the assembly directions to reattach to the engine.

Charge Air Cooler

Component



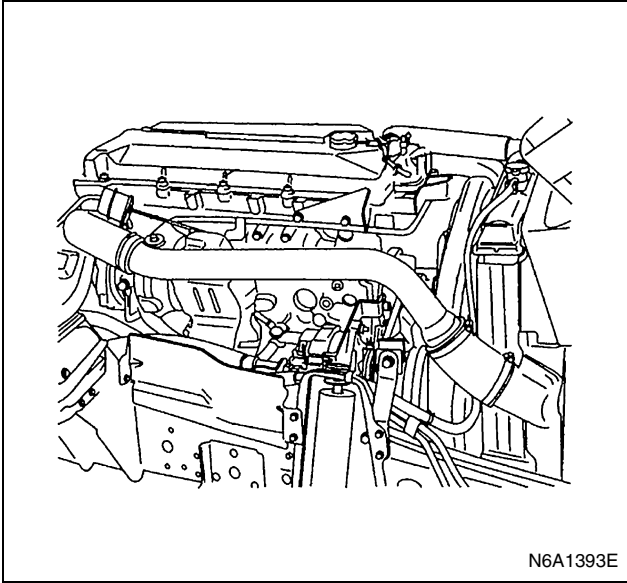
N6A1684E

Legend

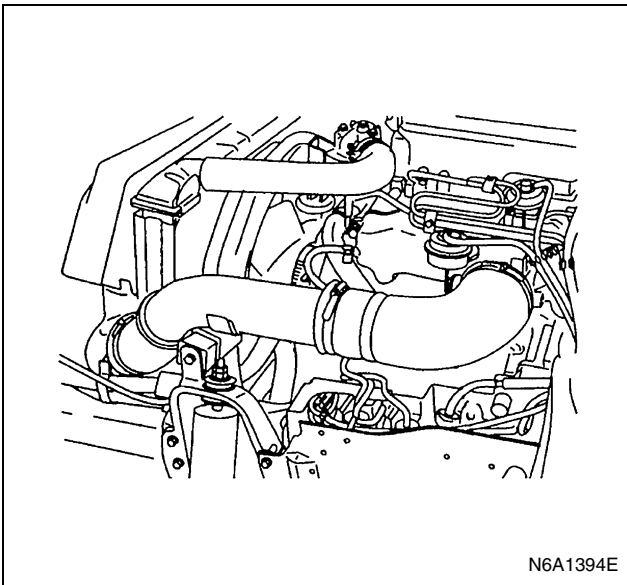
- | | |
|-------------------------------|----------------------------------|
| 1. Lower radiator hose | 8. Stay radiator support |
| 2. Upper radiator hose | 9. Charge air cooler |
| 3. Heater hose bracket | 10. Reserve tank hose |
| 4. Rubber ring and bell-mouth | 11. Air duct panel |
| 5. Fan shroud assembly | 12. Guide panel |
| 6. Flexible hose | 13. Mount nut and cushion rubber |
| 7. Flexible hose | 14. Radiator assembly |

Removal

- Disconnect the battery ground cables.
 - Drain the engine coolant.
1. Lower radiator hoses.



2. Upper radiator hoses.
3. Heater hose bracket.
4. Rubber Ring, bell-mouth to shroud.
5. Fan shroud assembly.
6. Flexible hose LH.
7. Flexible hose RH.

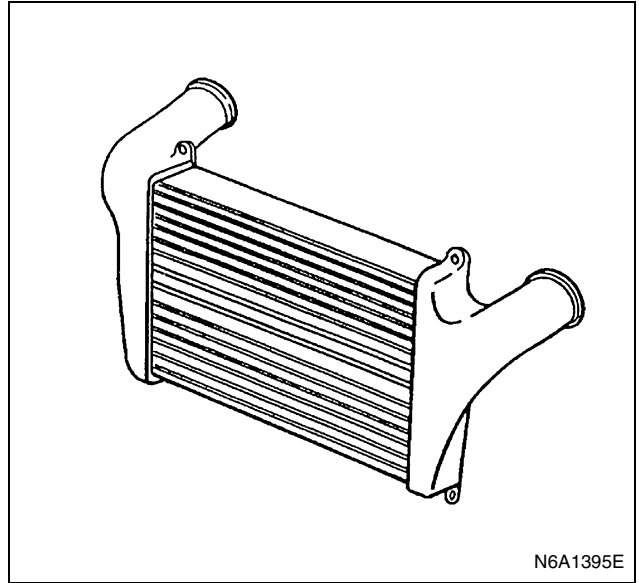


8. Stay radiator support.
9. Charge air cooler.
10. Reserve tank hose.
11. Air duct panel.
12. Guide panel.
13. Mount nut and cushion rubber.
14. Radiator assembly.

Installation

1. Radiator assembly.
2. Mount nut and cushion rubber.
3. Guide panel.
4. Air duct panel.

5. Reserve tank hose.
6. Charge air cooler.



7. Stay radiator support.
8. Flexible hose RH.
9. Flexible hose LH.
10. Fan shroud assembly.
11. Rubber Ring.
12. Heater hose bracket.
13. Upper radiator hoses.
14. Lower radiator hoses.
or brackets that were removed.

- Fill the system with new engine coolant as described in ENGINE COOLING (SEC. 6B) of this manual. Then check the system for leaks.
- Connect the battery ground cables.

MEMO

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MEMO

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**MANUAL TRANSMISSION
AND CLUTCH
MYY SERIES**

GENERAL INFORMATION

GENERAL REPAIR INSTRUCTIONS

General Precautions



N7A0238E

Preparation

- Prepare all the necessary tools, gauges and special tools before performing service operations.
- Prepare beforehand alternative parts which must be replaced or cannot be reused.

Work Clothes

- Make sure to wear a clean service uniform, cap and safety shoes (1).

Damage Prevention

- Make sure to use a cover on the vehicle body.
- Disconnect the ground cable from the battery before carrying out service operations.

Safety First

- Make sure to set chocks (2) before raising the vehicle using a jack set.
- After completing jacking-up the vehicle, make sure to set a safety stand (3) at the specified point to support the vehicle.
- Make sure to apply safety lock after raising the vehicle using a lift.
- If service operations are to be carried out by two persons or more, make sure to confirm safety of each other before performing service operations.

Precautions During Operations

- Keep the disassembled parts in good order to prevent them from confusing with unusable parts.
- When performing installation and assembly, clean or wash the relevant parts.
- Also, remove grease from the parts on which liquid packing etc. are applied.

Check After Operations

- When service operation is completed, make a final check that the service has been done properly and problem has been corrected.
- Check that there is no leakage of fuel, oil or coolant.

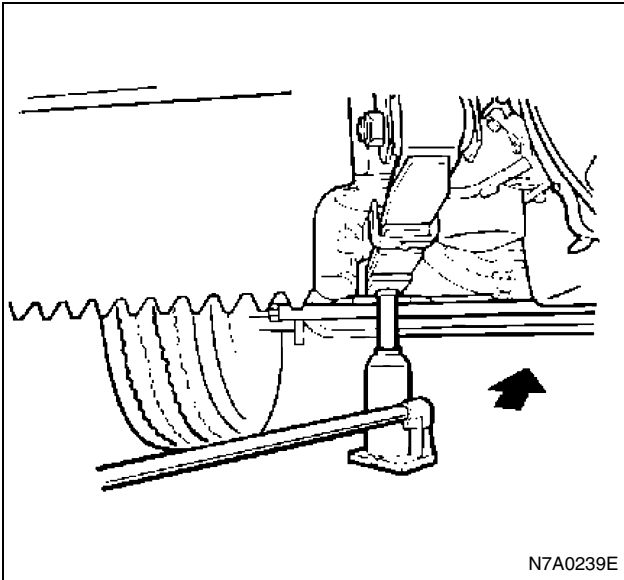
LIFTING POINTS

Lifting Points for Originally Equipped Jack

- The arrow indicates the front side of the vehicle.

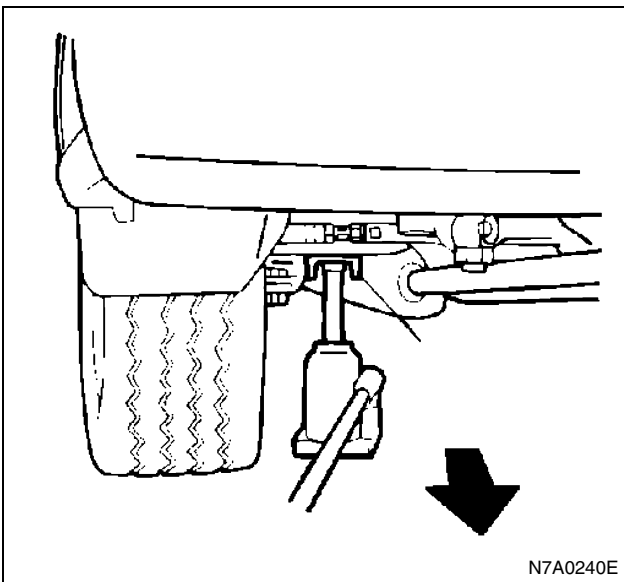
Front wheels of front wheel leaf spring type suspension vehicle (NHR, NKR, NPR, NQR)

- Set the jack at the leaf spring.



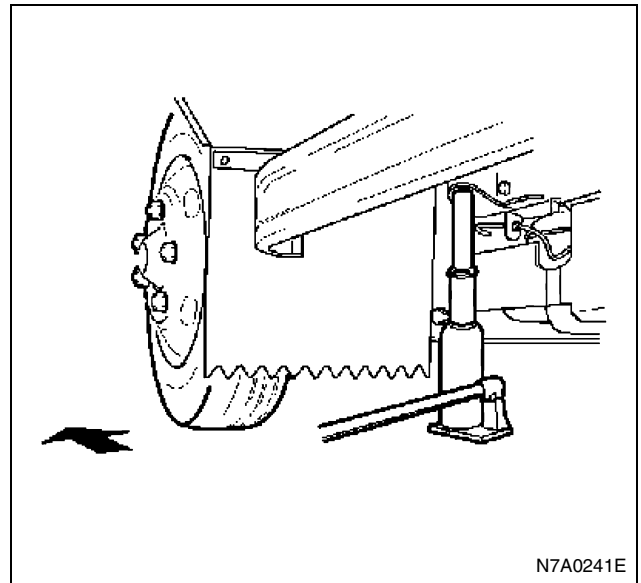
Front wheels of front wheel wishbone type suspension vehicle (NHR, NKR)

- Set the jack at the jack-up bracket on the front side of the lower link.



Front wheels of front wheel wishbone type suspension vehicle (NHR, NKR, NPR)

Set the jack at the lower side of the jack-up bracket.

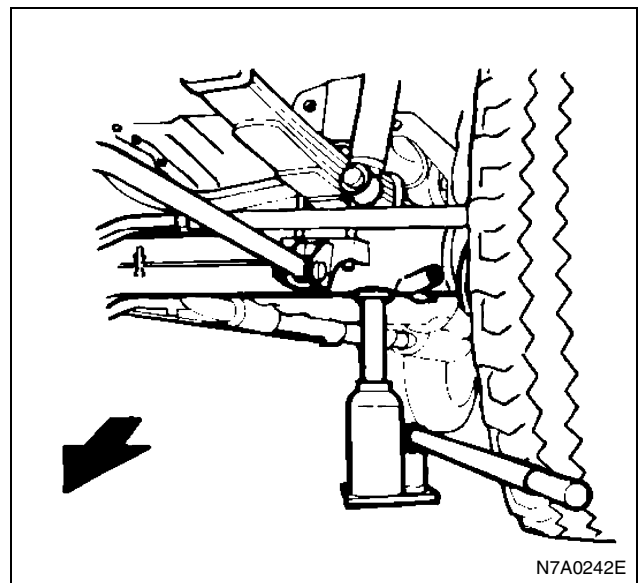


Caution:

Jack-up points for the vehicles of independent front suspension differ according to vehicle types. Make sure to check the jack-up bracket before jacking up the vehicle.

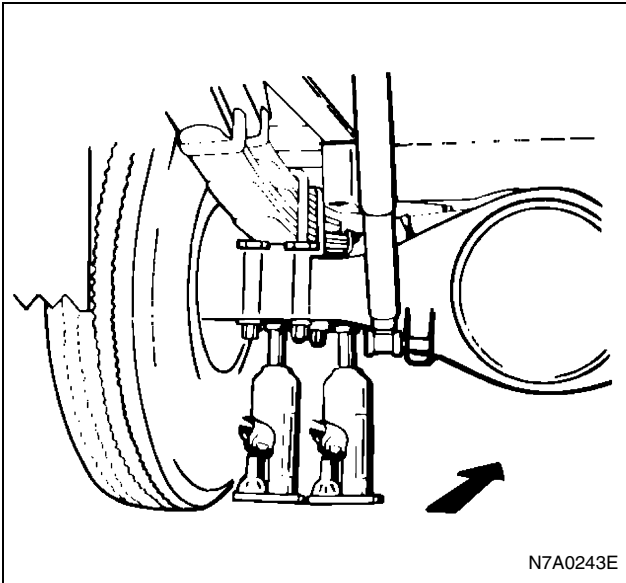
Front wheels (NPS)

- Set the jack at the lower side of the axle.



Rear wheels

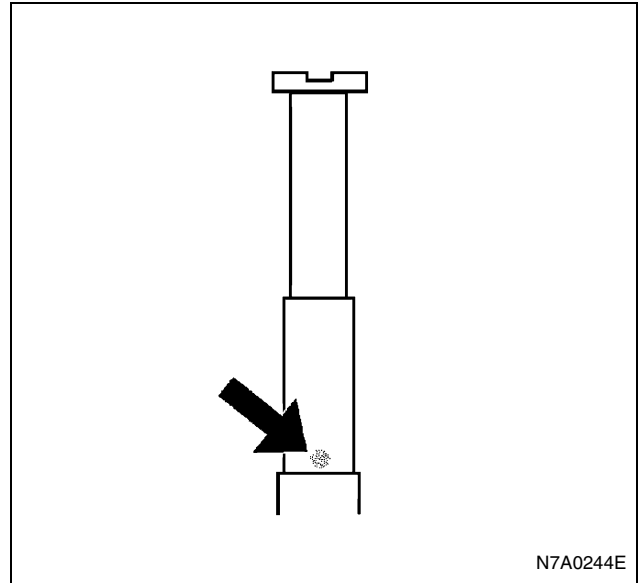
- Set the jack at the lower side of the leaf spring or axle case.



Caution:

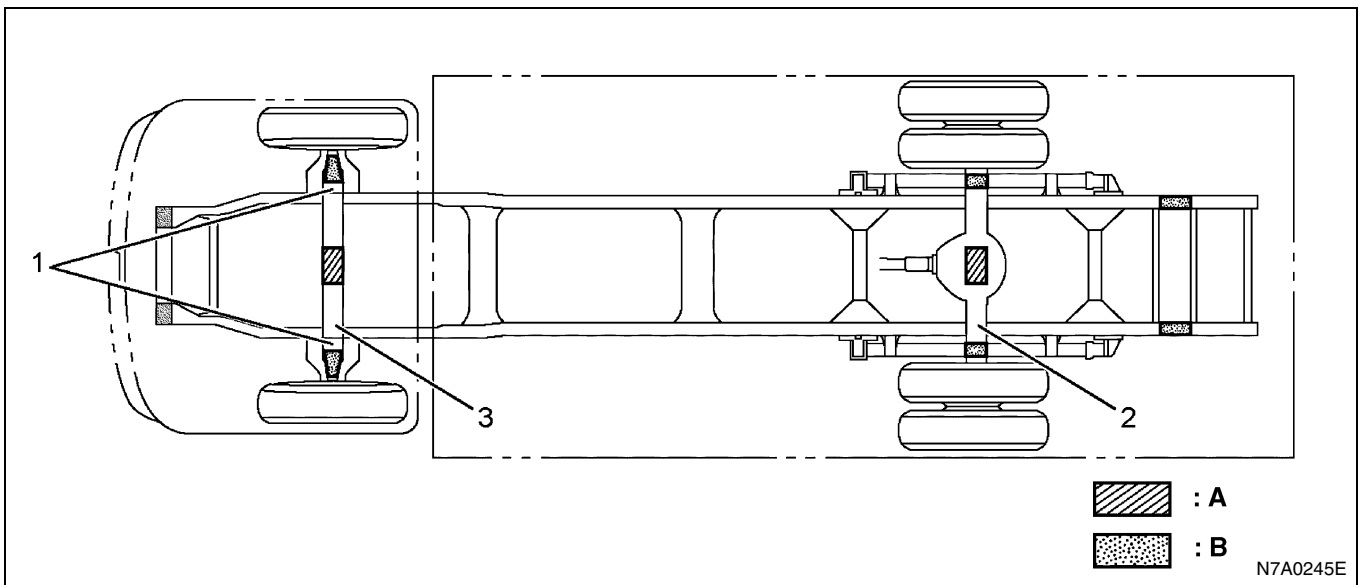
If a yellow mark appears when lifting the vehicle using the originally equipped jack, stop lifting. Continuing lifting may damage the jack.

Front wheel wishbone type (NHR, NKR, NPR)



Floor Jack Lifting Points and Chassis Stand Position

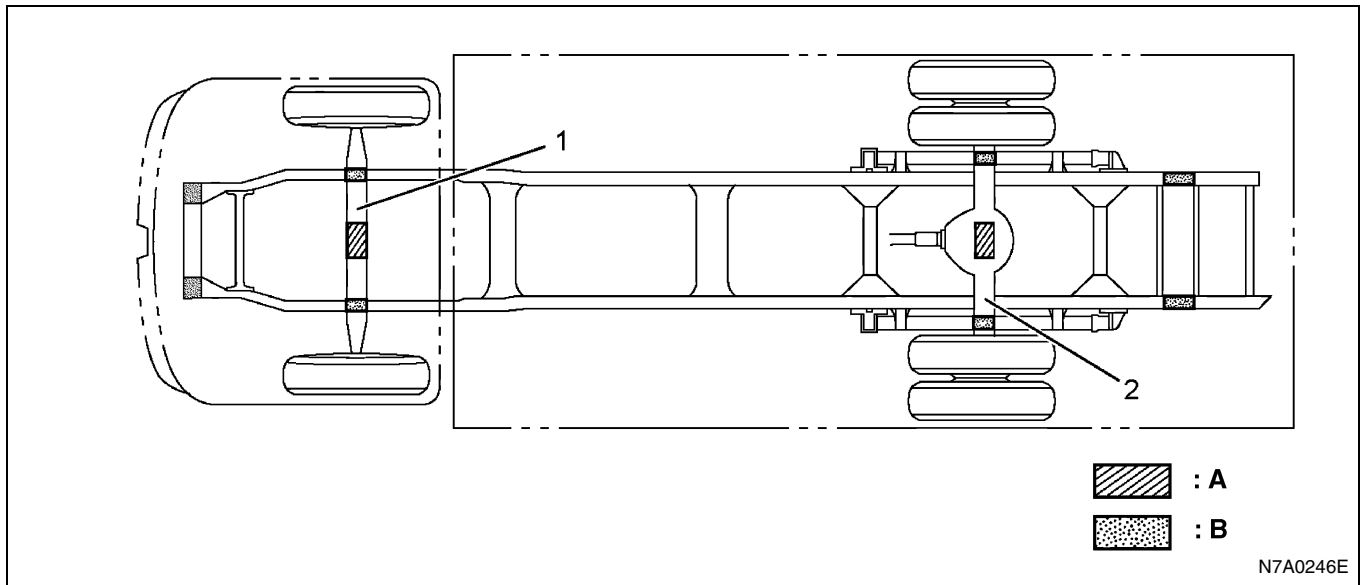
- Make sure to set the floor jack and the chassis stand properly at the specified positions.



Legend

- A: Floor jack point
- B: Chassis stand lifting position
- 1. Lower link (except NPR independent suspension vehicles)
- 2. Rear axle
- 3. Front suspension crossmember

Front wheel leaf spring type (NHR, NKR, NPR, NQR)

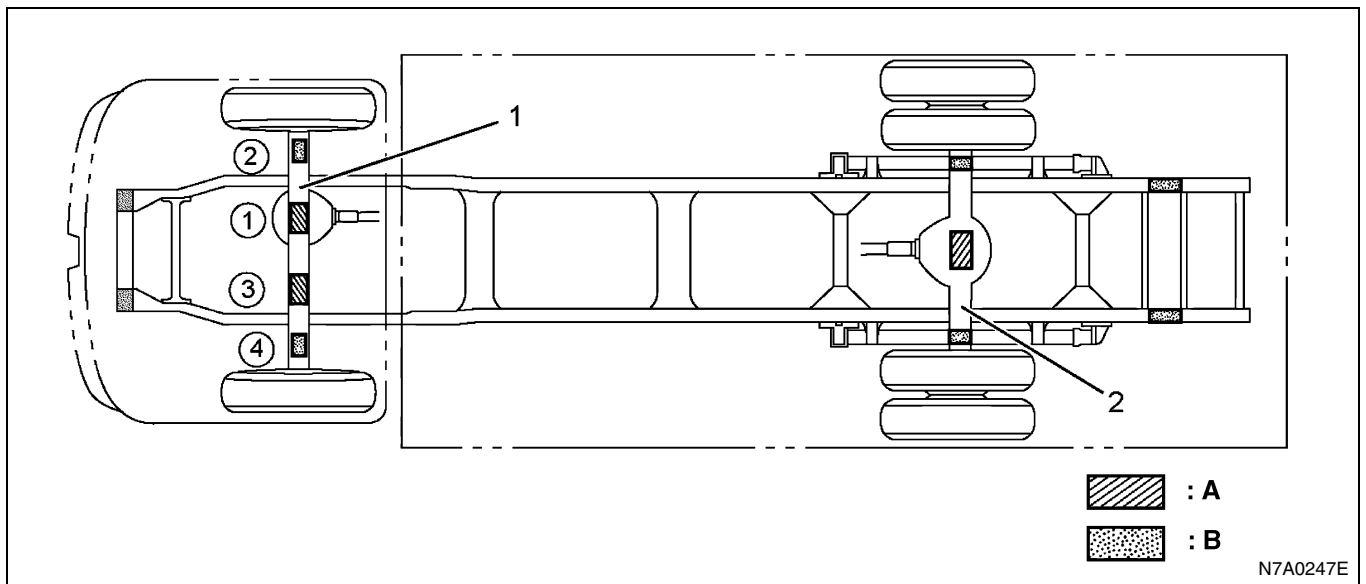


Legend

- | | |
|-----------------------------------|---------------|
| A: Floor jack point | 1. Front axle |
| B: Chassis stand lifting position | 2. Rear axle |

Front wheel leaf spring type (NPS)

- Follow the numbers in circle when jacking up the front wheel side.



Legend

- | | |
|-----------------------------------|---------------|
| A: Floor jack point | 1. Front axle |
| B: Chassis stand lifting position | 2. Rear axle |

CAB TILTING

Notes for Tilting of the Cab

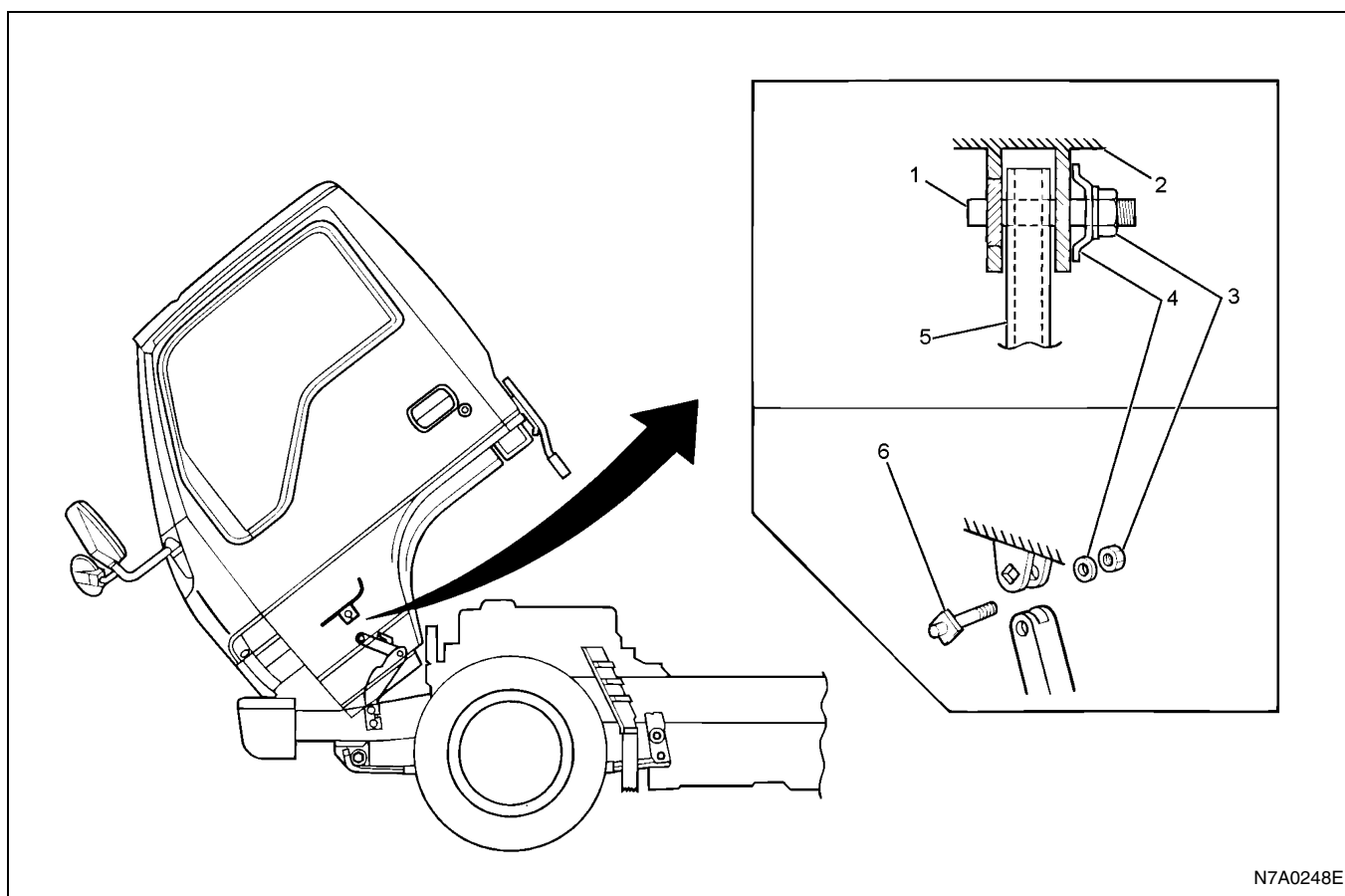
Make sure to observe the precautions below when removing the cab tilt stay assembly to tilt the cab in order to carry out service operations.

- When lifting the cab by tilting, use shop cloth to prevent damage to the cab.
- When tilting, the maximum tilt angle of the cab is 50 degrees. If the cab is tilted at an angle of more than 50 degrees, the torsion bar supporting the cab may be damaged.

- When tilting the cab, pay special attention not to let the cab come into contact with peripheral parts.
- The nut securing the cab tilt stay assembly is tightened with its thread deformed. Do not reuse the nut because the specified fixing torque is not obtained when reused.
- Strictly observe the specified fixing torques when tightening the nut.

Tighten:

Nut to 22 ± 5 N·m (2.2 ± 0.5 kg·m / 16 ± 3.7 lb·ft)



Legend

- | | |
|----------------------|----------------------|
| 1. Cab tilt stay pin | 4. Washer |
| 2. Cab side bracket | 5. Cab tilt stay |
| 3. Nut | 6. Cab tilt stay pin |

NOTES FOR WORKING ON ELECTRIC EQUIPMENT

Battery Cable

Disconnecting The Battery Cable

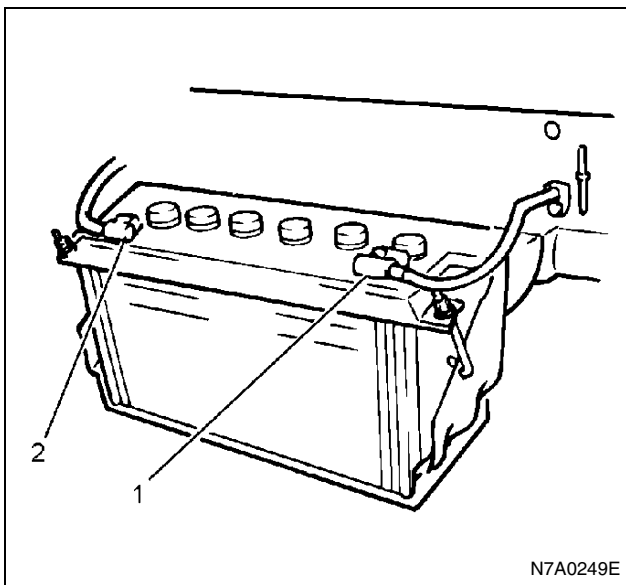
1. Turn all the switches to "OFF" positions.
2. Disconnect the battery ground cable (1).
3. Disconnect the battery positive cable (2).
4. Disconnect the battery cable (3) (Only 24V model).

Caution:

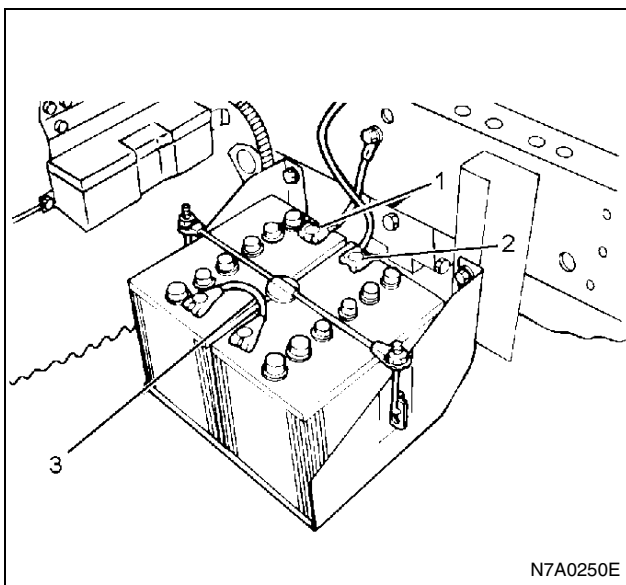
It is important that the battery ground cable should be disconnected first.

Disconnecting the battery positive cable first may result in a short circuit.

- For 12V model



- For 24V model



Connecting The Battery Cable

Connect in the reverse order of removal.

Caution:

Clean the battery terminal and apply a light coat of grease to prevent terminal corrosion.

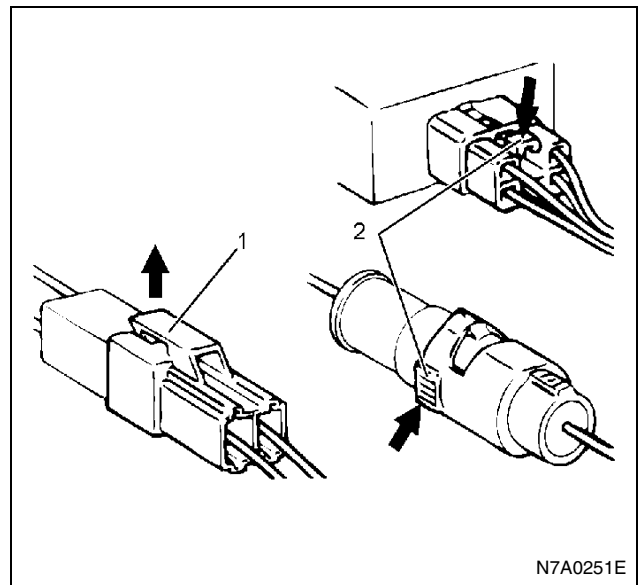
Connector Handling

Disconnecting The Connectors

Most of the connectors have a tang lock to hold the connectors together.

Some tang locks are released by pulling them up (1). Other tang locks are released by pressing them forward (2).

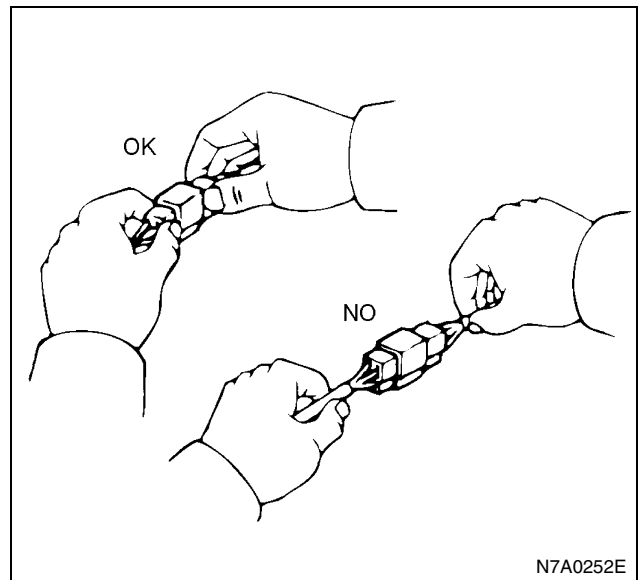
Determine which type of tang lock is adopted on the connector when disconnecting.



Firmly grasp both sides (male and female) of the connector.

Release the tang lock and carefully pull the two halves of the connector apart.

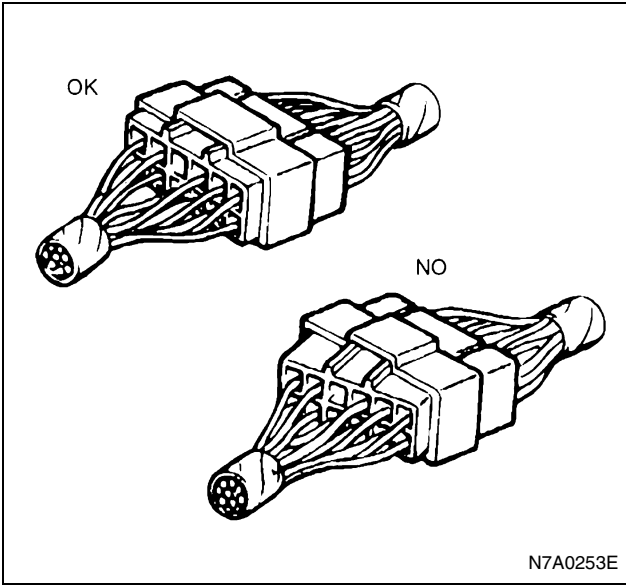
Never pull on the harness to separate the connectors. This will result in wire breakage.



Connecting The Connector

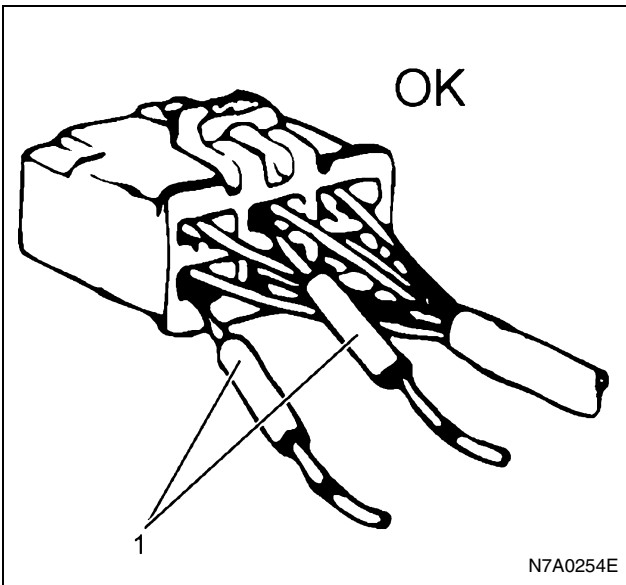
Firmly grasp both sides (male and female) of the connector.

Firmly but carefully push the two sides of the connector together until a distinct click is heard.

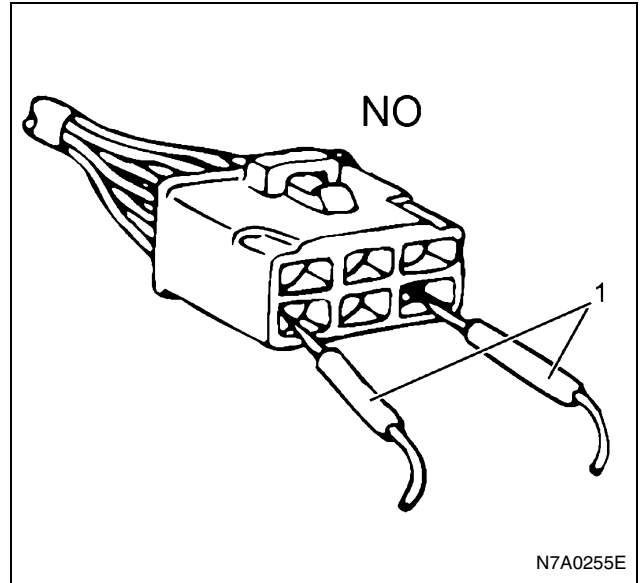


Connector Inspection

Use a circuit tester to check the connector for continuity. Insert the test probes (1) from the connector harness side.

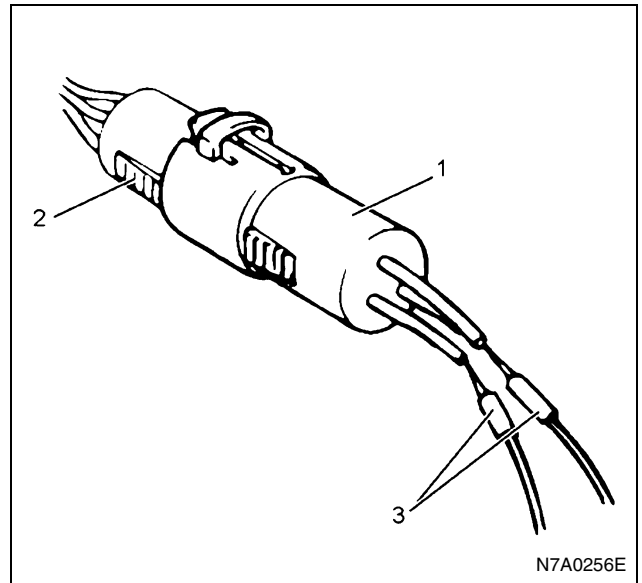


Never insert the circuit tester test probes (1) into the connector open end to test the continuity. Broken connector terminals will result.



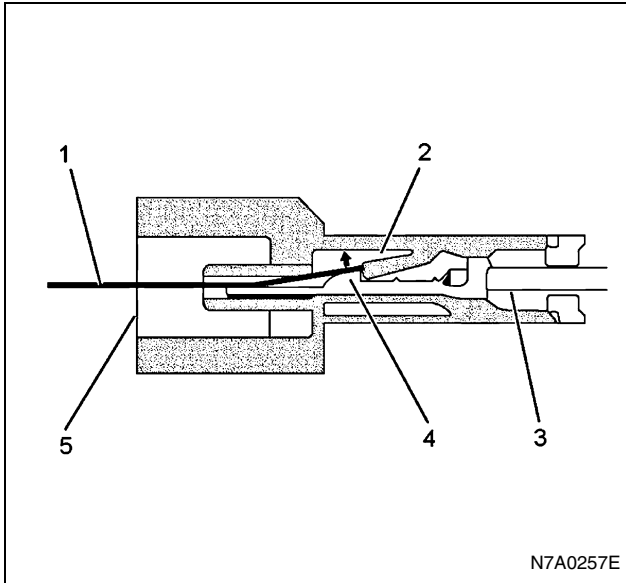
Waterproof Connector Inspection

It is not possible to insert the test probes into the connector wire side of a waterproof connector. Use a previously made connector (1) with its wires cut to carry out the test. Connect the test connector (2) to the connector to be tested. Connect the test probes (3) to the cut wires to check the connector continuity.



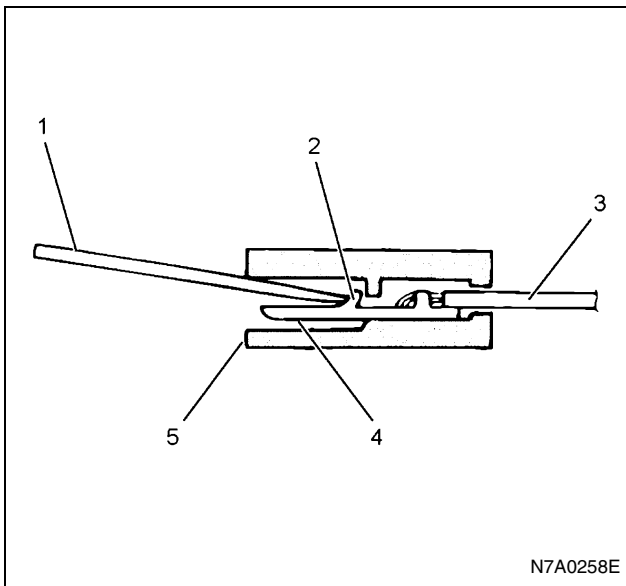
Connector Pin Removal Connector Housing Tang Lock Type

1. Insert a thin flat-tip screwdriver or equivalent (1) into the connector housing open end (5).
2. Push the tang lock (2) up (in the direction of the arrow in the figure). Pull the wire (3) with pin (4) free from the wire side of the connector.



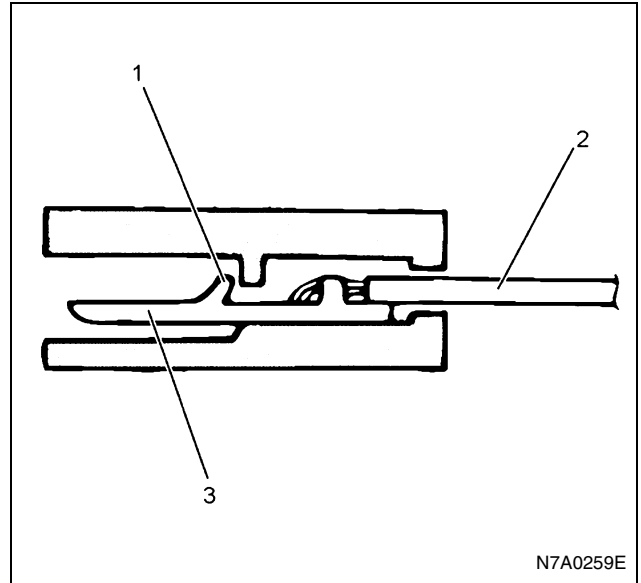
Pin Tang Lock Type

1. Insert a thin flat-tip screwdriver or equivalent (1) into the connector housing open end (5).
2. Push the tang lock (2) flat (toward the wire side of the connector). Pull the wire (3) with pin (4) free from the wire side of the connector.



Connector Pin Insertion

1. Check that the tang lock (1) is fully up.
2. Insert the pin (3) from the connector wire (2) side. Push the pin in until the tang lock closes firmly.
3. Gently pull on the wires to make sure that the connector pin is firmly set in place.

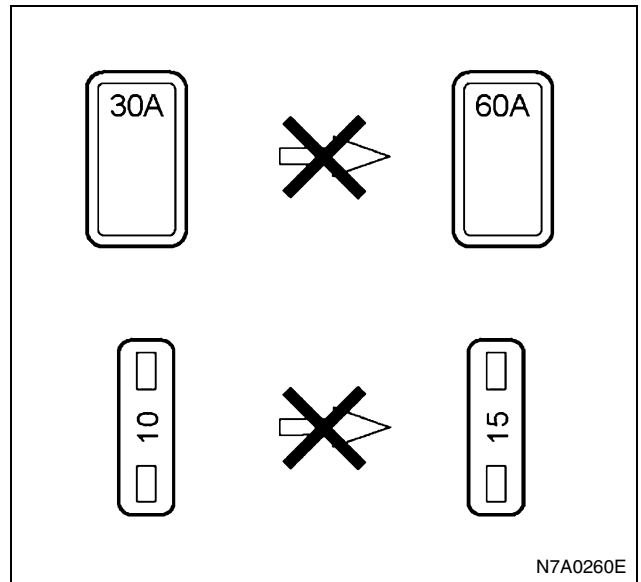


Fuse Replacement

WARNING:

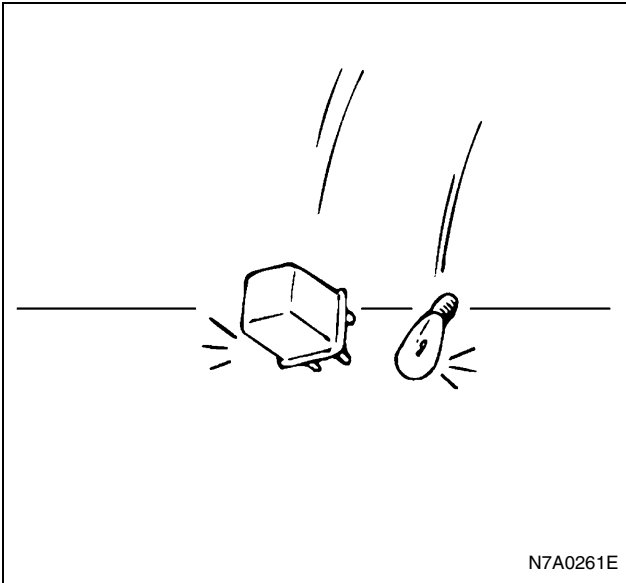
WHEN A FUSE IS BLOWN OUT, REPLACE IT WITH A NEW ONE OF THE SAME CAPACITY AFTER FINDING THE CAUSE.

IF A FUSE OF TOO LARGE CAPACITY IS USED, IT RESULTS TO BE MEANINGLESS WHEN AN OVER CURRENT FLOWS. THEREFORE, A WIRE MAY BE BURNED RESULTING IN A FIRE.



Electric Equipment Handling

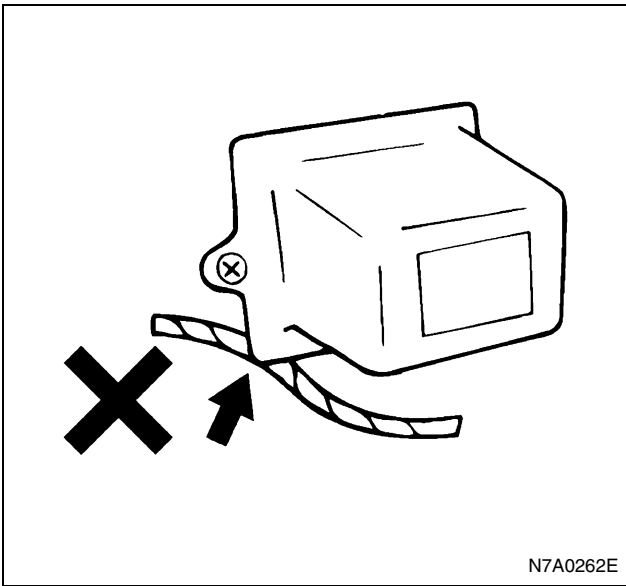
Be careful when handling electrical parts. They should not be dropped or thrown, because short circuit or other damage may result.



N7A0261E

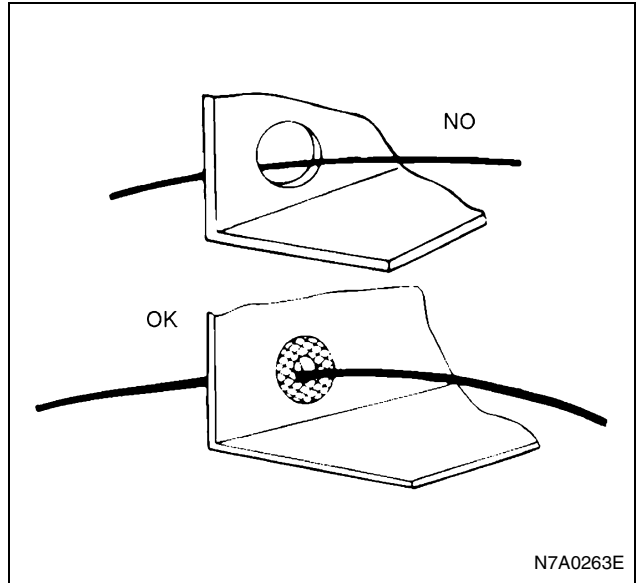
Cable Harness

1. When installing the parts, be careful not to pinch or wedge the wiring harness.



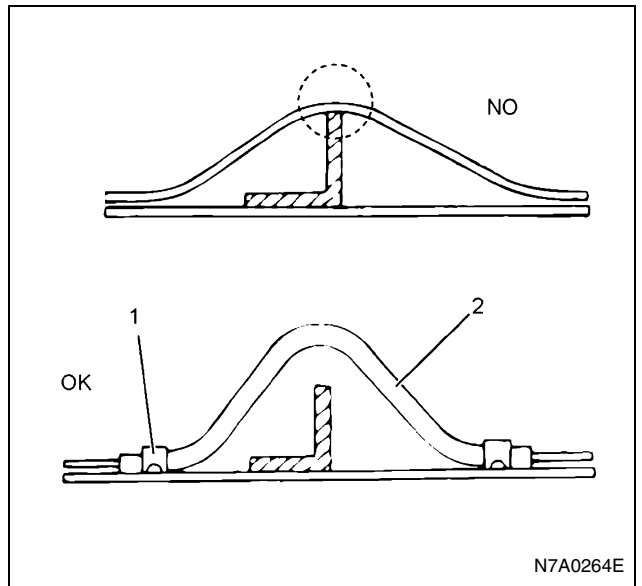
N7A0262E

2. All electrical connections must be kept clean and tight.
3. Use a grommet or guard tube to protect the wiring harness from contacting a sharp edge or surface.



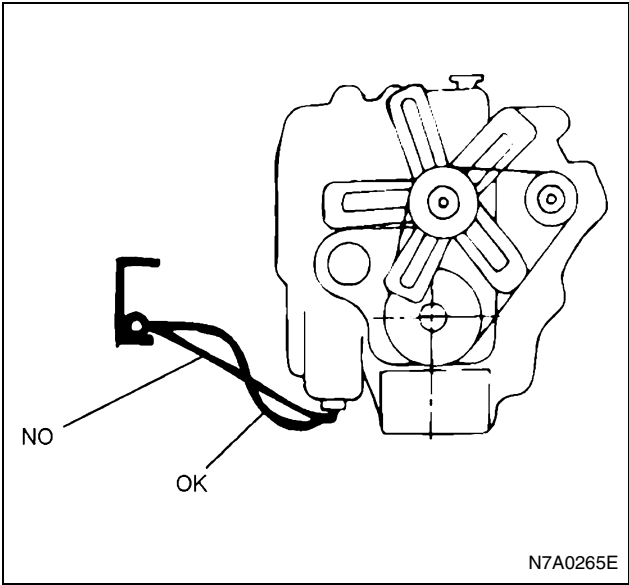
N7A0263E

4. Position the wiring harness with an enough clearance from the other parts, and guard the wiring harness with a vinyl tube (2) and clips (1) to avoid direct contact.



N7A0264E

5. The wiring harness between engine and chassis should be long enough to prevent chafing or damage due to various vibrations.



VEHICLES WITH SRS AIRBAG SYSTEM

Notes for Handling SRS Airbag System

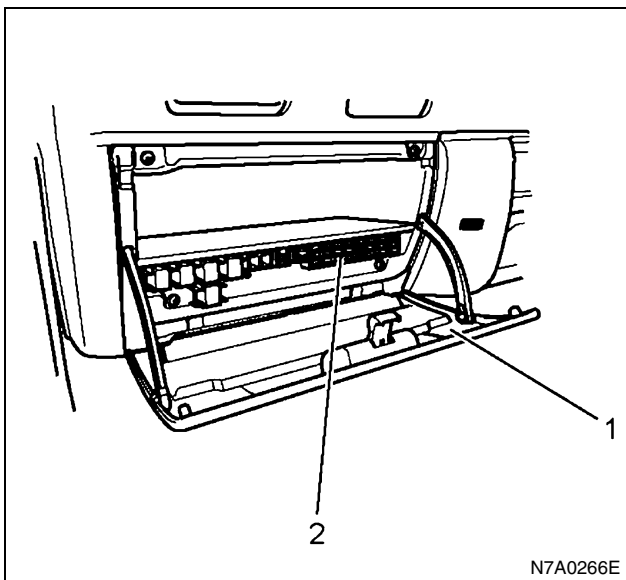
All the information necessary to securely and properly carry out service operations for SRS airbag system is provided in the section "Seat Belt, SRS Airbag." In this section, notes related to the SRS airbag system are provided, which are to be observed when carrying out service operations for items other than SRS airbag system. When doing an inspection work, make sure to set the ignition switch to "LOCK".

Be careful not to impact the SRS airbag system and its peripheral parts to prevent the deployment of the airbag. Also, before carrying out service operations for SRS parts, SRS harnesses and other service operations as shown below, make sure to temporarily deactivate the SRS airbag system. Not observing the following procedure may result in an injury because of sudden deployment of the airbag, or damage to the SRS airbag system.

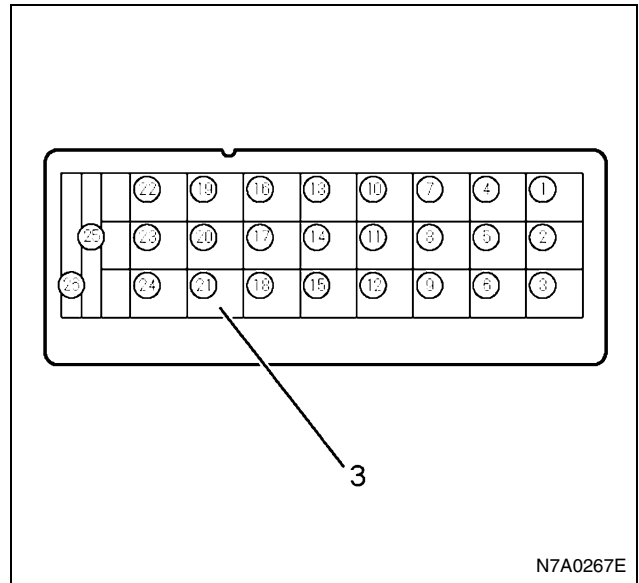
1. Repairs around the steering wheel
2. Repairs around the instrument panel, glove box and fuse box.
3. Repairs around the dashboard and center console.
4. Installation of car stereo etc.
5. Sheet metal coating on the right side of the cab

Deactivation of SRS Airbag System

- Turn the ignition key to "LOCK", and release the key.
- Remove the SRS fuse (3) from the fuse box (2) located in the lower part of the glove box (1), or disconnect the ground cable from the battery. And leave all these parts untouched for about 15 seconds or more.
- In 15 seconds or more after removing the fuse and the ground cable of the battery, remove the two yellow connectors located in the lower part of the steering column.



N7A0266E



N7A0267E

Reactivation of SRS Airbag System

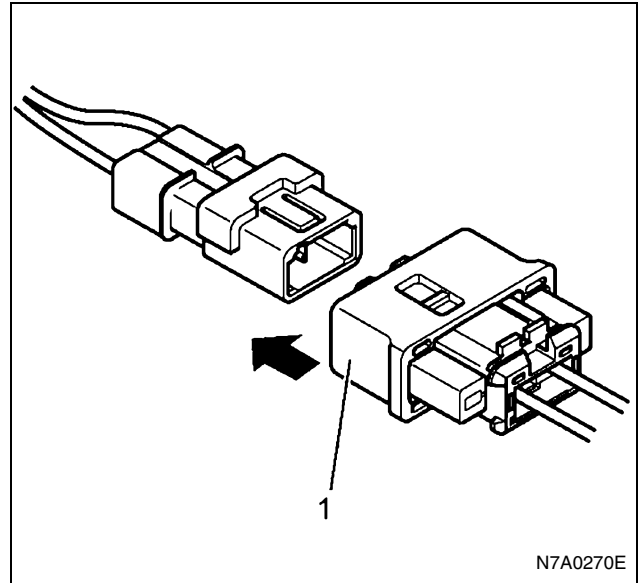
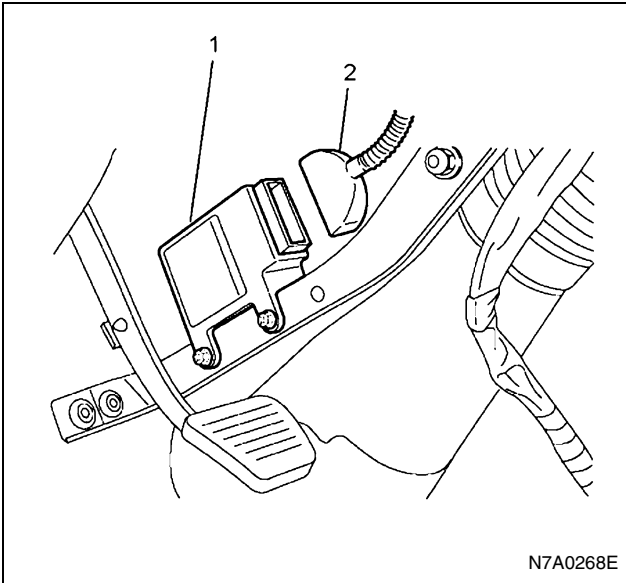
- Carry out the operation in the reverse order of deactivation.
- Turn the ignition switch to "ON."
- Check that the AIRBAG warning lamp turns off after blinking seven times. (If the warning lamp is not activated correctly, refer to "SRS Control System.")

Caution:

- Do not expose the airbag assembly to the temperature of 93°C (199°F) or more. Accidental airbag deployment may result.
- If the airbag assembly and controller are dropped from a height of about one meter or more, do not use the airbag assembly.
- Check the part number before installing the airbag assembly. If a not applicable item is installed, malfunction may result.
- When disposing of the airbag assembly, make sure to deploy the airbag. If the airbag is discarded without being deployed, secondary accident may result.

Handling of Airbag Controller Connector

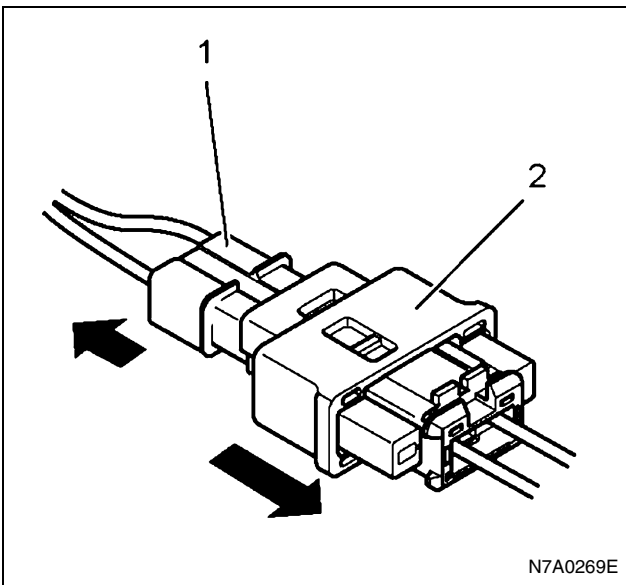
- Removal of connector (2)
Remove the connector from controller (1) by pressing the arrow mark on the connector.



- Connection of connector
Push connector (2) inside, and check that the connector is installed securely.

Handling of Inflator Connector

- Removal of connector
Remove connector (1) on the pin side (male side) by pulling cover insulator (2) in the direction indicated by an arrow.



- Connecting of connector
Hold socket insulator (1) and push it inside until a click is heard.

NOTES FOR ELECTRONIC CONTROL SYSTEM INSPECTION AND SERVICE

Scan Tool (External Diagnosis Device)

Use the specified scan tool in order to carry out fast and correct inspection of parts.

Make sure to refer to detailed description in the repair manual because the type and connection of a scan tool to be used differ according to vehicles and devices.

Circuit Tester

When using a circuit tester, observe the procedure indicated in the repair manual. If the procedure is not observed, other relevant parts may be damaged. If a specific type of circuit tester is specified, do not use any circuit tester of other type. If a circuit tester, which is not of the specified type, is used, other relevant parts may be damaged, and measurement may not be done correctly.

Caution:

If any circuit tester, which is not of the specified type, is used, the SRS and other electronic control system may malfunction.

Failure due to Static Electricity Discharge

When static electricity is discharged, relevant parts are charged with high voltage, and may be damaged. Observe the following items and take a proper action.

- Repair staff may be charged with static electricity through work place and clothes. Touch any normal grounding before inspecting and replacing relevant parts.
- Do not directly touch the connector pins of relevant parts. Do not rub them with other parts or cover.
- Connect the replacement parts to the normal grounding without unwrapping them. And then, take them out without letting them come into contact with the connector pins.

Additional Electric Equipment

If the vehicle is equipped with additional electric parts including lights, audio and radio devices, the electronic control system may be adversely affected by electric noises including radio wave emitted by those devices, depending on the installing condition. Turn off the additional electric parts beforehand, or carry out removal inspection and service.

Notes for Welding

Take the following actions before carrying out welding operation to protect the relevant parts.

- Remove the battery cable.
- Remove harnesses from all the control units.
- Turn all the switches to "OFF".
- Install the grounding of the welding machine in a place as close to the welding point as possible.

Repetition of Trouble

If the same trouble is generated repeatedly or momentarily, or the trouble does not repeat whereas the trouble display is indicated, check whether the trouble repeats by taking following actions.

- Shake by hand the relevant parts, including control units, sensors, relays and harnesses.
The trouble may repeat in case of connection failure.
- Heat the relevant parts using a dryer, or cool these parts using a refrigerant. The trouble may repeat if it is caused by temperature change.

Caution:

Do not heat the parts excessively to the level that cannot be touched.

- Sprinkle the vehicle with water. The trouble may repeat if it is caused by humidity change.

Caution:

Do not sprinkle water directly on the electric parts.

RECOMMENDED LIQUID GASKET AND LOCTITE

Liquid Gasket

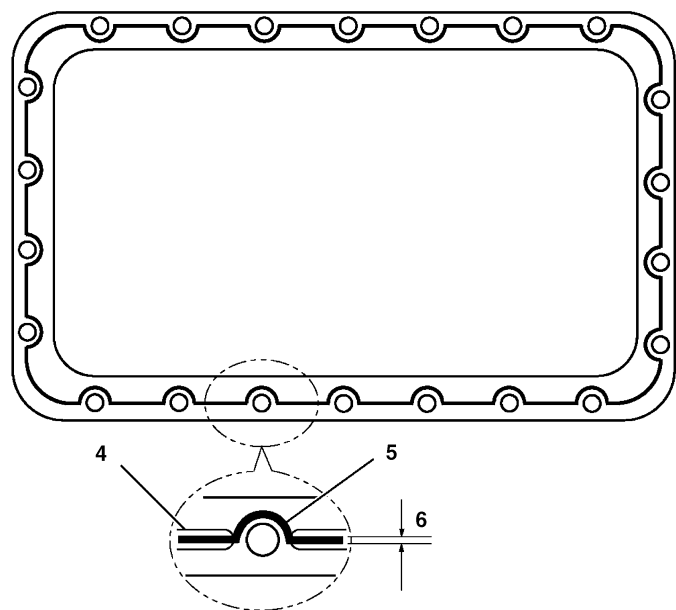
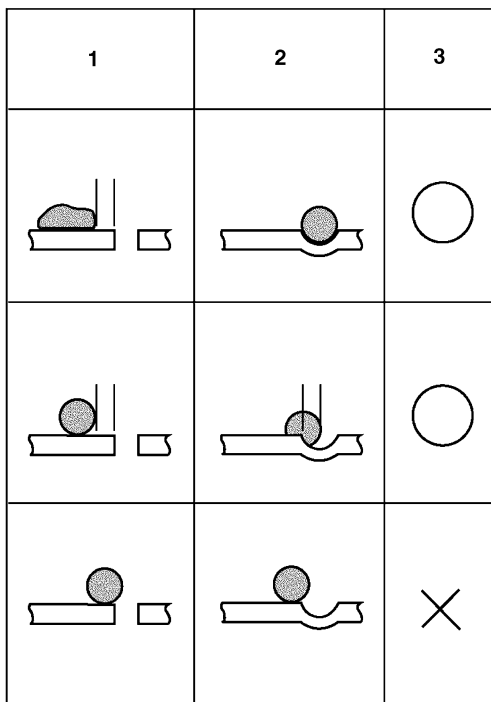
TYPE	PRODUCT NAME	MANUFACTURER	APPLICATION PARTS (EXAMPLE)
Silicon Base (Room Temperature Vulcanizer)	ThreeBond 1207B	ThreeBond	Engine Oil Seal Retainer Engine Oil Pan Timing Gear Case Cylinder Head Cover
	ThreeBond 1207C	ThreeBond	
Water Base	ThreeBond 1215	ThreeBond	Fuel Pump
	ThreeBond 1216	ThreeBond	
Solvent	ThreeBond 1104	ThreeBond	Water Pump Rear Axle etc.
	BelcoBond 4	ISUZU	
	BelcoBond 401 BelcoBond 402	ISUZU	
Anaerobic	LOCTITE 515	LOCTITE	Engine Oil Seal Retainer Water Pump Transaxle etc.
	LOCTITE 518	LOCTITE	
	FMD127	LOCTITE	

- It is very important that the liquid gasket listed above or their exact equivalent be used on the vehicle.
- LOCTITE 515, LOCTITE 518 and FMD127 harden upon contact with a metal surface. Do not apply LOCTITE 515, LOCTITE 518 or FMD127 between two metal surfaces having a clearance of greater than 0.25 mm (0.001 in). Poor adhesion will result.

- Use a proper amount of the liquid gasket. Observe the precautions for each product.

Application Procedure

1. Completely remove lubricant and moisture from the connecting surfaces. The surfaces must be perfectly dry.
2. Apply specified bead width 2 — 3 mm (0.08 — 0.12 in) of liquid gasket to one of the connecting surfaces. And the bead should be continuous.



N7A0271E

Legend

- | | |
|---------------|--|
| 1. BOLT HOLE | 4. Depression |
| 2. DEPRESSION | 5. Apply liquid gasket to the bolt hole interior. |
| 3. JUDGEMENT | 6. Specified bead width: 2 — 3 mm (0.08 — 0.12 in) |
-

Notice:

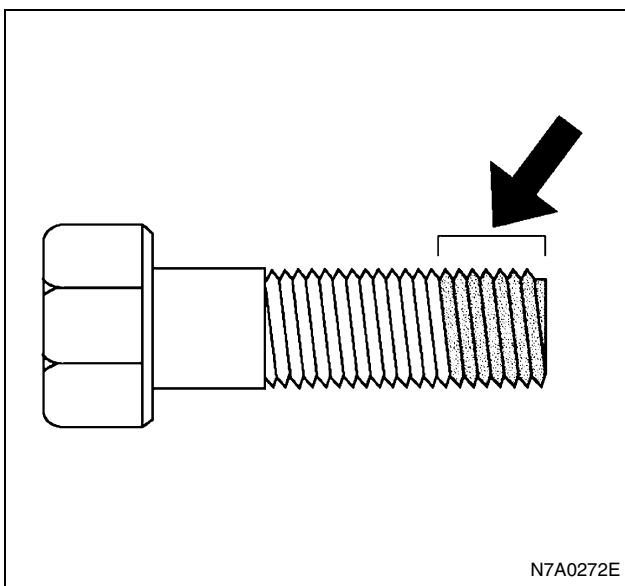
When the application procedures are specified in this workshop manual, follow them.

Recommended Loctite (Thread Locking Agent)

TYPE	COLOR
LOCTITE242	Blue
LOCTITE262	Red
LOCTITE271	Red

Application Steps

1. Completely wipe all lubricant and moisture from the bolts and bolt holes, and the female thread connecting surfaces. The surfaces must be perfectly dry.
2. Apply LOCTITE to the 1/3 tip of the bolt's threaded area.



3. Tighten the bolts to the specified torque.

Important:

After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until LOCTITE hardens.

TERMS AND ABBREVIATIONS

Term Definition

TERM	DESCRIPTION
DIMENSION	The standard dimension values to be observed when manufacturing.
STANDARD	The standard values to be observed when carrying out service operations, including inspection, adjustment, assembly and installation.
LIMIT	The maximum or minimum values, which must not be exceeded when service operations are carried out. If this value is exceeded, replacement or repair is required.
WARNING:	If not observed, danger of death or serious injury will result.
CAUTION:	If not observed, danger of injury or accident will result.
IMPORTANT:	If not observed, normal performance of relevant parts and system is not guaranteed, and failure of the vehicle may result.
NOTE:	Matters, which should be specially mentioned.

Abbreviations Charts

ABBREVIATION	DESCRIPTION
2L	2L Shoe Brake
2WD, 4×2	Two Wheel Drive
4WD, 4×4	Four Wheel Drive
A/C	Air Conditioning
A/F	Air Fuel Ratio
A/T, AT	Automatic Transmission
ABDC	After Bottom Dead Center
ABS	Antilock Brake System
AC	Alternating Current
ACC	Accessory
ACG	Alternating Current Generator
ACL	Air Cleaner
ACT	Actuator
ANT	Antenna
AP	Accelerator Position
API	American Petroleum Institute
ASM (Assy)	Assembly
ASR	Anti-slip Regulator
ASSIT	Assistant / Assist
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
B/K	Brake
B+	Battery Positive Voltage
BAL	Balance
BAT, BATT	Battery
BBDC	Before Bottom Dead Center

ABBREVIATION	DESCRIPTION
BJ	Birfield Joint
BKT, BRKT	Bracket
BRG, Brg	Bearing
BTDC	Before Top Dead Center
C/B	Circuit Braker
C/U	Control Unit
CAM	Camshaft
CAN	Control Unit Communication Type
CFS	Clutch Free System
CKP	Crankshaft Position
CMP	Camshaft Position
CNG	Compressed Natural Gas
CO	Carbon Monoxide
CONN	Connector
CPU	Central Processing Unit
CSD	Cold Starting Device
D2L	D2L Shoe Brake
DC	Direct Current
DD	Direct Drive
DFI	Diesel Fuel Injection
DI	Direct Injection
DLC	Data Link Connector
DMM	Digital Multi-meter
DOJ	Double Offset Joint
DPF	Diesel Particulate Filter

ABBREVIATION	DESCRIPTION
DTC	Diagnostic Trouble Code
DVM	Digital Voltage Meter
E/B	Exhaust Brake
ECM	Engine Control Module
ECT	Engine Coolant Temperature
ECU	Engine Control Unit
EDU	Engine Driver Unit
EEPROM	Electrically Erasable and Programmable Read Only Memory
EGR	Exhaust Gas Recirculation
EHCU	Electronic Hydraulic Control Unit
EMI	Electromagnetic Interference
ESD	Electrostatic Discharge
EVAP	Evaporation
EVRV	Electric Vacuum Regulating Valve
Exh, EXH	Exhaust
F/B	Feedback
F/C	Fuel Cut
F/L, FL	Fusible Link
FCS	Fuel Cut System
FICD	Fast Idle Control Device
FIO	Fast Idle Open
FLW	Fusible Link Wire
FRZ	Freezer
FT	Fuel Temperature
Ft, FRT	Front
FWD	Front Wheel Drive
GEN	Generator
GND	Ground
GVW	Gross Vehicle Weight
GVM	Gross Vehicle Mass
H/L	Head Lamp
HAB	Hydraulic Assist Brake
HC	Hydrocarbons
HD	Heavy Duty
HID	High Intensity Discharge Head-lamp
HO 2 S	Heated Oxygen Sensor
HAS	Hill Start Aid
HT	Hypoid Tandem
HUD	Head-Up Display

ABBREVIATION	DESCRIPTION
HVAC	Heater Ventilation Air Conditioner
I/PUMP, I/P	Injection Pump
IAC	Idle Air Control
IAT	Intake Air Temperature
IC	Integrated Circuit
ID Plate	Identification Plate
IGN / IG	Ignition
IN	Intake
INJ	Injection
ISC	Idle Speed Control
ISM	Intake Step Motor
ISO	International Standardization Organization
ISP	Intake Shutter Position
ITP	Intake Throttle Position
J/B	Junction Block
J/C	Joint Connector
JIS	Japan Industrial Standards
L/H, LH	Left-Hand
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LEV	Low Emission Vehicle
LPG	Liquefied Petroleum Gas
LSD	Limited Slip Differential
LSPV	Load Sensing Proportioning Valve
LT	LT Shoe Brake
LWB	Long Wheel Base
M/T, MT	Manual Transmission
M/V	Electromagnetic Valve
MAP	Manifold Absolute Pressure
Max	Maximum
MIL	Malfunction Indicator Lamp
Min	Minimum
MPU	Micro Processing Unit
NC	Normally Closed
NE	Engine RPM
NO	Normally Open
Nox	Nitrogen Oxides
O/D	Over Drive
O2S	O2 Sensor

ABBREVIATION	DESCRIPTION
OBD	Onboard Diagnosis
ODM	Output Driver Module
OEM	Original Equipment Manufacturing
OHC	Overhead Camshaft
OHV	Overhead Valve
OPT	Option
OT	Oil Temperature
P	Poles
P/L, PL	Pilot Lamp
P/S	Power Steering
PCM	Power Train Control Module
PCV	Positive Crankcase Ventilation
P-I	Proportion / Integration
PID	Control Type
PM	Particulate Matter
POS	Position
PTO	Power Take Off
PWM	Pulse Width Modulation
Q	Quantity (Fuel Injection Quantity)
QDM	Quad Driver Module
QOS	Quick On Start Module
QWS	Quick Warming Up System
R/H, RH	Right-Hand
R/L	Relay
RAM	Random Access Memory
REF	Reference
RET	Retarder
REV	Reverse
ROM	Read Only Memory
RP	Rail Pressure
Rr, RR	Rear
RWD	Rear Wheel Drive Vehicle
S/M	Step Motor
SAE	Society of Automotive Engineers
SBF	Slow Blow Fuse
SCV	Suction Control Valve
SIG	Signal
SLD	Shield
SPV	Spill Control Valve
SRS	Supplemental Restraint System

ABBREVIATION	DESCRIPTION
ST	Starter / Start
STD	Standard
STRG	Steering
SW	Switch
SWB	Short Wheel Base
T/F	Transfer
TCC	Torque Converter Clutch
TCM	Transmission Control Module
TCV	Timing Control Valve
TDC	Top Dead Center
TEMP	Temperature
TFT	Transmission Fluid Temperature
TP	Throttle Position
TWV	Two Way Valve
V/P	Vacuum Pump
VB	Battery Voltage
Vcc	Collector Voltage
VCI	Vehicle Communication Interface
VIM	Vehicle Interface Module
VIN	Vehicle Identification Number
VOL, Vol.	Volume
VSS	Vehicle Speed Sensor
VSV	Vacuum Switching Valve
W/B, WB	Wheel Base
W/H	Wire / Harness
W/L	Warning Lamp
WOT	Wide Open Throttle

Introduction of SI (International System of Unit)

The SI was founded with an aim to standardize various unit systems, e.g. the metric system, pound system etc., and to get rid of complicated conversion of units using calculators.

Introduction of the SI in Japan is standardized in JIS-Z-8203.

In this manual, all the units are indicated based on the International System of Units, along with conventional units in ().

- SI is the abbreviation of “Le Systeme Internationale d’Unites.”

STANDARD BOLTS TIGHTENING

Isuzu Standard Fixing Torque Specifications

The torque values given in the following table should be applied where a particular torque is not specified.

N·m (kg·m/lb·ft)				
Strength Class	4.8 4T		7T	
Bolt Identification	Hexagon Head Bolt	Flange Bolt	Hexagon Head Bolt	Flange Bolt
M6 × 1	3.9 — 7.8 (0.4 — 0.8/2.9 — 5.8)	4.6 — 8.5 (0.5 — 0.9/3.4 — 6.3)	4.9 — 9.8 (0.5 — 1.0/3.6 — 7.2)	5.7 — 10.6 (0.6 — 1.1/4.2 — 7.8)
M8 × 1.25	7.8 — 17.7 (0.8 — 1.8/5.8 — 13.1)	10.5 — 19.6 (1.1 — 2.0/7.7 — 14.5)	11.8 — 22.6 (1.2 — 2.3/8.7 — 16.7)	13.5 — 25.0 (1.4 — 2.5/10 — 18.4)
M10 × 1.25	20.6 — 34.3 (2.1 — 3.5/15.2 — 25.3)	23.1 — 38.5 (2.4 — 3.9/17 — 28.4)	27.5 — 46.1 (2.8 — 4.7/20.3 — 34)	31.0 — 51.7 (3.2 — 5.3/22.9 — 38.1)
*M10 × 1.5	19.6 — 33.3 (2.0 — 3.4/14.5 — 24.6)	22.3 — 37.2 (2.3 — 3.8/16.4 — 27.4)	27.5 — 45.1 (2.8 — 4.6/20.3 — 33.3)	30.3 — 50.4 (3.1 — 5.1/22.3 — 37.2)
M12 × 1.25	49.0 — 73.5 (5.0 — 7.5/36.1 — 54.2)	54.9 — 82.3 (5.6 — 8.4/40.5 — 60.7)	60.8 — 91.2 (6.2 — 9.3/44.8 — 67.3)	68.1 — 102.1 (6.9 — 10.4/50.2 — 75.3)
*M12 × 1.75	45.1 — 68.6 (4.6 — 7.0/33.3 — 50.6)	51.0 — 76.5 (5.2 — 7.8/37.6 — 56.4)	56.9 — 84.3 (5.8 — 8.6/42 — 62.2)	62.7 — 94.0 (6.4 — 9.6/46.2 — 69.3)
M14 × 1.5	76.5 — 114.7 (7.8 — 11.7/56.4 — 84.6)	83.0 — 124.5 (8.5 — 12.7/61.2 — 91.8)	93.2 — 139.3 (9.5 — 14.2/68.7 — 102.7)	100.8 — 151.1 (10.3 — 15.4/74.3 — 111.4)
*M14 × 2	71.6 — 106.9 (7.3 — 10.9/52.8 — 78.8)	77.2 — 115.8 (7.9 — 11.8/56.9 — 85.4)	88.3 — 131.4 (9.0 — 13.4/65.5 — 96.9)	94.9 — 142.3 (9.7 — 14.5/70 — 105)
M16 × 1.5	104.0 — 157.0 (10.6 — 16.0/76.7 — 115.8)	115.6 — 173.3 (11.8 — 17.7/85.3 — 127.8)	135.3 — 204.0 (13.8 — 20.8/99.8 — 150.5)	150.1 — 225.2 (15.3 — 23.0/110.7 — 166.1)
*M16 × 2	100.0 — 149.1 (10.2 — 15.2/73.8 — 110)	109.4 — 164.2 (11.2 — 16.7/80.7 — 121.1)	129.4 — 194.2 (13.2 — 19.8/95.4 — 143.2)	142.5 — 213.8 (14.5 — 21.8/105.1 — 157.7)
M18 × 1.5	151.0 — 225.6 (15.4 — 23.0/111.4 — 166.4)	—	195.2 — 293.2 (19.9 — 29.9/144 — 216.3)	—
*M18 × 2.5	151.0 — 225.6 (15.4 — 23.0/111.4 — 166.4)	—	196.1 — 294.2 (20.0 — 30.0/144.6 — 217)	—
M20 × 1.5	206.0 — 310.0 (21.0 — 31.6/151.9 — 228.6)	—	269.7 — 405.0 (27.5 — 41.3/198.9 — 298.7)	—
*M20 × 2.5	190.2 — 286.4 (19.4 — 29.2/140.3 — 211.2)	—	249.1 — 374.6 (25.4 — 38.2/183.7 — 276.3)	—

N·m (kg·m/lb·ft)				
Strength Class	4.8 4T		7T	
Bolt Identification	Hexagon Head Bolt	Flange Bolt	Hexagon Head Bolt	Flange Bolt
M22 × 1.5	251.1 — 413.8 (25.6 — 42.2/185.2 — 305.2)	—	362.8 — 544.3 (37.0 — 55.5/267.6 — 401.5)	—
*M22 × 2.5	217.7 — 327.5 (22.2 — 33.4/160.6 — 241.6)	—	338.3 — 507.0 (34.5 — 51.7/249.5 — 373.9)	—
M24 × 2	358.9 — 539.4 (36.6 — 55.0/264.7 — 397.8)	—	430.0 — 711.0 (43.9 — 72.5/317.2 — 524.4)	—
*M24 × 3	338.3 — 507.0 (34.5 — 51.7/249.5 — 373.7)	—	406.0 — 608.0 (41.4 — 62.0/299.5 — 448.4)	—

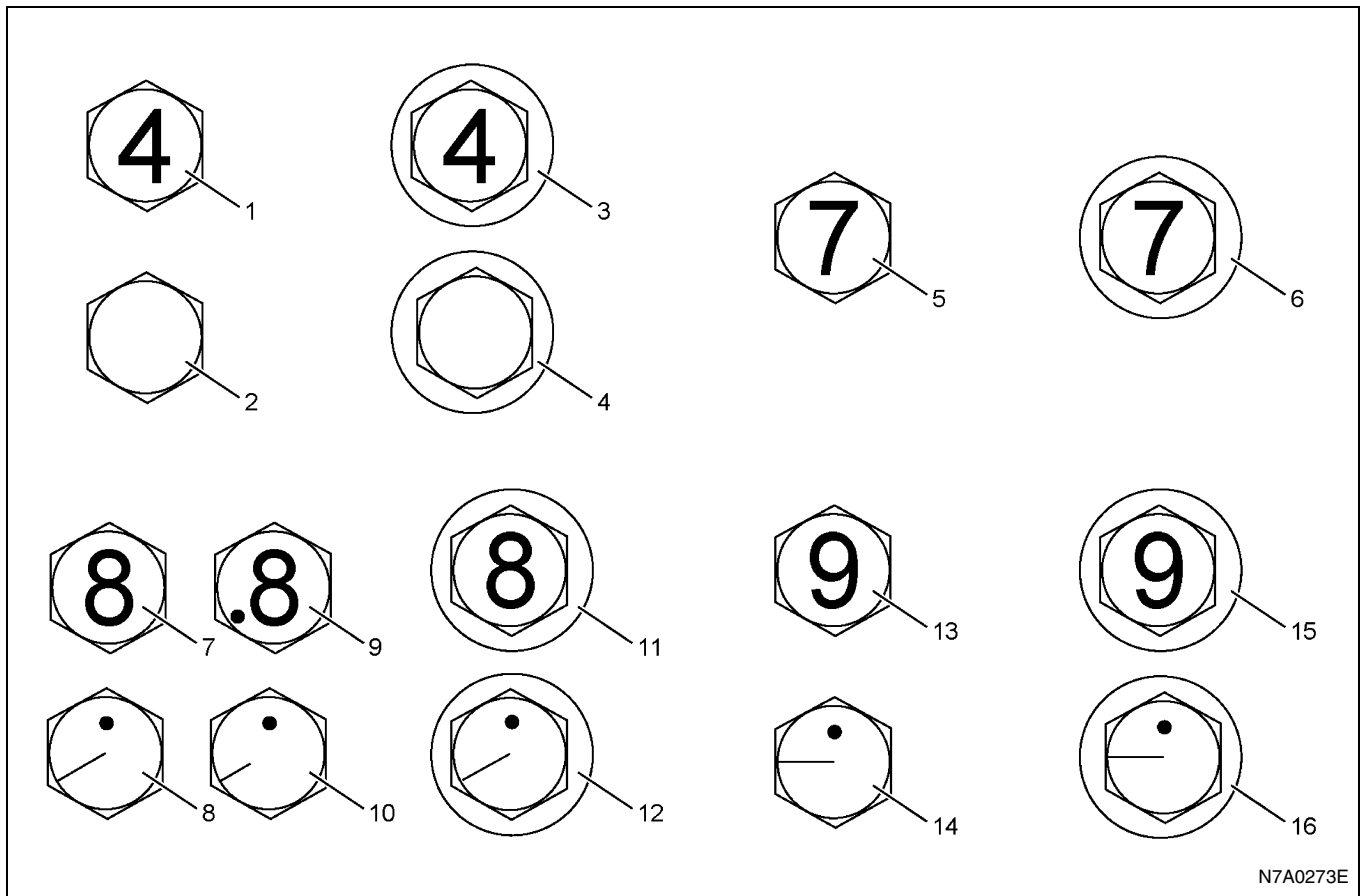
The asterisk * indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.

N·m (kg·m/lb·ft)				
Strength Class	8.8		9.8 9T	
Bolt Identification	Hexagon Head Bolt	Flange Bolt	Hexagon Head Bolt	Flange Bolt
M6 × 1	5.6 — 11.2 (0.6 — 1.1/4.1 — 8.3)	6.6 — 12.2 (0.6 — 1.2/4.9 — 9)	—	—
M8 × 1.25	13.4 — 25.7 (1.4 — 2.6/9.9 — 19)	15.3 — 28.4 (1.6 — 2.9/11.3 — 20.9)	16.7 — 30.4 (1.7 — 3.1/12.3 — 22.4)	18.1 — 33.6 (1.9 — 3.4/13.3 — 24.8)
M10 × 1.25	31.3 — 52.5 (3.2 — 5.4/23.1 — 38.7)	35.4 — 58.9 (3.6 — 6.1/26.1 — 43.4)	37.3 — 62.8 (3.8 — 6.4/27.5 — 46.3)	42.3 — 70.5 (4.3 — 7.2/31.2 — 52)
*M10 × 1.5	31.3 — 51.4 (3.2 — 5.2/23.1 — 37.9)	34.5 — 57.5 (3.5 — 5.8/34.5 — 42.4)	36.3 — 59.8 (3.7 — 6.1/26.8 — 44.1)	40.1 — 66.9 (4.1 — 6.8/29.6 — 49.3)
M12 × 1.25	69.3 — 104.0 (7.1 — 10.6/51.1 — 76.7)	77.7 — 116.5 (7.9 — 11.9/57.3 — 85.9)	75.5 — 113.8 (7.7 — 11.6/55.7 — 83.9)	85.0 — 127.5 (8.7 — 13.0/62.7 — 94)
*M12 × 1.75	64.8 — 96.1 (6.6 — 9.8/47.8 — 70.9)	71.4 — 107.2 (7.3 — 10.9/52.7 — 79.1)	71.6 — 106.9 (7.3 — 10.9/52.8 — 78.8)	79.5 — 119.2 (8.1 — 12.2/58.6 — 87.9)
M14 × 1.5	106.2 — 158.8 (10.8 — 16.2/78.3 — 117.1)	114.9 — 172.3 (11.7 — 17.6/84.7 — 127.1)	113.8 — 170.6 (11.6 — 17.4/83.9 — 125.8)	123.4 — 185.1 (12.6 — 18.9/91 — 136.5)
*M14 × 2	100.6 — 149.8 (10.3 — 15.3/74.2 — 110.5)	108.2 — 162.2 (11.1 — 16.6/79.8 — 119.6)	106.9 — 160.0 (10.9 — 16.3/78.8 — 118)	115.5 — 173.3 (11.8 — 17.7/85.2 — 127.8)
M16 × 1.5	154.3 — 232.5 (15.7 — 23.7/113.8 — 171.5)	171.1 — 256.7 (17.4 — 26.2/126.2 — 189.3)	160.0 — 240.3 (16.3 — 24.5/118 — 177.2)	176.9 — 265.3 (18.0 — 27.1/130.5 — 195.7)

N·m (kg·m/lb·ft)				
Strength Class	8.8		9.8 9T	
Bolt Identification	Hexagon Head Bolt	Flange Bolt	Hexagon Head Bolt	Flange Bolt
*M16 × 2	147.6 — 221.4 (15.0 — 22.6/108.9 — 163.3)	162.5 — 243.8 (16.6 — 24.9/119.9 — 179.8)	153.0 — 229.5 (15.6 — 23.4/112.8 — 169.3)	168.5 — 252.7 (17.2 — 25.8/124.3 — 186.4)
M18 × 1.5	222.5 — 334.3 (22.7 — 34.1/164.1 — 246.6)	—	229.5 — 345.2 (23.4 — 35.2/169.3 — 254.6)	—
*M18 × 2.5	223.6 — 335.4 (22.8 — 34.2/164.9 — 247.4)	—	230.5 — 346.2 (23.6 — 35.3/170 — 255.3)	—
M20 × 1.5	307.4 — 461.7 (31.4 — 47.1/226.7 — 340.5)	—	316.8 — 475.6 (32.3 — 48.5/233.7 — 350.8)	—
*M20 × 2.5	284.0 — 472.1 (29.0 — 43.5/209.5 — 348.2)	—	293.2 — 440.3 (29.2 — 44.9/216.3 — 324.7)	—
M22 × 1.5	413.6 — 620.5 (42.2 — 63.3/305.1 — 457.7)	—	424.6 — 636.5 (43.3 — 64.9/313.2 — 469.5)	—
*M22 × 2.5	385.7 — 578.0 (39.3 — 58.9/284.5 — 426.3)	—	394.2 — 592.3 (40.0 — 60.4/290.7 — 436.9)	—
M24 × 2	490.8 — 810.5 (50.0 — 82.7/362 — 597.8)	—	554.1 — 830.6 (56.5 — 84.7/408.7 — 612.6)	—
*M24 × 3	462.8 — 693.1 (47.2 — 70.7/341.3 — 511.2)	—	520.7 — 781.6 (53.1 — 79.7/384 — 576.5)	—

The asterisk * indicates that the bolts are used for female-threaded parts that are made of soft materials such as casting, etc.

Isuzu Standard Bolt Head Marks

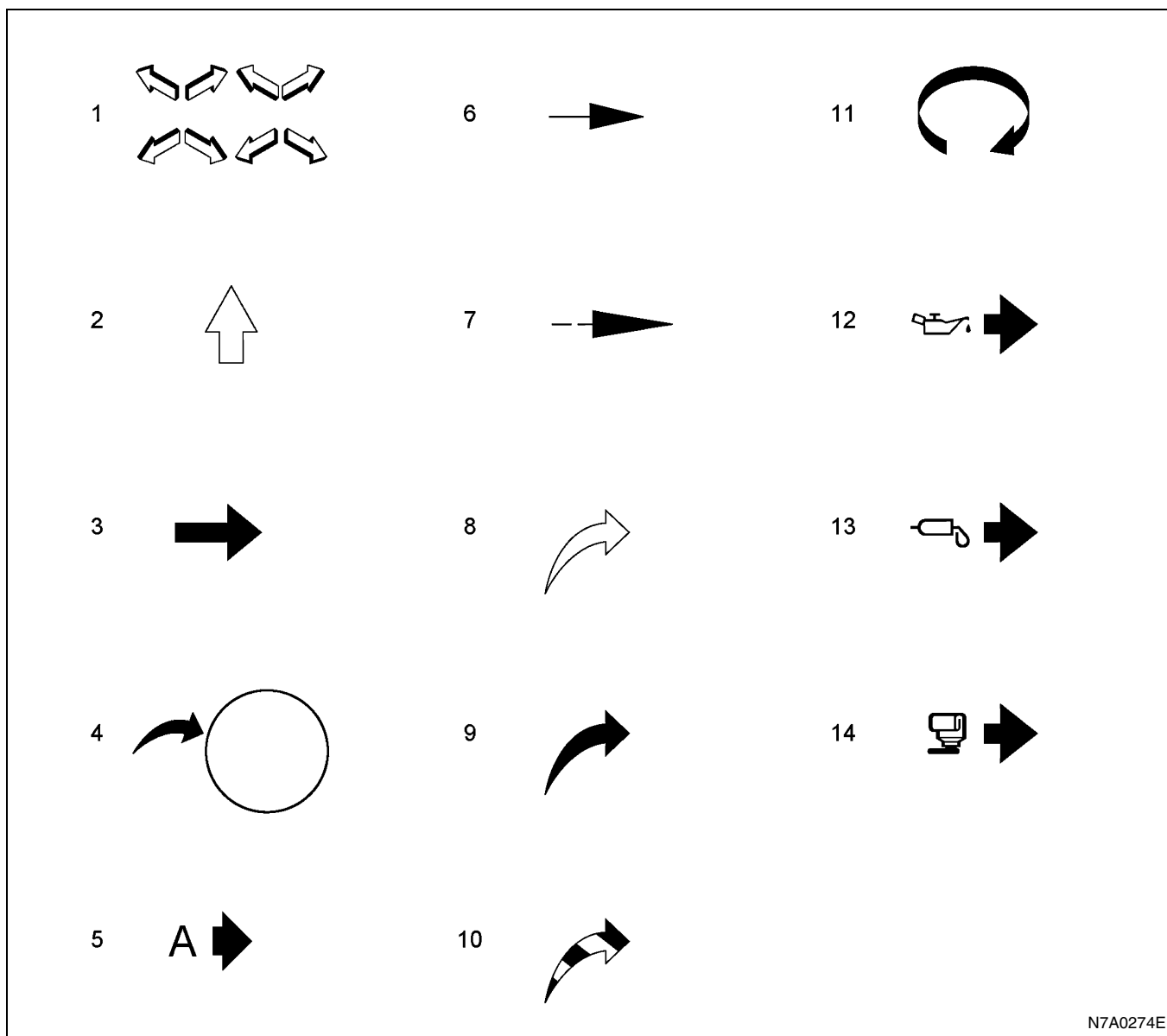


Legend

- | | |
|------------------------------------|---|
| 1. Hexagon Head Bolt (4.8, 4T) | 9. Hexagon Bolt (Non Heat-Treated 8.8) |
| 2. Hexagon Head Bolt (4.8, 4T) | 10. Hexagon Bolt (Non Heat-Treated 8.8) |
| 3. Flange Bolt (4.8, 4T) | 11. Flange Bolt (8.8) |
| 4. Flange Bolt (4.8, 4T) | 12. Flange Bolt (8.8) |
| 5. Hexagon Head Bolt (7T) | 13. Hexagon Bolt (9.8, 9T) |
| 6. Flange Bolt (7T) | 14. Hexagon Bolt (9.8, 9T) |
| 7. Hexagon Bolt (Heat-Treated 8.8) | 15. Flange Bolt (9.8, 9T) |
| 8. Hexagon Bolt (Heat-Treated 8.8) | 16. Flange Bolt (9.8, 9T) |

ARROWS USED IN FIGURES

Arrows Descriptions



N7A0274E

Legend

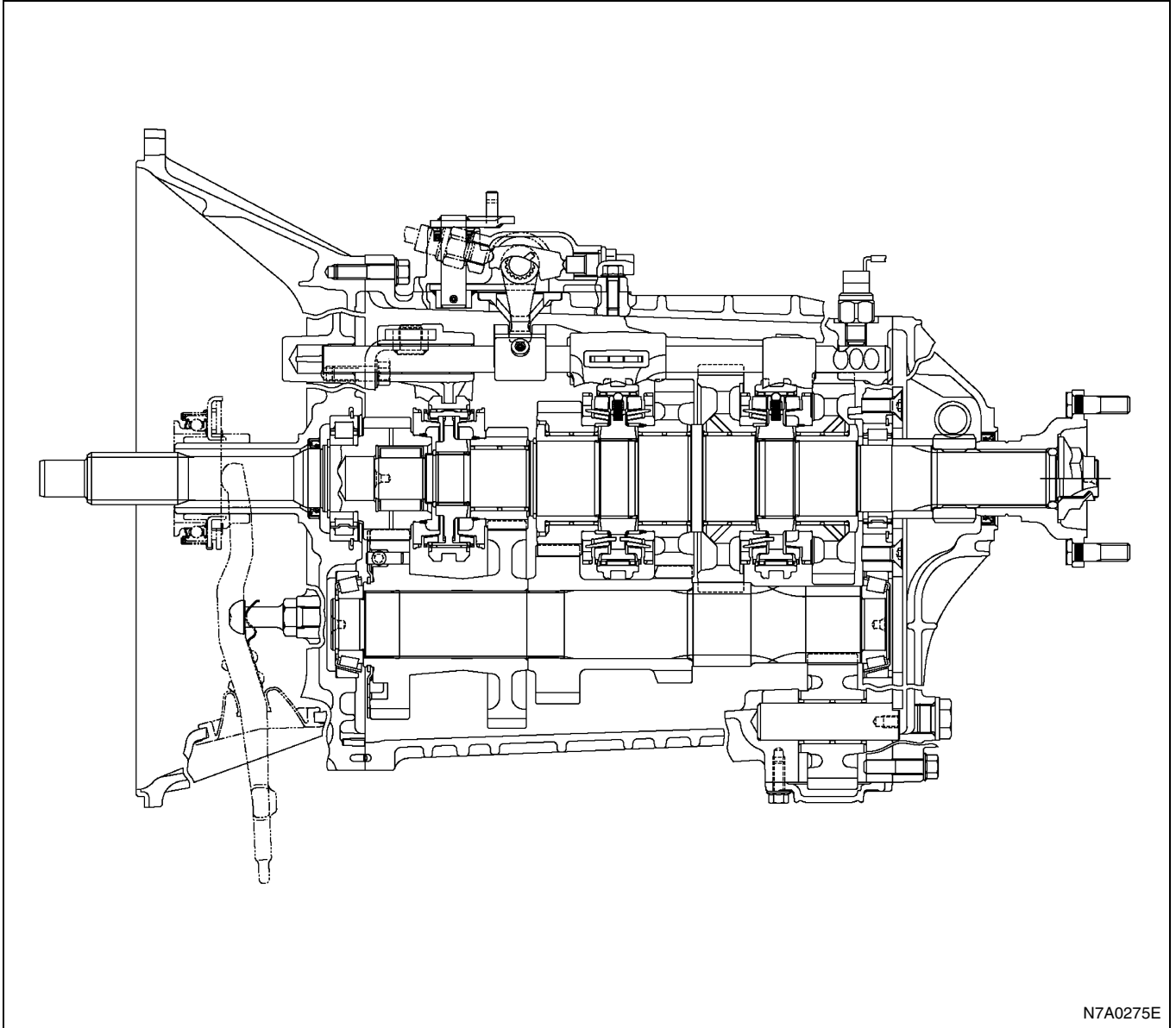
- | | |
|--|--|
| <ul style="list-style-type: none"> 1. Front side of the vehicle 2. Upper side 3. Servicing part, or servicing direction 4. Detail of a part 5. Detail from the point of view A 6. Arrow meaning dimension 7. Arrow meaning a cross section 8. External air or cool air flow (Used to indicate an air flow) | <ul style="list-style-type: none"> 9. Gas or warm air flow 10. Mixture of air and gas, or mixture of cool air and warm air flow 11. Rotation direction 12. Fuel supply 13. Lubrication supply 14. Application of liquid gasket |
|--|--|

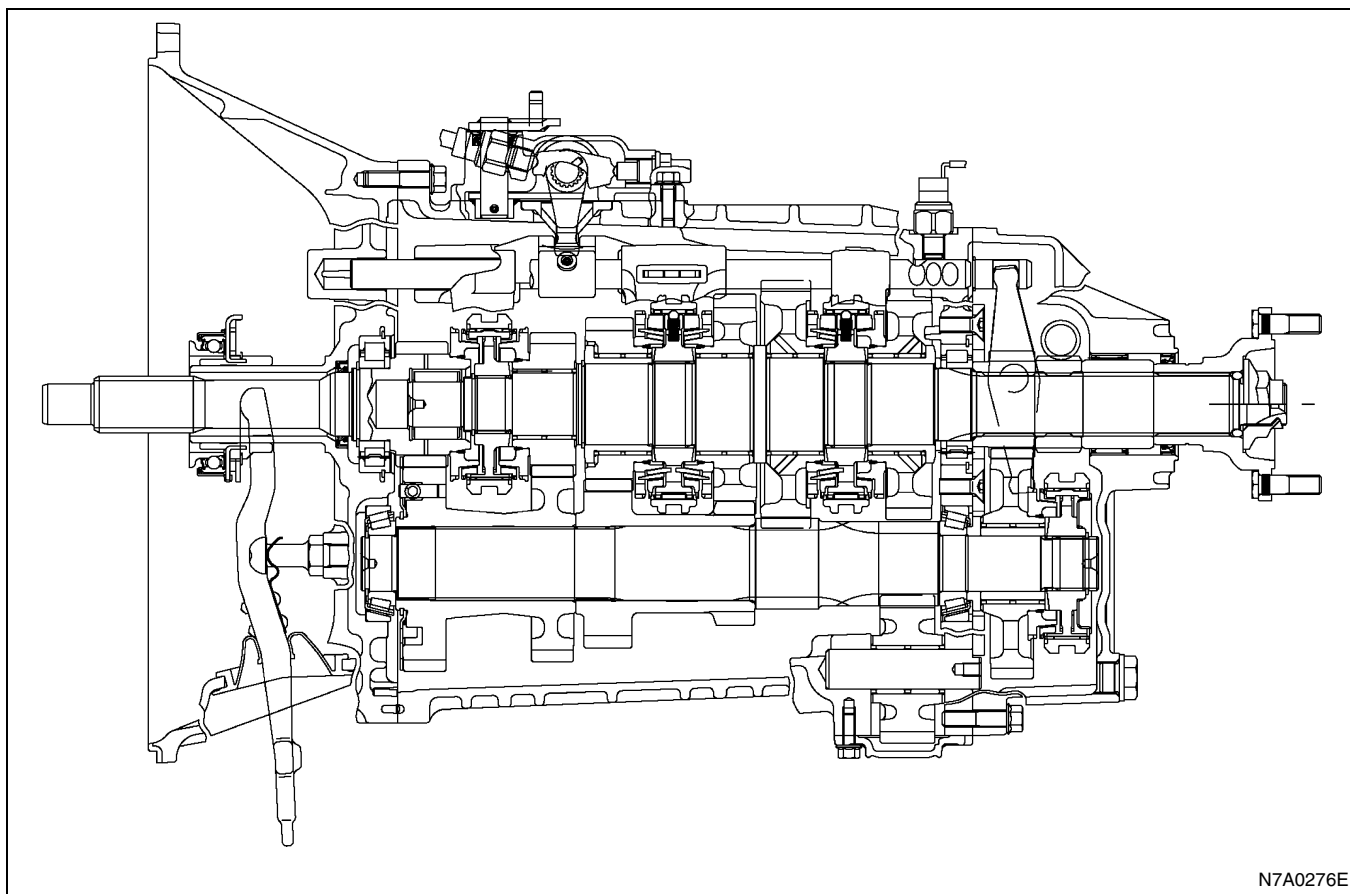
MANUAL TRANSMISSION

MANUAL TRANSMISSION MECHANISM

Function and Operation

- 5MT





N7A0276E

MYT transmission is designed to enable weight saving and to adapt larger available torque input 392 N·m (40 kg·m/289.3 lb·ft). New technology is adopted such as

aluminum-tube type case (3 piece) structure, tapered roller bearing (main shaft front and rear, counter shaft front and rear) and twin-rod type shift control layout.

Inspection

Diagnostic chart for troubleshooting

Trouble	Cause	Treatment
Noise	Wear of flywheel pilot bearing	Replace
	Wear or damage of bearing (main shaft, counter shaft)	Replace
	Wear, crack and damage of gear (main shaft, counter shaft, reverse idle gear)	Replace
	Wear of spline (main shaft, synchronizer clutch hub)	Replace
	Seizure of gear or bearing thrust surface	Replace
	Backlash shortage of mesh gear	Replace
Shift difficulty	Clutch pedal play inaccuracy	Adjust
	Wear of change lever sliding portion	Repair or replace, lubricate grease
	Wear of shift block, shift rod or control box sliding portion	Replace
	Wear of shift arm or synchronizer sleeve groove	Replace the worn parts
	Wear of thrust washer, collar or gear thrust surface (main shaft and counter shaft thrust play)	Replace the worn parts
	Wear of synchronizer parts	Replace

Trouble	Cause	Treatment
Out of gear	Wear of detent ball	Replace
	Wear of shift rod or control box sliding portion	Replace
	Wear of shift arm or synchronizer sleeve groove	Replace the worn parts
	Wear of thrust washer, collar or gear thrust surface (main shaft and counter shaft thrust play)	Replace the worn parts
	Wear or damage of bearing	Replace
	Wear of spline (main shaft, synchronizer hub)	Replace
	Fatigue or damage of synchronizer spring	Replace
Oil leakage	Looseness of drain plug or filler plug	Tighten the plug or refill oil
	Damaged gasket	Replace
	Wear or damage of oil seal	Replace

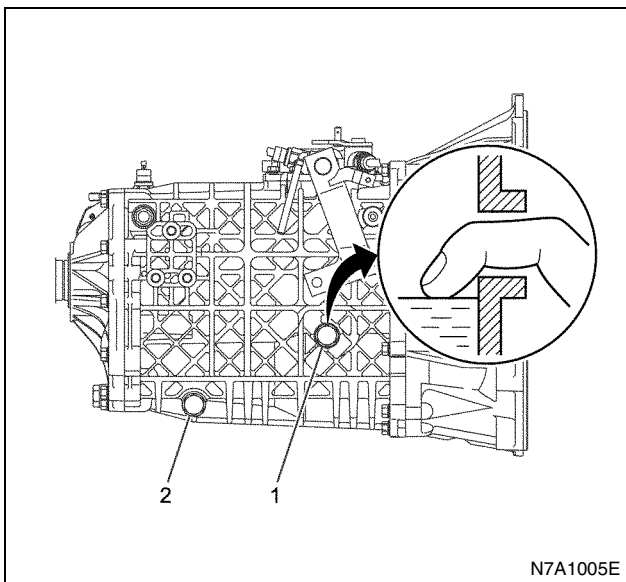
Oil Inspection

1. Remove the filler plug.
2. Check the oil level by inserting a finger to the filler plug hole.
3. Refill oil when the oil level is out of the specified amount.
 - Applicable oil = Besco gear oil transaxle (5W-30)
4. Fix the filler plug to the specified torque.

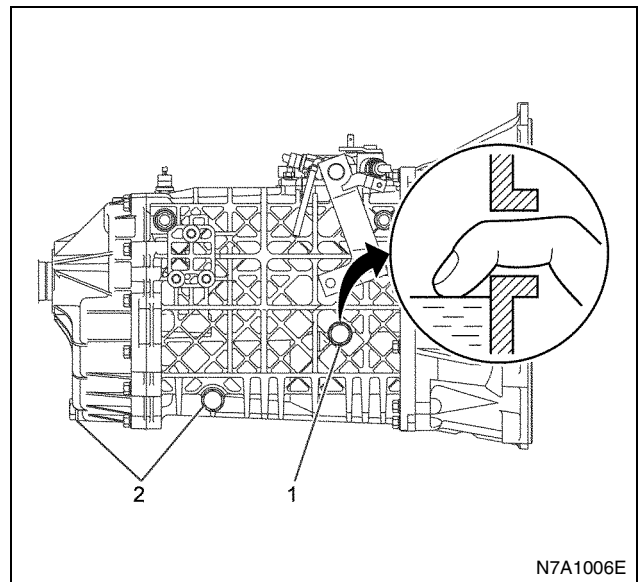
Tighten:

Filler plug to 39 N·m (4.0 kg·m / 29 lb·ft)

- 5MT



- 6MT



Legend

1. Filler plug
2. Drain plug

Oil Replacement

1. Start the engine and idle the transmission sufficiently.
2. Stop the engine, remove the drain plug, and then drain oil.
3. Fix the drain plug.

Tighten:

Drain plug to 39 N·m (4.0 kg·m / 29 lb·ft)

4. Remove the filler plug.
5. Fill oil through the filler plug hole to the lower edge of the hole.
 - Applicable oil = Besco gear oil transaxle (5W-30)

Oil Capacity	L (US qt/Imp qt)	
	6MT	5MT
Normal	3.5 (3.7 / 3.1)	2.8 (3.0 / 2.5)
4WD	—	3.5 (3.7 / 3.1)
With front PTO	—	5.5 — 6.0 (5.8 — 6.3 / 4.8 — 5.3)
With side PTO	3.8 (4.0 / 3.3)	3.1 (3.3 / 2.7)
With side PTO (4WD)	—	3.8 (4.0 / 3.3)

6. Fix the filler plug to the specified torque.

Tighten:

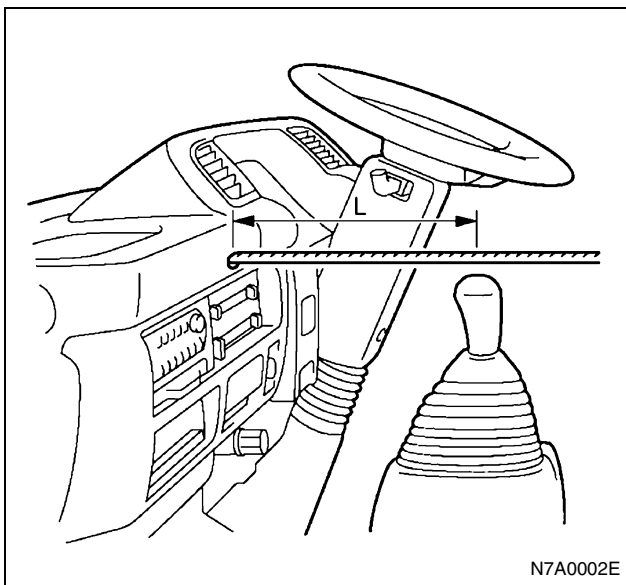
Filler plug to 39 N·m (4.0 kg·m / 29 lb·ft)

Inspection and Adjustment of The Gear Control

1. Shift the shift select external lever of the transmission side to neutral.
2. Measure the dimension (L) between the center of the change lever play and the instrument panel.
L dimension

Standard cab model = 247 ± 15 mm (9.72 ± 0.6 in)

Wide cab model = 283 ± 15 mm (11.1 ± 0.6 in)



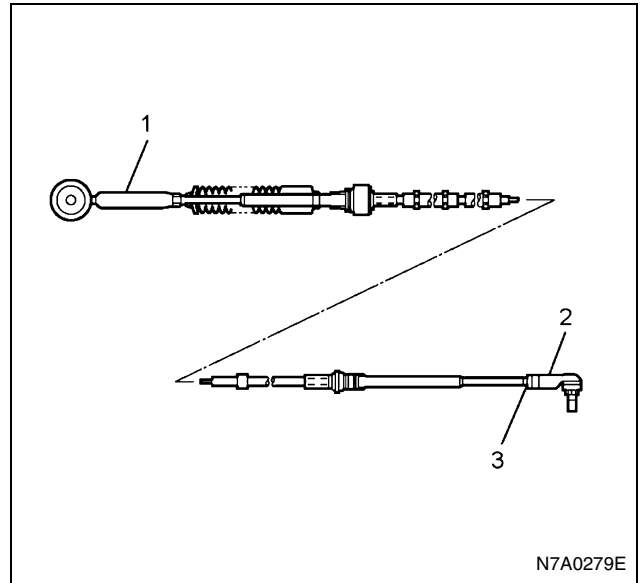
N7A0002E

3. When the L dimension is out of specification, adjust it by the following:

- Remove the change lever knob.
- Remove the boot.
- Remove the console box assembly.
- Remove the shift select cable at the change lever side.
- Shift the shift select external lever of the transmission side to neutral.
- Loosen the lock nut of the shift cable, and install it by adjusting the cable length and making the L dimension become within specification.
- Fix the lock nut.

Tighten:

Lock nut to 6 N·m (0.6 kg·m / 4 lb·ft)



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Legend

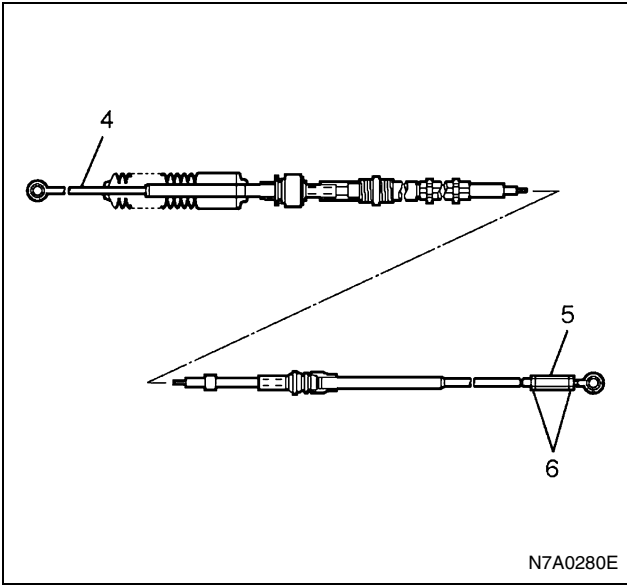
1. Transmission side
2. Joint ball
3. Change lever side

- Loosen the lock nut of the select cable joint, adjust the select cable length to make the change lever select direction (right and left direction) tilt a little (2.7°) to the left against the vertical direction, and then joint the change lever.
- Fix the lock nut.

Tighten:

Lock nut to 6 N·m (0.6 kg·m / 4 lb·ft)

- Install the console box, the boot and the change lever knob.

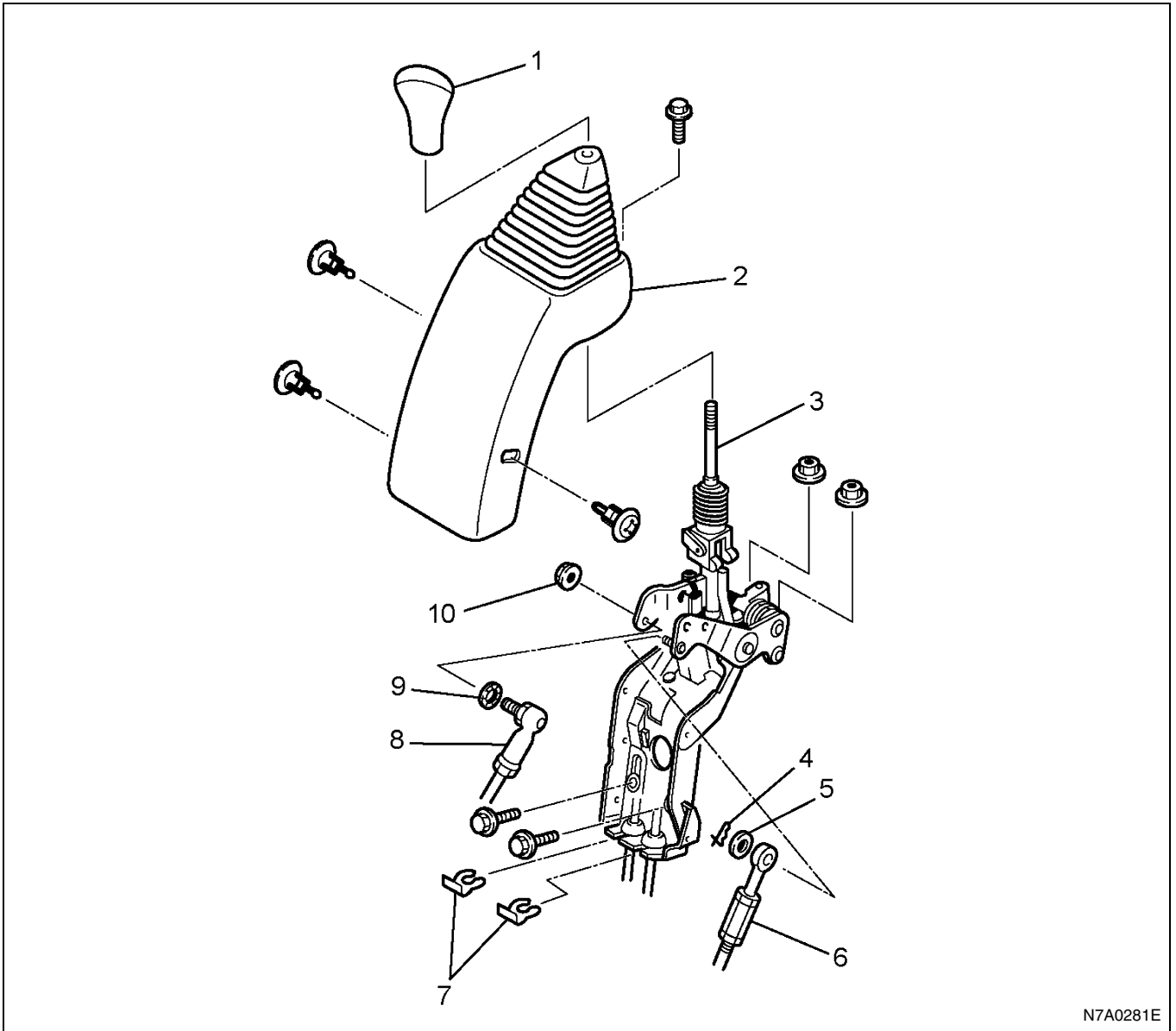


Legend

- 4. Transmission side
- 5. Turn buckle
- 6. Lock nut

ON-VEHICLE SERVICE

Change Lever Components



N7A0281E

Legend

- | | |
|--------------------------|-------------------------|
| 1. Change lever knob | 6. Shift & select cable |
| 2. Gear control cover | 7. Clip |
| 3. Change lever assembly | 8. Shift & select cable |
| 4. Snap pin | 9. Lock washer |
| 5. Plain washer | 10. Nut |

Removal

1. Remove the change lever knob.
2. Remove the gear control cover.
3. Disconnect the change lever and cable from the shift & select cable.
4. Remove the change lever assembly.

- Remove the parking brake cable from the bracket and put it aside, remove the bracket securing bolt and nut, and then remove the change lever assembly with the bracket.

Installation

1. Install the change lever assembly.
2. Install the shift & select cable.

- Adjustment should be done after fixing the shift cable securing nut to the specified torque.
- Install the parking brake cable to the bracket.
- For adjustment, refer to MANUAL TRANSMISSION MECHANISM.

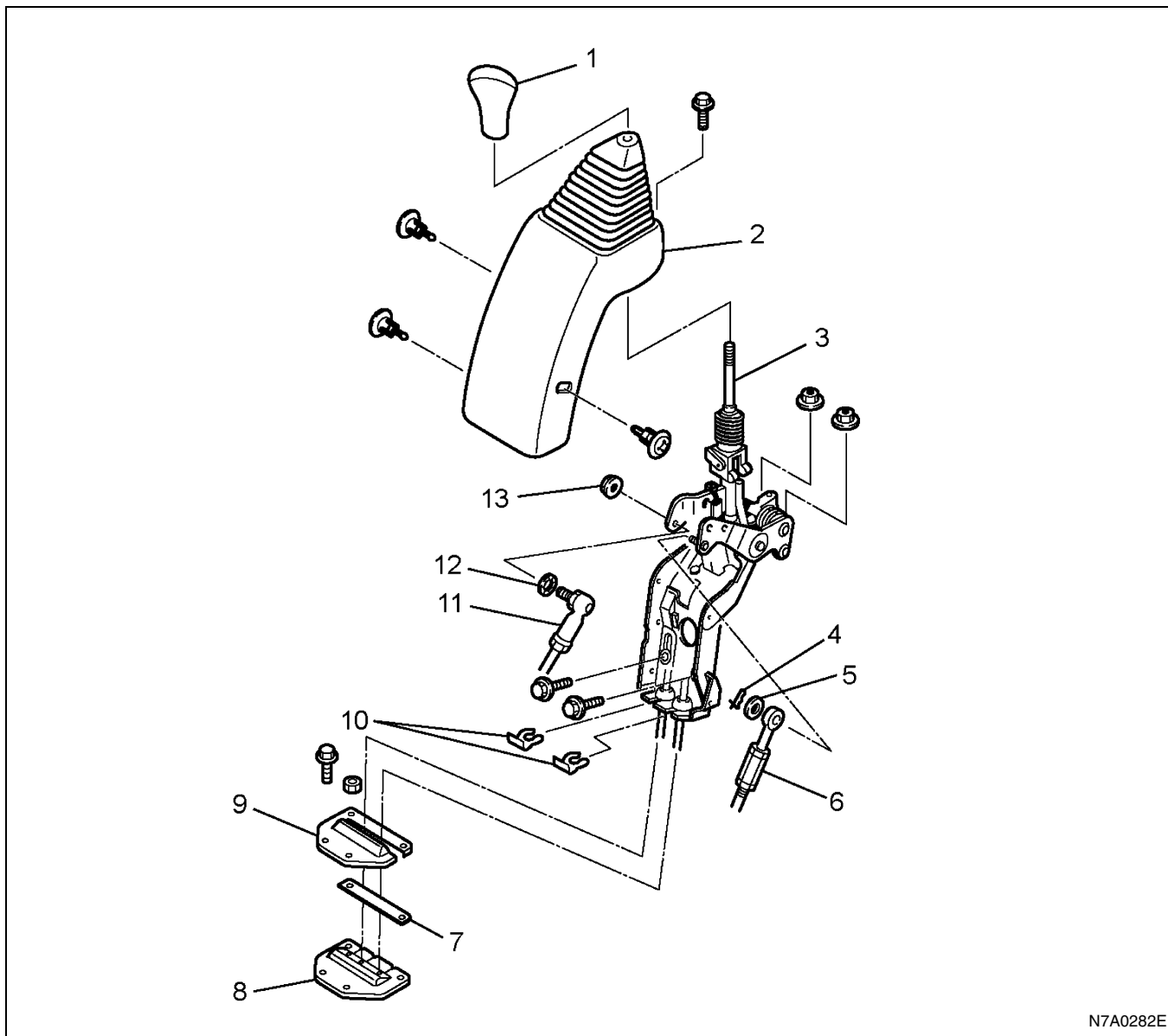
Tighten:

Shift cable securing nut to 21 N·m (2.1 kg·m / 15 lb·ft)

3. Install the gear control cover.
4. Install the change lever knob.

Gear Control Cable

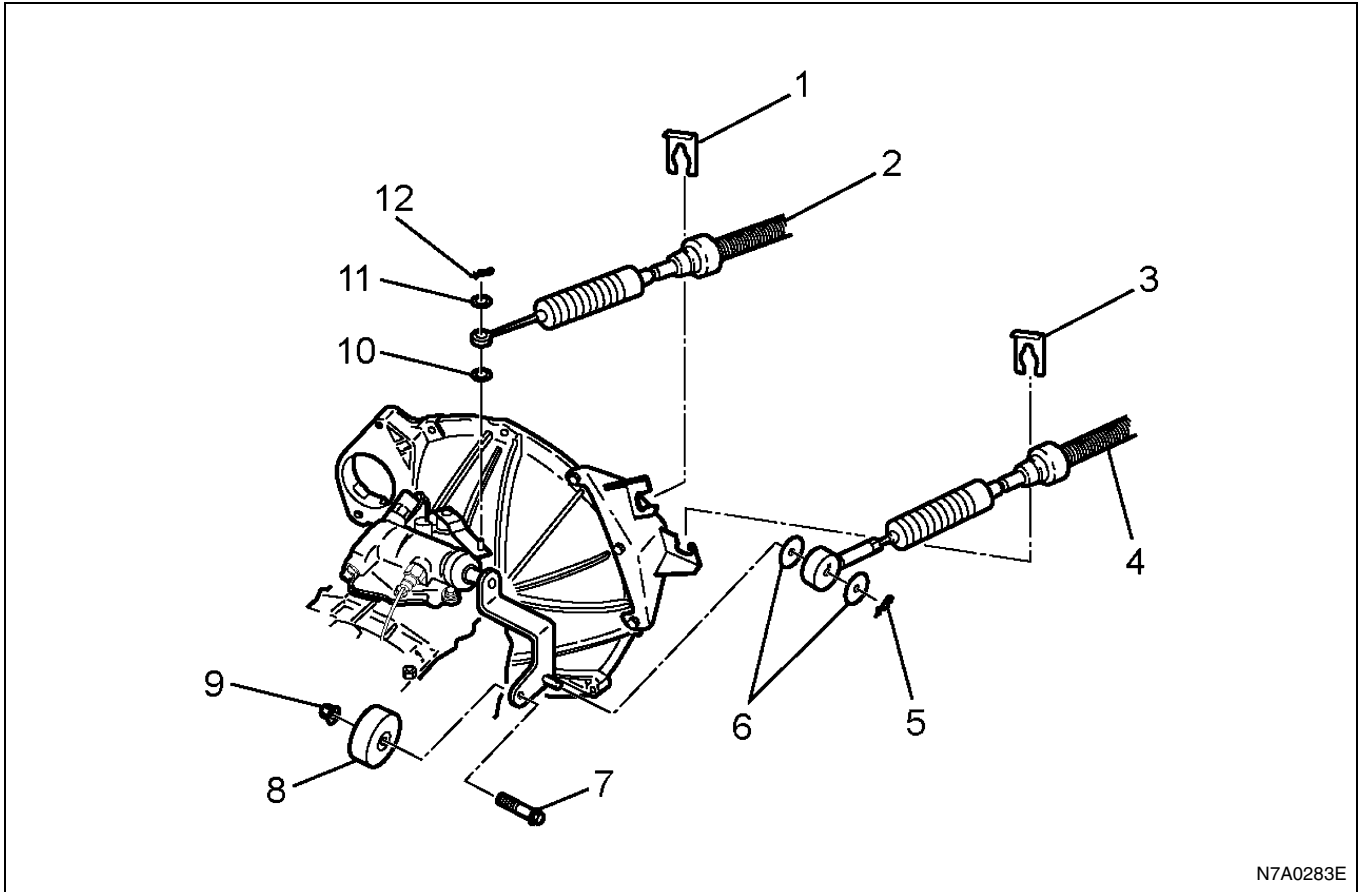
Components



N7A0282E

Legend

- | | |
|--------------------------|--------------------------|
| 1. Change lever knob | 8. Grommet |
| 2. Gear control cover | 9. Grommet retainer |
| 3. Change lever assembly | 10. Clip |
| 4. Snap pin | 11. Shift & select cable |
| 5. Plain washer | 12. Lock washer |
| 6. Shift & select cable | 13. Nut |
| 7. Grommet seat | |

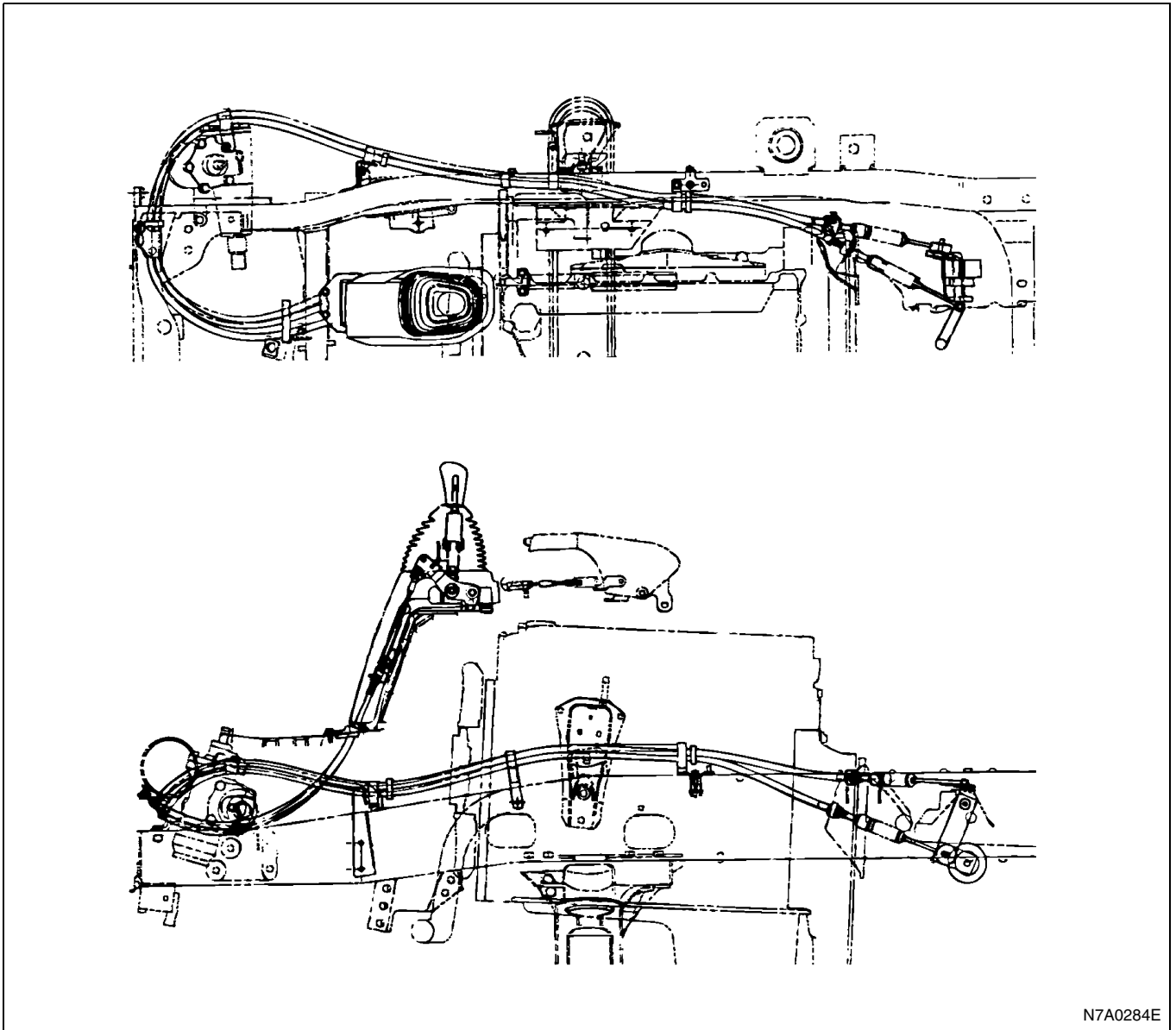


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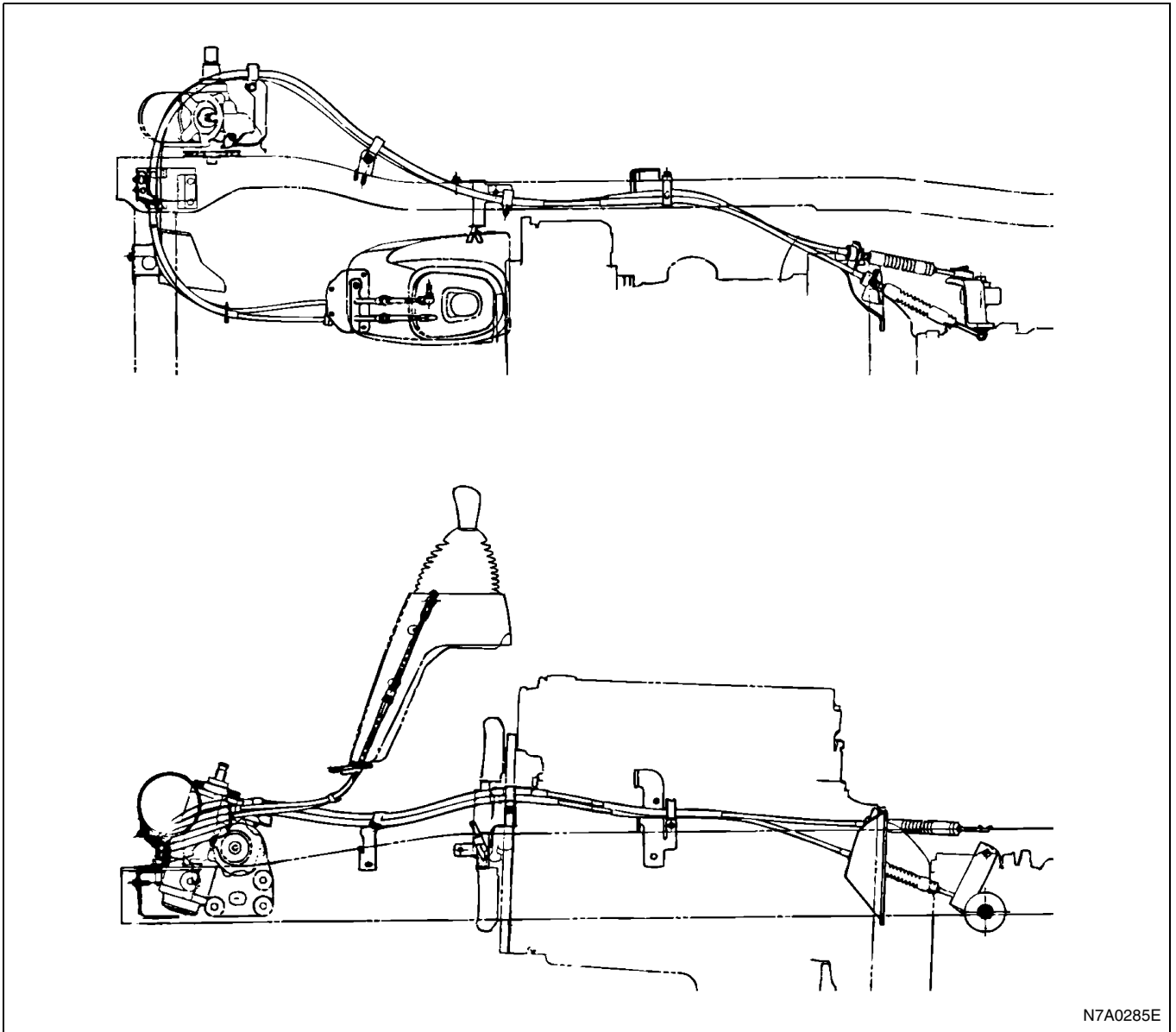
Legend

- | | |
|-----------------|------------------|
| 1. Clip | 7. Bolt |
| 2. Select cable | 8. Weight |
| 3. Clip | 9. Nut |
| 4. Shift cable | 10. Wave washer |
| 5. Snap pin | 11. Plain washer |
| 6. Plain washer | 12. Snap pin |

Gear Control Cable Layout
NKR

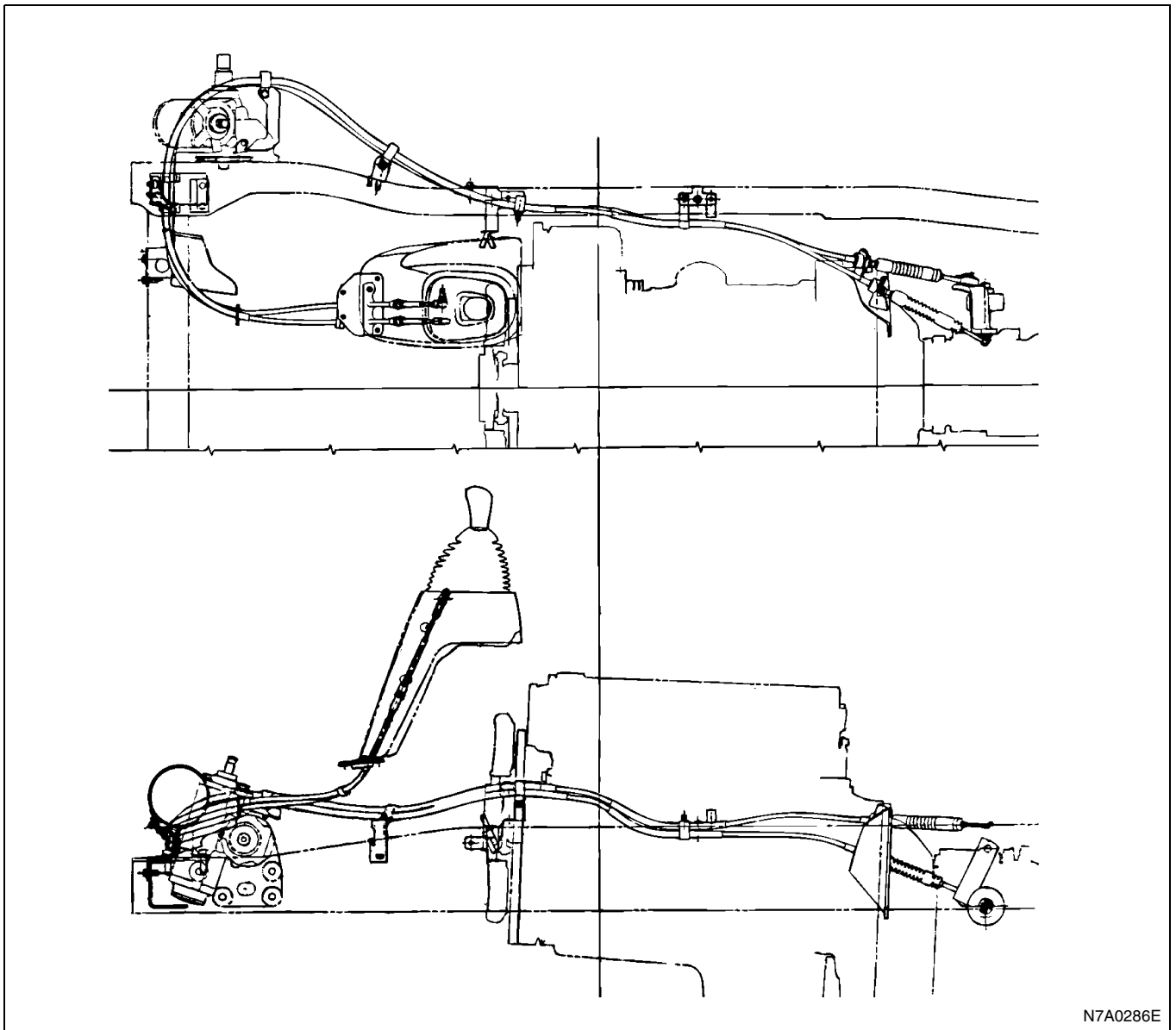


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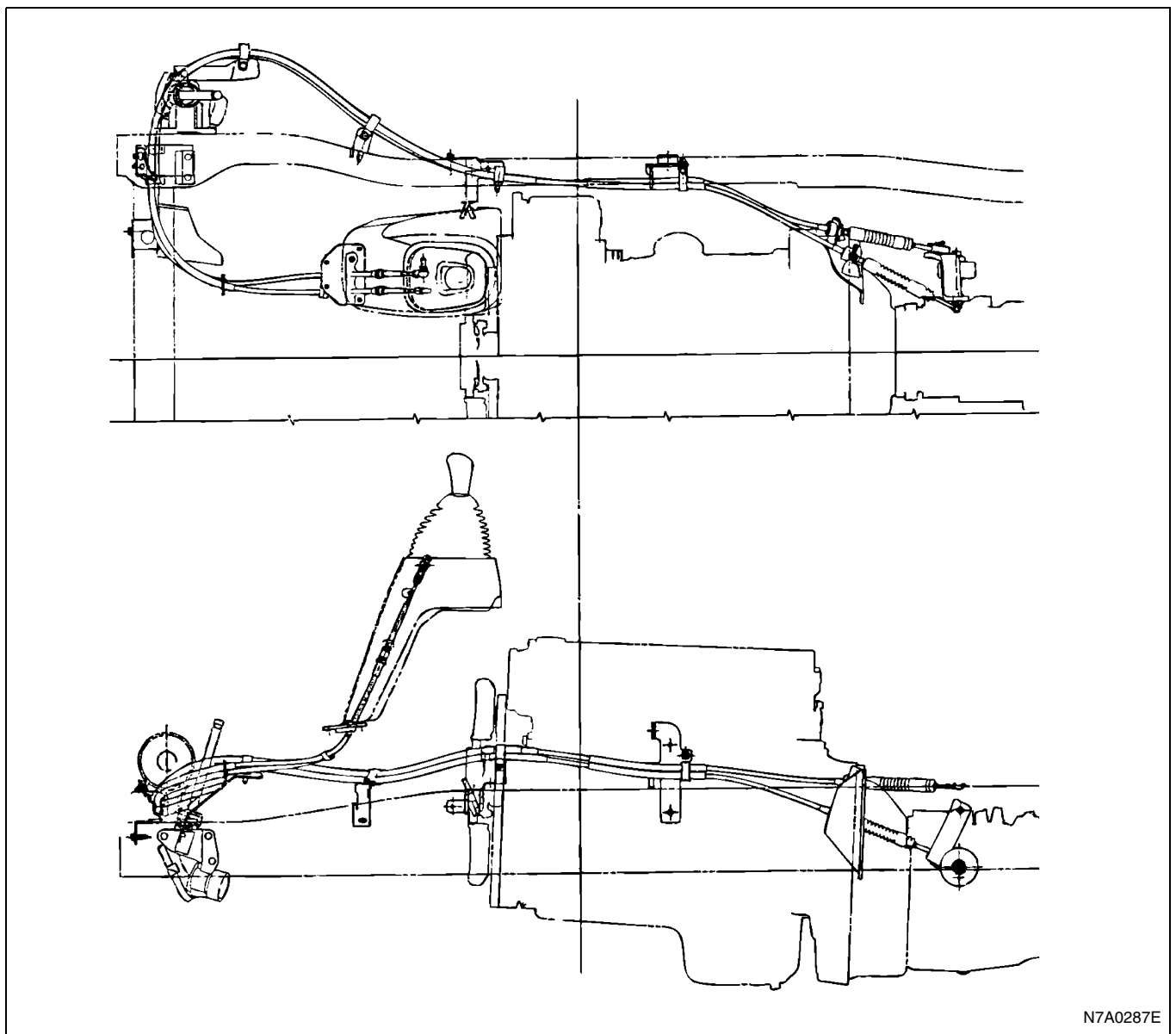
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NPR (Bottle Car)

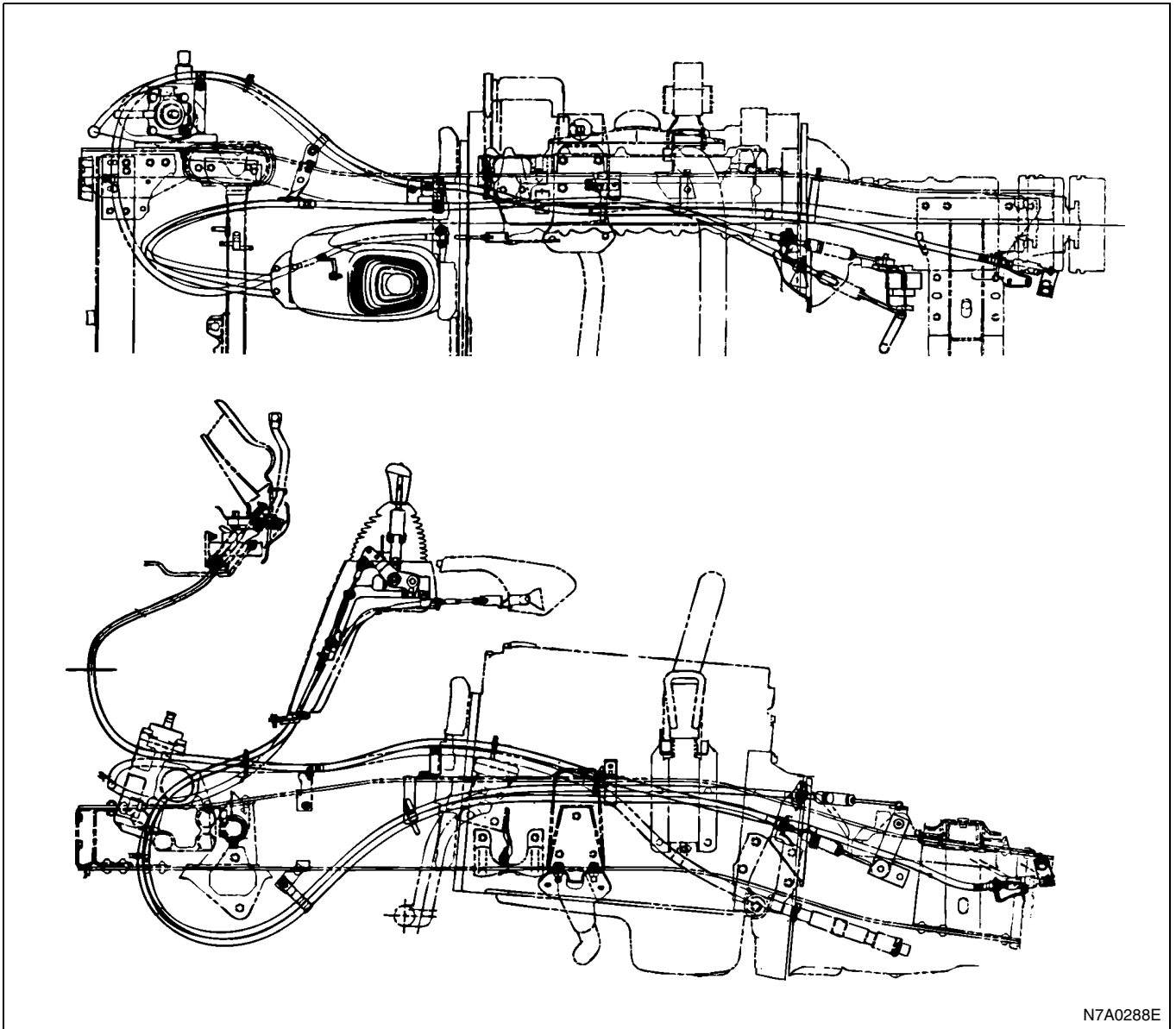


N7A0286E

NPR/S (Double Wishbone Suspension)



N7A0287E



N7A0288E

Removal

1. Remove the change lever knob.
2. Remove the gear control cover.
 - Remove the screw and clip, and then remove the cover.
3. Remove the shift & select cable from the change lever side.
 - Disconnect the cable from the change lever.
 - Remove the clip securing the cable.
4. Remove the grommet retainer and the grommet seat.
 - Remove the securing bolt and nut, and then remove the grommet retainer and the seal.
5. Remove the grommet.
6. Remove the shift & select cable of the transmission side.
7. Remove all the clips and clamps.

- Remove all the clips and clamps securing the cable to the frame, etc.

8. Remove the shift & select cable.

Inspection

- Check whether the cable is deformed, damaged, corroded or not, and whether the boot is damaged, poor-slid or not, and then replace abnormal parts found by the check.

Installation

1. Install the shift & select cable.
2. Secure the cable with a clip and clamp.
3. Fix the shift & select cable nut of the transmission side.

Tighten:

- Select cable nut to 21 N·m (2.1 kg·m / 15 lb-ft)
 - Shift weight nut to 103 N·m (10.5 kg·m / 76 lb-ft)
4. Install the grommet.

5. Install the grommet retainer.

Tighten:

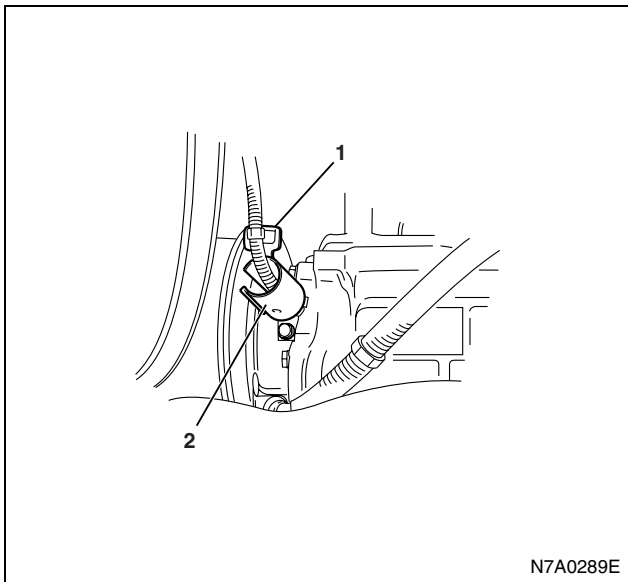
Securing bolt & nut to 11 N·m (1.1 kg·m / 8 lb·ft)

6. Install the shift & select cable joint portion (change lever side).
 - Adjust it after fixing the shift cable securing nut to the specified torque.
 - For adjustment, refer to MANUAL TRANSMISSION MECHANISM.
7. Install the gear control cable cover.
8. Install the change lever knob.
9. Install the seal behind the cab.

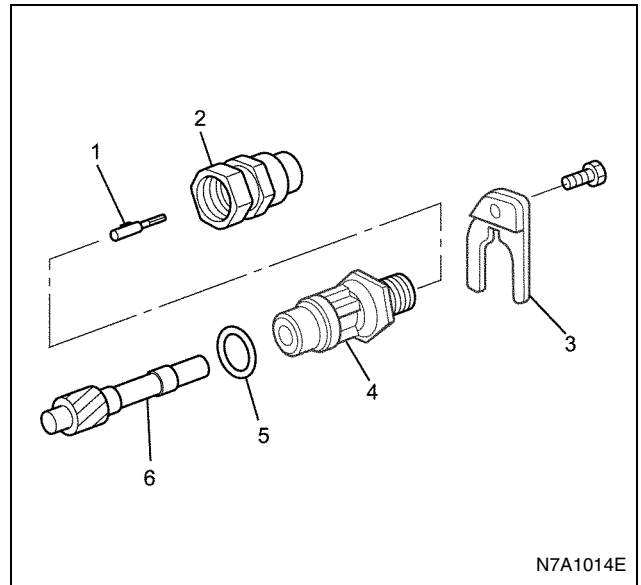
Vehicle Speed Sensor

Removal

1. Remove the clip (1), and then remove the protector (2).
2. Remove the wiring connector.



3. Remove the securing screw, and then remove the vehicle speed sensor.



Legend

1. Plug sensor
2. Vehicle speed sensor
3. Plate
4. Bush
5. O-ring
6. Driven gear

Installation

1. Install the vehicle speed sensor with a securing screw.

Tighten:

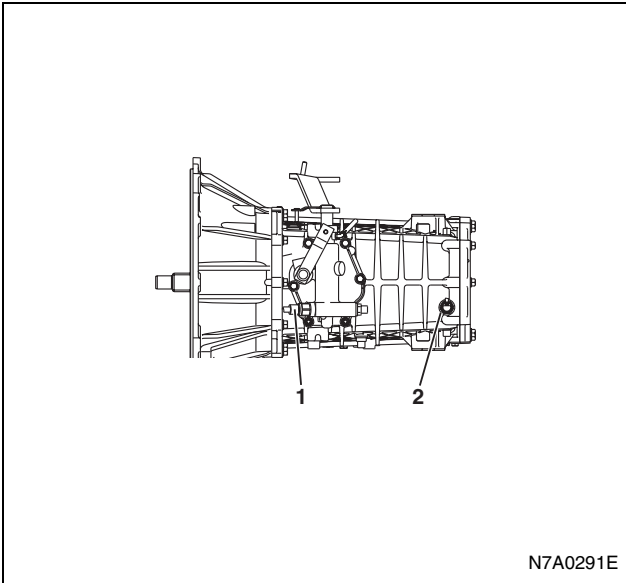
- Securing screw to 20 N·m (2.0 kg·m / 15 lb·ft)
 - Bush and vehicle speed sensor to 25 N·m (2.5 kg·m / 18 lb·ft)
2. Connect the wiring connector.
 3. Secure the protector with a clip.

Reverse and Neutral Switch

Removal

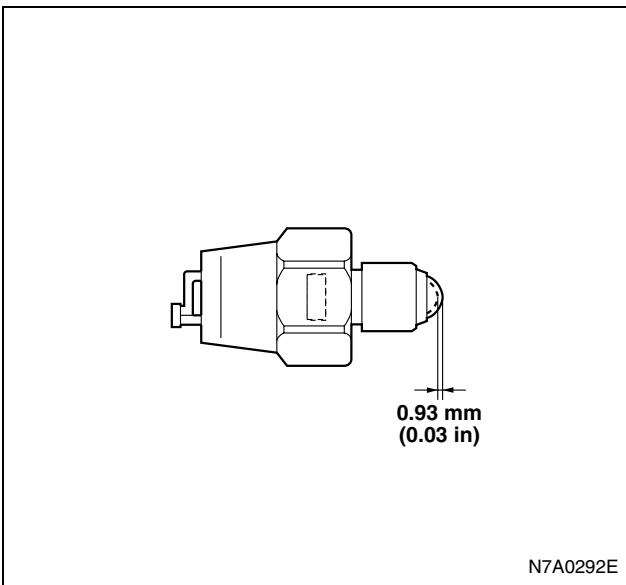
1. Remove the wiring connector.
2. Remove the reverse switch (2) (black connector).
3. Remove the neutral switch (1) (black connector).

3. Connect the wiring connector.



Inspection

- It is normal if there is continuity between the switch terminals when the ball is not pushed, and no continuity when pushing in the ball.
- Switch operating stroke = 0.93 mm (0.03 in)



Installation

1. Install the neutral switch.

Liquid gasket: Three Bond 1141

Tighten:

Neutral switch to 34 N·m (3.5 kg·m / 25 lb·ft)

2. Install the reverse switch.

- Apply liquid gasket to the switch thread before installation.

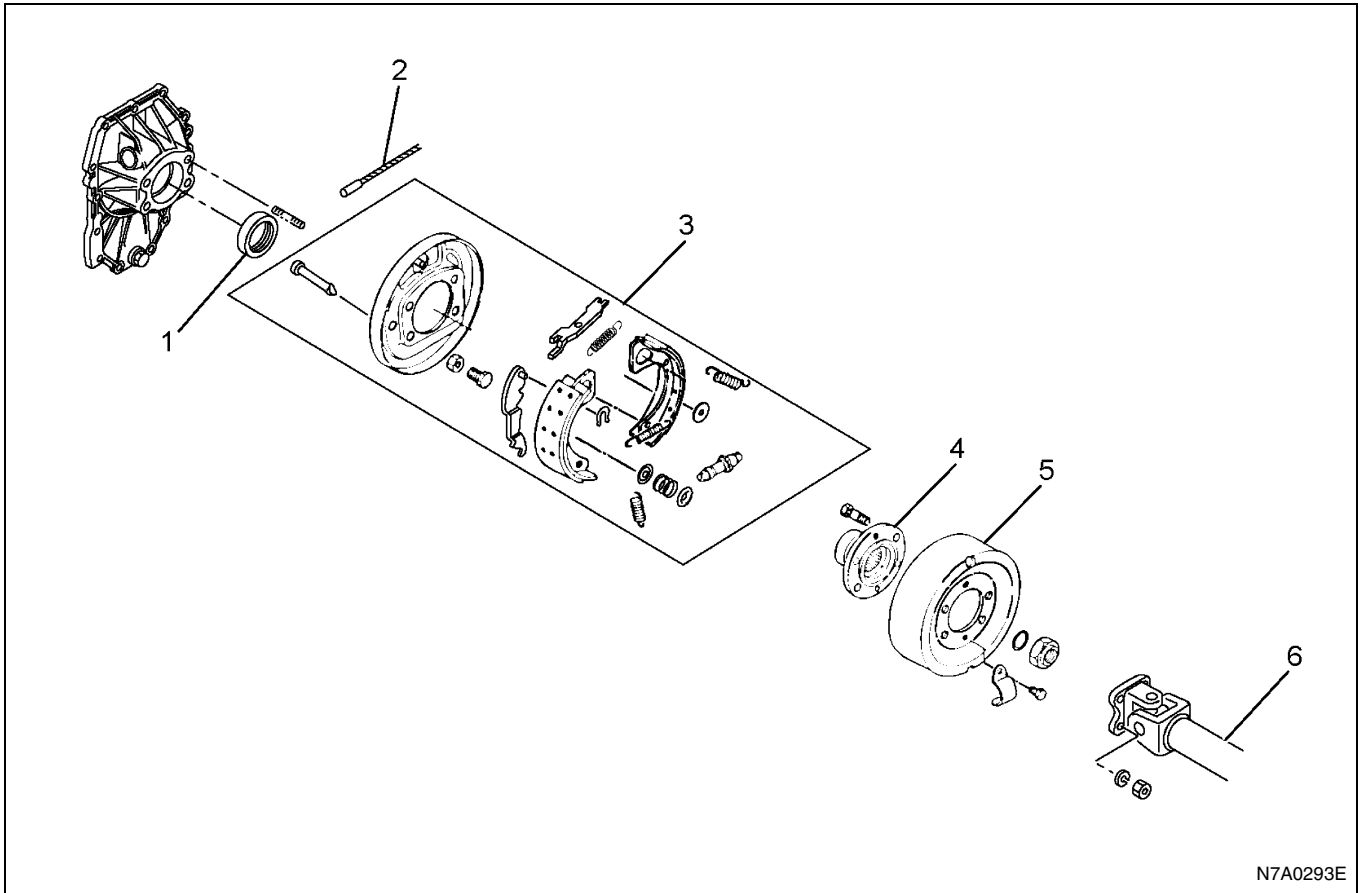
Liquid gasket: Three Bond 1141

Tighten:

Reverse switch to 39 N·m (4.0 kg·m / 29 lb·ft)

Rear Oil Seal (5MT)

Components



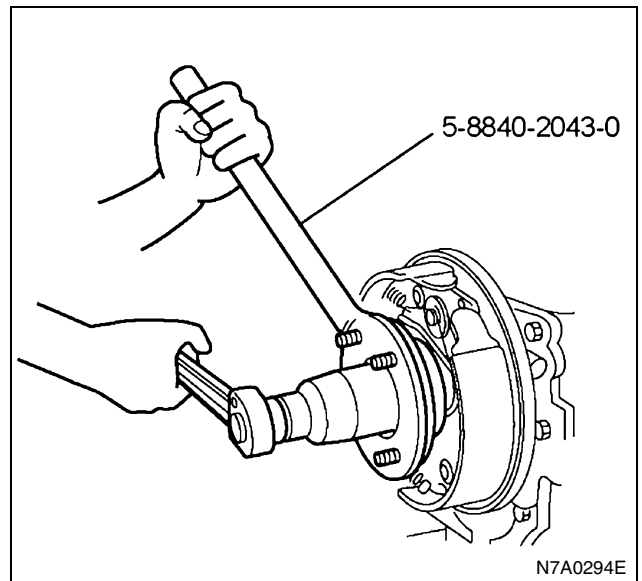
N7A0293E

Legend

- | | |
|---------------------------|----------------------------------|
| 1. Oil seal | 4. Coupling driver |
| 2. Parking brake cable | 5. Parking brake drum |
| 3. Parking brake assembly | 6. Rear propeller shaft assembly |

Removal

1. Remove the rear propeller shaft assembly.
 - Refer to REAR PROPELLER SHAFT ASSEMBLY.
2. Remove the parking brake cable.
 - Refer to PARKING BRAKE CABLE.
3. Remove the parking brake drum.
 - Refer to PARKING BRAKE ASSEMBLY.
4. Remove the coupling driver and O-ring.
 - Raise the lock nut caulking portion (two parts) securely, and then remove the lock nut using the flange holder 5-8840-2043-0.



N7A0294E

5. Remove the parking brake assembly.
 - Refer to PARKING BRAKE ASSEMBLY.

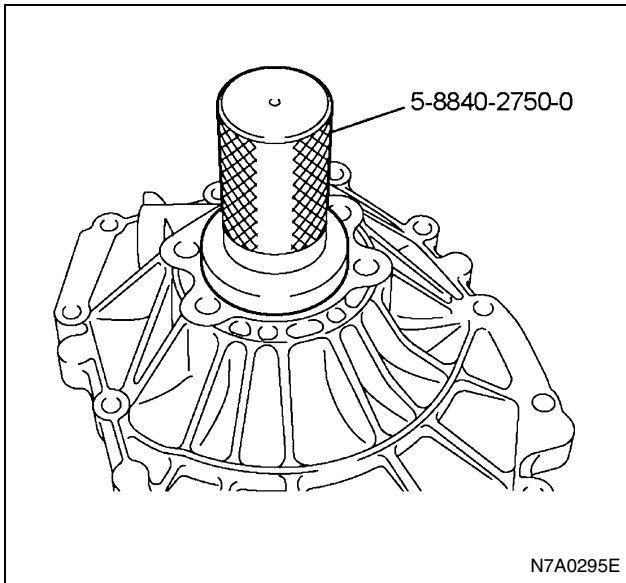
6. Remove the rear oil seal using the flat-tip screwdriver.

Installation

1. Apply engine oil 5W-30 around a new oil seal, and then press in the oil seal to the rear cover using the installer 5-8840-2750-0.
 - Apply Besco L2 grease on the lip of the oil seal.

Caution:

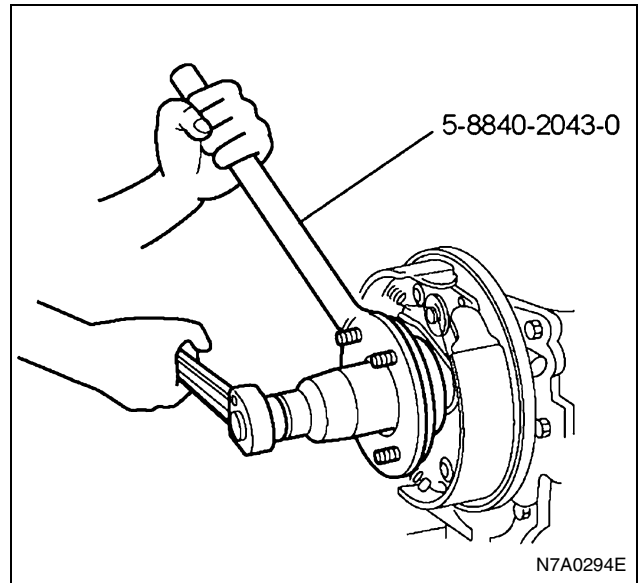
Be careful not to damage the lip of the oil seal.



2. Install the parking brake assembly.
 - Refer to PARKING BRAKE ASSEMBLY.
3. Install the coupling driver.
 - a. Apply engine oil 5W-30 to the O-ring, and then install the coupling driver and the O-ring.
 - b. Use a new lock nut and apply engine oil 5W-30 on its seat, and then fix the lock nut using the flange holder 5-8840-2043-0.

Tighten:

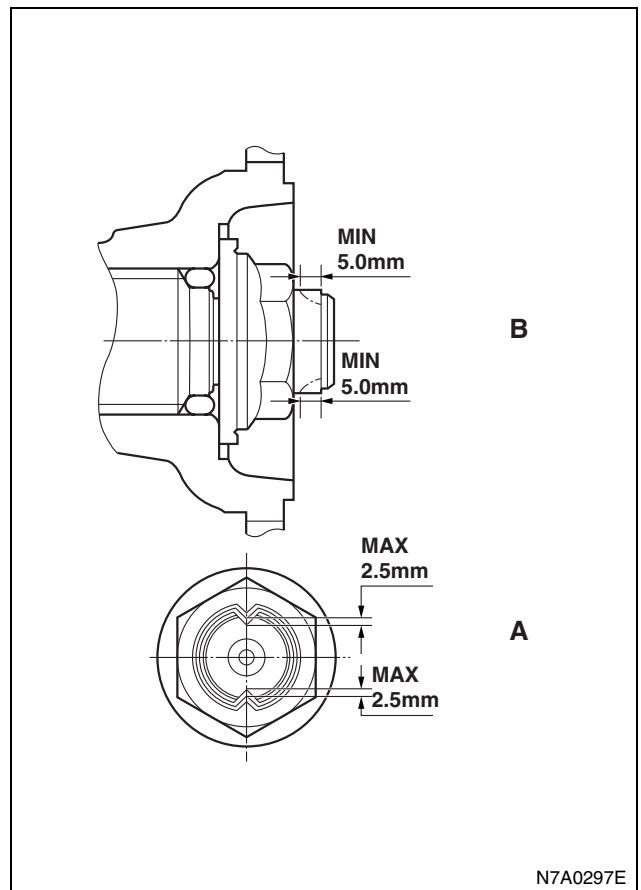
Lock nut to 289 N·m (29.5 kg·m / 213 lb·ft)



- After fixing it to the specified torque, align the lip part of the nut to the V-groove of the shaft edge. Securely caulk the two parts of the nut lip using a chisel whose tip form is approx. 1 mm (0.04 in) radius by 60°, to make a length (B) of 5 mm (0.2 in) or more, and a clearance between the bottom of the shaft and the nut lip (A) of 1.5 mm (0.06 in) or less.

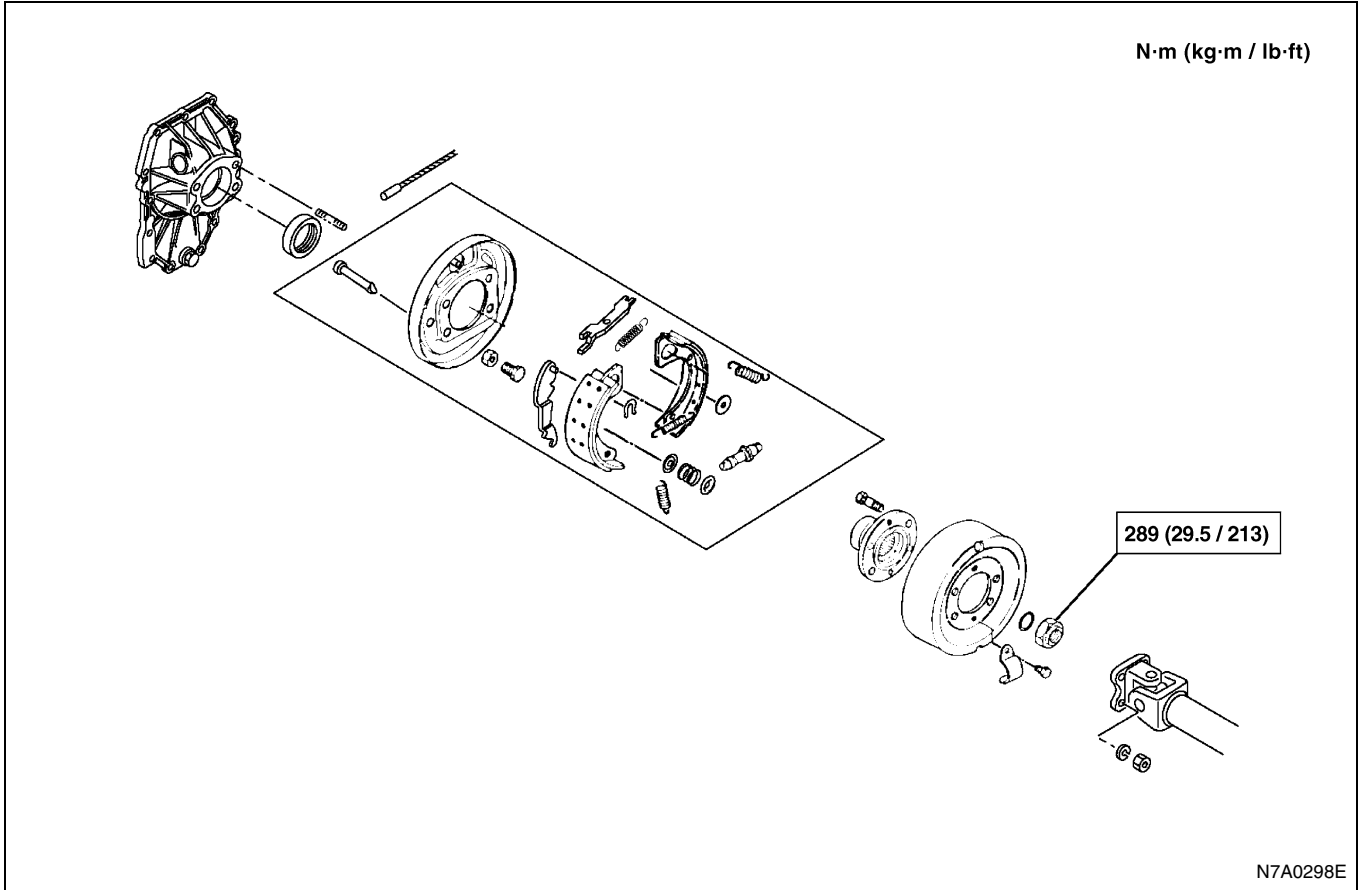
Caution:

If any crack is found on the caulking portions of the nut after the check, replace the lock nut and caulk it again.

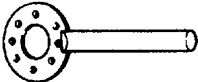
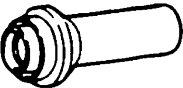


4. Install the parking brake drum.
 - Refer to PARKING BRAKE ASSEMBLY.
5. Install the parking brake cable.
 - Refer to PARKING BRAKE CABLE.
6. Install the rear propeller shaft assembly.
 - Refer to REAR PROPELLER SHAFT ASSEMBLY.

Fixing Torque

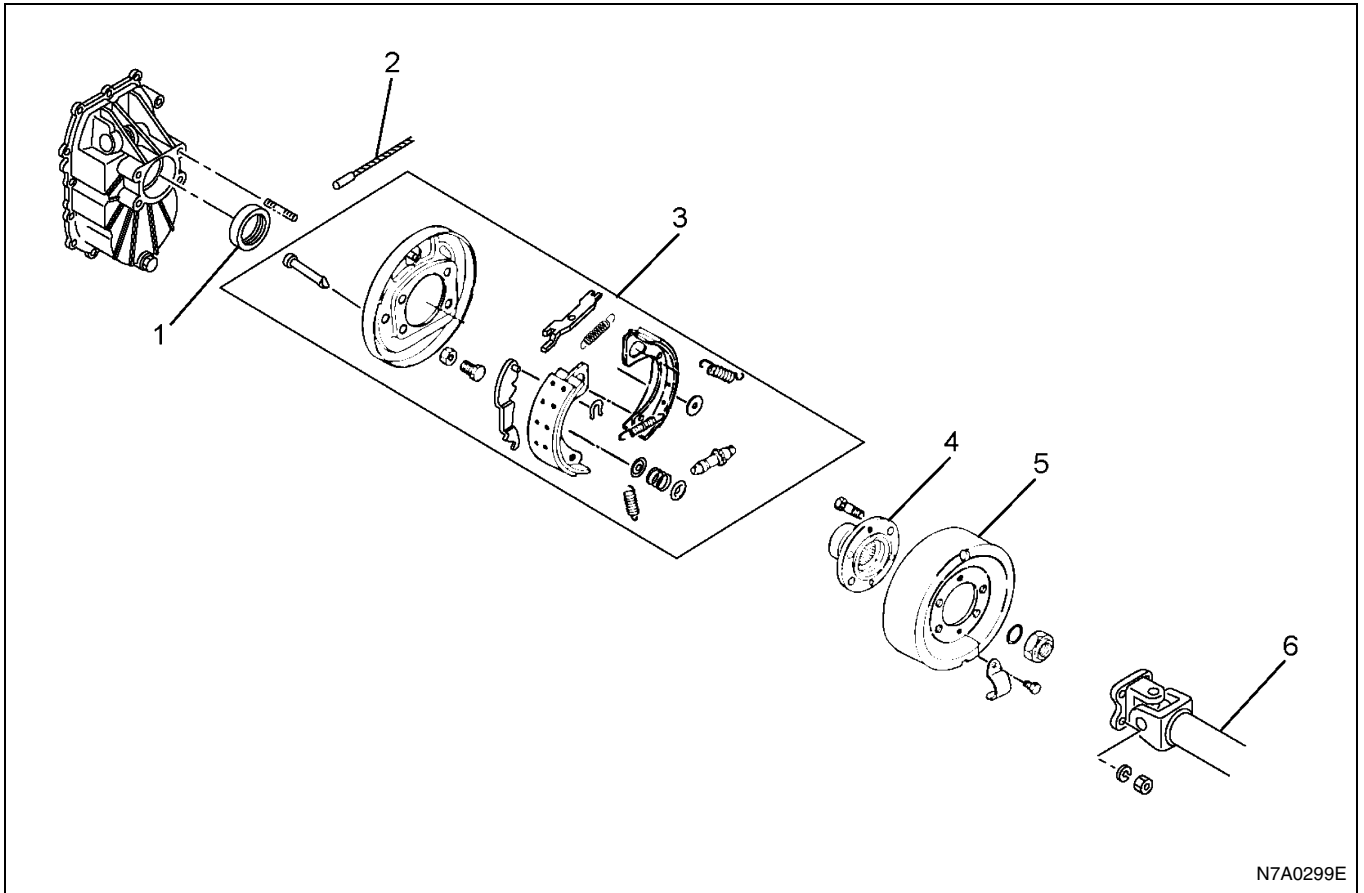


Special Tools

Illustration	Tool Number / Description / Remarks
 <p>5884020430</p>	5-8840-2043-0 / Flange Holder
 <p>5884027500</p>	5-8840-2750-0 / Oil Seal Installer

Rear Oil Seal (6MT)

Components



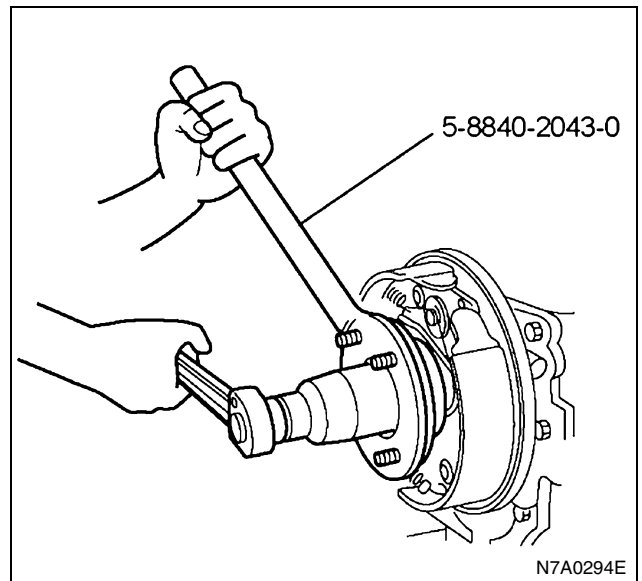
N7A0299E

Legend

- | | |
|---------------------------|----------------------------------|
| 1. Oil seal | 4. Coupling driver |
| 2. Parking brake cable | 5. Parking brake drum |
| 3. Parking brake assembly | 6. Rear propeller shaft assembly |

Removal

1. Remove the rear propeller shaft assembly.
 - Refer to REAR PROPELLER SHAFT ASSEMBLY.
2. Remove the parking brake cable.
 - Refer to PARKING BRAKE CABLE.
3. Remove the parking brake drum.
 - Refer to PARKING BRAKE ASSEMBLY.
4. Remove the coupling driver and O-ring.
 - Raise the caulking portion (2 parts) of the lock nut securely, and remove it using the flange holder 5-8840-2043-0.



N7A0294E

5. Remove the parking brake assembly.
 - Refer to PARKING BRAKE ASSEMBLY.

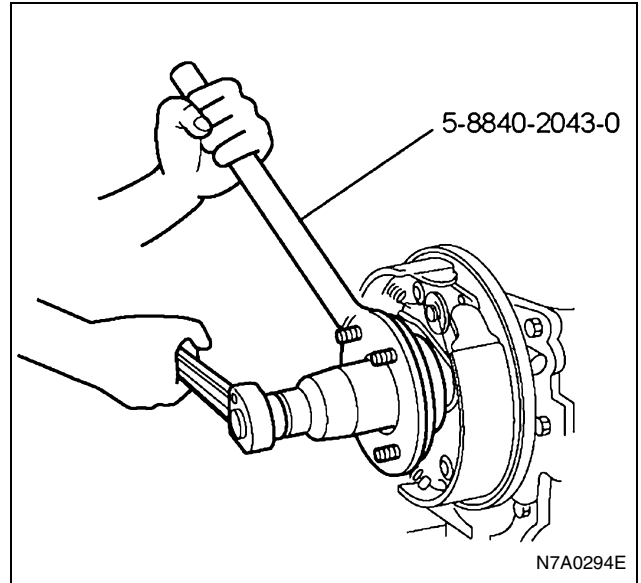
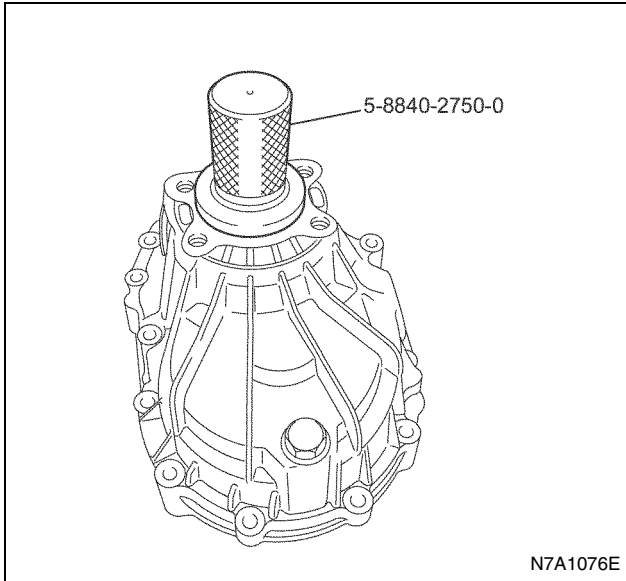
6. Remove the rear oil seal using the flat-tip screwdriver.

Installation

1. Apply engine oil 5W-30 around a new oil seal, and then press in the oil seal to the rear cover using the installer 5-8840-2750-0.
 - Apply Besco L2 grease to the lip portion of the oil seal.

Caution:

Be careful not to damage the oil seal lip portion.



- After fixing it to the specified torque, align the lip part of the nut to the V-groove of the shaft edge. Securely caulk the two parts of the nut lip using a chisel whose tip form is approx. 1 mm (0.04 in) radius by 60°, to make a length (B) of 5 mm (0.2 in) or more, and a clearance between the bottom of the shaft and the nut lip (A) of 1.5 mm (0.06 in) or less.

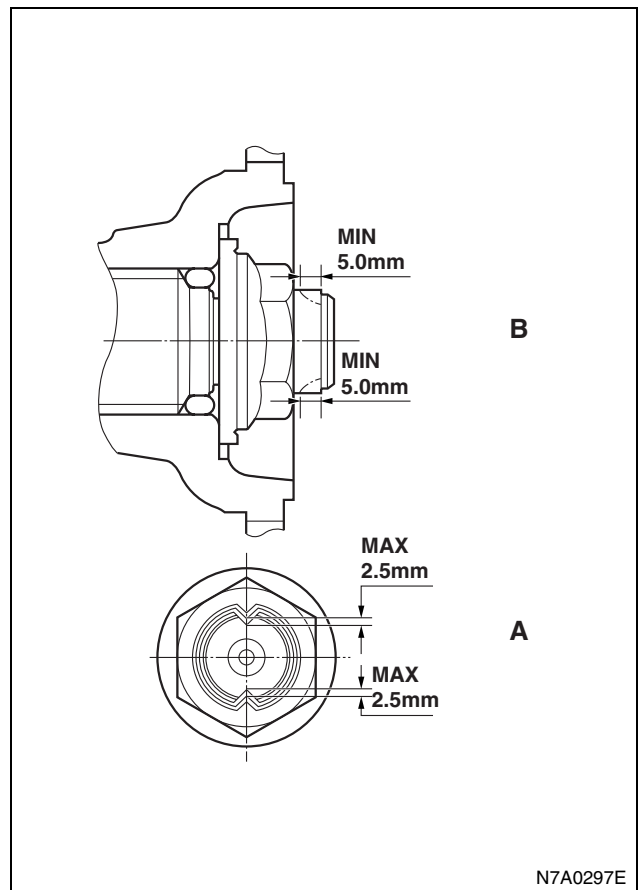
Caution:

If any crack is found on the caulking portions of the nut after the check, replace the lock nut and caulk it again.

2. Install the parking brake assembly.
 - Refer to PARKING BRAKE ASSEMBLY.
3. Install the coupling driver.
 - a. Apply engine oil 5W-30 to the O-ring, and then install the coupling driver and the O-ring.
 - b. Use a new lock nut and apply engine oil 5W-30 on its seat, and then fix the lock nut using the flange holder 5-8840-2043-0.

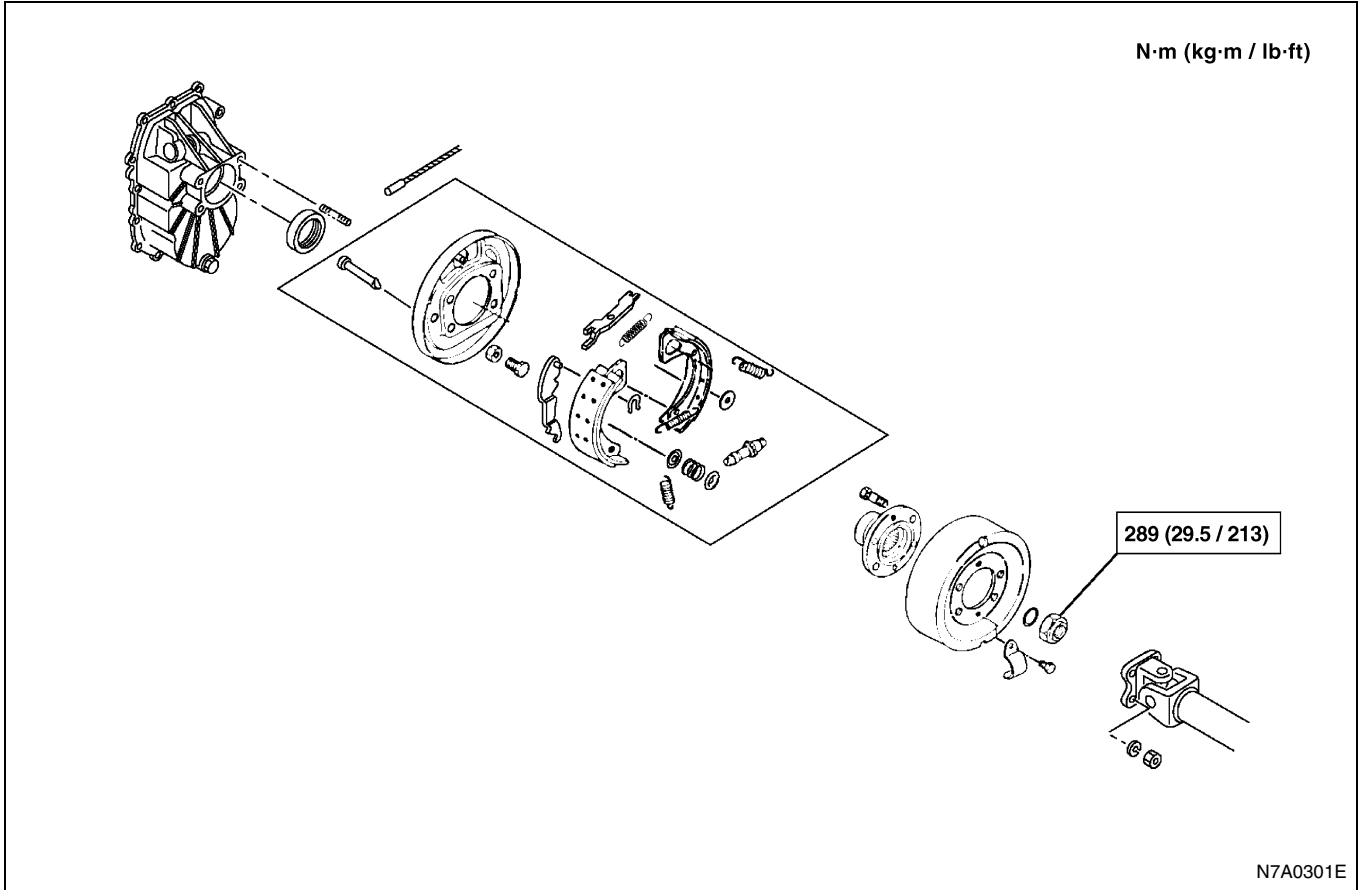
Tighten:

Lock nut to 289 N·m (29.5 kg·m / 213 lb·ft)

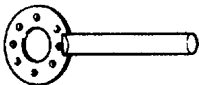
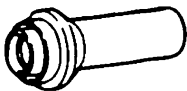


4. Install the parking brake drum.
 - Refer to PARKING BRAKE ASSEMBLY.
5. Install the parking brake cable.
 - Refer to PARKING BRAKE CABLE.
6. Install the rear propeller shaft assembly.
 - Refer to REAR PROPELLER SHAFT ASSEMBLY.

Fixing Torque



Special Tools

Illustration	Tool Number / Description / Remarks
 <p style="text-align: center;">5884020430</p>	5-8840-2043-0 / Flange Holder
 <p style="text-align: center;">5884027500</p>	5-8840-2750-0 / Oil Seal Installer

Transmission Assembly

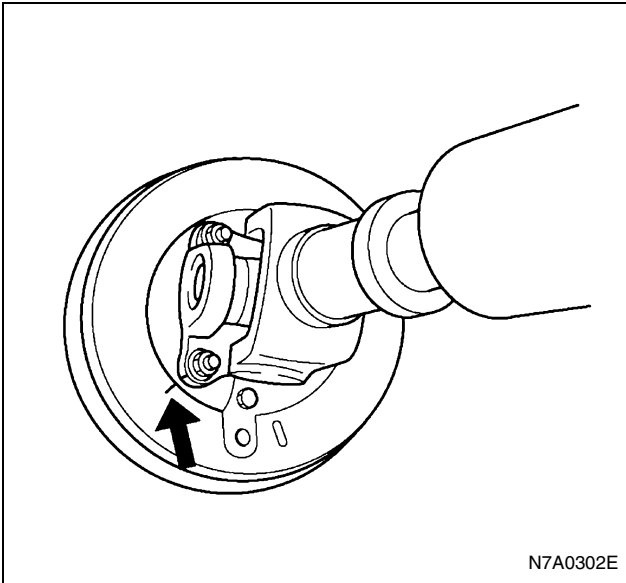
Removal

Preparation: Jack up the vehicle, and support it with rigid racks.

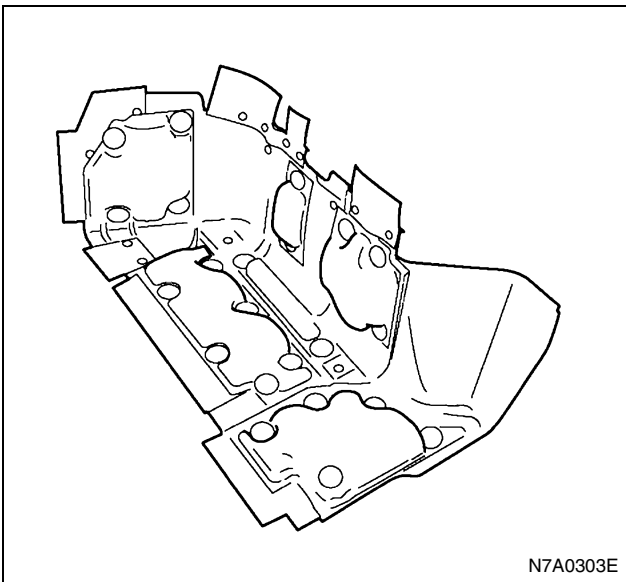
1. Remove the rear propeller shaft assembly.

Caution:

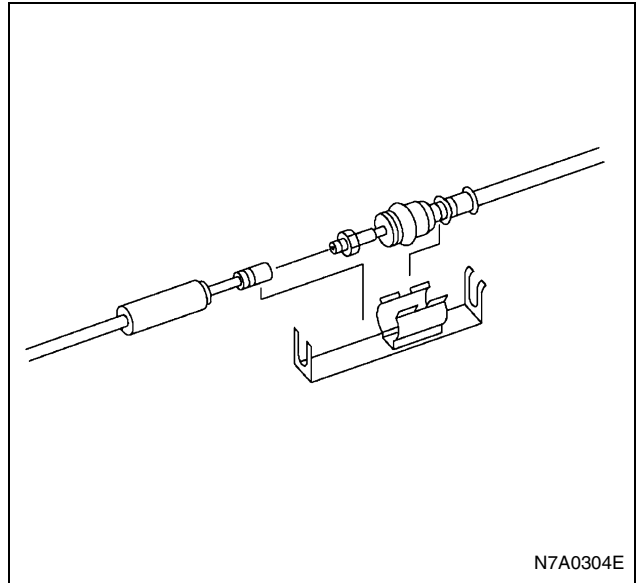
Put an alignment mark on the drum and the flange yoke. Put them aside and hang them up using a wire or something to prevent them from interrupting the work.



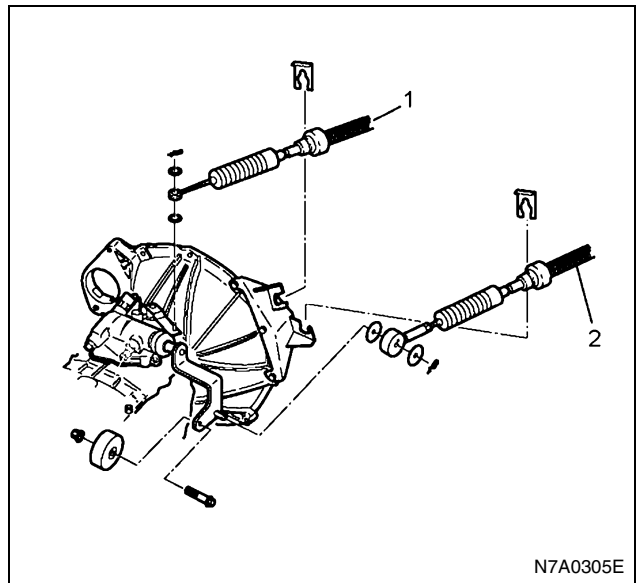
2. Remove the transmission side cover.



3. Remove the connection of the vehicle speed sensor connector.
4. Remove the connection of the neutral switch connector.
5. Remove the connection of the reverse switch connector.
6. Remove the connector from the harness bracket taking care not to damage the clip portion.
7. Disconnect the parking cable.
 - Remove the cable bracket and move the cover, and then disconnect the cable by loosening the longer nut located to the vehicle front side.



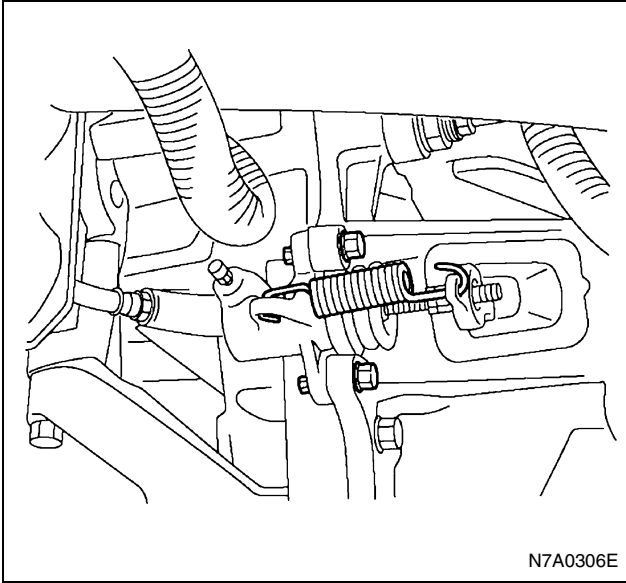
8. Remove the shift cable split pin and disconnect the shift cable.
9. Remove the select cable split pin and disconnect the select cable.



Legend

1. Select cable
2. Shift cable

10. Remove the clutch slave cylinder assembly.
 - Remove the return spring and the securing bolt, and then hang them up using a wire or something to prevent them from interrupting the work.



Installation

1. Install the mounting bracket assembly.

Tighten:

Mounting bracket to 97 N·m (9.9 kg·m / 72 lb·ft)

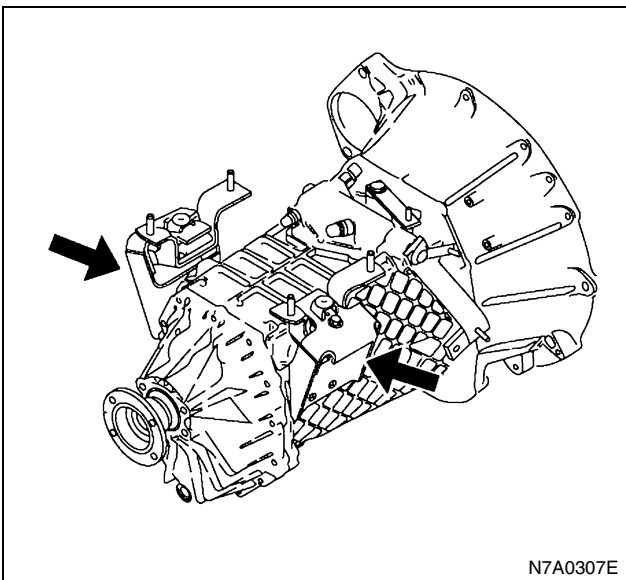
2. Install the transmission assembly.

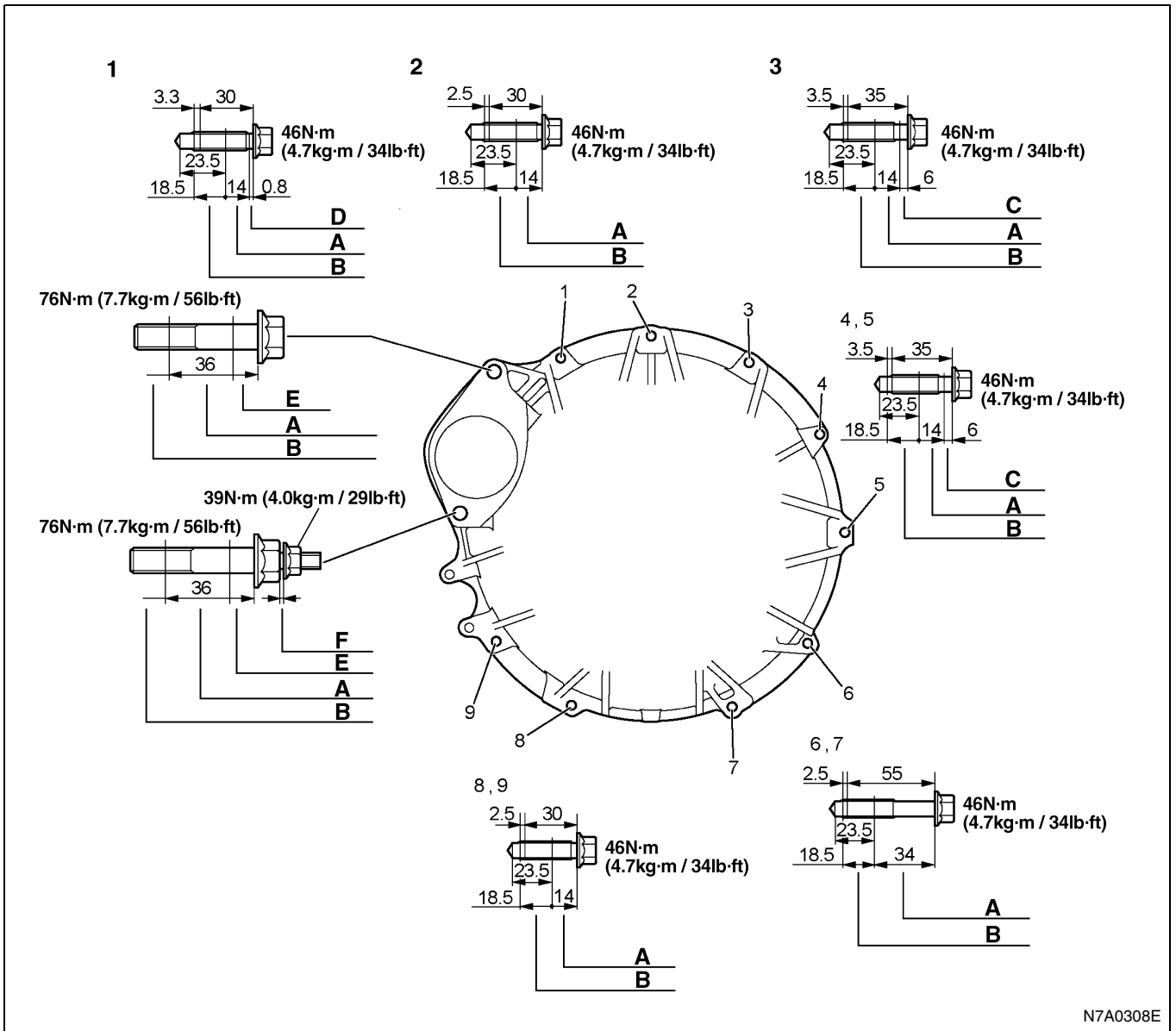
- Fix and secure the transmission in the same way of removal.

Tighten:

Transmission assembly to 46 N·m (4.7 kg·m / 34 lb·ft)

11. Remove the starter ground cable.
12. Remove the starter motor assembly.
 - Hang them up using a wire or something to prevent them from interrupting the work.
13. Remove the nut securing the transmission and the frame (crossmember).
 - Support the engine using a garage jack or a wire, and then set the transmission jack under the transmission and secure it with a chain not to fall down.
 - For the vehicles with a double wishbone type suspension, remove the mounting bracket bolt on the transmission side, if necessary, and remove the mounting bracket.
14. Remove the transmission assembly.
 - Remove the bolt securing the clutch housing, and then remove the transmission assembly by operating the transmission jack.
15. Remove the mounting bracket assembly bolt, and then remove the bracket.





Legend

- | | |
|-------------------------|------------------------|
| A: Clutch housing | D: Harness clip |
| B: Fly wheel housing | E: Starter |
| C: Gear control bracket | F: Engine ground cable |

3. Fix the nut securing the transmission and the frame (crossmember).

Tighten:

Nut to 40 N·m (4.1 kg·m / 30 lb·ft)

- For the vehicles with a double wishbone type suspension, install the mounting bracket on the transmission after installing the transmission.

Tighten:

Mounting bracket on the transmission to 46 N·m (4.7 kg·m / 34 lb·ft)

4. Install the starter motor assembly.

Tighten:

Starter motor assembly to 76 N·m (7.7 kg·m / 56 lb·ft)

5. Install the starter ground cable.

Tighten:

Starter ground cable to 39 N·m (4.0 kg·m / 29 lb·ft)

6. Install the clutch slave cylinder assembly.

Tighten:

Clutch slave cylinder assembly 16 N·m (1.6 kg·m / 12 lb·ft)

7. Install the select cable.

- For installation, refer to GEAR CONTROL CABLE.

8. Install the shift cable.

- For installation, refer to GEAR CONTROL CABLE.

-
9. Install the parking brake cable.
 10. Install the harness connector.
 11. Install the reverse switch connector.
 12. Install the neutral switch connector.
 13. Install the vehicle speed sensor connector.
 14. Install the transmission side cover.
 15. Install the rear propeller shaft assembly aligning it to the alignment mark.

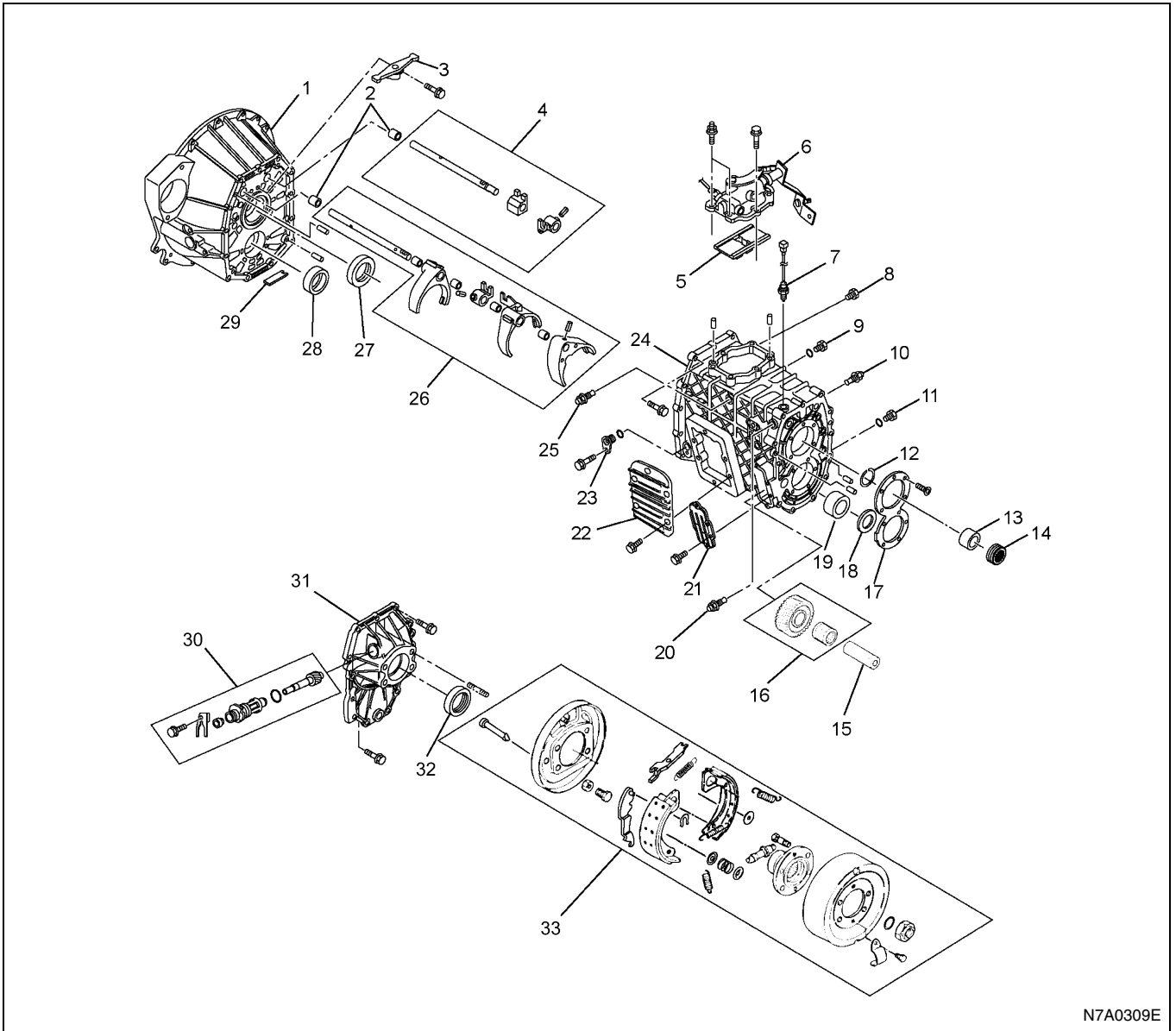
Tighten:

Rear propeller shaft assembly to 102 N·m (10.5 kg·m / 75 lb·ft)

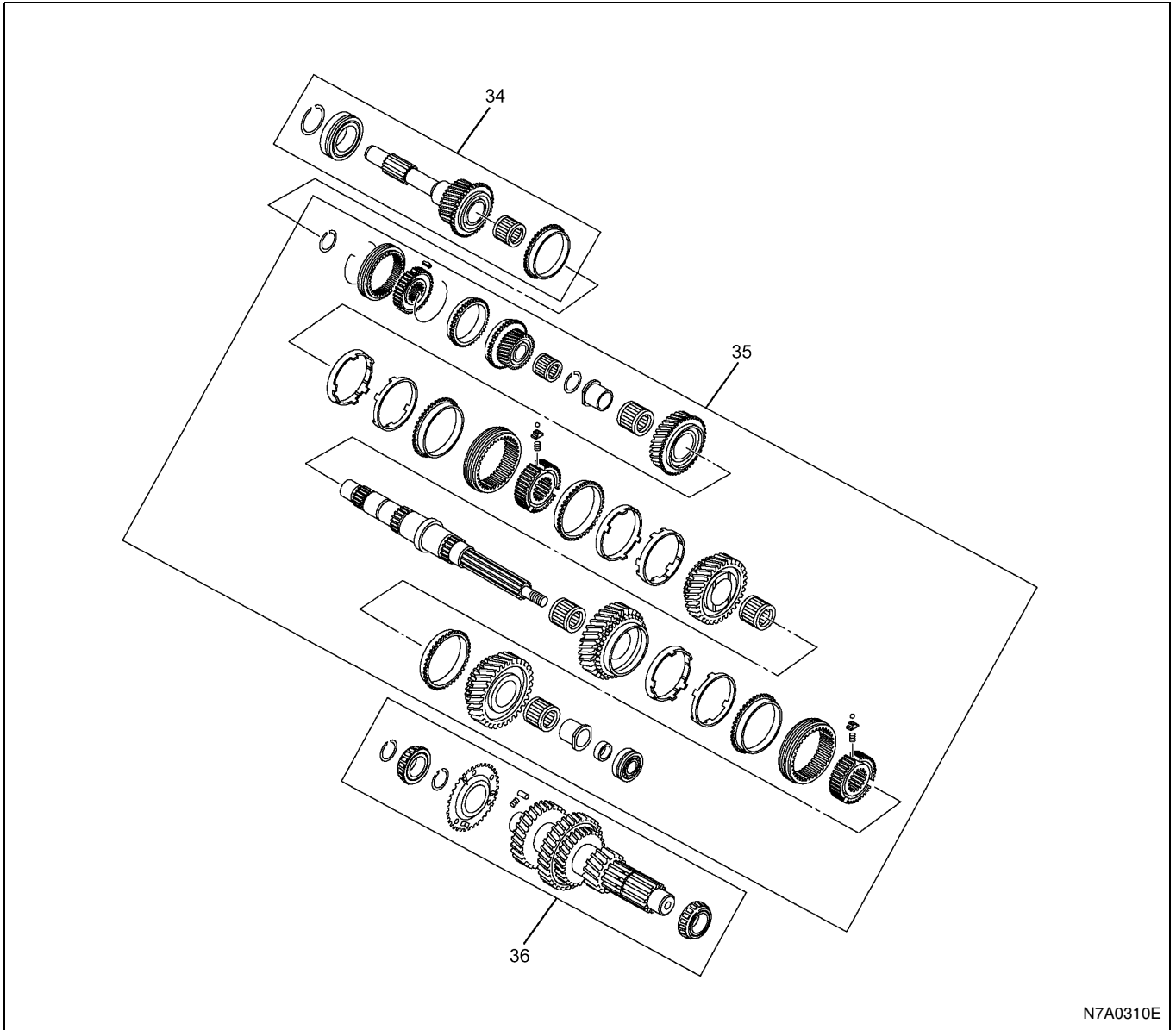
UNIT REPAIR

Transmission (5MT)

Components



N7A0309E



N7A0310E

Legend

- | | |
|--|--|
| 1. Clutch housing | 19. Counter rear bearing |
| 2. Bush; Clutch housing | 20. Detent assembly |
| 3. 5th relay lever | 21. Reverse idle cover |
| 4. 4th-5th shift block | 22. PTO cover |
| 5. Interlock plate | 23. Sensor dummy plug |
| 6. Control box | 24. Transmission case |
| 7. Reverse switch | 25. Detent assembly |
| 8. Detent plug | 26. 1st reverse, 2nd-3rd and 4th-5th shift arm |
| 9. Filler plug | 27. Front oil seal |
| 10. Detent assembly | 28. Bearing outer race |
| 11. Drain plug | 29. Magnet |
| 12. Snap ring | 30. Speedometer driven gear |
| 13. Collar | 31. Rear cover |
| 14. Speedometer gear | 32. Rear oil seal |
| 15. Reverse idle shaft | 33. Parking brake assembly |
| 16. Reverse idle gear and needle bearing | 34. Top gear shaft assembly |
| 17. Retainer | 35. Main shaft assembly |
| 18. Shim; Counter | 36. Counter shaft assembly |

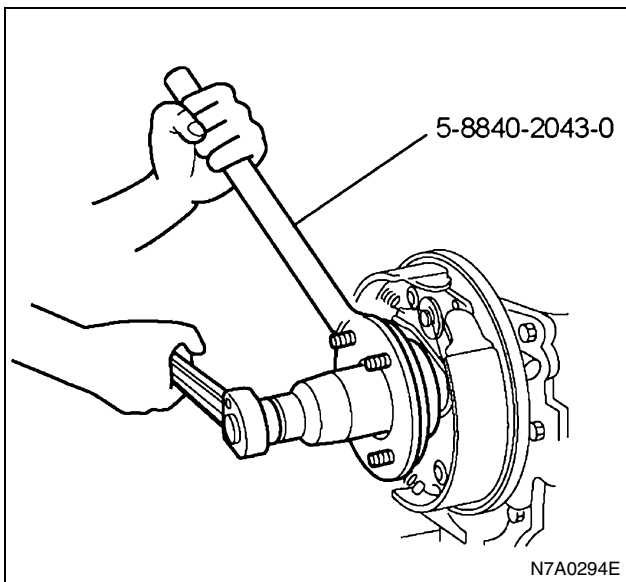
Disassembly

Caution:

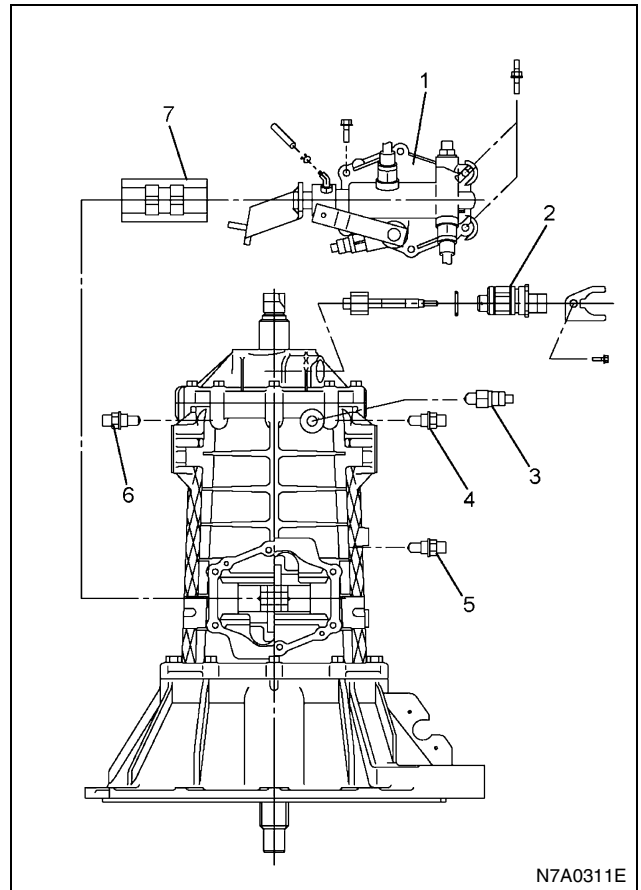
Be careful not to damage the transmission case and the clutch housing because they are made of aluminum. Further attention should be paid to the rib because its damage weakens hardness of the case.

Do not hurt yourself when working on something heavy such as cases and gears.

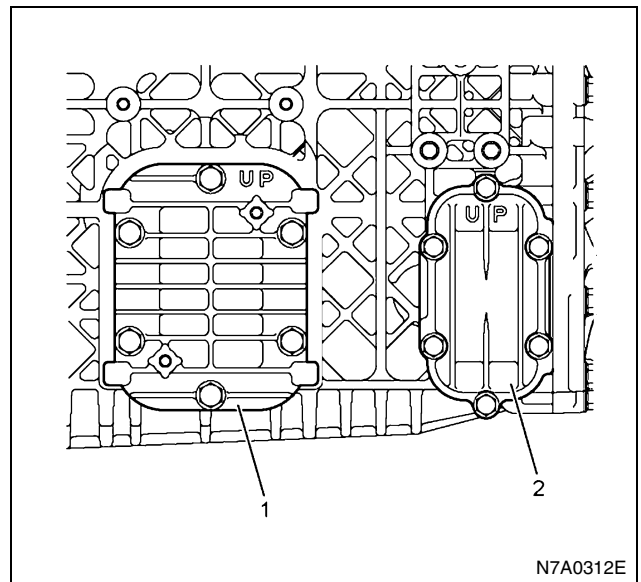
1. Remove the shift block assembly.
 - Refer to CLUTCH.
2. Remove the shift fork and the support bolt.
 - Refer to CLUTCH.
3. Remove the bolt securing the adjust hole cover and remove the parking brake drum.
 - Refer to PARKING BRAKE ASSEMBLY.
4. Raise the caulking portion (2 parts) of the coupling driver lock nut securely, and then remove the lock nut using the flange holder 5-8840-2043-0.



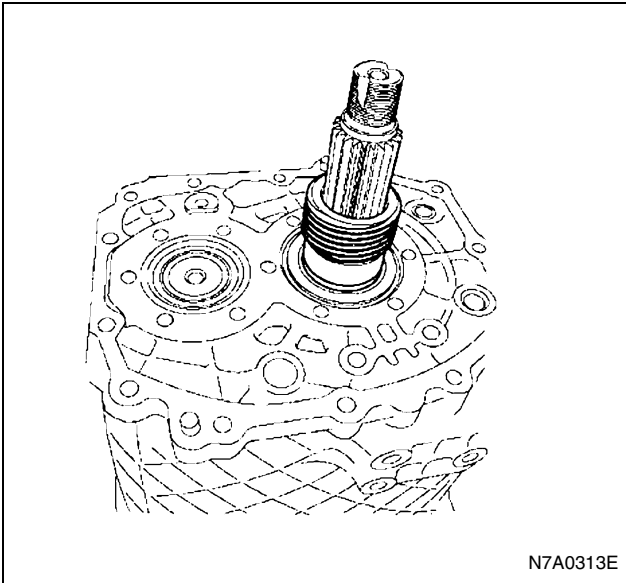
5. Remove the coupling driver and O-ring.
6. Remove the parking brake assembly.
 - Refer to PARKING BRAKE ASSEMBLY.
7. Remove the filler plug and O-ring.
8. Remove the drain plug and O-ring.
 - Drain the transmission oil. Check the amount of oil and the existence of metal particles and foreign matters while draining oil.
9. Remove the speedometer driven gear (2).
10. Remove the reverse switch (3).
11. Remove the detent assembly (4)(5)(6).
12. Remove the control box (1) and the interlock plate (7).



13. Remove the PTO cover (1).
14. Remove the reverse idle cover (2).

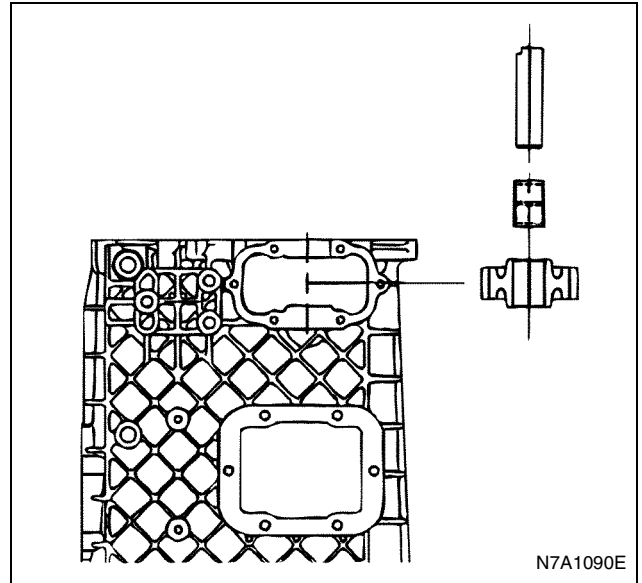


15. Remove the rear cover assembly.
16. If worn or damaged parts are found after checking the rear cover oil seal, remove the oil seal from rear cover using the flat-tip screwdriver.
17. Remove the speedometer gear and collar.



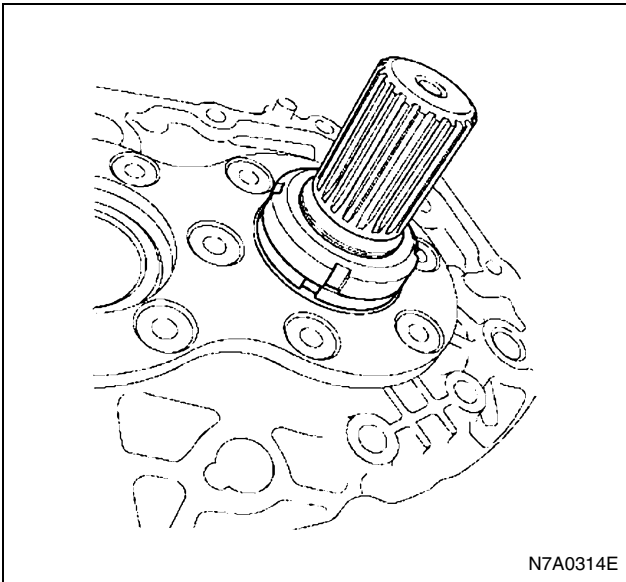
N7A0313E

18. Remove the main shaft end lock nut using the wrench 5-8840-2798-0. (4WD model)



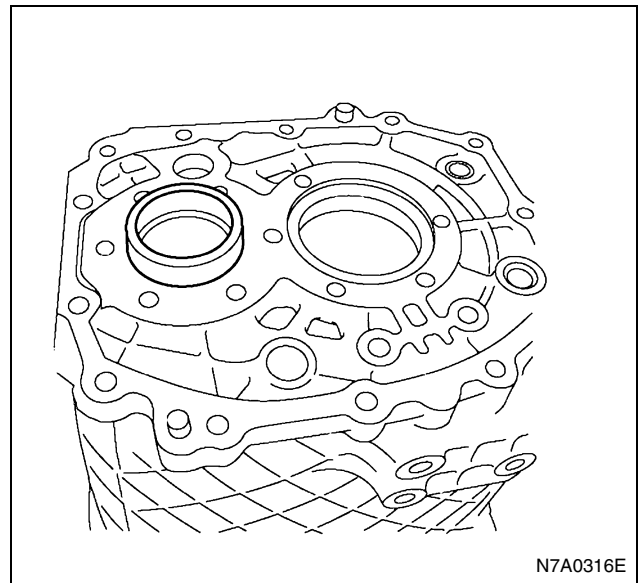
N7A1090E

21. Remove the snap ring from the main shaft rear bearing.
22. Remove the shim from the counter shaft rear bearing.
23. Remove the transmission case from the clutch housing.
24. Remove the bearing rear outer race from the transmission case.



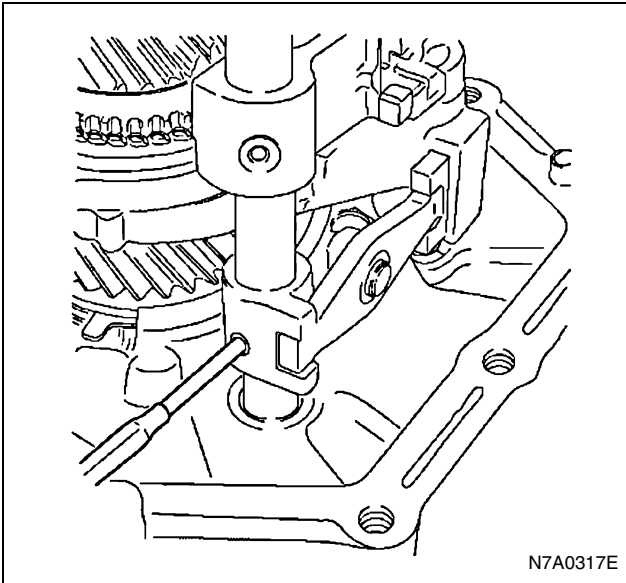
N7A0314E

19. Remove the retainer from the transmission case.
20. Pull out the reverse idle shaft, and then remove the reverse idle gear and the needle bearing.

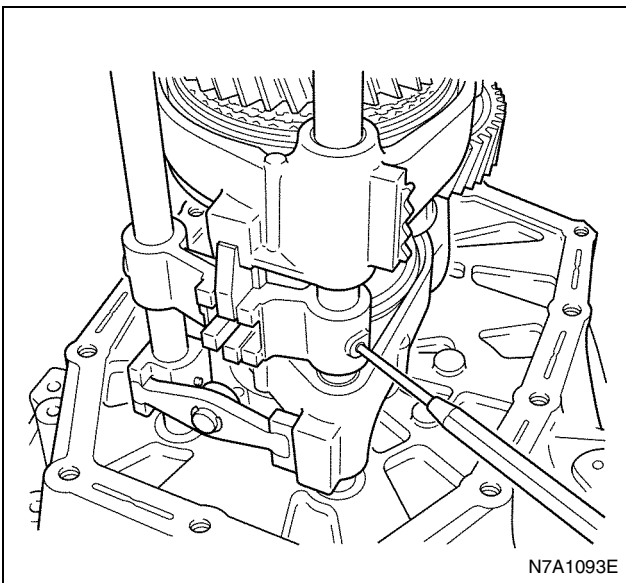


N7A0316E

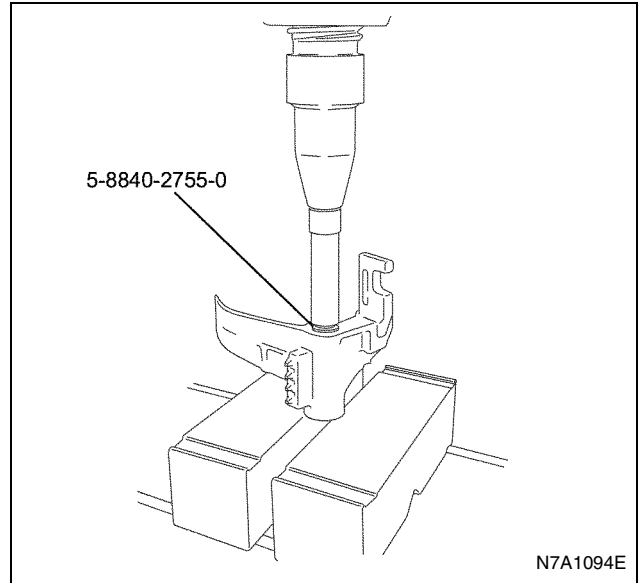
25. Remove the 4th-5th shift rod, 4th-5th main shift block and 4th-5th sub shift block.
 - When driving out the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then remove the spring pin using the spring pin remover.



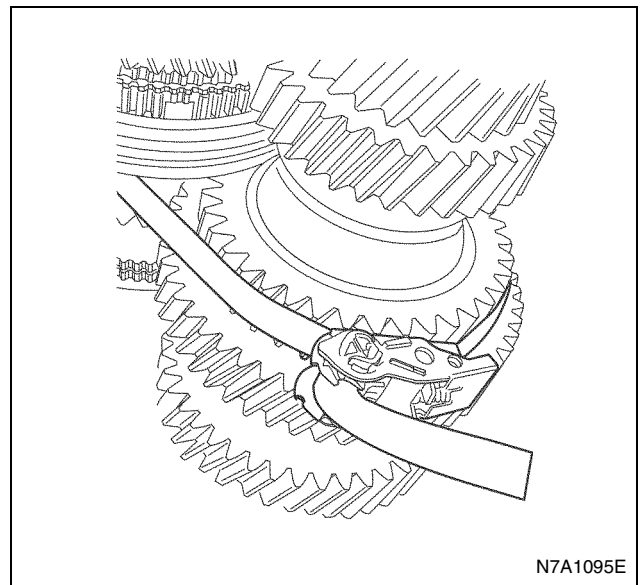
26. Remove the 1st-reverse and 2nd-3rd shift rod, 1st-reverse shift arm, 2nd-3rd shift arm, 1st-reverse shift block, and 4th-5th shift arm.
- When driving out the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then remove the spring pin using the spring pin remover.



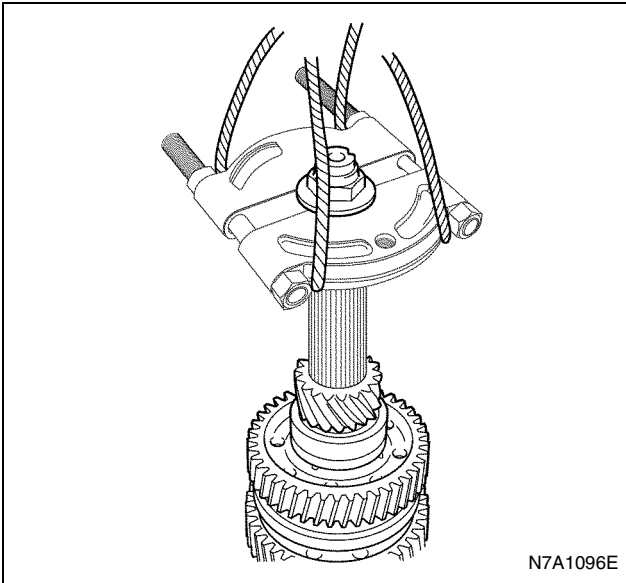
27. Remove the bush from the 2nd-3rd shift arm using the remover 5-8840-2755-0.
28. Remove the bush from the 4th-5th shift arm using the remover 5-8840-2755-0.
- Use the remover with a round pole whose length is enough to push the remover to the end.



29. Remove the 5th relay lever from the clutch housing.
30. Remove the magnet from the clutch housing.
31. Remove the main shaft assembly, the top gear shaft assembly and counter shaft assembly.
- a. Tie the main shaft assembly, the counter shaft assembly and the top gear shaft assembly at the two positions not to let them come apart using a lashing belt or other belts with a fixing function, and then fix them securely.

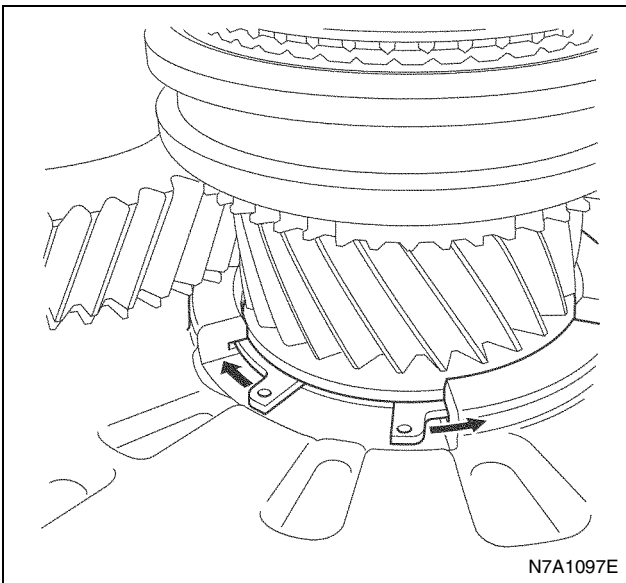


- b. Install the bearing remover to the main shaft and secure it with a lock nut, hang them with a hoist and a wire, and then remove the top gear shaft assembly, the main shaft assembly, the counter shaft assembly from the clutch housing as a unit while spreading the top gear shaft bearing outer snap ring installed to the clutch housing.

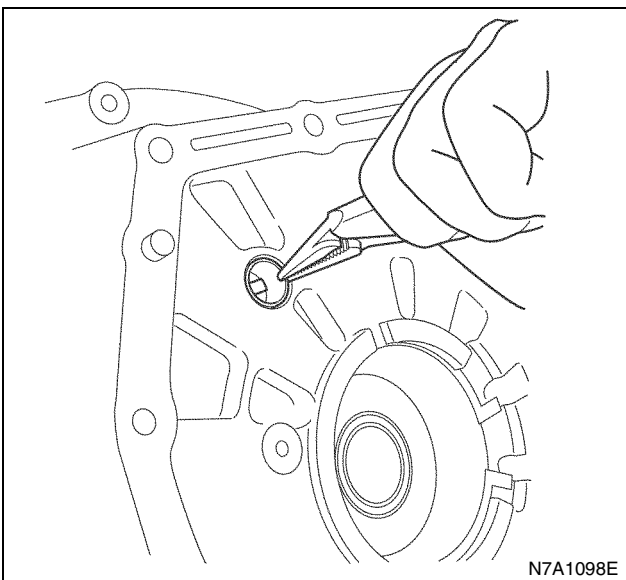
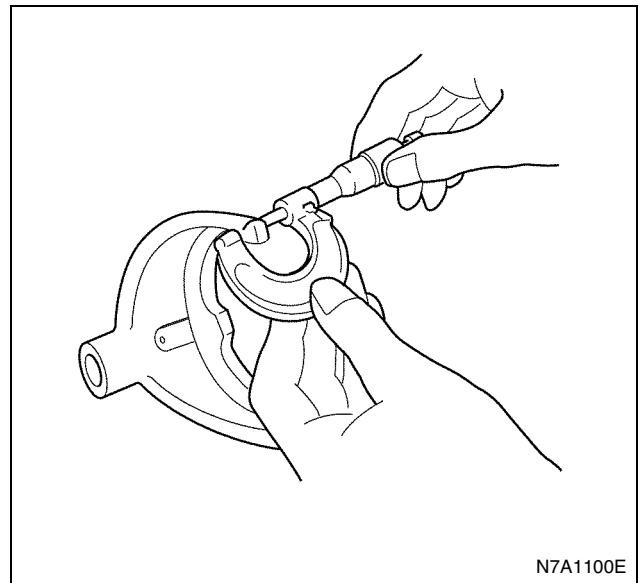


33. Check the front oil seal, and then remove it from the clutch housing using a flat-tip screwdriver if it is worn or damaged.
34. Check each part, and then correct and replace it if some worn, damaged or faulty parts are found. Check each part of the shift mechanism, and then correct light damage, deflection or stepped wear. Replace it when it is heavily damaged or its usage limit is over.
 - Deflection, wear and damage of the shift rod and the shift arm
 - Shift arm thickness
 - Measure the thickness of the shift arm tip using the micrometer.

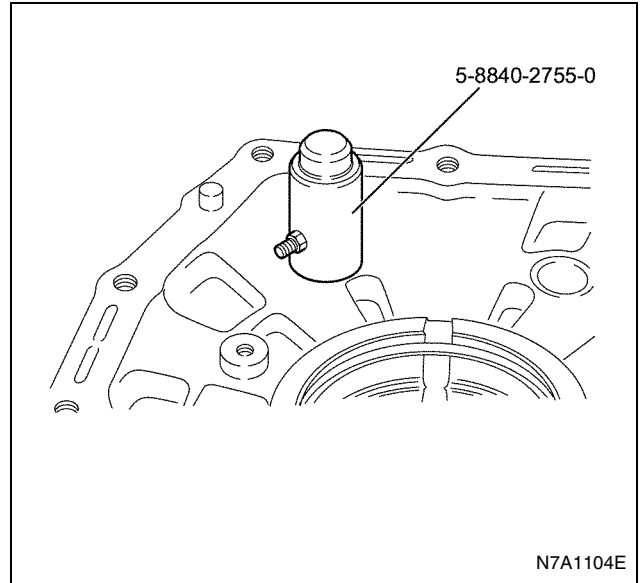
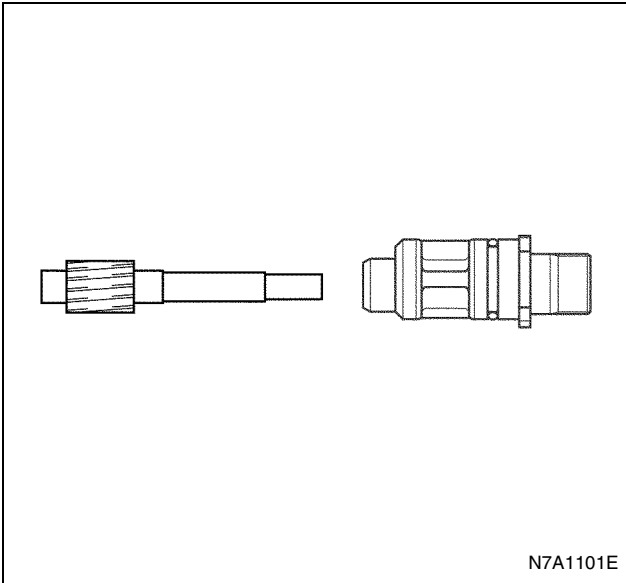
Shift arm thickness, mm (in)		
	Standard	Limit
1st-reverse	9.60 — 9.85	9.0 (0.354)
3rd-2nd	(0.377 —	
5th-4th	0.387)	



32. Check the clutch housing bush, and then remove it from the clutch housing using a pliers if it is worn or damaged.



35. Check the wear of the speedometer driven gear and the driven gear bush.
 - Replace them if they are heavily worn.

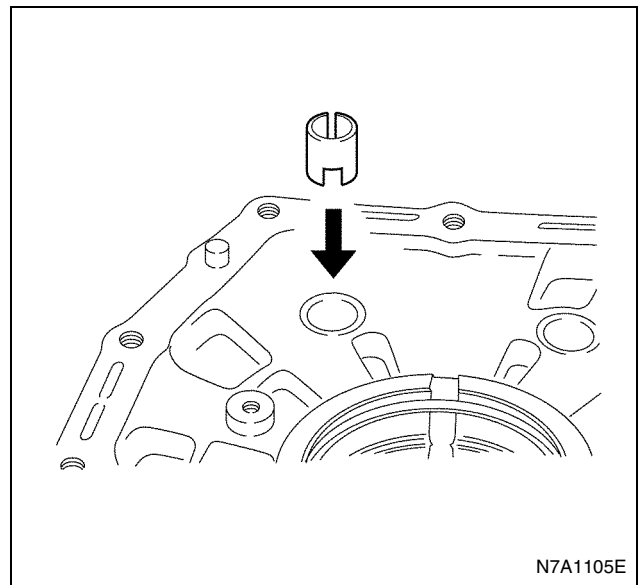
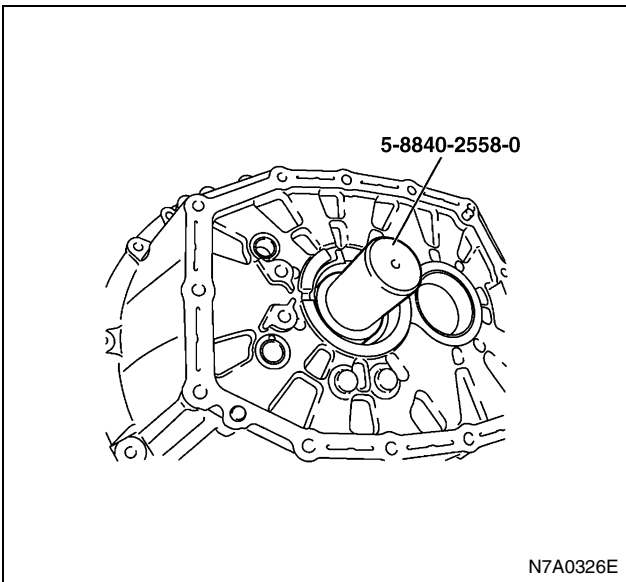


Assembly

1. When finding the oil seal worn and damaged after the check and replacing it with a new one, apply engine oil 5W-30 around the oil seal, and then press in the oil seal into the clutch housing using the installer 5-8840-2558-0, or when the front PTO is equipped, using the installer 5-8840-2754-0 and the grip 5-8840-0007-0.
 - Apply Besco L2 grease on the oil seal lip portion.

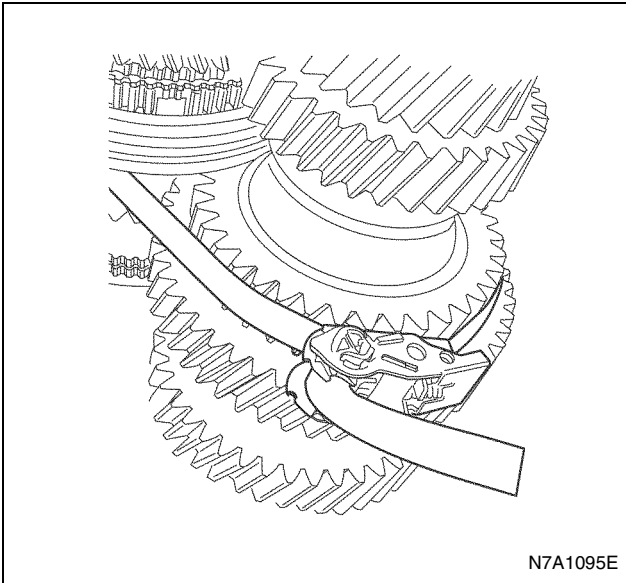
Caution:

Be careful not to damage the oil seal lip portion.



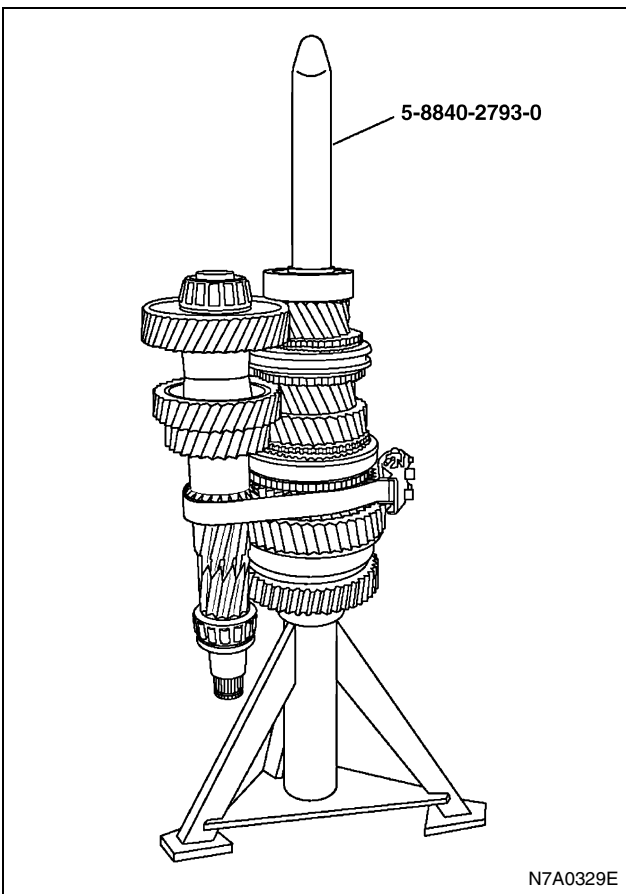
3. Install the main shaft assembly, the top gear shaft assembly and the counter shaft assembly.
 - a. Tie the main shaft assembly, the counter shaft assembly and the top gear shaft at the two positions not to let them come apart using a lashing belt or other belts with a fixing function, and then fix them securely. Be careful not to drop the top gear shaft while lifting up.

2. When the clutch housing bush is replaced with a new one after checking it for wear and damage, press it in using the installer 5-8840-2755-0.
 - During installation, caulk three portions securely except older caulking portions and grooves.



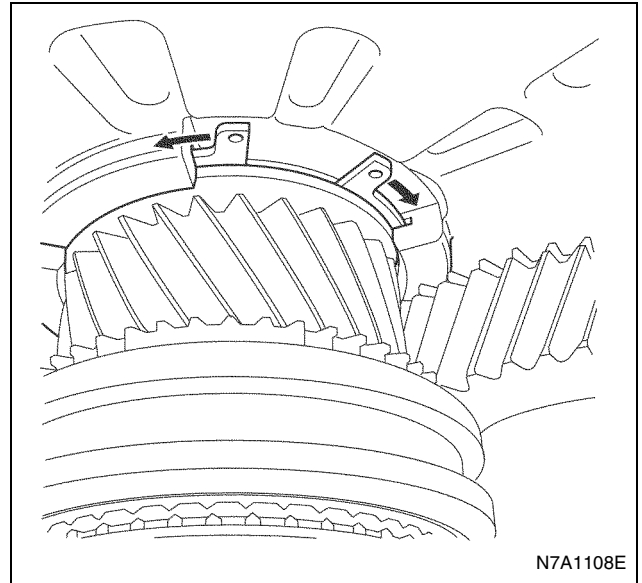
N7A1095E

- b. Stick up the three of the top gear shaft assembly, the main gear shaft assembly and the counter shaft assembly on the support stand as the top gear shaft assembly is put on the top.
- c. Install the oil seal protector 5-8840-2793-0 to the main shaft.



N7A0329E

- d. Set the top gear shaft bearing outer snap ring to the clutch housing, spread it using a snap ring pliers, and then insert it to the clutch housing after aligning the top gear shaft, the counter shaft and the shift rod positions.



N7A1108E

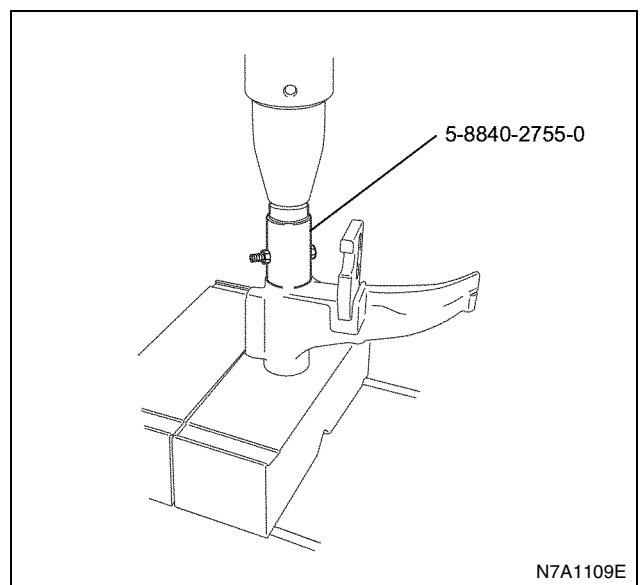
Caution:

- Make sure the snap ring is installed securely.
 - Work carefully not to damage the front oil seal.
4. Install the magnet to the clutch housing.
 5. Install the 5th relay lever to the clutch housing.

Tighten:

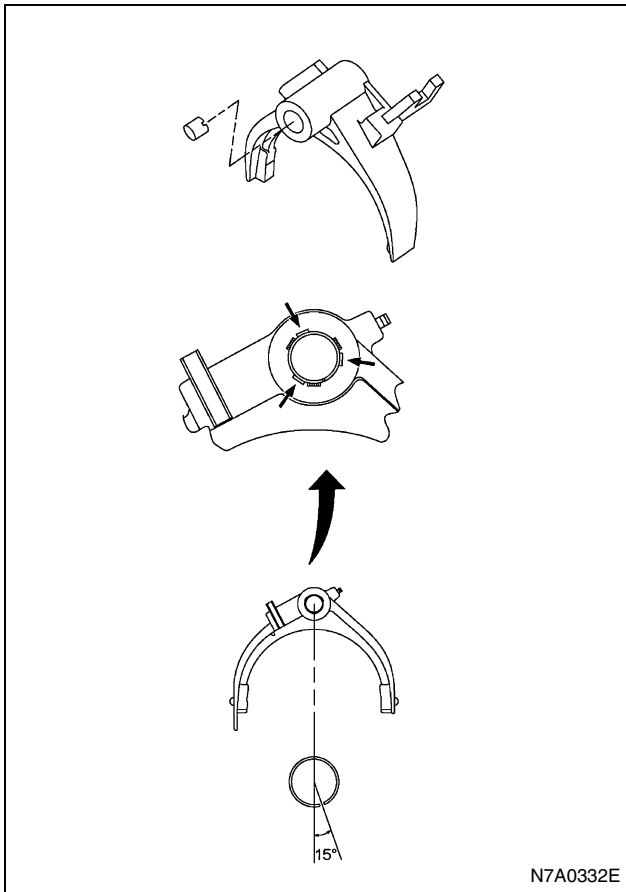
5th relay lever to 44 N·m (4.5 kg·m / 34 lb·ft)

6. When replacing the 4th-5th shift arm bush with a new one after checking it for wear or damage, press fit the bush using the installer 5-8840-2755-0.
7. When replacing the 2nd-3rd shift arm bush with a new one after checking it for wear or damage, press in the bush using the installer 5-8840-2755-0.

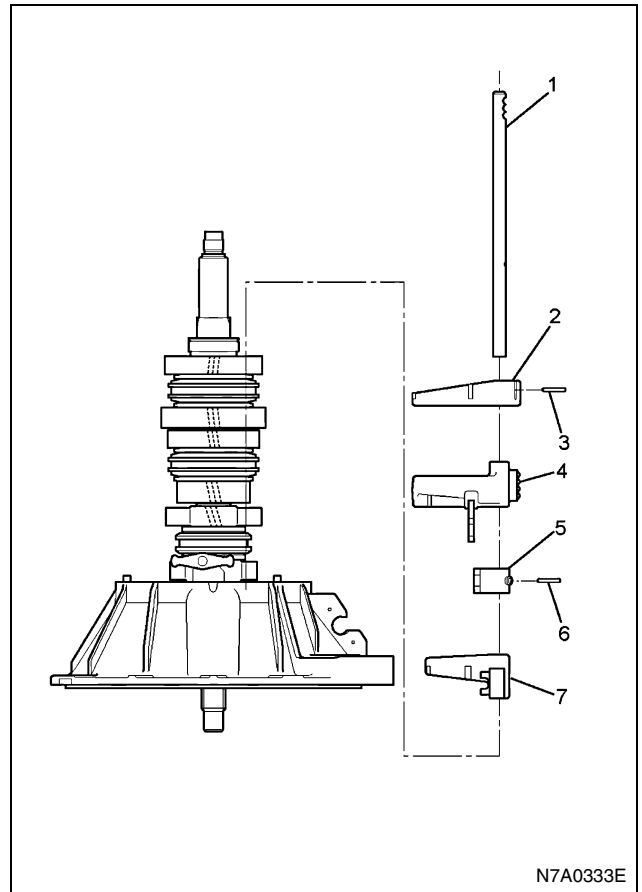


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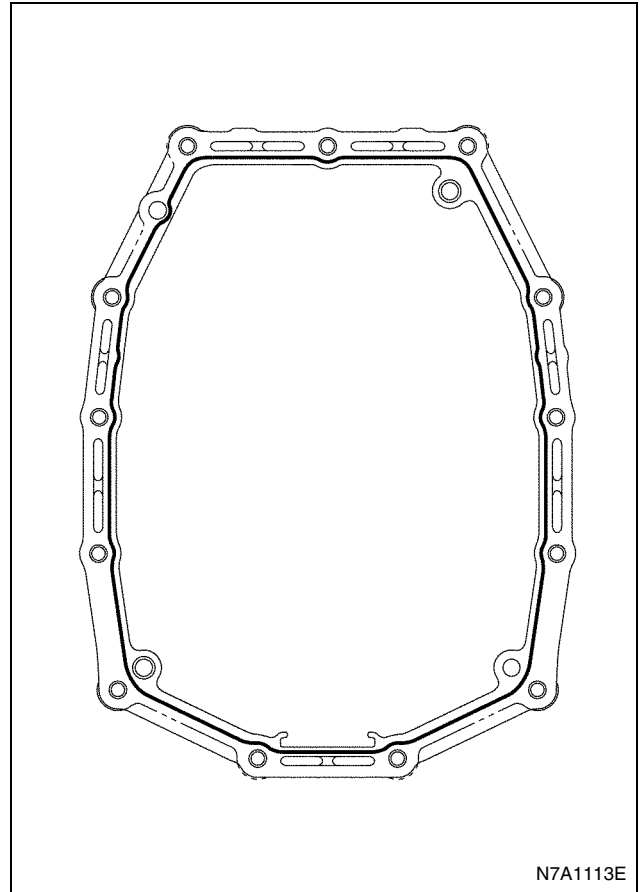
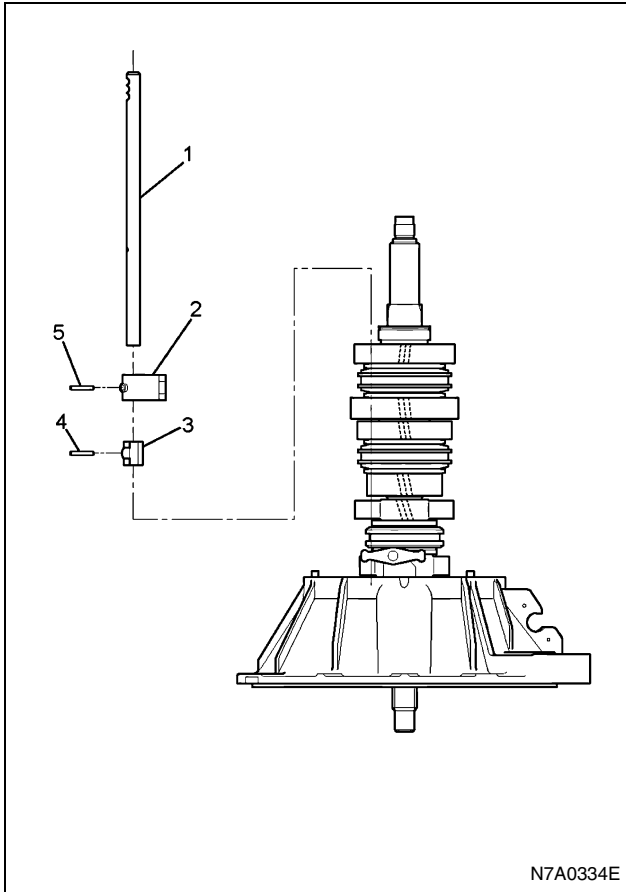
- Press it taking care of the direction and angle of the shift arm bush, caulk the three portions except the bush cut and older caulking portions.



8. Install the 4th-5th shift arm (7), the 1st-reverse shift block (5), the 2nd-3rd shift arm (4), the 1st-reverse shift arm (2), and the 1st-reverse and 2nd-3rd shift rod (1).
- Drive the spring pin (3) and (6) using a hammer after aligning the spring pin hole.
 - When pressing in the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then press in the spring pin.



9. Install the 4th-5th sub shift block (3), 4th-5th main shift block (2), 4th-5th shift rod (1).
- Drive in the spring pin (4) and (5) using a hammer after aligning the spring pin hole.
 - When pressing in the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then press in the spring pin.

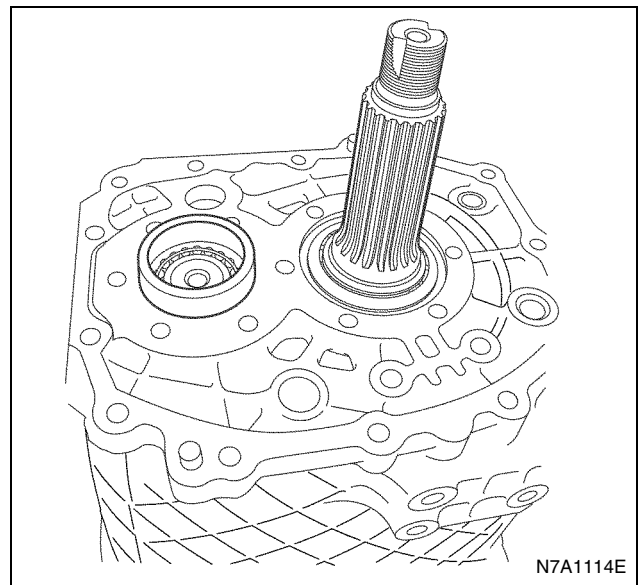


10. Apply ThreeBond 1215 to the mating surface of the transmission case and the clutch housing, and then install the clutch housing.
- Wipe off moisture and lubricant from the mating surface, and then apply the bond continuously with a diameter of 2 mm (0.079 in) or more.

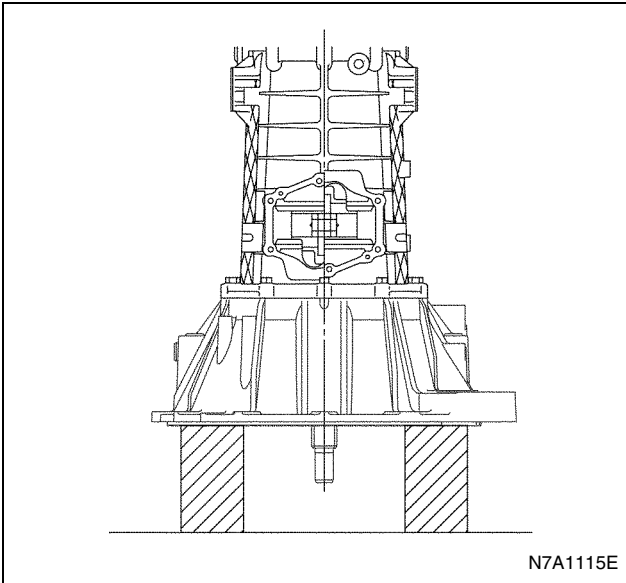
Tighten:

Clutch housing to 46 N·m (4.7 kg·m / 34 lb·ft)

11. Install the bearing rear outer race to the transmission case.



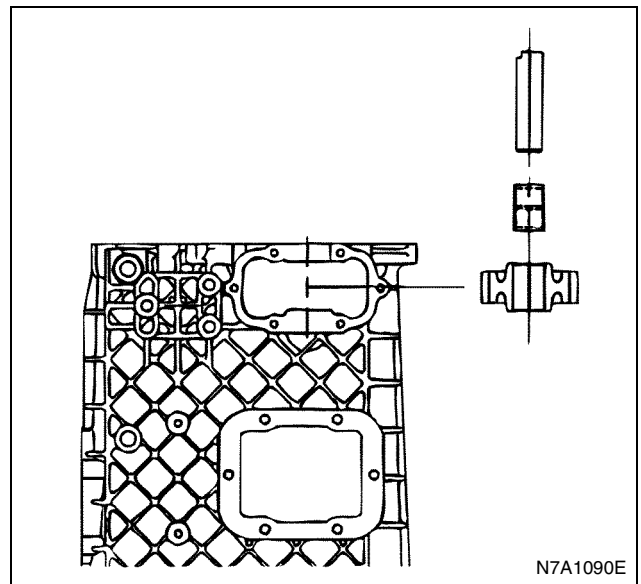
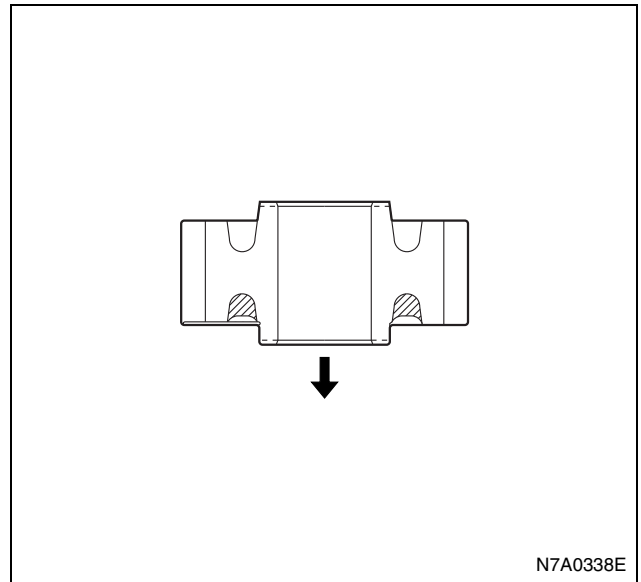
12. Install the shim to the counter shaft rear bearing.
- Shift the position to the neutral.
 - Set the transmission assembly with the clutch housing faced down.



- c. Revolve the counter shaft more than 30 times and smooth the taper roller bearing.
- d. Select the counter shim.
 - Measure the depth at the points equally divided into three from the end surface of the transmission case to the outer ring edge surface of the counter shaft rear bearing, and then take an average of them.
 - Select the shim whose thickness agrees with the list below.

Measured value, mm (in) more than — less than	Thickness of applicable shim
3.34 — 3.40 (0.132 — 0.133)	3.19 (0.125)
3.28 — 3.34 (0.130 — 0.131)	3.13 (0.123)
3.22 — 3.28 (0.127 — 0.129)	3.70 (0.120)
3.16 — 3.22 (0.125 — 0.126)	3.01 (0.118)
3.10 — 3.16 (0.122 — 0.124)	2.95 (0.116)
3.04 — 3.10 (0.120 — 0.122)	2.89 (0.113)
2.98 — 3.04 (0.118 — 0.119)	2.83 (0.111)
2.92 — 2.98 (0.115 — 0.117)	2.77 (0.109)
2.86 — 2.92 (0.113 — 0.114)	2.71 (0.106)
2.80 — 2.86 (0.110 — 0.112)	2.65 (0.104)
2.74 — 2.80 (0.108 — 0.110)	2.59 (0.101)
2.68 — 2.74 (0.106 — 0.107)	2.53 (0.099)
2.62 — 2.68 (0.104 — 0.105)	2.47 (0.097)
2.56 — 2.62 (0.101 — 0.103)	2.41 (0.094)
2.50 — 2.56 (0.099 — 0.100)	2.35 (0.092)
2.44 — 2.50 (0.096 — 0.098)	2.29 (0.090)
2.38 — 2.44 (0.094 — 0.096)	2.23 (0.087)
2.32 — 2.38 (0.092 — 0.093)	2.17 (0.085)
2.26 — 2.32 (0.089 — 0.091)	2.11 (0.083)

- 13. Install the snap ring to the main shaft rear bearing.
- 14. Apply engine oil 5W-30 to the needle bearing, install the reverse idle gear and needle bearing, and then insert the reverse idle shaft.
 - The arrow mark shows the direction of the transmission front side.



- 15. Install the retainer to the transmission case.

Tighten:

Retainer to 26 N·m (2.7 kg·m / 19 lb·ft)

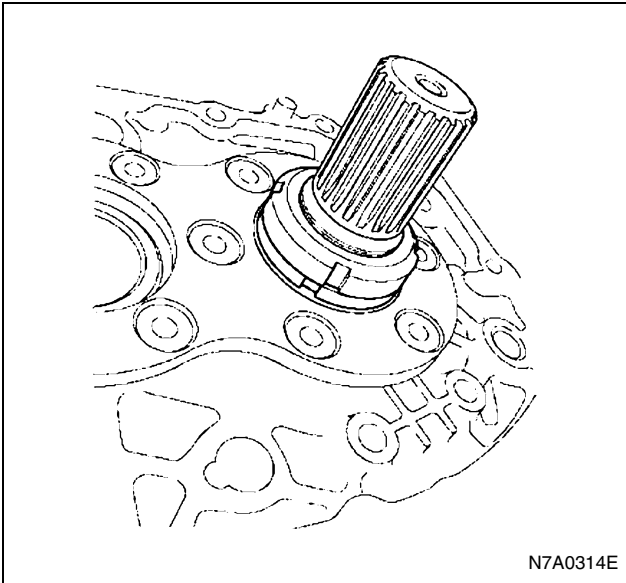
Caution:

Clean up the sealing agent on the screw thread of the transmission case and replace all screws with new ones.

- 16. Fix the main shaft end lock nut using the wrench 5-8840-2798-0. (4WD model)

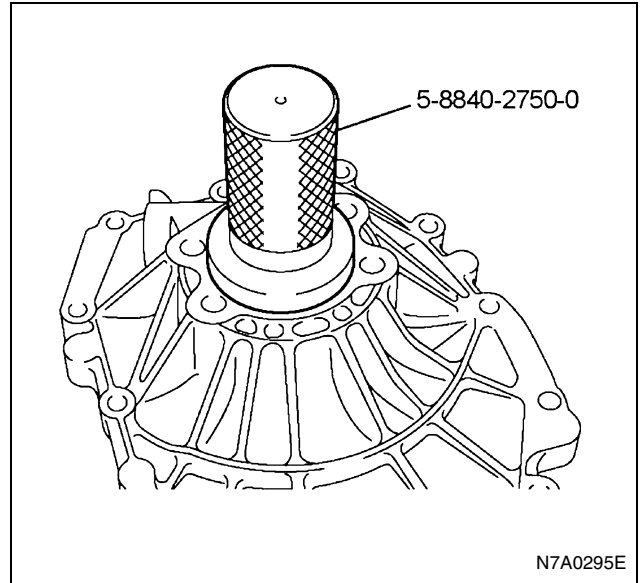
Tighten:

Main shaft end lock nut to 359 N·m (36.6 kg·m / 265 lb·ft)



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17. Install the collar and speedometer gear.



N7A0295E

19. Apply ThreeBond 1215 to the mating surface of the transmission case rear cover, and then install the rear cover.

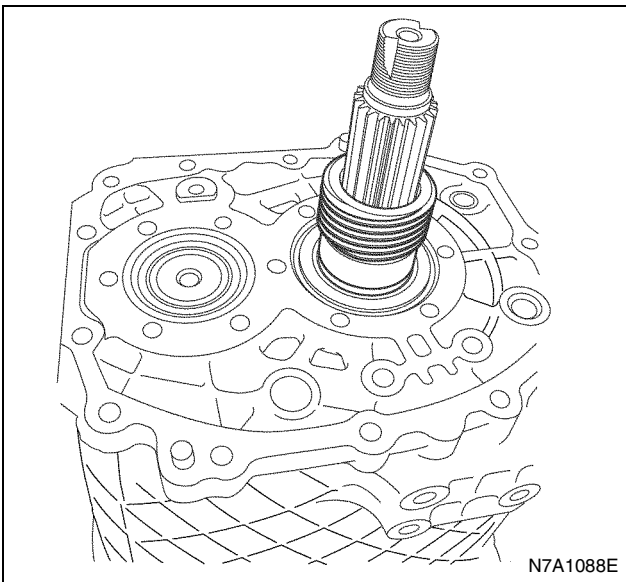
Wipe off moisture and lubricant from the connecting surface, and then apply the gasket continuously with a diameter of 2 mm (0.079 in) or more.

Caution:

Since the two bolts with arrow marks are installed with LOCTITE sealing agent, clean up the sealing agent remaining on the screw thread of the transmission case, and then use new bolts with LOCTITE sealing agent.

Tighten:

Rear cover to 46 N·m (4.7 kg·m / 34 lb·ft)



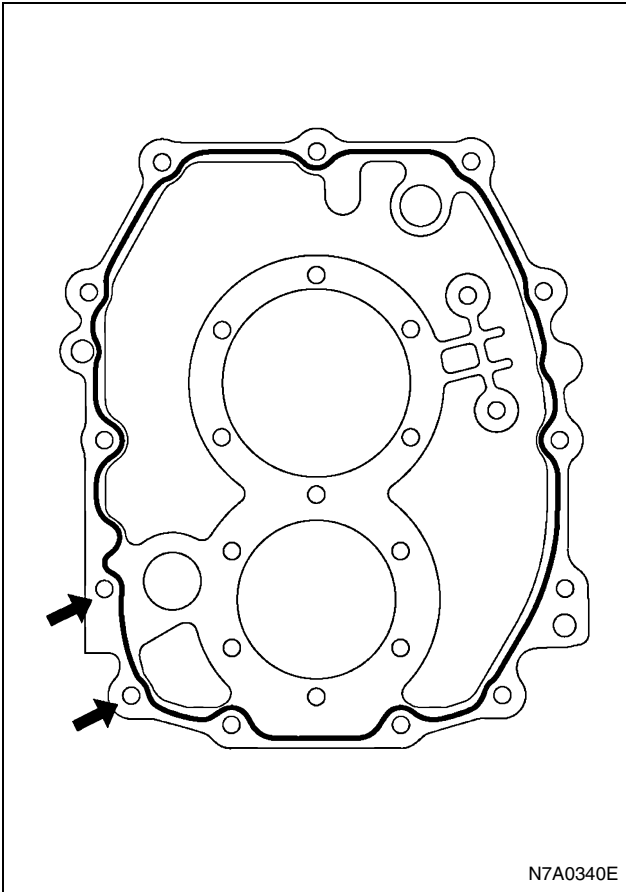
N7A1088E

18. When replacing the oil seal of the rear cover with a new one after checking it for wear or damage, apply engine oil 5W-30 around the oil seal, and then press it in to the rear cover using the installer 5-8840-2750-0.

- Apply Besco L2 grease to the oil seal lip.

Caution:

Be careful not to damage the lip portion of the oil seal.

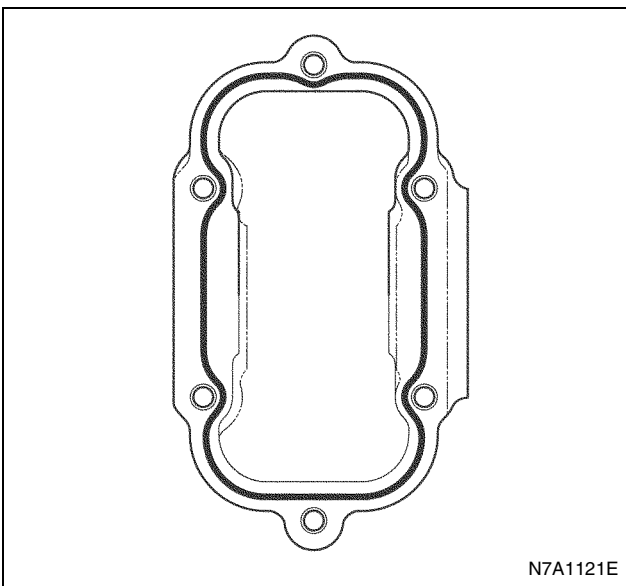


20. Apply ThreeBond 1215 to the mating surface of the transmission case reverse idle cover, and then install the reverse idle cover.

Tighten:

Reverse idle cover to 20 N·m (2.0 kg·m / 15 lb·ft)

- Wipe off moisture water and lubricant from the mating surface, and then apply the gasket continuously with a diameter of 2 mm (0.079 in) or more.



21. Apply ThreeBond 1215 to the mating surface of the transmission case front side cover, and then install the PTO cover.

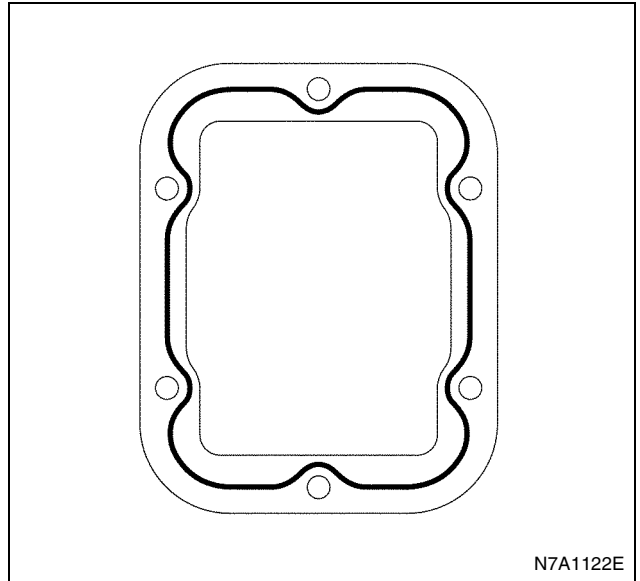
- Wipe off moisture and lubricant from the mating surface, and then apply the gasket continuously with a diameter of 2 mm (0.079 in) or more.

Tighten:

PTO cover to 37 N·m (3.8 kg·m / 27 lb·ft)

Caution:

Since the bolt is installed with LOCTITE sealing agent, clean up the sealing agent remaining on the screw thread of the transmission case, and then use a new bolt with LOCTITE sealing agent.



22. Shift the position to the neutral, apply ThreeBond 1215 to the mating surface of the transmission case control box, and then install the interlock plate (7) and the control box (1).

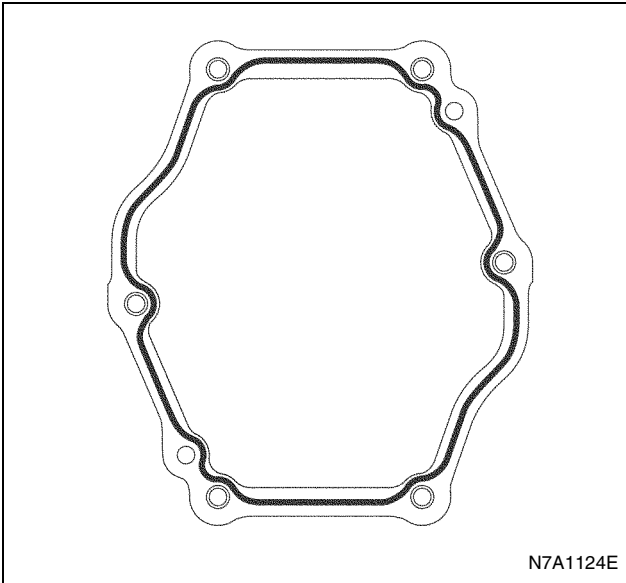
- Wipe off moisture and lubricant from the mating surface, and then apply the gasket continuously with a diameter of 2 mm (0.079 in) or more.

Tighten:

Control box (1) to 27 N·m (2.8 kg·m / 20 lb·ft)

Caution:

Since the bolt is installed with LOCTITE sealing agent, clean up the sealing agent remaining on the screw thread of the transmission case, and then use a new bolt with LOCTITE sealing agent.



23. Install the detent assembly (6) (5) (4).

Tighten:

Detent assembly (6) (5) (4) to 27 N·m (2.8 kg·m / 20 lb·ft)

24. Apply Three Bond 1141 to the reverse switch thread portion, and then install the reverse switch (3).

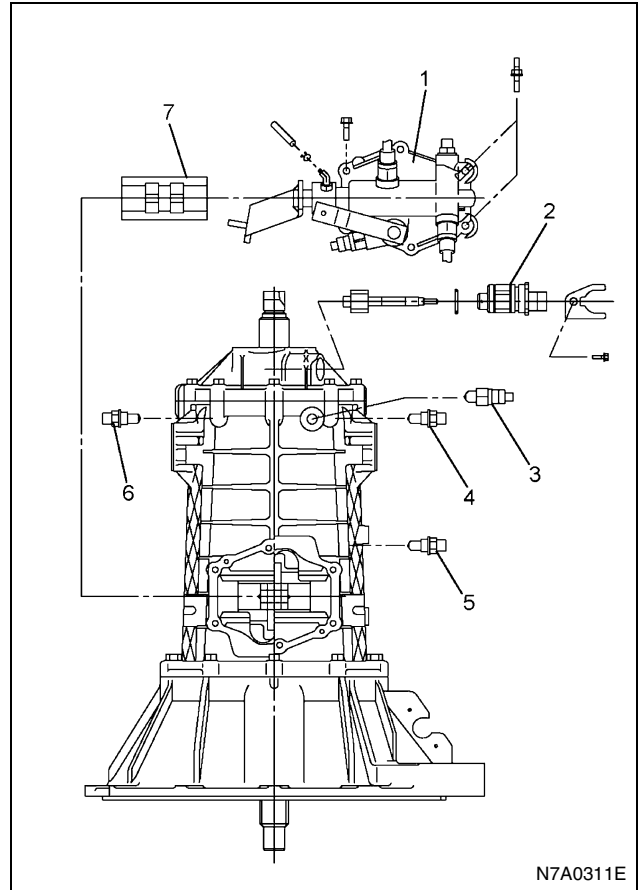
Tighten:

Reverse switch (3) to 39 N·m (4.0 kg·m / 29 lb·ft)

25. Apply engine oil 5W-30 to the speedometer driven gear and the O-ring, and then install the speedometer driven gear (2).

Tighten:

Speedometer driven gear (2) to 20 N·m (2.0 kg·m / 15 lb·ft)



26. Apply engine oil 5W-30 to the O-ring, and then install the drain plug and the O-ring.

Tighten:

Drain plug to 39 N·m (4.0 kg·m / 29 lb·ft)

27. Apply engine oil 5W-30 to the O-ring, and then install the filler plug and the O-ring.

Tighten:

Filler plug to 39 N·m (4.0 kg·m / 29 lb·ft)

28. Install the parking brake assembly.

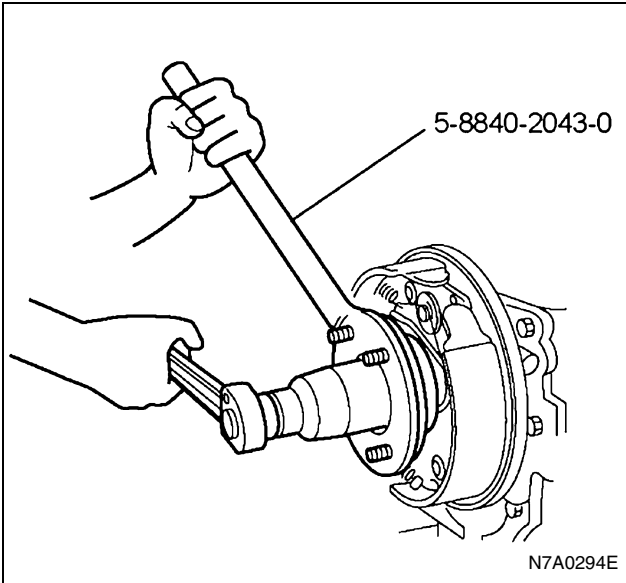
- Refer to PARKING BRAKE ASSEMBLY.

29. Apply engine oil 5W-30 to the O-ring, and then install the coupling driver and the O-ring.

30. Use a new lock nut, apply engine oil 5W-30 to the seat, and then fix the lock nut using the flange holder 5-8840-2043-0.

Tighten:

Lock nut to 289 N·m (29.5 kg·m / 213 lb·ft)

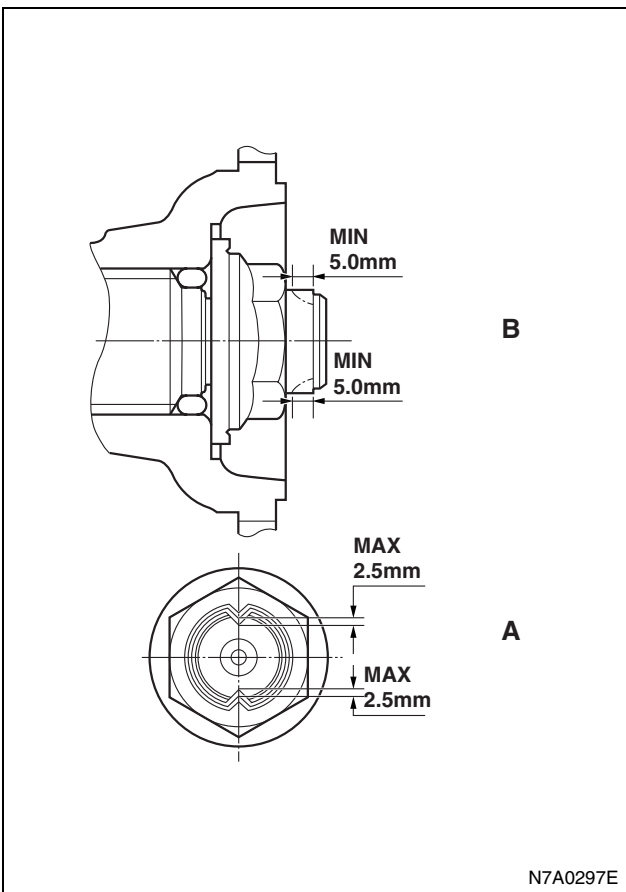


31. Install the parking brake drum and the adjust hole cover securing bolt.
 - Refer to PARKING BRAKE ASSEMBLY.
32. Install the shift fork and the support bolt.
 - Refer to CLUTCH.
33. Install the shift block assembly.
 - Refer to CLUTCH.

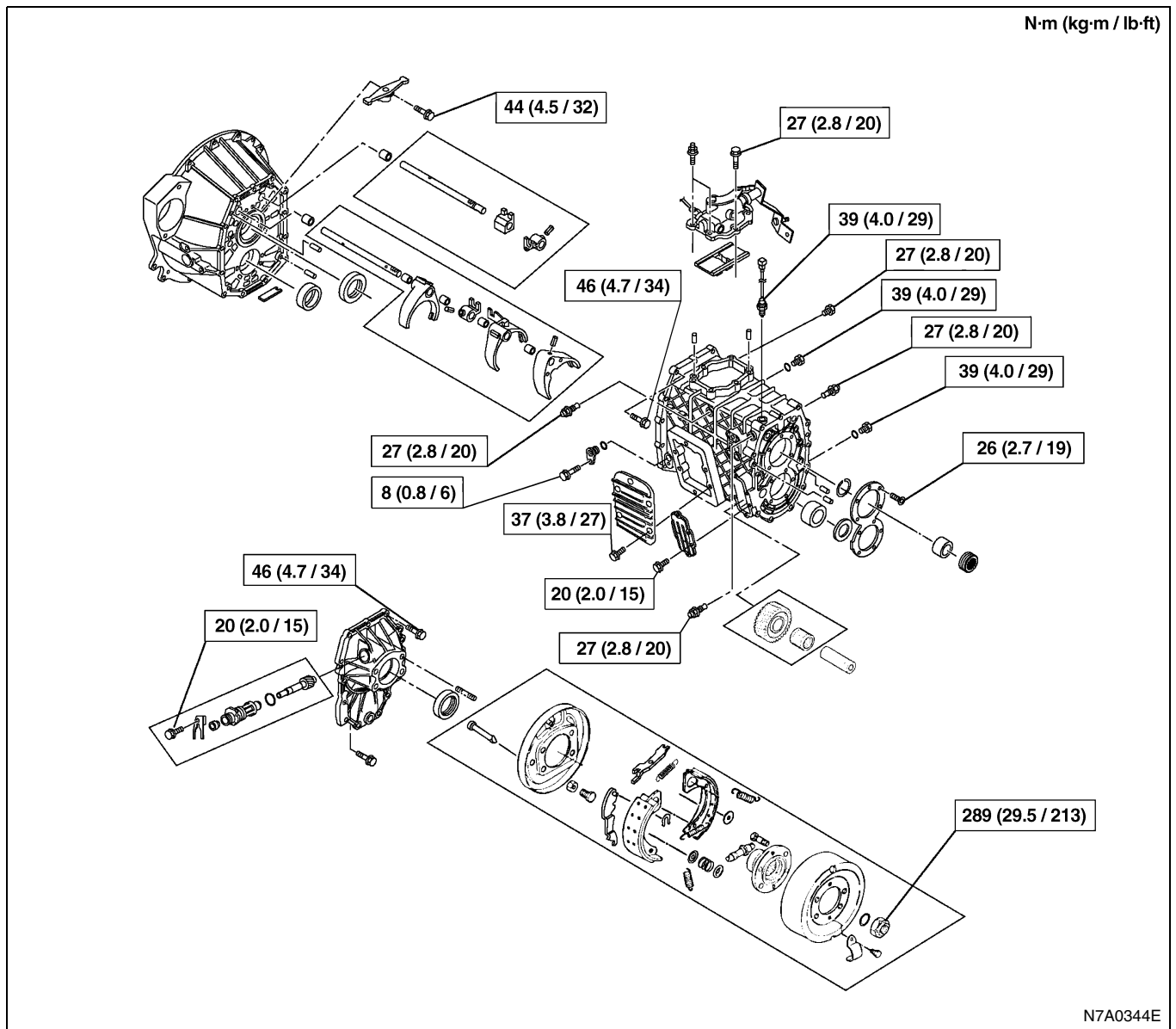
- After fixing it to the specified torque, align the lip part of the nut to the V-groove of the shaft edge. Securely caulk the two parts of the nut lip using a chisel whose tip form is approx. 1 mm (0.04 in) radius by 60°, to make a length (B) of 5 mm (0.2 in) or more, and a clearance between the bottom of the shaft and the nut lip (A) of 2.5 mm (0.06 in) or less.

Caution:

If any crack is found on the caulking portions of the nut after the check, replace the lock nut and caulk it again.



Fixing Torque



Special Tools


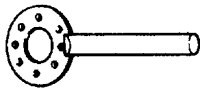
Illustration	Tool Number / Description / Remarks
 5884000070	5-8840-0007-0 / Grip
 5884020430	5-8840-2043-0 / Flange Holder

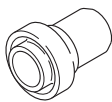
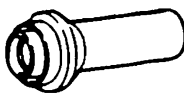
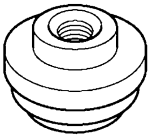
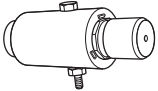
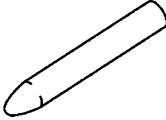
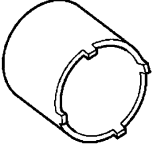
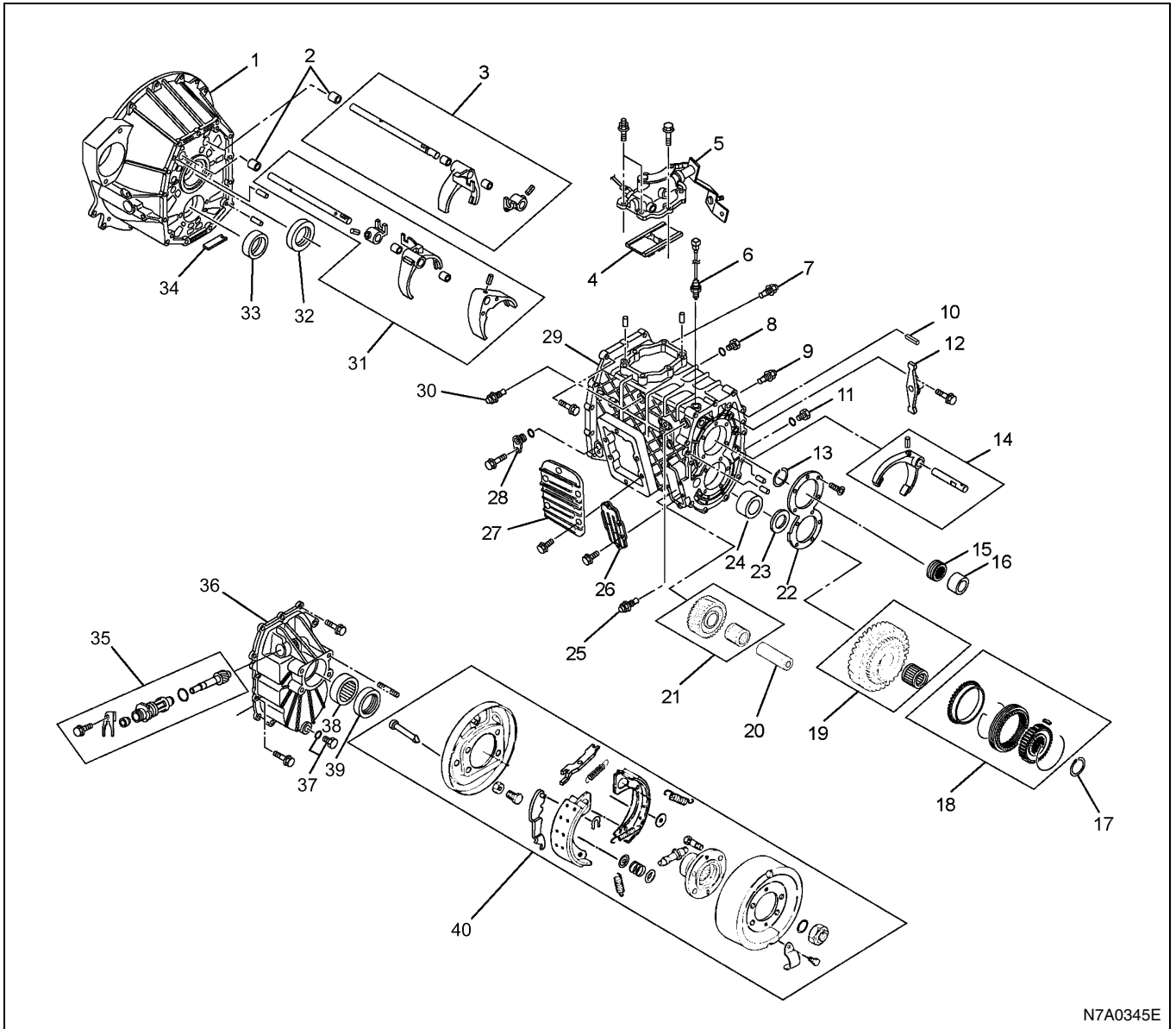
Illustration	Tool Number / Description / Remarks
 5884025580	5-8840-2558-0 / Oil Seal Installer
 5884027500	5-8840-2750-0 / Oil Seal Installer

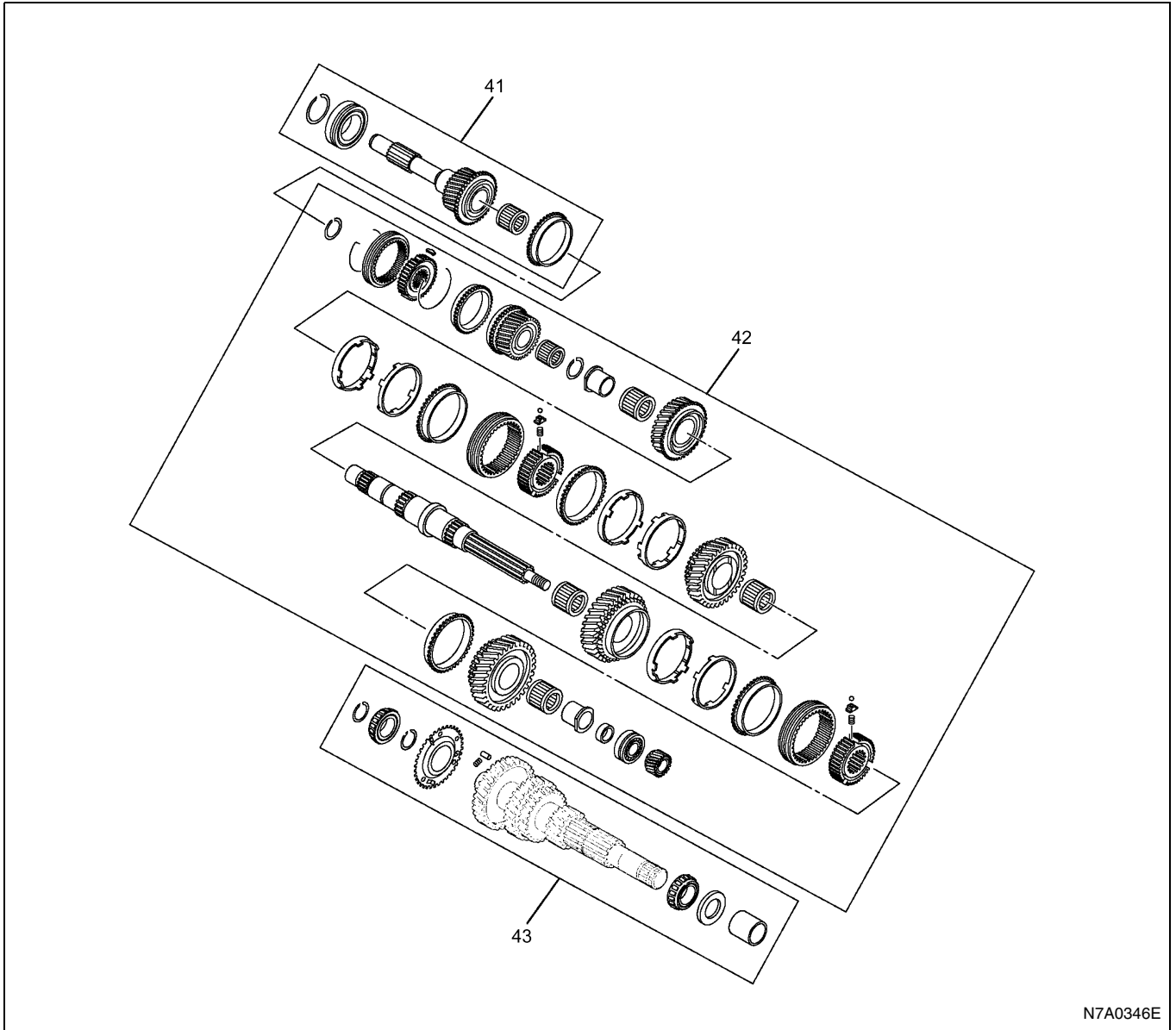
Illustration	Tool Number / Description / Remarks
 <p>5884027540</p>	<p>5-8840-2754-0 / Oil Seal Installer</p>
 <p>5884027550</p>	<p>5-8840-2755-0 / Bush Remover & Installer</p>
 <p>5884027930</p>	<p>5-8840-2793-0 / Oil Seal Protector</p>
 <p>5884027980</p>	<p>5-8840-2798-0 / Wrench</p>

Transmission (6MT)

Components



N7A0345E



N7A0346E

Legend

- | | |
|--|---------------------------------------|
| 1. Clutch housing | 23. Shim; counter |
| 2. Bush; Clutch housing | 24. Counter rear bearing |
| 3. 4th-5th, 6th shift arm | 25. Detent assembly |
| 4. Interlock plate | 26. Reverse idle cover |
| 5. Control box | 27. PTO cover |
| 6. Reverse switch | 28. Sensor dummy plug |
| 7. Detent assembly | 29. Transmission case |
| 8. Filler plug | 30. Detent assembly |
| 9. Detent assembly | 31. 1st-reverse and 2nd-3rd shift arm |
| 10. Spring pin | 32. Front oil seal |
| 11. Drain plug | 33. Bearing outer race |
| 12. 6th relay lever | 34. Magnet |
| 13. Snap ring | 35. Speedometer driven gear |
| 14. 6th shift arm and shift rod | 36. Rear cover |
| 15. Speedometer gear | 37. Drain plug |
| 16. Collar | 38. Needle bearing; main end |
| 17. Snap ring | 39. Rear oil seal |
| 18. 6th clutch hub assembly and sleeve | 40. Parking brake assembly |

19. 6th gear and needle bearing
20. Reverse idle shaft
21. Reverse idle gear and needle bearing
22. Retainer

41. Top gear shaft assembly
42. Main shaft assembly
43. Counter shaft assembly

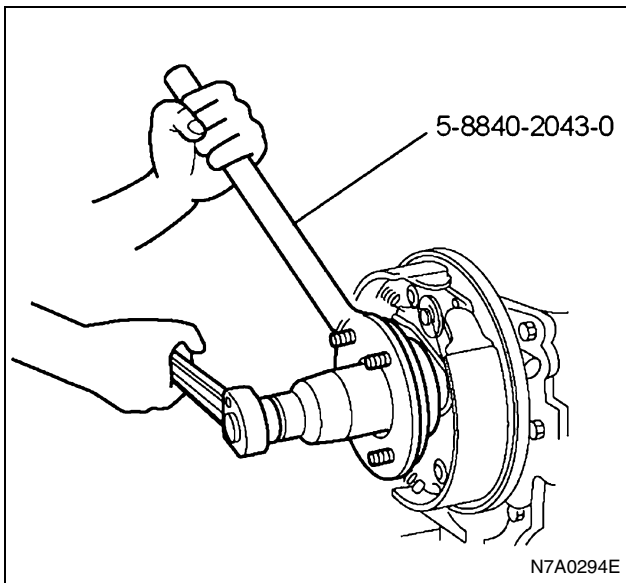
Disassembly

Caution:

Be careful not to damage the transmission case and the clutch housing because they are made of aluminum. Further attention should be paid to the rib because its damage weakens hardness of the case.

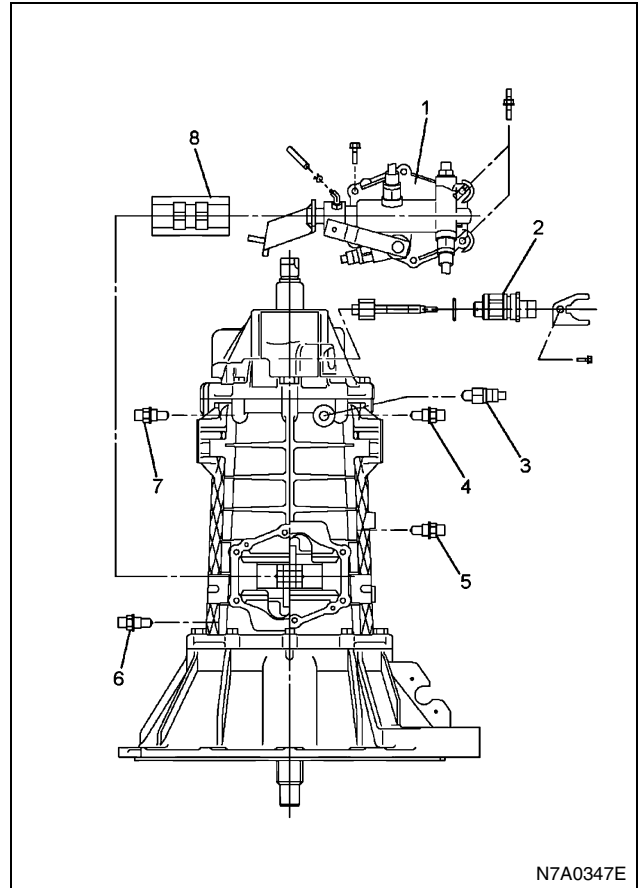
Do not hurt yourself when working on something heavy such as cases and gears.

1. Remove the shift block assembly.
 - Refer to CLUTCH.
2. Remove the shift fork and the support bolt.
 - Refer to CLUTCH.
3. Remove the adjust hole cover securing bolt, and then remove the parking brake drum.
 - Refer to PARKING BRAKE ASSEMBLY.
4. Raise the caulking portions (two parts) of the coupling driver lock nut securely, and then remove the lock nut using the flange holder 5-8840-2043-0.

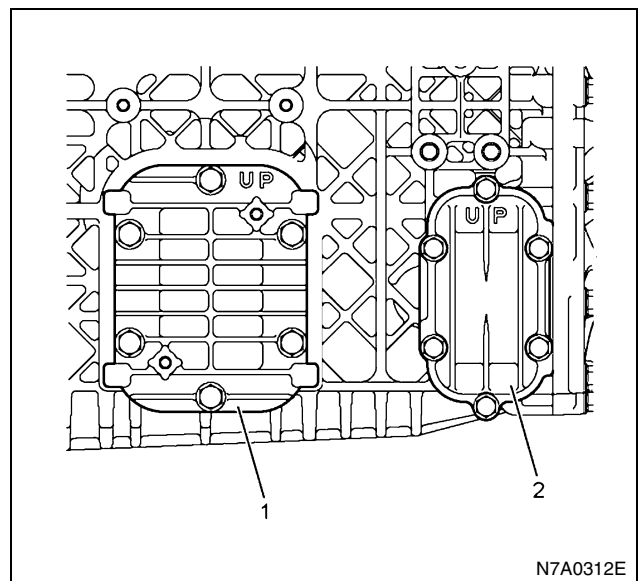


5. Remove the coupling driver and the O-ring.
6. Remove the parking brake assembly.
 - Refer to PARKING BRAKE ASSEMBLY.
7. Remove the filler plug and the O-ring.
8. Remove the drain plug and the O-ring.
 - Drain transmission oil. Check the amount of oil and the existence of metal particles and foreign matters while draining oil.
9. Remove the noise cover.
10. Remove the speedometer driven gear (2).
11. Remove the reverse switch (3).
12. Remove the detent assembly (4) (5) (6) (7).

13. Remove the control box (1) and the interlock plate (8).

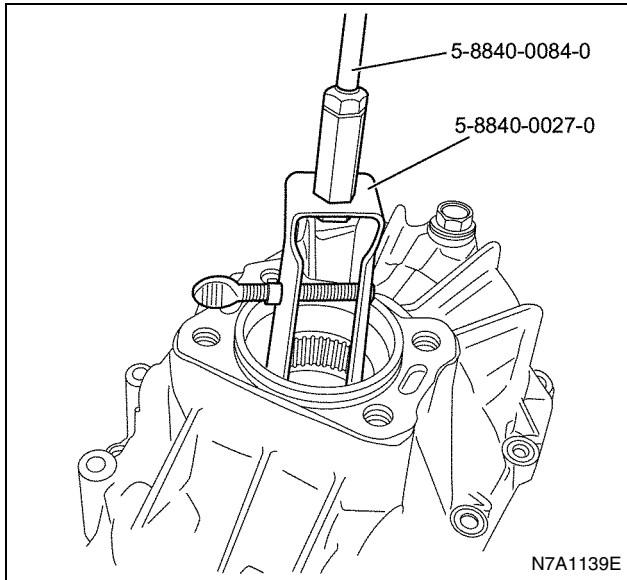


14. Remove the front side cover (1).
15. Remove the reverse idle cover (2).

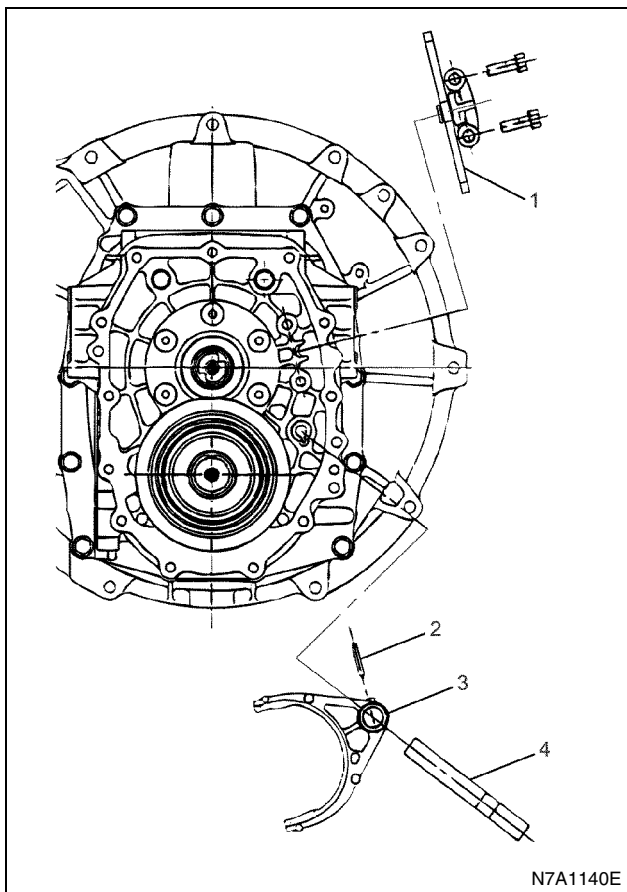


16. Remove the rear cover assembly.

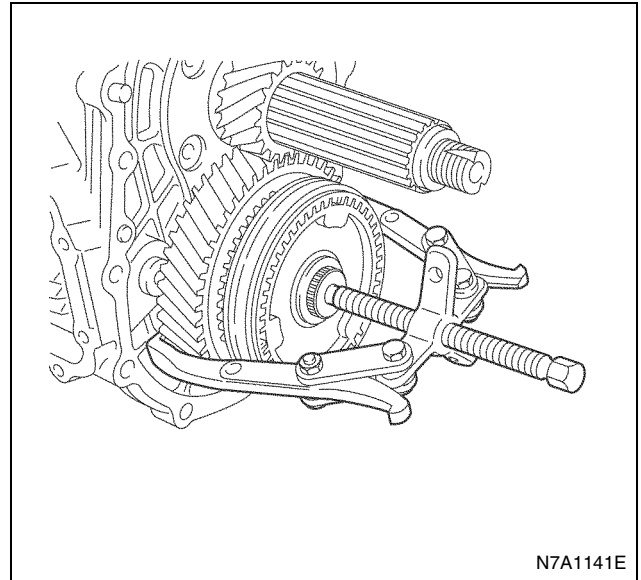
17. When worn or damaged parts are found after checking the rear cover oil seal, remove it from the rear cover using the flat-tip screwdriver.
18. Remove the needle bearing; main end from the rear cover using the remover 5-8840-0027-0 and the sliding hammer 5-8840-0084-0.



19. Remove the 6th relay lever (1).
20. Remove the 6th shift arm (3) and 6th shift rod (4).
 - Using the spring remover, drive out the spring pin (2).



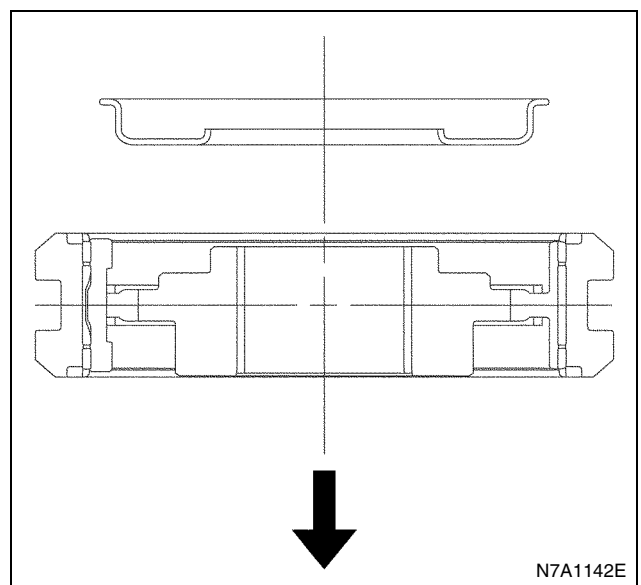
21. Using the snap ring pliers, remove the snap ring; 6th clutch hub.
22. Using the puller, remove the 6th clutch hub assembly and sleeve, the 6th block ring, the 6th gear and the needle bearing from the counter shaft.



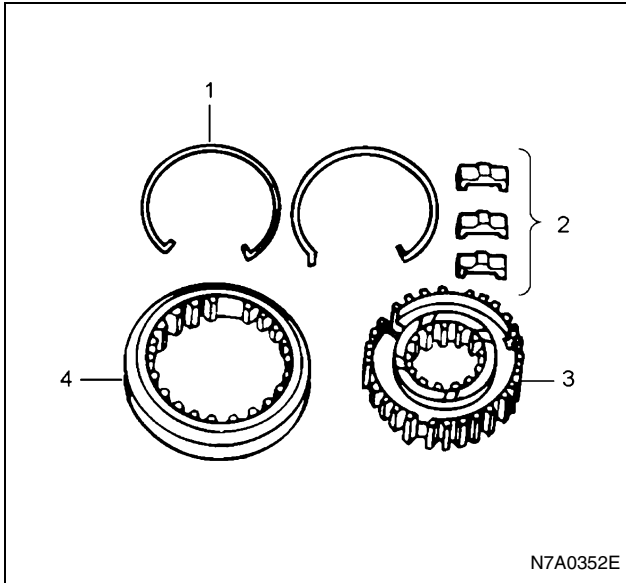
23. Disassemble the 6th clutch hub assembly and sleeve.
 - a. Remove the stopper from the clutch hub.
 - The arrow mark shows the direction of the transmission front side.

Caution:

When removing the stopper plate, replace it with a new one on installation.



- b. Disassemble the clutch hub assembly and sleeve.

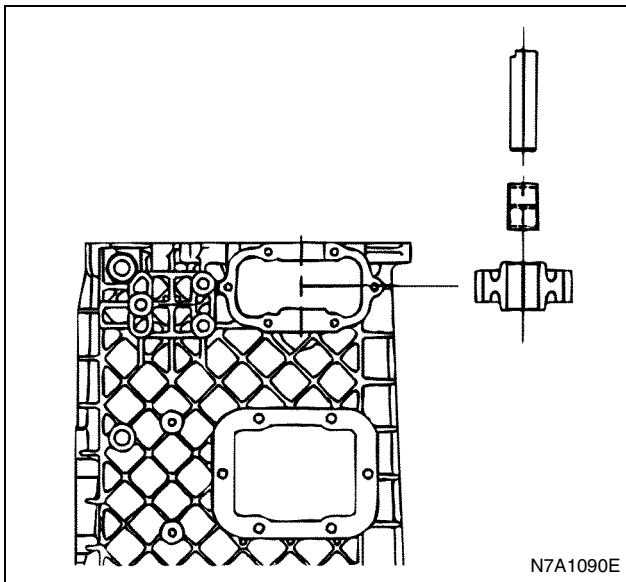


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Legend

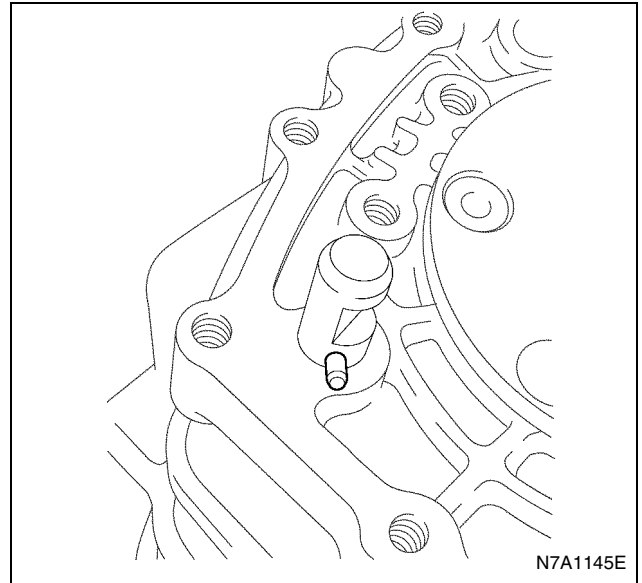
- 1. Spring
- 2. Insert
- 3. Clutch hub
- 4. Sleeve

- 24. Remove the collar and the speedometer gear.
- 25. Remove the retainer from the transmission case.
- 26. Pull out the reverse idle shaft, and then remove the reverse idle gear and the needle bearing.



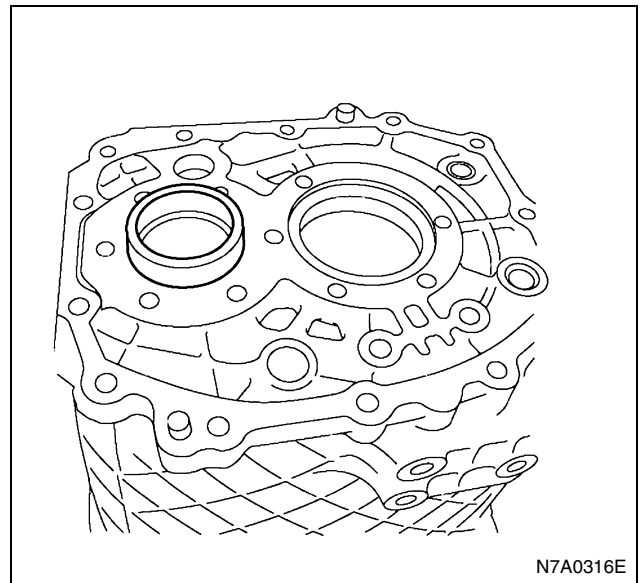
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- 27. Remove the snap ring from the main shaft rear bearing.
- 28. Remove the shim from the counter shaft rear bearing.
- 29. Remove the spring pin; 4th-5th and 6th shift rod.



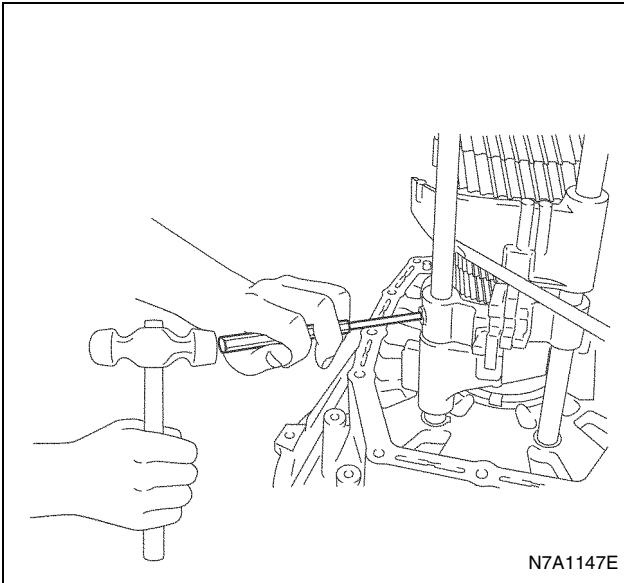
N7A1145E

- 30. Remove the transmission case from the clutch housing.
- 31. Remove the bearing rear outer race from the transmission case.



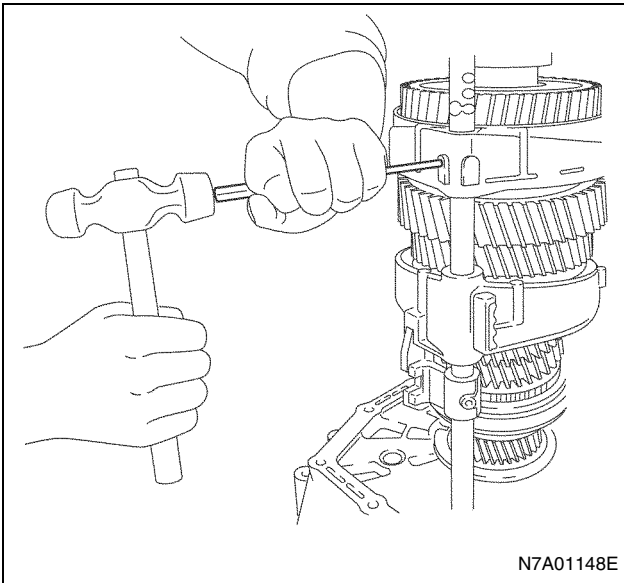
N7A0316E

- 32. Remove the 4th-5th and 6th shift rod, the 1st-reverse and 6th shift block and the 4th - 5th shift arm.
 - When driving out the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then remove the spring pin using the spring pin remover.



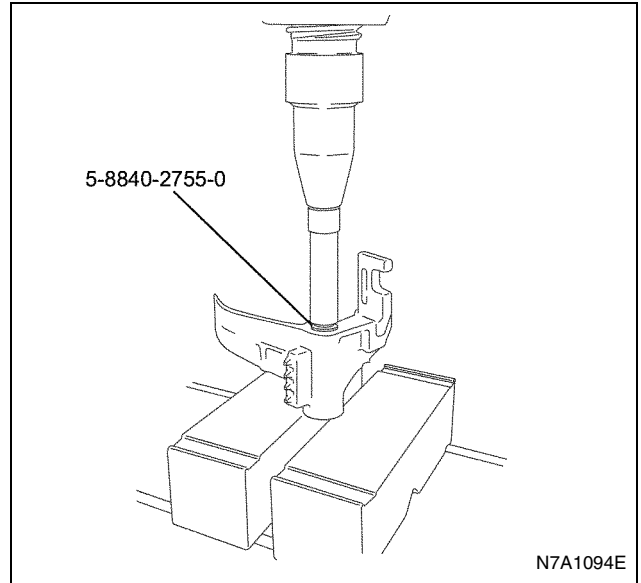
N7A1147E

33. Remove the 1st-reverse and 2nd-3rd shift rod, the 1st-reverse shift arm, the 3rd-2nd shift arm, the 1st-reverse and 6th shift block.
- When driving out the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then remove the spring pin using the spring pin remover.



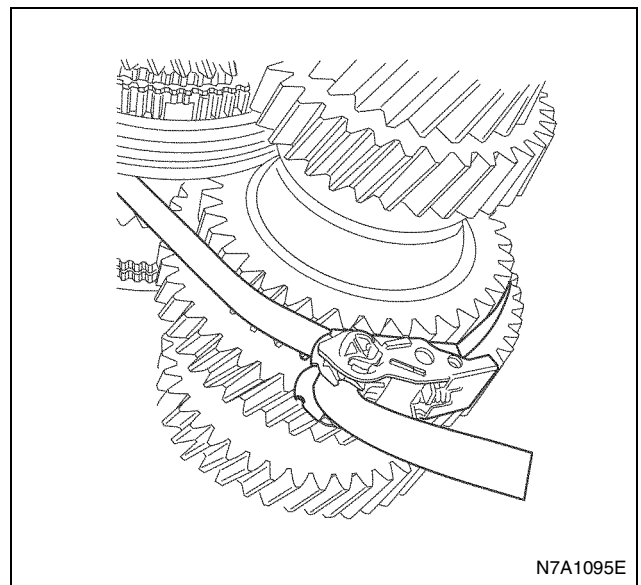
N7A01148E

34. Remove the bush from the 4th-5th shift arm using the remover 5-8840-2755-0.
35. Remove the bush from the 1st-reverse shift arm using the remover 5-8840-2755-0.
36. Remove the bush from the 3rd-2nd shift arm using the remover 5-8840-2755-0.
- Use a round pole whose length is enough to push the remover to the end.



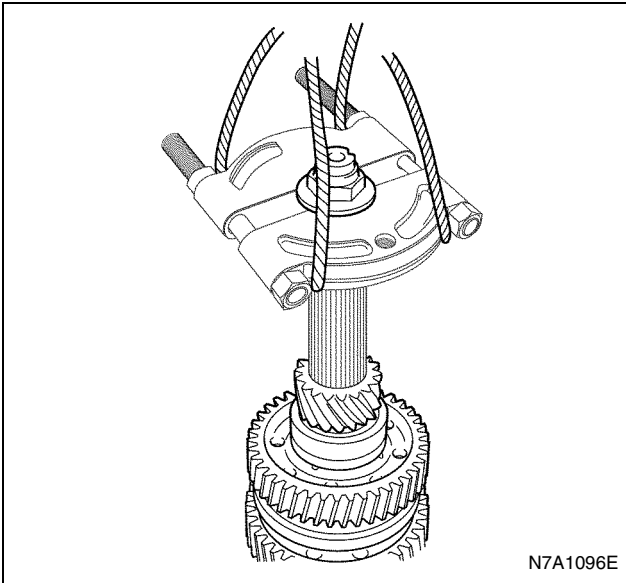
N7A1094E

37. Remove the magnet from the clutch housing.
38. Remove the mail shaft assembly, the top gear shaft assembly and the counter shaft assembly.
- a. Tie the main shaft assembly, the counter shaft assembly and the top gear shaft assembly at the two positions not to let them come apart using a lashing belt or other belts with a fixing function, and then fix them securely.

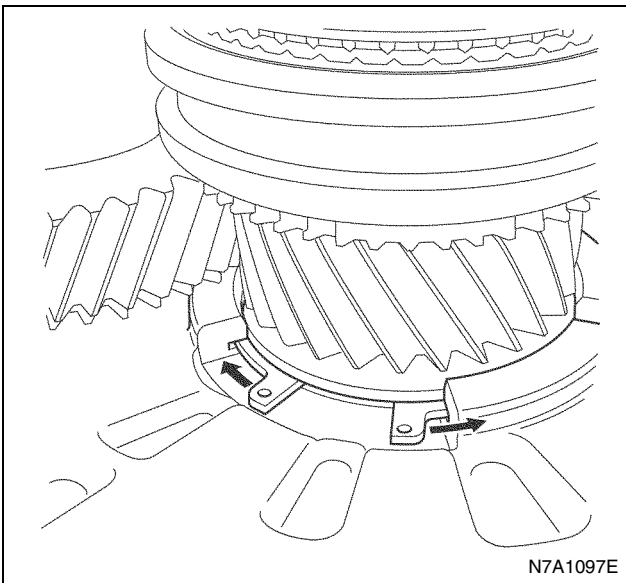


N7A1095E

- b. Install the bearing remover to the main shaft and secure it with a lock nut, hang them with a hoist and a wire, and then remove the top gear shaft assembly, the main shaft assembly, the counter shaft assembly from the clutch housing as a unit while spreading the top gear shaft bearing outer snap ring installed to the clutch housing.

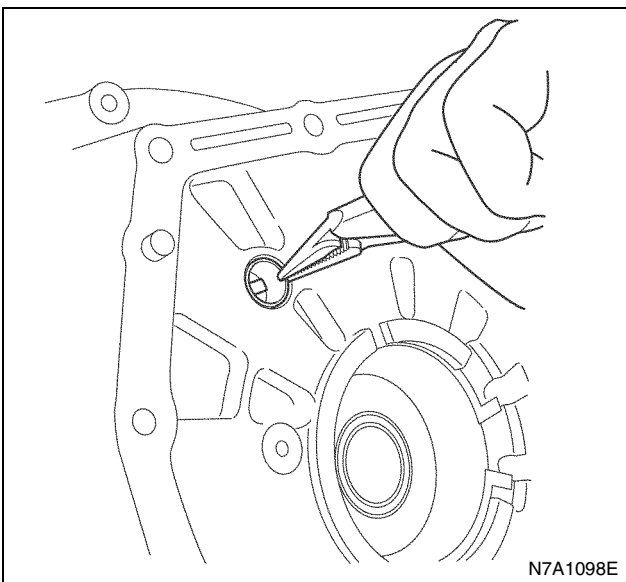


N7A1096E



N7A1097E

39. Check the clutch housing bush, and then remove it from the clutch housing using a pliers if it is worn or damaged.



N7A1098E

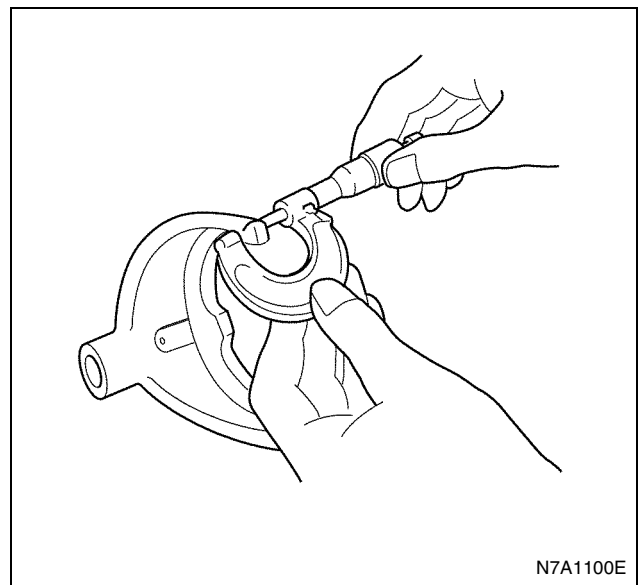
40. Check the front oil seal, and then remove it from the clutch housing using a flat-tip screwdriver if it is worn or damaged.

Check each part, and then correct and replace it if some worn, damaged or faulty parts are found.

41. Check each part of the shift mechanism, and then correct light damage, deflection or stepped wear. Replace it when it is heavily damaged or its usage limit is over.

- Deflection, wear and damage of the shift rod and the shift arm
- Shift arm thickness
 - Measure the thickness of the shift arm tip using the micrometer.

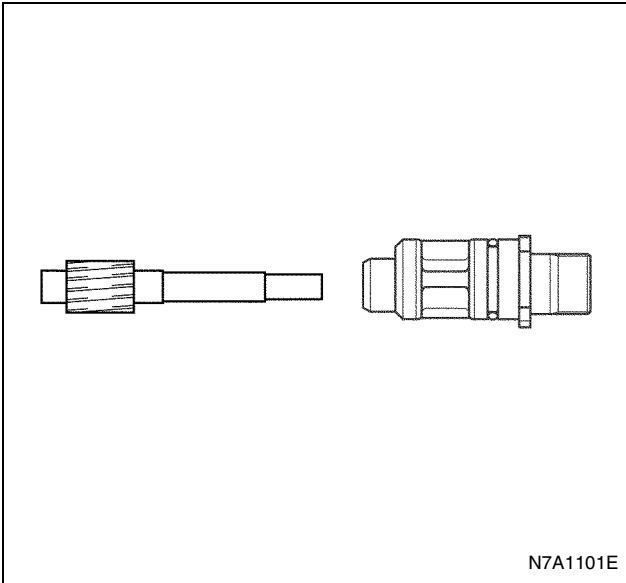
Shift arm thickness, mm (in)		
	Standard	Limit
1st-reverse 3rd-2nd 5th-4th	9.60 — 9.85 (0.378 — 0.387)	9.0 (0.354)
6th	9.60 — 9.85 (0.378 — 0.387)	9.3 (0.366)



N7A1100E

42. Check whether the speedometer driven gear and the driven gear bush are worn.

- Replace them if they are worn heavily.



43. Measure the clearance between the insert and the block ring groove.
- Measure the clearance using a caliper.
 - Replace the insert and the block ring if their measured values are out of the limit.

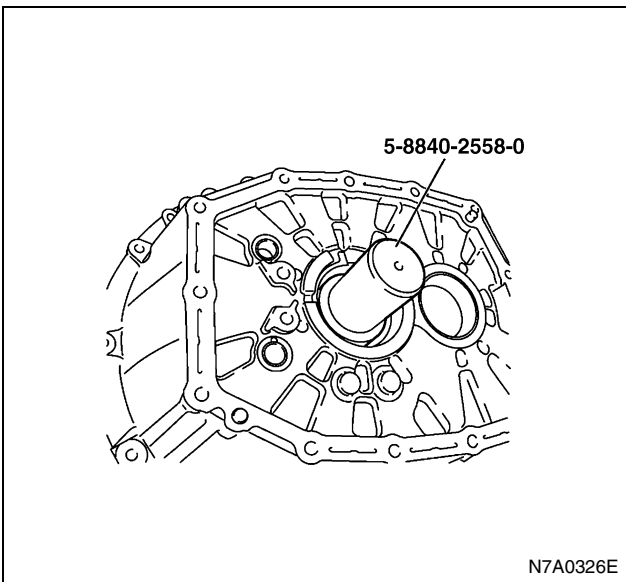
Clearance between insert and block ring, mm (in)	
	Standard
6th	3.46 — 3.76 (0.136 — 0.148)

Assembly

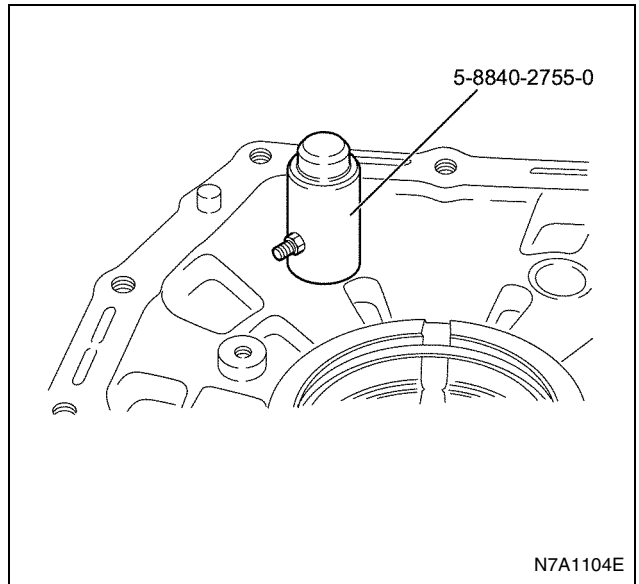
1. When finding the oil seal worn and damaged after the check and replacing it with a new one, apply engine oil 5W-30 around the oil seal, and then press in the oil seal into the clutch housing using the installer 5-8840-2558-0.
 - Apply Besco L2 grease on the oil seal lip portion.

Caution:

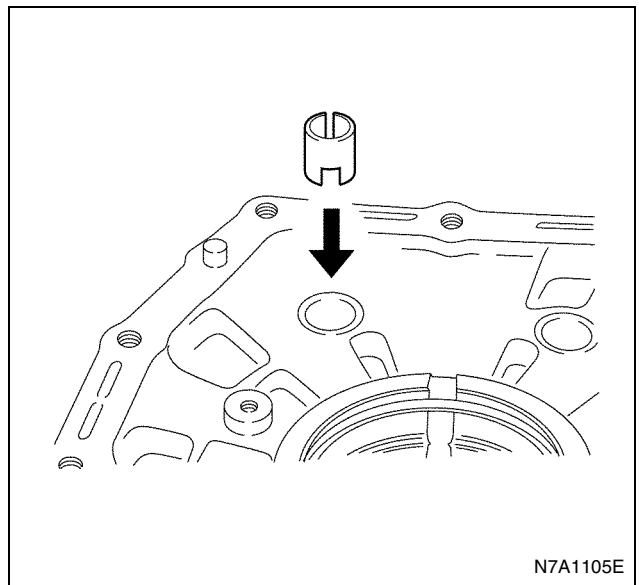
Be careful not to damage the oil seal lip portion.



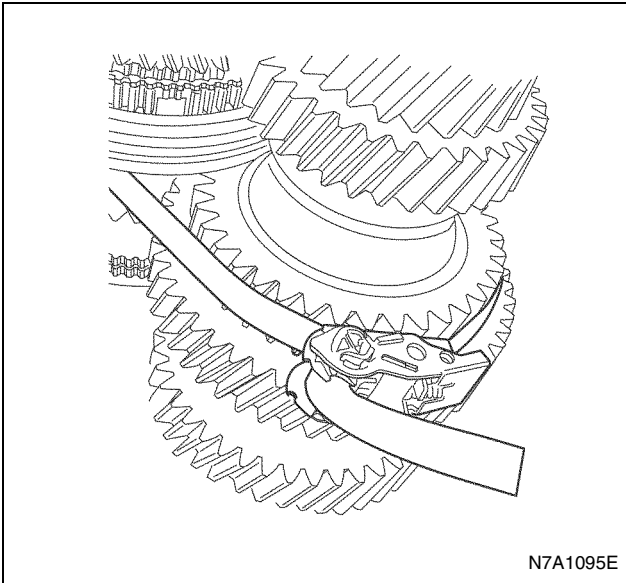
2. When the clutch housing bush is replaced with a new one after checking it for wear and damage, press it in using the installer 5-8840-2755-0.



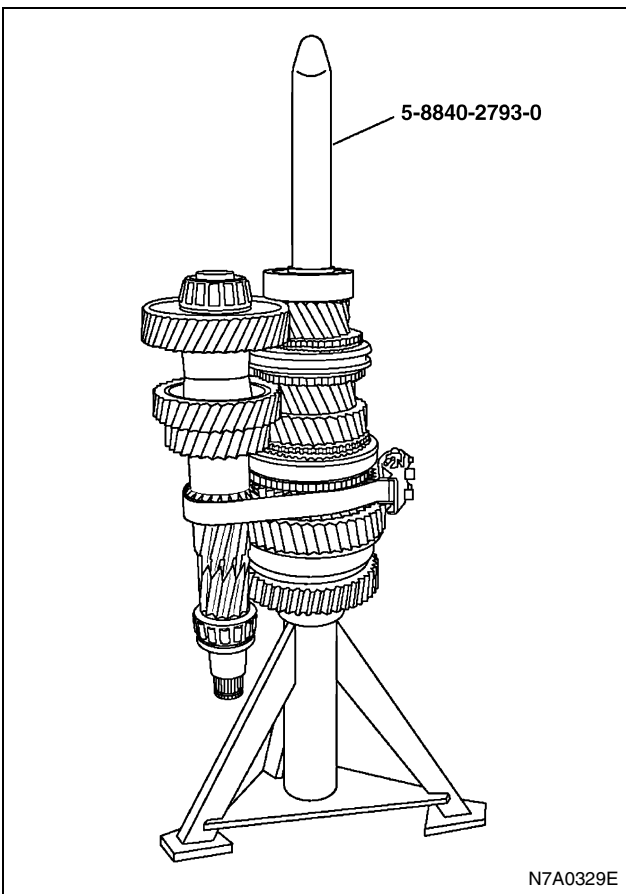
- During installation, the direction of the bush and the position of the caulking should be set as indicated in the figure.
- For the bush pressing in for the second time and onwards, press in the bush facing its notched portion to the clutch housing.



3. Install the main shaft assembly, the top gear shaft assembly and the counter shaft assembly.
 - a. Tie the main shaft assembly, the counter shaft assembly and the top gear shaft assembly at the two positions not to let them come apart using a lashing belt or other belts with a fixing function, and then fix them securely. Be careful not to drop the top gear shaft while lifting up.



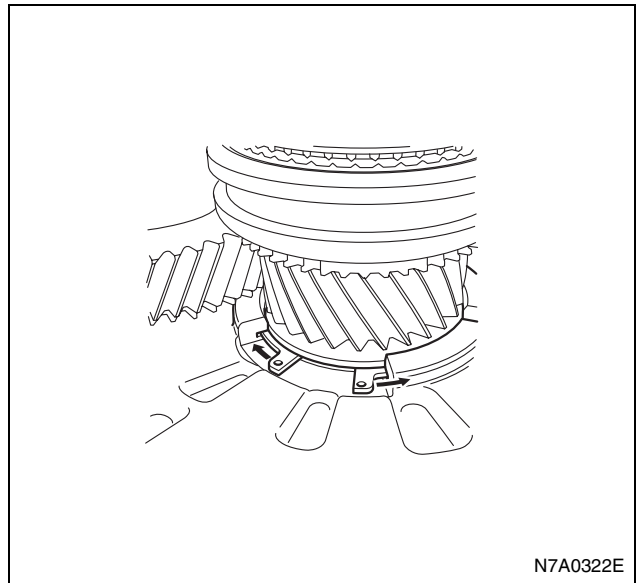
- b. Stick up the three of the top gear shaft assembly, the main gear shaft assembly and the counter shaft assembly on the support stand as the top gear shaft assembly is put on the top.
- c. Install the oil seal protector 5-8840-2793-0 to the main shaft.



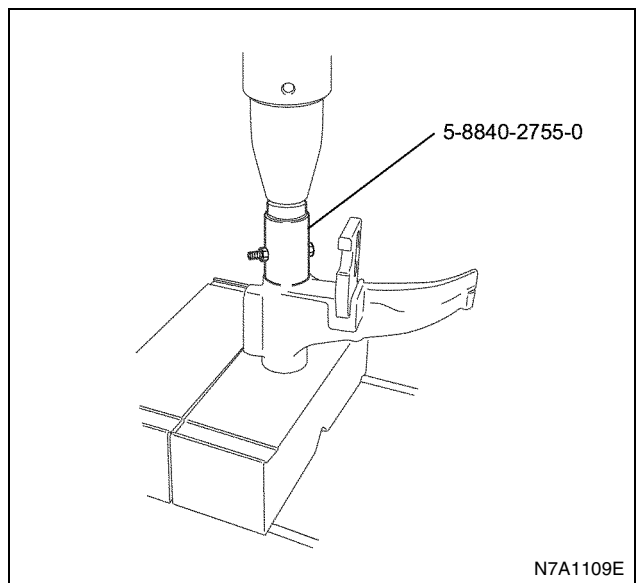
- d. Set the top gear shaft bearing outer snap ring to the clutch housing, spread it using a snap ring pliers, and then insert it to the clutch housing after aligning the top gear shaft, the counter shaft and the shift rod positions.

Caution:

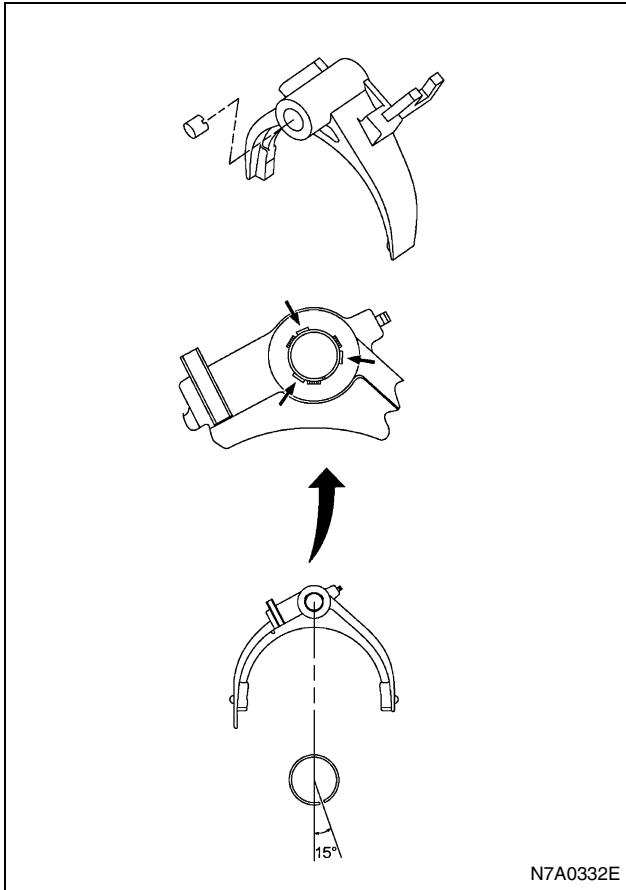
- Make sure the snap ring is installed securely.
- Work carefully not to damage the front oil seal.



4. Install the magnet to the clutch housing.
5. When replacing the 3rd-2nd shift arm bush with a new one after checking it for wear or damage, press in the bush using the installer 5-8840-2755-0.
6. When replacing the 4th-5th shift arm bush with a new one after checking it for wear or damage, press in the bush using the installer 5-8840-2755-0.
7. When replacing the 4th-5th shift arm bush with a new one after checking it for wear or damage, press in the bush using the installer 5-8840-2755-0.

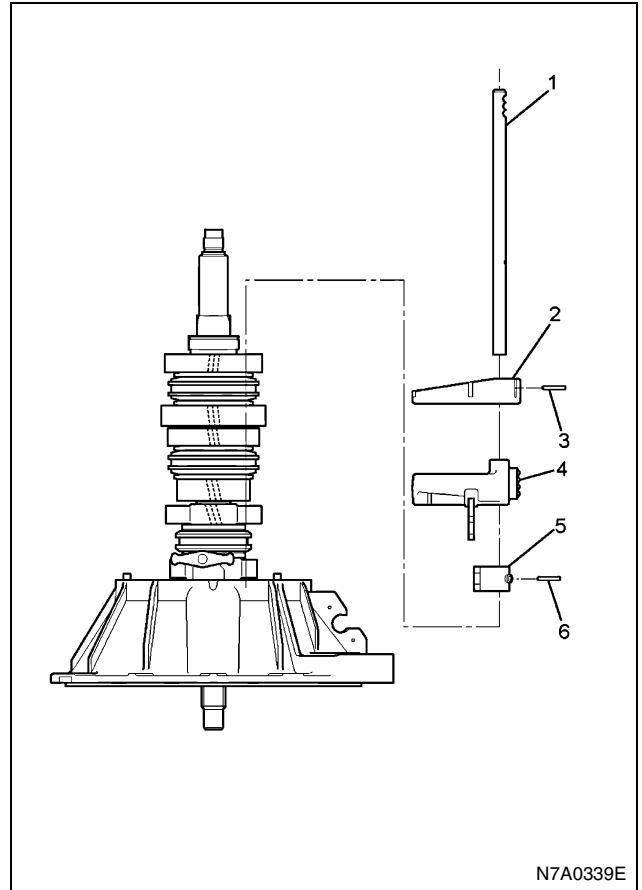


- Press it in taking care of the direction and angle of the shift arm bush, and then caulk the three portions except the bush cut and older caulking portions.



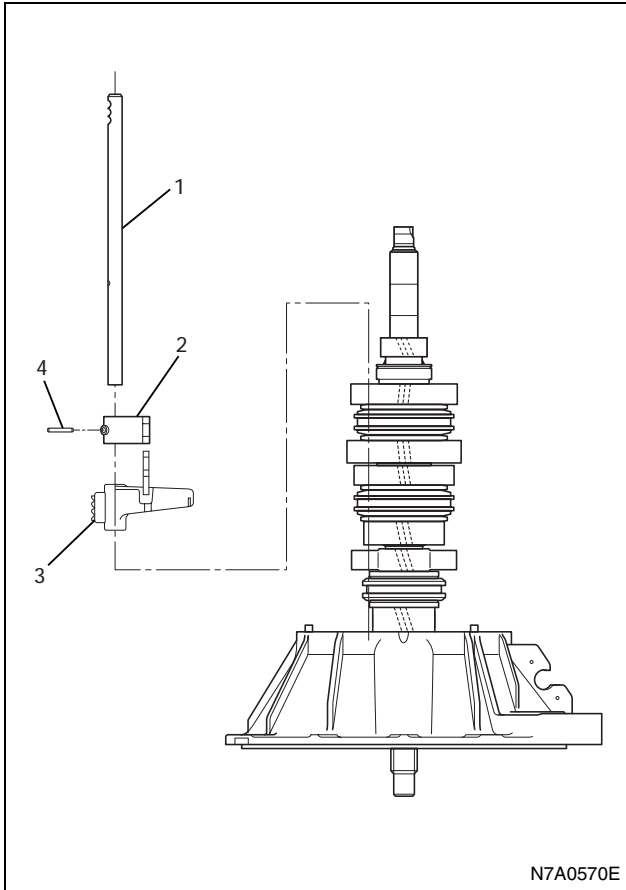
N7A0332E

8. Install the 1st-reverse and 2nd-3rd shift rod (1) to the 1st-reverse and 6th shift block (5), the 2nd-3rd shift arm (4), the 1st-reverse shift arm (2).
 - Drive in the spring pin (3) and (6) using a hammer after aligning the spring pin hole.
 - When pressing in the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then press in the spring pin.



N7A0339E

9. Install the 4th-5th and 6th shift rod (1) to the 4th-5th shift arm (3), 1st-reverse and 6th shift block (2).
 - Drive in the spring pin (4) using a hammer after aligning the spring pin hole.
 - When pressing in the spring pin, put a round pole on the opposite side of the shift rod not to damage other parts, and then press in the spring pin.

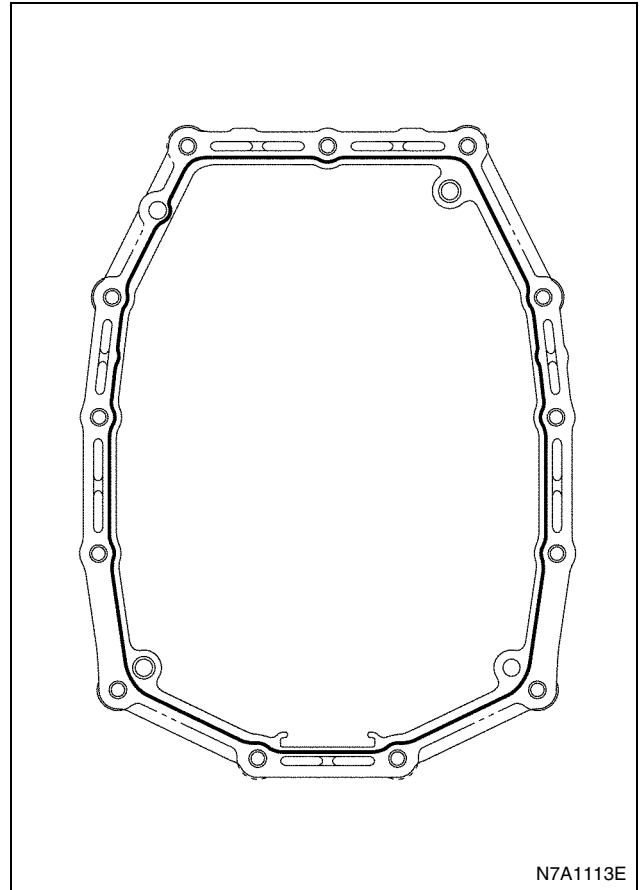


N7A0570E

10. Apply ThreeBond 1215 to the mating surface of the transmission case and the clutch housing, and then install the clutch housing.
 - Wipe off moisture and lubricant from the mating surface, and then apply the gasket continuously with a diameter of 2 mm (0.079 in) or more.

Tighten:

Clutch housing to 46 N·m (4.7 kg·m / 34 lb·ft)

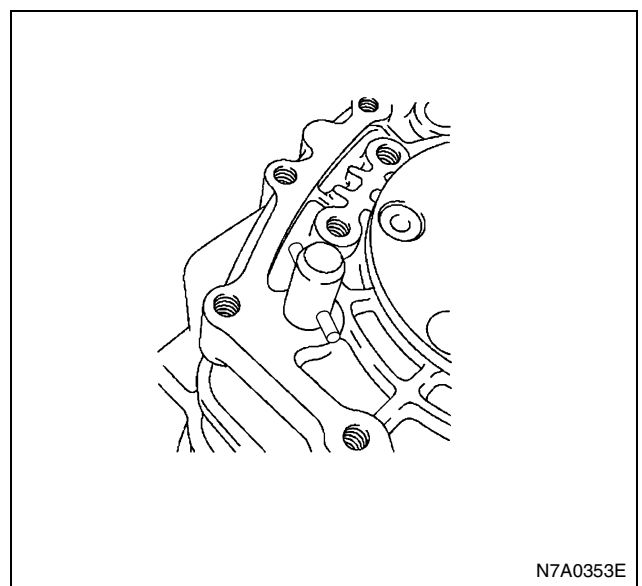


N7A1113E

11. Install the bearing rear outer race to the transmission case.
12. Install the spring pin; 4th-5th and 6th shift rod.

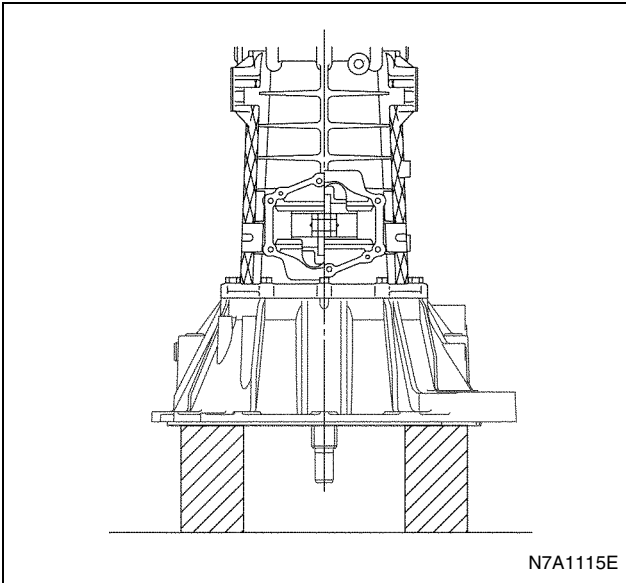
Caution:

When the snap ring is deformed or damaged, replace it with a new one, and make sure it is completely installed.



N7A0353E

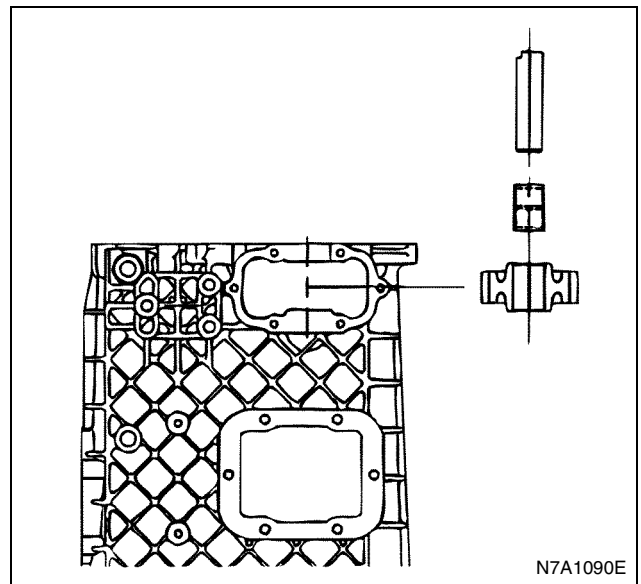
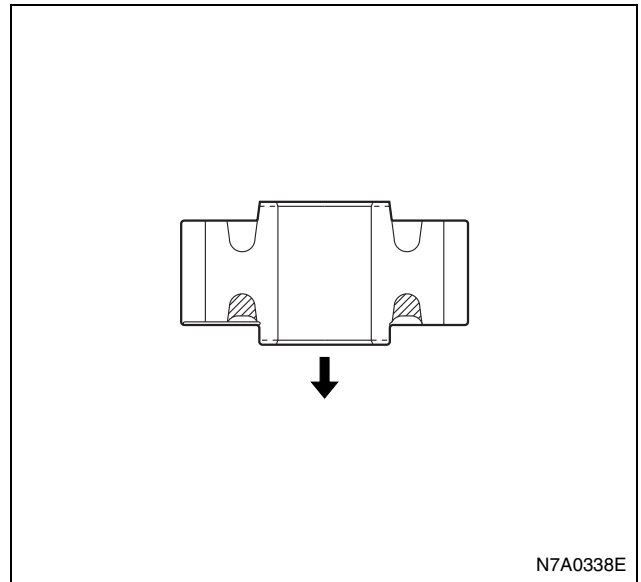
13. Install the shim to the counter shaft rear bearing.
 - a. Shift the position to the neutral.
 - b. Set the transmission assembly with the clutch housing faced down.



- c. Revolve the counter shaft more than 30 times and smooth the taper roller bearing.
- d. Select the counter shim.
 - Measure the depth at the points equally divided into three from the end surface of the transmission case to the outer ring edge surface of the counter shaft rear bearing, and then take an average of them.
 - Select the shim whose thickness agrees with the list below.

Measured value, mm (in) more than — less than	Thickness of applicable shim
3.34 — 3.40 (0.132 — 0.133)	3.19 (0.125)
3.28 — 3.34 (0.130 — 0.131)	3.13 (0.123)
3.22 — 3.28 (0.127 — 0.129)	3.70 (0.120)
3.16 — 3.22 (0.125 — 0.126)	3.01 (0.118)
3.10 — 3.16 (0.122 — 0.124)	2.95 (0.116)
3.04 — 3.10 (0.120 — 0.122)	2.89 (0.113)
2.98 — 3.04 (0.118 — 0.119)	2.83 (0.111)
2.92 — 2.98 (0.115 — 0.117)	2.77 (0.109)
2.86 — 2.92 (0.113 — 0.114)	2.71 (0.106)
2.80 — 2.86 (0.110 — 0.112)	2.65 (0.104)
2.74 — 2.80 (0.108 — 0.110)	2.59 (0.101)
2.68 — 2.74 (0.106 — 0.107)	2.53 (0.099)
2.62 — 2.68 (0.104 — 0.105)	2.47 (0.097)
2.56 — 2.62 (0.101 — 0.103)	2.41 (0.094)
2.50 — 2.56 (0.099 — 0.100)	2.35 (0.092)
2.44 — 2.50 (0.096 — 0.098)	2.29 (0.090)
2.38 — 2.44 (0.094 — 0.096)	2.23 (0.087)
2.32 — 2.38 (0.092 — 0.093)	2.17 (0.085)
2.26 — 2.32 (0.089 — 0.091)	2.11 (0.083)

14. Install the snap ring to the main shaft rear bearing.
15. Apply engine oil 5W-30 to the needle bearing, install the reverse idle gear and needle bearing, and then insert the reverse idle shaft.
 - The arrow mark shows the direction of the transmission front side.



16. Install the retainer to the transmission case.

Tighten:

Retainer to 26 N·m (2.7 kg·m / 19 lb·ft)

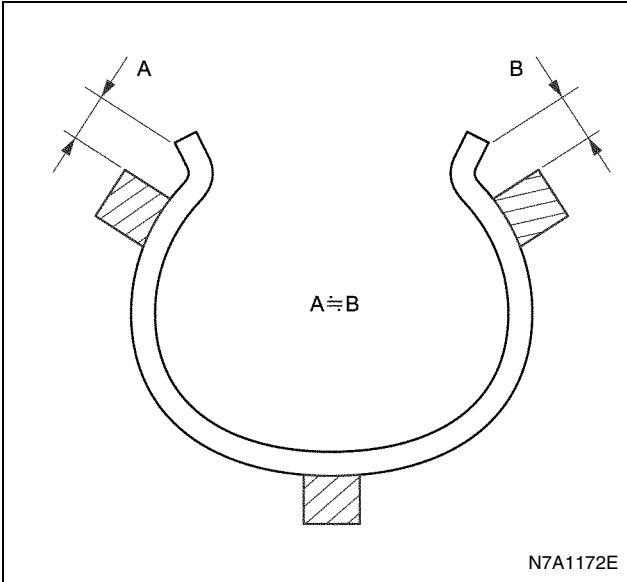
Caution:

Clean up the sealing agent on the screw thread of the transmission case and replace all screws with new ones.

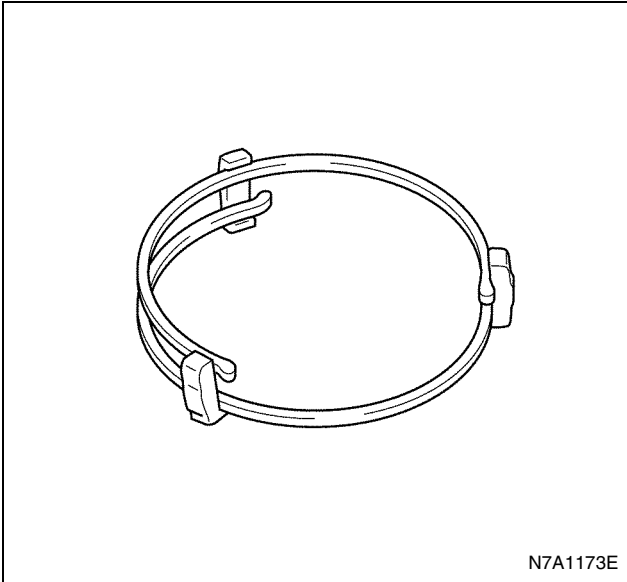
17. Install the collar and the speedometer gear.
18. Assemble the 6th clutch hub assembly (2) and the sleeve (1) following the procedure below.
 - a. Assemble the insert (3) securely to the block ring insert groove.
 - b. Install the insert spring (4) to the insert.

Caution:

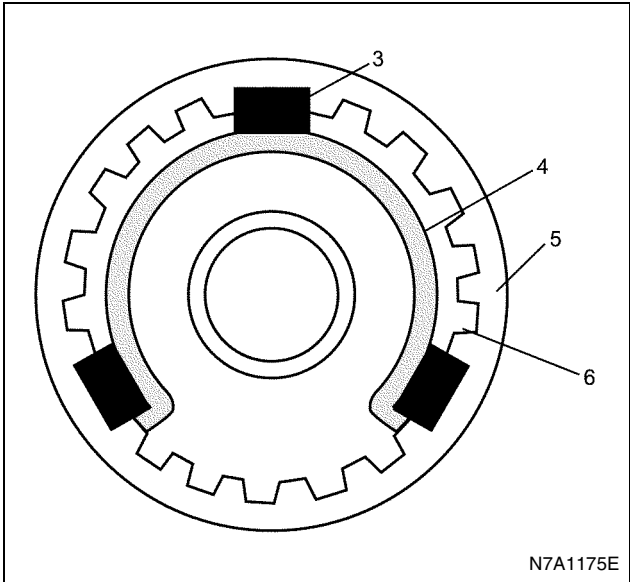
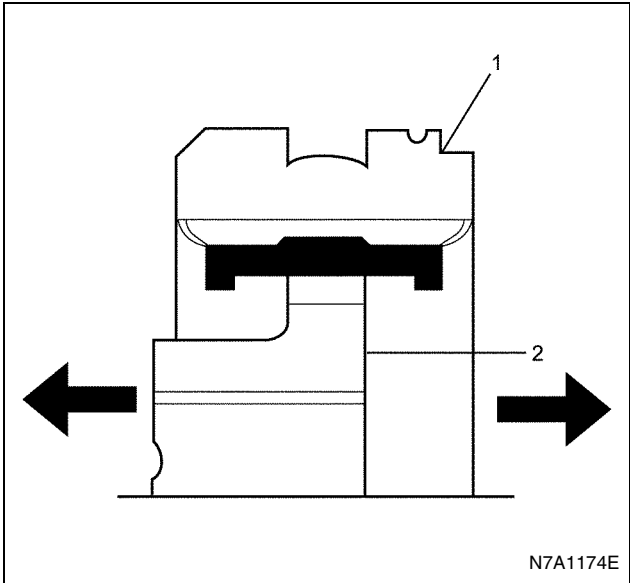
- When assembling the insert spring, equalize the length of the both edges of the spring not to adversely interfere with the inside diameter of the hub.



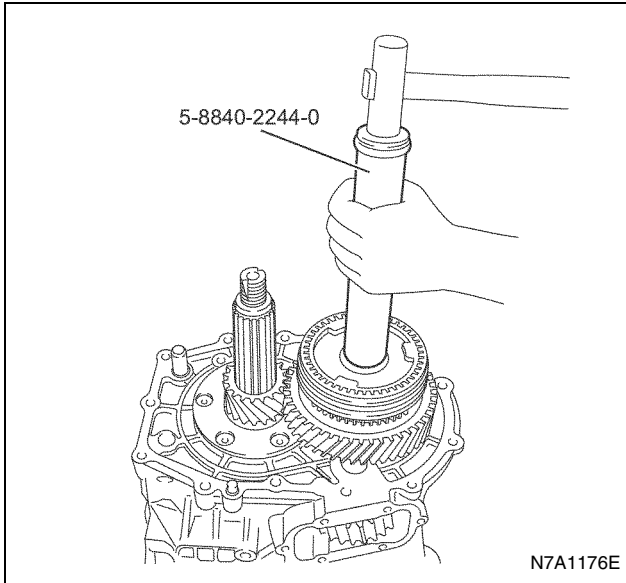
- Make sure that the open part of the insert spring assembled on the reverse side, is not aligned with the open part of the front side.



- c. Make sure the clutch hub (5) and the sleeve (6) slide smoothly.



- d. Install a new stopper plate to the clutch hub.
19. Apply engine oil 5W-30 to the needle bearing and the block ring bore, assemble the 6th gear, the needle bearing and the 6th block ring, align the aspect of the clutch hub block ring groove, assemble the 6th clutch hub assembly and the sleeve, and then press in them using the installer 5-8840-2244-0 and a hammer.



20. Using the snap ring pliers, install the snap ring and the 6th clutch hub.
- Select the thickest snap ring of the available three.

Thickness, mm (in)	Identification Color
1.7 (0.066)	White
1.8 (0.070)	No color
1.9 (0.074)	Blue

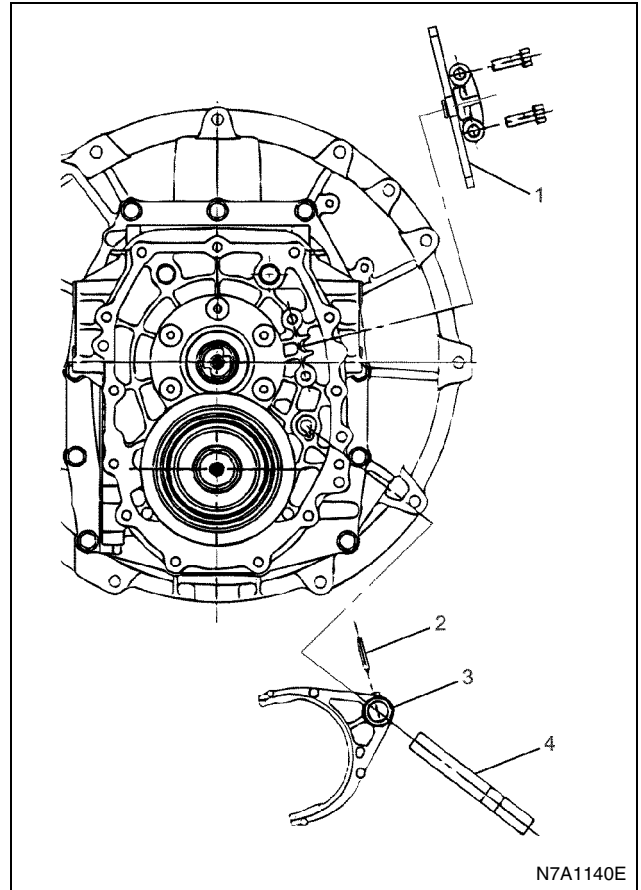
Caution:

When the snap ring is deformed or damaged on installation, replace it with a new one, and make sure it is completely installed.

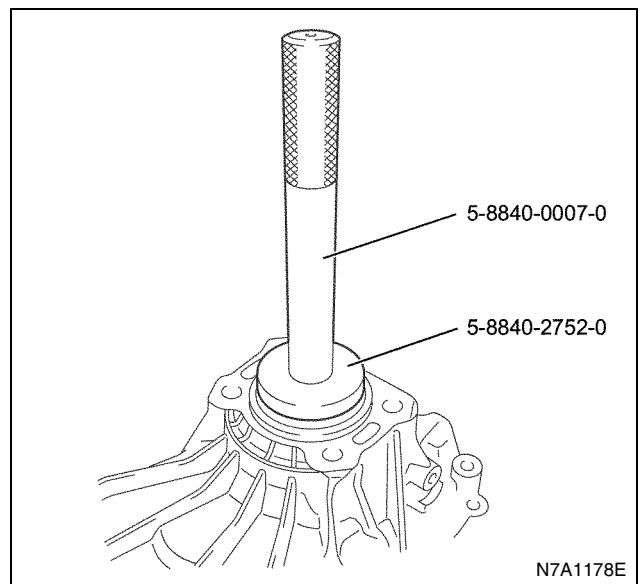
21. Apply engine oil 5W-30 to the shift rod hole of the transmission case, install the 6th shift arm (3) and 6th shift rod (4), and then press in the spring pin (2) aligning its hole.
22. Install the 6th relay lever (1).

Tighten:

6th relay lever (1) to 44 N·m (4.5 kg·m / 32 lb·ft)



23. Install the needle bearing; main end.
- Apply Besco L2 grease inside the needle bearing, and apply engine oil 5W-30 to the bearing connecting bore of the rear cover.
 - Press in the needle bearing to the rear cover from outside by turning the bearing stamped surface out and using the installer 5-8840-2752-0 and the grip 5-8840-0007-0.



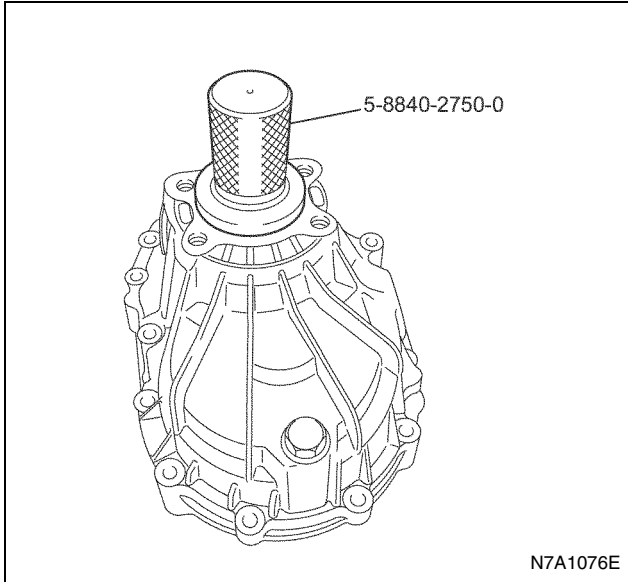
24. When replacing the rear cover oil seal with a new one after checking for wear and damage or when replacing the needle bearing, apply engine oil 5W-

30 around the oil seal, and then press in the oil seal to the rear cover using the installer 5-8840-2750-0.

- Apply Besco L2 grease to the lip portion of the oil seal.

Caution:

Be careful not to damage the oil seal lip portion.

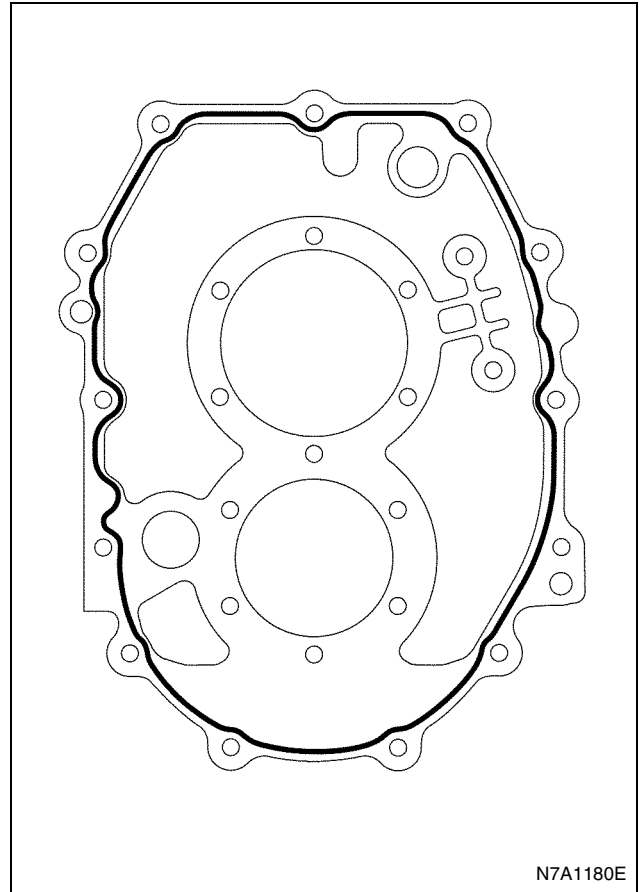


25. Apply ThreeBond 1215 to the mating surface of the transmission case rear cover, and then install the rear cover.

- Wipe off moisture and lubricant from the connecting surface. And then apply the bond continuously with a diameter of 2 mm (0.079 in).

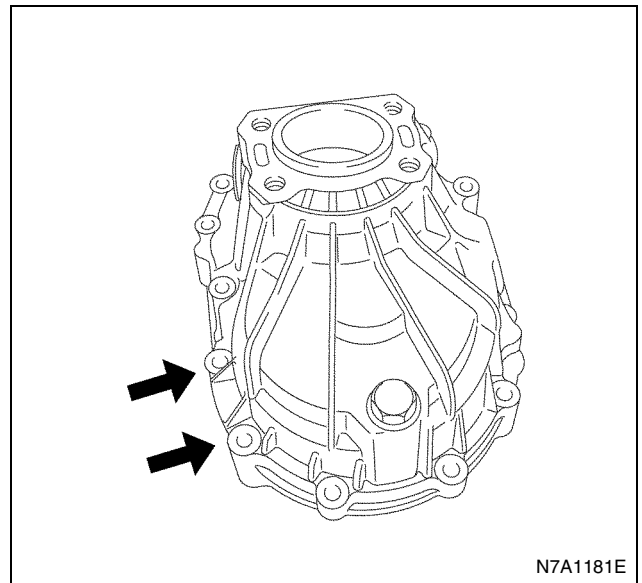
Tighten:

Rear cover to 46 N·m (4.7 kg·m / 34 lb·ft)



Caution:

Since the two bolts with arrow marks are installed with LOCTITE sealing agent, clean up the sealing agent remaining on the screw thread of the transmission case, and then use new bolts with LOCTITE sealing agent.

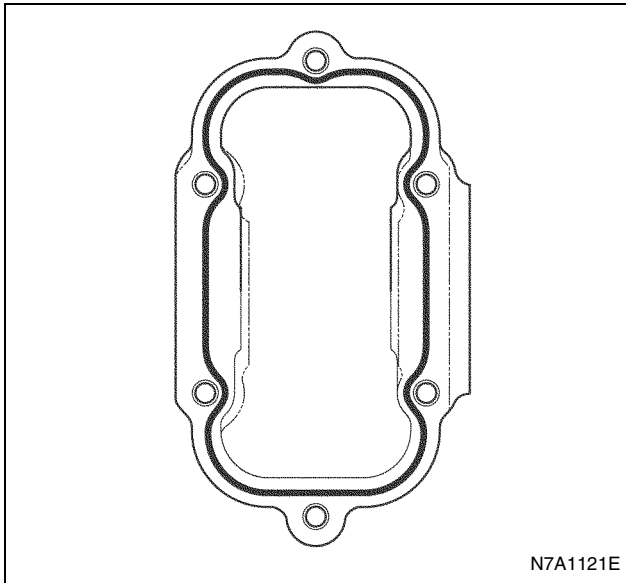


26. Apply ThreeBond 1215 to the mating surface of the transmission case reverse idle cover, and then install the reverse idle cover.

- Wipe off moisture and lubricant from the mating surface. And then apply the bond continuously with a diameter of 2 mm (0.079 in) or more.

Tighten:

Reverse idle cover to 20 N·m (2.0 kg·m / 15 lb·ft)



27. Apply ThreeBond 1215 to the mating surface of the transmission case PTO cover, and then install the PTO cover.

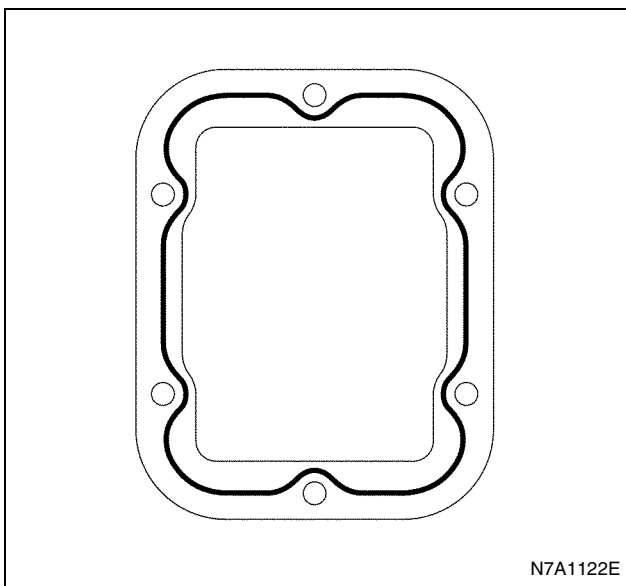
- Wipe off moisture and lubricant from the connecting surface before applying it as a more than 2 mm (0.079 in) diameter solid line.

Tighten:

PTO cover to 37 N·m (3.8 kg·m / 27 lb·ft)

Caution:

Since the bolt is installed with LOCTITE sealing agent, clean up the sealing agent remaining on the screw thread of the transmission case, and then use a new bolt with LOCTITE sealing agent.



28. Shift the position to the neutral, apply ThreeBond 1215 to the mating surface of the transmission case control box, and then install the interlock plate (8) and the control box (1).

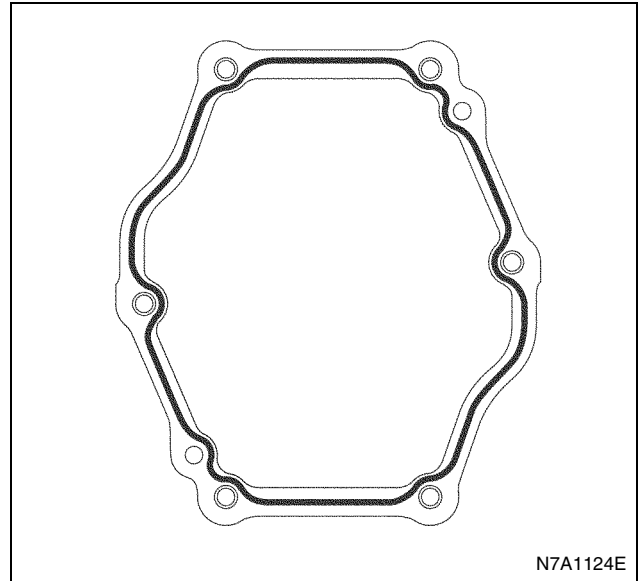
Tighten:

Control box (1) to 27 N·m (2.8 kg·m / 20 lb·ft)

- Wipe off moisture and lubricant from the mating surface. And then apply the bond continuously with a diameter of 2 mm (0.079 in) or more.

Caution:

Since the bolt is installed with LOCTITE sealing agent, clean up the sealing agent remaining on the screw thread of the transmission case, and then use a new bolt with LOCTITE sealing agent.



29. Install the detent assembly (7) (6) (5) (4) after cleaning up the sealing on the thread and applying the LOCTITE 242.

Tighten:

Detent assembly (7) (6) (5) (4) to 27 N·m (2.8 kg·m / 20 lb·ft)

30. Apply LOCTITE 242 to the reverse switch thread portion, and then install the reverse switch (3).

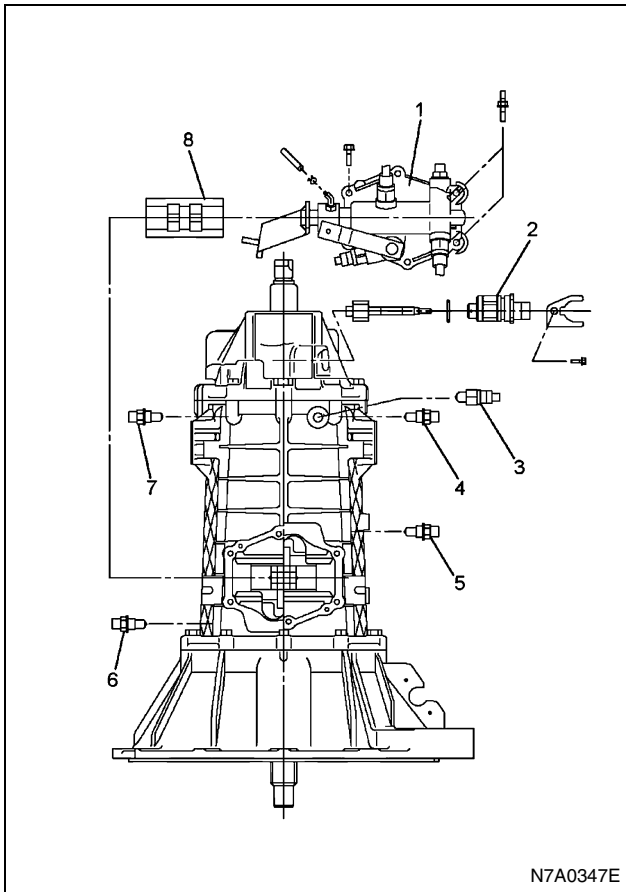
Tighten:

Reverse switch (3) to 39 N·m (4.0 kg·m / 29 lb·ft)

31. Apply engine oil 5W-30 to the speedometer driven gear and the O-ring, and then install the speedometer driven gear (2).

Tighten:

Speedometer driven gear (2) to 20 N·m (2.0 kg·m / 15 lb·ft)



N7A0347E

32. Apply engine oil 5W-30 to the O-ring, and then install the drain plug and the O-ring.

Tighten:

Drain plug to 39 N·m (4.0 kg·m / 29 lb·ft)

33. Apply engine oil 5W-30 to the O-ring, and then install the filler plug and the O-ring.

Tighten:

Filler plug to 39 N·m (4.0 kg·m / 29 lb·ft)

34. Install the parking brake assembly.

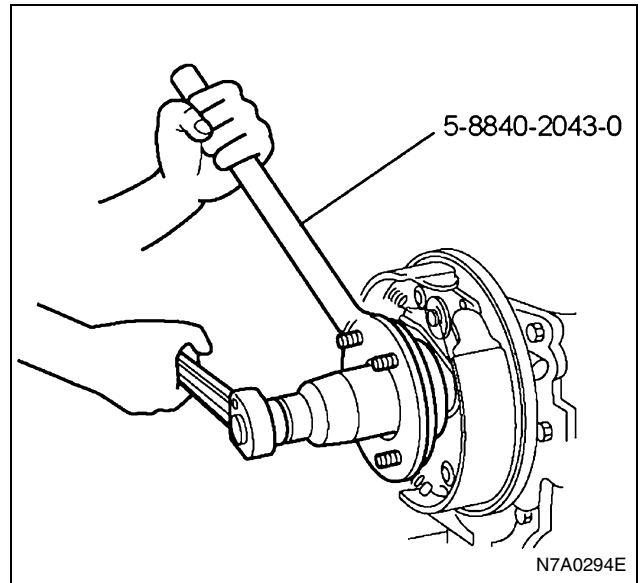
- Refer to PARKING BRAKE ASSEMBLY.

35. Apply engine oil 5W-30 to the O-ring, and then install the coupling driver and the O-ring.

36. Use a new lock nut, apply engine oil 5W-30 to the seat, and then fix the lock nut using the flange holder 5-8840-2043-0.

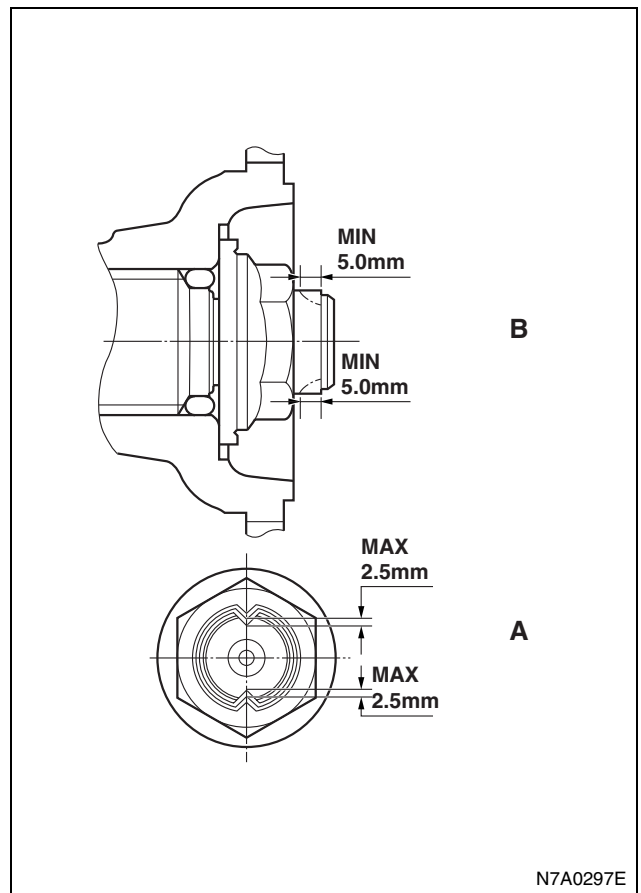
Tighten:

Lock nut to 289 N·m (29.5 kg·m / 213 lb·ft)



N7A0294E

- After fixing it to the specified torque, align the lip part of the nut to the V-groove of the shaft edge. Securely caulk the two parts of the nut lip using a chisel whose tip form is approx. 1 mm (0.04 in) radius by 60°, to make a length (B) of 5 mm (0.2 in) or more, and a clearance between the bottom of the shaft and the nut lip (A) of 2.5 mm (0.06 in) or less.



N7A0297E

37. Install the parking brake drum and adjust hole cover fixing bolt.

- Refer to PARKING BRAKE ASSEMBLY.

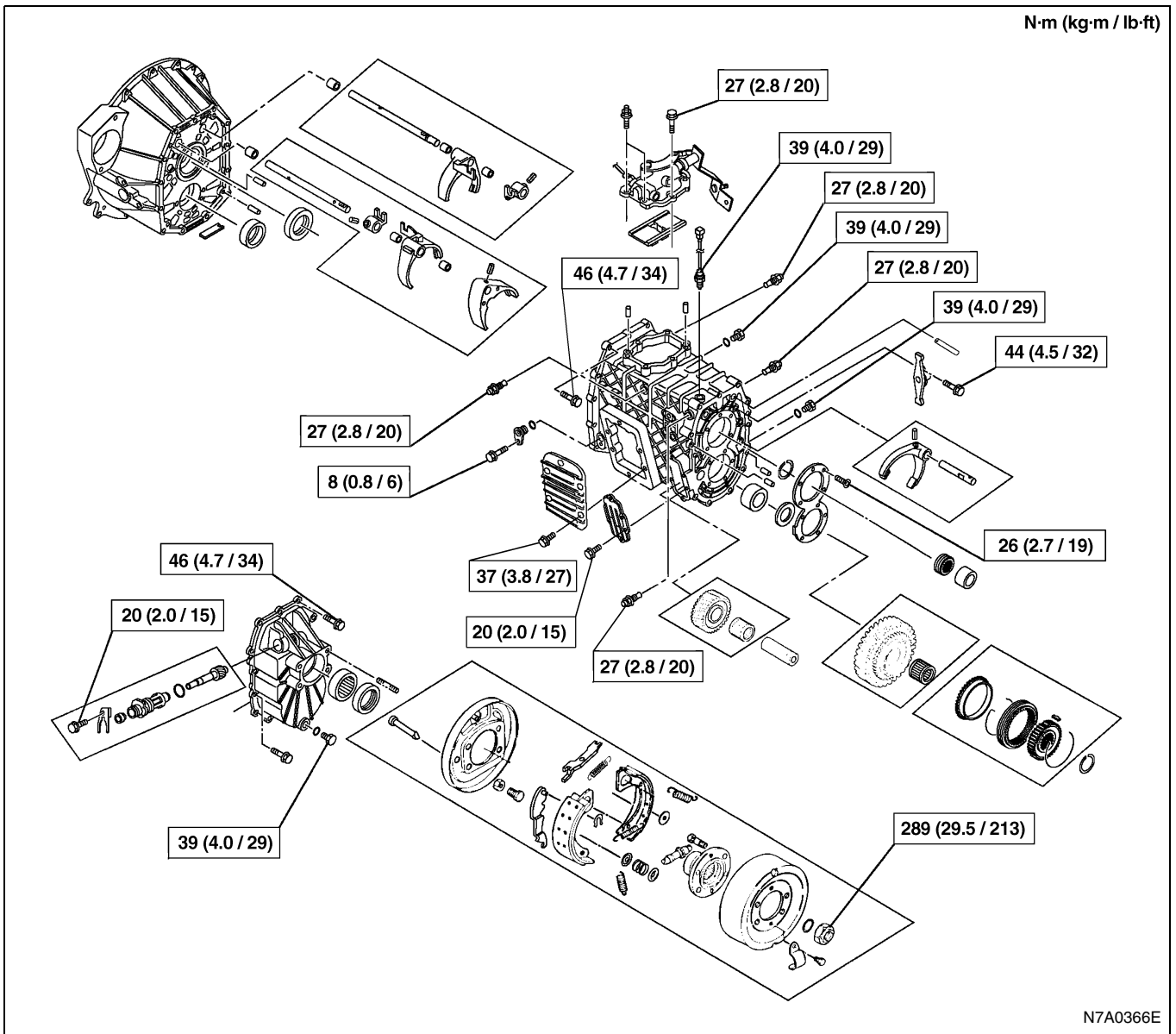
38. Install the shift fork and the support bolt.

- Refer to CLUTCH.

39. Install the shift block assembly.

- Refer to CLUTCH.

Fixing Torque



Special Tools


Illustration	Tool Number / Description / Remarks
	5-8840-0007-0 / Grip
5884000070	


Illustration	Tool Number / Description / Remarks
	5-8840-0084-0 / Sliding Hammer
5884000840	

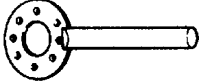
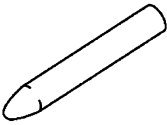
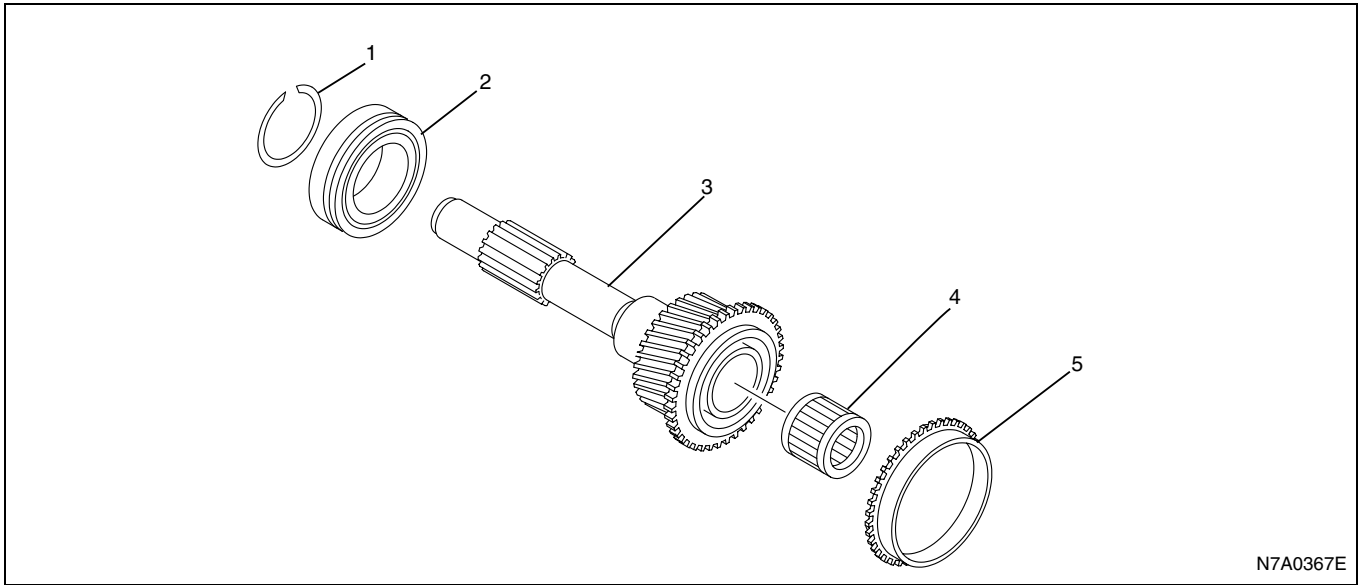
Illustration	Tool Number / Description / Remarks
 <p>5884000270</p>	<p>5-8840-0027-0 / Bearing Remover</p>
 <p>5884020430</p>	<p>5-8840-2043-0 / Flange Holder</p>
 <p>5884025580</p>	<p>5-8840-2558-0 / Oil Seal Installer</p>
 <p>5884027500</p>	<p>5-8840-2750-0 / Oil Seal Installer</p>
 <p>5884027520</p>	<p>5-8840-2752-0 / Bearing Installer</p>
 <p>5884027550</p>	<p>5-8840-2755-0 / Bush Remover & Installer</p>
 <p>5884022440</p>	<p>5-8840-2244-0 / Bearing Installer</p>

Illustration	Tool Number / Description / Remarks
 <p>5884027930</p>	<p>5-8840-2793-0 / Oil Seal Protector</p>

Top Gear Shaft Components



Legend

- | | |
|-------------------|-------------------|
| 1. Snap ring | 4. Needle bearing |
| 2. Bearing | 5. Block ring |
| 3. Top gear shaft | |

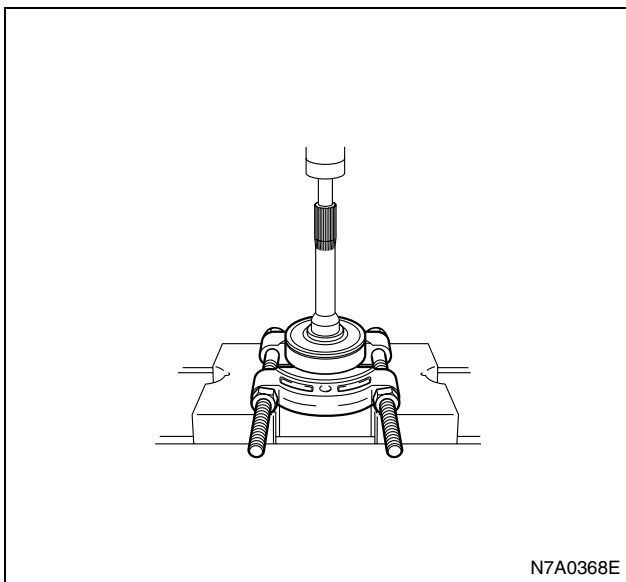
Disassembly

1. Remove the block ring from the top gear shaft.
2. Remove the needle bearing from the top gear shaft.

Caution:

As the needle bearing is of separation type, make sure not to drop and damage the roller.

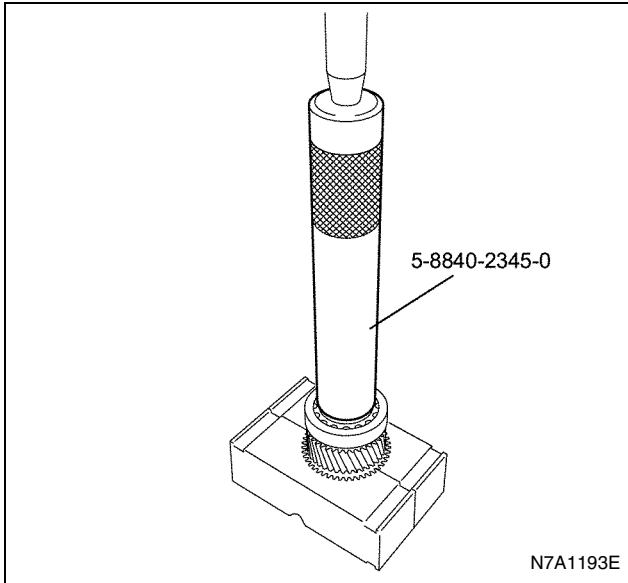
3. Remove the snap ring using snap ring pliers.
4. Remove the bearing by a press using a bearing remover.



5. Inspect each part. If any wear, damage or other abnormality is found, repair or replace the part.
5. Inspect the gear tooth, spline part and the sliding part of the top for damage and wear. If any abnormality is found, replace them with new ones.
6. Inspect each bearing regarding the following items. If any abnormality is found, replace it with a new one.
 - Smoothness of rotation
 - Noise
 - Abnormal external appearance, including damage, rust, etc.
 - Abnormal free play in thrust direction
 - Discoloration, excessive wear and pitching of the rolling body and surface of the needle bearing

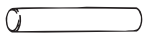
Assembly

1. Press the bearing using the installer 5-8840-2345-0.



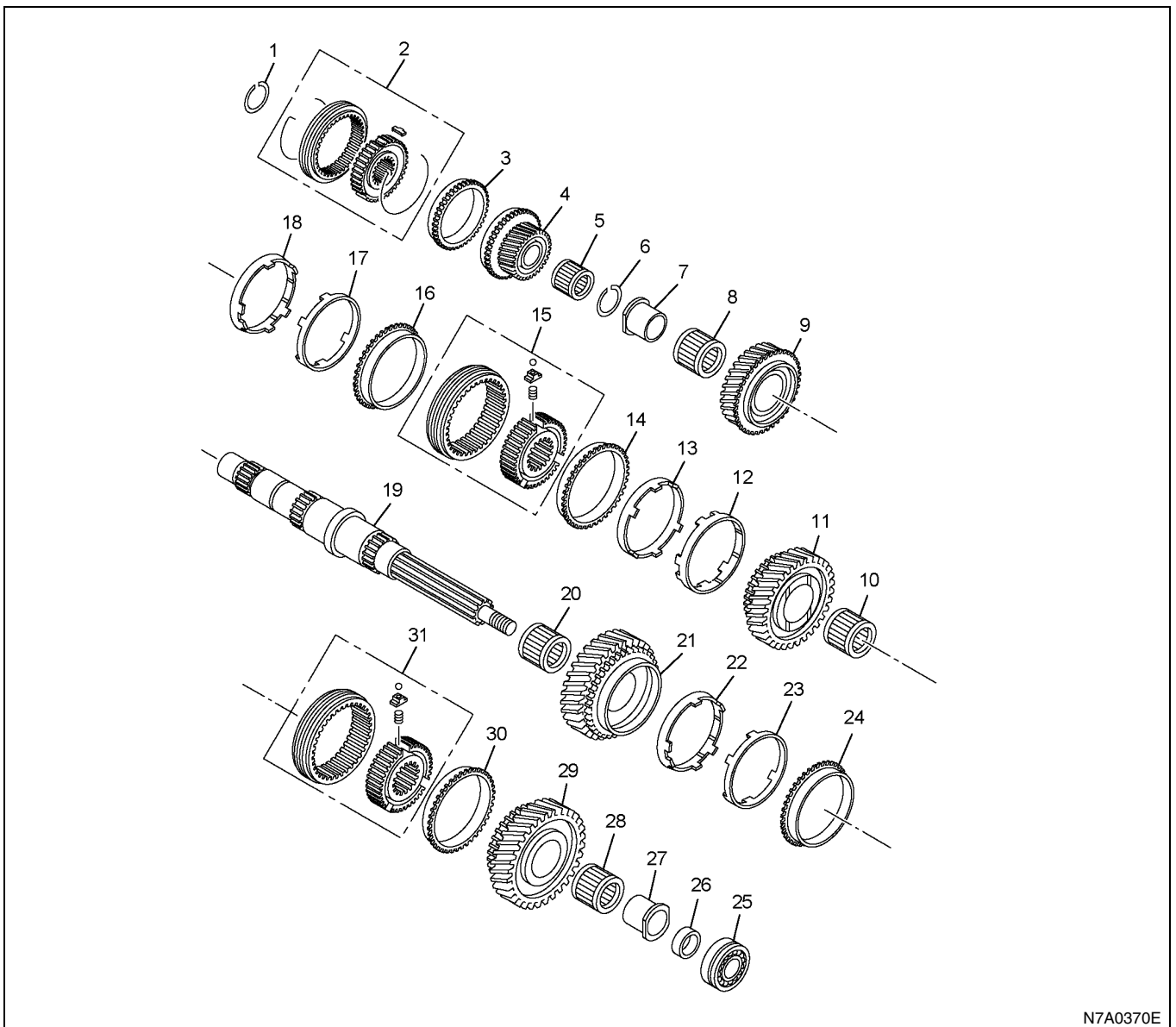
2. Install the snap ring using snap ring pliers.
3. Install the needle bearing to the top gear shaft.
4. Apply engine oil 5W-30 sufficiently to the internal surface of the block ring, and install the block ring to the top gear shaft.

Special Tools

Illustration	Tool Number / Description / Remarks
	5-8840-2345-0 / Clutch Hub & Collar Installer
5884023450	

Main Shaft (5MT)

Components

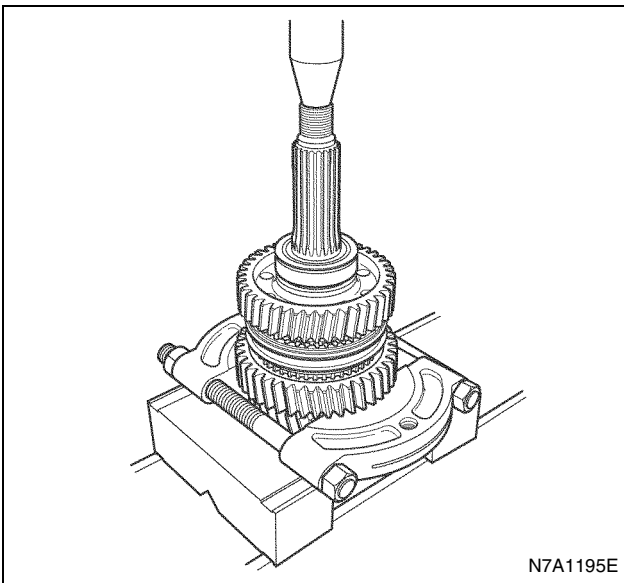


Legend

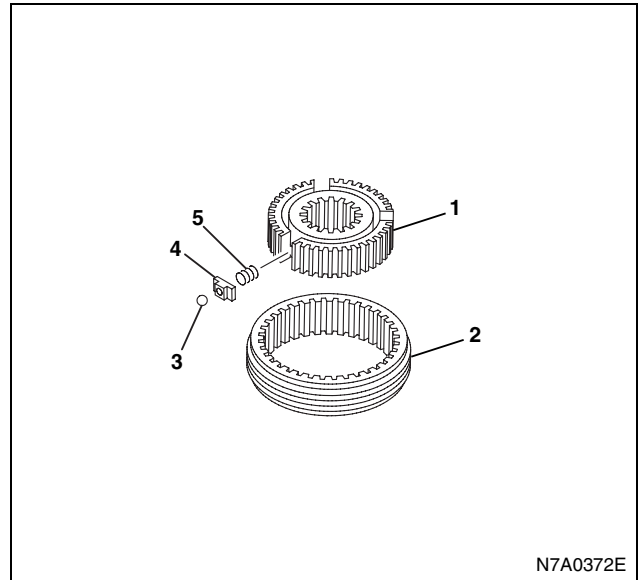
- | | |
|--|--|
| 1. Snap ring | 17. 3rd outside ring |
| 2. 4th-5th clutch hub assembly and sleeve | 18. 3rd inside ring |
| 3. 5th block ring | 19. Main shaft |
| 4. 5th gear | 20. Needle bearing |
| 5. Needle bearing | 21. 1st gear |
| 6. Snap ring | 22. 1st inside ring |
| 7. Collar | 23. 1st outside ring |
| 8. Needle bearing | 24. 1st block ring |
| 9. 3rd gear | 25. Bearing |
| 10. Needle bearing | 26. Spacer |
| 11. 2nd gear | 27. Collar |
| 12. 2nd inside ring | 28. Needle bearing |
| 13. 2nd outside ring | 29. Reverse gear |
| 14. 2nd block ring | 20. Reverse block ring |
| 15. 2nd-3rd clutch hub assembly and sleeve | 31. 1st-reverse clutch hub assembly & sleeve |
| 16. 3rd block ring | |

Disassembly

1. Remove simultaneously the following parts with a press using a bearing remover; the bearing, spacer, collar, reverse gear, needle bearing, reverse block ring, 1st-reverse clutch hub assembly & sleeve, 1st block ring, 1st outside ring, 1st inside ring, 1st gear, and needle bearing.

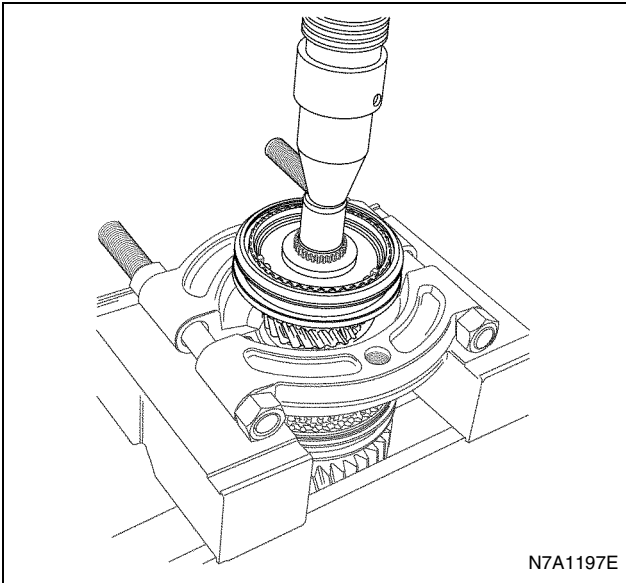


2. Disassemble the 1st-reverse clutch hub & sleeve.

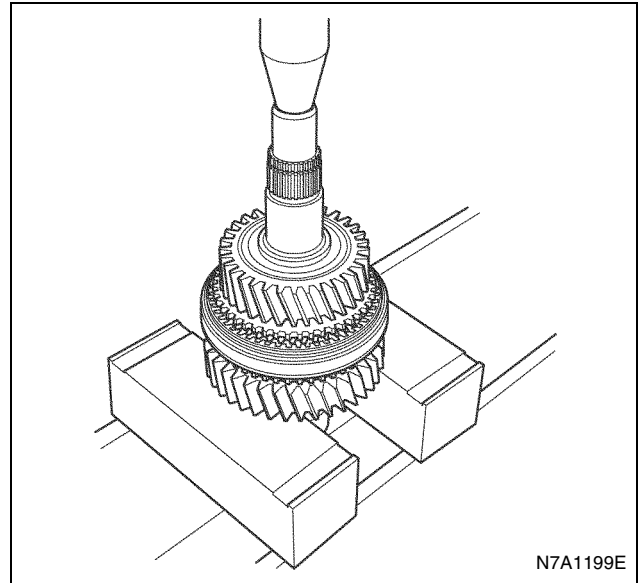


Legend

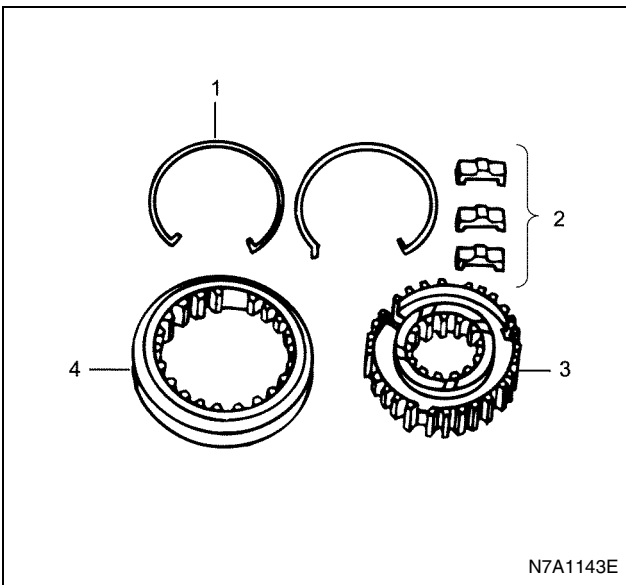
- | |
|---------------|
| 1. Clutch hub |
| 2. Sleeve |
| 3. Ball |
| 4. Block |
| 5. Spring |
3. Remove the 4th-5th clutch hub assembly fixing snap ring using snap ring pliers.
 4. Remove simultaneously the following parts with a press using a bearing remover; the 4th-5th clutch hub assembly & sleeve, 5th block ring, 5th gear, needle bearing.



5. Disassemble the 4th-5th clutch hub assembly & sleeve.



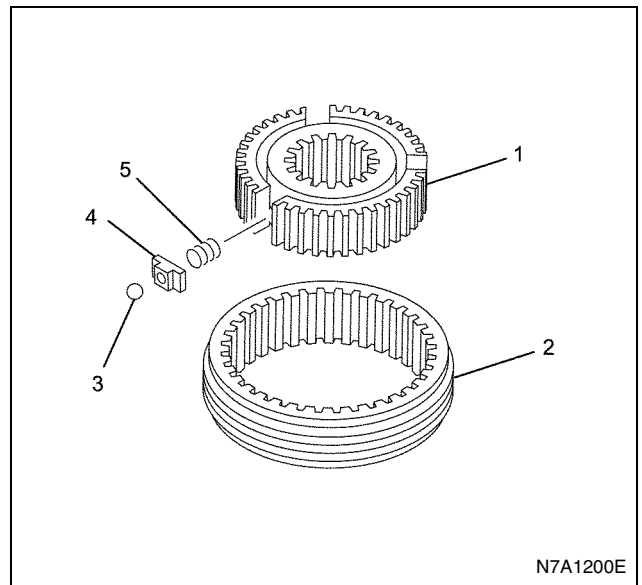
8. Disassemble the 2nd-3rd clutch hub assembly & sleeve.



Legend

- 1. Spring
- 2. Insert
- 3. Clutch hub
- 4. Sleeve

- 6. Remove the 3rd gear collar fixing snap ring using snap ring pliers.
- 7. Remove simultaneously from the main shaft the following parts with a press using a bearing remover; the collar, 3rd gear, needle bearing, 3rd inside ring, 3rd outside ring, 3rd block ring, 2nd-3rd clutch hub assembly & sleeve, 2nd block ring, 2nd outside ring, 2nd inside ring, 2nd gear, and needle bearing.



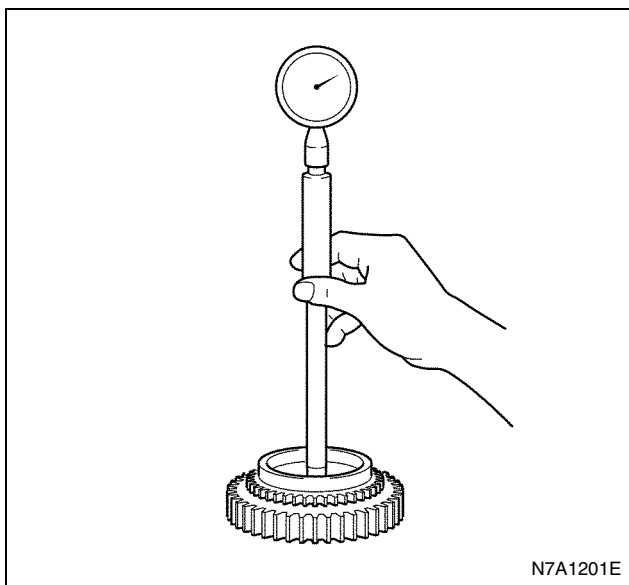
Legend

- 1. Clutch hub
- 2. Sleeve
- 3. Ball
- 4. Block
- 5. Spring

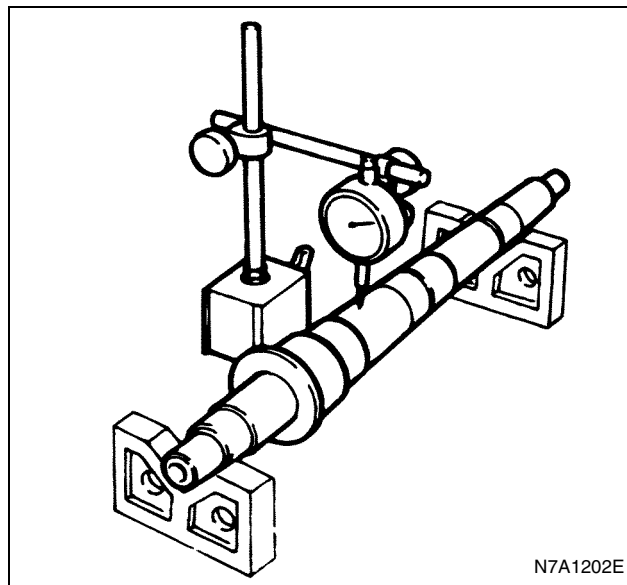
- Inspect each part, and if any wear, damage and other abnormality is found, repair or replace the item.
- 9. Inspect each bearing with respect to the following items, and if any abnormality is found, replace the part.
 - Smoothness of rotation
 - Noise
 - Abnormal external appearance, including damage, rust, etc.

- Abnormal free play in thrust direction
10. Inspect the internal diameter of the gear.
- Measure the inside diameter of each gear using an inside dial gauge.
 - If the measured value exceeds the limit, replace the gear.

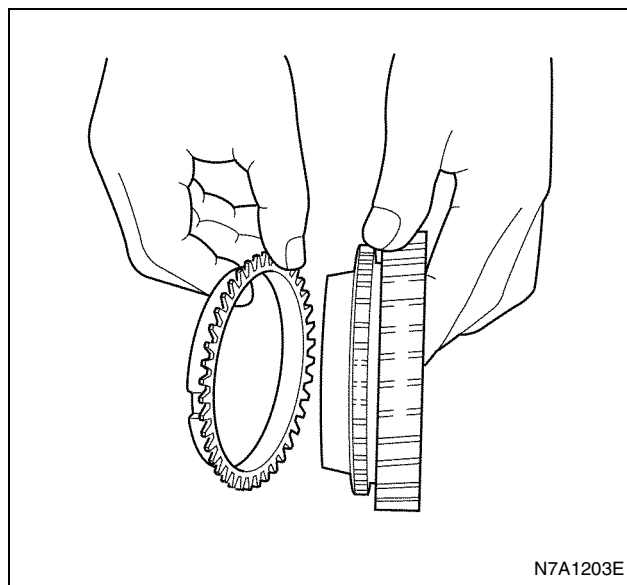
Gear Internal Diameter, mm (in)		
	Standard	Limit
5th gear	44.009 — 44.025 (1.732 — 1.733)	44.065 (1.734)
3rd gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)
2nd gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)
1st gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)
Reverse Gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)



11. Main shaft deflection
- Measure the deflection of the main shaft using a dial gauge.
 - If the measured value exceeds the limit, replace the main shaft.
Standard: 0.015 mm (0.000059 in)
Limit: 0.1 mm (0.00393 in)

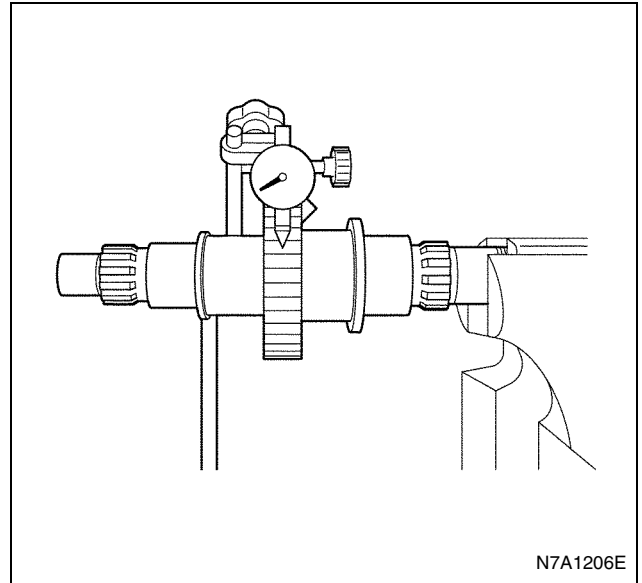
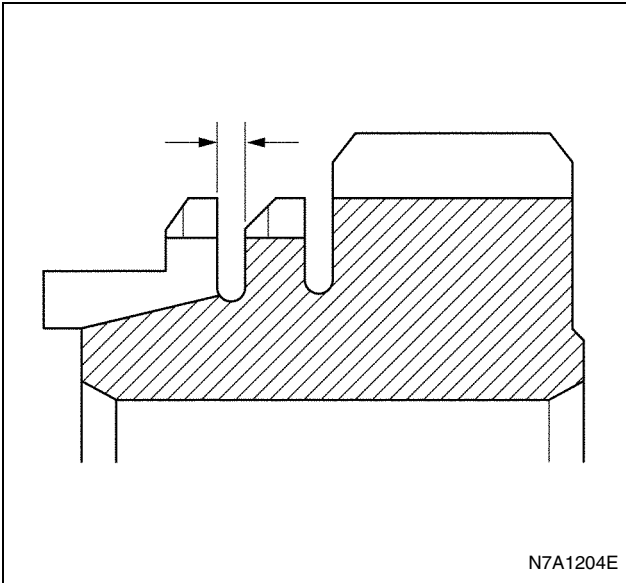


12. Inspect the synchronesh system.
- Inspect the components, and repair light stepped wear and damage using an oil stone or a pencil grinder.

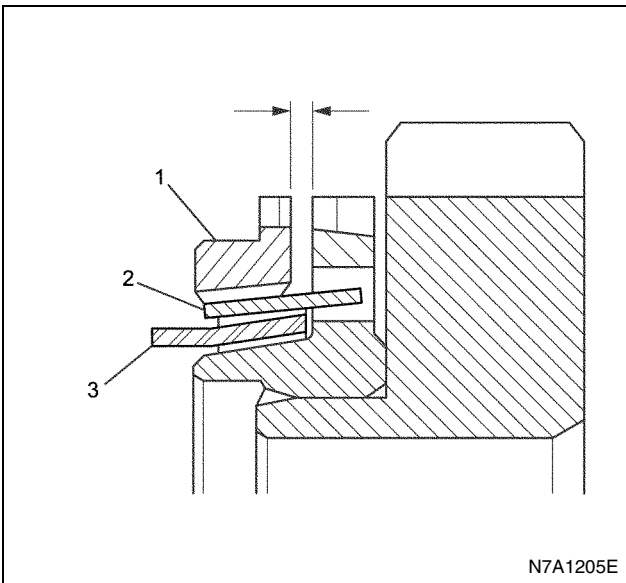


13. Clearance between block ring and dog gear
- Measure the clearance using a thickness gauge.
 - If the measured value exceeds the limit, replace the block gear.

Clearance between Block Ring and Dog Gear, mm (in)		
	Standard	Limit
4th / 5th / Reverse	1.30 — 2.60 (0.051 — 0.102)	0.5 (0.019)
2nd / 3rd	1.00 — 2.50 (0.039 — 0.098)	0.5 (0.019)
1st	1.00 — 2.50 (0.039 — 0.098)	0.5 (0.019)



16. Measure the clearance between the insert and block ring groove using a caliper.
- If the measured value exceeds the limit, replace the insert and block ring.



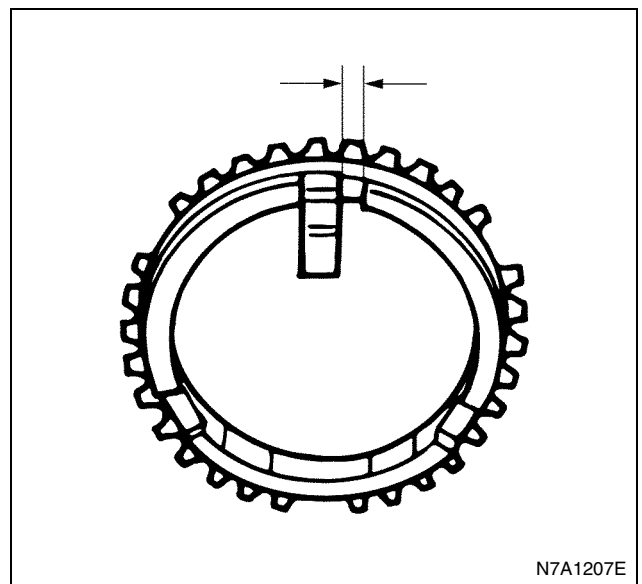
Clearance between Insert and Block Ring Groove, mm (in)	
	Standard
4th / 5th	3.46 — 3.76 (0.136 — 0.148)

Legend

- 1. Block ring
- 2. Outside ring
- 3. Inside ring

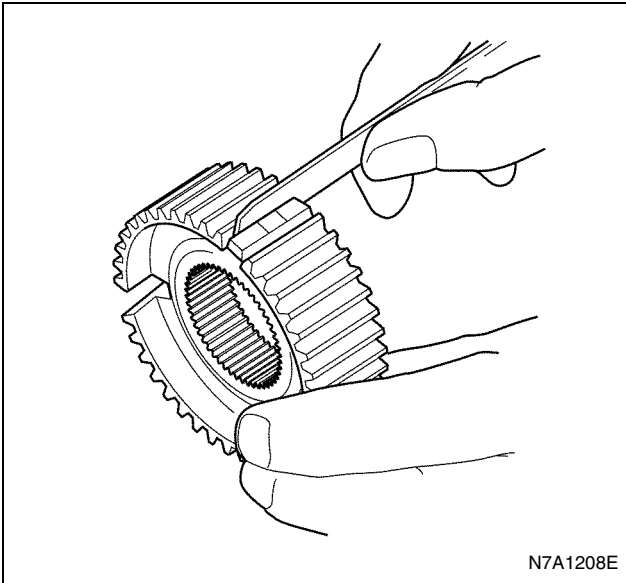
14. Inspect the sliding part, spline part, inserting part and insert groove of the clutch hub and sliding sleeve for wear and damage.
15. Measure the free play in the direction of spline rotation on the clutch hub external circumference.
- If the measured value exceed the limit, replace the part.

Spline Free Play, mm (in)	
Standard	Limit
0 — 0.05 (0 — 0.0019)	0.3 (0.0118)



17. Measure the clearance between the insert and clutch hub using a thickness gauge.
- If the measured value exceeds the limit, replace the insert and clutch hub.

Clearance between Insert and Clutch Hub, mm (in)	
	Standard
4th / 5th	0.01 — 0.21 (0.00039 — 0.00826)

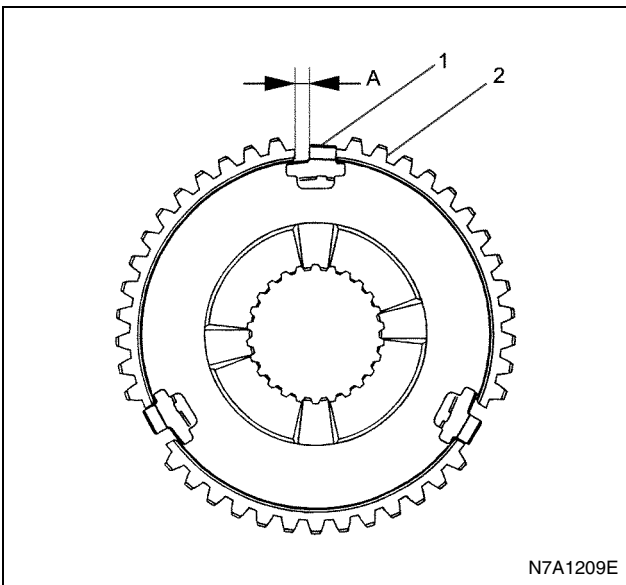


N7A1208E

18. Measure the clearance A between the block ring and the clutch hub using a thickness gauge.
- If the measured value exceeds the limit, replace the block and clutch hub.

Clearance between Block Ring and Clutch Hub, mm (in)

	Standard
2nd / 3rd	4.30 — 4.70 (0.16929 — 0.18503)
1st / Reverse	4.30 — 4.70 (0.16929 — 0.18503)



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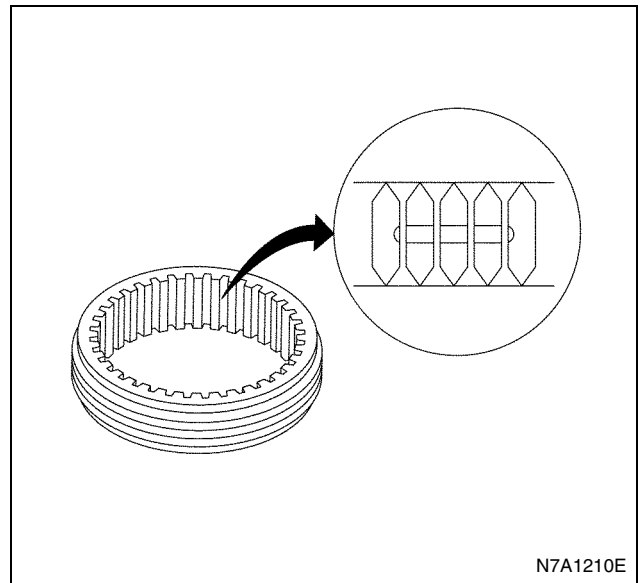
Legend

- 1. Block ring
- 2. Clutch hub

Assembly

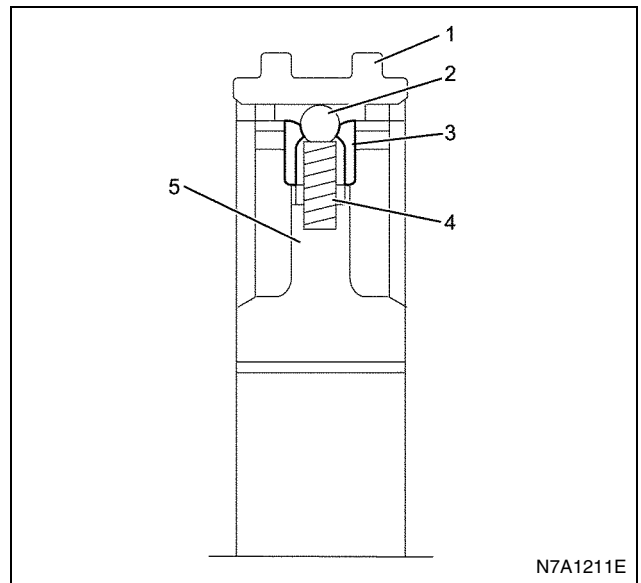
- Clean up each part.

- Set the main shaft in a vise, with the long spline part at the bottom. When setting the main shaft, make sure not to damage the grind surface.
1. Assemble the 2nd-3rd clutch hub assembly & sleeve following the procedure below.
 - a. Install the block and sleeve to the clutch hub.
 - b. Inside the sleeve, there are three ball grooves. Align the phase to let the ball enter the center of the ball grooves.



N7A1210E

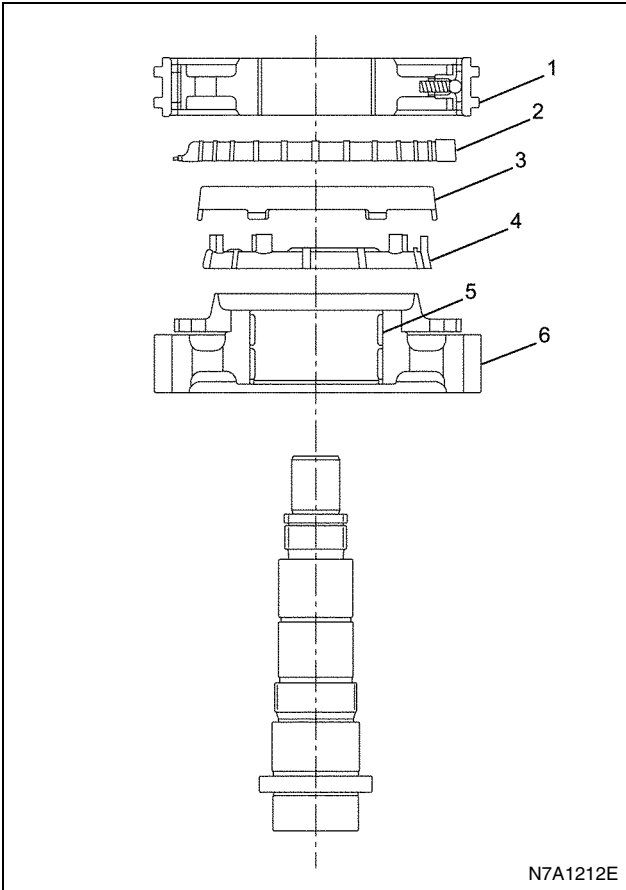
- c. Insert sleeve (1) until the clutch hub (5) slightly overlaps the block.
- d. Securely insert the sleeve until the ball enters the ball groove of the sleeve by pushing the ball (2), block (3) and spring (4).



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2. Apply engine oil 5W-30 to the needle bearing, 2nd gear thrust surface and synchro cone taper surface. And install the 2nd gear (6) and needle bearing (5) to the main shaft with the dog gear turned upward.

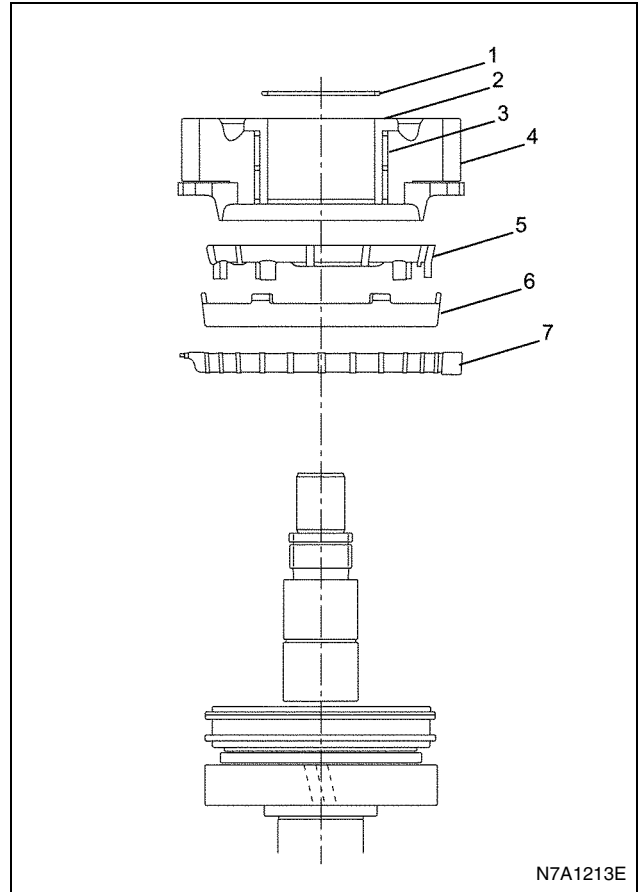
3. Install the 2nd inside ring (4), 2nd outside ring (3) and 2nd block ring (2) inserting the nail of the outside ring into the gear hole of the 2nd gear. At this time, make sure to apply engine oil 5W-30 sufficiently to the both sides of the inside ring and outside ring, and inside diameter surface of the block ring.
4. Insert the 2nd-3rd clutch hub assembly & sleeve with a press using the installer 5-8840-2345-0, setting the six nails of the inside ring to enter the six holes of the hub.



5. During installation, set the six nails of the inside ring of the 3rd block ring (7), 3rd outside ring (6) and 3rd inside ring (5) to enter the six hub holes respectively. At this time, apply engine oil 5W-30 sufficiently to the inside surface of the outside ring and the inside diameter surface of the block ring.
6. Apply engine oil 5W-30 to the needle bearing, 3rd gear thrust surface and synchro cone taper. Turn the dog gear downward, and insert the 3rd gear (4), needle bearing (3) and collar (2) with a press using the installer 5-8840-2345-0, setting the nail of the outer ring to enter the dog gear hole of the 3rd gear.
7. Install the snap ring (1) using snap ring pliers.

Caution:

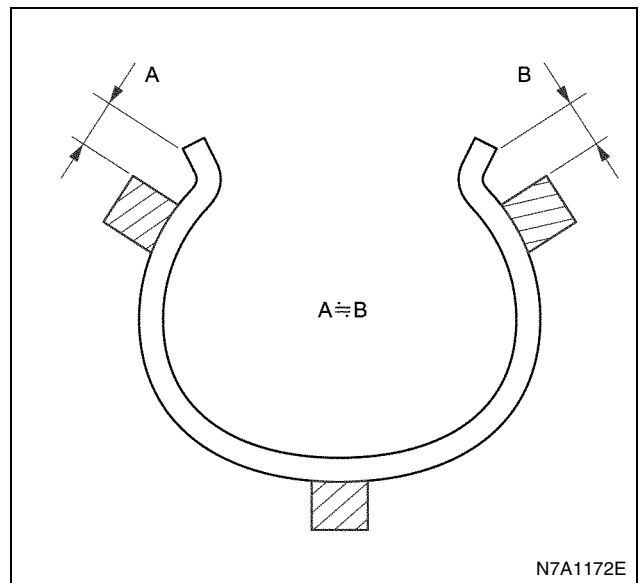
Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.



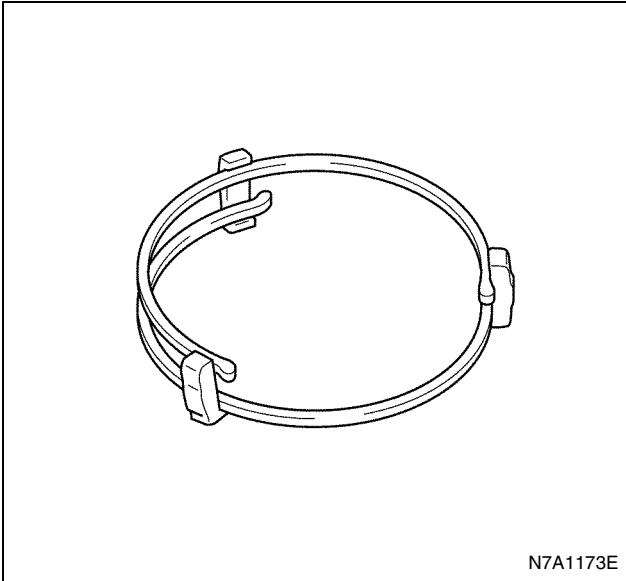
8. Assemble the 4th-5th clutch hub assembly & sleeve following the procedure below.
 - a. Assemble securely the insert (2) to the insert groove of the block ring.
 - b. Install the insert spring (3) to the insert.

Caution:

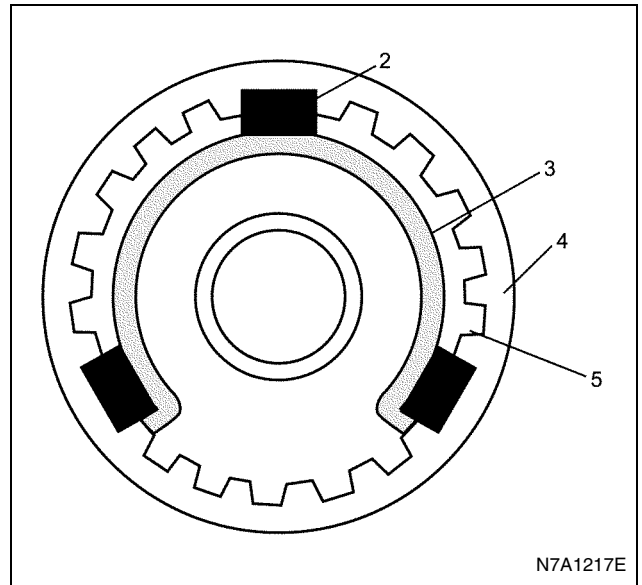
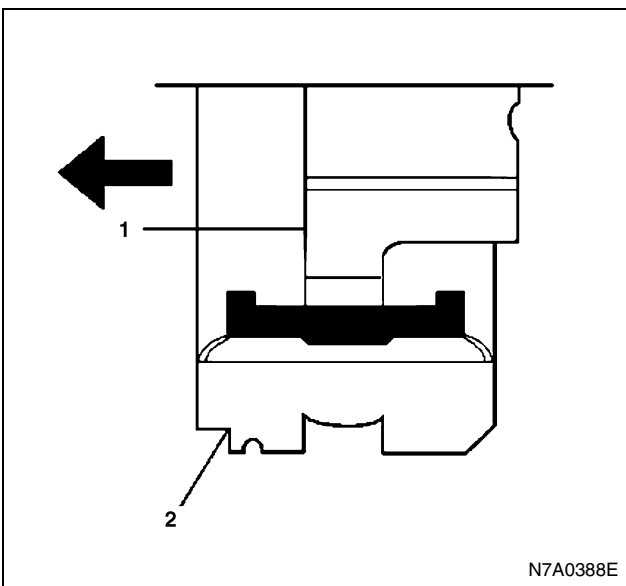
- When assembling the insert spring, equalize the length of the both edges of the spring not to adversely interfere with the inside diameter of the hub.



- Make sure that the open part of the insert spring assembled on the reverse side, is not aligned with the open part of the front side.



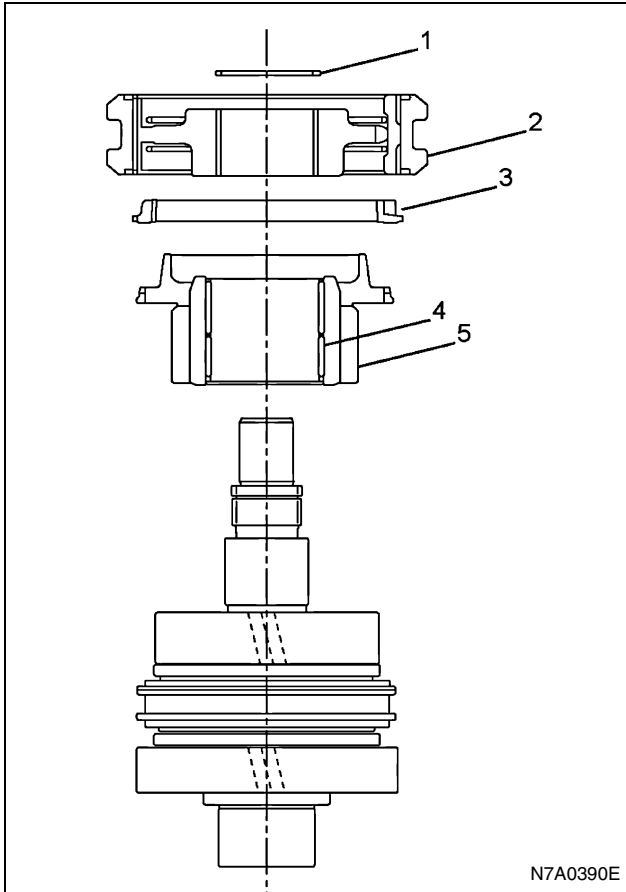
- c. Check that the clutch hub (5) and sleeve (4) are smoothly sliding.
- The arrow (1) indicates the front side of the transmission.



9. Apply engine oil 5W-30 sufficiently to the needle bearing, 5th gear thrust surface and synchro cone taper, and install the 5th gear (5) and needle bearing (4) with the dog gear turned upward.
10. Apply engine oil 5W-30 to the 5th block ring (3), and install.
11. Turning the surface with oil groove downward, align the 4th-5th clutch hub assembly and sleeve (2) to the groove of the 4th-5th block ring, and then insert with a press using the installer 5-8840-2345-0.
12. Install the snap ring (1) using snap ring pliers.

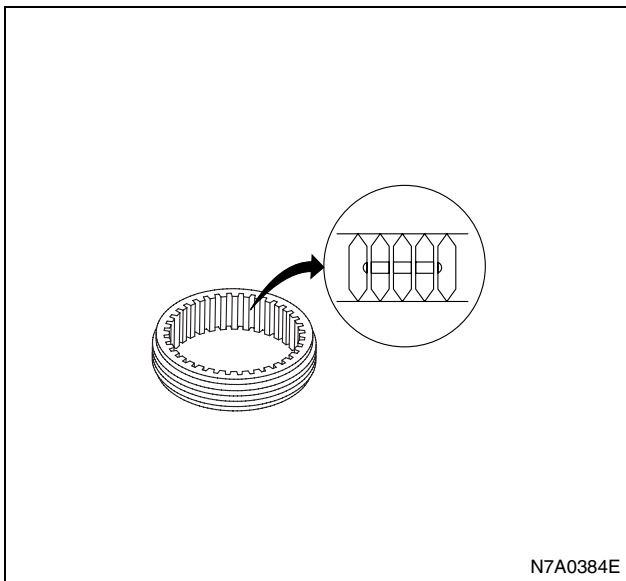
Caution:

Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.



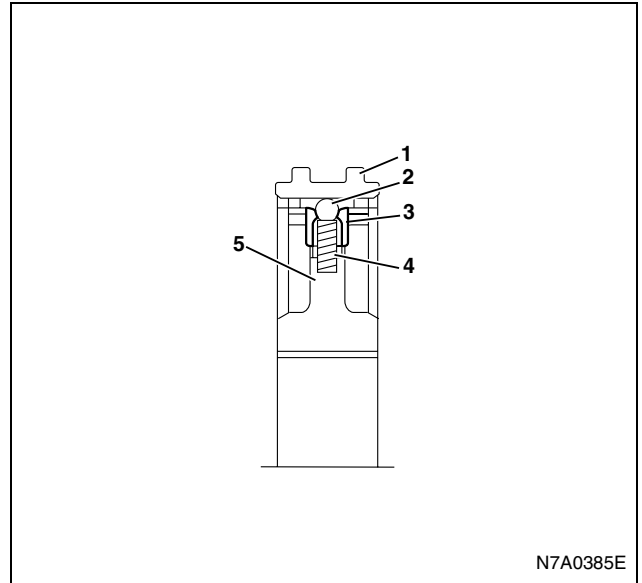
N7A0390E

13. Assemble the 1st-reverse clutch hub assembly and sleeve following the procedure below.
 - a. Install the block and spring to the clutch hub.
 - b. Inside the sleeve, there are three ball grooves. Align the phase to let the ball enter the ball groove.



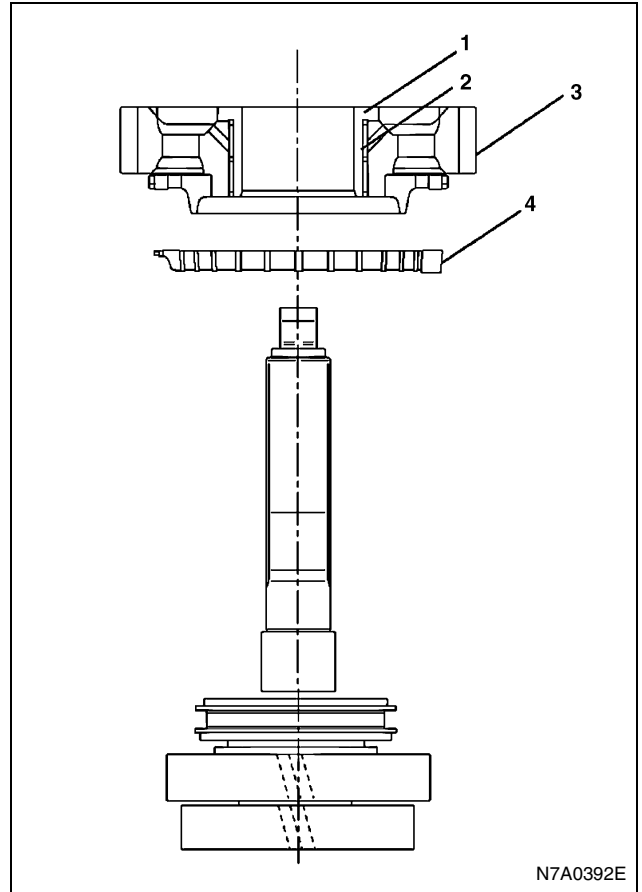
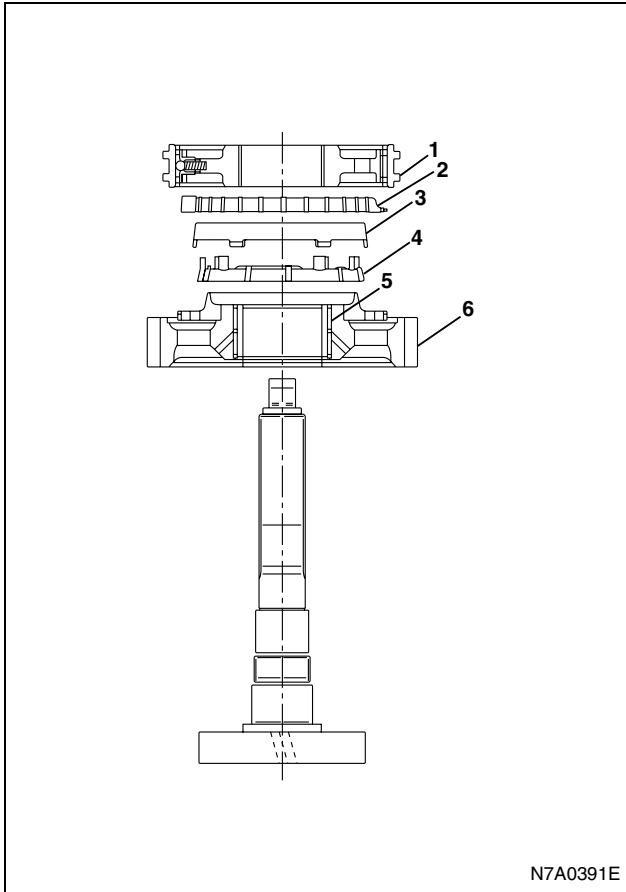
N7A0384E

- c. Insert the sleeve (1) until the block slightly overlaps the clutch hub (5).
- d. Securely insert the sleeve until the ball enters the ball groove of the sleeve by pushing the ball (2), block (3) and spring (4).



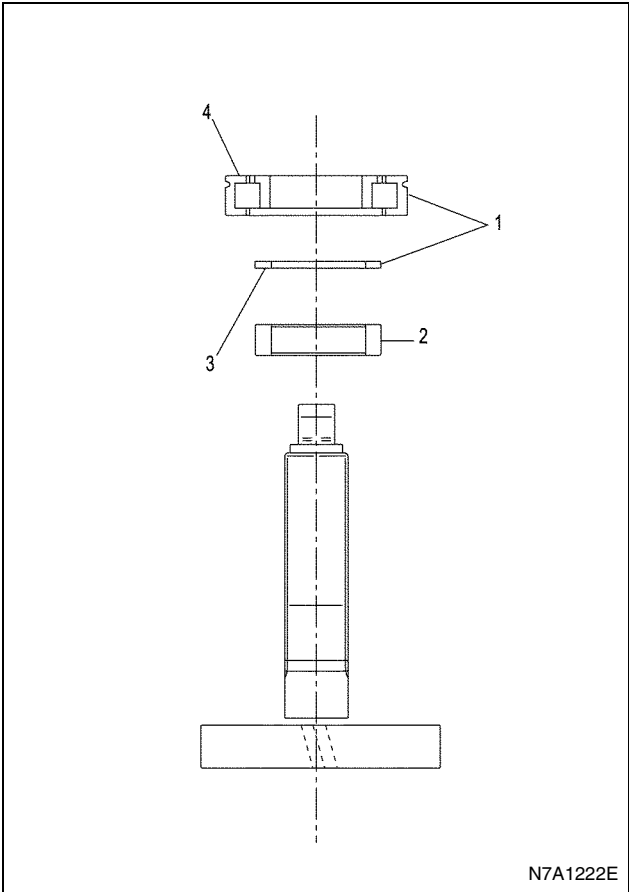
N7A0385E

14. Apply engine oil 5W-30 to the needle bearing, 1st gear thrust surface and synchro cone taper surface. And install the 1st gear (6) and needle bearing (5), turning the dog gear upward.
15. Assemble the 1st inside ring (4), 1st outside ring (3) and 1st block ring (2), inserting the nail of the outer ring into the dog gear hole of the 1st gear. At this time, make sure to apply engine oil 5W-30 sufficiently to the both sides of the inside ring and outside ring, and inside diameter surface of the block ring.
16. Insert the 1st-reverse clutch hub assembly & sleeve (1) with a press using the installer 5-8840-2345-0, setting the six nails of the inside ring to enter the six holes of the hub.

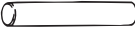


17. Apply engine oil 5W-30 sufficiently to the reverse block ring (4), and then align the phase of the block ring groove to the 1st-reverse clutch hub assembly and sleeve, and install.
18. Apply engine oil 5W-30 to the needle bearing, the reverse gear thrust surface and the synchro cone taper. Turning the dog gear downward, align the phase of the synchro cone phase of the reverse gear to the nail of the outer ring, and insert the reverse gear (3), needle bearing (2), and collar (1) with a press using the installer 5-8840-2345-0.

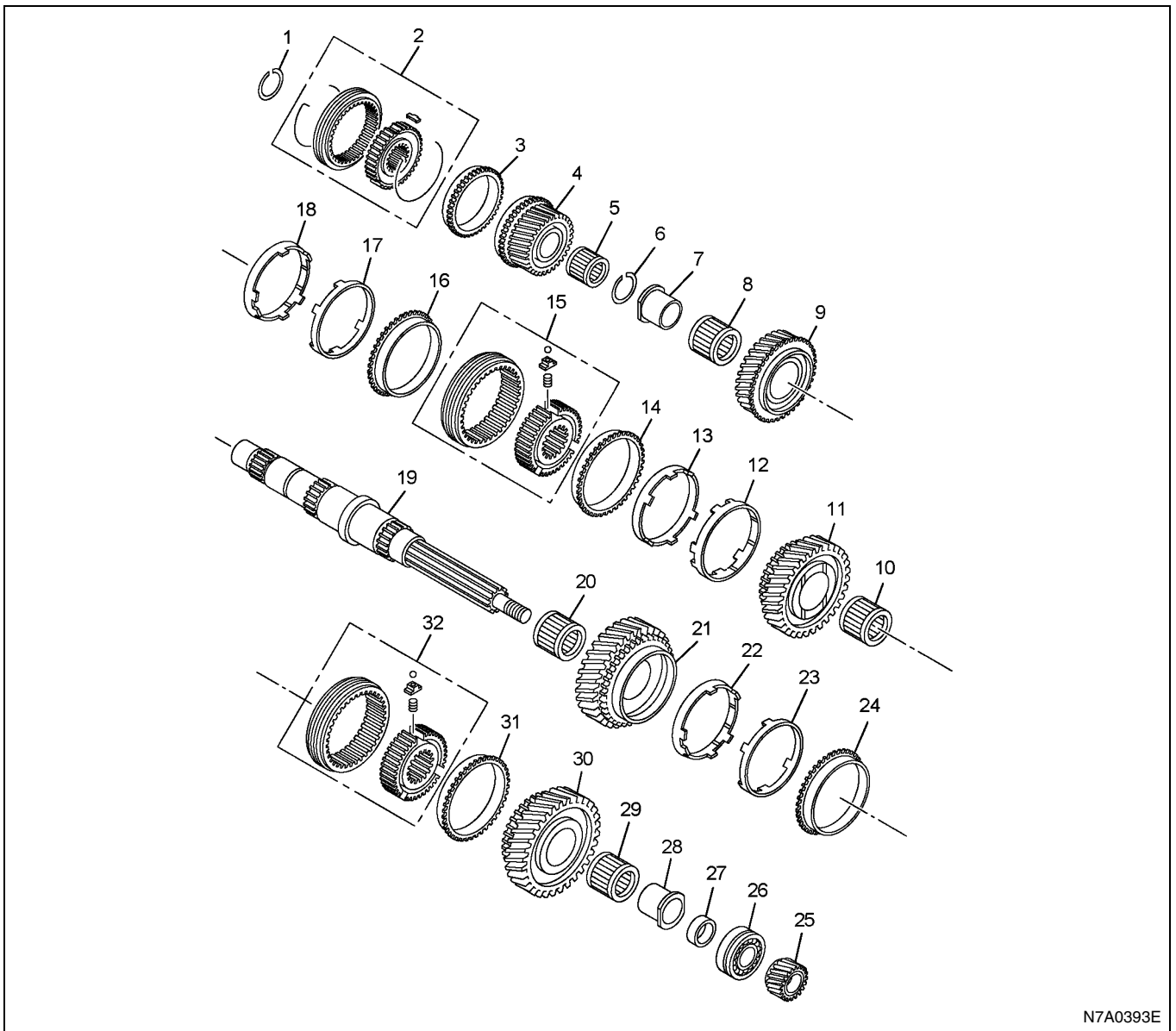
19. Install the spacer (2).
20. Insert the bearing (1) with a press using the installer 5-8840-2345-0, turning the stamped surface (4) upward and the stamped surface (3) downward.



Special Tools

Illustration	Tool Number / Description / Remarks
 <p>5884023450</p>	<p>5-8840-2345-0 / Clutch Hub & Collar Installer</p>

Main Shaft (6MT) Components



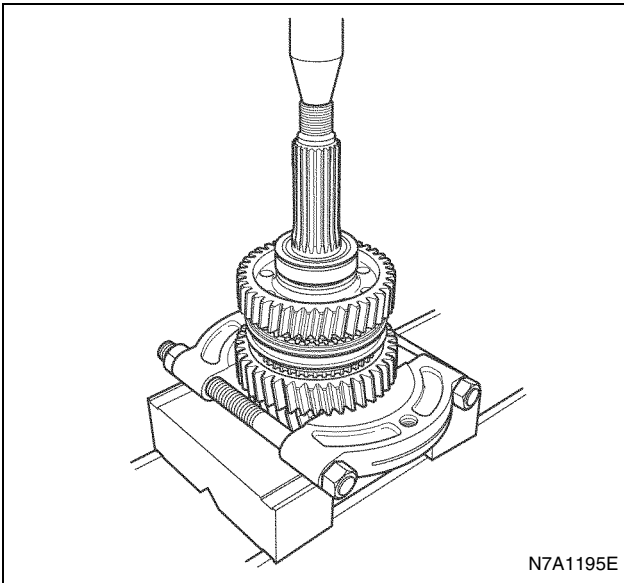
N7A0393E

Legend

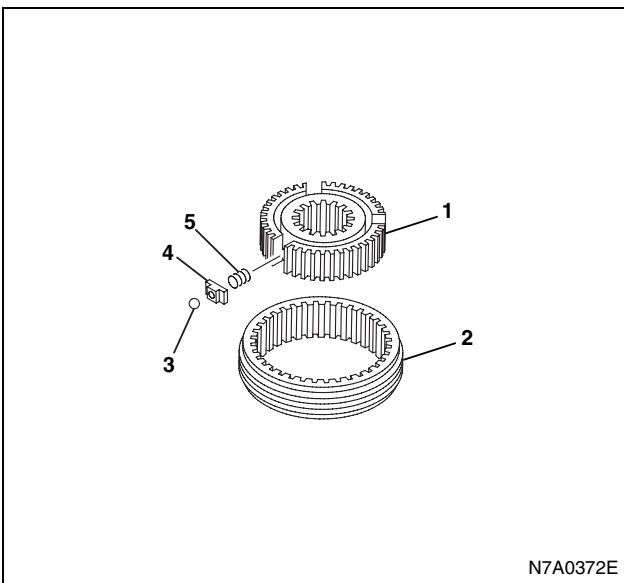
- | | |
|--|--|
| 1. Snap ring | 17. 3rd outside ring |
| 2. 4th-5th clutch hub assembly & sleeve | 18. 3rd inside ring |
| 3. 4th block ring | 19. Main shaft |
| 4. 4th gear | 20. Needle bearing |
| 5. Needle bearing | 21. 1st gear |
| 6. Snap ring | 22. 1st inside ring |
| 7. Collar | 23. 1st outside ring |
| 8. Needle bearing | 24. 1st block ring |
| 9. 3rd bearing | 25. 6th gear |
| 10. Needle bearing | 26. Bearing |
| 11. 2nd bearing | 27. Spacer |
| 12. 2nd inside ring | 28. Collar |
| 13. 2nd outside ring | 29. Needle bearing |
| 14. 2nd block ring | 30. Reverse gear |
| 15. 2nd-3rd clutch hub assembly & sleeve | 31. Reverse block ring |
| | 32. 2nd-3rd clutch hub assembly & sleeve |

Disassembly

1. Remove the 6th gear.
2. Remove simultaneously the following parts using a bearing remover with a press; the bearing, spacer, collar, reverse gear, needle bearing, 2nd-3rd, reverse block ring, 1st-reverse clutch hub assembly & sleeve, 1st block ring, 1st outside ring, 1st inside ring, 1st gear, needle bearing.



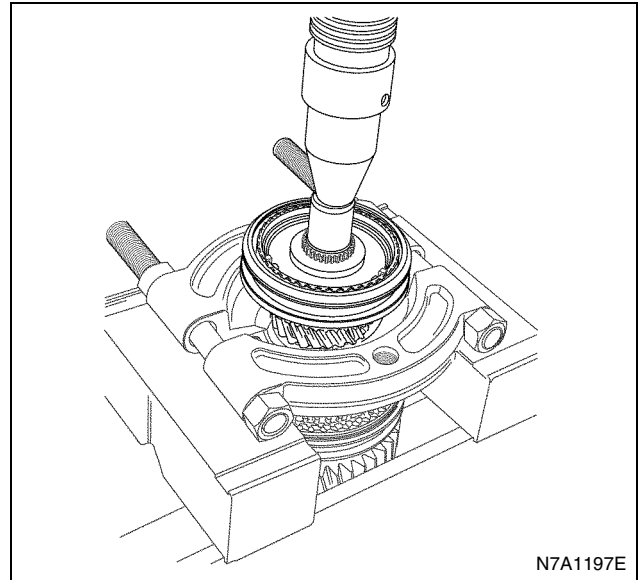
3. Disassemble the 1st-reverse clutch hub assembly & sleeve.



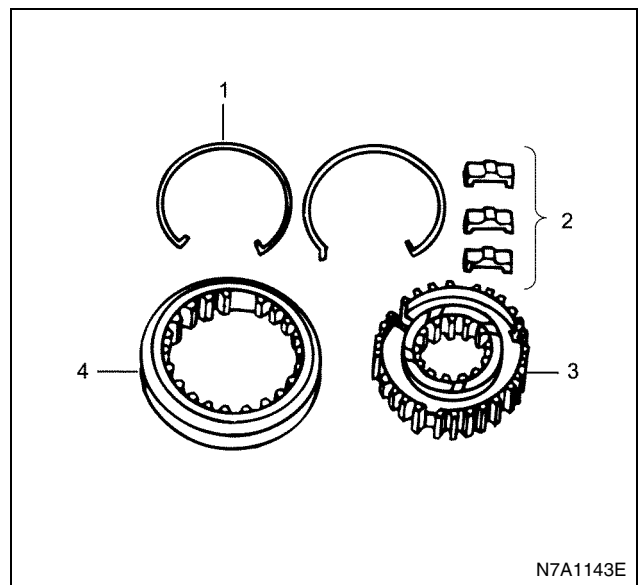
Legend

1. Clutch hub
2. Sleeve
3. Ball
4. Block
5. Spring

4. Remove the 4th-5th clutch hub assembly fixing snap ring using snap ring pliers.
5. Remove simultaneously the following parts, using a bearing remover with a press; 4th-5th clutch hub assembly & sleeve, 4th block ring 4th gear and needle bearing.



6. Disassemble the 4th-5th clutch hub assembly & sleeve.

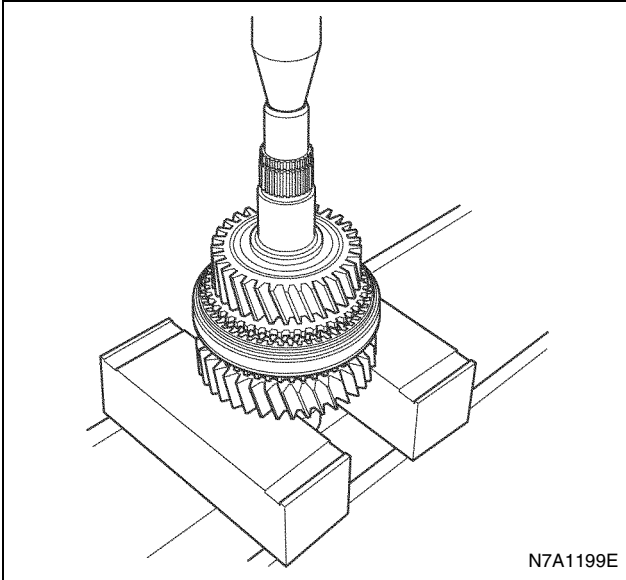


Legend

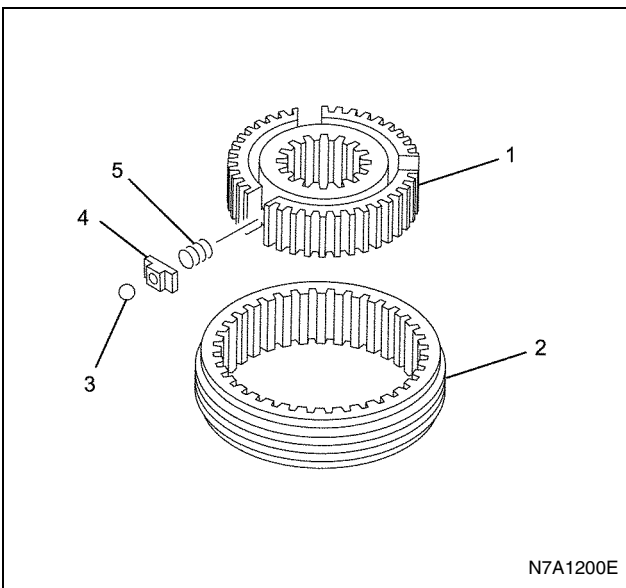
1. Spring
2. Insert
3. Clutch hub
4. Sleeve

7. Remove the 3rd gear collar fixing snap ring, using snap ring pliers.

8. Remove from the main shaft the following parts using a bearing remover with a press; the collar, 3rd gear, needle bearing, 3rd inside ring, 3rd outside ring, 3rd block ring, 2nd-3rd clutch hub assembly & sleeve, 2nd block ring, 2nd outside ring, 2nd inside ring, 2nd gear, needle bearing.



9. Disassemble the 2nd-3rd clutch hub assembly & sleeve.



Legend

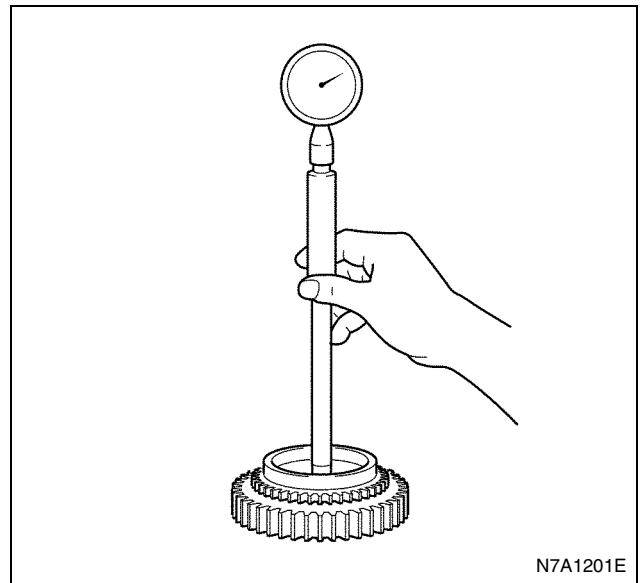
- 1. Clutch hub
- 2. Sleeve
- 3. Ball
- 4. Block
- 5. Spring

Inspect each part. If any wear, damage or other abnormality is found, repair or replace the part.

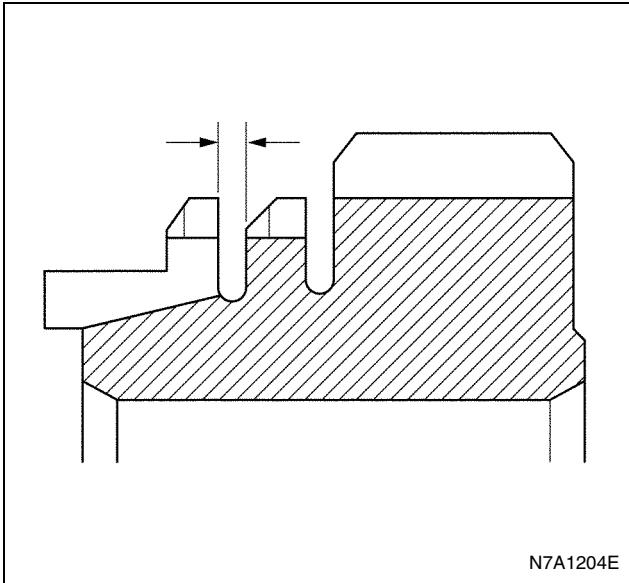
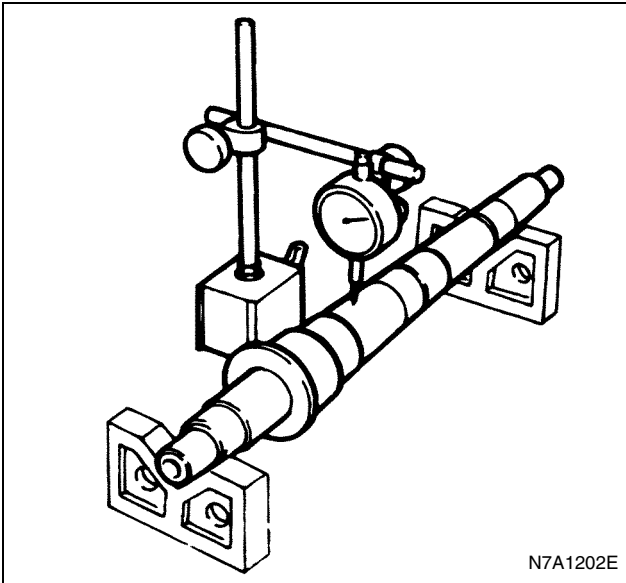
10. Inspect each bearing with respect to the following items. If any abnormality is found, replace the item.
- Smoothness of rotation

- Noise
 - Abnormal external appearance, including damage, rust, etc.
11. Inspect the inside diameter of the gear.
- Measure the inside diameter of each gear using an inside dial gauge.
 - If the measured value exceeds the limit, replace the gear.

Gear Inside Diameter, mm (in)		
	Standard	Limit
6th gear	50.009 — 50.025 (1.968 — 1.969)	50.065 (1.971)
4th gear	44.009 — 44.025 (1.732 — 1.733)	44.065 (1.734)
3rd gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)
2nd gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)
1st gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)
Reverse Gear	63.010 — 63.029 (2.480 — 2.481)	63.069 (2.483)

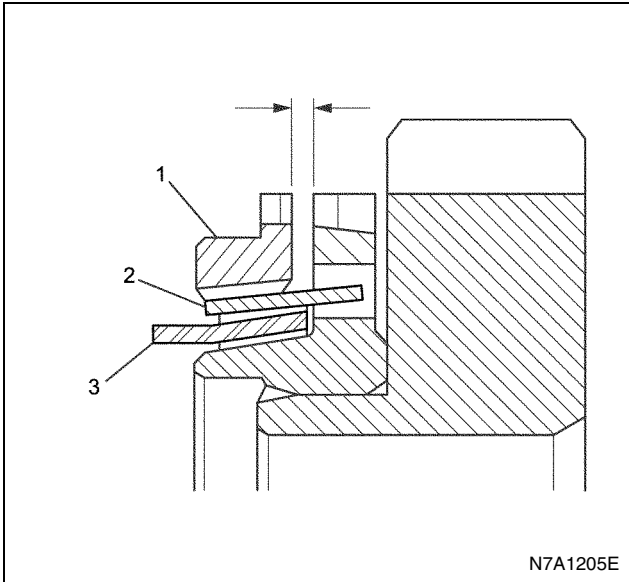
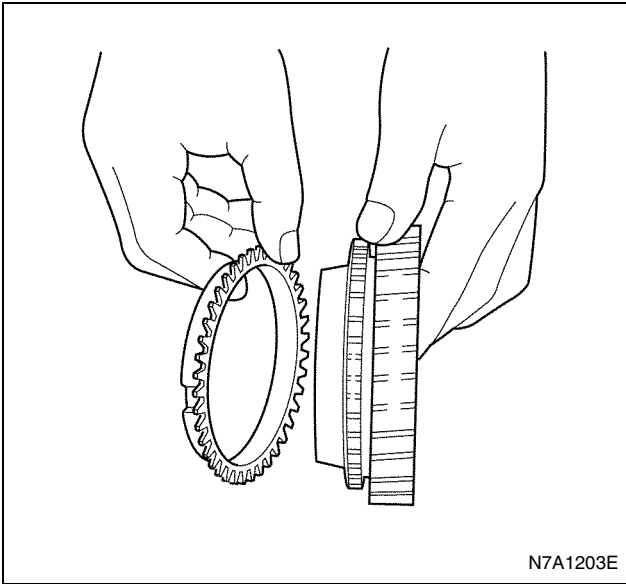


12. Inspect the deflection of the main shaft.
- Measure the deflection of the main shaft using a dial gauge.
 - If the measured value exceeds the limit, replace the main shaft.
Standard: 0.015 mm (0.00059 in)
Limit: 0.1 mm (0.00393 in)



13. Inspect the synchromesh system.

- Inspect the components. Repair the slight stepped wear and damage using an oil stone or a pencil grinder.



14. Measure the clearance between the block ring and the dog gear using a thickness gauge.

- If the measured value exceeds the limit, replace the block gear.

Clearance between Block Ring and Dog Gear, mm (in)		
	Standard	Limit
4th / 5th / 6th / Reverse	1.30 — 2.60 (0.051 — 0.102)	0.5 (0.019)
2nd / 3rd	1.00 — 2.50 (0.039 — 0.098)	0.5 (0.019)
1st	1.00 — 2.50 (0.039 — 0.098)	0.5 (0.019)

Legend

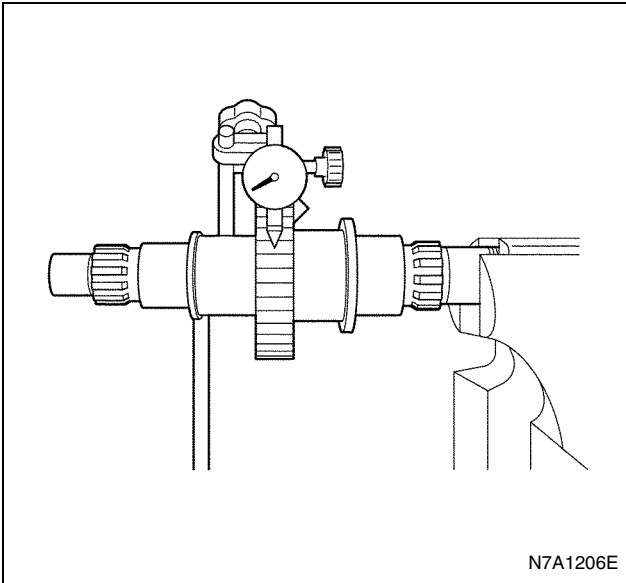
1. Block ring
2. Outside ring
3. Inside ring

15. Inspect the sliding part, spline part, inserting part and insert groove of the clutch hub and sliding sleeve for wear and damage.

16. Measure the free play in the direction of spline rotation on the clutch hub external circumference.

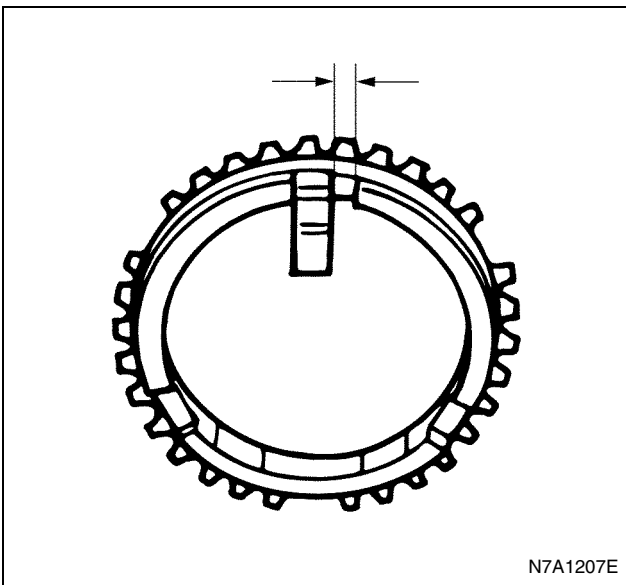
- If the measured value exceeds the limit, replace the part.

Spline Free Play, mm (in)	
Standard	Limit
0 — 0.05 (0 — 0.0019)	0.3 (0.0118)



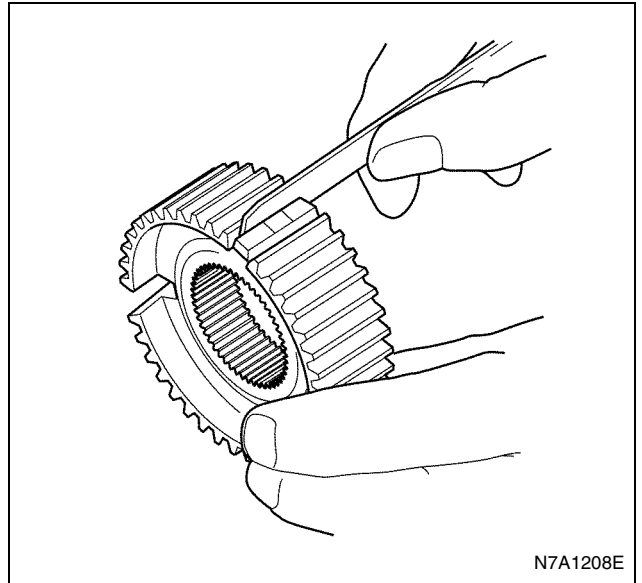
17. Measure the clearance between the insert and block ring groove using a caliper.
- If the measured value exceeds the limit, replace the insert and block ring.

Clearance between Insert and Block Ring Groove, mm (in)	
	Standard
4th / 5th / 6th	3.46 — 3.76 (0.136 — 0.148)



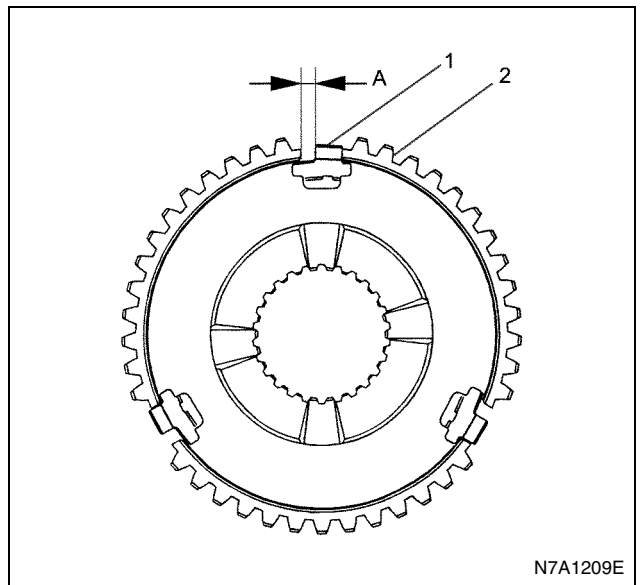
18. Measure the clearance between the insert and clutch hub using a thickness gauge.
- If the measured value exceeds the limit, replace the insert and clutch hub.

Clearance between Insert and Clutch Hub, mm (in)	
	Standard
4th / 5th / 6th	0.01 — 0.21 (0.00039 — 0.00826)



19. Measure the clearance between the block ring and the clutch hub using a thickness gauge.
- If the measured value exceeds the limit, replace the block and clutch hub.

Clearance between Block Ring and Clutch Hub, mm (in)	
	Standard
2nd / 3rd	4.30 — 4.70 (0.16929 — 0.18503)
1st / Reverse	4.30 — 4.70 (0.16929 — 0.18503)



Legend

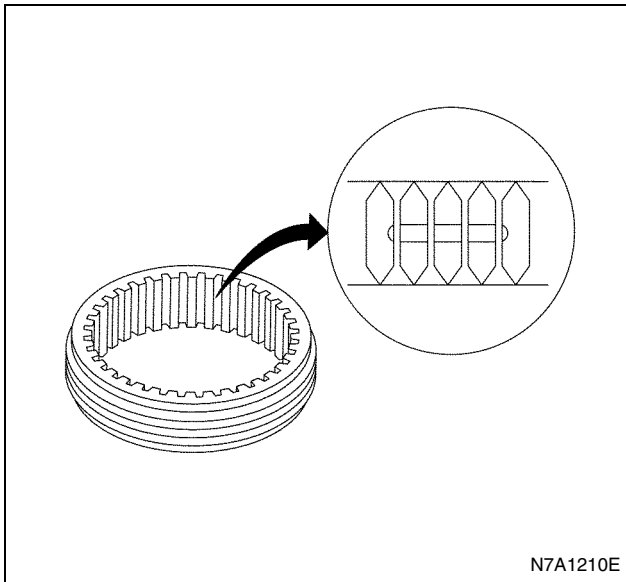
1. Block ring
2. Clutch hub

Assembly

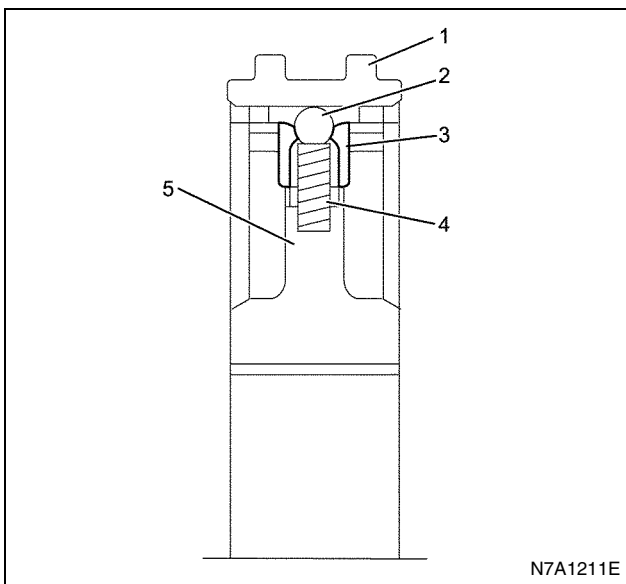
- Clean up each part.
- Set the main shaft in a vise, with the long spline part at the bottom.

When setting the main shaft, make sure not to damage the grind surface.

1. Assemble the 2nd-3rd clutch hub assembly & sleeve following the procedure below.
 - a. Install the block and sleeve to the clutch hub.
 - b. Inside the sleeve, there are three ball grooves. Align the phase to let the ball enter the center of the ball grooves.



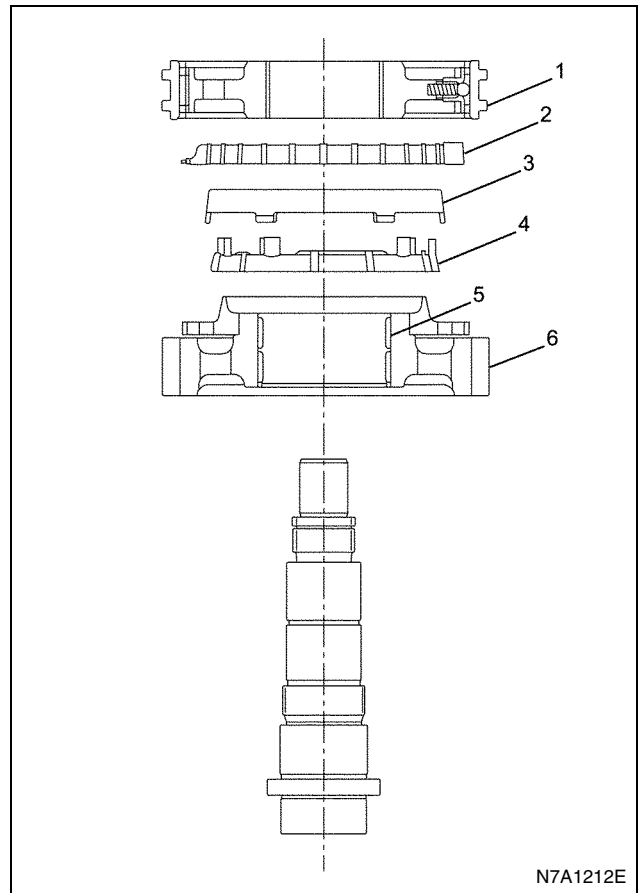
- c. Insert sleeve (1) until the clutch hub (5) slightly overlaps the block.
- d. Securely insert the sleeve until the ball enters the ball groove of the sleeve by pushing the ball (2), block (3) and spring (4).



2. Apply engine oil 5W-30 to the needle bearing, 2nd gear thrust surface and synchro cone taper surface. And install the 2nd gear (6) and needle bearing (5) to the main shaft with the dog gear turned upward.
3. Install the 2nd inside ring (4), 2nd outside ring (3) and 2nd block ring (2) inserting the nail of the out-

side ring into the gear hole of the 2nd gear. At this time, make sure to apply engine oil 5W-30 sufficiently to the both sides of the inside ring and outside ring, and inside diameter surface of the block ring.

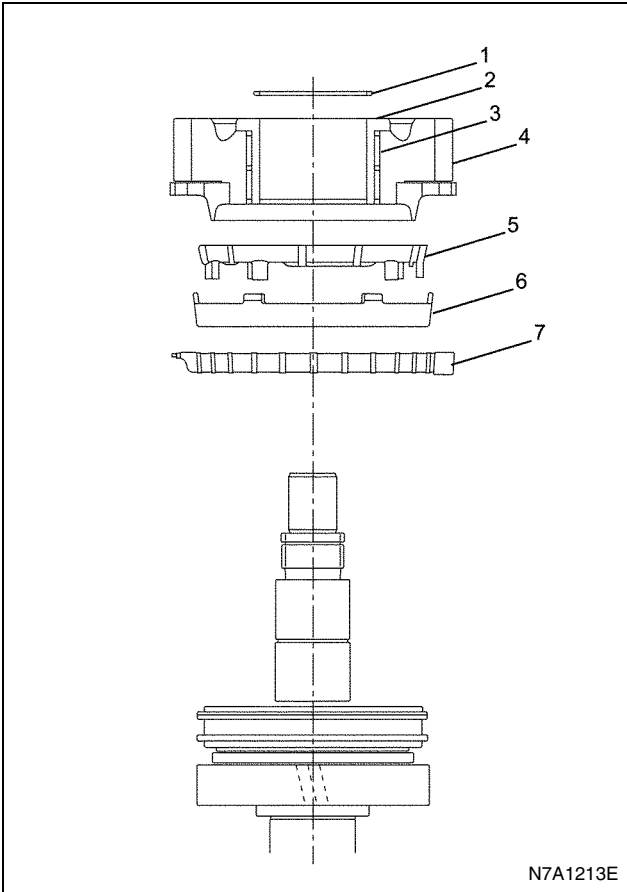
4. Insert the 2nd-3rd clutch hub assembly & sleeve with a press using the installer 5-8840-2345-0, setting the six nails of the inside ring to enter the six holes of the hub.



5. During installation, set the six nails of the inside ring of the 3rd block ring (7), 3rd outside ring (6) and 3rd inside ring (5) to enter the six hub holes, respectively. At this time, apply engine oil 5W-30 sufficiently to the inside surface of the outside ring and the inside diameter surface of the block ring.
6. Apply engine oil 5W-30 to the needle bearing, 3rd gear thrust surface and synchro cone taper. Turn the dog gear downward, and insert the 3rd gear (4), needle bearing (3) and collar (2) using the installer 5-8840-2345-0 with a press, setting the nail of the outer ring to enter the dog gear hole of the 3rd gear.
7. Install the snap ring (1) using snap ring pliers.

Caution:

Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.

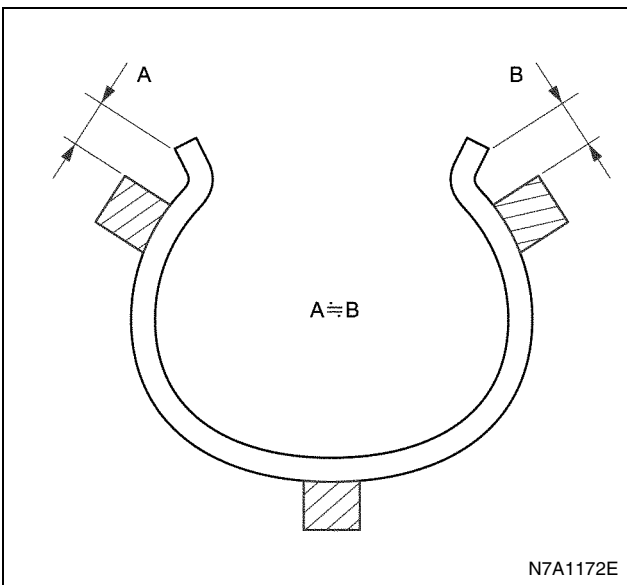


N7A1213E

8. Assemble the 4th-5th clutch hub assembly & sleeve following the procedure below.
 - a. Assemble securely the insert (2) to the insert groove of the block ring.
 - b. Install the insert spring (3) to the insert.

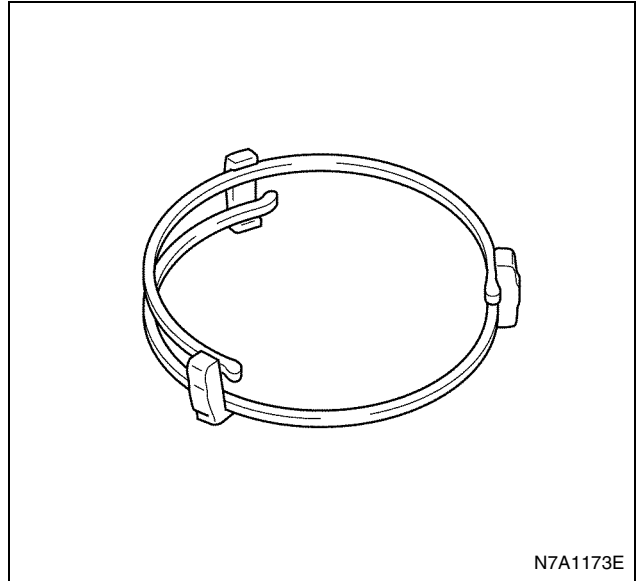
Caution:

- When assembling the insert spring, equalize the length of the both edges of the spring not to adversely interfere with the inside diameter of the hub.



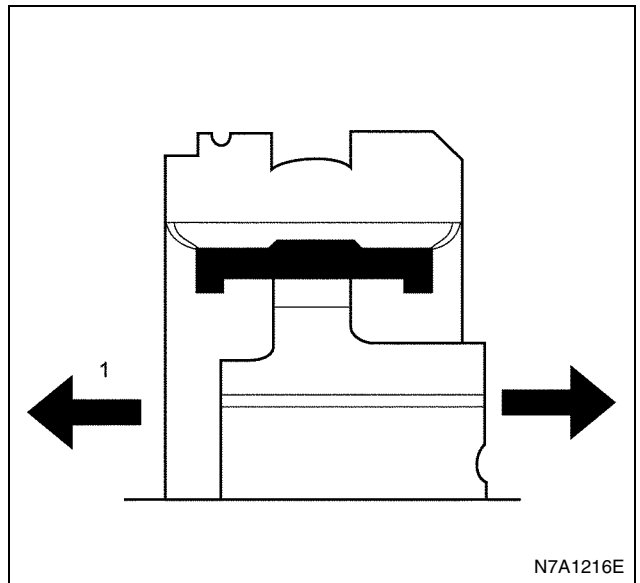
N7A1172E

- Make sure that the open part of the insert spring assembled on the reverse side, is not aligned with the open part of the front side.

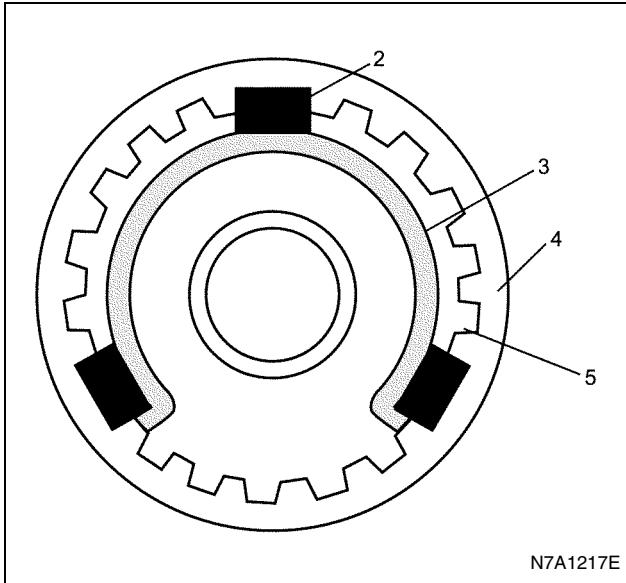


N7A1173E

- c. Check that the clutch hub (5) and sleeve (4) are smoothly sliding.
 - The arrow (1) indicates the front side of the transmission.



N7A1216E

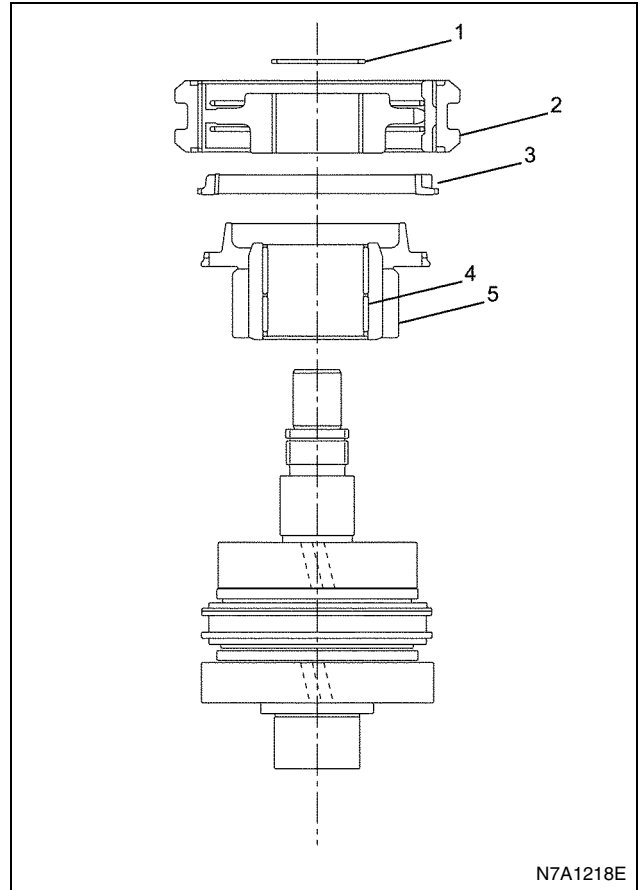


N7A1217E

9. Apply engine oil 5W-30 sufficiently to the needle bearing, 4th gear thrust surface and synchro cone taper, and install the 4th gear (5) and needle bearing (4) with the dog gear turned upward.
10. Apply engine oil 5W-30 to the 4th block ring (3), and install.
11. Turning the surface with oil groove downward, align the 4th-5th clutch hub assembly and sleeve (2) to the groove of the 4th-5th block ring, and then insert with a press using the installer 5-8840-2345-0.
12. Install the snap ring (1) using snap ring pliers.

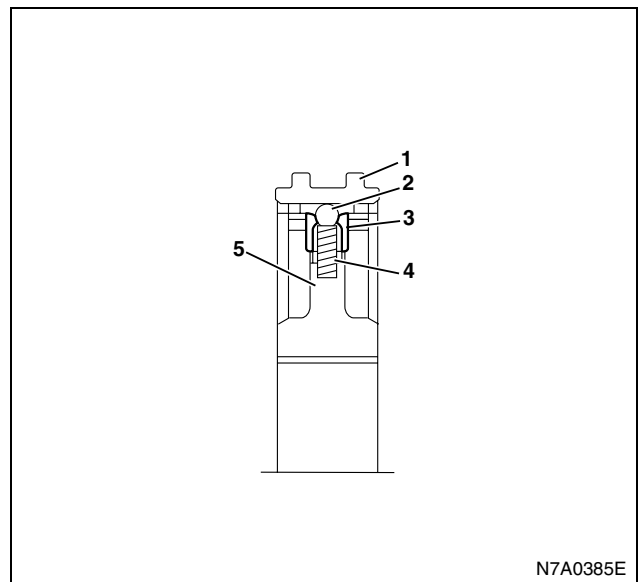
Caution:

Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.



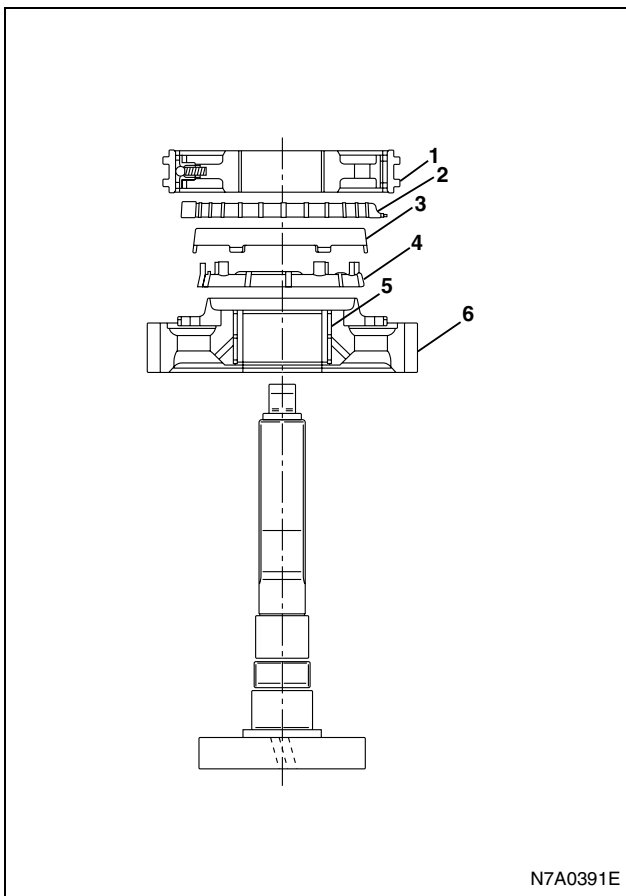
N7A1218E

13. Assemble the 1st-reverse clutch hub assembly and sleeve following the procedure below.
 - a. Install the block and spring to the clutch hub.
 - b. Inside the sleeve, there are three ball grooves. Align the phase to let the ball enter the ball groove.
 - c. Insert the sleeve (1) until the block slightly overlaps the clutch hub (5).
 - d. Securely insert the sleeve until the ball enters the ball groove of the sleeve by pushing the ball (2), block (3) and spring (4).

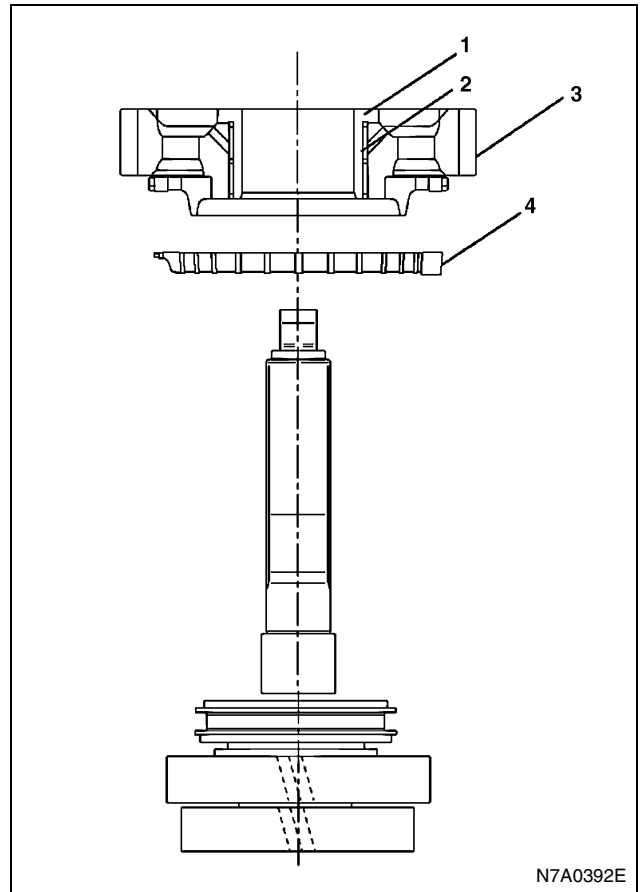


N7A0385E

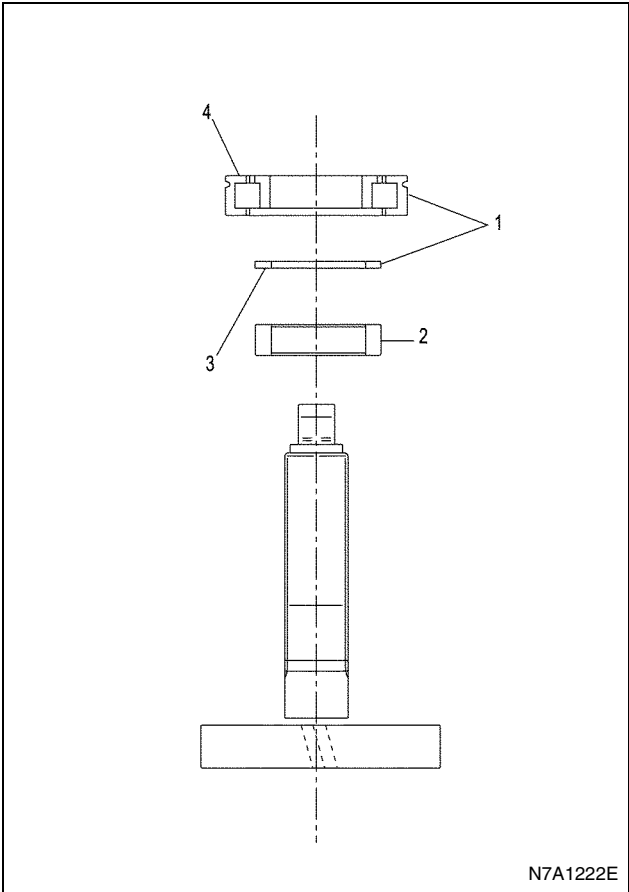
14. Apply engine oil 5W-30 to the needle bearing, 1st gear thrust surface and synchro cone taper surface, and then install the 1st gear (6) and needle bearing (5), turning the dog gear upward.
15. Assemble the 1st inside ring (4), 1st outside ring (3) and 1st block ring (2), inserting the nail of the outer ring into the dog gear hole of the 1st gear. At this time, make sure to apply engine oil 5W-30 sufficiently to the both sides of the inside ring and outside ring, and inside diameter surface of the block ring.
16. Insert the 1st-reverse clutch hub assembly & sleeve (1) with a press using the installer 5-8840-2345-0, setting the six nails of the inside ring to enter the six holes of the hub.



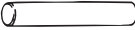
17. Apply engine oil 5W-30 sufficiently to the reverse block ring (4), and then align the phase of the block ring groove to the 1st-reverse clutch hub assembly and sleeve, and install.
18. Apply engine oil 5W-30 to the needle bearing, the reverse gear thrust surface and the synchro cone taper. Turning the dog gear downward, align the phase of the synchro cone phase of the reverse gear to the nail of the outer ring, and then insert the reverse gear (3), needle bearing (2), and collar (1) with a press using the installer 5-8840-2345-0.



19. Install the spacer (2).
20. Insert the bearing (1) with a press using the installer 5-8840-2345-0, turning the stamped surface (4) upward and the stamped surface (3) downward.
21. Install the 6th gear.
 - Install with the convex part at the bottom.

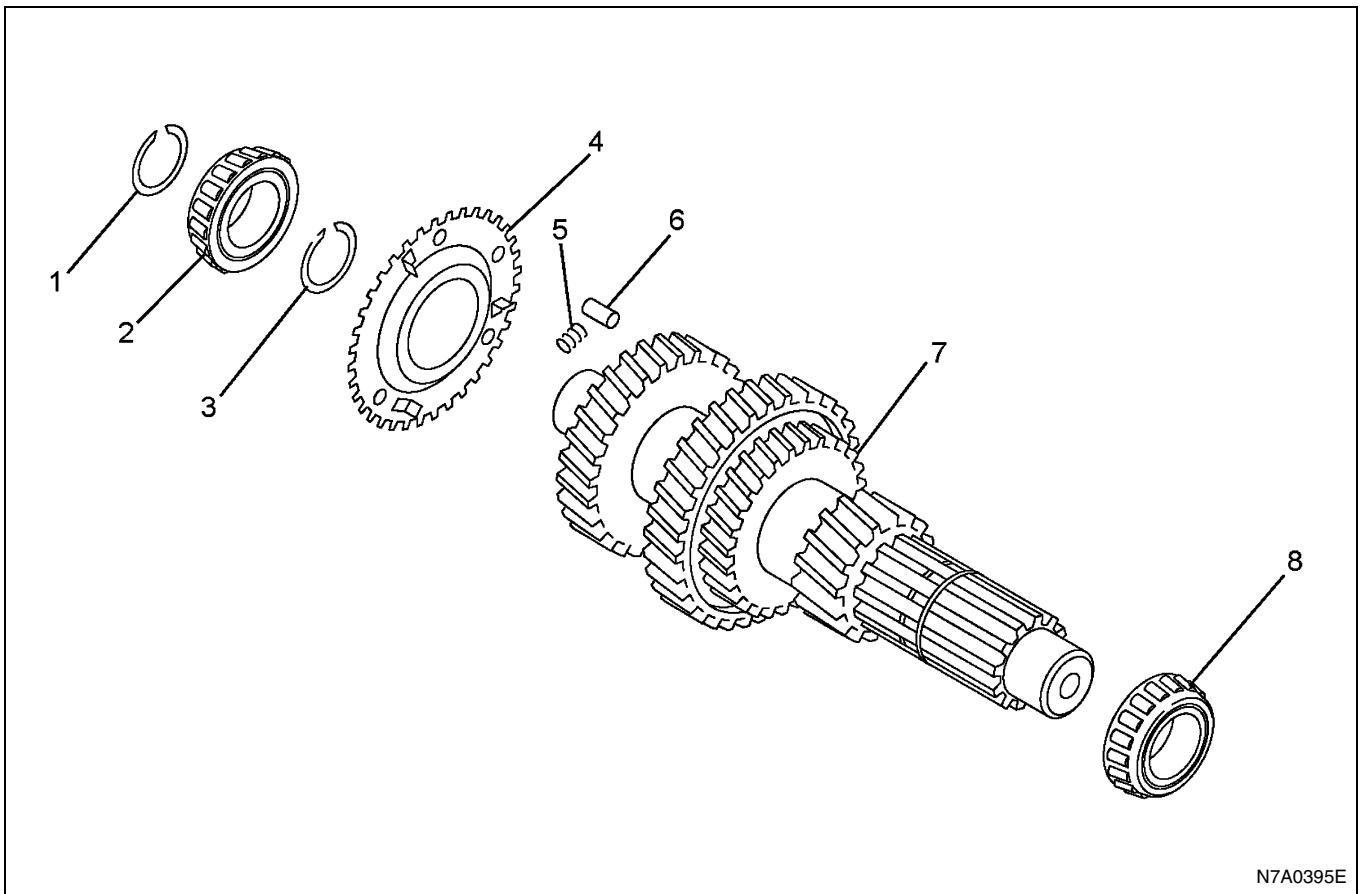


Special Tools

Illustration	Tool Number / Description / Remarks
 <p>5884023450</p>	<p>5-8840-2345-0 / Clutch Hub & Collar Installer</p>

Counter Shaft (5MT)

Components

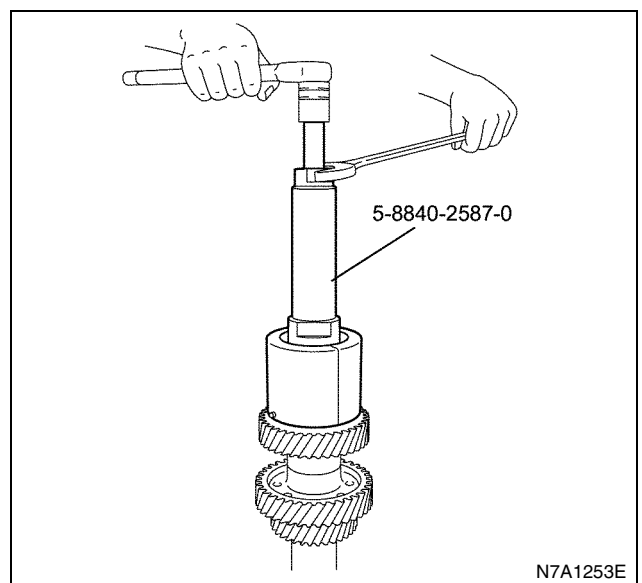


Legend

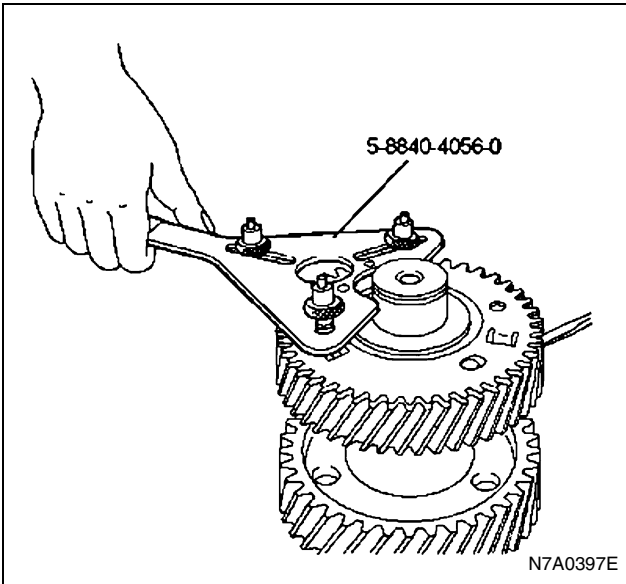
- | | |
|---------------------------|---------------------------|
| 1. Snap ring | 5. Coil spring |
| 2. Bearing; Counter front | 6. Straight pin |
| 3. Snap ring | 7. Counter shaft assembly |
| 4. Anti-lash plate | 8. Bearing; Counter rear |

Disassembly

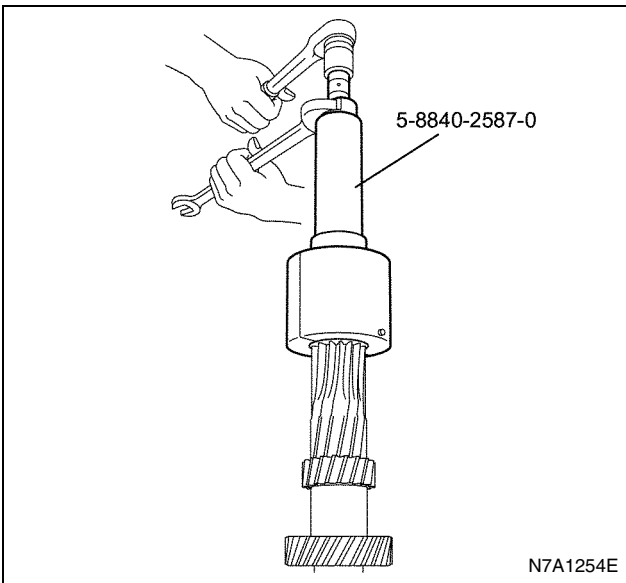
1. Remove the bearing fixing snap ring using snap ring pliers.
2. Remove the bearing; counter front using the bearing remover 5-8840-2587-0.



3. Remove the anti-lash plate fixing snap ring using snap ring pliers.
4. Remove the anti-lash plate using the flange holder 5-8840-4056-0.



5. Remove the three coil springs from the 5th gear.
6. Remove the straight pin from the 5th gear.
7. Remove the bearing; counter rear using the bearing remover 5-8840-2587-0.



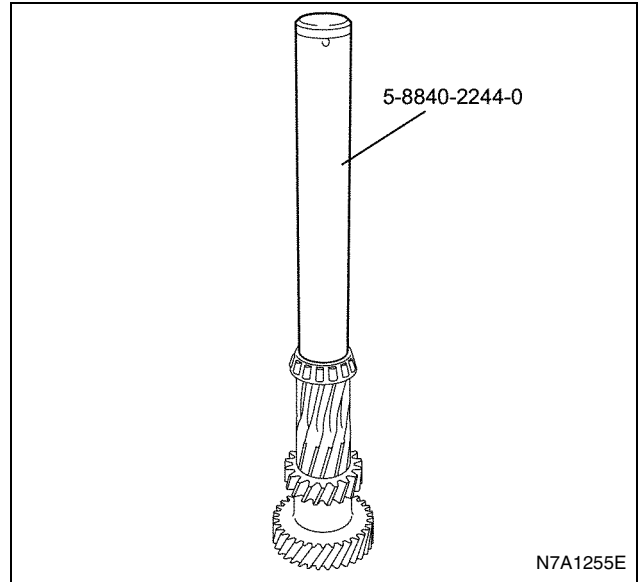
If any wear, damage or other abnormality is found on the disassembled parts, repair or replace the parts.

8. Inspect the surface of each gear for damage or wear. If any abnormality is found, replace the gear.
9. Inspect each bearing with respect to the following items. If any abnormality is found, replace with a new one.
 - Smoothness of rotation
 - Noise
 - Abnormal external appearance, including damage, rust, etc.

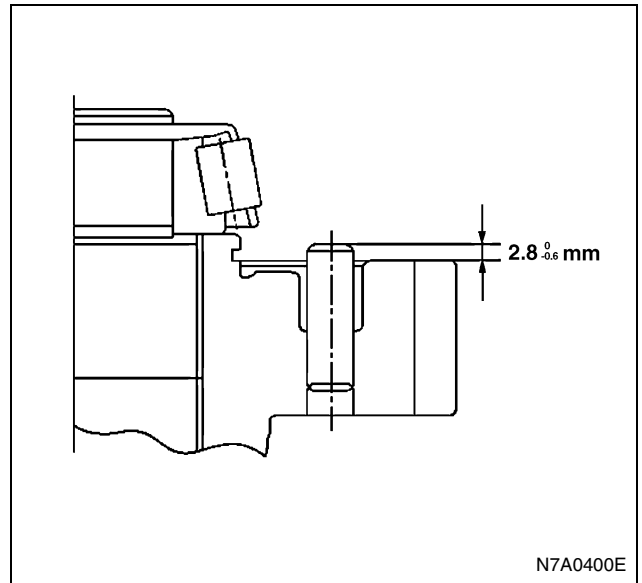
- Abnormal free play in thrust direction

Assembly

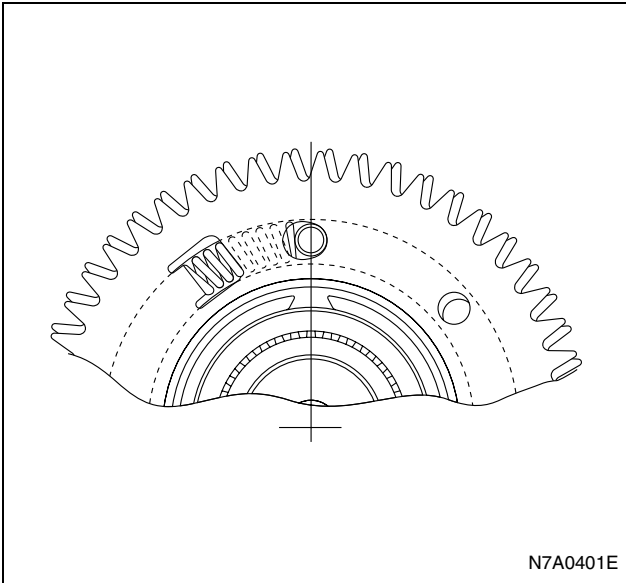
1. Insert the bearing counter rear with a press using the installer 5-8840-2244-0.



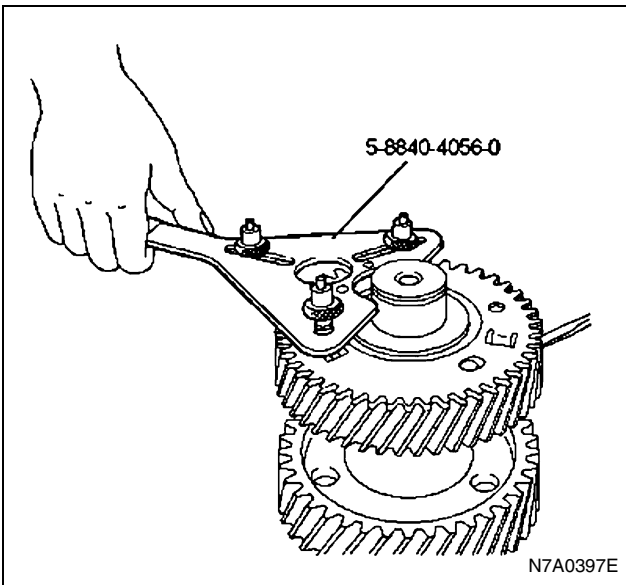
2. Install the straight pin within the range of protrusion.



3. Assemble the three coil springs to the groove on the side of the 5th gear, while these springs have to touch the left side of the pin viewing from the center of the gear.



- Set the springs between the folded protrusion of the anti-lash plate and the straight pin. Using the flange holder 5-8840-4056-0, align the set hole of the anti-lash plate with the set hole of the 5th gear, and install.

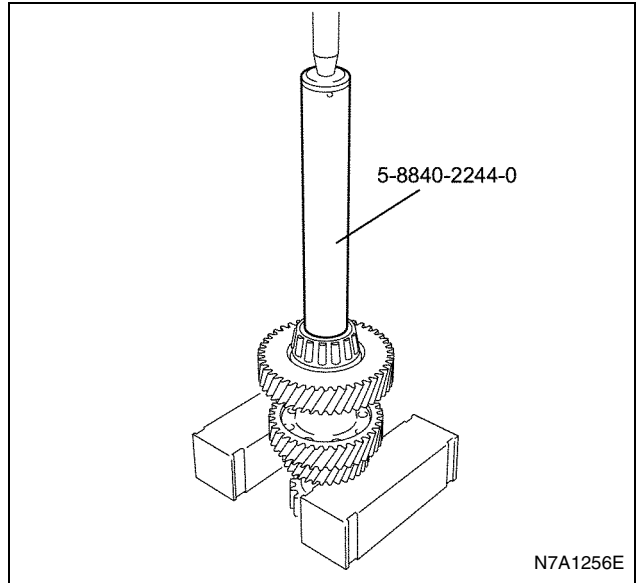


- Install the anti-lash plate fixing snap ring using snap ring pliers.

Caution:

Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.

- Install the bearing: counter front with a press using the installer 5-8840-2244-0.



- Install the bearing fixing snap ring using snap ring pliers.
 - Select the thickest snap ring installable from the following three types.

Thickness, mm (in)	Color
1.9 (0.0748)	Blue
2.1 (0.0826)	Yellow
2.3 (0.0905)	Pink

Caution:

Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.

Special Tools

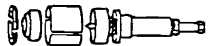
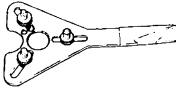
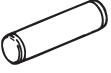
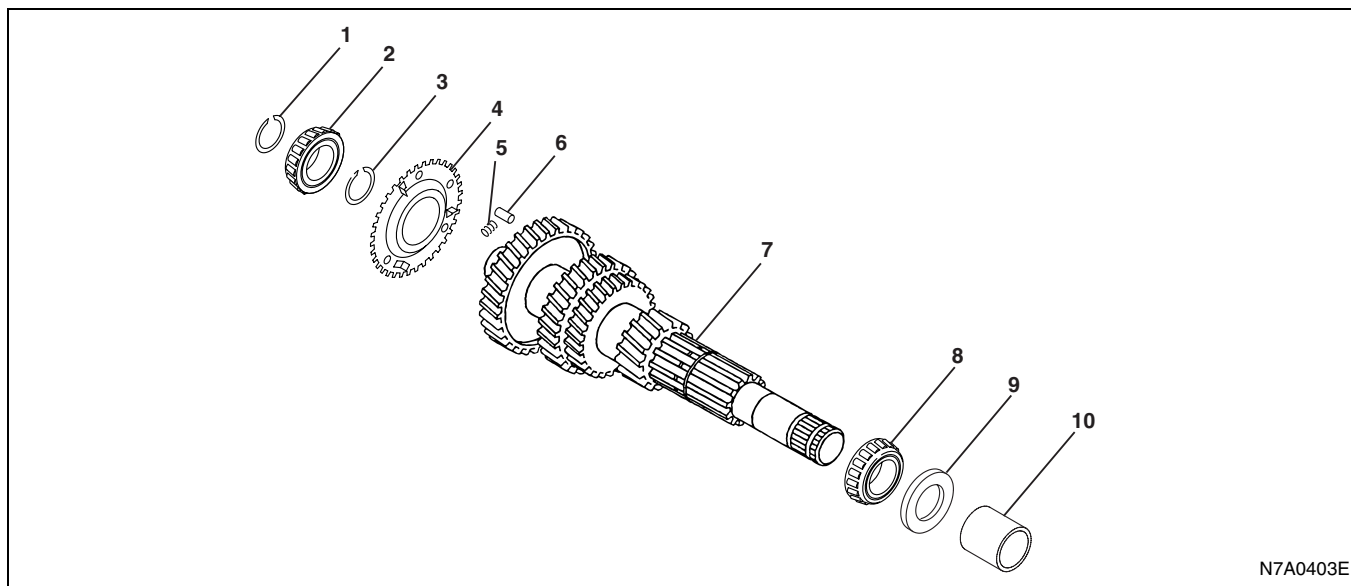
Illustration	Tool Number / Description / Remarks
 5884025870	5-8840-2587-0 / Bearing Remover
 5884040560	5-8840-4056-0 / Flange Holder

Illustration	Tool Number / Description / Remarks
 <p>5884022440</p>	<p>5-8840-2244-0 / Bearing Installer</p>

Counter Shaft (6MT)

Components



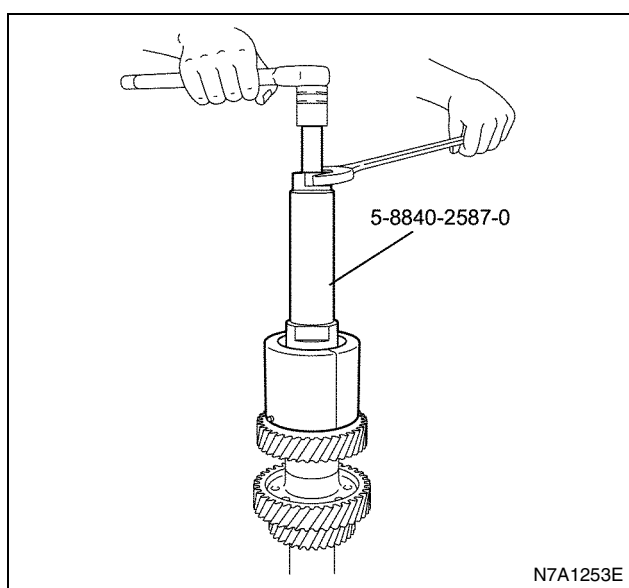
N7A0403E

Legend

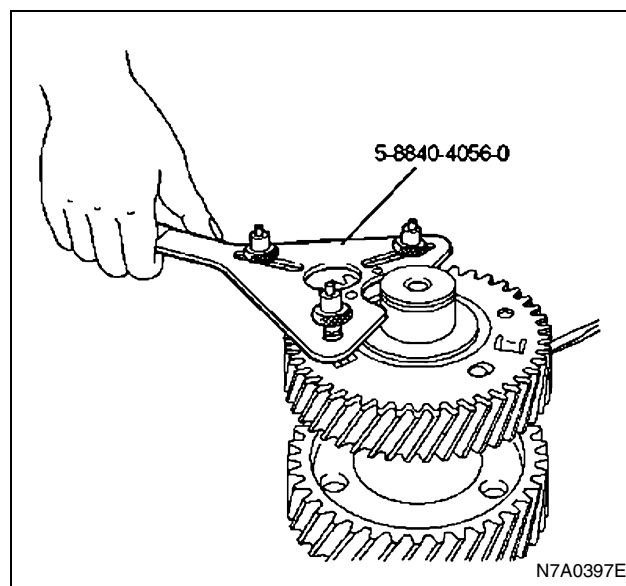
- | | |
|---------------------------|---------------------------|
| 1. Snap ring | 6. Straight pin |
| 2. Bearing; Counter front | 7. Counter shaft assembly |
| 3. Snap ring | 8. Bearing; Counter rear |
| 4. Anti-lash plate | 9. Thrust washer |
| 5. Coil spring | 10. Collar |

Disassembly

1. Remove the bearing fixing snap ring using snap ring pliers.
2. Remove the bearing; counter front using the bearing remover 5-8840-2587-0.



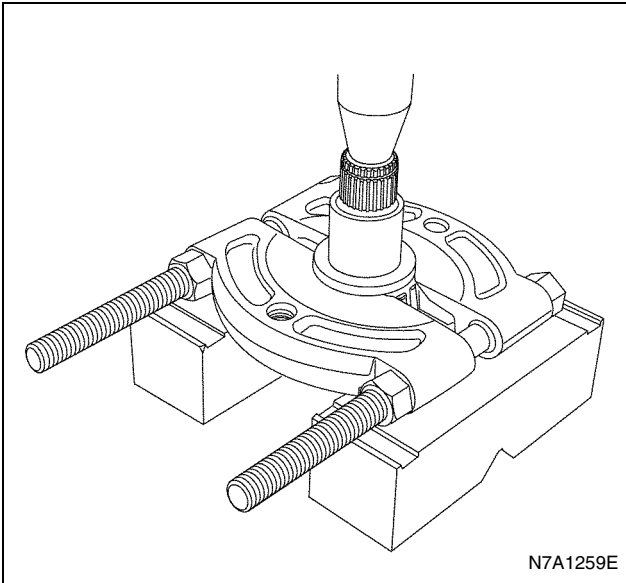
N7A1253E



N7A0397E

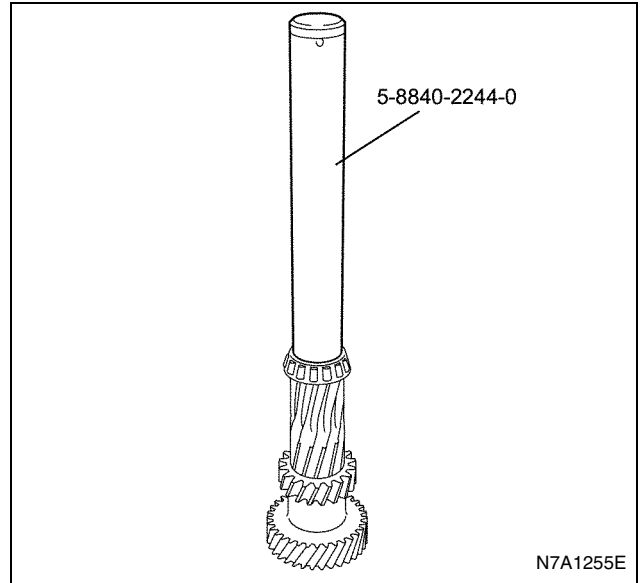
5. Remove the three coil springs from the 5th gear.
6. Remove the straight pin from the 5th gear.
7. Remove the collar and thrust washer with a press using a bearing remover.

3. Remove the anti-lash plate fixing snap ring using snap ring pliers.
4. Remove the anti-lash plate using the flange holder 5-8840-4056-0.



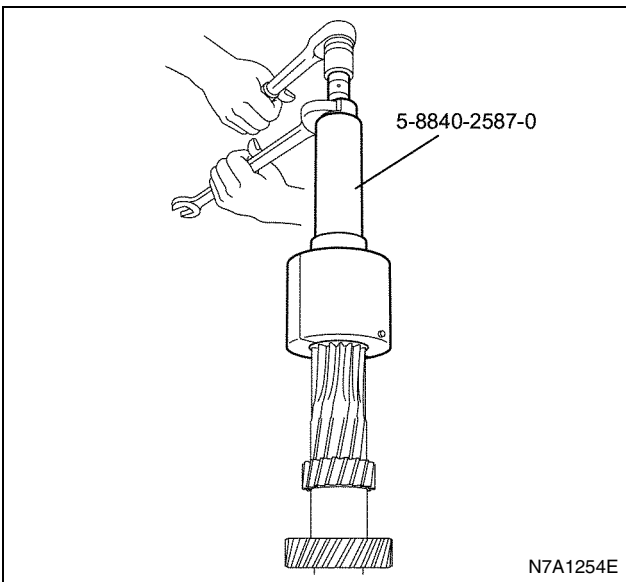
N7A1259E

8. Remove the bearing; counter rear using the bearing remover 5-8840-2587-0.



N7A1255E

2. Insert the collar and thrust washer with a press using the installer 5-8840-2244-0.



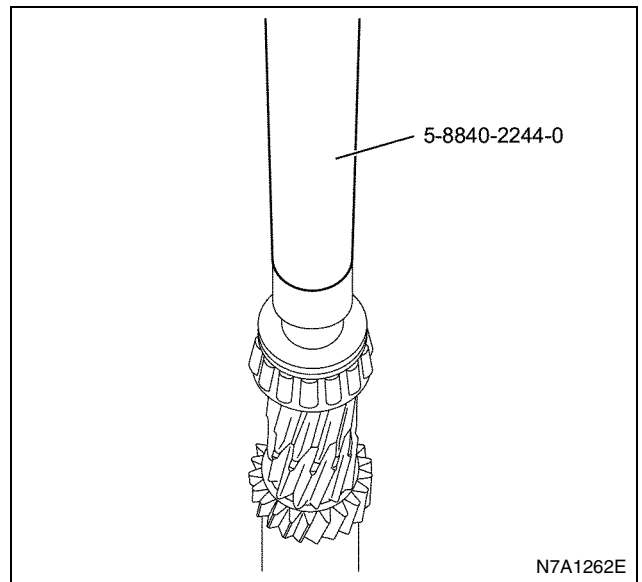
N7A1254E

If any wear, damage or other abnormality is found on the disassembled parts, repair or replace the parts.

9. Inspect the surface of each gear for damage or wear. If any abnormality is found, replace the gear.
10. Inspect each bearing with respect to the following items. If any abnormality is found, replace with a new one.
 - Smoothness of rotation
 - Noise
 - Abnormal external appearance, including damage, rust, etc.
 - Abnormal free play in thrust direction

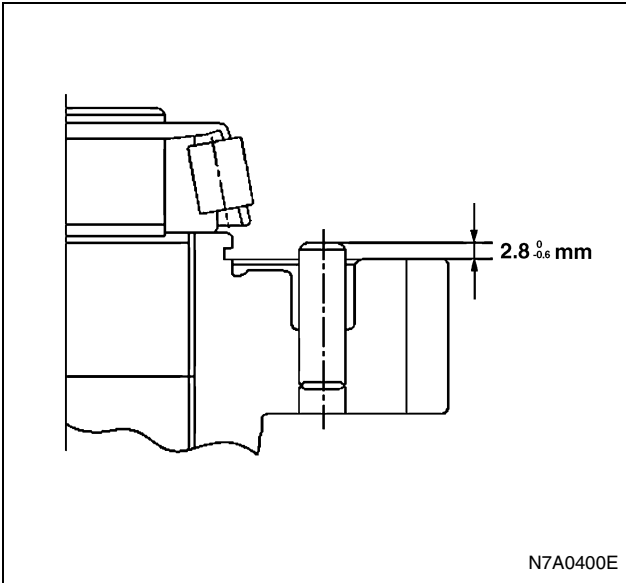
Assembly

1. Insert the bearing; counter rear with a press using the installer 5-8840-2244-0.

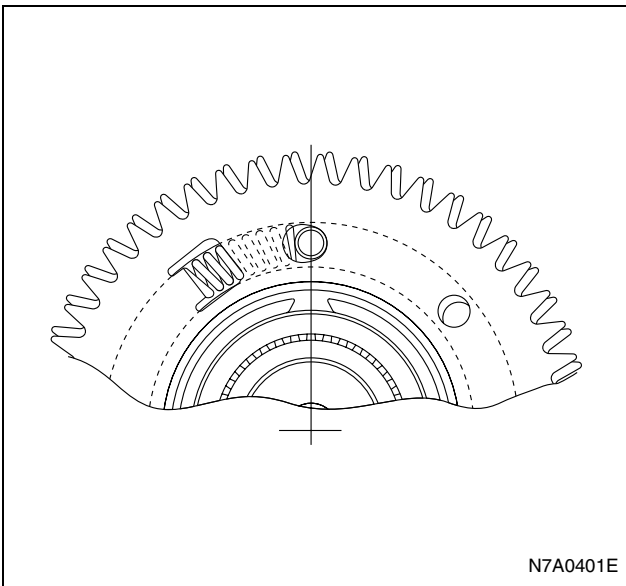


N7A1262E

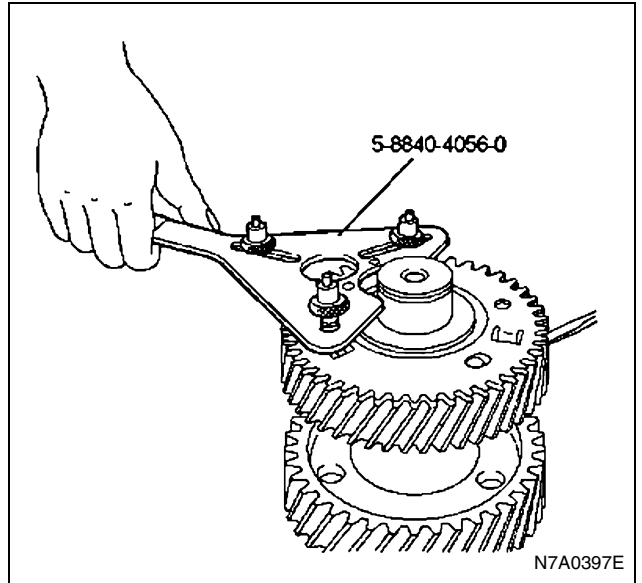
3. Install the straight pin within the range of protrusion.



- Assemble the three coil springs to the groove on the side of the 5th gear, while these springs have to touch the left side of the pin viewing from the center of the gear.



- Set the springs between the folded protrusion of the anti-lash plate and the straight pin. Using the flange holder 5-8840-4056-0, align the set hole of the anti-lash plate with the set hole of the 5th gear, and install.

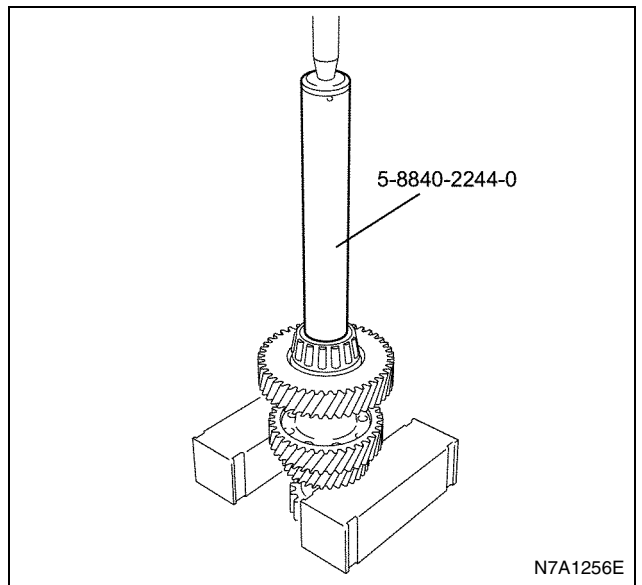


- Install the anti-lash plate fixing snap ring using snap ring pliers.

Caution:

Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.

- Install the bearing: counter front with a press using the installer 5-8840-2244-0.




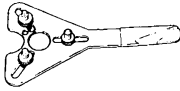
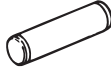
- Install the bearing fixing snap ring using snap ring pliers.
 - Select the thickest snap ring installable from the following three types.

Thickness, mm (in)	Color
1.9 (0.0748)	Blue
2.1 (0.0826)	Yellow
2.3 (0.0905)	Pink

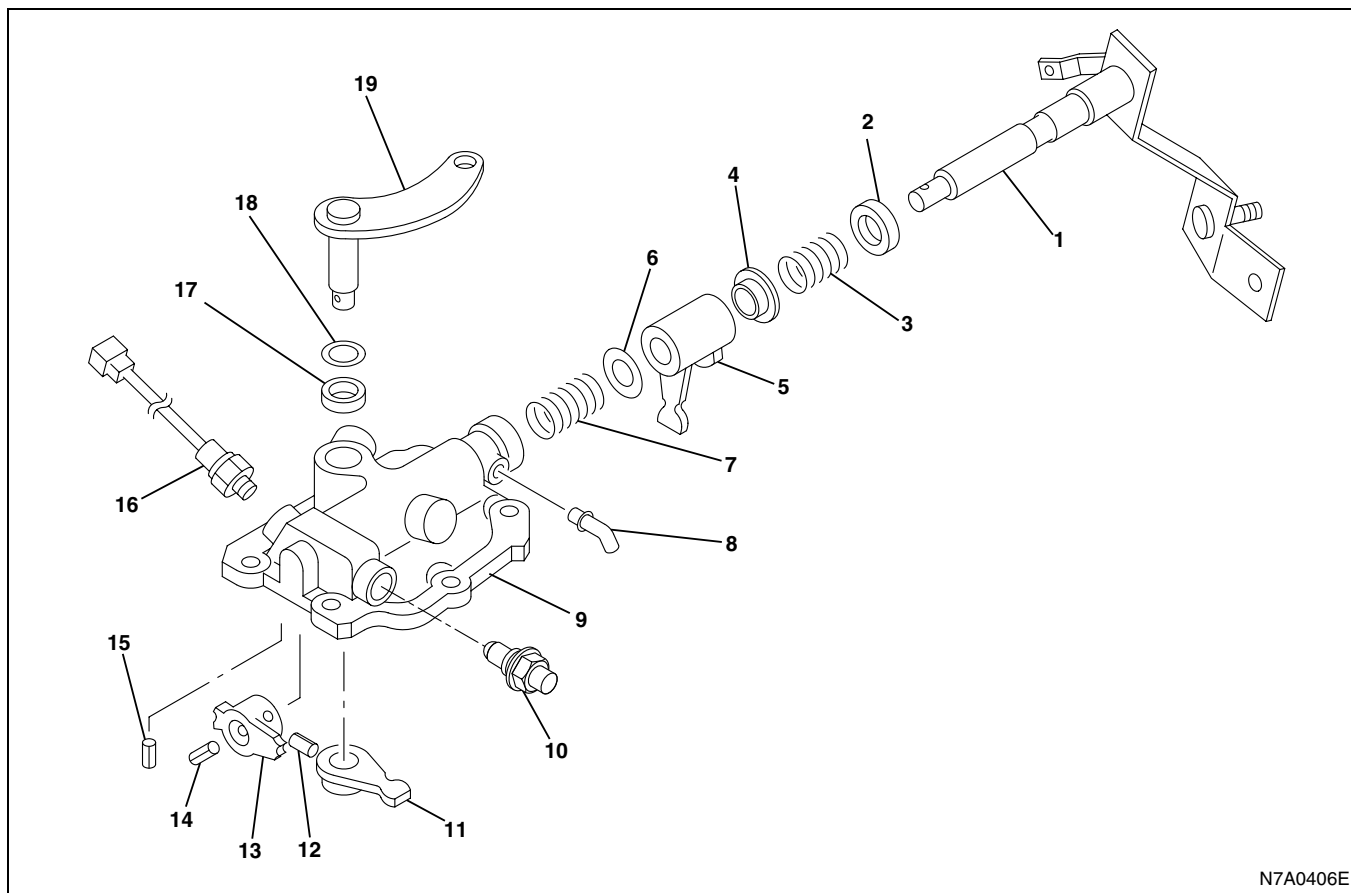
Caution:

Replace deformed or damaged snap rings with new ones. Check that the parts are securely installed.

Special Tools

Illustration	Tool Number / Description / Remarks
 5884025870	5-8840-2587-0 / Bearing Remover
 5884040560	5-8840-4056-0 / Flange Holder
 5884022440	5-8840-2244-0 / Bearing Installer

Control Box Components



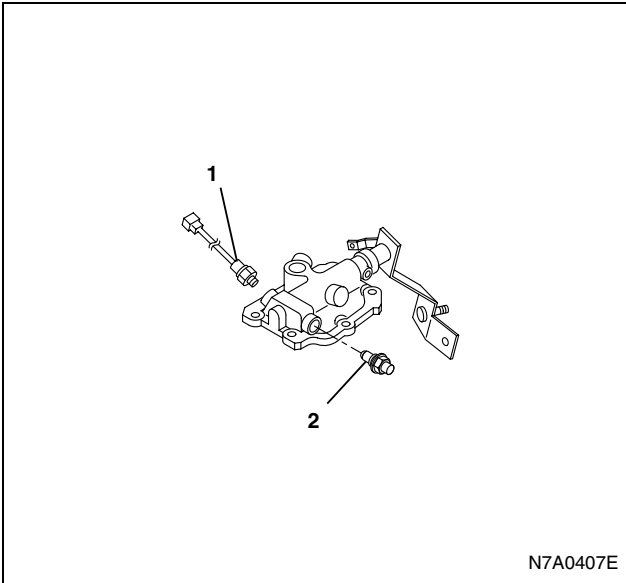
N7A0406E

Legend

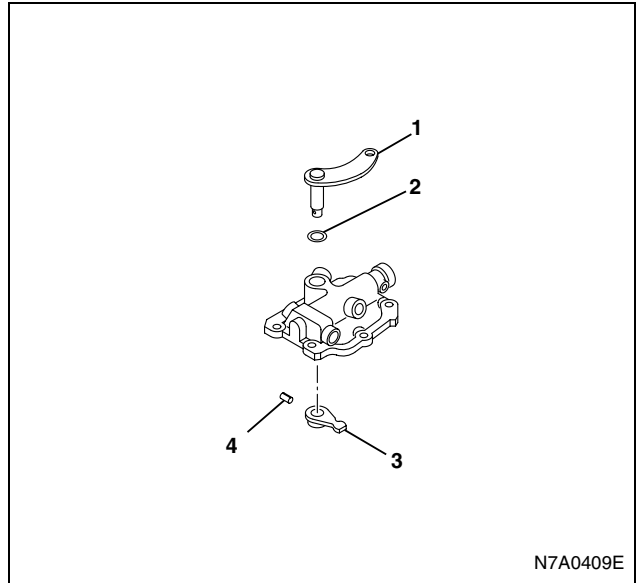
- | | |
|-------------------------------|---------------------------------------|
| 1. Shift lever shaft | 11. Select internal lever |
| 2. Shift lever shaft oil seal | 12. Spring pin; Select internal lever |
| 3. Spring | 13. Stopper ring |
| 4. Washer | 14. Spring pin; Stopper ring |
| 5. Shift internal lever | 15. Spring pin; Shift lever shaft |
| 6. Spring sheet | 16. Neutral switch |
| 7. Spring | 17. Select lever shaft oil seal |
| 8. Pipe | 18. Washer |
| 9. Control box | 19. Select external lever |
| 10. Detent | |

Disassembly

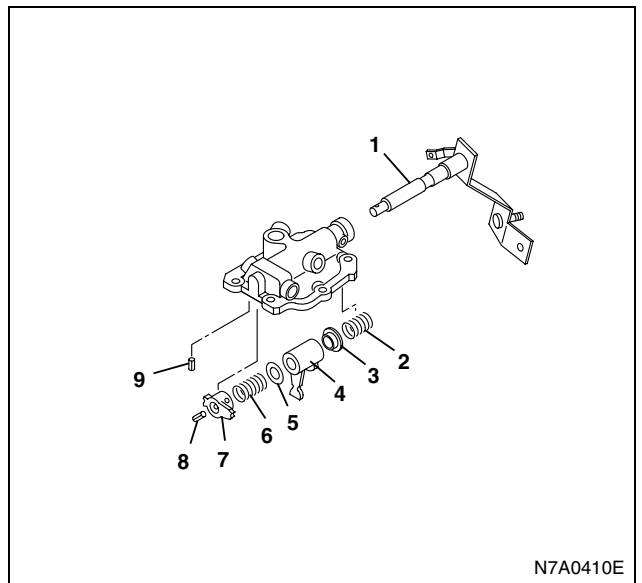
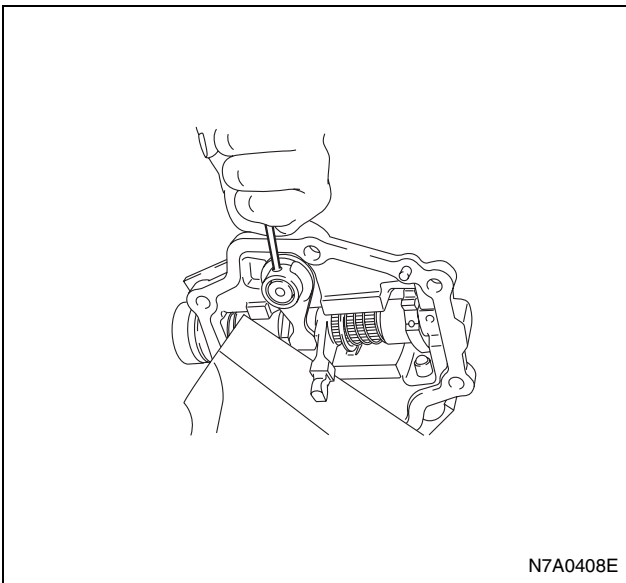
1. Remove the neutral switch (1) and detent (2).



2. Remove the spring pin; select internal lever (4) using the spring pin remover, and then remove the select internal lever (3), select external lever (1) and washer (2).



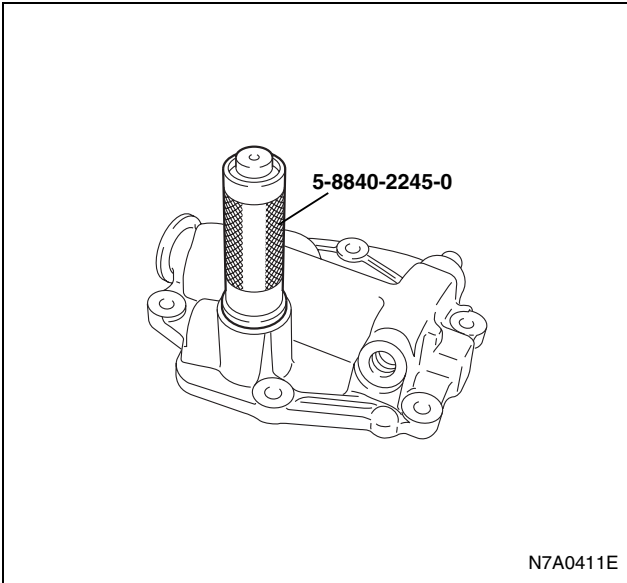
3. Remove the spring pin; stopper ring (8) and the spring pin; shift lever shaft (9).
4. Pull out the shift lever shaft (1), and remove the stopper ring (7), spring (6), spring sheet (5), shift internal lever (4), washer (3) and spring (2).



5. Pry and remove with a driver the select lever shaft oil seal and shift lever shaft oil seal from the control box.
If any wear, damage or other abnormality is found on the disassembled parts, repair or replace them.
6. Inspect wear of the shift shaft, free play of the control box and roughness of the manipulation. If any abnormality is found, replace the part.

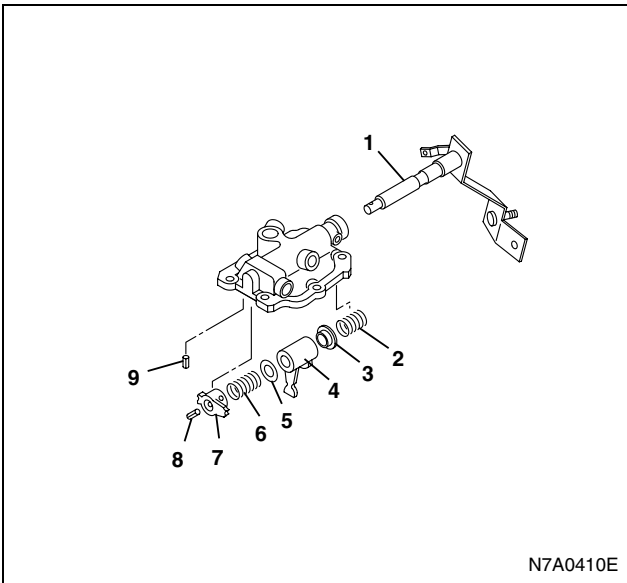
Assembly

1. Using the installer 5-8840-2245-0 for the control box, install the shift lever shaft oil seal and select lever shaft oil seal.



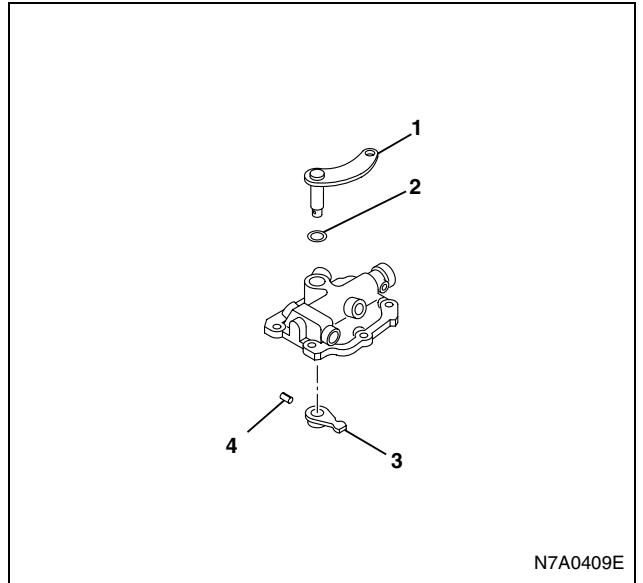
N7A0411E

- Assemble the spring (2), washer (3), shift internal lever (4), spring sheet (5), spring (6) and stopper ring (7) to the control box. Insert the shift lever shaft (1). Align the pin hole of the shift lever shaft with the pin hole of the stopper ring, and then drive in a new spring pin; stopper ring (8) and spring pin; shift lever shaft (9).



N7A0410E

- Insert the select external lever (1) and washer (2) into the control box. Install the select internal lever (3), and then drive in a new spring pin; select internal lever (4).



N7A0409E

- Install the detent (2).
 - The detent contains pre-coating agent. Remove completely the seal agent on the screw of the case side before using new detent.

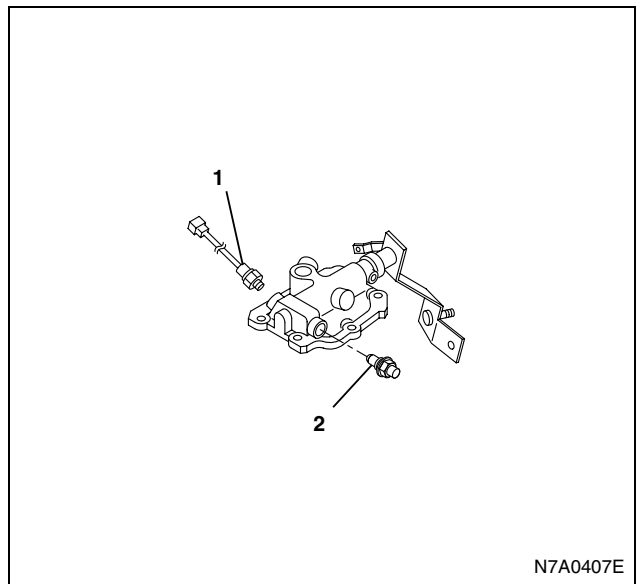
Tighten:

Detent (2) to 28 N·m (2.9 kg·m / 21 lb·ft)

- Fix the neutral switch (1) to the specified torque.

Tighten:

Neutral switch (1) to 34 N·m (3.5 kg·m / 25 lb·ft)

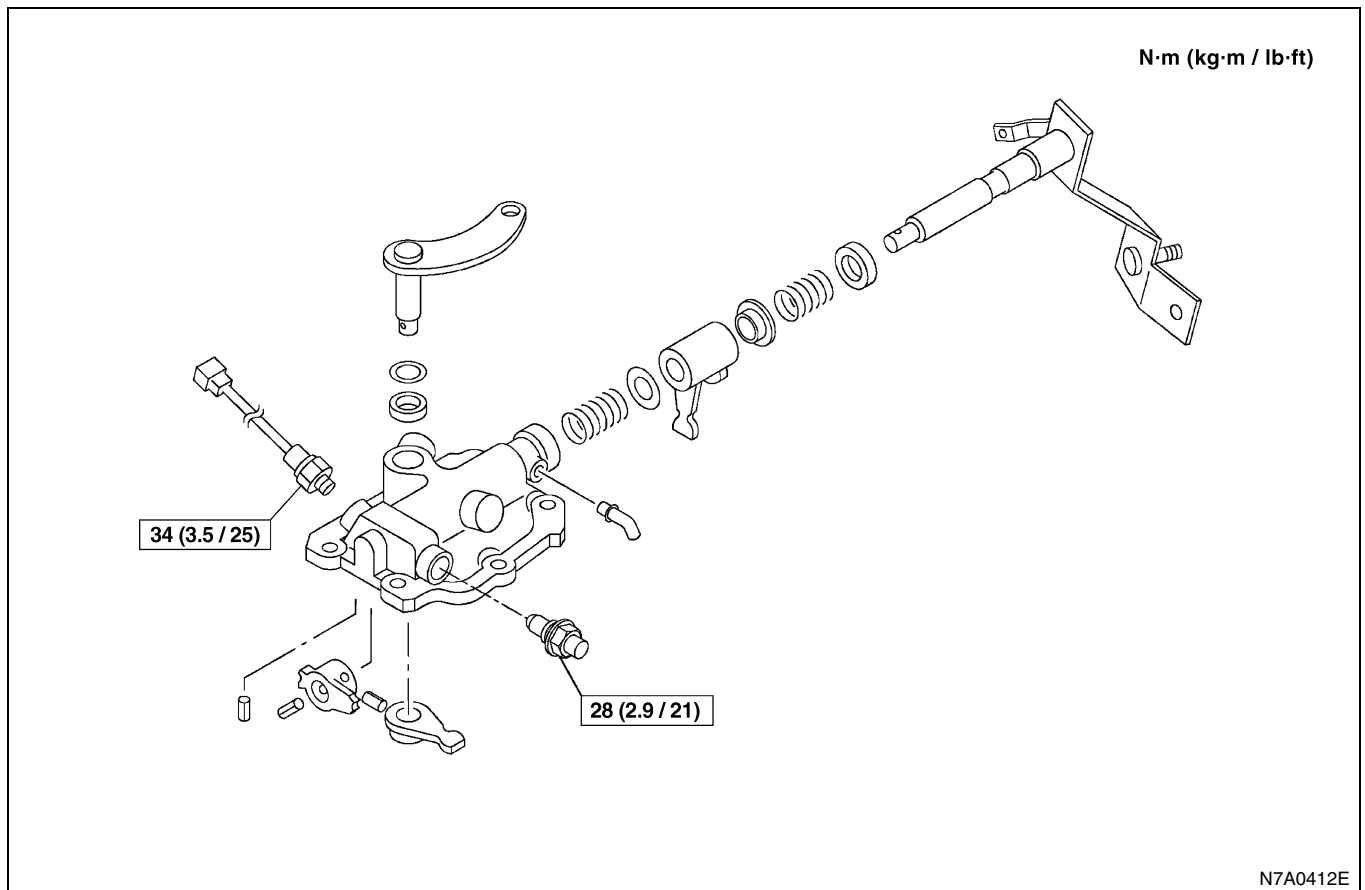


N7A0407E


Specifications

Transmission Type			MY6P	MY5T
Control System			Floor Remote Control	Floor Remote Control
Gear Ratio				
	Transmission	1st	5.979	5.315
		2nd	3.434	3.053
		3rd	1.862	1.655
		4th	1.297	1
		5th	1	0.721
		6th	0.774	—
		Reverse	5.701	5.068
Oil Capacity	L (US qt / Imp qt)	Standard	3.5 (3.7 / 3.1)	2.8 (3.0 / 2.5)
		4 × 4 Vehicle	—	3.5 (3.7 / 3.1)
		With Front PTO	—	5.5 — 6.0 (5.8 — 6.3 / 4.8 — 5.3)
		With Side PTO	3.8 (4.0 / 3.3)	3.1 (3.3 / 2.7)
		With Side PTO (4 × 4 Vehicle)	—	3.8 (4.0 / 3.3)
Oil			Besco Transaxle Oil 5W-30	

Fixing Torque

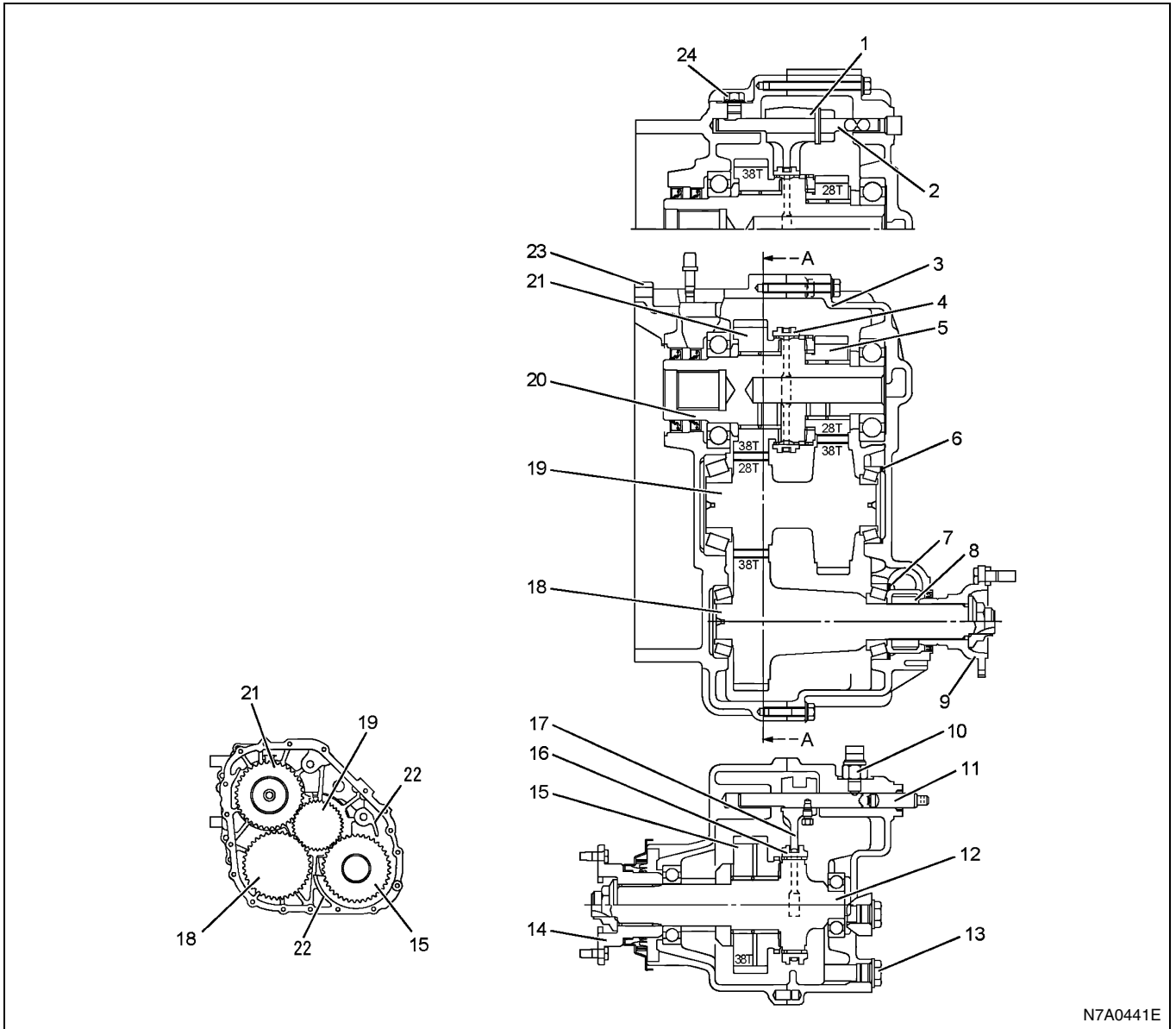


Special Tools

Illustration	Tool Number / Description / Remarks
 <p>5884022450</p>	<p>5-8840-2245-0 / Control Box Oil Seal Installer</p>

Transfer System (MYR Rigid Type)

Function and Operation



N7A0441E

Legend

- | | |
|------------------------------------|-----------------------------------|
| 1. Low / high shift arm | 13. Drain plug |
| 2. Low / high shift rod | 14. Driver coupling; Front output |
| 3. Transfer rear case | 15. Front output drive gear |
| 4. Sleeve; Low / high | 16. Sleeve; 2WD / 4WD |
| 5. Transfer low gear | 17. 2WD / 4WD shift arm |
| 6. Shim; Counter shaft bearing | 18. Rear output shaft |
| 7. Shim; Rear output shaft bearing | 19. Idle gear shaft |
| 8. Speedometer drive gear | 20. Input shaft |
| 9. Driver coupling; Rear output | 21. Transfer high gear |
| 10. 2WD / 4WD sensor switch | 22. Current plate |
| 11. 2WD / 4WD shift rod | 23. Transfer front case |
| 12. Front output shaft | 24. Low / high sensor switch |

Specifications

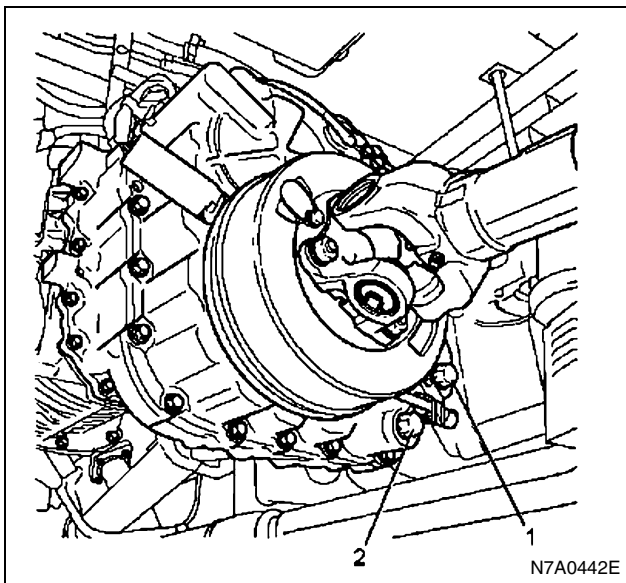
Type	2nd, helical gear type	
Gear Ratio	High Range	1.000 (28/38 × 38/28)
	Low Range	1.842 (38/28 × 38/28)
Specified Oil	Besco Gear Oil Transaxle (5W-30)	
Oil Capacity	L (US qt/Imp qt)	1.8 (1.9 / 1.6)

Transfer Assembly (MYR Rigid Type)

Removal

Preparation

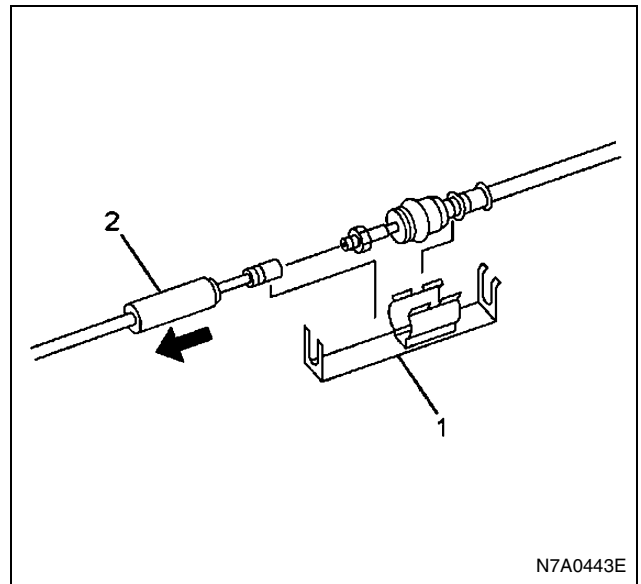
- Jack up the vehicle, and support with a rigid rack.
- Remove the drain plug, and drain the oil.



Legend

1. Filler plug
2. Drain plug

1. Remove the propeller shaft guard.
2. Remove the transfer side of the rear propeller shaft.
 - Before removing the propeller shaft, put alignment marks on the transfer flange and the propeller shaft flange yoke.
 - The removed propeller shaft must be put aside not to interfere with the operation, and fix securely with wire.
3. Disconnect the parking brake cable.
 - Remove the cable bracket (1) and slide the cover (2) in the direction indicated by an arrow.
 - Loosen the lock nut, and remove the front cable and the rear cable.



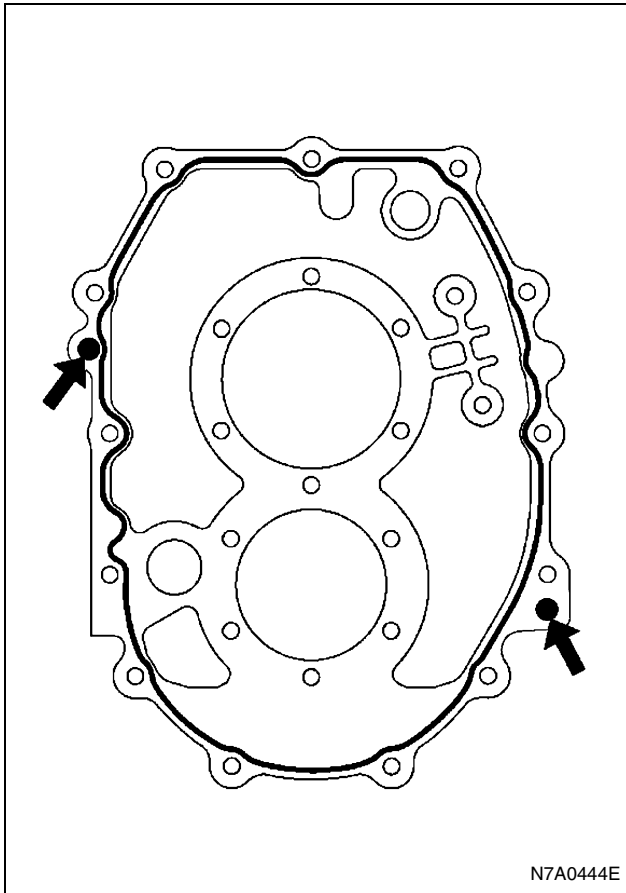
- Remove the cable clip of the rear cable.
4. Remove the front propeller shaft.
 - Before removing the propeller shaft, put alignment marks on the transfer flange and the propeller shaft flange yoke.
 5. Remove the low / high shift cable installation bracket.
 6. Remove the vehicle speed sensor connector.
 7. Remove the 2WD / 4WD change warning lamp switch connector.
 8. Remove the 2 parts of the vacuum hose.
 9. Remove the harness and nut on the transfer side.
 10. Remove the transfer assembly from the transmission.
 - Set securely the transmission jack to the transfer assembly.
 - Remove 11 bolts and 2 nuts for transfer installation.
 - Remove the transfer assembly by operating the transmission jack.

Installation

Install in the reverse order of removal, observing the following items.

- Apply liquid packing (ThreeBond 1215) on the transfer mating surface of the transmission case.

- Liquid packing (ThreeBond 1215) must be applied continuously with a diameter of 2 mm (0.079 in).
- Align the transfer assembly with the stud bolts indicated by arrows, and install it to the transmission.

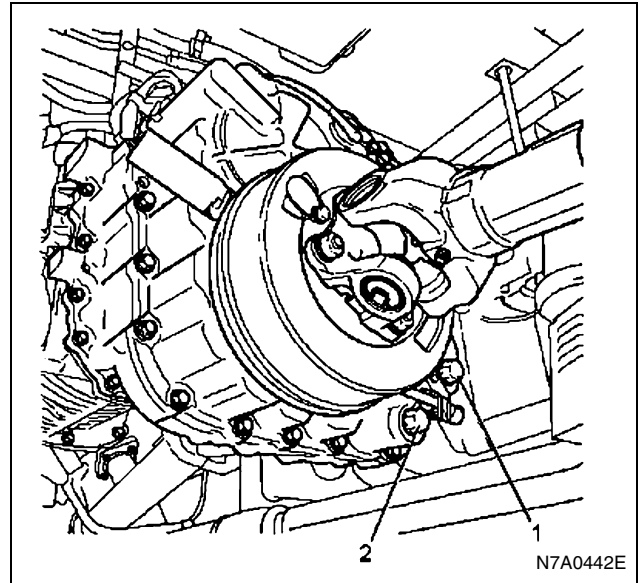


- Transfer assembly to transmission assembly fixing torque

Tighten:

Transfer assembly to transmission assembly to 46 N·m (4.7 kg·m / 34 lb·ft)

- Inject gear oil into the transfer assembly.
Product Name: Besco Gear Oil Transaxle (5W-30)
Capacity: 1.8L (1.9 US qt / 1.6 Imp qt)



Legend

1. Filler plug
2. Drain plug

- Fixing torque of the oil filler and drain plug

Tighten:

Oil filler and drain plug to 39 N·m (4.0 kg·m / 29 lb·ft)

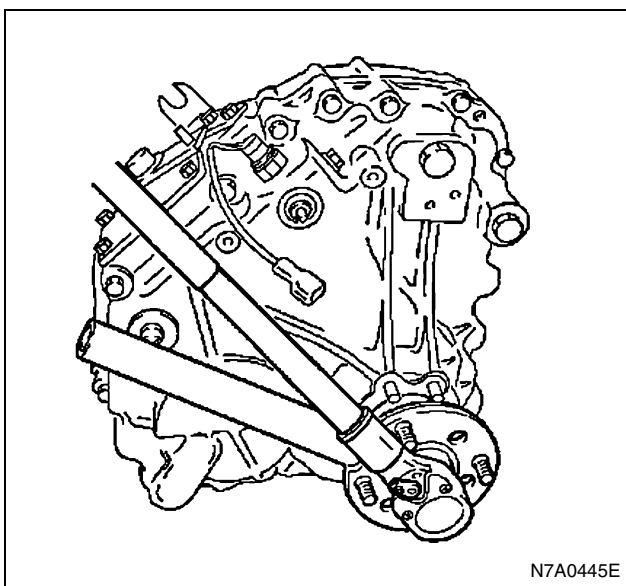
Transfer (MYR Rigid Type)

Disassembly

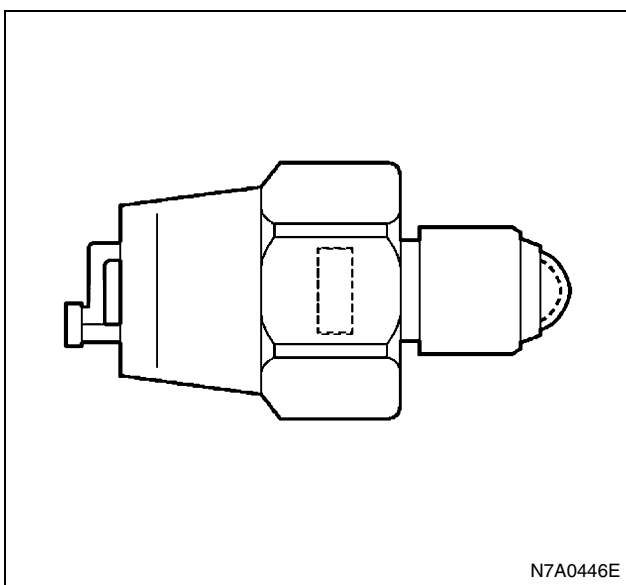
Caution:

Make sure to shift the gear to 4H before disassembling the front & rear transfer case.

1. Securely raise the caulking parts of the lock nut of the coupling driver.
2. Fix the rear coupling driver using the flange holder 5-8840-2043-0, and remove the lock nut.
3. Fix the front coupling driver using the flange holder 5-8840-0133-0, and remove the lock nut.
 - The rear coupling driver is shown in the figure below.

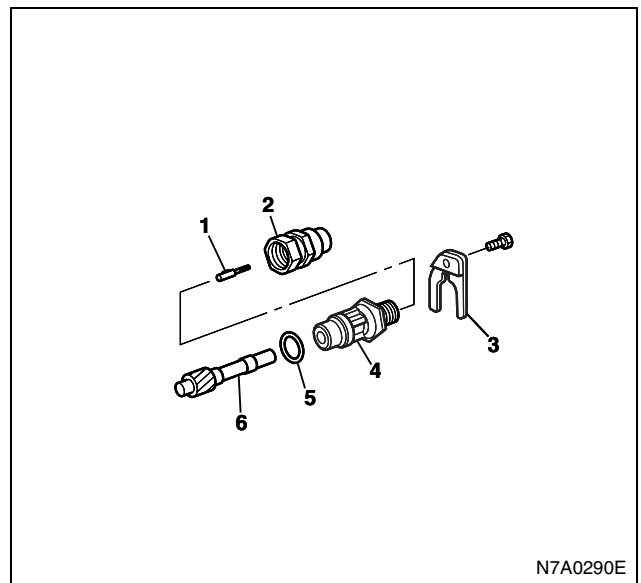


4. Remove the 2WD/4WD change warning lamp switch.



5. Remove the breather.

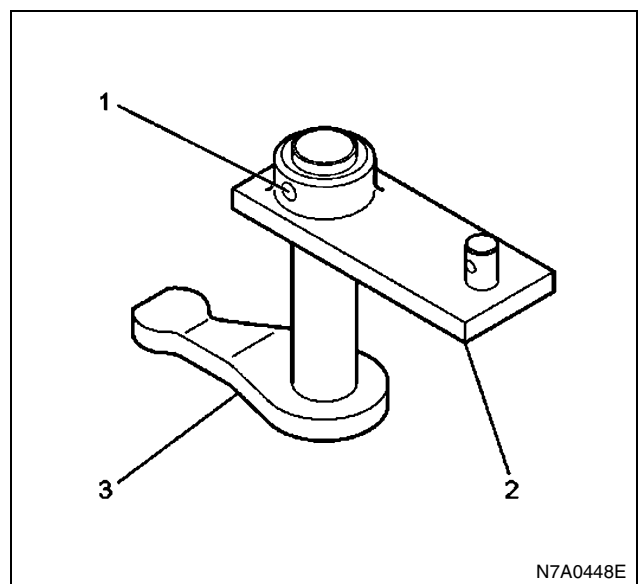
6. Remove the speed sensor driven gear.



Legend

1. Insertion key
2. Vehicle speed sensor
3. Plate
4. Bush
5. O-ring
6. Driven gear

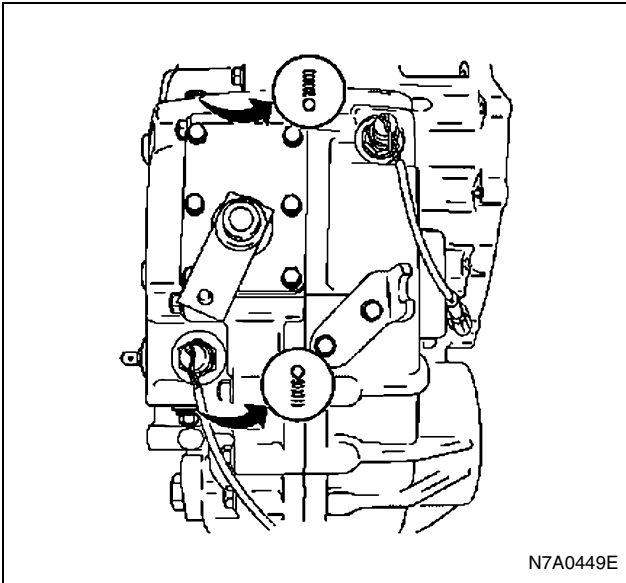
7. Remove the low / high change lever.



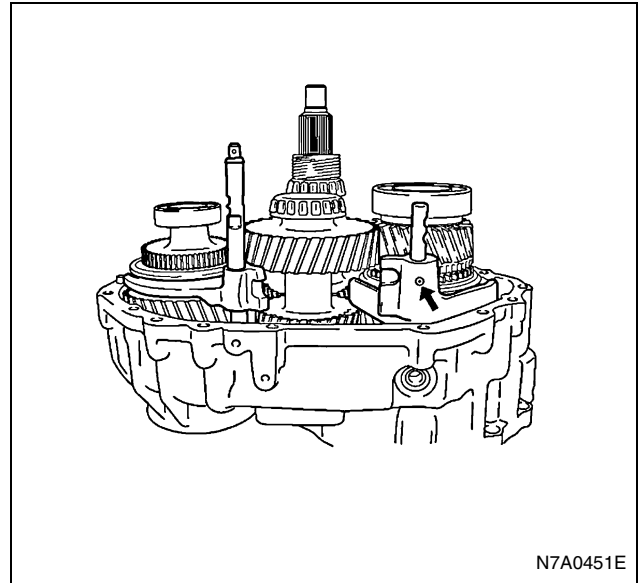
Legend

1. Spring pin
2. Select external lever
3. Select internal lever

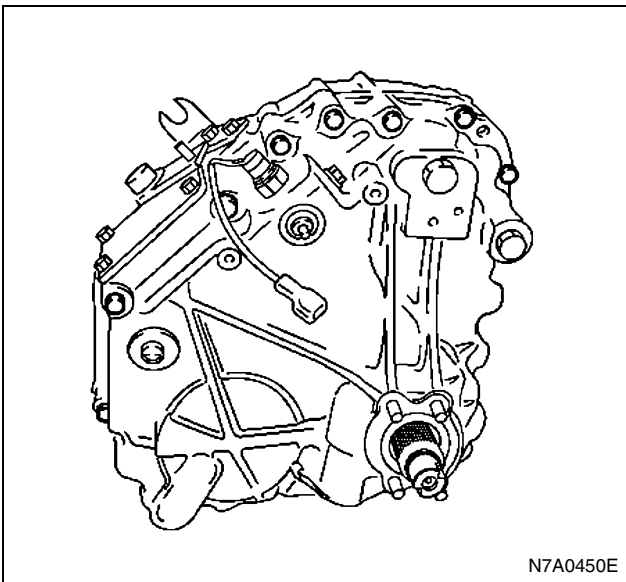
8. Remove the control cable bracket.
9. Remove the detent ball and detent spring.
 - Two parts



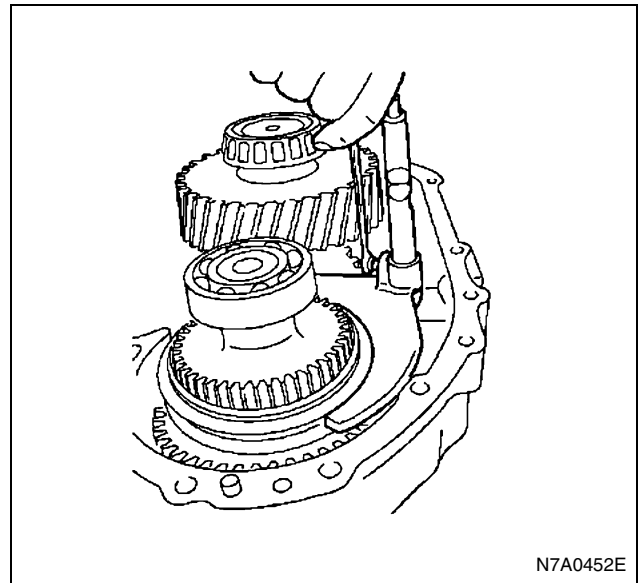
10. Remove the transfer rear case.
- Remove the 18 bolts.



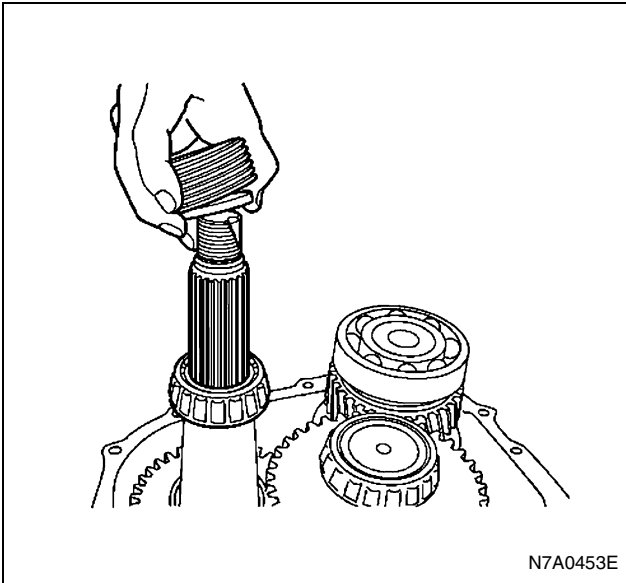
12. Remove the 2WD / 4WD change shift arm and shift rod.
- Loosen the shift arm fixing bolt, and remove the shift arm and the shift rod.



11. Remove the low / high change shift arm and the shift lock.
- Drive out the spring pin, and then remove the shift arm and the shift rod.

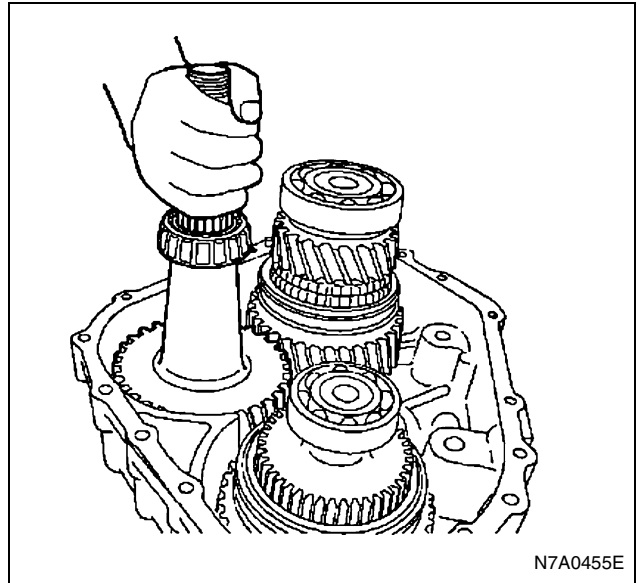


13. Remove the speedometer driven gear and the thrust washer.



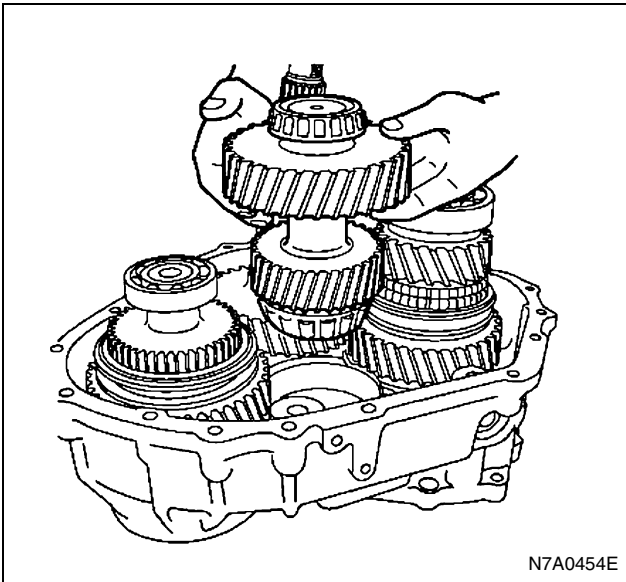
N7A0453E

14. Remove the idle gear shaft from the transfer case.



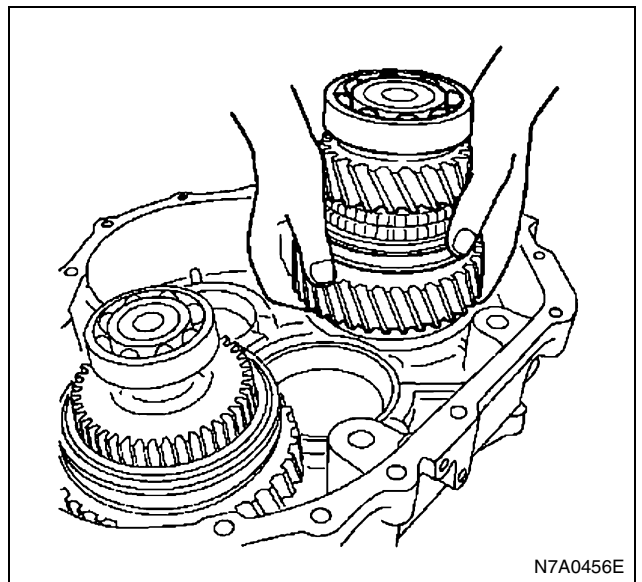
N7A0455E

16. Remove the input gear shaft from the transfer case.



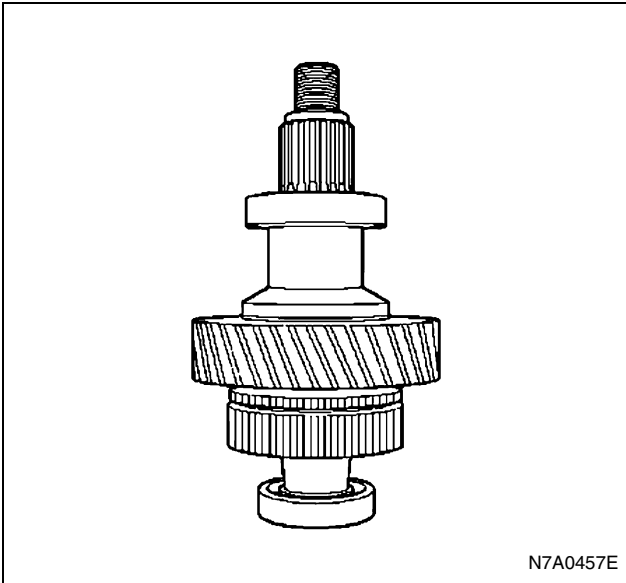
N7A0454E

15. Remove the rear output gear shaft from the transfer case.

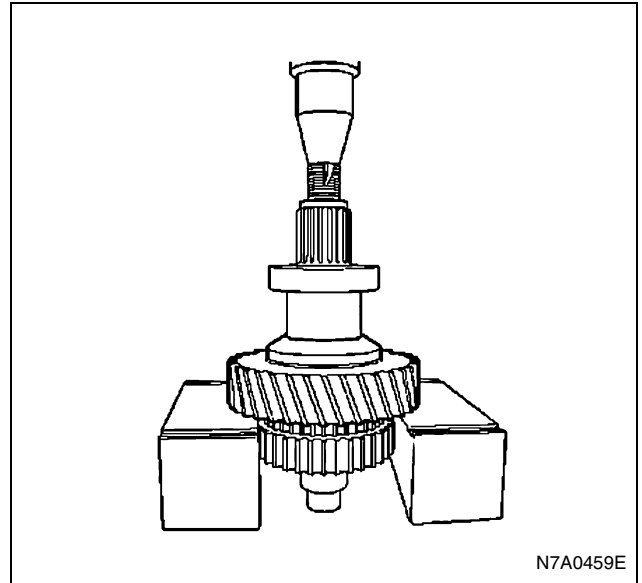


N7A0456E

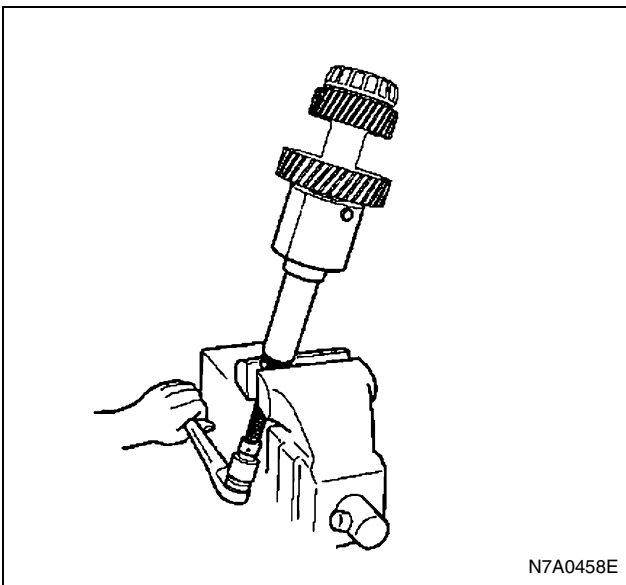
17. Remove the front output gear shaft from the transfer case.



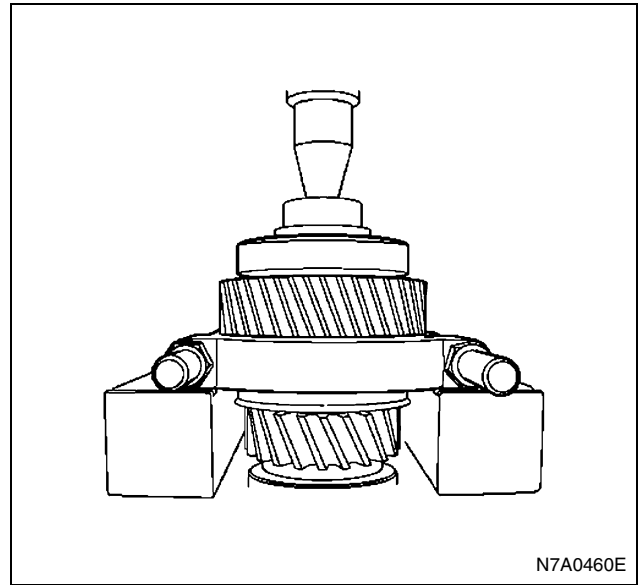
18. Remove the front & rear bearing from the idle shaft.
- Remove the front bearing using a general-purpose bearing remover.
 - Remove the rear bearing using the insert 303173 and the collet 44801 from among the parts of the bearing remover 5-8840-2587-0.



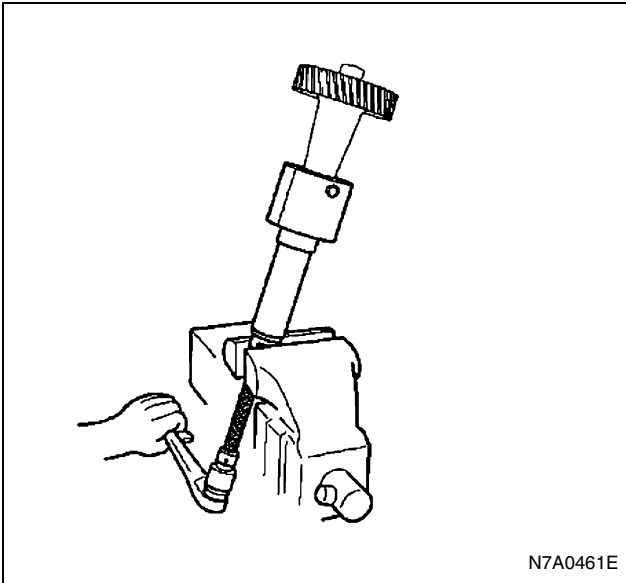
- After removing the ball bearing, remove the collar, thrust washer, front output drive gear and needle bearing.
20. Disassemble the input gear shaft.
- Remove the front & rear bearing using a general-purpose bearing remover.



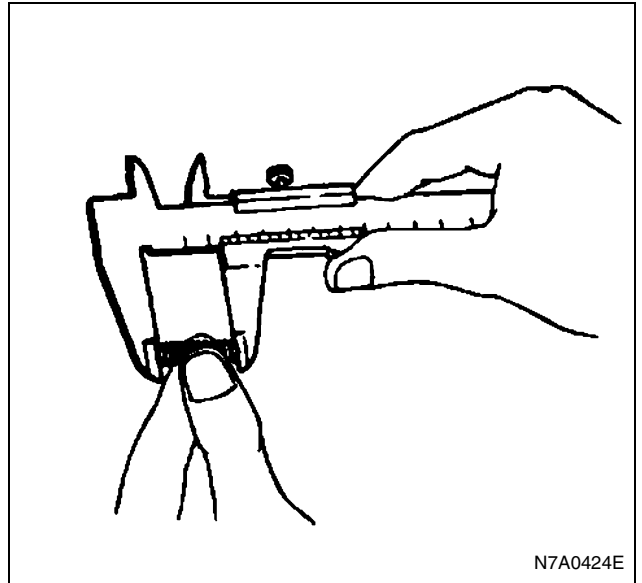
19. Disassemble the front output gear shaft.
- Before removing the ball bearing, put a mark which indicates the installation direction.
 - Remove the front & rear bearing using a general-purpose bearing remover.



- After removing the front bearing, remove the thrust washer, transfer high gear, needle bearing and sleeve.
 - After removing the rear bearing, remove the thrust washer, transfer low gear and needle bearing.
21. Remove the front & rear bearing from the rear output gear shaft.
- Remove using the bearing remover 5-8840-2587-0.
 - Remove using the insert 303173 and the collet 44801 from among the parts of the bearing remover.

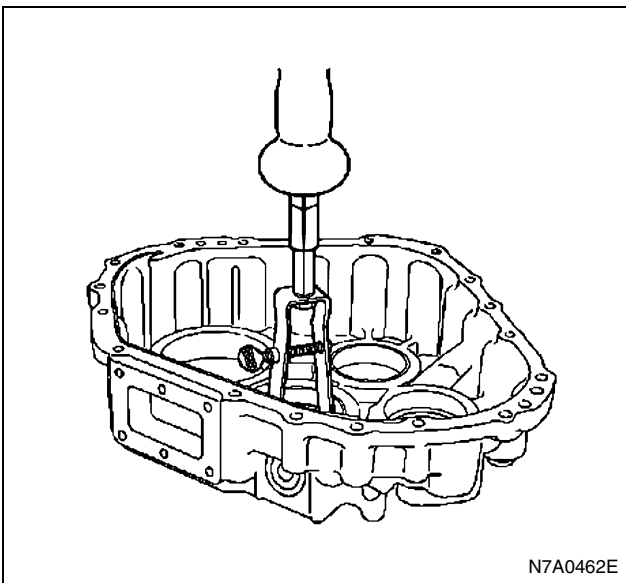


22. Remove the bearing outer race of the idle gear shaft.
- Remove using the bearing race remover 5-8840-0027-0.



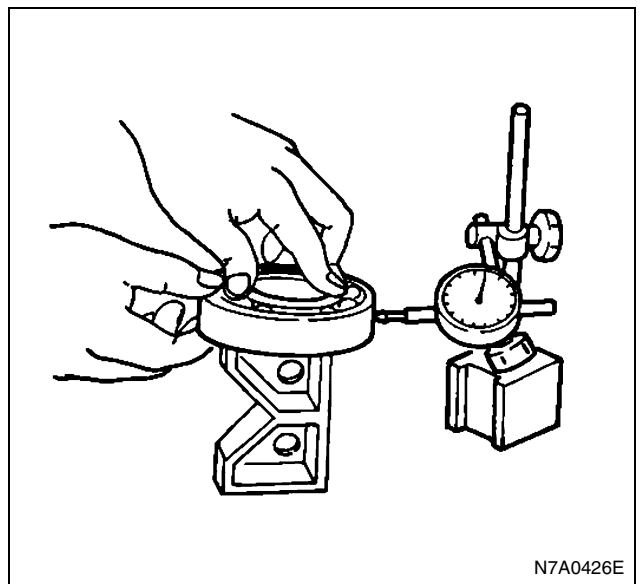
- Inspect each bearing. If any abnormality is found, replace the bearing.
 - Smoothness of rotation
 - Noise
 - Abnormal external appearance, including damage or rust
 - Abnormal free play in thrust direction
 - Discoloration, excessive wear and pitching of rotating body and rotating surface of needle bearing
- Measure the free play in the radial direction of the ball bearing.

Free play in the radial direction of the ball bearing
Limit: 0.2 mm (0.0079 in)



Assembly

1. Clean and inspect the disassembled parts. If any abnormality including wear, damage or corrosion is found, repair or replace the part.
 - Measure the free length of the detent spring.
- Free Length of Detent Spring
Standard: 31.6 mm (1.244 in) Limit: 30.1 mm (1.185 in)

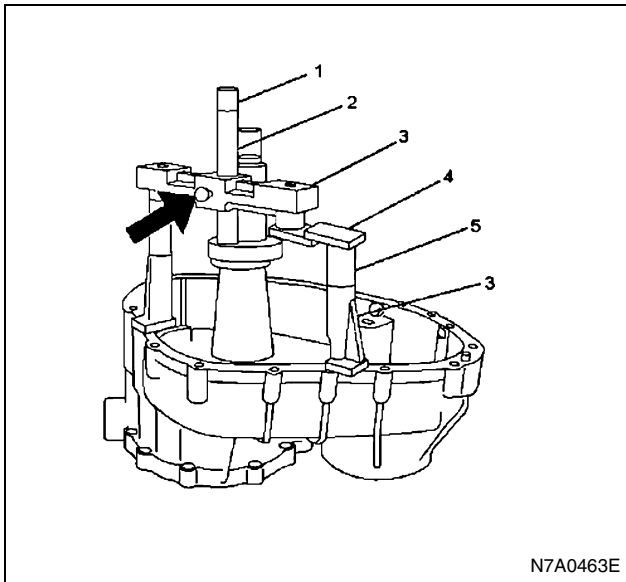


- Inspect the sleeve sliding surface of the shift arm. Check that there is no excessive wear or damage.
- Inspect the gear. Repair slight stepped surface or roughness using an oil stone or pencil grinder.

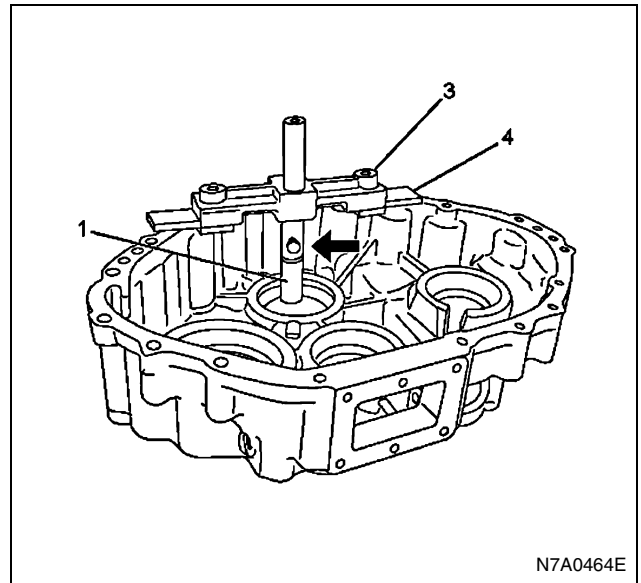
- Damage on tooth surfaces
- Excessive wear of tooth surfaces
- If excessive wear or damage is found on the tooth surfaces of the dog clutch, replace the part.
- Oil seal
 - Replace the removed oil seal with a new one.

2. Bearing shim adjustment

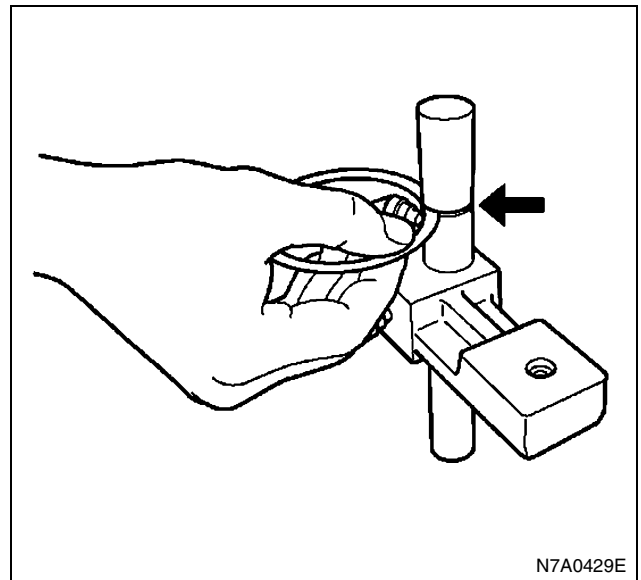
- Adjust the thickness of the shim of the rear output shaft rear bearing, using the shim selector 5-8840-0194-0 and shim selector adaptor 5-8840-2794-0.
- Measure the thickness of the shim, using the gauge pin J-35824-8 (1), gauge cylinder J-35824-31(2), bridge assembly J-35824-1(3), extension J-35824-19(4) and spacer J-35824-30(5) included in the shim selector gauge and the shim selector set.



- a. Loosen the screw, put the gauge cylinder on the rear bearing edge surface of the output shaft, and fix with the screw.
- b. Remove the leg and spacer from the bridge. Install the extension (4) to the bridge to enable the bridge to connect to the rear transfer case mating surface.



- c. Turn the bridge assembly upside down, and then set the bearing assembly to the installation hole surface of the output shaft rear bearing of the mating side rear transfer case.
- d. Loosen the screw, put the gauge pin (1) on the bearing installation surface, and fix the screw.
- e. Measure the clearance between the gauge cylinder and the gauge pin, and select the size of the shim. Adjustment to the standard end plate 0 — 0.05 mm (0 — 0.002 in) becomes possible.



- Set the selected shim on the bearing surface of the bearing race, and press in the race.
- Adjust the shim for the bearing outer of the idle shaft in the same manner.

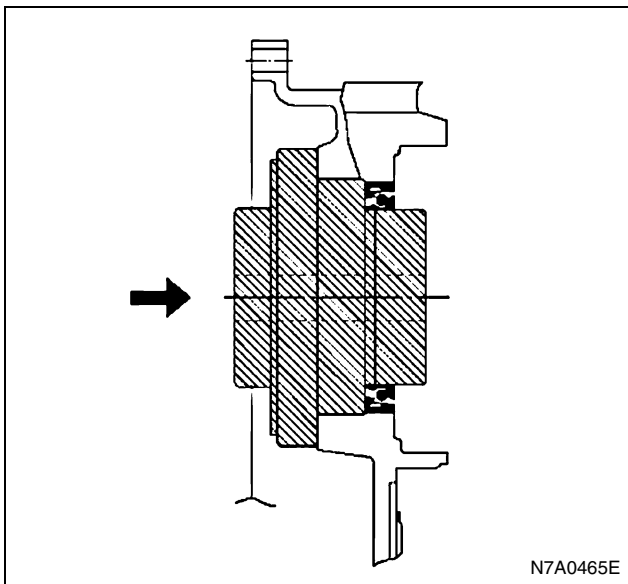
Shims, which can be selected, mm (in)	
Idle gear shaft	0.18 (0.0070)
Rear output gear shaft	0.25 (0.0098)
	0.30 (0.0118)
	0.35 (0.0137)
	0.40 (0.0157)
	0.50 (0.0196)

3. Install the oil seals of the rear output shaft, front output shaft and input shaft.
 - Apply engine oil on the outer circumference of a new oil seal, and apply grease (Besco L2 or equivalent) to the lip part.
 - Install the rear output oil seal using the installer 5-8840-2775-0.
 - Install the front output oil seal using the installer 5-8840-2774-0.
 - Install the input oil seal using the installer 5-8840-2776-0.

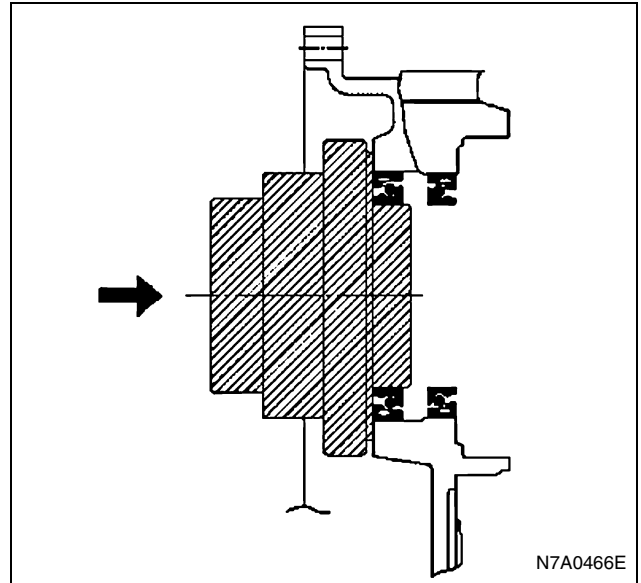
Caution:

Make sure to install the inner side and outer side of the input shaft oil seal from the transmission side.

- Installation direction of the inner side oil seal of the input shaft is indicated.

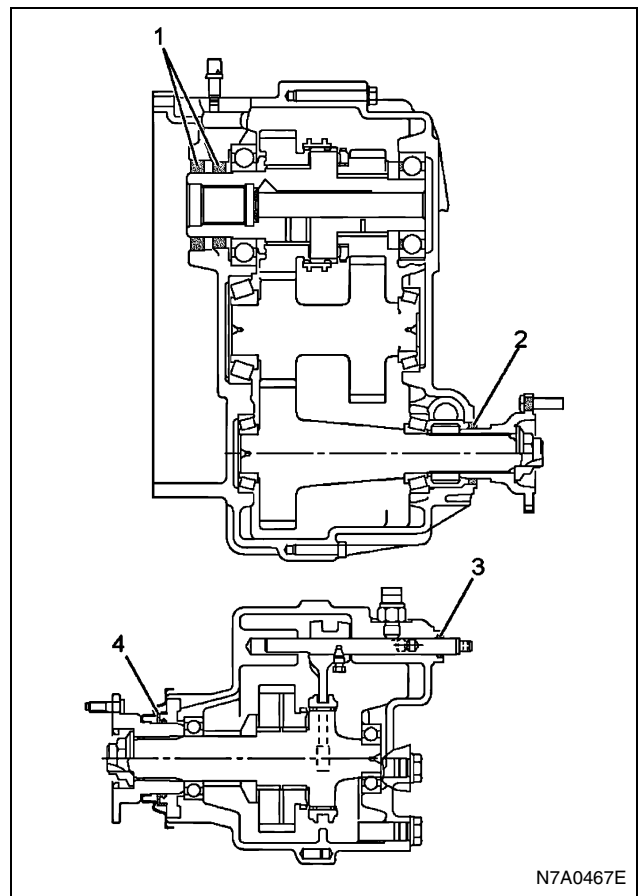


- Installation direction of the outer side oil seal of the input shaft is indicated.



- Install the oil seal of the 2WD / 4WD change shift rod part of the rear transfer case.
- Install the front output shaft oil seal to the front transfer case.

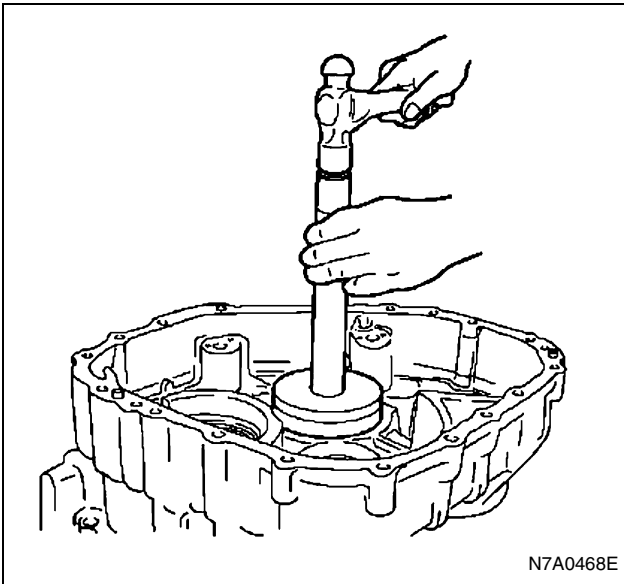
Installation Position



Legend

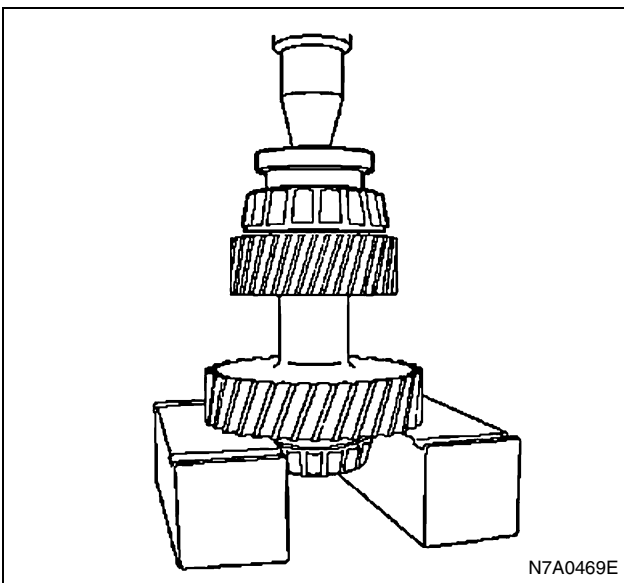
1. Input shaft oil seal
2. Rear output shaft oil seal
3. Shift rod oil seal
4. Front output shaft oil seal

4. Press in the bearing outer race of the idle gear shaft and rear output gear shaft.
 - Use the installer 5-8840-2773-0 and the grip 5-8840-0007-0 to press in the front side outer race of the idle gear shaft.
 - Use the installer 5-8840-2235-0 and the grip 5-8840-0007-0 to press in the rear side outer race of the idle gear shaft.
 - Use the installer 5-8840-2772-0 and the grip 5-8840-0007-0 to press in the front & rear side outer race of the rear output gear shaft.



N7A0468E

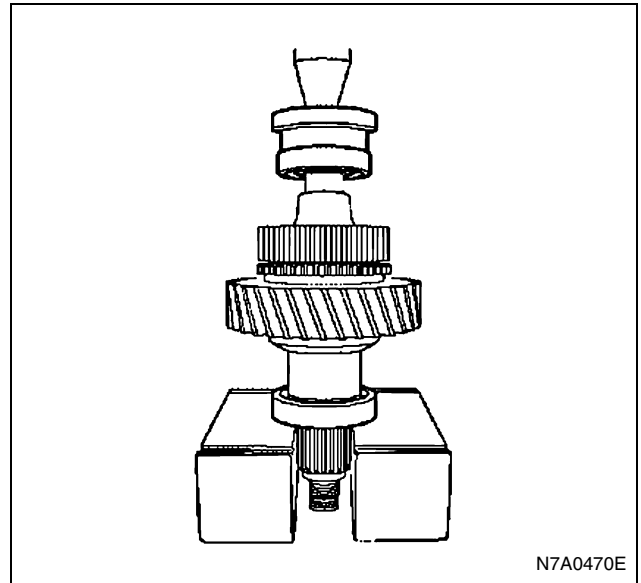
5. Install the front & rear bearing inner race of the idle gear shaft.
 - Use a press machine to press in the roller bearing.



N7A0469E

6. Assemble the front output gear shaft.
 - Before installing the ball bearing, install the needle bearing, front output drive gear, thrust washer and collar.

- Use a press machine to press in the ball bearing.



N7A0470E

- After installing the ball bearing, install the sleeve in accordance with the marked direction.

Caution:

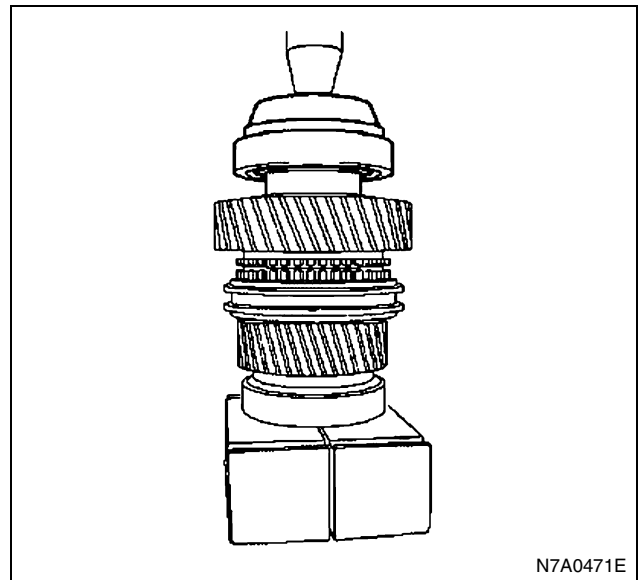
Make sure to install in the correct direction.

7. Assemble the input gear shaft.
 - Before installing the front side ball bearing, install the needle bearing, transfer low gear and thrust washer.
 - Before installing the rear side ball bearing, install the sleeve, needle bearing, transfer high gear and thrust washer.

Caution:

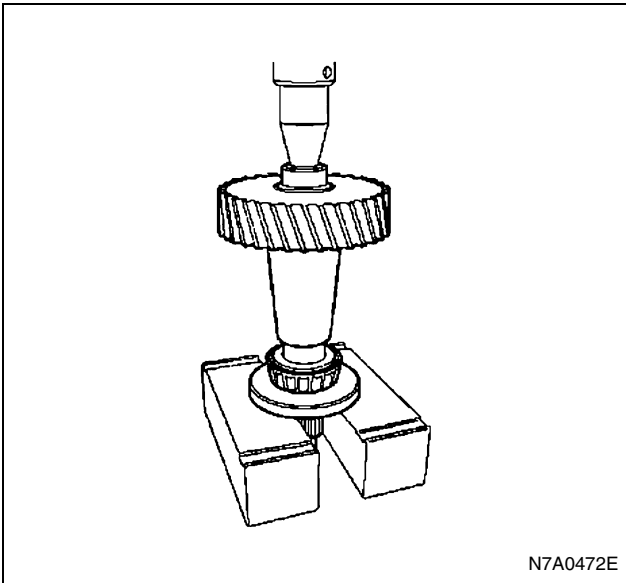
Install the sleeve by turning the side, which has a groove along its outer circumference, toward the front side.

- Use a press machine to press in the ball bearing.

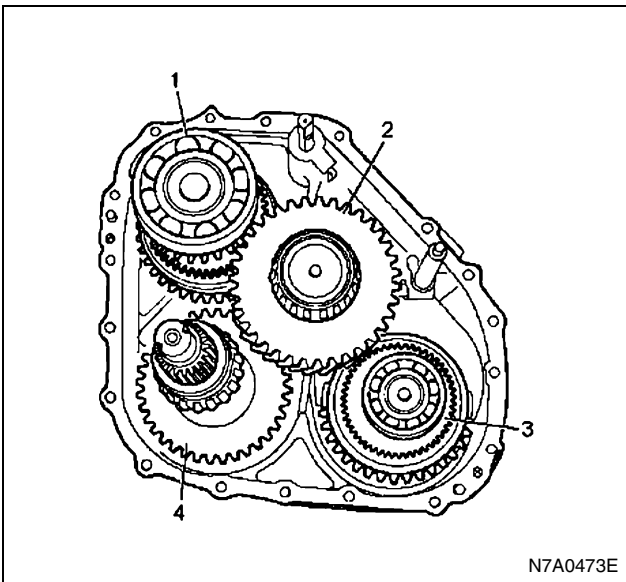


N7A0471E

8. Install the bearing of the rear output gear shaft.
 - Use a press machine to press in the ball bearing.



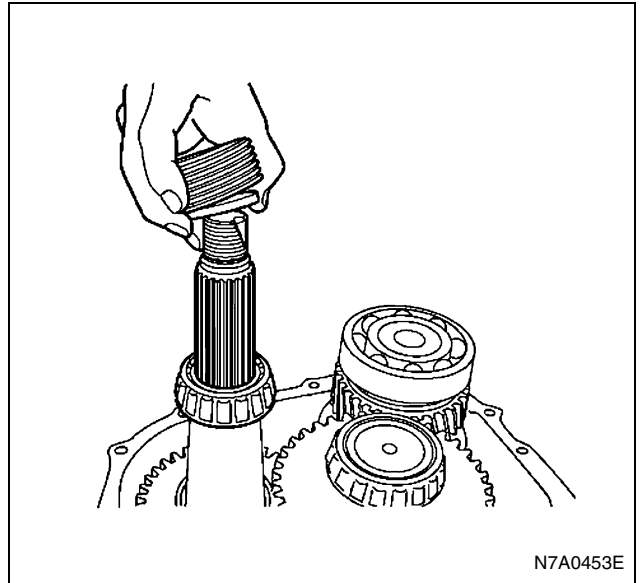
9. Install the front output gear shaft to the front transfer case.
10. Install the input gear shaft.
11. Install the rear output gear shaft.
12. Install the idle gear shaft.
 - Install in the order of 9, 10, 11 and 12.



Legend

1. Input gear shaft
2. Idle gear shaft
3. Front output gear shaft
4. Rear output gear shaft

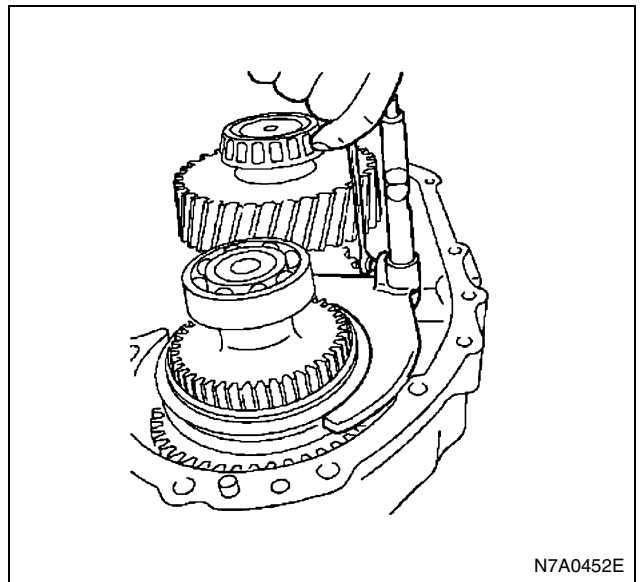
13. Install the thrust washer and speedometer drive gear.



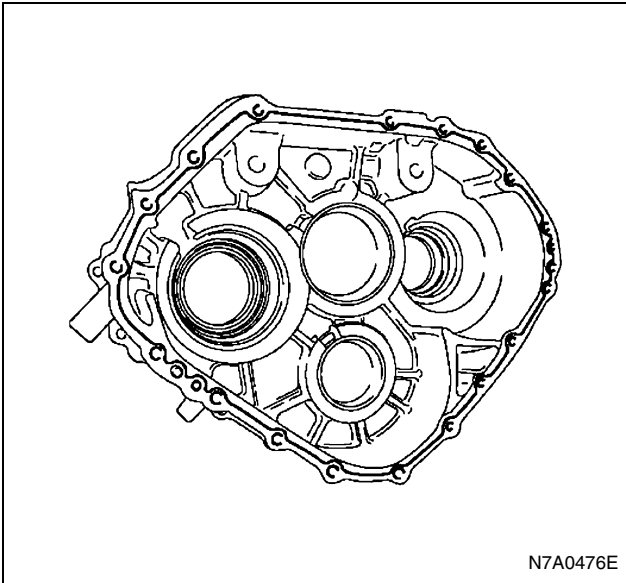
14. Install the shift arm and shift rod.
 - Use a spring pin to install the shift arm of the low / high change side.
 - Use a bolt to fix the shift arm of the 2WD / 4WD change side. Apply LOCTITE 242 to the threaded part of the bolt.

Tighten:

Shift arm and shift rod to 23 N·m (2.3 kg·m / 17 lb·ft)



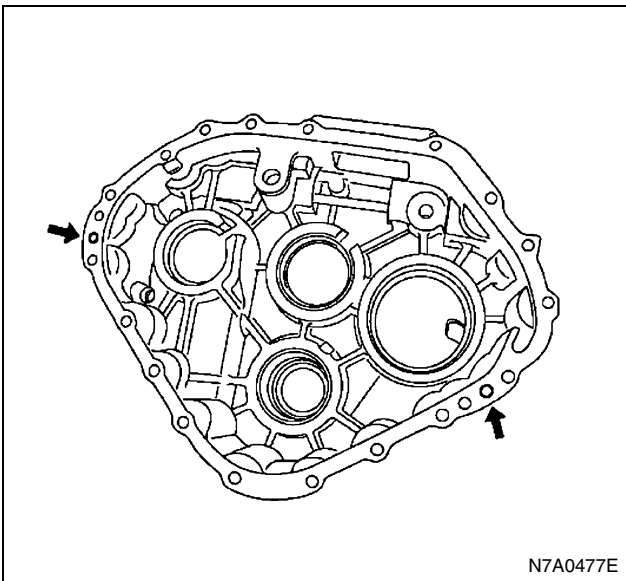
15. Install the rear transfer case.
 - Apply liquid packing (ThreeBond 1215) to the mating surface of the front transfer case. Liquid packing must be applied to the inside of the bolt hole continuously with a diameter of 2 mm (0.079 in).



- Do not drop the detent shaft.
- Align with the 2 knock pins.
- Set the 18 bolts on the fixing holes, and fix them diagonally and equally.

Tighten:

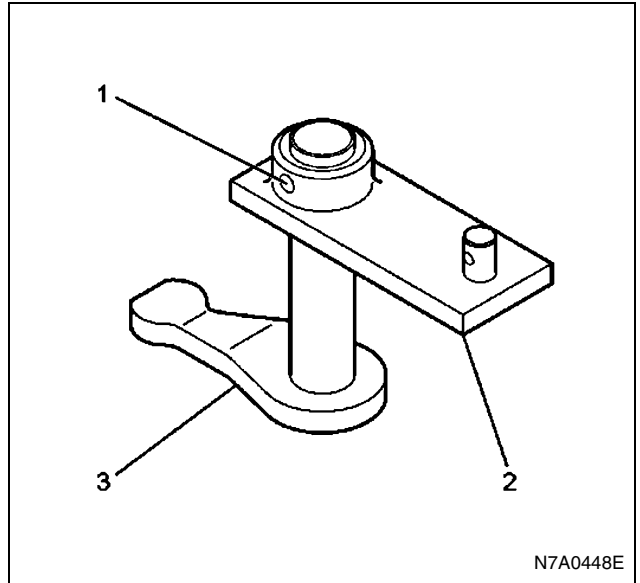
Transfer case to 33 N·m (3.4 kg·m / 24 lb·ft)



16. Install the shift lever.
- Check that the internal lever is securely put in the groove of the shift arm.
 - Apply liquid packing (ThreeBond 1215) to the mating surfaces of the shift cover and transfer case, and fix it with a bolt.

Tighten:

Shift lever to 17 N·m (1.7 kg·m / 13 lb·ft)



Legend

1. Spring pin
2. Select external lever
3. Select internal lever

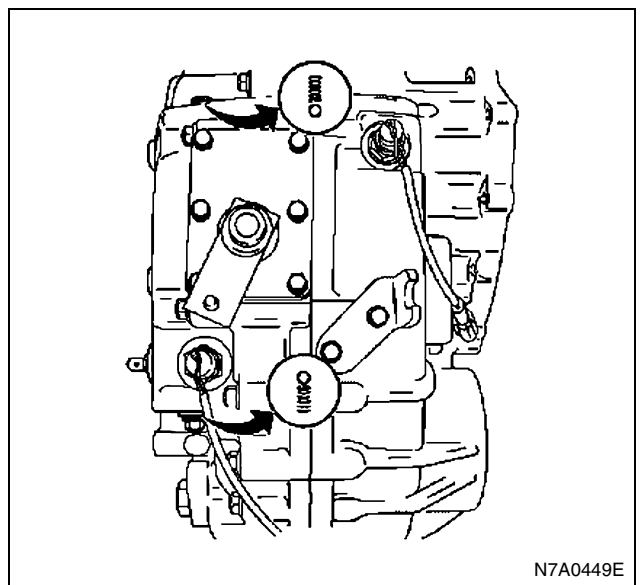
17. Install the detent balls and springs in two parts.
- Install the detent balls and springs for 4H & 4L and 2WD & 4WD to the rear transfer case.
 - Apply liquid gasket (ThreeBond 1105) to the thread of the plug, and fix it to the specified torque.

Tighten:

Plug to 25 N·m (2.5 kg·m / 18 lb·ft)

Caution:

Do not drop the parts.



18. Install the low / high shift lever cable installation bracket.

- Apply liquid gasket (ThreeBond 1215) only to the thread of the bolt, which is to be fixed through the bore hole of the case side.

Tighten:

Bolt to 17 N·m (1.7 kg·m / 13 lb·ft)

19. Install the 2WD / 4WD change warning lamp switch.

- Apply liquid gasket (ThreeBond 1105) to the switch thread.

Tighten:

2WD / 4WD change warning lamp switch to 33 N·m (3.4 kg·m / 25 lb·ft)

20. Install the rear & front coupling driver.

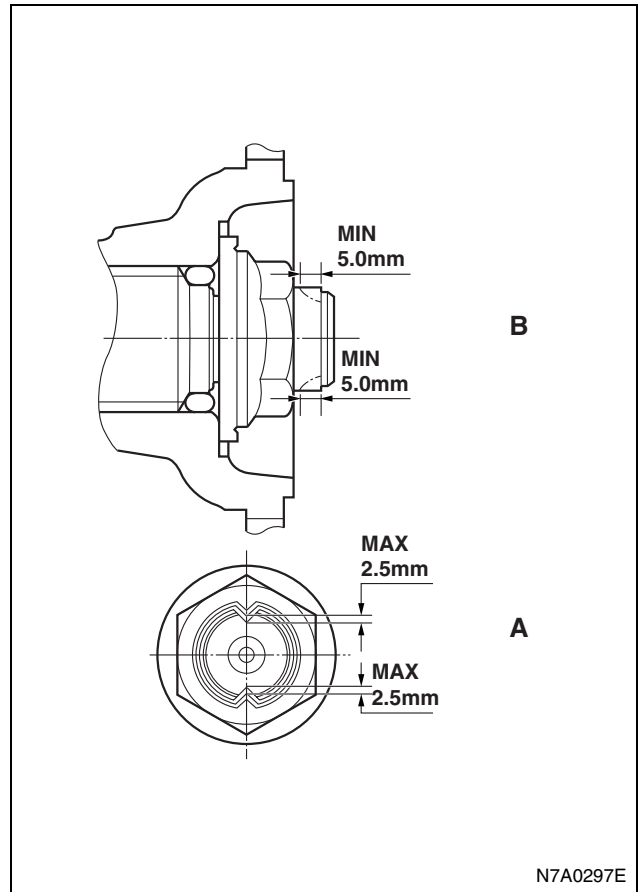
- Use the flange holder 5-8840-0133-0 to fix the front coupling driver, and tighten it with a lock nut.
- After installing the parking brake assembly, use the coupling driver and lock nut to install the rear output shaft.
Tighten the lock nut by fixing the coupling driver using the flange holder 5-88470-2043-0.

Tighten:

- Parking brake to 83 N·m (8.5 kg·m / 61 lb·ft)
- Front output shaft to 290 N·m (29 kg·m / 214 lb·ft)
- Rear output shaft to 226 N·m (23 kg·m / 167 lb·ft)
- After tightening to the specified torque, align the lip part of the nut to the V-groove of the shaft edge. Caulk the nut lip with a chisel to make a length (B) of 5 mm (0.2 in) or more, and a clearance between the bottom of the shaft and the nut lip (A) of 2.5 mm (0.06 in) or less.

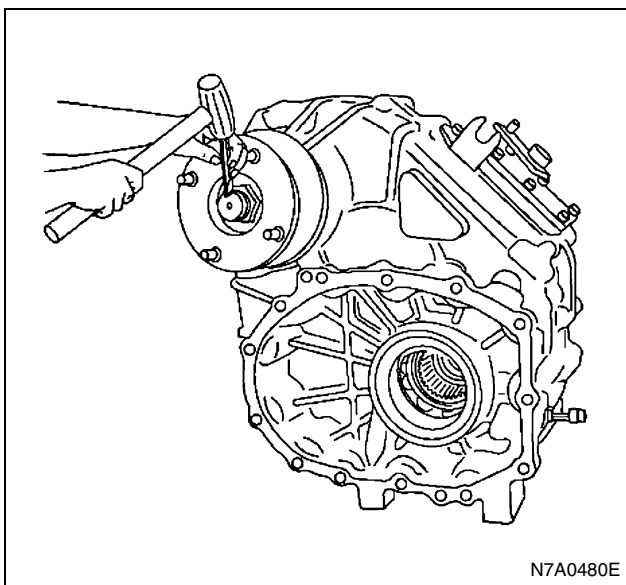
Caution:

When caulking, be careful not to crack the nut.



21. Install the parking brake drum.

- Tighten the adjustment hole cover fixing bolt.



Special Tools

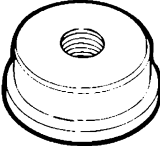
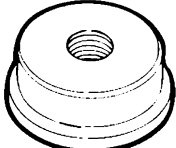
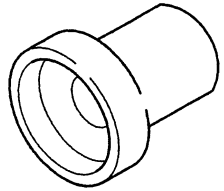
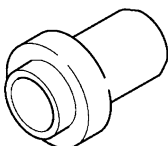
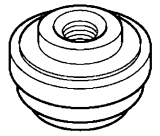

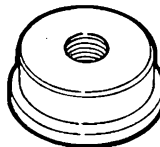
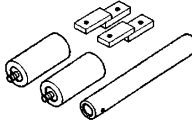

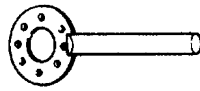

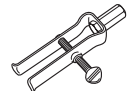
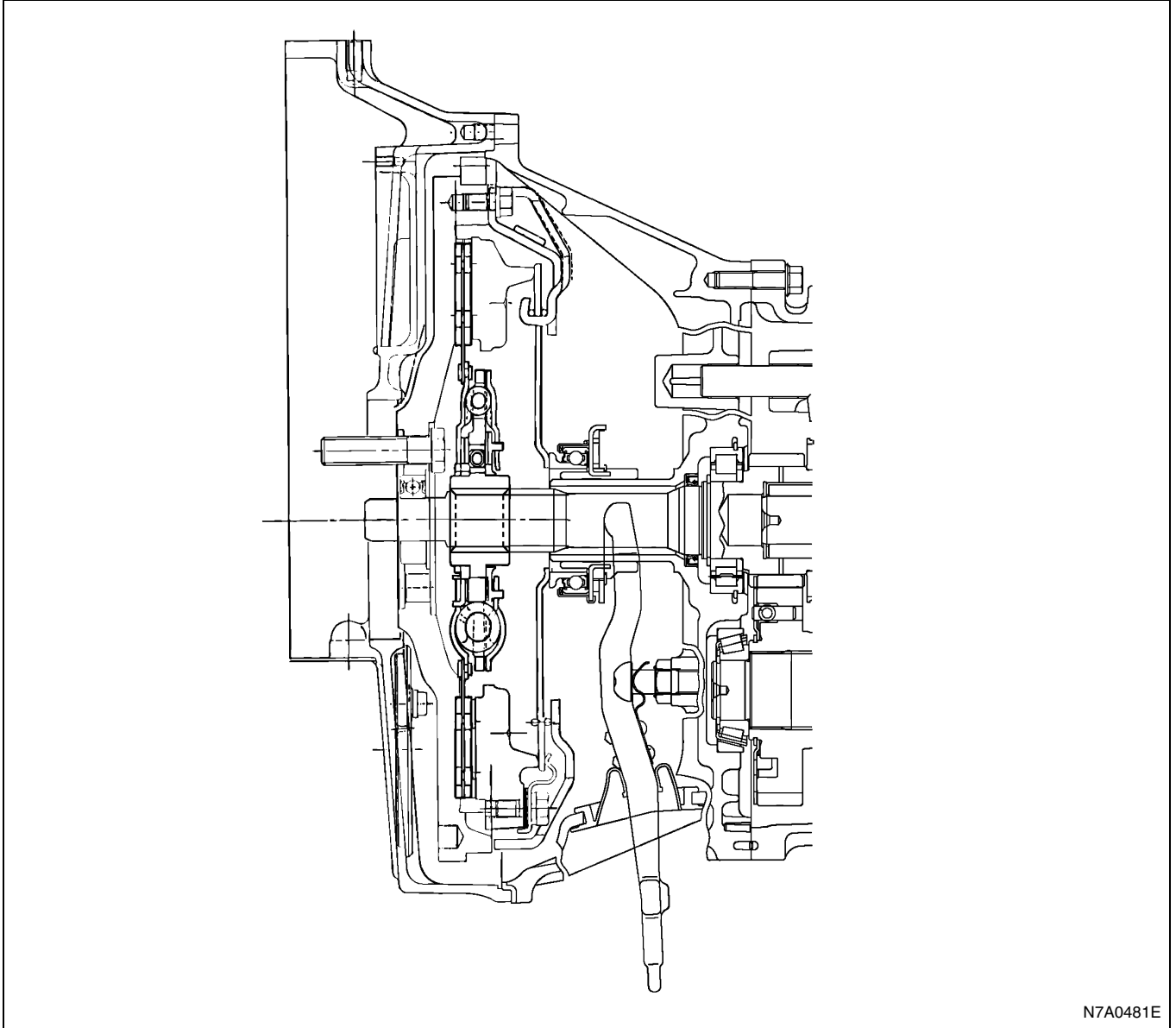
Illustration	Tool Number / Description / Remarks
 5884027720	5-8840-2772-0 / Bearing Installer
 5884027730	5-8840-2773-0 / Bearing Installer
 5884027740	5-8840-2774-0 / Bearing Installer
 5884027750	5-8840-2775-0 / Oil Seal Installer
 5884027760	5-8840-2776-0 / Oil Seal Installer
 5884001940	5-8840-0194-0 / Shim Selector

Illustration	Tool Number / Description / Remarks
 5884022350	5-8840-2235-0 / Bearing Installer
 5884027940	5-8840-2794-0 / Shim Selector Adapter Kit
 5884000070	5-8840-0007-0 / Grip
 5884020430	5-8840-2043-0 / Flange Holder
 5884025870	5-8840-2587-0 / Bearing Remover
 5884000270	5-8840-0027-0 / Remover

CLUTCH

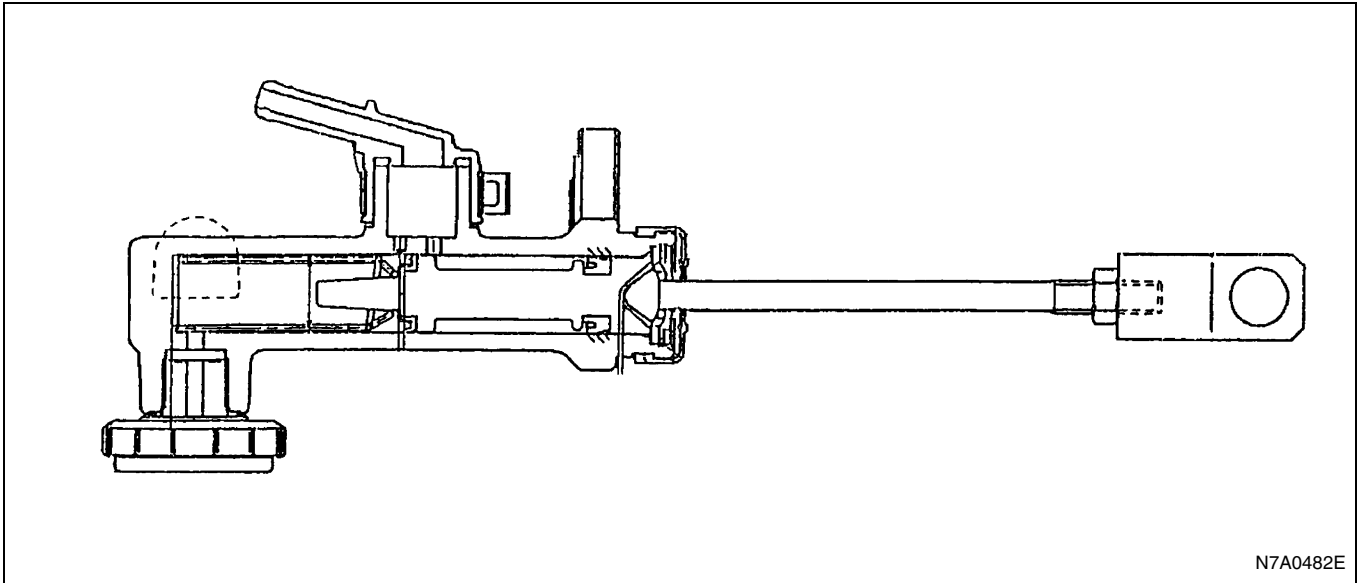
GENERAL DESCRIPTION

Clutch System
Clutch

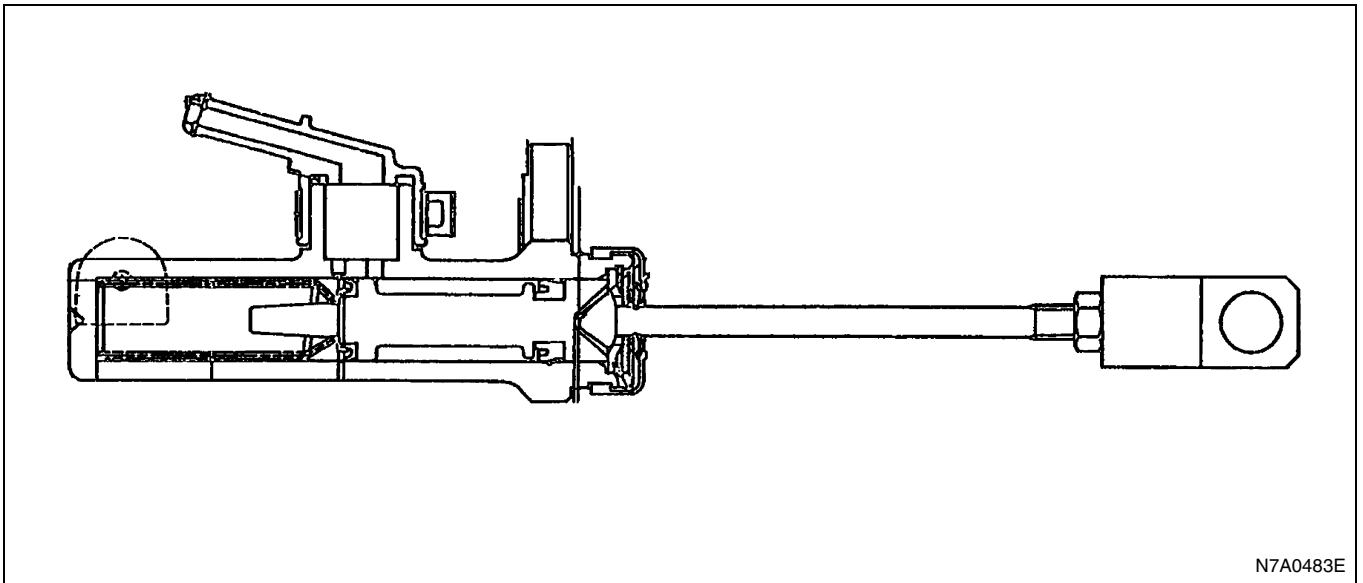


N7A0481E

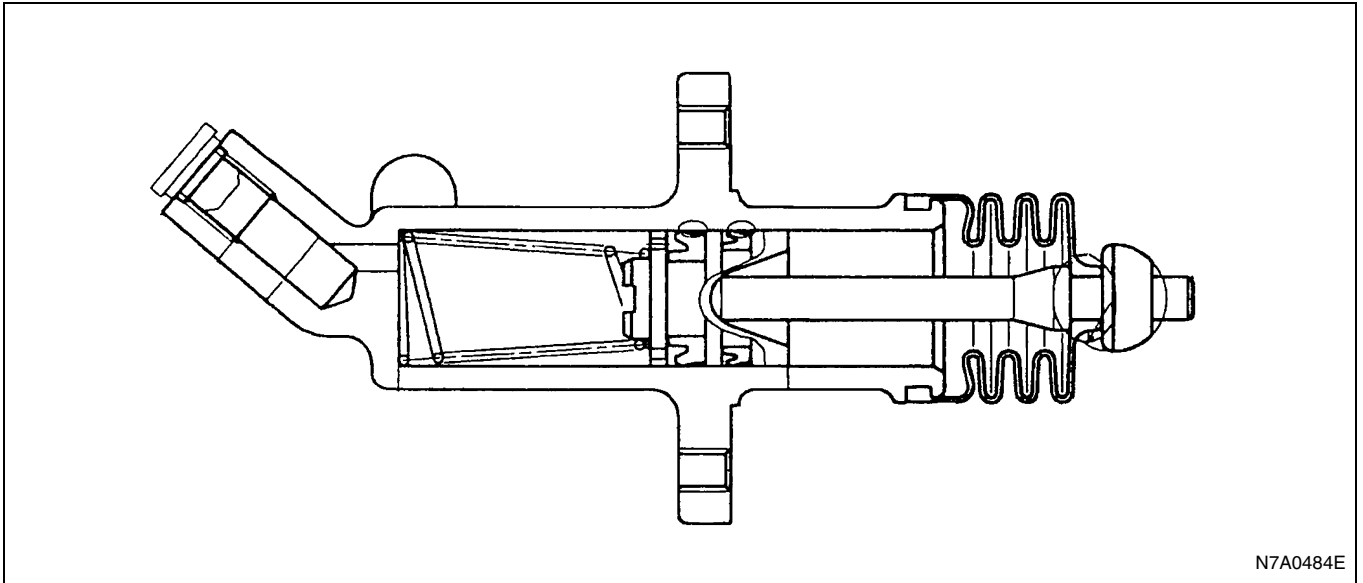
Master Cylinder



Master Cylinder (without Booster)

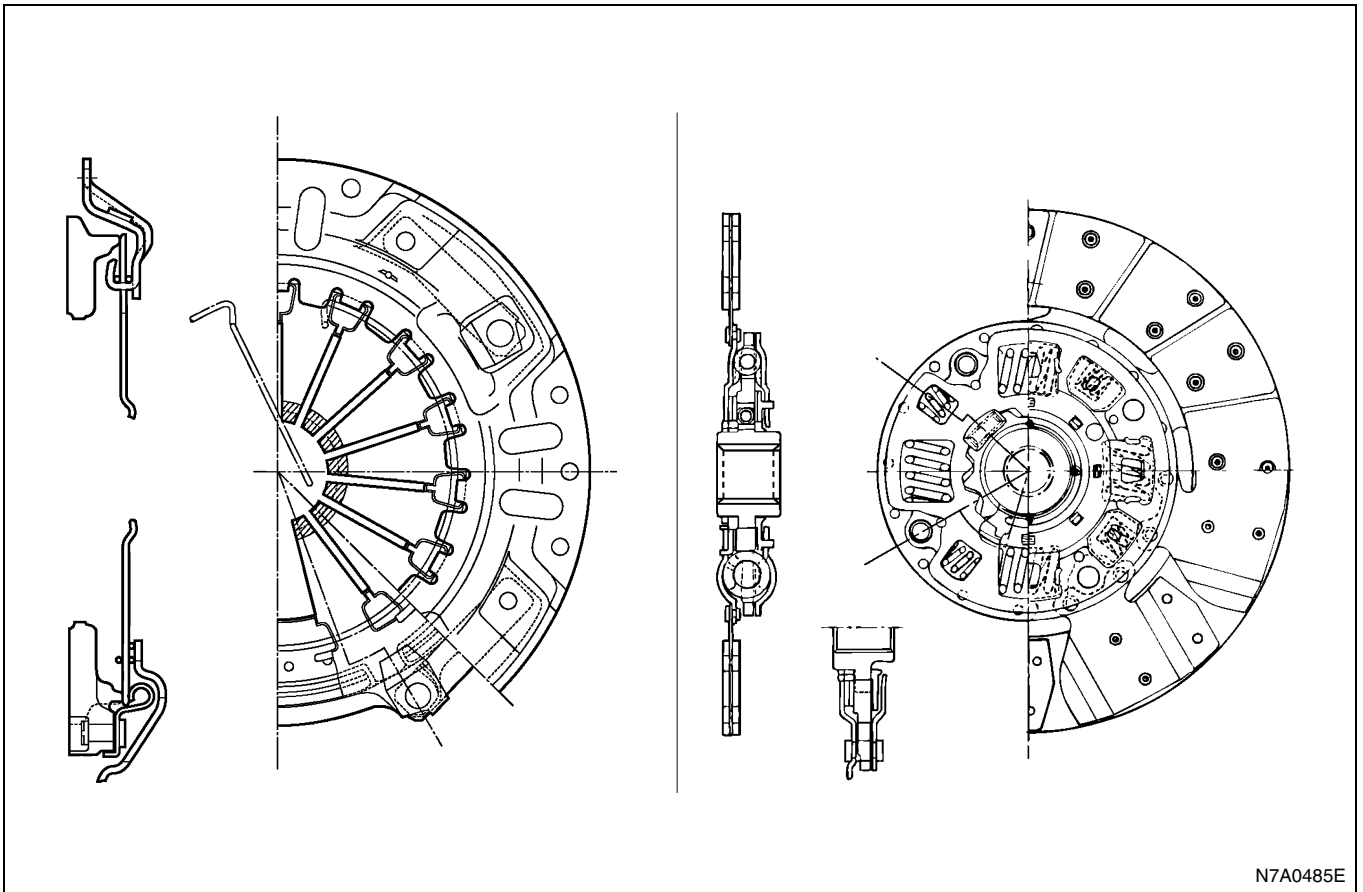


Slave Cylinder (Auto Adjustment Type)



N7A0484E

Pressure Plate Assembly and Clutch Disk Assembly



N7A0485E

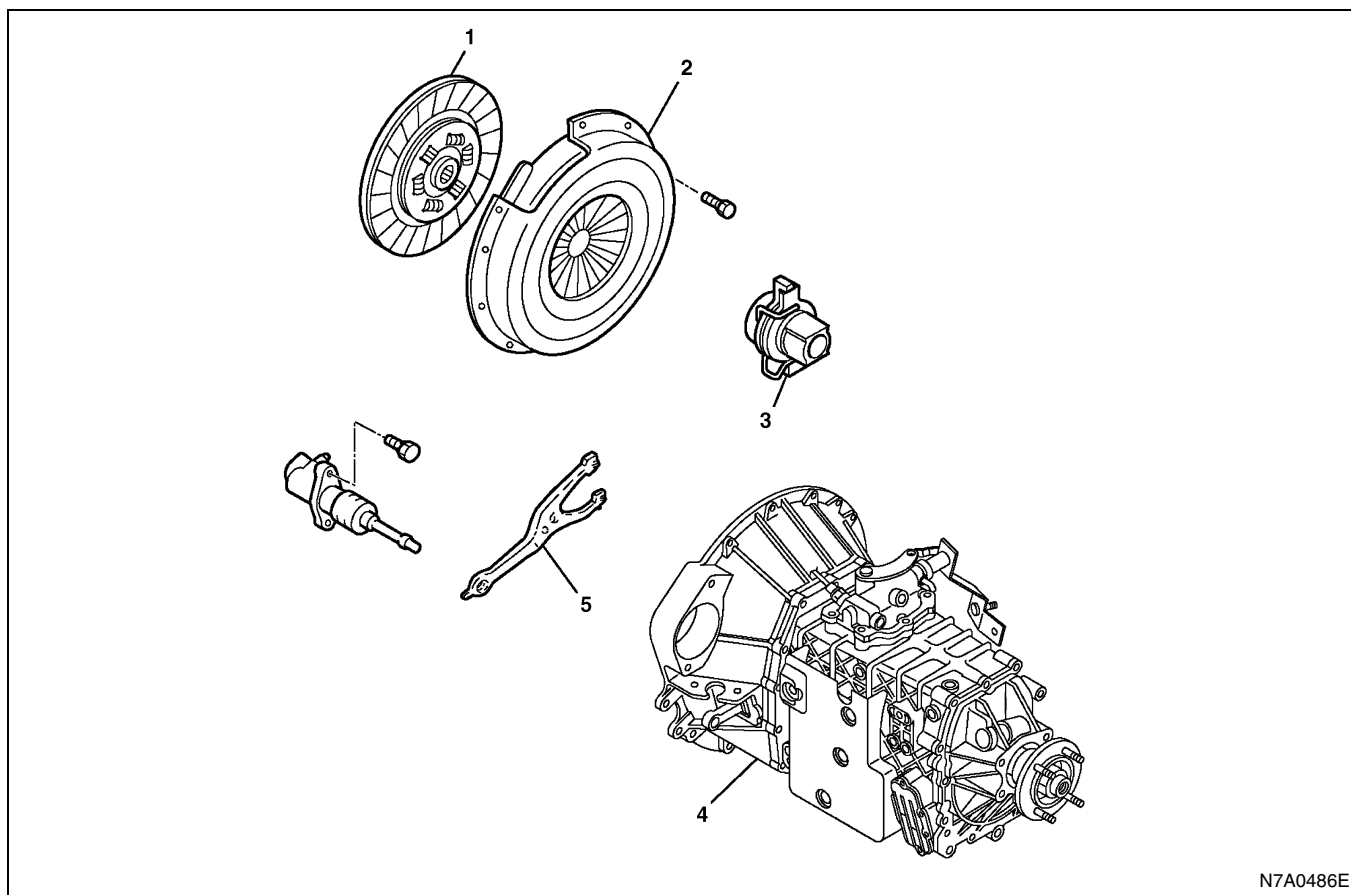
Troubleshooting

Trouble	Cause	Treatment
Dragging	Hydraulic line leakage.	Repair.
	Air in line.	Bleed air.
	Master cylinder and/or slave cylinder seals worn.	Replace seals.
	Driven plate worn or warped.	Replace.
	Diaphragm spring weak or tip of finger worn.	Replace.
	Driven plate sticking on spline.	Apply grease or replace.
	Release bearing worn or damaged.	Replace.
	Clutch pedal excessive free play.	Readjust.
Slippage	Driven plate facing worn or oil soaked.	Replace.
	Diaphragm spring weak.	Replace.
	Pressure plate and/or flywheel warped.	Repair or replace.
	Clutch pedal lack of free play.	Readjust.
Shudder (Chattering)	Engine mounting loose or broken.	Tighten or replace.
	Driven plate facing warped.	Replace.
	Driven plate surface of facing hardened.	Replace.
	Driven plate facing oil soaked.	Replace and check oil leakage.
	Driven plate damper spring weakened or broken.	Replace.
	Pressure plate and/or flywheel warped.	Repair or replace.
Noisy	Release bearing binding.	Repair or replace, apply grease.
	Release bearing worn or broken.	Replace.
	Release bearing insufficiently lubricated.	Replace.
	Driven plate damper springs weakened or broken.	Replace driven plate.
	Pilot bearing worn or broken.	Replace.
	Driven plate rivet loosened.	Replace driven plate.
	Ball stud insufficiently lubricated.	Lubricate with grease.
	Clutch pedal lack of free play.	Readjust.
	Clutch pedal shaft insufficiently lubricated.	Repair or replace.
Pedal is Hard to Push	Hydraulic line blocked or crimped.	Clean out or replace.
	Clutch booster malfunction.	Repair or replace.
	Clutch pedal shaft insufficiently lubricated.	Repair or replace.

ON-VEHICLE SERVICE

Clutch Assembly

Components



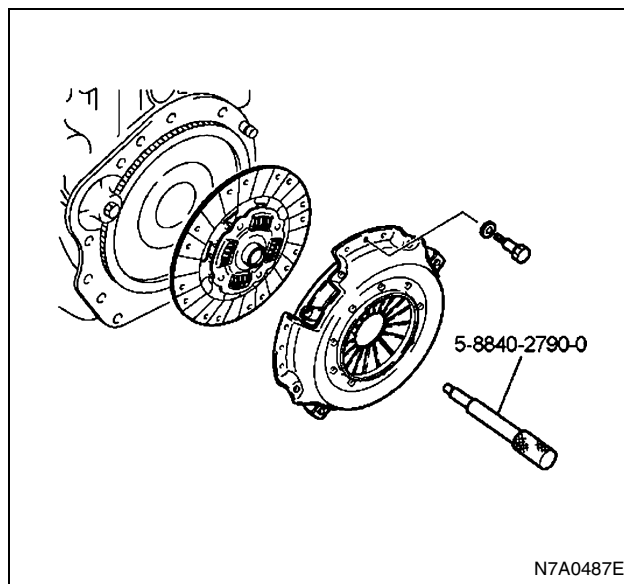
N7A0486E

Legend

- | | |
|-----------------------------|--------------------------|
| 1. Driven plate assembly | 4. Transmission assembly |
| 2. Pressure plate assembly | 5. Shift fork |
| 3. Release bearing assembly | |

Removal

1. Remove the transmission assembly from the vehicle.
 - Refer to TRANSMISSION ASSEMBLY.
2. Remove the pressure plate assembly.
3. Remove the driven plate assembly.
 - Use pilot aligner 5-8840-2790-0 to prevent the driven plate assembly from falling.
 - Mark the flywheel and clutch cover for alignment when installing.



N7A0487E

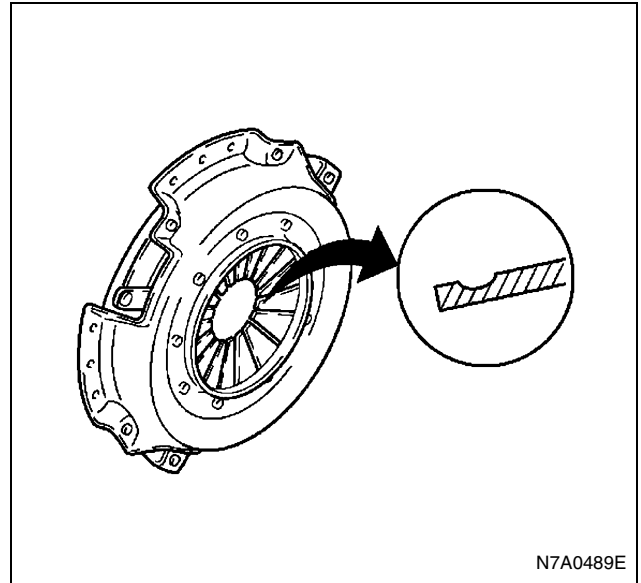
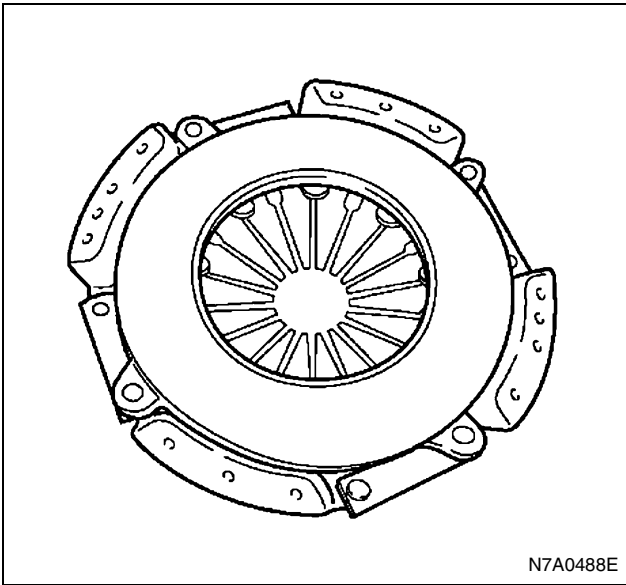
4. Remove the release bearing.
5. Remove the shift fork.

Inspection

Make the necessary adjustment, repairs, and part replacement if excessive wear or damage is found during inspection.

Pressure Plate Assembly

- Visually inspect the pressure plate friction surface for excessive wear and heat cracks. If excessive wear or deep heat cracks are present, the pressure plate assembly must be replaced.



Clutch Set Force

1. Invert the pressure plate.
2. Place on the pressure plate, a new clutch disk, or a spacer of 8.5 mm (0.33 in) in place of the clutch disk.
3. Compress the pressure plate assembly until the dimension becomes 19 mm (0.748 in).
4. Note the pressure plate gauge reading.

Clutch Set Force :	
Set Force	Engine Model
8,340 N (850 kg / 1,874 lb)	4HF1, 4HG1, 4HF1-II
9,500 N (970 kg / 2,139 lb)	4HG1-T, 4HE1-TC-N, 4HK1-TC
6,200 N (633 kg / 1,396 lb)	4JH1-TC-S

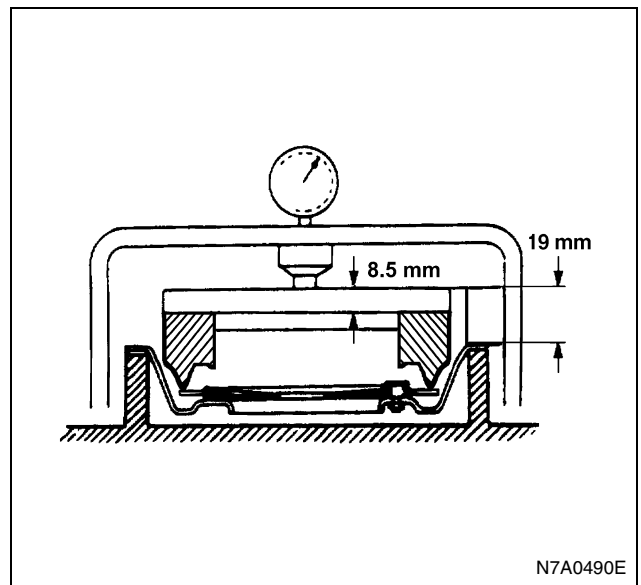
Pressure Plate Warpage

- Use a straight gauge and a filler gauge to measure the pressure plate friction surface flatness in four directions. If any of the measured values exceed the specified limit, the pressure plate assembly must be replaced.

Pressure Plate Warpage
Limit : 0.3 mm (0.012 in)

Clutch Cover

- Visually inspect the entire clutch cover for excessive wear, cracking, and other damage. The pressure plate assembly must be replaced if any of these conditions are present.



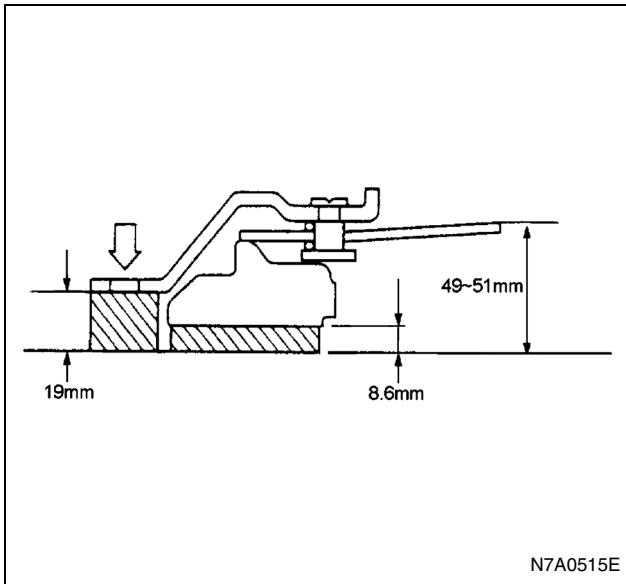
Diaphragm Spring Finger Height

1. Place a spacer of 8.5 mm (0.33 in) under the pressure plate.

2. Compress the pressure plate assembly and the diaphragm spring until the distance "B" becomes specified. There are two ways to do this.
 - a. Use a bench press to press down on the pressure plate assembly from the top.
 - b. Tighten the pressure plate assembly fixing bolts.
3. Measure the distance between the base and the top of the diaphragm spring.

Spring Finger Height

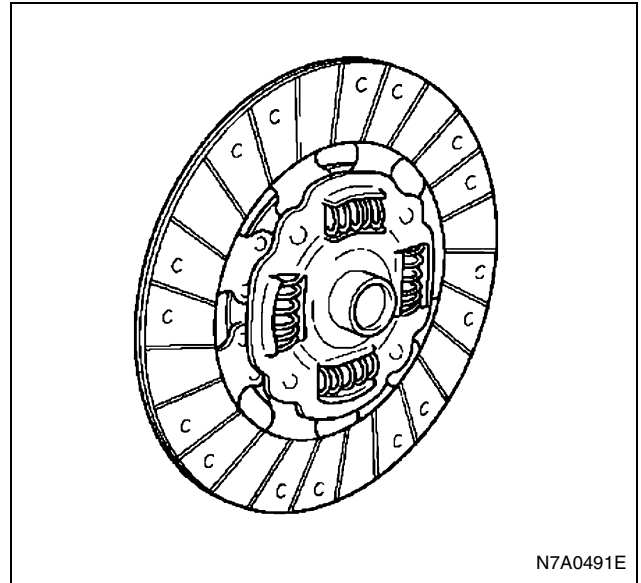
Standard : 49.0 — 51.0 mm (1.929 — 2.008 in)



N7A0515E

Driven Plate Assembly

- Visually inspect the torsion spring for looseness, breakage, and weakening. If any of these conditions are found, the driven plate assembly must be replaced.
- Visually inspect the facing surfaces for cracking and excessive scorching.
- Visually inspect the facing surfaces for the presence of oil or grease. If any of these conditions are found, the facing must be cleaned or the driven plate assembly replaced.
- Check that the driven plate moves smoothly on the transmission top gear shaft spline. Minor ridges on the top gear shaft spline may be removed with an oil stone.



N7A0491E

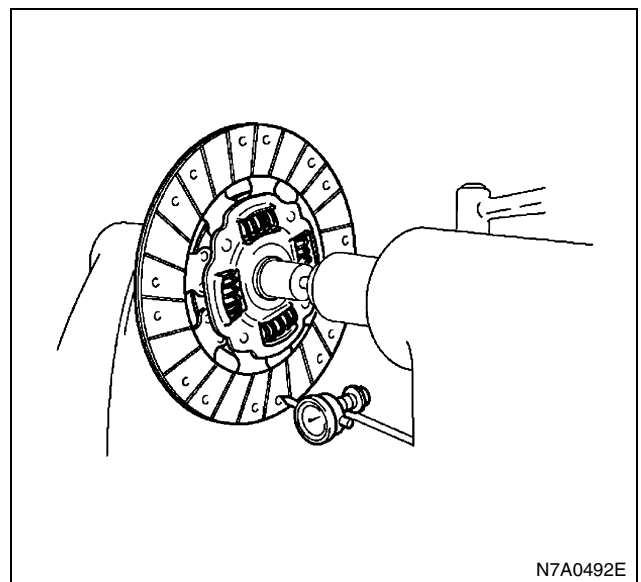
Driven Plate Warpage

1. Insert pilot aligner 5-8840-2790-0 into the driven plate spline hub. The pilot aligner must be held perfectly horizontal.
2. Set a dial indicator to the driven plate outside circumference.
3. Slowly turn the driven plate, and read the dial indicator.
4. If the measured value exceeds the specified limit, replace the driven plate assembly.

Driven Plate Warpage

Standard : 0.7 mm (0.028 in) or less

Limit : 1.0 mm (0.039 in)



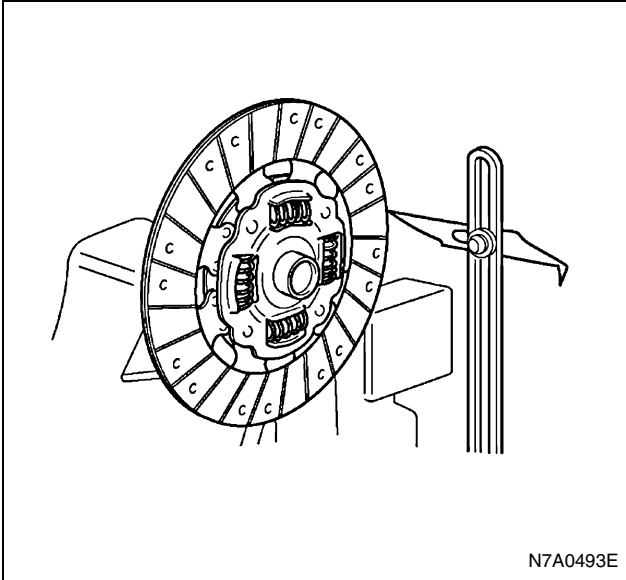
N7A0492E

Driven Plate Spline Free Play

1. Install the driven plate to the transmission top gear shaft spline.
2. Set a surface gauge to the driven plate outside circumference.
3. Slowly turn the driven plate. Measure the spline rotation free play.

If the measured value exceeds the specified limit, replace the driven plate assembly.

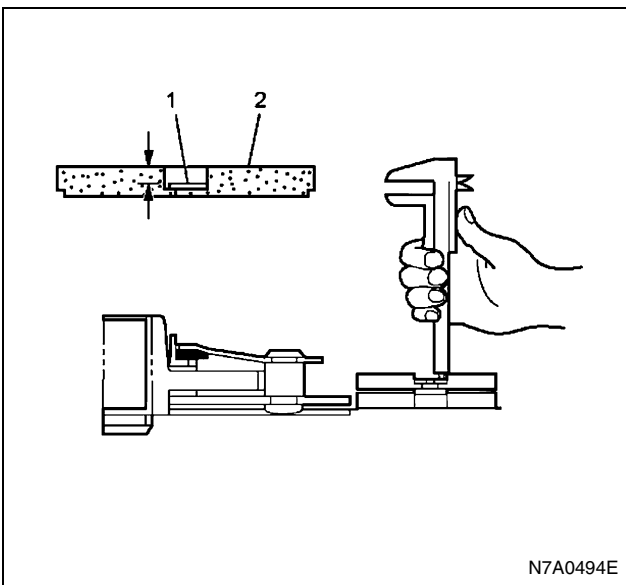
Driven Plate Spline Free Play
 Standard : 0.5 mm (0.020 in) or less
 Limit : 1.0 mm (0.039 in)



Driven Plate Rivet Head Depression

- Use the depth gauge to measure the rivet head depression (1) from the facing surface (2).
- Be sure to measure the rivet head depression (1) on both sides of the driven plate (2).
- If the measured value exceeds the specified limit, replace the driven plate assembly.

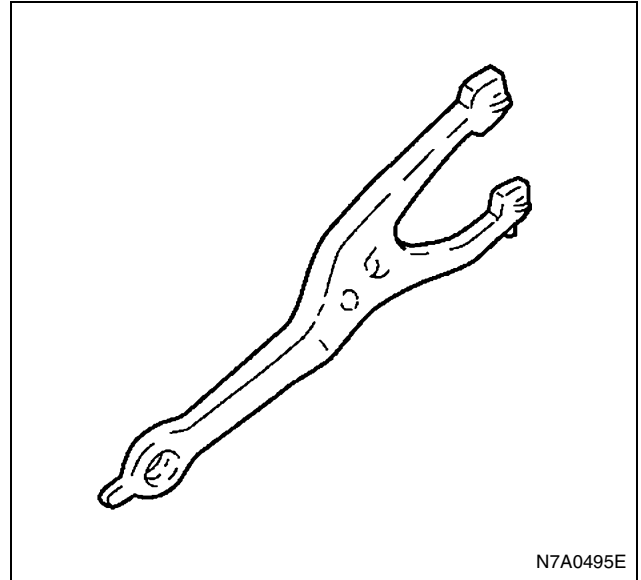
Facing Rivet Head Depression
 Standard : 1.4 — 2.0 mm (0.055 — 0.078 in) (Flywheel side)
 1.7 — 2.3 mm (0.067 — 0.090 in) (Transmission side)
 Limit : 0.2 mm (0.008 in)



Shift Fork

- Inspect the wear and damage on the release bearing and facing surface.

- Correct a slight stepped wear or surface roughness with an oil stone.
 Replace the shift fork if unrecoverable damage is found.
- Inspect the wear and damage on the surface of the support bolt.

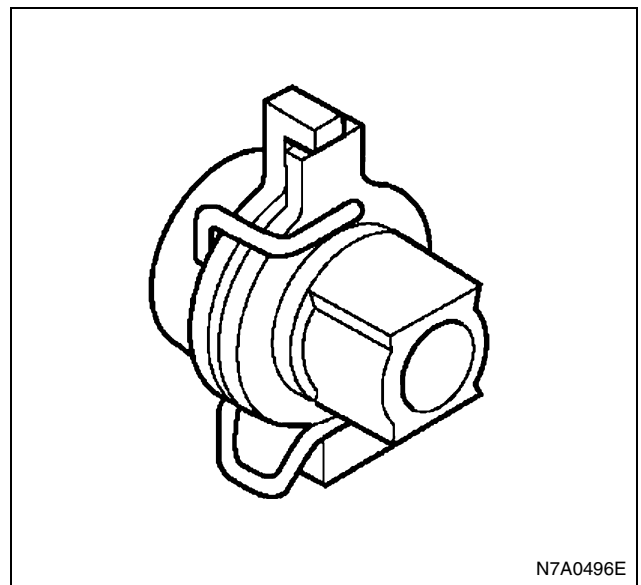


Release Bearing

- Inspect the looseness, noise, damage, etc. or wear of the inside diameter. If any abnormality is found, replace the part.

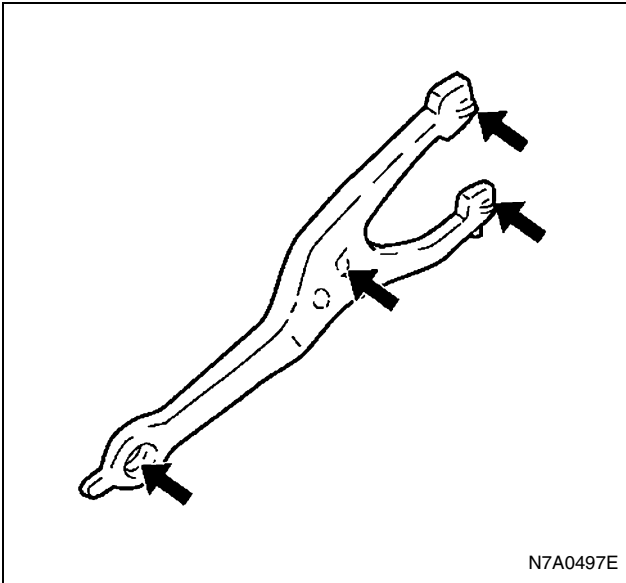
Caution:

Never wash the release bearing because this part is sealed with grease.

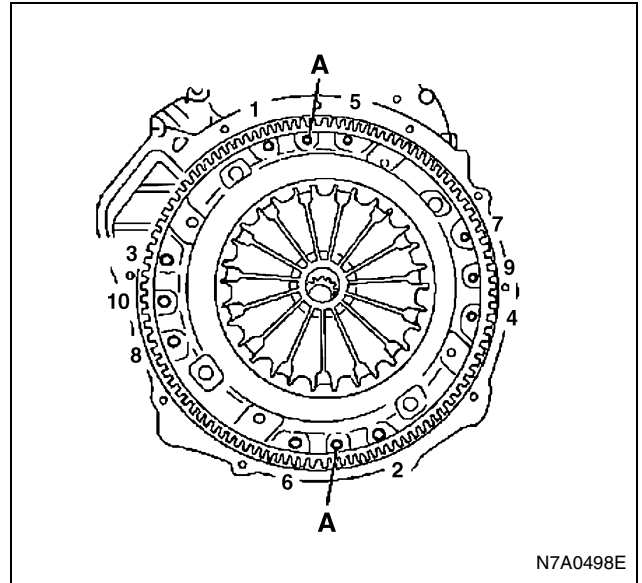


Installation

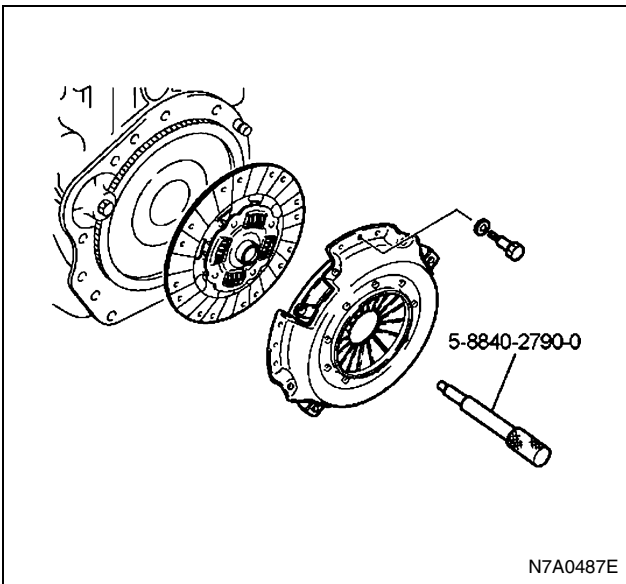
1. Install the shift fork after applying the MO-NO2 type grease to the contact surfaces of the shift fork.
2. Install the release bearing to the transmission front part.



3. Install the clutch disk assembly.
4. Install the pressure plate assembly.
 - Clean the facing surfaces and pressure plate surface of the flywheel and the driven plate.
 - Install the driven plate assembly to the flywheel using pilot aligner 5-8840-2790-0.



5. Install the transmission assembly.
 - Refer to TRANSMISSION ASSEMBLY.



- Install the pressure plate assembly, adjusting to knock pins (A) of the flywheel. And tighten the pins slowly and equally in numerical order.

Tighten:

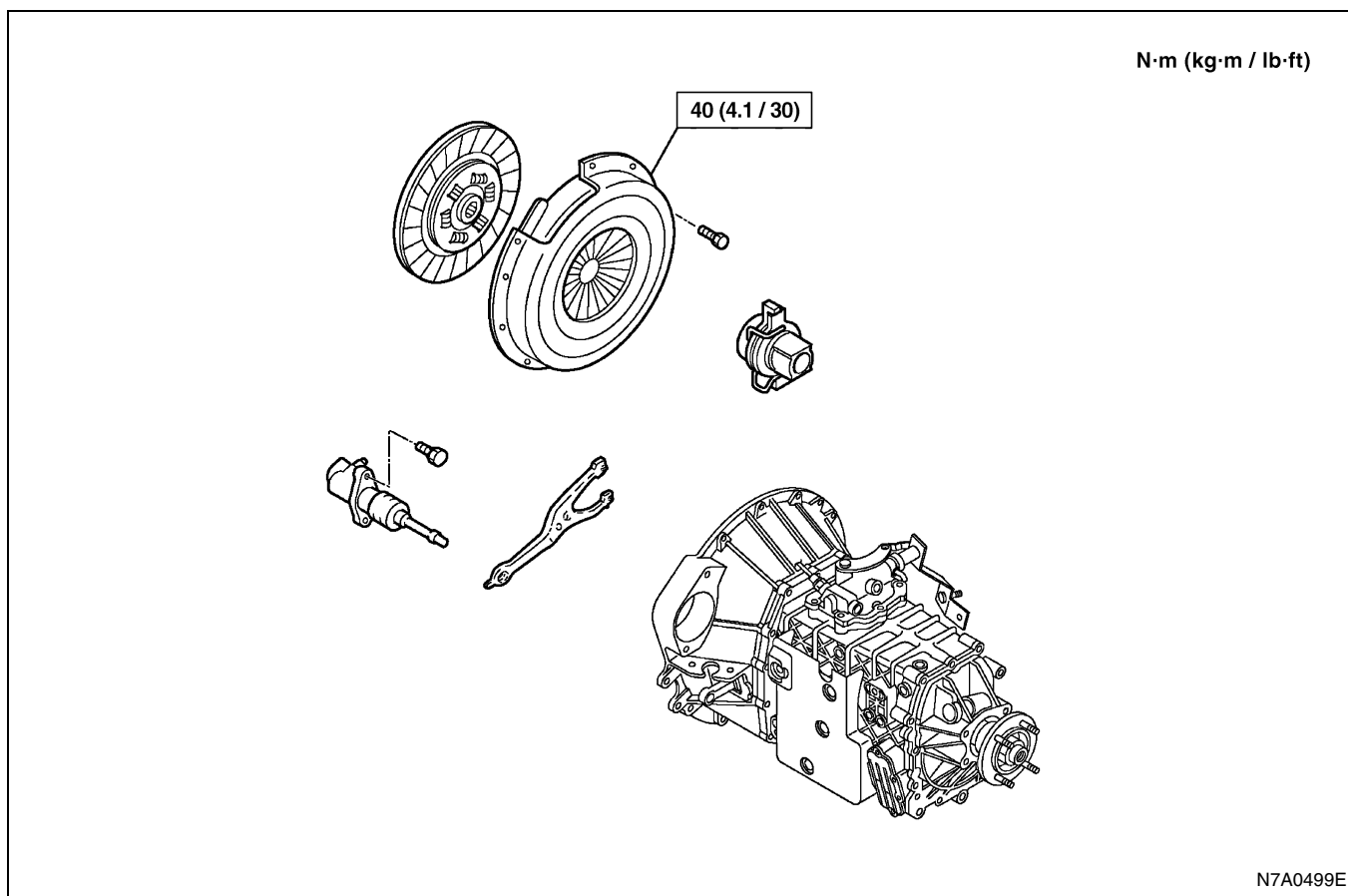
Pressure plate to 40 N·m (4.1 kg·m / 30 lb·ft)

- When installing a new pressure plate assembly, make sure to remove the wiring after the tightening.


Caution:

Do not beat with hammer when removing the aligner.

Fixing Torque

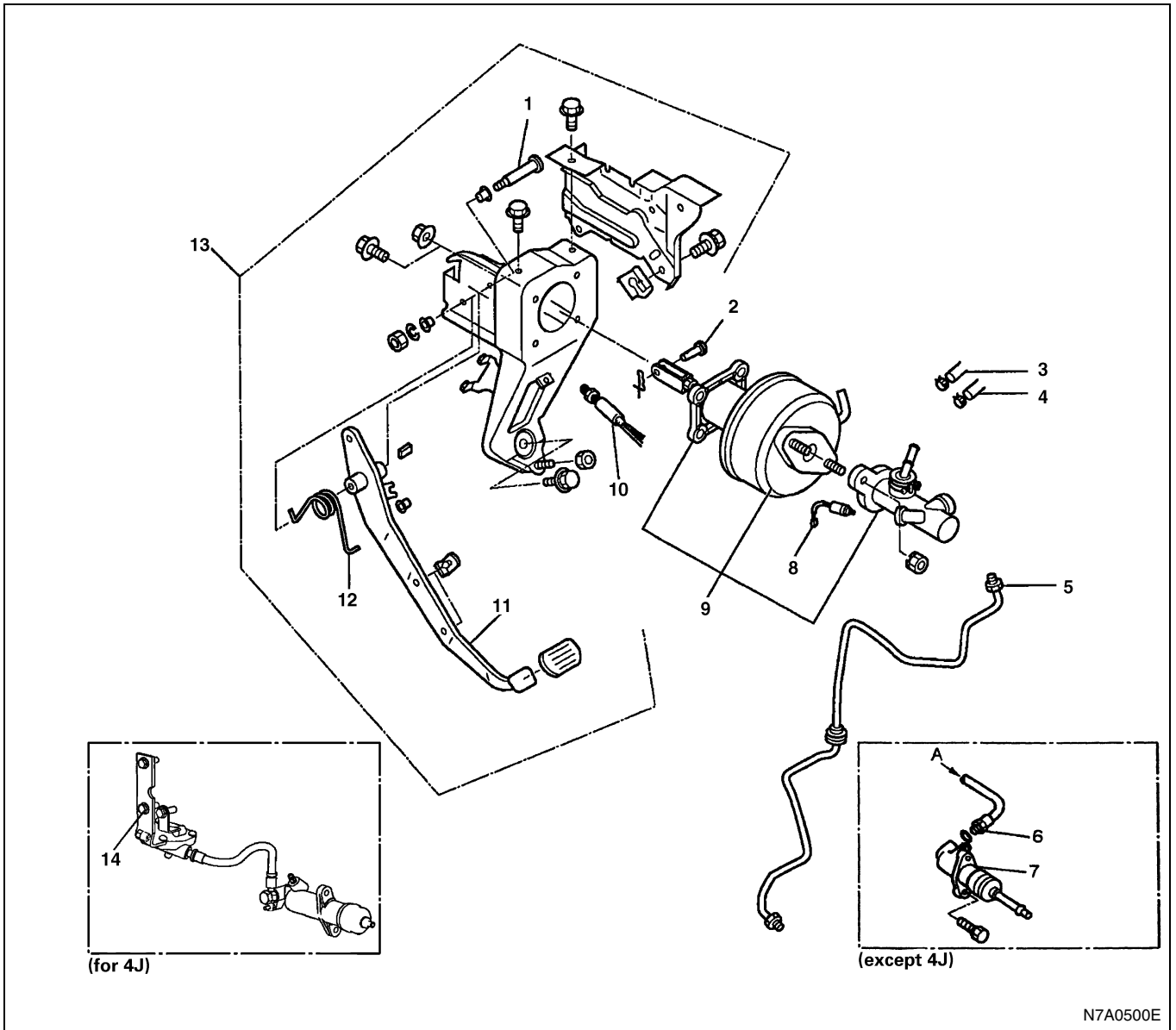


Special Tools

Illustration	Tool Number / Description / Remarks
 5884027900	5-8840-2790-0 / Clutch Pilot Aligner

Clutch Control

Components



Legend

- | | |
|-------------------|--|
| 1. Pin | 8. Pressure switch connector |
| 2. Clevis pin | 9. Clutch booster and master cylinder assembly |
| 3. Vacuum hose | 10. Clutch switch |
| 4. Oil hose | 11. Clutch pedal |
| 5. Clutch pipe | 12. Return spring |
| 6. Flexible hose | 13. Clutch pedal and bracket assembly |
| 7. Slave cylinder | 14. Damper cylinder |

Removal

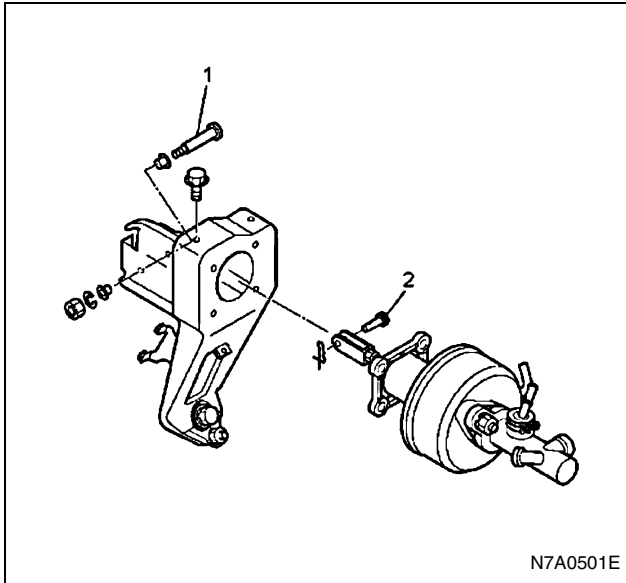
- Drain the brake fluid before removal.

Caution:

Do not let brake fluid contact painted surface. Wash it off immediately.

1. Remove the oil hose and clutch pipe.

2. Remove the vacuum hose.
3. Remove the clutch pedal and bracket assembly.
4. Remove the clutch switch.
5. Remove pin (1).
6. Remove clevis pin (2).



7. Remove the return spring.
8. Remove the clutch pedal.
9. Remove the clutch booster & spacer, and master cylinder assembly.
 - Removal of the master cylinder can be done only by removing the meter cluster.

Inspection

Make necessary adjustment, repairs, and part replacement if excessive wear or damage is found during inspection.

Installation

1. Install the clutch booster, spacer and master cylinder assembly.
 - Tighten the lock nut where the distance between the center of the clevis pin hole and the installation surface is 156.5 — 157.5 mm (6.161 — 6.201 in).

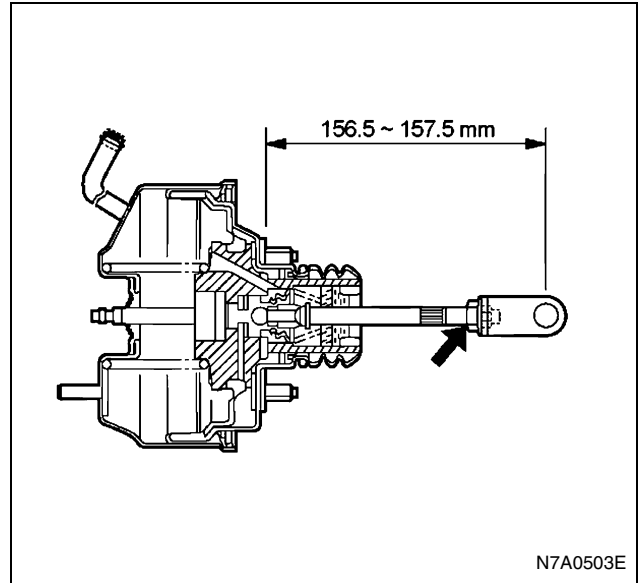
Tighten:

Lock nut to 26 N·m (2.6 kg·m / 19 lb·ft)

- Install the clutch booster, spacer and master cylinder assembly to the clutch pedal bracket.

Tighten:

Nut to 13 N·m (1.3 kg·m / 10 lb·ft)



2. Install the pressure switch connector.
3. Install the clutch pedal.
4. Install the return spring.
5. Install the clevis pin.
6. Install the pin.
7. Install the clutch switch.
8. Install the clutch pedal and bracket assembly.

Tighten:

Clutch bracket bolts to 37 N·m (3.8 kg·m / 27 lb·ft)

- The clutch pedal adjustment is not necessary if the length of the clutch booster operation rod is adjusted when installing the clutch booster. The length of the clutch booster operation rod: The distance between the installation surface and the center of the clevis pin hole is 156.5 — 157.5 mm (6.161 — 6.200 in).
- Check the clutch pedal play.
- Adjust the clearance between the pedal and the clutch switch bolt, to the measured value.

Clutch Pedal Height (A)

160 — 170 mm (6.299 — 6.693 in) (Reference value)

Pedal Stroke (B)

159 — 169 mm (6.260 — 6.653 in) (Reference value)

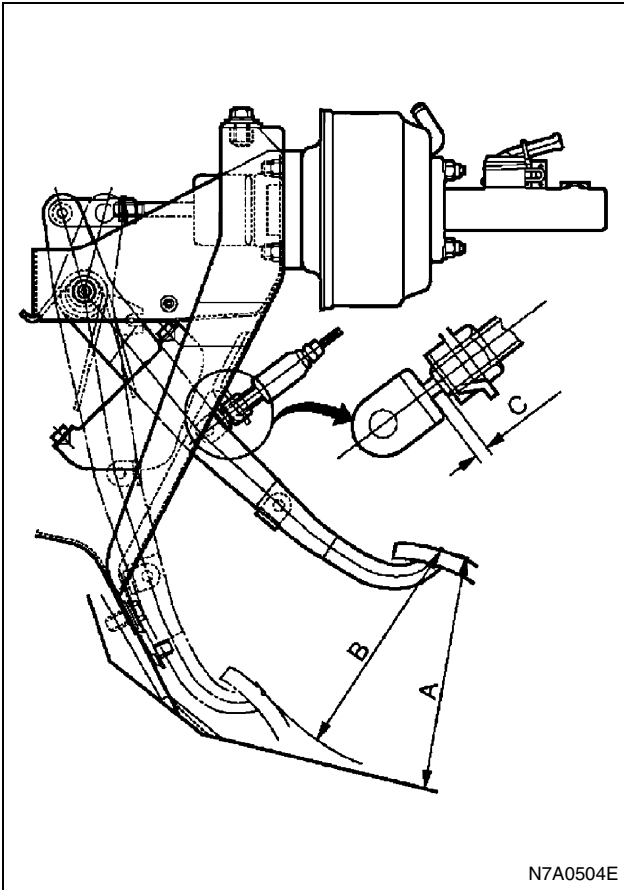
Clutch Pedal Play

15 — 25 mm (0.590 — 0.984 in) (Reference value)

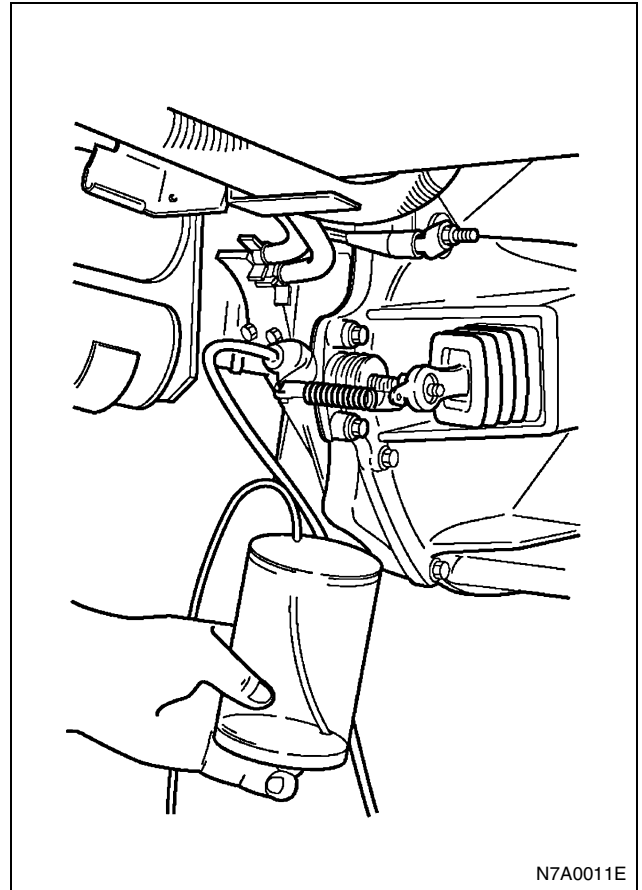
Pedal and Clutch Switch

Bolt Clearance (C)

0.5 — 1.0 mm (0.020 — 0.039 in)



N7A0504E



N7A0011E

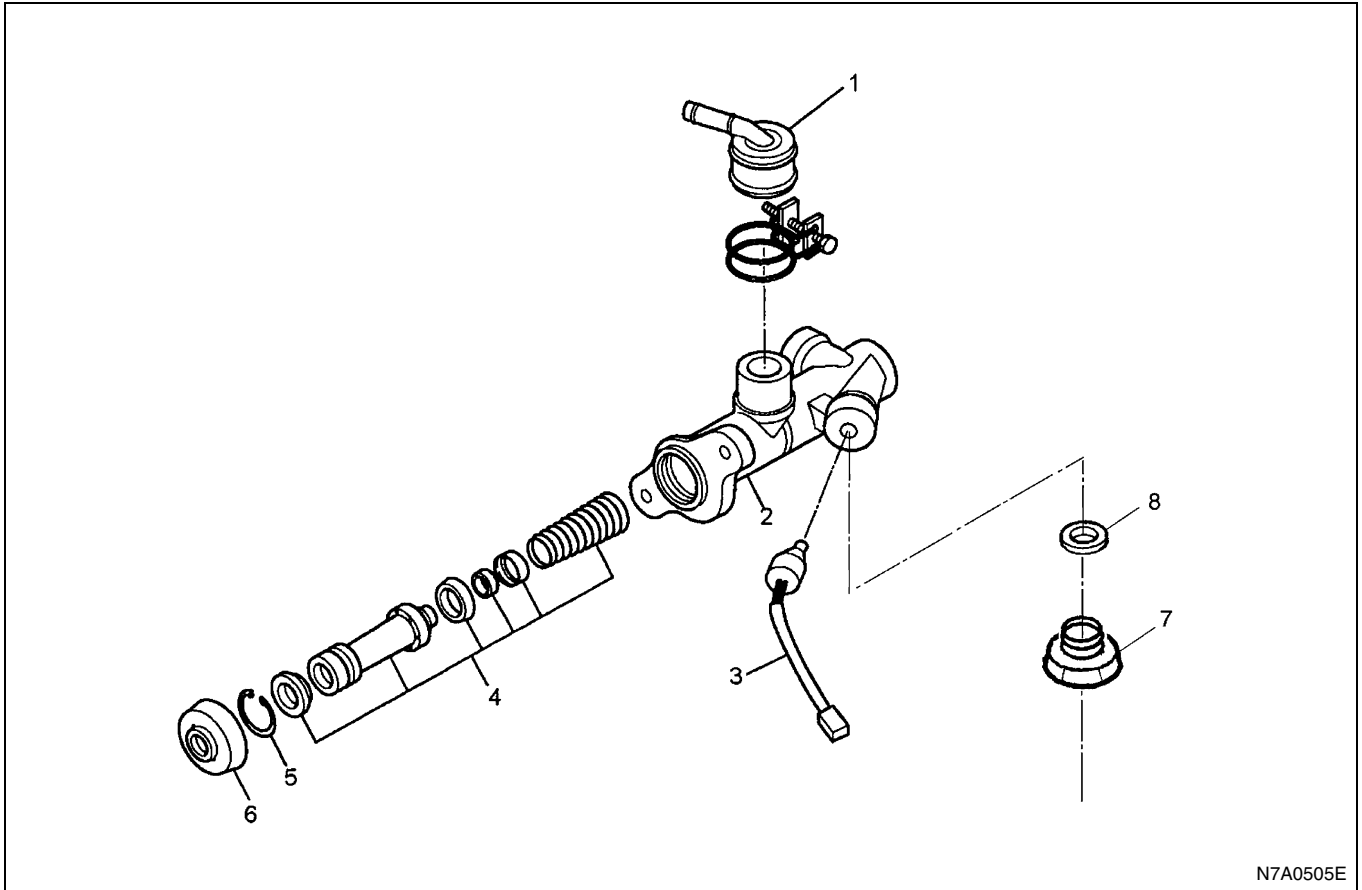
9. Install the vacuum hose.
 10. Install the oil hose and clutch pipe.
- Bleeding of Slave Cylinder

- After the installation, make sure to perform the bleeding of the slave cylinder conforming to the following procedure.
 - a. Refill brake fluid to the maximum level of the reservoir.
 - b. Connect a vinyl tube to the bleeder screw, and insert the other end of the vinyl tube into a transparent container.
 - c. Pump the clutch pedal several times and hold it depressed.
 - d. Loosen the bleeder screw on the clutch slave cylinder to bleed air in the fluid. Tightening the bleeder screw, slowly return the clutch pedal.
 - e. Repeat steps (c) and (d) until the air in the fluid is completely bled.
 - f. After bleeding the air, securely tighten the bleeder screw and install the bleeder cap.
 - g. Refill brake fluid to the maximum level of the reservoir.

UNIT REPAIR

Master Cylinder

Components



N7A0505E

Legend

- | | |
|--------------------|--------------------|
| 1. Hose joint | 5. Snap ring |
| 2. Cylinder body | 6. Dust cover |
| 3. Pressure switch | 7. Damper Cylinder |
| 4. Piston assembly | 8. Washer |

Removal

Caution:

Press down the piston with your fingers or shop cloth to prevent it from jumping out.

1. Remove the pressure switch (3).
2. Remove the hose joint (1).
3. Remove the dust cover (6).
4. Remove the snap ring (5).
5. Remove the piston assembly (4).
6. Remove the cylinder body (2).

Inspection

Make the necessary adjustments, repairs, and parts replacements if excessive wear or damage is found during inspection.

Cylinder body

- Check the fluid return port for clogging.
- Internal parts

- Replace the parts indicated in the figure with new ones.

Clearance of cylinder body and piston

- Check the cylinder body for stepped wear, corrosion and damage, and measure the inside diameter.

Cylinder body inside diameter

Standard : Limit $\phi 20.64$ mm (0.8126 in)

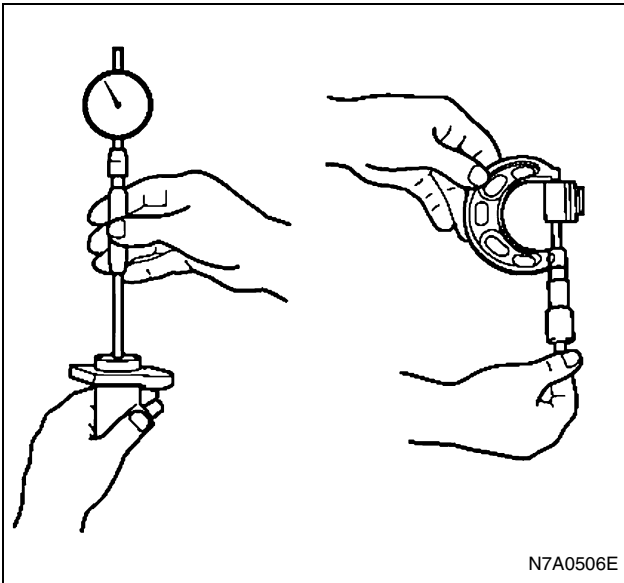
- Check the piston for damage, rust and wear.
- Measure the clearance between the cylinder body and the piston.

Clearance between cylinder body and piston

Standard : 0.03 — 0.11 mm (0.0012 — 0.0043 in)

Limit : 0.12 mm (0.0047 in)

- If the wear limit is exceeded, replace the master cylinder assembly with a new one.



Installation

1. Cylinder body
 - Immerse the cylinder body in clean brake fluid.
2. Install the piston of the piston assembly after applying rubber grease.

Caution:

Do not damage the piston assembly when installing.

3. Install the snap ring.
4. Install the dust cover.
5. Install the hose joint.

Tighten:

Hose joint to 4.5 N·m (0.45 kg·m / 3.25 lb·ft)

6. Install the pressure switch.
 - Apply liquid gasket to the switch screw, and install to the master cylinder.

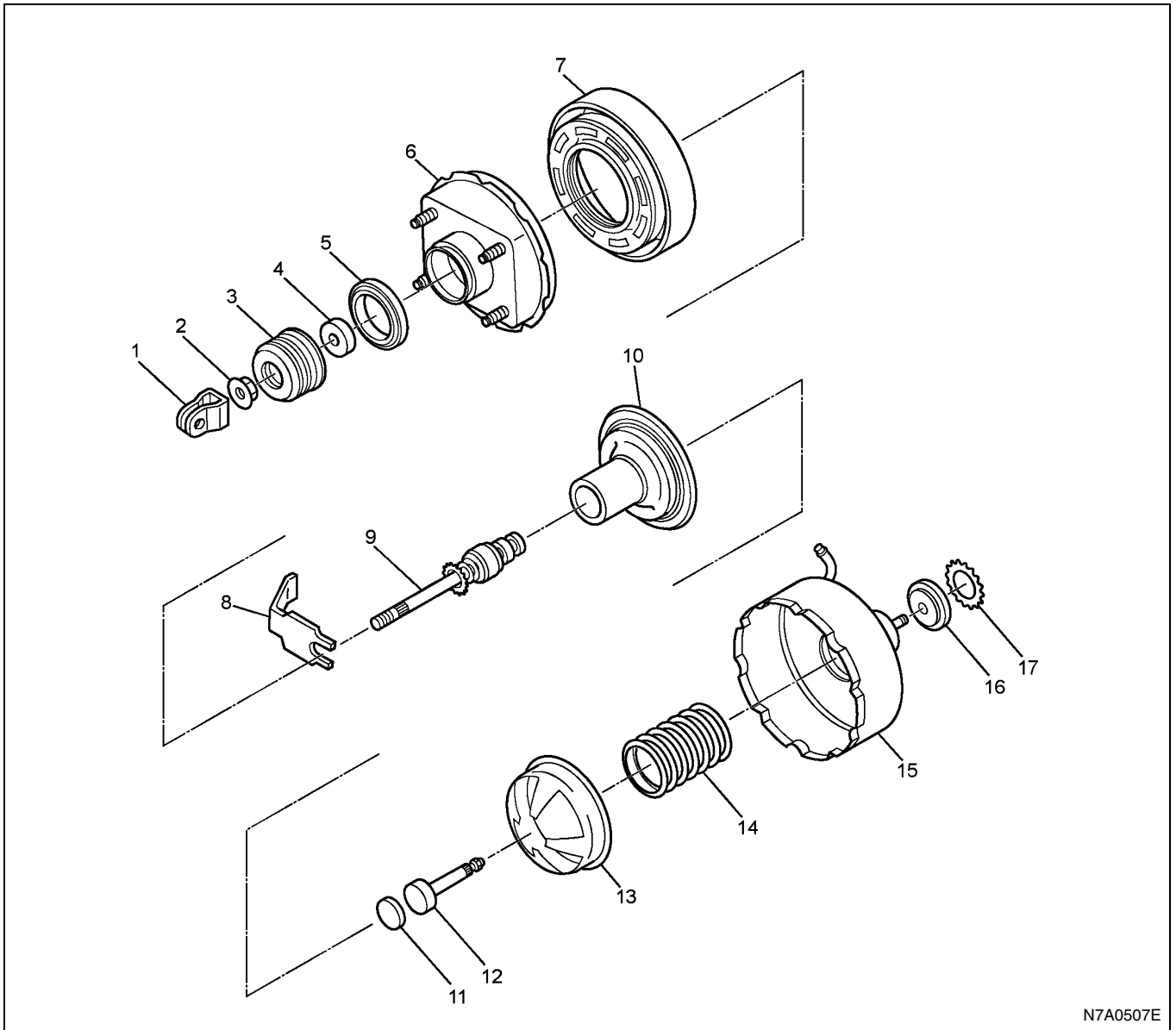
Liquid Gasket : LOCTITE 575

Tighten:

Pressure switch to 2.5 N·m (0.25 kg·m / 1.81 lb·ft)

Clutch Booster

Components



N7A0507E

Legend

- | | |
|------------------------------------|-------------------------------------|
| 1. Clevis master cylinder push rod | 10. Piston sub assembly booster |
| 2. Nut | 11. Disk reaction |
| 3. Boots | 12. Rod sub assembly booster piston |
| 4. Separator air cleaner | 13. Retainer rod |
| 5. Seal booster body No. 2 | 14. Spring booster piston return |
| 6. Body assembly booster No. 2 | 15. Body assembly booster No. 1 |
| 7. Diaphragm booster | 16. Seal booster body No. 1 |
| 8. Key valve stopper | 17. Ring circular |
| 9. Valve sub assembly booster air | |

Removal

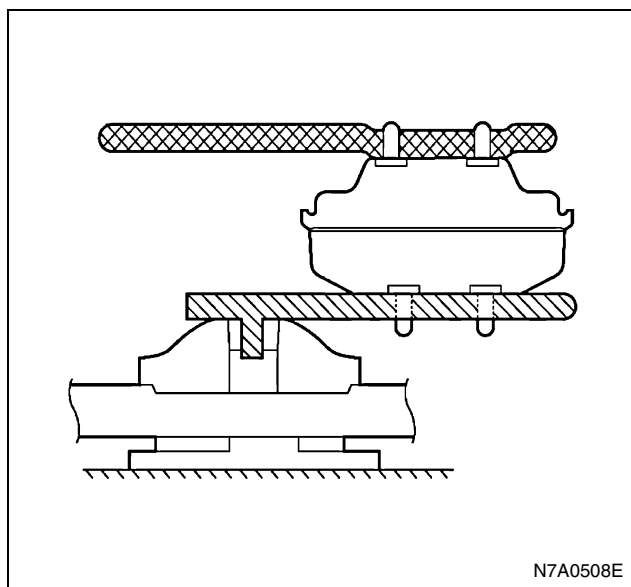
Before disassembling, mark the front shell and rear shell for alignment.

1. Remove the clevis master cylinder push rod.
2. Remove the nut.
3. Remove the boots.
4. Remove the separator air cleaner.
5. Remove the body assembly booster No. 2 (rear shell).

- Separate the rear shell from the front shell using handle 9-8523-1733-0 and support plate 5-8840-2056-0.

Caution:

Make sure to prevent the diaphragm spring from jumping out.



6. Remove the body assembly booster No. 1 (front shell).
7. Remove the spring booster piston return.
8. Remove the retainer rod.
9. Remove the rod sub assembly booster piston.
10. Remove the disk reaction.
11. Remove the diaphragm booster.
12. Remove the key valve stopper.
13. Remove the valve sub assembly booster air.
14. Remove the piston sub assembly booster.
15. Remove the link circular.
16. Remove the seal booster body No. 2.
17. Remove the seal booster body No. 1.

Inspection

Inspect the parts by washing and drying. Replace the damaged parts with new ones.

Caution:

Use trichlene or metachlene (commercial product) for metal parts, and clean alcohol for rubber and resin parts, respectively.

Installation

Apply silicone grease to each sliding part.

- Seal mating part and lip part of the rear shell
- Internal & external surface of the diaphragm plate, and outer circumference of the valve body
- Seal of the front shell, sliding surface of the push rod and outer circumference of the valve booster control

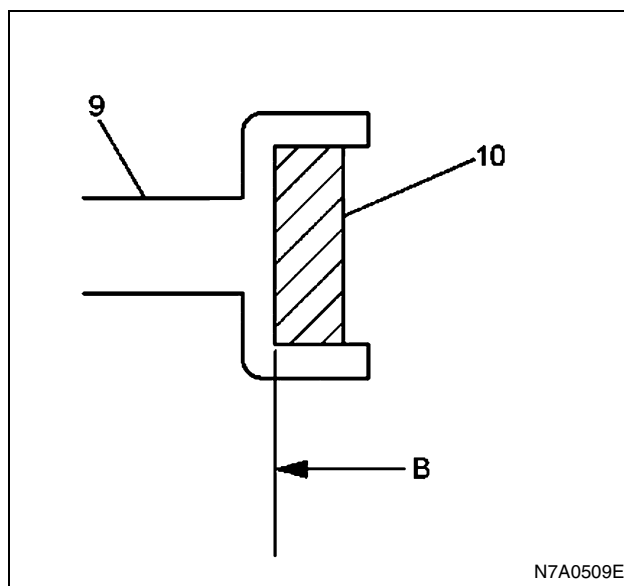
1. Install seal booster body No. 1.

2. Install body assembly booster No. 2.
3. Install the piston sub assembly booster.
4. Install the valve sub assembly booster air.
5. Install the key valve stopper.
6. Install the diaphragm booster.

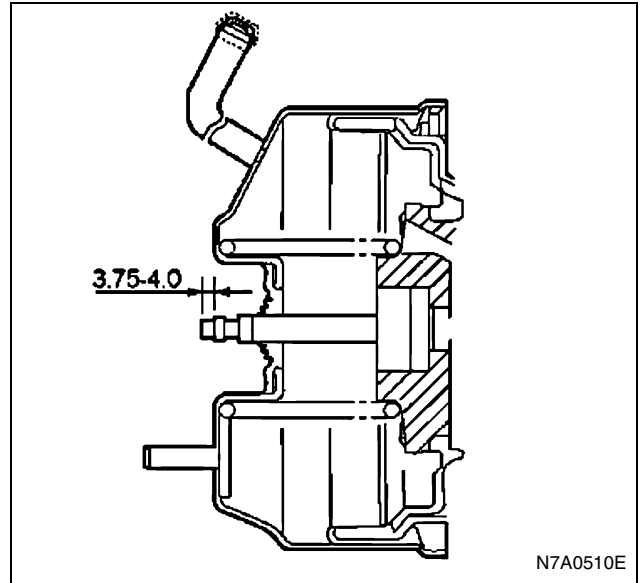
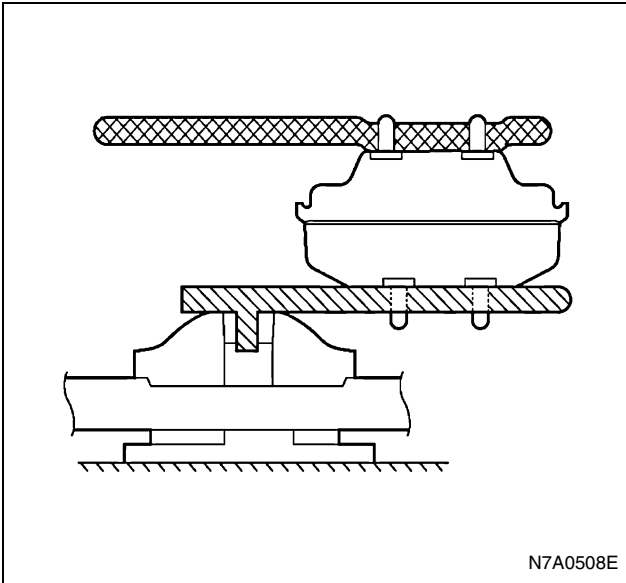
Caution:

Never tear the diaphragm. Make sure that the reaction disk is securely inserted to the surface B. (Bleed the air from the outer circumference.)

7. Install the disk reaction (10).



8. Install the rod sub assembly booster piston (9).
9. Install the retainer rod.
10. Install the spring booster piston return.
11. Install seal booster body No. 1.
12. Install the link circular.
13. Install body assembly booster No. 1 (front shell).
 - Installation has to be done using handle 9-8523-1733-0 and support plate 5-8840-2056-0.
 - When installing, the marks on the rear shell and the front shell, which were put when disassembling, has to mate with each other.



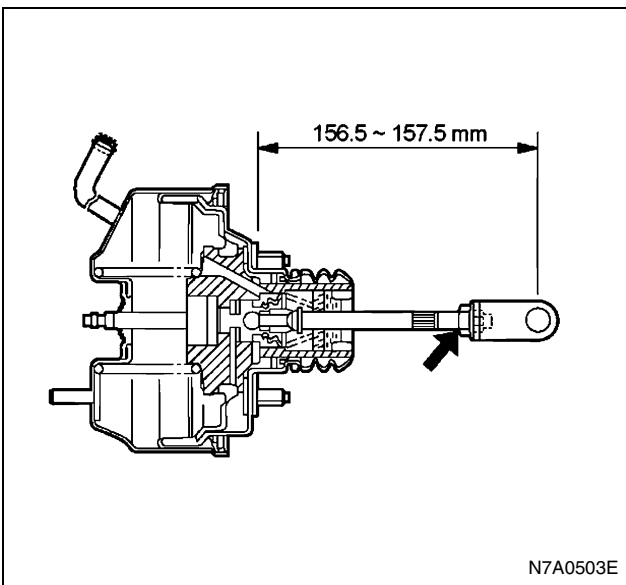
14. Install the separator air cleaner.
15. Install the boots.
16. Install the nut.
17. Install and adjust the clevis master cylinder push rod.
 - Adjust the distance between the center of the pin hole of the clevis yoke and the installation surface, and tighten the lock nut.

Dimension between the center of the pin hole of the clevis yoke and the rear shell.

156.5 — 157.5 mm (6.161 — 6.201 in)

Tighten:

Lock nut to 26 N·m (2.6 kg·m / 19 lb·ft)



Adjustment of the rod sub assembly booster piston

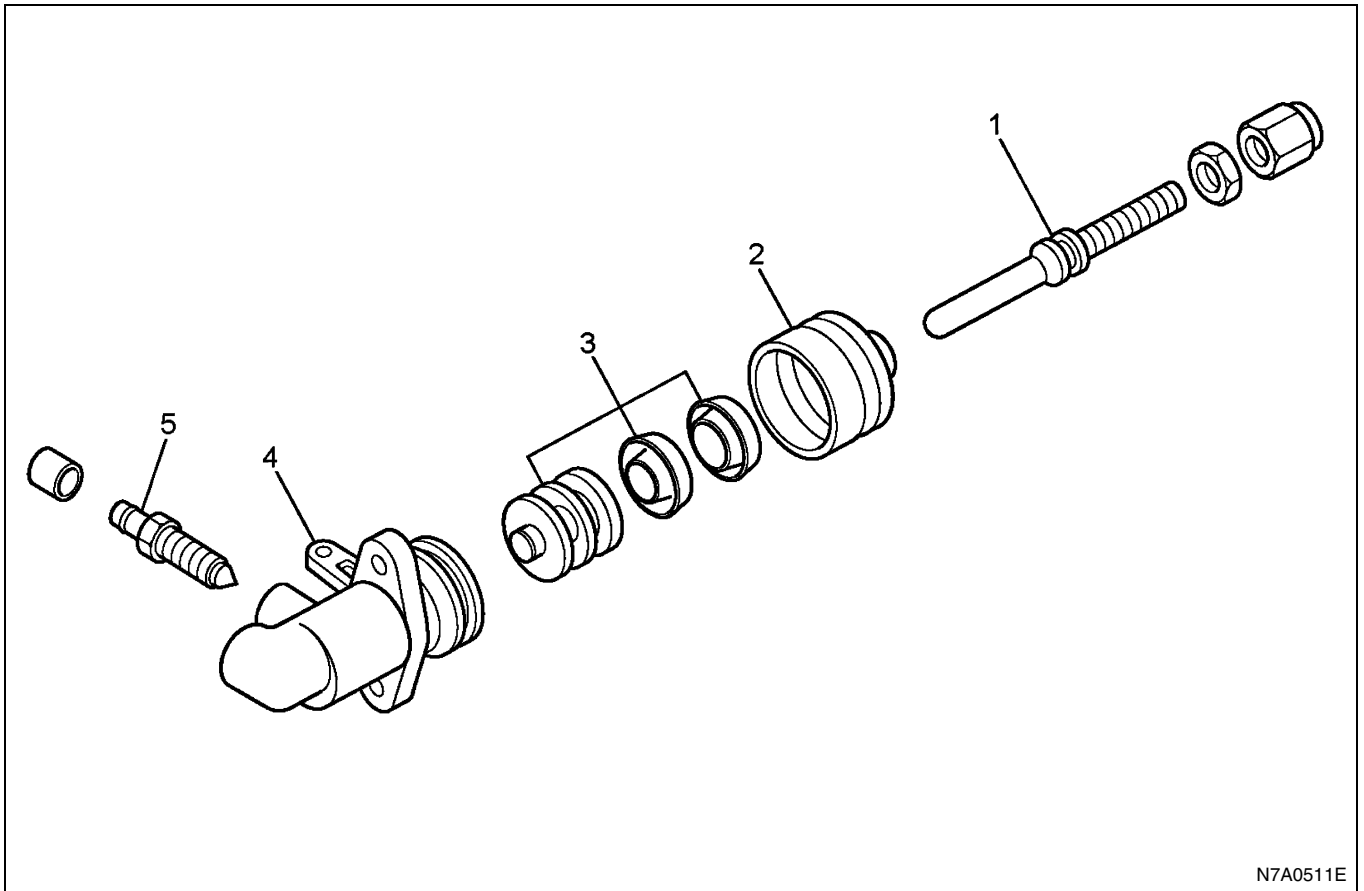
- After assembling the clutch booster, adjust the length between the top of the push rod and the surface of the rear shell.

Dimension between the top of the push rod and the rear shell

3.75 — 4.0 mm (0.15 — 0.16 in)

Slave Cylinder

Components



N7A0511E

Legend

- | | |
|--------------------|------------------|
| 1. Push rod | 4. Cylinder body |
| 2. Boots | 5. Bleeder screw |
| 3. Piston assembly | |

Removal

1. Remove the push rod (1).
2. Remove the boots (2).
3. Remove the piston assembly (3).
4. Remove the bleeder screw (5)
5. Remove the cylinder (4).

Inspection

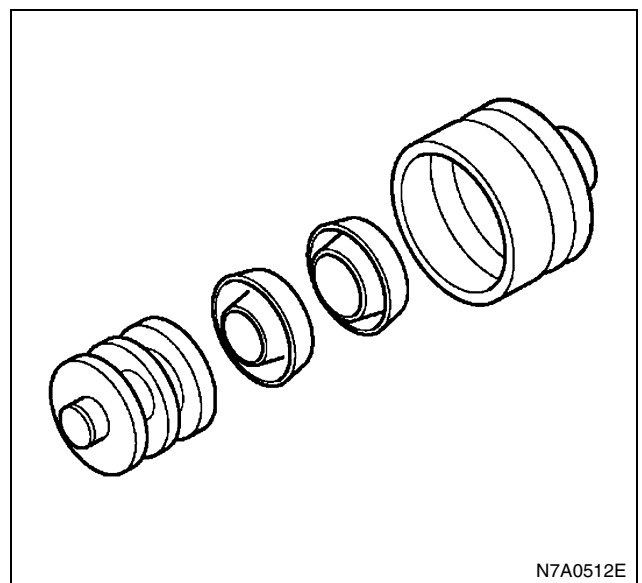
Inspect the removed parts by washing. Replace the damaged parts with new ones.

Cylinder body

- Check the fluid return port for clogging.

Internal parts

- Replace the parts indicated in the figure with new ones.



N7A0512E

Clearance between the cylinder body and the piston

- Check the internal surface of the cylinder body for stepped wear, corrosion and damage, and measure the inside diameter.

Inside diameter of the cylinder body.

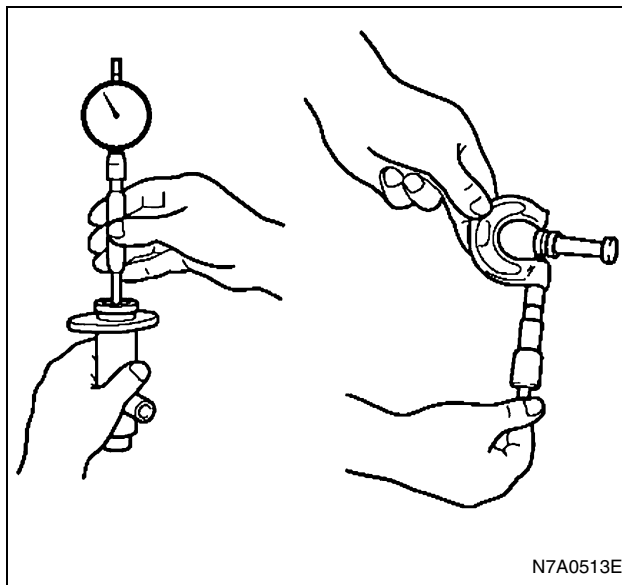
Standard inside diameter : $\phi 25.4$ mm (1.0 in)

- Check the piston for damage, rust and wear.
- Measure the clearance between the cylinder body and the piston.

Standard inside diameter : 0.02 — 0.10 mm (0.00078 — 0.0039 in)

Limit : 0.11 mm (0.0043 in)

- If the limit value is exceeded, replace the slave cylinder assembly.



N7A0513E

Installation

1. Assemble the cylinder body.
2. Assemble the bleeder screw.
3. Assemble the piston assembly.
 - Before assembling, apply a thin coat of rubber grease to the piston.

Caution:

Make sure not to damage the piston assembly when assembling.

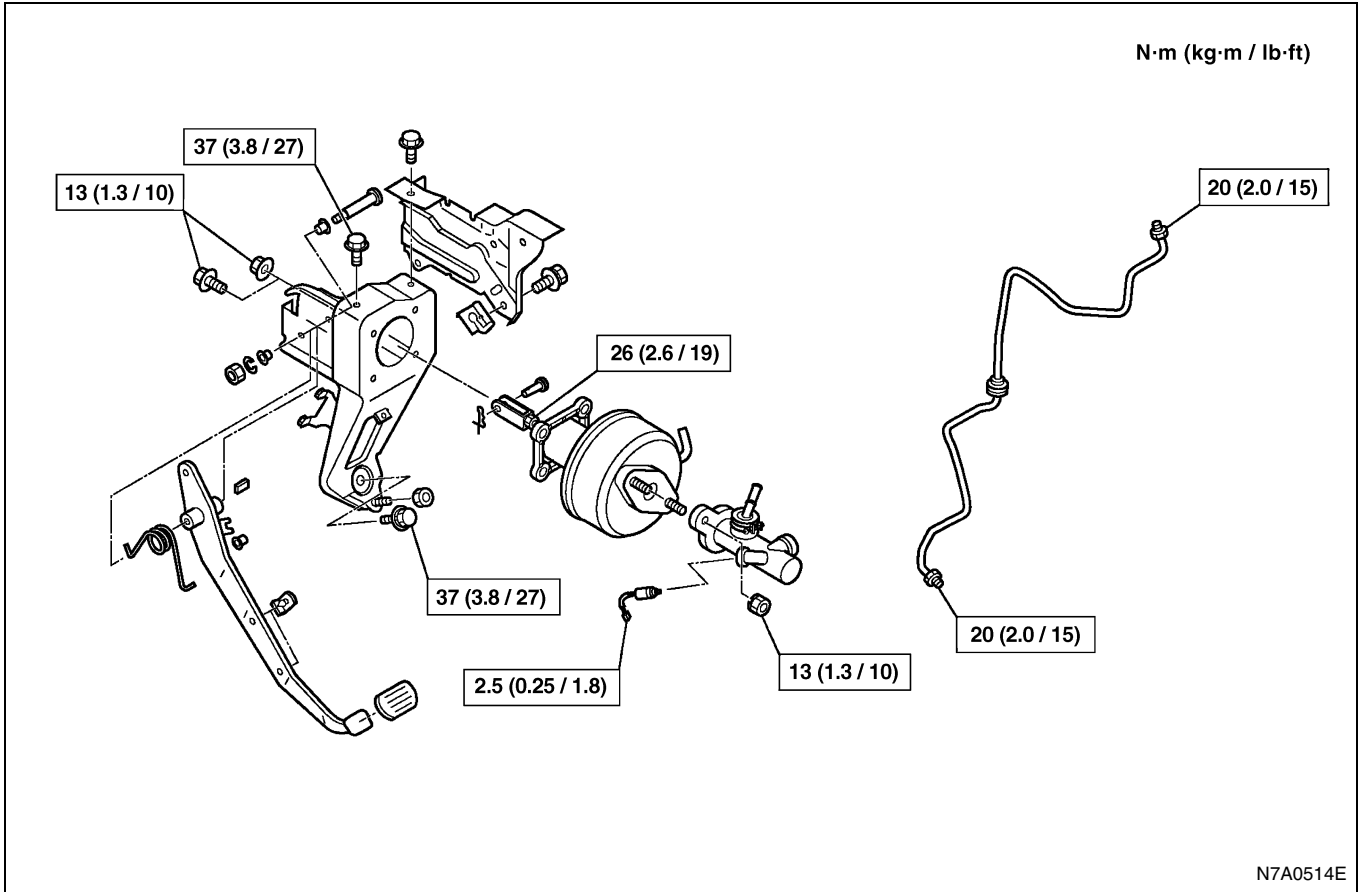
4. Assemble the boots.
5. Assemble the push rod.

Specifications

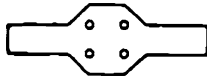
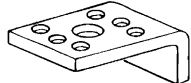
PRESSURE PLATE	Spring Shape	Diaphragm Spring	
	Outer Circumference	373 mm (14.685 in)	
	Installation Force	Set Force	Engine Model
		8,340 N (850 kg / 1,874 lb)	4HF1, 4HG1, 4HF1-II
		9,500 N (970 kg / 2,139 lb)	4HG1-T, 4HE1-TC-N, 4HK1-TC
	6,200 N (633 kg / 1,396 lb)	4JH1-TC-S	
	Spring Finger Installation Height	49 — 51 mm (1.93 — 2.01 in)	
CLUTCH DISK	Outside Diameter × Inside Diameter	300 × 190 mm (11.81 × 7.48 in)	
	Assembly Thickness: When free	8.9 mm (0.35 in)	
	Assembly Thickness: When compressed	8.5 mm (0.33 in)	
CLUTCH PEDAL	Clutch Pedal Height	160 — 170 mm (6.29 — 6.69 in)	
	Clutch Pedal Stroke	159 — 169 mm (6.25 — 6.65 in)	
	Clutch Pedal Free Play	15 — 25 mm (0.59 — 0.98 in)	
MASTER CYLINDER	Inside Diameter	$\phi 20.64$ mm (0.81 in) (with Booster)	
		$\phi 19.05$ mm (0.74 in) (without Booster)	

CLUTCH BOOSTER	Diaphragm Valid Diameter	$\phi 130$ mm (5.11 in)
SLAVE CYLINDER	Inside Diameter	$\phi 25.4$ mm (1.00 in)

Fixing Torque



Special Tools

Illustration	Tool Number / Description / Remarks
 <p style="text-align: center;">9852317330</p>	9-8523-1733-0 / Handle
 <p style="text-align: center;">5884020560</p>	5-8840-2056-0 / Support Plate

MEMO

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MEMO

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CAB AND CHASSIS ELECTRICAL (LEFT HAND DRIVE MODEL)

CAB AND CHASSIS ELECTRICAL

GENERAL INFORMATION

General Information

The chassis electrical system is of 12-volt specifications with a negative ground polarity.

Wire sizes are appropriate to respective circuits, and classified by color. (The classification of harnesses by color is shown on the circuit diagram for ease of harness identification.)

The wire size is determined by load capacity and the length of wire required.

The vehicle harnesses are: body harness, floor harness, engine harness, frame front harness, frame rear harness, rear body harness, dome light harness, door harness and battery cable.

The harnesses are protected either by tape or corrugated tube, depending on harness location.

The circuit for each system consists of the power source, wire, fuse, relay switch, load parts and ground, all of which are shown on the circuit diagram.

In this manual, each electrical device is classified by system. For major parts shown on the circuit based on the circuit diagram for each system, a summary, diagnosis of troubles, inspection and removal and installation procedures are detailed.

Notes for Working on Electrical Items

Battery Cable

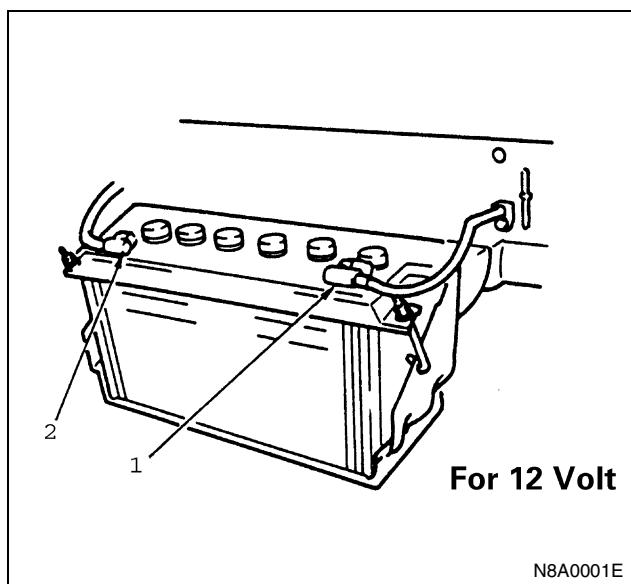
Disconnecting The Battery Cable

1. All switches should be in the "OFF" position.
2. Disconnect the battery ground cable 1.
3. Disconnect the battery positive cable 2.
4. Disconnect the battery cable 3.

Caution:

It is important that the battery ground cable be disconnected first.

Disconnecting the battery positive cable first can result in a short circuit.

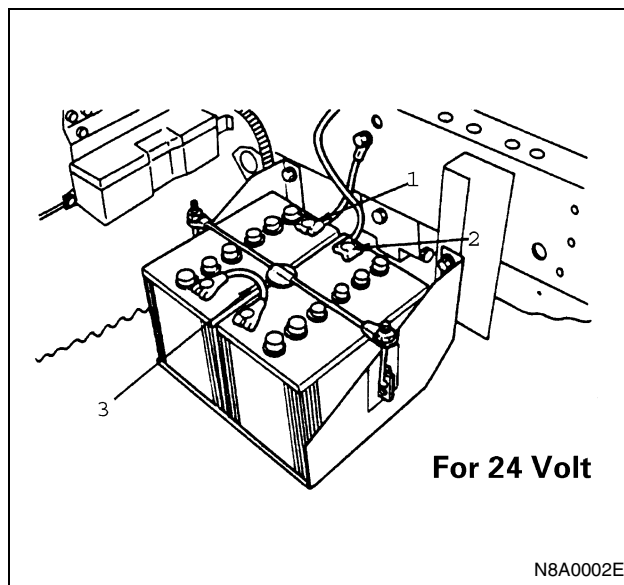


Connecting The Battery Cable

Follow the disconnecting procedure in the reverse order.

Caution:

Clean the battery terminal and apply a light coat of grease to prevent terminal corrosion.



Connector Handling

Disconnecting The Connectors

Some connectors have a tang lock to hold the connectors together during vehicle operation.

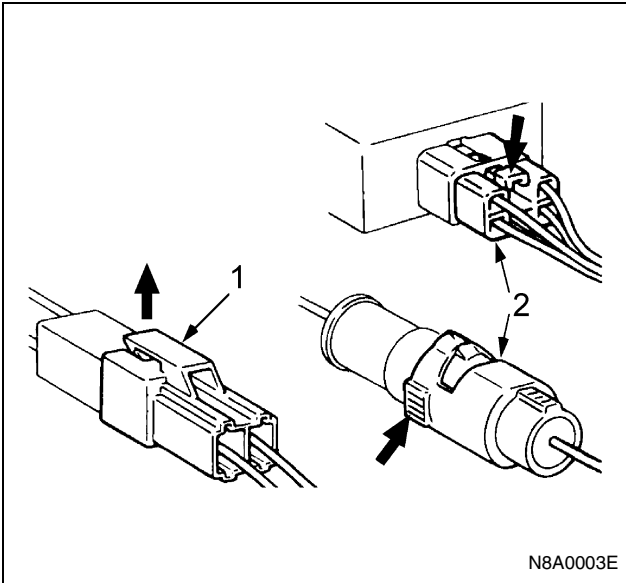
Some tang locks are released by pulling them towards you 1.

Other tang locks are released by pressing them forward 2.

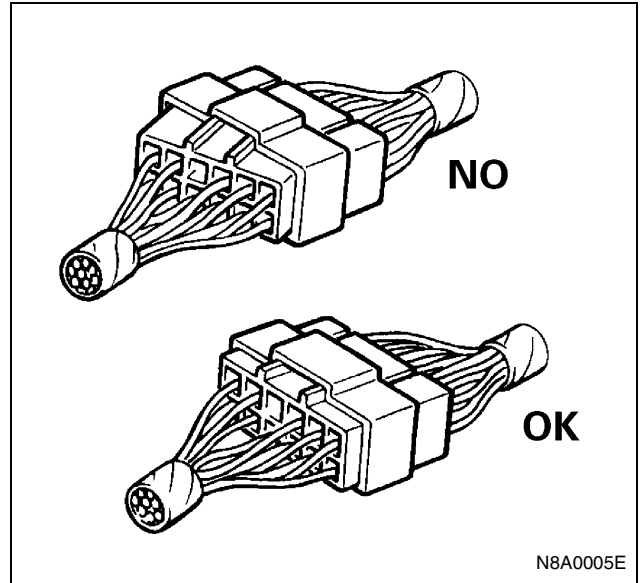
Determine which type of tang lock is on the connector being handled.

Firmly grasp both sides (male and female) of the connector.

Release the tang lock and carefully pull the two halves of the connector apart.

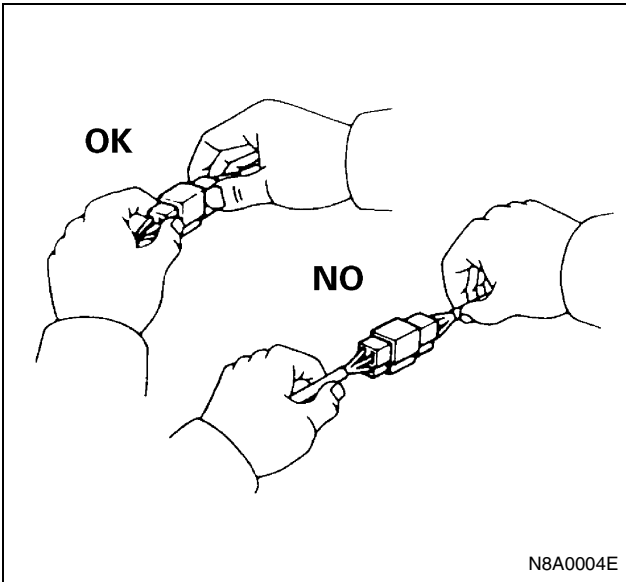


Never pull on the wires to separate the connectors. This will result in wire breakage.



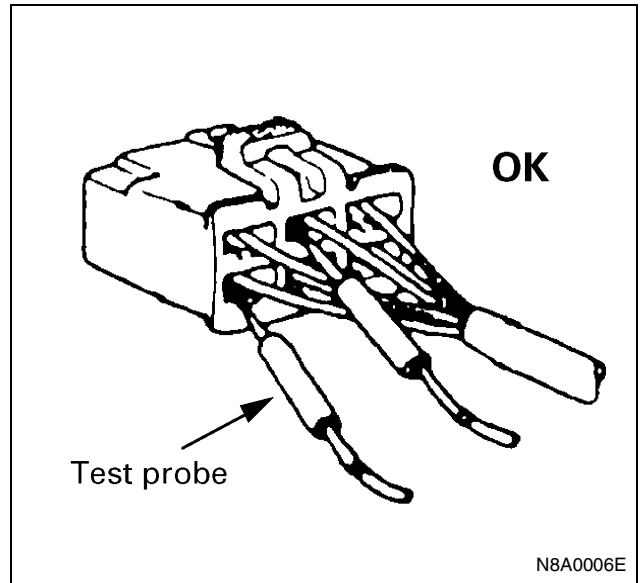
Connector Inspection

Use a circuit tester to check the connector for continuity. Insert the test probes from the connector wire side.

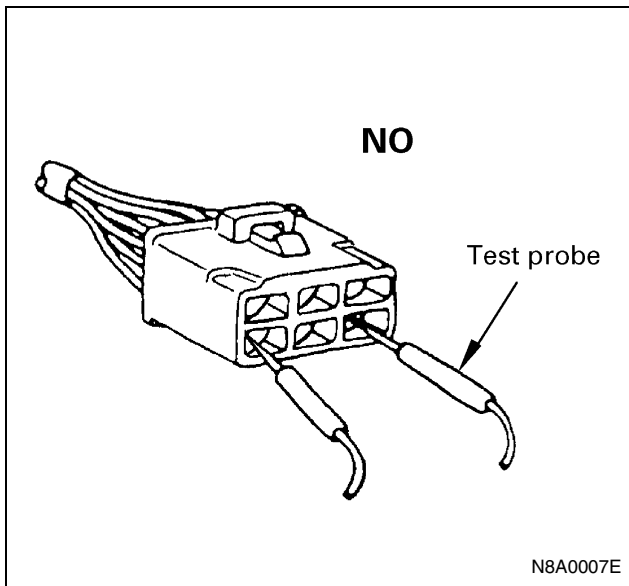


Connecting the Connector

Firmly grasp both sides (male and female) of the connector. Be sure that the connector pins and pin holes match. Be sure that both sides of the connector are aligned with each other. Firmly but carefully push the two sides of the connector together until a distinct click is heard.

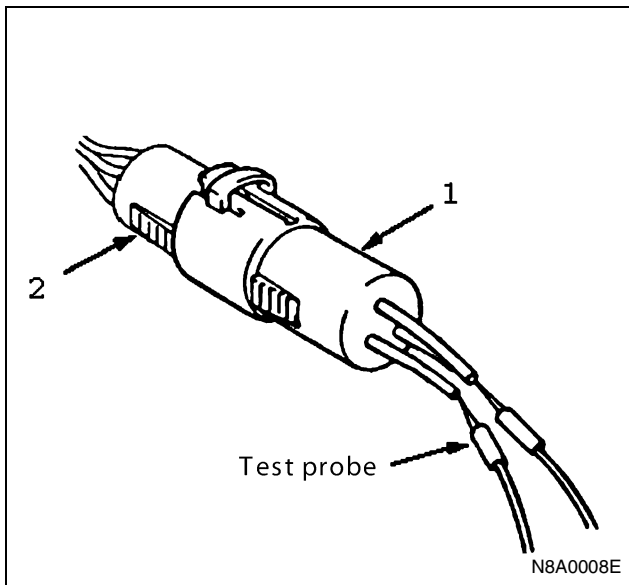


Never insert the circuit tester test probes into the connector open end to test the continuity. Broken or open connector terminals will result.



Waterproof Connector Inspection

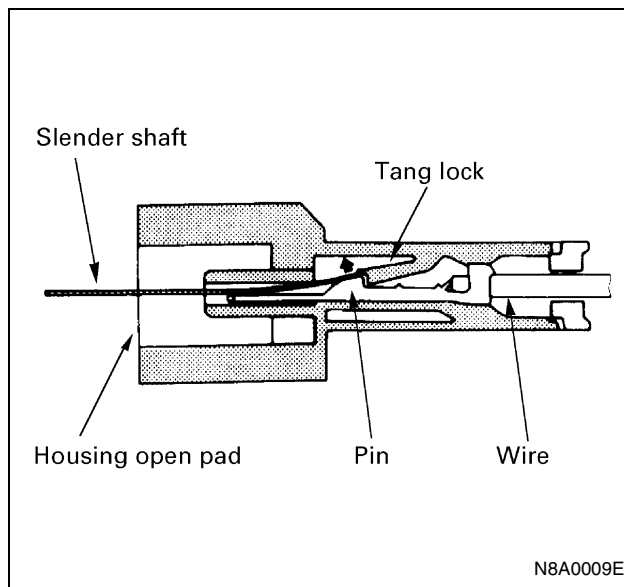
It is not possible to insert the test probes into the connector wire side of a waterproof connector. Use one side of a connector 1 with its wires cut to make the test. Connect the test connector 2 to the connector to be tested. Connect the test probes to the cut wires to check the connector continuity.



Connector Pin Removal

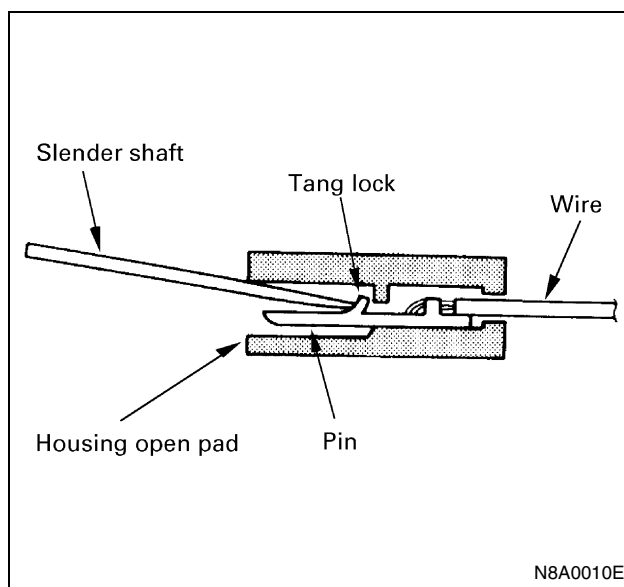
Connector Housing Tang Lock Type

1. Insert a slender shaft into the connector housing open end.
2. Push the tang lock up (in the direction of the arrow in the illustration). Pull the wire with pin free from the wire side of the connector.



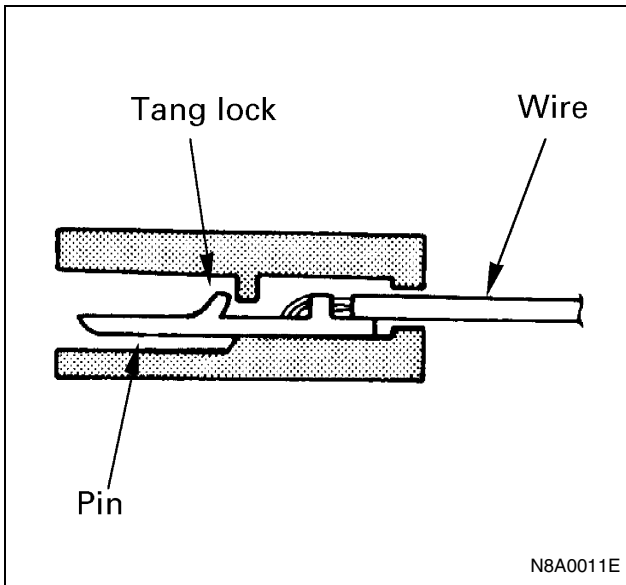
Pin Tang Lock Type

1. Insert a slender shaft into the connector housing open end.
2. Push the tang lock flat (toward the wire side of the connector). Pull the wire with pin free from the wire side of the connector.



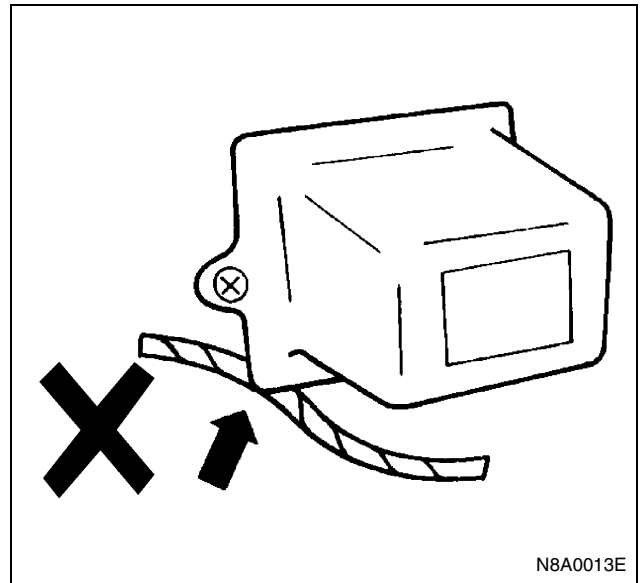
Connector Pin Insertion

1. Check that the tang lock is fully up.
2. Insert the pin from the connector wire side. Push the pin in until the tang lock closes firmly.
3. Gently pull on the wires to make sure that the connector pin is firmly set in place.



Cable Harness

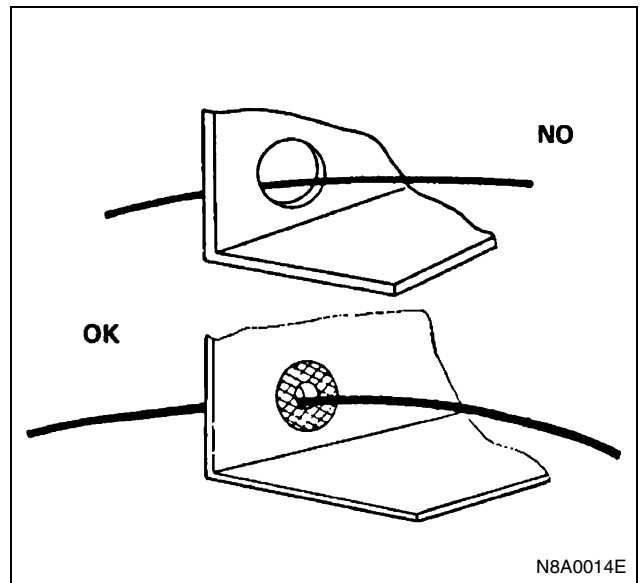
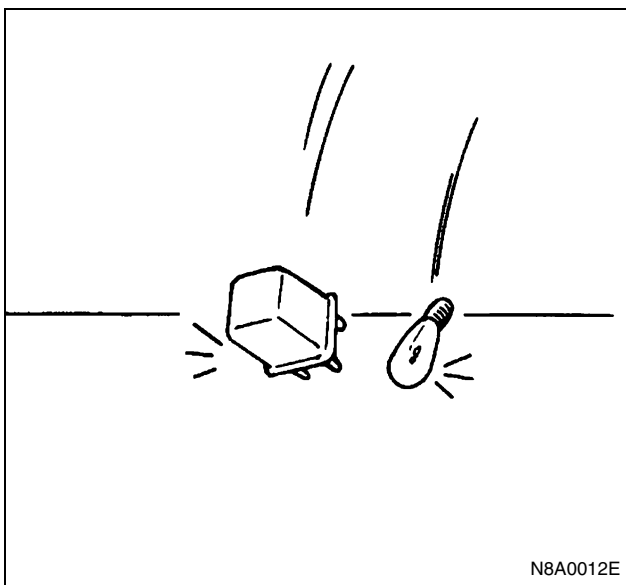
When installing the parts, be careful not to pinch or wedge the wiring harness. All electrical connections must be kept clean and tight.



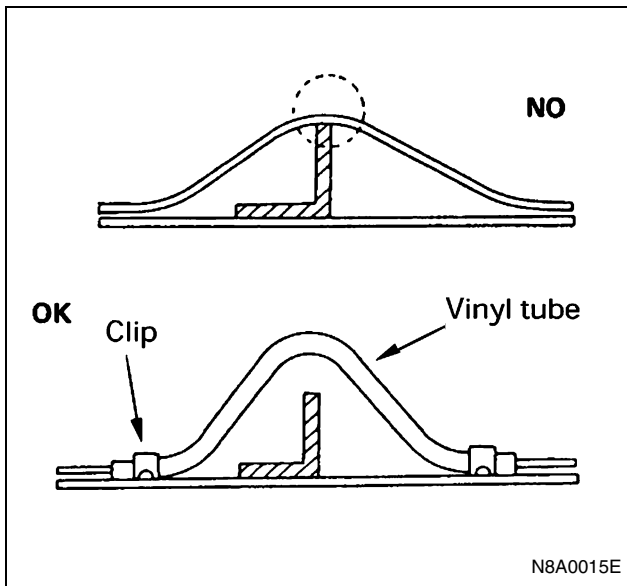
Use a grommet or guard tube to protect the wiring harness from contacting a sharp edge or surface.

Parts Handling

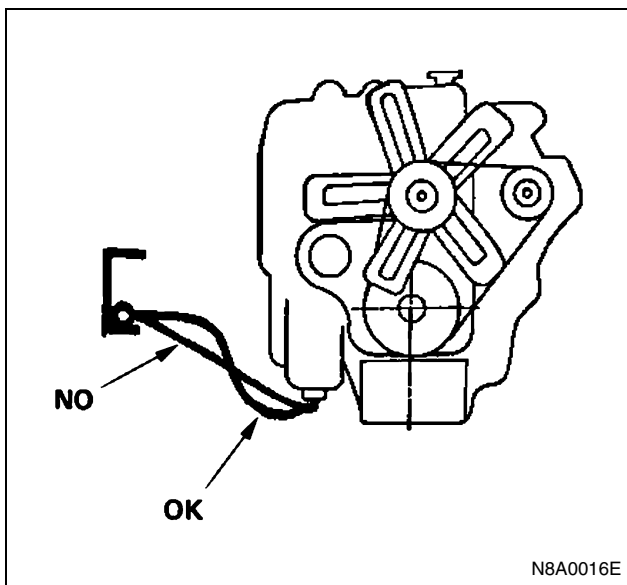
Be careful when handling electrical parts. They should not be dropped or thrown, because short circuit or other damage may result.



Position the wiring harness with a enough clearance from the other parts and guard the wiring harness with a vinyl tube and clips to avoid direct contact.



The wiring harness between engine and chassis should be long enough to prevent chafing or damage due to various vibrations.

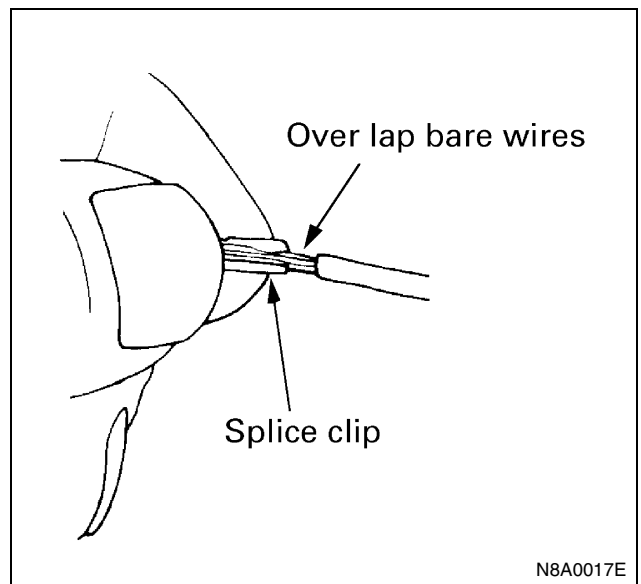


Splicing Wire

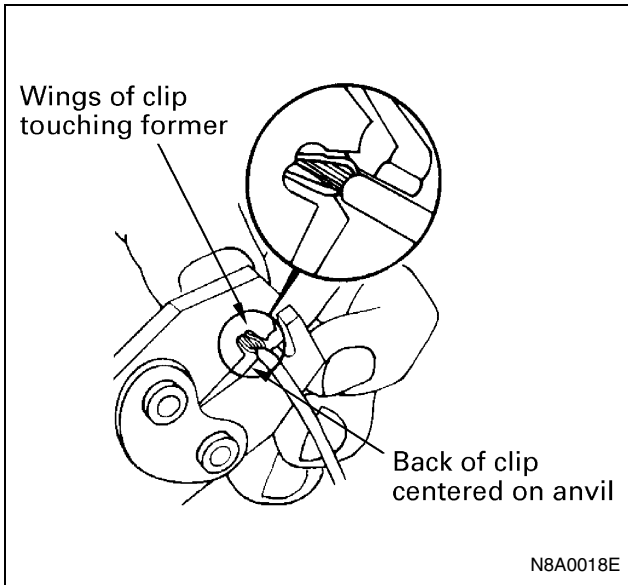
1. Open the Harness
If the harness is taped, remove the tape. To avoid wire insulation damage, use a sewing "seam ripper" (available from sewing supply stores) to cut open the harness.
If the harness has a block plastic conduit, simply pull out the desired wire.
2. Cut the wire
Begin by cutting as little wire off the harness as possible. You may need the extra length of wire later if you decide to cut more wire off to change the location of a splice. You may have to adjust splice locations to make certain that each splice is at least

1-2/2" (40 mm) away from other splices, harness branches, or connectors.

3. Strip the insulation
When replacing a wire, use a wire of the same size as the original wire. Check the stripped wire for nicks or cut stands. If the wire is damaged, repeat the procedure on a new section of wire. The two stripped wire ends should be equal in length.
4. Crimp the Wires
Select the proper clip to secure the splice. To determine the proper clip size for the wire being spliced, follow the directions included with your clips.
Select the correct anvil on the crimper. (On most crimpers your choice is limited to either a small or large anvil.) Overlap the two stripped wire ends and hold them between your thumb and forefinger. Then, center the splice clip under the stripped wires and hold it in place.



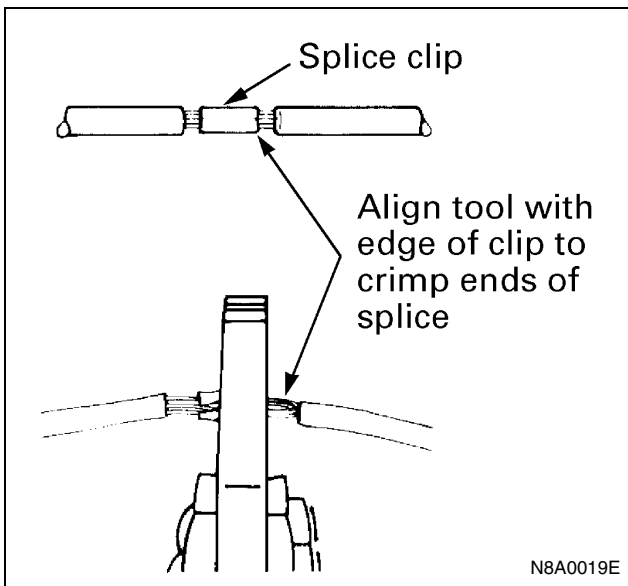
- Open the crimping tool to its full width and rest one handle on a firm flat surface.
- Center the back of the splice clip on the proper anvil and close the crimping tool to the point where the back of the splice clip touches the wings of the clip.
- Make sure that the clip and wires are still in the correct position. Then, apply steady pressure until the crimping tool closes.



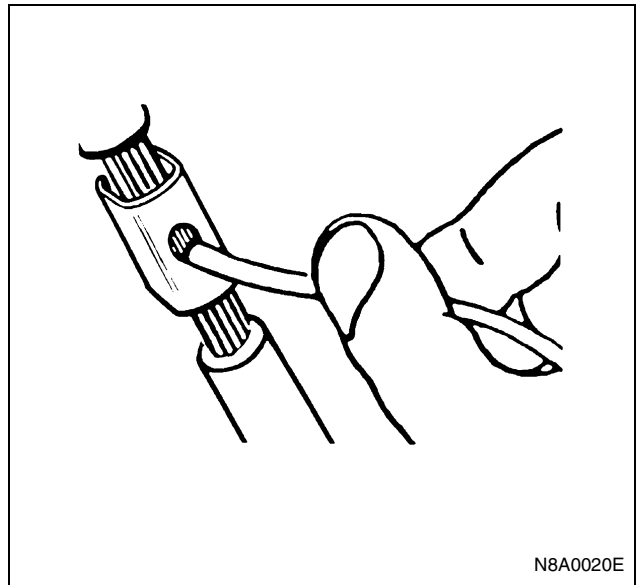
Before crimping the ends of the clip, be sure that:

- The wires extend beyond the clip in each direction.
- No strands of wire are cut loose, and
- No insulation is caught under the clip.

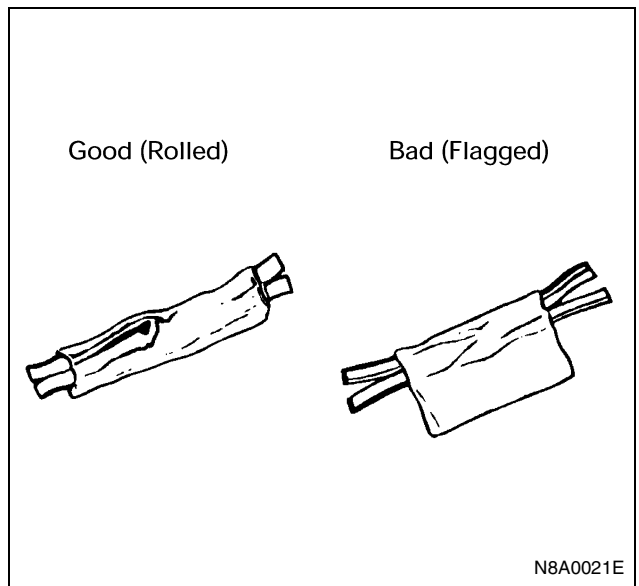
Crimp the splice again, once on each end. Do not let the crimping tool extend beyond the edge of the clip or you may damage or nick the wires.



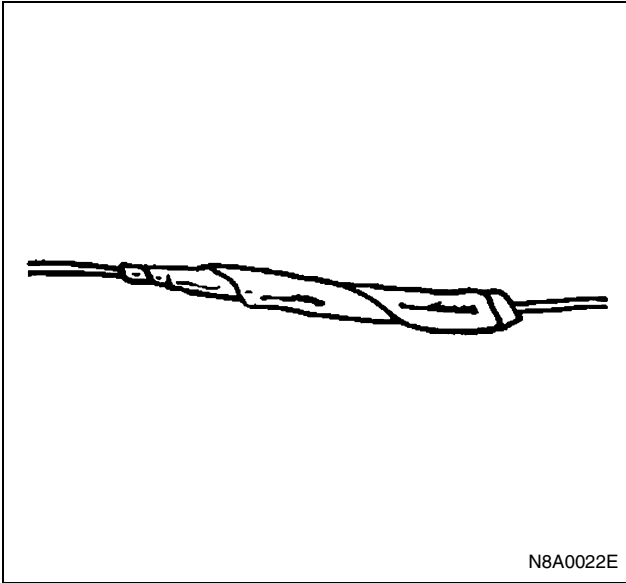
5. Solder
Apply 60/40 rosin core solder to the opening in the back of the clip. Follow the manufacturer's instructions for the solder equipment you are using.



6. Tape the Splice
Center and roll the splicing tape. The tape should cover the entire splice. Roll on enough tape to duplicate the thickness of the insulation on the existing wires. Do not flag the tape. Flagged tape may not provide enough insulation, and the flagged ends will tangle with the other wires in the harness.






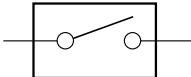
If the wire does not belong in a conduit or other harness covering, tape the wire again. Use a winding motion to cover the first piece of tape.

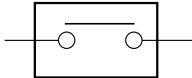
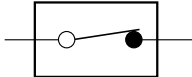
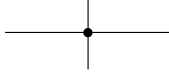
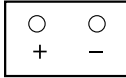
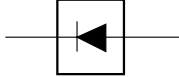




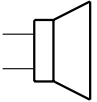
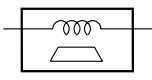
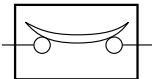


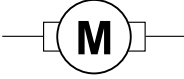
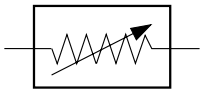
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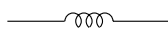
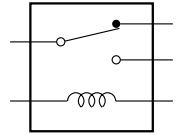

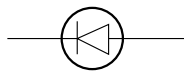
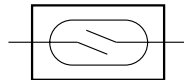
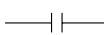
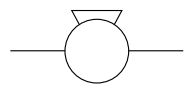
Symbols and Abbreviations

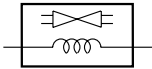
Symbols

Symbol	Meaning of Symbol
 N8A5501E	Fuse
 N8A5502E	Fusible link
 N8A5503E	Fusible link wire
 N8A5504E	Switch

Symbol	Meaning of Symbol
 N8A5505E	Switch
 N8A5506E	Switch (Normal close type)
 N8A5507E	Contact wiring
 N8A5508E	Battery
 N8A5509E	Diode
 N8A5510E	Electronic Parts
 N8A5511E	Resistor

Symbol	Meaning of Symbol
 N8A5512E	Speaker
 N8A5513E	Buzzer
 N8A5514E	Circuit breaker
 N8A5515E	Bulb
 N8A5516E	Double filament bulb
 N8A5517E	Motor
 N8A5518E	Variable resistor Rheostat

Symbol	Meaning of Symbol
 N8A5519E	Coil (inductor), solenoid, magnetic valve
 N8A5520E	Relay
 N8A5521E	Connector
 N8A5522E	Light emitting diode
 N8A5523E	Reed switch
 N8A5524E	Condenser
 N8A5525E	Horn

Symbol	Meaning of Symbol
 <p>N8A5526E</p>	Vacuum switching valve

Abbreviations

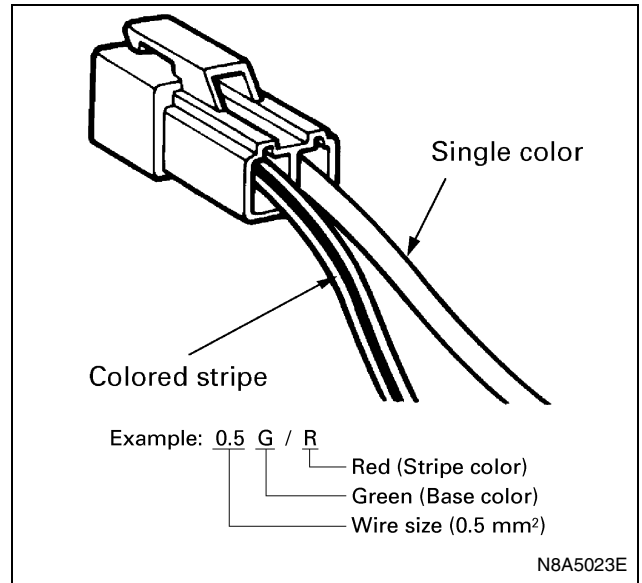
Abbreviation	Meaning of Abbreviation	Abbreviation	Meaning of Abbreviation
A	Ampere (S)	kW	kilowatt
ABS	Anti-lock brake system	LH	Left hand
ASM	Assembly	LWB	Long wheel base
AC	Alternating current	M/T	Manual transmission
A/C	Air conditioner	OD	Over drive
ACC	Accessories	OPT	Option
C/B	Circuit breaker	QOS	Quick on start
CSD	Cold start device	RH	Right hand
DIS	Direct ignition system	RR	Rear
EBCM	Electronic brake control module	RWAL	Rear wheel anti-lock brake system
ECGI	Electronic control gasoline injection	ST	Start
ECM	Electronic control module	STD	Standard
ECU	Electronic control unit	SW	Switch
EFE	Early fuel evaporation	SWB	Short wheel base
4X4	Four-wheel drive	V	Volt
FL	Fusible link	VSV	Vacuum switching valve
FRT	Front	W	Watt (S)
H/L	Headlight	WOT	Wide open throttle
IC	Integrated circuit	W/	With
IG	Ignition	W/O	Without

Parts for Electrical Circuit

Wiring

Wire Color

All wires have color-coded insulation. Wires belonging to a system's main harness will have a single color. Wires belonging to a system's subcircuits will have a colored stripe. Striped wires use the following code to show wire size and colors.



Abbreviations are used to indicate wire color within a circuit diagram. Refer to the following table.

Wire Color Coding

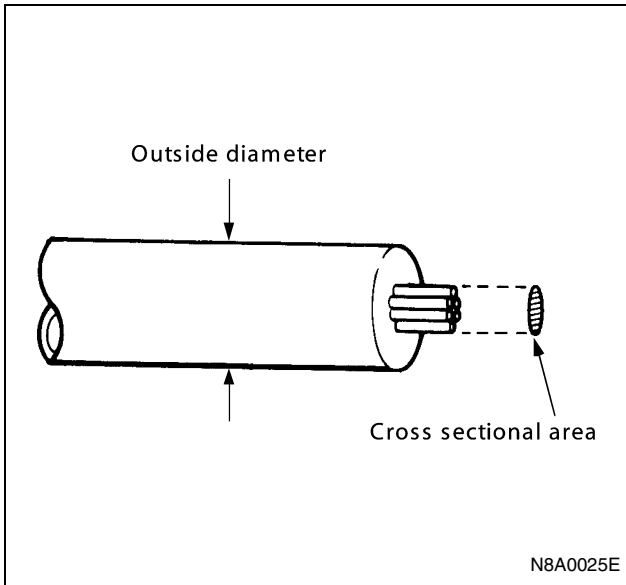
Color-Coding	Meaning	Color-Coding	Meaning
B	Black	BR	Brown
W	White	LG	Light green
R	Red	GR	Grey
G	Green	P	Pink
Y	Yellow	LB	Light blue
L	Blue	V	Violet
O	Orange		

Distinction of Circuit by Wire Base Color

Base color	Circuits	Base color	Circuits
B	Starter circuit	Y	Instrument circuit
W	Charging circuit	L, O, BR, LG, GR, P, LB, V	Other circuit
R	Lighting circuit		
G	Signal circuits		

Wire Size

The size of wire used in a circuit is determined by the amount of current (amperage), the length of the circuit, and the voltage drop allowed. The following wire size and load capacity, shown below, are specified by AWG (American Wire Gauge) (Nominal size means approximate cross sectional area).



Wire Size Table

Nominal size	Cross sectional area (mm ²)	Outside diameter (mm)	Allowable current (A)	AWG size (cross reference)
0.3	0.372	1.8	9	22
0.5	0.563	2.0	12	20
0.85	0.885	2.2	16	18
1.25	1.287	2.5	21	16
2	2.091	2.9	28	14
3	3.296	3.6	37.5	12
5	5.227	4.4	53	10
8	7.952	5.5	67	8
15	13.36	7.0	75	6
20	20.61	8.2	97	4

Fuse, Fusible Link and Circuit Breaker

Fuse

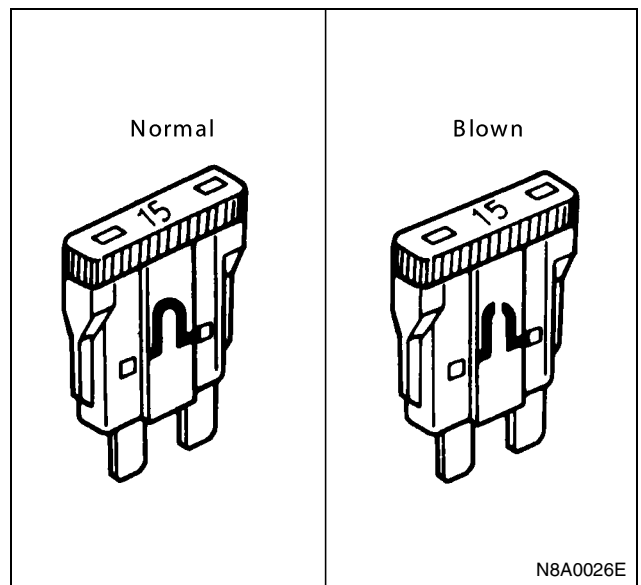
Fuses are the most common form of circuit protection used in vehicle wiring. A fuse is a thin piece of wire or strip of metal encased in a glass or plastic housing. It is wired in series with the circuit it protects. When there is an overload of current in a circuit, such as a short to ground, the wire or metal strip is designed to burn out and interrupt the flow of current. This prevents a surge of high current from reaching and damaging other components in the circuit.

Determine the cause of the overloaded before replacing the fuse.

The replacement fuse must have the same amperage specifications as the original fuse.

Never replace a blown fuse with a fuse of a different amperage specification.

Doing so can result in an electrical fire or other serious circuit damage. A blown fuse is easily identified.



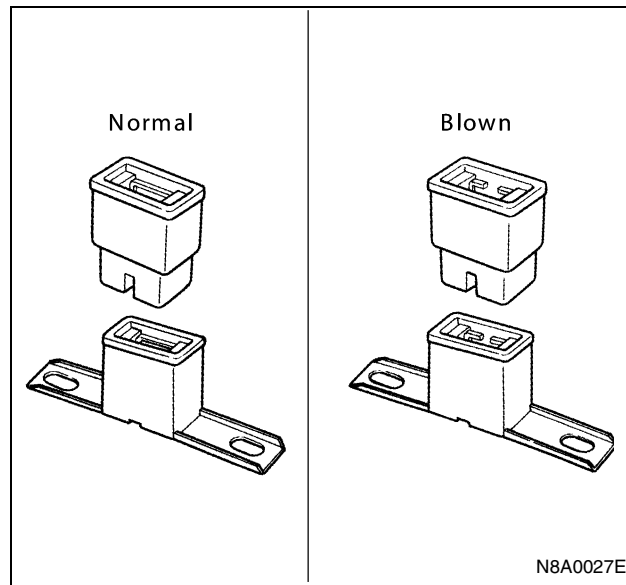
Fusible Link

The fusible link is primarily used to protect circuits where high amounts of current flow and where it would not be practical to use a fuse. For example, the starter circuit. When a current overload occurs, the fusible link melts open and interrupts the flow of current so as to prevent the rest of the wiring harness from burning.

Determine the cause of the overload before replacing the fusible link. The replacement fusible link must have the same amperage specification as the original fusible link.

Never replace a blown fusible link with a fusible link of a different amperage specification. Doing so can result in an electrical fire or other serious circuit damage.

A blown fusible link is easily identified.

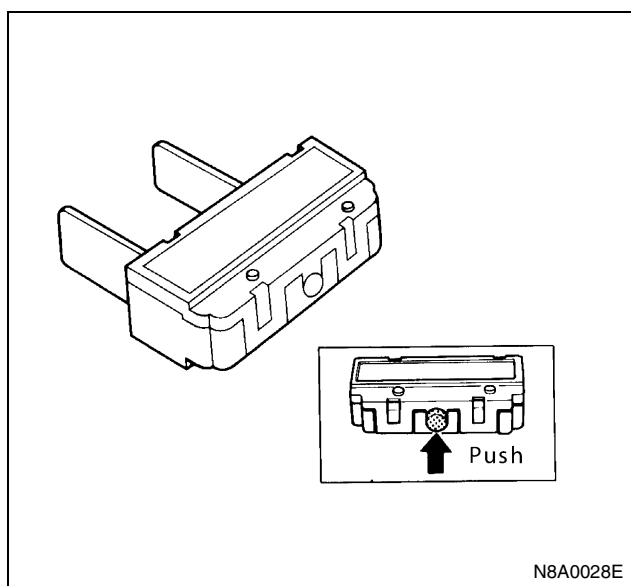


Fusible Link Specifications

Type	Rating	Case Color	Maximum Circuit Current (A)
Connector	30 A	Pink	15
Connector	40 A	Green	20
Bolted	50 A	Red	25
Bolted	60 A	Yellow	30
Bolted	80 A	Black	40

Circuit Breaker

The circuit breaker is a protective device designed to open the circuit when a current load is in excess of rated breaker capacity. If there is a short or other type of overload condition in the circuit, the excessive current will open the circuit between the circuit breaker terminals. The reset knob pops out when the circuit is open. Push the reset knob in place to restore the circuit after repairing it.

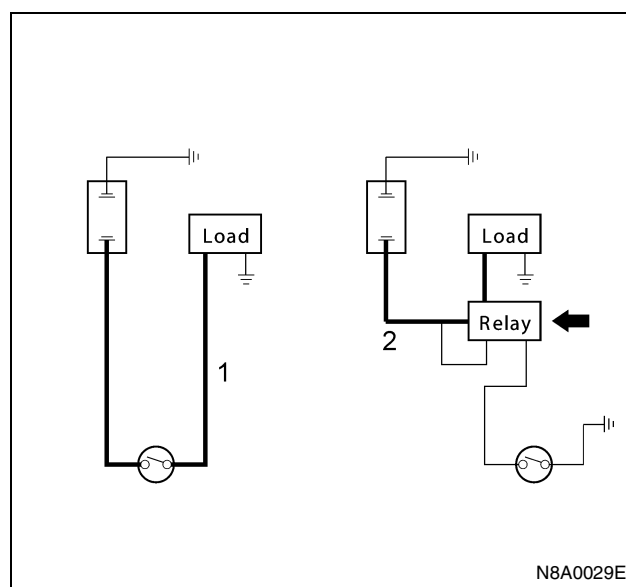


Relay

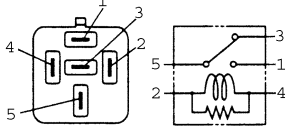
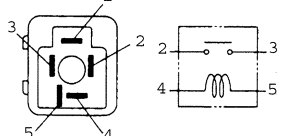
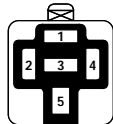
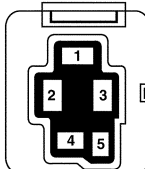
Battery and load location may require that a switch be placed some distance from either component. This means a longer wire and a higher voltage drop 1.

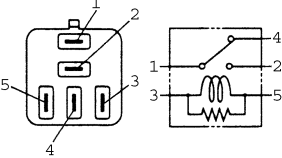
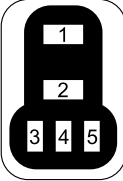
The installation of a relay between the battery and the load reduces the voltage drop 2.

Because the switch controls the relay, amperage through the switch can be reduced.



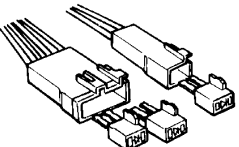

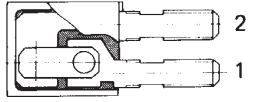



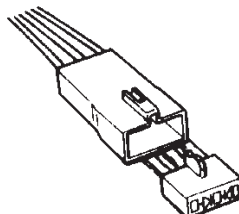
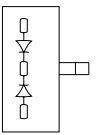
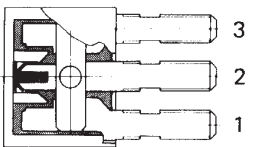






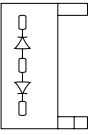
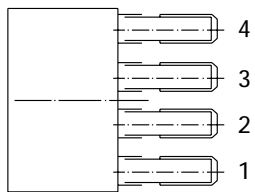






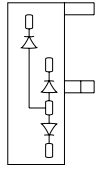









Relay Specification, Configuration and Inspection

Name/ Color	Rated voltage/ Coil resistance	Internal circuit		Name/ Color	Rated voltage/ Coil resistance	Internal circuit	
MR5C (1T)/ Black	12 V/ Approx. 90 Ω Minimum operating voltage: 7 V at 25°C (77°F)			MR82C/ White label	12 V/ Approx. 23 Ω Minimum operating voltage: 7 V at 20°C (68°F)		
MR5C (1T)/ Brown	12 V/ Approx. 90 Ω Minimum operating voltage: 10.5 V at 25°C (77°F)					N8A0431E	N8A0433E
MR5C (1T)/ Green	24 V/ Approx. 266 Ω Minimum operating voltage: 16 V at 25°C (77°F)			MR82C/ Green label	24 V/ Approx. 100 Ω Minimum operating voltage: 16 V at 20°C (68°F)		
MR5C (1T)/ Grey	24 V/ Approx. 266 Ω Minimum operating voltage: 20 V at 25°C (77°F)	(connector face)				N8A0432E	N8A0434E	(connector face)
Inspection		The way	Check to see if there is any continuity between the relay terminals.	Inspection		The way	Check to see if there is any continuity between the relay terminals.
	Result	(When no voltage is applied relay terminals 2 -4)			Result	(When no voltage is applied relay terminals 4 -5)	
	Normal	3 -5 → continuity 1 -5 → No continuity			Normal	2 -3 → No continuity	
	Abnormal	(When minimum operating voltage is applied relay terminals between 2 -4) 3 -5 → continuity 1 -5 → No continuity			Abnormal	(When minimum operating voltage is applied relay terminals between 4 -5) 2 -3 → No continuity	
	Normal	(When minimum operating voltage is applied relay terminals between 2 -4) 3 -5 → No continuity 1 -5 → continuity			Normal	(When minimum operating voltage is applied relay terminals between 4 -5) 2 -3 → continuity	

Name/ Color	Rated voltage/ Coil resistance	Internal circuit		
ACM 13221 M04/ Black	12 V/ Approx. 120 Ω Minimum operating voltage: 8 V at 25°C (77°F)	 <p style="text-align: right;">N8A5571E</p>		
ACM 13222 M01/ Green	24 V/ Approx. 320 Ω Minimum operating voltage: 18 V at 25°C (77°F)	 <p style="text-align: right;">N8A5572E</p> <p style="text-align: center;">(connector face)</p>		
Inspection		<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">The way</td> <td>Check to see if there is any continuity between the relay terminals.</td> </tr> </table>	The way	Check to see if there is any continuity between the relay terminals.
	The way	Check to see if there is any continuity between the relay terminals.		
	Result	(When no voltage is applied relay terminals 3 - 5)		
	Normal	1 - 4 → continuity 1 - 2 → No continuity Inspection		
Abnormal	(When minimum operating voltage is applied relay terminals between 3 - 5) 1 - 4 → continuity 1 - 2 → No continuity			
Normal	(When minimum operating voltage is applied relay terminals between 3 - 5) 1 - 4 → No continuity 1 - 2 → continuity			

Diode

Diode Specifications and Configurations

SHAPE	MARK/ COLOR	CONSTRUCTION	CHECKING																													
	 BLACK	 2 1	<p>(THERE SHOULD BE CONTINUITY IN EITHER A OR B WHEN A CIRCUIT TESTER IS CONNECTED WITH DIODE TERMINAL)</p> <table border="1"> <tr> <td>TERMINAL NO.</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td>2</td> <td>1</td> <td></td> </tr> <tr> <td rowspan="2">CONNECTION PATTERN</td> <td>A</td> <td>⊕</td> <td>⊖</td> </tr> <tr> <td>B</td> <td>⊖</td> <td>⊕</td> </tr> </table>	TERMINAL NO.					2	1		CONNECTION PATTERN	A	⊕	⊖	B	⊖	⊕														
TERMINAL NO.																																
	2	1																														
CONNECTION PATTERN	A	⊕	⊖																													
	B	⊖	⊕																													
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CONNECTION PATTERN	A	⊖	⊕	⊖																												
	B	⊕	⊖	⊕																												
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CONNECTION PATTERN	A	⊖	⊕	⊖																												
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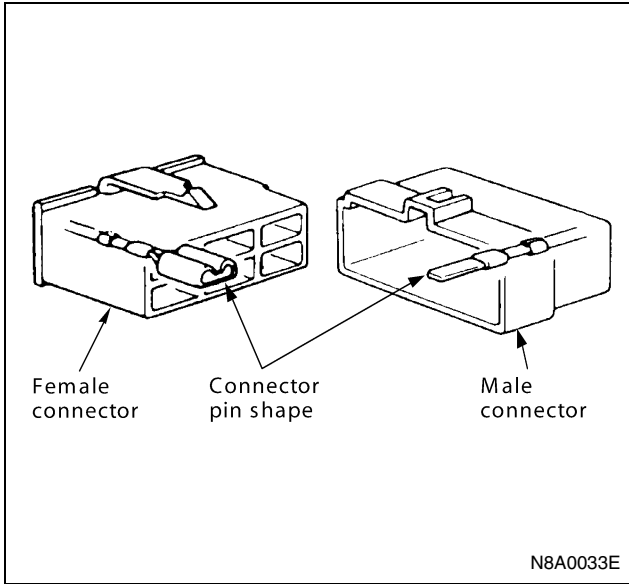
N8A0032E

Maximum Rating (Temp. = 25°C)

Items	Rating	Remarks
Peak reverse voltage	400 V	
Transient peak reverse voltage	500 V	
Average output current	1.5 A	Temp. = 40°C
Working ambient temperature	-30°C — 80°C	
Storage temperature	-40°C — 100°C	

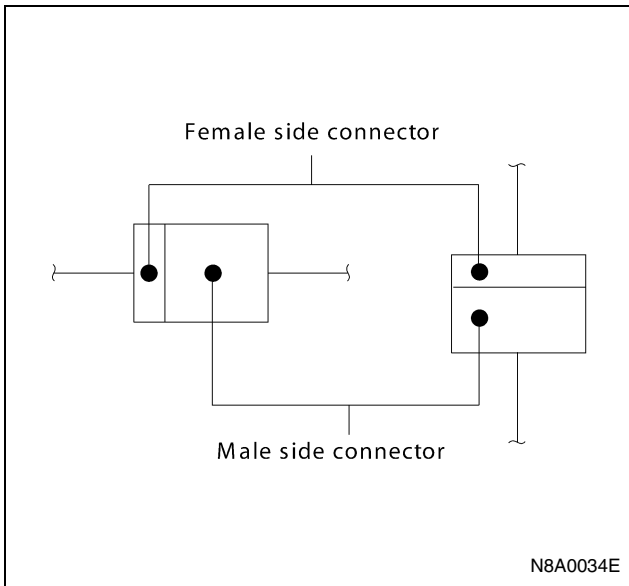
Connector

The connector pin shape determines whether the connector is male or female.
 The connector housing configuration does not determine whether a connector is male or female.



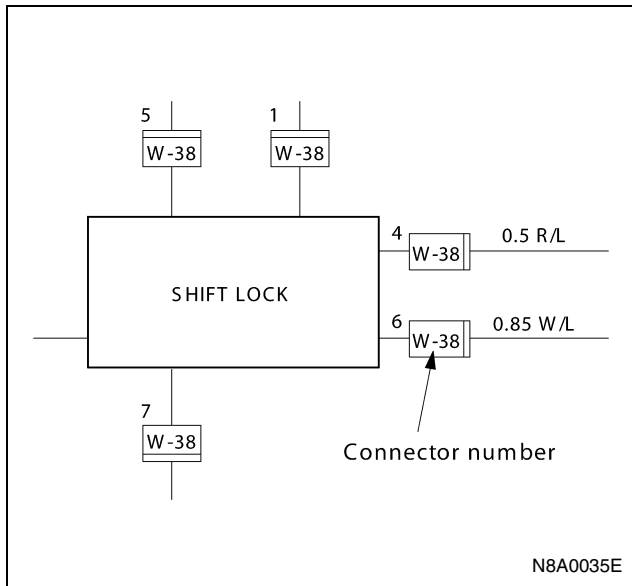
N8A0033E

The symbol illustrated in the figure is used as connector, in the circuit of this section.



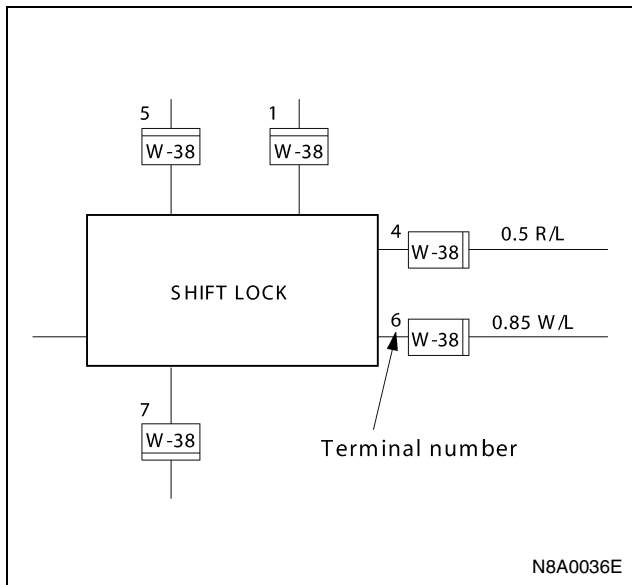
N8A0034E

Connector is identified with a number.



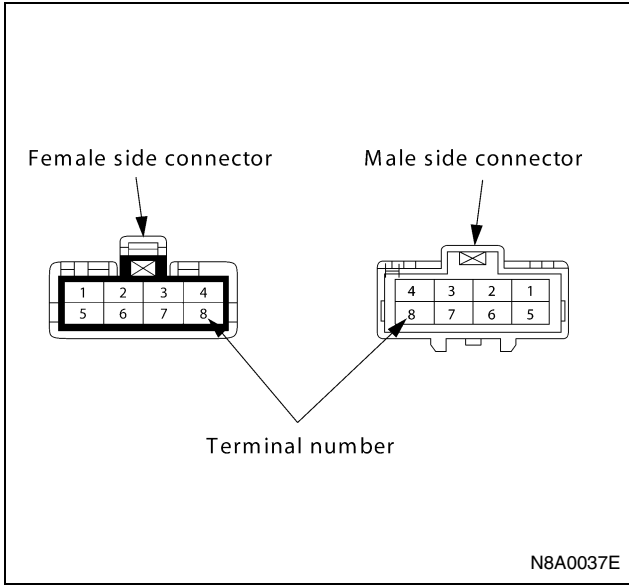
N8A0035E

The applicable terminal number is shown for each connector.

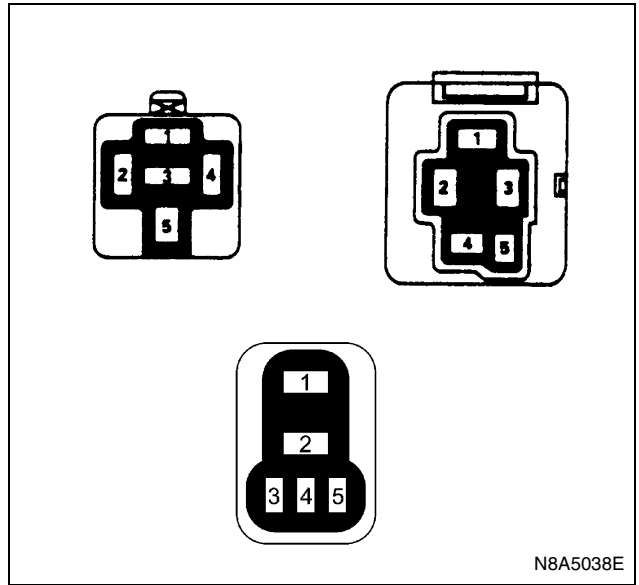


N8A0036E

Connector terminal numbers are clearly shown.
 Male side connector terminal numbers are in sequence from upper right to lower left.
 Female side connector terminal numbers are in sequence from upper left to lower right.

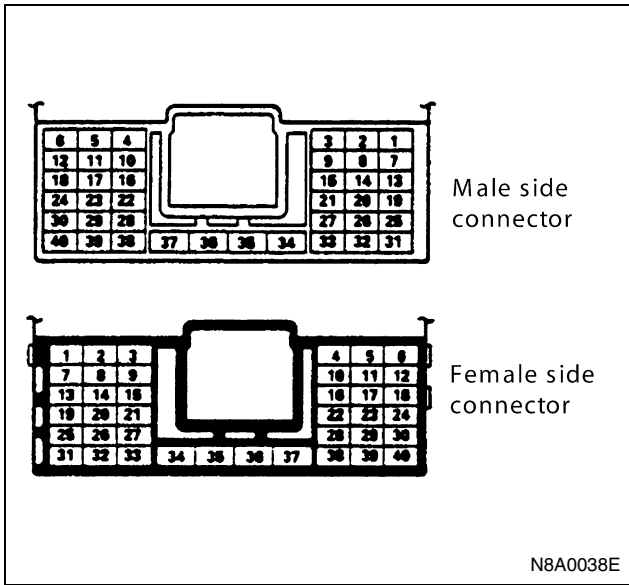


The connectors used for relays have their own terminal number assignment, irrespective of the above rule.



Notice:

For those connectors on which specific terminal numbers or symbols are shown (such as ECM), the terminal numbers or symbols are used in the circuit diagram, irrespective of the above rule.

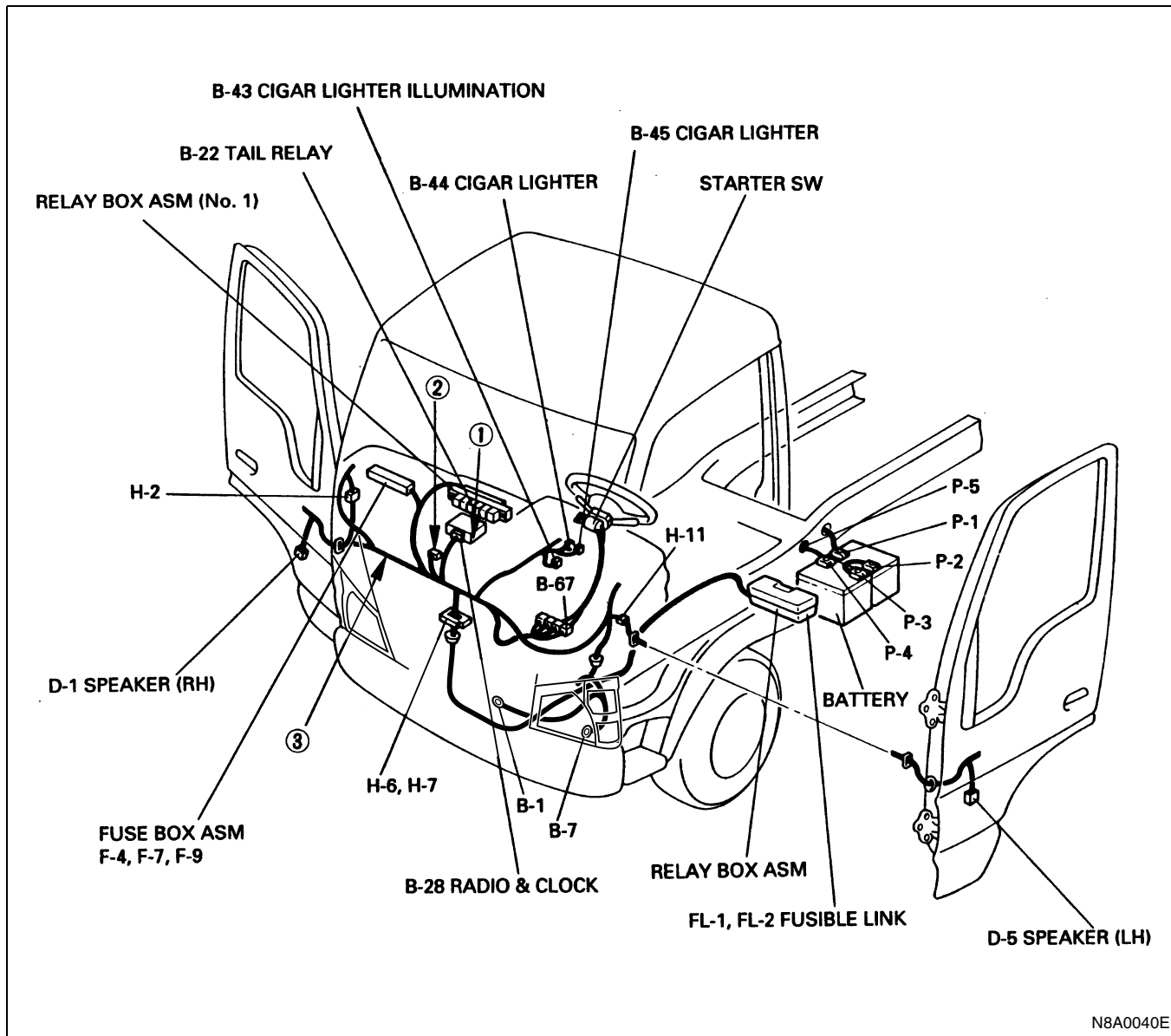


Reading The Circuit Diagram

In this manual, each system has its own parts location illustration, circuit diagram and connector configuration used in the circuit diagram.

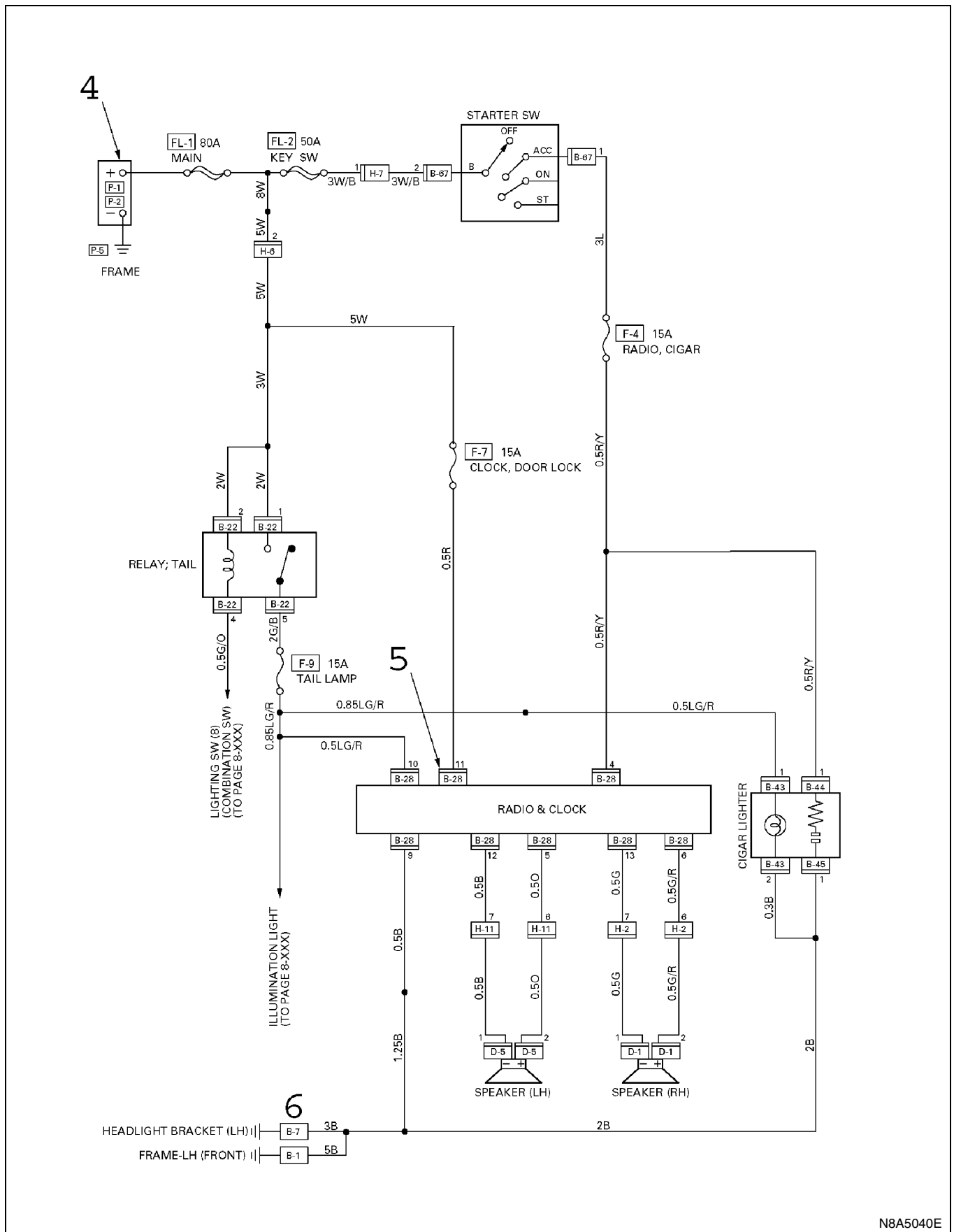
Parts Location

The parts location shows the location of the parts 1 and the connector 2 used in each harness routing 3.



Circuit Diagram

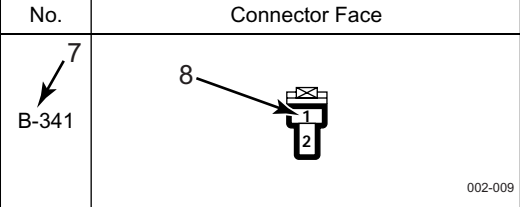
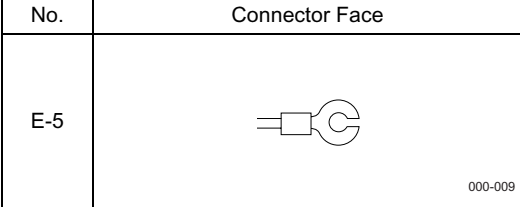
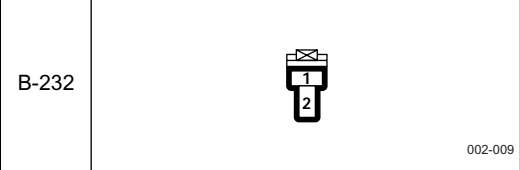
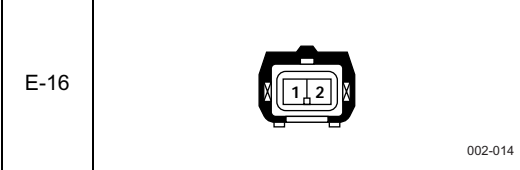
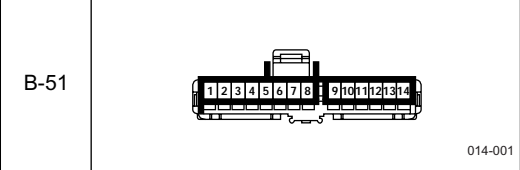
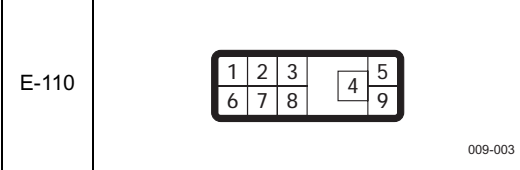
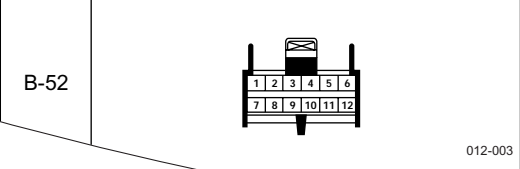
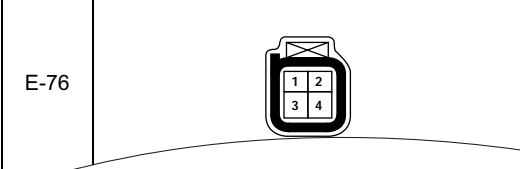
The circuit diagram shows the power supply 4 the load or loads 5 and the grounding point(s) 6.



N8A5040E

Connector List

The connector list shows each connectors' configuration 7 and the pin number 8.

No.	Connector Face	No.	Connector Face
B-341	 <p style="text-align: right;">002-009</p>	E-5	 <p style="text-align: right;">000-009</p>
B-232	 <p style="text-align: right;">002-009</p>	E-16	 <p style="text-align: right;">002-014</p>
B-51	 <p style="text-align: right;">014-001</p>	E-110	 <p style="text-align: right;">009-003</p>
B-52	 <p style="text-align: right;">012-003</p>	E-76	

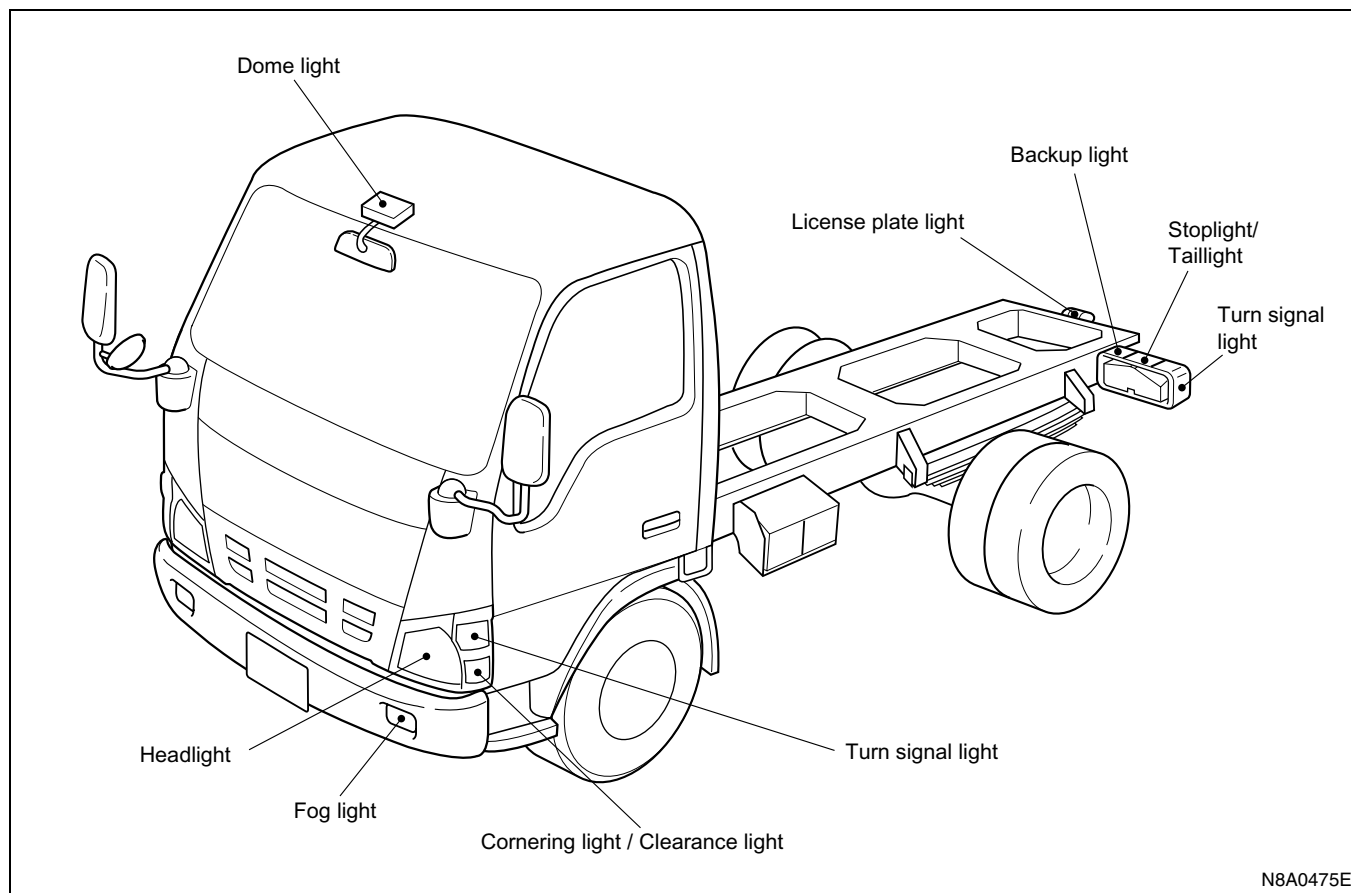
N8A0430E

Connector Symbol

Connector Symbol	Harness name	Connector Symbol	Harness name
B	Body harness	L	Dome Light harness
D	Door harness	N	Floor harness (LH & RH)
E	Engine harness	P	Battery harness
H	For joint between harnesses	R	Rear body harness
J	Front frame & Rear frame harness		

MAIN DATA AND SPECIFICATIONS

Bulb Specifications



N8A0475E

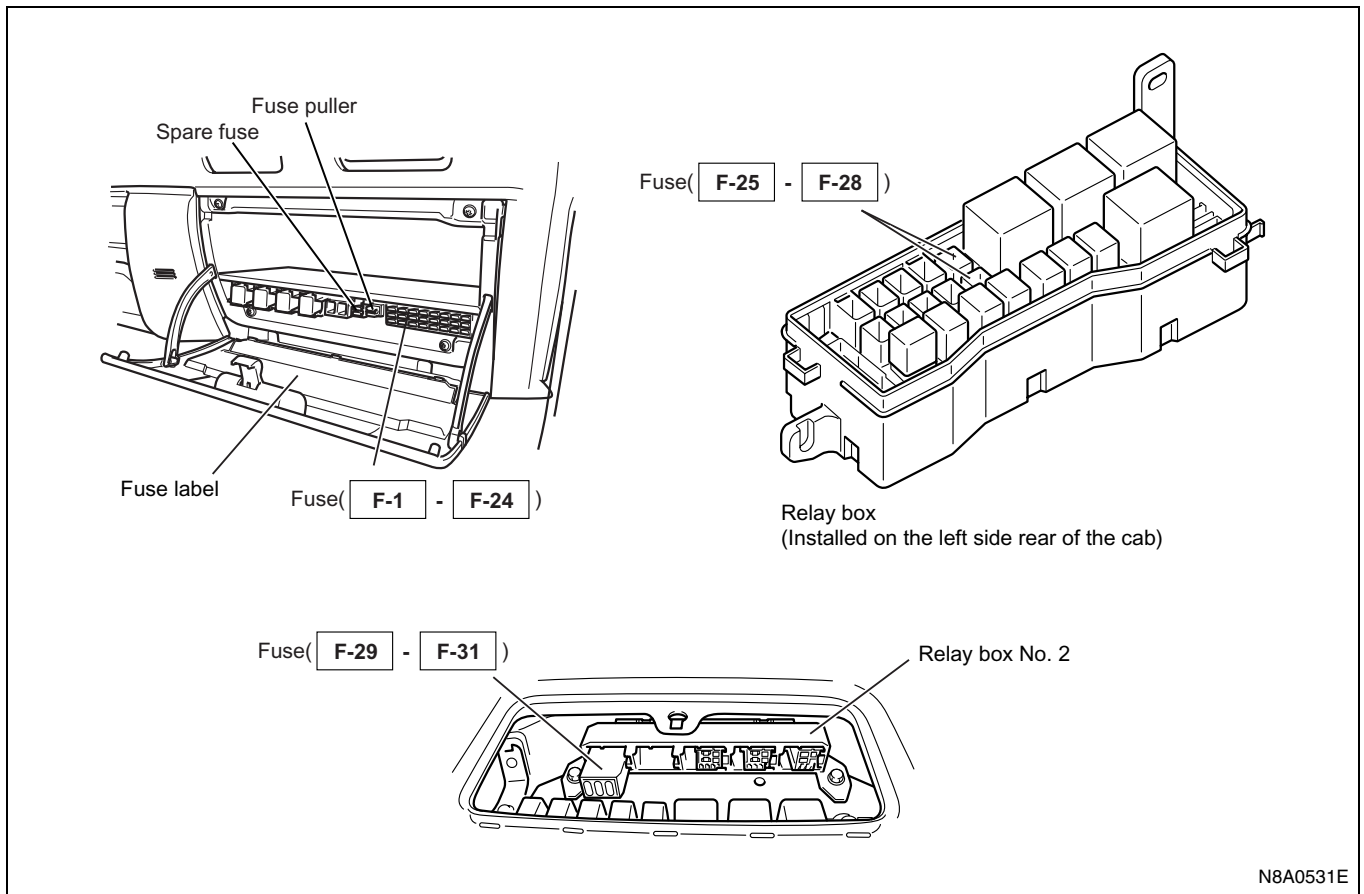
Light Name		Rated Power	No. of Bulb	Lens Color	Remarks
Halogen Headlight		60 W / 55 W	2	Clear	12 V
		75 W / 70 W	2		24 V
Front combination light	Turn signal light	21 W	2	Amber	12 V, 24 V
	Cornering light / Clearance light	21 W / 5 W	2	Clear	12 V, 24 V
Fog light	Front	55 W	2	Clear	12 V
		70 W			24 V
	Rear	21 W	1	Red	12 V, 24 V
Rear combination light	Stoplight / Taillight	21 W / 5 W	2	Red	12 V, 24 V
	Turn signal light	21 W	2	Amber	12 V, 24 V
	Backup light	21 W	2	Clear	12 V, 24 V
License plate light		5 W	1	Clear	12 V, 24 V
Dome light		10 W	1	White	12 V, 24 V
Roof marker light		5 W	2	White	24 V
Side turn signal light		21 W	2	Amber	24 V

Light Name		Rated Power		No. of Bulb	Remarks
		Except 4HK1-TC	4HK1-TC		
Indicator / Warning Light (In the meter assembly)	Glow	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Engine oil pressure	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Fuel sedimenter	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Brake fluid level / Parking brake	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Charge	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Exhaust brake	2 W	—	1	12 V
	High beam	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Turn signal	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Fuel level	2 W	—	1	12 V
		1.8 W	1.8 W		24 V
	Seat belt	2 W	—	1	12 V
		1.8 W	1.8 W		24 V
	4WD	1.8 W	1.8 W	1	24 V
	Rear fog	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Brake booster	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	ABS	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
	Check engine	1.4 W	—	1	12 V
		1.4 W	1.8 W		24 V
P.T.O.	1.4 W	—	1	12 V	
	1.4 W	1.8 W		24 V	
Smoother	—	LED	1	24 V	
1st start	—	LED	1	24 V	
ECONO	—	LED	1	24 V	
ASR	—	1.8 W	1	24 V	

Light Name		Rated Power		No. of Bulb	Remarks
		Except 4HK1-TC	4HK1-TC		
Illumination	Illumination light for meter assembly		3.4 W	1	12 V
			3 W		24 V
	Hazard warning Switch		2 W	1	12 V
			1.8 W		24 V
	Dome light switch		2 W	1	12 V
			1.8 W		24 V
	Front fog light switch		2 W	1	12 V
			1.8 W		24 V
	Rear fog light switch	For indicator	60 mA	1	12 V
		For illumination	60 mA	1	
	Cigar lighter		1.4 W	1	12 V
			1.8 W		24 V
Heater bezel		1.4 W	1		
Ashtray		1.4 W	1		

Fuse and Fusible Link Location

Fuse and Circuit Breaker



N8A0531E

Fuse Label-for 12 Volt (4JB1)

10 A (1)	AIR CON
15 A (2)	EXH. BRAKE, FUEL HEATER
15 A (3)	REAR HEATER
15 A (4)	AUDIO (B), DOOR LOCK
10 A (5)	STOP LIGHT
10 A (6)	FRT FOG LIGHT, CORNERING LAMP
10 A (7)	TAIL LIGHT
10 A (8)	EGR
10 A (9)	FUEL CUT
15 A (10)	FRONT WIPER & WASHER

10 A (11)	TURN LIGHT
10 A (12)	H/LAMP LEVEL
(13)	—
(14)	—
15 A (15)	AUDIO (IG), CIGAR LIGHTER
10 A (16)	METER
(17)	—
(18)	—
15 A (19)	HORN, HAZARD
10 A (20)	ABS (IG)
15 A (21)	GENERATOR
10 A (22)	STARTER
10 A (23)	HEAD LIGHT RH

10 A (24)	HEAD LIGHT LH
15 A (25)	MARKER LAMP
15 A (26)	COND. FAN
10 A (27)	RR FOG
(28)	—

Fuse Label-for 12 Volt (4HG1 / 4HE1)

10 A (1)	AIR CON
15 A (2)	EXH. BRAKE
(3)	—
15 A (4)	AUDIO (B), DOOR LOCK
10 A (5)	STOP LIGHT
(6)	—
10 A (7)	TAIL LIGHT
10 A (8)	FRT FOG LIGHT, CORNERING LAMP
10 A (9)	ENG.(IG)
15 A (10)	FRONT WIPER & WASHER
10 A (11)	TURN LIGHT
(12)	—
10 A (13)	ENG. STOP
(14)	—
15 A (15)	AUDIO (IG), CIGAR LIGHTER
10 A (16)	METER
(17)	—
(18)	—
15 A (19)	ENG.(B)
15 A (20)	HORN, HAZARD
(21)	—
10 A (22)	STARTER

10 A (23)	HEAD LIGHT RH
10 A (24)	HEAD LIGHT LH
15 A (25)	MARKER LAMP
(26)	—
10 A (27)	RR FOG
(28)	—

Fuse Label-for 12 Volt (4JH1)

10 A (1)	AIR CON
15 A (2)	FUEL HEATER
15 A (3)	REAR HEATER
15 A (4)	AUDIO (B), DOOR LOCK
10 A (5)	STOP LIGHT
10 A (6)	FRT FOG LIGHT, CORNERING LAMP
10 A (7)	TAIL LIGHT
15 A (8)	ENG.(B1)
15 A (9)	ENG.(B2)
15 A (10)	FRONT WIPER & WASHER
10 A (11)	TURN LIGHT
10 A (12)	H/LAMP LEVEL
(13)	—
(14)	—
15 A (15)	AUDIO (IG), CIGAR LIGHTER
10 A (16)	METER
(17)	—
(18)	—
15 A (19)	HORN, HAZARD
10 A (20)	ABS (IG)

(21)	—
10 A (22)	STARTER
10 A (23)	HEAD LIGHT RH
10 A (24)	HEAD LIGHT LH
15 A (25)	MARKER LAMP
15 A (26)	COND. FAN
10 A (27)	RR FOG
(28)	—

Fuse Label-for 24 Volt (4HF1 / 4HG1 / 4HE1)

15 A (1)	HEATER, AIR CON
10 A (2)	EXH. BRAKE, FUEL HEATER
15 A (3)	REAR HEATER
15 A (4)	AUDIO (B), DOOR LOCK
10 A (5)	STOP LIGHT
20 A (6)	POWER WINDOW
10 A (7)	TAIL LIGHT
10 A (8)	FRT FOG LIGHT, CORNERING LAMP
10 A (9)	ENG. (IG)
	FUEL CUT
15 A (10)	FRONT WIPER & WASHER
10 A (11)	TURN LIGHT
10 A (12)	H/LAMP LEVEL
10 A (13)	ENG. STOP
(14)	—
15 A (15)	AUDIO (IG), CIGAR LIGHTER
10 A (16)	METER
(17)	—

15 A (18)	GENERATOR
15 A (19)	ENG. (B)
15 A (20)	HORN, HAZARD
10 A (21)	ABS (IG)
10 A (22)	STARTER
10 A (23)	HEAD LIGHT RH
10 A (24)	HEAD LIGHT LH
15 A (25)	MARKER LAMP
15 A (26)	COND. FAN
10 A (27)	RR FOG
(28)	—
20 A (29)	PTO
10 A (30)	PTO
10 A (31)	PTO

Fuse Label-for 24 Volt (4HK1)

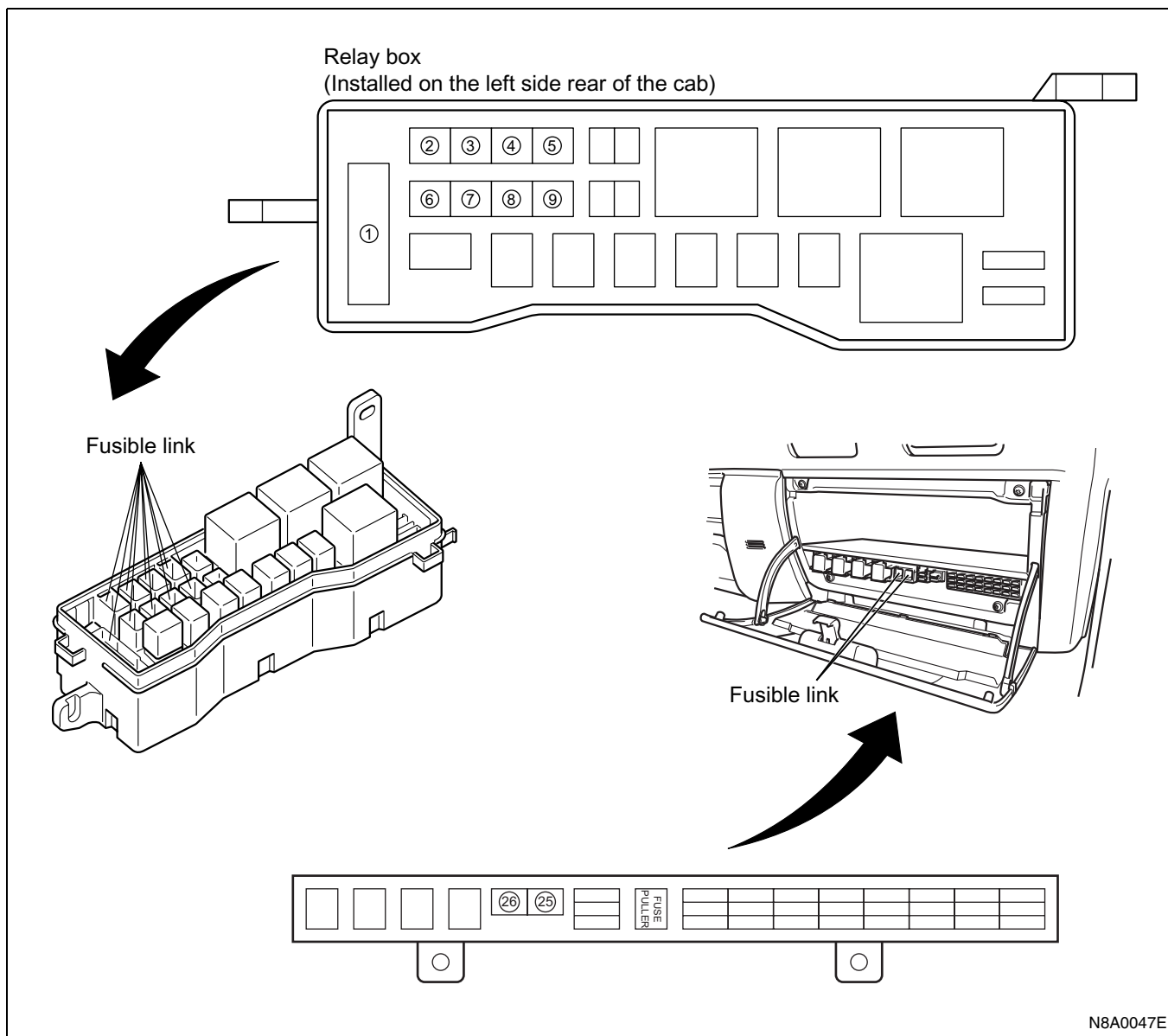
15 A (1)	HEATER, AIR CON
10 A (2)	FUEL HEATER
15 A (3)	REAR HEATER
15 A (4)	AUDIO (B), DOOR LOCK
10 A (5)	STOP LIGHT
20 A (6)	POWER WINDOW
10 A (7)	TAIL LIGHT
10 A (8)	FRT FOG LIGHT
10 A (9)	ENG. (IG)
15 A (10)	FRONT WIPER & WASHER

10 A (11)	TURN LIGHT
10 A (12)	H/LAMP LEVEL
10 A (13)	NEES (B)
(14)	—
15 A (15)	AUDIO (IG), CIGAR LIGHTER
10 A (16)	METER
10 A (17)	NEES (IG)
	HSA
10 A (18)	SRS
10 A (19)	ENG. (BACK UP) HSA
15 A (20)	HORN, HAZARD
10 A (21)	ABS (IG)
10 A (22)	STARTER
10 A (23)	HEAD LIGHT RH
10 A (24)	HEAD LIGHT LH
15 A (25)	MARKER LAMP
15 A (26)	COND. FAN
10 A (27)	RR FOG
10 A (28)	ECM. ENG.

Notice:

The fuse numbers (1) — (31) indicated on the fuse labels are expressed as F-1 — F-31 in the circuit diagrams of this manual.

Fusible Link



For 12 Volt (4JB1)

100 A (1)	MAIN
50 A (2)	KEY
60 A (3)	GLOW
30 A (4)	HEAD LAMP
(5)	—
(6)	—
(7)	—
60 A (8)	STARTER

60 A (9)	ABS
30 A (25)	HEATER
30 A (26)	POWER WINDOW

For 12 Volt (4HG1 / 4HE1)

100 A (1)	MAIN
50 A (2)	KEY
60 A (3)	GLOW

30 A (4)	HEAD LAMP
(5)	—
(6)	—
(7)	—
60 A (8)	STARTER
(9)	—
30 A (25)	HEATER
30 A (26)	POWER WINDOW

For 12 Volt (4JH1)

100 A (1)	MAIN
50 A (2)	KEY
60 A (3)	GLOW
30 A (4)	HEAD LAMP
(5)	—
(6)	—
(7)	—
60 A (8)	STARTER
60 A (9)	ABS
30 A (25)	HEATER
30 A (26)	POWER WINDOW

For 24 Volt (4HF1 / 4HG1 / 4HE1)

100 A / 120 A (1)	MAIN
40 A (2)	KEY
60 A (3)	GLOW
30 A (4)	HEAD LAMP
(5)	—
(6)	—

(7)	—
60 A (8)	STARTER
40 A (9)	ABS

For 24 Volt (4HK1)

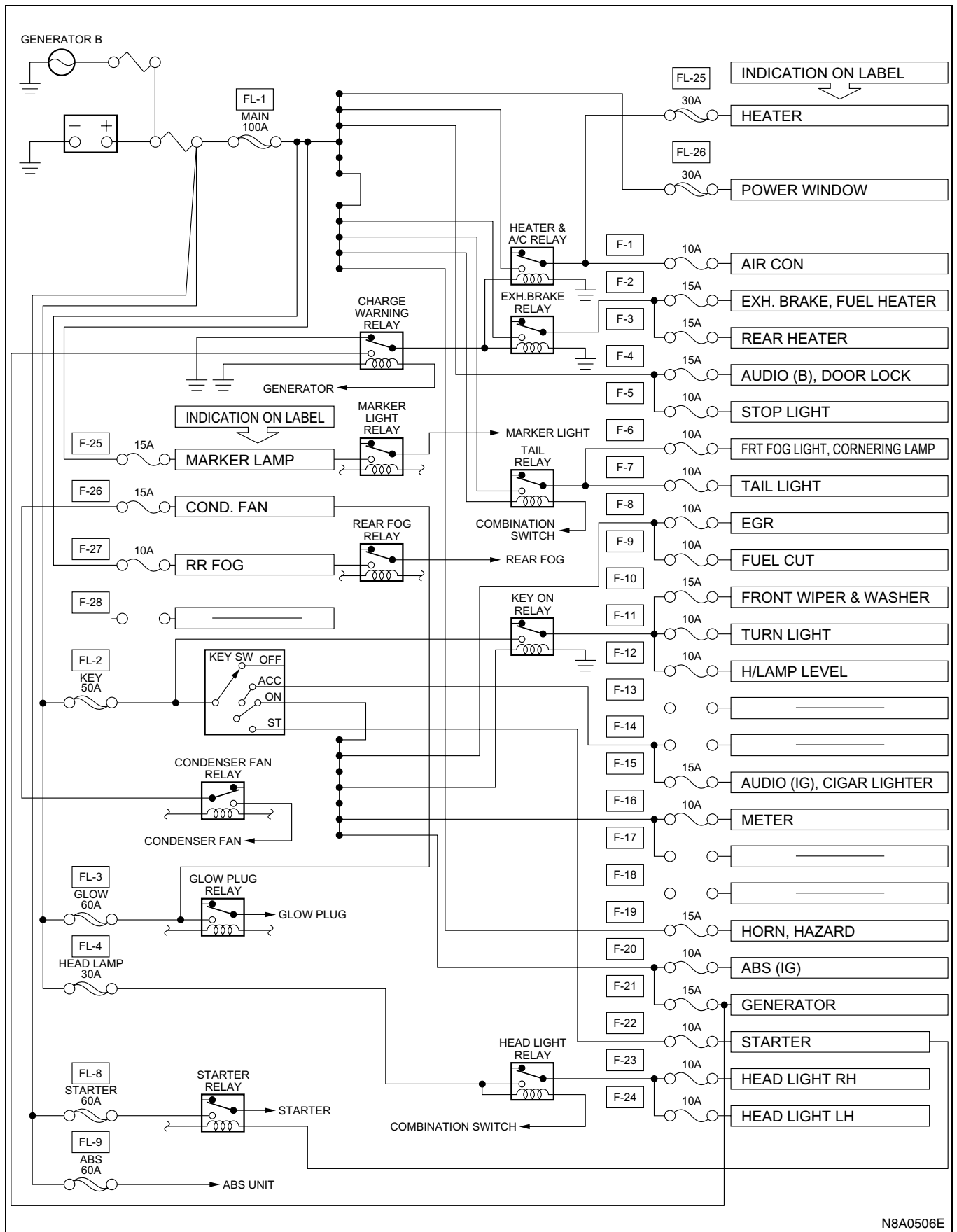
100 A / 120 A (1)	MAIN
40 A (2)	KEY
60 A (3)	GLOW
30 A (4)	HEAD LAMP
40 A (5)	ECM. ENG.
60 A (6)	CERAMIC HEATER
60 A (7)	NEES
60 A (8)	STARTER
40 A (9)	ABS

Notice:

The fusible link numbers (1) — (26) are expressed as FL-1 — FL-26 in the circuit diagrams of this manual.

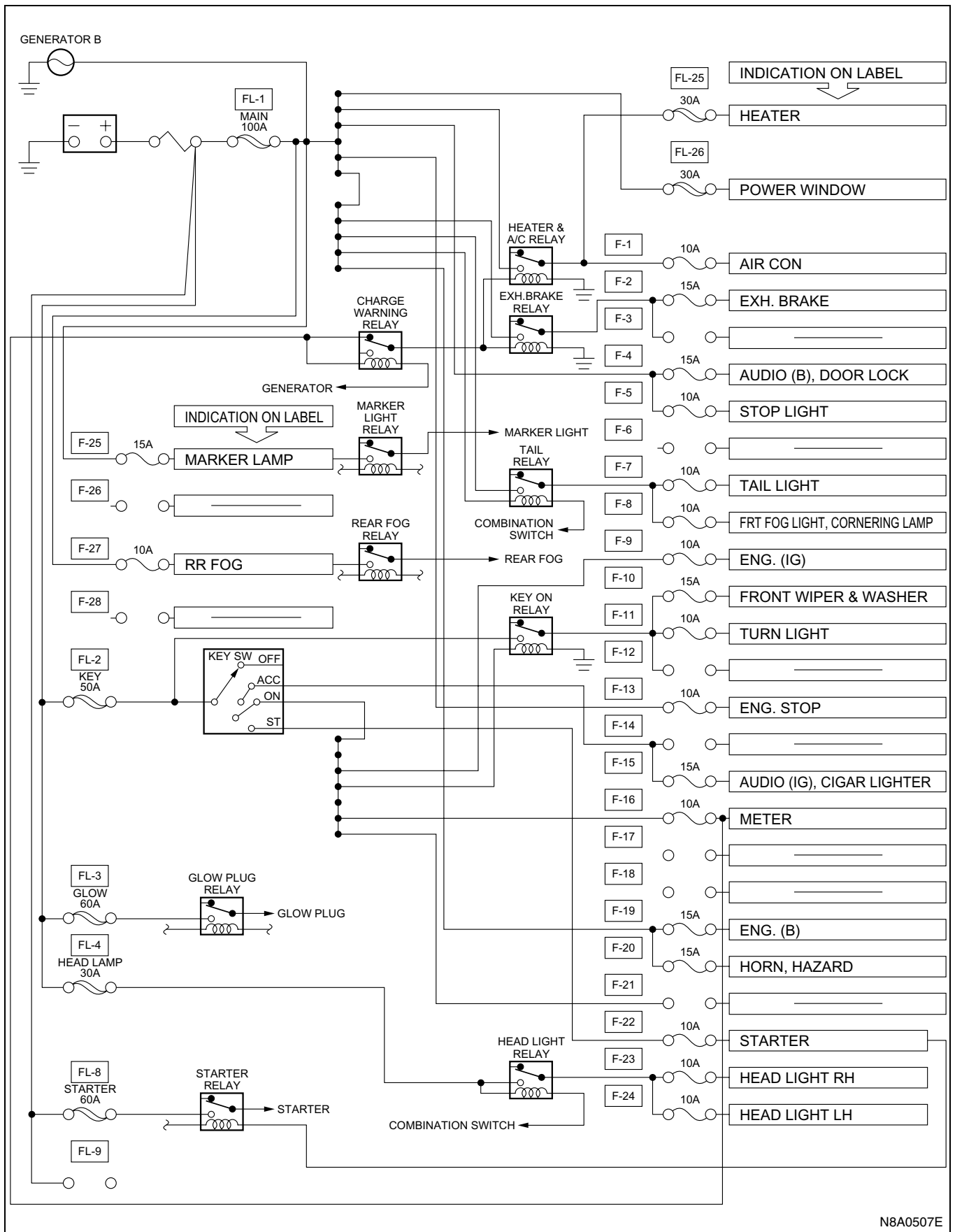
Fuse Block Circuit

For 12 Volt-4JB1 Engine



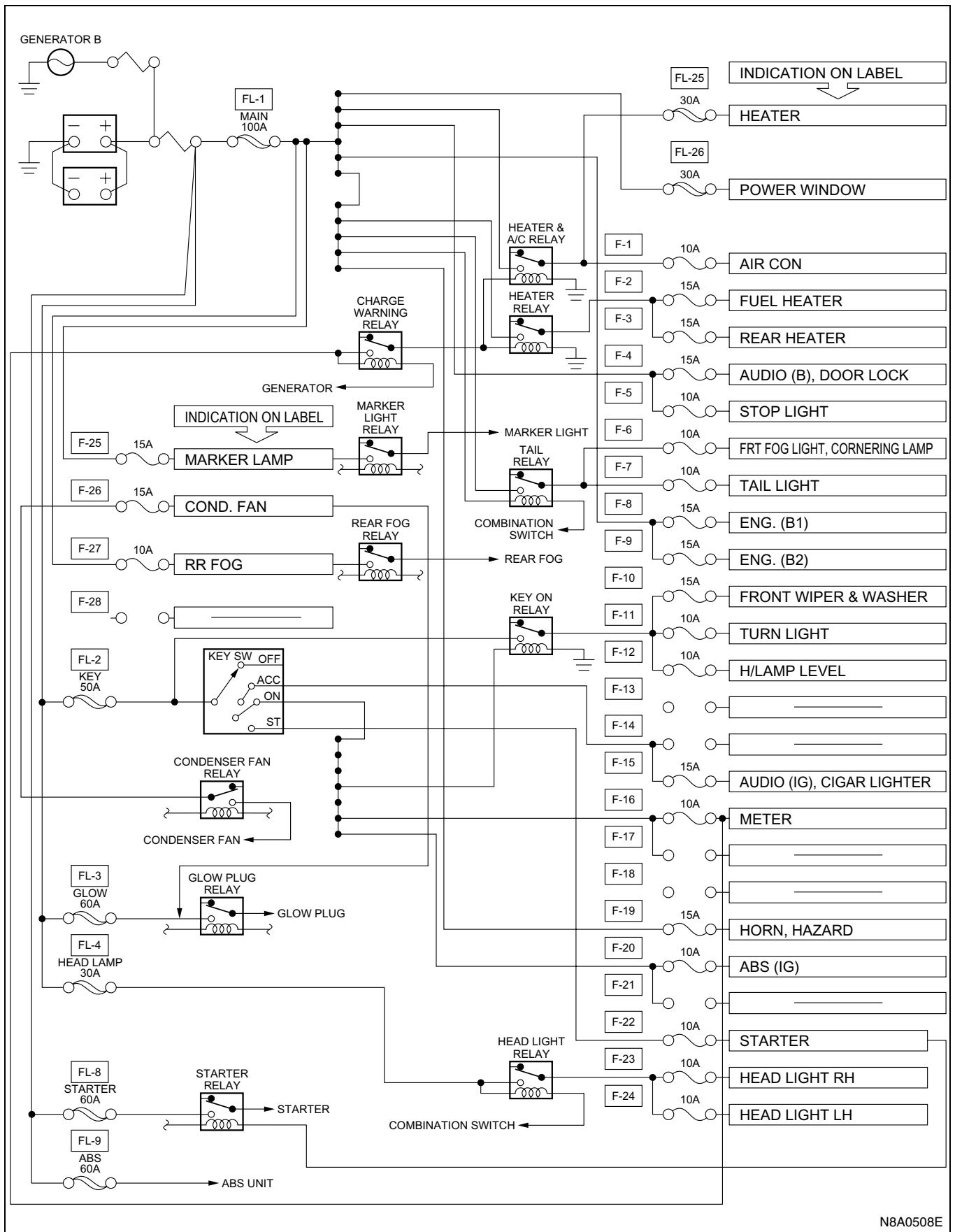
N8A0506E

For 12 Volt-4HG1 / 4HE1 Engine



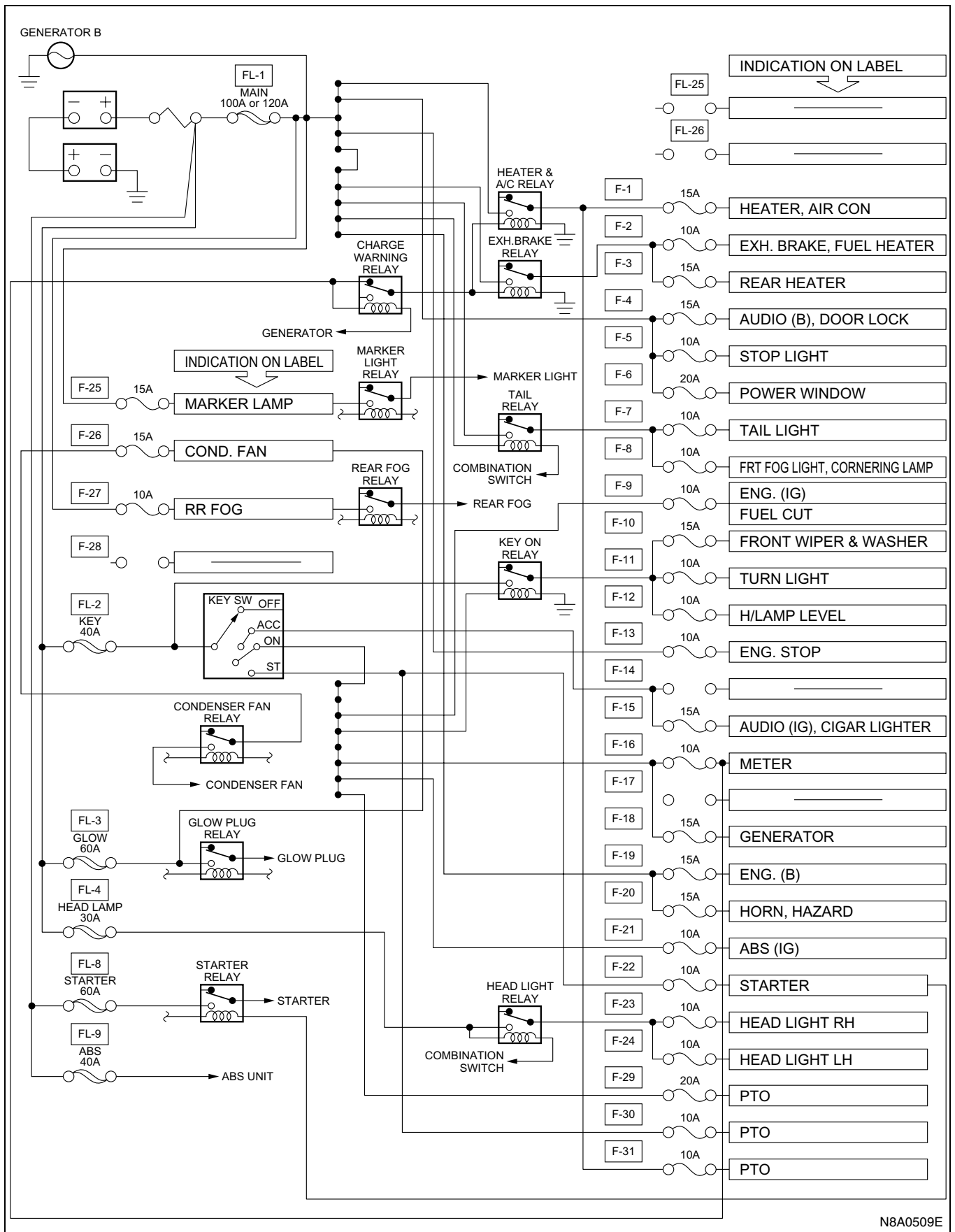
N8A0507E

For 12 Volt-4JH1 Engine



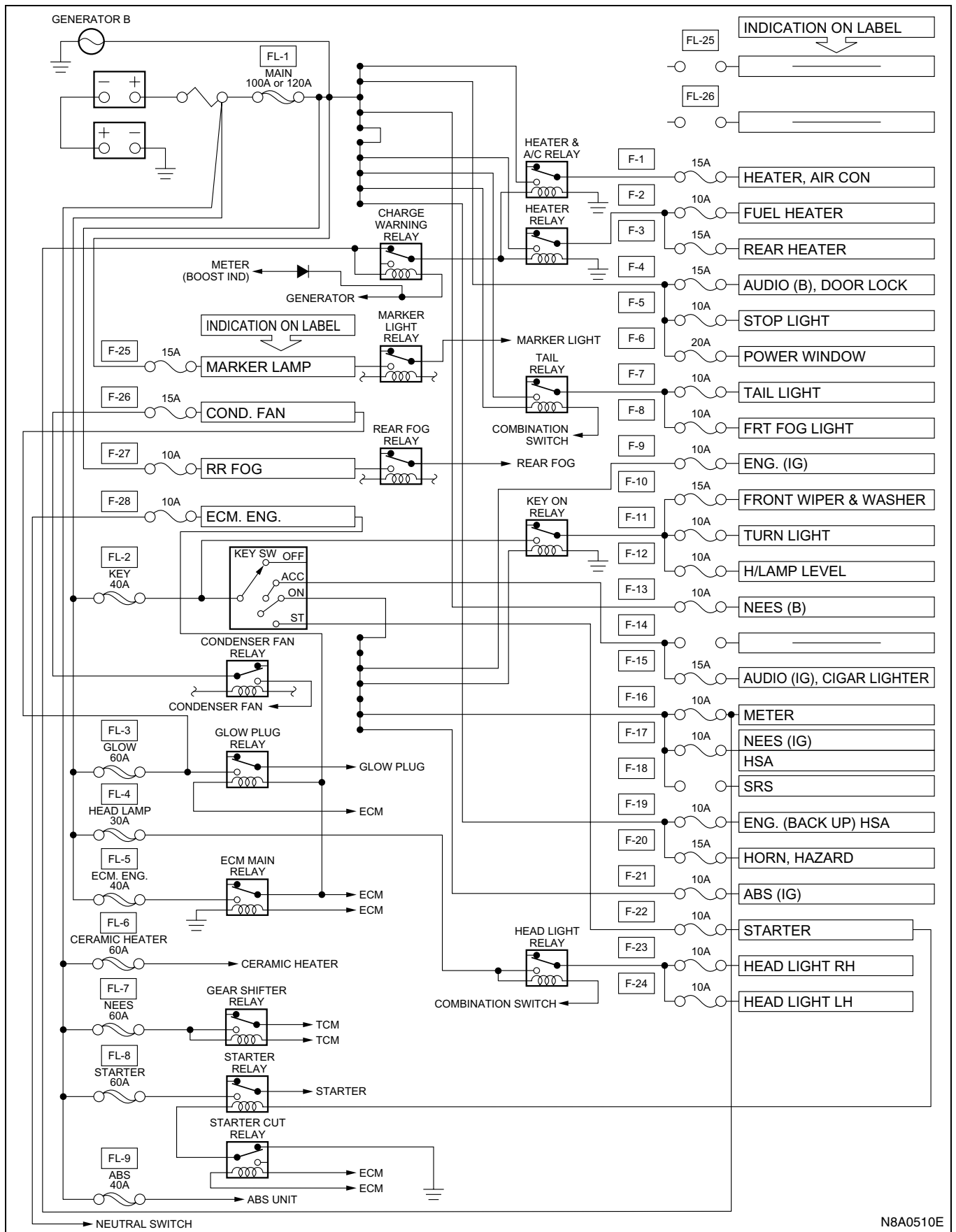
N8A0508E

For 24 Volt-4HF1 / 4HG1 / 4HE1 Engine



N8A0509E

For 24 Volt-4HK1 Engine



Reference Table of Fuse and Circuit Breaker

Fuse

12 Volt 4JB1 Engine

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-1	10 A	AIR CON	A/C switch, A/C thermo relay, Pressure switch, Magnetic clutch, VSV: FICD, Electronic thermostat
F-2	15 A	EXH. BRAKE, FUEL HEATER	Exhaust brake switch, Exhaust brake control relay, Exhaust brake magnetic valve, Clutch switch, Accel switch, Fuel heater
F-3	15 A	REAR HEATER	Rear heater, Rear heater switch
F-4	15 A	AUDIO (B), DOOR LOCK	Radio & clock, Dome light switch, Dome light, Door switch (RH & LH), Door lock switch, Door lock actuator, Door lock controller, Speedometer, Key cylinder switch, Key remind buzzer
F-5	10 A	STOP LIGHT	Stoplight switch, Stoplight
F-6	10 A	FRT FOG LIGHT, CORNERING LAMP	Fog light switch, Fog light, Lighting switch, Cornering light relay, Cornering light, Cornering light switch
F-7	10 A	TAIL LIGHT	Tail relay, Illumination light(s), Clearance light(s), Tail light(s)
F-8	10 A	EGR	ECM ignition
F-9	10 A	FUEL CUT	Fuel cut solenoid
F-10	15 A	FRONT WIPER & WASHER	Wiper & Washer switch, Wiper motor, Washer motor, Intermittent relay
F-11	10 A	TURN LIGHT	Flasher unit, Front turn signal light, Rear turn signal light, Turn signal light switch, Hazard warning switch
F-12	10 A	H/LAMP LEVEL	Headlight leveling switch, Headlight leveling motor (actuator)
F-13	—	—	—
F-14	—	—	—
F-15	15 A	AUDIO (IG), CIGAR LIGHTER	Radio, Cigar lighter
F-16	10 A	METER	Exhaust brake control relay, CSD Relay, Key remind buzzer, Backup light switch, Backup light, Neutral switch, Starter relay, QOS-II controller, QOS-III controller, Glow relay, Glow-1 relay, Glow-2 relay, Glow indicator (Meter), Coolant temperature gauge, Thermo unit, Vehicle speed sensor (Installed on the meter assembly & Transmission), Meter assembly, Power window relay, Cornering light relay
F-17	—	—	—
F-18	—	—	—
F-19	15 A	HORN, HAZARD	Horn, Horn relay, Horn switch, Flasher unit, Hazard warning switch
F-20	10 A	ABS (IG)	ABS
F-21	15 A	GENERATOR	Generator
F-22	10 A	STARTER	Starter relay, QOS-II controller, QOS-III controller
F-23	10 A	HEAD LIGHT RH	Headlight (RH), Dimmer relay, High beam indicator light
F-24	10 A	HEAD LIGHT LH	Headlight (LH), Dimmer relay
F-25	15 A	MARKER LAMP	Marker light, Marker light relay
F-26	15 A	COND. FAN	Condenser fan
F-27	10 A	RR FOG	Rear fog light switch, Rear fog light relay

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-28	—	—	—

12 Volt 4HG1 / 4HE1 Engine

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-1	10 A	AIR CON	A/C switch, A/C thermo relay, Pressure switch, Magnetic clutch, VSV: FICD, Electronic thermostat
F-2	15 A	EXH. BRAKE	Exhaust brake switch, Exhaust brake control relay, Exhaust brake magnetic valve, Clutch switch, Accel switch
F-3	—	—	—
F-4	15 A	AUDIO (B), DOOR LOCK	Radio & clock, Dome light switch, Dome light, Door switch (RH & LH), Door lock switch, Door lock actuator, Door lock controller, Speedometer, Key cylinder switch, Key remind buzzer
F-5	10 A	STOP LIGHT	Stoplight switch, Stoplight
F-6	—	—	—
F-7	10 A	TAIL LIGHT	Tail relay, Illumination light(s), Clearance light(s), Tail light(s)
F-8	10 A	FRT FOG LIGHT, CORNERING LAMP	Fog light switch, Fog light, Lighting switch, Cornering light relay, Cornering light, Cornering light switch
F-9	10 A	ENG. (IG)	ECM ignition
F-10	15 A	FRONT WIPER & WASHER	Wiper & Washer switch, Wiper motor, Washer motor, Intermittent relay
F-11	10 A	TURN LIGHT	Flasher unit, Front turn signal light, Rear turn signal light, Turn signal light switch, Hazard warning switch
F-12	—	—	—
F-13	10 A	ENG. STOP	Engine stop motor
F-14	—	—	—
F-15	15 A	AUDIO (IG), CIGAR LIGHTER	Radio, Cigar lighter
F-16	10 A	METER	Exhaust brake control relay, CSD Relay, Key remind buzzer, Backup light switch, Backup light, Inhibitor switch, Neutral switch, Starter relay, QOS-II controller, QOS-III controller, Glow relay, Glow-1 relay, Glow-2 relay, Glow indicator (Meter), Coolant temperature gauge, Thermo unit, Vehicle speed sensor (Installed on the meter assembly & Transmission), Meter assembly, Power window relay, Cornering light relay
F-17	—	—	—
F-18	—	—	—
F-19	15 A	ENG. (B)	ECM battery
F-20	15 A	HORN, HAZARD	Horn, Horn relay, Horn switch, Flasher unit, Hazard warning switch
F-21	—	—	—
F-22	10 A	STARTER	Starter relay, Inhibitor switch, QOS-II controller, QOS-III controller
F-23	10 A	HEAD LIGHT RH	Headlight (RH), Dimmer relay, High beam indicator light
F-24	10 A	HEAD LIGHT LH	Headlight (LH), Dimmer relay
F-25	15 A	MARKER LAMP	Marker light, Marker light relay

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-26	—	—	—
F-27	10 A	RR FOG	Rear fog light switch, Rear fog light relay
F-28	—	—	—

12 Volt 4JH1 Engine

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-1	10 A	AIR CON	A/C switch, A/C thermo relay, Pressure switch, Magnetic clutch, VSV: FICD, Electronic thermostat
F-2	15 A	FUEL HEATER	Fuel heater
F-3	15 A	REAR HEATER	Rear heater, Rear heater switch
F-4	15 A	AUDIO (B), DOOR LOCK	Radio & clock, Dome light switch, Dome light, Door switch (RH & LH), Door lock switch, Door lock actuator, Door lock controller, Speedometer, Key cylinder switch, Key remind buzzer
F-5	10 A	STOP LIGHT	Stoplight switch, Stoplight
F-6	10 A	FRT FOG LIGHT, CORNERING LAMP	Fog light switch, Fog light, Lighting switch, Cornering light relay, Cornering light, Cornering light switch
F-7	10 A	TAIL LIGHT	Tail relay, Illumination light(s), Clearance light(s), Tail light(s)
F-8	15 A	ENG. (B1)	ECM battery
F-9	15 A	ENG. (B2)	ECM battery
F-10	15 A	FRONT WIPER & WASHER	Wiper & Washer switch, Wiper motor, Washer motor, Intermittent relay
F-11	10 A	TURN LIGHT	Flasher unit, Front turn signal light, Rear turn signal light, Turn signal light switch, Hazard warning switch
F-12	10 A	H/LAMP LEVEL	Headlight leveling switch, Headlight leveling motor (actuator)
F-13	—	—	—
F-14	—	—	—
F-15	15 A	AUDIO (IG), CIGAR LIGHTER	Radio, Cigar lighter
F-16	10 A	METER	Exhaust brake control relay, CSD Relay, Key remind buzzer, Backup light switch, Backup light, Neutral switch, Starter relay, QOS-II controller, QOS-III controller, Glow relay, Glow-1 relay, Glow-2 relay, Glow indicator (Meter), Coolant temperature gauge, Thermo unit, Vehicle speed sensor (Installed on the meter assembly & Transmission), Meter assembly, Power window relay, Cornering light relay
F-17	—	—	—
F-18	—	—	—
F-19	15 A	HORN, HAZARD	Horn, Horn relay, Horn switch, Flasher unit, Hazard warning switch
F-20	10 A	ABS (IG)	ABS
F-21	—	—	—
F-22	10 A	STARTER	Starter relay, QOS-II controller, QOS-III controller
F-23	10 A	HEAD LIGHT RH	Headlight (RH), Dimmer relay, High beam indicator light
F-24	10 A	HEAD LIGHT LH	Headlight (LH), Dimmer relay
F-25	15 A	MARKER LAMP	Marker light, Marker light relay

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-26	15 A	COND. FAN	Condenser fan
F-27	10 A	RR FOG	Rear fog light switch, Rear fog light relay
F-28	—	—	—

24 Volt 4HF1 / 4HG1 / 4HE1 Engine

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-1	15 A	HEATER, AIR CON	Blower motor, Blower resistor, Fan switch, A/C switch, A/C thermo relay, Pressure switch, A/C cut relay, Thermo switch (A/C cut), VSV: FICD, Electronic thermostat
F-2	10 A	EXH. BRAKE, FUEL HEATER	Exhaust brake switch, Exhaust brake control relay, Exhaust brake magnetic valve, Clutch switch, Accel switch, Fuel heater
F-3	15 A	REAR HEATER	Rear heater, Rear heater switch
F-4	15 A	AUDIO (B), DOOR LOCK	Radio & clock, Dome light switch, Dome light, Door switch (RH & LH), Door lock switch, Door lock actuator, Door lock controller, Speedometer, Key cylinder switch, Key remind buzzer
F-5	10 A	STOP LIGHT	Stoplight switch, Stoplight
F-6	20 A	POWER WINDOW	Power window
F-7	10 A	TAIL LIGHT	Tail relay, Illumination light(s), Clearance light(s), Tail light(s)
F-8	10 A	FRT FOG LIGHT, CORNERING LAMP	Fog light switch, Fog light, Lighting switch, Cornering light relay, Cornering light, Cornering light switch
F-9	10 A	ENG. (IG)	ECM ignition (EXCEPT 4HF1-2)
		FUEL CUT	Fuel cut solenoid (4HF1-2)
F-10	15 A	FRONT WIPER & WASHER	Wiper & Washer switch, Wiper motor, Washer motor, Intermittent relay
F-11	10 A	TURN LIGHT	Flasher unit, Front turn signal light, Rear turn signal light, Turn signal light switch, Hazard warning switch
F-12	10 A	H/LAMP LEVEL	Headlight leveling switch, Headlight leveling motor (actuator)
F-13	10 A	ENG. STOP	Engine stop motor
F-14	—	—	—
F-15	15 A	AUDIO (IG), CIGAR LIGHTER	Radio, Cigar lighter
F-16	10 A	METER	Exhaust brake control relay, CSD Relay, Key remind buzzer, Backup light switch, Backup light, Neutral switch, Starter relay, QOS-II controller, QOS-III controller, Glow relay, Glow-1 relay, Glow-2 relay, Glow indicator (Meter), Coolant temperature gauge, Thermo unit, Vehicle speed sensor (Installed on the meter assembly & Transmission), Meter assembly, Power window relay, Cornering light relay
F-17	—	—	—
F-18	15 A	GENERATOR	Generator
F-19	15 A	ENG. (B)	ECM battery (4HG1-T)
F-20	15 A	HORN, HAZARD	Horn, Horn relay, Horn switch, Flasher unit, Hazard warning switch
F-21	10 A	ABS (IG)	ABS
F-22	10 A	STARTER	Starter relay, QOS-II controller, QOS-III controller

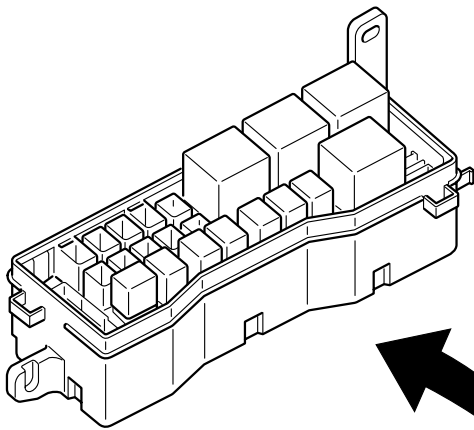
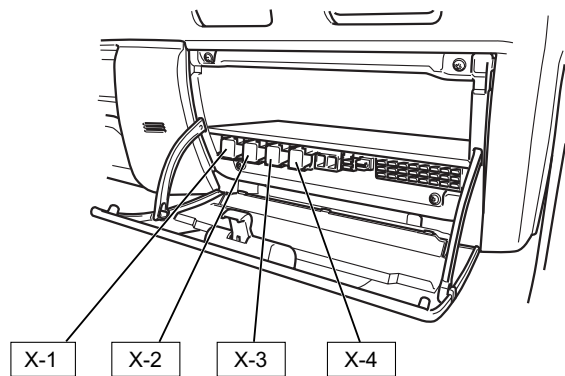
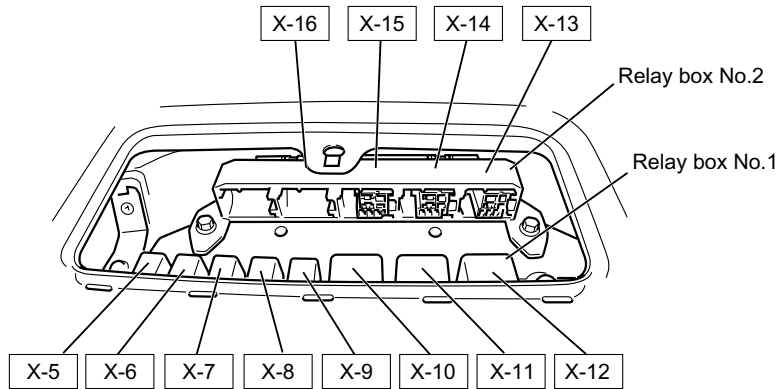
Fuse No.	Capacity	Indication on label	Main parts (Load)
F-23	10 A	HEAD LIGHT RH	Headlight (RH), Dimmer relay, High beam indicator light
F-24	10 A	HEAD LIGHT LH	Headlight (LH), Dimmer relay
F-25	15 A	MARKER LAMP	Marker light, Marker light relay
F-26	15 A	COND. FAN	Condenser fan
F-27	10 A	RR FOG	Rear fog light switch, Rear fog light relay
F-28	—	—	—
F-29	20 A	PTO	PTO main relay (Electronic control type PTO)
F-30	10 A	PTO	PTO cut relay (Electronic control type PTO)
F-31	10 A	PTO	PTO cut relay (Electronic control type PTO)

24 Volt 4HK1 Engine

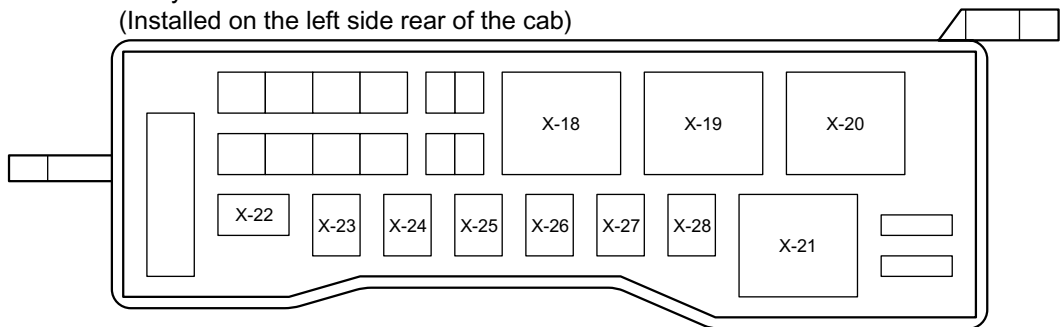
Fuse No.	Capacity	Indication on label	Main parts (Load)
F-1	15 A	HEATER, AIR CON	Blower motor, Blower resistor, Fan switch, A/C switch, A/C thermo relay, Pressure switch, VSV: FICD, Electronic thermostat, A/C compressor, A/C thermo relay, Condenser fan, ECM (A/C compressor SIG.)
F-2	10 A	FUEL HEATER	Exhaust brake magnetic valve, Clutch switch, Accel switch, Fuel heater, VSV: Intake throttle, ABS (Exhaust brake SIG.), Ceramic heater relay
F-3	15 A	REAR HEATER	Rear heater, Rear heater switch
F-4	15 A	AUDIO (B), DOOR LOCK	Radio & clock, Dome light switch, Dome light, Door switch (RH & LH), Door lock switch, Door lock actuator, Door lock controller, Speedometer, Key cylinder switch, Key remind buzzer, Side turn signal light(s)
F-5	10 A	STOP LIGHT	Stoplight switch, Stoplight, ABS (Stop on SIG.), ECM (brake on SIG.)
F-6	20 A	POWER WINDOW	Power window
F-7	10 A	TAIL LIGHT	Tail relay, Illumination light(s), Clearance light(s), Tail light(s), Roof marker light, License light(s), Marker light relay
F-8	10 A	FRT FOG LIGHT	Fog light switch, Fog light, Lighting switch, Cornering light relay, Cornering light, Cornering light switch
F-9	10 A	ENG. (IG)	ECM (IG SIG.), Starter cut relay, ECM (Exhaust brake SIG.), Exhaust brake indicator, ECM (brake off SIG.), ECM (clutch on SIG.), ALDL connector
F-10	15 A	FRONT WIPER & WASHER	Wiper & Washer switch, Wiper motor, Washer motor, Intermit-tent relay
F-11	10 A	TURN LIGHT	Flasher unit, Front turn signal light, Rear turn signal light, Turn signal light switch, Hazard warning switch, Side turn signal light relay
F-12	10 A	H/LAMP LEVEL	Headlight leveling switch, Headlight leveling motor (actuator)
F-13	10 A	NEES (B)	Smoother
F-14	—	—	—
F-15	15 A	AUDIO (IG), CIGAR LIGHTER	Radio, Cigar lighter, Digital clock

Fuse No.	Capacity	Indication on label	Main parts (Load)
F-16	10 A	METER	CSD Relay, Key remind buzzer, Backup light switch, Backup light, Neutral switch, Starter relay, QOS-II controller, Glow relay, Glow indicator (Meter), Coolant temperature gauge, Thermo unit, Vehicle speed sensor (Installed on the meter assembly & Transmission), Meter assembly, Power window relay, Cornering light relay, Backup buzzer, ABS indicator relay, Charge relay, Heater A/C relay, VSV: 2WD (4WD), VSV: 4WD (4WD), 4WD relay
F-17	10 A	NEES (IG)	Smoother (IGN SIG.)
		HSA	—
F-18	—	SRS	—
F-19	10 A	ENG. (BACK UP) HSA	ECM (Back up)
F-20	15 A	HORN, HAZARD	Horn, Horn relay, Horn switch, Flasher unit, Hazard warning switch, Turn light(s), Side turn signal light relay
F-21	10 A	ABS (IG)	ABS (IGN SIG.)
F-22	10 A	STARTER	Starter relay, QOS-II controller
F-23	10 A	HEAD LIGHT RH	Headlight (RH), Dimmer relay, High beam indicator light
F-24	10 A	HEAD LIGHT LH	Headlight (LH), Dimmer relay
F-25	15 A	MARKER LAMP	Marker light, Marker light relay
F-26	15 A	COND. FAN	Condenser fan
F-27	10 A	RR FOG	Rear fog light switch, Rear fog light relay
F-28	10 A	ECM. ENG.	ECM

Relay Location



Relay box
(Installed on the left side rear of the cab)



N8A0054E

Relay List

○: Standard, □: Option

		X-1		X-2	X-3	X-4	X-5		X-6
		Charge warning	Key ON	Horn	Lamp	Tail	ABS IND.	Smoother main	Dimmer
12 V	NHR55	—	○	○	○	○	—	—	○
	NKR55	—	○	○	○	○	—	—	○
	NKR69	—	○	○	○	○	—	—	○
	NPR71	—	○	○	○	○	—	—	○
	NKR77	—	○	○	○	○	□	—	○
	NPR77	—	○	○	○	○	□	—	○
	NKR77 for Taiwan	—	○	○	○	○	—	—	○
24 V	NKR66	○	—	○	○	○	—	—	○
	NPR66	○	—	○	○	○	□	—	○
	NQR66	○	—	○	○	○	□	—	○
	NPR70	○	—	○	○	○	—	—	○
	NQR70	○	—	○	○	○	—	—	○
	NKR71	○	—	○	○	○	—	—	○
	NQR71 with turbocharger	○	—	○	○	○	□	—	○
	NPS71	○	—	○	○	○	—	—	○
	NPR71	○	—	○	○	○	—	—	○
	NQR71 w/o turbocharger	○	—	○	○	○	—	—	○
	NPR75	○	—	○	○	○	—	□	○
NQR75	○	—	○	○	○	—	□	○	

		X-7	X-8		X-9	X-10	X-11		X-12
		Power window	Exh. brake	Heater	Cornering lamp	Thermo A/C	Charge warning	Key ON	Heater & A/C
12 V	NHR55	☐	☐	—	○	☐	○	—	○
	NKR55	☐	☐	—	○	☐	○	—	○
	NKR69	☐	☐	—	○	☐	○	—	○
	NPR71	☐	○	—	○	☐	○	—	○
	NKR77	☐	—	—	☐	☐	○	—	○
	NPR77	☐	—	—	☐	☐	○	—	○
	NKR77 for Taiwan	☐	—	—	○	☐	○	—	○
24 V	NKR66	☐	☐	—	○	☐	—	○	○
	NPR66	☐	○	—	○	☐	—	○	○
	NQR66	☐	○	—	○	☐	—	○	○
	NPR70	☐	○	—	○	☐	—	○	○
	NQR70	☐	○	—	○	☐	—	○	○
	NKR71	☐	☐	—	○	☐	—	○	○
	NQR71 with turbocharger	☐	○	—	○	☐	—	○	○
	NPS71	☐	○	—	○	☐	—	○	○
	NPR71	☐	○	—	○	☐	—	○	○
	NQR71 w/o turbocharger	☐	○	—	○	☐	—	○	○
	NPR75	☐	—	○	☐*	☐	—	○	○
NQR75	☐	—	○	☐*	☐	—	○	○	

* : Except EC / Turkey

		X-13		X-14				X-15	X-16
		Heater	Buzzer cancel	ECM	PTO main	Timing	Smoother emergency	PTO solenoid, M/T	PTO cut
12 V	NHR55	—	—	—	—	—	—	—	—
	NKR55	—	—	—	—	—	—	—	—
	NKR69	—	—	—	—	—	—	—	—
	NPR71	—	—	—	—	—	—	—	—
	NKR77	○	—	○	—	—	—	—	—
	NPR77	○	—	○	—	—	—	—	—
	NKR77 for Taiwan	○	—	○	—	—	—	—	—
24 V	NKR66	—	—	—	—	—	—	—	—
	NPR66	—	□	—	—	—	—	—	—
	NQR66	—	□	—	—	—	—	—	—
	NPR70	—	□	—	—	○	—	—	—
	NQR70	—	□	—	—	○	—	—	—
	NKR71	—	—	—	—	—	—	—	—
	NQR71 with turbocharger	—	□	—	—	—	—	—	—
	NPS71	—	—	—	□	—	—	□	□
	NPR71	—	□	—	—	—	—	—	—
	NQR71 w/o turbocharger	—	□	—	—	—	—	—	—
	NPR75	—	□	○	—	—	□	—	—
NQR75	—	□	○	—	—	□	—	—	

		X-18	X-19		X-20	X-21	X-22	X-23	X-24
		ECM main	Gear shifter	Glow 2	Glow plug	Starter	Marker lamp	Rear fog	A/C COMP
12 V	NHR55	—	—	—	○	○	—	—	—
	NKR55	—	—	—	○	○	—	□	—
	NKR69	—	—	○	○	○	—	—	—
	NPR71	—	—	—	○	○	—	—	—
	NKR77	—	—	—	○	○	□ ^{*1}	□ ^{*1}	□
	NPR77	—	—	—	○	○	□ ^{*1}	□ ^{*1}	□
	NKR77 for Taiwan	—	—	—	○	○	—	—	□
24 V	NKR66	—	—	—	○	○	—	—	—
	NPR66	—	—	—	○	○	□ ^{*2}	□ ^{*2}	—
	NQR66	—	—	—	○	○	—	—	—
	NPR70	—	—	—	○	○	—	—	—
	NQR70	—	—	—	○	○	—	—	—
	NKR71	—	—	—	○	○	—	—	—
	NQR71 with turbocharger	—	—	—	○	○	□ ^{*2}	□ ^{*2}	—
	NPS71	—	—	—	○	○	—	—	—
	NPR71	—	—	—	○	○	—	—	—
	NQR71 w/o turbocharger	—	—	—	○	○	—	—	—
	NPR75	○	□	—	○	○	□ ^{*3}	□ ^{*3}	—
NQR75	○	□	—	○	○	□ ^{*3}	□ ^{*3}	—	

*1 : For EC

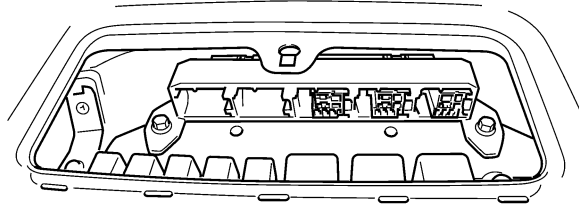
*2 : For Turkey

*3 : For EC / Turkey

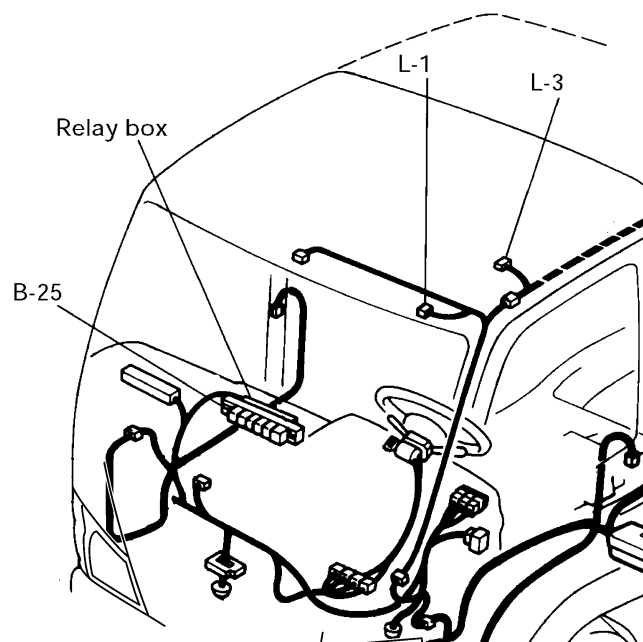
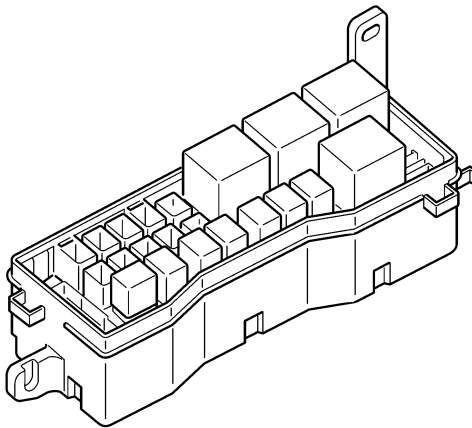
		X-24	X-25	X-26			X-27	X-28
		4WD ind. lamp	Exh. brake control	CSD	A/C ON SIGNAL	Starter cut	Condenser fan	Exh. brake cut
12V	NHR55	—	☐	○	—	—	—	—
	NKR55	—	☐	○	—	—	—	—
	NKR69	—	☐	—	—	—	—	—
	NPR71	—	○	—	—	—	—	—
	NKR77	—	—	—	☐	—	—	—
	NPR77	—	—	—	☐	—	—	—
	NKR77 for Taiwan	—	—	—	☐	—	☐	—
24V	NKR66	—	☐	—	—	—	—	—
	NPR66	—	○	—	—	—	—	☐
	NQR66	—	○	—	—	—	—	☐
	NPR70	—	○	—	—	—	☐	—
	NQR70	—	○	—	—	—	☐	—
	NKR71	—	☐	—	—	—	—	—
	NQR71 with turbocharger	—	○	—	—	—	—	☐
	NPS71	○	○	—	—	—	—	—
	NPR71	—	○	—	—	—	—	☐
	NQR71 w/o turbocharger	—	○	—	—	—	—	—
	NPR75	—	—	—	—	○	○	—
NQR75	—	—	—	—	○	○	—	

Diode Location

Relay box
(Installed on the instrument panel)



Relay box
(Installed on the cab left side rear)



N8A0055E

Connector No.	B-17	B-18	B-25	J-23	L-1	L-3
Usage	A/C Door switch	Lighting	QOS-III (Except GCC and Taiwan)	VSV: FICD (Except GCC and Taiwan)	Dome light	Dome light (Except Tai- wan)

Reference Table of Grounding Point

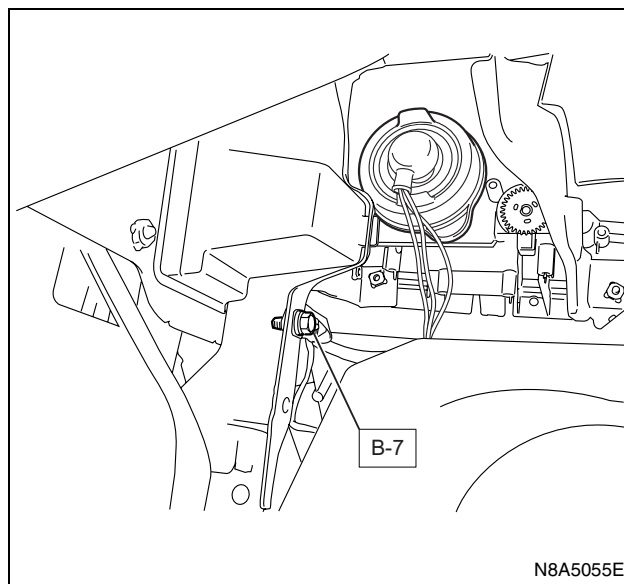
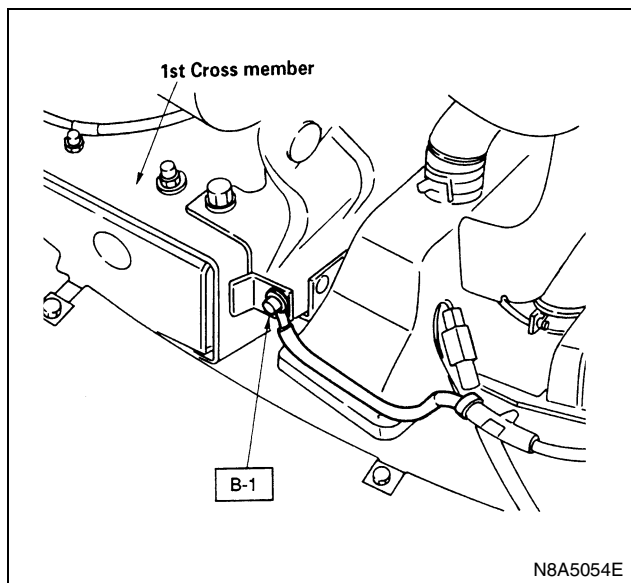
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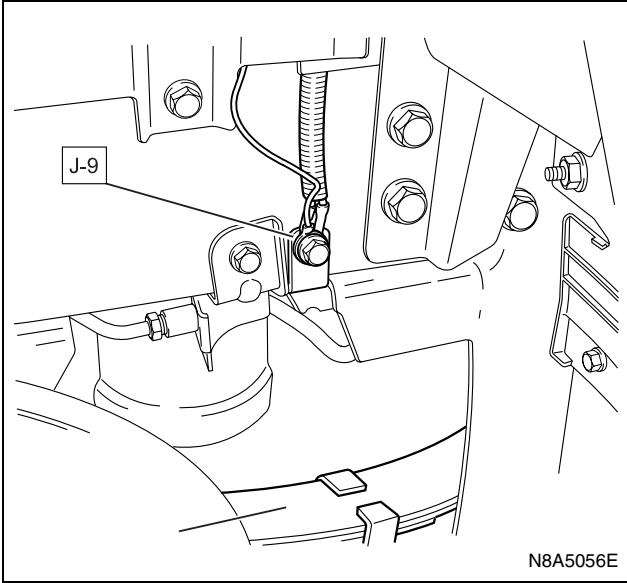
Abnormal phenomena of electrical components are considered resulted from defective grounding.

In repair, be sure to inspect grounding points and to tighten all fastening parts surrounding the grounding points.

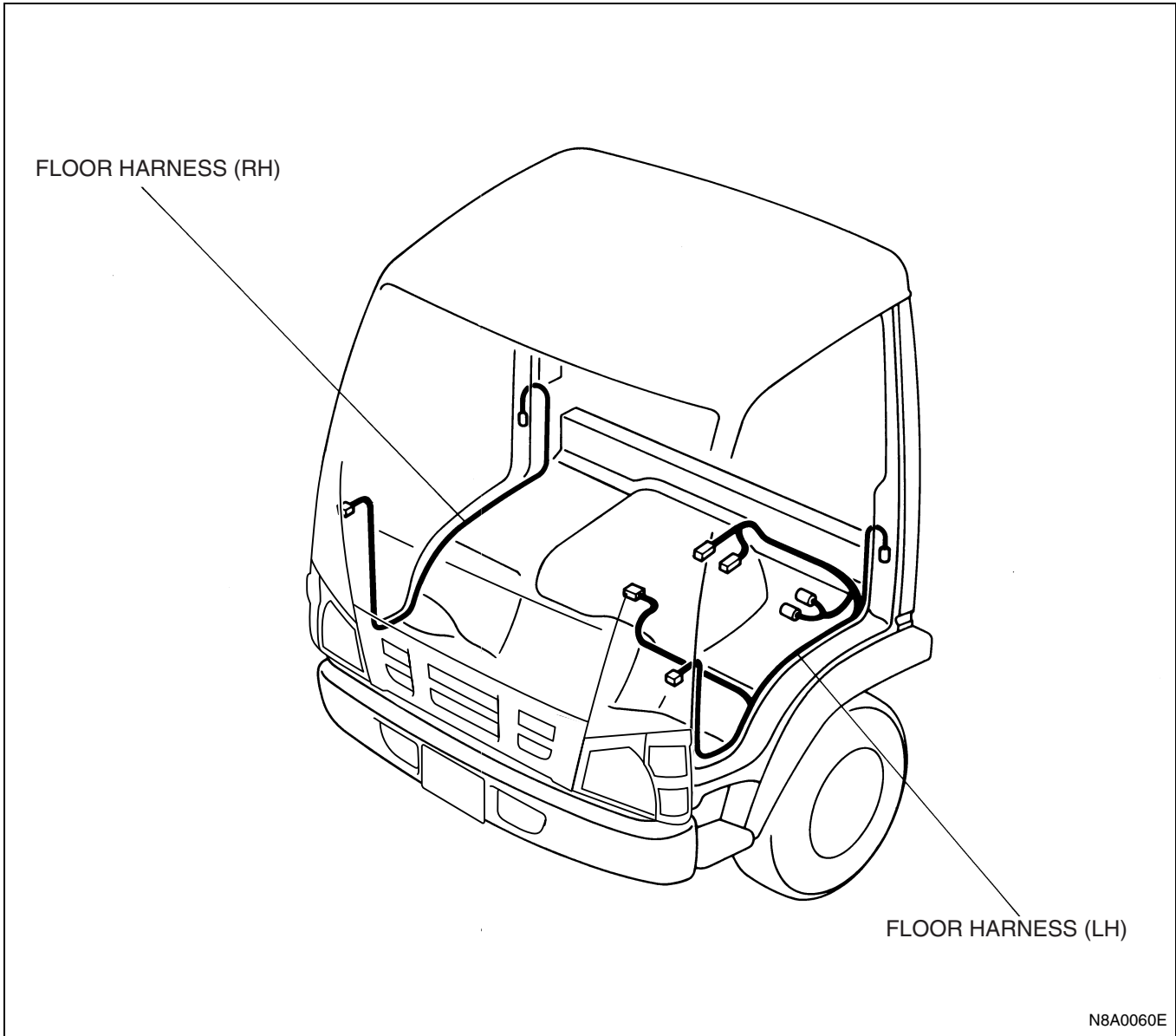
Connector No.	Cable harness name	Location	Main parts (Load)
B-1	Body harness	Frame-LH (FRT)	Vehicle speed sensor, QOS-III control unit, Turn signal indicator light, Meter, High beam indicator light, PTO lever, TCM
B-7		Headlight bracket-LH	Charge relay, Exhaust brake relay, QOS-II control unit, QOS-III control unit, Dome light switch, Key remind and back up buzzer, Meter, Brake fluid switch, Tail relay, Cornering light switch, Cornering light, Cornering light relay, Fog light switch, Fog light, Dimmer relay, Door lock switch, Door lock relay, Power window switch (RH), Power window relay, Stoplight switch, Mirror switch, Wiper motor, Washer motor intermittent relay, Radio, Cigar lighter, Heater & A/C relay, Fan switch, Horn relay, Rear heater switch, Rear heater, Radio & clock, Cigar lighter, Fan switch, Blower resistor, A/C switch, Blower motor, Electronic thermostat, Accel switch, Door lock switch, Door lock controller, Headlight leveling switch, Headlight leveling motor, Power window relay, Power window switch, QOS-III control unit, Ceramic heater relay, Emergency relay, Select switch, Emergency adjust switch, PTO-Smoother switch
J-9	Frame front harness	Frame-LH (CTR)	Marker light relay, Marker light, Water sedimenter switch, Fuel tank unit, Starter relay, Neutral switch, Fuel heater, Pressure switch, A/C thermo relay, VSV: FICD, Exhaust brake control relay, Exhaust brake magnetic valve, Accel switch, Clutch switch, VSV: intake throttle, Engine stop motor, ECM, ECM main relay, Starter cut relay, Shift 1,3,5 solenoid, Shift 2,4,R solenoid, Select solenoid License plate light, Taillight, Rear fog light, Rear turn signal light, Stoplight, Stoplight switch, Backup light

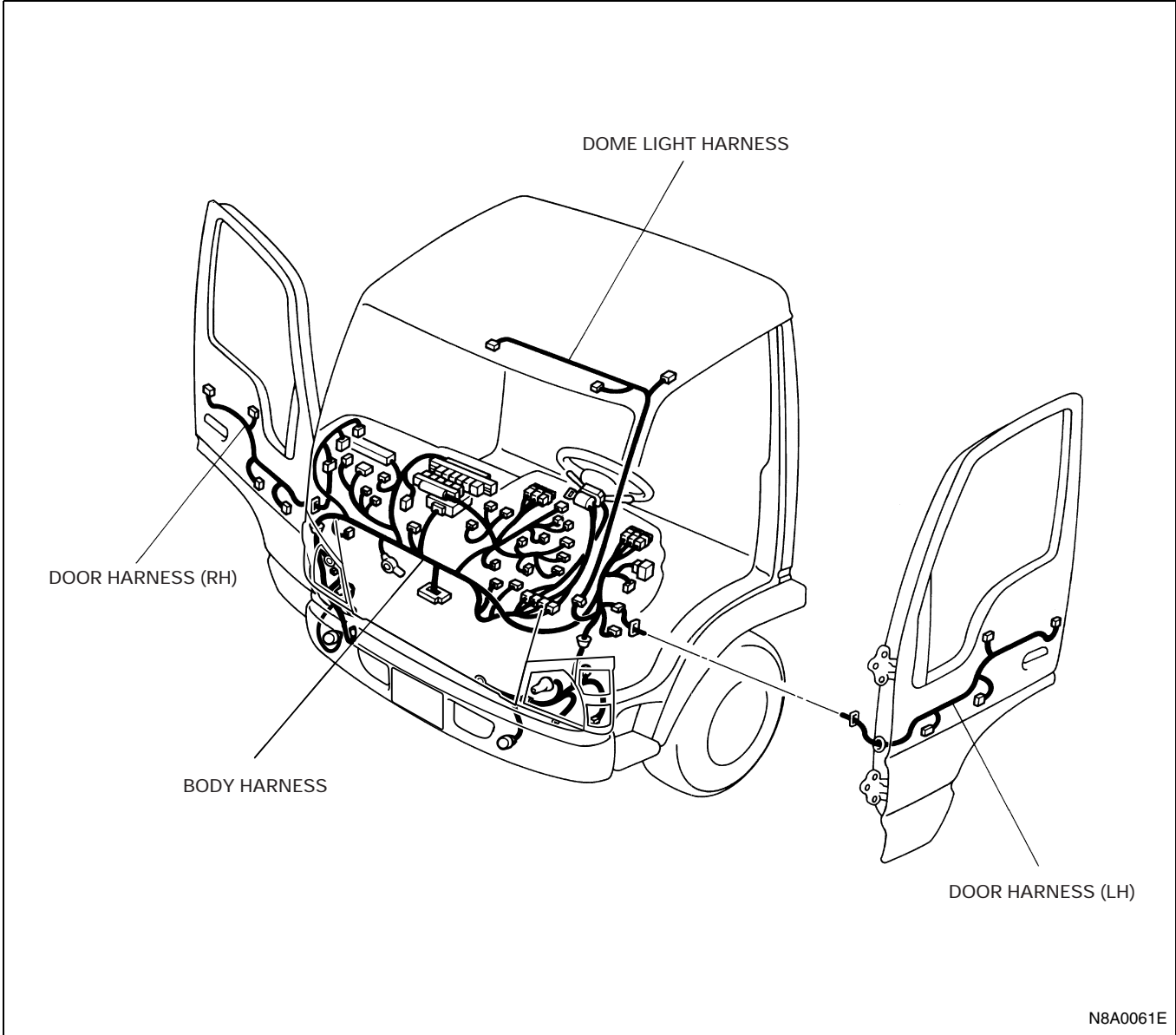
Grounding Point Location





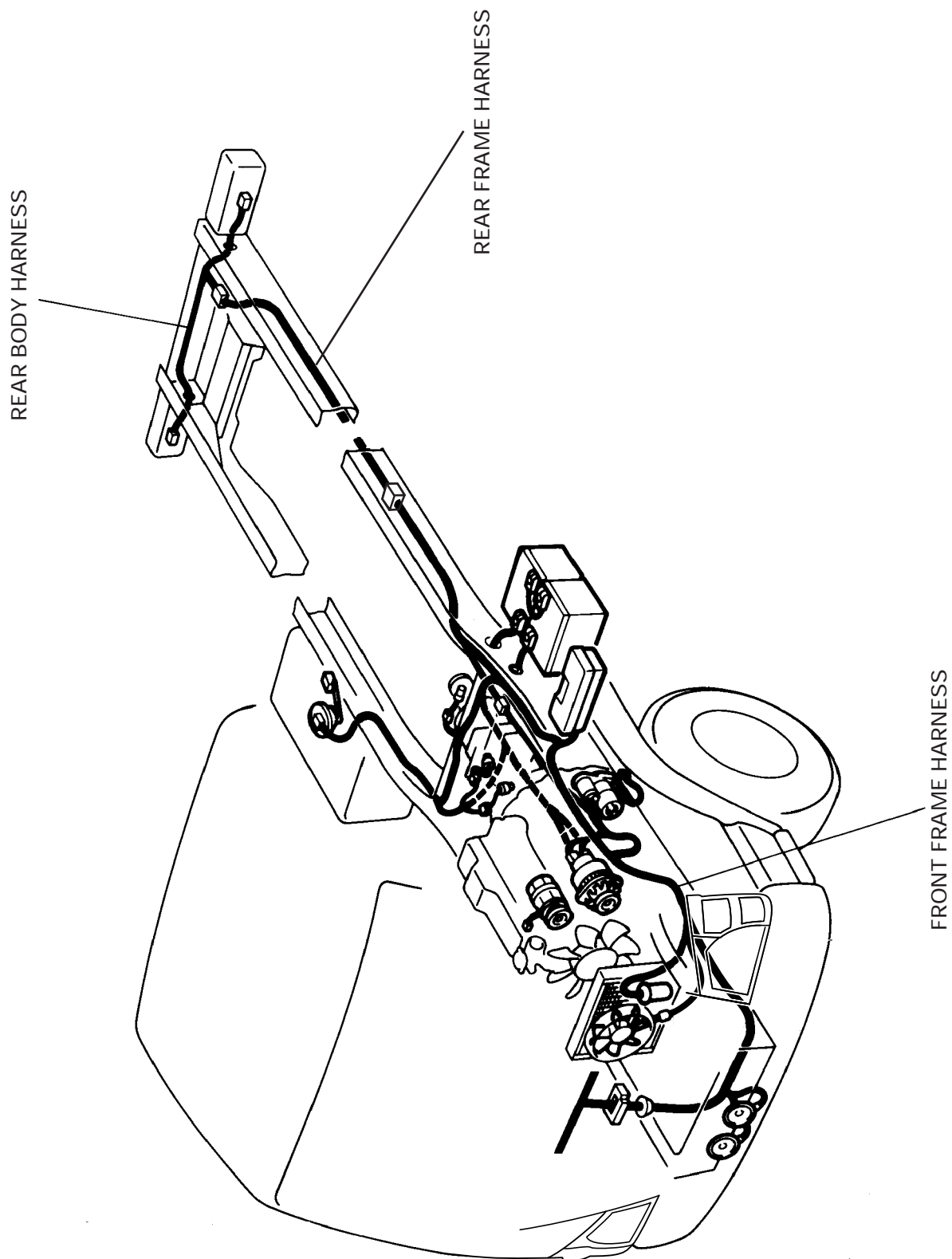
Cable Harness Routing





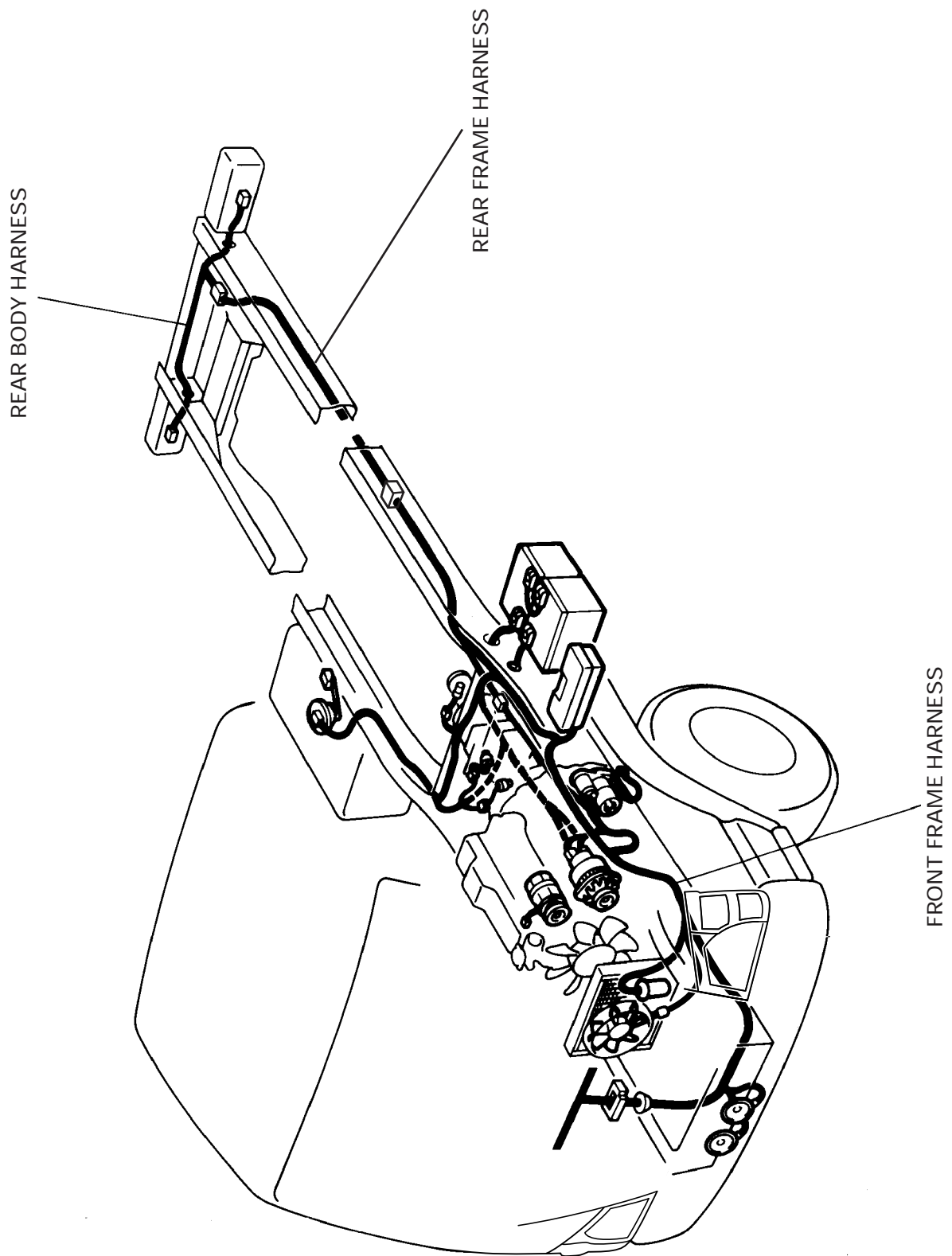
N8A0061E

For Taiwan



N8A0062E

For GCC



N8A0063E

SYSTEM REPAIR

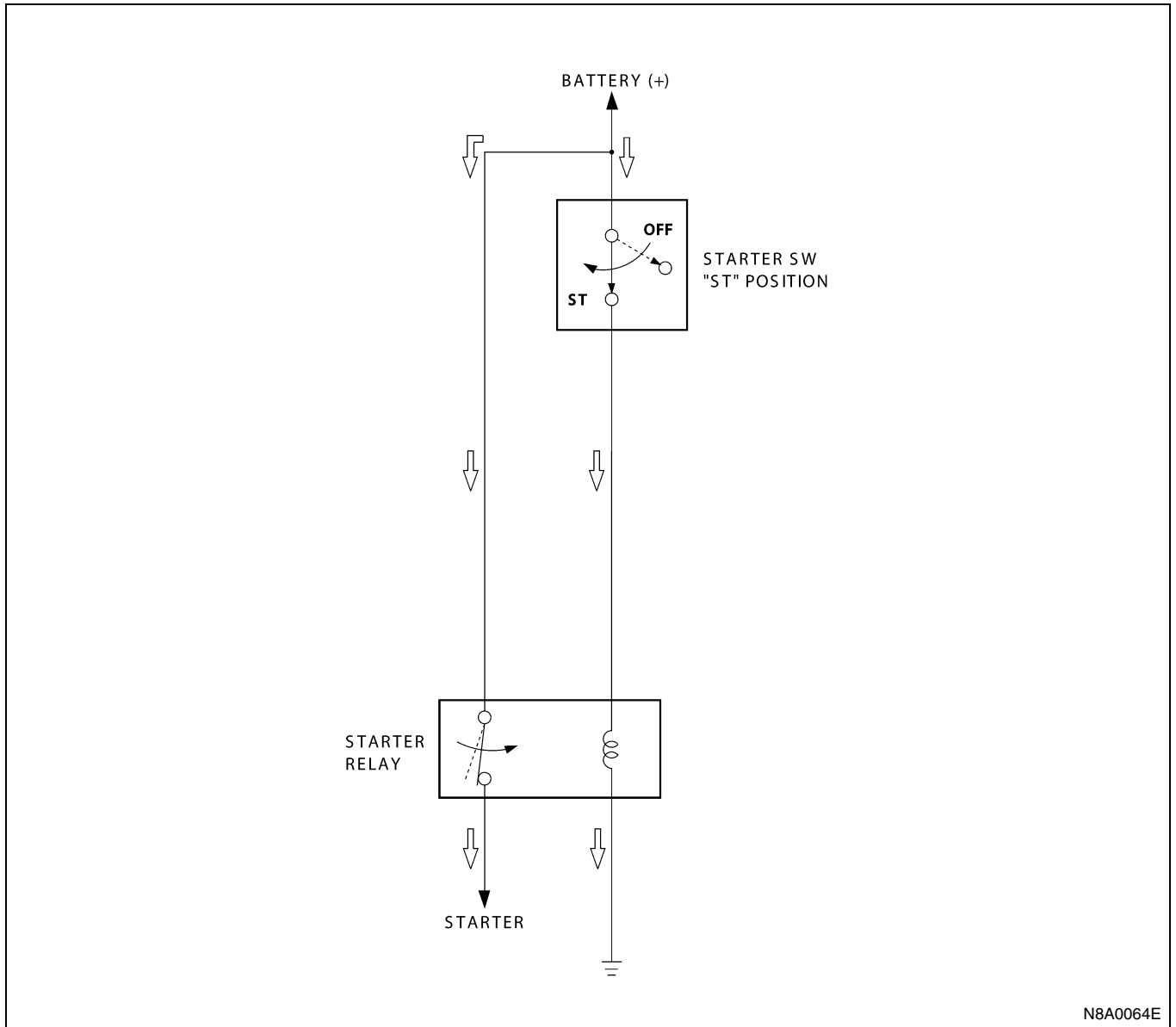
Start and Charging

General Description

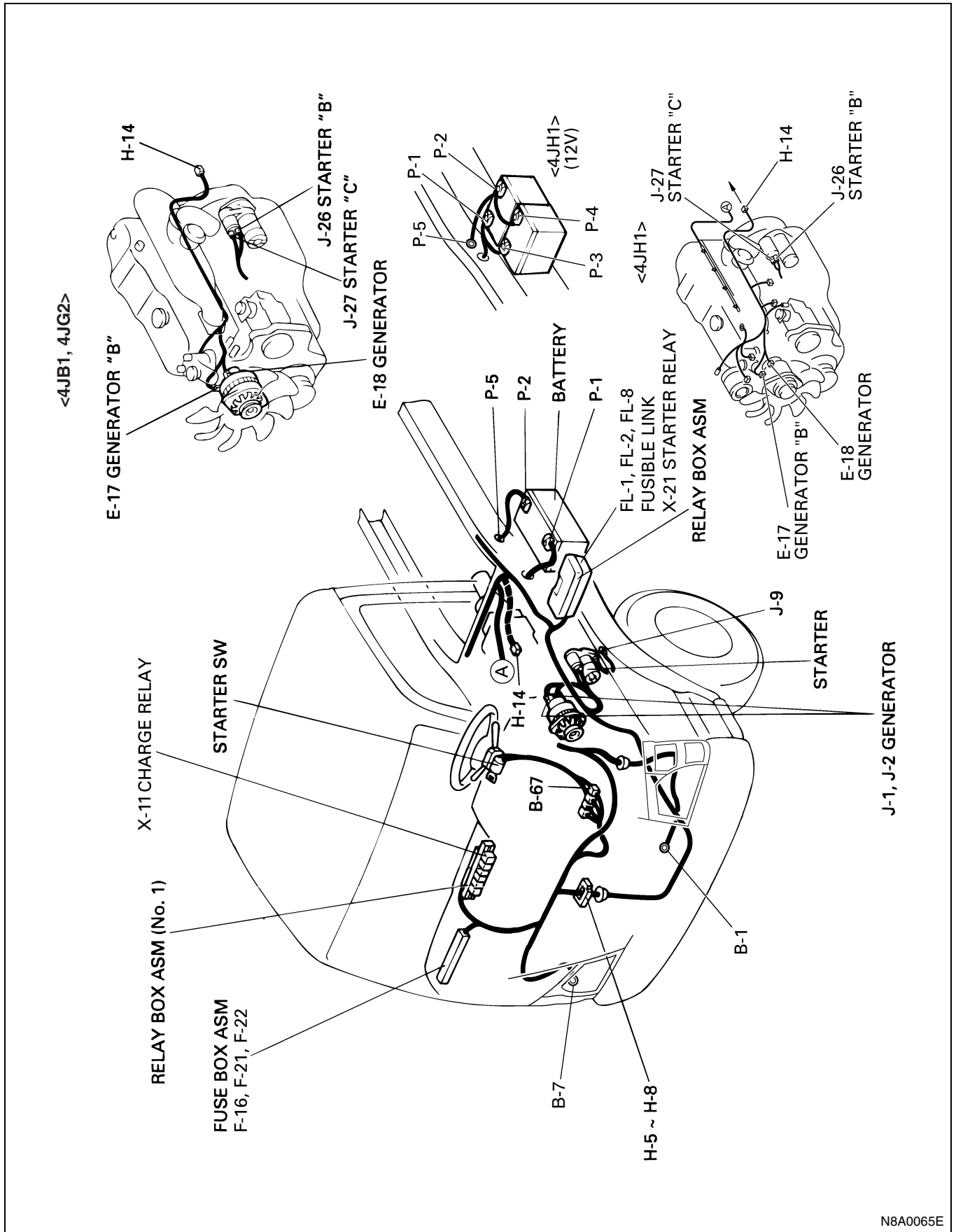
The system consists of the starter switch, starter, AC generator, starter relay, charge relay and heater and A/C relay. When the starter SW is set to the "ST" position, the battery voltage is applied to the starter solenoid coil through the starter relay to start the starter.

- On the 4HK1 engine, the function that ECM controls STARTER RELAY is added.

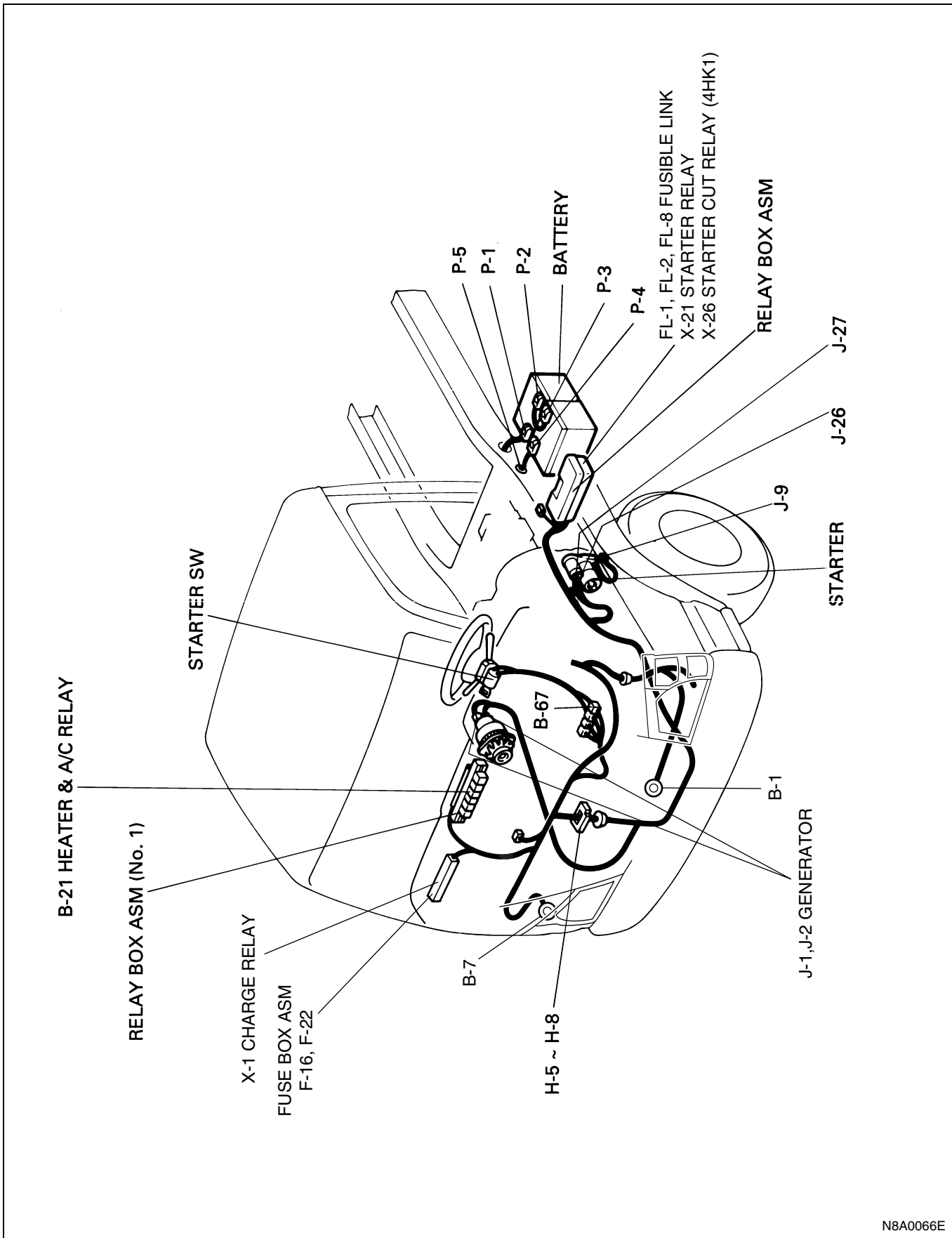
Starting Circuit



Parts Location
For 12 Volt



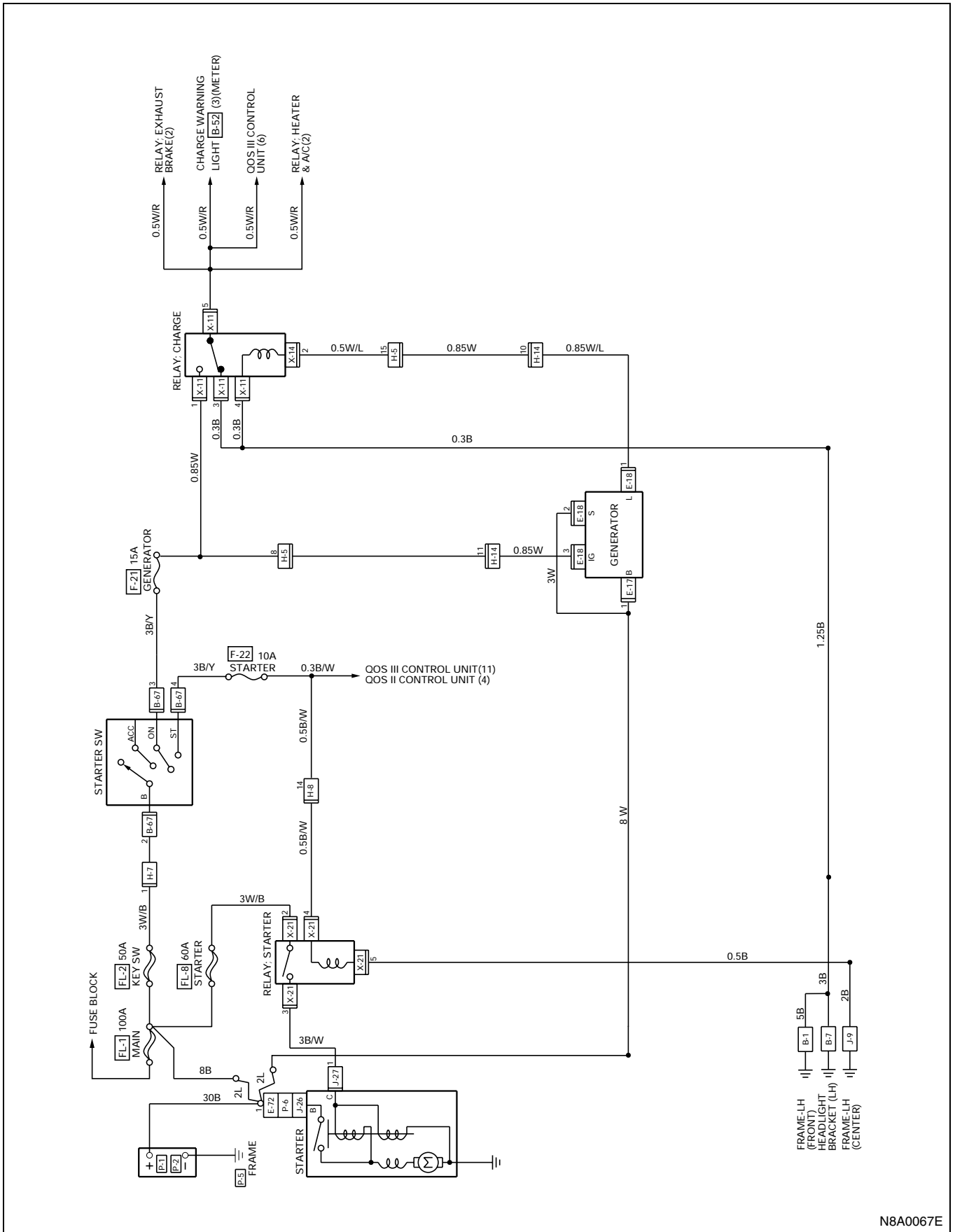
N8A0065E



N8A0066E

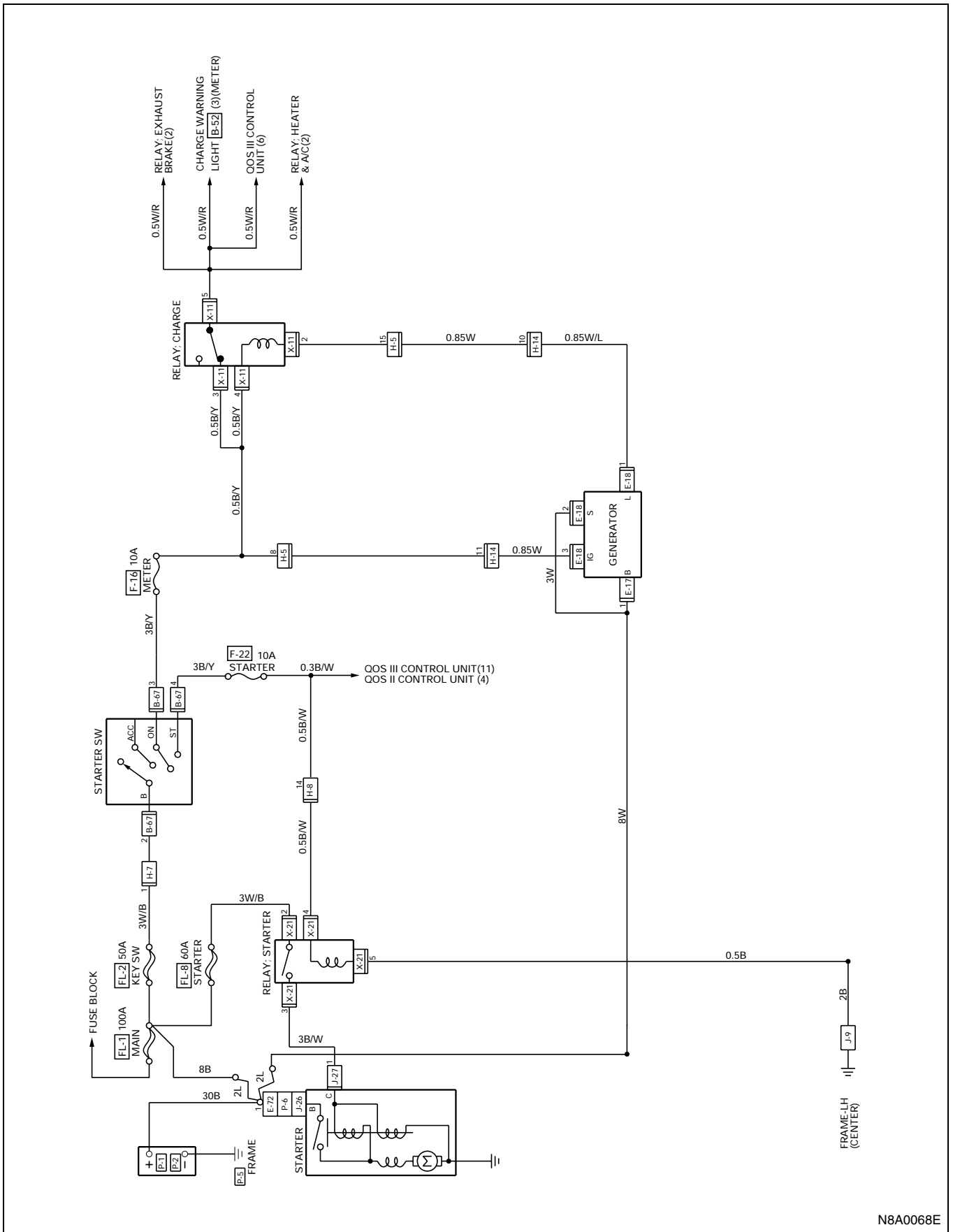
Circuit Diagram

For 4JB1, 4JB1-TC, 4JG2 Engine & 12 Volt



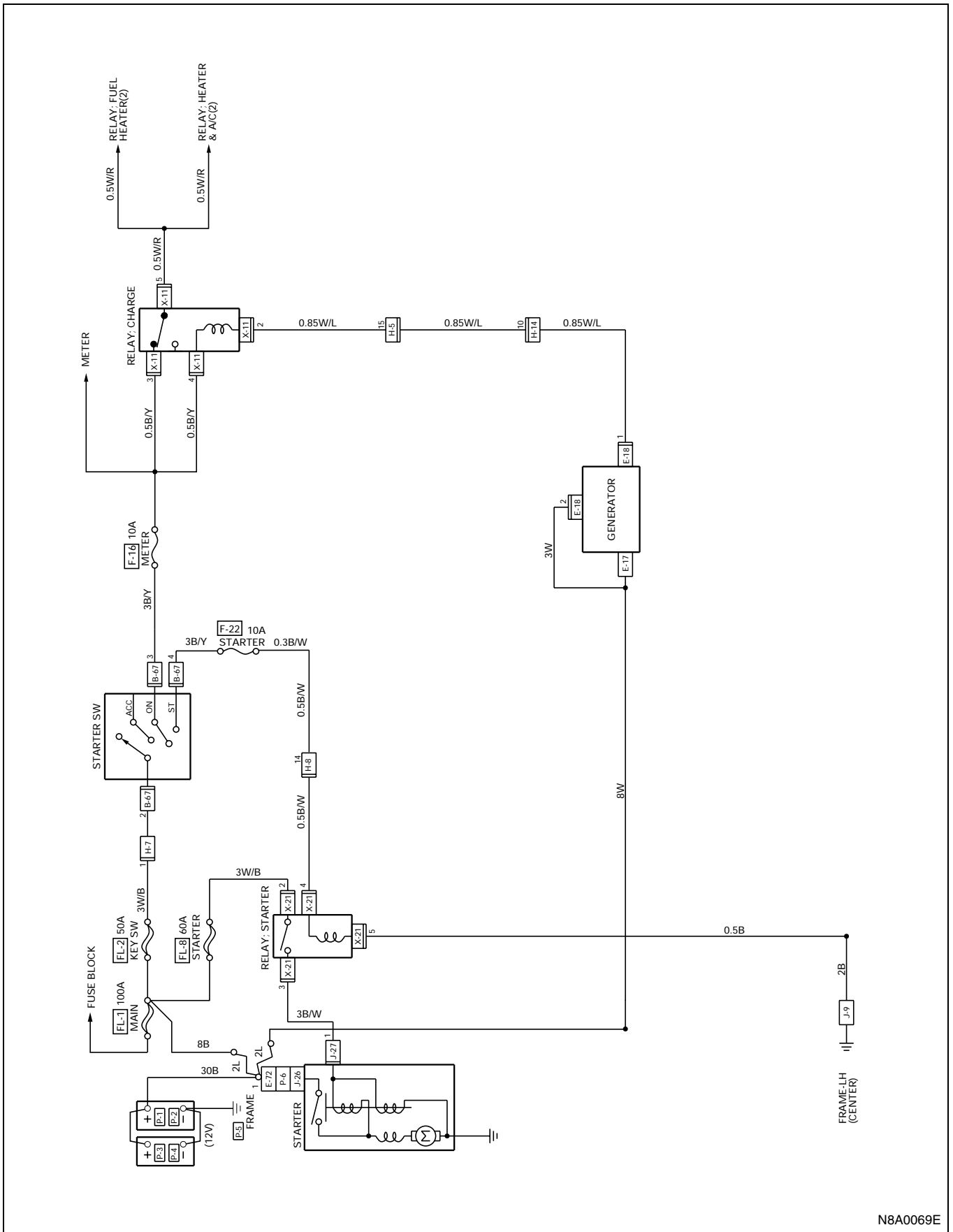
N8A0067E

For 4HG1-T Engine & 12 Volt



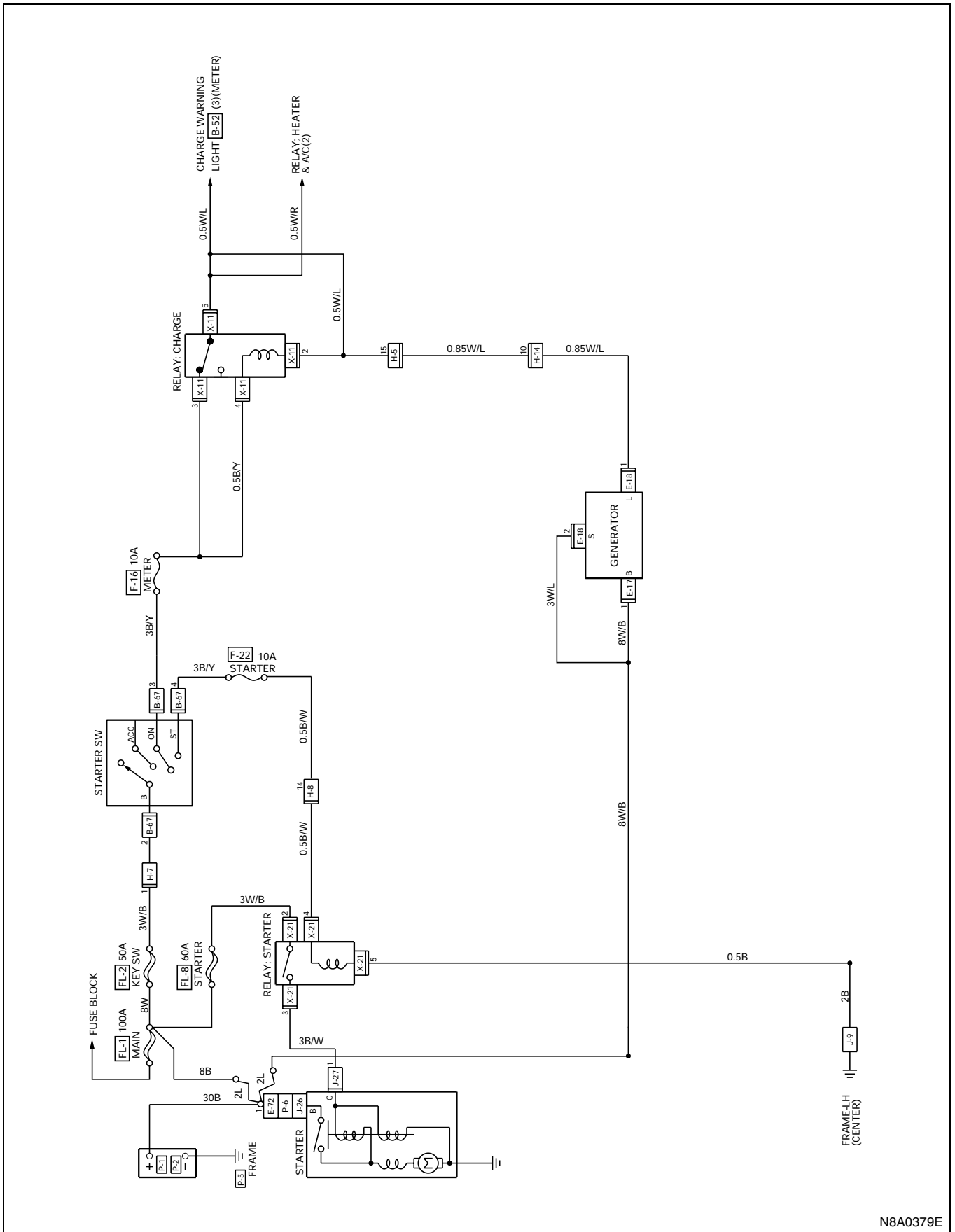
N8A0068E

For 4JH1 Engine & 12 Volt



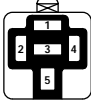


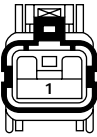
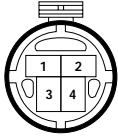



N8A0069E

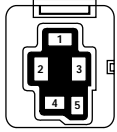
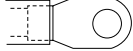
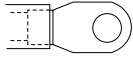
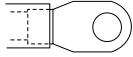

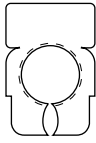
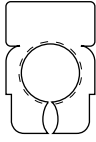
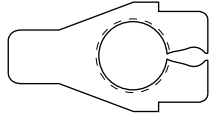
For 4JH1 Engine, NKR77 for Taiwan

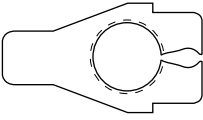
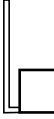


N8A0379E

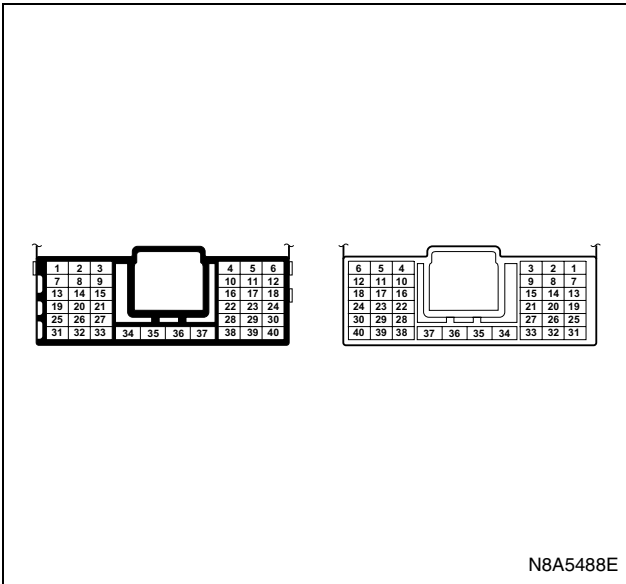
Connector List
For 12 Volt

No.	Connector Face
X-11	 005-001
B-67	 004-001
B-67	 004-002
E-17	 001-001
E-18	 004-003
E-18 (4JH1)	 002-003
H-14	 016-001
H-14	 016-002

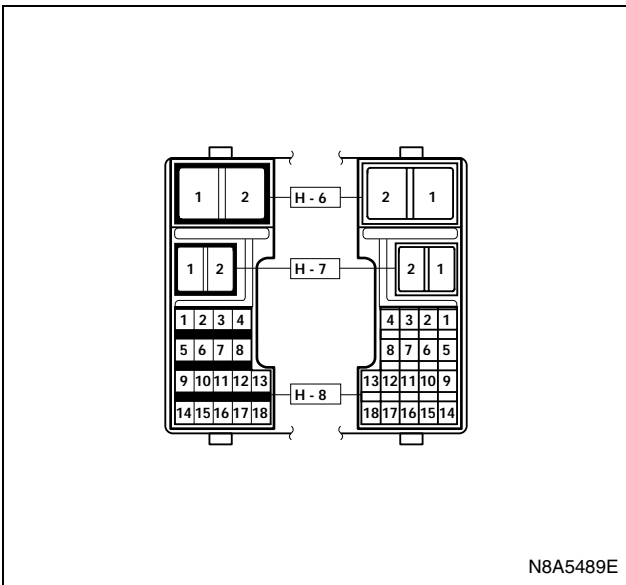
No.	Connector Face
X-21	 005-003
E-17 (4JH1)	 000-002
J-26	 000-002
P-6	 000-002
J-27	 001-002
P-1	 000-004
P-4	 000-004
P-2	 000-006

No.	Connector Face
P-3 (4JH1)	 <p style="text-align: right;">000-006</p>
P-5	 <p style="text-align: right;">000-007</p>

H-5

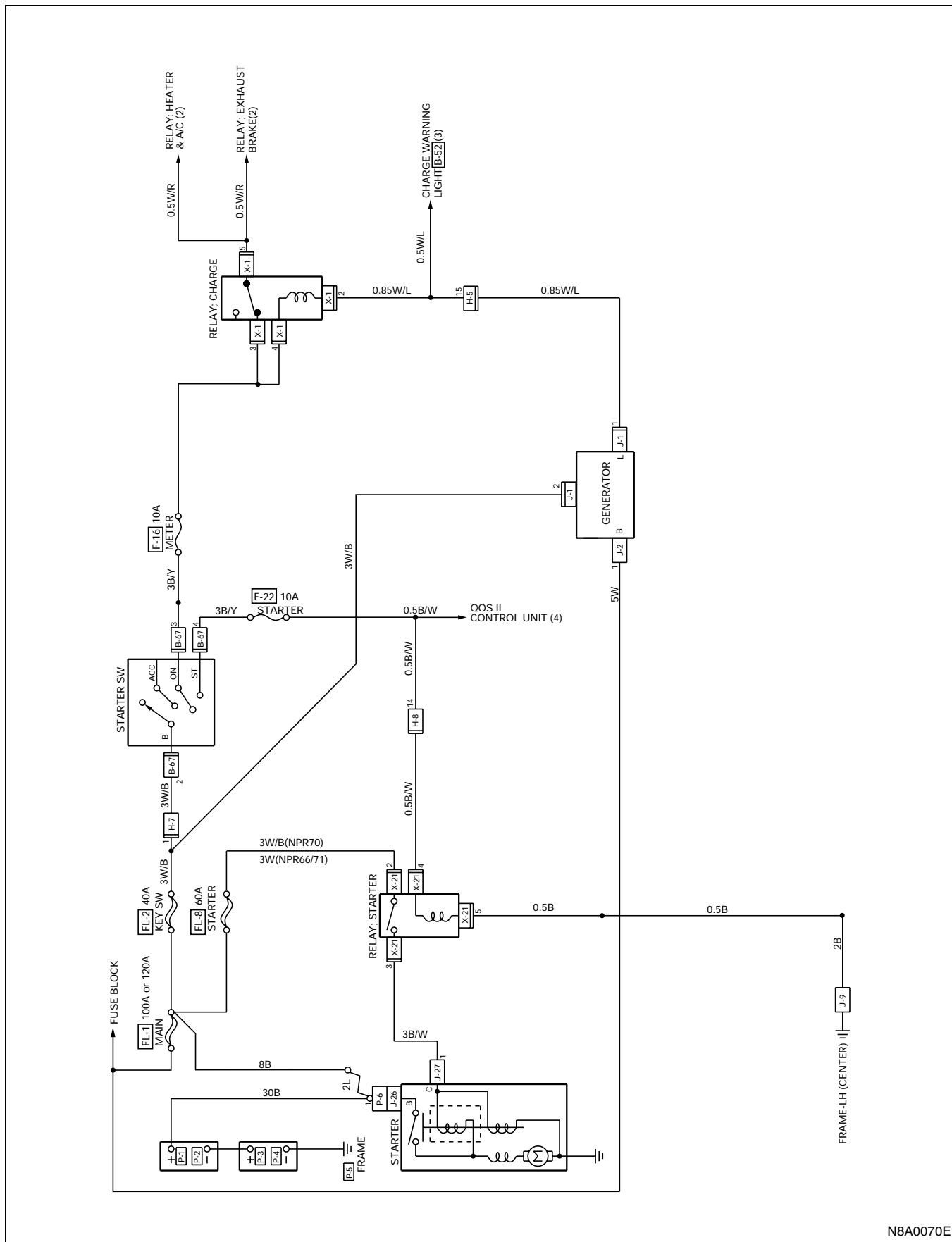


H-6, H-7, H-8



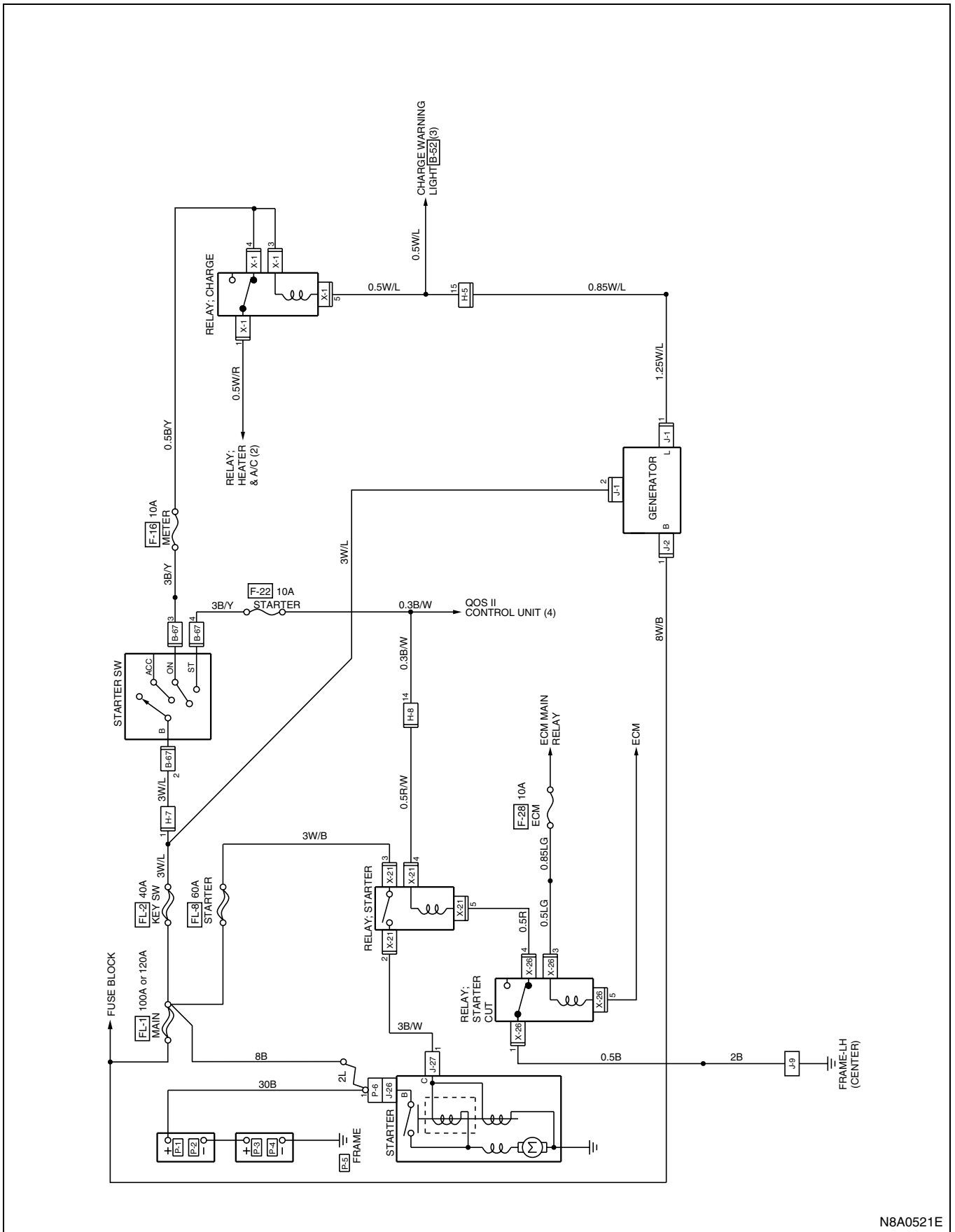
Circuit Diagram

4H Type Engine & 24 Volt (Except 4HK1 Engine)



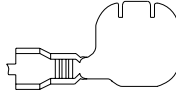
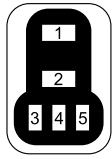
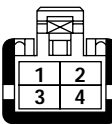
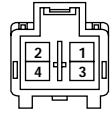

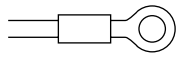
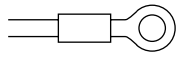
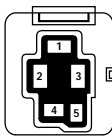
N8A0070E

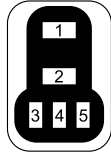
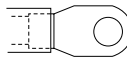
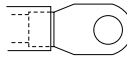
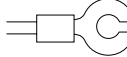


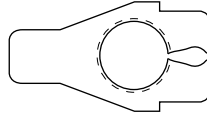
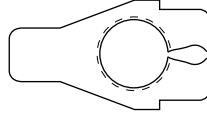
4HK1 Engine

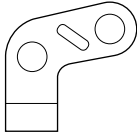


N8A0521E

Connector List
For 24 Volt

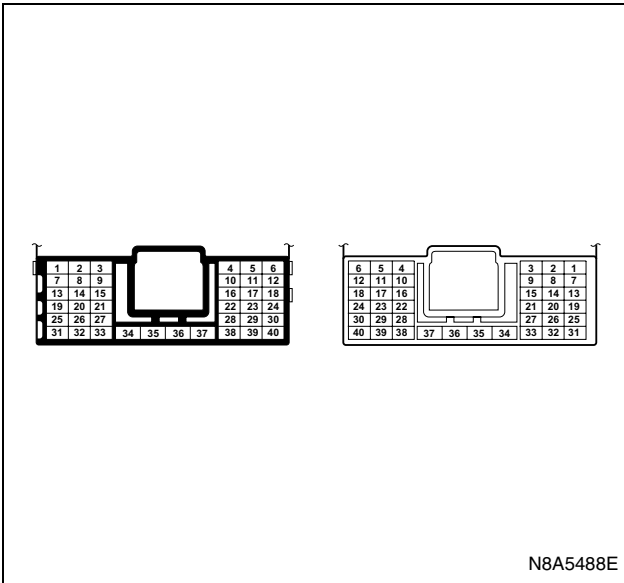
No.	Connector Face
B-7	 000-012
X-1	 005-006
B-67	 004-001
B-67	 004-002
J-1	 002-003
J-2	 000-001
J-9	 000-001
X-21	 005-003

No.	Connector Face
X-26 (N*R 75)	 005-006
J-26	 000-002
P-5	 000-002
J-27	 000-009
P-1	 000-004
P-4	 000-004
P-2	 000-006
P-3	 000-006

No.	Connector Face
P-6 (N*R 66)	

000-008

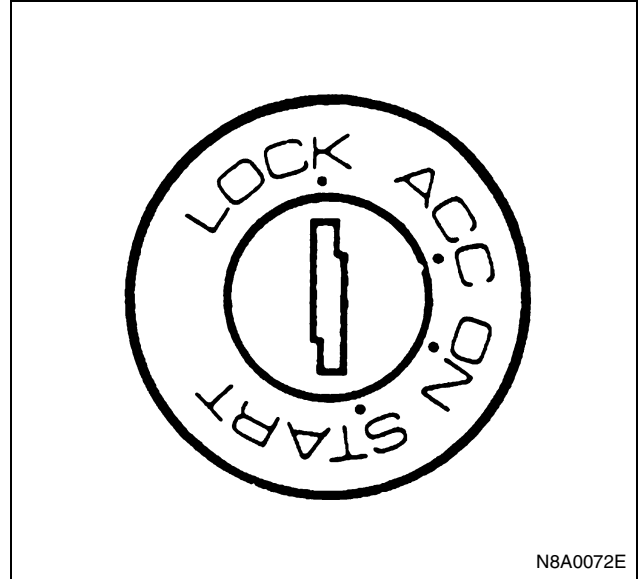
H-5



N8A5488E

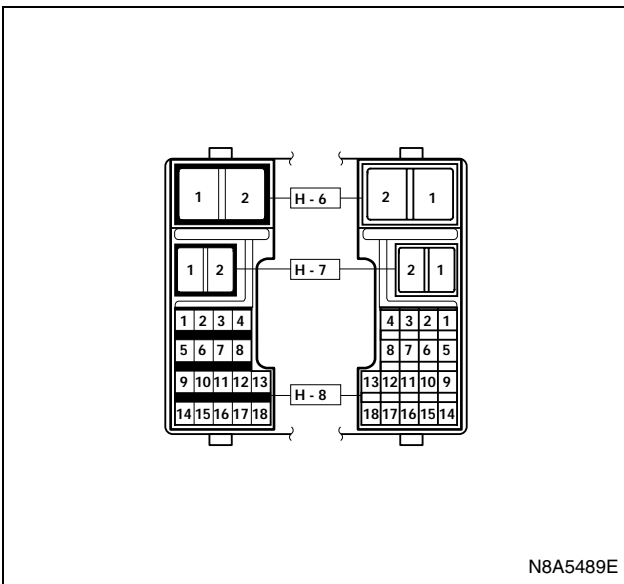
Starter Switch

The starter switch positions are LOCK, ACC, ON and START. Turning the starter key to these positions a circuit for starting the engine, the operation of accessories, or stop the engine.



N8A0072E

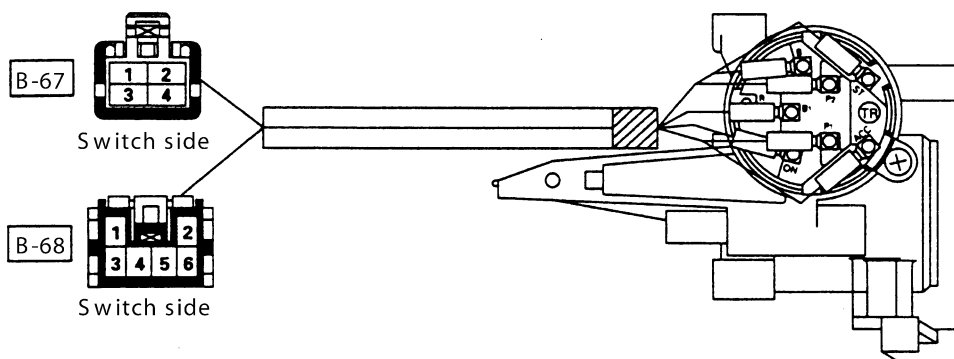
H-6, H-7, H-8



N8A5489E

Inspection

Check the continuity between the starter switch connector terminals.
Repair or replace the switch when the result of inspection is found abnormal.



		Connector No.	B-67				B-68				
			Terminal No.	1	2	3	4	1	2	4	5	6
Starter SW key position			ACC	B	ON	ST	B1	P1	P2	W	W
Removed	LOCK						○	○			
Inserted	ACC		○	○			○	○			
	ON		○	○	○		○	○	○		○
	START			○	○	○	○	○	○		

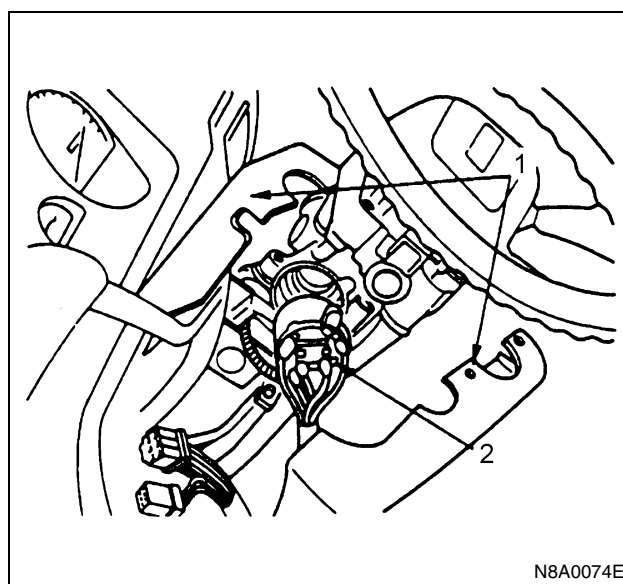
N8A0073E

Removal

Preparation:

Disconnect the battery ground cable.

1. Steering Cowl
Remove four screws and take off the steering cowl.
2. Starter Switch
 - 1) Disconnect the connector.
 - 2) Remove the screw.



N8A0074E

QOS (Quick On Start) II System (4HF1 and 4JB1 Engine Model)

General Description

The circuit consists of starter switch, QOSII control unit, glow relay, thermo switch, glow plug, fuel cut solenoid, CSD relay, CSD solenoid and glow indicator light.

The QOS-II controller controls glow plug relay by the ON or OFF signal of QOS thermo switch.

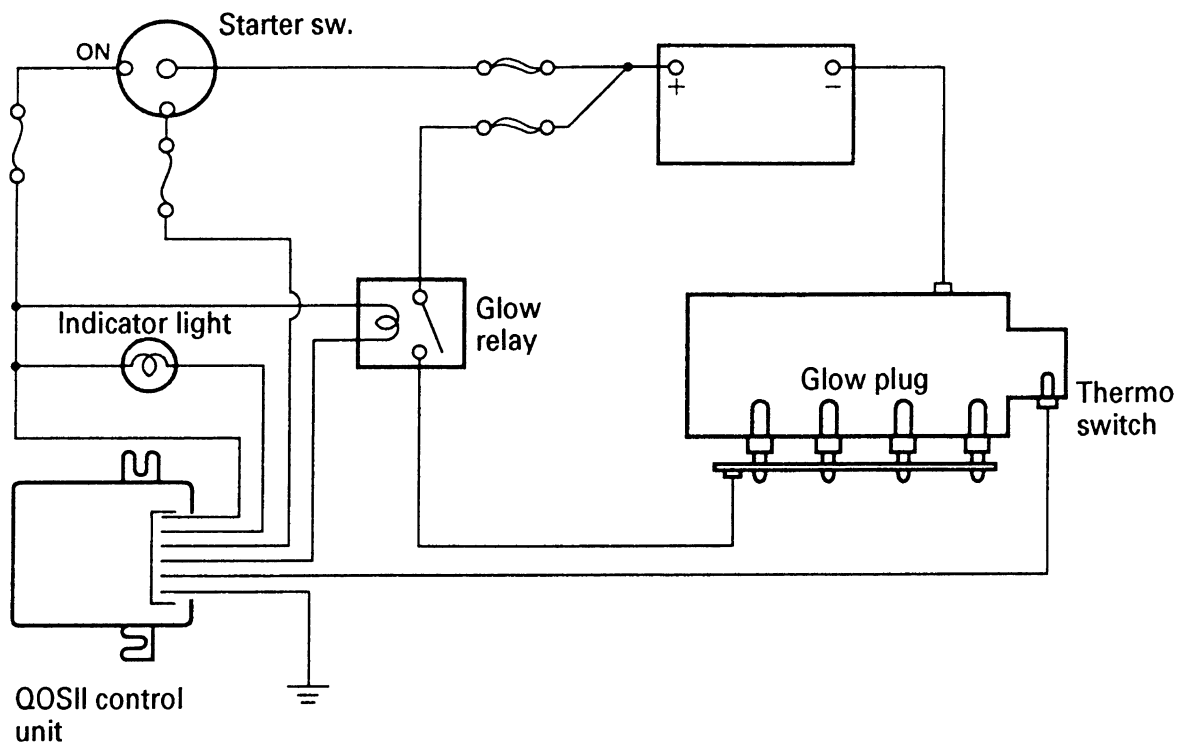
Immediately when the starter switch turns "ON", the glow plug relay indicator light turns on to start preheating.

The engine should be started after the indicator light is off. However, the glow plug relay keeps preheating for a fixed period even after the indicator light turns off. When the fixed time is over, QOS-II controller performs to switch the glow plug relay off to stop preheating.

For details, refer to "PREHEATING SYSTEM".

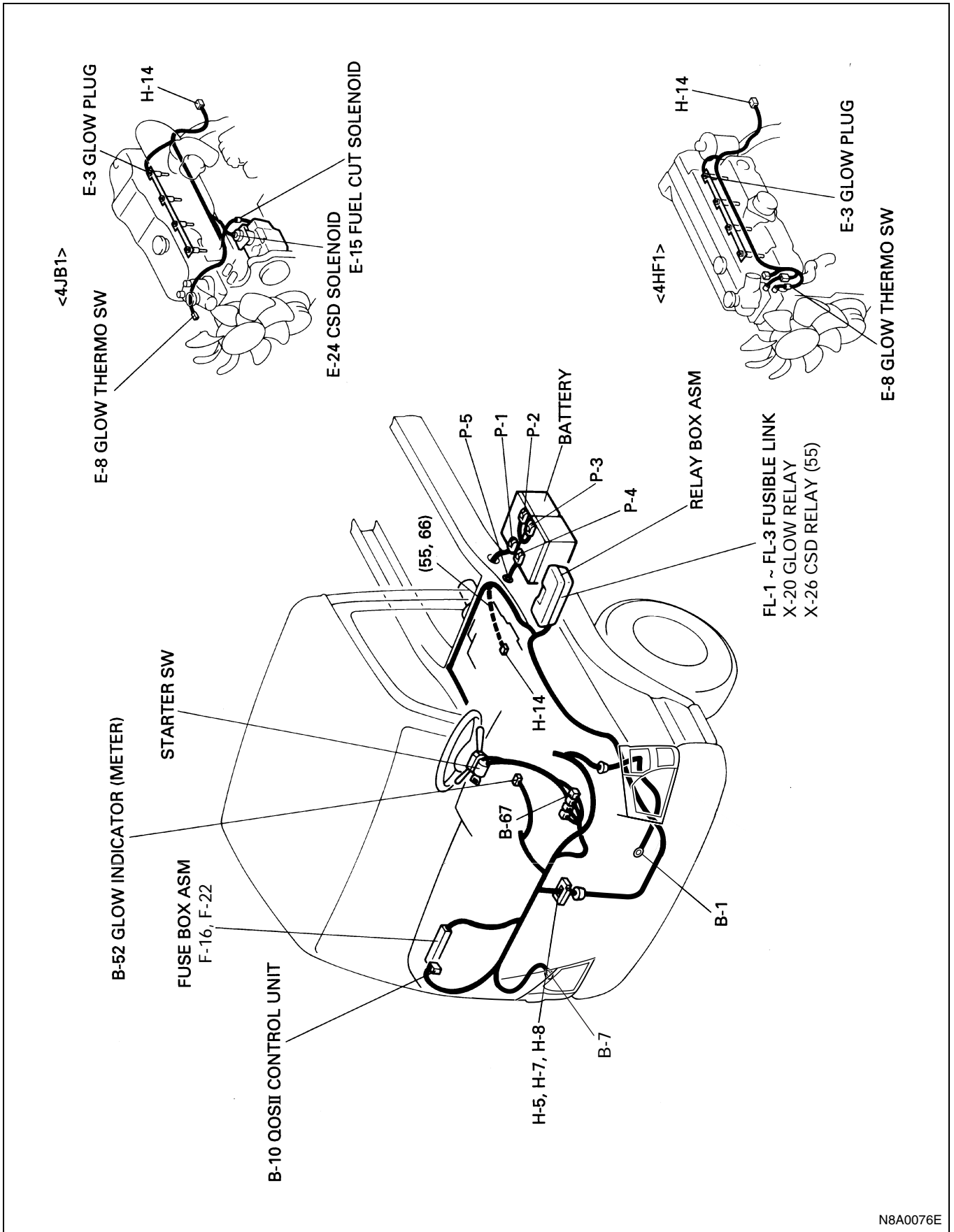
System Circuit

This illustration is based on N*R 66-55.



N8A0075E

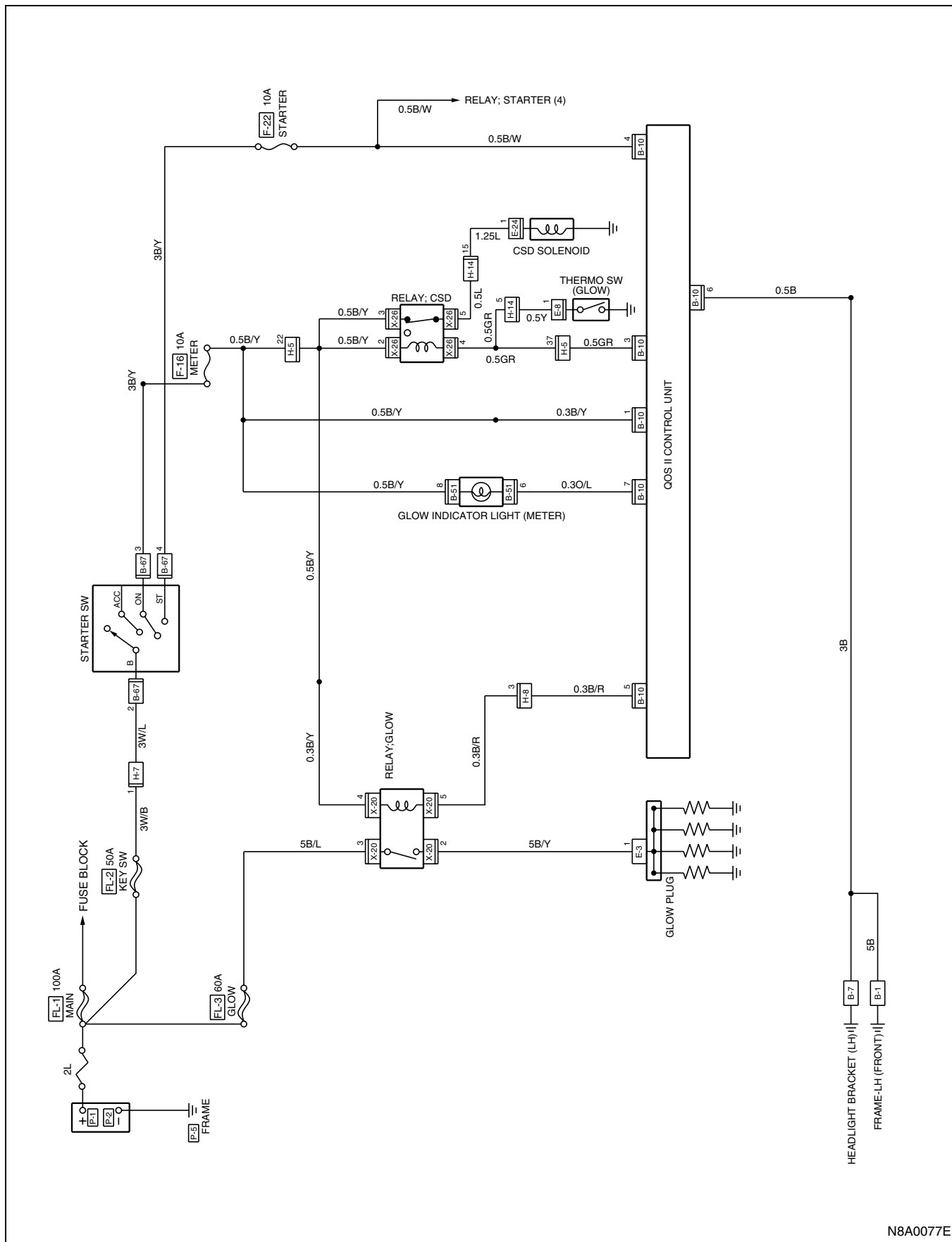
Parts Location



N8A0076E

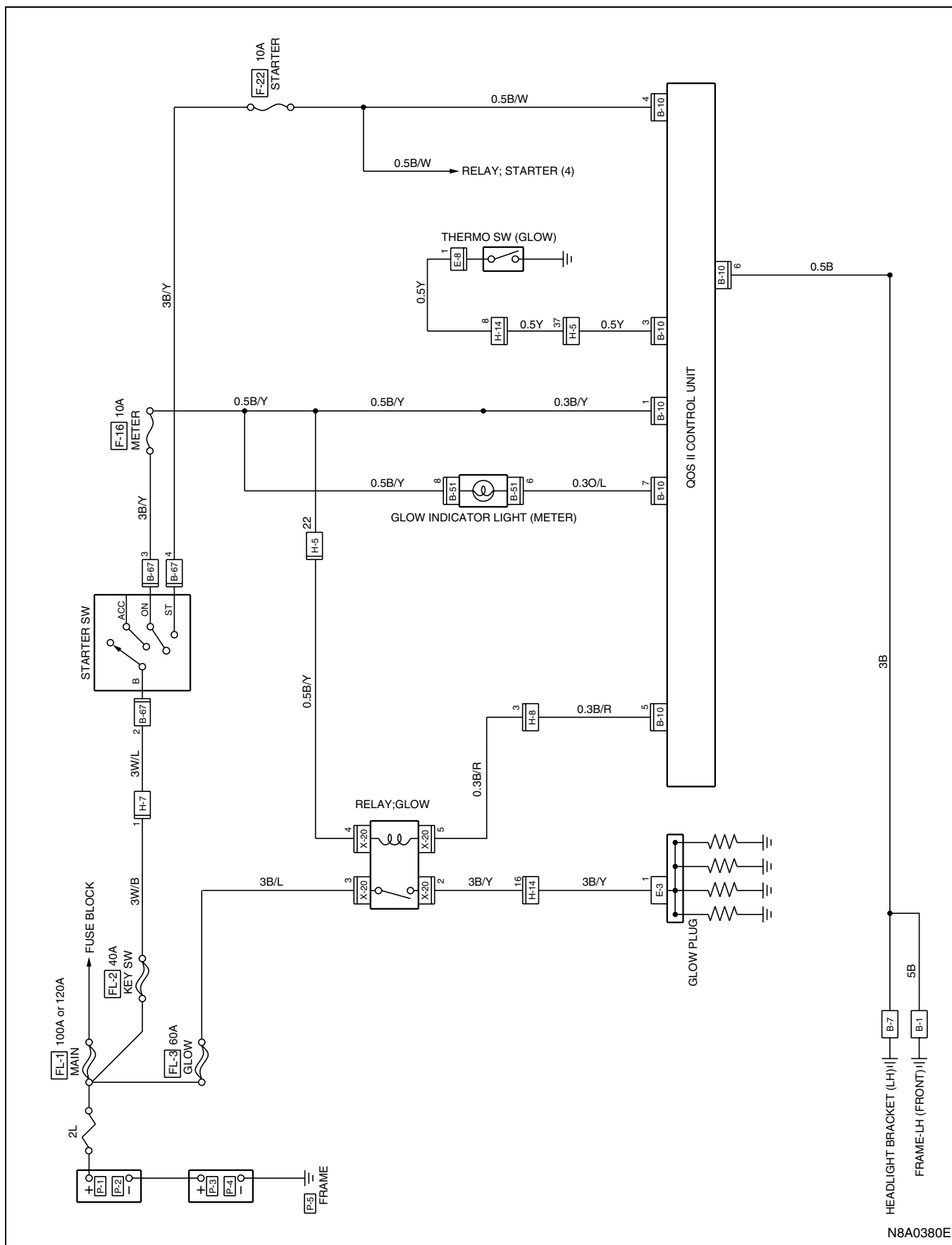
Circuit Diagram

NHR55, NKR55



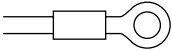
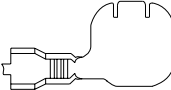
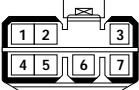

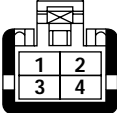
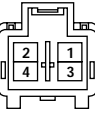
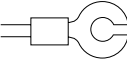
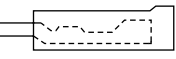
N8A0077E








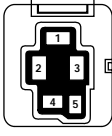
NKR66, NPR66, NQR66

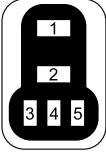
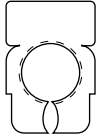
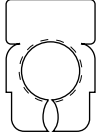
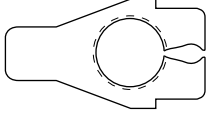
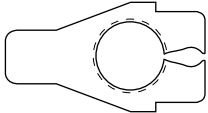
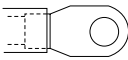

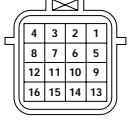


N8A0380E

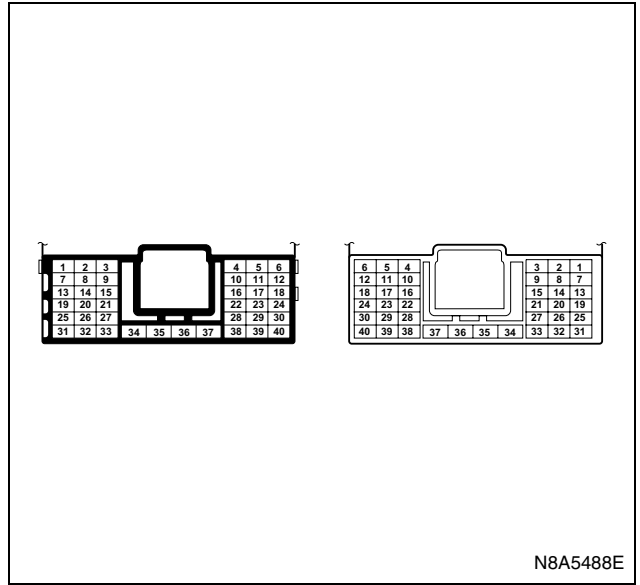
Connector List

No.	Connector Face
B-1	 000-001
B-7	 000-012
B-10	 007-001
B-51	 014-001
B-67	 004-001
B-67	 004-002
E-3	 000-009
E-8	 000-010

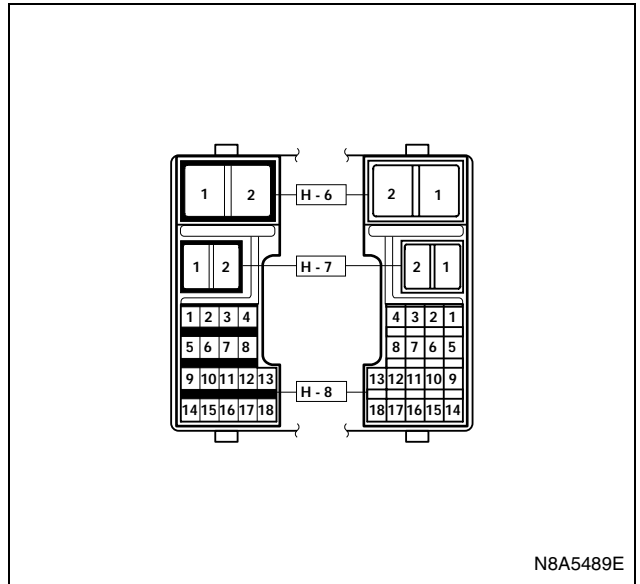
No.	Connector Face
E-8	 000-011
E-15	 001-002
E-15	 001-003
E-24	 001-002
E-24	 001-003
H-14 (4H/ 4JH1 type ENGINE E)	 016-003
H-14 (4H/ 4JH1 type ENGINE E)	 016-004
X-20	 005-003

No.	Connector Face
X-26	 005-006
P-1	 000-004
P-4	 000-004
P-2	 000-006
P-3	 000-006
P-5	 000-002
H-14 (4J type ENGIN E) (Except 4JH1)	 016-001
H-14 (4J type ENGIN E) (Except 4JH1)	 016-002

H-5



H-7, H-8



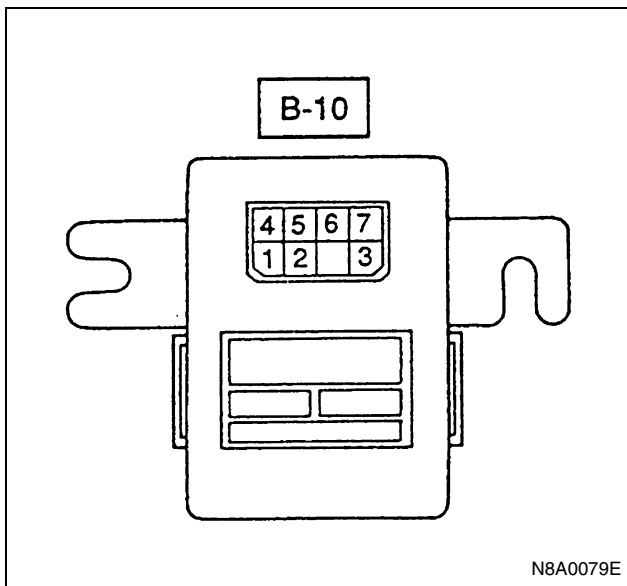
Starter Switch

Refer to "START AND CHARGING" in this section.

Glow Indicator Light Thermo Switch

Refer to "METER AND WARNING/INDICATOR LIGHT" in this section.

QOSII Control Unit



Terminal No.	Connected to
1	Starter switch (ON)
2	—
3	Thermo switch
4	Starter switch (ST)
5	Glow relay
6	Ground
7	Glow indicator (Meter)

Exhaust Brake System

General Description

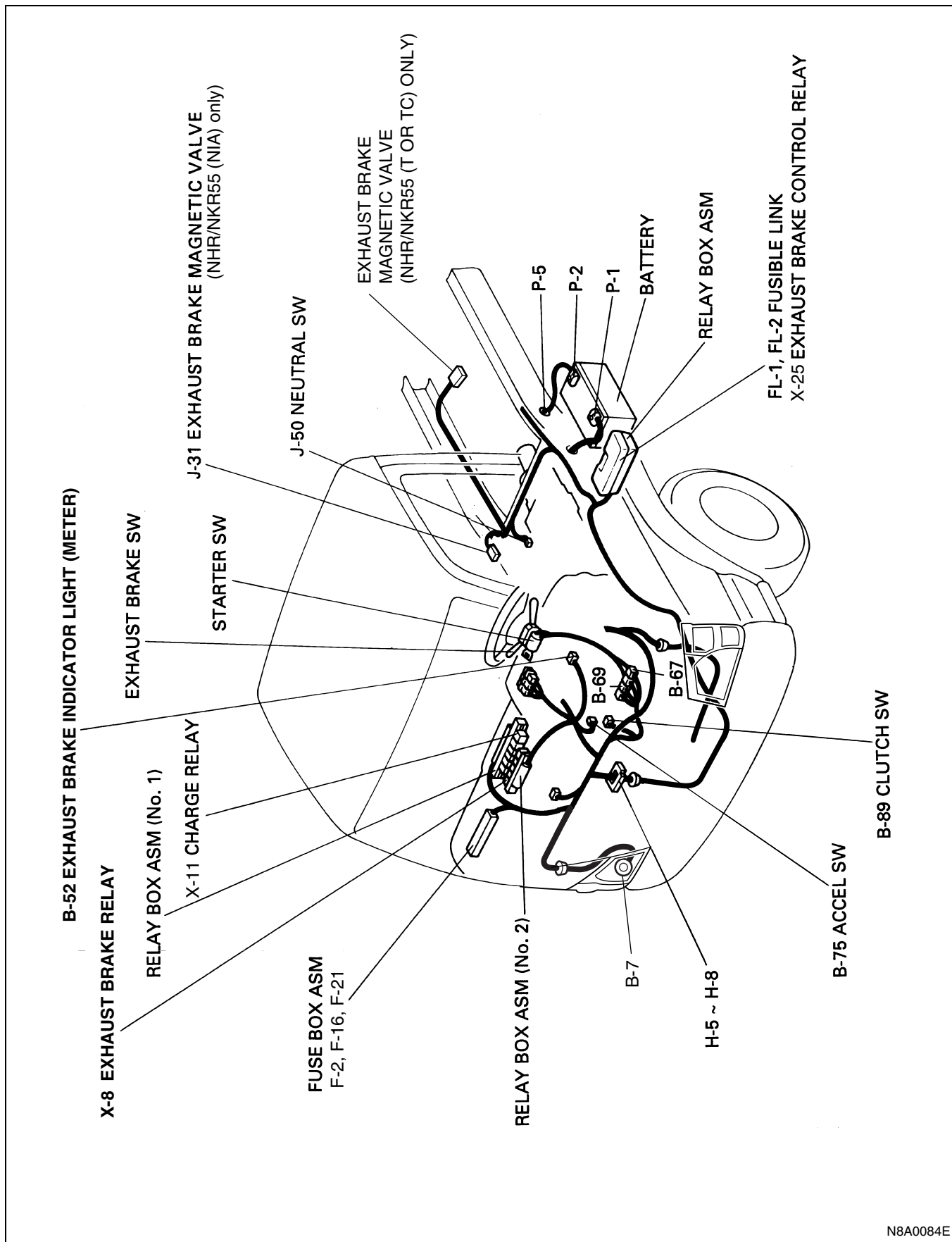
This circuit consists of starter switch, exhaust brake switch (combination switch), accelerator switch, clutch switch, vacuum switching valve, neutral switch and relay.

Exhaust brake is a system to increase exhaust pressure by means of squeezing exhaust gas from engine and exert engine brake.

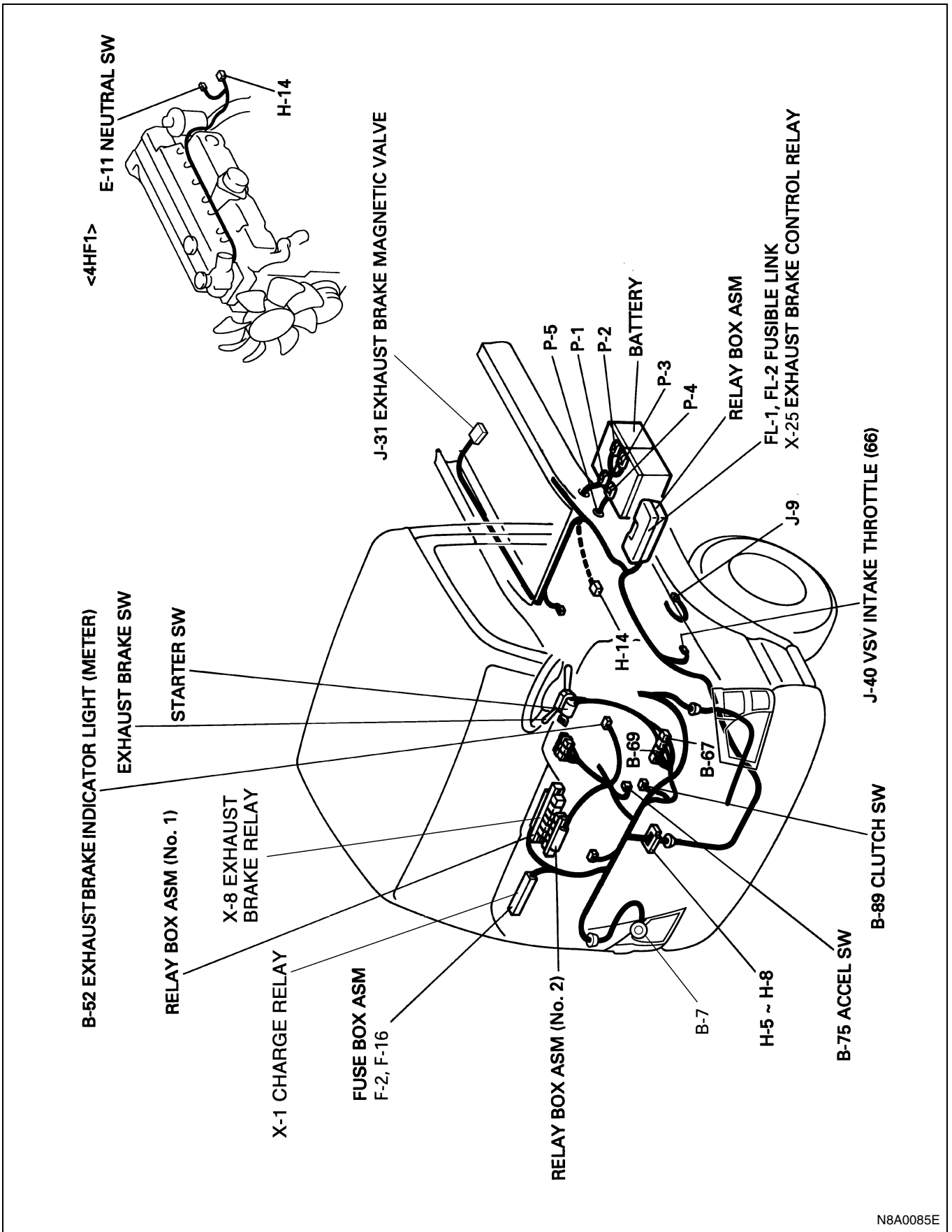
Turn the exhaust brake SW on, and the exhaust brake valve starts to work by the function of the magnetic valve to enable the exhaust brake to operate, when the exhaust brake indicator light will be on.

When either the accelerator pedal or the clutch pedal is depressed while driving, the switch of the depressed pedal will turn off, subsequently the exhaust braking will stop working.

Parts Location
NHR55, NKR55



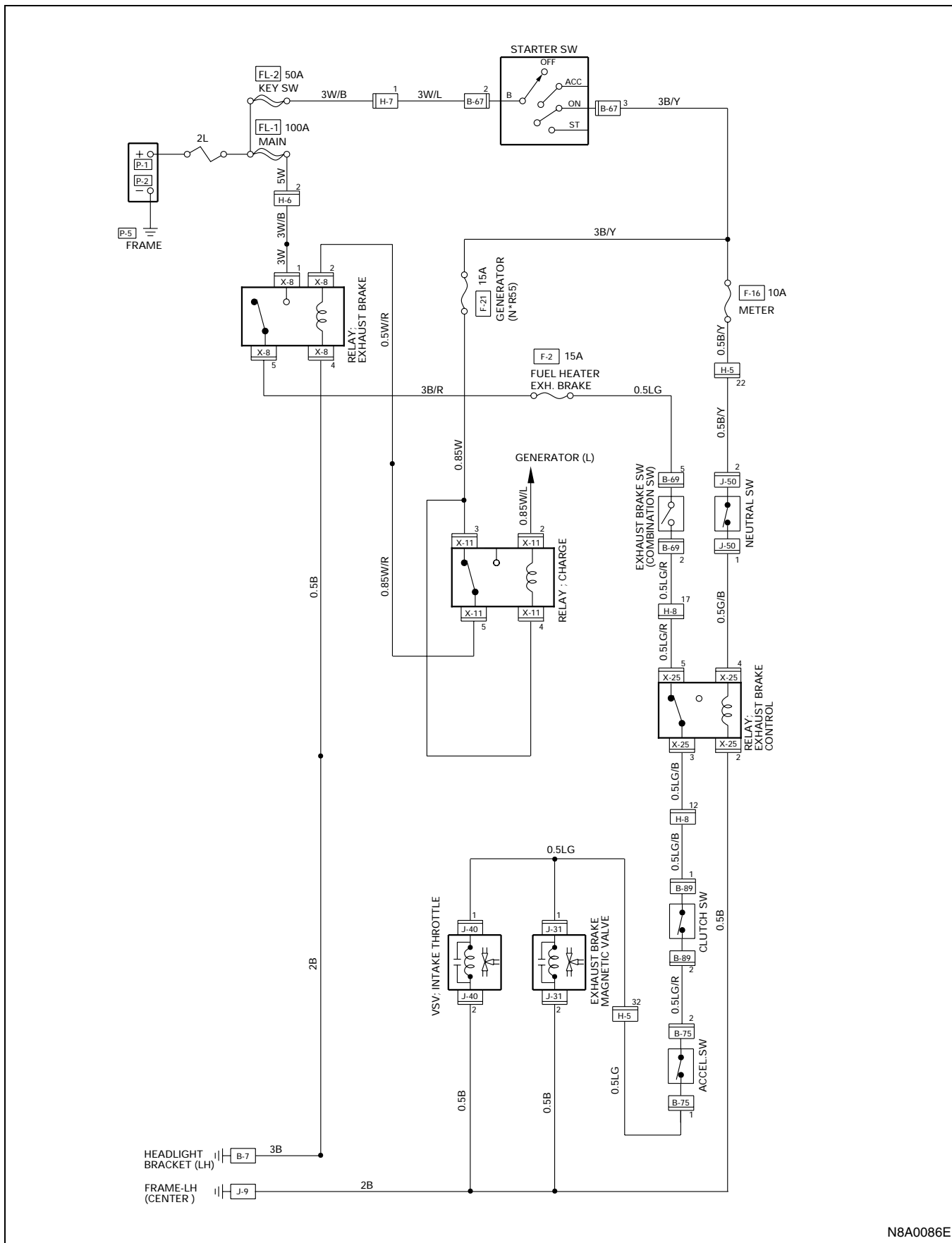
N8A0084E



N8A0085E

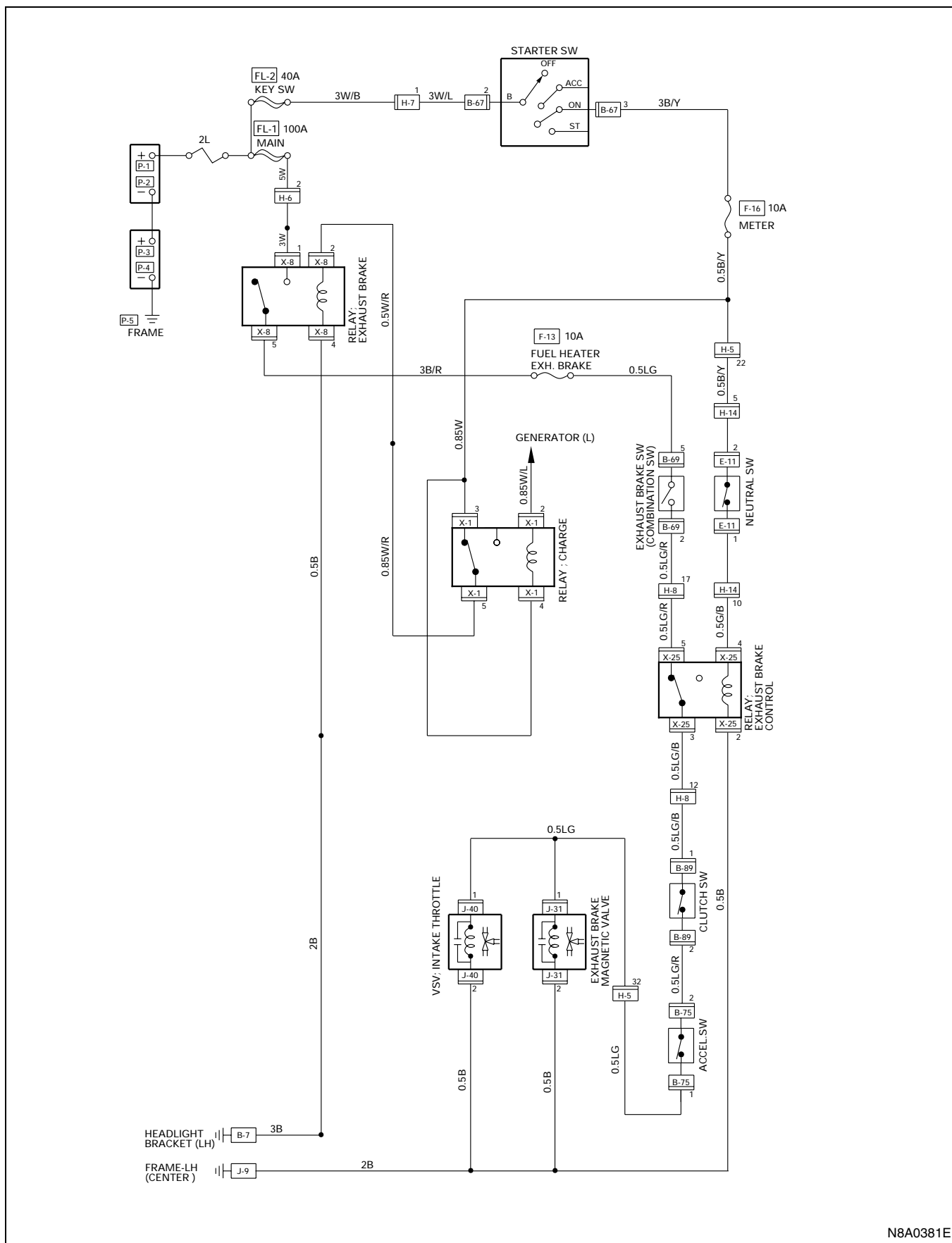
Circuit Diagram

NHR55, NKR55



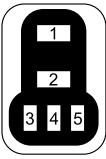
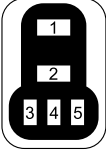
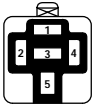
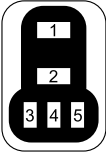
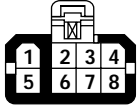
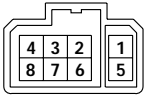

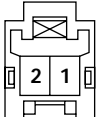
N8A0086E


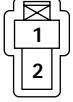
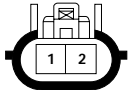
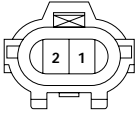

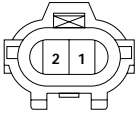


NKR66, NPR66, NQR66





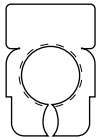

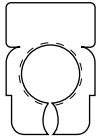
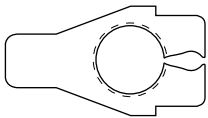


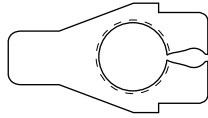



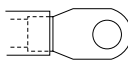
N8A0381E

Connector List

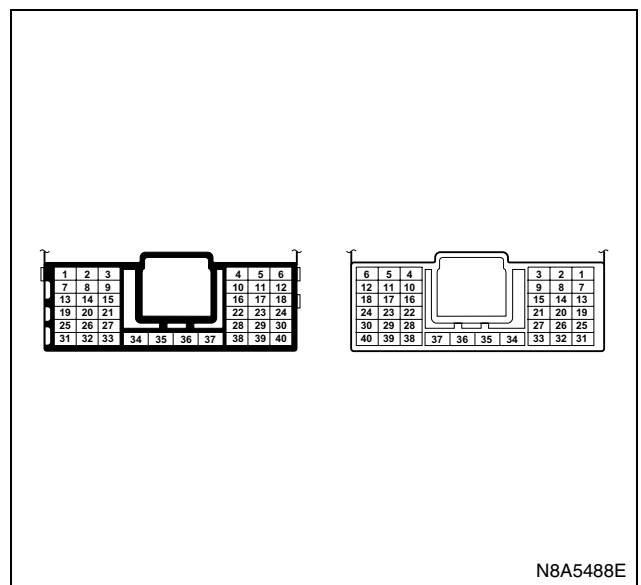
No.	Connector Face
X-1	 005-006
X-8	 005-006
X-11	 005-001
X-25	 005-006
B-69	 008-001
B-69	 008-002
B-75	 002-022
B-75	 002-023

No.	Connector Face
B-89	 002-009
B-89	 002-010
E-11	 002-001
E-11	 002-002
J-50	 002-001
J-50	 002-002
H-14	 016-003
H-14	 016-004

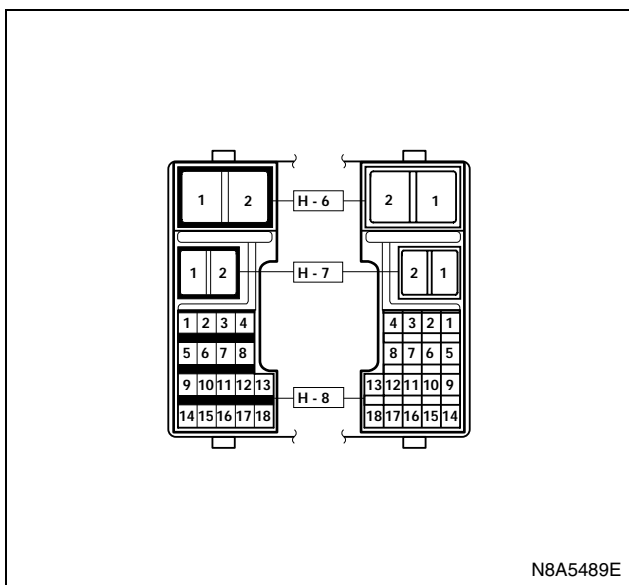
No.	Connector Face
J-31	 002-011
J-31	 002-012
J-40	 002-014
P-1 (12 V)	 000-003
P-1 (12 V)	 000-004
P-2	 000-003
P-2	 000-004
P-2 (24 V)	 000-006

No.	Connector Face
P-3	 000-006
P-1 (24 V)	 000-004
P-4	 000-004
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002

H-5



H-6, H-7, H-8



N8A5489E

Neutral Switch

Refer to "START AND CHARGING" in this section.

Starter Relay

Refer to "START AND CHARGING" in this section.

Charge Relay

Refer to "START AND CHARGING" in this section.

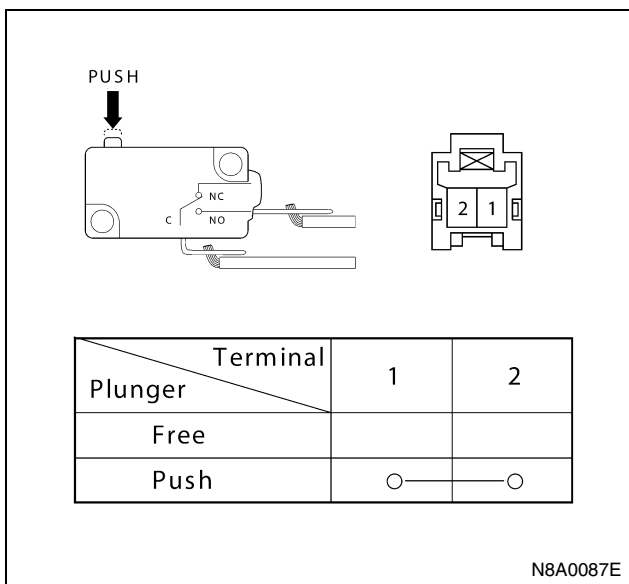
Starter Switch

Refer to "START AND CHARGING" in this section.

Accel Switch

Inspection

1. Check the continuity between the switch connector terminals.
2. Check to see if switch plunger operates smoothly. Repair or replace the accel switch when result of inspection is found abnormal.



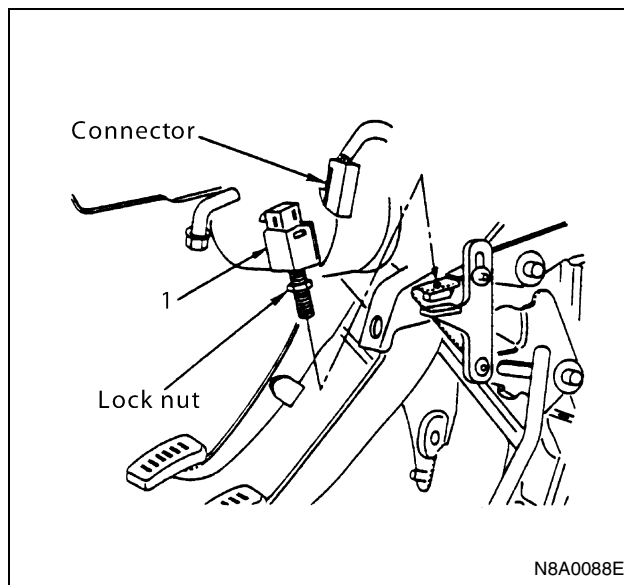
N8A0087E

Removal

Preparation:

Disconnect the battery ground cable.

1. Accel Switch
 - 1) Disconnect the connector.
 - 2) Remove the two screws.



N8A0088E

Installation

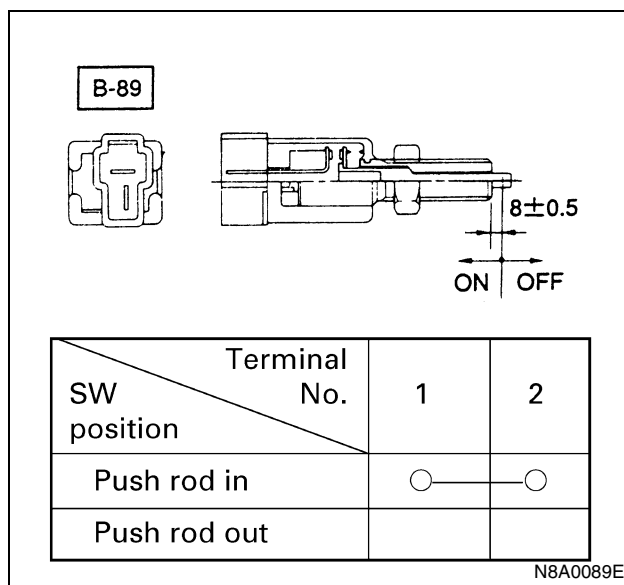
To install, follow the removal steps in the reverse order, noting the following points.

1. Check to see if the accel pedal has been returned by the return spring to the specified position.

Clutch Switch

Inspection

1. Check the continuity between the switch connector terminals.
2. Check to see if switch push rod operates smoothly. Repair or replace the switch when result of inspection is found abnormal.



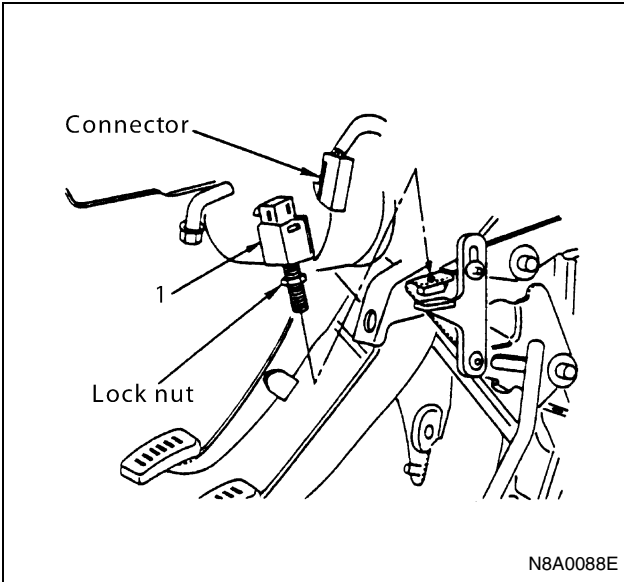
N8A0089E

Removal

Preparation:

Disconnect the battery ground cable.

1. Clutch Switch
 - 1) Disconnect the connector.
 - 2) Loosen the lock nut of the switch.
 - 3) Remove the switch by turning it.



Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Check to see if the clutch pedal has been returned by the return spring to the specified position.
2. Turn the clutch switch clockwise until the tip of the threaded portion of the switch contacts the pedal arm.
3. Tighten the lock nut to the specified torque.

Tighten:

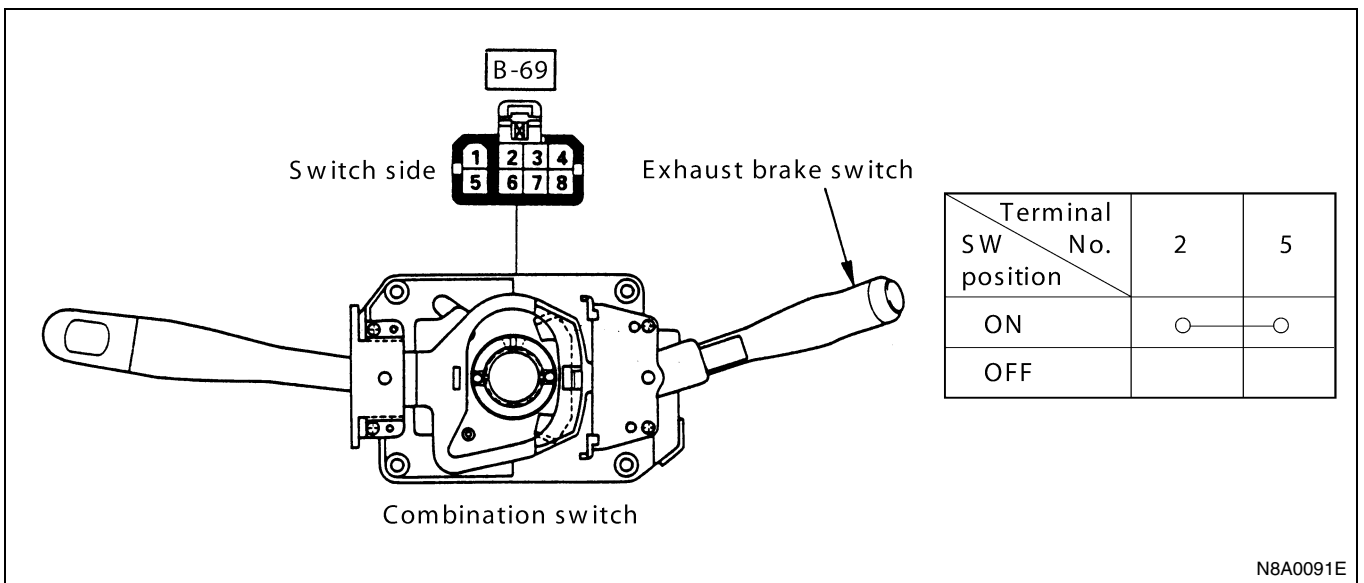
Lock nut to 13 N·m (130 kg·cm / 115 lb-in)

Exhaust Brake Switch

Inspection

Check the continuity between the terminals of the exhaust brake switch.

Repair or replace the switch when the result of inspection is found abnormal.



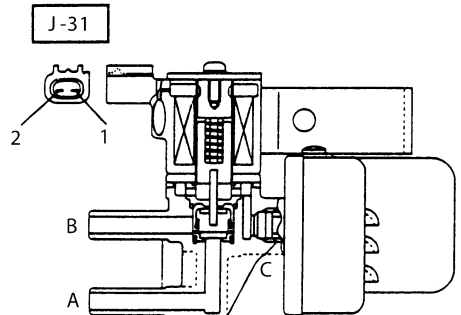
Removal and Installation

Refer to "HEADLIGHT, FOG LIGHT AND CORNERING LIGHT" in this section.

Exhaust Brake Magnetic Valve (4H Series Engine)

Inspection

Connect the magnetic valve connector terminal No. 1 to the battery (+) terminal and terminal No. 2 to the (-) terminal and then check the continuity among each port.



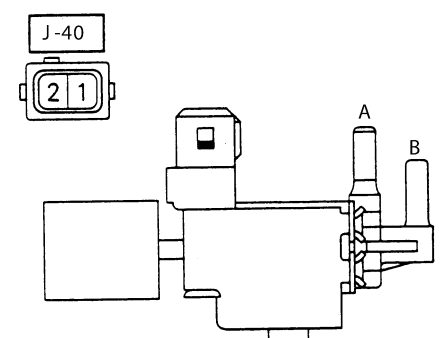
Port	A	B	C
Operation			
When battery voltage applied	○—○		
When battery voltage not applied		○—○	

N8A0094E

Vacuum Switching Valve: Intake Throttle (4H Series Engine)

Inspection

Connect the magnetic valve connector terminal No. 1 to the battery (+) terminal and terminal No. 2 to the (-) terminal and then check the continuity among each port. Repair or replace the vacuum switching valve when the result of inspection is found abnormal.



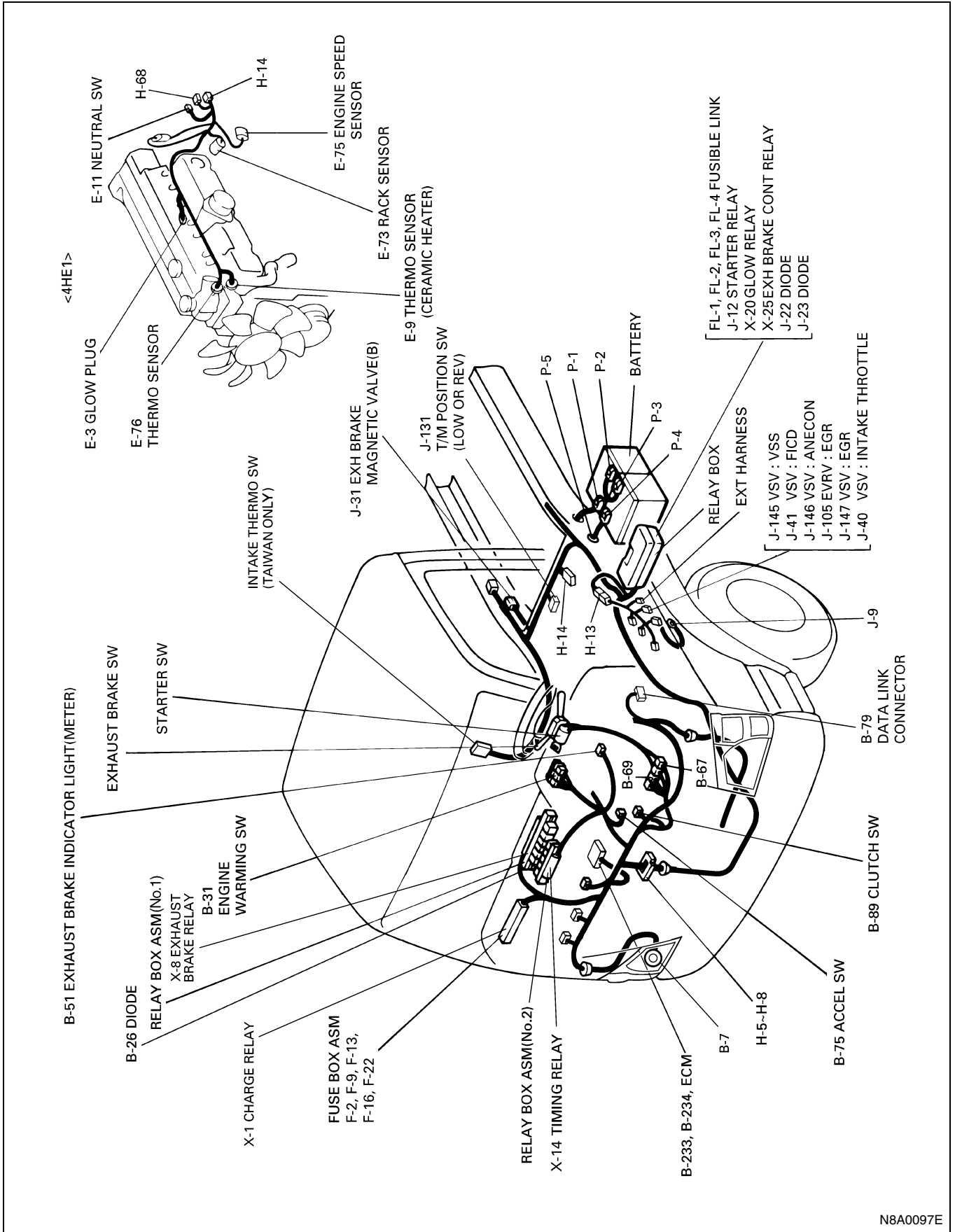
Port	A	B
Operation		
When battery voltage applied	○—○	
When battery voltage not applied		

N8A0096E

Exhaust Brake System and Engine Control

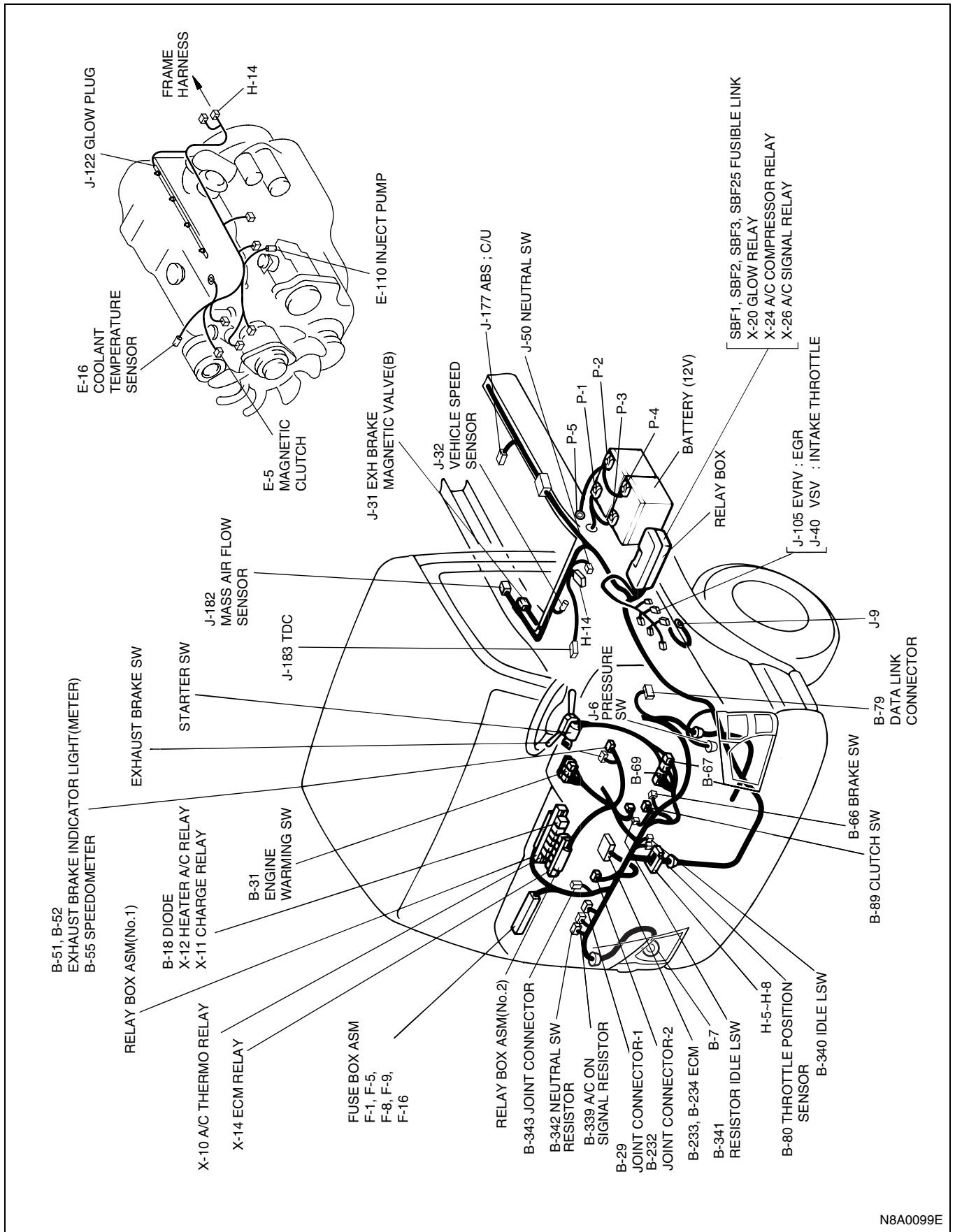
Parts Location

For 4HE1-TC Engine



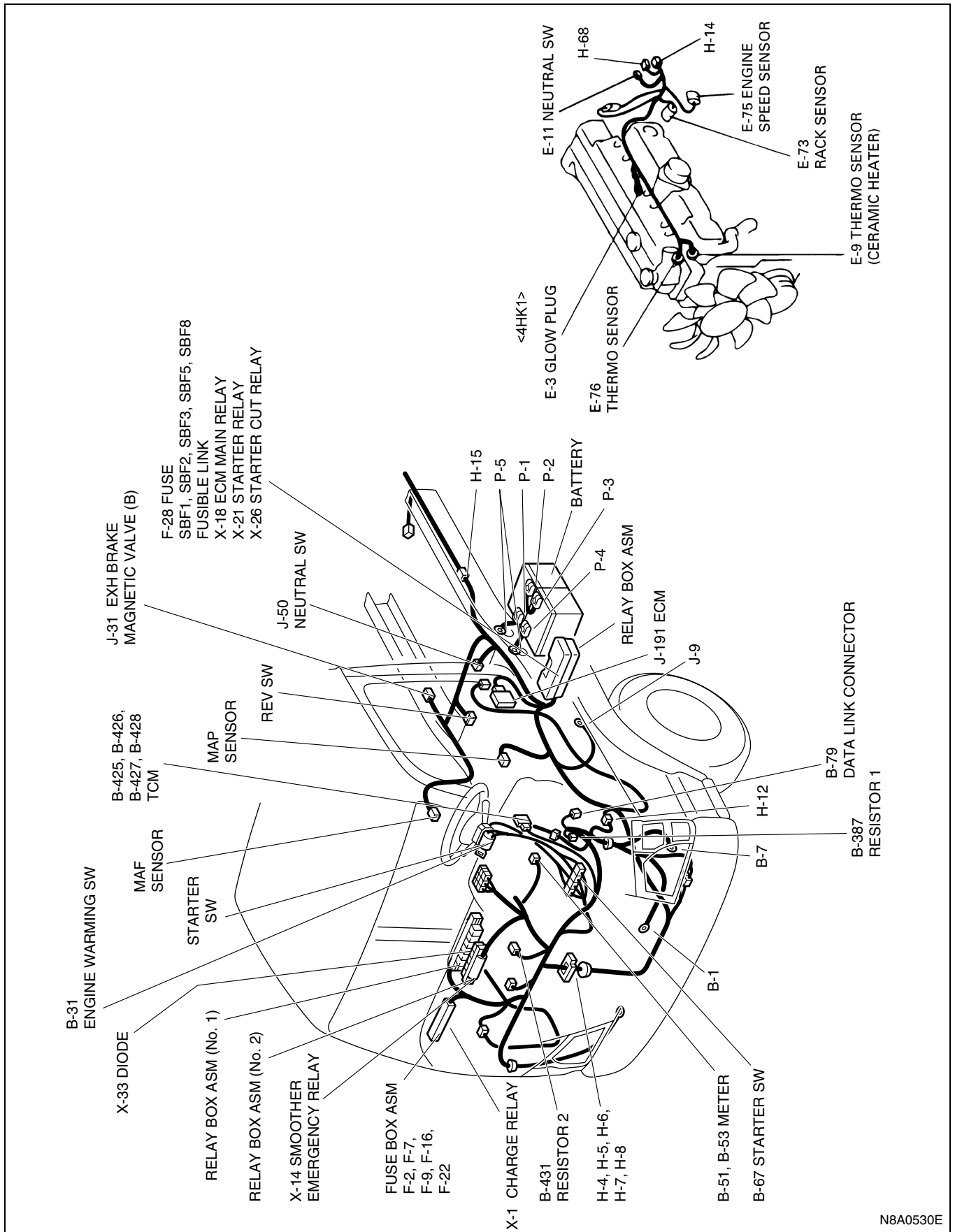
N8A0097E

For 4JH1 Engine



N8A0099E

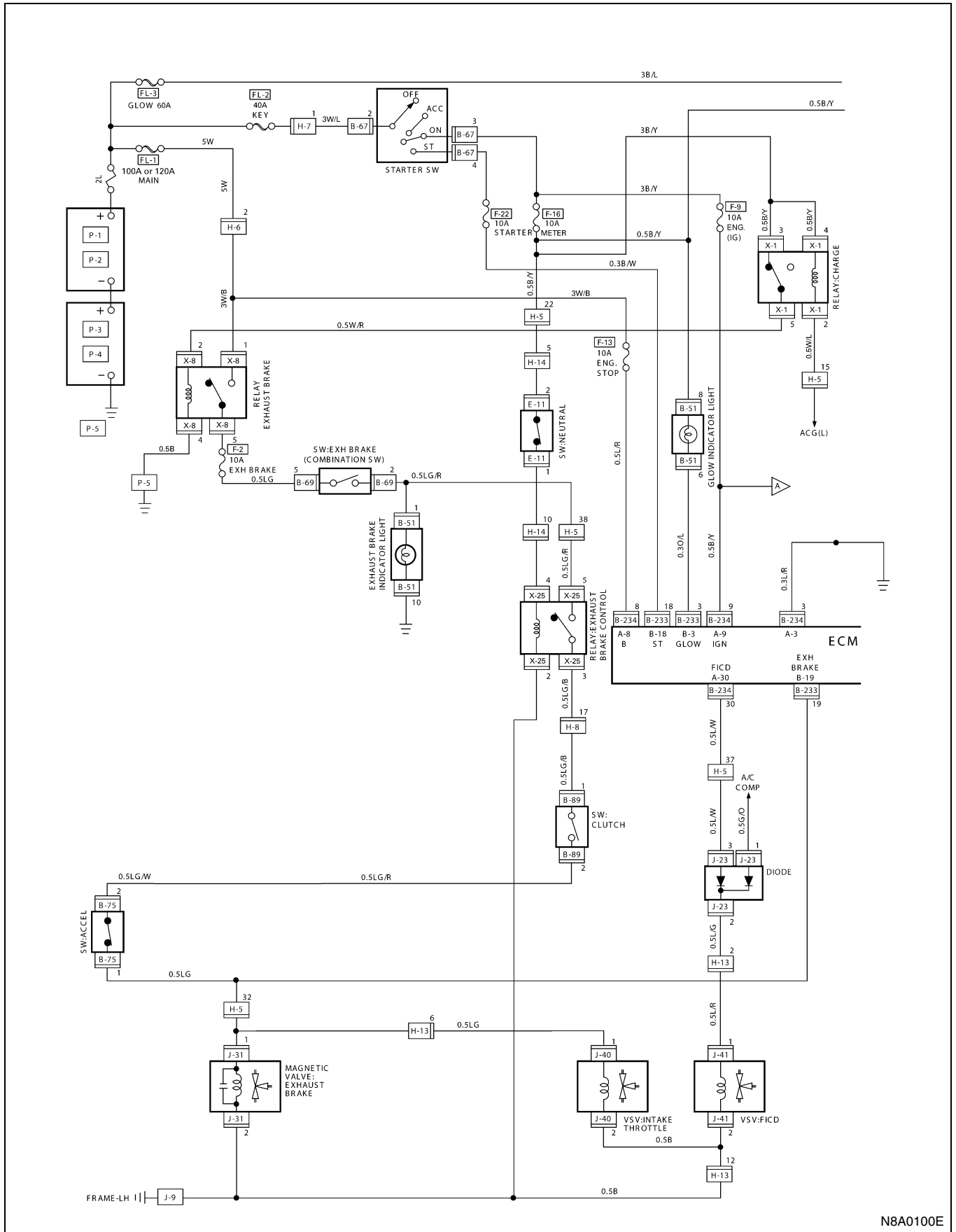
For 4HK1-TC Engine



N8A0530E

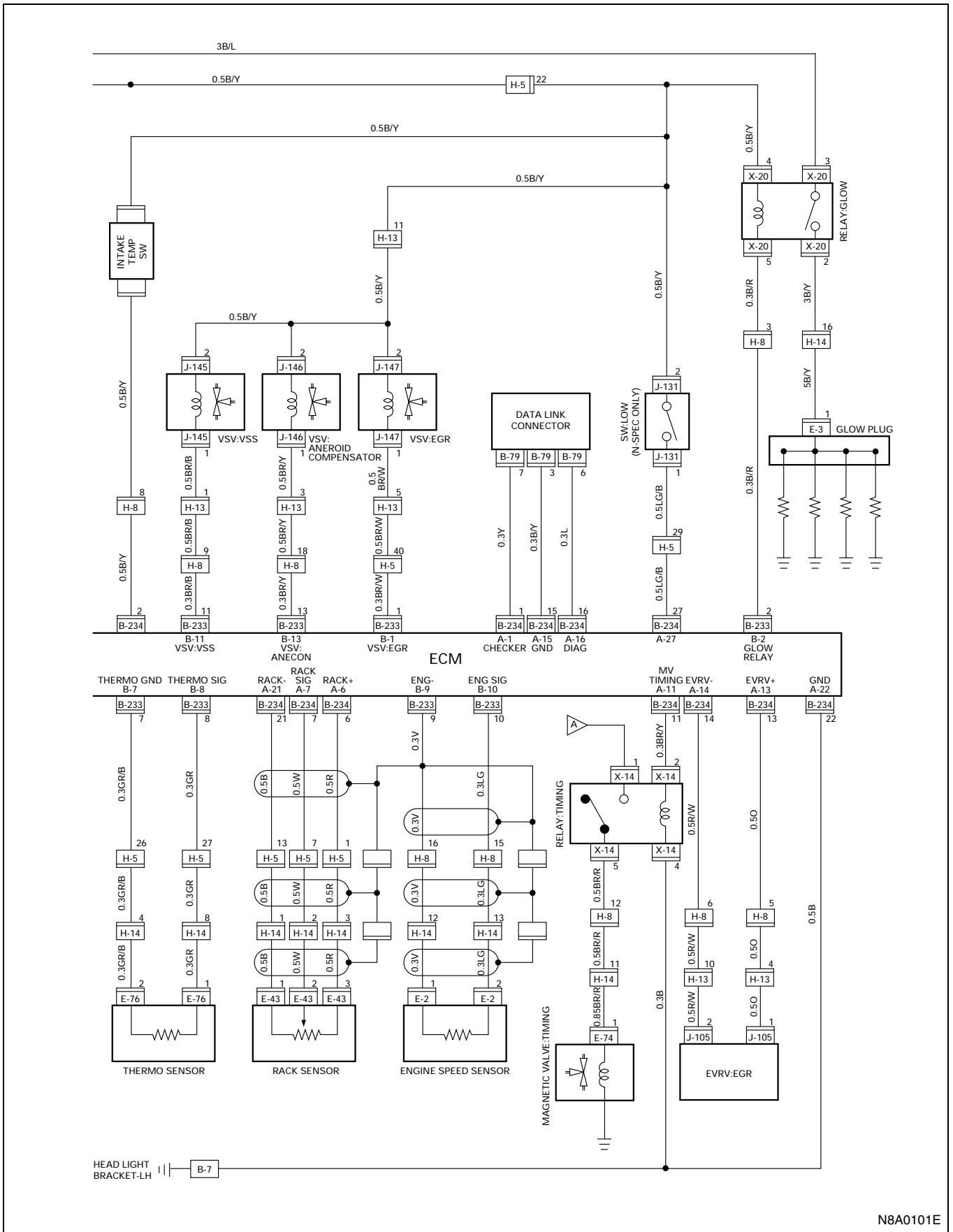
Circuit Diagram

4HE1-TC Engine (1)



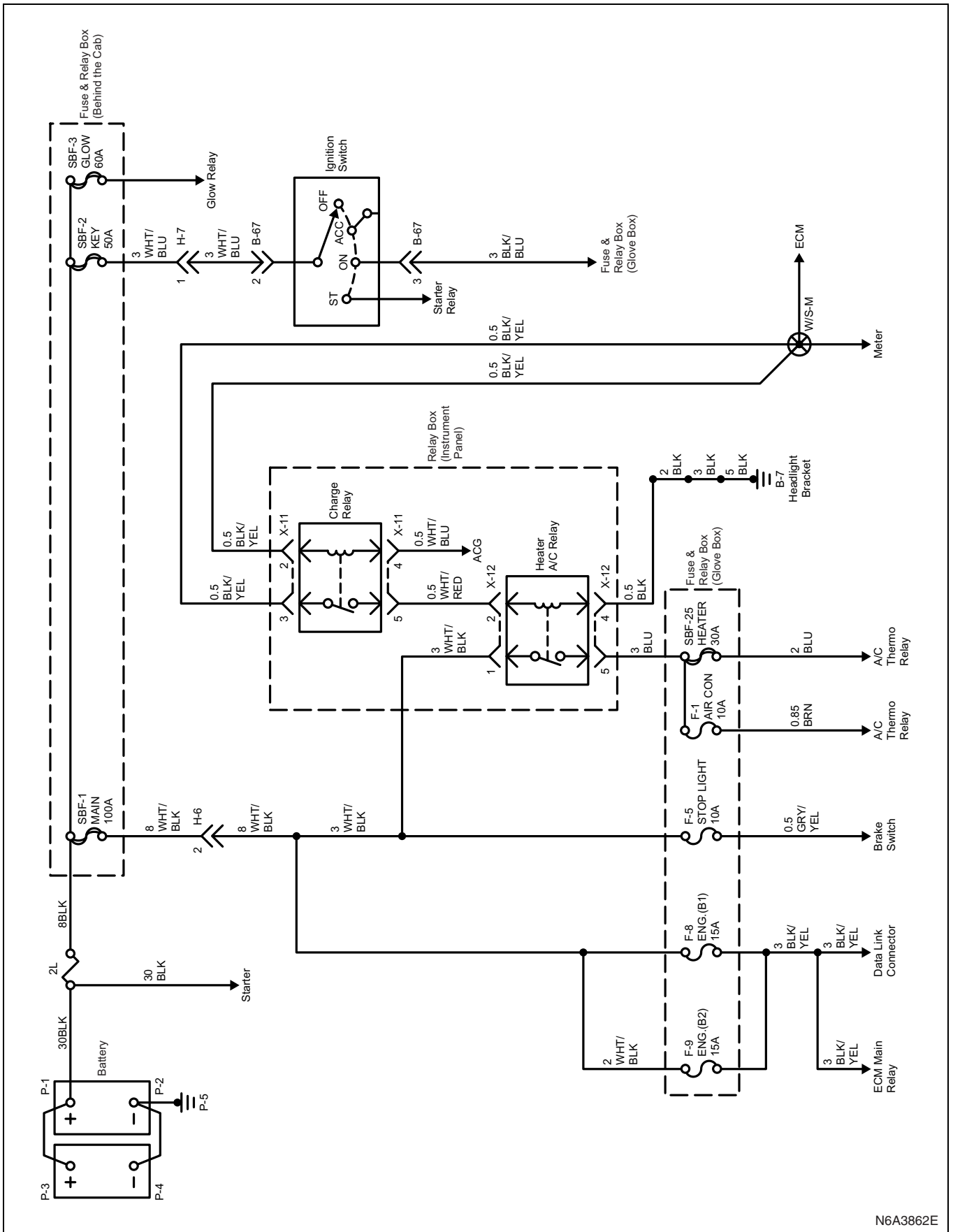
N8A0100E

4HE1-TC Engine (2)



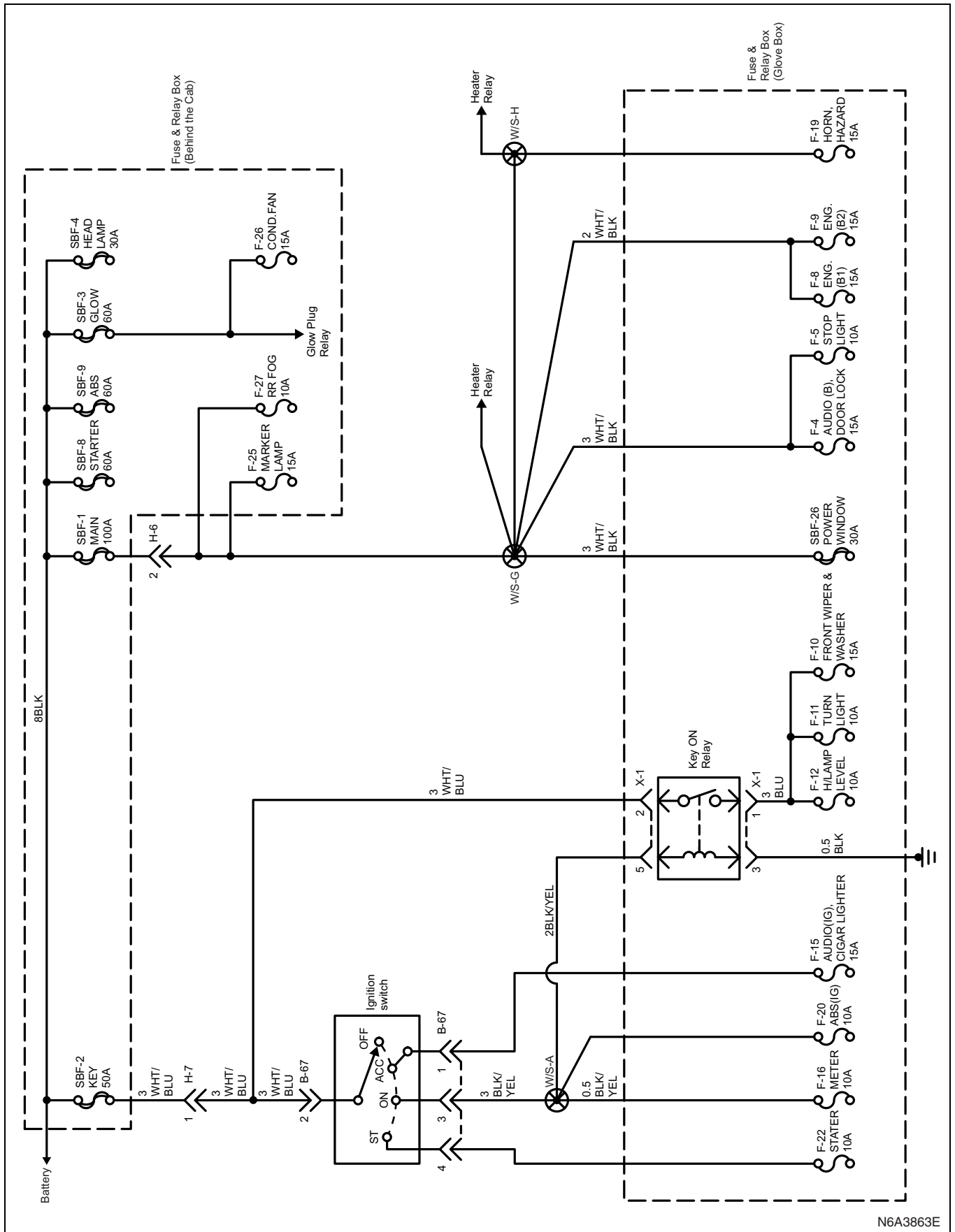
N8A0101E

4JH1 Engine (1)



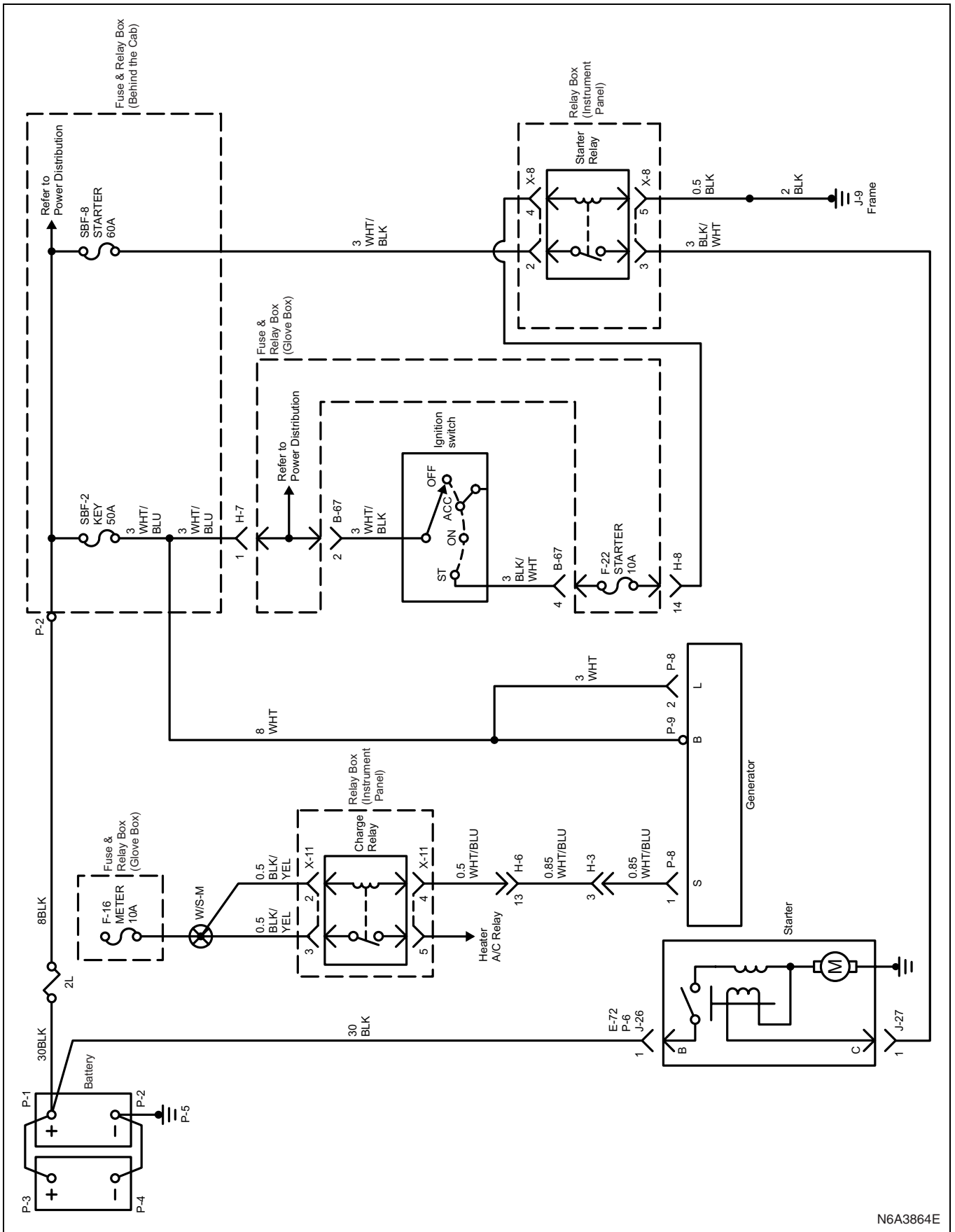
N6A3862E

4JH1 Engine (2)



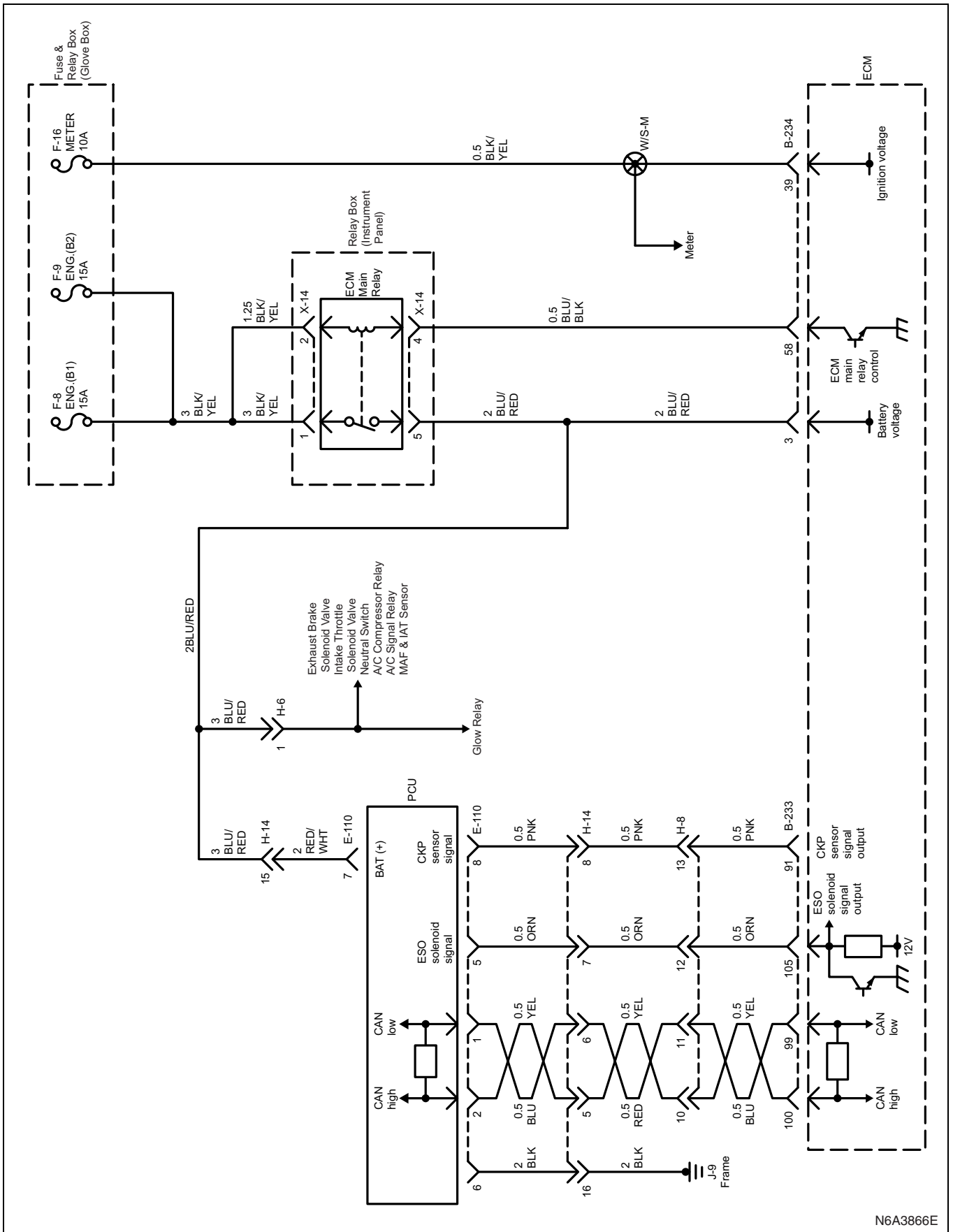
N6A3863E

4JH1 Engine (3)



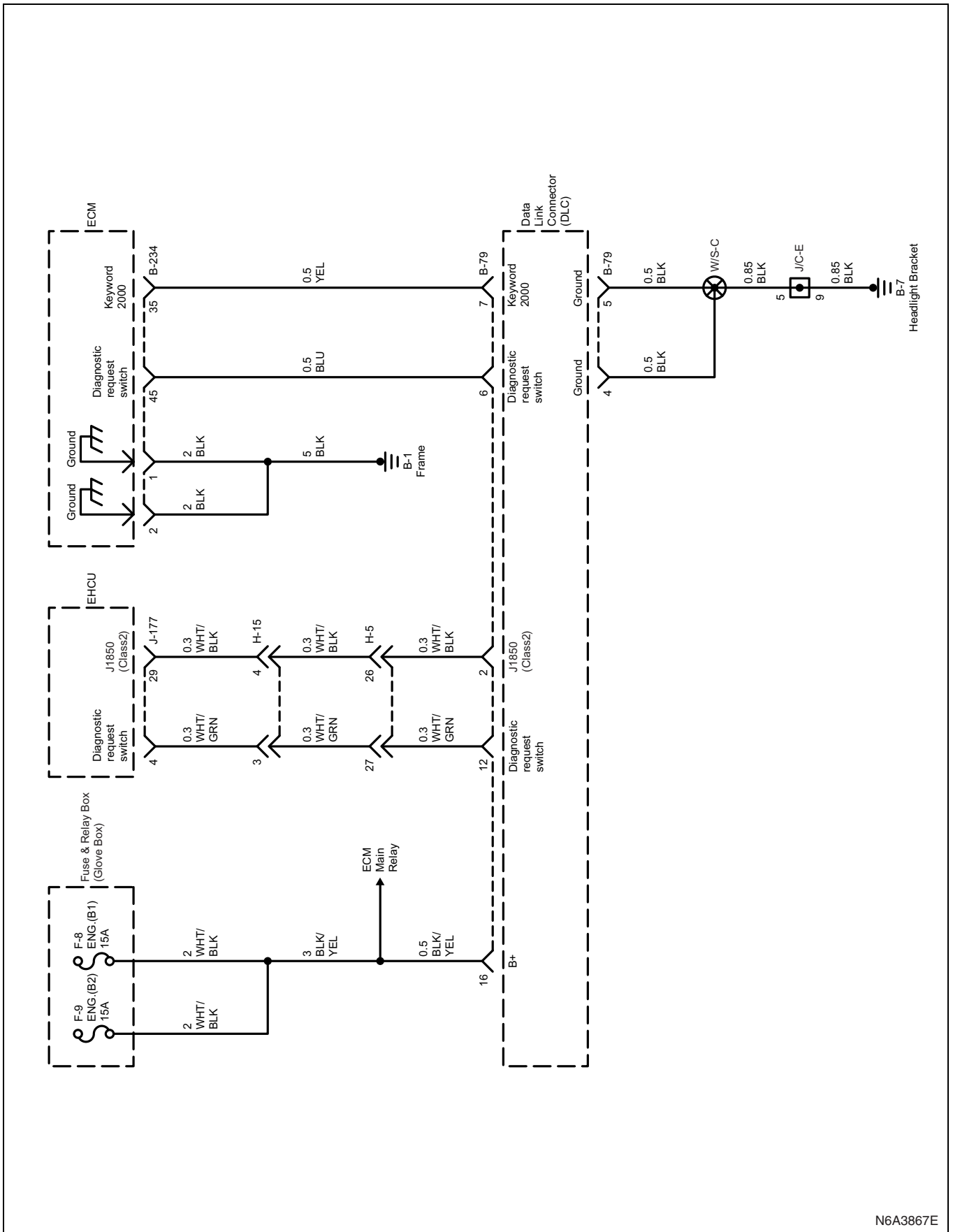
N6A3864E

4JH1 Engine (4)



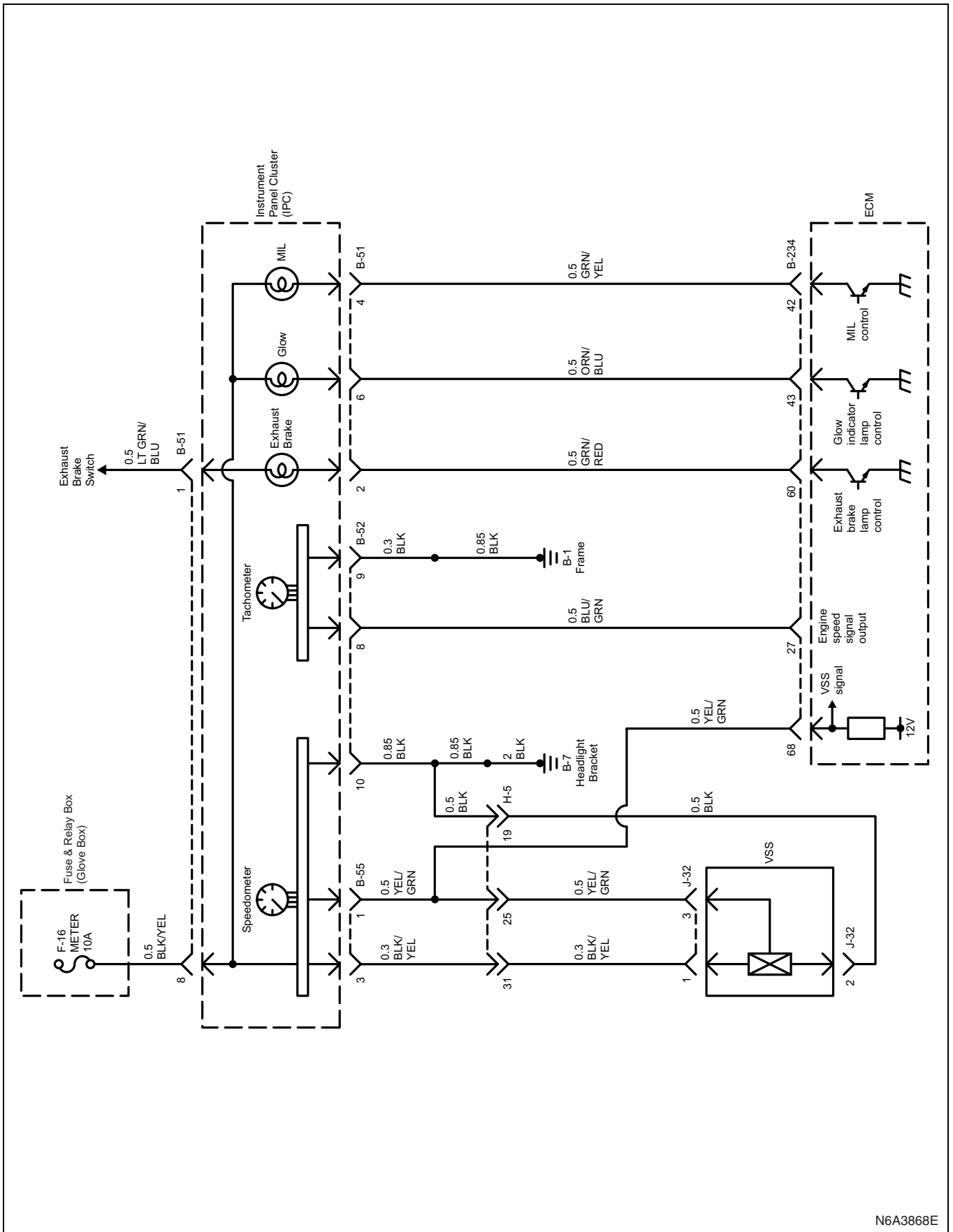
N6A3866E

4JH1 Engine (5)



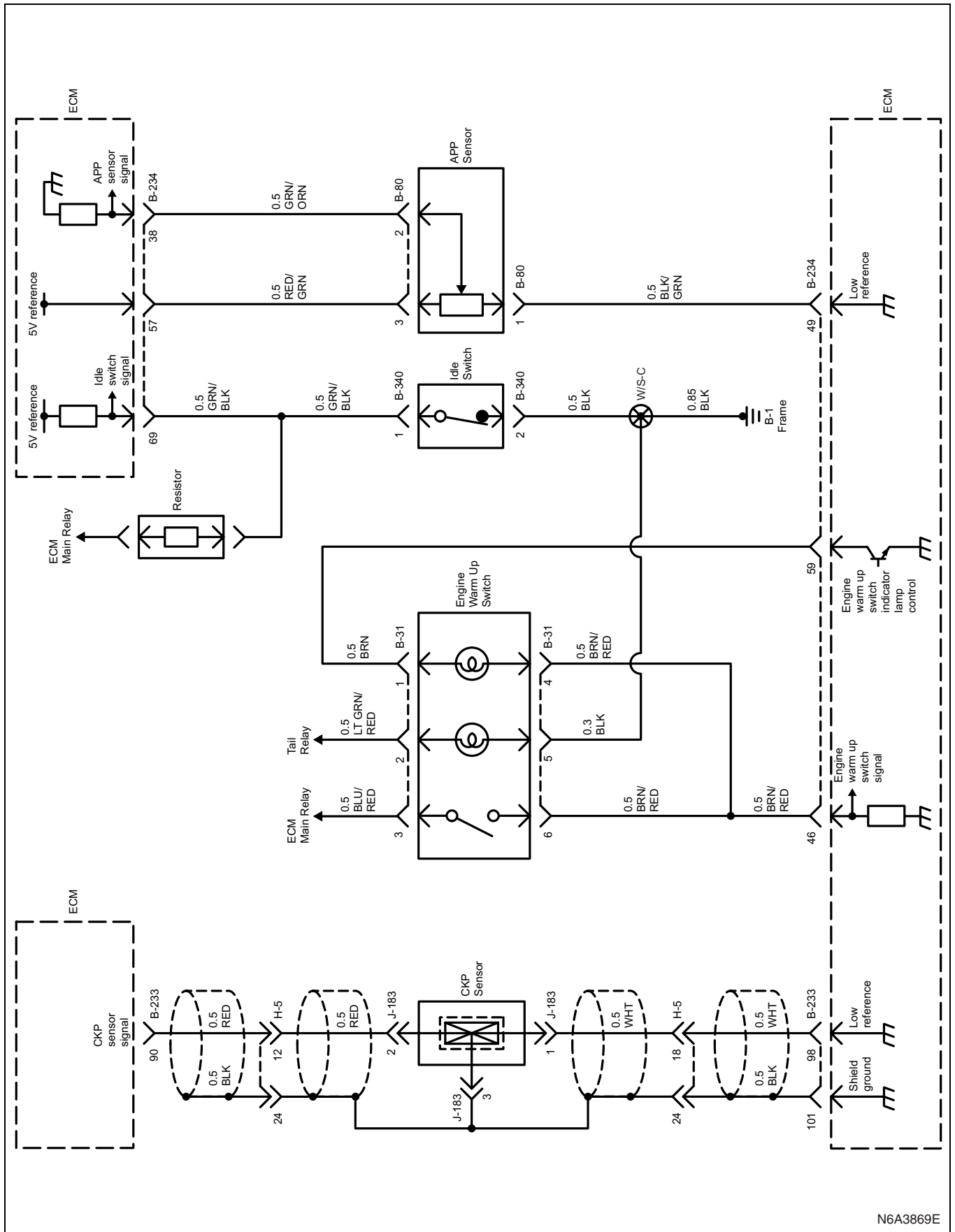
N6A3867E

4JH1 Engine (6)



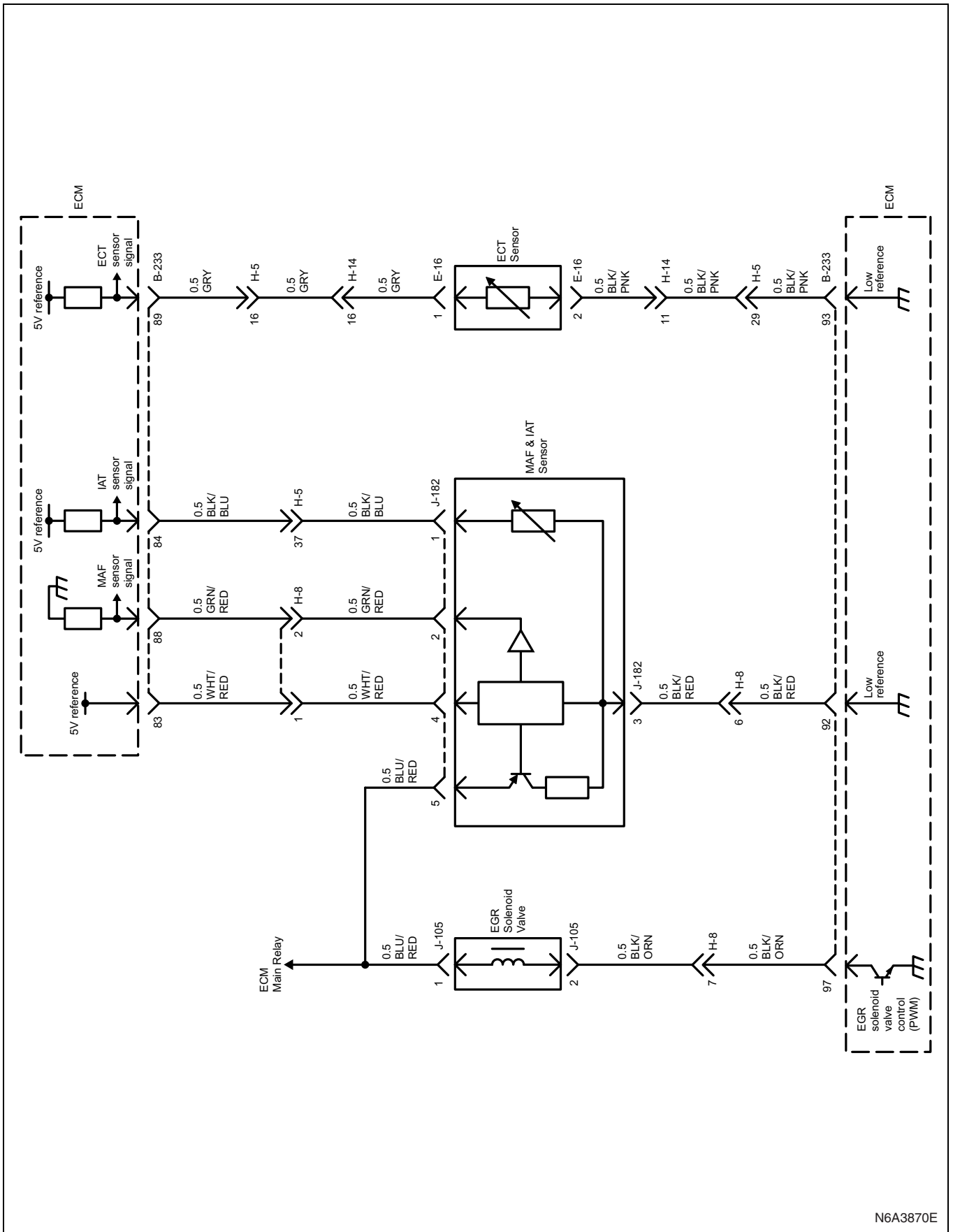
N6A3868E

4JH1 Engine (7)



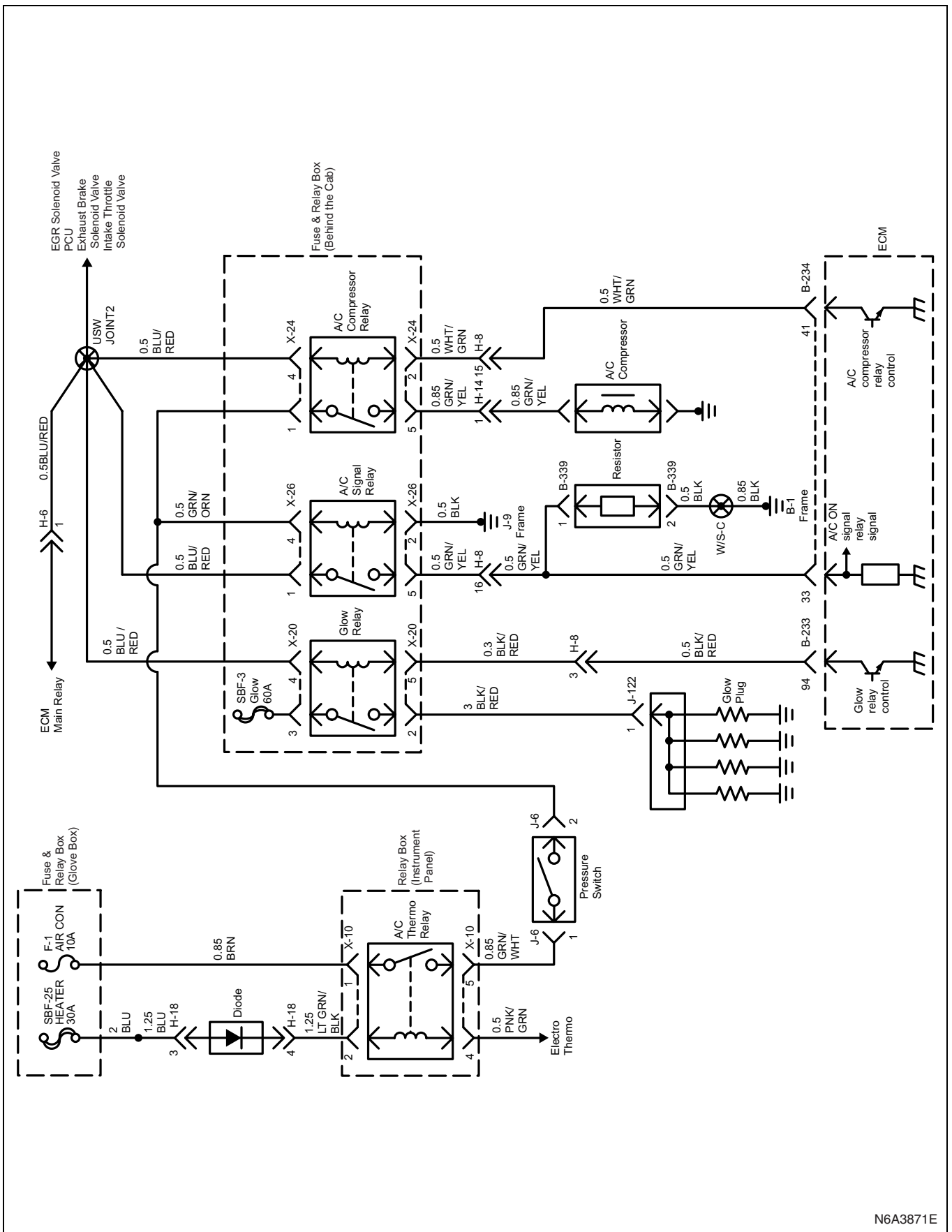
N6A3869E

4JH1 Engine (8)



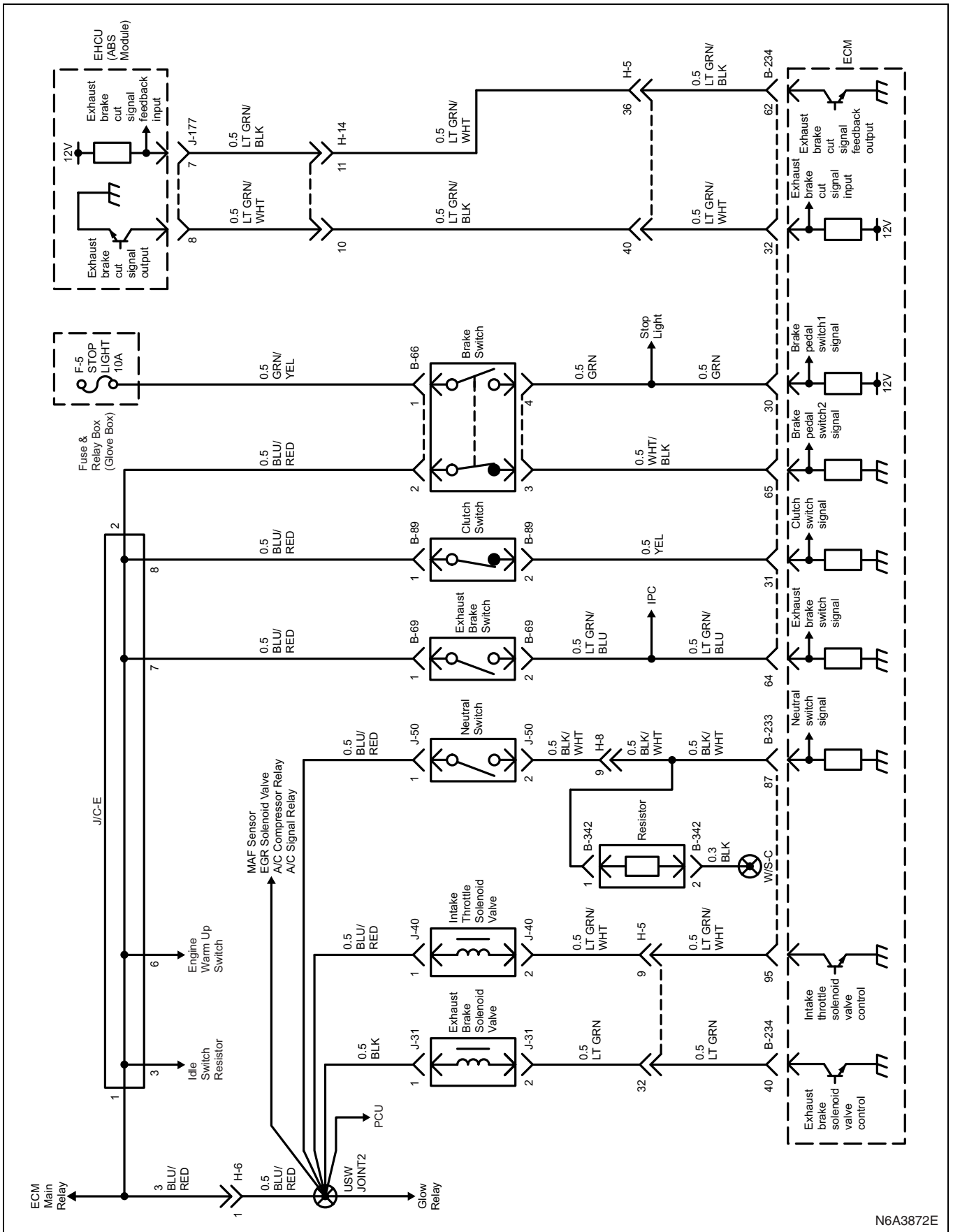
N6A3870E

4JH1 Engine (9)



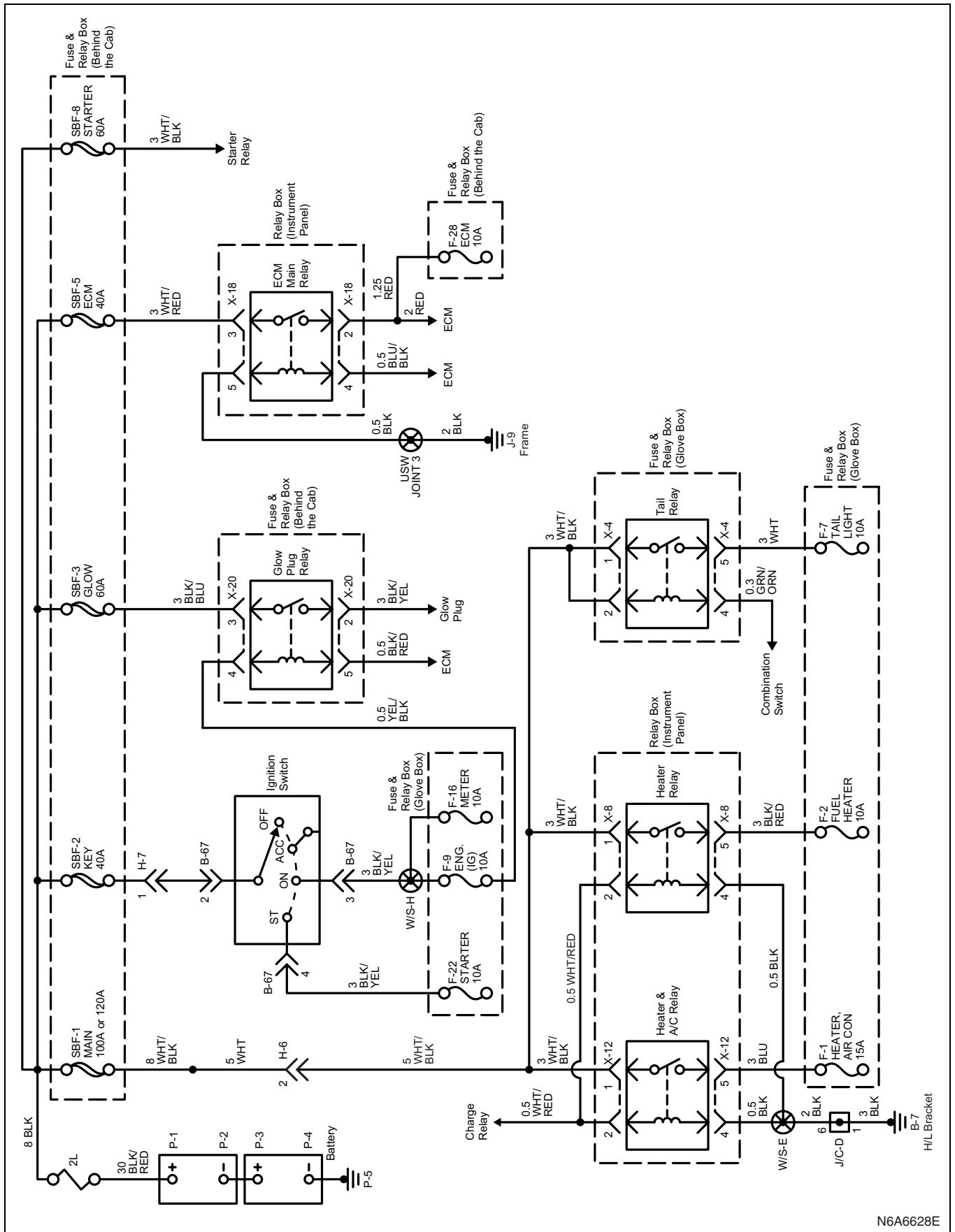
N6A3871E

4JH1 Engine (10)



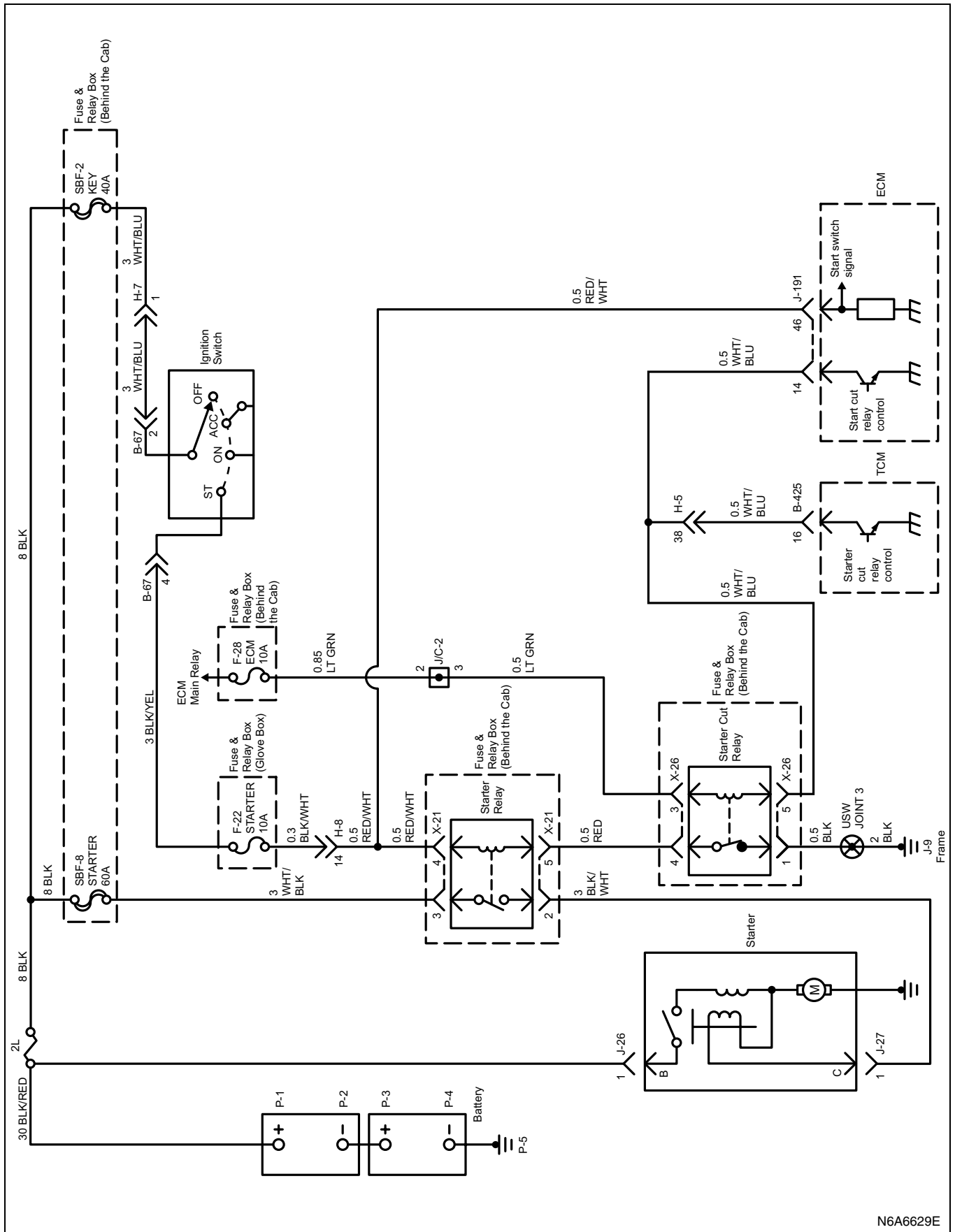
N6A3872E

4HK1-TC Engine (1)



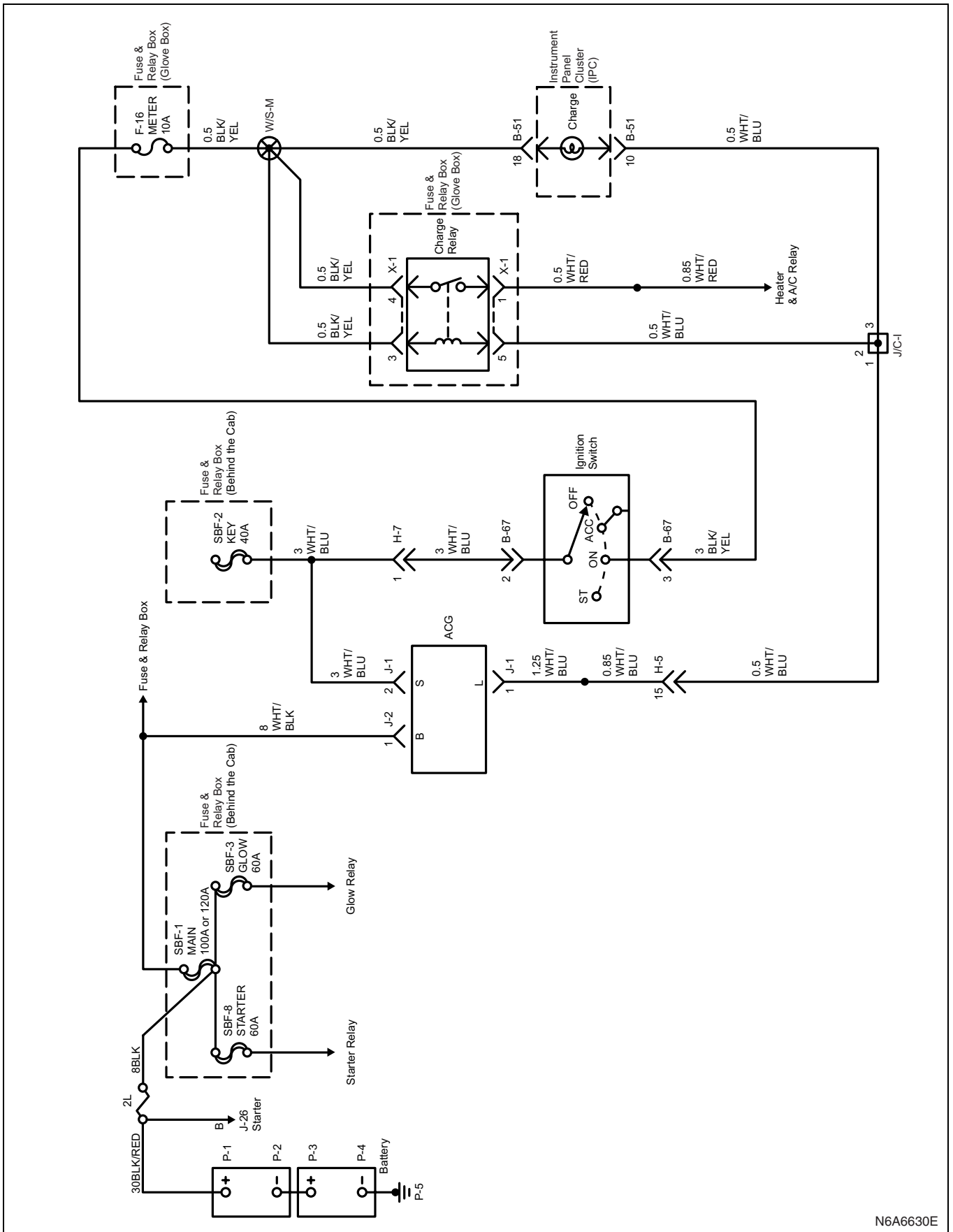
N6A6628E

4HK1-TC Engine (2)



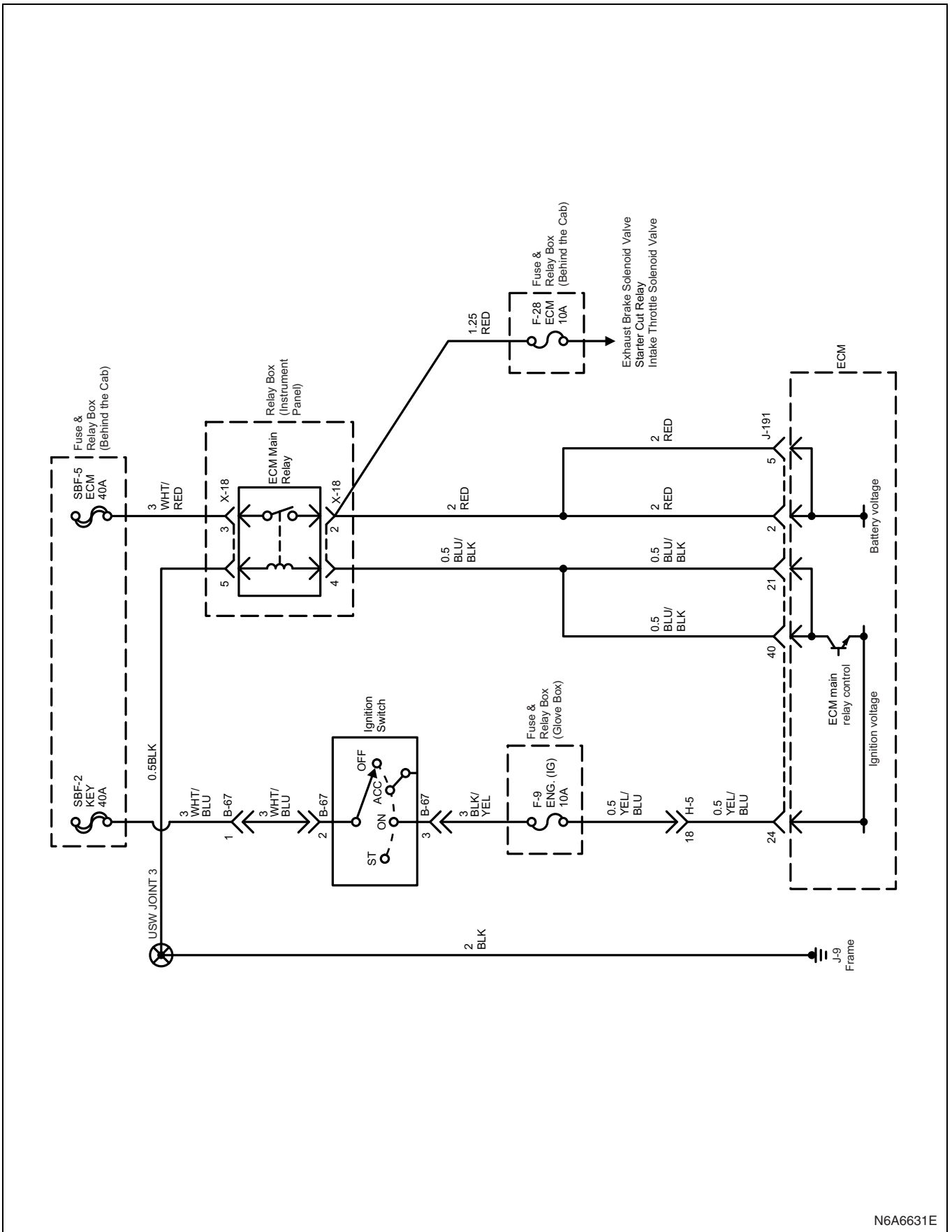
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4HK1-TC Engine (3)



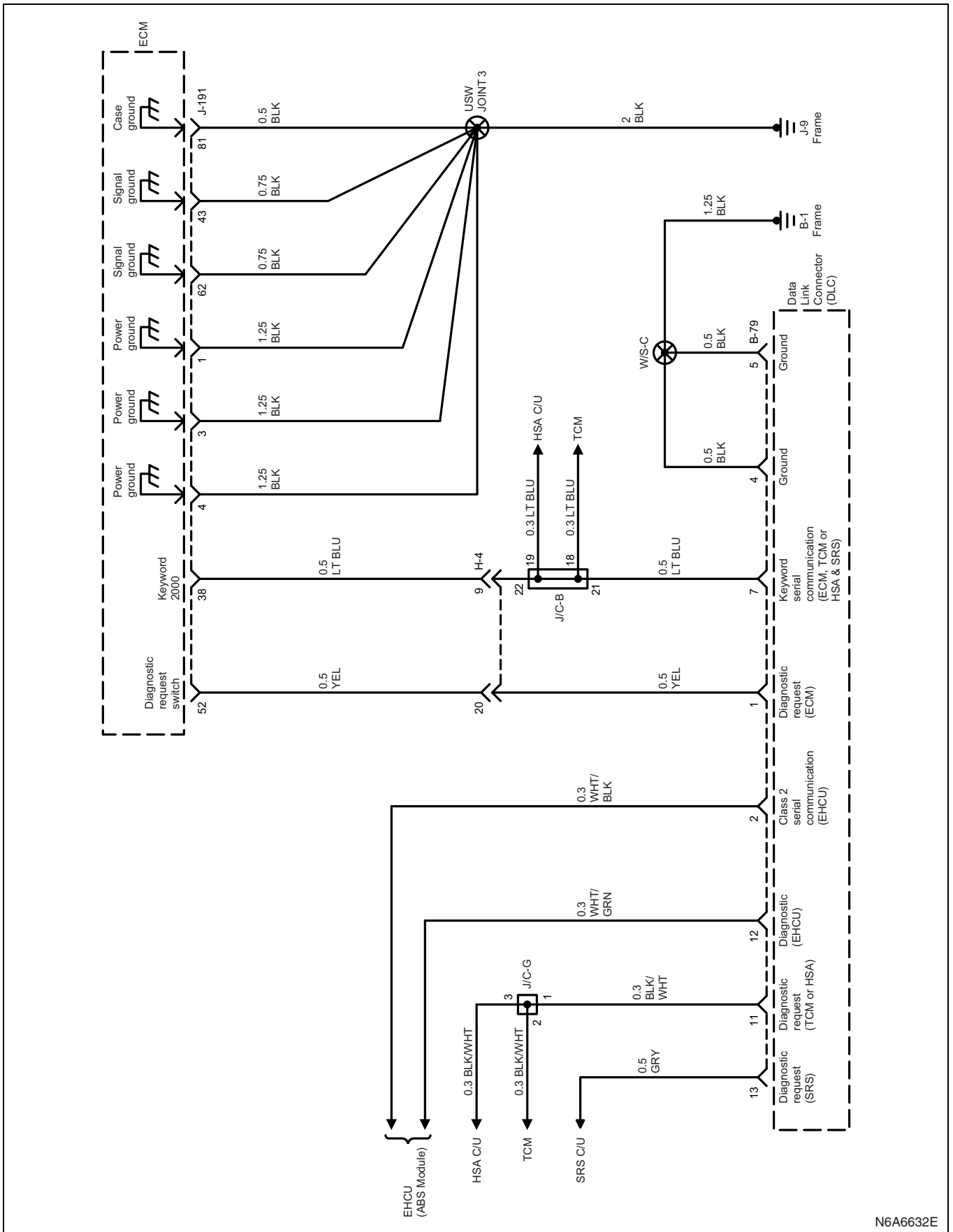
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4HK1-TC Engine (4)



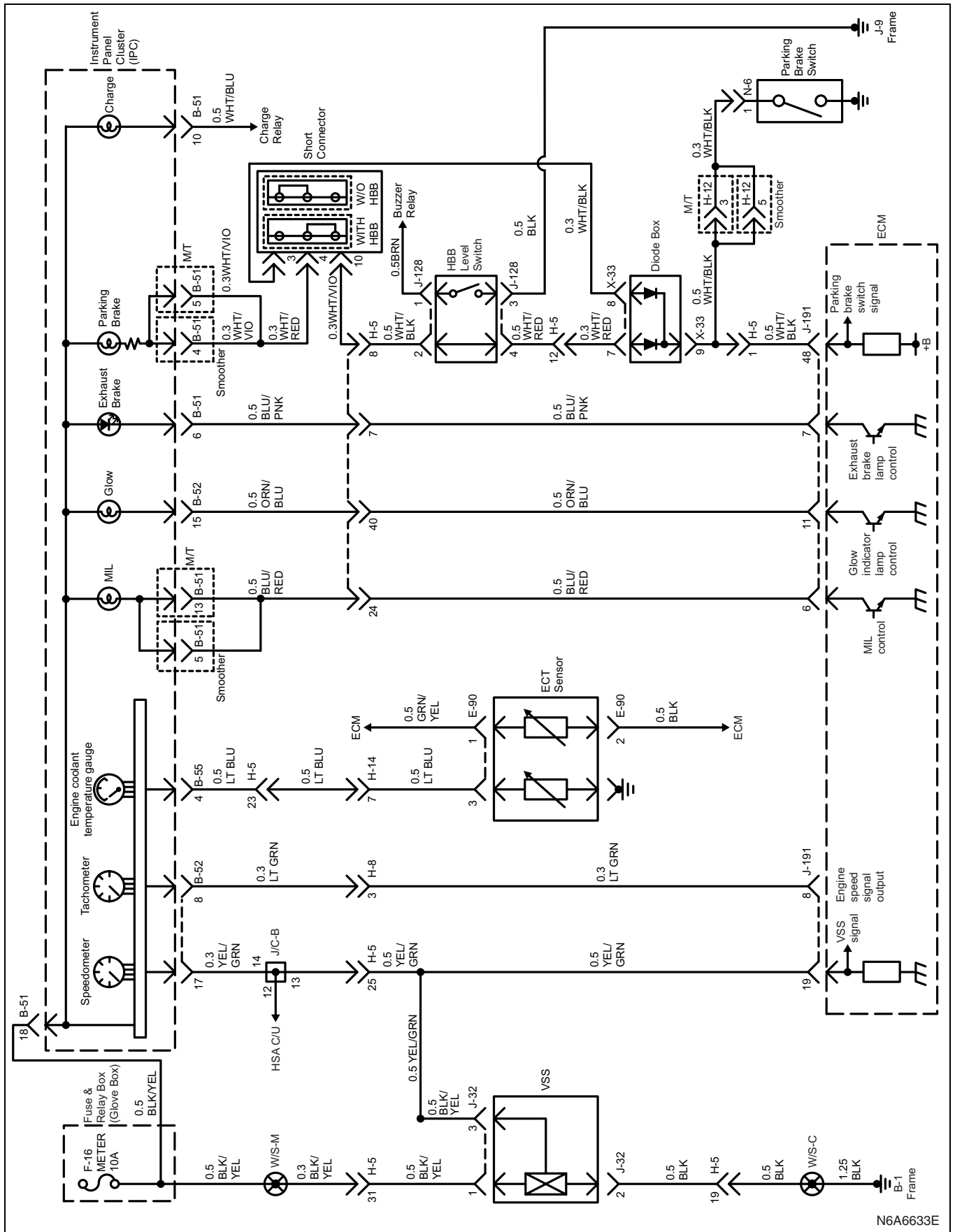
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4HK1-TC Engine (5)



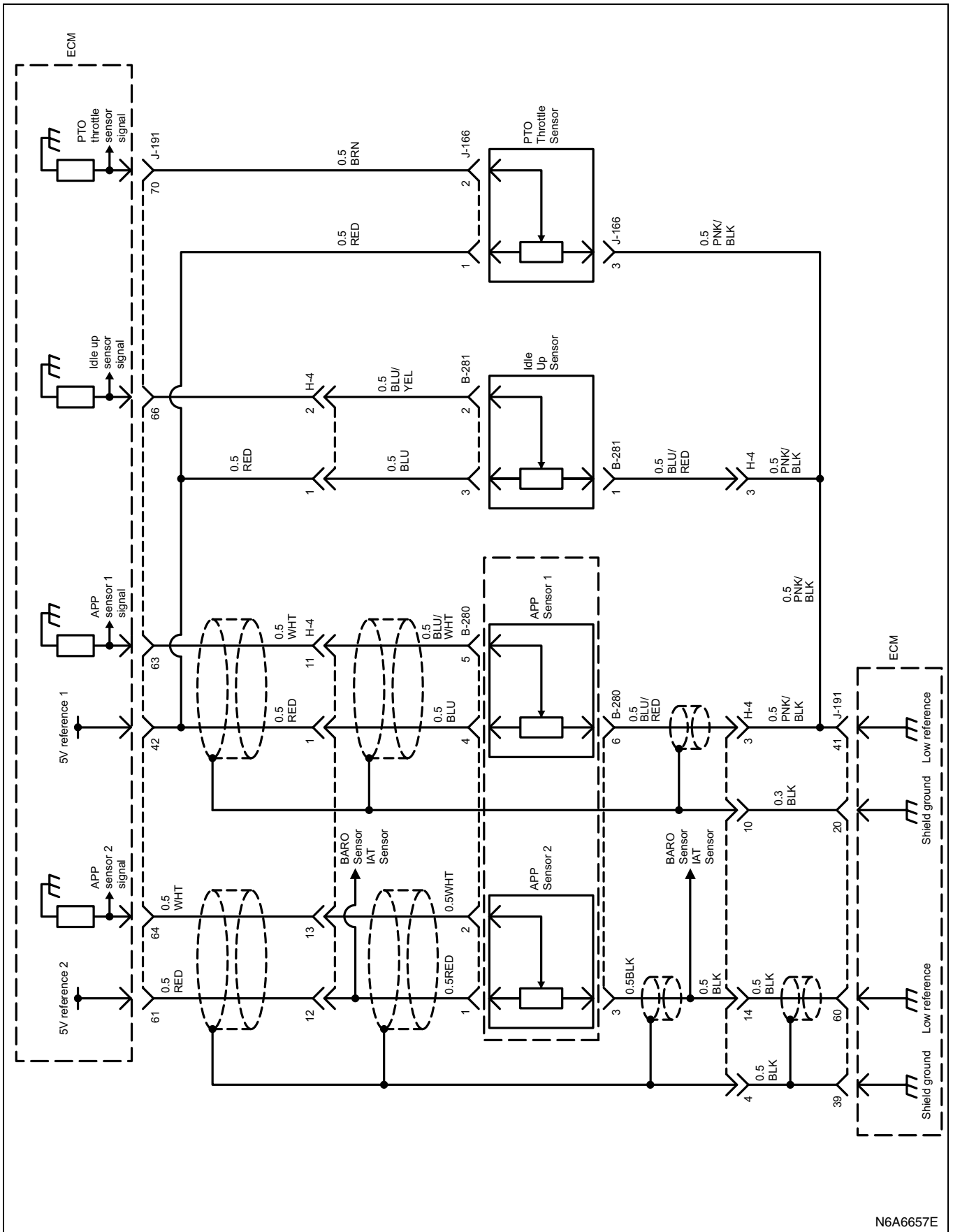
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4HK1-TC Engine (6)



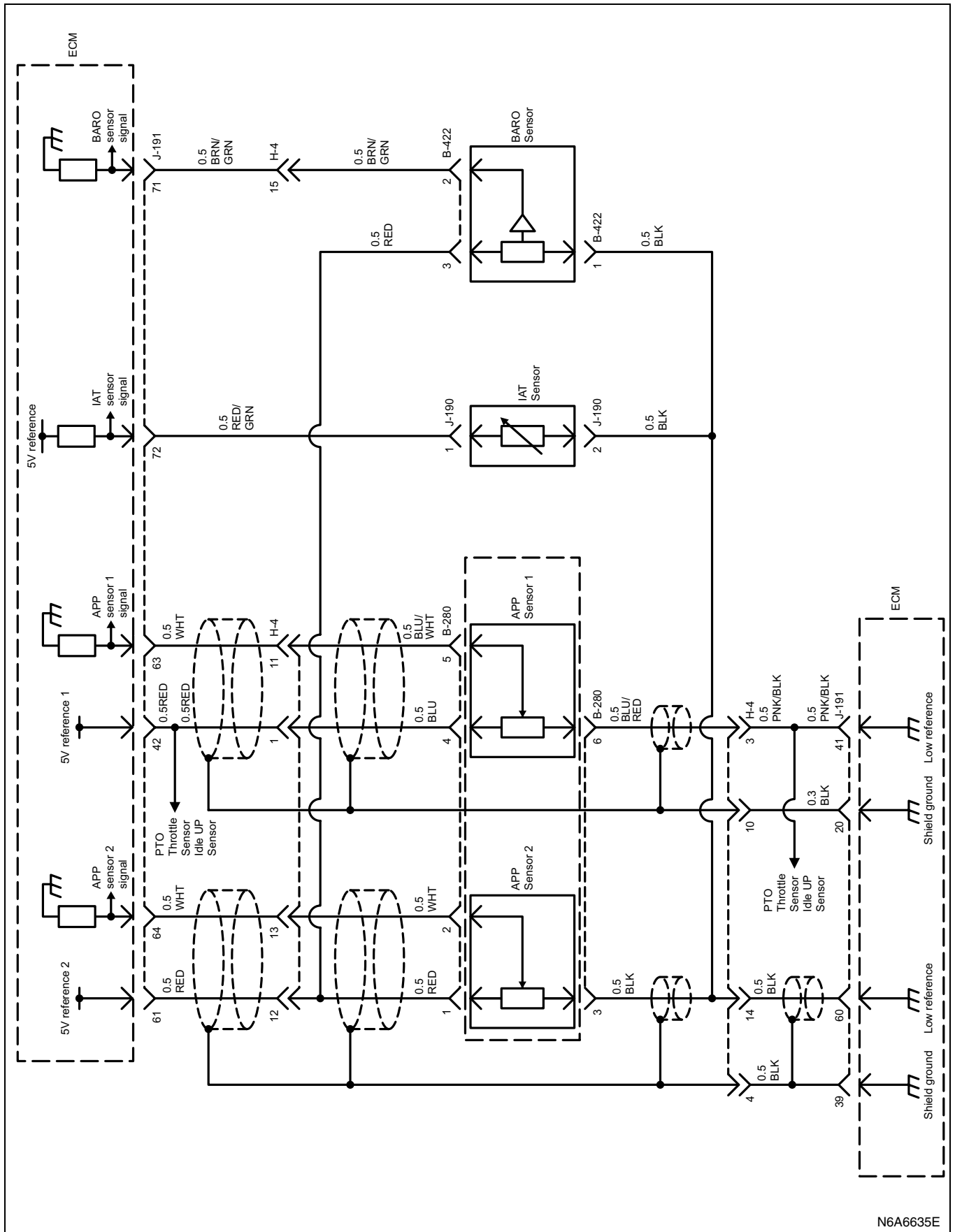
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4HK1-TC Engine (7)



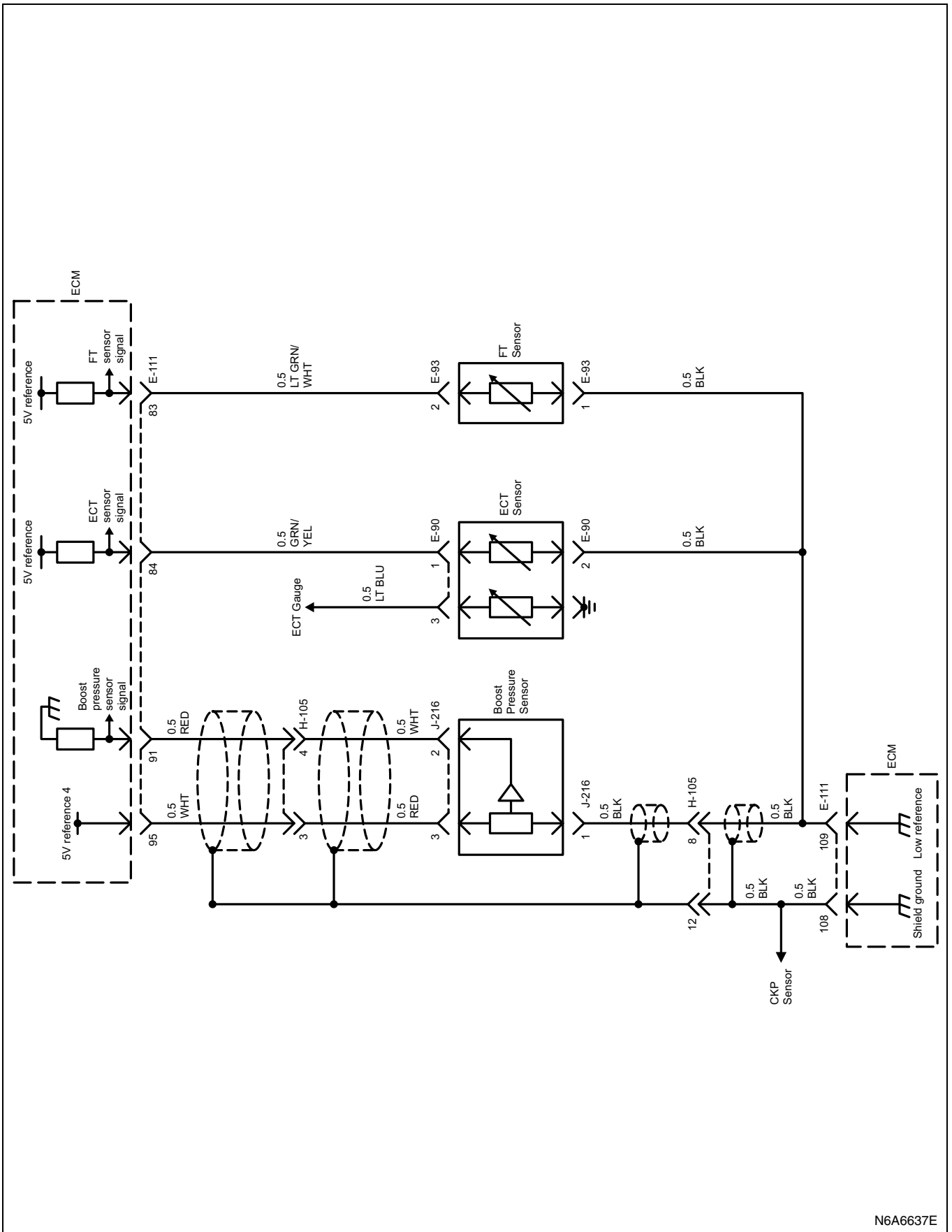
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4HK1-TC Engine (8)



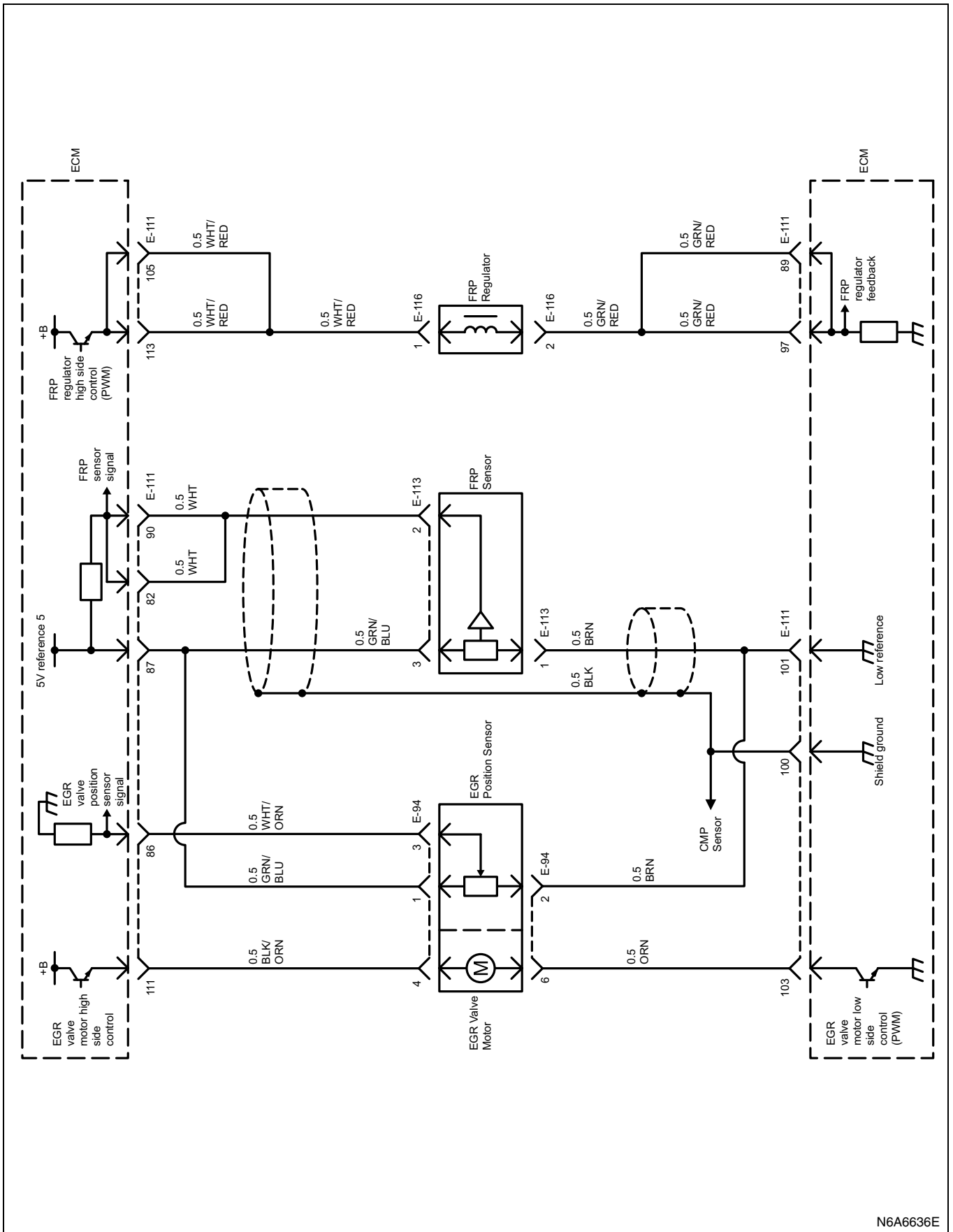
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4HK1-TC Engine (9)



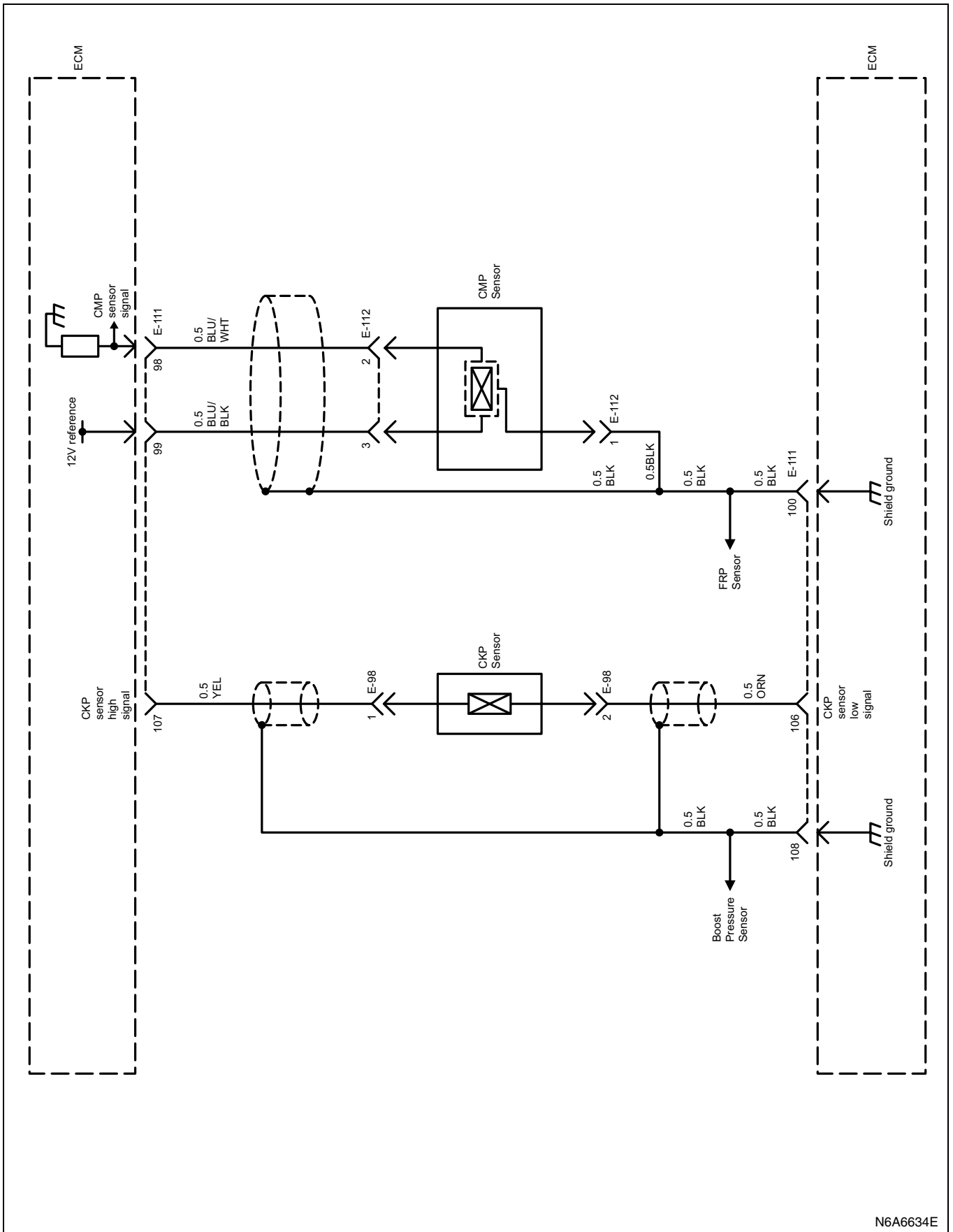
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4HK1-TC Engine (10)



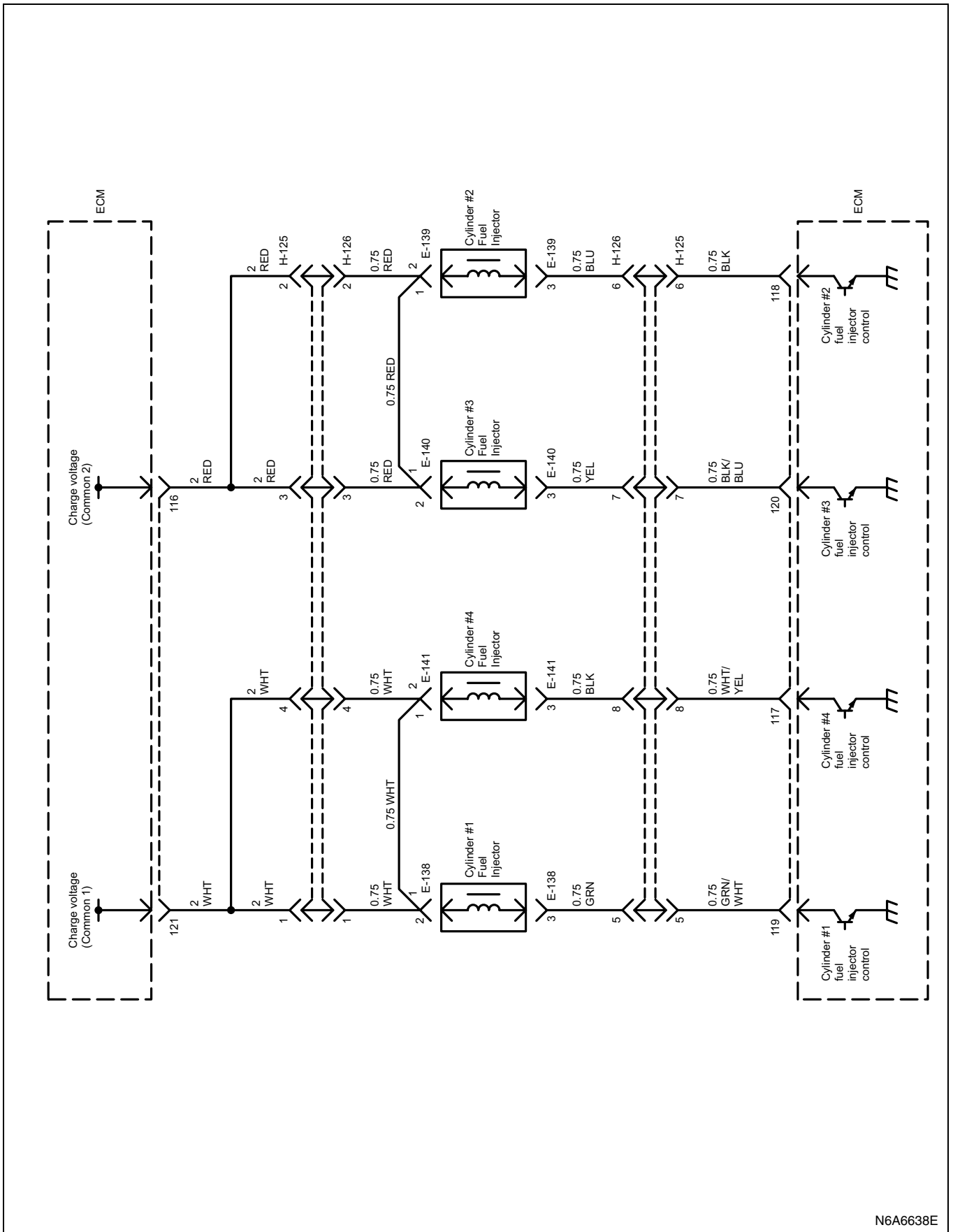
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4HK1-TC Engine (11)



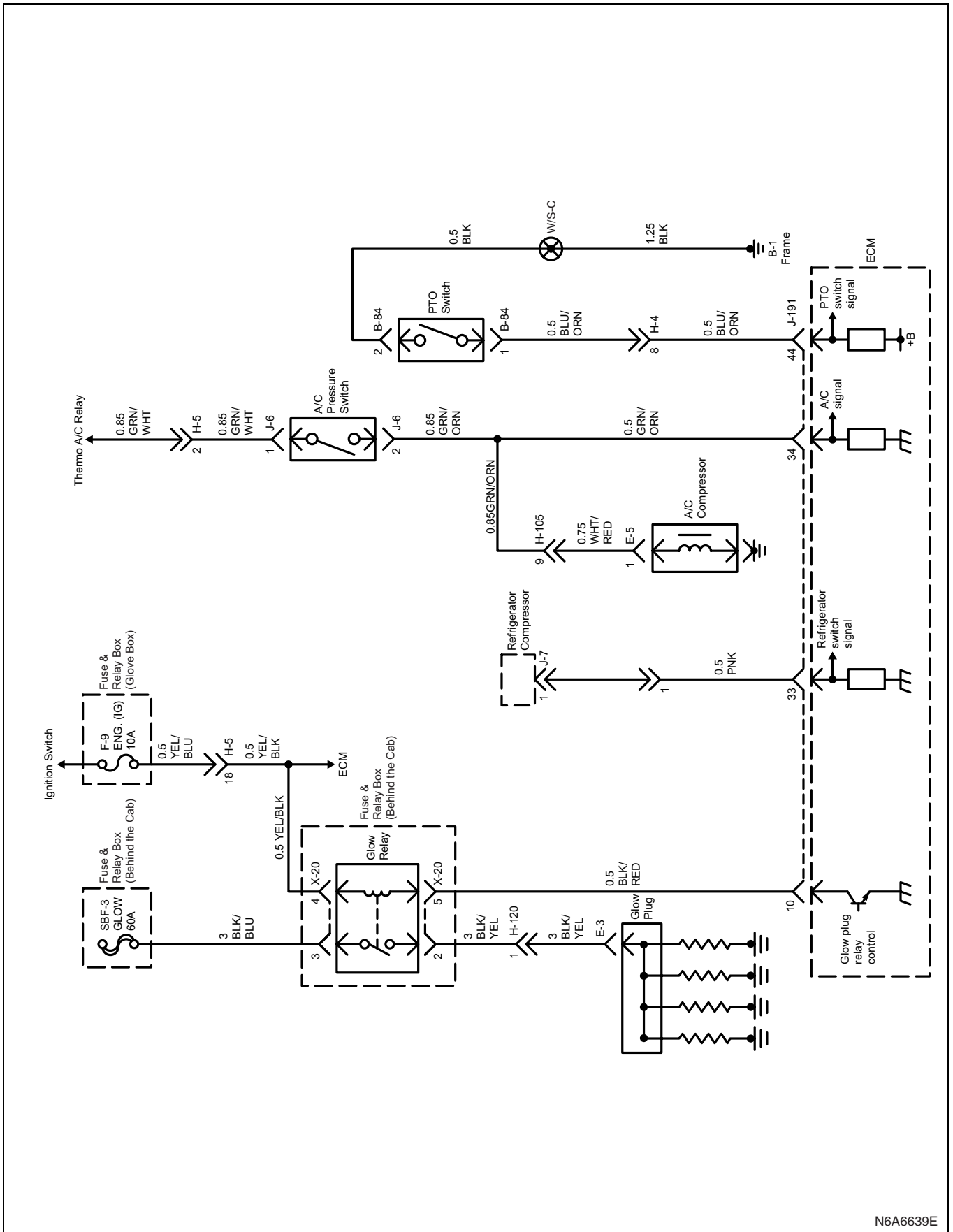
N6A6634E

4HK1-TC Engine (12)



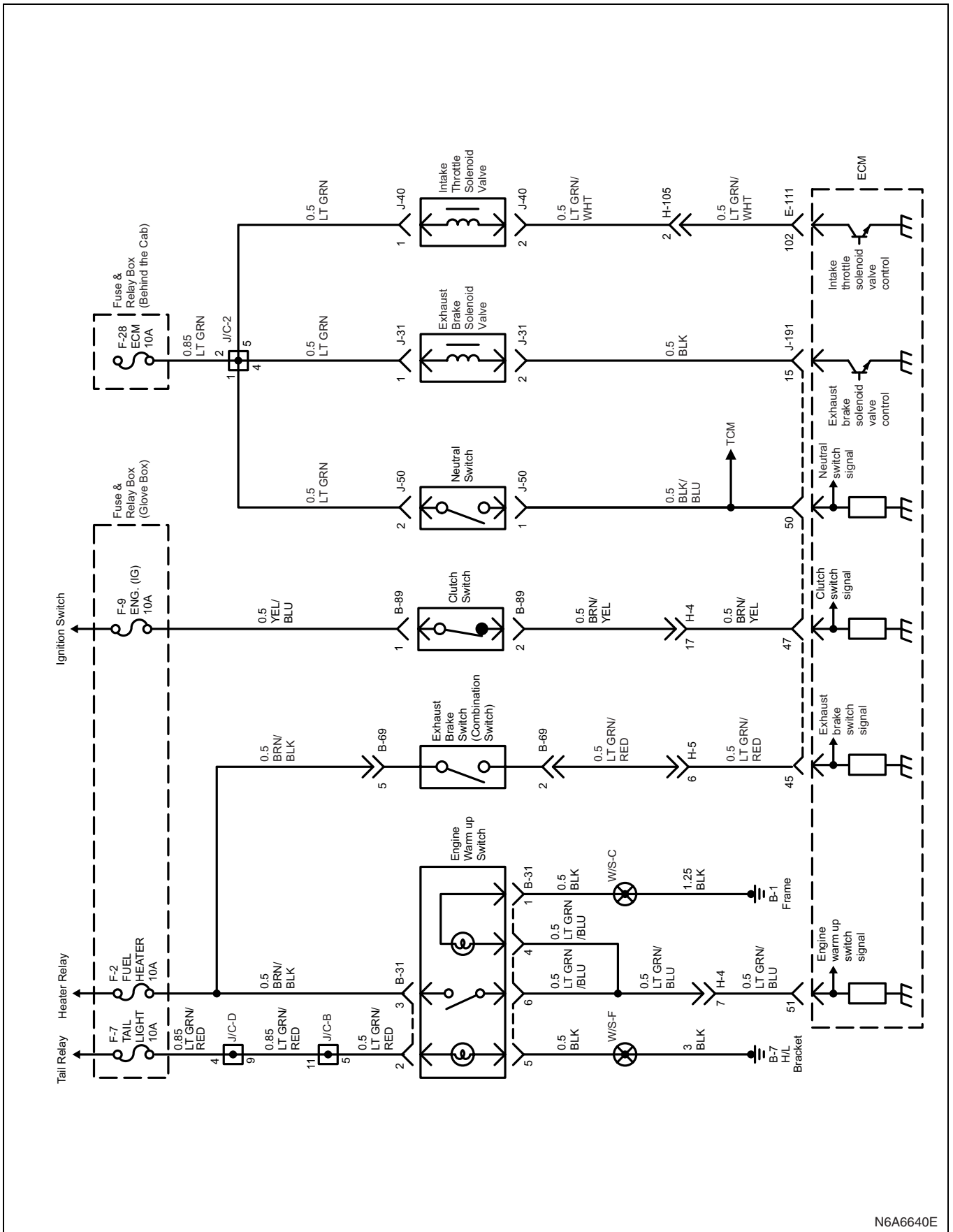
N6A6638E

4HK1-TC Engine (13)



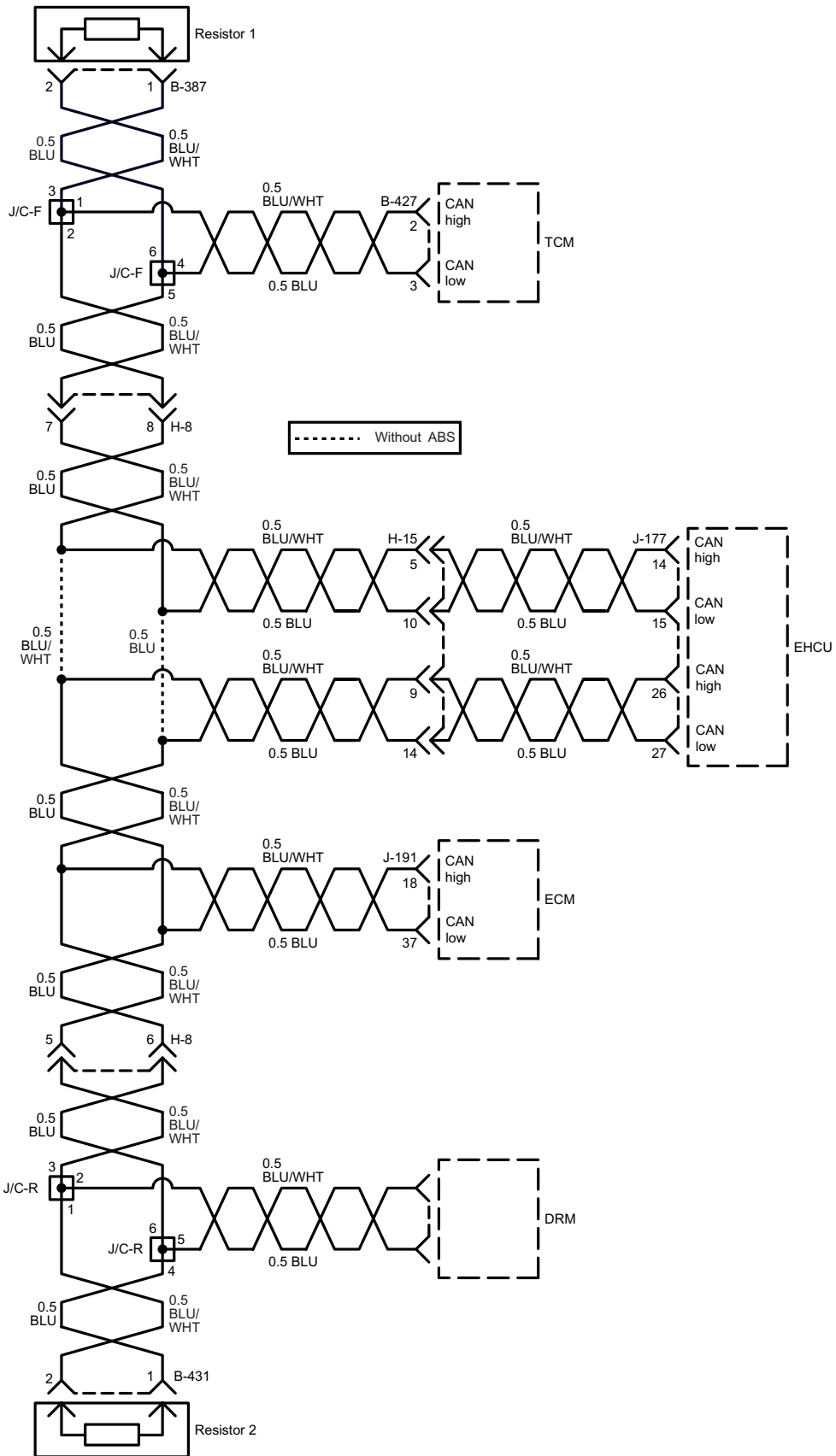
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4HK1-TC Engine (14)



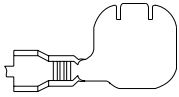
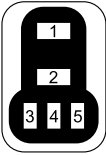
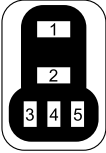
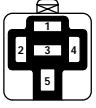
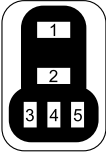
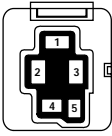

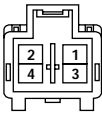
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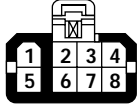
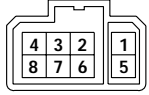

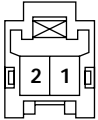

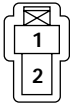
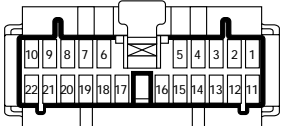
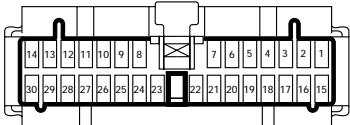
4HK1-TC Engine (15)

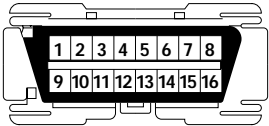
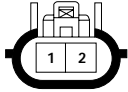

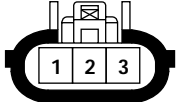





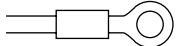
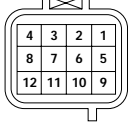
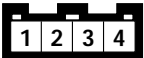


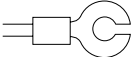











N6A6641E

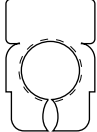
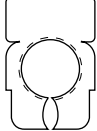
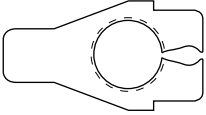
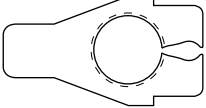
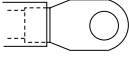
Connector List
For 4HE1-TC Engine

No.	Connector Face
B-7	 000-012
X-1	 005-006
X-8	 005-006
X-14	 005-001
X-25	 005-006
X-20	 005-003
B-67	 004-001
B-67	 004-002

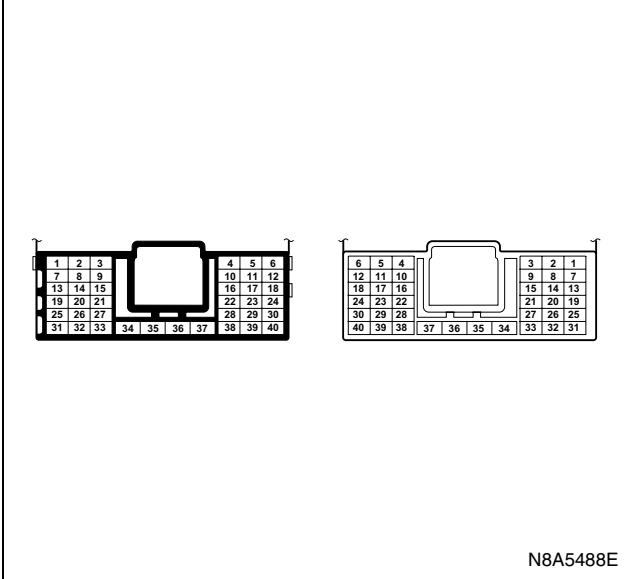
No.	Connector Face
B-69	 008-001
B-69	 008-002
B-75	 002-022
B-75	 002-023
B-89	 002-009
B-89	 002-010
B-233	 022-002
B-234	 030-002

No.	Connector Face	No.	Connector Face
B-79	 <p>016-005</p>	E-11	 <p>002-001</p>
B-51	 <p>014-001</p>	E-43	 <p>003-003</p>
H-14	 <p>016-003</p>	E-74	 <p>001-013</p>
H-14	 <p>016-004</p>	E-76	 <p>003-004</p>
H-13	 <p>012-001</p>	J-9	 <p>000-001</p>
H-13	 <p>012-002</p>	J-23	 <p>004-009</p>
E-2	 <p>002-013</p>	J-31	 <p>002-011</p>
E-3	 <p>000-009</p>	J-31	 <p>002-012</p>

No.	Connector Face
J-131	 002-011
J-131	 002-012
J-145	 002-014
J-146	 002-015
J-41	 002-015
J-40	 002-015
J-105	 002-016
J-147	 002-017

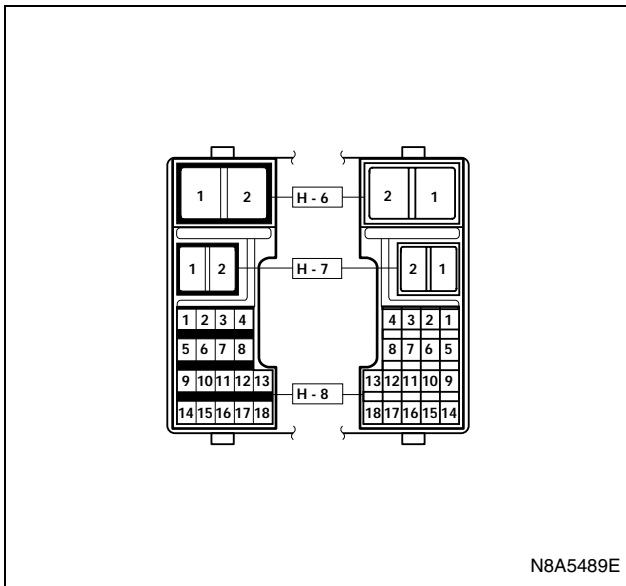
No.	Connector Face
P-1	 000-004
P-4	 000-004
P-2	 000-006
P-3	 000-006
P-5	 000-002

H-5



N8A5488E


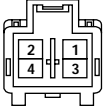
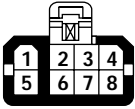
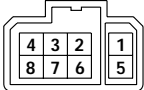
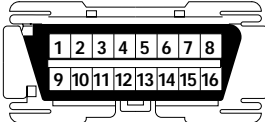

H-6, H-7, H-8





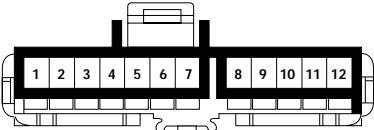

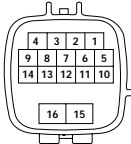







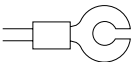



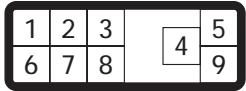



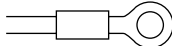
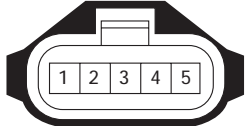

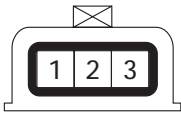
For 4JH1 Engine

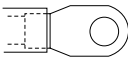
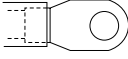
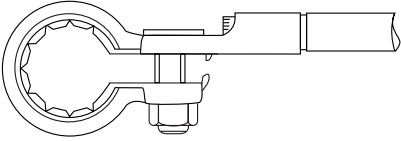
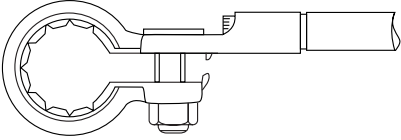

No.	Connector Face
B-1	000-001
B-7	000-012
B-18	004-004
X-10	005-001
X-11	005-001

No.	Connector Face
X-12	005-001
X-14	005-001
X-20	005-003
X-24	005-006
X-26	005-006
B-31	006-001
B-66	004-010
B-339	004-010

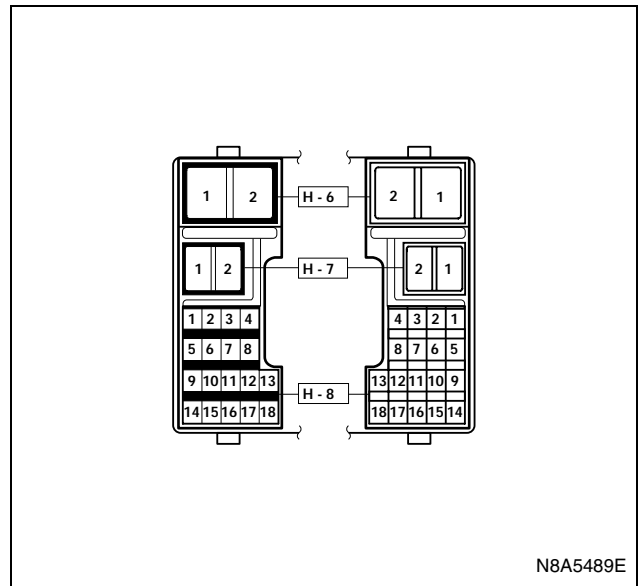
No.	Connector Face																																																																																				
B-67	 <p style="text-align: right;">004-001</p>																																																																																				
B-67	 <p style="text-align: right;">004-002</p>																																																																																				
B-69	 <p style="text-align: right;">008-001</p>																																																																																				
B-69	 <p style="text-align: right;">008-002</p>																																																																																				
B-79	 <p style="text-align: right;">016-005</p>																																																																																				
B-89	 <p style="text-align: right;">002-019</p>																																																																																				
B-233	<table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>121</td><td>120</td><td>119</td><td>113</td><td>112</td><td>111</td><td>110</td><td>109</td><td>108</td><td>107</td><td>106</td><td></td><td></td></tr> <tr><td></td><td></td><td></td><td>105</td><td>104</td><td>103</td><td>102</td><td>101</td><td>100</td><td>99</td><td>98</td><td></td><td></td></tr> <tr><td></td><td></td><td>118</td><td>117</td><td>97</td><td>96</td><td>95</td><td>94</td><td>93</td><td>92</td><td>91</td><td>90</td><td></td></tr> <tr><td></td><td></td><td>116</td><td>115</td><td>114</td><td>89</td><td>88</td><td>87</td><td>86</td><td>85</td><td>84</td><td>83</td><td>82</td></tr> </table> <p style="text-align: right;">121-002</p>	121	120	119	113	112	111	110	109	108	107	106						105	104	103	102	101	100	99	98					118	117	97	96	95	94	93	92	91	90				116	115	114	89	88	87	86	85	84	83	82																																
121	120	119	113	112	111	110	109	108	107	106																																																																											
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		118	117	97	96	95	94	93	92	91	90																																																																										
		116	115	114	89	88	87	86	85	84	83	82																																																																									
B-234	<table border="1" style="border-collapse: collapse; text-align: center;"> <tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td></td><td></td></tr> <tr><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td><td>41</td><td>42</td><td>43</td><td>5</td><td>4</td></tr> <tr><td>44</td><td>45</td><td>46</td><td>47</td><td>48</td><td>49</td><td>50</td><td>51</td><td>52</td><td>53</td><td>54</td><td>55</td><td>56</td><td>57</td><td>58</td><td>59</td><td>60</td><td>61</td><td>62</td><td>3</td><td></td></tr> <tr><td>63</td><td>64</td><td>65</td><td>66</td><td>67</td><td>68</td><td>69</td><td>70</td><td>71</td><td>72</td><td>73</td><td>74</td><td>75</td><td>76</td><td>77</td><td>78</td><td>79</td><td>80</td><td>81</td><td>2</td><td>1</td></tr> </table> <p style="text-align: right;">121-001</p>	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24			25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	5	4	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	3		63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1
6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24																																																																			
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63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	2	1																																																																	

No.	Connector Face
B-340	 <p style="text-align: right;">002-022</p>
B-341	 <p style="text-align: right;">002-009</p>
B-342	 <p style="text-align: right;">002-009</p>
B-51	 <p style="text-align: right;">014-001</p>
B-52	 <p style="text-align: right;">012-005</p>
H-14	 <p style="text-align: right;">016-003</p>
H-14	 <p style="text-align: right;">016-004</p>
H-15	 <p style="text-align: right;">008-023</p>

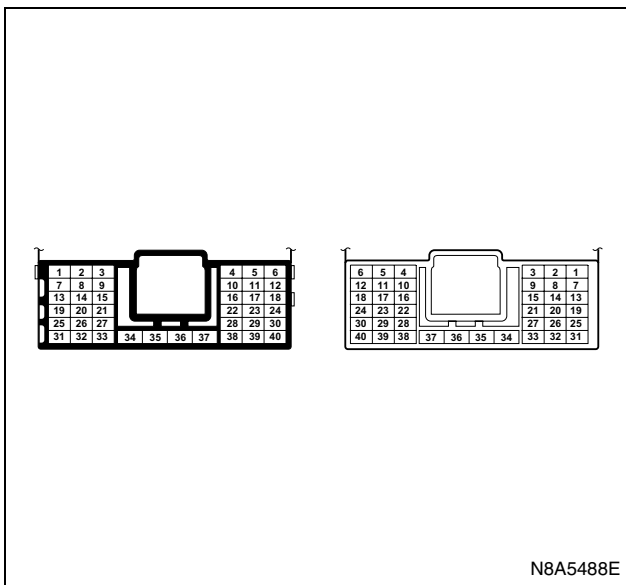
No.	Connector Face	No.	Connector Face
H-15	 008-024	J-31	 002-012
B-80	 003-005	J-32	 003-018
E-5	 000-009	J-40	 002-017
E-16	 002-014	J-50	 002-035
E-110	 009-003	J-122	 001-007
J-6	 004-011	J-177	 034-001
J-9	 000-001	J-182	 005-004
J-31	 002-011	J-183	 003-006

No.	Connector Face
P-1	 000-002
P-2	 000-002
P-4	 000-014
P-3	 000-014
P-5	 000-007

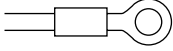
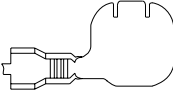
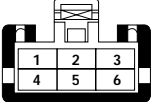
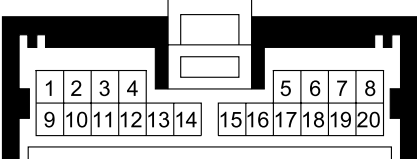
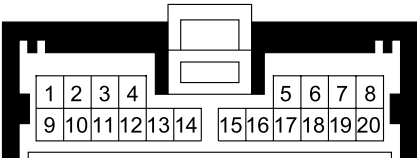

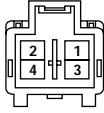
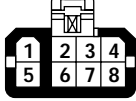
H-6, H-7, H-8

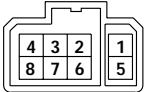
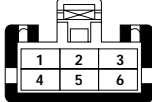

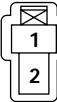
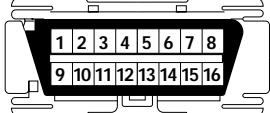

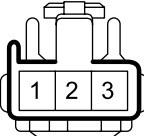
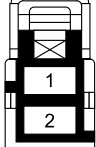


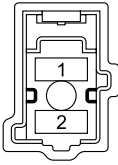

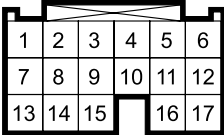
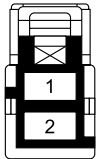
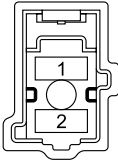
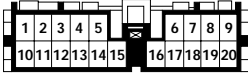
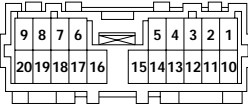
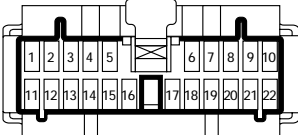
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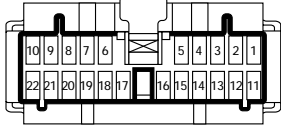


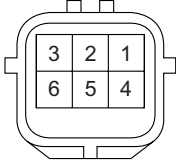






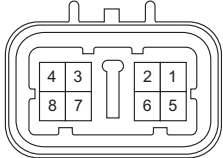
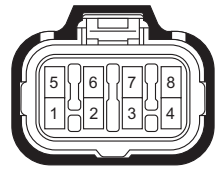
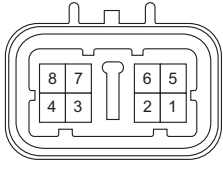
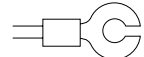
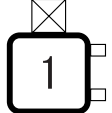


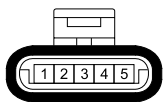
For 4HK1-TC Engine


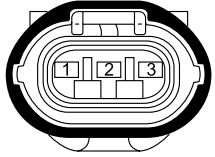
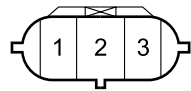

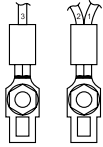
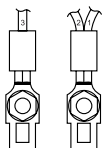
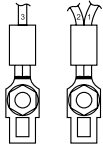
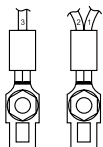
No.	Connector Face
B-1	 000-001
B-7	 000-012
B-31	 006-001
B-51	 020-005
B-52	 020-005
B-67	 004-001
B-67	 004-002
B-69	 008-001

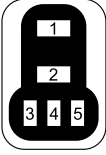
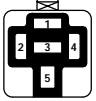
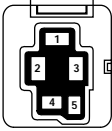
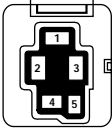
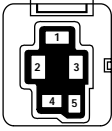
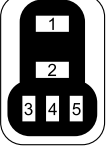
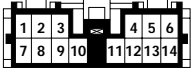

No.	Connector Face
B-69	 008-002
B-84	 006-001
B-89	 002-009
B-89	 002-010
B-79	 016-005
B-280	 003-005
B-281	 003-028
B-387	 002-038

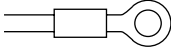


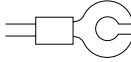




No.	Connector Face
B-387	 <p style="text-align: right;">002-039</p>
B-422	 <p style="text-align: right;">002-027</p>
B-427	 <p style="text-align: right;">017-001</p>
B-431	 <p style="text-align: right;">002-038</p>
B-431	 <p style="text-align: right;">002-039</p>
H-4	 <p style="text-align: right;">020-002</p>
H-4	 <p style="text-align: right;">020-003</p>
H-12	 <p style="text-align: right;">022-001</p>


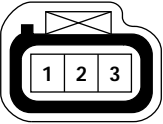
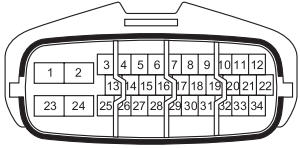
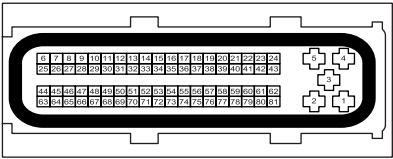

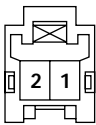
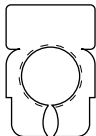
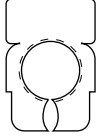
No.	Connector Face
H-12	 <p style="text-align: right;">022-002</p>
H-15	 <p style="text-align: right;">016-003</p>
H-15	 <p style="text-align: right;">016-004</p>
H-105	 <p style="text-align: right;">006-026</p>
H-105	 <p style="text-align: right;">006-027</p>
H-120	 <p style="text-align: right;">001-023</p>
H-120	 <p style="text-align: right;">001-022</p>
H-125	 <p style="text-align: right;">008-019</p>

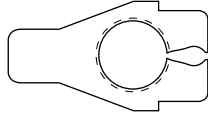
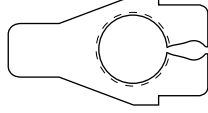

No.	Connector Face
H-125	 008-020
H-126	 008-022
H-126	 008-021
E-3	 000-009
E-5	 001-021
E-90	 003-004
E-93	 002-035
E-94	 005-007

No.	Connector Face
E-98	 002-036
E-112	 003-026
E-113	 003-029
E-116	 002-036
E-138	 003-031
E-139	 003-031
E-140	 003-031
E-141	 003-031

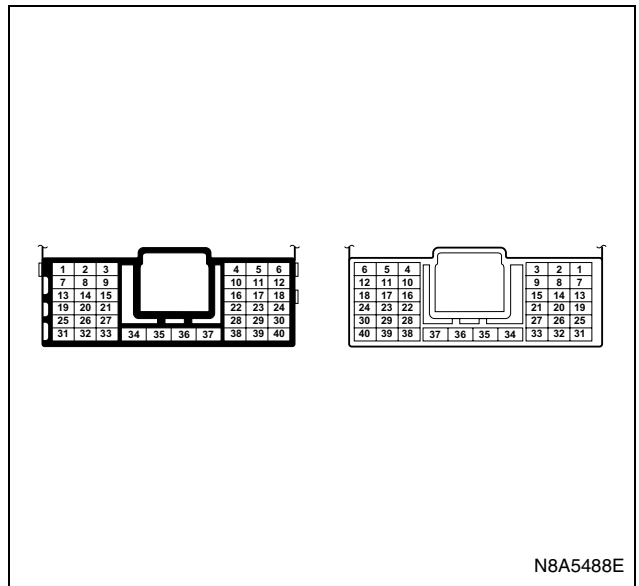
No.	Connector Face
X-1	 005-006
X-11	 005-001
X-18	 005-003
X-20	 005-003
X-21	 005-003
X-26	 005-006
X-33	 014-002
J-1	 002-003

No.	Connector Face
J-2	 000-001
J-6	 002-032
J-26	 000-002
J-27	 000-009
J-31	 002-011
J-31	 002-012
J-32	 003-018
J-40	 002-017

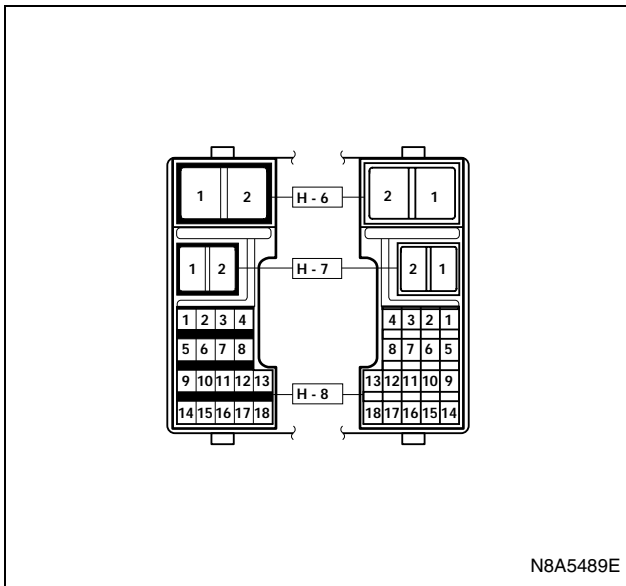
No.	Connector Face
J-50	 <p style="text-align: right;">002-035</p>
J-166	 <p style="text-align: right;">003-001</p>
J-177	 <p style="text-align: right;">034-001</p>
J-191	 <p style="text-align: right;">081-001</p>
N-6	 <p style="text-align: right;">002-022</p>
N-6	 <p style="text-align: right;">002-023</p>
P-1	 <p style="text-align: right;">000-004</p>
P-4	 <p style="text-align: right;">000-004</p>

No.	Connector Face
P-2	 <p style="text-align: right;">000-006</p>
P-3	 <p style="text-align: right;">000-006</p>
P-5	 <p style="text-align: right;">000-002</p>

H-5



H-6, H-7, H-8



Engine Stop System

General Description

The circuit consists of starter switch and engine stop motor.

The engine stop mechanism aims at shut-off of fuel supply.

Available are motor type and solenoid type depending on the types of the engine mounted.

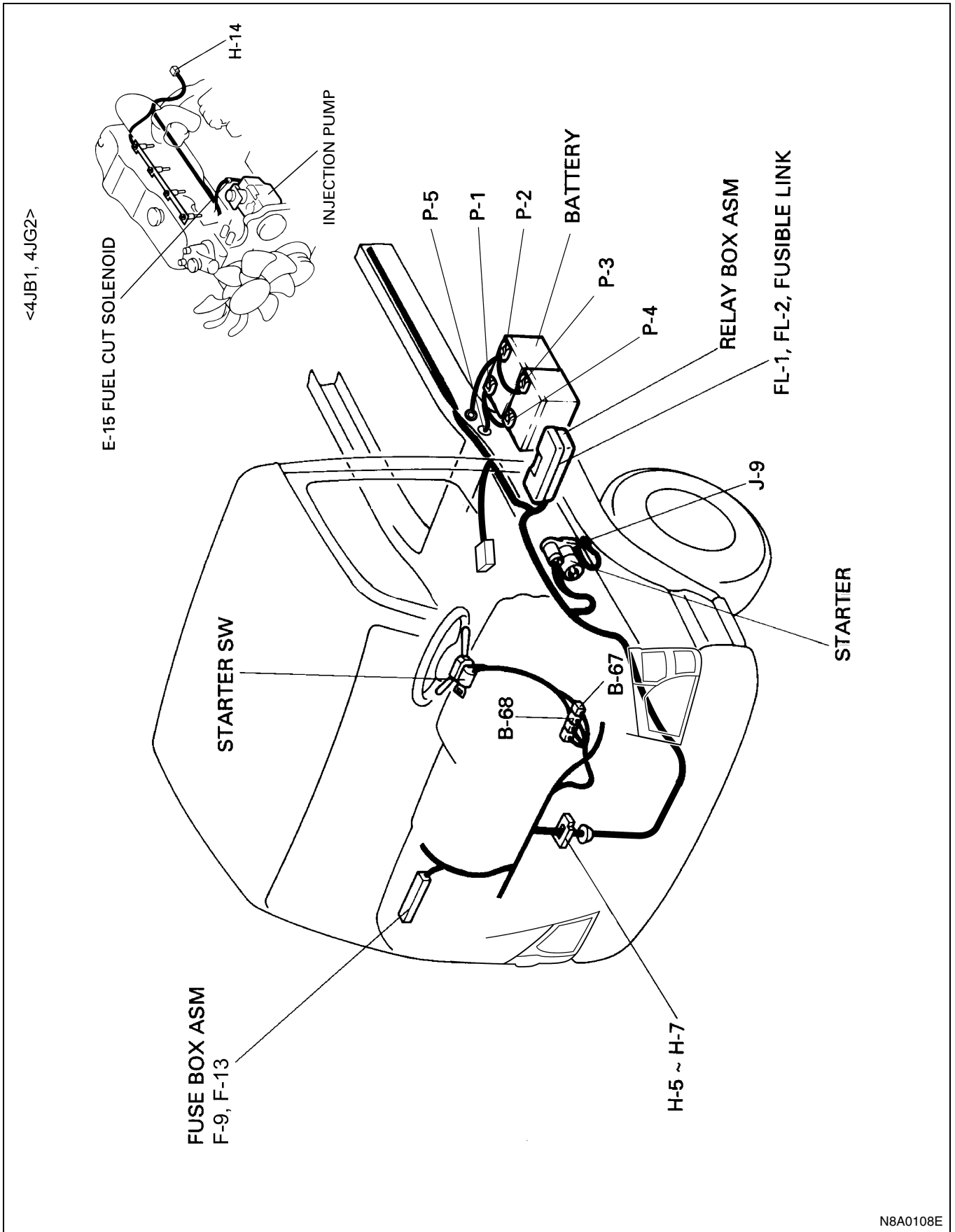
Motor type is forcible pull the injection pump control rack to the direction of fuel supply reduction by means of engine stop motor, thus shutting it off.

Solenoid type is to have the starter switch turn from "ON" position to "OFF", so that the solenoid valve fitted to the injection pump closes to shut off the fuel circuit.

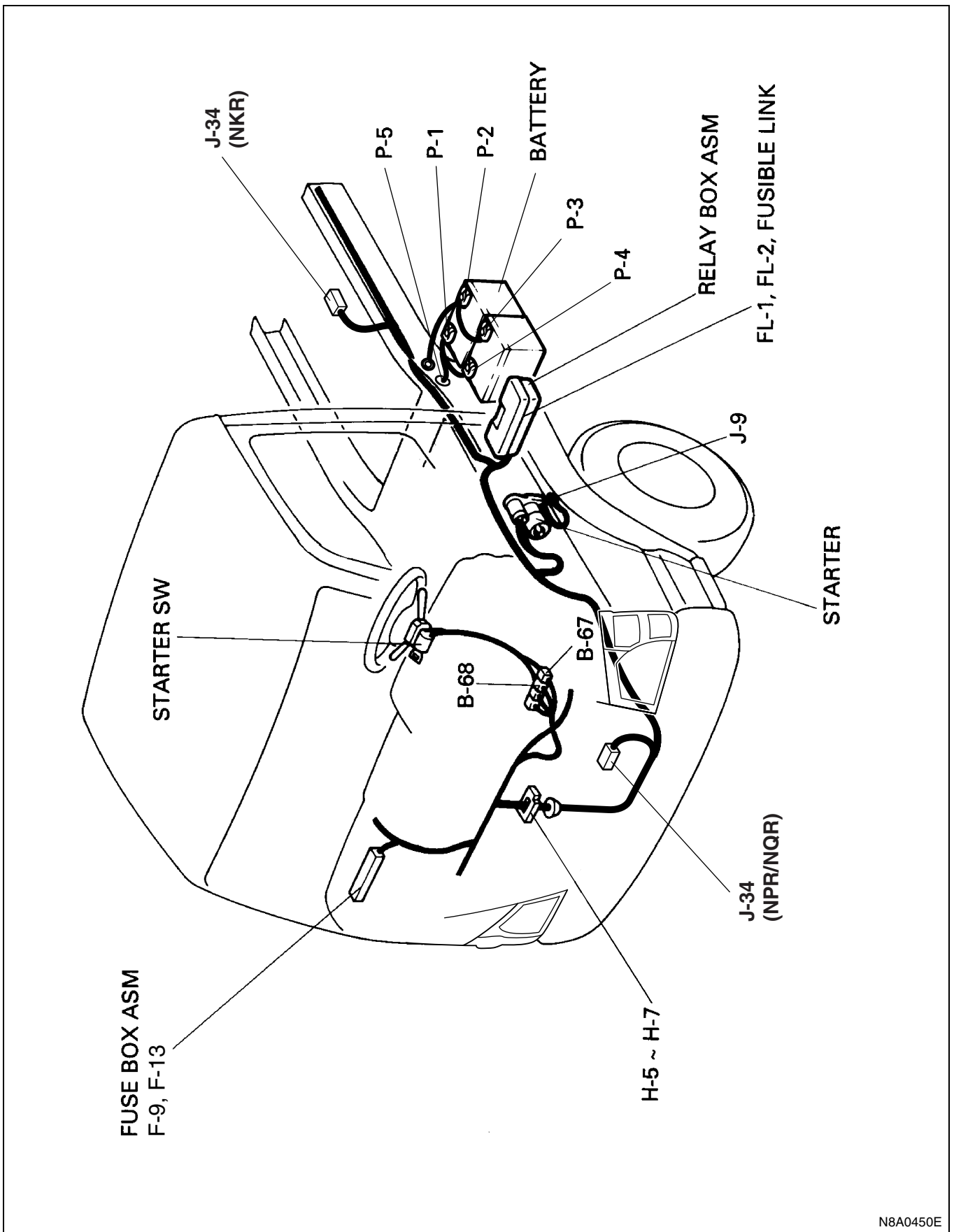
Engine stop system	Engine model
Motor type	4HF1, 4HG1, 4HE1
Solenoid type	4JB1, 4JG2

Parts Location

4JB1 / 4JG2 / 4HG1 (N-Spec) Engine

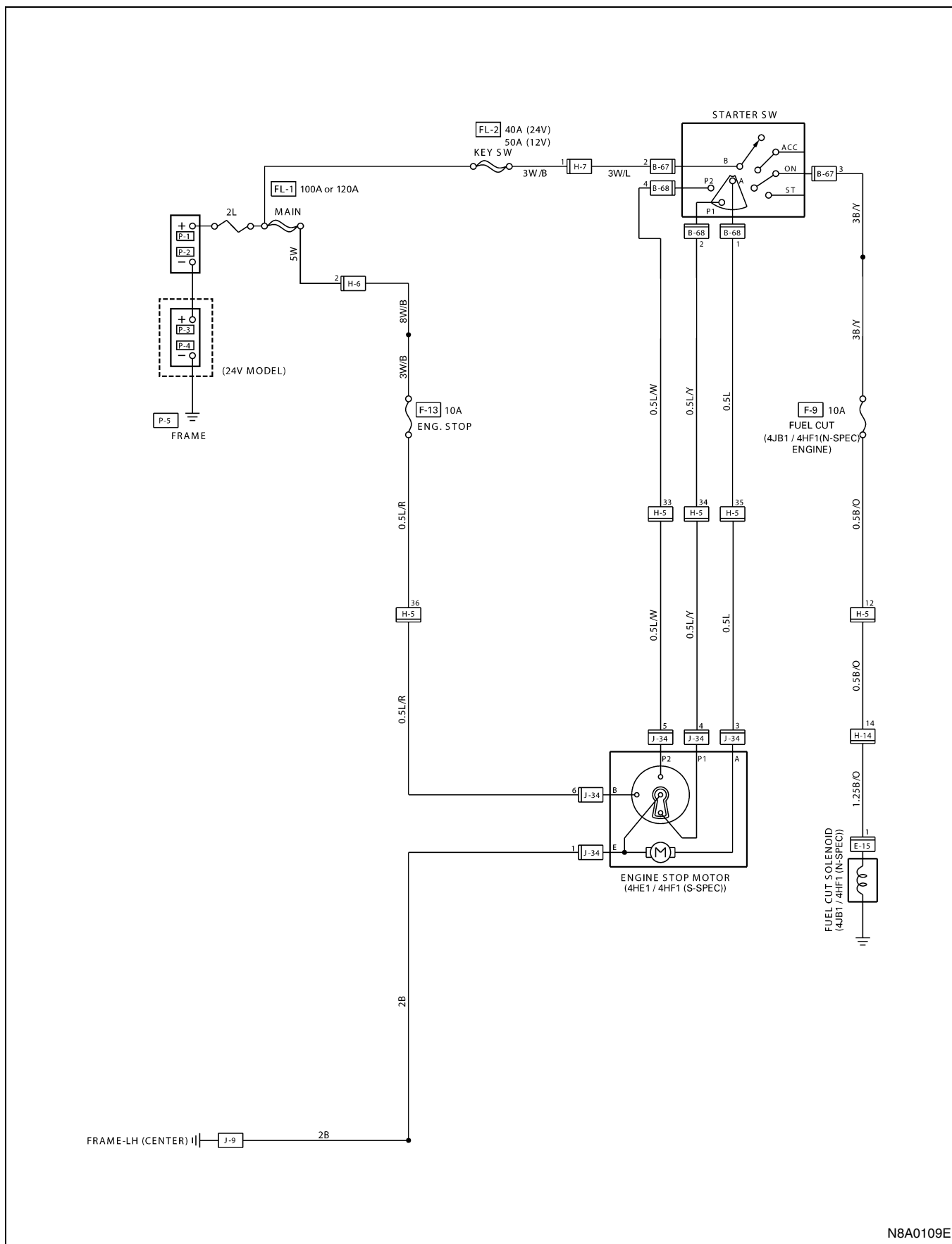


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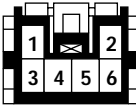
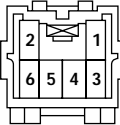

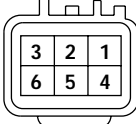
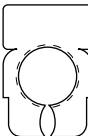
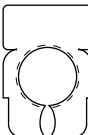
N8A0450E

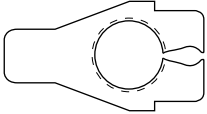
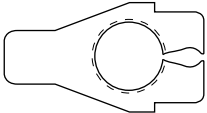
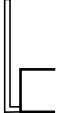
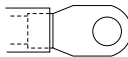



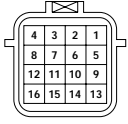
Circuit Diagram



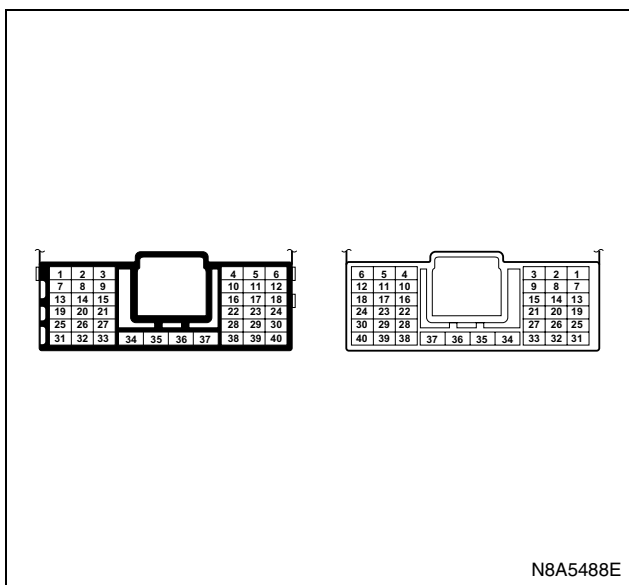
N8A0109E

Connector List

No.	Connector Face
B-67	 004-001
B-67	 004-002
B-68	 006-002
B-68	 006-003
J-34	 006-004
J-34	 006-005
P-1	 000-004
P-4	 000-004

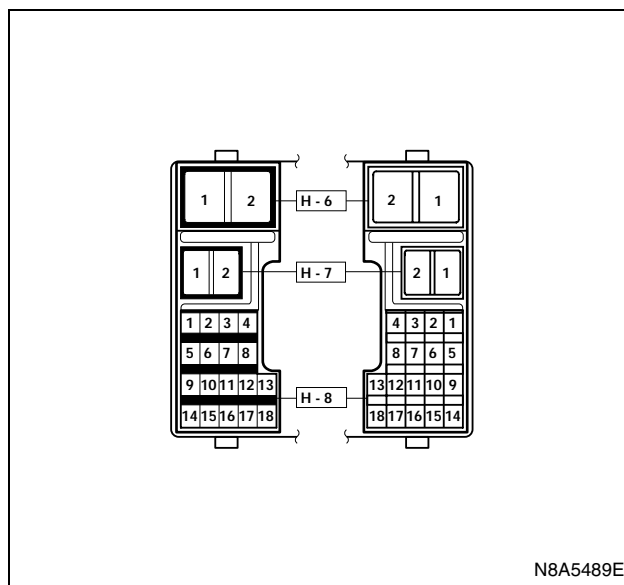
No.	Connector Face
P-2	 000-006
P-3	 000-006
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002
E-15	 001-002
E-15	 001-003
H-14	 016-001
H-14	 016-002

H-5



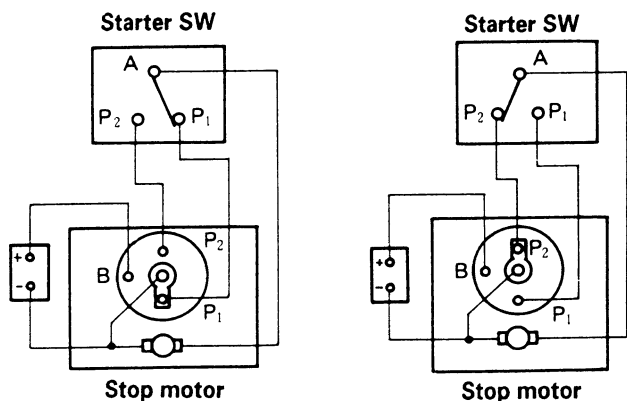
N8A5488E

H-6, H-7



N8A5489E

Function of Engine Stop Motor



Turn the starter switch from "ACC" position to "ON", and the engine stop motor will turn by 180 degrees (from 0° to 180°) so that the stop motor's electrode will be in potential equal to that of the starter switch for the stop.

Turn the starter switch from "ON" position to "ACC" or "LOCK", and then the stop motor will rotate by 180 degrees (from 180° to 360°) and cease operating.

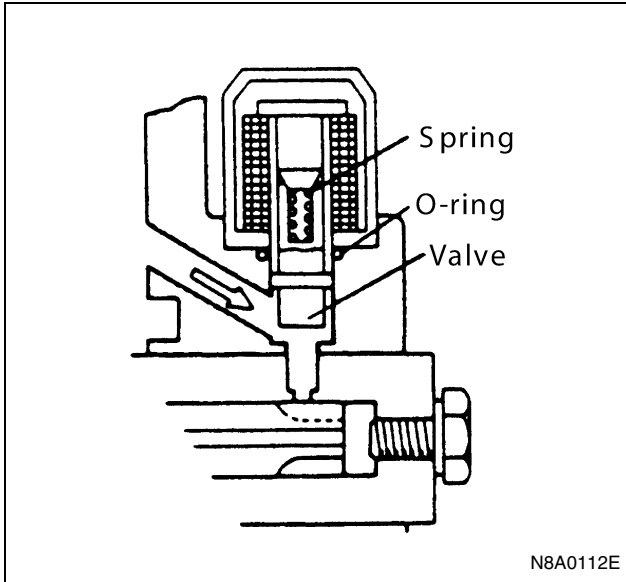
Starter SW key position	Connector No. Terminal No.	B-68			Stop motor	Stop lever position
		A	P1	P2		
LOCK	1	○	○		0° (360°)	Stop
ACC	1	○	○		0° → 180°	Stop → Run
ACC → ON					180°	Stop
ON		○	○	○	0° → 360°	Stop → Run
ON → ACC LOCK						

N8A5127E

Solenoid Type

Starter Switch and Solenoid Valve

Turn the starter switch from "ON" position to "OFF", and then the solenoid valve fitted to the injection pump closes to cut off the fuel circuit.



Key position	Solenoid valve
LOCK	Close
ACC	
ON	Open
START	

Headlight, Fog Light, Rear Fog Light and Cornering Light

General Description

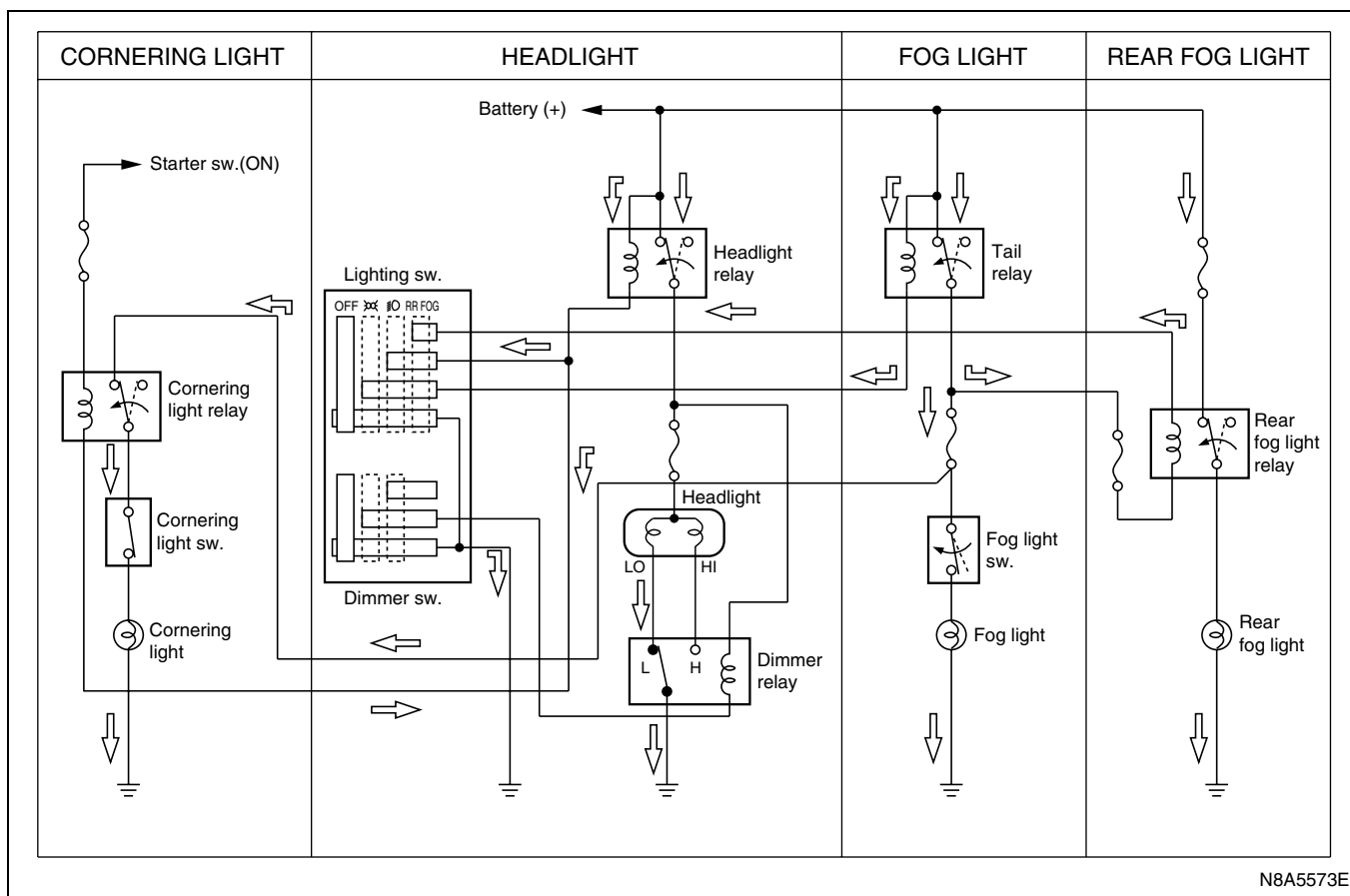
The circuit consists of headlight, fog light, cornering light, starter switch, combination switch (Lighting switch, dimmer / passing switch, cornering light switch), fog light switch, rear fog light switch, rear fog light, high beam indicator light and relay.

When the lighting SW is turned on by setting it at headlight position, the lighting relay is actuated to turn on the headlight. The optical axis of the headlight can be turned up or down by operating the dimmer SW while headlight is on. The passing SW is independent of the lighting SW, and the optical axis of the passing light can be turned up only while the switch lever is pulled and held in this state.

Fog light turns on by switching it to "ON" position to activate relay only while lighting SW is on. Rear fog light turns on by switching it to "ON" position to activate relay only while lighting SW is at headlight position.

When the headlight is on, turn the turn-signal switch left or right, and then the cornering switch built in the combination switch turns on, followed by the cornering light turning on.

Lighting Circuit

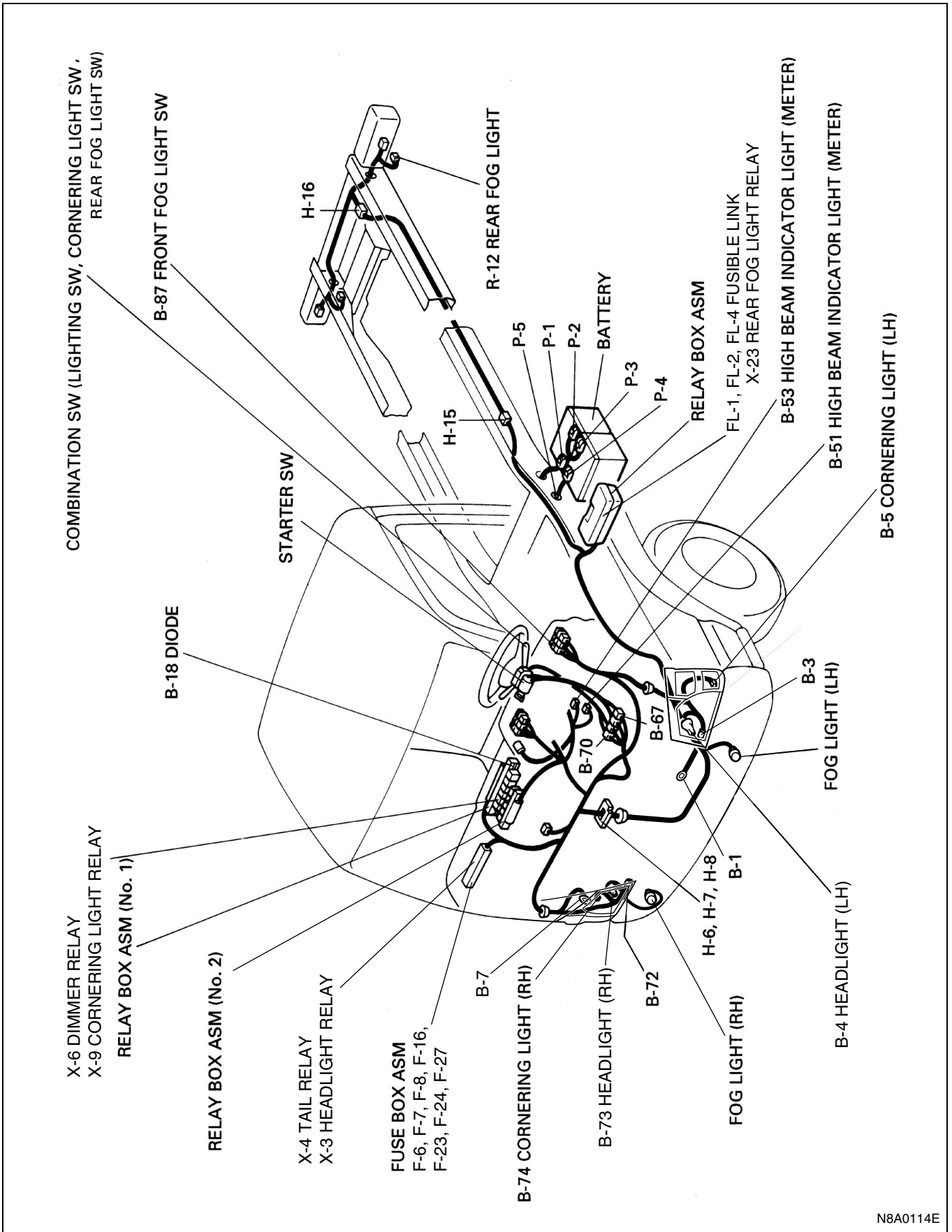


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Notice:

Arrow marks indicate the direction of current.

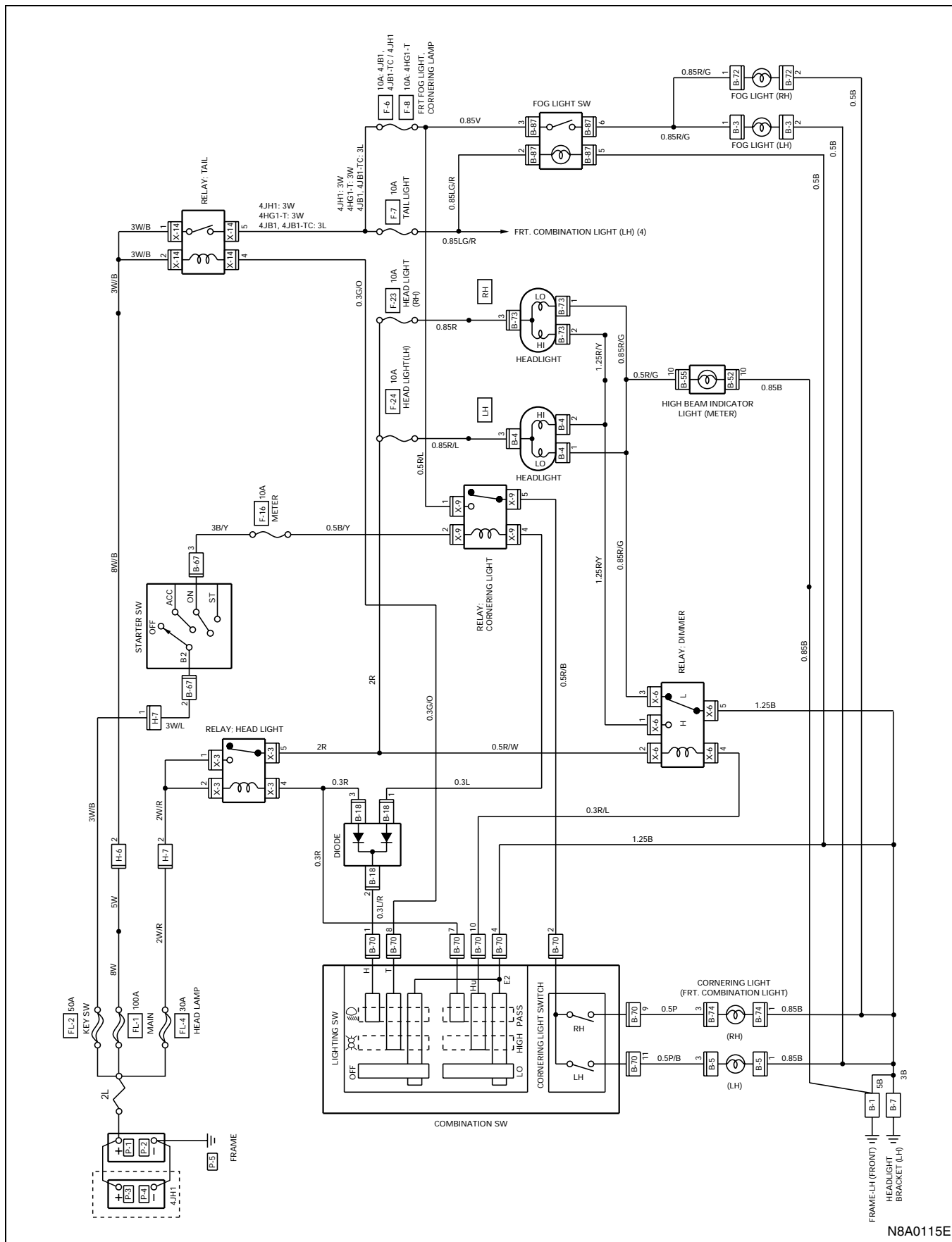
Parts Location



N8A0114E

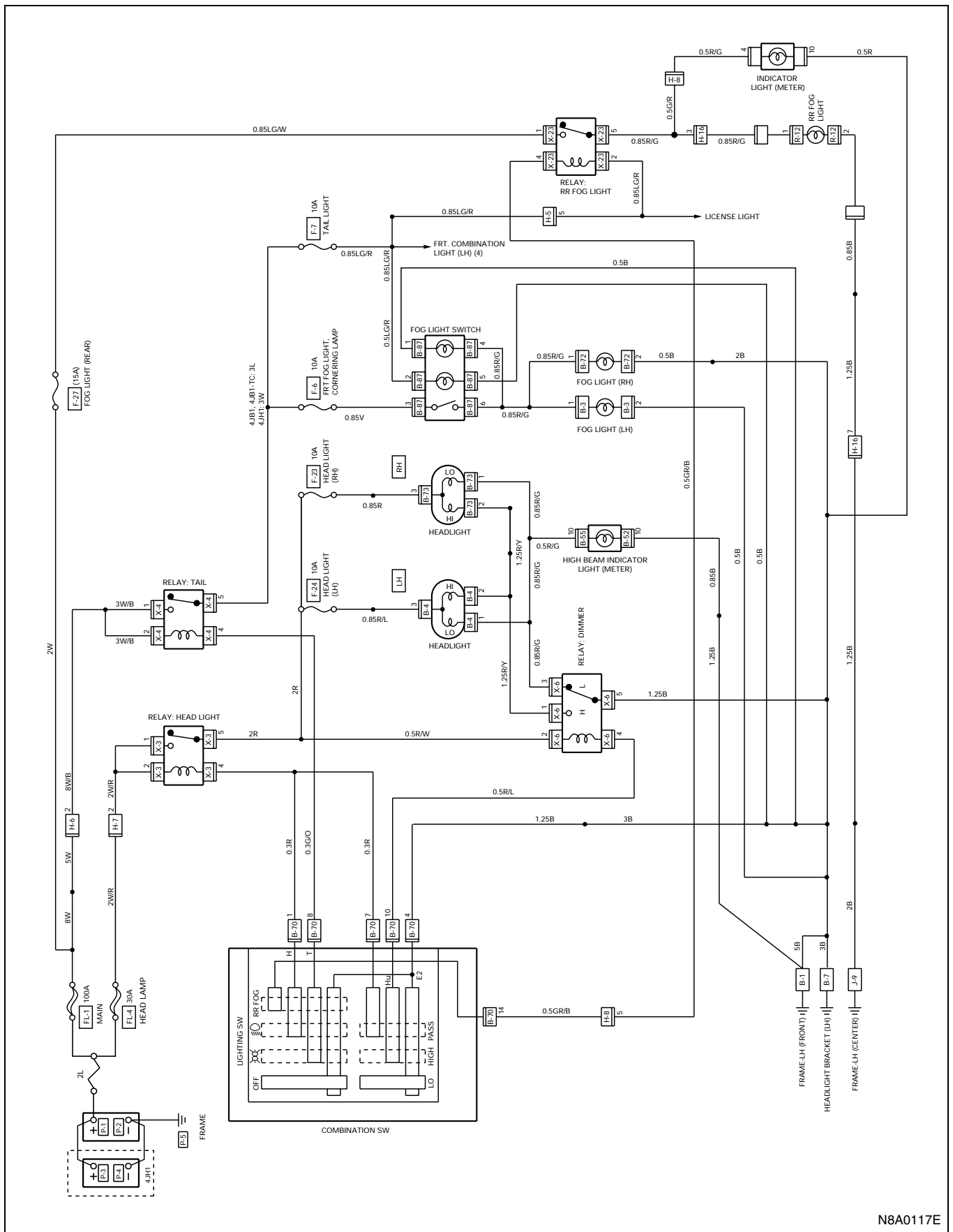
Circuit Diagram

For 12 Volt (Except NKR77 for Taiwan)



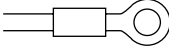
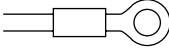
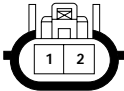
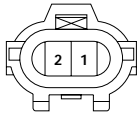
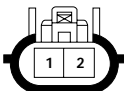
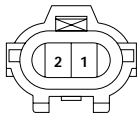
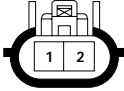
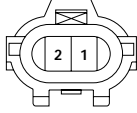
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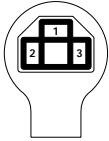
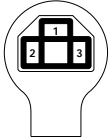
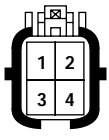
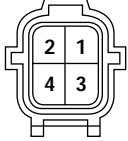
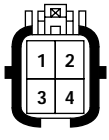
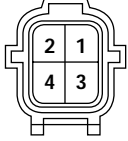
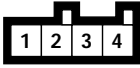
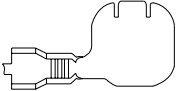
With Rear Fog Light

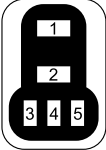
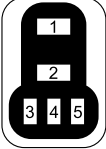
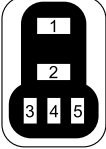
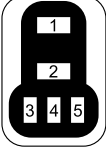
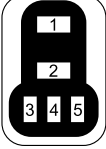
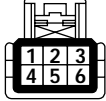

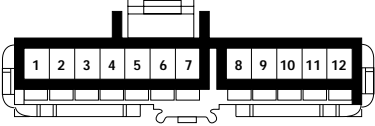


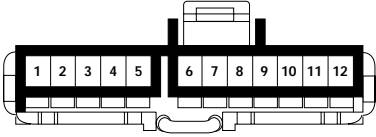
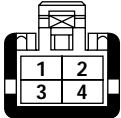
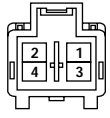
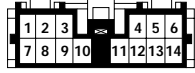
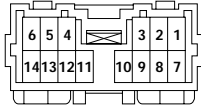
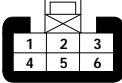

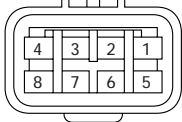
N8A0117E

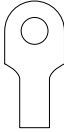
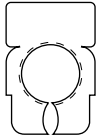
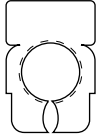
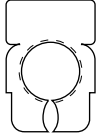
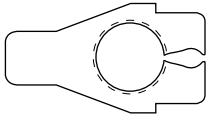
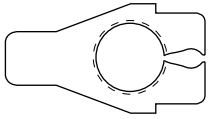

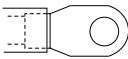
Connector List

No.	Connector Face
B-1	 000-001
J-61	 000-001
B-3	 002-001
B-3	 002-002
B-72	 002-001
B-72	 002-002
R-12	 002-001
R-12	 002-002

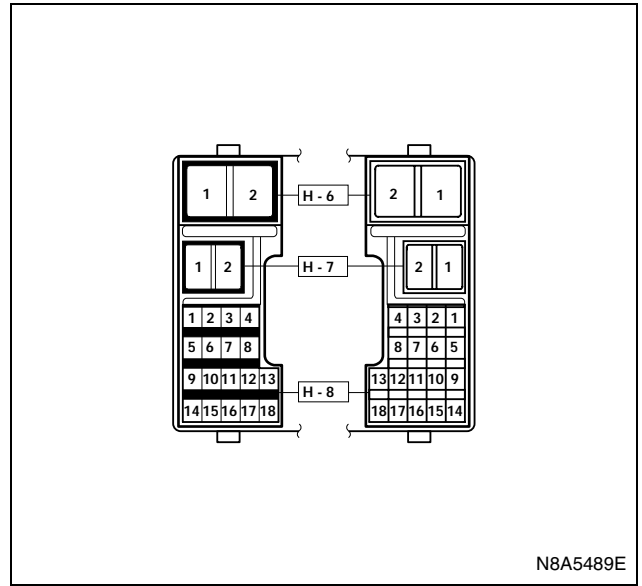
No.	Connector Face
B-4	 003-007
B-73	 003-007
B-5	 004-012
B-5	 004-013
B-74	 004-012
B-74	 004-013
B-18	 004-004
B-7	 000-012

No.	Connector Face
X-3	 <p style="text-align: right;">005-006</p>
X-4	 <p style="text-align: right;">005-006</p>
X-6	 <p style="text-align: right;">005-006</p>
X-9	 <p style="text-align: right;">005-006</p>
X-23	 <p style="text-align: right;">005-006</p>
B-153	 <p style="text-align: right;">006-007</p>
B-154	 <p style="text-align: right;">000-016</p>
B-52	 <p style="text-align: right;">012-005</p>

No.	Connector Face
B-55	 <p style="text-align: right;">012-004</p>
B-67	 <p style="text-align: right;">004-001</p>
B-67	 <p style="text-align: right;">004-002</p>
B-70	 <p style="text-align: right;">014-002</p>
B-70	 <p style="text-align: right;">014-003</p>
B-87	 <p style="text-align: right;">006-006</p>
H-16	 <p style="text-align: right;">008-003</p>
H-16	 <p style="text-align: right;">008-004</p>

No.	Connector Face
P-1 (12 V)	 <p style="text-align: right;">000-003</p>
P-2	 <p style="text-align: right;">000-004</p>
P-1 (24 V)	 <p style="text-align: right;">000-004</p>
P-4	 <p style="text-align: right;">000-004</p>
P-2 (24 V)	 <p style="text-align: right;">000-006</p>
P-3	 <p style="text-align: right;">000-006</p>
P-5 (12 V)	 <p style="text-align: right;">000-007</p>
P-5 (24 V)	 <p style="text-align: right;">000-002</p>

H-6, H-7, H-8



Diagnosis

Quick Chart for Check Point

1. Headlight

		Check point											
		Fuse			Fusible link FL-4 (30A)	Headlight relay	Lighting SW	Dimmer / Passing SW	Dimmer relay	Headlight bulb		Cable harness	
		F-6 F-8 (10 A)	F-23 (10 A)	F-24 (10 A)						LH	RH		
Trouble mode	1-1. Both Headlights inoperative				○ (2)	○ (1)	○ (4)					○ (3)	
	1-2. Headlight on the left (or right) side inoperative		○ (1)	○ ((1))								○ (2)	
	1-3. Headlight in low-beam inoperative								○ (1)			○ (2)	
	1-4. Headlight in high-beam inoperative								○ (1)			○ (2)	
	1-5. Headlight on the left (or right) side in low (or high)-beam inoperative									○ (1)	○ ((1))	○ (2)	
	1-6. Headlight beam does not change	○ (1)						○ (2)	○ (3)				○ (4)
	1-7. Headlights remain on when the lighting switch turned off					○ (1)	○ (2)						○ (3)
	1-8. Headlights come on with the lighting SW at the clearance light position						○ (1)						

Notice:

Figure in parenthesis “()” indicates the order of inspection.

2. Fog Light

		Check point						
		Fuse F-6 (10 A): 4JH1,4JB1, 4JB1-TC F-8 (10 A): 24V, 4HG1-T (12 V)		Tail-light relay	Fog light SW	Fog light bulb		Cable harness
		LH	RH					
Trouble mode	2-1. Both fog lights inoperative (while lighting switch is on)	○ (1)	○ (2)	○ (3)			○ (4)	
	2-2. Fog light on the left (or right) side inoperative (while lighting switch is on)				○ (1)	○ (1)	○ (2)	
	2-3. Fog lights remain on		○ (1)	○ (2)			○ (3)	

Notice:

Figure in parenthesis “()” indicates the order of inspection.

3. Cornering Light

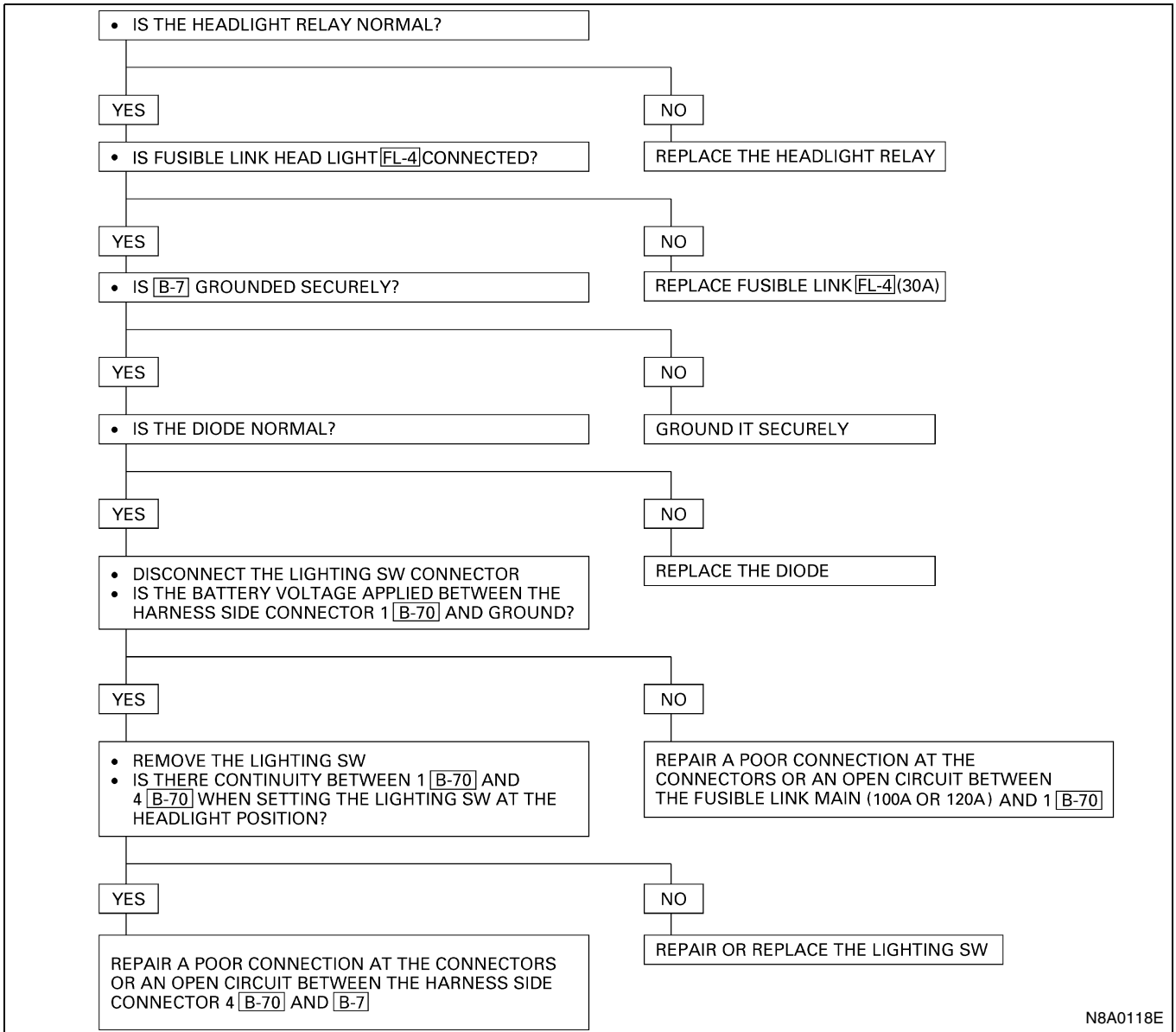
		Check point					
		Fuse		Cornering light SW	Cornering light bulb	Cornering light relay	Cable harness
		F-6 : 4JH1,4JB1,4JB1-TC F-8 : 24V,4HG1-T(12V)	F-16 (10 A)				
Trouble mode	3-1. Both cornering lights inoperative	○ (2)	○ (1)	○ (5)		○ (3)	○ (4)
	3-2. Cornering light on the left (or right) side inoperative			○ (2)	○ (1)		○ (3)
	3-3. Cornering light remains on even when steering wheel is in the straight ahead position			○ (1)			

4. Rear Fog Light

		Check point				
		Fuse F-27 (15 A)	Rear fog light SW	Rear fog light relay	Rear fog light bulb	Cable harness
Trouble mode	4-1. Rear fog light inoperative (while headlight is ON)	○ (2)	○ (4)	○ (3)	○ (1)	○ (5)

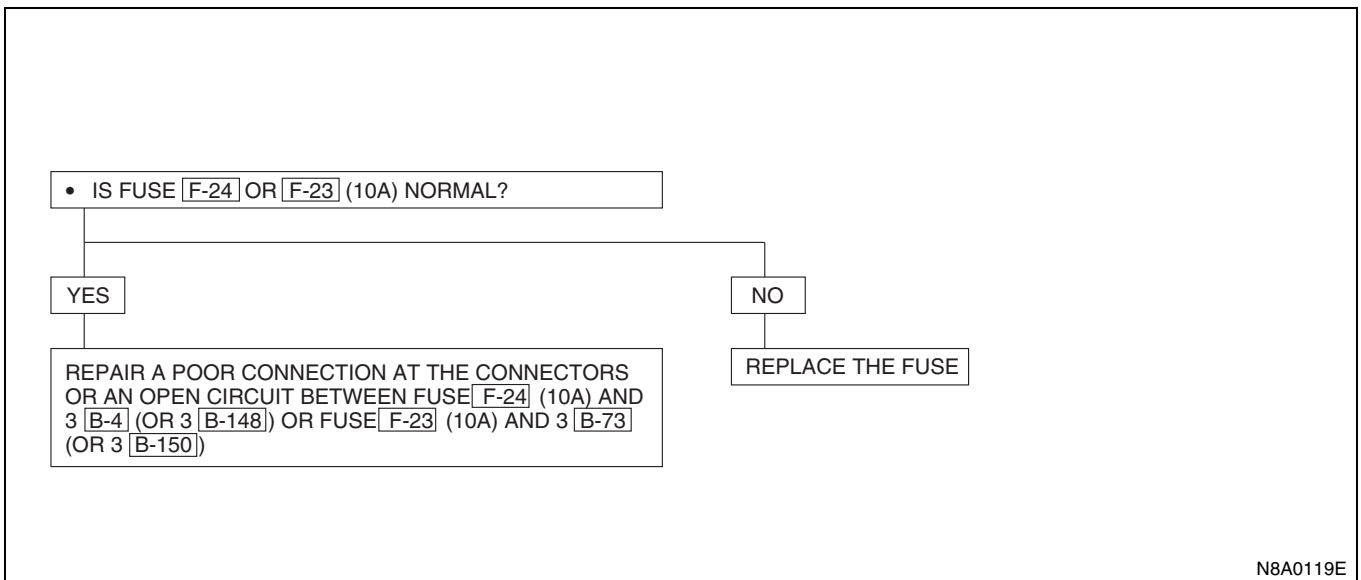
1. Headlight

1-1. Both Headlights Inoperative



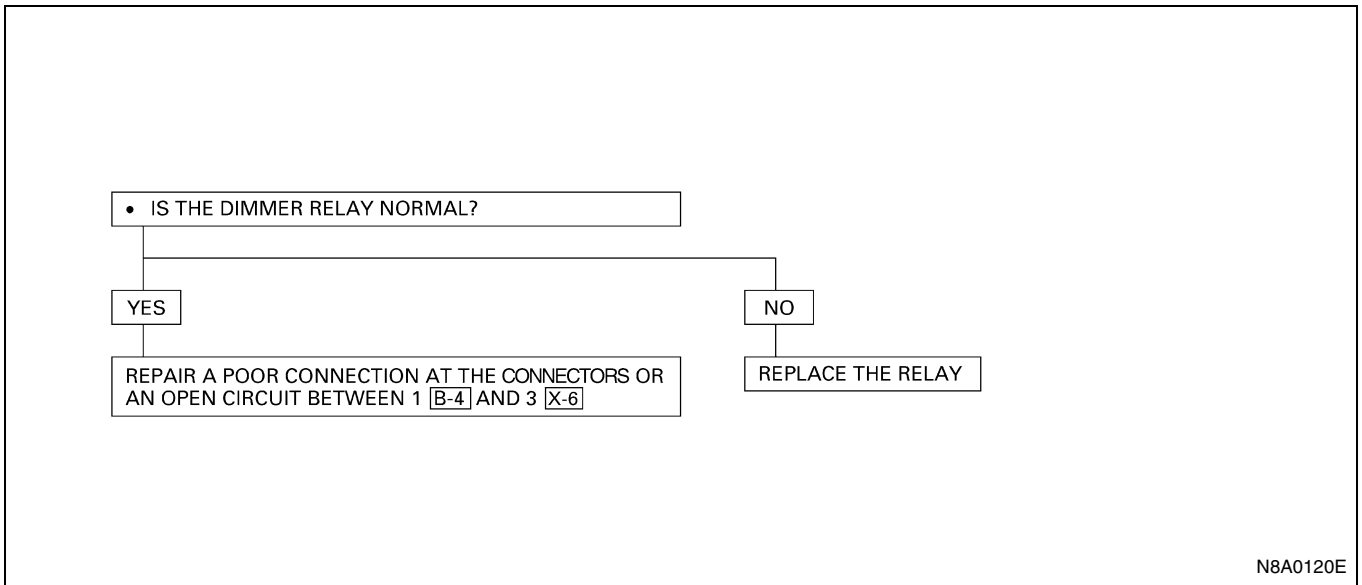
N8A0118E

1-2. Headlight on The Left (or Right) Side Inoperative

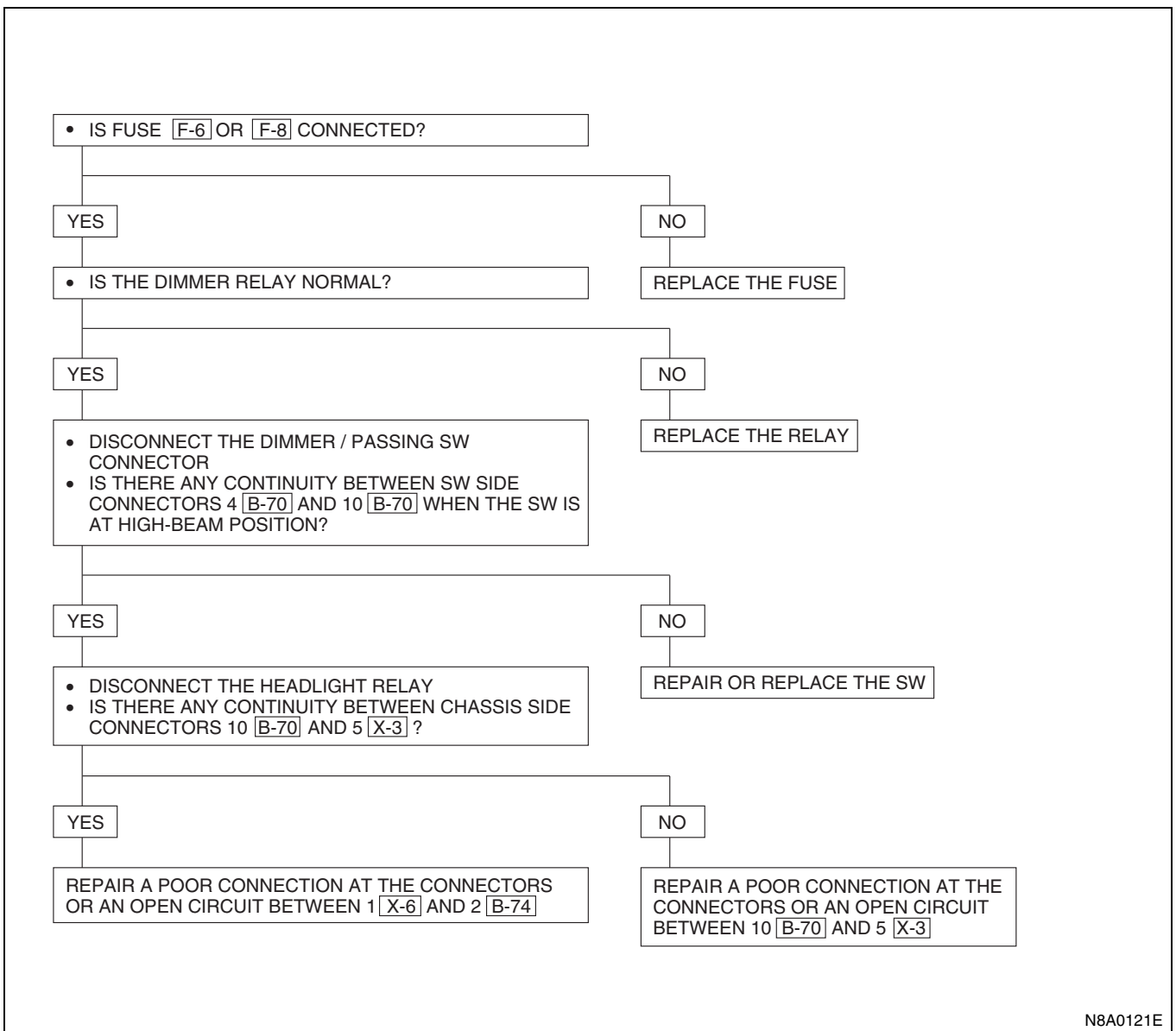


N8A0119E

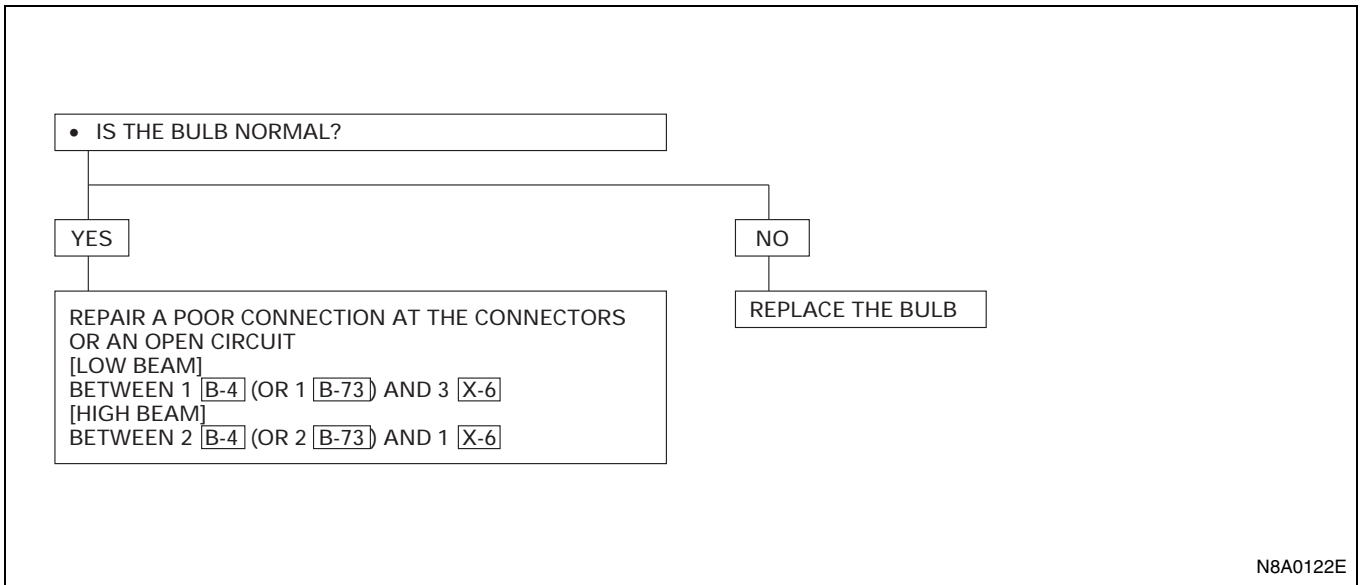
1-3. Headlight in Low-beam Inoperative



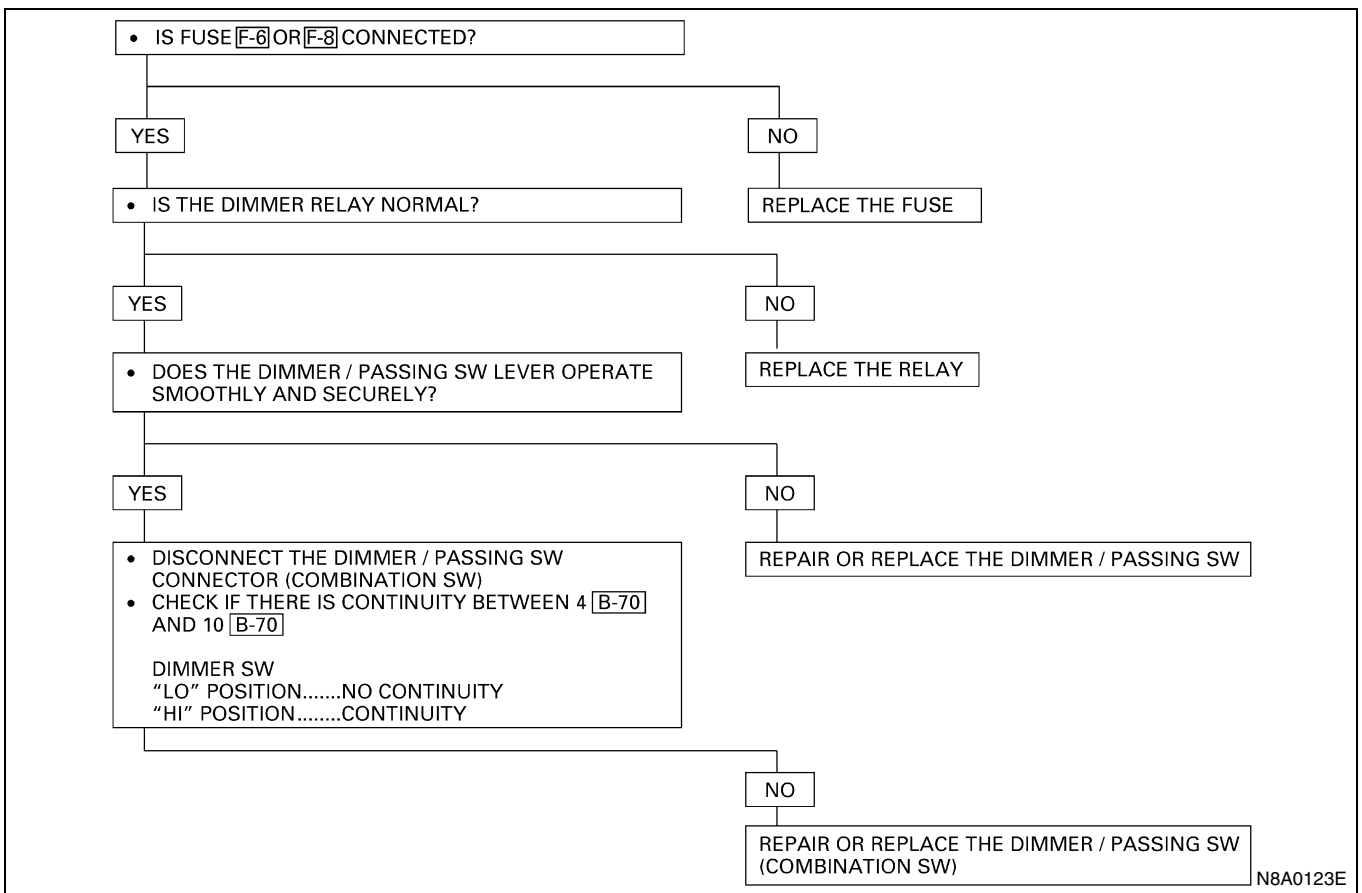
1-4. Headlight in High-beam Inoperative



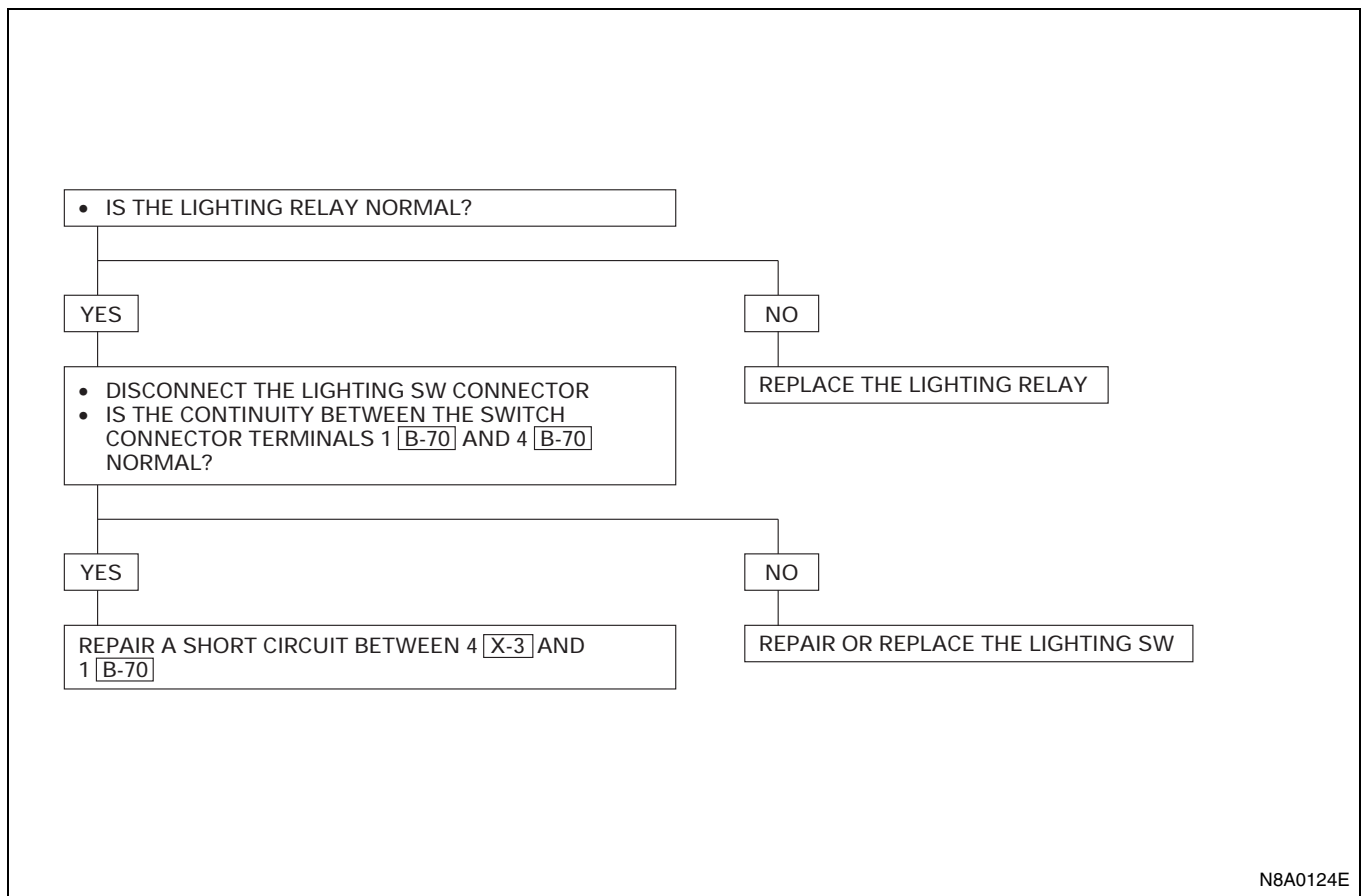
1-5. Headlight on The Left (or Right) Side in Low (or High)-beam Inoperative



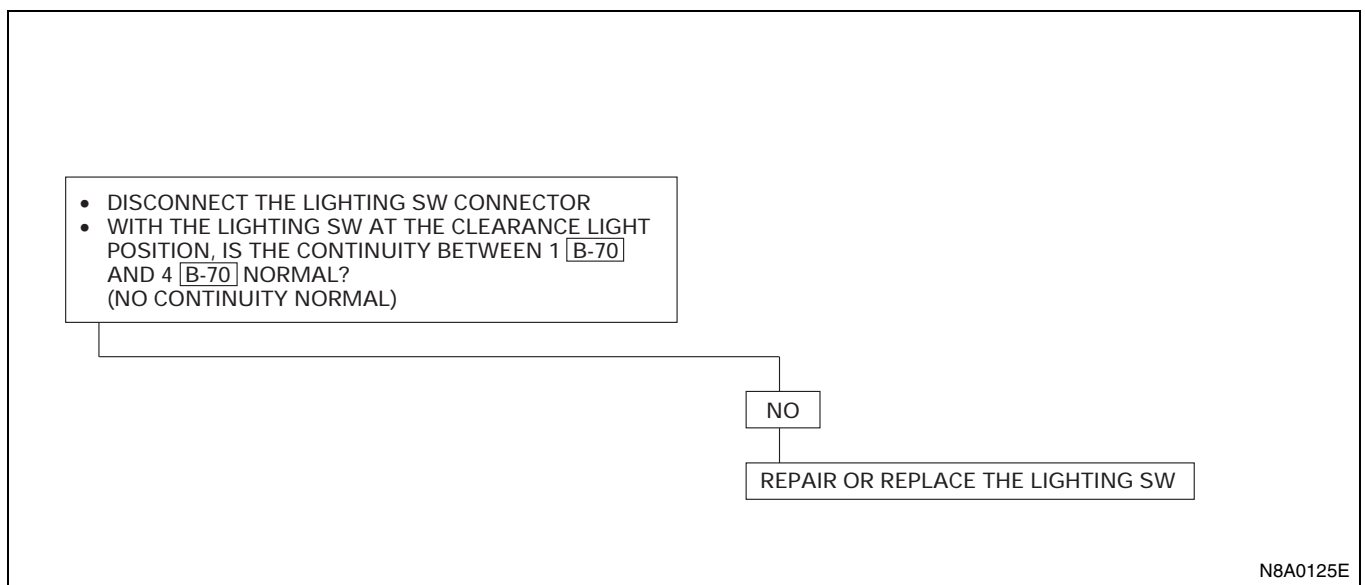
1-6. Headlight Beam Does Not Change



1-7. Headlight Remains On when the Lighting SW is Turned Off

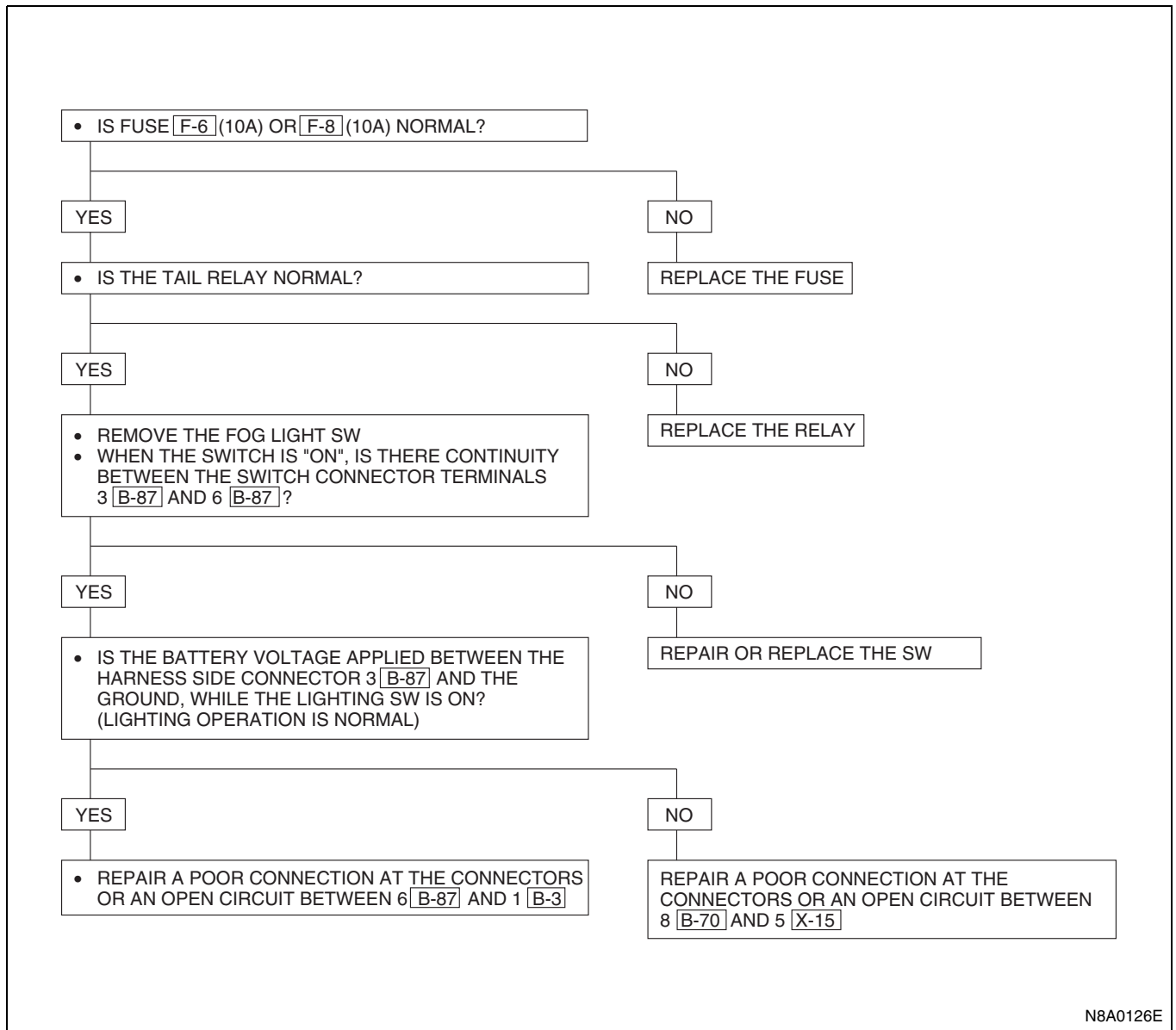


1-8. Headlight Comes On with The Lighting SW at The Clearance Light Position



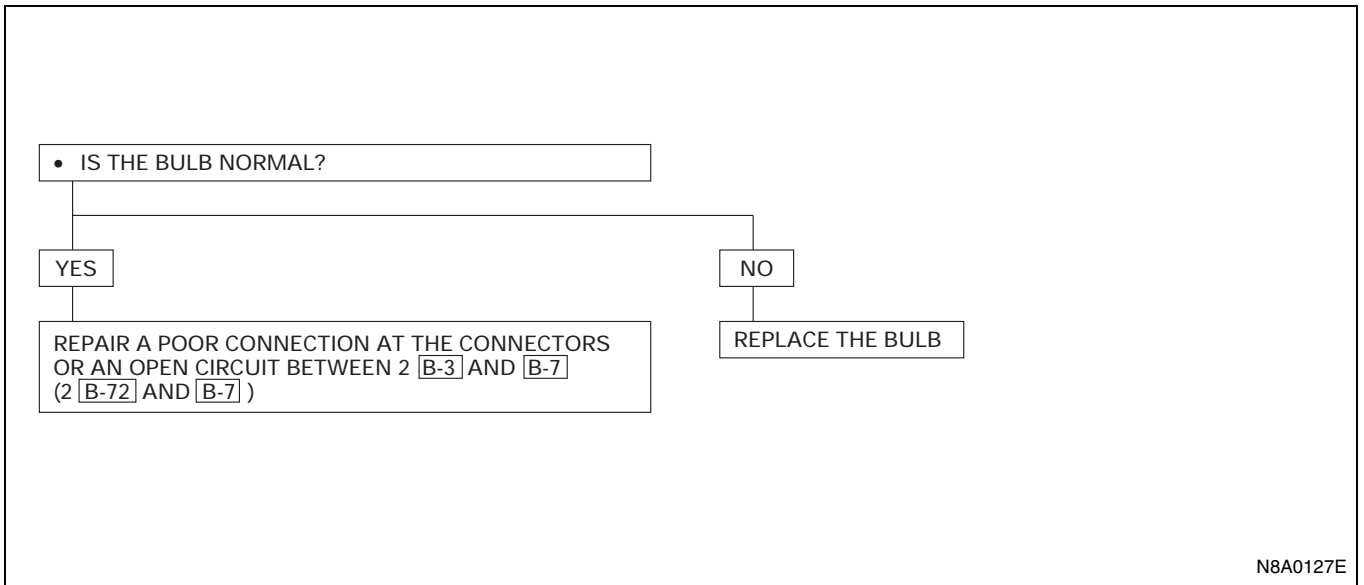
2. Fog Light

2-1. Both Fog Lights Inoperative (While Lighting Switch is On)



N8A0126E

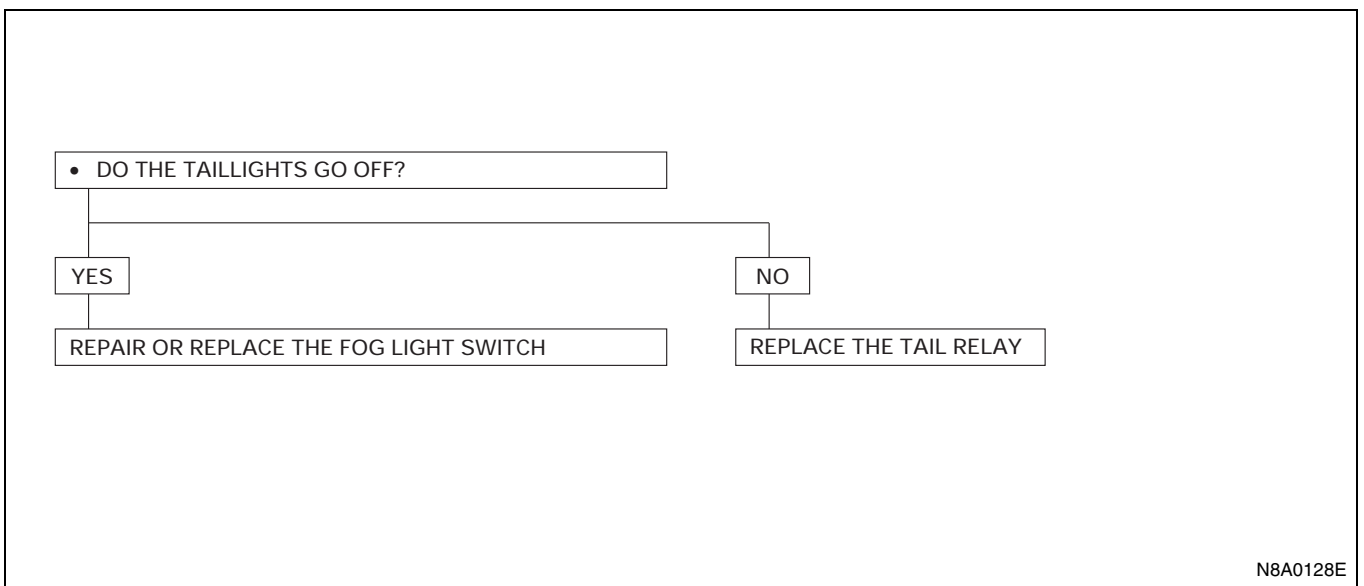
2-2. Fog Light on The Left (or Right) Side Inoperative (While Lighting Switch is On)



Notice:

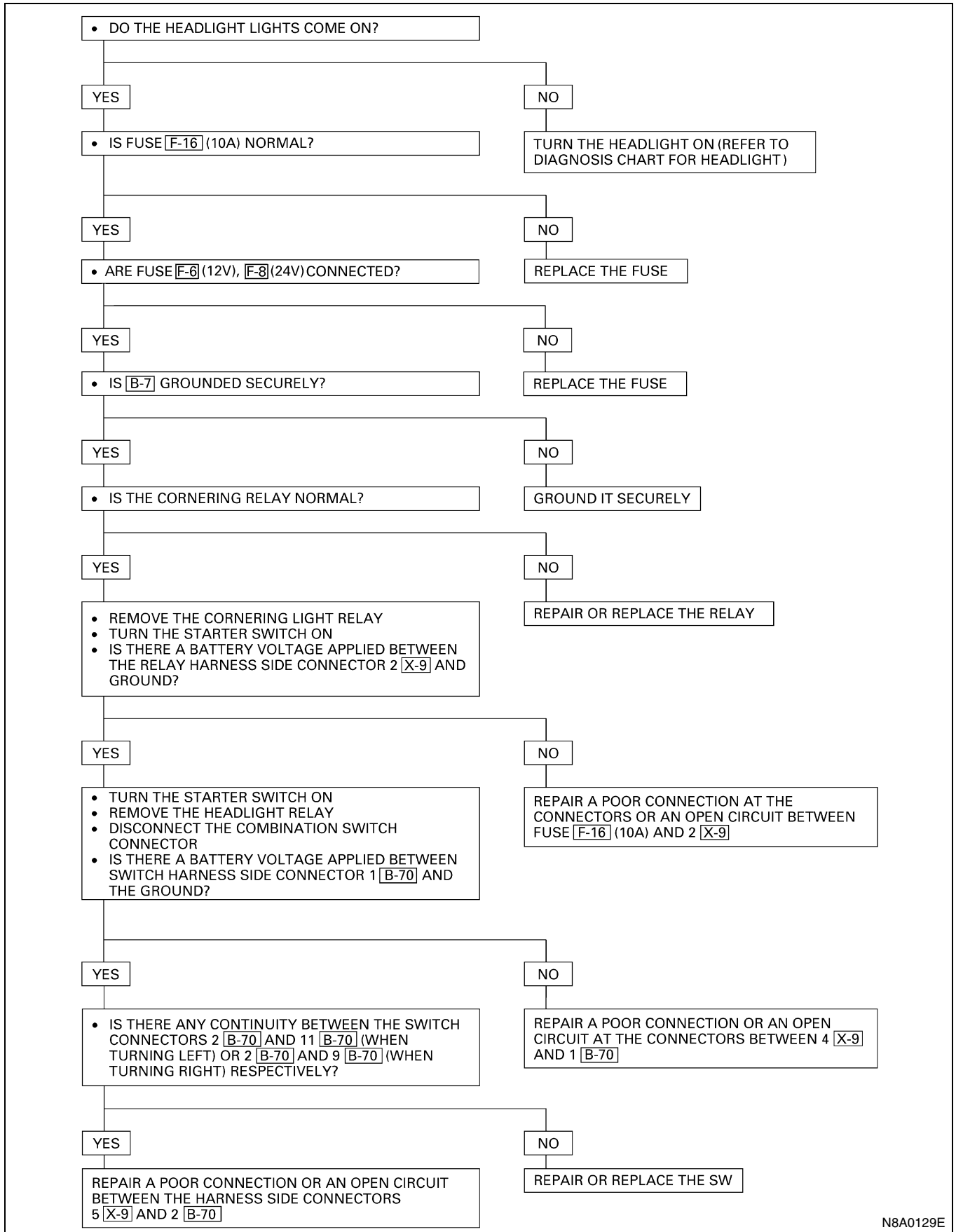
Figures in parenthesis “()” indicate place of inspection for the fog light on the right.

2-3. Fog Light Remains On



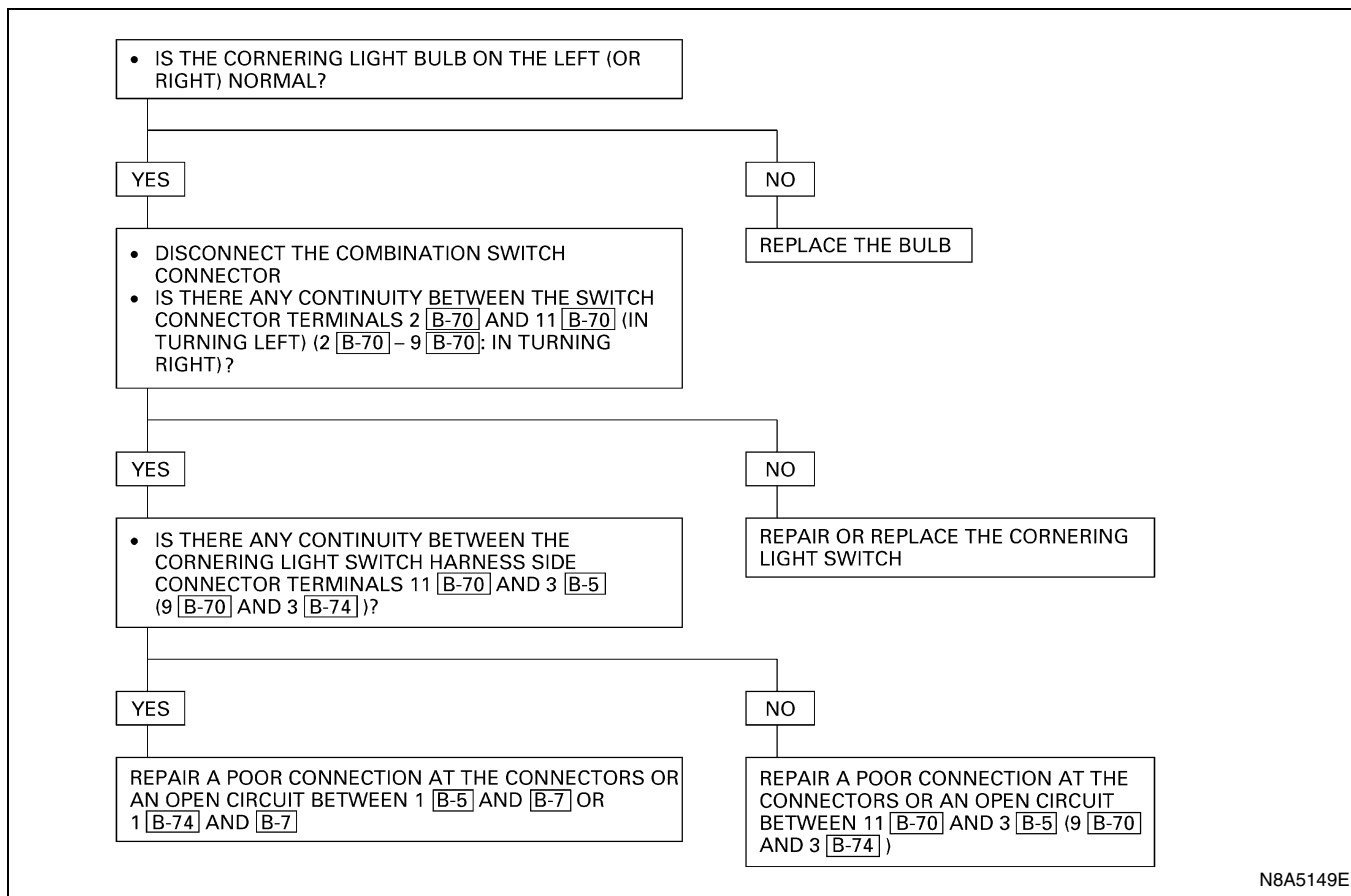
3. Cornering Light

3-1. Both Cornering Lights Inoperative



N8A0129E

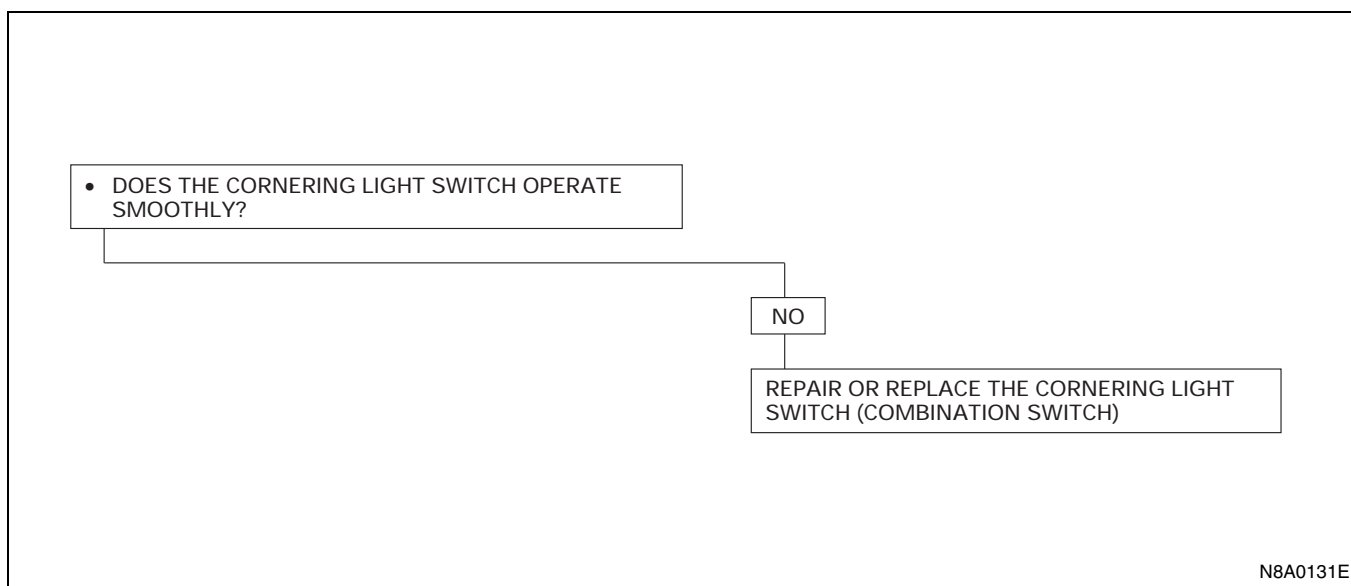
3-2. Cornering Light on The Left (or Right) Side Inoperative



Notice:

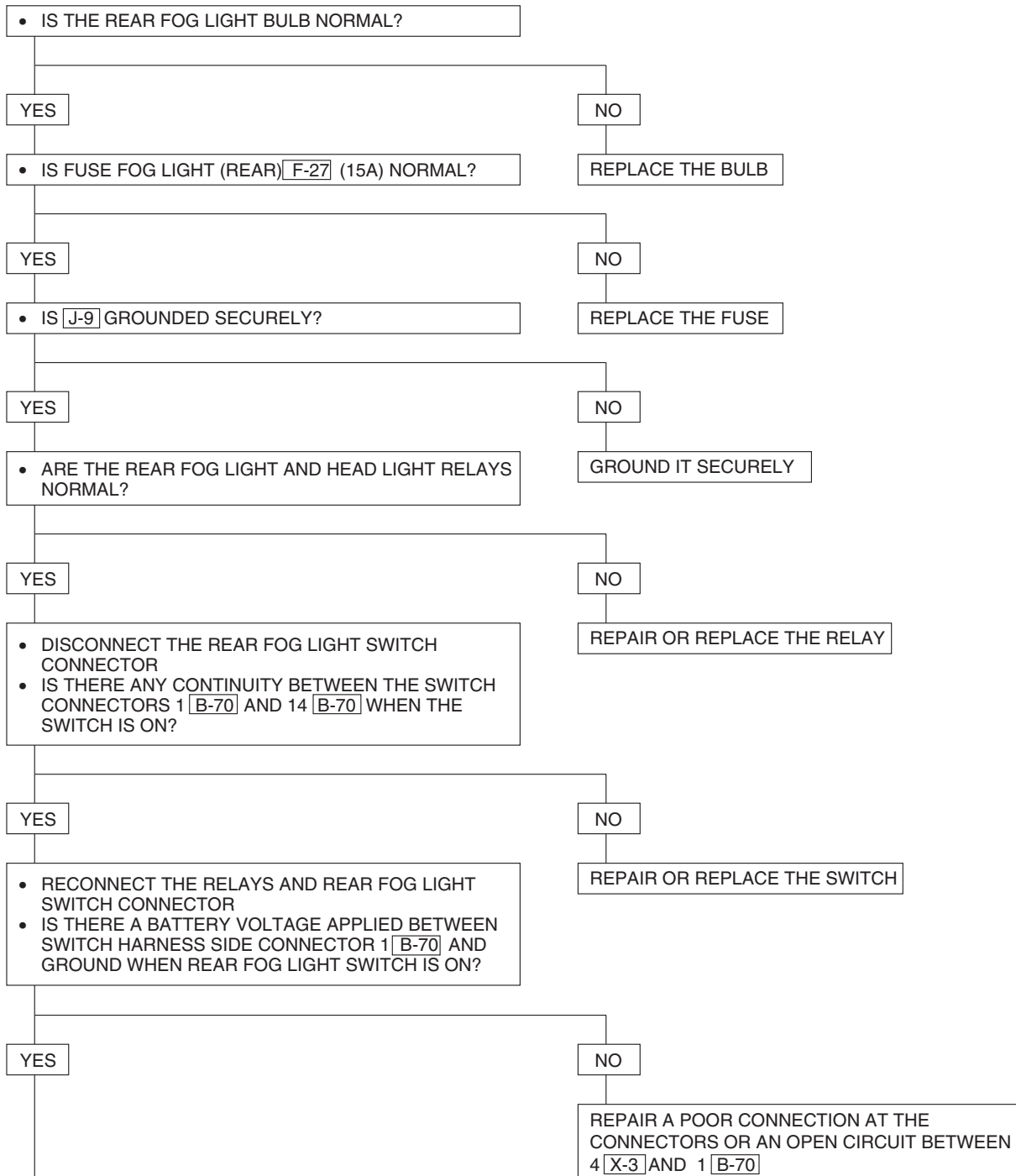
Figures in parenthesis “()” indicate place of inspection for the cornering light on the right.

3-3. Cornering Light Remains on Even when Steering Wheel is in Straight Ahead Position



4. Rear Fog Light

4-1. Rear Fog Light Inoperative (while Headlight is On)



CONTINUED ON THE FOLLOWING PAGE

N8A0132E

CONTINUED FROM THE PREVIOUS PAGE

- SET THE REAR FOG LIGHT SWITCH TO ON POSITION
- IS THERE BATTERY VOLTAGE APPLIED BOTH BETWEEN REAR FOG LIGHT RELAY HARNESS SIDE CONNECTOR 4 [X-23] AND GROUND, AND 1 [X-23] AND GROUND?

YES

- DISCONNECT THE REAR FOG LIGHT CONNECTOR
- IS THERE A BATTERY VOLTAGE APPLIED BETWEEN REAR FOG LIGHT HARNESS SIDE CONNECTOR 1 [R-12] AND GROUND WHEN REAR FOG LIGHT SWITCH IS ON?

YES

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN 2 [R-12] AND [J-9] (GROUND)

NO

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN FUSE MARKER LIGHT (15A) AND 1 [X-23] AND 14 [B-70] AND 4 [X-23]

NO

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN 1 [R-12] AND 5 [X-23]

N8A0133E

Starter Switch

Refer to "START AND CHARGING" in this section.

High Beam Indicator Light

Refer to "METER AND WARNING/INDICATOR LIGHT" in this section.

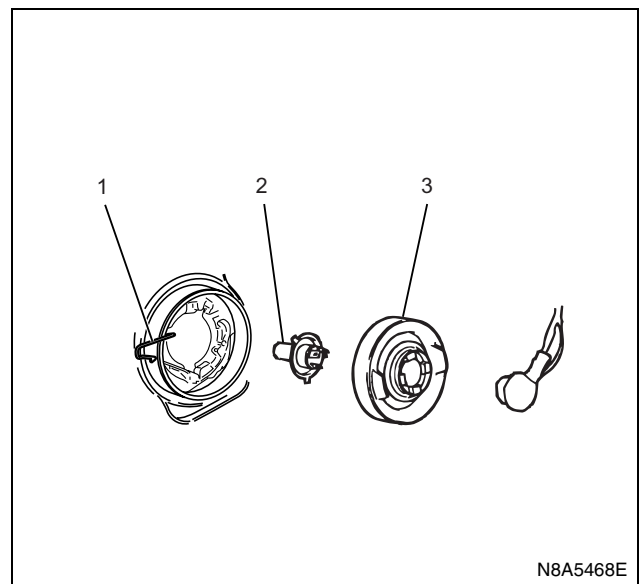
Headlight Bulb Replacement

Removal

1. Remove the battery ground cable at the battery.
2. Remove the headlight assembly. (Refer to 'Headlight Replacement' below.)
3. Remove the headlight bulb.
 - Remove the dust cover (3).
 - Remove the clip (1).
 - Remove the headlight bulb (2).

Caution:

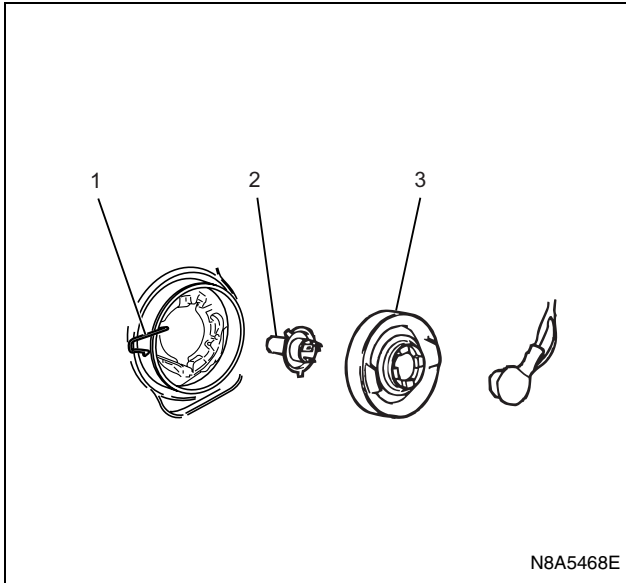
Do not touch the glass portion of the bulb with your fingers.



N8A5468E

Installation

1. Install the headlight bulb.
 - Set the headlight bulb (2).
 - Fix the headlight bulb with clip (1).
 - Install the dust cover (3).
2. Install the headlight assembly. (Refer to 'Headlight Replacement' below.)
3. Connect the battery ground cable at the battery.
4. Check if the light lights.



Caution:

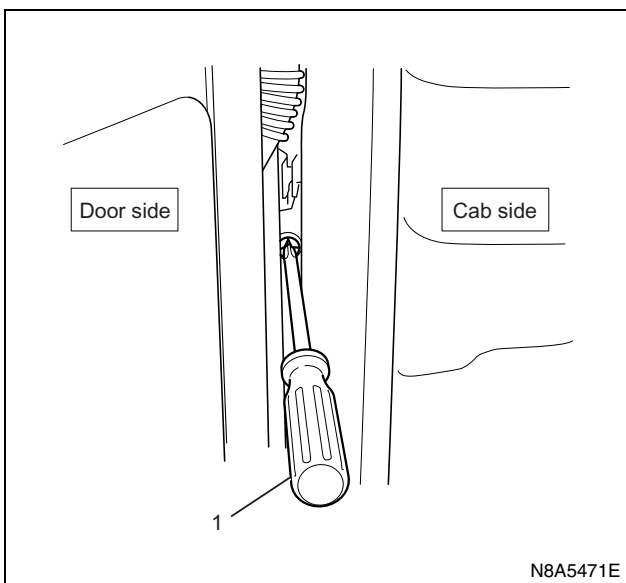
Do not touch the glass portion of the new bulb with your fingers.

Headlight Replacement

Removal

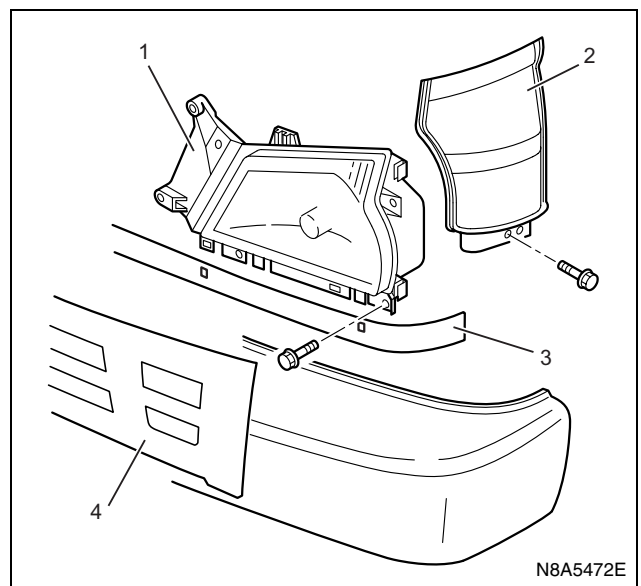
Preparation: Disconnect the battery ground cable.

1. Remove the battery ground cable at the battery.
2. Remove the seal rubber (3).
 - Remove the seal rubber from beneath the headlight.
3. Remove the front combination light (2).
 - Open the cab door. Insert a screwdriver (1) into the space between the cab and the cab door. Use the screwdriver to force out the stud pin at the center of the grommet (the pin securing the front combination light).



- Remove the fixing screw.
- Remove the two catches.

- Remove the front combination light connector.
4. Remove the front grille (4).
 - Remove the bolt at the center of the front grille.
 - Remove the four clips securing the front grille.
 - The grille is secured by 4 clips (2 clips at the inside of each headlight). Pull the grille toward you to remove it.
 5. Remove the front corner panel.
 6. Remove the headlight (1).
 - Remove the four bolts securing the headlight (loosen the fixing bolts at the bottom of the front side panel to create working space).
 - Remove the headlight clips.
 - Remove the headlight connector.



Installation

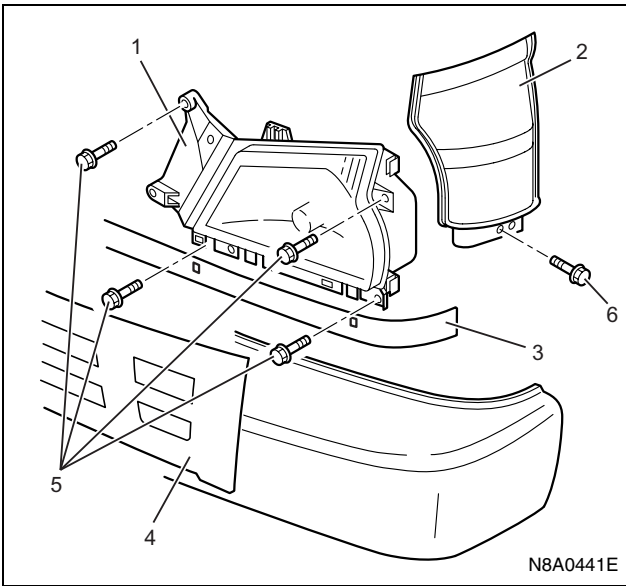
1. Assemble the headlight assembly (1).
 - Connect the connector.
 - Fix it to body panel with four bolts (5).
2. Assemble the front panel side. (Refer to "DOOR" in section 2.)
3. Install the front grille (4).
4. Install the front combination assembly (2).
 - 1) Position it by aligning two pawls with the groove of H/L.
 - 2) Fit the iron PIN in the upper portion by aligning it with the center of corresponding grommet.

Notice:

Push it into securely with a force of approx. 250 N (25 kgf) until click is heard.

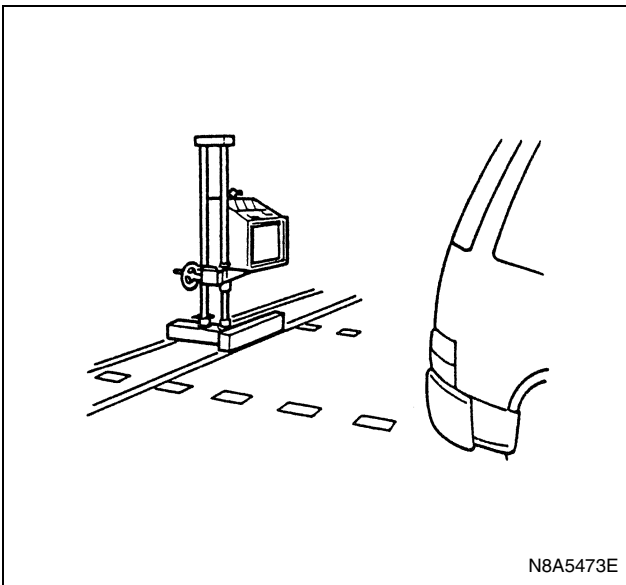
- 3) Pull the front combination light assembly lightly toward the front of vehicle to make sure that the PIN and grommet are engaged securely.
- 4) Tighten one bolt (6) in the lower portion of front combination light assembly.
- 5) Hook the seal rubber (3) on two projections under H/L.

5. Connect the battery ground cable.
6. Check the operation and lighting of each lamp.



Aiming of Headlight

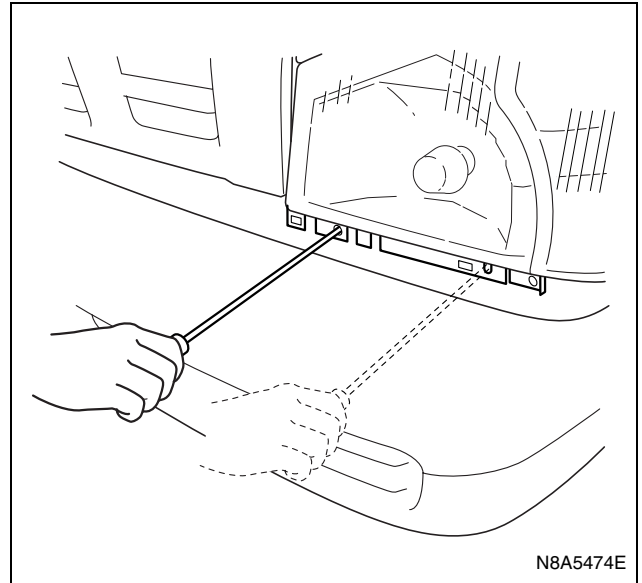
Preparation: Place the unloaded vehicle on a level surface and check to see if the inflation pressure of the tires is correct, the lenses are clean, and the battery is sufficiently charged. Adjust the aim with the headlight tester. When adjusting, follow the procedure of the tester manufacturer's.



Vertical Adjustment

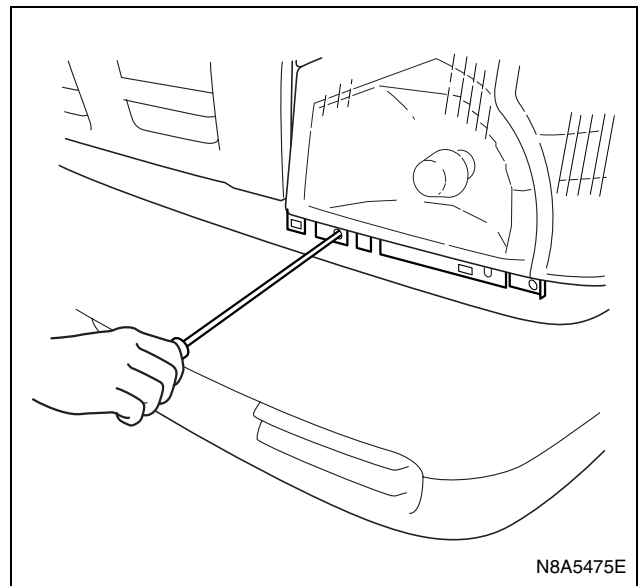
Insert the tip of a screwdriver into the hole beneath the headlight (the shaft of the screwdriver must be slanted up) until contact is made with the head of the adjusting screw. Turn the screw to adjust headlight focus up or down.

Two vertical aim screws should be turned in the same direction at the same time to adjust aiming.



Horizontal Adjustment

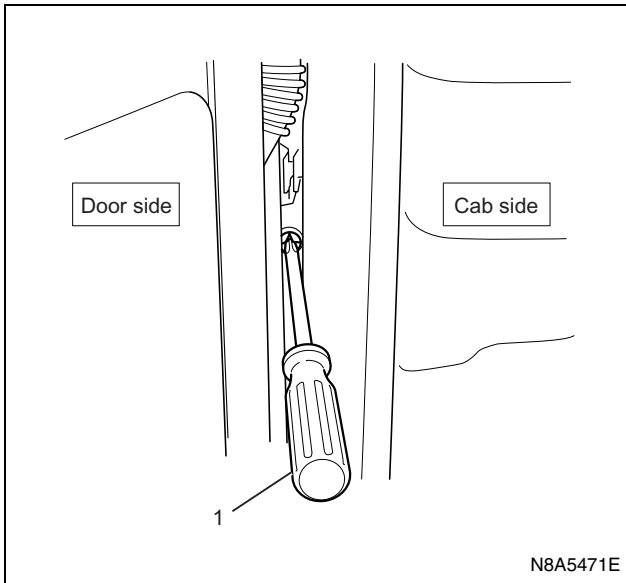
Insert the tip of a screwdriver into the hole beneath the headlight (the shaft of the screwdriver must be slanted up) until contact is made with the head of the adjusting screw. Turn the screw to adjust headlight focus to the left or right.



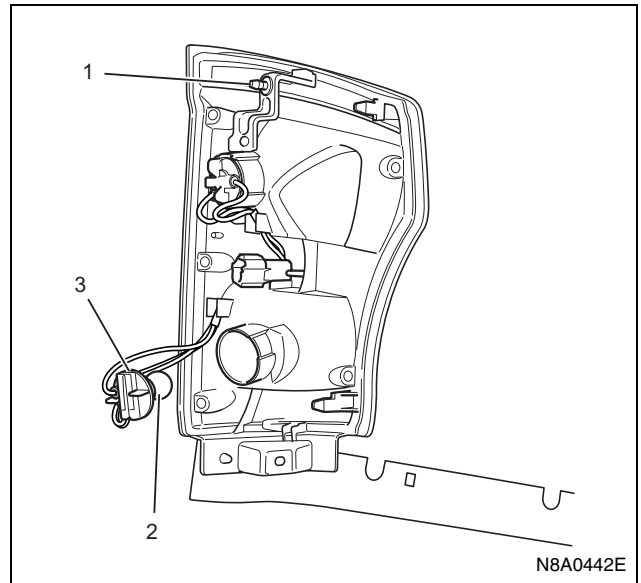
Cornering Light Bulb Replacement

Removal

1. Remove the battery ground cable at the battery.
2. Remove the front combination light.
 - Open the cab door. Insert a screwdriver (1) into the space between the cab and the cab door. Use the screwdriver to force out the stud pin at the center of the grommet (the pin securing the front combination light).



- Remove the fixing screw.
- Remove the two catches.
- Remove the front combination light (1) connector.



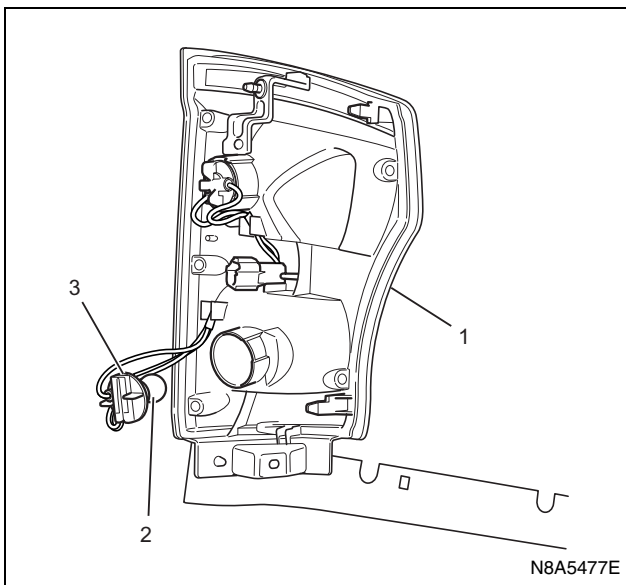
- Installation procedure of front combination light assembly
 - Connect the connector of the front combination light assembly.
 - Position it by aligning two pawls with the groove of H/L.
 - Fit the iron PIN (1) in the upper portion of the side by aligning it with the center of corresponding grommet.

Notice:

Push it into securely with a force of approx. 250 N (25 kgf) until click is heard.

- Pull the front combination light assembly lightly toward the front of vehicle to make sure that the PIN and grommet are engaged securely.
- Tighten one bolt in the lower portion of front combination light assembly.

- Hook the seal rubber on two projections under H/L.
- Connect the battery ground cable.
- Check lighting of each light.



- Remove the cornering light bulb.
 - Turn the cornering / clearance bulb socket (3) to the left to remove it.
 - Press the bulb (2) in and turn it to the left to remove it from the socket.

Installation

- Install the cornering / clearance bulb.
 - While pressing the bulb (2), turn it clockwise to fit.

Notice:

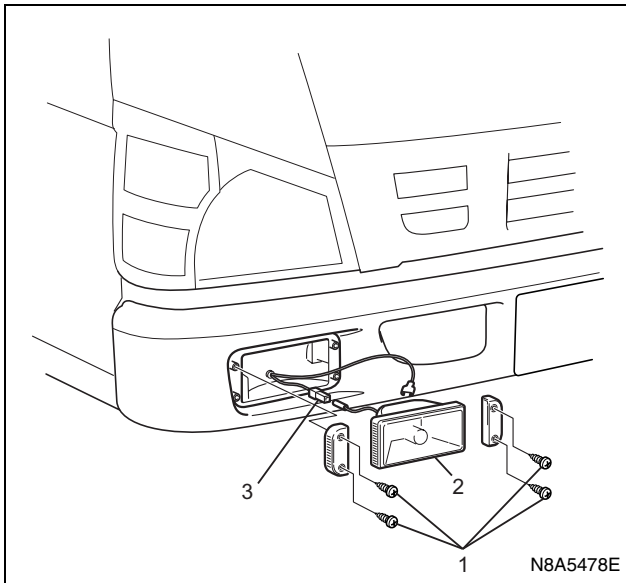
Do not let the glass portion dirty with sebum etc.

- Turn the bulb socket (3) clockwise to fit.

Fog Light Bulb

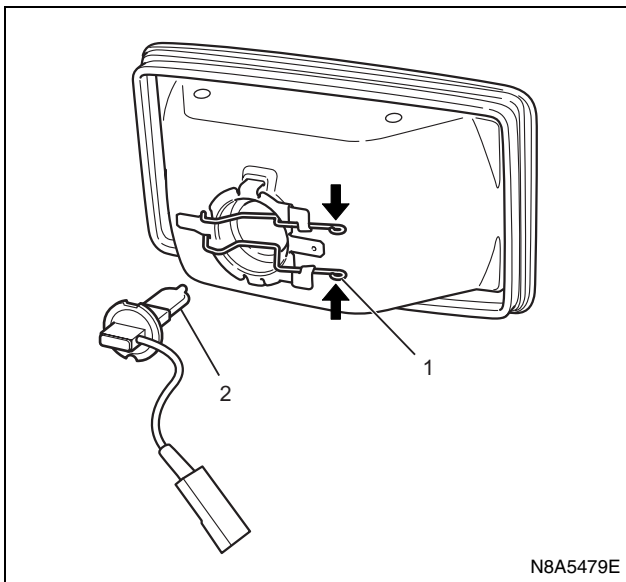
Removal

1. Remove the battery ground cable at the battery.
2. Remove the four screws (1) to remove the cover which holds fog light assembly (2).
3. Remove the connector (3).
4. Remove the fog light assembly (2).



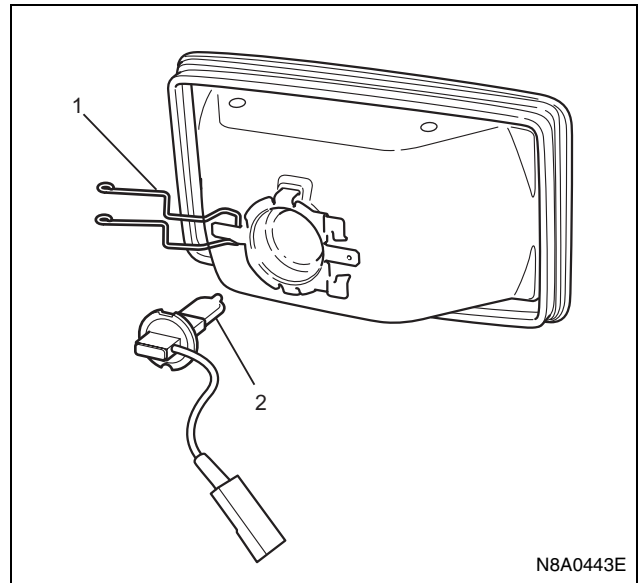
5. Bulb

- Push the clip (1) inward as arrow to remove.
- Remove the bulb (2).



Installation

1. Install the fog light bulb.
 - Set the fog light bulb (2).
 - Hook the clip (1) to secure fog light bulb.

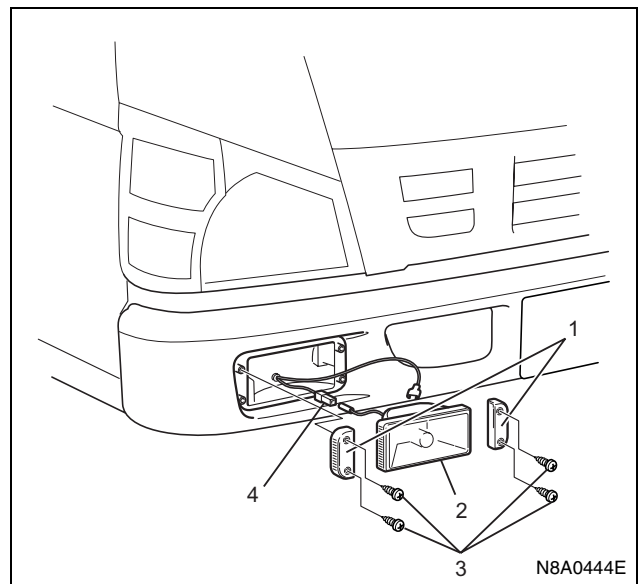


2. Connect the two locations of connector (4).
3. Install the fog light assembly.
 - Hold the fog light (2) with right and left covers (1) and secure it with four screws (3).

Notice:

Make sure that "TOP" mark on the lens comes upside.

4. Connect the battery ground cable.
5. Check lighting.

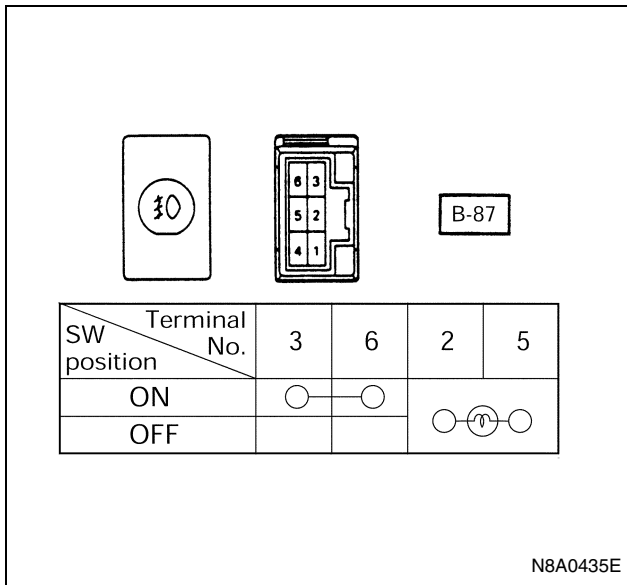


Fog Light Switch

Inspection

Check the continuity between the connector terminals while operating the switch.

Replace the switch when the result of inspection is found abnormal.

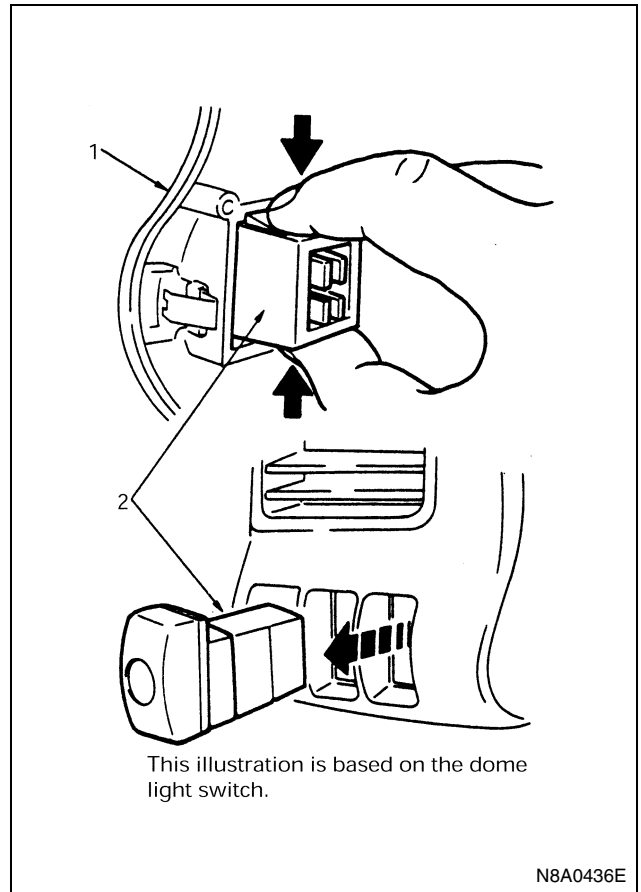


Removal

Preparation:

Disconnect the battery ground cable.

1. Meter Cluster
Refer to "METER AND WARNING/INDICATOR LIGHT" in this section.
2. Fog Light Switch
Release the lock pushing the switch from the back side of the meter cluster.



Installation

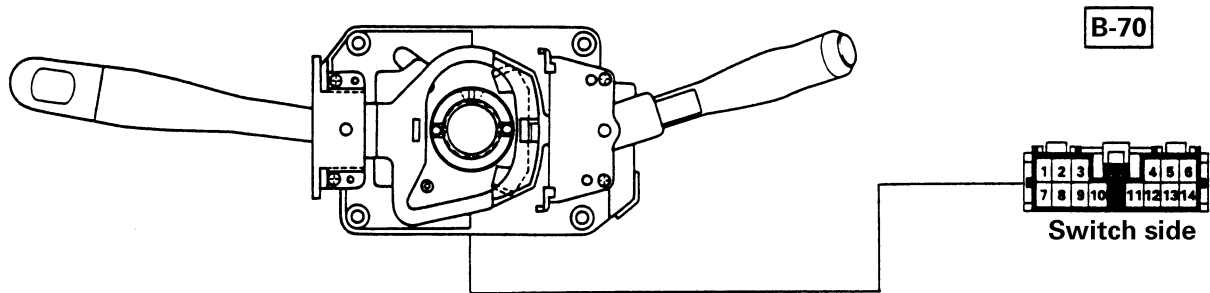
To install, follow the removal steps in the reverse order.

Combination Switch (Lighting Switch, Dimmer, Passing Switch, Cornering Light Switch and Rear Fog Light Switch)

Inspection

Check the continuity between the connector terminals while operating the switch.

Replace the switch when the result of inspection is found abnormal.



SW position		Terminal No.	1	2	4	5	7	8	9	10	11	12	13	14
		Lighting SW			○		○			○				
					○			○						
REAR FOG SW			○		○			○						○
OFF														
Dimmer-passing SW	High beam				○					○				
	Passing				○		○			○				
Cornering light SW	Turning left		○								○			
	Neutral													
	Turning right		○						○					

N8A0143E

Removal

Preparation:

Disconnect the battery ground cable.

1. Horn Pad

1) Hold the horn pad and pull it upward.

2. Steering Wheel

1) Remove the steering shaft nut.

2) Remove the steering wheel by using steering wheel remover.

(Refer to Section 3B4 "STEERING COLUMN" for steering wheel removal steps.)

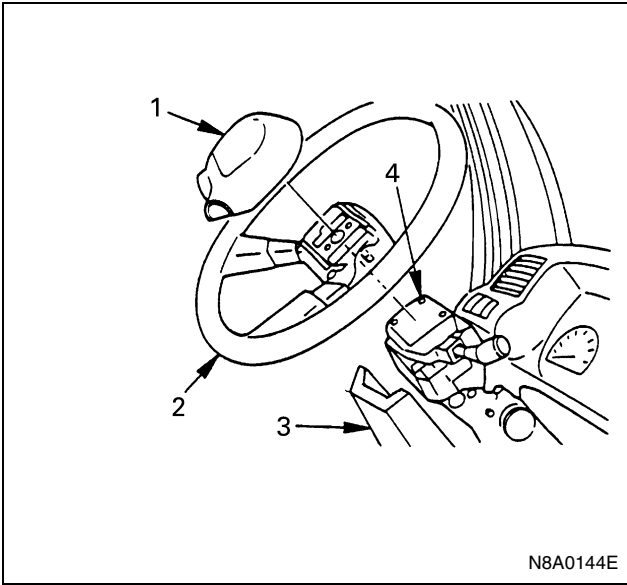
3. Steering Cowl

Remove the four screws.

4. Combination Switch

1) Remove the four screws.

2) Disconnect the connector.



Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the steering shaft nut to the specified torque.

Tighten:

Shaft nut to 49 N·m (5 kg·m / 36 lb·ft)

Headlight Leveling

General Description

The circuit consists of starter SW, headlight leveling SW and headlight leveling actuator.

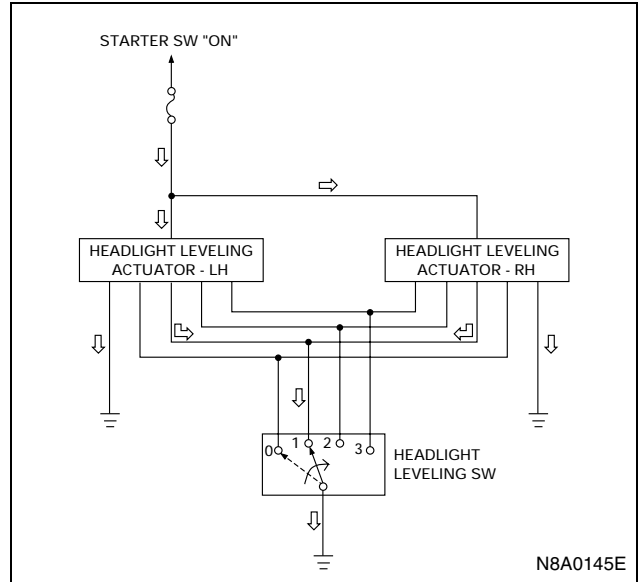
When the headlight leveling SW is operated with the starter SW at ON position, the actuator is operated to change the angle of the optical axis of the headlight.

Operation of The Circuit

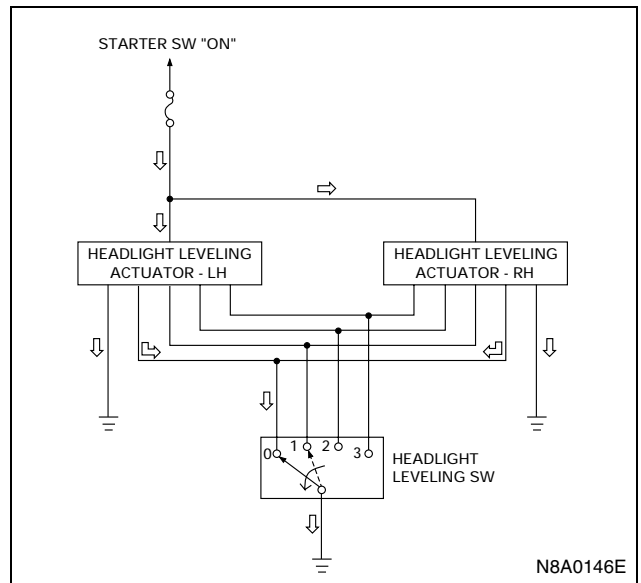
Notice:

Arrow marks indicate the direction of current.

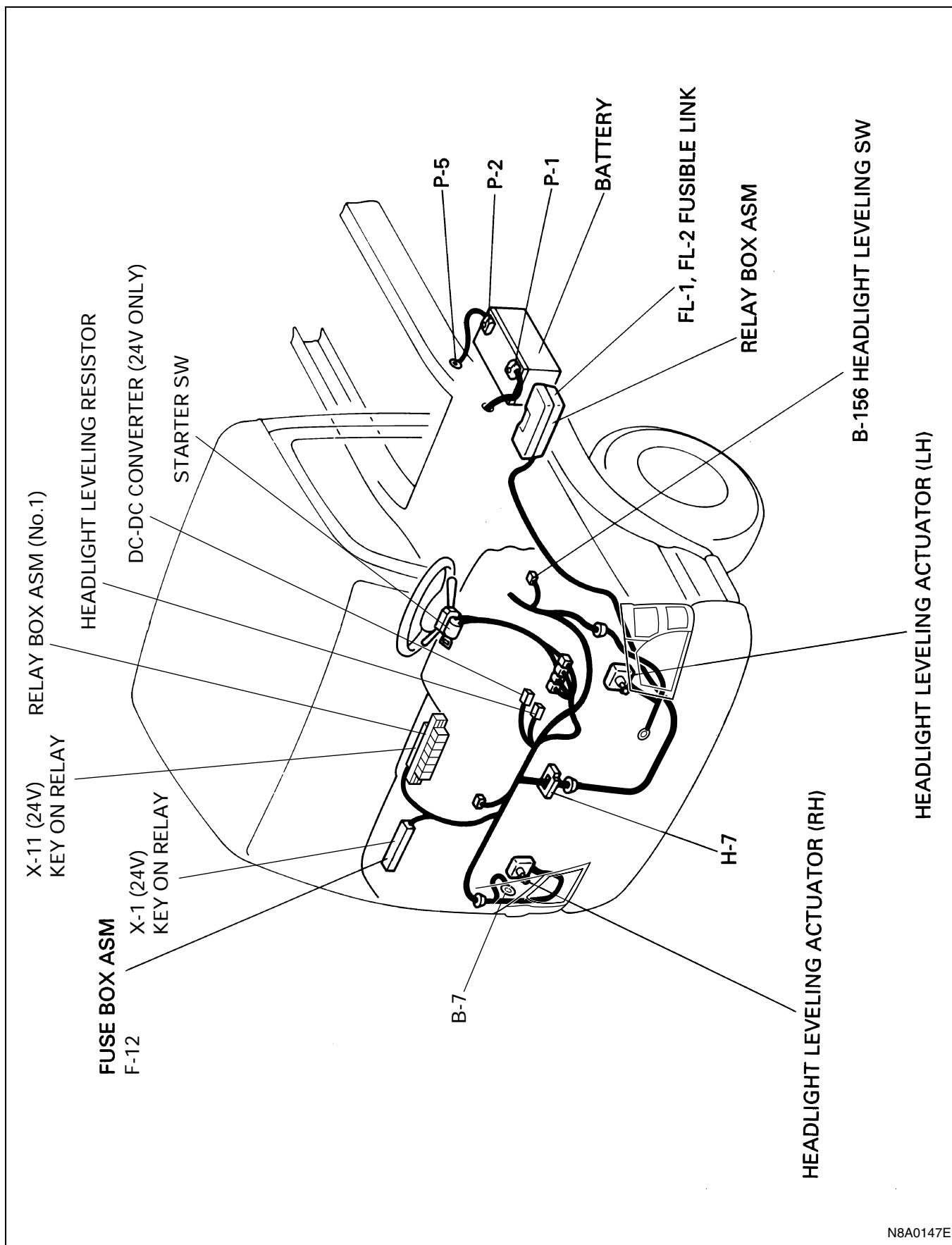
1. When headlight leveling SW is turned to “1” position



2. When headlight leveling SW is turned to “0” position

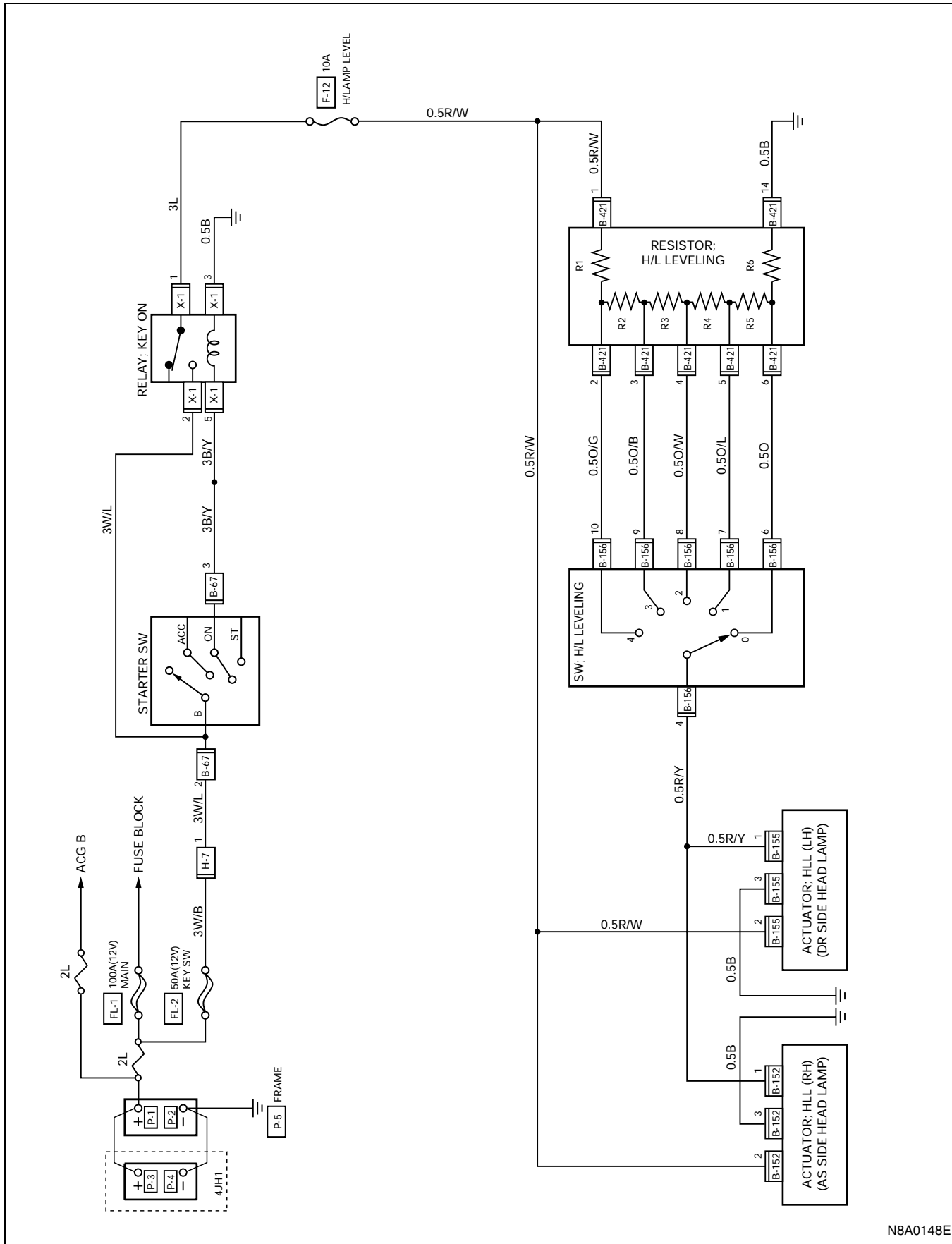


Parts Location



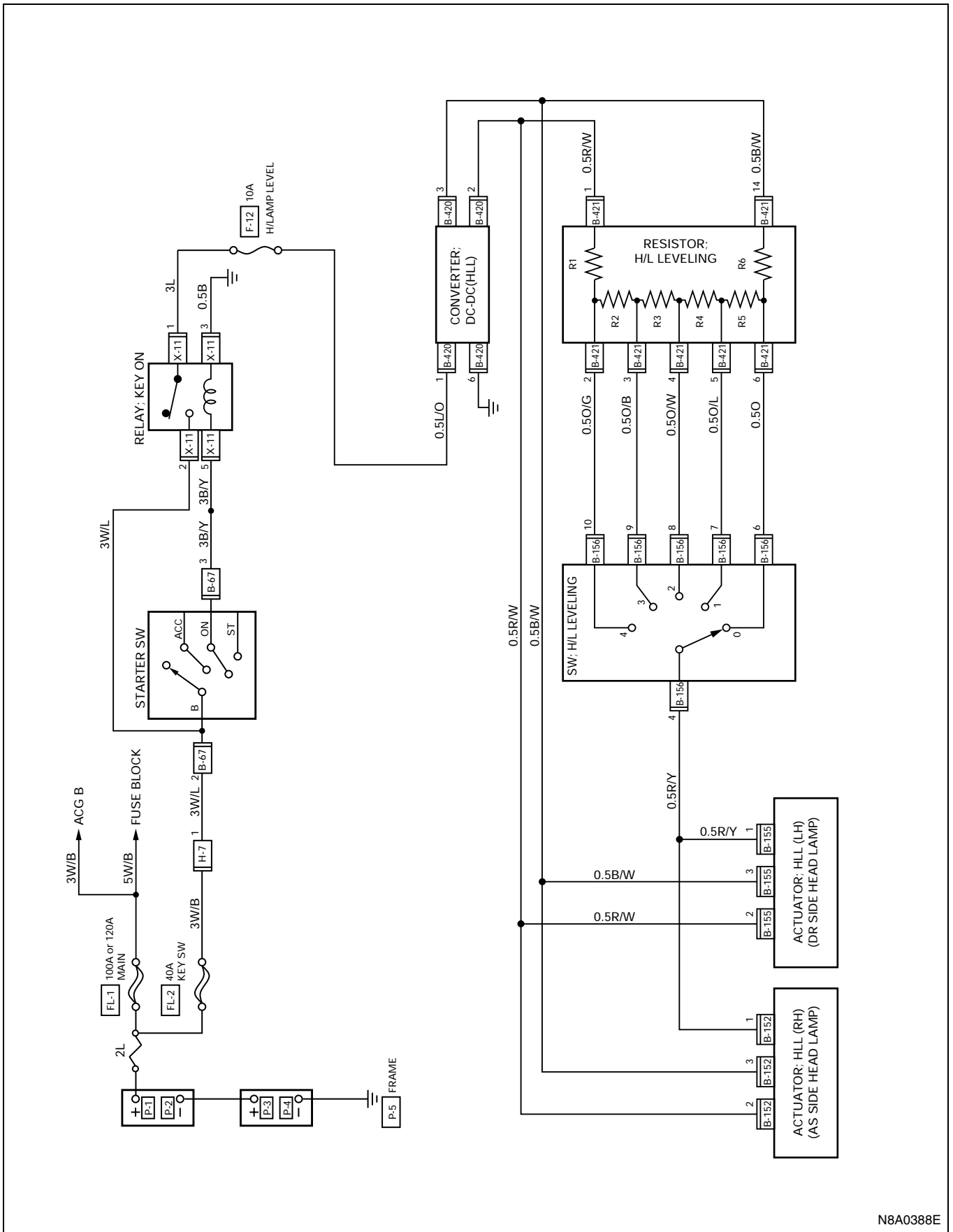
N8A0147E

Circuit Diagram For 12 Volt



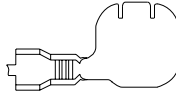

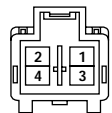


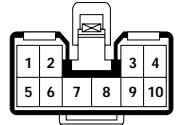


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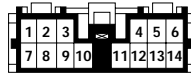
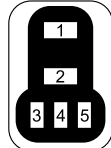
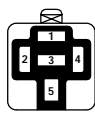
For 24 Volt



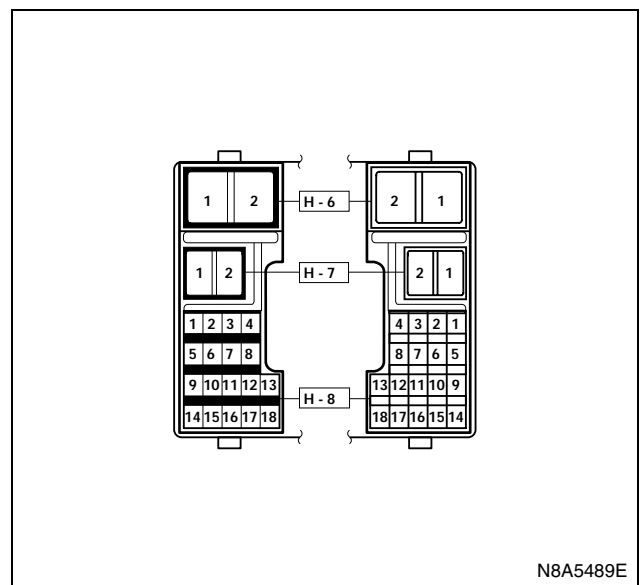
N8A0388E

Connector List

No.	Connector Face
B-7	 000-012
B-67	 004-001
B-67	 004-002
B-152	 003-016
B-155	 003-016
B-156	 010-002
P-1	 000-004
P-2	 000-003

No.	Connector Face
P-5	 000-007
B-420 (24 V)	 006-019
B-421	 014-002
X-1 (12V)	 005-006
X-11 (24 V)	 005-001

H-7



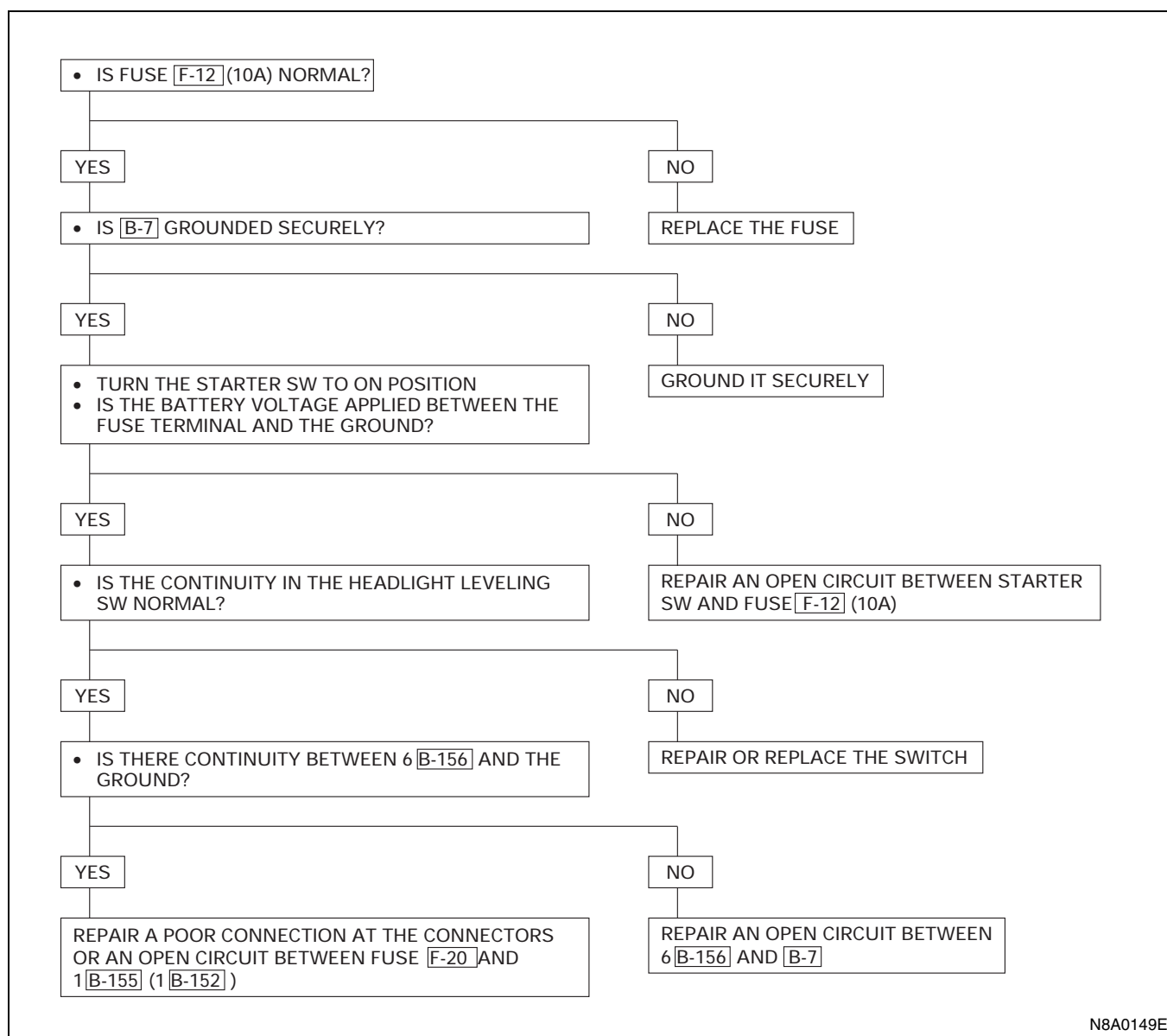
N8A5489E

Diagnosis

Quick Chart for Check Points

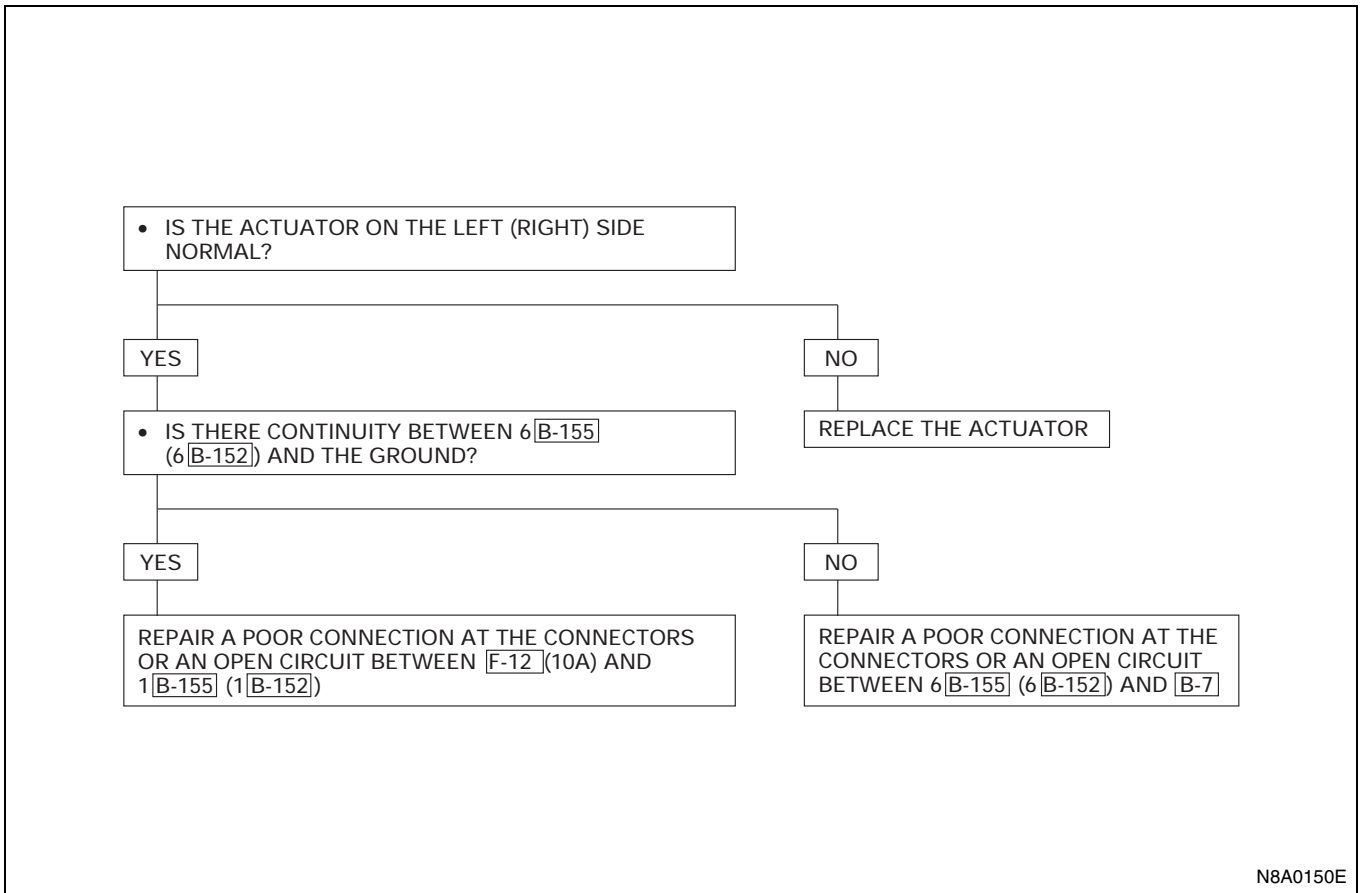
		Check point			
		Fuse F-12 (10 A)	Headlight leveling switch	Headlight leveling actuator	Cable harness
Trouble mode	1. Both actuators inoperative	○	○		○
	2. Actuator on the left (right) side inoperative			○	○
	3. When leveling SW is turned to a certain position, actuator inoperative		○	○	○

1. Both Actuators Inoperative



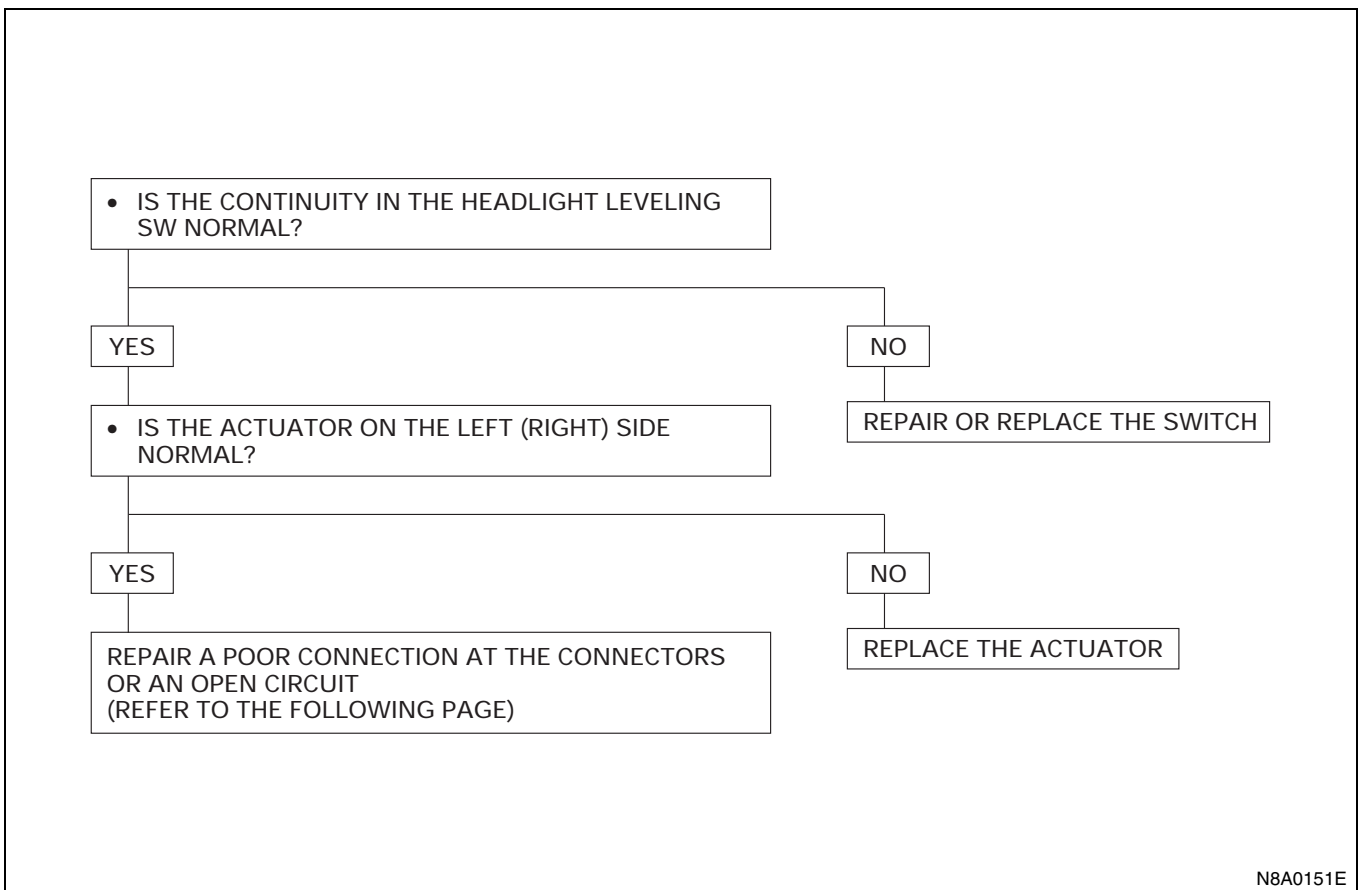
N8A0149E

2. Actuator on the Left (Right) Side Inoperative



N8A0150E

3. When Headlight Leveling SW is Turned to A Certain Position, Actuator Inoperative



N8A0151E

Inspect and repair the circuit that is corresponding to the headlight leveling switch position where the actuator becomes inoperative.

Actuator - LH

Headlight leveling SW position	Circuit
1	Between 3 B-156 and 3 B-155
2	Between 2 B-156 and 4 B-155
3	Between 1 B-156 and 5 B-155
0	Between 4 B-156 and 2 B-155

Actuator - RH

Headlight leveling SW position	Circuit
1	Between 3 B-156 and 3 B-152
2	Between 2 B-156 and 4 B-152
3	Between 1 B-156 and 5 B-152
0	Between 4 B-156 and 2 B-152

Starter Switch

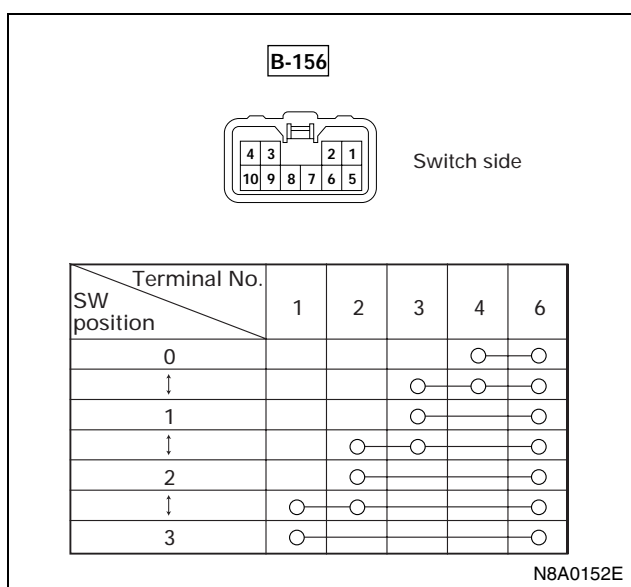
Refer to "START AND CHARGING" in this manual.

Headlight Leveling Switch

Inspection

Check the continuity between the switch connector terminals.

Repair or replace the switch when the result of inspection is found abnormal.

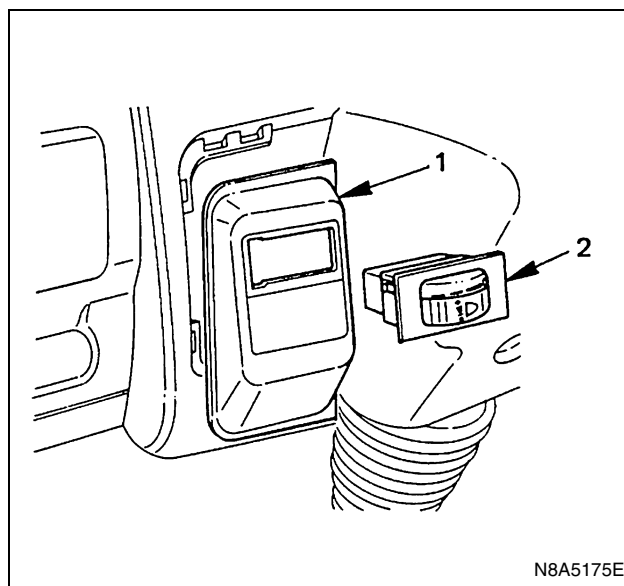


Removal

Preparation:

Disconnect the battery ground cable.

1. Switch Bezel
2. Headlight Leveling Switch
Disconnect the connector.



Installation

To install, follow the removal steps in the reverse order.

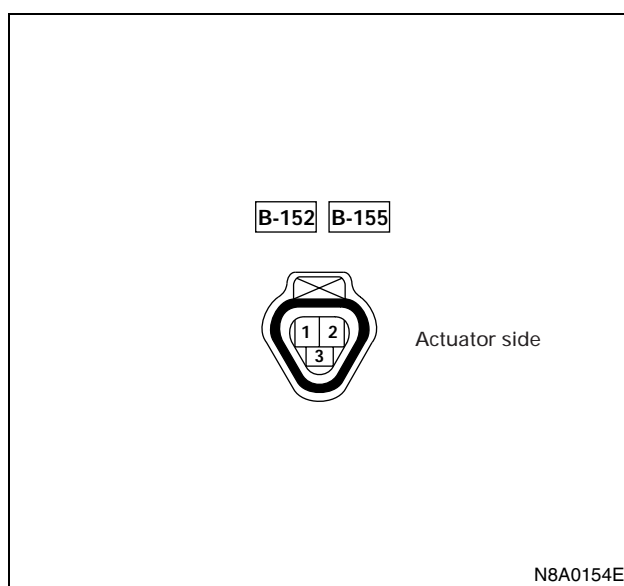
Headlight Leveling Actuator

Inspection

Apply the battery voltage to the connector terminals and check its function.

This actuator has a mechanism that the angle of headlight leveling varies according to input voltage of SIGNAL.

1. Make sure that the voltage specified in table is output to vehicle harness connector which will be connected to actuator.
If the power supply is not 12 V, the SIGNAL output varies in proportion to its voltage.
2. Connect the connector of actuator and vehicle harness connector.
Make sure that the reflector of headlight moves to the position indicated by HEAD LAMP LEVELING SW.



1	2	3
SIGNAL	-	+

		Input signal voltage ratio for SIGNAL when the voltage difference between positive and negative is specified as 100%	-	+
HEAD LAMP POSITION	Position 0	10.0% (1.2 V)	0 V	12 V
	Position 1	23.4% (2.8 V)	0 V	12 V
	Position 2	36.7% (4.4 V)	0 V	12 V
	Position 3	50.0% (6.0 V)	0 V	12 V
	Position 4	63.4% (7.6 V)	0 V	12 V

Caution:

1. For vehicles with 12 V and 24 V, this leveling input voltage is 12 V.
2. Input to SIGNAL must be less than 65% of the input voltage to positive terminal.

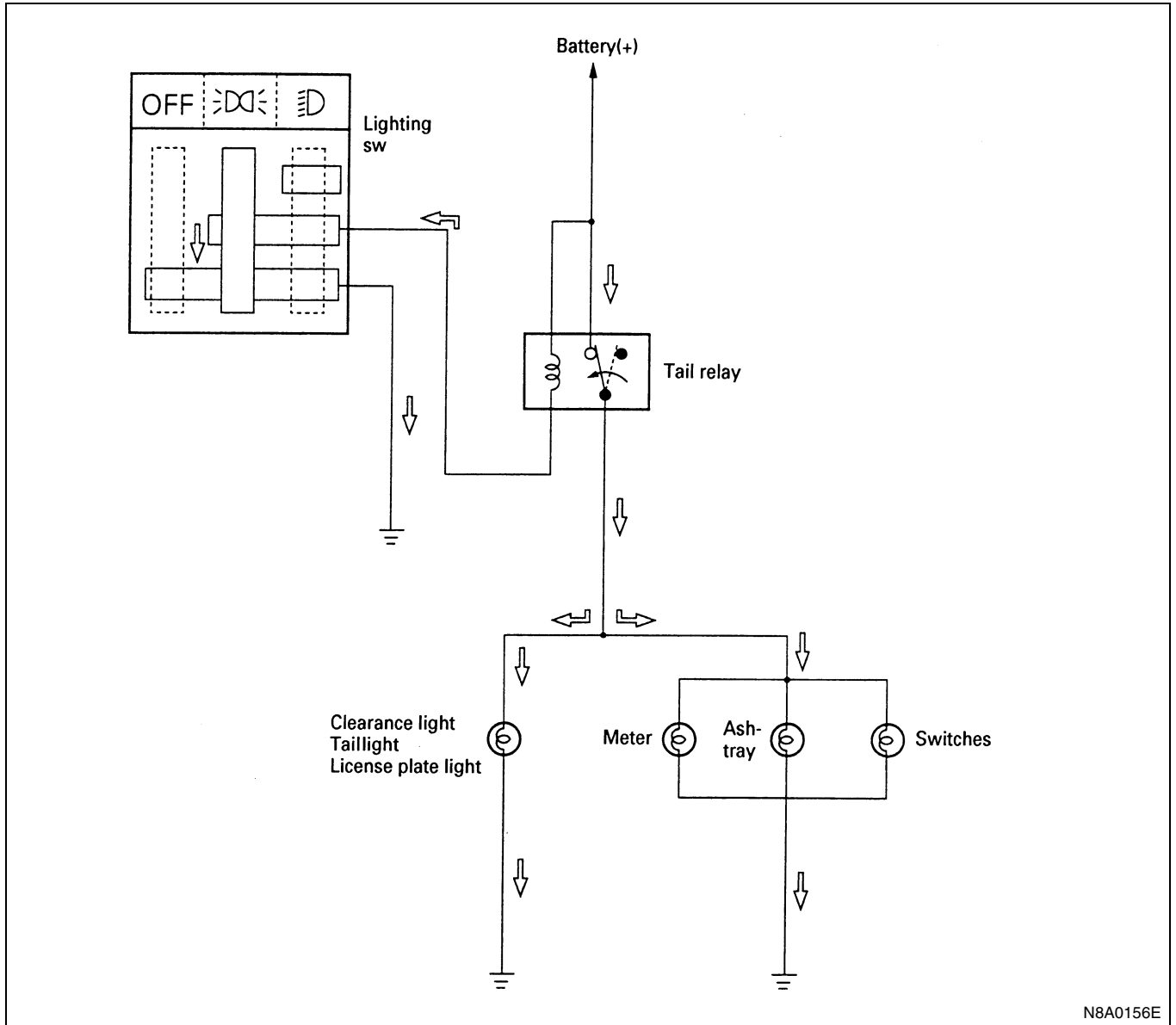
Clearance Light, Taillight, License Plate Light and Illumination Light

General Description

The circuit consists of the lighting switch, clearance light, taillight, license plate light and the illumination light for each of switch, meter and ashtray.

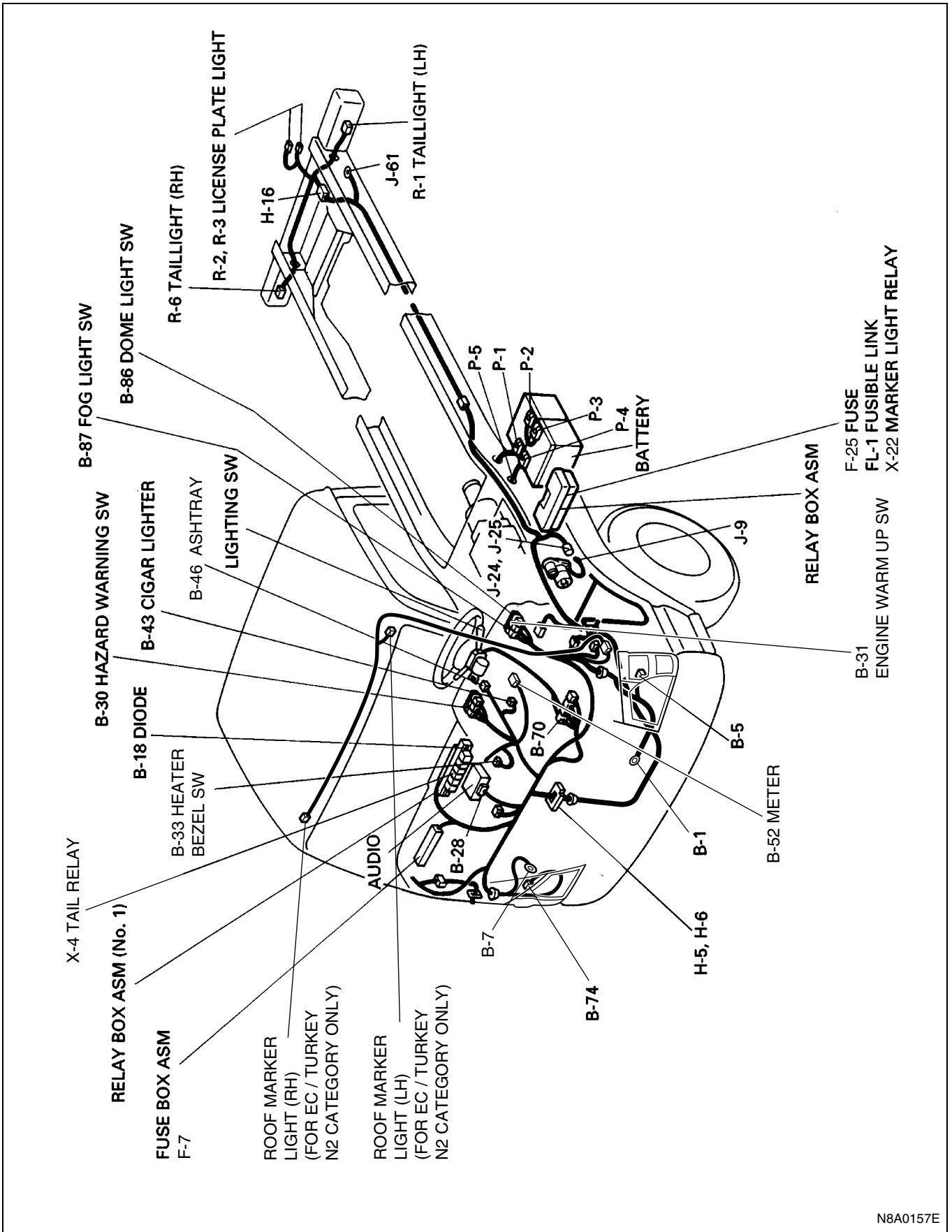
All these lights come on when the lighting switch is turned on with the switch to either clearance or headlight position.

Lighting Circuit



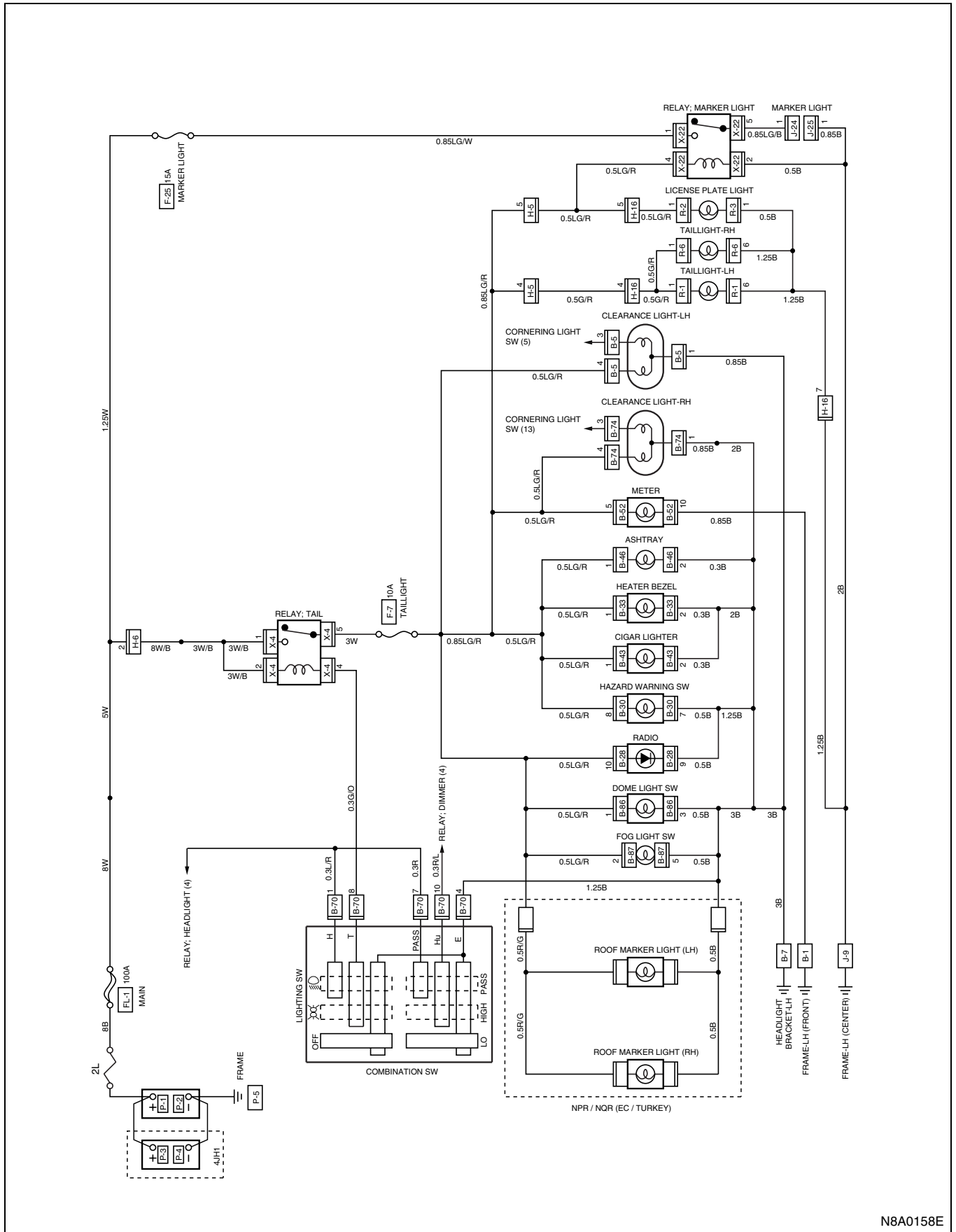
N8A0156E

Parts Location



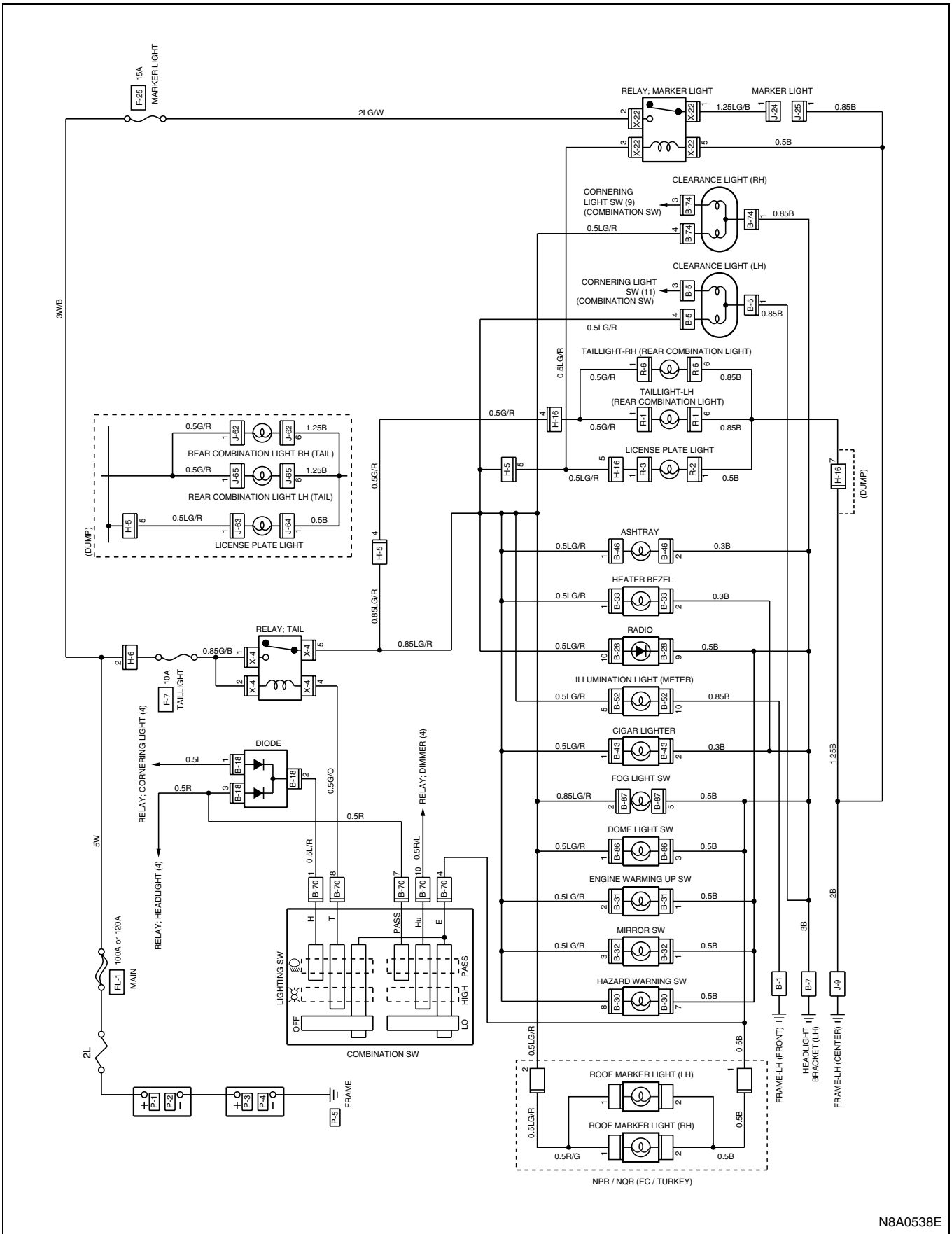
N8A0157E

Circuit Diagram For 12 Volt




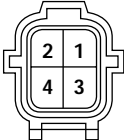
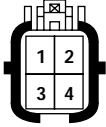
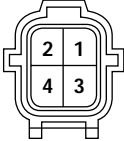

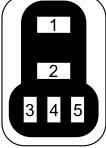
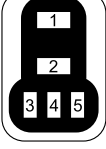
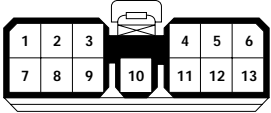
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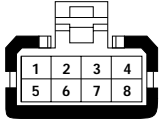
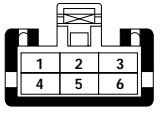

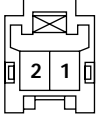

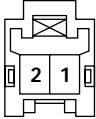


For 24 Volt

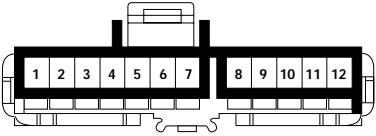
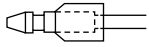
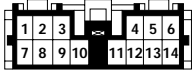
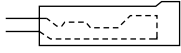
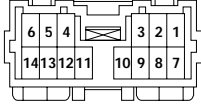
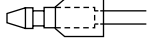

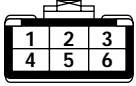
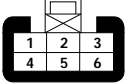


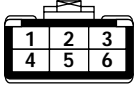
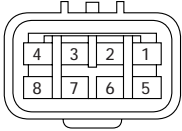
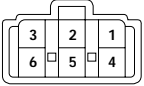
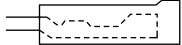
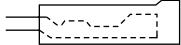


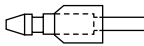
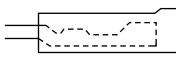
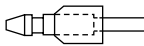
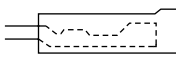

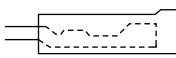
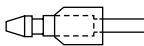

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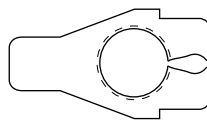
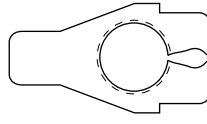

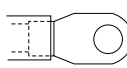
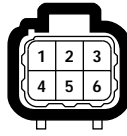
Connector List

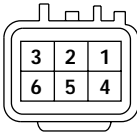

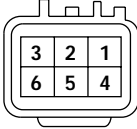
No.	Connector Face
B-5	 004-012
B-5	 004-013
B-74	 004-012
B-74	 004-013
B-18	 003-024
X-4	 005-006
X-22	 005-006
B-28	 013-001

No.	Connector Face
B-30	 008-005
B-31	 006-001
B-33	 002-022
B-33	 002-023
B-46	 002-022
B-46	 002-023
B-43	 002-009
B-43	 002-010

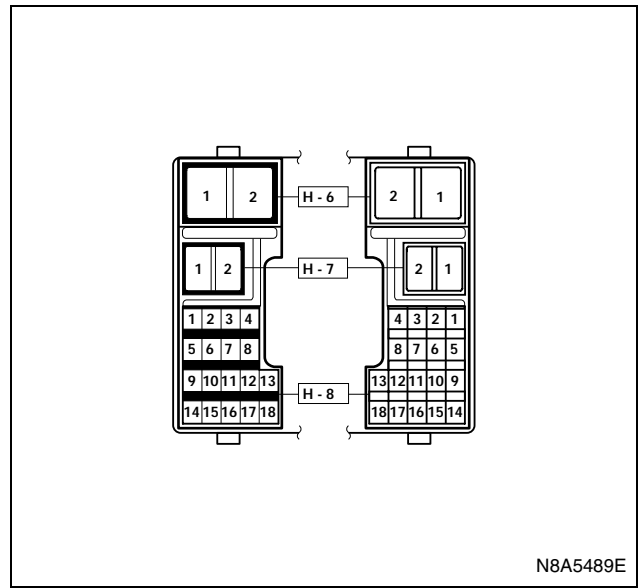
No.	Connector Face	No.	Connector Face
B-52	 012-005	J-24	 000-011
B-70	 014-002	J-25	 000-010
B-70	 014-003	J-25	 000-011
B-86	 004-001	J-62	 006-010
B-87	 006-006	J-62	 006-015
H-16	 008-003	J-65	 006-010
H-16	 008-004	J-65	 006-015
J-24	 000-010	J-63	 000-010

No.	Connector Face
J-63	 000-011
J-64	 000-010
J-64	 000-011
R-2	 000-010
R-2	 000-011
R-3	 000-010
R-3	 000-011
P-1 (12 V)	 000-003

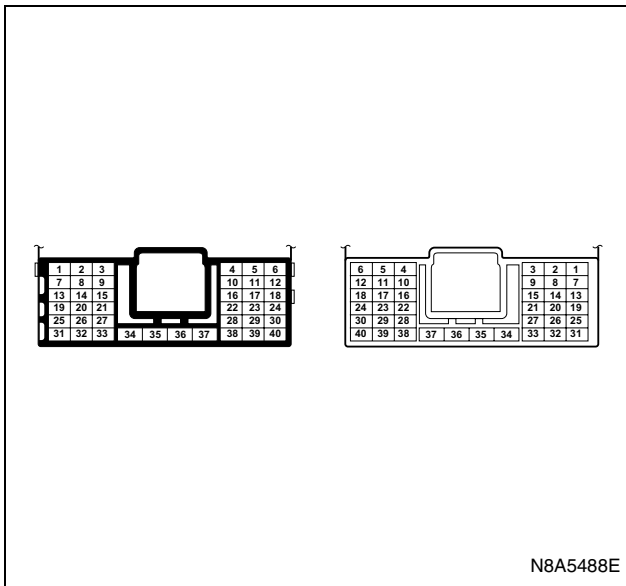
No.	Connector Face
P-2	 000-004
P-1 (24 V)	 000-004
P-4	 000-004
P-2 (24 V)	 000-006
P-3	 000-006
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002
R-1	 006-004

No.	Connector Face
R-1	 006-005
R-6	 006-004
R-6	 006-005

H-6



H-5



Diagnosis

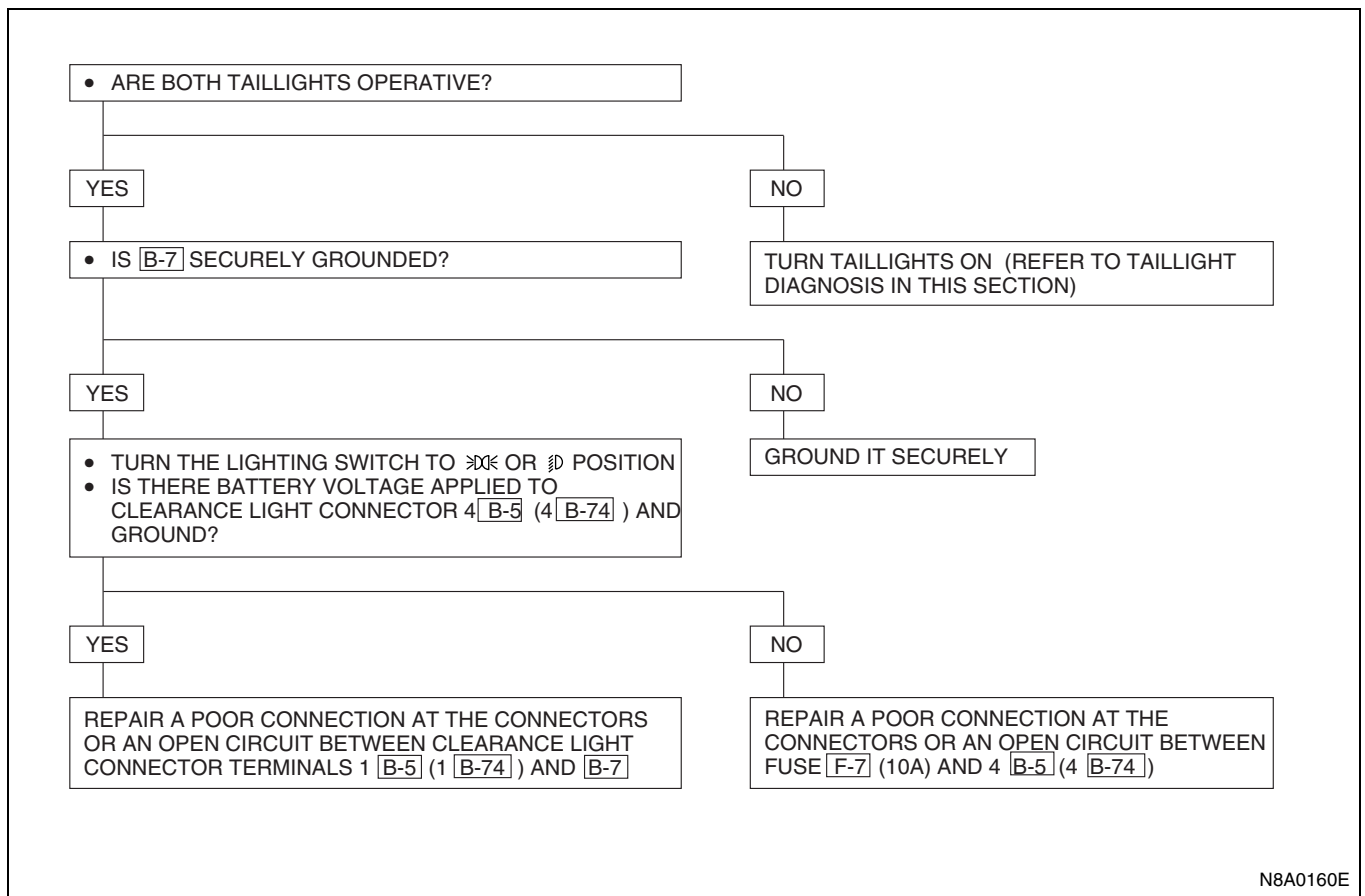
Quick Chart for Check Point

		Check point								
		Fuse		Lighting SW	Tail-light bulb	Clearance light bulb	License plate light bulb	Marker light relay	Cable harness	Marker light bulb
		F-7 (10 A)	F-25 (15 A)							
Trouble mode	1. Both clearance lights inoperative	○ (1)		○ (3)		○ (2)			○ (4)	
	2. Clearance light on the left (or right) side inoperative					○ (1)			○ (2)	
	3. Both taillights inoperative	○ (1)		○ (2)					○ (3)	
	4. Taillight on the left (or right) side inoperative				○ (1)				○ (2)	
	5. License plate light inoperative						○ (1)		○ (2)	
	6. Marker light inoperative		○ (2)					○ (3)	○ (4)	○ (1)

Notice:

Figure in parenthesis “()” indicates the order of inspection.

1. Both Clearance Lights Inoperative

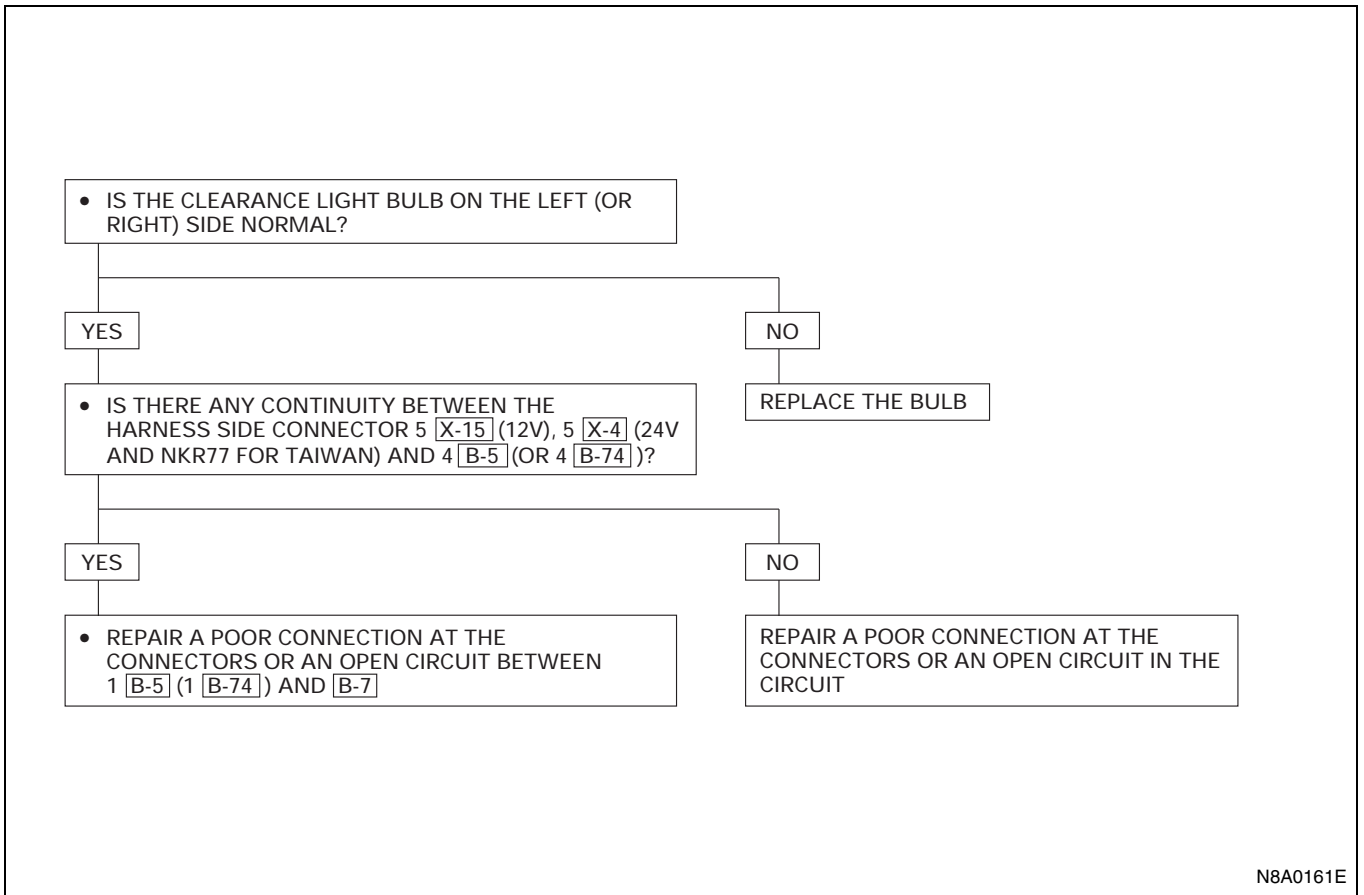


N8A0160E

Notice:

Figure in parenthesis “()” indicates place of inspection for clearance light on the right side.

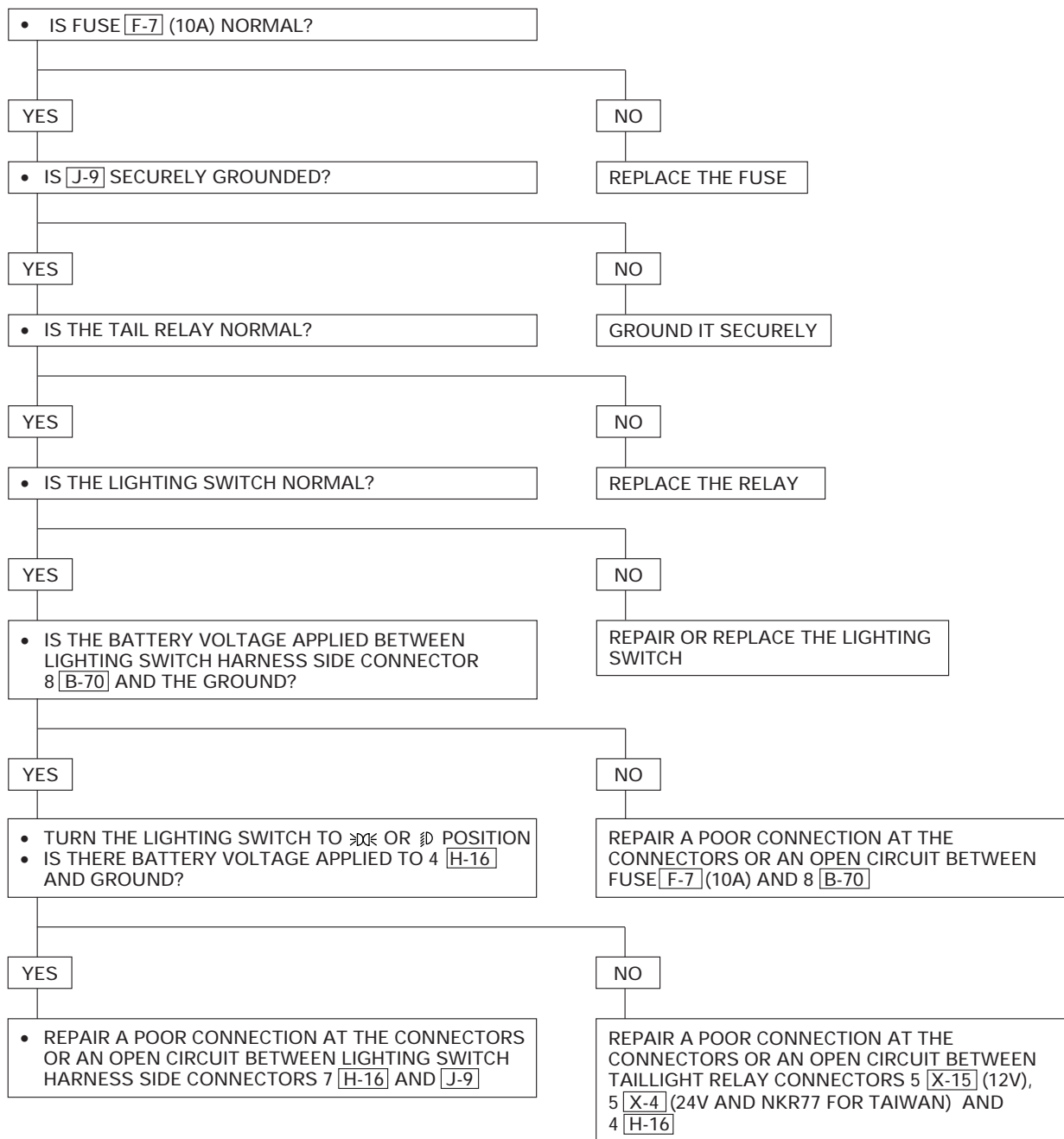
2. Clearance Light on the Left (or Right) Side Inoperative



Notice:

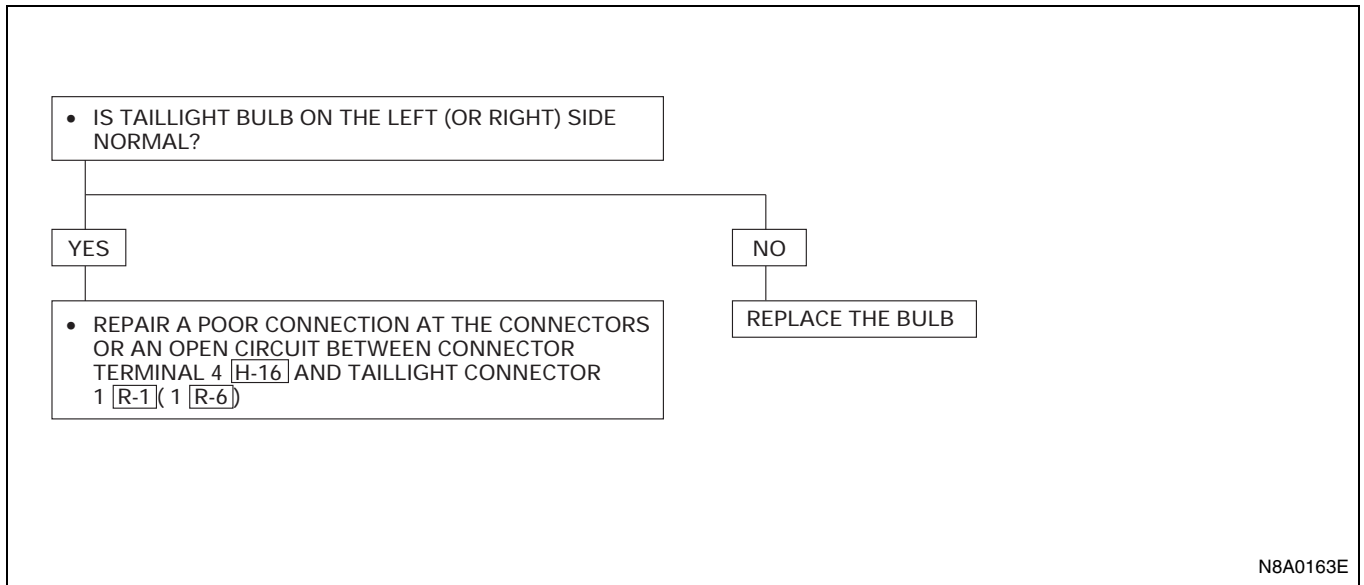
Figure in parenthesis “()” indicates place of inspection for clearance light on the right side.

3. Both Taillights Inoperative



N8A0162E

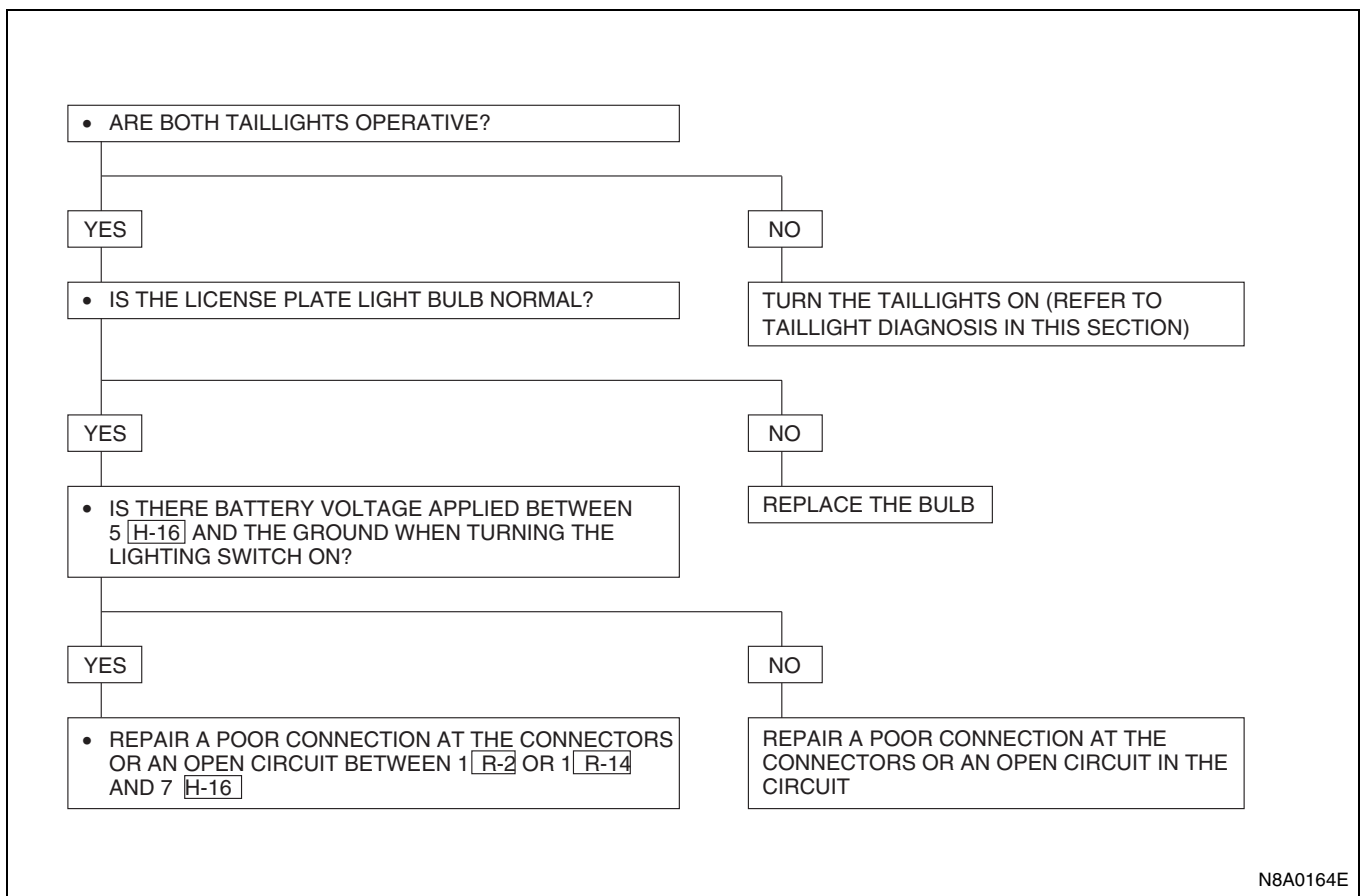
4. Taillight on the Left (or Right) Side Inoperative



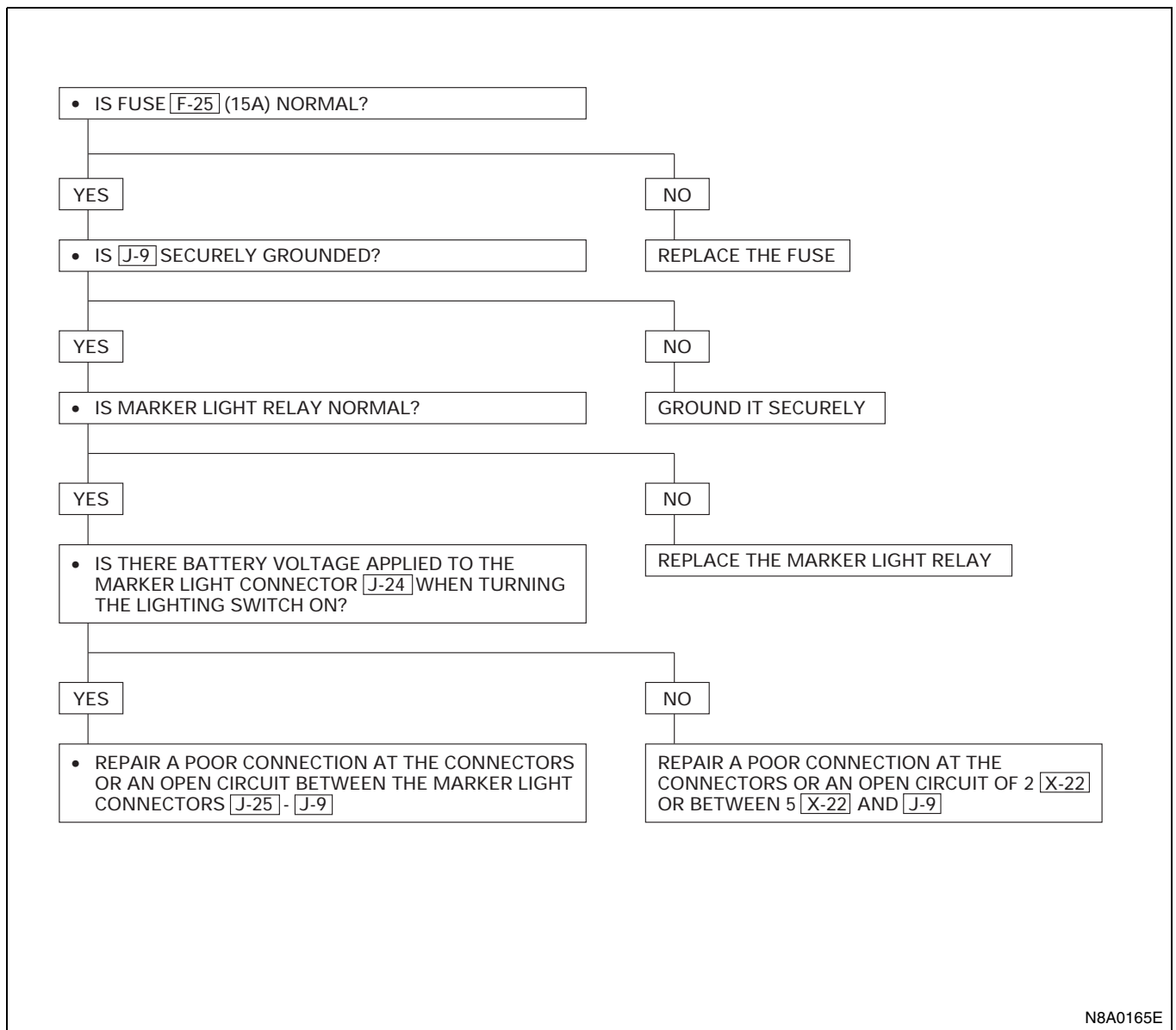
Notice:

Figure in parenthesis “()” indicates place of inspection for taillight on the right side.

5. License Plate Light Inoperative



6. Marker Light Inoperative



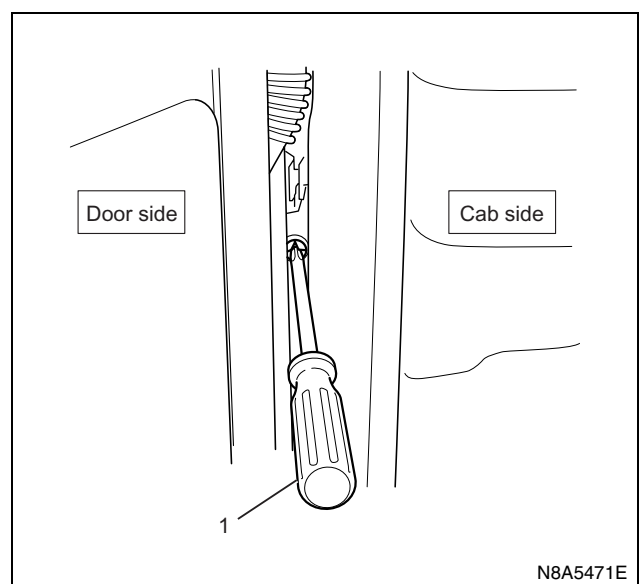
Lighting Switch

Refer to “HEADLIGHT, FOG LIGHT AND CORNERING LIGHT” in this section.

Clearance Light/Bulb

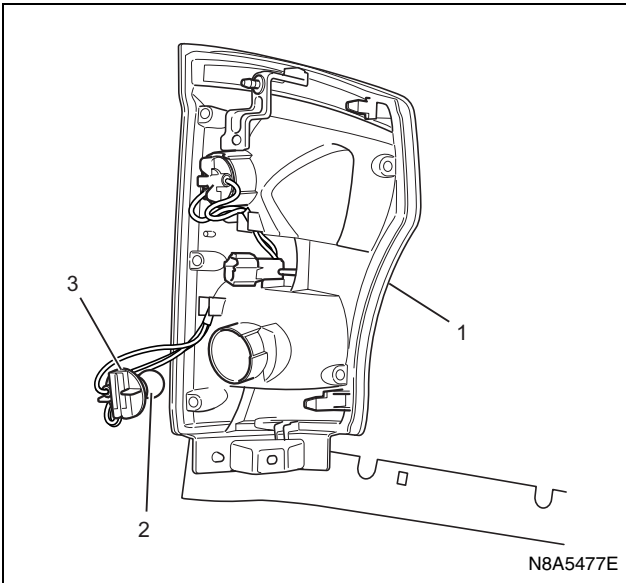
Removal

1. Remove the battery ground cable at the battery.
2. Remove the front combination light.
 - Open the cab door. Insert a screwdriver (1) into the space between the cab and the cab door. Use the screwdriver to force out the stud pin at the center of the grommet (the pin securing the front combination light).



- Remove the fixing screw.

- Remove the two catches.
- Remove the front combination light (1) connector.



3. Remove the clearance light bulb.
 - Turn the bulb socket (3) to the left to remove it.
 - Press the bulb (2) in and turn it to the left to remove it from the socket.

Installation

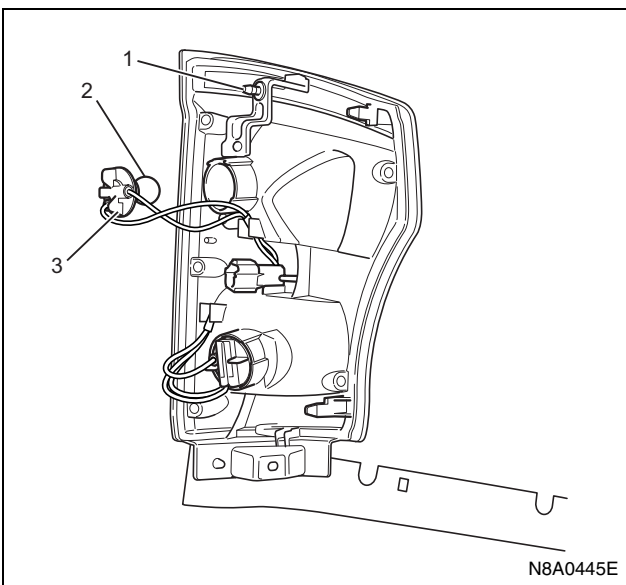
Installation procedure of cornering/clearance light bulb

1. Install the cornering/clearance light bulb.
 - While pressing the bulb (2), turn it clockwise to fit.

Notice:

Do not let the glass portion dirty with sebum etc.

- Turn the bulb socket (3) clockwise to fit.



2. Installation procedure of front combination light assembly
 - Connect the connector of the combination light assembly.

- Position it by aligning two pawls with the groove of H/L.
- Fit the iron PIN (1) in the upper portion of the side by aligning it with the center of corresponding grommet.

Notice:

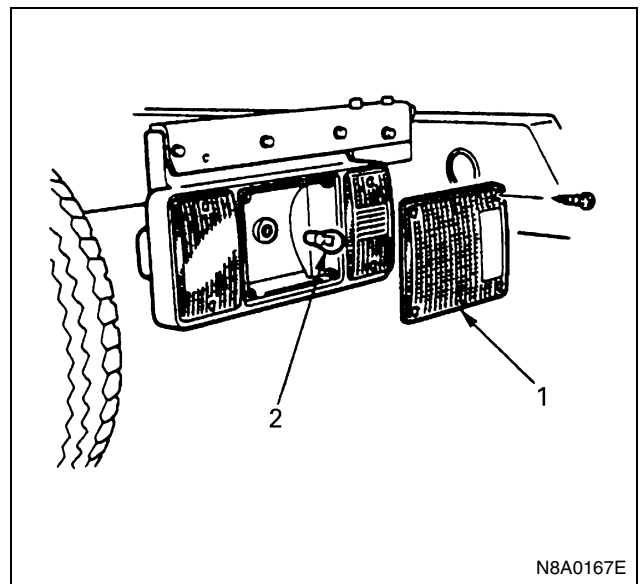
Push it into securely with a force of approx. 250 N (25 kgf) until click is heard.

- Pull the front combination light assembly lightly toward the front of vehicle to make sure that the PIN and grommet are engaged securely.
 - Tighten one bolt in the lower portion of front combination light assembly.
3. Hook the seal rubber on two projections under H/L.
 4. Connect the battery ground cable.
 5. Check lighting of each light.

Taillight Bulb

Removal

1. Lens
2. Bulb



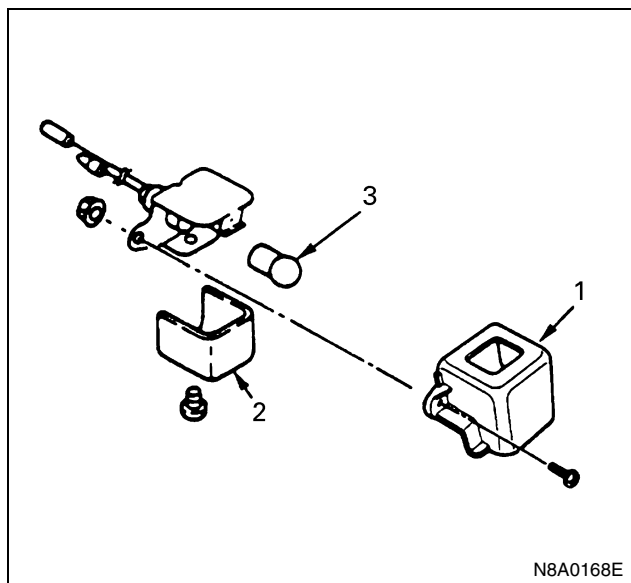
Installation

To install, follow the removal steps in the reverse order.

License Plate Light Bulb

Removal

1. Cover
2. Lens
3. Bulb



Installation

To install, follow the removal steps in the reverse order.

Turn Signal Light, Hazard Warning Light, and Stoplight

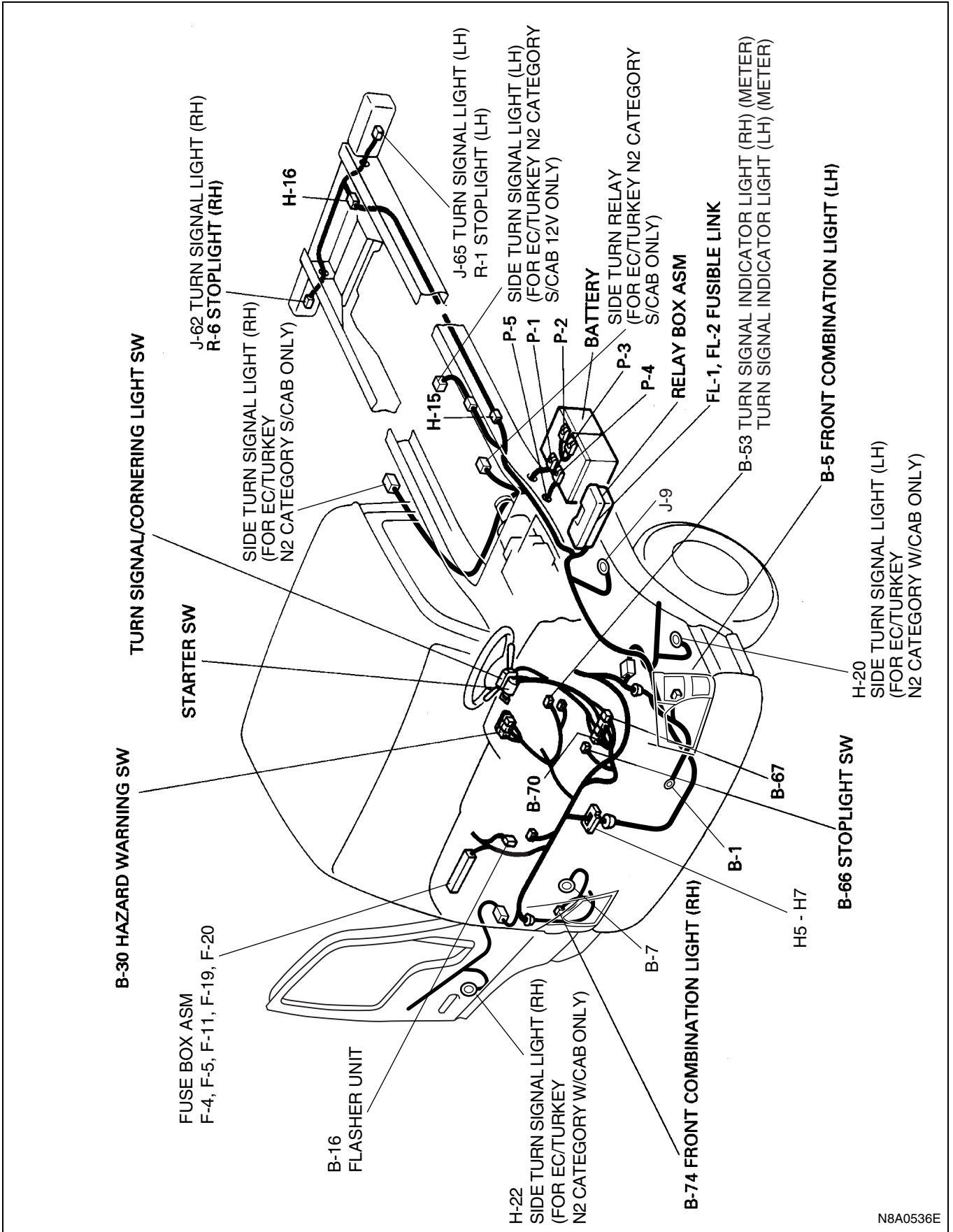
General Description

The circuit consists of the starter switch, turn signal light (front and rear), turn signal light switch, hazard warning light, flasher unit, stoplight and stoplight switch.

When turning on the respective switches with the starter switch on, the turn signal light will operate. When the turn signal light is flashing, the indicator light in the meter also starts flashing. When the hazard warning switch is turned on, the current flows to the flasher unit through the hazard warning switch to cause the hazard warning light to flash, independent of the position of the starter switch. At the same time, the indicator lights in the meter also start flashing.

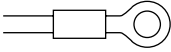
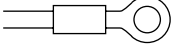
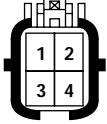
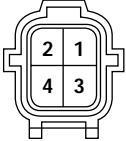
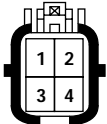
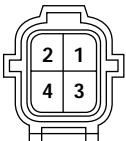
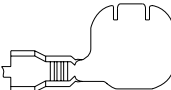
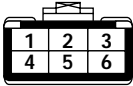
The stoplight switch will turn on and the light comes on once the brake pedal is depressed, independent of the position of the starter switch.

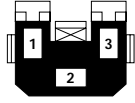
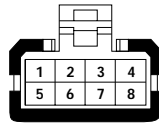
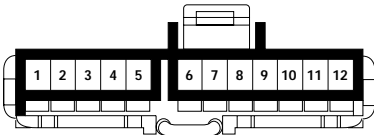

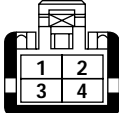
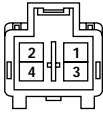
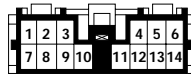
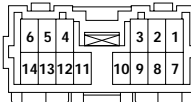
Parts Location


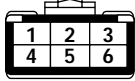
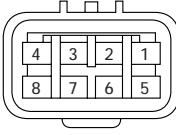
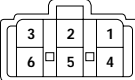
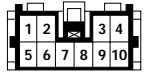
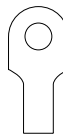

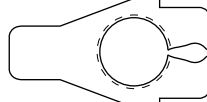
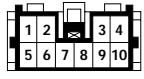
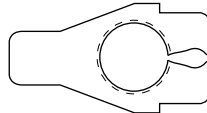
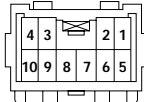
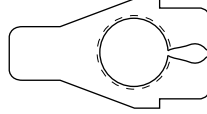
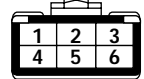
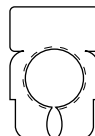
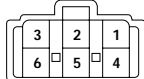



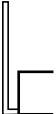
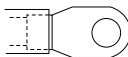
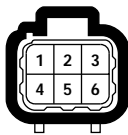
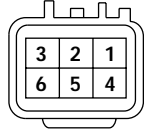

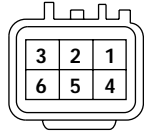
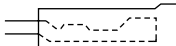
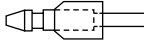
N8A0536E

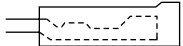
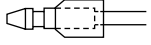
Connector List

No.	Connector Face
B-1	 000-001
J-9	 000-001
B-5	 004-012
B-5	 004-013
B-74	 004-012
B-74	 004-013
B-7	 000-012
B-16 (24 V)	 006-010

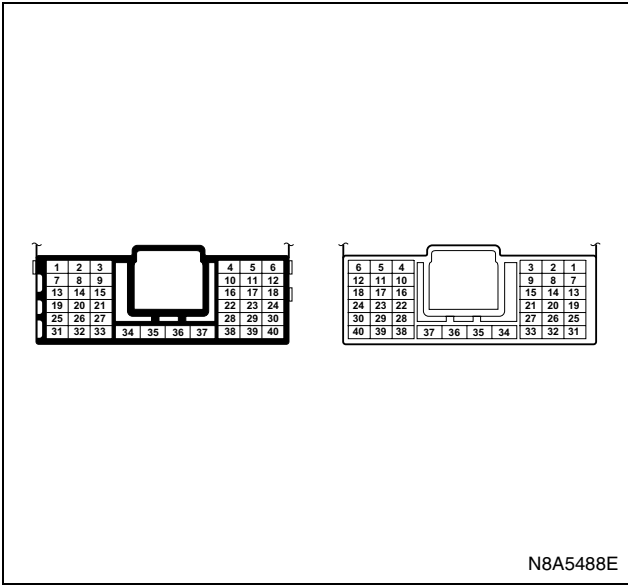
No.	Connector Face
B-16 (12 V)	 003-008
B-30	 008-005
B-53	 012-004
B-66	 002-024
B-67	 004-001
B-67	 004-002
B-70	 014-002
B-70	 014-003

No.	Connector Face	No.	Connector Face
H-16	 008-003	J-65	 006-010
H-16	 008-004	J-65	 006-015
H-20	 010-003	P-1 (12 V)	 000-003
H-20	 010-004	P-2	 000-006
H-22	 010-003	P-1 (24 V)	 000-006
H-22	 010-004	P-4	 000-006
J-62	 006-010	P-2 (24 V)	 000-004
J-62	 006-015	P-3	 000-004

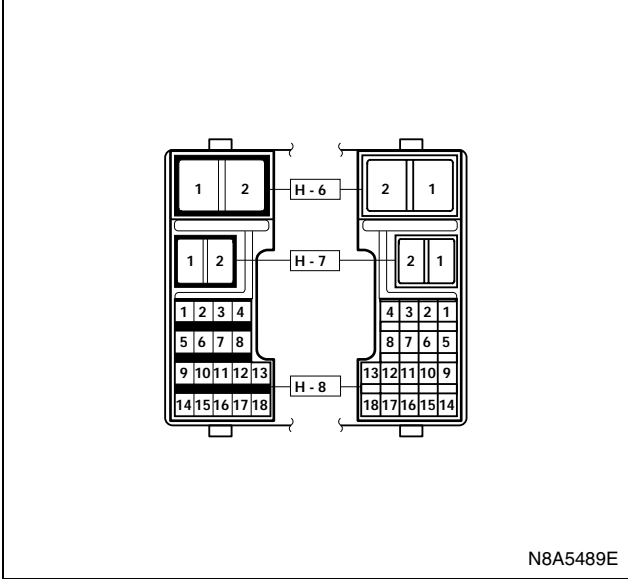
No.	Connector Face
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002
R-1	 006-004
R-1	 006-005
R-6	 006-004
R-6	 006-005
	 000-010
	 000-011

No.	Connector Face
	 000-010
	 000-011

H-5



H-6, H-7



Diagnosis

Quick Chart for Check Point

1. Turn Signal Light, Hazard Warning Light

		Check point						
		Fuse		Turn signal light SW	Hazard warning light SW	Flasher unit	Turn signal light bulb	Cable harness
		F-19, F-20 (15 A)	F-11 (10 A)					
Trouble mode	1-1. Turn signal lights inoperative		○	○		○		○
	1-2. Turn signal lights flash too quickly						○	○
	1-3. Hazard warning lights inoperative	○			○			

Notice:

Figure in parenthesis “()” indicates the order of inspection.

2. Stoplight

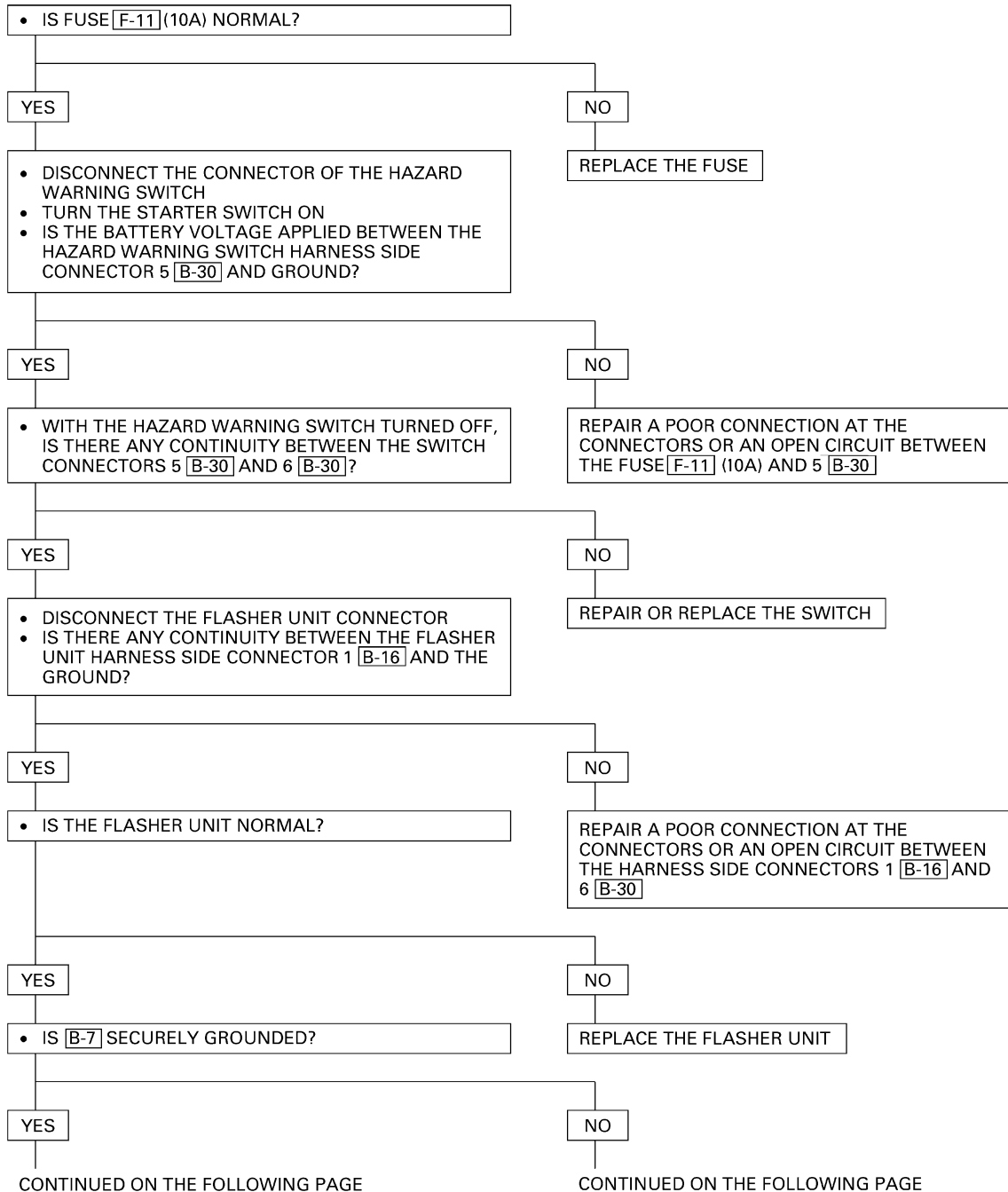
		Check point			
		Fuse F-5 (10 A)	Stoplight SW	Stoplight bulb	Cable harness
Trouble mode	2-1. Both stoplights inoperative	○	○		○
	2-2. Stoplight on the left (or right) side inoperative			○	○

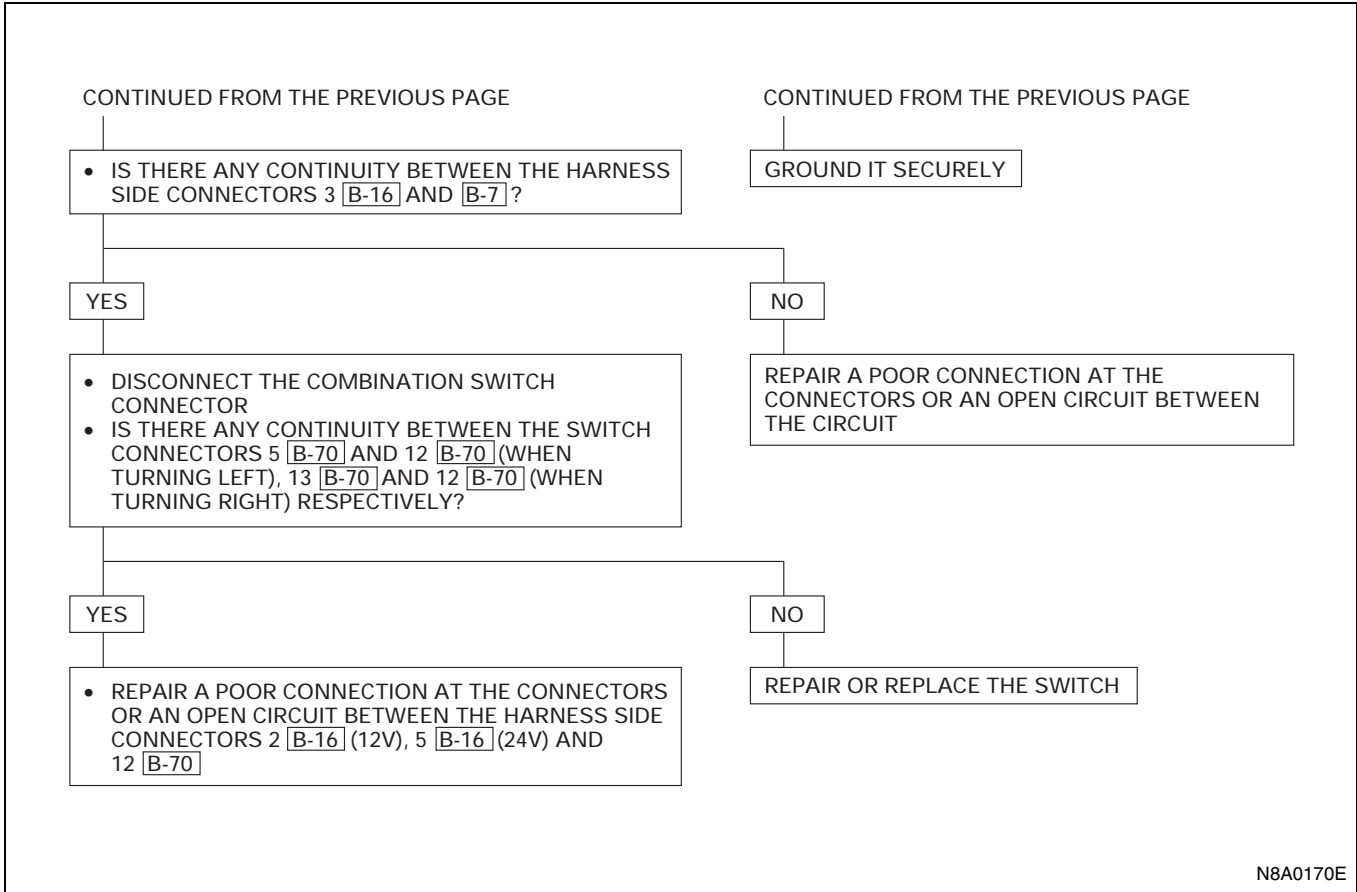
Notice:

Figure in parenthesis “()” indicates the order of inspection.

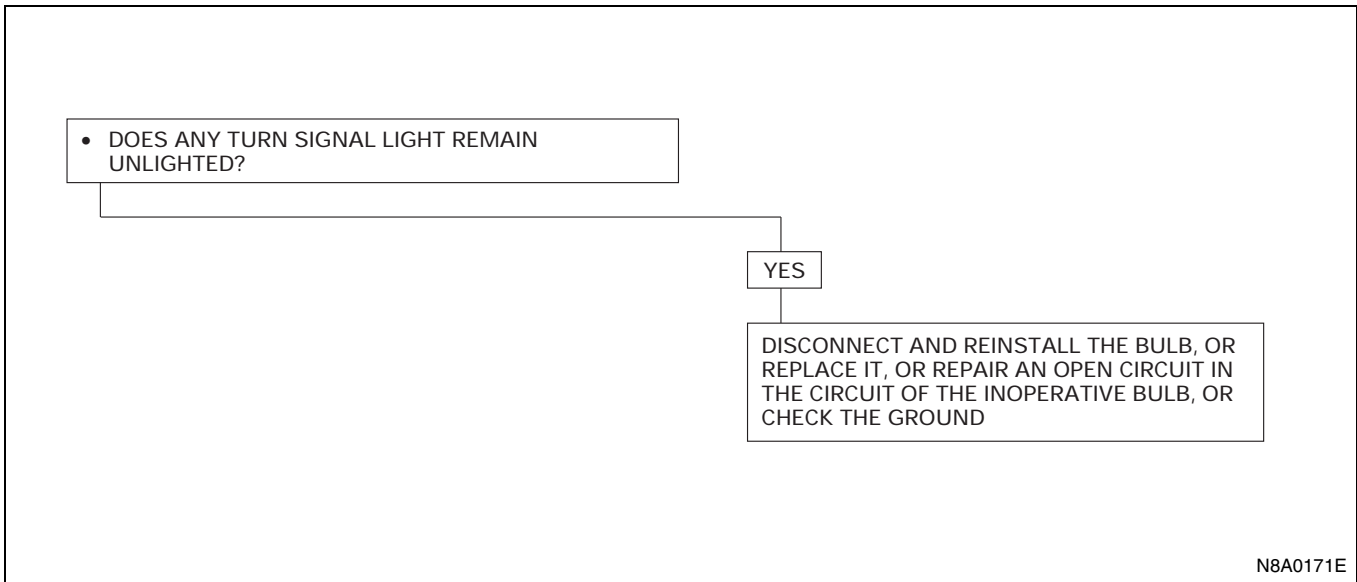
1. Turn Signal Light, Hazard Warning Light

1-1. Turn Signal Lights Inoperative

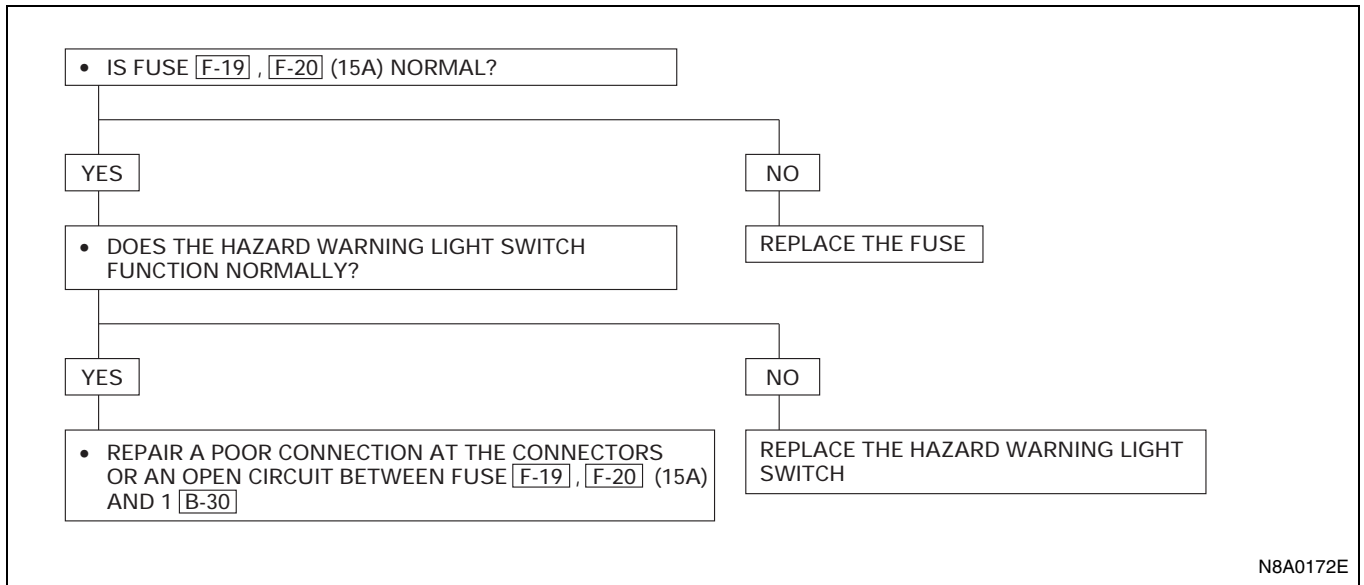




1-2. Turn Signal Lights Flash Too Quickly

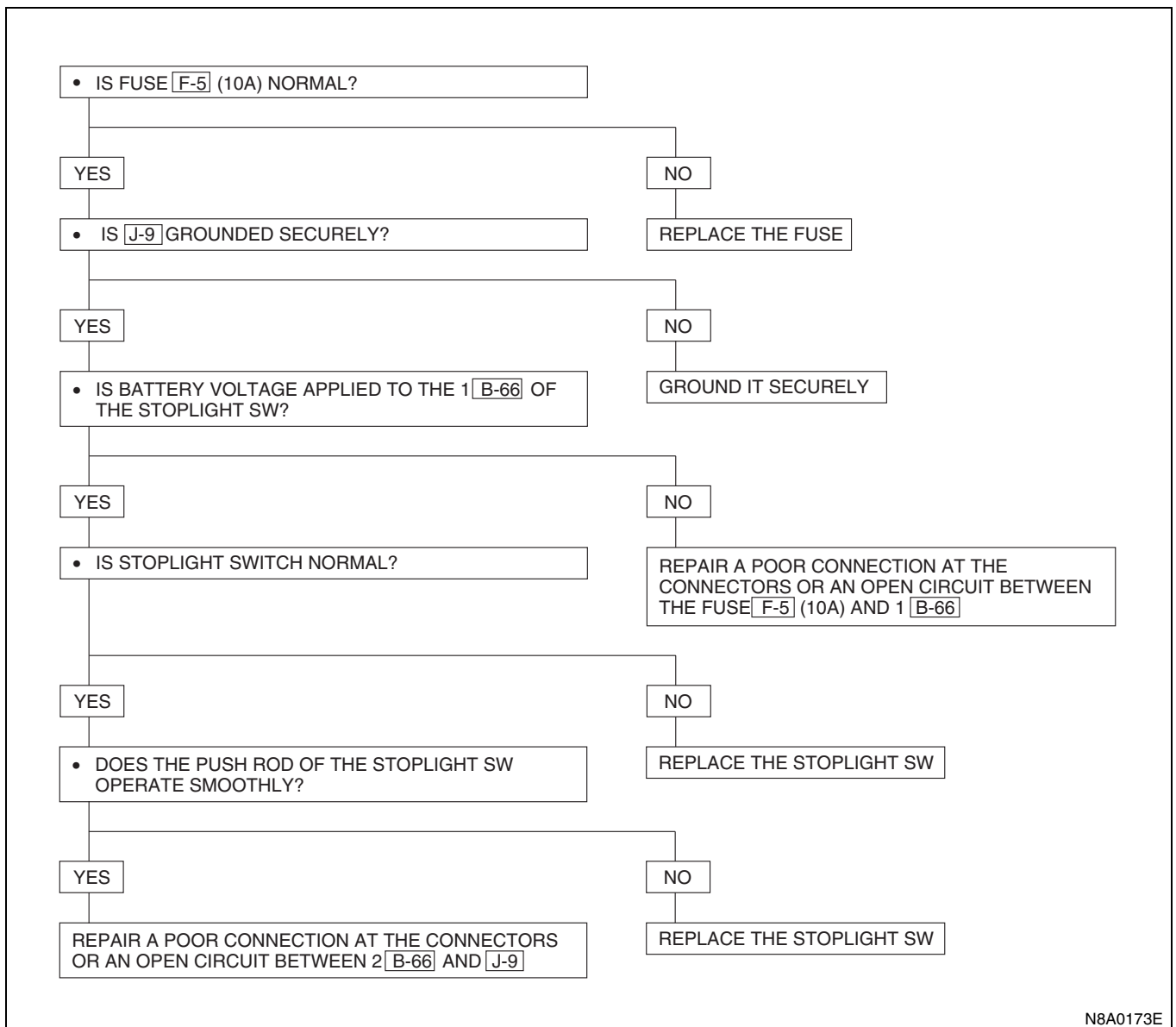


1-3. Hazard Warning Lights Inoperative

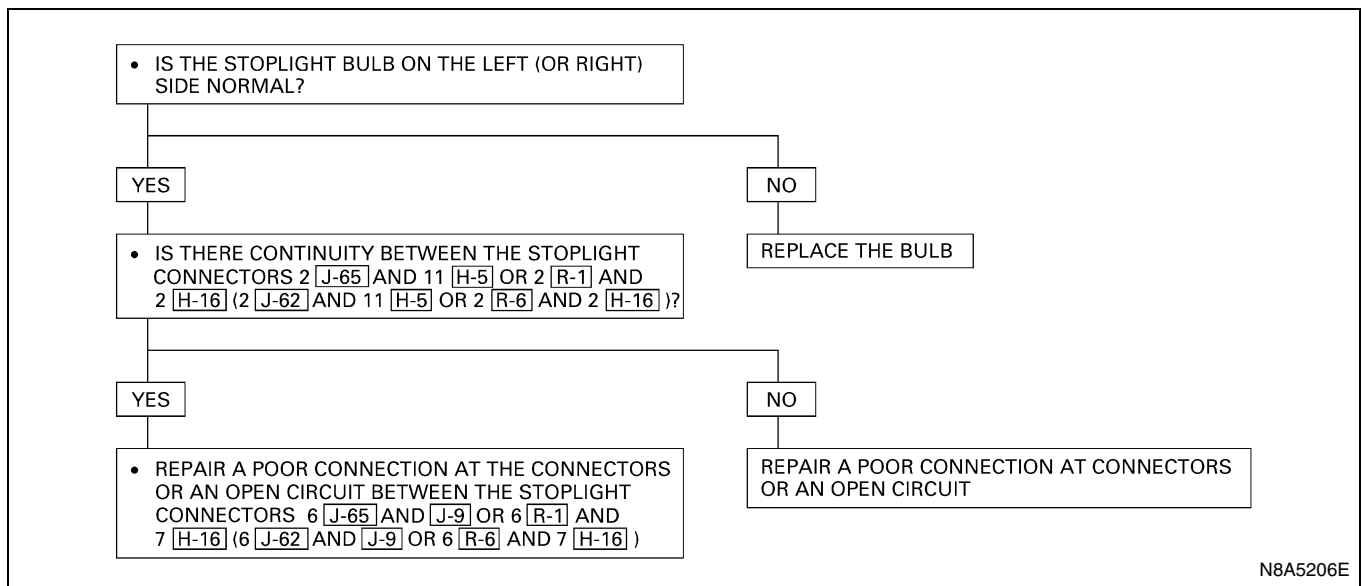


2. Stoplight

2-1. Both Stoplights Inoperative



2-2. Stoplight on the Left (or Right) Side Inoperative



Notice:

Figure in parenthesis “()” indicates the place of inspection for the right side stoplight.

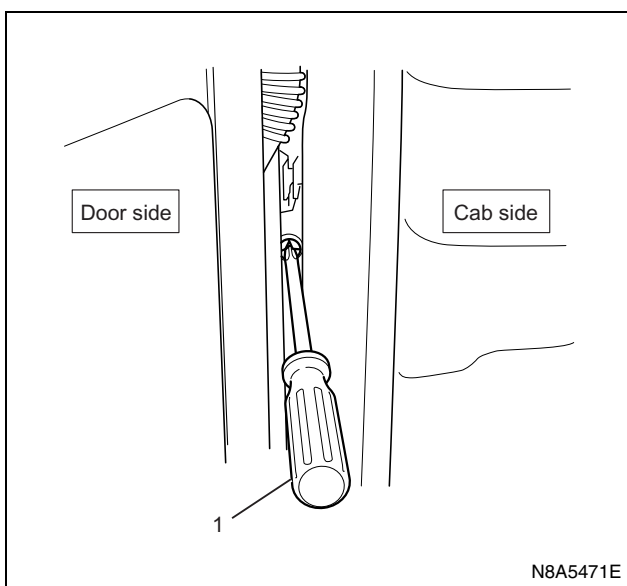
Starter Switch

Refer to “START AND CHARGING” in this section.

Front Turn Signal Light/Bulb

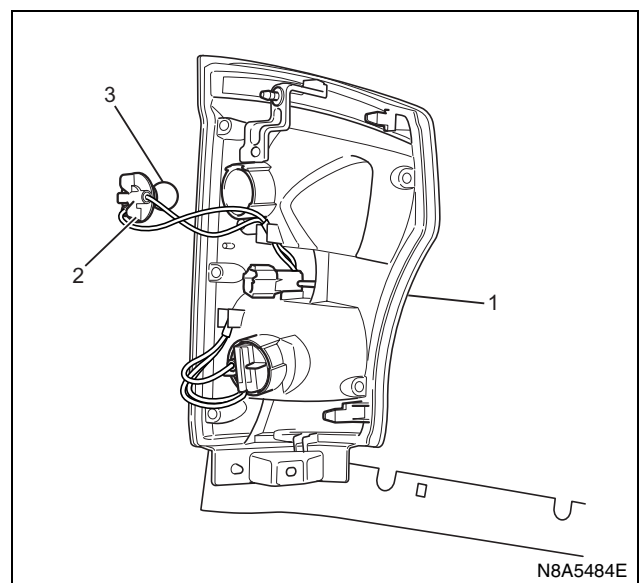
Removal

1. Remove the battery ground cable at the battery.
2. Remove the front combination light.
 - Open the cab door. Insert a screwdriver (1) into the space between the cab and the cab door. Use the screwdriver to force out the stud pin at the center of the grommet (the pin securing the front combination light).



- Remove the fixing screw.
- Remove the two catches.

- Remove the front combination light (1) connector.



3. Remove the front turn signal light bulb.
 - Turn the bulb socket (2) to the left to remove it.
 - Press the bulb (3) in and turn it to the left to remove it from the socket.

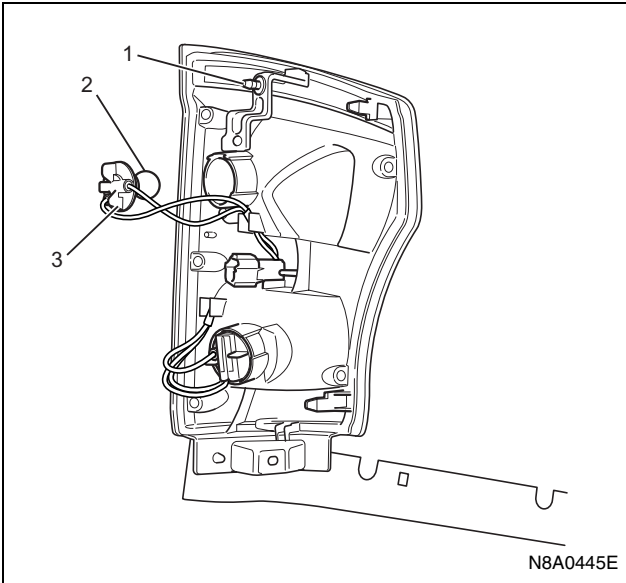
Installation

1. Install the front turn signal light bulb.
 - While pressing the bulb (2), turn it clockwise to fit.

Notice:

Do not let the glass portion dirty with sebum etc.

- Turn the bulb socket (3) clockwise to fit.



2. Installation procedure of front combination light assembly

- Connect the connector of the front combination light assembly.
- Position it by aligning two pawls with the groove of H/L.
- Fit the iron PIN (1) in the upper portion of the side by aligning it with the center of corresponding grommet.

Notice:

Push it into securely with a force of approx. 250 N (25 kgf) until click is heard.

- Pull the front combination light assembly lightly toward the front of vehicle to make sure that the PIN and grommet are engaged securely.
- Tighten one bolt in the lower portion of front combination light assembly.

3. Hook the seal rubber on two projections under H/L.

4. Connect the battery ground cable.
5. Check lighting of each light.

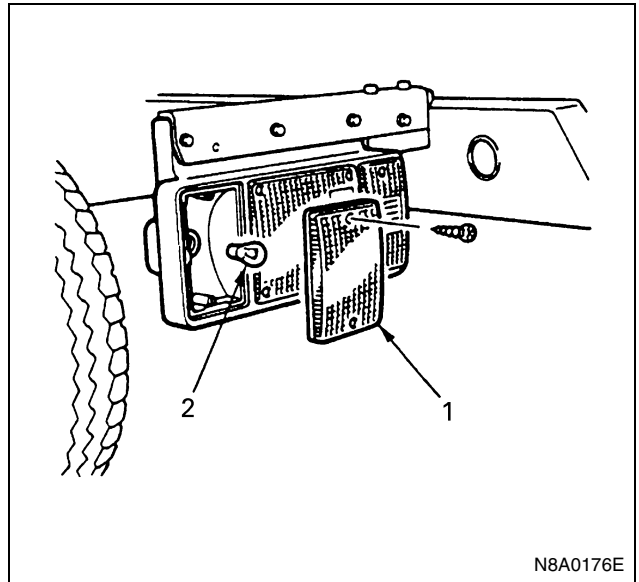
Rear Turn Signal Light/Bulb

Removal

Preparation:

Disconnect the battery ground cable.

1. Lens
2. Bulb



Installation

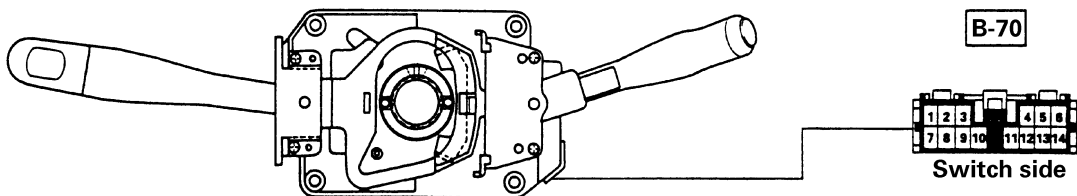
To install, follow the removal steps in the reverse order.

Turn Signal Light Switch (Combination Switch)

Inspection

Check the continuity between the terminals of the turn signal light switch.

Repair or replace the switch when the result of inspection is found abnormal.



SW position		Terminal No.					
		2	5	9	11	12	13
Turn signal light SW	Turning left		○			○	
	Neutral						
	Turning right					○	○

N8A0177E

Removal and Installation

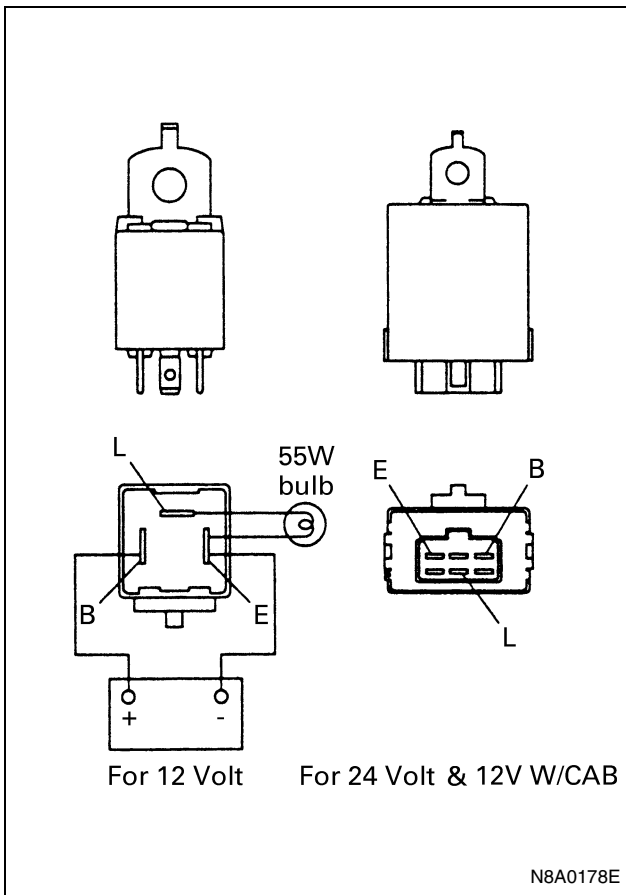
Refer to "HEADLIGHT, FOG LIGHT AND CORNERING LIGHT" in this section.

Flasher Unit

Inspection

When a 55W bulb is connected to the unit side terminals "L" and "E" while connecting the battery (+) terminal to terminal "B", and the battery (-) terminal to terminal "E", does the bulb light on and off?

Replace the unit when the result of inspection is found abnormal.



Stoplight Bulb

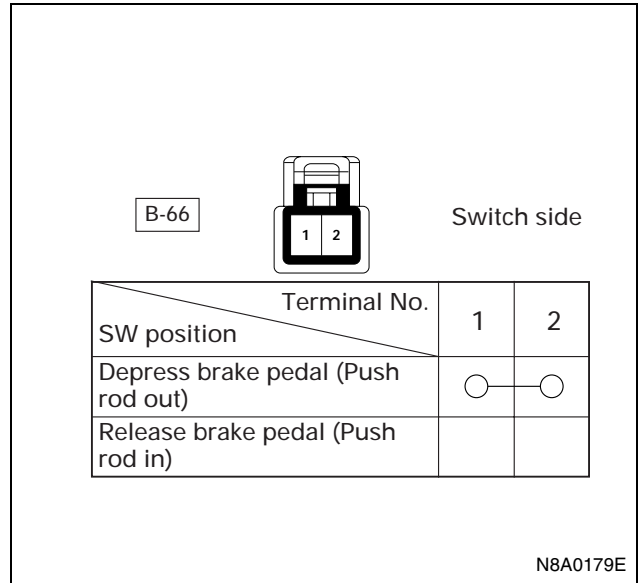
Removal and Installation

Refer to "CLEARANCE LIGHT, TAILLIGHT, LICENSE PLATE LIGHT AND ILLUMINATION LIGHT" for TAIL-LIGHT BULB removal and installation steps in this section.

Stoplight Switch

Inspection

1. Check to see if the stoplight switch is installed correctly to the specified position. Adjust the position when the result of the inspection is found abnormal.
2. Check to see if there is any continuity between the terminals of the stoplight switch. Replace the switch when the result of inspection is found abnormal.

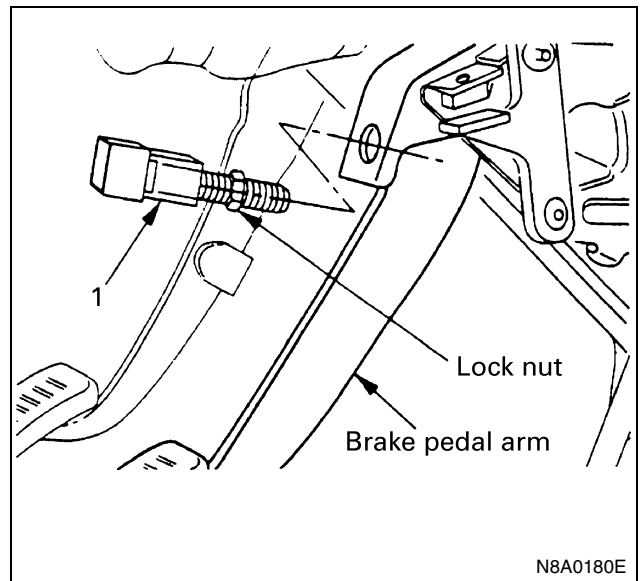


Removal

Preparation:

Disconnect the battery ground cable.

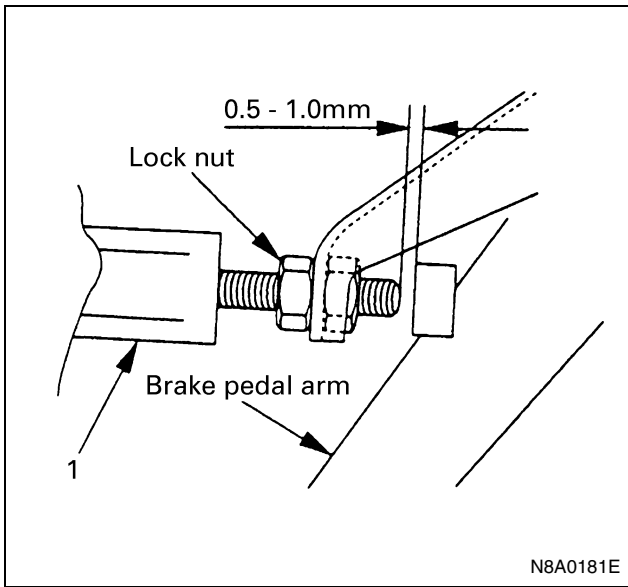
1. Stoplight Switch
 - 1) Disconnect the connector.
 - 2) Loosen the lock nut of the switch.
 - 3) Remove the switch by turning it.



Installation

To install, follow the removal steps in the reverse order, noting the following points.

- 1) Check to see if the brake pedal has been returned by the return spring to the specified position.
- 2) Turn the stoplight switch clockwise until the tip of the threaded portion of the switch contacts the pedal arm.
- 3) Turn the switch counterclockwise until the space between the tip of the threaded portion and the pedal arm is 0.5 to 1.0 mm (0.02 — 0.04 in.).

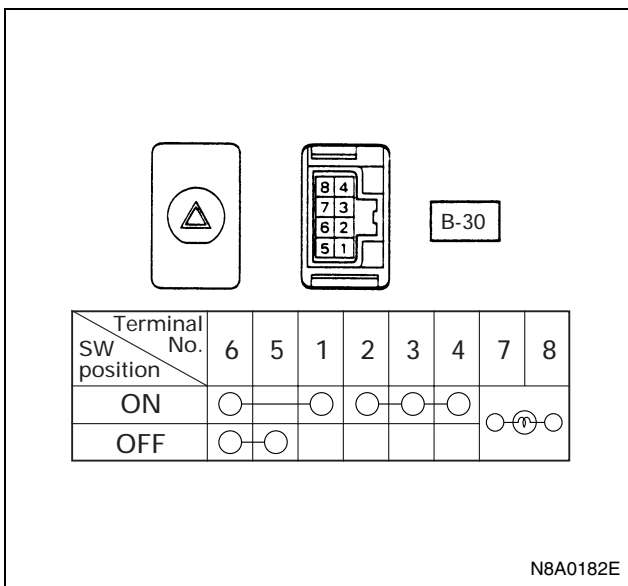


N8A0181E

Hazard Warning Switch

Inspection

Check the continuity between the terminals of the hazard warning switch. Repair or replace the switch when the result of inspection is found abnormal.



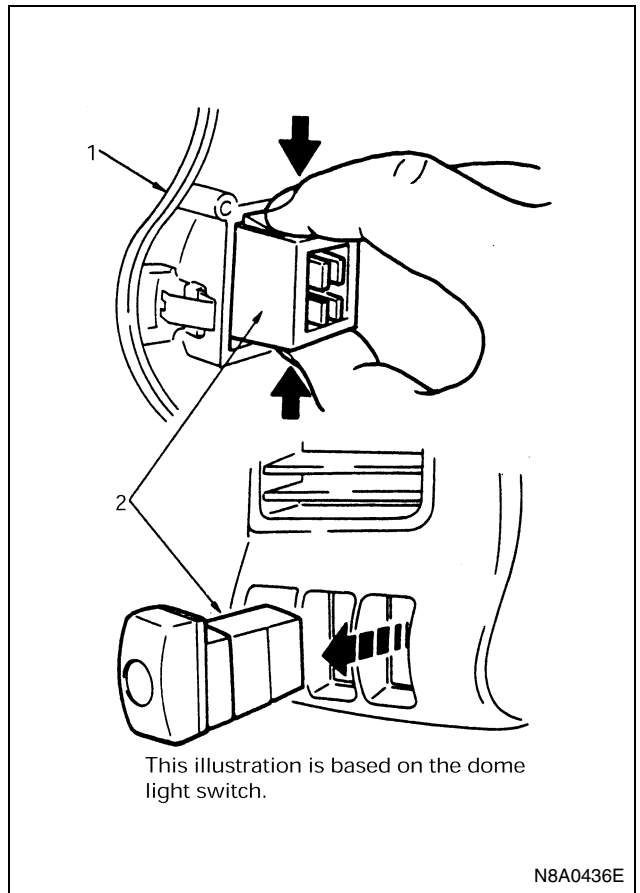
N8A0182E

Removal

Preparation:

Disconnect the battery ground cable.

1. Meter Cluster
Refer to the "METER AND WARNING/INDICATOR LIGHT" in this section.
2. Hazard Warning Switch
Release the lock pushing the switch from the back side of the meter cluster.



N8A0436E

Installation

To install, follow the removal steps in the reverse order noting the following point.

1. Push the switch with your fingers until locks securely.

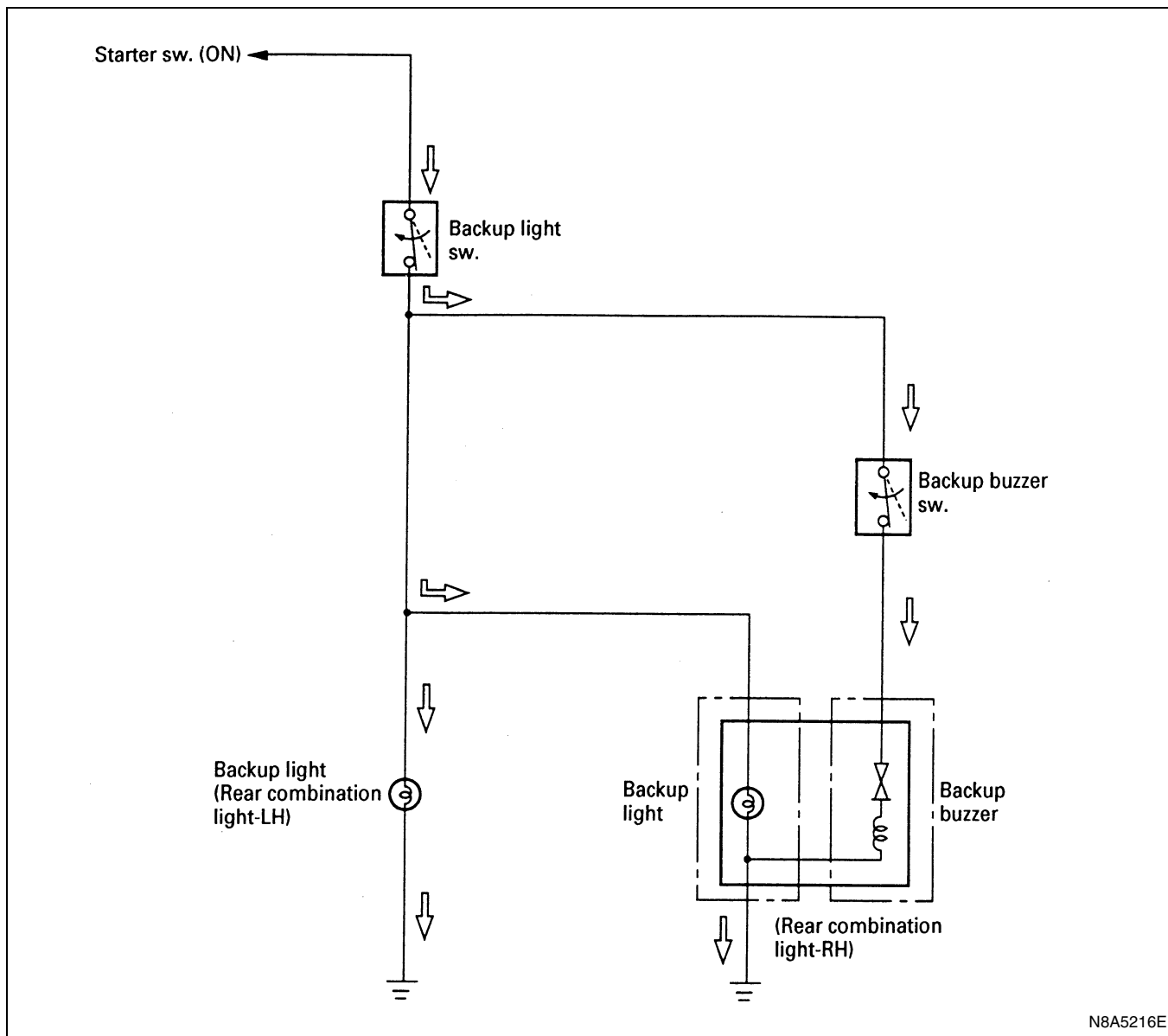
Horn, Backup Light and Backup Buzzer

General Description

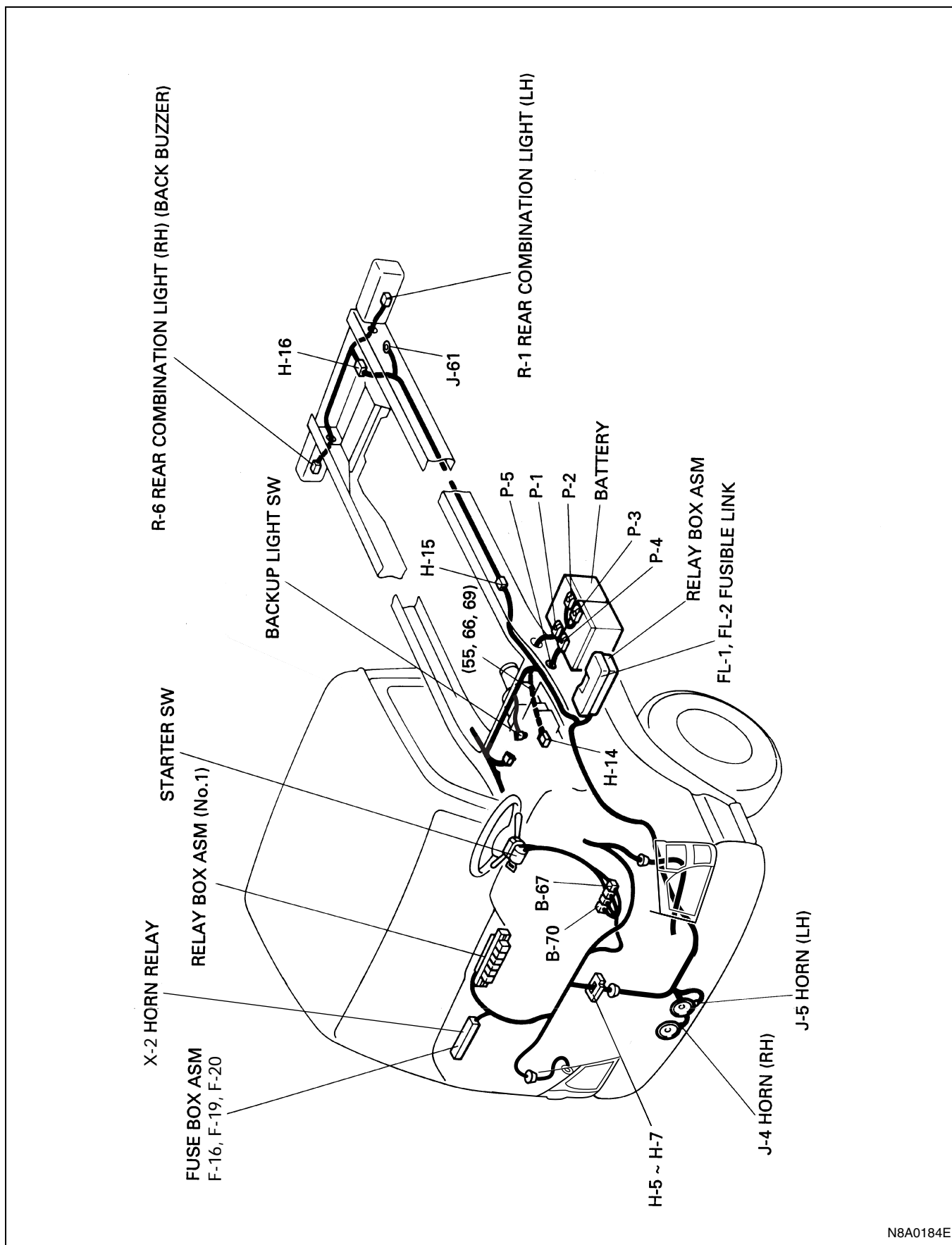
The circuit consists of the starter switch, horn, horn switch, backup light (Rear combination light), backup light switch, back buzzer and the relay.

When the horn switch is turned on independent of the position of the starter switch, the relay is activated to sound the horn. When the backup light switch turns on with the starter switch on, the backup light will operate.

Backup Light and Backup Buzzer Circuit

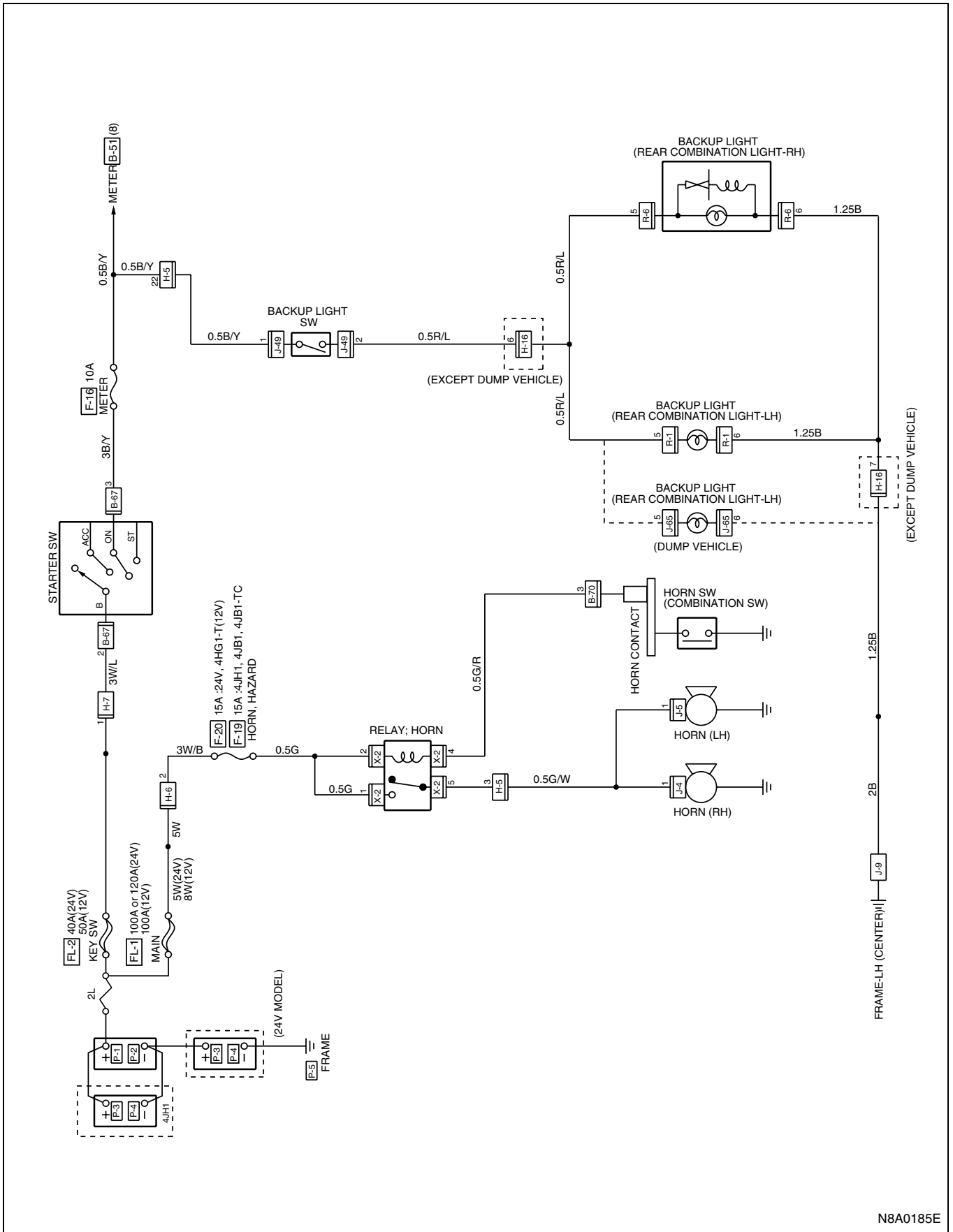


Parts Location



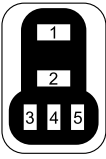
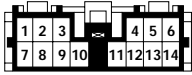
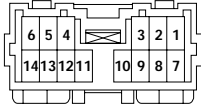





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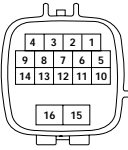

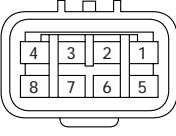

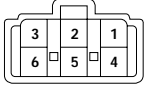
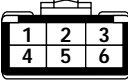
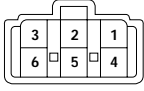

Circuit Diagram



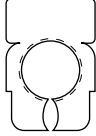
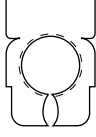
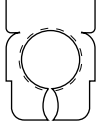
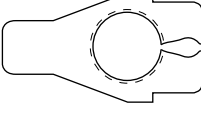
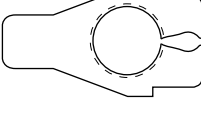
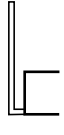


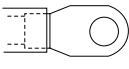

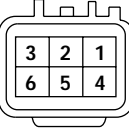
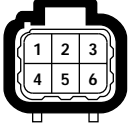
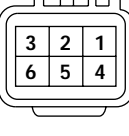
N8A0185E

Connector List

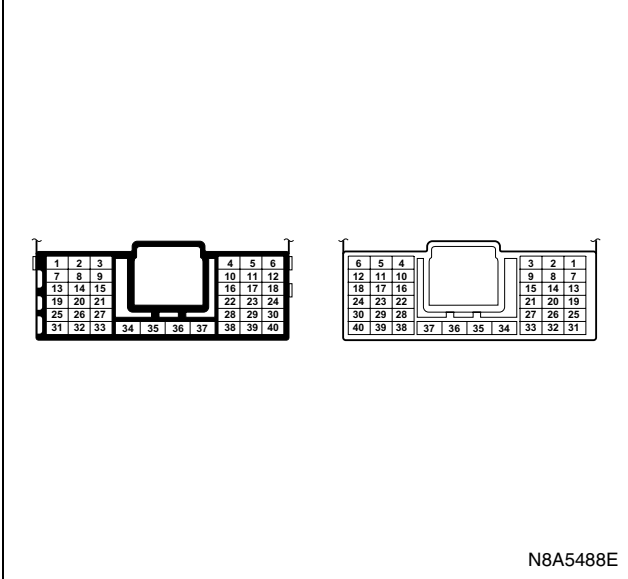
No.	Connector Face
X-2	 005-006
B-70	 014-002
B-70	 014-003
E-10	 002-025
E-10	 002-026
J-49	 002-025
J-49	 002-026
H-14	 016-003

No.	Connector Face
H-14	 016-004
H-16	 008-003
H-16	 008-004
J-62	 006-010
J-62	 006-015
J-65	 006-010
J-65	 006-015
J-4	 001-018

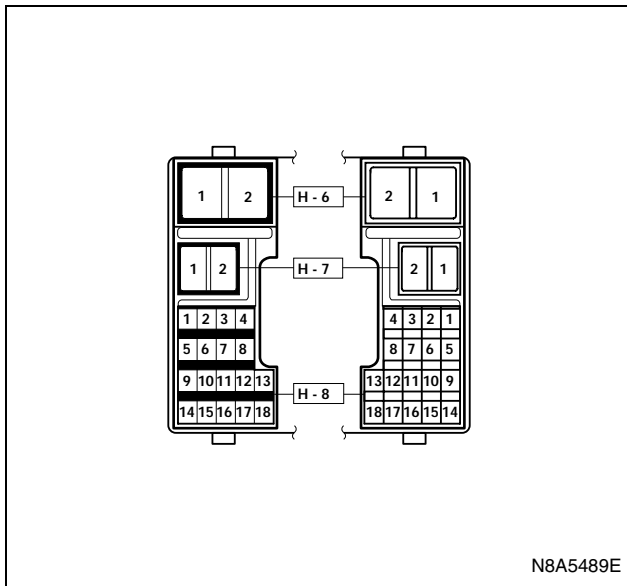
No.	Connector Face
J-5	 001-018
P-1 (12 V)	 000-003
P-2	 000-004
P-1 (24 V)	 000-004
P-4	 000-004
P-2 (24 V)	 000-006
P-3	 000-006
P-5 (12 V)	 000-007

No.	Connector Face
P-5 (24 V)	 000-002
R-1	 006-004
R-1	 006-005
R-6	 006-004
R-6	 006-005

H-5



H-6



Diagnosis

Quick Chart for Check Point

1. Horn

		Check point					
		Fuse F-19, F-20 (15 A)	Horn	Horn SW	Horn relay	Horn contact	Cable harness
Trouble mode	1-1. Horn does not sound	○ (1)	○ (4)	○ (6)	○ (2)	○ (5)	○ (3)
	1-2. Horn does not shut off			○ (2)	○ (1)		○ (3)

Notice:

Figure in parenthesis “()” indicates the order of inspection.

2. Backup Light

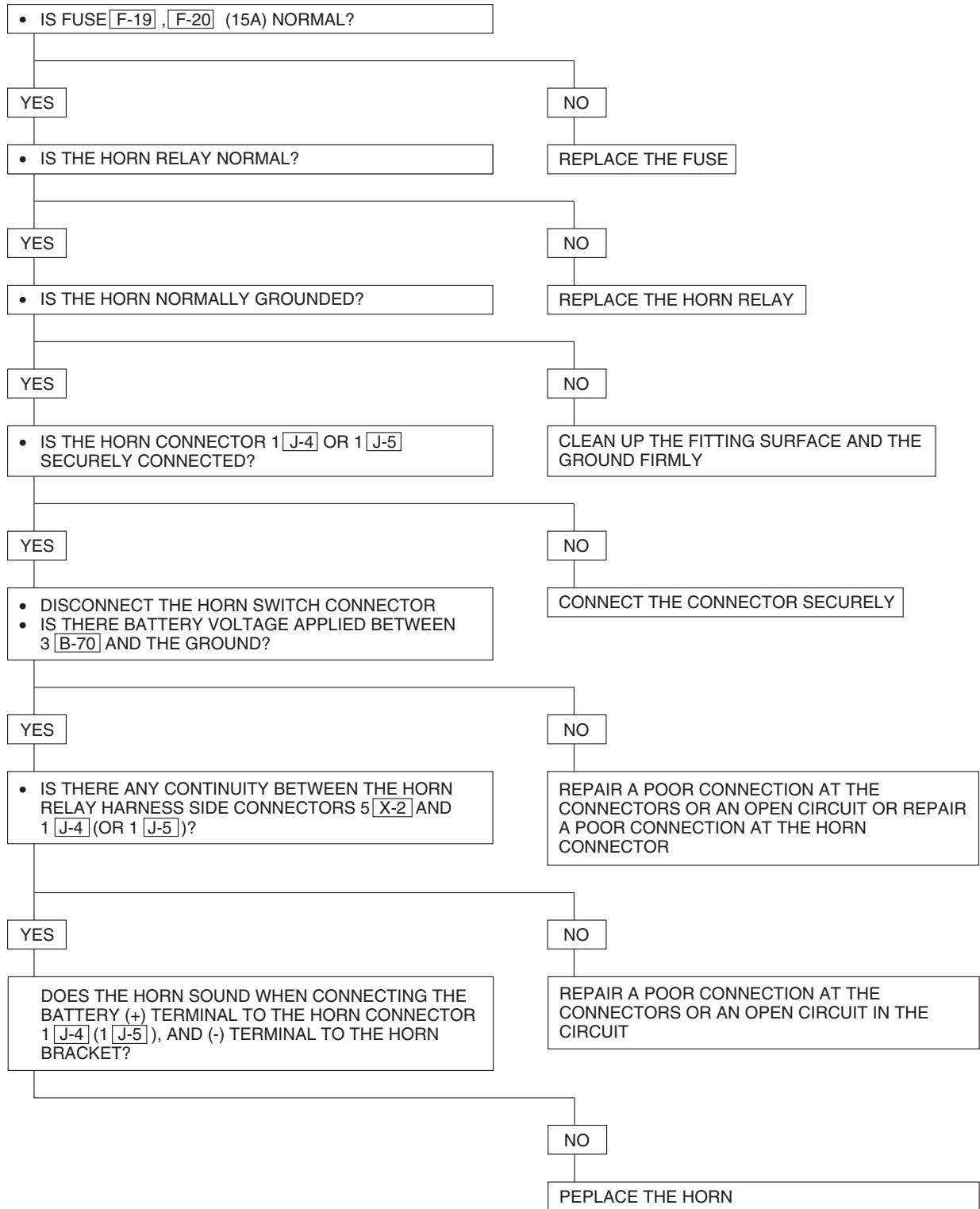
		Check point				
		Fuse F-16 (10 A)	Backup light SW (Inhibitor SW)	Backup light bulb	Backup buzzer	Cable harness
Trouble mode	2-1. Both backup lights inoperative	○ (1)	○ (3)			○ (2)
	2-2. Backup light on the left (or right) side inoperative			○ (1)		○ (2)
	2-3. Backup light remains on		○ (1)			

Notice:

Figure in parenthesis “()” indicates the order of inspection.

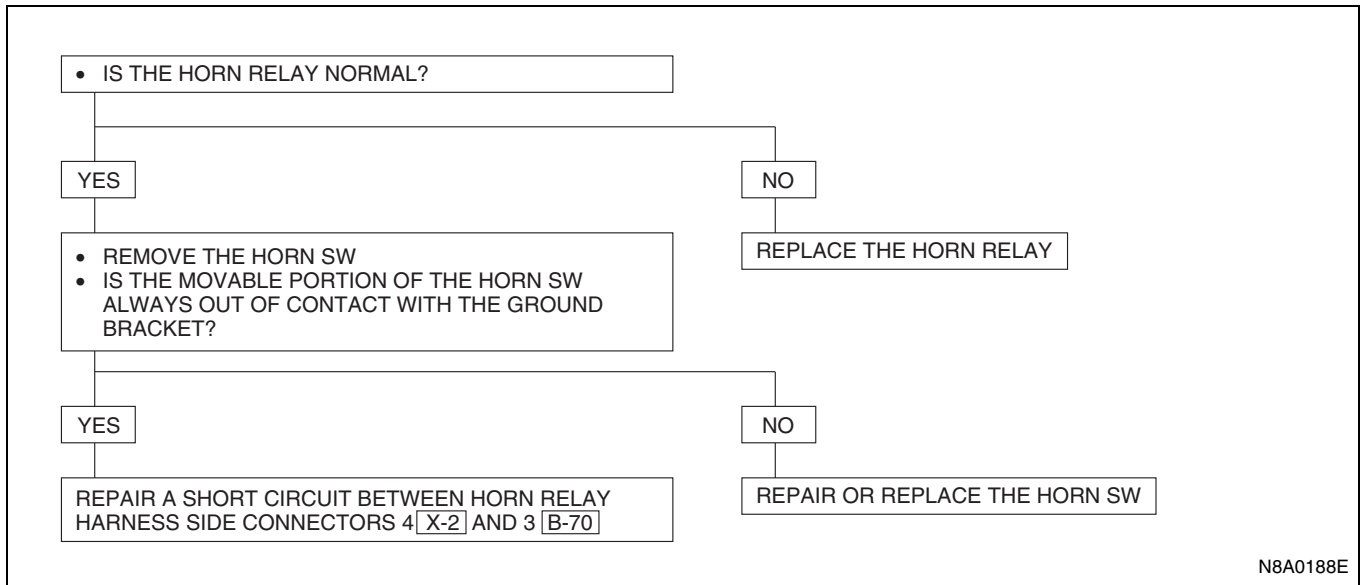
1. Horn

1-1. Horn Does Not Sound



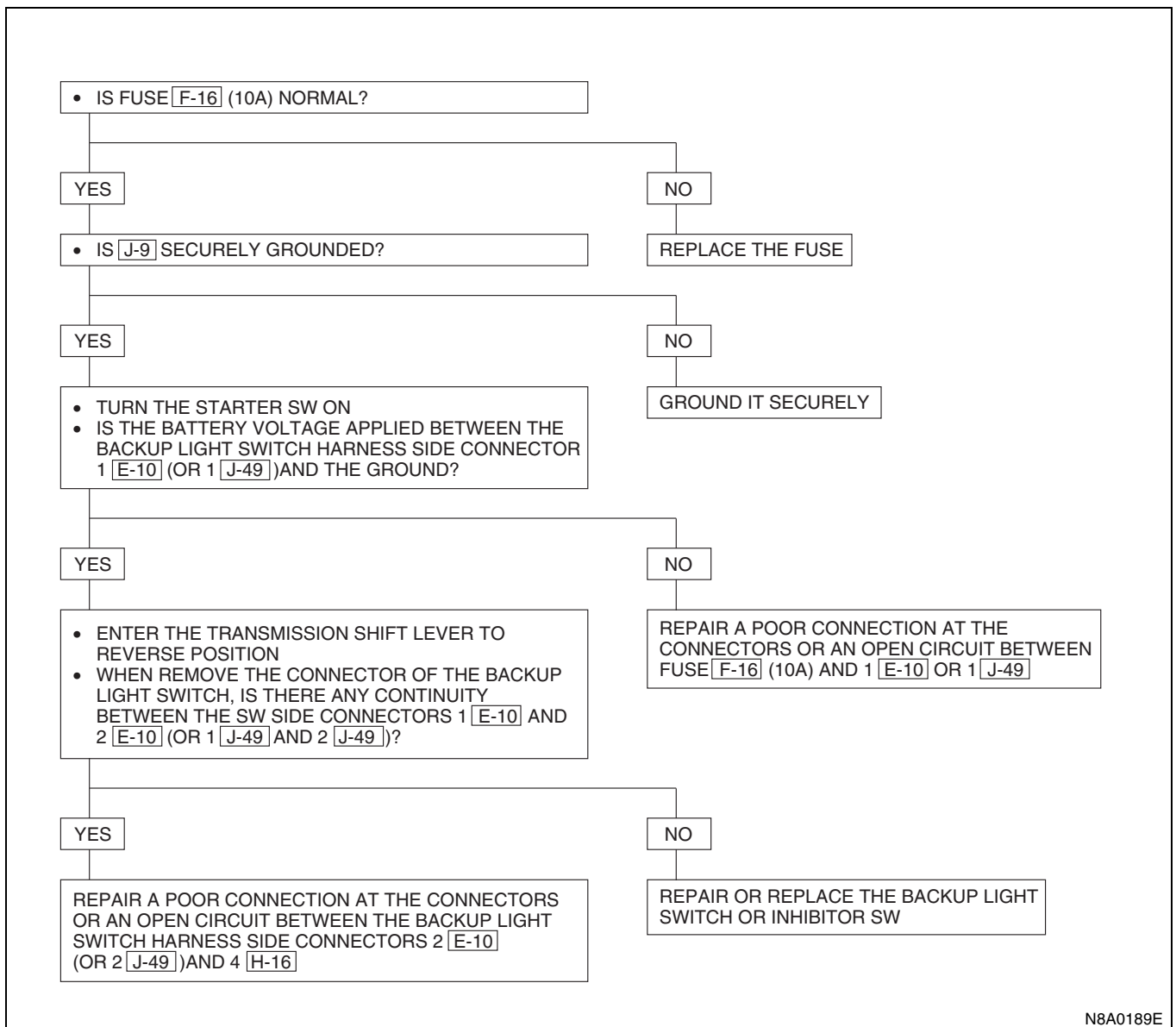
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1-2. Horn Does Not Shut Off

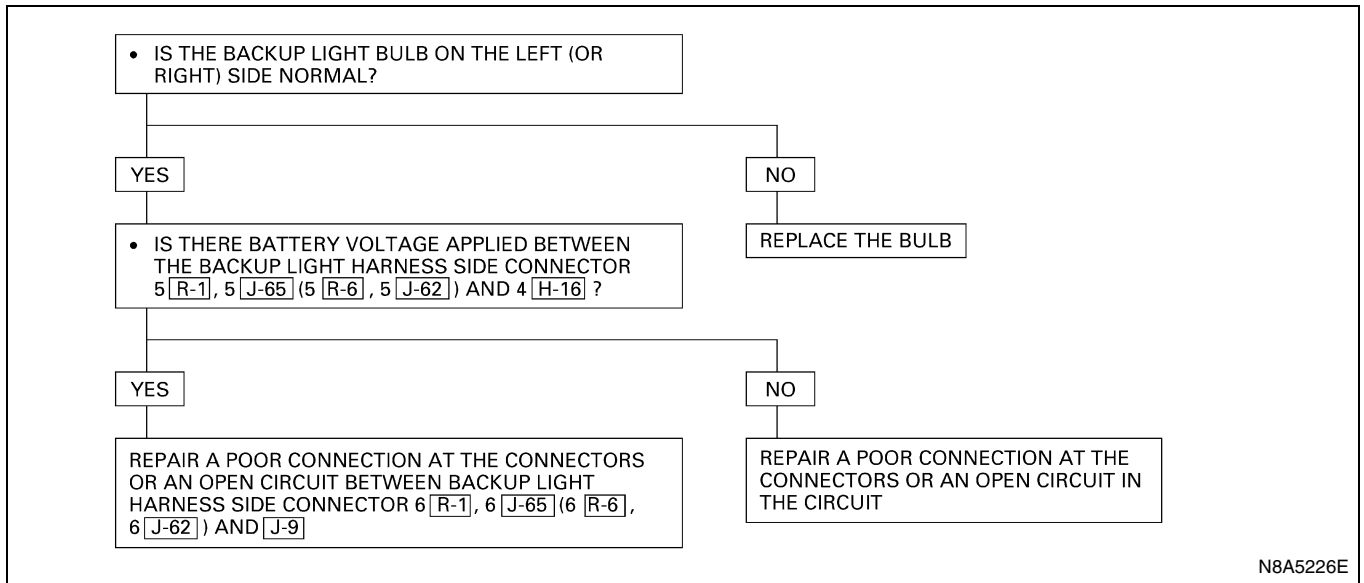


2. Backup Light

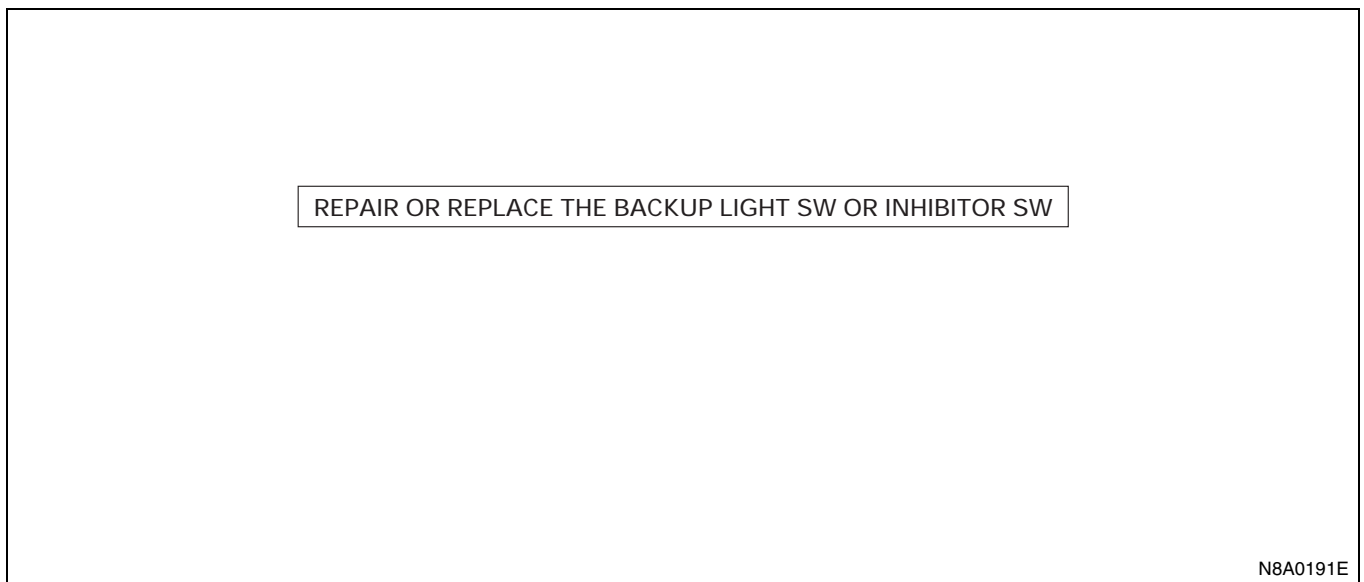
2-1. Backup Lights Inoperative



2-2. Backup Light on the Left (or Right) Side Inoperative



2-3. Backup Light Remains on



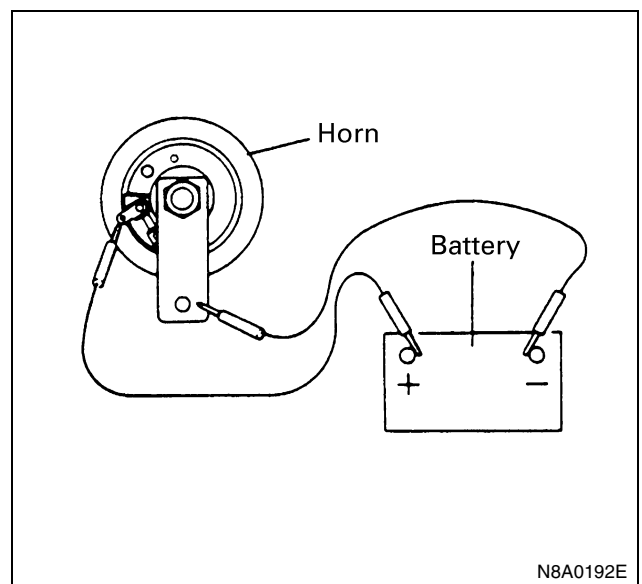
Starter Switch

Refer to "START AND CHARGING" in this section.

Horn

Inspection

Check to see if horn sound when a battery voltage between horn terminal and the fixing bracket. Repair or replace the horn when the result of inspection is found abnormal.

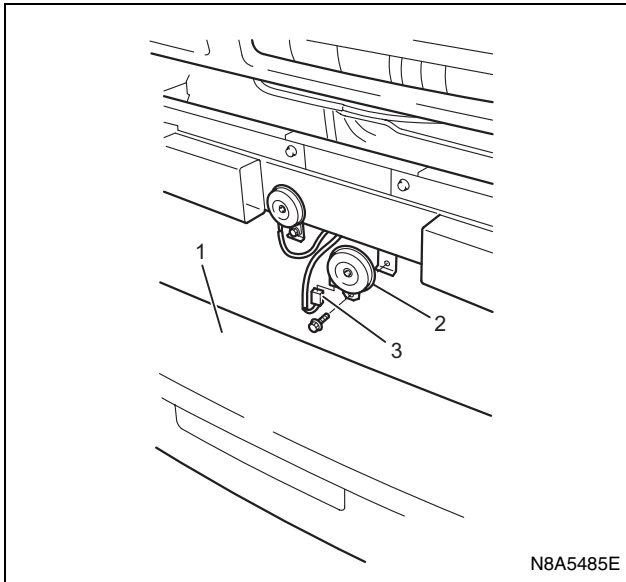


Removal

Preparation:

Disconnect the battery ground cable.

1. Bumper
Refer to "BUMPER" in section 2.
2. Horn
Disconnect the connector (3).



Installation

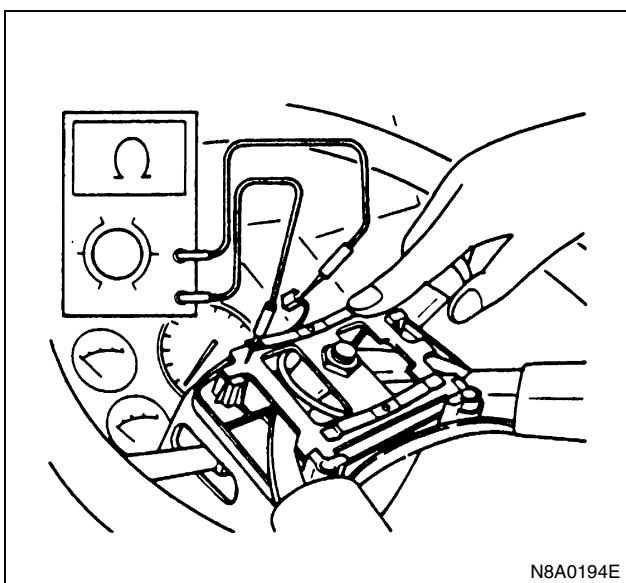
To install, follow the removal steps in the reverse order.

Horn Switch

Inspection

With the contact point of the horn switch pressed to the switch bracket, check the continuity between the connector terminal and the bracket of the switch.

Check the contact condition between horn contact of the combination switch and contact plate of steering wheel. Repair or replace the switch when the result of inspection is found abnormal.

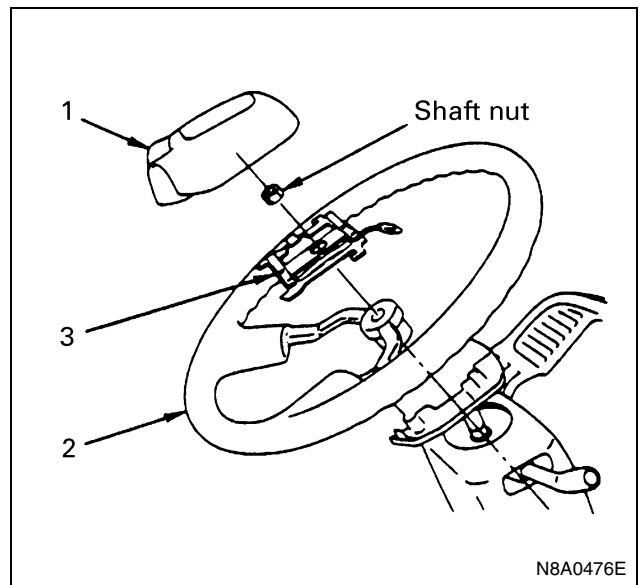


Removal

Preparation:

Disconnect the battery ground cable.

1. Horn Pad
 - 1) Hold the horn pad and pull it upward.
2. Steering Wheel
 - 1) Remove the steering shaft nut.
 - 2) Remove the steering wheel by using steering wheel remover.
(Refer to Section 3B4 "STEERING COLUMN" for steering wheel removal steps.)
3. Horn Switch



Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the steering shaft nut to the specified torque.

Tighten:

Shaft nut to 49 N·m (5 kg·m / 36 lb·ft)

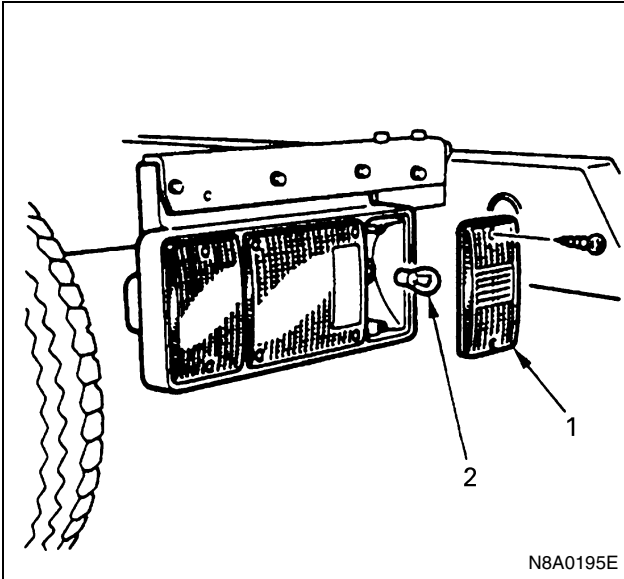
Backup Light Bulb

Removal

Preparation:

Disconnect the battery ground cable.

1. Lens
2. Bulb



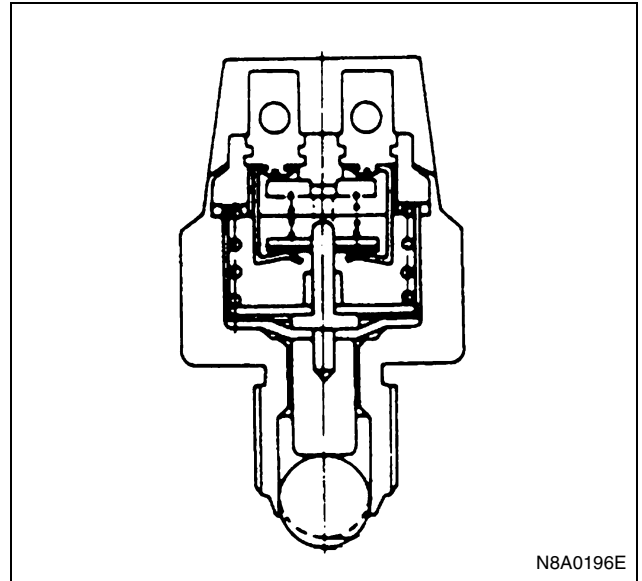
Installation

To install, follow the removal steps in the reverse order.

Backup Light Switch

Inspection

1. With the switch installed to the transmission, check the continuity between the terminals of the switch connectors.
When the continuity is found between the terminals only with the switch shifted to the reverse position, the switch is normal.
2. When the result of the above inspection is found abnormal, remove the switch from the transmission and conduct a test on the switch alone.
If the continuity appears between the connector terminals when the ball of the switch is released, the switch is normal. (When the ball is pushed, the continuity disappears.)
3. If there is no continuity with the switch installed to the transmission, even though the switch is found to be normal, then adjust the stroke of the switch by changing the thickness of the switch gasket.



Removal

Preparation:

Disconnect the battery ground cable.

1. Backup Light Switch
 - 1) Disconnect the connectors.
 - 2) Remove the switch by turning it counterclockwise.

Installation

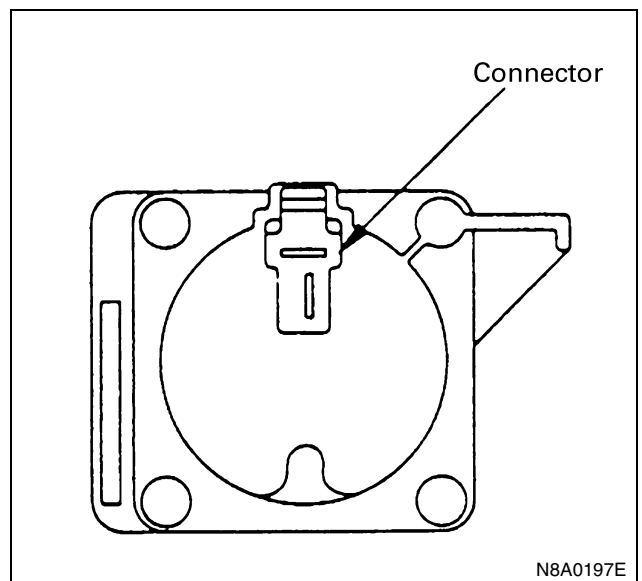
1. Backup Light Switch
Apply liquid gasket to the screw portion of the switch to prevent oil leak.

Backup Buzzer

Inspection

Apply battery voltage to the backup buzzer connector to check the buzzer sound.

Repair or replace the buzzer when the result of inspection is found abnormal.

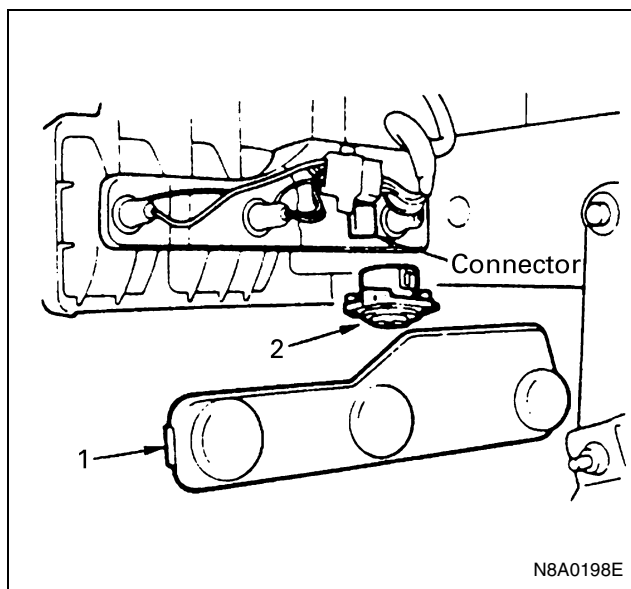


Removal

Preparation:

Disconnect the battery ground cable.

1. Rear Combination Light Cover
2. Backup Buzzer
 - 1) Remove the rear combination light connector fixing screw.
 - 2) Remove buzzer fixing screw.
 - 3) Disconnect the connector.



Installation

To install, follow the removal steps in the reverse order.

Dome Light and Key Remind Buzzer

General Description

The circuit consists of the starter switch, dome light, dome light switch, door switch, backup light switch and the key remind buzzer.

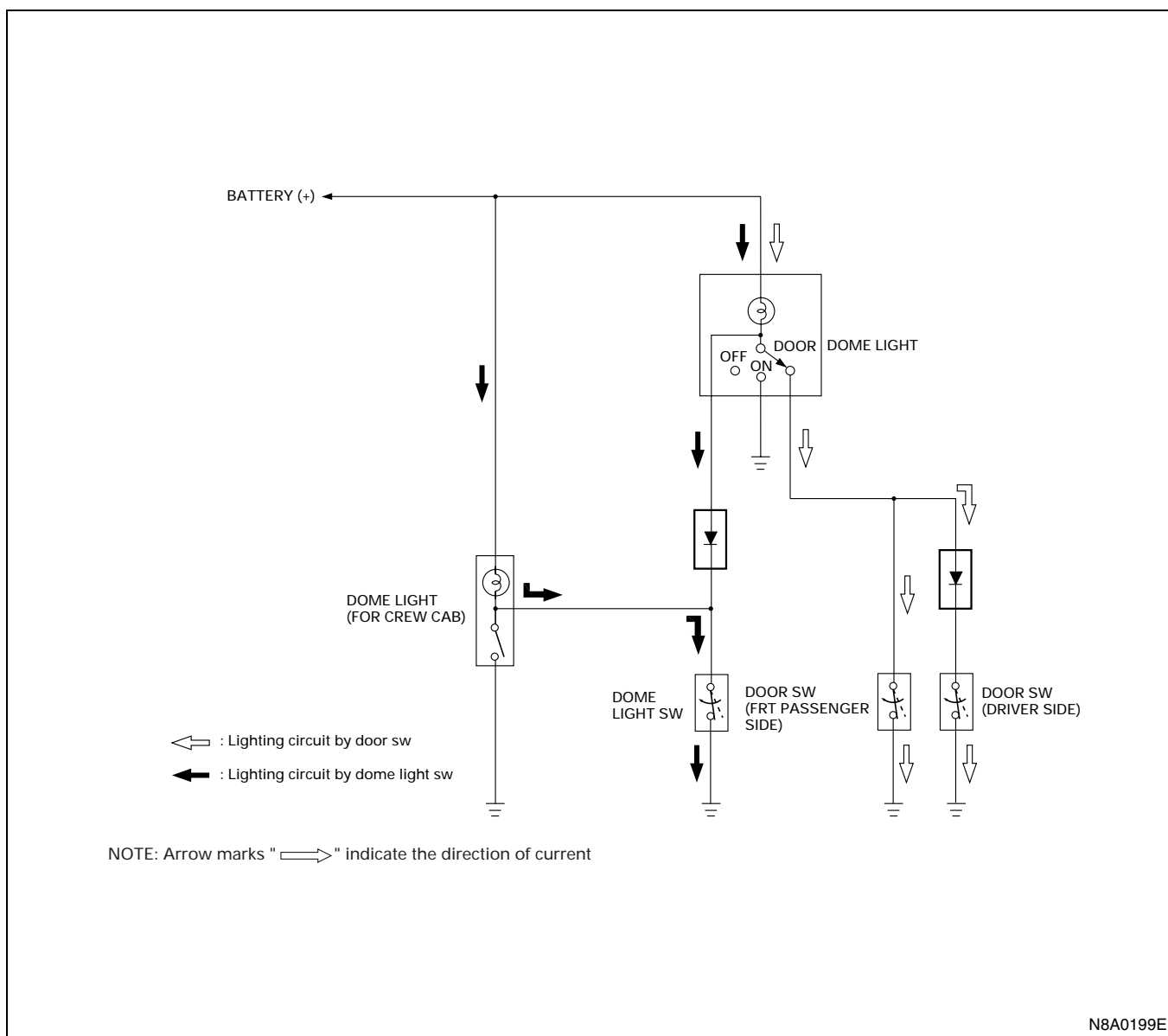
The dome light lights up when the left or right side door is opened with the switch set at the door mode. It can be lit by operating ON or OFF of the dome light switch.

The dome light can be lit by respective switch independent of the position of the starter switch.

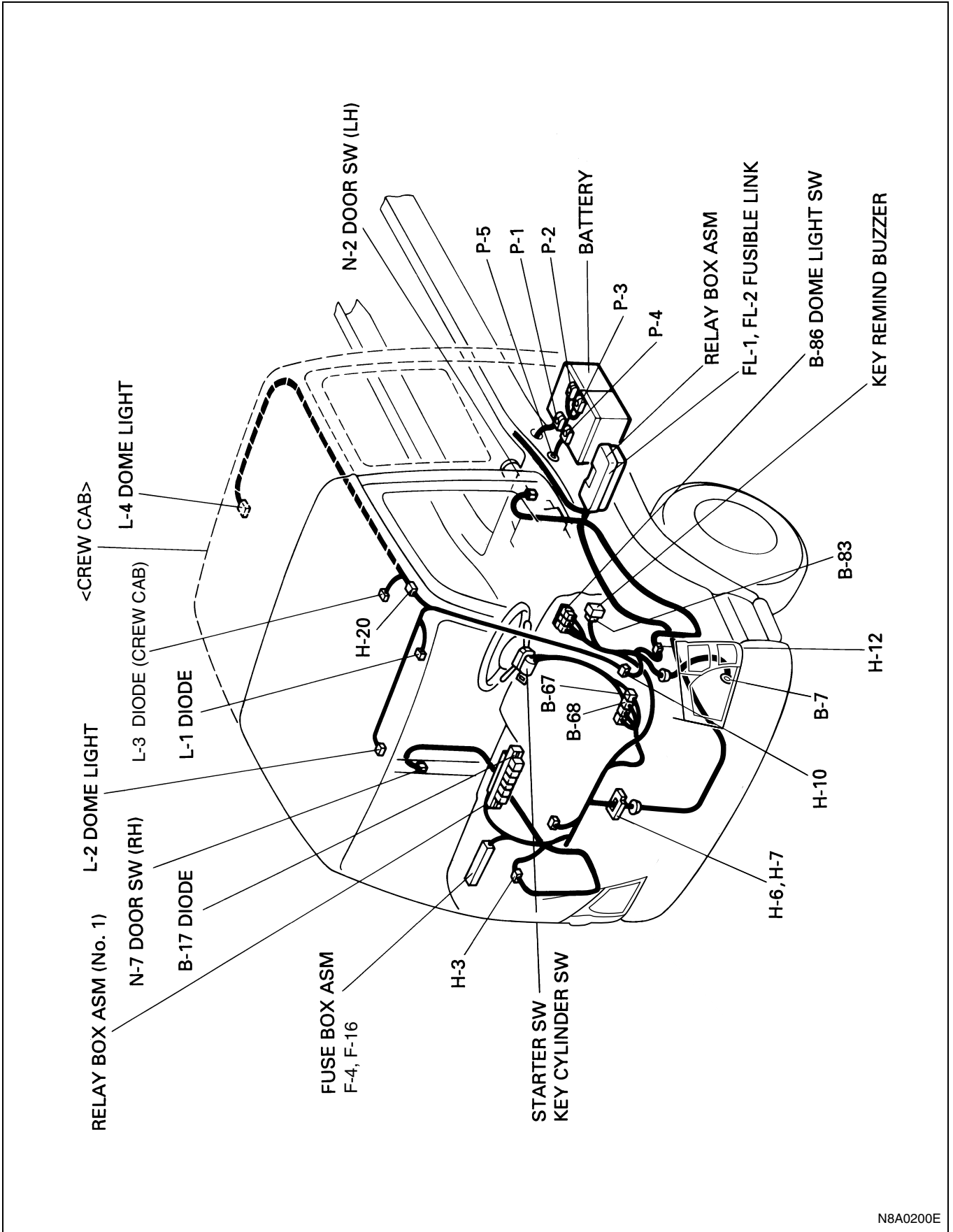
By operating the dome light switch fitted on the instrument panel, the dome light can be lit independent of the switch position of dome light.

Key remind buzzer sounds to remind the driver of leaving the key in the starter switch when opening the driver's side door.

Lighting Circuit

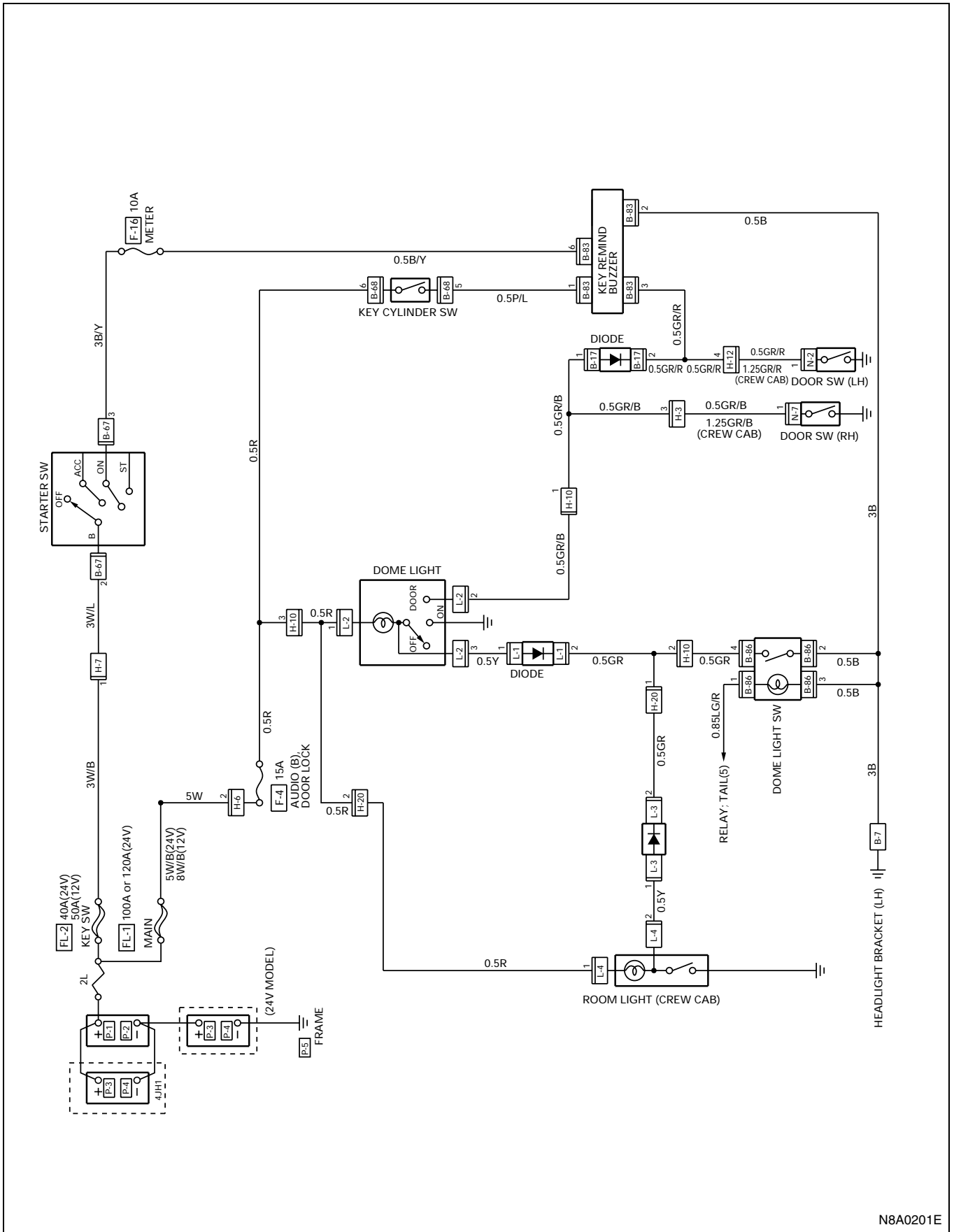


Parts Location



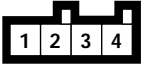


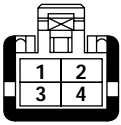

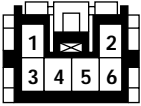
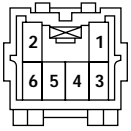
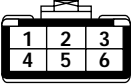
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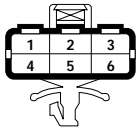
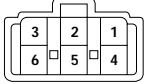
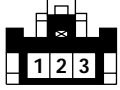
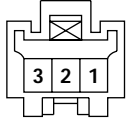
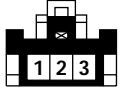
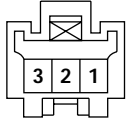

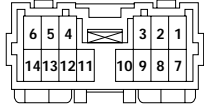
Circuit Diagram

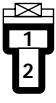
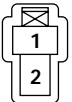

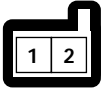

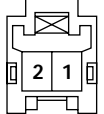








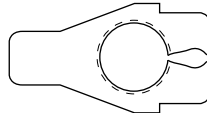
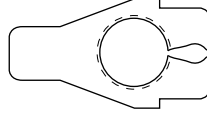

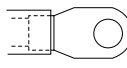
N8A0201E

Connector List

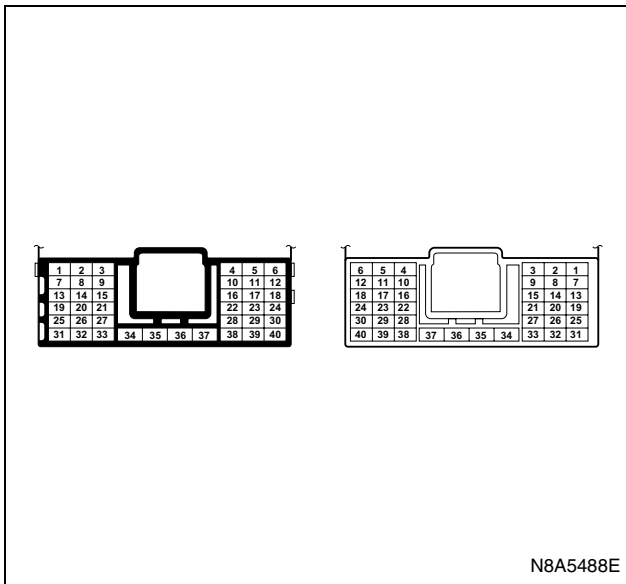
No.	Connector Face
B-17	 004-004
B-67	 004-001
B-67	 004-002
B-86	 004-001
B-86	 004-002
B-68	 006-002
B-68	 006-003
B-83	 006-010

No.	Connector Face
H-3	 006-014
H-3	 006-015
H-10	 003-009
H-10	 003-010
L-2	 003-009
L-2	 003-010
H-12	 014-002
H-12	 014-003

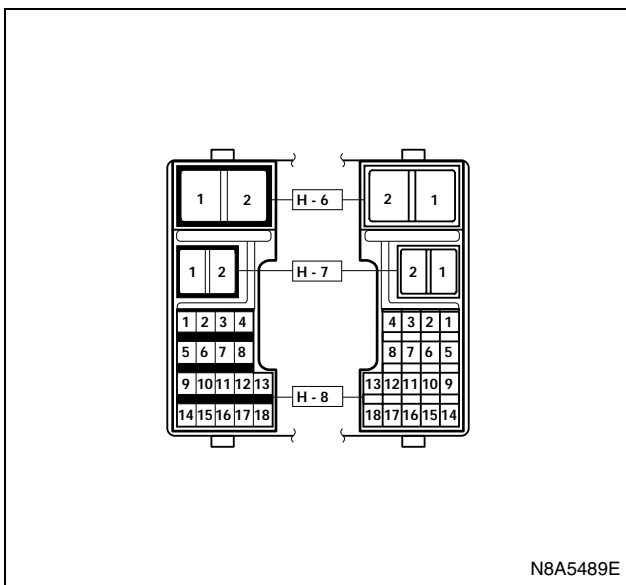
No.	Connector Face
H-20	 002-009
H-20	 002-010
L-1	 002-027
L-3	 002-027
L-4	 002-022
L-4	 002-023
N-2	 001-009
N-7	 001-009

No.	Connector Face
P-1 (12 V)	 000-003
P-2	 000-004
P-1 (24 V)	 000-004
P-4	 000-004
P-2 (24 V)	 000-006
P-3	 000-006
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002

H-5



H-7



Starter Switch

Refer to "START AND CHARGING" in this section.

Key Cylinder Switch

Refer to "START AND CHARGING" in this section.

Backup Light Switch

Refer to "HORN, BACKUP LIGHT AND BACKUP BUZZER" in this section.

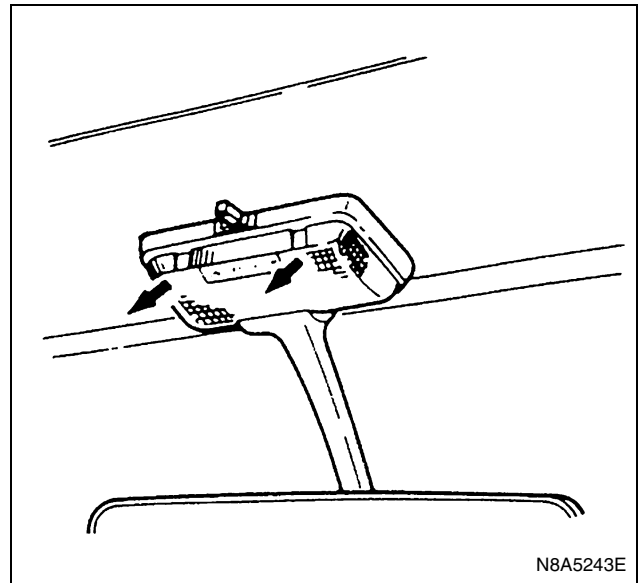
Dome Light Bulb

Removal

Preparation:

Disconnect the battery ground cable.

1. Lens
Hold the lens and pull it downward.



2. Bulb Installation

To install, follow the removal steps in the reverse order.

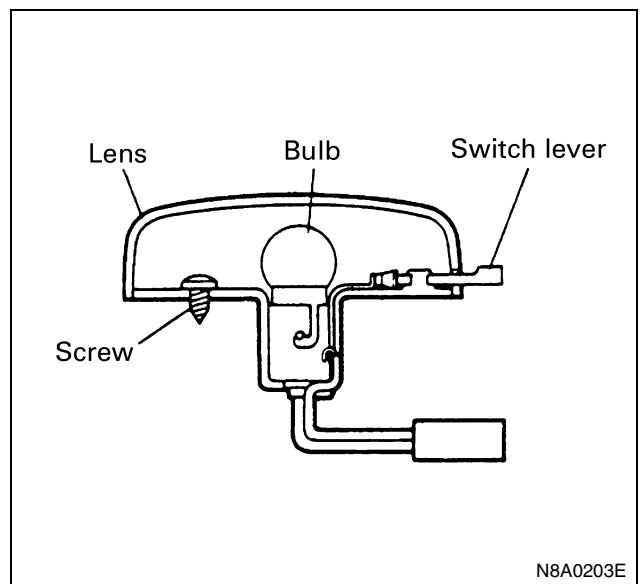
Dome Light Bulb (for Crew Cab)

Removal

Preparation:

Disconnect the battery ground cable.

1. Lens
Hold the lens and pull it down.
2. Bulb



Installation

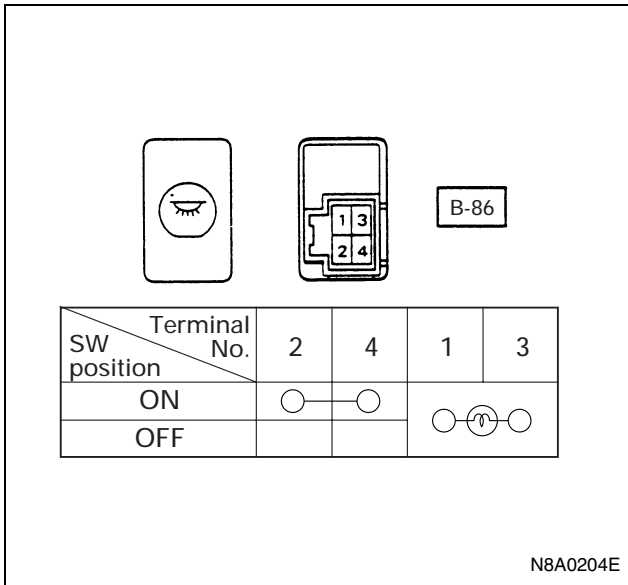
To install, follow the removal steps in the reverse order.

Dome Light Switch

Inspection

Check the continuity between the dome light switch connector terminals.

Repair or replace the switch when the result of inspection is found abnormal.

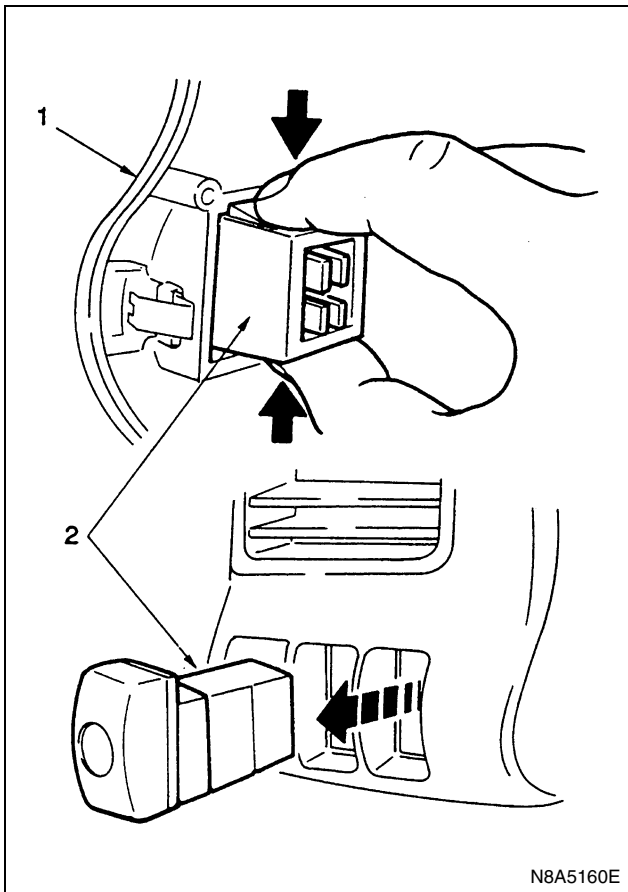


Removal

Preparation:

Disconnect the battery ground cable.

1. Meter cluster
Refer to the "METER AND WARNING/INDICATOR LIGHT" in this section.
2. Dome Light Switch
Release the lock pushing the switch from the back side of the meter cluster.



Installation

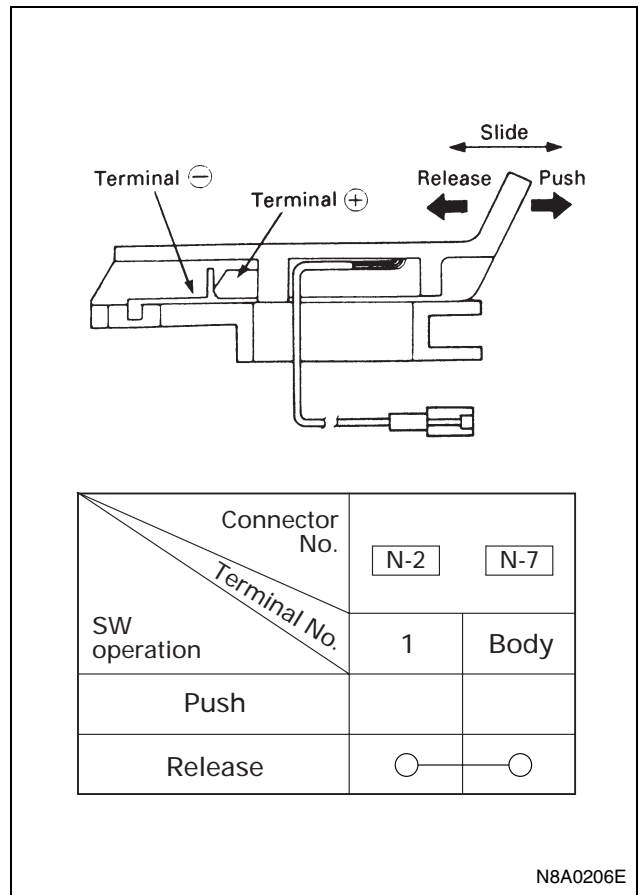
To install, follow the removal steps in the reverse order noting the following point.

1. Push the switch with your fingers until locks securely.

Door Switch

Inspection

Check to see if there is any continuity between the terminals and the body while operating the door switch. Repair or replace the switch, when the result of inspection is found abnormal.

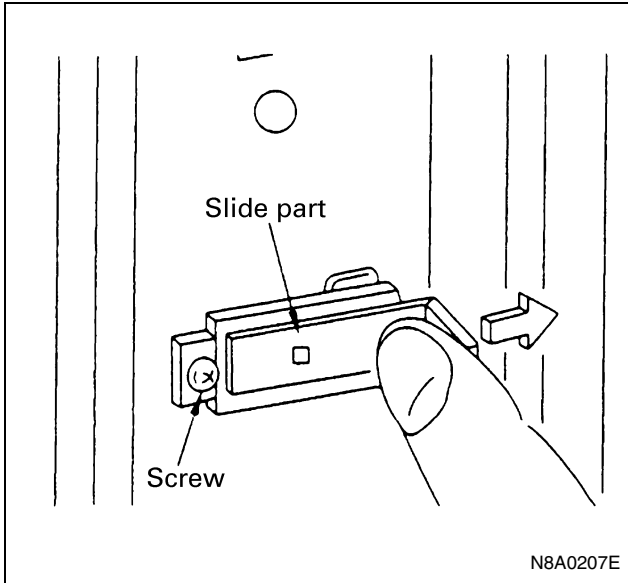


Removal

Preparation:

Disconnect the battery ground cable.

1. Door Switch
 - 1) Remove the screw.
 - 2) Disconnect the connector of the switch.

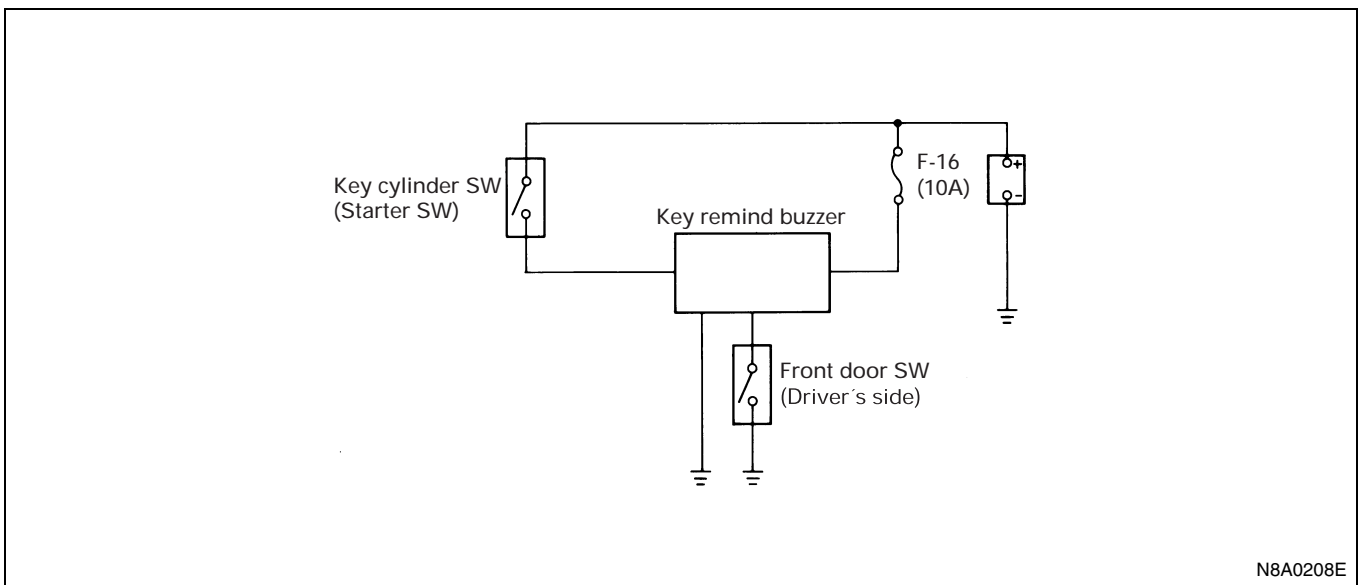


Installation

To install, follow the removal steps in the reverse order.

Key Remind Buzzer

The key remind buzzer sounds to remind the driver to remove the starter key from the starter switch when front driver side door is opened (Front driver side door switch is on).



Inspection of The Buzzer Circuit

Disconnect the key remind buzzer connector, measure the continuity and voltage between the harness side connector terminals.



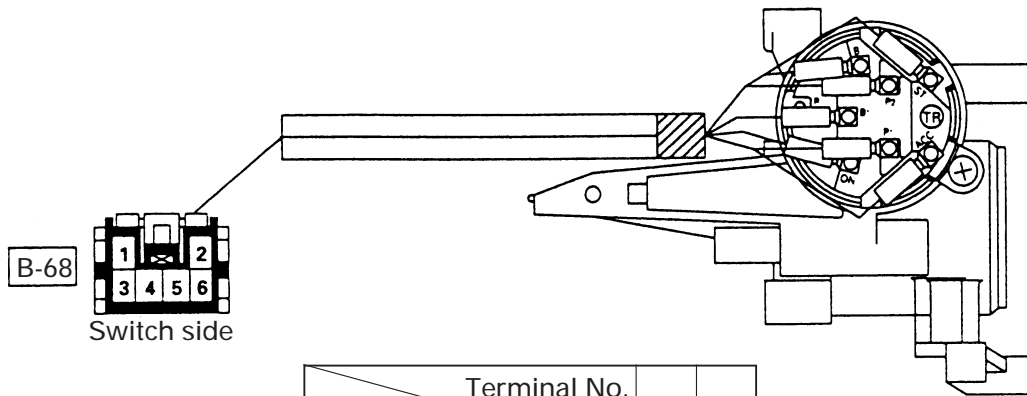
Terminal No.	Wire color	Connected to	Item to be checked	Connecting terminal	Checking conditions	Standard
2	B	Ground	Continuity	2-Ground	-	Continuity
1	P/L	Ground	Voltage	1-Ground	Starter key inserted	Approx. battery voltage
					Starter key removed	0V
3	GR/R	Ground	Continuity	3-Ground	Front driver-s side door "OPEN"	Continuity
					Front driver-s side door "CLOSE"	No Continuity
6	B/Y	Fuse F-12 (10A)	Voltage	6-Ground	• Starter SW ON	Approx. battery voltage

N8A0209E

Key Cylinder Switch (Starter Switch)

Inspection

Check to see if there is any continuity between the connector terminals of the key cylinder switch. Repair or replace the switch when the result of inspection is found abnormal.



		Terminal No.	
		5	6
Starter key position	Key removed		
	Key inserted	○—○	
LOCK			
OFF			
ACC			
ON			
START			

N8A0210E

Power Door Lock

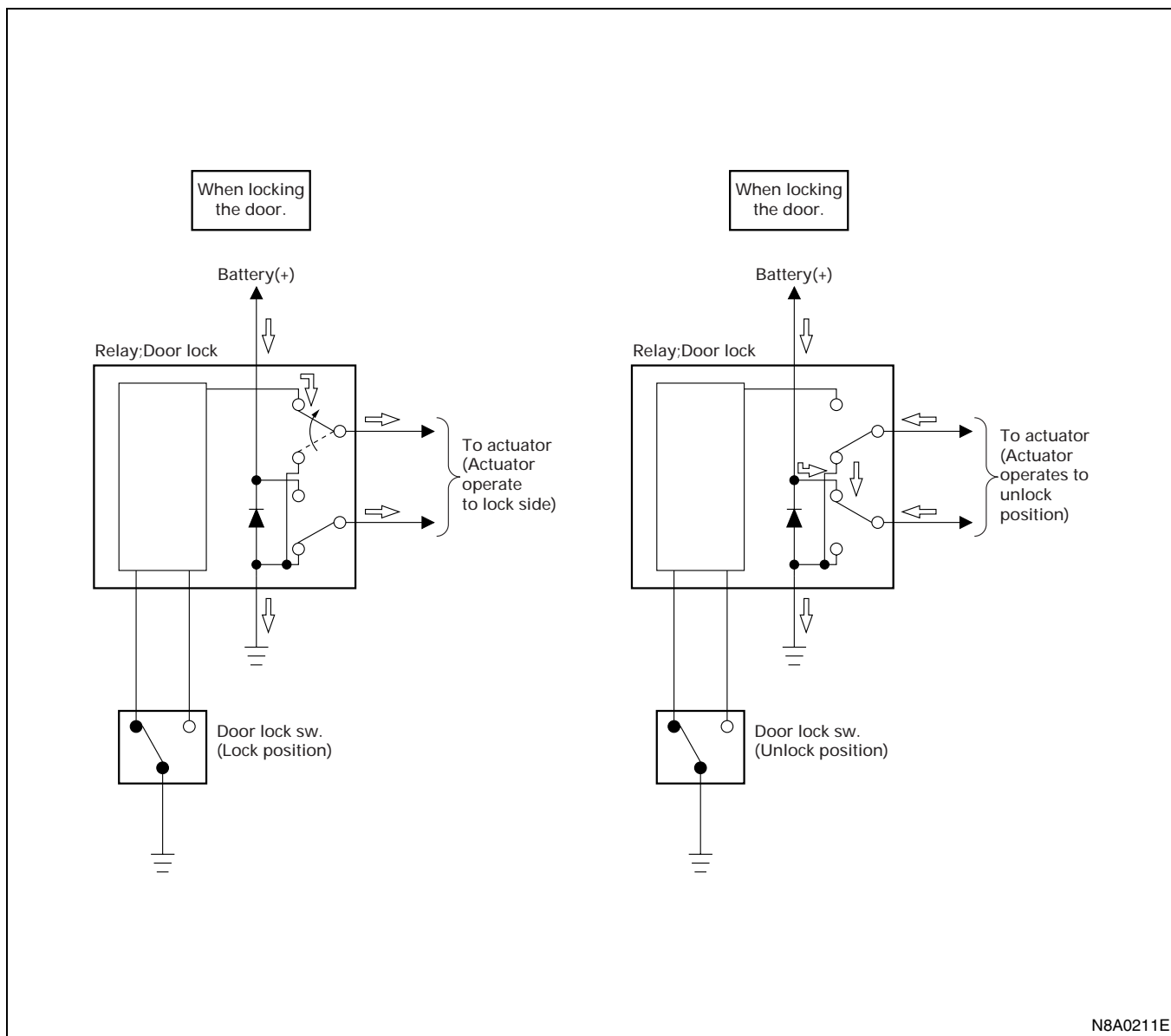
General Description

The circuit consists of the door lock switch, actuator for the front passenger door, rear doors and the door lock controller.

The door lock controller is always provided with battery voltage. The key or the inside lock knob on the driver's door can activate the lock mechanism of all the doors.

When the driver's door lock switch is turned on, current flows for about one second to the door lock actuator of each door connected in parallel with the controller to activate the actuator to lock and unlock the doors.

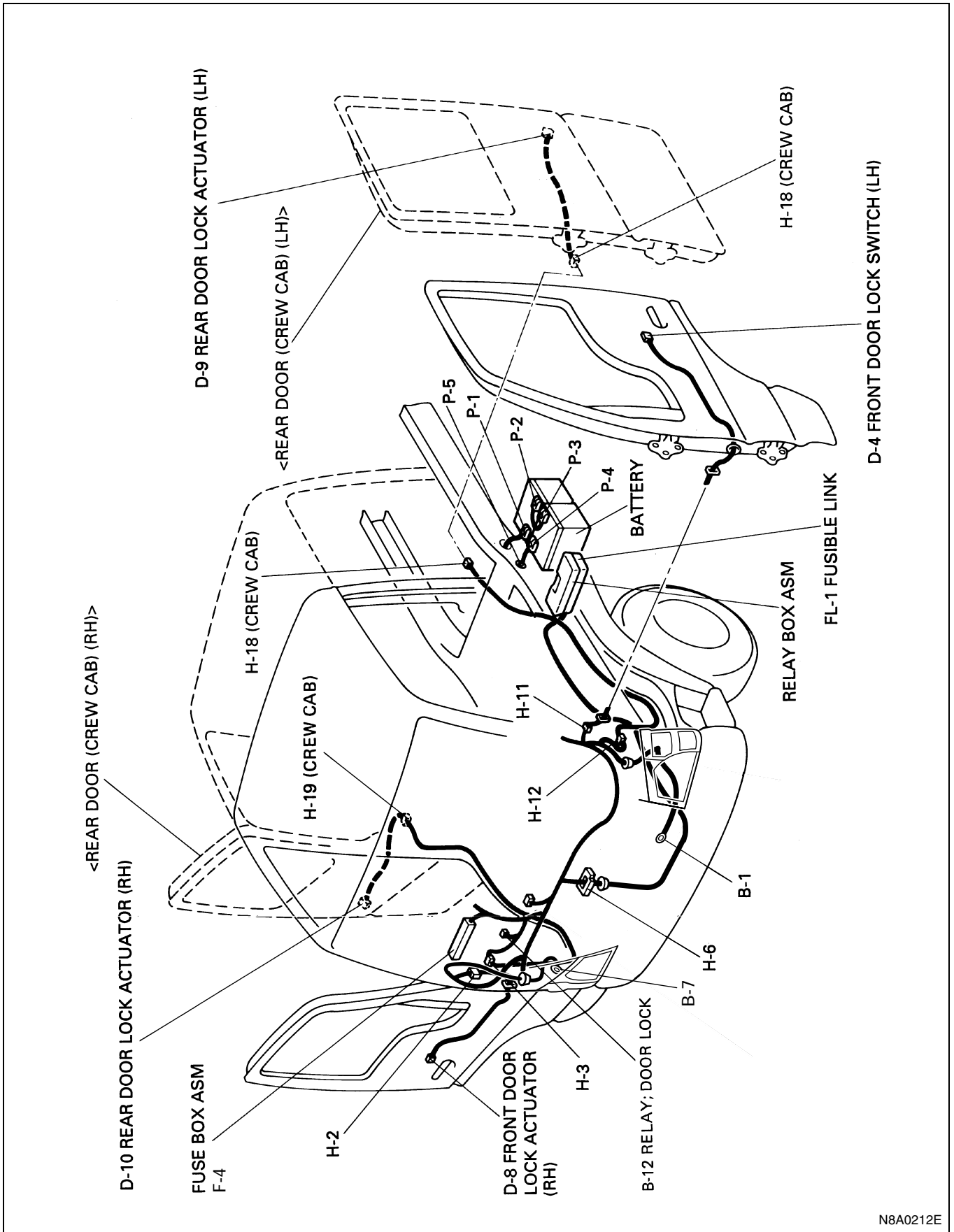
Operation of Door Lock Controller



Notice:

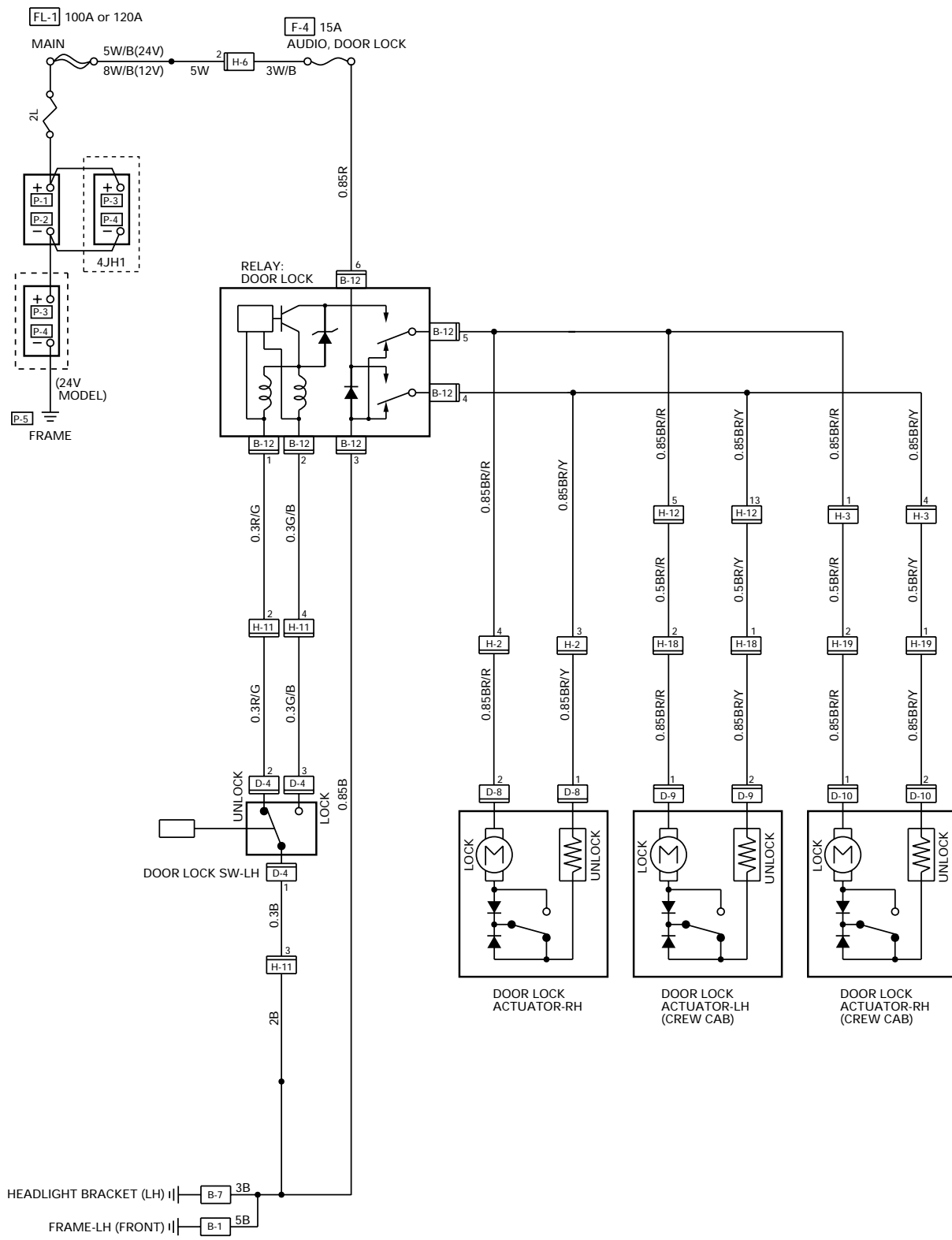
Arrow marks indicate the direction of current.

Parts Location



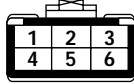
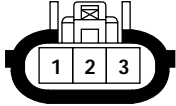
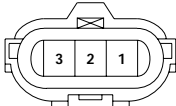
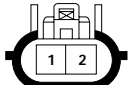

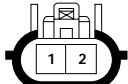

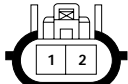
N8A0212E


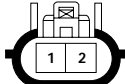

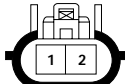




Circuit Diagram

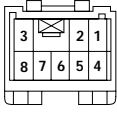
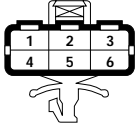
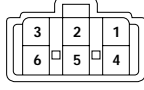
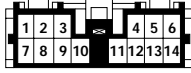
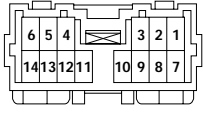


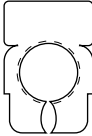


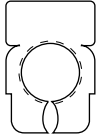
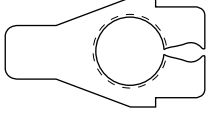
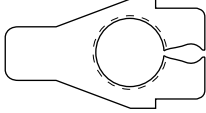
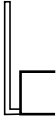
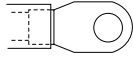
N8A0213E

Connector List

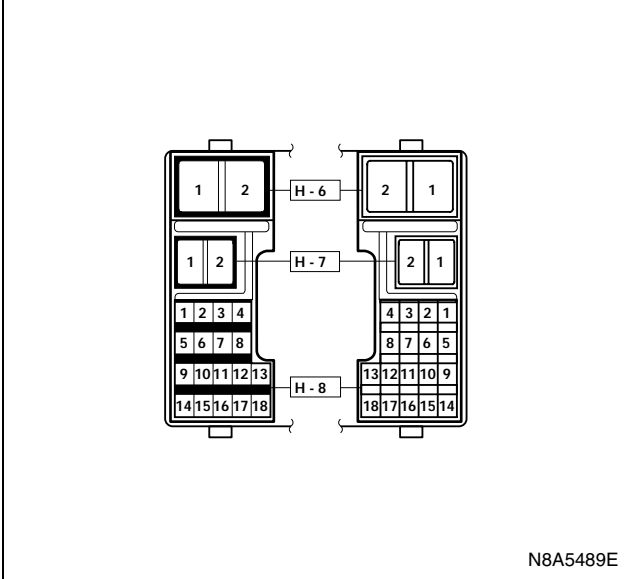
No.	Connector Face
B-12	 006-010
D-4	 003-003
D-4	 003-011
D-8	 002-001
D-8	 002-002
D-9	 002-001
D-9	 002-002
D-10	 002-001

No.	Connector Face
D-10	 002-002
H-18	 002-001
H-18	 002-002
H-19	 002-001
H-19	 002-002
H-2	 008-009
H-2	 008-010
H-11	 008-009

No.	Connector Face
H-11	 <p style="text-align: right;">008-010</p>
H-3	 <p style="text-align: right;">006-014</p>
H-3	 <p style="text-align: right;">006-015</p>
H-12	 <p style="text-align: right;">014-002</p>
H-12	 <p style="text-align: right;">014-003</p>
P-1 (12 V)	 <p style="text-align: right;">000-003</p>
P-2	 <p style="text-align: right;">000-004</p>
P-1 (24 V)	 <p style="text-align: right;">000-004</p>

No.	Connector Face
P-4	 <p style="text-align: right;">000-004</p>
P-2 (24 V)	 <p style="text-align: right;">000-006</p>
P-3	 <p style="text-align: right;">000-006</p>
P-5 (12 V)	 <p style="text-align: right;">000-007</p>
P-5 (24 V)	 <p style="text-align: right;">000-002</p>

H-6



Diagnosis

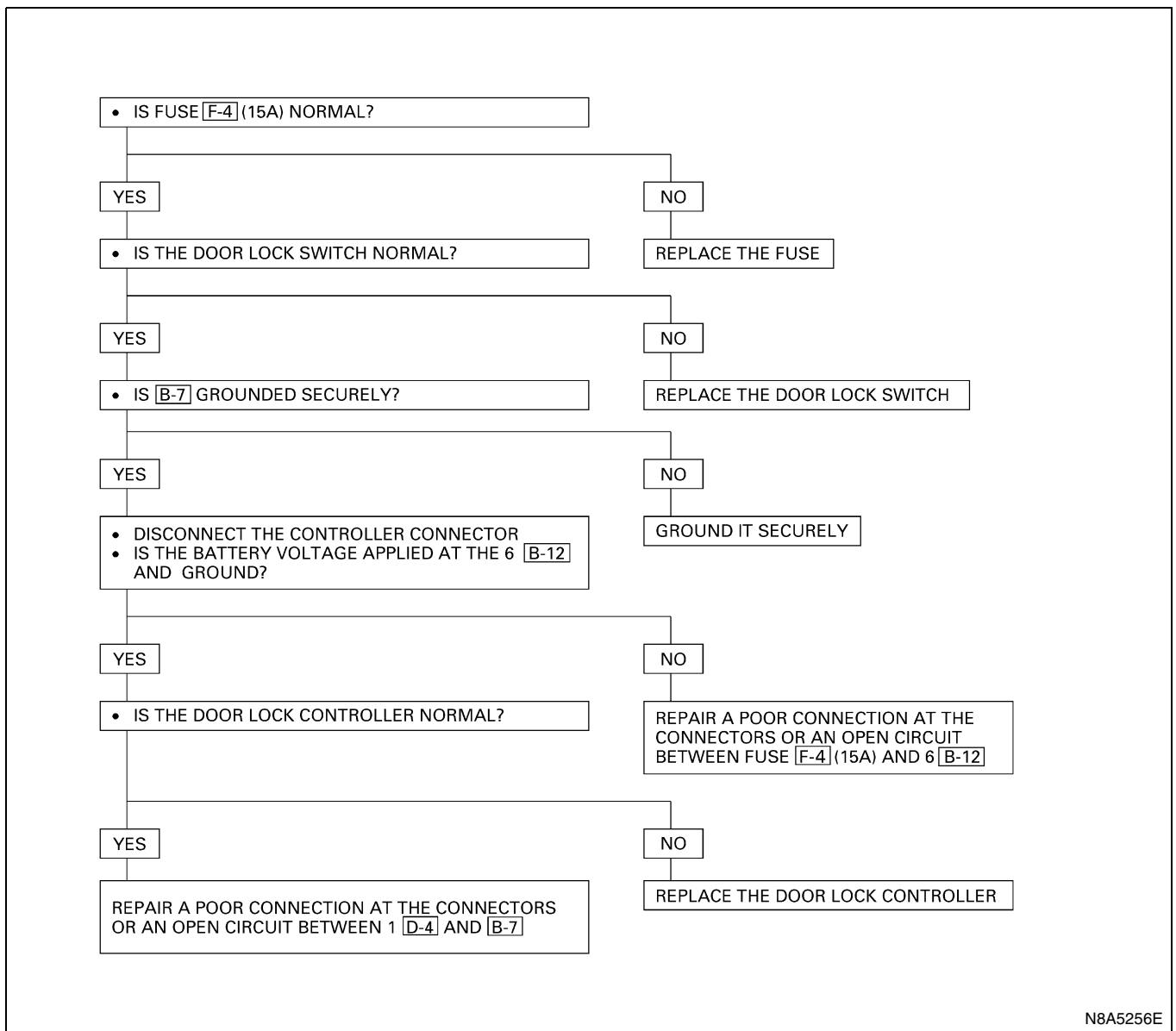
Quick Chart for Check Point

		Check point						
		Fuse F-4 (15 A)	Door lock controller	Door lock SW (Driver side)	Door lock actuator			
					Front (Passen- ger side)	Rear (RH)	Rear (LH)	Cable harness
Trouble mode	1. All the doors do not lock and unlock	○	○					○
	2. All the doors do not get locked (or unlocked)		○					○
	3. Driver side door does not get locked (or unlocked)			○				○
	4. Front passenger side door does not get locked (or unlocked)				○			○
	5. Rear door-RH side does not get locked (or unlocked)					○		○
	6. Rear door-LH side does not get locked (or unlocked)						○	○

Notice:

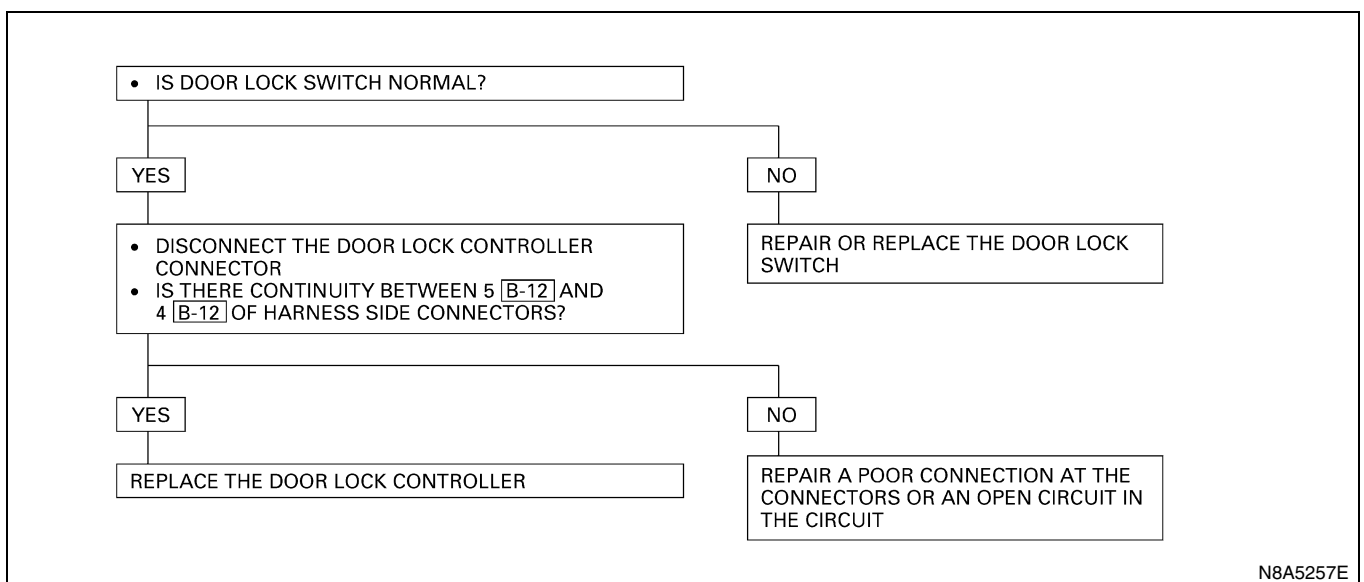
Figure in parenthesis “()” indicates the order of inspection.

All the Doors Do Not Lock and Unlock



N8A5256E

All the Doors Do Not Get Locked (or Unlocked)



N8A5257E

Driver Side Door Does Not Get Locked (or Unlocked)

REPLACE THE DOOR LOCK SWITCH

N8A0216E

FRT Passenger Side Door Does Not Get Locked (or Unlocked)
RR Door-RH Side Does Not Get Locked (or Unlocked)
RR Door-LH Side Does Not Get Locked (or Unlocked)

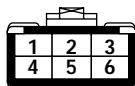
REPLACE THE DOOR LOCK ACTUATOR

N8A0217E

Inspection of The Door Lock Circuit

Check the voltage and the continuity between the controller harness side connector terminals.

B-12



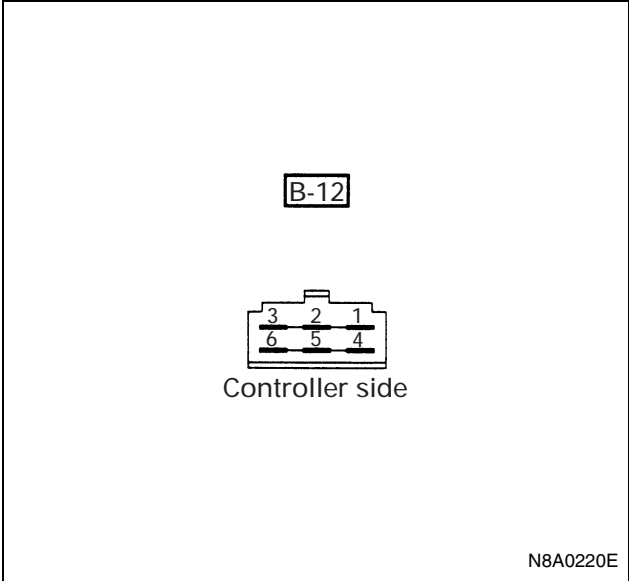
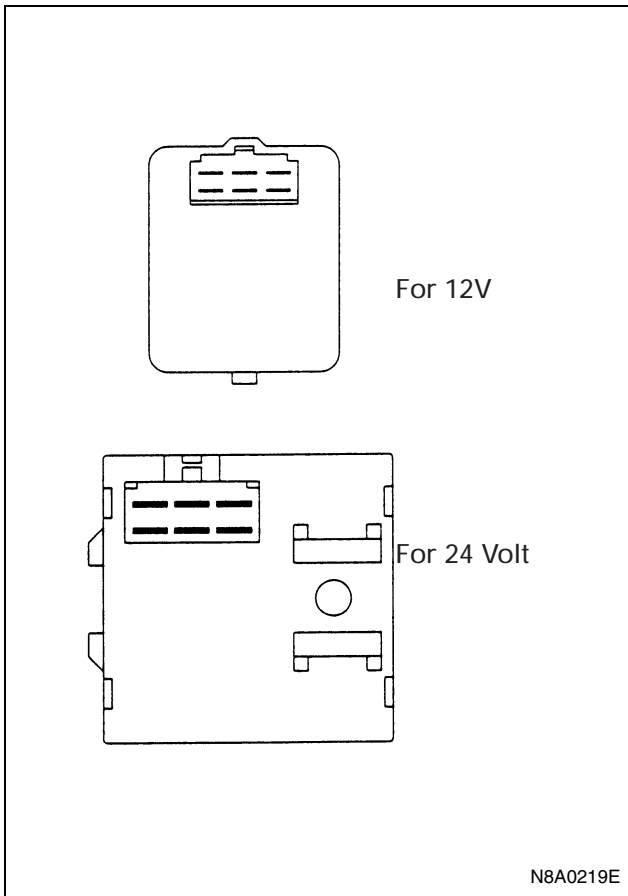
Harness side

Terminal No.	Wire color	Connected to	Item to be checked	Connecting terminal	Checking conditions		Standard
1	R/G	Door lock SW (Unlock)	Continuity (Resistance)	1-Ground	Driver seat side door	Unlock	Continuity
						Lock	No continuity
2	G/B	Door lock SW (Lock)		2-Ground	Driver seat side door	Unlock	No continuity
							Lock	Continuity
3	B	Ground		3-Ground	-		Continuity
4	BR/Y	Actuator (Unlock)		4-5	-		Continuity (There is some resistance)
5	BR/R	Actuator (Lock)	5-4	-		Continuity (There is some resistance)	
6	R	Fuse F-7 (15A)	Voltage	6-Ground	-		Battery voltage

N8A0218E

Door Lock Relay

The door lock controller sends out to each door lock actuator the lock/unlock signals received from door lock switch of driver seat side.

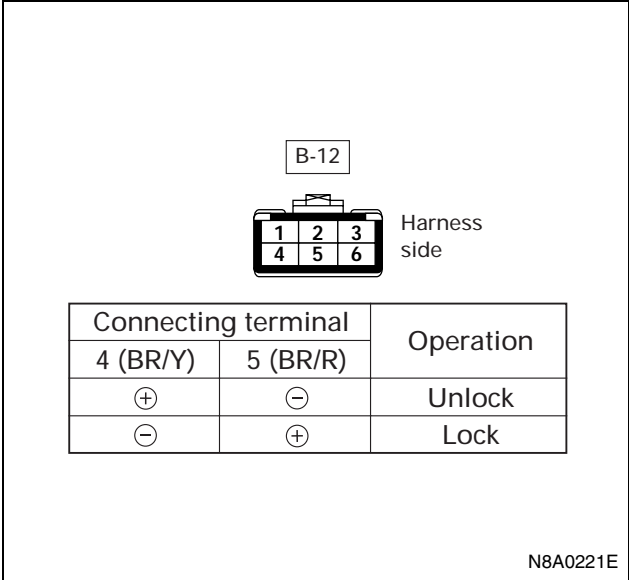


Door Lock Operation Test

After confirming that there is continuity between the harness side connector terminals 4 [B-12] and 5 [B-12] of the door lock controller, apply battery voltage to each of the terminals to conduct the operation test. When the door lock will not operate, check the door lock actuator for any trouble.

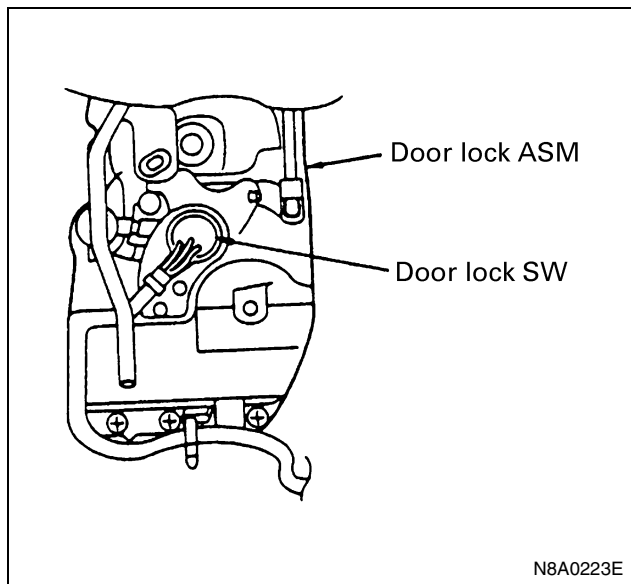
Inspection

Remove the connector of the door lock controller, and check the continuity and the voltage between the controller side connector terminals.
 (Connect the (+) terminal of the battery to 6 [B-12] and the (-) terminal to 3 [B-12].)
 3 [B-12] — 5 [B-12]Continuity
 3 [B-12] — 4 [B-12]Continuity
 (Then, ground 2 [B-12].)
 5 [B-12]Voltage for approx. 1 second
 (Disconnect the ground of 2 [B-12], and ground 1 [B-12].)
 4 [B-12]Voltage for approx. 1 second
 Replace the controller when the result of inspection is found abnormal.



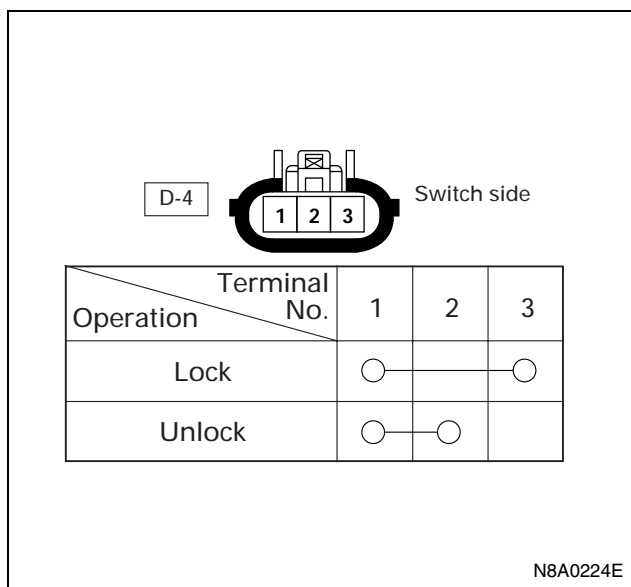
Door Lock Switch (Driver Seat Side)

The door lock switch on the driver's door is connected with the door lock cylinder and the inside lock knob with a rod. The switch sends lock/unlock signals to the door lock controller.



Inspection

Check to see if there is any continuity between the connector terminals of the door lock switch. Replace the switch when the result of inspection is found abnormal.

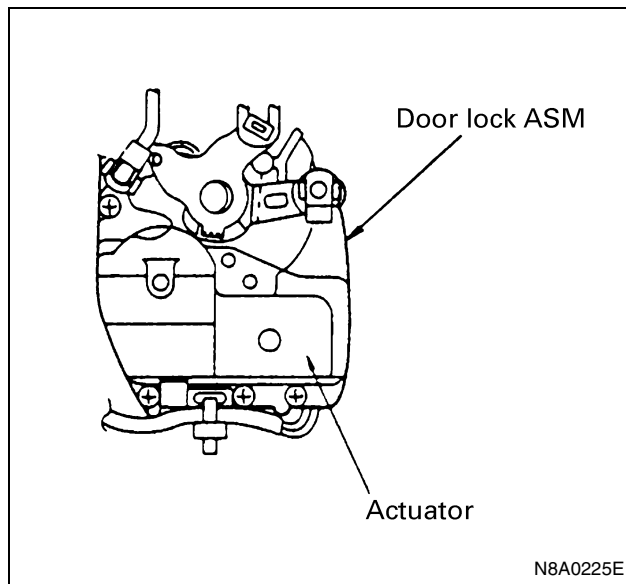


Removal and Installation

Refer to Section 2 for "DOOR LOCK ASSEMBLY".

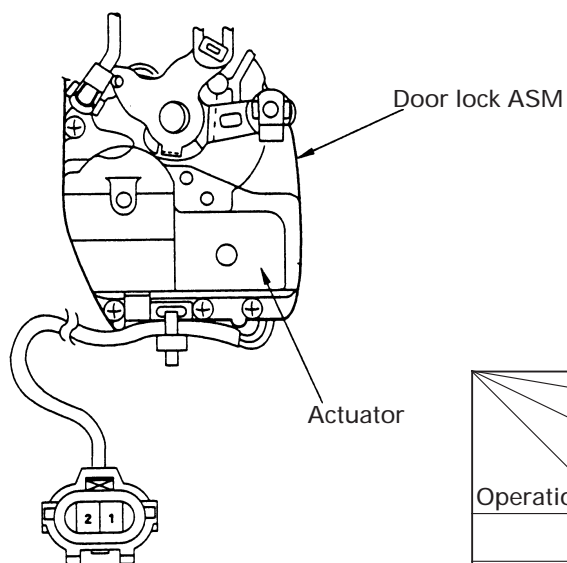
Door Lock Actuator

Receiving forward or reverse current from the door lock controller, the door lock actuator locks or unlocks the door with the rod connected to the door lock mechanism.



Inspection of The Door Lock Actuator

Apply the battery voltage to the connector terminals of the door lock actuator to check the operation. When the door lock actuator is checked on the vehicle and there is no continuity, and when the door lock actuator itself is checked and no trouble is found, check the circuit between the door lock actuator and the door lock controller for any failure.



D-8

D-9

D-10



Actuator side

Actuator side

Operation	Terminal No.	Door Connector No.		FRT Passenger		RR-LH		RR-RH	
		D-8		D-9		D-10			
		1	2	1	2	1	2		
Lock		⊖	⊕	⊕	⊖	⊕	⊖		
Unlock		⊕	⊖	⊖	⊕	⊖	⊕		

N8A0226E

Removal and Installation

Refer to Section 2 for "DOOR LOCK ASSEMBLY".

Power Window

General Description

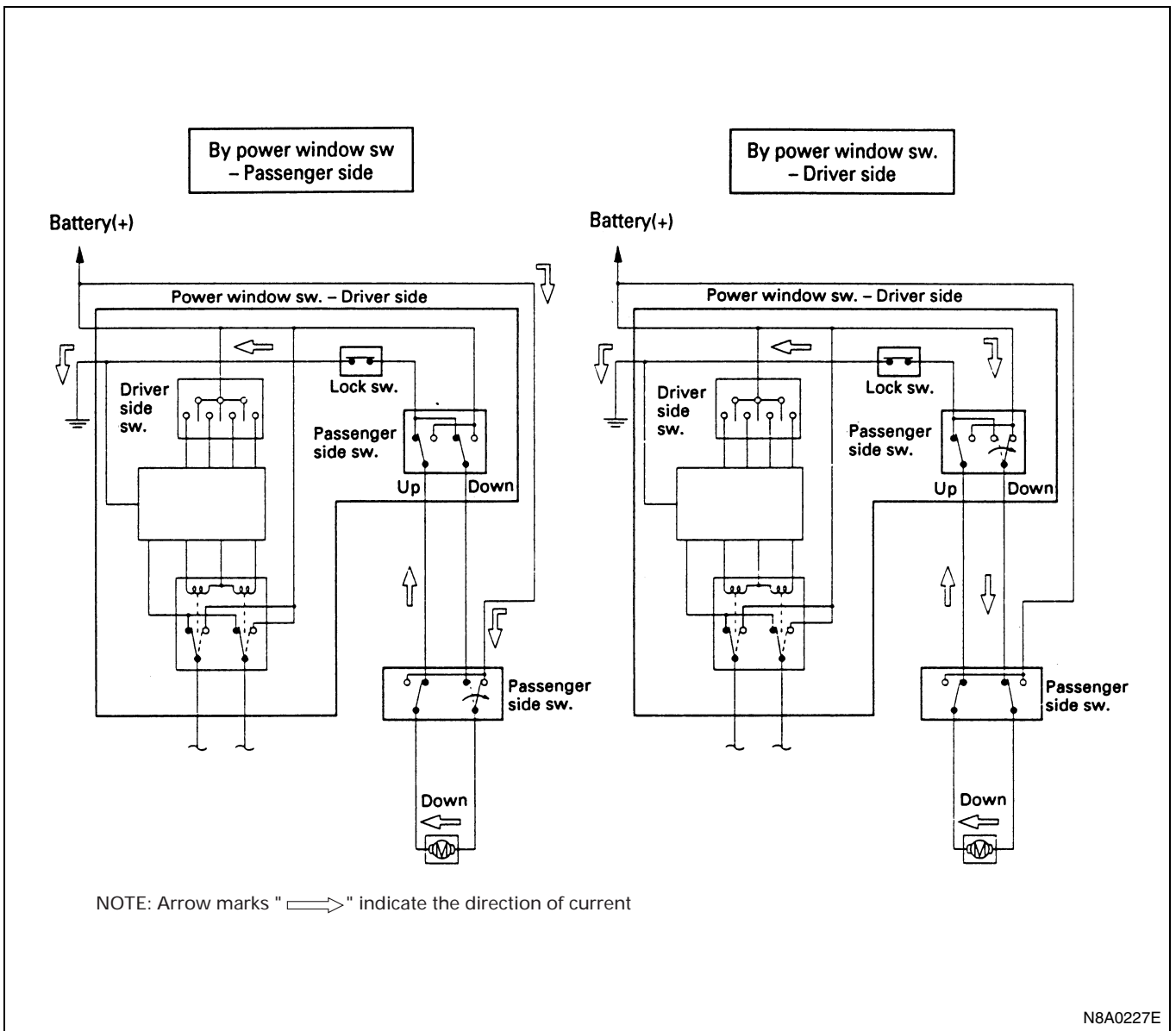
The circuit consists of the starter switch, power window switch for each of the windows and power window motor. When the starter switch is turned on, the battery voltage is applied to each of the power window switches through the circuit breaker and the power window relay on the circuit.

By operating the switches of each window to select "UP" or "DOWN", the revolving direction of the power window motor changes to open or close the window.

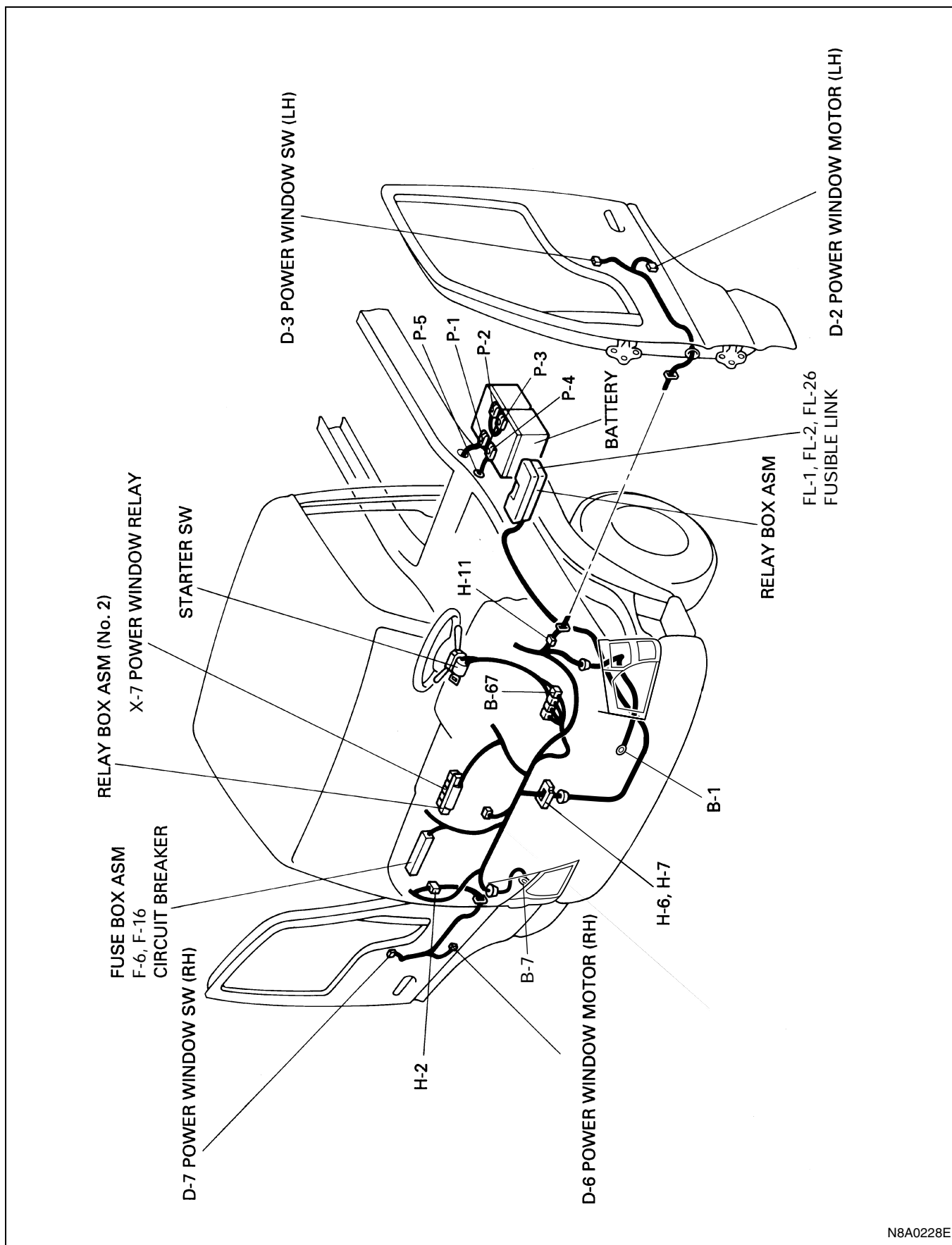
The driver's power window switch has a built-in one-touch operating circuit which allows to automatically open the window by operating the switch to the AUTO position.

When the driver's power lock switch at the driver side is depressed, the power source to the passenger's power window switches will be shut off and passenger's side power window motor will not operate if the switch is operated.

Operation of Passenger Side Window

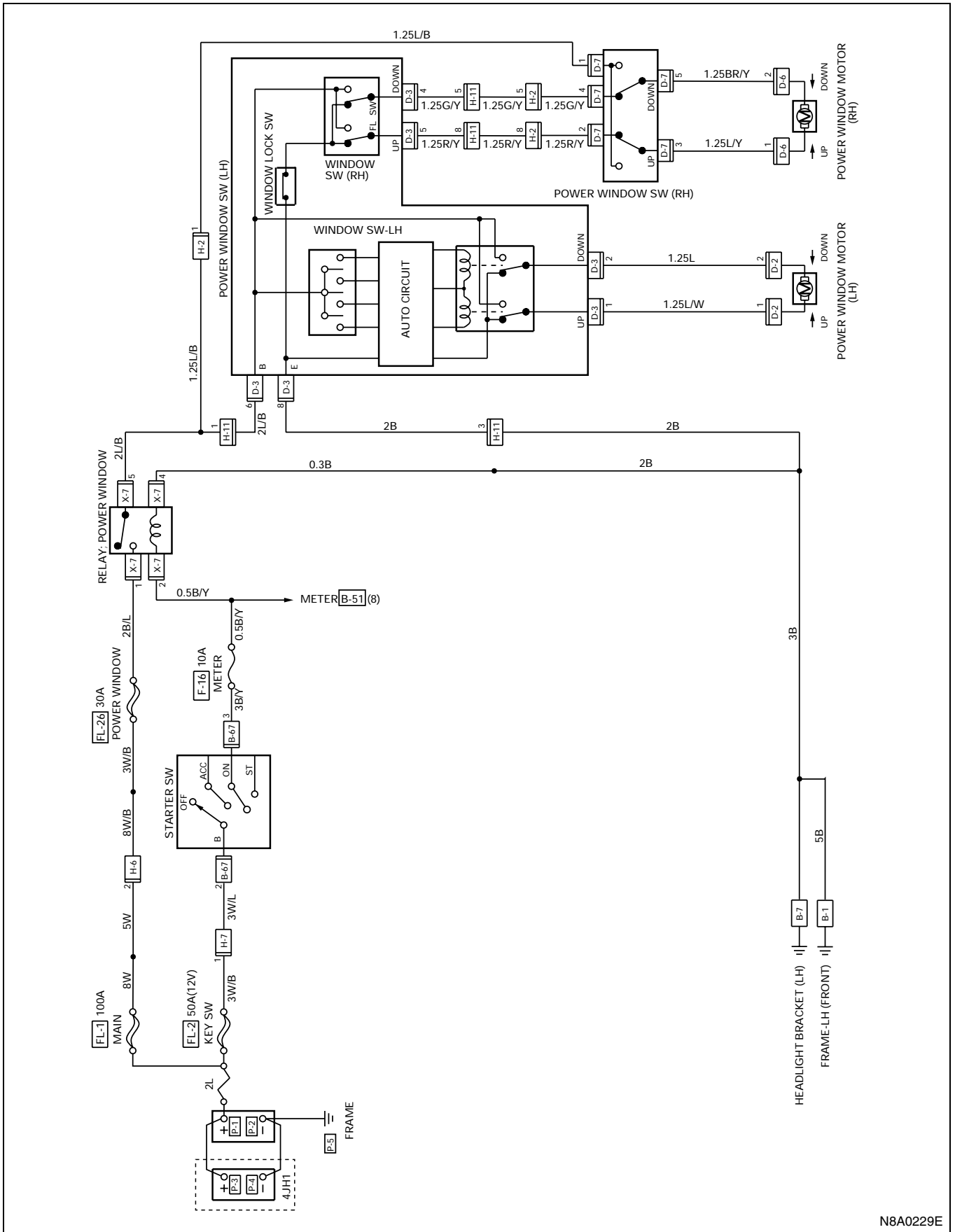


Parts Location



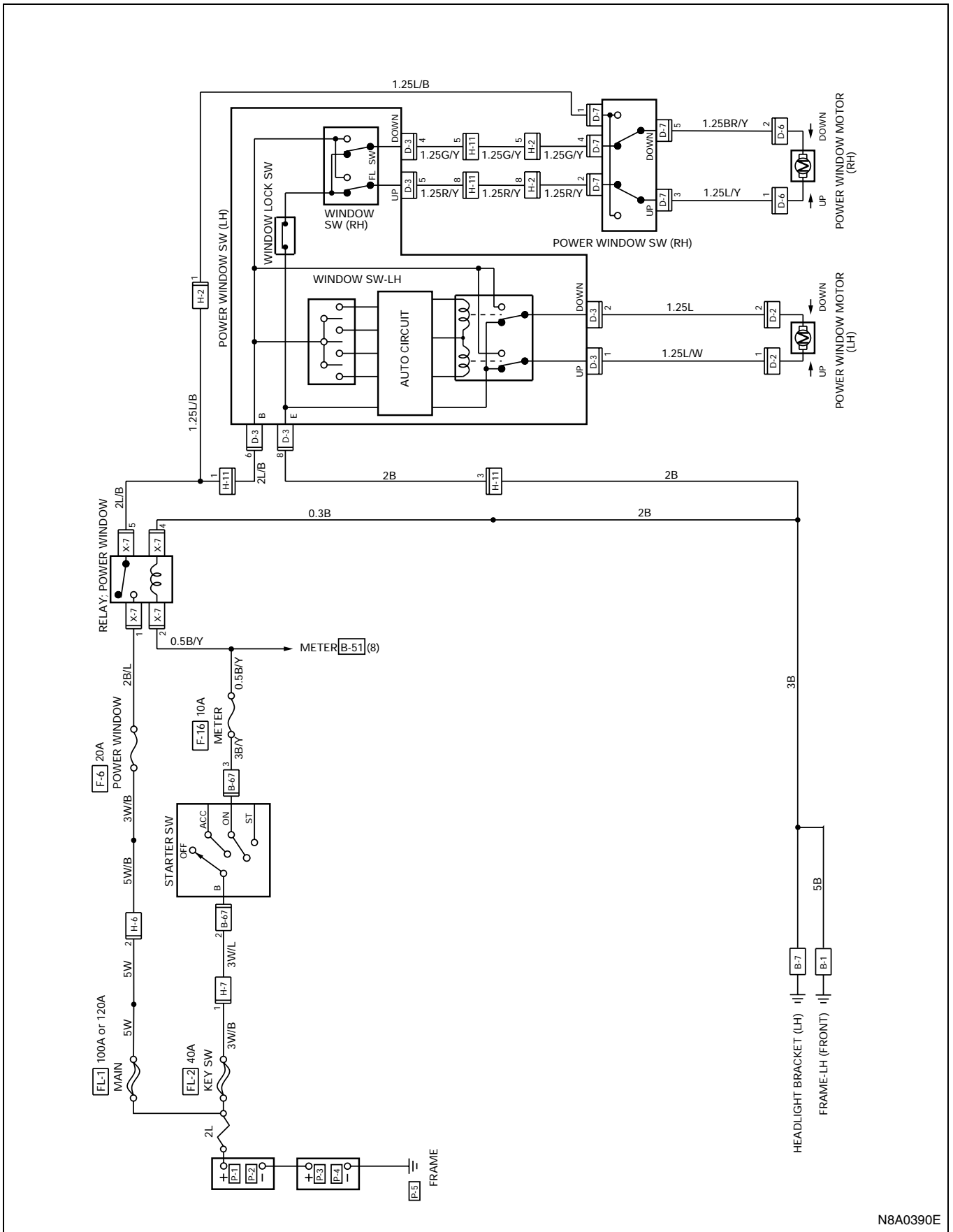
N8A0228E

Circuit Diagram For 12 Volt



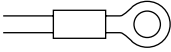
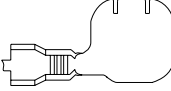
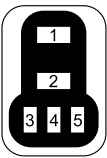


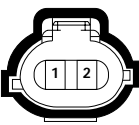
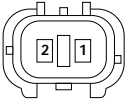

N8A0229E

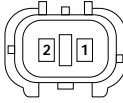
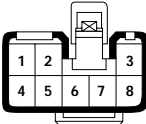
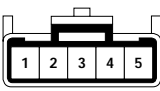
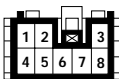
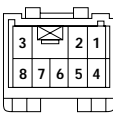

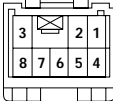

For 24 Volt

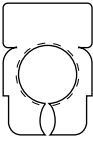
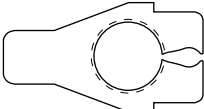
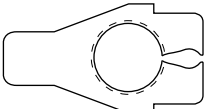
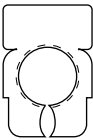
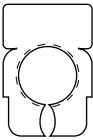
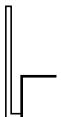
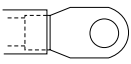


N8A0390E

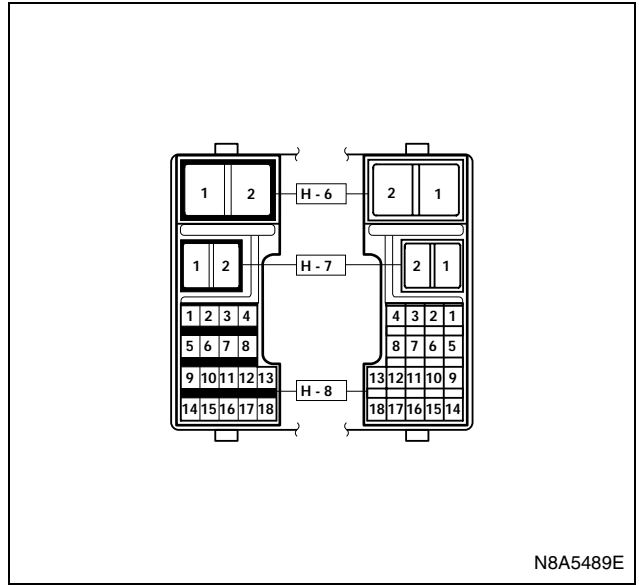
Connector List

No.	Connector Face
B-1	 000-001
B-7	 000-012
X-7	 005-006
B-67	 004-001
B-67	 004-002
D-2	 002-028
D-2	 002-029
D-6	 002-028

No.	Connector Face
D-6	 002-029
D-3	 008-011
D-7	 005-005
H-2	 008-009
H-2	 008-010
H-11	 008-009
H-11	 008-010
P-1 (12V)	 000-003

No.	Connector Face
P-2	 <p style="text-align: right;">000-004</p>
P-1 (24V)	 <p style="text-align: right;">000-006</p>
P-4	 <p style="text-align: right;">000-006</p>
P-2 (24V)	 <p style="text-align: right;">000-004</p>
P-3	 <p style="text-align: right;">000-004</p>
P-5 (12V)	 <p style="text-align: right;">000-007</p>
P-5 (24V)	 <p style="text-align: right;">000-002</p>

H-6, H-7



Diagnosis

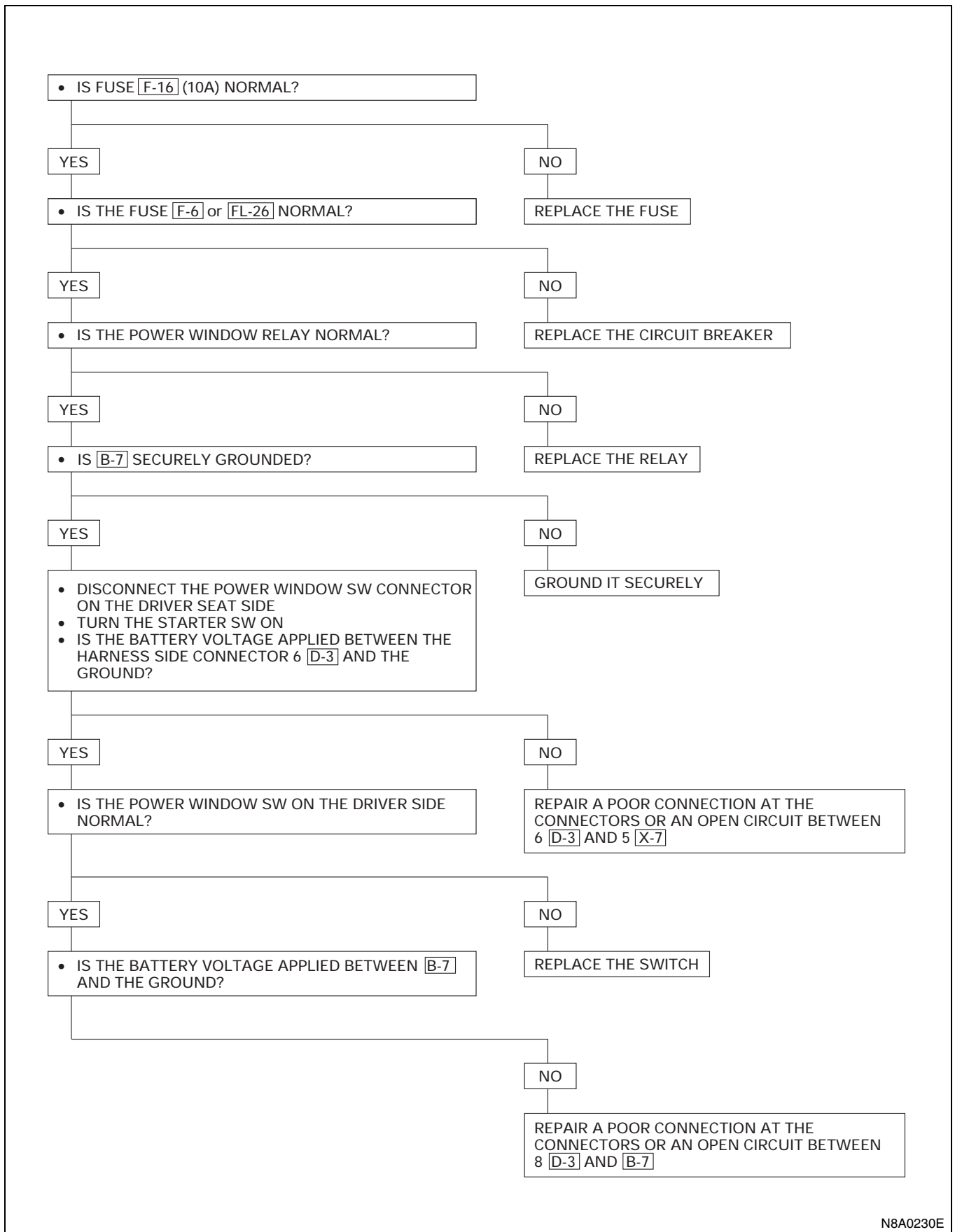
Quick Chart for Check Point

		Check point							
		Fuse F-16 (10A)	F-6, FL-26 (20A, 30A)	Power win- dow relay	Power window SW		Power window motor		Cable har- ness
					Driver side	Pas- senger side	Driver side	Pas- senger side	
Trouble mode	All windows do not operate	○ (1)	○ (2)	○ (3)	○ (5)				○ (4)
	Lock SW does not function				○ (1)				
	Driver side window								
	Window does not operate				○ (1)		○ (2)		○ (3)
	One-touch opera- tion does not opera- te				○ (1)				
	Window operates in only one direction				○ (1)				
	Front passenger side window								
	Window does not operate				○ (2)	○ (1)		○ (3)	○ (4)
	Window does not operate when opera- ting the driver side SW				○ (1)				○ (2)
	Window does not operate when opera- ting the passen- ger side SW					○ (1)			○ (2)
	Window operates in only one direction when operating the driver side SW				○ (1)				○ (2)
	Window operates in only one direction when operating the passenger side SW				○ (2)	○ (1)			

Notice:

Figure in parenthesis “()” indicates the order of inspection.

All Windows Do Not Operate



N8A0230E

Lock Sw Does Not Function

REPAIR OR REPLACE THE POWER WINDOW SW
ON THE DRIVER SEAT SIDE

N8A0231E

Window on the Driver Side Does Not Operate

• IS THE POWER WINDOW SWITCH ON THE DRIVER SEAT SIDE NORMAL?

YES

• DISCONNECT THE CONNECTOR OF THE POWER WINDOW MOTOR ON THE DRIVER SEAT SIDE
• WHEN CONNECTING THE MOTOR CONNECTOR 1 [D-2] TO THE BATTERY (+) TERMINAL AND 2 [D-2] TO THE (-) TERMINAL, DOES THE MOTOR ROTATE IN THE "UP" DIRECTION OF THE WINDOW (OR WHEN CONNECTING 2 [D-2] TO THE (+) TERMINAL AND 1 [D-2] TO THE (-) TERMINAL, DOES THE MOTOR ROTATE IN THE "DOWN" DIRECTION OF THE WINDOW)?

YES

REPAIR A POOR CONNECTION AT THE CONNECTORS OR AN OPEN CIRCUIT BETWEEN HARNESS SIDE CONNECTOR TERMINALS 1 [D-3] AND POWER WINDOW MOTOR 1 [D-2] OR 2 [D-3] AND 2 [D-2]

NO

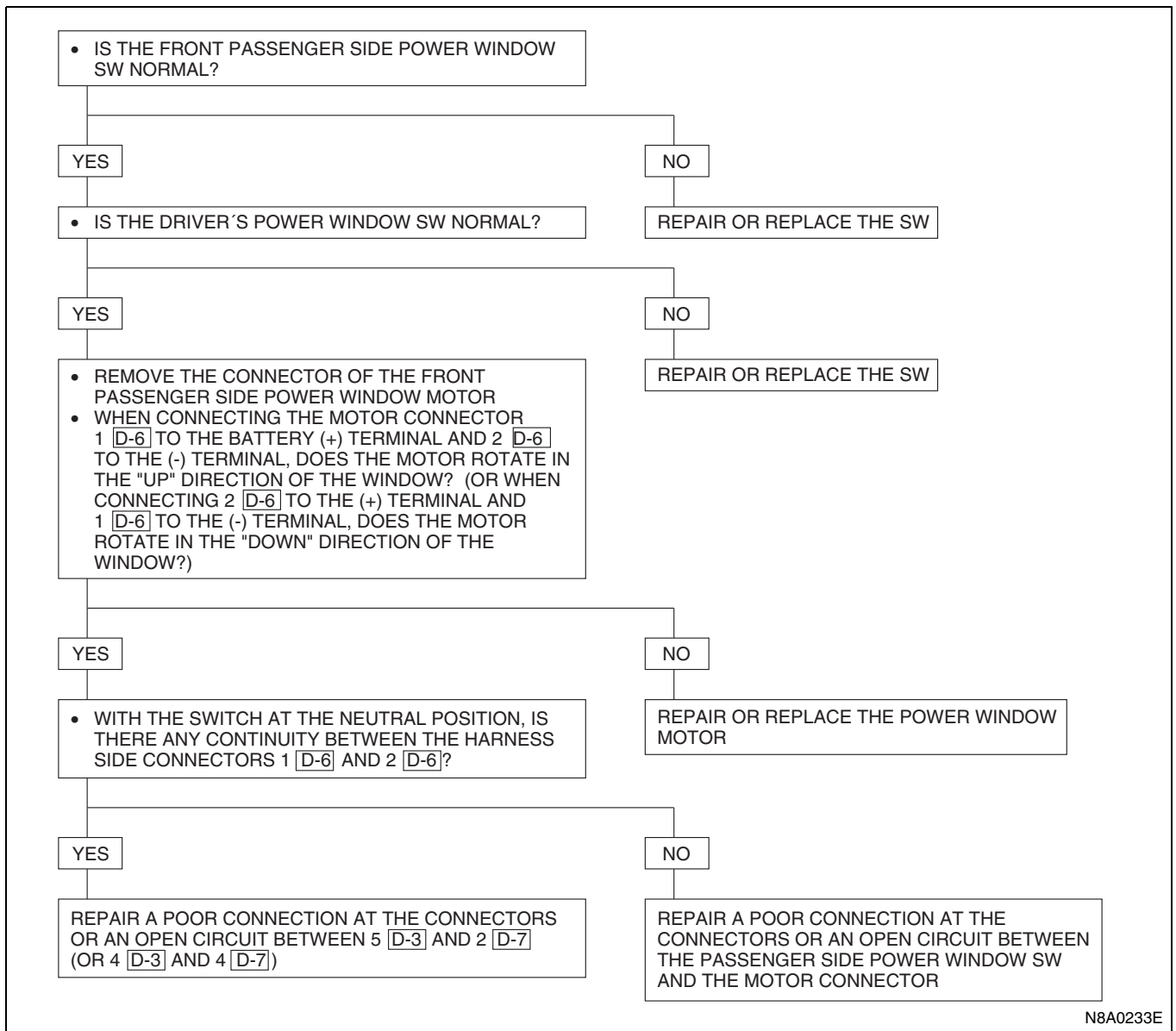
REPLACE THE POWER WINDOW SWITCH ON THE DRIVER SEAT SIDE

NO

REPAIR OR REPLACE THE POWER WINDOW MOTOR

N8A0232E

Window on the Front Passenger Side Does Not Operate



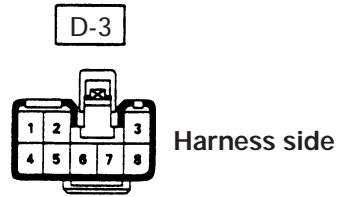
Starter Switch

Refer to "START AND CHARGING" in this section.

Power Window Switch-driver Side

Circuit Inspection

Disconnect the switch connectors to check the voltage and the continuity between the harness side connector terminals.

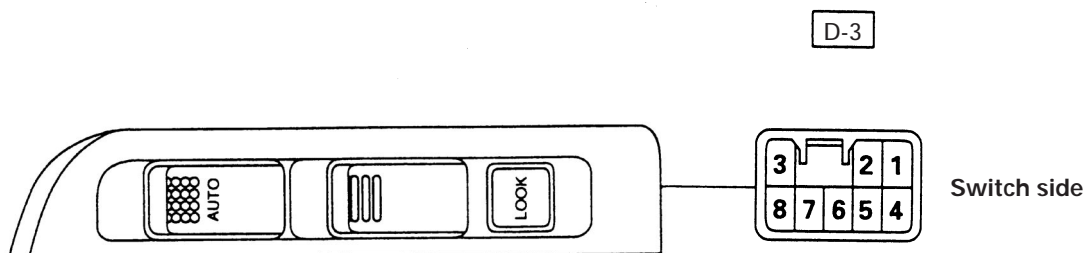


Terminal No.	Wire color	Connected to	Item to be checked	Connecting terminal	Checking conditions	Standard
1	L/W	Driver seat side motor	Continuity (resistance)	1-2	-	Continuity
2	L					
4	G/Y	Passenger side power window SW		4-5		
5	R/Y		5-4			
6	L/B	Power window relay	Voltage	6-Ground	Starter SW "ON"	Battery voltage
8	B	Ground	Continuity (resistance)	8-Ground	-	Continuity

N8A0234E

Inspection

Check the continuity between the connector terminals of the switch.
Repair or replace the switch when the result of inspection is found abnormal.



Window SW position		Terminal No.	Driver side				Passenger side			
			6	1	2	8	6	5	4	8
UP			○	○	○	○	○	○	○	○
				○		○		○		○
DOWN			○		○		○		○	
				○		○		○		○
LOCK	UP		○	○	○	○	○			
	OFF			○		○		○	○	
	DOWN		○		○		○		○	

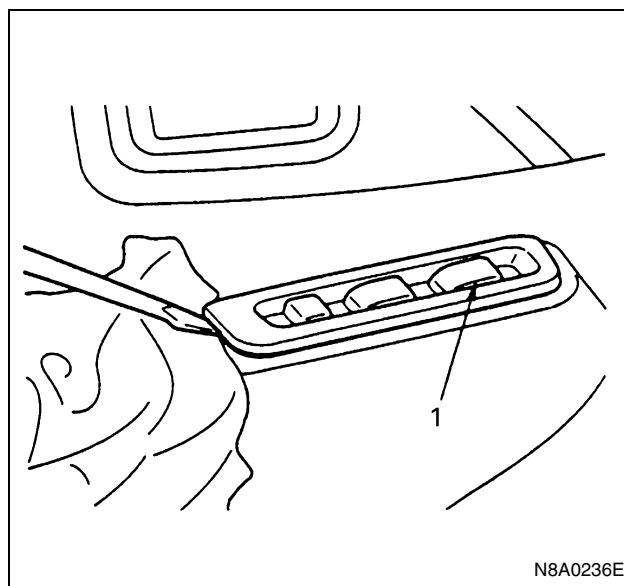
N8A0235E

Removal

Preparation:

Disconnect the battery ground cable.

1. Switch
 - 1) Insert the screw driver to the cut off portion to remove the switch.
 - 2) Disconnect the connector.



N8A0236E

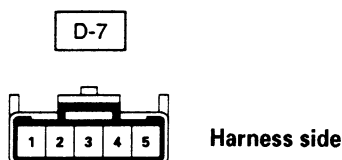
Installation

To install, follow the removal steps in the reverse order.

Power Window Switch-passenger Side

Circuit Inspection

Disconnect the switch connectors to check the voltage and the continuity between the harness side connector terminals.



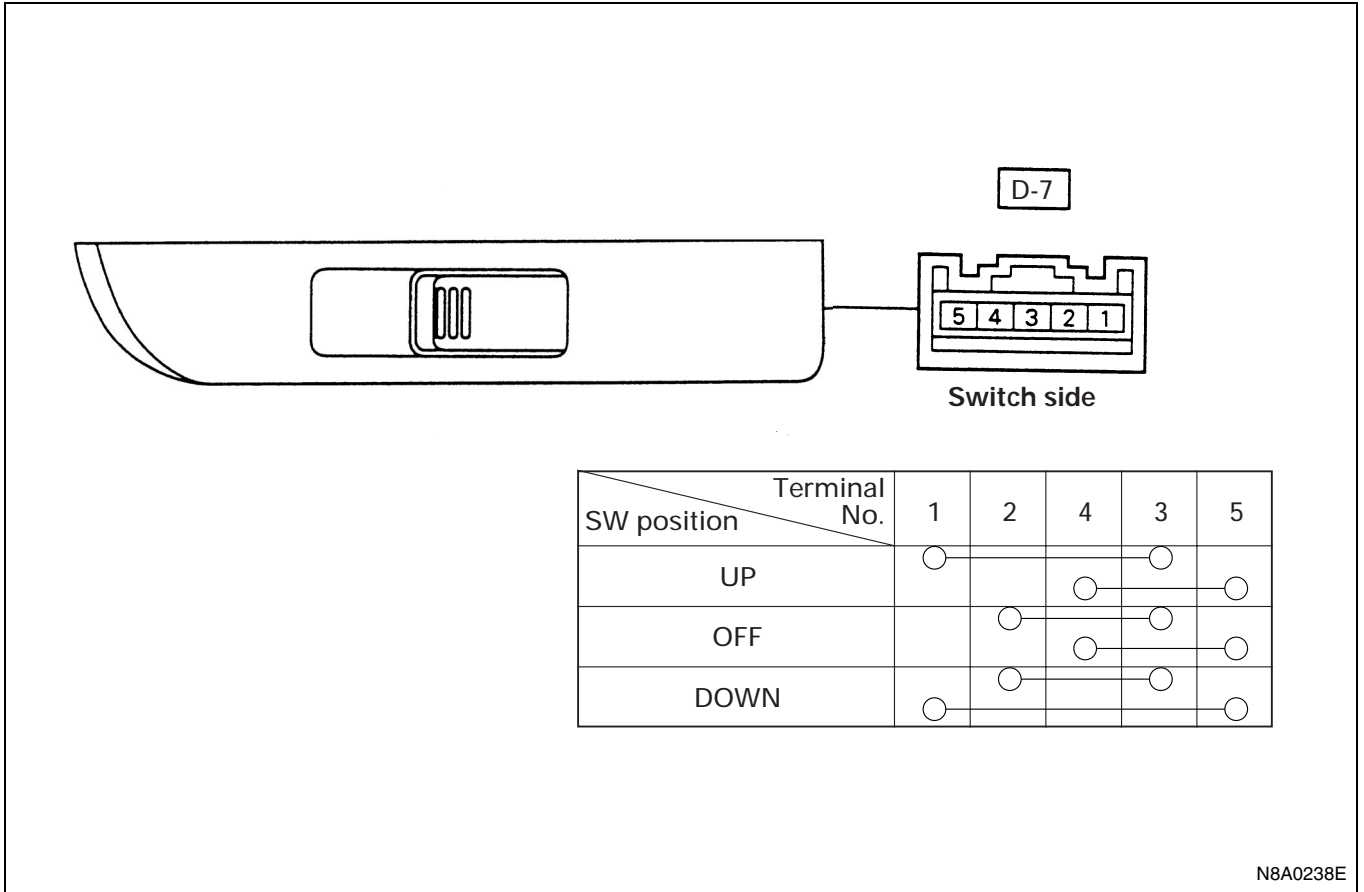
Terminal No.	Wire color	Connected to	Item to be checked	Connecting terminal	Checking conditions	Standard
1	L/B	Power window relay	Voltage	1-Ground	· Turn "ON" the starter SW	Battery voltage
2	R/Y	Driver side SW	Continuity (Resistance)	2-Ground	· Turn "OFF" the passenger side SW at the driver side SW	Continuity
			Voltage	2-Ground	· Turn "ON" the starter SW · Turn to "UP" the passenger side SW at the driver side SW	Battery voltage
3	L/Y	Passenger side motor	Continuity (Resistance)	3-5	-	Continuity
4	G/Y	Driver side SW	Continuity (Resistance)	4-Ground	· Turn "OFF" the passenger side SW at the driver side SW	Continuity
			Voltage	4-Ground	· Turn "ON" the starter SW · Turn to "DOWN" the passenger side SW at the driver side SW	Battery voltage
5	BR/Y	Passenger side motor	Continuity (Resistance)	5-3	-	Continuity

N8A5280E

Inspection

Check the continuity between the connector terminals of the switch.

Repair or replace the switch when the result of inspection is found abnormal.

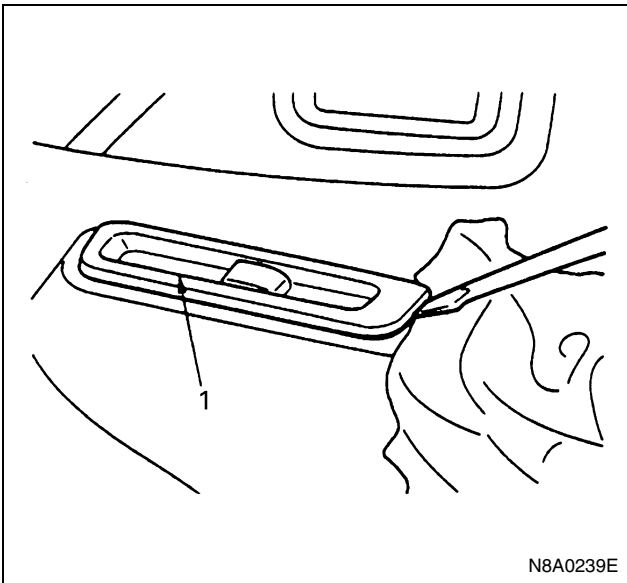


Removal

Preparation:

Disconnect the battery ground cable.

1. Switch
 - 1) Insert the screw driver to the cut off portion to remove the switch.
 - 2) Disconnect the connector.



Driver Seat Side Power Window Motor

Inspection

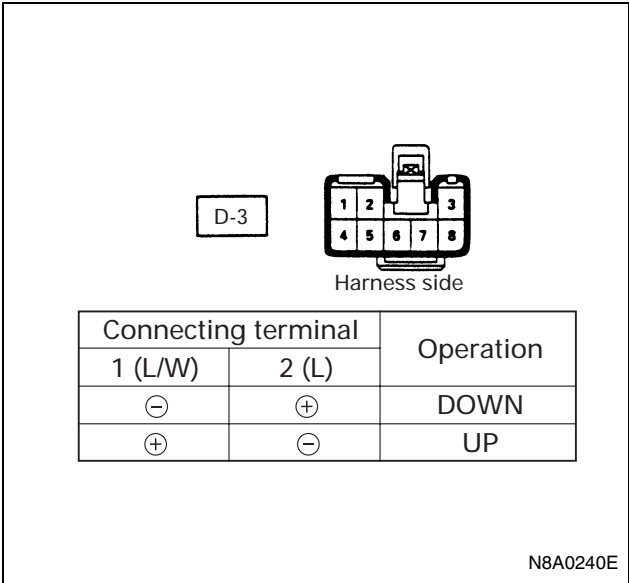
Before checking to see if the motor functions correctly, be sure to check the circuit through the connector **D-3** of the driver's power window switch.

If the motor does not operate smoothly, either the motor or the circuit between the switch and the motor is defective.

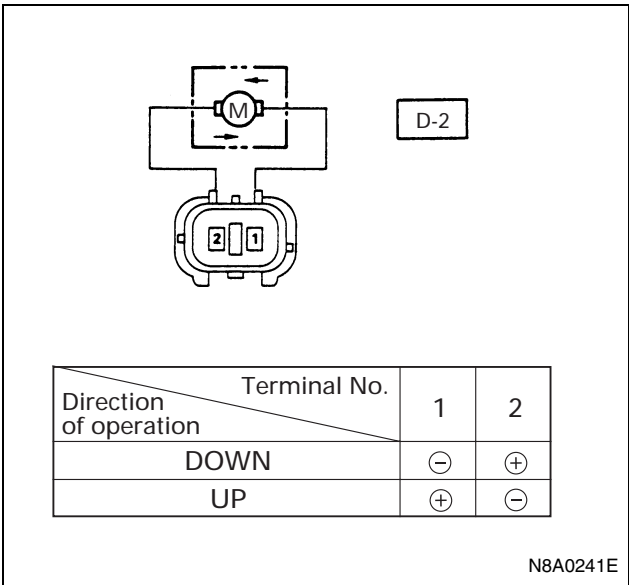
1. Circuit inspection of the driver side window switch
Disconnect the switch connector and apply battery voltage to the harness side connector terminals to check its function.

Installation

To install, follow the removal steps in the reverse order.



2. Inspection of the driver seat side motor
Remove the motor connector and apply battery voltage to the motor side connector terminals to check its function.
Replace the motor when the result of inspection is found abnormal.

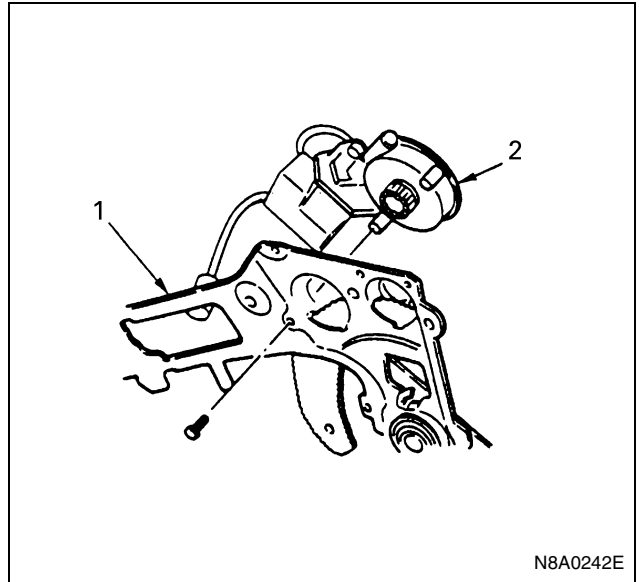


Removal

Preparation:

Disconnect the battery ground cable.

1. Window Regulator Assembly
Refer to Section 2 for Window Regulator and Glass.
2. Power Window Motor
Remove three screws.



Installation

To install, follow the removal steps in the reverse order.

Front Passenger Seat Side Power Window Motor

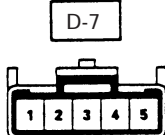
Inspection

Before checking to see if the motor functions correctly, be sure to check the circuit through the front passenger's switch connector **D-7** and the driver's power window switch connector **D-3**.

If the motor does not operate smoothly, either the motor or the circuit between the switch and the motor is defective.

1. Circuit inspection of the front passenger seat side window

Disconnect the switch connector and apply battery voltage to the harness side connector terminals to check its function.

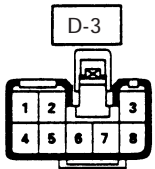


Harness side

Connecting terminal		Direction of operation
3 (L/Y)	5 (BR/Y)	
⊖	⊕	DOWN
⊕	⊖	UP

N8A0243E

2. Circuit inspection of the driver seat side switch
- Disconnect the switch connector and apply battery voltage to the harness side connector terminals to check its function.



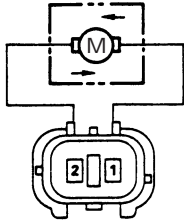
Harness side

Connecting terminal		Direction of operation
4 (G/Y)	5 (R/Y)	
⊕	⊖	DOWN
⊖	⊕	UP

N8A0244E

3. Inspection of the front passenger window motor
- Disconnect the motor connector and apply battery voltage to the motor side connector terminals to check its function.

Repair or replace the motor when the result of inspection is found abnormal.



D-6

Direction of operation	Terminal No.	
	1	2
DOWN	⊖	⊕
UP	⊕	⊖

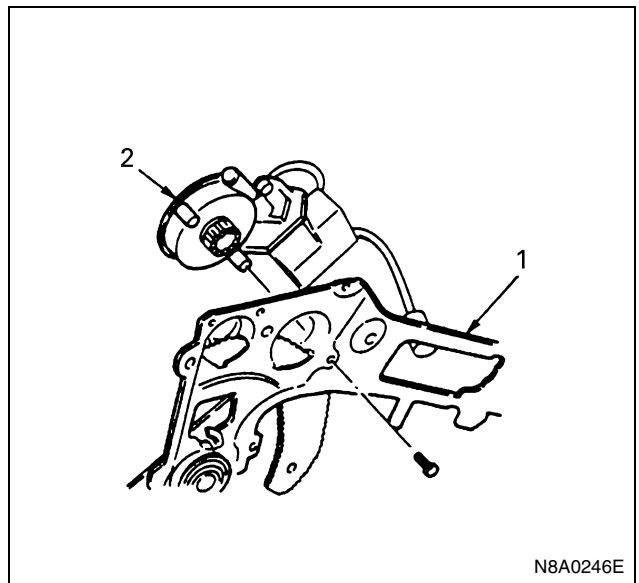
N8A0245E

Removal

Preparation:

Disconnect the battery ground cable.

1. Window Regulator Assembly
Refer to Section 2 for Window Regulator and Glass.
2. Power Window Motor
Remove three screws.



Installation

To install, follow the removal steps in the reverse order.

Windshield Wiper and Washer

General Description

The circuit consists of the starter switch, windshield wiper & washer switch, wiper motor, washer motor and the intermittent relay.

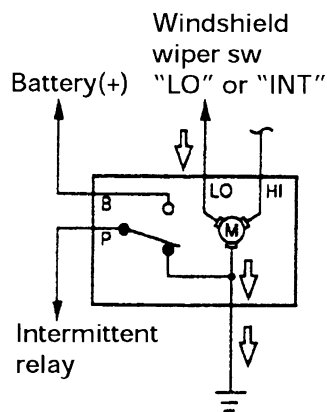
When the wiper & washer switch is turned on with starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.

The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The intermittent relay is used to control motion of the wiper.

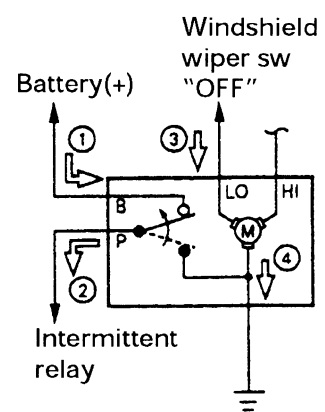
Operation of Windshield Wiper Motor

(When wiper "LO" or "INT" position)

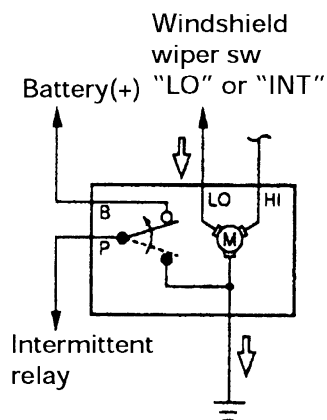
1. Condition of wiper switch is "LO" or "INT" position (Wiper motor is starting to operate)



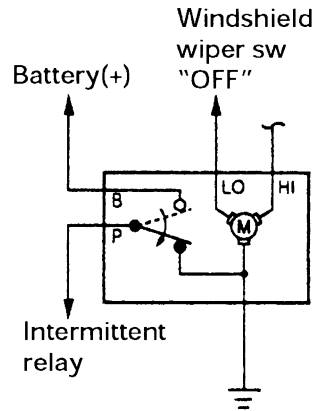
3. Condition of wiper switch is just "OFF" (Wiper motor is still operating until auto-stop position)



2. Condition of wiper motor is operating



4. Wiper motor stops at auto-stop position

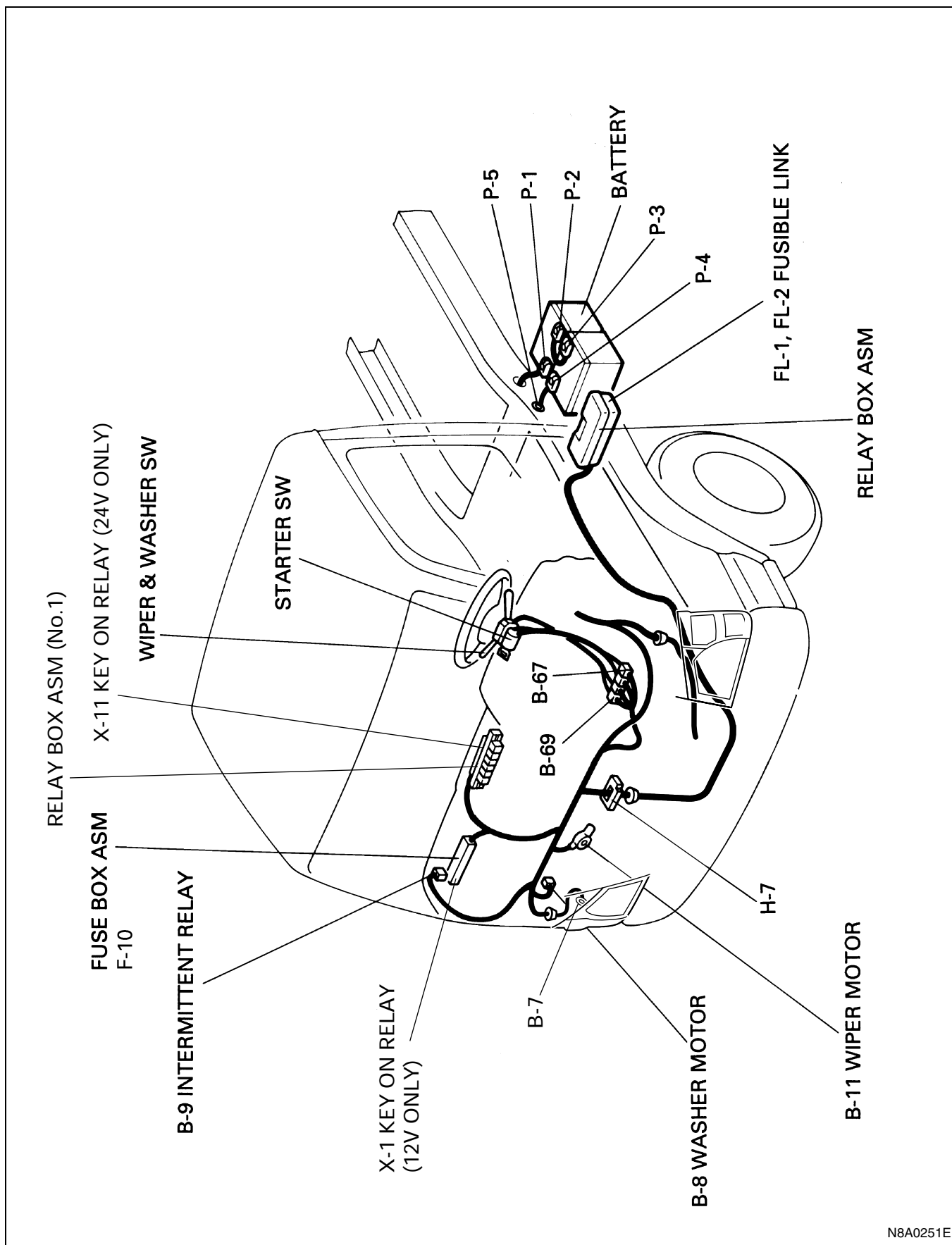


N8A0250E

Notice:

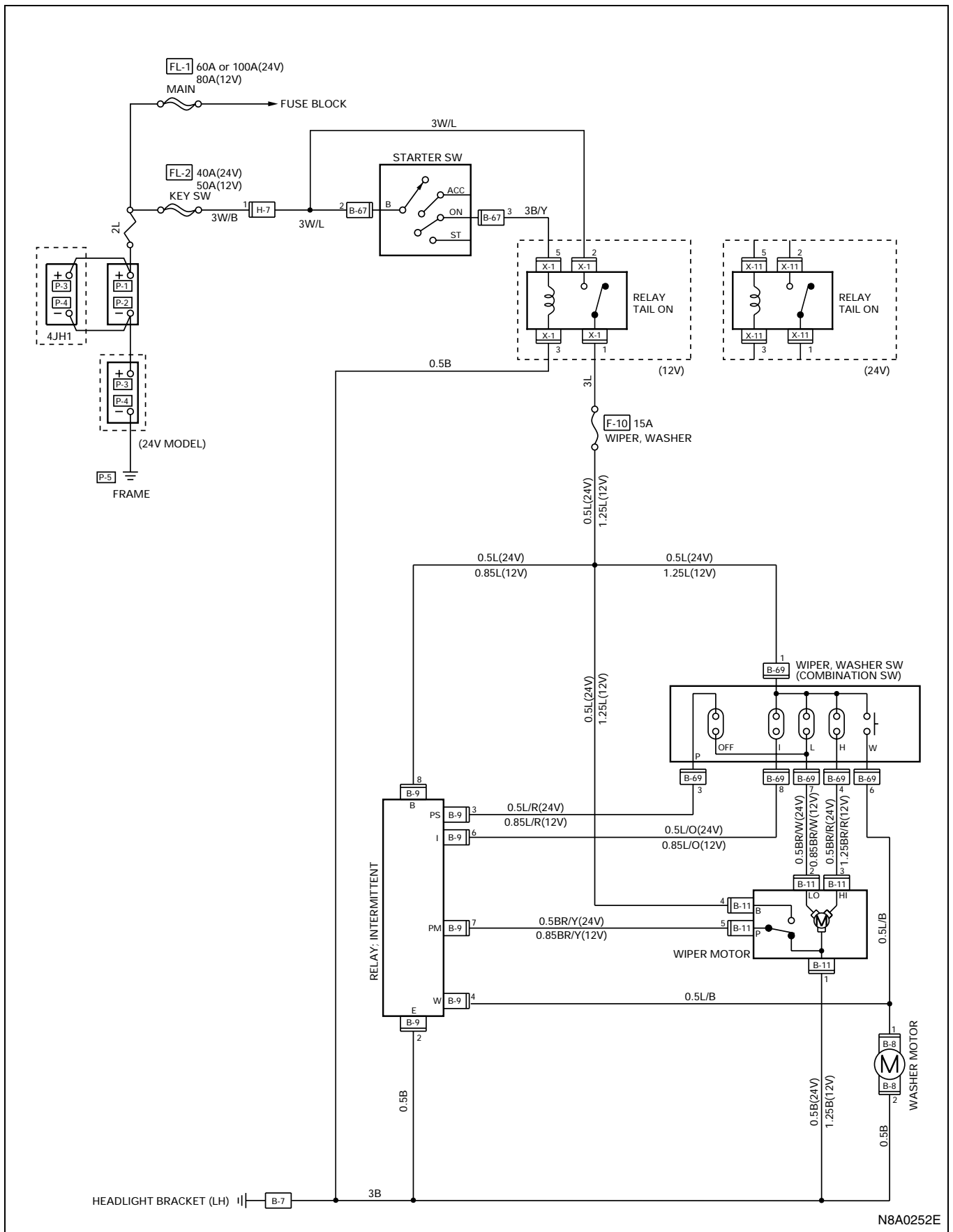
Arrow marks indicate the direction of current.

Parts Location




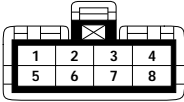
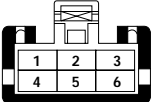
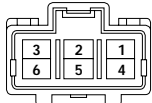
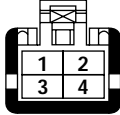

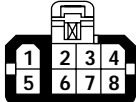
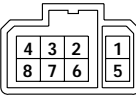
N8A0251E


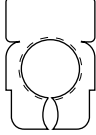
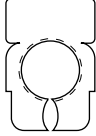
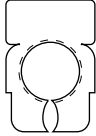
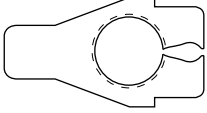
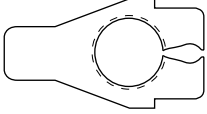

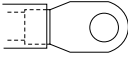
Circuit Diagram

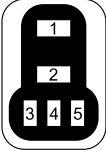
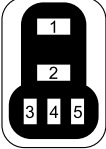


N8A0252E

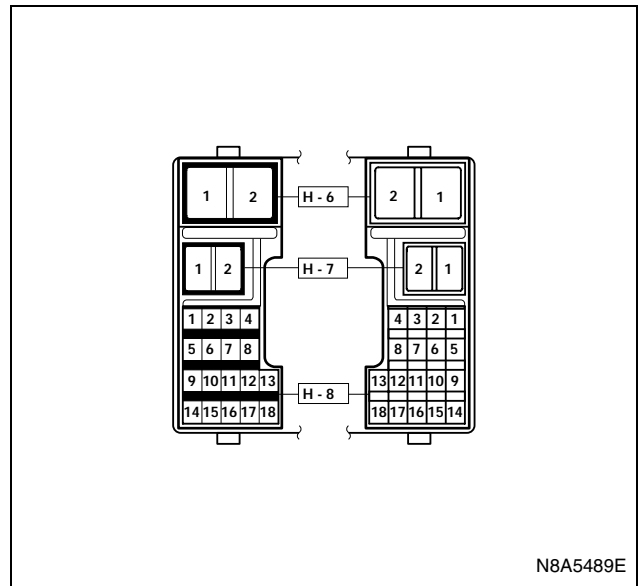
Connector List

No.	Connector Face
B-8	 002-009
B-9	 008-012
B-11	 006-001
B-11	 006-016
B-67	 004-001
B-67	 004-002
B-69	 008-001
B-69	 008-002

No.	Connector Face
P-1 (12V)	 000-003
P-2	 000-004
P-1 (24V)	 000-004
P-4	 000-004
P-2 (24V)	 000-006
P-3	 000-006
P-5 (12V)	 000-007
P-5 (24V)	 000-002

No.	Connector Face
X-1	 005-006
X-11	 005-006

H-7



Diagnosis

Quick Chart for Check Point

1. Windshield Wiper and Washer

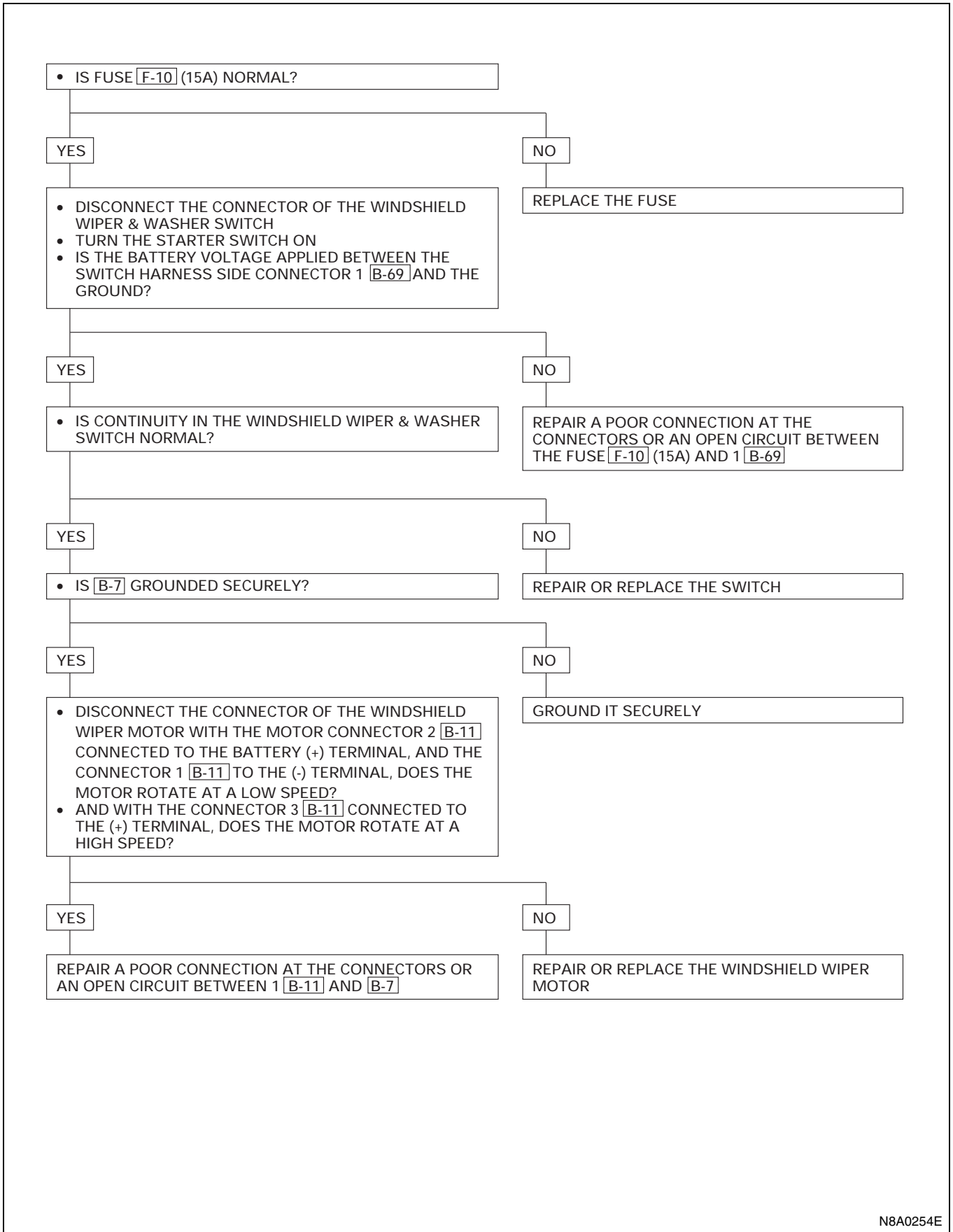
		Check point					
		Fuse F-10 (15A)	Wiper & washer SW	Intermittent relay	Wiper motor	Washer motor	Cable harness
Trouble mode	1. Windshield wiper does not operate at any switch position	○ (1)	○ (3)		○ (4)		○ (2)
	2. Windshield wiper does not operate at "INT" position		○ (1)	○ (3)			○ (2)
	3. Windshield wiper does not operate at "LO" position		○ (1)		○ (3)		○ (2)
	4. Windshield wiper does not operate at "HI" position		○ (1)		○ (2)		○ (3)
	5. Auto-stop function of the windshield wiper motor does not operate		○ (1)	○ (4)	○ (2)		○ (3)
	6. Rotation of the windshield wiper motor does not stop		○ (1)		○ (2)		
	7. Windshield washer motor does not operate		○ (1)			○ (3)	○ (2)

Notice:

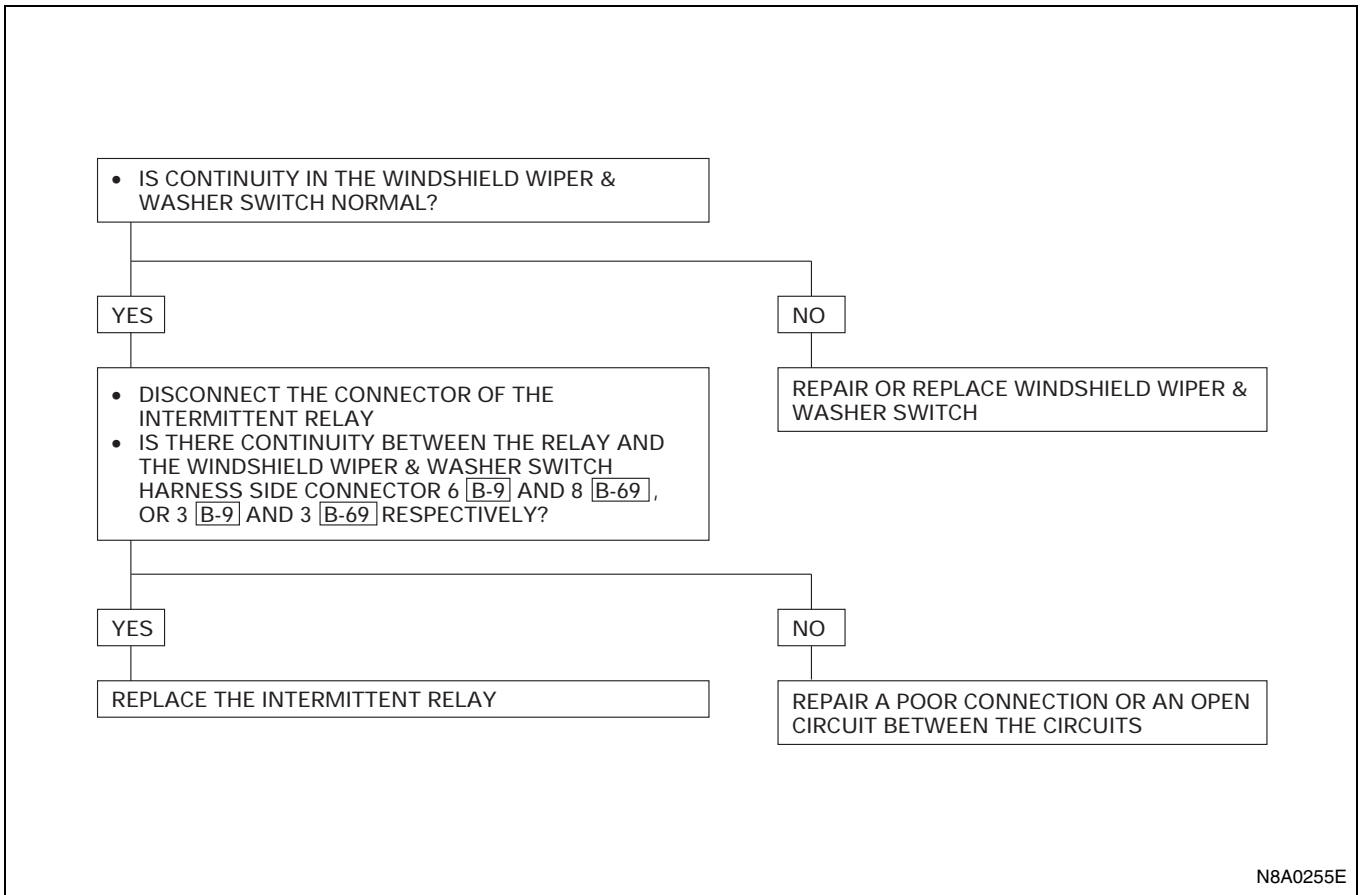
Figure in parenthesis "()" indicates the order of inspection.

1. Windshield Wiper and Washer

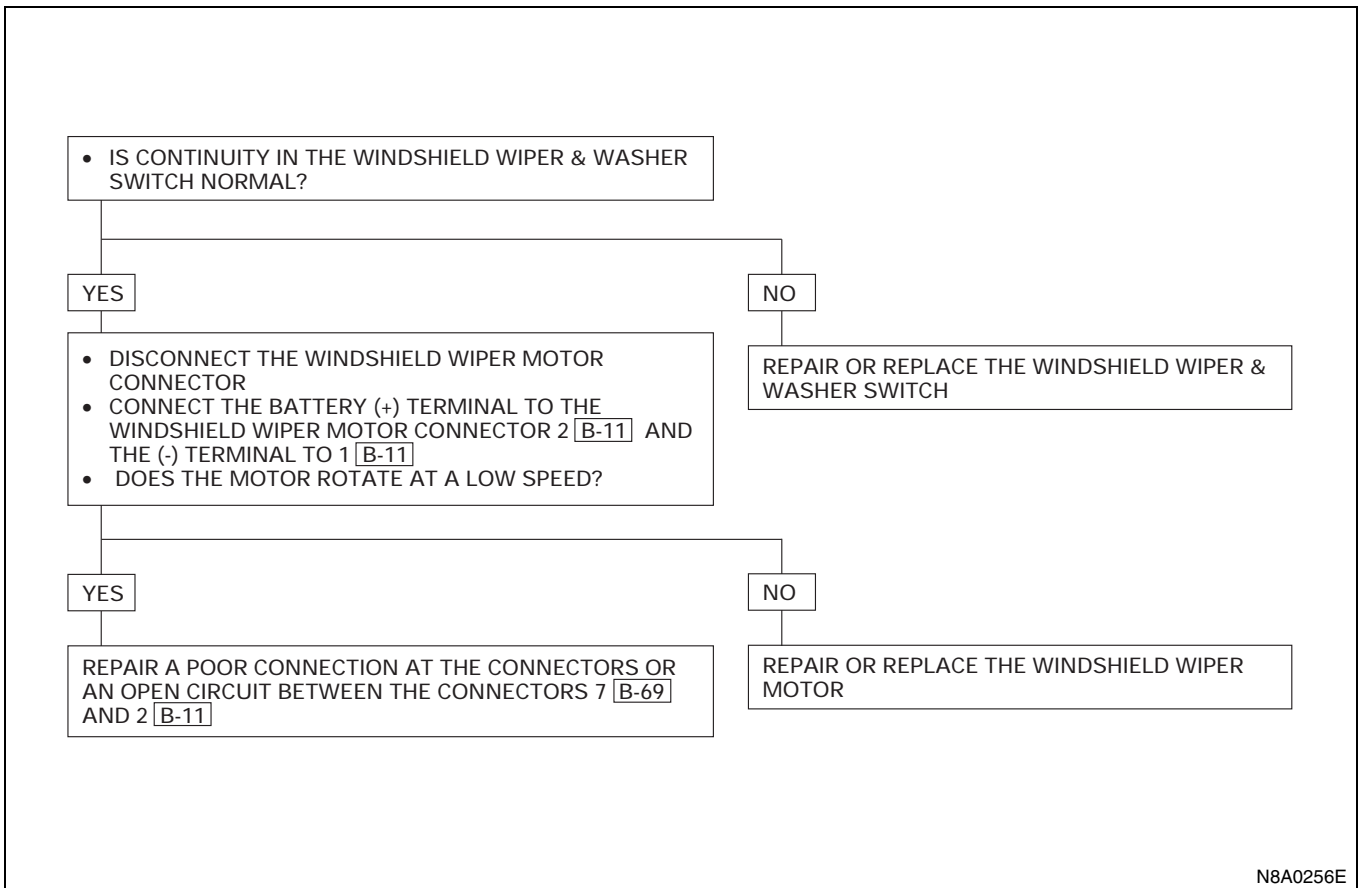
1-1. Windshield Wiper Does Not Operate at Any Switch Position



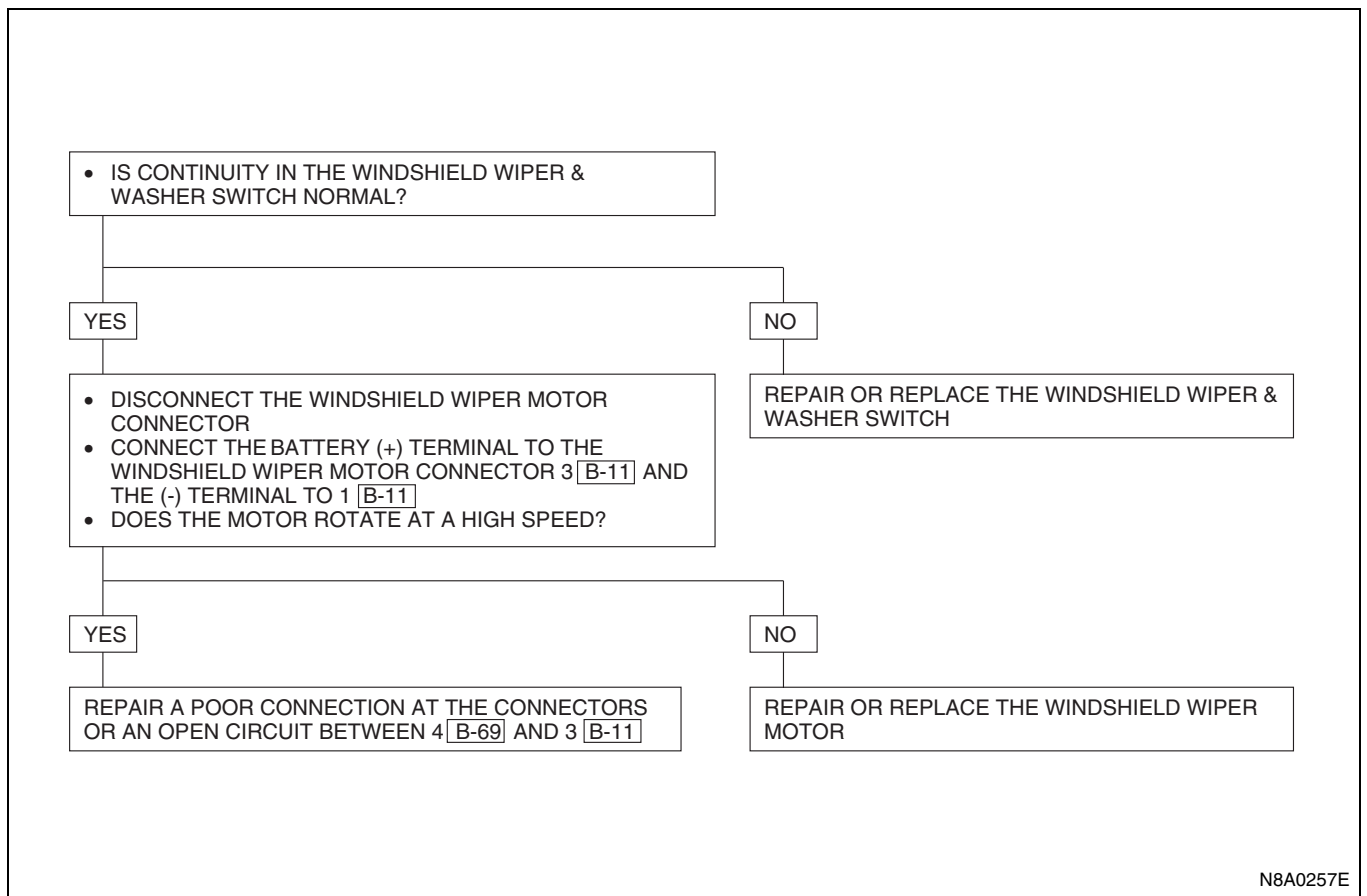
1-2. Windshield Wiper Does Not Operate at “INT” Position



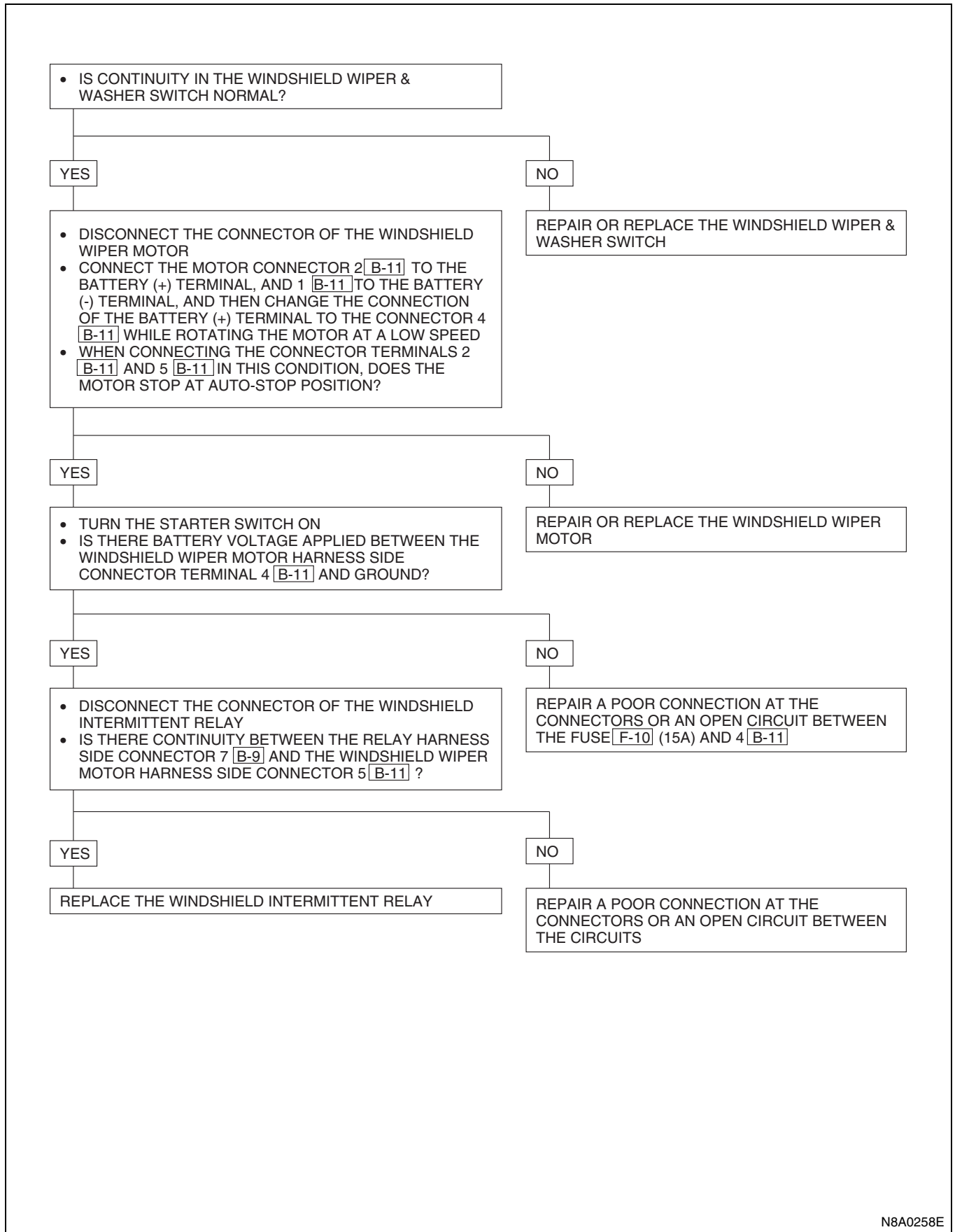
1-3. Windshield Wiper Does Not Operate at “LO” Position



1-4. Windshield Wiper Does Not Operate at "HI" Position

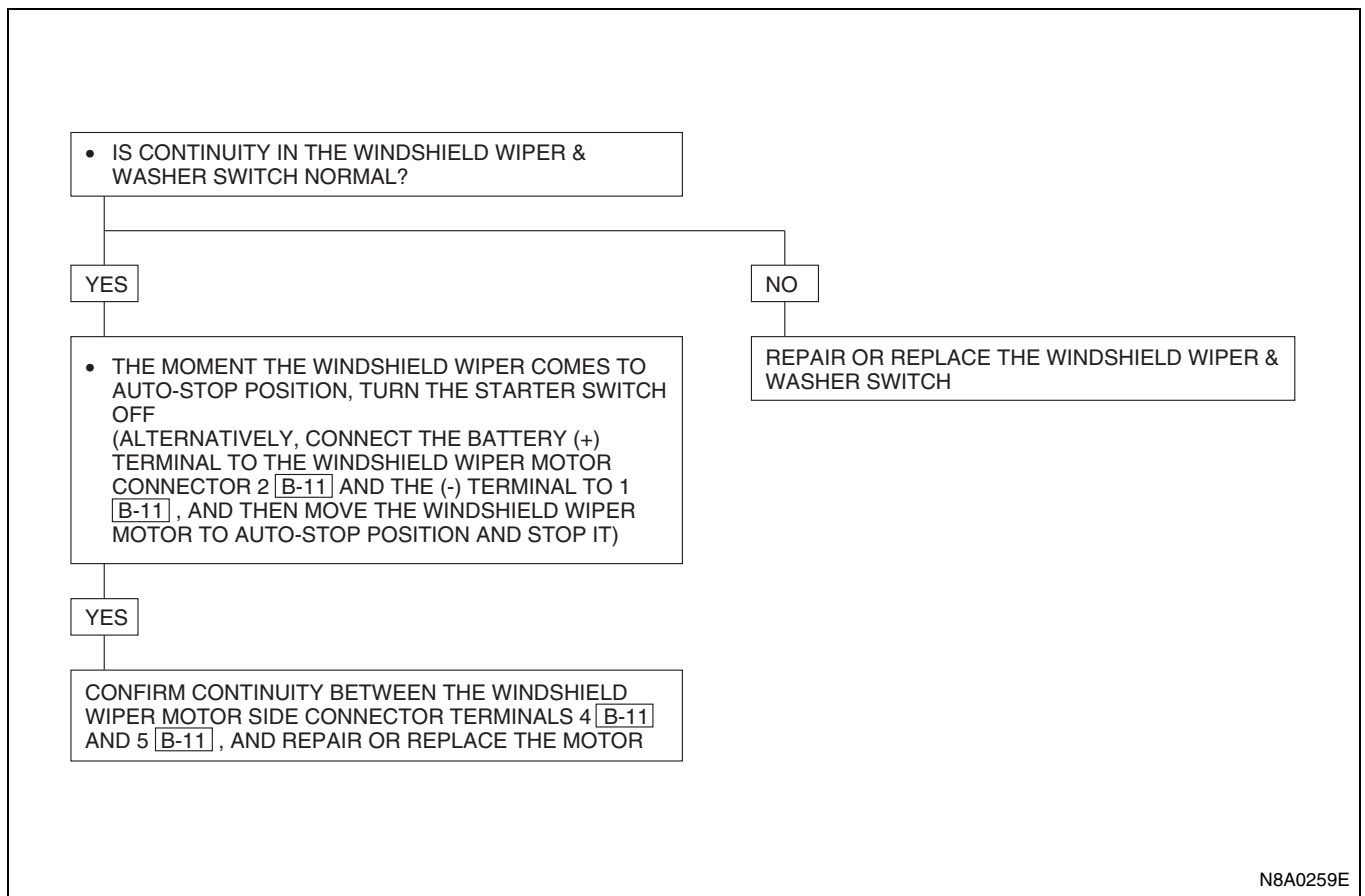


1-5. Auto-stop Function of the Windshield Wiper Motor Does Not Operate

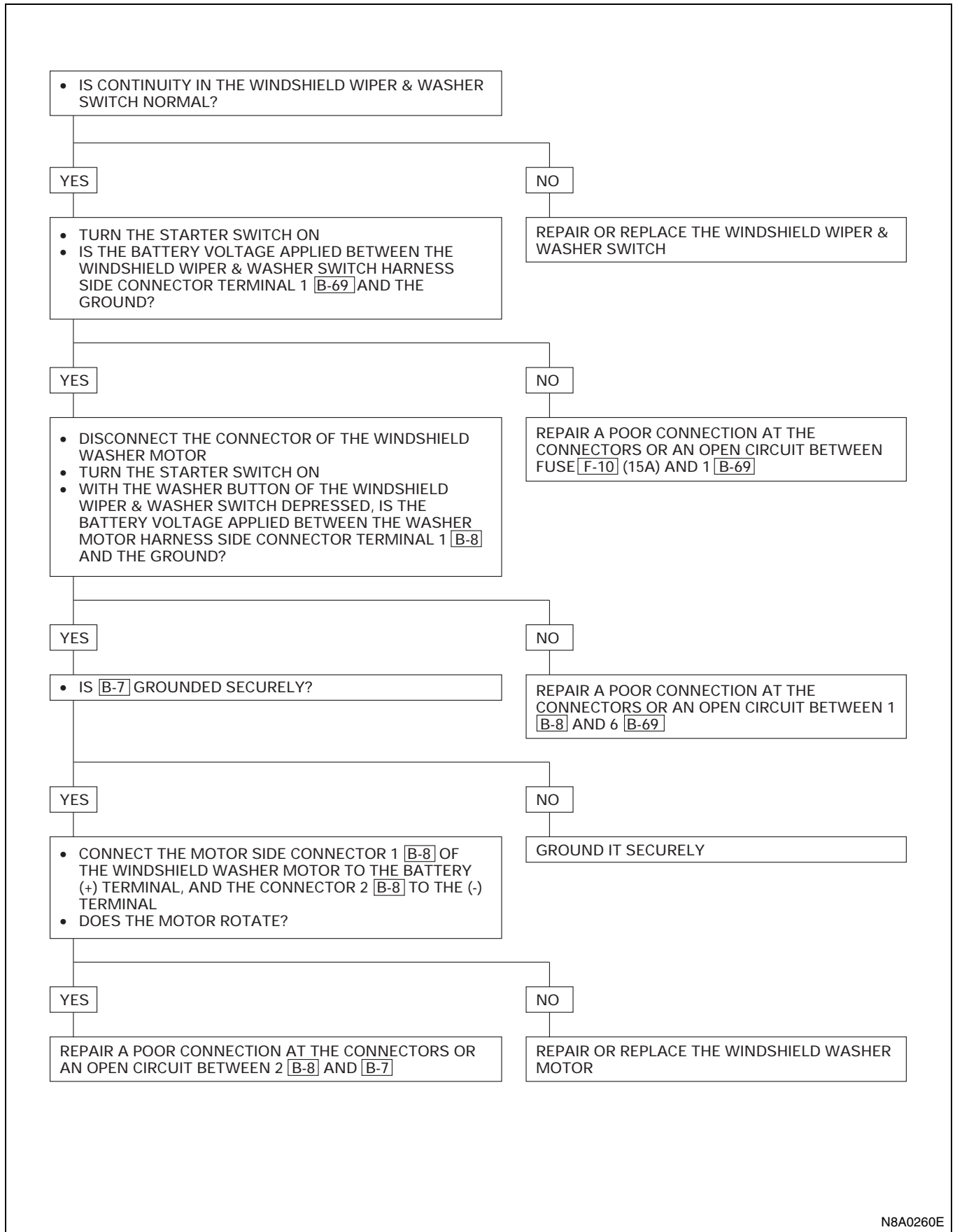


N8A0258E

1-6. Rotation of the Windshield Wiper Motor Does Not Stop



1-7. Windshield Washer Motor Does Not Operate



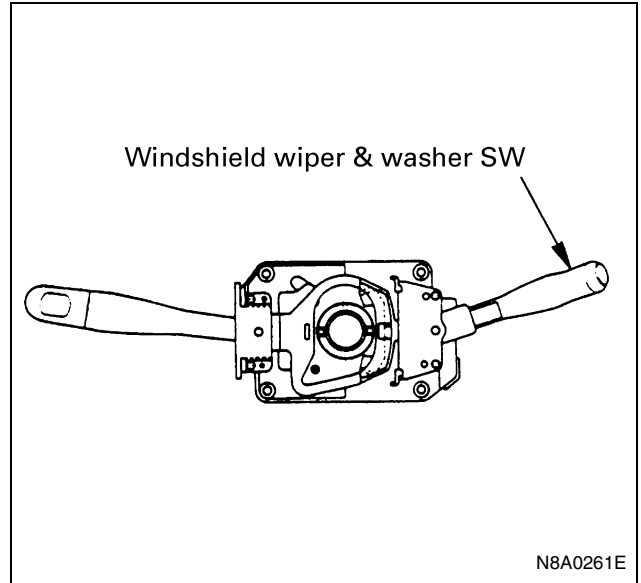
N8A0260E

Starter Switch

Refer to “START AND CHARGING” in this section.

Windshield Wiper & Washer Switch

With the starter switch on, the windshield wiper and washer switch controls the start and stop operation as well as the change of operating speeds. Both the windshield washer motor and the wiper motor jointly operate while the washer button is pushed.



Inspection

Check the continuity between the connector terminals of the switch.
Repair or replace the switch when the result of inspection is found abnormal.

B-69

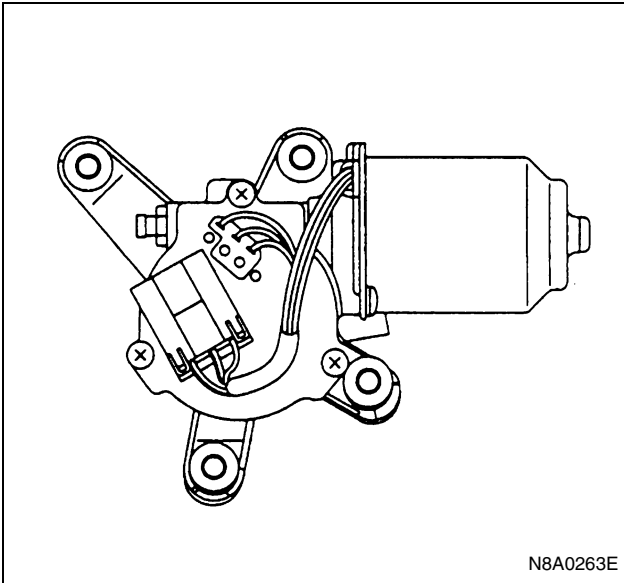
Switch side

Washer SW	Wiper SW	Terminal No.					
		3	7	1	4	8	6
OFF	OFF	○	○				
	INT	○	○	○		○	
	LO		○	○			
	HI			○	○		
ON	MIST,OFF INT,LO,HI			○			○

Removal and Inspection

Refer to “HEADLIGHT, FOG LIGHT AND CORNERING LIGHT” in this section.

Windshield Wiper Motor



Inspection

1. Operation in low speed
With the motor connector terminal 2 [B-11] connected to the battery (+) terminal and the connector 1 [B-11] to the (-) terminal, check to see if the motor rotates in low speed.
2. Operation in high speed
With the motor connector terminal 3 [B-11] connected to the battery (+) terminal and the connector 1 [B-11] to the (-) terminal, check to see if the motor rotates in low speed.
3. Stop operation
After stopping the windshield wiper in the position on the way by confirming the operation at the low speed in item No. 1.
When the connectors 2 [B-11] and 5 [B-11] are connected, while connecting the motor connector terminal 4 [B-11] to the battery (+) terminal, check to see, if the motor rotates at low speed and stops at the auto-stop position.

Repair or replace the motor when the results of the above inspections are found abnormal.

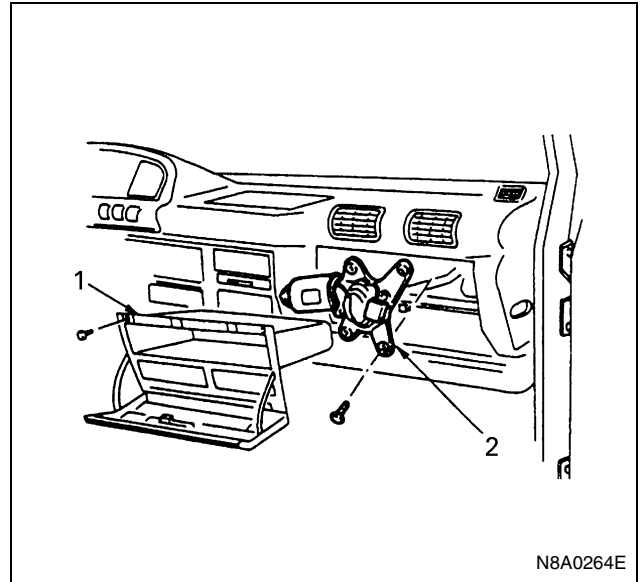
Removal

Preparation:

Disconnect the battery ground cable.

1. Glove Box
Refer to "INSTRUMENT PANEL" of section 2.

2. Windshield Wiper Motor
 - 1) Disconnect the connector.
 - 2) Remove four screws.
 - 3) Remove the ball joint between crank arm and wiper link.



Installation

To install, follow the removal steps in the reverse order, noting the following points.

- Windshield Wiper Motor
When the crank arm is removed from the windshield wiper motor, tighten the motor shaft nut with the specified torque.

Tighten:

Shaft nut to 17 N·m (170 kg·cm/147 lb·in)

- Temporarily fit the motor by using one of the four wiper motor fixing screws.
- Put the crank arm ball joint in the wiper link hole and fix them together while pulling the wiper link.

Windshield Washer Motor

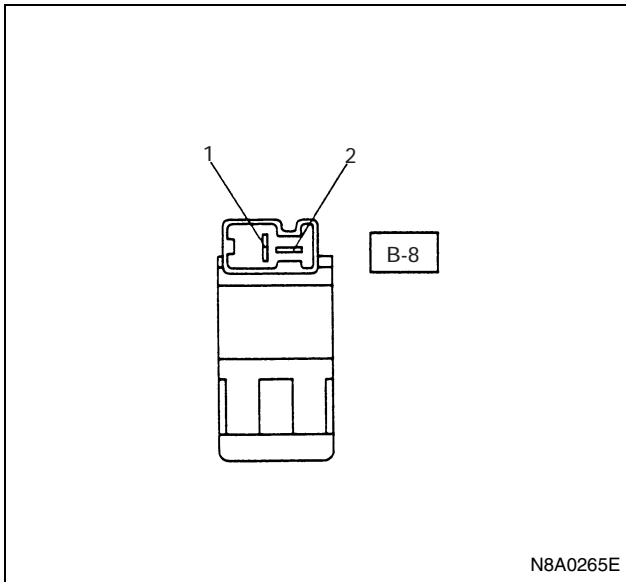
Inspection

With the battery (+) terminal connected to the washer motor connector terminal 1 B-8 and the (-) terminal to the connector 2 B-8, check to see if the cleaning fluid pushes out.

Replace the tank/motor when the result of inspection is found abnormal.

Installation

To install, follow the removal steps in the reverse order.

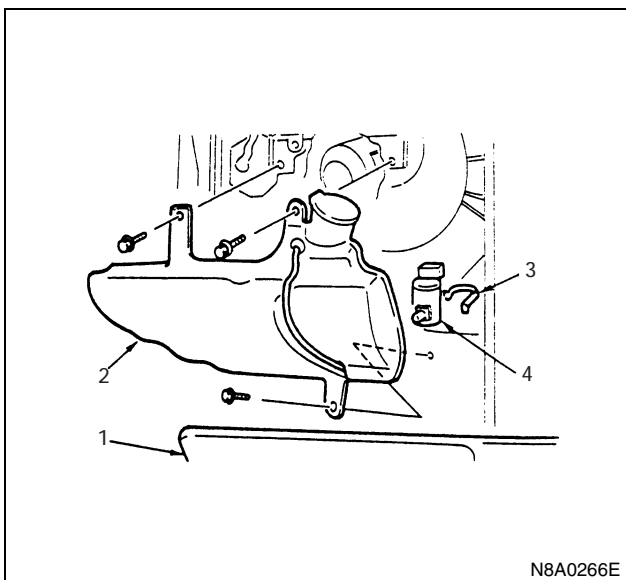


Removal

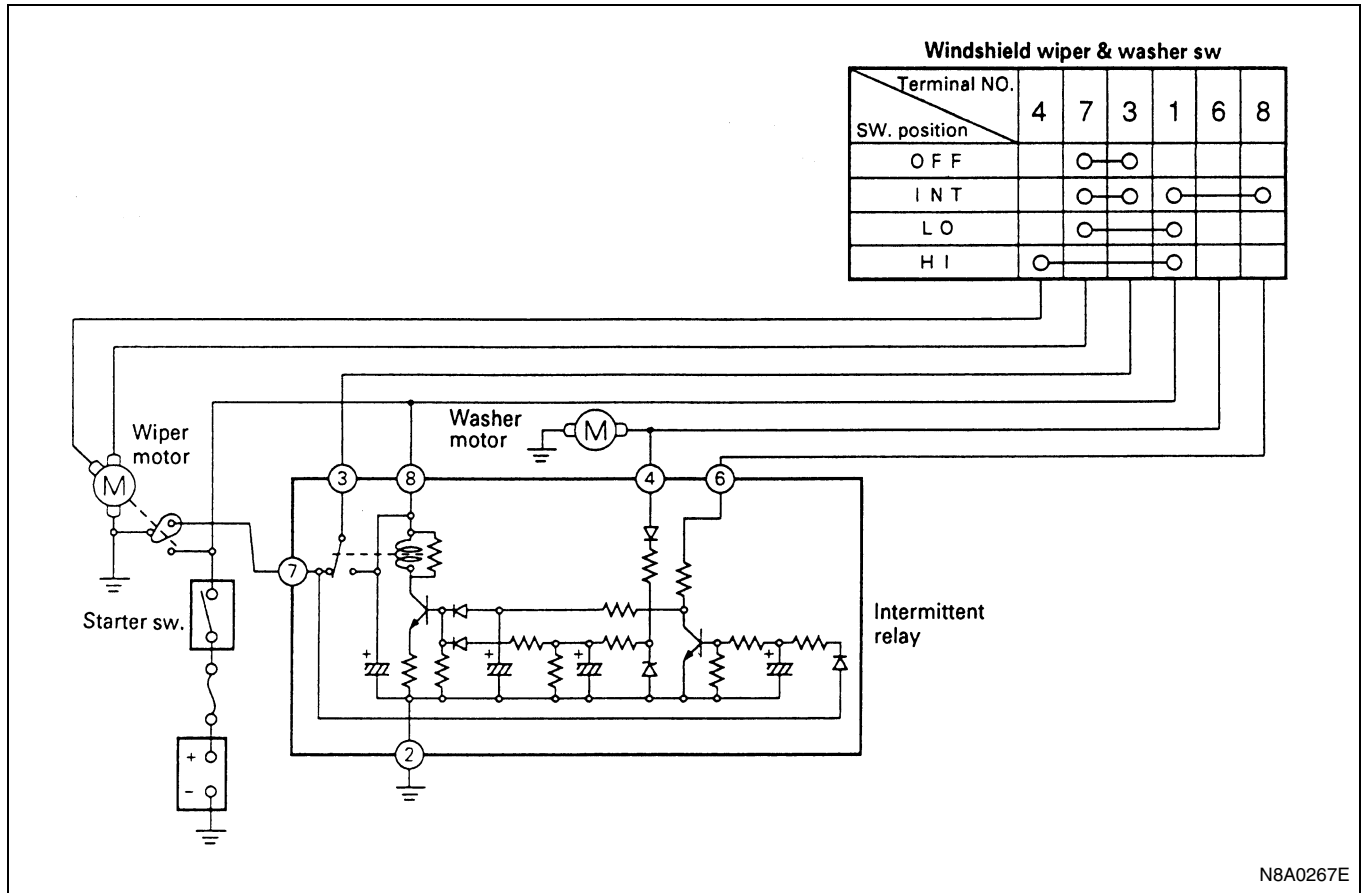
Preparation:

Disconnect the battery ground cable.

1. Instrument Panel Under Cover
Refer to "INSTRUMENT PANEL" of section 2.
2. Washer Tank
 - 1) Disconnect the washer motor connector.
 - 2) Disconnect the washer hose.
 - 3) Remove three fixing screws.
3. Clip Band
4. Windshield Washer Motor
Hold the motor and pull it out from the washer tank.



Intermittent Relay Circuit Diagram

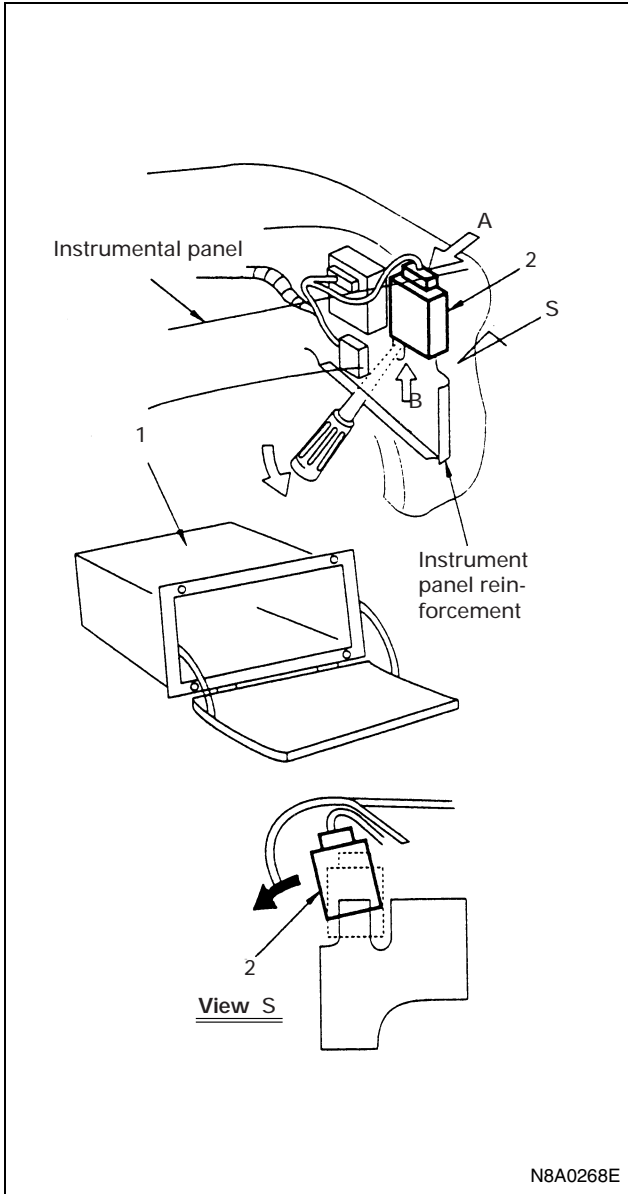


Removal

Preparation:

Disconnect the battery ground cable.

1. Glove Box
Open the lid and remove the four screws.
2. Intermittent Relay
 - 1) Press A position with your finger and pry up B position with the tip of a screw-driver.
 - 2) When the relay moves up by about 2/3 of its size, tilt and take off the relay to avoid interference with the instrument panel.
 - 3) Disconnect the connector.



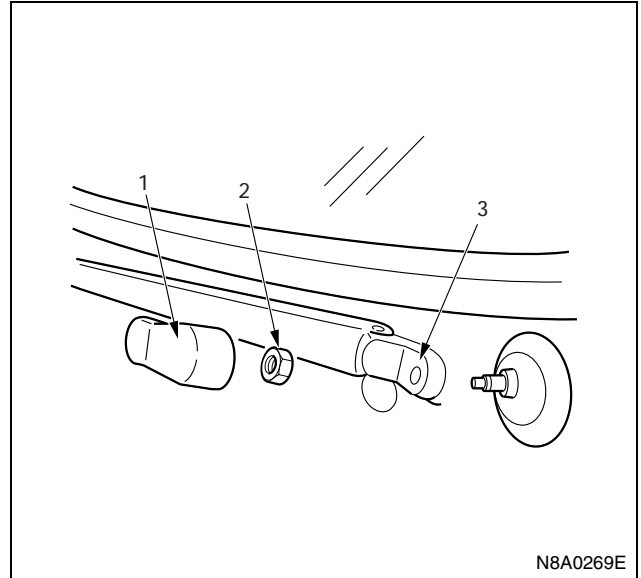
Installation

To install, follow the removal steps in the reverse order.

Windshield Wiper Arm & Blade

Removal

1. Cover
2. Wiper Arm Nut
3. Wiper Arm & Blade



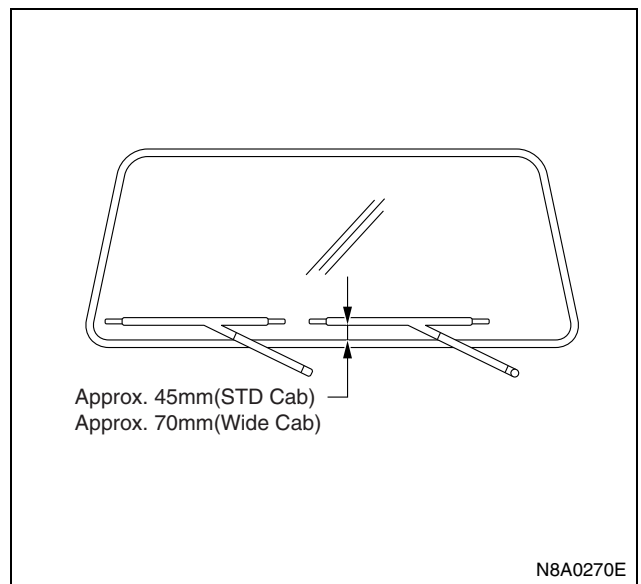
Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Before installing the wiper arm & blade to the shaft, confirm that the motor stops at the auto-stop position.
2. Set the wiper arm & blade so that the tips of both blades are positioned as shown in the illustration.
3. Tighten the wiper arm nut to the specified torque.

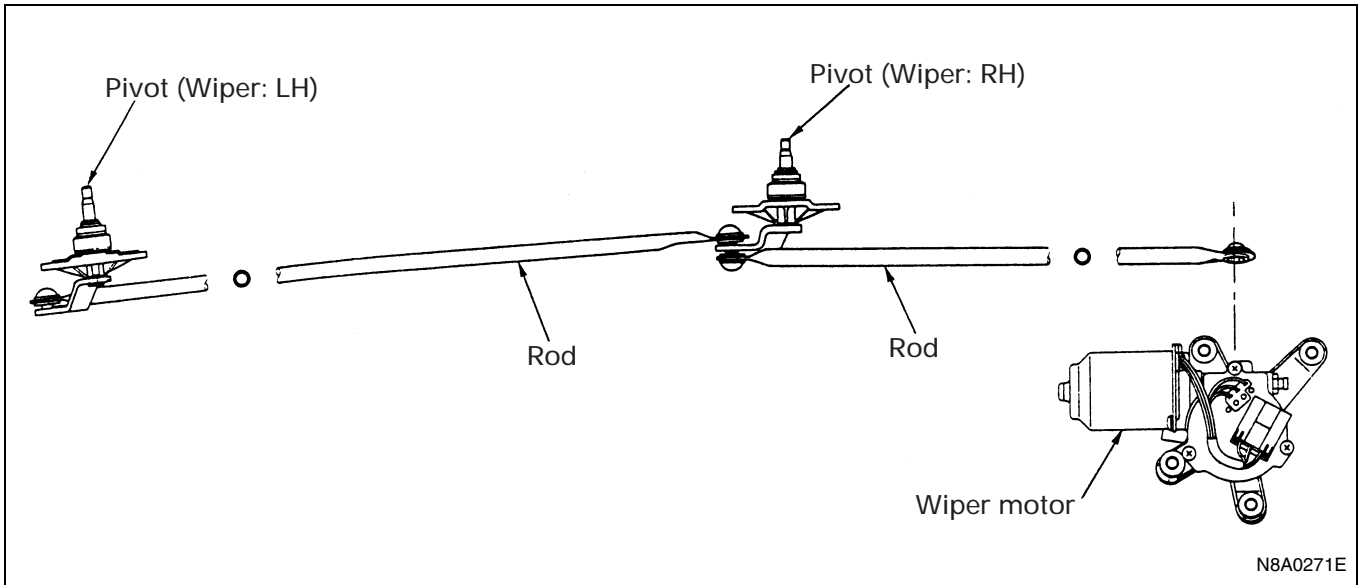
Tighten:

Wiper arm nut to 17 N·m (170 kg·cm/147 lb·in)



Windshield Wiper Linkage

Location of Rod and Pivot

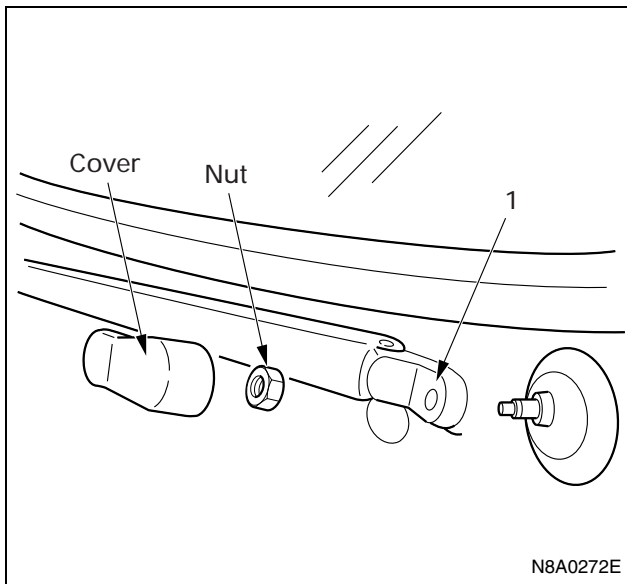


Removal

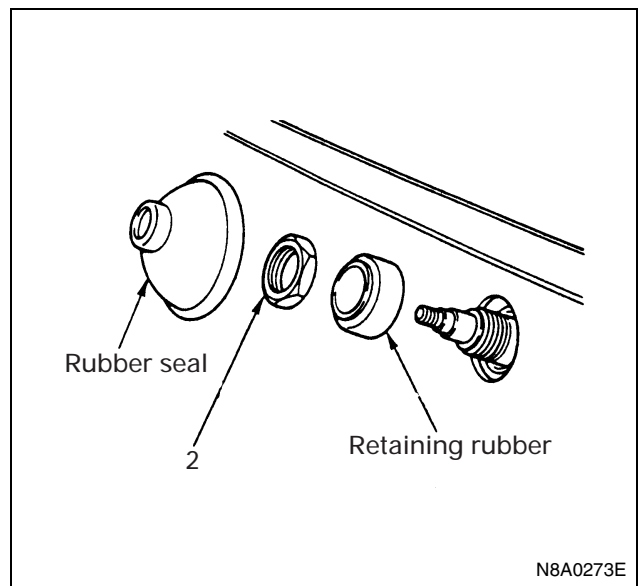
Preparation:

Disconnect the battery ground cable.

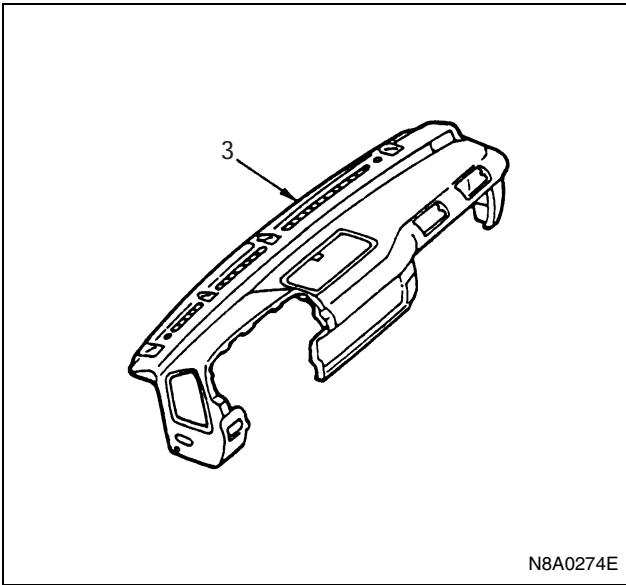
1. Wiper Arm & Blade
Remove the cover, nut and wiper arm & blade.



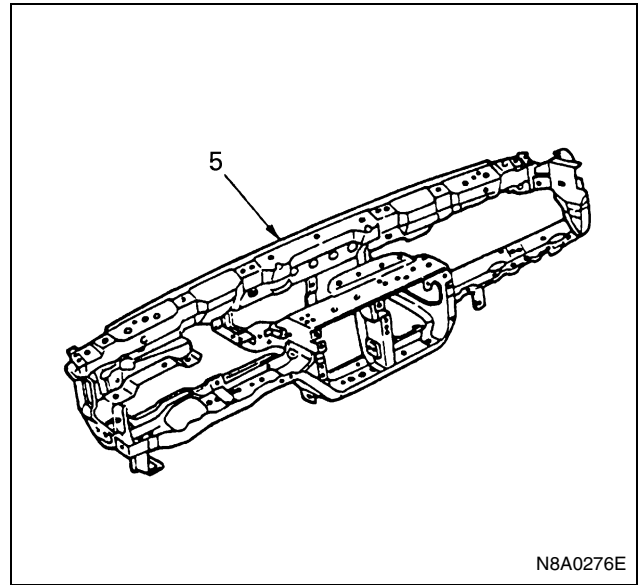
2. Pivot Nut
Remove the rubber seal, nut and retaining rubber.



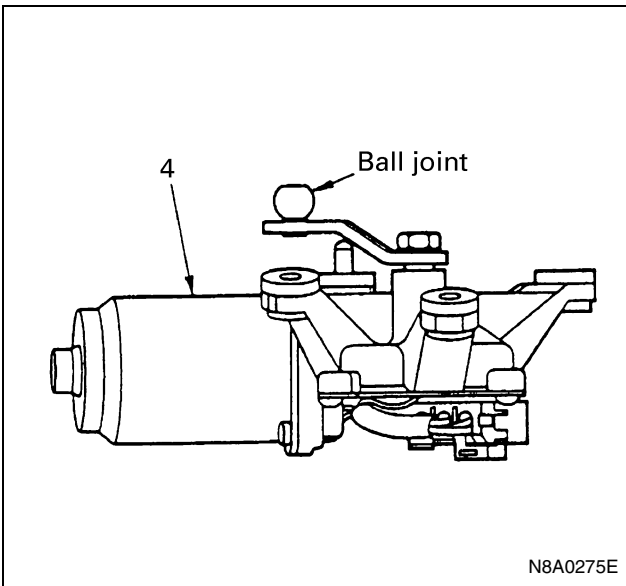
3. Instrument Panel Assembly
Refer to "INSTRUMENT PANEL" of section 2.



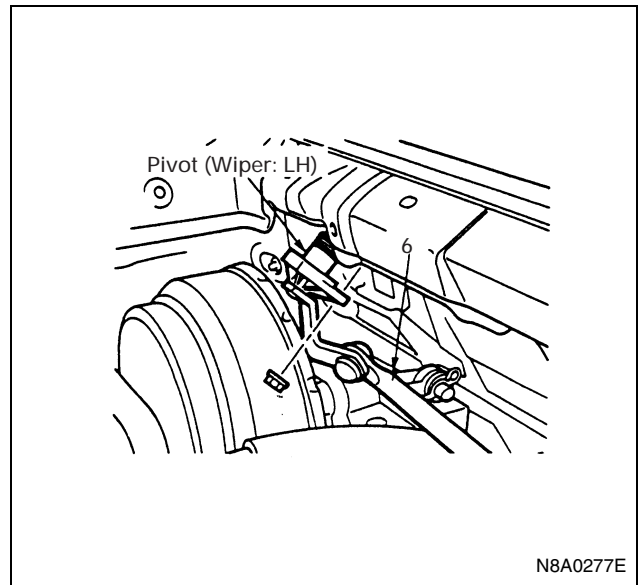
5. Instrument Panel Reinforcement
Refer to "INSTRUMENT PANEL" of section 2.



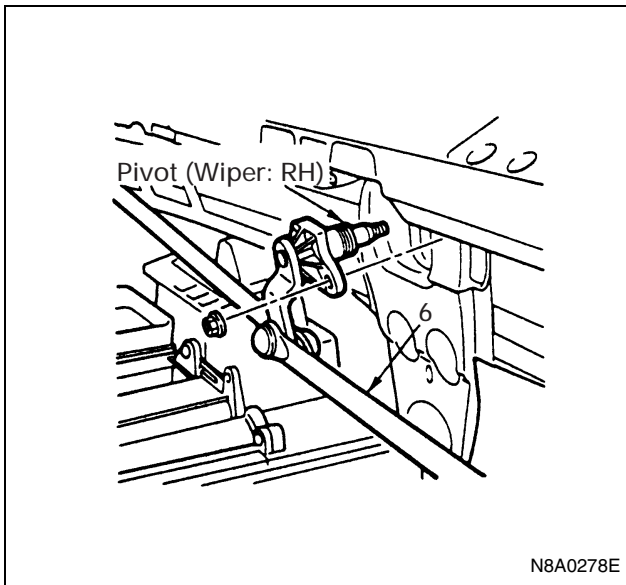
4. Wiper Motor
1) Remove the four screws.
2) Disconnect the ball joint between the crank arm and the wiper link.



6. Wiper Link Assembly
Remove two retaining nuts from left hand side of pivot.



Remove two retaining nuts from right hand side of pivot.



Installation

To install, follow the removal steps in the reverse order, noting the following points.

- Temporarily fit the wiper motor by using one of the four wiper motor fixing screws.
- Put the crank arm ball joint in the wiper link hole and fix them together while pulling the wiper link.
- Fit the motor with four screws.
- Tighten the pivot nut with the specified torque.

Tighten:

Pivot nut to 8 N·m (80 kg·cm/70 lb·in)

- Tighten the wiper arm nut with the specified torque.

Tighten:

Wiper arm nut to 17 N·m (170 kg·cm/147 lb·in)

Wiper Blade Rubber

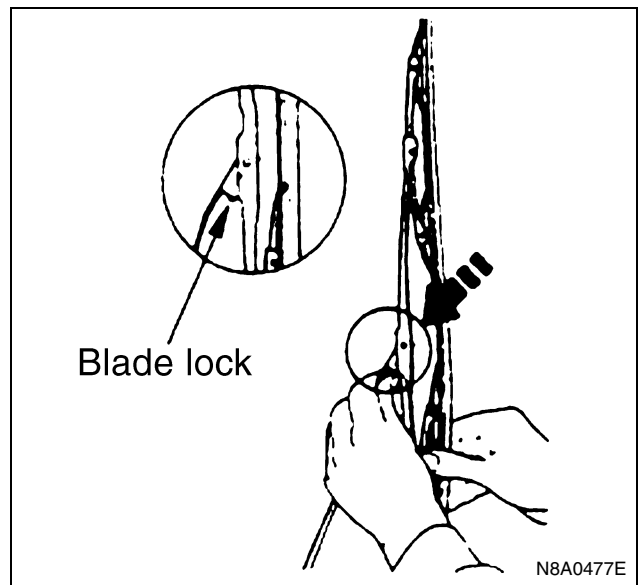
Removal

1. Wiper Blade

Push the wiper blade lock while pulling the wiper blade in the arrow direction.

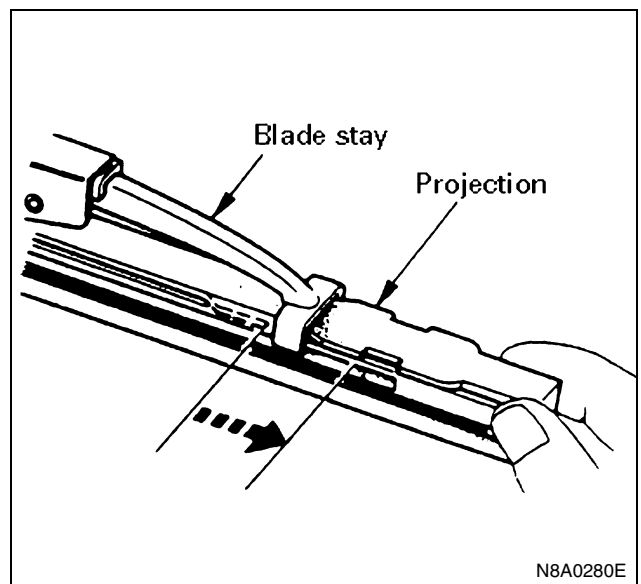
Notice:

When the wiper blade has been removed, wrap the tip of the wiper arm with cloth, to avoid damaging the glass.



2. Wiper Blade Rubber

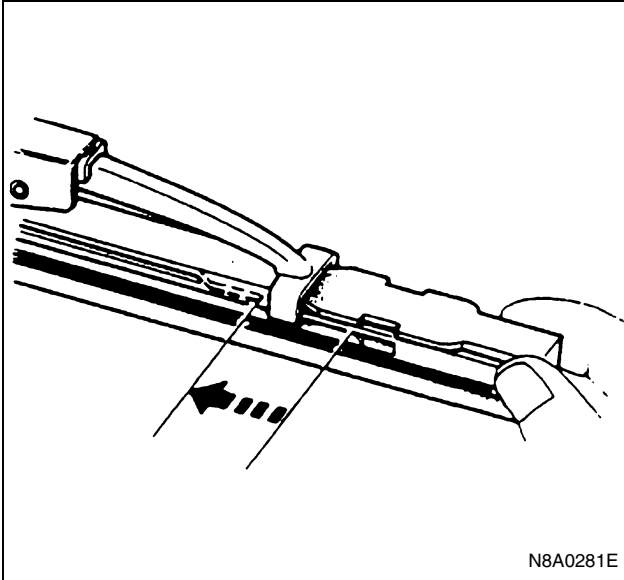
- 1) Pull the end of rubber and remove the projection from the click of the blade stay.
- 2) Pull the rubber out in the same direction.



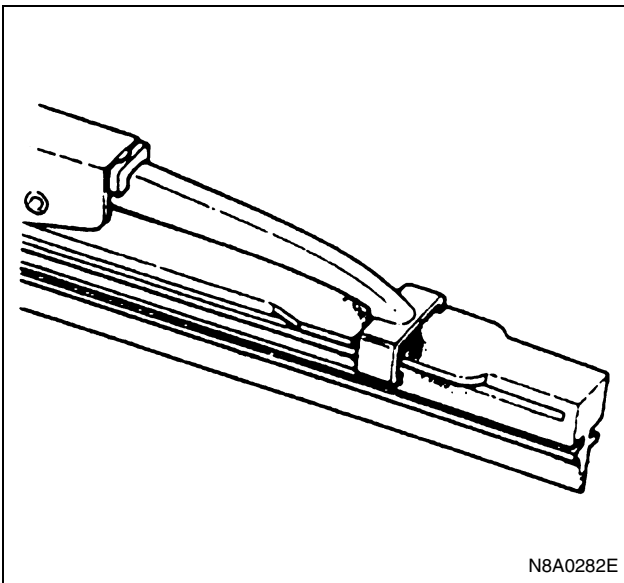
Installation

1. Wiper Blade Rubber

Install the click of the blade stay in the groove of the new rubber and slide it in. Complete installation by pushing the click.

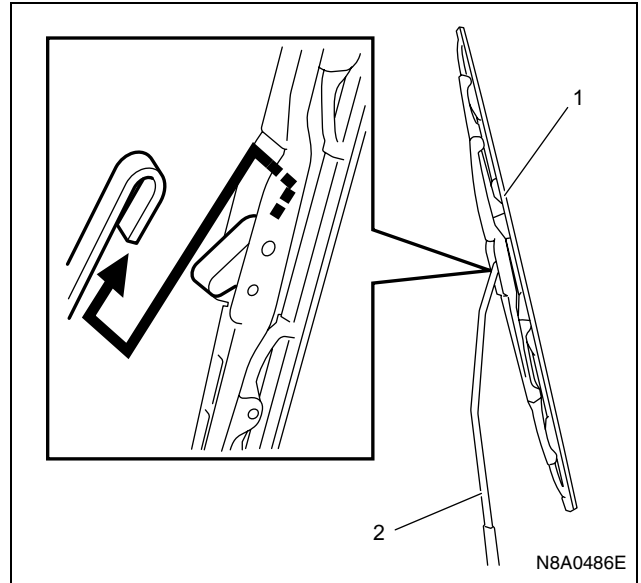


Finally, check that the click of the stay has caught in the hole of the rubber.



2. Wiper Blade

Push the lock of wiper blade (1) into the retentive portion on the tip of wiper arm (2).



Audio and Cigar Lighter

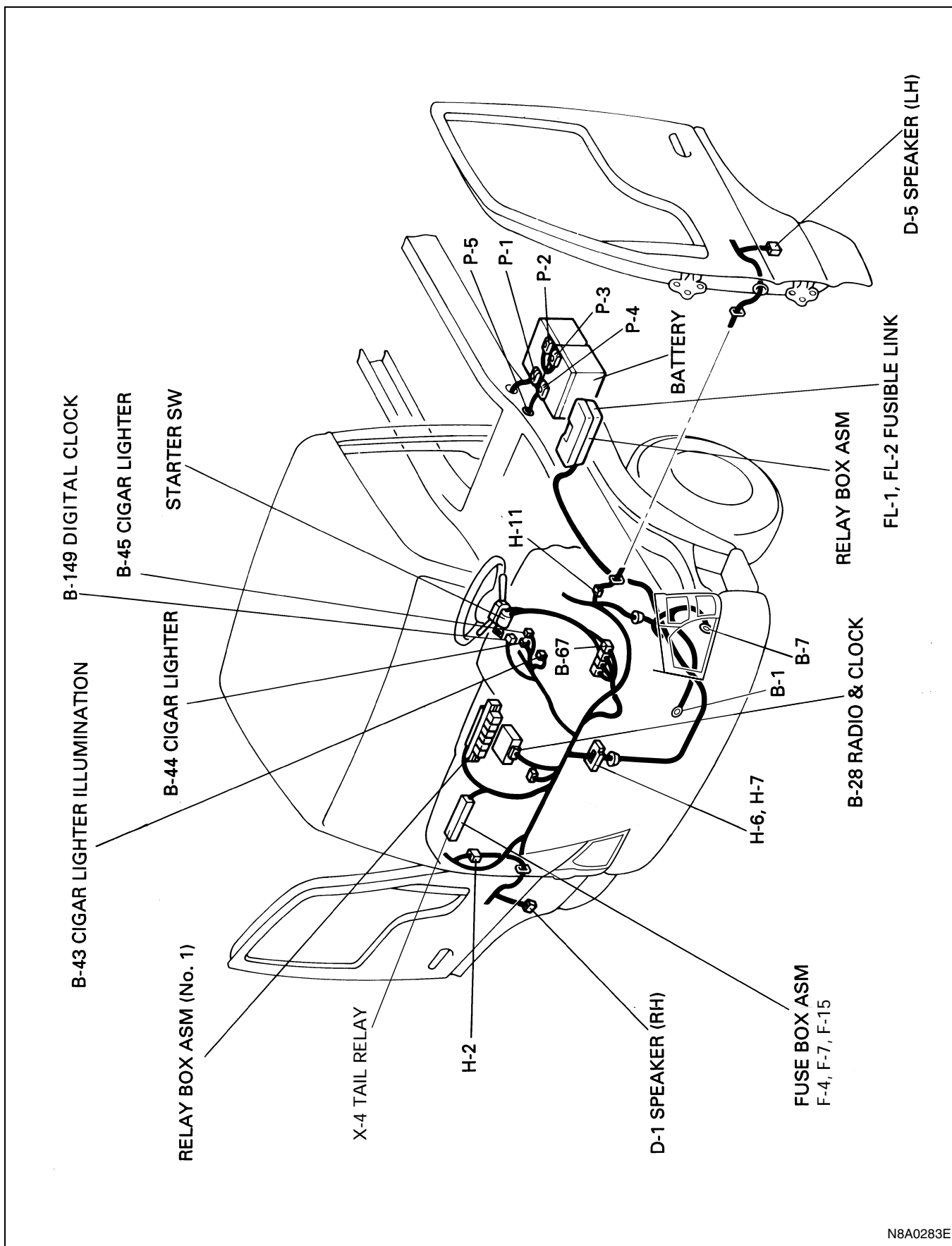
General Description

The circuit consists of the starter switch, radio, cigar lighter and the relay.

The audio circuit is designed for the current to flow through the receiver circuit when the radio switch is turned on with the starter switch in "ACC" or "ON". Current runs through the memory circuit of the audio regardless of the position of the starter switch.

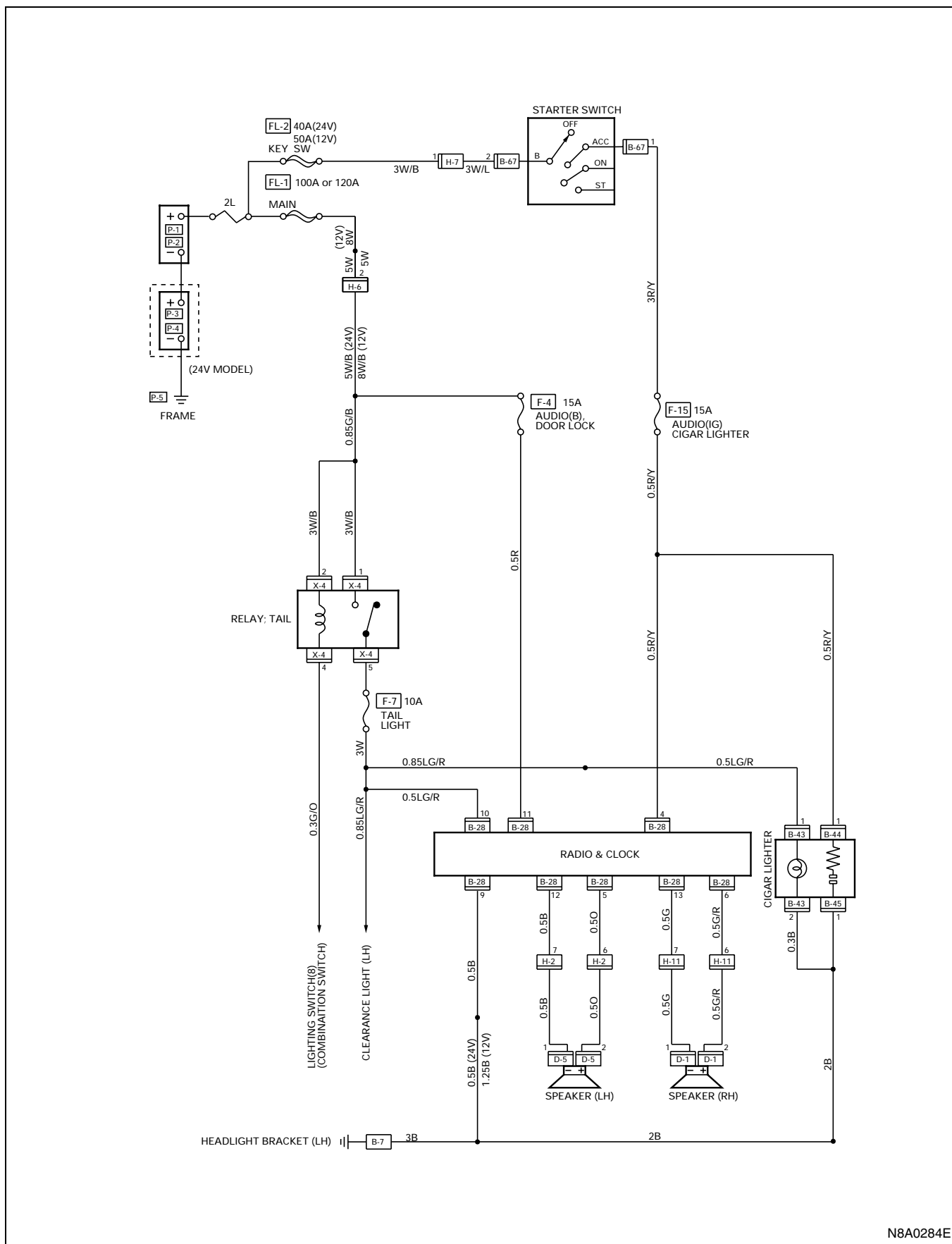
When the cigar lighter is pushed in with the starter switch at either "ACC" or "ON" position, a circuit is formed in the cigar lighter case to heat the lighter coil. The cigar lighter is spring back to its original position after the lighter coil is heated.

Parts Location



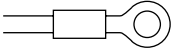
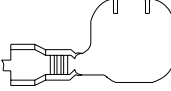
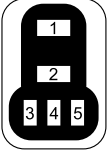
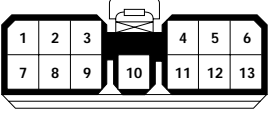

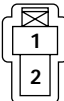

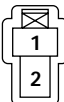
N8A0283E

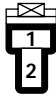
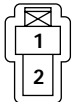


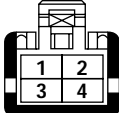
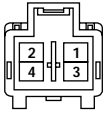
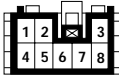
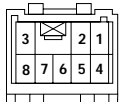
Circuit Diagram

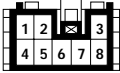
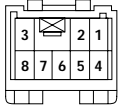


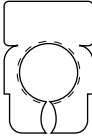
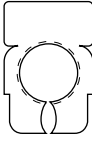
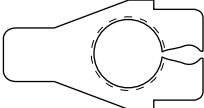
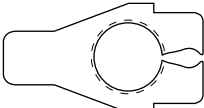



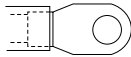
N8A0284E

Connector List

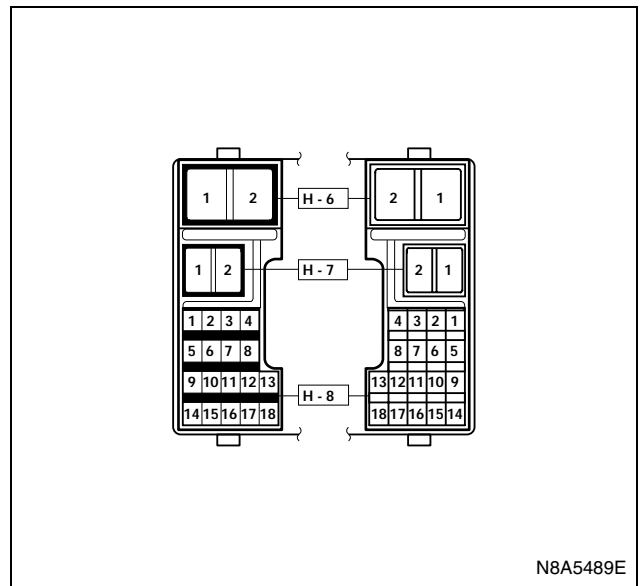
No.	Connector Face
B-1	 000-001
B-7	 000-012
X-4	 005-006
B-28	 013-001
B-43	 002-009
B-43	 002-010
D-5	 002-009
D-5	 002-010

No.	Connector Face
D-1	 002-009
D-1	 002-010
B-44	 001-011
B-45	 001-009
B-67	 004-001
B-67	 004-002
H-2	 008-009
H-2	 008-010

No.	Connector Face
H-11	 008-009
H-11	 008-010
P-1 (12V)	 000-003
P-2	 000-004
P-1 (24V)	 000-004
P-4	 000-004
P-2 (24V)	 000-006
P-3	 000-006

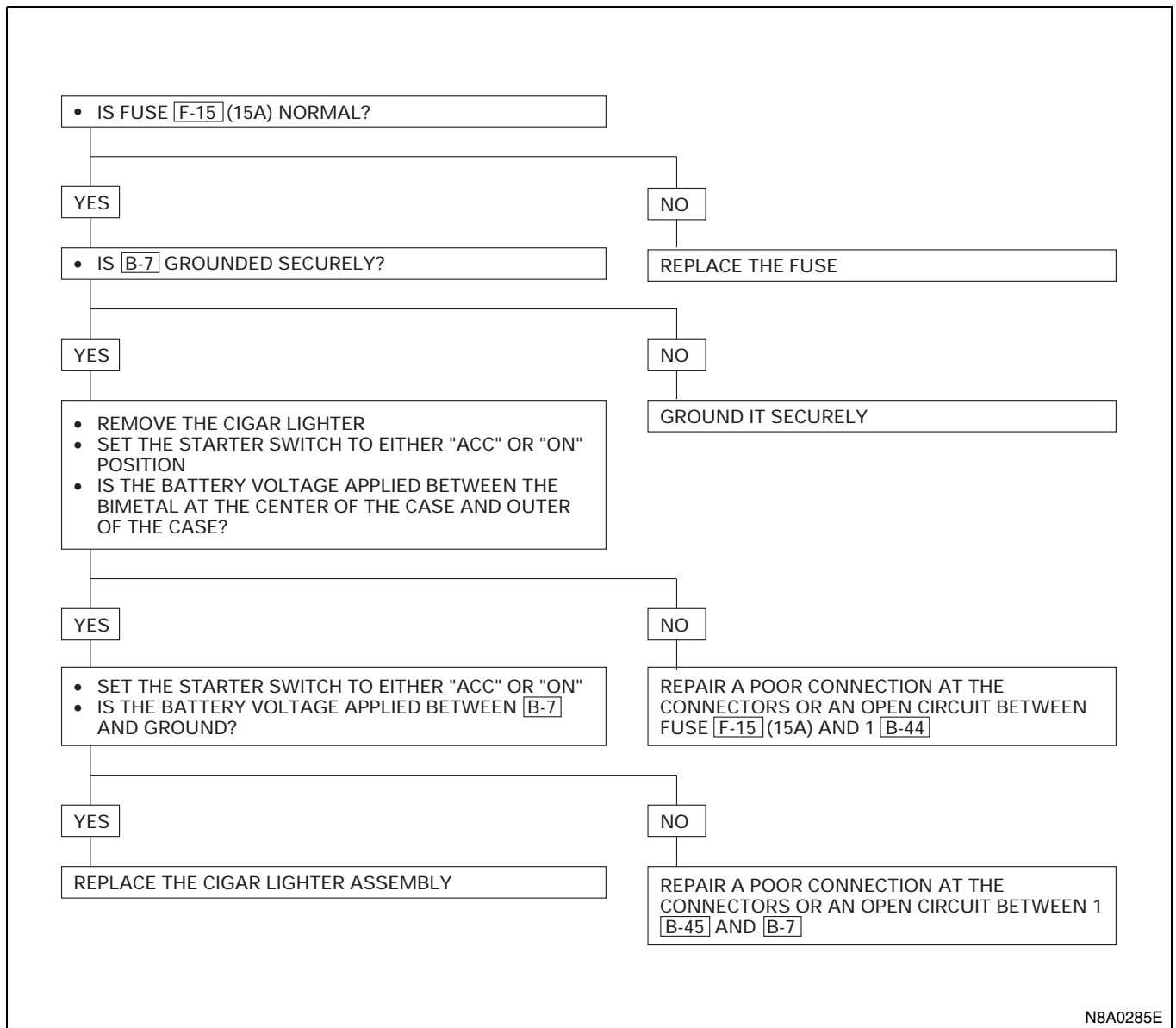
No.	Connector Face
P-5 (12V)	 000-007
P-5 (24V)	 000-002

H-6, H-7

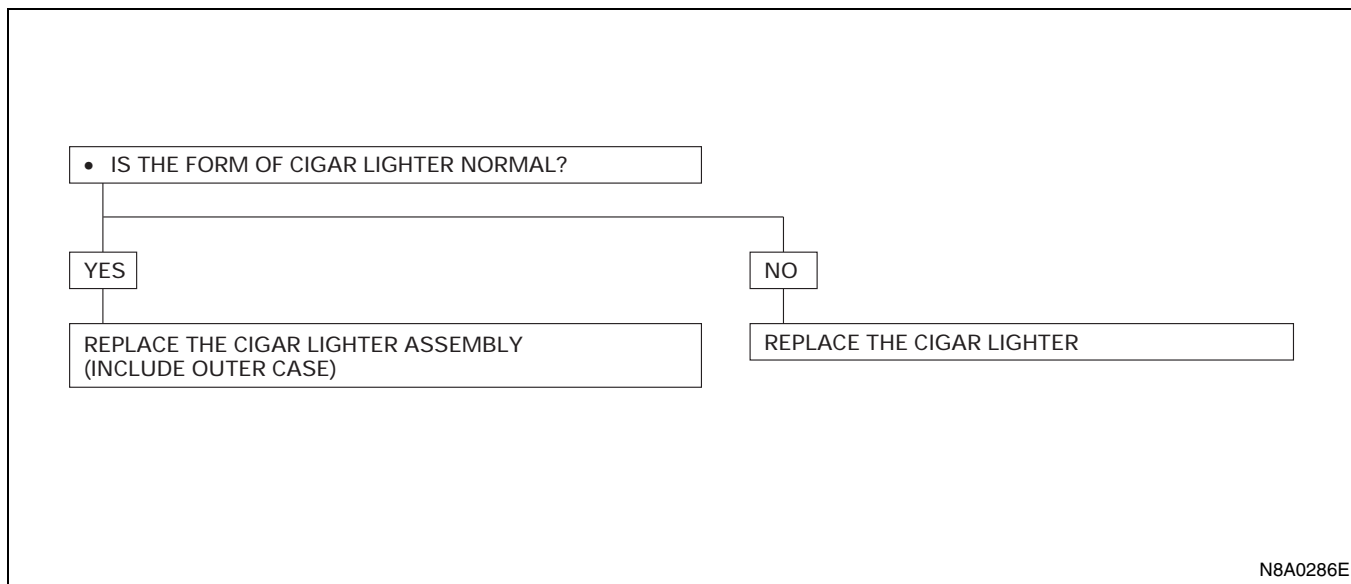


Diagnosis

1. Cigar Lighter Does Not Heat Sufficiently



2. The Cigar Lighter Does Not Spring Out After Being Heated



Starter Switch

Refer to “START AND CHARGING” in this section.

Radio

Removal

Preparation:

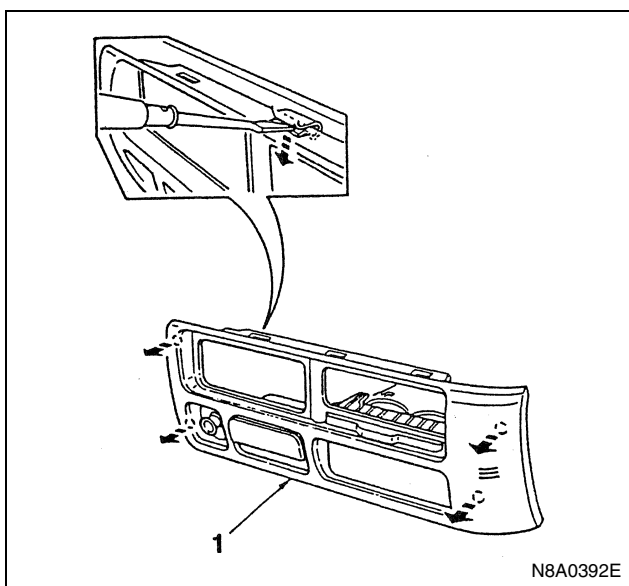
Disconnect the battery ground cable.

1. Center Cluster

- 1) Pull it to remove. Pry off three clips by the tip of screwdriver.
- 2) Remove the cigar lighter power source and its illumination connector.

Notice:

To remove the center cluster, do not force to pry off three clips at upper portion of the center cluster.

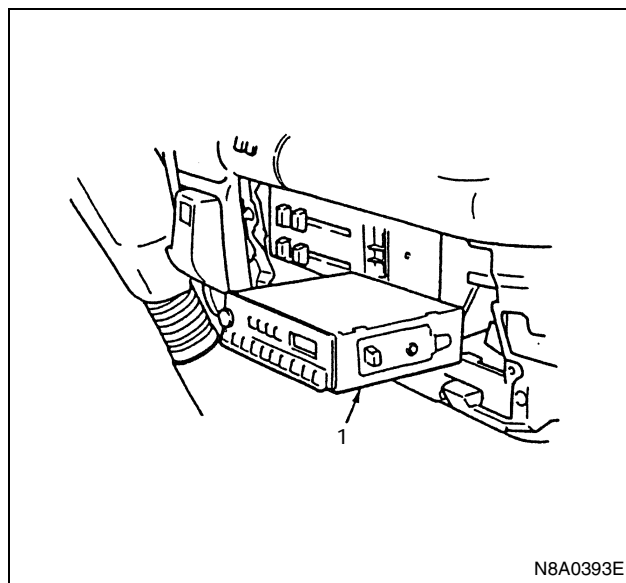


Legend

1. Center Cluster

2. Radio

- 1) Remove the two radio fixing screws.
- 2) Disconnect the connector and feeder plug.



Legend

1. Radio

Installation

To install, follow the removal steps in the reverse order.

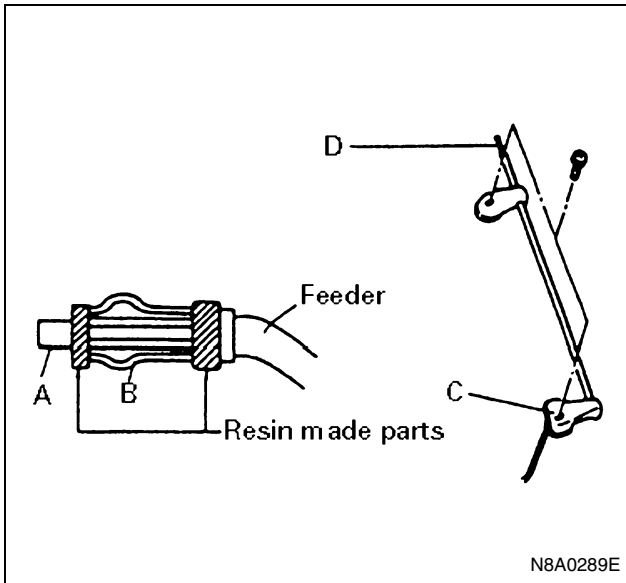
Antenna

Inspection

The metal A is connected to the pole D at the top of the antenna through the core of the feeder.

The metal B is fitted in the feeder shielding the core, and grounded at the screw C to avoid the core hampered by noise.

Defective grounding would cause noise.



In checking, measure the following three points with the circuit tester in the range of "resistance x 1 (Ω)."

Between A and B

No continuity (No reading at the indicator) → Normal

Continuity (A bite in the feeder. The core grounded) → Lower reception

Between B and C

Continuity (Indicator reading: 0Ω) → Normal
 No continuity (Shielded core disconnected or defective grounding at the screw → Hampered by noise)

Between A and D

Continuity or no continuity
 There are some antenna feeders and relay feeders with a condenser built in their connections.

Measuring resistance between the two points does not result in correct judgment. Connect temporarily another normal antenna to the radio and check to see if its reception is audible. Most antenna now available are slide type. Rust at the screw C and the cab panel where grounded would lead no continuity, followed by lower reception.

Keep this portion clean to avoid rust.

Removal

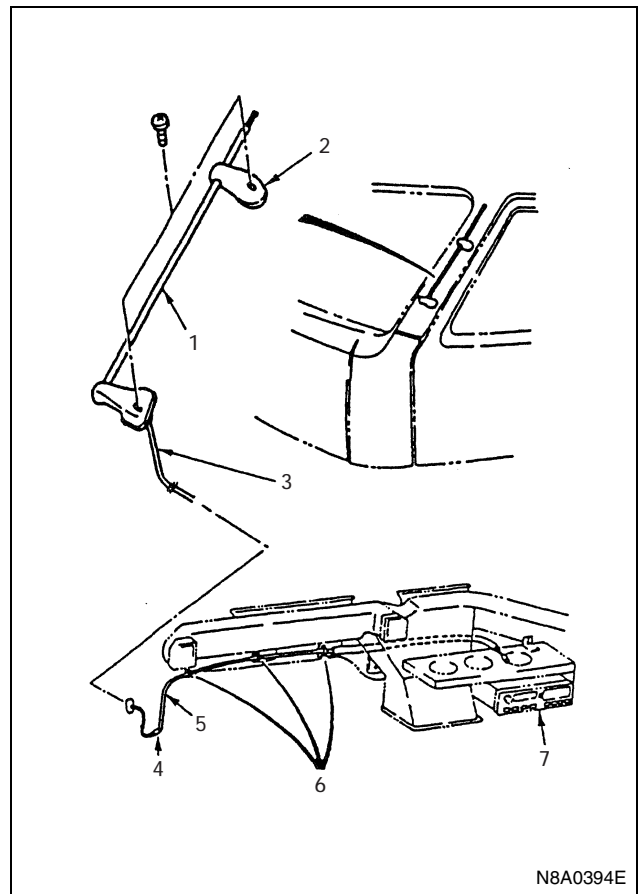
Preparation:

Disconnect the battery ground cable.

1. Antenna
 - 1) Disconnect the joint connector.
 - 2) Remove the upper and lower side antenna bracket.
 - 3) Pull out the antenna feeder.

Notice:

For easier fitting, tie the lead wire to the end of the antenna feeder in advance.



Legend

1. Antenna
2. Antenna Bracket
3. Feeder
4. Joint Connection
5. Feeder
6. Clip
7. Radio

Installation

To install, follow the removal steps in the reverse order.

Speaker

Inspection

1. With the circuit tester set to the range of $\times 1 (\Omega)$, connect the circuit tester probes (red and black) to the (+) and (-) terminals of the speaker.
2. When the speaker is normal, a low buzzing sound is heard.
3. When the speaker is defective, no sound is heard. However, the distortion or chattering of the sound cannot be identified.
 When the speaker is installed to the vehicle, disconnect the connectors before checking.

When no sound is heard, the following are considered as the cause.

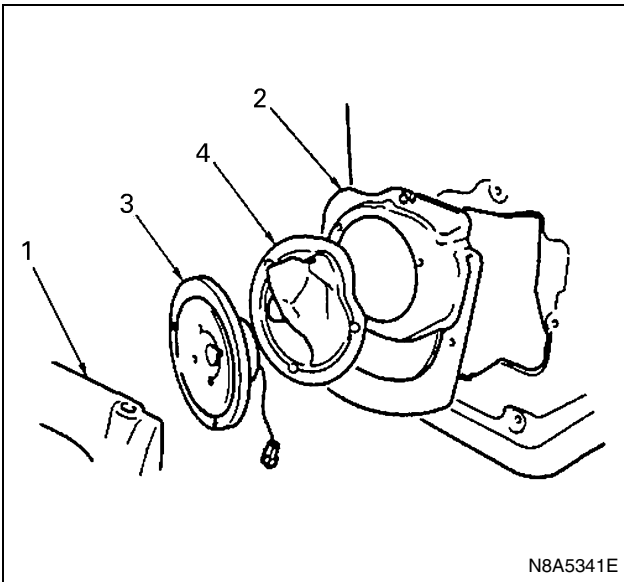
- The speaker wiring is disconnected at the speaker terminals.
- The speaker body is defective.
- There is an open circuit somewhere in the speaker harness on the vehicle side.
- The speaker harness on the vehicle side is grounded or caught up.

Removal

Preparation:

Disconnect the battery ground cable.

1. Door Pad
Refer to "FRONT DOOR TRIM PAD" of section 2.
2. Speaker Panel
Disconnect the speaker connector.
3. Speaker
4. Waterproof Sheet



Legend

1. Trim Panel
2. Speaker Panel
3. Speaker
4. Waterproof Sheet

Installation

To install, follow the removal steps in the reverse order.

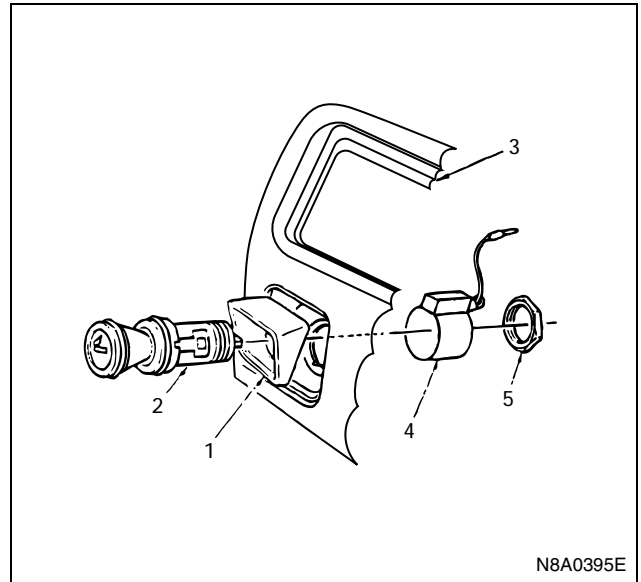
Cigar Lighter

Removal

Preparation:

Disconnect the battery ground cable.

1. Center Cluster
Refer to "RADIO" in this section.
2. Cigar Lighter Assembly
Remove the nut, then remove cigar lighter assembly, bezel and outer case.



Legend

1. Bezel
2. Cigar Lighter Assembly
3. Center Cluster
4. Outer Case
5. Nut

Installation

To install, follow the removal steps in the reverse order.

Meter and Warning/indicator Light

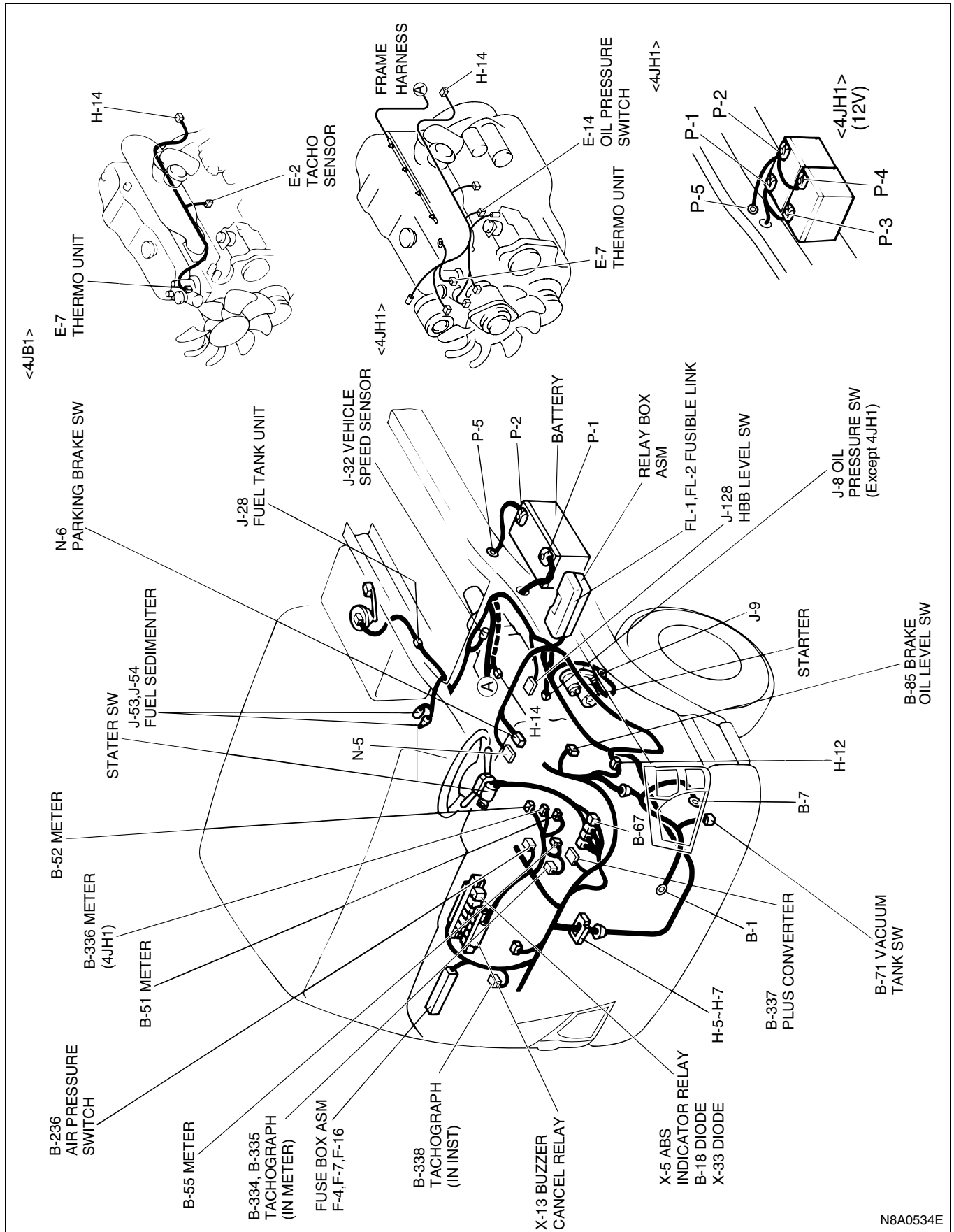
General Description

The circuit consists of the starter switch, meter assembly, vacuum tank switch, seat belt switch, oil pressure switch, fuel sedimenter switch, brake fluid switch, parking brake switch, vehicle speed sensor, fuel tank unit, thermo unit and engine speed sensor.

The meter assembly contains the speedometer, tachometer, fuel meter, thermometer and the warning/indicator light.

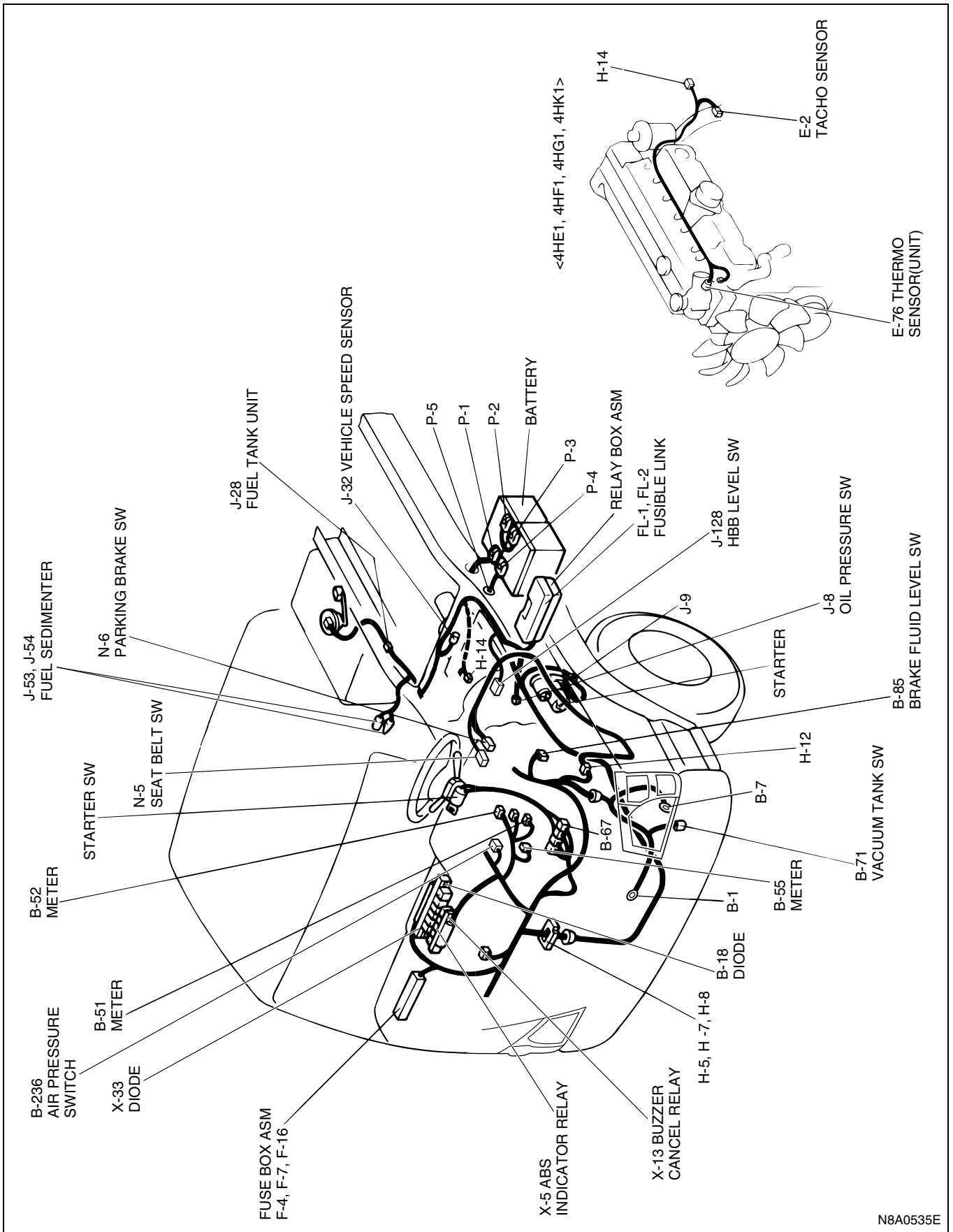
The meter warning/indicator lights and their bulb sockets are a unit, they are installed from the back of the speedometer assembly.

**Parts Location
For 12 Volt**



N8A0534E

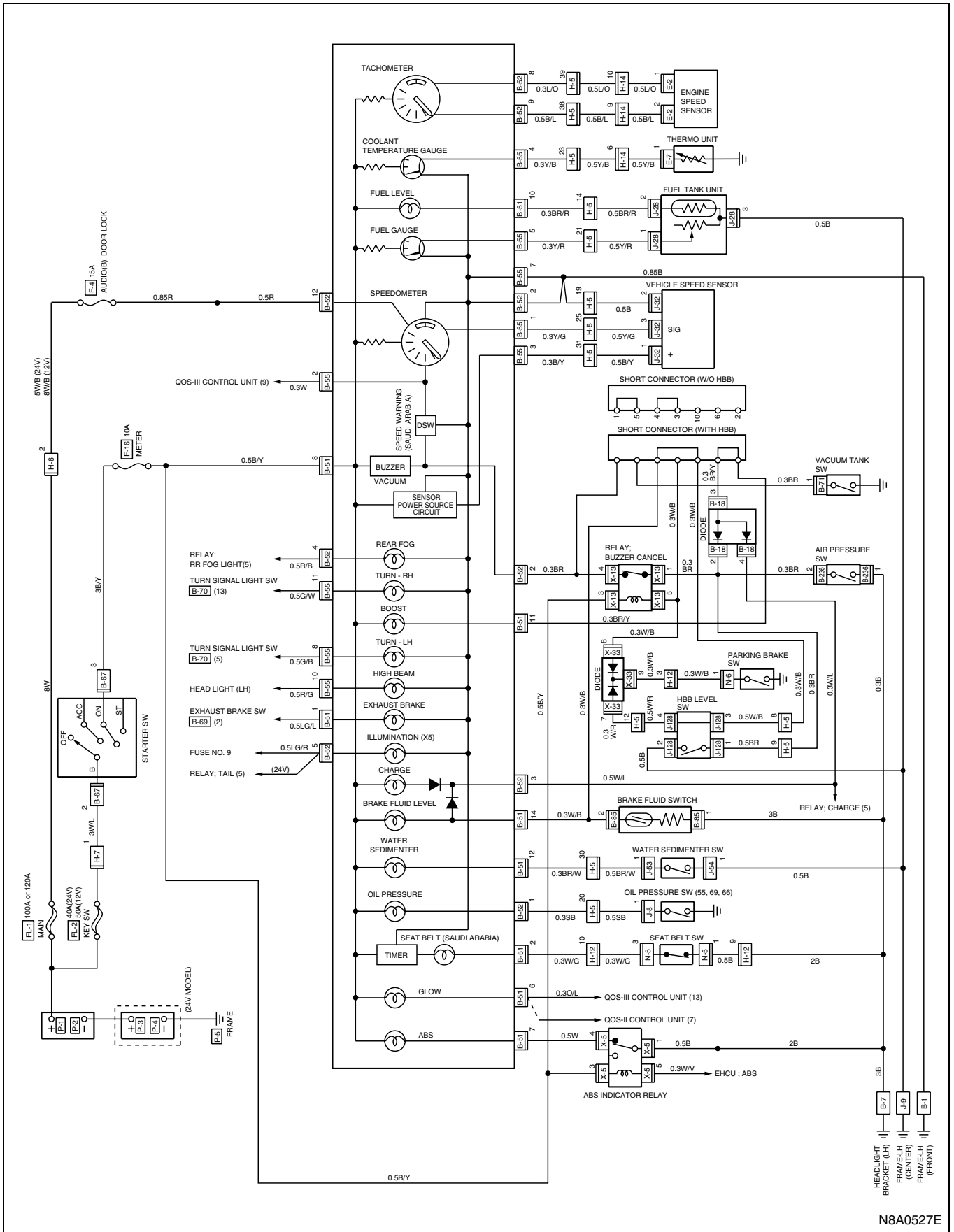
For 24 Volt



N8A0535E

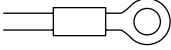
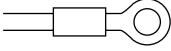
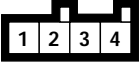
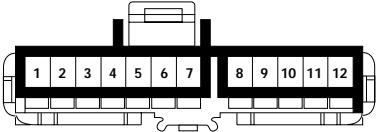

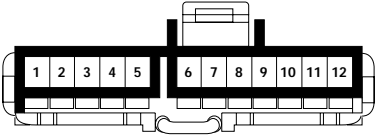


Circuit Diagram

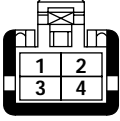
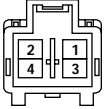

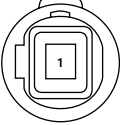

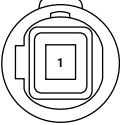

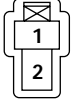
Except 4JH1 / 4HK1 Engine


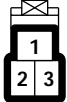
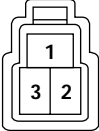







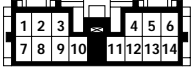
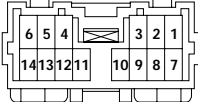


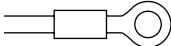
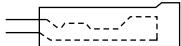
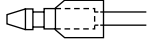
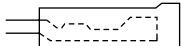
N8A0527E

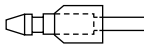
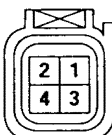


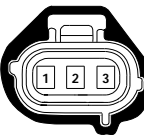



Connector List
Except 4JH1 / 4HK1 Engine

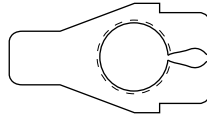
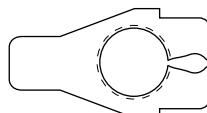
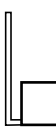
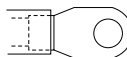

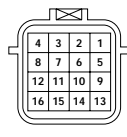

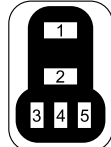
No.	Connector Face
B-1	 000-001
B-7	 000-001
B-18	 004-004
B-52	 012-005
B-51	 014-001
B-55	 012-004
N-6	 001-002
N-6	 001-011

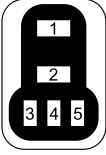
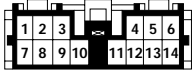
No.	Connector Face
B-67	 004-001
B-67	 004-002
B-71	 001-013
B-71	 001-014
J-8	 001-013
J-8	 001-014
B-85	 002-009
B-85	 002-010

No.	Connector Face
B-236	 <p style="text-align: right;">002-022</p>
N-5	 <p style="text-align: right;">003-020</p>
N-5	 <p style="text-align: right;">003-021</p>
E-2 (66)	 <p style="text-align: right;">002-001</p>
E-2 (66)	 <p style="text-align: right;">002-002</p>
E-2 (55,69)	 <p style="text-align: right;">002-011</p>
E-2 (55,69)	 <p style="text-align: right;">002-012</p>
E-7	 <p style="text-align: right;">001-018</p>

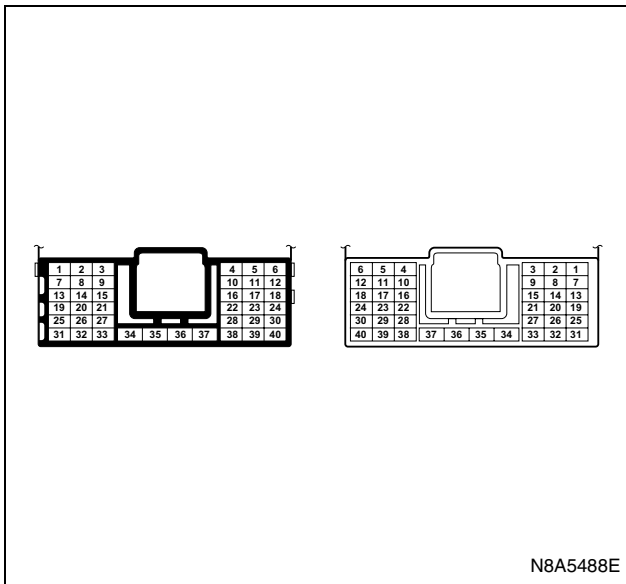
No.	Connector Face
H-12	 <p style="text-align: right;">014-002</p>
H-12	 <p style="text-align: right;">014-003</p>
H-14	 <p style="text-align: right;">016-003</p>
H-14	 <p style="text-align: right;">016-004</p>
J-9	 <p style="text-align: right;">000-001</p>
J-53	 <p style="text-align: right;">000-010</p>
J-53	 <p style="text-align: right;">000-011</p>
J-54	 <p style="text-align: right;">000-010</p>

No.	Connector Face
J-54	 <p style="text-align: right;">000-011</p>
J-128	 <p style="text-align: right;">004-018</p>
J-28	 <p style="text-align: right;">003-016</p>
J-28	 <p style="text-align: right;">003-017</p>
J-32	 <p style="text-align: right;">003-018</p>
P-1 (12V)	 <p style="text-align: right;">000-003</p>
P-1	 <p style="text-align: right;">000-004</p>
P-4	 <p style="text-align: right;">000-004</p>

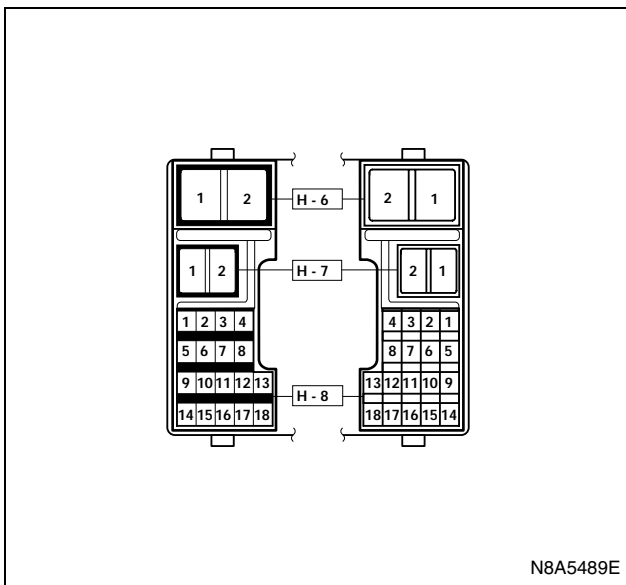
No.	Connector Face
P-2	 <p style="text-align: right;">000-006</p>
P-3	 <p style="text-align: right;">000-006</p>
P-5 (12V)	 <p style="text-align: right;">000-007</p>
P-5	 <p style="text-align: right;">000-002</p>
H-14	 <p style="text-align: right;">016-001</p>
H-14	 <p style="text-align: right;">016-002</p>
J-8 (FOR 4Jtype ENGIN E)	 <p style="text-align: right;">001-019</p>
X-5	 <p style="text-align: right;">005-006</p>

No.	Connector Face
X-13	 005-006
X-33	 014-002

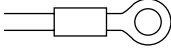
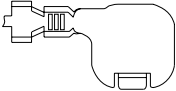
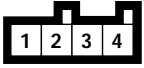
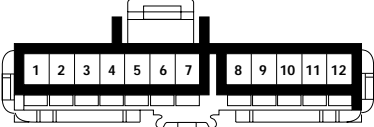

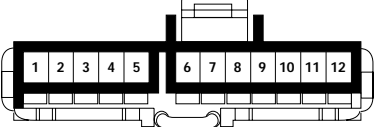
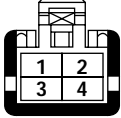

H-5

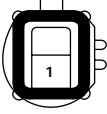
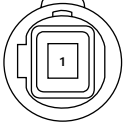
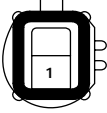
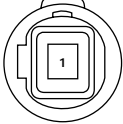

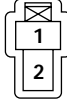
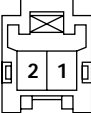





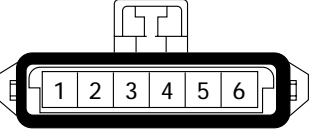
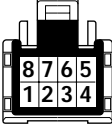
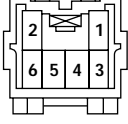
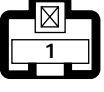
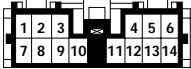
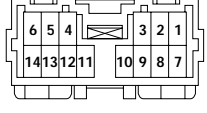
H-6, H-7


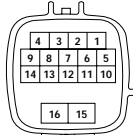
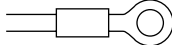
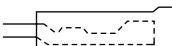
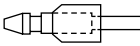
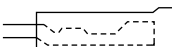
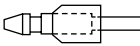






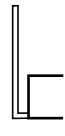

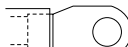
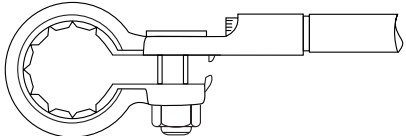
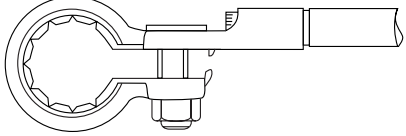
For 4JH1 Engine

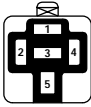
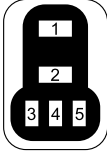
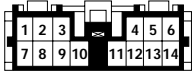
No.	Connector Face
B-1	 000-001
B-7	 000-017
B-18	 004-004
B-52	 012-005
B-51	 014-001
B-55	 012-004
B-67	 004-001
B-67	 004-002

No.	Connector Face
B-71	 001-013
B-71	 001-014
E-14	 001-013
E-14	 001-014
B-85	 002-009
B-85	 002-010
N-6	 002-023
B236	 002-022

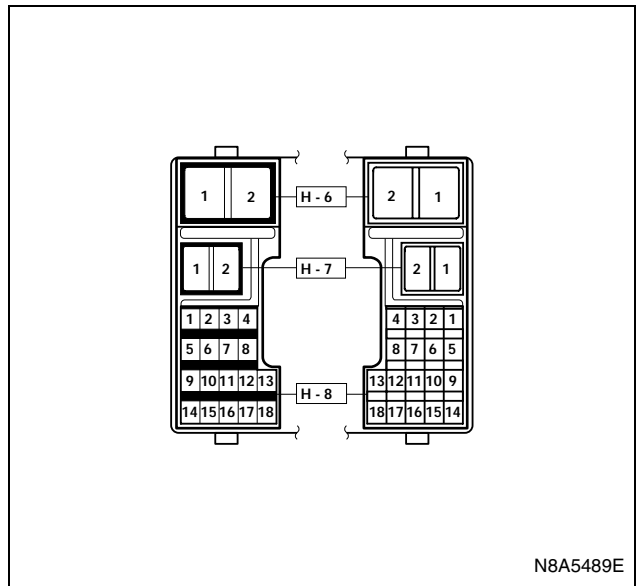
No.	Connector Face
B-334	 004-014
B-335	 008-014
B-336	 006-018
B-337	 008-013
B-338	 006-003
E-7	 001-009
H-12	 014-002
H-12	 014-003

No.	Connector Face
H-14	 <p style="text-align: right;">016-003</p>
H-14	 <p style="text-align: right;">016-004</p>
J-9	 <p style="text-align: right;">000-001</p>
J-53	 <p style="text-align: right;">000-010</p>
J-53	 <p style="text-align: right;">000-011</p>
J-54	 <p style="text-align: right;">000-010</p>
J-54	 <p style="text-align: right;">000-011</p>
J-28	 <p style="text-align: right;">003-016</p>

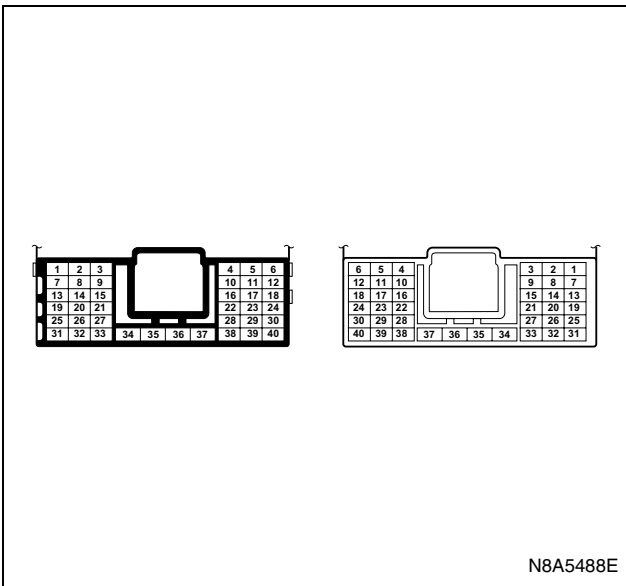
No.	Connector Face
J-28	 <p style="text-align: right;">003-017</p>
J-32	 <p style="text-align: right;">003-018</p>
J-128	 <p style="text-align: right;">004-018</p>
P-5	 <p style="text-align: right;">000-007</p>
P-1	 <p style="text-align: right;">000-002</p>
P-2	 <p style="text-align: right;">000-002</p>
P-3	 <p style="text-align: right;">000-014</p>
P-4	 <p style="text-align: right;">000-014</p>

No.	Connector Face
X-5	 <p style="text-align: right;">005-001</p>
X-13	 <p style="text-align: right;">005-006</p>
X-33	 <p style="text-align: right;">014-002</p>

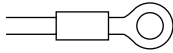
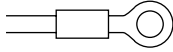
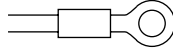
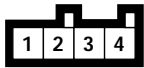
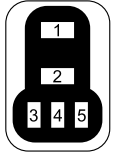
H-6, H-7

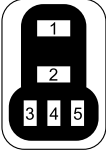
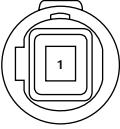
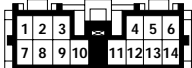

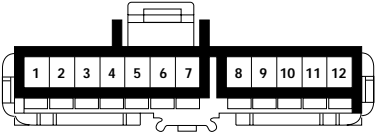
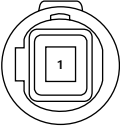


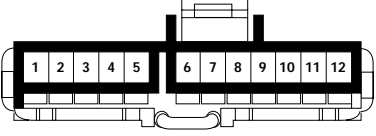

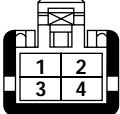

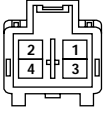
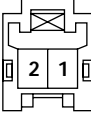






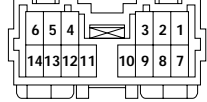





H-5

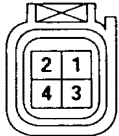
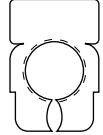
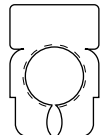
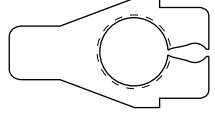
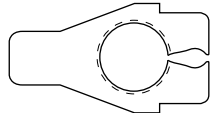
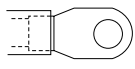


For 4HK1 Engine

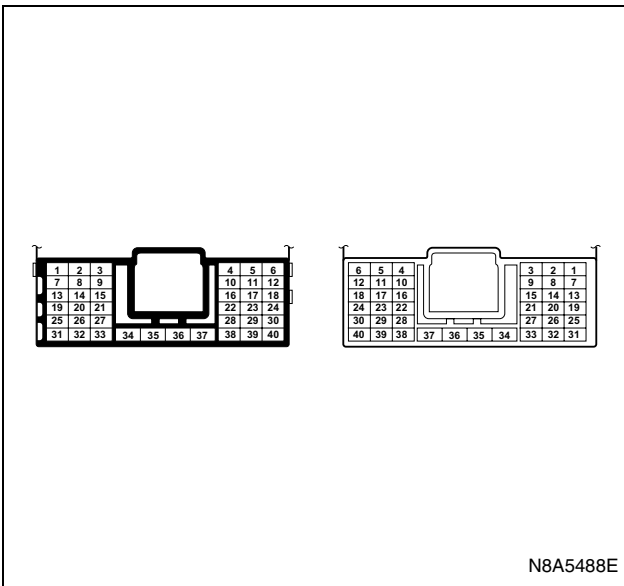
No.	Connector Face
B-1	 <p style="text-align: right;">000-001</p>
B-7	 <p style="text-align: right;">000-001</p>
J-9	 <p style="text-align: right;">000-001</p>
B-18	 <p style="text-align: right;">004-004</p>
X-5	 <p style="text-align: right;">005-006</p>

No.	Connector Face	No.	Connector Face
X-13	 005-006	B-71	 001-014
X-33	 014-002	J-8	 001-013
B-52	 012-005	J-8	 001-014
B-51	 014-001	B-85	 002-009
B-55	 012-004	B-85	 002-010
B-67	 004-001	B-236	 002-022
B-67	 004-002	N-6	 002-023
B-71	 001-013	E-2	 002-013

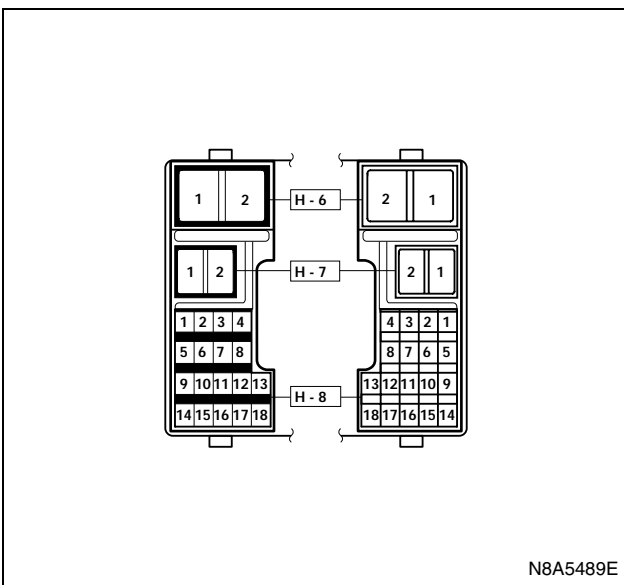
No.	Connector Face
E-76	 <p style="text-align: right;">003-004</p>
H-12	 <p style="text-align: right;">014-002</p>
H-12	 <p style="text-align: right;">014-003</p>
H-14	 <p style="text-align: right;">016-003</p>
H-14	 <p style="text-align: right;">016-004</p>
J-28	 <p style="text-align: right;">003-016</p>
J-28	 <p style="text-align: right;">003-017</p>
J-32	 <p style="text-align: right;">003-018</p>

No.	Connector Face
J-128	 <p style="text-align: right;">004-018</p>
P-1	 <p style="text-align: right;">000-004</p>
P-4	 <p style="text-align: right;">000-004</p>
P-2	 <p style="text-align: right;">000-006</p>
P-3	 <p style="text-align: right;">000-006</p>
P-5	 <p style="text-align: right;">000-002</p>

H-5



H-6, H-7, H-8



Diagnosis

Quick Chart for Check Point

1. Speedometer

		Check point		
		Speedometer	Vehicle speed sensor	Cable harness
Trouble mode	1-1. Speedometer and odometer do not function	○ (3)	○ (1)	○ (2)
	1-2. Speedometer does not function (odometer is normal)	○ (1)		
	1-3. Odometer does not function (Speedometer is normal)	○ (1)		
	1-4. Speedometer needle fluctuates (May be wide fluctuation)	○ (3)	○ (1)	○ (2)
	1-5. Speedometer needle jumps erratically	○ (3)	○ (1)	○ (2)

Notice:

Figure in parenthesis “()” indicates the order of inspection.

2. Tachometer

		Check point		
		Tachometer	Engine speed sensor	Cable harness
Trouble mode	2-1. Tachometer does not function	○ (3)	○ (1)	○ (2)
	2-2. Tachometer needle fluctuates (May be wide fluctuation)	○ (3)	○ (1)	○ (2)
	2-3. Tachometer needle jumps erratically	○ (3)	○ (1)	○ (2)

Notice:

Figure in parenthesis “()” indicates the order of inspection.

3. Coolant Temperature Gauge

		Check point				
		Meter ASM	Thermometer	Thermo unit	Thermo seat	Cable harness
Trouble mode	3-1. Coolant temperature gauge needle does not move	○ (3)	○ (4)	○ (2)		○ (1)
	3-2. Coolant temperature gauge reading is too low (or high)	○ (4)	○ (5)	○ (3)	○ (1)	○ (2)
	3-3. Needle overshoots (or goes up to the “H” range)	○ (3)	○ (4)	○ (1)		○ (2)

Notice:

Figure in parenthesis “()” indicates the order of inspection.

4. Fuel Gauge

		Check point			
		Meter ASM	Fuel gauge	Fuel tank unit	Cable harness
Trouble mode	4-1. Fuel gauge needle does not move	○ (3)	○ (4)	○ (2)	○ (1)
	4-2. Even when the tank is filled up with fuel, the needle does not reach "F"	○ (3)	○ (4)	○ (2)	○ (1)
	4-3. When the tank is not full of fuel, the needle overshoots (or goes to "F")	○ (3)	○ (4)	○ (2)	○ (1)

Notice:

Figure in parenthesis "()" indicates the order of inspection.

5. Warning/indicator Light

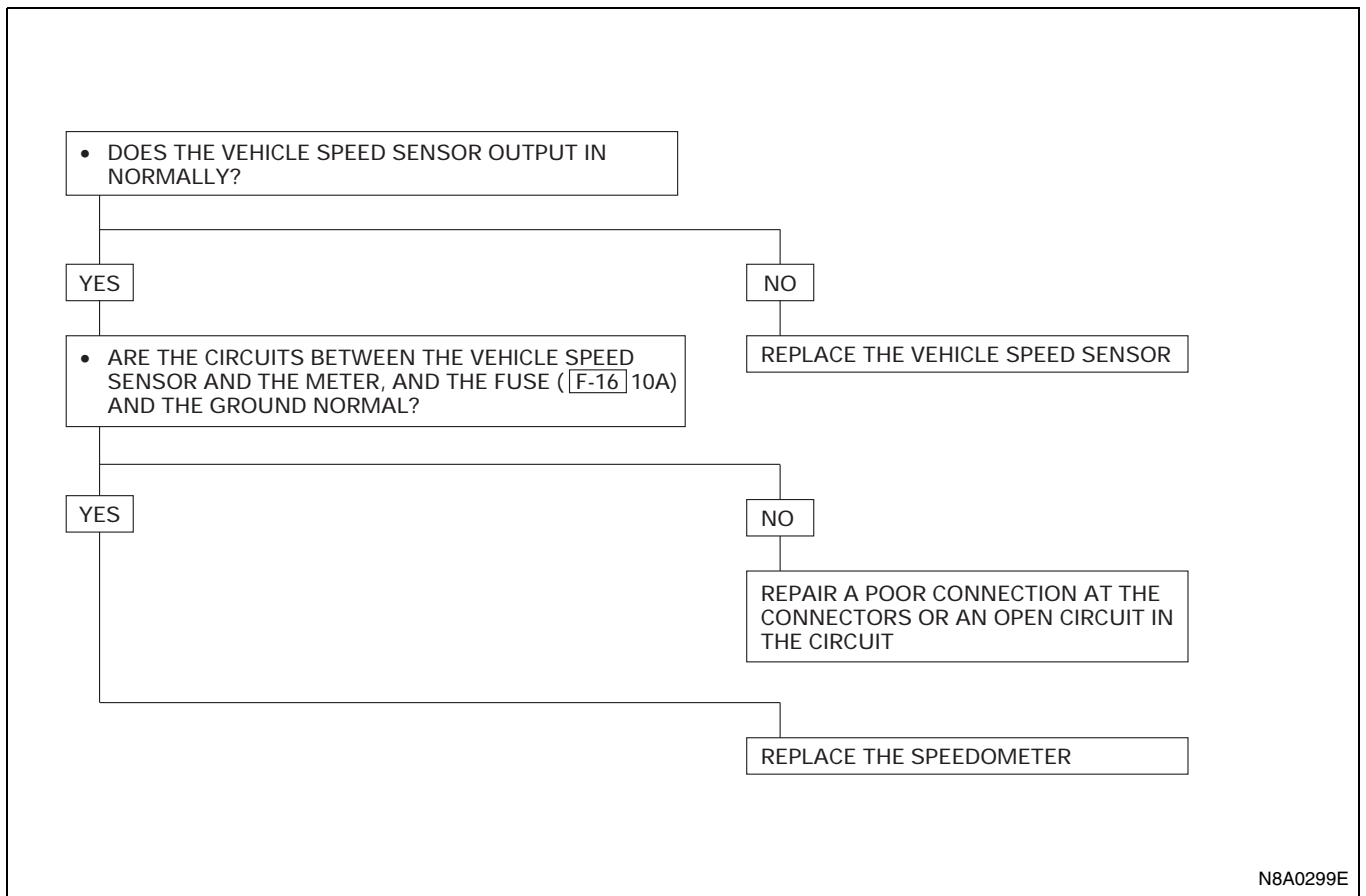
		Check point									
		Light bulb	Parking brake SW	Brake fluid SW	Oil pressure SW	Fuel tank unit	Vacuum SW	4WD SW	Sedim enter SW	Seat belt SW	Cable harness
Trouble mode	5-1. When the parking brake lever is pulled, the indicator light does not light up	○ (2)	○ (1)								○ (3)
	5-2. Even when the parking brake lever is released, the indicator light does not go off		○ (1)								○ (2)
	5-3. While the engine operating, the oil pressure warning light does not go off				○ (2)						○ (1)
	5-4. Even when the tank is full with fuel, the fuel warning light lights up					○ (1)					○ (2)
	5-5. Even when the tank is empty, the low fuel warning light does not light up	○ (1)				○ (2)					○ (3)
	5-6. Even when the float in the water sedimenter goes up above the drain warning level, the indicator light does not light up	○ (2)							○ (1)		○ (3)
	5-7. Even when the brake fluid is lower than specified level, the level warning light does not light up	○ (1)		○ (2)							○ (3)
	5-8. Even when the vacuum tank is empty vacuum warning buzzer does not sound						○ (1)				○ (2)

Notice:

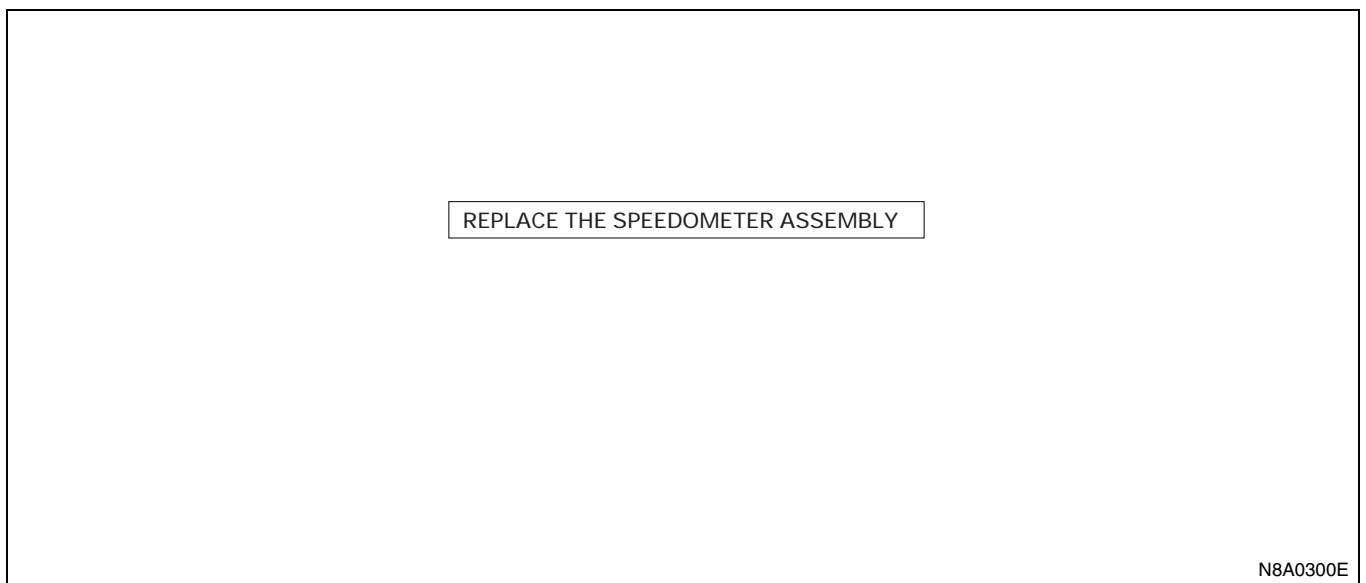
Figure in parenthesis “()” indicates the order of inspection.

1. Speedometer

1-1. Speedometer and Odometer Do Not Function



1-2. Speedometer Does Not Function (Odometer Is Normal)



1-3. Odometer Does Not Function (Speedometer Is Normal)

REPLACE THE SPEEDOMETER ASSEMBLY

N8A0300E

1-4. Speedometer Needle Fluctuates (May Be Wide Fluctuation)

• DOES THE VEHICLE SPEED SENSOR OUTPUT NORMALLY?

YES

NO

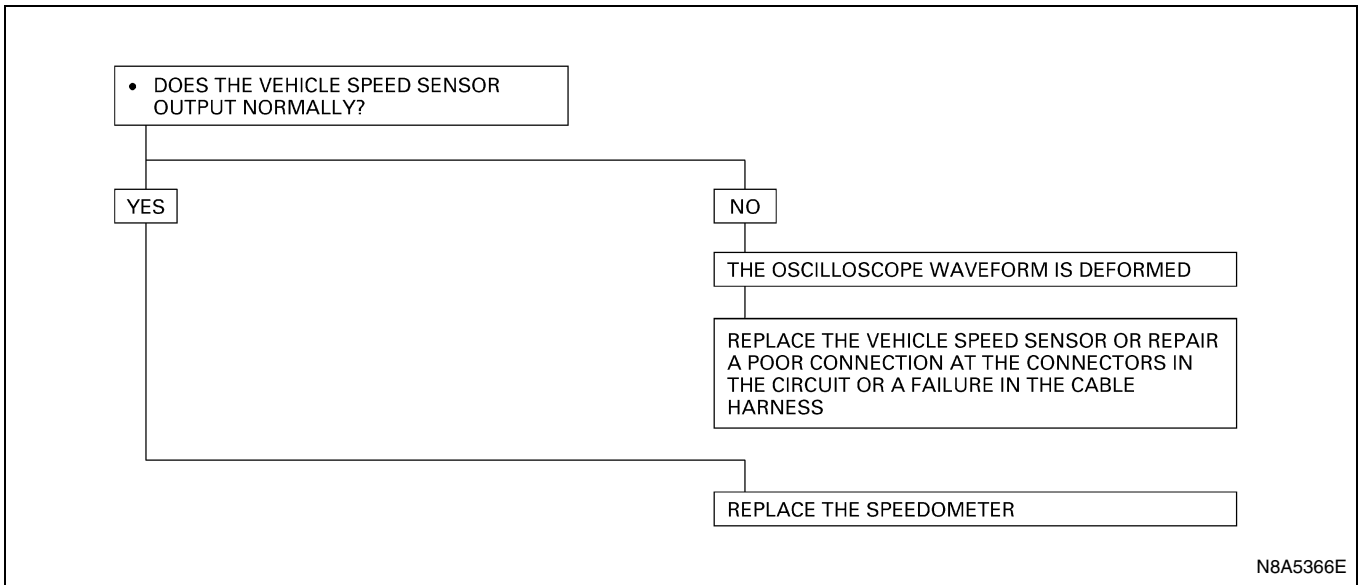
THE OSCILLOSCOPE WAVEFORM IS DEFORMED

REPLACE THE VEHICLE SPEED SENSOR OR REPAIR A POOR CONNECTION AT THE CONNECTORS IN THE CIRCUIT OR A FAILURE IN THE CABLE HARNESS

REPLACE THE SPEEDOMETER

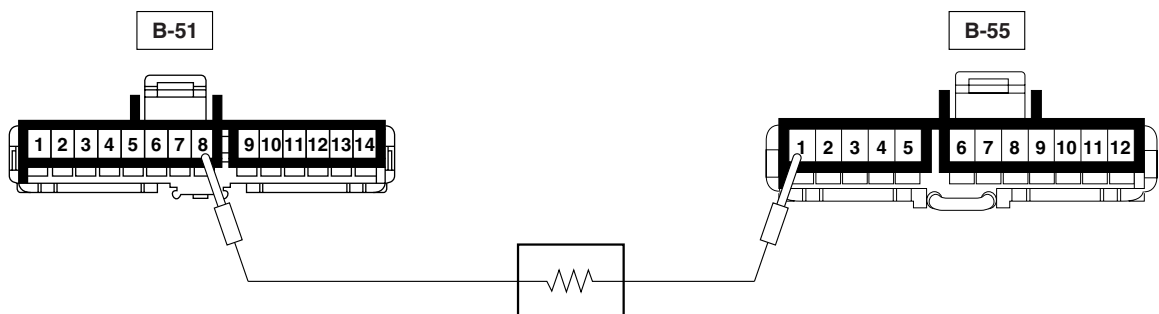
N8A5366E

1-5. Speedometer Needle Jumps Erratically

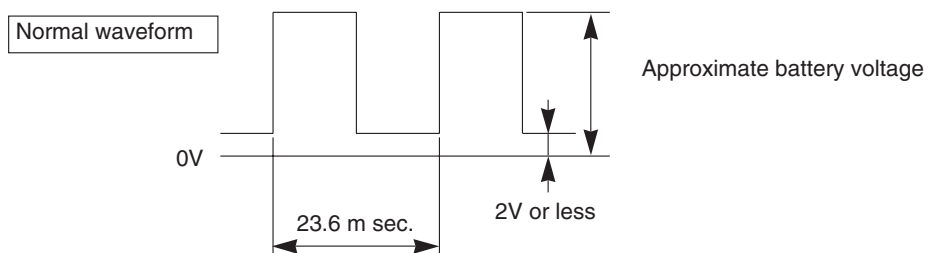


Inspection of waveform by oscilloscope

1. Connect a resistance of 1.3 to 5k ohm (1.4W or more) between the harness side connectors 8 **B-51** and 1 **B-55** of the meter.



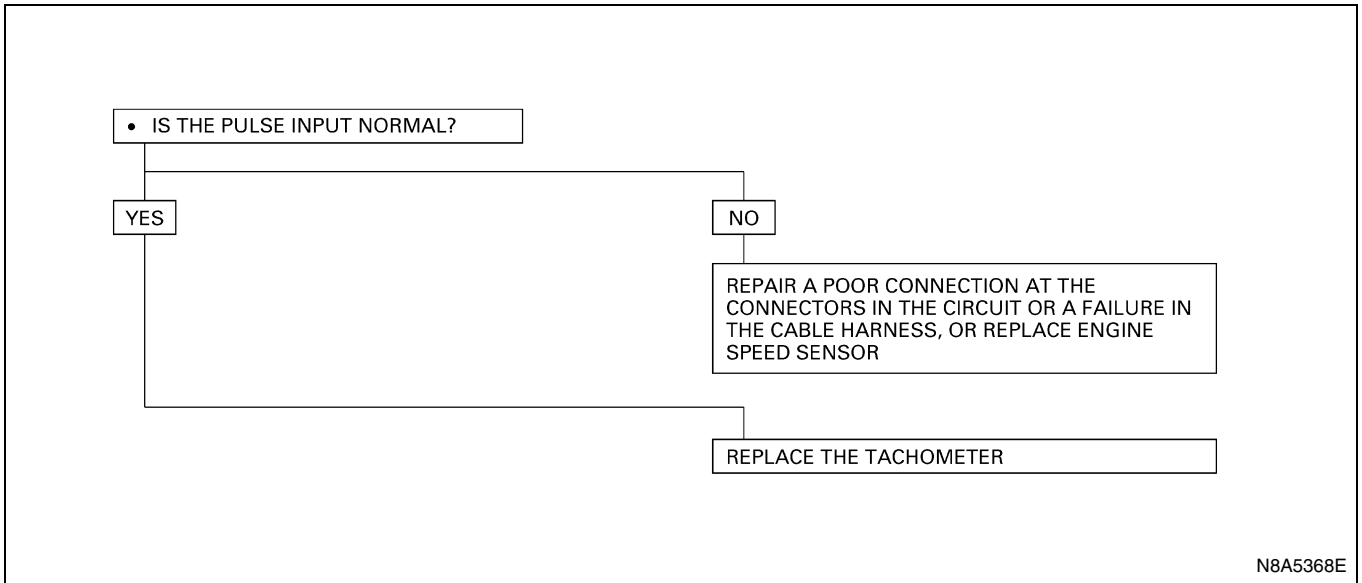
2. Install a speedometer tester.
3. Turn on the starter SW.
4. Check the waveform at the time when the vehicle speed is at 60 Km (37 mph).



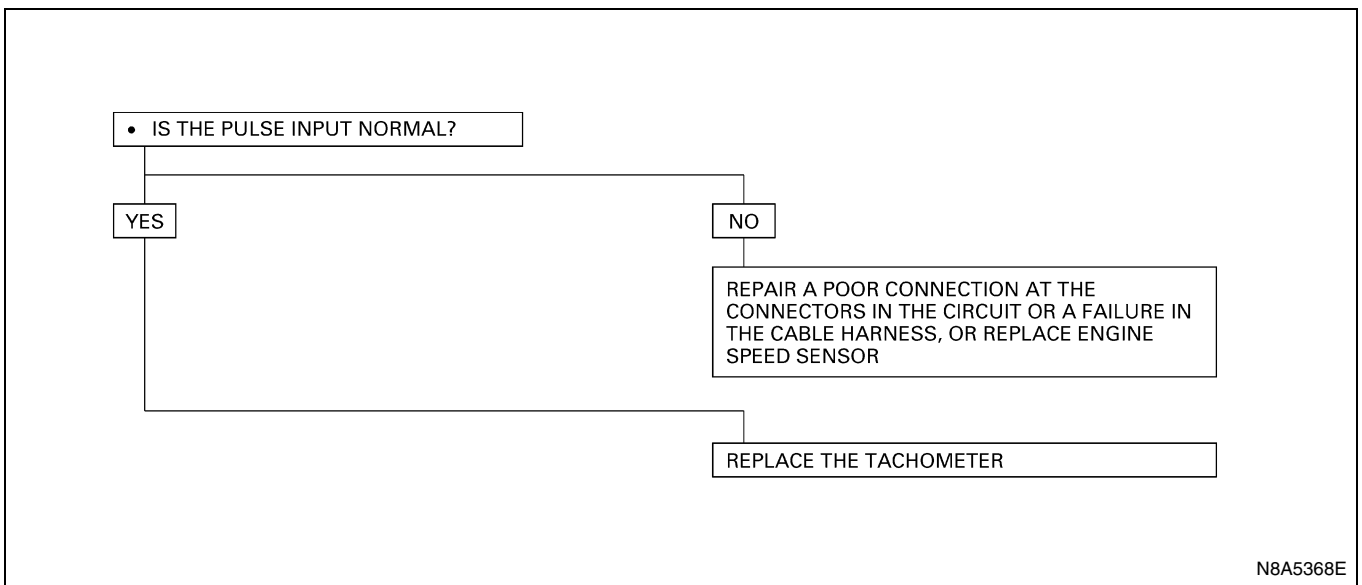
N8A0304E

2. Tachometer

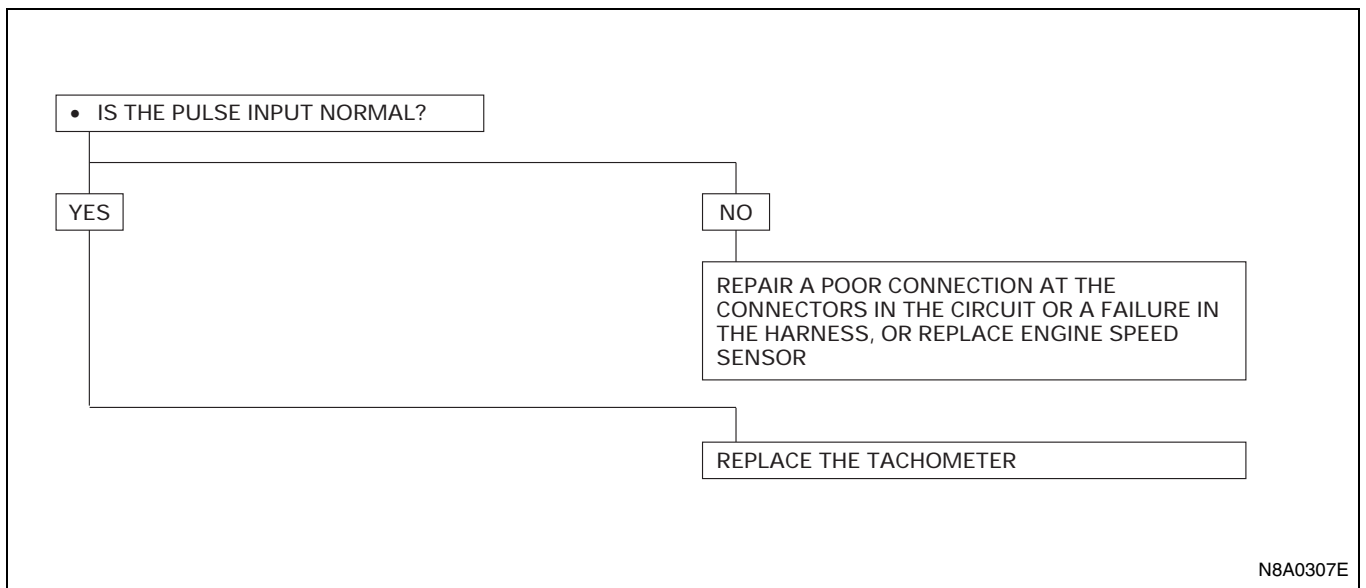
2-1. Tachometer Does Not Function



2-2. Tachometer Needle Fluctuates (May Be Wide Fluctuation)



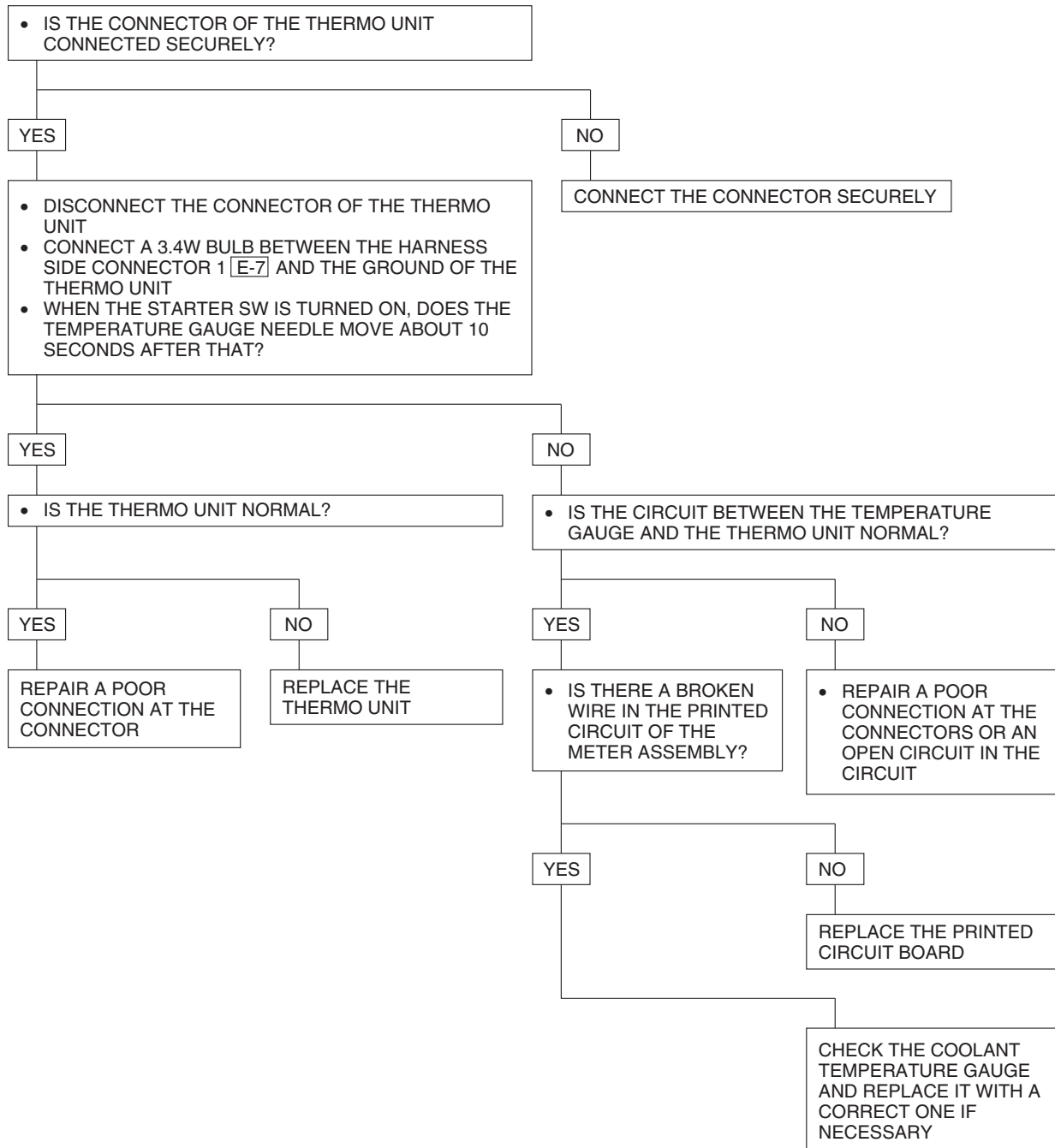
2-3 Tachometer Needle Jumps Erratically



N8A0307E

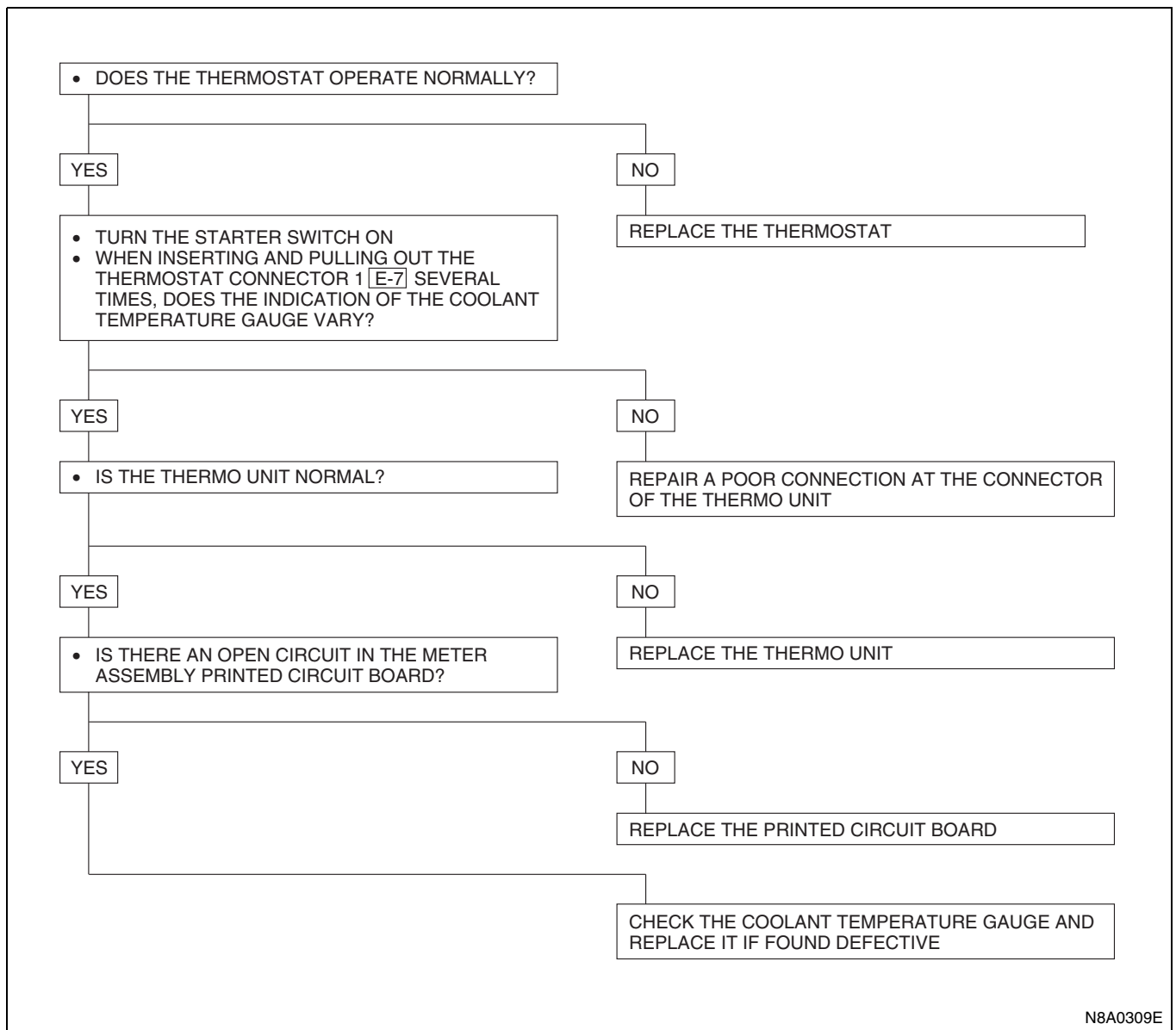
3. Coolant Temperature Gauge

3-1. Coolant Temperature Gauge Needle Does Not Move



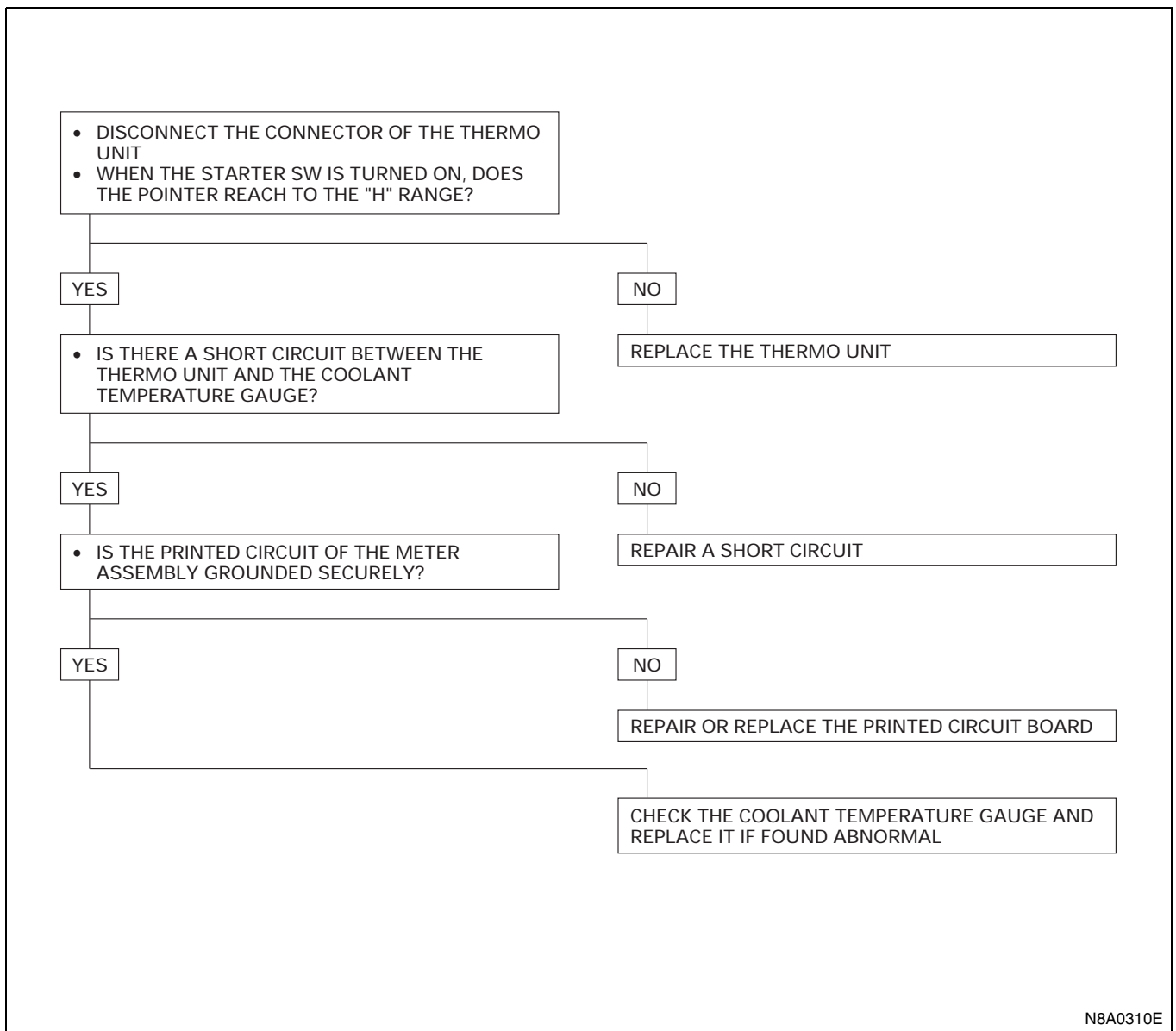
N8A0308E

3-2. Coolant Temperature Gauge Reading Is Too Low (or High)



N8A0309E

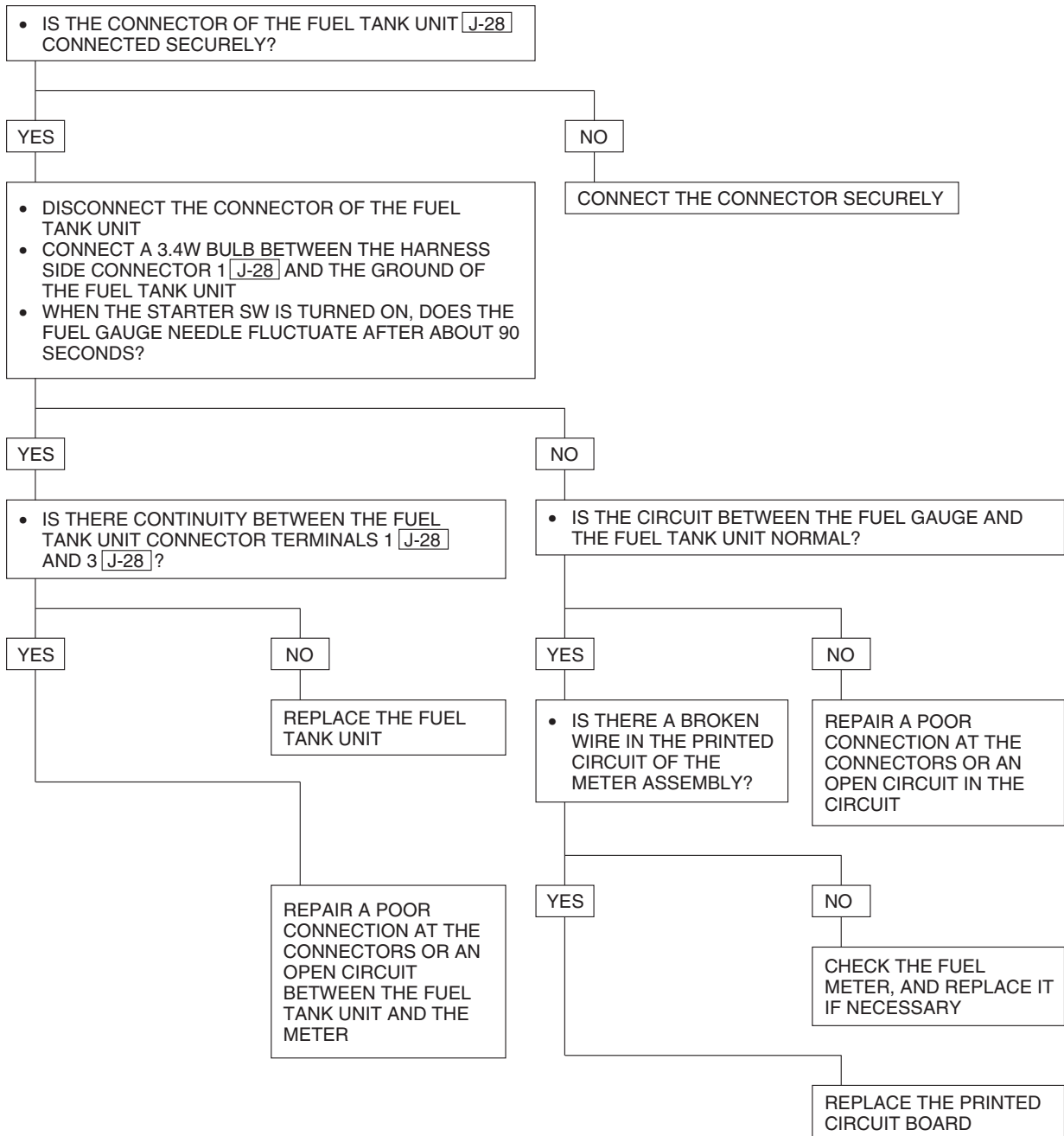
3-3. Needle Overshoots (or Goes Up to the "H" Range)



N8A0310E

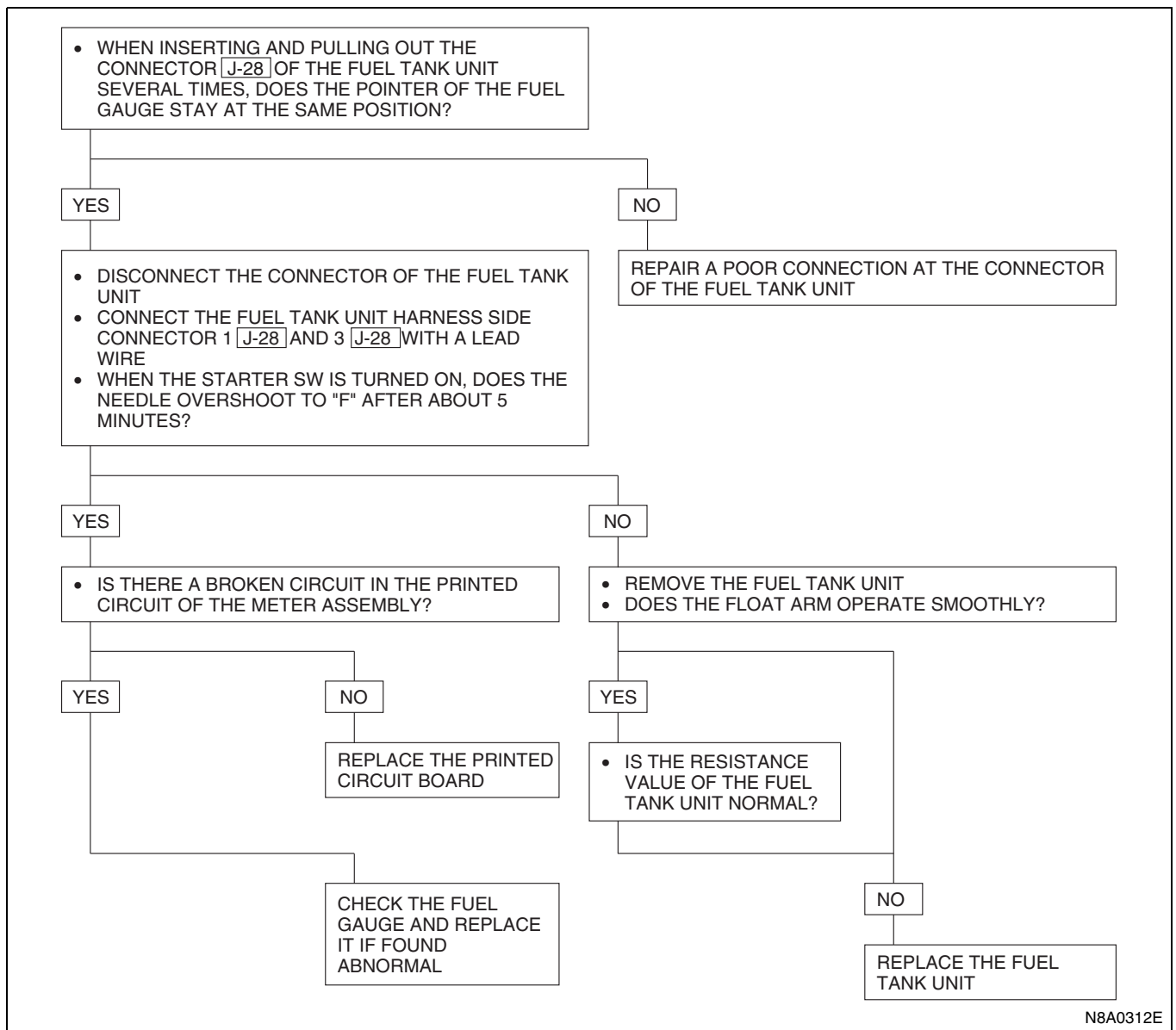
4. Fuel Gauge

4-1. Fuel Gauge Needle Does Not Move

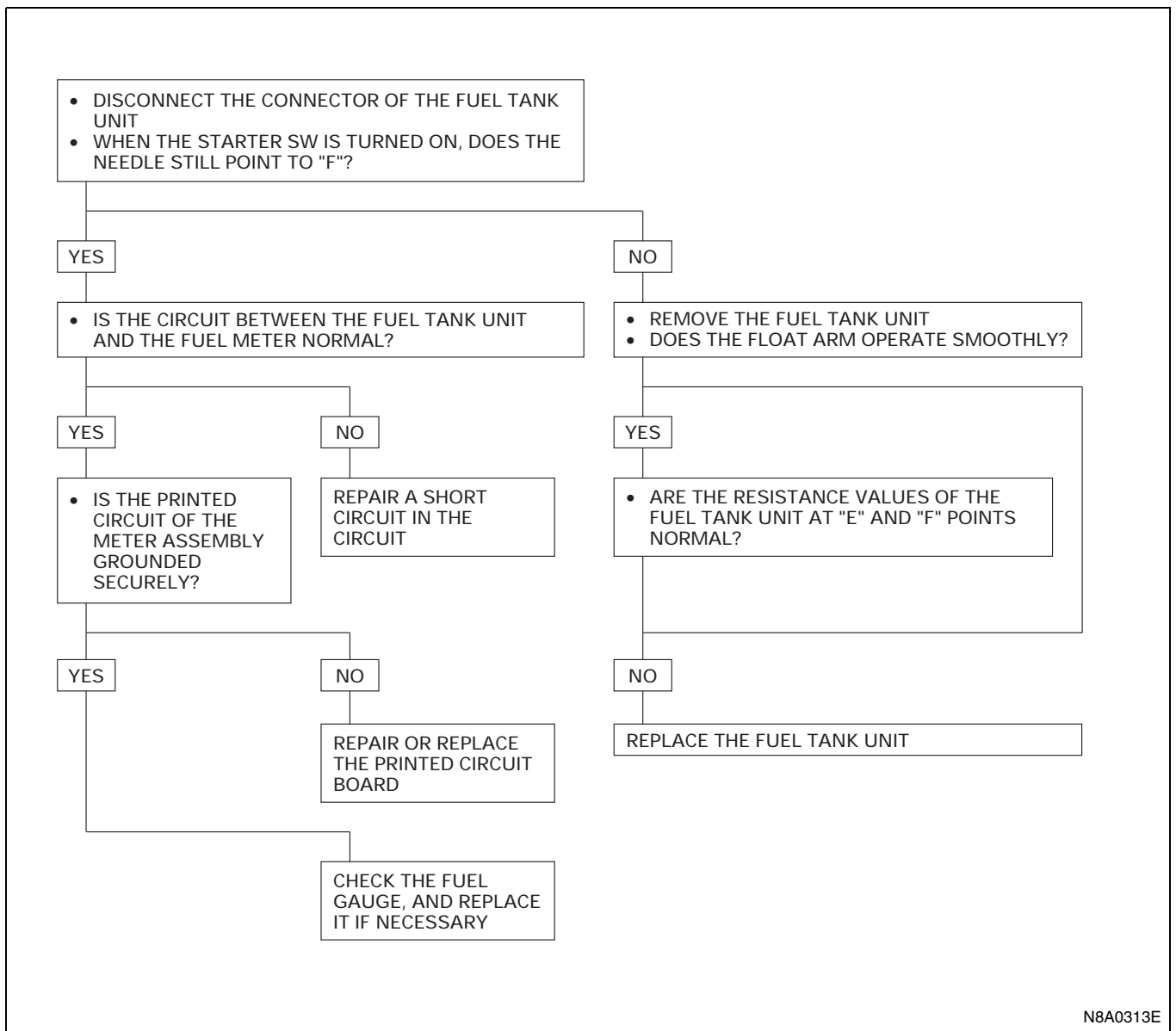


N8A0311E

4-2. Even when the Tank Is Filled Up with Fuel, the Needle Does Not Reach "F"



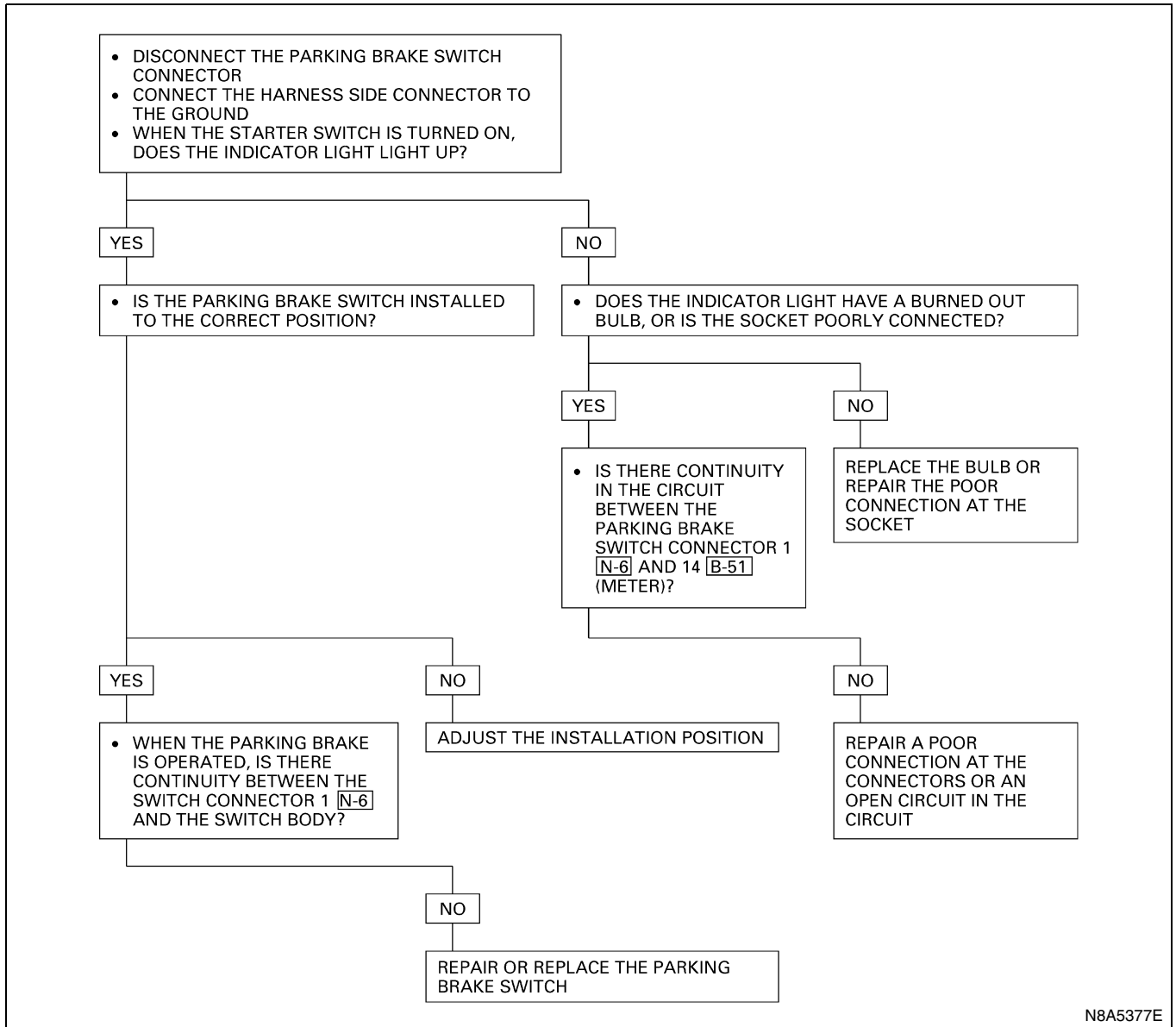
4-3. When the Tank Is Not Full of Fuel, the Needle Overshoots (or Goes Up To "F")



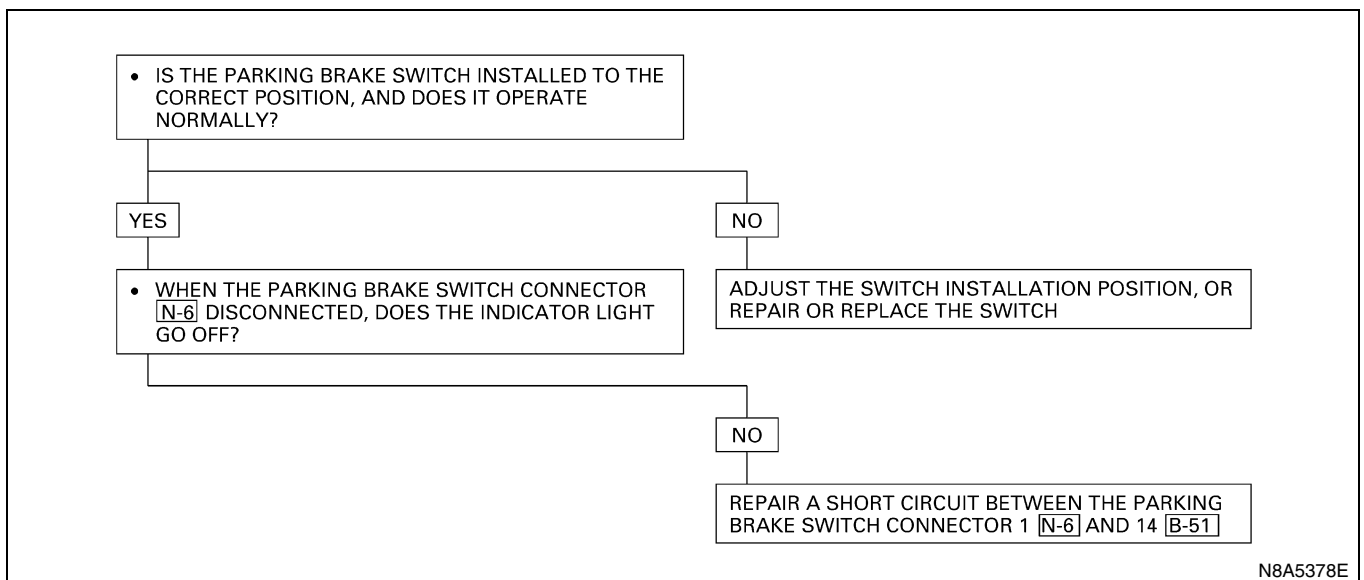
N8A0313E

5. Warning/indicator Light

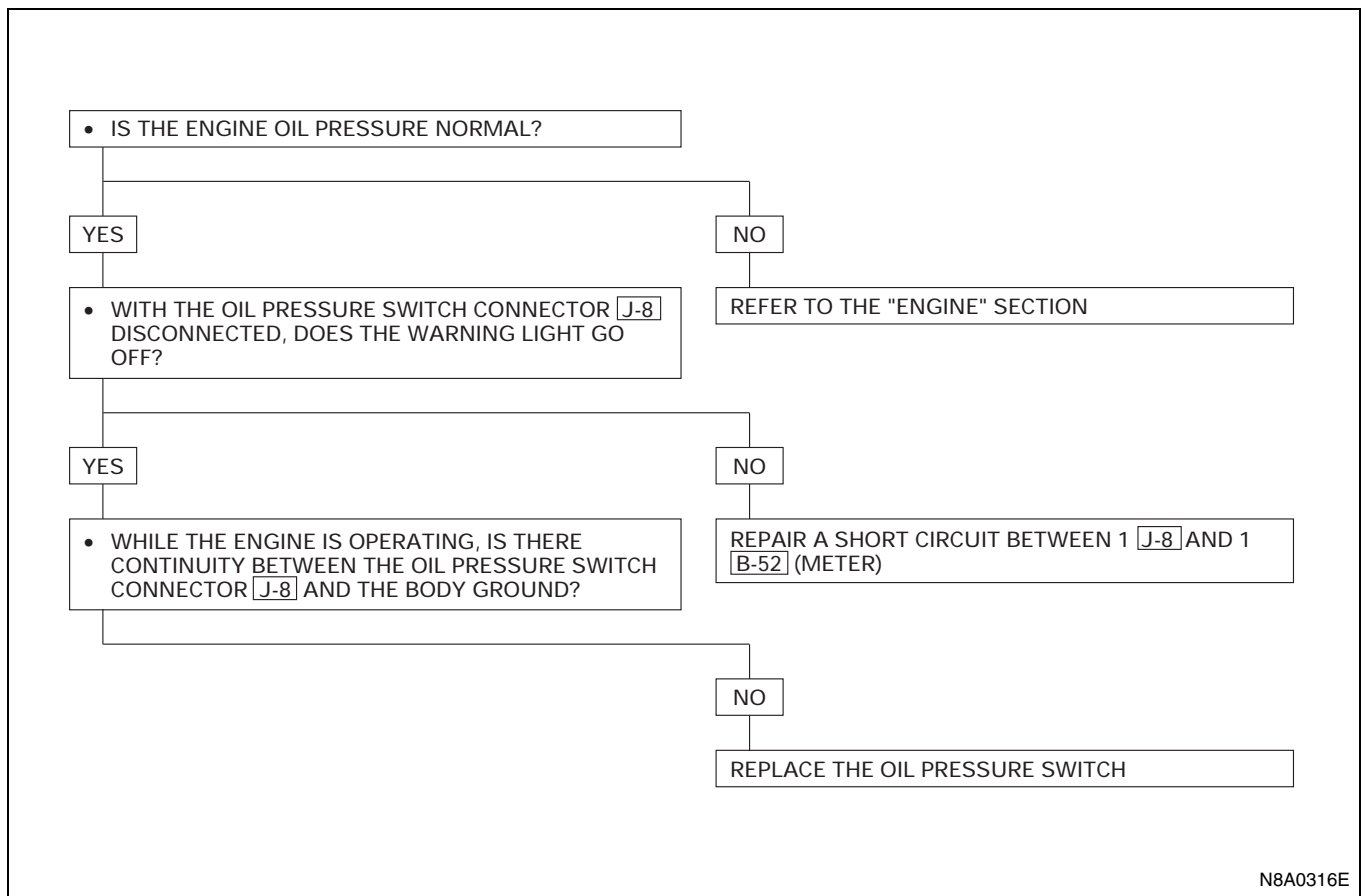
5-1. When the Parking Brake Lever Is Pulled, the Indicator Light Does Not Light Up



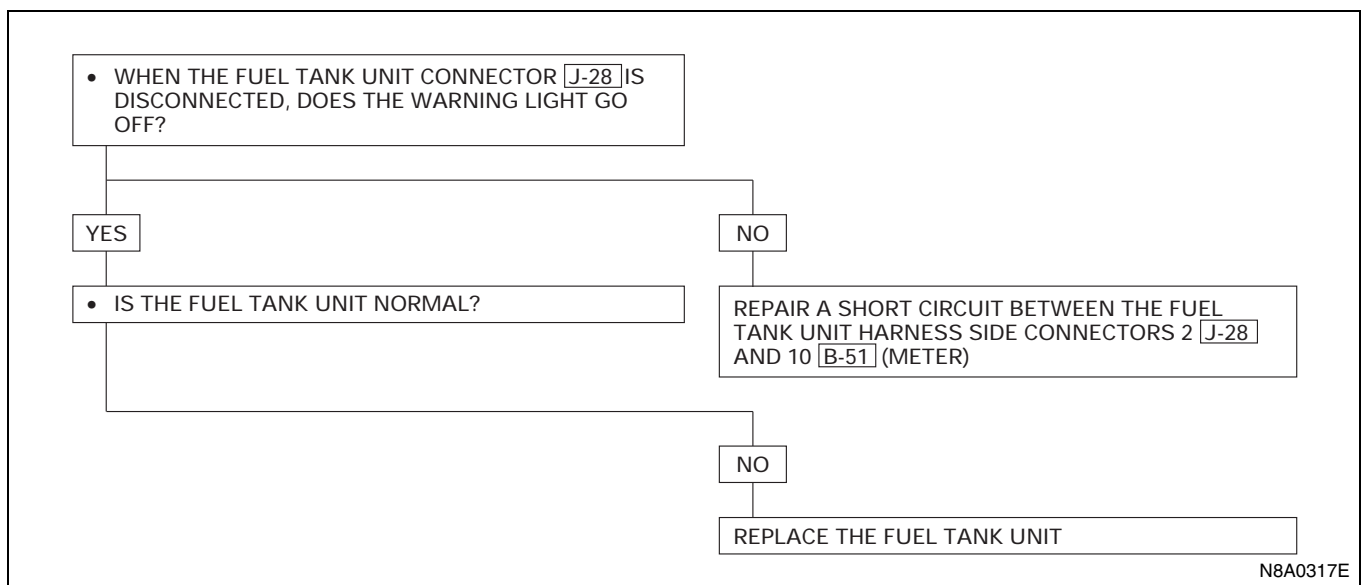
5-2. Even when the Parking Brake Lever Is Released, the Indicator Light Does Not Go Off



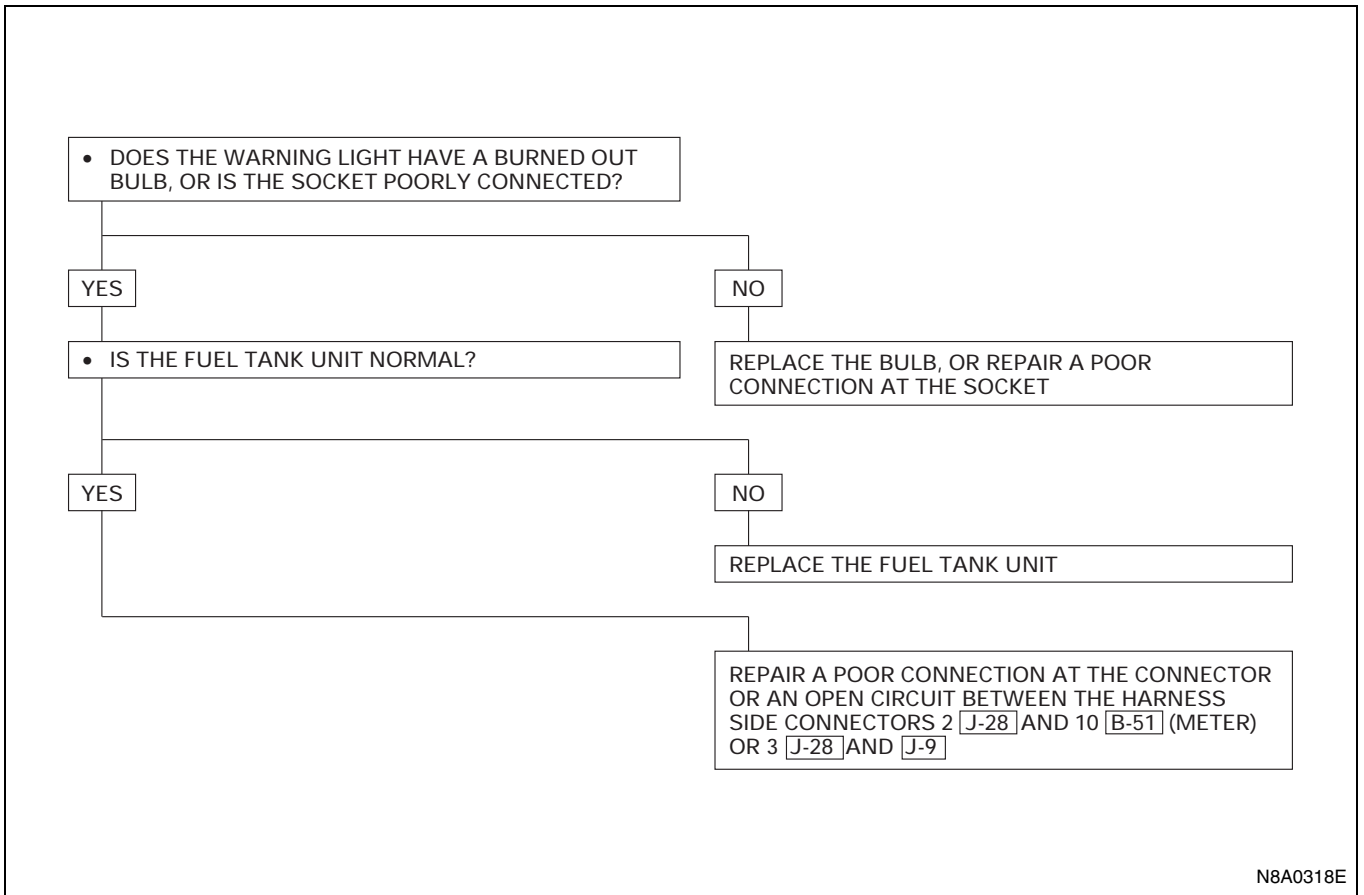
5-3. While the Engine Is Operating, the Oil Pressure Warning Light Does Not Go Off



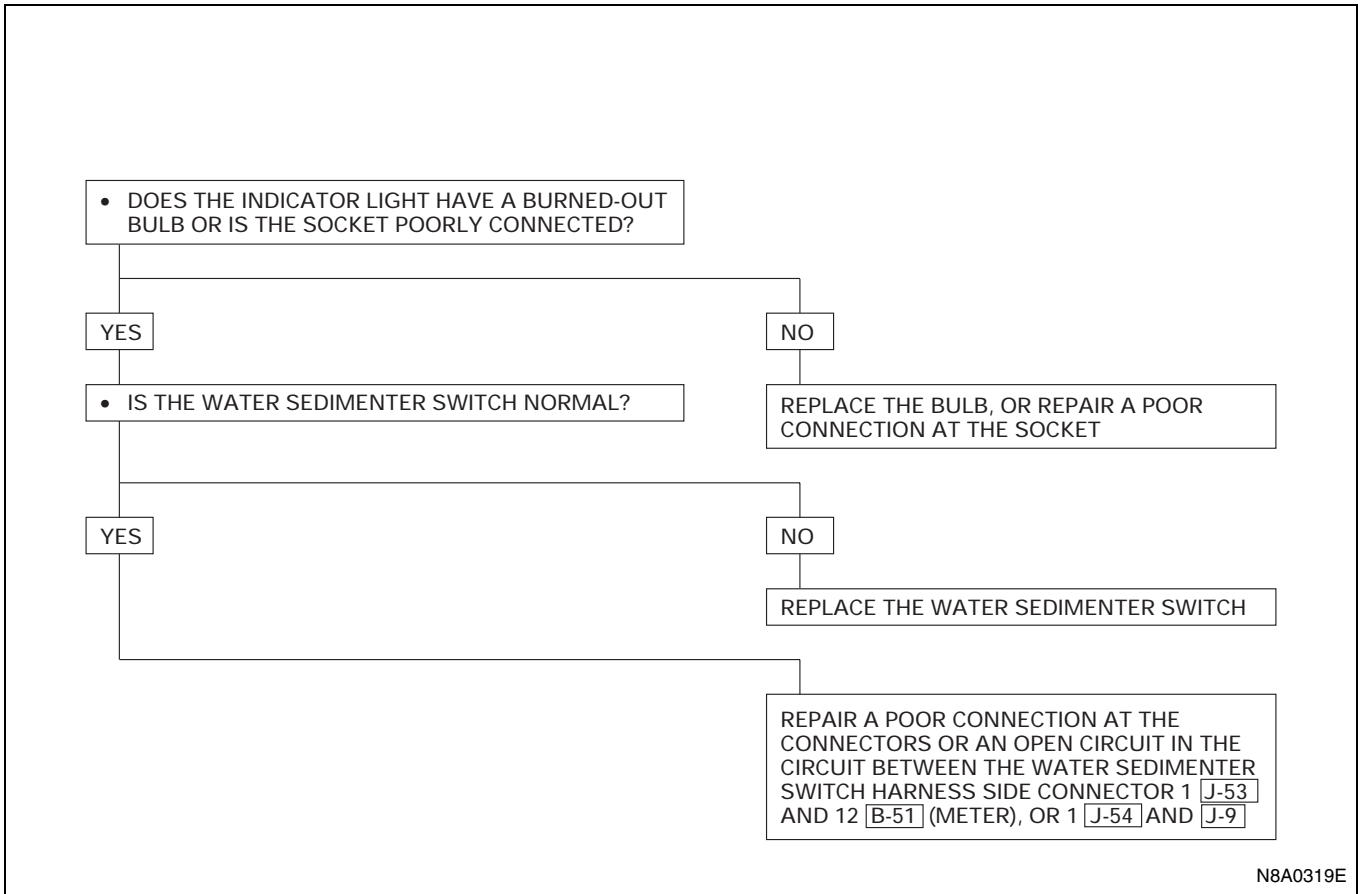
5-4. Even when the Fuel Tank Is Full with Fuel, the Fuel Warning Light Lights Up



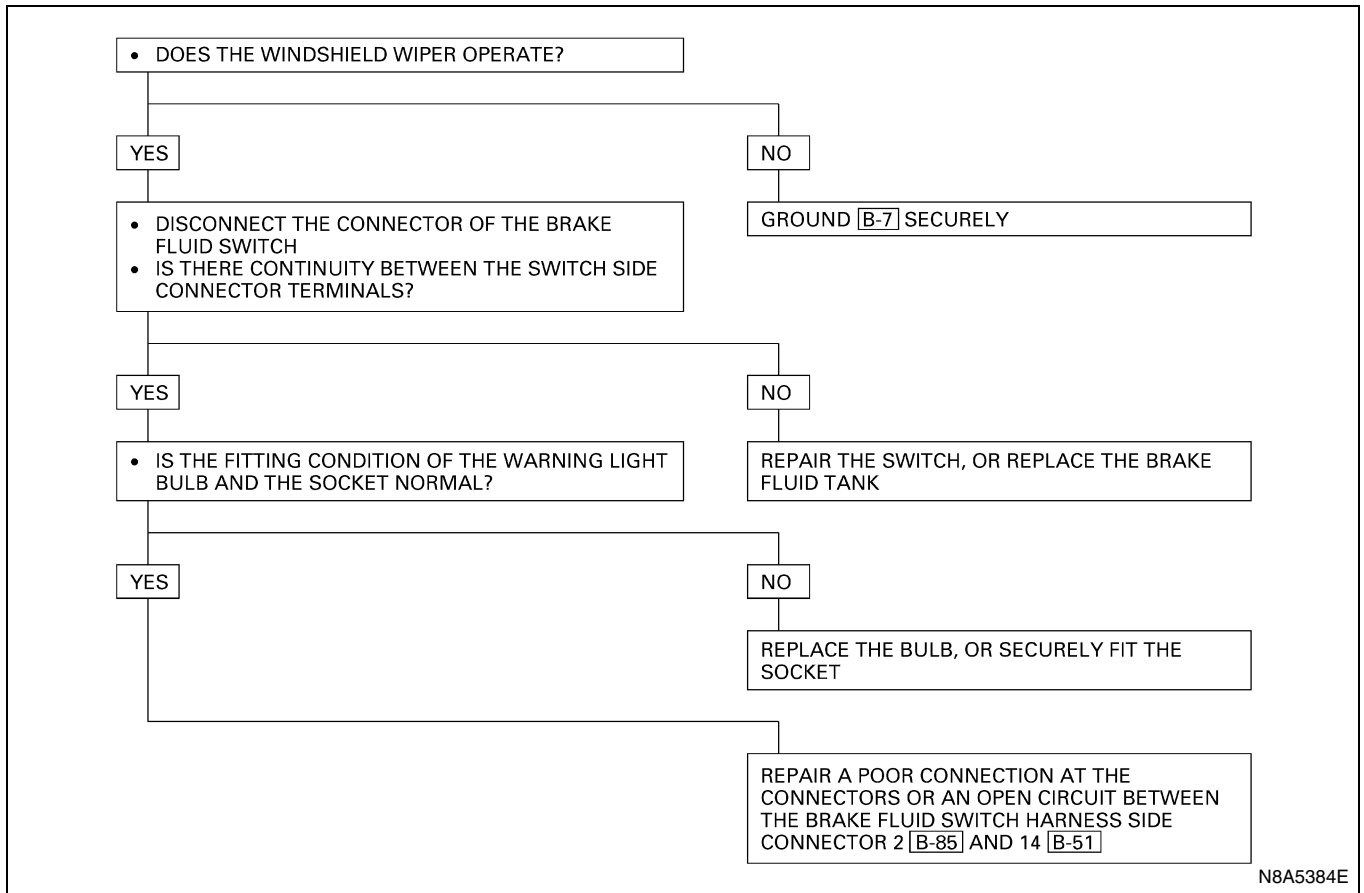
5-5. Even when the Fuel Tank Is Empty, the Low Fuel Warning Light Does Not Light Up



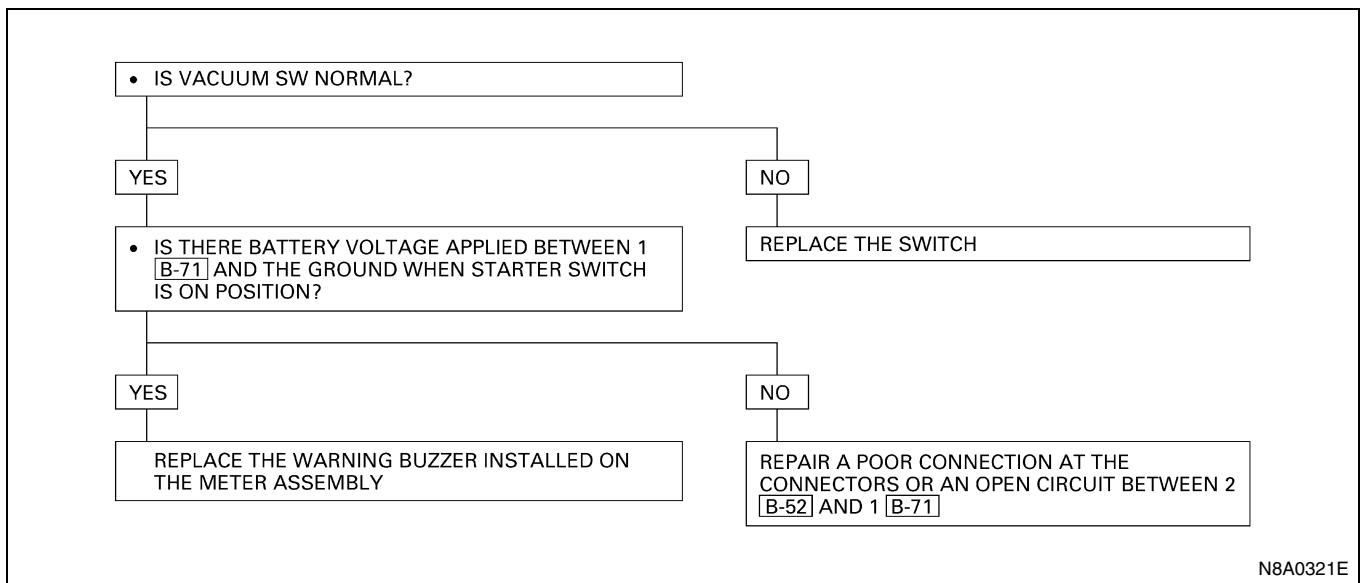
5-6. Even when the Float in the Water Sedimeter Goes Up above the Drain Warning Level, the Indicator Light Does Not Light Up



5-7. Even when the Brake Fluid Is Lower than Specified Level, the Level Warning Light Does Not Light Up



5-8. Vacuum Warning Buzzer Does Not Sound



Starter Switch

Refer to “START AND CHARGING” in this section.

Turn Signal Light Switch

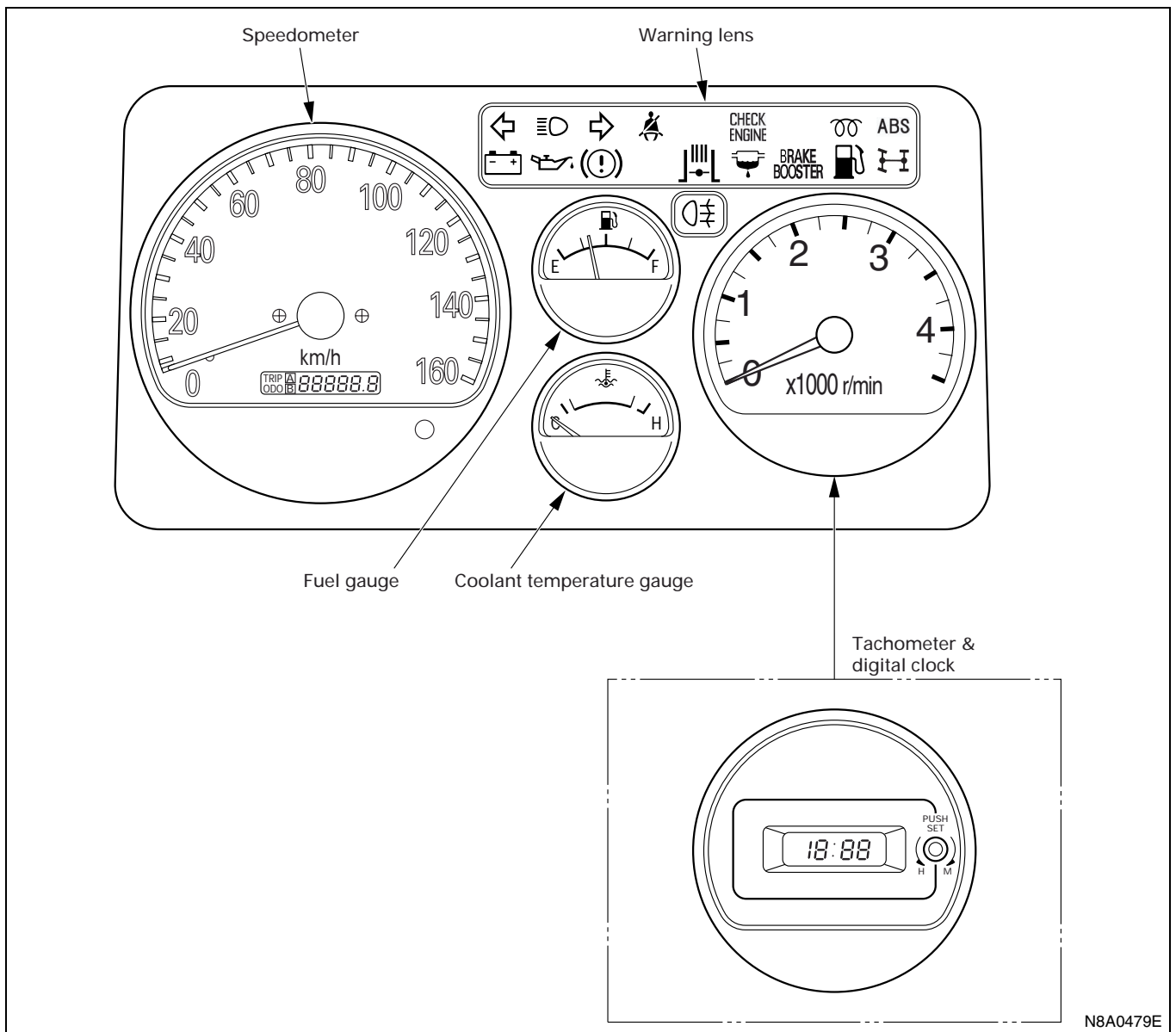
Refer to “TURN SIGNAL LIGHT, HAZARD WARNING LIGHT AND STOPLIGHT” in this section.

Exhaust Brake Switch

Refer to “EXHAUST BRAKE” in this section.

Meter Assembly

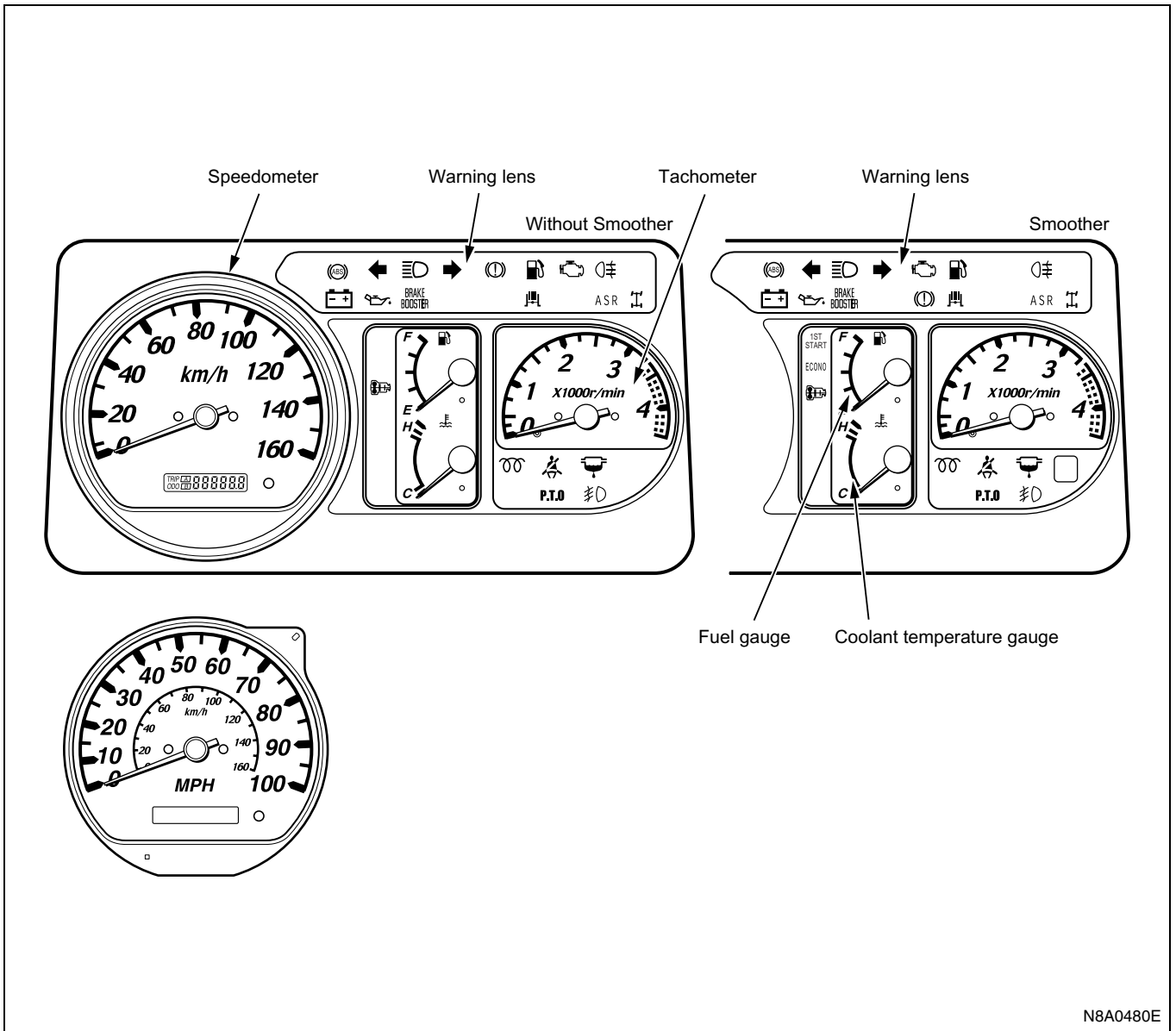
Layout for Gauges, Warning, Indicator and Illumination Lights Except 4HK1-TC



Notice:

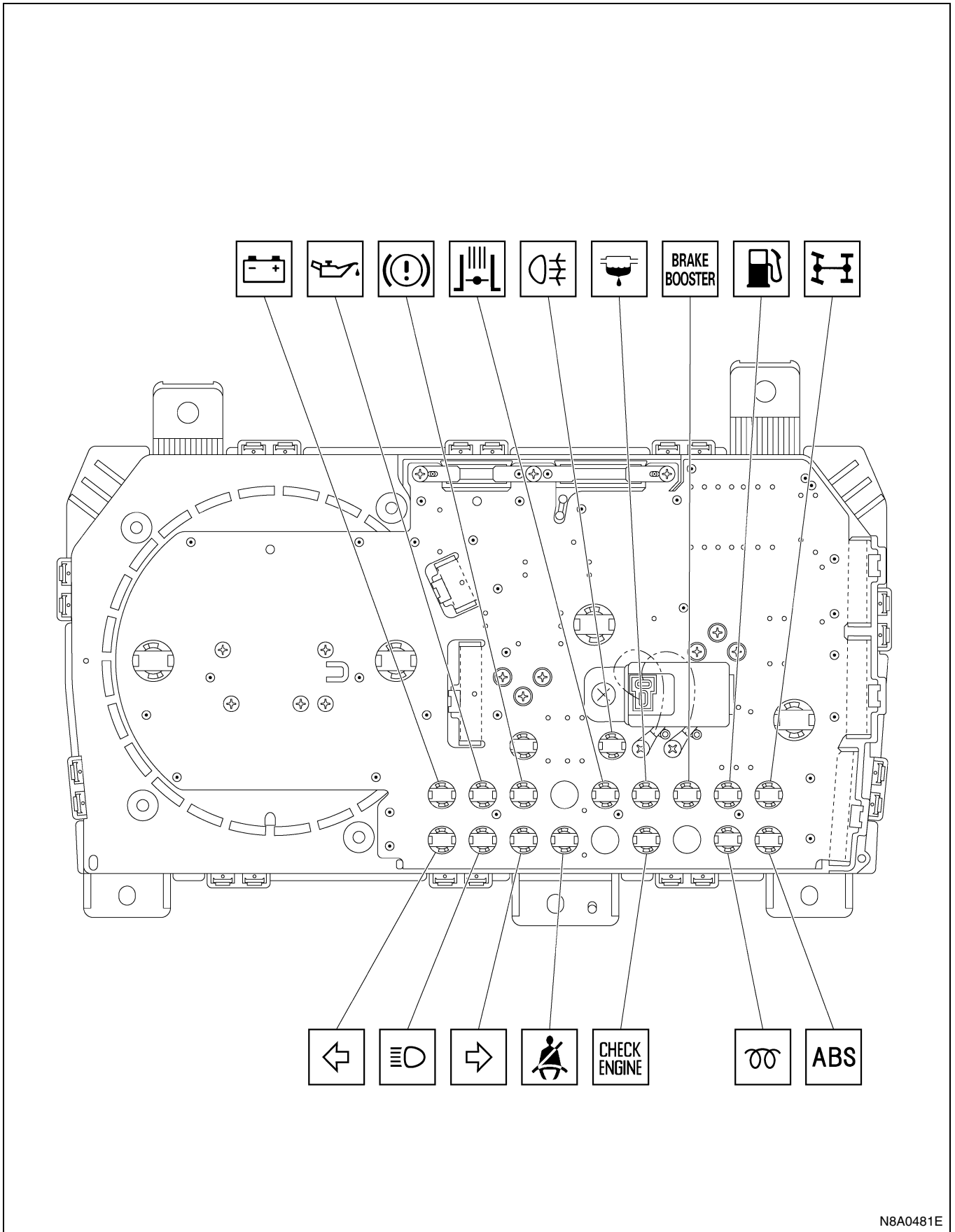
The calibration and the red zone of tachometer are various depending on the models fitted.

For 4HK1-TC



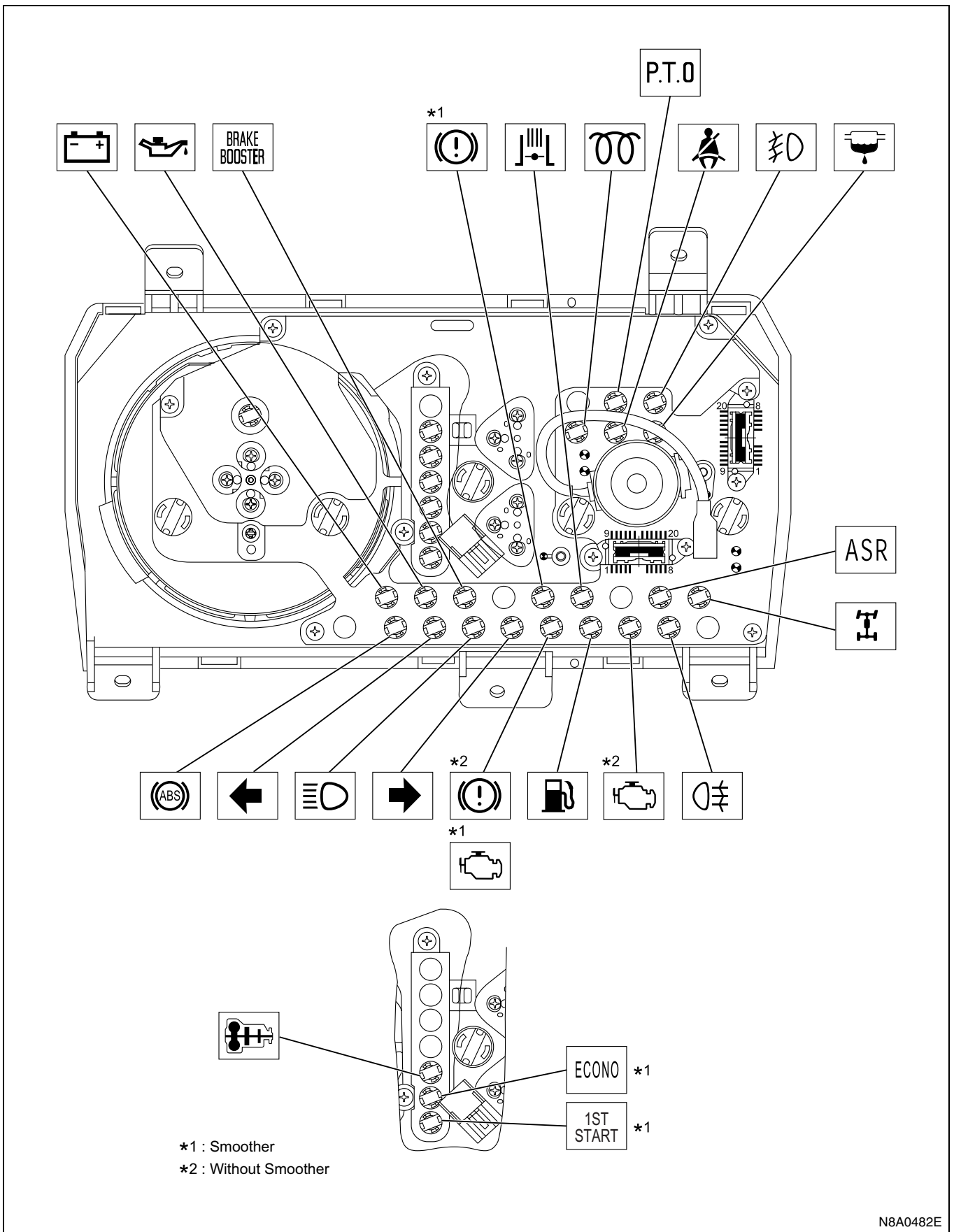
N8A0480E

Bulb Location for Warning Lens
Except 4HK1-TC



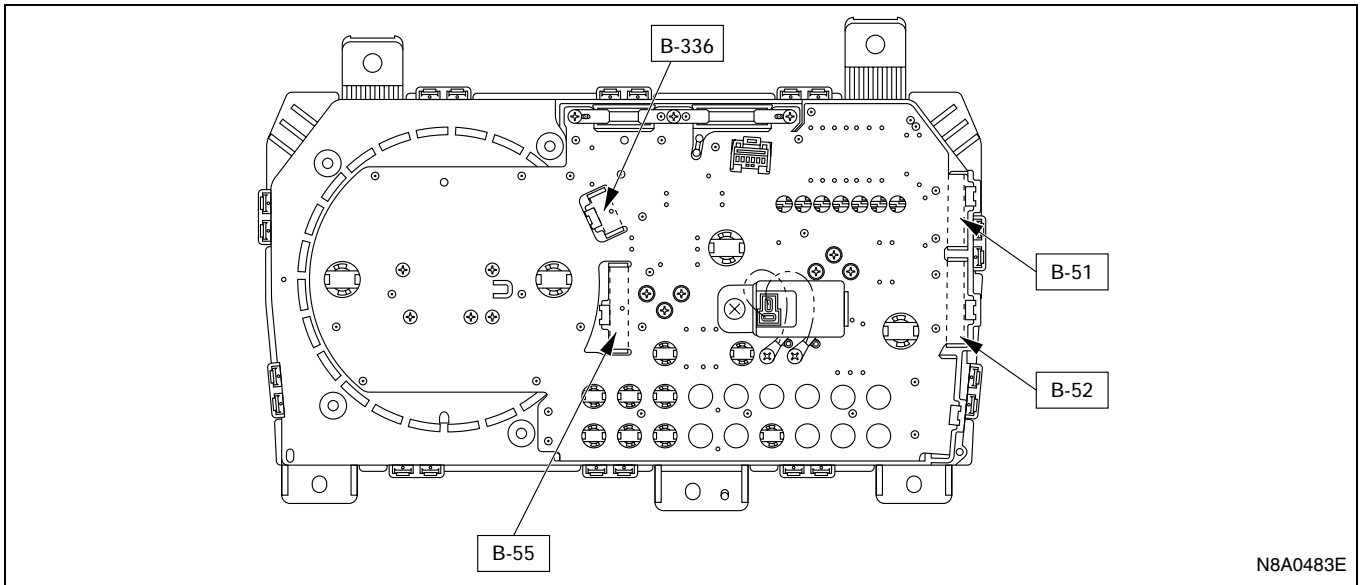
N8A0481E

For 4HK1-TC



N8A0482E

**Table for Meter Connector Terminal Connections
Except 4HK1-TC**



N8A0483E

B-336

Terminal No.	Connected to
1	IGN (+)
2	—
3	Speed pulse input
4	—
5	Ground
6	Illumination (+)

B-55

Terminal No.	Connected to
1	Speed pulse input
2	—
3	Power output (sensor)
4	ECT unit (GAUGE)
5	Fuel tank unit (GAUGE)
6	—
7	Ground
8	Turn signal (LH)
9	—
10	Beam (+)
11	Turn signal (RH)
12	—

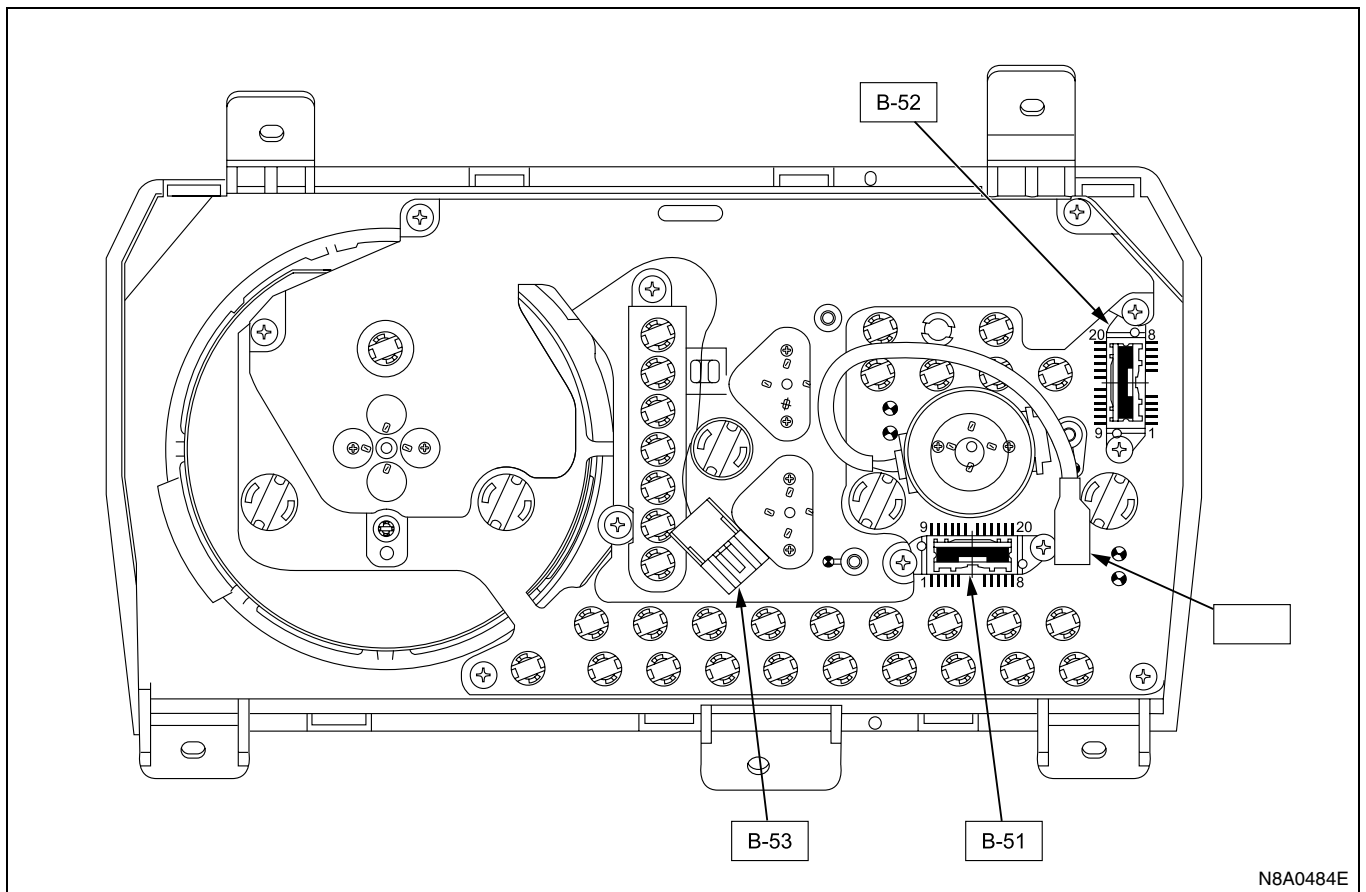
B-51

Terminal No.	Connected to
1	Exh. Brake
2	Exh. Brake / Seat belt (GCC)
3	—
4	Check engine
5	PTO
6	Glow
7	ABS
8	IGN (+)
9	4WD
10	Fuel low
11	Vacuum / Booster
12	Sedimenter
13	Low coolant
14	Brake

ECT - Engine Coolant Temperature

B-52

Terminal No.	Connected to
1	Oil pressure
2	Vacuum SW
3	Charge
4	Parking / Rear fog
5	Illumination (+)
6	—
7	Illumination (-)
8	Signal (tacho)
9	Ground (tacho)
10	Ground
11	—
12	+B

For 4HK1-TC

N8A0484E

B-53 (With Smoother)

Terminal No.	Connected to
1	TCM
2	—
3	—
4	—
5	—
6	1st Start
7	ECONO
8	Smoother
9	—
10	—
11	—
12	—

B-51

Terminal No.	Connected to
1	Turn LH
2	Beam
3	—
4	Brake (*1) / — (*2)
5	Check Engine (*1) / Brake (*2)
6	Exhaust Brake
7	—
8	—
9	Brake Booster
10	Charge
11	Oil Pressure
12	ABS
13	— (*1) / Check Engine (*2)
14	—
15	Ground
16	Vehicle Speed Signal Output
17	Illumination +
18	Ignition
19	Rear Fog
20	ASR

*1: With Smoother

*2: Without Smoother

B-52

Terminal No.	Connected to
1	4WD
2	—
3	Turn RH
4	—
5	Thermal
6	Fuel
7	TAM Pulse (-)
8	TAM Pulse (+)
9	—
10	Sedimenter
11	Front Fog
12	—
13	—
14	—
15	Glow
16	Battery
17	Vehicle Speed Sensor
18	—
19	—
20	Ground

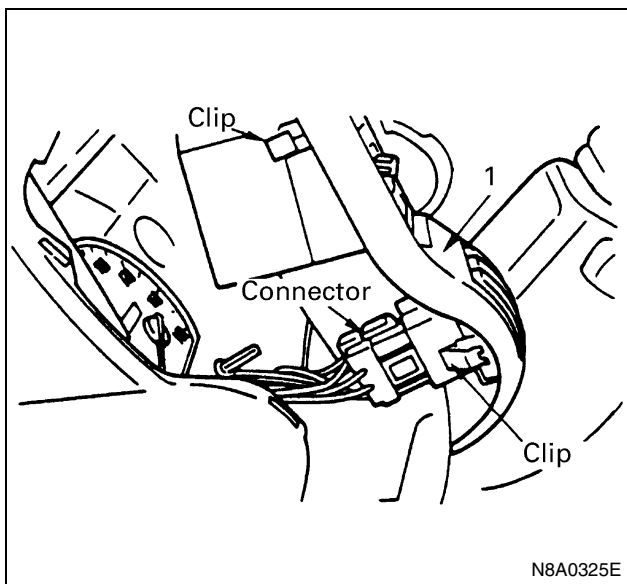
Terminal No.	Connected to
1	Battery
2	—
3	Ground

Removal

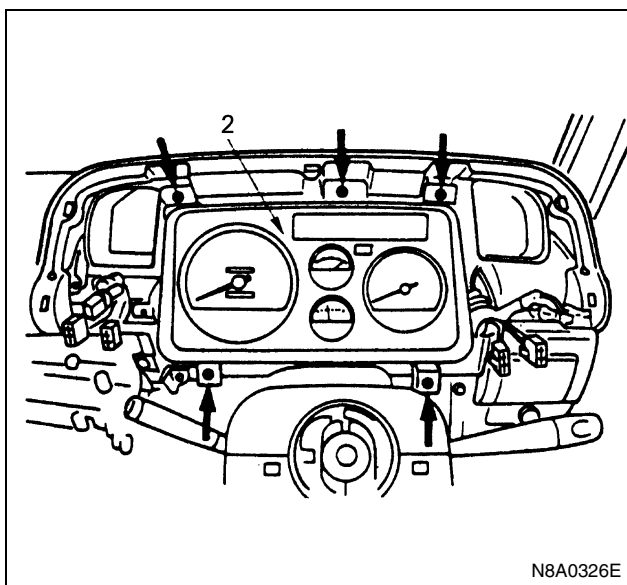
Preparation:

Disconnect the battery ground cable.

1. Meter Cluster



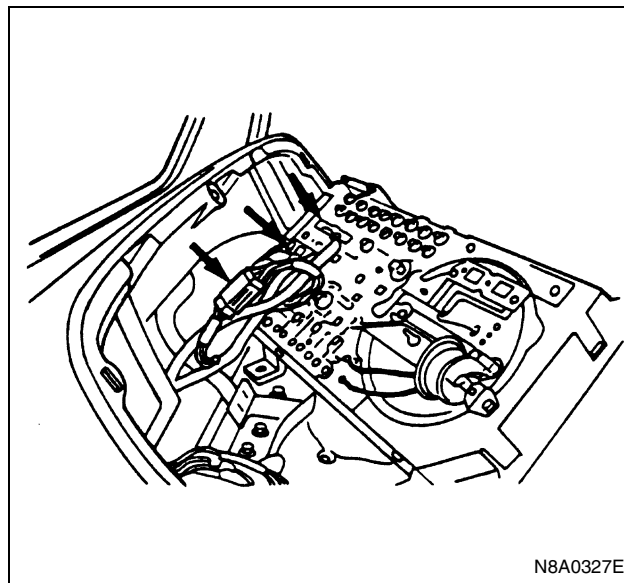
2. Meter Assembly
Remove the five screws.



Disconnect the meter connectors.

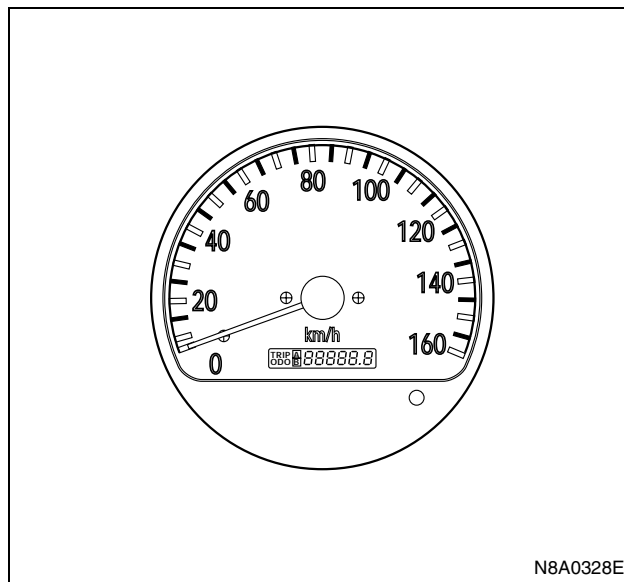
Installation

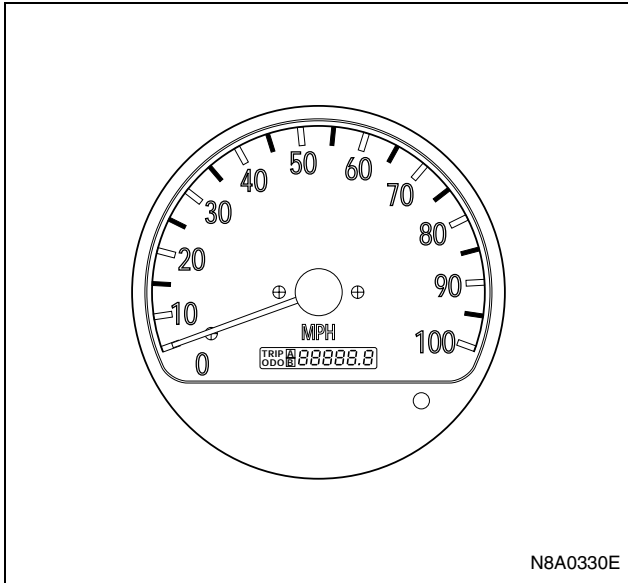
To install, follow the removal steps in the reverse order.



Speedometer

The speedometer is made up of the cross coil type ammeter (movement) that displays indications, the stepper motor that drives and adds up the odometer and trip meter, and the driving circuit (printed circuit board) that makes exchanges between the pulse signals and the current.





On-vehicle Service

Check the meter display accuracy and the operation of the odometer with the speedometer tester.

Notice:

Inappropriate tire inflation may affect the accuracy of the odometer.

(To conduct this test, refer to the tester manufacturer's instruction manual.)

Since the meter display permissible levels above are specifications solely for the meter, they are to be used as reference values when conducting on-vehicle service.

Except 4HK1-TC

Tester display speed	Meter display permissible level
20 km/h	17.5 — 22.5 km/h
40	37.5 — 42.5
60	57.5 — 62.5
80	77.5 — 82.5
100	97.6 — 103.4
120	117.6 — 123.4
140	137.6 — 143.4

Tester display speed	Meter display permissible level
20 MPH	18.3 — 21.7 MPH
40	38.3 — 41.7
60	58.3 — 61.7
80	77.8 — 82.8

For 4HK1-TC (General Export)

Tester display speed	Meter display permissible level
40 km/h	37 — 41 km/h
60	58 — 62
80	77.5 — 82.5
100	97.5 — 103
120	117 — 122.5
140	137.5 — 143

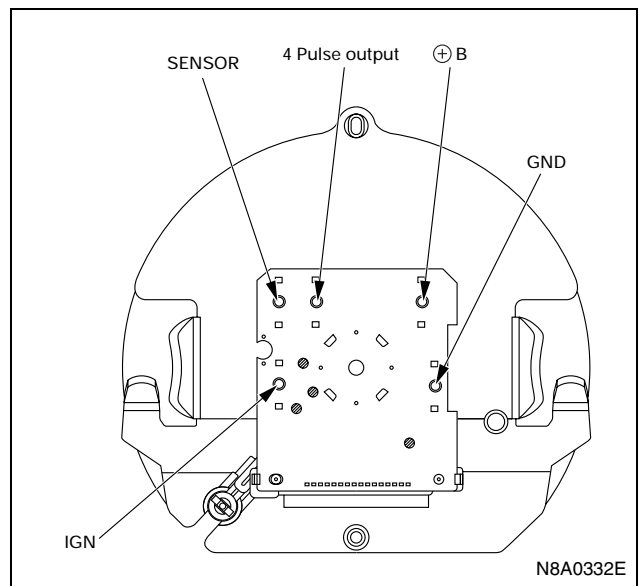
For 4HK1-TC (Europe)

Tester display speed	Meter display permissible level
20 km/h	20 — 22.5 km/h
40	40 — 42.5
60	60 — 63.2
80	79.7 — 83.4

Individual Inspection

Remove the speedometer from the meter assembly and measure the resistance and the current consumption between each terminals.

Replace the speedometer when the result of inspection is found abnormal.



Terminal symbol	Resistance value
IGN — GND	58±20 kΩ
SEN — GND	70±20 kΩ
4P — GND	∞

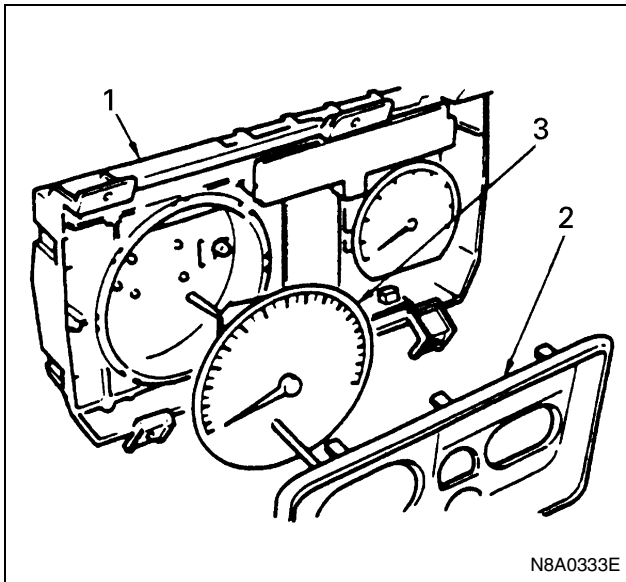
Removal

Preparation:

Disconnect the battery ground cable.

- Except 4HK1-TC

1. Meter Assembly
Refer to "METER ASSEMBLY" in this section.
2. Meter Glass
Remove it by pushing the catches with your finger.
3. Speedometer
Remove four screws securing the meter at the back side.



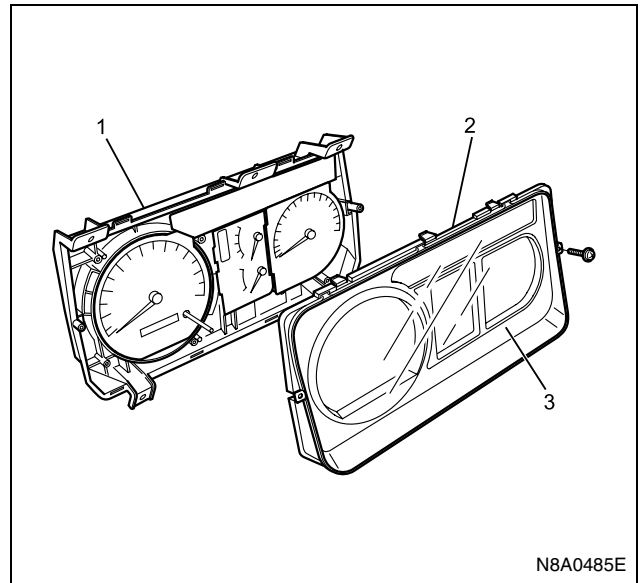
- For 4HK1-TC

1. Remove the meter assembly/speedometer (1).

Notice:

Speedometer cannot be removed as a single unit since it is integrated into the meter assembly.

- Refer to "Meter Assembly" in this section.
2. Remove the meter plate (2) and meter glass (3).
 - Remove the two installing screws on the meter surface.
 - Remove the meter plate by pushing the catches with your finger.

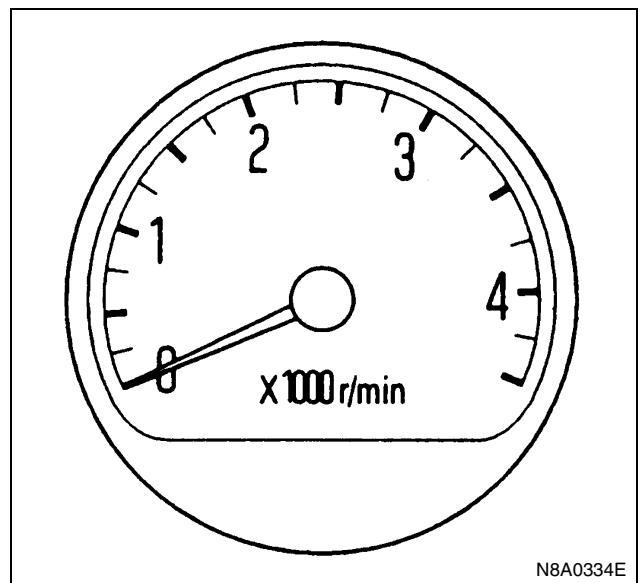


Installation

To install, follow the removal steps in the reverse order.

Tachometer

The tachometer is made up of the cross coil type ammeter (movement) that displays indications, and the drive circuit (printed board) that makes exchange between the pulse signals and the current.



On-vehicle Service Inspection

1. Set up the tune-up tester to the engine.
2. Start the engine and compare the readings displayed by the tachometer and the tester.
When the difference between these two readings differs largely from the specified value, replace it with a correct one.

Notice:

Since the meter display permissible levels above are specifications solely for the meter, they are to be used as reference values when conducting on-vehicle inspection.

Except 4HK1-TC

Tester display speed	Meter display permissible level
500	400 — 500
1000	800 — 1050
2000	1800 — 2050
3000	2800 — 3050
4000	3800 — 4050

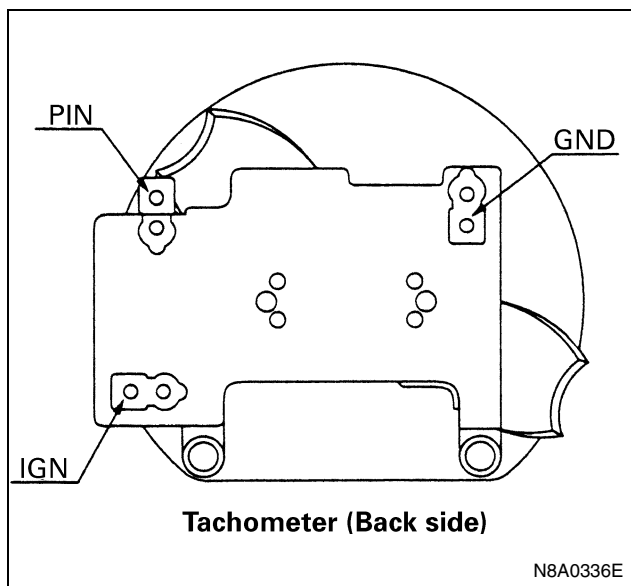
For 4HK1-TC

Tester display speed	Meter display permissible level
750	700 — 800
2000	1900 — 2150
3000	2950 — 3200
4000	3950 — 4200

Individual Inspection

Remove the tachometer from the meter assembly and measure the resistance value and the current consumption between each terminals.

Replace the tachometer when the result of inspection is found abnormal.



1. Resistance value

Use the analog type circuit tester. (Range: 1K)
For 12 Volt tachometer

Terminal symbol	Tester terminal			
	Red (+)	Black (-)	Black (-)	Red (+)
IGN — GND	IGN	GND	IGN	GND
	∞		30±5 kΩ	
PIN — GND	PIN	GND	PIN	GND
	33±5 kΩ		500 — 1000 kΩ	

For 24 Volt tachometer

Terminal symbol	Tester terminal			
	Red (+)	Black (-)	Black (-)	Red (+)
IGN — GND	IGN	GND	IGN	GND
	∞		30±5 kΩ	
PIN — GND	PIN	GND	PIN	GND
	33±5 kΩ		500 — 1000 kΩ	

2. Current value

Use the analog type circuit tester.

Since the current consumption fluctuates as the power voltage varies, check to be sure that the voltage applied is 12±1 V or 24±1 V.

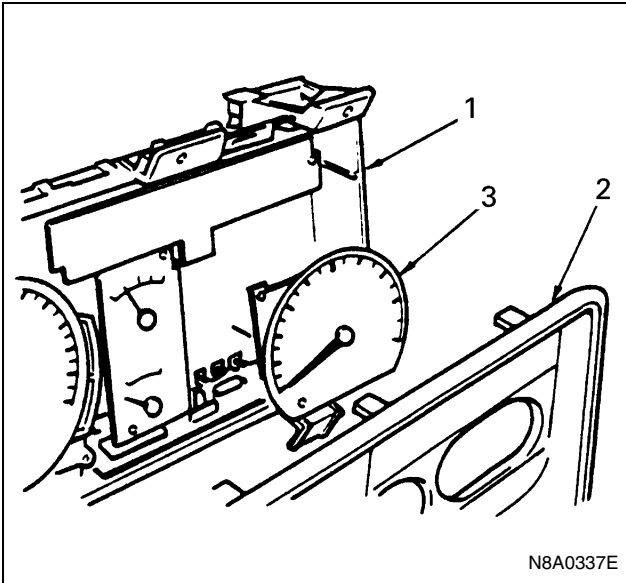
Voltage	Connecting terminal	Current consumption	Remarks
12Volt	IGN — GND	12±1 V (when 12±1 V applied)	No signal input
24Volt		24±1 V (when 24±1 V applied)	No signal input

Removal

Preparation:

Disconnect the battery ground cable.

- Except 4HK1-TC
1. Meter Assembly
Refer to "METER ASSEMBLY" in this section.
 2. Meter Glass
Remove it by pushing the catches with your finger.
 3. Tachometer
Remove three screws securing the meter at the back side.



- For 4HK1-TC

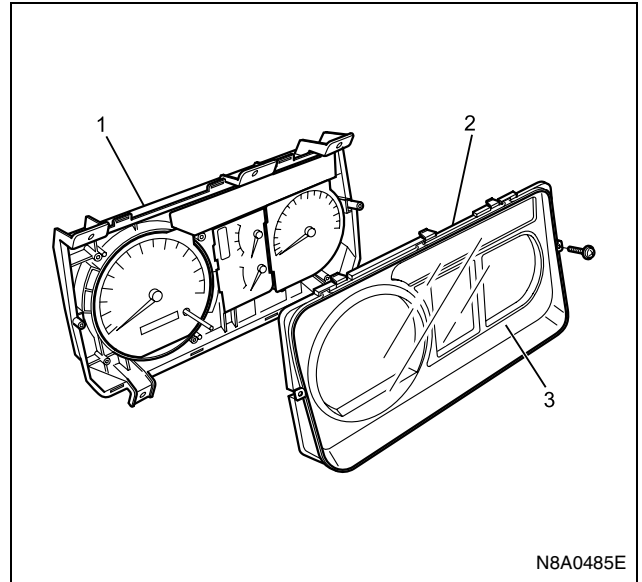
1. Remove the meter assembly/tachometer (1).

Notice:

Tachometer cannot be removed as a single unit since it is integrated into the meter assembly.

- Refer to “Meter Assembly” in this section.

2. Remove the meter plate (2) and meter glass (3).
- Remove the two installing screws on the meter surface.
 - Remove the meter plate by pushing the catches with your finger.

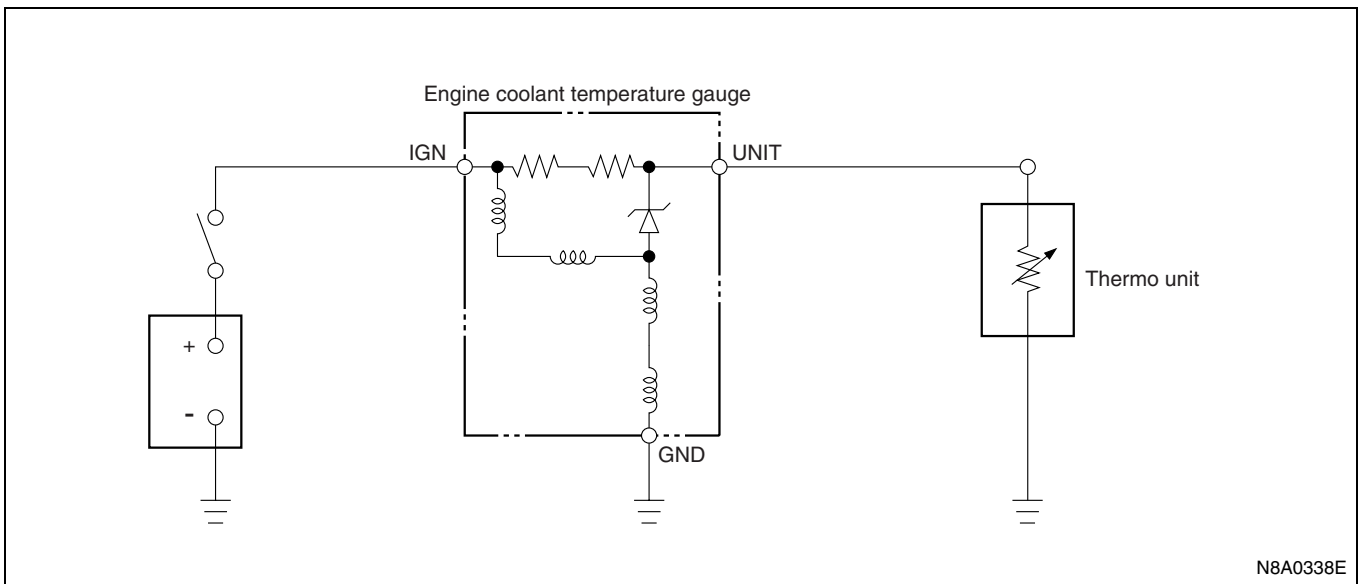


Installation

To install, follow the removal steps in the reverse order.

Coolant Temperature Gauge

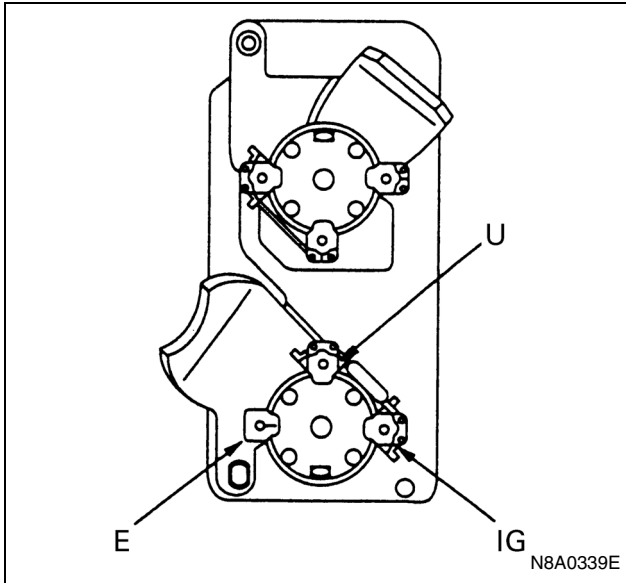
Circuit Diagram



Inspection

Remove the coolant temperature gauge from the meter assembly, and measure the resistance value between each terminal.

Replace the coolant temperature gauge when the result of inspection is found abnormal.



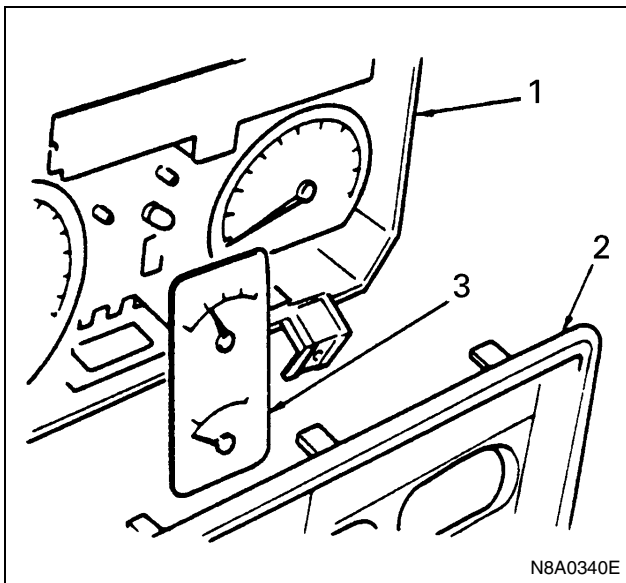
Terminal symbol	Resistance value
IG — U	169 $\Omega \pm 10\%$
U — E	333 $\Omega \pm 10\%$
IG — E	242 $\Omega \pm 10\%$

Removal

Preparation:

Disconnect the battery ground cable.

- Except 4HK1-TC
1. Meter Assembly
Refer to “METER ASSEMBLY” in this section.
 2. Meter Glass
Remove it by pushing the catches with your finger.
 3. Coolant Temperature Gauge
Remove six screws securing the meter at the back side.

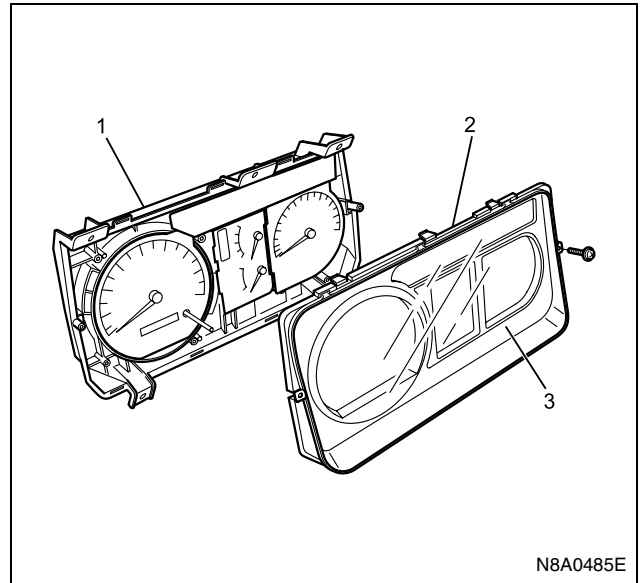


- For 4HK1-TC
1. Remove the meter assembly (1).

Notice:

Coolant temperature gauge and fuel gauge cannot be removed as a single unit since they are integrated into the meter assembly.

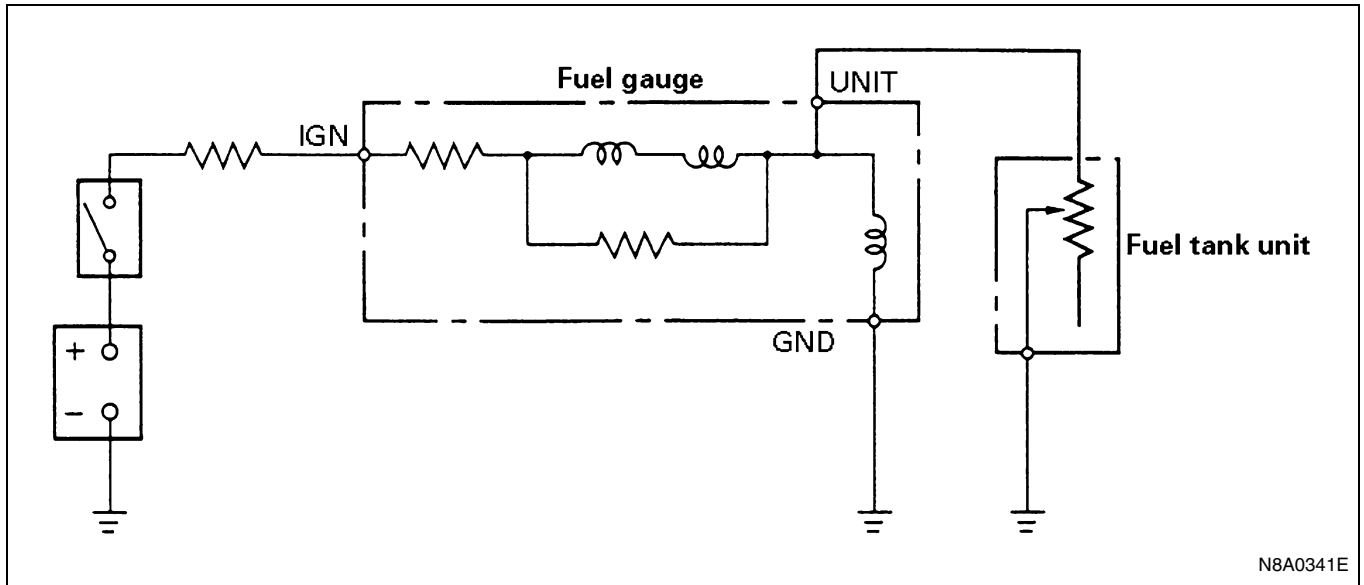
- Refer to “Meter Assembly” in this section.
2. Remove the meter plate (2) and meter glass (3).
 - Remove the two installing screws on the meter surface.
 - Remove the meter plate by pushing the catches with your finger.



Installation

To install, follow the removal steps in the reverse order.

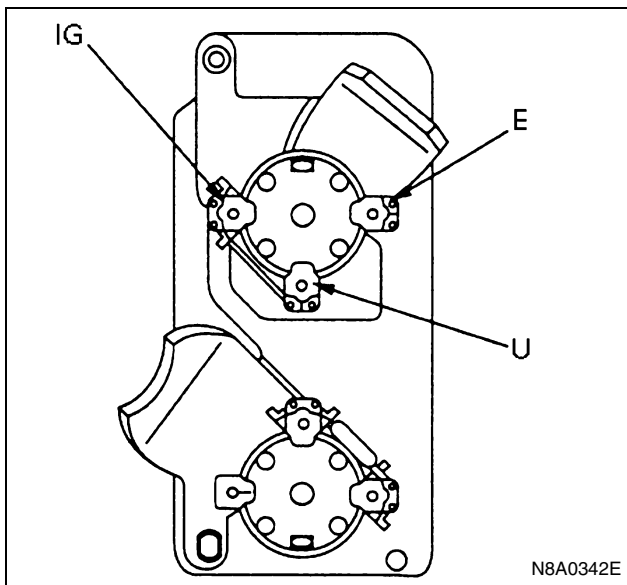
Fuel Gauge Circuit Diagram



N8A0341E

Inspection

Remove the fuel gauge from the meter assembly, and measure the resistance value between each terminal. Replace the meter when the result of inspection is found abnormal.



N8A0342E

Terminal symbol	Resistance value
IG — U	108.1 $\Omega \pm 10\%$
U — E	103 $\Omega \pm 10\%$
IG — E	211.1 $\Omega \pm 10\%$

Removal and Installation

Refer to the "COOLANT TEMPERATURE GAUGE" in this section.

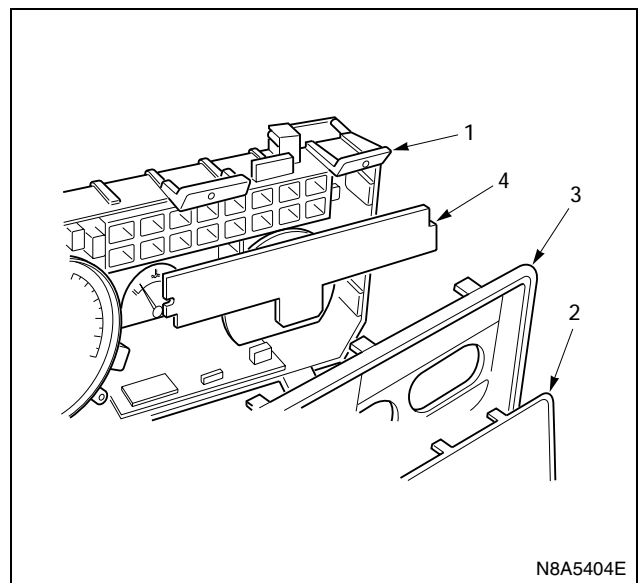
Warning Lens

Removal

Preparation:

Disconnect the battery ground cable.

1. Meter Assembly
Refer to "METER ASSEMBLY" in this section.
2. Meter Glass
Remove it by pushing the catches with your finger.
3. Meter Plate
Remove it by pushing the catches with your finger.
4. Warning Lens



N8A5404E

Legend

1. Meter Assembly
2. Meter Glass
3. Meter Plate
4. Warning Lens

Installation

To install, follow the removal steps in the reverse order.

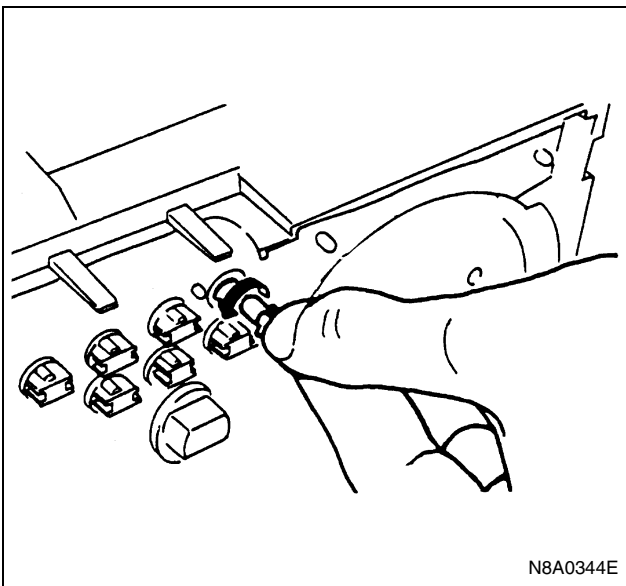
Warning Light Bulb, Indicator Light Bulb and Illumination Light Bulb

Removal

Preparation:

Disconnect the battery ground cable.

1. Meter Assembly
Refer to "METER ASSEMBLY" in this section.
2. Socket and Bulb
Hold the bulb socket by hand and rotate it counter-clockwise to remove them from the meter body.
3. Bulb
Pull out the bulb from the socket.



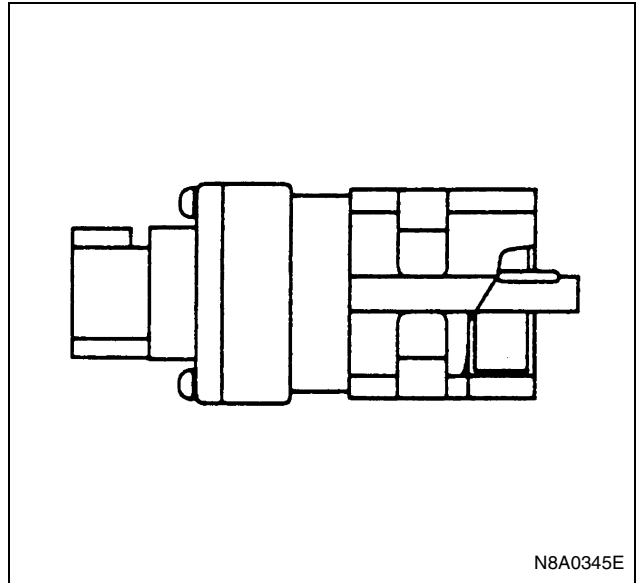
Installation

To install, follow the removal steps in the reverse order.

Vehicle Speed Sensor

The vehicle speed sensor is installed on the rear portion of the transmission or transfer case.

The number of pulses generated is four pulses per one rotation of the pinion shaft.



Inspection

1. Connect a resistance of $390 \Omega \pm 5\%$, 2W between connector terminal 1 [J-32] and battery (+) terminal and connect the connector terminal 2 [J-32] to the battery (-) terminal.

Caution:

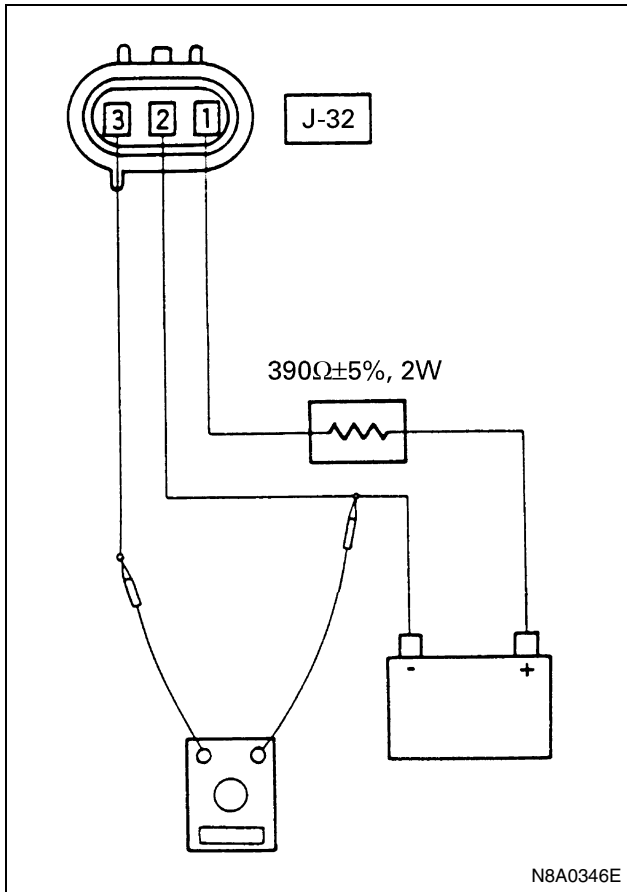
Be extremely careful not to connect the battery (+) terminal to the connector 3 [J-32].

This may damage the vehicle speed sensor.

2. Rotate the shaft of the vehicle speed sensor slowly and measure the voltage between 3 [J-32] and 2 [J-32] with a digital tester.

The voltage, with one rotation of shaft, fluctuates four times in the following range: 10 to 14V \leftrightarrow 24 or less.

Replace the sensor when the result of inspection is found abnormal.



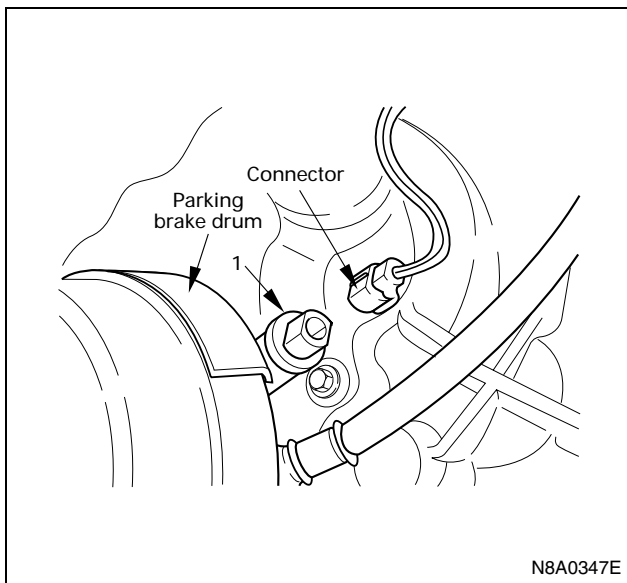
N8A0346E

Removal

Preparation:

Disconnect the battery ground cable.

1. Vehicle Speed Sensor
Disconnect the connector.



N8A0347E

Installation

1. Tighten the vehicle speed sensor to the specified torque.

Tighten:

Vehicle speed sensor to 25 N·m (2.5 kg·m/18 lb·ft)

Caution:

Tightening must be made at the hexagonal part of the sensor.

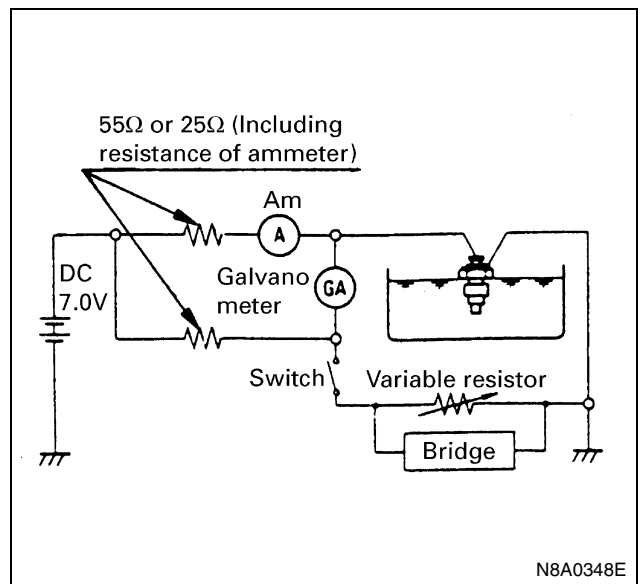
To tighten the connector itself would cause damage.

Thermo Unit

Inspection

The thermo unit is thermistor type and must be inspected under the conditions as shown below.

1. Put the deviation of the galvanometer to 0 by using the variable resistor, switch the thermo unit off and then measure the resistance of the resistor through the bridge.
Confirm that the resistance is continuously variable in any other points than those shown below.
2. Dip the thermo unit into 80 — 90°C (176 — 194°F) water and confirm that there is no bubble continuously coming out of inside of the unit.
Replace the unit when the result of inspection is found abnormal.



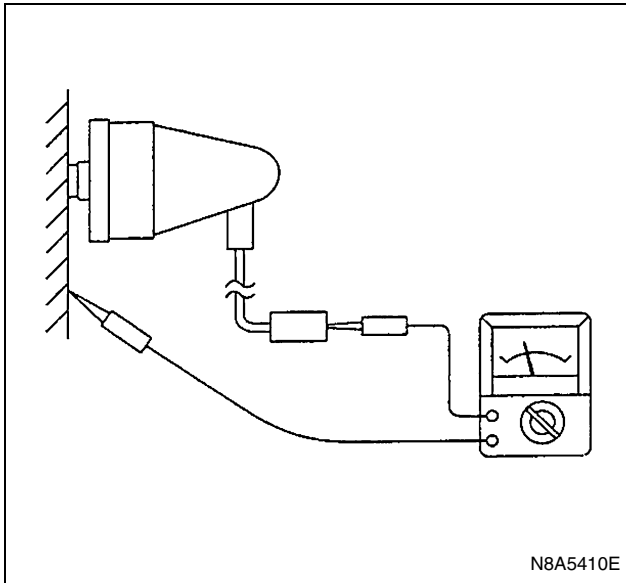
N8A0348E

Check condition	Temperature	
	50°C (112°F)	115°C (239°F)
7 V 55 Ω Gauge	+33.6 -33.6 226.0	+1.71 -2.21 26.4
7 V 25 Ω Gauge	—	+2.68 -3.68 24.3

Oil Pressure Switch

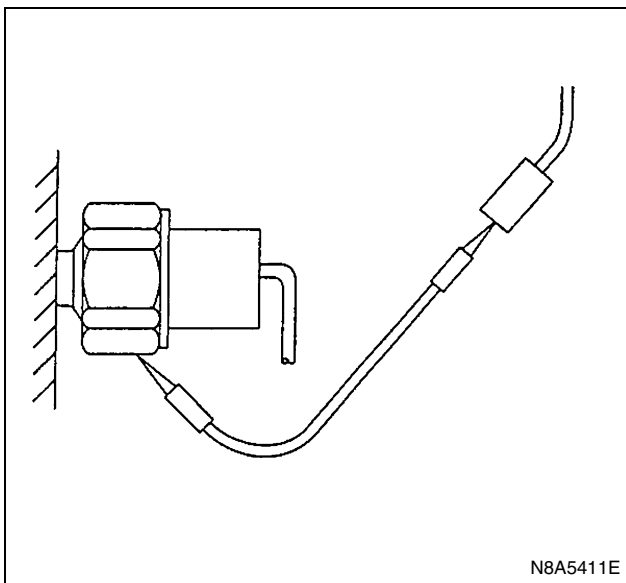
Inspection

Check the continuity between the switch terminal and the body ground with the starter switch is OFF position. Replace the switch when the result of inspection is found abnormal.



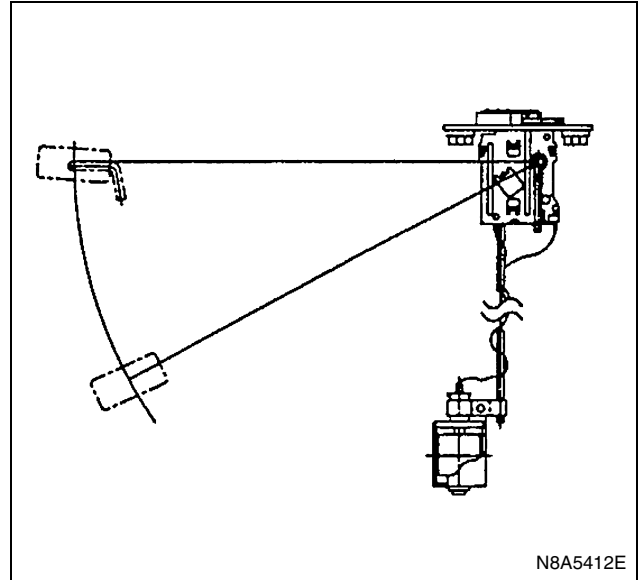
Circuit Inspection

1. Start the engine.
2. When disconnecting the oil pressure switch connector then connecting the harness side connector to the ground, check to see if the oil pressure warning light lights up. When the light will not light up, check the circuit between the meter and the oil pressure switch, and repair an open circuit if necessary.



Fuel Tank Unit

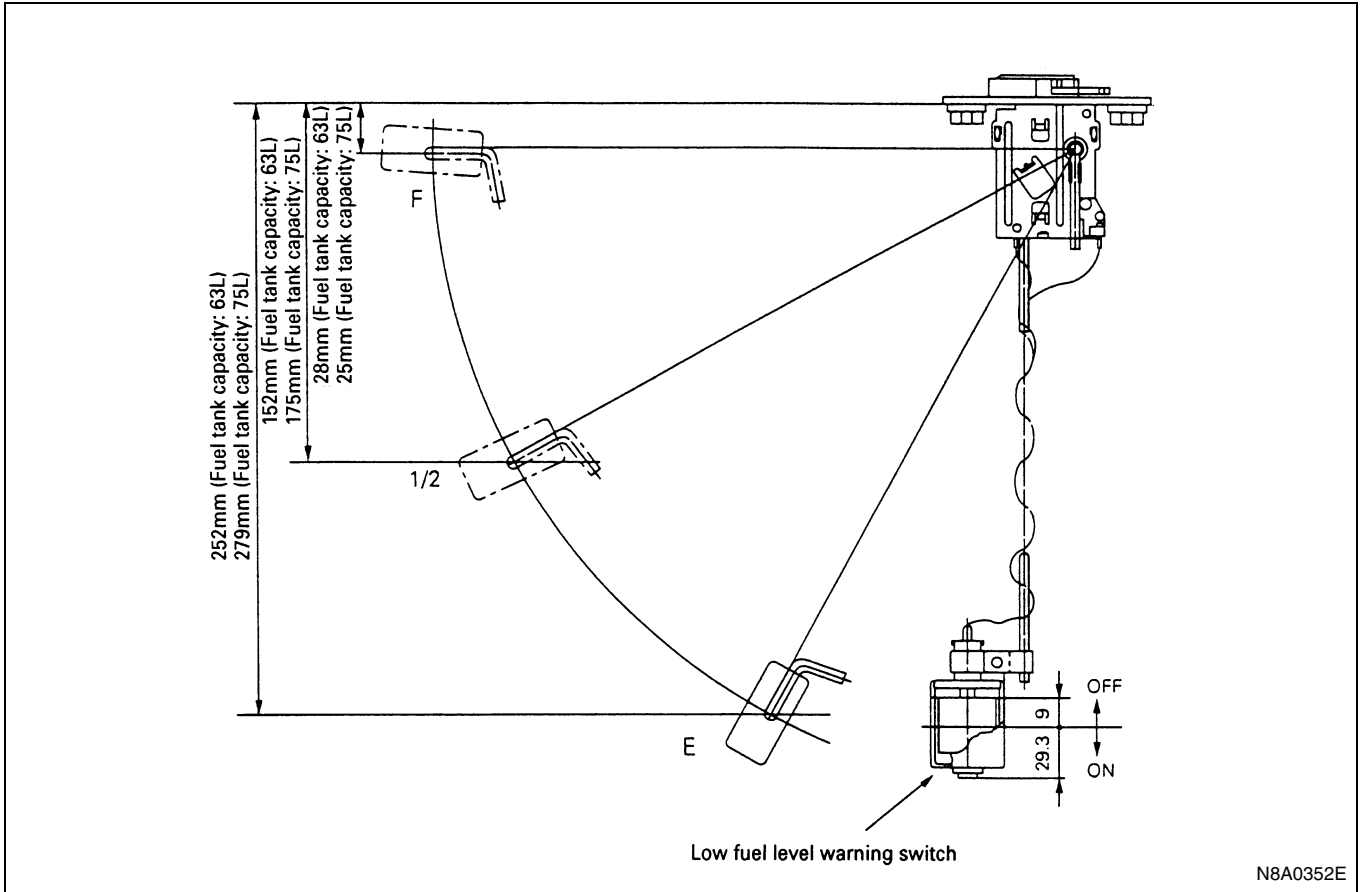
The tank unit varies the internal resistance according to the float position (fluid level) to operate the fuel meter needle. Also available is the build-in switch type to warn the driver of low fuel level (about 5 liters left in the tank) by illuminating the fuel warning light.



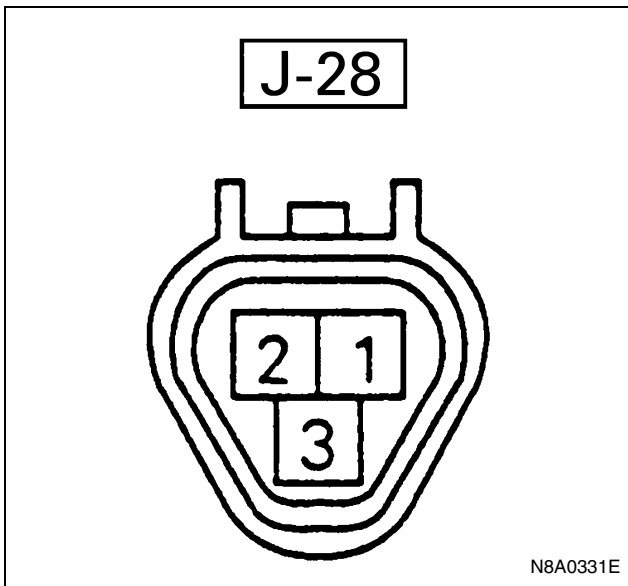
Inspection

(Level Switch type of warn low fuel level)

1. Check the resistance between the connector terminals 1 **J-28** and 3 **J-28** while shifting the float from "E" to "F" point.
2. Check if the low fuel warning switch turns on and off at the specified positions. If found defective, replace the fuel tank unit.



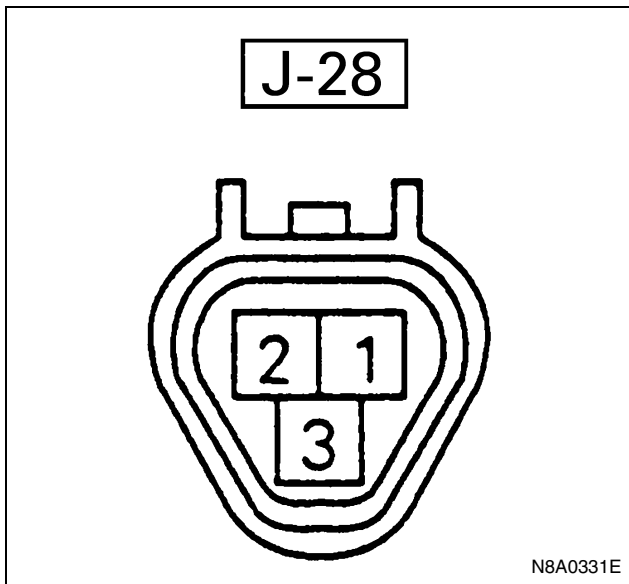
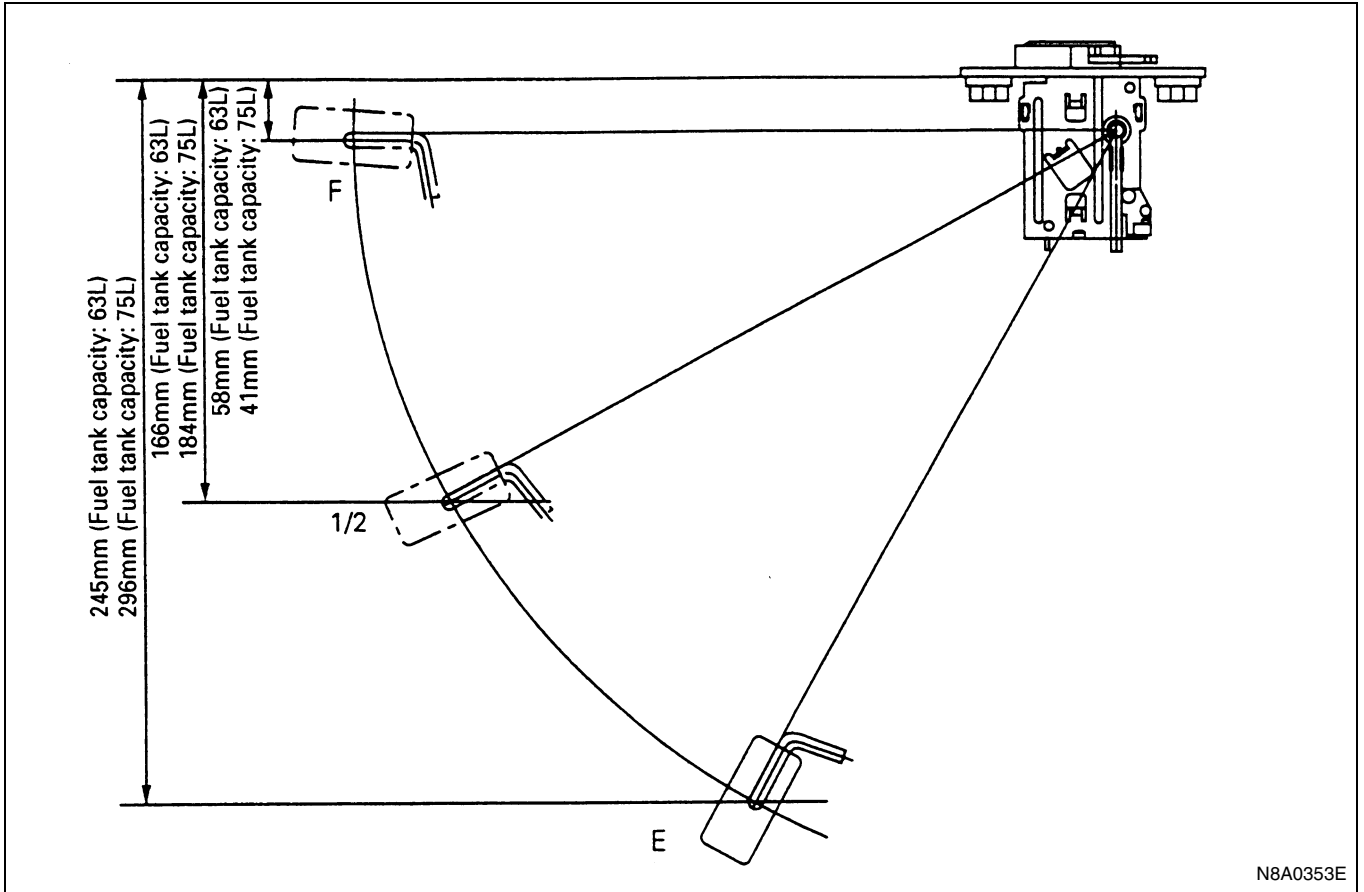
2. Check if the low fuel warning light turns on when the float is at "E" position. If found defective replace the fuel tank unit.



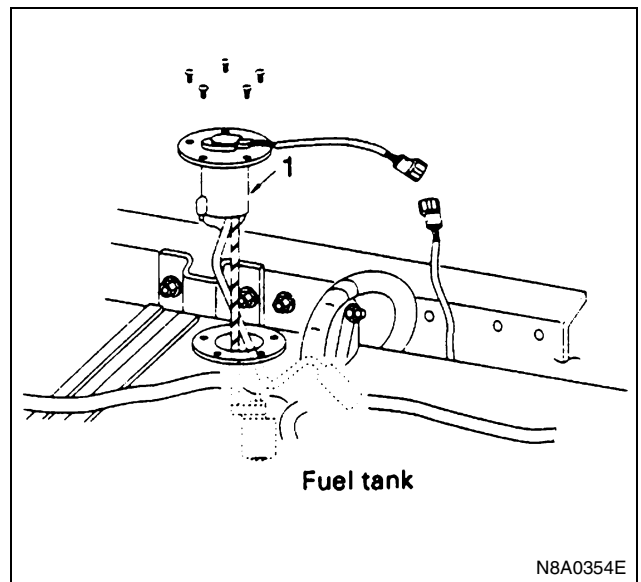
Float position	Resistance value (Ω)
F	3 ± 2.1
1/2	32.5 ± 4.8
E	110 ± 7.7

(Float type of warn low fuel level)

1. Check the resistance between the connector terminals 1 J-28 and 3 J-28 while shifting the float from "E" to "F" point.



2) Remove five screws.



Float position	Resistance value (Ω)
F	3 ± 2.1
1/2	32.5 ± 4.8
E	110 ± 7.7

Removal

Preparation:

Disconnect the battery ground cable.

1. Fuel Tank Unit

1) Disconnect the connector.

Installation

To install, follow the removal steps in the reverse order.

Engine Speed Sensor

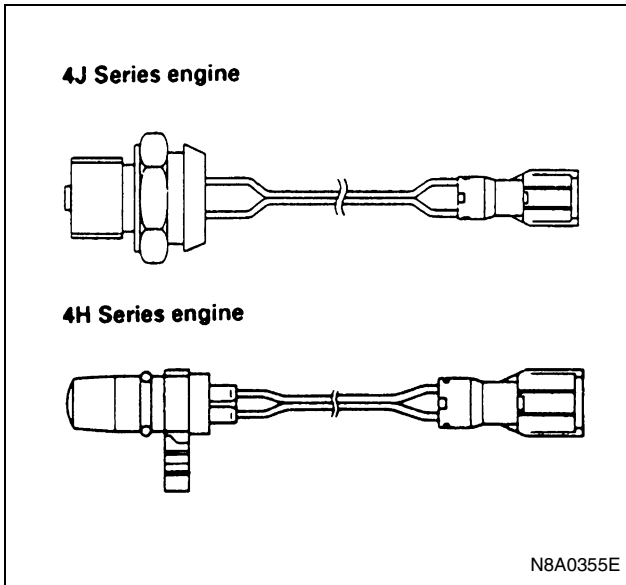
Inspection

Measure the resistance value between the engine speed sensor connector terminals.

Replace the engine speed sensor when the result of inspection is found abnormal.

4J Series engine = 1.36 — 1.86 K Ω

4H Series engine = 0.57 — 0.86 K Ω

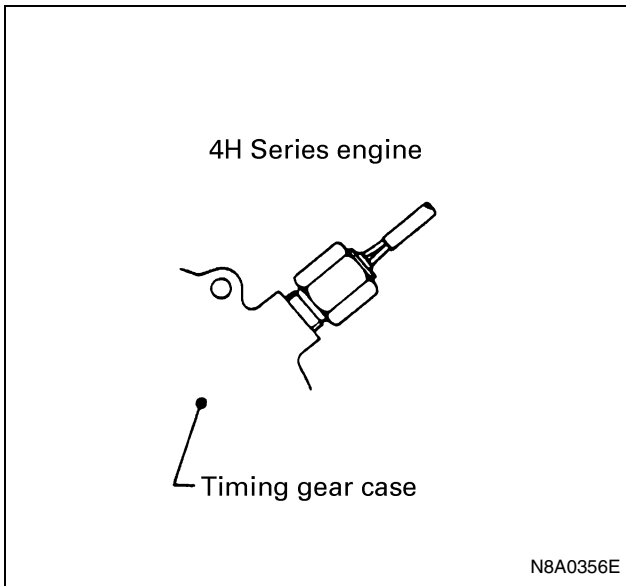


Removal

Preparation:

Disconnect the battery ground cable.

1. Engine Speed Sensor
 - 1) Disconnect the connector.
 - 2) Remove the engine speed sensor.



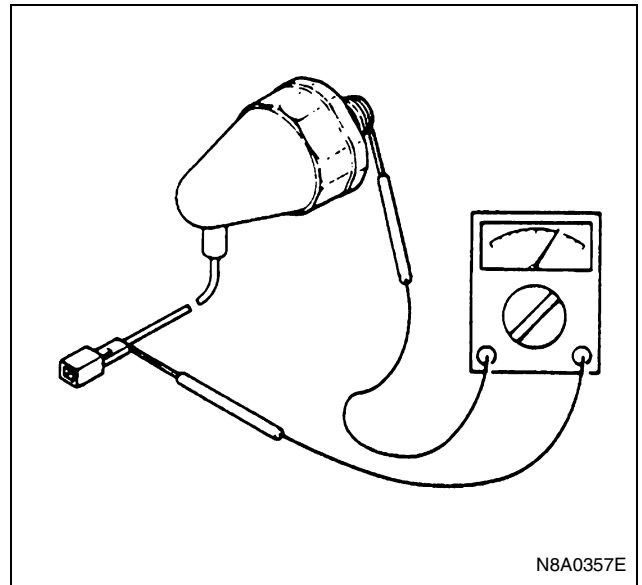
Installation

To install, follow the removal steps in the reverse order.

Vacuum Switch

Inspection

When the pressure value is below 250 ± 30 mm Hg (33.3 ± 4.0 kPa), check to see if there is continuity between the terminal and the ground. If no continuity, replace the switch with a normal one.



Removal

Preparation:

Disconnect the battery ground cable.

1. Vacuum Switch
 - 1) Disconnect the connector.
 - 2) Remove the vacuum switch.

Installation

Apply liquid gasket to the screw portion of the switch to prevent vacuum leak.

Vacuum Warning Buzzer

Inspection

Apply battery voltage to the buzzer connector terminals to check the buzzer sound.

Replace the buzzer when the result of inspection is found abnormal.

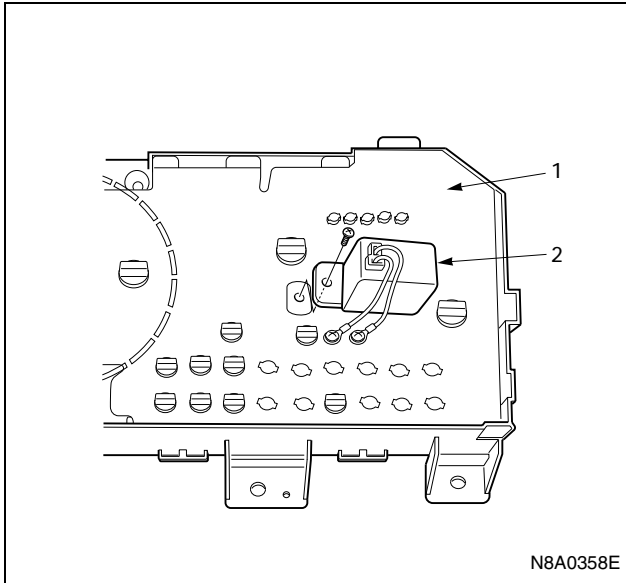
Removal

Preparation:

Disconnect the battery ground cable.

1. Meter Assembly

Refer to "METER ASSEMBLY" in this section.
2. Vacuum Warning Buzzer
 - 1) Disconnect the connector.
 - 2) Remove the buzzer fixing screw.



Legend

1. Meter Assembly
2. Vacuum Warning Buzzer

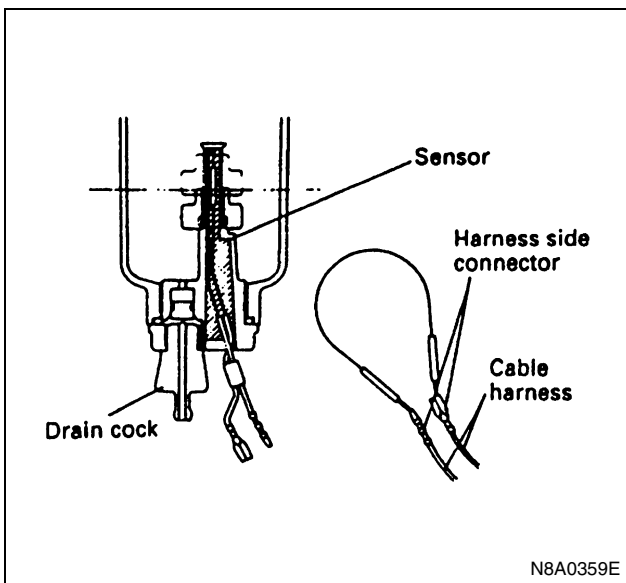
Installation

To install, follow the removal steps in the reverse order.

Water Sedimenter Switch

Inspection

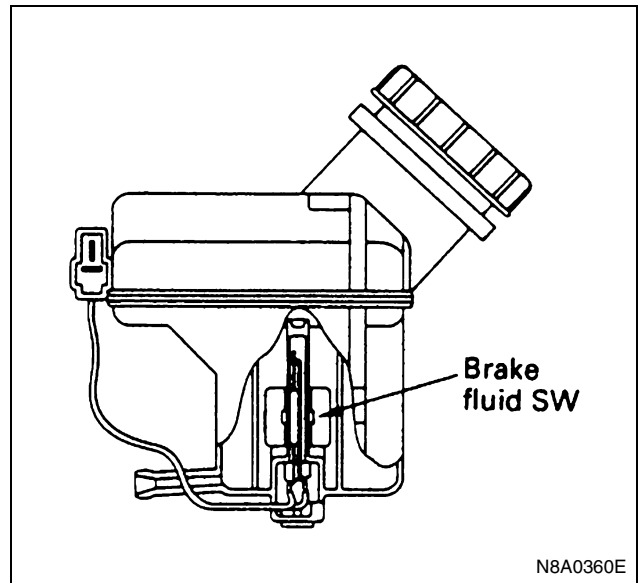
1. When the float in the water sedimenter is above the drain warning level, confirm if there is continuity between the switch connector terminals.
2. Turn the starter switch on, disconnect the water sedimenter connector and connect the harness side connector terminals. Then confirm that the sedimenter warning light turns on.
If found defective, replace the switch or repair a poor connection or an open circuit between the connector terminals.



Brake Fluid Switch

Inspection

1. Confirm there is continuity between the switch connector terminals when the brake fluid in the tank is between 60 — 75 cc level.
2. Turn the switch on, disconnect the brake fluid switch connector and connect the harness side connector terminals. Then confirm that brake warning light turns on.
If found defective, replace the tank, or repair a poor connection or an open circuit between the connector terminals.



Removal

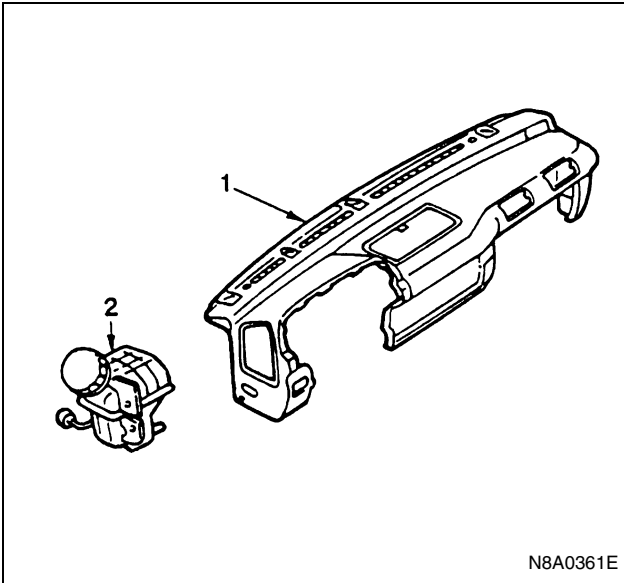
Preparation:

Disconnect the battery ground cable.

1. Instrument Panel Assembly
Refer to "INSTRUMENT PANEL" of section 2.
2. Brake Fluid Tank (Brake Fluid Switch)
 - 1) Disconnect the switch connector.
 - 2) Remove four fixing nuts.
 - 3) Drain brake fluid in the tank.
 - 4) Disconnect the tubes.

Caution:

Be very careful not to allow the brake fluid to come in contact with painted surfaces or resin parts surfaces.



Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Bleed the air from brake and clutch fluid pipe line.
2. Check to see if the brake fluid level in the tank with-in specified level.
3. Check to see if brake warning light comes on when starter switch is turned on and then warning light goes off after the engine running.

Parking Brake Indicator Light

The parking brake indicator light is connected in series with the parking brake switch installed to the parking brake lever bracket.

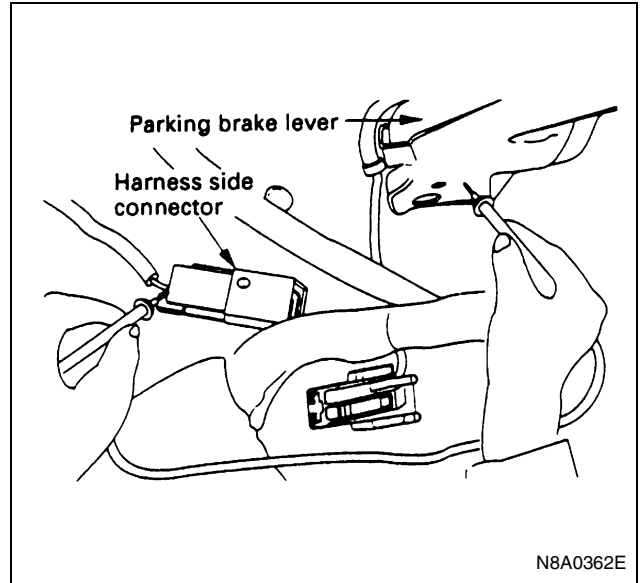
The light comes on when the parking brake lever is pulled, and goes out when the parking brake lever is fully released.

Notice:

The parking brake indicator light illuminates to warn the driver that the parking brake is on. This light does not indicate the condition of the operability of the parking brake.

Circuit Inspection

1. Disconnect the parking brake switch connector.
2. Connect the harness side connector terminal to the ground.
3. Check to see if the indicator light comes on with the starter switch "ON".
Check the bulb or the harness when the result of inspection is found abnormal.



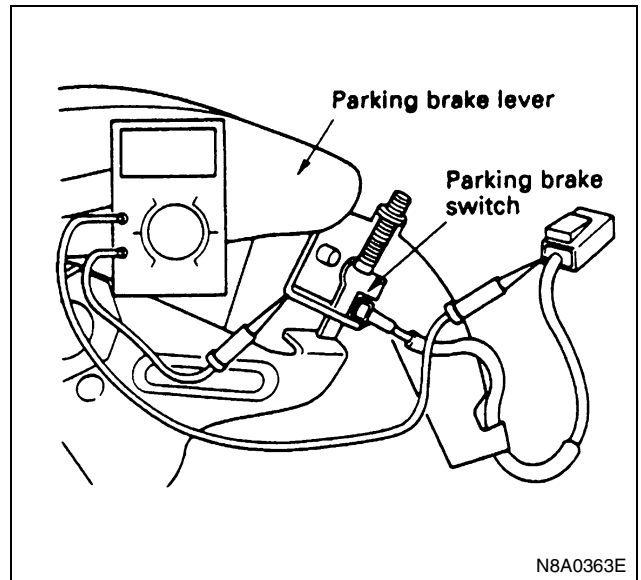
Parking Brake Switch

Inspection

1. Disconnect the parking brake switch connector.
2. Check to see if there is any continuity between the switch terminal and the body ground with the circuit tester connected between them.

When parking brake applied	Continuity
When parking brake released	No continuity

Repair the parking brake switch or replace it when the result of inspection is found abnormal.

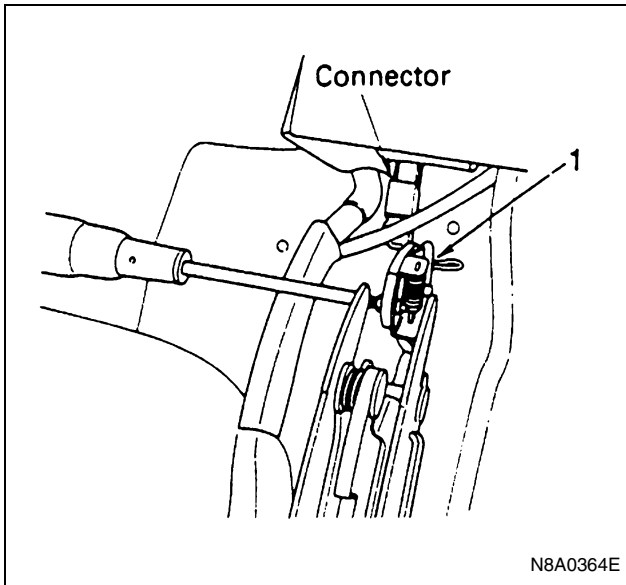


Removal

Preparation:

Disconnect the battery ground cable.

1. Parking Brake Switch
 - 1) Disconnect the connector.
 - 2) Remove the fixing screw.



Installation

To install, follow the removal steps in the reverse order.

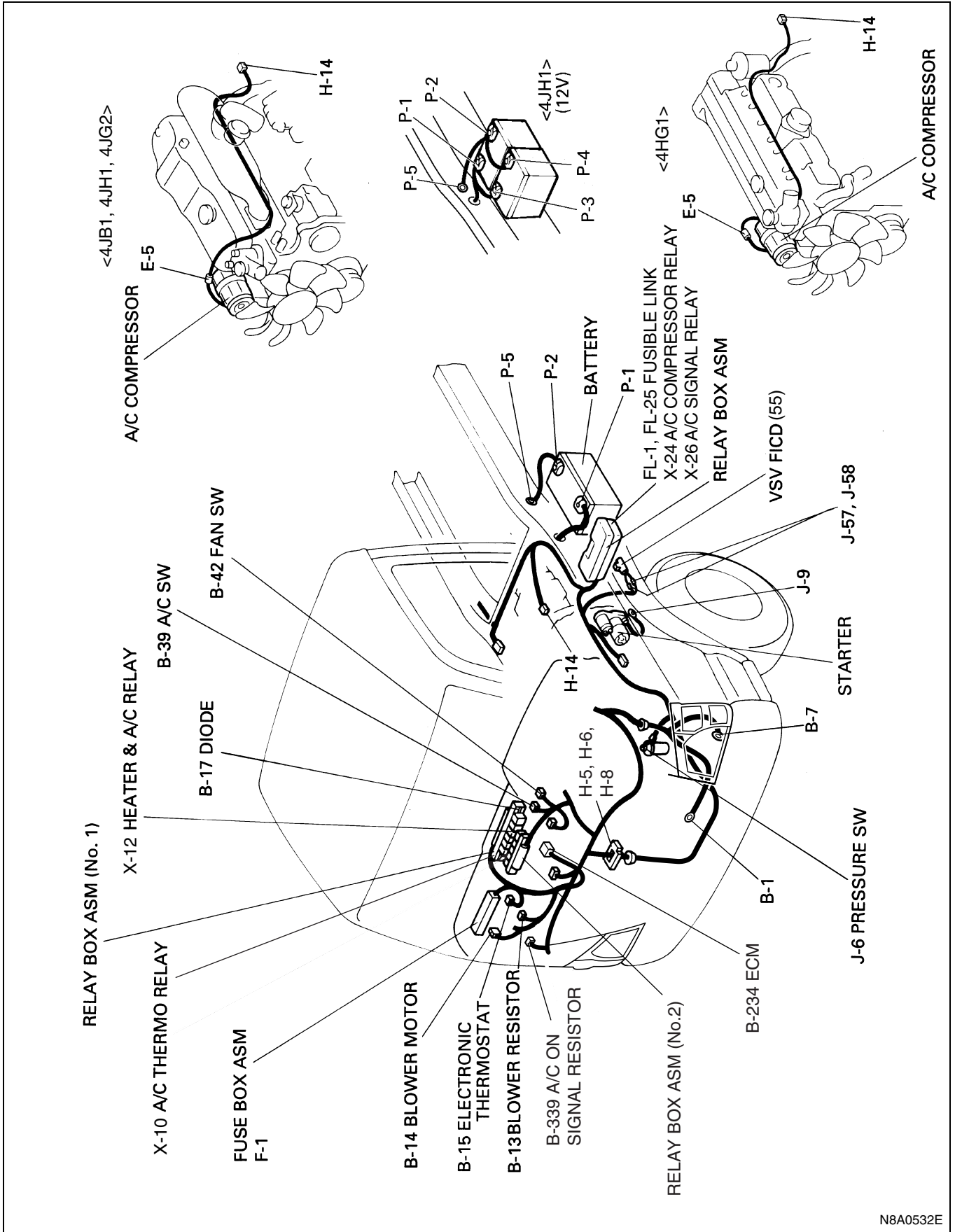
Heater and Air Conditioning

General Description

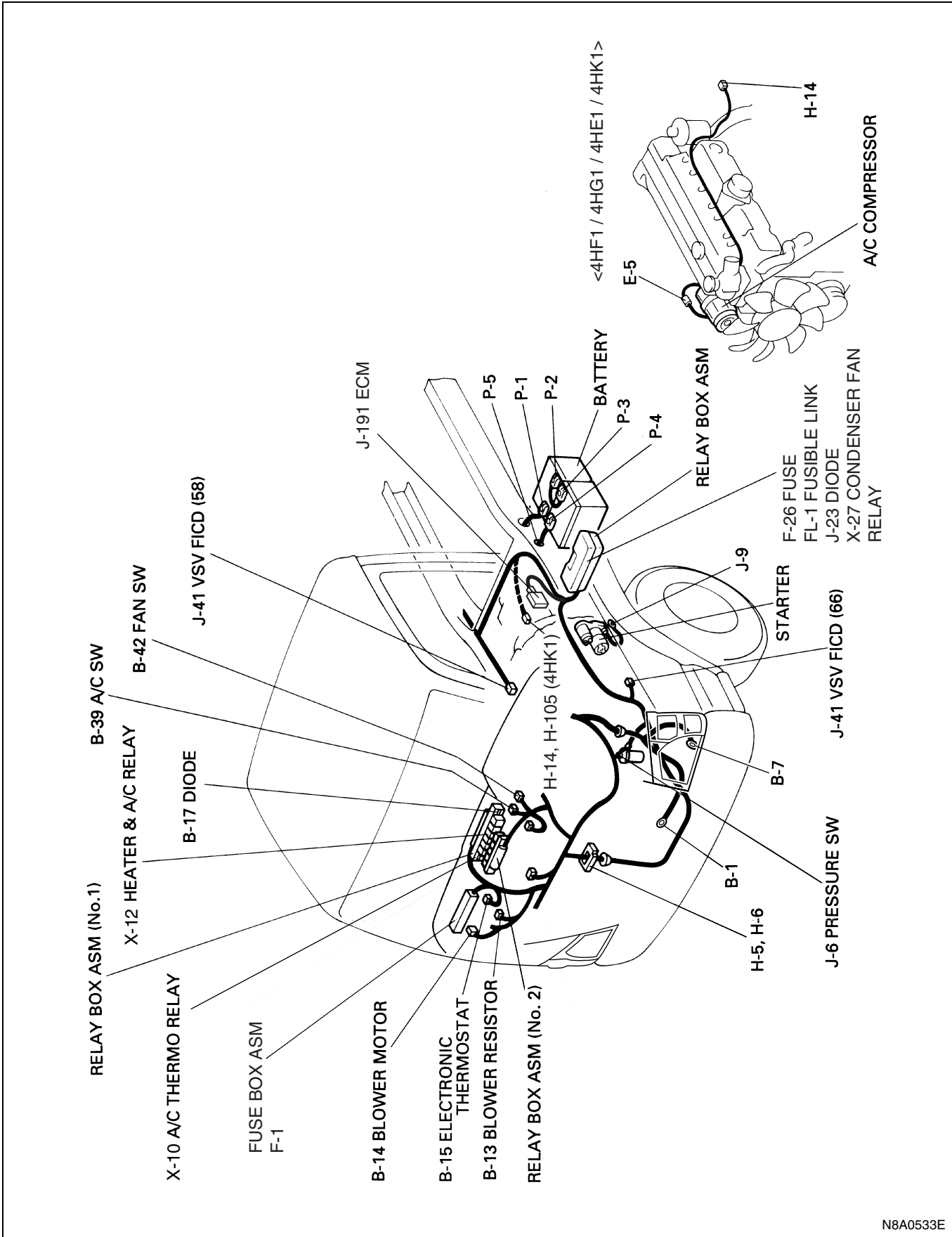
The air conditioning consists of compressor, evaporator, condenser, A/C switch, fan switch, etc. When the engine is rotating, the A/C starts to work with both the A/C and fan switches "ON", followed by the engagement of the magnetic clutch. It stops to work when either the fan switch or the A/C switch turns "OFF". In addition to the switches, the A/C has the function of temporary stop of its operation by the sensing system in the A/C cycle, such as:

- sensing abnormal rise of the refrigerant pressure by means of the pressure switch.
- sensing temperature of the blowing-off air by means of the thermo switch preventing the evaporator from freezing.
- sensing the coolant temperature by the thermo switch (available for limited models only).

Parts Location
For 12 Volt



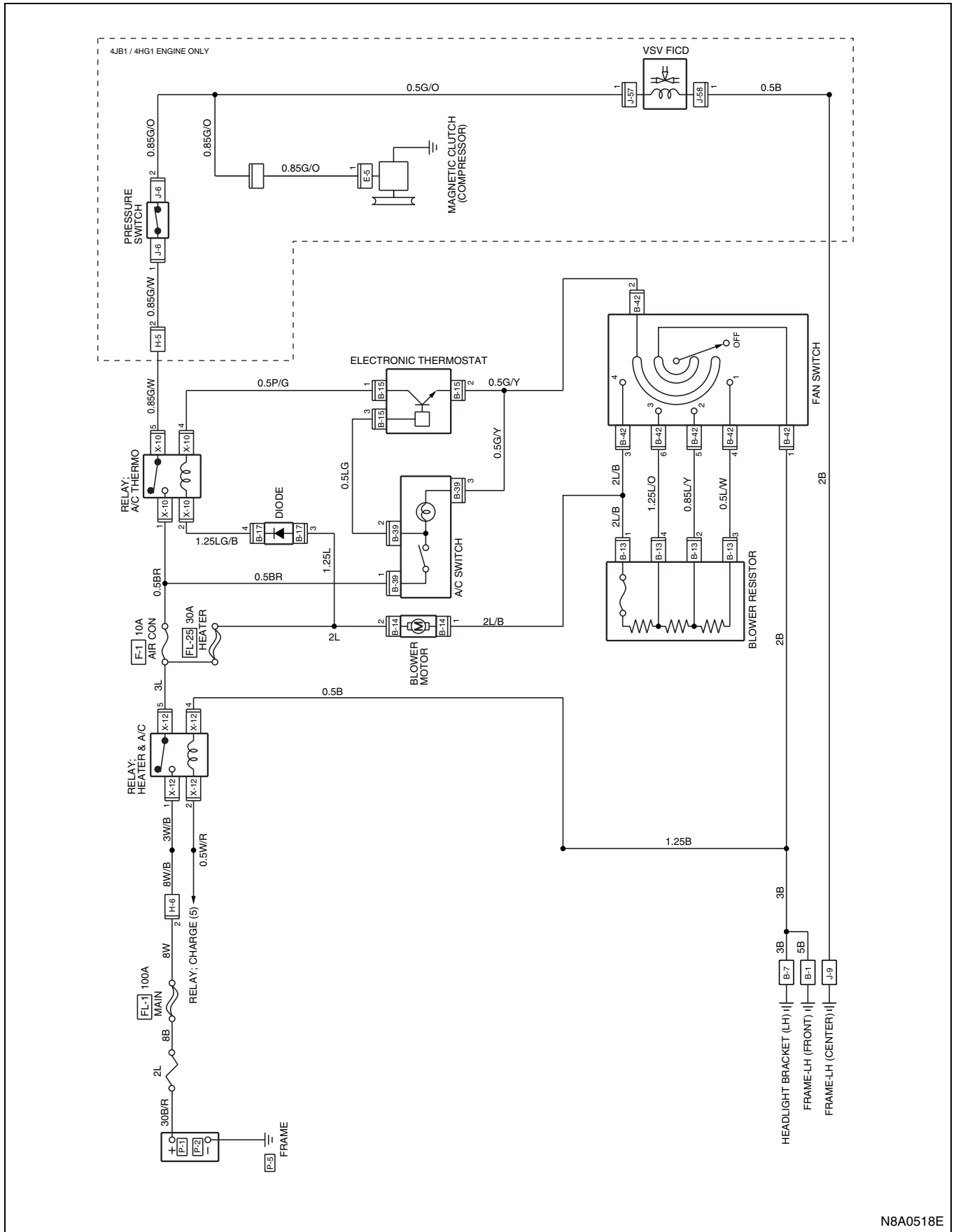
N8A0532E



N8A0533E

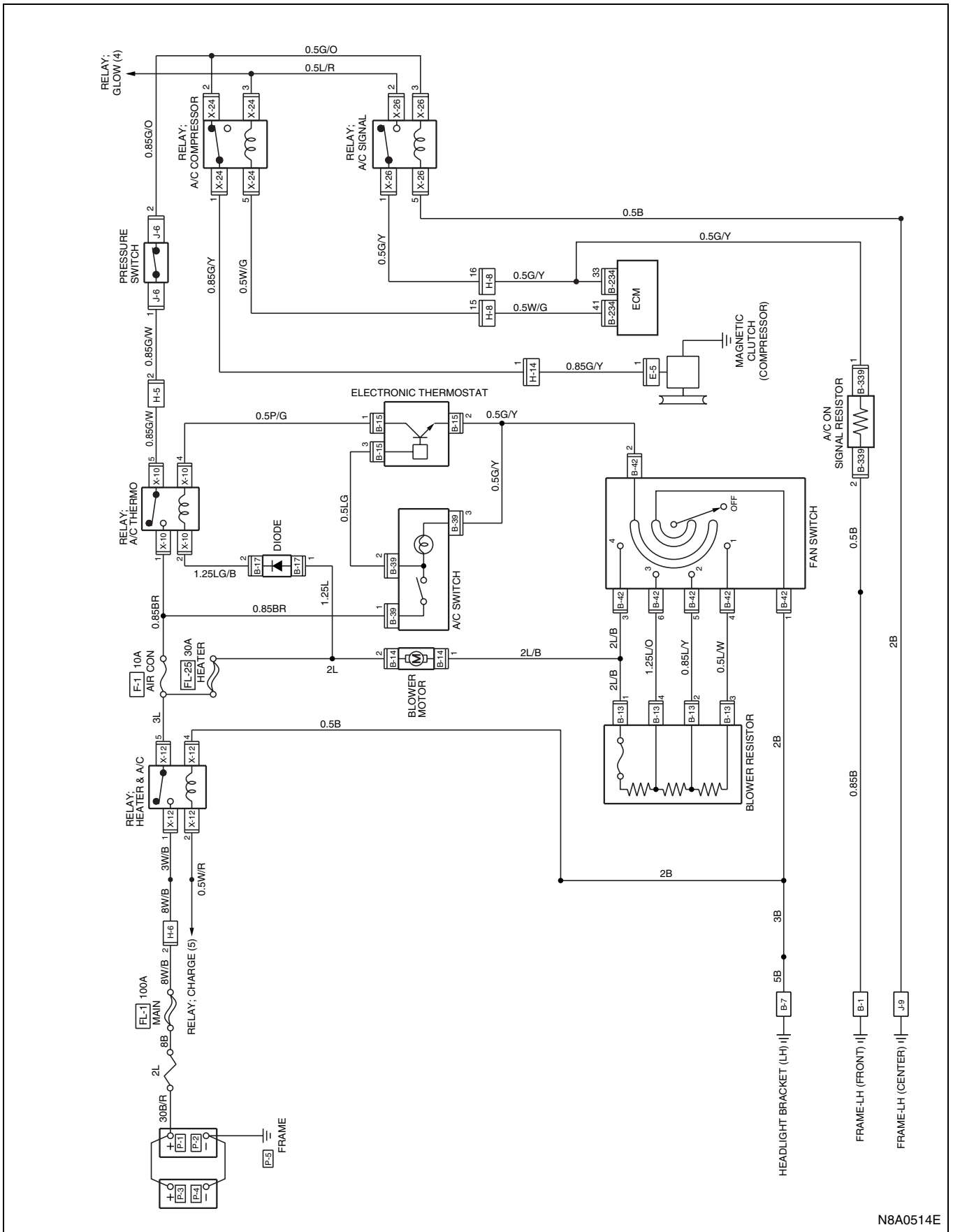
Circuit Diagram

For 12 Volt - Except 4JH1



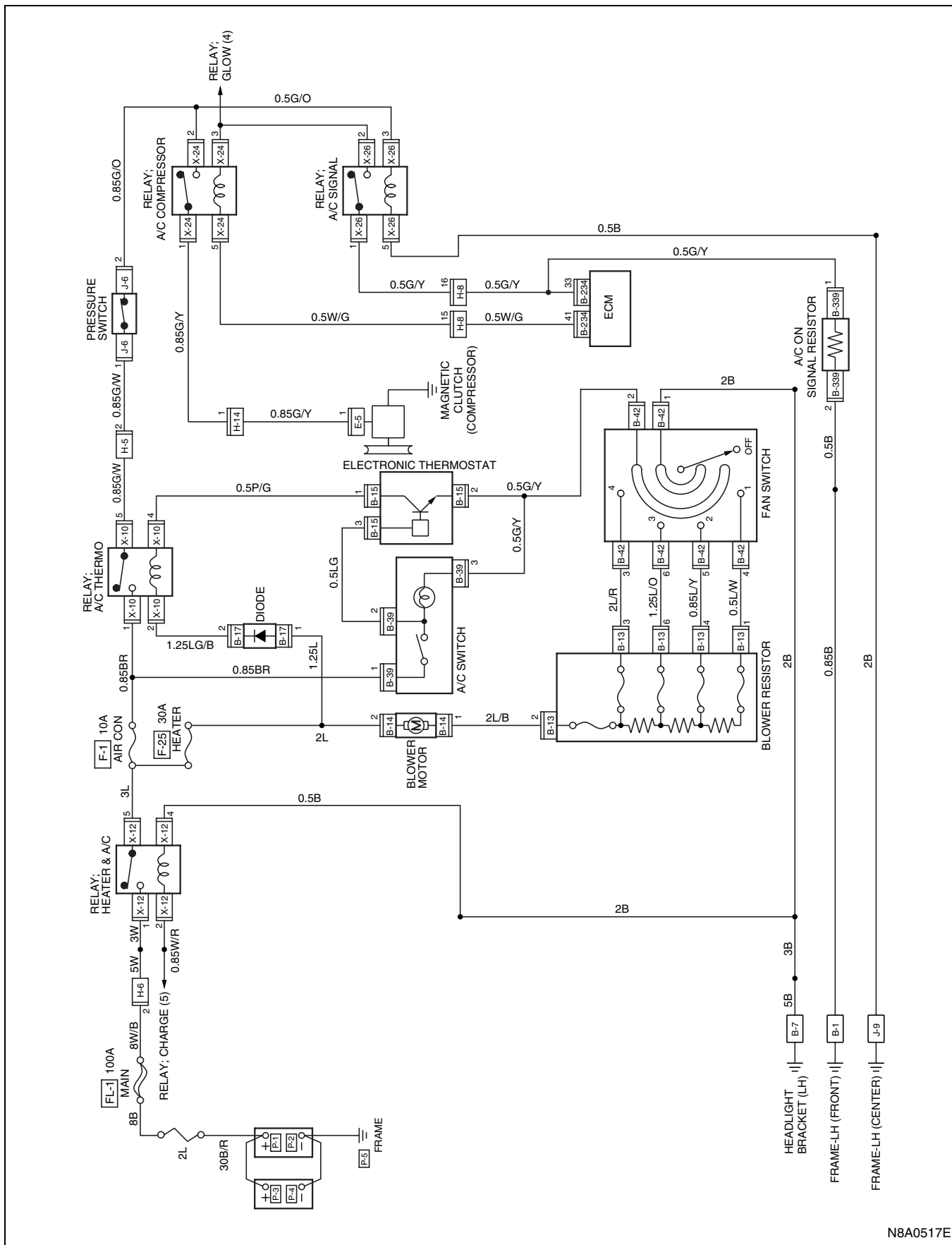
N8A0518E

For 12 Volt - 4JH1 Engine



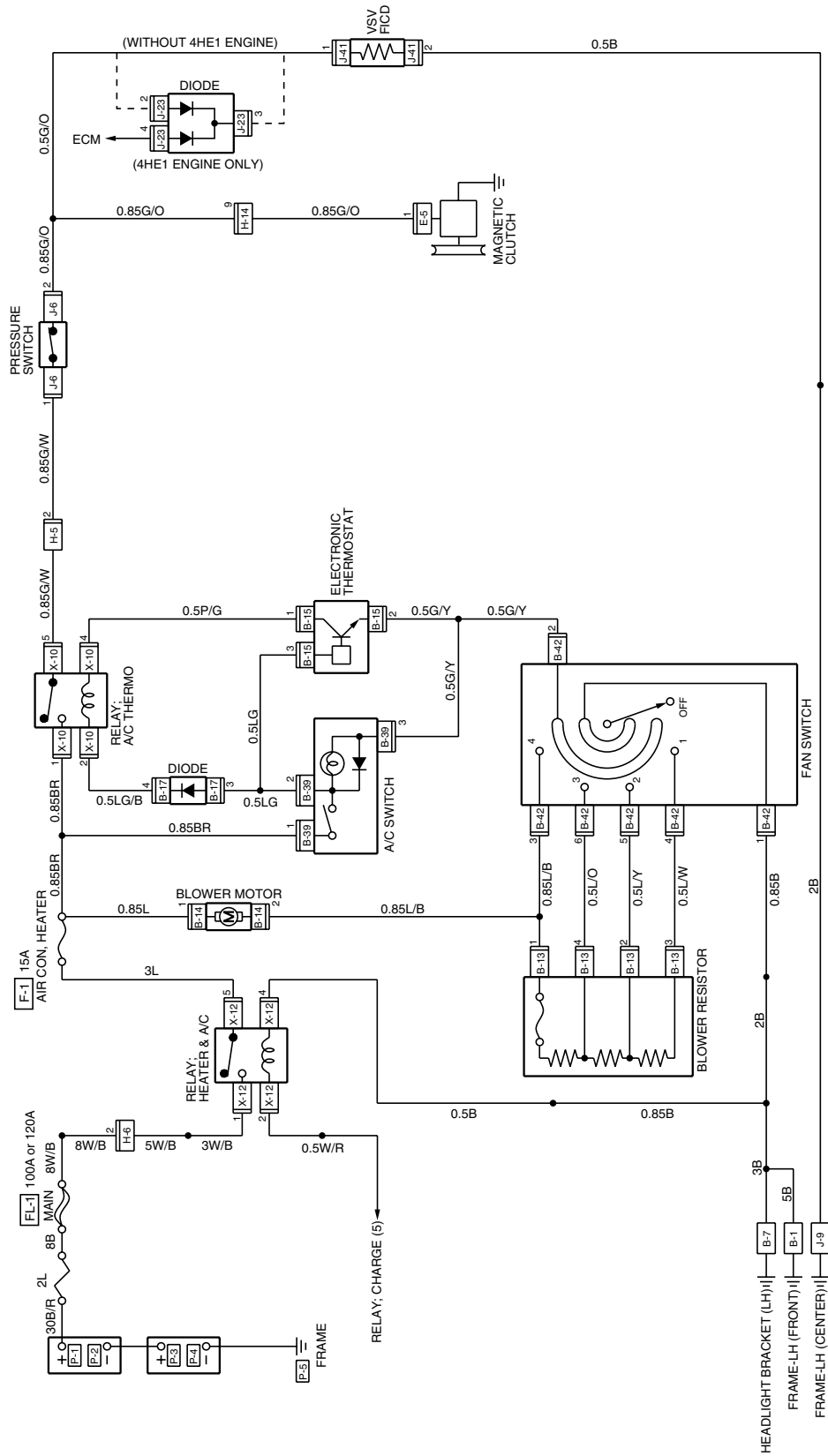
N8A0514E

For 12 Volt - 4JH1 Engine For Taiwan



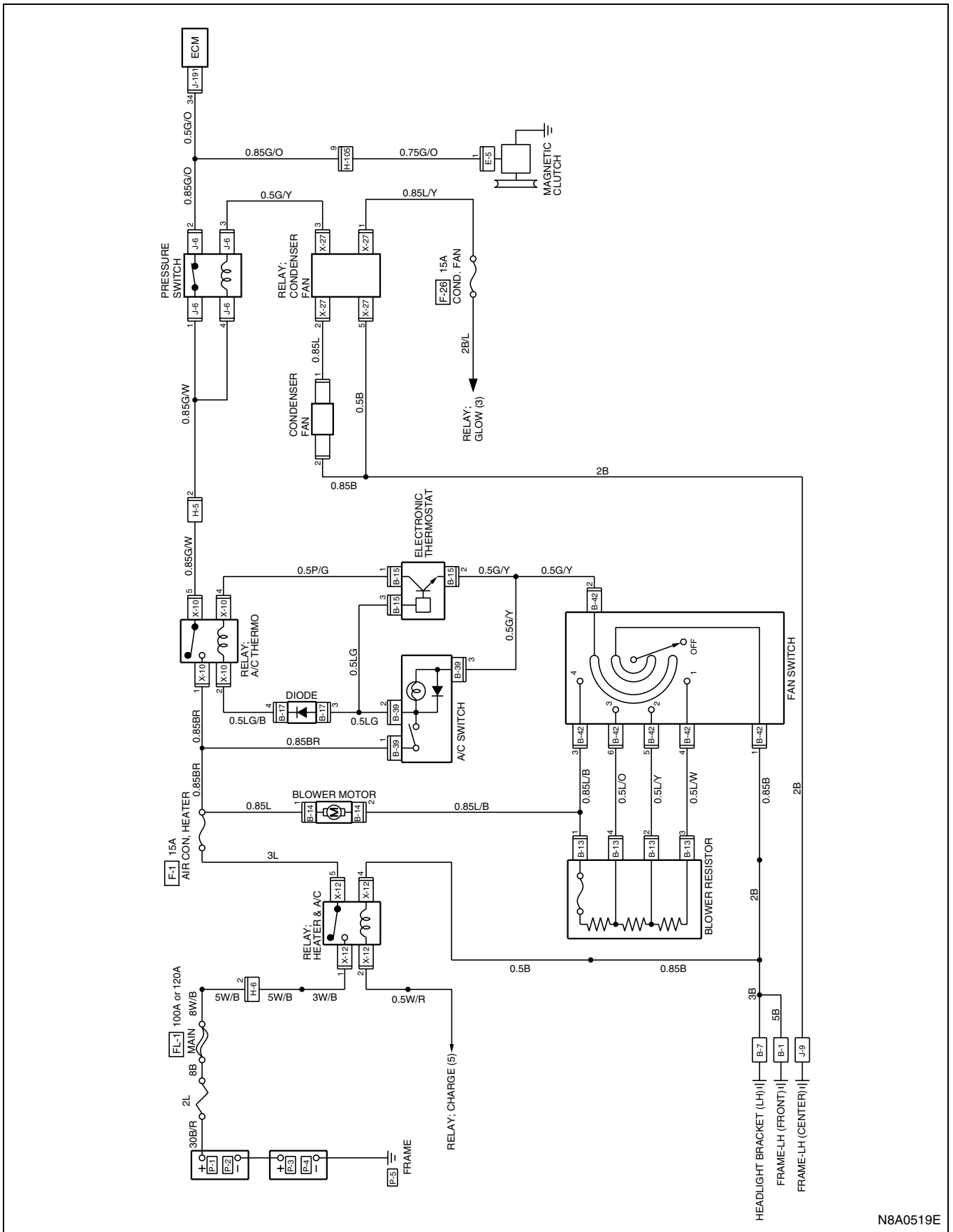
N8A0517E

For 24 Volt - Except 4HE1 Engine



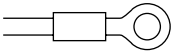
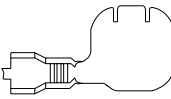



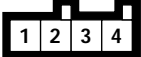


N8A0515E

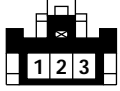
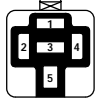
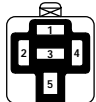
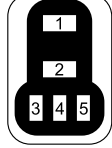
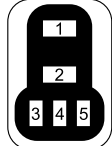

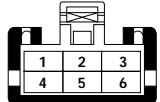
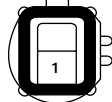
For 24 Volt - 4HK1 Engine

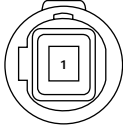

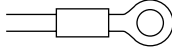
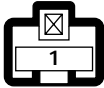

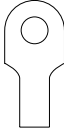
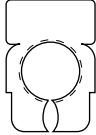
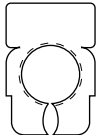


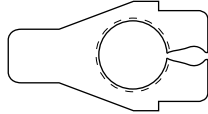
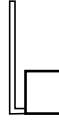

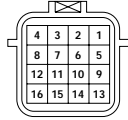
N8A0519E

Connector List
For 12 Volt

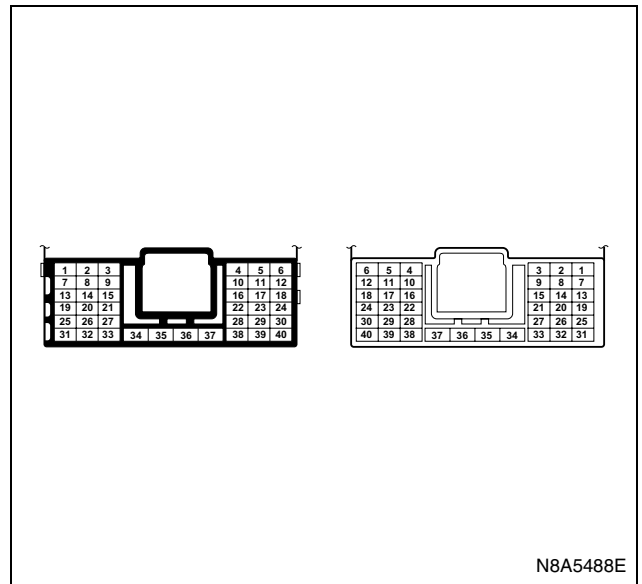
No.	Connector Face
B-1	 000-001
B-7	 000-012
B-13	 004-010
B-13 (For Tai- wan)	 006-010
B-14	 002-009
B-17	 004-004
B-234	 121-001
B-339	 004-010

No.	Connector Face
B-15	 003-009
X-12	 005-001
X-10	 005-001
X-24	 005-006
X-26	 005-006
B-39	 003-019
B-42	 006-001
E-5	 001-013

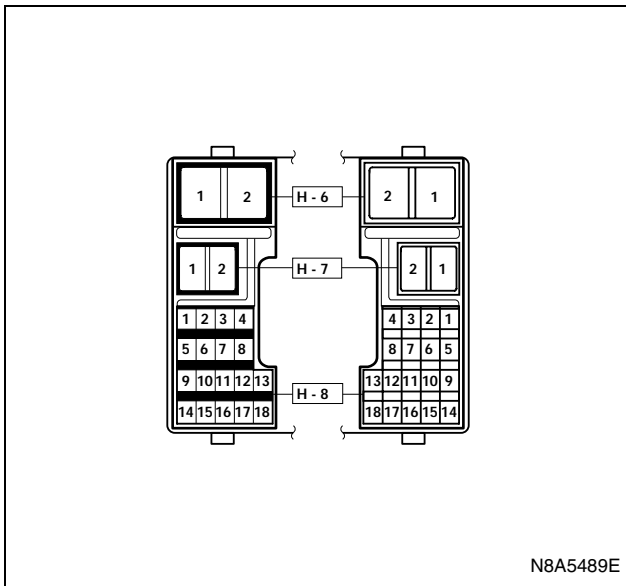
No.	Connector Face
E-5	 001-014
J-6	 004-011
J-9	 000-001
J-57	 001-009
J-58	 001-009
P-1	 000-003
P-2	 000-004
P-4	 000-004

No.	Connector Face
P-3	 000-006
P-5	 000-007
H-14	 016-001
H-14	 016-002

H-5



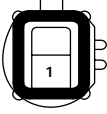
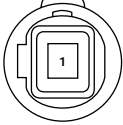



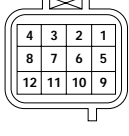

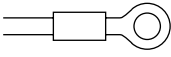
H-6

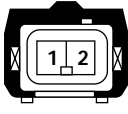
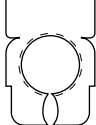
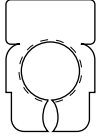
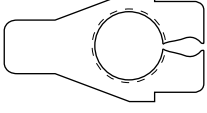
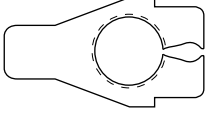
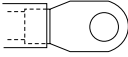



For 24 Volt

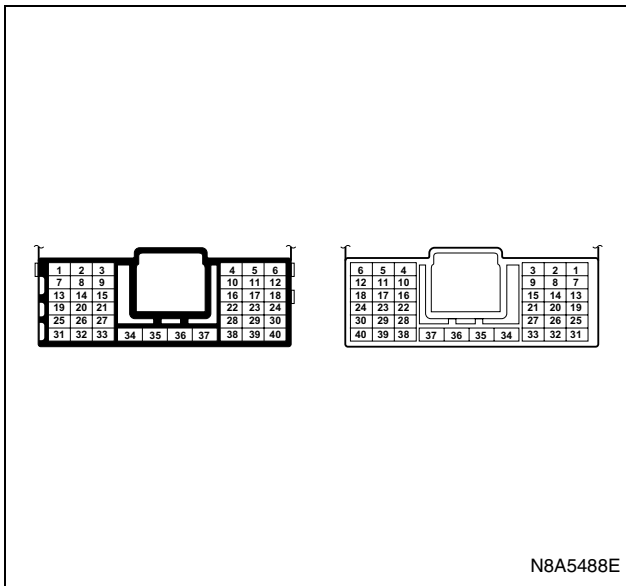
No.	Connector Face
B-1	 000-001
B-7	 000-012
B-13	 004-010
B-14	 002-009
B-17	 004-004

No.	Connector Face
J-23	 004-004
J-191	 081-001
B-15	 003-009
X-12	 005-001
X-10	 005-001
X-27	 005-006
B-39	 003-019
B-42	 006-001

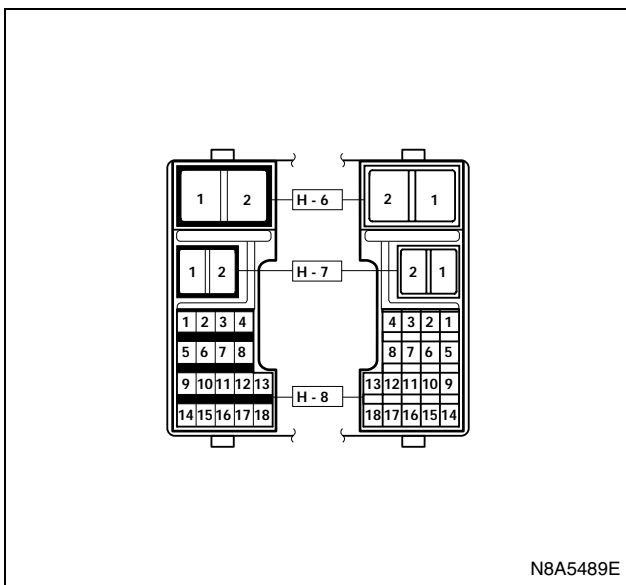
No.	Connector Face
E-5	 <p style="text-align: right;">001-013</p>
E-5	 <p style="text-align: right;">001-014</p>
H-14	 <p style="text-align: right;">016-003</p>
H-14	 <p style="text-align: right;">016-004</p>
H-105	 <p style="text-align: right;">012-001</p>
H-105	 <p style="text-align: right;">012-002</p>
J-6	 <p style="text-align: right;">004-011</p>
J-9	 <p style="text-align: right;">000-001</p>

No.	Connector Face
J-41	 <p style="text-align: right;">002-015</p>
P-1	 <p style="text-align: right;">000-004</p>
P-4	 <p style="text-align: right;">000-004</p>
P-2	 <p style="text-align: right;">000-006</p>
P-3	 <p style="text-align: right;">000-006</p>
P-5	 <p style="text-align: right;">000-002</p>
J-23	 <p style="text-align: right;">001-009</p>

H-5



H-6



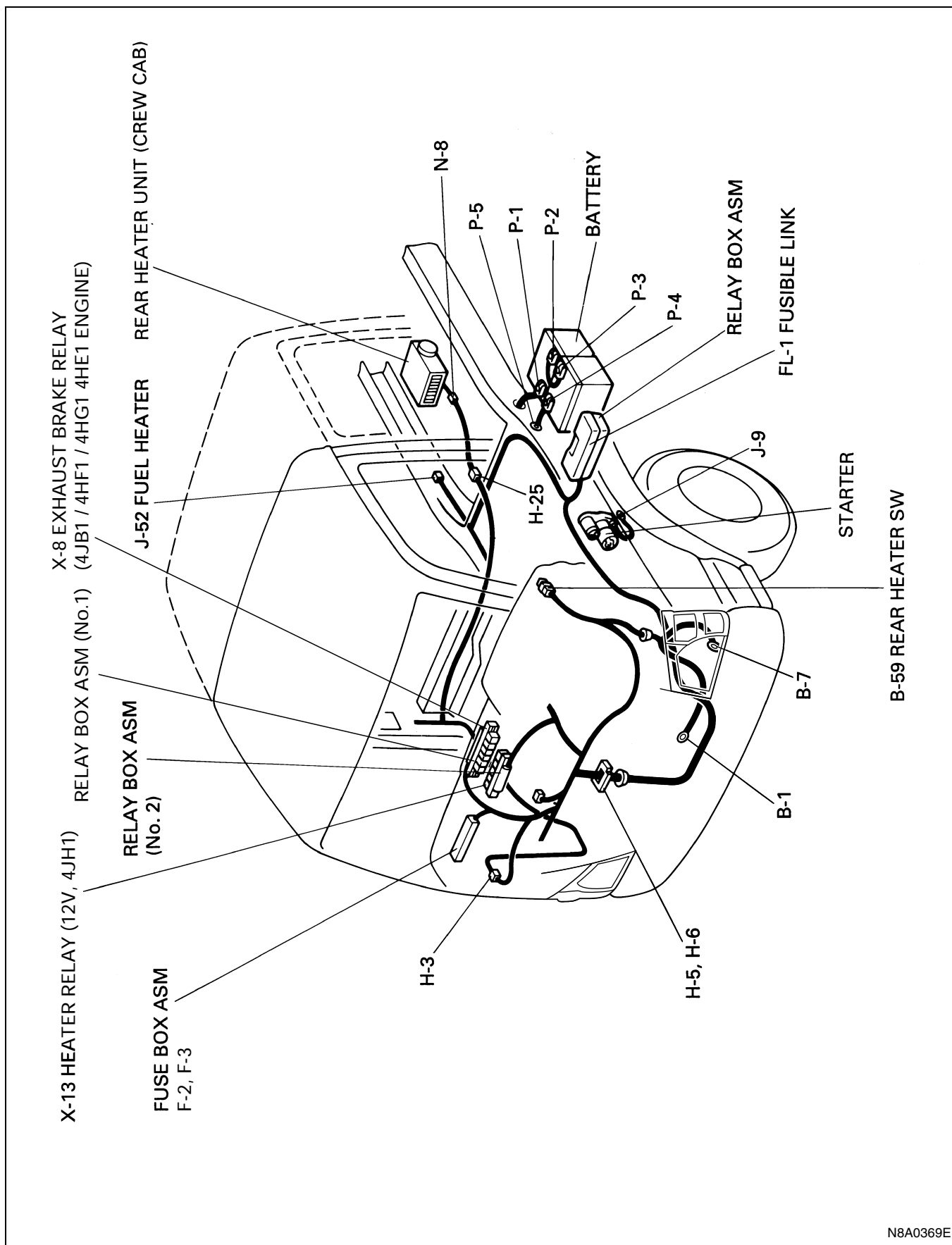
Fuel Heater and Rear Heater

General Description

The circuit consists of fuel heater, rear heater, rear heater switch and the exhaust brake relay.

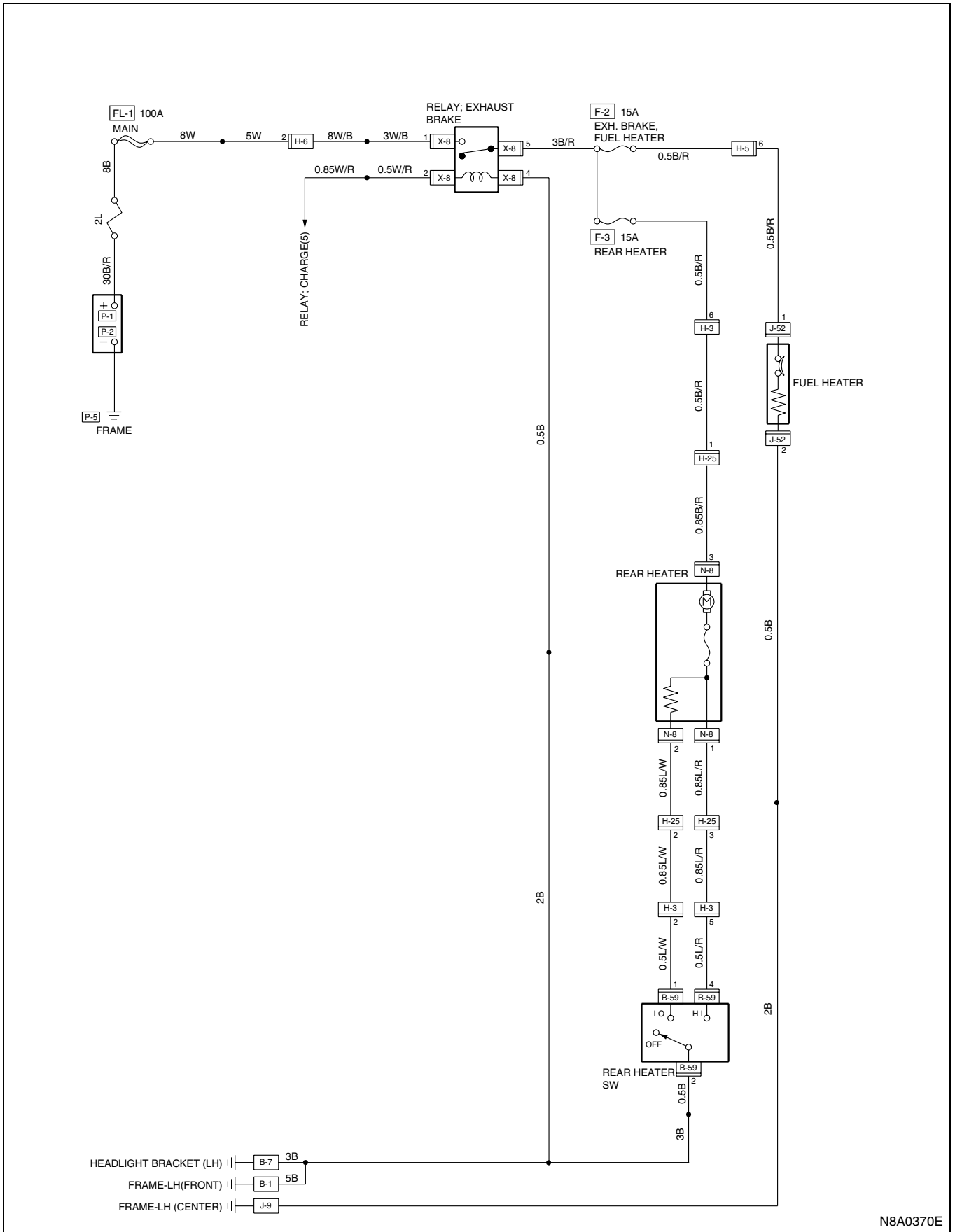
The fuel heater circuit is always in "ON" position when the generator is charging and its temperature is automatically controlled by the circuit breaker built in the fuel heater.

Parts Location



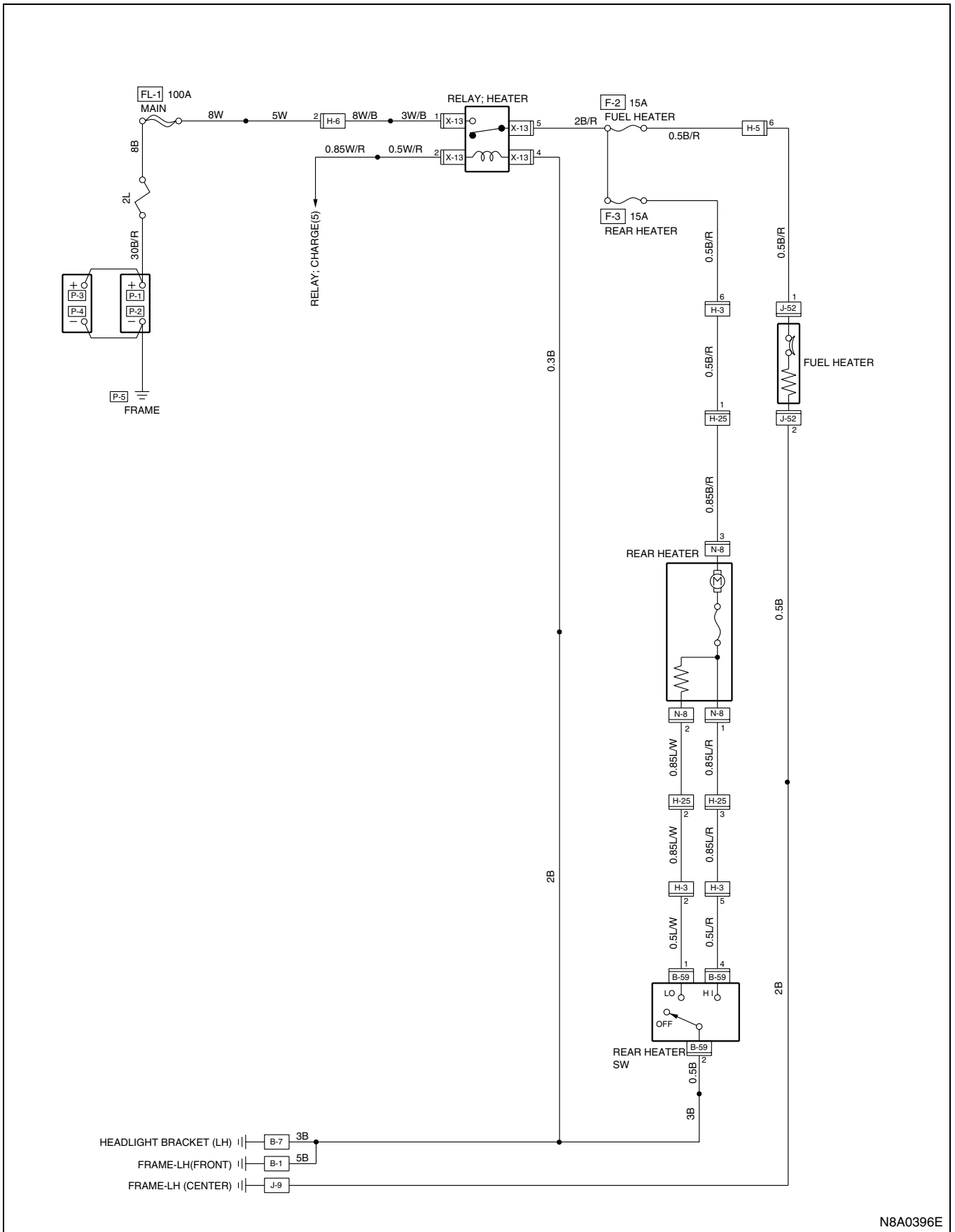
N8A0369E

Circuit Diagram Except 4JH1 Engine



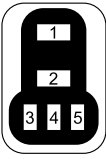
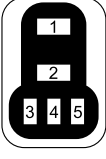
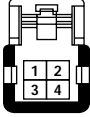
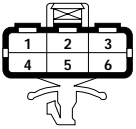
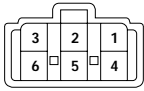
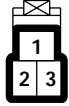
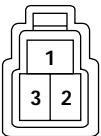

N8A0370E



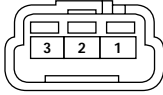

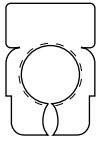
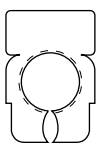
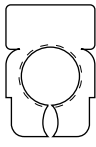
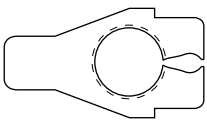
4JH1 Engine

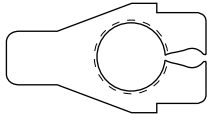

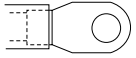


N8A0396E

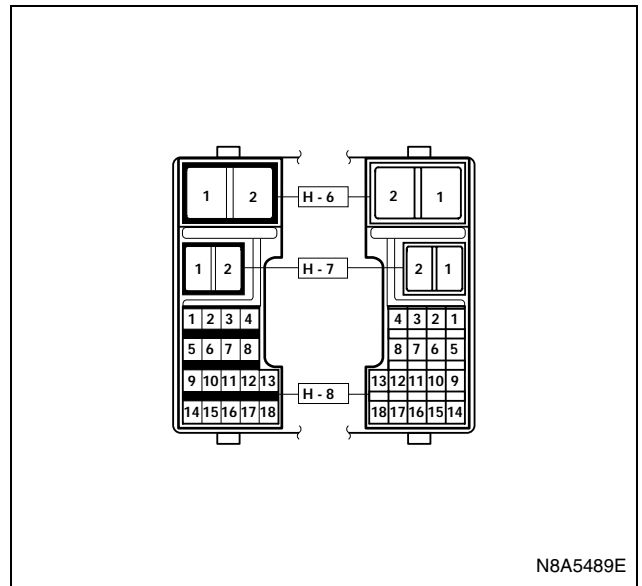
Connector List

No.	Connector Face
X-8	 005-006
X-13	 005-006
B-59	 004-015
H-3	 006-014
H-3	 006-015
H-25	 003-020
H-25	 003-021
J-52	 002-033

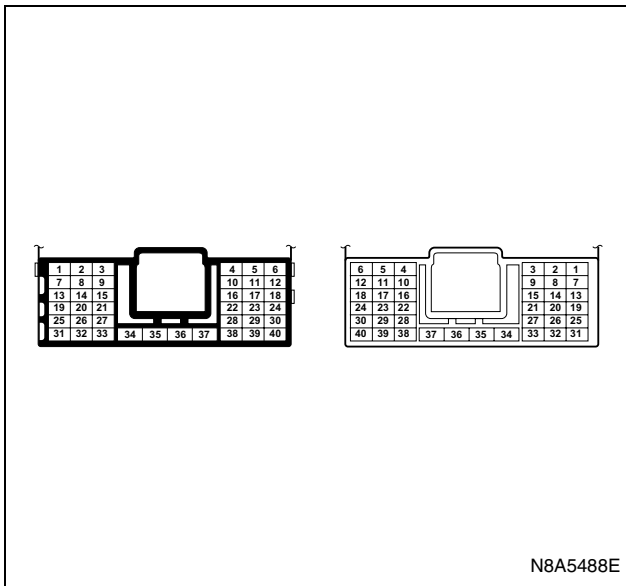
No.	Connector Face
J-52	 002-034
N-8	 003-022
N-8	 003-023
P-1 (12 V)	 000-003
P-2	 000-004
P-1 (24 V)	 000-004
P-4	 000-004
P-2 (24 V)	 000-006

No.	Connector Face
P-3	 000-006
P-5 (12 V)	 000-007
P-5 (24 V)	 000-002

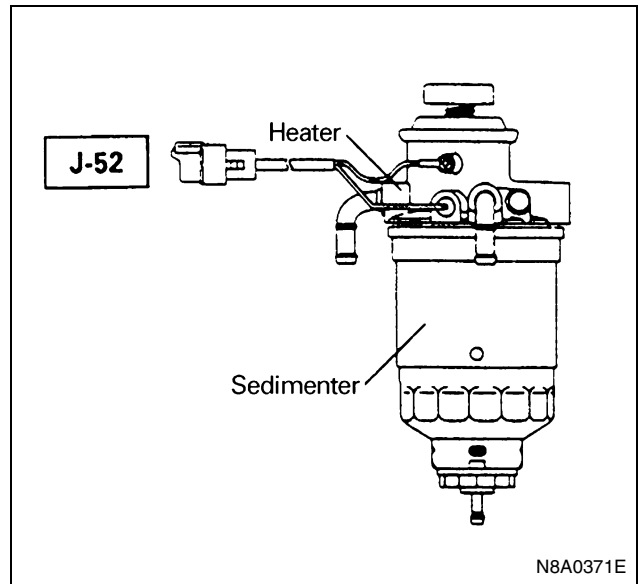
H-6



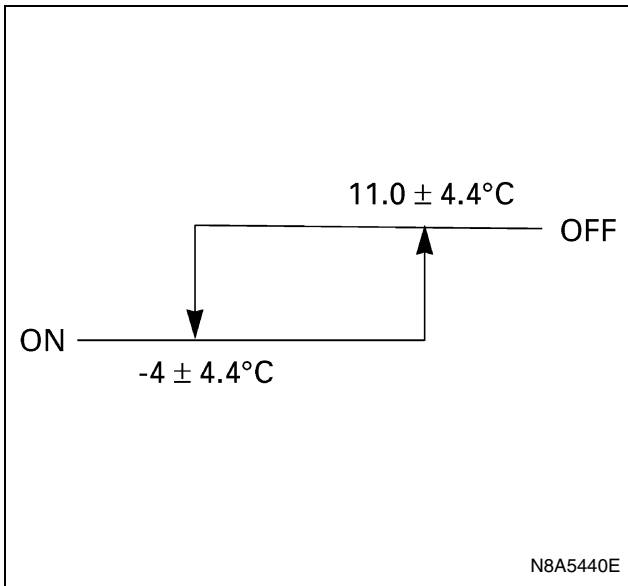
H-5



Fuel Heater



Characteristic of fuel heater

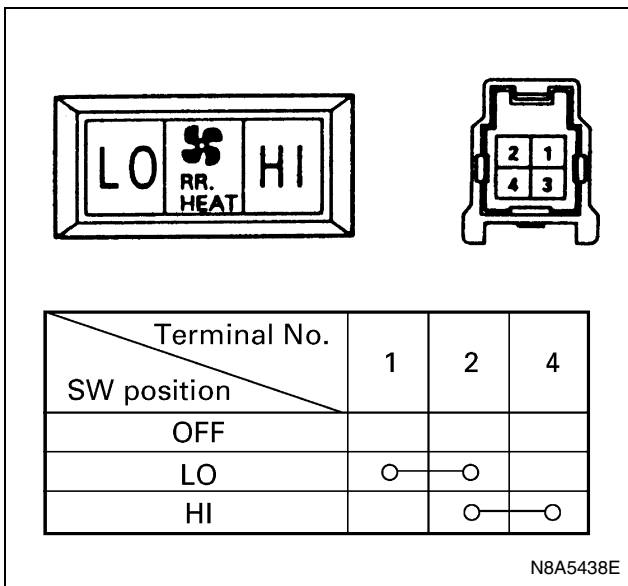


N8A5440E

Rear Heater Switch

Inspection

Check the continuity between the connector terminals while operating the switch. Replace the switch when the result of inspection is found abnormal.

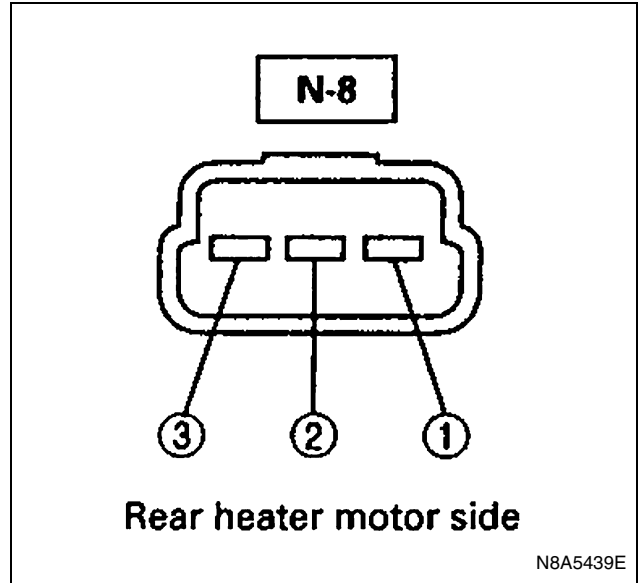


N8A5438E

Rear Heater Motor

Inspection

Disconnect the rear heater connector. Connect the battery positive terminal to the NO.3 terminal of the rear heater motor side connector and negative to the NO.2. Check to see if rear heater motor operates low-speed correctly. Connect the battery positive terminal to the NO.3 terminal of the rear heater motor side connector and negative to the NO.1. Check to see if rear heater motor operates high-speed correctly. Replace the rear heater motor when the result of inspection is found abnormal.



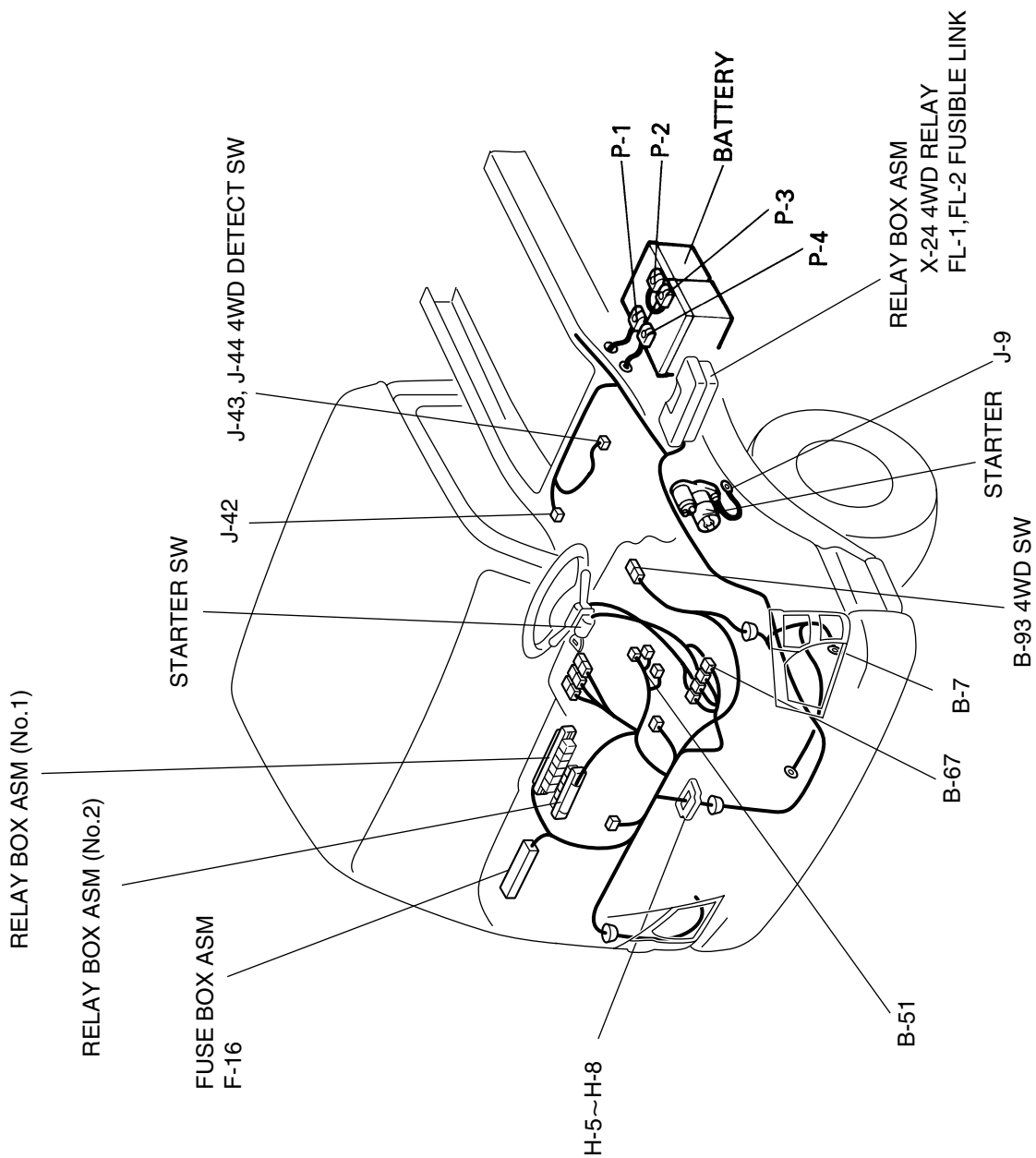
N8A5439E

4WD Transfer (Vacuum Control)

General Description

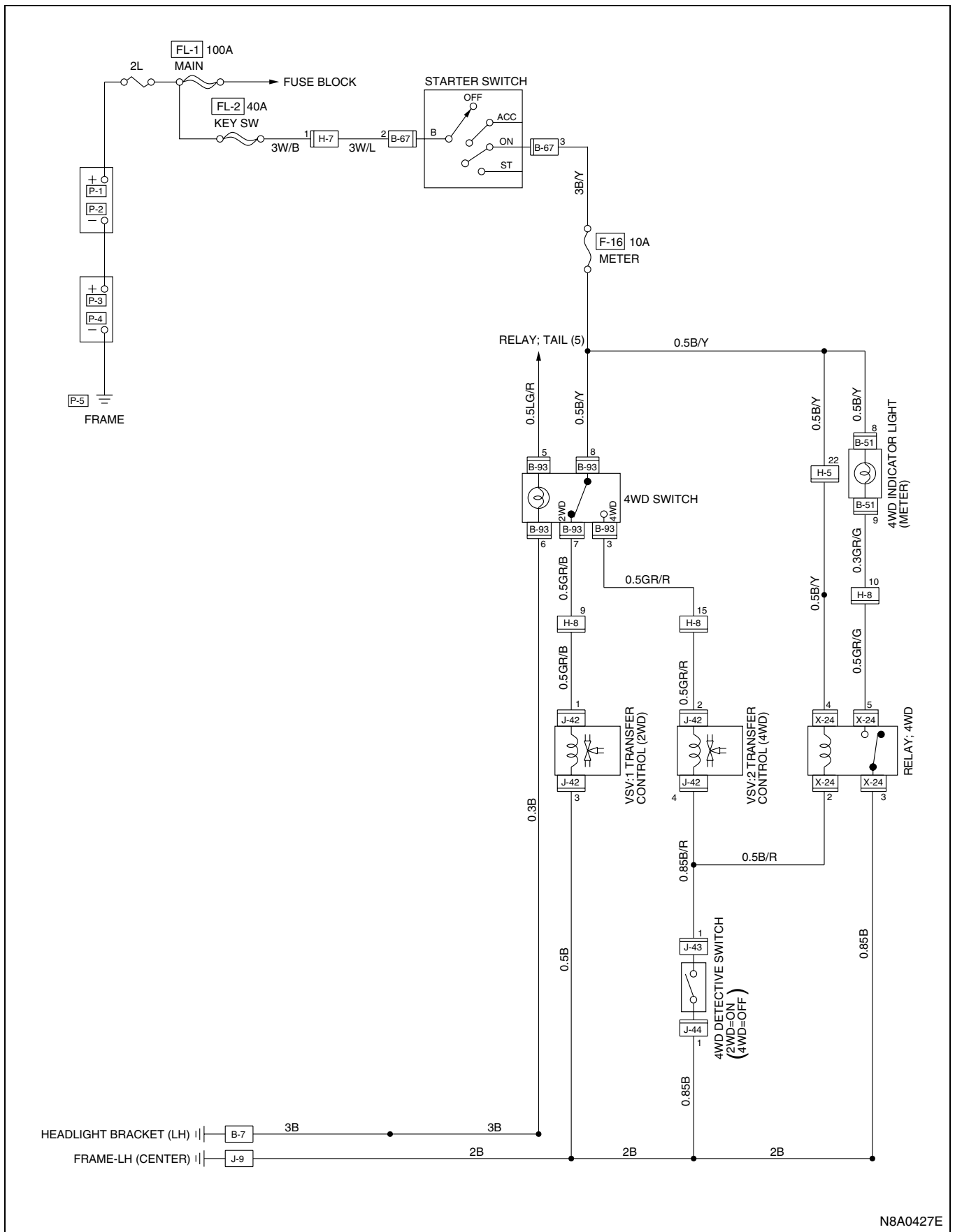
The circuit consists of the starter switch, 4WD switch, 4WD detect switch, 4L switch, vacuum switching valve, 4WD indicator light, neutral switch and the relay. When the 4WD switch is turned on to drive in the 4WD mode, the vacuum switching valve for the transfer control is activated through the 4WD relay, and the transfer shift rod connected to the vacuum actuator is shifted to the 4WD side to turn on the 4WD detect switch. At the same time, the indicator light in the meter lights on to tell that the mode is transferred to 4WD mode. However, when running in the normal mode (2WD), the 4WD switch is not operated. Accordingly, no current flows through the 4WD vacuum switching valve for the transfer control, with the 4WD detect switch left in the "OFF" condition (2WD mode).

Parts Location



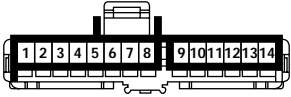
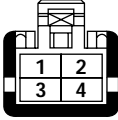

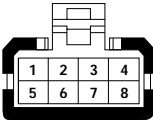
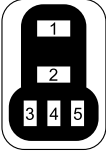
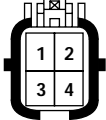
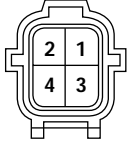

N8A0398E




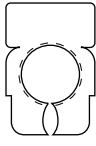
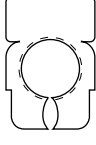
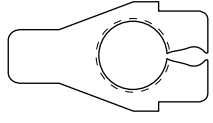
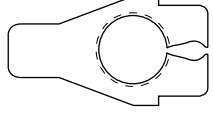
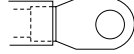
Circuit Diagram



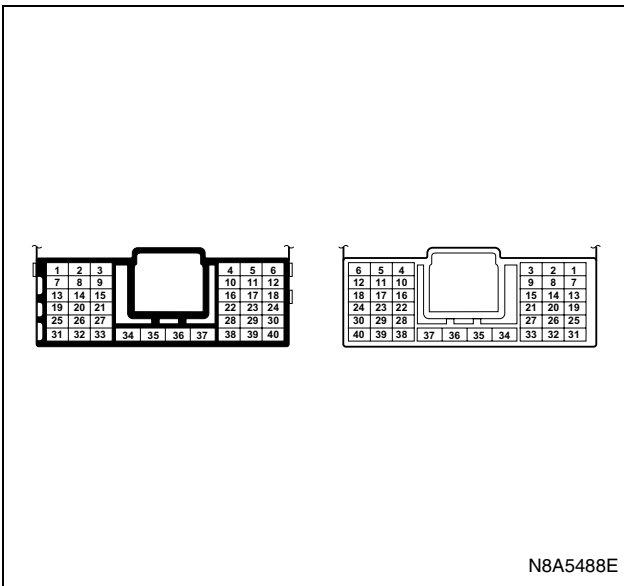
N8A0427E

Connector List

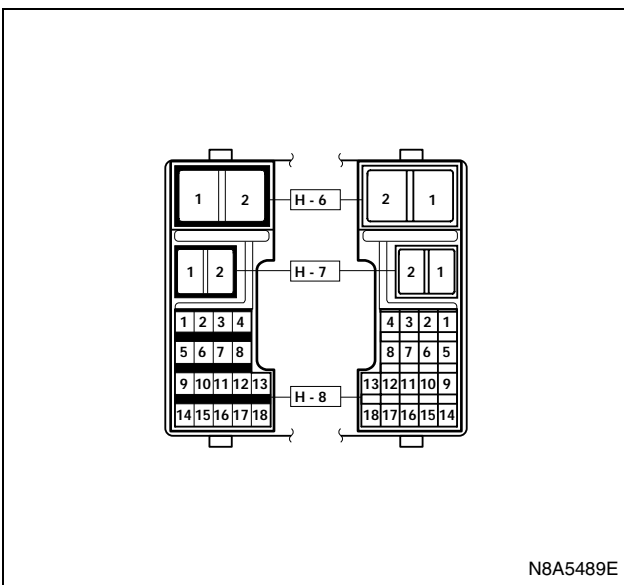
No.	Connector Face
B-51	 014-001
B-67	 004-001
B-67	 004-002
B-93	 008-005
X-24	 005-006
J-42	 004-012
J-42	 004-013
J-43	 001-002

No.	Connector Face
J-43	 001-003
J-44	 001-002
J-44	 001-003
P-1	 000-004
P-4	 000-004
P-2	 000-006
P-3	 000-006
P-5	 000-002

H-5



H-7



Starter Switch

Refer to "START AND CHARGING" in this section.

Neutral Switch

Refer to "START AND CHARGING" in this section.

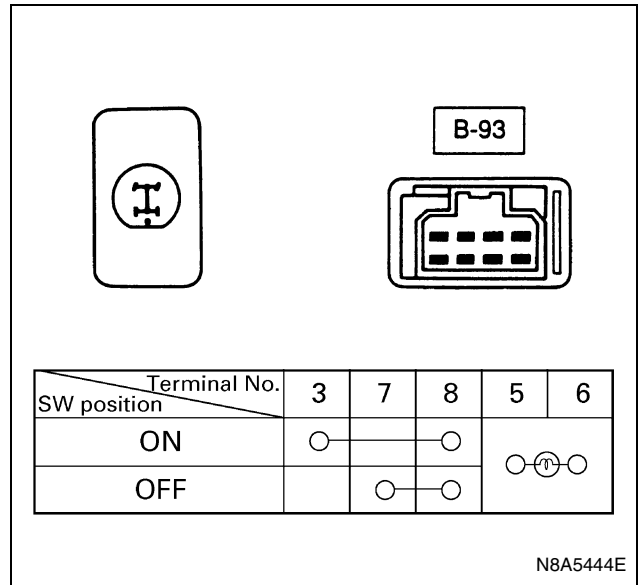
4WD Indicator Light

Refer to "METER AND WARNING/INDICATOR LIGHT" in this section.

4WD Switch

Inspection

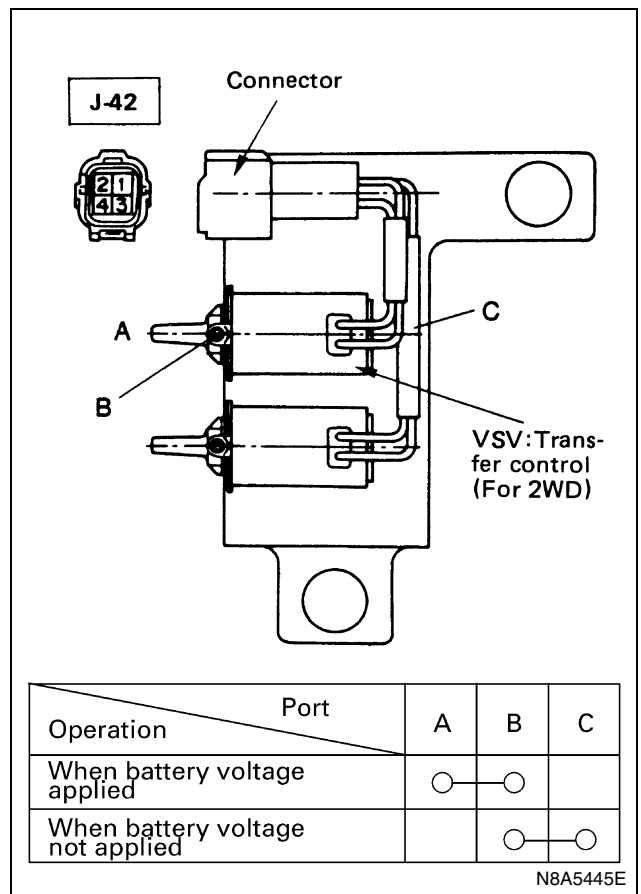
Check the continuity between the connector terminals while operating the switch. Replace the switch when the result of inspection is found abnormal.



Vacuum Switching Valve: Transfer Control (for 2WD)

Inspection

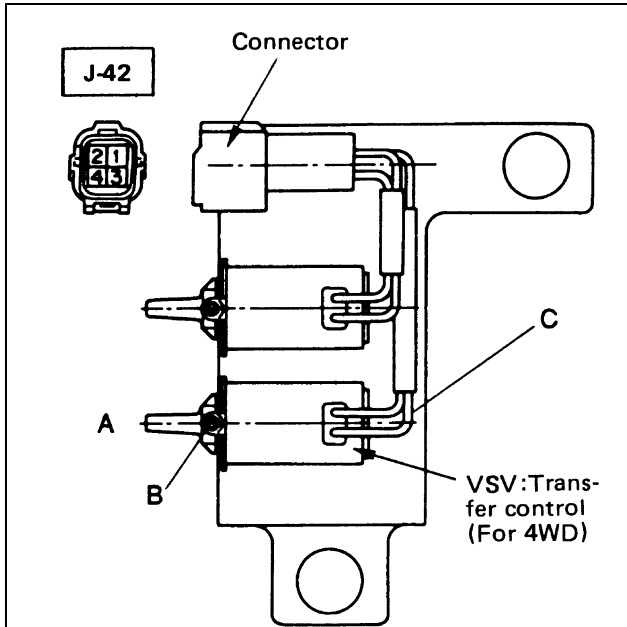
Connect the vacuum switching valve connector terminal No. 1 to the battery (+) terminal and terminal No. 3 to the (-) terminal and then check the continuity among each port.



Vacuum Switching Valve: Transfer Control (for 4WD)

Inspection

Connect the vacuum switching valve connector terminal No. 2 to the battery (+) terminal and terminal No. 4 to the (-) terminal and then check the continuity among each port.



Operation \ Port	A	B	C
When battery voltage applied	○—○		
When battery voltage not applied		○—○	

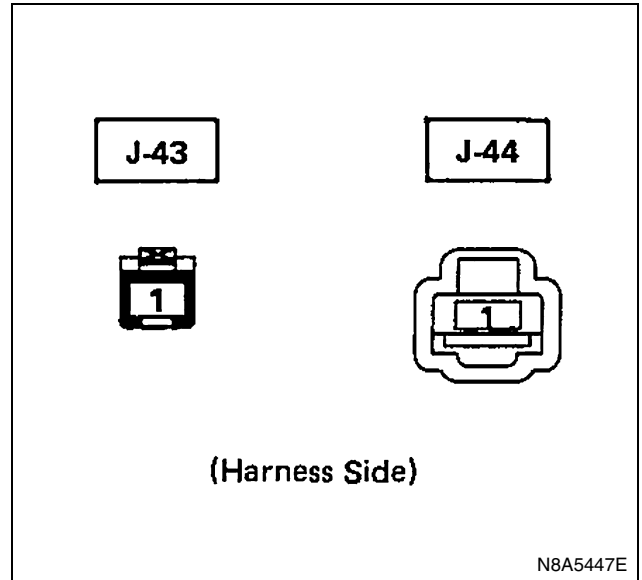
N8A5446E

4WD Detective Switch

Inspection of the 4WD Warning Light Circuit

1. Disconnect the 4WD switch connectors.
2. Connect the harness side connector terminals.
3. Check to see if the indicator light comes on with the starter switch "ON".

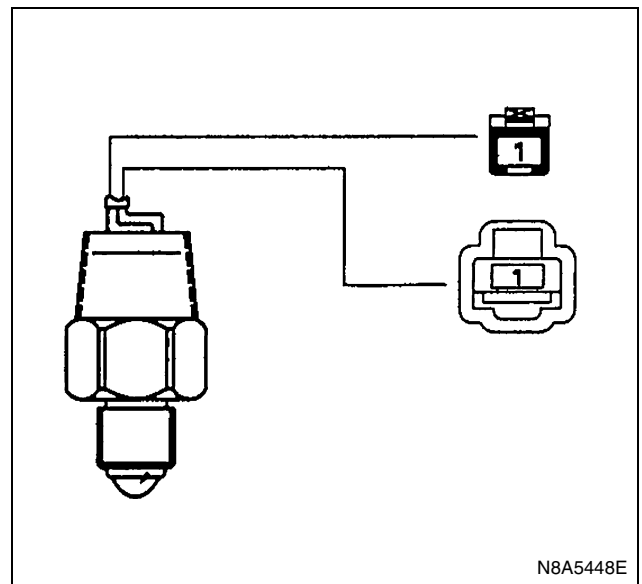
Check the bulb or harness when the result of inspection is found abnormal.



N8A5447E

Inspection

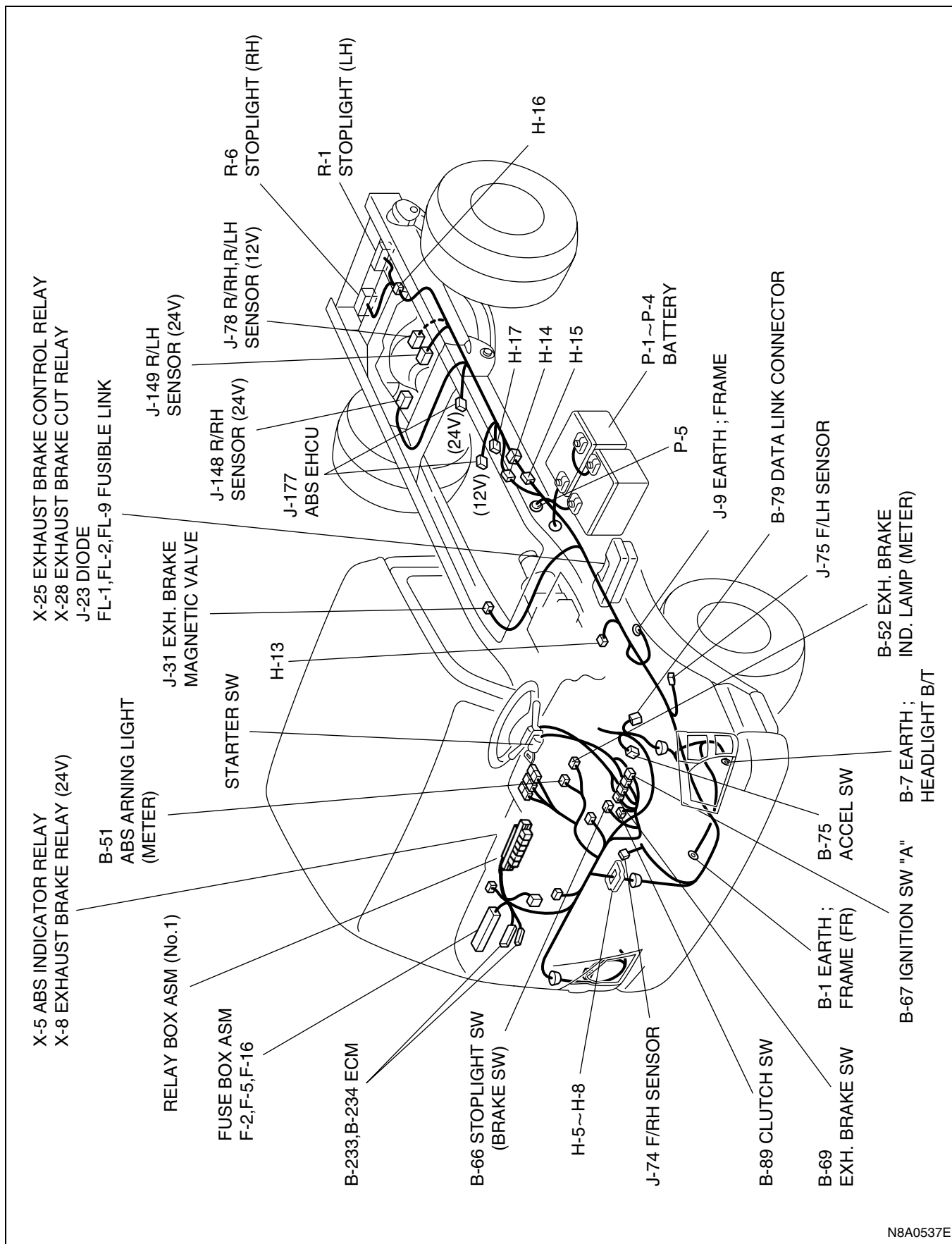
1. Shift the transfer lever to the 4H (4L) position.
 2. Check to see if there is continuity between the 4WD switch connectors.
- Replace the switch when the result of the inspection is found abnormal.



N8A5448E

ABS (Anti-lock Brake System, Without ASR)

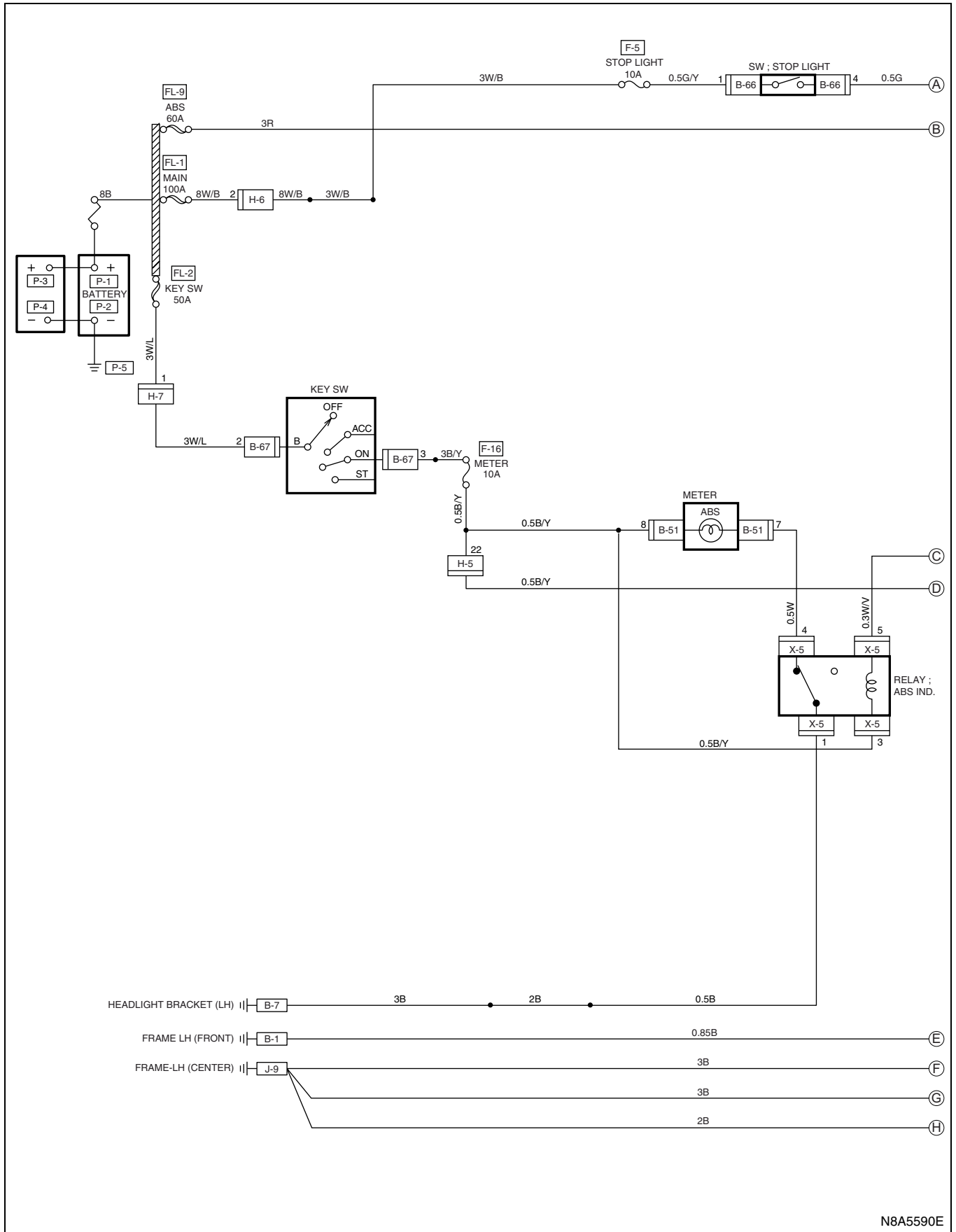
Parts Location



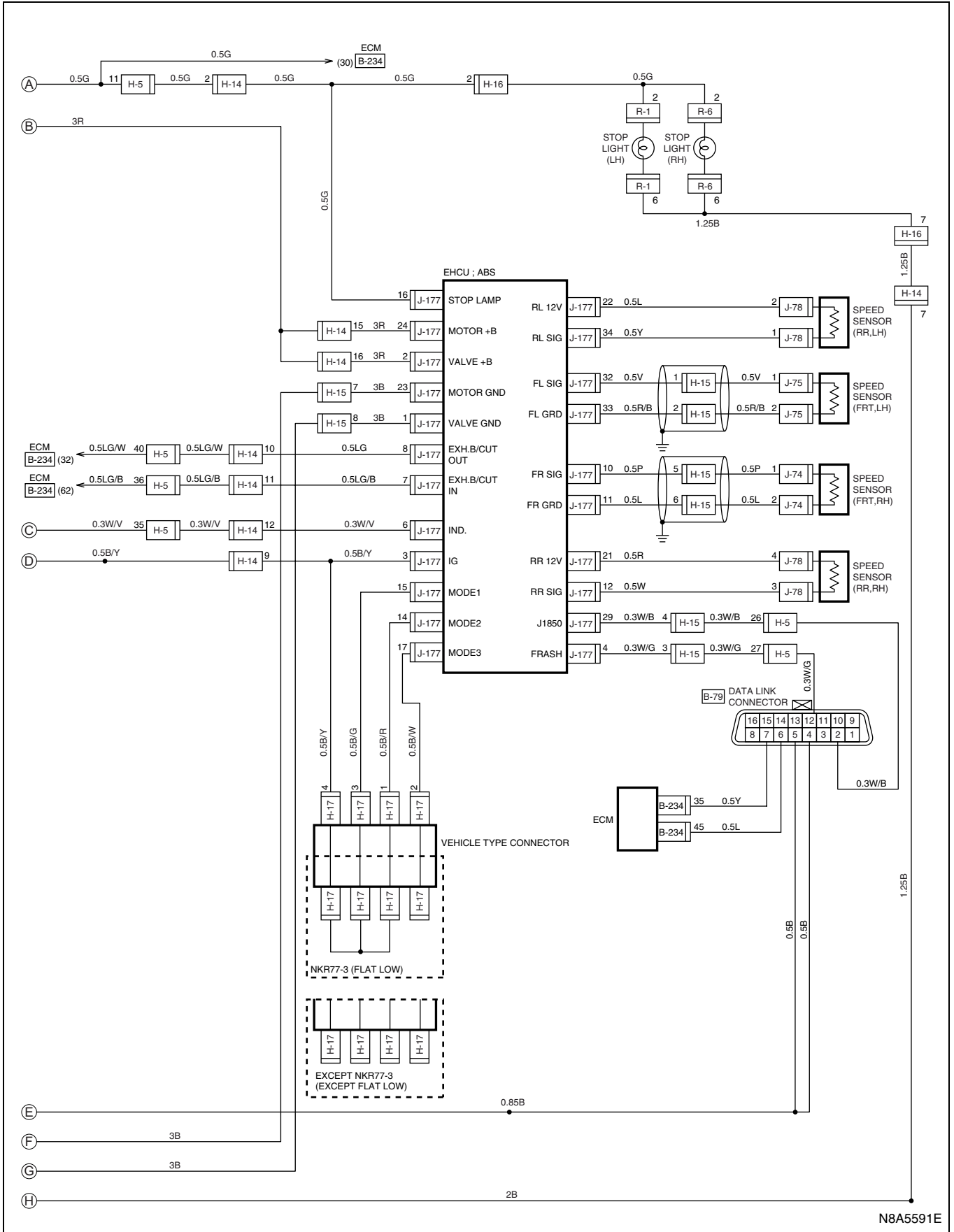
N8A0537E

Circuit Diagram

For 12 Volt (4JH1 Engine)

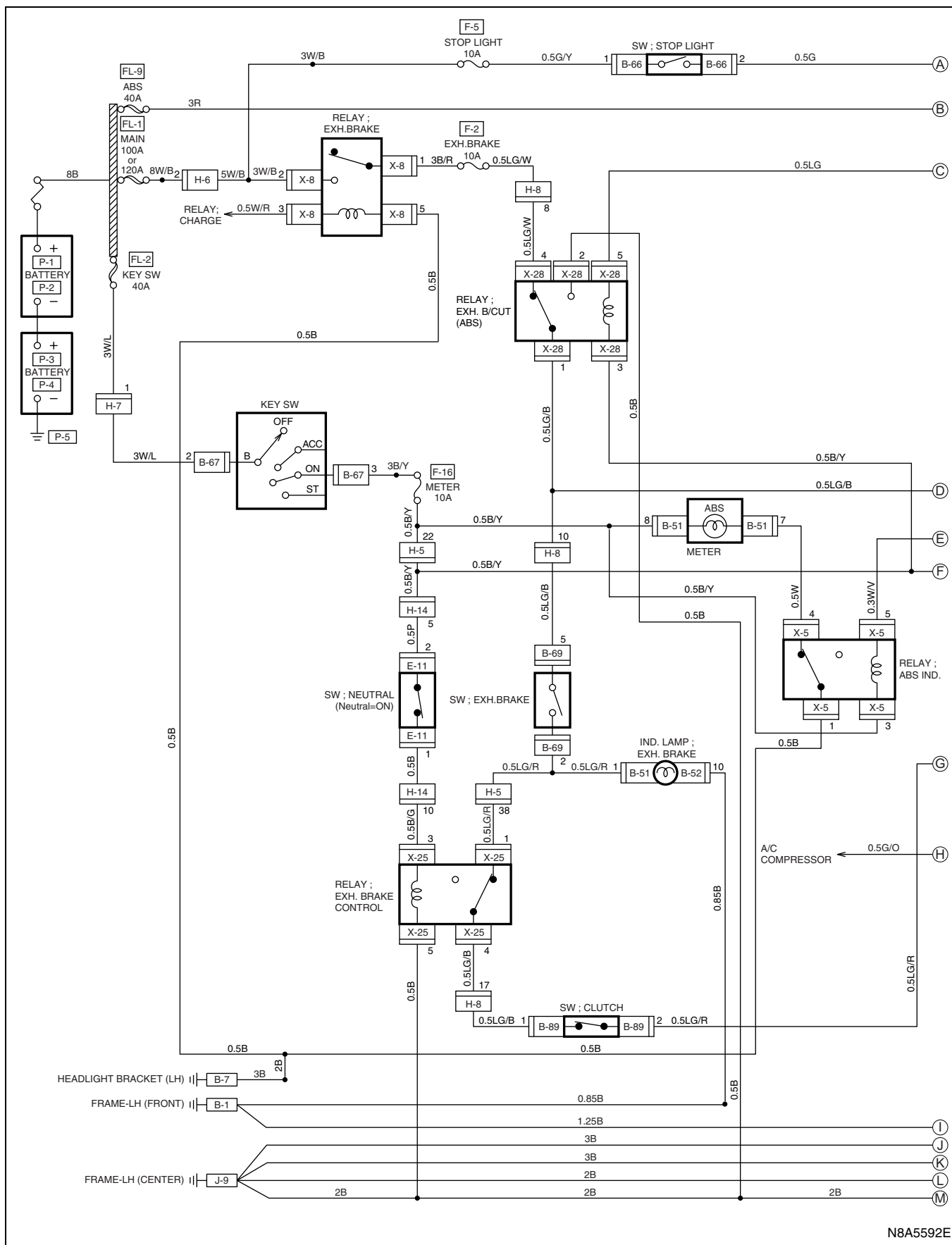


N8A5590E



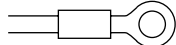
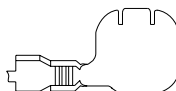
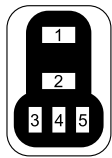
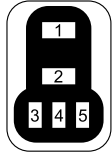
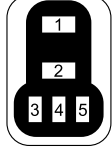
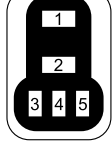
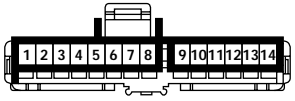
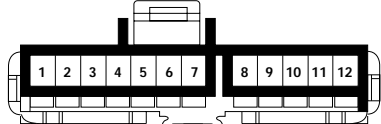
N8A5591E


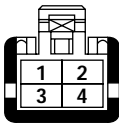

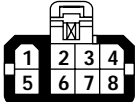
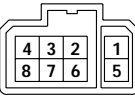

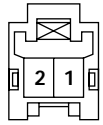
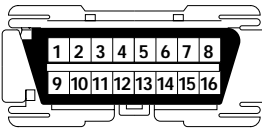
For 24 Volt


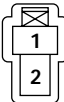
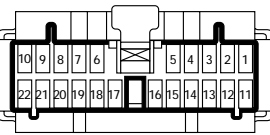
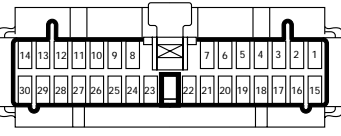
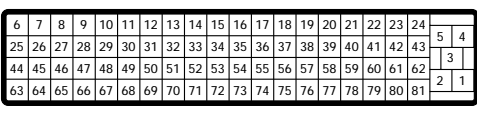
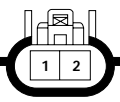
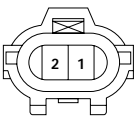



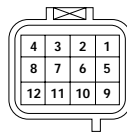

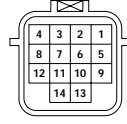

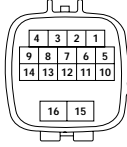

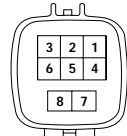

N8A5592E



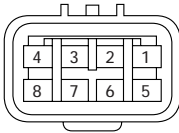

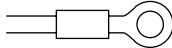
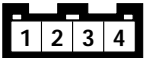


Connector List






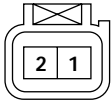


No.	Connector Face
B-1	 000-001
B-7	 000-012
X-5	 005-006
X-8	 005-006
X-25	 005-006
X-28	 005-006
B-51	 014-001
B-52	 012-005


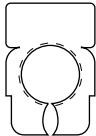

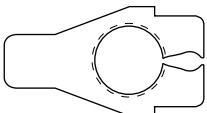

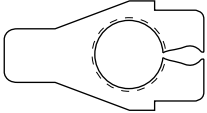
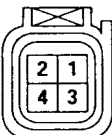

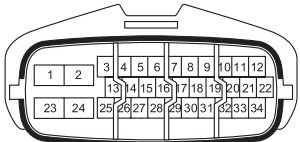
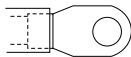


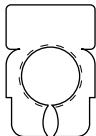
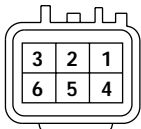
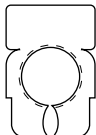
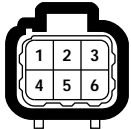
No.	Connector Face
B-66	 004-010
B-67	 004-001
B-67	 004-002
B-69	 008-001
B-69	 008-002
B-75	 002-022
B-75	 002-023
B-79	 016-005

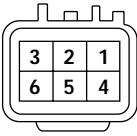
No.	Connector Face
B-89	 <p style="text-align: right;">002-009</p>
B-89	 <p style="text-align: right;">002-010</p>
B-233 (24 V)	 <p style="text-align: right;">022-002</p>
B-234 (24 V)	 <p style="text-align: right;">030-002</p>
B-234 (12 V)	 <p style="text-align: right;">121-001</p>
E-11	 <p style="text-align: right;">002-001</p>
E-11	 <p style="text-align: right;">002-002</p>
H-13	 <p style="text-align: right;">012-001</p>

No.	Connector Face
H-13	 <p style="text-align: right;">012-002</p>
H-14 (12 V)	 <p style="text-align: right;">014-004</p>
H-14 (12 V)	 <p style="text-align: right;">014-005</p>
H-14 (24 V)	 <p style="text-align: right;">016-003</p>
H-14 (24 V)	 <p style="text-align: right;">016-004</p>
H-15 (12 V)	 <p style="text-align: right;">008-023</p>
H-15 (12 V)	 <p style="text-align: right;">008-024</p>
H-15 (24 V)	 <p style="text-align: right;">016-003</p>

No.	Connector Face
H-15 (24 V)	 016-004
H-16	 008-003
H-16	 008-004
H-17	 004-011
J-9	 000-001
J-23	 004-009
J-31	 002-011
J-31	 002-012

No.	Connector Face
J-40	 002-015
J-41	 002-015
J-74	 002-011
J-74	 002-012
J-75	 002-011
J-75	 002-012
J-148	 002-011
J-148	 002-012

No.	Connector Face	No.	Connector Face
J-149 (24 V)	 002-011	P-4	 000-004
J-149 (24 V)	 002-012	P-2 (24 V)	 000-006
J-78 (12 V)	 004-011	P-3	 000-006
J-78 (12 V)	 004-018	P-5 (12 V)	 000-007
J-177	 034-001	P-5 (24 V)	 000-002
P-1 (12 V)	 000-003	R-1	 006-004
P-2	 000-004	R-1	 006-005
P-1 (24 V)	 000-004	R-6	 006-004

No.	Connector Face
R-6	 006-005

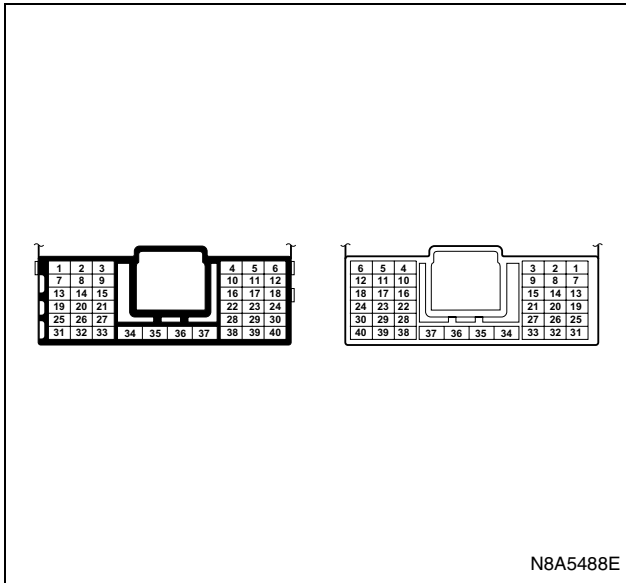
ABS/ASR System

General Description

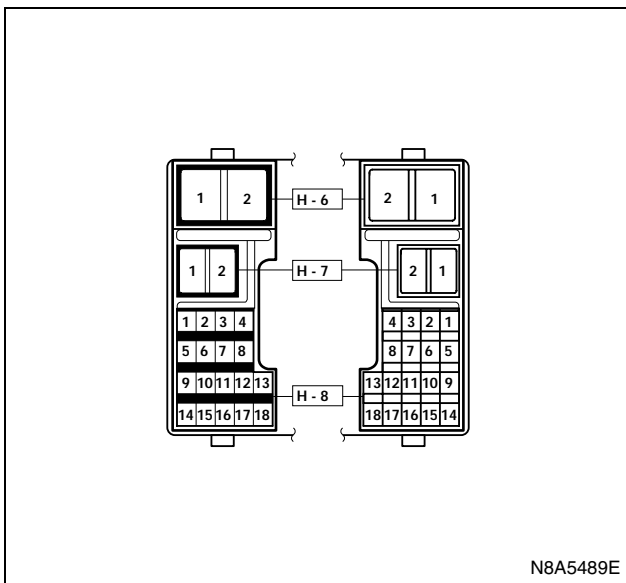
ABS (Anti-lock Brake System) and ASR (Anti-Slip Regulator) are the system to prevent the wheels from locking and wheel spin, and to assure stability and steering ability of the vehicle.

When a malfunction occurs in the system, fail-safe deactivate the ABS and ASR, and the warning lamp comes on. Also, the self-diagnosis function is equipped to improve serviceability.

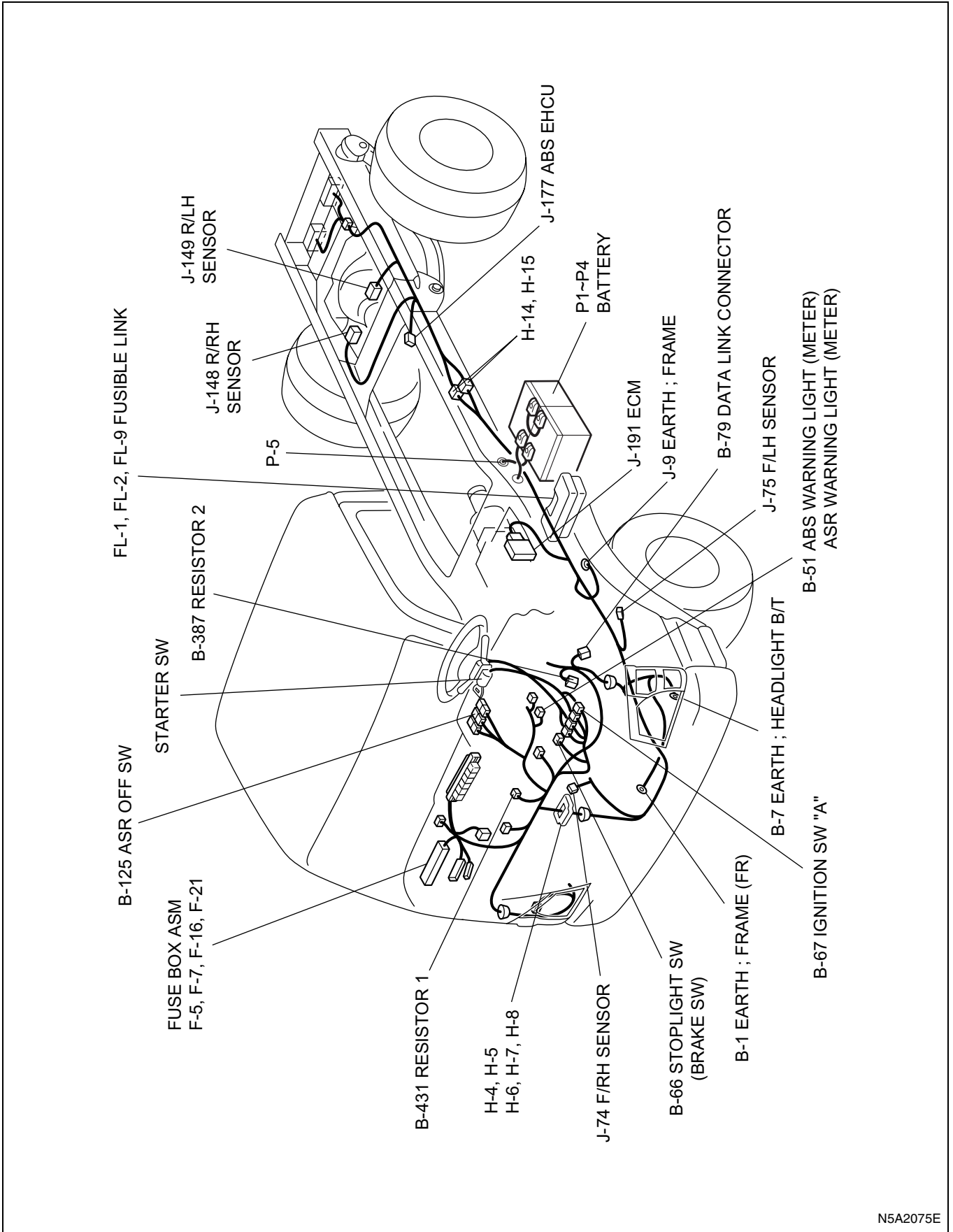
H-5



H-6, H-7, H-8

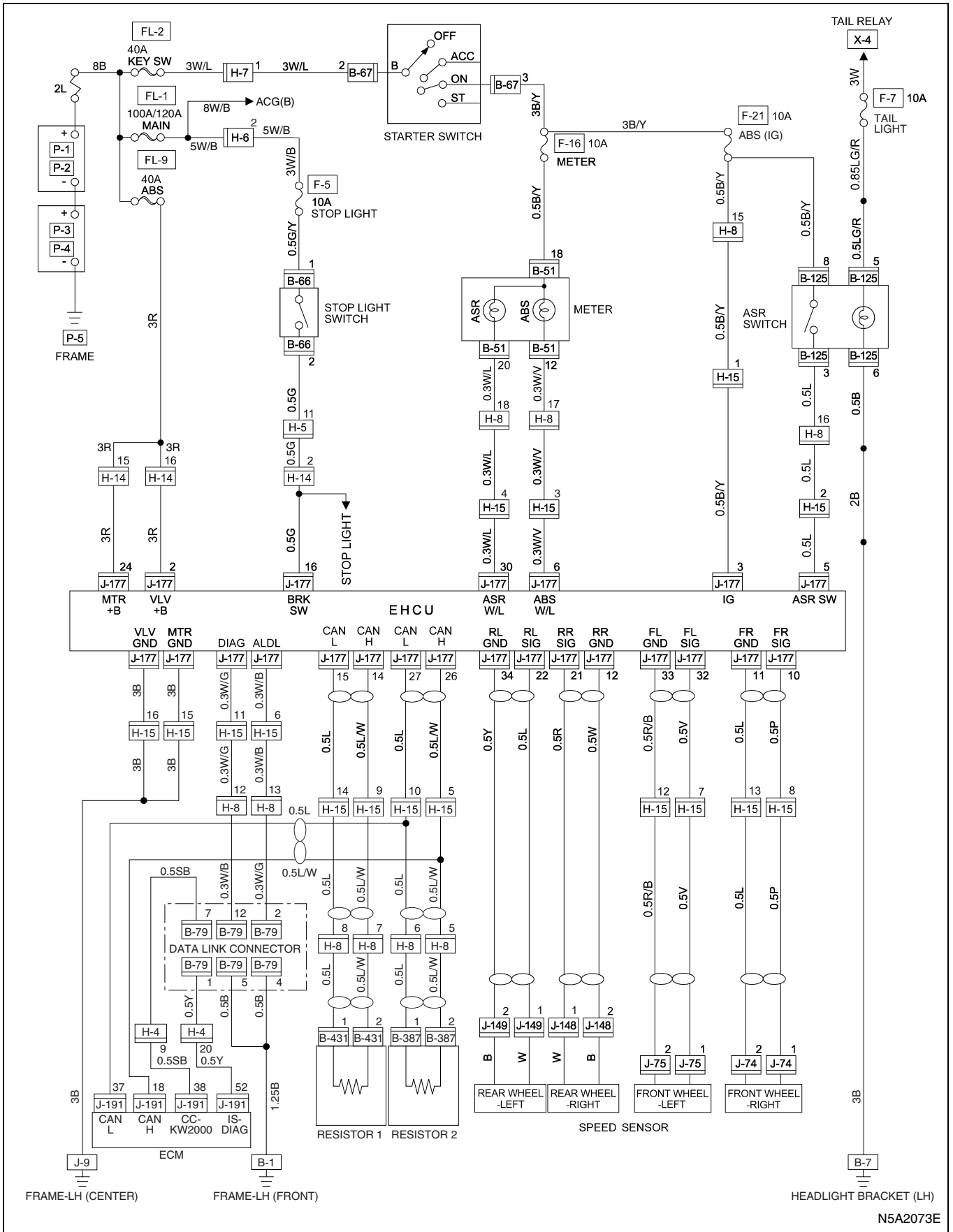


Parts Location



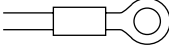
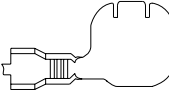
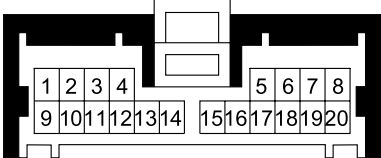
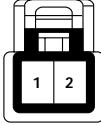
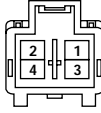
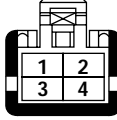
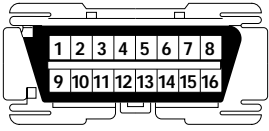
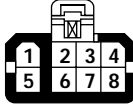
N5A2075E

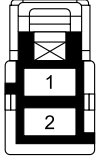
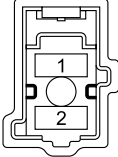
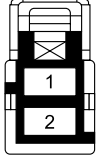
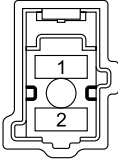
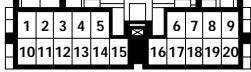
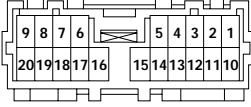


Circuit Diagram



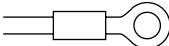










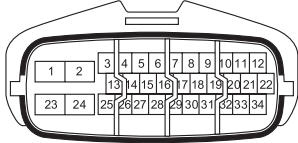
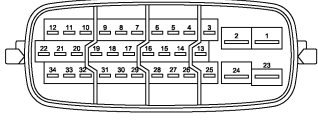
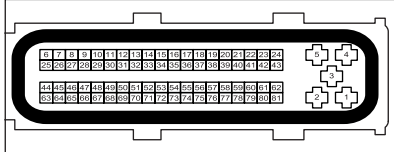
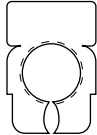
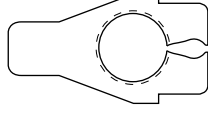
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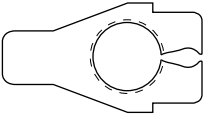

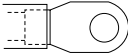
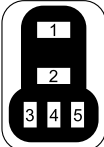
Connector List

No.	Connector Face
B-1	 000-001
B-7	 000-012
B-51	 020-004
B-66	 002-031
B-67	 004-002
B-67	 004-001
B-79	 016-005
B-125	 008-001

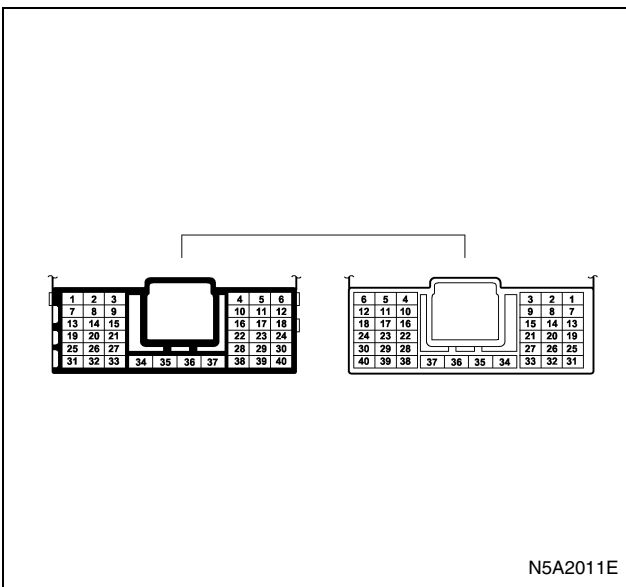
No.	Connector Face
B-387	 002-038
B-387	 002-039
B-431	 002-038
B-431	 002-039
H-4	 020-002
H-4	 020-003
H-14	 016-004
H-14	 016-003

No.	Connector Face
H-15	 <p style="text-align: right;">016-003</p>
H-15	 <p style="text-align: right;">016-004</p>
J-9	 <p style="text-align: right;">000-001</p>
J-74	 <p style="text-align: right;">002-012</p>
J-74	 <p style="text-align: right;">002-011</p>
J-75	 <p style="text-align: right;">002-012</p>
J-75	 <p style="text-align: right;">002-011</p>
J-148	 <p style="text-align: right;">002-012</p>

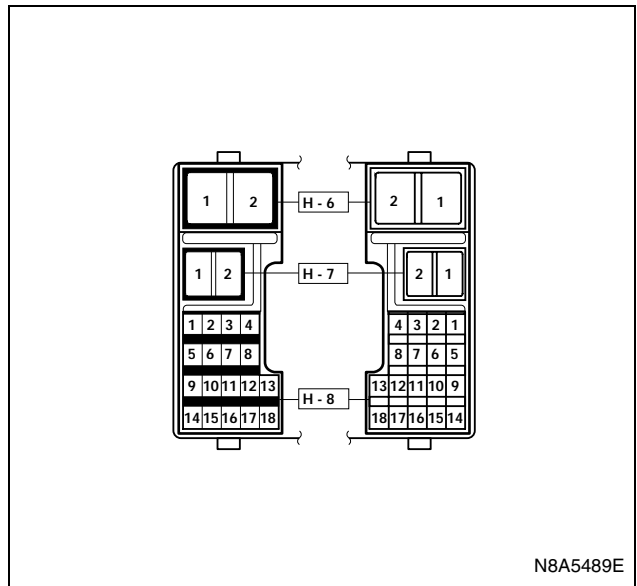
No.	Connector Face
J-148	 <p style="text-align: right;">002-011</p>
J-149	 <p style="text-align: right;">002-012</p>
J-149	 <p style="text-align: right;">002-011</p>
J-177	 <p style="text-align: right;">034-001</p>
J-177	 <p style="text-align: right;">034-002</p>
J-191	 <p style="text-align: right;">081-001</p>
P-1	 <p style="text-align: right;">000-004</p>
P-2	 <p style="text-align: right;">000-006</p>

No.	Connector Face
P-3	 000-006
P-4	 000-004
P-5	 000-002
X-4	 005-006

H-5



H-6, H-7, H-8

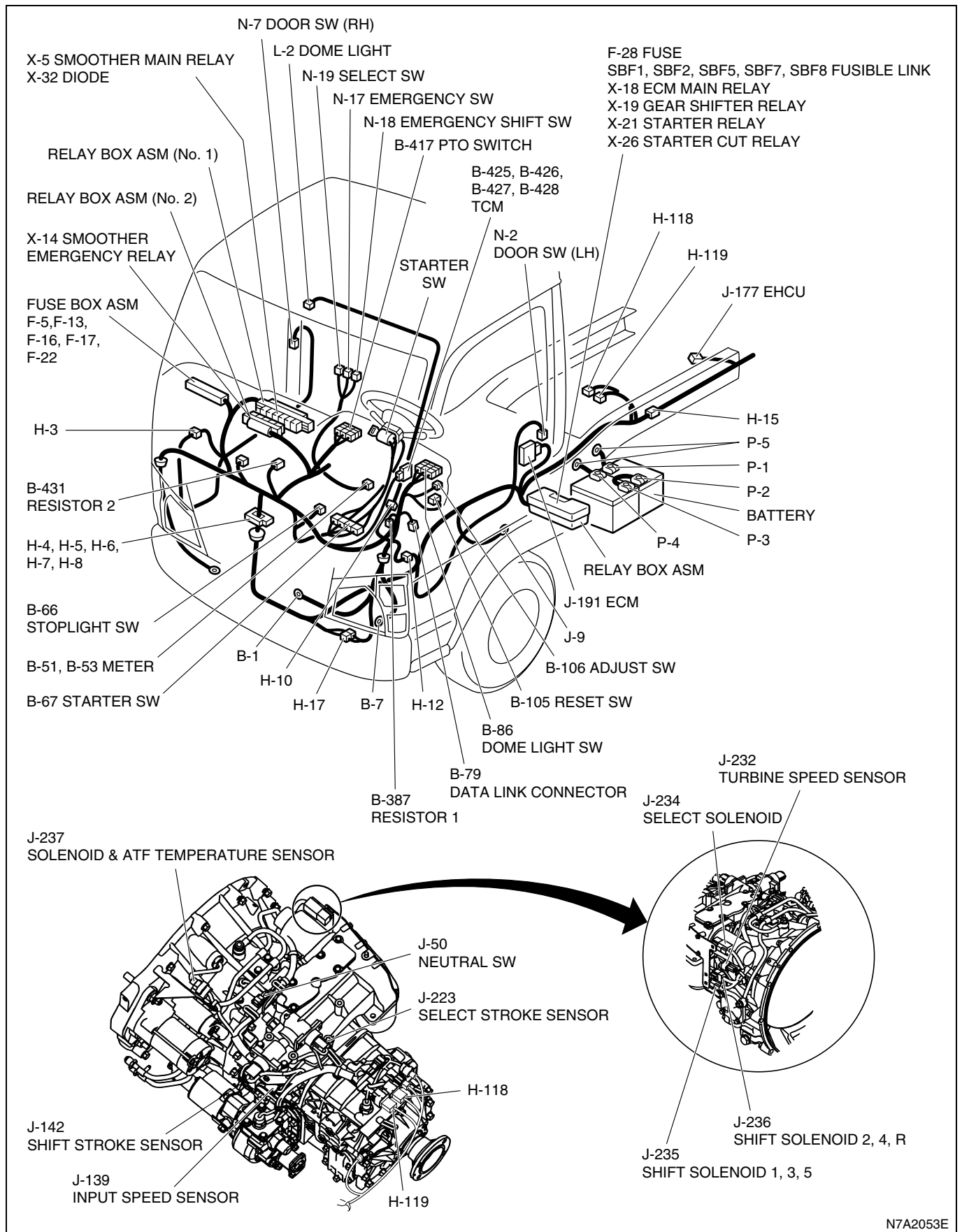


Transmission Control System (Smoother)

General Description

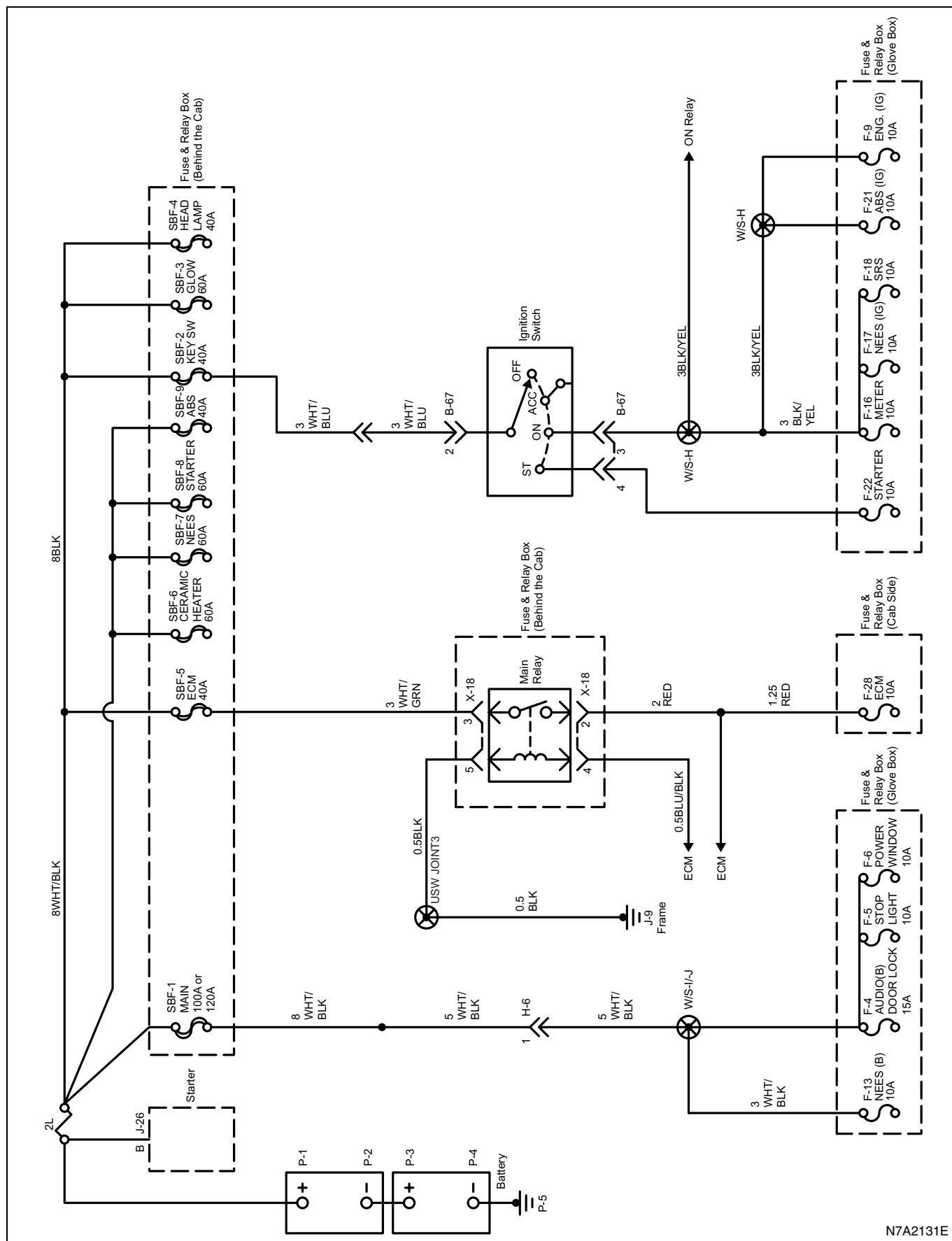
“Smoother” is the name of a new-generation drive train that provides benefits in terms of both life cycle costs (low initial cost and maintenance cost, lower fuel consumption, etc.) and easy driving. Smoother is a system that adds an automatic transmission to the existing Smoother, for even better fuel consumption and easier driving. This is accomplished by installing a solenoid system shift control box on the Smoother, which combines a manual transmission with fluid coupling, so all shifting is performed automatically in accordance with signals from the transmission control module (TCM). When starting moving the vehicle, depressing the brake pedal and operating the change lever as on an automatic vehicle causes a change lever position signal to be detected by the TCM. This actuates the shift control box solenoid and shifts the gear into the starting position or the reverse position, and then engages the shift change clutch (wet multi-disc clutch). (After the shift clutch engages, creep force is generated the same as on an AT vehicle.) Releasing the foot from the brake pedal and pressing the accelerator pedal starts the vehicle moving forward. If there is an up-shift or down-shift while running, the control unit determines the vehicle status based on vehicle speed, accelerator opening angle, and other factors, and shifts to the optimal gear automatically. If the driver moves the change lever in the “+” or “-” direction, a gear change is indicated, so sequential manual shifting is also possible. (Even during sequential manual shifting, the transmission shifts to the starting position when the vehicle is stopped.)

Parts Location

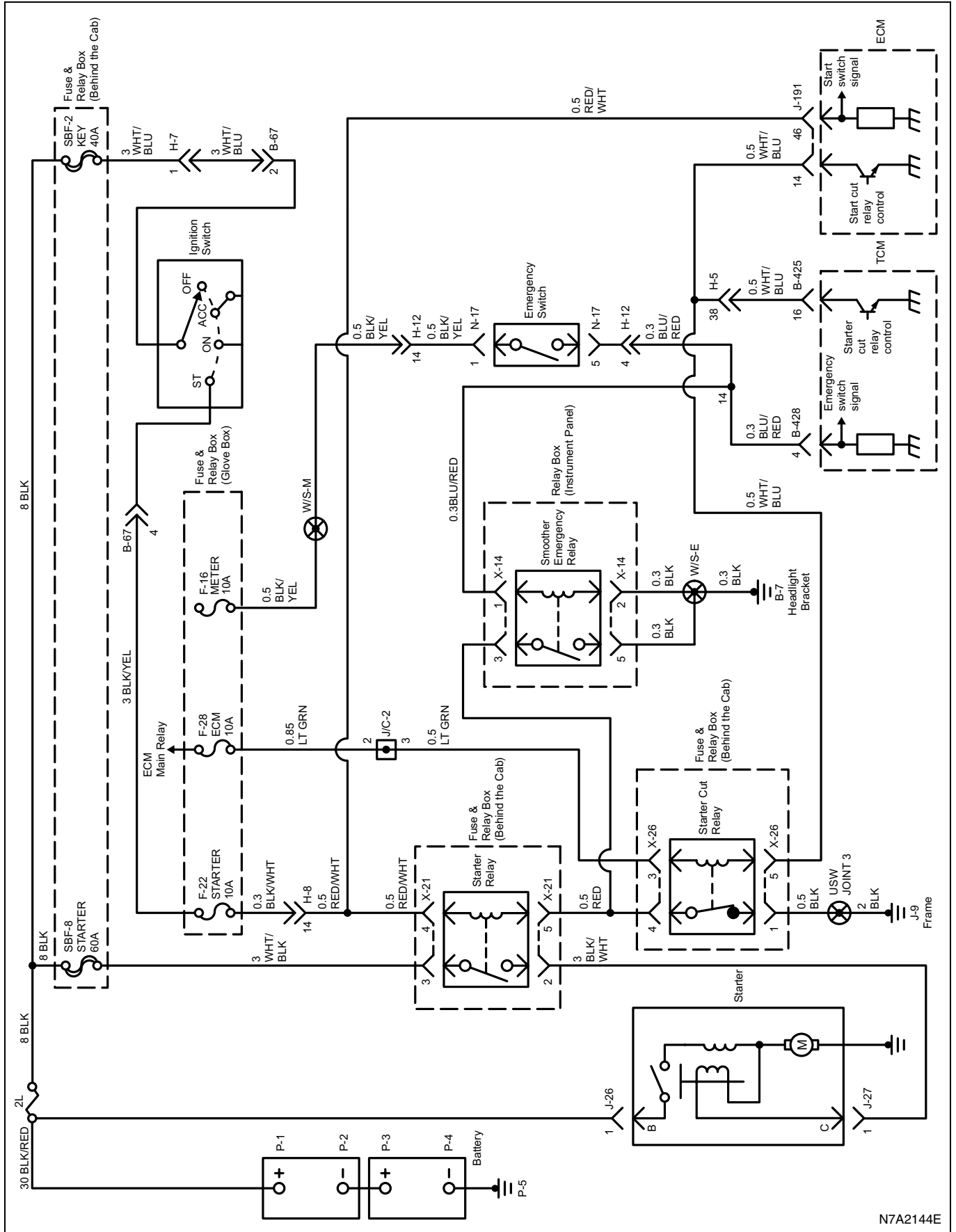


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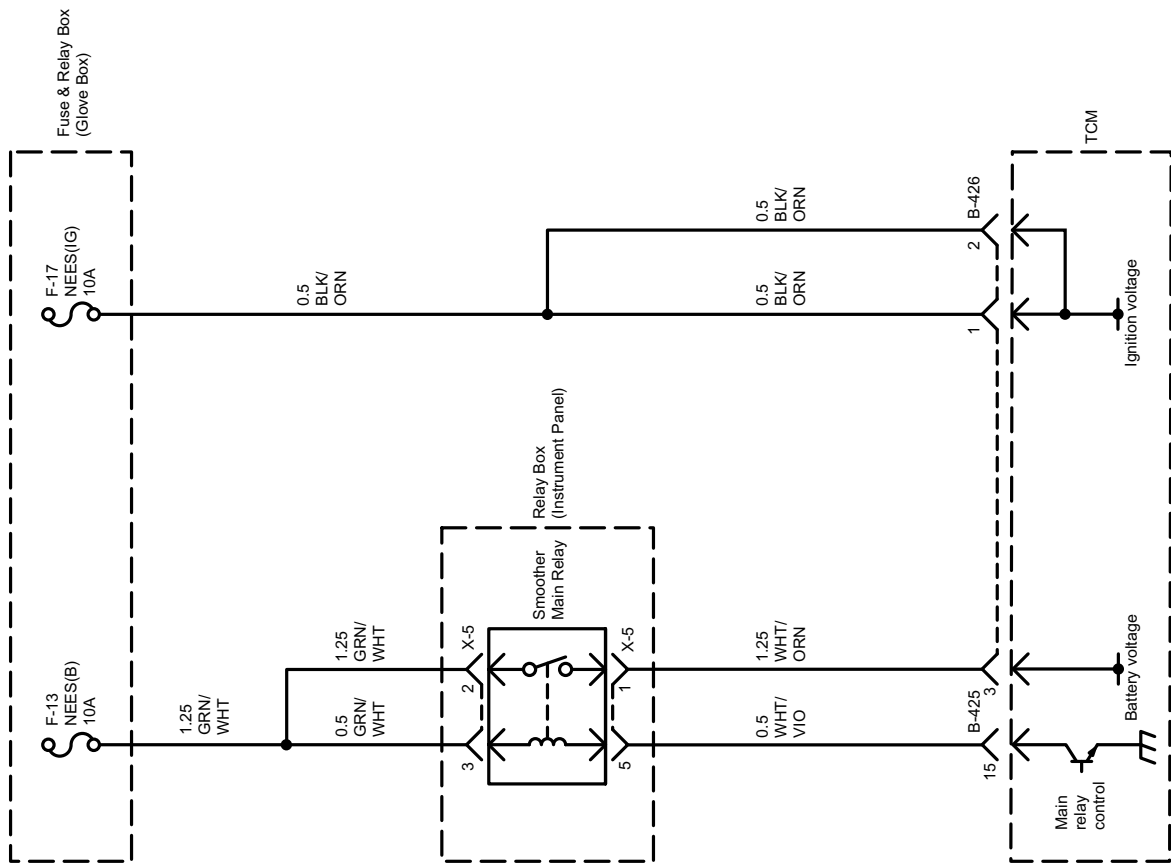
Circuit Diagram



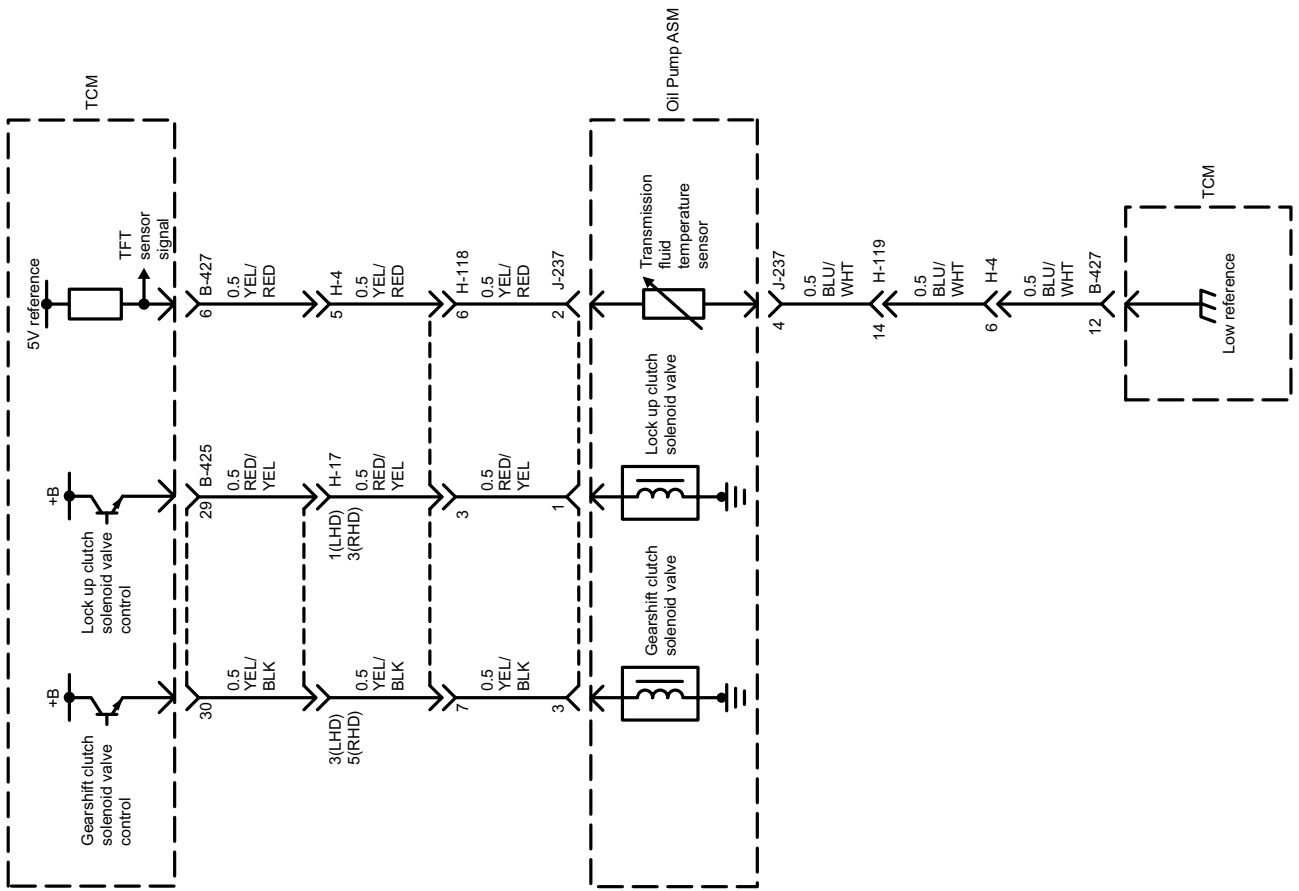
N7A2131E



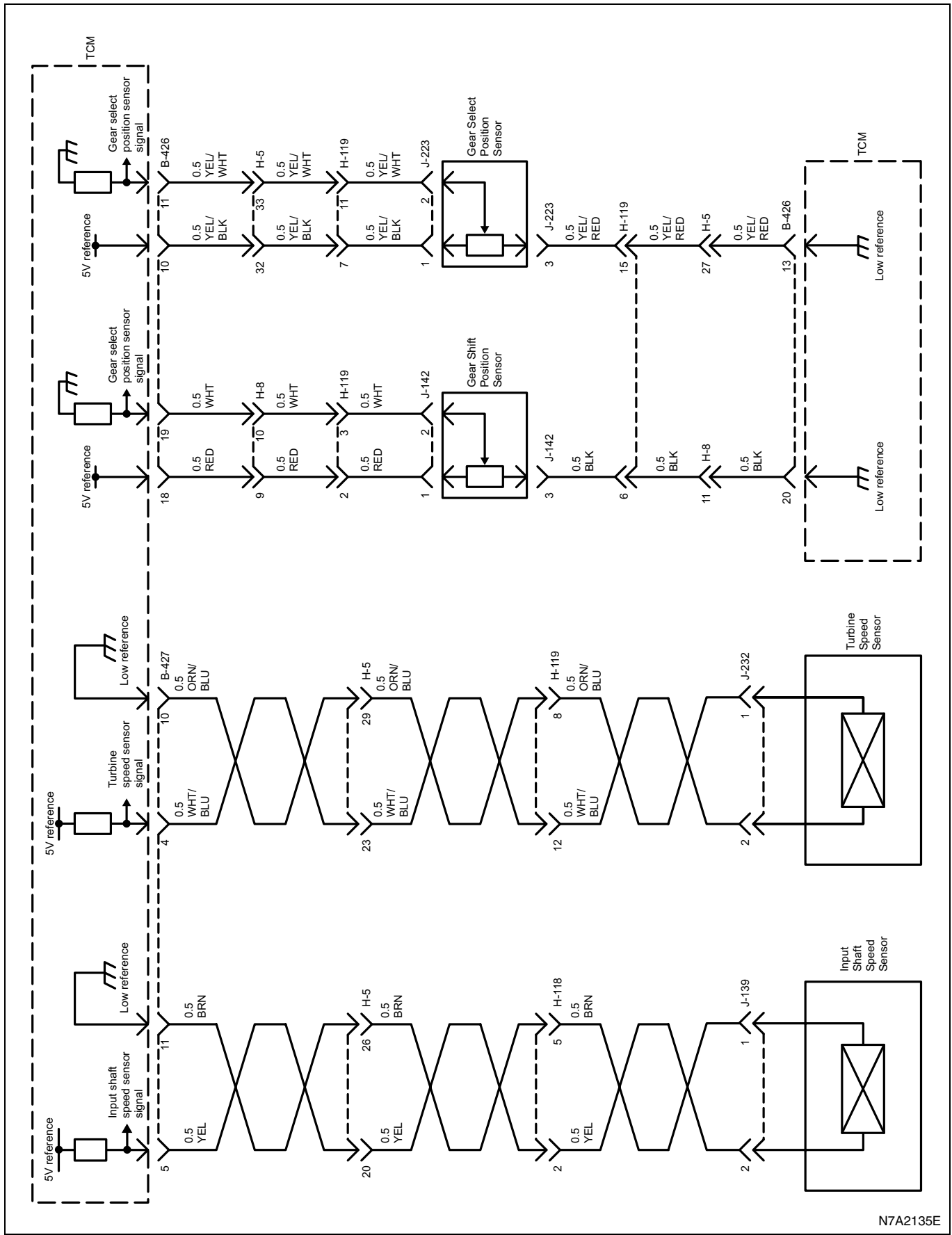
N7A2144E



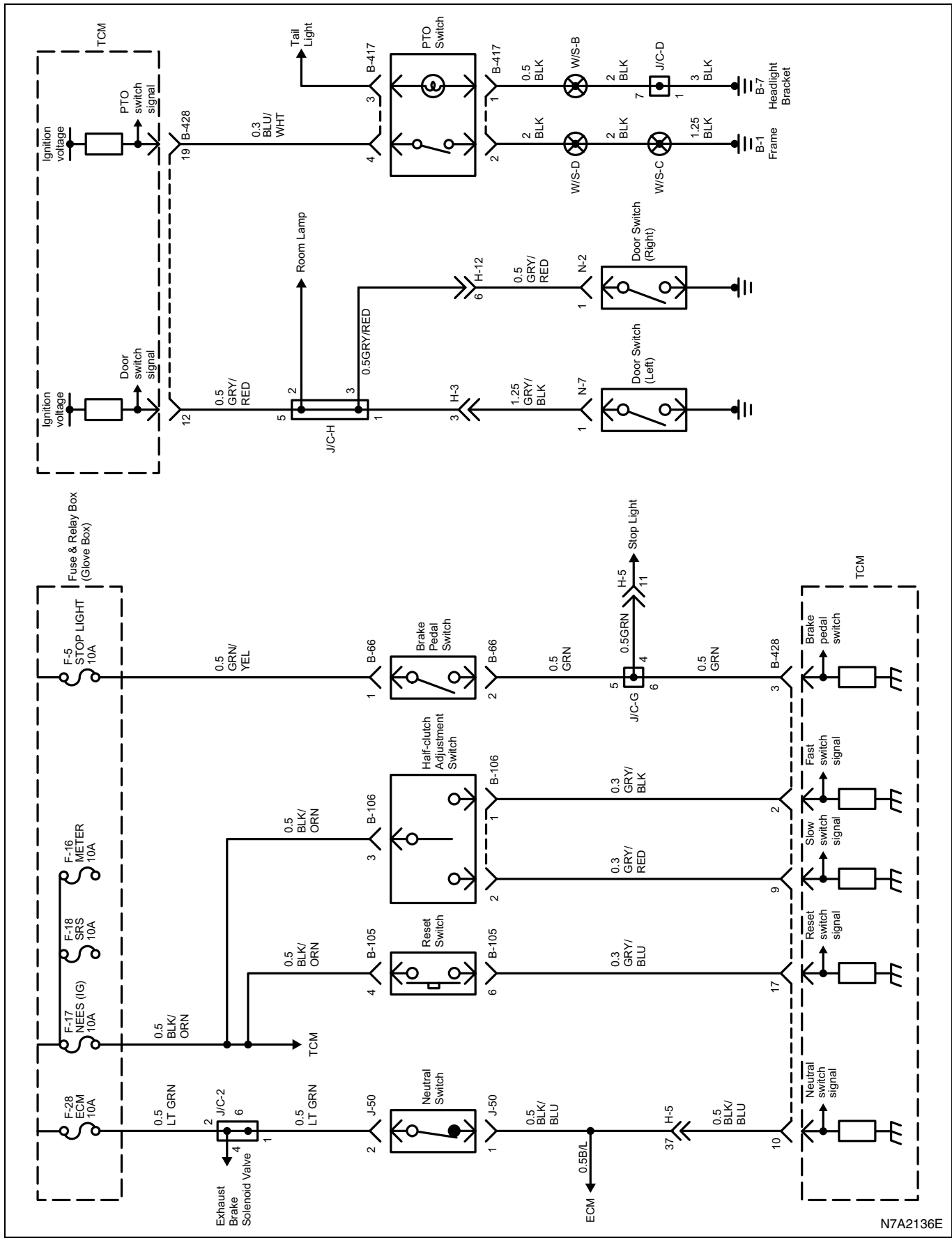
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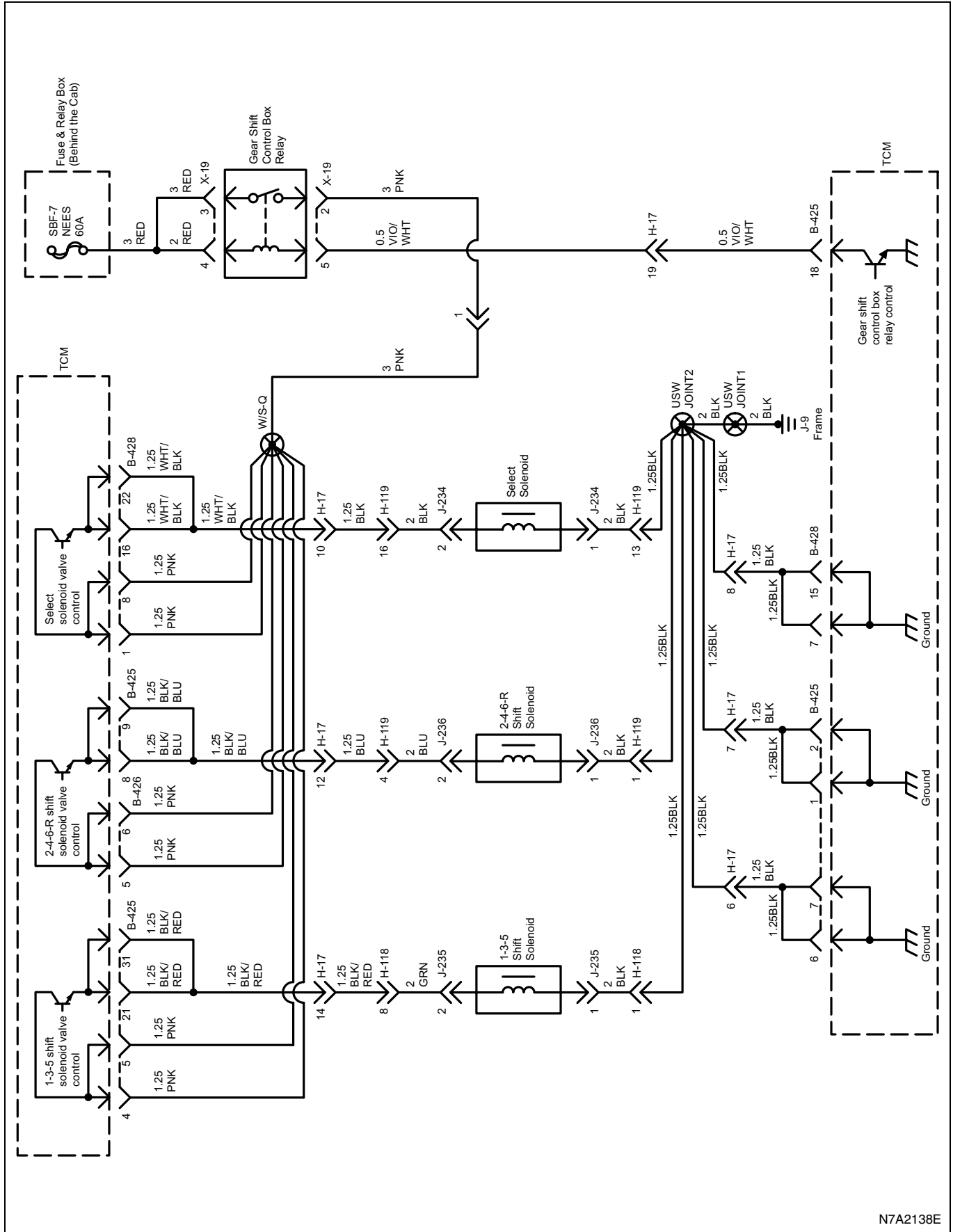
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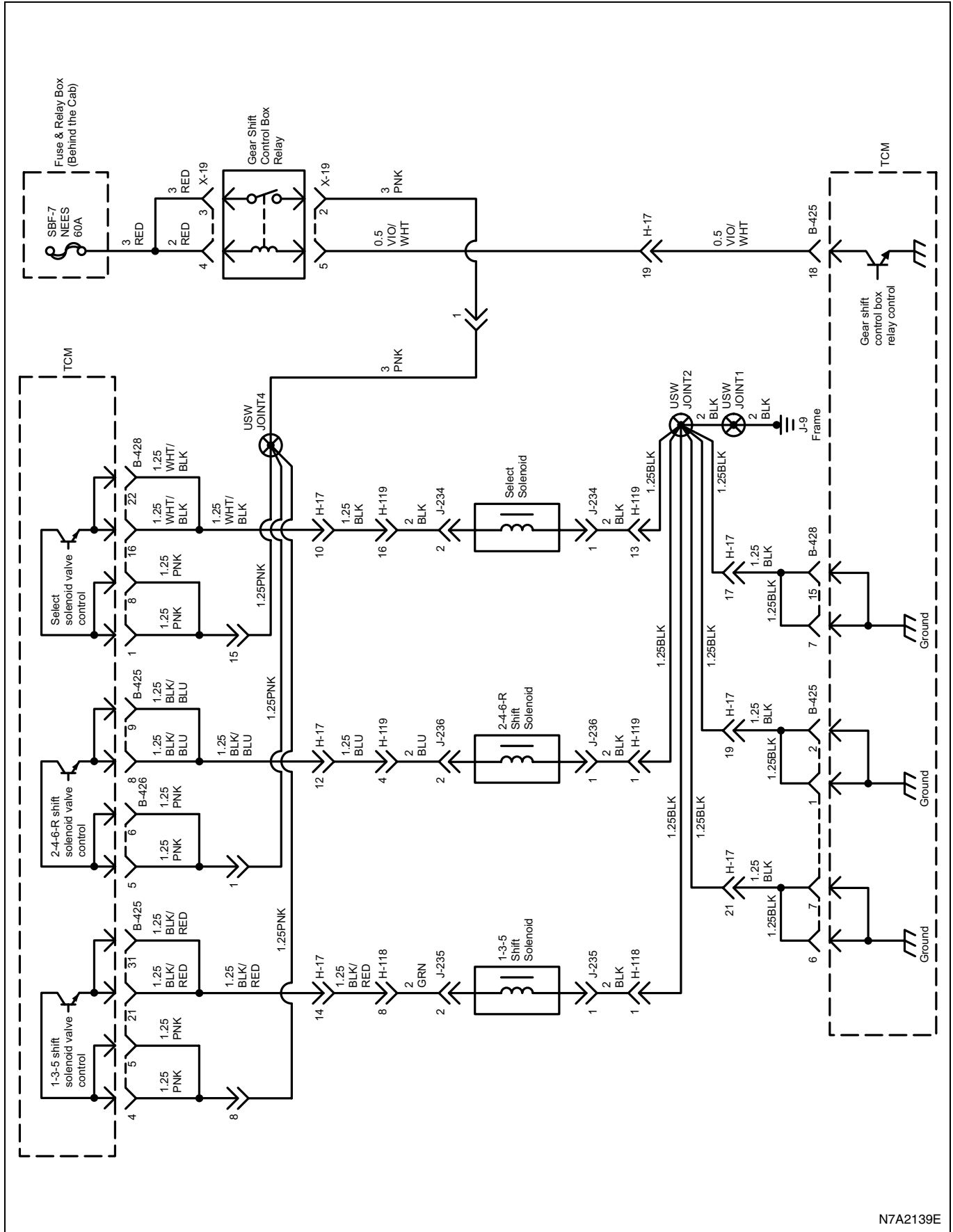
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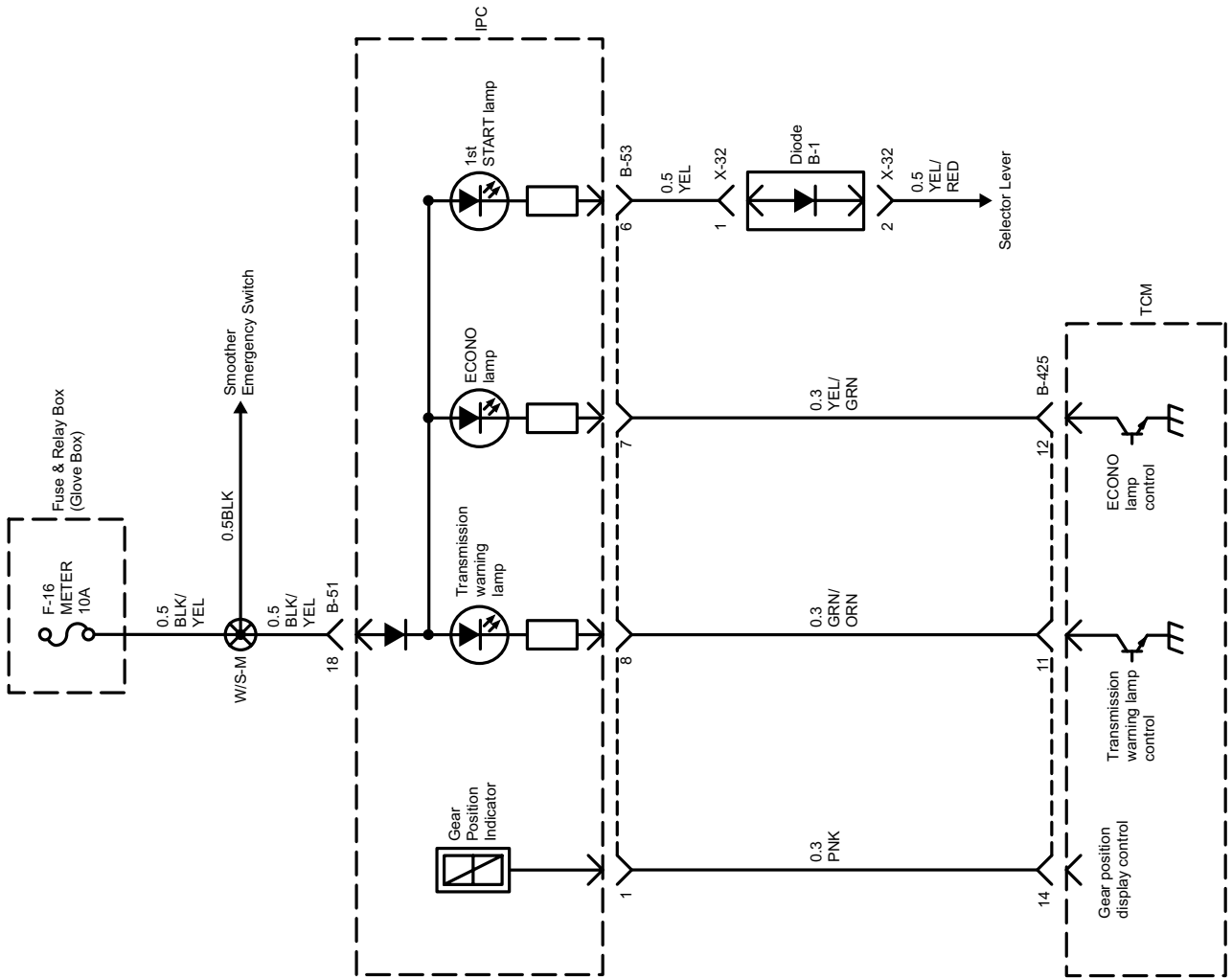
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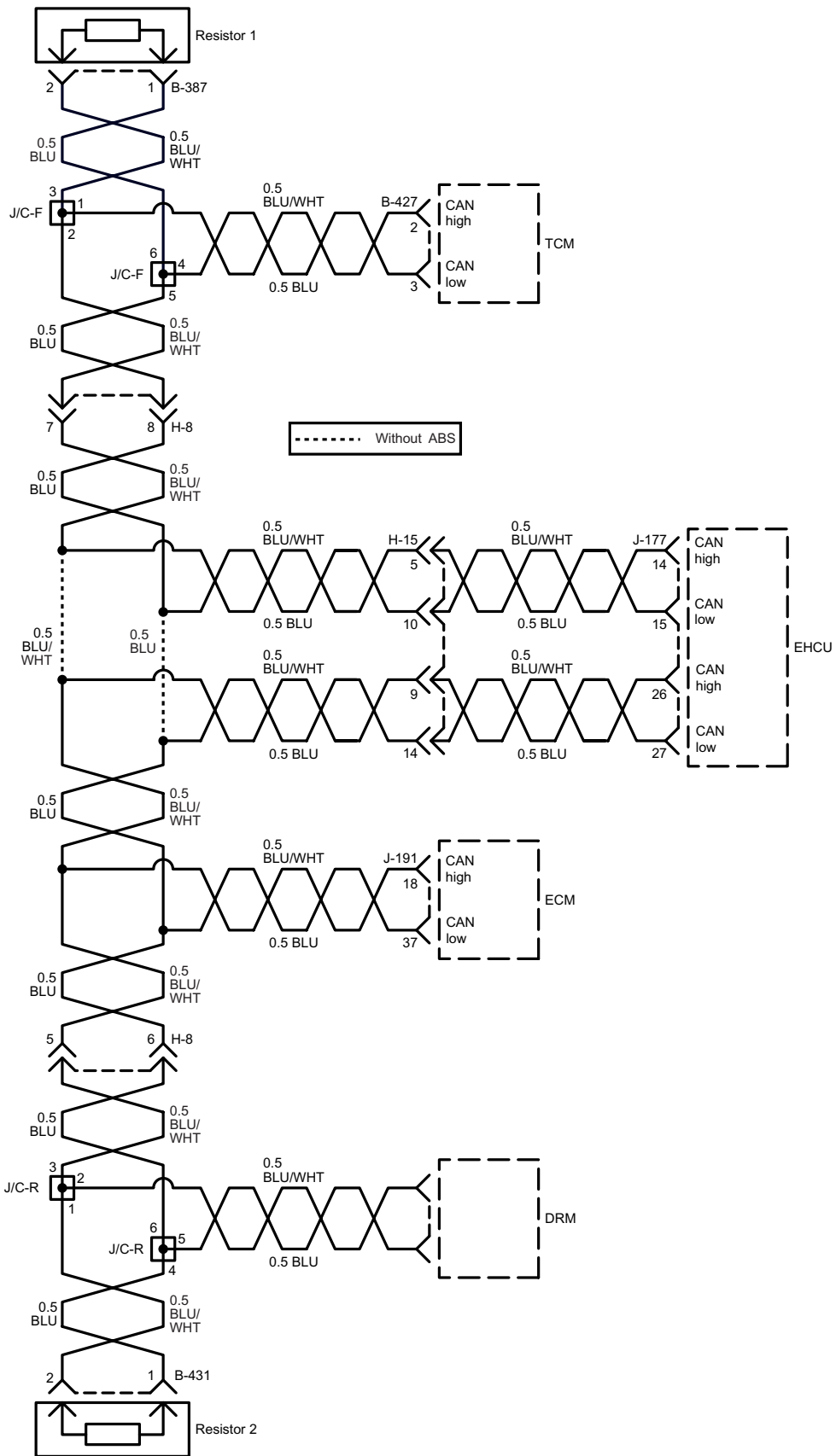
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N7A2139E

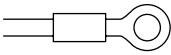
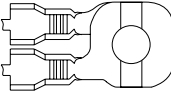
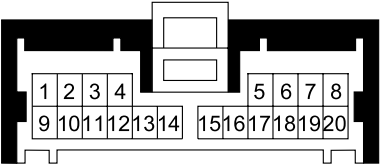
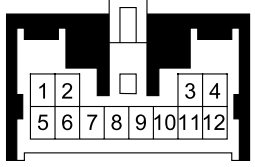
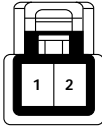
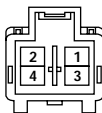
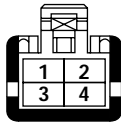
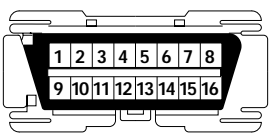



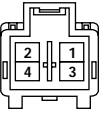
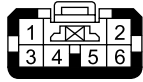
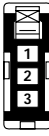
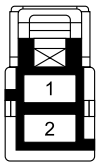
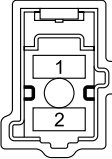
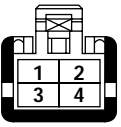
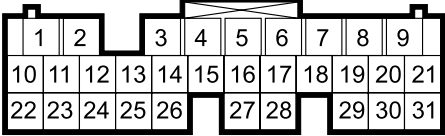
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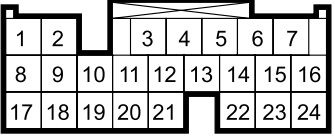
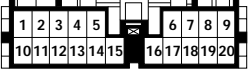
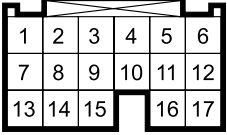
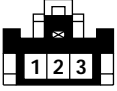
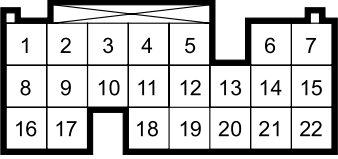
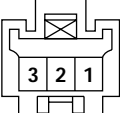
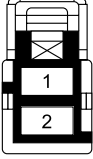
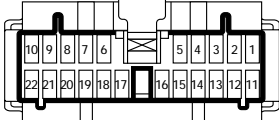
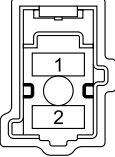
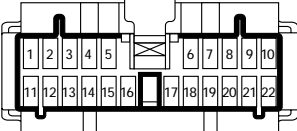
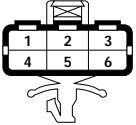

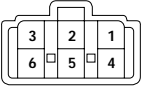

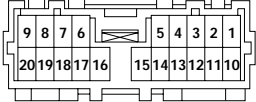
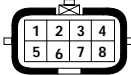




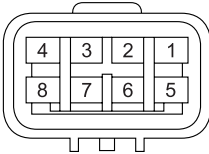

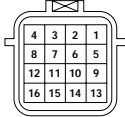

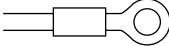
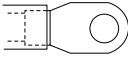
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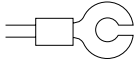

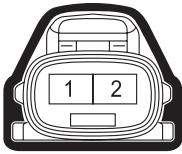

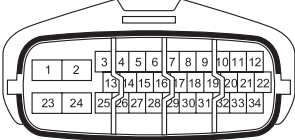
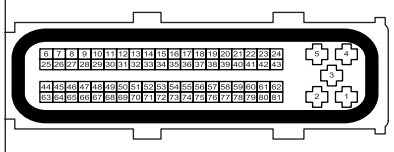

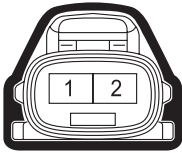
Connector list



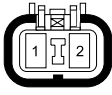

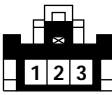
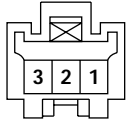
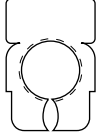
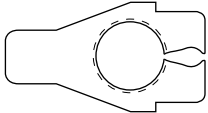
No.	Connector Face
B-1	 000-001
B-7	 000-018
B-51	 020-004
B-53	 012-009
B-66	 002-031
B-67	 004-002
B-67	 004-001
B-79	 016-005

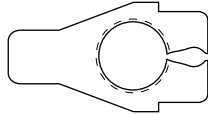
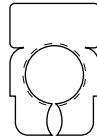
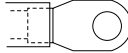
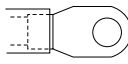
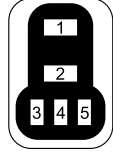
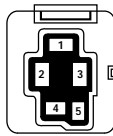
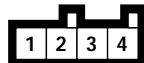

No.	Connector Face
B-86	 004-001
B-86	 004-002
B-105	 006-021
B-106	 003-014
B-387	 002-038
B-387	 002-039
B-417	 004-001
B-425	 031-001



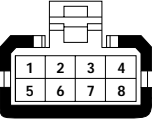


No.	Connector Face	No.	Connector Face
B-426	 <p>024-001</p>	H-4	 <p>020-002</p>
B-427	 <p>017-001</p>	H-10	 <p>003-009</p>
B-428	 <p>022-006</p>	H-10	 <p>003-010</p>
B-431	 <p>002-038</p>	H-12	 <p>022-002</p>
B-431	 <p>002-039</p>	H-12	 <p>022-001</p>
H-3	 <p>006-014</p>	H-15	 <p>016-003</p>
H-3	 <p>006-015</p>	H-15	 <p>016-004</p>
H-4	 <p>020-003</p>	H-17	 <p>008-007</p>

No.	Connector Face
H-17	 <p style="text-align: right;">008-008</p>
H-118	 <p style="text-align: right;">008-003</p>
H-118	 <p style="text-align: right;">008-018</p>
H-119	 <p style="text-align: right;">016-001</p>
H-119	 <p style="text-align: right;">016-002</p>
H-xx	 <p style="text-align: right;">001-002</p>
J-9	 <p style="text-align: right;">000-001</p>
J-26	 <p style="text-align: right;">000-002</p>

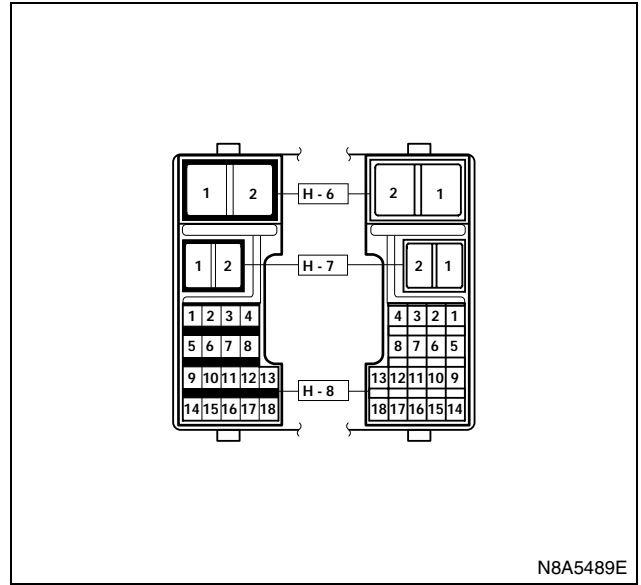
No.	Connector Face
J-27	 <p style="text-align: right;">000-009</p>
J-50	 <p style="text-align: right;">002-035</p>
J-139	 <p style="text-align: right;">002-040</p>
J-142	 <p style="text-align: right;">003-005</p>
J-177	 <p style="text-align: right;">034-001</p>
J-191	 <p style="text-align: right;">081-001</p>
J-223	 <p style="text-align: right;">003-005</p>
J-232	 <p style="text-align: right;">002-040</p>

No.	Connector Face
J-234	 002-003
J-235	 002-003
J-236	 002-042
J-237	 004-020
L-2	 003-009
L-2	 003-010
P-1	 000-004
P-2	 000-006

No.	Connector Face
P-3	 000-006
P-4	 000-004
P-5	 000-002
P-6	 000-002
X-5, 14, 18, 26	 005-006
X-19, 21	 005-003
X-32	 004-004
X-33	 014-002

No.	Connector Face
N-2	 001-020
N-7	 001-020
N-17	 008-005
N-18	 006-007
N-19	 010-003

H-6, H-7, H-8



Electronic Control Type PTO

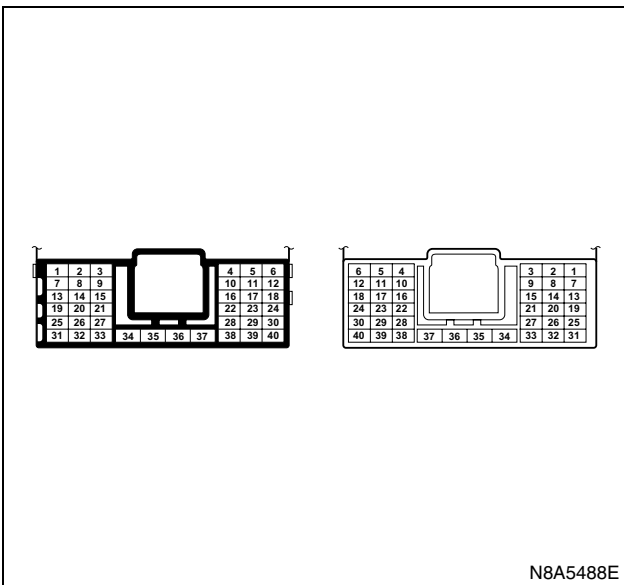
General Description

This circuit consists of starter switch, PTO switch (for dump vehicle, it shares with dump control switch), relay, diodes, solenoid and control unit.

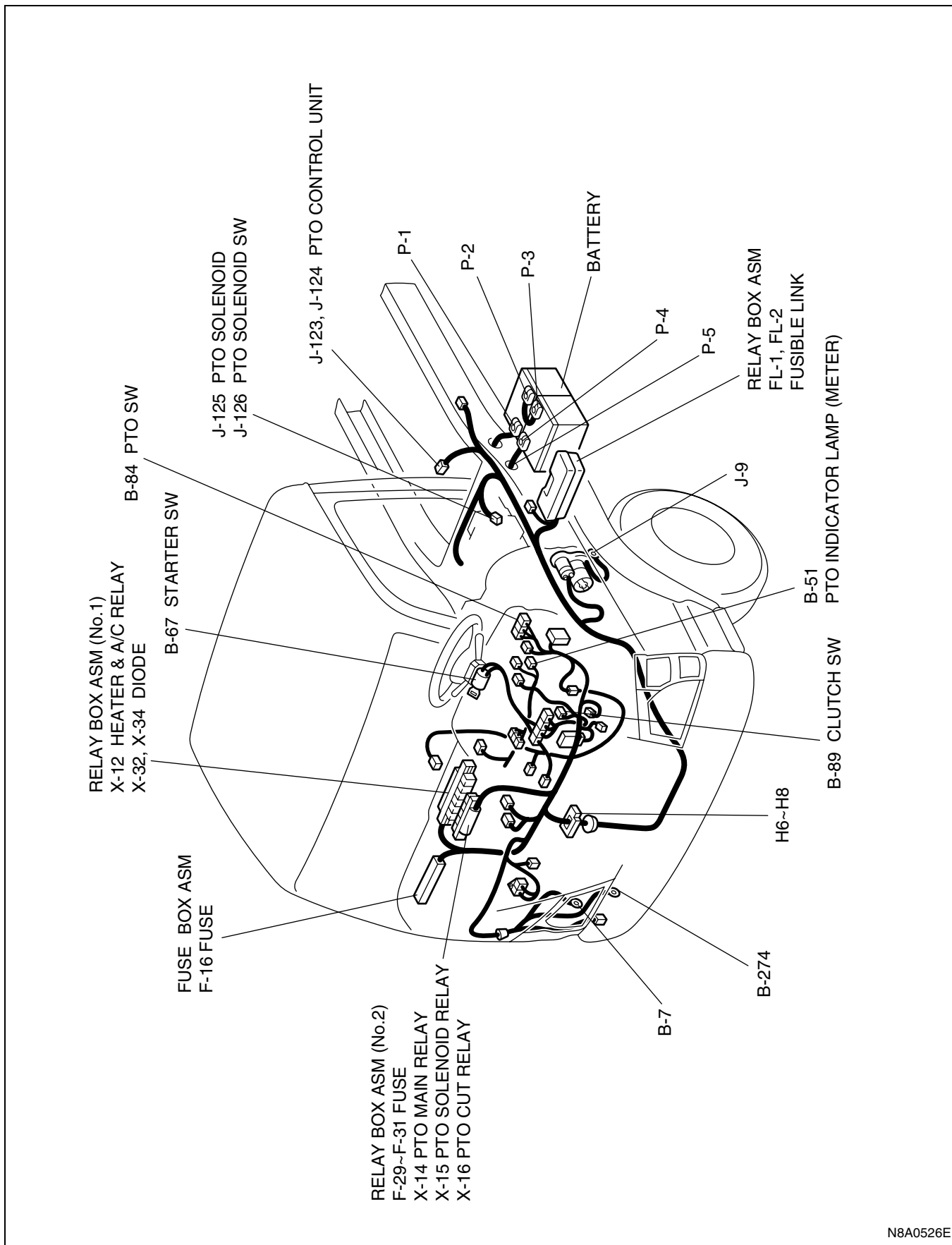
Electronic control type PTO is installed on the left side of transmission.

PTO's gears are engaged at any time. There is a sleeve installed on the output shift, and the sleeve is shifted by the solenoid through the shift rods(s) and shift arm(s). This causes turning the power on or off.

H-5

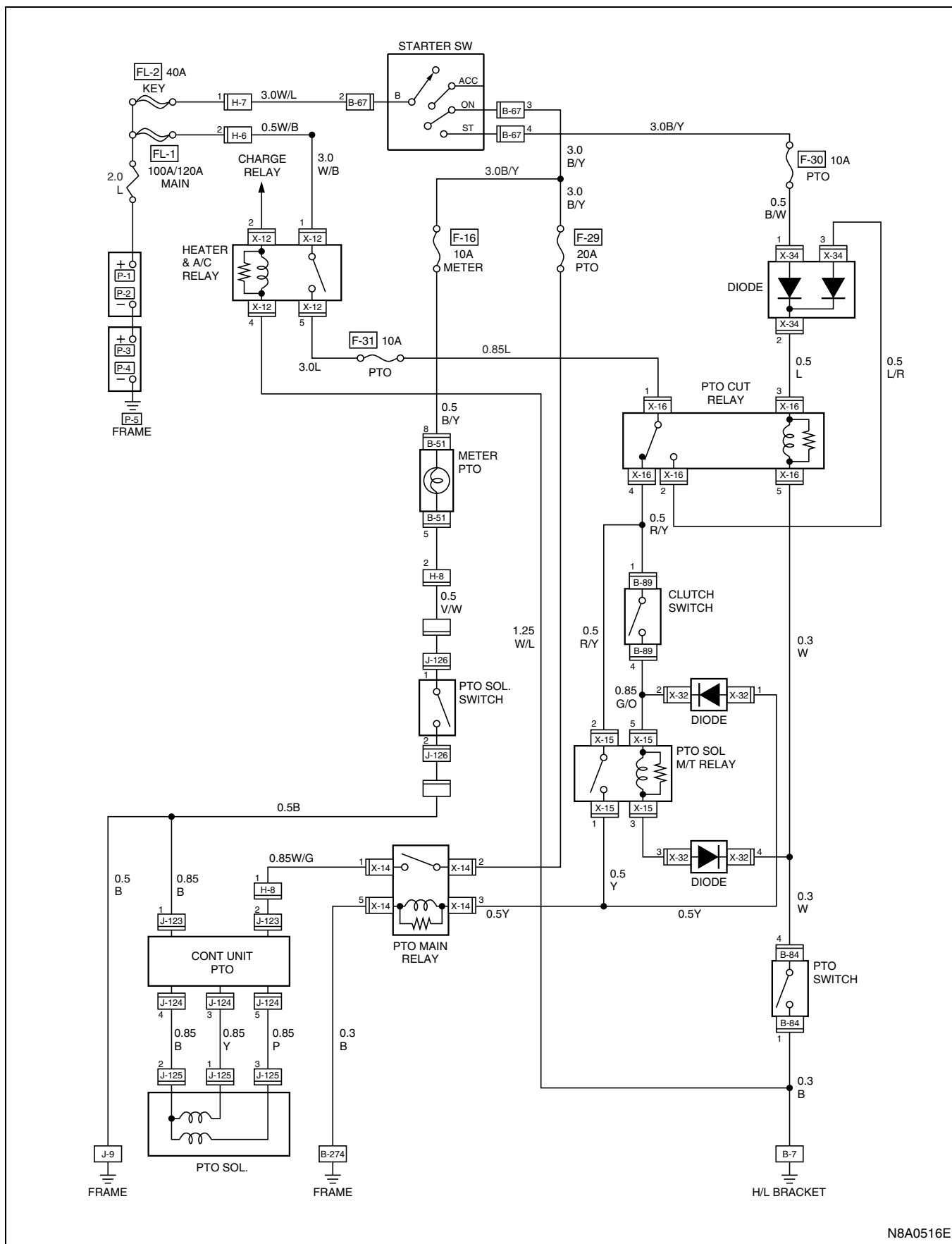


Parts Location



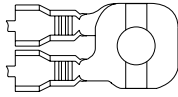



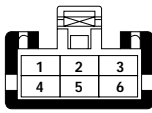
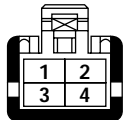
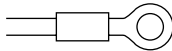
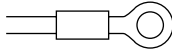
N8A0526E





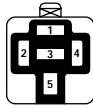
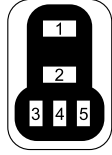
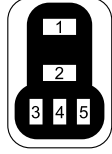
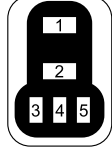
Circuit Diagram

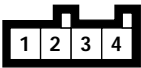
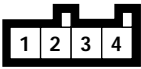


N8A0516E

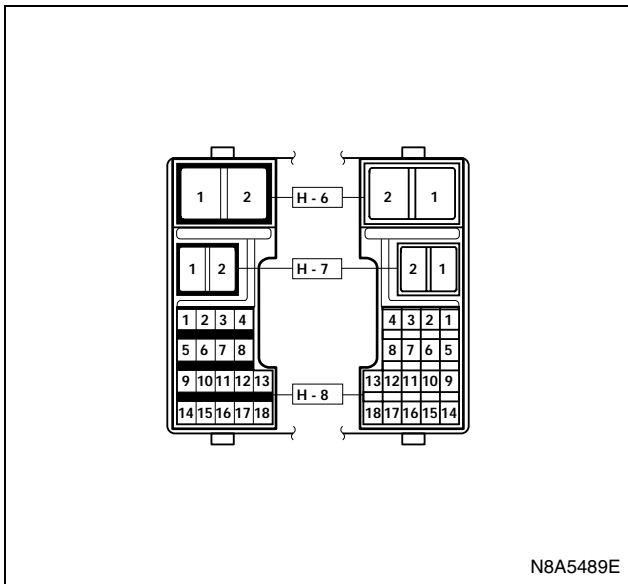
Connector List

No.	Connector Face
B-7	 000-018
B-51	 014-001
B-67	 004-002
B-67	 004-001
B-84	 006-001
B-89	 004-001
B-274	 000-001
J-9	 000-001

No.	Connector Face
J-123	 002-012
J-123	 002-011
J-126	 002-012
J-126	 002-011
X-12	 005-001
X-14	 005-006
X-15	 005-006
X-16	 005-006

No.	Connector Face
X-32	 <p style="text-align: right;">004-004</p>
X-34	 <p style="text-align: right;">004-004</p>

H-6, H-7, H-8



MEMO

A series of horizontal dotted lines for writing.

MEMO

A series of 30 horizontal dotted lines for writing.

