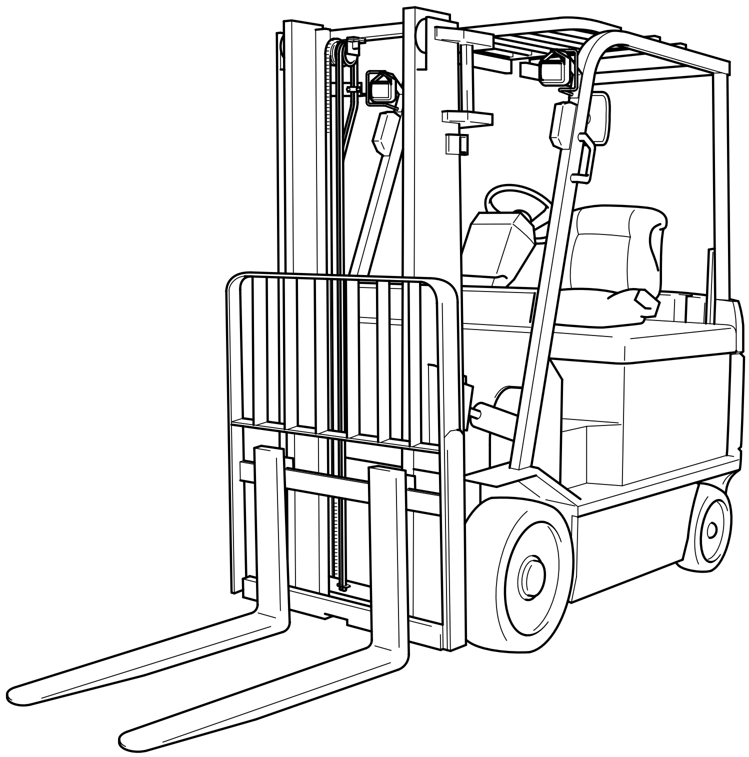
7FBCU 15-55 INDEX

<Tillbaka till Index

GENERAL

EXTERIOR VIEWS



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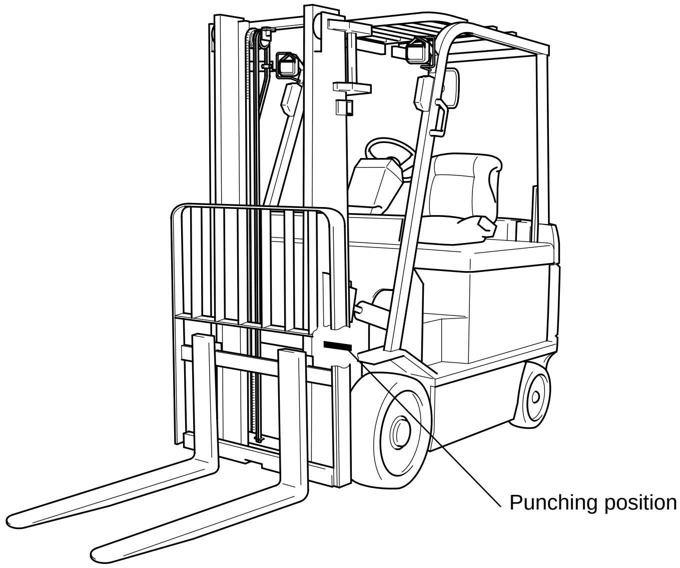
VEHICLE MODEL

Model Code	Load Capacity	Vehicle Model	Voltage	Remarks
15	3000 lbs	7FBCU15	36V/48V	
		30-7FBCU15	↑	Dust proof
18	3500 lbs	7FBCU18	↑	
		30-7FBCU18	↑	Dust proof
20	4000 lbs	7FBCU20	↑	
		30-7FBCU20	↑	Dust proof
25	5000 lbs	7FBCU25	↑	
		30-7FBCU25	↑	Dust proof
		7FBCHU25	↑	High capacity (battery compartment)
		30-7FBCHU25	↑	• Dust proof • High capacity (battery compartment)
30	6000 lbs	7FBCU30	↑	
		30-7FBCU30	↑	Dust proof
32	6500 lbs	7FBCU32	↑	
		30-7FBCU32	↑	Dust proof
35	8000 lbs	7FBCU35	↑	
		30-7FBCU35	↑	Dust proof
45	10000 lbs	7FBCU45	↑	
		30-7FBCU45	↑	Dust proof
55	12000 lbs	7FBCU55	↑	
		30-7FBCU55	↑	Dust proof

FRAME NUMBER

Frame No. Punching Position



Vehicle Model	Punching format
7FBCU15	7FBCU18-60011
7FBCU18	* 7FBCU18Ⓔ60011
30-7FBCU15	307FBCU18-60011
30-7FBCU18	* 307FBCU18Ⓔ60011
7FBCU20	7FBCU25-60011
7FBCU25	* 7FBCU25Ⓔ60011
30-7FBCU20	307FBCU25-60011
30-7FBCU25	* 307FBCU25Ⓔ60011
7FBCHU25	7FBCHU25-60011
30-7FBCHU25	307FBCHU25-60011
7FBCU30	7FBCU32-60011
7FBCU32	* 7FBCU32Ⓔ60011
30-7FBCU30	307FBCU32-60011
30-7FBCU32	* 307FBCU32Ⓔ60011

Vehicle Model	Punching format
7FBCU35	7FBCU45-60011
7FBCU45	
30-7FBCU35	307FBCU45-60011
30-7FBCU45	
7FBCU55	7FBCU55-60011
30-7FBCU55	307FBCU55-60011

*: EEC spec.

HOW TO USE THIS MANUAL

EXPLANATION METHOD

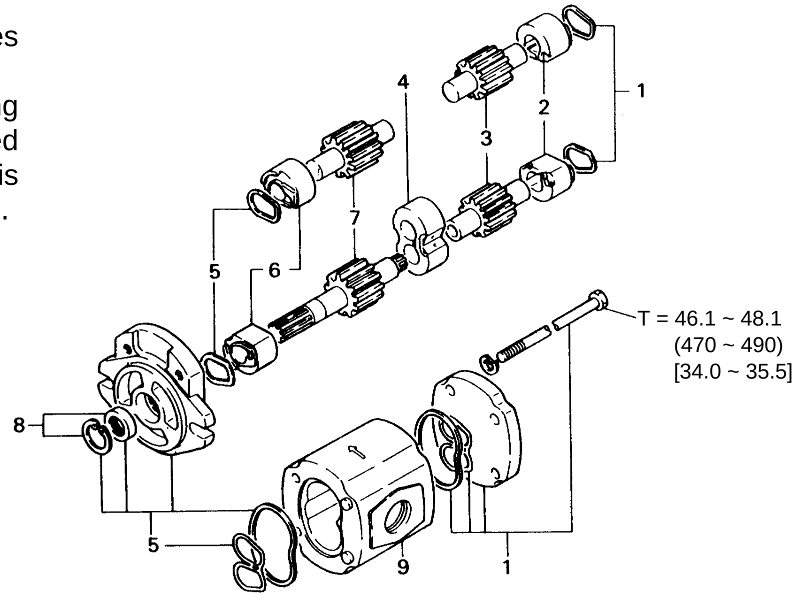
1. Operation procedure
   (1) The operation procedure is described in either pattern A or pattern B below.
   Pattern A: Explanation of each operation step with illustration.
   Pattern B: Explanation of operation procedure by indicating step numbers in one illustration, followed by explanation of cautions and notes summarized as point operations.

Example of description in pattern B

DISASSEMBLY·INSPECTION·REASSEMBLY

Tightening torque unit T = N·m (kgf-cm) [ft-lbf]

- Step Nos. are partially sometimes omitted in illustrations.
- When a part requiring tightening torque instruction is not indicated in the illustration, the part name is described in the illustration frame.



Disassembly Procedure

1 Remove the cover. **[Point 1]**
2 Remove the bushing **[Point 2]** 🡐 Operation explained later
3 Remove the gear.

Point Operations Explanation of key point for operation with an illustration

🡗

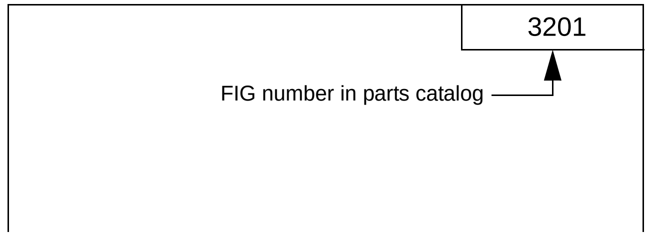
[Point 1]
Disassembly:
Put a match mark when removing the pump cover.

[Point 2]
Inspection:
Measure the bushing inside diameter.
Limit: 19.12 mm (0.7528 in)

2. How to read components figures

(1) The components figure uses the illustration in the parts catalog for the vehicle model. Please refer to the catalog for checking the part name.
The number at the right shoulder of each components figure indicates the Fig. number in the parts catalog.

(Example)



3. Matters omitted in this manual

(1) This manual omits description of the following jobs, but perform them in actual operation:
(a) Cleaning and washing of removed parts as required
(b) Visual inspection (partially described)

TERMINOLOGY

Caution:
Important matters of which negligence may cause hazards on human body. Be sure to observe them.

Note:
Important items of which negligence may cause breakage or breakdown, or matters in operation procedure requiring special attention.

Standard: Values showing allowable range in inspection and adjustment.

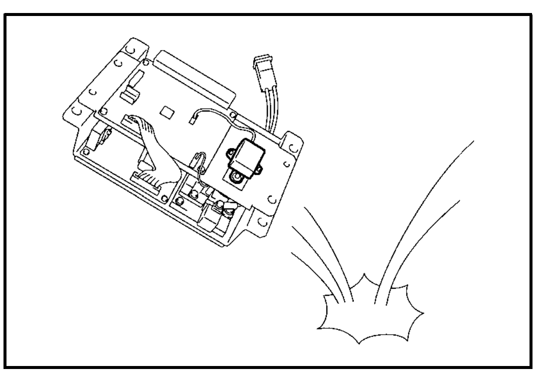
Limit: Maximum or minimum allowable value in inspection or adjustment.

ABBREVIATIONS

Abbreviation (code)	Meaning	Abbreviation (code)	Meaning
ASSY	Assembly	SAE	Society of Automotive Engineers (USA)
EHPS	Electronically controlled fully hydraulic power steering	SAS	System of active stability
FHPS	Fully hydraulic power steering	SST	Special service tool
LH	Left hand	STD	Standard
L/	Less	T =	Tightening torque
OPT	Option	○○T	Number of teeth (○○)
O/S	Oversize	U/S	Undersize
PS	Power steering	W/	With
RH	Right hand		

OPERATIONAL TIPS

1. Safe operation
   (1) After jacking up, always support with wooden blocks or rigid stands.
   (2) When hoisting the vehicle or its heavy component, use wire rope(s) with a sufficient reserve in load capacity.
   (3) Always disconnect the battery plug before the inspection or servicing of electrical parts.
2. Tactful operation
   (1) Prepare the mechanic tools, necessary measuring instruments (circuit tester, megger, oil pressure gauge, etc.) and SSTs before starting operation.
   (2) Before disconnecting wiring, always check the cable color and wiring state.
   (3) When overhauling functional parts, complicated portions or related mechanisms, arrange the parts neatly to prevent confusion.
   (4) When disassembling and inspecting such a precision part as the control valve, use clean tools and operate in a clean location.
   (5) Follow the described procedures for disassembly, inspection and reassembly.
   (6) Replace, gaskets, packing and O-rings with new ones each time they are disassembled.
   (7) Use genuine Toyota parts for replacement.
   (8) Use specified bolts and nuts. Observe the specified tightening torque at the time of reassembly. (Tighten to the center of the specified tightening torque range.)
   If no tightening torque is specified, tighten the bolt or nut according to the standard tightening torque table.
3. Protection of functional parts
   (1) Thoroughly check each connector for any failure in or imperfect connection before reconnecting the battery plug after the end of vehicle inspection or maintenance.
   Failure in or imperfect connection of connectors related to controllers, especially, may damage elements inside the controllers.
4. Confirming defect status
   Do not start immediate disassembly or replacement, but first confirm if such disassembly or replacement is actually needed.
5. Handling of waste fluid, etc.
   When draining waste fluid from the vehicle, always receive it with an appropriate container.
   Since careless or arbitrary discharge or disposal of oil, fuel, coolant, oil filter, battery or any other harmful substance may cause adverse affect to people or environmental destruction, sort each waste and always ask an authorized contractor for appropriate disposal.
6. Handling of electronic parts

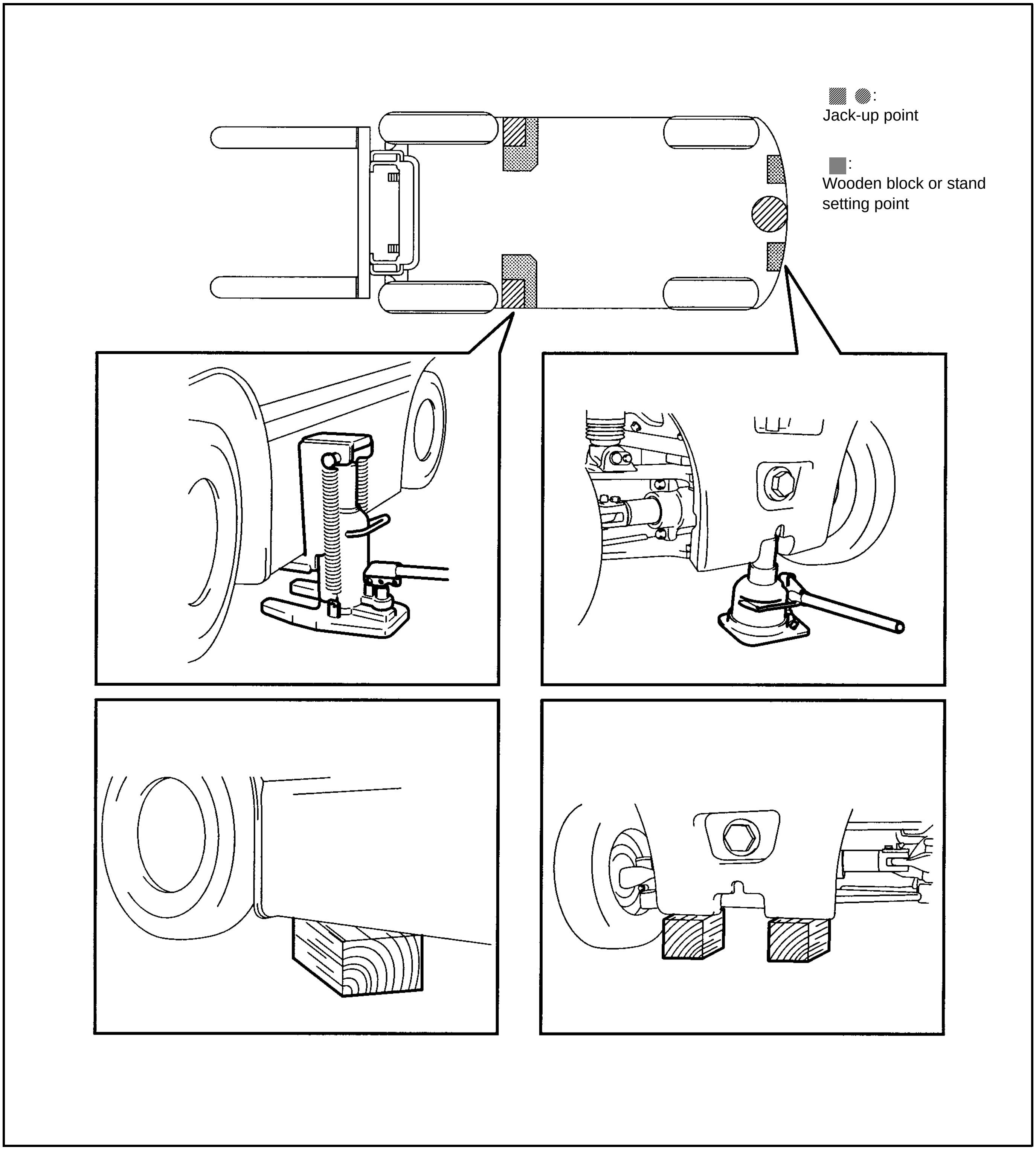


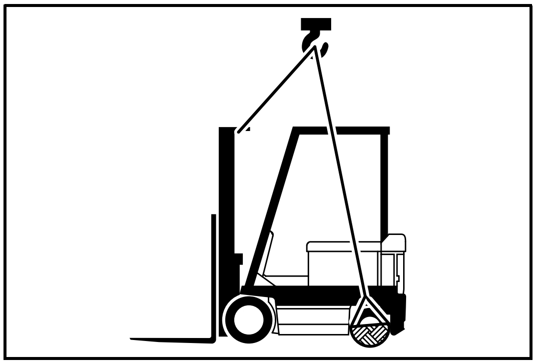
   (1) Never apply impacts to electronic parts such as a microcomputer or relay.
   (2) Never let electronic parts be exposed to a high temperature or humidity.
   (3) Do not touch connector pins since they may be deformed or be damaged due to static electricity.

JACK-UP POINT

Strictly observe the following instructions when jacking up the vehicle.

- When a load is on the fork, unload it and park the vehicle on a flat floor. Be sure to avoid an inclined or rugged place.
- Use a jack with ample capacity and jack up the vehicle at the specified jack-up point. Jacking up at any other point will be dangerous.
- Never operate while the vehicle is held with a jack. Always support the frame with a wooden block after jacking up.
- In any case, never let a part of the body (including hands and feet) be under the jacked-up vehicle.

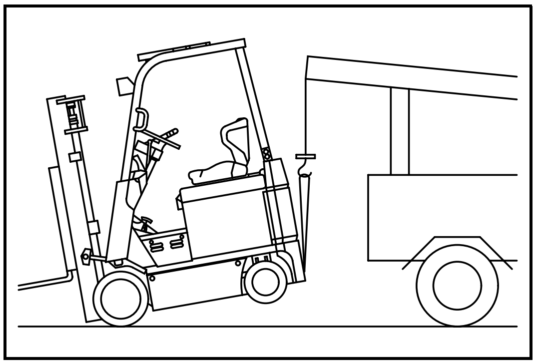




HOISTING THE VEHICLE

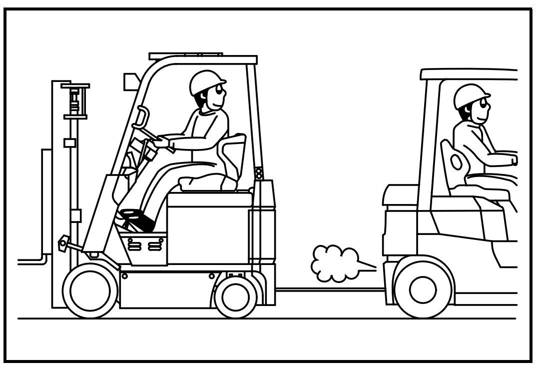
When hoisting the vehicle, use the mast hook on the front of the vehicle and a wire net on the rear wheel.

Caution:
- **Use wire ropes having sufficient strength.**
- **Never hoist the forklift by the weight hook holes or head guard.**

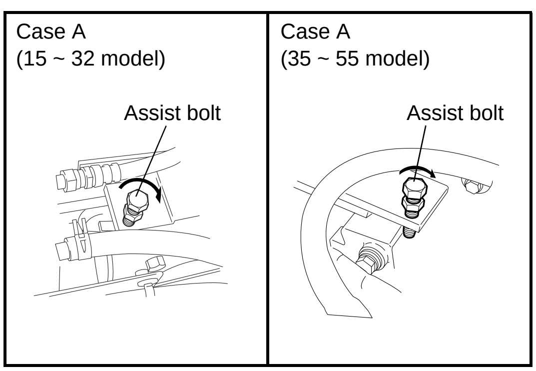


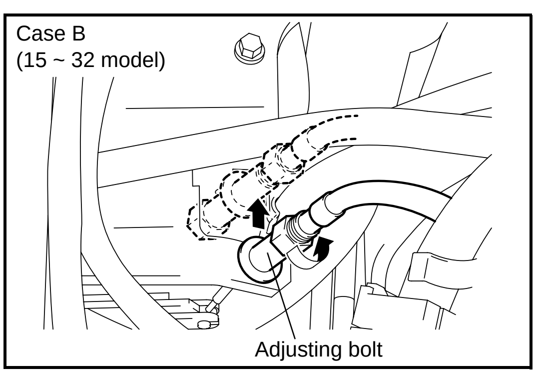
CAUTION FOR TOWING

1. When towing the forklift, always lift the rear wheels away from the ground.
2. The traveling speed in towing must not exceed the maximum traveling speed of the forklift.



3. Always set the key switch to OFF and the direction switch to the neutral position before starting towing.
   In case of towing by connection with a wire rope with the operator on the forklift, however, set the key switch to ON (PS operation) and always set the direction switch to the neutral position.
4. Before towing, either remove the fork or take an action to prevent fork contact with the ground due to bounding.





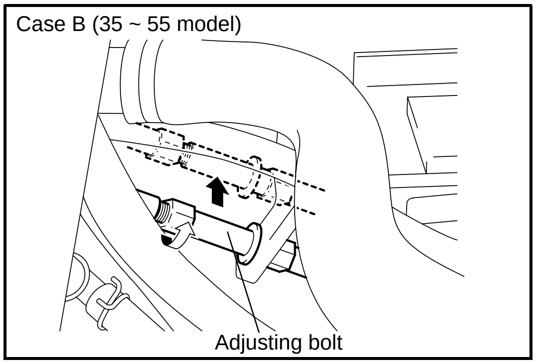
Cautions for Deadman Brake Spec. Model

The brake exclusive to the deadman brake must be released before towing.
The deadman brake can be released in the two following ways. Select according to the situation.

A. Releasing after battery removal
B. Releasing with the battery installed

Case A:
1. Remove the battery.
2. Loosen the lock nut for the assist bolt for forced releasing of the brake, and tighten the assist bolt fully to release the brake.
3. Be sure to adjust after towing. (See Page 10-57, 58.)

Case B:
1. Remove the toe board.
2. Loosen the deadman brake cable adjusting bolt and free the cable from the cable clamp.
   15 ~ 32 model:
   Remove the PS controller first for easier operation.



35 ~ 55 model:
Move the position of the pump motor No. 1 W/motor bracket first for easier operation.

3. Be sure to adjust after towing. (See Page 10-57, 58.)

ATTENTIVE POINTS ON SAS

1. Reference should be made to seperate manual “New Model Feature 7FBCU15 to 55 Pub. No.PU312” for the explanations of SAS functions and operations.
2. Read Section 17 “SAS Precautions for Repair” on Page 17-12 in this repair manual in advance.
3. Whenever the repair or replacement is performed to the place where relative to SAS function, maching procedure by which the SAS regain proper function must be performed. (See VOL.2 Page 3-54)
4. The warning on the SAS caution label must be confirmed when the modification or change is such as to change the original specification.
   If improper, change the label. (See Page 17-27)
5. Care should always be exercised for safety operation whenever you operate the truck.
   Make distinction between the SAS featured trucks and those of none, because the control features are different.
6. The SAS oil control valves comprise many precision valves. Since dirty or contaminated hydraulic oil will adversely affect the functions of these valves, always wash the parts clean at the time of installation after disassembly or for replacement of hydraulic parts (valves, piping, etc.). Periodic replacement of the hydraulic oil is very important.
7. Since this vehicle uses high-precision electronic devices, modification of electrical parts may cause faults. Always use genuine Toyota parts when replacing or installing electrical parts (auxiliary equipment, optional parts, etc.).

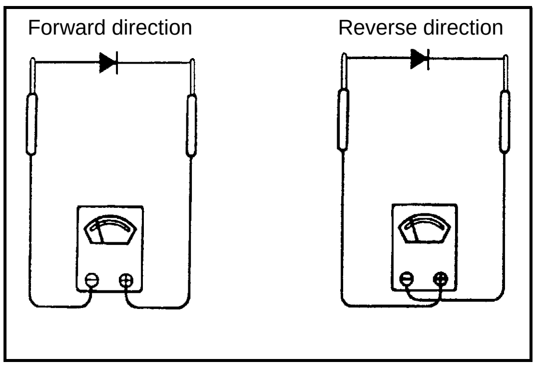
CIRCUIT TESTER

Circuit testers are available in both the analog and digital types. They should be used selectively according to the purpose of measurement.

Analog type: This type is convenient for observing movement during operation, but the measured value should only be used for reference or rough judgement.
Digital type: Fairly accurate reading is possible, but it is difficult to observe the variation or movement.

1. Difference in measurement results with the digital type and analog type
   * The result may be different between measurements with the analog type and digital type.
     Always use a circuit tester according to its operation manual.
     Cautions when the polarities are different between the analog type and digital type are described below.

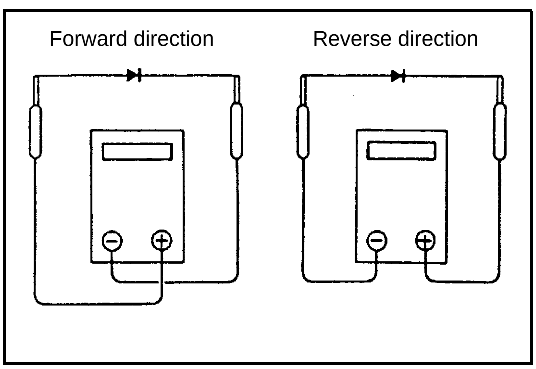
   (1) Analog circuit tester



Measurement result example
Tester range: kΩ range

	Analog type
Forward	Continuity exists
	11 kΩ
Reverse	No continuity
	∞

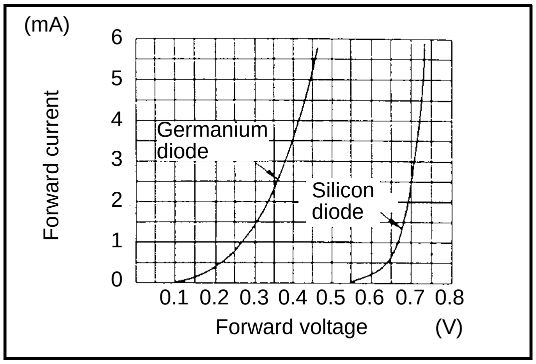
   (2) Digital circuit tester



Measurement result example
Tester range: MΩ range

	Digital type
Forward	No continuity
	1
Reverse	Continuity exists
	2 MΩ

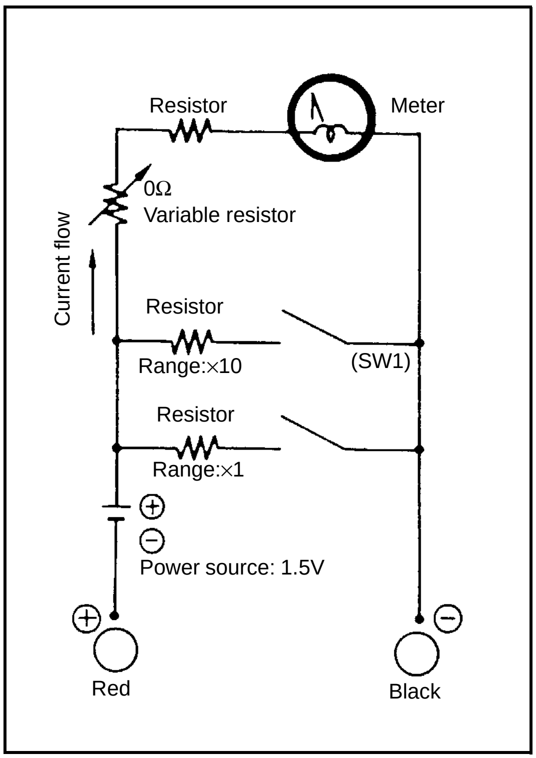
2. Difference in result of measurement with circuit tester
   The circuit tester power supply voltage depends on the tester type. 1.5 V, 3.0 V or 6.0 V is used.
   The resistance of a semiconductor such as a diode varies with the circuit tester power supply voltage.
   The diode characteristics are shown in the figure below.



The resistance values of the same semiconductor measured with two types of circuit testers having different power supply voltages are different.

This manual describes the results of measurement with a circuit tester whose power supply voltage is 3.0 V.

3. Difference in measurement result by measurement range (analog type)
   In the analog type circuit tester, changing the measurement range switches over the internal circuit to vary the circuit resistance. Even when the same diode is measured, the measurement result varies with the measurement range.



Always use the range described in the repair manual for measurement.

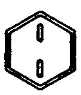
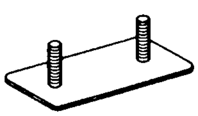
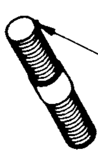
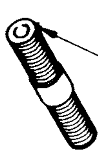
STANDARD BOLT & NUT TIGHTENING TORQUE

Standard bolt and tightening torques are not indicated.
Judge the standard tightening torque as shown below.

1. Find out the type of the bolt from the list below and then find the bolt tightening torque from the table.
2. The nut tightening torque can be judged from the mating bolt type.

BOLT STRENGTH TYPE IDENTIFICATION METHOD

1. Identification by bolt shape

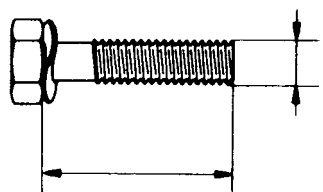
	Shape and class		Class
Hexagon head bolt		Bolt head No.	4 = 4T 5 = 5T 6 = 6T 7 = 7T 8 = 8T
		No mark	4T
Hexagon flange bolt		No mark	4T
Hexagon head bolt		Two protruding lines	5T
Hexagon flange bolt		Two protruding lines	6T
Hexagon head bolt		Three protruding lines	7T
Hexagon head bolt		Four protruding lines	8T
Welded bolt			4T
Stud bolt		No mark	4T
		Grooved	6T

2. Identification by part No.

Hexagon head bolt

Parts No.
9 1 6 1 1 - 4 0 6 2 5

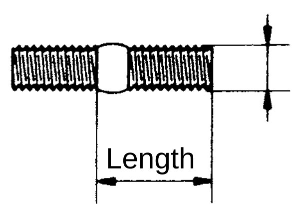
Length (mm)
Diameter (mm)
Class



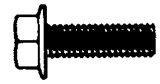
Stud bolt

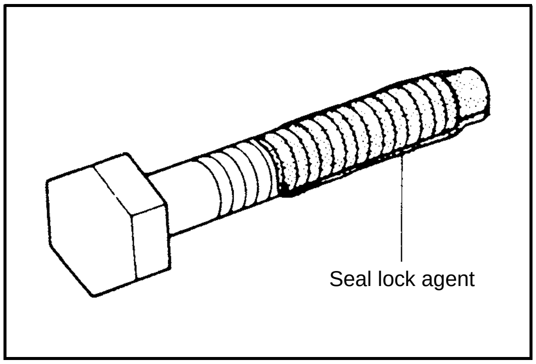
Parts No.
9 2 1 3 2 - 4 0 6 1 4

Length (mm)
Diameter (mm)
Class



TIGHTENING TORQUE TABLE

Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt 			Hexagon flange bolt 		
			N·m	kgf-cm	ft-lbf	N·m	kgf-cm	ft-lbf
4T	6	1.0	5.4	55	48 in-lbf	5.9	60	52 in-lbf
	8	1.25	13	130	9	14	145	10
	10	1.25	25	260	19	28	290	21
	12	1.25	47	480	35	53	540	39
	14	1.5	75	760	55	83	850	61
	16	1.5	113	1150	83	—	—	—
5T	6	1.0	6.4	65	56 in-lbf	7.5	75	65 in-lbf
	8	1.25	16	160	12	18	175	13
	10	1.25	32	330	24	36	360	26
	12	1.25	59	600	43	65	670	48
	14	1.5	91	930	67	100	1050	76
	16	1.5	137	1400	101	157	1600	116
6T	6	1.0	7.8	80	69 in-lbf	8.8	90	78 in-lbf
	8	1.25	19	195	14	21	215	16
	10	1.25	38	400	29	43	440	32
	12	1.25	72	730	53	79	810	59
	14	1.5	110	1100	80	123	1250	90
	16	1.5	170	1750	127	191	1950	141
7T	6	1.0	11	110	8	12	120	9
	8	1.25	25	260	19	28	290	21
	10	1.25	52	530	38	58	590	43
	12	1.25	95	970	70	103	1050	76
	14	1.5	147	1500	108	167	1700	123
	16	1.5	226	2300	166	—	—	—
8T	6	1.0	12	125	9	14	145	9
	8	1.25	29	300	22	32	330	24
	10	1.25	61	620	45	68	690	50
	12	1.25	108	1100	80	123	1250	90
	14	1.5	172	1750	127	196	2000	145
	16	1.5	265	2700	195	299	3050	221



PRECOAT BOLTS

(Bolts with seal lock agent coating on threads)

1. Do not use the precoat bolt as it is in either of the following cases:
   (a) After it is removed.
   (b) When the precoat bolt is moved (loosened or tightened) by tightness check, etc.

   Note:
   For torque check, use the lower limit of the allowable tightening torque range. If the bolt moves, retighten it according to the steps below.

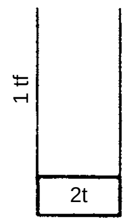
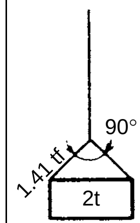
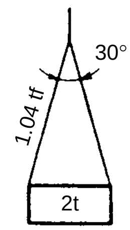
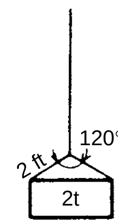
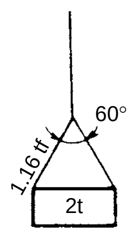
2. Method for reuse of precoat bolts
   (1) Wash the bolt and threaded hole. (The threaded hole must be washed even for replacement of the bolt.)
   (2) Perfectly dry the washed parts by air blowing.
   (3) Coat the specified seal lock agent to the threaded portion of the bolt.

HIGH PRESSURE HOSE FITTING TIGHTENING TORQUE

1. When connecting a high pressure hose, wipe the hose fitting and mating nipple contact surfaces with clean cloth to remove foreign matters and dirt. Also check no dent or other damage on the contact surfaces before installation.
2. When connecting a high pressure hose, hold the hose to align the fitting with the nipple and tighten the fitting.
3. The maximum tightening torque must not exceed twice the standard tightening torque.

Nominal diameter of screw	Standard tightening torque N·m (kgf-cm) [ft-lbf]		Hose inside diameter mm (in)
	Standard	Tightening range	
7/16 — 20UNF	25 (250) [18.1]	24 ~ 26 (240 ~ 270) [17.4 ~ 19.5]	6 (0.24)
9/16 — 18UNF	49 (500) [36.2]	47 ~ 52 (480 ~ 530) [34.7 ~ 38.3]	9 (0.35)
3/4 — 16UNF	59 (600) [43.4]	56 ~ 62 (570 ~ 630) [41.2 ~ 45.6]	12 (0.47)
7/8 — 14UNF	59 (600) [43.4]	56 ~ 62 (570 ~ 630) [41.2 ~ 45.6]	12 (0.47), 15 (0.59)
1·1/16 — 12UNF	118 (1200) [86.8]	112 ~ 123 (1140 ~ 1250) [82.5 ~ 90.4]	19 (0.75)
1·5/16 — 12UNF	137 (1400) [101.3]	130 ~ 144 (1330 ~ 1470) [96.2 ~ 106.4]	25 (0.98)
PF1/4	25 (250) [18.1]	24 ~ 26 (240 ~ 270) [17.4 ~ 19.5]	6 (0.24)
PF3/8	49 (500) [36.2]	47 ~ 52 (480 ~ 530) [34.7 ~ 38.3]	9 (0.35)
PF1/2	59 (600) [43.4]	56 ~ 62 (570 ~ 630) [41.2 ~ 45.6]	12 (0.47)
PF3/4	118 (1200) [86.8]	112 ~ 123 (1140 ~ 1250) [82.5 ~ 90.4]	19 (0.75)
PF1	137 (1400) [101.3]	130 ~ 144 (1330 ~ 1470) [96.2 ~ 106.4]	25 (0.98)

WIRE ROPE SUSPENSION ANGLE LIST

Lifting angle	Tension	Compression	Suspension method	Lifting angle	Tension	Compression	Suspension method
0°	1.00 time	0 time		90°	1.41 time	1.00 time	
30°	1.04 time	0.27 time		120°	2.00 time	1.73 time	
60°	1.16 time	0.58 time					

SAFE LOAD FOR EACH WIRE ROPE SUSPENSION ANGLE

Unit: N (tf) [lbf]

Rope diameter	Cutting load	Single-rope suspension	Two-rope suspension				Four-rope suspension			
		0°	0°	30°	60°	90°	0°	30°	60°	90°
6 mm (0.24 in)	21380 (2.18) [4807]	3040 (0.31) [683.6]	6080 (0.62) [1367]	5880 (0.6) [1323]	5200 (0.53) [1169]	4310 (0.44) [970]	12160 (1.24) [2734]	11770 (1.2) [2646]	10400 (1.06) [2337]	8630 (0.88) [1940]
8 mm (0.32 in)	31480 (3.21) [7078]	4410 (0.45) [992.3]	8830 (0.9) [1985]	8530 (0.87) [1918]	7650 (0.78) [1720]	6280 (0.64) [1411]	17650 (1.8) [3969]	17060 (1.74) [3937]	15300 (1.56) [3440]	12550 (1.28) [2322]
10 mm (0.4 in)	49230 (5.02) [11.69]	6960 (0.71) [1565.6]	14020 (1.43) [3153]	13440 (1.37) [3021]	11770 (1.2) [2646]	9810 (1.0) [2205]	27460 (2.8) [6174]	26480 (2.7) [5954]	23540 (2.4) [5292]	19610 (2.0) [4410]
12.5 mm (0.5 in)	76880 (7.84) [17387]	10980 (1.12) [2469.5]	21570 (2.2) [4851]	21280 (2.1) [4631]	18630 (1.9) [4190]	14710 (1.5) [3308]	43150 (4.4) [9702]	41190 (4.2) [9261]	37270 (3.8) [8379]	29420 (3.0) [6615]
14 mm (0.56 in)	96400 (9.83) [21675]	13730 (1.4) [3087]	27460 (2.8) [6174]	26480 (2.7) [5954]	23540 (2.4) [5292]	18630 (1.9) [4190]	54920 (5.6) [12348]	52960 (5.4) [11907]	47070 (4.8) [10584]	37270 (3.8) [8379]

COMPONENTS WEIGHT

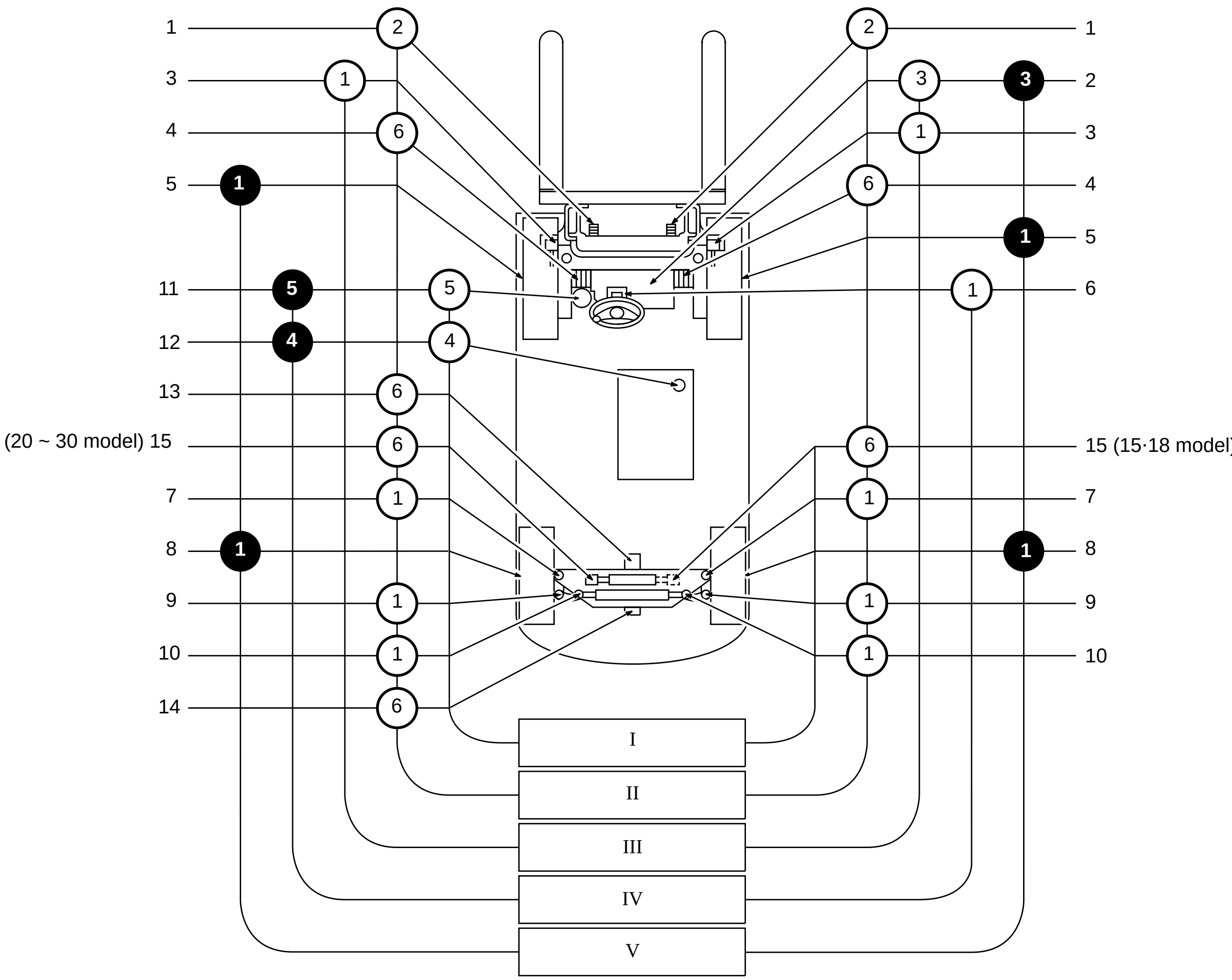
Member	Model	Weight kg (lbs)
Battery ASSY	See page 1-2.	
Drive motor ASSY	15·18	Approx. 90 (198)
	20 ~ 32	Approx. 120 (265)
	35 ~ 55	Approx. 190 (419)
Pump motor ASSY	15·18	Approx. 40 (88)
	20 ~ 32	Approx. 65 (143)
	35 ~ 55	Approx. 65 (143)
Counterweight	15	Approx. 565 (1246)
	18	Approx. 695 (1532)
	20	Approx. 670 (1477)
	25	Approx. 1065 (2348)
	30	Approx. 1195 (2635)
	32	Approx. 1370 (3021)
	35	Approx. 1420 (3131)
	45	Approx. 2240 (4939)
	55	Approx. 2370 (5226)
V mast ASSY L/fork and backrest (with lift cylinder, max. lifting height: 3300 (130 in))	15·18	Approx. 440 (970)
	20·25	Approx. 510 (1120)
	30·32	Approx. 630 (1390)
V mast ASSY L/fork and backrest (with lift cylinder, max. lifting height: 3000 (118 in))	35	Approx. 890 (1960)
	45	Approx. 950 (2090)
	55	Approx. 1270 (2800)

RECOMMENDED LUBRICANT QUANTITY & TYPES

Description	Application	Quantity l (US gal)	Classification	Type
Drive unit	15·18 model	3.8 (1.00)	API GL-4	Hypoid gear oil SAE75W-80W
	15·18 (dead-man spec.) model 20 ~ 32 model	5.5 (1.45)		
	35 ~ 55 model	2.0 (0.53)		
Differential	35 ~ 55 model	4.5 (1.18)		
Planetary gear	35 ~ 55 model	Proper quantity		
Hydraulic oil (V·FV·FSV mast: lifting height 3300 mm (130 in))	15·18 model	17.0 (4.49)	ISO VG32	Hydraulic oil
	20 ~ 32 model	22.0 (5.81)		
Hydraulic oil (V·FV·FSV mast: lifting height 3000 mm (118 in))	35 ~ 55 model	34.5 (9.11)		
Brake line	15 ~ 32 model	Proper quantity	—	SAE J-1703 DOT-3
Chassis parts	All model	Proper quantity	—	• MP grease • Molybdenum disulfide grease
Battery	All model	Proper quantity	—	Distilled water

LUBRICATION CHART

15 ~ 32 Model



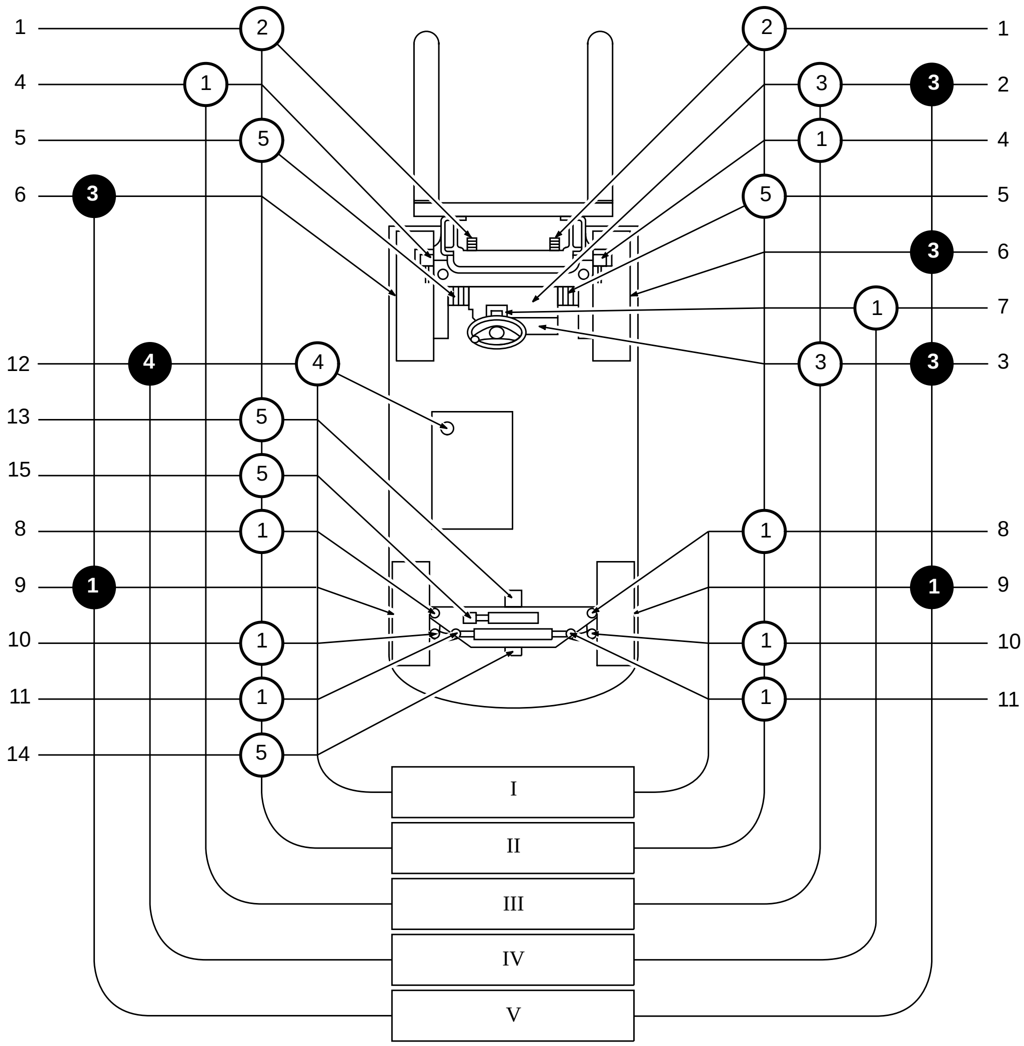
○ Inspection
● Replacement
① MP Grease
② Engine Oil
③ Hypoid gear Oil
④ Hydraulic Oil
⑤ Brake Fluid
⑥ Molybdenum disulfide greass

I. Inspect every 8 hours (daily)
II. Inspect every 40 hours (weekly)
III. Inspect every 170 hours (monthly)
IV. Inspect every 1000 hours (6 monthly)
V. Inspect every 2000 hours (annual)

1 Chain
2 Drive unit
3 Tilt cylinder front pin
4 Mast support bush
5 Front wheel bearing
6 Tilt steering lock mechanism
7 Steering knuckle king pin
8 Rear wheel bearing

9 Tie rod end pin
10 Rear axle cylinder end pin
11 Brake master cylinder
12 Oil tank
13 Rear axle beam front pin
14 Rear axle beam rear pin
15 Swing lock cylinder crank and rod pin

35 ~ 55 Model



- ○ Inspection
- ● Replacement
- ① MP Grease
- ② Engine Oil
- ③ Hypoid gear Oil
- ④ Hydraulic Oil
- ⑤ Molybdenum disulfide greass

I. Inspect every 8 hours (daily)
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V. Inspect every 2000 hours (annual)

1 Chain
2 Differential
3 Drive unit
4 Tilt cylinder front pin
5 Mast support bush
6 Planetary gear
7 Tilt steering lock mechanism
8 Steering knuckle king pin
9 Rear wheel bearing
10 Tie rod end pin
11 Rear axle cylinder end pin
12 Oil tank
13 Rear axle beam front pin
14 Rear axle beam rear pin
15 Swing lock cylinder crank and rod pin

PERIODIC MAINTENANCE

Inspection Method

I : Inspection·Repair or replacement if required.
M : Measurement·Repair or adjustment if required.
T : Retightening C: Cleaning L: Lubrication
* : For new vehicle *1: Flaw detector

Item	Inspection Period	Every month / Every 170 hours	Every 3 months / Every 500 hours	Every 6 months / Every 1000 hours	Every 12 months / Every 2000 hours
ELECTRICAL SYSTEM					
Motor	Rotation sound	I	←	←	←
	Looseness in the connecting parts	T	←	←	←
	Insulation resistance		M	←	←
	Brush wear and sliding condition (For pump motor and PS motor only)			I	←
	Commutator contamination, damage (For pump motor and PS motor only)			I	←
	Brush, spring wear (For pump motor and PS motor only)				M
Battery	Charging level	I	←	←	←
	Electrolyte level	I	←	←	←
	Electrolyte specific gravity	M	←	←	←
	Terminal looseness	I	←	←	←
	Abnormality in the upper portion of the battery case	I	←	←	←
	Insulation resistance		M	←	←
	Voltage measurement of each battery cell after charging				M
Magnet contactor	Contact looseness, damage, abrasion	I	←	←	←
	Operating condition of the auxiliary contact, contamination, abrasion	I	←	←	←
	Mounting condition of the arc shooter				I
	Operating condition and timings				I
	Looseness of the coil mounting parts				I
	Mounting condition of the main circuit lead wire, looseness				I
Microswitch	Operating condition and timing	I	←	←	←
	Damage and looseness of installing parts	I	←	←	←
Direction switch	Operation condition, damage	I	←	←	←
Controller	Operation condition	I	←	←	←
	Interior contamination, damage	C	←	←	←
	Motor input voltage				M
Fuse	Looseness	I	←	←	←

Item		Every month / Every 170 hours	Every 3 months / Every 500 hours	Every 6 months / Every 1000 hours	Every 12 months / Every 2000 hours
Wiring (including charging cord)	Harness deterioration, champ damage and looseness	I	←	←	←
	Looseness in connecting parts, taping condition	I	←	←	←
	Connecting condition and damage of the battery connector	I	←	←	←
POWER TRANSFER SYSTEM					
Drive unit	Oil leakage	I	←	←	←
	Oil level	I	←	←	←
	Bolt or nut looseness				T
Differential (35 ~ 55 model)	Leak	I	←	←	←
	Oil level	I	←	←	←
	Bolt loosening				T
Planetary gear (35 ~ 55 model)	Leak	I	←	←	←
	Oil level	I	←	←	←
	Bolt loosening				T
DRIVE SYSTEM					
Wheels	Tire cuts, damage and uneven wearing	I	←	←	←
	Loose rim and hub nuts	T	←	←	←
	Tire groove depth	M	←	←	←
	Metal chips, pebbles and other foreign matter trapped in tire grooves	I	←	←	←
	Rim, side bearing and disc wheel damage	I	←	←	←
	Abnormal sound and looseness of front wheel bearing	I	←	←	←
	Abnormal sound and looseness of rear wheel bearing	I	←	←	←
Front axle	Cracks, damage and deformation of housing				I
Rear axle	Cracks, damage and deformation of beam				I
	Looseness of axle beam in vehicle longitudinal direction	M*			M
STEERING SYSTEM					
Steering wheel	Play and looseness	I	←	←	←
	Function	I	←	←	←
Steering valve	Oil leak	I	←	←	←
	Looseness of mounting	T	←	←	←
Power steering	Oil leake	I	←	←	←
	Mounting and linkage looseness	I	←	←	←
	Damage of power steering hose				I
Knuckle	King pin looseness	I	←	←	←
	Cracks and deformation				I

Item \ Inspection Period		Every month / Every 170 hours	Every 3 months / Every 500 hours	Every 6 months / Every 1000 hours	Every 12 months / Every 2000 hours
BRAKING SYSTEM					
Brake pedal	Play and reserve	M	←	←	←
	Braking effect	I	←	←	←
Parking brake	Operating force	I	←	←	←
	Braking effect	I	←	←	←
	Rod and cable looseness and damage	I	←	←	←
Brake pipe	Leak, damage and mounting condition	I	←	←	←
Reservoir tank	Leak and fluid level	I	←	←	←
Master cylinder and wheel cylinder	Function, wear, damage, leak and mounting looseness				I
Brake drum and brake shoe	Clearance between drum and lining	M	←	←	←
	Wear of shoe sliding portion and lining				I
	Drum wear and damage				I
	Shoe operating condition				I
	Anchor pin rusting				I
	Return spring fatigue				M
	Automatic adjuster function				I
Backing plate	Deformation, cracks and damage				I
	Loose mounting				T
MATERIAL HANDLING SYSTEM					
Forks	Abnormality of fork and stopper pin	I	←	←	←
	Misalignment between left and right fork fingers	I	←	←	←
	Cracks at fork root and welded part				I*1
Mast and lift bracket	Deformation and damage of each part and crack at welded part	I	←	←	←
	Mast and lift bracket looseness	I	←	←	←
	Wear and damage of mast support bushing				I
	Wear, damage and rotating condition of rollers	I	←	←	←
	Wear and damage of roller pins				I
	Wear and damage of mast trip	I	←	←	←
Chain and chain wheel	Tension, deformation and damage of chain	I	←	←	←
	Chain lubrication	I	←	←	←
	Abnormality of chain anchor bolt	I	←	←	←
	Wear, damage and rotating condition of chain wheel	I	←	←	←
Various attachments	Abnormality and mounting condition of each part	I	←	←	←

Item \ Inspection Period		Every month	Every 3 months	Every 6 months	Every 12 months
		Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
HYDRAULIC SYSTEM					
Cylinder	Loosening and damage of cylinder mounting	T	←	←	←
	Deformation and damage of rod, rod screw and rod end	I	←	←	←
	Cylinder operation	I	←	←	←
	Natural drop and natural forward tilt (hydraulic drift)	M	←	←	←
Cylinder	Oil leak and damage	I	←	←	←
	Wear and damage of pin and cylinder bearing	I	←	←	←
	Lifting speed	M	←	←	←
	Uneven movement	I	←	←	←
Oil pump	Oil leak and abnormal sound	I	←	←	←
Hydraulic oil tank	Oil level and contamination	I	←	←	←
	Tank and oil strainer			C	←
	Oil leak	I	←	←	←
Control lever	Loose linkage	I	←	←	←
	Operation	I	←	←	←
Oil control valve	Oil leak	I	←	←	←
	Relief pressure measurement				M
	Relief valve and tilt lock valve functions	I	←	←	←
Hydraulic piping	Oil leak	I	←	←	←
	Deformation and damage	I	←	←	←
	Loose joint	T	←	←	←
SAFETY DEVICES, ETC.					
Head guard	Cracks at welded portion	I	←	←	←
	Deformation and damage	I	←	←	←
Back-rest	Loosening of mounting	T	←	←	←
	Deformation, crack and damage	I	←	←	←
Lighting system	Function and mounting condition	I	←	←	←
Horn	Function and mounting condition	I	←	←	←
Direction indicator	Function and mounting condition	I	←	←	←
Instruments	Functions	I	←	←	←
Backup buzzer	Function and mounting condition	I	←	←	←
Rear-view mirror	Dirt, damage	I	←	←	←
	Rear reflection status	I	←	←	←
Seat	Loosening and damage of mounting	I	←	←	←
	Seatbelt damage and function	I	←	←	←

Item		Inspection Period: Every month	Every 3 months	Every 6 months	Every 12 months
		Every 170 hours	Every 500 hours	Every 1000 hours	Every 2000 hours
Body	Damage and cracks of frame, cross members, etc.				I
	Bolts and nuts looseness				T
SAS	Functions	I	←	←	←
	Loosening and damage at sensor mounting portion	I	←	←	←
	Damage, deformation, oil leakage and loosening of the mounting of functional parts	I	←	←	←
	Loosening and damage of wire harnesses	I	←	←	←
	Lock cylinder accumulator performance				I
	Rusting and corrosion of load sensor				I
Others	Grease up	L	←	←	←

PERIODIC REPLACEMENT OF PARTS AND LUBRICANTS

● : Replacement

Item \ Replacement timing	Every month / Every 170 hours	Every 3 months / Every 500 hours	Every 6 months / Every 1000 hours	Every 12 months / Every 2000 hours
Drive unit oil				●
Differential oil (35 ~ 55 model)				●
Planetary gear oil (35 ~ 55 model)				●
Hydraulic oil			●	←
Hydraulic oil filter	● New vehicle initial replacement		●	←
Wheel bearing grease				●
Brake fluid (15 ~ 32 model)			●	←
Brake master cylinder rubber parts				●
Wheel cylinder cup seals				●
Brake fluid reservoir hose (15 ~ 32 model)				● Every 2 years
Power steering hose				● Every 2 years
Power steering rubber parts				● Every 2 years
Hydraulic hose				● Every 2 years
Chain				● Every 3 years
Swing lock cylinder				● Every 10,000 hours

Replacement shall be made upon arrival of the operation hours or months, whichever is earlier.

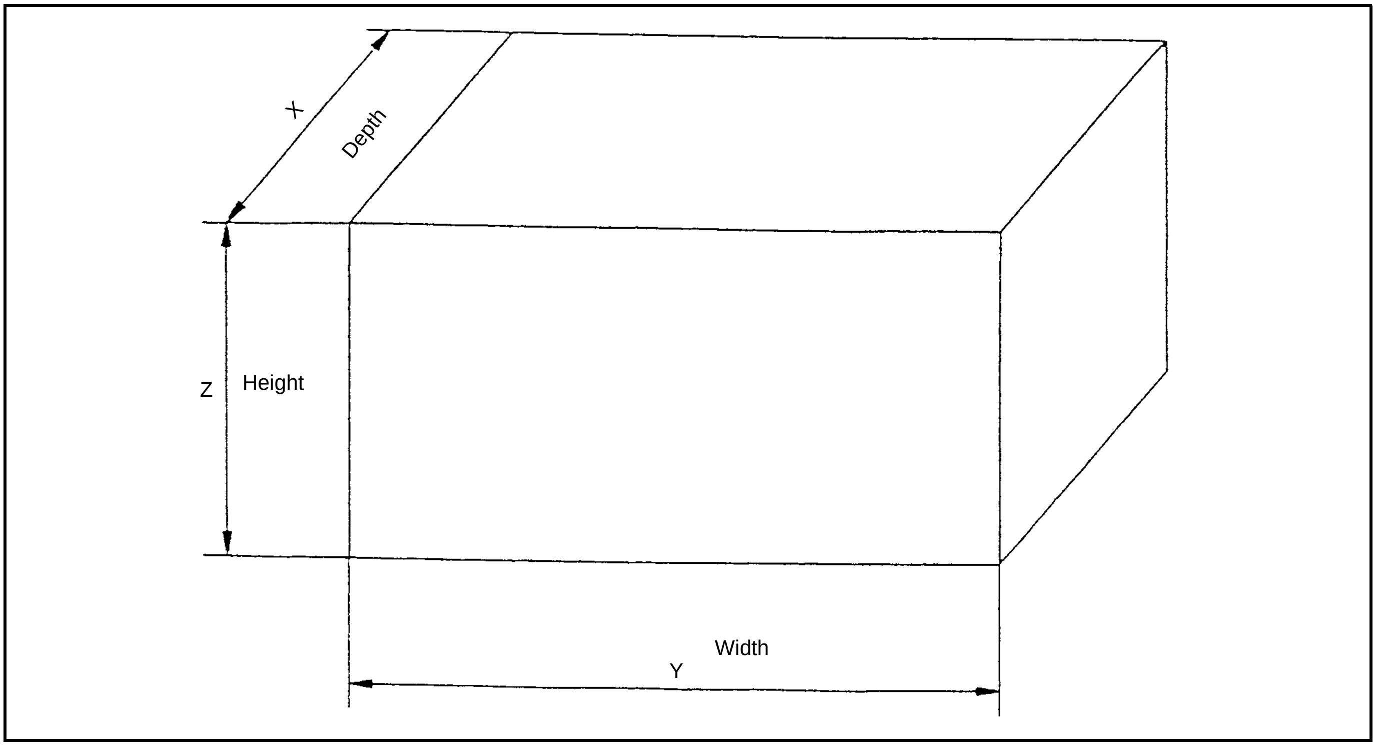
BATTERY

BATTERY COMPARTMENT AND REQUIRED WEIGHT

When the battery is to be purchased locally, always adjust the weight to satisfy the minimum required weight as shown in the table below.

See New Model Features (Pub. No. PU312) for the battery recommendation.

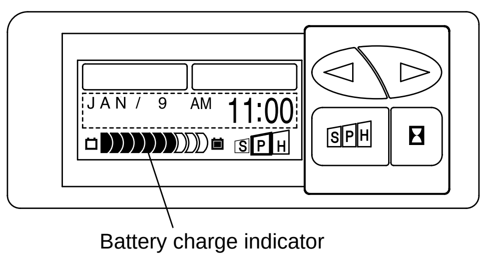
	Compartment dimensions mm (in.)			Minimum required battery weight (with case) kg (lb)	Remarks
	Depth X	Width Y	Height Z		
7FBCU15·18	680 (26.8)	878 (34.6)	585 (23.0)	830 (1840)	
7FBCU20·25	775 (30.5)	992 (39.1)	585 (23.0)	1090 (2400)	
7FBCHU25 7FBCU30·32	870 (34.3)	992 (39.1)	585 (23.0)	1360 (3000)	
7FBCU35	996 (39.2)	1148 (45.2)	585 (23.0)	1542 (3400)	
7FBCU45	996 (39.2)	1148 (45.2)	585 (23.0)	1635 (3600)	
7FBCU55	1161 (45.7)	1148 (45.2)	585 (23.0)	1918 (4230)	



SERVICE STANDARD

Specific gravity upon full charge		1.280 [20°C (68°F)]
Specific gravity upon end of discharge		1.150 [20°C (68°F)]
Discharge end voltage	36 V	32.0 V
	48 V	42.5 V
Electrolyte		Refined dilute sulfuric acid
Fluid to be added		Distilled (deionized) water
Insulation resistance		1MΩ or more

DISPLAY



Battery Charge Indicator

The battery charge indicator indicates 10 levels of battery charge on the LCD.

Battery discharged state %	LCD									
	10 F	9	8	7	6	5	4	3	2	1 E
0 to 10 (exclusive)	○	○	○	○	○	○	○	○	○	○
10 to 20 (exclusive)	—	○	○	○	○	○	○	○	○	○
20 to 30 (exclusive)	—	—	○	○	○	○	○	○	○	○
30 to 40 (exclusive)	—	—	—	○	○	○	○	○	○	○
40 to 50 (exclusive)	—	—	—	—	○	○	○	○	○	○
50 to 60 (exclusive)	—	—	—	—	—	○	○	○	○	○
60 to 70 (exclusive)	—	—	—	—	—	—	○	○	○	○
70 to 80 (exclusive)	—	—	—	—	—	—	—	○	○	○
80 to 90 (exclusive)	—	—	—	—	—	—	—	—	○	○
90 to 100 (exclusive)	—	—	—	—	—	—	—	—	—	○
100 or more	—	—	—	—	—	—	—	—	—	—

Low Remaining Battery Charge Warning

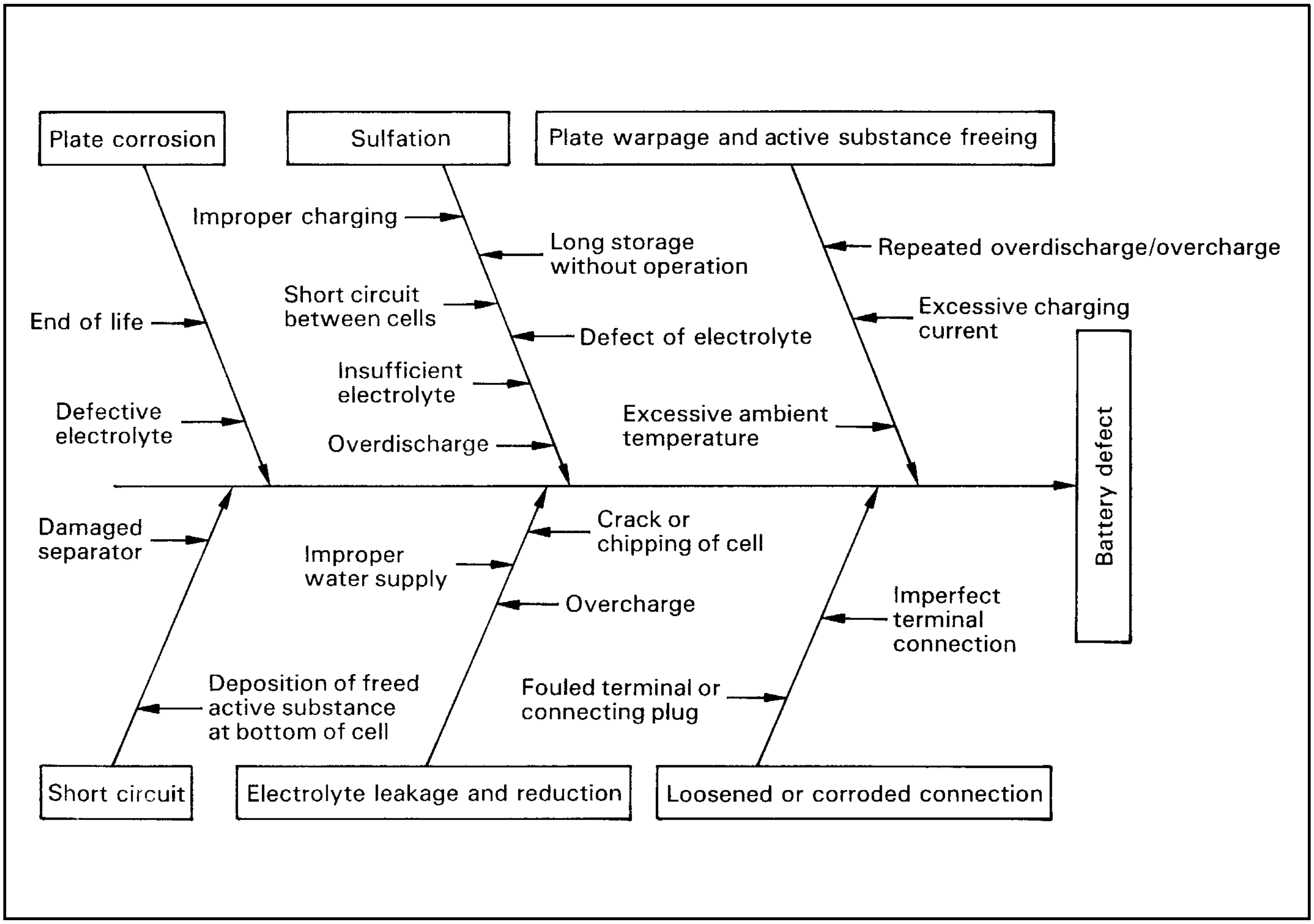
When the remaining battery charge drops below the set level, the charge display blinks.

When the key switch is turned to OFF and ON again in this state, the buzzer sounds for 5 seconds to warn the operator.

Battery Overdischarge Warning Function

When the battery charge decreases further below the set level after the remaining battery charge warning, any attempt at traveling or material handling operation will cause all charge indicator segments to blink and the alarm to sound to warn the operator.

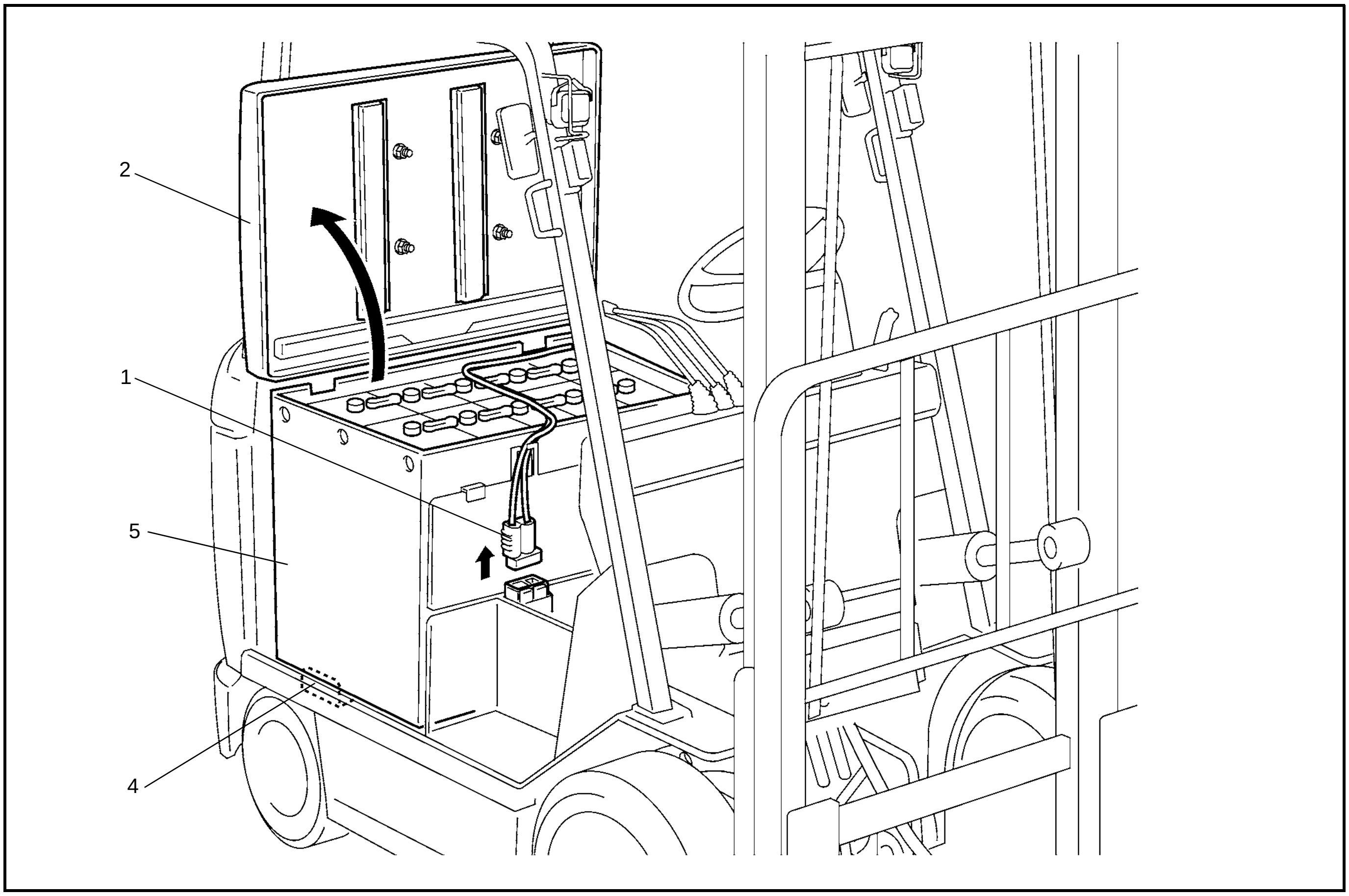
TROUBLESHOOTING



BATTERY ASSY

REMOVAL·INSTALLATION

Always remove or install the battery in no-load state (without any load on the fork).

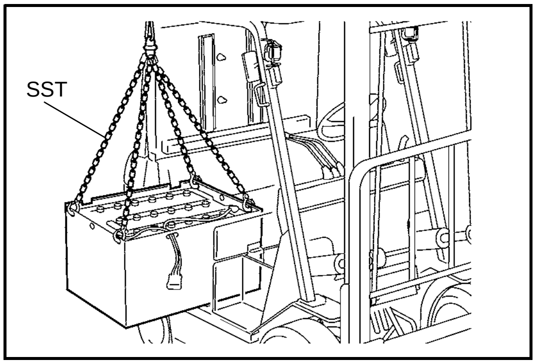


Removal Procedure

1 Disconnect the battery plug.
2 Open the battery hood.
3 Remove the rear toe board.
4 Loosen battery stoppers (RH and LH) and the fixing bolts.
5 Remove the battery ASSY. **[Point 1]**

Installation Procedure

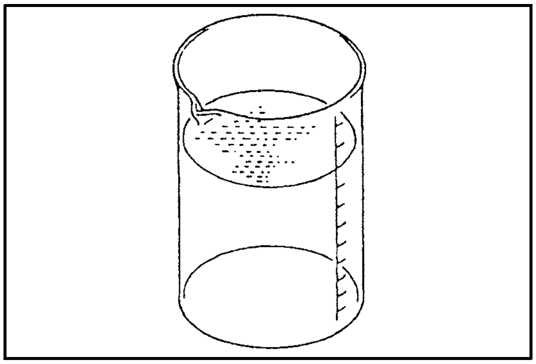
The installation procedure is the reverse of the removal procedure.



Point Operation

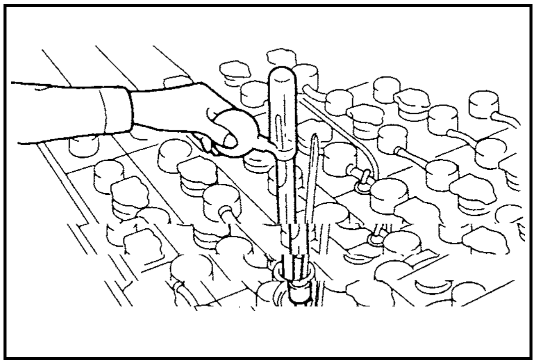
[Point 1]

Removal Installation:
SST 25009-13201-71

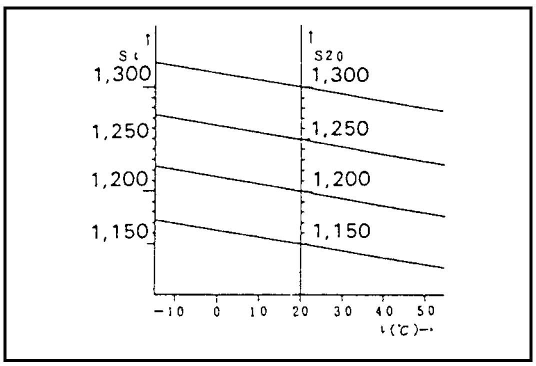


INSPECTION

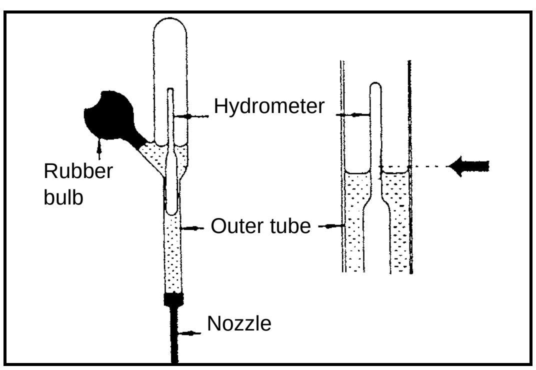
1. Electrolyte inspection
   Battery electrolyte is normal when it is transparent. Check turbidity when inspecting the specific gravity. If it cannot be checked clearly, put the electrolyte in a beaker for inspection.



2. Specific gravity inspection
   Use a hydrometer and measure the specific gravity of the electrolyte.
   Specific gravity upon full charge:
   .. 1.280 [20°C (68°F)]
   Specific gravity upon end of discharge:
   .. 1.150 [20°C (68°F)]
   The specific gravity of the electrolyte at 20°C (68°F) is used as the standard.

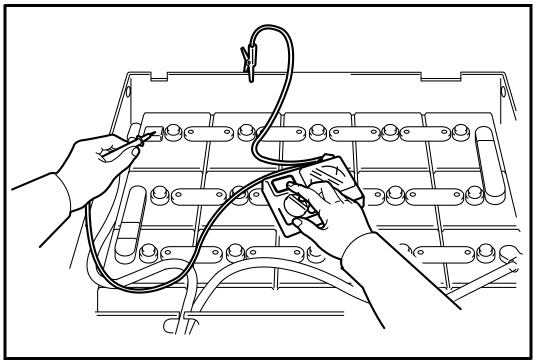


Equation for conversion
S_{20} = St+0.0007 (t-20)
S_{20} = Specific gravity at 20°C
St:Specific gravity measured at t°C
t:Electrolyte temperature upon measurement (°C)



* How to use the hydrometer

(1) Insert the nozzle of the hydrometer into the electrolyte port and allow the electrolyte to be sucked into its outer tube.
(2) Let the hydrometer float correctly without contact with the outer tube, top or bottom, and read the scale at the highest point of the electrolyte surface as illustrated at left when the bubbles in the electrolyte disappear.
(3) After the measurement, wash the inside and outside of the hydrometer well with clear water and store it after wiping water off with clean cloth.



3. Insulation resistance inspection
   Use an insulation resistance meter (megohmmeter) and measure the resistance between the battery and battery case.
   Insulation resistance:1 MΩ or more

Note:
- **When the insulation resistance is less than 1 MΩ, wash the battery with water after removing it from the vehicle.**
- **Fully dry the washed battery and measure the insulation resistance again. Install the battery on the vehicle after confirming that the insulation resistance is 1 MΩ or more.**

* Battery control table
Prepare a control table for each battery to record and maintain the inspection results.

Inspection date and time	Inspected cell No.	Specific gravity	Electrolyte temperature	Added water quantity	Remarks	Inspector

CONTROLLER

GENERAL

The following controller is installed on the 7FBCU series:
- Traveling/Material handling system: Traveling/Material handling controller (15 ~ 32 model)
- Traveling system: Traveling controller (35 ~ 55 model)
- Material handling system: Material handling controller (35 ~ 55 model)
- PS system: PS controller (15 ~ 32 model)
- SAS function (Mast control, Rear wheel swing control): SAS controller

Each of them is a multifunctional controller utilizing a microcomputer. The traveling system provides high performance in a wide range by means of inverter control of the AC motor drive system.

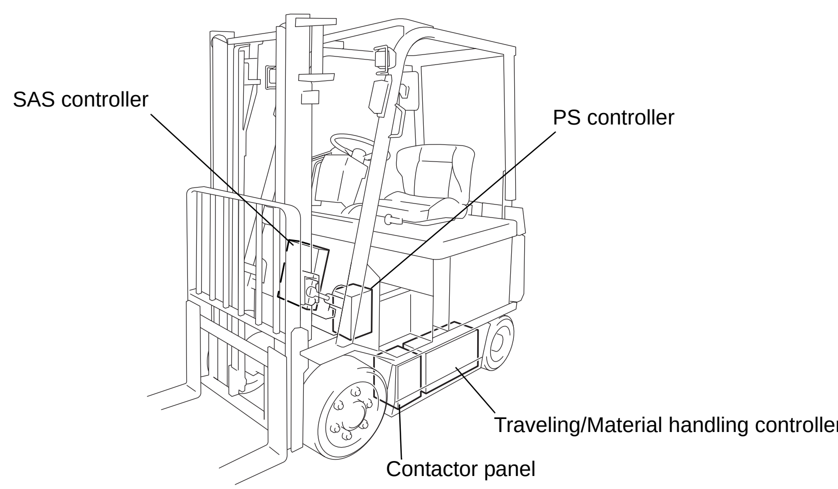
The controller has self diagnosis function that automatically detects any abnormality of the accelerator, PS circuit, SAS function or any other sensor and displays the corresponding error code together with the warning buzzer tone.

At the same time, an action such as stopping traveling, stopping load handling or restriction of traveling speed is automatically taken to ensure safety.

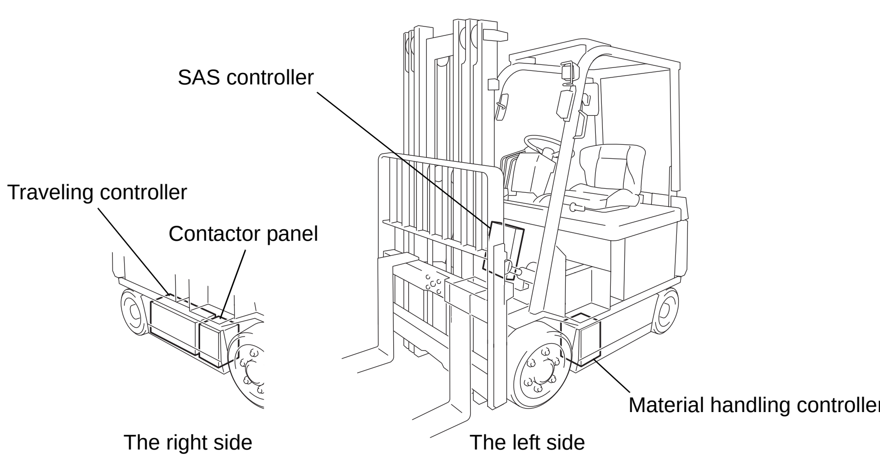
Identification of faulty portion and functional check of the traveling and load handling circuits, each operating system and sensors are also possible by setting the display to the analyzer (fault analysis) mode.

See page 3-58 in the “MULTIDISPLAY FUNCTION” section for the diagnosis.
See page 3-32 in the “MULTIDISPLAY FUNCTION” section for the analyzer.

15 ~ 32 model



35 ~ 55 model



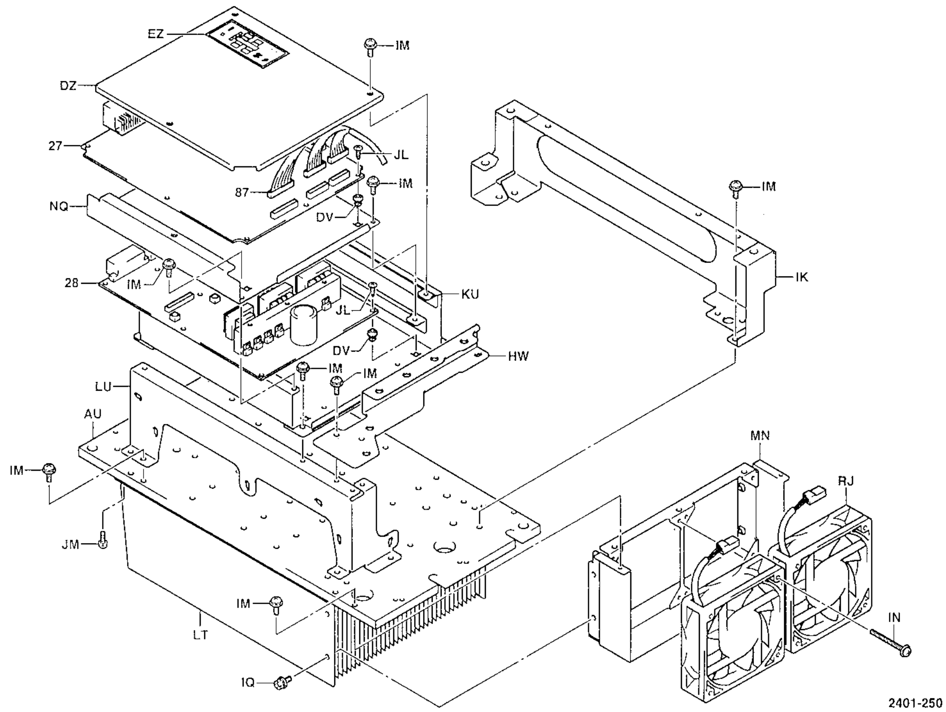
SPECIFICATIONS

		15·18 model (chopper-less)	20 ~ 32 model (chopper-less)	15·18 model (chopper)	20 ~ 32 model (chopper)	35 ~ 55 model
Fuse	F1 (For drive)	275A	325A	500A	600A	700A
	F2 (For pump)	225A	325A	—	—	—
	F2A (For pump No.1)	—	—	—	—	325A
	F2B (For pump No.2)	—	—	—	—	325A
	F3 (For PS)	75A	←	←	←	—
	F4 (For lamps)	10A	←	←	←	←
	F5 (For control circuit)	10A	←	←	←	←
	F6 (For controller)	10A	←	←	←	←
	F7 (For SAS controller)	10A	←	←	←	←
	FD (For DC/DC converter)	8A	←	←	←	←
Transistor	TMD (For drive)	100V/800A	100V/880A	100V/800A	100V/880A	100V/880A
	TMD2 (For drive)	—	—	—	—	100V/880A
	TMP (For pump)	—	—	100V/800A	100V/880A	100V/880A
	TMPS (For PS)	1MI100H-025	←	←	←	—
Current sensor	CSBATT (For power supply)	S3CM7-800/4QG	←	←	←	←
	CSDA, CSDB (For drive)	S3CM7-800/4QG	←	←	←	←
	CSDA2, CSDB2 (For drive)	—	—	—	—	S3CM7-800/4QG
	CSP (For pump)	—	—	S3CM7-800/4QG	←	←
Capacitor	CO (For traveling and material handling).	100V/2700µF×16	100V/2700µF×20	100V/2700µF×18	100V/3300µF×20	100V/3300µF×22
Contactor	MB [MD] (For power supply)	ME251	←	←	←	—
	MD1 (For drive)	—	—	—	—	ME251
	MD2 (For drive)	—	—	—	—	ME251
	MP (For pump)	ME251	—	—	—	—
	MP1 (For pump)	—	—	—	—	ME251
	MP2 (For pump)	—	—	—	—	ME251
	MPS (For PS)	ME251	←	←	←	—

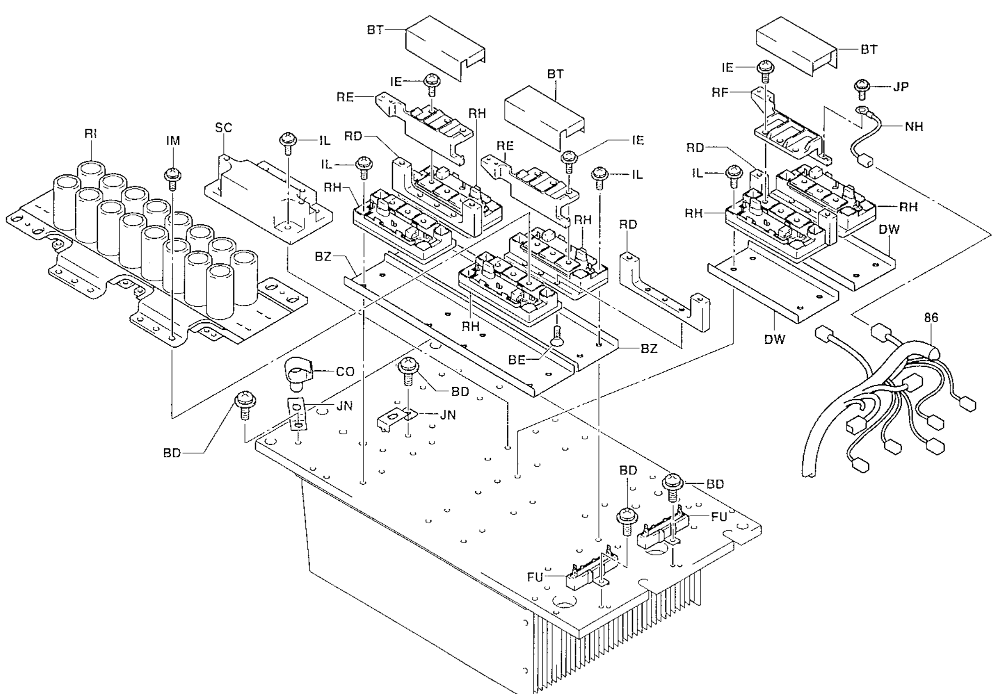
COMPONENTS

Traveling/Material Handling Controller (15 ~ 32 Model)

2401

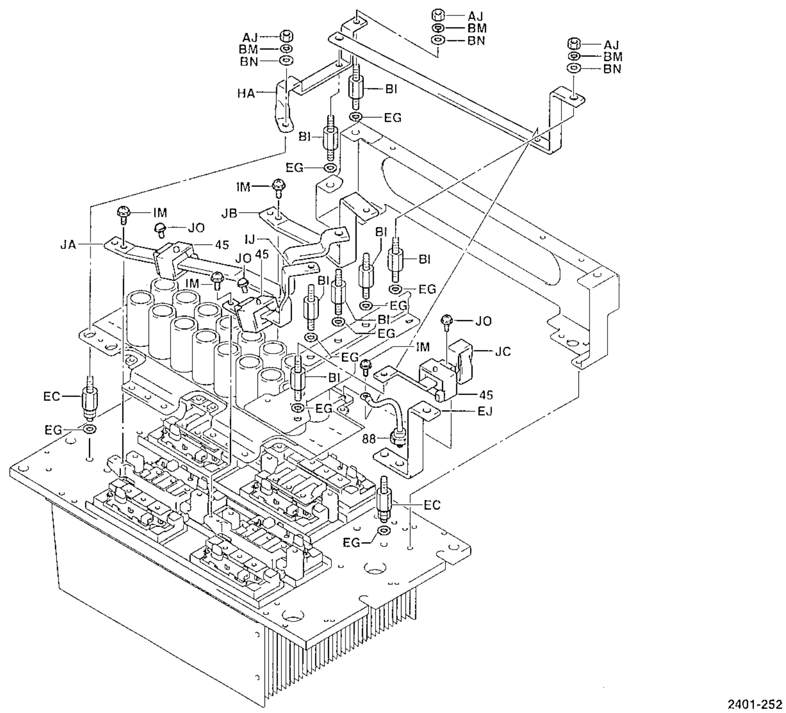


Chopper-less

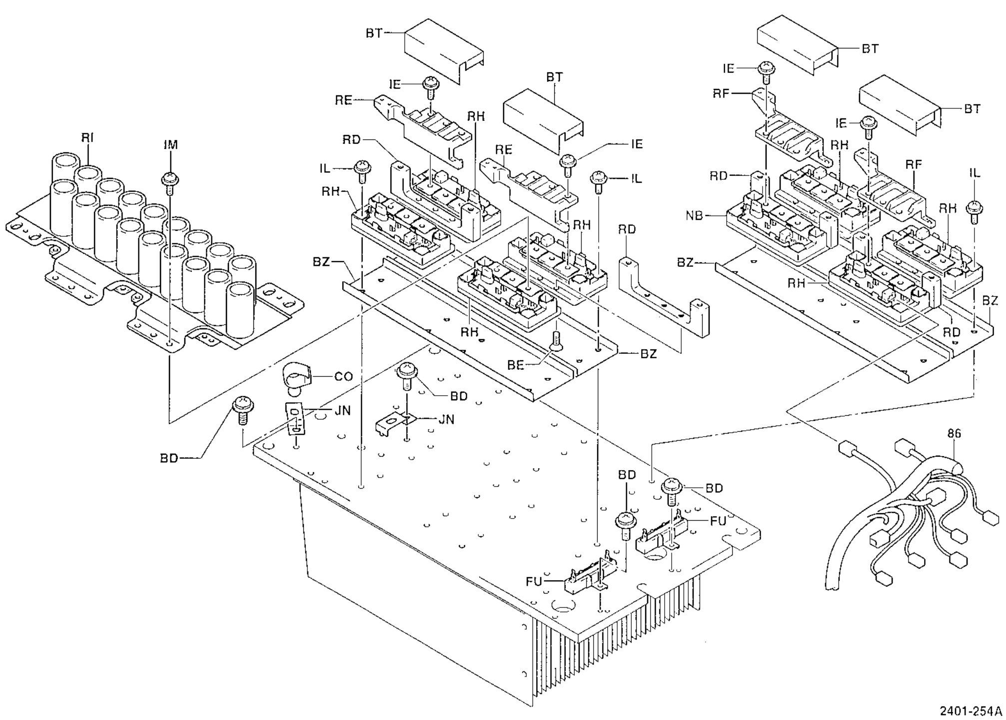


Chopper-less

2401

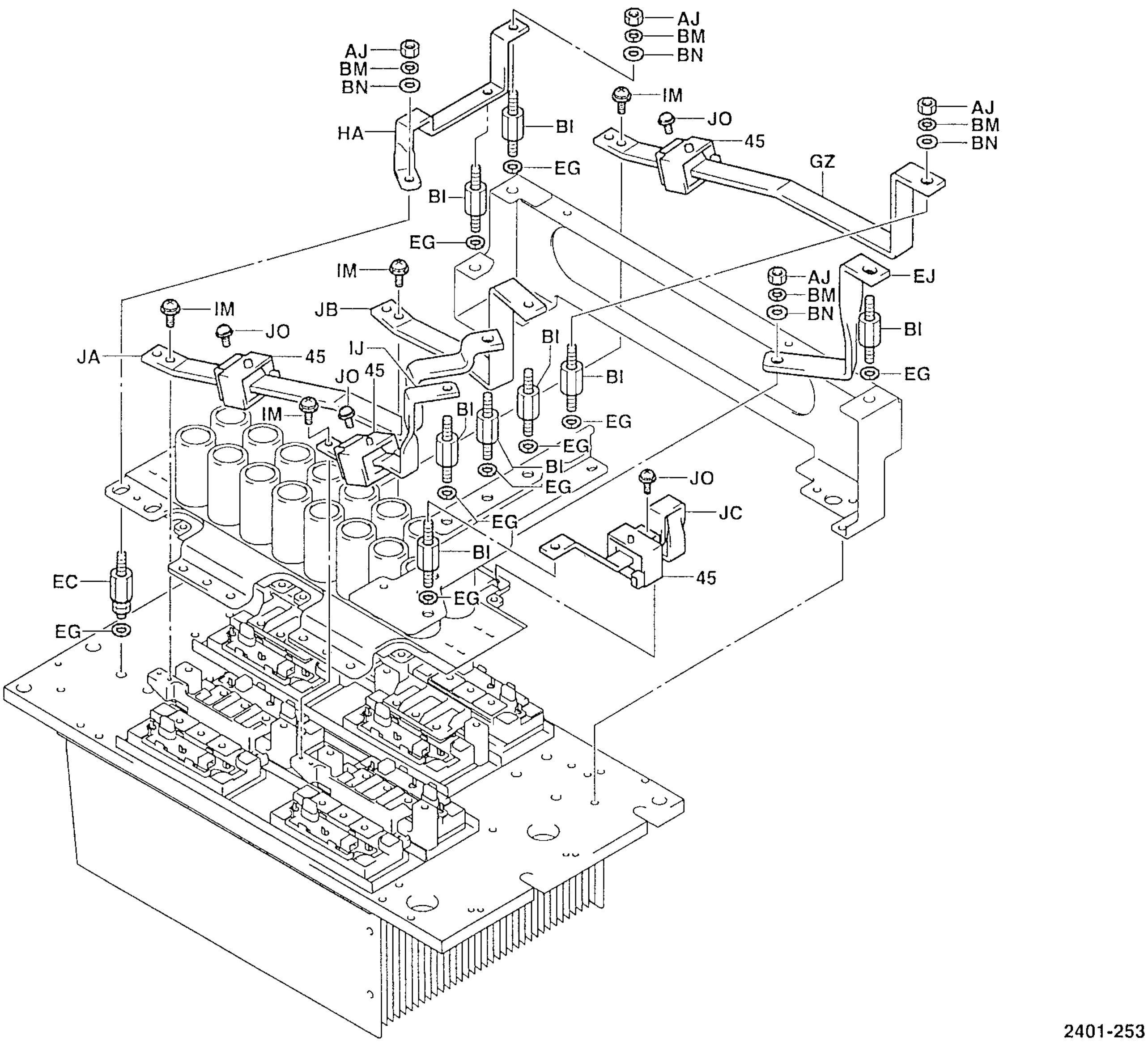


Chopper



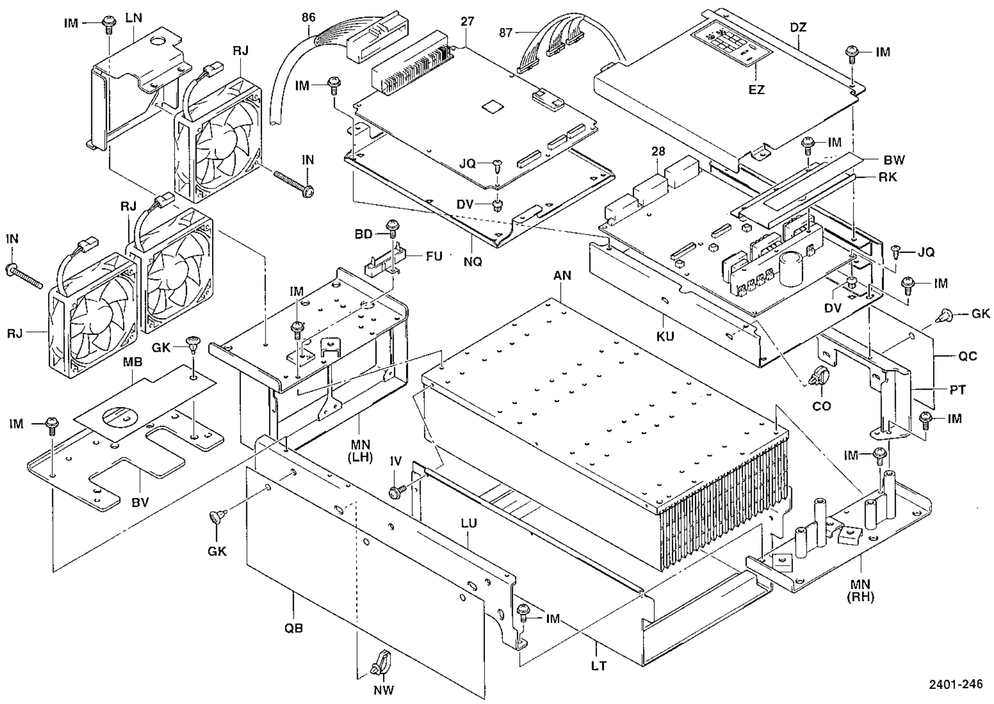
Chopper

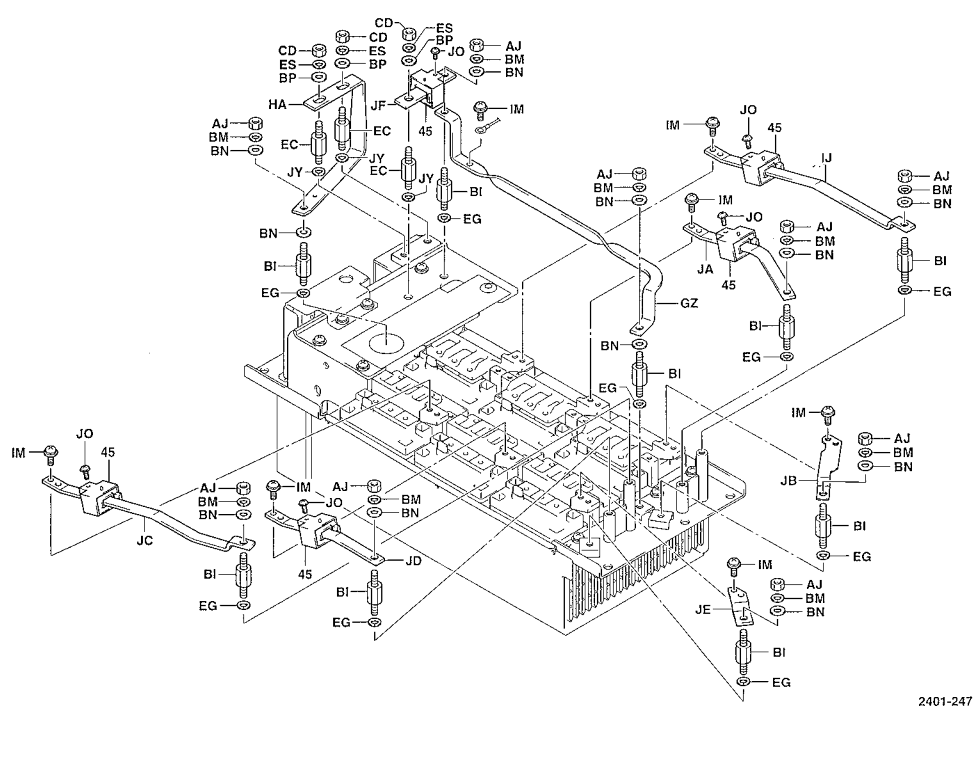
2401

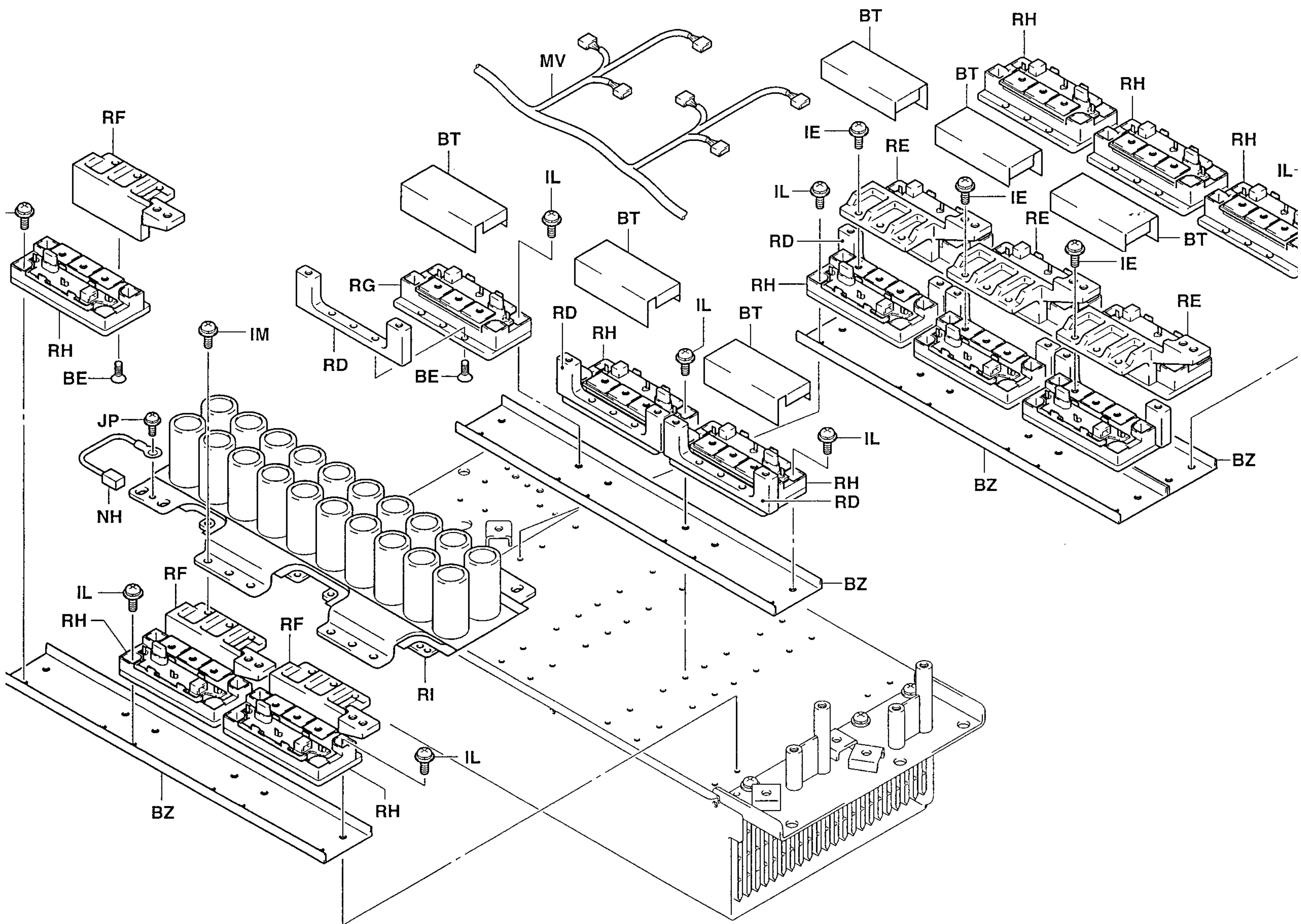


Traveling Controller (35 ~ 55 Model)

2401







BT
RH
BT
RH
MV
RF
BT
IE
RE
RH
IL
IL
IE
IL
BT
RE
BT
IE
RD
RG
RH
IL
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RE
IM
RD
RH
RD
RH
BE
BE
JP
IL
NH
RH
RD
BZ
BZ
BZ
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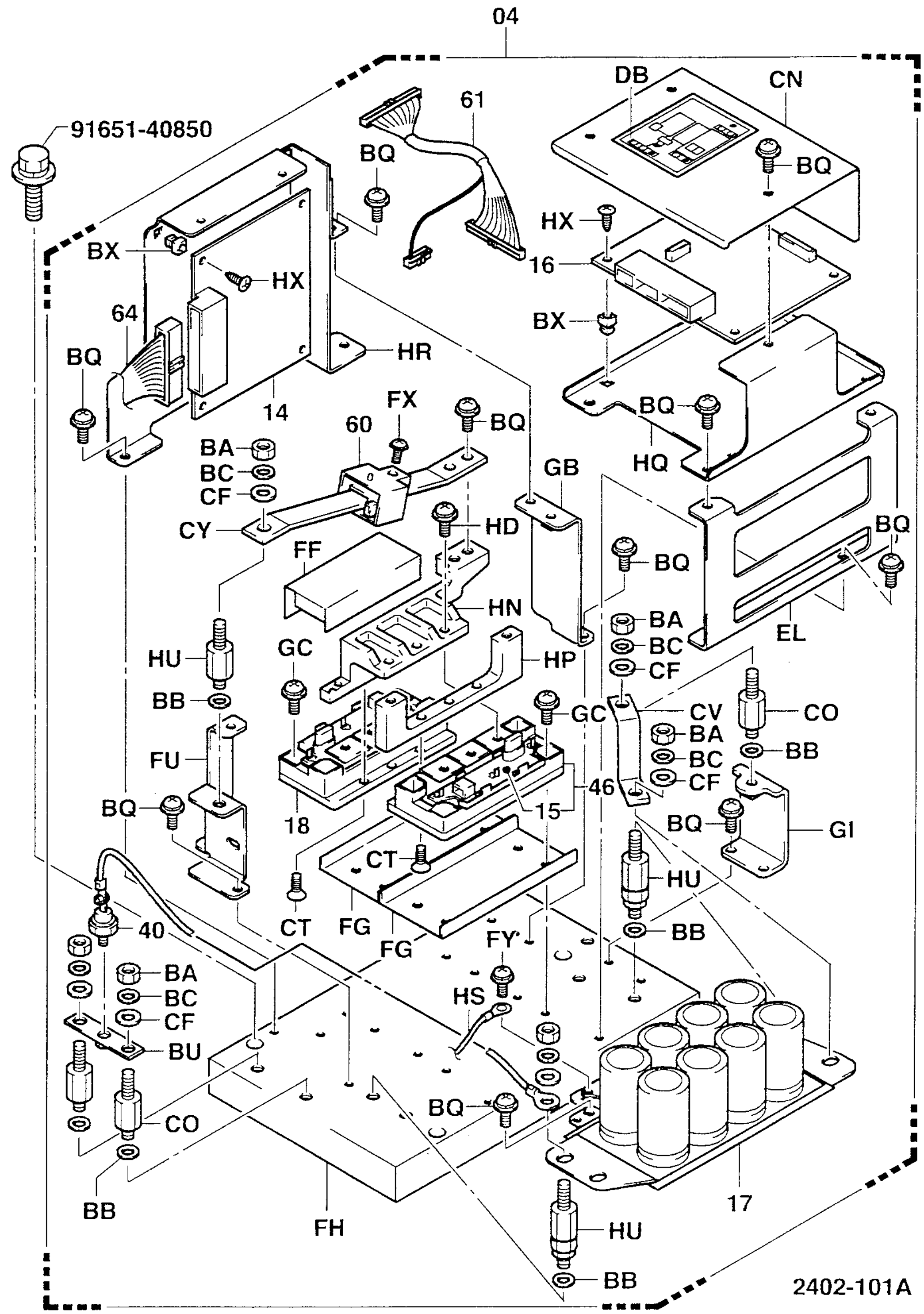
BZ
RH
2401

2401

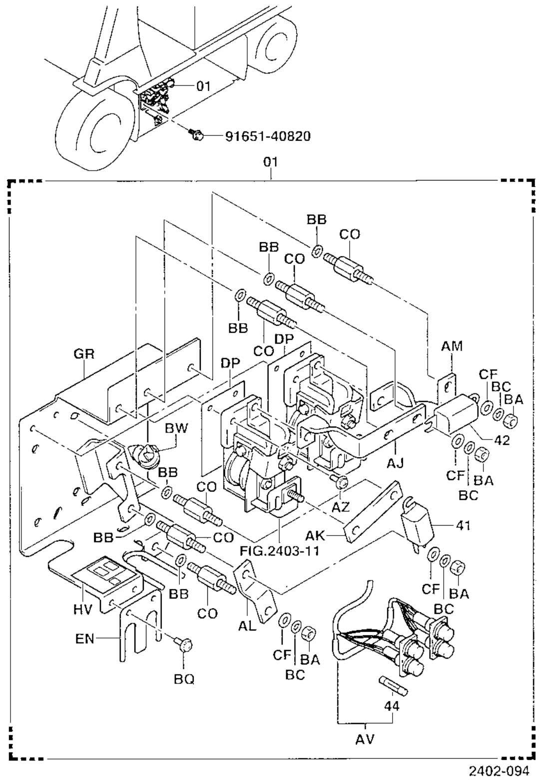
Material Handling Controller (35 ~ 55 Model)

2402

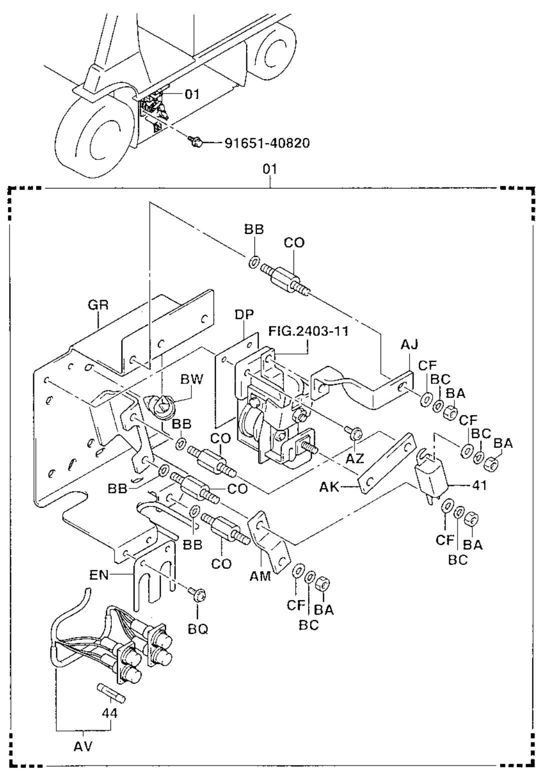


Contactor Panel (15 ~ 32 Model)

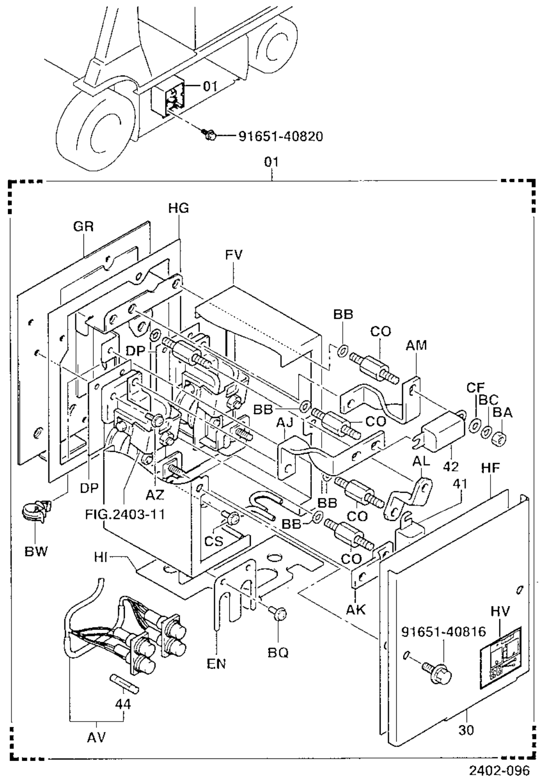
Chopper-less	2402



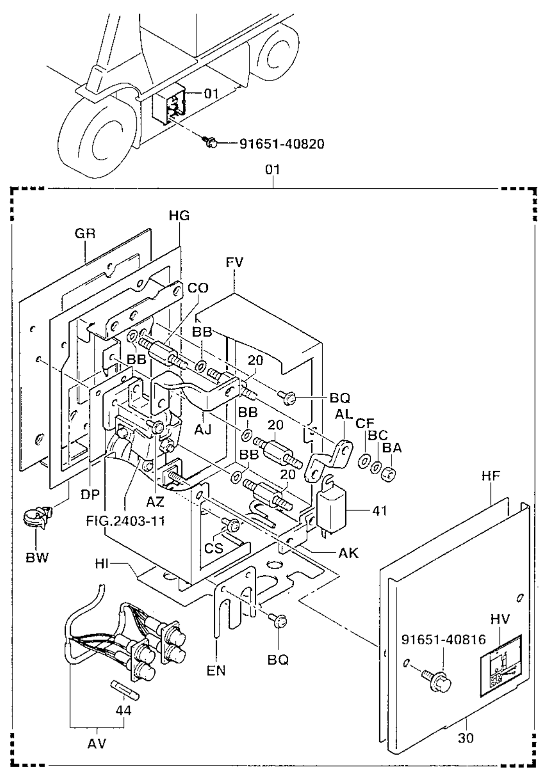
Chopper



Chopper-less Dust proof	2402

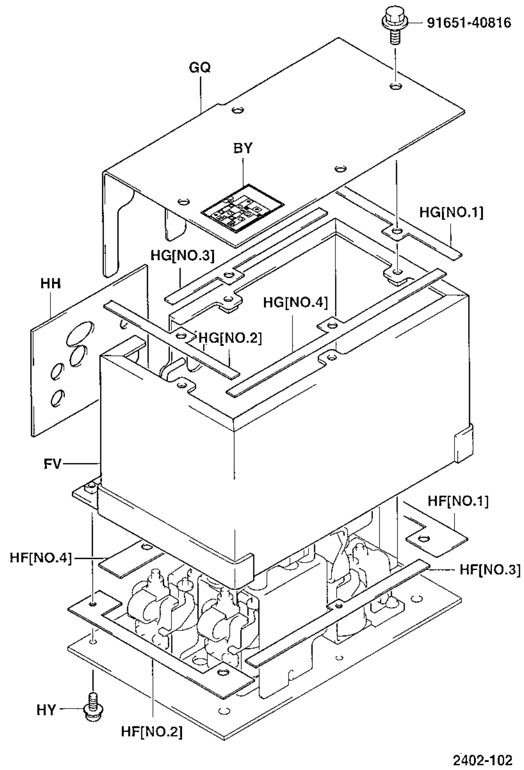


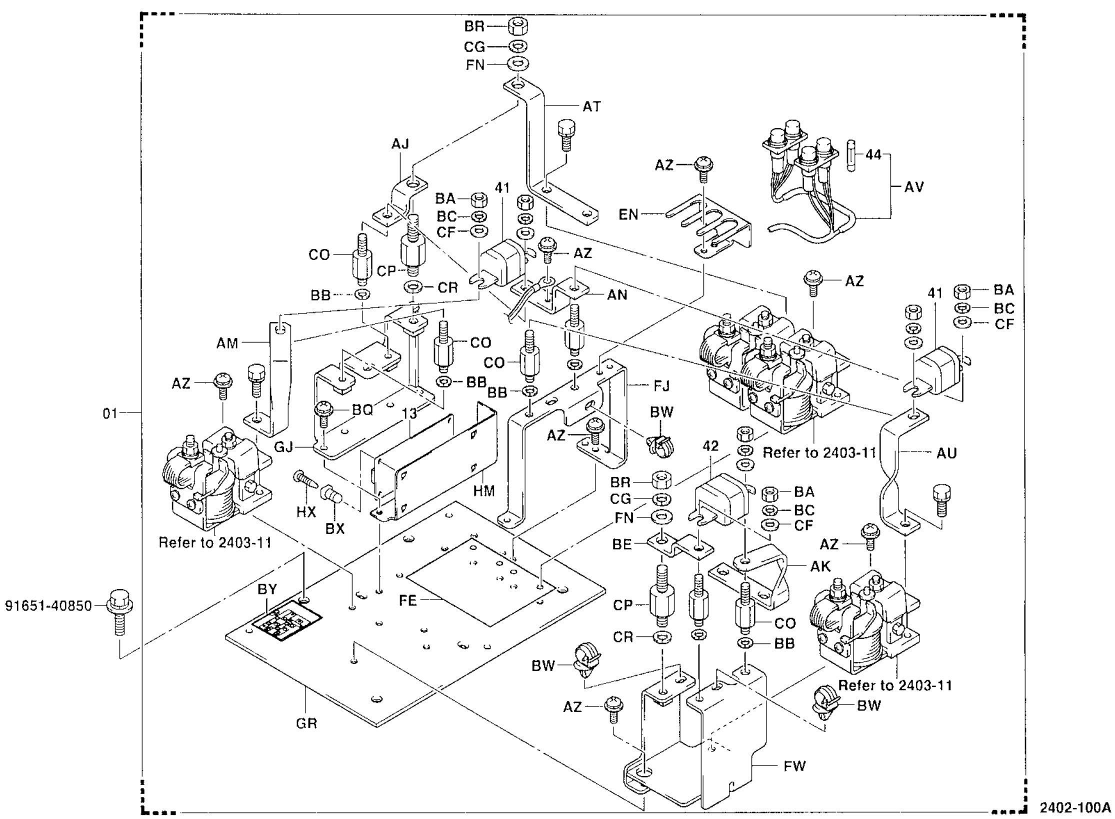
Chopper
Dust proof



Contactor Panel (35 ~ 55 Model)

2402

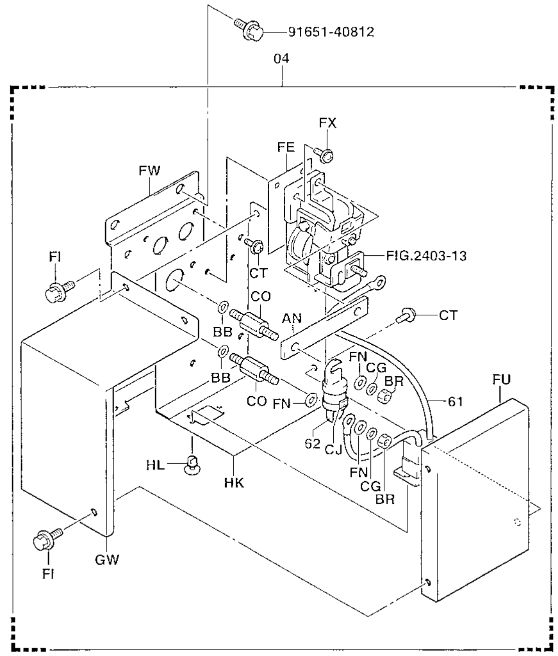




PS Controller

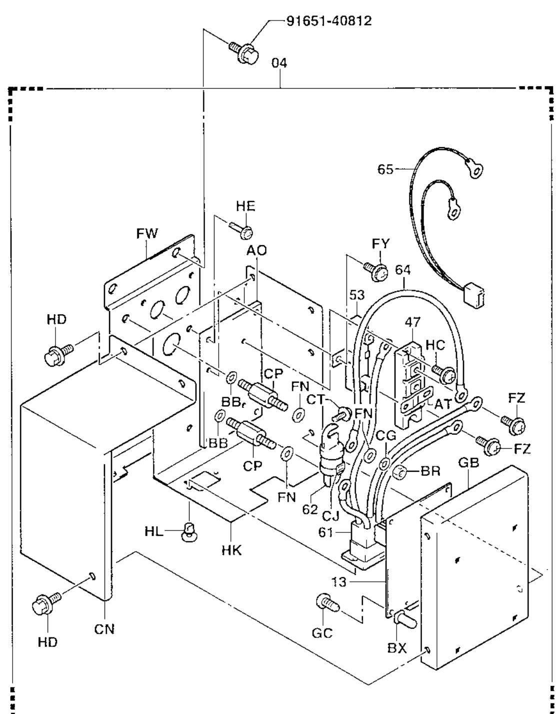
FHPS

2402



2402-098A

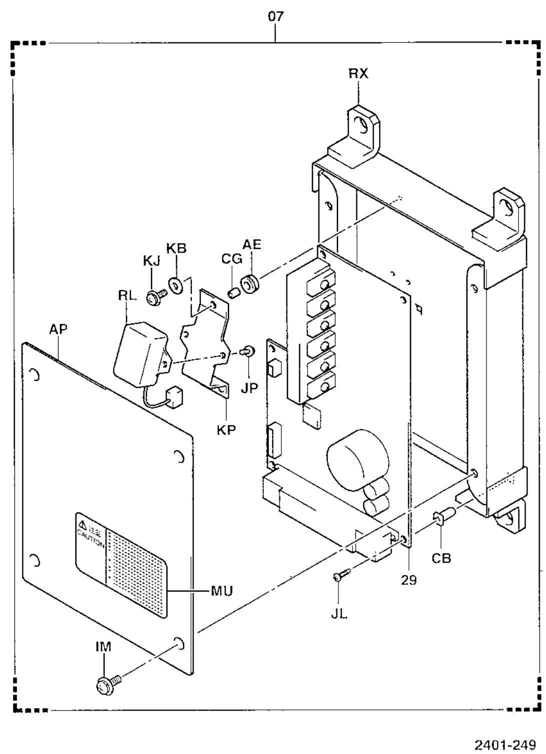
EHPS



2402-099

SAS Controller

2401

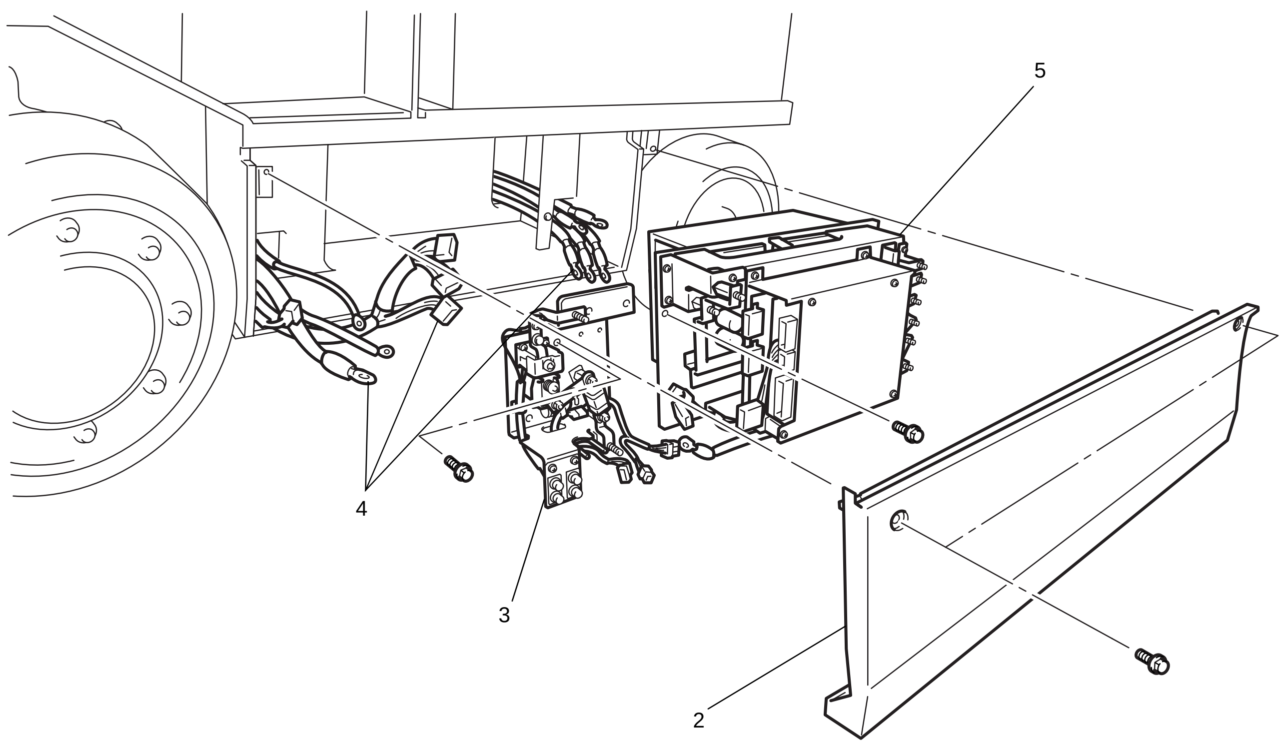


CONTROLLER

TRAVELING/MATERIAL HANDLING CONTROLLER ASSY REMOVAL·INSTALLATION (15 ~ 32 MODEL)

Caution:
Before starting the job, measure the voltage between P14 and N1; if there is any voltage, insert a resistor at approx. 100 Ω between P14 and N1 to discharge the capacitor.

T = N·m (kgf-cm) [ft-lbf]



Nut connecting controller to cable	M8	T = 11 ~ 15 (112 ~ 153) [8.1 ~ 11.1]
	M10	T = 15 ~ 19 (153 ~ 194) [11.1 ~ 14.0]

Removal Procedure

1 Disconnect the battery plug.
2 Remove the side cover LH.
3 Remove the contactor panel ASSY. (See page 2-21)
4 Disconnect the connectors and terminals from the traveling/material handling controller ASSY.
5 Remove the controller ASSY.

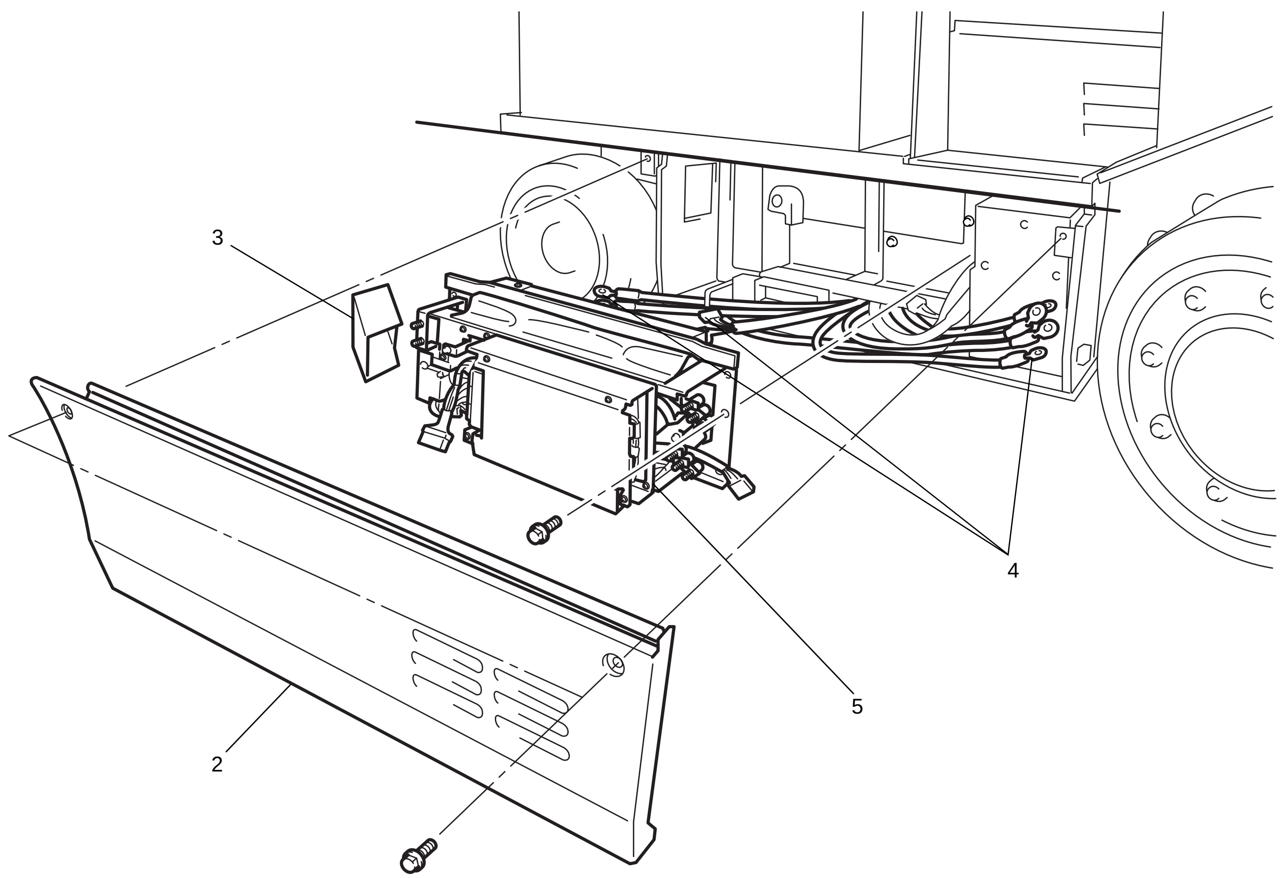
Installation Procedure

The installation procedure is the reverse of the removal procedure.

TRAVELING CONTROLLER ASSY REMOVAL·INSTALLATION (35 ~ 55 MODEL)

Caution:
Before starting the job, measure the voltage between P4 and N1; if there is any voltage, insert a resistor at approx. 100 Ω between P4 and N1 to discharge the capacitor.

T = N·m (kgf-cm) [ft-lbf]



Nut connecting controller to cable	M8	T = 11 ~ 15 (112 ~ 153) [8.1 ~ 11.1]
	M10	T = 15 ~ 19 (153 ~ 194) [11.1 ~ 14.0]

Removal Procedure

1 Disconnect the battery plug.
2 Remove the side cover RH.
3 Remove the duct.
4 Disconnect the connectors and terminals from the traveling controller ASSY.
5 Remove the controller ASSY.

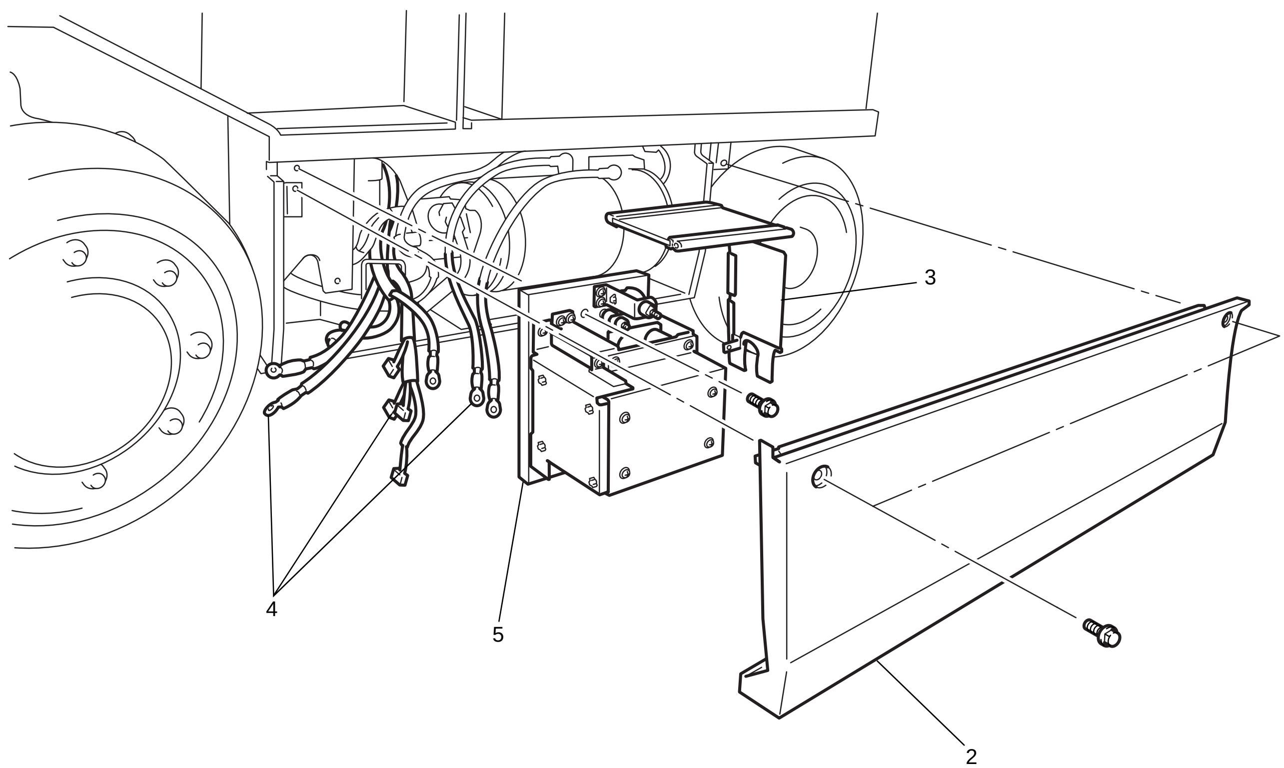
Installation Procedure

The installation procedure is the reverse of the removal procedure.

MATERIAL HANDLING CONTROLLER ASSY REMOVAL·INSTALLATION (35 ~ 55 MODEL)

Caution:
Before starting the job, measure the voltage between P12 and N2; if there is any voltage, insert a resistor at approx. 100 Ω between P12 and N2 to discharge the capacitor.

T = N·m (kgf-cm) [ft-lbf]



Nut connecting controller to cable	M8	T = 11 ~ 15 (112 ~ 153) [8.1 ~ 11.1]
	M10	T = 15 ~ 19 (153 ~ 194) [11.1 ~ 14.0]

Removal Procedure

1 Disconnect the battery plug.
2 Remove the side cover LH.
3 Remove the controller cover.
4 Disconnect the connectors and terminals from the material handling controller ASSY.
5 Remove the controller ASSY.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

TRAVELING AND MATERIAL HANDLING CONTROLLER INSPECTION

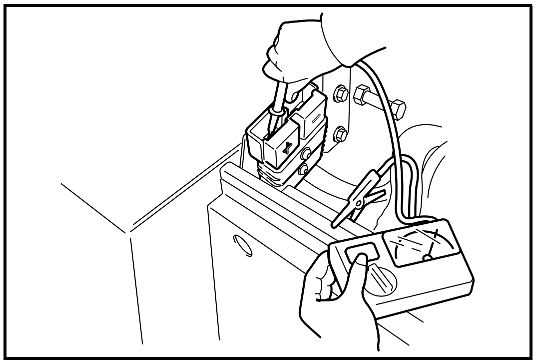
Some components can be inspected after they are removed from the vehicle, while others can only be inspected as installed on the vehicle.

Inspect the CPU board, DC/MD board, SCPU board and DC/PD board as installed on the vehicle since the battery voltage must be applied.

The explanation here is mainly for inspection of the traveling/material handling controller as removed from the vehicle.

1. Insulation resistance measurement (Always measure before inspecting the traveling/material handling controller.)
   (1) Disconnect the battery plug and measure the insulation resistance between the battery plug and body.

Measurement terminals	Controller side of battery plug — Body
Standard	The higher the resistance the better, but it varies greatly with the vehicle operating condition, place and weather. (Approx. 1 MΩ or more)



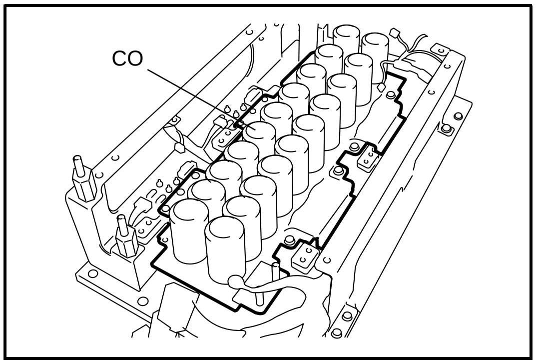
2. CO (overall capacitor)

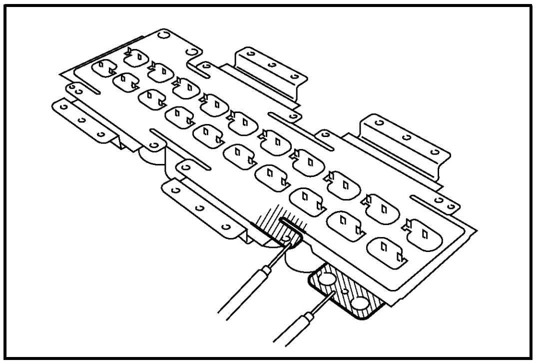
(1) Inspection method
Confirm complete discharge of CO before inspection.

Portion to be inspected	Measurement terminals	Tester range
CO	Both terminals on the rear side of CO	$\Omega \times 1k$

Standard:

Bring tester probes into contact with both terminals of CO. The pointer once reflects to the 0 Ω side. Then it gradually returns to ∞ and finally indicates ∞.
∞ Ω is indicated because the capacitor is charged by the tester current.



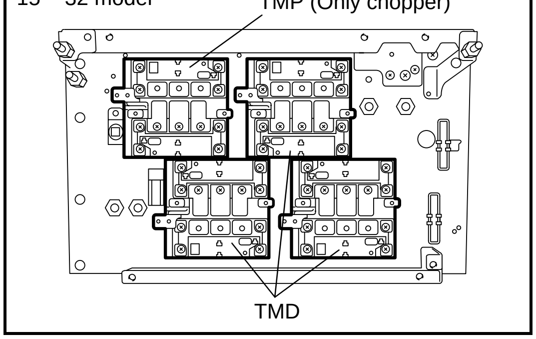


3. TMD (drive motor transistor), TMP (pump motor transistor)

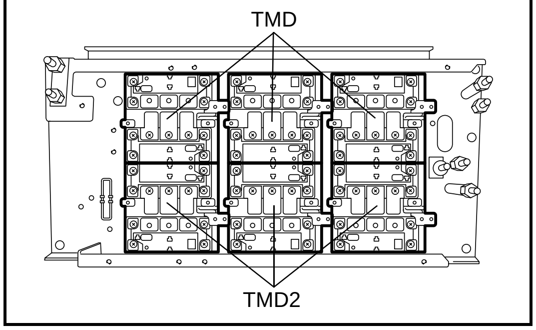
(1) Inspection method
Remove CO (overall capacitor) and the insulation cover.

Portion to be inspected	Measurement terminals	Standard	Tester range
TMD TMP	D1 (D2) (+) - S1 (S2) (-)	Approx. 2 kΩ	$\Omega \times 1k$
	D1 (D2) (+) - G (-)	Approx. 12 kΩ	
	S1 (S2) (+) - D1 (D2) (-)	∞ Ω	
	S1 (S2) (+) - G (-)	Approx. 10 kΩ	
	G (+) - D1 (2) (-)	∞ Ω	
	G (+) - S1(S2) (-)	Approx. 1 kΩ	

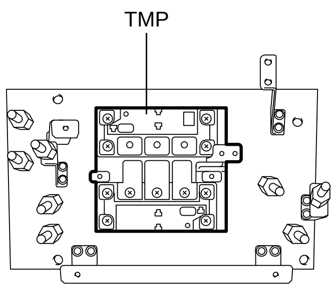
15 ~ 32 model

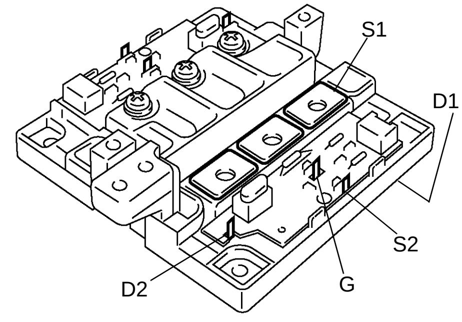


35 ~ 55 model (For traveling)



35 ~ 55 model (For material handling)



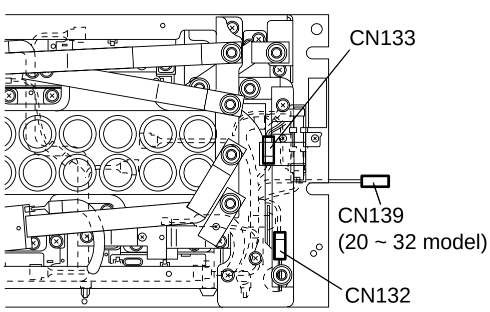


4. Cooling fan

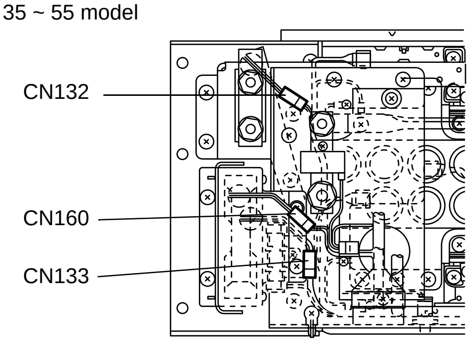
(1) Inspection method
Fan connector disconnected

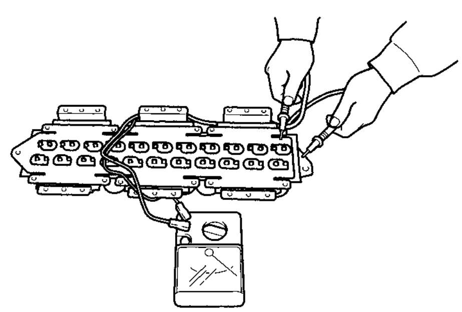
Model	Portion to be inspected	Measurement terminals	Standard	Tester range
15 ~ 32	FAN NO.1	CN132-1 (17) - CN132-2 (N2)	∞ Ω	Ω × 1
	FAN NO.2	CN133-1 (7) - CN133-2 (8)		
	FAN NO.3 (20 ~ 32 model)	CN139-1 (18) - CN139-2 (N2)		
35 ~ 55	FAN NO.1	CN132-1 (7) - CN132-2 (8)		
	FAN NO.2	CN133-1 (9) - CN133-2 (10)		
	FAN NO.3	CN160-1 (17) - CN160-2 (N2)		

15 ~ 32 model



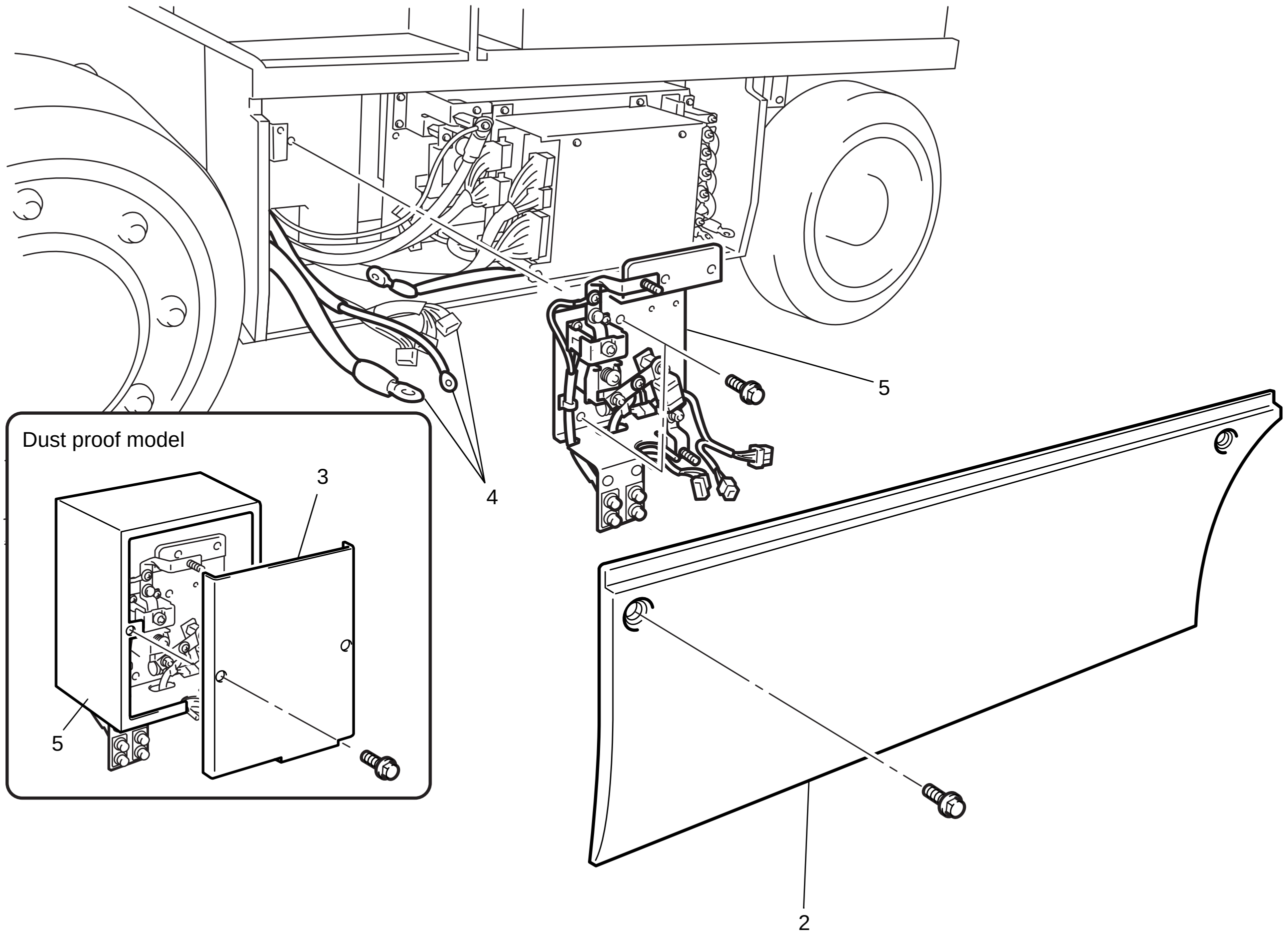
35 ~ 55 model





CONTACTOR PANEL ASSY REMOVAL·INSTALLATION (15 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Nut connecting panel to cable	M8	T = 11 ~ 15 (112 ~ 153) [8.1 ~ 11.1]
	M10	T = 15 ~ 19 (153 ~ 194) [11.1 ~ 14.0]

Removal Procedure

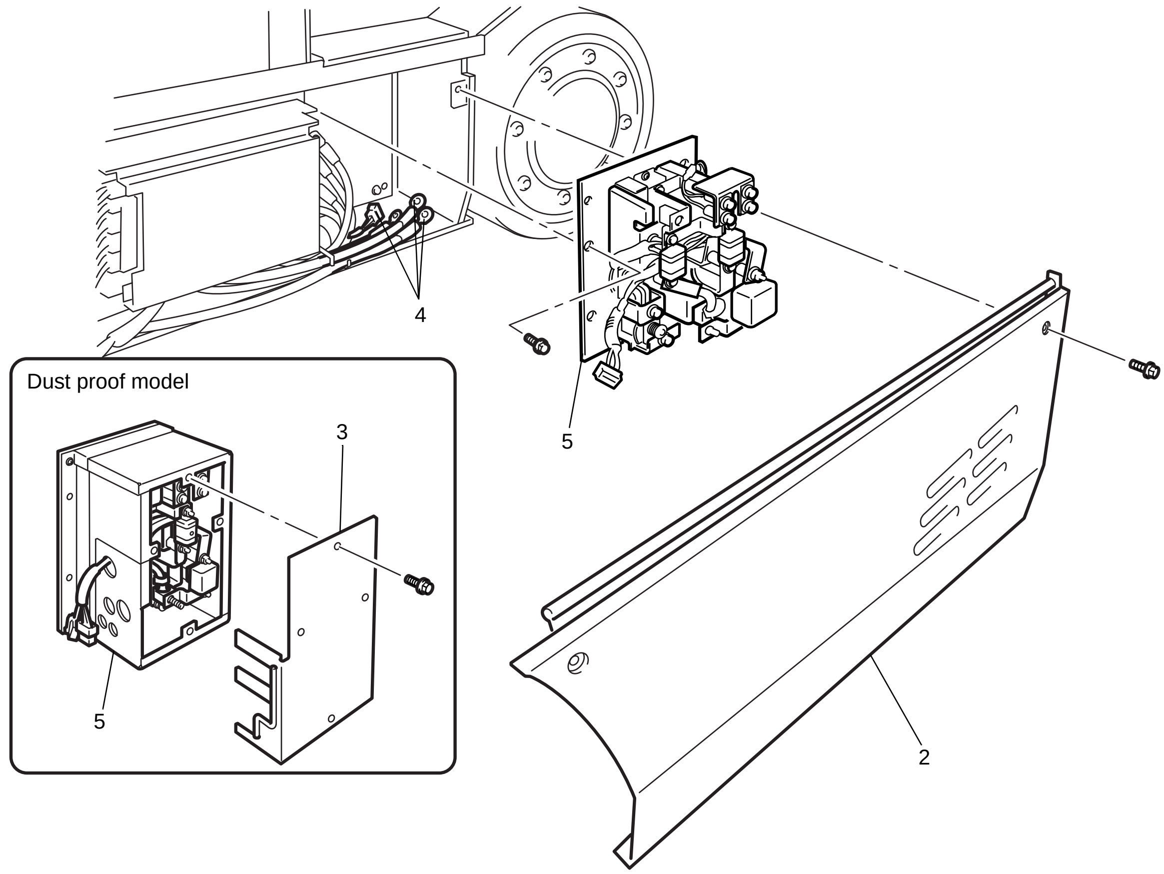
1 Disconnect the battery plug.
2 Remove the side cover LH.
3 Remove the contactor cover. (Dust proof model)
4 Disconnect the connectors and terminals from the contactor panel ASSY.
5 Remove the contactor panel ASSY.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

CONTACTOR PANEL ASSY REMOVAL·INSTALLATION (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Nut connecting panel to cable	M8	T = 11 ~ 15 (112 ~ 153) [8.1 ~ 11.1]
	M10	T = 15 ~ 19 (153 ~ 194) [11.1 ~ 14.0]

Removal Procedure

1 Disconnect the battery plug.
2 Remove the side cover RH.
3 Remove the contactor cover. (Dust proof model)
4 Disconnect the connectors and terminals from the contactor panel ASSY.
5 Remove the contactor panel ASSY.

Installation Procedure

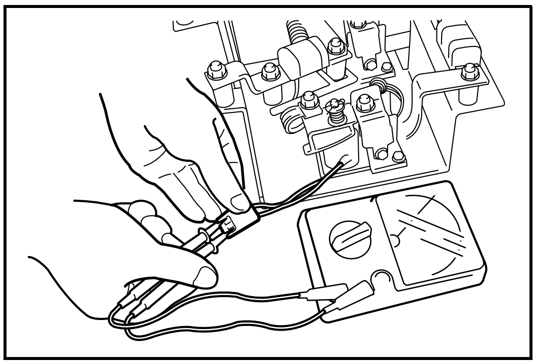
The installation procedure is the reverse of the removal procedure.

CONTACTOR PANEL INSPECTION

1. Power supply contactor
   (1) Inspection method
   Disconnect the contactor connector, and measure the resistance of the contactor coil.

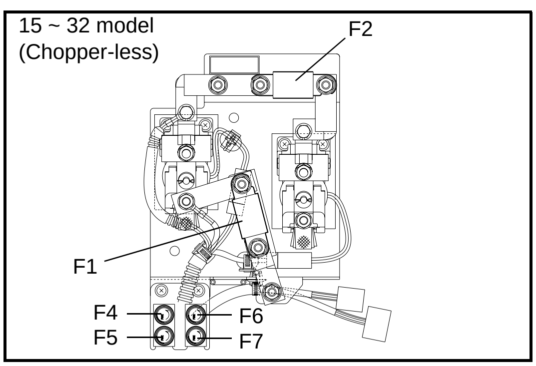
Model	Portion to be inspected	Measurement terminals	Standard	Tester range
15 ~ 32 Chopper less	MD·MP Coil	Both terminals of contactor connector	Approx. 20 Ω (at 20°C (68°F))	Ω × 1
15 ~ 32 Chopper	MB (MD) Coil*1			
35 ~ 55	MD1·MD2 MP1·MP2 Coil			

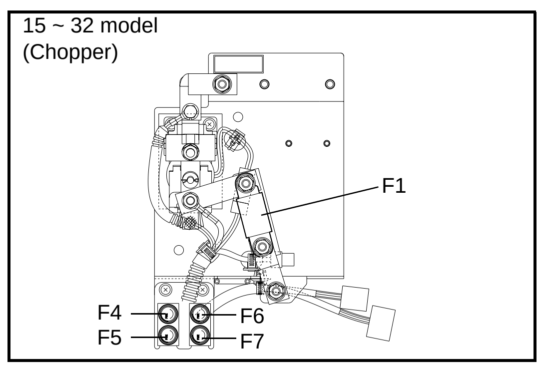
*1: “MD” is printed on the connector.

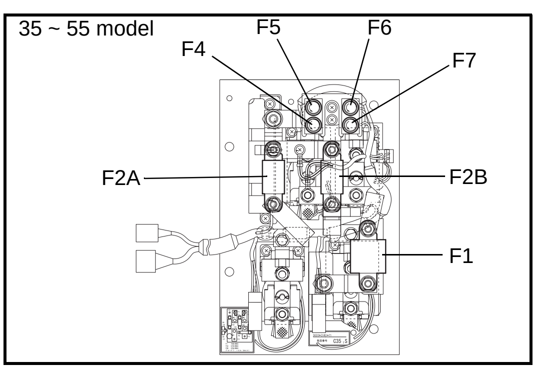


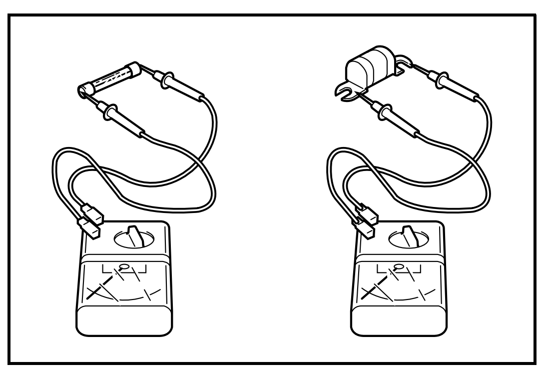
2. Fuse
   (1) Inspection method
   Remove the fuse and measure the resistance.

Portion to be inspected	Measurement terminals	Standard	Tester range
Fuse	Both terminals of fuse	0 Ω	Ω × 1

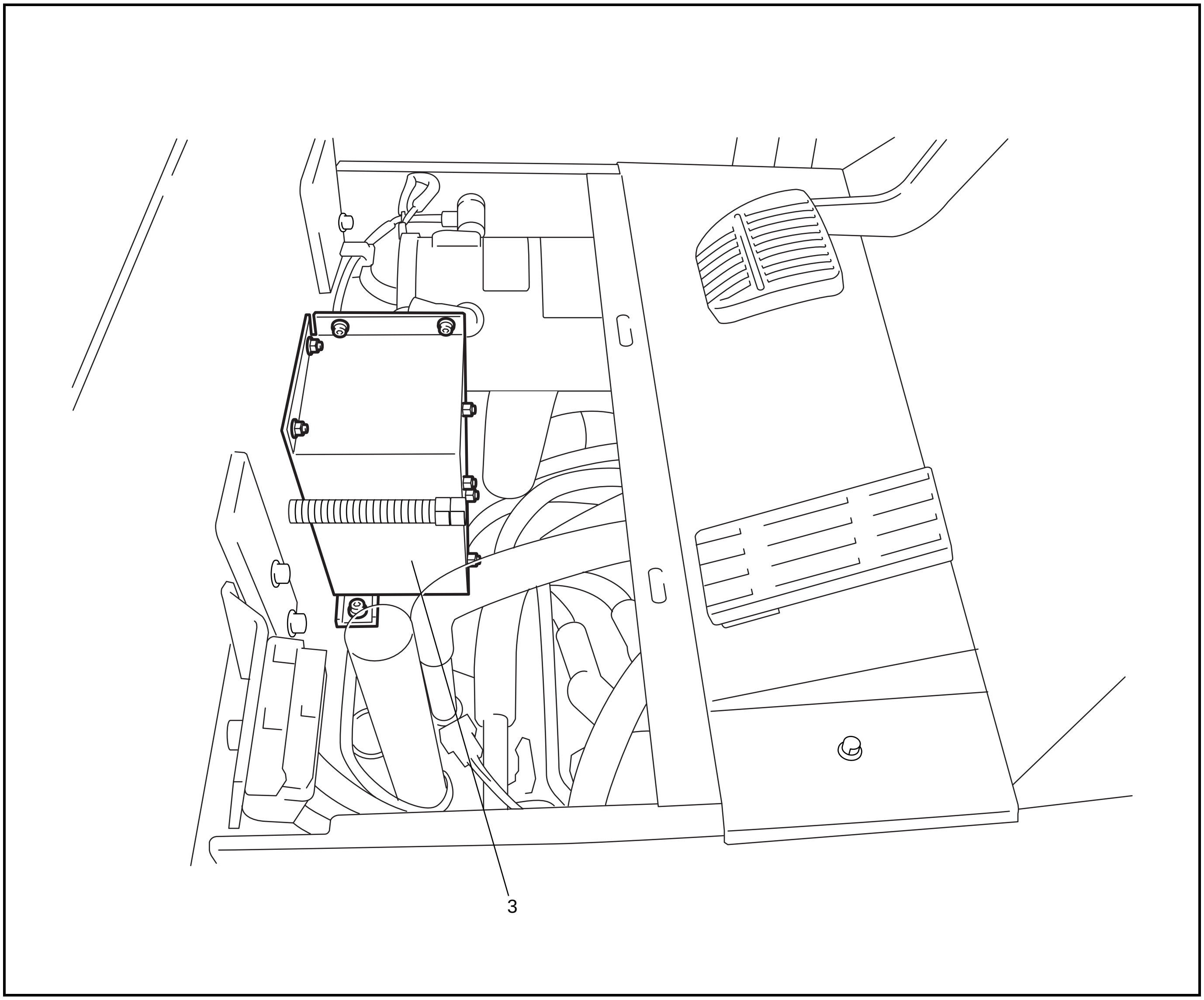








PS CONTROLLER ASSY REMOVAL·INSTALLATION (15 ~ 32 MODEL)



Removal Procedure

1 Disconnect the battery plug.
2 Remove the toe board (rear).
3 Remove the control panel ASSY.
4 Disconnect the electrical wiring.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

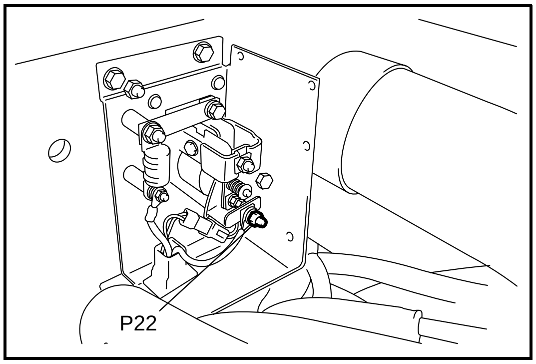
PS CONTROLLER INSPECTION (15 ~ 32 MODEL)

FHPS

Remove the cover and perform the operation with the controller installed on the vehicle.

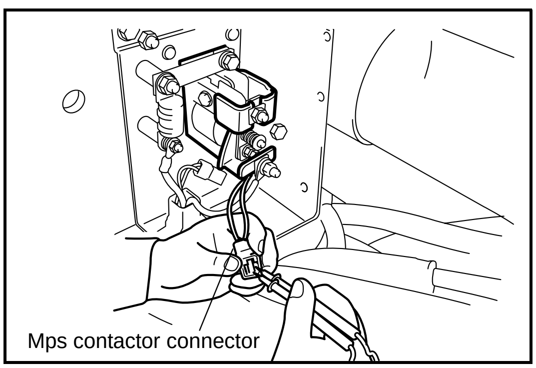
1. P22-N1 voltage measurement
   Battery plug connected·key switch ON

Measurement terminals	P22 — N1
Circuit tester range	DC200 V
Standard	36/48 V



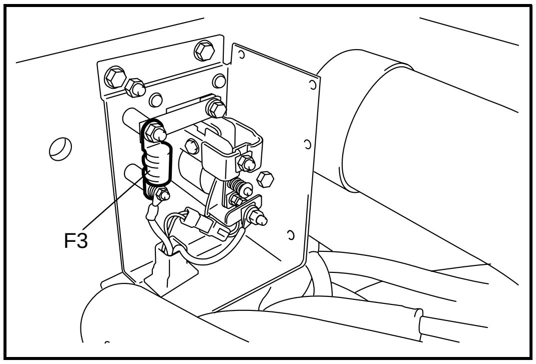
2. Mps contactor coil conduction measurement
   Battery plug disconnected·key switch OFF

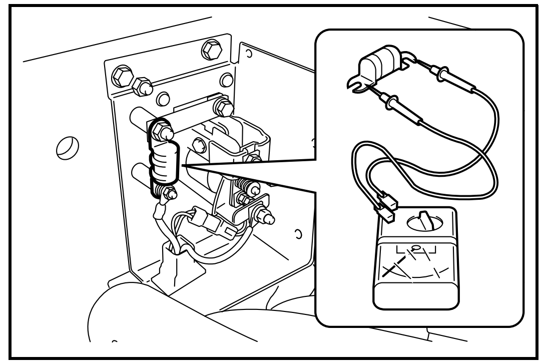
Measurement terminals	Both terminals of connector of Mps Contactor
Circuit tester range	Ω × 1
Standard	Approx. 20 Ω (at 20°C (68°F))



3. F3 (PS circuit fuse) inspection
   Battery plug disconnected, F3 removal

Measurement terminals	Both terminals of F3
Circuit tester range	$\Omega \times 1$
Standard	$0\ \Omega$





EHPS

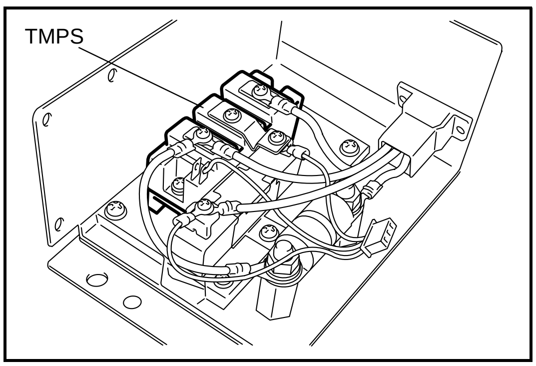
Similarly as the traveling/material handling controllers, some components can be inspected after removal from the vehicle while others cannot unless they are installed on the vehicle.

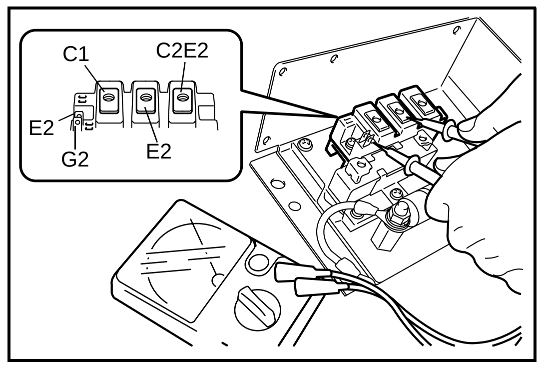
The EHPS board is to be inspected as installed on the vehicle because they must be applied with the battery voltage. The inspection method for the PS controller ASSY explained here is mainly for the state after removal from the vehicle.

1. TMPS (transistor for PS)

(1) Inspection method
Disconnect the TMPS wiring.

Portion to be inspected	Measurement terminals		Standard	Tester range
TMPS	C2E1-E2	C2E1 (-) probe - E2 (+) probe	∞ Ω	Ω × 1k
		C2E1 (+) probe - E2 (-) probe	Continuity shall exist.	
	G2-E2	G2 (-) probe - E2 (+) probe	∞ Ω	
		G2 (+) probe - E2 (-) probe	∞ Ω	
	C2E1-C1	C2E1 (-) - C1 (+)	Continuity shall exist.	
		C2E1 (+) - C1 (-)	∞ Ω	





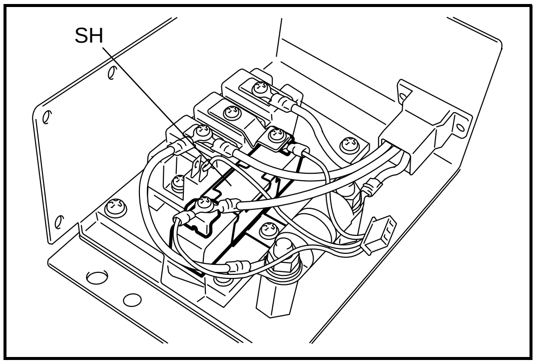
Caution:

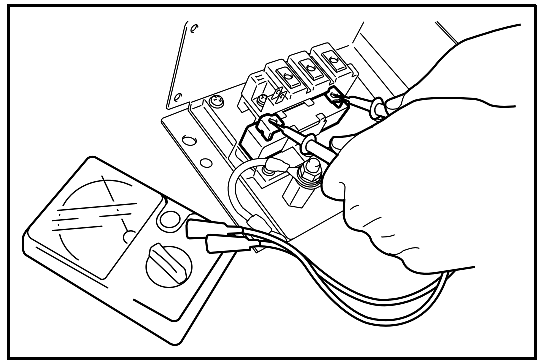
- **When shifting to check C2E1-E2 from G2-E2 short connect G2-E2 to avoid the possibility of continuity on both directions.**
- **Never touch to G2 terminal with a naked hand. Because static electricity may damage the transistor.**

2. SH (shunt)

(1) Inspection method
Disconnect the SH wiring.

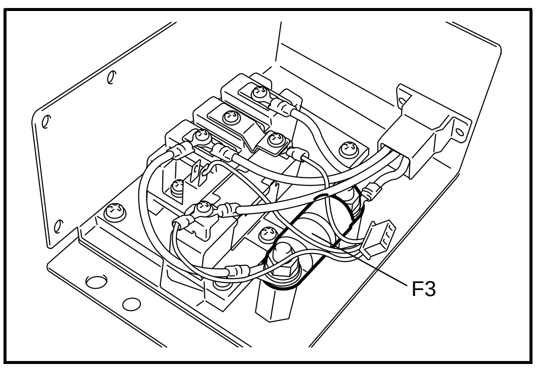
Portion to be inspected	Measurement to be inspected	Standard	Tester range
SH	Both terminals of SH	Continuity shall exist.	$\Omega \times 1$

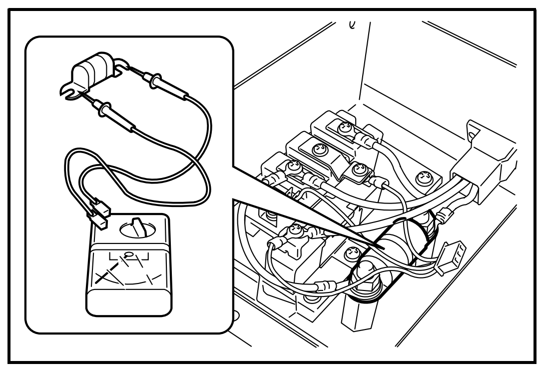




3. F3 (PS circuit fuse) inspection
F3 removal

Measurement terminals	Both terminals of F3
Tester range	$\Omega \times 1$
Standard	0 Ω

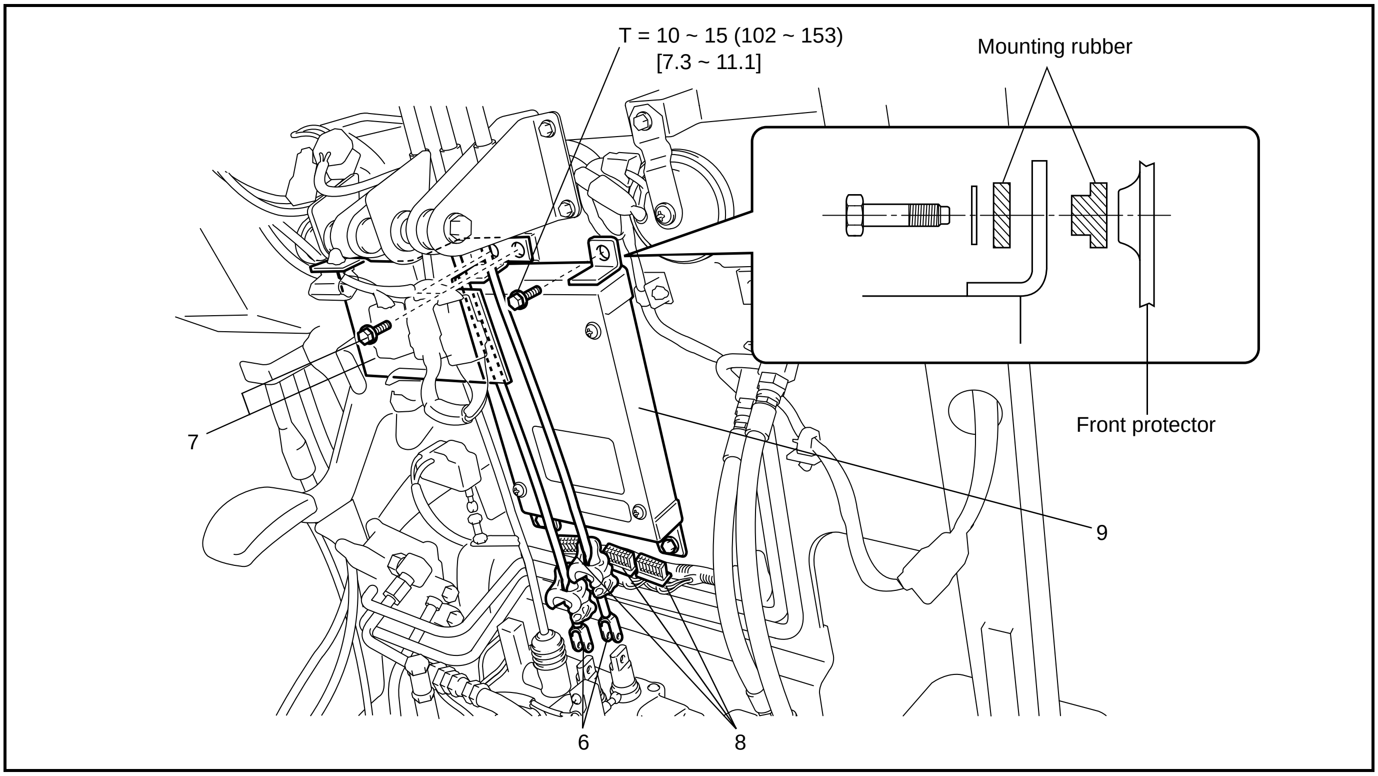




SAS CONTROLLER ASSY REMOVAL·INSTALLATION

Note:
SAS controller has a built-in yaw rate sensor. Care should be taken in handling it by preventing the dropping, contact with other objects and so forth. If dropped, replace with a new one. Don't apply the impact wrench in removing/installing the set bolts from/to the oil control valve connector bracket and SAS controller.

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

1 Disconnect the battery plug.
2 Remove the toe board (front and rear.).
3 Remove the lower panel.
4 Remove the instrument panel RH.
5 Remove the front piller cover RH.
6 Disconnect the tilt lever rod and the attachment lever rod.
7 Remove the oil control valve connector bracket.
8 Disconnect the connector.
9 Remove the controller.

Installation Procedure

Reverse the removal procedure.

Note:
- **Apply locking agent (08833-76002-71 (08833-00080)) on the threaded portion of the controller set bolts.**
- **Always use genuine controller set bolts. Correct tightening will fail if non-genuine bolts are used.**
- **When the SAS controller is replaced, perform the matching (See page 17-24).**

BOARD INSPECTION

If the cause of the trouble is judged to exist in any board, check the applied voltage and the resistance at each connector.

Also check the following items, since they may damage the board in its normal state or cause a new problem.

- Abnormality of related circuit harnesses
- Looseness of related circuit connector
- Broken or bent connector pin or defective connector pin contact on related circuits

Applied voltage and resistance measurement

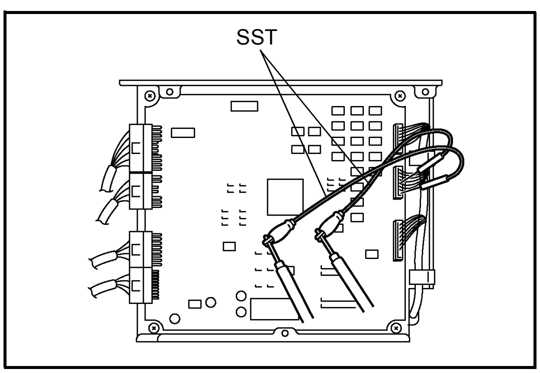
(1) Connecting SST

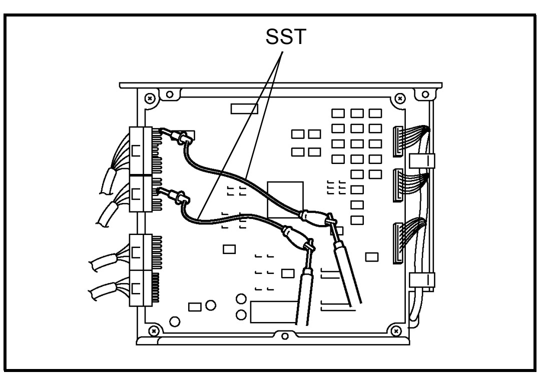
(a) Disconnect battery plug and turn the key switch to OFF.

(b) Connect the SST to the connector pin to be measured.

Caution:

- **Before starting the job, measure the voltage between P4 and N1; if there is any voltage, insert a resistor at approx. 100 Ω between P4 and N1 to discharge the capacitor. The material handling controller on models 35 to 55 is between P12 and N2.**
- **Always disconnect the battery plug before installing or removing the controller ASSY or each board.**
- **Since incorrect SST connection may damage a normal portion, always perform correct connection.**
- **Always disconnect the battery plug before resistance measurement.**



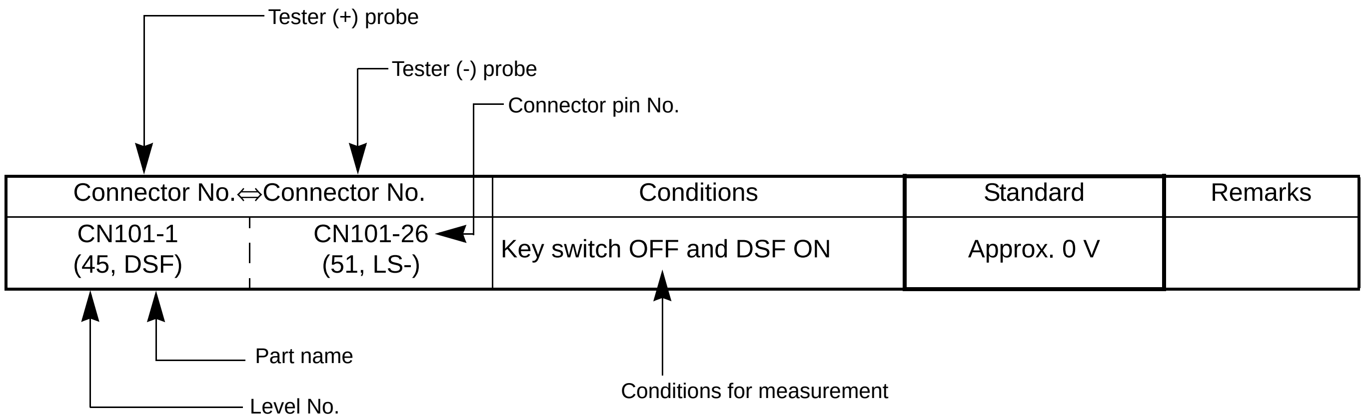


SST 09230-13700-71
Applicable connector
Traveling/material handling (15 ~ 32 model), Traveling (35 ~ 55 model) controller
CPU board :CN105 to CN107
DC/MC board :CN108 to CN110
PS controller (15 ~ 32 model)
EHPS board :CN146
Material handling controller (35 ~ 55 model)
SCPU board :CN150 and CN152
DC/PD board :CN153

SST 09240-23400-71
Applicable connector
Traveling/material handling (15 ~ 32 model), Traveling (35 ~ 55 model) controller
CPU board :CN101 to CN104
SAS controller
ST board :CN141 to CN143
PS controller (15 ~ 32 model)
EHPS board :CN145
Material handling controller (35 ~ 55 model)
SCPU board :CN147, CN148
DC/PD board :CN154, CN155

(2) CPU board: CN141 to CN143 measuring method and standard list

(a) How to read the list



15 ~ 32 MODEL

Traveling/material handling controller (15 ~ 32 model)

CPU board

CN101 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN101-1 (45, DSF)	CN101-12 (51, LS-)	Key switch OFF, DSF OFF Key switch OFF, DSF ON	Approx. 5 V Approx. 0 V	
CN101-2 (46, DSR)	CN101-12 (51, LS-)	Key switch OFF, DSR OFF Key switch OFF, DSR ON	Approx. 5 V Approx. 0 V	
CN101-3 (65, LSB)	CN101-12 (51, LS-)	Key switch OFF, LSB OFF Key switch OFF, LSB ON	Approx. 0 V Approx. 5 V	
CN101-4 (66, LSPB)	CN101-12 (51, LS-)	Key switch OFF, LSPB OFF Key switch OFF, LSPB ON	Approx. 0 V Approx. 5 V	
CN101-5 (67, LSD)	CN101-12 (51, LS-)	Key switch OFF, LSD OFF Key switch OFF, LSD ON	Approx. 5 V Approx. 0 V	
CN101-6 (63, LSAT1)		Immeasurable	—	
CN101-7 (61, LST)	CN101-12 (51, LS-)	LST OFF LST ON	Approx. 5 V Approx. 0 V	
CN101-8 (60, LSL1)	CN101-12 (51, LS-)	Key switch OFF, LSL1 OFF Key switch OFF, LSL1 ON	Approx. 5 V Approx. 0 V	
CN101-9 (—, LSOPT1)		Immeasurable	—	
CN101-10 (68, LSL2)	CN101-12 (51, LS-)	Key switch OFF, LSL2 OFF Key switch OFF, LSL2 ON	Approx. 5 V Approx. 0 V	
CN101-11 (69, LSAT2)		Immeasurable	—	
CN101-12 (51, LS-)		Immeasurable	—	
CN101-13 (—, OPTO)		Immeasurable	—	
CN101-14 (343, ISPS-)		Immeasurable	—	

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN101-15 (342, ISPS+)		Immeasurable	—	
CN101-16 (196, BMPS)	CN101-12 (51, LS-)		Approx. 0 V	Vehicle with motor brush wear warning
CN101-17 (193 BMP)	CN101-12 (51, LS-)		Approx. 0 V	Vehicle with motor brush wear warning
CN101-18 (—, LSOPT2)		Immeasurable	—	

CN102 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN102-1 (64, SWAC)	CN102-8 (50, POT-)	Key switch OFF, accelerator pedal ON	Approx. 0 V	
		Key switch OFF, accelerator pedal OFF	Approx. 5 V	
CN102-2 (52, POTA)	CN102-8 (50, POT-)	Key switch OFF, accelerator pedal depressed	0 ~ 4 V	Varies with the degree of operation
CN102-3 (80, SSD+)	CN102-8 (50, POT-)		Approx. 15 V	
CN102-4 (82, SSD2)	CN102-8 (50, POT-)		0.4 ~ 1.6 V	
CN102-5 (81, SSD1)	CN102-8 (50, POT-)		0.4 ~ 1.6 V	
CN102-6 (88, TP+)	CN102-8 (50, POT-)	Key switch OFF	Approx. 5 V	
CN102-7 (89, TP-)	CN102-8 (50, POT-)	Key switch OFF	1 ~ 4 V	
CN102-8 (50, POT-)		Immeasurable	—	
CN102-9 (86, TD+)	CN102-8 (50, POT-)	Key switch OFF	Approx. 5 V	
CN102-10 (87, TD-)	CN102-8 (50, POT-)	Key switch OFF	1 ~ 4 V	
CN102-11 (53, POTA+)	CN102-8 (50, POT-)	Key switch OFF	Approx. 5 V	
CN102-12		Unused	—	

CN103 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN103-1 (307, SMTSA)		Immeasurable	—	
CN103-2 (308, SMTSK)		Immeasurable	—	
CN103-3 (309, SSTMA)		Immeasurable	—	
CN103-4 (310, SSTMK)		Immeasurable	—	

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN103-5 (144, SMTDK)		Immeasurable	—	
CN103-6 (143, SDTMK)		Immeasurable	—	
CN103-7 (142, SDTMA)		Immeasurable	—	
CN103-8 (141, SMTDA)		Immeasurable	—	
CN103-9 (326, SS016-)		Immeasurable	—	
CN103-10 (324, SS0+)	CN102-8 (50, POT-)		Approx. 1 V	
CN103-11		Unused	—	
CN103-12 (345, ERR+)	CN103-13 (346, ERR-)		Approx. 1 V	
CN103-13 (346, ERR-)		Immeasurable	—	
CN103-14		Unused	—	
CN103-15		Unused	—	
CN103-16		Unused	—	

CN104 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN104-1 (44, VBMB)	CN104-17 (N2, N2)	Key switch OFF	Approx. 0 V	
		Key switch ON	Approx. 36 V/48 V	
CN104-2 (15, C15V)	CN104-17 (N2, N2)	Key switch OFF	14 ~ 15 V	
CN104-3 (P4, VBP4)	CN104-17 (N2, N2)		Approx. 36 V/48 V	
CN104-4 (75, CSD+)	CN104-17 (N2, N2)		14 ~ 15 V	
CN104-5 (75, CSP+)	CN104-17 (N2, N2)		14 ~ 15 V	
CN104-6 (71, CSDA)	CN104-17 (N2, N2)		Approx. 7 V	
CN104-7 (72, CSDB)	CN104-17 (N2, N2)		Approx. 7 V	
CN104-8 (73, CSP)	CN104-17 (N2, N2)		Approx. 7 V	
CN104-9 (54, CSBATT)	CN104-17 (N2, N2)		Approx. 7 V	
CN104-10 (79, THCP)	CN104-17 (N2, N2)	Key switch OFF	1 ~ 4 V	

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN104-11		Unused	—	
CN104-12 (76, CSP-)	CN104-17 (N2, N2)		Approx. 0 V	
CN104-13 (76, CSD-)	CN104-17 (N2, N2)		Approx. 0 V	
CN104-14 (14, GNDC)	CN104-17 (N2, N2)	Key switch OFF	Approx. 0 V	
CN104-15 (77, THC+)	CN104-17 (N2, N2)	Key switch OFF	Approx. 5 V	
CN104-16 (41, VBBT)	CN104-17 (N2, N2)		Approx. 36 V/48 V	
CN104-17 (N2, N2)	CN104-17 (N2, N2)		Approx. 0 V	
CN104-18 (43, VBKY)	CN104-17 (N2, N2)		Approx. 36 V/48 V	
CN104-19 (78, THCD)	CN104-17 (N2, N2)	Key switch OFF	1 ~ 4 V	
CN104-20		Unused	—	

CN105 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN105-1 (38, FAN+)	CN104-17 (N2, N2)		Approx.5 V	
CN105-2 (38, FAN+)	CN104-17 (N2, N2)		Approx. 5 V	
CN105-3 (36, FANCD)	CN104-17 (N2, N2)	When the fan is off When the fan is on	Approx. 5 V Approx. 0 V	
CN105-4 (19, 20V NO.20N)	CN104-17 (N2, N2)		Approx. 4 V	
CN105-5		Unused	—	
CN105-6 (39, DDC)	CN104-17 (N2, N2)		Approx. 4 V	
CN105-7 (40, PDC)	CN104-17 (N2, N2)		Approx. 4 V	
CN105-8 (94, CKFAND+)	CN105-9 (97, CKFAND-)	When the fan is on	0 ~ 1.5 V	
CN105-9 (97, CKFAND-)		Immeasurable	—	
CN105-10 (13, 20V NO.10N)	CN104-17 (N2, N2)		Approx. 4 V	
CN105-11 (37, CK20V)	CN104-17 (N2, N2)		Approx. 0 V	

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN105-12		Unused	—	
CN105-13		Unused	—	
CN105-14		Unused	—	

CN106 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN106-1		Unused	—	
CN106-2 (27, CHOPB)		Immeasurable	—	
CN106-3 (28, CHOPP)		Immeasurable	—	
CN106-4 (29, CHOPS)		Immeasurable	—	
CN106-5 (31, OCL)		Immeasurable	—	
CN106-6		Unused	—	
CN106-7 (32, TMPAD-)		Immeasurable	—	
CN106-8 (33, TMPD+)	CN104-17 (N2, N2)		Approx. 5 V	
CN106-9 (35, CKPV)	CN104-17 (N2, N2)		Approx. 10 V	
CN106-10		Unused	—	
CN106-11		Unused	—	

CN107 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN107-1 (26, TMDU+)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-2 (20, TMDAU-)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-3 (21, TMDBU-)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-4 (22, TMDCU-)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-5 (23, TMDAD-)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-6 (24, TMDBD-)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-7 (25, TMDCD-)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-8 (26, TMDD+)	CN104-17 (N2, N2)		Approx. 5 V	
CN107-9 (34, CKDV)	CN104-17 (N2, N2)		Approx. 10 V	
CN107-10		Unused	—	

DC/MD board

CN111 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN111-1 (41, B48V)	CN112-18 (N2, N2)		Approx. 36 V/48 V	
CN111-2 (10, MPS+)	CN111-8 (9, MPS-)	Measurement with (-) probe in contact with CN111-8	Approx. 11 V	PS controller STD model
CN111-3 (338, H15V+)	CN111-9 (315, H15V)		Approx. 15 V	
CN111-4 (11, S20V+)	CN111-12 (12, S20V-)		Approx. 20 V	
CN111-5 (16, D15V)	CN111-13 (14, GNDD)		14 ~ 15 V	
CN111-6 (43, VBKY)	CN112-18 (N2, N2)		Approx. 36 V/48 V	
CN111-7		Unused	—	
CN111-8 (9, MPS-)	CN111-2	Battery plug disconnected Resistance measurement	Approx. 20 Ω	PS controller STD model
CN111-9 (315, H15V-)		Immeasurable	—	
CN111-10 (338, B20V+)		Unused	—	
CN111-11 (44, VBMB)	CN112-18 (N2, N2)		Approx. 36 V/48 V	
CN111-12 (12, S20V-)		Immeasurable	—	
CN111-13 (14, GNDD)		Immeasurable	—	
CN111-14		Unused	—	

CN112 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN112-1 (162, TMPD2+)	CN112-2 (N2, TMPD-SD)		13 ~ 15 V	
CN112-2 (N2, TMPD-SD)		Immeasurable	—	
CN112-3 (153, TMPD-G)	CN112-2 (N2, TMPD-SD)		13 ~ 15 V	
CN112-4 (162, TMPD1+)	CN112-2 (N2, TMPD-SD)		13 ~ 15 V	
CN112-5 (15, C15V)	CN112-18 (N2, N2)		14 ~ 15 V	
CN112-6 (41, B48V)	CN112-18 (N2, N2)		Approx. 36 V/48 V	
CN112-7 (43, VBKY)	CN112-18 (N2, N2)		Approx. 36 V/48 V	

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN112-8 (44, VBMB)	CN112-18 (N2, N2)		Approx. 36 V/48 V	
CN112-9		Unused	—	
CN112-10 (1, MB+ (MD+))	CN112-11 (2, MB- (MD-))	Measurement with (-) probe in contact with CN112-11	Approx. 11 V	
CN112-11 (2, MB- (MD-))	CN112-10 (1, MB+ (MD+))	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN112-12 (7, FAND+)	CN112-13 (8, FAND-)	When the fan is off When the fan is on	Approx. 24 V Approx. 0 V	
CN112-13 (8, FAND-)		Immeasurable	—	
CN112-14 (14, GNDC)		Immeasurable	—	
CN112-15 (5, MP+)		Unused	—	
CN112-16 (6, MP-)		Unused	—	
CN112-17 (N2, N2)		Immeasurable	—	
CN112-18 (N2, N2)		Immeasurable	—	

CN113 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN113-1 (150, TMDAU1+)	CN113-14 (P5, TMDAU-SD)		13 ~ 15 V	
CN113-2 (152, TMDAD1+)	CN113-15 (N2, TMDAD-SD)		13 ~ 15 V	
CN113-3 (154, TMDBU1+)	CN113-16 (P6, TMDBU-SD)		13 ~ 15V	
CN113-4 (151, TMDAU-G)	CN113-14 (P5, TMDAU-SD)		13 ~ 15V	
CN113-5 (153, TMDAD-G)	CN113-15 (N2, TMDAD-SD)		13 ~ 15 V	
CN113-6 (155, TMDBU-G)	CN113-16 (P6, TMDBU-SD)		13 ~ 15 V	
CN113-7 (157, TMDBD-G)	CN113-24 (N2, TMDBD-SD)		13 ~ 15V	
CN113-8 (159, TMDCU-G)	CN113-25 (P9, TMDCU-SD)		13 ~ 15 V	
CN113-9 (161, TMDCD-G)	CN113-26 (N2, TMDCD-SD)		13 ~ 15 V	
CN113-10		Unused	—	

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN113-11 (156, TMDBD1+)	CN113-24 (N2, TMDBD-SD)		13 ~ 15 V	
CN113-12 (158, TMDCU1+)	CN113-25 (P7, TMDCU-SD)		13 ~ 15 V	
CN113-13 (160, TMDCD1+)	CN113-26 (N2, TMDCD-SD)		13 ~ 15 V	
CN113-14 (P5, TMDAU-SD)		Immeasurable	—	
CN113-15 (N2, TMDAD-SD)		Immeasurable	—	
CN113-16 (P6, TMDBU-SD)		Immeasurable	—	
CN113-17 (150, TMDAU2+)	CN113-14 (P3, TMDAU-SD)		13 ~ 15 V	
CN113-18 (152, TMDAD2+)	CN113-15 (N2, TMDAD-SD)		13 ~ 15 V	
CN113-19 (154, TMDBU2+)	CN113-16 (P5, TMDBU-SD)		13 ~ 15 V	
CN113-20 (156, TMDBD2+)	CN113-24 (N2, TMDBD-SD)		13 ~ 15 V	
CN113-21 (158, TMDCU2+)	CN113-25 (P7, TMDCU-SD)		13 ~ 15 V	
CN113-22 (160, TMDCD2+)	CN113-26 (N2, TMDCD-SD)		13 ~ 15 V	
CN113-23		Unused	—	
CN113-24 (N2, TMDBD-SD)		Immeasurable	—	
CN113-25 (P9, TMDCU-SD)		Immeasurable	—	
CN113-26 (N2, TMDCD-SD)		Immeasurable	—	

MMP board

CN114 to CN119, and CN123 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CNOOO-1 (TM ***2+)	CNOOO-3 (TM ***-SD)		14 ~ 15 V	
CNOOO-2 (TM ***1+)	CNOOO-3 (TM ***-SD)		14 ~ 15 V	
CNOOO-3 (TM ***-SD)	—		—	
CNOOO-4 (TM ***-G)	CNOOO-3 (TM ***-SD)		13 ~ 15 V	

Traverling/material handling controller (15 ~ 32 model)

CN137 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN137-1 (2, MD-)	CN137-3 (1, MD+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN137-2 (N2, N2)		Immeasurable	—	
CN137-3 (1, MD+)	CN137-1 (2, MD-)	Measurement with (-) probe in contact with CN137-1	Approx. 11 V	
CN137-4 (6, MP-)	CN137-5 (5, MP+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	Chopper-less
CN137-5 (5, MP+)	CN137-4 (6, MP-)	Measurement with (-) probe in contact with CN137-4	Approx. 11 V	Chopper-less
CN137-6 (44, F6)			—	

CN139 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN139-1 (18, FAN3+)	CN139-2 (N2, FAN3-)		Approx. 24 V	
CN139-2 (N2, FAN3-)		Immeasurable	—	

SAS controller (15 ~ 32 model)

ST board

CN141 basic conditions (battery plug connected, key switch ON)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN141-1 (137, SL/L+)	CN141-11 (320, STPOT-)		Approx. 5 V	
CN141-2 (57, POTT+)	CN141-11 (320, STPOT-)		Approx. 5 V	
CN141-3 (56, POTT)	CN141-11 (320, STPOT-)		0.5 ~ 4.5 V	
CN141-4 (58, SPL+)	CN141-11 (320, STPOT-)		Approx. 15 V	
CN141-5 (309, SSTMA)		Immeasurable	—	
CN141-6 (307, SMTSA)		Immeasurable	—	
CN141-7 (310, SSTMK)		Immeasurable	—	
CN141-8 (308, SMTSK)		Immeasurable	—	
CN141-9 (51, OLSD-)		Immeasurable	—	
CN141-10 (138, SL/L-)	CN141-11 (320, STPOT-)		Approx. 5 V	
CN141-11 (320, STPOT-)		Immeasurable	—	
CN141-12 (59, SPL)	CN141-11 (320, STPOT-)		0.5 ~ 4.5 V	
CN141-13 (324, SS+)	CN141-14 (326, SS-)		Approx. 1.5 V	
CN141-14 (326, SS-)		Immeasurable	—	
CN141-15 (61, OLST+)	CN141-16 (51, OLST-)		Approx. 5 V	
CN141-16 (51, OLST-)		Immeasurable	—	
CN141-17 (67, OLSD+)	CN141-9 (51, OLSD-)	LSD OFF	Approx. 5 V	
		LSD ON	Approx. 0 V	
CN141-18		Unused	—	

CN142 basic conditions (battery plug connected, key switch ON)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN142-1 (303, VBMB2)	CN142-7 (N2, N2)		48 V/36 V	
CN142-2 (90, MH1)	CN141-11 (12, S20V-)	SWMH1 ON SWMH1 OFF	Approx. 0 V Approx. 5 V	
CN142-3 (91, MH2-1)	CN141-11 (12, S20V-)	SWMH1 ON SWMH1 OFF	Approx. 5 V Approx. 0 V	
CN142-4 (70, SWTK)	CN141-11 (12, S20V-)	SWTK OFF SWTK ON	Approx. 5 V Approx. 0 V	
CN142-5 (11, S20V+)	CN141-11 (12, S20V-)		Approx. 20 V	
CN142-6 ((N2), (N2))		Unused	—	
CN142-7 (N2, N2)		Immeasurable	—	
CN142-8 (304, STLSD)	CN142-11 (12, S20V-)	LSD OFF LSD ON	Approx. 5 V Approx. 0 V	
CN142-9 (305, STLSTF)	CN142-11 (12, S20V-)	LSTF OFF LSTF ON	Approx. 5 V Approx. 0 V	
CN142-10 (306, STLSTR)	CN142-11 (12, S20V-)	LSTR OFF LSTR ON	Approx. 5 V Approx. 0 V	
CN142-11 (12, S20V-)			—	
CN142-12 ((12), (S20V-))		Unused	—	

CN143 basic conditions (battery plug connected, key switch ON)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN143-1 (330, SOLT-)	CN143-7 (327, SOLTS+)	Battery plug disconnected Resistance measurement	Approx. 10 Ω	
		LSTR ON	Approx. 12 V	
CN143-2 (328, SOLS-)	CN143-7 (327, SOLTS+)	Battery plug disconnected Resistance measurement	Approx. 6 Ω	
			Approx. 12 V	
CN143-3 (334, SOLD)	CN143-8 (331, SOLLD+)	Battery plug disconnected Resistance measurement	Approx. 10 Ω	
		LSD ON	Approx. 12 V	
CN143-4		Unused	—	
CN143-5 (332, SOLL-)	CN143-8 (331, SOLLD+)	Battery plug disconnected Resistance measurement	Approx. 10 Ω	
			Approx. 12 V	
CN143-6 ((327), (SOLTS+))		Unused	—	
CN143-7 (327, SOLTS+)		Immeasurable	—	
CN143-8 (331, SOLLD+)		Immeasurable	—	
CN143-9 (—, SXTSA)		Unused	—	
CN143-10 (—, SSTXA)		Unused	—	
CN143-11 (—, SXTSK)		Unused	—	
CN143-12 (—, SSTXK)		Unused	—	

CN144 basic conditions (battery plug connected, key switch ON)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN144-1 (321, SYR+)	CN144-2 (323, SYR-)		Approx. 5 V	
CN144-2 (323, SYR-)		Immeasurable	—	
CN144-3 (322, SYR)	CN144-2 (323, SYR-)		Approx. 2.5 V	

PS controller (15 ~ 32 model)

EHPS board

CN145 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN145-1 (43, VBKY)	CN145-5 (315, STS-)		48 V/36 V	
CN145-2		Unused	—	
CN145-3 (312, STS1)		Immeasurable	—	
CN145-4 (313, STS2)		Immeasurable	—	
CN145-5 (315, STS-)		Immeasurable	—	
CN145-6		Unused	—	
CN145-7		Unused	—	
CN145-8 (342, ISTPA)	CN145-9 (343, ISTPK)		Approx. 1.5 V	
CN145-9 (343, ISTPK)		Immeasurable	—	
CN145-10 (345, ERR+)	CN145-11 (346, ERR-)		Approx. 1.5 V	
CN145-11 (346, ERR-)		Immeasurable	—	
CN145-12		Unused	—	

CN146 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN146-1 (340, TMPSG)		Immeasurable	—	
CN146-2 (P24, SH+)		Immeasurable	—	
CN146-3 (N1, SH-)		Immeasurable	—	

CN51 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN51-1 (P21, FET/C1)	CN51-4 (N1, SH)		48/36 V	
CN51-2 (P1, F3 FUSE)	CN51-4 (N1, SH)		48/36 V	
CN51-3 (P23, FET/C2E1)		Immeasurable	—	
CN51-4 (N1, SH)		Immeasurable	—	

35 ~ 55 MODEL

Traveling controller (35 ~ 55 model)

CPU board

CN101 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN101-1 (45, DSF)	CN101-26 (51, LS-)	Key switch OFF, DSF ON Key switch OFF, DSF OFF	Approx. 0 V Approx. 5 V	
CN101-2 (46, DSR)	CN101-26 (51, LS-)	Key switch OFF, DSR ON Key switch OFF, DSR OFF	Approx. 0 V Approx. 5 V	
CN101-3 (65, LSB)	CN101-26 (51, LS-)	Key switch OFF, LSB ON Key switch OFF, LSB OFF	Approx. 5 V Approx. 0 V	
CN101-4 (66, LSPB)	CN101-26 (51, LS-)	Key switch OFF, LSPB ON Key switch OFF, LSPB OFF	Approx. 5 V Approx. 0 V	
CN101-5 (67, LSD)	CN101-26 (51, LS-)	Key switch OFF, LSD ON (with shorting connector) Key switch OFF, LSD OFF	Approx. 0 V Approx. 5 V	
CN101-6		Unused	—	
CN101-7		Unused	—	
CN101-8		Unused	—	
CN101-9 (307, SMTSA)		Immeasurable	—	
CN101-10 (308, SMTSK)		Immeasurable	—	
CN101-11		Unused	—	
CN101-12 (309, SSTMA)		Immeasurable	—	
CN101-13 (310, SSTMK)		Immeasurable	—	
CN101-14		Unused	—	

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN101-15		Unused	—	
CN101-16		Unused	—	
CN101-17		Unused	—	
CN101-18		Unused	—	
CN101-19		Unused	—	
CN101-20		Unused	—	
CN101-21		Unused	—	
CN101-22		Unused	—	
CN101-23 (68, LSL2)	CN101-26 (51, LS-)	Key switch OFF, LSL2 ON Key switch OFF, LSL2 OFF	Approx. 0 V Approx. 5 V	
CN101-24		Unused	—	
CN101-25		Unused	—	
CN101-26 (51, LS-)		Immeasurable	—	
CN101-27		Unused	—	
CN101-28		Unused	—	
CN101-29		Unused	—	
CN101-30		Unused	—	
CN101-31		Unused	—	
CN101-32 (60, LSL)	CN101-26 (51, LS-)	Key switch OFF, LSL ON Key switch OFF, LSL OFF	Approx. 0 V Approx. 5 V	
CN101-33 (324, SS0+)	CN101-26 (51, LS-)	Key switch ON Key switch OFF	Approx. 1 V Approx. 5 V	
CN101-34 (325, SS0-)		Immeasurable	—	

CN102 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN102-1 (64, SWAC)	CN102-22 (51, POT-)	Key switch OFF, SWAC ON Key switch OFF, SWAC OFF	Approx. 0 V Approx. 5 V	
CN102-2 (52, POTA)	CN102-22 (51, POT-)	Key switch OFF, accelerator pedal depressed	0.5 ~ 3 V	Varies with the degree of operation
CN102-3		Unused	—	
CN102-4		Unused	—	
CN102-5		Unused	—	
CN102-6 (81, SSD1)	CN102-22 (51, POT-)		1 ~ 3 V	
CN102-7 (82, SSD2)	CN102-22 (51, POT-)		1 ~ 3 V	
CN102-8		Unused	—	
CN102-9		Unused	—	
CN102-10 (86, TD+)	CN102-22 (51, POT-)		Approx. 5 V	
CN102-11 (87, TD-)	CN102-22 (51, POT-)		1 ~ 4 V	
CN102-12 (88, TD2+)	CN102-22 (51, POT-)		Approx. 5 V	
C102-13 (89, TD2-)	CN102-22 (51, POT-)		1 ~ 4 V	
CN102-14 (53, POTA+)	CN102-22 (51, POT-)		Approx. 4.6 V	
CN102-15		Unused	—	
CN102-16		Unused	—	
CN102-17		Unused	—	
CN102-18 (80, SSD+)	CN102-22 (51, POT-)		Approx. 15 V	
CN102-19		Unused	—	
CN102-20		Unused	—	
CN102-21		Unused	—	
CN102-22 (51, POT-)		Immeasurable	—	

CN103 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN103-1 (3, MP1+)	CN103-2 (4, MP1-)	Measurement with (-) probe in contact with CN103-2	Approx. 11 V	
CN103-2 (4, MP1-)	CN103-1 (3, MP1+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN103-3 (41, B48V)	CN104-10 (N2, N2)		Approx. 36 V Approx. 48 V	
CN103-4 (43, VBKY)	CN104-10 (N2, N2)		Approx. 36 V Approx. 48 V	
CN103-5 (5, MP2+)		Immeasurable	—	
CN103-6 (6, MP2-)	CN103-5 (5, MP2+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN103-7 (41, VBBT)	CN104-10 (N2, N2)		Approx. 36 V Approx. 48 V	
CN103-8		Unused	—	
CN103-9		Unused	—	
CN103-10 (16, D15V)	CN104-10 (N2, N2)		14 ~ 15 V	
CN103-11		Unused	—	
CN103-12 (14, GNDD)	CN104-10 (N2, N2)		Approx. 0 V	
CN103-13 (144, SMTDK)		Immeasurable	—	
CN103-14 (143, SDTMK)		Immeasurable	—	
CN103-15 (142, SDTMA)		Immeasurable	—	
CN103-16 (141, SMTDA)		Immeasurable	—	

CN104 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN104-1 (N2, N2C)	CN104-10 (N2, N2)		Approx. 0 V	
CN104-2 (54, CSBATT)	CN104-10 (N2, N2)		Approx. 7 V	
CN104-3 (19, CHOPD2-)			4 ~ 5 V	
CN104-4		Unused	—	
CN104-5 (75, CSD+)	CN104-10 (N2, N2)		14 ~ 15 V	
CN104-6 (75, CSD2+)	CN104-10 (N2, N2)		14 ~ 15 V	

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN104-7 (71, CSDA)	CN104-10 (N2, N2)		Approx. 7 V	
CN104-8 (72, CSDB)	CN104-10 (N2, N2)		Approx. 7 V	
CN104-9 (13, C20V)	CN104-10 (N2, N2)		Approx. 21 V	
CN104-10 (N2, N2)	CN104-10 (N2, N2)		Approx. 0 V	
CN104-11 (2, MD1-)	CN104-13 (1, MD1+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN104-12 (P4, VBP4)	CN104-10 (N2, N2)		Approx. 36 V Approx. 48 V	
CN104-13 (1, MD1+)	CN104-11 (2, MD1-)	Measurement with (-) probe in contact with CN104-11	Approx. 11 V	
CN104-14 (44, VBMB)	CN104-10 (N2, N2)		Approx. 36 V Approx. 48 V	
		Key switch OFF	Approx. 0 V	
CN104-15 (41, B48V)	CN104-10 (N2, N2)		Approx. 36 V Approx. 48 V	
CN104-16 (16, D15V)	CN104-10 (N2, N2)		14 ~ 15 V	
CN104-17 (15, C15V)	CN104-10 (N2, N2)		14 ~ 15 V	
CN104-18 (73, CSDA2)	CN104-10 (N2, N2)		Approx. 7 V	
CN104-19 (74, CSDB2)	CN104-10 (N2, N2)		Approx. 7 V	
CN104-20 (78, THCD)	CN104-10 (N2, N2)		1 ~ 4 V	
CN104-21 (77, THC+)	CN104-10 (N2, N2)		Approx. 5 V	
CN104-22 (44, VBMB)	CN104-10 (N2, N2)		Approx. 36 V Approx. 48 V	
		Key switch OFF	Approx. 0 V	
CN104-23 (14, GNDD)	CN104-10 (N2, N2)		Approx. 0 V	
CN104-24 (14, GNDC)	CN104-10 (N2, N2)		Approx. 0 V	
CN104-25 (79, THCD2)	CN104-10 (N2, N2)		1 ~ 4 V	
CN104-26		Unused	—	
CN104-27 (76, CSD-)	CN104-10 (N2, N2)		Approx. 0 V	
CN104-28 (76, CSD2-)	CN104-10 (N2, N2)		Approx. 0 V	

CN105 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN105-1 (38, FAN+)	CN106-10		Approx. 5 V	
CN105-2 (38, FAN+)	CN106-10		Approx. 5 V	
CN105-3 (36, FANCD)			3 ~ 5 V (3 ~ 5 V)	Fan stopped (fan ON)
CN105-4 (37, FANCD2)			3 ~ 5 V (3 ~ 5 V)	Fan stopped (fan ON)
CN105-5		Unused	—	
CN105-6 (39, DDC)	CN106-10		Approx. 4 V	
CN105-7 (40, D2DC)	CN106-10		Approx. 4 V	
CN105-8 (94, CKFAND+)	CN105-9 (97, CKFAND-)		0 ~ 1 V (0 ~ 1 V)	Fan stopped (fan ON)
CN105-9 (97, CKFAND-)		Immeasurable	—	
CN105-10 (98, CKFAND2+)	CN106-10		0 ~ 1 V (0 ~ 1 V)	Fan stopped (fan ON)
CN105-11 (99, CKFAND2-)		Immeasurable	—	
CN105-12		Unused	—	
CN105-13		Unused	—	
CN105-14 (100, CHGFAN)	CN106-10		Approx. 5 V	

CN106 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN106-1 (33, TMDU2+)	CN106-10		Approx. 5 V	
CN106-2 (27, TMDAU2-)	CN106-10		Approx. 5 V	
CN106-3 (28, TMDBU2-)	CN106-10		Approx. 5 V	
CN106-4 (29, TMDCU2-)	CN106-10		Approx. 5 V	
CN106-5 (30, TMDAD2-)	CN106-10		Approx. 5 V	
CN106-6 (31, TMDBD2-)	CN106-10		Approx. 5 V	
CN106-7 (32, TMDCD2-)	CN106-10		Approx. 5 V	
CN106-8 (33, TMDD2+)	CN106-10		Approx. 5 V	
CN106-9 (35, CKDV2)	CN106-10		Approx. 10 V	
CN106-10		Immeasurable	—	
CN106-11		Immeasurable	—	

CN107 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN107-1 (26, TMDU+)	CN106-10		Approx. 5 V	
CN107-2 (20, TMDAU-)	CN106-10		Approx. 5 V	
CN107-3 (21, TMDBU-)	CN106-10		Approx. 5 V	
CN107-4 (22, TMDCU-)	CN106-10		Approx. 5 V	
CN107-5 (23, TMDAD-)	CN106-10		Approx. 5 V	
CN107-6 (24, TMDBD-)	CN106-10		Approx. 5 V	
CN107-7 (25, TMDCD-)	CN106-10		Approx. 5 V	
CN107-8 (26, TMDD+)	CN106-10		Approx. 5 V	
CN107-9 (34, CKDV)	CN106-10		Approx. 10 V	
CN107-10		Unused	—	

DC/MD board

CN111 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN111-1 (150, TMDAU1+)	CN111-14 (P3, TMDAU-SD)		13 ~ 15 V	
CN111-2 (152, TMDAD1+)	CN111-15 (N2, TMDAD-SD)		13 ~ 15 V	
CN111-3 (154, TMDBU1+)	CN111-16 (P5, TMDBU-SD)		13 ~ 15 V	
CN111-4 (151, TMDAU-G)	CN111-14 (P3, TMDAU-SD)		13 ~ 15 V	
CN111-5 (153, TMDAD-G)	CN111-15 (N2, TMDAD-SD)		13 ~ 15 V	
CN111-6 (155, TMDBU-G)	CN111-16 (P5, TMDBU-SD)		13 ~ 15 V	
CN111-7 (157, TMDBD-G)	CN111-24 (N2, TMDBD-SD)		13 ~ 15 V	
CN111-8 (159, TMDCU-G)	CN111-25 (P7, TMDCU-SD)		13 ~ 15 V	
CN111-9 (161, TMDCD-G)	CN111-26 (N2, TMDCD-SD)		13 ~ 15 V	
CN111-10		Unused	—	
CN111-11 (156, TMDBD1+)	CN111-24 (N2, TMDBD-SD)		13 ~ 15 V	
CN111-12 (158, TMDCU1+)	CN111-25 (P7, TMDCU-SD)		13 ~ 15 V	
CN111-13 (160, TMDCD1+)	CN111-26 (N2, TMDCD-SD)		13 ~ 15 V	
CN111-14 (P3, TMDAU-SD)		Immeasurable	—	
CN111-15 (N2, TMDAD-SD)		Immeasurable	—	
CN111-16 (P5, TMDBU-SD)		Immeasurable	—	
CN111-17 (150, TMDAU2+)	CN111-14 (P3, TMDAU-SD)		13 ~ 15 V	
CN111-18 (152, TMDAD2+)	CN111-15 (N2, MDAD-SD)		13 ~ 15 V	
CN111-19 (154, TMDBU2+)	CN111-16 (P5, TMDBU-SD)		13 ~ 15 V	
CN111-20 (156, TMDBD2+)	CN111-24 (N2, TMDBD-SD)		13 ~ 15 V	
CN111-21 (158, TMDCU2+)	CN111-25 (P7, TMDCU-SD)		13 ~ 15 V	
CN111-22 (160, TMDCD2+)	CN111-26 (N2, TMDCD-SD)		13 ~ 15 V	
CN111-23		Unused	—	

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN111-24 (N2, TMDBD-SD)		Immeasurable	—	
CN111-25 (P7, TMDCU-SD)		Immeasurable	—	
CN111-26 (N2, TMDCD-SD)		Immeasurable	—	

CN112 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN112-1 (162, TMDAU21+)	CN112-14 (P51, TMDAU2-SD)		13 ~ 15 V	
CN112-2 (164, TMDAD21+)	CN112-15 (N2, TMDAD2-SD)		13 ~ 15 V	
CN112-3 (166, TMDBU21+)	CN112-16 (P61, TMDBU2-SD)		13 ~ 15 V	
CN112-4 (163, TMDAU2-G)	CN112-14 (P51, TMDAU2-SD)		13 ~ 15 V	
CN112-5 (165, TMDAD2-G)	CN112-15 (N2, TMDAD2-SD)		13 ~ 15 V	
CN112-6 (167, TMDBU2-G)	CN112-16 (P61, TMDBU2-SD)		13 ~ 15 V	
CN112-7 (169, TMDBD2-G)	CN112-24 (N2, TMDBD2-SD)		13 ~ 15 V	
CN112-8 (171, TMDCU2-G)	CN112-25 (P91, TMDCU2-SD)		13 ~ 15 V	
CN112-9 (173, TMDCD2-G)	CN112-26 (N2, TMDCD2-SD)		13 ~ 15 V	
CN112-10		Unused	—	
CN112-11 (168, TMDBD21+)	CN112-24 (N2, TMDBD2-SD)		13 ~ 15 V	
CN112-12 (170, TMDCU21+)	CN112-25 (P91, TMDCU2-SD)		13 ~ 15 V	
CN112-13 (172, TMDCD21+)	CN112-26 (N2, TMDCD2-SD)		13 ~ 15 V	
CN112-14 (P51, TMDAU2-SD)		Immeasurable	—	
CN112-15 (N2, TMDAD2-SD)		Immeasurable	—	
CN112-16 (P61, TMDBU2-SD)		Immeasurable	—	
CN112-17 (162, TMDAU22+)	CN112-14 (P51, TMDAU2-SD)		13 ~ 15 V	
CN112-18 (164, TMDAD22+)	CN112-15 (N2, TMDAD2-SD)		13 ~ 15 V	
CN112-19 (166, TMDBU22+)	CN112-16 (P61, TMDBU2-SD)		13 ~ 15 V	
CN112-20 (168, TMDBD22+)	CN112-24 (N2, TMDBD2-SD)		13 ~ 15 V	

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN112-21 (170, TMDCU22+)	CN112-25 (P91, TMDCU2-SD)		13 ~ 15 V	
CN112-22 (172, TMDCD22+)	CN112-26 (N2, TMDCD2-SD)		13 ~ 15 V	
CN112-23		Unused	—	
CN111-24 (N2, TMDBD2-SD)		Immeasurable	—	
CN111-25 (P91, TMDCU2-SD)		Immeasurable	—	
CN112-26 (N2, TMDCD2-SD)		Immeasurable	—	

CN113 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN113-1 (41, B48V)	CN113-18 (N2, N2)		Approx. 36 V Approx. 48 V	
CN113-2 (44, VBMB)	CN113-18 (N2, N2)		Approx. 36 V Approx. 48 V	
CN113-3		Unused	—	
CN113-4 (7, FAND+)	CN113-18 (N2, N2)		Approx. 0 V (Approx. 24 V)	Fan stopped (fan ON)
CN113-5 (8, FAND-)		Immeasurable	—	
CN113-6 (9, FANP+)	CN113-18 (N2, N2)		Approx. 0 V (Approx. 24 V)	Fan stopped (fan ON)
CN113-7 (10, FANP-)		Immeasurable	—	
CN113-8		Unused	—	
CN113-9		Unused	—	
CN113-10		Unused	—	
CN113-11		Unused	—	
CN113-12 (14, GNDD)	CN113-18 (N2, N2)		Approx. 0 V	
CN113-13 (14, GNDC)	CN113-18 (N2, N2)		Approx. 0 V	
CN113-14 (16, D15V)	CN113-18 (N2, N2)		14 ~ 15 V	
CN113-15 (15, C15V)	CN113-18 (N2, N2)		14 ~ 15 V	
CN113-16 (13, C20V)	CN113-18 (N2, N2)		Approx. 21 V	
CN113-17 (N2, N2)		Immeasurable	—	
CN113-18 (N2, N2)		Immeasurable	—	

MMP board

CN114 to CN125 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CNOOO-1 (TM ***2+)	CNOOO-3 (TM ***-SD)		14 ~ 15 V	
CNOOO-2 (TM ***1+)	CNOOO-3 (TM ***-SD)		14 ~ 15 V	
CNOOO-3 (TM ***-SD)	—	Immeasurable	—	
CNOOO-4 (TM ***-G)	CNOOO-3 (TM ***-SD)		13 ~ 15 V	

Contactor panel (35 ~ 55 model)

CN134 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN134-1 (2, MD1-)	CN134-2 (1, MD1+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN134-2 (1, MD1+)	CN134-1 (2, MD1-)		Approx. 11 V	

CN136 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN136-1 (101, LAMP+)	CN136-2 (41, B48V)	Battery plug disconnected	Continuity	
CN136-2 (41, B48V)		Immeasurable	—	
CN136-3 (N2, N2)		Immeasurable	—	
CN136-4 (303, VBMB2)	CN137-8 (44, VBMB)	Battery plug disconnected	Continuity	

CN137 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN137-1 (N2, N2)		Immeasurable	—	
CN137-2 (2, MD1-)	CN137-3 (1, MD1+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN137-3 (1, MD1+)	CN137-2 (2, MD1-)		Approx. 11 V	
CN137-4 (6, MP2-)	CN137-7 (5, MP2+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN137-5 (44, VBMB)	CN137-1 (N2, N2)		36/48 V	
CN137-6 (19, CHOPCD-)		Immeasurable	—	
CN137-7 (5, MP2+)	CN137-4 (6, MP2-)		Approx. 11 V	
CN137-8 (44, VBMB)	CN137-9 (N2, N2)		36/48 V	
CN137-9 (N2, N2)		Immeasurable	—	
CN137-10 (4, MP1-)	CN137-11 (3, MP1+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN137-11 (3, MP1+)	CN137-10 (4, MP1-)		Approx. 11 V	
CN137-12 (77, THC+)		Immeasurable	—	

CN138 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN138-1 (6, MP2-)	CN138-2 (5, MP2+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN138-2 (5, MP2+)	CN138-1 (6, MP2-)	LSL1 ON	Approx. 11 V	

CN139 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN139-1 (4, MP1-)	CN139-2 (3, MP1+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN139-2 (3, MP1+)	CN139-1 (4, MP1-)		Approx. 11 V	

CN157 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN157-1 (49, CD-)	CN157-2 (47, CD+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN157-2 (47, CD+)	CN157-1 (49, CD-)		Approx. 11 V	

CN158 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN158-1 (44, VBMB)	CN158-4 (N2, N2)		36/48 V	
CN158-2 (47, CD+)	CN158-3 (49, CD-)		Approx. 11 V	
CN158-3 (49, CD-)	CN158-2 (47, CD+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN158-4 (N2, N2)		Immeasurable	—	
CN158-5 (77, CHOPCD+)		Immeasurable	—	
CN158-6 (19, CHOPCD-)		Immeasurable	—	

Traveling controller (35 ~ 55 model)

CN137 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN137-1 (N2, N2)	CN137-9 (N2, N2)		Approx. 0 V	
CN137-2 (2, MD1-)	CN137-3 (1, MD1+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN137-3 (1, MD1+)	CN137-2 (2, MD1-)	Measurement with (-) probe in contact with CN137-2	Approx. 11 V	
CN137-4 (6, MP2-)	CN137-7 (5, MP2+)	Battery plug disconnected Resistance measurement	Approx. 20 Ω	
CN137-5 (44, VBMB)	CN137-1 (N2, N2)		Approx. 36 V Approx. 48 V	
		Key switch OFF	Approx. 0 V	
CN137-6 (19, CHOPCD-)		Immeasurable	—	
CN137-7 (5, MP2+)	CN137-5 (44, VBMB)	Measurement with (-) probe in contact with CN137-5, LSL1 ON	Approx. 11 V	
CN137-8 (44, VBMB)	CN137-1 (N2, N2)		Approx. 36 V Approx. 48 V	
		Key switch OFF	Approx. 0 V	
CN137-9 (N2, N2)	CN137-1 (N2, N2)		Approx. 0 V	
CN137-10 (4, MP1-)	CN137-11 (3, MP1+)	Battery plug disconnect Resistance measurement	Approx. 20 Ω	
CN137-11 (3, MP1+)	CN137-10 (4, MP1-)	Measurement with (-) probe in contact with CN137-10	Approx. 11 V	
CN137-12 (77, THC+)	CN137-1 (N2, N2)		Approx. 5 V	

SAS controller (35 ~ 55 model)

ST board

CN141 basic conditions (battery plug connected, key switch ON)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN141-1 (137, SL/L+)	CN141-11 (320, STPOT-)		Approx. 5 V	
CN141-2 (57, POTT+)	CN141-11 (320, STPOT-)		Approx. 5 V	
CN141-3 (56, POTT)	CN141-11 (320, STPOT-)		0.5 ~ 4.5 V	
CN141-4 (58, SPL+)	CN141-11 (320, STPOT-)		Approx. 15 V	
CN141-5 (309, SSTMA)		Immeasurable	—	
CN141-6 (307, SMTSA)		Immeasurable	—	
CN141-7 (310, SSTMK)		Immeasurable	—	
CN141-8 (308, SMTSK)		Immeasurable	—	
CN141-9 (51, OLSD-)		Immeasurable	—	
CN141-10 (138, SL/L-)	CN141-11 (320, STPOT-)		Approx. 5 V	
CN141-11 (320, STPOT-)		Immeasurable	—	
CN141-12 (59, SPL)	CN141-11 (320, STPOT-)		0.5 ~ 4.5 V	
CN141-13 (324, SS+)	CN141-14 (325, SS-)		Approx. 1.5 V	
CN141-14 (325, SS-)		Immeasurable	—	
CN141-15 (354, OLST+)	CN141-16 (350, OLST-)		Approx. 5 V	
CN141-16 (350, OLST-)		Immeasurable	—	
CN141-17 (67, OLSD+)	CN141-9 (51, OLSD-)	LSD OFF LSD ON	Approx. 5 V Approx. 0 V	
CN141-18		Unused	—	

CN143 basic conditions (battery plug connected, key switch ON)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN143-1 (330, SOLT-)	CN143-7 (327, SOLTS+)	Battery plug disconnected Resistance measurement	Approx. 10 Ω	
		LSTR ON	Approx. 12 V	
CN143-2 (328, SOLS-)	CN143-7 (327, SOLTS+)	Battery plug disconnected Resistance measurement	Approx. 6 Ω	
			Approx. 12 V	
CN143-3 (334, SOLD-)	CN143-8 (331, SOLLD+)	Battery plug disconnected Resistance measurement	Approx. 10 Ω	
		LSD ON	Approx. 12 V	
CN143-4		Unused	—	
CN143-5 (332, SOLL-)	CN143-8 (331, SOLLD+)	Battery plug disconnected Resistance measurement	Approx. 10 Ω	
			Approx. 12 V	
CN143-6 ((327), (SOLTS+))		Unused	—	
CN143-7 (327, SOLTS+)		Immeasurable	—	
CN143-8 (331, SOLLD+)		Immeasurable	—	
CN143-9 (316, SXTSA)		Immeasurable	—	
CN143-10 (318, SSTXA)		Immeasurable	—	
CN143-11 (317, SXTSK)		Immeasurable	—	
CN143-12 (319, SSTXK)		Immeasurable	—	

CN142 basic conditions (battery plug connected, key switch ON)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN142-1 (303, VBMB2)	CN142-7 (N2, N2)		48 V/36 V	
CN142-2 (90, MH1)	CN141-11 (320, STPOT-)	SWMH1 ON SWMH1 OFF	Approx. 0 V Approx. 5 V	
CN142-3 (91, MH2-1)	CN141-11 (320, STPOT-)	SWMH1 ON SWMH1 OFF	Approx. 5 V Approx. 0 V	
CN142-4 (70, SWTK)	CN141-11 (320, STPOT-)	SWTK OFF SWTK ON	Approx. 5 V Approx. 0 V	
CN142-5 (11, S20V)			—	
CN142-6 ((N2), (N2))		Unused	Approx. 20 V	
CN142-7 (N2, N2)		Immeasurable	—	
CN142-8 (304, STLSD)	CN142-11 (12, S20V-)	LSD OFF LSD ON	Approx. 5 V Approx. 0 V	
CN142-9 (305, STLSTF)	CN142-11 (12, S20V-)	LSTF OFF LSTF ON	Approx. 5 V Approx. 0 V	
CN142-10 (306, STLSTR)	CN142-11 (12, S20V-)	LSTR OFF LSTR ON	Approx. 5 V Approx. 0 V	
CN142-11 (12, S20V-)		Immeasurable	—	
CN142-12 ((12), (S20V-))		Unused	—	

CN144 basic conditions (battery plug connected, key switch ON)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN144-1 (321, SYR+)	CN144-2 (323, SYR-)		Approx. 5 V	
CN144-2 (323, SYR-)		Immeasurable	—	
CN144-3 (322, SYR)	CN144-2 (323, SYR-)		Approx. 2.5 V	

Material handling controller (35 ~ 55 model)

SCPU board

CN147 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN147-1 (—, SSTYA)		Unused	—	
CN147-2 (—, SYTSA)		Unused	—	
CN147-3 (316, SXTSA)		Immeasurable	—	
CN147-4 (318, SSTXA)		Immeasurable	—	
CN147-5			—	
CN147-6 (312, STS1)		Immeasurable	—	
CN147-7 (313, STS2)		Immeasurable	—	
CN147-8 (314, STSC)		Unused	—	
CN147-9 (—, SSTYK)		Unused	—	
CN147-10 (—, SYTSK)		Unused	—	
CN147-11 (317, SXTSK)		Immeasurable	—	
CN147-12 (319, SSTXK)		Immeasurable	—	
CN147-13		Unused	—	
CN147-14		Unused	—	
CN147-15		Unused	—	
CN147-16 (315, STS-)		Immeasurable	—	
CN147-17 (311, STS+)	CN147-16 (315, STS-)		Approx. 15 V	
CN147-18		Unused	—	

CN148 basic conditions
(battery plug disconnected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN148-1		Unused	—	
CN148-2 (341, STP1-)	CN152-6 (353, GNDSC)	Vehicle in level position	Approx. 1 ~ 4 V	
CN148-3 (343, STP2-)	CN152-6 (353, GNDSC)	Steering wheel in neutral postion	Approx. 1 ~ 4 V	
CN148-4 (—, SSN+)		Unused	—	
CN148-5 (51, SSN-)		Immeasurable	—	
CN148-6		Unused	—	
CN148-7		Unused	—	
CN148-8		Unused	—	
CN148-9		Unused	—	
CN148-10 (340, STP1+)	CN152-6 (353, GNDSC)		Approx. 5 V	
CN148-11 (342, STP2+)	CN152-6 (353, GNDSC)		Approx. 5 V	
CN148-12 (60, OLSL+)	CN148-5 (51, SSN-)		Approx. 5 V	

CN150 basic conditions
(battery plug disconnected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN150-1		Unused	—	
CN150-2		Unused	—	
CN150-3 (349, OUTAD)		Immeasurable	—	

CN152 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN152-1		Unused	—	
CN152-2 (P12, VBMBP)	CN152-6 (353, GNDSC)		Approx. 36 V Approx. 48 V	
CN152-3		Unused	—	
CN152-4		Unused	—	
CN152-5 (352, SC15V)	CN152-6 (353, GNDSC)		Approx. 15 V	
CN152-6 (353, GNDSC)		Immeasurable	—	
CN152-7		Unused	—	
CN152-8 (344, PDUTY)		Immeasurable	—	
CN152-9 (347, DATA1)		Immeasurable	—	
CN152-10 (348, DATA2)		Immeasurable	—	
CN152-11 (335, DRPMOS)	CN152-6 (353, GNDSC)		Approx. 15 V	
CN152-12 (345, SELT1)		Immeasurable	—	
CN152-13 (346, SELT2)		Immeasurable	—	
CN152-14		Unused	—	

DC/PD board

CN153 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.⇔Connector No.		Conditions	Standard	Remarks
CN153-1		Unused	—	
CN153-2 (P12, VBMBP)	CN154-8 (344, PDUTY)		Approx. 36 V Approx. 48 V	
CN153-3		Unused	—	
CN153-4		Unused	—	
CN153-5 (352, SC15V)	CN154-8 (344, PDUTY)		Approx. 15 V	
CN153-6 (353, GNDSC)	CN154-8 (344, PDUTY)		Approx. 0 V	
CN153-7 (349, OUTAD)		Immeasurable	—	
CN153-8 (344, PDUTY)		Immeasurable	—	
CN153-9 (347, DATA1)		Immeasurable	—	
CN153-10 (348, DATA2)		Immeasurable	—	
CN153-11 (335, DRPMOS)		Immeasurable	—	
CN153-12 (345, SELT1)		Immeasurable	—	
CN153-13 (346, SELT2)		Immeasurable	—	
CN153-14		Unused	—	

CN154 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN154-1 (41, B48V)	CN154-8 (N1, N1)		Approx. 36 V Approx. 48 V	
CN154-2 (P12, VBMBP)	CN154-8 (N1, N1)		Approx. 36 V Approx. 48 V	
		Key switch OFF	Approx. 0 V	
CN154-3 (352, PCSP+)	CN154-8 (N1, N1)		Approx. 15 V	
CN154-4 (337, PCSP)	CN154-8 (N1, N1)		Approx. 7 V	
CN154-5 (353, PCSP-)	CN154-8 (N1, N1)		Approx. 0 V	
CN154-6 (338, THP+)	CN154-8 (N1, N1)		Approx. 15 V	
CN154-7 (—, CK20V)	CN154-12 (359, TMPD-SD)		Approx. 20 V	
CN154-8 (N1, N1)		Immeasurable	—	
CN154-9 (356, TMPD1+)	CN154-12 (359, TMPD-SD)		13 ~ 15 V	
CN154-10 (357, TMPD2+)	CN154-12 (359, TMPD-SD)		13 ~ 15 V	
CN154-11 (358, TMPD-G)	CN154-12 (359, TMPD-SD)		13 ~ 15 V	
CN154-12 (359, TMPD-SD)		Immeasurable	—	
CN154-13 (339, THP)	CN154-8 (N1, N1)		1 ~ 4 V	
CN154-14		Unused	—	

CN155 basic conditions
(battery plug connected, key switch ON, direction lever at N, and motor cable disconnected)

Connector No.	⇔Connector No.	Conditions	Standard	Remarks
CN155-1 (193, BMP)	CN154-8 (N1, N1)		Approx. 0 V	Vehicle with motor brush wear warning
CN155-2 (354, PLST)	CN155-10 (350, PLS-)	PLST ON, key switch OFF PLST OFF, key switch OFF	Approx. 0 V Approx. 13 V	
CN155-3 (351, PLSL1)	CN155-10 (350, PLS-)	PLSL1 ON, key switch OFF PLSL1 OFF, key switch OFF	Approx. 0 V Approx. 13 V	
CN155-4 (—, PLSAT2)	CN155-10 (350, PLS-)	Immeasurable	—	
CN155-5 (—, CKT-G)		Immeasurable	—	
CN155-6 (194, BMP2)	CN154-8 (N1, N1)		Approx. 0 V	Vehicle with motor brush wear warning
CN155-7 (11, S20V+)	CN155-8 (12, S20V-)		Approx. 19.5 V	
CN155-8 (12, S20V-)		Immeasurable	—	
CN155-9 (355, PLSAT1)	CN155-10 (350, PLS-)	PLSAT1 ON, key switch OFF PLSAT1 OFF, key switch OFF	Approx. 0 V Approx. 13 V	
CN155-10 (350, PLS-)	CN154-8 (N1, N1)		Approx. 0 V	

DISASSEMBLY

Control panel disassembly is rarely needed. In most cases, it is performed to replace defective parts after the source of the problem is detected by inspection.
Therefore, perform correct operation by referring to the components and assembly drawings.

Notes for parts replacement

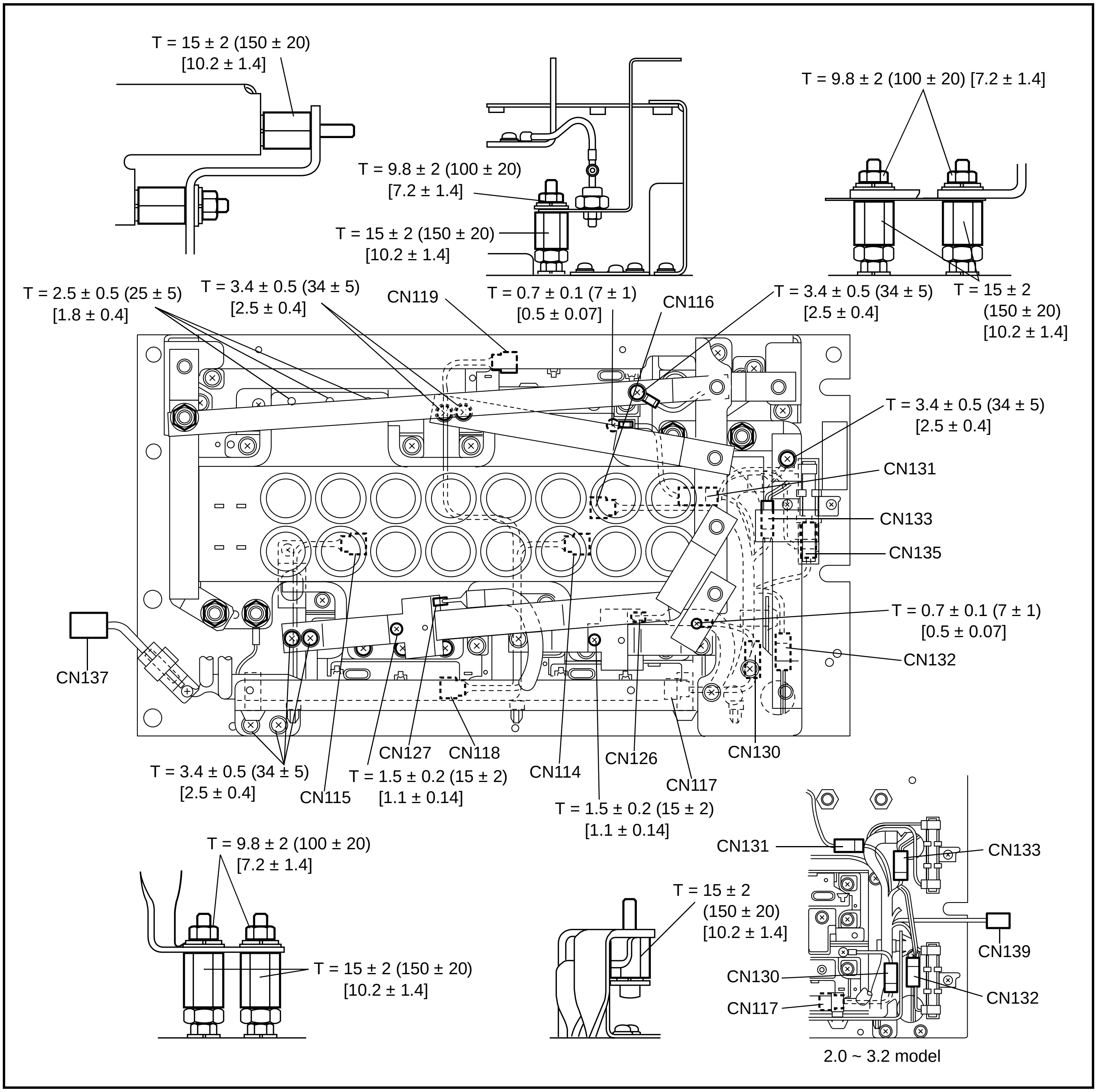
- Tighten bar and harness set nuts and screws to the specfied torque levels.
  Looseness or tightening failure will cause new problems.
- Accurately record the installation location or attach a tag showing the location before disconnecting each bar or harness. At the time of reassembly, check the record or tag to avoid incorrect assembly or wiring.
  Incorrect assembly or wiring will cause new problems.
- Always apply silicone grease to parts that have been applied with it.
  Failure to apply it may cause overheating.
- After completing reassembly, check non-contact portions of bars and wiring for undesirable contact.
  Before installation on the vehicle, use a circuit tester to check continuity at specified points.
  (See VOL.2 page 2-73 for the points requiring inspection with the tester.)
- Always replace the TMD and TMP for each arm unit.
  Always check the part number for identification.

REASSEMBLY

Control panel reassembly drawing

Traveling/Material Handling Controller (15 ~ 32 Model (Chopper-less))

T = N·m (kgf-cm) [ft-lbf]



Caution:

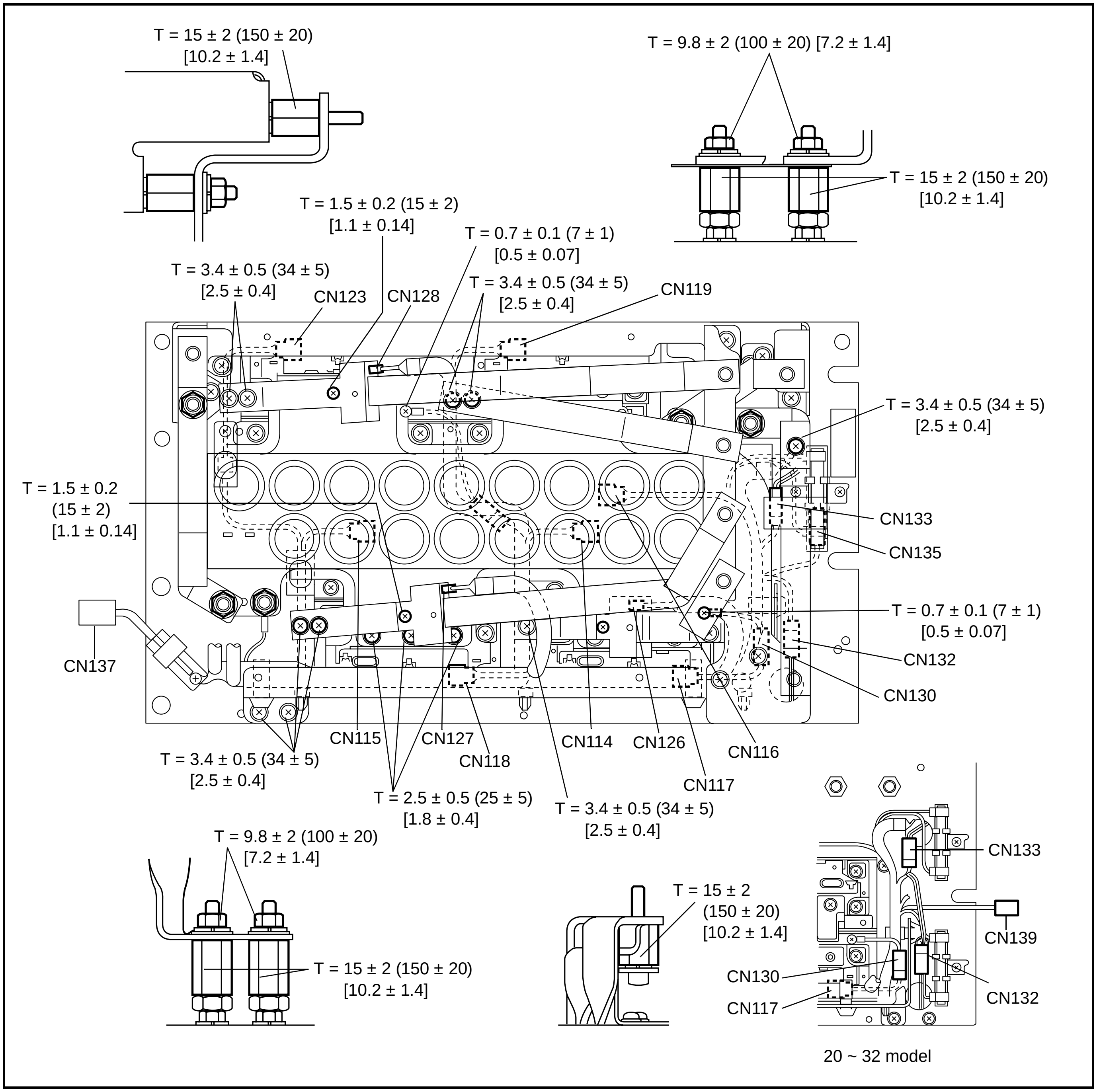
Be sure to install insulating sheets without fail.

- **Failure to install the insulating sheet for the TMD will damage the TMD.**
- **Check the insulation resistance between the bracket and each P terminal after controller reassembly.**

  Standard: 3 MΩ or more

Traveling/Material Handling Controller (15 ~ 32 Model (Chopper))

T = N·m (kgf-cm) [ft-lbf]



Caution:

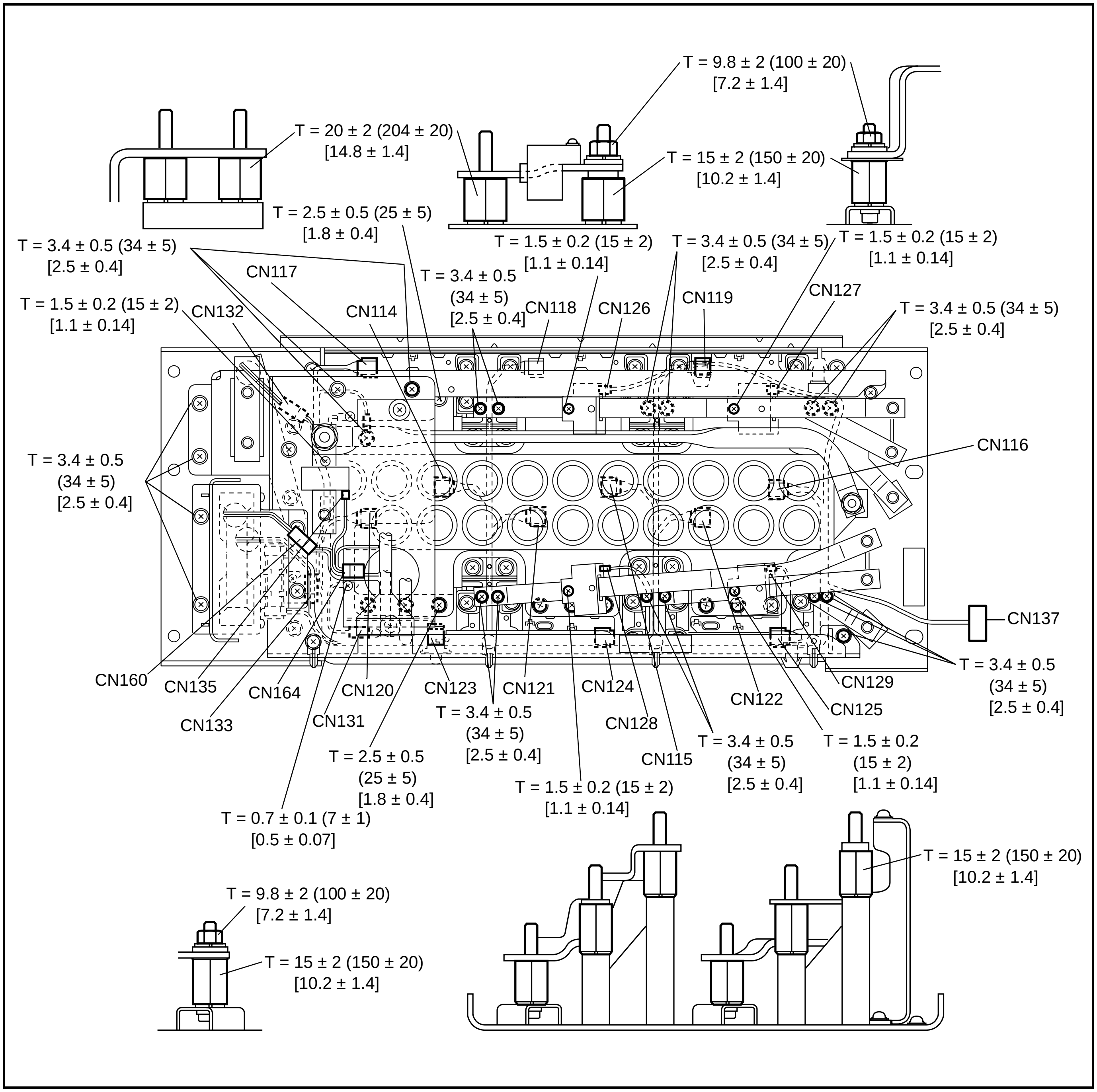
Be sure to install insulating sheets without fail.

- **Failure to install the insulating sheet for the TMD or TMP will damage the TMD and TMP.**
- **Check the insulation resistance between the bracket and each P terminal after controller reassembly.**

  Standard: 3 MΩ or more

Traveling Controller (35 ~ 55 Model)

T = N·m (kgf-cm) [ft-lbf]



Caution:

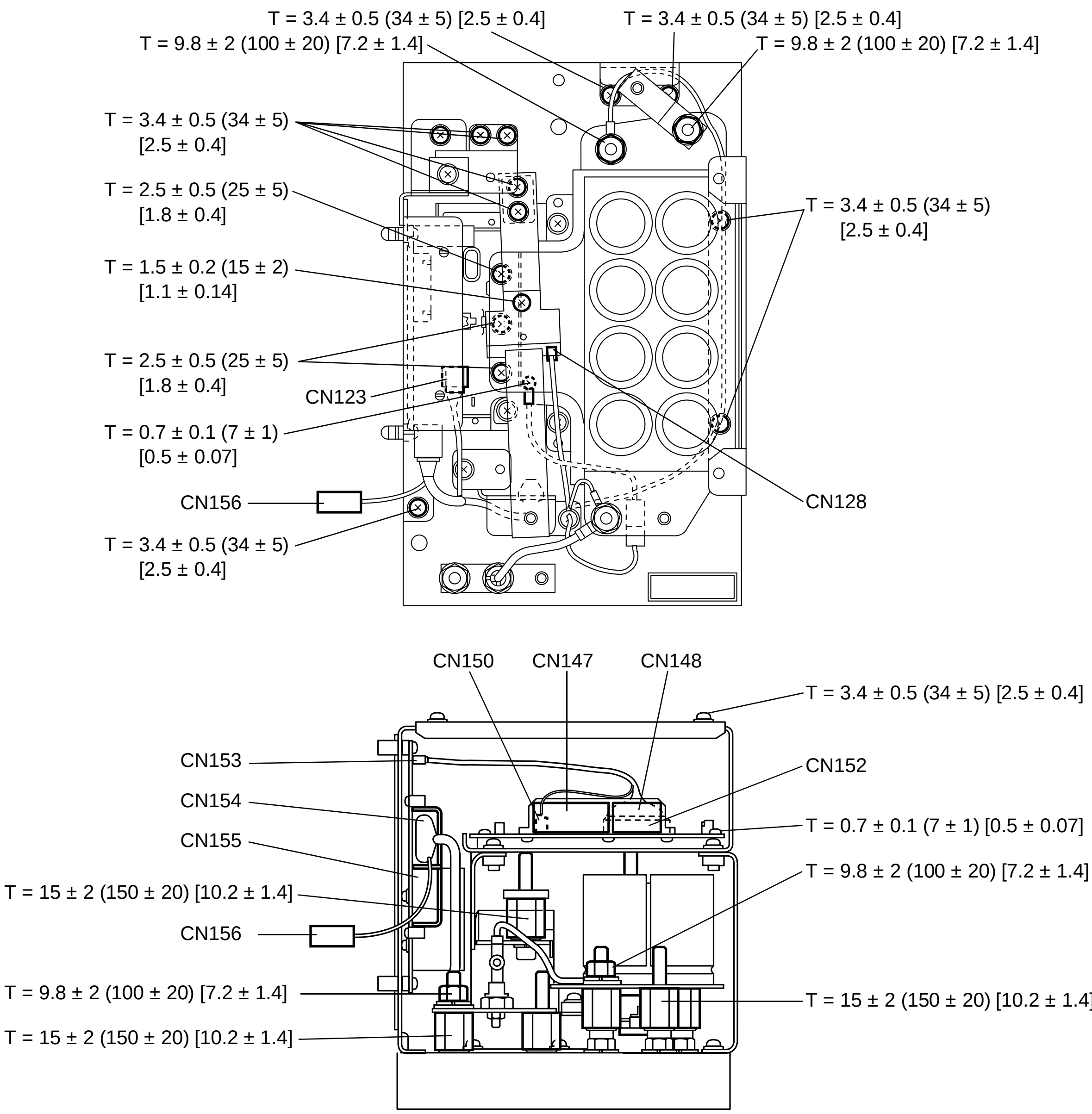
Be sure to install insulating sheets without fail.

- **Failure to install the insulating sheet for the TMD will damage the TMD.**
- **Check the insulation resistance between the bracket and each P terminal after controller reassembly.**

  Standard: 3 MΩ or more

Material Handling Controller (35 ~ 55 Model)

T = N·m (kgf-cm) [ft-lbf]



Caution:

Be sure to install insulating sheets without fail.

- **Failure to install the insulating sheet for the TMP will damage the TMP.**
- **Check the insulation resistance between the bracket and each P terminal after controller reassembly.**

  Standard: 3 MΩ or more

Contactor Panel

Caution:
- **Failure to install the insulating sheet under the MD, MP contactor will cause a critical failure.**

PS Controller Assy (FHPS)

Caution:
- **Failure to install the insulating sheet under the contactor will cause a critical failure.**
- **When installing the fuses, installing washers or wiring in incorrect order may damage the fuses.**

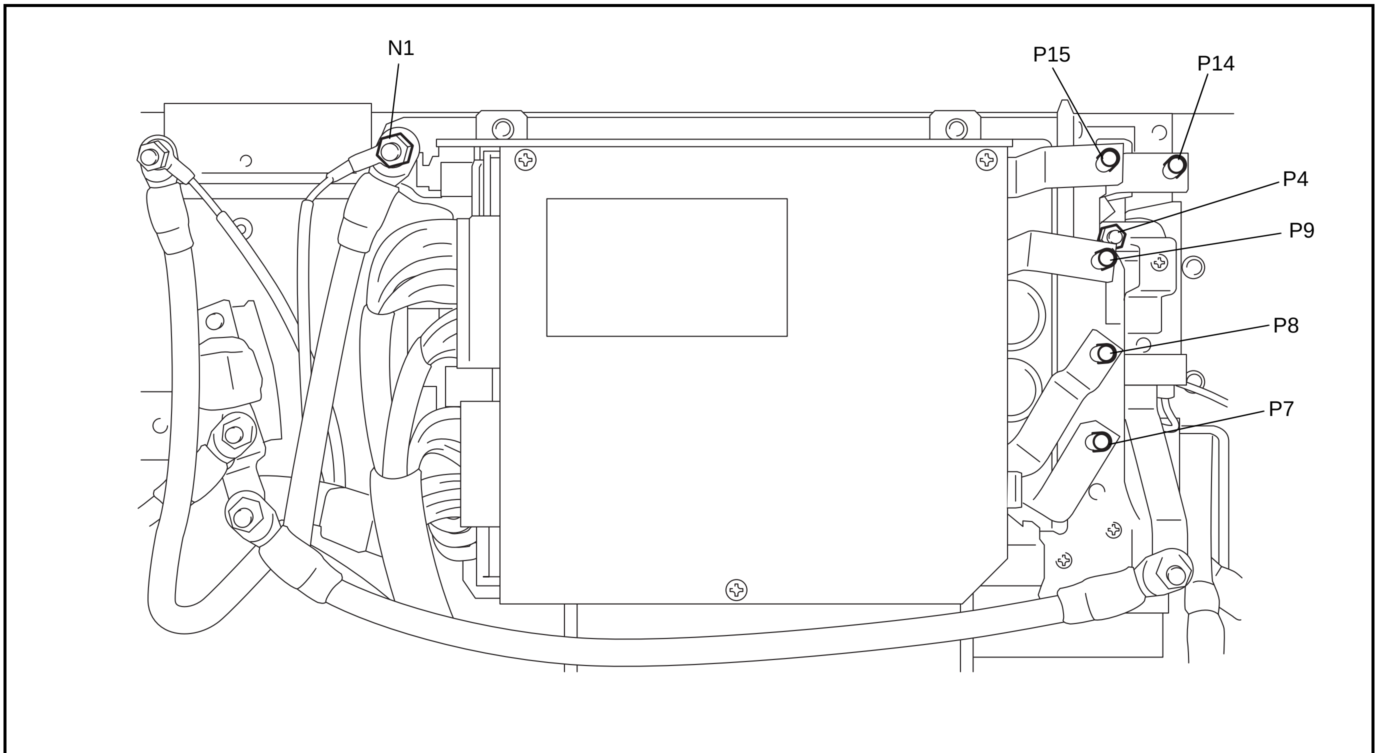
Continuity checks after reassembly of control panel ASSY

Traveling/Material Handling Controller (15 ~ 32 Model (Chopper-less))

(1) Inspection method

Always disconnect the drive motor cables.

Tester range:$\Omega \times 10$



(a) Motor cable terminal inspection

Motor cable terminal		N1		P4	
		(-)	(+)	(-)	(+)
P7·P8·P9	(-)	—	Capacitor characteristic	—	Approx. 50 Ω
	(+)	Approx. 50 Ω	—	Capacitor characteristic	—
P14	(-)	—	∞ Ω		
	(+)	Approx. 50 Ω	—		
P15	(-)	—	0 Ω		
	(+)	0 Ω	—		

(b) P4 - N1 inspection

P4 (-) — N1 (+)	Capacitor characteristic
P4 (+) — N1 (-)	Approx. 50 Ω

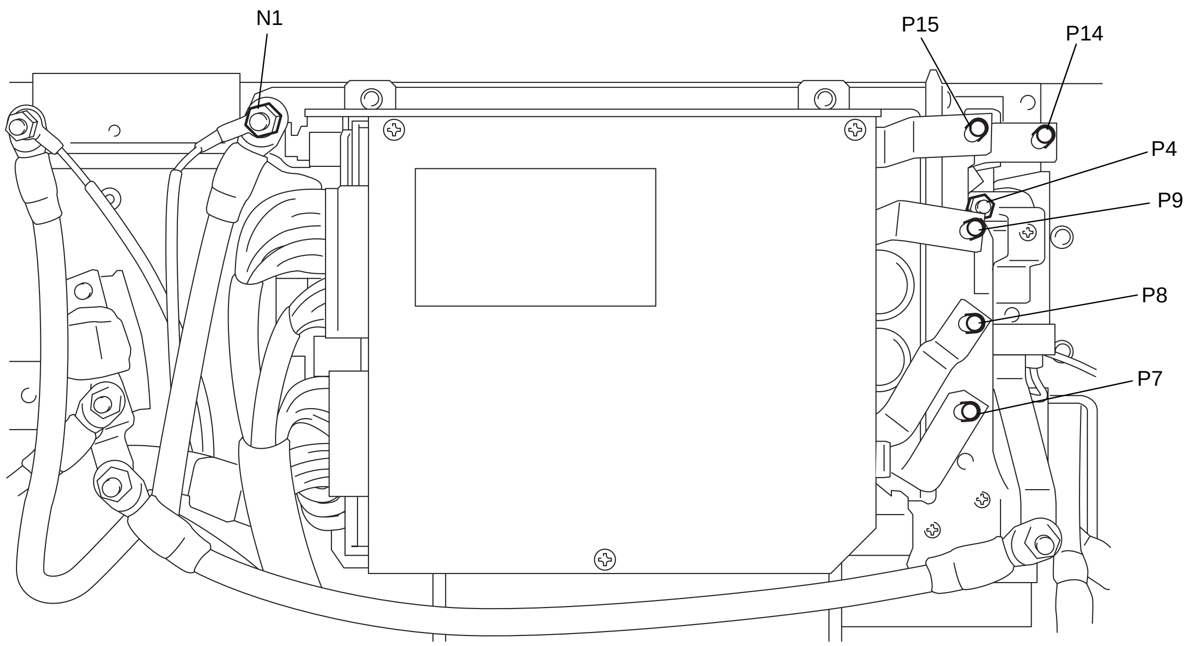
Capacitor characteristic:The pointer deflects to the 0 Ω position once, then it gradually returns to ∞ Ω. Finally it indicates ∞ Ω.

Traveling/Material Handling Controller (15 ~ 32 Model (Chopper))

(1) Inspection method

Always disconnect the drive and pump motor cables.

Tester range:$\Omega \times 10$



(a) Motor cable terminal inspection

Motor cable terminal		N1		P4	
		(-)	(+)	(-)	(+)
P7·P8·P9	(-)	—	Capacitor characteristic	—	Approx. 50 Ω
	(+)	Approx. 50 Ω	—	Capacitor characteristic	—
P14	(-)	—	Capacitor characteristic	—	0 Ω
	(+)	Approx. 50 Ω	—	0 Ω	—
P15	(-)	—	Capacitor characteristic	—	Approx. 50 Ω
	(+)	Approx. 50 Ω	—	Capacitor characteristic	—

(b) P4 - N1 inspection

P4 (-) — N1 (+)	Capacitor characteristic
P4 (+) — N1 (-)	Approx. 50 Ω

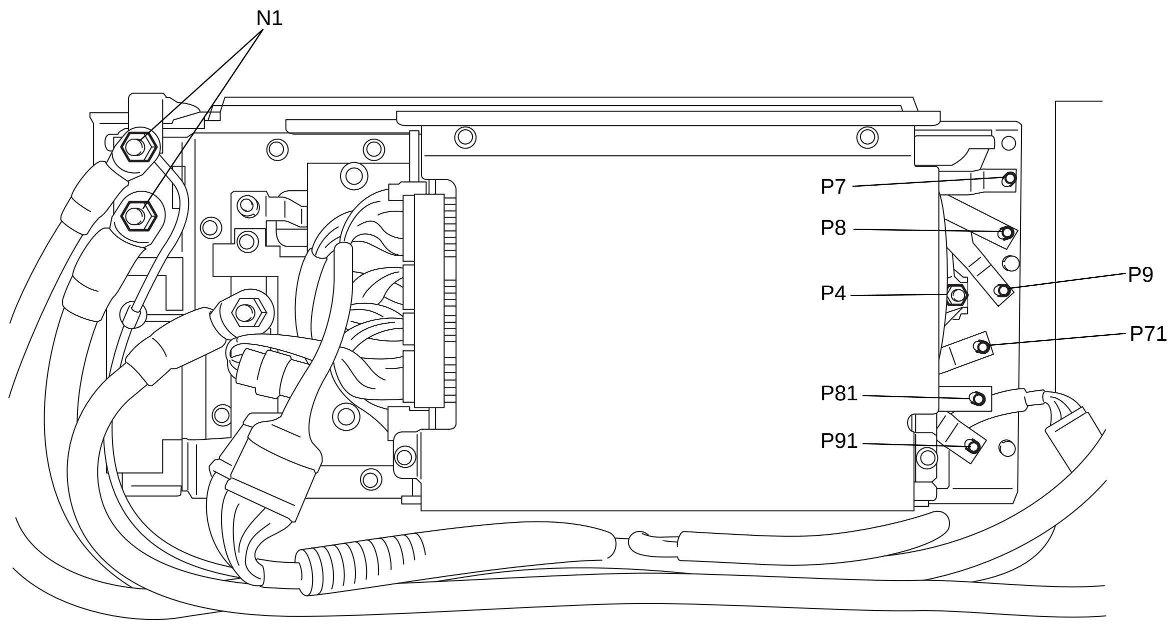
Capacitor characteristic:The pointer deflects to the 0 Ω position once, then it gradually returns to ∞ Ω. Finally it indicates ∞ Ω.

Traveling Controller (35 ~ 55 Model)

(1) Inspection method

Always disconnect the drive motor cables.

Tester range:Ω × 10



(a) Motor cable terminal inspection

Motor cable terminal		N1		P4	
		(-)	(+)	(-)	(+)
P7·P8·P9 P71·P81·P91	(-)	—	Capacitor characteristic	—	Approx. 50 Ω
	(+)	Approx. 50 Ω	—	Capacitor characteristic	—

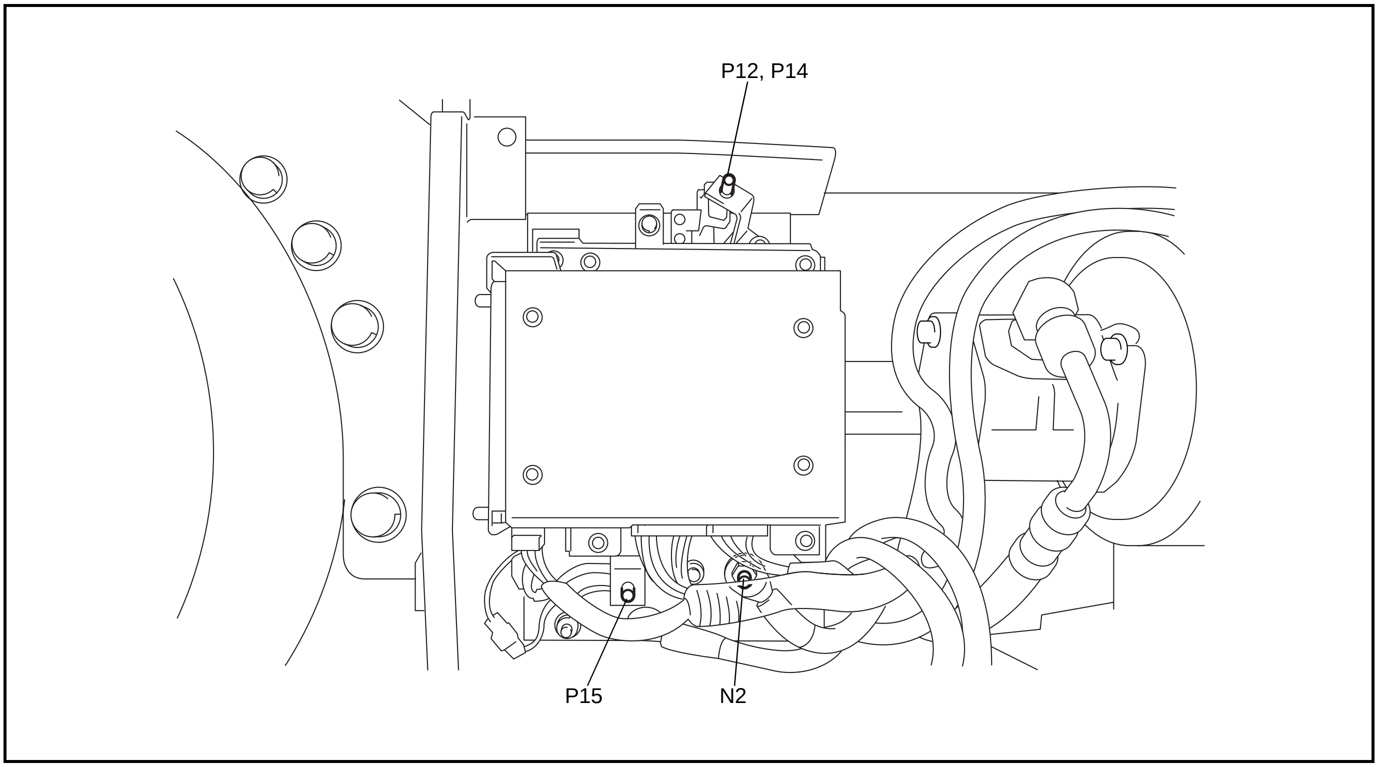
(b) P4 - N1 inspection

P4 (-) — N1 (+)	Capacitor characteristic
P4 (+) — N1 (-)	Approx. 50 Ω

Capacitor characteristic:The pointer deflects to the 0 Ω position once, then it gradually returns to ∞ Ω. Finally it indicates ∞ Ω.

Material Handling Controller (35 ~ 55 Model)

(1) Inspection method
Always disconnect the pump motor cables.
Tester range:Ω × 10



(a) Motor cable terminal inspection

Motor cable terminal		N2		P12	
		(-)	(+)	(-)	(+)
P14	(-)	—	Capacitor characteristic		
	(+)	Approx. 50 Ω	—		
P15	(-)	—	Capacitor characteristic	—	Approx. 50 Ω
	(+)	Approx. 50 Ω	—	Capacitor characteristic	—

(b) P12 - N2 inspection

P12 (-) — N2 (+)	Capacitor characteristic
P12 (+) — N2 (-)	Approx. 50 Ω

Capacitor characteristic:The pointer deflects to the 0 Ω position once, then it gradually returns to ∞ Ω. Finally it indicates ∞ Ω.

Drive motor input voltage measurement

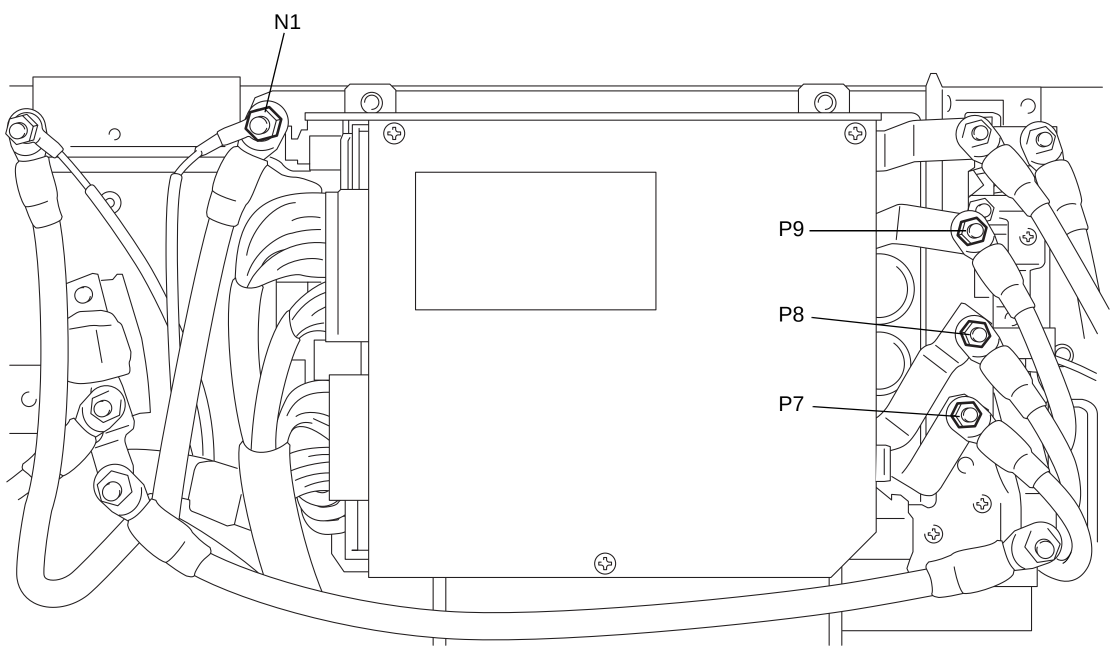
If traveling does not seem to be normal or after overhauling the traveling/material handling controller, measure the drive motor input voltage to accurately judge whether the controller functions normally.

Drive Motor Input Voltage Measuring Method (15 ~ 32 Model)
Procedure

1. Disconnect the battery plug.
2. Remove the side cover LH.
3. Jack up the drive wheel.
4. Connect the (-) probe of an analog voltmeter to the N1 terminal.
5. Connect the (+) probe of the voltmeter to P7 (P8, P9).
6. Connect the battery plug.
7. Turn the key switch to ON. Release the parking brake.
8. Shift the direction switch to the forward (or back) position.
9. Depress the accelerator pedal fully and record the voltmeter reading at the time.
   Do not depress the brake pedal.
10. Measure in the same way for P8 and P9.
11. Compare the voltage measured between N1 and each of P7, P8 and P9. See that the difference is as specified below.

    Difference between input voltages to P7, P8 and P9

    Standard: 2 V or less



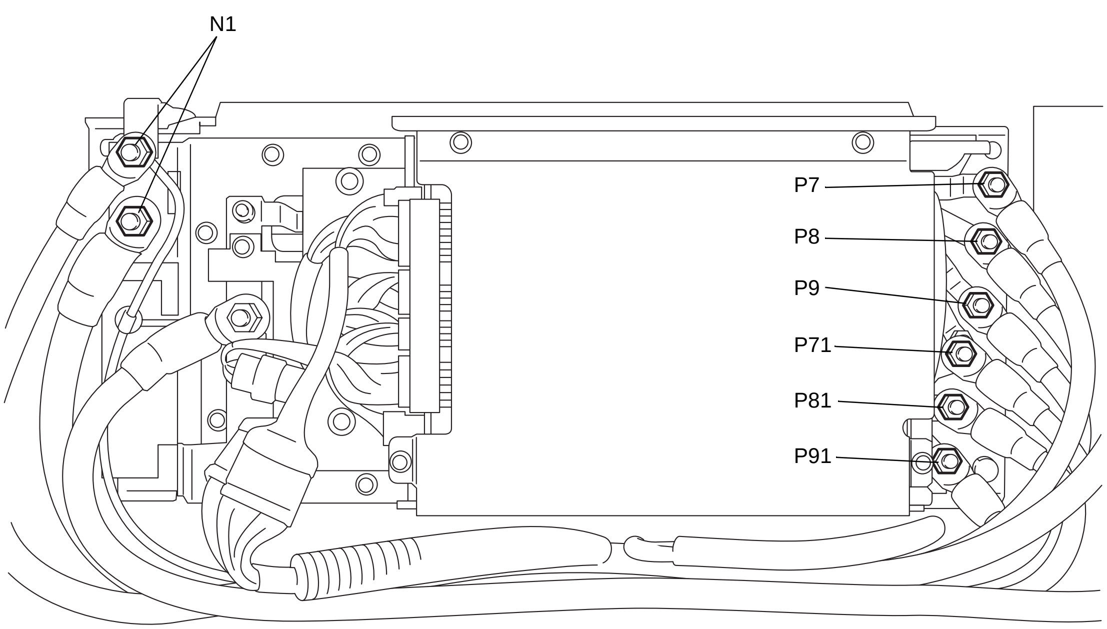
Drive Motor Input Voltage Measuring Method (35 ~ 55 Model)

Procedure

1 Disconnect the battery plug.
2 Remove the side cover RH.
3 Jack up the drive wheel.
4 Connect the (-) probe of an analog voltmeter to the N1 terminal.
5 Connect the (+) probe of the voltmeter to P7 (P8, P9, P71, P81 and P91).
6 Connect the battery plug.
7 Turn the key switch to ON. Release the parking brake.
8 Shift the direction switch to the forward (or back) position.
9 Depress the accelerator pedal fully and record the voltmeter reading at the time. Do not depress the brake pedal.
10 Measure in the same way for P8, P9, P71, P81 and P91.
11 Compare the voltage measured between N1 and each of P7, P8, P9, P71, P81 and P91. See that the difference is as specified below.

Difference between input voltages to P7, P8, P9, P71, P81 and P91

Standard: 2 V or less



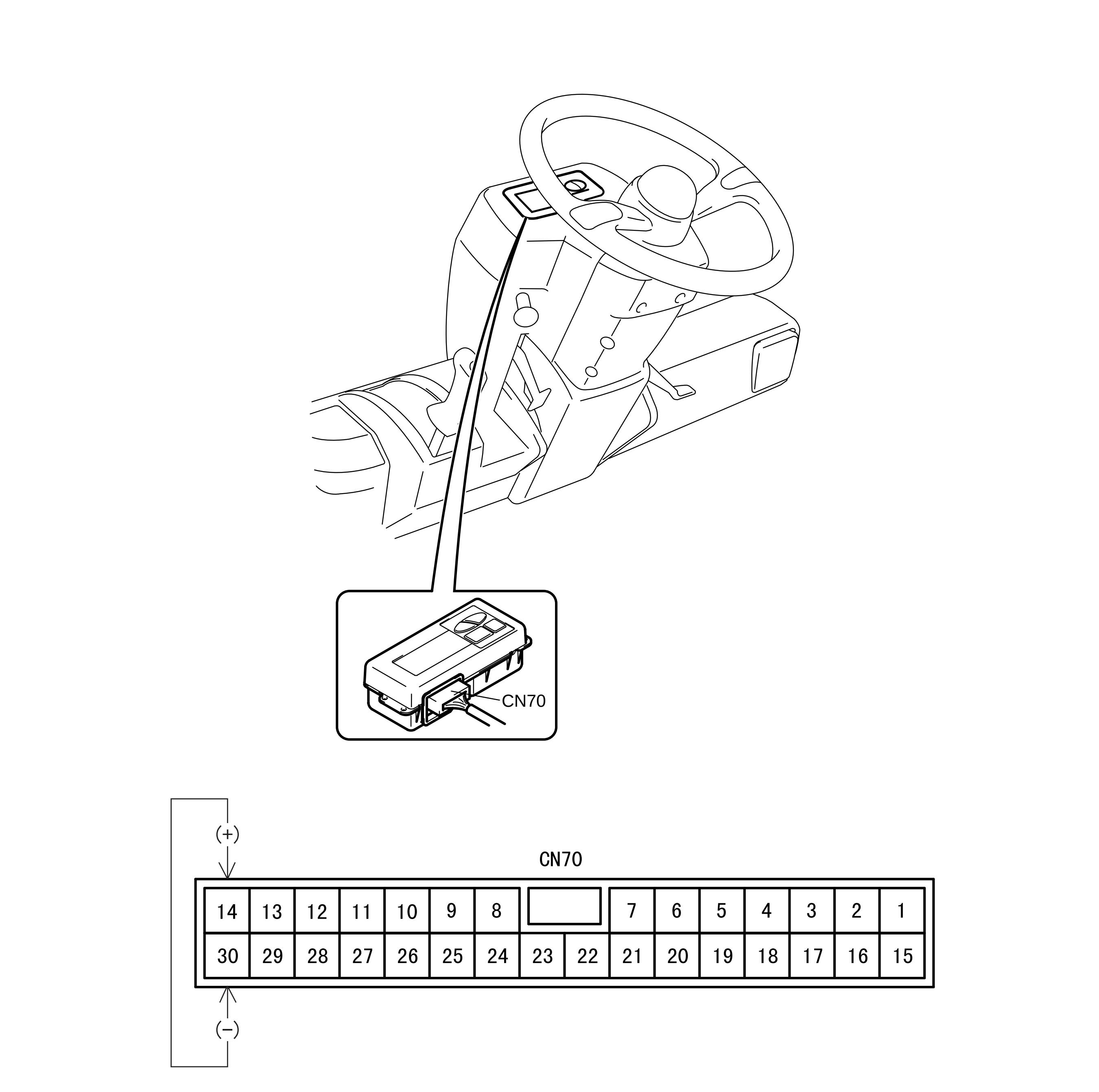
Material handling circuit OCL value measurement

In the material handling system, the relief valve in the control valve is actuated at the stroke end of each cylinder.

The OCL value of the material handling circuit is set higher than the current at the relief value set pressure. Because of relief from the hydraulic circuit before the current of the material handling circuit reaches the OCL value, the OCL value cannot be measured.

DISPLAY INSPECTION

If the cause of trouble is judged to exist in the display, apply the battery voltage and measure the voltage at CN70.

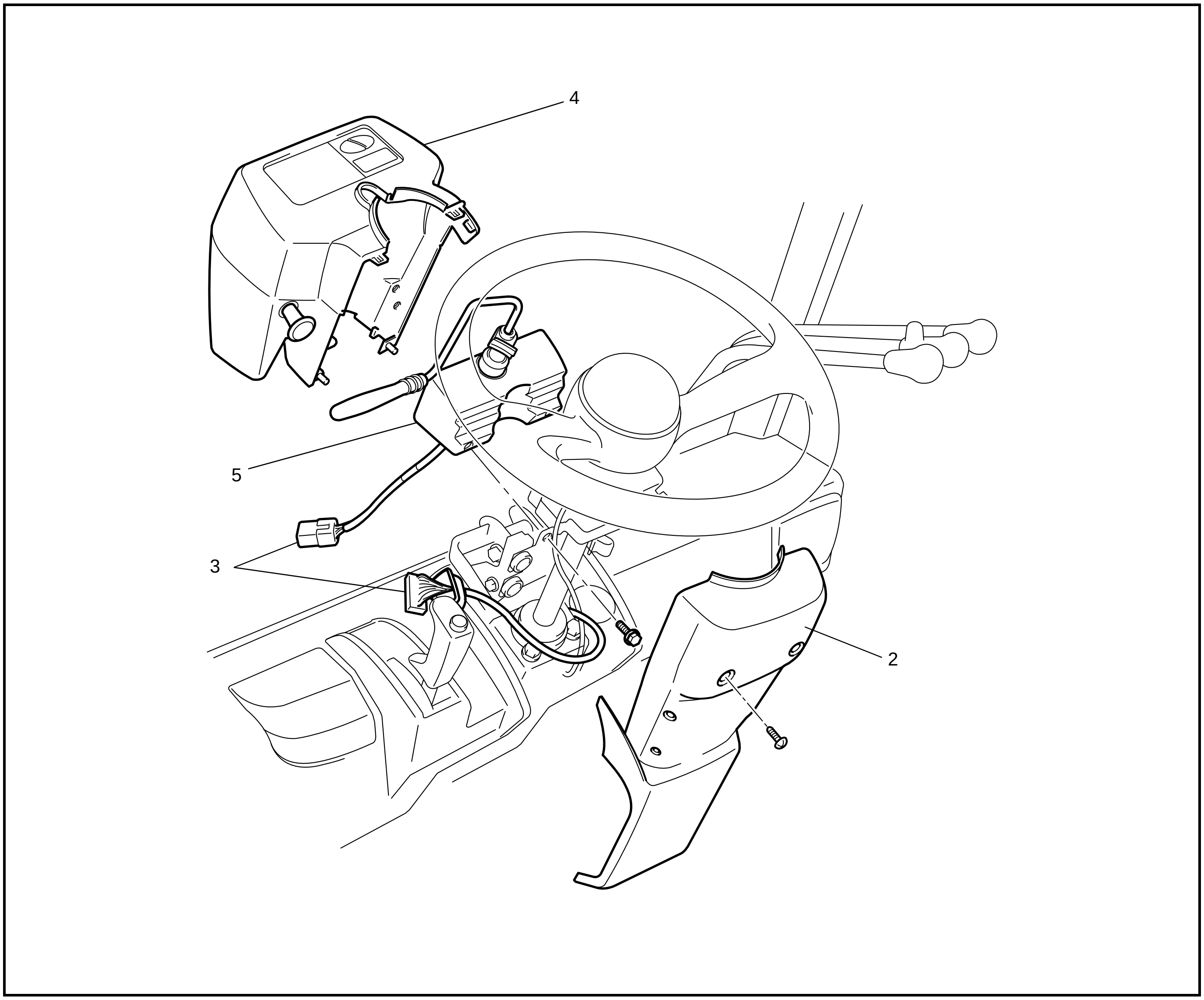


CN70 basic condition (battery plug connected)

Connector No.⇔Connector No.		Conditions	Standard
CN70-14 (16, D15V)	CN70-30 (14, GNDD)		Approx.10 ~ 18V

DIRECTION SWITCH

REMOVAL·INSTALLATION



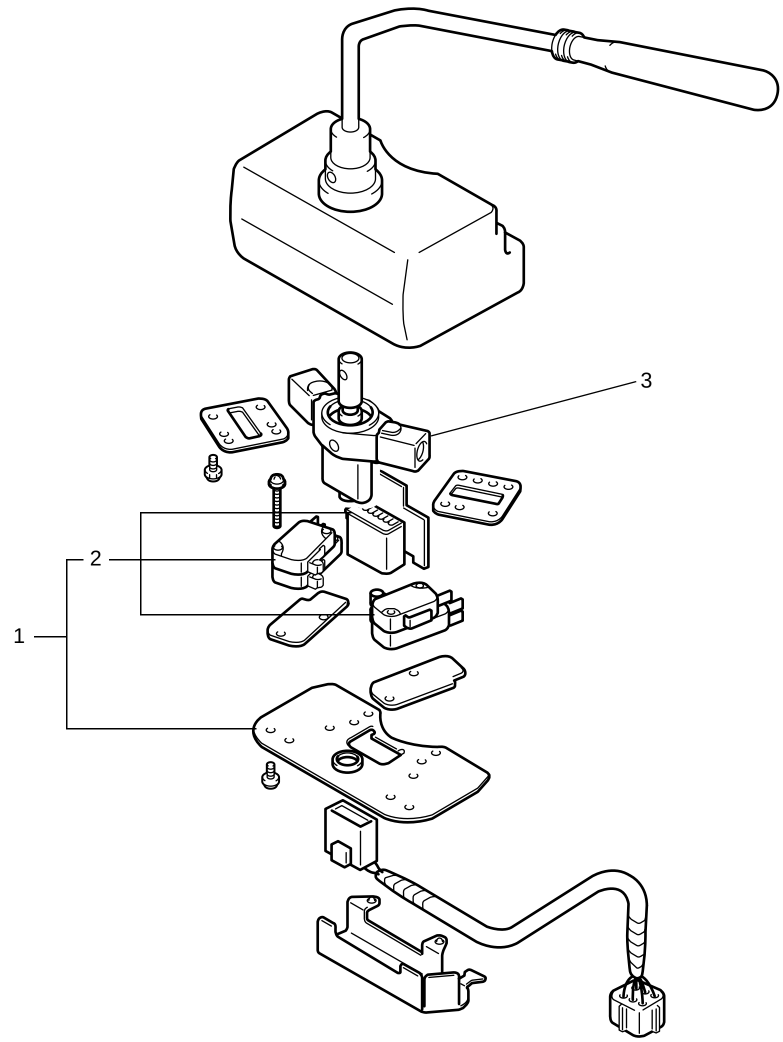
Removal Procedure

1 Disconnect the battery plug.
2 Remove the steering cover.
3 Disconnect wiring of the display and direction switch.
4 Remove the meter cover with display.
5 Remove the direction switch

Installation Procedure

The installation procedure is the reverse of the removal procedure.

DISASSEMBLY·INSPECTION·REASSEMBLY

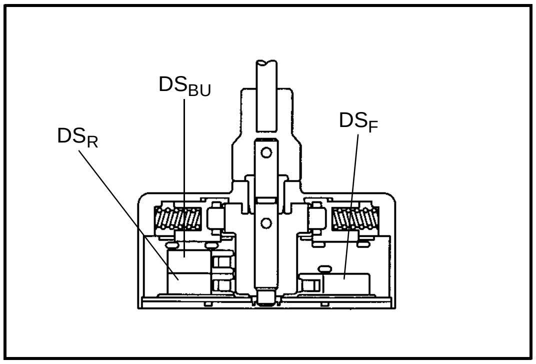


Disassembly Procedure

1 Remove the plate.
2 Remove the base with micro-switch. **[Point 1]**
3 Remove the cam.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

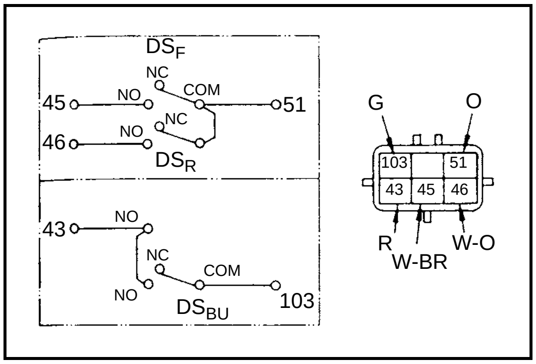


Point Operation

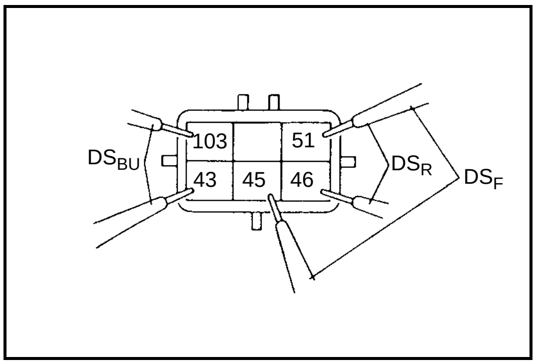
[Point 1]

Reassembly:

1. Install the micro-switch in the correct position.



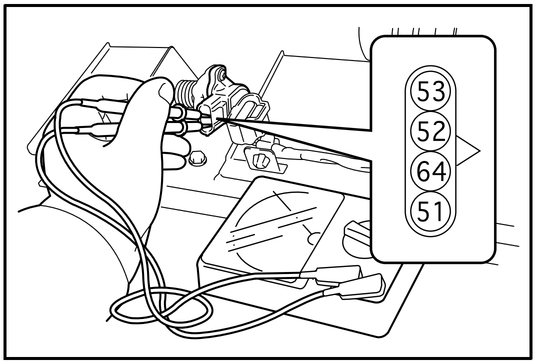
2. Carry out wiring according to the cable colors shown in the illustration when replacing the micro-switch.

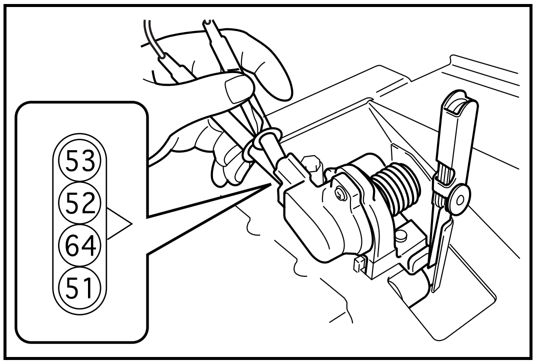


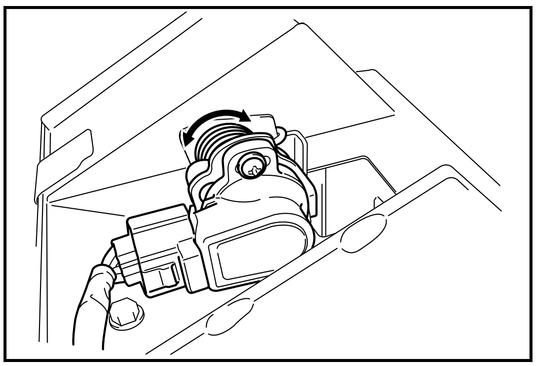
Inspection

After installing the direction switch, check continuity of each switch before mounting on the vehicle.
Standard

	Lever position		
Check point	Neutral	Forward	Backward
DS_F	∞ Ω	0 Ω	∞ Ω
DS_R	∞ Ω	∞ Ω	0 Ω
DS_{BU}	∞ Ω	∞ Ω	0 Ω







ACCELERATOR POTENTIOMETER ADJUSTMENT

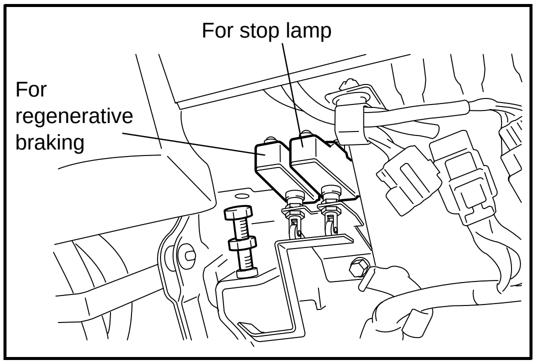
1. Check that the switch is set to ON and OFF as the accelerator pedal is operated.

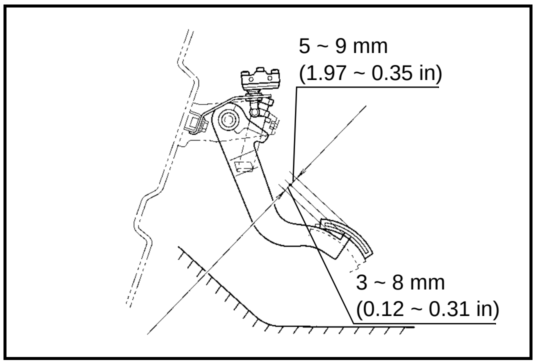
Measurement terminals		51-64
Standard	Pedal not operated	∞ Ω
	Pedal operated	0 Ω

2. Adjustment of Accelerator Potentiometer Installation
   (1) Insert a 1.5-mm (0.059 in) thickness gauge between the acceleration link stopper and the accelerator bracket.
   (2) Tentatively set the potentiometer so that the accelerator switch (SW_{AC}) is turned ON.
   (3) Check the ON/OFF switching point of the accelerator switch (SW_{AC}).
   When 1.0-mm (0.0394 in) thickness gage is inserted: OFF (∞ Ω)
   When 2.0-mm (0.0787 in) thickness gage is inserted: ON (0 Ω)
   (4) After the end of switch ON/OFF adjustment, apply 08833-76002-71 (08833-00080) on the threaded portion of the set screw.

BRAKE SWITCH ADJUSTMENT

FOOT BRAKE





1. Adjust the brake pedal play.

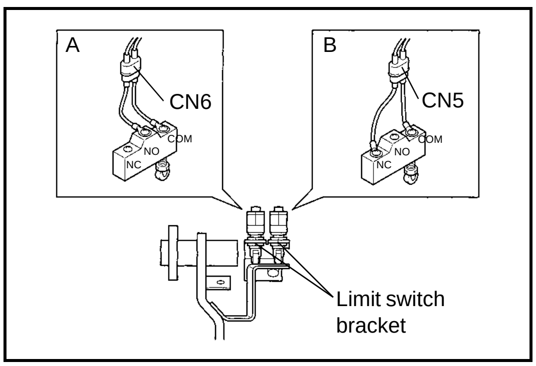
   Standard: 5 ~ 9 mm (1.97 ~ 0.35 in)

2. Adjust protrusion of the limit switch roller.
3. Check continuity of the limit switch for the stop lamp when the brake pedal is operated and when not operated.

   Standard: Not operated: OFF (∞ Ω)
   Operated: ON (0 Ω)

4. See that the limit switch for regeneration is activated (OFF) when the brake pedal is depressed further (3 ~ 8 mm (0.12 ~ 0.31 in)) from the position without any play.

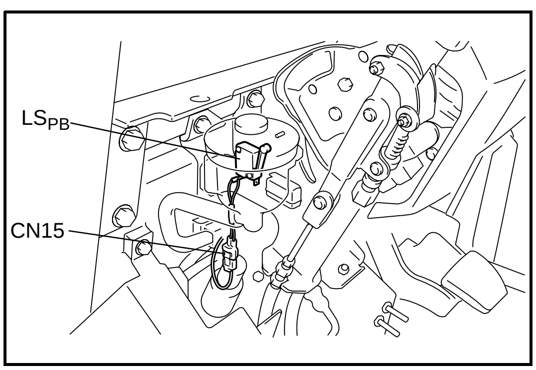
   Standard: Not operated: ON (0 Ω)
   Operated: OFF (∞ Ω)

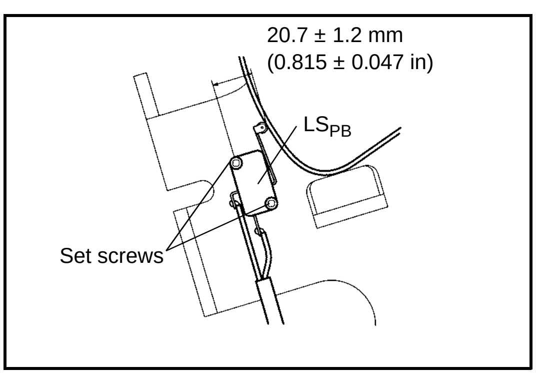


5. If the standard is not satisfied, make adjustment by bending the limit switch bracket.

   A: For regenerative brake
   B: For stop lamp

PARKING BRAKE



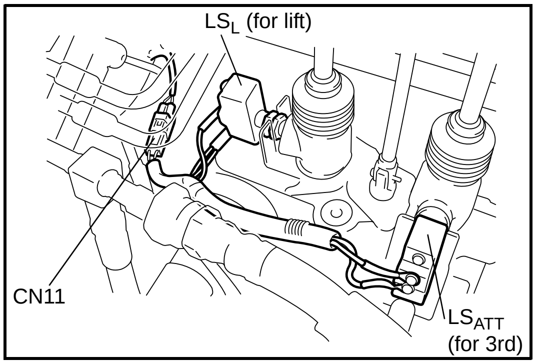


1. Check ON and OFF of the parking brake limit switch.

   Standard: Lever returned: ON (0 Ω)
   Lever pulled: OFF (∞ Ω)

2. If the measured values are out of the standard, adjust the limit switch position.

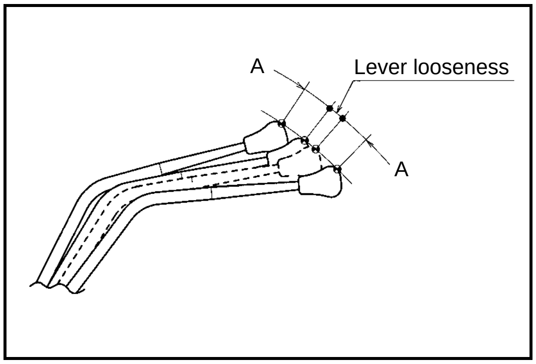
MATERIAL HANDLING LEVER SWITCH ADJUSTMENT



1. Operate the lift lever or the 3rd lever and check continuity of the limit switch.

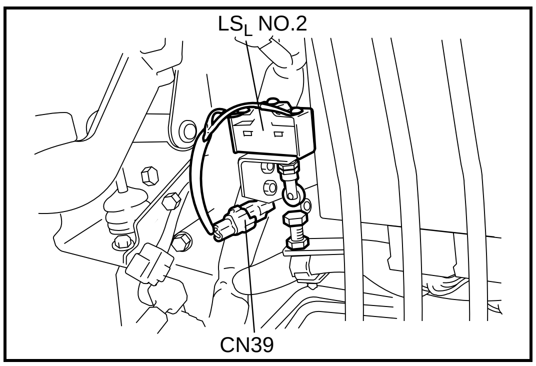
   Standard:
   For lift: Between CN11-1 and CN11-2
   Not operated: OFF (∞ Ω)
   Operated: ON (0 Ω)

   Standard:
   For 3rd: Between CN11-2 and CN11-3
   Not operated: OFF (∞ Ω)
   Operated: ON (0 Ω)



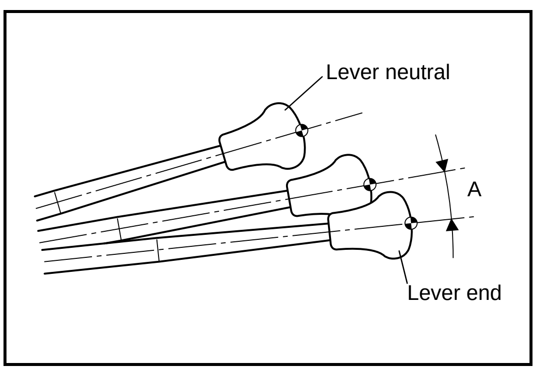
2. Operate the lift lever or the 3rd lever and check that the limit switch is turned on at dimension A beyond the no-play position.
   A = 10 ~ 20 mm (0.40 ~ 0.79 in)
3. If the limit switch ON timing is deviated from dimension A, adjust the limit switch position.

For Chopper



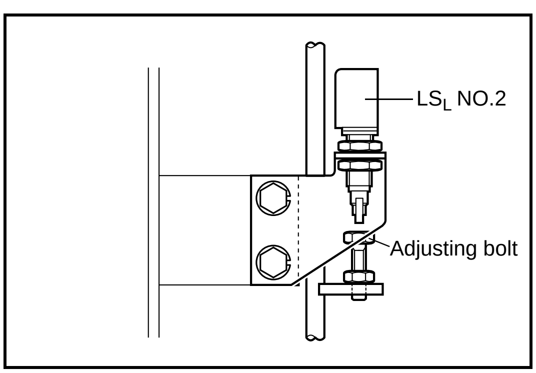
1. Operate the lift lever and check continuity of the limit switch No.2.

   Standard:
   Lift: Between CN39-1 and CN39-2
   Not operated: ON (∞ Ω)
   Operated: OFF (0 Ω)



2. Pull the lift lever and check if limit switch No. 2 turns off within dimension A from the lever end.

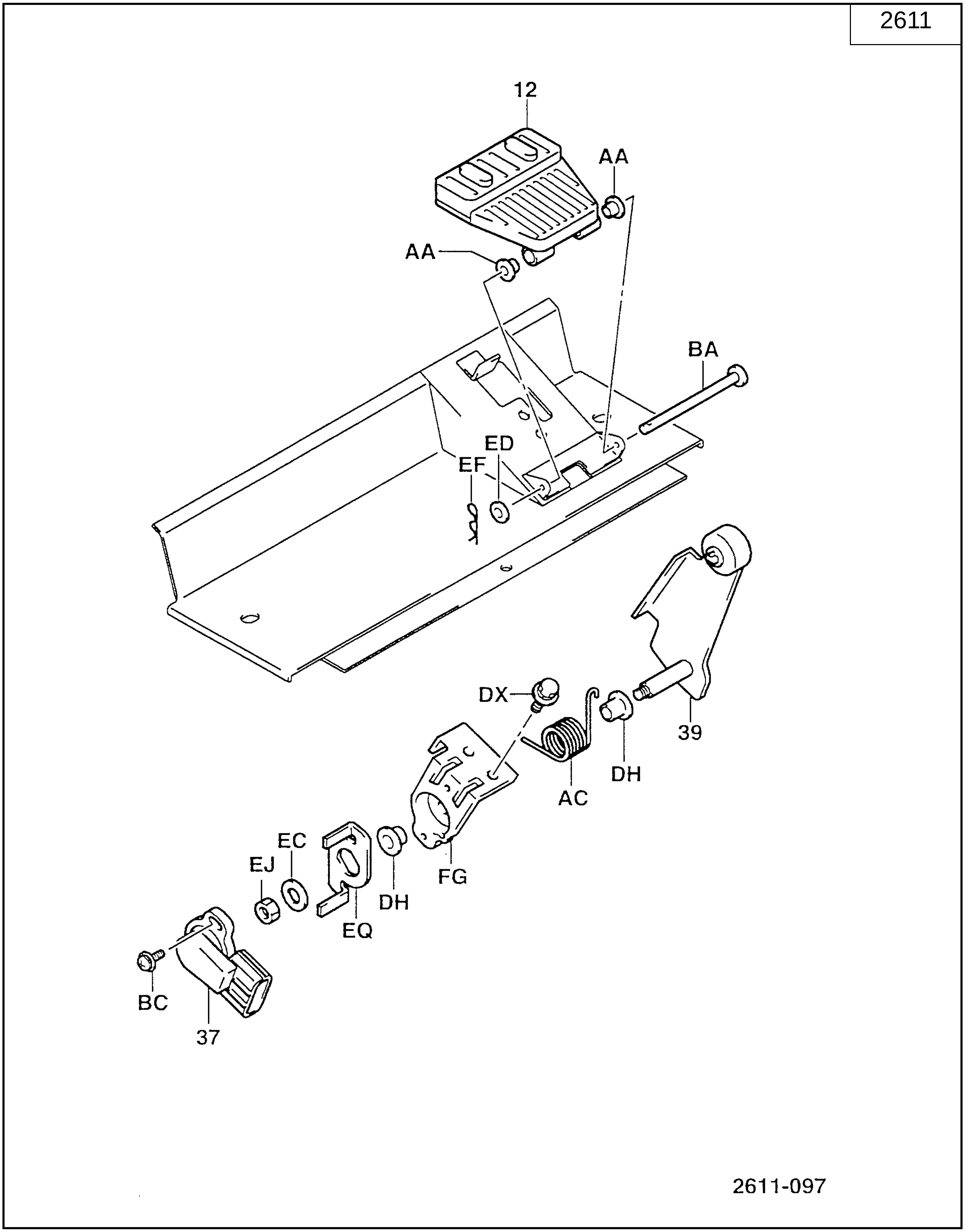
   A = 10 ~ 20 mm (0.40 ~ 0.79 in)

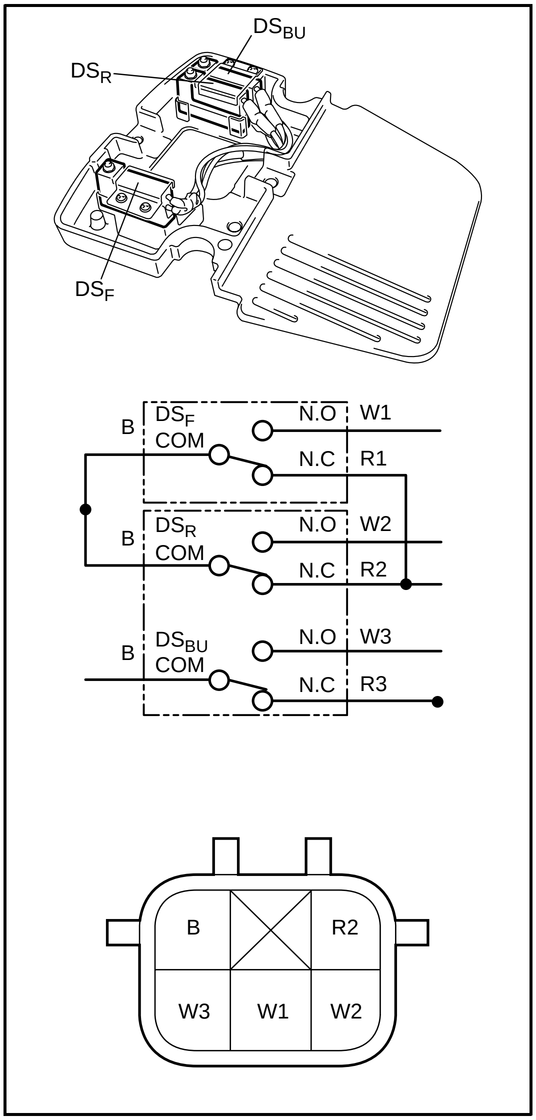


3. If the OFF timing of limit switch No. 2 is not within dimension A, adjust by turning the adjusting bolt.
   As for the tilt lever, the micro-switch is built in the control valve ASSY. So, no adjustment is required.

EZ PEDAL (OPT)

COMPONENTS





INSPECTION

Check continuity of the micro-switch.
Standard

Check point		Pedal position		
		Neutral	Forward	Reverse
DS_F	W1-B	∞ Ω	0 Ω	∞ Ω
DS_R	W2-B	∞ Ω	∞ Ω	0 Ω
DS_{BU}	W3-B	∞ Ω	∞ Ω	0 Ω

MULTI-DISPLAY FUNCTIONS

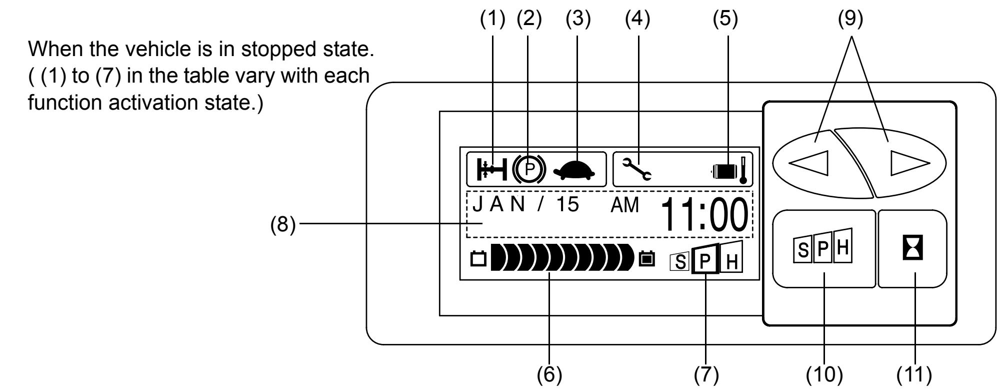
Page

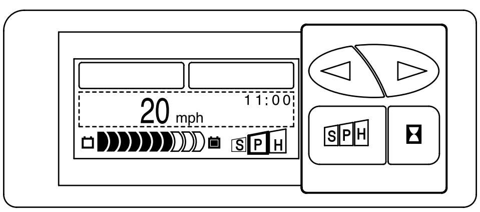
MULTIPLE DISPLAY

GENERAL

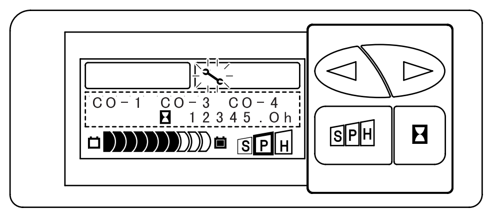
The multiple display is capable of indicating various types of vehicle information by switching the screen according to the displayed contents.

Note:
Be sure to operate buttons for the display with your finger. If a sharp-edged tool is used, the button may be damaged.

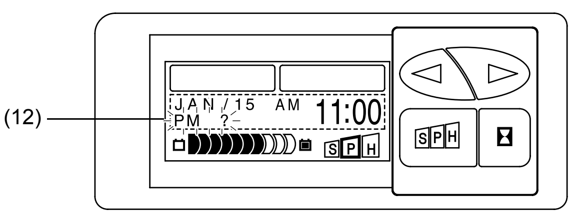




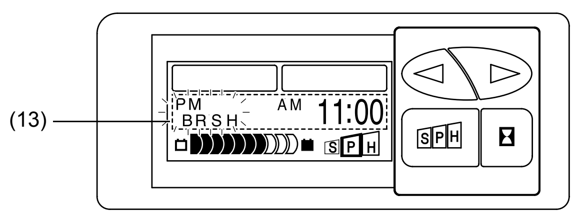
During traveling <speed indication>



Upon error occurrence <error indication>



Maintenance hour meter warning screen



Brush wear warning screen

No.	Description	No.	Description
(1)	Swing lock indicator	(8)	Multiple screen display area
(2)	Parking brake indicator	(9)	Up/Down switch
(3)	Travel speed limiter setting indicator	(10)	Power select switch
(4)	Diagnostic mode indicator	(11)	Multiple hour meter mode selection switch
(5)	Overheat warning indicator	(12)	Planned maintenance hour meter warning indicator
(6)	Battery capacity indicator	(13)	Brush wear warning indicator
(7)	Power select indicator		

(1) Swing lock indicator

This indicator comes on when the rear wheel swing lock is activated. It automatically goes out when the swing lock is released.

(2) Parking brake indicator

This indicator comes on upon activation of the parking brake. If the operator fails to release the parking brake during forward or reverse traveling, alarm sounds (beeps) to warn the operator. For a vehicle with the optional deadman switch, alarm sounds when moving from the operator's seat without pulling the parking brake.

(3) Travel speed limiter setting indicator

This indicator is lit while the travel speed limiter level setting is 7 or less. (See page 3-17 (export model), 3-25 (USA spec. model).)

(4) Diagnostic mode indicator

This indicator blinks when the diagnostic mode operates, the error code is displayed, and the buzzer sounds.

Up to 3 abnormality codes are displayed at a time. When more than 3 abnormalities occur at a time, up to 6 abnormality codes are displayed with switching at intervals of 2 seconds.

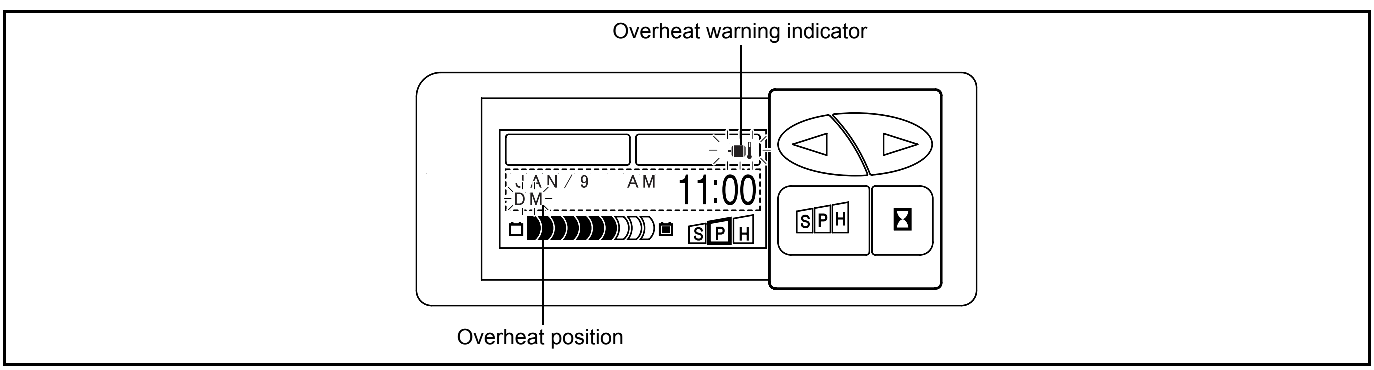
When the SAS function matching is not complete, this indicator comes on to warn the serviceman. If it is on, carry out matching by referring to the Matching section.

(5) Overheat warning indicator

Should the drive motor, the pump motor (OPT), or the controller be suffering from overheating, the overheat warning indicator is flashing and a buzzer will sound to warn the operator. While the overheat alarm indicator is blinking, the vehicle operation is restricted and the overheated component is indicated on the display.

Indication contents:

C/R : Controller
DM : Drive motor
PM : Pump motor



Vehicle Operation Restriction at Overheating

C/R:Controller (For traveling)

Model	Selected mode	Content of control		
		Primary control	Secondary control	The 3rd control
15 ~ 32 model	H mode P mode S mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Switching to half speed		
35 ~ 55 model	H mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Switching to P mode	1. Character indication, blinking indicator 2. No buzzer sound 3. Switching to S mode	1. Character indication, blinking indicator 2. No buzzer sound 3. Switching to half speed
	P mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Switching to S mode	1. Character indication, blinking indicator 2. No buzzer sound 3. Switching to half speed	
	S mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Switching to half speed		

C/R:Controller (For material handling)

Model	Selected mode	Content of control
15 ~ 32 model	H mode P mode S mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Material handling operation disabled
35 ~ 55 model	H mode P mode S mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Switching to half speed with output restricted to 50%

DM:Drive motor

Model	Selected mode	Content of control		
		Primary control	Secondary control	The 3rd control
STD	H mode P mode S mode	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding 3. Switching to half speed		
Dust proof	H mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Switching to P mode	1. Character indication, blinking indicator 2. No buzzer sound 3. Switching to S mode	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding 3. Switching to half speed
	P mode	1. Character indication, blinking indicator 2. Intermittent buzzer sounding for 5 seconds 3. Switching to S mode	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding 3. Switching to half speed	
	S mode	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding 3. Switching to half speed		

PM:Pump motor

Model	Selected mode	Content of control	
		Primary control	Secondary control
15 ~ 32 model	H mode P mode S mode	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding 3. Material handling operation disabled
35 ~ 55 model	H mode P mode S mode	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding	1. Character indication, blinking indicator 2. Continuous beeping buzzer sounding 3. Switching to half speed with output restricted to 50%

(6) Battery charge indicator

This indicator indicates the remaining battery charge in 10 stages.

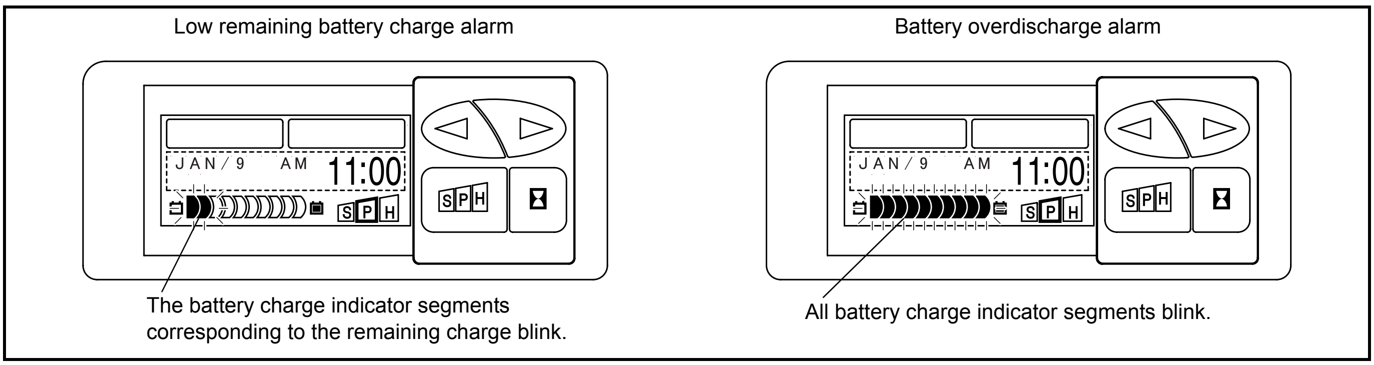
A: Low remaining battery charge alarm

The battery charge indicator blinks when the remaining battery charge drops to the set level* or below. When the key switch is turned from OFF to ON in this state, the alarm sounds for 5 seconds to warn the operator of the low battery charge.

B: Battery overdischarge alarm (lift interrupt function)

When the remaining battery charge drops further from tha remaining charge warning level to the set level*, all segments of the battery charge indicator start blinking to warn the operator. Then, material handling during traveling is disabled.

Note:
The level can be set using TUNING FUNCTION of the SERVICE FUNCTION. (See page 3-48)



(7) Power select indicator (traveling and material handling)

The currently selected mode is indicated by enclosing S, P or H with a square. Press the power select switch on the normal function menu to change the mode setting. (Export model only in default)

When all of S, P and H are enclosed in squares, the control is performed in the mode set on the Power Control Function Set Menu screen. (All model, See page 3-18 (export model), 3-26 (USA spec. model).)

Note:
Mode change by the power select switch in default state cannot be performed in the US spec. model. Mode change can be performed by using MANAGER'S FUNCTION in MASK FUNCTION, or it can be performed in the same way as in the export models if P/C LOCK is unlocked using the OPTION SET FUNCTION of SERVICE FUNCTION in MASK FUNCTION. Once the switch is turned off, P/C LOCK functions, so that the mode change cannot be performed.

(8) Multiple-screen display area

The date and time are normally indicated in this area. This area is also used for various purposes such as function setting and abnormality code display by the diagnosis function.

(9) Up/Down switch

Use this switch to select each item and value.

(10) Power select switch

This switch selects the operating mode from S, P and H. Press this switch on the normal function screen to shift the position of the square indicating the currently selected mode sequentially to the right. (Export model only in default) Press the switch continuously for 2 seconds to set the level of each function. (All model)

Note:
Mode change by the power select switch in default state cannot be performed in the US spec. model. Mode change can be performed by using MANAGER'S FUNCTION in MASK FUNCTION, or it can be performed in the same way as in the export models if P/C LOCK is unlocked using the OPTION SET FUNCTION of SERVICE FUNCTION in MASK FUNCTION. Once the switch is turned off, P/C LOCK functions, so that the mode change cannot be performed.

(11) Multiple hour meter mode selection switch

This switch changes the screen of multi-hour-meter function.

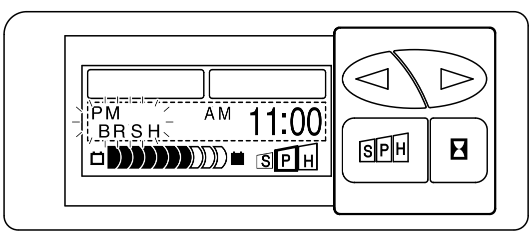
(12) Planned maintenance hour meter warning indicator

Time when maintenance and service are necessary can be set in advance, and the time so set will be noticed by the display and the sound. Buzzer continues 5 seconds after key switch ON.

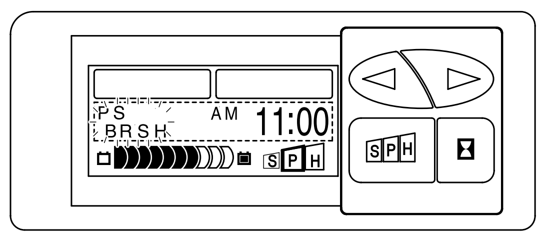
The time setting is selective from 10 to 2000 hours range. Time can be set by the MANAGER'S FUNCTION in MASK FUNCTION. (See page 3-22)

(13) Brush wear warning indicator (OPT)

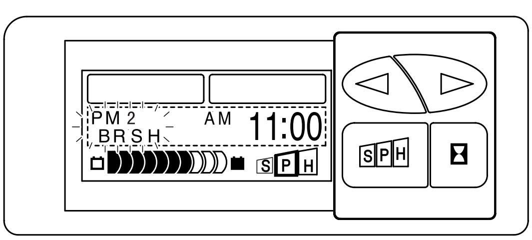
When the brush of the pump motor and the PS motor wears out to warning level, the warning indicator flashes and a buzzer sounds. If it becomes necessary to use the vehicle before inspection and repair when the motor brush wear alarm sounds, it will be possible to stop the alarm by temporary cancellation of brush wear warning.



Pump motor brush warning indicator (flashing)
(all model)



PS motor brush warning indicator (flashing)
(15 ~ 32 model)



Pump motor brush warning indicator (flashing)
(35 ~ 55 model)

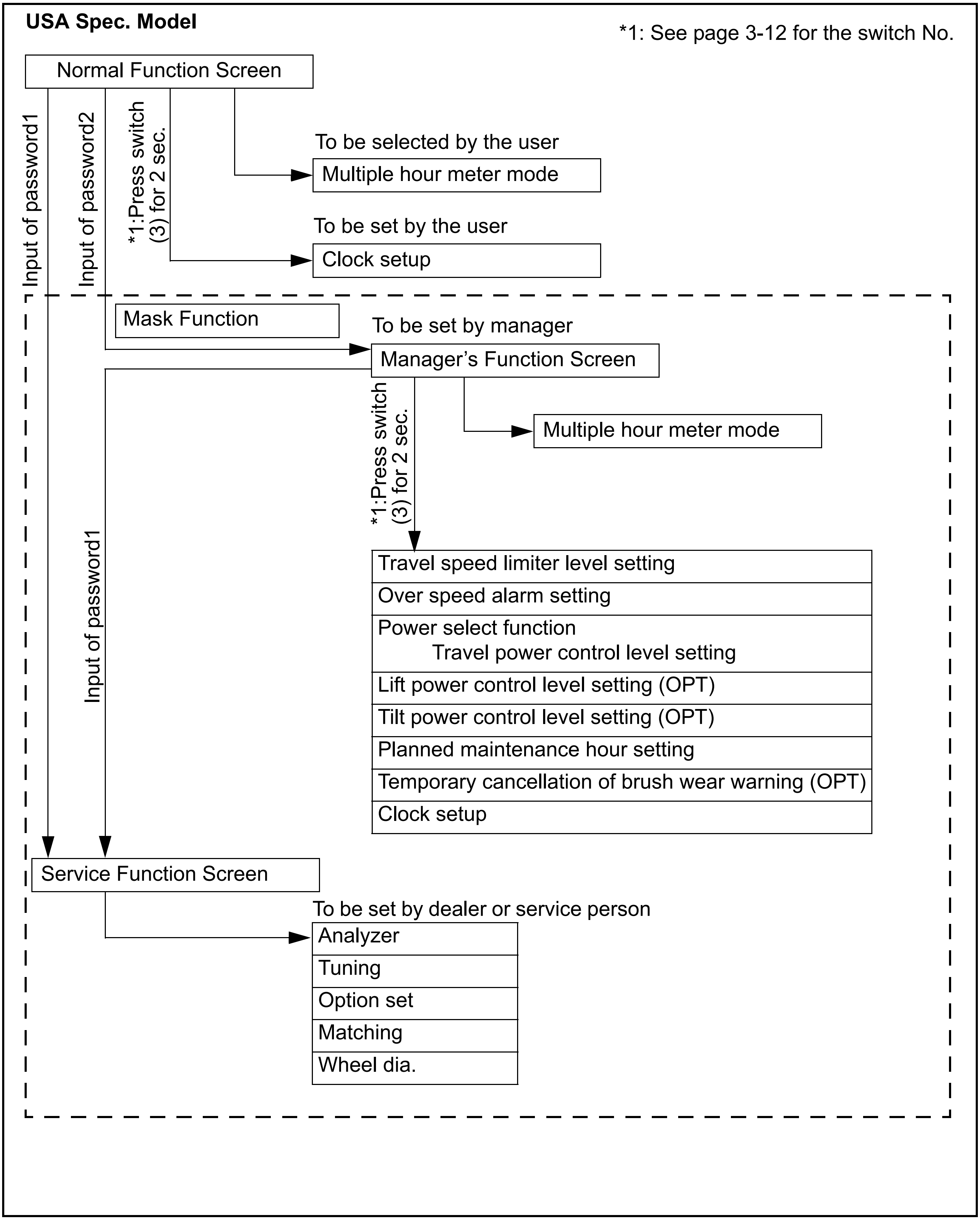
GENERAL FUNCTIONS

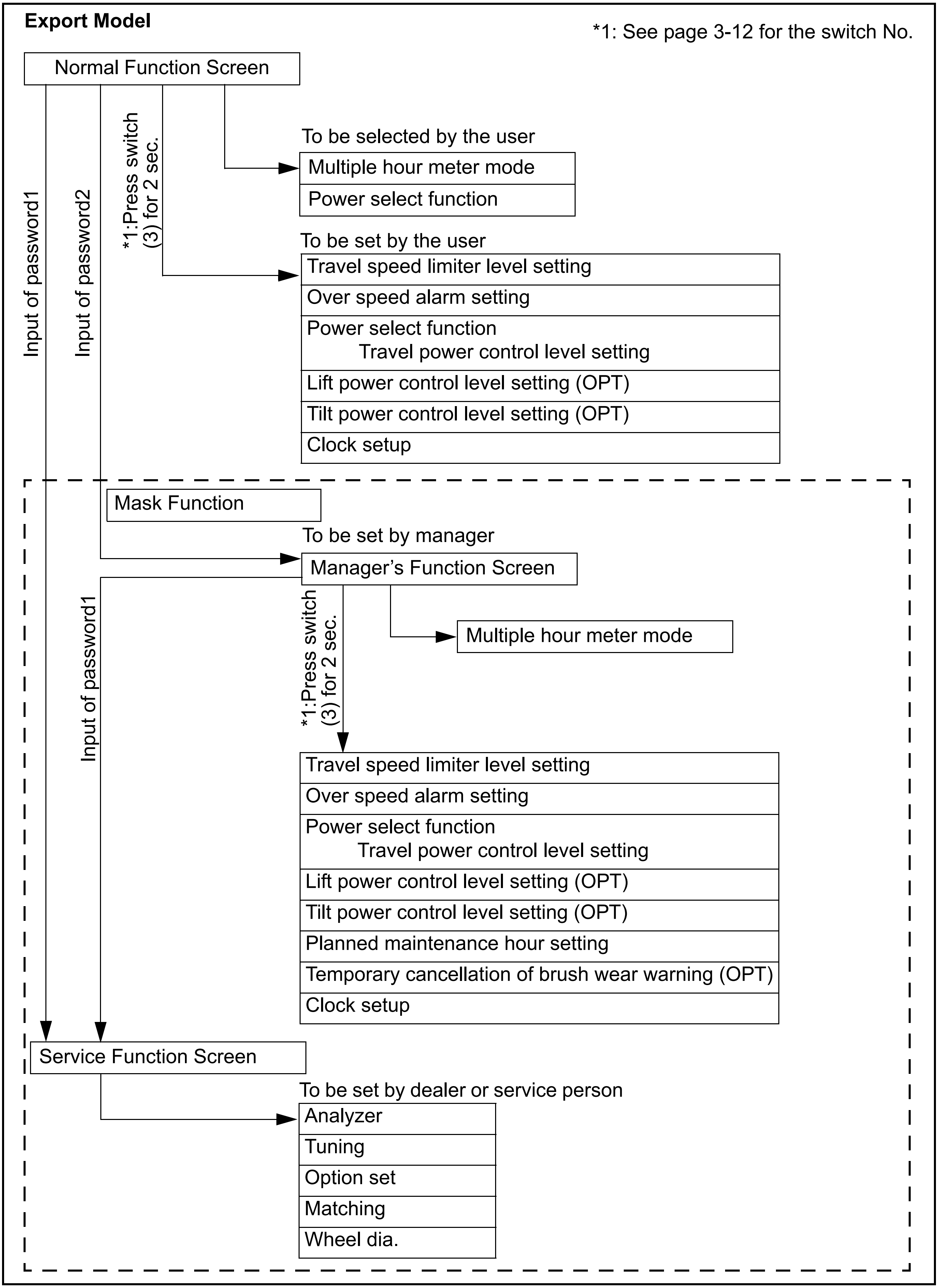
1. General functions can generally be used or seen by the user.
2. Multi-display is provided in US spec. models and export models. Availability of the functions for each model is shown below.

○: User available
Δ: Manager available (protected by the password 2)

Functions	Model	USA Spec. Model	Export Model
Status display	Battery capacity indicator	○	○
	Speedometer	○	○
	Swing lock indicator	○	○
	Parking brake indicator	○	○
	Power select indicator	○	○
	Travel speed limiter setting indicator	○	○
Level setting	Power select function	Δ	○
	Travel power control level setting	Δ	○
	Lift power control level setting (OPT)	Δ	○
	Tilt power control level setting (OPT)	Δ	○
	Travel speed limiter level setting	Δ	○
Integrating meters	Key switch on hour meter	○	○
	Travel or material handling motors service hour meter	○	○
	Travel motor service hour meter	○	○
	Material handling motor service hour meter	○	○
	Lap time meter	○	○
	Odometer	○	○
	Trip meter	○	○
	Planned maintenance hour meter	○	○
	Calendar/Clock	○	○
Warning	Battery over-discharge warning	○	○
	Low battery capacity warning	○	○
	Overheat warning	○	○
	Parking brake ON warning	○	○
	Parking brake OFF warning	○	○
	Return to neutral warning	○	○
	Over speed alarm	○	○
	Planned maintenance hour warning indicator	○	○
	Brush wear warning (OPT)	○	○
	Diagnostic code display	○	○

DISPLAY INDICATION LIST




Export Model
*1: See page 3-12 for the switch No.
Normal Function Screen
Input of password1
Input of password2
*1:Press switch (3) for 2 sec.
To be selected by the user
Multiple hour meter mode
Power select function
To be set by the user
Travel speed limiter level setting
Over speed alarm setting
Power select function
Travel power control level setting
Lift power control level setting (OPT)
Tilt power control level setting (OPT)
Clock setup
Mask Function
To be set by manager
Manager's Function Screen
Input of password1
*1:Press switch (3) for 2 sec.
Multiple hour meter mode
Travel speed limiter level setting
Over speed alarm setting
Power select function
Travel power control level setting
Lift power control level setting (OPT)
Tilt power control level setting (OPT)
Planned maintenance hour setting
Temporary cancellation of brush wear warning (OPT)
Clock setup
Service Function Screen
To be set by dealer or service person
Analyzer
Tuning
Option set
Matching
Wheel dia.

Details of Service Function Screen

ANALYZER	DIAG MEMORY	Checking past diagnosis codes stored in memory
	I/O MONITOR1	Checking the temperature and voltage of each functional part
	I/O MONITOR2	Checking traveling-related sensors
	I/O MONITOR3	Checking material handling and mast control sensors
	I/O MONITOR4	Steering control and checking other sensors
	ACTIVE TEST	Forced ON/OFF test of each switch
TUNING	NO.1	Setting regenerative braking torque (switch back)
	NO.2	Setting regenerative braking torque (accelerator off)
	NO.3	Lift interrupt level setting
	NO.4	Battery charge indication correction
	NO.5	Travel speed limiter
	NO.6	Attachment power control NO.1
	NO.7	Tilt power control
	NO.8	Material handling chopper duty after activation
	NO.9	Material handling chopper soft start
	NO.10	Lifting power control
	NO.11	Material handling chopper duty in 1st stage
	NO.12	Attachment power control NO.2
	NO.13	Spare
	NO.14	Spare
	NO.15	Spare
OPTION SET	DEMO MODE	Enabling simultaneous traveling and material handling before starting the hour meter
	H/M START	Starting integration by hour meter
	P/C LOCK	Disabling setting the traveling/material handling power control, travel speed limiter level and speed alarm level
	MPH	Selecting the traveling speed display
	BATTERY	Setting the calculation constant for battery charge indication
	B-TYPE	Battery type setting
	AUTO P-OFF	Setting the auto power OFF function
	PARKING ERR	Setting of Parking Brake Warning Function
	TILT CONT	Setting the mast forward tilt angle limit
	TILT F-LIM	Setting the mast forward/backward tilt speed control function
	USA	Setting the USA specification
	EHPS	Setting the EHPS specification
	36 V	Selecting the battery voltage
	BRUSH WEAR	Setting the brush wear warning
	P-CHOPPER	Setting the material handling chopper
	SEAT BRAKE	Setting the deadman brake
MATCHING	TILTL	Horizontal matching for tilt angle sensor
	TILTF	Forward tilt position matching for tilt angle sensor
	LOAD	Pressure sensor no-load matching
	PDUTY	Material handling duty correction
WHEEL DIA	WHEEL DIA	Tire constant setting

SPECIFICATIONS

LCD	Dot matrix + fixed display
Buttons	Four buttons
Back light	LED type that comes on when the key switch is turned to ON

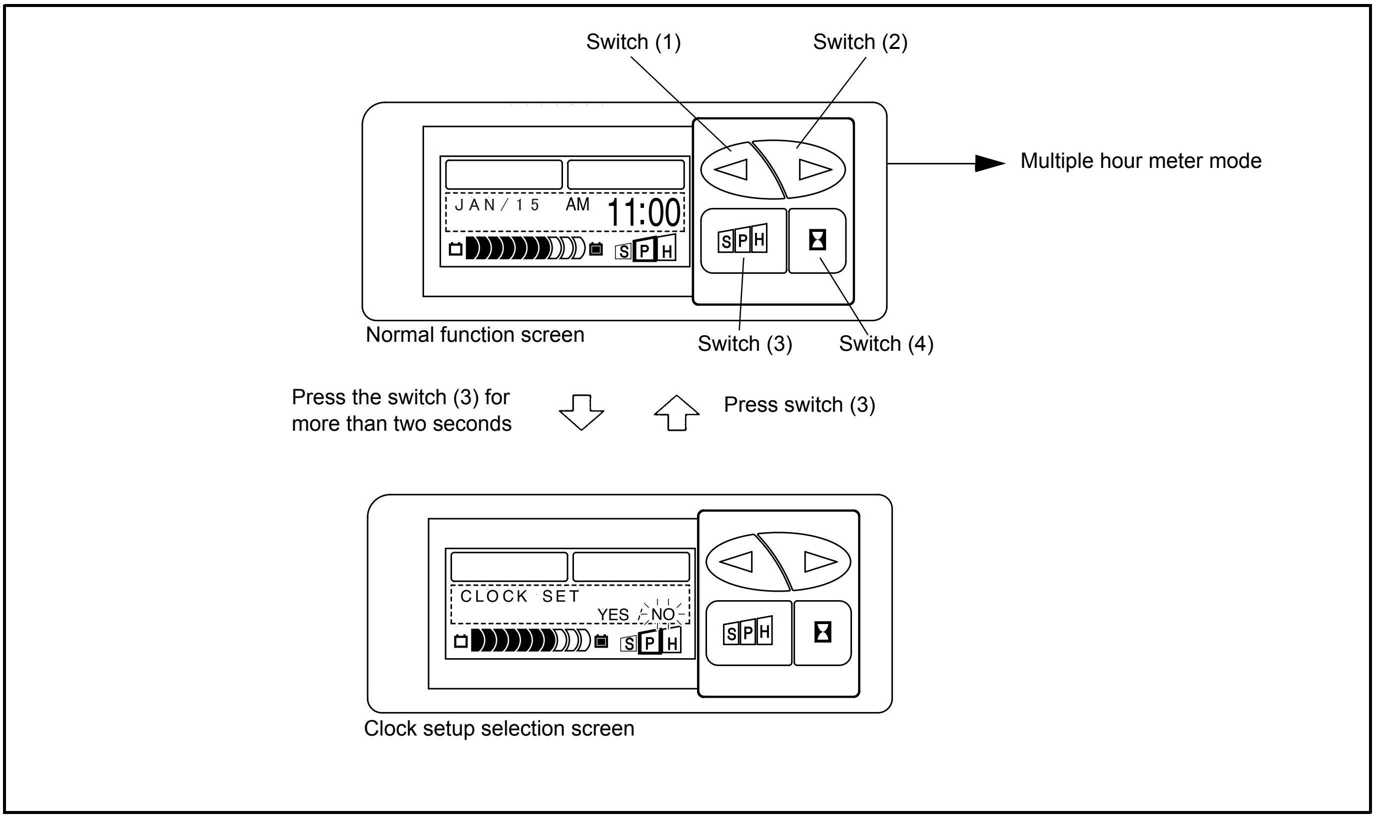
ABBREVIATIONS DISPLAYED ON THE SCREEN

Abbreviation	Meaning	Abbreviation	Meaning
AOPT	Analog input voltage	SPL	Load sensor
C/R	Controller	SSD1	Traveling motor rpm sensor (1)
CSBATT	Battery current	SSD2	Traveling motor rpm sensor (2)
CSP	Pump current sensor	SSOL	Swing solenoid
DM	Drive motor	STLSD	Dead-man seat switch (ST input)
DSF	Forward direction switch	STS	Steering angle sensor
DSOL	Dead-man solenoid	STS1	Steering angle sensor No.1
DSR	Reverse direction switch	STS2	Steering angle sensor No.2
FAND	Traveling system fan	SWAC	Accelerator switch
FAND2	Traveling system fan2	SWTK	Tilt knob switch
H/M	Hour meter	TD	Drive motor temperature
LOAD	Material handling hydraulic pressure	TD2	Drive motor temperature2
LSAT1	Attachment switch No.1	TEMP	Temperature on CPU board
LSAT2	Attachment switch No.2	THCD	Main traveling circuit temperature
LSB	Brake switch	THCD2	Main traveling circuit temperature2
LSD	Dead-man seat switch (main input)	THCP	Main load handling circuit temperature
LSL	Lift 1st·2nd stage switch (main input)	TILTF	Forward tilt
LSOPT1	Option limit switch No.1	TILTL	Tilt neutral position
LSOPT2	Option limit switch No.2	TP	Material handling pump motor temperature
LST	Tilt switch	TP2	Material handling pump motor temperature 2
LSTF	Forward tilt switch	VBBT	Battery voltage
LSTR	Backward tilt switch	VBMB	Main battery input voltage
MH	Lifting height switch	VBKY	Voltage after key switch
P/C	Power control	VBMB (M)	Voltage after (main input) MB contactor
PDUTY	Material handling duty correction	VBMB (S)	Voltage after (ST input) MB contactor
PLSL1	Lift 1st stage switch (SCPU input)	VBMBP	Voltage after (SCPU input) MP1 contactor
PM	Pump motor	VBP4	P4 terminal voltage
POTA	Accelerator potentiometer	YAW	Yaw rate sensor voltage
POTT	Tilt angle potentiometer	chopper	Material handling chopper
SPDM	Main vehicle speed		
SPDS	PS vehicle speed		

NORMAL FUNCTION SCREEN

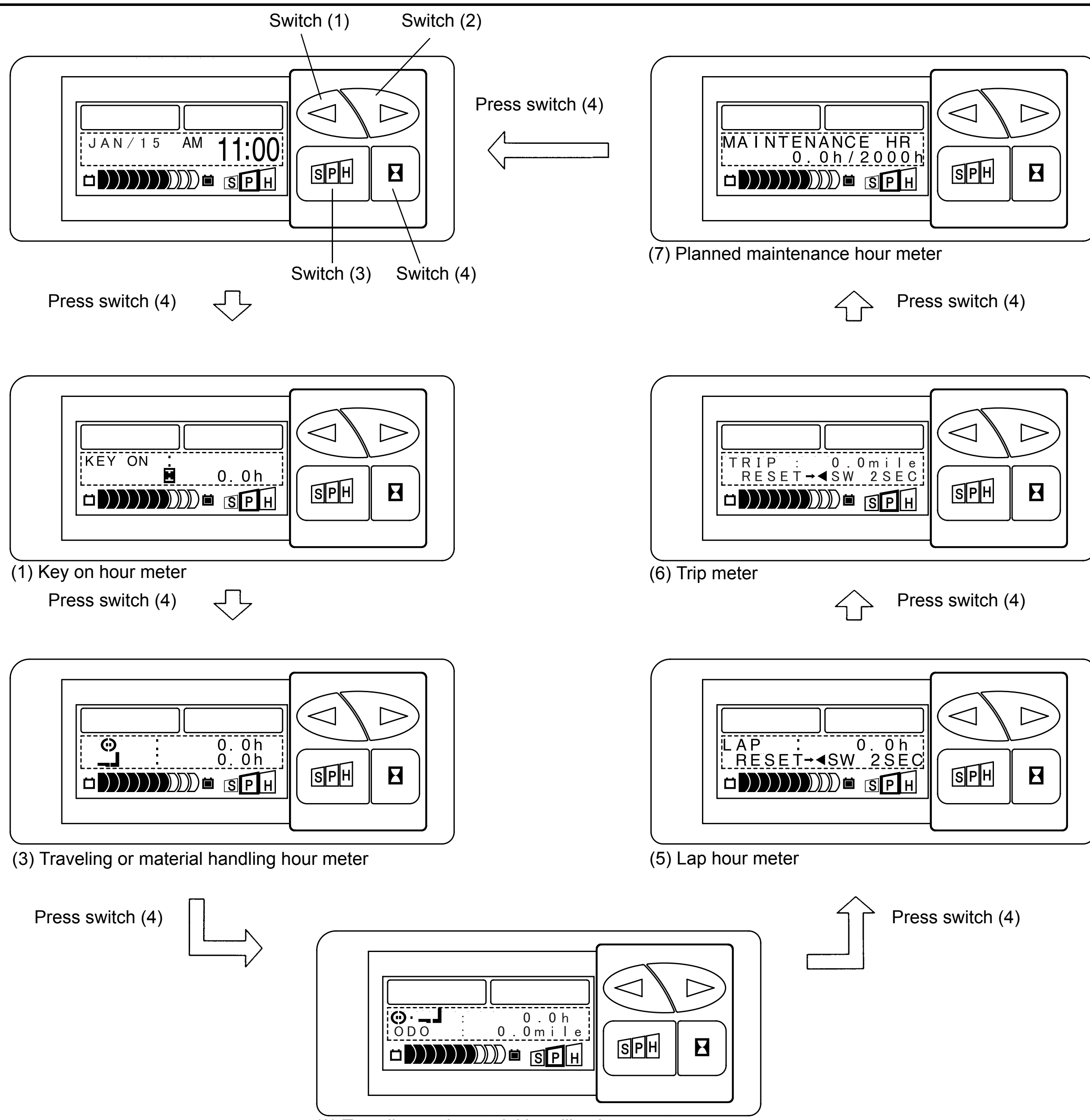
USA SPECIFICATION MODEL

OPERATION PROCEDURE



NORMALLY INDICATED SCREEN

1. Selection of hour meter type to be displayed
   Press switch (4) to select the hour meter type to be displayed.
   (1) Key ON hour meter: Indicate the total key ON hours.
   (2) Traveling/material handling hour meter: Drive/pump motor ON hours
   (3) Traveling or material handling hour meter: Total of drive or pump motor ON hours
   (4) Odometer: Total traveling distance
   (5) Lap hour meter: Lap time at key ON
   (6) Trip meter: Trip traveling distance
   (7) Planned maintenance hour meter: Accumulated hours total in key on-state since last maintenance.



(7) Planned maintenance hour meter

(1) Key on hour meter

(6) Trip meter

(3) Traveling or material handling hour meter

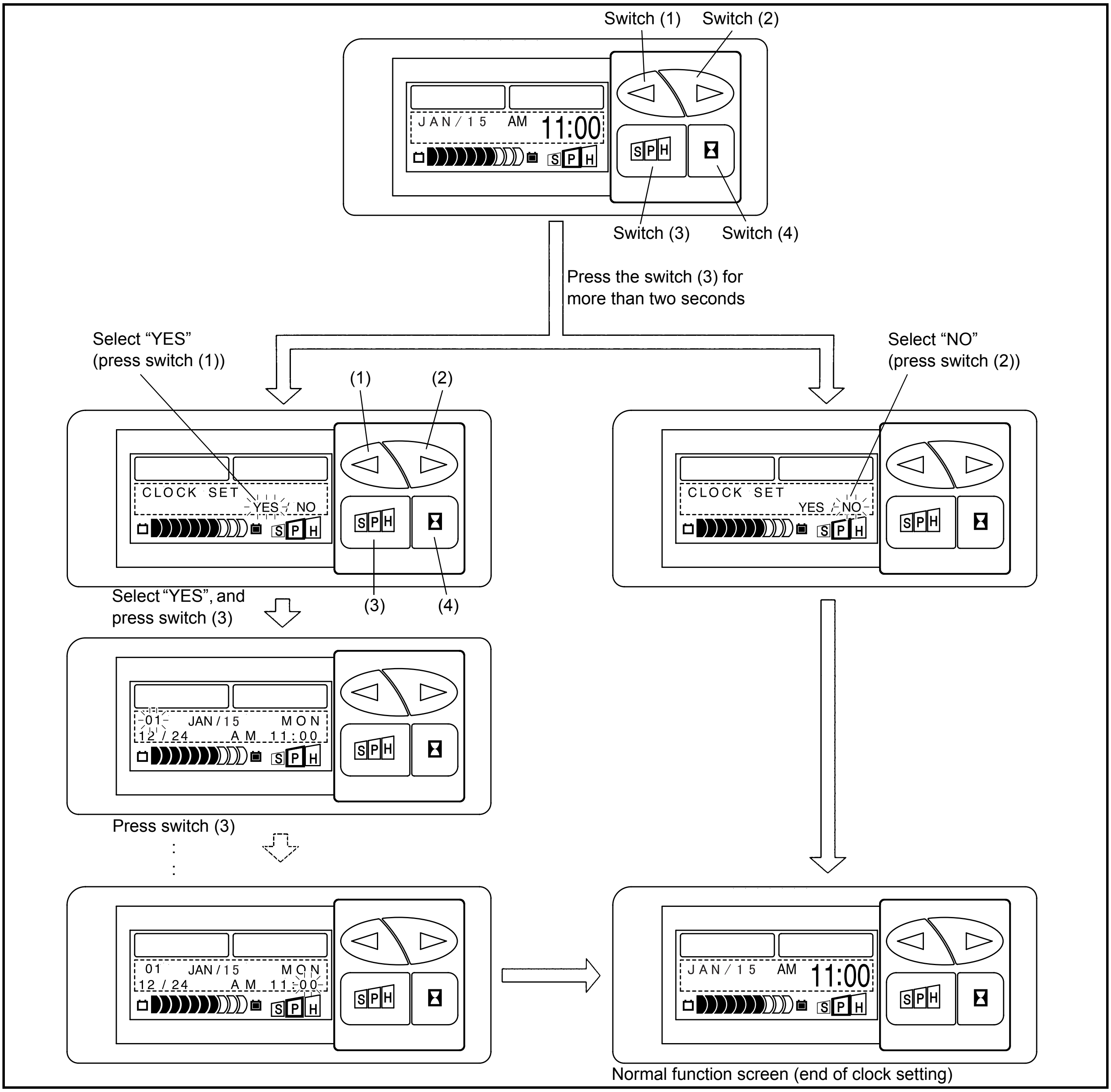
(5) Lap hour meter

(3) Traveling and material handling hour meter
(4) Odometer

The lap time and trip meter can be reset by pressing switch (1) for two seconds or more.

CLOCK SETUP SELECTION SCREEN

The year, month, day, day of week, time and 12/24-hour system can be set independently.
Press switch (3) on the normal function screen for two seconds or more to open the CLOCK SETUP SELECTION screen.

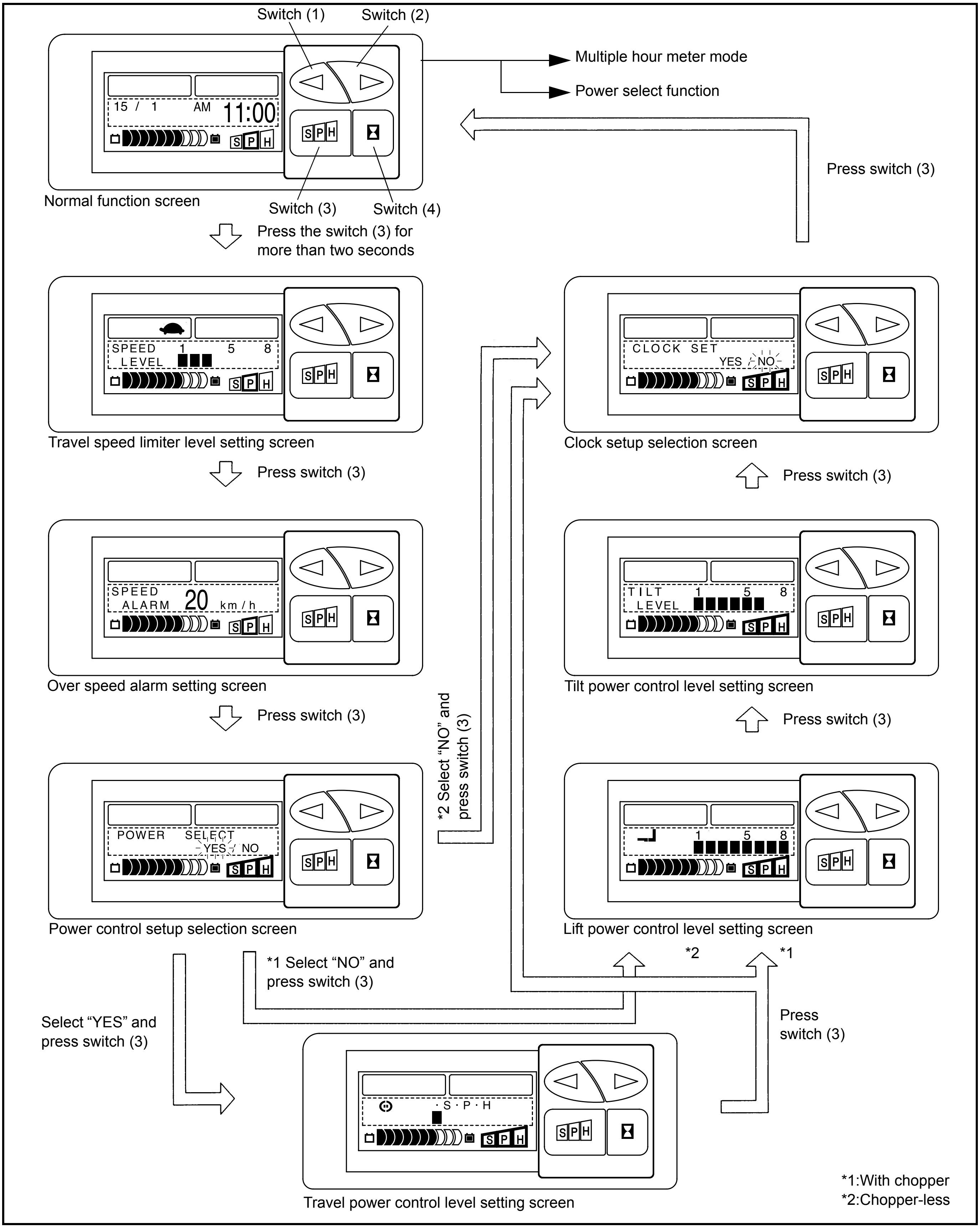


1. Press switch (1) on the CLOCK SET screen, select "YES" and press switch (3) to open the CLOCK SET screen.
   (1) CLOCK SET screen
   - Press switch (1) to decrease the set value (blinking).
   - Press switch (2) to increase the set value (blinking).
   - Press switch (3) to set the currently selected item (blinking) and go to the next item.
   - Press switch (3) when minute is selected on the CLOCK SET screen to return to the normal function screen.

   (2) Press switch (2) on the CLOCK SET screen, select "NO" and press switch (2) to return to the normal function screen.

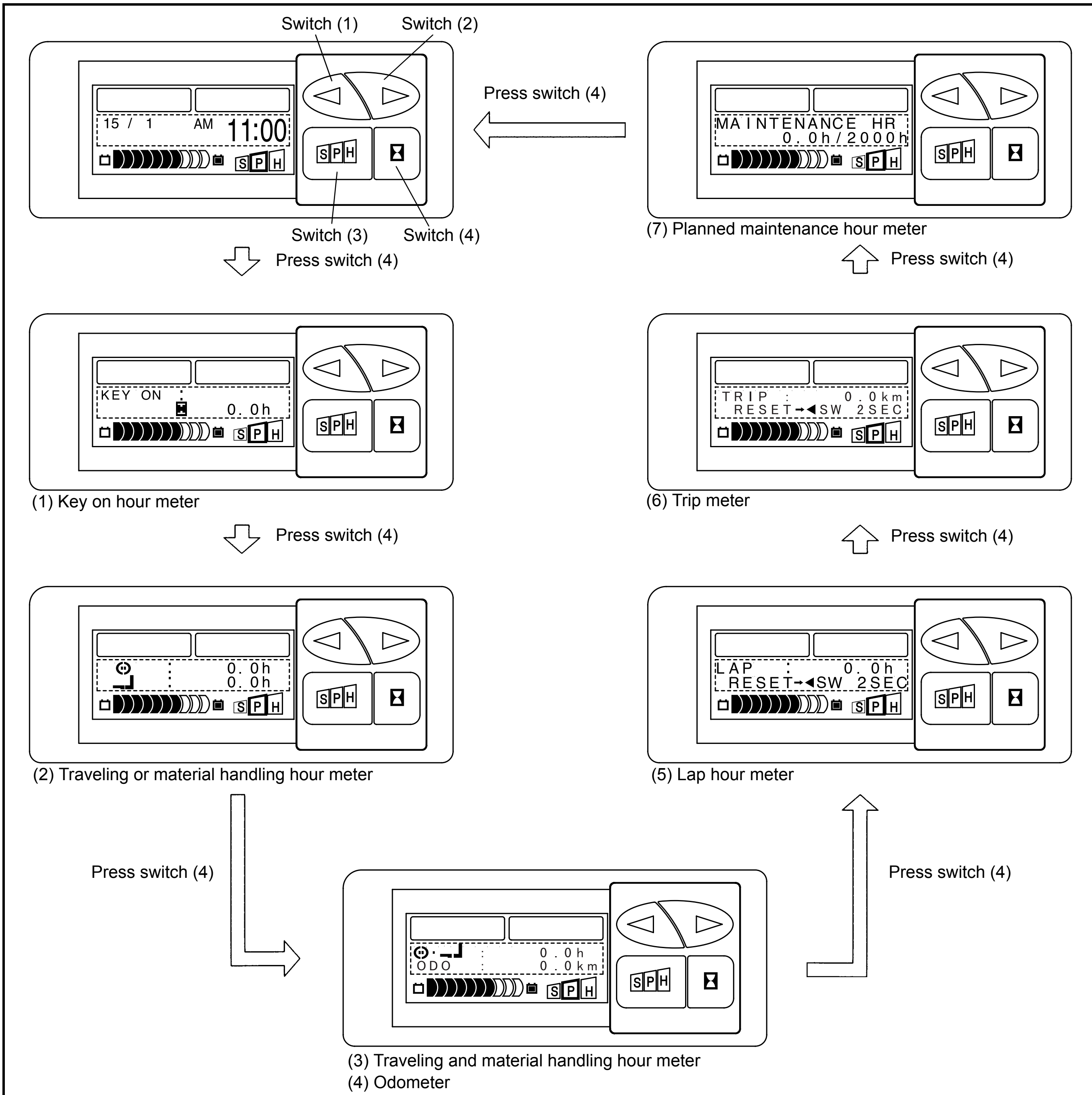
EXPORT MODEL

OPERATION PROCEDURE

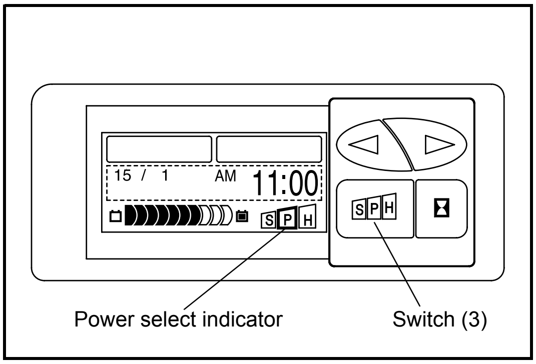


NORMALLY INDICATED SCREEN

1. Selection of hour meter type to be displayed
   Press switch (4) to select the hour meter type to be displayed.
   (1) Key ON hour meter: Indicate the total key ON hours.
   (2) Traveling/material handling hour meter: Drive/pump motor ON hours
   (3) Traveling or material handling hour meter: Total of drive or pump motor ON hours
   (4) Odometer: Total traveling distance
   (5) Lap hour meter: Lap time at key ON
   (6) Trip meter: Trip traveling distance
   (7) Planned maintenance hour meter: Accumulated hours total in key on-state since last maintenance.

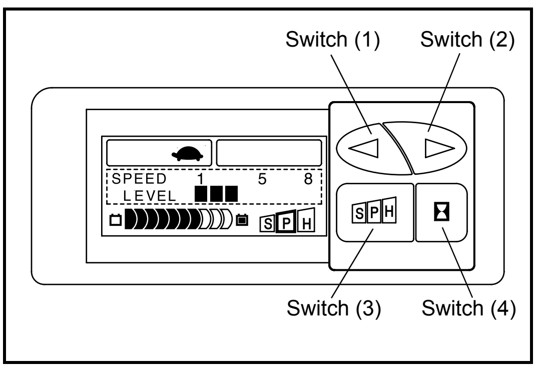


The lap time and trip meter can be reset by pressing switch (1) for two seconds or more.



2. Selecting the power select mode (S , P or H) Press switch (3) on the normal function screen to select the desired power mode by shifting to the corresponding indicator position.
   - S : To hold down the output and realize operation of long time
   - P : Power equivalent to the maximum power of previous model
   - H : 15% increase in performance under loaded condition

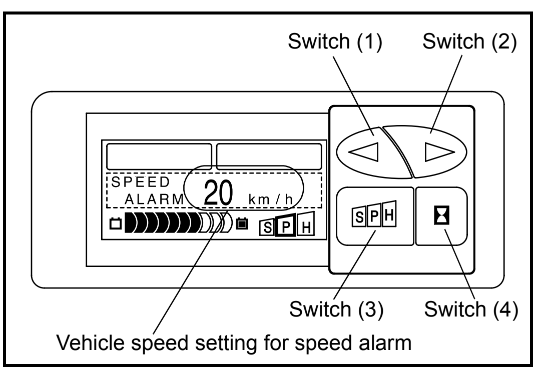
- Pattern1: When nothing is set on the POWER CONTROL SET UP SELECTION screen
  Each time switch (3) is pressed, the selected mode position shifts to the right in the order shown below:
  S → P → H → S and so on
- Pattern2: When setting is made on the POWER CONTROL SET UP SELECTION screen
  Each time switch (3) is pressed, the selected mode shifts to the right as shown below:
  S → P → H → SPH → S → P and so on
  When all modes are enclosed in squares, the control is made by the mode selected on the POWER CONTROL SET UP SELECTION screen.



TRAVEL SPEED LIMITER LEVEL SETTING SCREEN

Use this screen to set the travel speed limiter level. Indicator lights when travel speed limit set is seven or less.

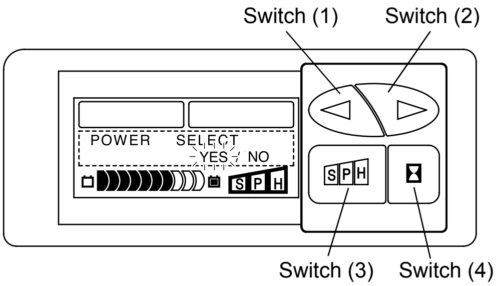
(1) Press switch (1) to decrease the travel speed limiter level.
(2) Press switch (2) to increase the travel speed limiter level.
(3) Press switch (3) to go to the next screen, (OVERSPEED ALARM SET screen).



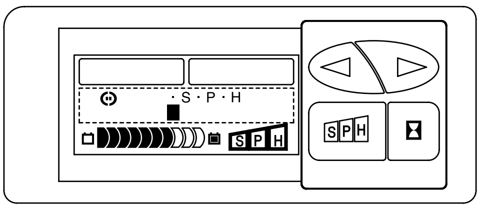
OVERSPEED ALARM SETTING SCREEN

This screen sets the traveling speed level for overspeed alarming. To call the OVERSPEED ALARM SET screen from the TRAVEL SPEED LIMITER LEVEL SETTING screen, press switch (3) once.

(1) Press switch (1) to decrease the set traveling speed.
(2) Press switch (2) to increase the set traveling speed.
(3) Press switch (3) to go to the next screen, POWER CONTROL set up selection screen.

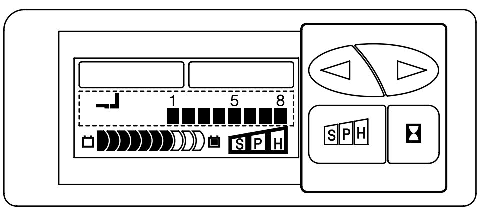


Select “YES”, and press switch (3)



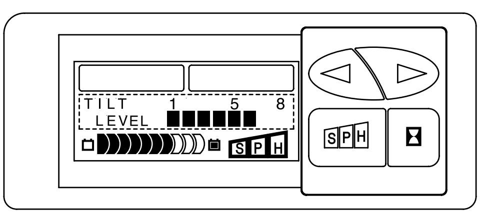
Traveling power control level setting screen

Press switch (3)



Lift power control level setting screen (with chopper)

Press switch (3)



Tilt power control level setting screen (with chopper)

POWER CONTROL SET UP SELECTION SCREEN

This screen sets the travel and material handling power control levels independently.

Press switch (3) on the OVERSPEED ALARM SETTING screen to go to the POWER CONTROL SET UP SELECTION screen.

(1) Press switch (1) on the POWER CONTROL SET UP SELECTION screen, select “YES” and press switch (3) to go to the TRAVEL POWER CONTROL LEVEL SETTING screen.

(2) Press switch (2) on the POWER CONTROL SET UP SELECTION screen, select “NO” and press switch (3) to go to the LIFT POWER CONTROL LEVEL SETTING screen. (with chopper) Go to the next menu in case of the chopper-less type.

TRAVEL POWER CONTROL LEVEL SETTING SCREEN

This screen sets the travel power control levels.

Press switch (1) on the POWER CONTROL SET UP SELECTION screen, select “YES” and press switch (3) to go to the TRAVEL POWER CONTROL LEVEL SETTING screen.

1) Press switch (1) to decrease the set level.
2) Press switch (2) to increase the set level.
3) Press switch (3) to go to the next screen, LIFT POWER CONTROL LEVEL SETTING screen. (with chopper)
   It goes to the CLOCK SET UP SELECTION screen, in case of chopper-less type models.

LIFT POWER CONTROL LEVEL SETTING SCREEN (WITH CHOPPER)

This screen sets the lift power control levels.

Press switch (2) on the POWER CONTROL SET UP SELECTION screen, select “NO” and press switch (3) to go to the LIFT POWER CONTROL LEVEL SETTING screen.

1) Press switch (1) to decrease the set level.
2) Press switch (2) to increase the set level.
3) Press switch (3) to go to the next screen, TILT POWER CONTROL LEVEL SETTING screen. (with chopper)

TILT POWER CONTROL LEVEL SETTING (WITH CHOPPER)

This screen sets the tilt power control levels.

Press switch (3) on the LIFT POWER CONTROL LEVEL SETTING screen to go to the TILT POWER CONTROL LEVEL SETTING screen.

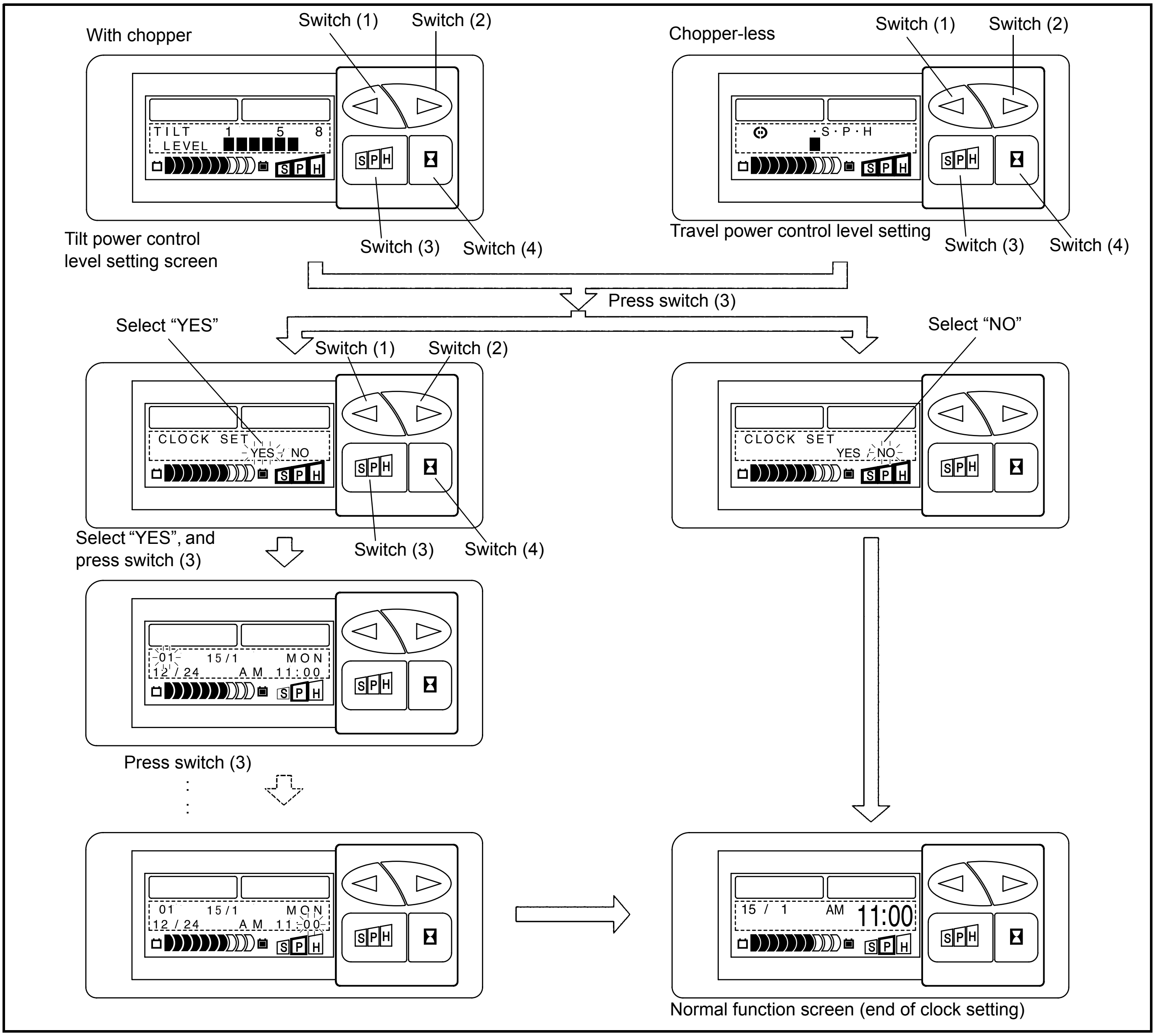
(1) Press switch (1) to decrease the set level.
(2) Press switch (2) to increase the set level.
(3) Press switch (3) to go to the next menu, CLOCK SET UP SELECTION screen.

CLOCK SET UP SELECTION SCREEN

The year, month, day, day of week, time and 12/24-hour system can be set independently.

With chopper: Press switch (3) on the TILT POWER CONTROL LEVEL SETTING screen to go to the CLOCK SET UP SELECTION screen.

Chopper-less: Press switch (3) on the TRAVEL POWER CONTROL LEVEL SETTING screen to go to the CLOCK SET UP SELECTION screen.



1. Press switch (1) on the CLOCK SET screen, select "YES" and press switch (3) to open the CLOCK SET screen.
   (1) CLOCK SET screen
   - Press switch (1) to decrease the set value (blinking).
   - Press switch (2) to increase the set value (blinking).
   - Press switch (3) to set the currently selected item (blinking) and go to the next item.
   - Press switch (3) when Minute is selected on the CLOCK SET screen to return to the normal function screen.
2. Press switch (2) on the CLOCK SET screen, select "NO" and press switch (2) to return to the normal function screen.

MASK FUNCTIONS

GENERAL

In addition to the functions described in the owner's manual for use by general users, the multi-screen display provides two MASK FUNCTIONs: the MANAGER'S FUNCTION to be used by the vehicle manager for performance adjustment and specification setting, and the SERVICE FUNCTION to be used by the service person for vehicle maintenance and specification setting.

The mask functions are protected by the password so that the important internal data will not be damaged by wrong use of mask functions by users by mistake.

Mask Function List

MANAGER'S FUNCTION

○: Only for manager
●: User and manager available

Functions \ Model	USA Model	Export model
Power select function	○	●
Travel speed limiter level setting	○	●
Over speed alarm setting	○	●
Travel power control level setting	○	●
Lift power control level setting (OPT)	○	●
Tilt power control level setting (OPT)	○	●
Planned maintenance hour setting	○	○
Temporary cancellation of brush wear warning (OPT)	○	○

SERVICE FUNCTION

Functions		Description	When used		
			Vehicle delivery	Board replacement	Others
Analyzer		Used for displaying the operation status of electrical systems onboard or for accessing information on errors detected by the controller.	-	-	Upon vehicle abnormality
Tuning		Used for fine-tuning the traveling and material handing control features.	-	○ *2,*4	As requested by customer
Option setting	Specifications	Used for changing the setups according to the availability of options. *1	-	○ *2,*4,*6	-
	Availability of controls	Used for changing the setups according to the availability of various control features.	-	○ *2,*3,*4,*5,*6	-
	Multiple hour meter startup	Used for starting up the multiple hour meter.	○	○ *6	-
	Demonstration mode	Used for setting and canceling the demonstration mode. (Function prohibiting material handing operation during traveling which is set at the time delivery.)	-	-	New vehicle or before demonstration
Matching		Used for readjusting the sensor signal voltage values associated with the standard vehicle condition.	-	○ *2,*3,*4,*5	-
Wheel dia. (tire constant)		Used for improving the speedometer accuracy by updating the wheel diameter information	-	○ *2,*4	-

*1: These functions are used to adjust the controller and display setups to the availability of optional or control features. They do not enable or disable the actual functioning of the optional or control features.
*2: Board: Traveling/material handling controller (15 ~ 32 model)
*3: Board: SAS controller
*4: Board: Traveling controller (35 ~ 55 model)
*5: Board: Material handling controller (35 ~ 55 model)
*6: Board: Multiple display

Traveling, Material Handling and EHPS Operations on Each Mode Screen

○:Operable ×:Not operable

Mode screen	Traveling	Material handling	PS	Mode screen	Traveling	Material handling	PS
MASK MENU screen	○	○	○	TUNING screen	○	○	○
ANALYZER MENU screen	○	○	○	OPTION SET screen	×	×	○
ANALYZER MODE, MONITOR1 to MONITOR4 screen	○	○	○	MATCHING screen	○	○*	○
ANALYZER MODE, ACTIVE TEST screen	○	○	○	TIRE CONSTANT SET screen	○	○	○

* Only tilt control function disabled

MANAGER'S FUNCTION

PASSWORD2 FOR MANAGER'S FUNCTION

Notes on Password Input:

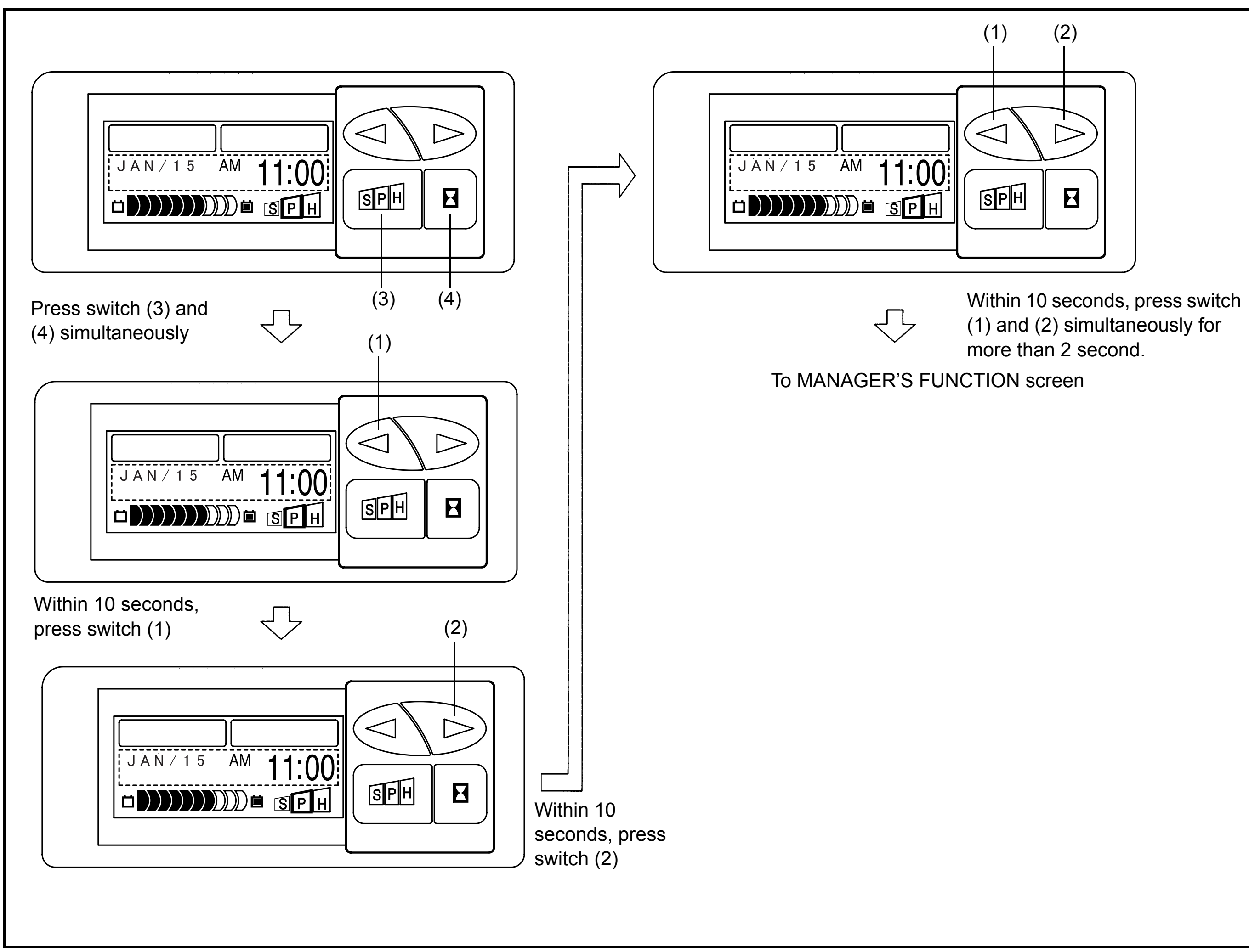
If a wrong input is found midway, turn the key switch to OFF and restart from the beginning. If the MANAGER'S FUNCTION cannot be displayed after several attempts, the system may be faulty.

Password 2 Input Procedure

Step	Operation	Vehicle operation
1	Press switches (3) and (4) at a time.	A short high-pitched electronic sound is given off.
2	Press switch (1).	A short high-pitched electronic sound is given off.
3	Press switch (2).	A short high-pitched electronic sound is given off.
4	Simultaneously press switches (1) and (2) for 2 seconds or more. (End of password input)	A longer high-pitched electronic sound is given off.

⇩

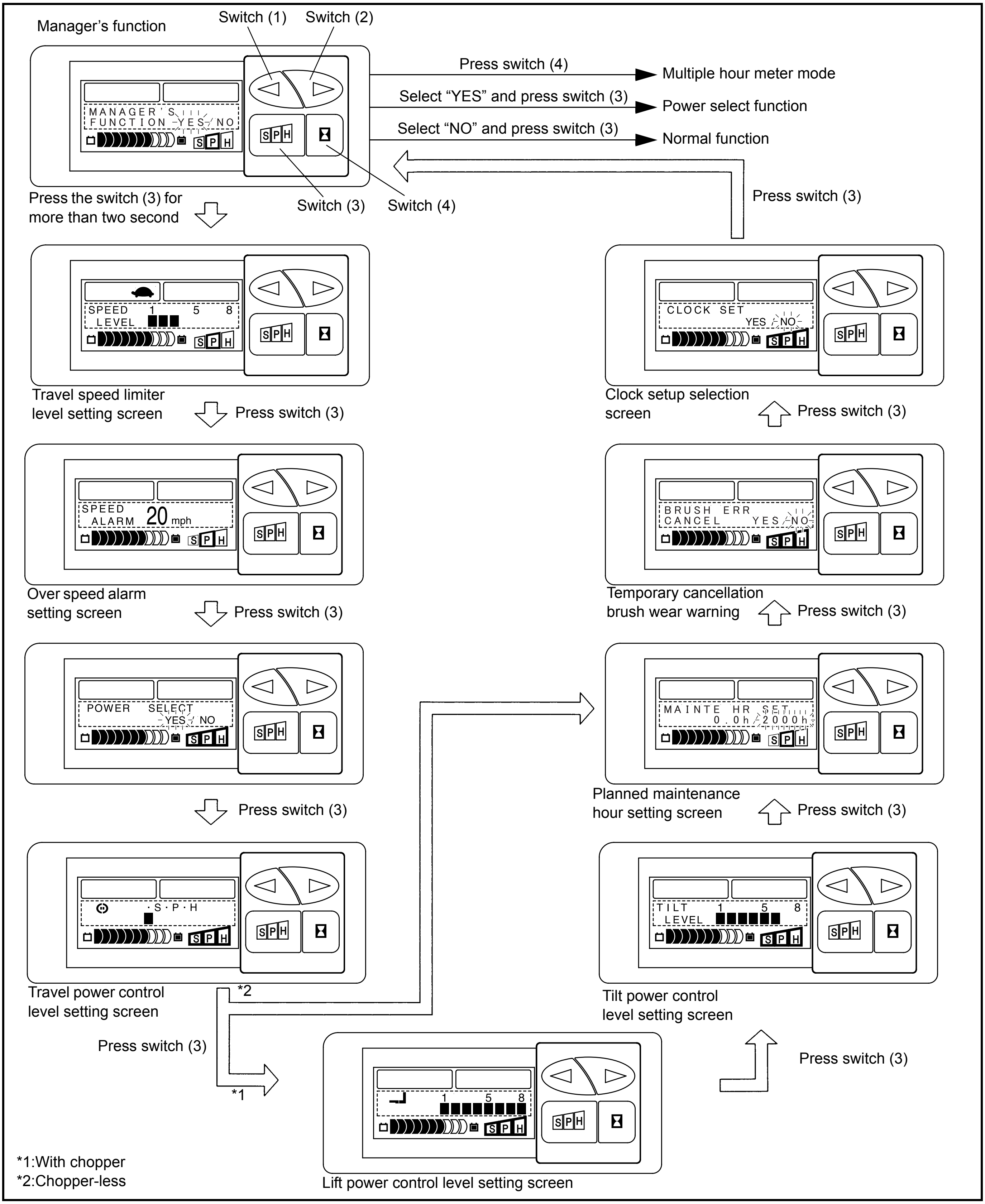
To MANAGER'S FUNCTION screen



OPERATION ON MANAGER’S FUNCTION SCREEN

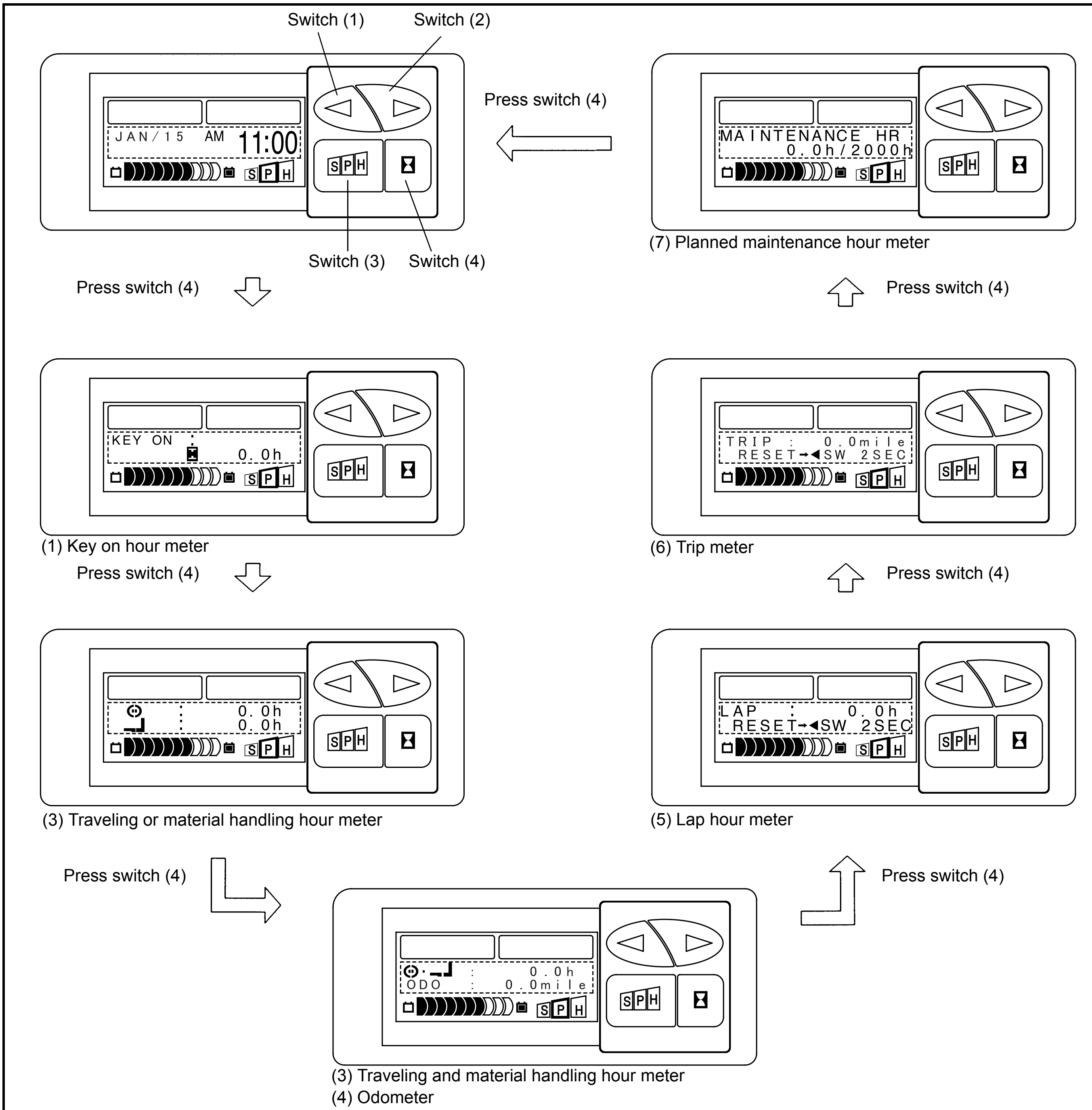
Operation Procedure

Input the password on the normal function menu (as explained on the preceding page) to display the SERVICE FUNCTION screen.

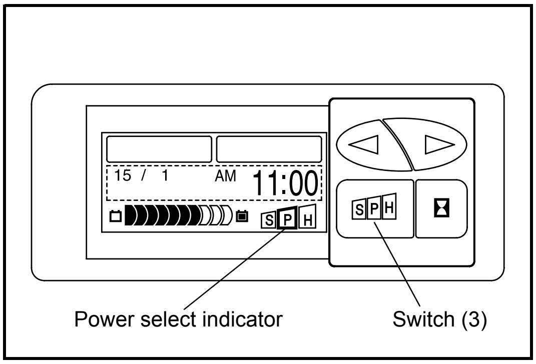


Manager's Function Indicated Screen

1. Selection of hour meter type to be displayed
   Press switch (4) to select the hour meter type to be displayed.
   (1) Key ON hour meter: Indicate the total key ON hours.
   (2) Traveling/material handling hour meter: Drive/pump motor ON hours
   (3) Traveling or material handling hour meter: Total of drive or pump motor ON hours
   (4) Odometer: Total traveling distance
   (5) Lap hour meter: Lap time at key ON
   (6) Trip meter: Trip traveling distance
   (7) Planned maintenance hour meter: Accumulated hours total in key on-state since last maintenance.

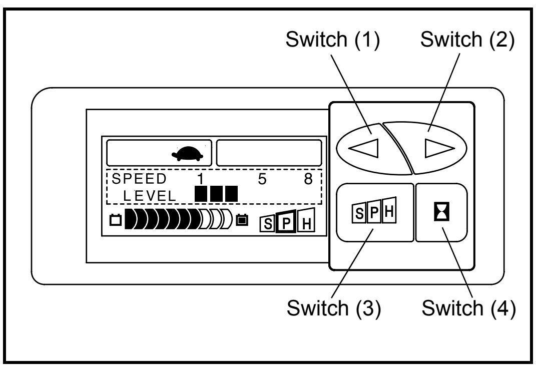


The lap time and trip meter can be reset by pressing switch (1) for two seconds or more.



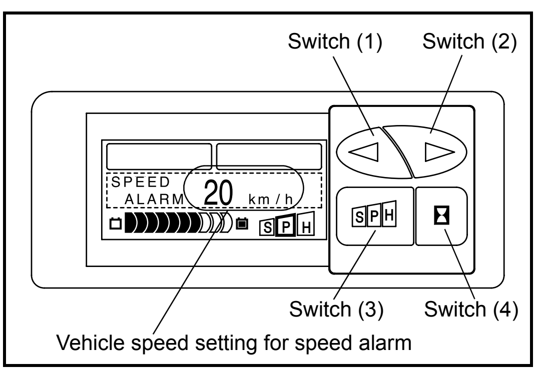
2. Selecting the power select mode ($\boxed{S}$, $\boxed{P}$ or $\boxed{H}$) Press switch (3) on the normal function screen to select the desired power mode by shifting to the corresponding indicator position.
   - S : To hold down the output and realize operation of long time
   - P : Power equivalent to the maximum power of previous model
   - H : 15% increase in performance under loaded condition

- Pattern1: When nothing is set on the POWER CONTROL SET UP SELECTION screen
  Each time switch (3) is pressed, the selected mode position shifts to the right in the order shown below:
  $\boxed{S} \rightarrow \boxed{P} \rightarrow \boxed{H} \rightarrow \boxed{S}$ and so on
- Pattern2: When setting is made on the POWER CONTROL SET UP SELECTION screen
  Each time switch (3) is pressed, the selected mode shifts to the right as shown below:
  $\boxed{S} \rightarrow \boxed{P} \rightarrow \boxed{H} \rightarrow \boxed{S}\boxed{P}\boxed{H} \rightarrow \boxed{S} \rightarrow \boxed{P}$ and so on
  When all modes are enclosed in squares, the control is made by the mode selected on the POWER CONTROL SET UP SELECTION screen.



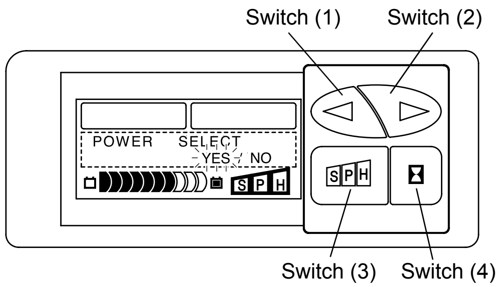
TRAVEL SPEED LIMITER LEVEL SETTING SCREEN
Use this screen to set the travel speed limiter level. Indicator lights when travel speed limit set is seven or less.

(1) Press switch (1) to decrease the travel speed limiter level.
(2) Press switch (2) to increase the travel speed limiter level.
(3) Press switch (3) to go to the next screen, (OVERSPEED ALARM SET screen).

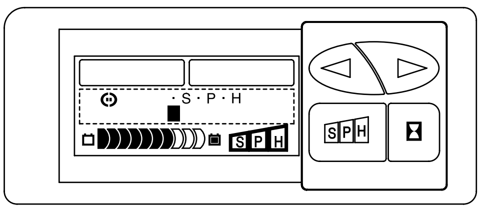


OVERSPEED ALARM SETTING SCREEN
This screen sets the traveling speed level for overspeed alarming. To call the OVERSPEED ALARM SET screen from the TRAVEL SPEED LIMITER LEVEL SETTING screen, press switch (3) once.

(1) Press switch (1) to decrease the set traveling speed.
(2) Press switch (2) to increase the set traveling speed.
(3) Press switch (3) to go to the next screen, POWER CONTROL set up selection screen.

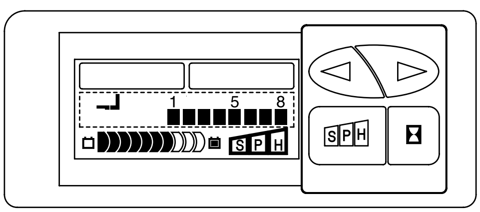


Select “YES”, and press switch (3)



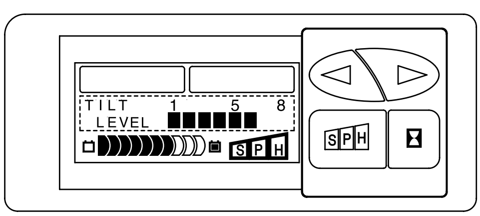
Traveling power control level setting screen

Press switch (3)



Lift power control level setting screen (with chopper)

Press switch (3)



Tilt power control level setting screen (with chopper)

POWER CONTROL SET UP SELECTION SCREEN

This screen sets the travel and material handling power control levels independently.
Press switch (3) on the OVERSPEED ALARM SETTING screen to go to the POWER CONTROL SET UP SELECTION screen.

(1) Press switch (1) on the POWER CONTROL SET UP SELECTION screen, select “YES” and press switch (3) to go to the TRAVEL POWER CONTROL LEVEL SETTING screen.

(2) Press switch (2) on the POWER CONTROL SET UP SELECTION screen, select “NO” and press switch (3) to go to the LIFT POWER CONTROL LEVEL SETTING screen. (with chopper) Go to the next menu in case of the chopper-less type.

TRAVEL POWER CONTROL LEVEL SETTING SCREEN

This screen sets the travel power control levels.
Press switch (1) or (2) on the POWER CONTROL SET UP SELECTION screen, select “YES” (with chopper) or “NO” (chopper-less) and press switch (3) to go to the TRAVEL POWER CONTROL LEVEL SETTING screen.

1) Press switch (1) to decrease the set level.
2) Press switch (2) to increase the set level.
3) Press switch (3) to go to the next screen, LIFT POWER CONTROL LEVEL SETTING screen. (with chopper)
   It goes to the CLOCK SET UP SELECTION screen, in case of chopper-less type models.

LIFT POWER CONTROL LEVEL SETTING SCREEN (WITH CHOPPER)

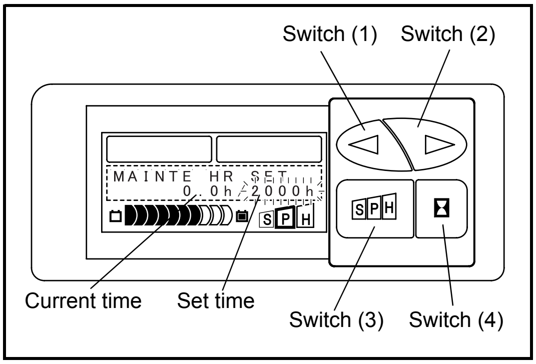
This screen sets the lift power control levels.
Press switch (2) on the POWER CONTROL SET UP SELECTION screen, select “NO” and press switch (3) to go to the LIFT POWER CONTROL LEVEL SETTING screen.

1) Press switch (1) to decrease the set level.
2) Press switch (2) to increase the set level.
3) Press switch (3) to go to the next screen, TILT POWER CONTROL LEVEL SETTING screen. (with chopper)

TILT POWER CONTROL LEVEL SETTING (WITH CHOPPER)

This screen sets the tilt power control levels.
Press switch (3) on the LIFT POWER CONTROL LEVEL SETTING screen to go to the TILT POWER CONTROL LEVEL SETTING screen.

(1) Press switch (1) to decrease the set level.
(2) Press switch (2) to increase the set level.
(3) Press switch (3) to go to the next menu, CLOCK SET UP SELECTION screen.

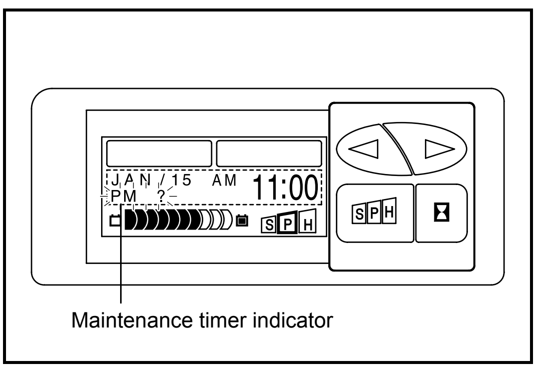


PLANNED MAINTENANCE HOUR SETTING SCREEN

This screen sets the planned maintenance hour. The time setting can be set 10 to 2000 hours.

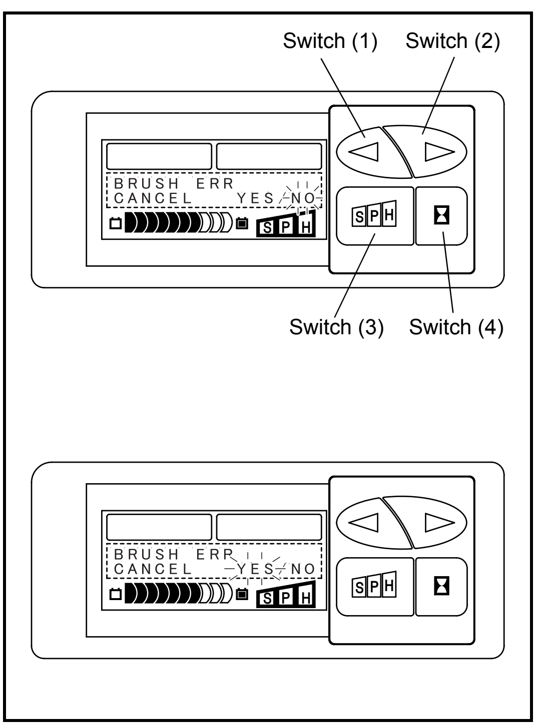
Press switch (3) on the TILT POWER CONTROL LEVEL SETTING screen to go to the PLANNED MAINTENANCE HOUR SETTING screen.

(1) Press switch (1) to decrease the setting time.
(2) Press switch (2) to increase the setting time.
(3) Current time can be reset by pressing switch (4) for two seconds or more.
(4) Press switch (3) to go to the next screen, TEMPORARY CANCELLATION BRUSH WEAR WARNING.



This indicator flashes when it comes to the maintenance time.

Buzzer continues 5 seconds after key switch ON.



TEMPORARY CANCELLATION BRUSH WEAR WARNING (OPT)

Brush wear warning can be canceled. Press switch (3) on the PLANNED MAINTENANCE HOUR SETTING screen to go to the TEMPORARY CANCELLATION BRUSH WEAR WARNING SCREEN.

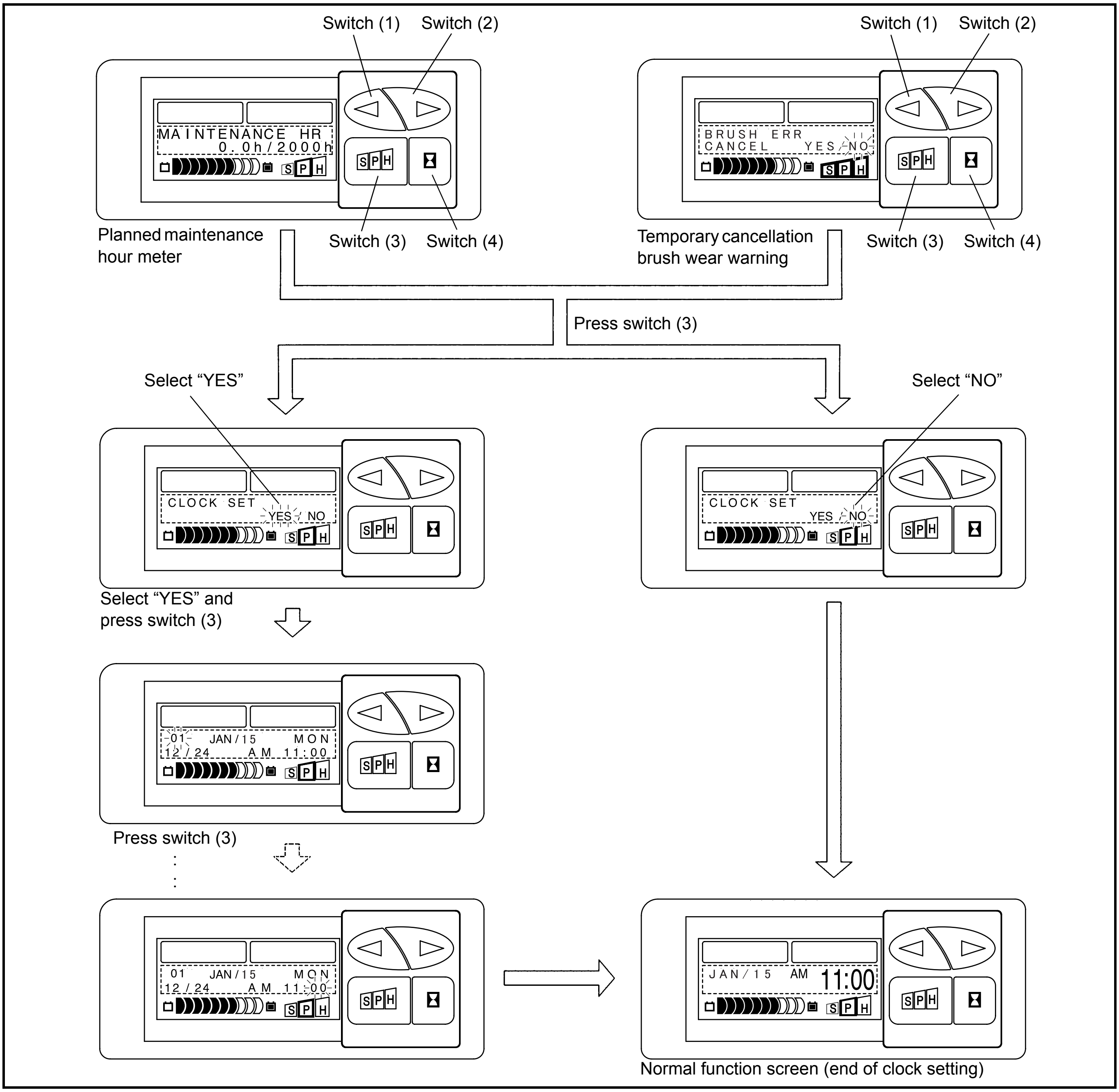
(1) After selecting YES by pressing switch (1), press switch (3) to cancel brush wear warning and to go to the next screen, “CLOCK SET UP SELECTION”.
(2) After selecting No by pressing switch (2), press switch (3) to go to the next screen, “CLOCK SET UP SELECTION” without canceling brush wear warning.

Note:

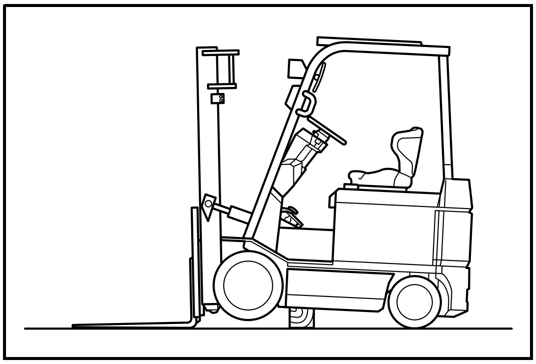
- **The shifting “No” to “Yes” can only be operable in case that the error took place.**
- **In the event of the cancellation, i.e., turn to “Yes”, of the brush wear warning, it should be returned to “No” after the brush replacements.**

CLOCK SETUP SELECTION SCREEN

The year, month, day, day of week, time and 12/24-hour system can be set independently.
Press switch (3) on the PLANNED MAINTENANCE HOUR METER screen or the TEMPORARY CANCELLATION BRUSH WEAR WARNING screen to go to the CLOCK SET UP SELECTION screen.



1. Press switch (1) on the CLOCK SET screen, select "YES" and press switch (3) to open the CLOCK SET screen.
   (1) CLOCK SET screen
   - Press switch (1) to decrease the set value (blinking).
   - Press switch (2) to increase the set value (blinking).
   - Press switch (3) to set the currently selected item (blinking) and go to the next item.
   - Press switch (3) when Minute is selected on the CLOCK SET screen to return to the normal function screen.
2. Press switch (2) on the CLOCK SET screen, select "NO" and press switch (2) to return to the MANAGER'S FUNCTION screen.



SERVICE FUNCTION

HOW TO USE THE SERVICE FUNCTION SCREEN

Preparation

Caution:
Always jack up the frame until the drive wheels (front tires) leave the ground and support the vehicle with wooden block under both side frames in the front. Fully lower the fork.

1. See that the battery plug is connected securely and turn the key switch to ON.

2. Operate the SERVICE FUNCTION according to the password input procedure explained on page 3-30.

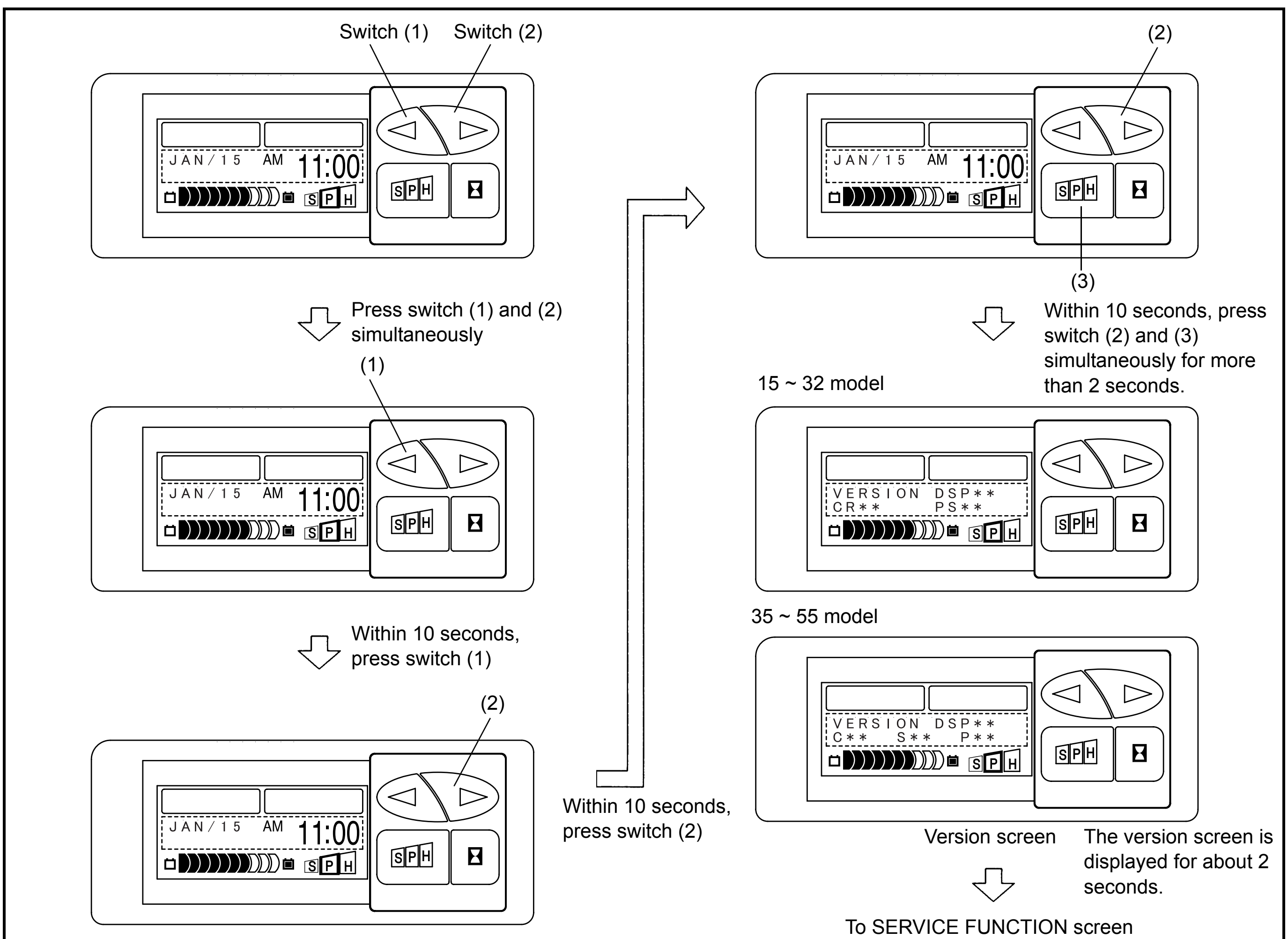
PASSWORD1 FOR SERVICE FUNCTION

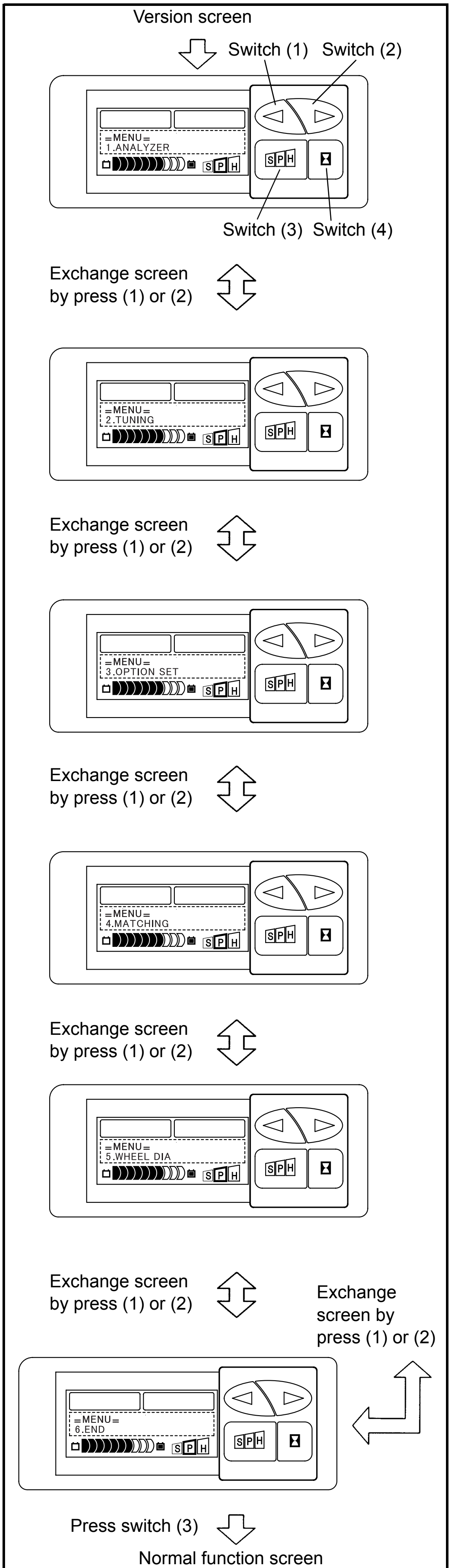
Notes on Password Input:

If a wrong input is found midway, turn the key switch to OFF and restart from the beginning. If the SERVICE FUNCTION cannot be displayed after several attempts, the system may be faulty.

Password 1 Input Procedure

Step	Operation	Vehicle operation
1	Press switches (1) and (2) at a time.	A short high-pitched electronic sound is given off.
2	Press switch (1).	A short high-pitched electronic sound is given off.
3	Press switch (2).	A short high-pitched electronic sound is given off.
4	Simultaneously press switches (2) and (3) for 2 seconds or more. (End of password input)	A longer high-pitched electronic sound is given off.
5	The version screen appears automatically.	
6	After displaying the version screen for 2 seconds, the SERVICE FUNCTION screen appears automatically.	





OPERATION ON SERVICE FUNCTION SCREEN

Operation Procedure

1. Input the password on the normal function menu (as explained on the preceding page) to display the SERVICE FUNCTION screen.

2. Select a desired function using switches (1) and (2). Then, press switch (3) (set) to display the function screen or setting screen of the selected function.

   (1) ANALYZER SCREEN
   This screen indicates the electrical system status and reads the error information detected by the controller.

   (2) TUNING SCREEN
   Use this screen for fine adjustment of control of the traveling and material handling.

   (3) OPTION SET SCREEN
   Use this screen to match the controller or display control according to the set option or control.

   (4) MATCHING SCREEN
   This screen updates the signal voltage values stored in the controller (signal voltage values from the SAS function sensors under the standard vehicle condition).

   (5) WHEEL DIA SCREEN
   This screen rewrites the tire information in the controller for correcting the speed indication and trip meter.

   (6) END SCREEN
   It is possible to go to the normal function screen from this screen. Press switch (3) on this screen to go to the normal function screen.
   Press switch (2) to return to the (1) ANALYZER MENU. As an alternative method, turn the key switch to OFF when any menu is displayed to return to the normal function screen.

ANALYZER

GENERAL

1. Switching the multi-display to the analyzer mode permits checks of traveling, material handling, EHPS and SAS main circuits, operation systems such as the accelerator and sensor functions as well as detection of problem components.
2. Full utilization of the analyzer functions helps quick, easy servicing.
3. The analyzer supports inspection of the control system and troubleshooting through full communication with the traveling/material handling controller.
4. The analyzer has the following functions:

(1) Diagnosis memory function (DIAG MEMORY)

The controller stores up to 10 error codes (diagnosis codes) detected in the electrical system in the past. The diagnosis function reads these error codes and indicates them on the display.

Each error code is displayed with its detection time as the key ON hour meter reading.

(2) In/out monitor function (I/O MONITOR)

This function displays the analog input values from individual sensors in the traveling, material handling, EHPS and SAS systems. Monitoring the displayed values enables the quality of each circuit/sensor to be judged.

1) I/O MONITOR1
Displays the temperature and analog input voltage at the respective terminal of each electrical component detected by the controller.

2) I/O MONITOR2
Displays each switch ON/OFF state and analog input voltages from sensors for traveling and swing control.

3) I/O MONITOR3
Displays the material handling and mast switch ON/OFF states and analog input voltages from material handling and mast sensors.

4) I/O MONITOR4
Displays the ON/OFF states of steering control and other switches and the analog input voltages from respective sensors.

(3) Active test (ACTIVE TEST)

In the active test mode, the controller forcibly outputs an activate signal (ON or OFF signal) to the selected item in order to permit operation check of that function.

ANALYZER MENU SCREEN LIST

Note:
Values displayed on the second row are examples and not the standard.

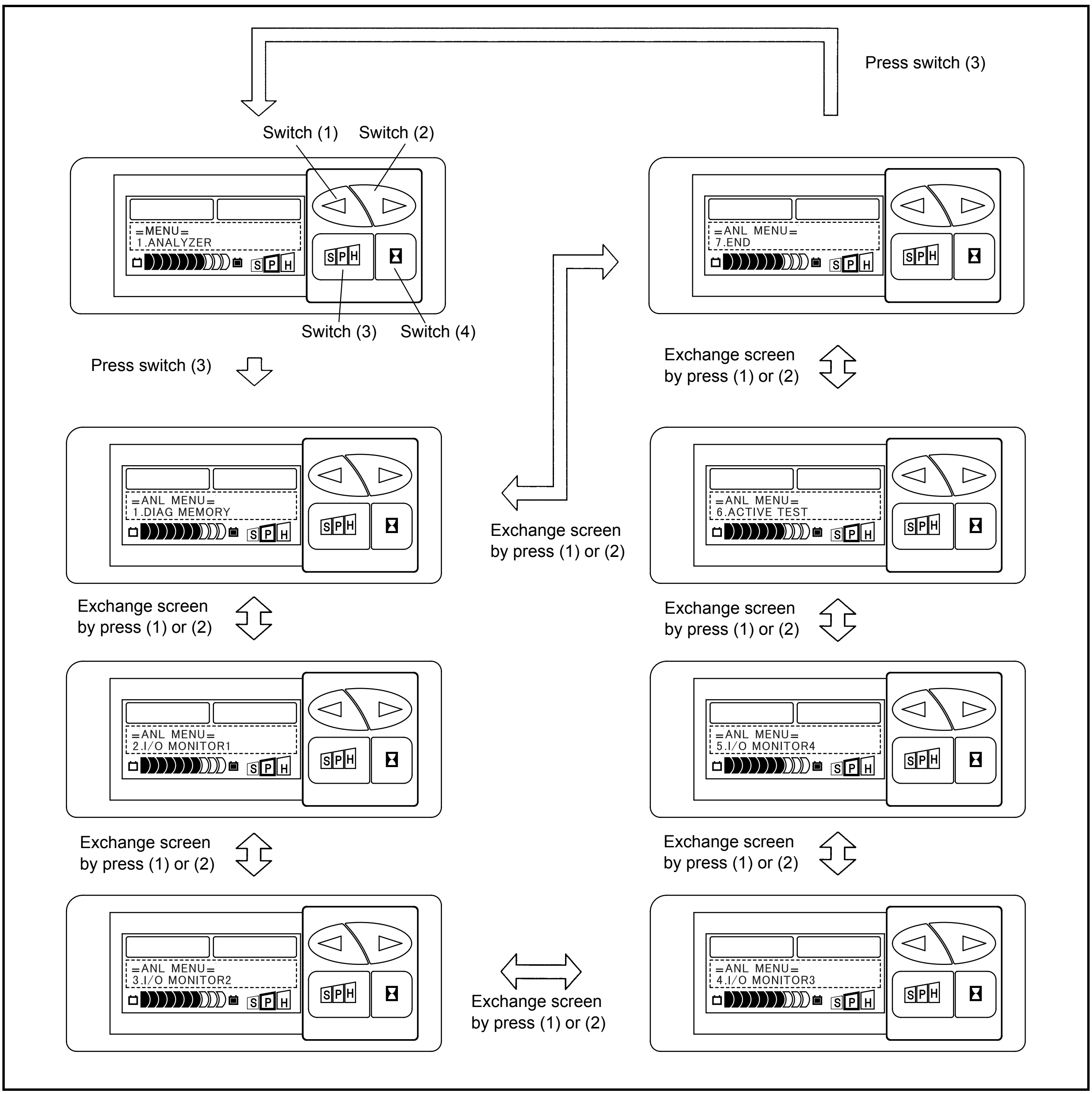
Analyzer menu screen	Indication				Description
	1st row	2nd row	15 ~ 32 model	35 ~ 55 model	
1. DIAG MEMORY • Diagnosis code display	DIAG-1 ~ DIAG-10		Error codes are displayed together with detection time information.		Refer to the Diagnosis Code List.
2. I/O MONITOR1 • Voltage • Temperature	I/O1-1	THCD:	+25	+25	Main traveling circuit temperature: °C
	I/O1-2	THCD2:	+25 (*1)	+25	Main traveling circuit temperature2: °C
	I/O1-3	THCP:	--- (*2)	+25	Main meterial handling circuit temperature: °C
	I/O1-4	TD:	+25	+25	Drive motor temperature: °C
	I/O1-5	TD2:	---	+25	Drive motor temperature2: °C
	I/O1-6	TP:	--- (*3)	--- (*3)	Pump motor temperature: °C
	I/O1-7	TP2:	---	--- (*3)	Pump motor temperature2: °C
	I/O1-8	TEMP:	+25.0	+25.0	Temperature on CPU board: °C
	I/O1-9	VBBT:	50.0	50.0	Battery voltage: V
	I/O1-10	VBKY:	50.0	50.0	Voltage after key switch: V
	I/O1-11	VBP4:	50	50	Voltage at P4 terminal: V
	I/O1-12	VBMB (M):	50	50	Voltage after MB contactor: V (*7)
	I/O1-13	VBMB (S):	50	50	Voltage after MB contactor: V (*8)
	I/O1-14	VBMBP:	---	50	Voltage after MP1 contactor: V
3. I/O MONITOR2 • Traveling system • Swing control	I/O2-1	POTA: SWAC:	0.70 0	0.70 0	Accelerator potentiometer voltage: V Accelerator switch :0 (OFF), 1 (ON)
	I/O2-2	DSF: DSR:	0 (*4) 0 (*4)	0 0	Forward switch:0 (OFF), 1 (ON) Reverse switch:0 (OFF), 1 (ON)
	I/O2-3	LSB:	0	0	Brake switch :0 (OFF), 1 (ON)
	I/O2-4	LSD: STLSD:	0 0	0 0	Seat switch: 0 (OFF), 1 (ON) (*7) Seat switch: 0 (OFF), 1 (ON) (*8)
	I/O2-5	SSD1: SSD2:	00 00	00 00	Drive motor rpm sensor1: sensor voltage × 0.1 V (15 ~ 32 model), number of pulses (35 ~ 55 model) Drive motor rpm sensor2: sensor voltage × 0.1 V (15 ~ 32 model), number of pulses (35 ~ 55 model)
	I/O2-6	SPD: SPD:	M10.0 S10.5	M10.0 S10.5	Main traveling speed: mph (or km/h) ST traveling speed: mph (or km/h)
	I/O2-7	YAW:	2.50	2.50	Yaw rate sensor voltage: V
4. I/O MONITOR3 • Material handling system • Mast control	I/O3-1	LSL: PLSL1:	0- (*5) -	00 0	Lift switch1, 2: 0 (OFF), 1 (ON) (*7) Lift switch1: 0 (OFF), 1 (ON) (*9)
	I/O3-2	SWTK: LST:	0 0	0 0	Tilt knob switch: 0 (OFF), 1 (ON) Tilt switch: 0 (OFF), 1 (ON)
	I/O3-3	LSTF: LSTR:	0 0	0 0	Forward tilt switch: 0 (OFF), 1 (ON) Backward tilt switch: 0 (OFF), 1 (ON)
	I/O3-4	LSAT1: LSAT2:	0 -	0 1	Attachment switch 1: 0 (OFF), 1 (ON) Attachment switch 2: 0 (OFF), 1 (ON)
	I/O3-5	MH:	10	10	Lifting height switch: 0 (OFF), 1 (ON)
	I/O3-6	POTT:	2.17	2.17	Tilt angle sensor voltage: V
	I/O3-7	SPL:	0.84 (1.7)	0.84 (1.7)	Load sensor voltage: V (Mpa)
	I/O3-8	CSP:	--- (*6)	200	Pump current sensor: A
5. I/O MONITOR4 • Steering control • Others	I/O4-1	STS:	--	00	Steering angle sensor: 0 (OFF), 1 (ON)
	I/O4-2	CSBATT:	2.50	2.50	Voltage from battery current sensor: V
	I/O4-3	AOPT:	0.00	0.00	Spare
	I/O4-4	LSOPT:	1→0 2→0	1→ - 2→0	Spare Spare
6. ACTIVE TEST • Operation test	ACT-1	FAND:	ON/OFF (0)	ON/OFF (0)	Drive fan
	ACT-2	FAND2:	--- (-)	ON/OFF (0)	Drive fan2
	ACT-3	SSOL:	ON/OFF (0)	ON/OFF (0)	Swing solenoid
	ACT-4	DSOL:	ON/OFF (0)	ON/OFF (0)	Dead-man solenoid
7. END	Return to Mask Menu by pressing switch (3)				

*1 (---), *2 (+25), *5 (00), *6 (200): With chopper
*3 (+25): With brush wear warning and overheat warning
*4: The indications are reverse on 15·18 model with dead-man brake.
*7: Traveling & Material handling controller input (15 ~ 32 model)
Traveling controller input (35 ~ 55 model)
*8: SAS controller input
*9: Material handling & PS controller input

Operation Procedure

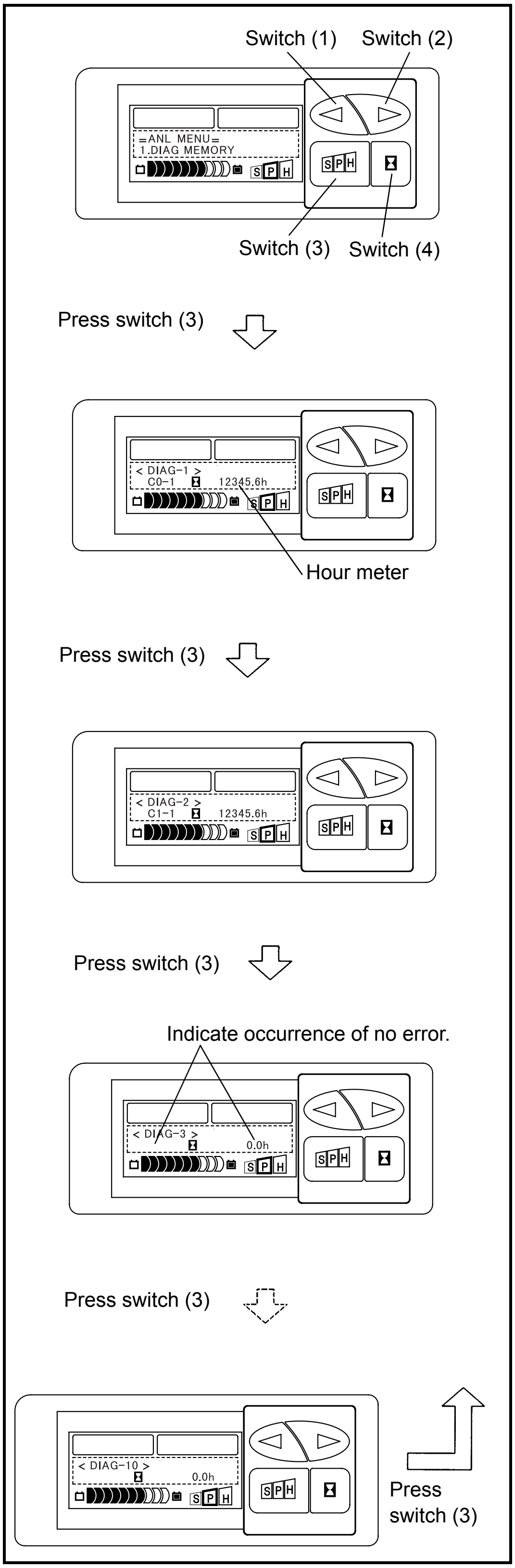
1. Input the password on the normal function menu (as instructed before) to display the MASK MENU screen.
2. Check that 1. ANALYZER is selected (highlighted) on the screen and press switch (3) (enter) to call the ANALYZER MENU screen.
3. Select the menu for the desired test using switches (1) and (2) and then press switch (3) (enter) to display the set screen.
   - Switch (1): The cursor moves to the preceding item.
   - Switch (2): The cursor moves to the next item.
   - Switch (3): Enters (Changes to the test screen for the selected item.)

Note:
If you select 7. END on the SERVICE FUNCTION screen and press switch (3), the ANALYZER MENU screen appears again.



DIAG MEMORY

The controller stores up to 10 most recent errors. The DIAG MEMORY screen displays these diagnosis codes together with their detection time information (in key ON hour meter reading).
The most recent diagnosis code is displayed as DIAG-1, followed by DIAG-2, DIAG-3 and so on to DIAG-10.



Operation Procedure

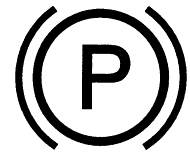
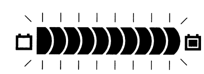
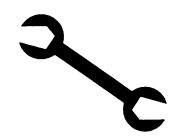
1. Call the ANALYZER MENU screen.
2. Check that 1. DIAG MEMORY is displayed and then press switch (3) (enter) to activate the diag memory function which displays diagnosis codes detected in the past sequentially starting from the most recent one.
3. Functions of switches on the 1. DIAG MEMORY screen are as follows:
   - Switch (1): Not used
   - Switch (2): Not used
   - Switch (3): Displays diagnosis code detected in the past.

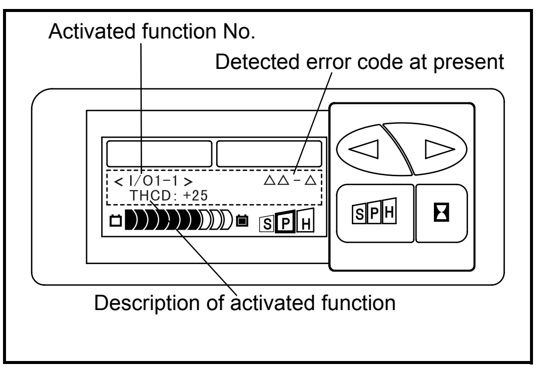
Note:
Press switch (3) on the DIAG-10 screen to return to the ANALYZER MENU screen.
When no error codes are displayed on the screen and the hour-meter time is 0.0h, it indicates that no errors occurred in the past after that row.
It is impossible to directly jump from the DIAG MEMORY screen to other test screen. Return to the ANALYZER MENU screen once and then go to the desired test screen.

Note:
As for diagnosis codes, problem components, error modes and phenomena on the vehicle, see pages 3-58 through 3-66.

Vehicle Abnormalities Not Stored in Diag Memory

There are abnormalities that are not stored in the diagnosis memory even if the controller detects them.

Alarm item	Alarm content	Symbol displayed
1. Parking lever ON alarm Alarm occurs upon attempt at traveling with the direction switch at either forward or reverse position while the parking lever is kept applied.	• Alarm indication: Blinking parking brake indicator • A short high-pitched electronic sound	
2. Parking lever OFF alarm Alarm occurs when the operator leaves the operator's seat without applying the parking brake (also without turning the key switch to OFF). This alarm is provided on vehicles with the deadman switch (option).	• Alarm sound (short high-pitched electronic sound)	No display
3. Overdischarge alarm (lift interrupt) Overdischarged state of the battery is warned at the level set at the tuning (explained later) to prohibit material handling.	• Alarm indication: Blinking battery charge indicator • Alarm sound (short high-pitched electronic sound)	
4. Return to neutral alarm Alarm occurs when the key switch is turned to ON while the direction switch is set at the forward or reverse position.	• Alarm sound (short high-pitched electronic sound)	No display
5. Mismatching alarm (1) Tilt angle sensor when the fork is horizontal (2) Tilt angle sensor at forward tilt limit angle (3) Pressure sensor in no-load state	• Alarm indication (spanner symbol)	



I/O MONITOR Function

This function displays the analog input voltage from each of traveling, material handling and SAS sensors. The circuit or sensor quality can be judged by monitoring the displayed value.

During activation of I/O MONITOR function

When any abnormality is detected, it is indicated as an error code on the display.

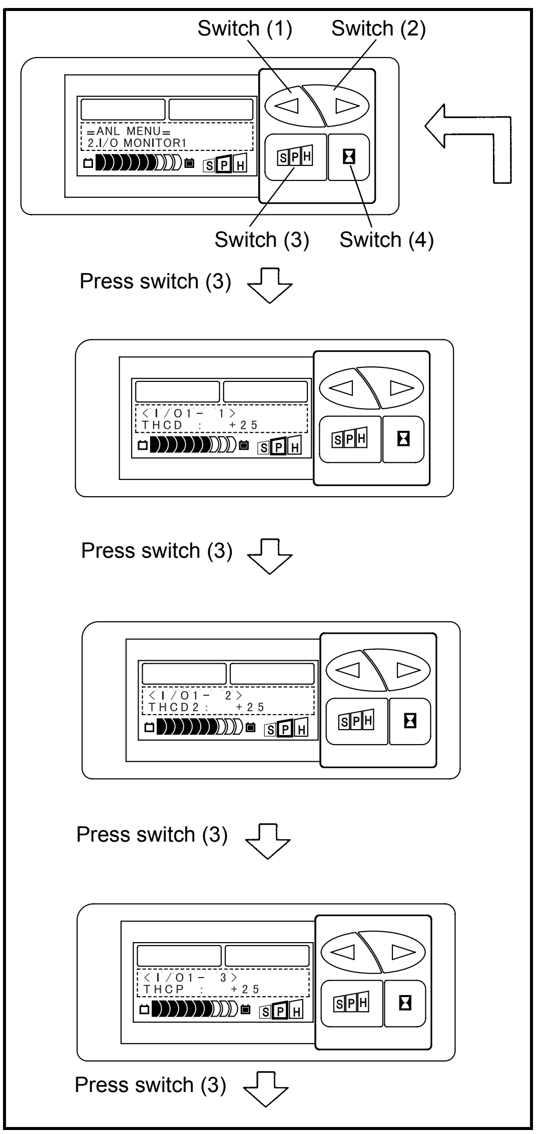
I/O MONITOR1

This function displays the temperature of each electrical component and the voltage at the respective terminal.

Operation Procedure

1. Display the ANALYZER MENU screen.
2. Press switch (2) once.
3. Check that the 2. I/O MONITOR1 is displayed and press switch (3) to activate the I/O MONITOR1 function. Press switch (3) each time to sequentially display I/O1-1 through I/O1-14.
4. Functions of switches on this screen are as follows:
   - Switch (1): Unused
   - Switch (2): Unused
   - Switch (3): Sequentially changes the screen from I/O1-1 to I/O1-14.

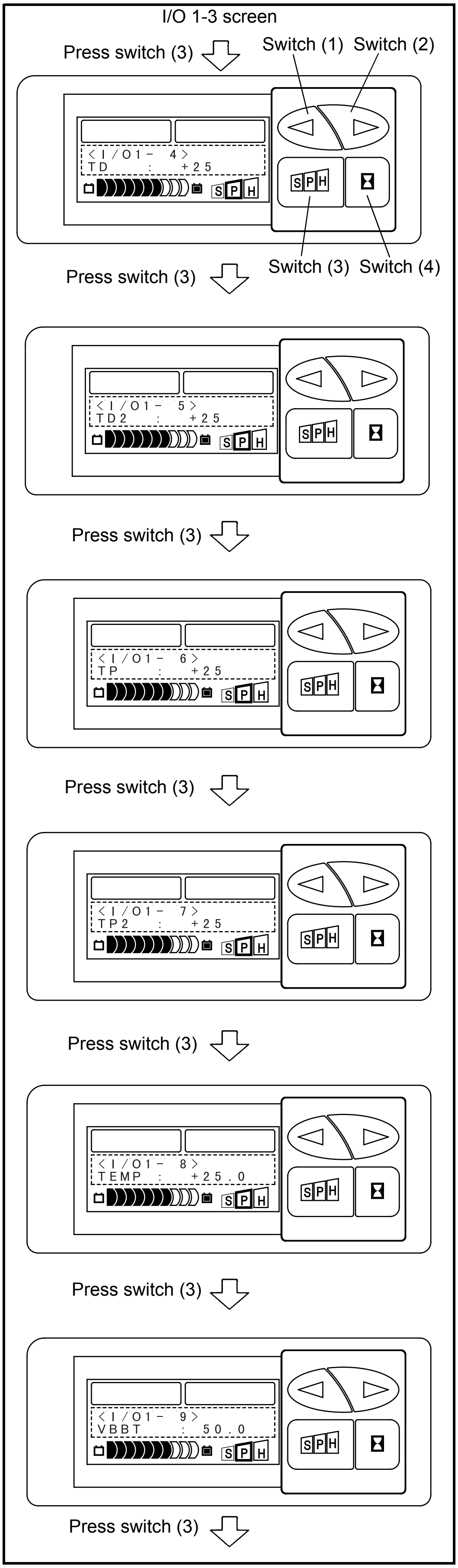
Note:
Press switch (3) on the I/O1-14 screen to return to the ANALYZER MENU screen.
It is impossible to directly jump from I/O MONITOR1 function screen to another test screen. Return to the ANALYZER MENU screen once and then go to the desired test menu.



(1) I/O1-1 screen
THCD:Main drive circuit temperature (°C)
Temperature of the main traveling circuit

(2) I/O1-2 screen
THCD2:Main drive circuit temperature 2 (°C)
Temperature of the main traveling circuit 2

(3) I/O1-3 screen
THCP:Main material handling circuit temperature (°C)
Temperature of the main material handling circuit



(4) I/O1-4 screen
TD:Drive motor temperature (°C)
Temperature at the drive motor.

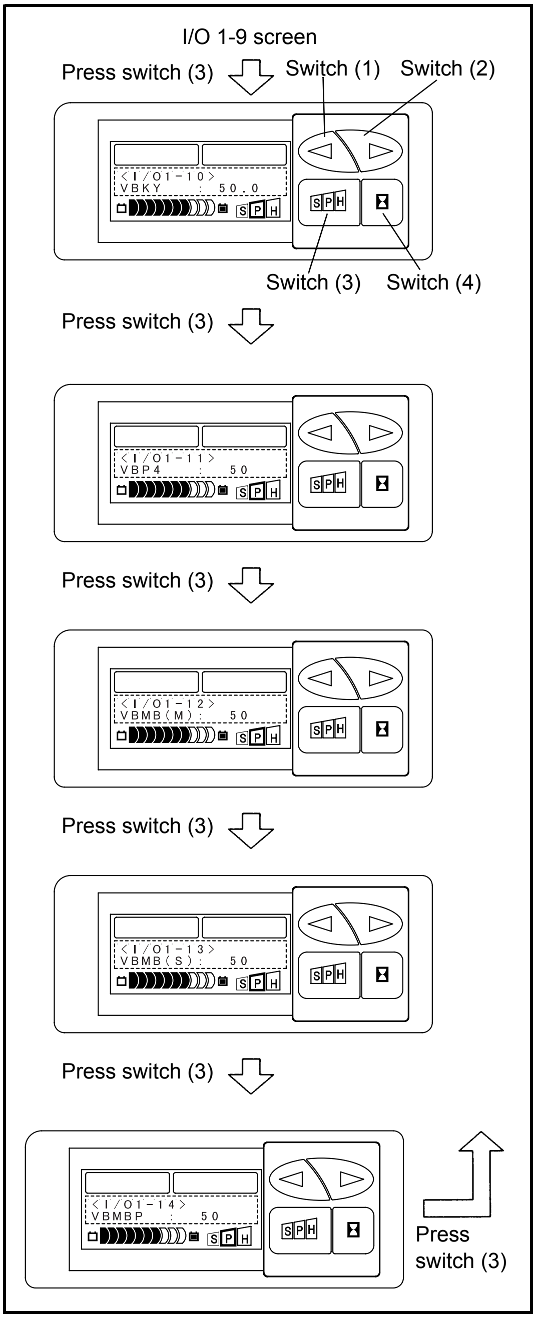
(5) I/O1-5 screen
TD2:Drive motor temperature 2 (°C)
Temperature at the drive motor 2.

(6) I/O1-6 screen
TP:Pump motor temperature (°C)
Temperature at the pump motor.

(7) I/O1-7 screen
TP2:Pump motor temperature 2 (°C)
Temperature at the pump motor 2.

(8) I/O1-8 screen
TEMP:Temperature on the CPU board (°C)
Temperature on the CPU board of the traveling/ material handring controller

(9) I/O1-9 screen
VBBT:Battery voltage (V)
Voltage before key switch



(10) I/O1-10 screen
VBKY:Battery voltage (V)
Voltage after key switch.

(11) I/O1-11 screen
VBP4:Voltage at P4 terminal (V)
Voltage measured at terminal P4.

(12) I/O1-12 screen
VBMB(M):Voltage (V) after (main input) MB contactor
Input voltage to the main controller after the MB contactor.

(13) I/O1-13 screen
VBMB(S):Voltage (V) after (SAS input) MB contactor
Input voltage to the SAS controller after the MB contactor.

(14) I/O1-14 screen
VBMBP:Voltage (V) after MP1 contactor
Input voltage after the MP1 contactor.

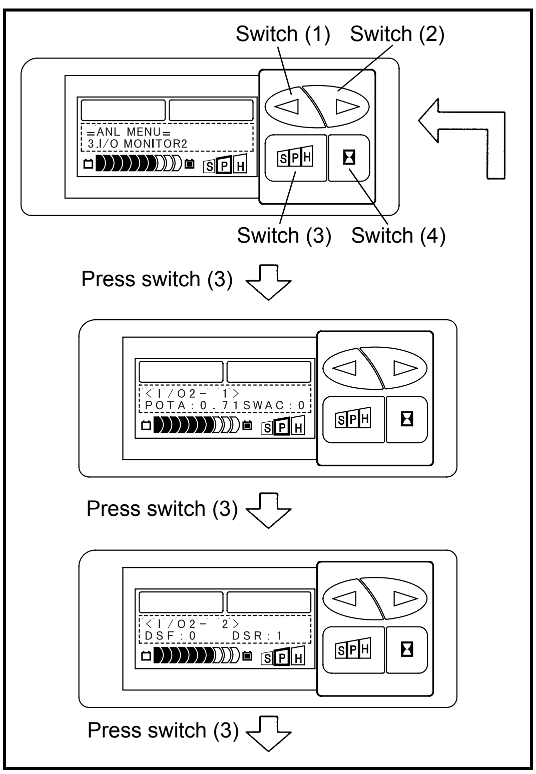
I/O MONITOR2

This function displays the ON/OFF status of traveling and swing switches and analog input voltages of sensors.

Operation Procedure

1. Display the ANALYZER MENU screen.
2. Press switch (2) twice.
3. Check that the 3. I/O MONITOR2 is displayed and press switch (3) to enter the I/O MONITOR2 function and to sequentially display I/O2-1 to I/O2-7 menu.
4. Functions of switches on this screen are as follows:
   - Switch (1): Unused
   - Switch (2): Unused
   - Switch (3): Press switch (3) each time to sequentially change the screen from I/O2-1 to I/O2-7.

Note:
Press switch (3) on the I/O2-7 menu to return to the ANALYZER MENU screen.
It is impossible to directly jump from I/O MONITOR2 function screen to another test menu. Return to the ANALYZER MENU screen once and then go to the desired test screen.



(1) I/O2-1 menu
- POTA:Accelerator potentiometer voltage (V)
  a Standard voltage when the accelerator pedal is not depressed (SWAC at OFF): 0.3 to 2.4 V
  b Standard voltage when the accelerator pedal is depressed to its stroke end: 1.7 to 4.7 V
  c Normal if b - a = 1.4 V or more
- SWAC:Accelerator switch check
  When accelerator pedal is not operated: 0→OFF
  When accelerator pedal is depressed: 1→ON
  Switch ON/OFF quality judgment by operating the accelerator pedal

(2) I/O2-2 menu
- Direction switch check
  DSF: Forward switch, DSR: reverse switch

Indication / Operation	DSF	DSR
Forward traveling	1	0
Neutral	0	0
Reverse traveling	0	1

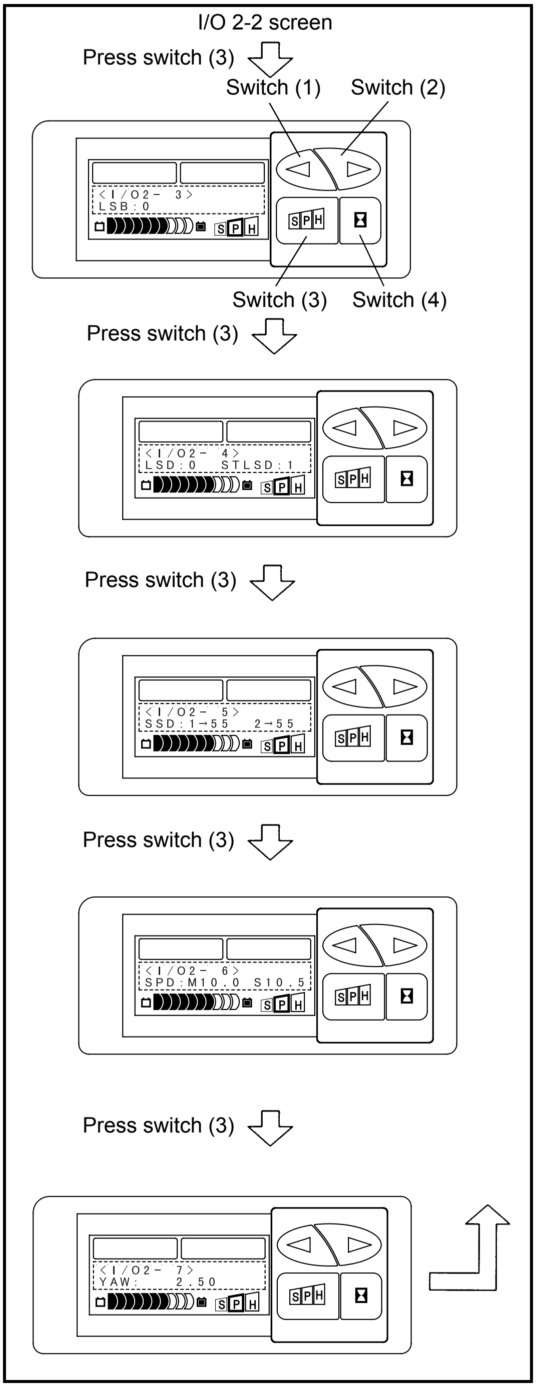
1→ON 0→OFF

Switch ON/OFF quality judgment by operating the direction lever

15·18 model (dead-man brake spec. only)

Indication / Operation	DSF	DSR
Forward traveling	0	1
Neutral	0	0
Reverse traveling	1	0

1→ON 0→OFF



(3) I/O2-3 screen

LSB:Brake switch check

When brake pedal is not operated: 1→ON

When brake pedal is depressed: 0→OFF

Switch ON/OFF quality judgment by operating the brake pedal

(4) I/O2-4 screen

LSD:Deadman switch check (main input)

STLSD:Dead-man switch check (ST input)

When the operator is on the seat: 0→OFF

When the operator leaves the seat: 1→ON

Switch ON/OFF quality judgment by sitting on and leaving the operator's seat

(5) I/O2-5 screen

SSD1:Drive motor rpm sensor 1 (number of pulses)

SSD2:Drive motor rpm sensor 2 (number of pulses)

Check the rpm sensors while actually traveling the vehicle. The number of pulse increases with the traveling speed.

(6) I/O2-6 screen

SPDM:Main traveling speed (mph or km/h)

SPDS:ST traveling speed (mph or km/h)

Check the vehicle speed by actually depressing the accelerator pedal to increase the speed. Check that the measured value changes in proportion to the traveling speed. Also, check that the value detected by the main controller equals the input value to the PS controller.

(7) I/O2-7 screen

YAW:Yaw rate sensor voltage (V)

Check the input voltage to the yaw rate sensor controller.

Standard when the vehicle is stopping: 2.50 V

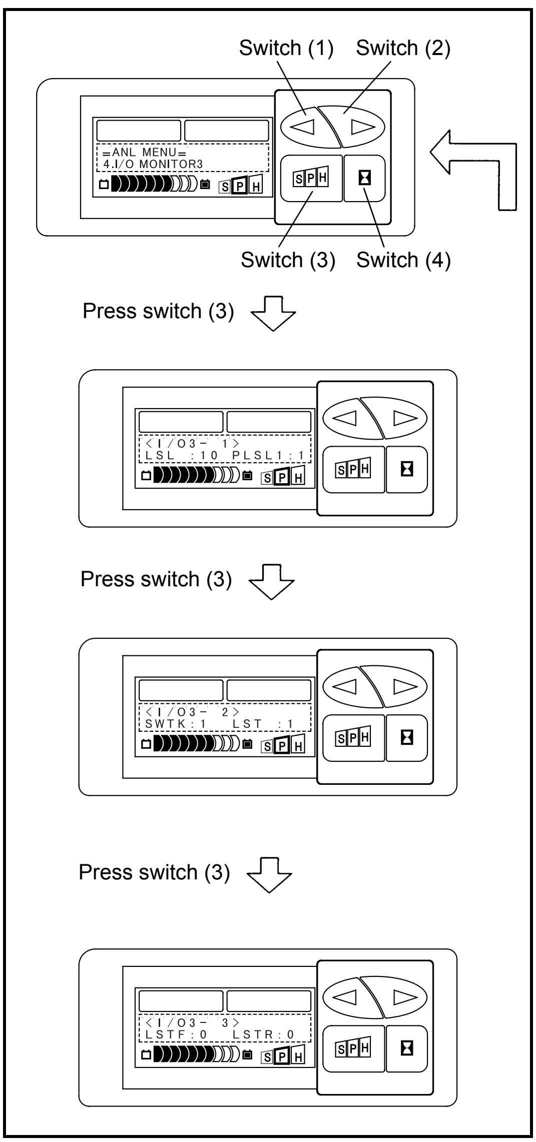
I/O MONITOR3

This function displays the ON/OFF status of material handling and mast control switches and analog input voltages from sensors.

Operation Procedure

1. Display the ANALYZER MENU screen.
2. Press switch (2) three times.
3. Check that the 4. I/O MONITOR3 is displayed and press switch (3) to activate the Input/Output MONITOR3 function and to display I/O3-1 to I/O3-8 on the display.
4. Functions of switches on this screen are as follows:
   - Switch (1): Unused
   - Switch (2): Unused
   - Switch (3): Sequentially changes the screen from I/O3-1 to I/O3-8.

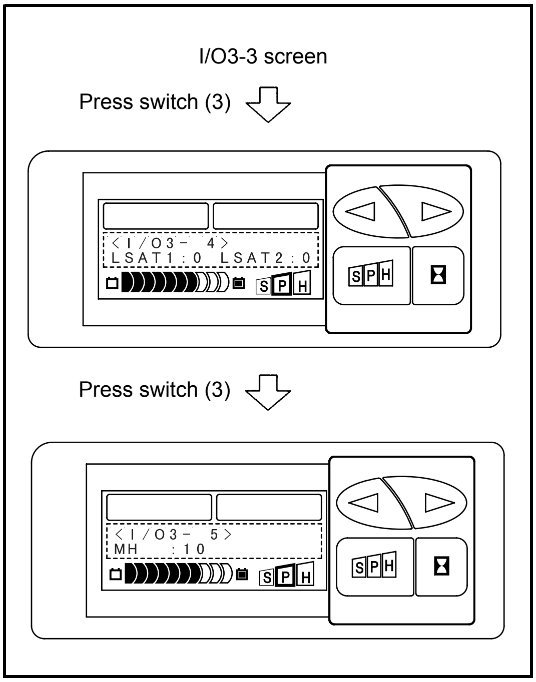
Note:
Press switch (3) on the I/O3-8 screen to return to the ANALYZER MENU screen. It is impossible to directly jump from I/O MONITOR3 function screen to another test screen. Return to the ANALYZER MENU screen once and then go to the desired test screen.



(1) I/O3-1 screen
LSL:Lift 1st/2nd stage switch (main input): 0→OFF
1→ON
PLSL:Lift 1st stage switch (SCPU input): 0→OFF
1→ON
Switch ON/OFF quality judgment by operating the lift lever

(2) I/O3-2 screen
SWTK:Tilt knob switch 0→OFF
1→ON
LST:Tilt switch 0→OFF
1→ON
(15 ~ 32 model: main input, 35 ~ 55 model: SCPU input)
Switch ON/OFF quality judgement by operating the tilt knob or tilt lever.

(3) I/O3-3 screen
LSTF:Forward tilt switch: 0→OFF
1→ON
LSTR:Backward tilt switch: 0→OFF
1→ON
Switch ON/OFF quality judgment by operating the tilt lever to forward or backward



(4) I/O3-4 screen

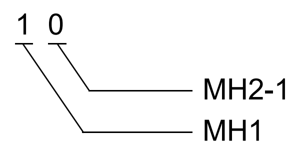
LSAT1:Attachment switch No. 1:	0→OFF
	1→ON
LSAT2:Attachment switch No. 2:	0→OFF
	1→ON

Switch ON/OFF quality judgment by operating the attachment lever No. 1 or No. 2
For a vehicle without attachment, the input value (ON/OFF) is not displayed.

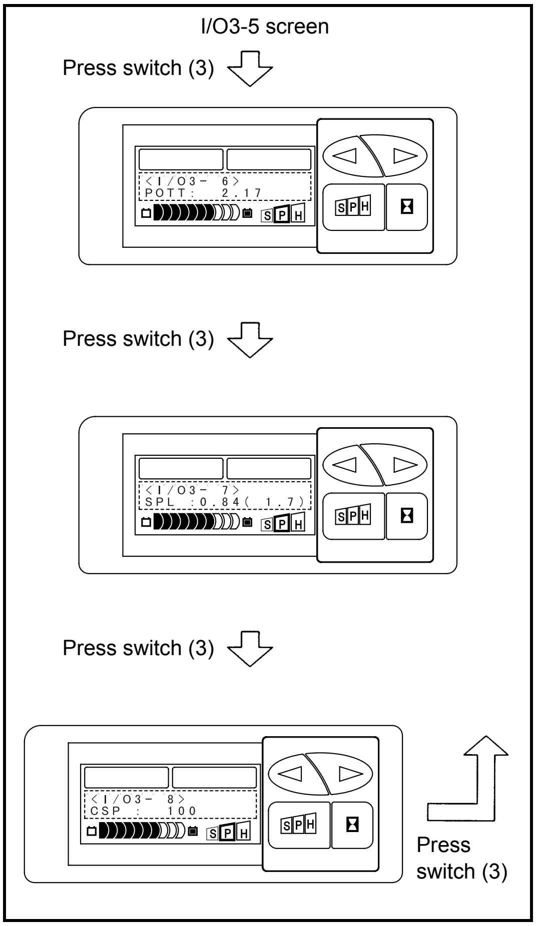
(5) I/O3-5 screen

MH:Lifting height:	1→ON
	0→OFF

Note:
Example indication
(When the number of lifting height switch is 1 and the lifting height is low)



	MH1	MH2-1
Low lifting height	1	0
High lifting height	0	1



(6) I/O3-6 screen
POTT:Tilt angle sensor voltage (V)
Check the input voltage to the tilt angle sensor controller.

Standard with mast set to vertical position: 2.5 V
Note:
Neutral to forward tilt: Input voltage decreases.
Neutral to backward tilt: Input voltage increases.

(7) I/O3-7 screen
SPL:Load sensor voltage (V)
Check the input voltage to the lift sensor controller.

Standard at no-load condition: 2.5 V
( ): MPA display

Note:
The input voltage increases as the load increases.

(8) I/O3-8 screen
CSP:Pump current sensor (A)
Check the input value from the pump current sensor to the controller.

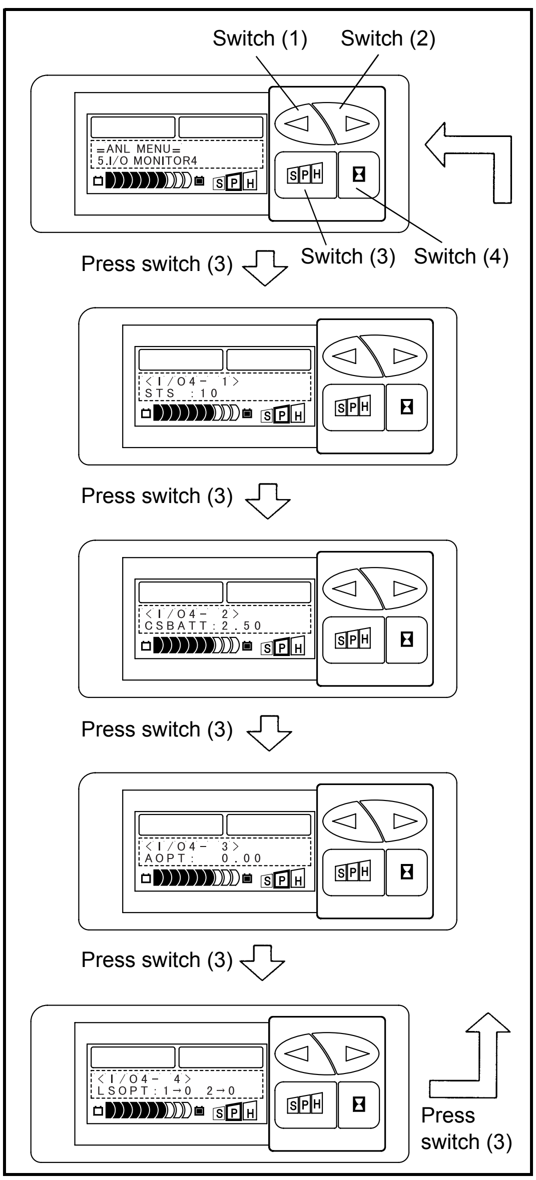
I/O MONITOR4

This function displays ON/OFF status of the steering control and other switches and analog input voltages from sensors.

Operation Procedure

1. Display the Analyzer Menu screen.
2. Press switch (2) four times.
3. Check that the 4. I/O MONITOR4 is displayed and press switch (3) to activate the I/O MONITOR4 function and to display I/O4-1 to I/O4-4 sequentially.
4. Functions of switches on this screen are as follows:
   - Switch (1): Unused
   - Switch (2): Unused
   - Switch (3): Press switch (3) to change the screen sequentially from I/O4-1 to I/O4-4.

Note:
Press switch (3) on the I/O4-4 screen to return to the ANALYZER MENU screen. It is impossible to directly jump from I/O MONITOR4 function screen to another test screen. Return to the ANALYZER MENU screen once and then go to the desired test screen.



(1) I/O4-1 screen
STS:Steering angle sensor: 1→ON
0→OFF

1 0
STS2
STS1

When the steering wheel is rotated to the right or left, STS1 and STS2 repeat ON and OFF.

(2) I/O4-2 screen
CSBATT:Battery current sensor voltage (V)
Indicates the voltage of an input from current sensor to the main controller.

(3) I/O4-3 screen
AOPT:Spare

(4) I/O4-4 screen
LSOPT1:Spare: 0→OFF
1→ON
LSOPT2:Spare: 0→OFF
1→ON

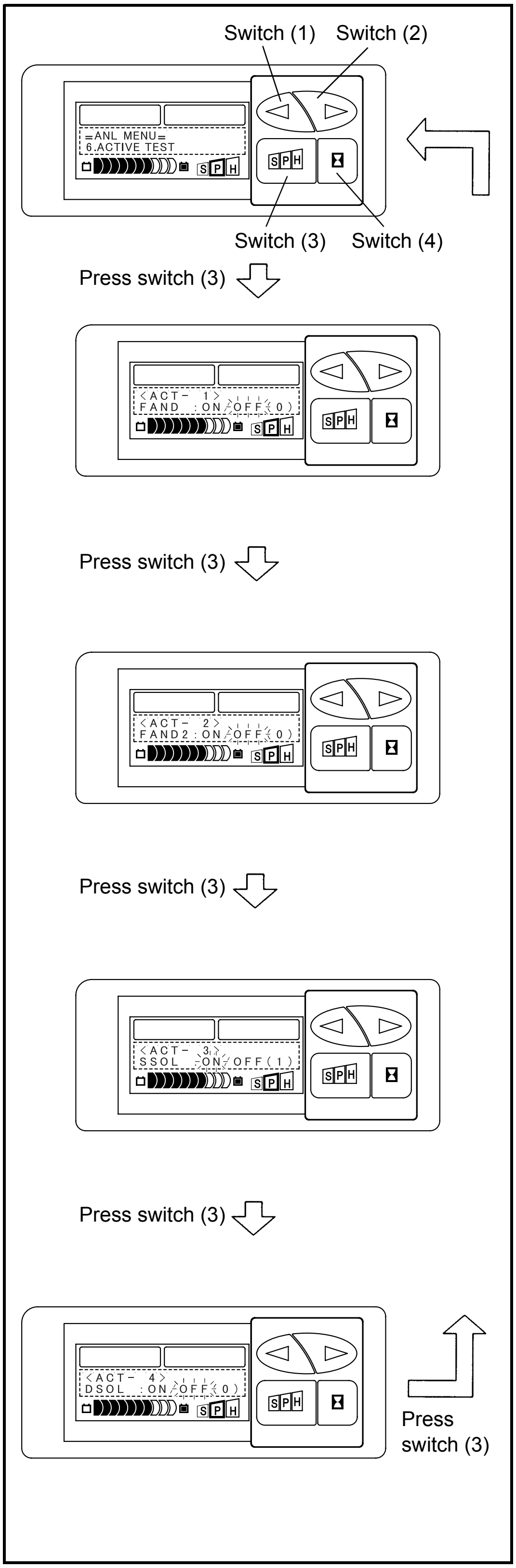
ACTIVE TEST

This function outputs ON/OFF signals to switches in the electrical system and compare controller input signals with those signals.

Operation Procedure

1. Display the ANALYZER MENU screen.
2. Press switch (2) four times.
3. Check that the 5. ACTIVE TEST is displayed and press switch (3) to activate the ACTIVE TEST function to display ACT-1 to ACT-4 screens sequentially.
4. Functions of switches on this screen are as follows:
   - Switch (1): Forced ON
   - Switch (2): Forced OFF
   - Switch (3): Sequentially changes the screen from ACT-1 to ACT-4.

Note:
Press switch (3) on the ACT-4 screen to return to the ANALYZER MENU screen.
It is impossible to directly jump from the ACTIVE TEST FUNCTION screen to another test screen.
Return to the ANALYZER MENU screen once and then go to the desired test screen.



(1) ACT-1 screen
FAND:Drive circuit fan
(1):Drive circuit fan ON
(0):Drive circuit fan OFF
The traveling system fan operation is checked visually and observing the display while forcibly outputting the ON/OFF signal.
Press switch (1) and select ON: Fan rotates and the signal is set to (1).
Press switch (2) and select OFF: Rotation stops and the signal is set to (0).

(2) ACT-2 screen
FAND2:Drive circuit fan2
(1):Drive circuit fan2 ON
(0):Drive circuit fan2 OFF
If not provided: --- (-)
The drive system fan operation is checked visually and observing the display while forcibly outputting the ON/OFF signal.

(3) ACT-3 screen
SSOL:Rear stabilizer swing control solenoid.
(1):Signal check line ON (error occurrence)
(0):Signal check line OFF (normal)
You can send signals to forcibly turn the rear stabilizer swing control solenoid ON and OFF. Check the signal check line by watching indications on the display.

(4) ACT-4 screen
DSOL:Dead-man solenoid
(1):Signal check line ON
(0):Signal check line OFF
Set to ON to release the deadman brake. (Traveling is enabled)

TUNING

GENERAL

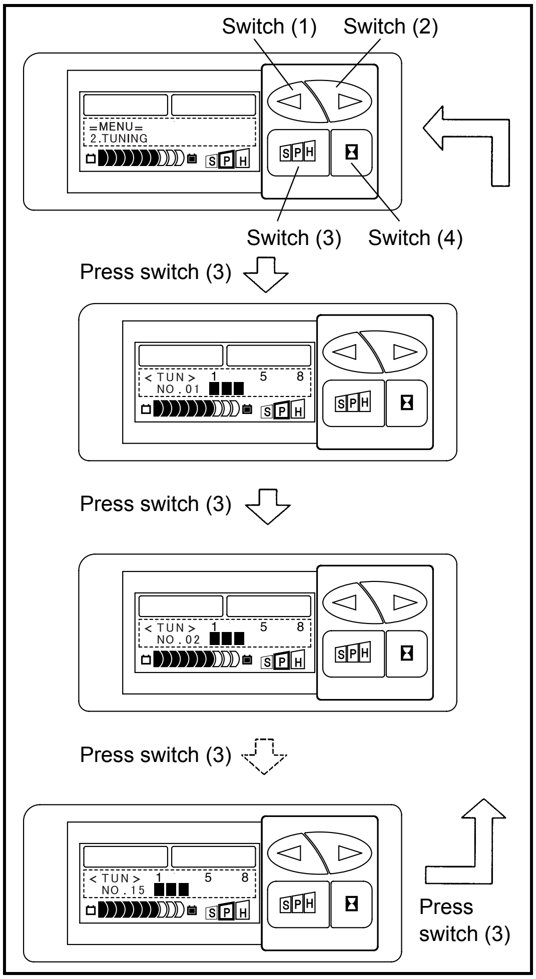
When the user requests to limit the maximum speed or weaken the regenerative braking force, each setting can be performed on the TUNING screen.

Fifty tuning items are prepared, including spares.

Tuning Item List

Tuning No.	Item	Level (●,⊙,○: initial setting position)							
		1	2	3	4	5	6	7	8
1	Switchback regenerative braking torque: Changes the regenerative braking torque at switchback	Weak				●			Strong
2	Acceleration OFF regenerative braking torque: Changes regenerative braking torque when acceleration is OFF	None	Weak			●			Strong
3	Battery warning (lift interrupt) set level: Changes the activation timings of low remaining battery charge warning and battery overdischarge warning (See P3-49)	Small						Large ●	Disabled
4	Battery charge indicator correction: Corrects decreasing rate of battery charge indicator	Slow decrease		●					Fast decrease
5	Traveling speed limiter: Adjust the maximum traveling speed	Low speed						High speed	None ●
6	Attachment power control No.1: Changes the pump motor rpm when attachment switch No.1 is ON.	Low speed							High speed ●
7	Tilt power control: Changes the pump motor rpm when the tilt switch is ON.	Low speed					⊙		High speed ○
8	Material handling offset output	Small		●					Large
9	Material soft start output	Small				●			Large
10	Lifting power control: Changes the pump motor rpm when the lift switch is ON.	Low speed							High speed ●
11	Lift 1st stage power control: Changes the pump motor rpm when lift switch No.1 is ON.	Low speed							High speed ●
12	Attachment power control No.2: Changes the pump motor prm when attachment switch No.2 is ON.	Low speed							High speed ●
13	Spare					●			
14	Spare					●			
15	Spare					●			

●: All the models
⊙: 15 ~ 32 model
○: 35 ~ 55 model



TUNING Screen Operation Procedure

1. Input the password on the normal function screen (see page 3-30) to display the SERVICE FUNCTION screen.

2. Press switch (2) to display 2. TUNING. Press switch (3) (enter) to display the TUNING screen.

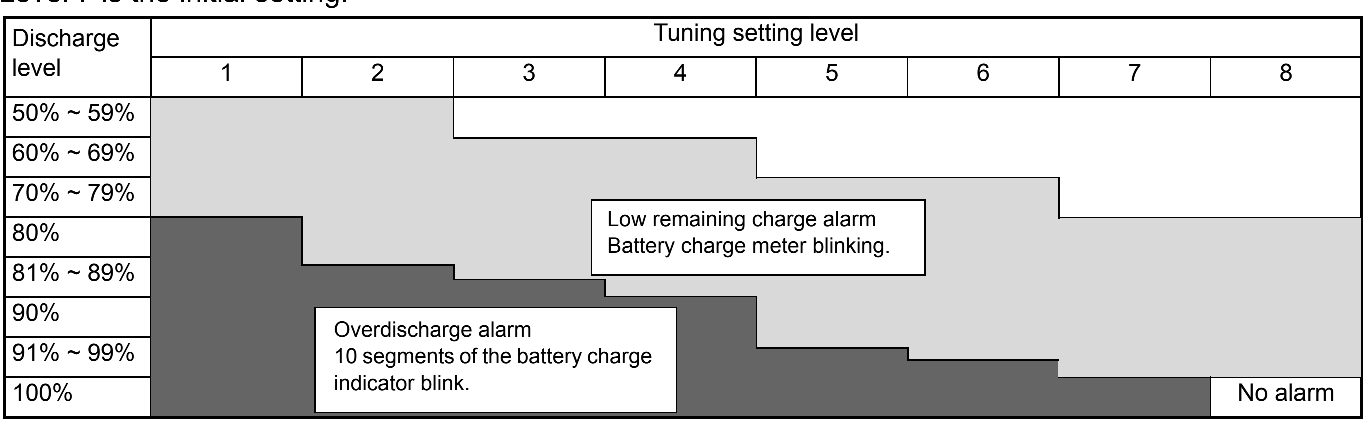
3. Select the desired tuning item using switches (3) and (2).

4. Functions of switches on the TUNING screen are as follows:
   - Switch (1):Decreases the tuning level.
   - Switch (2):Increases the tuning level.
   - Switch (3):Enters (and switches to the next screen)

Note:
Press switch (3) on the Tuning No.15 (spare) screen to return to the SERVICE FUNCTION screen.

Low Remaining Battery Charge Alarm and Overdischarge Alarm Setting Levels (Tuning No. 3)

Level 7 is the initial setting.



How to read the figure:
Example: When set to level 5
The battery charge indicator (10 segments) on the normal function screen is activated when the battery discharge is up to 69%. The low remaining battery charge alarm is activated when the battery discharge level is between 70% and 90% to blink the battery charge indicator. All 10 segments blink in case of overdischarge alarm, which is activated when the degree of battery discharge exceeds 90%.

Caution:
When level 8 is set, the overdischarge alarm (including lift interrupt) does not function. Carefully avoid overdischarge of battery also in view of the battery life.

OPTION SET

Option Set Menu List

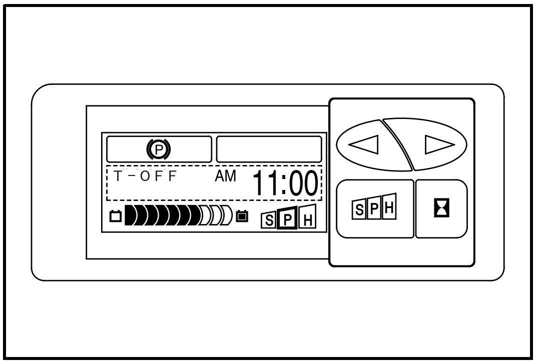
No.	Indication	Description	Selection	
			Y	N
OPT-1	DEMO MODE	Enables simultaneous traveling and material handling before starting the hour meter.	Enable	Disable
OPT-2	H/M START	Start counting by hour meter.	Counting	No counting
OPT-3	P/C LOCK *1	Disables setting of levels for traveling/ material handling power control, travel speed limiter setting and overspeed alarm.	Lock	Unlock
OPT-4	MPH *1	Displays the vehicle speed in mph.	Setting to mph	Setting to km/h
OPT-5	BATTERY *2	Changes the battery characteristic.	Characteristic A (A)	Characteristic B (B)
OPT-6	B-TYPE *3	Changes the battery type.	TYPE 1 (1)	TYPE 2 (2)
OPT-7	AUTO P-OFF	Enables/disables the auto power off function.	Enable	Disable
OPT-8	PARKING ERR	Enables/disables the parking lever OFF alarm.	Enable	Disable
OPT-9	TILT CONT	Enables/disables the mast forward tilt automatic stopping function	Enable	Disable
OPT-10	TILT F-LIM *1	Not used	Enable	Disable
OPT-11	USA *1	Validates/invalidates the USA specification.	Enable	Disable
OPT-12	EHPS *4	Validates/invalidates the EHPS specification.	Enable	Disable
OPT-13	36 V	Switches over between 36 V and 48 V.	36 V	48 V
OPT-14	BRUSH WEAR	Enables/disables brush wear warning.	Enable	Disable
OPT-15	P-CHOPPER *1	Enables/disables the material handling chopper.	Enable	Disable
OPT-16	SEAT BRAKE	Enables/disables the deadman brake.	Enable	Disable

*1: Matched to the specification of the vehicle at the time of vehicle shipment.

*2,*3: Select according to the decreasing speed of the battery charge indicator reading (quick or slow). The default value upon shipment is A1. (Select other type when the optimum value cannot be obtained by tuning.)
Select according to the battery type. (Reference)
A1:USA
A2:EEC
B1:JAPAN type
B2:Maintenance-free battery

*4: OPTION SET is provided for models 15 to 32.
OPTION SET is not provided for models 35 to 55.

Note:
When the controller board is replaced, it is necessaly to set again according to the vehicle specification. (See page 3-20)



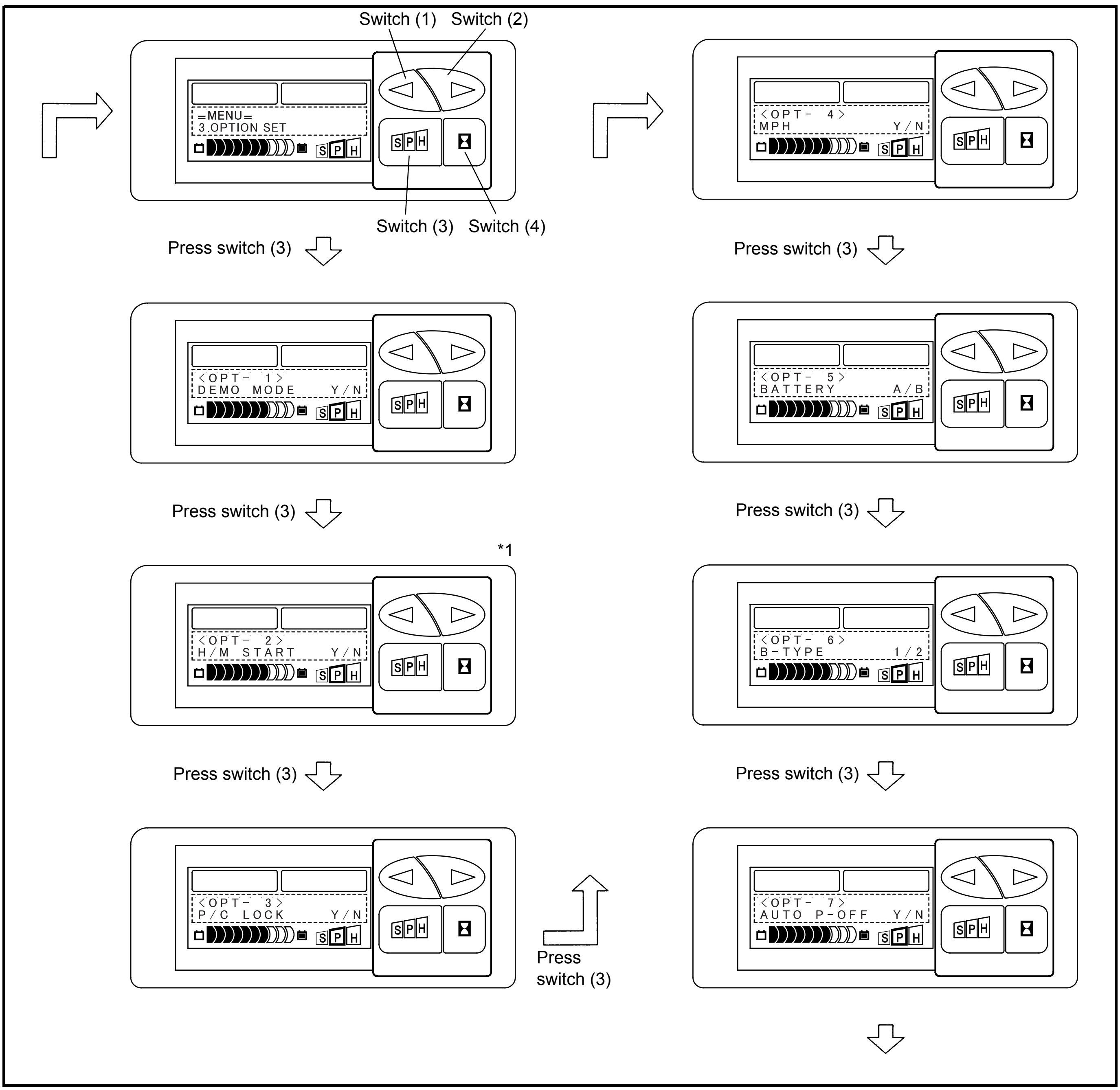
Caution:
- **The Option Set function is used to adjust the controller with the display control according to the options equipped on the vehicle and does not enable or disable the function itself.**
- **When the TILT CONT is disabled by option setting, the disabled status is displayed for 5 seconds upon key switch ON.**

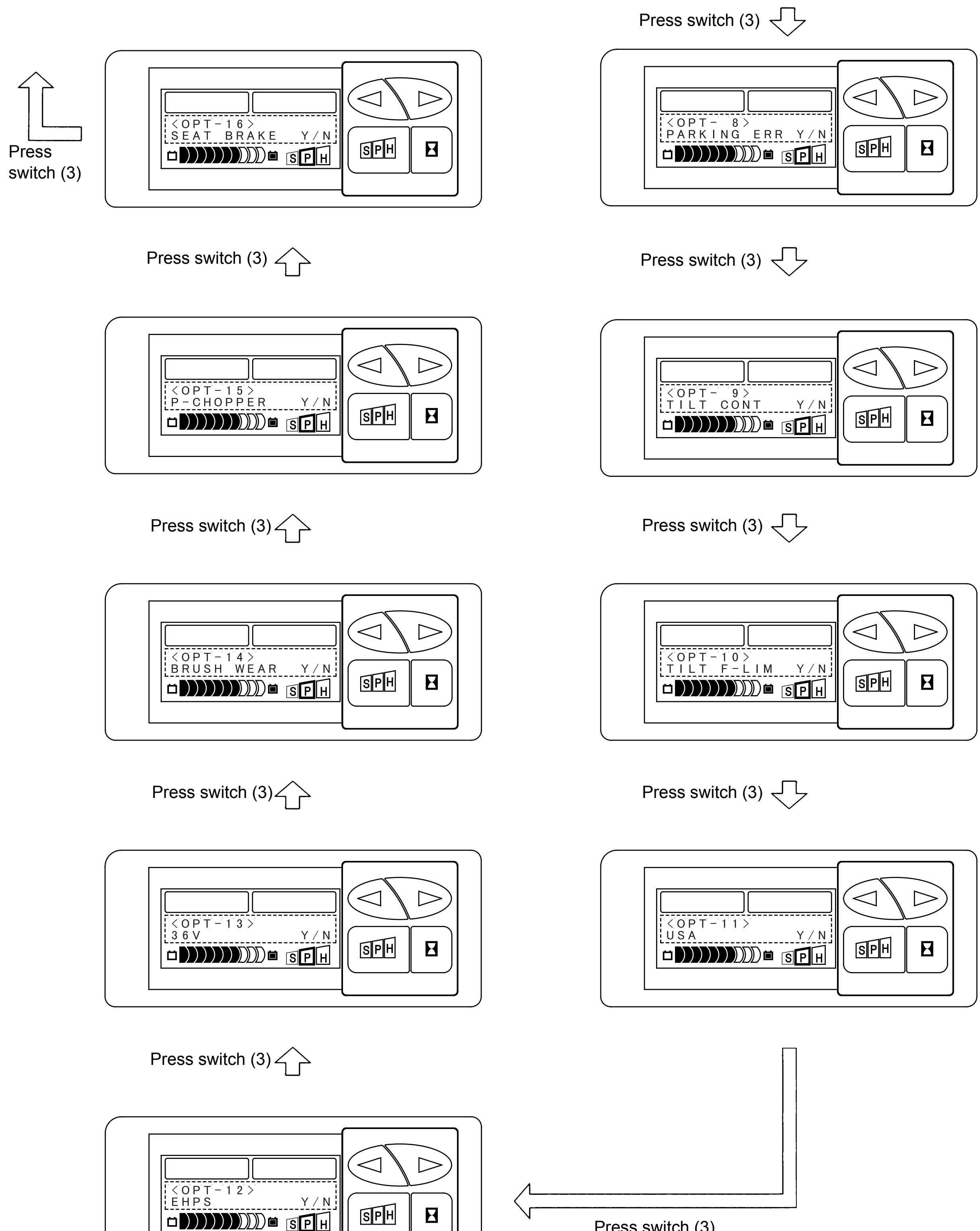
Indication contents:
T-OFF: TILT CONT (mast forward tilt automatic stopping function is disabled)

Operation Procedure Screen

1. Input the password on the normal function screen (see page 3-30) to display the SERVICE FUNCTION screen.
2. Press switch (2) twice to display 3. OPTION SET. Press switch (3) (enter) to display the OPTION SET MENU screen.
3. Select a desired option menu item using switches (3).
4. Functions of switches on the OPTION SET MENU screens are as follows:
   - Switch (1): Changes the setting from N to Y.
   - Switch (2): Changes the setting from Y to N.
   - Switch (3): Enters (changes to the next item setting screen)

Note:
Press switch (3) on the OPT-16 OPTION SET MENU screen to return to the SERVICE FUNCTION screen.





*1: Hour meter starting method
1. Press switch (1) for 2 seconds or more.
2. Press switch (1) while pressing switch (2) (held in the state of 1 above).

MATCHING

GENERAL

For the tilt angle and load sensors among sensors used for SAS functions, the signal voltage values under the mast vertical and no load are stored, respectively, in the controller for the control based on these values. When servicing or replacing these sensors, matching (updating the sensor signal voltage to match the standard vehicle condition) is necessary. Also, matching is needed for the tilt angle sensor when the vehicle posture has changed excessively, and for the load sensor when the load under no load condition (no load on fork) is changed because of addition or removal of any attachment.

Matching Menu List

No.	Indication	Description	Necessary condition	
			15 ~ 32 model	35 ~ 55 model
1	TILTL	Stores the tilt angle sensor output value with fork in the horizontal position to the controller.	(1)·(4)·(5) (7)·(8)·(9)·(10)·(11)	(1)·(2)·(4)·(5) (7)·(8)·(9)·(10)·(11)
2	TILTF	Stores the tilt angle sensor output value at the mast vertical standard position to the controller.	(1)·(4)·(7) (8)·(9)·(10)·(11)	(1)·(2)·(4)·(7) (8)·(9)·(10)·(11)
3	LOAD	Stores the pressure sensor output value under no-load condition to the controller.	(1)·(3)·(6) (7)·(8)·(11)	(1)·(2)·(6) (7)·(8)·(11)
4	PDUTY	The material handling output value is stored in the controller. (Only 35 ~ 55 model)	—	(2)*

Contents of necessary conditions:

(1) Traveling and material handling controller replacement (15 ~ 32 model)
Traveling controller replacement (35 ~ 55 model)

(2) Material handling and PS controller replacement (35 ~ 55 model)

(3) PS controller replacement (15 ~ 32 model)

(4) Tilt angle sensor replacement

(5) Length change or replacement of tilt angle sensor rod

(6) Load sensor replacement

(7) Change of attachment

(8) Mast replacement

(9) Tilt cylinder replacement

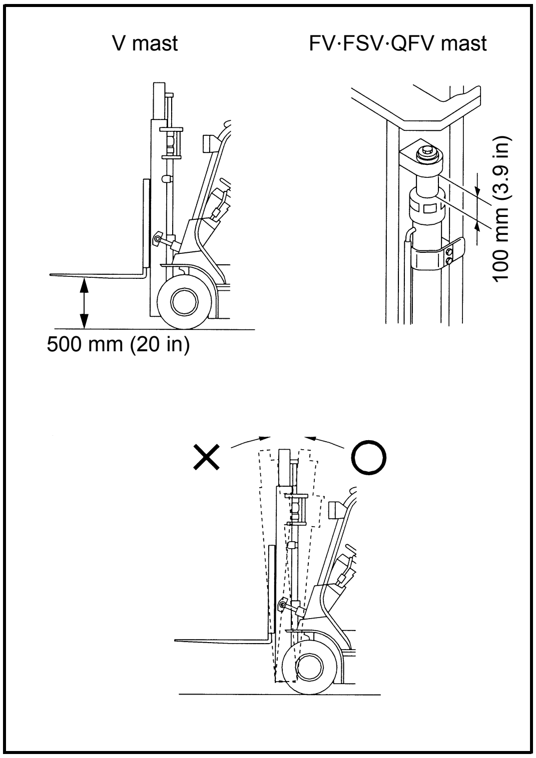
(10) Tilt angle sensor replacement

(11) SAS controller

*: Duty correction is necessary only when the board is replaced, but not necessary when the controller ASSY is replaced.

Before Starting Matching

Set the vehicle to the standard vehicle condition before starting matching. The standard vehicle condition means when the vehicle satisfies the conditions described below.



1. Floor levelness check
   If matching is conducted on an inclined or rough floor surface, errors in matching will result. So, perform matching on a flat, horizontal floor (inclination: Within 0.5°).
   Generally the inclination of floors in ordinary plants, warehouses and buildings is within 0.5°, which does not influence matching adversely. Be careful since some parts of floors may be inclined over 0.5° for some reason or other.

2. No-load vertical condition check
   The voltage of the load sensor signal in no-load state is stored in the controller. Therefore, the following conditions must be satisfied:
   - For the V mast, set the fork height to about 500 mm (20 in.) and use a goniometer to see that the mast is vertical.
   - For the FV/FSV/QFV mast, set the rear cylinder rod projection to about 100 mm (4 in.) and use a goniometer to see that the mast is vertical.
   - For the vehicle with an attachment, install the attachment.
   - Set the mast vertical by operating tilting it in the forward tilting direction from the backward tilted position.
   - In the case of a special vehicle with a heavy attachment (exceeding the additional weight shown in the table below), adjust the perpendicularity of the mast with the attachment height at 500 mm (19.7 in), and perform relief at the topmost position.

Allowable Weight for Installation on Mast kg (lbs)

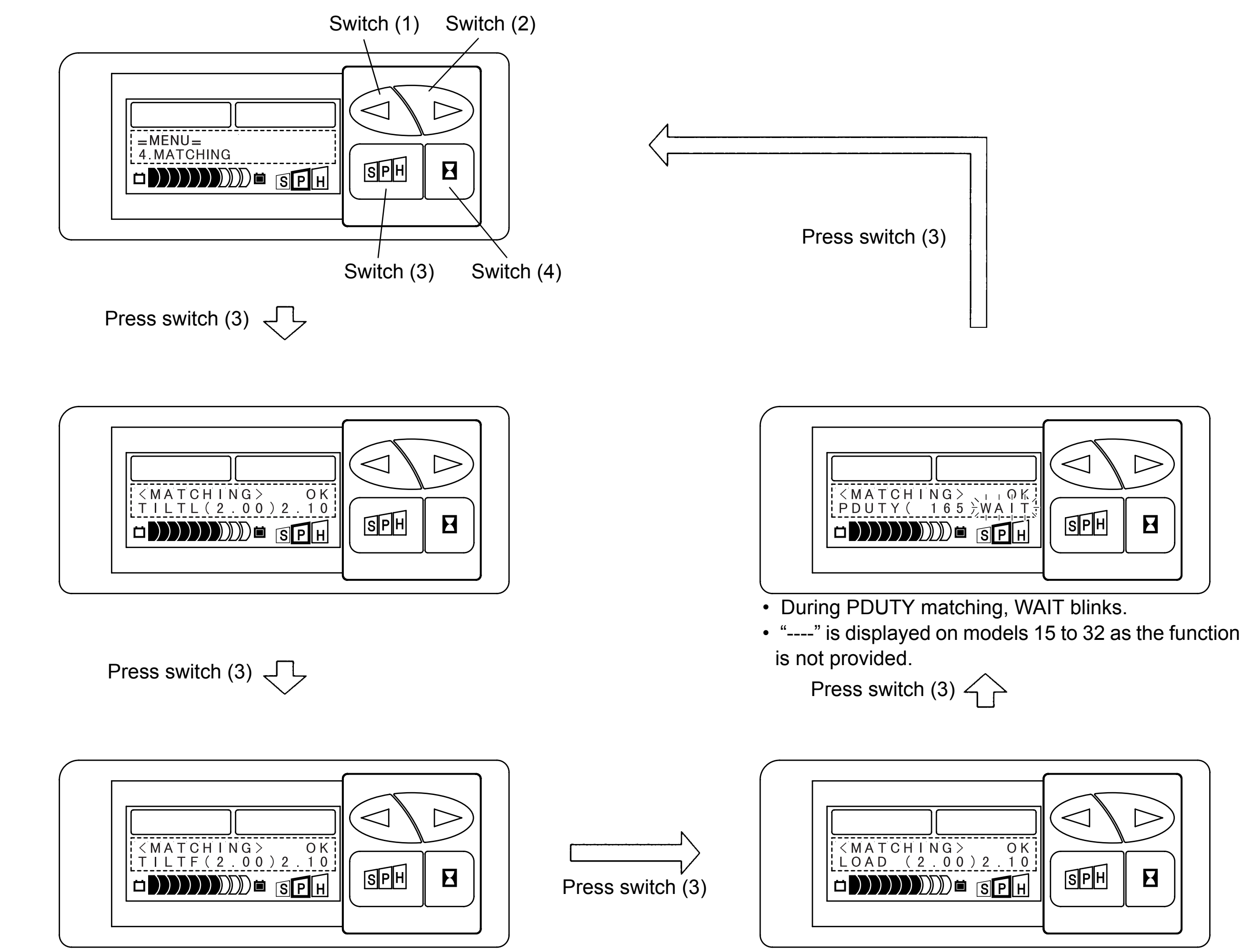
Lift height mm (in.) \ Model	15	18	20	25	30·32	35	45	55
3000 (118) or less	700 (1544)	800 (1764)	950 (2095)	950 (2095)	1200 (2646)	1400 (3086)	1800 (3968)	2200 (4850)
3300 (130) ~ 4000 (157.5)	700 (1544)	700 (1544)	950 (2095)	950 (2095)	1200 (2646)	1400 (3086)	1600 (3527)	2000 (4409)
4300 (169) ~ 5000 (197)	600 (1323)	650 (1433)	700 (1544)	900 (1985)	1000 (2205)	1000 (2205)	1500 (3307)	1800 (3968)
5500 (216.5) ~ 6000 (236)	450 (992)	550 (1213)	450 (992)	650 (1433)	800 (1764)	1000 (2205)	1500 (3307)	1500 (3307)
6500 (256) ~ 7000 (275.5)	-	-	300 (662)	500 (1103)	500 (1103)	-	-	-

Operation Procedure

1. Input the password on the normal function menu (see page 3-30) to display the SERVICE FUNCTION screen.
2. Press switch (2) twice to display 3. MATCHING. Press switch (3) (enter) to display the MATCHING SET Screen.
3. Select the desired matching item using switches (1) and (2).
4. Functions of switches on the MATCHING screen are as follows:
   - Switch (1): Unused.
   - Switch (2): Performs matching of the selected item.
   - Switch (3): Causes transition to the next item.

Note:

- **Press switch (3) on the PDUTY MATCHING SET Screen to return to the SERVICE FUNCTION screen.**
- **When PDUTY MATCHING is performed, turn the key switch OFF once and disconnect the battery plug after setting.**

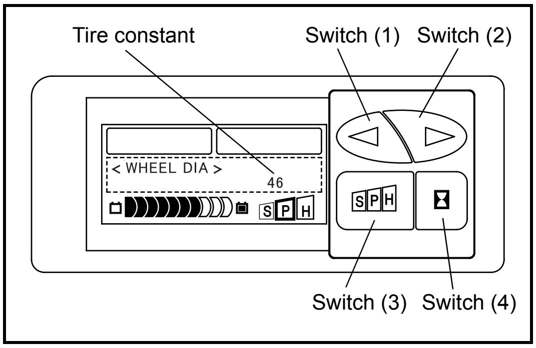


If values in 1 and 2 below are different while the vehicle is in the standard state, the item needs matching. Matching is also needed when the control panel or each sensor is replaced.

1. The value in parentheses is the stored value at present.
2. The value outside the parentheses is the one in the present vehicle state.
3. OK is displayed only when matching is performed (switch (2) is pressed).

WHEEL DIA

It is necessary to input the tire constant to the controller according to the tire radius, for optimizing the speedometer reading. Although the tire constant is set on a new vehicle at shipment from the factory, adjust it whenever the tire size is changed or the tires are worn excessively to a degree affecting the speedometer indication.



Operation Procedure

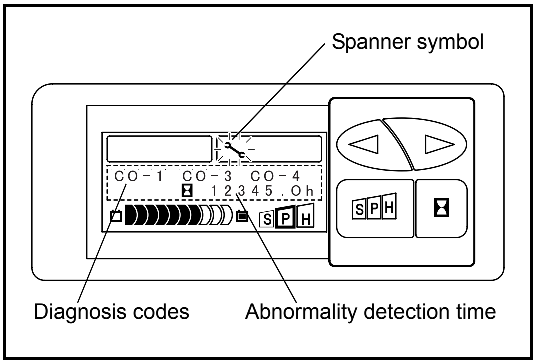
1. Input the password on the normal function screen (see page 3-30) to display the SERVICE FUNCTION screen.

2. Press switch (2) four times to display 5. WHEEL DIA. Press switch (3) (set) to display the CONSTANT SETUP screen.

3. Select the desired tire constant value using switches (1) and (2). Press switch (3) to enter the value and return to the SERVICE FUNCTION screen.
   Functions of switches on this screen are as follows:
   - Switch (1): Decreases the tire constant.
   - Switch (2): Increases the tire constant.
   - Switch (3): Enters the selected value and returns to the SERVICE FUNCTION screen.

Tire Constant List

Model	Constant
15·18 model	24
20 ~ 32 model	46
35 model	52
45 model	56
55 model	98



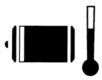
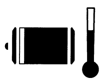
DIAGNOSIS

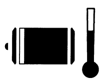
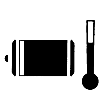
1. When diagnosis is activated, a spanner symbol appears on the display with alarm sounding to warn the operator of an abnormal state of the vehicle.
2. Also, one or up to 3 diagnosis codes appear to indicate the trouble positions.
3. The battery charge can be checked even while diagnosis codes are displayed.

DIAGNOSIS CODE LIST

15 ~ 32 Model

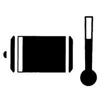
Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
51-1	51-1	Traveling speed sensor	Sensor open	• Swing lock during turning disabled • PS normal (partial function restricted)
52-1	52-1	Yaw rate sensor	Open	• Swing lock during turning disabled
52-2	52-2	Yaw rate sensor	Shorted	• Swing lock during turning disabled
52-3	52-3	Yaw rate sensor	Neutral voltage abnormality	• Swing lock during turning disabled
54-1	54-1	Swing solenoid	Solenoid open	Swing lock state holding
54-2	54-2	Swing solenoid	Solenoid abnormality	Swing lock state holding
61-1	61-1	Load sensor	Open	NL control
61-2	61-2	Load sensor	Shorted	No forward tilt restriction No automatic leveling control
62-1	62-1	Tilt angle sensor	Open	No forward tilt restriction No automatic leveling control
62-2	62-2	Tilt angle sensor	Shorted	
63-1	63-1	Tilt switch	Simultaneous ON of forward and backward tilt switches	No forward tilt restriction
63-2	63-2	Tilt switch	Shorting of forward tilt switch for 2 minutes or more	No automatic leveling control
63-3	63-3	Tilt switch	Shorting of backward tilt switch for 2 minutes or more	(Forward tilting disabled)
64-1	64-1	Lift solenoid	Open	Interruption of lift solenoid output
64-2	64-2	Lift solenoid	Shorted	
65-1	65-1	Tilt solenoid	Open	Interruption of tilt solenoid output
65-2	65-2	Tilt solenoid	Shorted	
66-1	66-1	Tilt angle sensor	Tilt matching abnormality	No forward tilt restriction No automatic leveling control

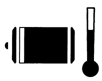
Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
67-1	67-1	Lifting height switch	Switch abnormality	Low lifting height control No forward tilt restriction No automatic leveling control
 C/R	A0-1	Main drive circuit temperature	Overheat	Restricted drive output
	A0-2	Main pump circuit temperature	Overheat	Stop of material handling operations
A0-4	A0-4	Traveling system fan	FAN abnormality	Limited drive output
A1	A1	Controller	High voltage	Traveling and material handling are halted after abnormality indication.
 C/R	A2	CPU board temperature	Overheat	Restricted drive output
A3	A3	Incorrect battery connection	Charger-related incorrect connection	Stopped traveling and material handling MB does not turn ON.
A4	A4	Acceleration switch	Switch abnormality	Traveling disabled after abnormality indication
A6-1	A6-1	Lift No.1 switch	Lift No.1 switch abnormality	Traveling disabled after abnormality indication
A6-2	A6-2	Lift No.2 switch	Lift No.2 switch abnormality	Stop of material handling operations
A6-3	A6-3	Tilt switch	Tilt switch abnormality	Stop of material handling operations
A6-5	A6-5	Attachment No.1 switch	Attachment No.1 switch abnormality	Stop of material handling operations
A8	A8	Traveling/material handling system	Open fuse F1	Indication only
AA	AA	CPU board thermo-sensor	Thermo-sensor abnormality	Indication only
AF-1	AF-1	Main CPU	CPU board abnormality (1)	Traveling and Material handling outputs are stopped after abnormality detection. Reset
AF-2	AF-2	Main CPU	CPU board abnormality (2)	
AF-3	AF-3	Main CPU	CPU board abnormality (3)	
AF-4	AF-4	Main CPU	CPU board abnormality (4)	Traveling and material handling outputs are stopped after abnormality detection.
AF-5	AF-5	ST board CPU	CPU abnormality (1)	Swing control·Tilt control disabled
AF-6	AF-6	ST board CPU	CPU abnormality (2)	Swing control·Tilt control disabled
AF-7	AF-7	ST board CPU	CPU abnormality (3)	Swing control·Tilt control disabled
AF-8	AF-8	ST board CPU	CPU abnormality (4)	Swing control·Tilt control disabled

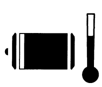
Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
C0-1	C0-1	Main drive circuit	Main drive circuit abnormality	Traveling disabled after abnormality indication Traveling drive power supply is stopped.
C0-3	C0-3	Traveling drive	Power supply abnormality	
C0-4	C0-4	Traveling drive	Circuit abnormality	
C1	C1	Drive current sensor	Sensor abnormality	Traveling disabled after abnormality indication
 DM	C2-1	Drive motor	Motor temperature overheating	Limited drive output
C2-2	C2-2	Drive motor	Thermo-sensor abnormality	
C3-1	C3-1	Main drive circuit1	Thermo-sensor abnormality	Limited drive output
C3-2	C3-2	Main drive circuit2	Thermo-sensor abnormality	Limited drive output
C4-1	C4-1	Drive accelerator	Accelerator potentiometer abnormality (1) (Open)	Traveling disabled
C4-2	C4-2	Drive accelerator	Accelerator potentiometer abnormality (2) (Open)	Traveling disabled
C4-3	C4-3	Drive accelerator	Accelerator potentiometer abnormality (3) (Shorted)	Traveling disabled
C4-4	C4-4	Drive accelerator	Accelerator potentiometer abnormality (4) (Shorted)	Indication only
C7	C7	Direction switch	Switch abnormality	Traveling disabled after abnormality detection
C8-1	C8-1	Drive motor	Drive motor rpm sensor No.1 abnormality (1) (Open)	Traveling disabled after abnormality detection Traveling resumed by key OFF and then ON
C8-2	C8-2	Drive motor	Drive motor rpm sensor No.2 abnormality (2) (Open)	
C8-3	C8-3	Drive motor	Drive motor rpm sensor No.1 abnormality (Shorted)	
C8-4	C8-4	Drive motor	Drive motor rpm sensor No.2 abnormality (Shorted)	
CB-1	CB-1	MB (main contactor)	Contactor abnormality	Traveling and material handling disabled.
CB-2	CB-2	MB (main contactor)	Contactor fused	Indication only
E0-1	E0-1	Main pump circuit	Main pump circuit abnormality	Material handling disabled after abnormality indication Stop of lift drive power supply
E0-3	E0-3	Material handling drive	Power supply abnormality	
E0-4	E0-4	Material handling drive	Circuit abnormality	
E1	E1	Material handling current sensor	Sensor abnormality	Material handling disabled after abnormality indication
 PM	E2-1	Pump motor	Motor overheating	Stop of material handling operations
E2-2	E2-2	Pump motor	Motor thermo-sensor abnormality	
E3	E3	Main pump circuit	Thermo-sensor abnormality	Stop of material handling operations
E6	E6	Lift switch	Switch abnormality	Stop of material handling operations

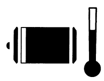
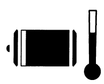
Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
EE-1	EE-1	Communications system between display and main controller	Communication abnormality (1)	Indication only
EE-2	EE-2	Communications system between display and main controller	Communication abnormality (2)	Indication only
EE-3	EE-3	Communications system between display and main controller	Communication abnormality (3)	Indication only (Operate under the default.)
EF-1	EF-1	Traveling/Material handling controller EEP-ROM	EEP-ROM abnormality (1)	Operate under the default.
EF-2	EF-2	Traveling/Material handling controller EEP-ROM	EEP-ROM abnormality (2)	Operate under the default.
EF-3	EF-3	Traveling/Material handling controller CPU	CPU board abnormality	Indication only
EF-4	EF-4	Material handling controller EEP-ROM	EEP-ROM abnormality (3)	Operate under the default.
EF-5	EF-5	ST board EEP-ROM	EEP-ROM abnormality (1)	Swing control·Tilt control disabled
EF-6	EF-6	ST board EEP-ROM	EEP-ROM abnormality (2)	Indication only
F0-1	F0-1	PS contactor	PS contactor abnormality (Coil short-circuit)	Stop of PS contactor output
F0-2	F0-2	EHPS system	EHPS abnormality	Indication only
F0-3	F0-3	PS power supply	Power supply abnormality	• Stop of 20 V power supply output • Limited drive output (dead-man brake spec.)
F1-1	F1-1	Communications system between Traveling/Material handling controller and display	Communication abnormality (1)	Indication only
F1-2	F1-2	Communications system between Traveling/Material handling controller and display	Communication abnormality (2)	Indication only
FE-1	FE-1	Communications system between SAS controller and main controller	Communication abnormality (1)	Indication only
FE-2	FE-2	Communications system between SAS controller and main controller	Communication abnormality (2)	Indication only
FE-4	FE-4	Communications system between main controller and SAS controller	Communication abnormality (1)	Tilt control disabled
FE-5	FE-5	Communications system between main controller and SAS controller	Communication abnormality (2)	Tilt control disabled
G4-1	G4-1	Dead-man solenoid	Solenoid open	Limited drive output (dead-man brake spec.)
G4-2	G4-2	Dead-man solenoid	Solenoid shorted	Limited drive output (dead-man brake spec.)
PS BRSH	—	PS motor brush	Brush wear	• Limited drive speed (5 km/h (3.1 mile/h)) • Traveling and material handling are prohibited after abnormality detection.
PM BRSH	—	Pump motor brush	Brush wear	

35 ~ 55 Model

Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
51-1	51-1	Traveling speed sensor	Sensor open	• Swing lock during turning disabled • PS normal (partial function restricted)
52-1	52-1	Yaw rate sensor	Open	• Swing lock during turning disabled
52-2	52-2	Yaw rate sensor	Shorted	• Swing lock during turning disabled
52-3	52-3	Yaw rate sensor	Neutral voltage abnormality	• Swing lock during turning disabled
54-1	54-1	Swing solenoid	Solenoid open	Swing lock state holding
54-2	54-2	Swing solenoid	Solenoid abnormality	Swing lock state holding
61-1	61-1	Load sensor	Open	NL control No forward tilt restriction No automatic leveling control
61-2	61-2	Load sensor	Shorted	
62-1	62-1	Tilt angle sensor	Open	No forward tilt restriction No automatic leveling control
62-2	62-2	Tilt angle sensor	Shorted	
63-1	63-1	Tilt switch	Simultaneous ON of forward and backward tilt switches	No forward tilt restriction
63-2	63-2	Tilt switch	Shorting of forward tilt switch for 2 minutes or more	No automatic leveling control
63-3	63-3	Tilt switch	Shorting of backward tilt switch for 2 minutes or more	(Forward tilting disabled)
64-1	64-1	Lift solenoid	Open	Interruption of lift solenoid output
64-2	64-2	Lift solenoid	Shorted	
65-1	65-1	Tilt solenoid	Open	Interruption of tilt solenoid output
65-2	65-2	Tilt solenoid	Shorted	
66-1	66-1	Tilt angle sensor	Tilt matching abnormality	No forward tilt restriction No automatic leveling control
67-1	67-1	Lifting height switch	Switch abnormality	Low lifting height control No forward tilt restriction No automatic leveling control
 CR	A0-1	Main drive circuit temperature	Overheat	Restricted drive output
	A0-2	Material handling controller temperature	Overheat	Restricted drive, PS and material handling output
A0-4	A0-4	Traveling system fan1	FAN1 abnormality	Limited drive output
A0-5	A0-5	Traveling system fan2	FAN2 abnormality	Limited drive output

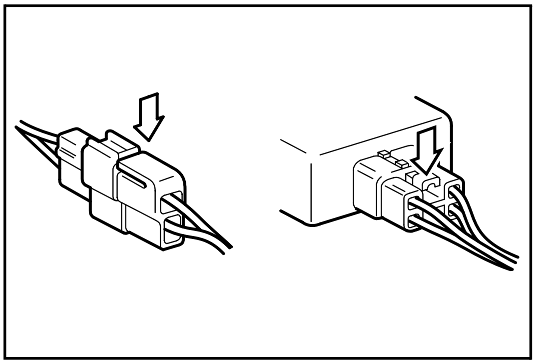
Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
A1	A1	Controller	High voltage	Traveling and material handling are halted after abnormality indication.
 C/R	A2	CPU board temperature	Overheat	Restricted drive output
A3	A3	Incorrect battery connection	Charger-related incorrect connection	Stopped traveling and material handling MB does not turn ON.
A4	A4	Acceleration switch	Switch abnormality	Traveling disabled after abnormality indication
A6-1	A6-1	Lift No.1 switch	Lift No.1 switch abnormality	Stop of material handling operations
A6-2	A6-2	Lift No.2 switch	Lift No.2 switch abnormality	Stop of material handling operations
A6-3	A6-3	Tilt switch	Tilt switch abnormality	Stop of material handling operations
A6-5	A6-5	Attachment No.1 switch	Attachment No.1 abnormality	Stop of material handling operations
A6-6	A6-6	Attachment No.2 switch	Attachment No.2 abnormality	Stop of material handling operations
A8	A8	Traveling system	Open fuse F1	Indication only
AA	AA	CPU board thermo-sensor	Thermo-sensor abnormality	Indication only
AE-1	AE-1	SCPU board	CPU abnormality	• Material handling and PS disabled. • Limited drive output (dead-man brake spec.)
AE-2	AE-2	SCPU board	CPU abnormality	
AE-3	AE-3	SCPU board	CPU abnormality	
AE-4	AE-4	SCPU board	CPU abnormality	
AF-1	AF-1	Main CPU	CPU board abnormality (1)	Traveling and Material handling outputs are stopped after abnormality detection. Reset
AF-2	AF-2	Main CPU	CPU board abnormality (2)	
AF-3	AF-3	Main CPU	CPU board abnormality (3)	
AF-4	AF-4	Main CPU	CPU board abnormality (4)	Traveling and material handling outputs are stopped after abnormality detection.
AF-5	AF-5	ST board CPU	CPU abnormality (1)	• Swing control·Tilt control disabled • Limited drive output (dead-man brake spec.)
AF-6	AF-6	ST board CPU	CPU abnormality (2)	
AF-7	AF-7	ST board CPU	CPU abnormality (3)	
AF-8	AF-8	ST board CPU	CPU abnormality (4)	

Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
C0-1	C0-1	Main drive circuit	Main drive circuit abnormality	• Traveling disabled after abnormality indication • Traveling disabled at power mode H • Traveling drive power supply is stopped.
C0-3	C0-3	Traveling drive1	Power supply abnormality	
C0-4	C0-4	Traveling drive1	Circuit abnormality	
C0-5	C0-5	Traveling drive2	Power supply abnormality	• Traveling disabled after abnormality indication • Traveling disabled at power mode H
C0-6	C0-6	Traveling drive2	Circuit abnormality	• Traveling disabled after abnormality indication • Traveling disabled at power mode H
C1-1	C1-1	Drive1 current sensor	Sensor abnormality	• Traveling disabled after abnormality indication • Traveling disabled at power mode H
C1-2	C1-2	Drive2 current sensor	Sensor abnormality	• Traveling disabled after abnormality indication • Traveling disabled at power mode H
 DM	C2-1	Drive motor	Motor temperature overheating	Limited drive output
C2-2	C2-2	Drive1 motor	Thermo-sensor abnormality	
C2-3	C2-3	Drive2 motor	Thermo-sensor abnormality	Limited drive output
C3-1	C3-1	Main drive circuit1	Thermo-sensor abnormality	Limited drive output
C3-2	C3-2	Main drive circuit2	Thermo-sensor abnormality	Limited drive output
C4-1	C4-1	Drive accelerator	Accelerator potentiometer abnormality (1)	Traveling disabled
C4-2	C4-2	Drive accelerator	Accelerator potentiometer abnormality (2)	Traveling disabled
C4-3	C4-3	Drive accelerator	Accelerator potentiometer abnormality (3)	Traveling disabled
C4-4	C4-4	Drive accelerator	Accelerator potentiometer abnormality (4)	Indication only
C7	C7	Direction switch	Switch abnormality	Traveling disabled after abnormality detection
C8-1	C8-1	Drive motor	Drive motor rpm sensor No.1 abnormality (1)	Traveling disabled after abnormality detection Traveling resumed by key OFF and then ON
C8-2	C8-2	Drive motor	Drive motor rpm sensor No.2 abnormality (2)	
CB-1	CB-1	MB (main contactor)	Contactor abnormality	Traveling and material handling disabled.
CB-2	CB-2	MB (main contactor)	Contactor fused	Indication only
E0-2	E0-2	Main pump circuit	Main pump circuit abnormality	Material handling and PS disabled after abnormality indication

Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
E0-4	E0-4	Material handling drive	Power supply abnormality	• Material handling and PS disabled after abnormality indication • Limited drive output (dead-man brake spec.)
E1	E1	Material handling current sensor	Sensor abnormality	• Material handling disbled after abnormality indication • Limited drive output (dead-man brake spec.)
 PM	E2-1	Pump motor1	Motor overheating	Limited pump motor1 output
E2-2	E2-2	Pump motor2	Motor thermo-sensor abnormality	• Limited pump motor2 output • Limited drive output
 PM	E2-3	Pump motor2	Motor overheating	Stop of pump motor2
E2-4	E2-4	Pump motor2	Motor thermo-sensor abnormality	• Stop of pump motor2 • Limited drive output
E3	E3	Main pump circuit	Thermo-sensor abnormality	• Limited lift output • Limited drive output
E6	E6	List switch	Switch abnormality	Stop of material handling operations
EA-2	EA-2	MP2 contactor	Contactor coil shorted	Stop of MP2 output
EB-1	EB-1	MP1 contactor	Contactor coil open	• Material handling and PS disabled • Limited drive output (dead-man brake spec.)
EB-2	EB-2	MP1 contactor	Contactor fusion	Indication only
EB-3	EB-3	MP1 contactor	Contactor coil shorted	Stop of MP1 output
EE-1	EE-1	Communications system between display and main controller	Communication abnormality (1)	Indication only
EE-2	EE-2	Communications system between display and main controller	Communication abnormality (2)	Indication only
EE-3	EE-3	Communications system between display and main controller	Communication abnormality (3)	Indication only (Operate under the default.)
EF-1	EF-1	Traveling controller EEP-ROM	EEP-ROM abnormality (1)	Operate under the default.
EF-2	EF-2	Traveling controller EEP-ROM	EEP-ROM abnormality (2)	Operate under the default.
EF-3	EF-3	Traveling controller CPU	CPU board abnormality	Indication only
EF-4	EF-4	Traveling controller EEP-ROM	EEP-ROM abnormality	Operate under the default.
EF-5	EF-5	ST board EEP-ROM	EEP-ROM abnormality (1)	• Swing control·PS control disabled • Limited drive output (dead-man brake spec.)
EF-6	EF-6	ST board EEP-ROM	EEP-ROM abnormality (2)	Indication only

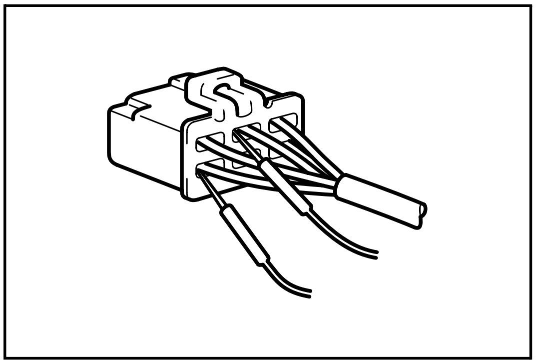
Display indication	Diag memory	Faulty portion	Defect mode	Phenomenon on vehicle
EF-7	EF-7	SCPU board EEP-ROM	EEP-ROM abnormality	• Material handling and PS disabled • Limited drive output (dead-man brake spec.)
EF-8	EF-8	SCPU board EEP-ROM	EEP-ROM abnormality	Indication only
F1-1	F1-1	Communications system between main controller and display	Communication abnormality (1)	Indication only
F1-2	F1-2	Communications system between main controller and display	Communication abnormality (2)	Indication only
FD-1	FD-1	Communications system between SAS controller and Material handling controller	Communication abnormality	Stop of material handling operations
FD-2	FD-2	Communications system between SAS controller and Material handling controller	Communication abnormality	Stop of material handling operations
FE-1	FE-1	Communications system between SAS controller and main controller	Communication abnormality (1)	Indication only
FE-2	FE-2	Communications system between SAS controller and main controller	Communication abnormality (2)	Indication only
FE-4	FE-4	Communications system between main controller and SAS controller	Communication abnormality (1)	Stop of material handling operations
FE-5	FE-5	Communications system between main controller and SAS controller	Communication abnormality (2)	Stop of material handling operations
FE-6	FE-6	Communications system between material handling controller and SAS controller	Communication abnormality (1)	Stop of material handling operations
FE-7	FE-7	Communications system between material handling controller and SAS controller	Communication abnormality (2)	Stop of material handling operations
G4-1	G4-1	Dead-man solenoid	Solenoid open	Limited drive output (dead-man brake spec.)
G4-2	G4-2	Dead-man solenoid	Solenoid shorted	Limited drive output (dead-man brake spec.)
PM BRSH	—	Pump motor brush	Brush wear	• Limited drive speed (5 km/h (3.1 mile/h)) • Traveling and material handling are prohibited after abnormality detection.
PM2 BRSH	—	Pump motor2 brush	Brush wear	

TROUBLESHOOTING

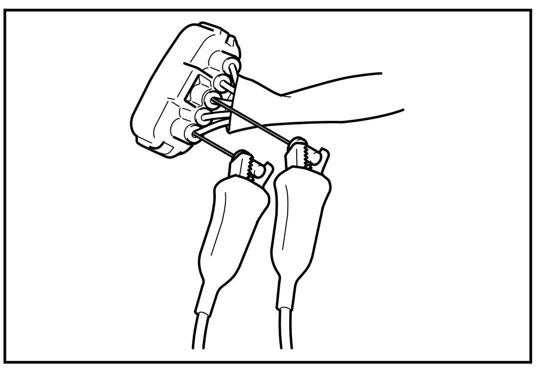


BEFORE TROUBLESHOOTING
CONNECTOR HANDLING

1. Disconnect the battery plug before connecting or disconnecting each connector or terminal.
2. When disconnecting a connector, do not pull it at the harness but hold the connector itself and pull it after unlocking it.
   To connect, push the connector fully until it is locked in position.



3. Bring a tester probe into contact with a connector terminal from the rear side of the connector (harness side).
4. If insertion from the rear side is impossible, as in the case of a waterproof connector, bring the tester probe carefully into contact with the terminal so as not to cause deformation of the connector terminal.
5. Do not touch connector terminals directly with your hand.
6. When bringing tester probes into contact with live terminals, prevent two tester probes from coming into contact with each other.



WIRE HARNESS AND CONNECTOR INSPECTION PROCEDURE

When any trouble occurs, first inspect the connectors and wire harness of the related circuit according to the following procedure:

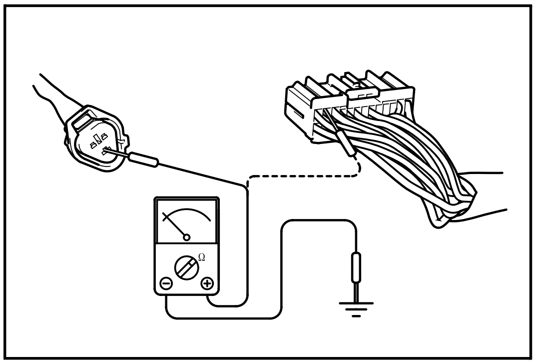
Continuity check

1. Disconnect the connectors at both ends of the corresponding harness.
2. Measure the resistance between corresponding terminals of the connectors at both ends.

   Standard: 10 Ω or less

Note:
Measure while lightly shaking the wire harness up and down and sideways.

[Reference] Open circuit at the wire harness occurs rarely partway through a vehicle wiring but mostly at connectors. Inspect especially the sensor connectors with sufficient care.

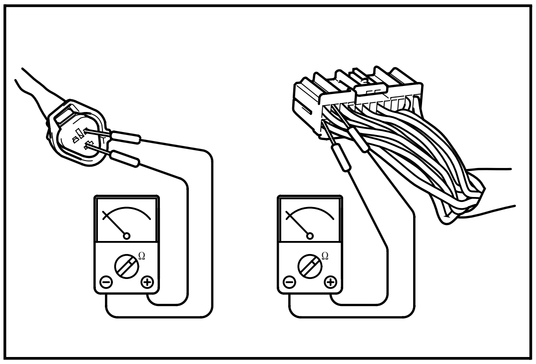


Short circuit check

1. Disconnect the connectors at both ends of the corresponding harness.
2. Measure the resistance between the corresponding connector terminal and N1. Always inspect the connectors at both ends.

   Standard: 1 MΩ or more.

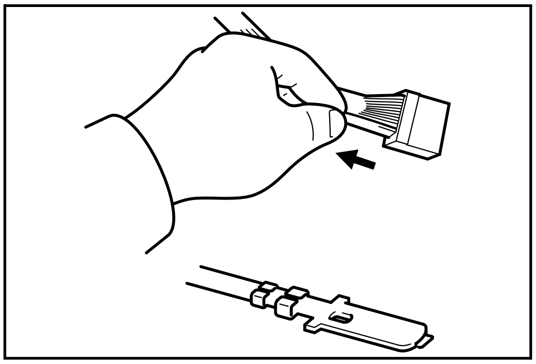
Note:
Measure while lightly shaking the wire harness up and down and sideways.



3. Measure the resistance between a terminal corresponding to the connector terminal and N1. Be sure to inspect the connectors at both ends.

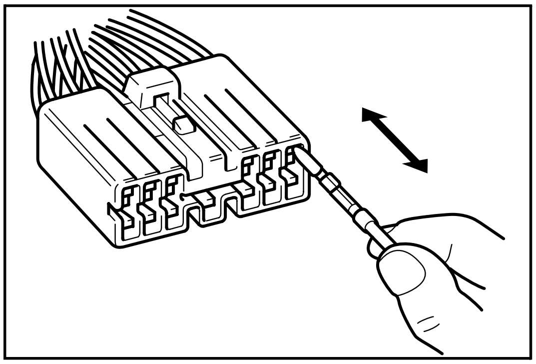
   Standard: 1 MΩ or more.

Note:
The wiring may short-circuit due to pinching by the body or defective clamping.



Visual and contact pressure checks

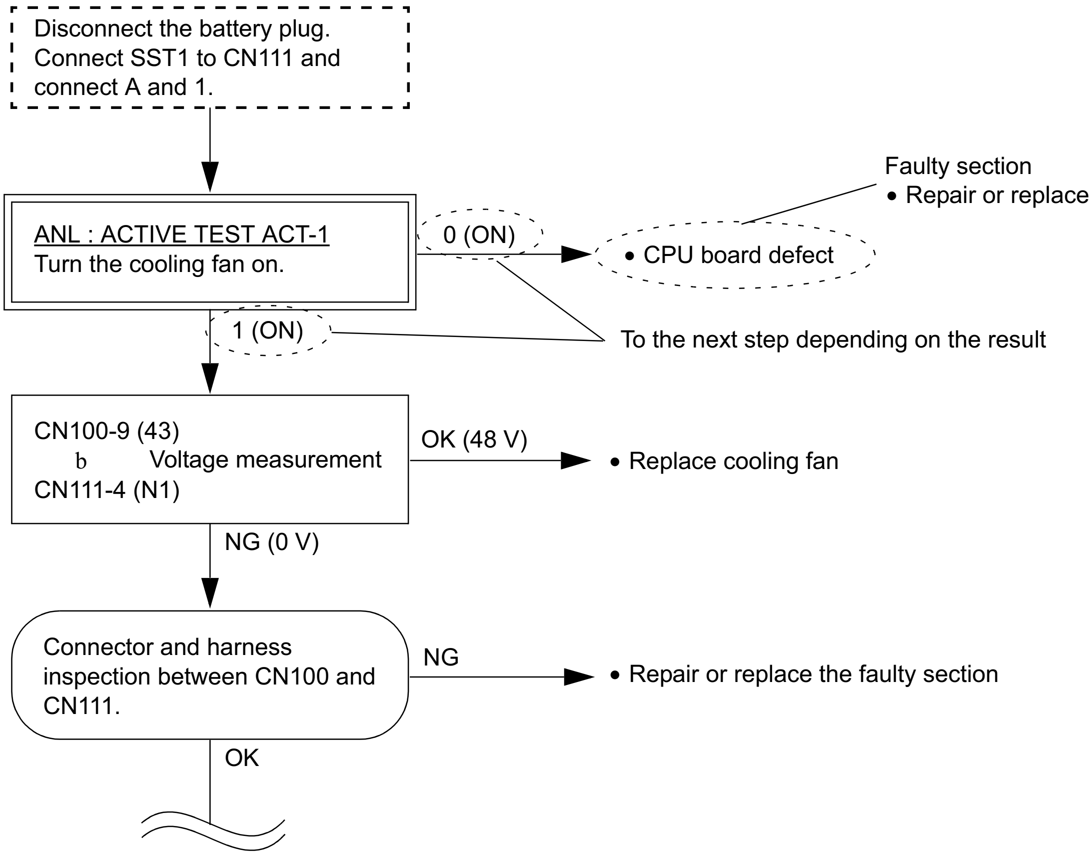
- Disconnect the connectors at both ends of the corresponding harness.
- Visually inspect that there is neither rust nor foreign matter trapped at connector terminals.
- Inspect that there is no loosening or damage at the locked portion. Also, lightly pull the wire harness from the connector to check that it does not come off.



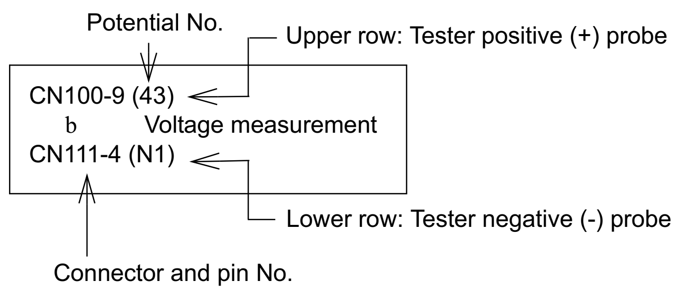
- Insert a male terminal same as that of the connector to a female terminal and check the extracting force. Defective contact may exist at a terminal where the extracting force is less than that of other terminals.

Note:
Even if there is rust or foreign matter trapped at the terminal, or the contact pressure between male and female terminals is low, abnormal contact condition may be changed to normal by disconnecting and reconnecting the connector. In that case, repeat connector connection and disconnection several times. If defect is perceived even once, terminal contact may be defective.

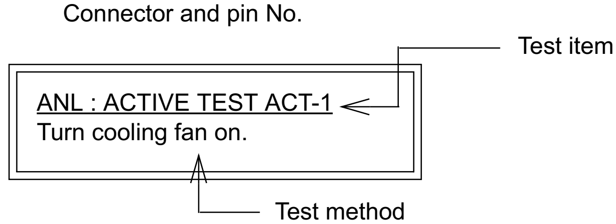
TROUBLESHOOTING METHOD



EXPLANATION OF BOXES



A single box indicates measurement with a tester or an ordinary step.



A double box indicates inspection by a mask function.Perform inspection by referring to page 3-20.

A dashed-line box indicates SST connection. Perform inspection by referring to page 4-5 (15 ~ 32 model) or 4-108 (35 ~ 55 model).

An rounded-corner box indicates connector or wire harness inspection.Perform inspection by referring to page 4-2.

SST SETTING METHODS (15 ~ 32 MODEL)

Use SSTs for quick, accurate troubleshooting of the 7FBCU series electrical system.

SST for 7FB, 7FBR, and 7FBCU is to be used respectively.

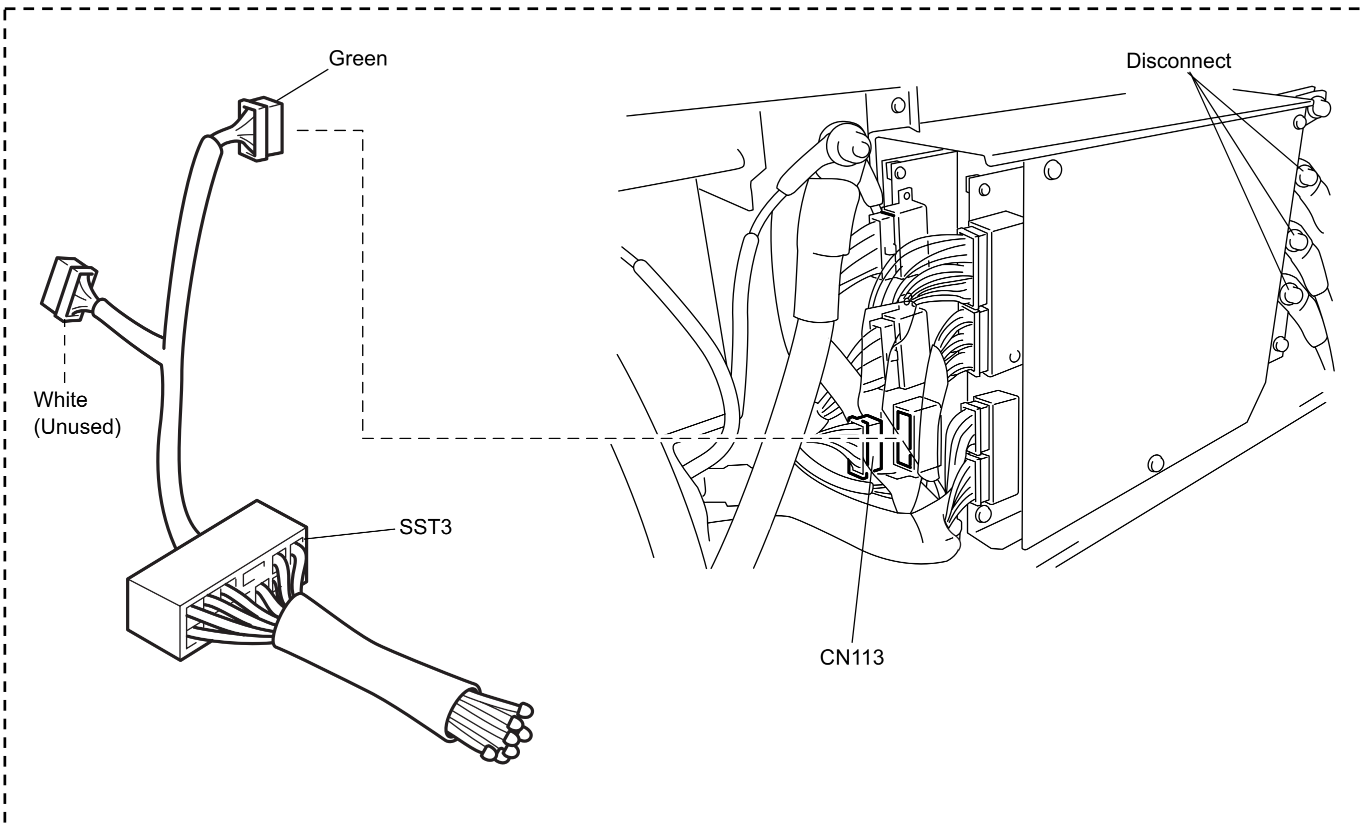
Incorrect connection will fail in correct check. Since boards may be damaged by incorrect connection, careful operation is necessary.

SST 09230-13130-71 Controller check harness (for 7FB)		
SST2	09232-13130-71	Shorting harness (for CN1, CN86 and CN90)
SST3	09233-13130-71	Harness to check if the CPU and DC/MD boards are driving the MOS normally (for CN113)
SST8	09238-13130-71	Acceleration potentio meter check harness (for CN25)
SST 09230-13900-71 Controller check harness (for 7FBR)		
SST10	09231-13900-71	Fan check harness (for CN105)
SST11	09232-13900-71	Harness to check if the CPU and DC/MD boards are driving the MOS normally (for CN106 and CN107)
SST13	09234-13900-71	Shorting harness (for CN104)
SST14	09235-13900-71	Main pump circuit check harness (for P14 and P15)
SST 09230-21440-71 Controller check harness (for 7FBCU)		
SST18	09231-21440-71	Drive motor speed sensor check harness (for CN57)

Caution:
- **Be sure to disconnect the battery plug before installing and removing each SST. If the battery plug is kept connected, board damage may result.**
- **Before connecting SST, measure the voltage between P14 and N1; if there is any voltage, insert a resistor at approx. 100 Ω between P14 and N1 to discharge the capacitor.**

4

1. SST2·SST8·SST13 setting method
   SST2·SST8·SST13 is a shorting harness to short-circuit between the corresponding connector pins. Carefully connect it since the board may be damaged if it is connected to wrong pin Nos.
2. SST3 setting method for troubleshooting for "Error code C0-1 or C0-4, failure of traveling only"
   (1) Jack up the front side of the vehicle until the drive wheels float.
   (2) Disconnect the battery plug.
   (3) Disconnect the drive motor cables (P7, P8 and P9) and the pump motor cables (P14 and P15).
   (4) Disconnect CN113 (for traveling circuit) and set SST3.
   (5) Connect the battery plug.
   For error code C0-4, make sure that "C0-4" disappears then.
   (6) Shift the direction lever to forward or reverse.
   (7) Depress the accelerator pedal.
   When the accelerator pedal is depressed, six LEDs repeat blinking. A pair of red and green LEDs correspond to the transistor operation for one phase, and the six LEDs in total correspond to the transistor operation for three phases. The speed of blinking varies with the degree of accelerator pedal depression.
   When either LED is off, either the signal from the CPU board or the signal from the DC/MD board is defective. The blinking sequence for three phases is reverse between forward traveling and reverse traveling.



3. SST10 setting method for troubleshooting for “Error code A0-1, A0-2, A0-4, C0-3, E0-3 or F0-3”
   (1) Disconnect the battery plug.
   (2) Disconnect CN105, CN106 and CN107 on the CPU board.
   (3) Connect SST10 to CN105 on the CPU board.
   (4) Connect SST11 to CN106 and CN107. (See pages 4-8 and 4-9)
   (5) Connect SST connector A to connector 2 and check fan power supply ON/OFF signal by analyzer “ACTIVE TEST”.

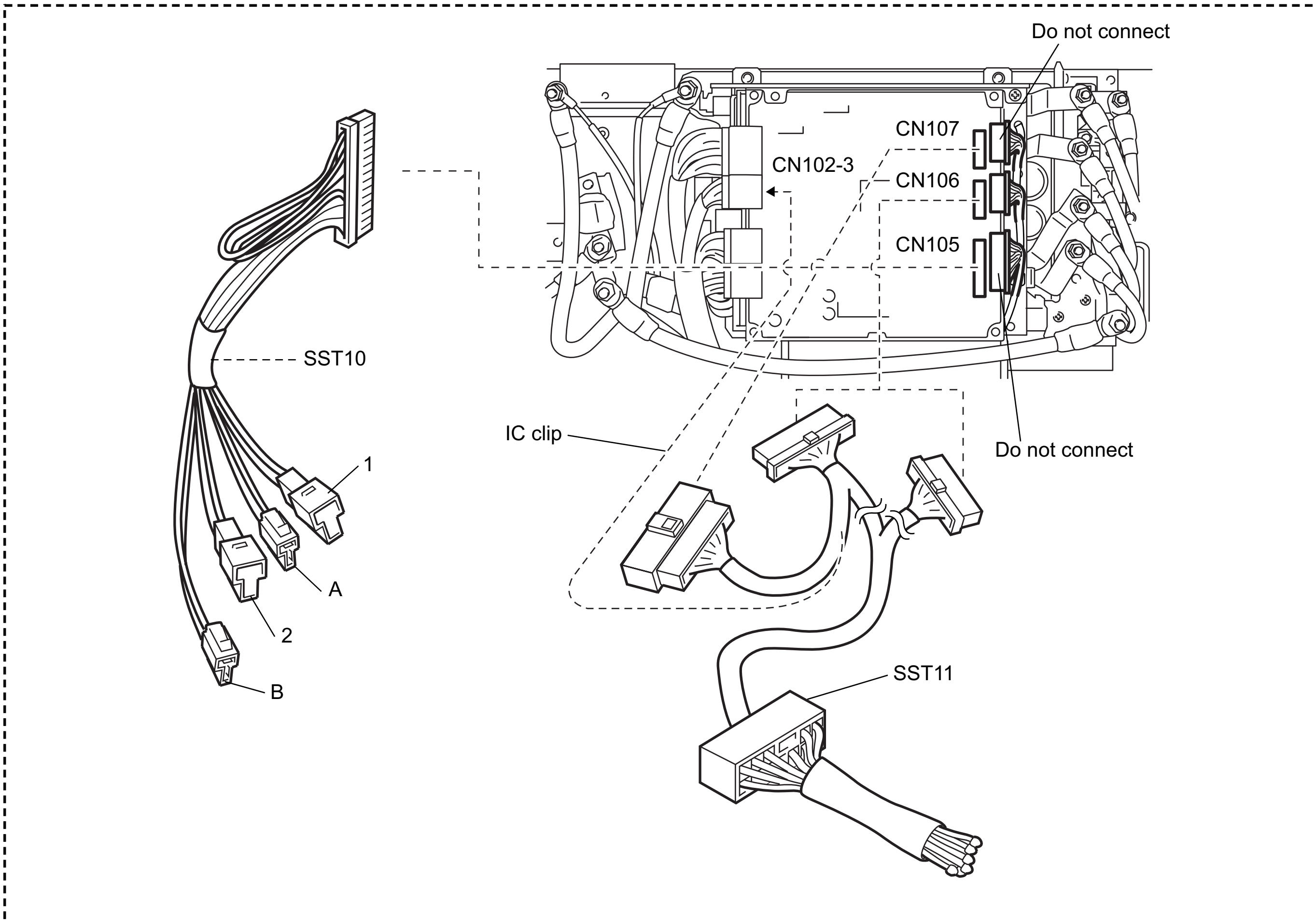
   For error code C0-3

   (6) Connect SST connector A to connector 1 and check fan power supply ON/OFF signal by analyzer “ACTIVE TEST”.

   For error code E0-3

   (7) Connect SST connector B to connector 1 and check fan power supply ON/OFF signal by analyzer “ACTIVE TEST”.
   (8) Connect the battery plug.

   For “Error code A0-1, A0-2, A0-4 or F0-3”



4. SST11 setting method for troubleshooting for "Error code C0-1, C0-4" and complete failure of moving the vehicle

(1) Jack up the front side of the vehicle until the drive wheels float.

(2) Disconnect the battery plug.

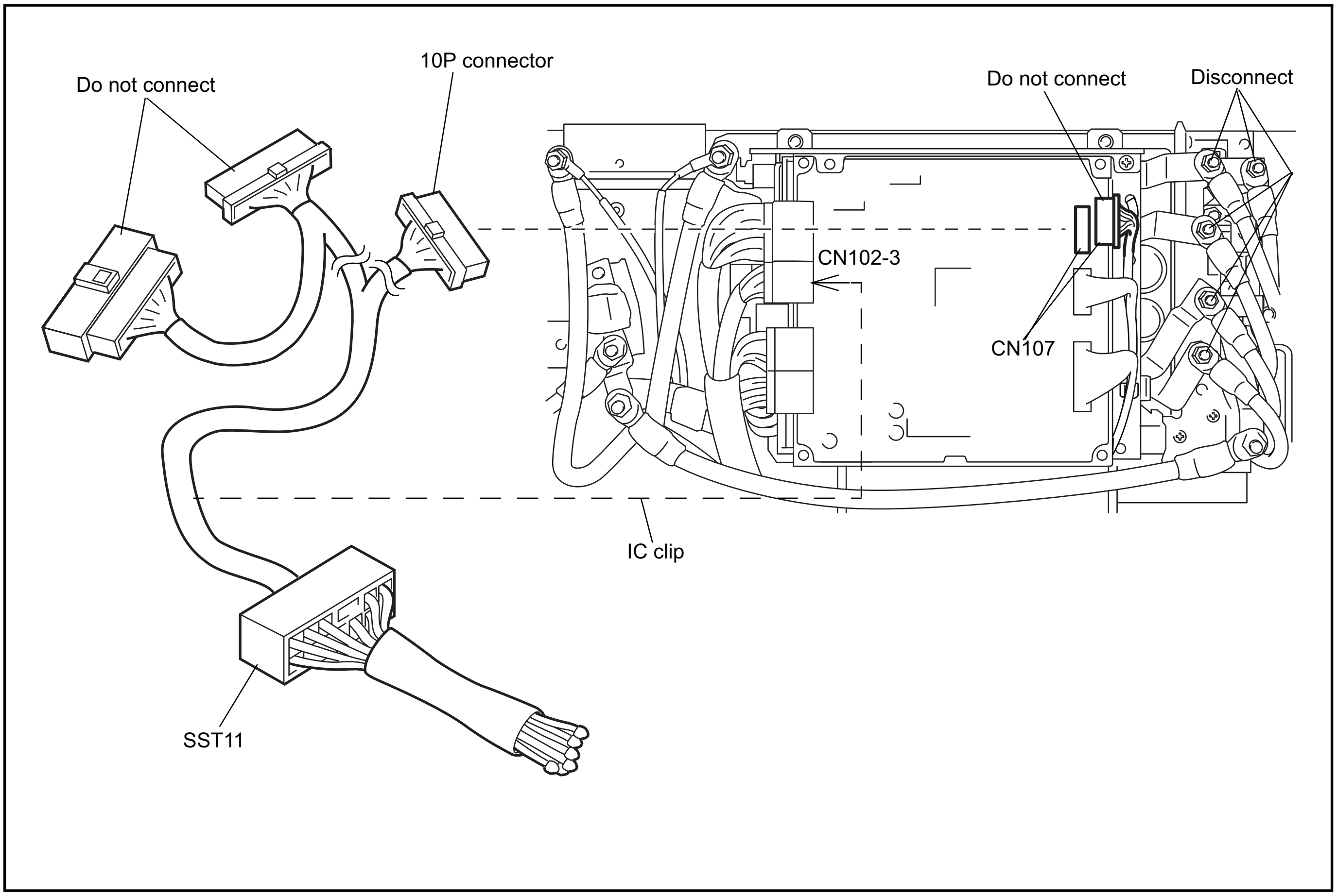
(3) Disconnect the drive motor cables (P7, P8 and P9) and the pump motor cables (P14 and P15).

(4) Disconnect CN107 on the CPU board and connect SST11.

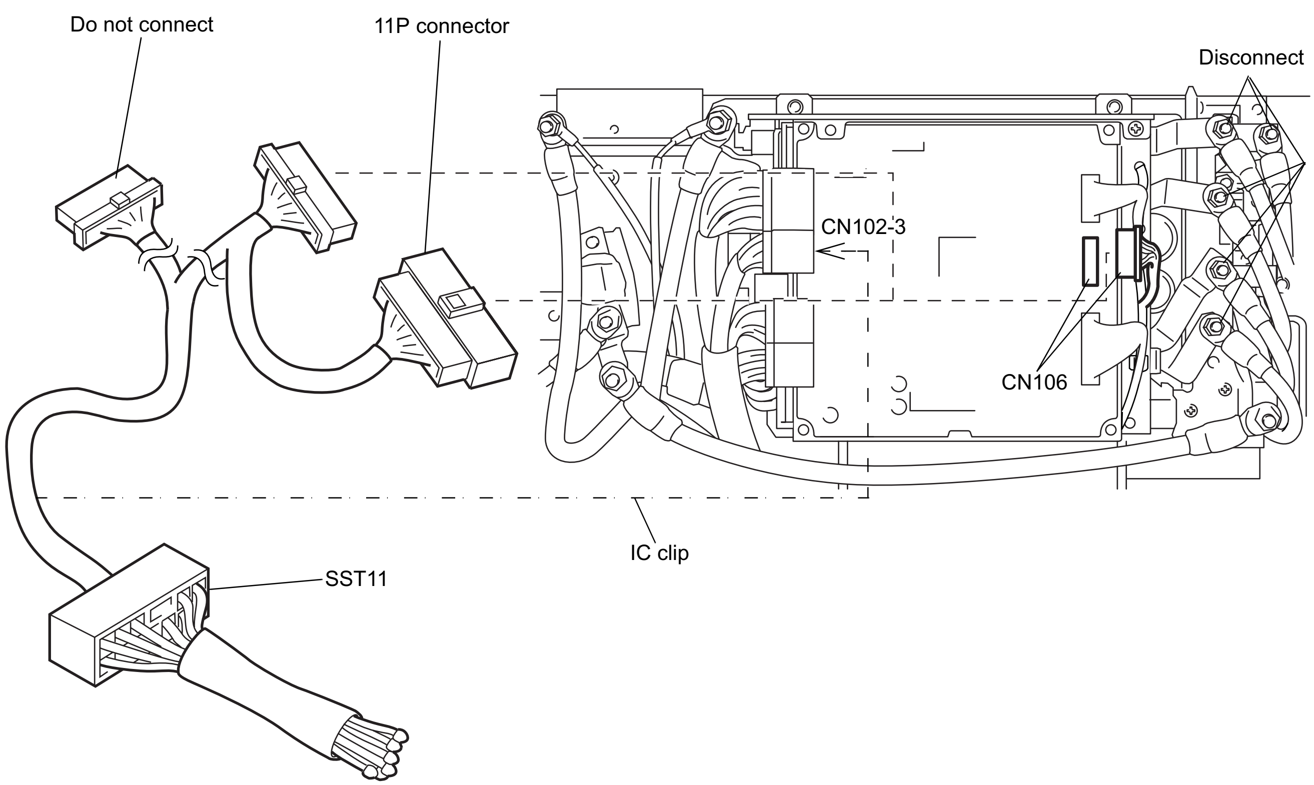
(5) Connect the battery plug.

For error code C0-4, make sure that "C0-4" disappears then.

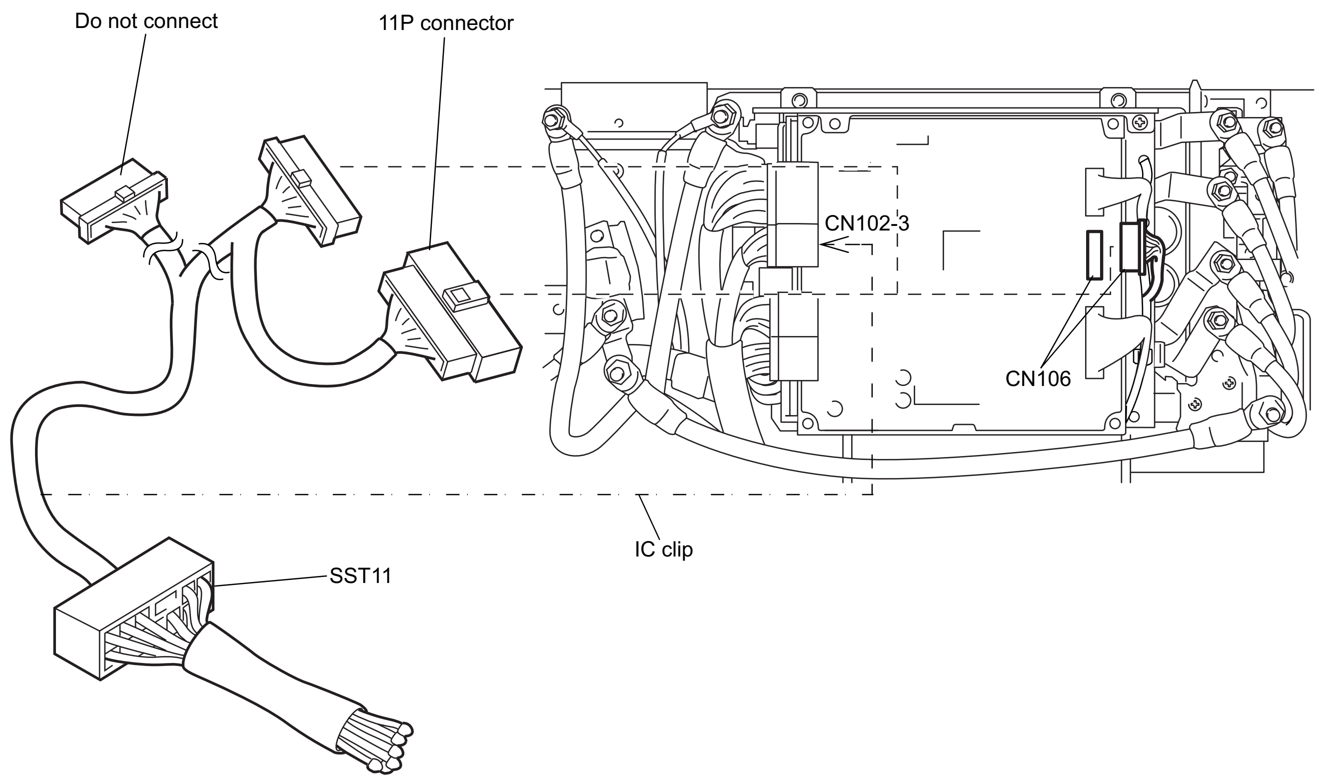
(6) Turn the key switch ON, and make sure that LED No. 1 – No. 6 blinking when the direction lever is operated and the accelerator pedal is depressed.



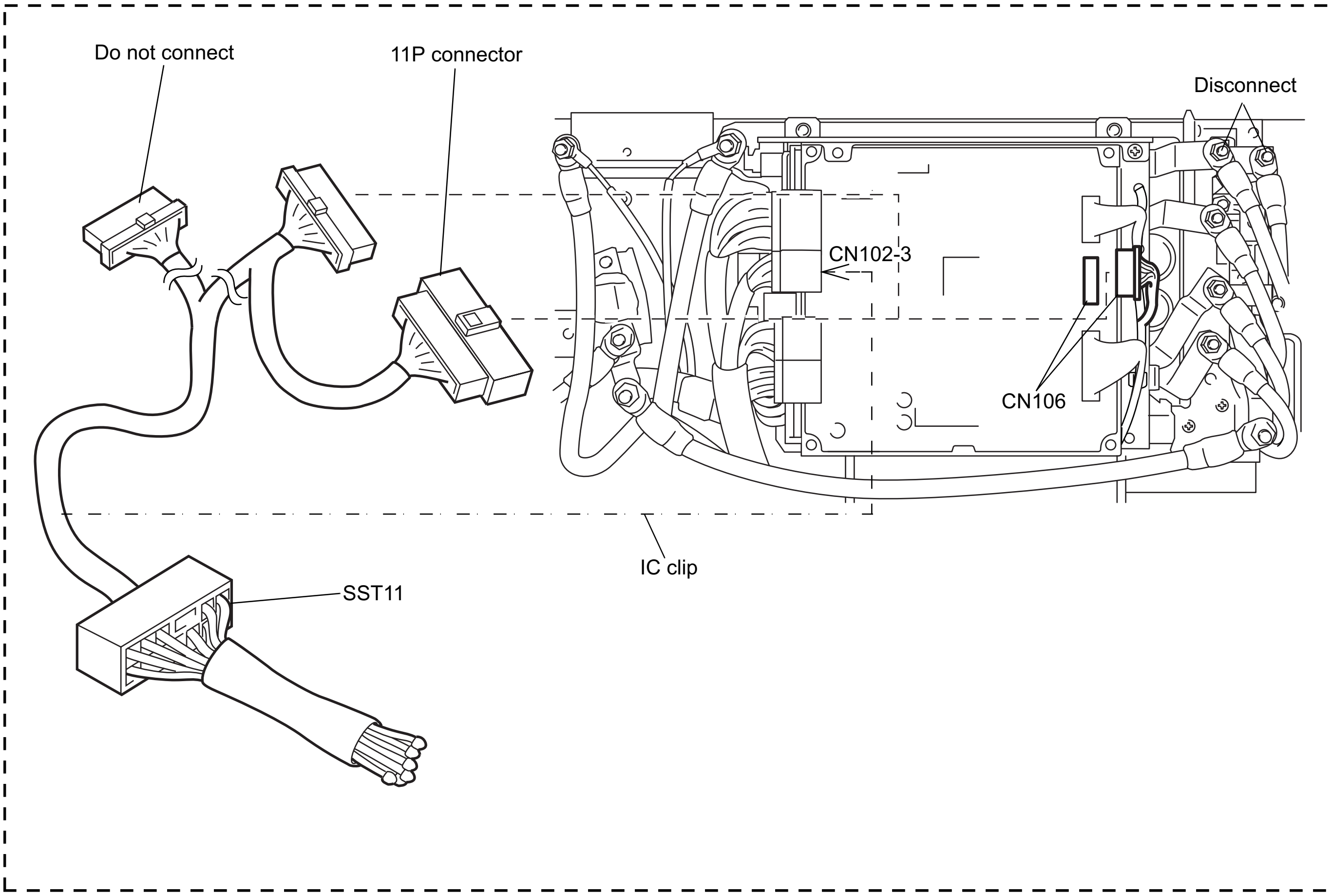
5. SST11 setting method for troubleshooting for “Error code CB-1, CB-2, E0-1, E0-4” and complete failure of moving the vehicle
   (1) Jack up the front side of the vehicle until the drive wheels float.
   (2) Disconnect the battery plug.
   (3) Disconnect the drive motor cables (P7, P8 and P9) and the pump motor cables (P14 and P15).
   (4) Disconnect CN106 on the CPU board and connect SST11.
   (5) Connect the battery plug.
   For error code E0-4, make sure that “E0-4” disappears then.
   (6) Turn the key switch ON, and make sure that LED No. 1 or No. 6 lights up then.



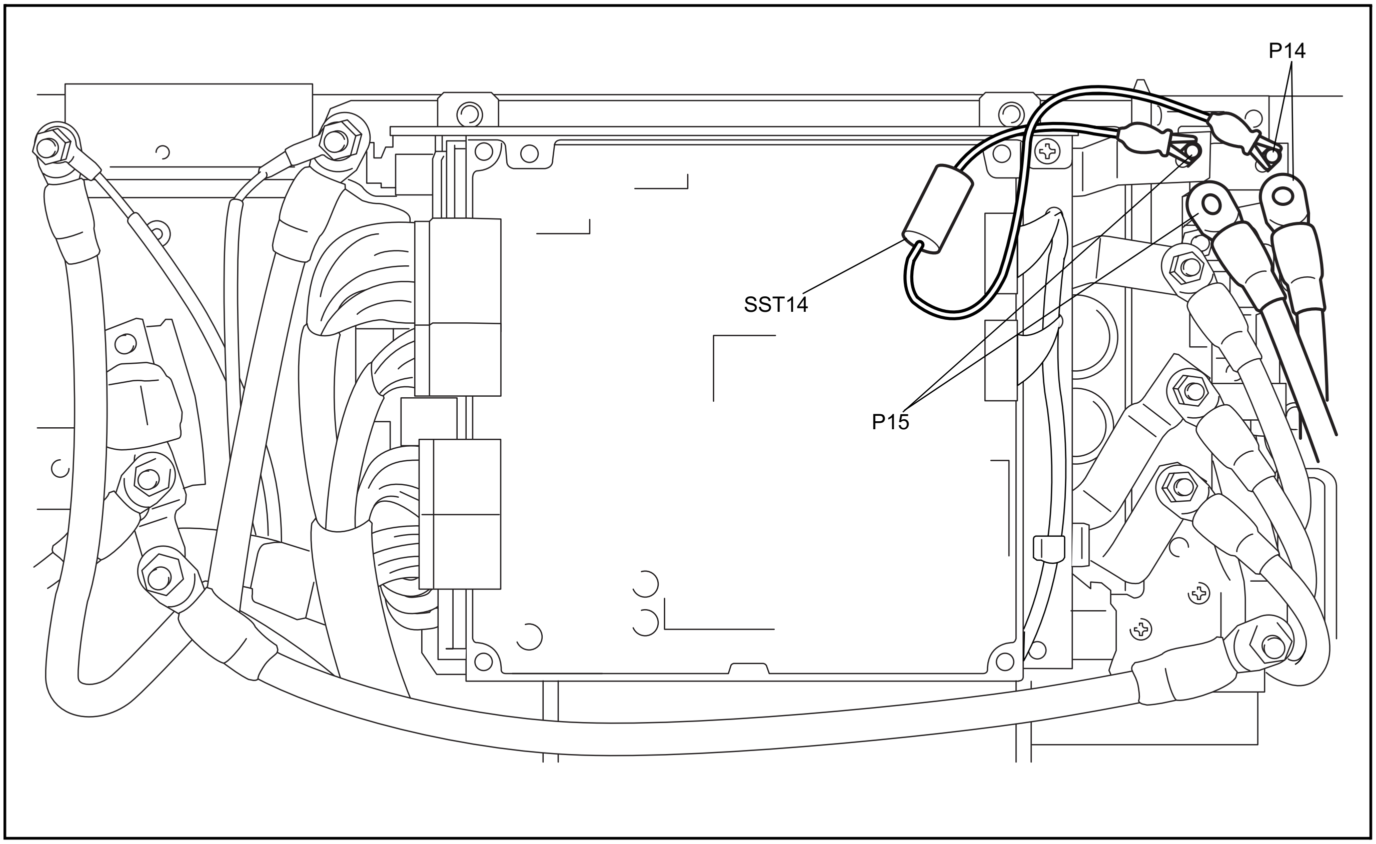
6. SST11 setting method for troubleshooting for "Error code F0-1, failure of power steering operation only"
   (1) Disconnect the battery plug.
   (2) Disconnect the PS motor cables (A1 and A2).
   (3) Disconnect CN106 on the CPU board and connect SST11.
   (4) Connect the battery plug.
   (5) Turn key switch ON and make sure that LED No. 3 lights up when the direction lever is operated.



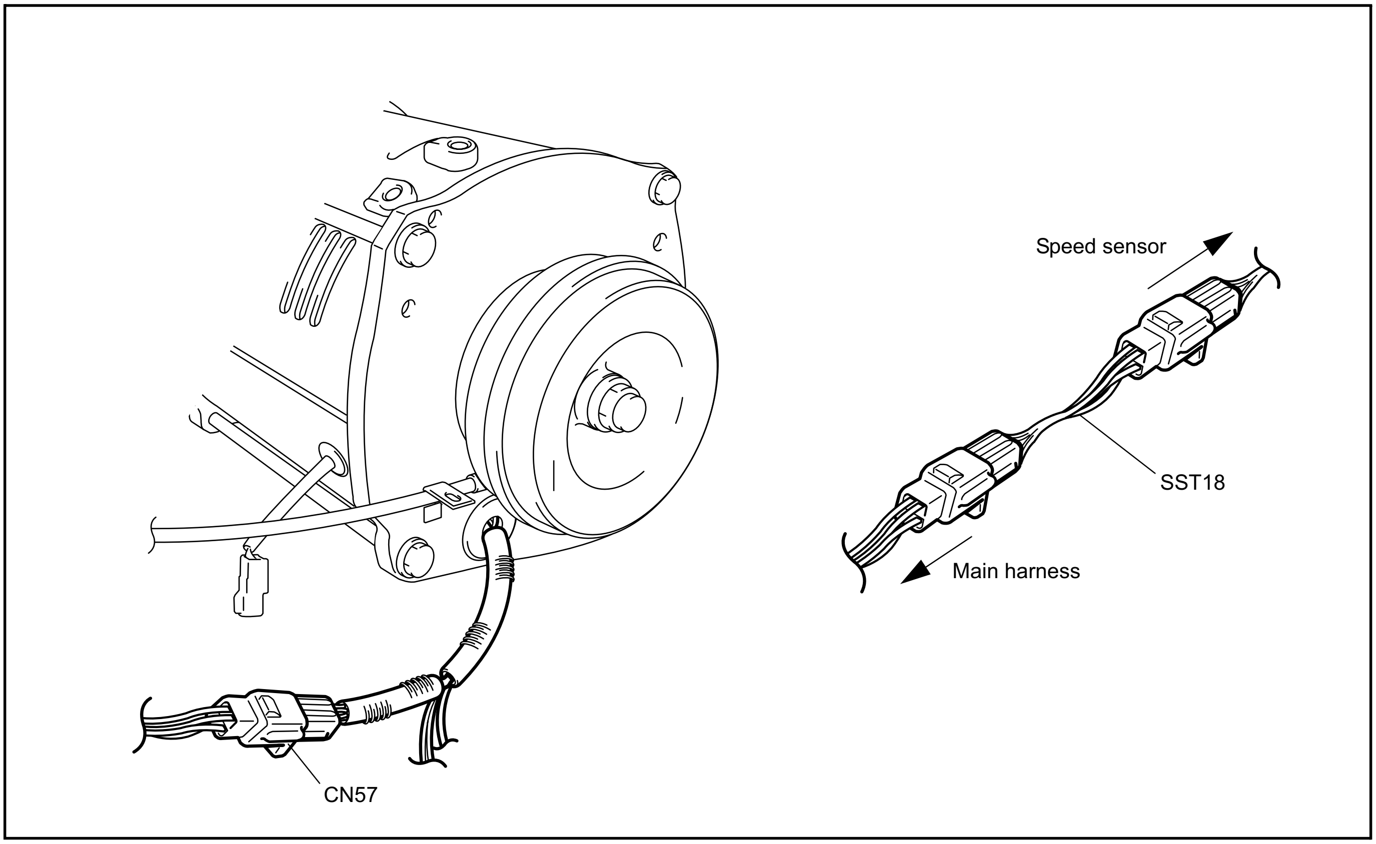
7. SST11 setting method for troubleshooting for “Failure of material handling only”
   (1) Disconnect the battery plug.
   (2) Disconnect the pump motor cables (P14 and P15).
   (3) Disconnect CN106 on the CPU board and connect SST11.
   (4) Connect the battery plug.
   (5) Turn key switch ON and make sure that LED No. 6 lights up when the material handling lever is operated.



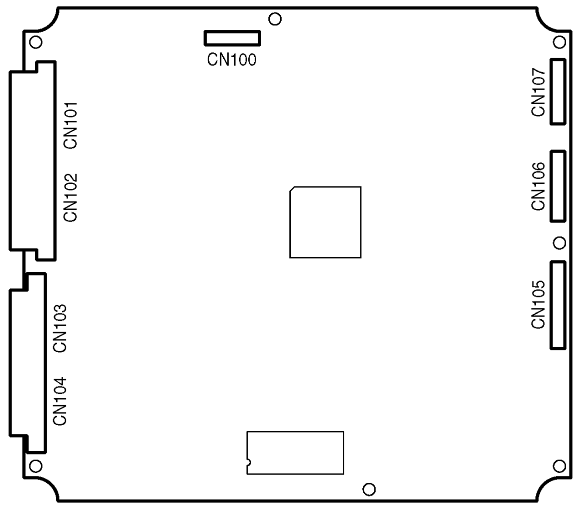
8. SST14 setting method for troubleshooting for “Error code E0-1, failure of material handling only”
   (1) Jack up the front side of the vehicle until the drive wheels float.
   (2) Disconnect the battery plug.
   (3) Disconnect the traveling/material handling controller cables (P14 and P15).
   (4) Connect SST14 between disconnected terminals P14 and P15.
   (5) Connect the battery plug.
   (6) Turn key switch ON, and measure the voltage between P14 and P15 when the material handling lever is operated.



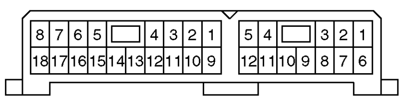
9. SST18 setting method for troubleshooting for “Error code C2-2, C8-1, C8-2, C8-3 or C8-4”
   (1) Jack up the front side of the vehicle until the drive wheels float.
   (2) Disconnect the battery plug.
   (3) Disconnect CN57 and set SST18.
   (4) Connect the battery plug.
   (5) Check to see if the error code changes.



CPU BOARD CONNECTOR



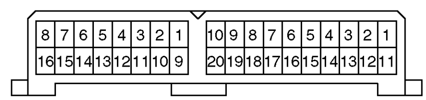
CN 101 CN 102



No.	P	J
1	45	DSF
2	46	DSR
3	65	LSB
4	66	LSPB
5	67	LSD
6	63	LSAT1
7	61	LST
8	60	LSL1
9	—	LSOPT1
10	68	LSL2
11	69	LSAT2
12	51	LS-
13	—	OPT0
14	343	ISPS-
15	342	ISPS+
16	196	BMPS
17	193	BMP
18	—	LSOPT2

No.	P	J
1	64	SWAC
2	52	POTA
3	80	SSD+
4	82	SSD2
5	81	SSD1
6	88	TP+
7	89	TP-
8	50	POT-
9	86	TD+
10	87	TD-
11	53	POTA+
12	—	—

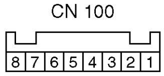
CN 103 CN 104



No.	P	J
1	307	SMTSA
2	308	SMTSK
3	309	SSTMA
4	310	SSTMK
5	144	SMTDK
6	143	SDTMK
7	142	SDTMA
8	141	SMTDA
9	326	SSO16-
10	324	SSO+
11	—	—
12	345	ERR+
13	346	ERR-
14	—	—
15	—	—
16	—	—

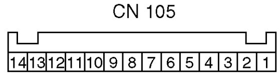
No.	P	J
1	44	VBMB
2	15	C15V
3	P4	VBP4
4	75	CSD+
5	75	CSP+
6	71	CSDA
7	72	CSDB
8	73	CSP
9	54	CSBATT
10	79	THCP
11	—	—
12	76	CSP-
13	76	CSD-
14	14	GNDC
15	77	THC+
16	41	VBBT
17	N2	N2
18	43	VBKY
19	78	THCD
20	—	—

CN 100



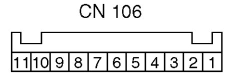
No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	MD2
6	—	FRES
7	—	FRXD
8	—	SELR

CN 105



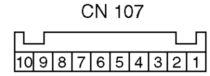
No.	P	J
1	38	FAN+
2	38	FAN+
3	36	FANCD
4	19	20VNO, 20N
5	—	—
6	39	DDC
7	40	PDC
8	94	CKFAND+
9	97	CKFAND-
10	13	20VNO, 10N
11	37	CK20V
12	—	—
13	—	—
14	—	—

CN 106



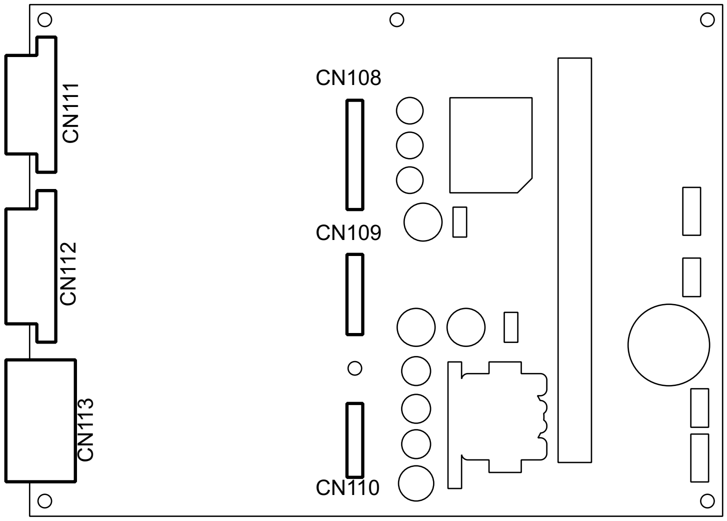
No.	P	J
1	—	—
2	27	CHOPB
3	28	CHOPP
4	29	CHOPS
5	31	OCL
6	—	—
7	32	TMPAD-
8	33	TMPD+
9	35	CKPV
10	—	—
11	—	—

CN 107

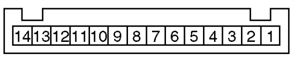


No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

DC/MD BOARD CONNECTOR

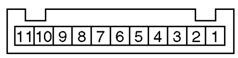


CN 108



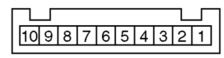
No.	P	J
1	38	FAN+
2	38	FAN+
3	36	FANCD
4	19	20VNO, 20N
5	—	—
6	39	DDC
7	40	PDC
8	94	CKFAND+
9	97	CKDAND-
10	13	20VNO, 10N
11	37	CK20V
12	—	—
13	—	—
14	—	—

CN 109



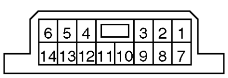
No.	P	J
1	—	—
2	27	CHOPB
3	28	CHOPP
4	29	CHOPS
5	31	OCL
6	—	—
6	32	TMPAD-
7	33	TMPD+
8	35	CKPV
10	—	—
11	—	—

CN 110



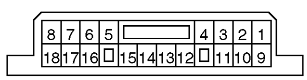
No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

CN 111



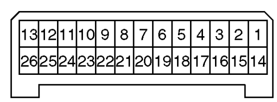
No.	P	J
1	41	B48V
2	10	MPS+
3	338	(H15V+)
4	11	S20V+
5	16	D15V
6	43	VBKY
7	—	—
8	9	MPS-
9	339	V20V- (H15V-)
10	338	B20V+
11	44	VBMB
12	12	S20V-
13	14	GNDD
14	—	—

CN 112



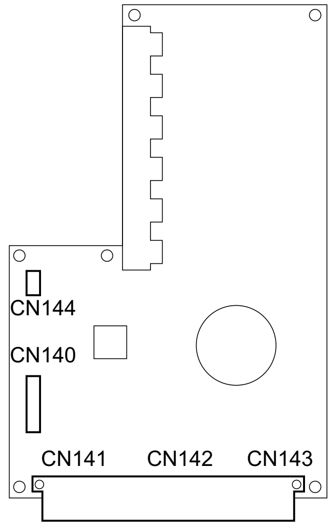
No.	P	J
1	162	TMPD2+
2	N2	TMPD-SD
3	153	TMPD-G
4	162	TMPD1+
5	15	C15V
6	41	B48V
7	43	VBKY
8	44	VBMB
9	—	—
10	1	MB+ (MD+)
11	2	MB- (MD-)
12	7	FAND+
13	8	FAND-
14	14	GNDC
15	5	MP+
16	6	MP-
17	N2	N2
18	N2	N2

CN 113

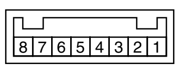


No.	P	J
1	150	TMDAU1+
2	152	TMDAD1+
3	154	TMDBU1+
4	151	TMDAU-G
5	153	TMDAD-G
6	155	TMDBU-G
7	157	TMDBD-G
8	159	TMDCU-G
9	161	TMDCD-G
10	—	—
11	156	TMDBD1+
12	158	TMDCU1+
13	160	TMDCD1+
14	P5	TMDAU-SD
15	N2	TMDAD-SD
16	P6	TMDBU-SD
17	150	TMDAU2+
18	152	TMDAD2+
19	154	TMDBU2+
20	156	TMDBD2+
21	158	TMDCU2+
22	160	TMDCD2+
23	—	—
24	N2	TMDBD-SD
25	P9	TMDCU-SD
26S	N2	TMDCD-SD

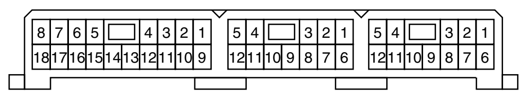
ST BOARD CONNECTOR



CN140



CN141 CN142 CN143



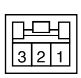
No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	FBUSY
6	—	FRES
7	—	FRXD
8	—	SELR
9	—	FCLK

No.	P	J
1	137	SL/L+
2	57	POTT+
3	56	POTT
4	58	SPL+
5	309	SSTMA
6	307	SMTSA
7	310	SSTMK
8	308	SMTSK
9	51	OLSD-
10	138	SL/L-
11	320	STPOT-
12	59	SPL
13	324	SS+
14	326	SS-
15	61	OLST+
16	51	OLST-
17	67	OLSD+
18	—	—

No.	P	J
1	303	VBMB2
2	90	MH1
3	91	MH2-1
4	70	SWTK
5	11	S20V+
6	(N2)	(N2)
7	N2	N2
8	304	STLSD
9	305	STLSTF
10	306	STLSTR
11	12	S20V-
12	(12)	(S20V-)

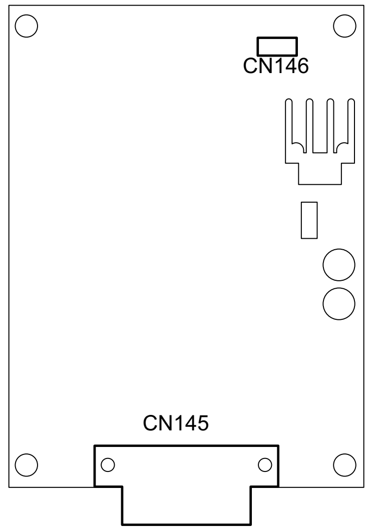
No.	P	J
1	330	SOLT-
2	328	SOLS-
3	334	SOLD-
4	—	—
5	332	SOLL-
6	(327)	(SOLTS+)
7	327	SOLTS+
8	331	SOLLD+
9	—	SXTSA
10	—	SSTXA
11	—	SXTSK
12	—	SSTXK

CN144

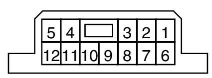


No.	P	J
1	321	SYR+
2	323	SYR-
3	322	SYR

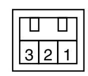
EHPS BOARD CONNECTOR



CN145



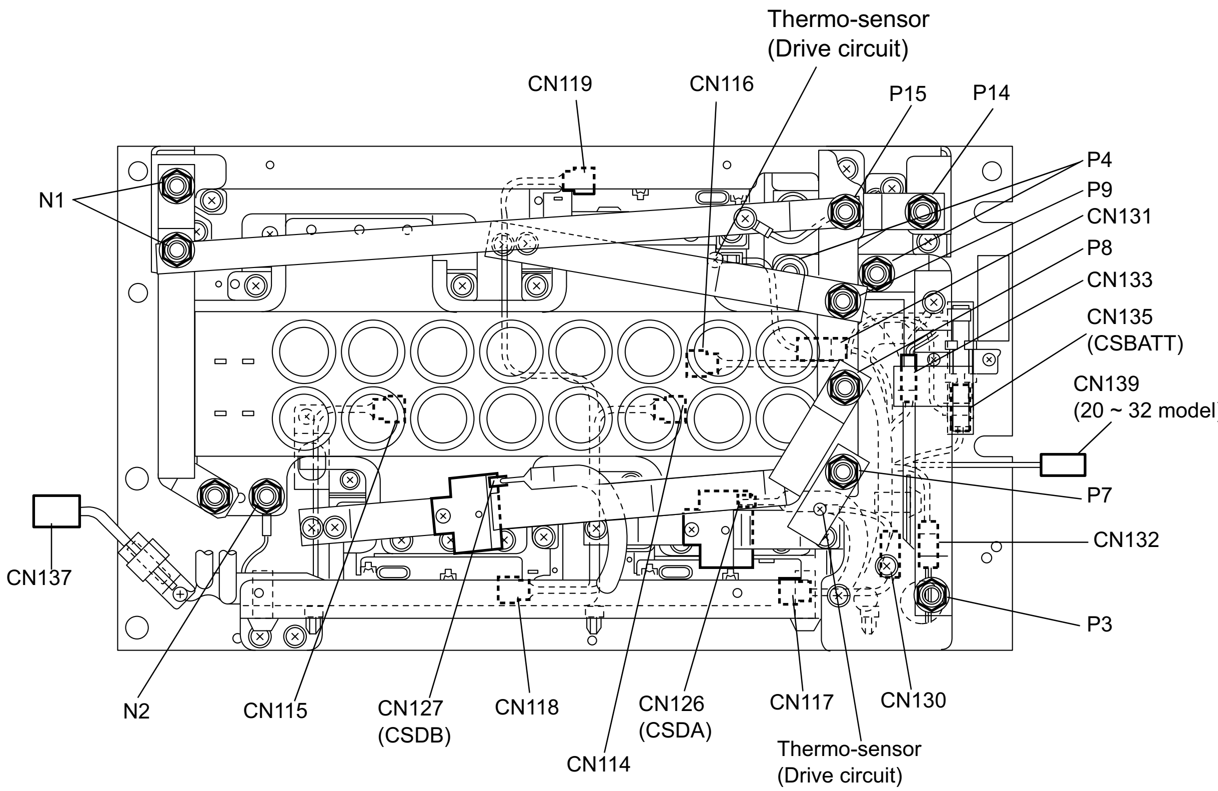
CN146

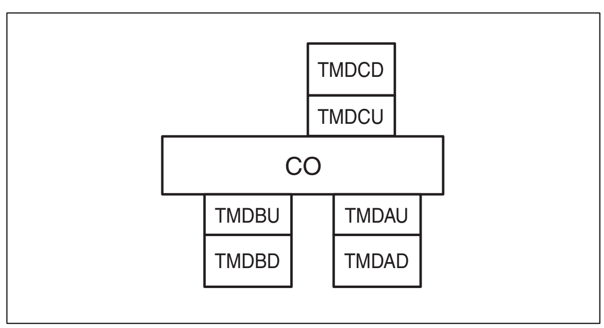


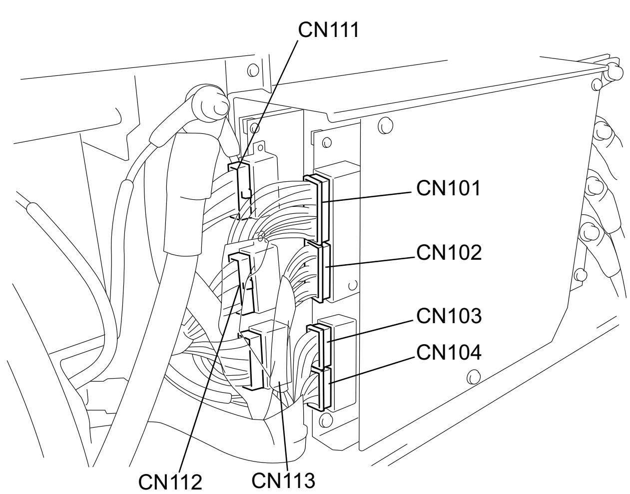
No.	P	J
1	43	VBKY
2	—	—
3	312	STS1
4	313	STS2
5	315	STS-
6	—	—
7	—	—
8	342	ISTPA
9	343	ISTPK
10	345	ERR+
11	346	ERR-
12	—	—

No.	P	J
1	340	TMPSG
2	P24	SH+
3	N1	SH-

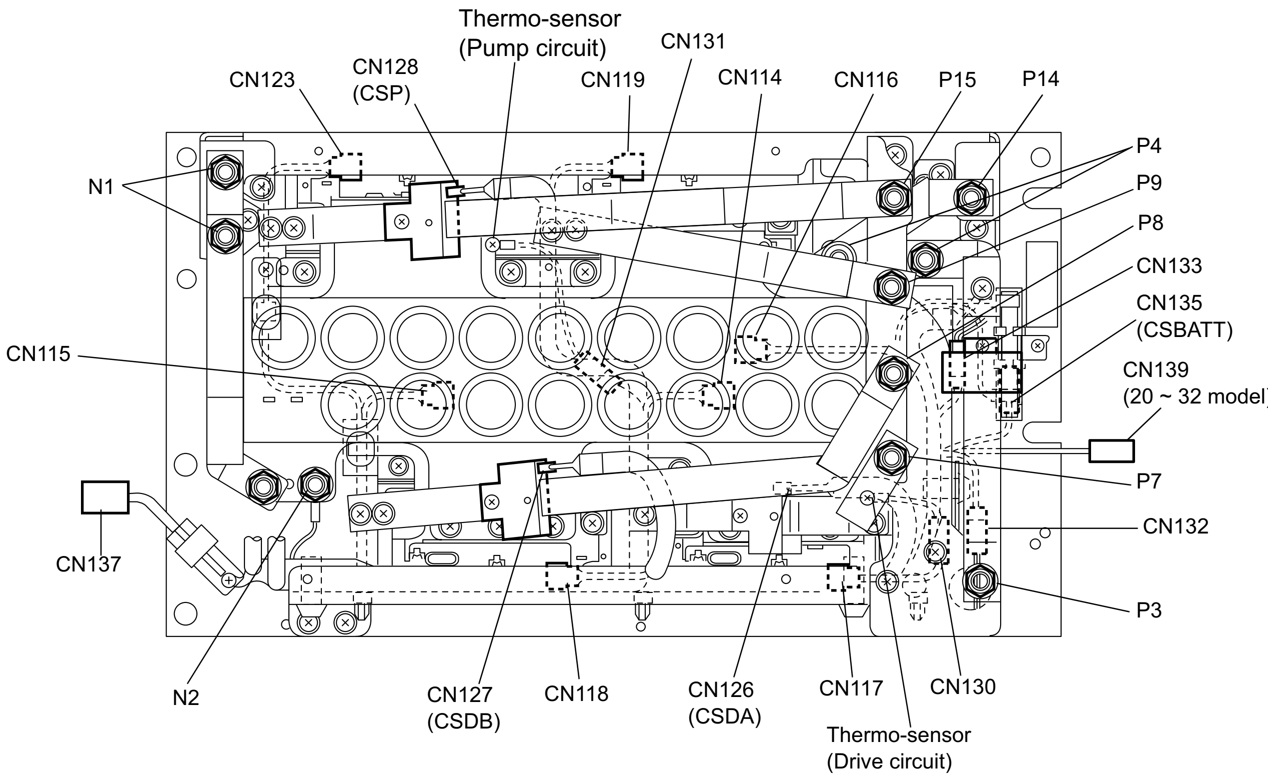
TRAVELING/MATERIAL HANDLING CONTROLLER (CHOPPER-LESS) CONNECTOR·COMPONENT

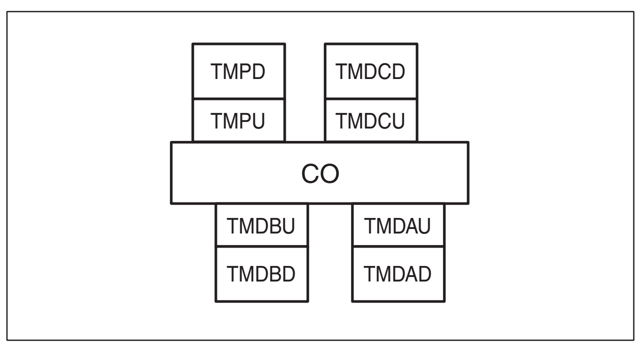


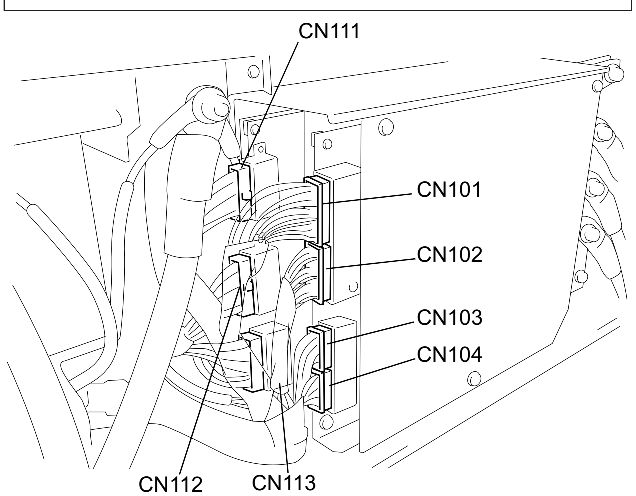




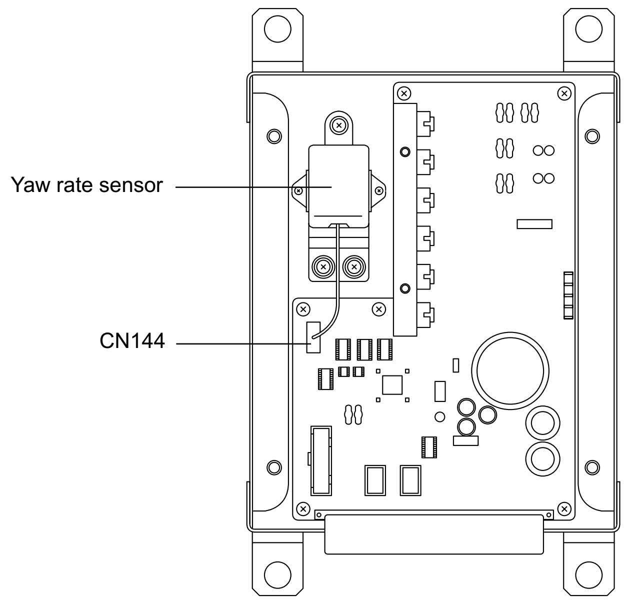
TRAVELING/MATERIAL HANDLING CONTROLLER (CHOPPER) CONNECTOR·COMPONENT

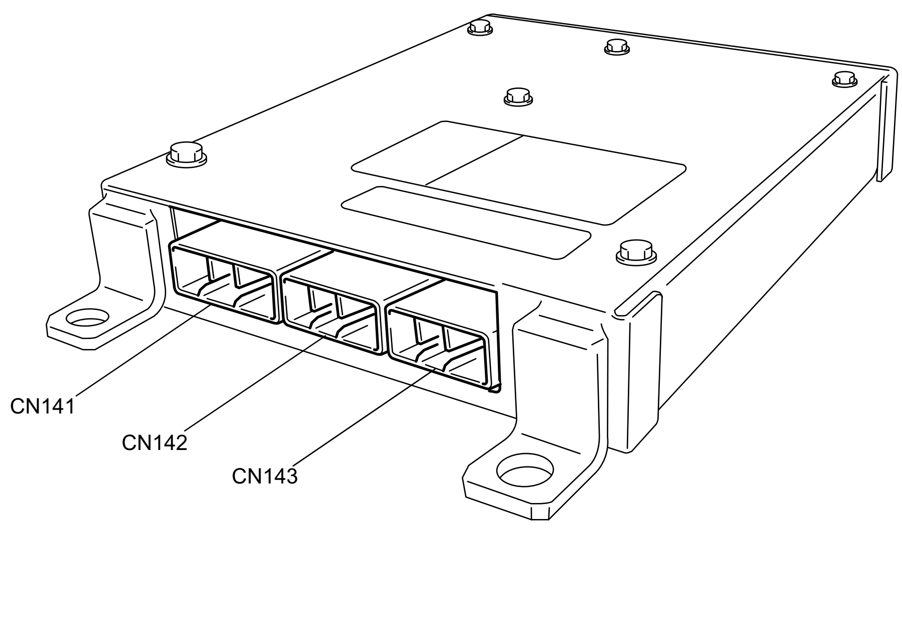




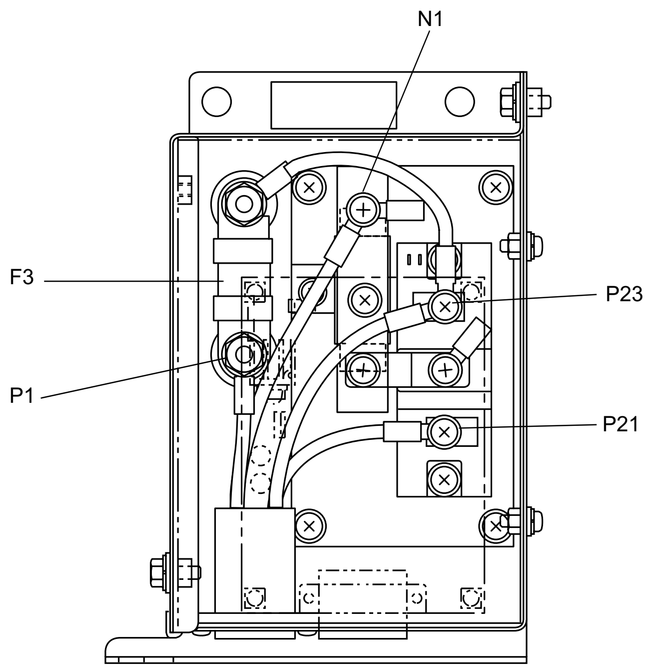


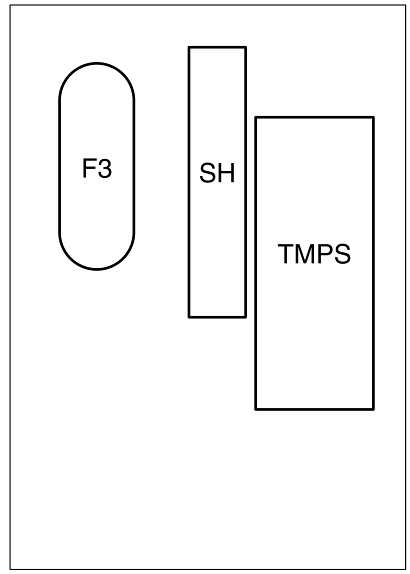
SAS CONTROLLER CONNECTOR·COMPONENT

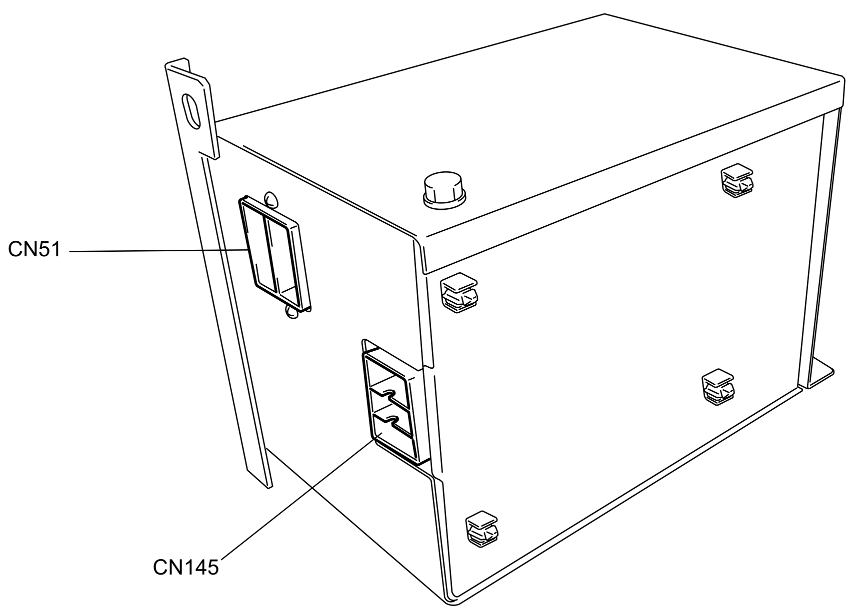




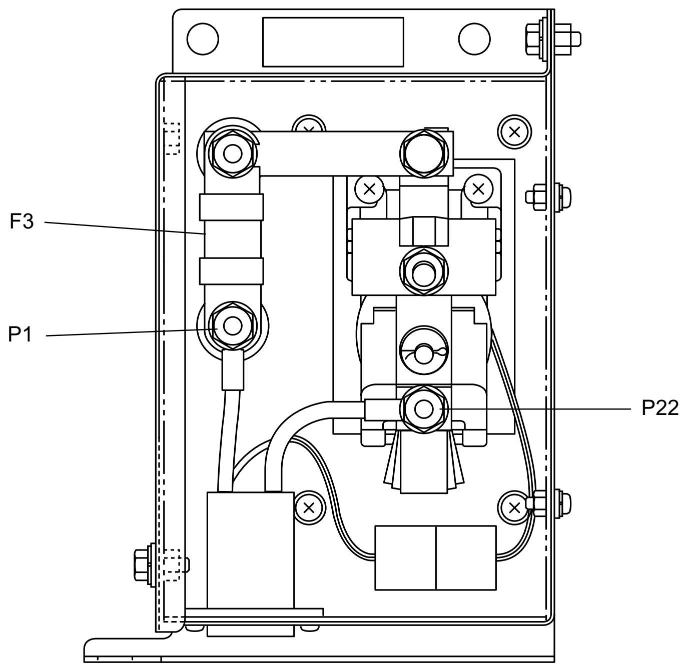
EHPS CONTROLLER CONNECTOR·COMPONENT

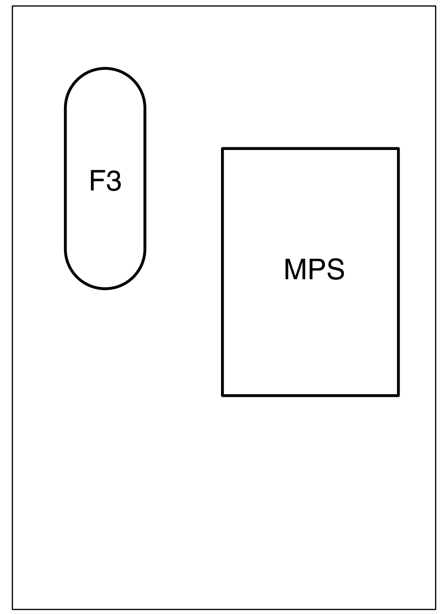


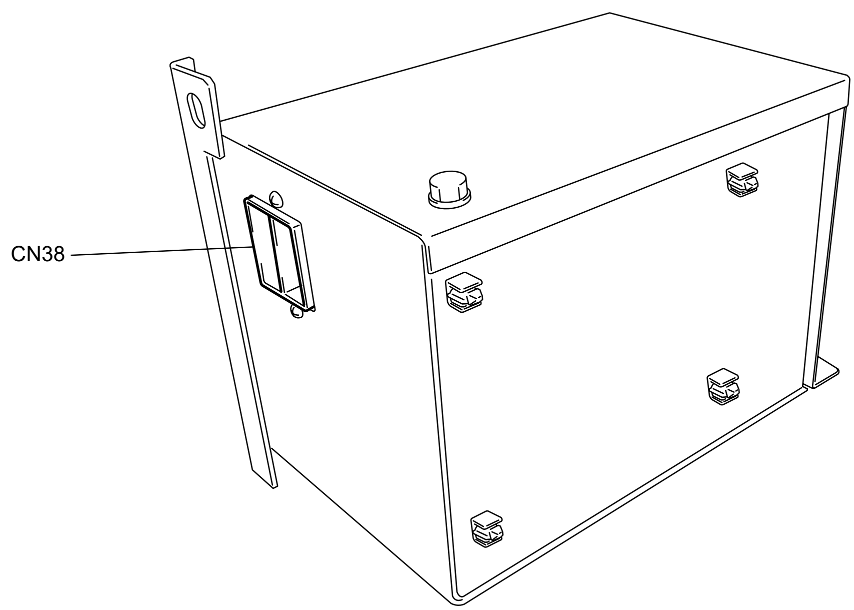




EHPS CONTROLLER CONNECTOR·COMPONENT

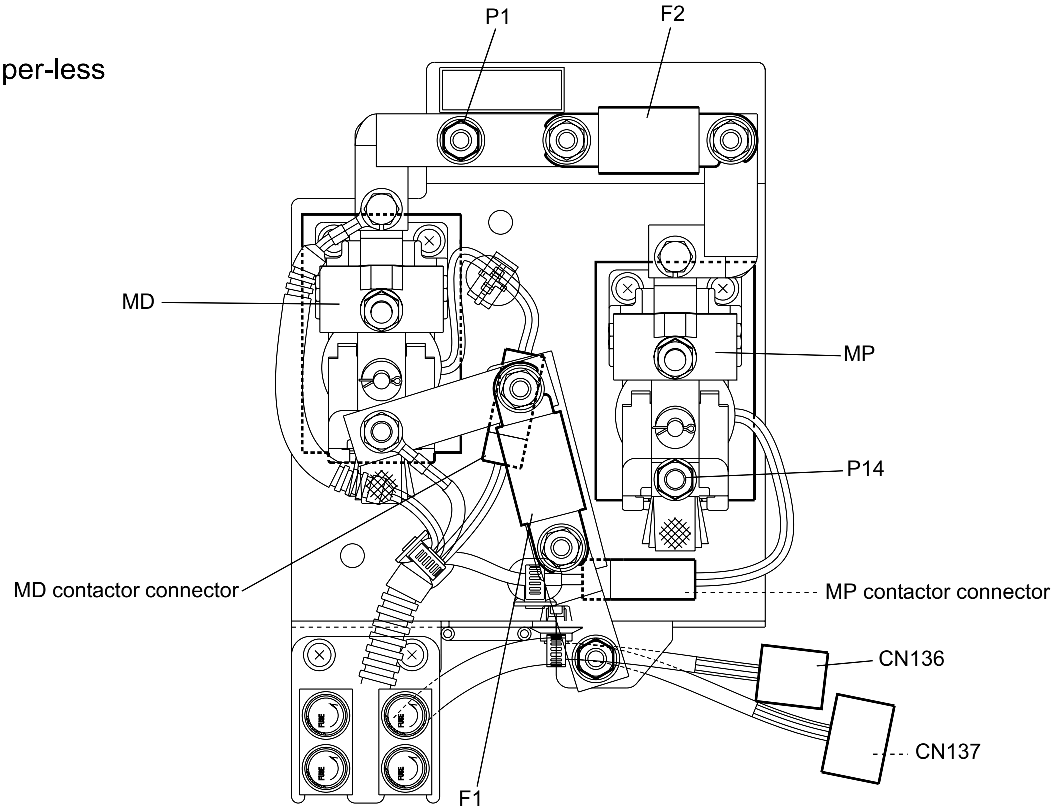




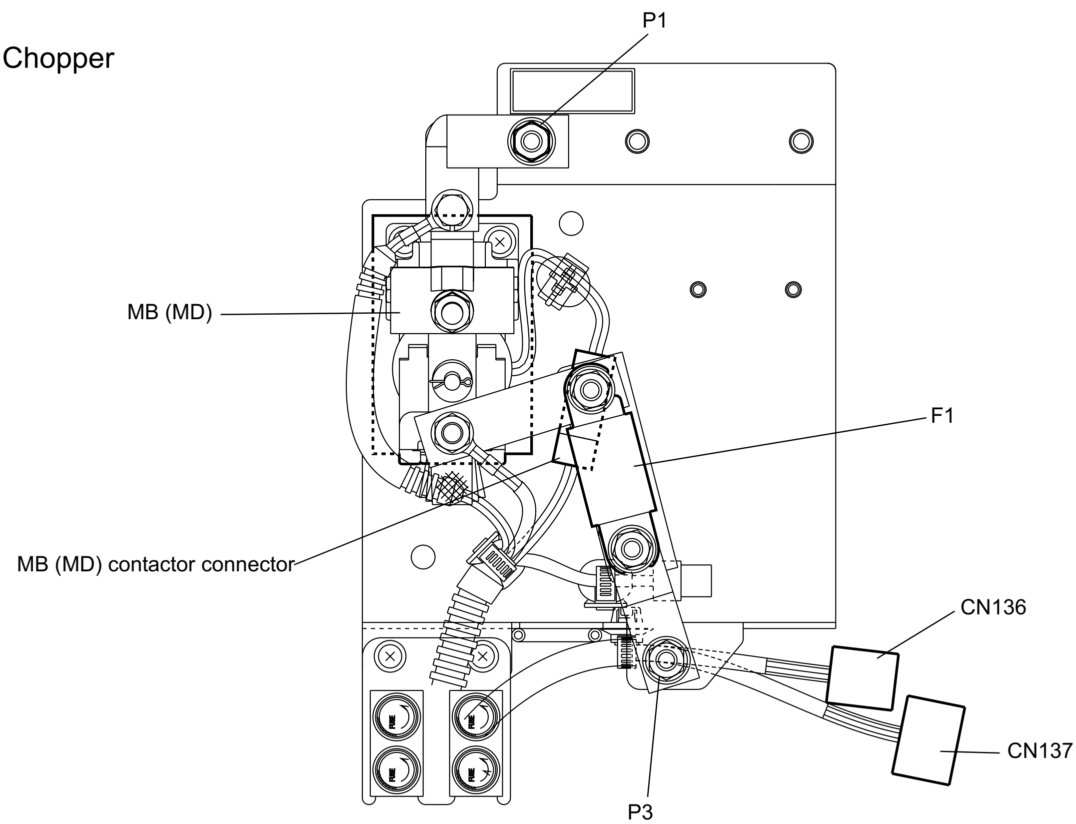


CONTACTOR PANEL CONNECTOR·COMPONENT

Chopper-less

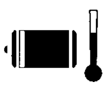


Chopper



TROUBLESHOOTING (15 ~ 32 MODEL)

COMPOSITION LIST

WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED			Page
Displayed code	**Diag memory code**	**Defect mode**	
51-1	51-1	Traveling speed sensor abnormality	4-80
52-1, 2, 3	52-1, 2, 3	Yaw rate sensor abnormality	4-81
54-1, 2	54-1, 2	Swing solenoid abnormality	4-82
61-1, 2	61-1, 2	Load sensor abnormality	4-83
62-1, 2	62-1, 2	Tilt angle sensor abnormality	4-85
63-1, 2, 3	63-1, 2, 3	Tilt switch abnormality	4-87
64-1, 2	64-1, 2	Lift solenoid abnormality	4-88
65-1, 2	65-1, 2	Tilt solenoid abnormality	4-89
66-1	66-1	Tilt matching value abnormality	4-90
67-1	67-1	Lifting height switch abnormality	4-91
 C/R	A0-1, 2	Main drive circuit overheat·main pump circuit overheat	4-27
A0-4	A0-4	Fan abnormality	4-28
A1	A1	Controller high voltage	4-29
 C/R	A2	CPU board overheat	4-30
A3	A3	Incorrect charging plug connection	4-31
A4	A4	Acceleration switch abnormality	4-32
A6-1, 2, 3, 5	A6-1, 2, 3, 5	Material handling switch abnormality	4-33
A8	A8	F1 fuse open	4-35
AA	AA	CPU board thermo-sensor abnormality	4-36
AF-1, 2, 3, 4	AF-1, 2, 3, 4	CPU board abnormality	4-36
AF-5, 6, 7, 8	AF-5, 6, 7, 8	ST board CPU abnormality	4-92
C0-1	C0-1	Main drive circuit abnormality	4-37
C0-3	C0-3	Traveling drive power supply abnormality	4-39
C0-4	C0-4	Traveling drive circuit abnormality	4-40
C1	C1	Drive current sensor abnormality	4-41

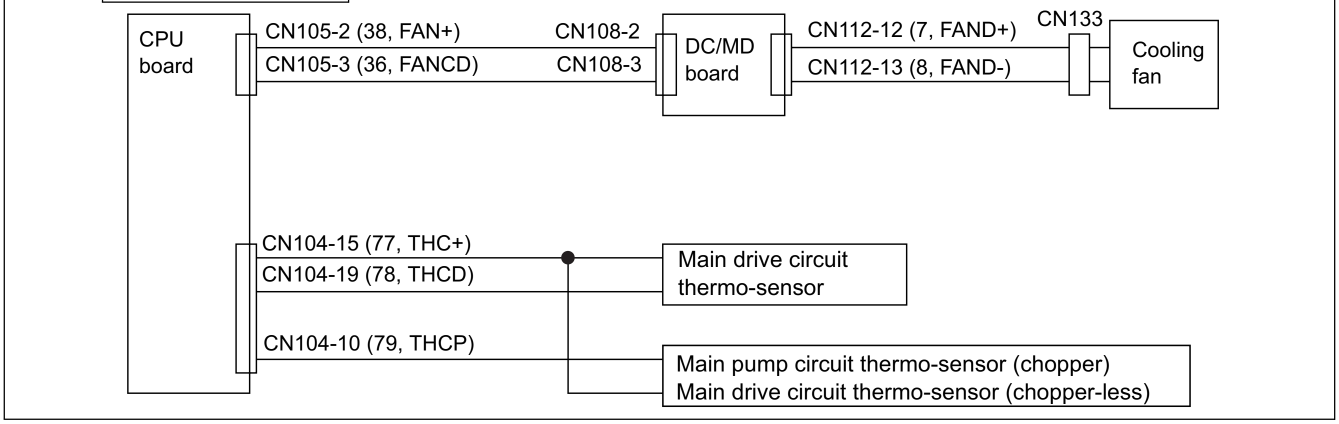
Displayed code	Diag memory code	Defect mode	Page
 DM	C2-1	Drive motor overheat	4-42
C2-2	C2-2	Drive motor thermo-sensor abnormality	4-43
C3-1	C3-1	Main drive circuit1 thermo-sensor abnormality	4-44
C3-2	C3-2	Main drive circuit2 thermo-sensor abnormality	4-45
C4-1, 2, 3, 4	C4-1, 2, 3, 4	Accelerator potentiometer abnormality	4-46
C7	C7	Direction switch abnormality	4-48
C8-1, 2	C8-1, 2	Drive motor speed sensor abnormality (open)	4-49
C8-3, 4	C8-3, 4	Drive motor speed sensor abnormality (short)	4-50
CB-1	CB-1	Battery contactor (MB) open	4-51
CB-2	CB-2	Battery contactor (MB) fusion	4-53
E0-1	E0-1	Pump main circuit abnormality	4-54
E0-3	E0-3	Material handling drive power supply abnormality	4-55
E0-4	E0-4	Material handling drive circuit abnormality	4-56
E1	E1	Pump current sensor abnormality	4-57
 PM	E2-1	Pump motor overheat	4-58
E2-2	E2-2	Pump motor thermo-sensor abnormality	4-59
E3	E3	Pump main circuit thermo-sensor abnormality	4-60
E6	E6	Lift switch abnormality	4-61
PM BRSH	-	Pump motor brush wear	4-62
PS BRSH	-	PS motor brush wear	4-69
EE-1, 2, 3	EE-1, 2, 3	Abnormal communication from display	4-75
EF-1, 2, 4	EF-1, 2, 4	EEP-ROM abnormality	4-63
EF-3	EF-3	CPU abnormality	4-63
EF-5, 6	EF-5, 6	ST board EEP-ROM abnormality	4-92
F0-1	F0-1	PS contactor abnormality (For FHPS)	4-70
F0-2	F0-2	EHPS abnormality	4-71
F0-3	F0-3	Power supply abnormality	4-72
F1-1, 2	F1-1, 2	MCS to multi-display communication system abnormality	4-76
FE-1, 2	FE-1, 2	SAS controller to traveling/material handling controller communication abnormality	4-77
FE-4, 5	FE-4, 5	Travering/material handling controller → SAS controller communication abnormality	4-78
G4-1, 2	G4-1, 2	Dead man solenoid abnormality	4-93

WHEN NO DIAGNOSIS ERROR CODE IS DISPLAYED	Page
The vehicle does not move at all (traveling, material handling and PS inoperable)	4-64
Only traveling disabled wobbling	4-66
Only material handling disabled (Chopper)	4-67
Only material handling disabled (Chopper-less)	4-68
Failure in PS operations only (FHPS)	4-73
Failure in PS operations only (EHPH)	4-74
No display on multi-display (no error displayed)	4-79
Stability not provided during traveling (-Locking hardly or not provided during traveling)	4-95
Swing lock always occurs during traveling. Or swing lock frequently occurs.	4-96
Stopping with automatic leveling fails. (Does not stop at a horizontal position but tilts at the forward-most position.)	4-97
Active fork leveling is not provided (Stops at a non-horizontal position.)	4-99
Active fork leveling is not provided (Stops at a position when active fork leveling switch is pressed.)	4-100
The active mast rear tilt speed is not regulated, or the backward tilting speed is always slow.	4-102
The mast does not perform forward/backward tilt.	4-104

TRAVELING/MATERIAL HANDLING SYSTEMS
WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED

A0-1, 2	Main drive circuit overheat·main pump circuit overheat

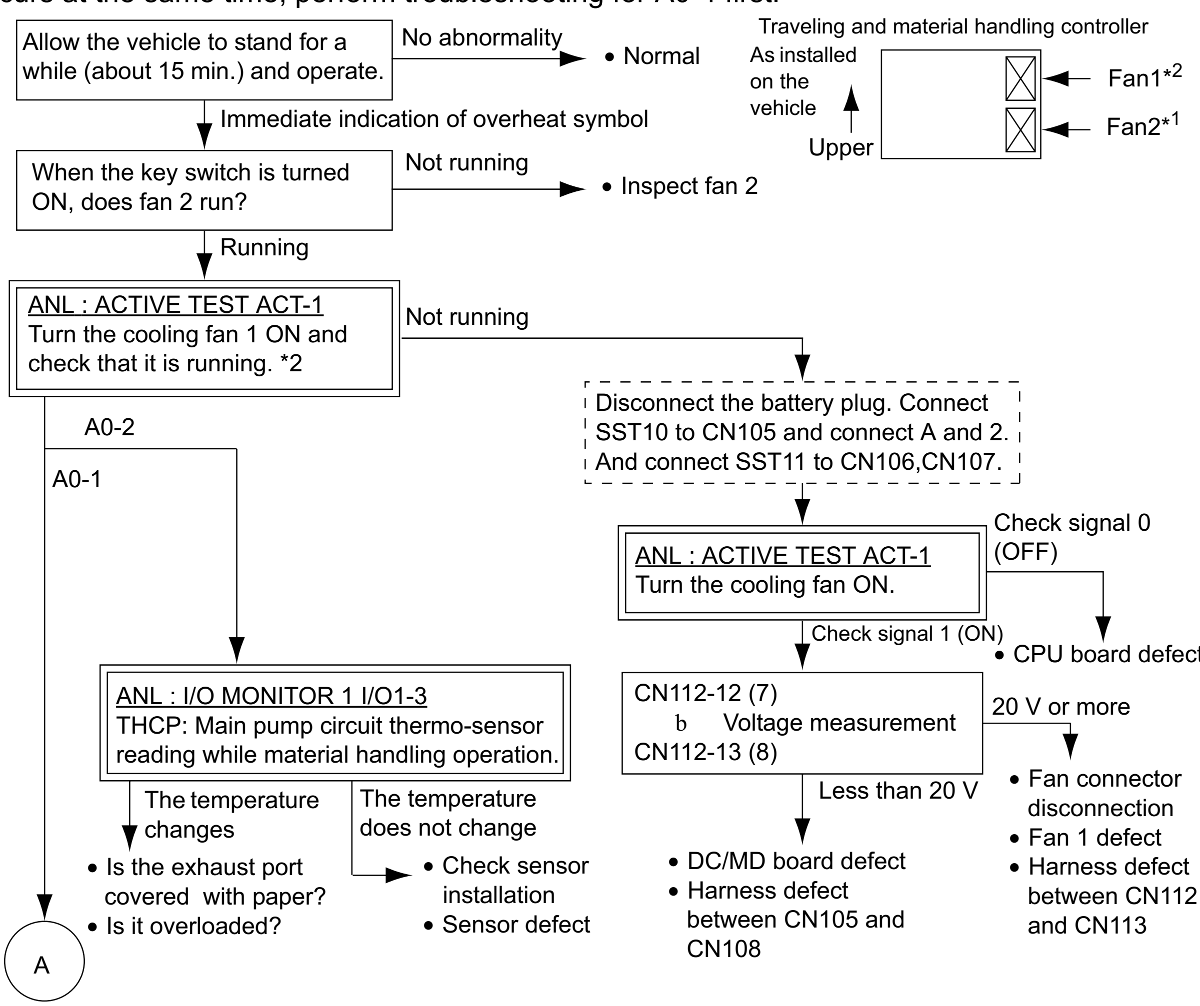
Related portion



Condition for error detection

Output when the temperature detected by the traveling/material handling controller thermo-sensor exceeds the specified level.

If A0-4 occurs at the same time, perform troubleshooting for A0-4 first.



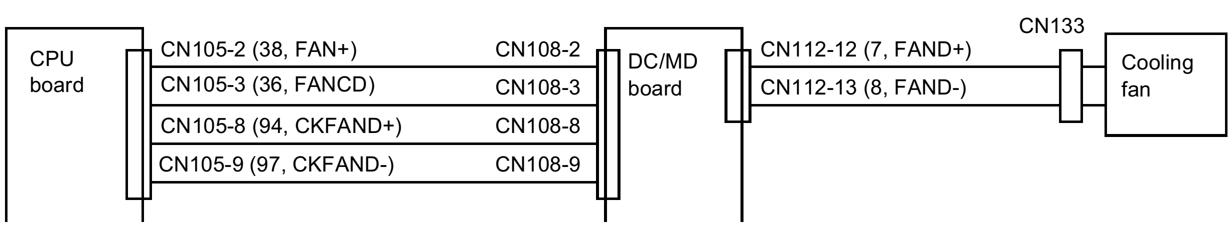
A

Is the material handling chopper equipped?

- Equipped:
  - ANL : I/O MONITOR 1 I/O1-1
    THCD: Main drive circuit thermo-sensor reading while traveling.
    - The temperature does not change → • Check sensor installation • Sensor defect
    - The temperature changes → • Is the exhaust port covered with paper? • Is it overloaded?
- Not equipped:
  - ANL : I/O MONITOR 1 I/O1-1
    ANL : I/O MONITOR 1 I/O1-2
    THCD, THCD2: Main drive circuit thermo-sensor reading while traveling.
    - The temperature changes → • Is the exhaust port covered with paper? • Is it overloaded?
    - The temperature does not change → • Check sensor installation • Sensor defect

A0-4	Fan abnormality

Related portion



Condition for error detection

Output when a low voltage or overcurrent of the cooling fan line output is detected.

If C0 occurs at the same time, perform troubleshooting for C0 first.

ANL : ACTIVE TEST ACT-1
Disconnect CN133 and turn the cooling fan ON.

- Check signal 1 (ON) → • Fan defect
- Check signal 0 (OFF) ↓

Disconnect the battery plug. Connect SST10 to CN105 and connect A and 2. And connect SST11 to CN106, CN107.

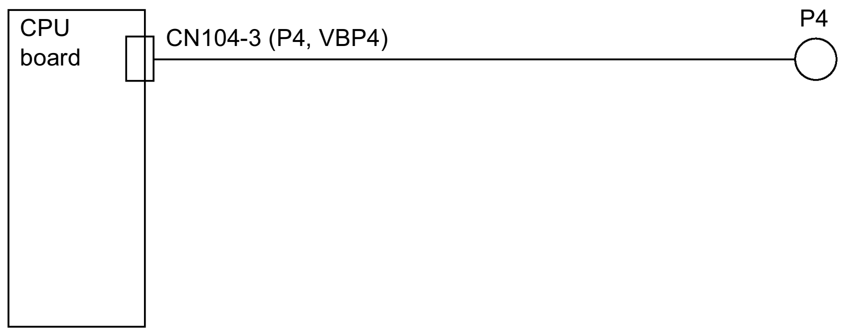
↓

ANL : ACTIVE TEST ACT-1
Turn the cooling fan ON with CN133 disconnected.

- Check signal 1 (ON) → • DC/MD board defect • Harness open circuit between CN105 and CN108
- Check signal 0 (OFF) → • CPU board defect

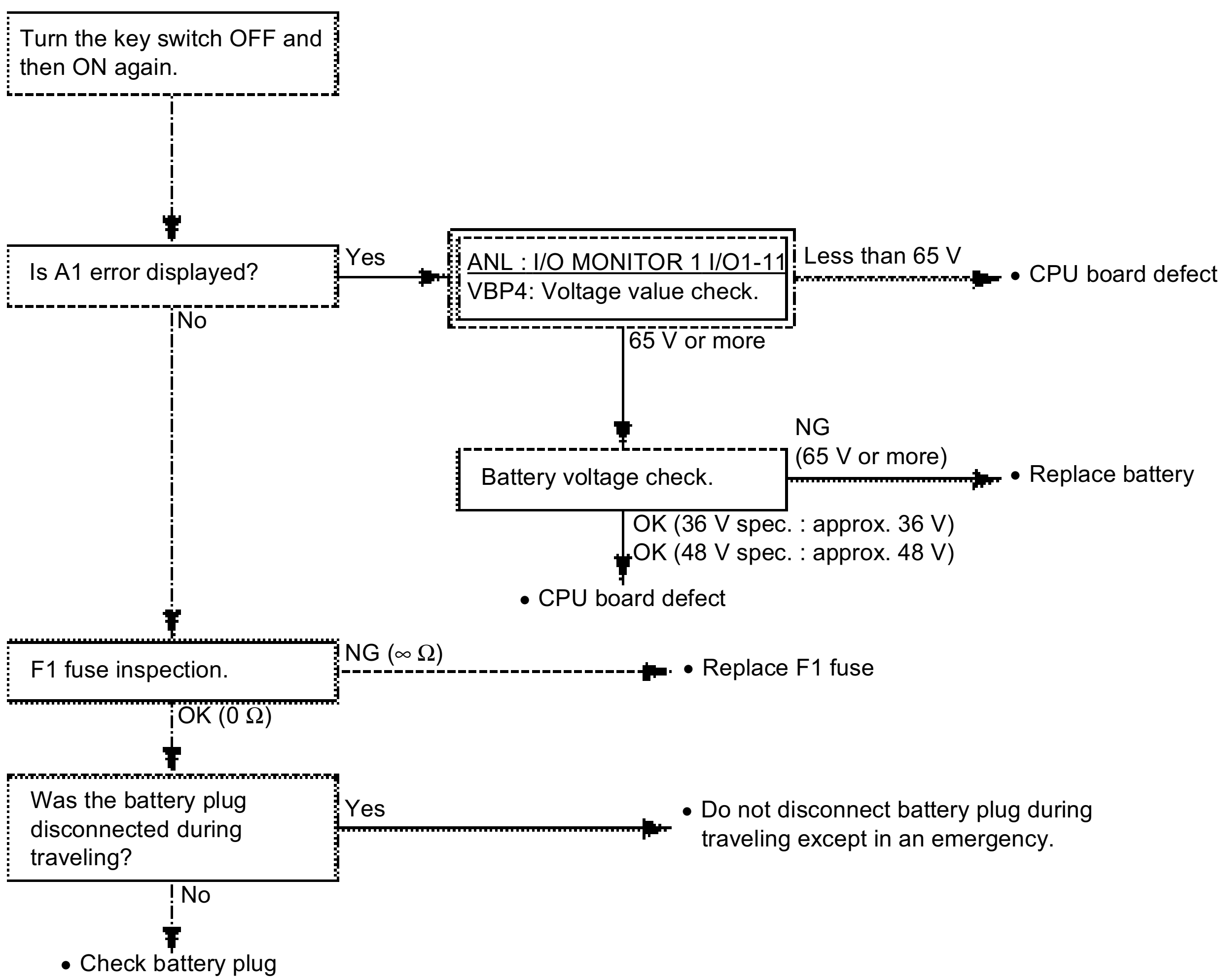
A1	Controller high voltage

Related portion



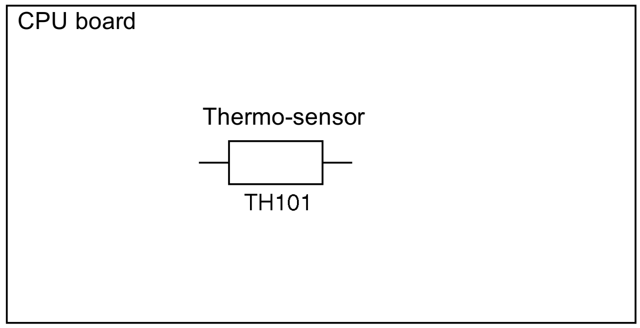
Condition for error detection

Output when P4 line overvoltage is detected.



A2	CPU board overheat

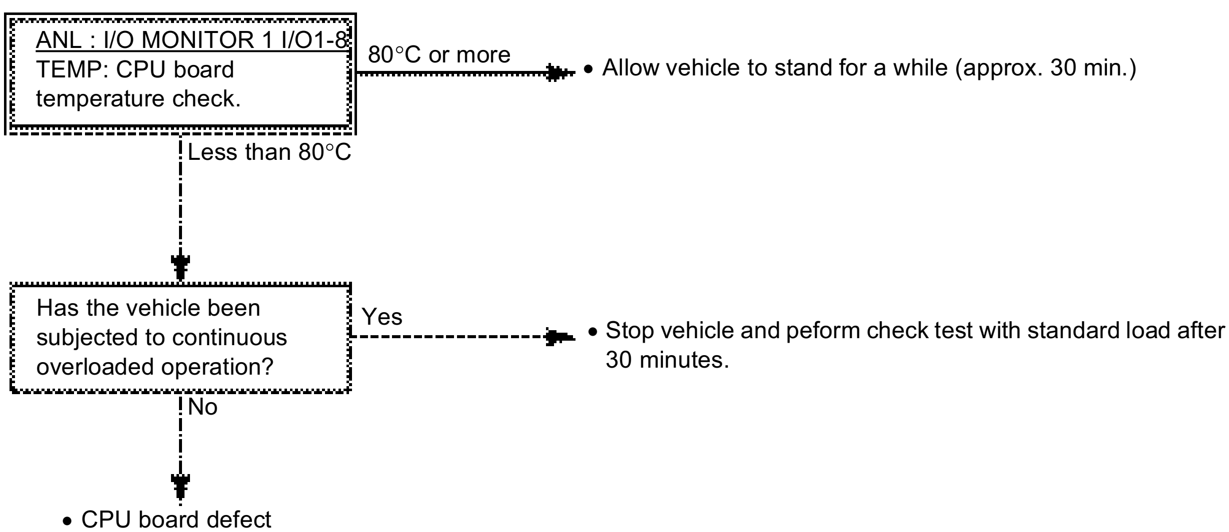
Related portion



Condition for error detection

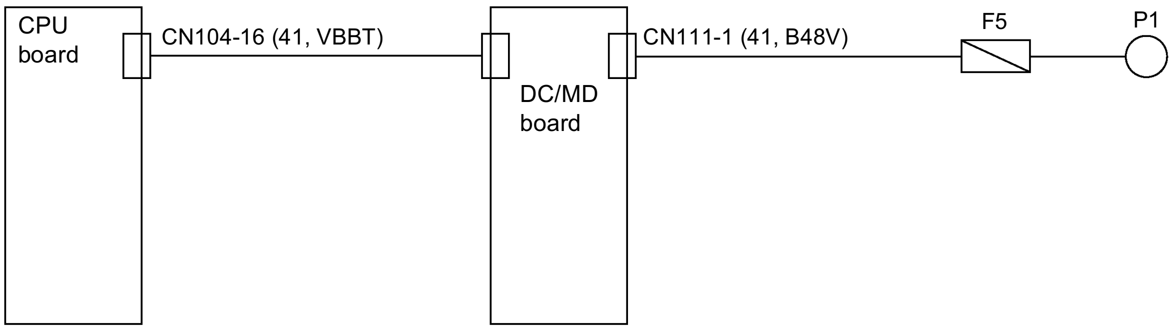
Output when the voltage detected by the thermo-sensor on the CPU board exceeds the specified level.

If A0 occurs at the same time, perform troubleshooting for A0 first.



A3	Incorrect charging plug connection

Related portion



Condition for error detection

Output when the voltage of the VBBT line after F5 fuse exceeds the specified level.

Is A3 error being displayed?
- No → • Do not connect charger plug to the controller side plug.
- Yes ↓

OPT-13 36 V
Check the battery voltage (36 V or 48 V) setting by option setting
- Setting is incorrect → • Correct the setting
- Setting is correct ↓

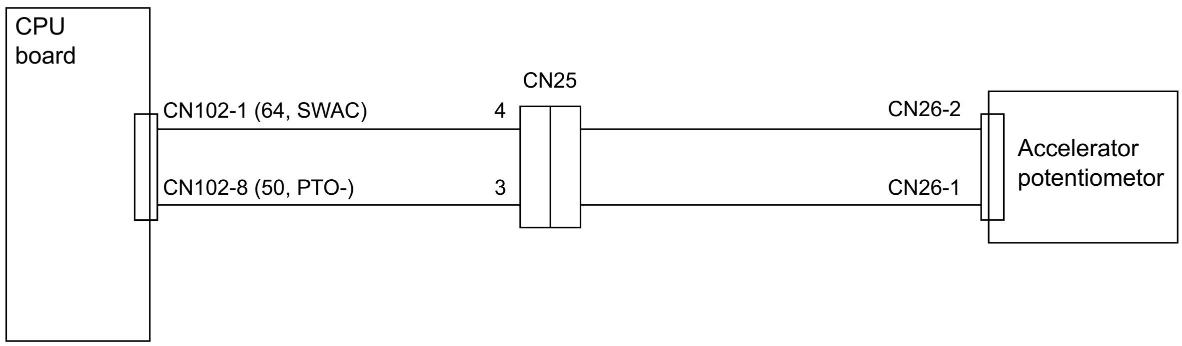
ANL : I/O MONITOR 1 I/O1-9
VBBT: Voltage check.
- Less than 65 V (48 V spec.) Less than 48 V (36 V spec.) → • CPU board defect
- 65 V or more (48 V spec.) 48 V or more (36 V spec.) ↓

P1
b Voltage measurement
N1
- Less than 65 V (48 V spec.) Less than 48 V (36 V spec.) → • CPU board defect
- 65 V or more (48 V spec.) 48 V or more (36 V spec.) ↓

• Inspect battery and replace it with a correct battery.

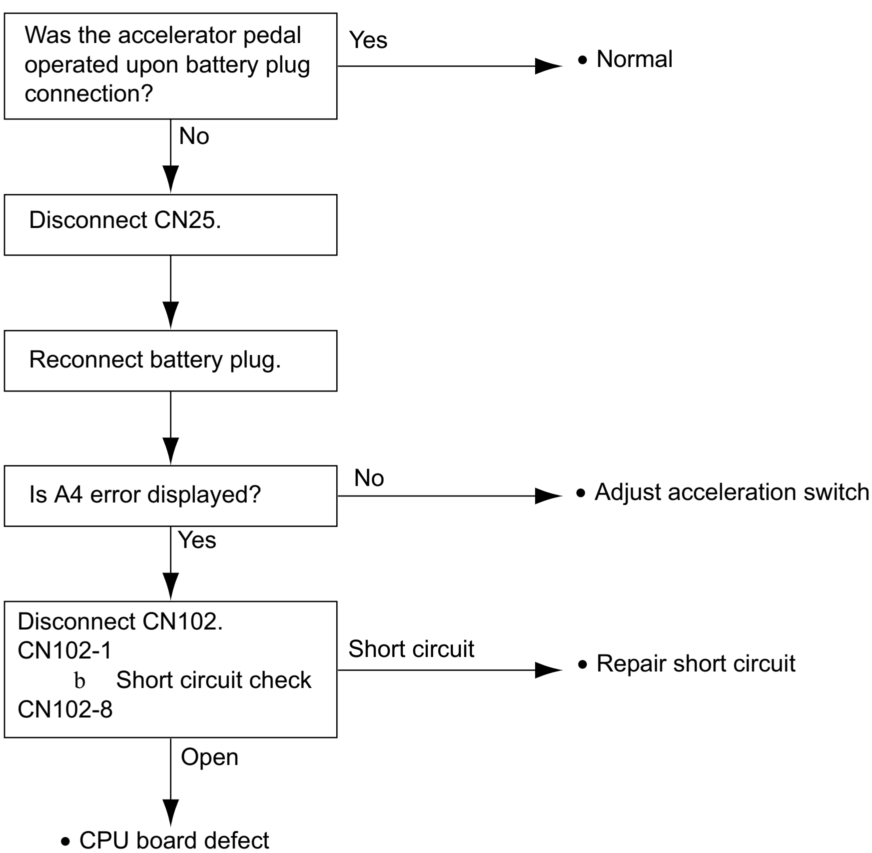
A4	Acceleration switch abnormality

Related portion



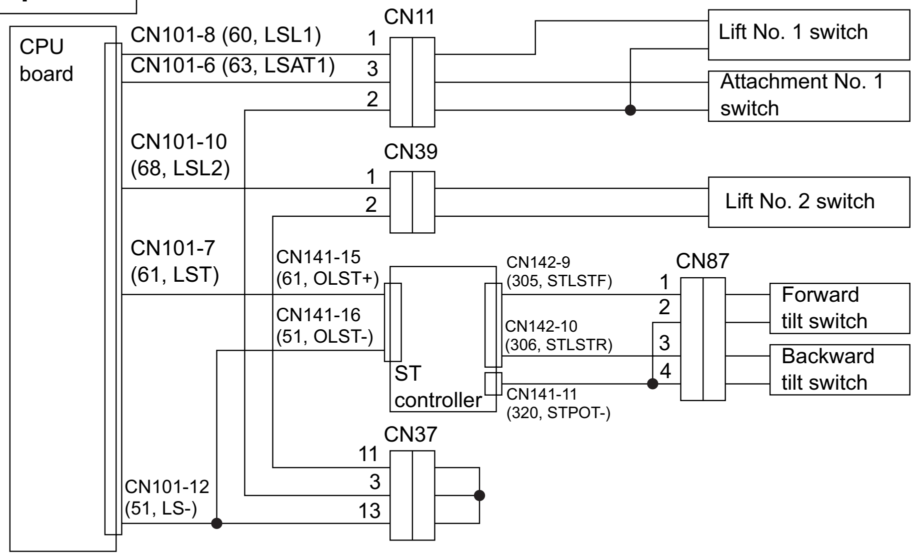
Condition for error detection

Output when the accelerator ON signal is detected upon battery plug connection.



A6-1, 2, 3, 5, 6	Material handling switch abnormality

Related portion



Condition for error detection

Output when the material handling switch ON signal is detected upon battery plug connection.

A6-1 Lift No. 1 switch defect
A6-2 Lift No. 2 switch defect
A6-3 Tilt switch defect
A6-5 Attachment No. 1 switch defect
A6-6 Attachment No. 2 switch defect

• A6-1, 2, 5

Was the material handling lever operated upon battery plug connection?
- Yes → • Normal
- No ↓

Disconnect material handling CN11 (CN39).

↓

Reconnect battery plug.

↓

Is A6 error displayed?
- No → • Adjust limit switch or switch abnormality
- Yes ↓

Disconnect CN101.
CN101-6,8,10
b Short circuit check
CN101-12
- Short circuit → • Repair short circuit
- Open circuit ↓

• CPU board defect

• A6-3

Was the tilt lever operated upon battery plug connection?

- Yes → • Normal
- No ↓

Disconnect battery plug and disconnect CN87.

↓

Reconnect battery plug.

↓

Is A6 error displayed?

- No → • Limit switch abnormality
- Yes ↓

Harness continuity check (short).
Disconnect battery plug and disconnect CN142.
CN142-9 (305) – CN142-11 (320)
CN142-10 (306) – CN142-11 (320)

- Continuity → • Main harness defect
- No continuity ↓

<u>ANL : I/O MONITOR 3 I/O3-2</u> LST
<u>ANL : I/O MONITOR 3 I/O3-3</u> LSTF, LSTR
Disconnect CN142

- LSTF or LSTR:1 → • ST board defect
- LST:1 LSTF, LSTR:0 ↓

Disconnect battery plug and disconnect CN141.
CN141-15 (354)
b Internal resistance check (harness side)
CN141-16 (355)

- 1 kΩ or more → • ST board defect
- Less than 1 kΩ ↓

Harness continuity check (short).
Disconnect CN101.
CN141-15 (354)
b
CN141-16 (355)

- Continuity → • Main harness defect
- No continuity ↓

• CPU board defect

• A6-6

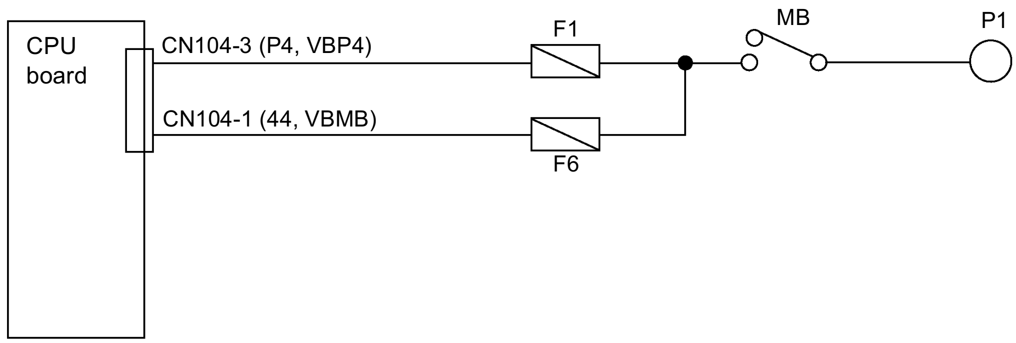
Is harness connected to CN101-11?

- Yes → • Main harness defect
- No ↓

• CPU board defect

A8	F1 fuse open

Related portion



Condition for error detection

Output when the voltage difference between the VBMB and VBP4 lines exceeds the specified level.

If CB-1 occurs at the same time, perform troubleshooting for CB-1 first.

Is A8 error being displayed?
- No → • Check F1 fuse installation.
- Yes ↓

ANL : I/O MONITOR 1
I/O1-11 (I/O1-12)
I/O1-11:VBP4, I/O1-12:VBMB (M)
Voltage check
- |I/O1-11 value – I/O1-12 value| ≤ 20 V → • CPU board defect
- | I/O1-11 value – I/O1-12 value| > 20 V ↓

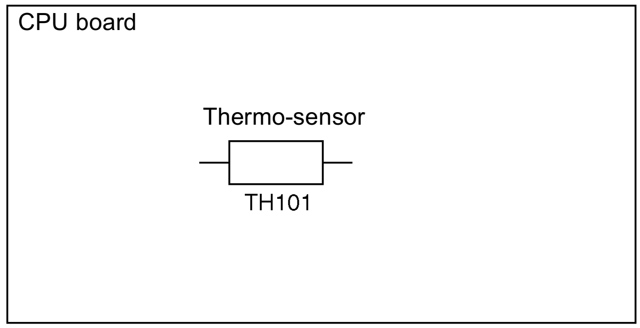
F1 fuse inspection.
- NG (∞ Ω) → • Replace F1 fuse
- OK (0 Ω) ↓

Disconnect battery plug and check.
CN104-3
b Continuity check
P4
- OK (0 Ω) → • CPU board defect
- NG (∞ Ω) ↓

• CN104-3 line harness defect

AA	CPU board thermo-sensor abnormality

Related portion



Condition for error detection

Output when CPU board thermo-sensor abnormality is detected.

- To correct, replace the CPU board.

AF1, 2, 3, 4	CPU board abnormality

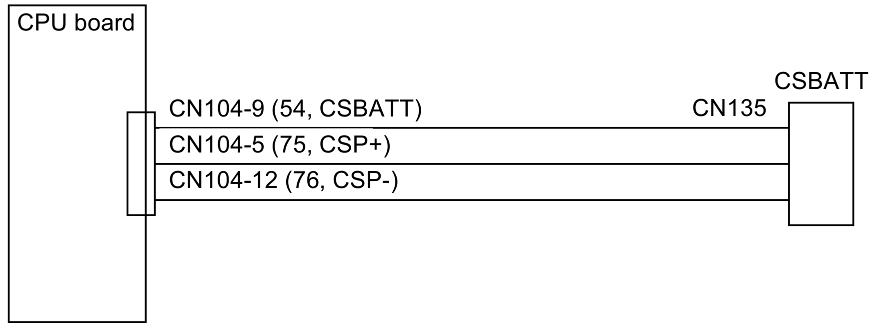
Condition for error detection

Output when CPU board CPU element abnormality is detected.

- To correct , replace the CPU board.

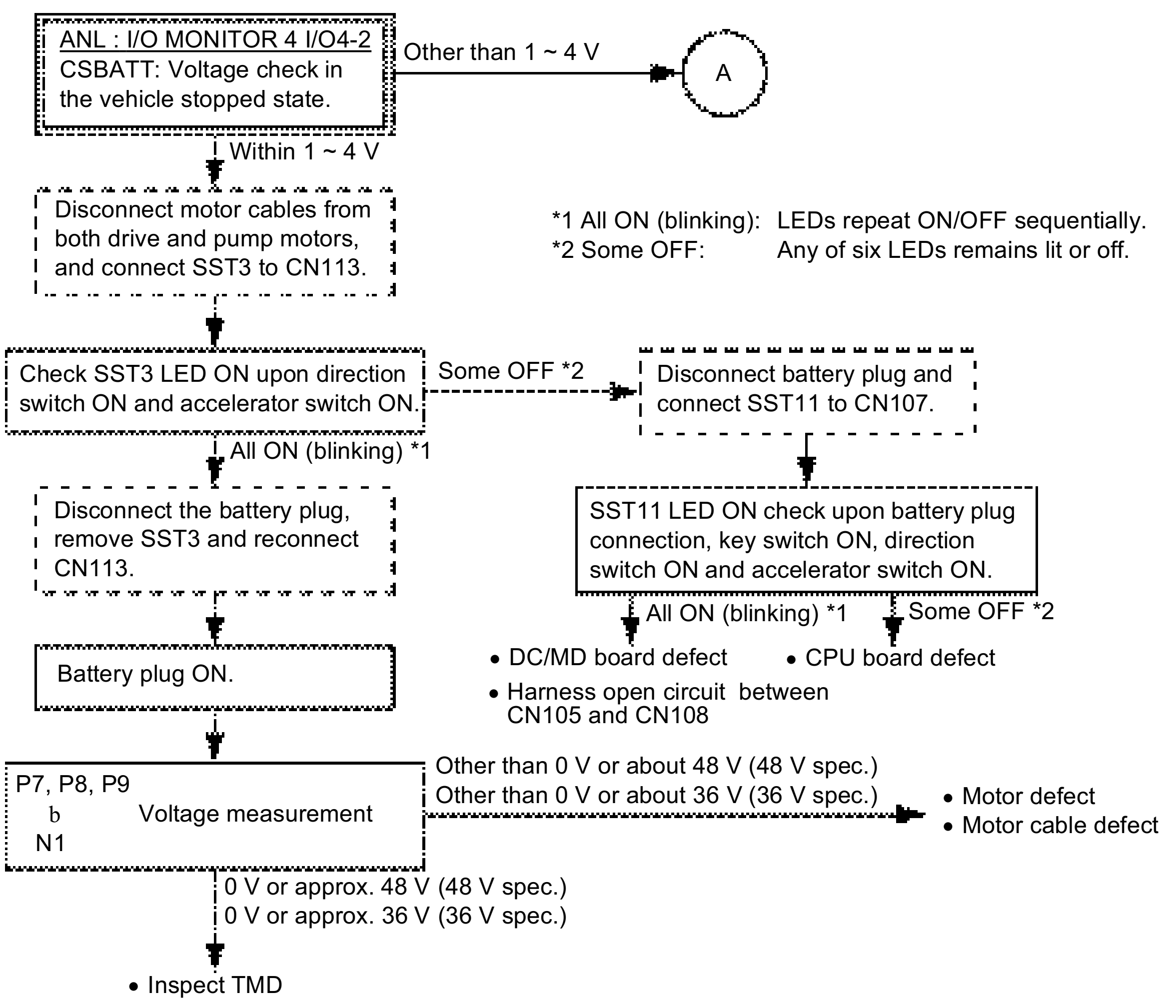
C0-1	Main drive circuit abnormality

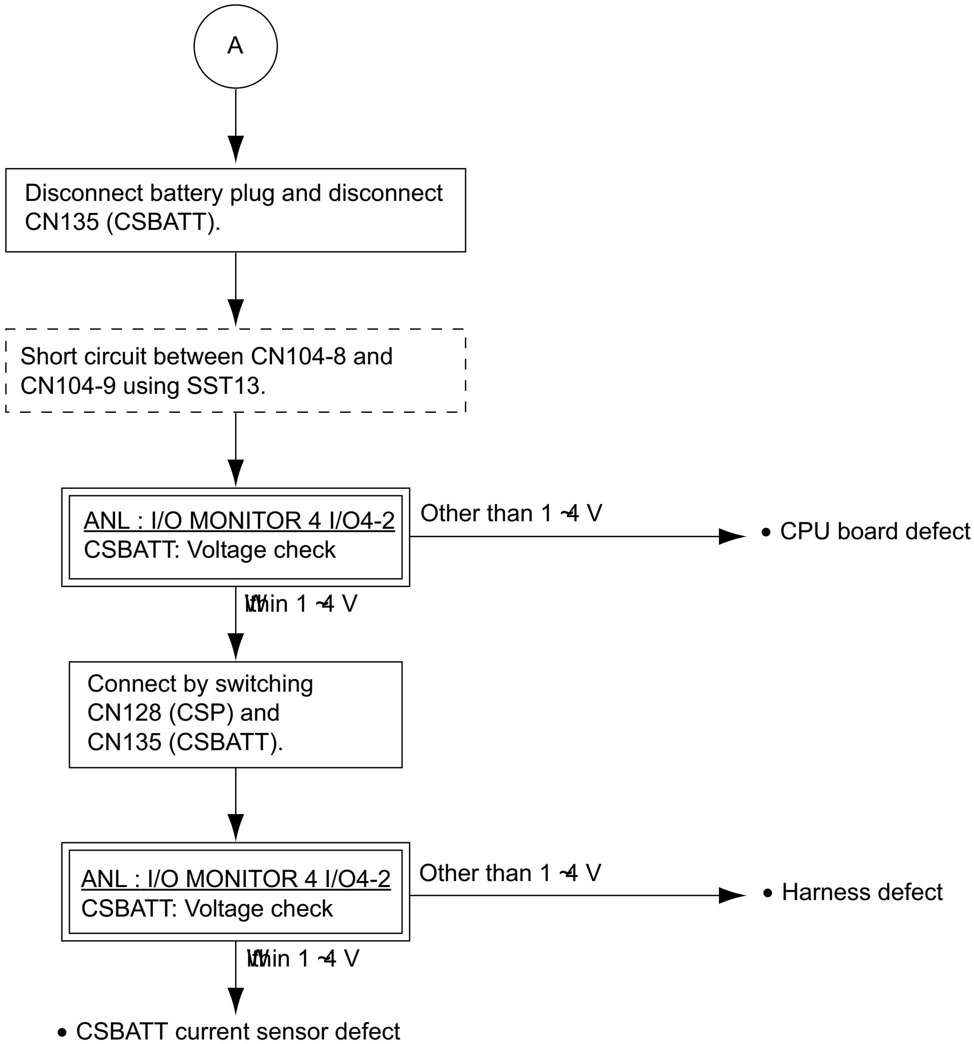
Related portion



Condition for error detection

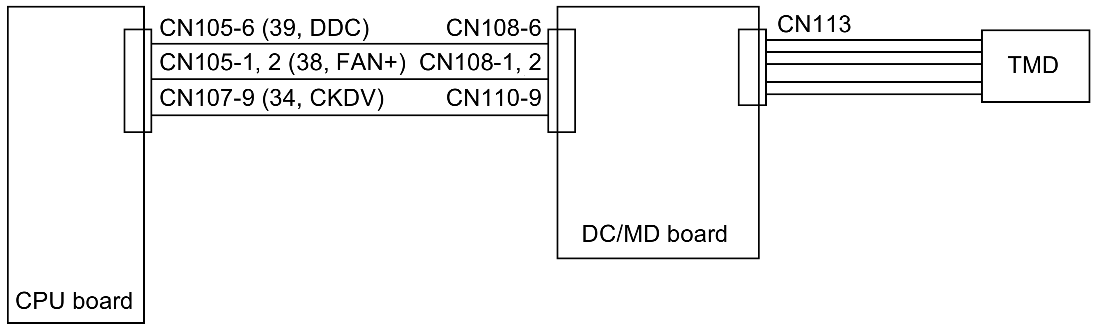
Output when the battery current sensor output exceeds the specified level.




A
Disconnect battery plug and disconnect CN135 (CSBATT).
Short circuit between CN104-8 and CN104-9 using SST13.
ANL : I/O MONITOR 4 I/O4-2
CSBATT: Voltage check
Other than 1 ~ 4 V
• CPU board defect
Within 1 ~ 4 V
Connect by switching CN128 (CSP) and CN135 (CSBATT).
ANL : I/O MONITOR 4 I/O4-2
CSBATT: Voltage check
Other than 1 ~ 4 V
• Harness defect
Within 1 ~ 4 V
• CSBATT current sensor defect

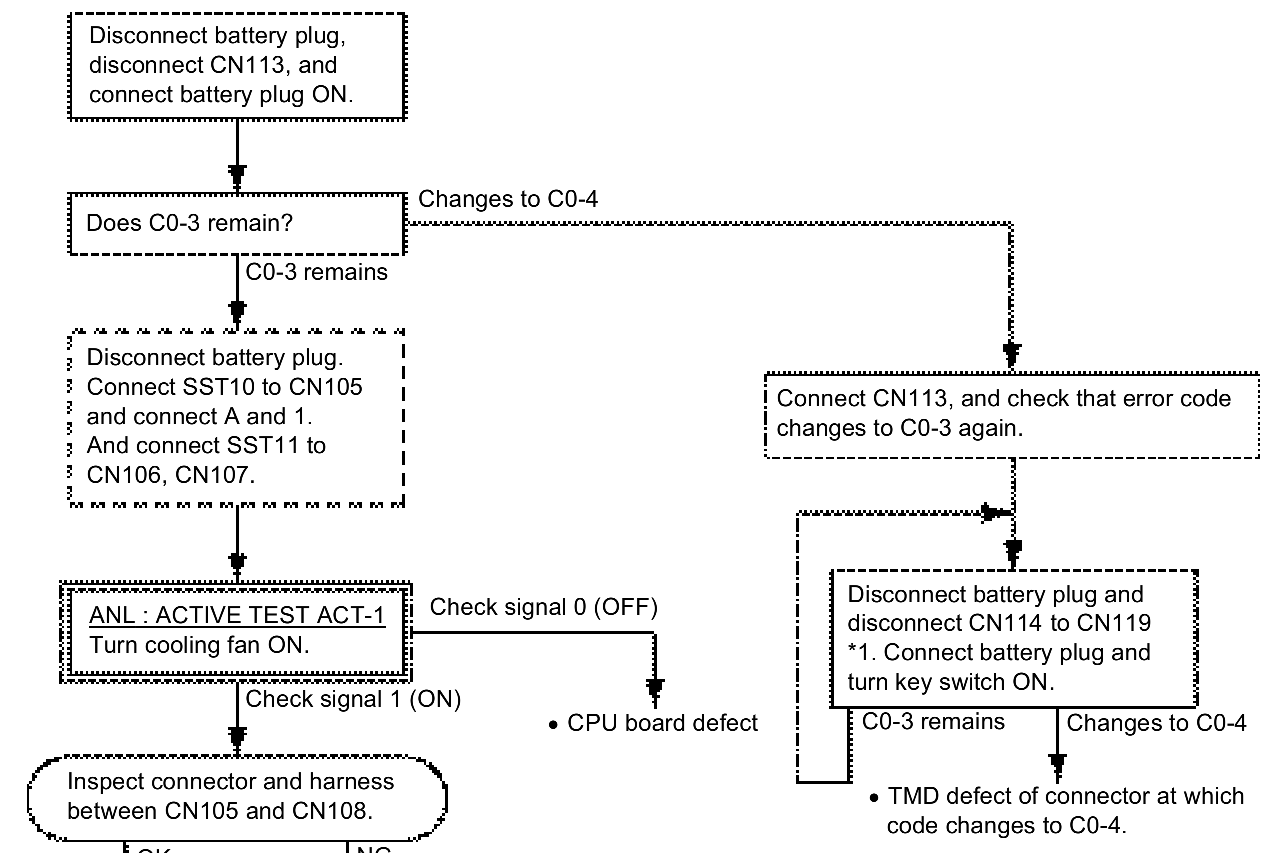
C0-3	Traveling drive power supply abnormality

Related portion



Condition for error detection

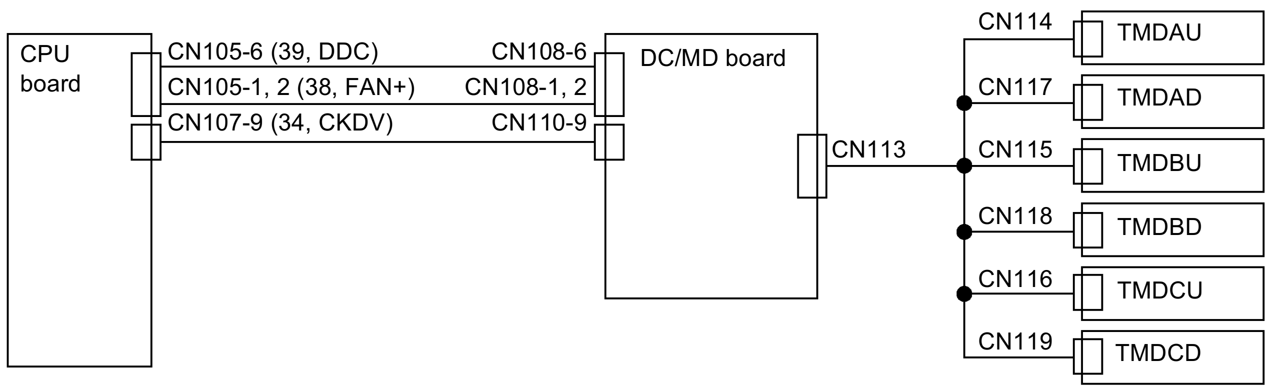
Output when low cooling fan line output voltage or low MMP power supply voltage is detected.



*1 Disconnect sequentially from CN114 to CN119, and find the connector at which the code changes to C0-4.

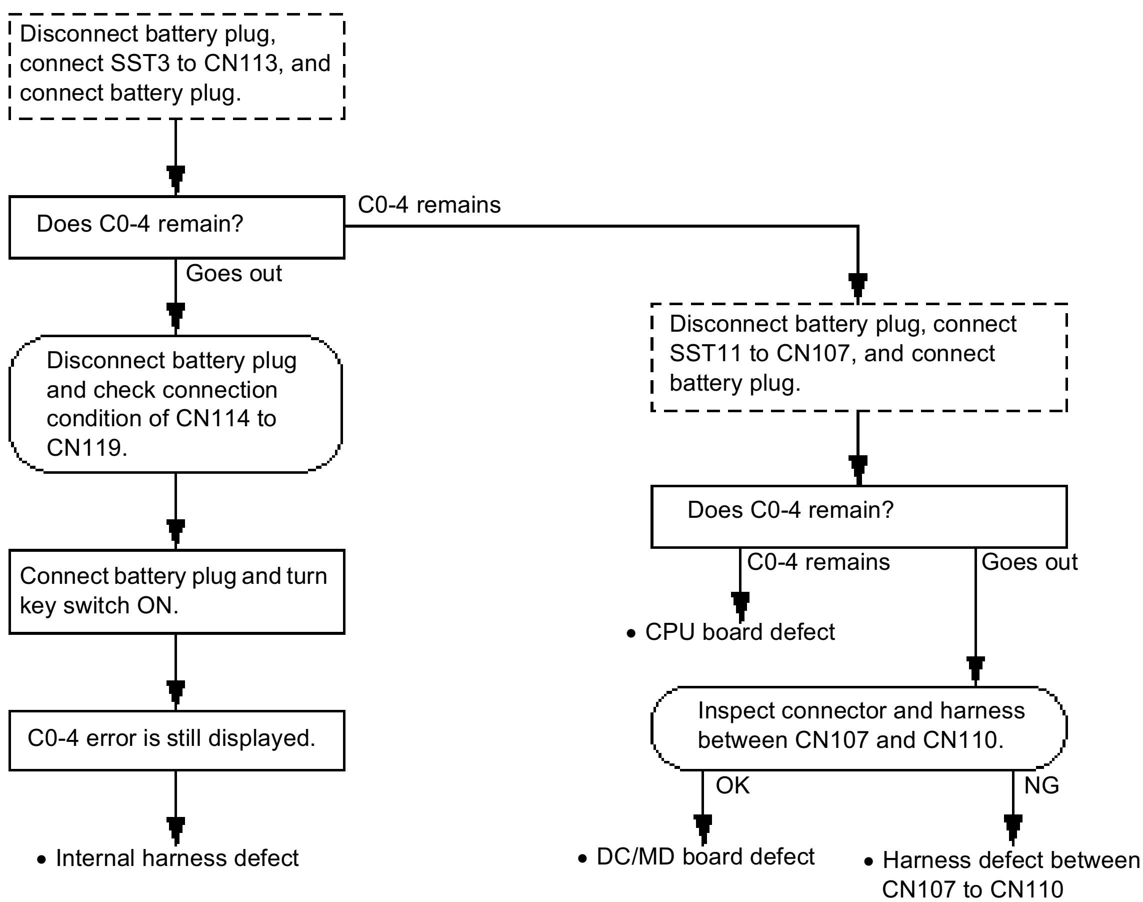
C0-4	Traveling drive circuit abnormality

Related portion



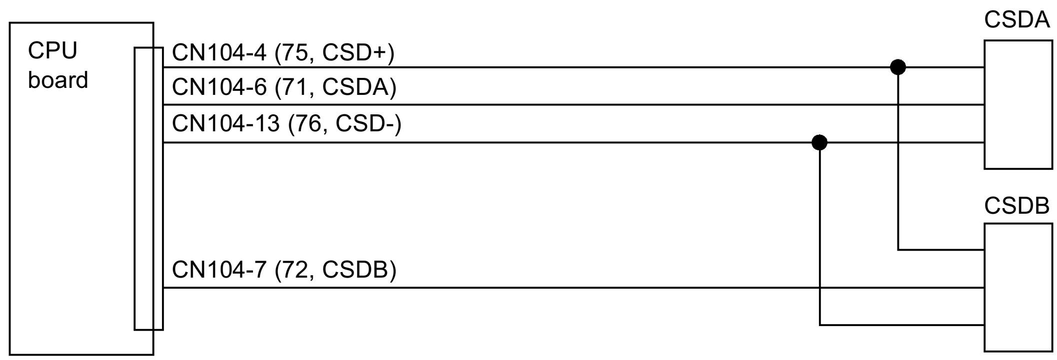
Condition for error detection

Output when line open circuit between DC/MD and MMP boards or low MMP power supply voltage is detected.



C1	Drive current sensor abnormality

Related portion



Condition for error detection

Output when the CSDA or CSDB output is outside the specified range.

Check CN126 (CSDA) and CN127 (CSDB) connection condition.
- NG → • Repair or replace
- OK ↓

Turn key switch ON.
CN104-6 (71)
b Voltage measurement
N1
- NG → Switch CN126 (CSDA) and CN127 (CSDB) and connect.
  CN104-6 (71)
  b Voltage measurement
  N1
  - NG → • Harness defect
  - OK (7 V ± 0.5 V) → • CSDA defect
- OK (7 V ± 0.5 V) ↓

Turn key switch ON.
CN104-7 (72)
b Voltage measurement
N1
- NG → Switch CN126 (CSDA) and CN127 (CSDB) and connect.
  CN104-7 (72)
  b Voltage measurement
  N1
  - NG → • Harness defect
  - OK (7 V ± 0.5 V) → • CSDB defect
- OK (7 V ± 0.5 V) → • CPU board defect

C2-1	Drive motor overheat

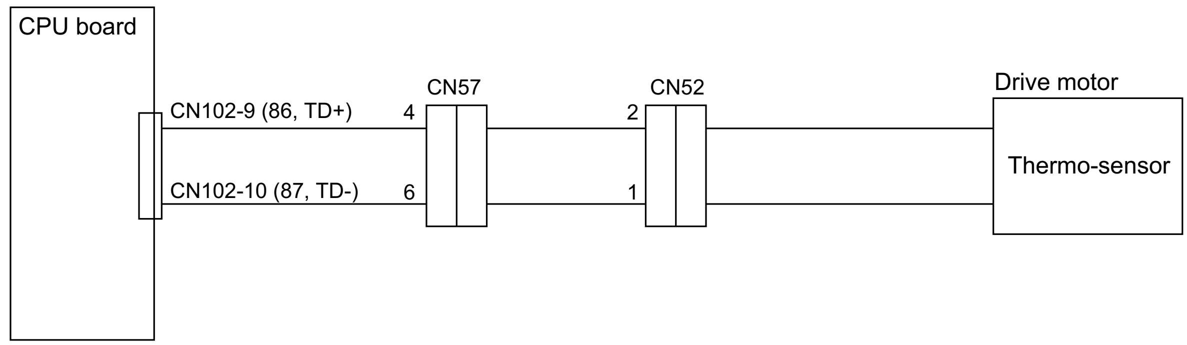
Condition for error detection

Output when the drive motor thermo-sensor output value exceeds the specified level.

- To correct, allow the vehicle to stand for a while (about 30 minutes) .

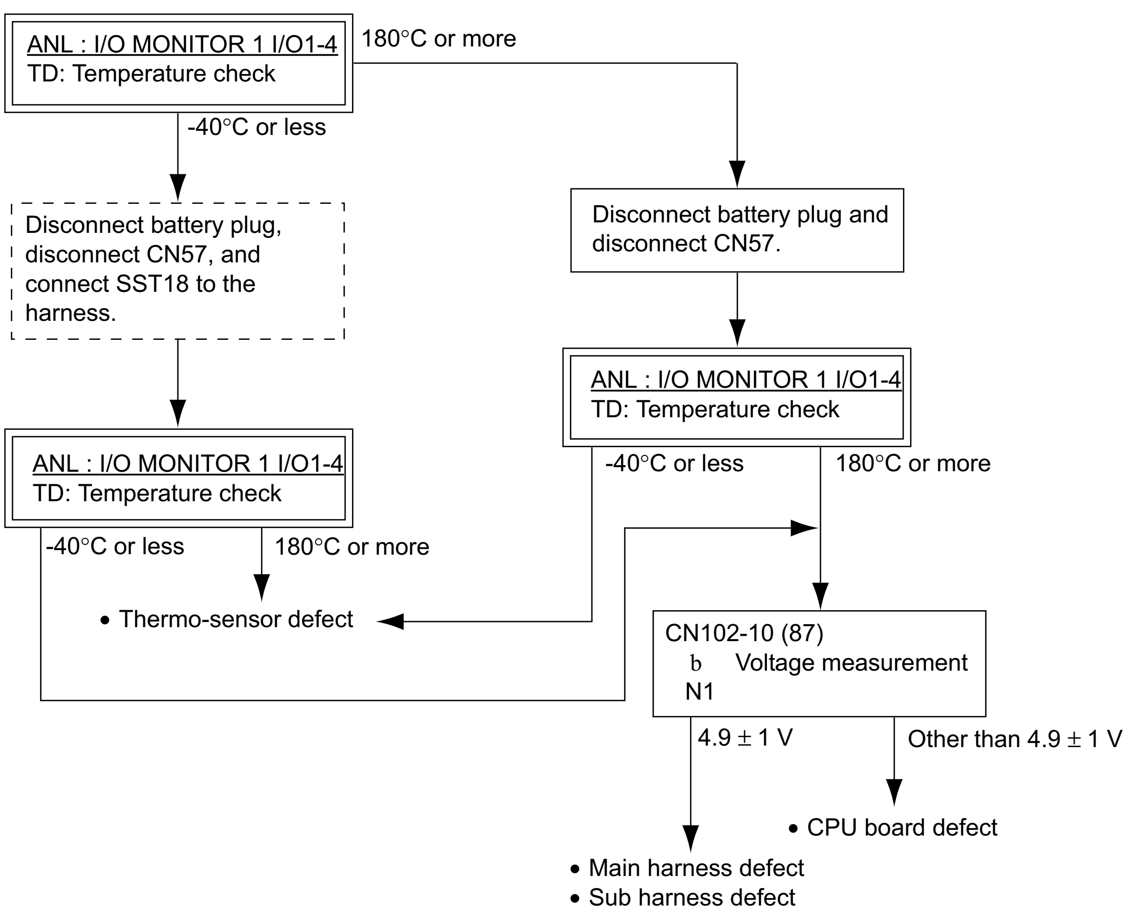
C2-2	Drive motor thermo-sensor abnormality

Related portion



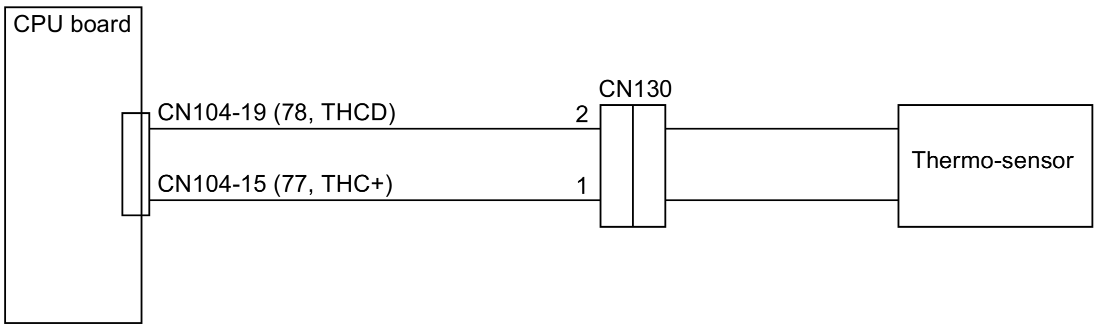
Condition for error detection

Output when motor thermo-sensor output value outside the specified range (open or short circuit) is detected.



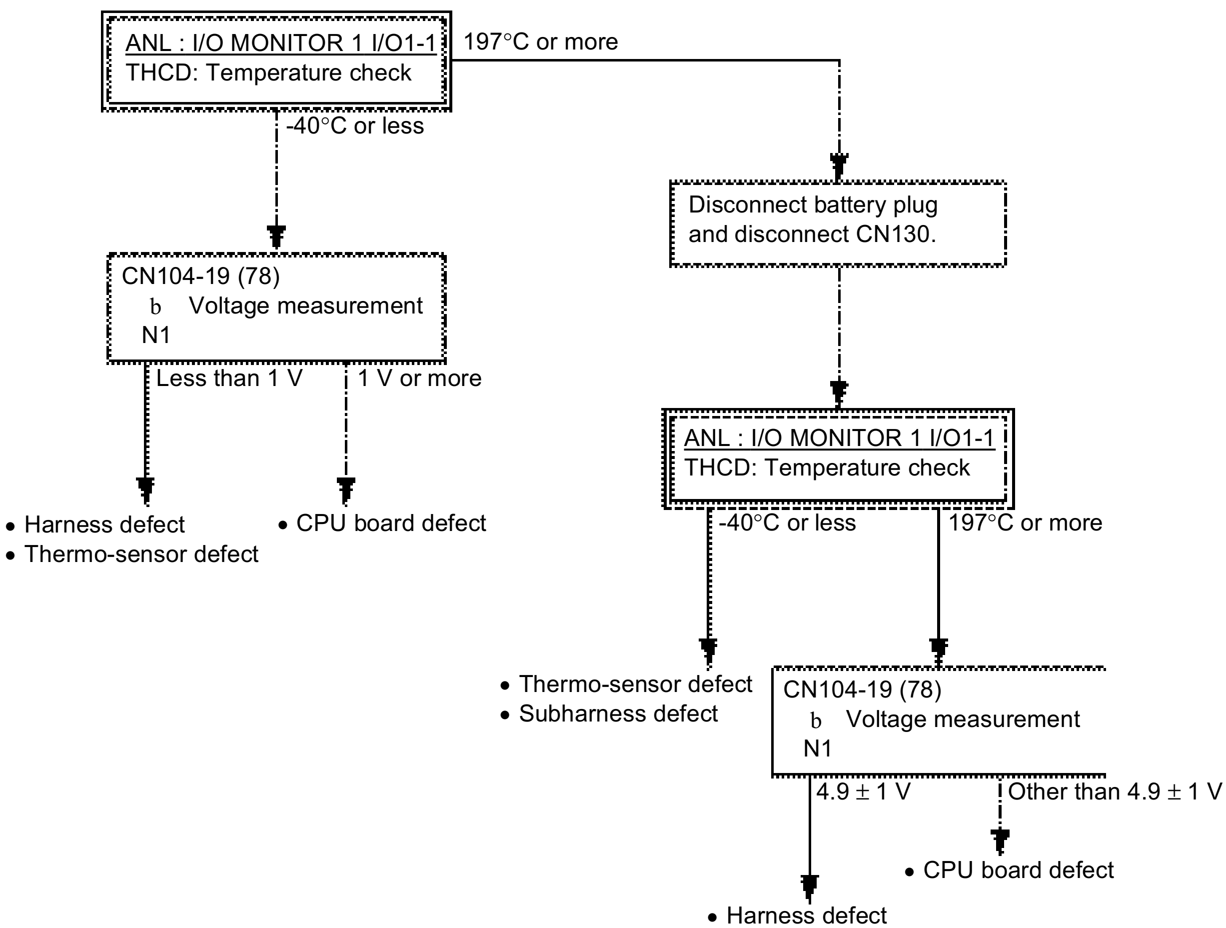
C3-1	Main drive circuit 1 thermo-sensor abnormality

Related portion



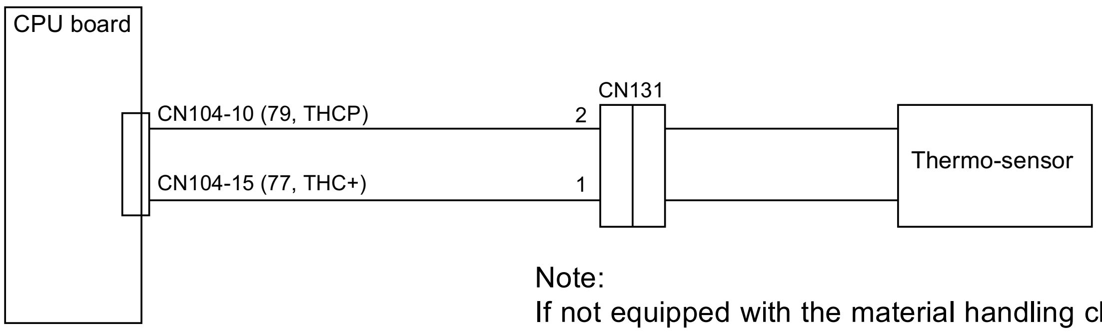
Condition for error detection

Output when controller thermo-sensor output value outside the specified range (open or short circuit) is detected.



C3-2	Main drive circuit 2 thermo-sensor abnormality

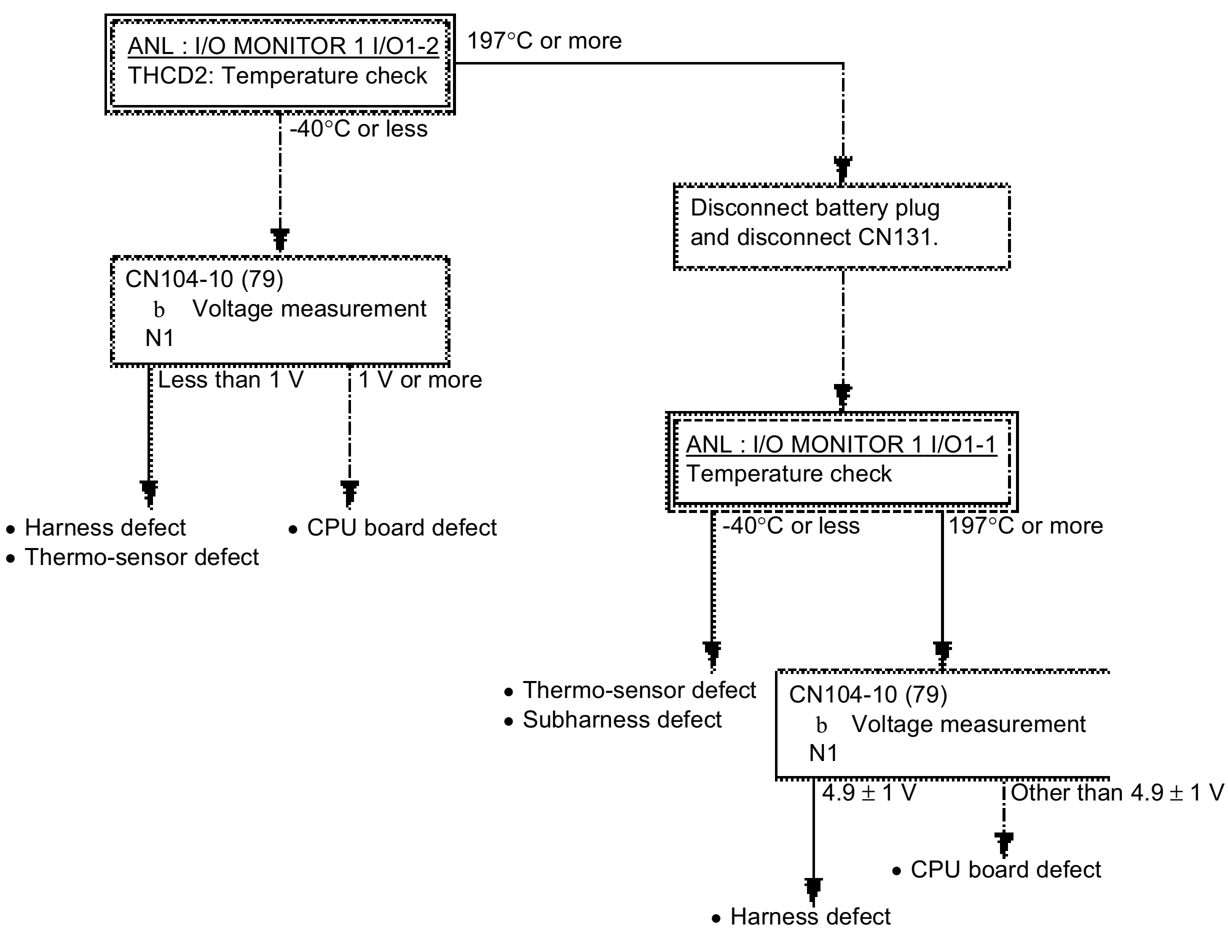
Related portion



Note:
If not equipped with the material handling chopper, the main pump circuit temperature sensor is used as main drive circuit temperature sensor 2.

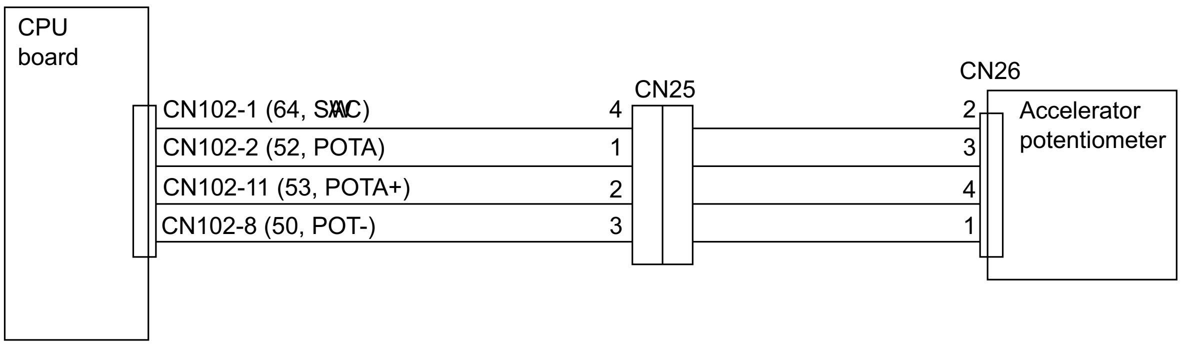
Condition for error detection

Output when controller thermo-sensor output value outside the specified range (open or short circuit) is detected.



C4-1, 2, 3, 4	Accelerator potentiometer abnormality

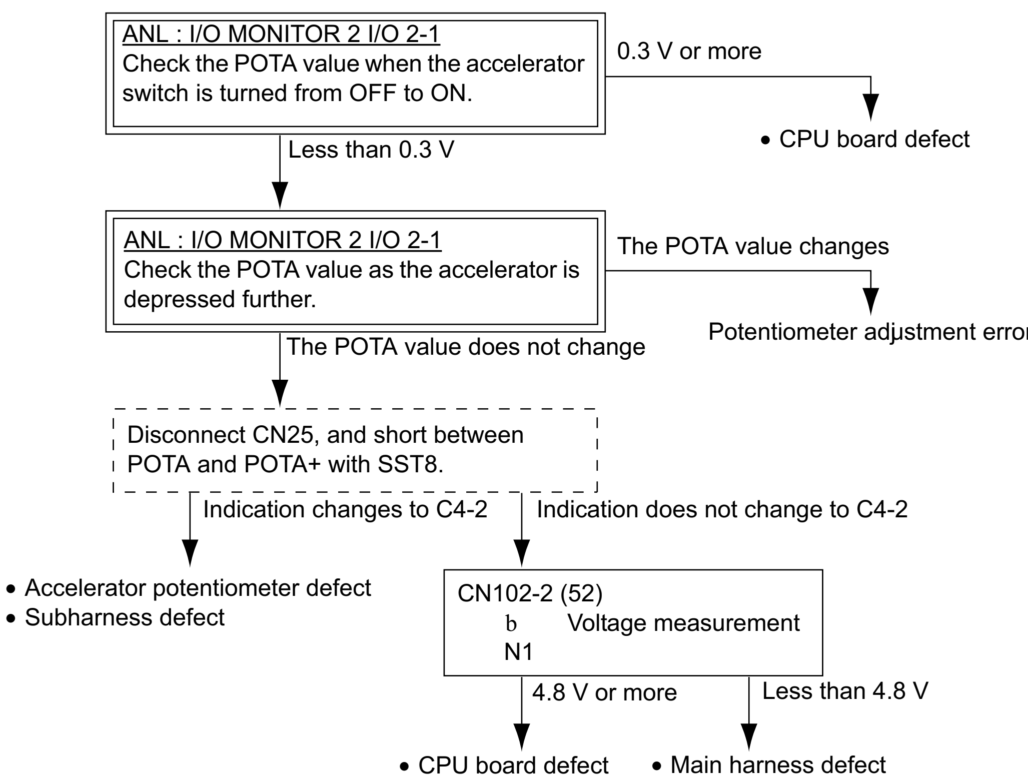
Related portion



Conditions for error detection

C4-1 Output if the accelerator line voltage (POTA) is less than the standard when the accelerator switch is turned ON.
C4-2 Output if the accelerator line voltage (POTA) is above the standard.
C4-3 Output if the accelerator line voltage (POTA) is above the standard when the accelerator switch is turned OFF.
C4-4 Output if the accelerator line voltage (POTA) is above the standard when the accelerator switch state changes.

- **C4-1**



• C4-2

Does C4-2 go out after disconnecting CN25?

- Yes → • Inspect sub-harness • Inspect accelerator variable resister
- No ↓

CN102-2 (52)
b Voltage measurement
N1

- Less than 4.5 V → • CPU board defect
- 4.5 V or more → • Main harness defect

• C4-3

ANL : I/O MONITOR 2 I/O2-1
Check if the SW/AC value changes from 0 to 1 as the accelerator pedal is depressed.

- 0 remains → • Acceleration switch defect
- Changes to 1 ↓

ANL : I/O MONITOR 2 I/O2-1
Check maximum POTA value when SW/AC is OFF.

- Less than 2.5 V → Is C4-3 error displayed?
  - Yes → • CPU board defect
  - No → • Sub-harness inspection • Accelerator variable resister inspection
- 2.5 V or more ↓

Does C4-3 go out after disconnecting CN25?

- Yes → • Sub-harness inspection • Accelerator variable resister inspection
- No ↓

CN102-2 (52)
b Voltage measurement
N1

- Less than 2.5 V → • CPU board defect
- 2.5 V or more → • Main harness defect

• C4-4

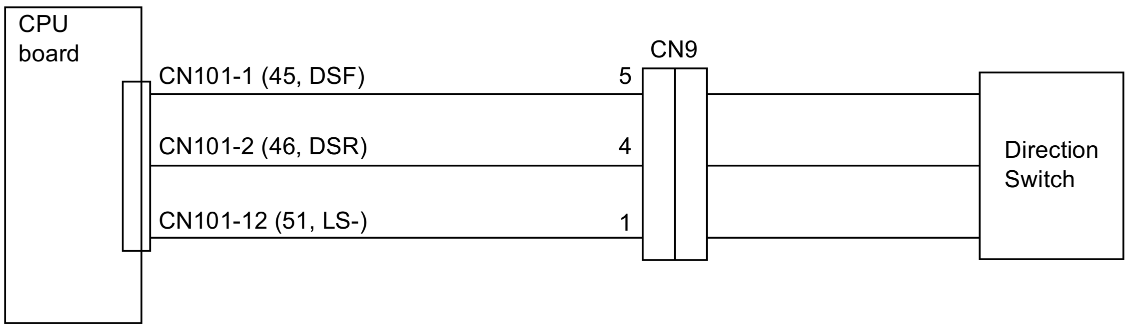
If C4-2,3 occurs at the same time, perform troubleshooting for C4-2, 3 first.

ANL : I/O MONITOR 2 I/O2-1
Check the POTA value when the accelerator switch is turned from OFF to ON or from ON to OFF.

- Less than 1.4 V → • CPU board defect
- 1.4 V or more → • Potentiometer adjustment error

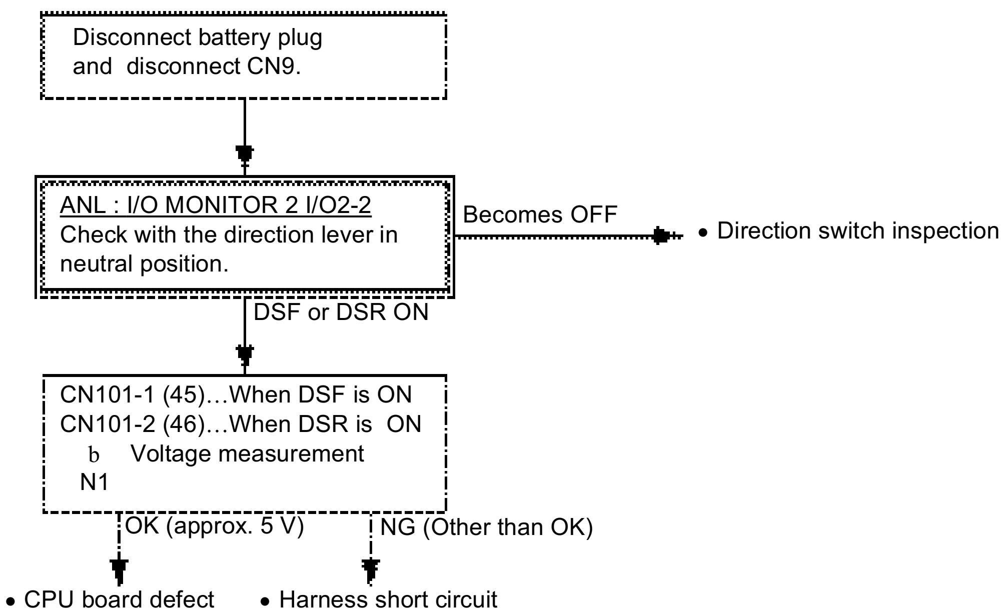
C7	Direction switch abnormality

Related portion



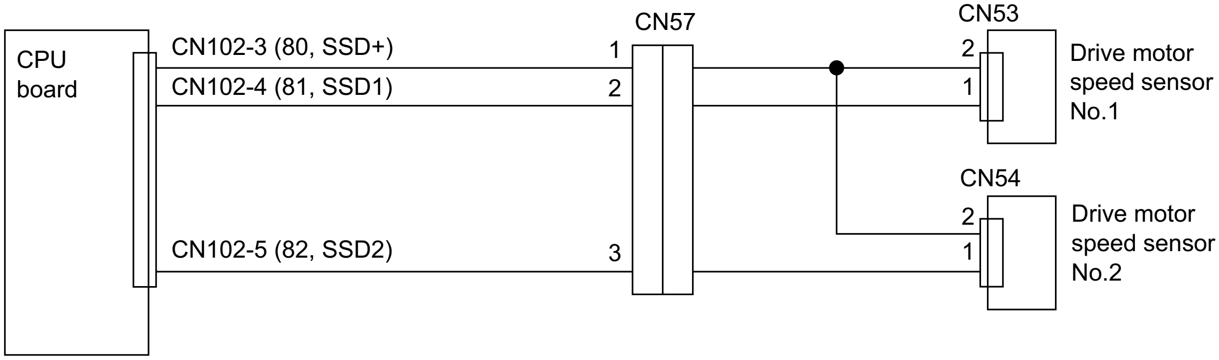
Condition for error detection

Output when both forward and reverse direction switches (DSF and DSR) are ON



C8-1, 2	Drive motor speed sensor abnormality (open)

Related portion



Condition for error detection

Output when vehicle speed sensor line open circuit or decreased output is detected.

Jack up the vehicle until drive wheels leave the gro und and support the frame with wooden blocks before starting troubleshooting.

Are both C8-1 and C8-2 displayed?

- Yes → Turn key switch ON. CN102-3 (80, SSD+) b Voltage measurement N1
  - 14 V or more → Turn the key switch to ON, OFF, and ON.
  - Less than 14 V → Does the value change when CN57 are disconnected?
    - No change → • Harness defect
    - Changes → • Sensor abnormality
- No → Turn the key switch to ON, OFF, and ON.

Turn the key switch to ON, OFF, and ON. → ANL : I/O MONITOR 2 I/O2-5 SSD: Drive motor speed sensor output value check.

- Less than 2 → *1
- 2 or more → Does the value drop below 2 when the drive wheel is turned slowly?
  - Less than 2 → *1
  - 2 or more → • Inspection CN53 or CN54

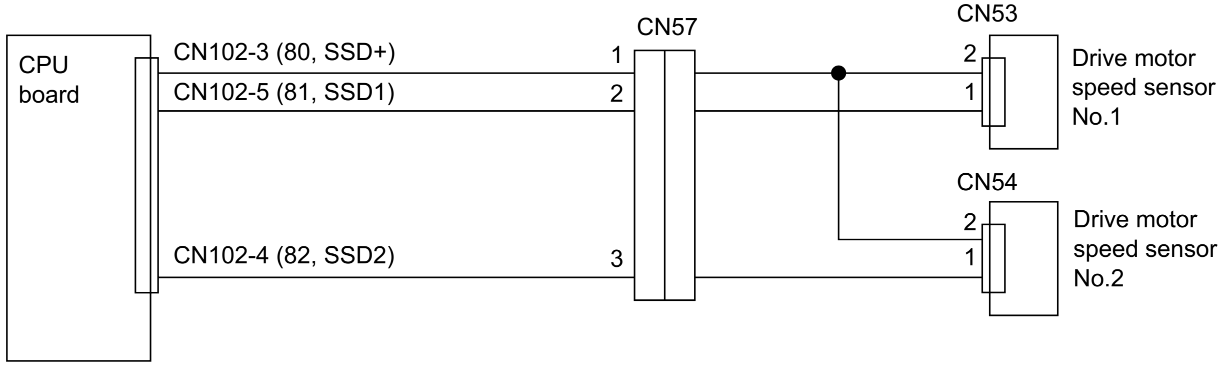
*1 Disconnect battery plug, disconnect CN57, connect SST18 to CN57.

- Changes from C8-1 to C8-2 → • Traveling speed sensor defect
- Does not change from C8-1to C8-2. → CN102-5 (81) .... SSD1 / CN102-4 (82) .... SSD2 b Voltage measurement N1
  - 0.2 V or more → • CPU board defect
  - Less than 0.2 V → • Main harness open circuit

*1: C2-2 error is indicated when SST18 is connected, but this is not abnormal

C8-3, 4	Drive motor speed sensor abnormality (short)

Related portion



Condition for error detection

Output when leak from traveling speed sensor line or output rise is detected.

ack up the vehicle until drive wheels leave the gro und and support the frame with wooden blocks before starting troubleshooting.

ANL : I/O MONITOR 2 I/O2-5
SSD: Traveling speed sensor output value check.

- 16 or more → *1
- Less than 16 → Does the value become 16 or more when the drive wheel is turned slowly?
  - 16 or more → *1
  - Less than 16 → • CN53 or CN54 inspection

*1
Disconnect battery plug, disconnect CN57 connect SST18 CN57.

- Changes from C8-3/C8-4 to C8-4/C8-3 → • Traveling speed sensor defect
- Does not change from C8-3/C8-4 to C8-4/C8-3 →

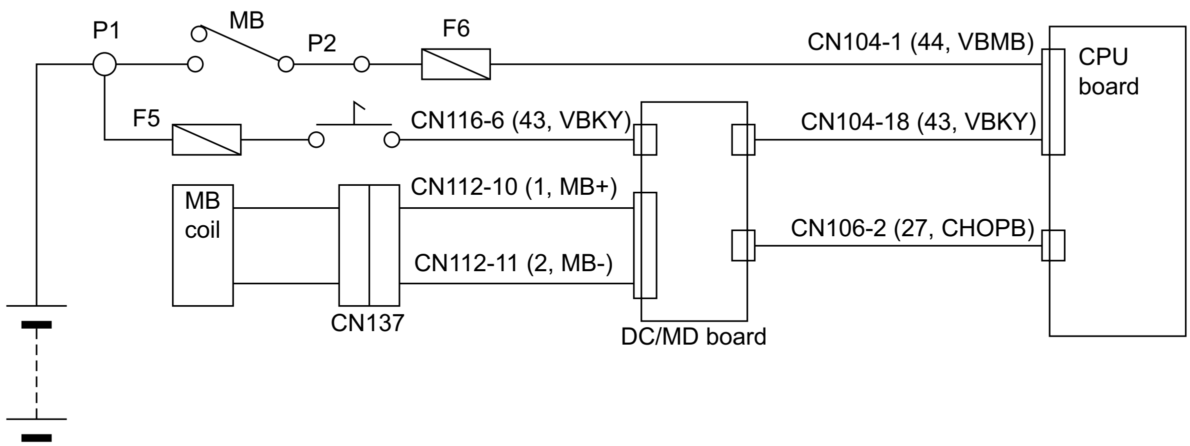
CN102-5 (81)........... SSD1
CN102-4 (82)........... SSD2
b Voltage measurement
N1

- 1.6 V or more → • Main harness open circuit
- Less than 1.6 V → • CPU board defect

*1: C2-2 error is indicated when SST18 is connected, but this is not abnormal

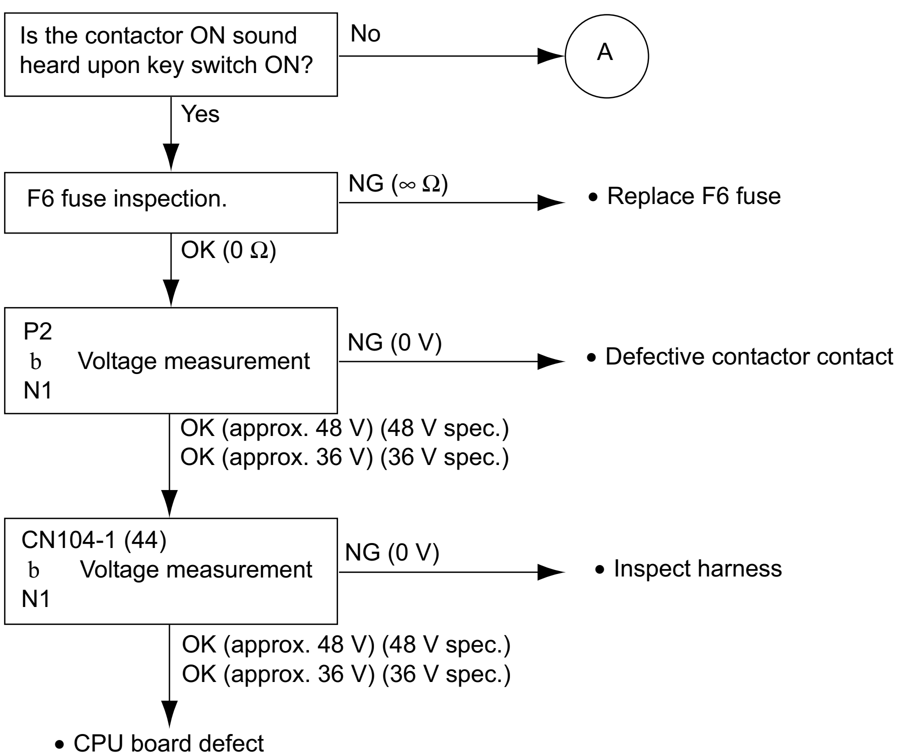
CB-1	Battery contactor (MB) open

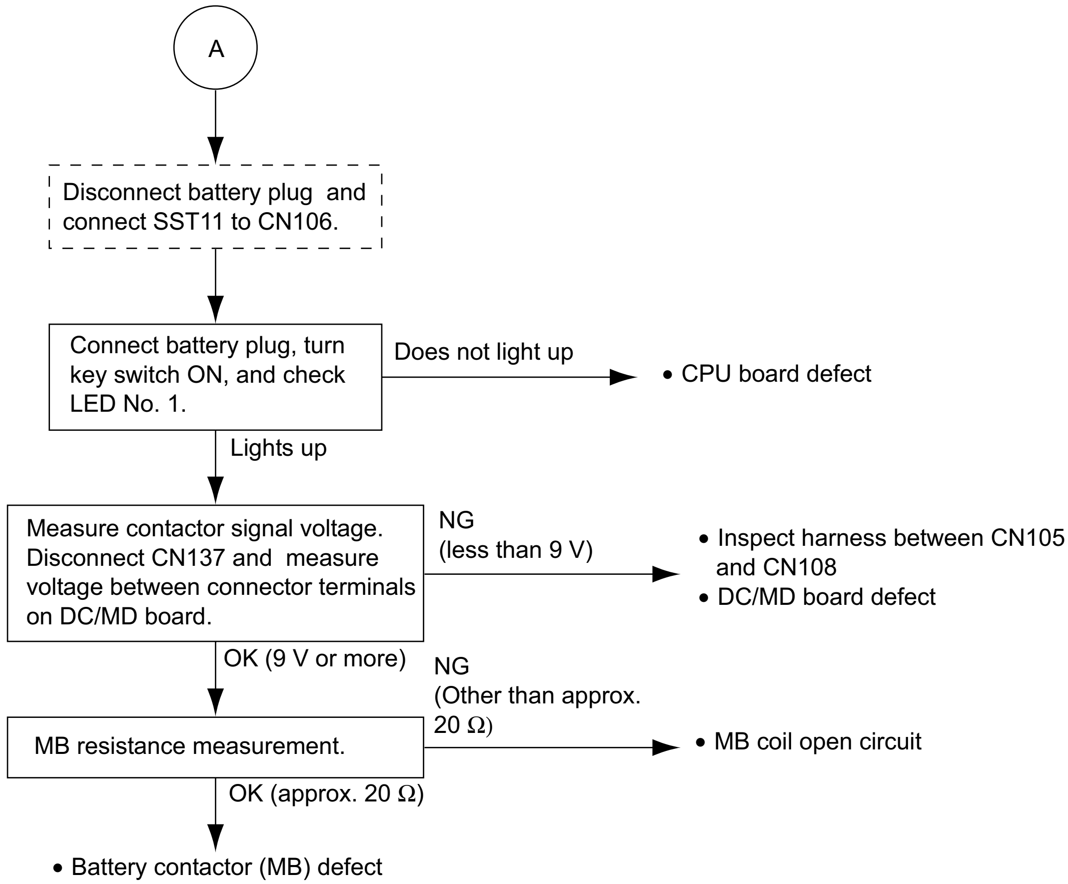
Related portion



Condition for error detection

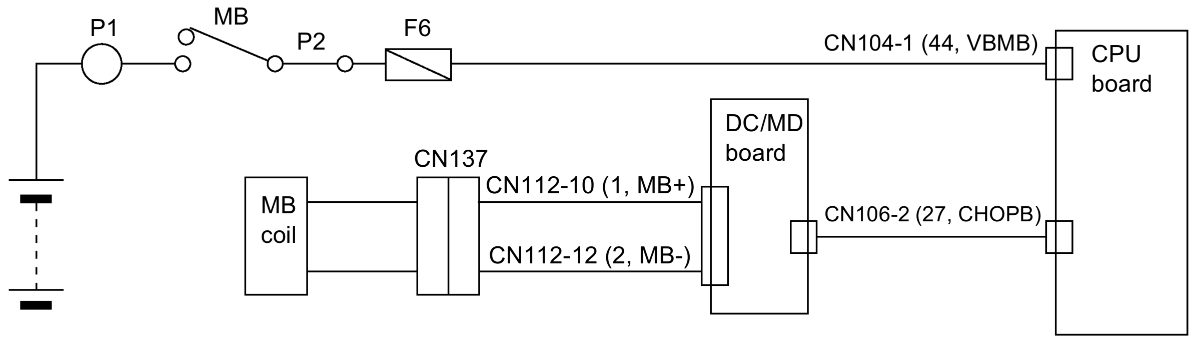
Output when the voltage difference between VBKY and VBMB lines exceeds the specified level.




A
Disconnect battery plug and connect SST11 to CN106.
Connect battery plug, turn key switch ON, and check LED No. 1.
Does not light up
• CPU board defect
Lights up
Measure contactor signal voltage. Disconnect CN137 and measure voltage between connector terminals on DC/MD board.
NG (less than 9 V)
• Inspect harness between CN105 and CN108
• DC/MD board defect
OK (9 V or more)
MB resistance measurement.
NG (Other than approx. 20 Ω)
• MB coil open circuit
OK (approx. 20 Ω)
• Battery contactor (MB) defect

CB-2	Battery contactor (MB) fusion

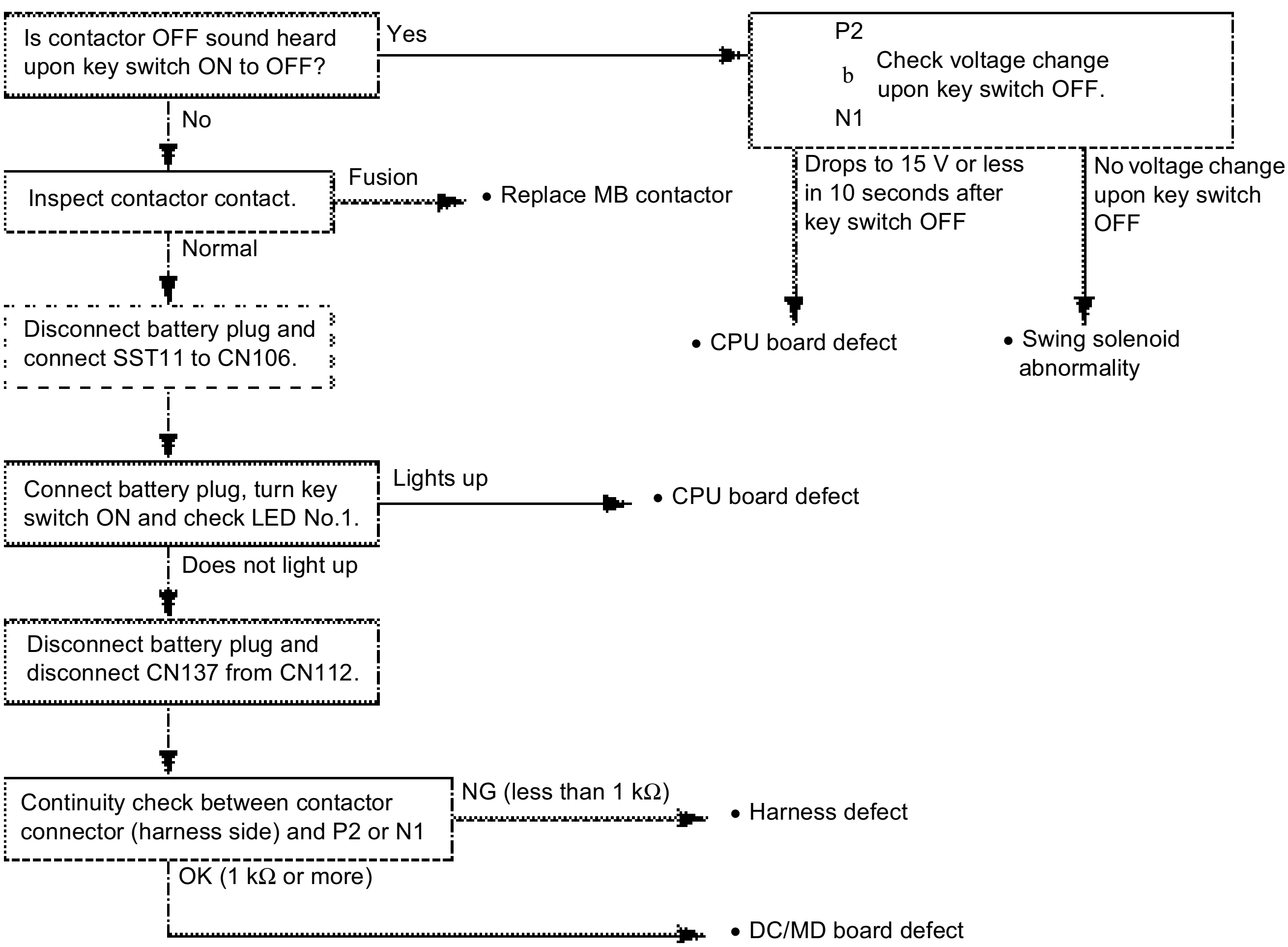
Related portion



Condition for error detection

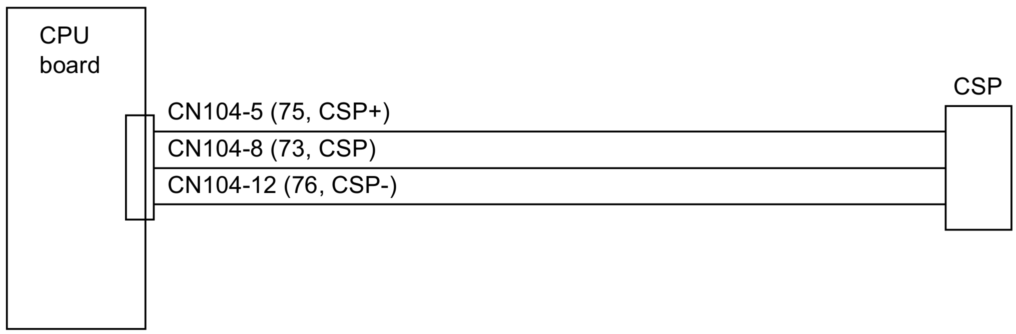
Output when the VBMB line voltage does not drop after key switch OFF.

If FE-1, 2, 4, 5, 54-1, 2 occurs at the same time, perform troubleshooting for FE-1, 2, 4, 5, 54-1, 2 first.



E0-1	Pump main circuit abnormality

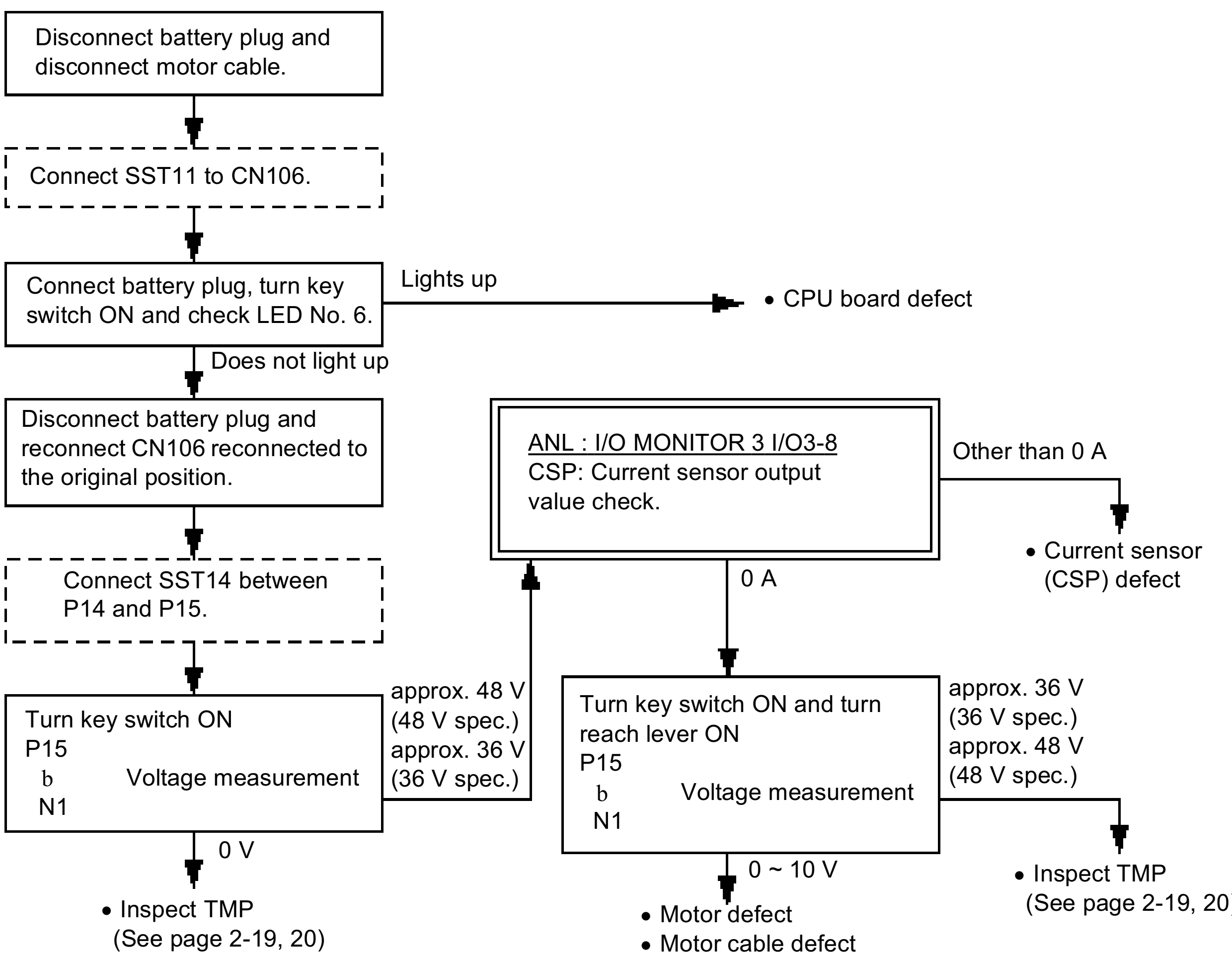
Related portion



Condition for error detection

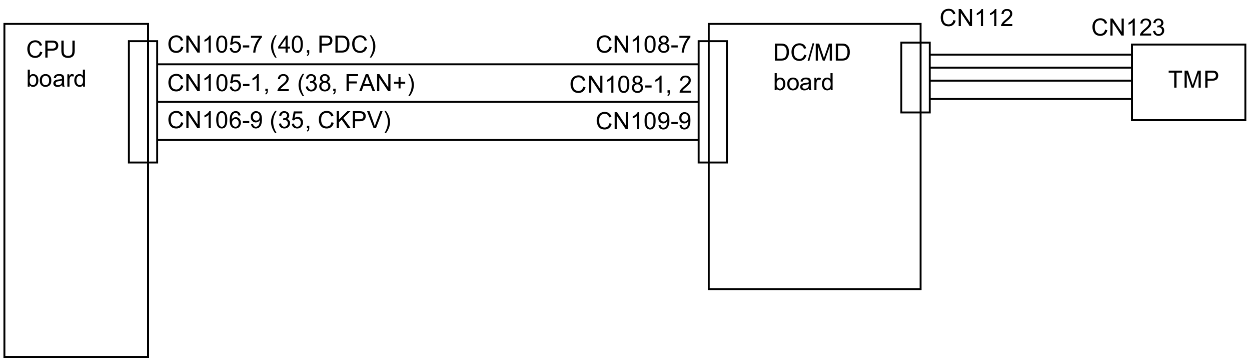
Output when the pump current sensor (CSP) output value exceeds the specified level without material handling operation.

If E1 occurs at the same time, perform troubleshooting for E1 first.



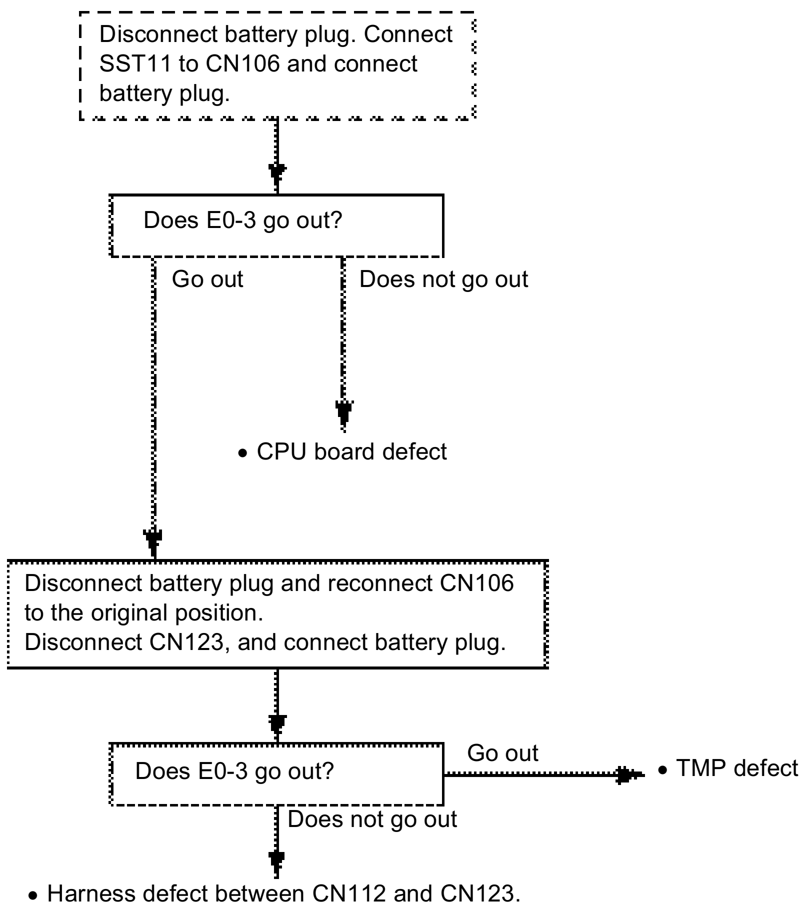
E0-3	Material handling drive power supply abnormality

Related portion



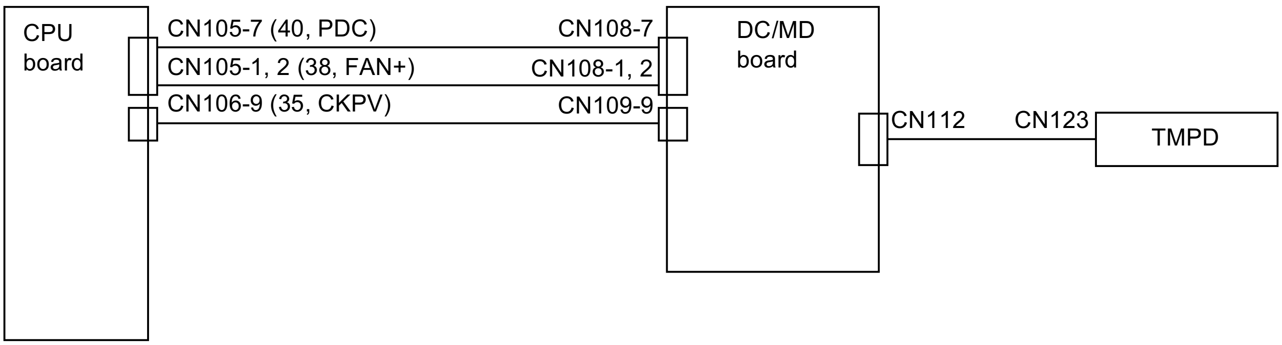
Condition for error detection

Output when low MMP power supply voltage is detected.



E0-4	Material handling drive circuit abnormality

Related portion



Condition for error detection

Output when line open circuit between DC/MD and MMP boards or low MMP power supply voltage is detected.

Disconnect battery plug, connect SST11 to CN106 and connect battery plug.

Vehicle with material handling chopper
Check if No. 15 P-CHOPPER is set to Y by option setting on the display.

Does E0-4 go out?

Does not go out → • CPU board defect

Go out ↓

Disconnect battery plug.
Connect SST10 to CN105 and connect B and 1.
And connect SST11 to CN106, CN107.

ANL : ACTIVE TEST ACT-1
Turn the fan ON.

Check signal 0 (OFF) → • CPU board defect

Inspect the connector and harness between CN106 and CN109.

NG → • Harness defect between CN106 and CN109

OK ↓

Disconnect battery plug and inspect connection condition of CN123 connector.

Connect battery plug and turn key switch ON

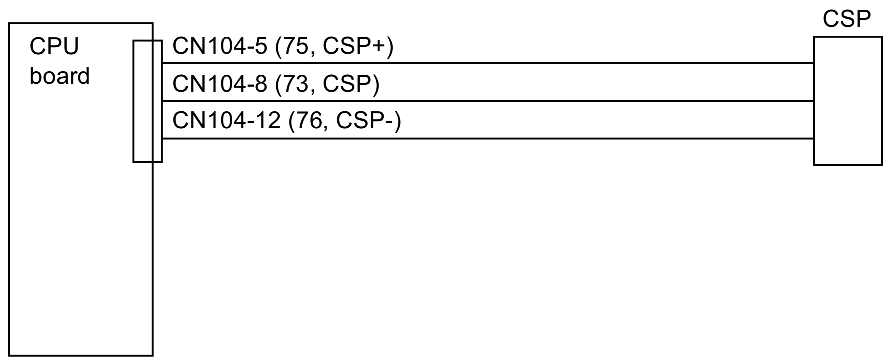
E0-4 is not displayed → • Harness defect between CN112 and CN123

E0-4 displayed ↓

• DC/MD board defect

E1	Pump current sensor abnormality

Related portion



Condition for error detection

Output when the CSP output is outside the specified range.

<u>ANL : I/O MONITOR 3 I/O3-8</u>
CSD: Current sensor output value check.

OK (0 A) → Check current sensor
- For connector insertion condition
- That it does not come off when harness is lightly pulled

NG (other than 0 A) ↓

Disconnect battery plug.
Disconnect CN128 and short circuit between CN104-8 and CN104-9 using SST13

↓

<u>ANL : I/O MONITOR 3 I/O3-8</u>
CSD: Current sensor output value check.

NG (other than 0 A) → • CPU board defect

OK (0 A) ↓

Install current sensor CSBATT (CN135) in place of current sensor CSP (CN128).

↓

<u>ANL : I/O MONITOR 3 I/O3-8</u>
CSD: Current sensor output value check

NG (other than 0 A) → • Harness defect

OK (0 A) ↓

- Current sensor (CSP) defect

E2-1	Pump motor overheat

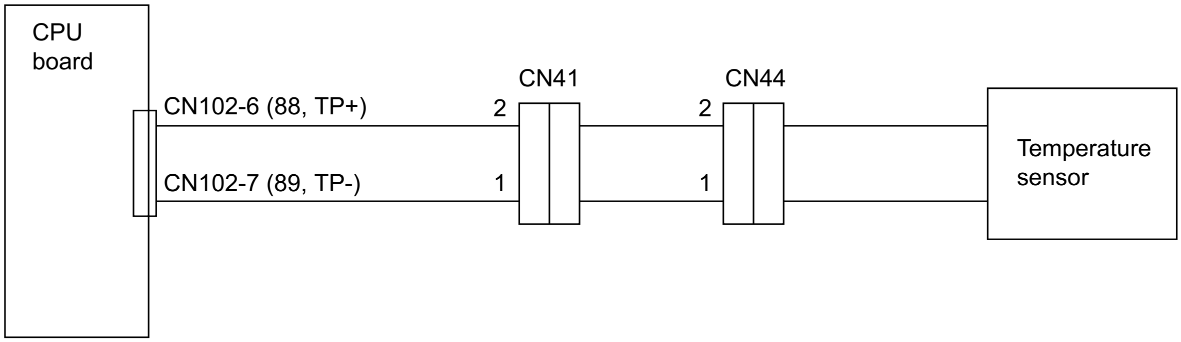
Condition for error detection

Output when the pump motor thermo-sensor output value exceeds the specified level.

- To correct, allow the vehicle to stand for a while (about 30 minutes).

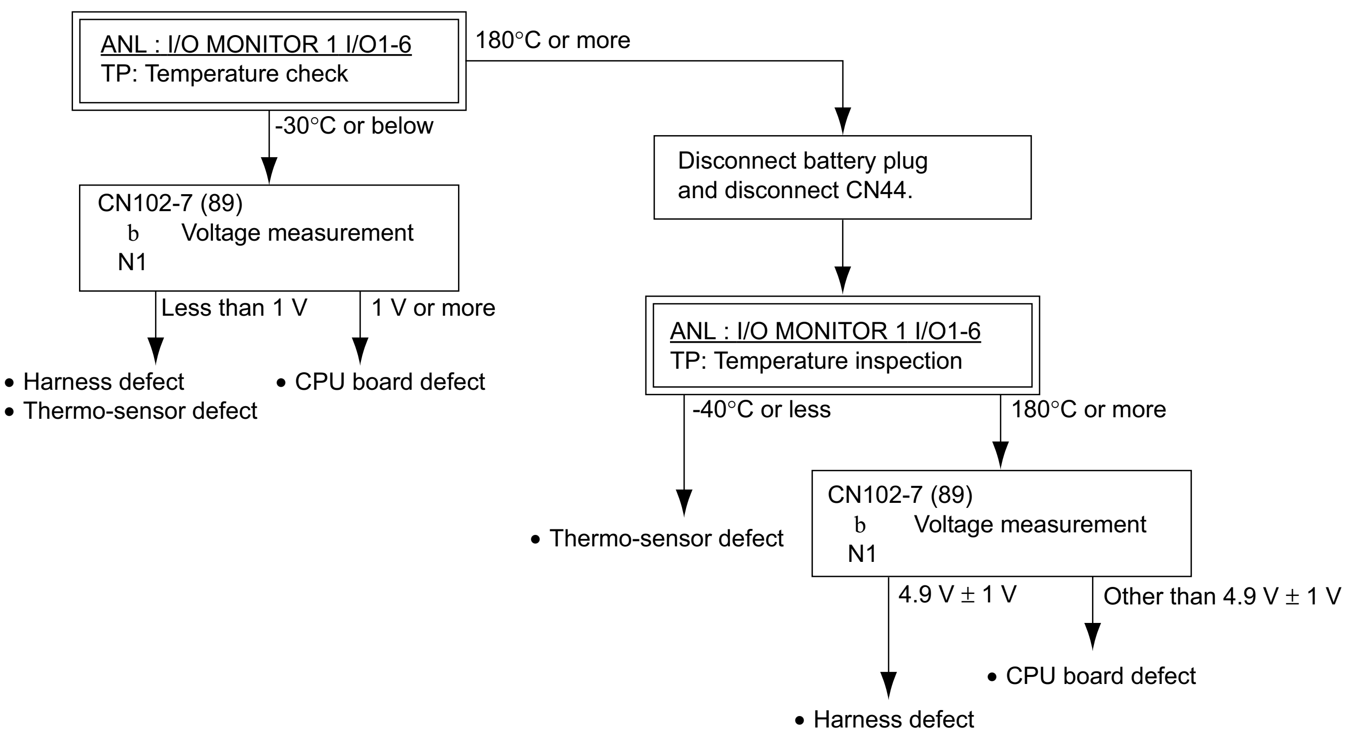
E2-2	Pump motor thermo-sensor abnormality

Related portion



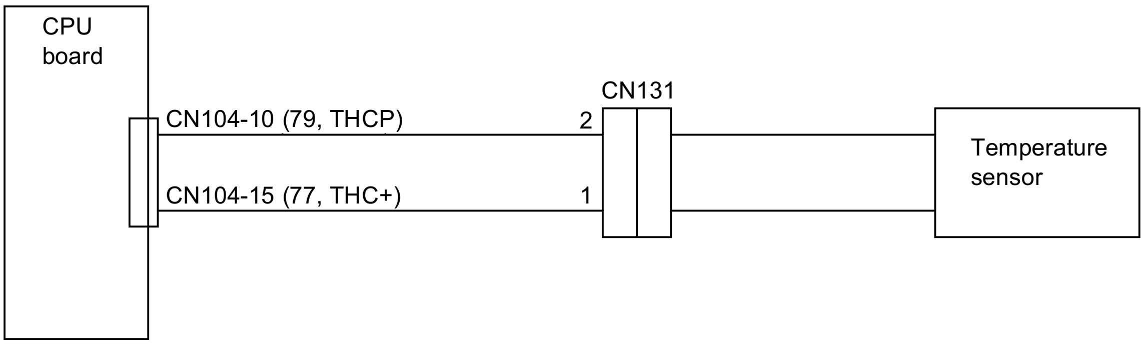
Condition for error detection

Output when the pump motor thermo-sensor output value is outside the specified range (open or short circuit).



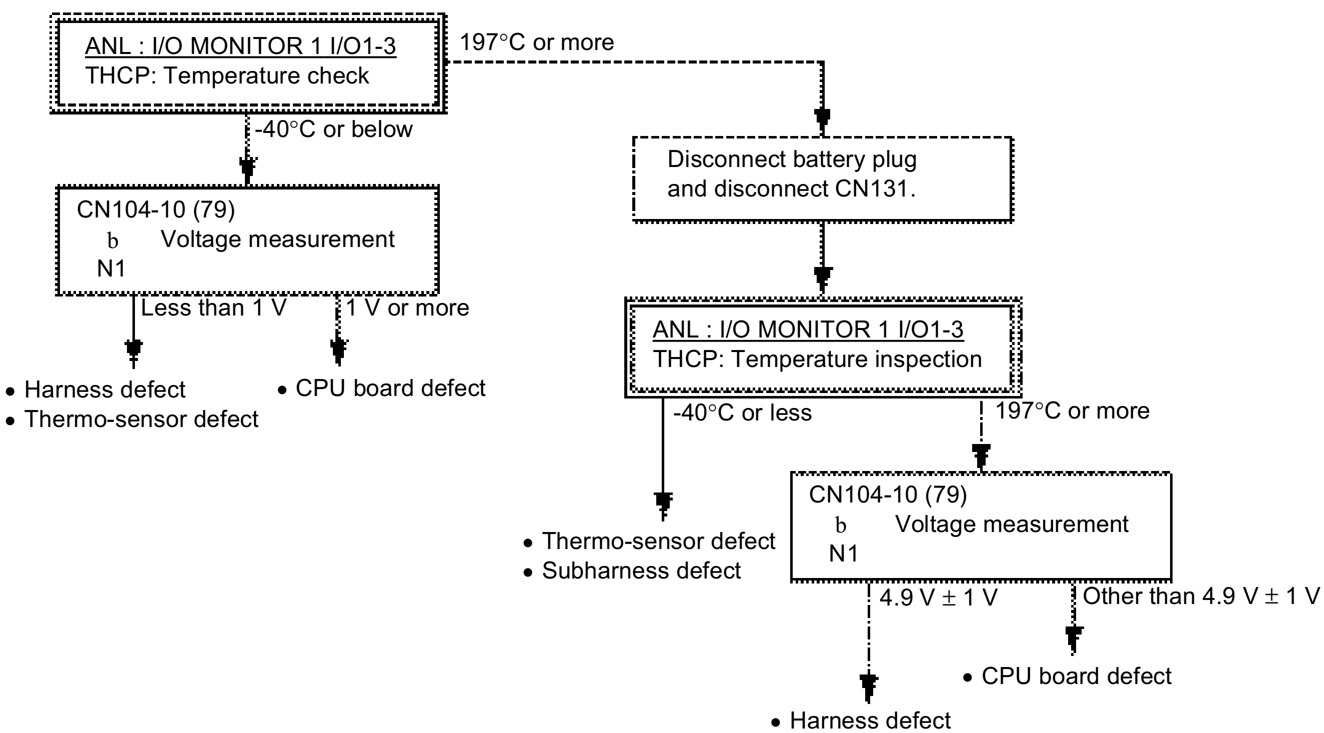
E3	Pump main circuit thermo-sensor abnormality

Related portion



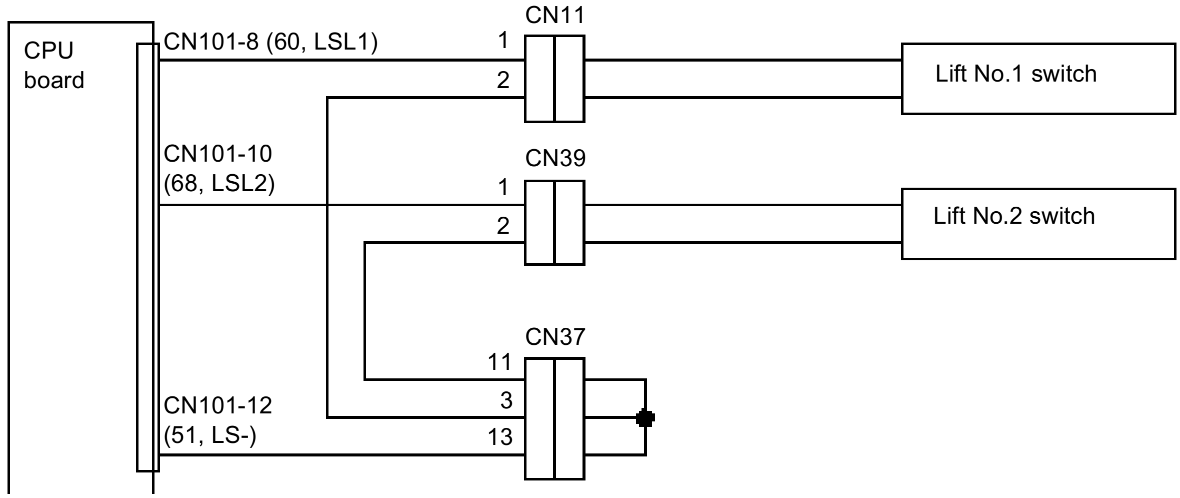
Condition for error detection

Output when the controller thermo-sensor output value is outside the specified range (open or short circuit).



E6	Lift switch abnormality

Related portion



Condition for error detection

Output if lift No. 1 switch is OFF when lift No. 2 switch is turned ON.

Operate the lift lever upward.

↓

ANL : I/O MONITOR 3 I/O3-1
Check the LSL1 and LSL2 values.

↓

What is the LSL1 value when the LSL2 value changes from 0 to 1?

1 → • CPU board defect

0 ↓

Disconnect CN101
CN101-8
b Continuity check
CN11-1
CN101-12
b Continuity check
CN11-2

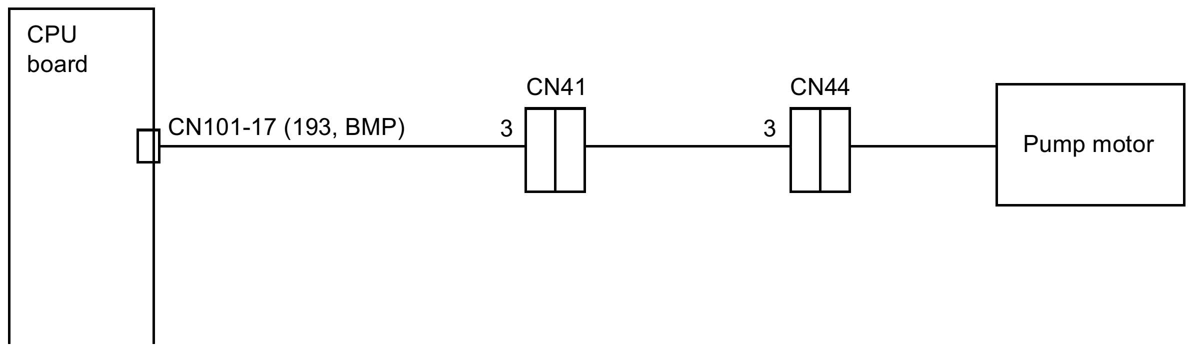
No continuity → • Repair no continuity circuit

Continuity ↓

• Limit switch adjustment error
• Switch abnormality

PM BRSH	Pump motor brush wear

Related portion



Condition for error detection

Output if the pump motor brush is worn.

Set to NO for temporary cancellation of worn brush warning on the display.

Disconnect the battery plug and CN44.
Wait for about 5 seconds after battery plug ON and key switch ON.*
Set worn brush warning to N by option setting.
Does worn brush warning occur?
Is simultaneous traveling and material handling prohibited while the traveling speed is restricted to approx. 3 mph (5 km/h)?

Warning occurs →
- Main harness defect
- CPU board defect

* Pump motor temperature sensor error (E2-2) is output, but this is not abnormal.

No warning ↓

Pump motor brush inspection.

NG → Check material handling operation after brush replacement.

OK ↓

Pump motor brush wear sensor defect

After troubleshooting, set worn brush warning to Y by option setting.

EF-1, 2, 4	Traveling/material handling controller EEP-ROM abnormality

Condition for error detection

Output when CPU board EEP-ROM element abnormality is detected.

- To correct, replace the CPU board.

EF-3	Traveling/material handling controller CPU abnormality

Condition for error detection

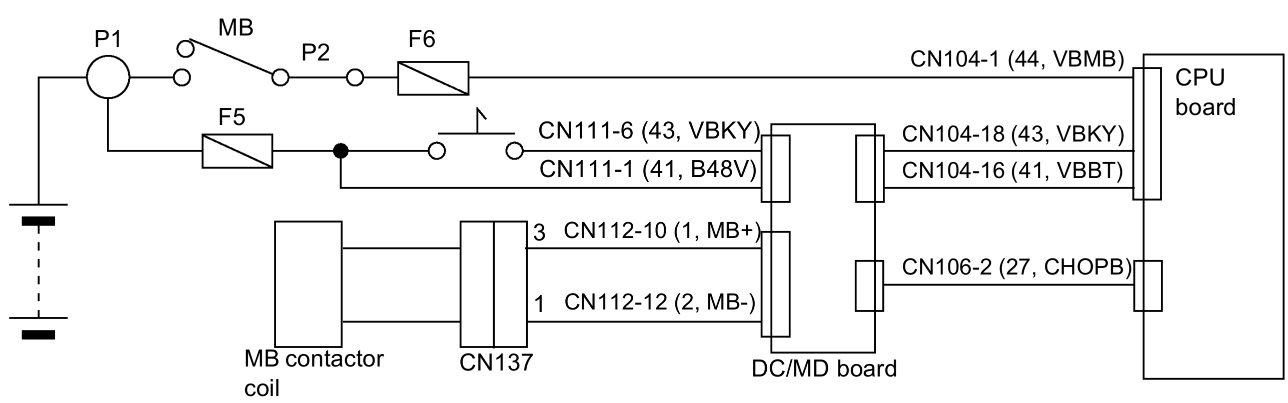
Output when CPU board CPU element abnormality is detected.

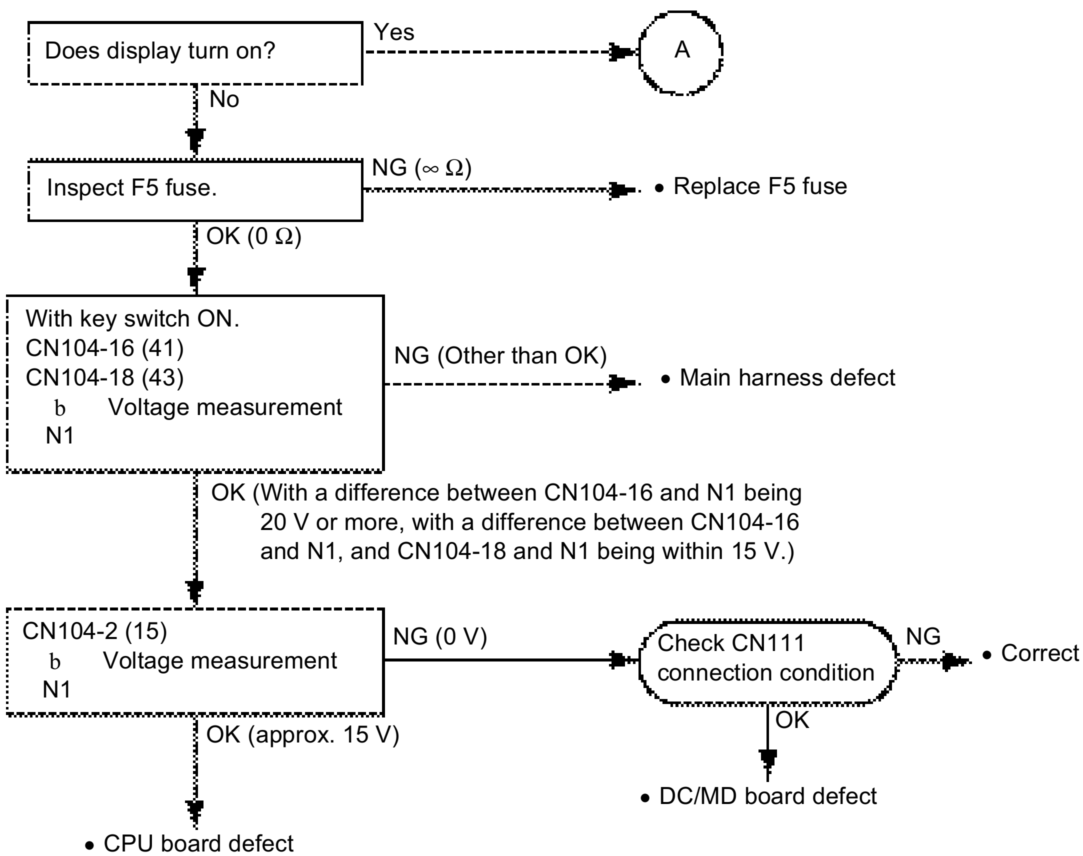
- To correct, replace the CPU board.

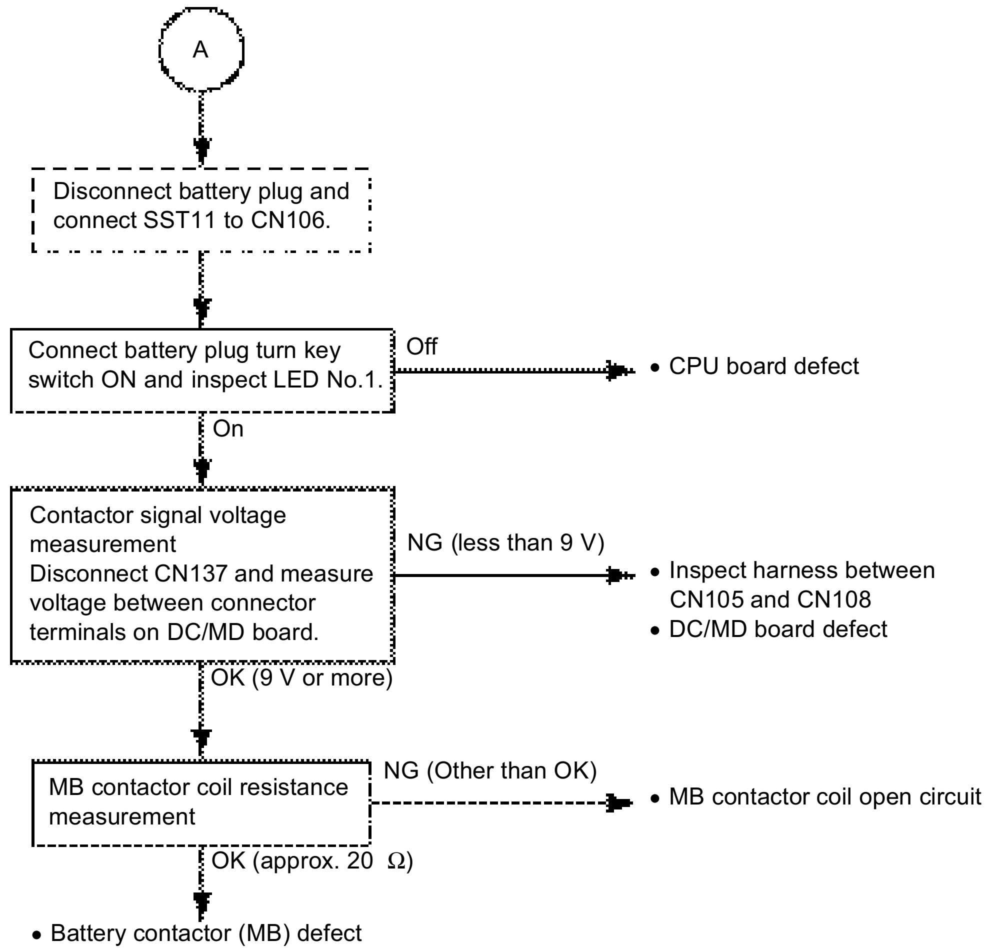
WHEN NO DIAGNOSIS ERROR CODE IS DISPLAYED

The vehicle does not move at all (traveling, material handling and PS inoperable)

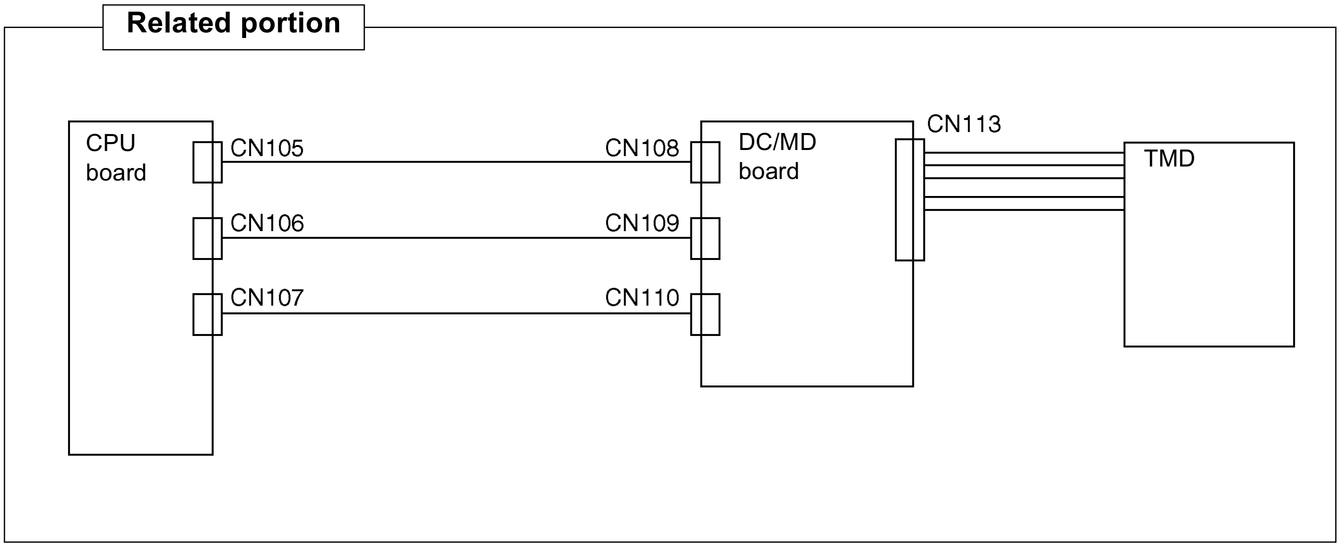
Related portion






A
Disconnect battery plug and connect SST11 to CN106.
Connect battery plug turn key switch ON and inspect LED No.1.
Off
• CPU board defect
On
Contactor signal voltage measurement
Disconnect CN137 and measure voltage between connector terminals on DC/MD board.
NG (less than 9 V)
• Inspect harness between CN105 and CN108
• DC/MD board defect
OK (9 V or more)
MB contactor coil resistance measurement
NG (Other than OK)
• MB contactor coil open circuit
OK (approx. 20 Ω)
• Battery contactor (MB) defect

Only traveling disabled or wobbling



On a vehicle with the deadman brake, check if No. 16 SEAT BRAKE is set to Y by option setting on the display.

ANL : I/O MONITOR 2 I/O2-1
Direction switch inspection and accelerator potentiometer reading check

- Direction switch : No ON/OFF
  Accelerator potentiometer reading: No change
  → • Inspect direction switch and accelerator
- Direction switch : ON/OFF
  Accelerator potentiometer reading : Change
  → next step

ANL : I/O MONITOR 2 I/O2-3
Inspect brake switch (LSB) with pedal depression

- 1 → • Brake inspection
- 0 → next step

*1 All ON (blinking) : LEDs light up and go out sequentially
*2 Some OFF : Any of six LEDs lights up

ANL : I/O MONITOR 2 I/O2-4
Check the deadman switch (LSD) by sitting on the seat

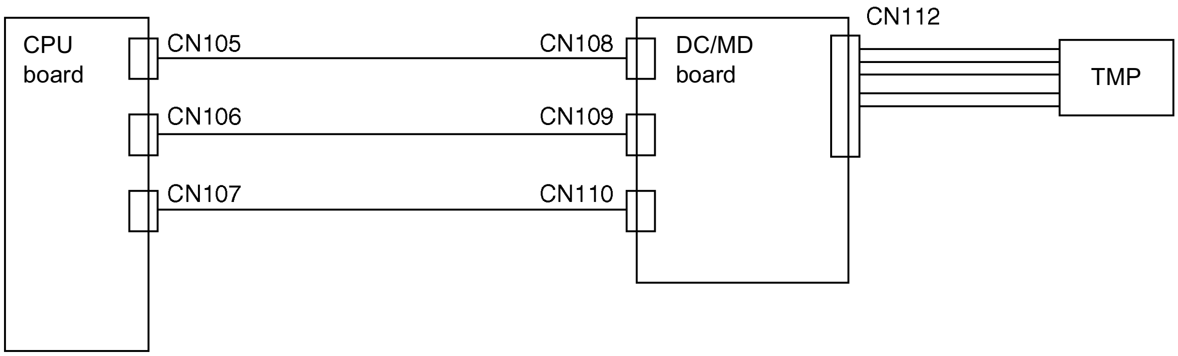
- 0 → • Dead-man switch inspection
- 1 → next step

Disconnect battery plug, connect SST3 to CN113, connect battery plug, and turn key switch ON

- Some OFF *2 → **Disconnect battery plug, connect SST11 to CN107, and connect battery plug**
  - Some OFF *2 → • CPU board defect
  - All ON (blinking) *2 → **Inspect connector and harness between CN105 and CN108**
    - OK → • DC/MD board defect
    - NG → • Harness defect between CN105 and CN108
- All ON (blinking) *1 → **Check voltage at motor cable terminals upon direction switch ON**
  - 0 V or approx. 36 V (36 V spec.) approx. 48 V (48 V spec.) → • Inspect TMD
  - Other than 0 V or approx. 36 V (36 V spec.) approx. 48 V (48 V spec.) → • Motor defect • Motor cable defect

Only material handling disabled (Chopper)

Related portion



ANL : I/O MONITOR 3 I/O3-1,2,3
Material handling switch inspection

- Lever operation does not turn the switch on → • Inspect material handling switch
- Lever operation turns the switch on ↓

Disconnected battery plug, connect SST11 to CN106, and connect battery plug

↓

Turn key switch on and check SST11 No.6 LED upon material handling lever ON.

- Does not light up → • CPU board defect
- ON (blinking) ↓

Disconnect battery plug and reconnect CN106 to the original position.

↓

Connect SST14 between P14 and P15

↓

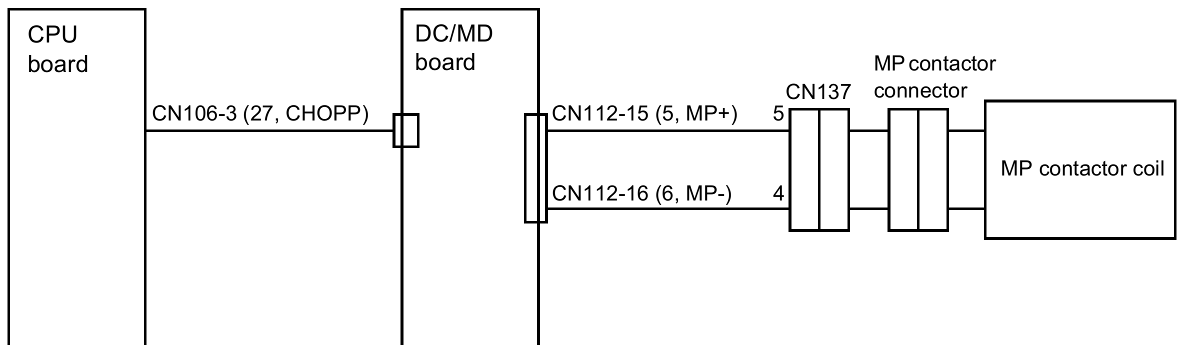
Turn the key switch ON and set the material handling lever to ON
P15
b Voltage measurement
N1

- Other than approx. 36 V (36 V spec.)
  Other than approx. 48 V (48 V spec.) → • Motor defect
  • Motor cable defect
- approx. 36 V (36 V spec.)
  approx. 48 V (48 V spec.) ↓

• Inspect TMP
(See page 2-19, 20)

Only material handling disabled (Chopper-less)

Related portion



Check if No. 15 P-CHOPPER is set to N by option setting on the display.

ANL : I/O MONITOR 3 I/O3-1,2,3
Material handling switch inspection

- Lever operation does not turn the switch on → • Inspect material handling switch
- Lever operation turns the switch on ↓

Is the contactor ON sound heard when the material handling lever is operated?

- Yes → • Motor defect • Motor cable defect • F2 fuse open
- No ↓

Disconnect battery plug, connect SST11 to CN106, and connect battery plug

↓

Turn key switch on and check SST11 No.2 LED upon material handling lever ON.

- Does not light up → • CPU board defect
- ON (blinking) ↓

MP contactor signal voltage measurement Disconnect MP contactor connector and measure voltage between connector terminals on DC/MD board.

- NG (Other than 9 V) → • Inspect harness between CN105 and CN108 • DC/MD board defect
- OK (9 V or more) ↓

MP contactor coil resistance measurement

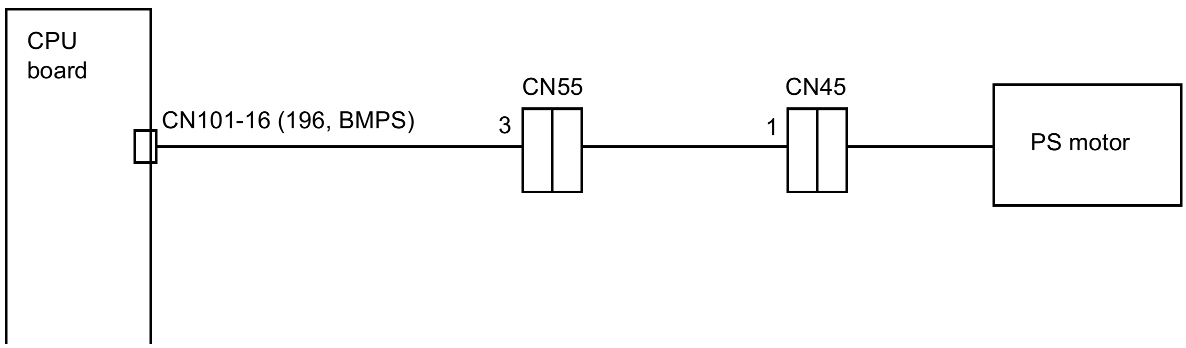
- NG (Other than OK) → • MP contactor coil open circuit
- OK (approx. 20 Ω) ↓

• MP contactor defect

STEERING SYSTEM
WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED

PS BRSH	PS motor brush wear

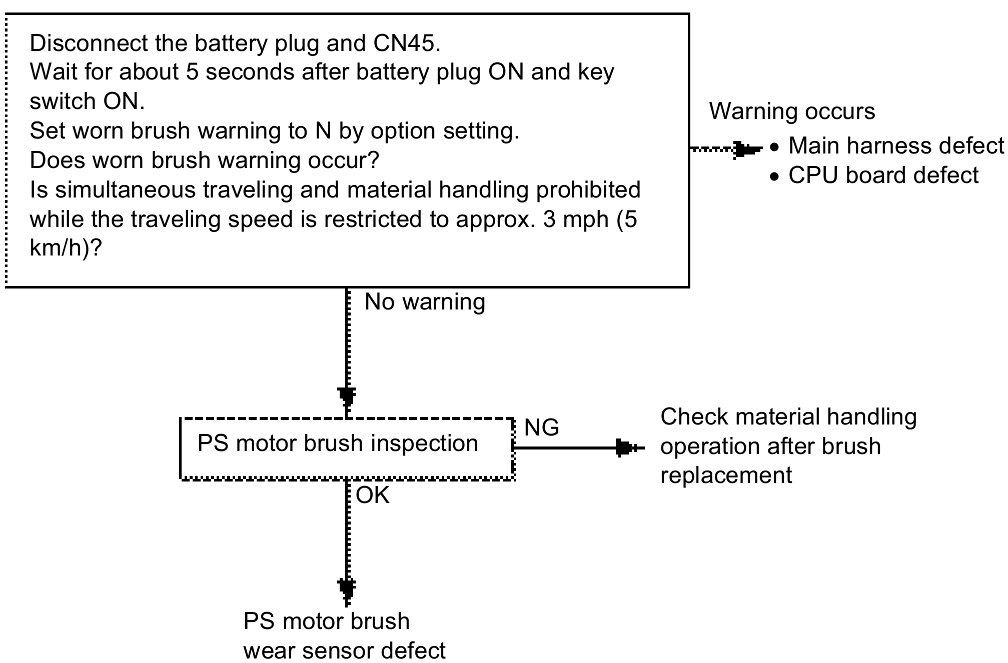
Related portion



Condition for error detection

Output if the PS motor brush is worn.

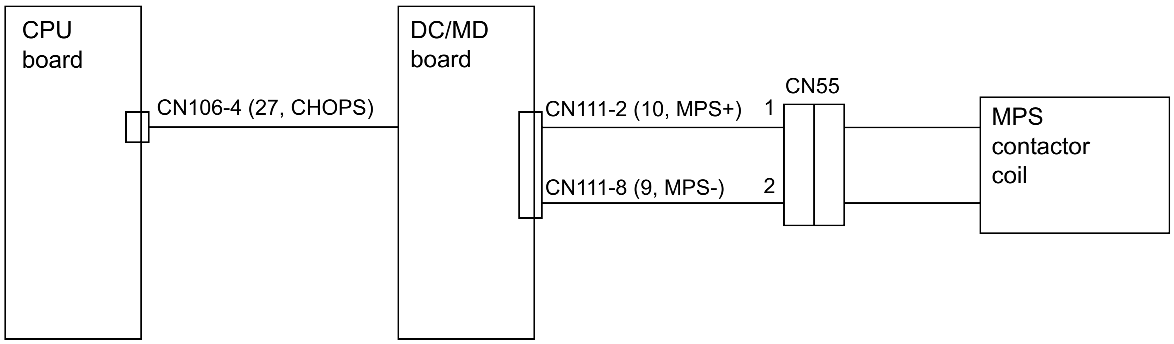
Set to NO for temporary cancellation of worn brush warning on the display.



After troubleshooting, set worn brush warning to Y by option setting.

F0-1	PS contactor abnormality (For FHPS)

Related portion



Condition for error detection

Output if the PS coil is shorted.

Check if EHPS is set to NO by option setting on the display.

Disconnect battery plug and disconnect CN55, and connect battery plug. Does F0-1 disappear upon key switch ON and direction switch ON?

Go out → • PS contactor coil defect

Does not go out ↓

Disconnect battery plug, connect SST11 to CN106 and connect battery plug.

↓

Turn the key switch ON and check if LED No. 3 on SST11 lights up upon direction switch ON.

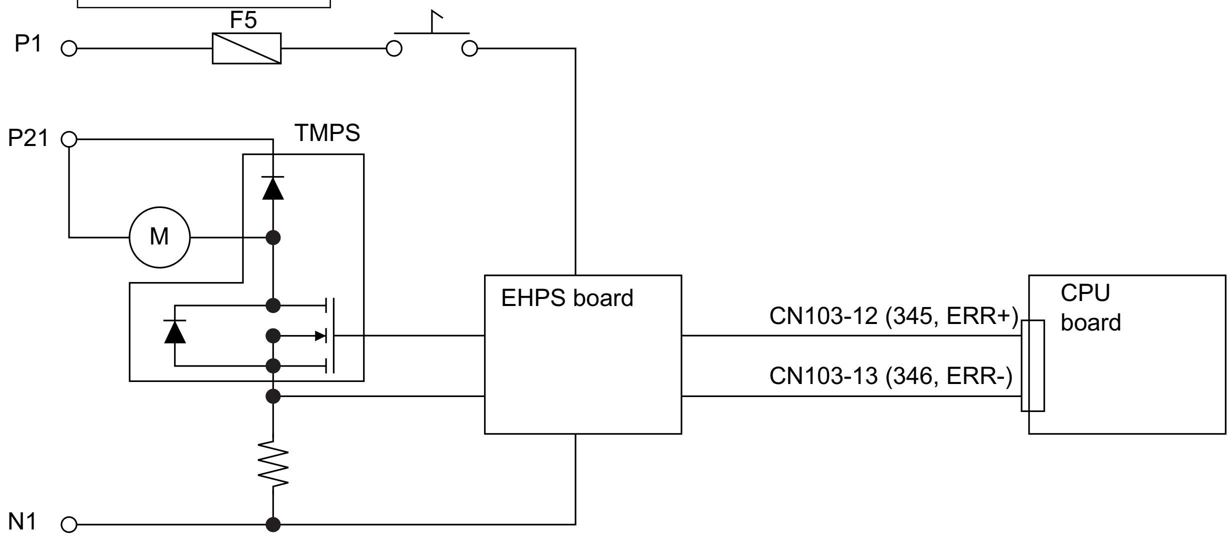
Off → • CPU board defect

On (blinking) ↓

- Harness defect between CN111 and CN55
- DC/MD board defect

F0-2	EHPS abnormality

Related portion



Condition for error detection

Current flows in the motor althugh TMPS is not ON

Check if EHPS is set to YES by option setting on the display.

Does the PS motor run when the key switch is turned OFF and the battery plug is connected?
- Yes → TMPS defect
- No ↓

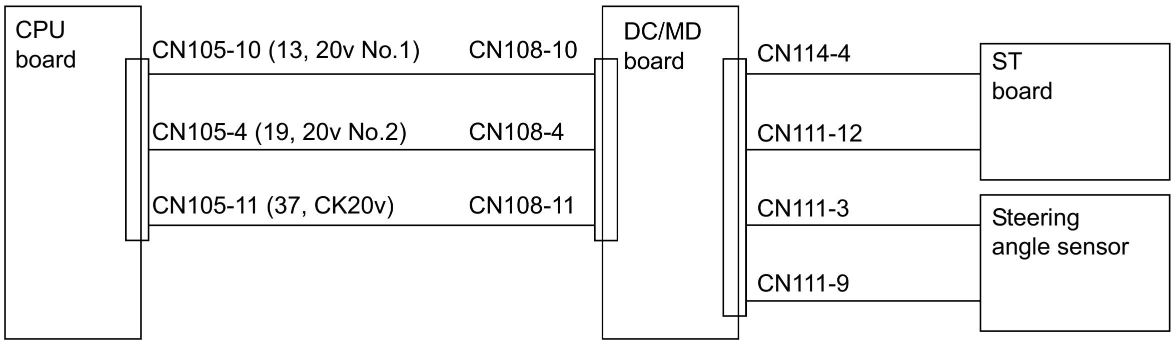
Connect battery plug and key switch ON. Does the PS motor run while the steering wheel is not operated?
- Yes → PBEHPS defect
- No ↓

Connect battery plug and key switch ON. Does the PS motor run while the steering wheel is operated?
- Yes → Connect battery plug and key switch ON.
  CN103-12 (345)
  b Voltage measurement
  CN103-13 (346)
  - OK (0 V) →
    - • Harness defect
    - • CPU board defect
  - NG (5 V) → PBEHPS defect
- No ↓

Connect battery plug and key switch ON.
P21
b Voltage measurement
N1
- OK (Battery voltage) →
  DMPS defect
  PBEHPS defect
  TMPS defect
  SH defect
- NG (0 V) →
  - • PS main circuit defect

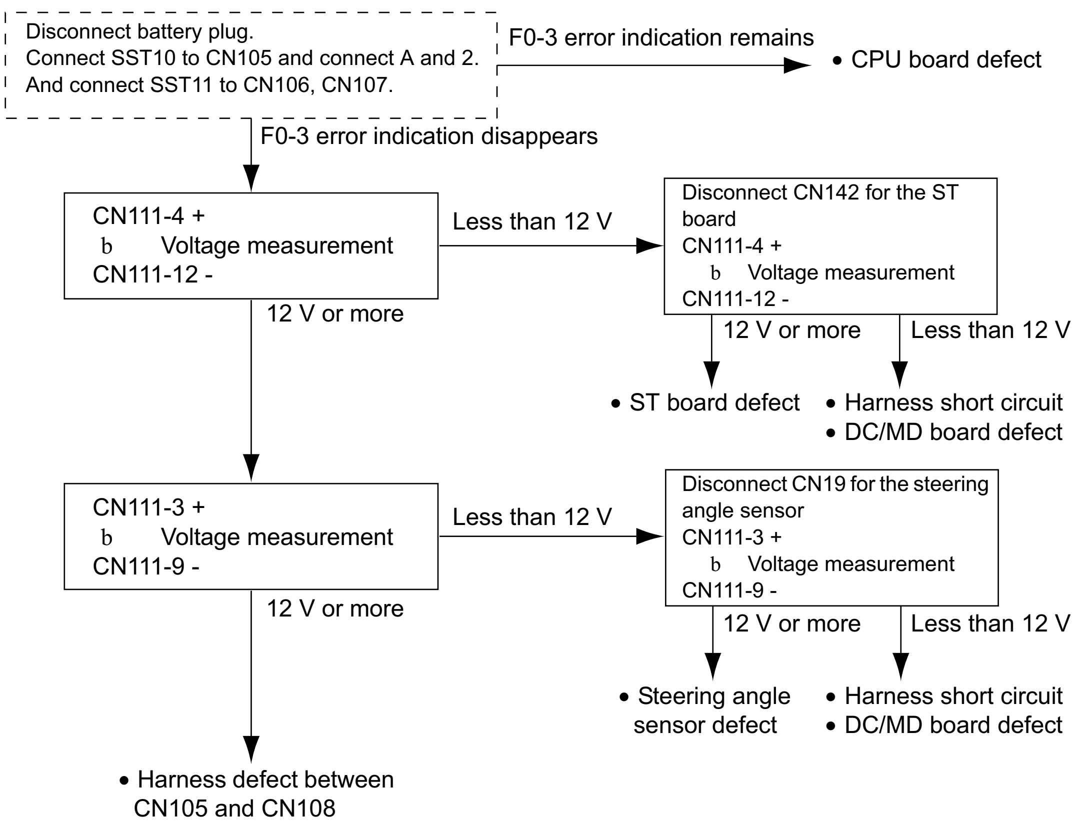
F0-3	Power supply abnormality

Related portion



Condition for error detection

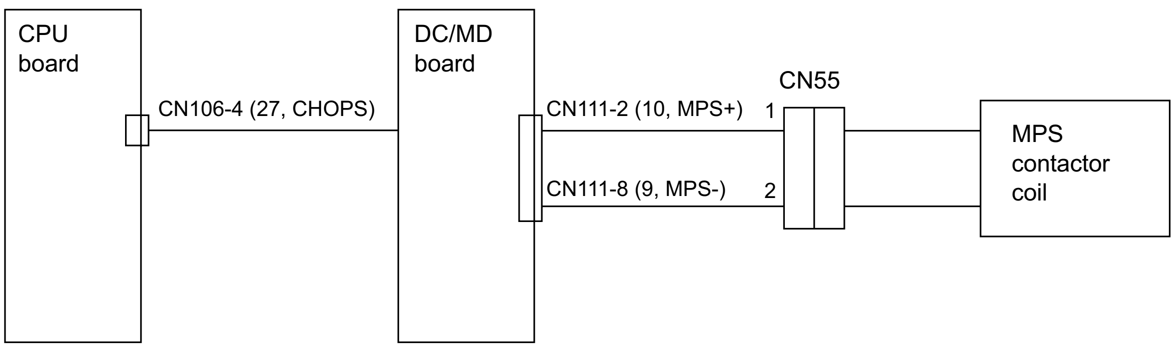
Output when the power supply voltage (20 V) is abnormal.



WHEN NO DIAGNOSIS ERROR CODE IS DISPLAYED

Failure in PS operations only (FHPS)

Related portion



Is the contactor closed upon direction switch ON?
- Closed →
  - Motor defect
  - Motor cable defect
- Not closed ↓

Disconnect battery plug, connect SST11 to CN106 and connect battery plug.

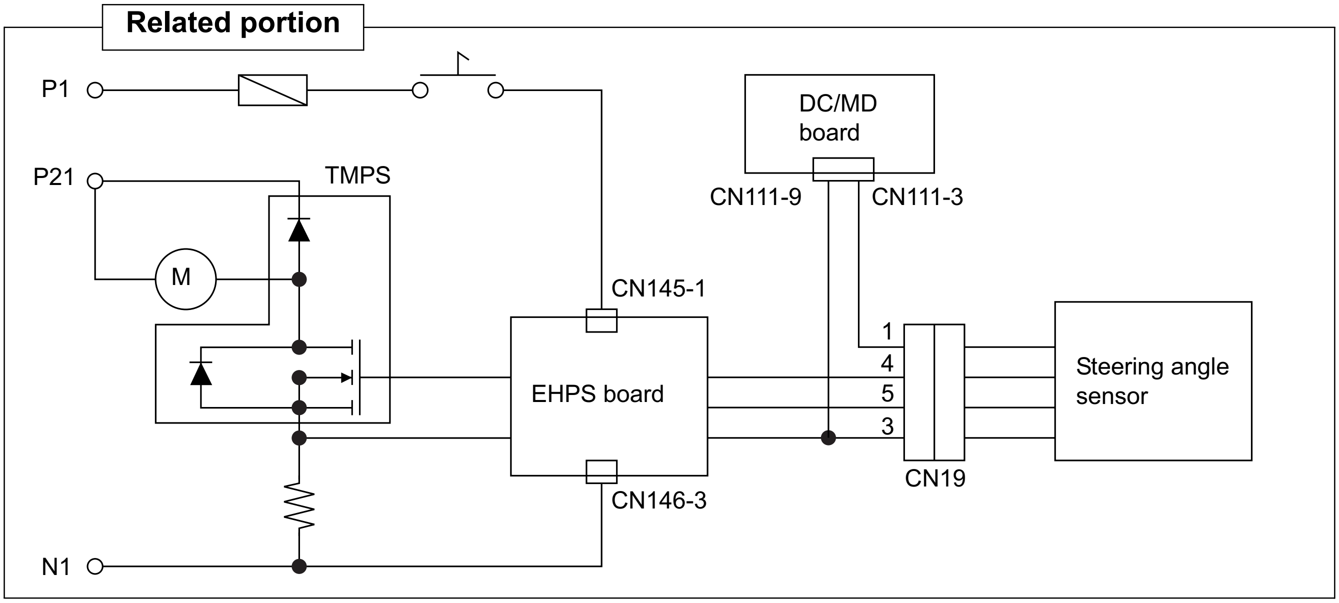
↓

Turn the key switch to ON and check if LED NO. 3 on SST11 lights up upon direction switch ON.
- Off →
  - CPU board defect
- ON (blinking) ↓

MPS contactor signal voltage measurement. Disconnect CN55 and measure voltage between connector tarminals on DC/MD board.
- NG (Less than 9 V) →
  - Inspect harness between CN105 and CN108
  - DC/MD board defect
- OK (9 V or more) ↓

MPS coil resistance measurement
- NG (other than approx. 20 Ω) →
  - MPS contactor coil open circuit
- OK (approx. 20 Ω) ↓
  - MPS contactor defect

Failure in PS operations only (EHPS)



Does the PS motor run when the steering wheel is operated after key switch ON?

- Runs. →
  - • Motor defect
  - • Motor cable defect
- Does not run ↓

CN145-1 (+) b Voltage measurement N1 (-)

- Less than 20 V → • Main harness inspection
- 20 V or more ↓

CN111-3 (+) b Voltage measurement CN111-9 (-)

- Less than 12 V → • DC/MD board defect
- 12 V or more ↓

Connect SST2 between CN19-1 and CN19-4

↓

Does the PS motor run upon key switch ON?

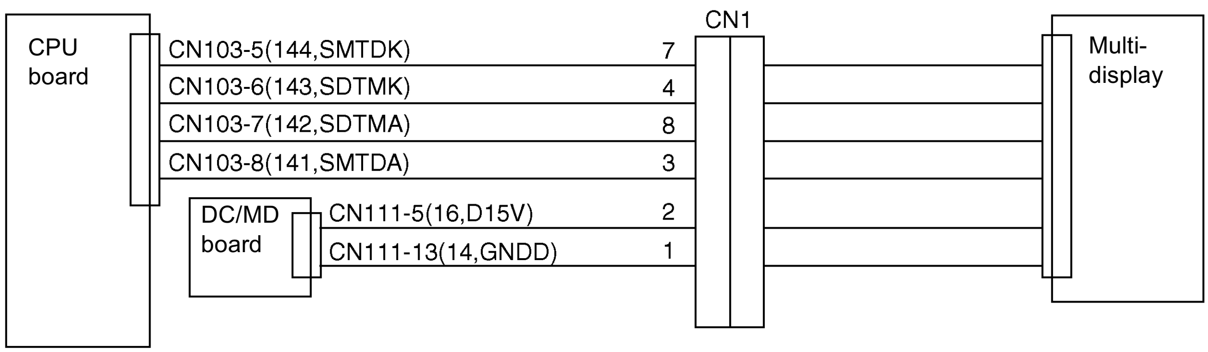
- Runs. → • Steering angle sensor defect
- Does not run ↓

• EHPS board defect

MULTI-DISPLAY - MCS COMMUNICATION SYSTEM WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED

EE-1, 2, 3	Abnormal communication from multi-display

Related portion



Condition for error detection

Output upon detection of communication data abnormality from display.

- **EE-1**

Is F1 error displayed?
- Yes → • See F1 error
- No ↓

Was the battery plug connected when the display is removed?
- Yes → • Connect the display
- No ↓

Does the display turn on upon key switch ON?
- No → Disconnect CN1, CN111-5 (16) b Voltage measurement CN111-13 (14)
  - 14 V or more → • Subharness defect • Display defect
  - Less than 14 V → • DC/MD board defect
- Yes ↓

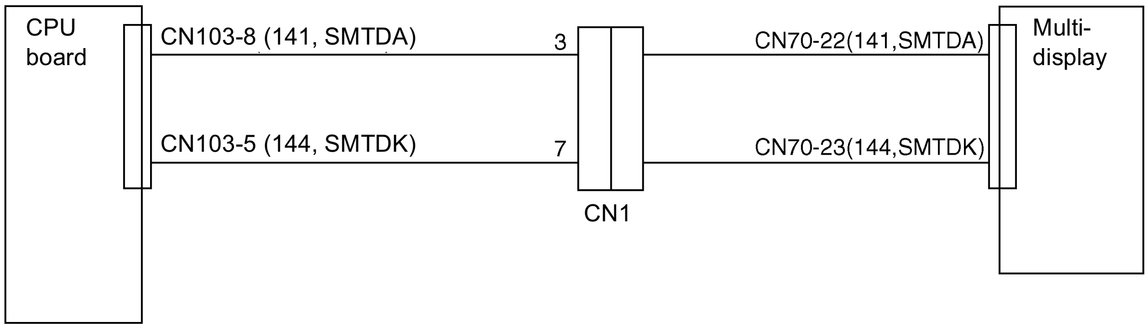
- **EE-2** →

Disconnect battery plug, connect CN1-3 and CN1-8, and CN1-4 and CN1-7 using SST2 x 2.
- Error displayed upon key switch ON → • Main harness defect • CPU board defect
- No error displayed upon key switch ON → • Subharness defect • Display defect

- **EE-3**
  - Reset the tuning value.
  - If EE-3 is displayed frequently, either the CPU board or the display may be defective.

F1-1, 2	Multi-display to MCS communication system abnormality

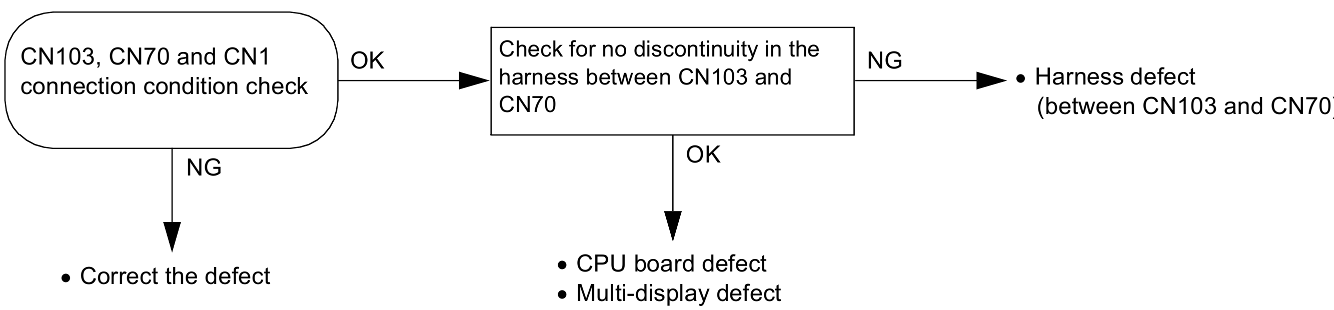
Related portion



Condition for error detection

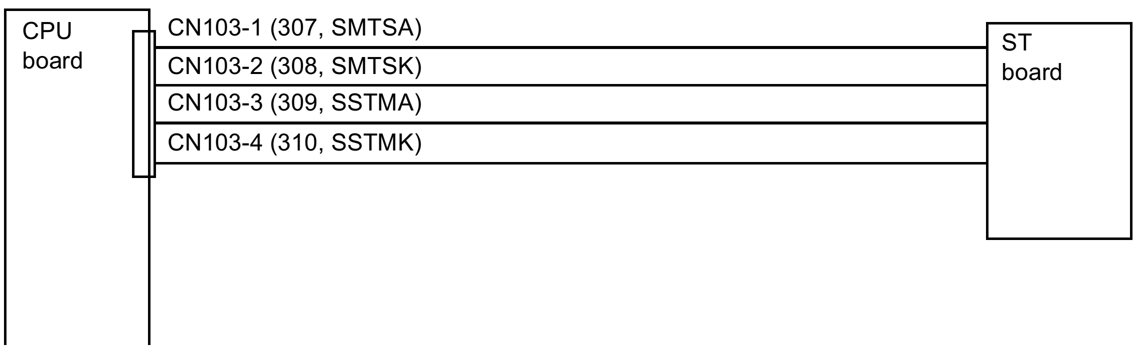
Output when abnormality of communication data from the CPU board is detected.

Other error codes, if any, cannot be displayed because communication from the CPU board is disabled when F1-1 occurs. F1-1 remains on the multi-display screen regardless of key switch ON or OFF.



FE-1, 2	SAS controller → traveling/material handling controller communication abnormality

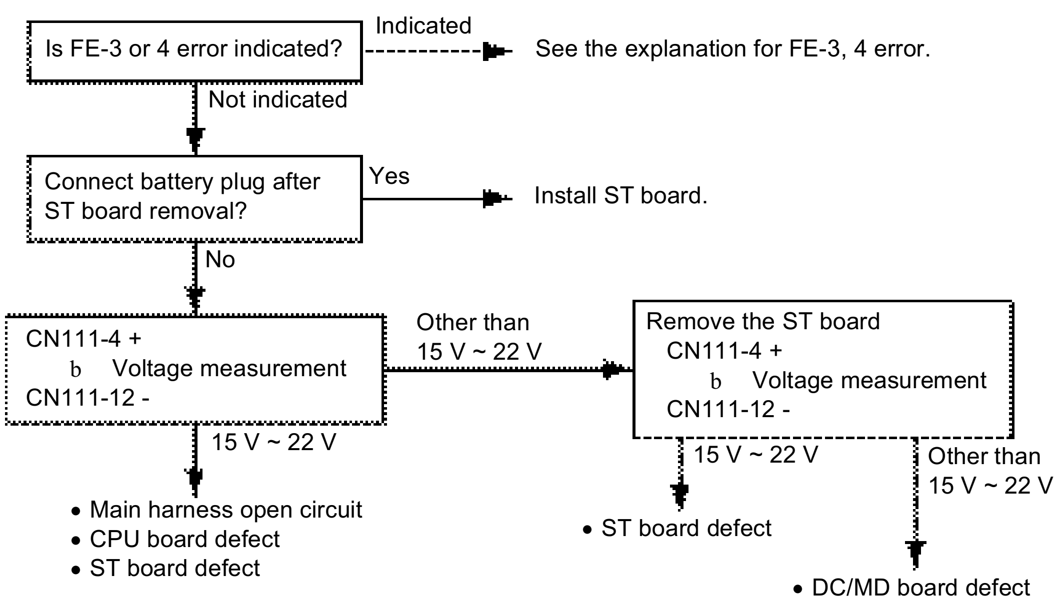
Related portion



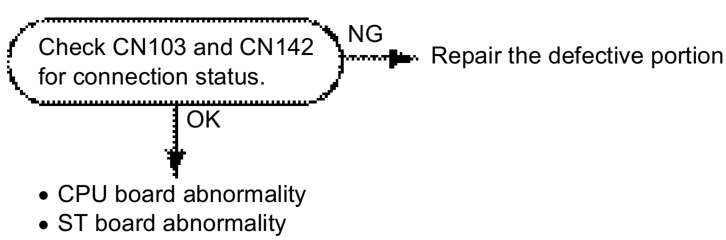
Condition for error detection

Output upon detection of any abnormality in the communication data from the ST board.

• FE-1

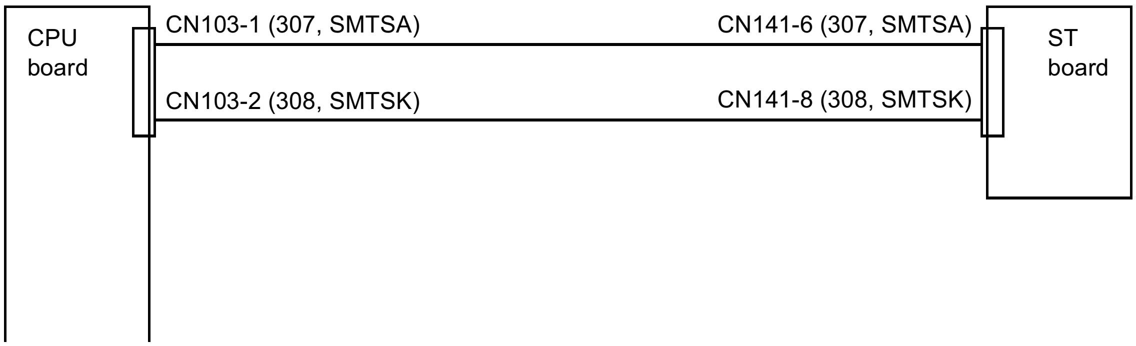


• FE-2



FE-4, 5	**Traveling/material handling controller → SAS controller communication abnormality**

Related portion



Condition for error detection

Output upon no communication within the specified time period or frequent error detection in the received data.

Harness continuity check (discontinuity)
Disconnect battery plug, CN103 and CN141 disconnection, and continuity check
CN103-1 (307) – CN141-6 (307)
CN103-2 (308) – CN141-8 (308)

No continuity (∞ Ω) → Main harness defect (open circuit)

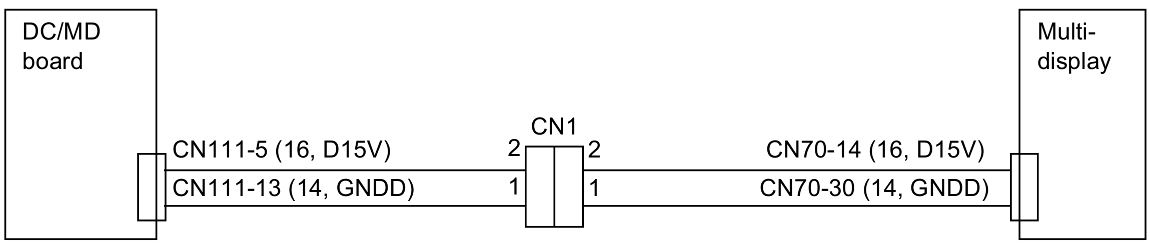
Continuity exists (Less than 20 Ω) →

- CPU board defect
- ST board defect

WHEN NO DIAGNOSIS ERROR CODE IS DISPLAYED

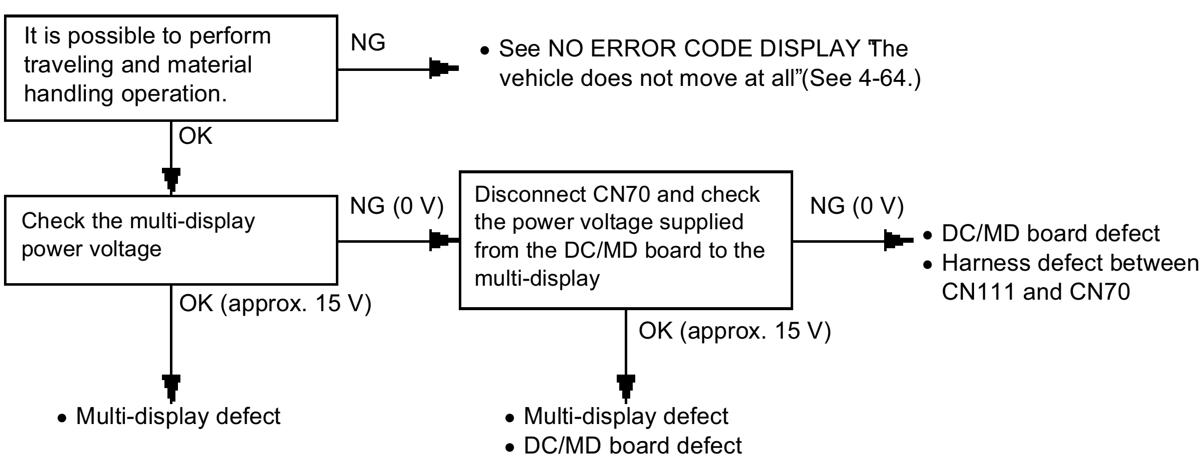
No display on multi-display (no error displayed)

Related portion



Condition for error detection

- No power supply to multi-display.
- Multi-display defect.

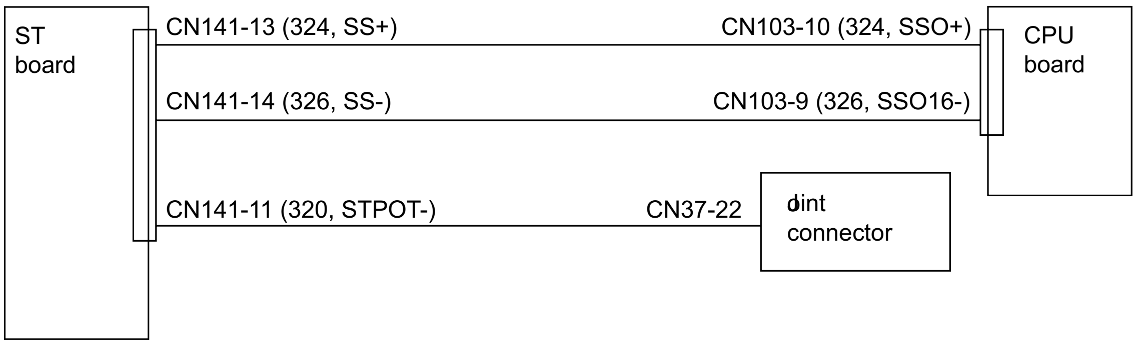


SAS SYSTEM

WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED

51-1	Traveling speed sensor abnormality

Related portion



Condition for error detection

Output if the traveling speed pulse line from the CPU board to the ST board is disconnected.

ST board voltage check
CN141-13 (324) (+) – CN141-11 (320) (-)
CN141-14 (326) (+) – CN141-11 (320) (-)

CN141-13: approx. 1 V
CN141-14: approx. 0 V
→ • ST board defect

CN141-13: other than approx. 1 V
CN141-14: other than approx. 0 V
↓

Harness continuity check (open circuit)
Disconnect battery plug, disconnect CN141 and CN103, for continuity check.
CN141-13 (324) – CN103-10 (324)
CN141-14 (326) – CN103-9 (326)

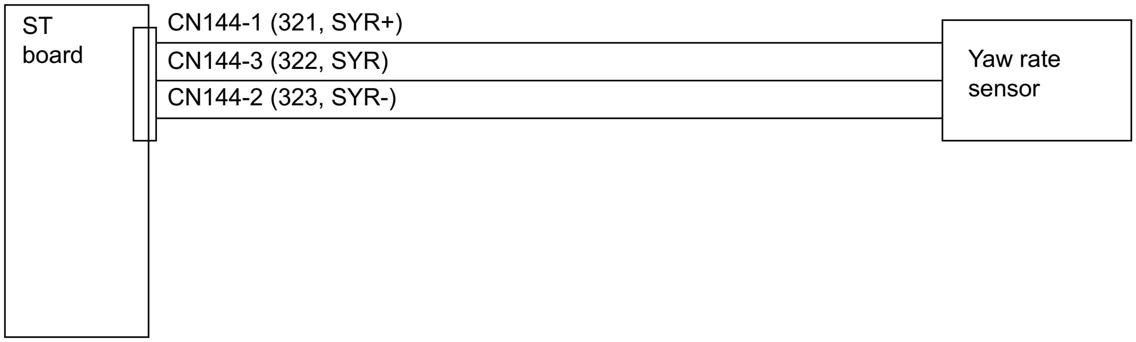
No continuity (∞ Ω) → • Main harness defect

Continuity exists (less than 20 Ω)
↓

- CPU board defect
- ST board defect

52-1, 2, 3	Yaw rate sensor abnormality

Related portion

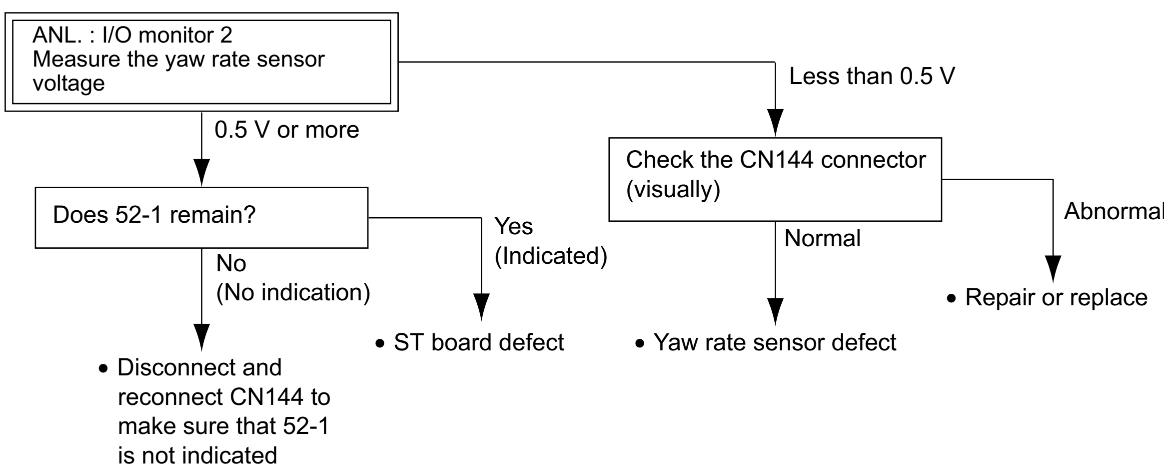


Condition for error detection

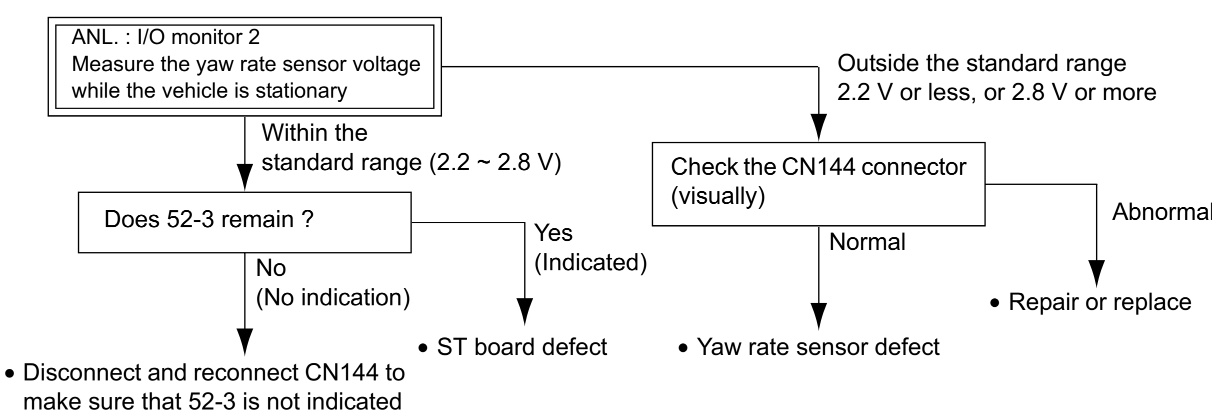
Output if the yaw rate sensor output voltage is outside the standard range (open or short circuit), or if the yaw rate sensor output voltage while the vehicle is stationary is outside the standard range (neutral voltage).

52-1 Yaw rate sensor open-circuit defect
52-2 Yaw rate sensor short-circuit defect
52-3 Yaw rate sensor neutral voltage defect

- **52-1, 2**

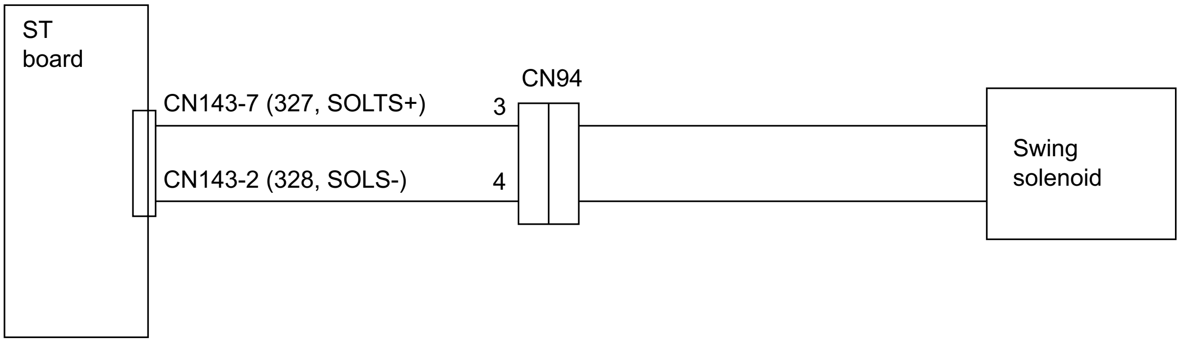


- **52-3**



54-1, 2	Swing solenoid abnormality

Related portion



Condition for error detection

Output upon detection of open or short circuit of the swing solenoid line.
54-1 Swing solenoid open-circuit defect
54-2 Swing solenoid OCL defect

- **54-1**

Disconnect CN143 and measure solenoid resistance.
CN143-7 (327)
b Resistance measurement
CN143-2 (328)

→ 5.5 ± 1 Ω (at 25°C) → • ST board defect

↓ Other than 5.5 ± 1 Ω (at 25°C)

Disconnect battery plug.
Disconnect CN94
CN94-3 (327)
b Resistance measurement
CN94-4 (328)

→ 5.5 ± 1 Ω (at 25°C) → • Main harness defect

↓ Other than 5.5 ± 1 Ω (at 25°C)

- Sub-harness defect
- Swing solenoid defect

- **54-2**

Disconnect battery plug.
Disconnect CN94

↓

Battery plug connected and key switch ON

→ 54-1 → • Sub-harness defect • Swing solenoid defect

↓ 54-2

Disconnect battery plug.
Disconnect CN143 and measure solenoid resistance.
CN143-7 (327)
b Resistance measurement
CN143-2 (328)

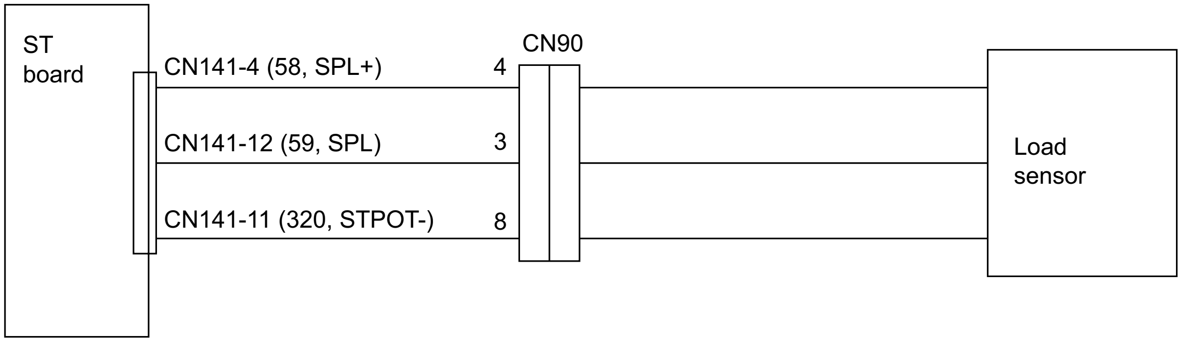
→ 3 Ω or more → • Main harness defect

↓ 3 Ω or more

- ST board defect

61-1, 2	Load sensor abnormality

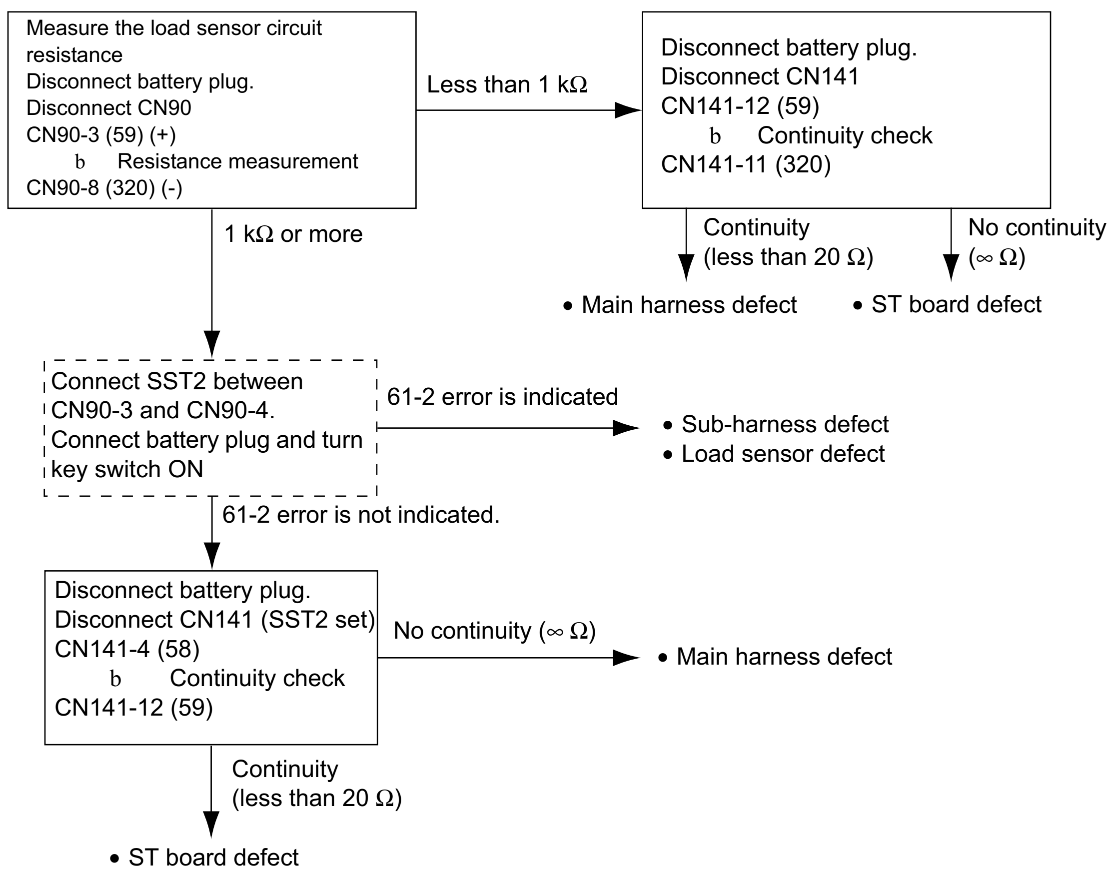
Related portion



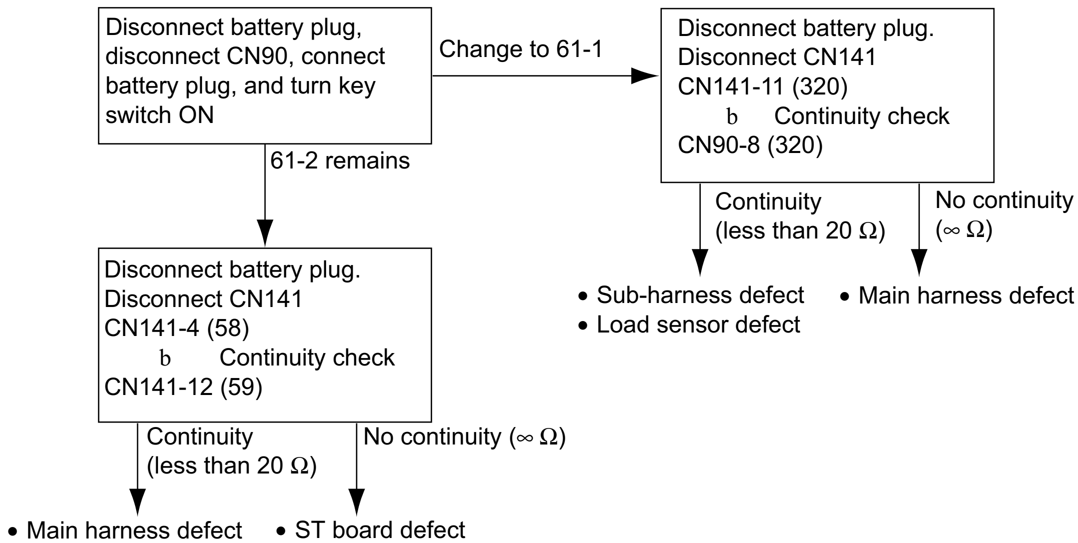
Condition for error detection

Output if the load sensor output voltage is outside the standard range.
61-1 Load sensor open-circuit defect
61-2 Load sensor short-circuit defect

- **61-1**

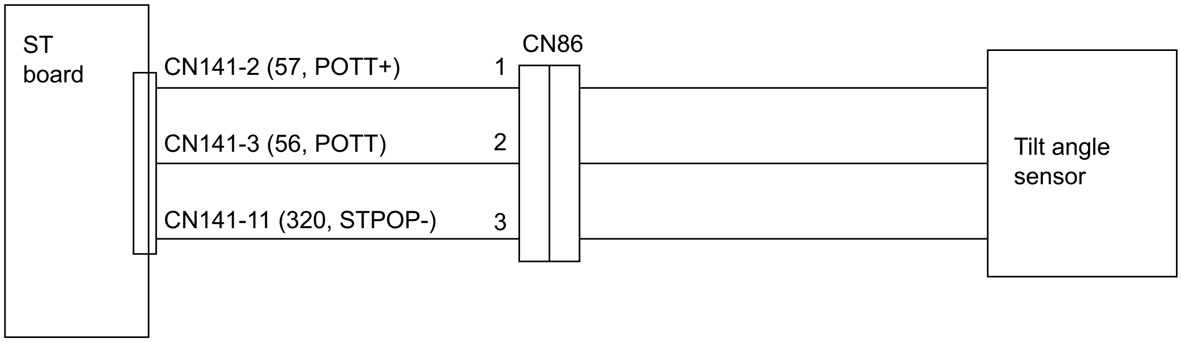


- **61-2**


Disconnect battery plug, disconnect CN90, connect battery plug, and turn key switch ON
Change to 61-1
61-2 remains
Disconnect battery plug. Disconnect CN141 CN141-11 (320) b Continuity check CN90-8 (320)
Continuity (less than 20 Ω)
No continuity (∞ Ω)
• Sub-harness defect
• Load sensor defect
• Main harness defect
Disconnect battery plug. Disconnect CN141 CN141-4 (58) b Continuity check CN141-12 (59)
Continuity (less than 20 Ω)
No continuity (∞ Ω)
• Main harness defect
• ST board defect

62-1, 2	Tilt angle sensor abnormality

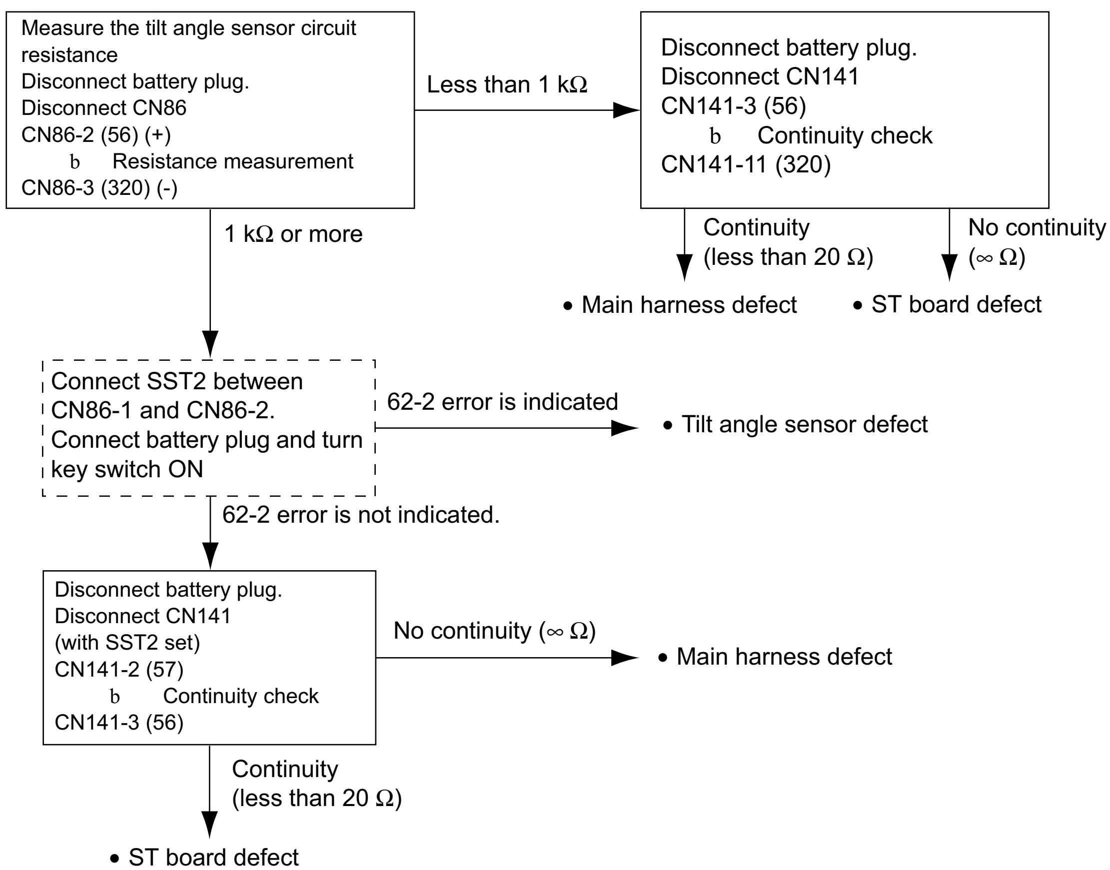
Related portion



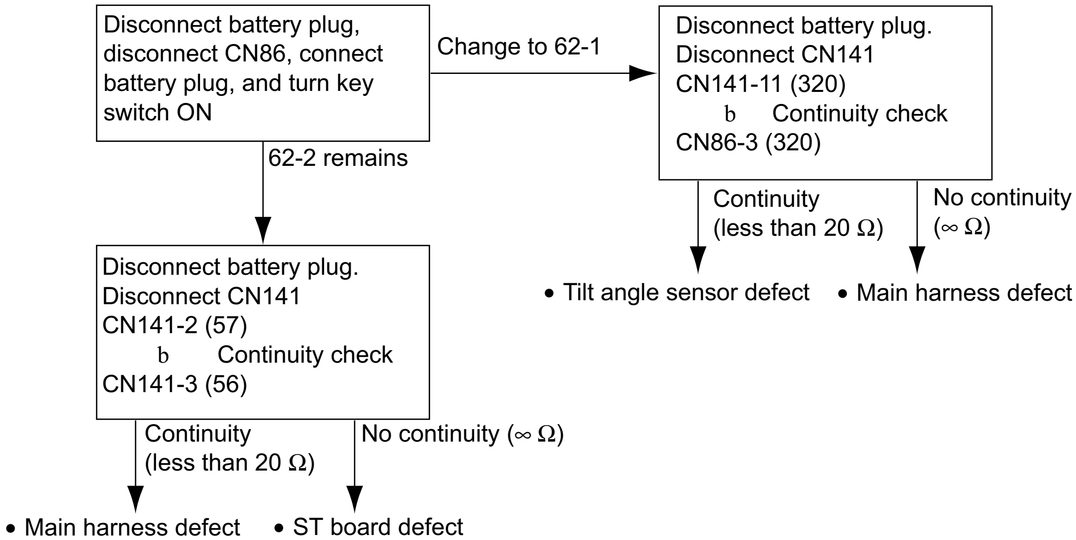
Condition for error detection

Output if the tilt angle sensor output voltage is outside the standard range.
62-1 Tilt angle sensor open-circuit defect
62-2 Tilt angle sensor short-circuit defect

- **62-1**

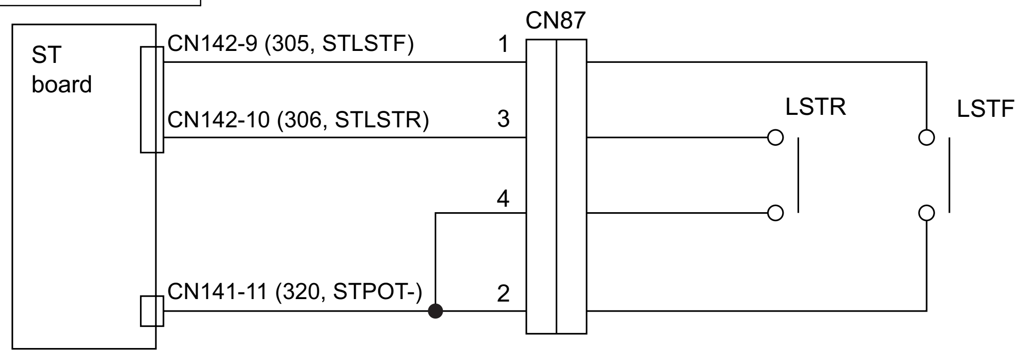


- **62-2**


Disconnect battery plug, disconnect CN86, connect battery plug, and turn key switch ON
Change to 62-1
Disconnect battery plug. Disconnect CN141 CN141-11 (320) b Continuity check CN86-3 (320)
Continuity (less than 20 Ω)
No continuity (∞ Ω)
• Tilt angle sensor defect
• Main harness defect
62-2 remains
Disconnect battery plug. Disconnect CN141 CN141-2 (57) b Continuity check CN141-3 (56)
Continuity (less than 20 Ω)
No continuity (∞ Ω)
• Main harness defect
• ST board defect

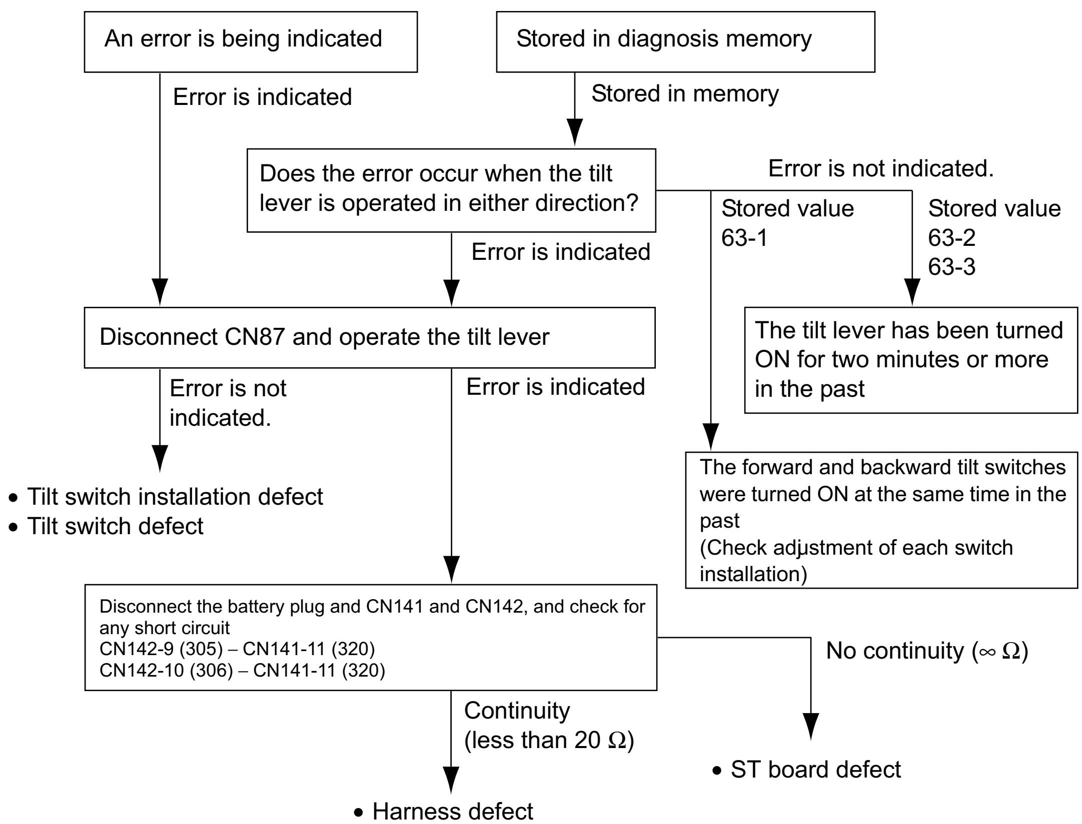
63-1, 2, 3	Tilt switch abnormality

Related portion



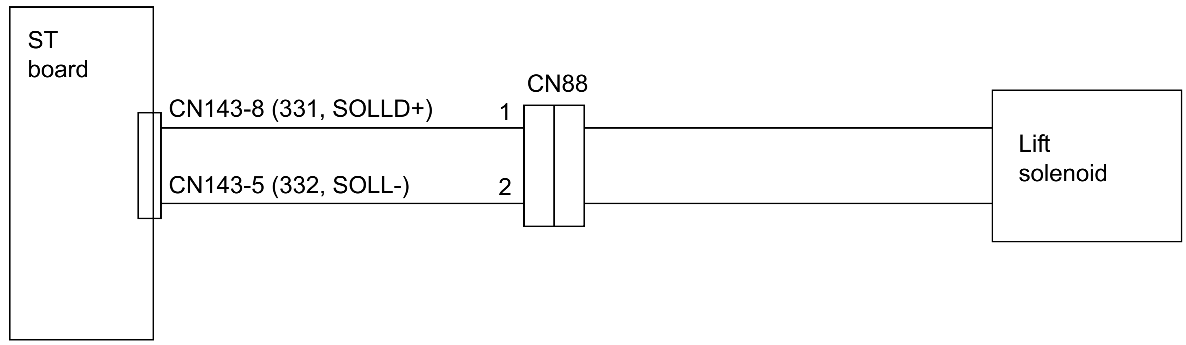
Condition for error detection

Output if the tilt switch input line is shorted.
63-1 Simultaneous tilt switch ON defect
63-2 Forward tilt switch short-circuit defect
63-3 Backward tilt switch short-circuit defect



64-1, 2	Lift solenoid abnormality

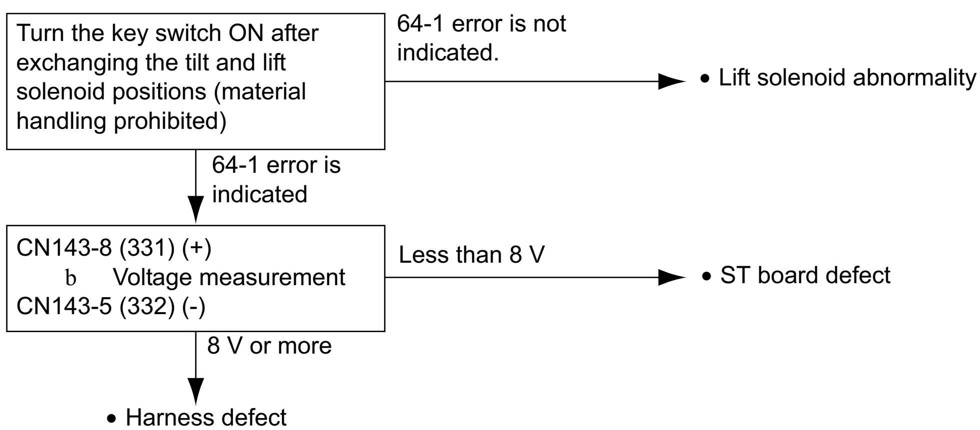
Related portion



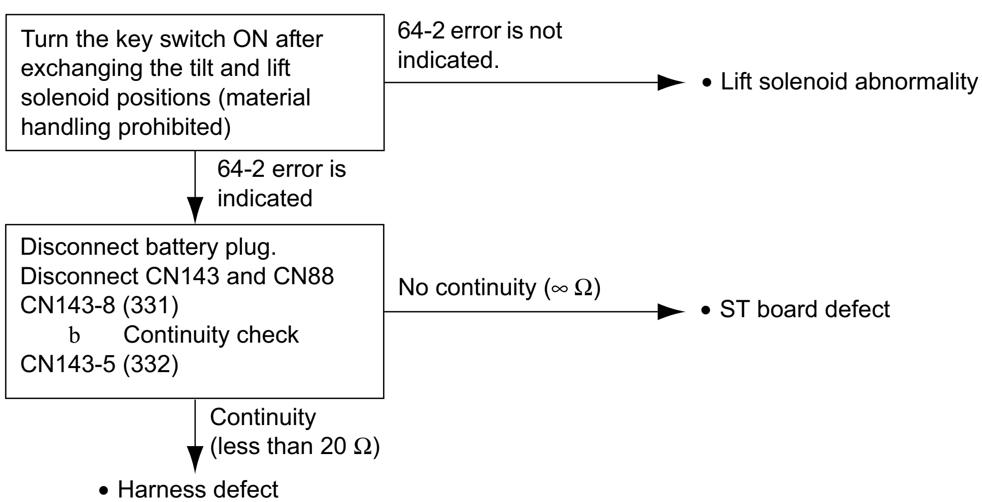
Condition for error detection

Output if the lift solenoid line from the ST board to the lift solenoid is open or shorted.
64-1 Lift solenoid open-circuit defect
64-2 Lift solenoid OCL defect

• 64-1

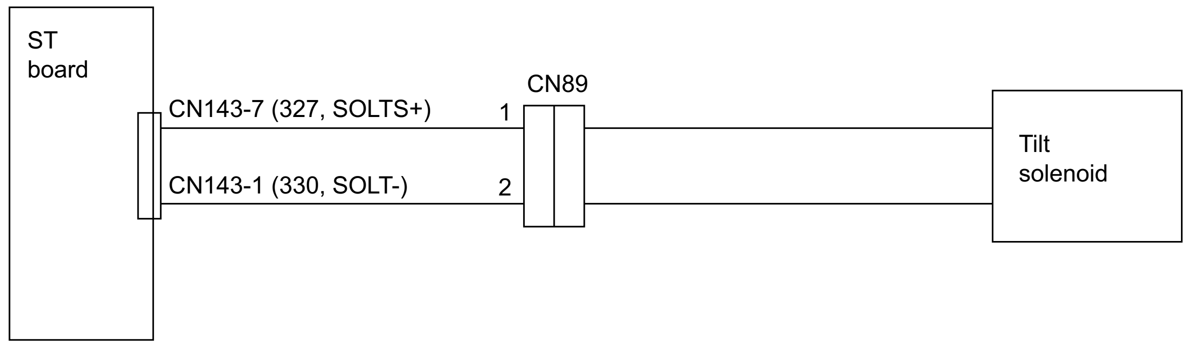


• 64-2



65-1, 2	Tilt solenoid abnormality

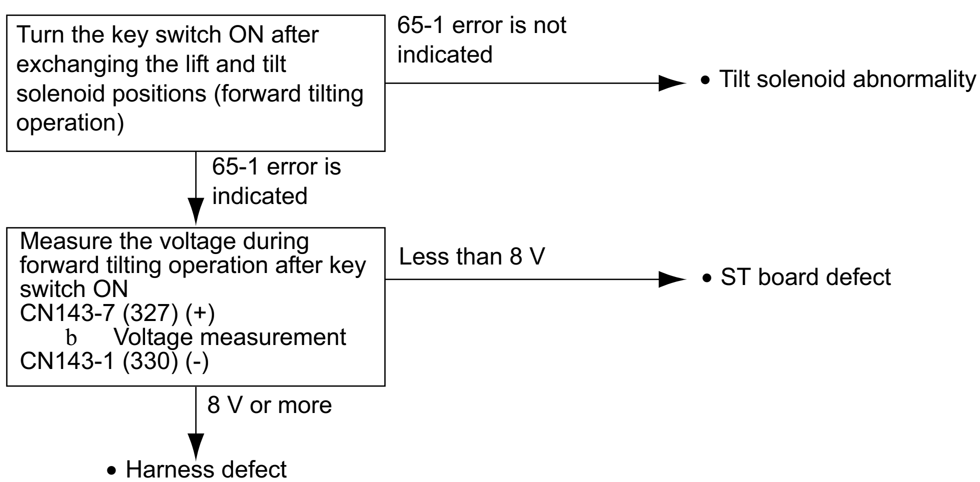
Related portion



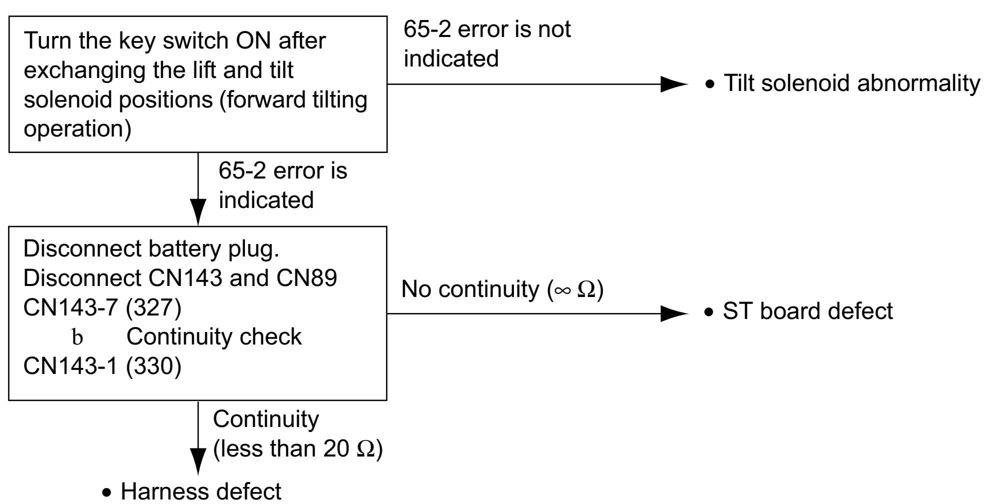
Condition for error detection

Output if the tilt solenoid line from the ST board to the tilt solenoid is open or shorted.
65-1 Tilt solenoid open-circuit defect
65-2 Tilt solenoid OCL defect

- **65-1**

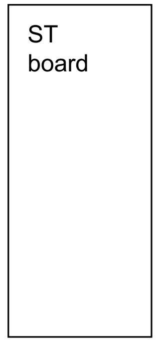


- **65-2**



66-1	Tilt matching value abnormality

Related portion



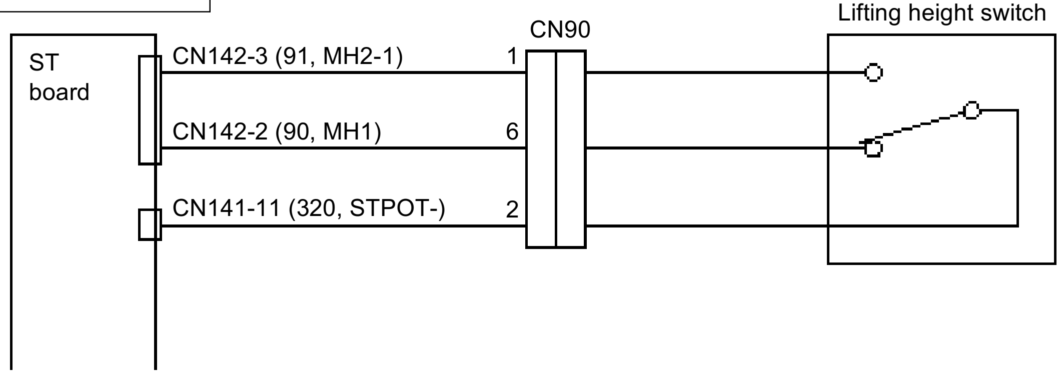
Condition for error detection

Output if any of the tilt neutral position angle, forward tilt angle or pressure sensor matching values is outside the standard range.

- To correct , replace the ST board.

67-1	Lifting height switch abnormality

Related portion



Condition for error detection

Output if the lifting height switch line from the ST board to the lifting height switch is open or shorted.

Check if an error is detected when the mast is fully lowered

- 67-1 error is not indicated. → Check if an error is detected when the mast is fully raised
- 67-1 error is indicated →

Check continuity after disconnecting the battery plug and CN90 (switch: low lifting height)
CN90-2 (320) – CN90-6 (90)
[OK] Continuity, [NG] No continuity
CN90-2 (320) – CN90-1 (91)
[OK] No continuity, [NG] Continuity

- NG → • Sub-harness defect • Lifting height switch defect
- OK → ANL. : I/O MONITOR 3

Check if an error is detected when the mast is fully raised

- 67-1 error is indicated →

Check continuity after disconnecting the battery plug and CN90 (switch: high lifting height)
CN90-2 (320) ~ CN90-6 (90)
[OK] No continuity, [NG] Continuity
CN90-2 (320) ~ CN90-1 (91)
[OK] Continuity, [NG] No continuity

- OK → ANL. : I/O MONITOR 3
- NG → • Sub-harness defect • Lifting height switch defect

ANL. : I/O MONITOR 3
Check the switch input value (with CN90 and battery plug connected)

- MH1 or MH2-1 indication MH:00 (both OFF) →

Disconnect battery plug, disconnect CN90 and CN142, for continuity check.
CN142-3 (91) – CN90-1 (91)
CN142-2 (90) – CN90-6 (90)
CN141-11 (320) – CN90-2 (320)

- Continuity → • ST board defect
- No continuity → • Harness defect

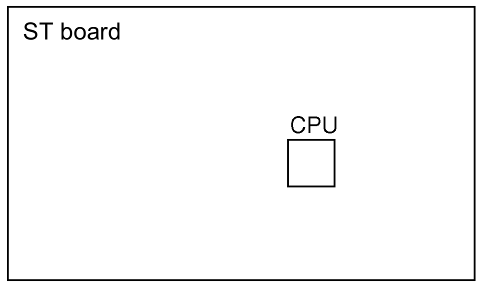
- MH1 or MH2-1 indication MH:11 (both ON) →

Disconnect battery plug, disconnect CN90 and CN142, for continuity check.
CN142-3 (91) – CN90-2 (320)
CN142-2 (90) – CN90-2 (320)
CN142-3 (91) – CN90-6 (90)

- Continuity → • Harness defect
- No continuity → • ST board defect

AF-5, 6, 7, 8	**ST board CPU abnormality**

Related portion



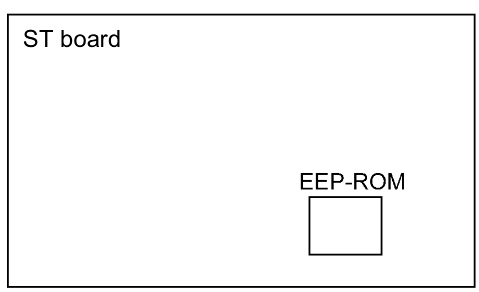
Condition for error detection

Output when an error is detected in ST board CPU inspection or the sensor input processing does not end. When this code is output, the CPU is reset.

- If AF-5, AF-6, AF-7 or AF-8 is displayed, replace the ST board.

EF-5, 6	**ST board EEP-ROM abnormality**

Related portion



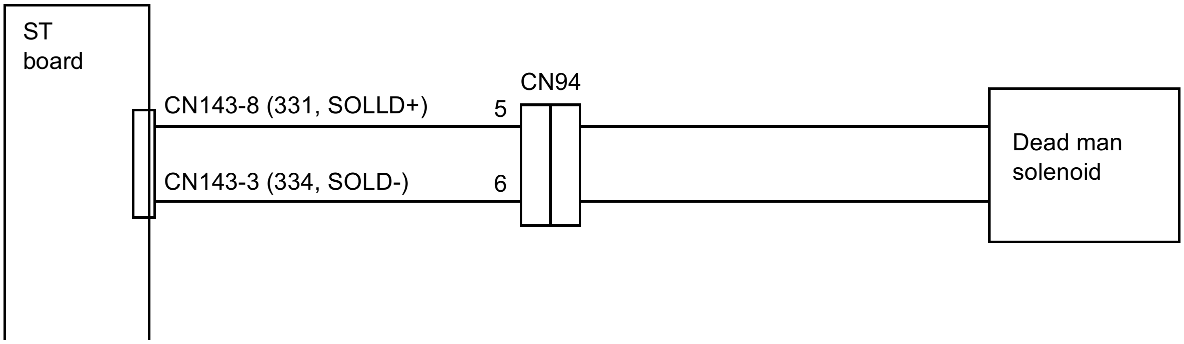
Condition for error detection

Output when access to the EEP-ROM on the ST board is disabled.

- If EF-5 or EF-6 is displayed, replace the ST board.

G4-1, 2	Deadman solenoid abnormality

Related portion



Condition for error detection

Output if the deadman solenoid line from the ST board to the deadman solenoid is open or shorted.
G4-1 Deadman solenoid open-circuit defect
G4-2 Deadman solenoid OCL defect

- **G4-1**

Is the deadman brake equipped?

Without deadman brake → Check option setting → Option setting is Y → Correct option setting to N

With deadman brake ↓

Disconnect battery plug.
Disconnect CN143 and measure solenoid resistance.
CN143-8 (331)
b Resistance measurement
CN143-3 (334)

11.8 ± 1 Ω (at. 20°C) → • ST board defect

Other than 11.8 ± 1 Ω (at. 20°C) ↓

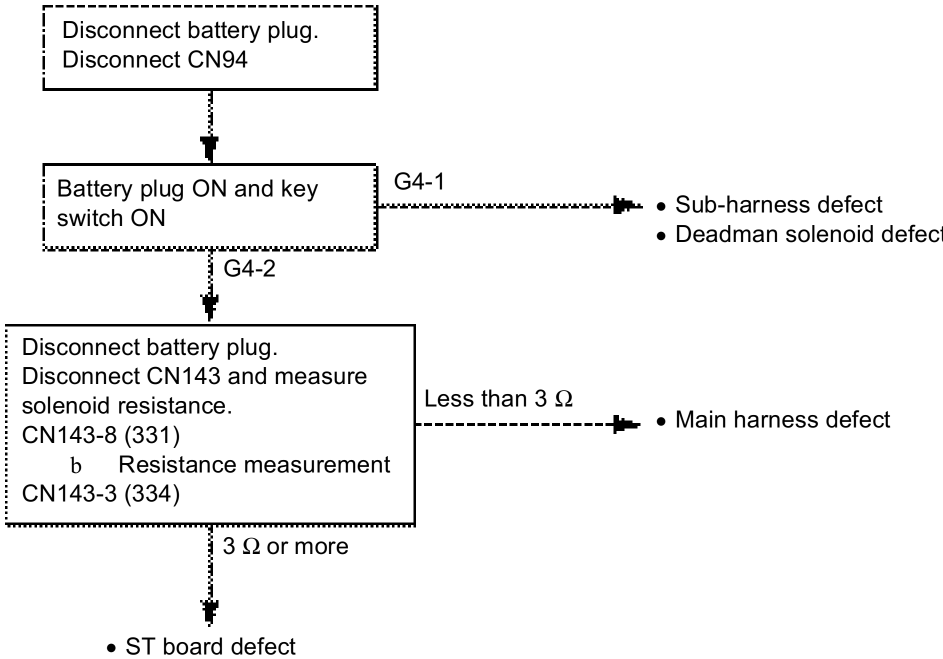
Disconnect battery plug.
Disconnect CN94
CN94-5(331)
b Resistance measurement
CN94-6(334)

11.8 ± 1 Ω (at. 20°C) → • Main harness defect

Other than 11.8 ± 1 Ω (at. 20°C) ↓

- Sub-harness defect
- Swing solenoid defect

- **G4-2**


Disconnect battery plug.
Disconnect CN94
Battery plug ON and key switch ON
G4-1
• Sub-harness defect
• Deadman solenoid defect
G4-2
Disconnect battery plug.
Disconnect CN143 and measure solenoid resistance.
CN143-8 (331)
b Resistance measurement
CN143-3 (334)
Less than 3 Ω
• Main harness defect
3 Ω or more
• ST board defect

WHEN NO ERROR CODE IS DISPLAYED

Stability not provided during traveling (-Locking hardly or not provided during traveling)

Hasn't any tire burst?

NG → • Tire burst.

OK ↓

Visually inspect for damages on the lock cylinder and pin.

NG → • Lock cylinder component failure.

OK ↓

ANL : ACTIVE TEST ACT-3 SSOL
Make sure that the rear axle does not swing when a front wheel goes over a step after swing SOL OFF.

NG → • Failure such as lock cylinder internal leak, leak of operation oil to the outside, or solenoid sticking.

OK ↓

ANL : Diag memory
Is the error code recorded?

Yes → Is there any current error in the record?

- Yes → • Go to that error code.
- No → (return to main flow)

No ↓

ANL : I/O MONITOR 2 I/O2-6 SPD (S)
Does the speed value change according to the traveling speed?

NG → • Speed sensor defect

OK ↓

ANL : I/O MONITOR 2 I/O2-7 YAW
(1) Is the yaw rate sensor voltage change normal upon accelerated swing along a circle with an approximately 2-meter radius? (Inspect the right and left, respectively.)
(2) Make sure that the lock lamp is not lit when the fork is lowered and the speed is gradually increased simply. (Fork height: 500 mm (19.7 in) or lower)

NG → • Yaw rate sensor defect

OK ↓

ANL : I/O MONITOR 3 I/O3-5 MH
Inspect the lifting height switch function
(ON/OFF of MH1 and MH2-1)

[OK]
Low lifting height MH-1 : ON, MH2-1 : OFF
Displayed code MH : 10
High lifting height MH-1 : OFF, MH2-1 : ON
Displayed code MH : 01
[NG] Other than above

NG → • Lifting height switch defect

OK ↓

Can the mast be tilted to the forward-most position with a large lifting height and without load (excluding relief)? Does the mast stop at an approximately 1 degree front tilted position when the fork is at the upper-most position with no-load relief?

NG → • Load sensor defect

OK ↓

• ST controller defect

**Swing lock always occurs during traveling or loarding work.
Or swing lock frequently occurs.**

Lock is always maintained (bracing kept) and the rear axle does not swing when the vehicle goes over a step although the swing lock indicator is not lit.

Yes → • Failure such as lock cylinder solenoid valve sticking or clogging.

No ↓

ANL : I/O MONITOR 2 I/O2-7 YAW
(1) Is the yaw rate sensor voltage change normal upon accelerated swing along a circle with an approximately 2-meter radius? (Inspect the right and left, respectively.)
(2) Make sure that the swing lock indicator is not lit when the fork is lowered and the speed is gradually increased simply. (Fork height: 500 mm (19.7 in) or lower).

NG → • Yaw rate sensor abnormality.

OK ↓

ALL : I/O MONITOR 3 I/O3-5 MH
Inspect the lifting height switch function
(ON/OFF of MH1 and MH2)

[OK]
Low lifting height MH-1 : ON, MH2-1 : OFF
Displayed code MH : 10
High lifting height MH-1 : OFF, MH2-1 : ON
Displayed code MH : 01
[NG] Other than above

NG → • Lifting height switch defect

OK ↓

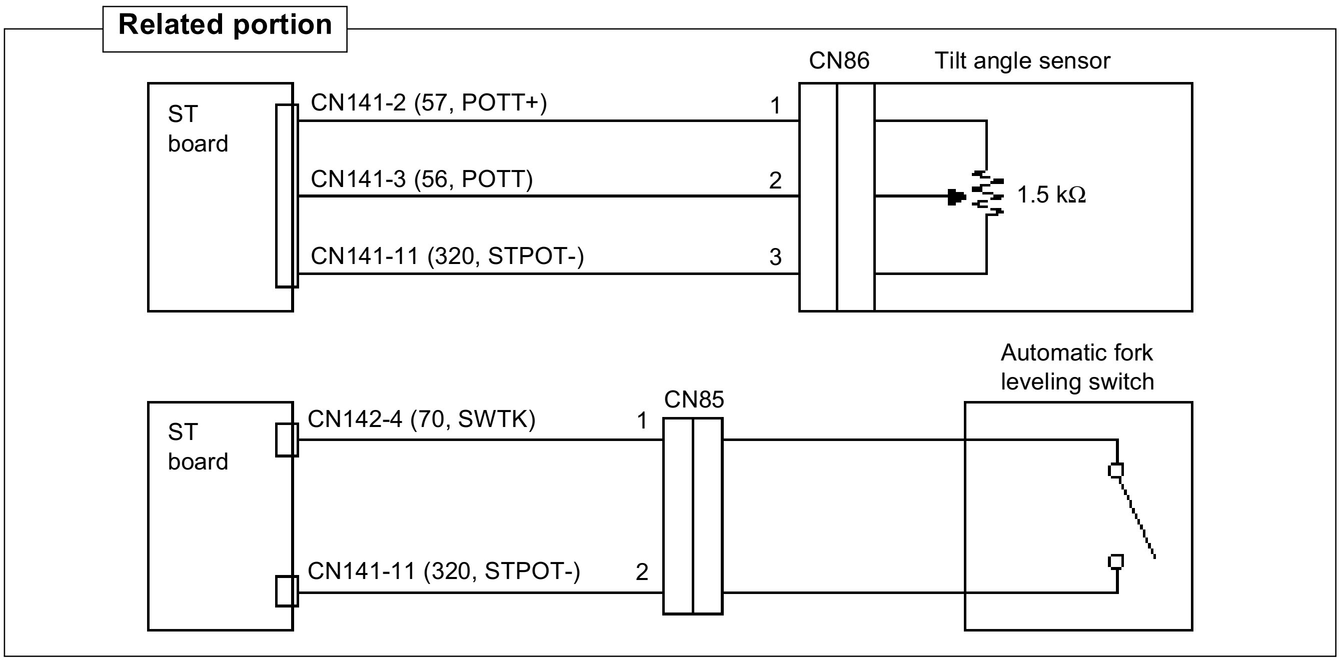
Can the mast be tilted to the forward-most position with a large lifting height and without load (excluding relief)? Does the mast stop at an approximately 1 degree front tilted position when the fork is at the upper-most position with no-load relief?

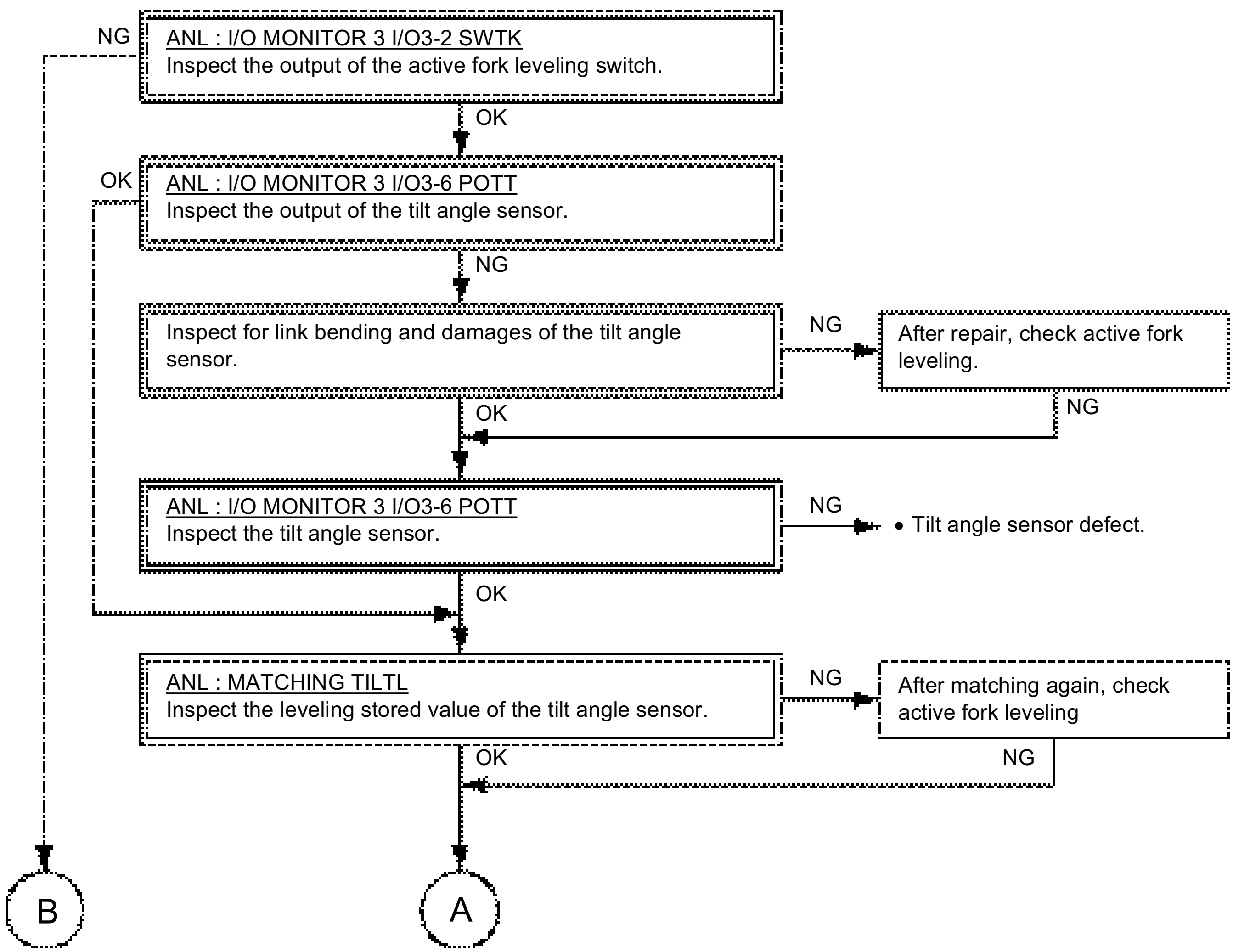
NG → • Load sensor abnormality.

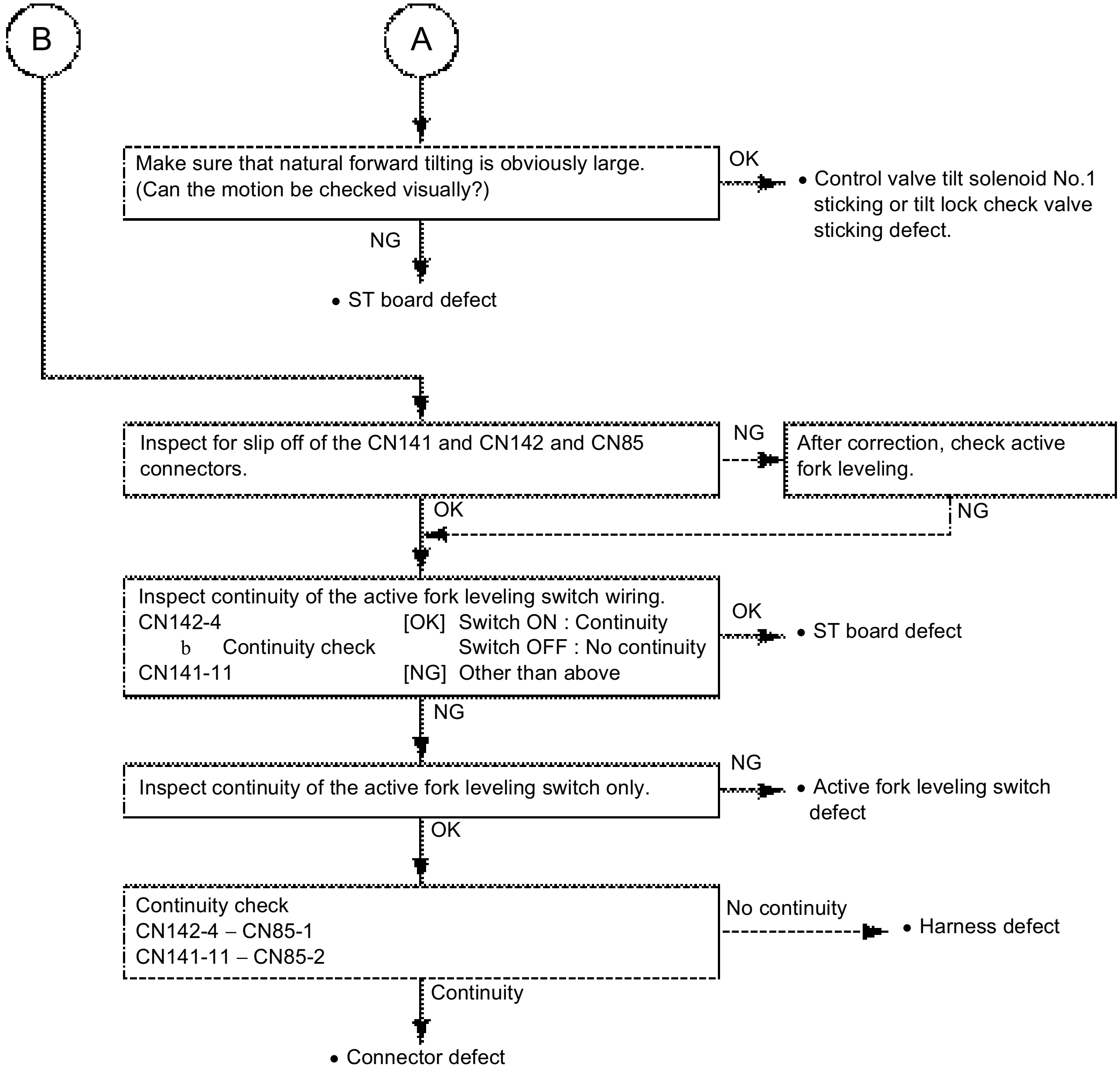
OK ↓

• ST controller defect

Stopping with automatic leveling fails. (Does not stop at a horizontal position but tilts at the forward-most position.)

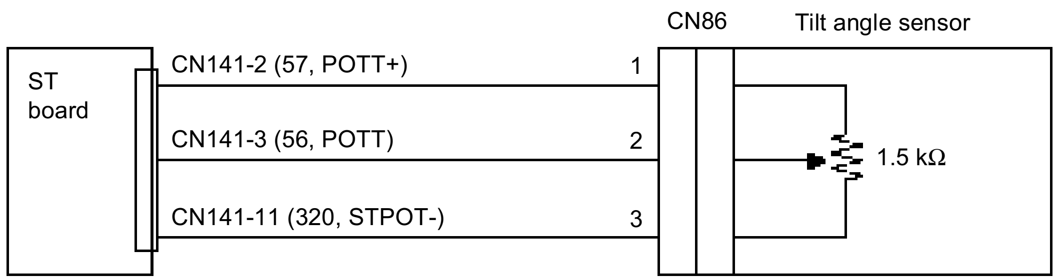





B
A
Make sure that natural forward tilting is obviously large.
(Can the motion be checked visually?)
OK
• Control valve tilt solenoid No.1 sticking or tilt lock check valve sticking defect.
NG
• ST board defect
Inspect for slip off of the CN141 and CN142 and CN85 connectors.
NG
After correction, check active fork leveling.
OK
NG
Inspect continuity of the active fork leveling switch wiring.
CN142-4
b Continuity check
CN141-11
[OK] Switch ON : Continuity
Switch OFF : No continuity
[NG] Other than above
OK
• ST board defect
NG
Inspect continuity of the active fork leveling switch only.
NG
• Active fork leveling switch defect
OK
Continuity check
CN142-4 – CN85-1
CN141-11 – CN85-2
No continuity
• Harness defect
Continuity
• Connector defect

Active fork leveling is not provided. (Stops at a non-horizontal position.)

Related portion



Inspect for link bending and damages of the tilt angle sensor.

NG → After repair, check active fork leveling. (NG → next step)

OK ↓

<u>ANL : I/O MONITOR I/O3-6 POTT</u>
Inspect the tilt angle sensor.

NG → • Tilt angle sensor defect.

OK ↓

<u>ANL : MATCHING TILTL</u>
Inspect the stored leveling value of the tilt angle sensor.

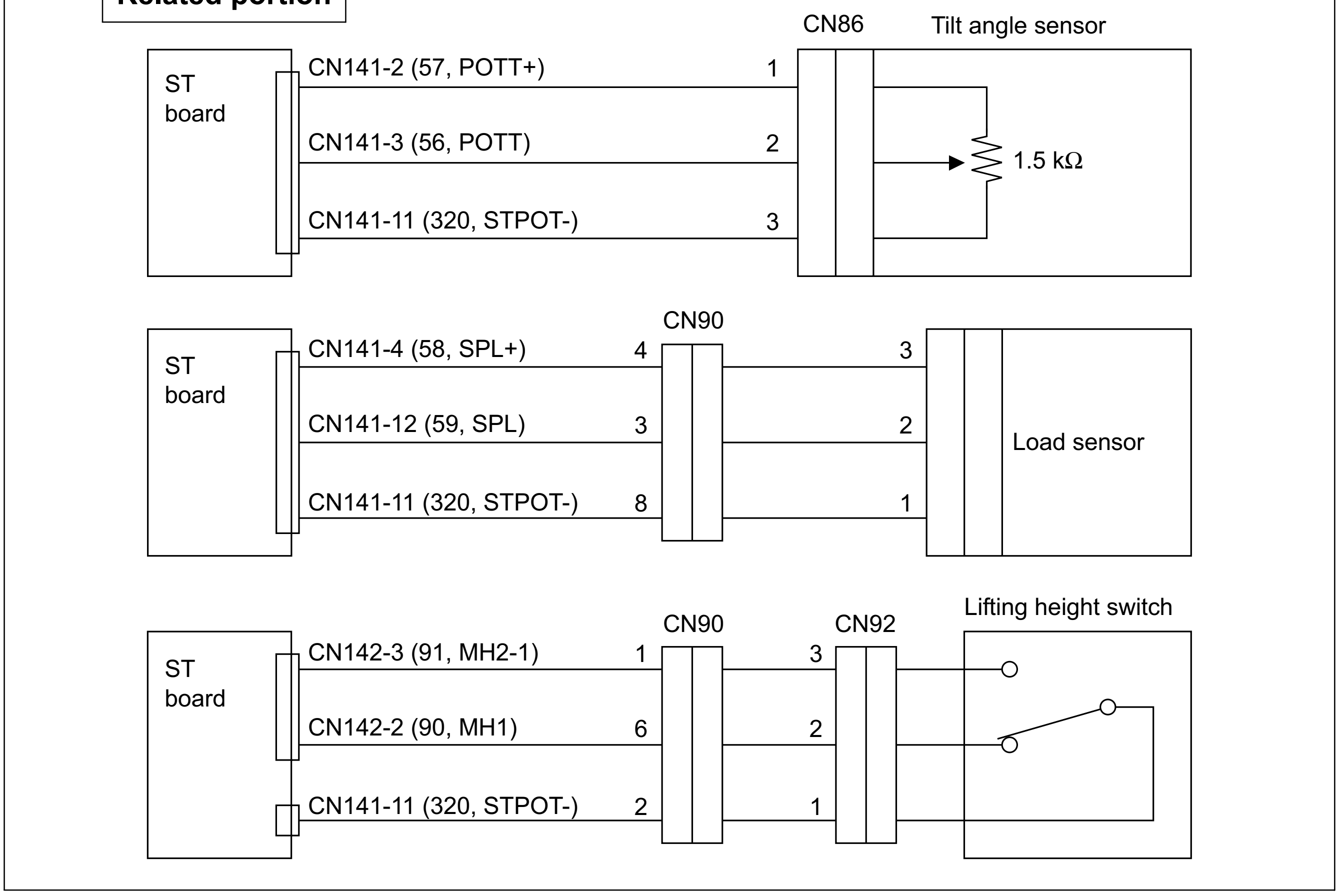
NG → After matching again, check active fork leveling. (NG → next step)

OK ↓

• ST board defect

Active fork leveling is not provided. (Stops at a position when the knob switch is pressed.)

Related portion



Make sure that active fork leveling is possible with a fork lifting height of approximately 500 mm (19.6 in) and approximately 500 mm (19.6 in) without load.
- OK → A
- NG ↓

Make sure that active fork leveling is possible with a fork lifting height of approximately 500 mm (19.6 in) and approximately 500 mm (19.6 in) with a load on the fork.
- OK → ST board defect
- NG ↓

Check if automatic leveling is possible at a high position without any load.
- OK → ST board defect
- NG ↓

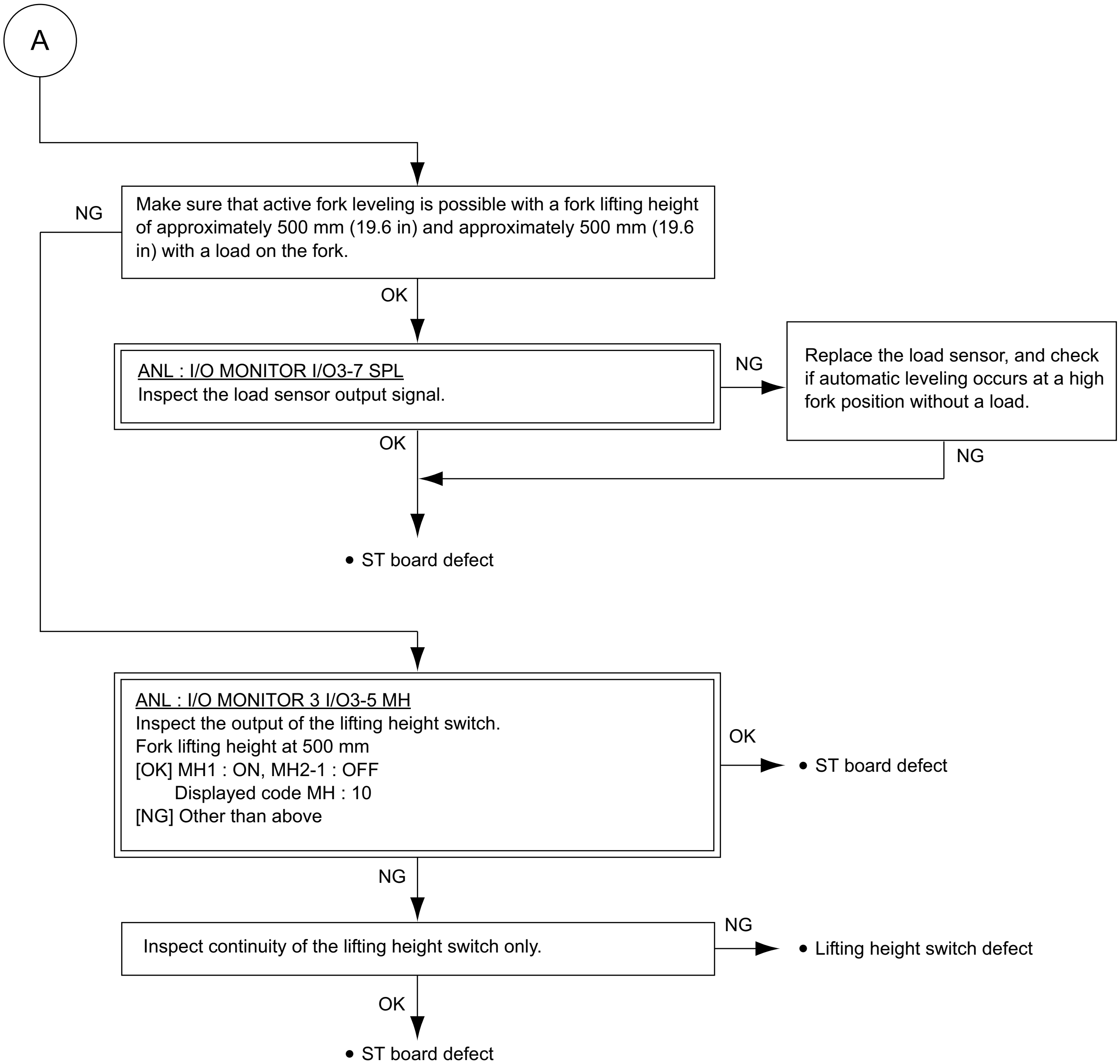
Inspect for link bending and damages of the tilt angle sensor.
- NG → After repair, check active fork leveling (NG ↓)
- OK ↓

<u>ANL : I/O MONITOR I/O3-6 POTT</u>
Inspect the tilt angle sensor.
- NG → • Tilt angle sensor defect.
- OK ↓

<u>ANL : MATCHING TILTL</u>
Inspect the stored leveling value of the tilt angle sensor.
- NG → After matching again, check active fork leveling (NG ↓)
- OK ↓

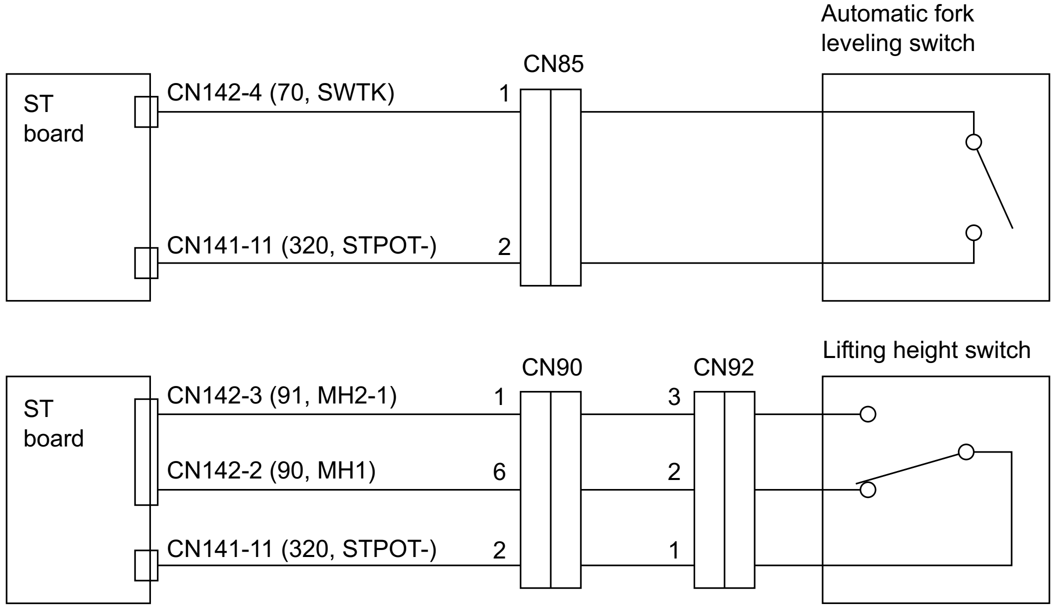
• ST board defect

A


A
Make sure that active fork leveling is possible with a fork lifting height of approximately 500 mm (19.6 in) and approximately 500 mm (19.6 in) with a load on the fork.
NG
OK
ANL : I/O MONITOR I/O3-7 SPL
Inspect the load sensor output signal.
NG
Replace the load sensor, and check if automatic leveling occurs at a high fork position without a load.
OK
NG
• ST board defect
ANL : I/O MONITOR 3 I/O3-5 MH
Inspect the output of the lifting height switch.
Fork lifting height at 500 mm
[OK] MH1 : ON, MH2-1 : OFF
Displayed code MH : 10
[NG] Other than above
OK
• ST board defect
NG
Inspect continuity of the lifting height switch only.
NG
• Lifting height switch defect
OK
• ST board defect

The active mast rear tilt speed is not regulated, or the backward tilting speed is always slow.

Related portion



ANL : I/O MONITOR I/O3-2 SWTK
Inspect the output signal of the active fork leveling switch.

- OK → A
- NG ↓

Inspect for slip off of the CN141 and CN142 and CN85 connectors.

- OK → After correction, check the backward tilting speed. (NG → return to next step)
- OK ↓

Inspect continuity of the active fork leveling switch wiring.
CN142-4 b Continuity check CN141-11
[OK] Switch ON : Continuity
Switch OFF : No continuity
[NG] Other than above

- OK → • ST board defect
- NG ↓

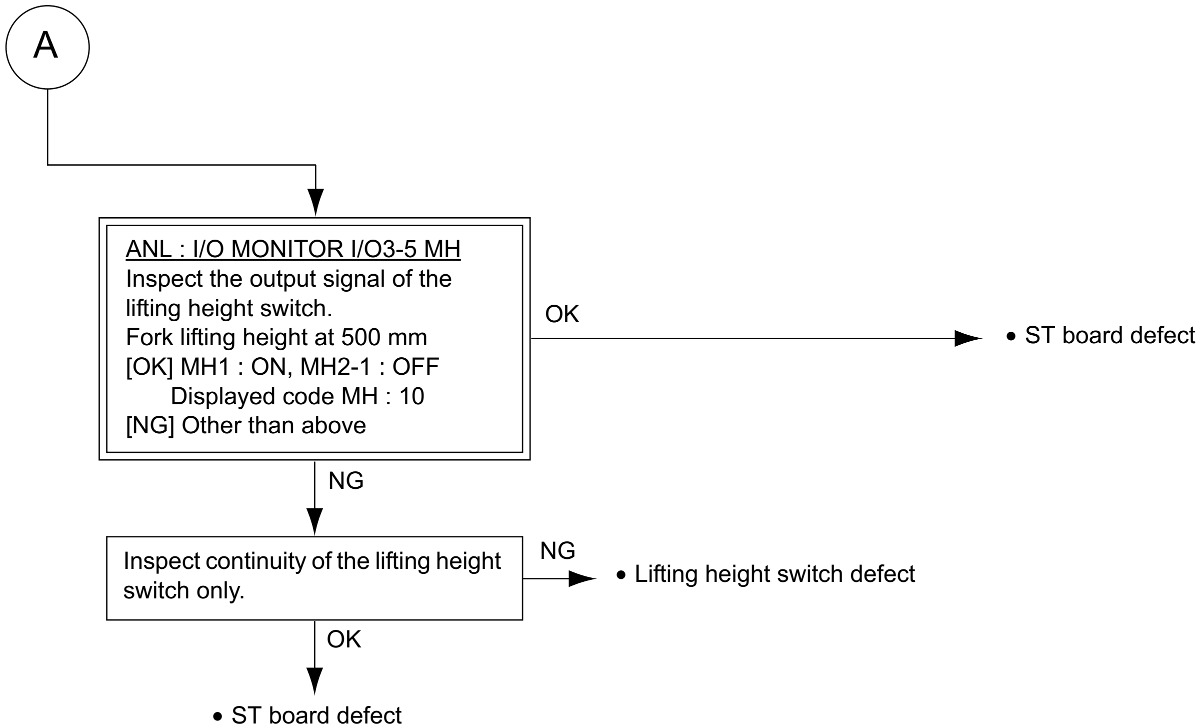
Inspect continuity of the active fork leveling switch only.

- NG → • Active fork leveling switch defect
- OK ↓

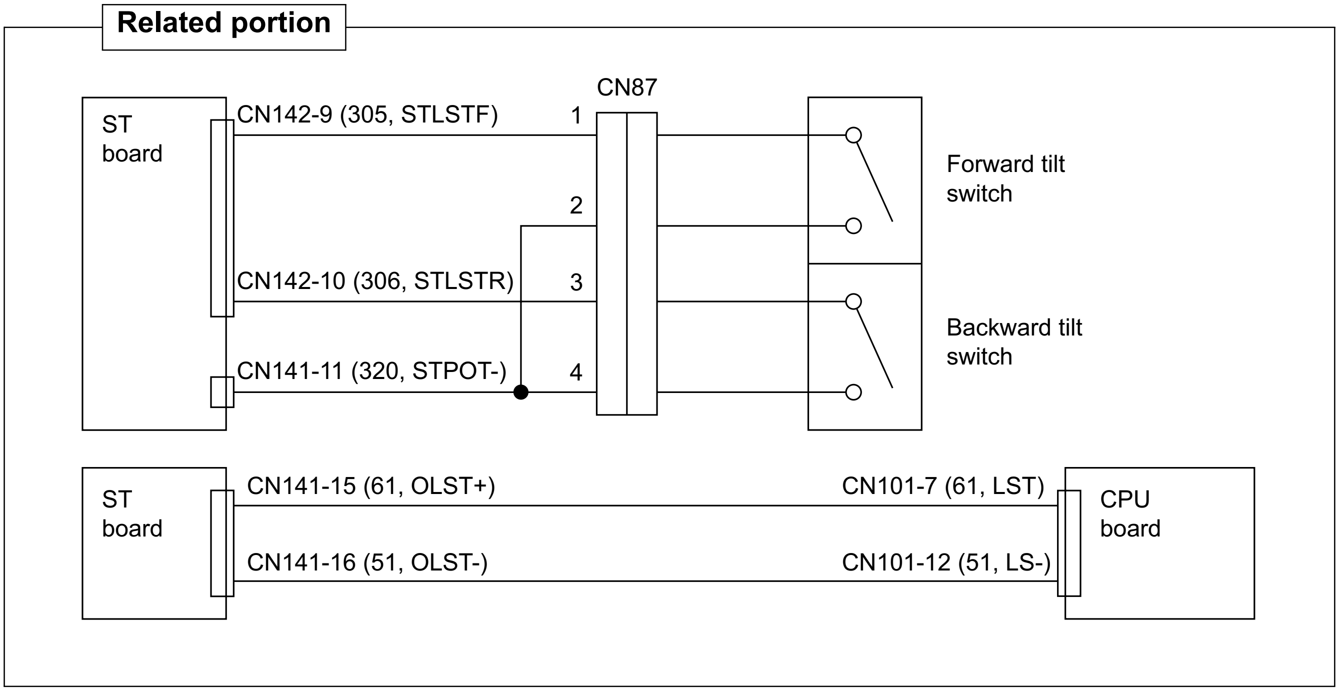
Continuity check
CN142-4 – CN85-1
CN141-11 – CN85-2

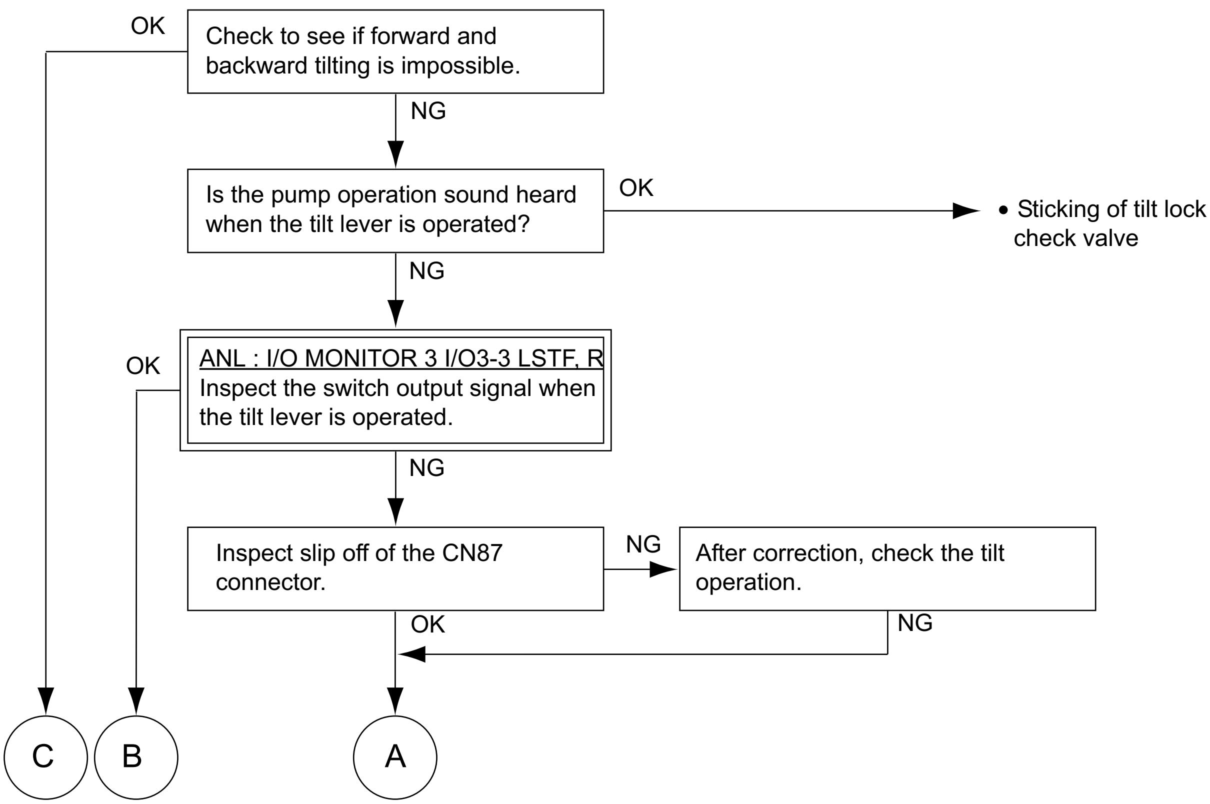
- No continuity → • Harness defect
- Continuity ↓ • Connector defect

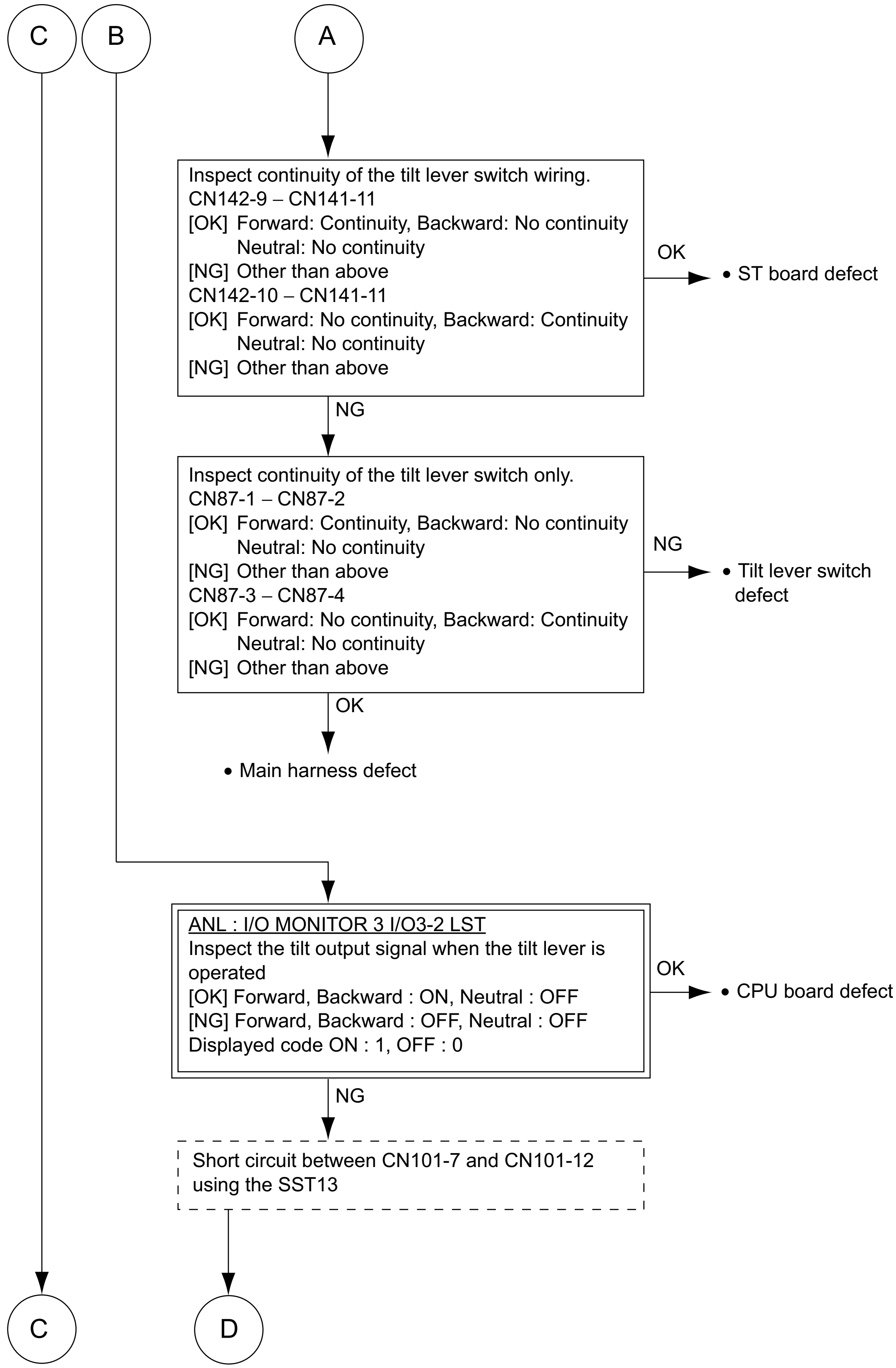
A

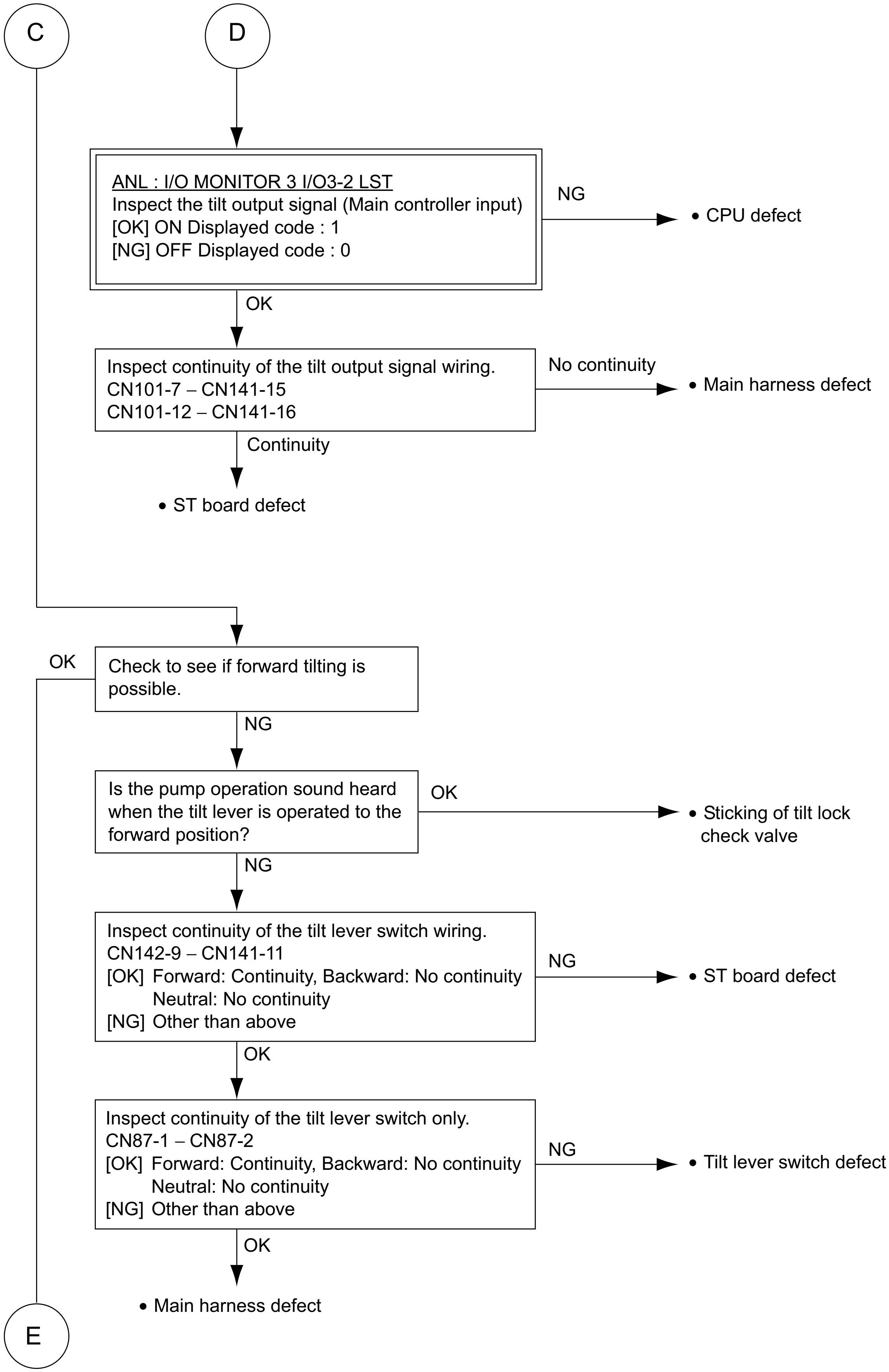

A
ANL : I/O MONITOR I/O3-5 MH
Inspect the output signal of the lifting height switch.
Fork lifting height at 500 mm
[OK] MH1 : ON, MH2-1 : OFF
Displayed code MH : 10
[NG] Other than above
OK
• ST board defect
NG
Inspect continuity of the lifting height switch only.
NG
• Lifting height switch defect
OK
• ST board defect

The mast does not perform forward/backward tilt.






C
B
A
Inspect continuity of the tilt lever switch wiring.
CN142-9 – CN141-11
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
CN142-10 – CN141-11
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above
OK
• ST board defect
NG
Inspect continuity of the tilt lever switch only.
CN87-1 – CN87-2
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
CN87-3 – CN87-4
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above
NG
• Tilt lever switch defect
OK
• Main harness defect
ANL : I/O MONITOR 3 I/O3-2 LST
Inspect the tilt output signal when the tilt lever is operated
[OK] Forward, Backward : ON, Neutral : OFF
[NG] Forward, Backward : OFF, Neutral : OFF
Displayed code ON : 1, OFF : 0
OK
• CPU board defect
NG
Short circuit between CN101-7 and CN101-12 using the SST13
C
D


C
D
ANL : I/O MONITOR 3 I/O3-2 LST
Inspect the tilt output signal (Main controller input)
[OK] ON Displayed code : 1
[NG] OFF Displayed code : 0
NG
• CPU defect
OK
Inspect continuity of the tilt output signal wiring.
CN101-7 – CN141-15
CN101-12 – CN141-16
No continuity
• Main harness defect
Continuity
• ST board defect
OK
Check to see if forward tilting is possible.
NG
Is the pump operation sound heard when the tilt lever is operated to the forward position?
OK
• Sticking of tilt lock check valve
NG
Inspect continuity of the tilt lever switch wiring.
CN142-9 – CN141-11
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
NG
• ST board defect
OK
Inspect continuity of the tilt lever switch only.
CN87-1 – CN87-2
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
NG
• Tilt lever switch defect
OK
• Main harness defect
E

E

Is the pump operation sound heard when the tilt lever is operated to the backward position?

OK → • Sticking of tilt lock check valve

NG ↓

Inspect continuity of the tilt lever switch wiring.
CN142-10 – CN141-11
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above

OK → • ST board defect

NG ↓

Inspect continuity of the tilt lever switch only.
CN87-3 – CN87-4
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above

NG → • Tilt lever switch defect

OK ↓

• Main harness defect

SST SETTING METHODS (35 ~ 55 MODEL)

Use SSTs for quick, accurate troubleshooting of the 7FBCU series electrical system.

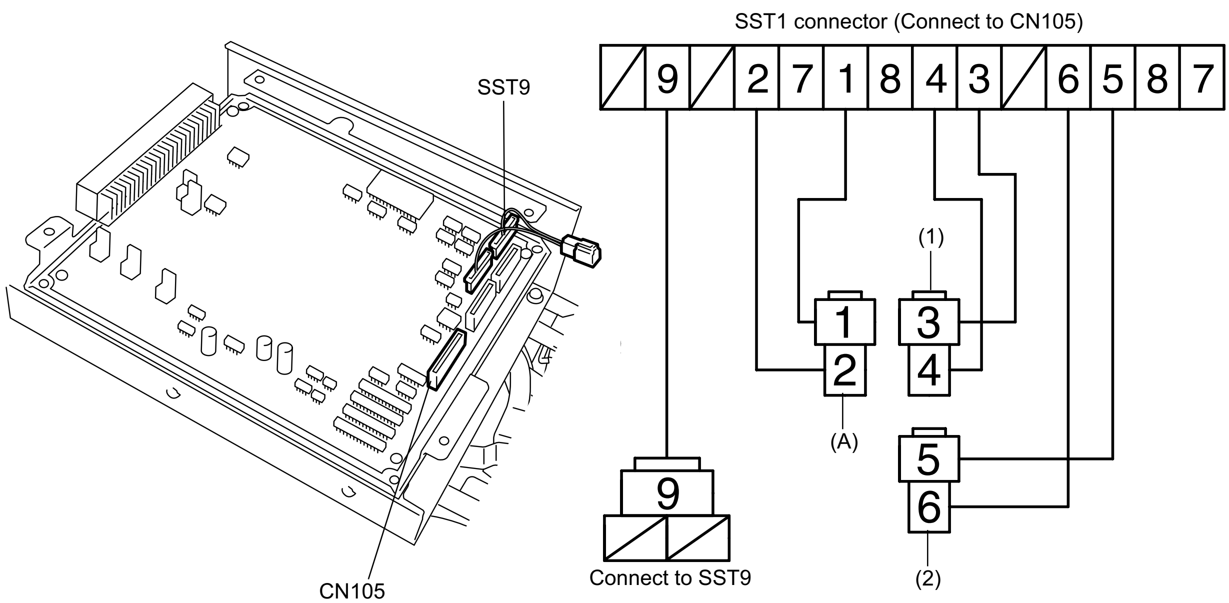
SST for 7FB, 7FBR, and 7FBCU is to be used respectively.

Incorrect connection will fail in correct check. Since boards may be damaged by incorrect connection, careful operation is necessary.

SST 09230-13130-71 Controller check harness (for 7FB)		
SST1	09231-13130-71	Fan check harness (for CN105) (also for DC/MD board power supply check)
SST2	09232-13130-71	Shorting harness (for CN1, CN52, CN86 and CN90)
SST3	09233-13130-71	Harness 1 to check if the CPU and DC/MD boards are driving the MOS normally (for CN111, CN112)
SST4	09233-13130-71	Harness 2 to check if the CPU and DC/MD boards are driving the MOS normally (for CN106, CN107)
SST7	09237-13130-71	Steering sensor check harness (for CN19)
SST8	09238-13130-71	Acceleration potentio meter check harness (for CN25)
SST9	09239-13130-71	Signal sub-harness (for CN106 and 107), Used in connection with SST1 or SST4.
SST 09230-13900-71 Controller check harness (for 7FBR)		
SST13	09234-13900-71	Shorting harness (for CN1, CN103, CN104 and CN142)
SST14	09235-13900-71	Main pump circuit check harness (for P14 and P15)
SST 09230-21440-71 Controller check harness (for 7FBCU)		
SST18	09231-21440-71	Drive motor rpm sensor check harness (for CN57)

Caution:
Be sure to disconnect the battery plug before installing and removing each SST.
If the battery plug is kept connected, board damage may result.

1. SST1·SST9 setting method for troubleshooting for “Error code A0-1, A0-4, A0-5, C0-3 or C0-5”
   SST 1 is used for two different types of check.
   (1) Disconnect CN105, 106 and 107 connectors from the CPU board.
   (2) Set the SST1 main connector to CN105.
   (3) Set the SST9 connector (for CN106 and 107) to CN106 and 107 on the CPU board.
   (4) Connect the 3-pin connector of SST1 to the 3-pin connector of SST9.
   <For fan signal line check (A0-1, A0-4, A0-5)>
   (5) Connect connector (A) and connector (2) and check the fan ON/OFF signal by the analyzer “ACTIVE TEST”.
   (6) The traveling system fan is selected by the switch on the display.
   <For DC/MD board check (C0-3, C0-5)>
   (5) Connect connectors (A) and (1) and check the power ON/OFF by the analyzer “ACTIVE TEST”.
   (6) The traveling signal is selected by the switch on the display.

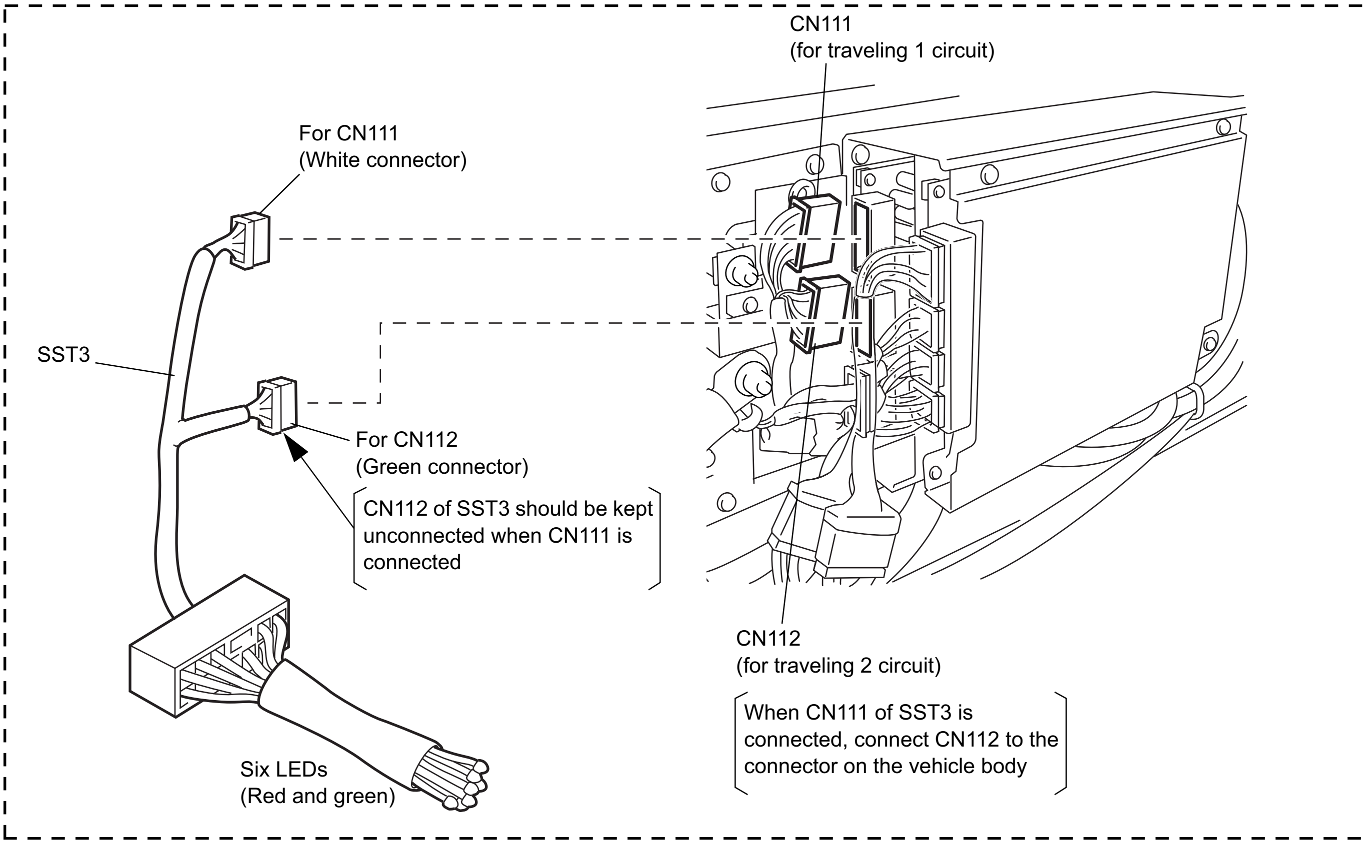


2. SST2·SST8·SST13 setting method

SST2·SST8·SST13 is a shorting harness to short-circuit between the corresponding connector pins.

Carefully connect it since the board may be damaged if it is connected to wrong pin Nos.

3. SST3 setting method for troubleshooting for “Error code C0-1, C0-4, C0-6, failure of traveling only or the traveling speed does not rise”
   (1) Jack up the front portion of the vehicle to let the drive wheels float.
   (2) Disconnect the drive motor cable (from P7, P8 and P9).
   (3) Disconnect CN111 (for traveling 1 circuit), and set SST3.
   SST3 must be connected to either CN111 or CN112, and must not be connected to both of them at a time.
   (4) Connect the battery plug.
   For error code C0-4 or C0-6, make sure that “C0-4 or C0-6” disappears then.



   (5) Operate the direction lever.
   (6) Depress the accelerator pedal.
   When the accelerator pedal is depressed, six LEDs repeat blinking. A pair of red and green LEDs correspond to the transistor operation for one phase, and the six LEDs in total correspond to the transistor operation for three phases. The speed of blinking varies with the degree of accelerator pedal depression.
   When either LED is off, either the signal from the CPU board or the signal from the DC/MD board is defective. The blinking sequence for three phases is reverse between forward traveling and reverse traveling.
   (7) Connect SST3 to CN112 (for traveling 2 circuit) in the same way as for CN111, and check if the LED on it blinks.

4. SST4·SST9 setting method for troubleshooting for "Error code C0-1, failure of traveling only or the traveling speed does not rise"

   SST4 and SST9 are used for judging the quality of the instruction signal from the CPU board to the DC/MD board and the drive signal from the DC/MD board to the MOS when any abnormality is found in the check using SST3.

   Pay special attention to the operation because SST4 and SST9 are set while SST3 is set. (Especially pay attention to battery plug connect/disconnect and motor cable disconnection.)

To check the traveling 1 circuit (Parenthesized portions apply to checking the traveling 2 circuit.)

(1) Disconnect the CN106 and 107 connectors on the CPU board and the CN110 (CN109) connector on the DC/MD board.

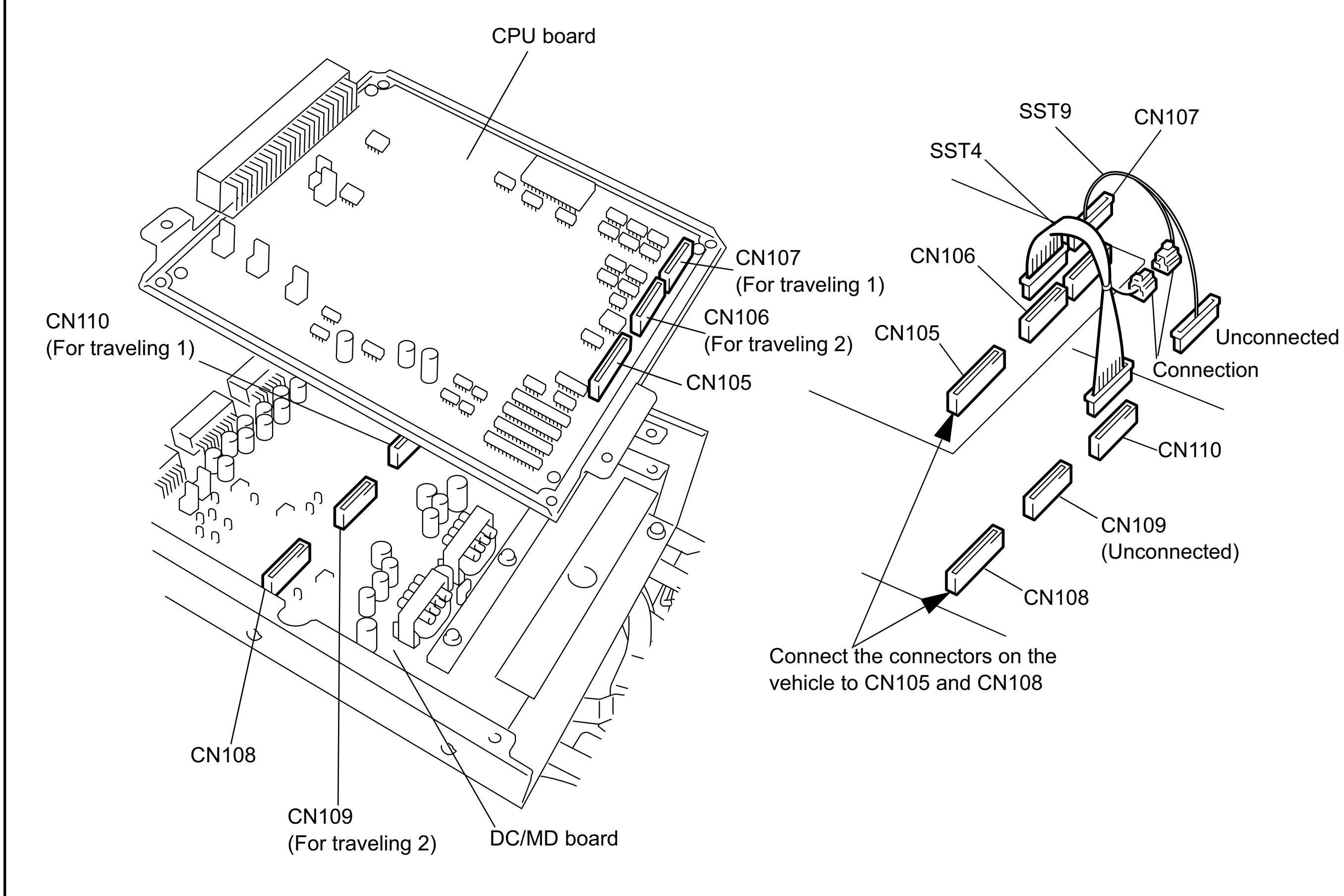
(2) Connect the 11-pin (10-pin) connector of SST4 to the CN106 (CN107) connector on the CPU board, and connect the 10-pin (11-pin) connector of SST4 to the CN110 (CN109) connector on the DC/MD board.

(3) Connect the 10-pin (11-pin) connector of SST9 to the CN107 (CN106) connector on the CPU board.

    The 11-pin (10-pin) connector of SST9 is left unconnected.

(4) Connect the 3-pin connector of SST4 to the 3-pin connector of SST9.

(5) Operate the direction lever with the battery plug connected and key switch ON and depress the accelerator pedal to check the LED blinking state.



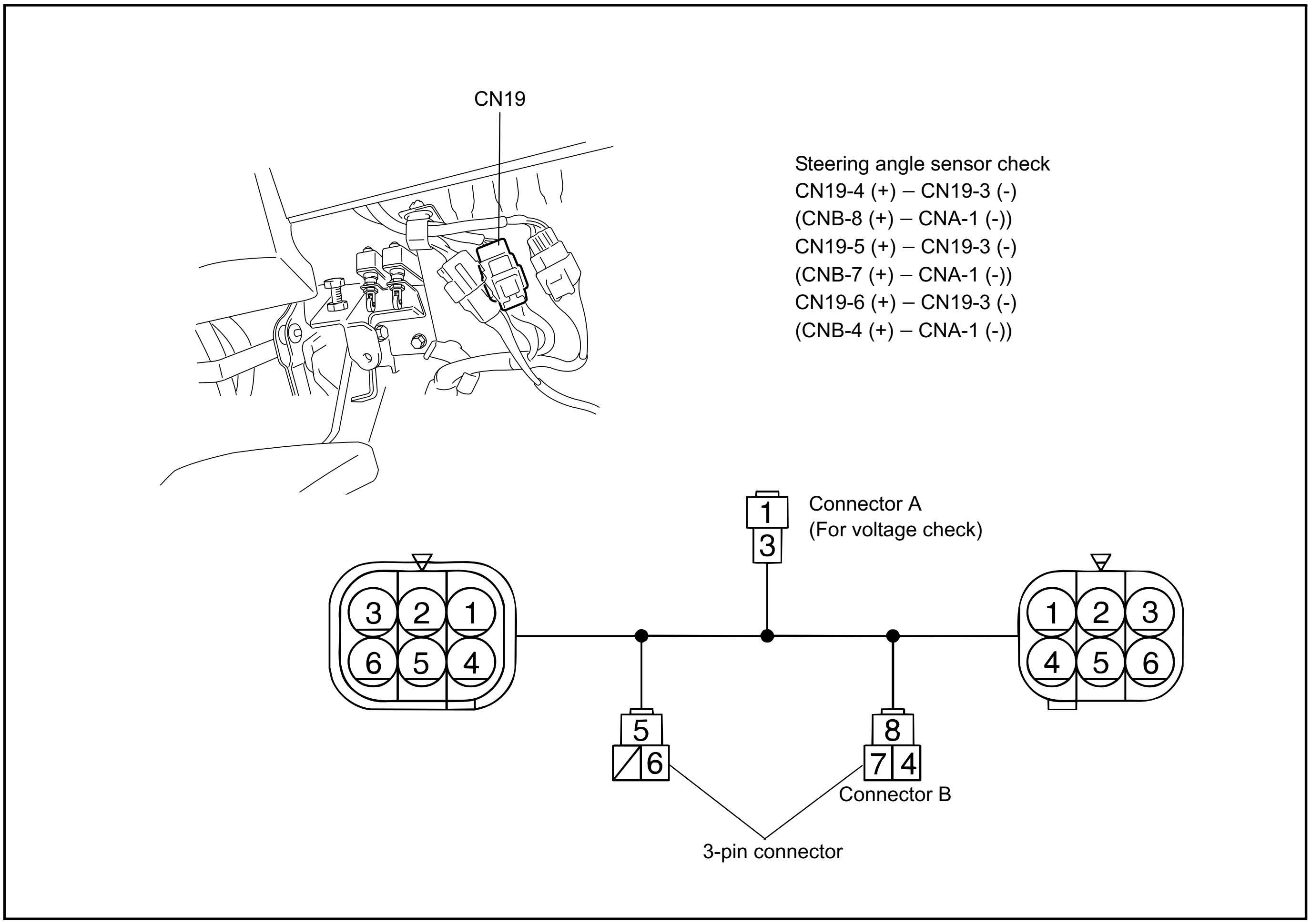
5. SST7 setting method for troubleshooting for "PS operation disabled"

SST7 is used for judging the steering sensor signal quality.

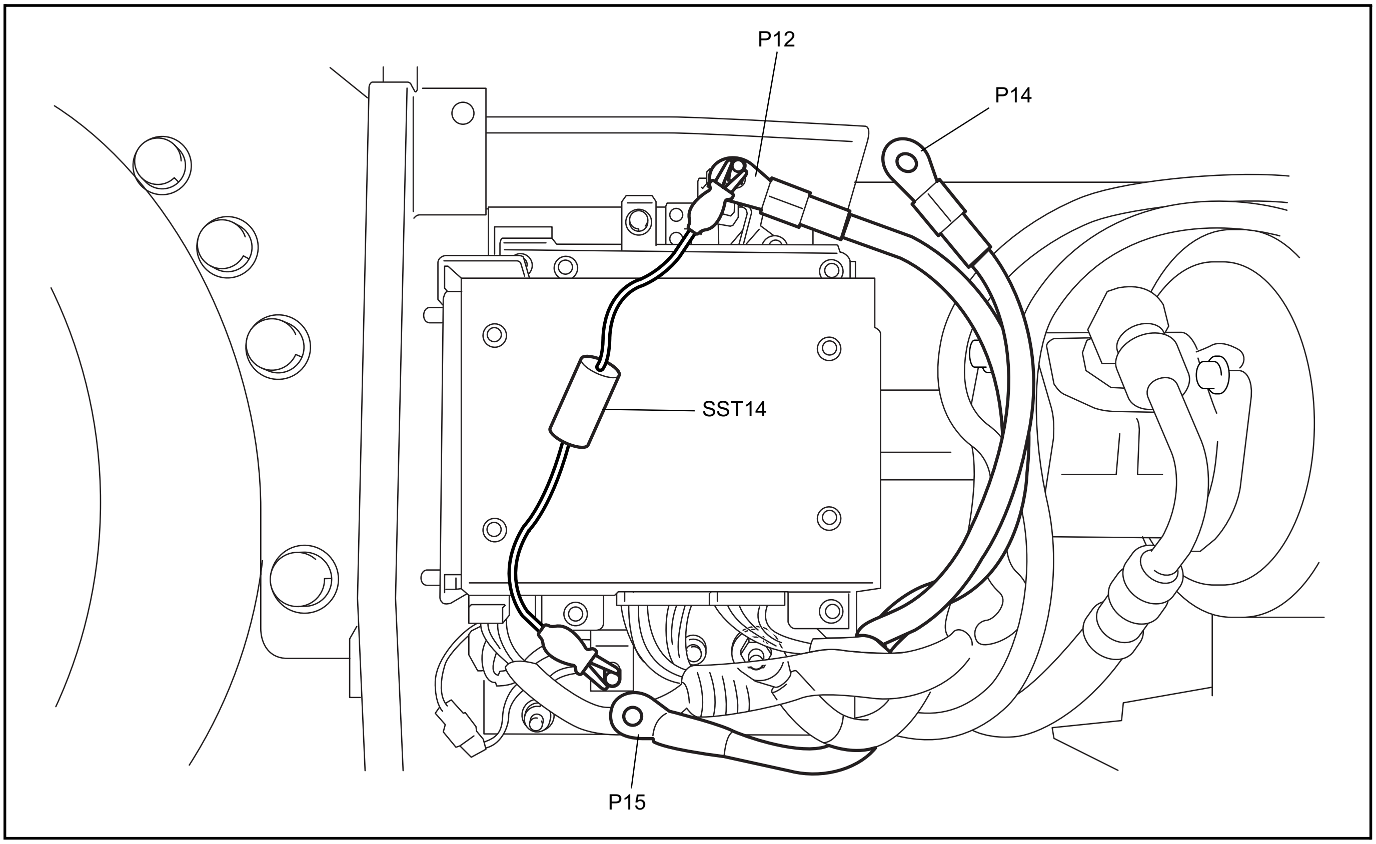
(1) Disconnect the CN19 connector and set SST7 (The 3-pin connector must be connected before reconnection).

(2) Check the steering angle sensor by using ANL.I/O monitor 4.

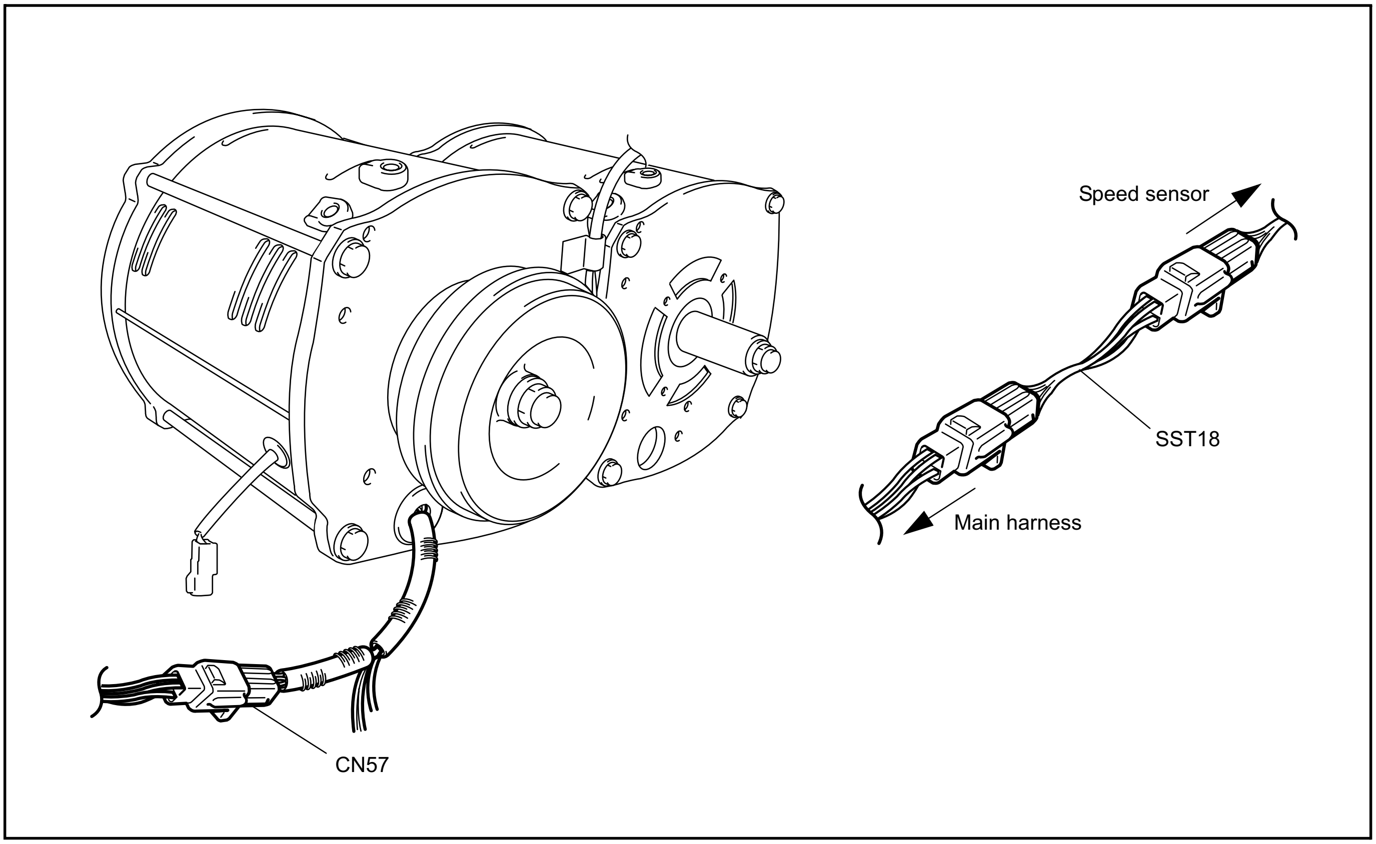
(3) Voltage check (connector B side) the steering angle sensor with a circuit tester.



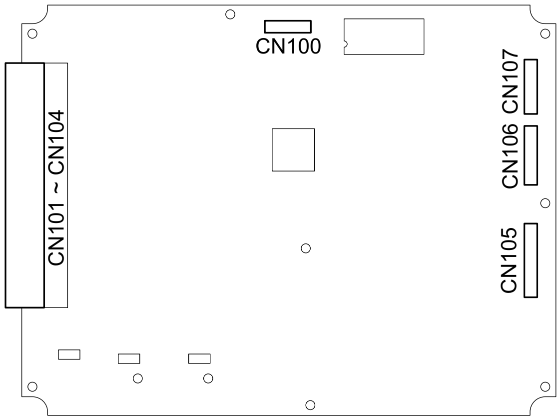
6. SST14 setting method for troubleshooting for “Failure of PS·material handling”
   (1) Jack up the front side of the vehicle until the drive wheels float.
   (2) Disconnect the battery plug.
   (3) Disconnect the material handling controller cables (P14 and P15).
   (4) Connect SST14 between disconnected terminals P14 and P15.
   (5) Connect the battery plug.
   (6) Turn key switch ON, and measure the voltage between P14 and P15 when the direction lever is operated.

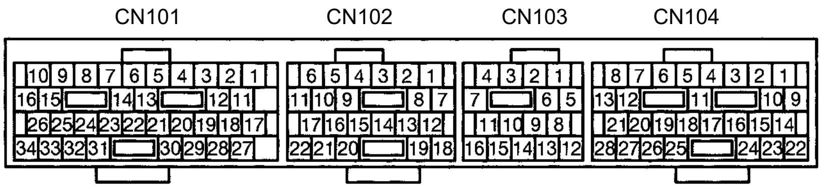


7. SST18 setting method for troubleshooting for “Error code C2-2, C2-3, C8-1 or C8-2”
   (1) Jack up the front side of the vehicle until the drive wheels float.
   (2) Disconnect the battery plug.
   (3) Disconnect CN57 and set SST18.
   (4) Connect the battery plug.
   (5) Check to see if the error code changes.



CPU BOARD CONNECTOR





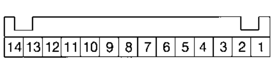
No.	P	J
1	45	DSF
2	46	DSR
3	65	LSB
4	66	LSPB
5	67	LSD
6	—	—
7	—	—
8	—	—
9	307	SNTSA
10	308	SMTSK
11	—	—
12	309	SSTMA
13	310	SSTMK
14	—	—
15	—	—
16	—	—
17	—	—
18	—	—
19	—	—
20	—	—
21	—	—
22	—	—
23	68	LSL2
24	—	—
25	—	—
26	51	LS-
27	—	—
28	—	—
29	—	—
30	—	—
31	—	—
32	60	LSL
33	324	SSO+
34	325	SSO-

No.	P	J
1	64	SWAC
2	52	POTA
3	—	AOPT
4	—	—
5	—	—
6	81	SSD1
7	82	SSD2
8	—	—
9	—	—
10	86	TD+
11	87	TD-
12	88	TD2+
13	89	TD2-
14	53	POTA+
15	—	—
16	—	—
17	—	—
18	80	SSD+
19	—	—
20	—	—
21	—	—
22	51	POT-

No.	P	J
1	3	MP1+
2	4	MP1-
3	41	B48V
4	43	VBKY
5	5	MP2+
6	6	MP2-
7	41	VBBT
8	—	—
9	—	—
10	16	D15V
11	—	—
12	14	GNDD
13	144	SMTDK
14	143	SDTMK
15	142	SDTMA
16	141	SMTDA

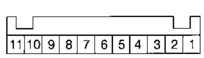
No.	P	J
1	N2	N2C
2	54	CSBATT
3	19	CHOPD2-
4	—	—
5	75	CSD+
6	75	CSD2+
7	71	CSDA
8	72	CSDB
9	13	C20V
10	N2	N2
11	2	MD1-
12	P4	VBP4
13	1	MD1+
14	44	VBMB
15	41	B48V
16	16	D15V
17	15	C15V
18	73	CSDA2
19	74	CSDB2
20	78	THCD
21	77	THC+
22	44	VBMB
23	14	GNDD
24	14	GNDC
25	79	THCD2
26	—	—
27	76	CSD-
28	76	CSD2-

CN105



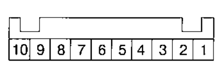
No.	P	J
1	38	FAN+
2	38	FAN+
3	36	FANCD
4	37	FANCD2
5	—	—
6	39	DDC
7	40	D2DC
8	94	CKFAND+
9	97	CKFAND-
10	98	CKFAND2+
11	99	CKFAND2-
12	—	—
13	—	—
14	100	CHGFAN

CN106



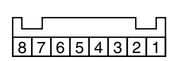
No.	P	J
1	33	TMDU2+
2	27	TMDAU2-
3	28	TMDBU2-
4	29	TMDCU2-
5	30	TMDAD2-
6	31	TMDBD2-
7	32	TMDCD2-
8	33	TMDD2+
9	35	CKDV2
10	—	—
11	—	—

CN107



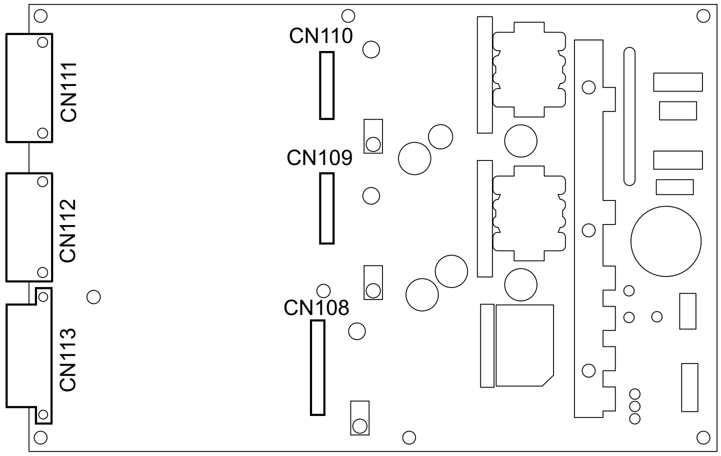
No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

CN100

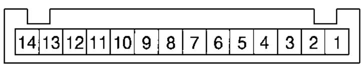


No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	MD2
6	—	FRES
7	—	FRXD
8	—	SELR

DC/MD BOARD CONNECTOR

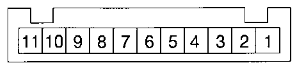


CN108



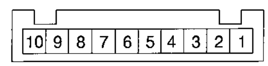
No.	P	J
1	100	CHGFAN
2	—	—
3	—	—
4	99	CKFANP-
5	98	CKFANP+
6	97	CKFAND-
7	94	CKFAND+
8	40	PDC
9	39	DDC
10	—	—
11	37	FANCP
12	36	FANCD
13	38	FAN+
14	38	FAN+

CN109



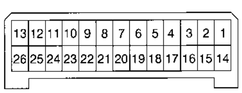
No.	P	J
1	33	TMDU2+
2	27	TMDAU2-
3	28	TMDBU2-
4	29	TMDCU2-
5	30	TMDAD2-
6	31	TMDBD2-
7	32	TMDCD2-
8	33	TMDD2+
9	35	CKDV2
10	—	—
11	—	—

CN110



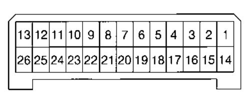
No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

CN111



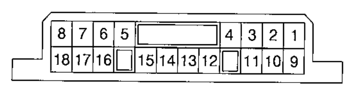
No.	P	J
1	150	TMDAU1+
2	152	TMDAD1+
3	154	TMDBU1+
4	151	TMDAU-G
5	153	TMDAD-G
6	155	TMDBU-G
7	157	TMDBD-G
8	159	TMDCU-G
9	161	TMDCD-G
10	—	—
11	156	TMDBD1+
12	158	TMDCU1+
13	160	TMDCD1+
14	P3	TMDAU-SD
15	N2	TMDAD-SD
16	P5	TMDBU-SD
17	150	TMDAU2+
18	152	TMDAD2+
19	154	TMDBU2+
20	156	TMDBD2+
21	158	TMDCU2+
22	160	TMDCD2+
23	—	—
24	N2	TMDBD-SD
25	P7	TMDCU-SD
26	N2	TMDCD-SD

CN112



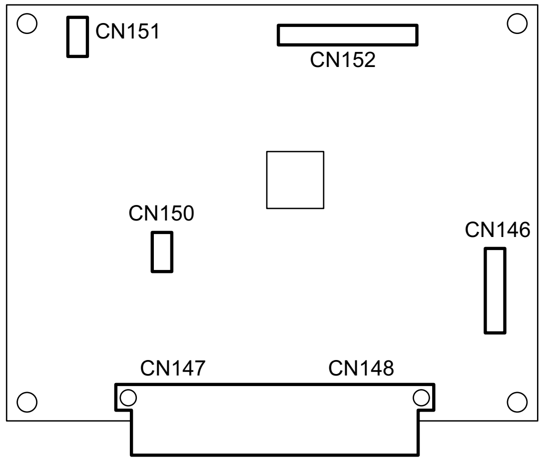
No.	P	J
1	162	TMDAU21+
2	164	TMDAD21+
3	166	TMDBU21+
4	163	TMDAU2-G
5	165	TMDAD2-G
6	167	TMDBU2-G
7	169	TMDBD2-G
8	171	TMDCU2-G
9	173	TMDCD2-G
10	—	—
11	168	TMDBD21+
12	170	TMDCU21+
13	172	TMDCD21+
14	P51	TMDAU2-SD
15	N2	TMDAD2-SD
16	P61	TMDBU2-SD
17	162	TMDAU22+
18	164	TMDAD22+
19	166	TMDBU22+
20	168	TMDBD22+
21	170	TMDCU22+
22	172	TMDCD22+
23	—	—
24	N2	TMDBD2-SD
25	P91	TMDCU2-SD
26	N2	TMDCD2-SD

CN113

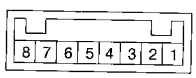


No.	P	J
1	41	B48V
2	44	VBMB
3	—	Q601G
4	7	FAND+
5	8	FAND-
6	9	FANP+
7	10	FANP-
8	—	Q701G
9	—	—
10	—	—
11	—	Q501G
12	14	GNDD
13	14	GNDC
14	16	D15V
15	15	C15V
16	13	C20V
17	N2	N2
18	N2	N2

SCPU BOARD CONNECTOR

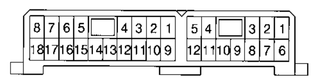


CN146



No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	MD1
6	—	FRES
7	—	FRXD
8	—	SELR

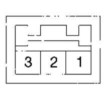
CN147 CN148



No.	P	J
1	—	SSTYA
2	—	SYTSA
3	316	SXTSA
4	318	SSTXA
5	—	—
6	312	STS1
7	313	STS2
8	314	STSC
9	—	SSTYK
10	—	SYTSK
11	317	SXTSK
12	319	SSTXK
13	—	—
14	—	—
15	—	—
16	315	STS-
17	311	STS+
18	—	—

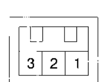
No.	P	J
1	—	—
2	341	STP1-
3	343	STP2-
4	—	SSN+
5	51	SSN-
6	—	—
7	—	—
8	—	—
9	—	—
10	340	STP1+
11	342	STP2+
12	60	OLSL+

CN150



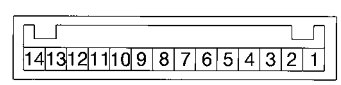
No.	P	J
1	—	—
2	—	—
3	349	OUTAD

CN151



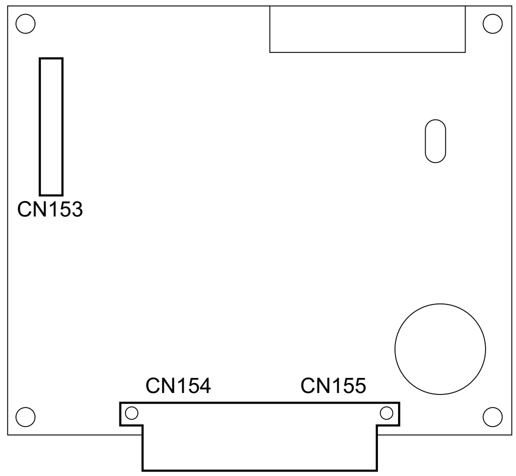
No.	P	J
1	—	—
2	—	—
3	—	—

CN152

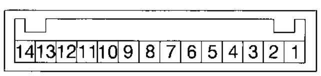


No.	P	J
1	—	—
2	P12	VBMBP
3	—	—
4	—	—
5	352	SC15V
6	353	GNDSC
7	—	—
8	344	PDUTY
9	347	DATA1
10	348	DATA2
11	335	DRPMOS
12	345	SELT1
13	346	SELT2
14	—	—

DC/PD BOARD CONNECTOR

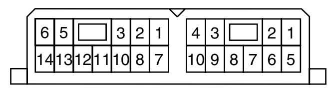


CN153



No.	P	J
1	—	—
2	P12	VBMBP
3	—	—
4	—	—
5	352	SC15V
6	353	GNDSC
7	349	OUTAD
8	344	PDUTY
9	347	DATA1
10	348	DATA2
11	335	DRPMOS
12	345	SELT1
13	346	SELT2
14	—	—

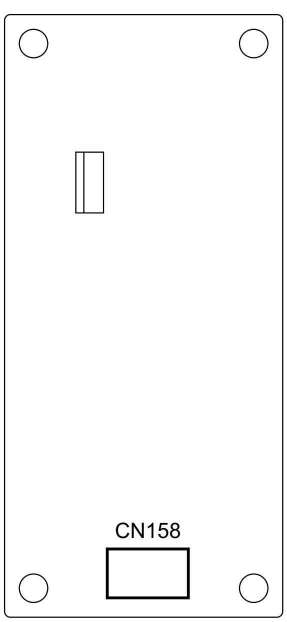
CN154 CN155



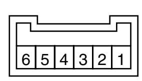
No.	P	J
1	41	B48V
2	P12	VBMBP
3	352	PCSP+
4	337	PCSP
5	353	PCSP-
6	338	THP+
7	—	CK20V
8	N1	N1
9	356	TMPD1+
10	357	TMPD2+
11	358	TMPD-G
12	359	TMPD-SD
13	339	THP
14	—	—

No.	P	J
1	193	BMP
2	354	PLST
3	351	PLSL1
4	—	PLSAT2
5	—	CKT-G
6	194	BMP2
7	11	S20V+
8	12	S20V-
9	355	PLSAT1
10	350	PLS-

CD BOARD CONNECTOR

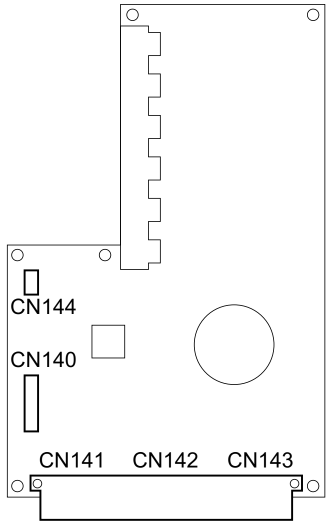


CN158

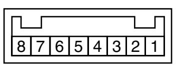


No.	P	J
1	44	VBMB
2	47	CD+
3	49	CD-
4	N2	N2
5	77	CHOPCD+
6	19	CHOPCD-

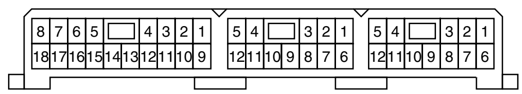
ST BOARD CONNECTOR



CN140



CN141 CN142 CN143



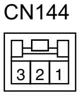
No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	FBUSY
6	—	FRES
7	—	FRXD
8	—	SELR
9	—	FCLK

No.	P	J
1	137	SL/L+
2	57	POTT+
3	56	POTT
4	58	SPL+
5	309	SSTMA
6	307	SMTSA
7	310	SSTMK
8	308	SMTSK
9	51	OLSD-
10	138	SL/L-
11	320	STPOT-
12	59	SPL
13	324	SS+
14	325	SS-
15	61	OLST+
16	51	OLST-
17	67	OLSD+
18	—	—

No.	P	J
1	303	VBMB2
2	90	MH1
3	91	MH2-1
4	70	SWTK
5	11	S20V+
6	(N2)	(N2)
7	N2	N2
8	304	STLSD
9	305	STLSTF
10	306	STLSTR
11	12	S20V-
12	(12)	(S20V-)

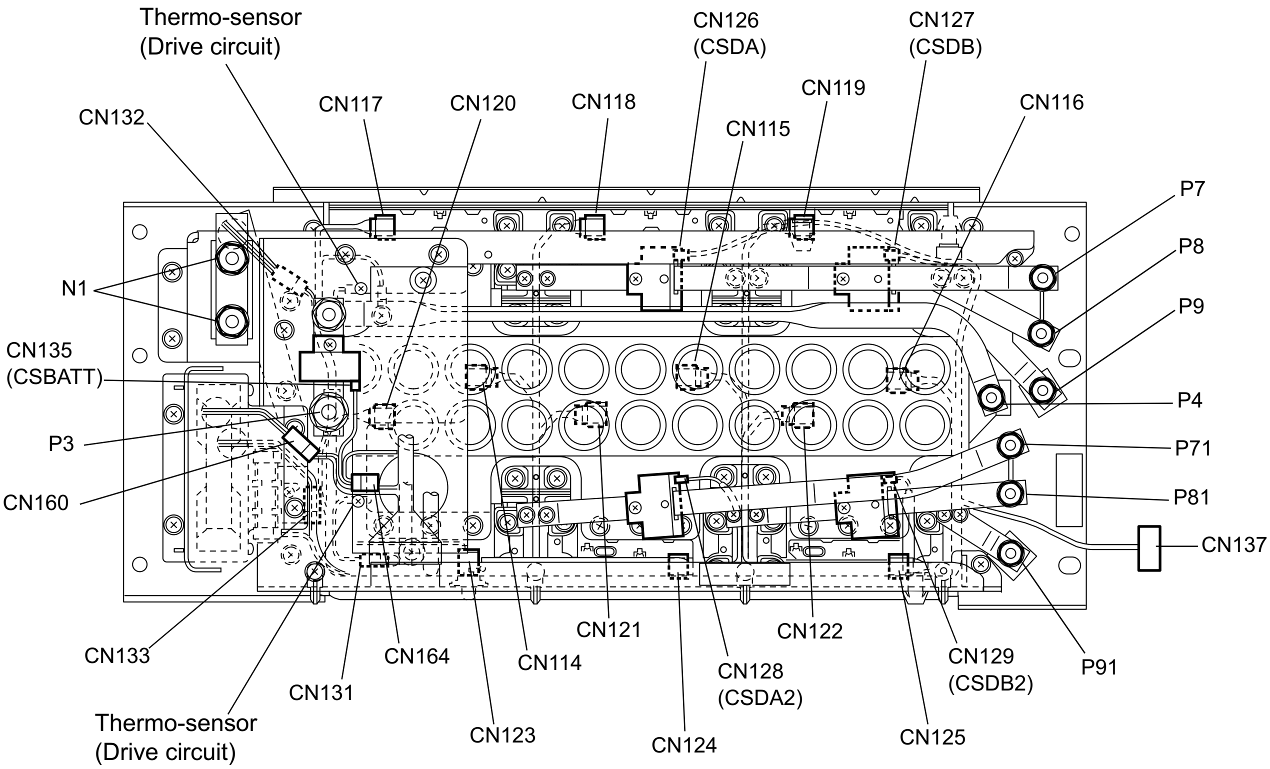
No.	P	J
1	330	SOLT-
2	328	SOLS-
3	334	SOLD-
4	—	—
5	332	SOLL-
6	(327)	(SOLTS+)
7	327	SOLTS+
8	331	SOLLD+
9	—	SXTSA
10	—	SSTXA
11	—	SXTSK
12	—	SSTXK

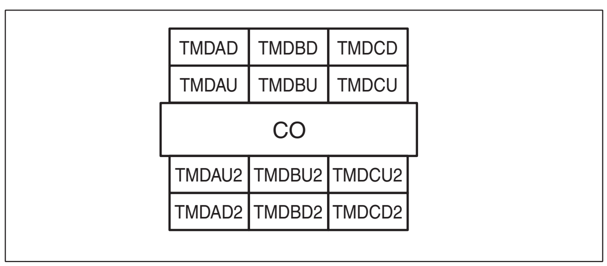
CN144

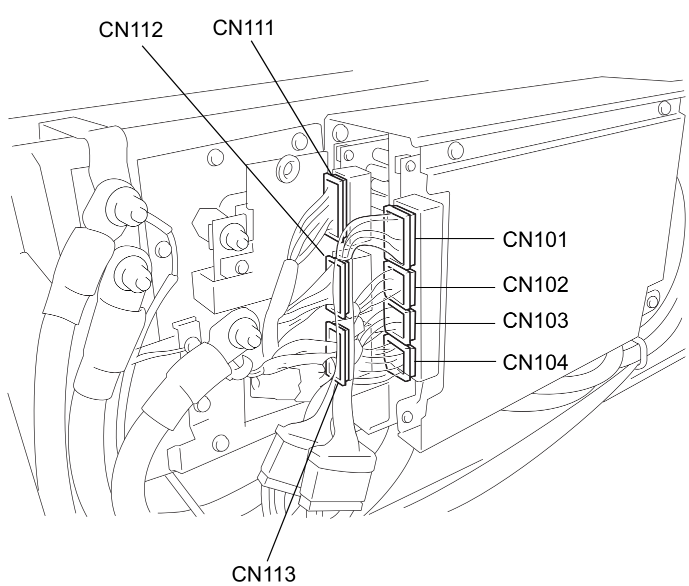


No.	P	J
1	321	SYR+
2	323	SYR-
3	322	SYR

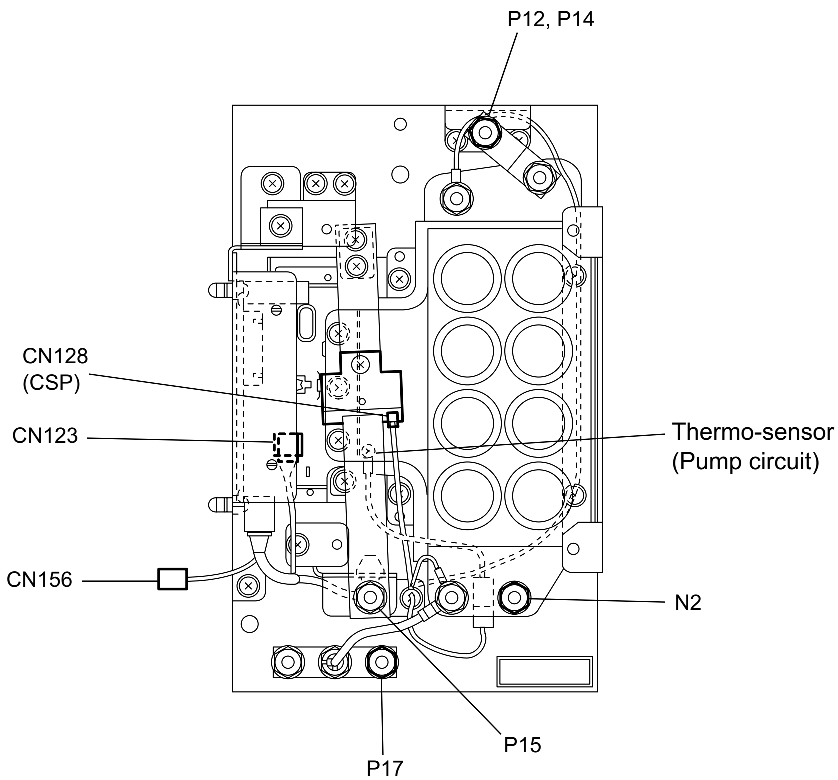
TRAVELING CONTROLLER CONNECTOR·COMPONENT

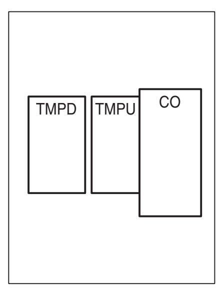


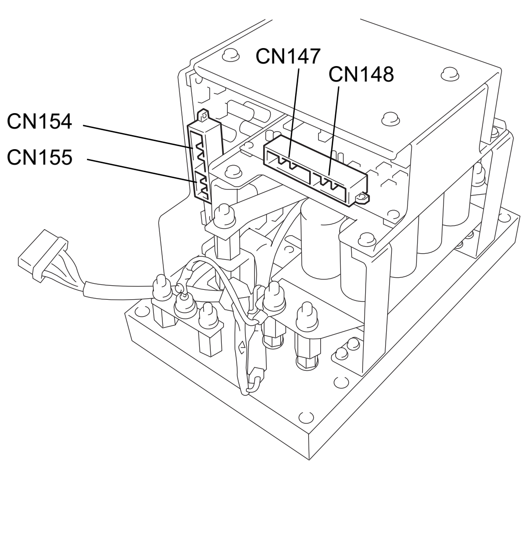




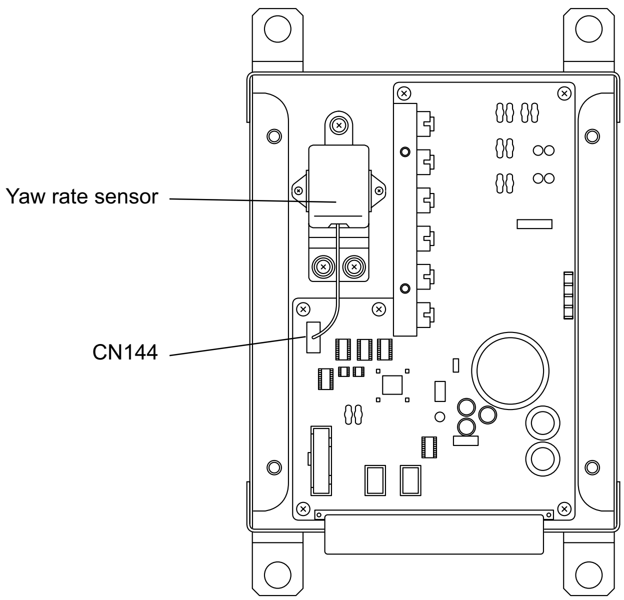
MATERIAL HANDLING CONTROLLER CONNECTOR·COMPONENT

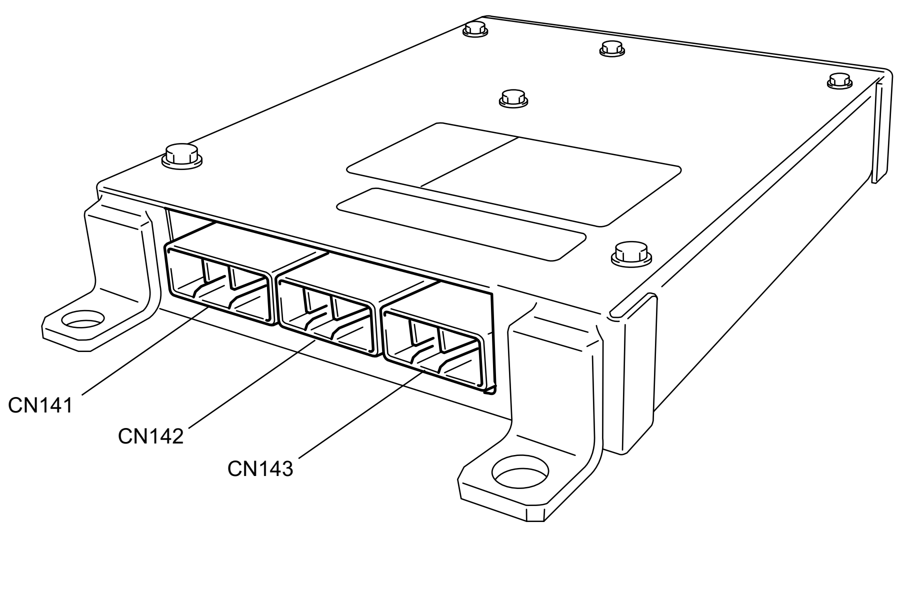




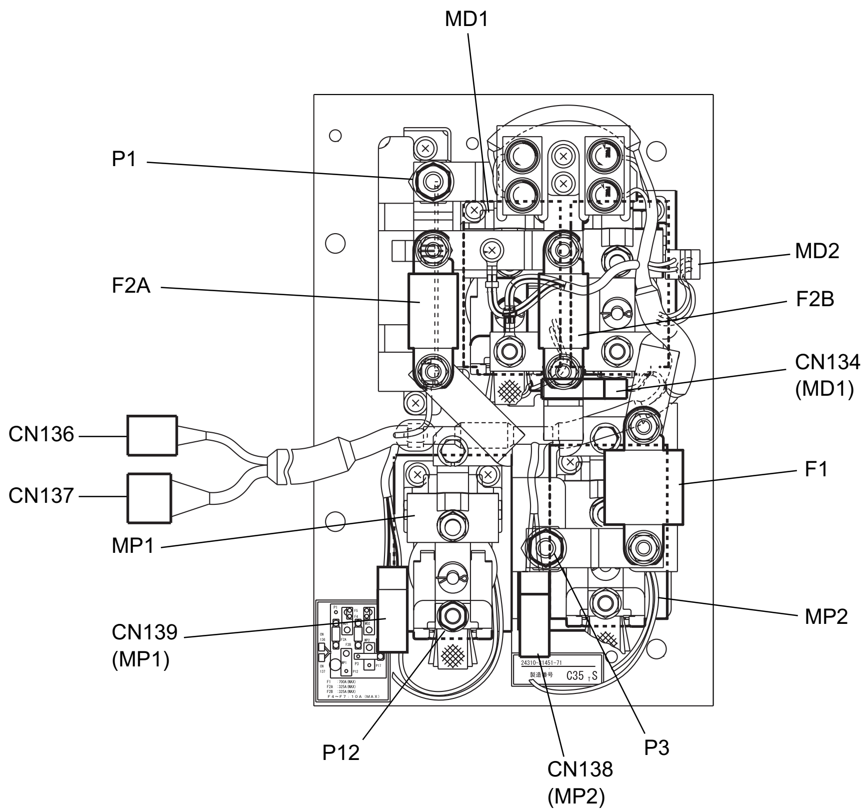


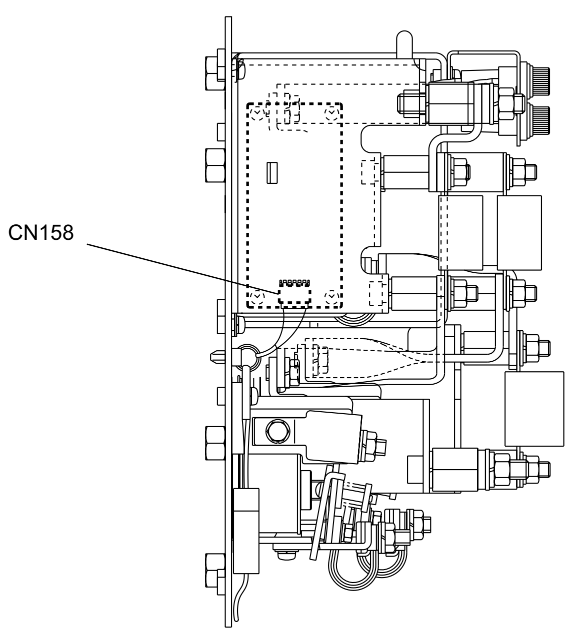
SAS CONTROLLER CONNECTOR·COMPONENT





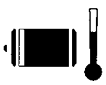
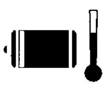
CONTACTOR PANEL CONNECTOR·COMPONENT





TROUBLESHOOTING (35 ~ 55 MODEL)

COMPOSITION LIST

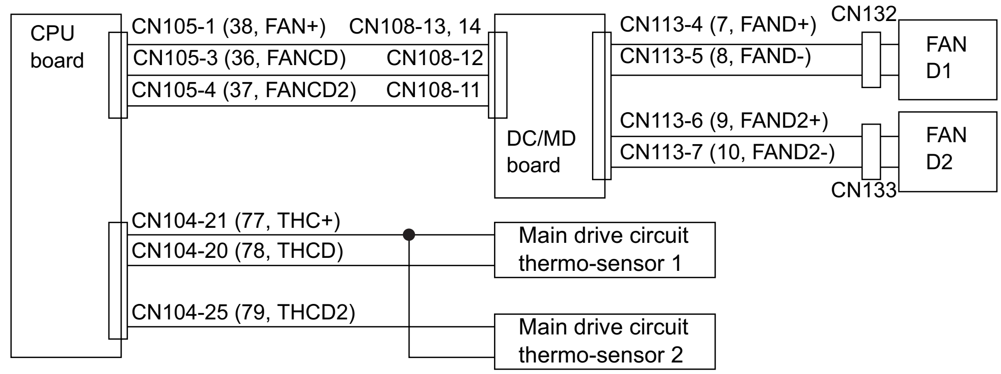
WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED			Page
Displayed code	Diag memory code	Defect mode	
51-1	51-1	Traveling speed sensor abnormality	4-196
52-1, 2, 3	52-1, 2, 3	Yaw rate sensor abnormality	4-197
54-1, 2	54-1, 2	Swing solenoid abnormality	4-198
61-1, 2	61-1, 2	Load sensor abnormality	4-199
62-1, 2	62-1, 2	Tilt angle sensor abnormality	4-201
63-1, 2, 3	63-1, 2, 3	Tilt switch abnormality	4-203
64-1, 2	64-1, 2	Lift solenoid abnormality	4-204
65-1, 2	65-1, 2	Tilt solenoid abnormality	4-205
66-1	66-1	Tilt matching value abnormality	4-206
67-1	67-1	Lifting height switch abnormality	4-207
 C/R	A0-1	Main drive circuit overheat	4-127
	A0-2	Material handling controller overheat	4-129
A0-4	A0-4	Fan 1 abnormality	4-130
A0-5	A0-5	Fan 2 abnormality	4-131
A1	A1	Controller high voltage	4-132
 C/R	A2	CPU board overheat	4-133
A3	A3	Incorrect charging plug connection	4-134
A4	A4	Acceleration switch abnormality	4-135
A6-1, 3, 5, 6	A6-1, 3, 5, 6	Material handling switch abnormality	4-136
A6-2	A6-2	Lift No.2 switch abnormality	4-139
A8	A8	F1 fuse open	4-140
AA	AA	CPU board thermo-sensor abnormality	4-141
AE-1, 2, 3, 4	AE-1, 2, 3, 4	SCPU board CPU abnormality	4-141
AF-1, 2, 3, 4	AF-1, 2, 3, 4	CPU board abnormality	4-142
AF-5, 6, 7, 8	AF-5, 6, 7, 8	ST board CPU abnormality	4-208
C0-1	C0-1	Main drive circuit abnormality	4-143
C0-3	C0-3	Traveling drive 1 power supply abnormality	4-145
C0-4	C0-4	Traveling drive 1 circuit abnormality	4-146
C0-5	C0-5	Traveling drive 2 power supply abnormality	4-147
C0-6	C0-6	Traveling drive 2 circuit abnormality	4-148
C1-1	C1-1	Drive 1 current sensor abnormality	4-149
C1-2	C1-2	Drive 2 current sensor abnormality	4-150

Displayed code	Diag memory code	Defect mode	Page
 DM	C2-1	Drive motor overheat	4-151
C2-2	C2-2	Drive motor 1 thermo-sensor abnormality	4-152
C2-3	C2-3	Drive motor 2 thermo-sensor abnormality	4-153
C3-1	C3-1	Main drive circuit 1 thermo-sensor abnormality	4-154
C3-2	C3-2	Main drive circuit 2 thermo-sensor abnormality	4-155
C4-1, 2, 3, 4	C4-1, 2, 3, 4	Accelerator potentiometer abnormality	4-156
C7	C7	Direction switch abnormality	4-158
C8-1, 2	C8-1, 2	Drive motor speed sensor (1, 2) abnormality	4-159
CB-1	CB-1	Battery contactor (MD) abnormality	4-160
CB-2	CB-2	Battery contactor (MD) fusion	4-162
E0-2	E0-2	Pump main circuit abnormality	4-163
E0-4	E0-4	Main pump circuit power abnormality	4-164
E1	E1	Pump current sensor abnormality	4-165
 PM	E2-1, 3	Pump motor temperature overheat	4-166
E2-2, 4	E2-2, 4	Pump motor thermo-sensor abnormality	4-167
E3	E3	Material handling controller thermo-sensor abnormality	4-170
E6	E6	Lift switch abnormality	4-172
PM BRSH	—	Pump motor 1 brush wear	4-173
PM2 BRSH	—	Pump motor 2 brush wear	4-174
EA-2	EA-2	MP2 contactor abnormality	4-175
EB-1	EB-1	MP1 contactor open abnormality	4-176
EB-2	EB-2	MP1 contactor fusion	4-178
EB-3	EB-3	MP1 contactor abnormality	4-179
EE-1, 2, 3	EE-1, 2, 3	Abnormal communication from display	4-189
EF-1, 2, 4	EF-1, 2, 4	Traveling controller EEP-ROM abnormality	4-180
EF-3	EF-3	Traveling controller CPU abnormality	4-180
EF-5, 6	EF-5, 6	ST board EEP-ROM abnormality	4-208
EF-7, 8	EF-7, 8	SCPU board EEP-ROM abnormality	4-181
FD-1, 2	FD-1, 2	Abnormal communication between ST board and SCPU board	4-191
F1-1, 2	F1-1, 2	MCS to multi-display communication system abnormality	4-190
FE-1, 2	FE-1, 2	SAS controller → traveling•material handling controller communication abnormality	4-192
FE-4, 5	FE-4, 5	Traveling•material handling controller → SAS controller communication abnormality	4-193
FE-6, 7	FE-6, 7	Material handling controller → SAS controller communication abnormality	4-194
G4-1, 2	G4-1, 2	Deadman solenoid abnormality	4-209

TRAVELING·MATERIAL HANDLING·PS SYSTEMS
WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED

A0-1	Main drive circuit overheat

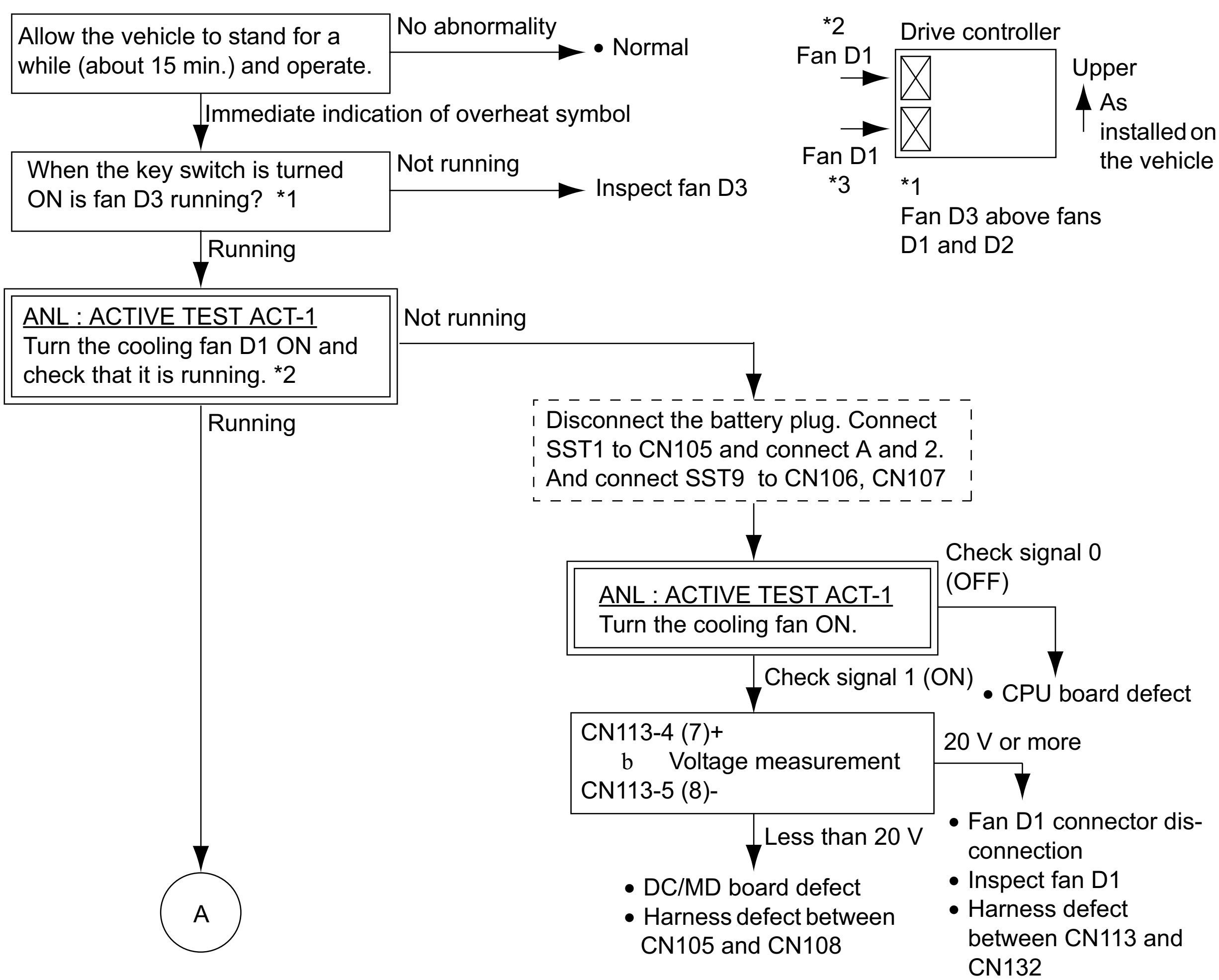
Related portion

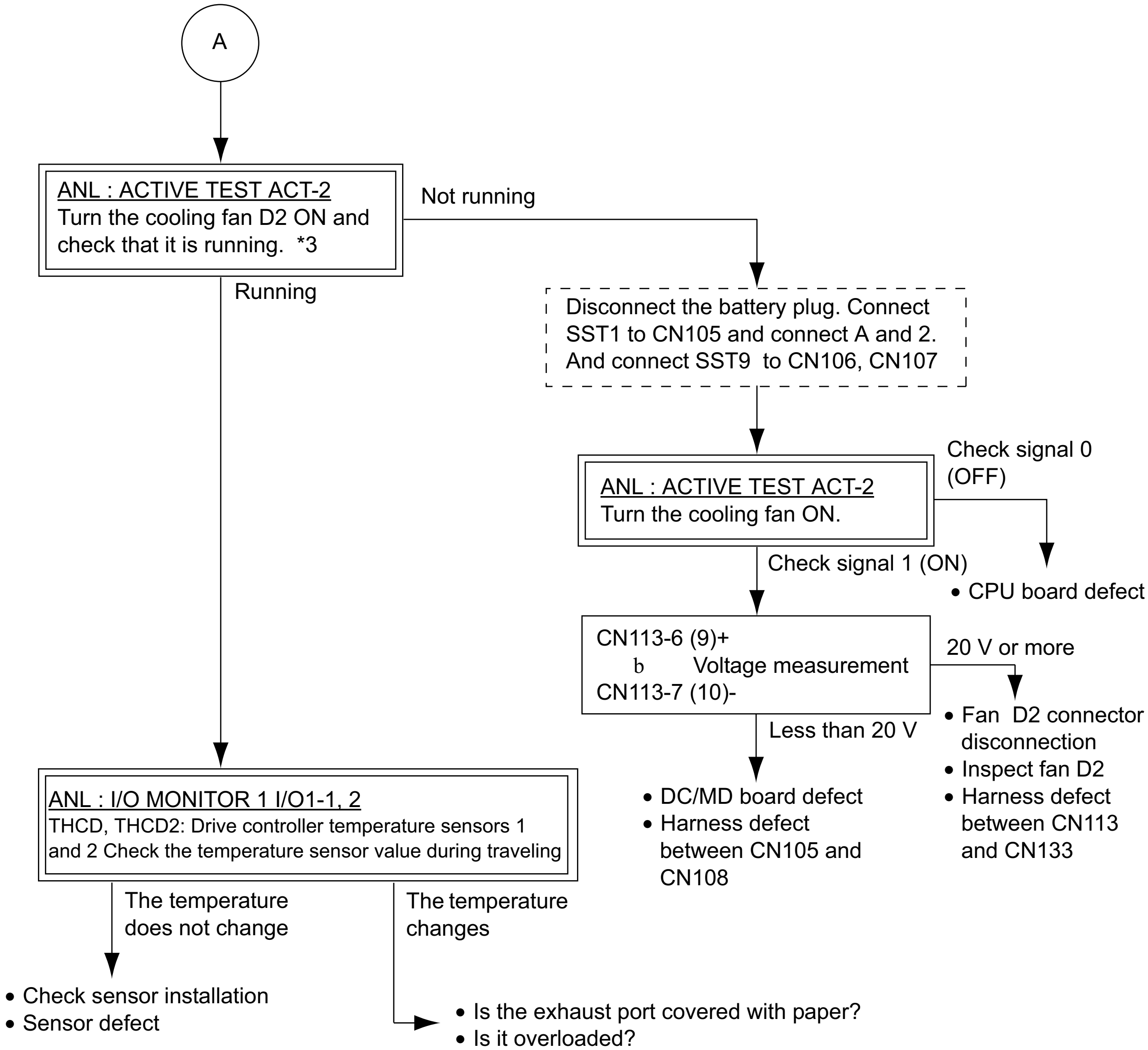


Condition for error detection

Output if the output from drive controller temperature sensor 1 or 2 exceeds the setting.

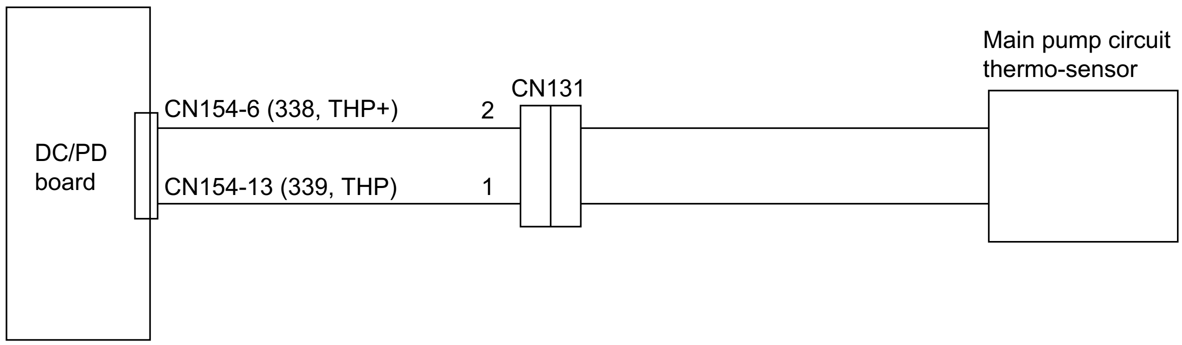
If A0-4 or A0-5 occurs at the same time, perform troubleshooting for A0-4 and A0-5 first.




A
ANL : ACTIVE TEST ACT-2
Turn the cooling fan D2 ON and check that it is running. *3
Not running
Running
Disconnect the battery plug. Connect SST1 to CN105 and connect A and 2. And connect SST9 to CN106, CN107
ANL : ACTIVE TEST ACT-2
Turn the cooling fan ON.
Check signal 0 (OFF)
• CPU board defect
Check signal 1 (ON)
CN113-6 (9)+
b Voltage measurement
CN113-7 (10)-
20 V or more
• Fan D2 connector disconnection
• Inspect fan D2
• Harness defect between CN113 and CN133
Less than 20 V
• DC/MD board defect
• Harness defect between CN105 and CN108
ANL : I/O MONITOR 1 I/O1-1, 2
THCD, THCD2: Drive controller temperature sensors 1 and 2 Check the temperature sensor value during traveling
The temperature does not change
• Check sensor installation
• Sensor defect
The temperature changes
• Is the exhaust port covered with paper?
• Is it overloaded?

A0-2	Material handling controller overheat

Related portion



Condition for error detection

Output when the temperature detected by material handling controller thermo-sensor exceeds the specified level.

Allow the vehicle to stand for a while (about 15 min.) and operate.

No abnormality → • Normal

Immediate indication of overheat symbol ↓

<u>ANL : I/O MONITOR 1-3 THCP</u>
Check the main pump circuit temperature sensor value during material handling operation (*)

The temperature changes → • Overloaded operation

The temperature does not change ↓

<u>ANL : I/O MONITOR 1-3 THCP</u>
Disconnect CN131 and check the main pump circuit temperature sensor value

Different from the preceding value (*) (smaller) ↓

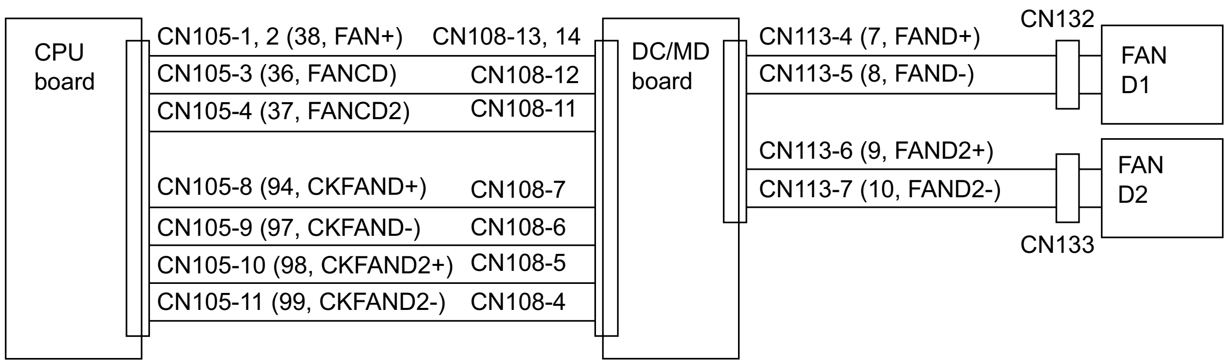
- Check thermo-sensor installation
- Thermo-sensor defect

Remains unchanged from the preceding value (*) ↓

- Internal harness defect
- DC/MD board defect
- Defect of harness between boards
- SCPU board defect

A0-4	Fan 1 abnormality

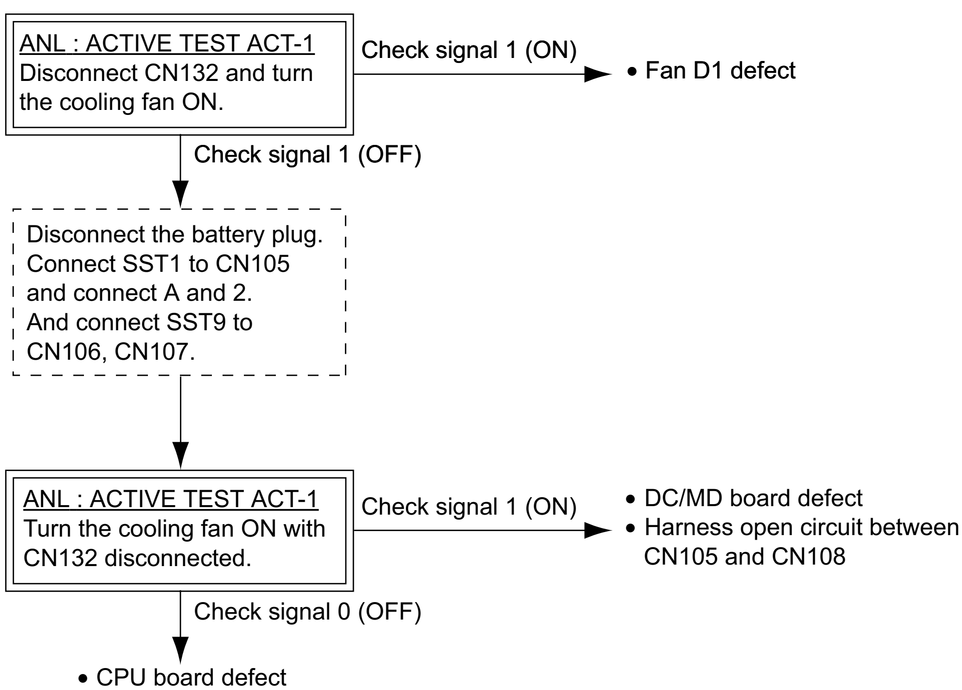
Related portion



Condition for error detection

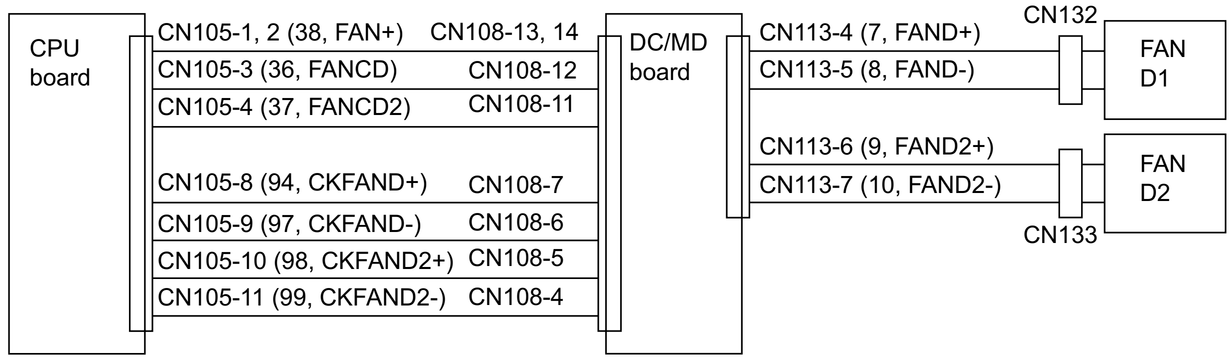
Output upon detection of FAN D1 abnormality.

If C0 occurs at the same time, perform troubleshooting for C0 first.



A0-5	Fan 2 abnormality

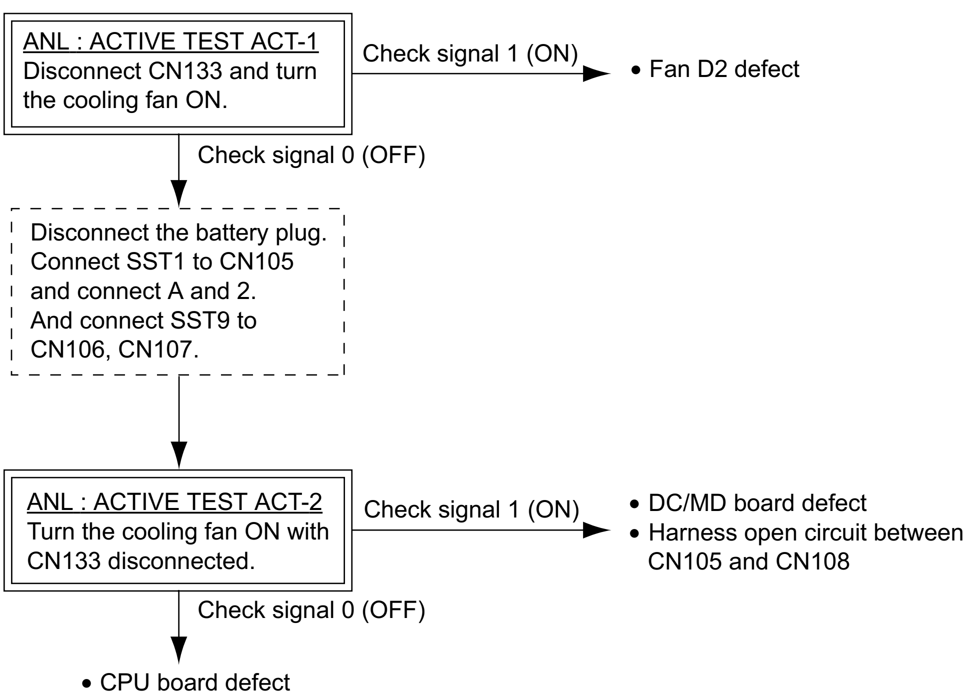
Related portion



Condition for error detection

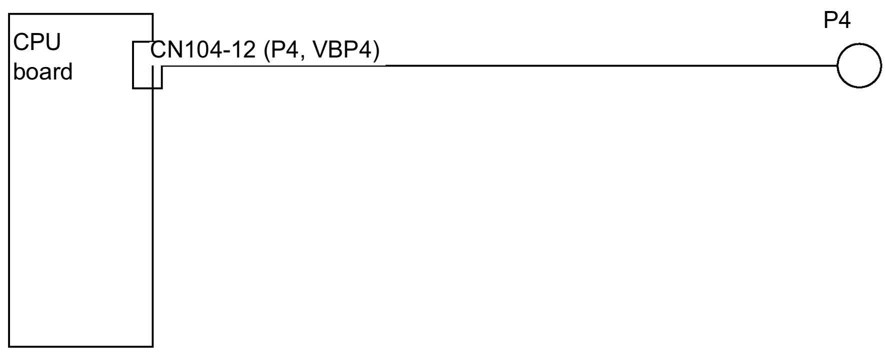
Output upon detection of FAN D2 abnormality.

If C0 occurs at the same time, perform troubleshooting for C0 first



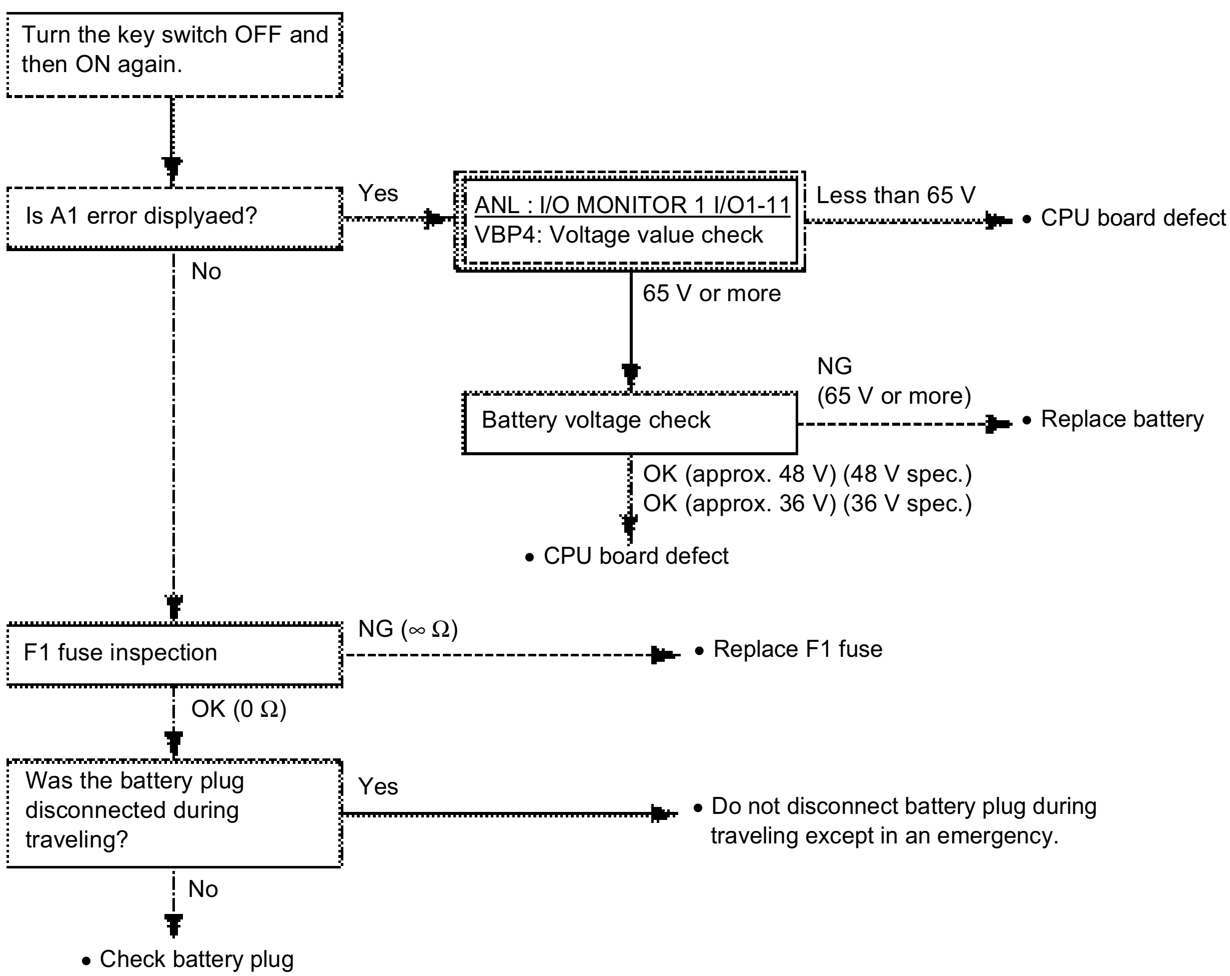
A1	Controller high voltage

Related portion



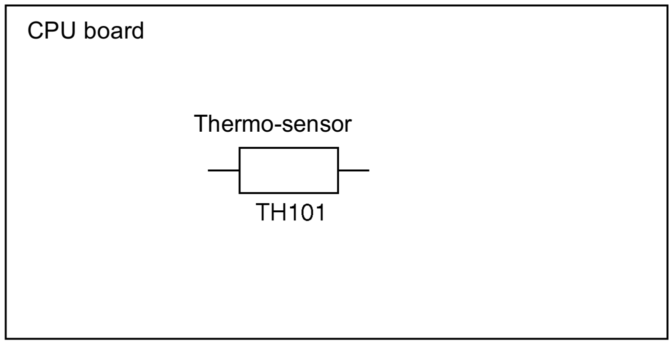
Condition for error detection

Output when P4 line overvoltage is detected.



A2	**CPU board overheat**

Related portion



Condition for error detection

Output when the voltage detected by the termo-sensor on the CPU board exceeds the specified level.

If A0 occurs at the same time, perform troubleshooting for A0 first.

ANL : I/O MONITOR 1 I/O1-8
TEMP: CPU board temperature check

80°C or more → • Allow vehicle to stand for a while (approx. 30 min.)

Less than 80°C ↓

Has the vehicle been subjected to continuous overloaded operation?

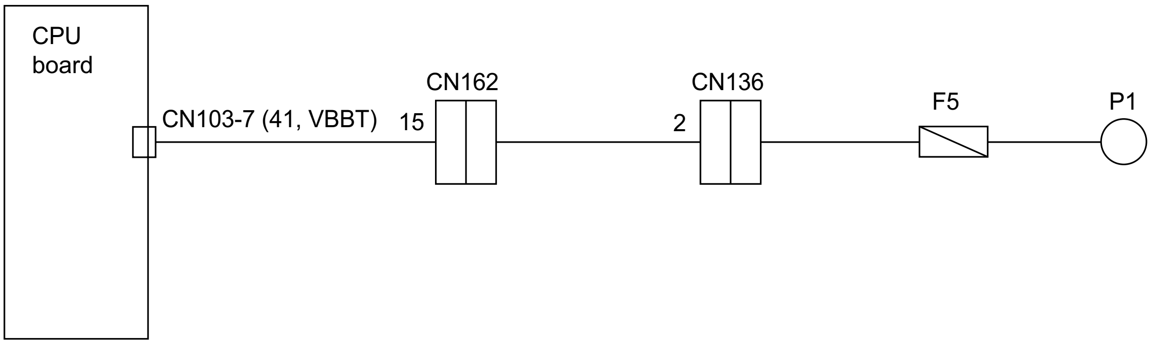
Yes → • Stop vehicle and peform check test with standard load after 30 minutes.

No ↓

• CPU board defect

A3	Incorrect charging plug connection

Related portion



Condition for error detection

Output when the voltage of the VBBT line after F5 fuse exceeds the specified level.

Is A3 error being displayed?

No → • Do not connect charger plug to the controller side plug.

Yes ↓

OPT-13 36 V
Check the battery voltage (36 V or 48 V) setting by option setting

Setting is incorrect → • Correct the setting

Setting is correct ↓

ANL : I/O MONITOR 1 I/O1-9
VBBT: Voltage check

Less than 65 V (48 V spec.)
Less than 48 V (36 V spec.) → • CPU board defect

65 V or more (48 V spec.)
48 V or more (36 V spec.) ↓

P1
b Voltage measurement
N1

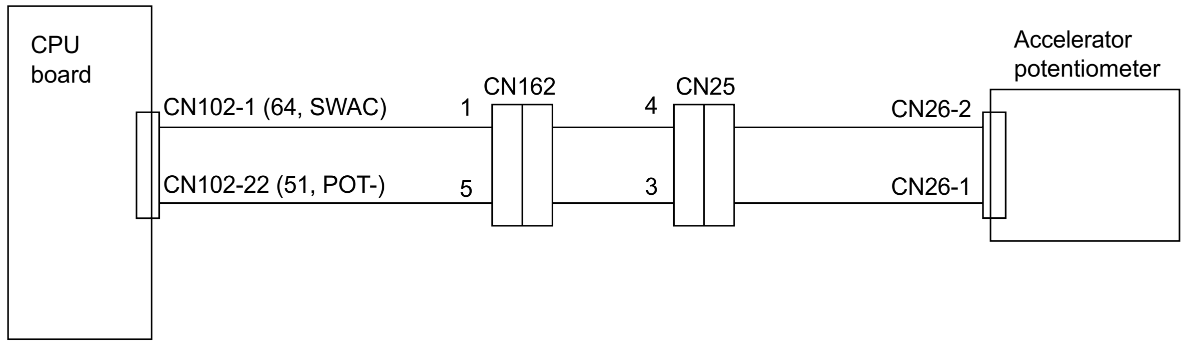
Less than 65 V (48 V spec.)
Less than 48 V (36 V spec.) → • CPU board defect

65 V or more (48 V spec.)
48 V or more (36 V spec.) ↓

• Inspect battery and replace it with a correct battery.

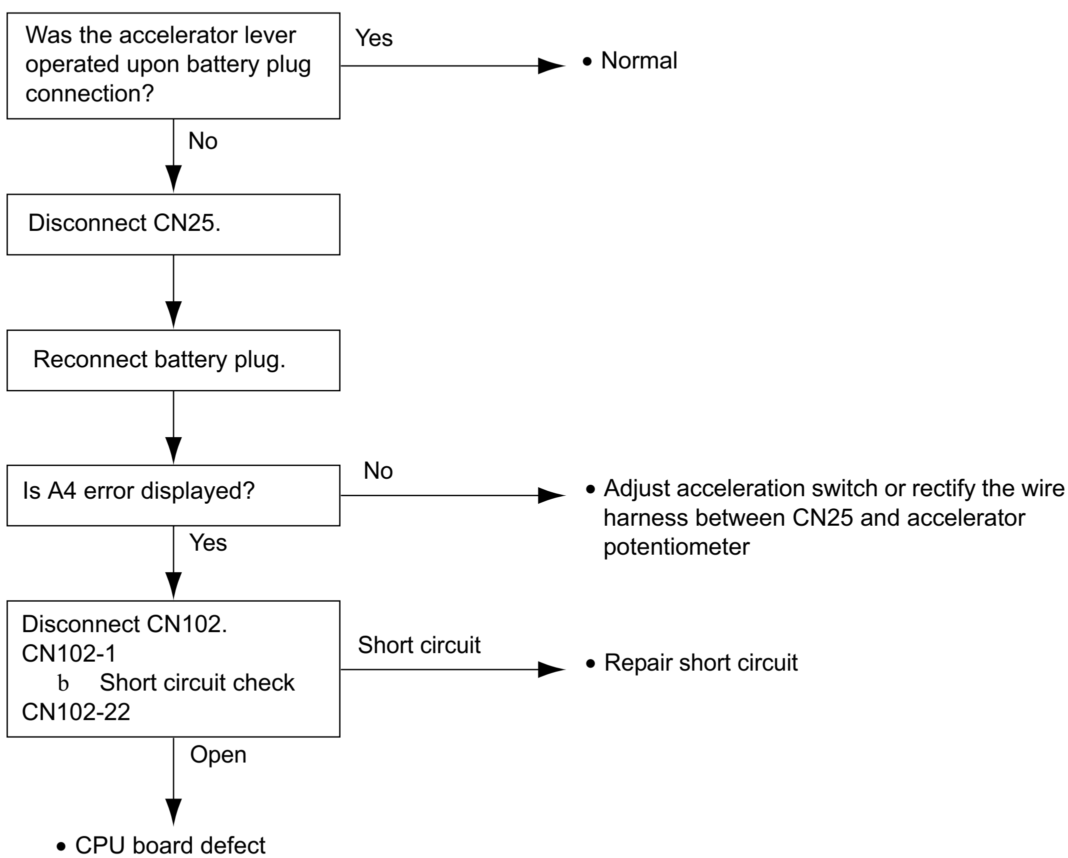
A4	Acceleration switch abnormality

Related portion



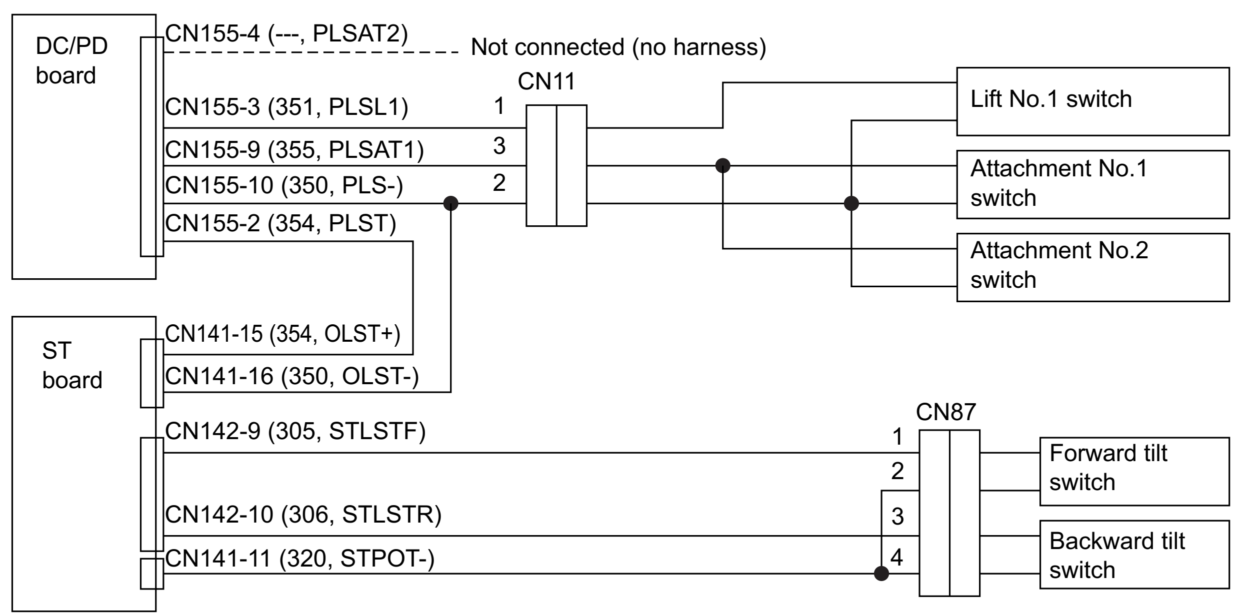
Condition for error detection

Output when the accelerator ON signal is detected upon battery plug connection.



A6-1, 3, 5, 6	Material handling switch abnormality

Related portion



Condition for error detection

Output when the material handling switch ON signal is detected upon battery plug connection.
A6-1 Lifting stage 1 switch short circuit
A6-3 Tilt switch short circuit
A6-5 Attachment 1 (or attachment 2) switch short circuit
A6-6 Attachment 2 switch short circuit

• A6-1, 5

Was the material handling lever operated upon battery plug connection?
- Yes → • Normal
- No ↓

Disconnect material handling CN11.
↓
Reconnect battery plug.
↓
Is A6-1, 5 error displayed?
- No → • Adjust limit switch
- Yes ↓

Disconnect battery plug, and disconnect CN155 for continuity check.
CN155-3 (351) – CN155-10 (350)
CN155-9 (355) – CN155-10 (350)
- Continuity → • Main harness defect
- No continuity ↓

- DC/PD board defect
- Defect of harness between boards
- SCPU board defect

• A6-3

Was the material handling lever operated upon battery plug connection?
- Yes → • Normal
- No ↓

Disconnect material handling CN87

↓

Reconnect battery plug.

↓

Is A6-3 error displayed?
- No → • Tilt switch defect
- Yes ↓

Harness continuity check (open circuit)
Disconnect battery plug, disconnect CN141 and CN142, for continuity check.
CN142-9 (305) – CN141-11 (320)
CN142-10 (306) – CN141-11 (320)
- Continuity → • Main harness defect
- No continuity ↓

ANL : I/O MONITOR 3-2, 3 LST, LSTF, LSTR
Check the tilt switch input (with CN142 connected)
- LSTF or LSTR is ON (indication: 1) → • ST board defect
- Both LSTF and LSTR are OFF (indication: 0)
  LST is ON (indication: 1) ↓

Disconnect battery plug, and disconnect CN141.
CN141-15 (354)
b Short circuit check
CN141-16 (355)
- 1 kΩ or more → • ST board defect
- Less than 1 kΩ ↓

Disconnect CN155.
CN141-15 (354)
b Short circuit check
CN141-16 (355)
- Continuity → • Main harness defect
- No continuity ↓

• DC/PD board defect
• Defect of harness between boards
• SCPU board defect

• A6-6

Is a harness connected to CN155-4 (---)?

Harness is connected

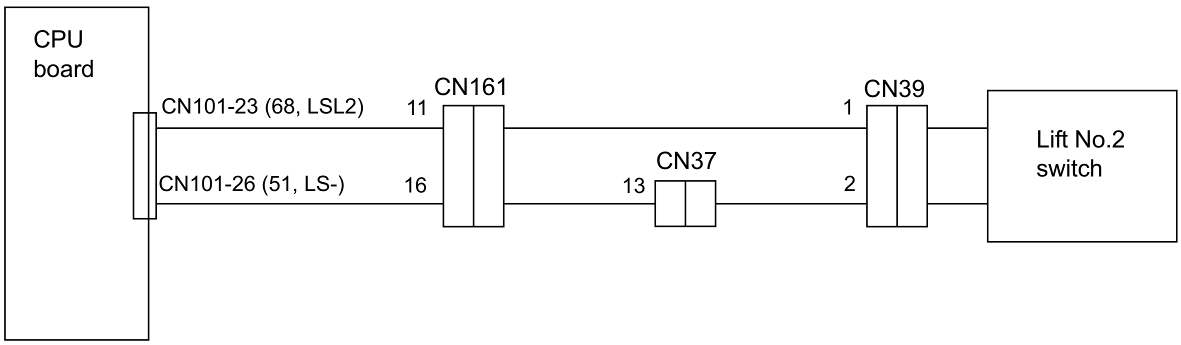
• Main harness defect

Harness is not connected

• DC/PD board defect
• Defect of harness between boards
• SCPU board defect

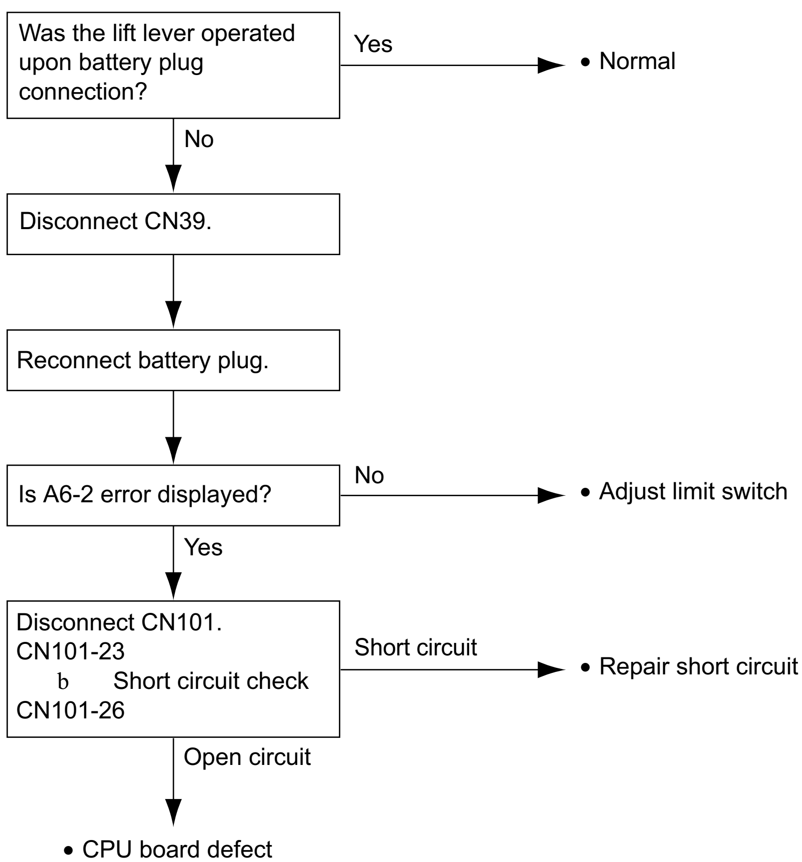
A6-2	Lift No.2 switch abnormality

Related portion



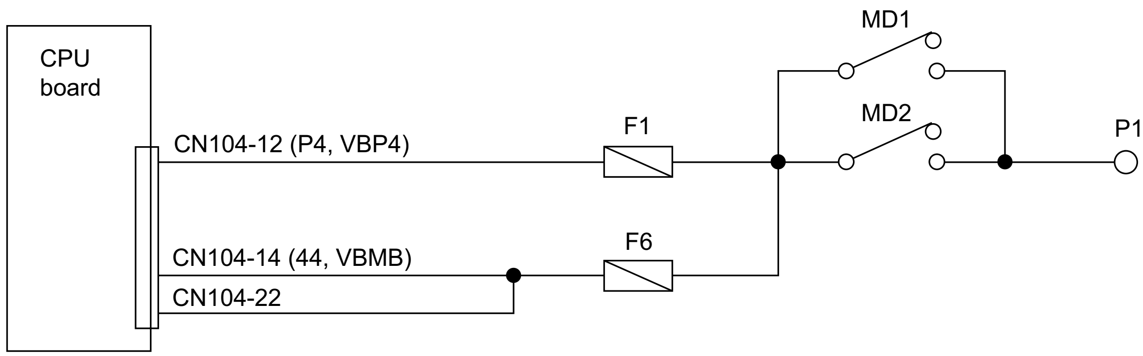
Condition for error detection

Output when the lift No.2 switch ON signal is detected upon battery plug connection



A8	F1 fuse open

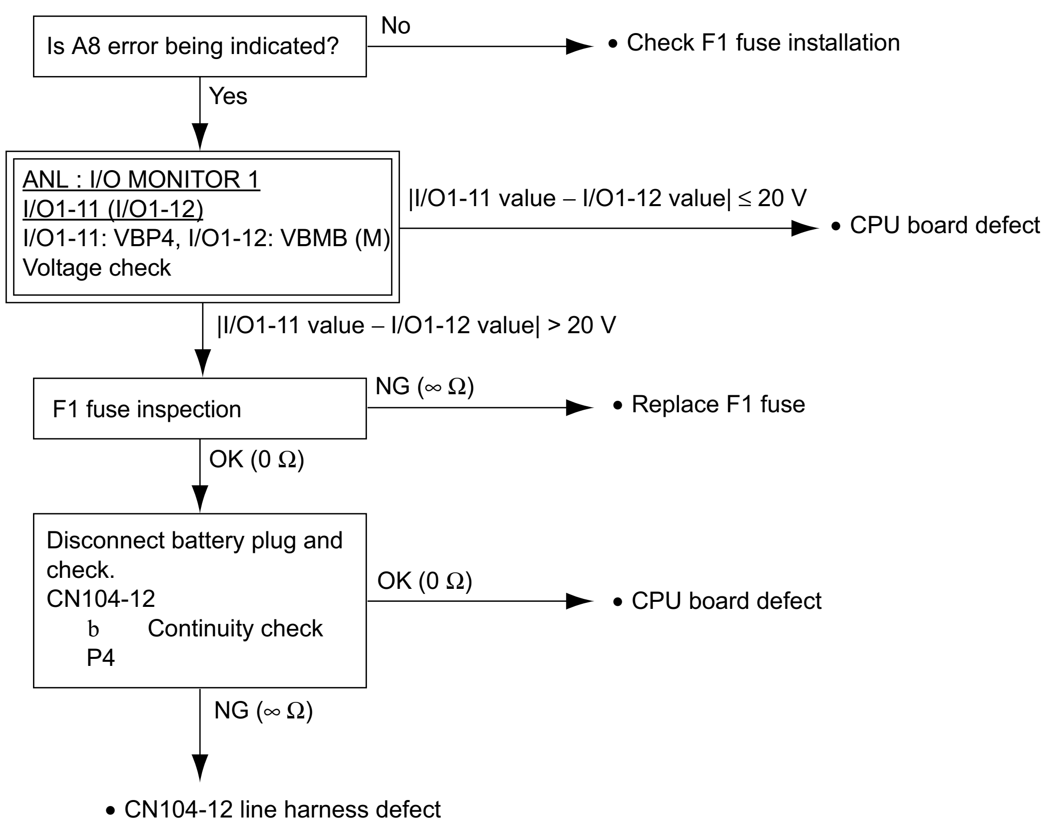
Related portion



Condition for error detection

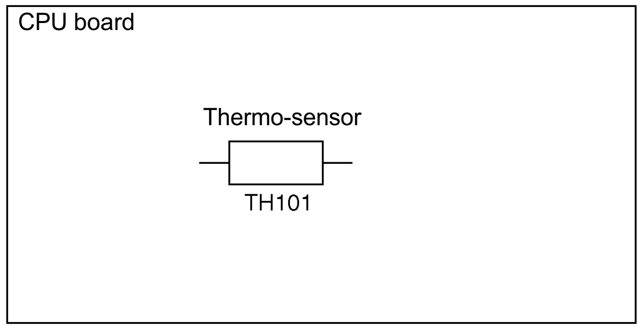
Output when the voltage difference between the VBMB and VBP4 lines exceeds the specified level.

If CB-1 occurs at the same time, perform troubleshooting for CB-1 first.



AA	CPU board thermo-sensor abnormality

Related portion



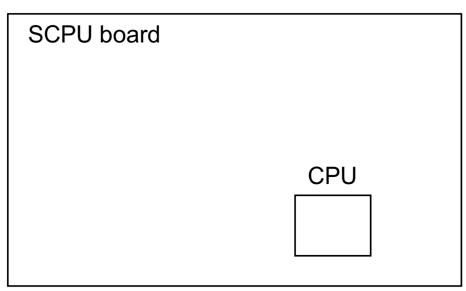
Condition for error detection

Output when CPU board thermo-sensor abnormality is detected.

- To correct, replace the CPU board.

AE-1, 2, 3, 4	SCPU board CPU abnormality

Related portion



Condition for error detection

Output if any abnormality is detected as a result of CPU inspection on the ST board or if sensor input processing does not come to an end.

- SCPU board defect

AF1, 2, 3, 4	CPU board abnormality

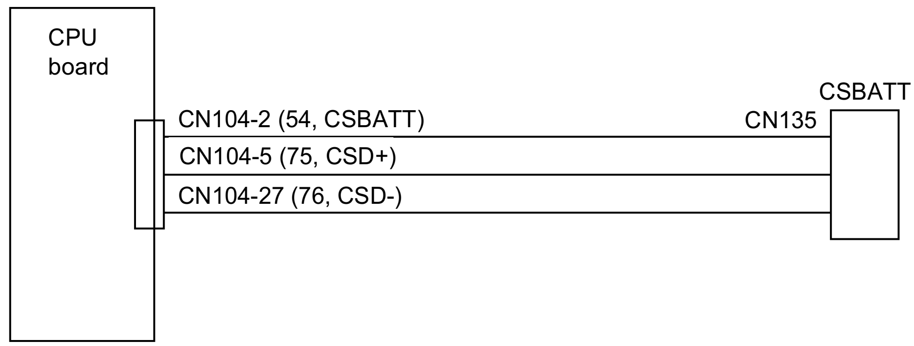
Condition for error detection

Output when CPU board CPU element abnormality is detected.

- To correct, replace the CPU board.

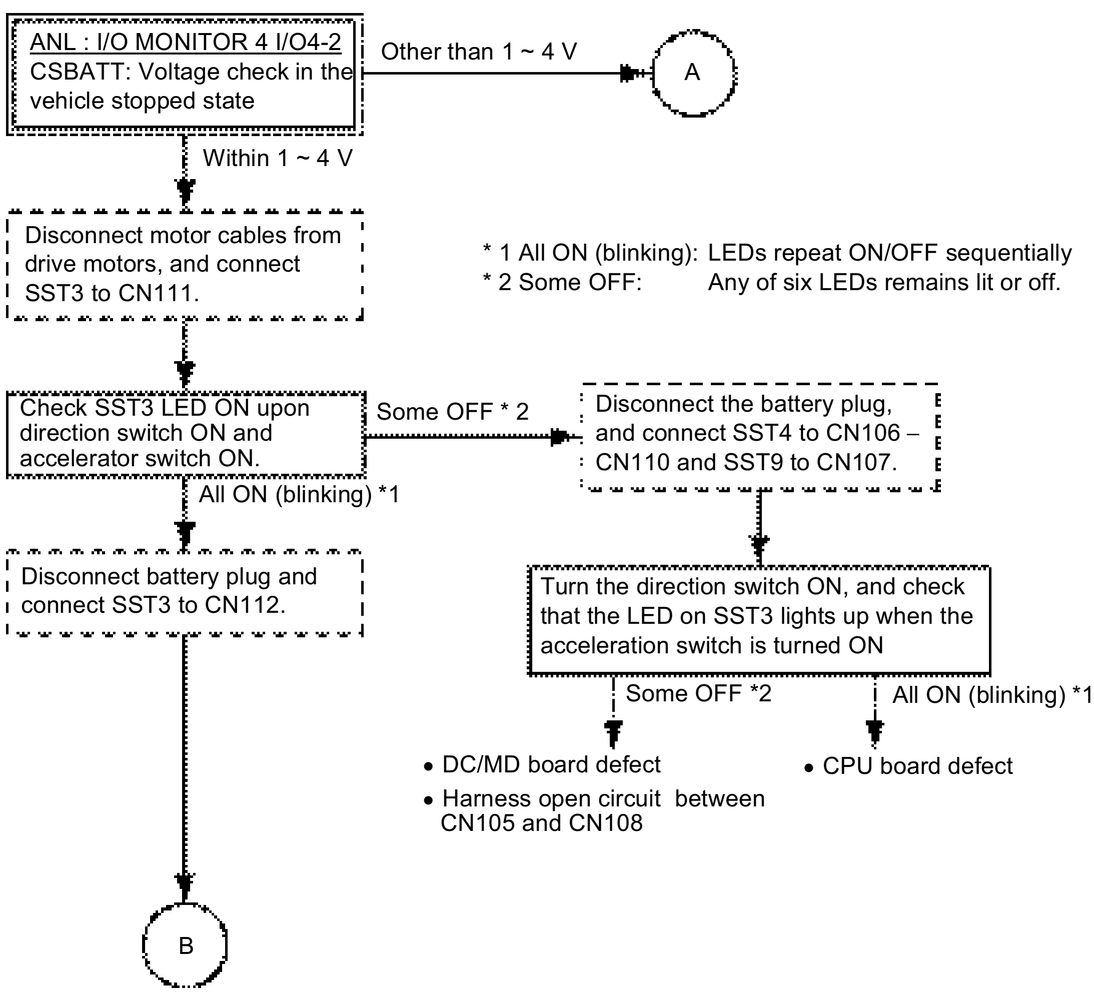
C0-1	Main drive circuit abnormality

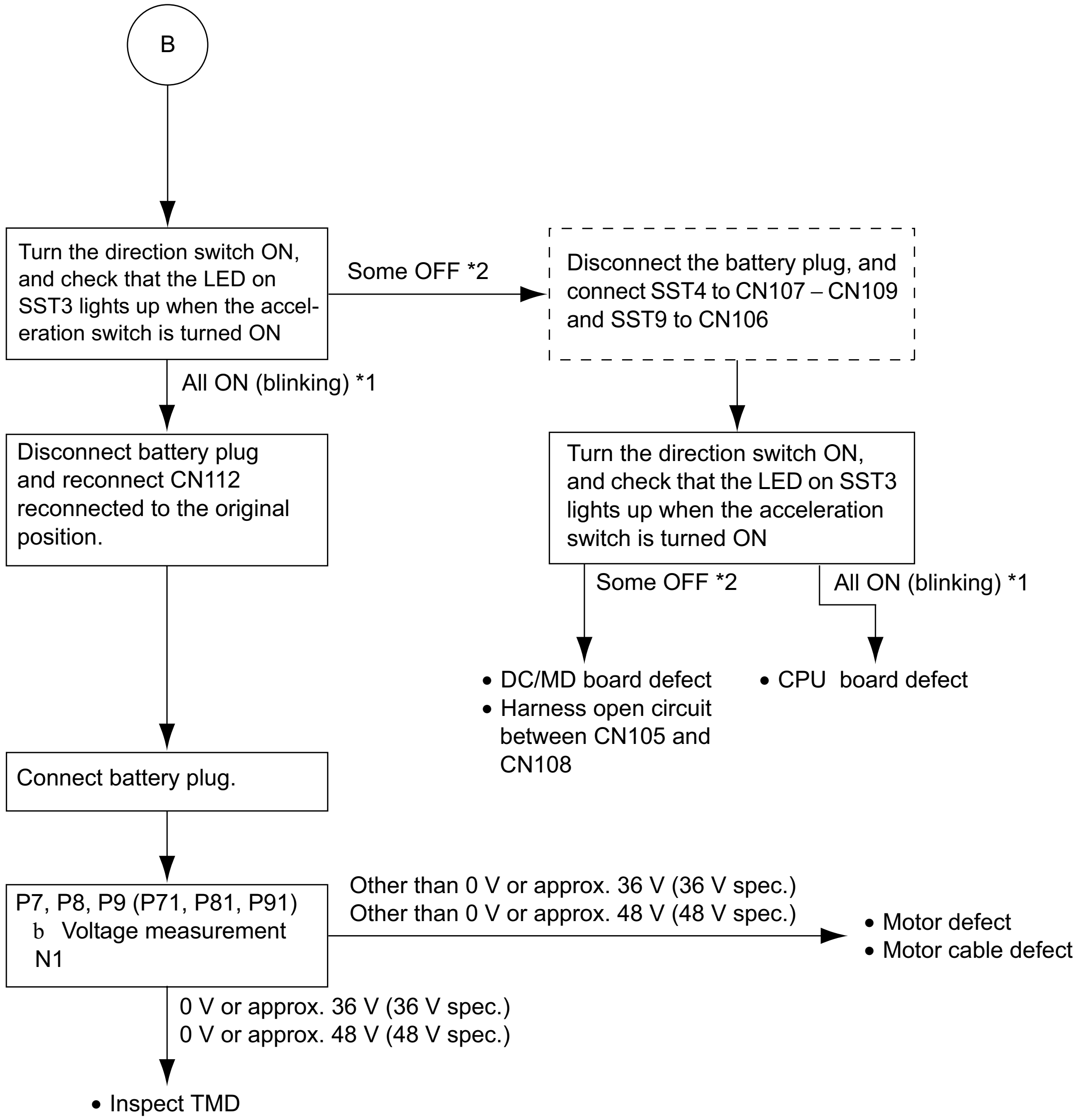
Related portion

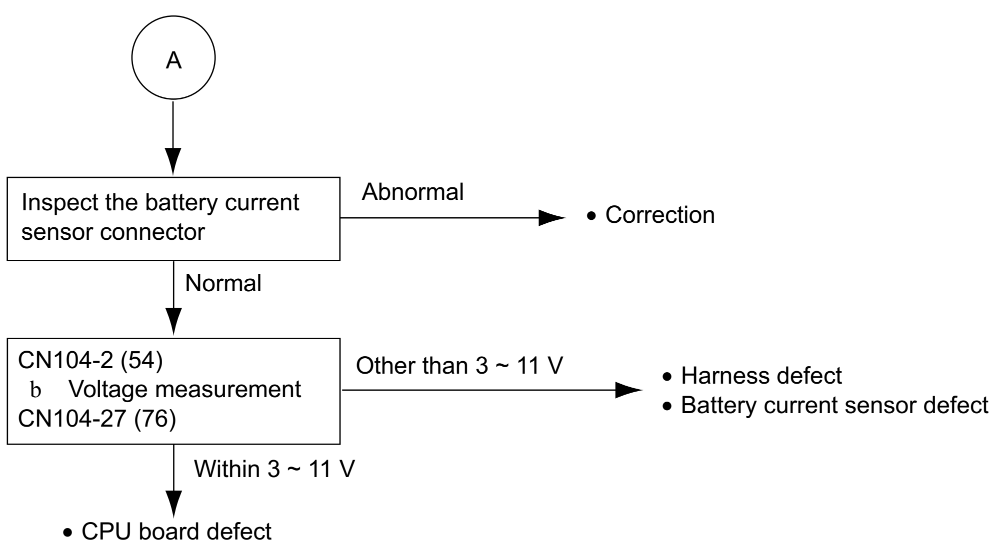


Conditions for error detection

Output when the battery current sensor output exceeds the specified level.

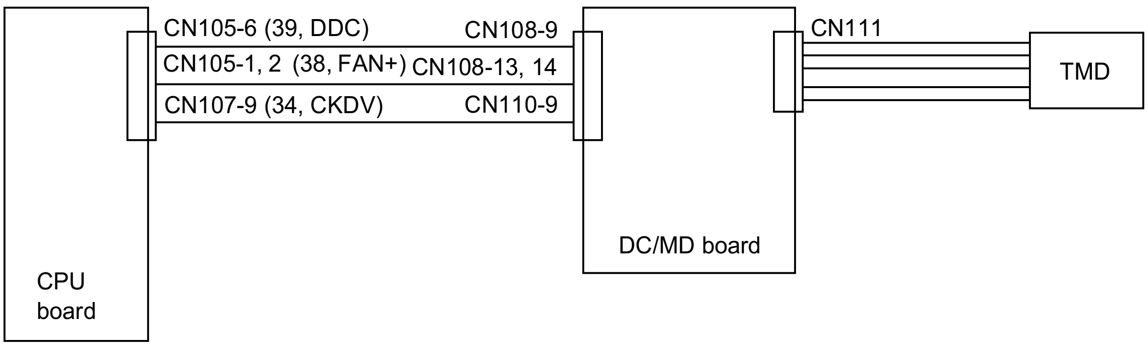



B
Turn the direction switch ON, and check that the LED on SST3 lights up when the accel-eration switch is turned ON
Some OFF *2
Disconnect the battery plug, and connect SST4 to CN107 – CN109 and SST9 to CN106
All ON (blinking) *1
Disconnect battery plug and reconnect CN112 reconnected to the original position.
Turn the direction switch ON, and check that the LED on SST3 lights up when the acceleration switch is turned ON
Some OFF *2
All ON (blinking) *1
• DC/MD board defect
• Harness open circuit between CN105 and CN108
• CPU board defect
Connect battery plug.
P7, P8, P9 (P71, P81, P91)
b Voltage measurement
N1
Other than 0 V or approx. 36 V (36 V spec.)
Other than 0 V or approx. 48 V (48 V spec.)
• Motor defect
• Motor cable defect
0 V or approx. 36 V (36 V spec.)
0 V or approx. 48 V (48 V spec.)
• Inspect TMD


A
Inspect the battery current sensor connector
Abnormal
• Correction
Normal
CN104-2 (54)
b Voltage measurement
CN104-27 (76)
Other than 3 ~ 11 V
• Harness defect
• Battery current sensor defect
Within 3 ~ 11 V
• CPU board defect

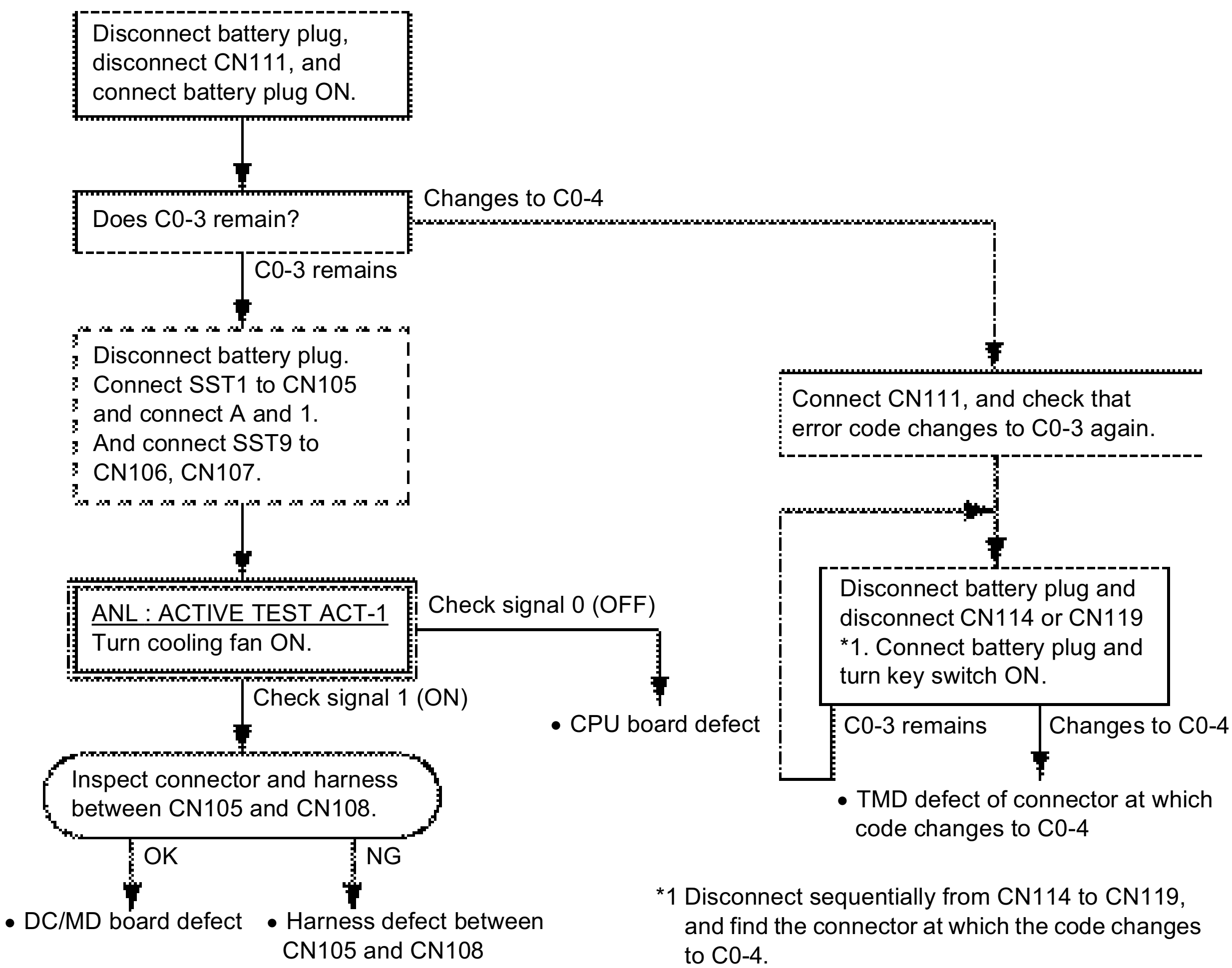
C0-3	Traveling drive 1 power supply abnormality

Related portion



Condition for error detection

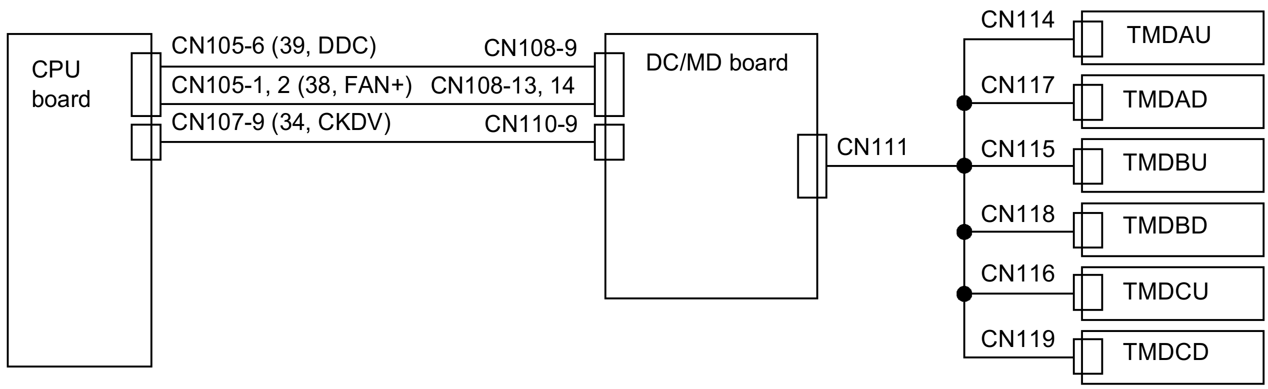
Output when low cooling fan line output voltage or low MMP power supply voltage is detected.



*1 Disconnect sequentially from CN114 to CN119, and find the connector at which the code changes to C0-4.

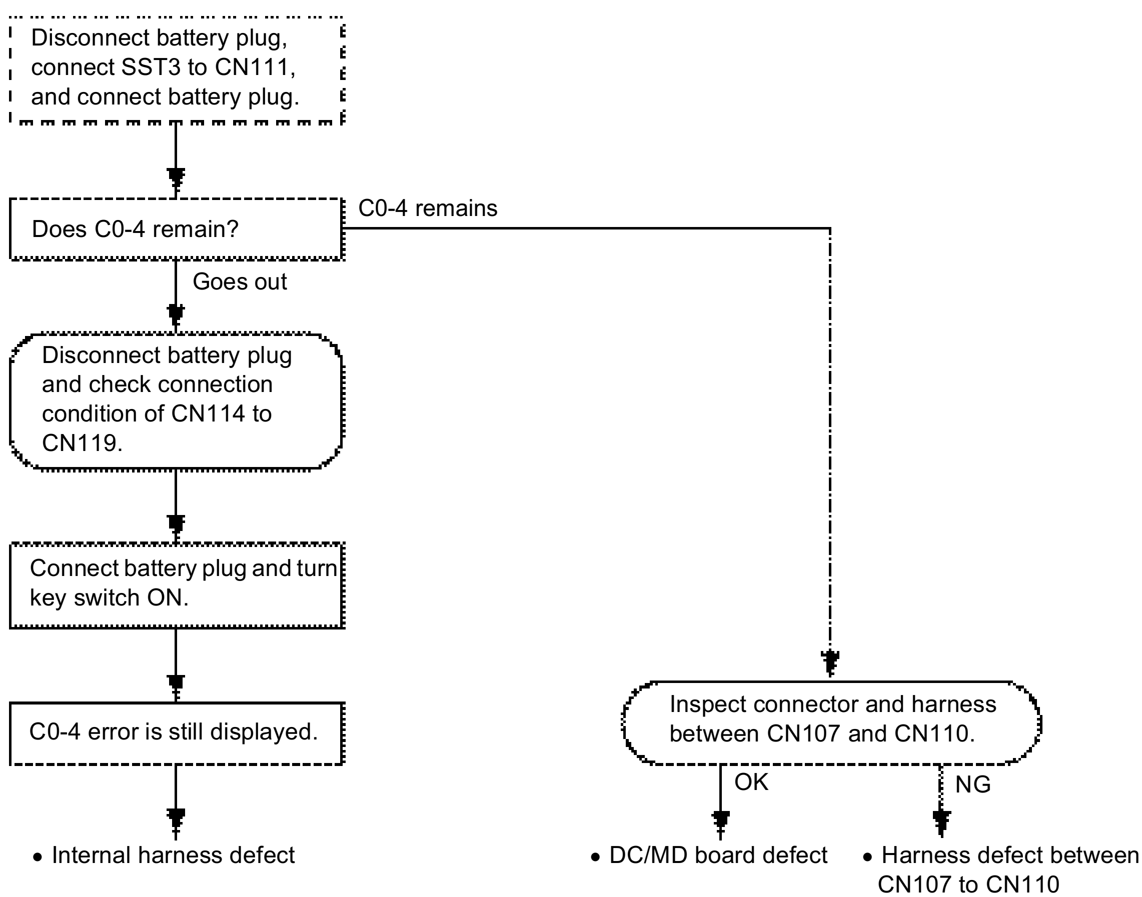
C0-4	Traveling drive 1 circuit abnormality

Related portion



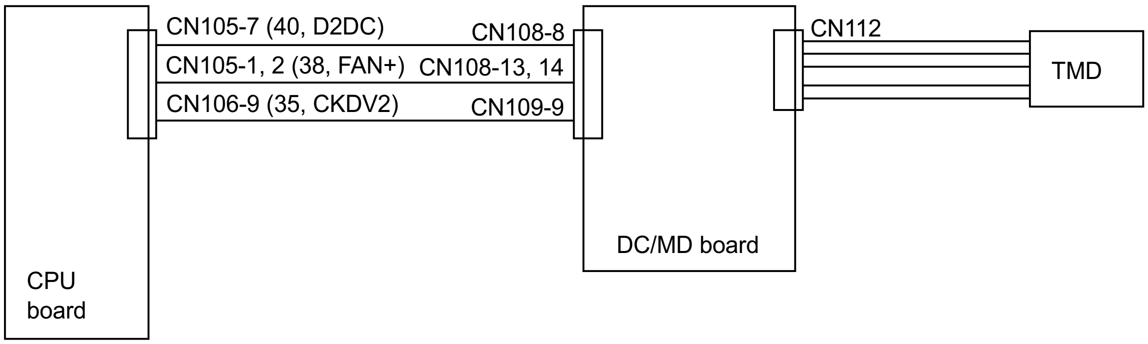
Condition for error detection

Output when line open circuit between DC/MD and MMP boards or low MMP power supply voltage is detected.



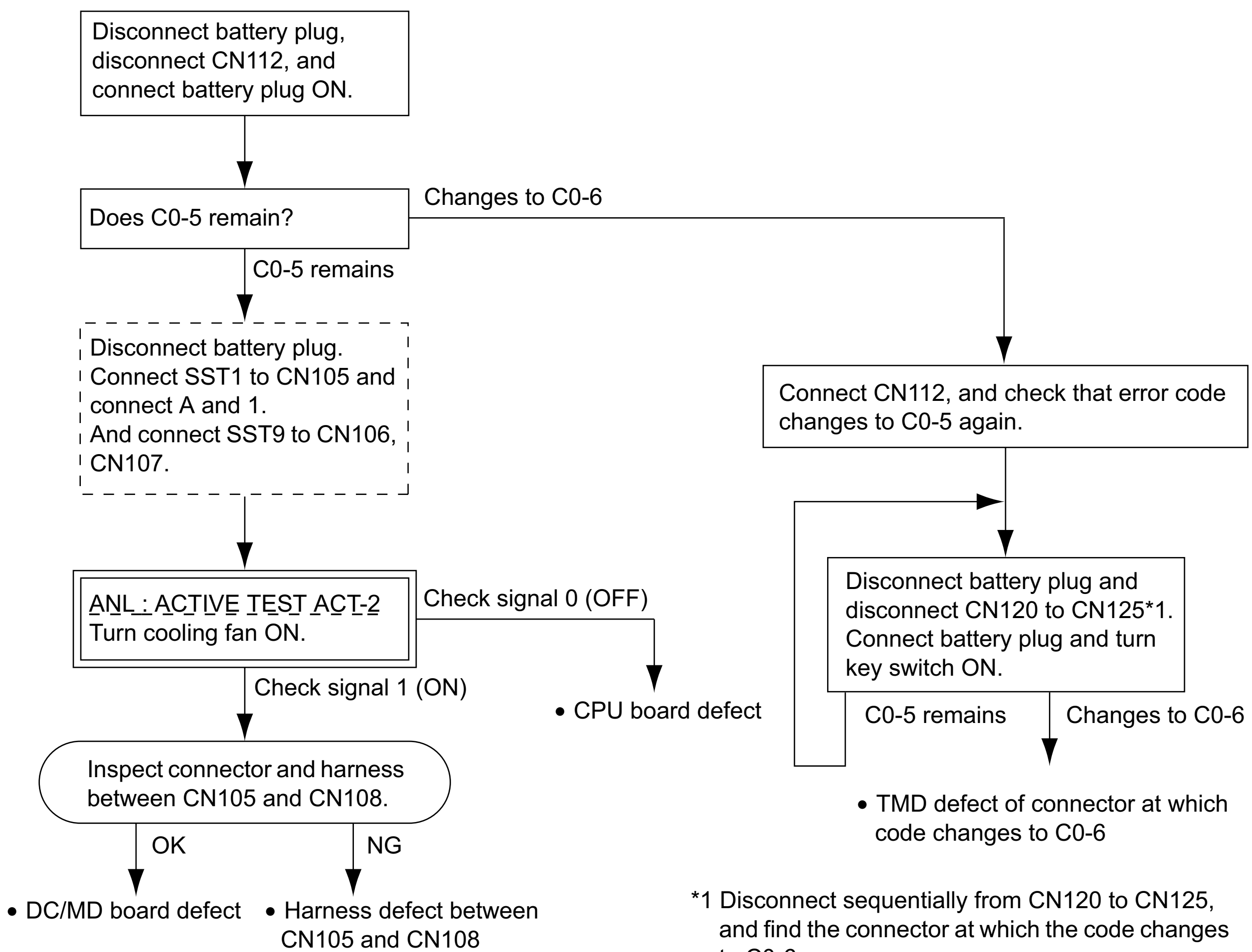
C0-5	Traveling drive 2 power supply abnormality

Related portion



Condition for error detection

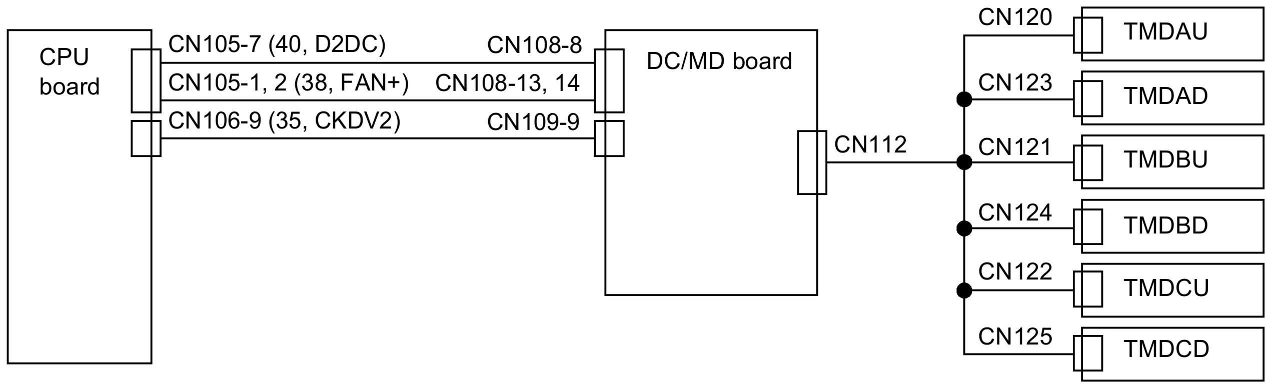
Output when low cooling fan line output voltage or low MMP power supply voltage is detected.



*1 Disconnect sequentially from CN120 to CN125, and find the connector at which the code changes to C0-6.

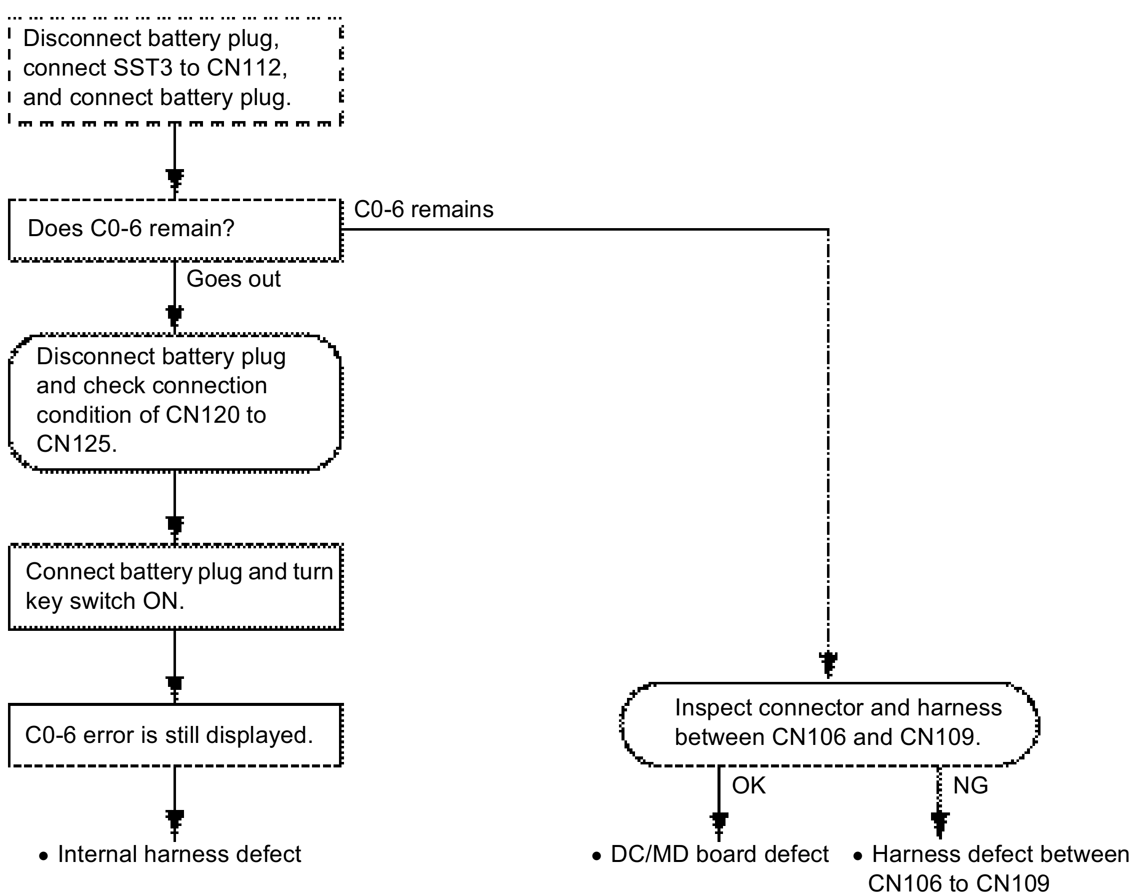
C0-6	Traveling drive 2 circuit abnormality

Related portion



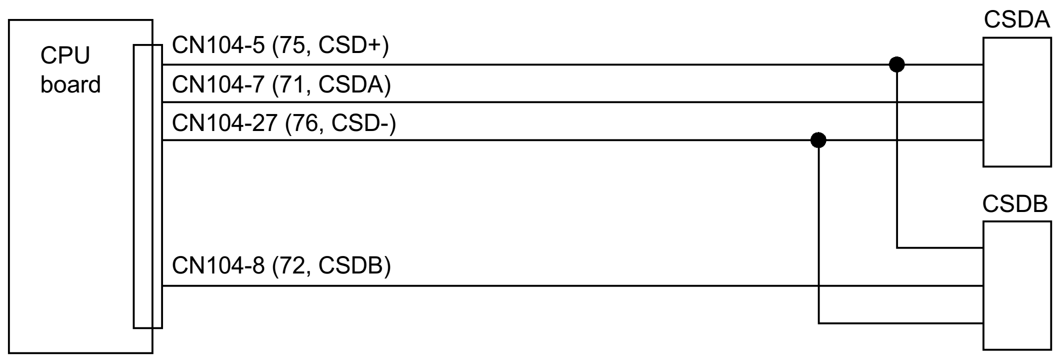
Condition for error detection

Output when line open circuit between DC/MD and MMP boards or low MMP power supply voltage is detected.



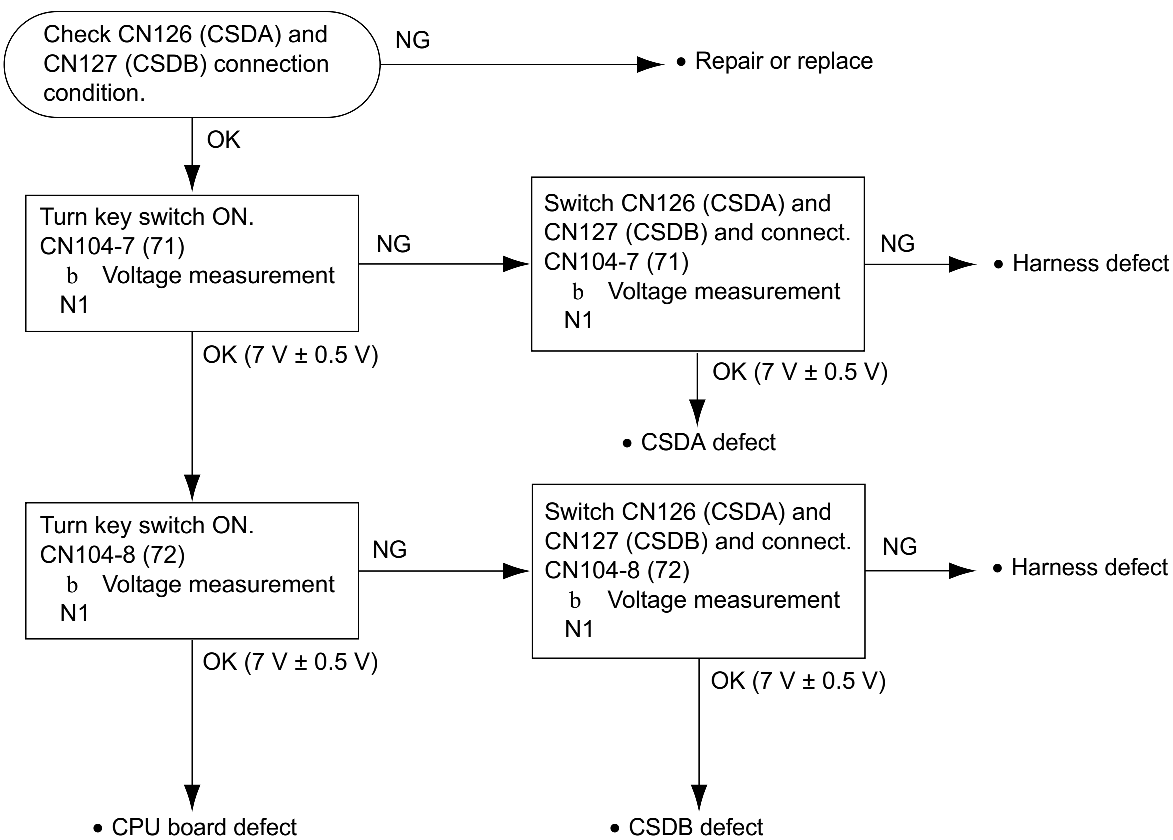
C1-1	Drive 1 current sensor abnormality

Related portion



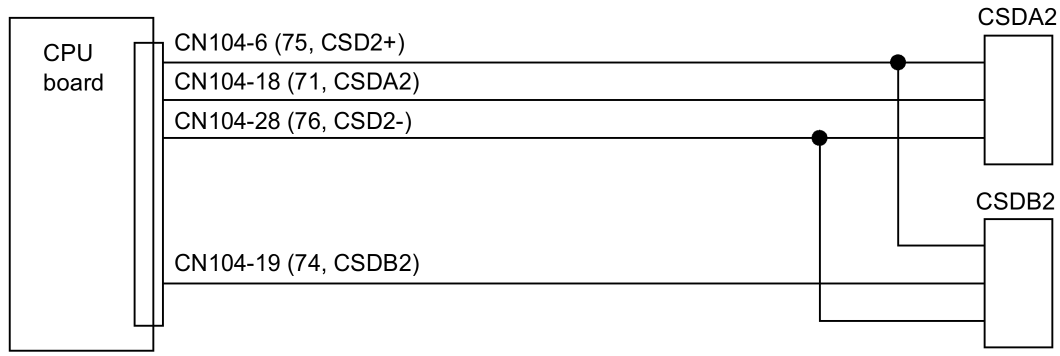
Condition for error detection

Output when the CSDA or CSDB output is outside the specified range.



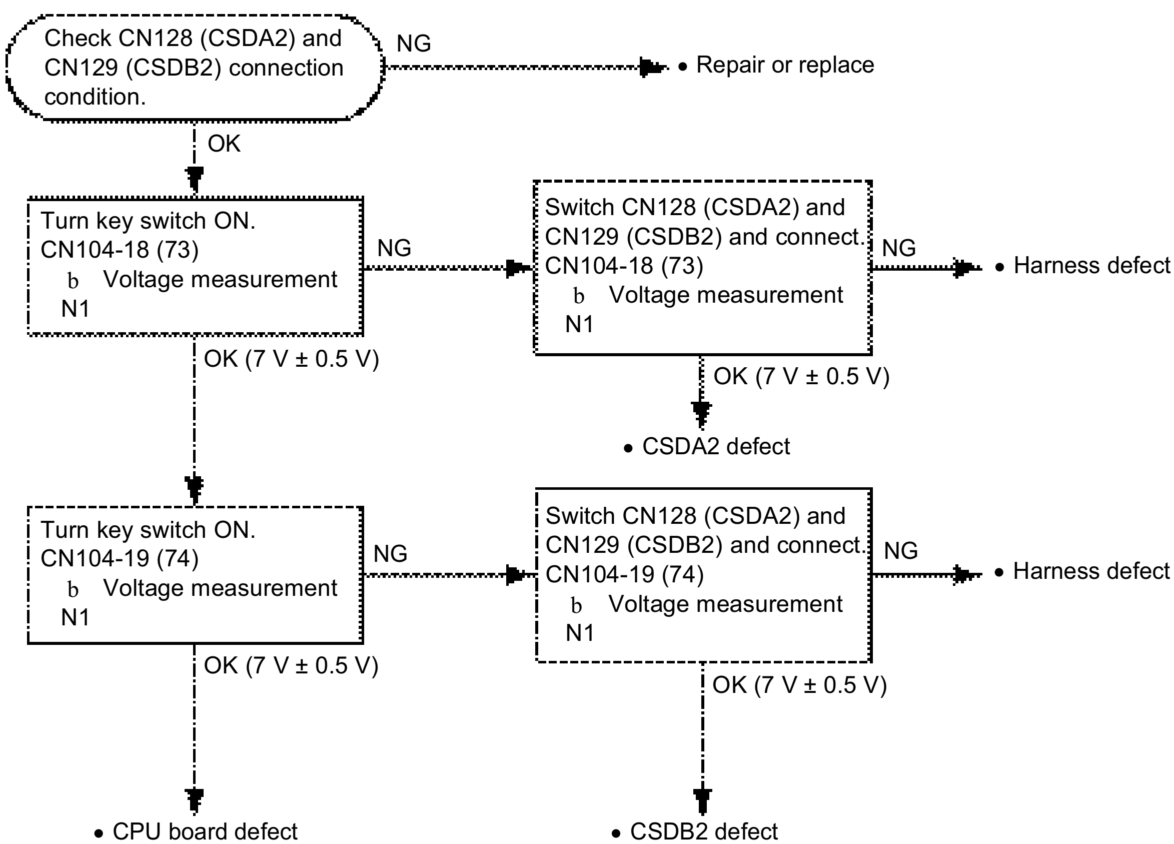
C1-2	Drive 2 current sensor abnormality

Related portion



Condition for error detection

Output when the CSDA2 or CSDB2 output is outside the specified range.



C2-1	Drive motor overheat

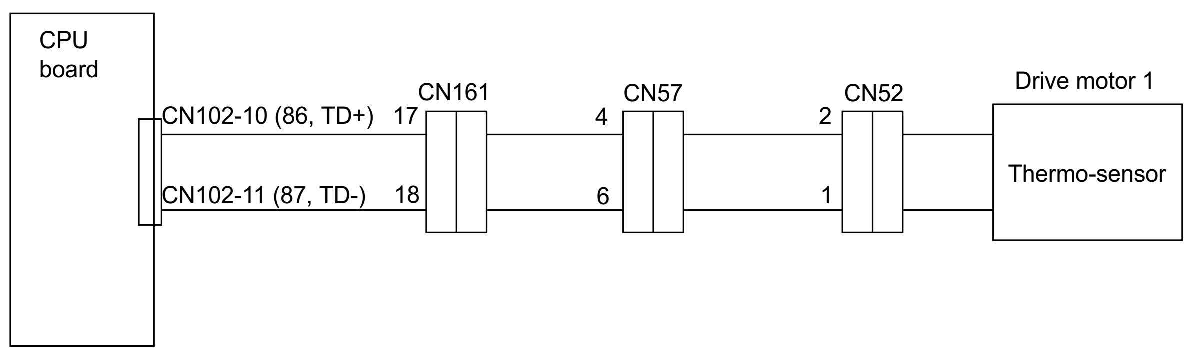
Condition for error detection

Output when the drive motor thermo-sensor output value exceeds the specified level.

- To correct, allow the vehicle to stand for a while (about 30 minutes) .

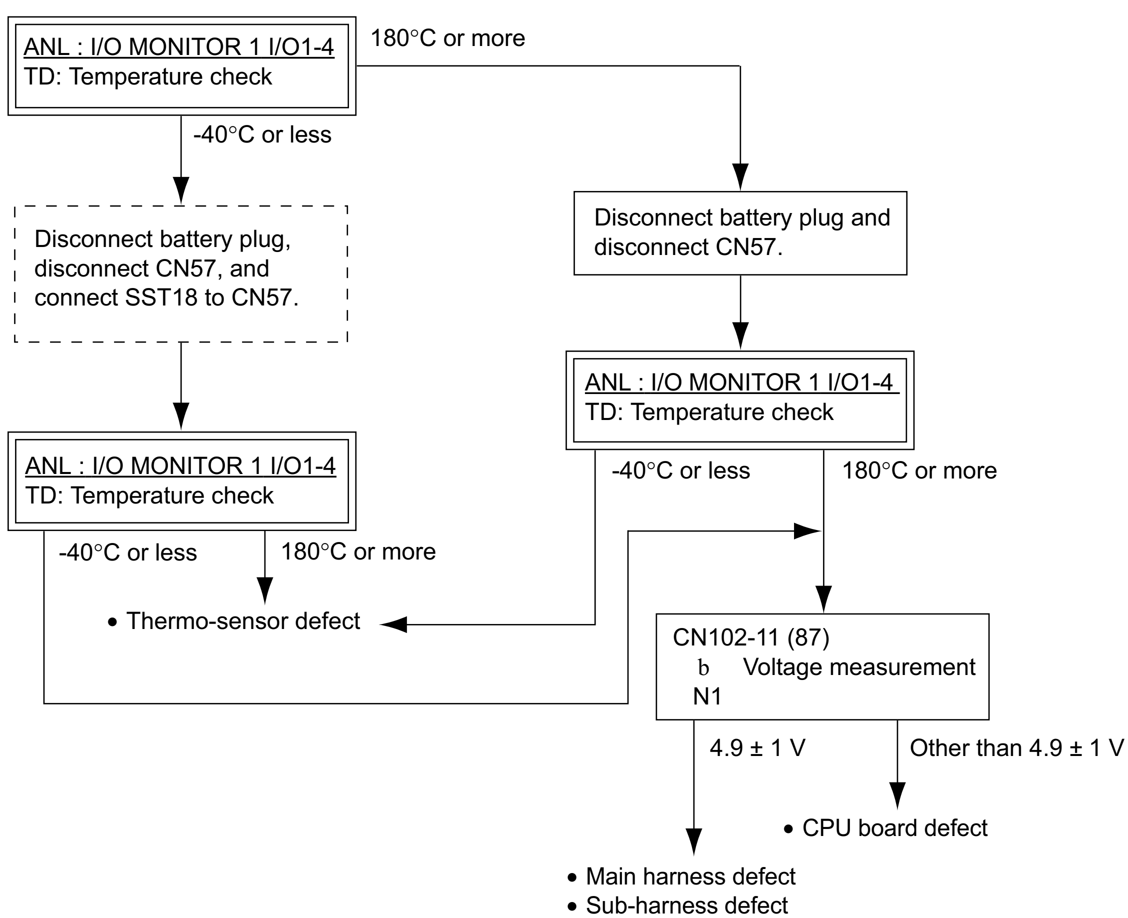
C2-2	Drive motor 1 thermo-sensor abnormality

Related portion



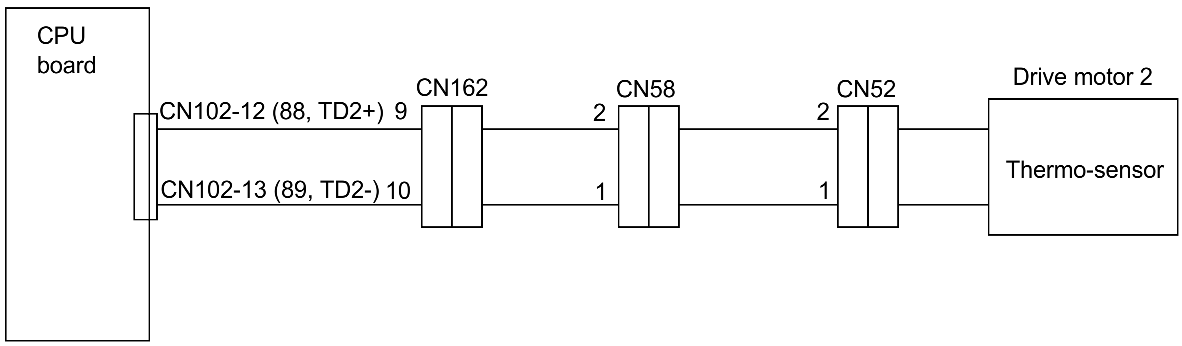
Condition for error detection

Output when motor thermo-sensor output value outside the specified range (open or short circuit) is detected.



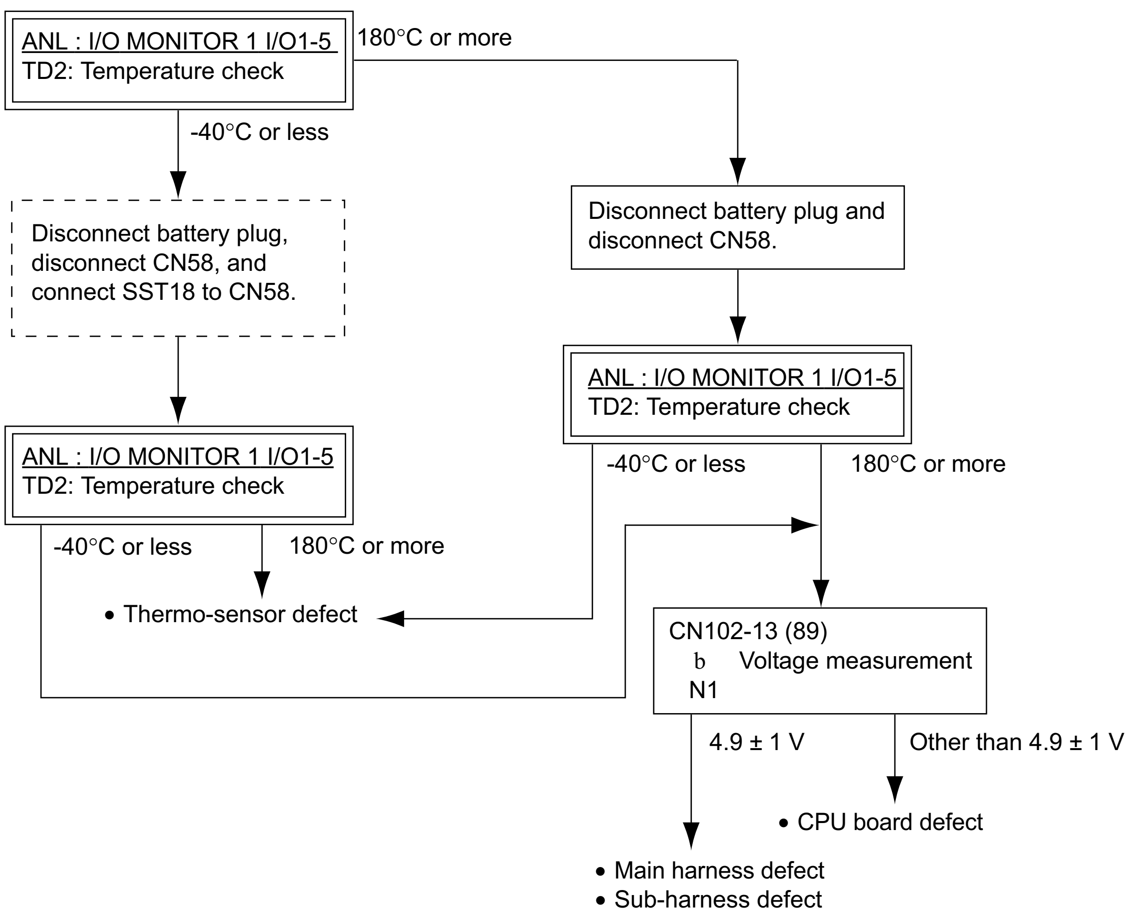
C2-3	Drive motor 2 thermo-sensor abnormality

Related portion



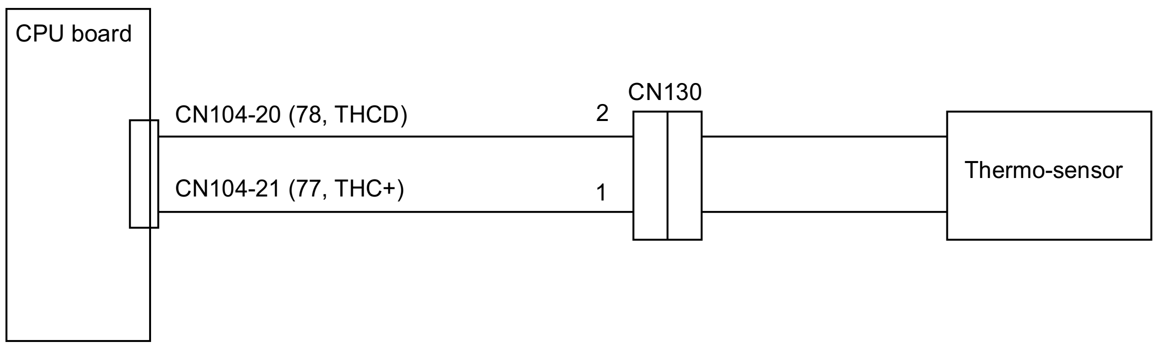
Condition for error detection

Output when motor thermo-sensor output value outside the specified range (open or short circuit) is detected.



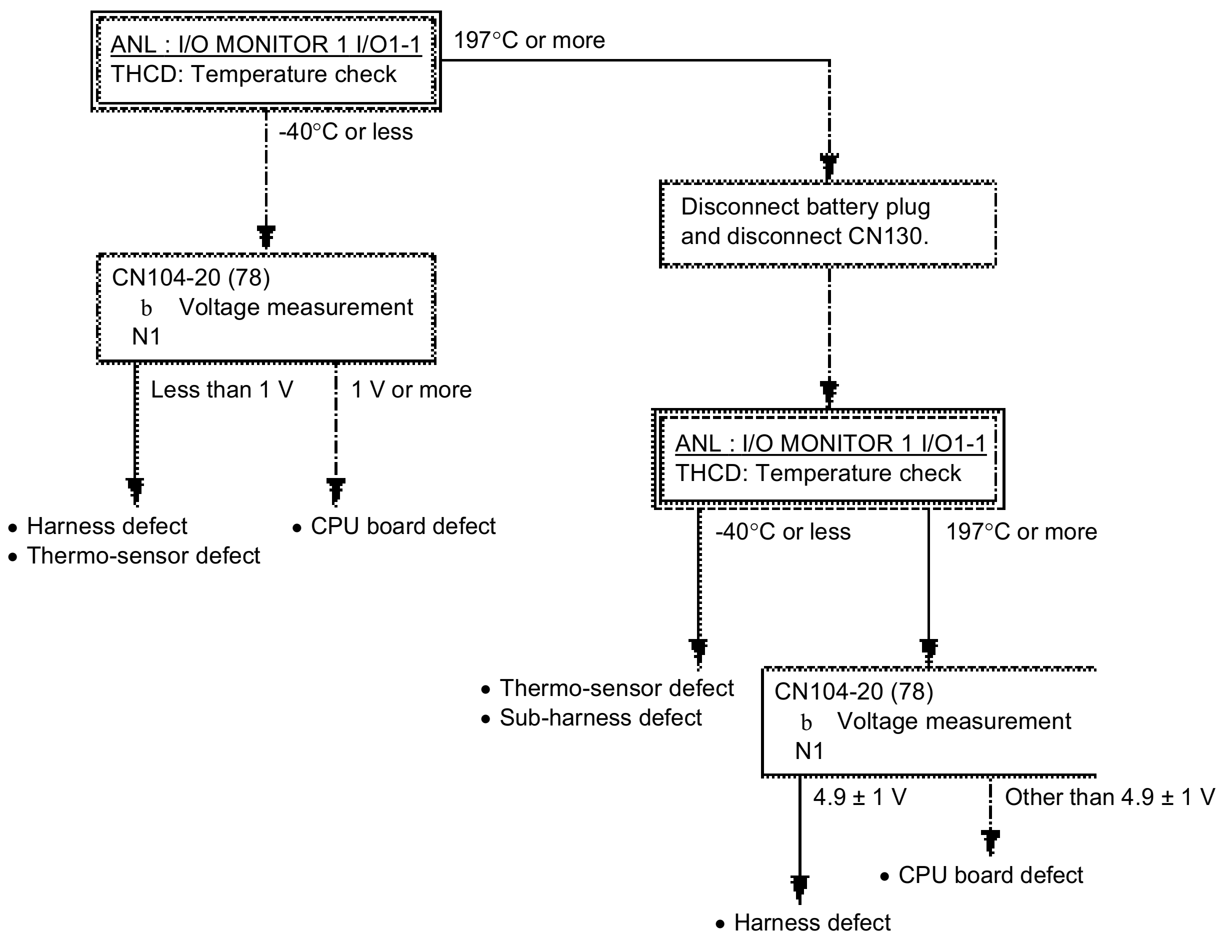
C3-1	Main drive circuit 1 thermo-sensor abnormality

Related portion



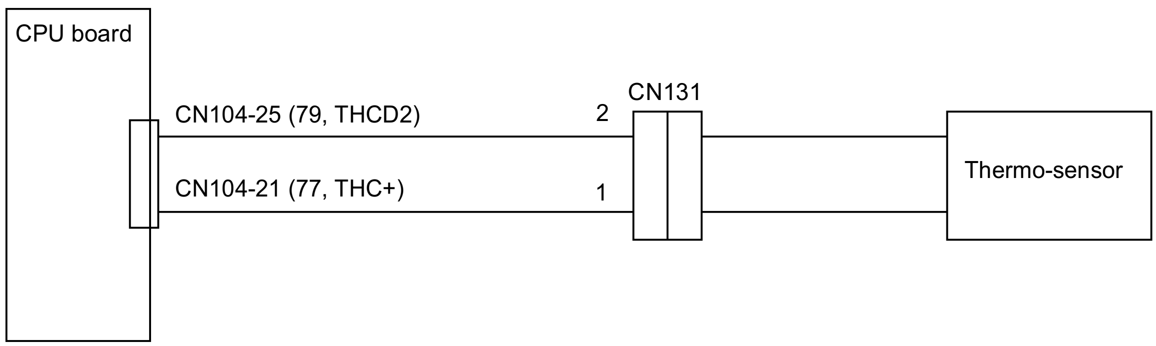
Condition for error detection

Output when controller thermo-sensor output value outside the specified range (open or short circuit) is detected.



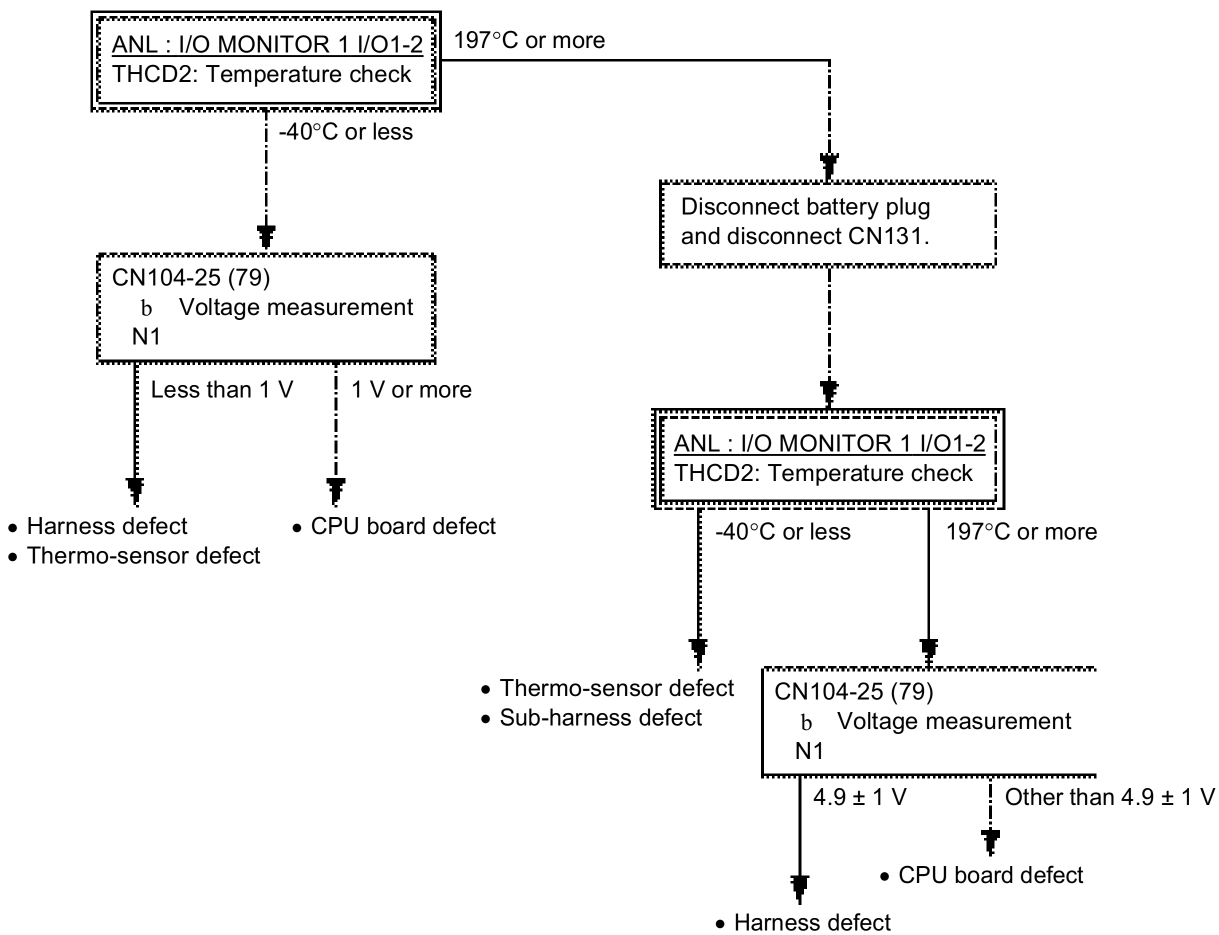
C3-2	Main drive circuit 2 thermo-sensor abnormality

Related portion



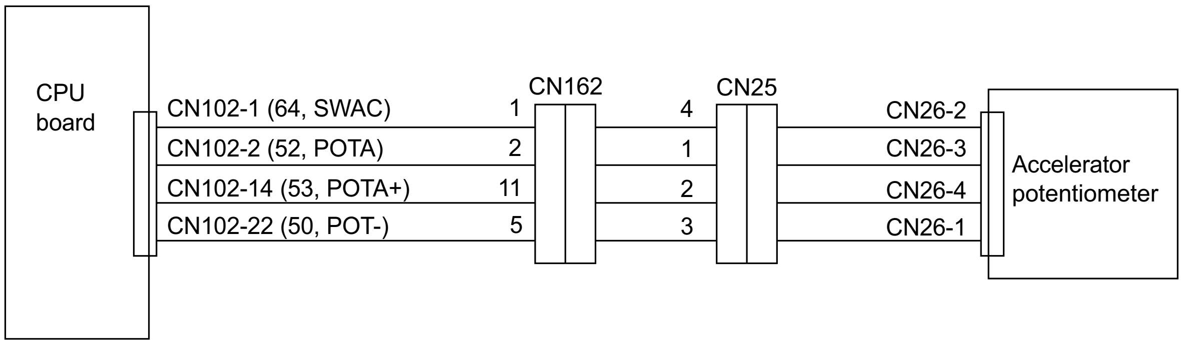
Condition for error detection

Output when controller thermo-sensor output value outside the specified range (open or short circuit) is detected.



C4-1, 2, 3, 4	Accelerator potentiometer abnormality

Related portion



Conditions for error detection

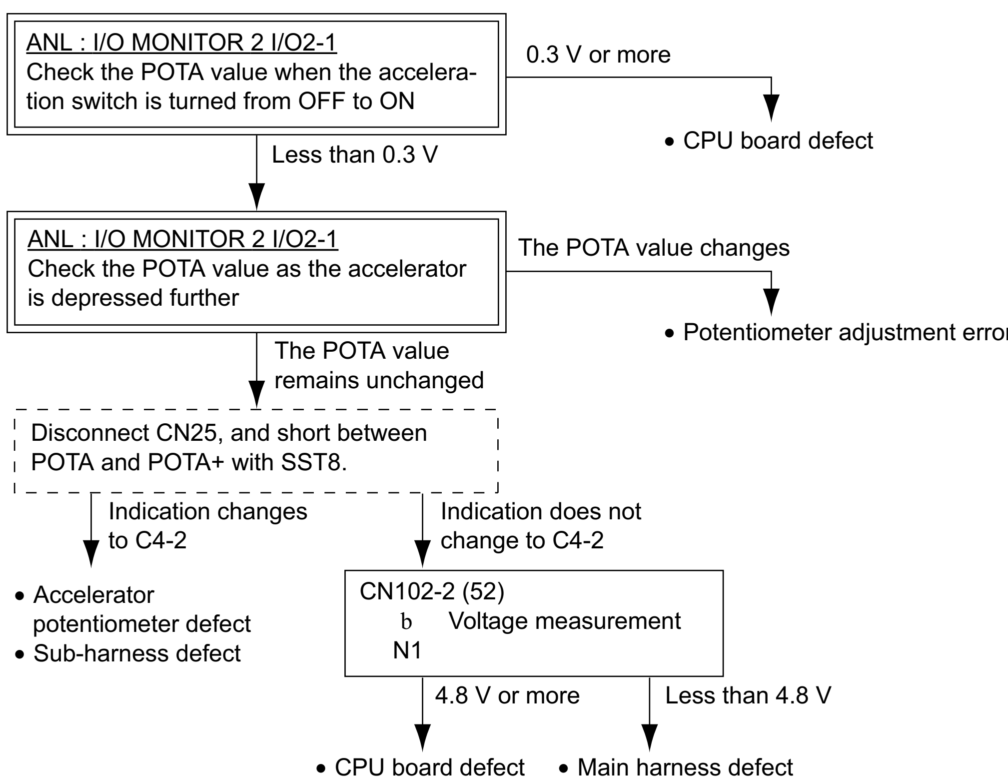
C4-1 Output if the accelerator line voltage (POTA) is below the standard level when the acceleration switch is turned ON.

C4-2 Output if the accelerator line voltage (POTA) is above the standard level.

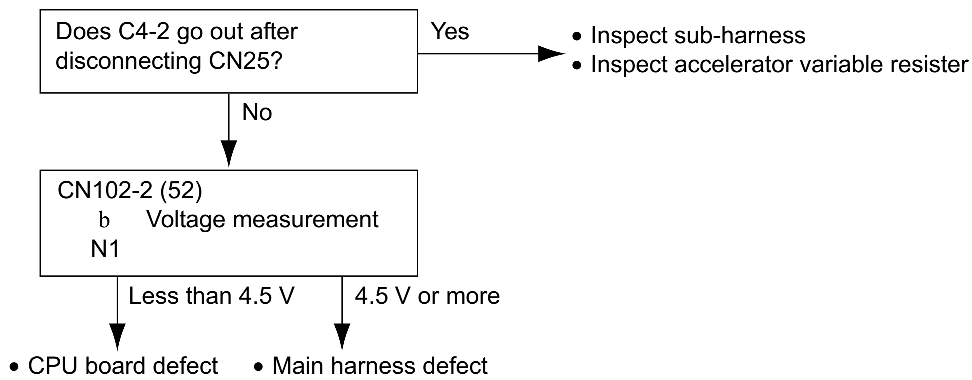
C4-3 Output if accelerator line voltage (POTA) is above the standard level when the acceleration switch is turned OFF.

C4-4 Output if the accelerator line voltage (POTA) is above the standard level when the acceleration switch state is changed.

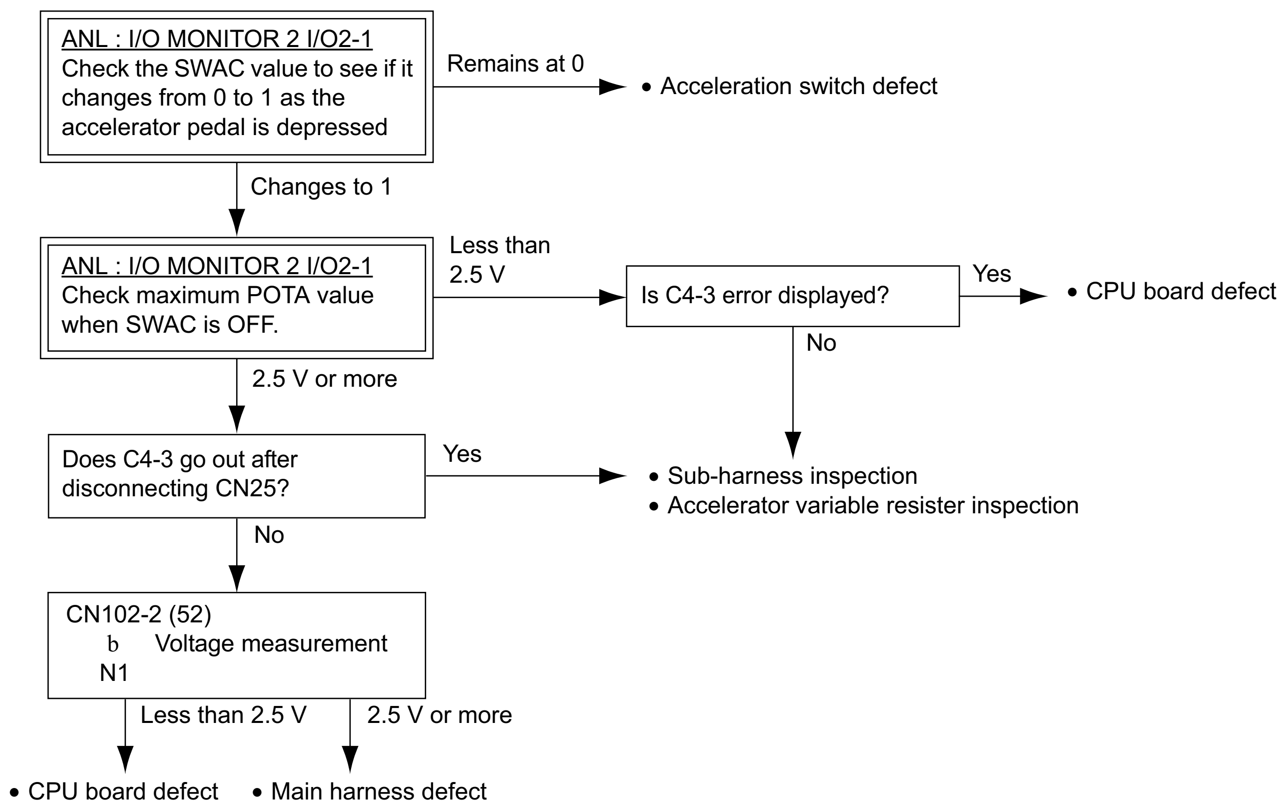
- **C4-1**



- **C4-2**

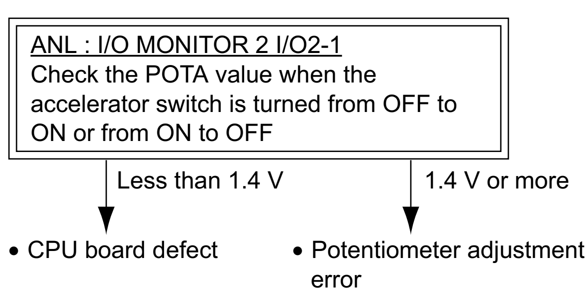


- **C4-3**



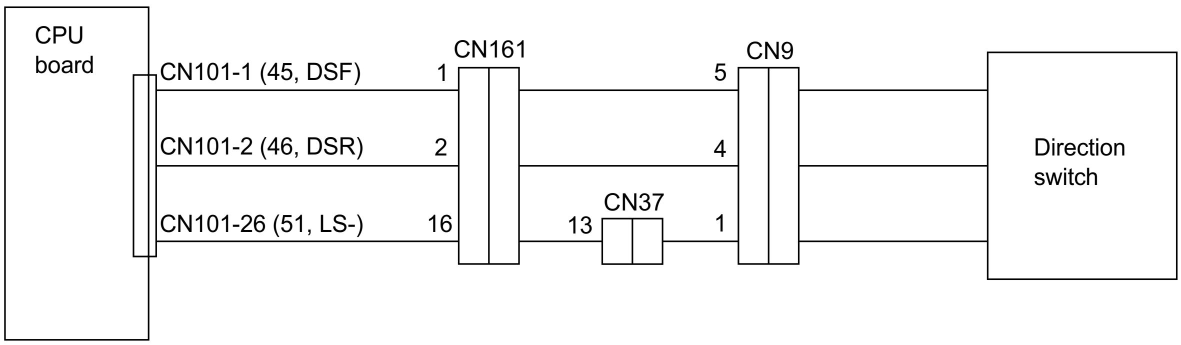
- **C4-4**

* If C4-2 or C4-3 occurs at the same time, perform troubleshooting for C4-2 and C4-3 first.



C7	Direction switch abnormality

Related portion



Condition for error detection

Output when both forward and reverse direction switches (DSF and DSR) are ON

Disconnect battery plug and disconnect CN9.

↓

<u>ANL : I/O MONITOR 2 I/O2-2</u>
DSF, DSR: Check with the direction lever in neutral position.

Becomes OFF → • Direction switch

DSF or DSR ON ↓

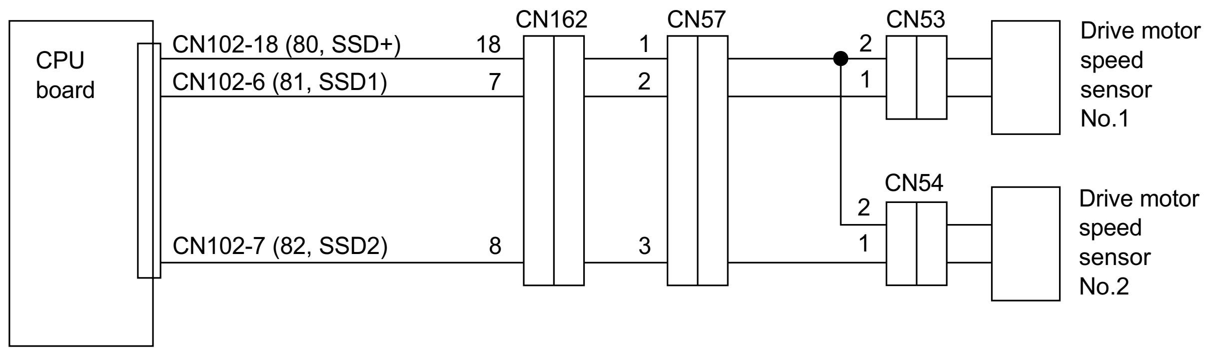
CN101-1 (45)…When DSF is ON
CN101-2 (46)…When DSR is ON
b Voltage measurement
N1

OK (approx. 5 V) ↓ • CPU board defect

NG (Other than OK) ↓ • Harness short circuit

C8-1, 2	Drive motor speed sensor (1, 2) abnormality

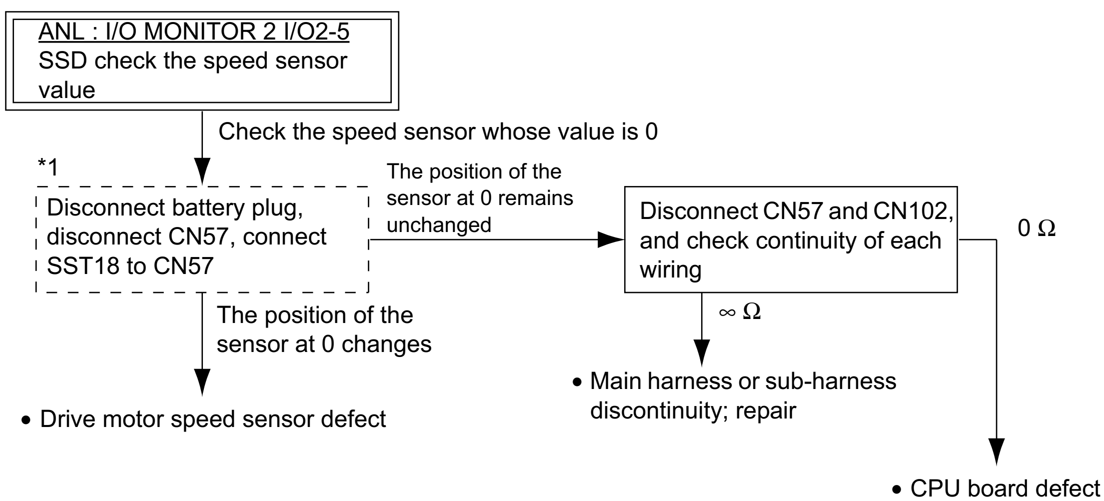
Related portion



Condition for error detection

Output when vehicle speed sensor line open circuit or decreased output is detected.

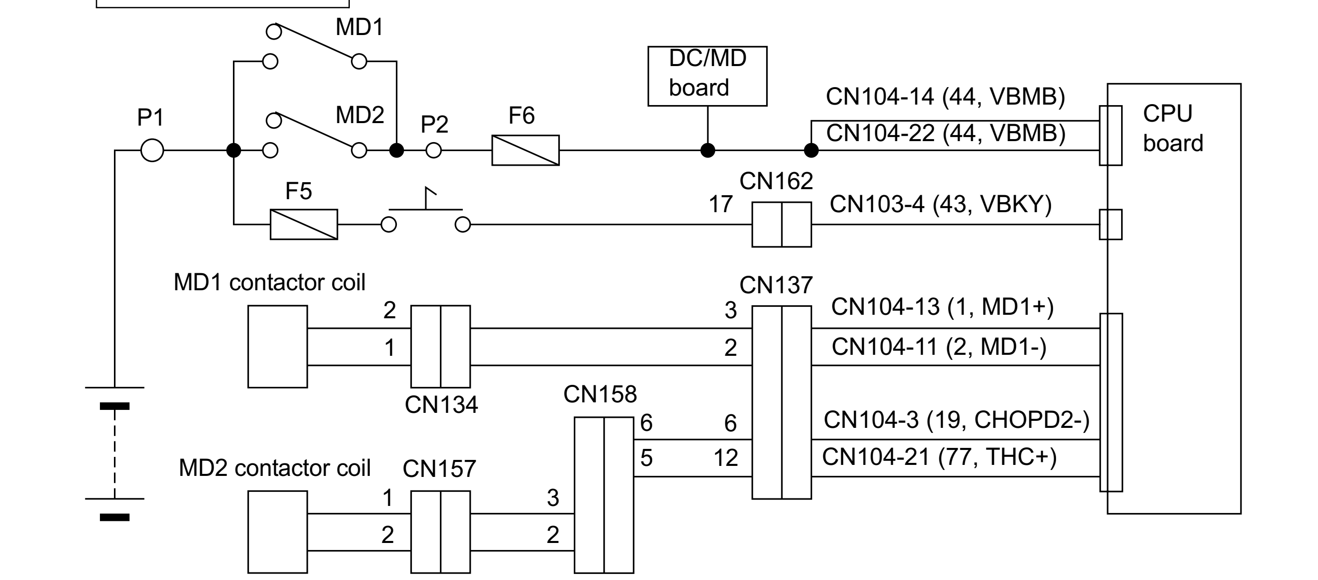
Jack up the vehicle until drive wheels leave the ground and support the frame with wooden blocks before starting troubleshooting.



*1: C2-2 error is indicated upon connection of SST18, but this is not abnormal

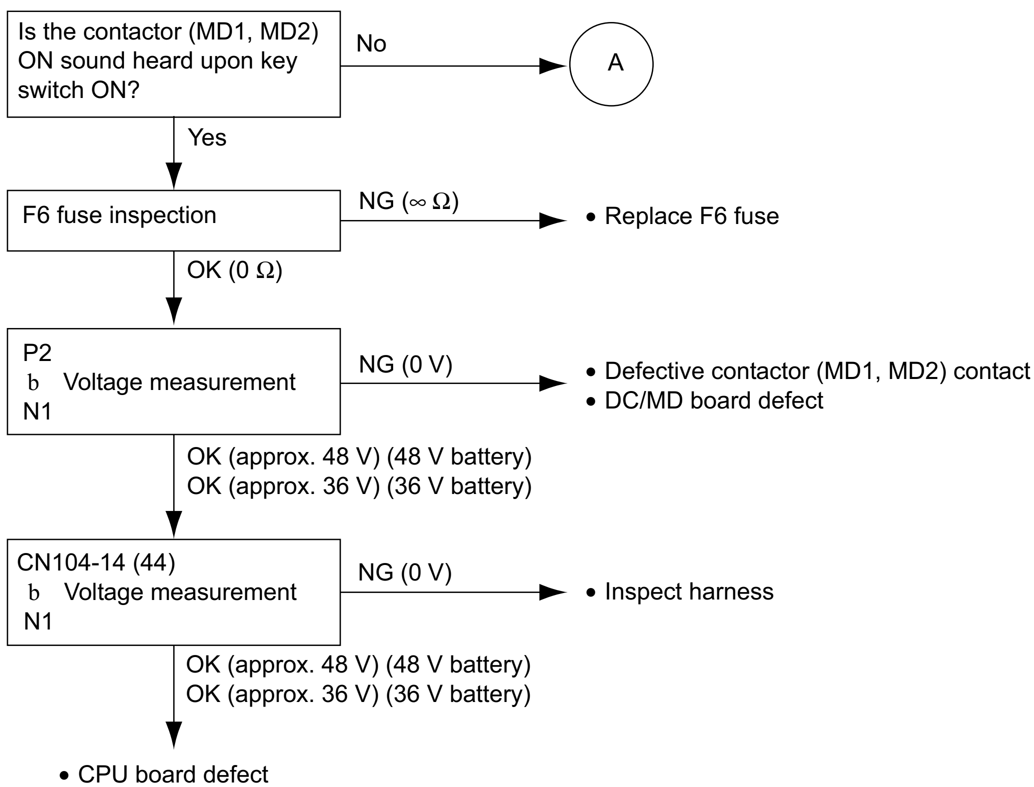
CB-1	Battery contactor (MD) abnormality

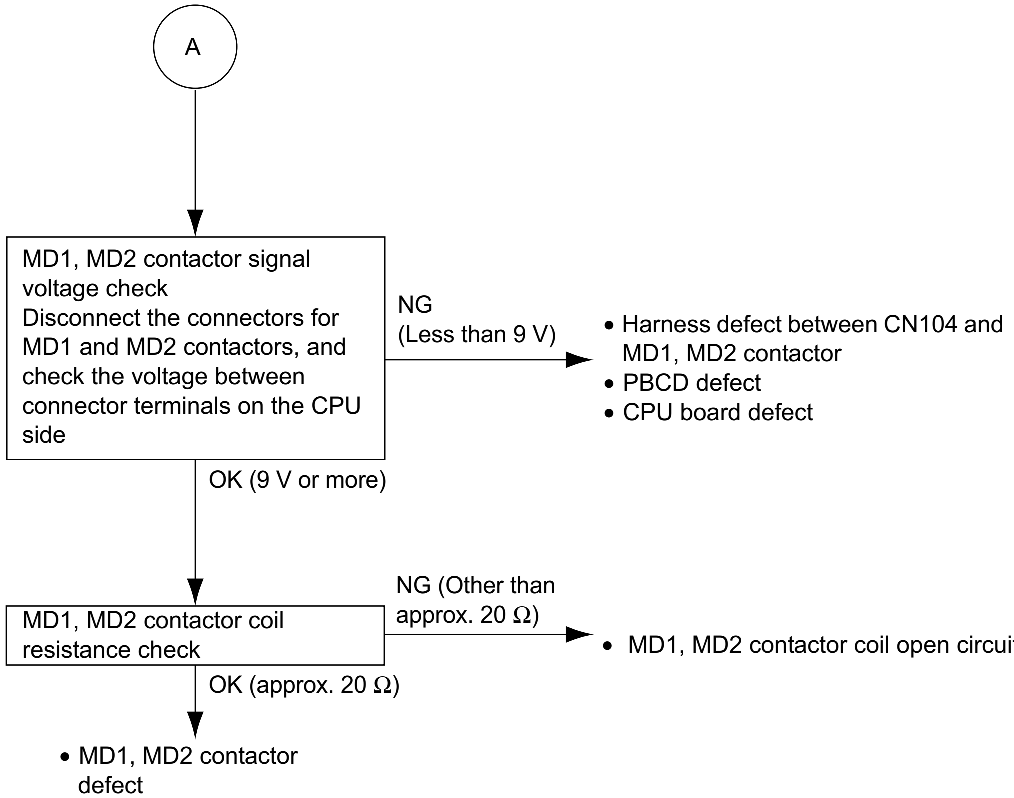
Related portion



Condition for error detection

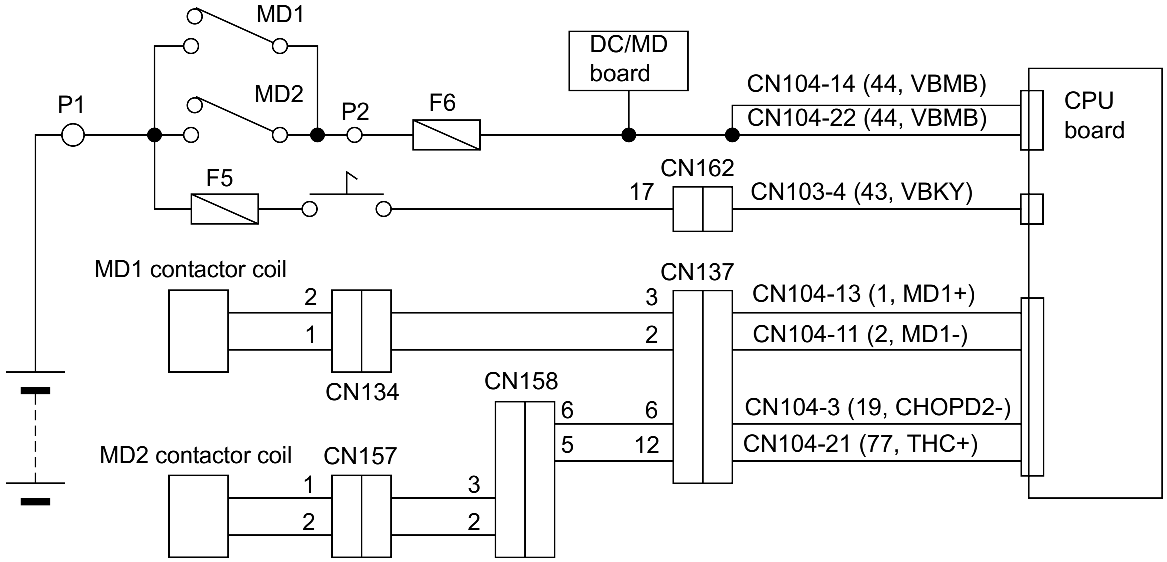
Output if the VBMB line voltage is below the setting when the key switch is turned ON.




A
MD1, MD2 contactor signal voltage check
Disconnect the connectors for MD1 and MD2 contactors, and check the voltage between connector terminals on the CPU side
NG
(Less than 9 V)
• Harness defect between CN104 and MD1, MD2 contactor
• PBCD defect
• CPU board defect
OK (9 V or more)
MD1, MD2 contactor coil resistance check
NG (Other than approx. 20 Ω)
• MD1, MD2 contactor coil open circuit
OK (approx. 20 Ω)
• MD1, MD2 contactor defect

CB-2	Battery contactor (MD) fusion

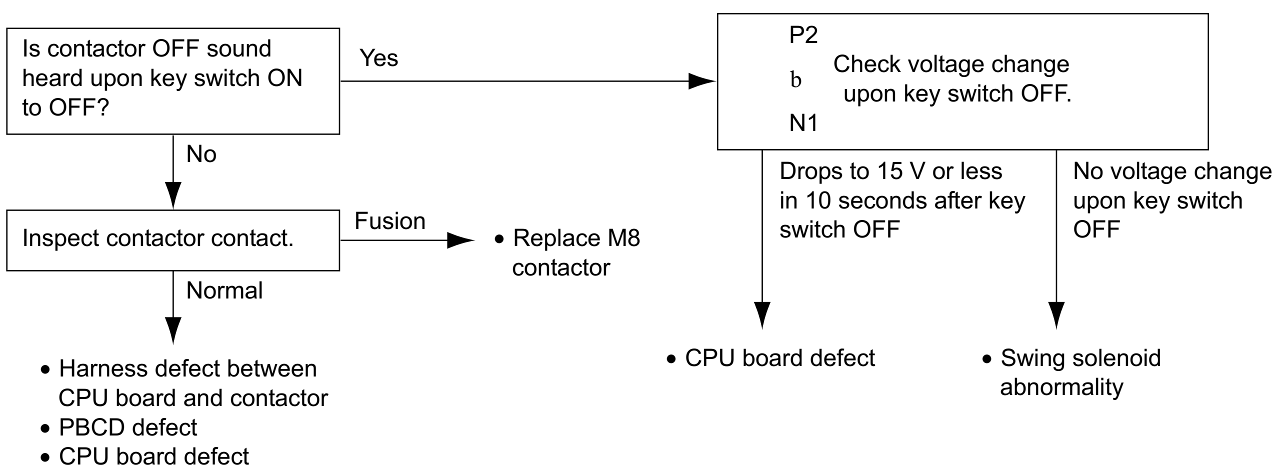
Related portion



Condition for error detection

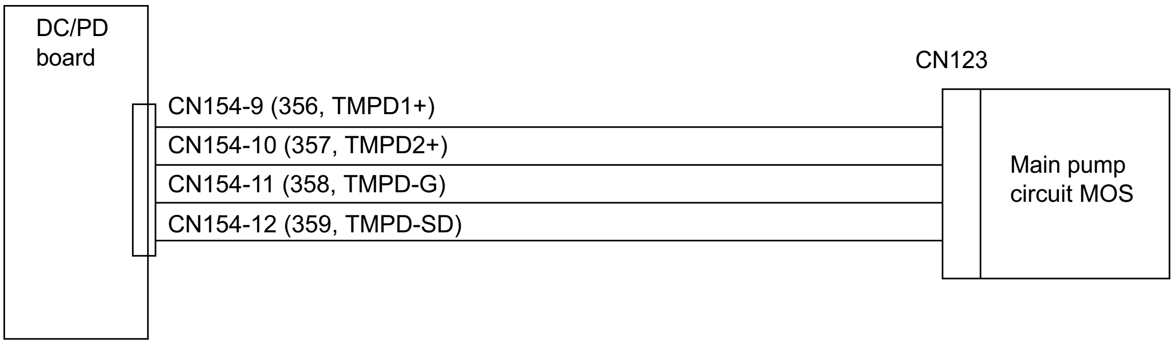
Output when the VBMB line voltage does not drop after key switch OFF.

If FE-1, 2, 4, 5 or 54-1, 2 occurs at the same time, perform troubleshooting for FE-1, 2, 4, 5 and 54-1, 2 first.



E0-2	Pump main circuit abnormality

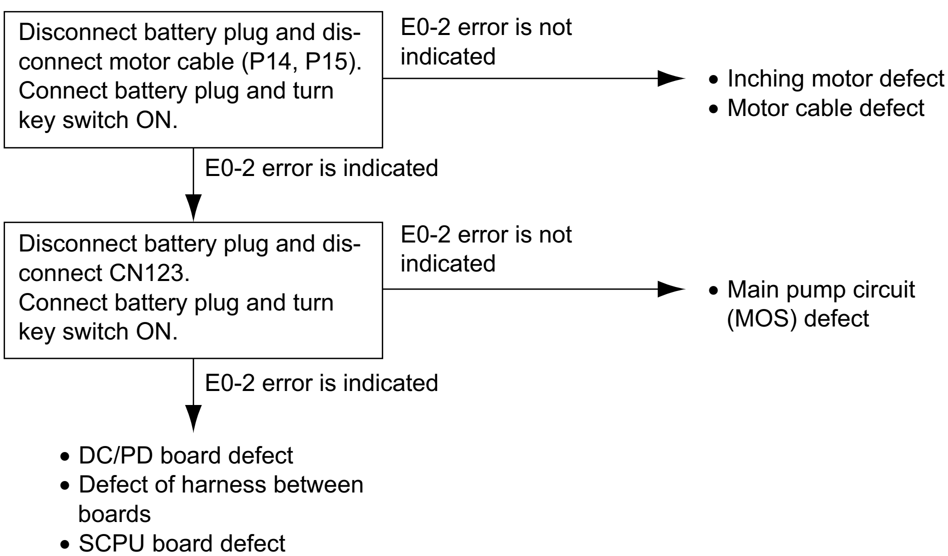
Related portion



Condition for error detection

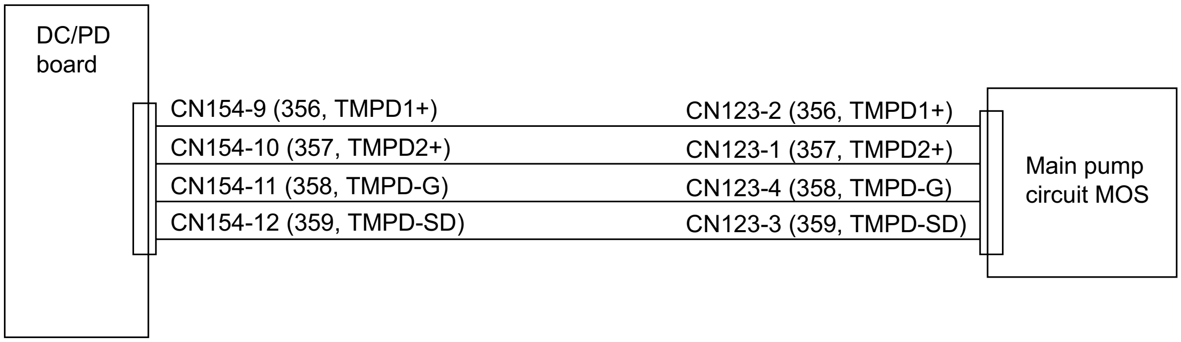
Output when the pump current sensor output value exceeds the specified level without material handling operation.

If E1 occurs at the same time, perform troubleshooting for E1 first.



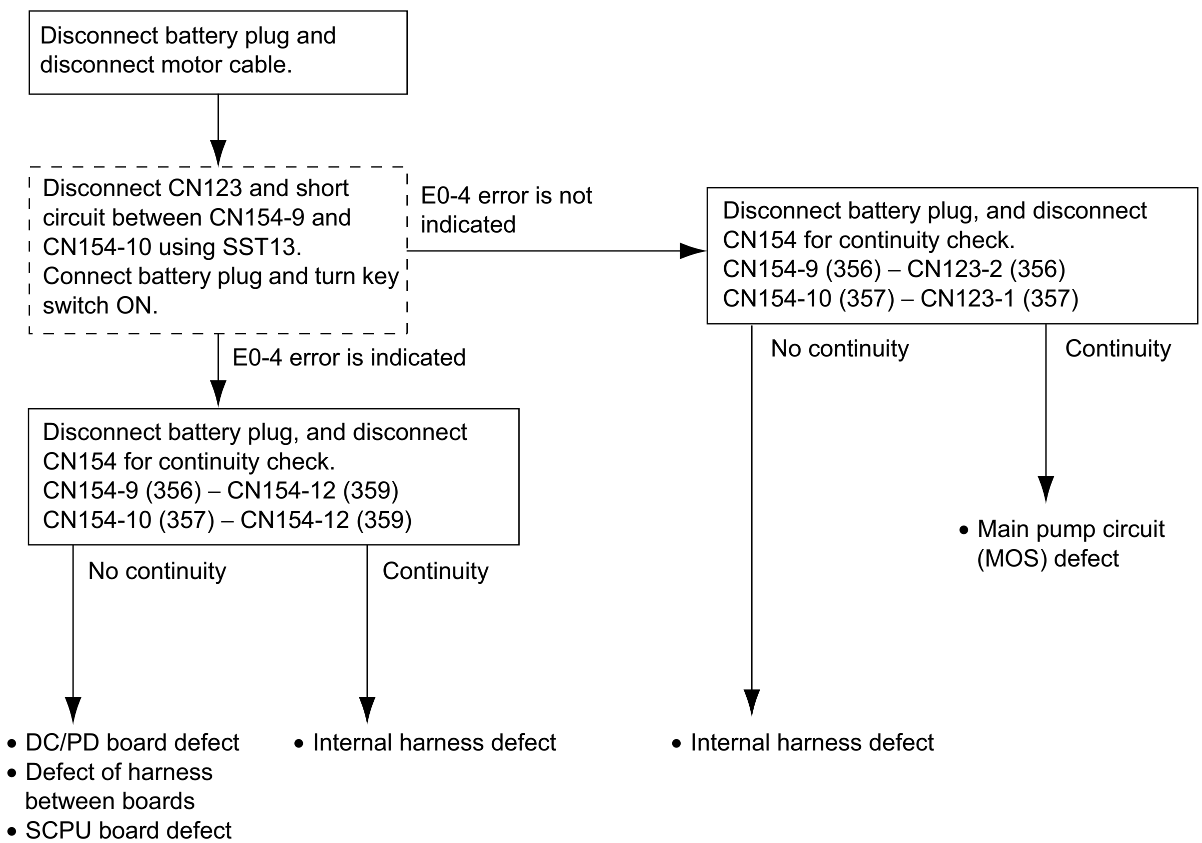
E0-4	Main pump circuit power abnormality

Related portion



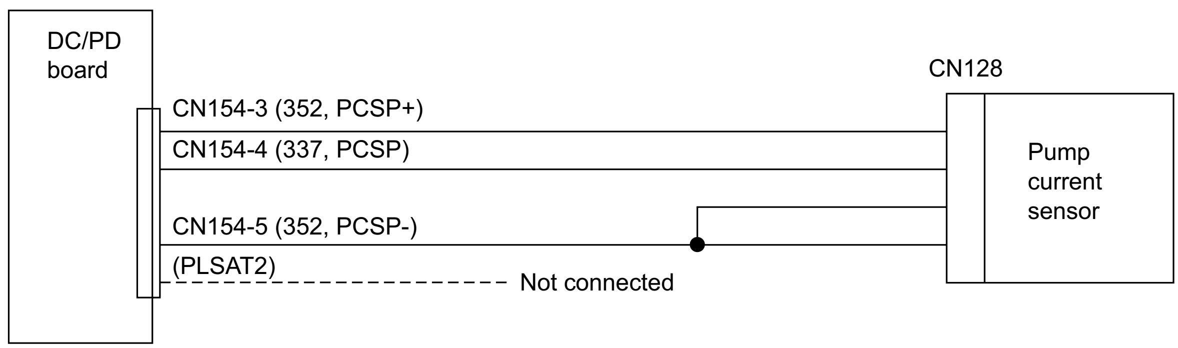
Condition for error detection

Output when line open circuit between DC/PD and MMP boards or low MMP power supply voltage is detected.



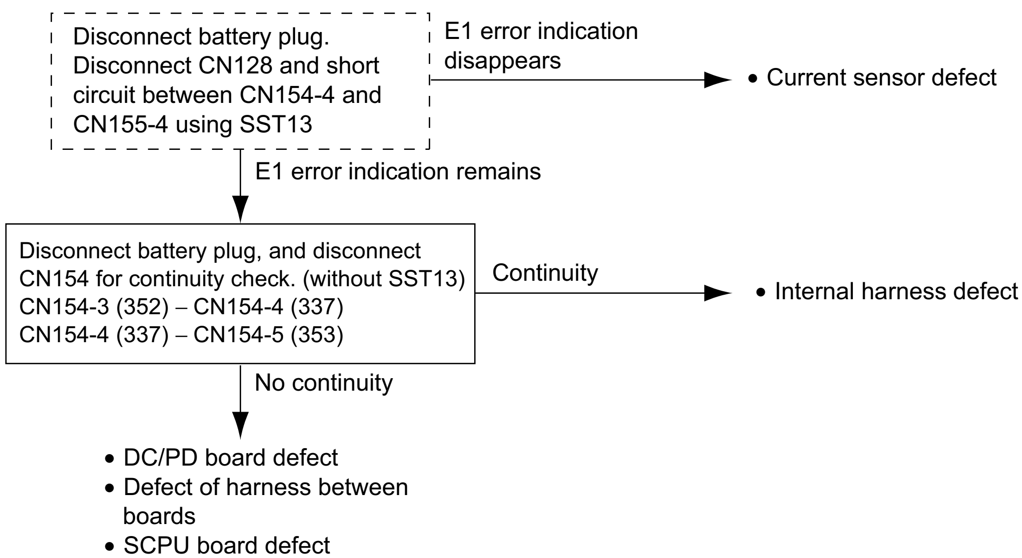
E1	Pump current sensor abnormality

Related portion



Condition for error detection

Output when the pump current sensor output value outside the specified range.



E2-1, 3	Pump motor temperature overheat

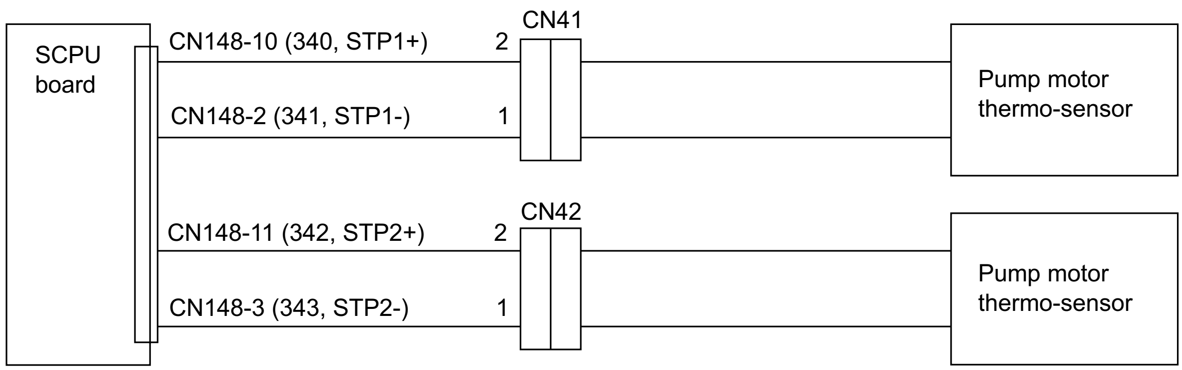
Condition for error detection

Output when the pump motor thermo-sensor output value exceeds the specified level.

- To correct, allow the vehicle to stand for a while (about 30 minutes).

E2-2, 4	Pump motor thermo-sensor abnormality

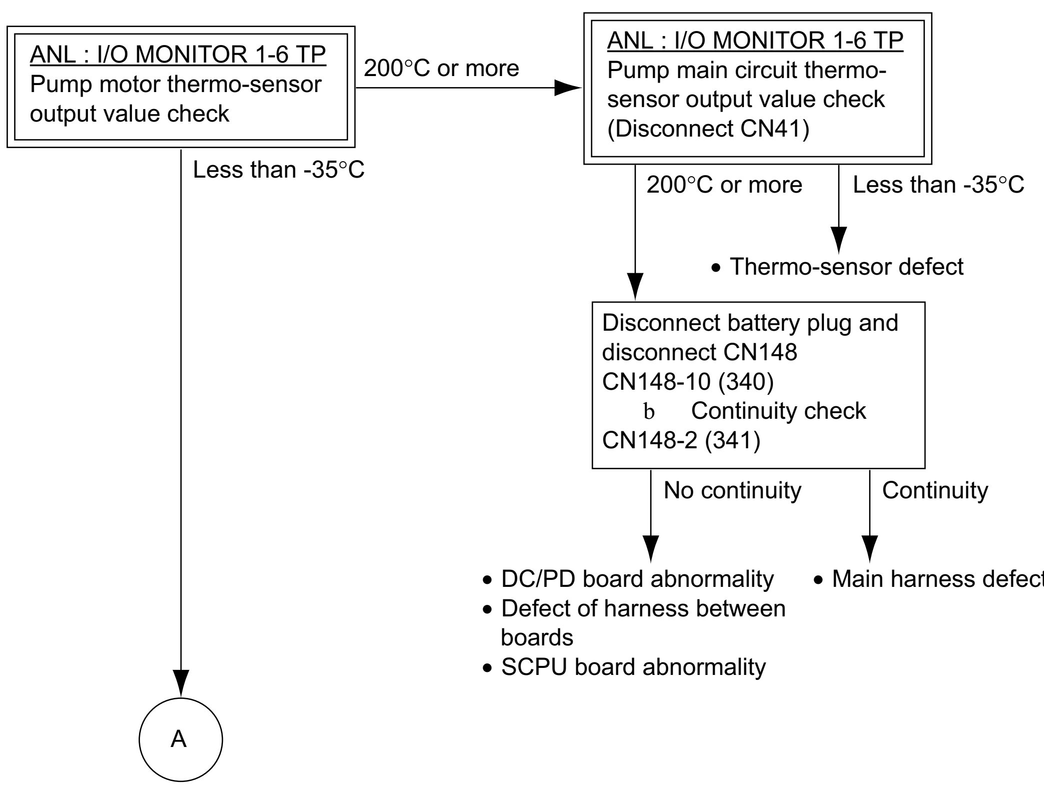
Related portion

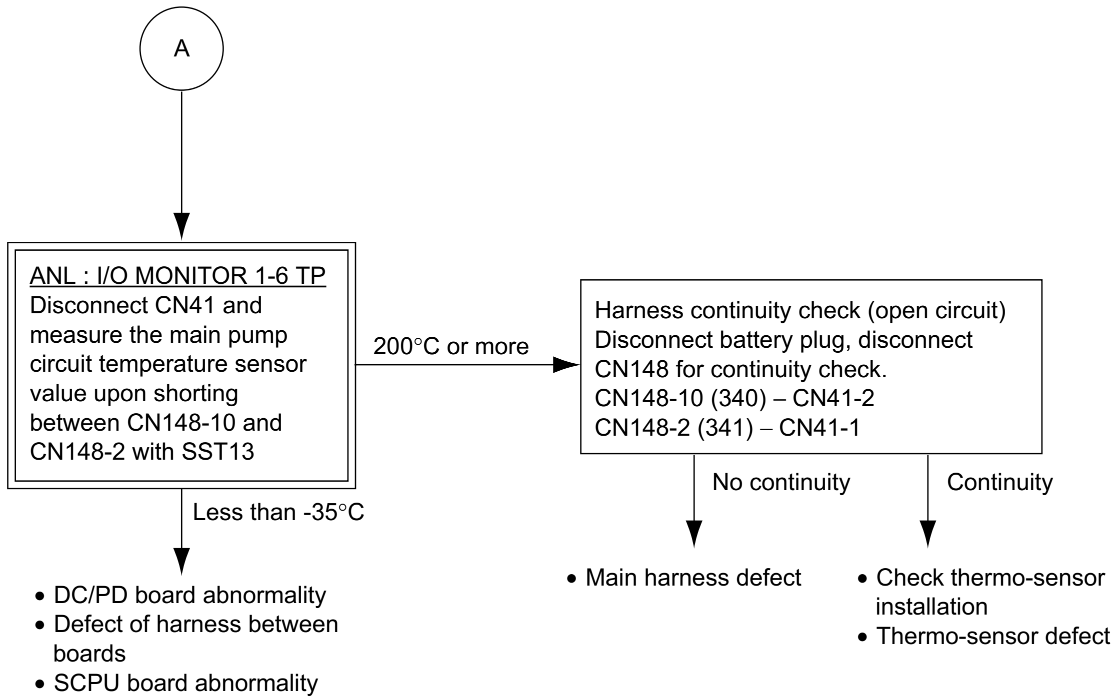


Condition for error detection

Output when the pump motor thermo-sensor output value exceeds the specified level.

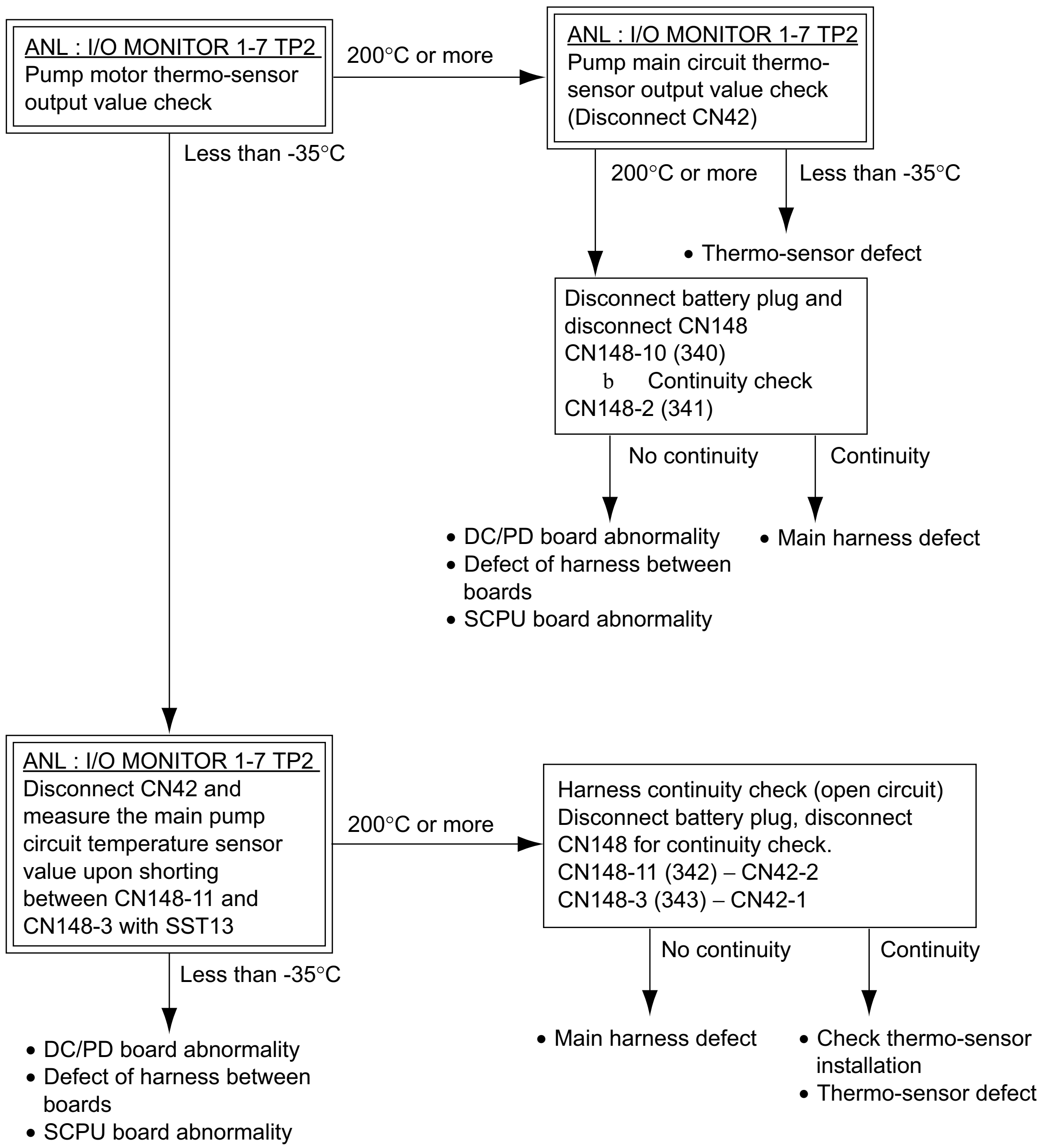
- **E2-2**





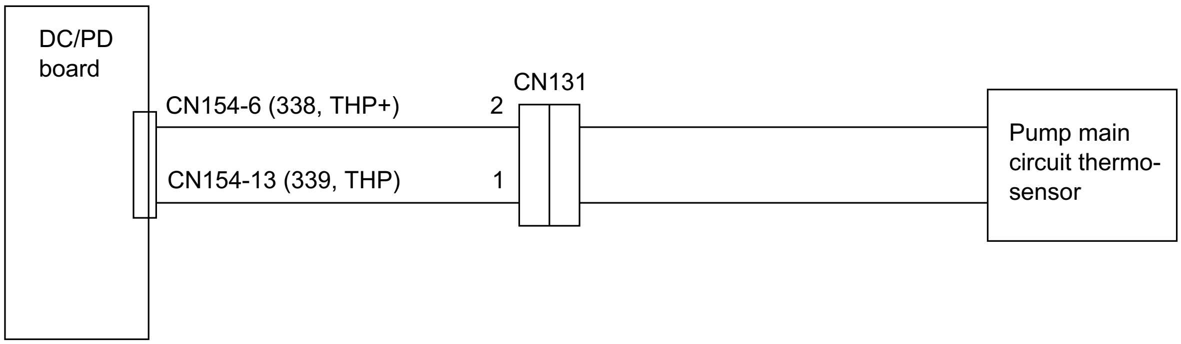
A
ANL : I/O MONITOR 1-6 TP
Disconnect CN41 and measure the main pump circuit temperature sensor value upon shorting between CN148-10 and CN148-2 with SST13
200°C or more
Harness continuity check (open circuit)
Disconnect battery plug, disconnect CN148 for continuity check.
CN148-10 (340) – CN41-2
CN148-2 (341) – CN41-1
Less than -35°C
• DC/PD board abnormality
• Defect of harness between boards
• SCPU board abnormality
No continuity
Continuity
• Main harness defect
• Check thermo-sensor installation
• Thermo-sensor defect

- **E2-4**


ANL : I/O MONITOR 1-7 TP2
Pump motor thermo-sensor output value check
200°C or more
ANL : I/O MONITOR 1-7 TP2
Pump main circuit thermo-sensor output value check (Disconnect CN42)
200°C or more
Less than -35°C
• Thermo-sensor defect
Disconnect battery plug and disconnect CN148
CN148-10 (340)
b Continuity check
CN148-2 (341)
No continuity
Continuity
• DC/PD board abnormality
• Defect of harness between boards
• SCPU board abnormality
• Main harness defect
Less than -35°C
ANL : I/O MONITOR 1-7 TP2
Disconnect CN42 and measure the main pump circuit temperature sensor value upon shorting between CN148-11 and CN148-3 with SST13
200°C or more
Harness continuity check (open circuit)
Disconnect battery plug, disconnect CN148 for continuity check.
CN148-11 (342) – CN42-2
CN148-3 (343) – CN42-1
No continuity
Continuity
• Main harness defect
• Check thermo-sensor installation
• Thermo-sensor defect
Less than -35°C
• DC/PD board abnormality
• Defect of harness between boards
• SCPU board abnormality

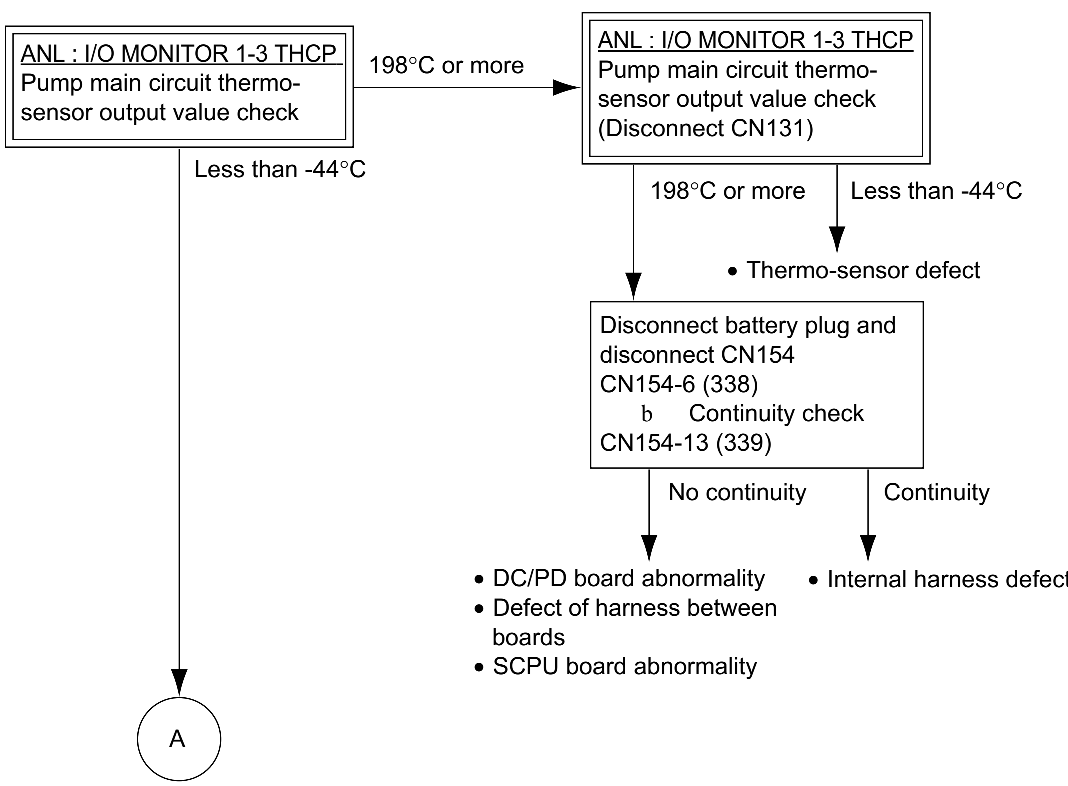
E3	Material handling controller thermo-sensor abnormality

Related portion



Condition for error detection

Output when the material handling controller thermo-sensor output value exceeds the specified level.



A

ANL : I/O MONITOR 1-7 THCP
Disconnect CN131 and measure the main pump circuit temperature sensor value upon shorting between CN154-6 and CN154-13 with SST13

198°C or more

Harness continuity check (open circuit)
Disconnect battery plug, disconnect CN154 for continuity check.
CN154-6 (338) – CN131-2
CN154-13 (339) – CN131-1

No continuity

- Internal harness defect

Continuity

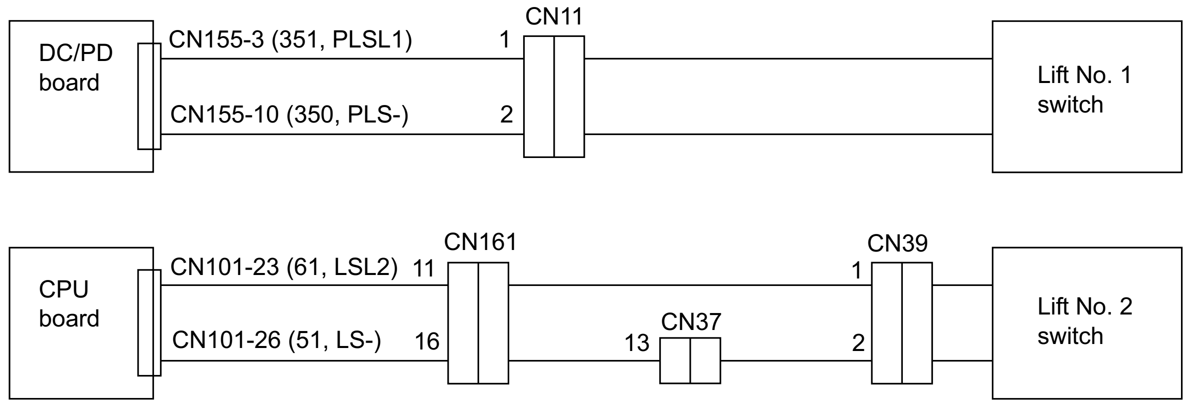
- Check thermo-sensor installation
- Thermo-sensor defect

Less than -44°C

- DC/PD board abnormality
- Defect of harness between boards
- SCPU board abnormality

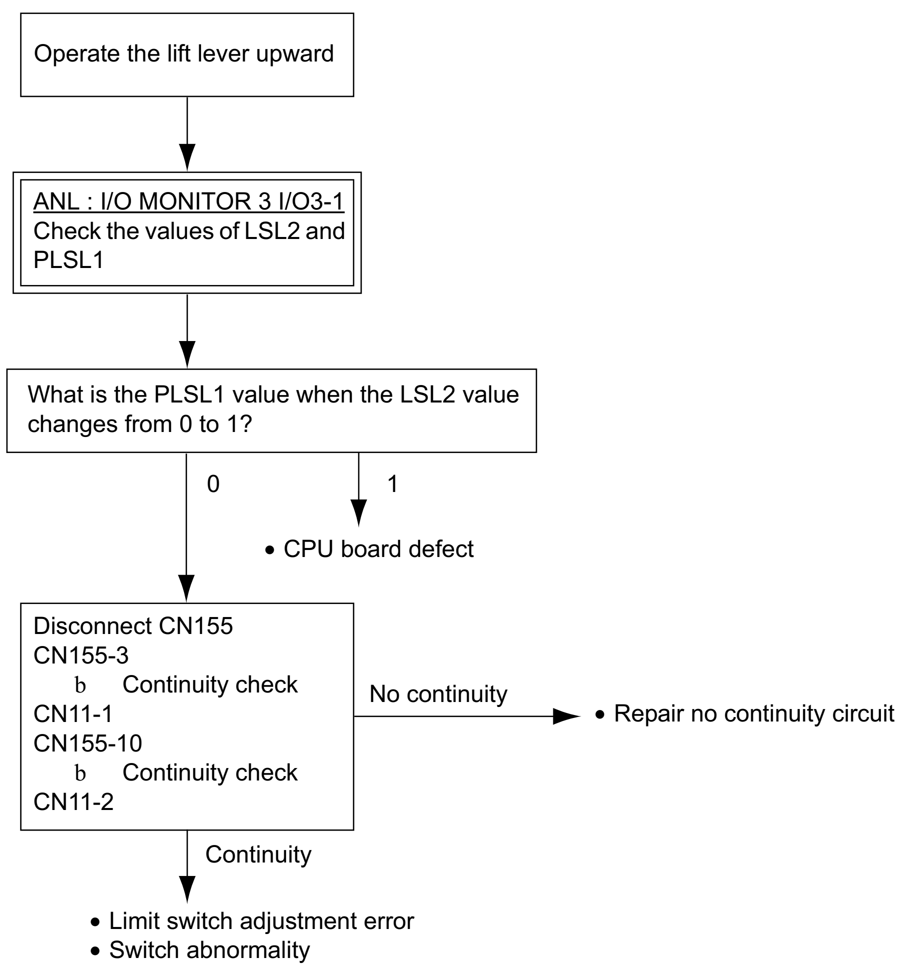
E6	Lift switch abnormality

Related portion



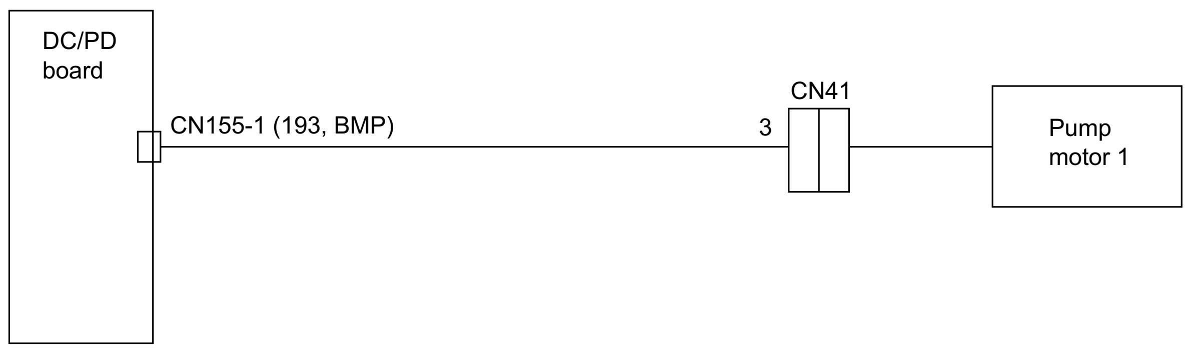
Condition for error detection

Output if lift No. 1 switch is OFF when lift No. 2 switch is turned ON.



PM BRSH	Pump motor 1 brush wear

Related portion



Condition for error detection

Output if the brush for pump motor 1 is worn.

On the display, temporarily cancel brush wear warning by setting to No.

Disconnect the battery plug and CN41.
Connect the battery plug, turn the key switch ON and wait for about five seconds.*1
Set worn brush warning to N by option setting.
Does worn brush warning occur?
Is simultaneous traveling and material handling prohibited while the traveling speed is restricted to approx. 3 mph (5 km/h)?

Warning occurs →
- Main harness defect
- CPU board defect

No warning ↓

* Pump motor temperature sensor error (E2-2) is output, but disregard it.

Pump motor 1 brush inspection

NG → Check material handling operation after brush replacement

OK ↓

Pump motor 1 brush wear sensor defect

After troubleshooting, reset worn brush warning to Y by option setting.

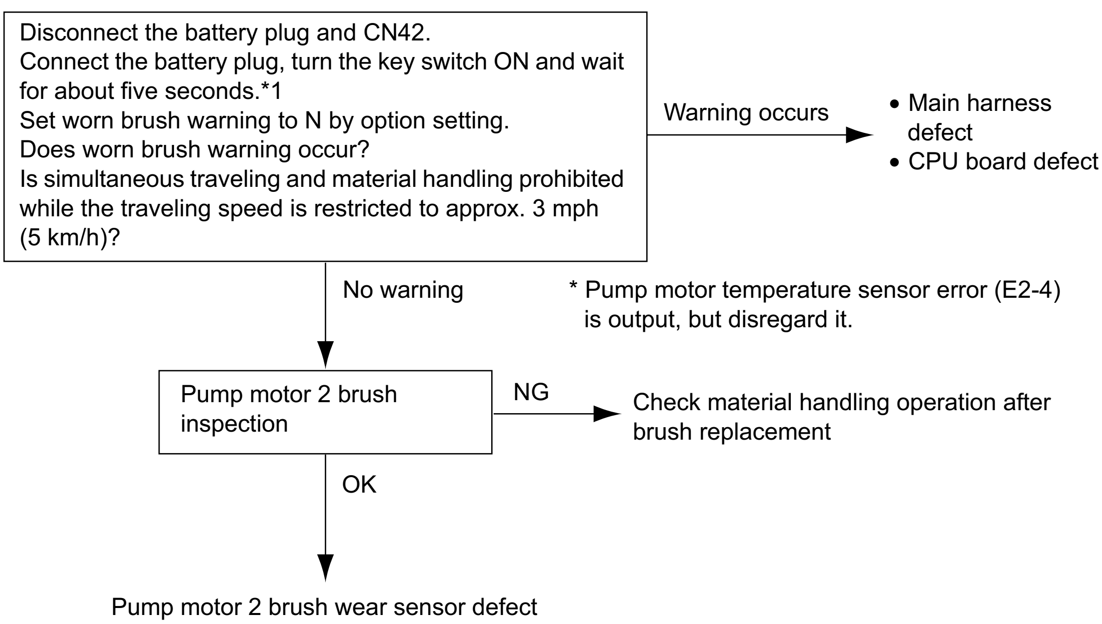
PM2 BRSH	Pump motor 2 brush wear

Related portion

Condition for error detection

Output if the brush for pump motor 2 is worn.

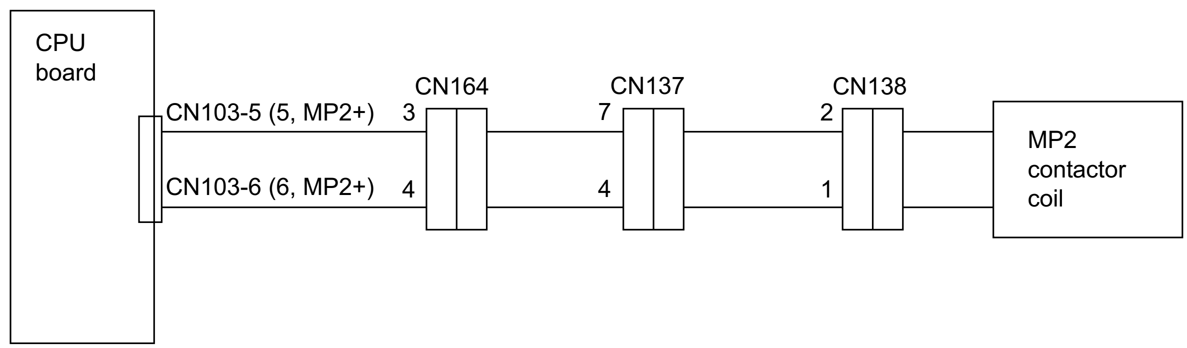
On the display, temporarily cancel brush wear warning by setting to No.



After troubleshooting, reset worn brush warning to Y by option setting.

EA-2	MP2 contactor abnormality

Related portion



Condition for error detection

Output if the MP2 contactor coil is shorted.

Disconnect CN138 and measure contactor resistance.
CN138-2 (5)
b Resistance measurement
CN138-1 (6)

NG (Less than 20 Ω) → • MP2 contactor coil defect

OK (approx. 20 Ω) ↓

Disconnect CN103 and CN138
CN103-5 (5)
b Resistance measurement
CN103-6 (6)

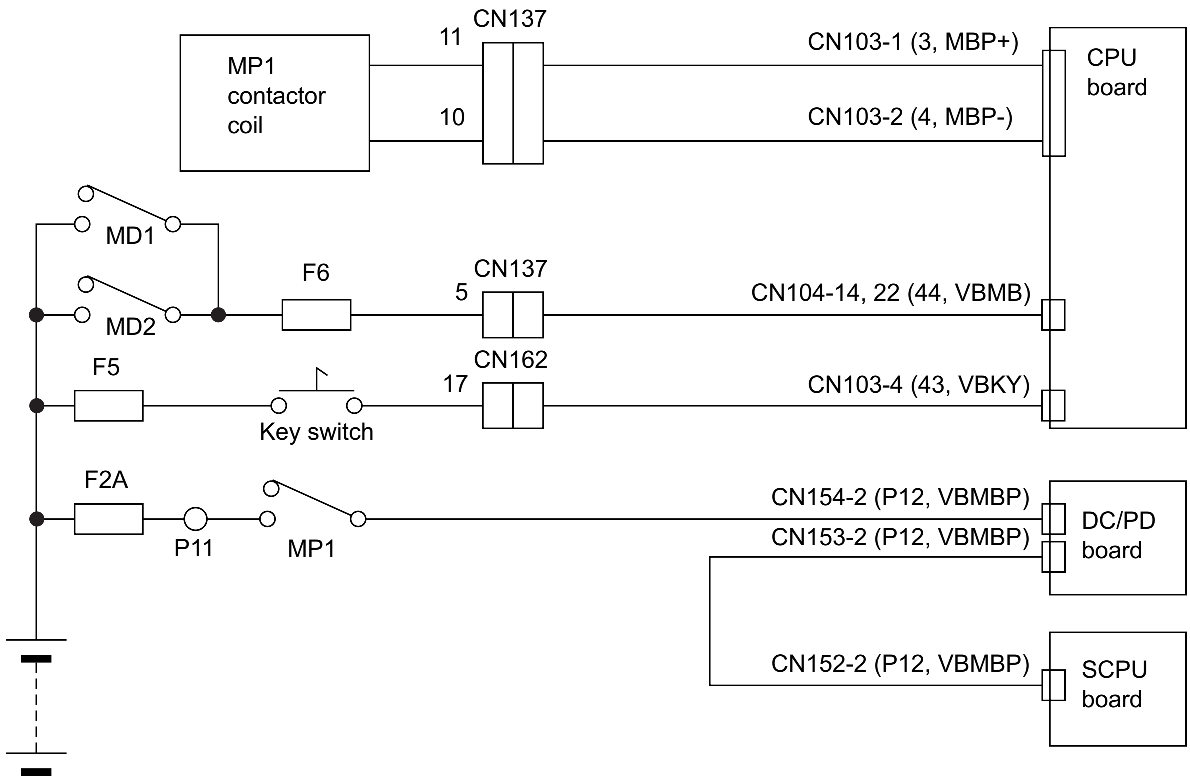
Open (∞ Ω) → • CPU board defect

Short (Less than 20 Ω) ↓

• Harness short

EB-1	MP1 contactor open-circuit defect

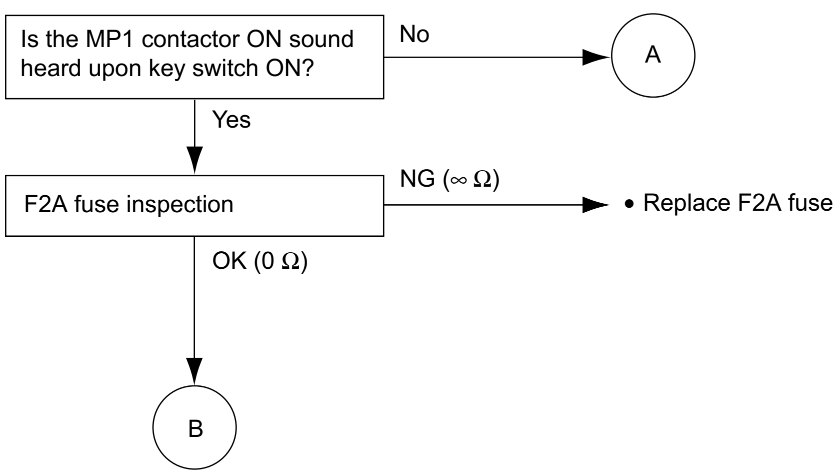
Related portion

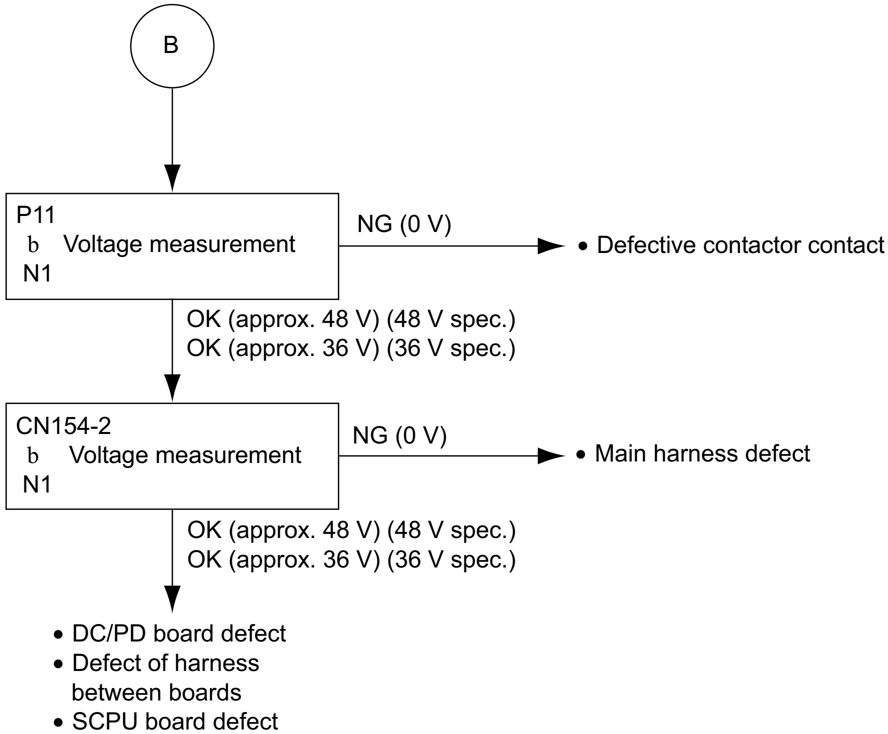


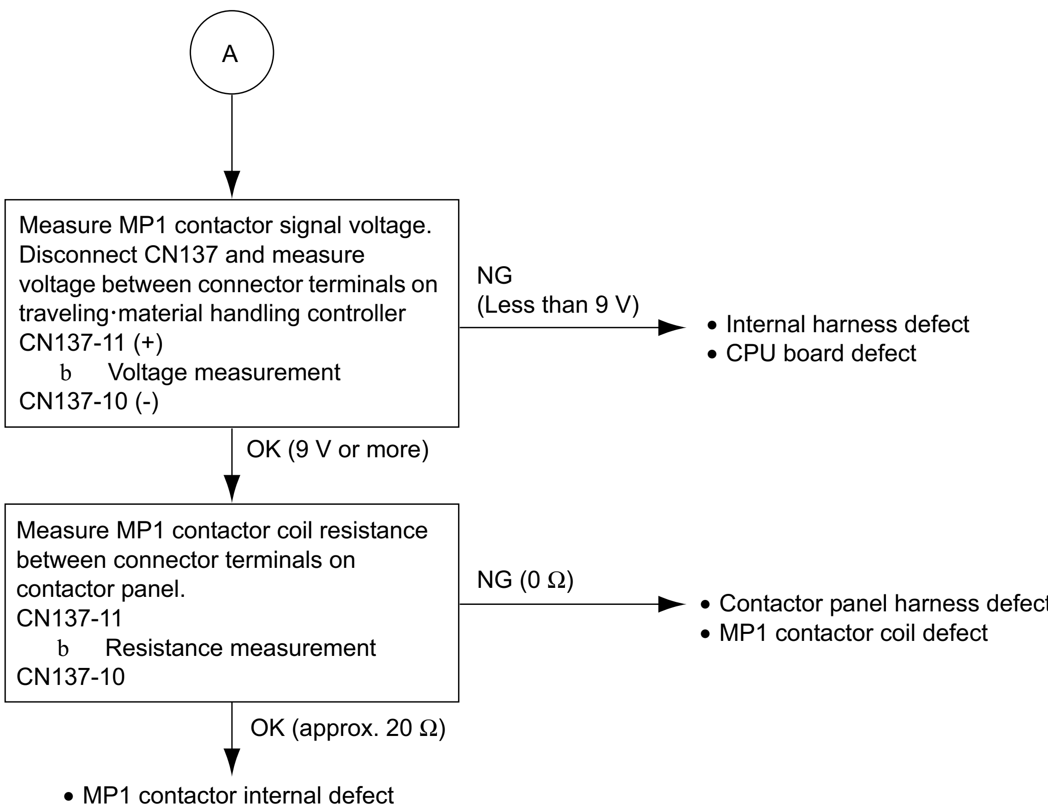
Condition for error detection

Output if low material pump motor voltage (VBMBP : P12) is detected during material handling.

If EB-2 occurs at the same time, perform troubleshooting for EB-2 first.

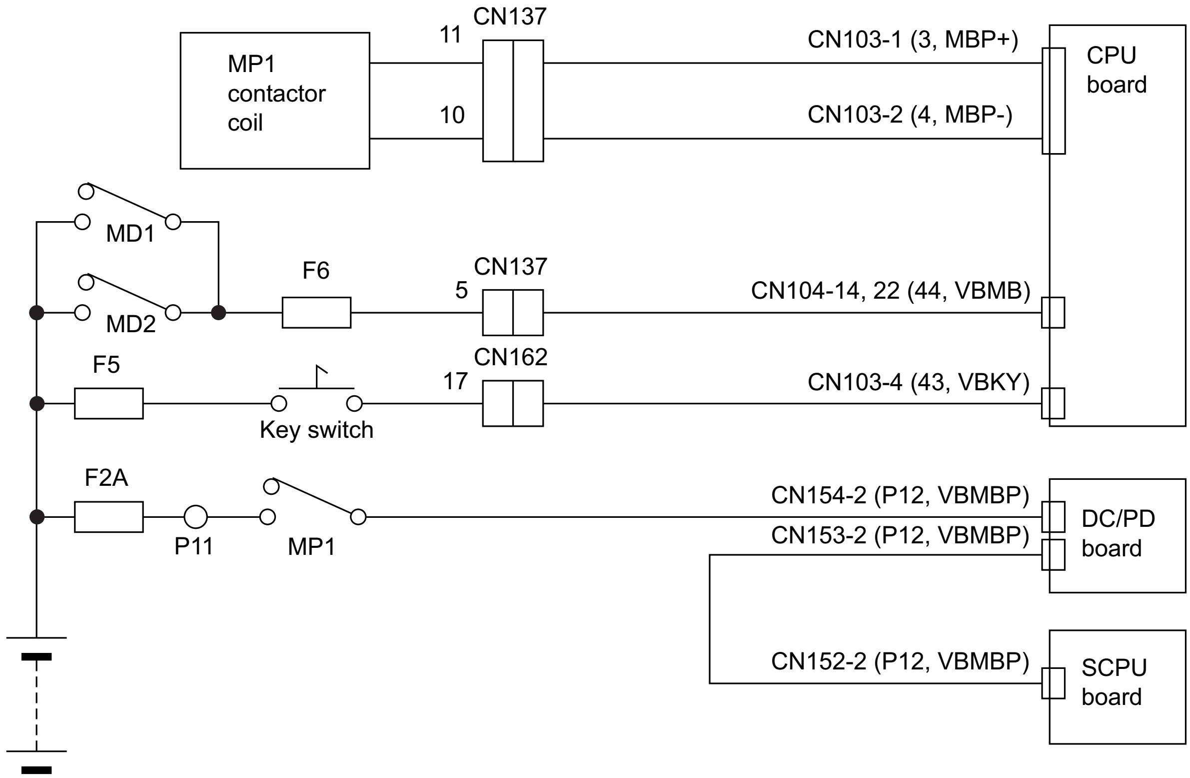



B
P11
b Voltage measurement
N1
NG (0 V)
• Defective contactor contact
OK (approx. 48 V) (48 V spec.)
OK (approx. 36 V) (36 V spec.)
CN154-2
b Voltage measurement
N1
NG (0 V)
• Main harness defect
OK (approx. 48 V) (48 V spec.)
OK (approx. 36 V) (36 V spec.)
• DC/PD board defect
• Defect of harness between boards
• SCPU board defect


A
Measure MP1 contactor signal voltage. Disconnect CN137 and measure voltage between connector terminals on traveling·material handling controller
CN137-11 (+)
b Voltage measurement
CN137-10 (-)
NG
(Less than 9 V)
• Internal harness defect
• CPU board defect
OK (9 V or more)
Measure MP1 contactor coil resistance between connector terminals on contactor panel.
CN137-11
b Resistance measurement
CN137-10
NG (0 Ω)
• Contactor panel harness defect
• MP1 contactor coil defect
OK (approx. 20 Ω)
• MP1 contactor internal defect

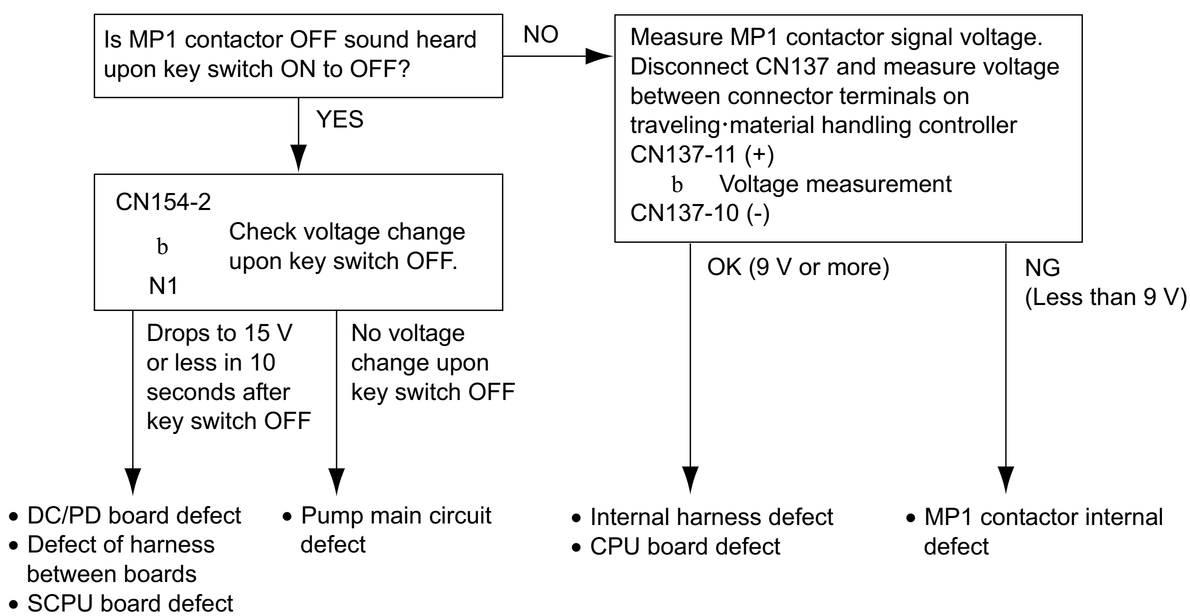
EB-2	MP1 contactor fusion

Related portion



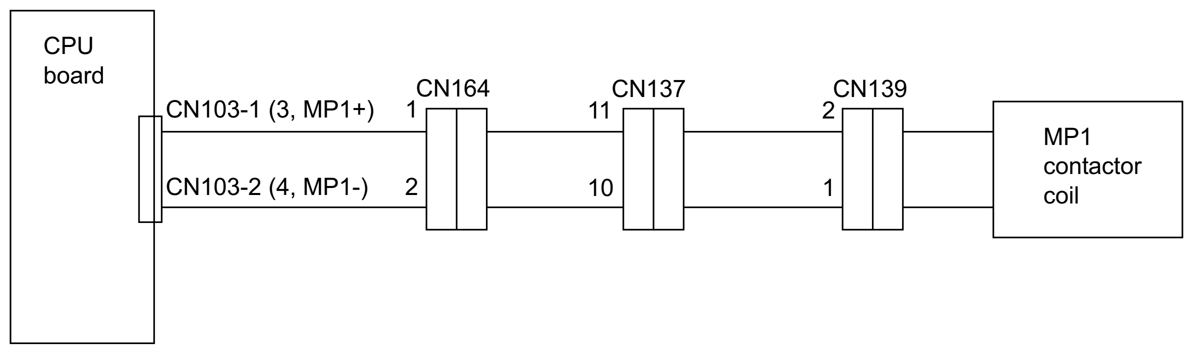
Condition for error detection

Output if the pump motor voltage (VBMBP:P12) does not drop after key switch OFF.



EB-3	MP1 contactor abnormality

Related portion



Condition for error detection

Output if the MP1 contactor coil is shorted.

Disconnect CN139 and measure contactor resistance.
CN139-2 (3)
b Resistance measurement
CN139-1 (4)

NG (Less than 20 Ω) → • MP1 contactor coil defect

OK (Approx. 20 Ω) ↓

Disconnect CN103 and CN139
CN103-1 (3)
b Resistance measurement
CN103-2 (4)

Open (∞ Ω) → • CPU board defect

Short (Less than 20 Ω) ↓

• Harness short

EF-1, 2, 4	Traveling controller EEP-ROM abnormality

Condition for error detection

Output when CPU board EEP-ROM element abnormality is detected.

- To correct, replace the CPU board.

EF-3	Traveling controller CPU abnormality

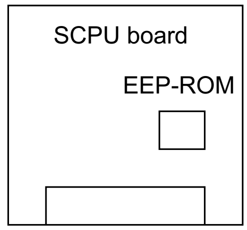
Condition for error detection

Output when CPU board CPU element abnormality is detected.

- To correct, replace the CPU board.

EF-7, 8	SCPU board EEP-ROM abnormality

Related portion



Condition for error detection

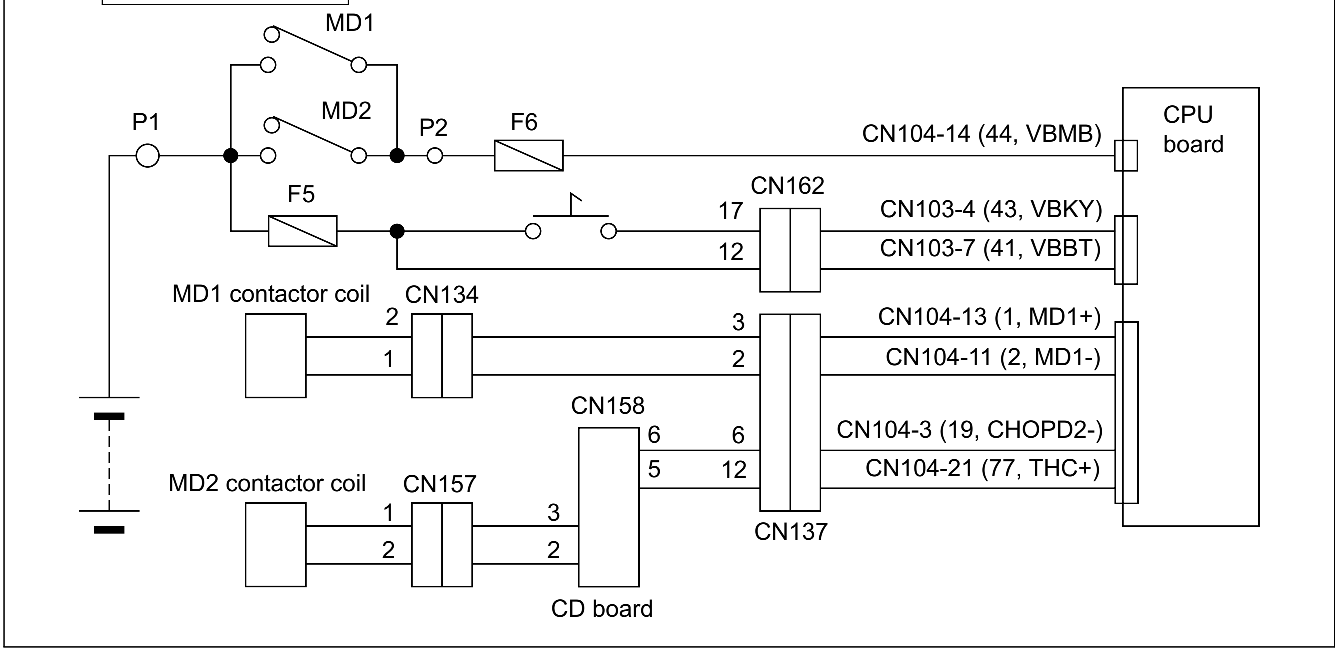
Output if access to the EEP-ROM on the SCPU board fails.

- SCPU board defect

WHEN NO DIAGNOSIS ERROR CODE IS DISPLAYED

The vehicle does not move at all (traveling and material handling inoperable)

Related portion



Inspect F5 fuse

- NG (∞ Ω) → • Replace F5 fuse
- OK (0 Ω) ↓

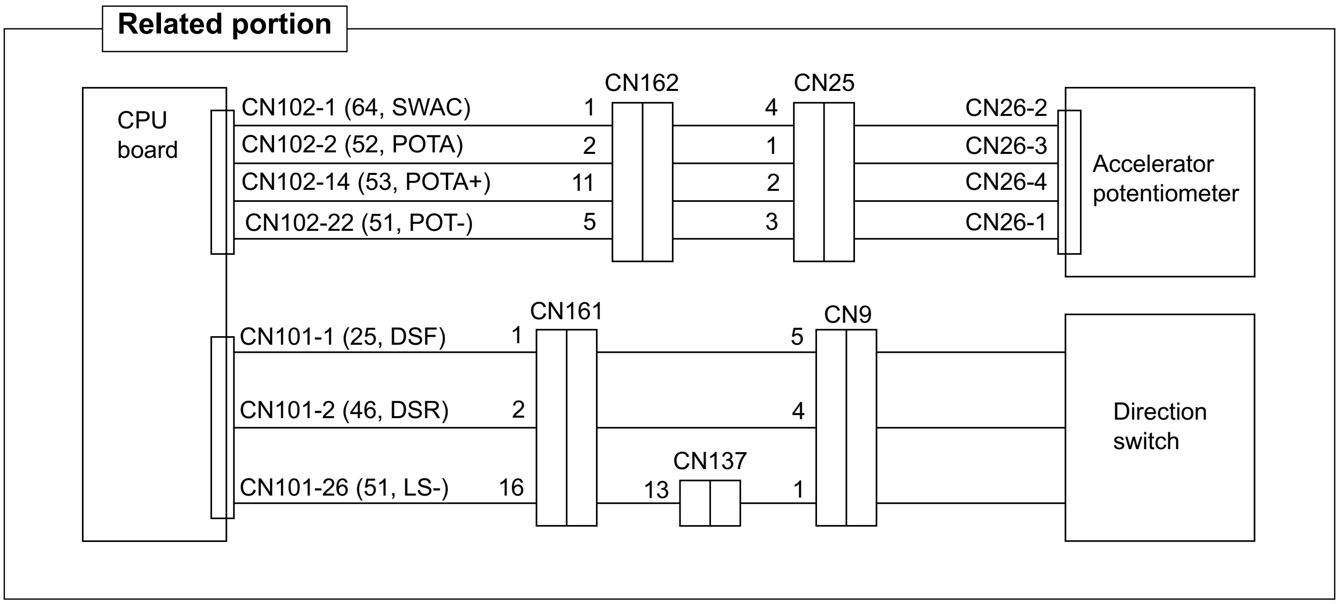
With key switch ON
CN103-7 (41)
CN103-4 (43)
b Voltage measurement
N1

- OK (Other than OK) → • Main harness defect • CN162 connection defect
- OK (With a difference between CN103-7 and N1 being 20 V or more, with a difference between CN103-4 and N1, and CN103-7 and N1 being within 15 V.) ↓

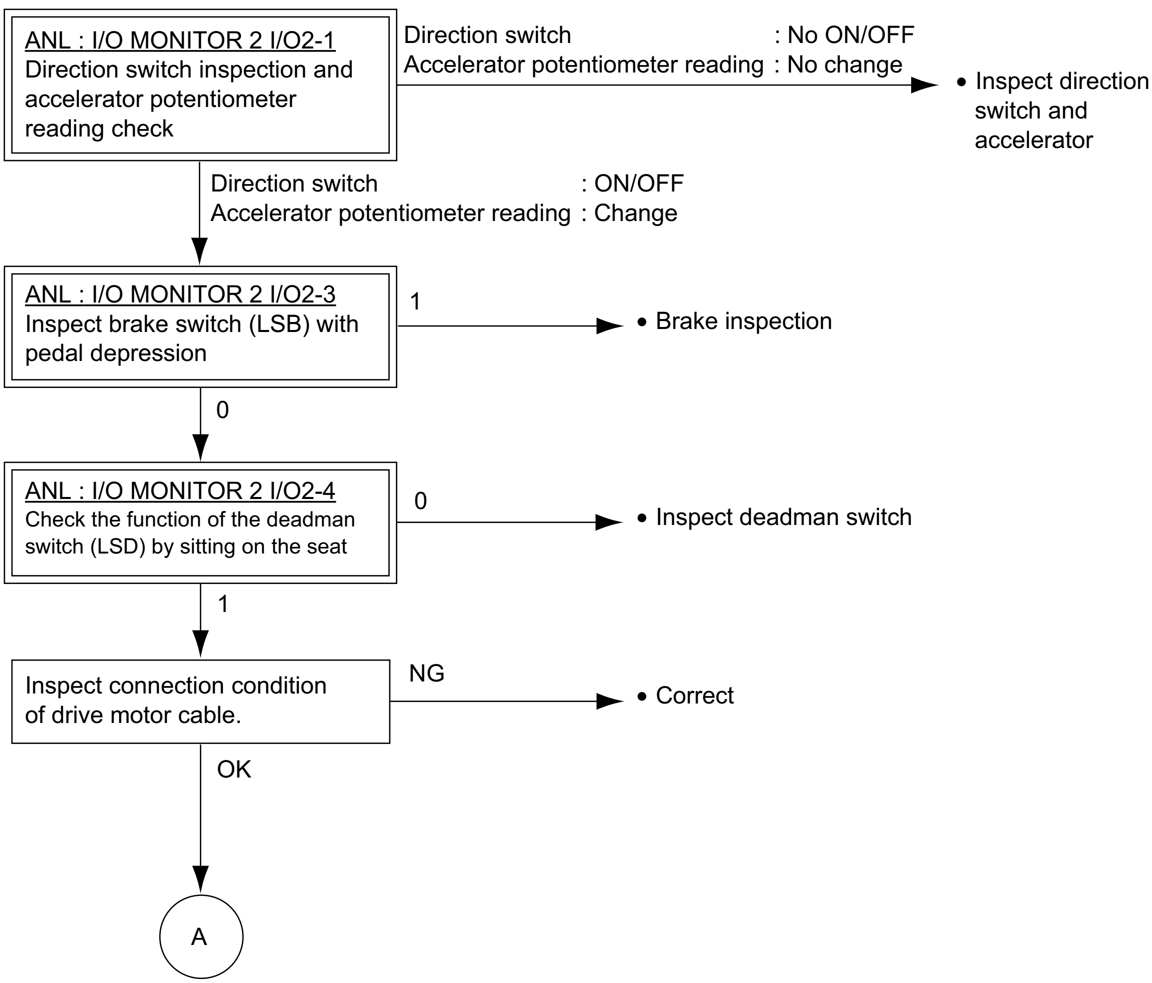
CN104-17 (15)
b Voltage measurement
N1

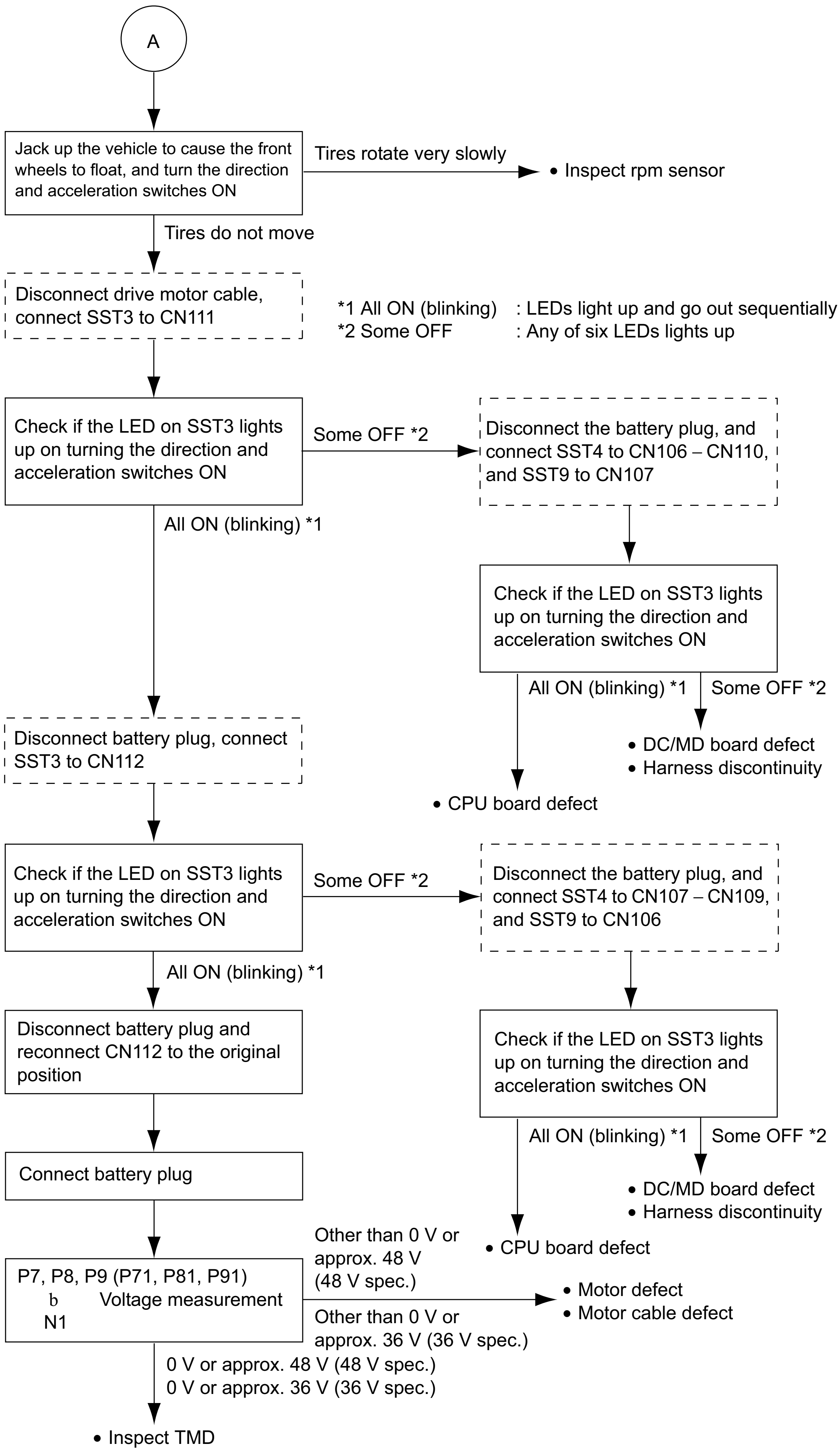
- NG (0 Ω) → Check CN113 connection condition
  - NG → • Correct
  - OK → • DC/MD board defect
- OK (approx. 15 V) → • CPU board defect

Only traveling disabled or wobbling



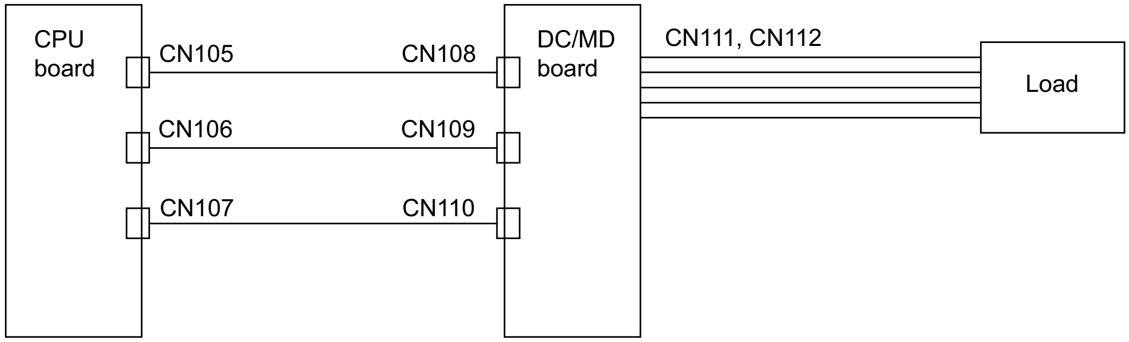
If the vehicle is equipped with the deadman brake, make sure that No. 16 SEAT BRAKE is set to Y by option setting on the display.




A
Jack up the vehicle to cause the front wheels to float, and turn the direction and acceleration switches ON
Tires rotate very slowly
• Inspect rpm sensor
Tires do not move
Disconnect drive motor cable, connect SST3 to CN111
*1 All ON (blinking) : LEDs light up and go out sequentially
*2 Some OFF : Any of six LEDs lights up
Check if the LED on SST3 lights up on turning the direction and acceleration switches ON
Some OFF *2
Disconnect the battery plug, and connect SST4 to CN106 – CN110, and SST9 to CN107
Check if the LED on SST3 lights up on turning the direction and acceleration switches ON
All ON (blinking) *1
Some OFF *2
• DC/MD board defect
• Harness discontinuity
• CPU board defect
All ON (blinking) *1
Disconnect battery plug, connect SST3 to CN112
Check if the LED on SST3 lights up on turning the direction and acceleration switches ON
Some OFF *2
Disconnect the battery plug, and connect SST4 to CN107 – CN109, and SST9 to CN106
Check if the LED on SST3 lights up on turning the direction and acceleration switches ON
All ON (blinking) *1
Some OFF *2
• DC/MD board defect
• Harness discontinuity
• CPU board defect
All ON (blinking) *1
Disconnect battery plug and reconnect CN112 to the original position
Connect battery plug
P7, P8, P9 (P71, P81, P91)
b Voltage measurement
N1
Other than 0 V or approx. 48 V (48 V spec.)
Other than 0 V or approx. 36 V (36 V spec.)
• Motor defect
• Motor cable defect
0 V or approx. 48 V (48 V spec.)
0 V or approx. 36 V (36 V spec.)
• Inspect TMD

Either the traveling speed or acceleration is slow

Related portion



Is the overheat alarm indicator on the display blinking?

- Blinking → • Allow the vehicle to stand for a while (about 15 min.) and operate.
- Not blinking ↓

OPT-12 36 V
Check the battery voltage (36 V or 48 V) set by option setting

- Setting is incorrect → • Setting is incorrect the setting
- Correct ↓

Disconnect drive motor cable, connect SST3 to CN111

↓

*1 All ON (blinking) : LEDs light up and go out sequentially
*2 Some OFF : Any of six LEDs lights up

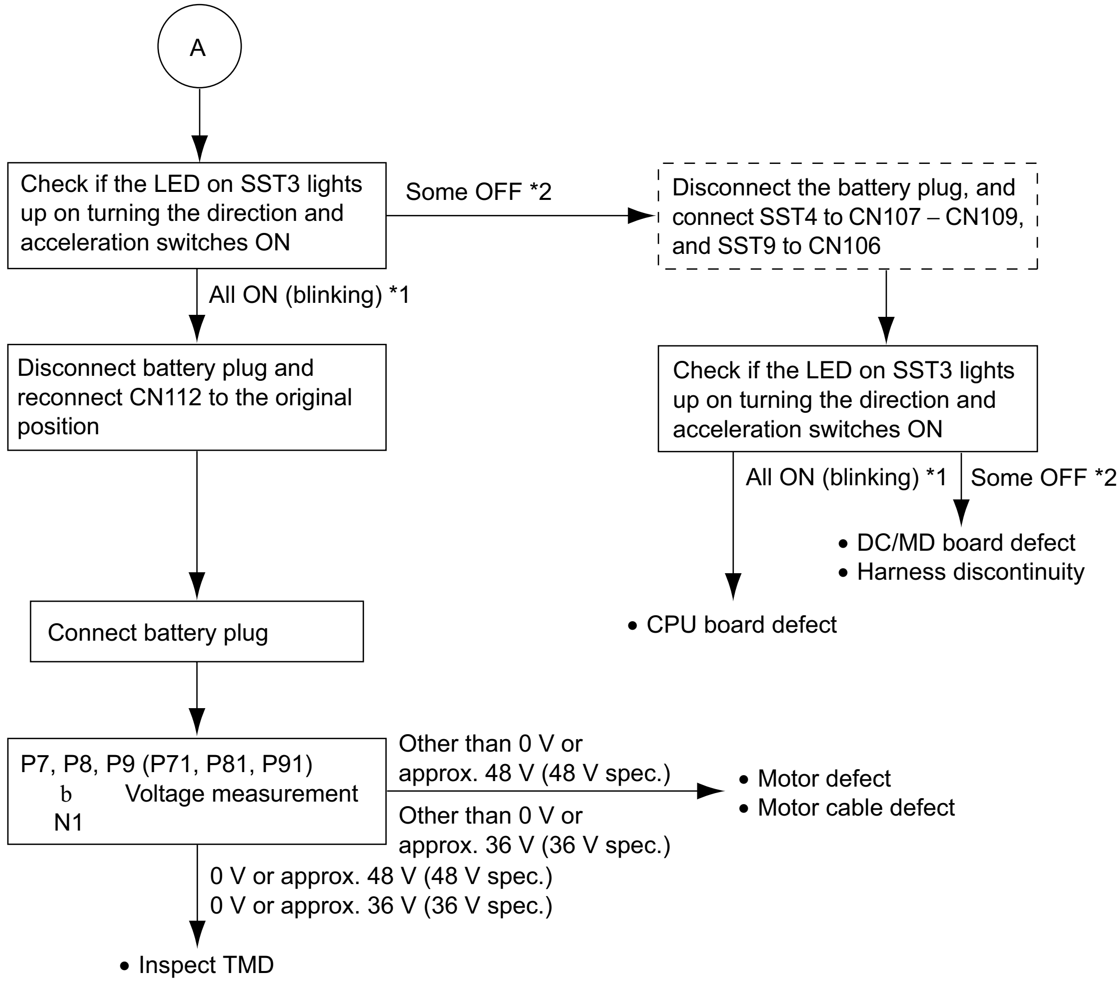
Check if the LED on SST3 lights up on turning the direction and acceleration switches ON

- Some OFF *2 → Disconnect the battery plug, and connect SST4 to CN106 – CN110, and SST9 to CN107
  - ↓ Check if the LED on SST3 lights up on turning the direction and acceleration switches ON
    - All ON (blinking) *1 → • CPU board defect
    - Some OFF *2 → • DC/MD board defect • Harness discontinuity
- All ON (blinking) *1 ↓

Disconnect battery plug, connect SST3 to CN112

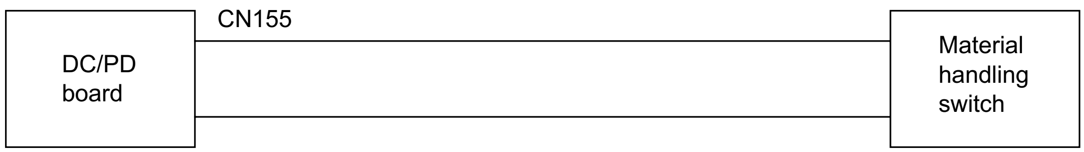
↓

A


A
Check if the LED on SST3 lights up on turning the direction and acceleration switches ON
Some OFF *2
Disconnect the battery plug, and connect SST4 to CN107 – CN109, and SST9 to CN106
All ON (blinking) *1
Disconnect battery plug and reconnect CN112 to the original position
Check if the LED on SST3 lights up on turning the direction and acceleration switches ON
All ON (blinking) *1
Some OFF *2
• DC/MD board defect
• Harness discontinuity
Connect battery plug
• CPU board defect
P7, P8, P9 (P71, P81, P91)
b Voltage measurement
N1
Other than 0 V or approx. 48 V (48 V spec.)
Other than 0 V or approx. 36 V (36 V spec.)
• Motor defect
• Motor cable defect
0 V or approx. 48 V (48 V spec.)
0 V or approx. 36 V (36 V spec.)
• Inspect TMD

Either PS or material handling fails

Related portion



Does the pump motor run when the steering wheel is rotated?

- Runs → ANL : I/O MONITOR 3 I/O3-1, 2, 3, 4 — Check the value of the operated lever →
  - OK → • Defective CPU board on the material handling panel
  - NG → • Check each limit SW
- Does not run ↓

Disconnect the battery plug, disconnect cables from P14 and P15, and connect SST14 between P14 and P15

↓

Connect the battery plug, turn the key switch ON, and turn the direction switch ON

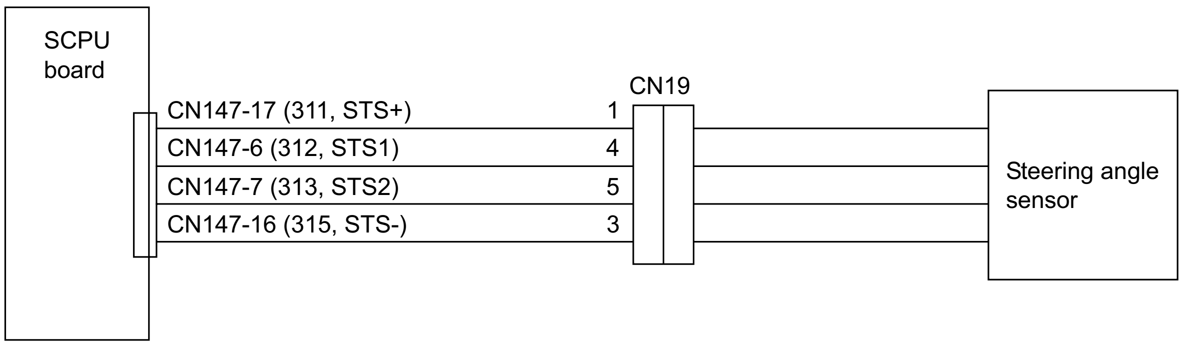
↓

CN15 (+)
b Voltage measurement
N1 (-)

- NG (approx. 48 V) (48 V spec.) / NG (approx. 36 V) (36 V spec.) →
  - DC/MD board defect
  - Defect of harness between boards
  - SCPU board defect
- OK (Other than NG) ↓
  - Inspect motor cable

Power assist disabled

Related portion



<u>ANL : I/O MONITOR 4 I/O4-1</u>
Check if STS1 or STS2 indication varies while the steering wheel is rotated

↓ Check for which signal the indication remains unchanged

Disconnect battery plug, connect SST7 to CN19

↓

<u>ANL : I/O MONITOR 4 I/O4-1</u>
Check if STS1 or STS2 indication varies while the steering wheel is rotated

→ Indication does not change; signal changes over → • Steering angle sensor defect

↓ Indication does not change; signal remains uncharged

Check any change in voltage value while rotating the steering wheel
CN147-6 (+)
b Voltage measurement
CN147-16 (-)
CN147-7 (+)
b Voltage measurement
CN147-16 (-)

→ NG (remains unchanged) → • Main harness defect

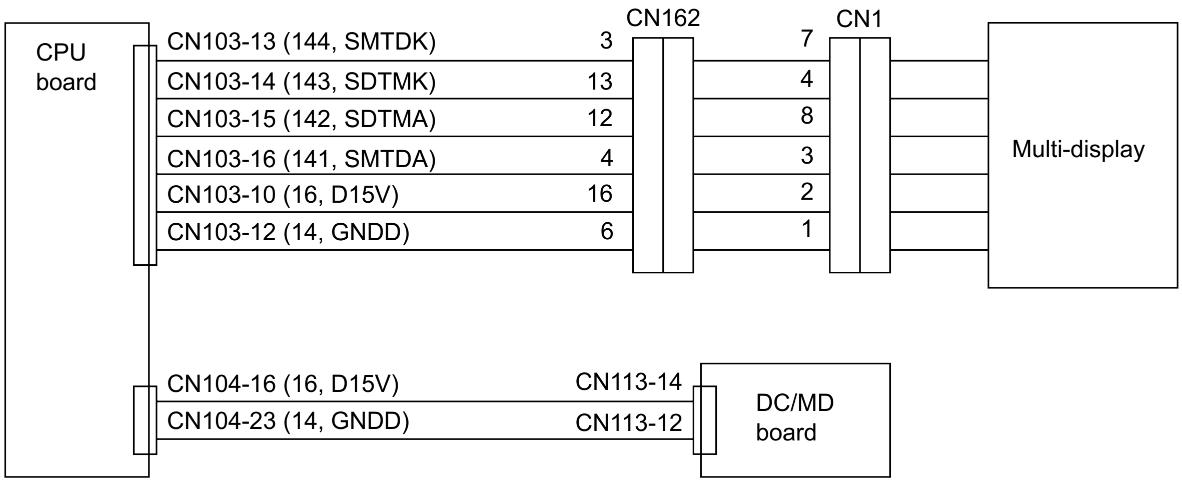
↓ OK (variation between 1 V and 4 V)

• SCPU board defect

MULTI-DISPLAY - MCS COMMUNICATION SYSTEM
WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED

EE-1, 2, 3	Abnormal communication from multi-display

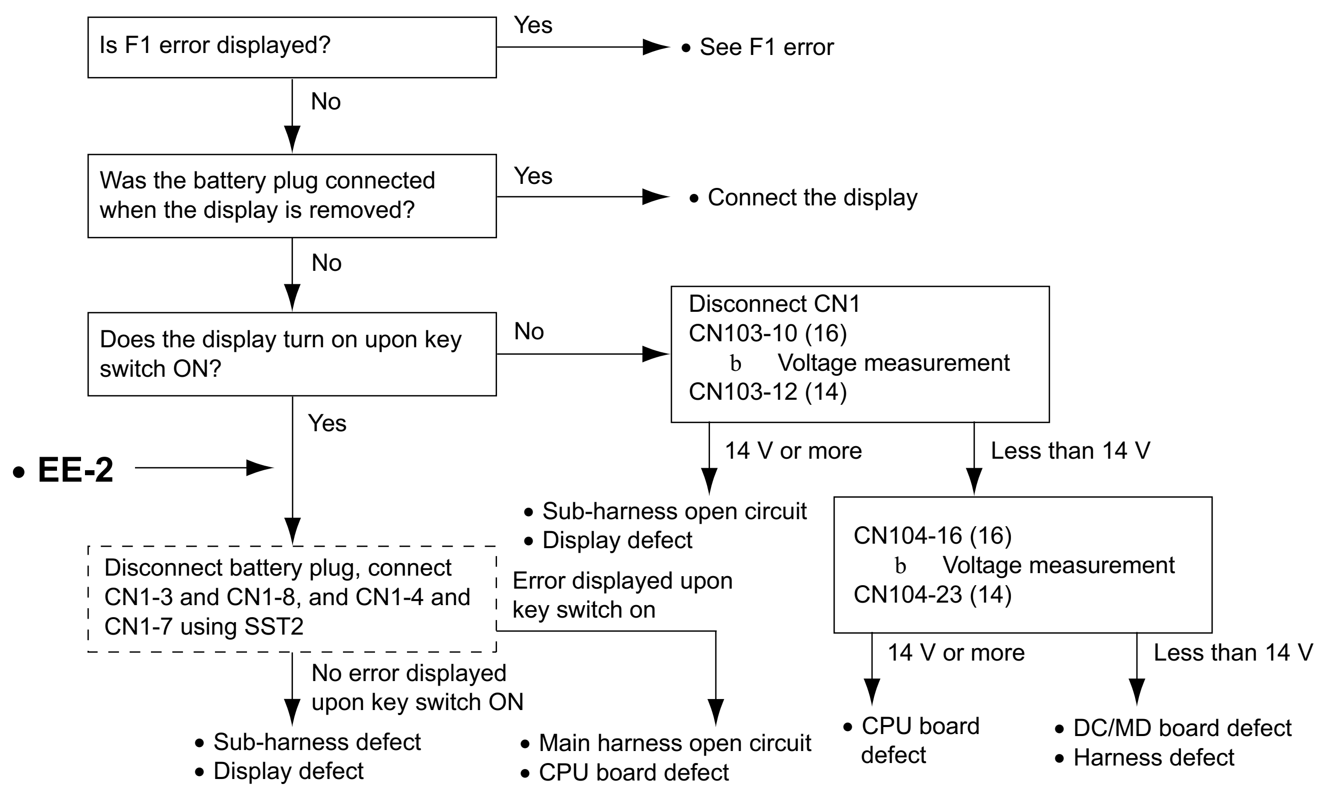
Related portion



Condition for error detection

Output upon detection of communication data abnormality from display.

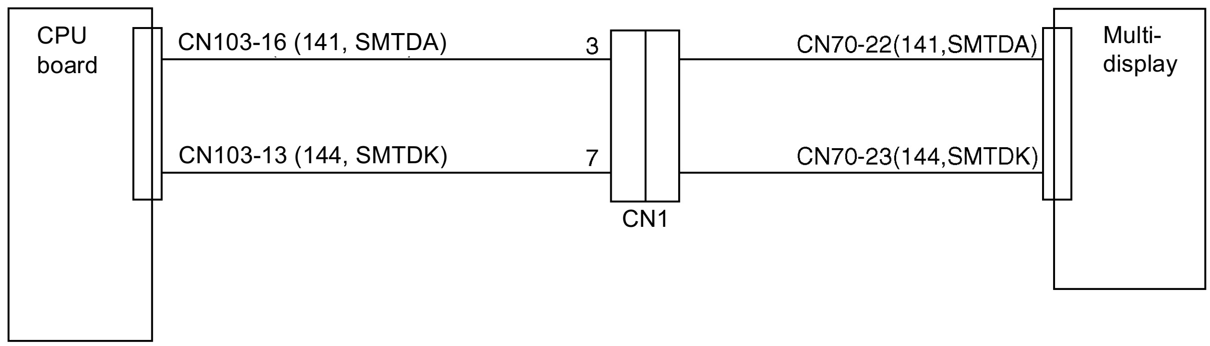
- **EE-1**



- **EE-3**
  - Reset the tuning value.
  - If EE-3 is displayed frequently, either the CPU board or the display may be defective.

F1-1, 2	Multi-display to MCS communication system abnormality

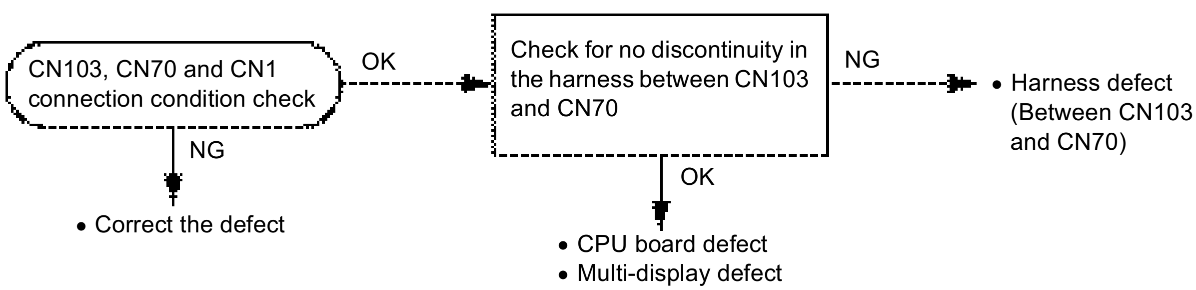
Related portion



Conditions for error detection

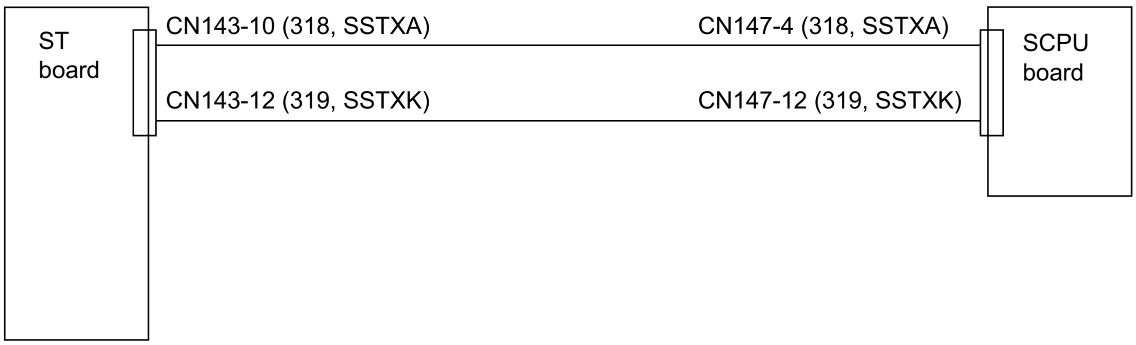
Output when abnormality of communication data from the CPU board is detected.

Other error codes, if any, cannot be displayed because communication from the CPU board is disabled when F1-1 occurs. F1-1 remains on the multi-display screen regardless of key switch ON or OFF.



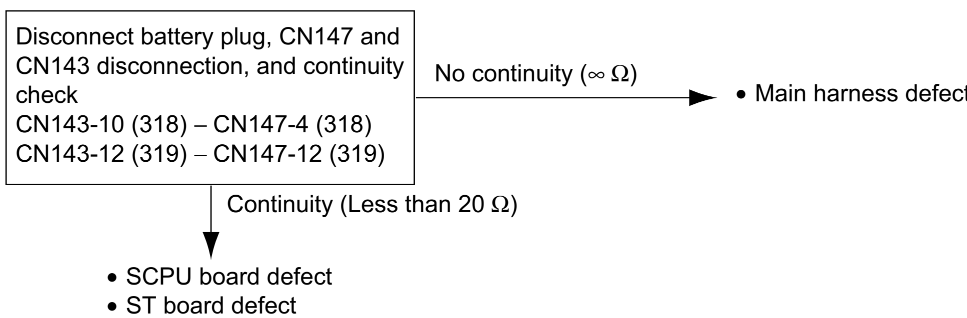
FD-1, 2	Abnormal communication between ST board and SCPU board

Related portion



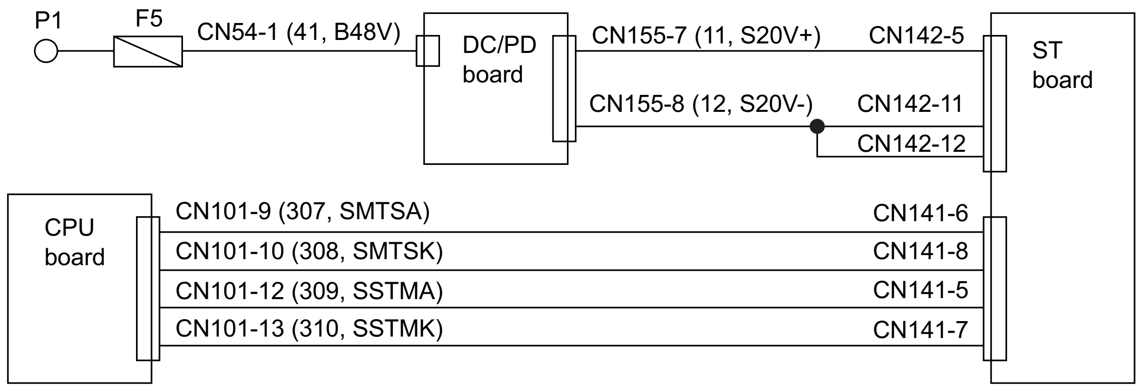
Condition for error detection

Output if communication fails for a certain period or if abnormal data is received frequently



FE-1, 2	SAS controller → traveling·material handling controller communication abnormality

Related portion



Condition for error detection

Output upon detection of any abnormality in the communication data from the ST board.

• FE-1

Connect battery plug, after ST board removal?

- Yes → • Install the ST board
- No ↓

Connect battery plug, and measure voltage
CN154-1 (B48V)
b Voltage measurement
N1

- Other than battery voltage → • Open circuit between F5 and DC/PD board
- Battery voltage ↓

Connect battery plug, and measure voltage
CN142-5 (S20+)
b Voltage measurement
CN142-11 (S20-)

- Other than 15 V ~ 22 V → • DC/PD board defect • Open circuit between DC/PD board and ST board
- 15 V ~ 22 V ↓

Continuity check between CPU board and ST board

- NG (∞ Ω) → • Repair harness
- OK (0 Ω) ↓

• CPU board defect
• ST board defect

• FE-2

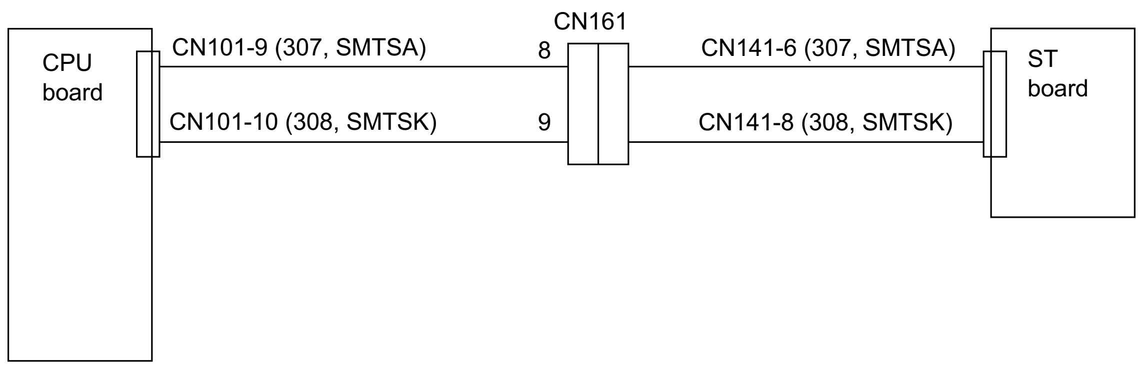
Check CN101 and CN141 for connection status

- NG → • Repair the defective portion
- OK ↓

• CPU board defect
• ST board defect

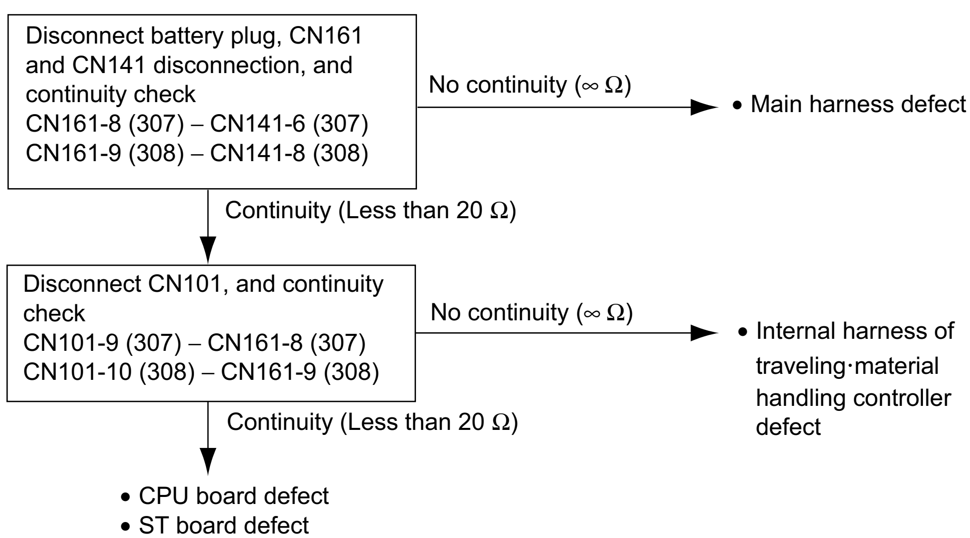
FE-4, 5	**Traveling·material handling controller → SAS controller communication abnormality**

Related portion



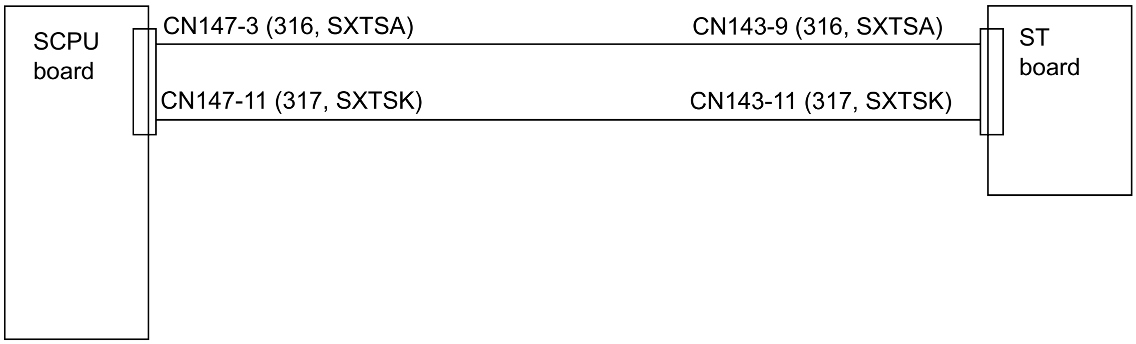
Condition for error detection

Output upon no communication within the specified time period or frequent error detection in the received data.



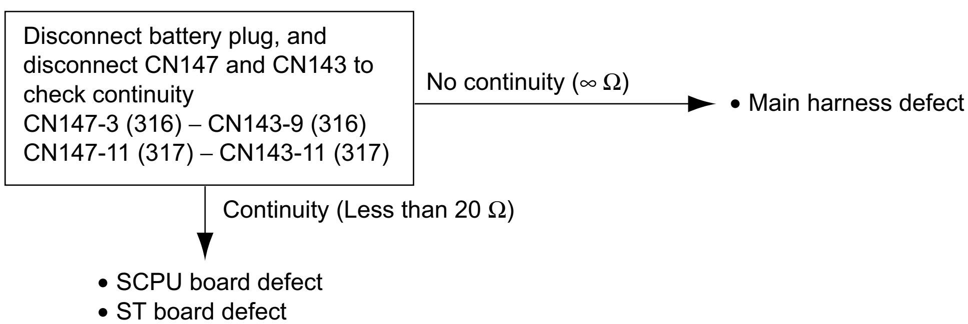
FE-6, 7	Material handling controller → SAS controller communication abnormality

Related portion



Condition for error detection

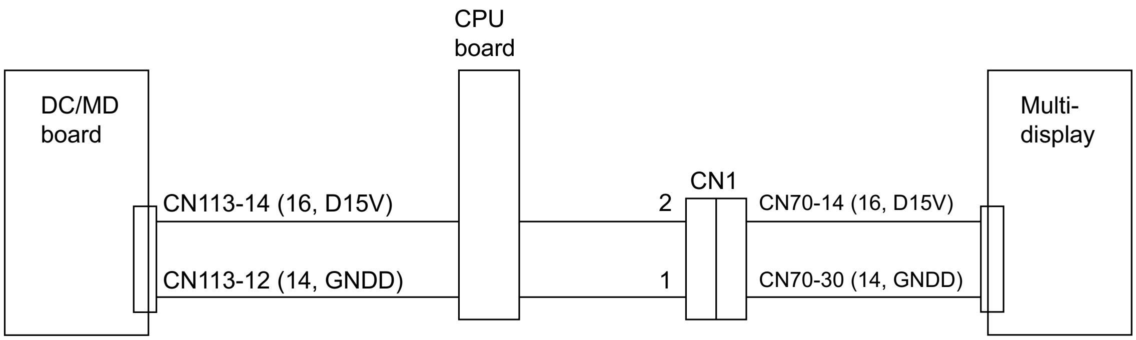
Output upon no communication within the specified time period or frequent error detection in the received data.



WHEN NO DIAGNOSIS ERROR CODE IS DISPLAYED

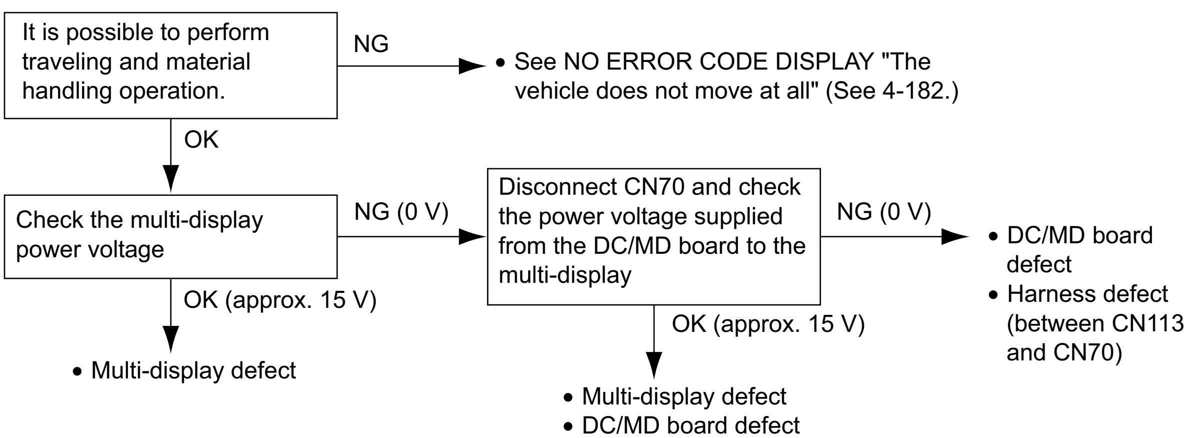
No display on multi-display (no error displayed)

Related portion



Condition for error detection

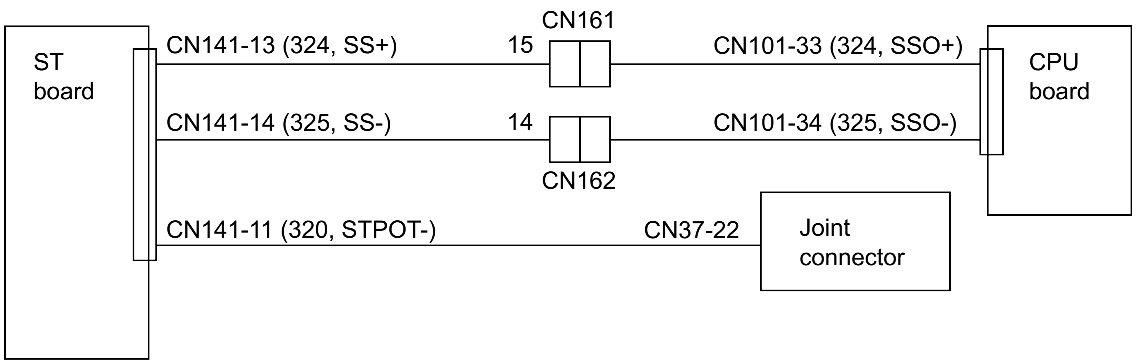
- No power supply to multi-display.
- Multi-display defect.



SAS SYSTEMS
WHEN A DIAGNOSIS ERROR CODE IS DISPLAYED

51-1	Traveling speed sensor abnormality

Related portion



Condition for error detection

Output if there is discontinuity in the traveling speed pulse line from the CPU board to the ST board

ST board voltage check
CN141-13 (324) (+) – CN141-11 (320) (-)
CN141-14 (325) (+) – CN141-11 (320) (-)

CN141-13 : approx. 1 V
CN141-14 : approx. 0 V
→ • ST board defect

CN141-13 : other than approx. 1 V
CN141-14 : other than approx. 0 V
↓

Harness continuity check (main harness open circuit)
Disconnect battery plug, disconnect CN141 and CN161 and CN162, for continuity check.
CN141-13 (324) – CN161-15 (324)
CN141-14 (325) – CN162-14 (325)

No continuity (∞ Ω) → • Main harness defect

Continuity exists (Less than 20 Ω)
↓

Harness continuity check (internal harness open circuit)
Disconnect CN101
CN161-15 (324) – CN101-33 (324)
CN162-14 (325) – CN101-34 (325)

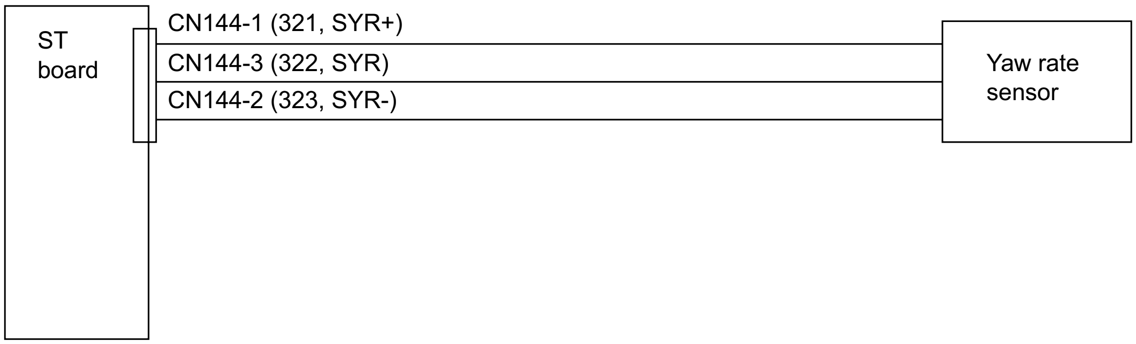
No continuity (∞ Ω) → • Internal harness of traveling·material handling controller defect

Continuity exists (Less than 20 Ω)
↓

- CPU board defect
- ST board defect

52-1, 2, 3	Yaw rate sensor abnormality

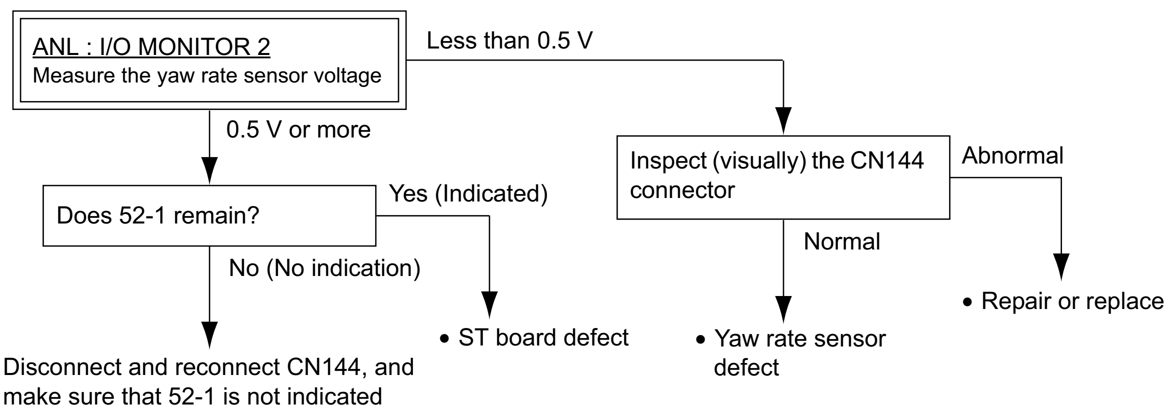
Related portion



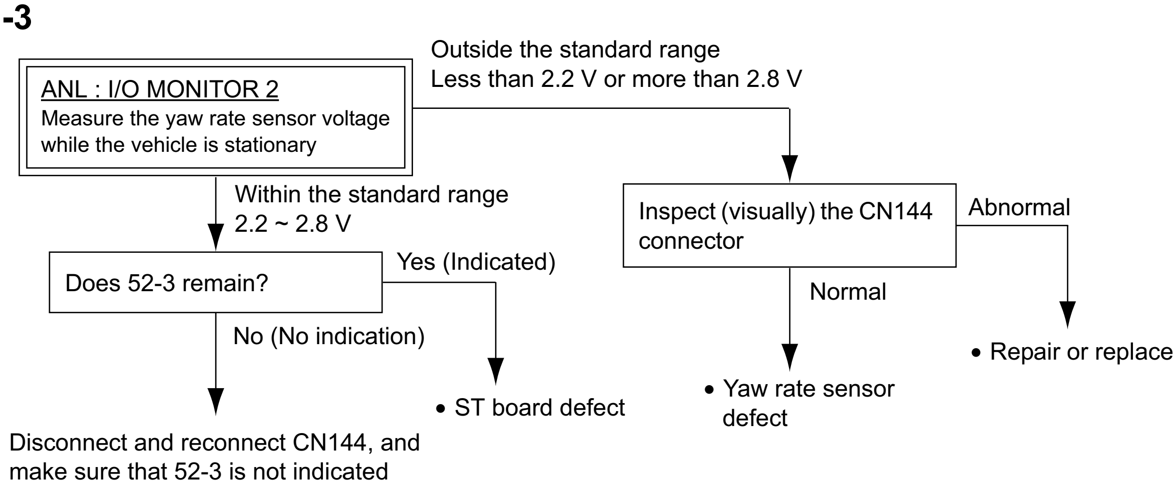
Condition for error detection

Output if the yaw rate sensor output voltage is outside the standard range (open or short circuit) or if the yaw rate sensor output voltage while the vehicle is stationary is outside the standard range (neutral voltage).
52-1 Yaw rate sensor defect (open circuit)
52-2 Yaw rate sensor defect (short circuit)
52-3 Yaw rate sensor defect (neutral voltage)

• 52-1, 2

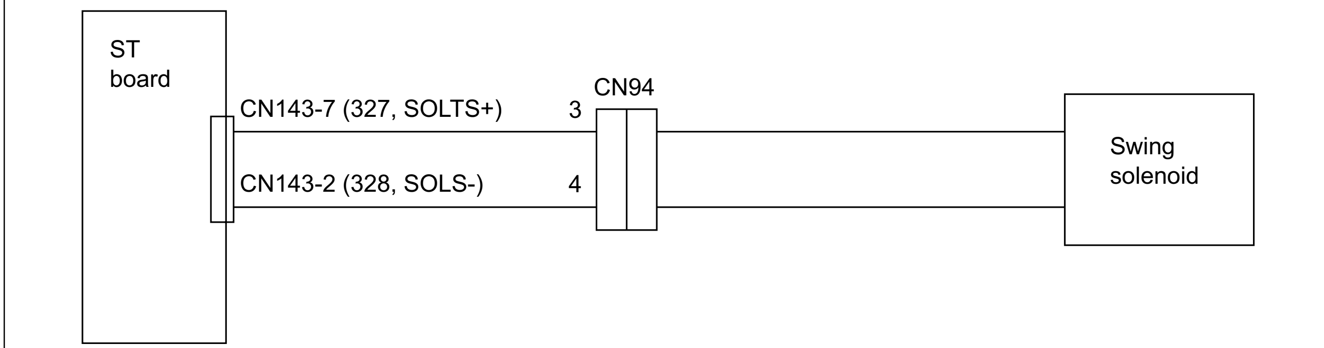


• 52-3



54-1, 2	Swing solenoid abnormality

Related portion



Condition for error detection

Output if open or short circuit in the swing solenoid line is detected.
54-1 Swing solenoid line open-circuit defect
54-2 Swing solenoid OCL defect

• 54-1

Disconnect CN143 and measure solenoid resistance.
CN143-7 (327)
b Resistance measurement
CN143-2 (328)

→ 5.5 ± 1 Ω (at 25°C) → • ST board defect

↓ Other than 5.5 ± 1 Ω (at 25°C)

Disconnect battery plug.
Disconnect CN94
CN94-3 (327)
b Resistance measurement
CN94-4 (328)

→ 5.5 ± 1 Ω (at 25°C) → • Main harness defect

↓ Other than 5.5 ± 1 Ω (at 25°C)

• Sub-harness defect
• Swing solenoid defect

• 54-2

Disconnect battery plug.
Disconnect CN94

↓

Battery plug ON and key switch ON

→ 54-1 → • Sub-harness defect • Swing solenoid defect

↓ 54-2

Disconnect battery plug.
Disconnect CN143 and measure solenoid resistance.
CN143-7 (327)
b Resistance measurement
CN143-2 (328)

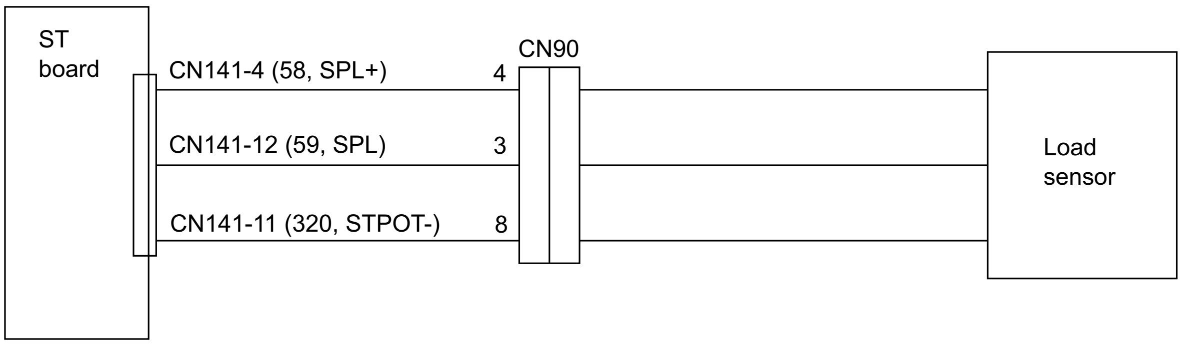
→ Less than 3 Ω → • Main harness defect

↓ 3 Ω or more

• ST board defect

61-1, 2	Load sensor abnormality

Related portion



Condition for error detection

Output if the load sensor output voltage is outside the standard range.
61-1 Load sensor defect (open circuit)
61-2 Load sensor defect (short circuit)

• 61-1

Measure the load sensor circuit resistance
Disconnect battery plug.
Disconnect CN90
CN90-3 (59) (+)
b Resistance measurement
CN90-8 (320) (-)

Less than 1 kΩ →

Disconnect battery plug.
Disconnect CN141
CN141-12 (59)
b Continuity check
CN141-11 (320)

Continuity (Less than 20 Ω) → • Main harness defect

No continuity (∞ Ω) → • ST board defect

1 kΩ or more ↓

Connect SST2 between CN90-3 and CN90-4.
Connect battery plug and turn key switch ON

61-2 error is indicated → • Sub-harness defect • Load sensor defect

61-2 error is not indicated ↓

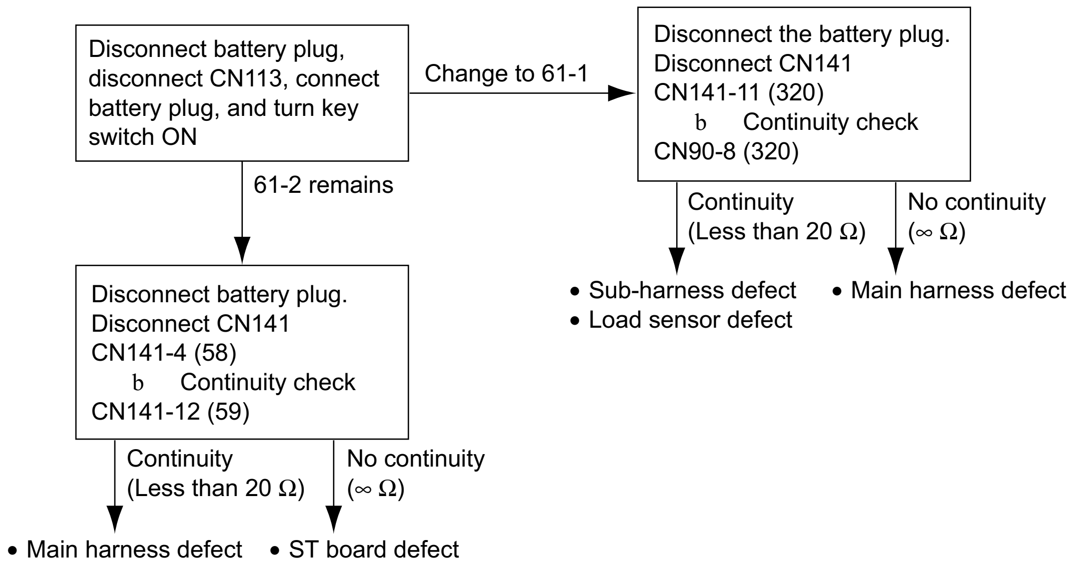
Disconnect the battery plug and CN141 (with SST2 set)
CN141-4 (58)
b Continuity check
CN141-12 (59)

No continuity (∞ Ω) → • Main harness defect

Continuity (Less than 20 Ω) ↓

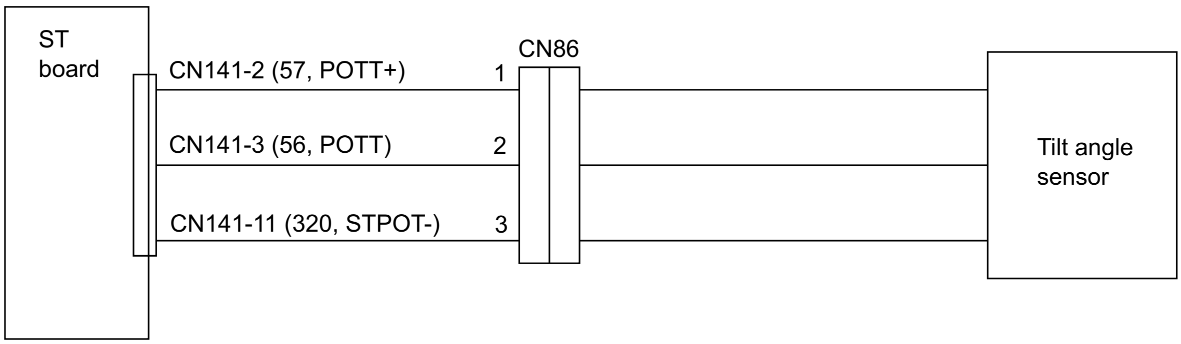
• ST board defect

- **61-2**


Disconnect battery plug, disconnect CN113, connect battery plug, and turn key switch ON
Change to 61-1
Disconnect the battery plug. Disconnect CN141
CN141-11 (320)
b Continuity check
CN90-8 (320)
Continuity (Less than 20 Ω)
No continuity (∞ Ω)
• Sub-harness defect
• Load sensor defect
• Main harness defect
61-2 remains
Disconnect battery plug. Disconnect CN141
CN141-4 (58)
b Continuity check
CN141-12 (59)
Continuity (Less than 20 Ω)
No continuity (∞ Ω)
• Main harness defect
• ST board defect

62-1, 2	Tilt angle sensor abnormality

Related portion



Condition for error detection

Output if the tilt angle sensor output voltage is outside the standard range.
62-1 Tilt angle sensor defect (open circuit)
62-2 Tilt angle sensor defect (short circuit)

• 62-1

Measure the tilt angle sensor circuit resistance
Disconnect battery plug.
Disconnect CN86
CN86-2 (56) (+)
b Resistance measurement
CN86-3 (320) (-)

Less than 1 kΩ →

Disconnect battery plug.
Disconnect CN141
CN141-3 (56)
b Continuity check
CN141-11 (320)

Continuity (Less than 20 Ω) → • Main harness defect

No continuity (∞ Ω) → • ST board defect

1 kΩ or more ↓

Connect SST2 between CN86-1 and CN86-2.
Connect battery plug and turn key switch ON

62-2 error is indicated → • Tilt angle sensor defect

62-2 error is not indicated ↓

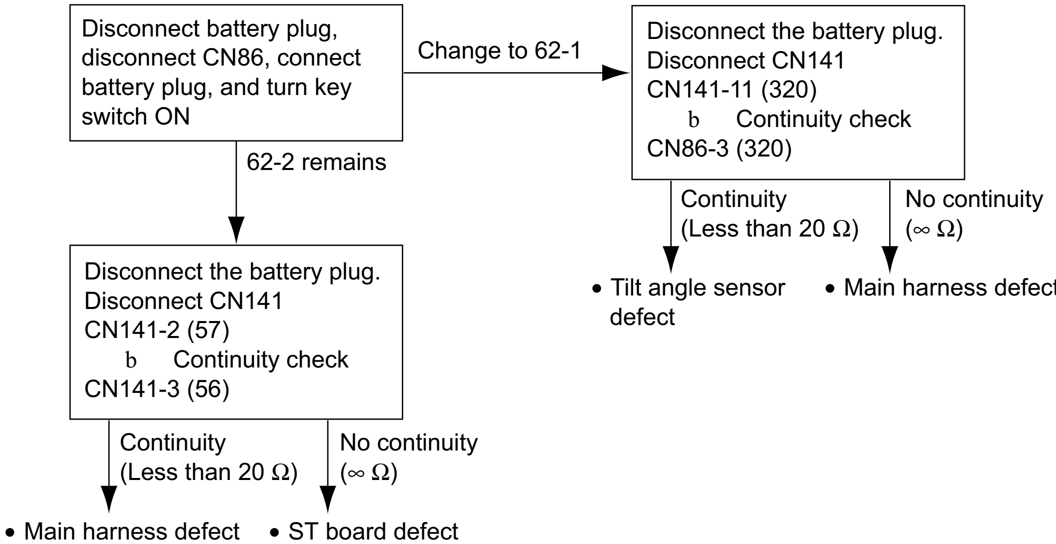
Disconnect the battery plug.
CN141 (with SST2 set)
CN141-2 (57)
b Continuity check
CN141-3 (56)

No continuity (∞ Ω) → • Main harness defect

Continuity (Less than 20 Ω) ↓

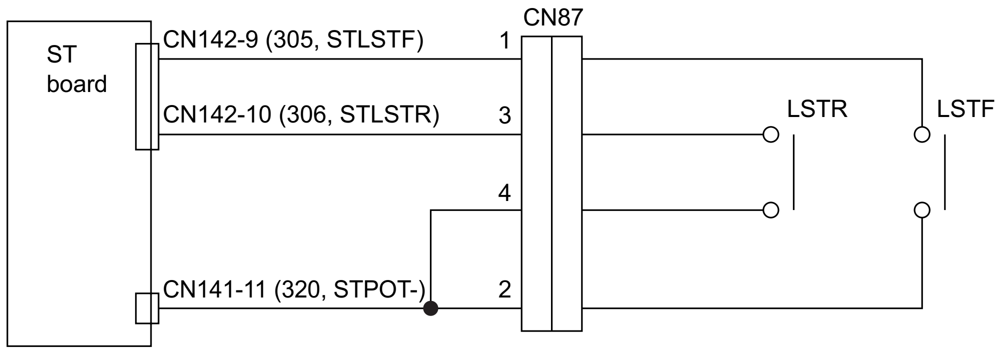
• ST board defect

- **62-2**


Disconnect battery plug, disconnect CN86, connect battery plug, and turn key switch ON
Change to 62-1
Disconnect the battery plug. Disconnect CN141 CN141-11 (320) b Continuity check CN86-3 (320)
Continuity (Less than 20 Ω)
No continuity (∞ Ω)
• Tilt angle sensor defect
• Main harness defect
62-2 remains
Disconnect the battery plug. Disconnect CN141 CN141-2 (57) b Continuity check CN141-3 (56)
Continuity (Less than 20 Ω)
No continuity (∞ Ω)
• Main harness defect
• ST board defect

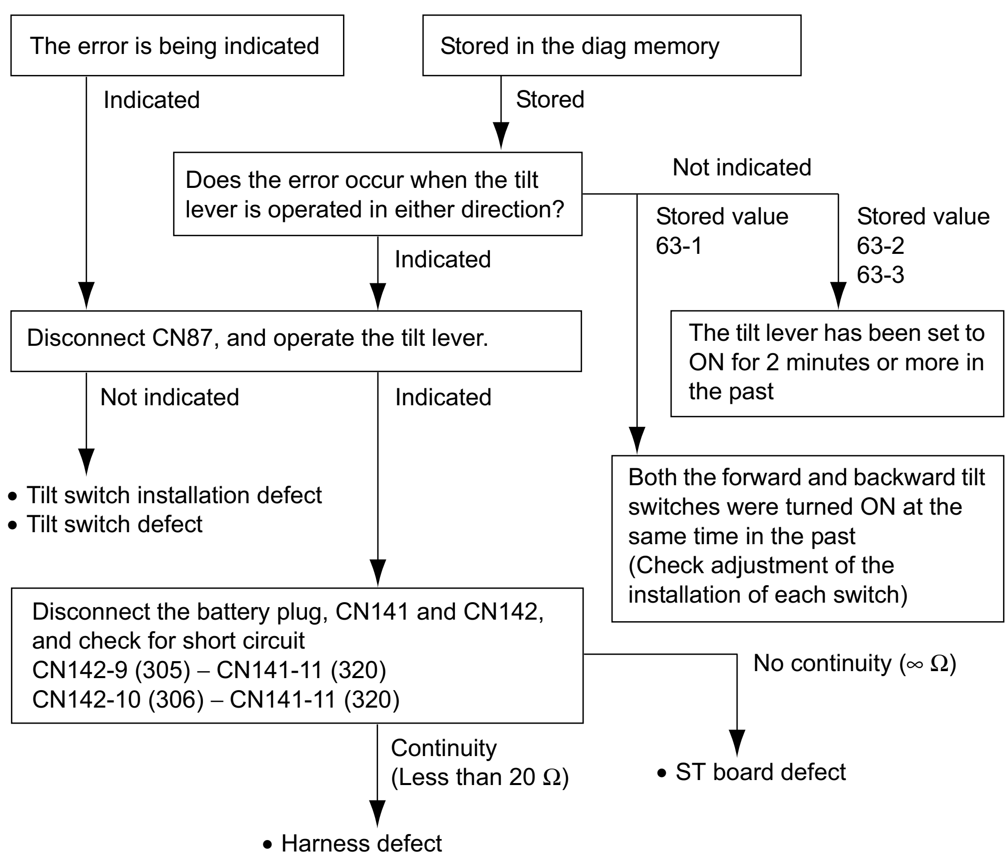
63-1, 2, 3	Tilt switch abnormality

Related portion



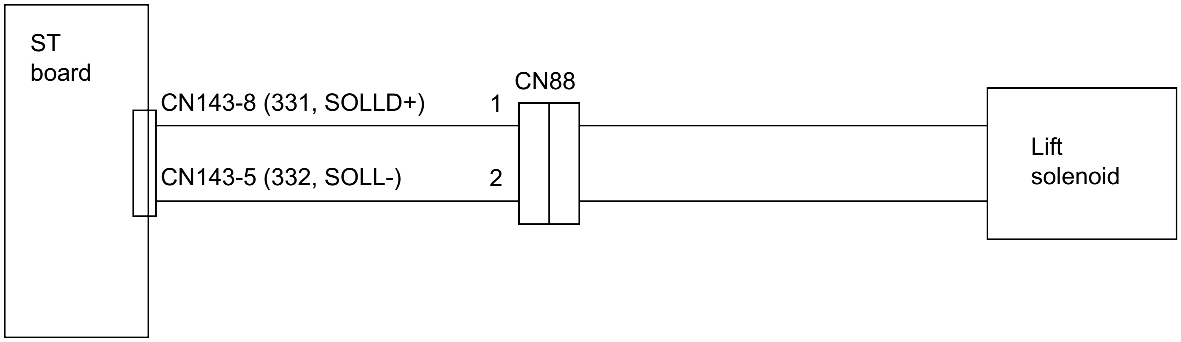
Condition for error detection

Output if the tilt switch input line is shorted.
63-1 Tilt switch abnormality (simultaneous ON)
63-2 Forward tilt switch abnormality (short circuit)
63-3 Backward tilt switch abnormality (short circuit)



64-1, 2	Lift solenoid abnormality

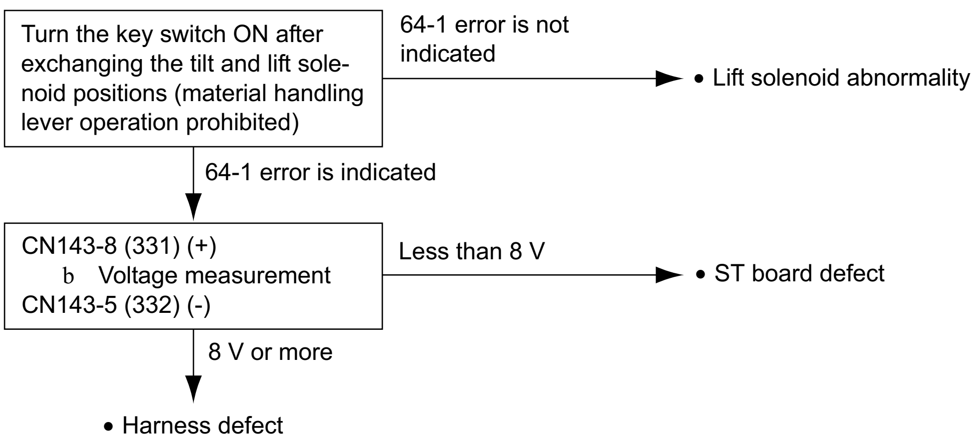
Related portion



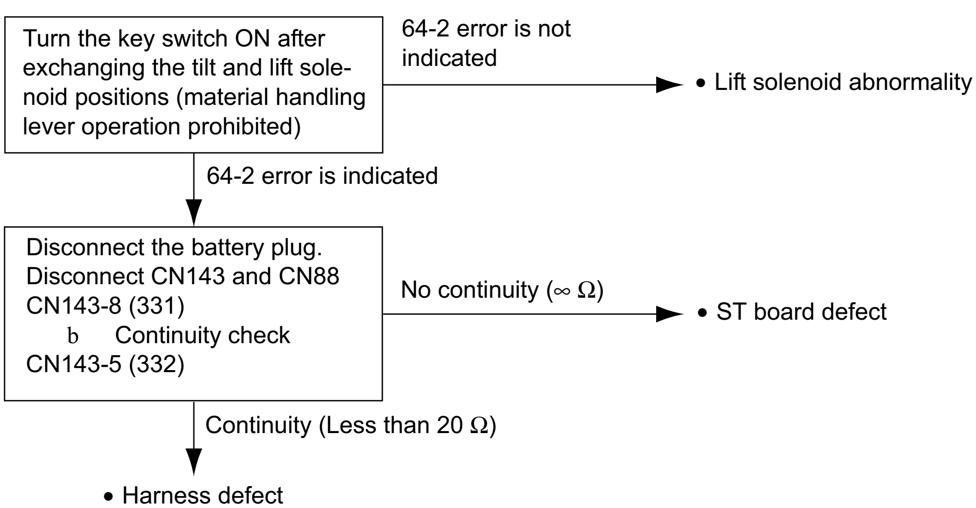
Condition for error detection

Output if the lift solenoid line from the ST board to the lift solenoid is open or shorted.
64-1 Lift solenoid open-circuit defect
64-2 Lift solenoid OCL defect

- **64-1**

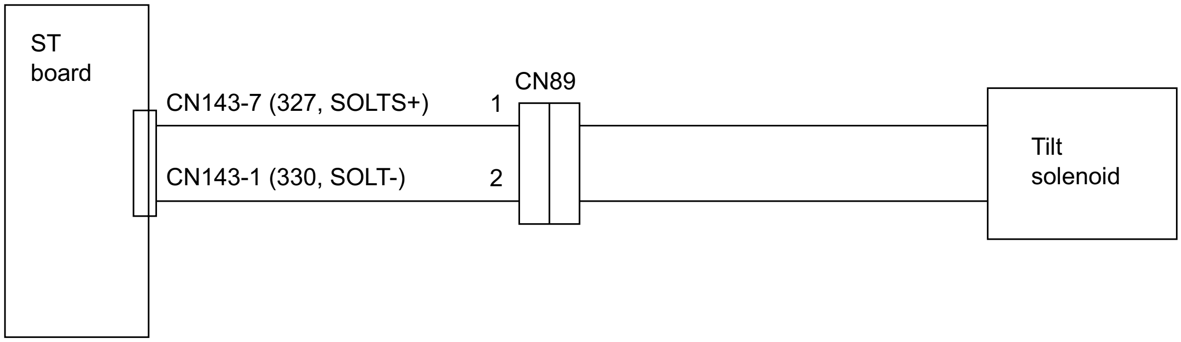


- **64-2**



65-1, 2	Tilt solenoid abnormality

Related portion



Condition for error detection

Output if the tilt solenoid line from the ST board to the tilt solenoid is open or shorted.
65-1 Tilt solenoid open-circuit defect
65-2 Tilt solenoid OCL defect

• 65-1

Turn the key switch ON after exchanging the lift and tilt solenoid positions (forward tilting operation)

- 65-1 error is not indicated → • Tilt solenoid abnormality
- 65-1 error is indicated ↓

Turn the key switch ON and measure the voltage during forward tilting
CN143-7 (327) (+)
b Voltage measurement
CN143-1 (330) (-)

- Less than 8 V → • ST board defect
- 8 V or more ↓ • Harness defect

• 65-2

Turn the key switch ON after exchanging the lift and tilt solenoid positions (material handling lever operation prohibited)

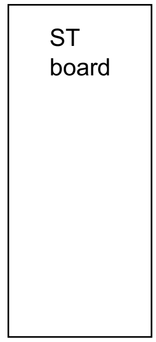
- 65-2 error is not indicated → • Tilt solenoid abnormality
- 65-2 error is indicated ↓

Disconnect the battery plug.
Disconnect CN143 and CN89
CN143-7 (327)
b Continuity check
CN143-1 (330)

- No continuity (∞ Ω) → • ST board defect
- Continuity (Less than 20 Ω) ↓ • Harness defect

66-1	Tilt matching value abnormality

Related portion



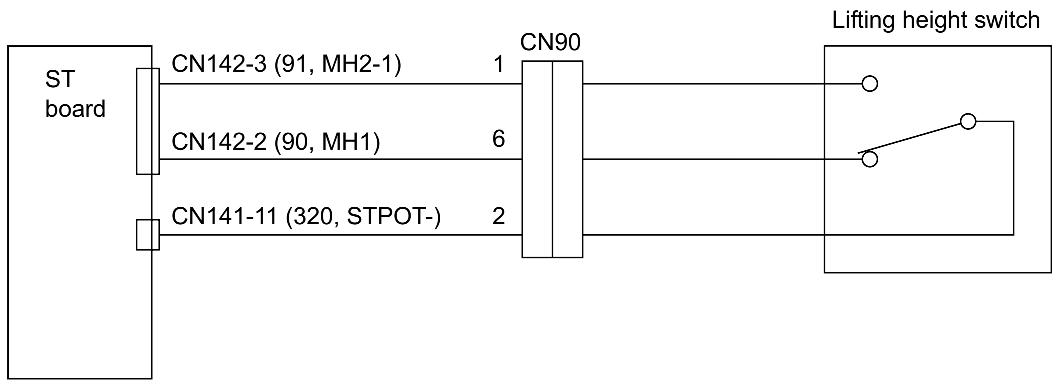
Condition for error detection

Output if any of the matching values of the tilt neutral position, forward tilt angle or pressure sensor is outside the standard range.

- To correct, replace the ST board.

67-1	Lifting height switch abnormality

Related portion



Condition for error detection

Output if the lifting height switch line from the ST board to the lifting switch is open or shorted.

Check if an error is detected when the mast is fully lowered

- 67-1 error is not indicated → **Check if an error is detected when the mast is fully raised**
- 67-1 error is indicated → Disconnect the battery plug and CN90, and check continuity (switch: low lifting height)
  CN90-2 (320) – CN90-6 (90)
  [OK] Continuity, [NG] No continuity
  CN90-2 (320) – CN90-1 (91)
  [OK] No continuity, [NG] Continuity
  - NG →
    - Sub-harness defect
    - Lifting height switch defect
  - OK → ANL : I/O MONITOR 3

Check if an error is detected when the mast is fully raised

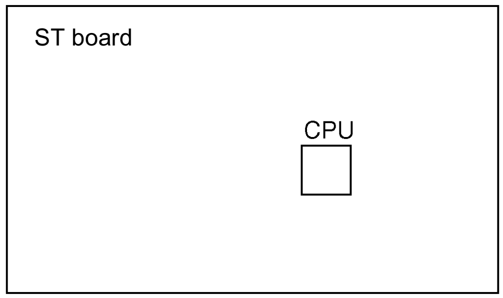
- 67-1 error is indicated → Disconnect the battery plug and CN90, and check continuity (switch: high lifting height)
  CN90-2 (320) – CN90-6 (90)
  [OK] No continuity, [NG] Continuity
  CN90-2 (320) – CN90-1 (91)
  [OK] Continuity, [NG] No continuity
  - OK → ANL : I/O MONITOR 3
  - NG →
    - Sub-harness defect
    - Lifting height switch defect

ANL : I/O MONITOR 3
Check the switch input value
(CN90 and battery plug connected)

- MH1 and MH2-1 indication MH: 00 (both OFF) → Disconnect battery plug. Disconnect CN90 and CN142, for continuity check.
  CN142-3 (91) – CN90-1 (91)
  CN142-2 (90) – CN90-6 (90)
  CN141-11 (320) – CN90-2 (320)
  - Continuity → • ST board defect
  - No continuity → • Harness defect
- MH1 and MH2-1 indication MH: 11 (both ON) → Disconnect battery plug. Disconnect CN90 and CN142, for continuity check.
  CN142-3 (91) – CN90-2 (320)
  CN142-2 (90) – CN90-2 (320)
  CN142-3 (91) – CN90-6 (90)
  - Continuity → • Harness defect
  - No continuity → • ST board defect

AF-5, 6, 7, 8	ST board CPU abnormality

Related portion



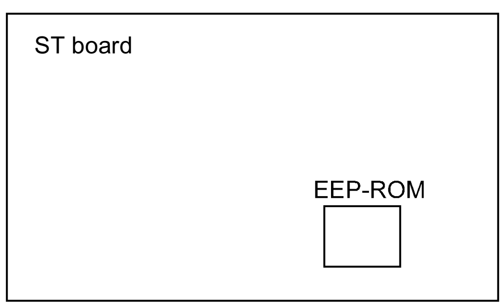
Condition for error detection

Output when an error is detected in ST board CPU inspection or the sensor input processing does not end. When this code is output, the CPU is reset.

- If AF-5, AF-6, AF-7 or AF-8 is displayed, replace the ST board.

EF-5, 6	ST board EEP-ROM abnormality

Related portion



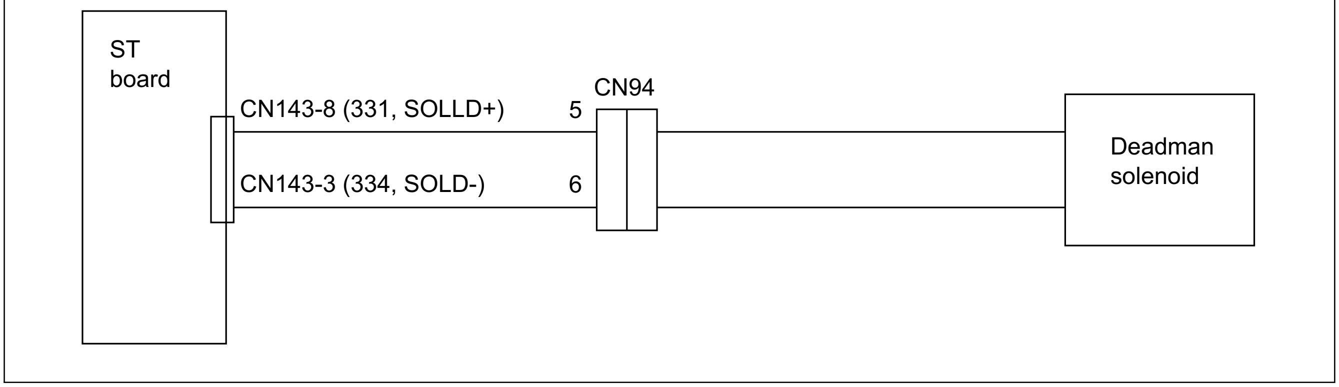
Condition for error detection

Output when access to the EEP-ROM on the ST board is disabled.

- If EF-5 or EF-6 is displayed, replace the ST board.

G4-1, 2	Deadman solenoid abnormality

Related portion



Condition for error detection

Output if the deadman solenoid line from the ST board to the deadman solenoid is open or shorted.
G4-1 Deadman solenoid open-circuit defect
G4-2 Deadman solenoid OCL defect

• G4-1

Is the vehicle equipped with the deadman brake?

Without deadman brake → Check option setting

Option setting is Y → Correct to N by option setting

With deadman brake ↓

Disconnect the battery plug.
Disconnect CN143 and measure solenoid resistance.
CN143-8 (331)
b Resistance measurement
CN143-3 (334)

11.8 ± 1 Ω (at 20°C) → • ST board defect

Other than 11.8 ± 1 Ω (at 20°C) ↓

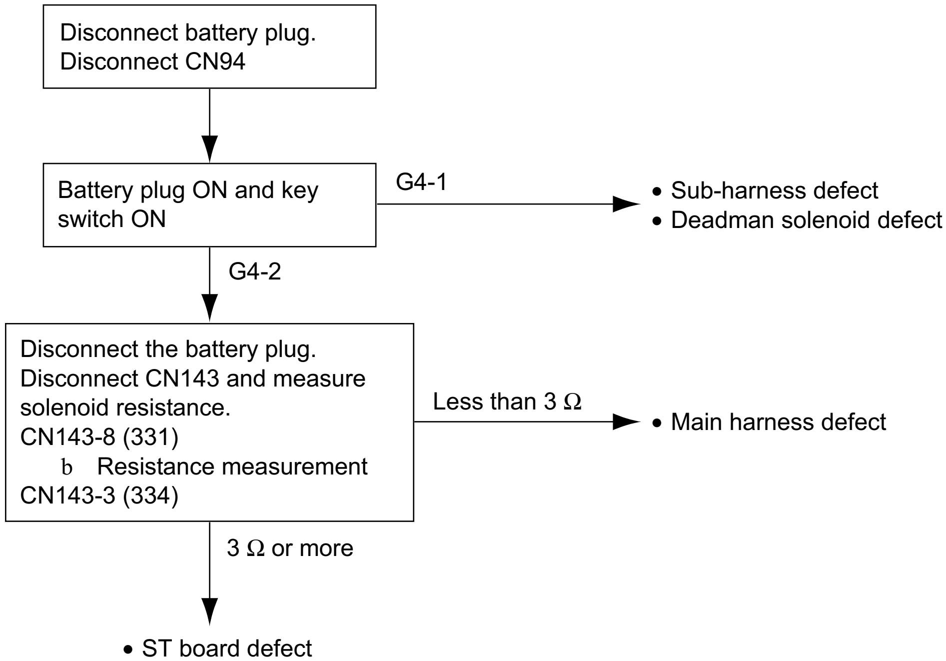
Disconnect the battery plug.
Disconnect CN94
CN94-5 (331)
b Resistance measurement
CN94-6 (334)

11.8 ± 1 Ω (at 20°C) → • Main harness defect

Other than 11.8 ± 1 Ω (at 20°C) ↓

• Sub-harness defect
• Deadman solenoid defect

• G4-2


Disconnect battery plug.
Disconnect CN94
Battery plug ON and key switch ON
G4-1
• Sub-harness defect
• Deadman solenoid defect
G4-2
Disconnect the battery plug.
Disconnect CN143 and measure solenoid resistance.
CN143-8 (331)
b Resistance measurement
CN143-3 (334)
Less than 3 Ω
• Main harness defect
3 Ω or more
• ST board defect

WHEN NO ERROR CODE IS DISPLAYED

Stability not provided during traveling (-Locking hardly or not provided during traveling)

Hasn't any tire burst?
- NG → • Tire burst
- OK ↓

Visually inspect for damages on the lock cylinder and pin.
- NG → • Lock cylinder component failure.
- OK ↓

ANL : ACTIVE TEST ACT-3 SSOL
Make sure that the rear axle does not swing when a front wheel goes over a step after swing SOL OFF.
- Yes → • Failure such as lock cylinder internal leak, leak of operation oil to the outside, or solenoid sticking.
- OK ↓

ANL : Diag memory
Is the error code recorded?
- NG → Is there any current error in the record?
  - Yes → • Go to that error code.
  - No → (to next step)
- No ↓

ANL : I/O MONITOR 2 I/O2-6 SPD (S)
Does the speed value change according to the traveling speed?
- NG → • Speed sensor defect
- OK ↓

ANL : I/O MONITOR 2 I/O2-7 YAW
① Is the yaw rate sensor voltage change normal upon accelerated swing along a circle with an approximately 2-meter radius? (Inspect the right and left, respectively.)
② Make sure that the lock lamp is not lit when the fork is lowered and the speed is gradually increased simply. (Fork height: 500 mm (19.7 in) or lower)
- NG → • Yaw rate sensor defect
- OK ↓

ANL : I/O MONITOR 3 I/O3-5 MH
Inspect the functions of lifting height switches (ON/OFF of MH1 and MH2)
[OK]
Low lifting height ⇒ MH-1: ON, MH2-1: OFF
Display code ⇒ MH: 10
High lifting height ⇒ MH-1: ON, MH2-1: ON
Display code ⇒ MH: 01
[NG] Other than above
- NG → • Lifting height switch defect
- OK ↓

Can the mast be tilted to the forward-most position with a large lifting height and without load (excluding relief)? Does the mast stop at an approximately 1 degree front tilted position when the fork is at the upper-most position with no-load relief?
- NG → • Load sensor defect
- OK ↓

• ST controller defect

Swing lock always occurs during traveling or loading work.
Or swing lock frequently occurs.

Lock is always maintained (bracing kept) and the rear axle does not swing when the vehicle goes over a step although the swing lock indicator is not lit.

Yes → • Failure such as lock cylinder solenoid valve sticking or clogging.

No ↓

ANL : I/O MONITOR 2 I/O2-7 YAW

① Is the yaw rate sensor voltage change normal upon accelerated swing along a circle with an approximately 2-meter radius? (Inspect the right and left, respectively.)

② Make sure that the swing lock indicator is not lit when the fork is lowered and the speed is gradually increased simply. (Fork height: 500 mm (19.7 in) or lower)

NG → • Yaw rate sensor abnormality.

OK ↓

ANL : I/O MONITOR 3 I/O3-5 MH

Inspect the functions of lifting height switches (ON/OFF of MH1 and MH2)

[OK]

Low lifting height ⇒ MH-1: ON, MH2-1: OFF
Display code ⇒ MH: 10

High lifting height ⇒ MH-1: OFF, MH2-1: ON
Display code ⇒ MH: 01

[NG] Other than above

NG → • Lifting heigh switch defect

OK ↓

Can the mast be tilted to the forward-most position with a large lifting height and without load (excluding relief)? Does the mast stop at an approximately 1 degree front tilted position when the fork is at the upper-most position with no-load relief?

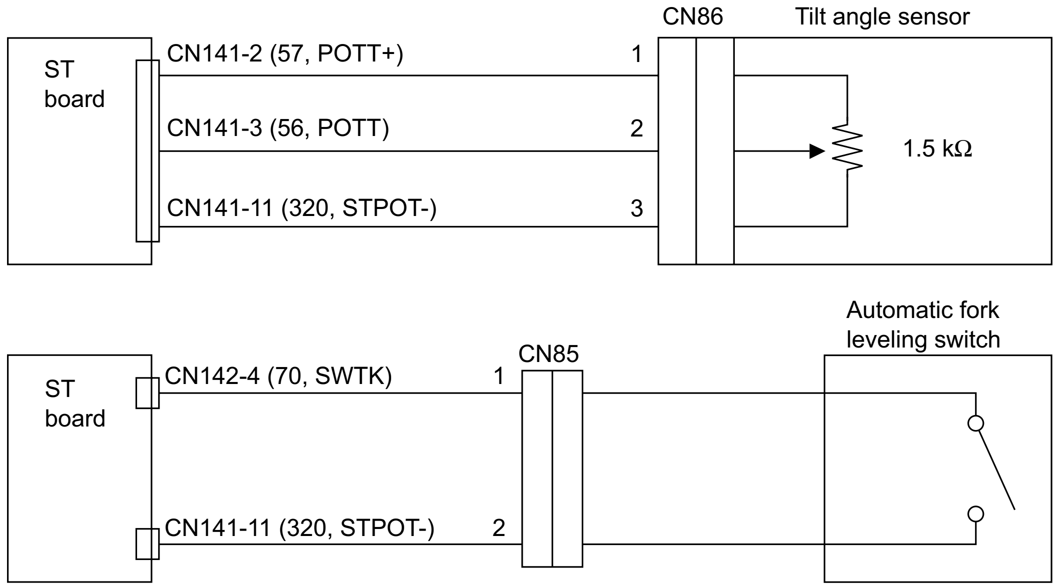
NG → • Load sensor abnormality.

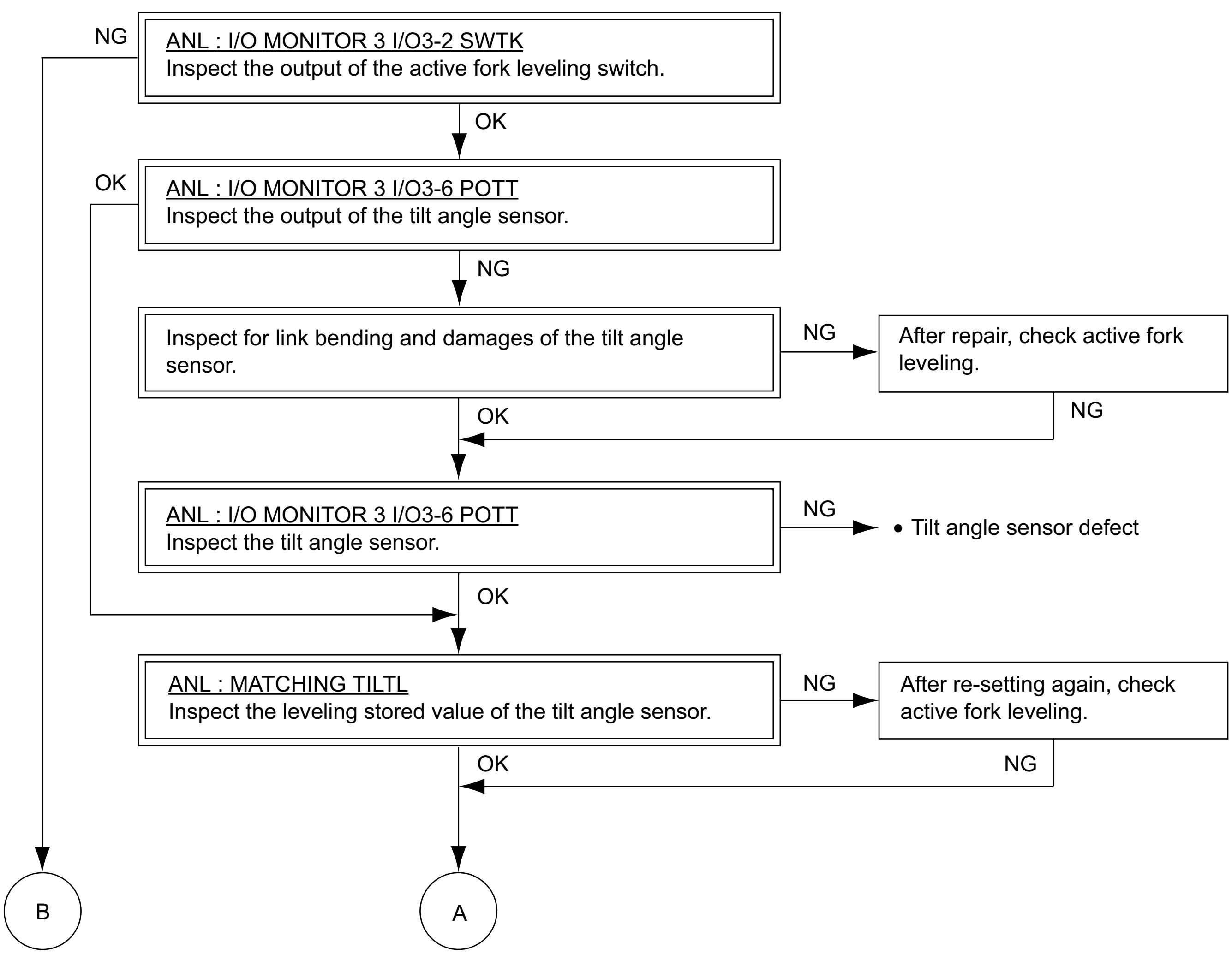
OK ↓

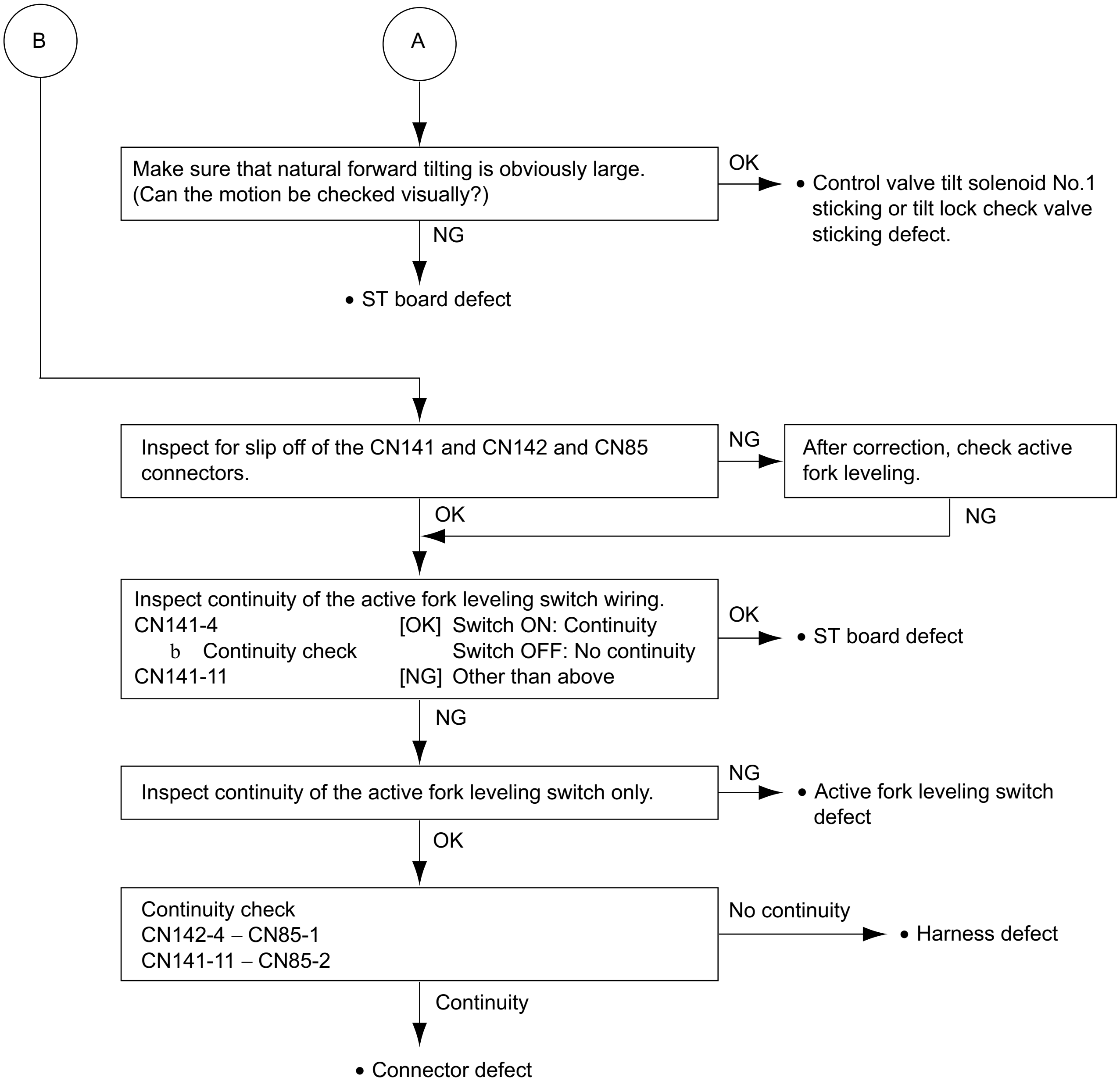
• ST controller defect

Stopping with automatic leveling fails. (Does not stop at a horizontal position but tilts at the forward-most position.)

Related portion

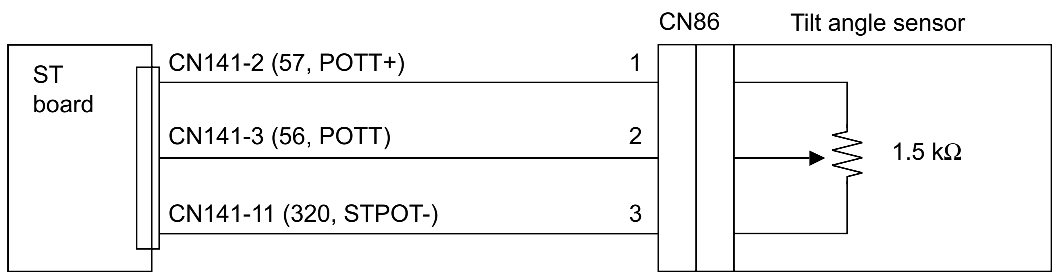





B
A
Make sure that natural forward tilting is obviously large.
(Can the motion be checked visually?)
OK
• Control valve tilt solenoid No.1 sticking or tilt lock check valve sticking defect.
NG
• ST board defect
Inspect for slip off of the CN141 and CN142 and CN85 connectors.
NG
After correction, check active fork leveling.
NG
OK
Inspect continuity of the active fork leveling switch wiring.
CN141-4
b Continuity check
CN141-11
[OK] Switch ON: Continuity
Switch OFF: No continuity
[NG] Other than above
OK
• ST board defect
NG
Inspect continuity of the active fork leveling switch only.
NG
• Active fork leveling switch defect
OK
Continuity check
CN142-4 – CN85-1
CN141-11 – CN85-2
No continuity
• Harness defect
Continuity
• Connector defect

Active fork leveling is not provided. (Stops at a non-horizontal position.)

Related portion



Inspect for link bending and damages of the tilt angle sensor.

- NG → After repair, check active fork leveling. (NG → next step)
- OK ↓

<u>ANL : I/O MONITOR I/O3-6 POTT</u>
Inspect the tilt angle sensor.

- NG → • Tilt angle sensor defect.
- OK ↓

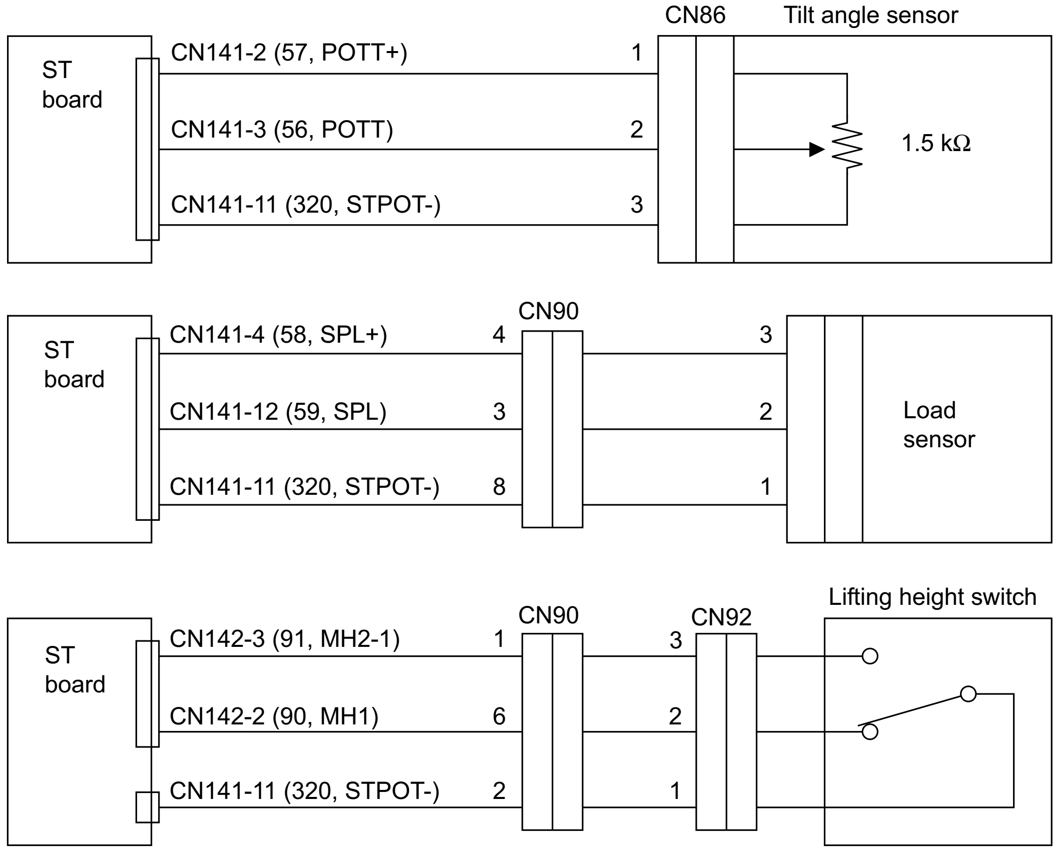
<u>ANL : MATCHING TILTL</u>
Inspect the stored leveling value of the tilt angle sensor.

- NG → After matching again, check active fork leveling. (NG → next step)
- OK ↓

• ST board defect

Active fork leveling is not provided. (Stops at a position when the knob switch is pressed.)

Related portion



Make sure that active fork leveling is possible with a fork lifting height of approximately 500 mm (19.6 in) and approximately 500 mm (19.6 in) without load.

- OK → A
- NG ↓

Make sure that active fork leveling is possible with a fork lifting height of approximately 500 mm (19.6 in) and approximately 500 mm (19.6 in) with a load on the fork.

- OK → • ST board defect
- NG ↓

Check if automatic leveling is possible at a high position without any load.

- OK → • ST board defect
- NG ↓

Inspect for link bending and damages of the tilt angle sensor.

- NG → After repair, check active fork leveling. (NG ↓)
- OK ↓

ANL : I/O MONITOR I/O3-6 POTT
Inspect the tilt angle sensor.

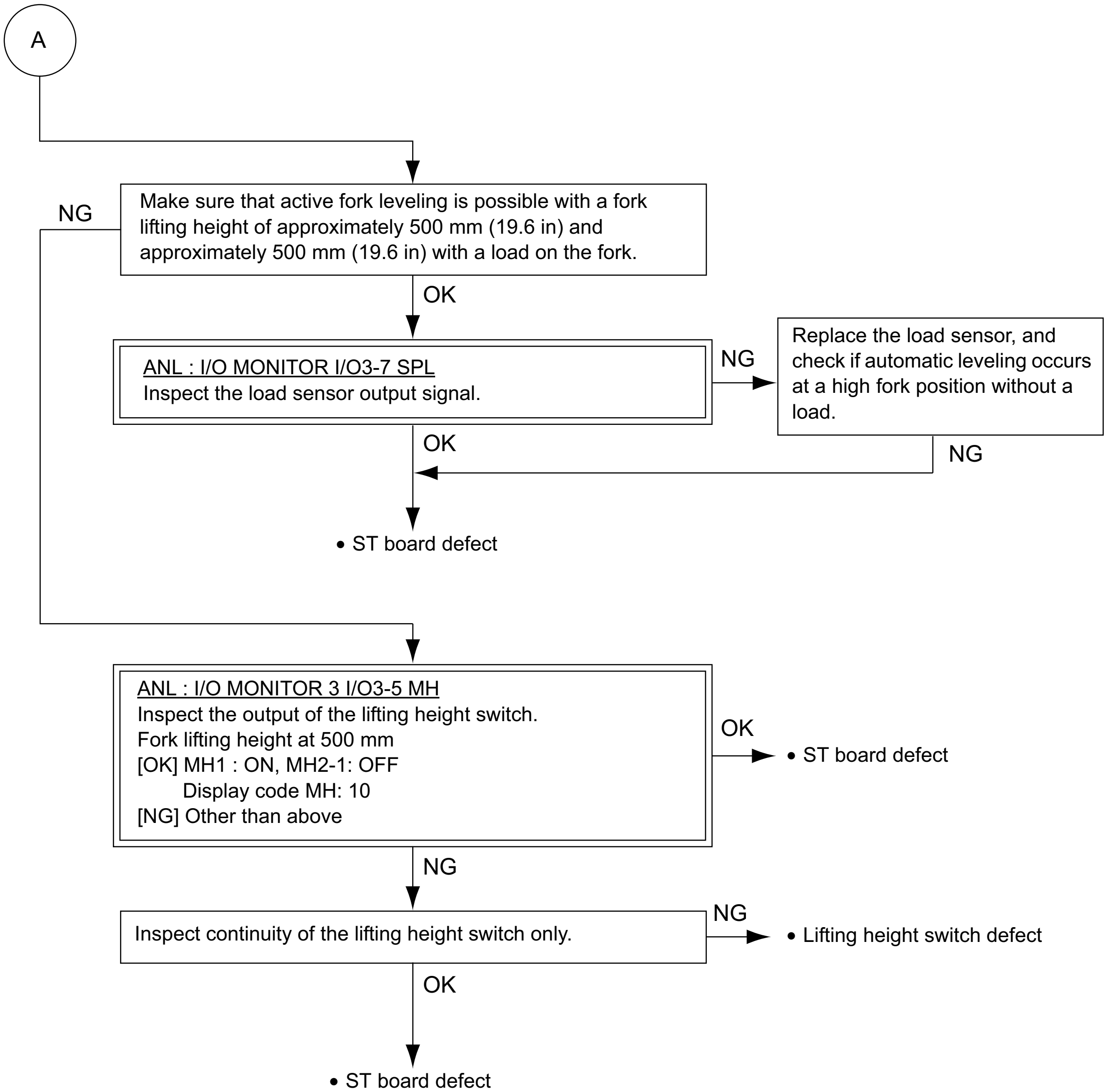
- NG → • Tilt angle sensor defect
- OK ↓

ANL : MATCHING TILTL
Inspect the stored leveling value of the tilt angle sensor.

- NG → After matching again, check active fork leveling. (NG ↓)
- OK ↓

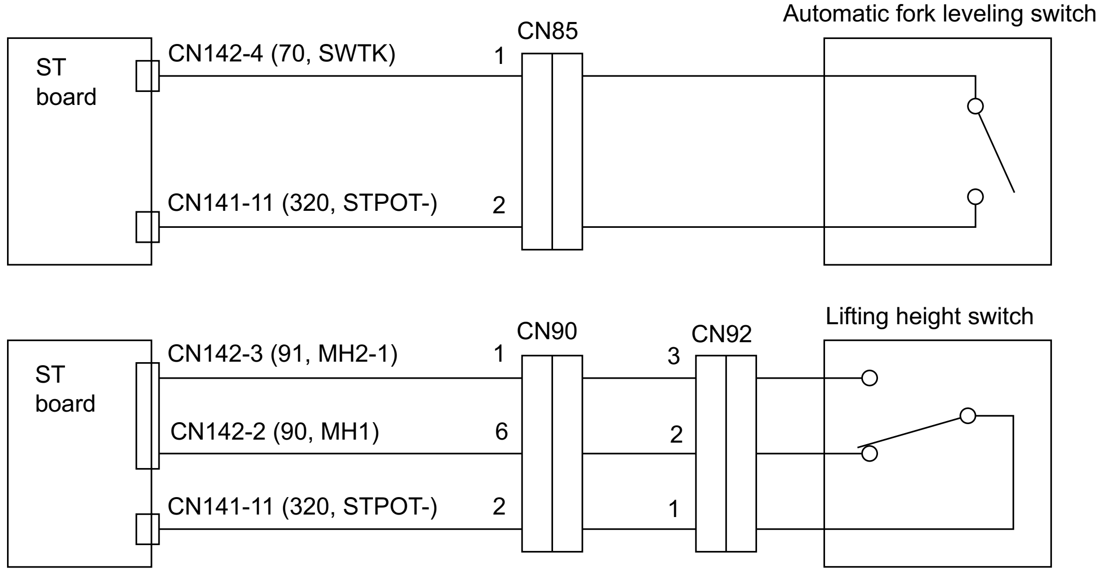
• ST board defect

A


A
NG
Make sure that active fork leveling is possible with a fork lifting height of approximately 500 mm (19.6 in) and approximately 500 mm (19.6 in) with a load on the fork.
OK
ANL : I/O MONITOR I/O3-7 SPL
Inspect the load sensor output signal.
NG
Replace the load sensor, and check if automatic leveling occurs at a high fork position without a load.
OK
NG
• ST board defect
ANL : I/O MONITOR 3 I/O3-5 MH
Inspect the output of the lifting height switch.
Fork lifting height at 500 mm
[OK] MH1 : ON, MH2-1: OFF
Display code MH: 10
[NG] Other than above
OK
• ST board defect
NG
Inspect continuity of the lifting height switch only.
NG
• Lifting height switch defect
OK
• ST board defect

The active mast rear tilt speed is not regulated, or the backward tilting speed is always slow.

Related portion



ANL : I/O MONITOR I/O3-2 SWTK
Inspect the output signal of the active fork leveling switch.

- OK → A
- NG ↓

Inspect for slip off of the CN141 and CN142 and CN85 connectors.

- NG → After correction, check the backward tilting speed. (NG ↓)
- OK ↓

Inspect continuity of the active fork leveling switch wiring.
CN142-4
b Continuity check
CN141-11
[OK] Switch ON: Continuity
Switch OFF: No continuity
[NG] Other than above

- OK → • ST board defect
- NG ↓

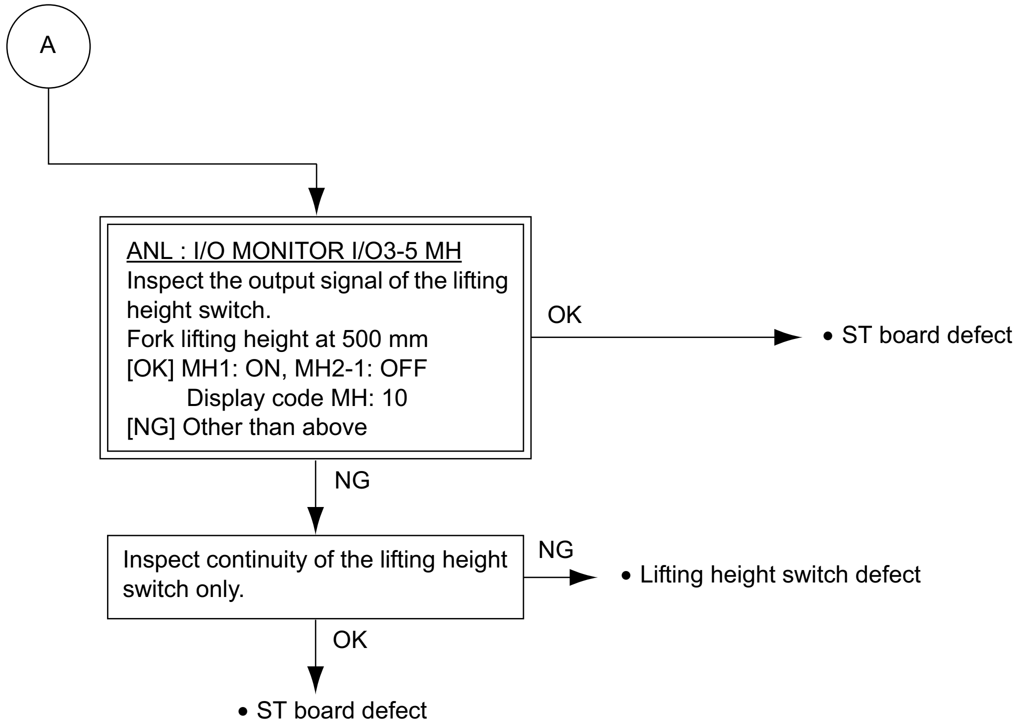
Inspect continuity of the active fork leveling switch only.

- NG → • Active fork leveling switch defect
- OK ↓

Continuity check
CN142-4 – CN85-1
CN141-11 – CN85-2

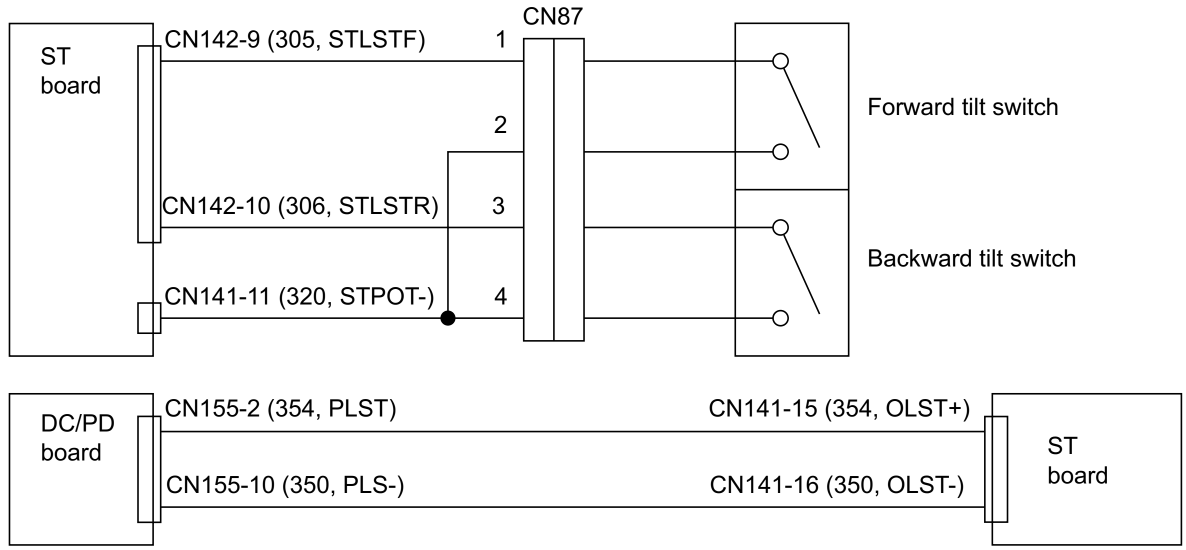
- No continuity → • Harness defect
- ↓ • Connector defect

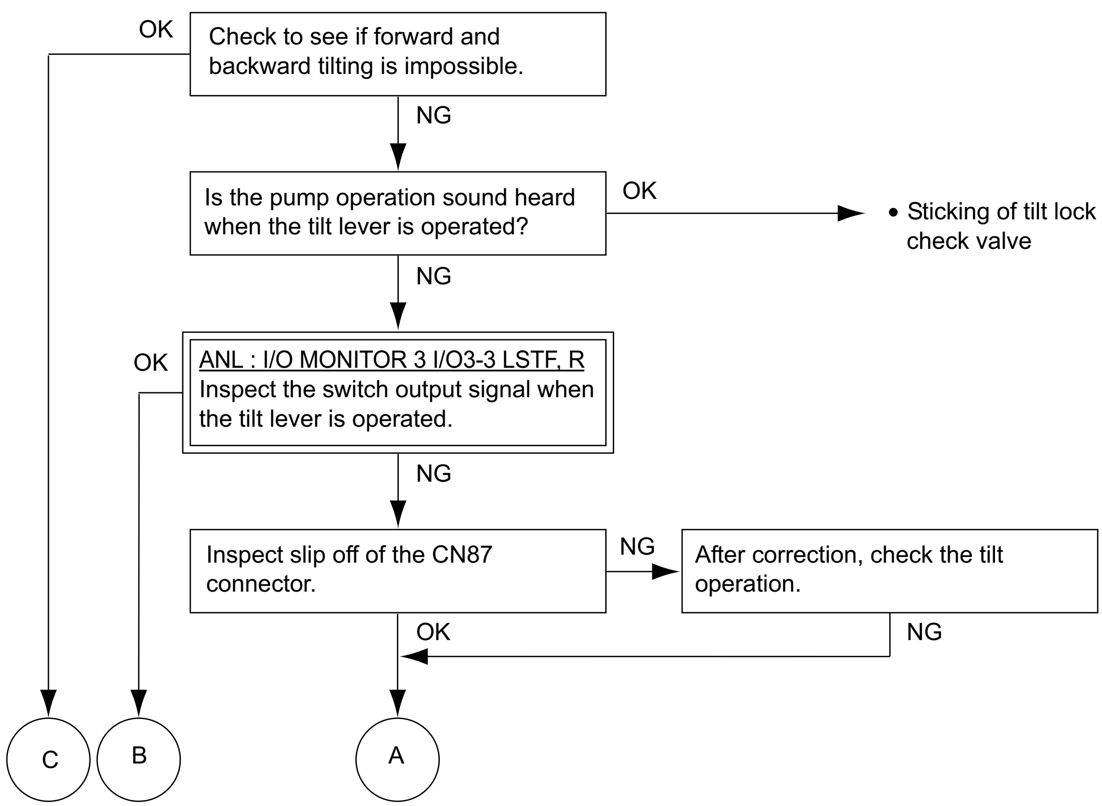
A


A
ANL : I/O MONITOR I/O3-5 MH
Inspect the output signal of the lifting height switch.
Fork lifting height at 500 mm
[OK] MH1: ON, MH2-1: OFF
Display code MH: 10
[NG] Other than above
OK
• ST board defect
NG
Inspect continuity of the lifting height switch only.
NG
• Lifting height switch defect
OK
• ST board defect

The mast does not perform forward/backward tilt.

Related portion





C B A

Inspect continuity of the tilt lever switch wiring
CN142-9 – CN141-11
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
CN142-10 – CN141-11
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above

OK → • ST board defect

NG ↓

Inspect continuity of the tilt lever switch only
CN87-1 – CN87-2
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
CN87-3 – CN87-4
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above

NG → • Tilt lever switch defect

OK ↓

• Main harness defect

(B)

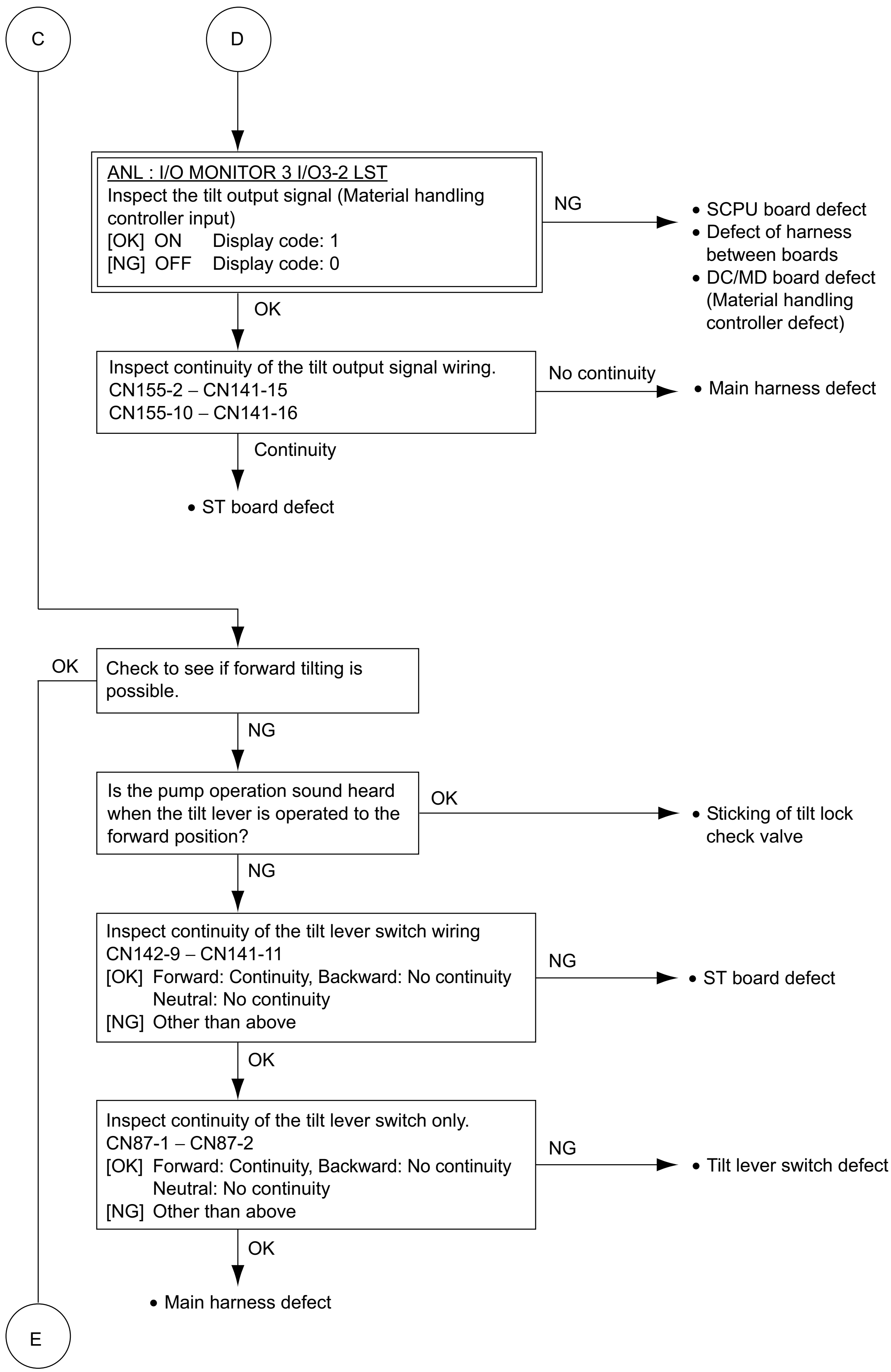
<u>ANL : I/O MONITOR 3 I/O3-2 LST</u>
Inspect the tilt output signal when the tilt lever is operated
[OK] Forward·Backward: ON,
Neutral (Material handling controller defect): OFF
[NG] Forward·Backward: OFF,
Neutral (Material handling controller defect): OFF
Display code ON: 1, OFF: 0

OK →
• CPU board defect
• Defect of harness between boards
• DC/MD board defect

NG ↓

Short circuit between CN155-7 and CN155-10 using the SST13

C D


C
D
ANL : I/O MONITOR 3 I/O3-2 LST
Inspect the tilt output signal (Material handling controller input)
[OK] ON Display code: 1
[NG] OFF Display code: 0
NG
• SCPU board defect
• Defect of harness between boards
• DC/MD board defect (Material handling controller defect)
OK
Inspect continuity of the tilt output signal wiring.
CN155-2 – CN141-15
CN155-10 – CN141-16
No continuity
• Main harness defect
Continuity
• ST board defect
OK
Check to see if forward tilting is possible.
NG
Is the pump operation sound heard when the tilt lever is operated to the forward position?
OK
• Sticking of tilt lock check valve
NG
Inspect continuity of the tilt lever switch wiring
CN142-9 – CN141-11
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
NG
• ST board defect
OK
Inspect continuity of the tilt lever switch only.
CN87-1 – CN87-2
[OK] Forward: Continuity, Backward: No continuity
Neutral: No continuity
[NG] Other than above
NG
• Tilt lever switch defect
OK
• Main harness defect
E

E

Is the pump operation sound heard when the tilt lever is operated to the backward position?

OK → • Sticking of tilt lock check valve

NG ↓

Inspect continuity of the tilt lever switch wiring
CN142-10 – CN141-11
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above

OK → • ST board defect

NG ↓

Inspect continuity of the tilt lever switch only.
CN87-3 – CN87-4
[OK] Forward: No continuity, Backward: Continuity
Neutral: No continuity
[NG] Other than above

NG → • Tilt lever switch defect

OK ↓

• Main harness defect

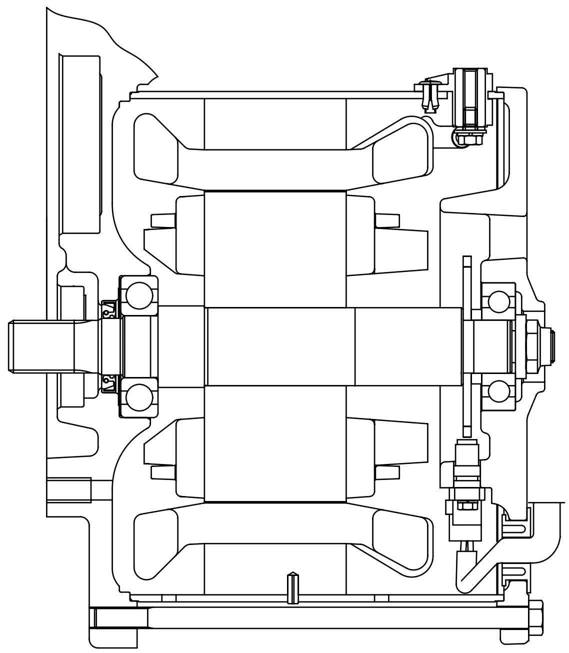
MOTOR

5

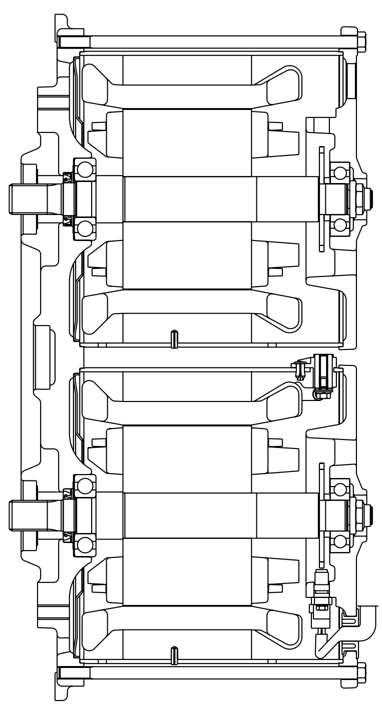
DRIVE MOTOR

GENERAL

15 ~ 32 model



35 ~ 55 model



SPECIFICATIONS

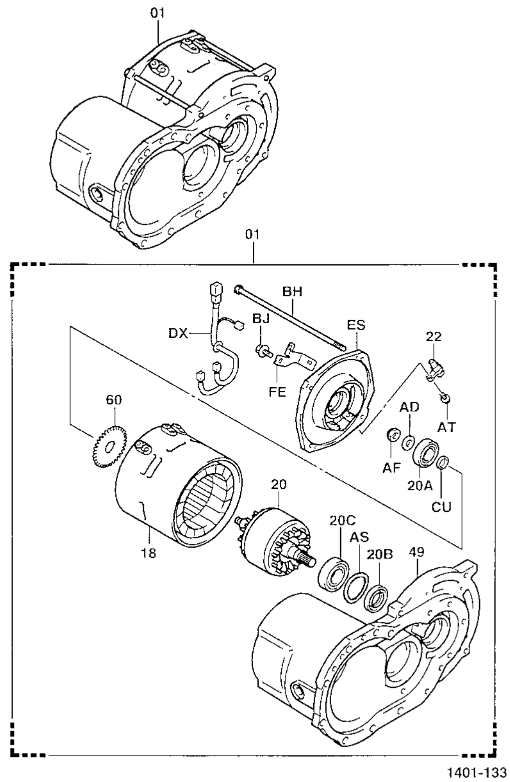
Item \ Vehicle model	7FBCU15·18	7FBC(H)U20 ~ 30	7FBCU35 ~ 55
Type	Three phase AC, open type		
Nominal voltage V	36/48		
Practical voltage V	22/28	23/26	←
Rated output kW	6.3/8.3	9.7/13.2	19.4/26.4 (9.7/13.2 × 2)
Dimensions (outside diameter × length) mm (in)	φ290 × 230 (11.42 × 9.06)	φ290 × 270 (11.42 × 10.63)	φ290 × 270 × 2 (11.42 × 10.63 × 2)
Weight kg (lb)	90 (198)	121 (267)	191 (421)
Insulation class	F	←	←

Item \ Vehicle model	30-7FBCU15·18	30-7FBC(H)U20 ~ 32	30-7FBCU35 ~ 55
Type	Three phase AC, closed type		
Nominal voltage V	36/48		
Practical voltage V	22/28	22/27	←
Rated output kW	5.0/6.6	7.8/10.6	15.6/21.2 (7.8/10.6 × 2)
Dimensions (outside diameter × length) mm (in)	φ290 × 230 (11.42 × 9.06)	φ290 × 270 (11.42 × 10.63)	φ290 × 270 × 2 (11.42 × 10.63 × 2)
Weight kg (lb)	91 (201)	122 (269)	192 (423)
Insulation class	F	←	←

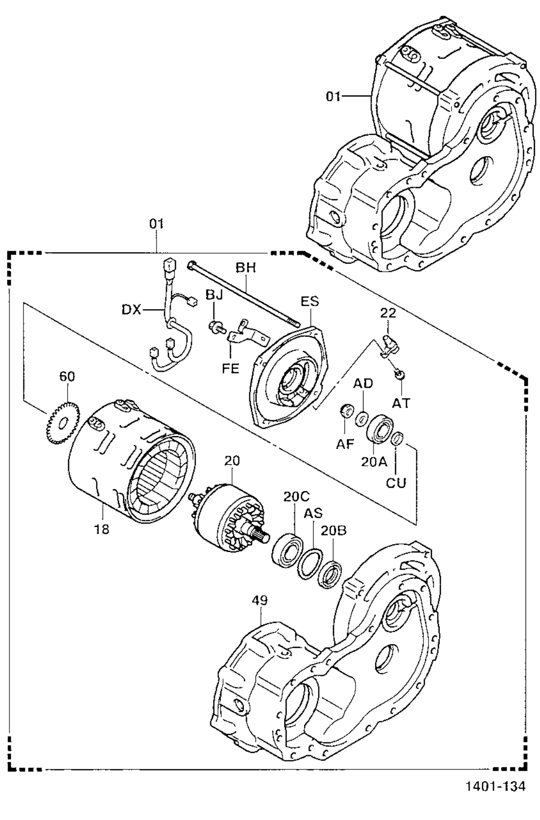
COMPONENTS

7FBCU15·18

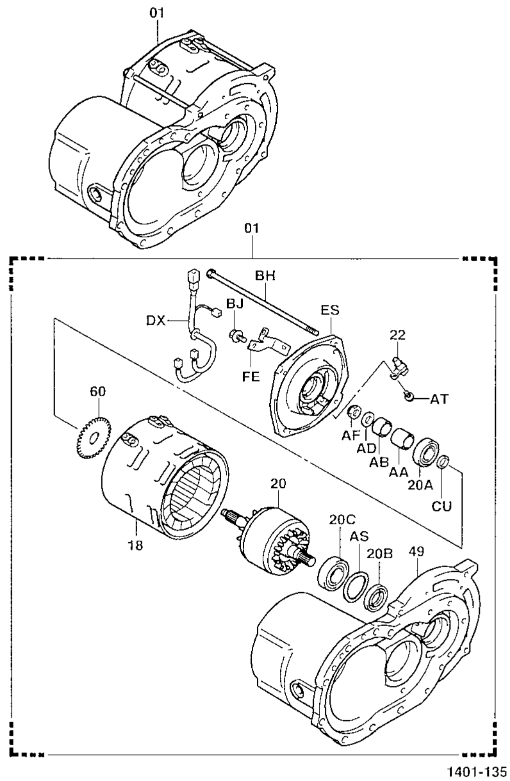
1401



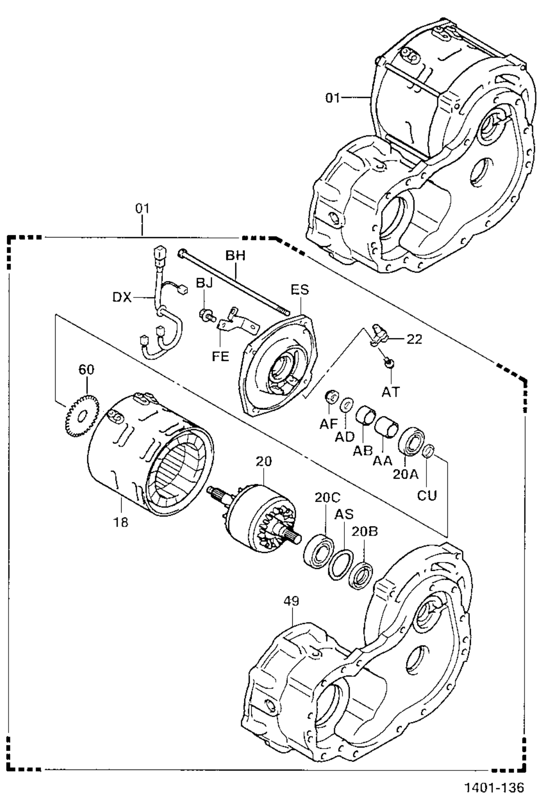
7FBCU20 ~ 32, 7FBCHU25



7FBCU15·18 (dead-man brake)	1401

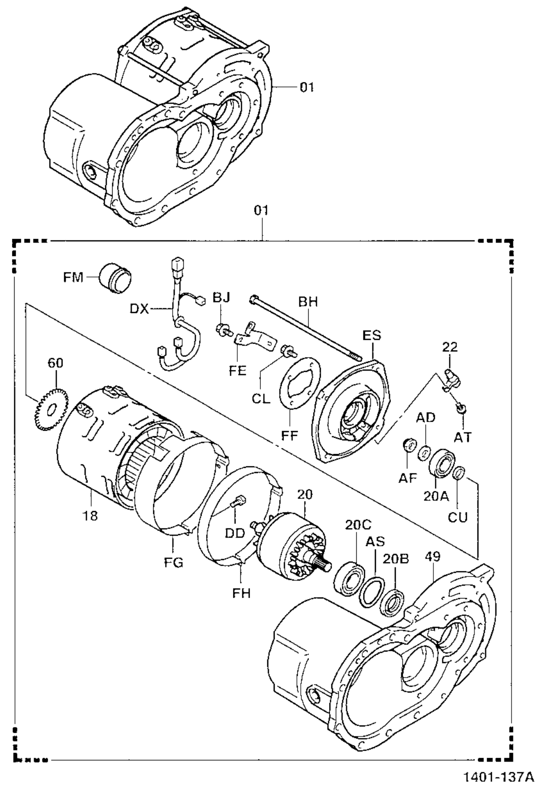


7FBCU20 ~ 32 (dead-man brake), 7FBCHU25 (dead-man brake)

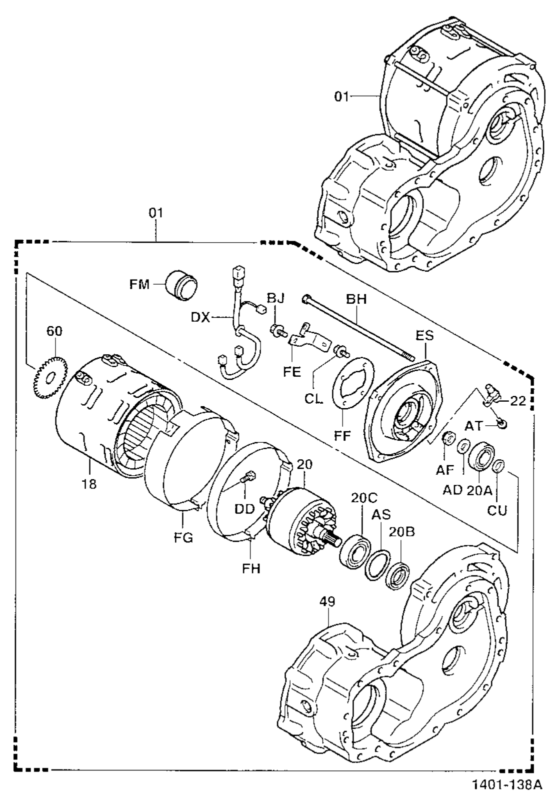


30-7FBCU15·18

1401

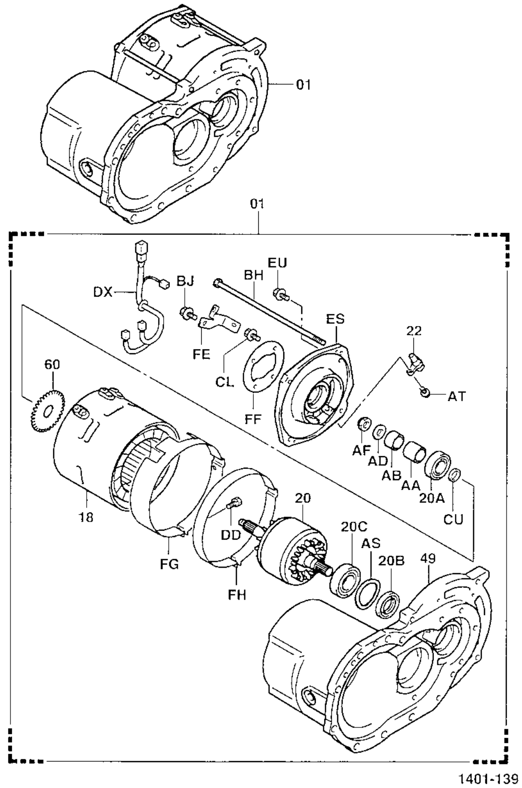


30-7FBCU20·30·32, 30-7FBCHU25

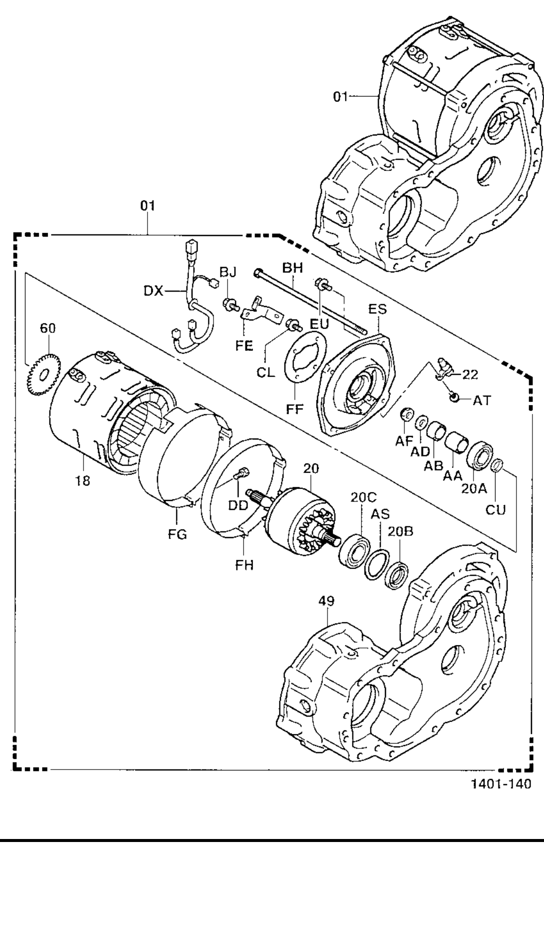


30-7FBCU15·18 (dead-man brake)

1401

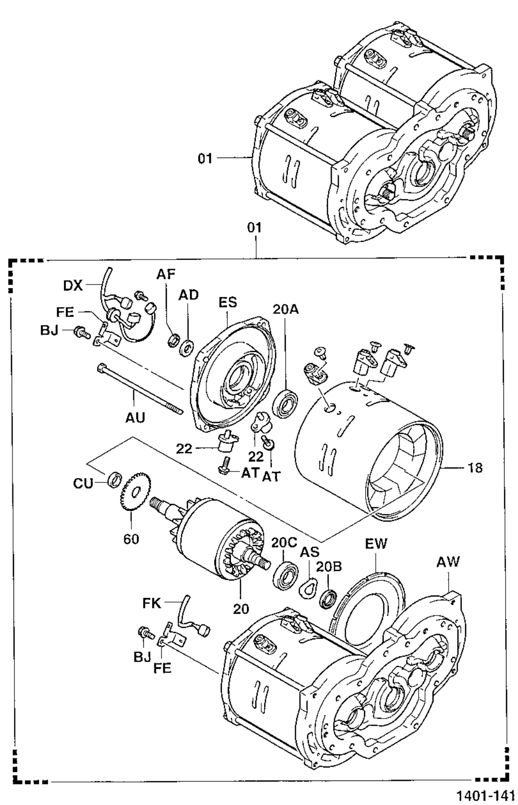


30-7FBCU20 ~ 32 (dead-man brake), 30-7FBCHU25 (dead-man brake)

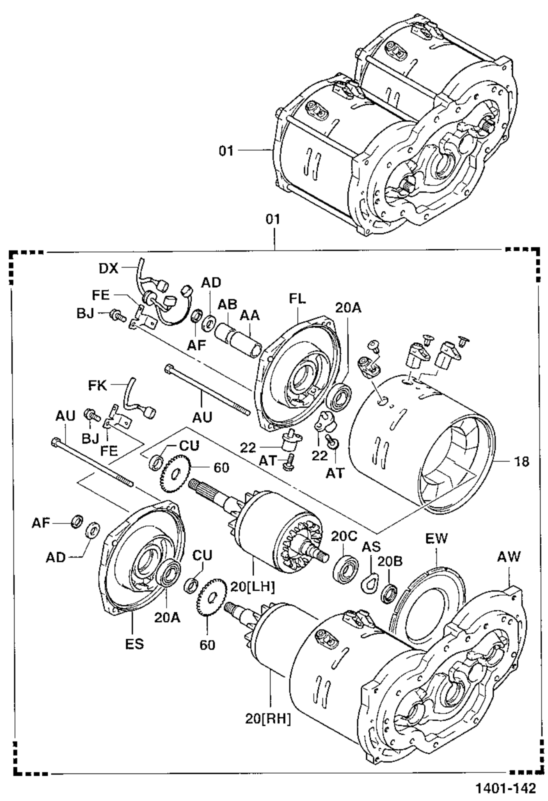


7FBCU35·45

1401

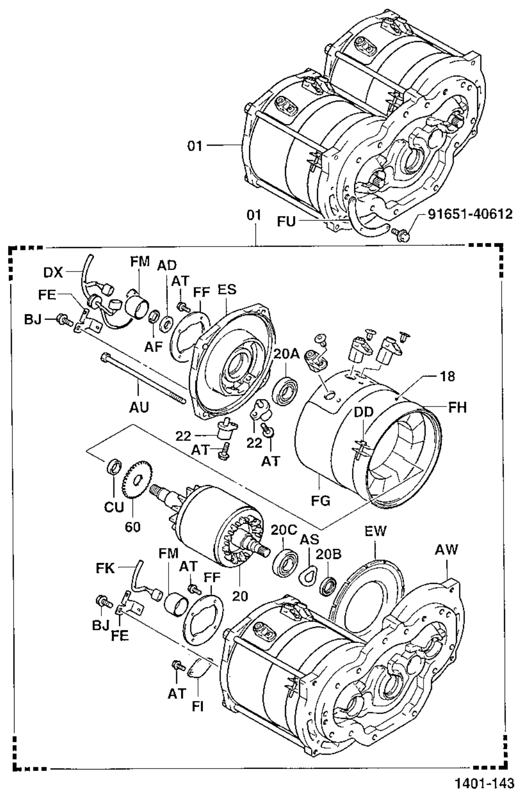


7FBCU35·45 (dead-man brake)

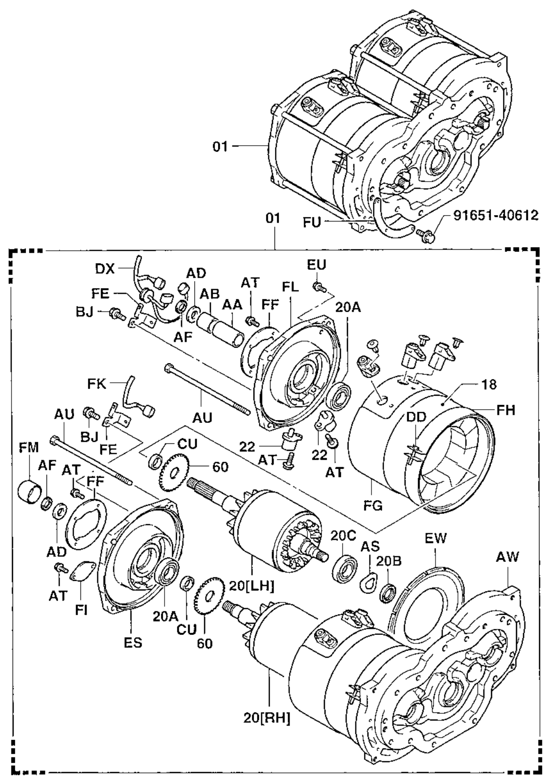


30-7FBCU35 ~ 55

1401

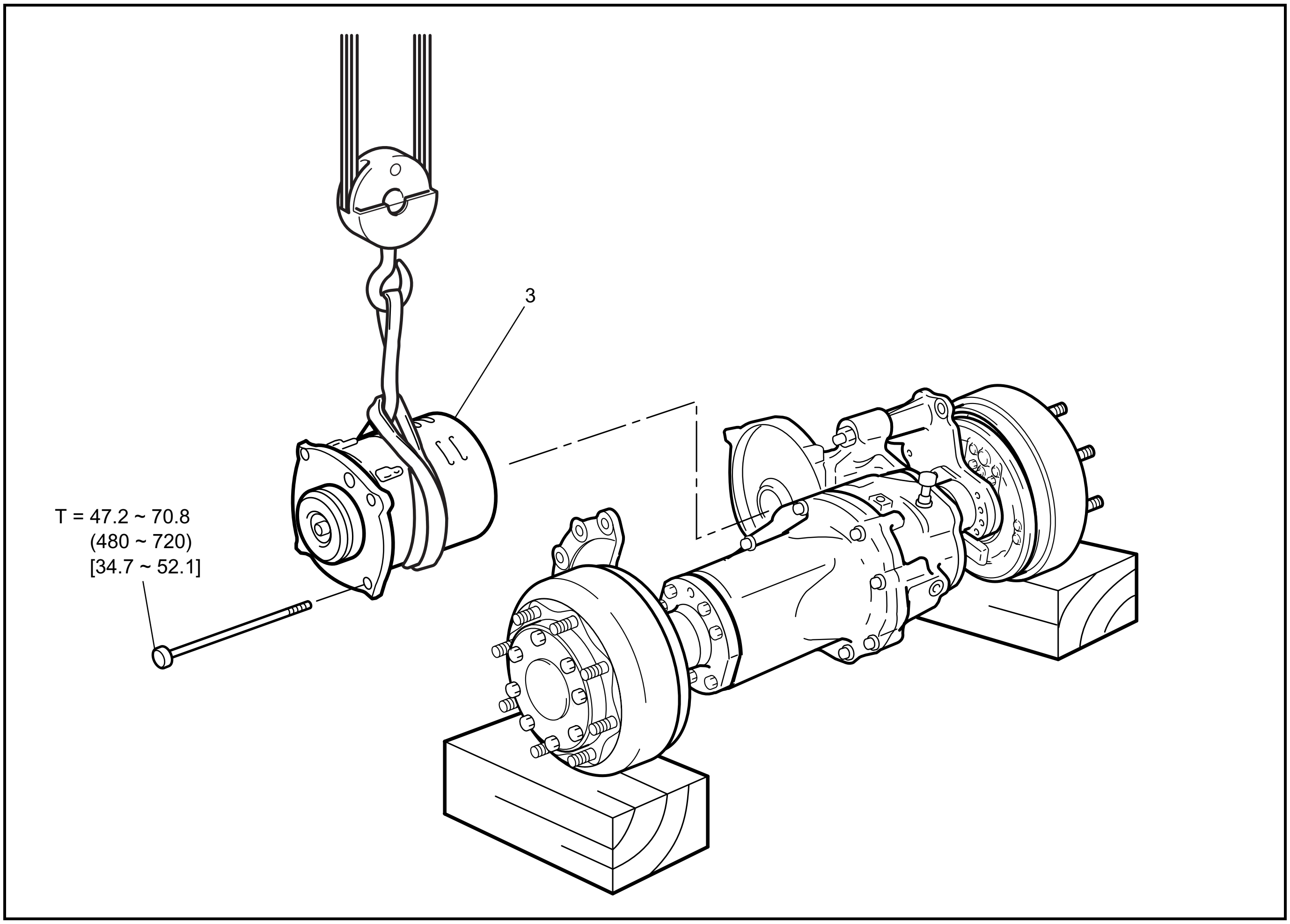


30-7FBCU35 ~ 55 (dead-man brake)



REMOVAL·INSTALLATION (15 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]

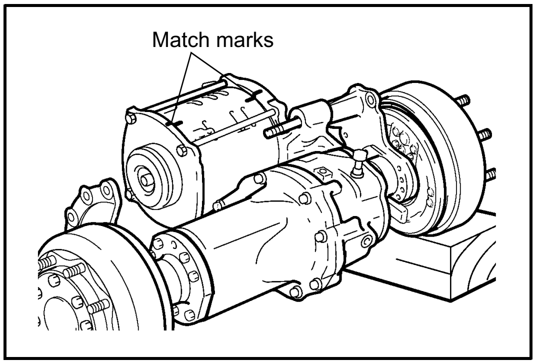


Removal Procedure

1 Remove the front axle ASSY W/drive motor ASSY. (See page 6-10)
2 Put mach marks between the bracket and the stator ASSY and between the drive unit case and stator ASSY. **[Point 1]**
3 Loosen the through bolt and remove the drive motor. **[Point 2]**

Installation Procedure

The installation procedure is the removal procedure.



Point Operations

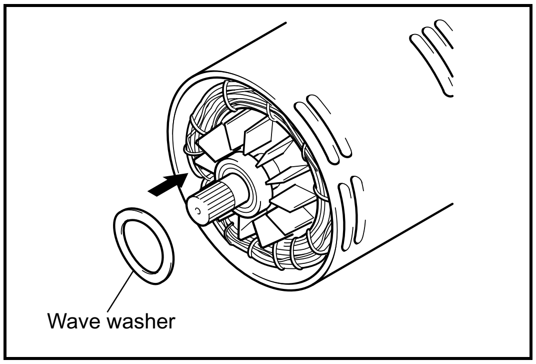
[Point 1]

Disassembly:

Put match marks on the bracket, drive unit case and stator ASSY.

Reassembly:

Align match marks when reassembling these parts.



[Point 2]

Removal·Installation:

Carefully operate so as not to drop the rotor ASSY.

Installation:

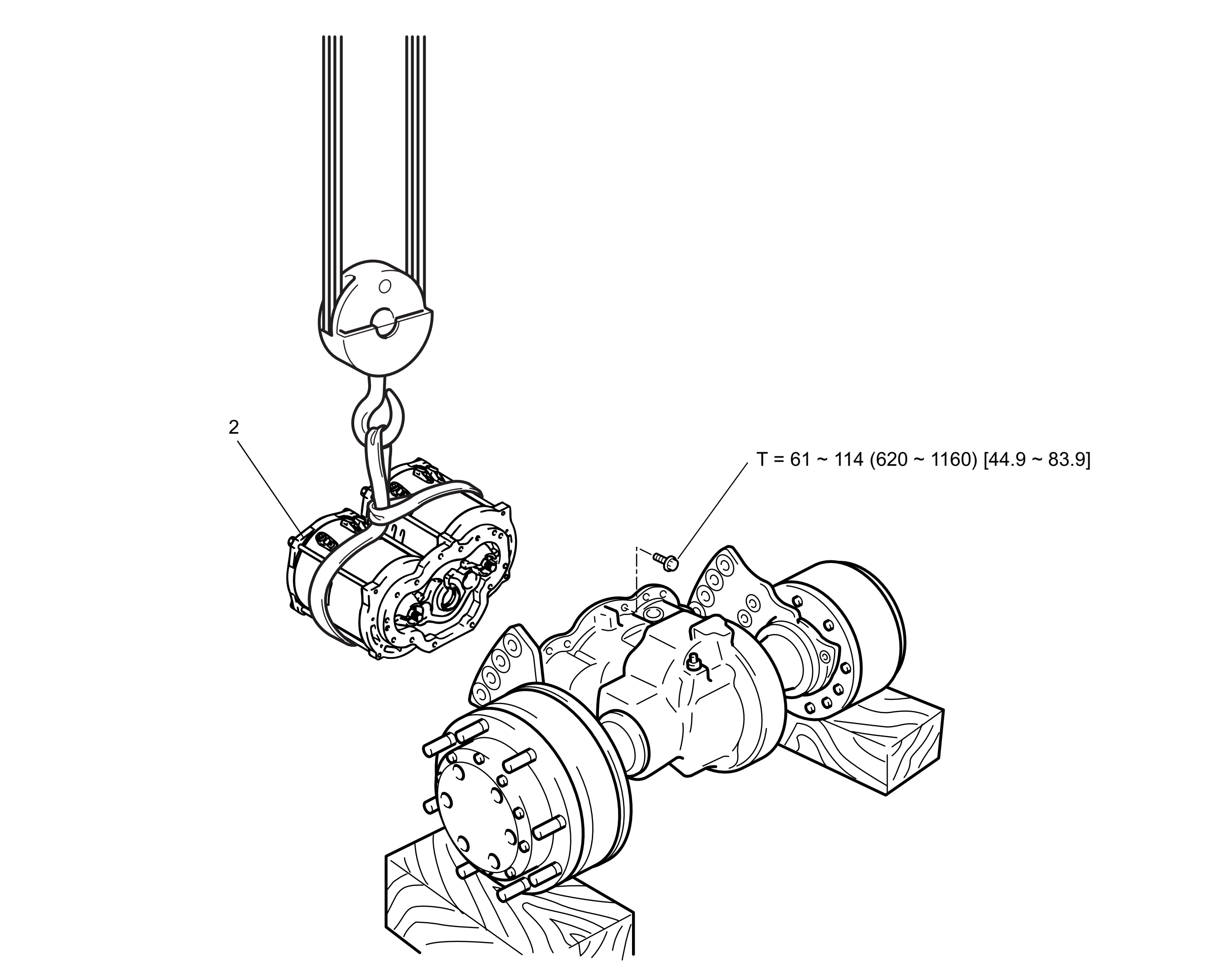
(1) Never fail to install the wave washer on the bearing face of the rotor ASSY. It is recommended to apply a small amount of MP grease in order to prevent the washer from falling.

(2) Apply the molybdenum disulfide grease at the splined portion of the rotor shaft.

(3) Carefully operate so as not to damage the oil seal lip surface.

REMOVAL·INSTALLATION (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]

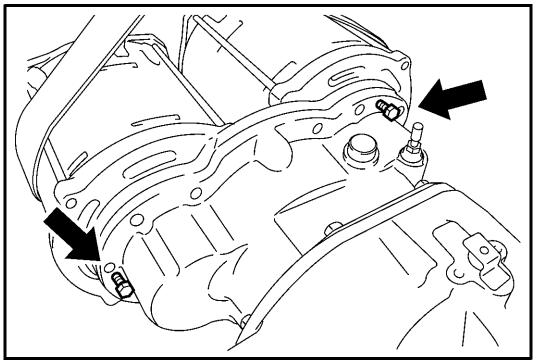


Removal Procedure

1 Remove the front axle ASSY W/drive motor ASSY. (See page 6-19)
2 Remove the drive motor ASSY. **[Point 1]**

Installation Procedure

The installation procedure is the removal procedure.



Point Operation

[Point 1]

Removal:

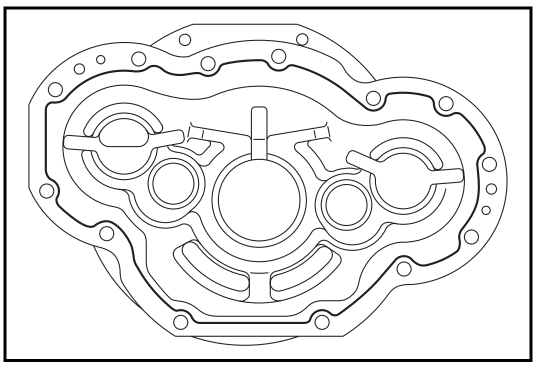
Wind a rope around the drive motor and remove it using a service bolt.

Service bolt: M14 × 1.5

Carefully remove it so as not to let the bearing fall.

Installation:

Install the reduction gear No. 1 with the bearing seal facing the motor.



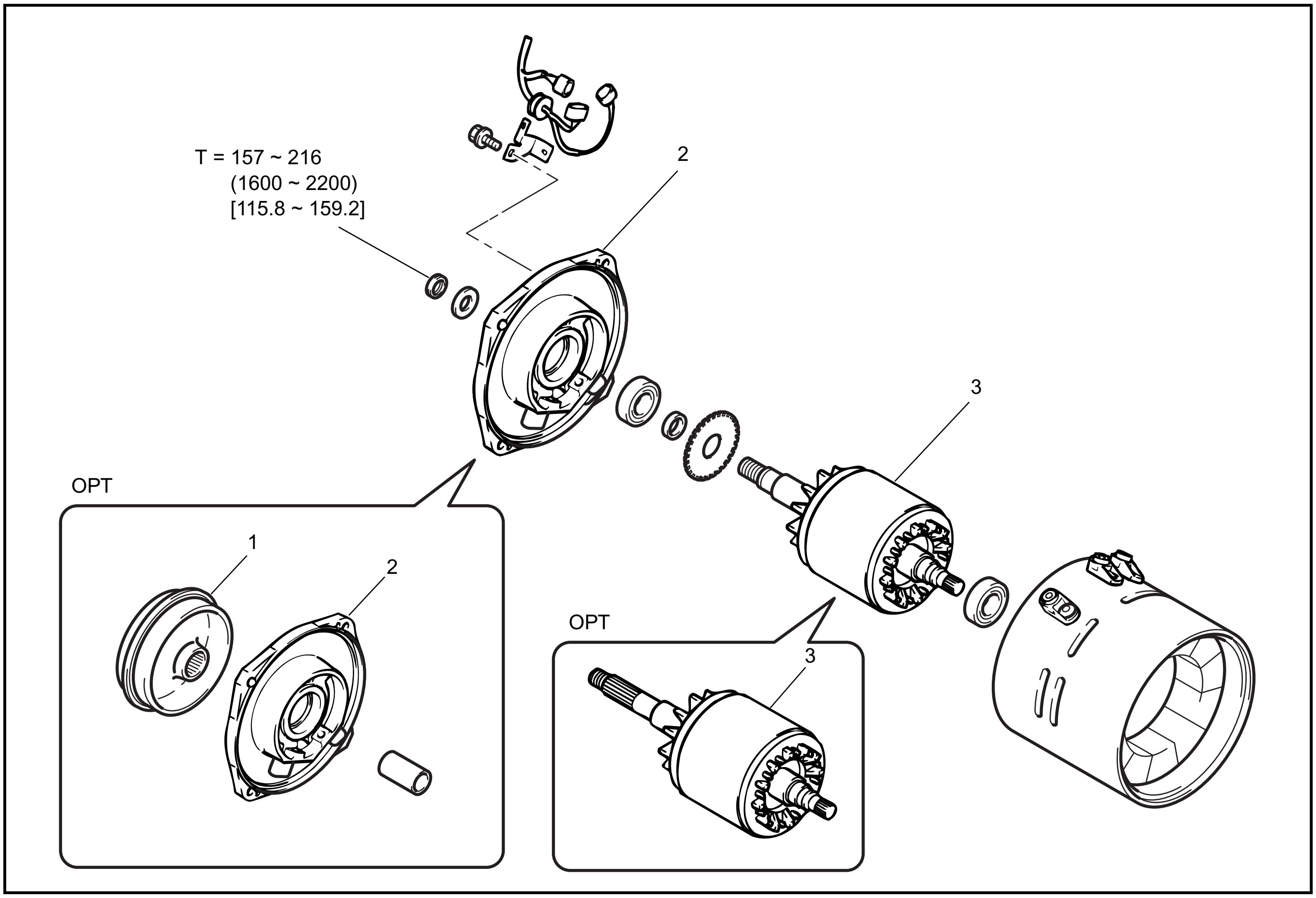
Installation:

(1) Apply liquid gasket (08826-76002-71 (08826-0090)) to the mating surface on the drive unit side.

(2) Apply the molybdenum disulfide grease at the splined portion of the rotor shaft.

DISASSEMBLY·INSPECTION REASSEMBLY (15 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

1 Remove the dead-man brake dram. (OPT)

2 STD: Remove the bracket
OPT: Remove the bracket W/dead-man brake ASSY.

3 Remove the rotor ASSY from the stator ASSY. **[Point 1]**

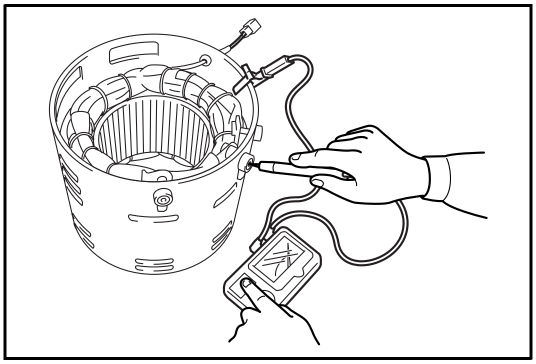
Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
After reassembly, perform dead-man brake ajustment (Dead-man brake spec.) (See page 10-39).

Point Operation

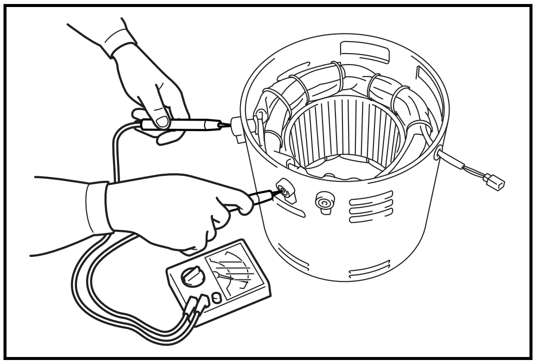
[Point 1]



Inspection:

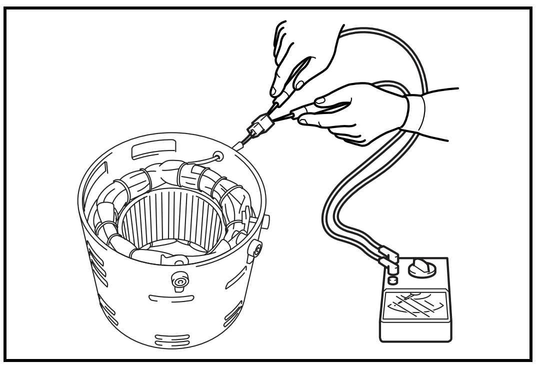
(1) Measure the insulation resistance of the stator ASSY.

Measurement terminals:
Between the terminals and body
Standard: 1 MΩ or more



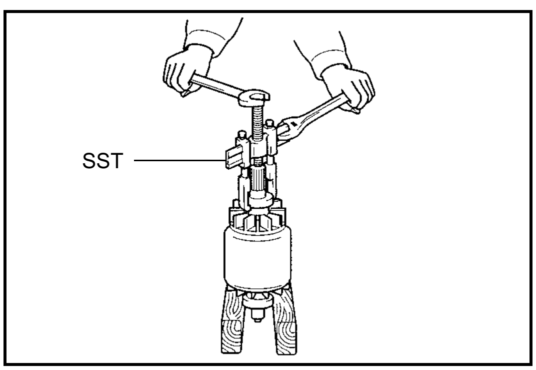
(2) Check continuity between terminals.

Measurement terminals: U-V, V-W, W-U
Standard: 0 Ω

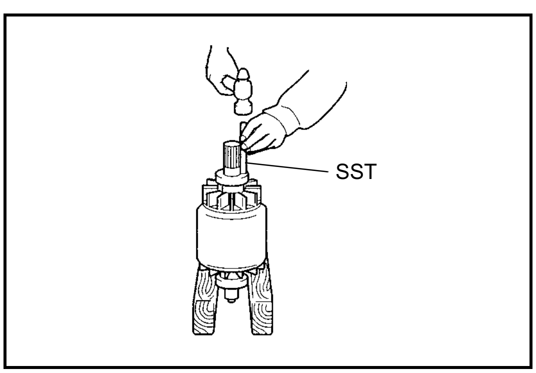


(3) Measure the resistance of the thermo-sensor.

Measurement terminals:
Both terminals of temperature sensor connector
Standard: Approx. 11 ~ 15 kΩ
(at 20°C [68°F])



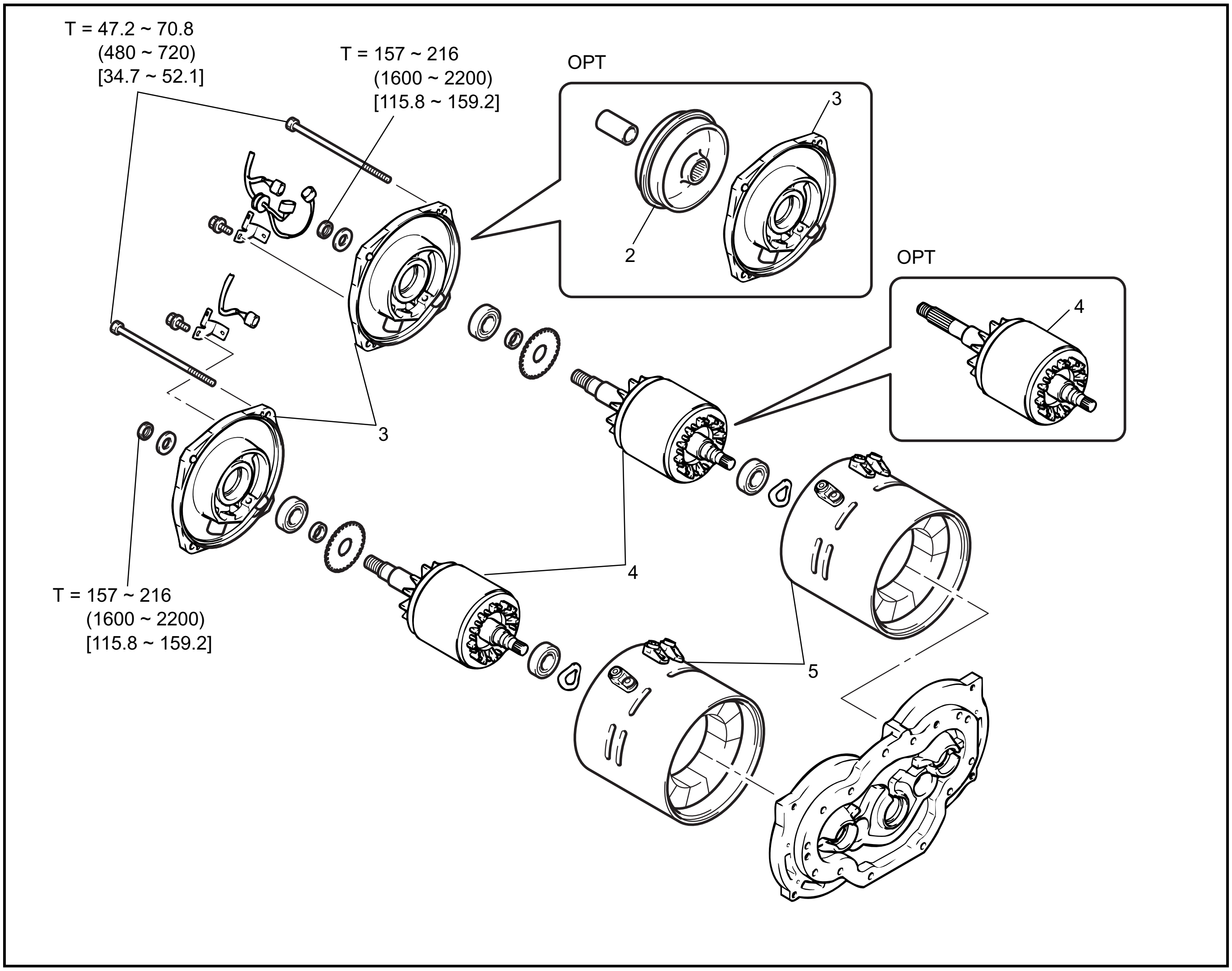
(4) Check the bearing of the rotor ASSY.
If abnormal noise or damage is found, replace the bearing.
Removal:
SST 09950-76014-71
(SST 09950-40011)



Installation:
SST 09700-30200-71

DISASSEMBLY·INSPECTION REASSEMBLY (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

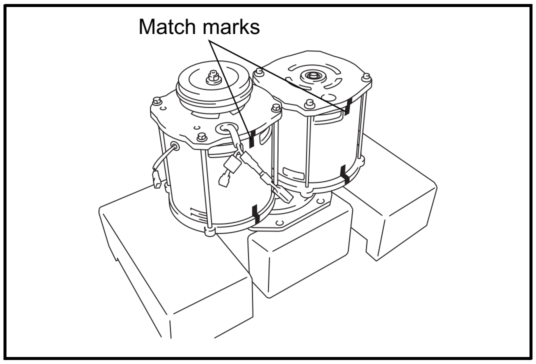
1 Put match marks between the bracket and the stator ASSY and between the cover and stator ASSY. **[Point 1]**
2 Remove the dead-man brake drum. (OPT)
3 STD: Remove the bracket.
OPT: Remove the bracket W/dead-man brake ASSY.
4 Remove the rotor ASSY. **[Point 2]**
5 Remove the stator ASSY. **[Point 3]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
After reassembly, perform dead-man brake adjustment (Dead-man brake spec.) (See page 10-39).

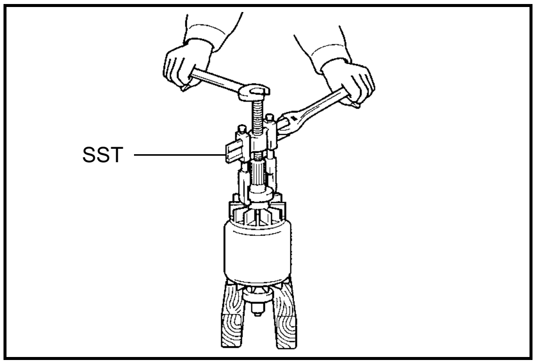
Point Operations



[Point 1]

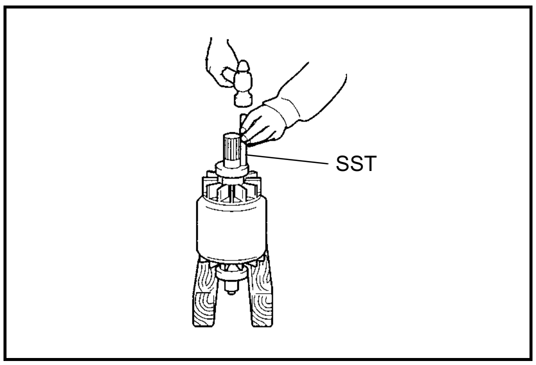
Disassembly:
Put match marks on the bracket, cover and stator ASSY.

Reassembly:
Align match marks when reassembling these parts.

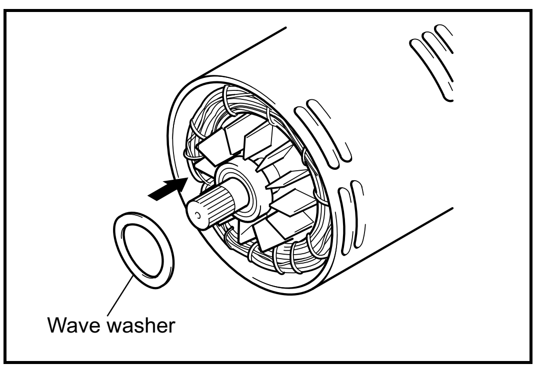


[Point 2]

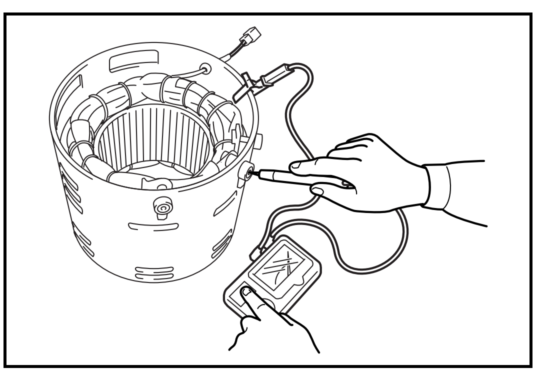
Disassembly:
Check the bearing of the rotor ASSY.
If abnormal noise or damage is found, replace the bearing.
Removal:
SST 09950-76014-71
(SST 09950-40011)



Installation:
SST 09700-30200-71



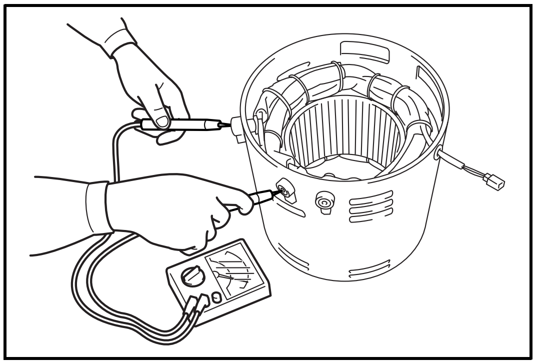
Installation:
Never forget to place a wave washer on the rotor ASSY bearing surface.



[Point 3]

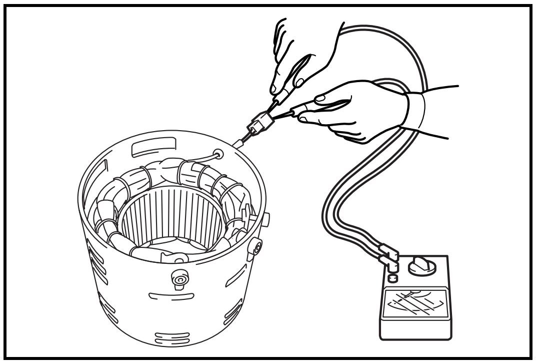
Inspection:
(1) Measure the insulation resistance of the stator ASSY.

Measurement terminals:
Between the terminals and body
Standard: 1 MΩ or more



(2) Check continuity between terminals.

Measurement terminals: U-V, V-W, W-U
Standard: 0 Ω

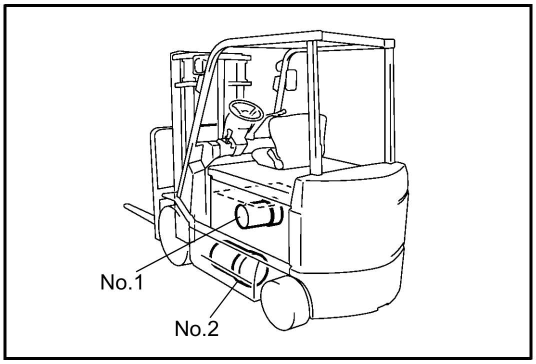


(3) Measure the resistance of the thermo-sensor.

Measurement terminals:
Both terminals of temperature sensor connector
Standard: Approx. 11 ~ 15 kΩ
(at 20°C [68°F])

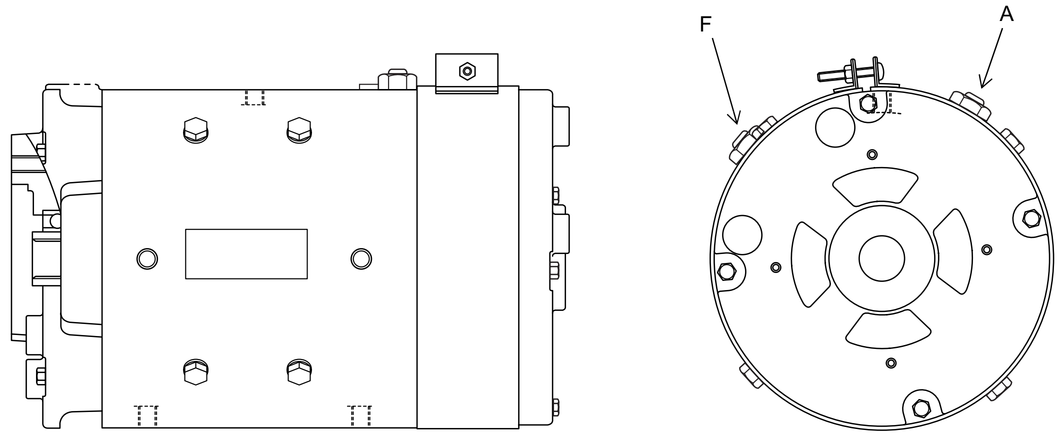
PUMP MOTOR

GENERAL

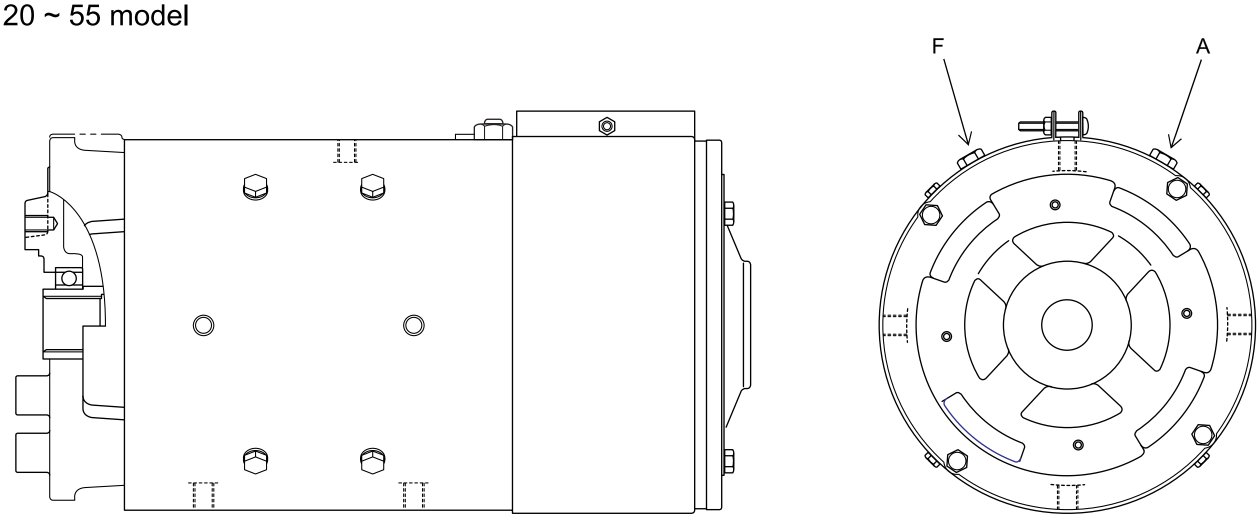


Note:
Of the two pump motors used on the 3.5 to 5.5 ton models, the one for both material handling and PS is described as No. 1 and the other for material handling only as No. 2 in this manual.

15·18 model



20 ~ 55 model



SPECIFICATIONS

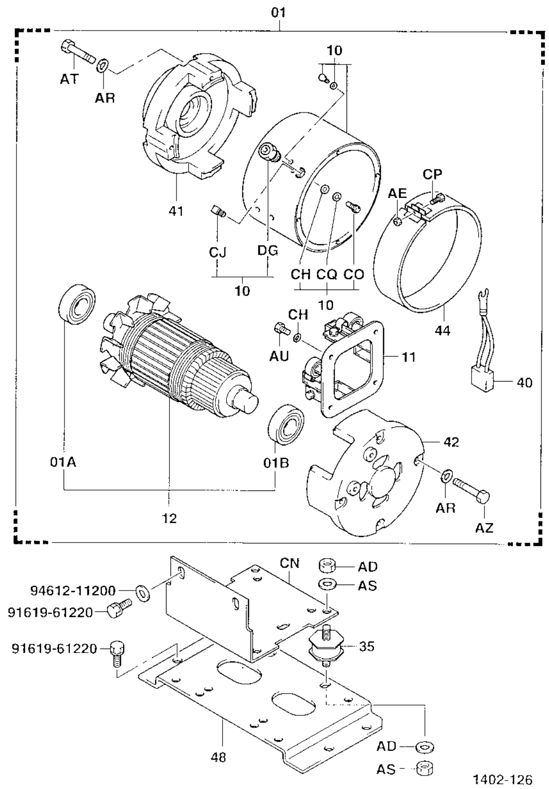
Item \ Vehicle model		7FBCU15·18	7FBC(H)U20 ~ 30, 7FBCU32 7FBCU35 ~ 55
Type		DC series-wound	←
Nominal voltage	V	36/48	←
Rated output	kW	7.4/10.4	9.2/12.8
Dimensions (outside diameter × length)	mm (in)	ϕ200 × 328 (7.87 × 12.91)	ϕ220 × 438 (8.66 × 17.24)
Weight	kg (lb)	41 (91)	60 (132)
Insulation class		H	←
Brush size (width × length × thickness)	mm (in)	40 × 27 × 12.5 (1.57 × 1.06 × 0.492)	40 × 34 × 12.5 (1.57 × 1.34 × 0.492)
Number of brushes		4	8

Item \ Vehicle model		30-7FBCU15·18	30-7FBC(H)U20 ~ 30 30-7FBCU32 30-7FBCU35 ~ 55
Type		DC series-wound	←
Nominal voltage	V	36/48	←
Rated output	kW	5.7/7.7	8.6/12.3
Dimensions (outside diameter × length)	mm (in)	ϕ200 × 350 (7.87 × 13.78)	ϕ220 × 445 (8.66 × 17.52)
Weight	kg (lb)	45 (99)	62 (137)
Insulation class		H	←
Brush size (width × length × thickness)	mm (in)	40 × 27 × 12.5 (1.57 × 1.06 × 0.492)	40 × 34 × 12.5 (1.57 × 1.34 × 0.492)
Number of brushes		4	8

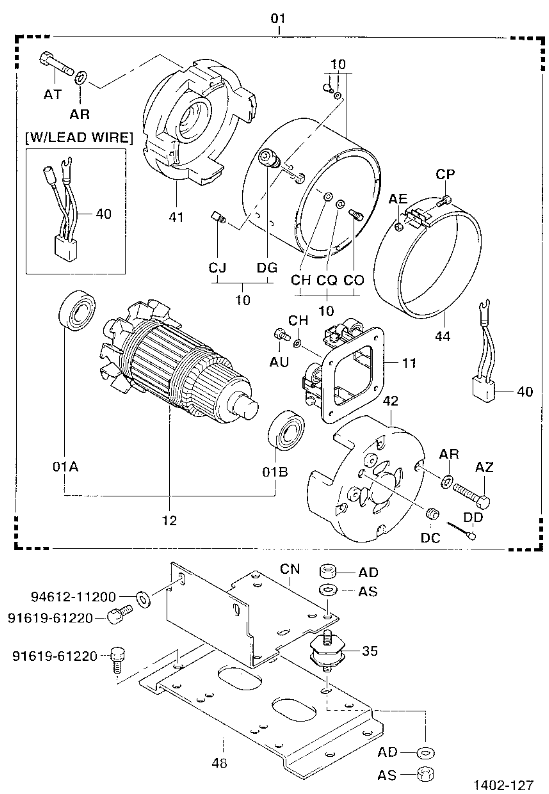
COMPONENTS

7FBCU15·18

1402

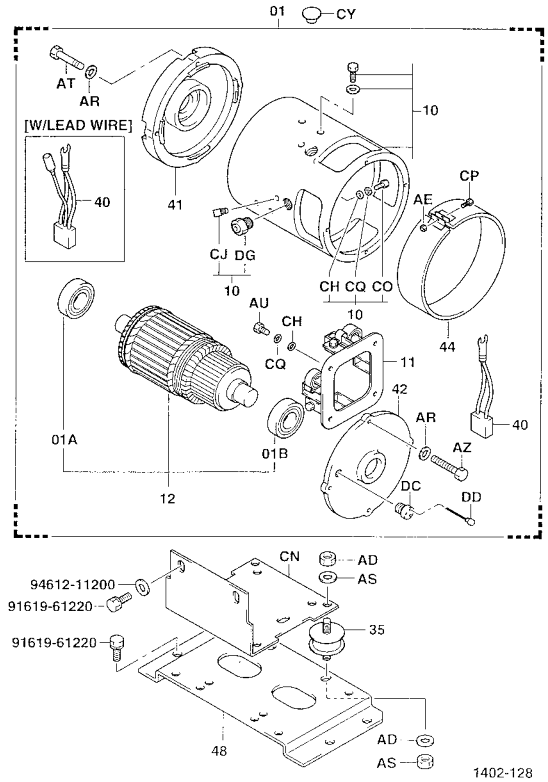


7FBCU15·18 (brush warning)

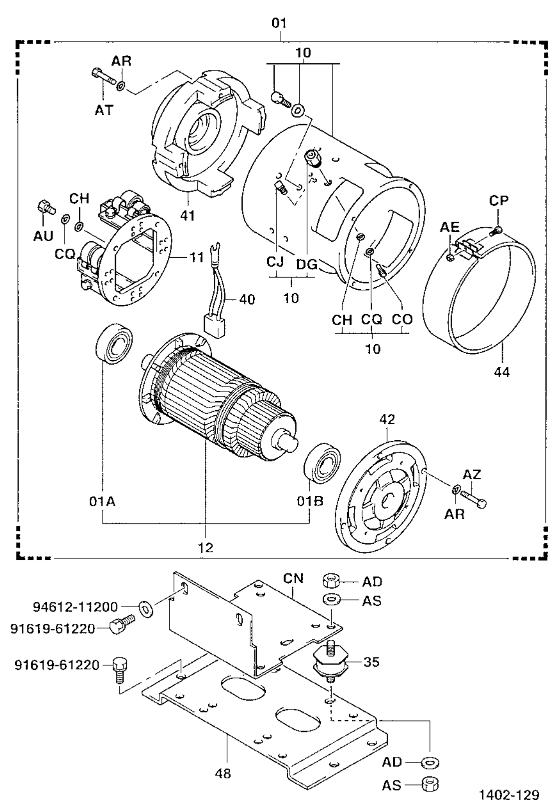


30-7FBCU15·18

1402

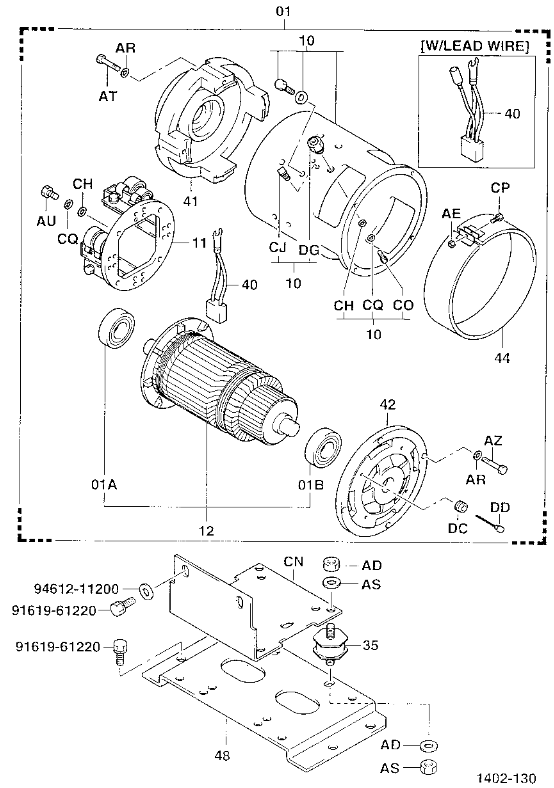


7FBCU20 ~ 32

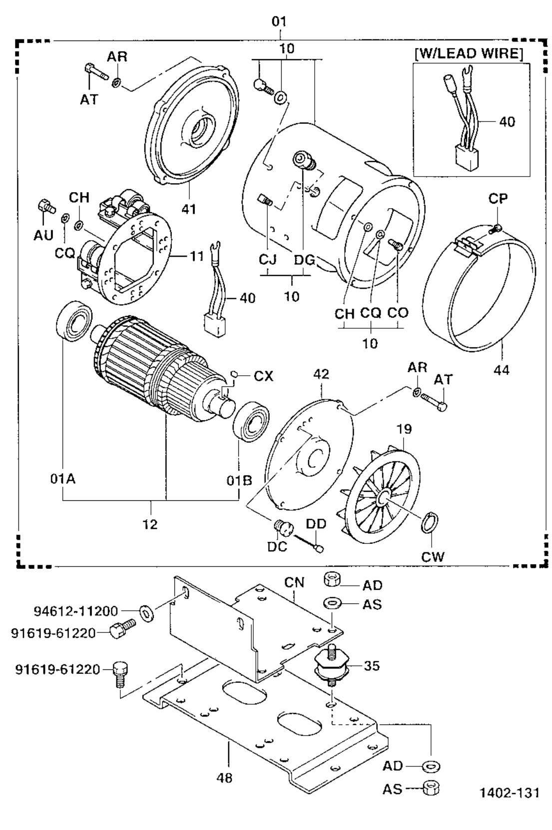


7FBCU20 ~ 32 (brush warning)

1402

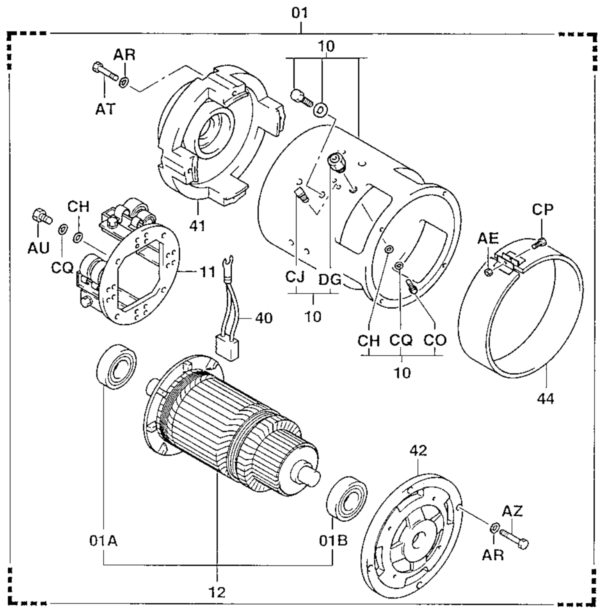


30-7FBCHU25



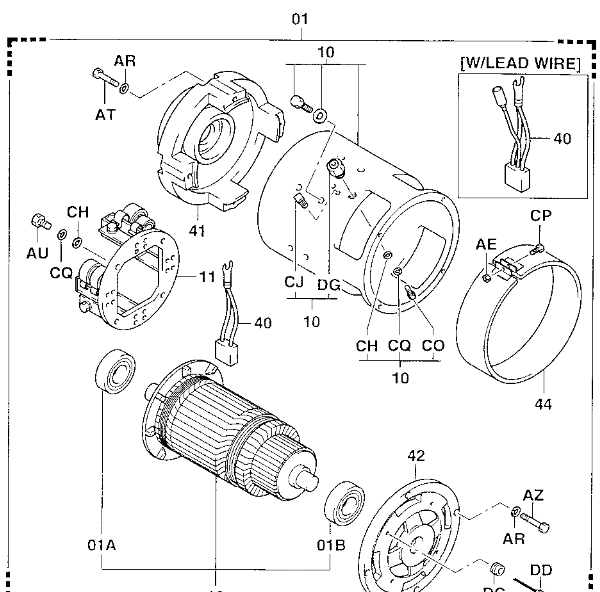
7FBCU35 ~ 55

1402



1402-132

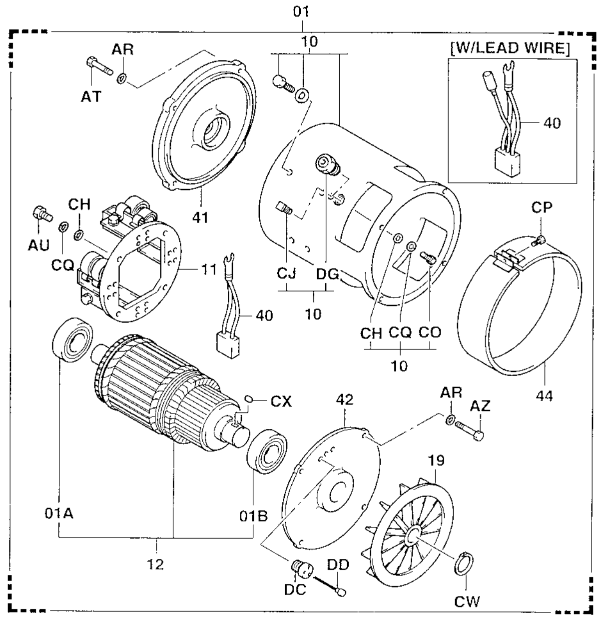
7FBCU35 ~ 55 (brush warning)



1402-133

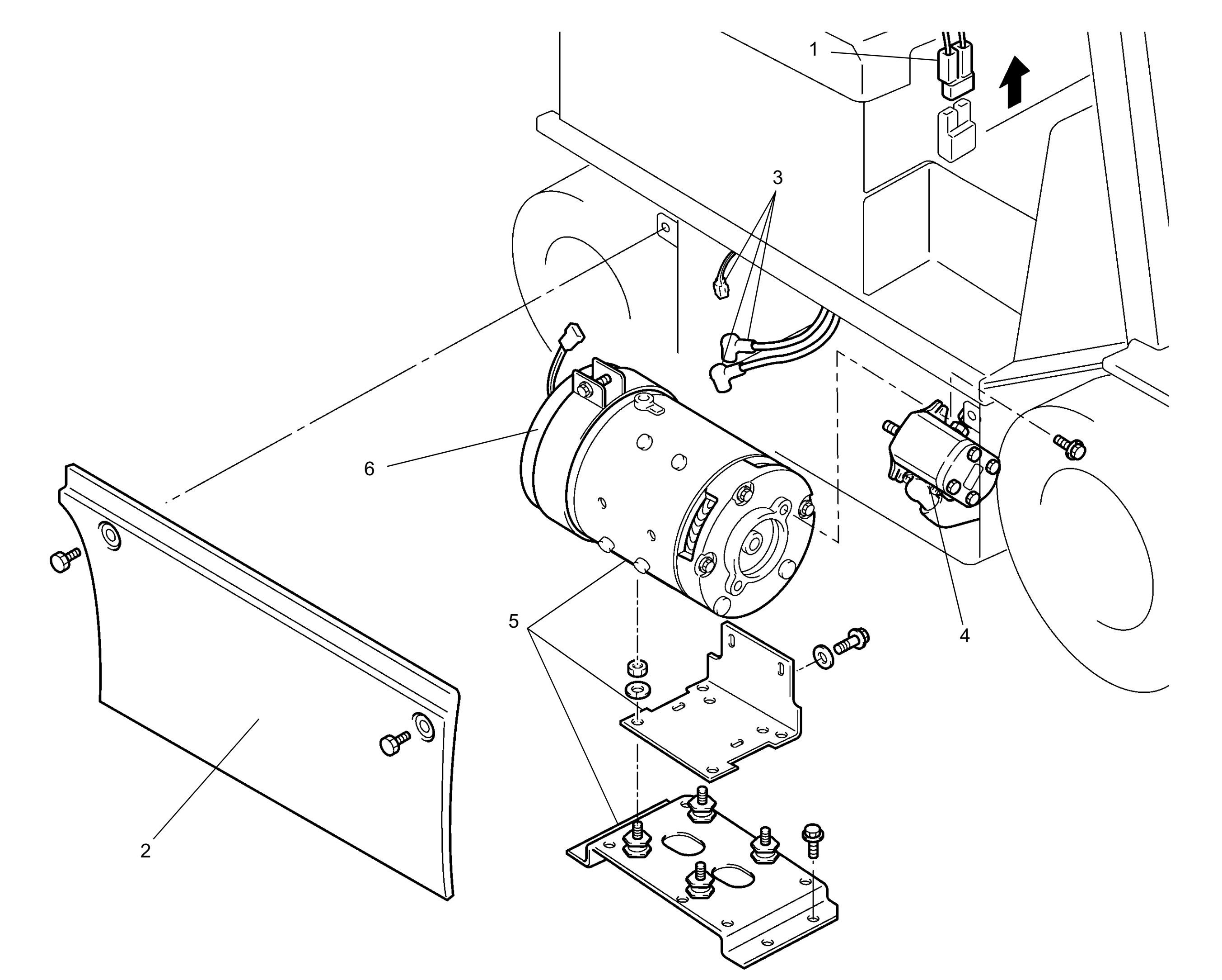
30-7FBCU35 ~ 55

1402



1402-134

REMOVAL·INSTALLATION (15 ~ 32 MODEL)



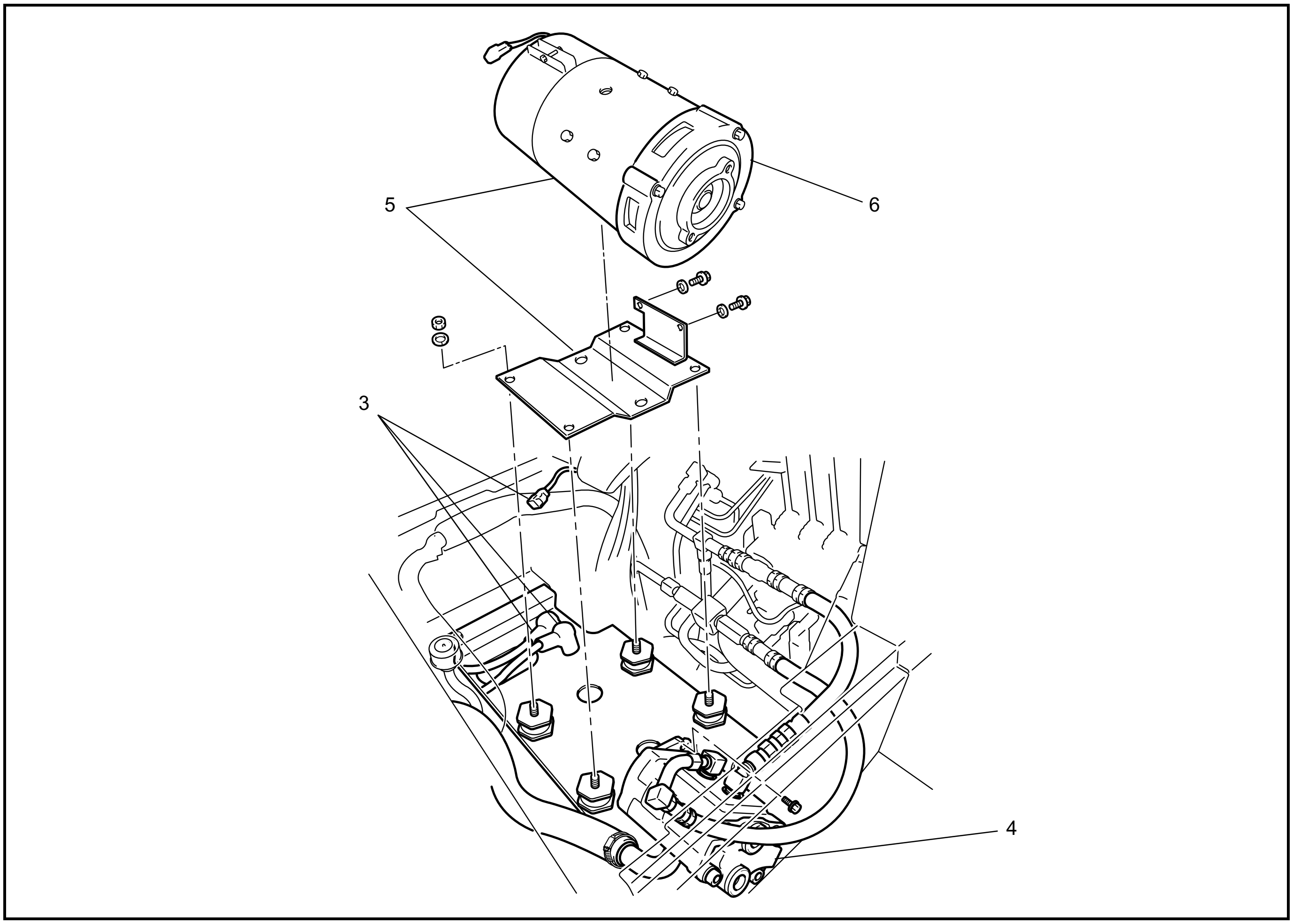
Removal Procedure

1 Disconnect the battery plug.
2 Remove the side cover RH.
3 Disconnect the wiring.
4 Disconnect the oil pump from the pump motor ASSY.
5 Remove the pump motor ASSY W/mounting bracket.
6 Remove the pump motor ASSY from the mounting bracket.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

REMOVAL·INSTALLATION (35 ~ 55 MODEL, NO.1)

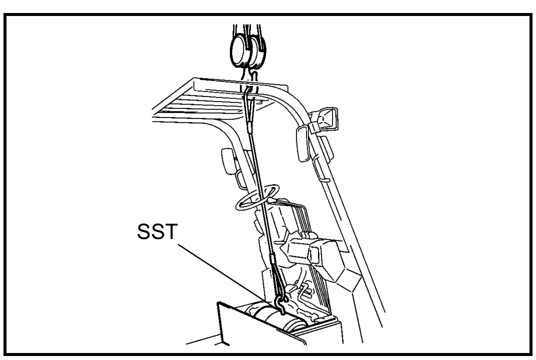


Removal Procedure

1 Disconnect the battery plug.
2 Remove the toe board (front and rear), lower panel and battery hood stand plate.
3 Disconnect the wiring.
4 Disconnect the oil pump from the pump motor.
5 Remove the pump motor ASSY W/plate. **[Point 1]**
6 Remove the pump motor ASSY from the plate.

Installation Procedure

The installation procedure is the reverse of the removal procedure.



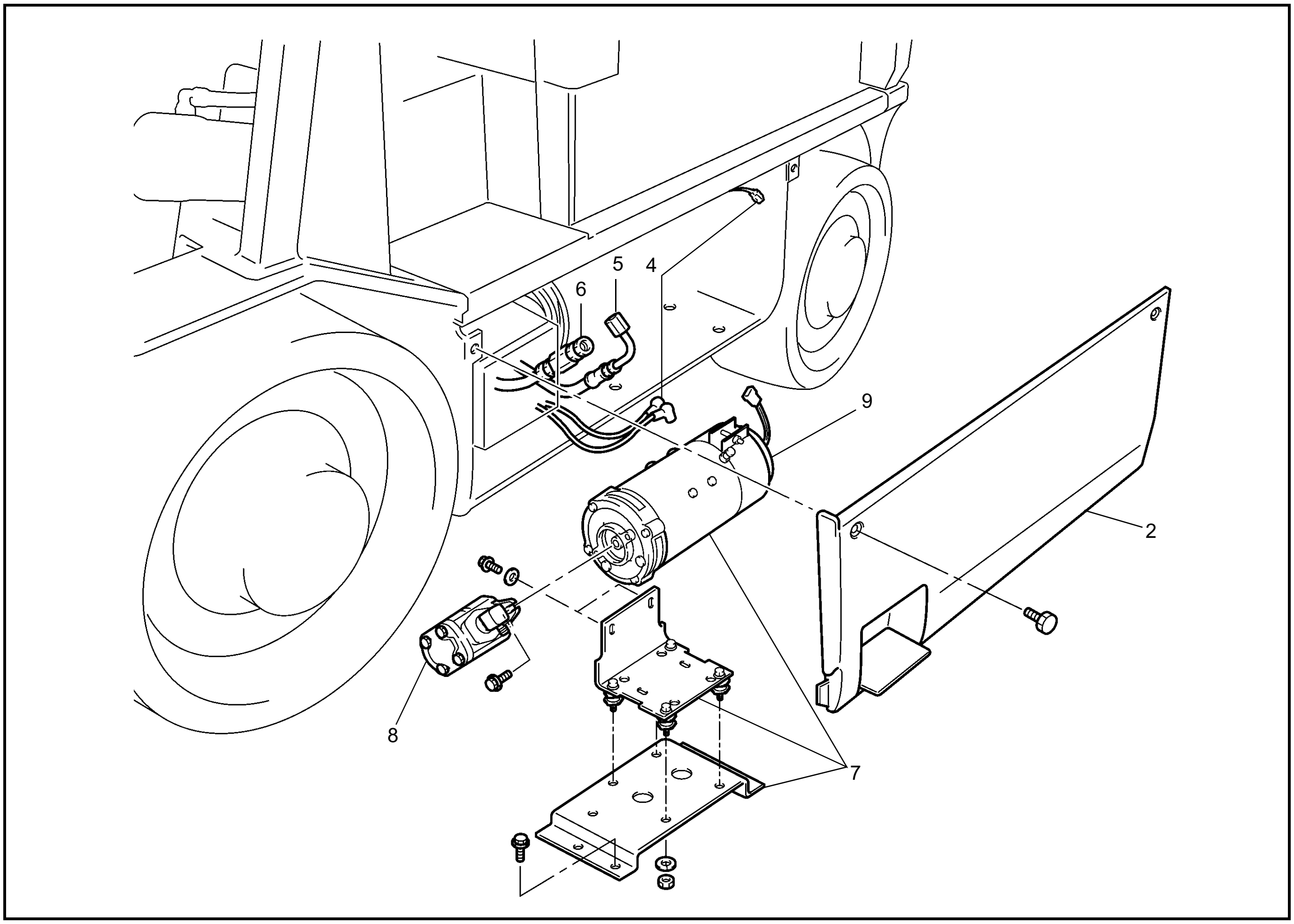
Point Operation

[Point 1]

Removal:

Hoist the pump motor using the SST. Carefully operate to prevent damage, as a wire rope passes through the steering wheel for hoisting.
SST 09010-10260-71

REMOVAL·INSTALLATION (35 ~ 55 MODEL, NO.2)



Removal Procedure

1 Disconnect the battery plug.
2 Remove the side cover LH.
3 Drain hydraulic oil.
4 Disconnect the wiring.
5 Disconnect the outlet hose.
6 Disconnect the inlet hose.
7 Remove the pump motor ASSY & oil pump ASSY W/pump motor set plate.
8 Remove the oil pump ASSY from the pump motor ASSY.
9 Remove the pump motor ASSY from the pump motor set plate.

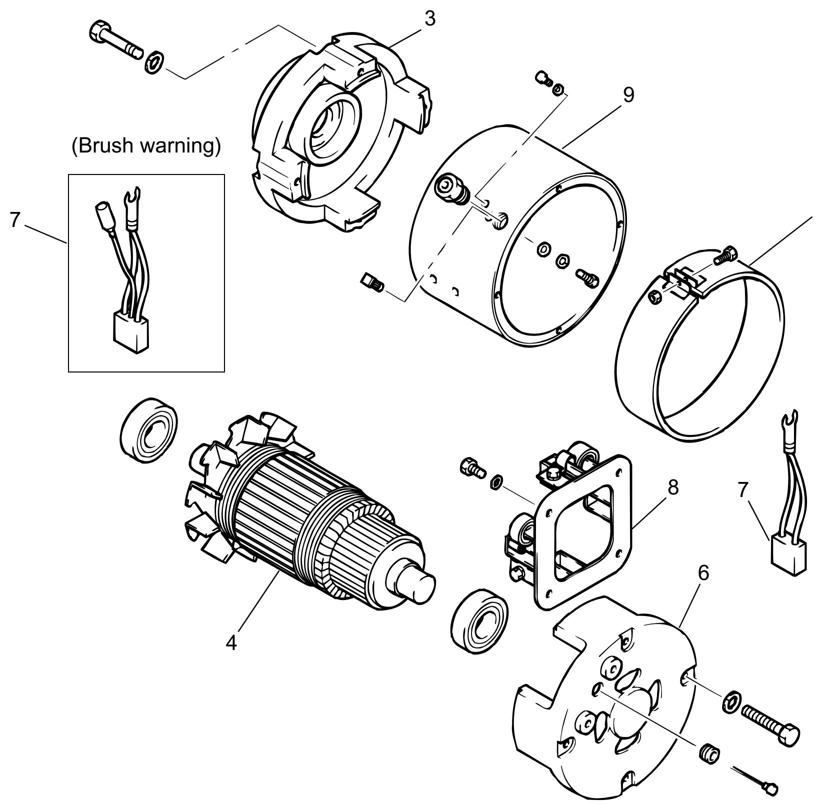
Installation Procedure

The installation procedure is the reverse of the removal procedure.

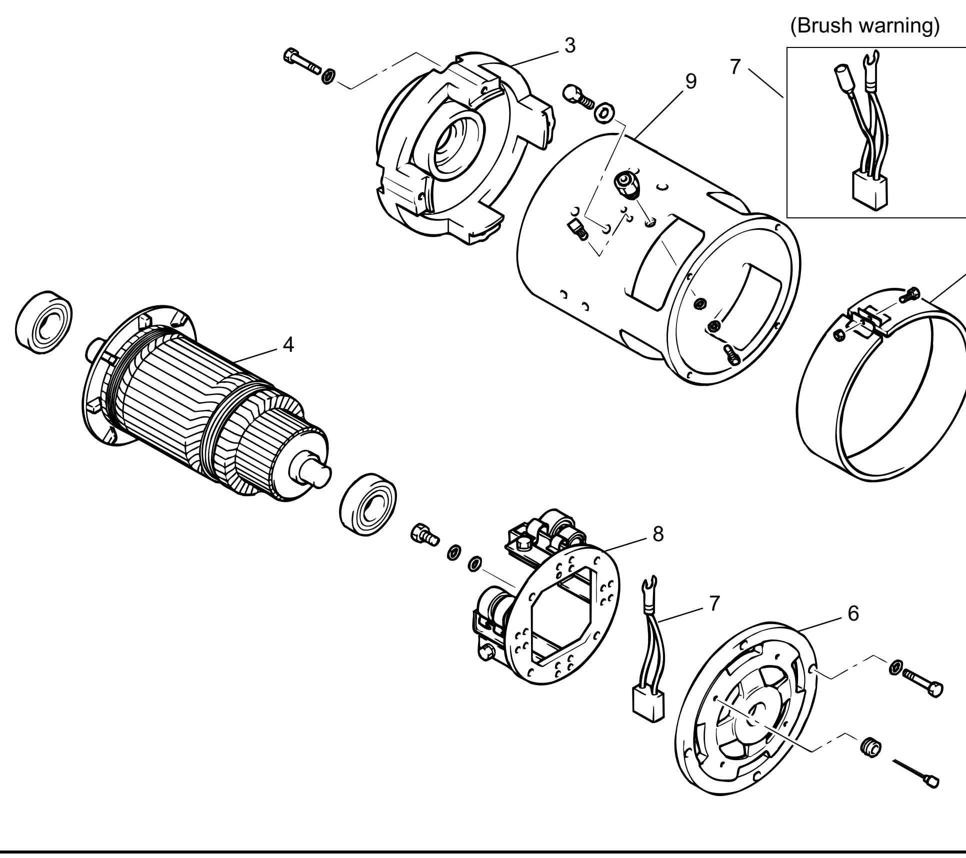
Note:
Apply grease (molybdenum disulfide grease) on the pump shaft spline portion before installation.

DISSASSEMBLY·INSPECTION·REASSEMBLY

15·18 model



20 ~ 55 model



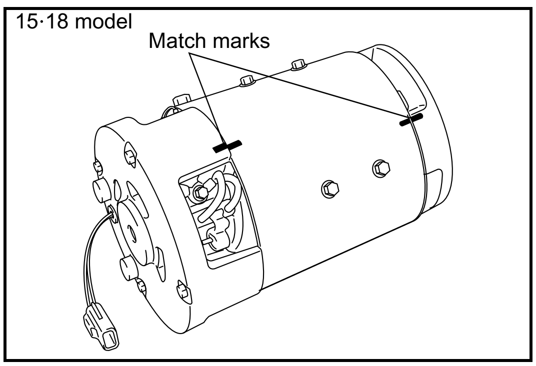
Disassembly Procedure

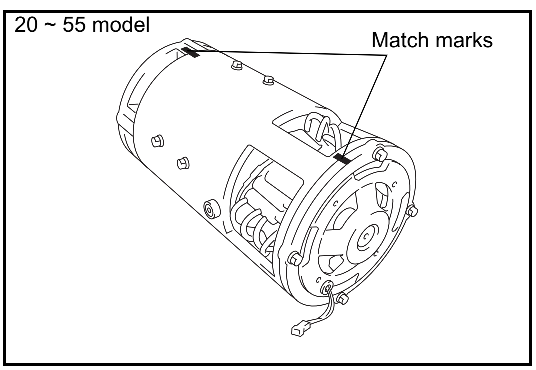
1 Remove the brush cover.
2 Free the brushes.
3 Remove the bracket No.1. **[Point 1]**
4 Remove the armature coil. **[Point 2]**
5 Disconnect the brush harness from the yoke ASSY.
6 Remove the commutator frame. **[Point 3]**
7 Remove the brushes from the commutator frame. **[Point 4]**
8 Remove the brush holder from the commutator frame.
9 Remove the yoke ASSY. **[Point 5]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
After reassembly, perform motor brush wear and overheat warning inspection (brush warning spec.) (See page 5-42).

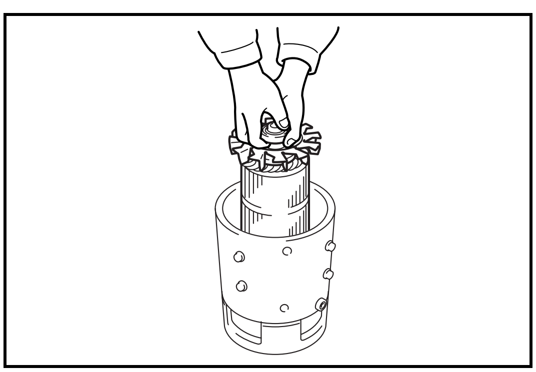




Point Operations

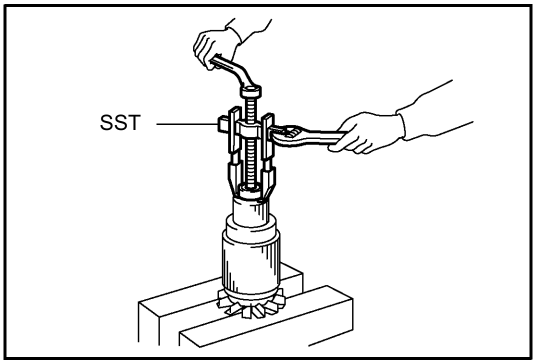
[Point 1]

Disassembly:
Make match marks on bracket No.1 and the yoke ASSY. (Same for the commutator frame and the yoke ASSY)



[Point 2]

Removal·Installation:
Remove and install the motor carefully so as not to damage the armature and field coils.



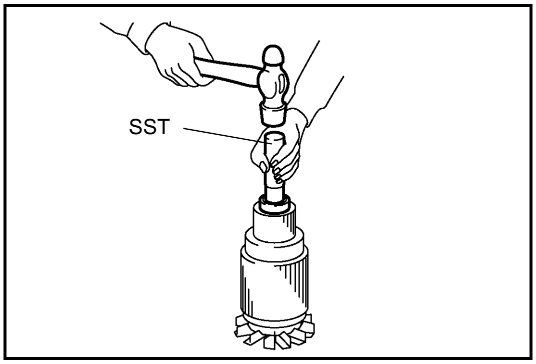
Inspection:

Inspect bearings No.1 and No.2, and replace them if worn or damaged.

Removal:

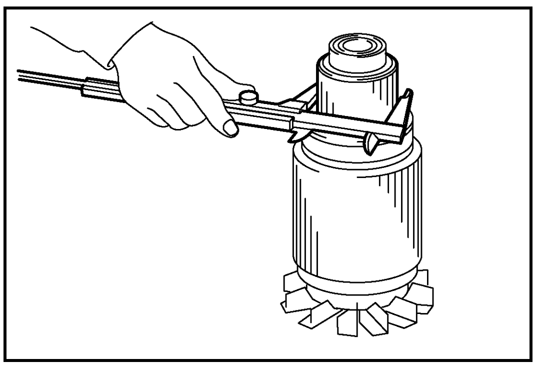
SST 09950-76014-71

(SST 09950-40011)



Installation:

SST 09381-41950-71

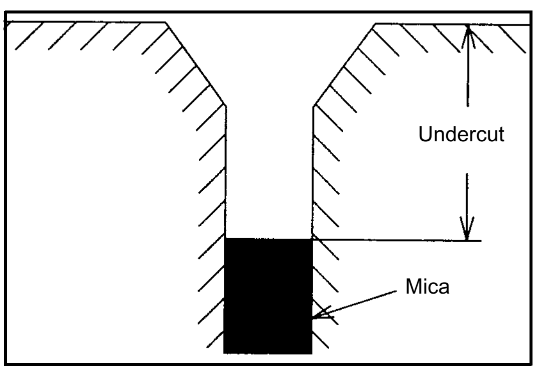


Inspection:

If the commutator surface is roughened, correct with sandpaper (#600 or similar) and clean well. If the surface is excessively rough, repair with a lathe.

Commutator outside diameter **mm (in)**

	15·18 model	20 ~ 55 model
Standard	85 (3.35)	100 (3.94)
Limit	82 (3.23)	97 (3.82)



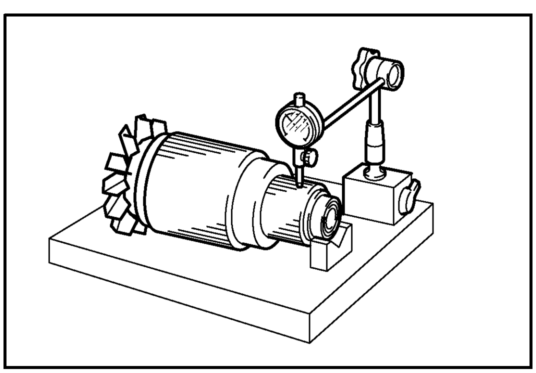
Inspection:

When the commutator is repaired, undercut the mica.

Undercut depth

Standard: 1.0 mm (0.039 in)

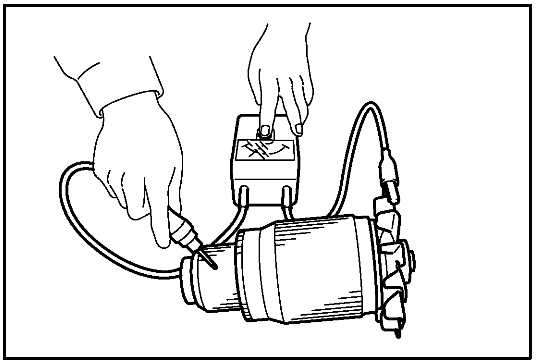
Limit: 0.5 mm (0.020 in)



Inspection:

Measure the commutator runout.

Standard: 0.03 mm (0.00118 in) or less

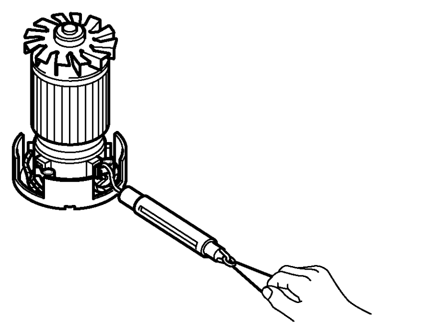


Inspection:

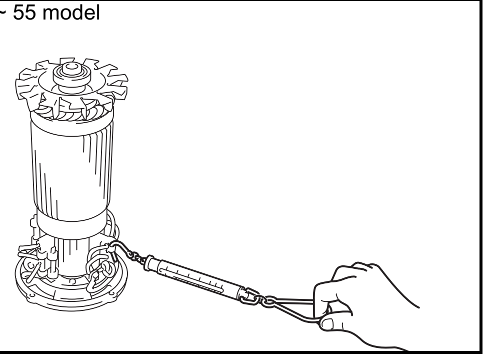
Measure the insulation resistance of the armature coil.

Standard: 1 MΩ or more

15·18 model



20 ~ 55 model



[Point 3]

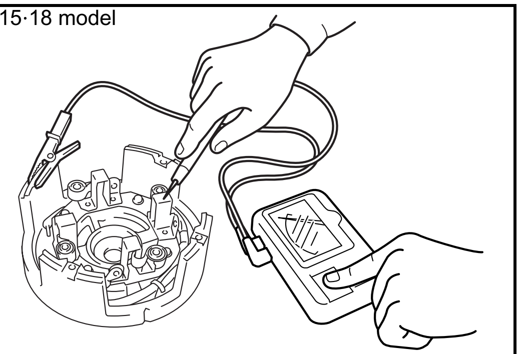
Inspection:

Install the armature brush, hook a spring scale on the brush spring, and measure the spring force the instant the spring leaves the brush.

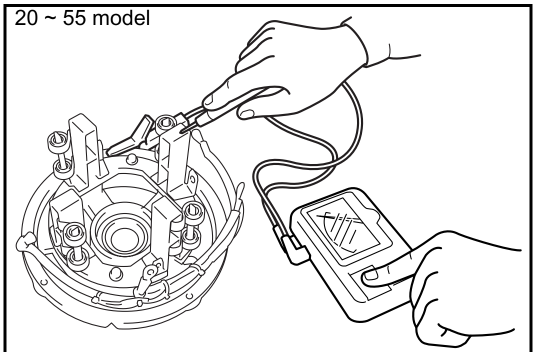
Spring force **N (gf) [lbf]**

	15·18 model	20 ~ 55 model
Standard	11.7 ~ 14.3 (1.19 ~ 1.46) [2.63 ~ 3.22]	12.15 ~ 14.85 (1.24 ~ 1.52) [2.74 ~ 3.35]

15·18 model



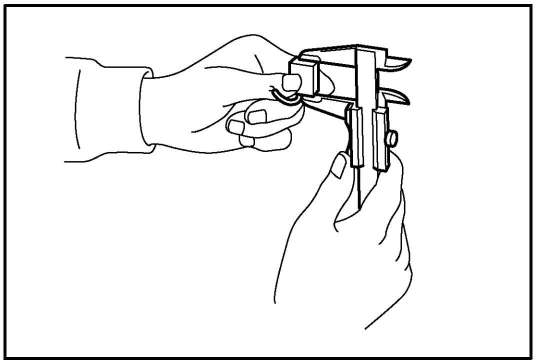
20 ~ 55 model



Inspection:

Measure the insulation resistance between the brush holder and the bracket.

Standard: 1 MΩ or more



[Point 4]

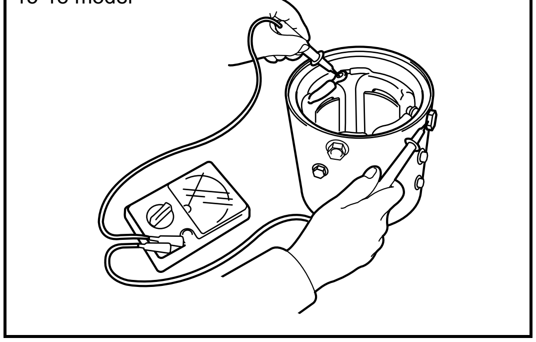
Inspection:

Inspect the brush for wear and contact state.

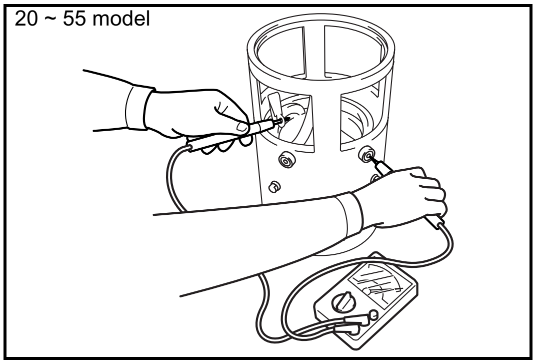
Brush length **mm (in)**

	15·18 model	20 ~ 55 model
Standard	27 (1.06)	34 (1.33)
Limit	13 (0.51)	13 (0.51)

15·18 model



20 ~ 55 model



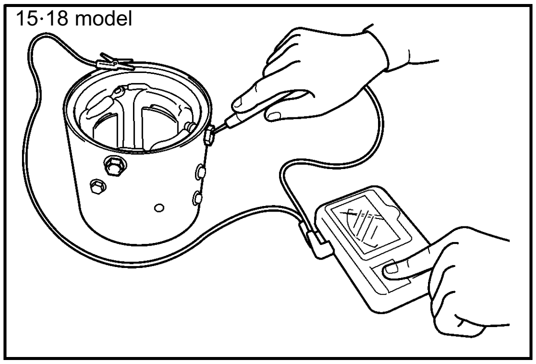
[Point 5]

Inspection:

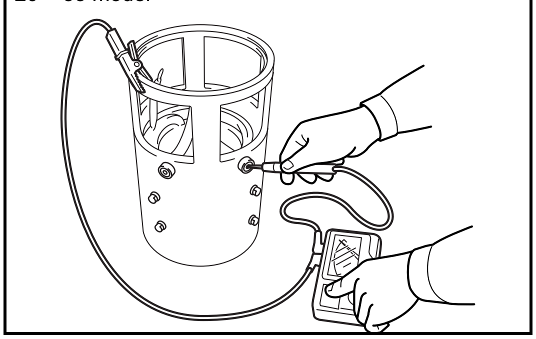
Inspect the field coil for continuity.

Measurement terminals:
Between F terminal and coil end terminal
Standard: 0 Ω (Tester range × 1 Ω)

15·18 model



20 ~ 55 model



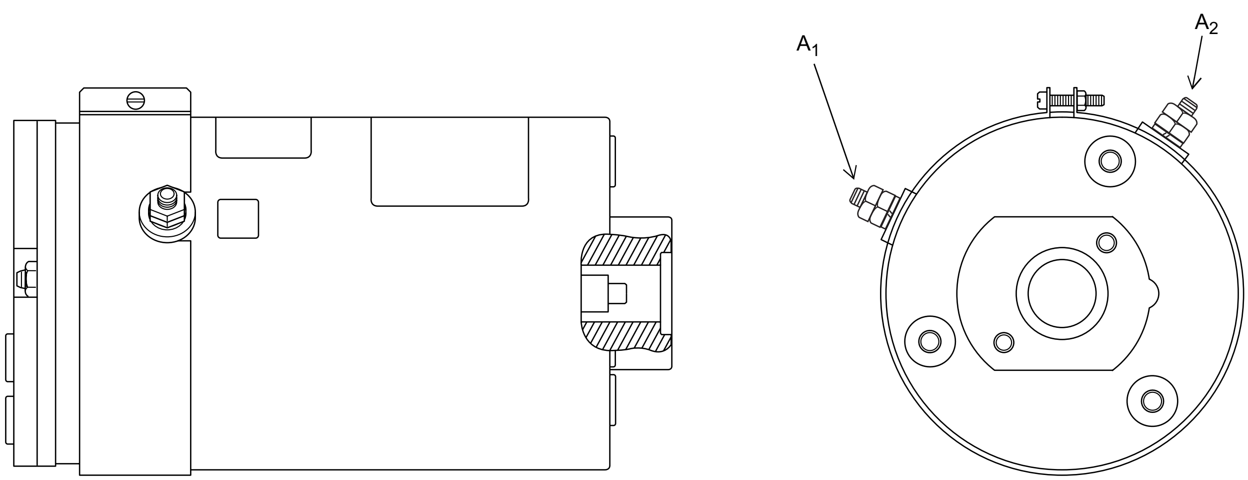
Inspection:

Measure the field coil insulation resistance.

Measurement terminals: F terminal and yoke
Standard: 1 MΩ or more

POWER STEERING MOTOR (15 ~ 32 MODEL)

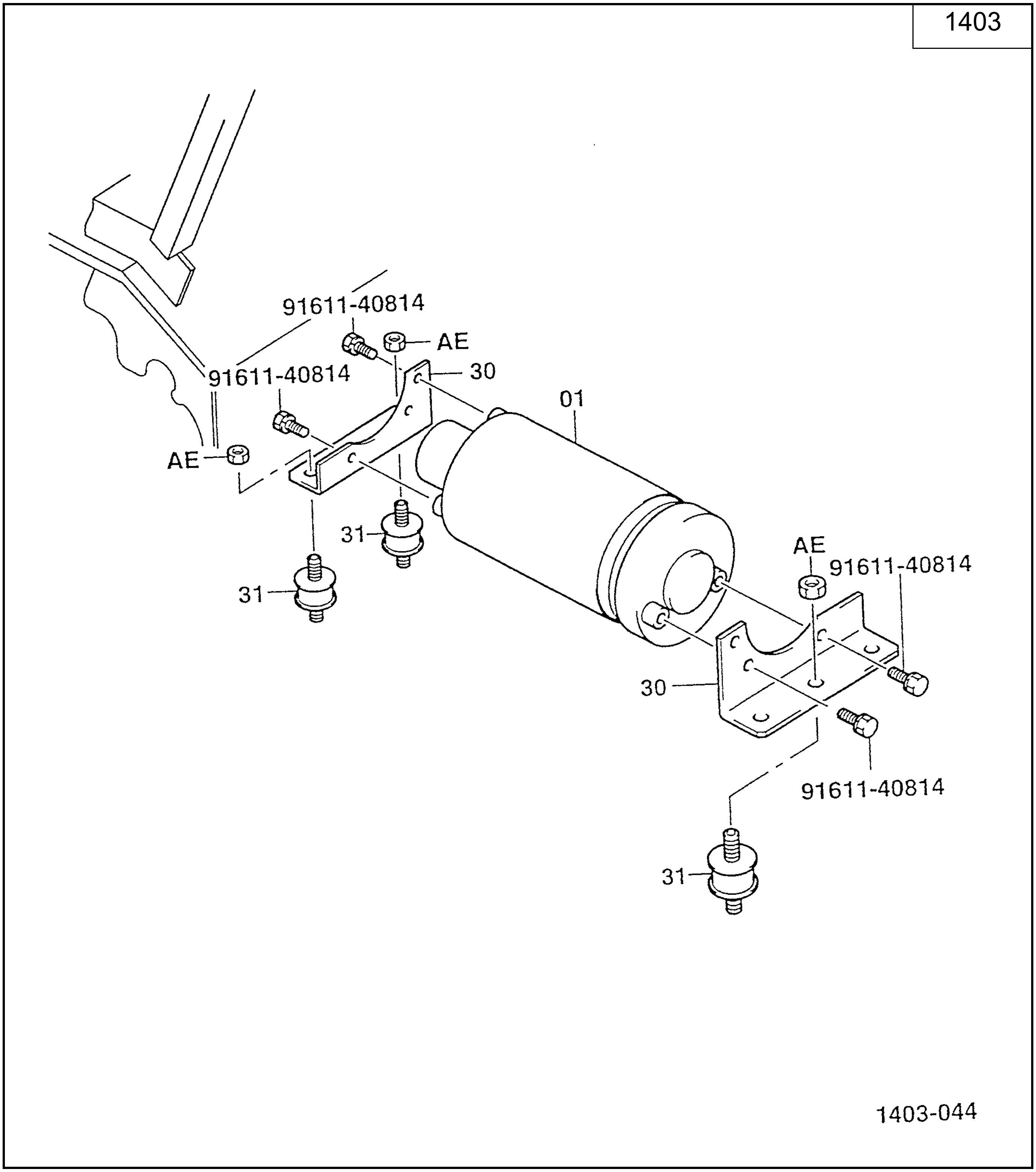
GENERAL



SPECIFICATIONS

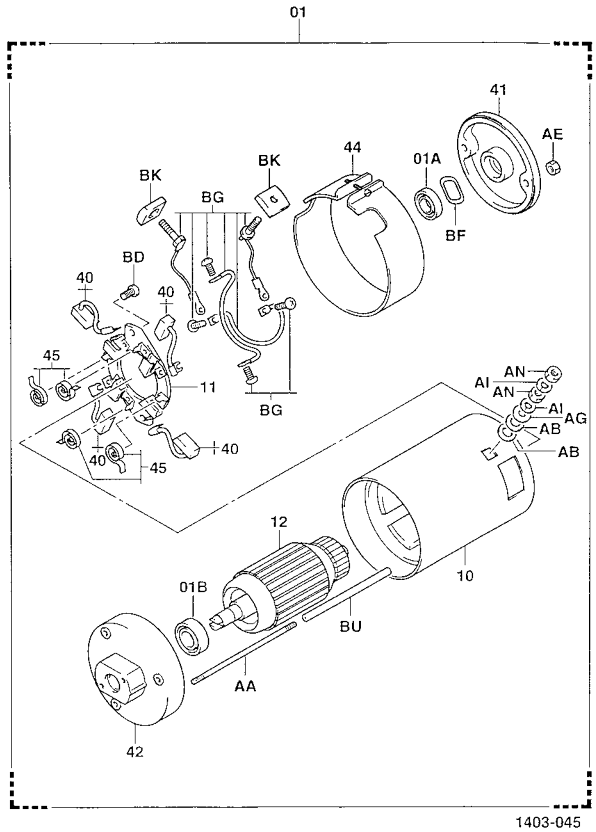
Item \ Vehicle model	7FBC(H)U15 ~ 32	30-7FBC(H)U15 ~ 32
Type	DC permanent magnet type enclosed motor	
Nominal voltage V	36/48	←
Rated output kW	0.7/0.9	←
Dimensions mm (outside diameter × length) (in)	φ144 × 269 (5.67 × 10.59)	←
Insulation class	H	←
Brush size mm (width × length × thickness) (in)	15.8 × 28.4 × 9.5 (0.622 × 1.118 × 0.374)	←
Number of brushes	4	←

COMPONENTS

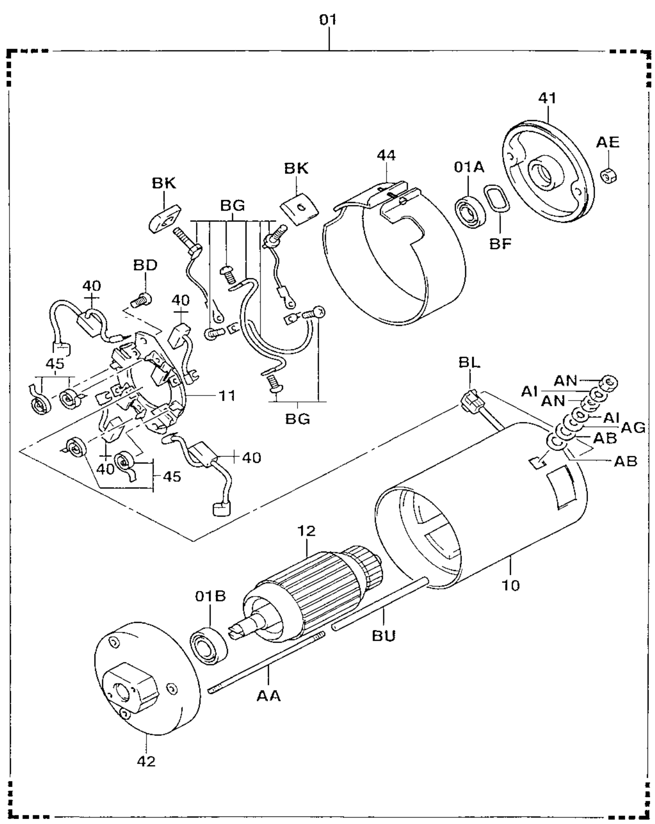

1403
91611-40814
AE
30
91611-40814
01
AE
31
31
AE
91611-40814
30
91611-40814
31
1403-044

STD

1403

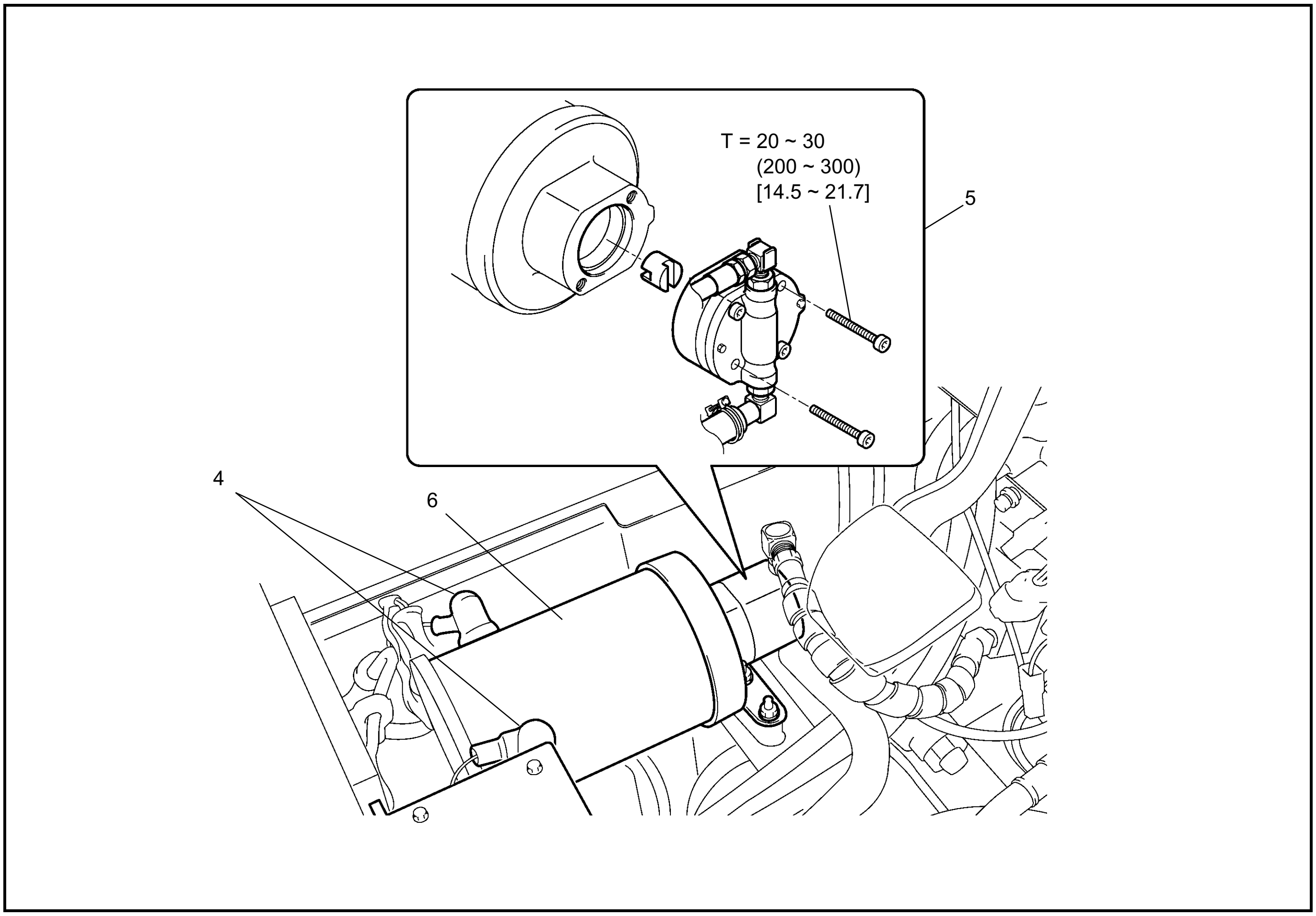


OPT (Brush warning)



REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]

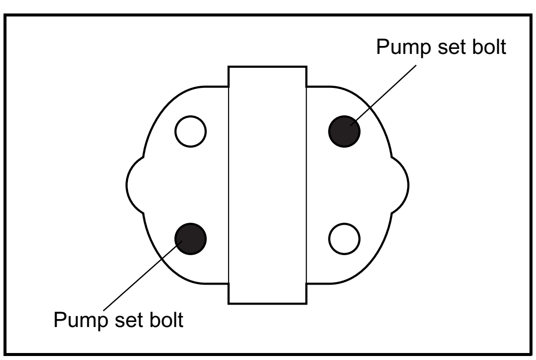


Removal Procedure

1 Disconnect the battery plug.
2 Remove the toe board (front and rear) and lower panel.
3 Remove the PS controller.
4 Disconnect the PS motor wiring.
5 Remove the PS pump set bolts and disconnect the PS pump from the PS motor ASSY. **[Point 1]**
6 Remove the PS motor ASSY.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

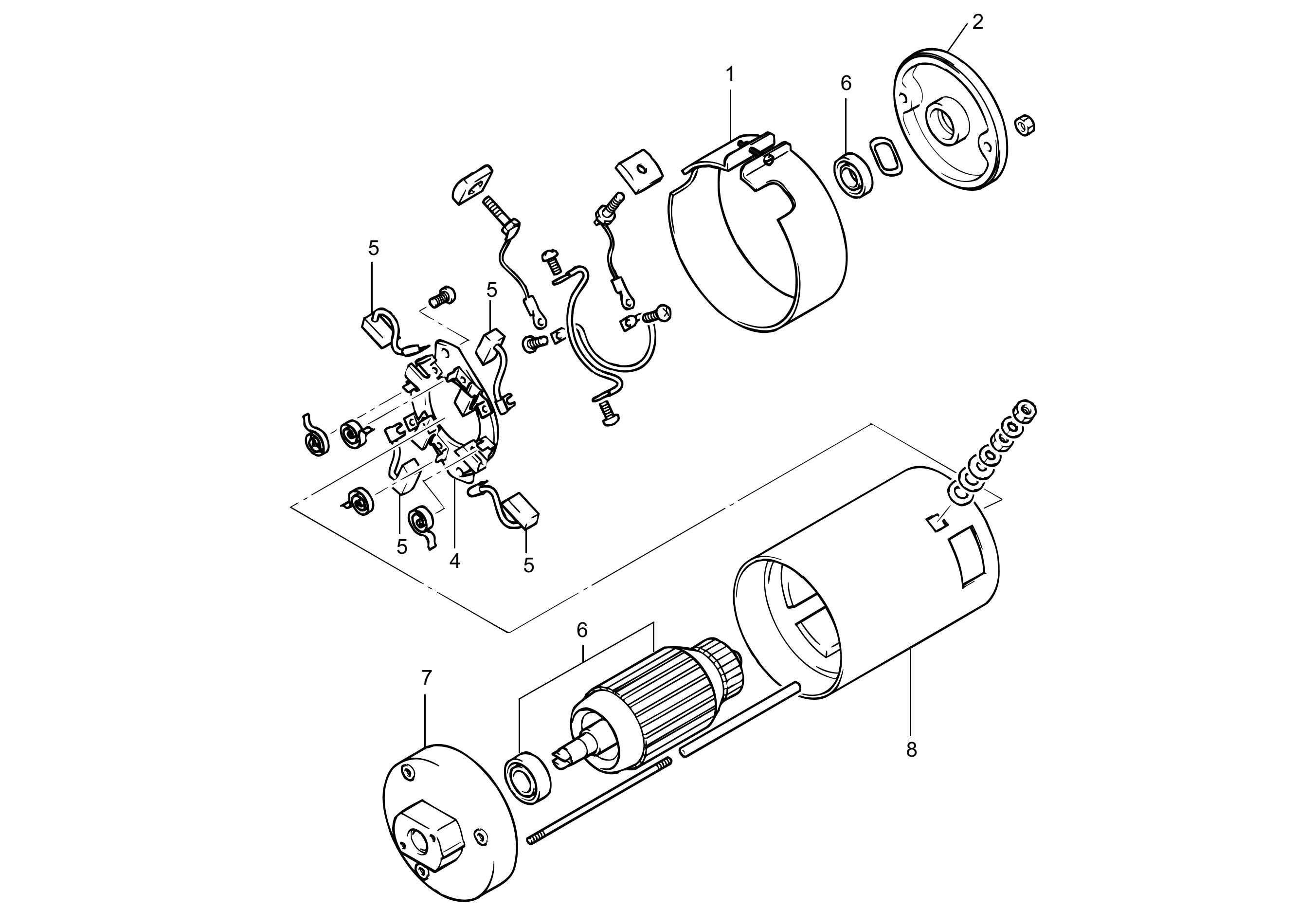


Point Operation

[Point 1]

Removal:
PS pump set bolts are located as illustrated.

DISASSEMBLY·INSPECTION·REASSEMBLY



Disassembly Procedure

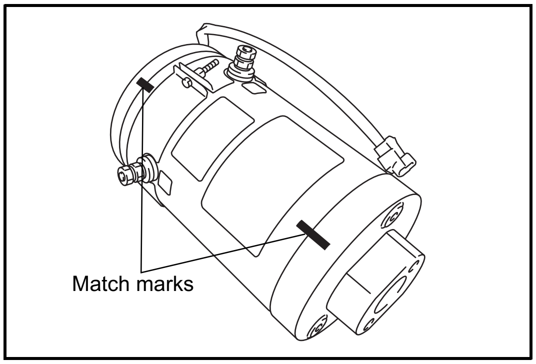
1 Remove the brush cover. **[Point 1]**
2 Remove the bracket No.1.
3 Free the brushes.
4 Remove the brush holder from the yoke ASSY. **[Point 2]**
5 Remove the brush from the brush holder. **[Point 3]**
6 Remove the armature coil from the yoke ASSY. **[Point 4]**
7 Remove the bracket No.2 from the yoke ASSY.
8 Remove the yoke ASSY. **[Point 5]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

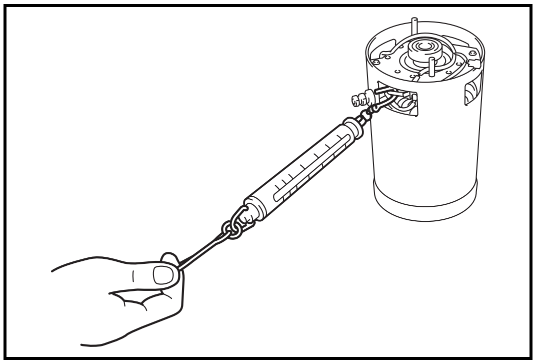
Note:
After reassembly, perform motor brush and overheat warning inspection (brush warning spec.) (See page 5-42).

Point Operations



[Point 1]

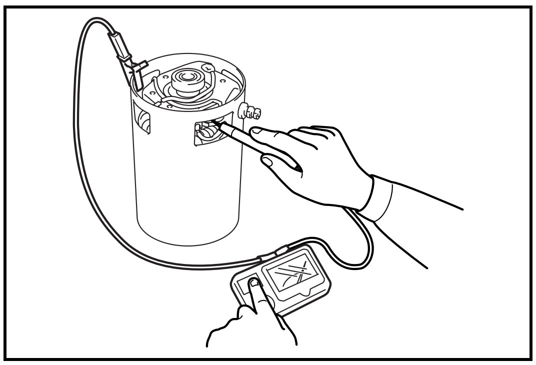
Reassembly:
Make match marks on bracket No. 1, yoke ASSY and bracket No. 2.



[Point 2]

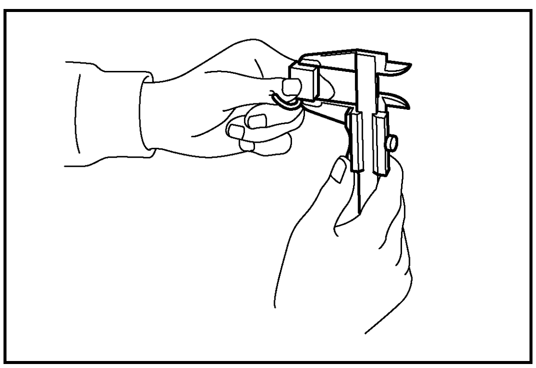
Inspection:
Reassemble the armature coil and brush. Hook a spring balance to the brush spring. Measure the reading on the instant when the spring comes off from the brush.

Spring force
Standard: 4.9 ~ 8.8 N (0.5 ~ 0.9 kgf) [1.1 ~ 2.0 lbf]



Inspection:
Measure the insulation resistance between the brush holder and the yoke ASSY.

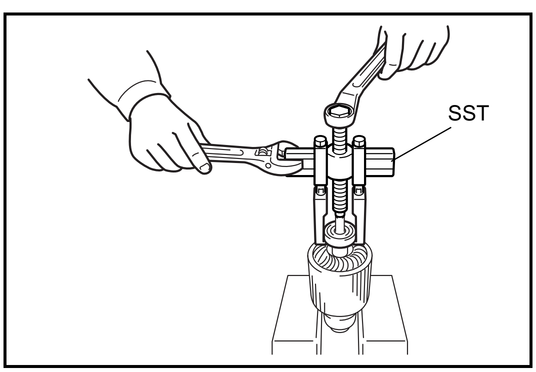
Standard: 1 MΩ or more



[Point 3]

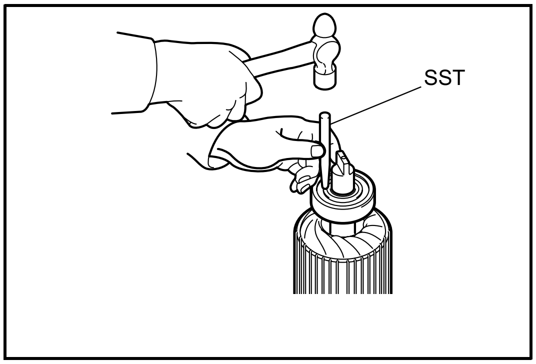
Inspection:
Inspect the brush for wear and contact state.

Brush length
Standard: 28.4 mm (1.118 in)
Limit: 15.4 mm (0.606 in)

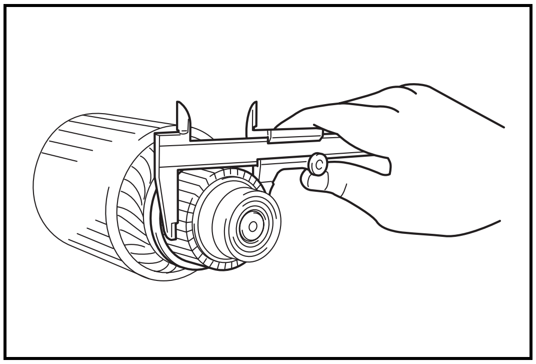


[Point 4]

Inspection:
Inspect bearings No.1 and No.2, and replace them if worn or damaged.
Removal:
SST 09950-76014-71
(SST 09950-40011)

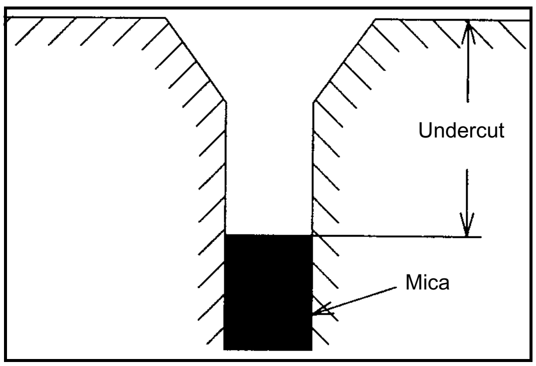


Installation:
SST 09700-30200-71



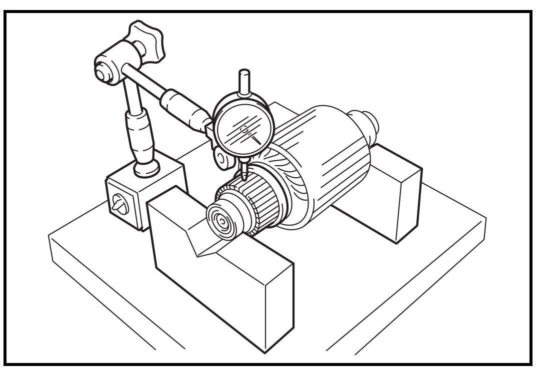
Inspection:
If the commutator surface is roughened, correct it with sandpaper (#600 or similar) and clean it well.
If the surface is excessively rough, repair with a lathe.

Commutator outside diameter
Standard: 57.2 mm (2.252 in)
Limit: 54.6 mm (2.150 in)



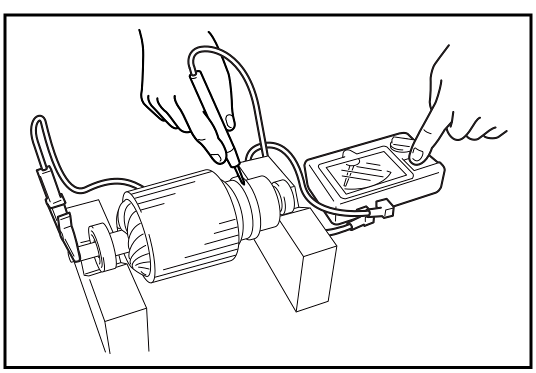
Inspection:
When the commutator is repaired, undercut the mica.

Under cut depth
Standard: 0.8 mm (0.031 in)
Limit: 0.3 mm (0.012 in)



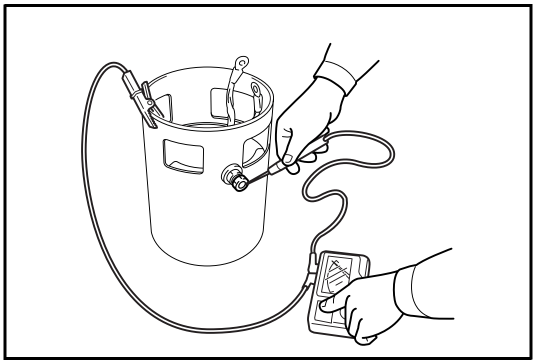
Inspection:
Measure the commutator runout.

Standard: 0.03 mm (0.0012 in) or less



Inspection:
Measure the insulation resistance of the armature coil.

Standard: 1 MΩ or more



[Point 5]

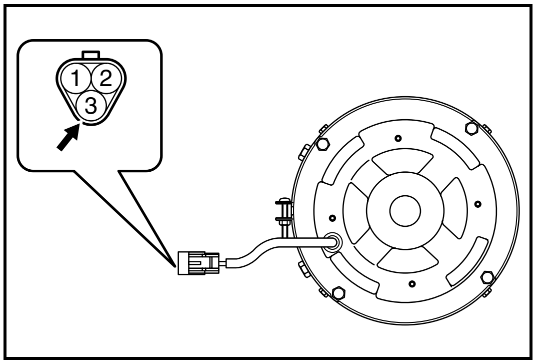
Inspection:

Measure the fierd coil insulation resistance.

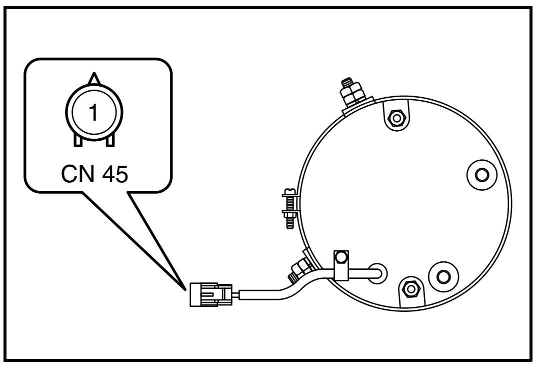
Measurement terminals:
A1/A2 terminal and yoke ASSY.
Standard: 1 MΩ or more

MOTOR BRUSH WEAR AND OVERHEAT WARNING

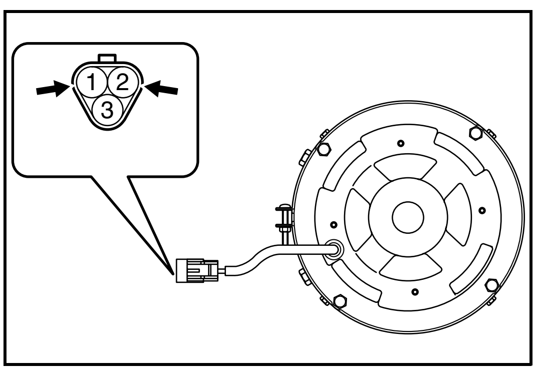
INSPECTION



1. Inspect the brush wear warning devices.
   (1) Pump motor
   In normal state, connector pin No.3 and motor terminal A are not connected.
   They are connected after brush wear warning. (Signal generation)



   (2) PS motor
   In normal state, motor terminal A1 and brush warning connector are not connected. They are connected after brush wear warning. (Signal generation)



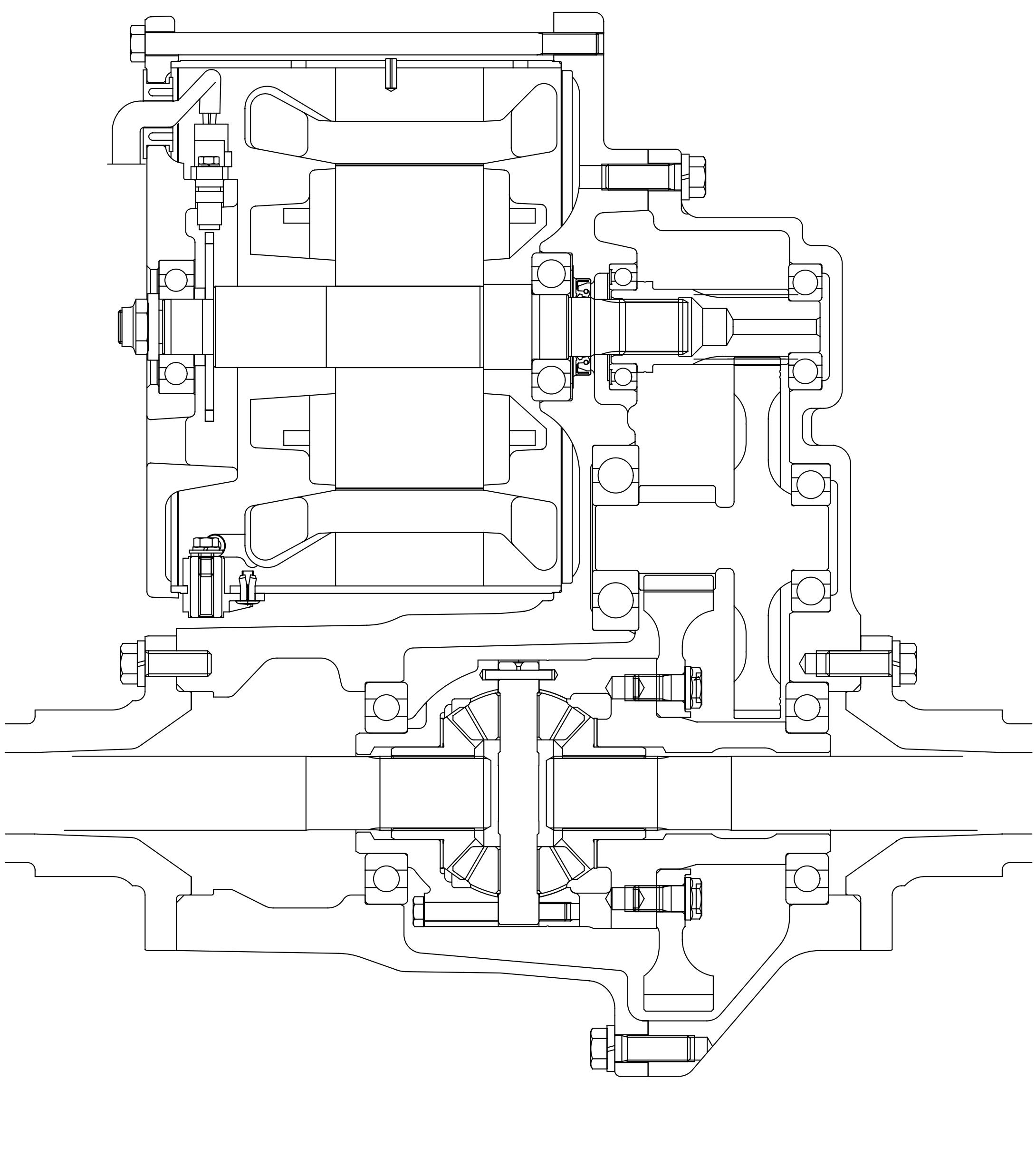
2. Inspect the overheat alarm device. (Only pump motor)
   (1) Measure the resistance when the motor is in cold state.
   Between connector pins No.1 and No.2.

   Standard: 100 ~ 500 kΩ
   [Atmospheric temperature:
   45°C (113°F) ~ 10°C (50°F)]

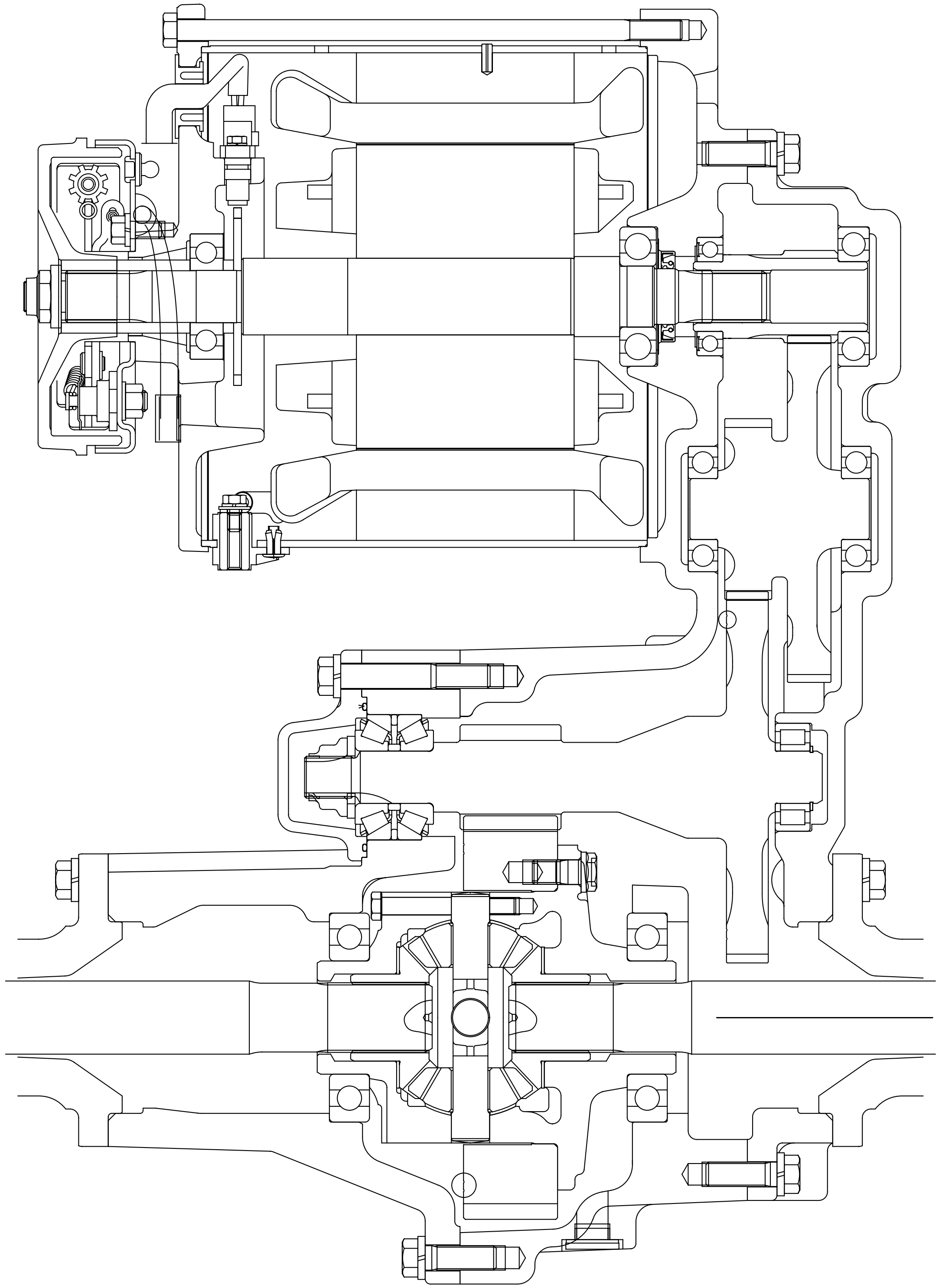
DRIVE UNIT

GENERAL

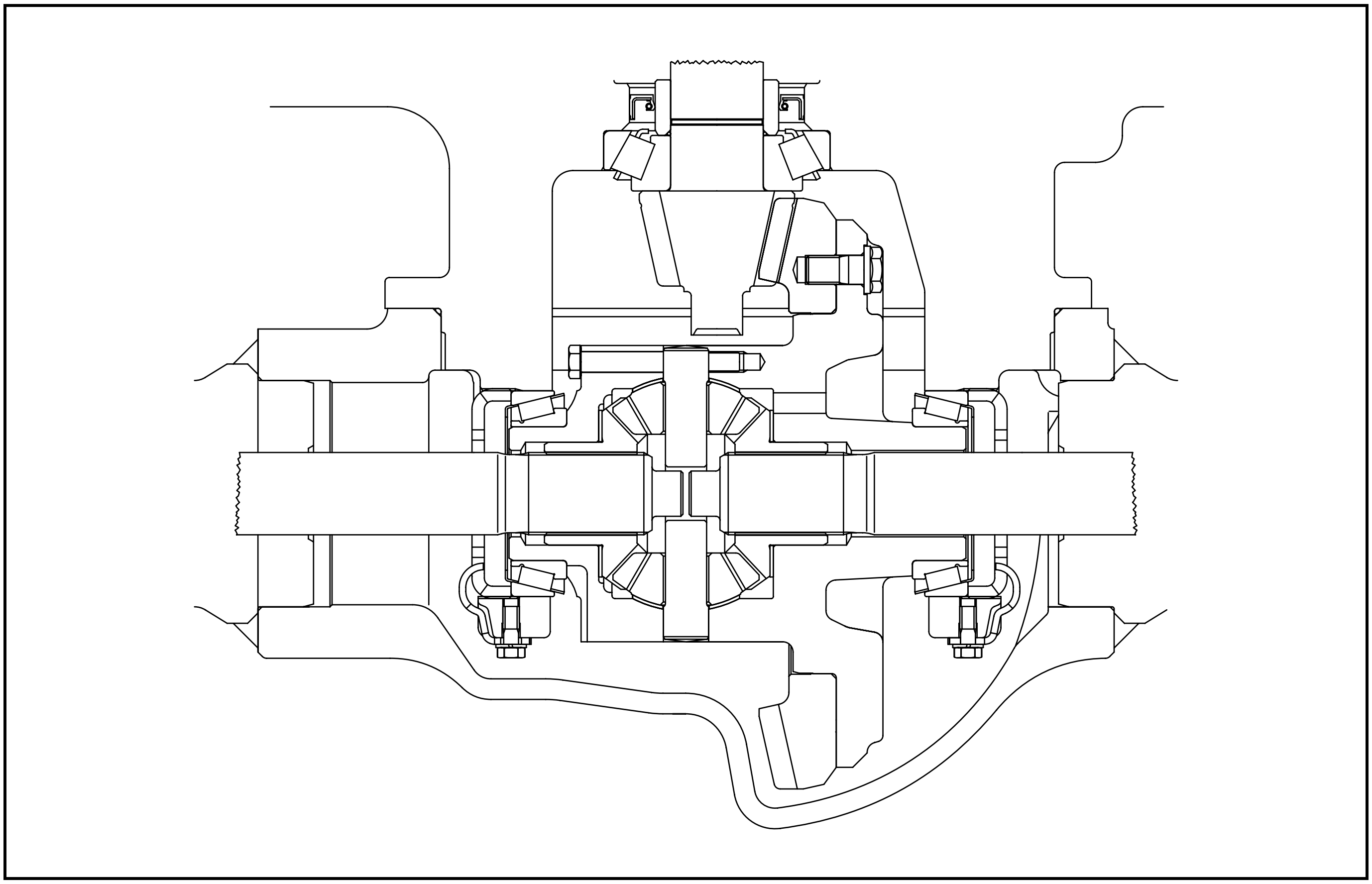
15·18 model



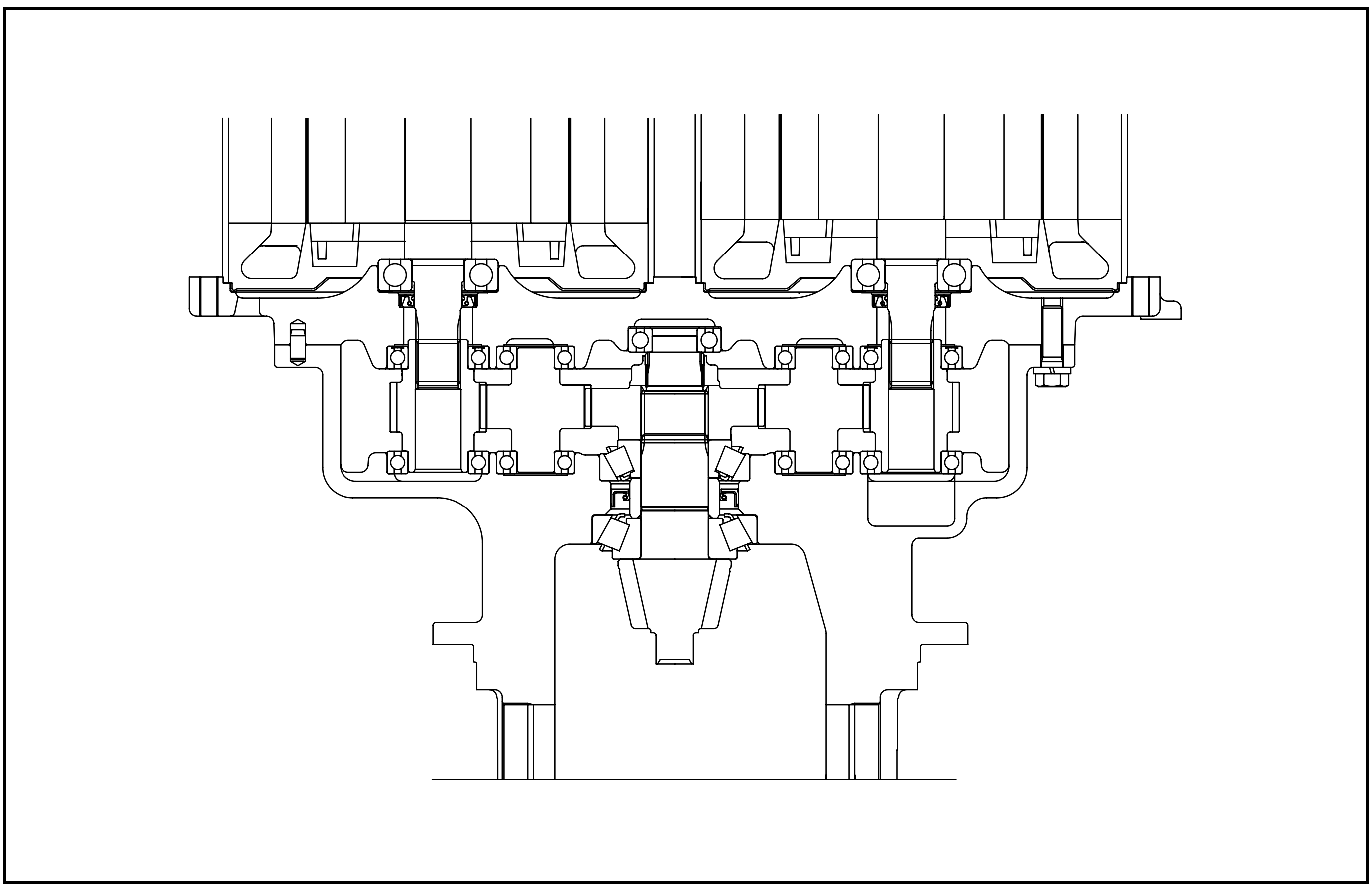
15·18 model (dead-man brake), 20 ~ 32 model



Differential (35 ~ 55 Model)



Reduction Gear (35 ~ 55 Model)



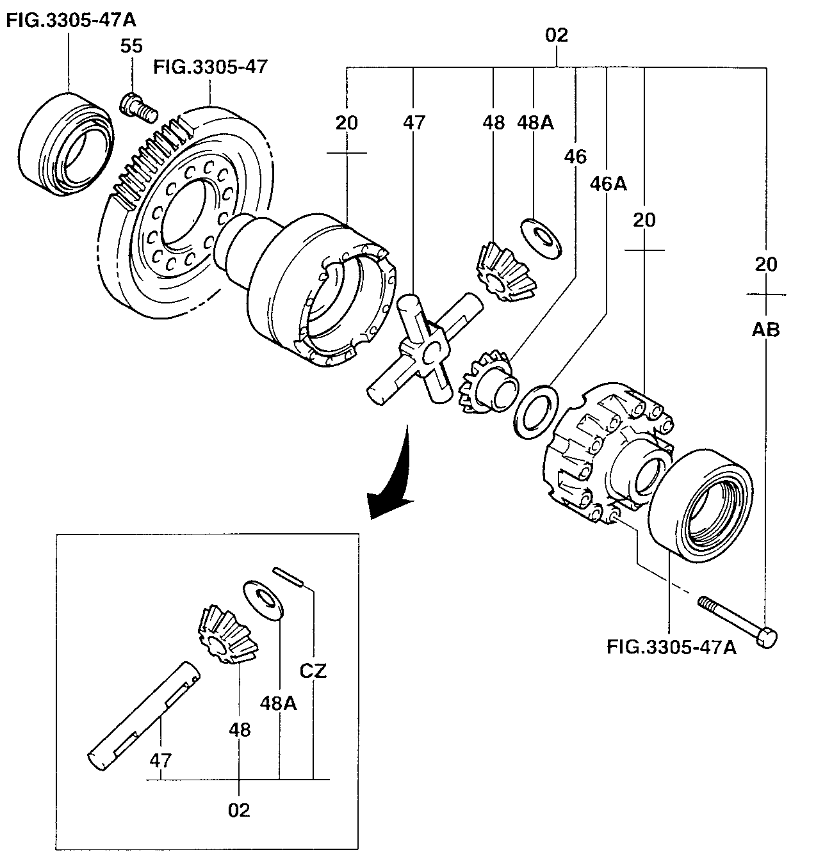
SPECIFICATIONS

Item \ Model	15·18	15·18 (dead-man)	20 ~ 32	35·45	55
Number of teeth of motor shaft gear	16	29	23	26	25
Number of teeth of idle gear	—	Large: 86 Small: 46	Large: 92 Small: 41	30	30
Number of teeth of pinion gear	Large: 89 Small: 11	Large: 86 Small: 12	Large: 86 Small: 12	Large: 50 Small: 6	Large: 50 Small: 6
Number of teeth of differential gear	54	53	53	35	35
Total reduction gear ratio	27.307	27.473	37.057	11.218	13.067
Drive unit oil quantity ℓ (US gal)	3.8 (1.00)	5.5 (1.45)	←	2.0 (0.53)	←
Differential oil quantity ℓ (US gal)				4.5 (1.18)	←

COMPONENTS

15·18 model

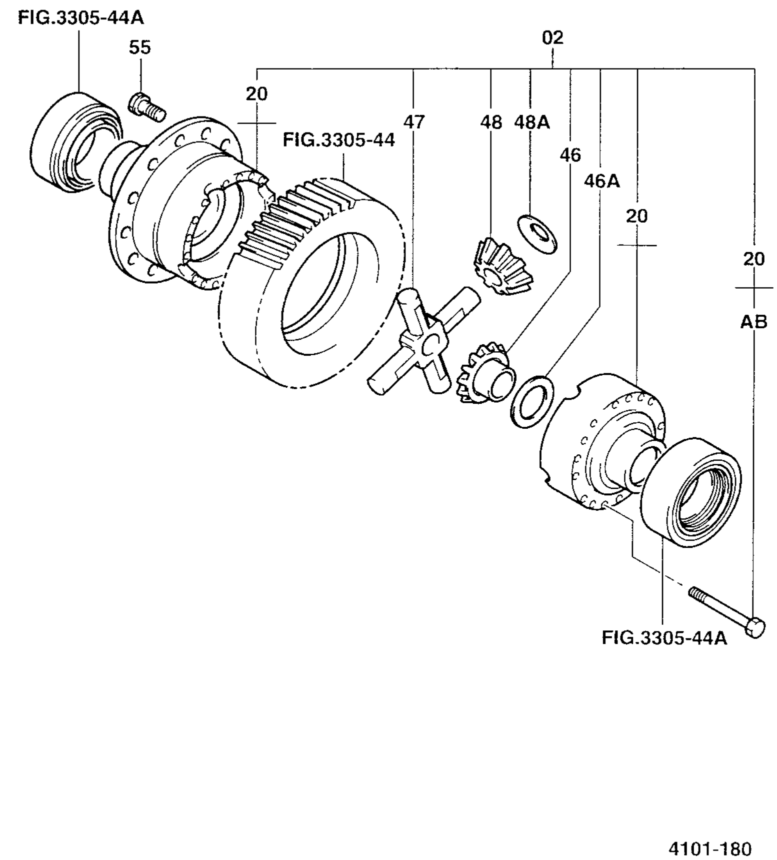
4101



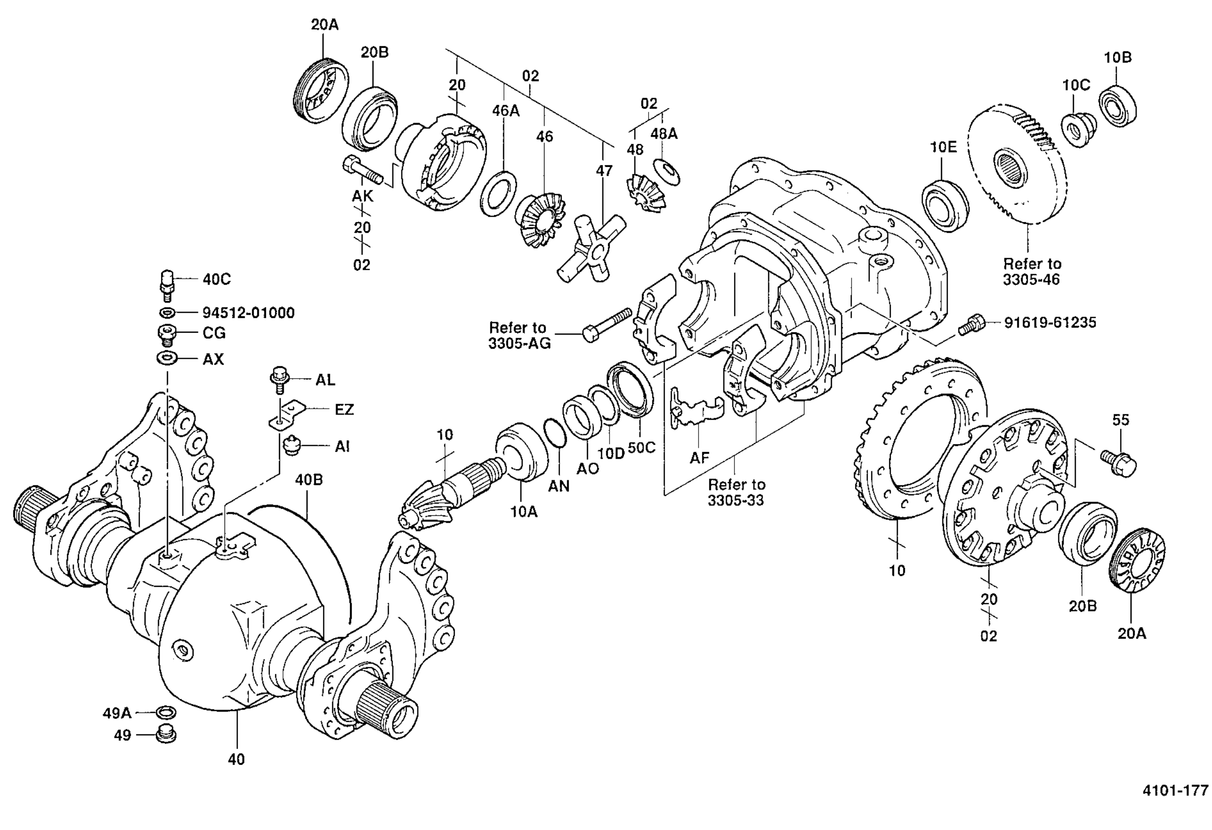
4101-179

15·18 model (dead-man), 20 ~ 32 model

4101

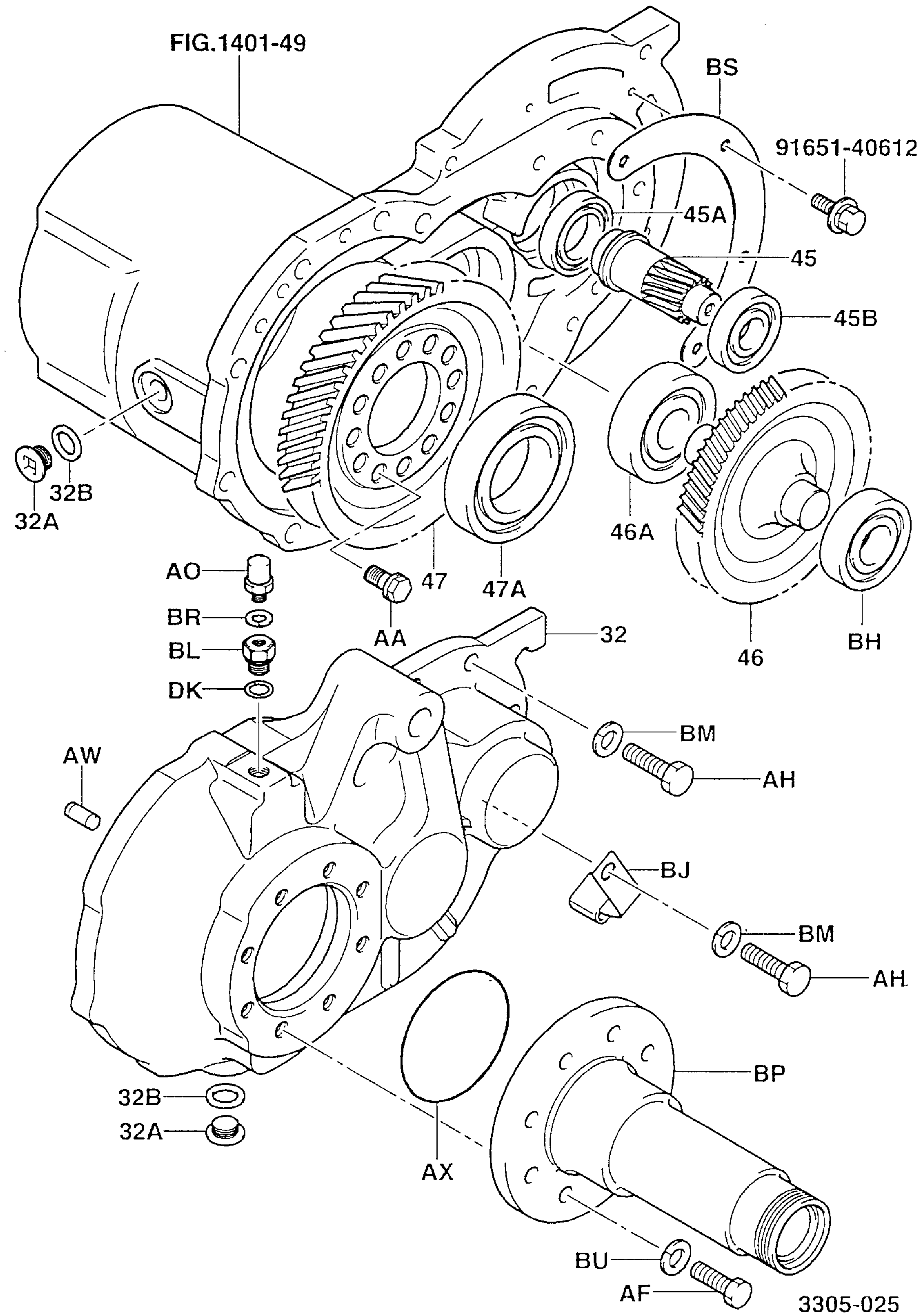


35 ~ 55 model



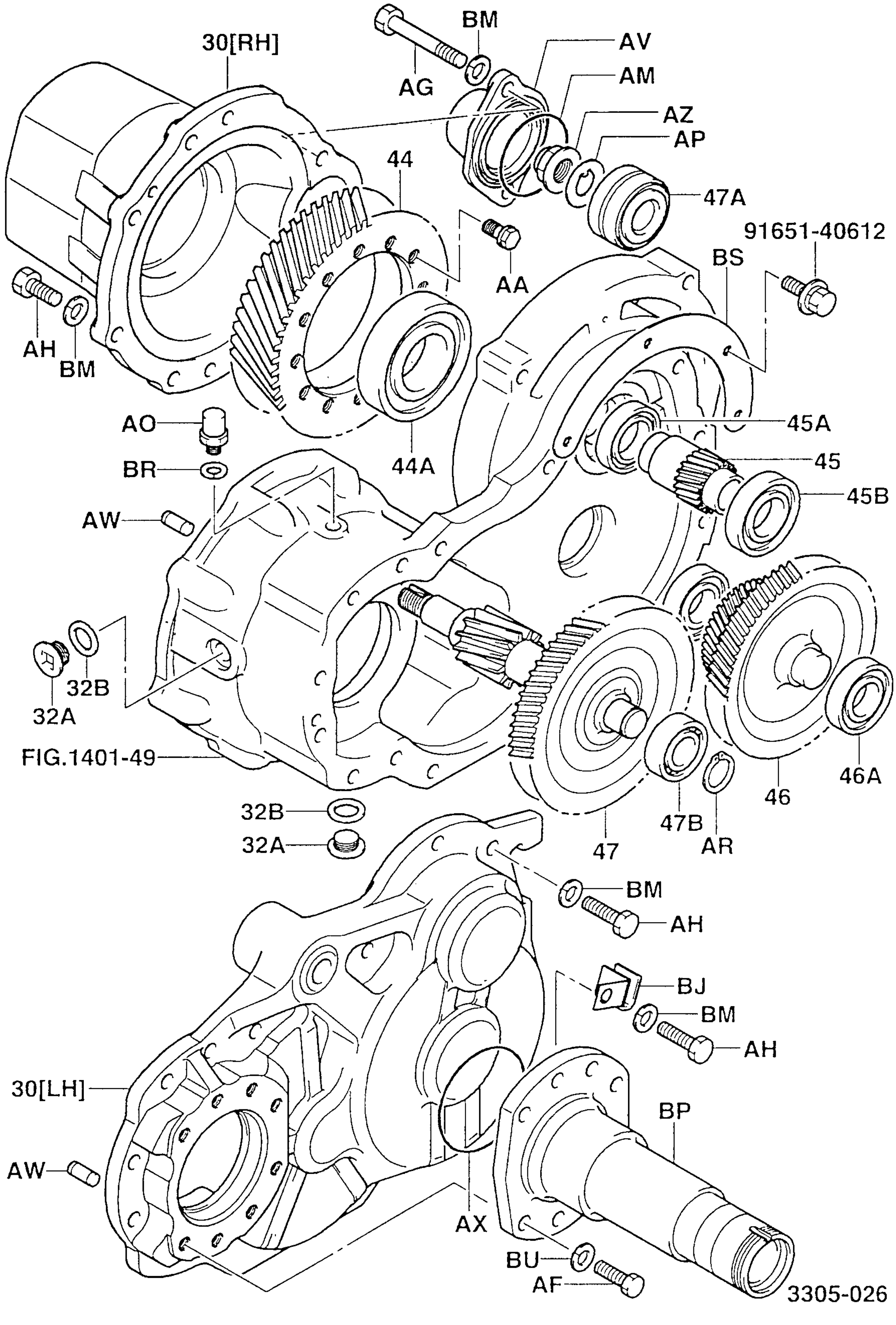
15·18 model

3305



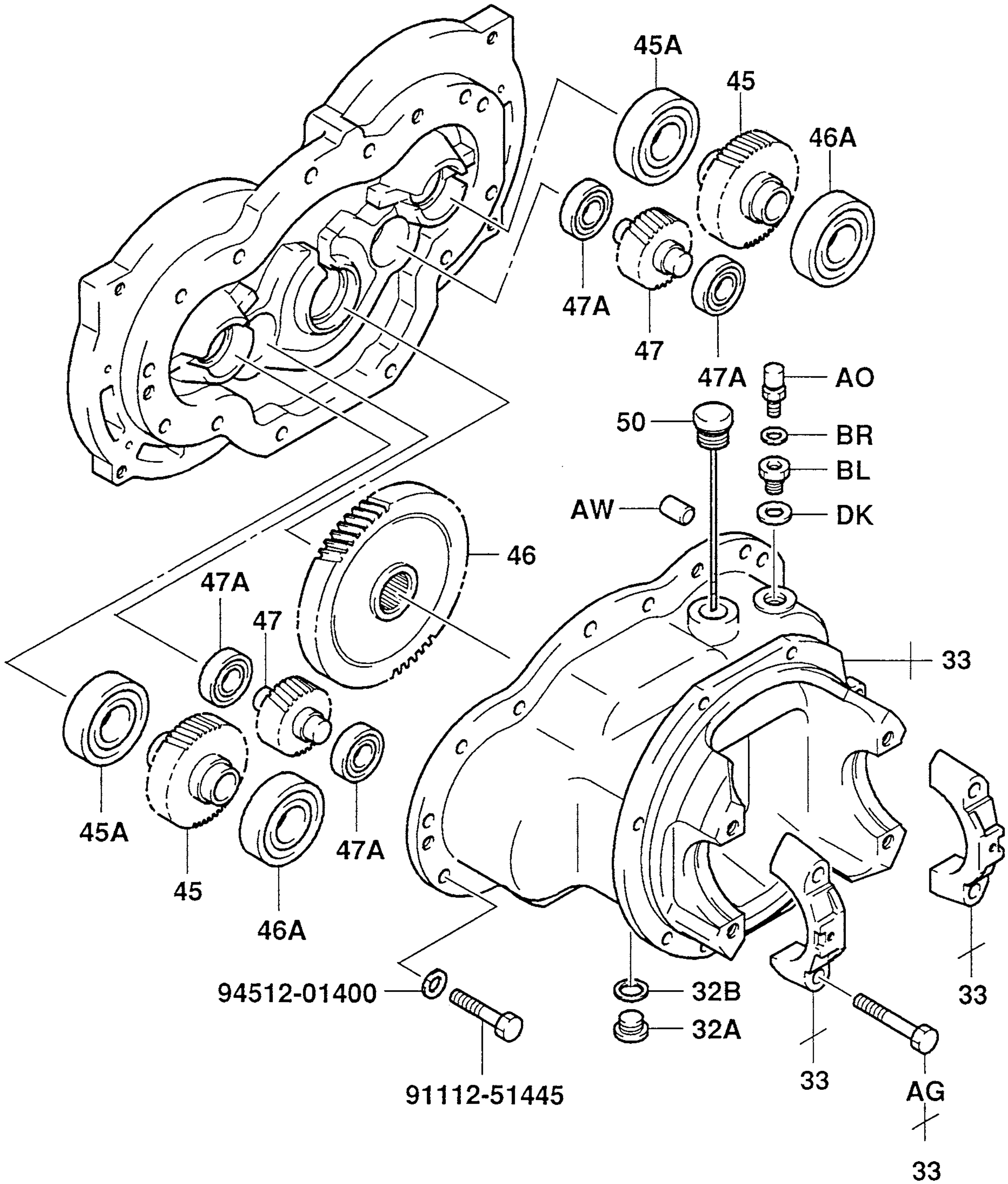
15·18 model (dead-man brake), 20 ~ 32 model

3305



35 ~ 55 model

3305

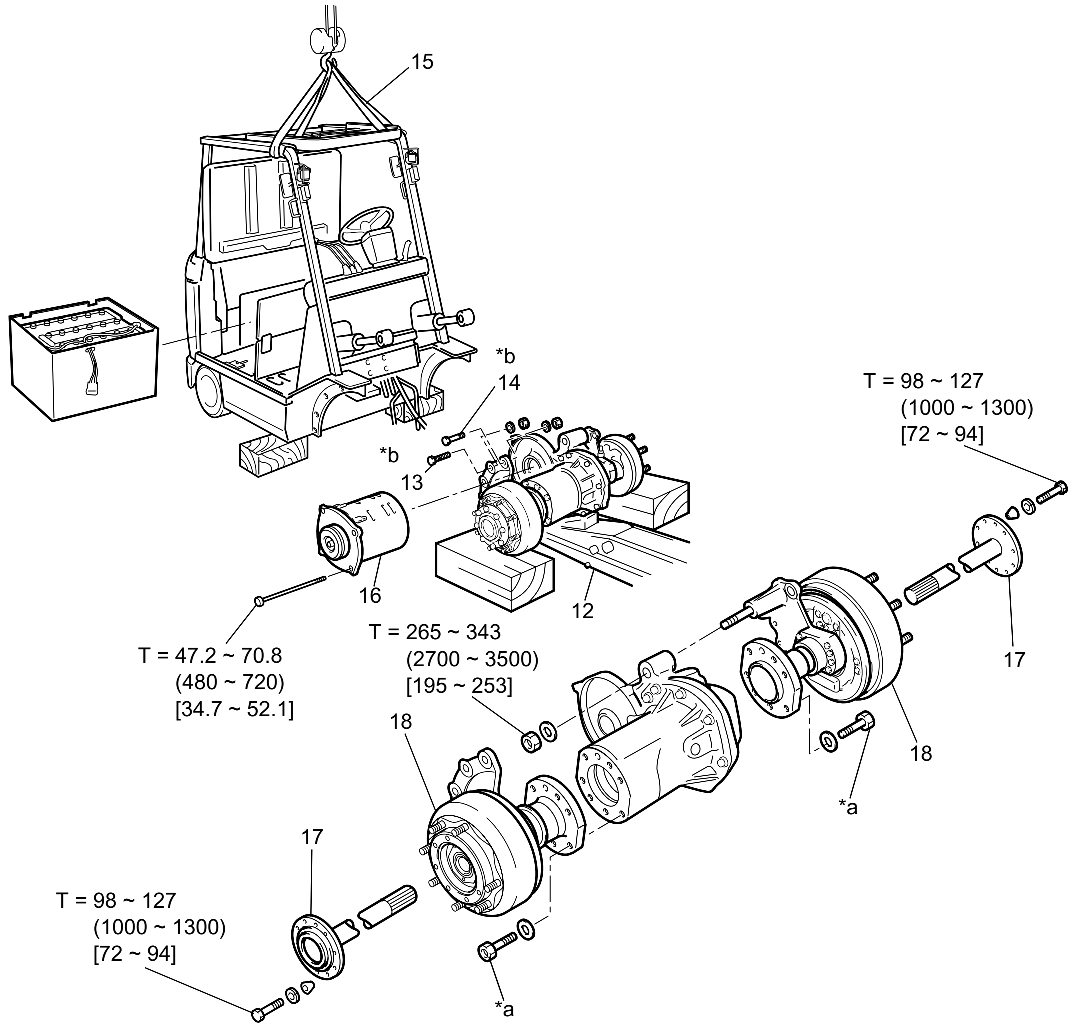


3305-027

DRIVE UNIT ASSY (15 ~ 32 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



*a Front axle housing set bolt	15·18 model	T = 73.5 ~ 98 (750 ~ 1000) [54.3 ~ 72.4]
	15·18 model (dead-man brake) 20 ~ 32 model	T = 108 ~ 137 (1100 ~ 1400) [79.6 ~ 101.3]
*b Front axle bracket set bolt	15·18 model	T = 156.8 ~ 215.6 (1600 ~ 2200) [115.8 ~ 159.2]
	15·18 model (dead-man brake) 20 ~ 32 model	T = 235 ~ 294 (2400 ~ 3000) [173.6 ~ 217.1]

Removal Procedure

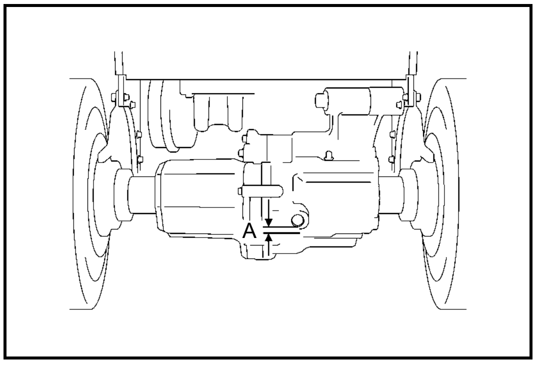
1 Remove the mast ASSY. (See page 13-10)
2 Remove the battery. (Dead-man brake spec. only) (See page 1-5)
3 Drain drive unit oil. **[Point 1]**
4 Jack up the vehicle, and remove the front wheels. **[Point 2]**
5 Drain brake fluid, and disconnect the brake piping.
6 Remove the toe board (front and rear), lower panel and instrument panel LH.
7 Disconnect the parking brake wire.
8 Remove the PS controller.
9 Disconnect the dead-man brake wire. (OPT) **[Point 3]**
10 Disconnect the wiring from the drive motor ASSY.
11 Disconnect the drive motor speed sensor connector and temperature sensor connector.
12 Use a garage jack and support the front axle ASSY W/drive motor. **[Point 4]**
13 Remove the front axle bracket set bolt. (through bolts)
14 Remove the front axle bracket set bolt. (reamer bolts) **[Point 5]**
15 Hoist the front side of the vehicle and move the vehicle backward. **[Point 6]**
16 Remove the drive motor ASSY. (See page 5-10)
17 Remove the front axle shaft.
18 Remove the front axle hub W/axle bracket and axle housing.

Installation Procedure

The installation prosedure is the reverse of the removal procedure.

Note:
After the end of installation, perform air bleeding from the brake system (See page 10-38), parking brake inspection adjustment (See page 10-56) and dead-man brake wire inspection adjustment (See page 10-57)

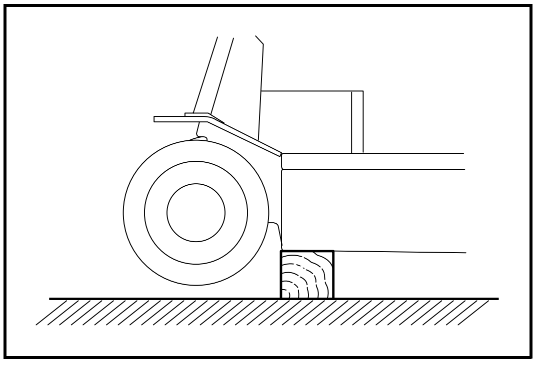
Point Operations



[Point 1]

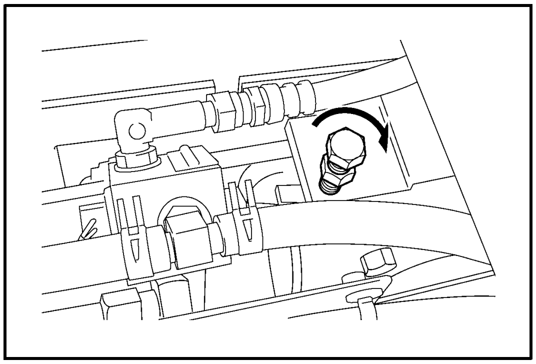
Installation:
After installation, fill hypoid gear oil to the specified level.

A = Within 15 mm (0.6 in)



[Point 2]

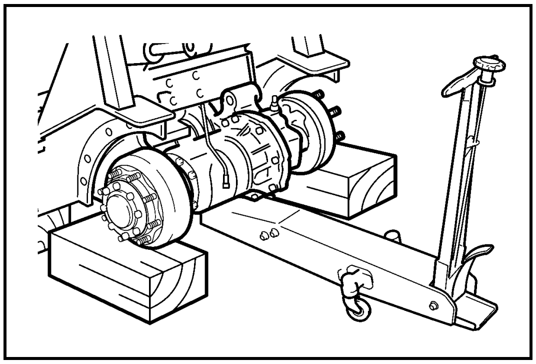
Removal·Installation:
Jack up the vehicle and support both sides of the front frame with wooden blocks.



[Point 3]

Removal:

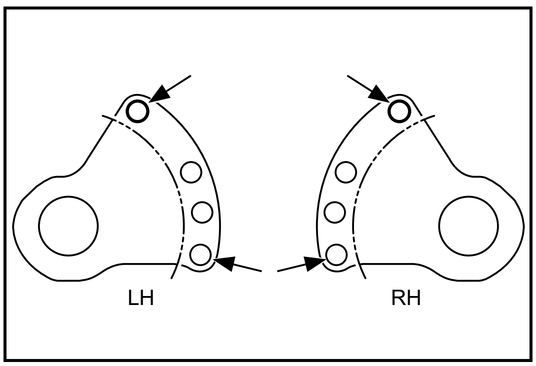
After slackening the deadman brake wire by tightening the assist bolt, disconnect the wire.



[Point 4]

Removal:

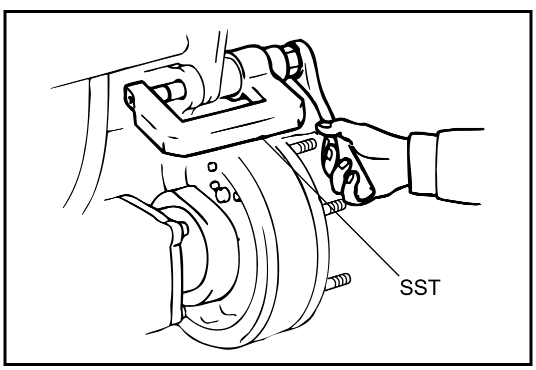
Support the differential with a garage jack.



[Point 5]

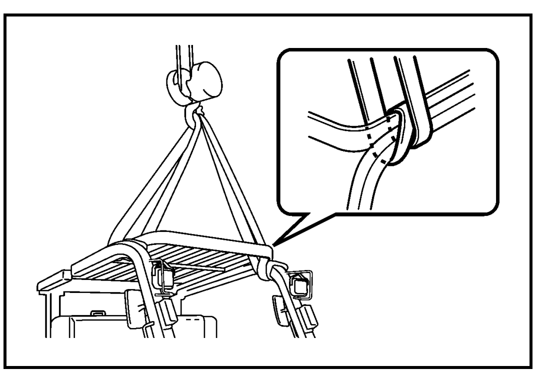
Removal:

Use the SST to remove the reamer bolts in the illustrated positions.



Removal:

SST 09310-23320-71



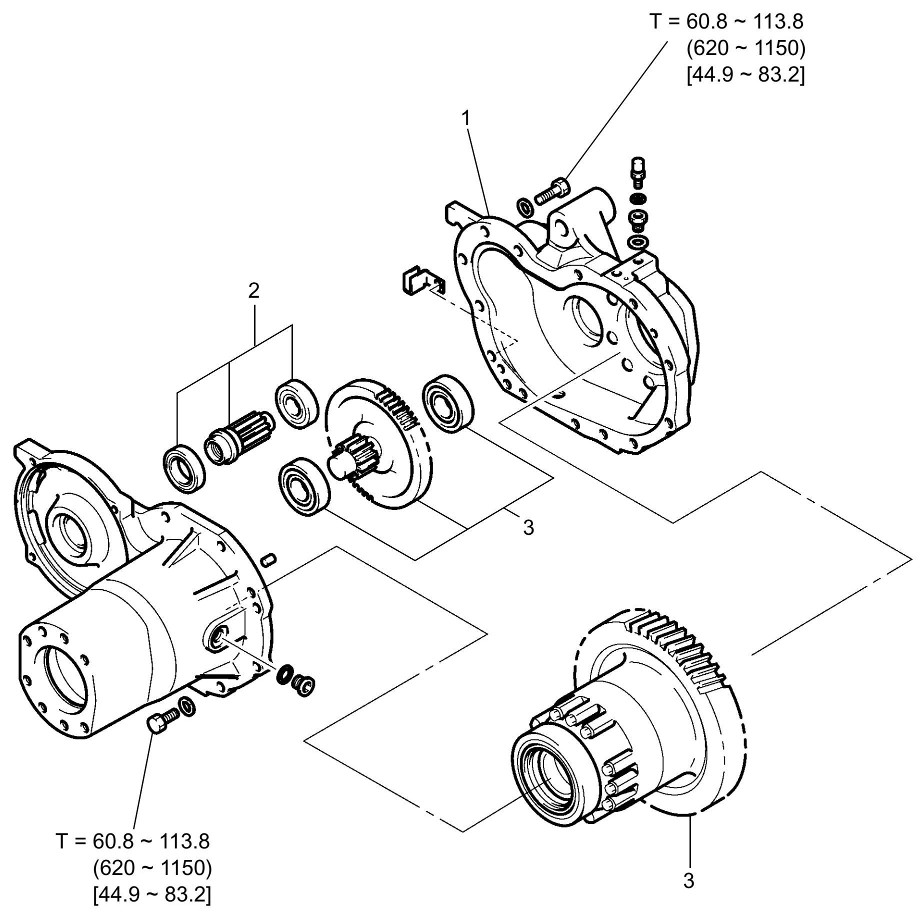
[Point 6]

Removal·Installation:

Wind a fiber rope on the front side of the over head guard.

DISASSEMBLY·INSPECTION·REASSEMBLY (15·18 MODEL)

T = N·m (kgf-cm) [ft-lbf]



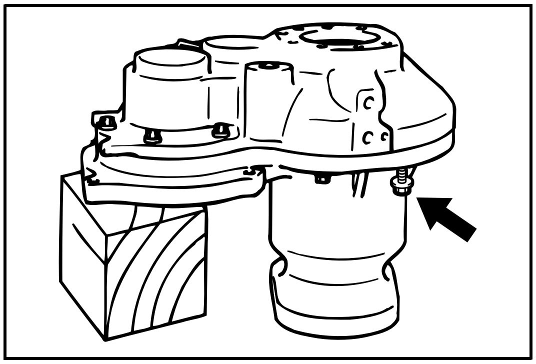
Disassembly Procedure

1 Erect it with the gear case on the upper side, and remove the gear case. **[Point 1]**
2 Remove the reduction gear No.1. **[Point 2]**
3 Remove the reduction gear No.2 and differential ASSY W/reduction gear No.3. **[Point 3]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

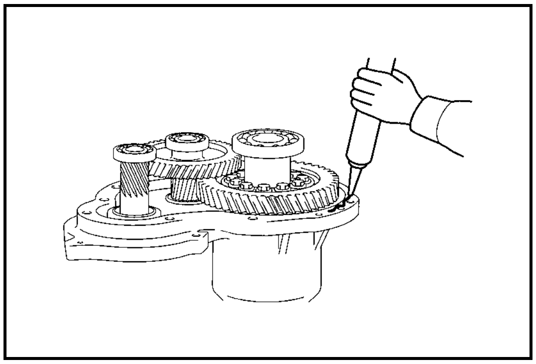
Point Operations



[Point 1]

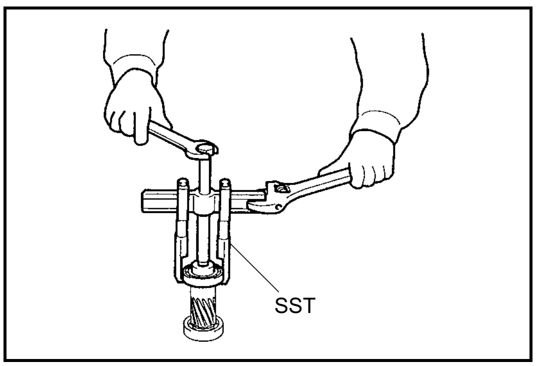
Disassembly:

Use a service bolt and remove the gear case.
Service bolt: M14 × 1.5



Reassembly:

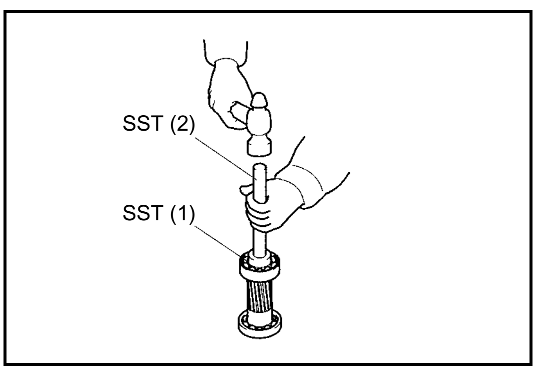
Apply liquid gasket (08826-76002-71 (08826-00090)) to the surface to be in contact with the gear case.



[Point 2]

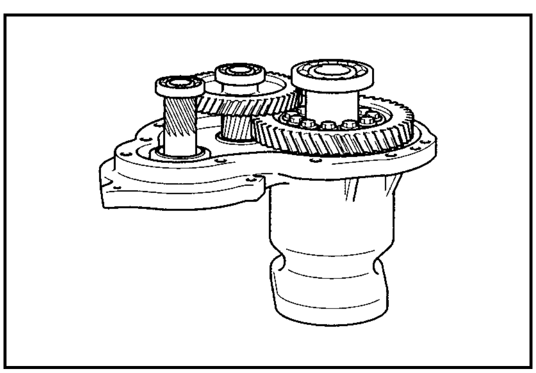
Disassembly:

Remove the bearing for reduction gear No.1.
SST 09950-76014-71
(SST 09950-40011)



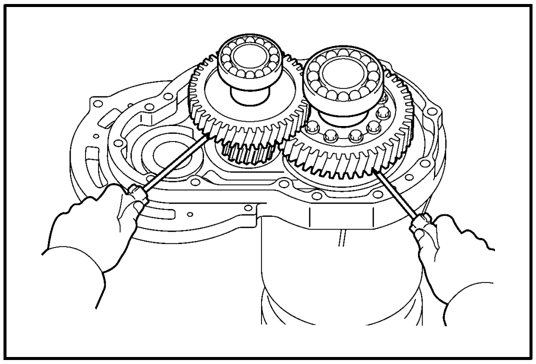
Reassembly:

Install the bearing for reduction gear No.1.
SST 09950-76018-71 .... (1)
(SST 09950-60010)
SST 09950-76020-71 .... (2)
(SST 09950-70010)
Assemble the drive unit case with the bearing seal facing the motor.



Reassembly:

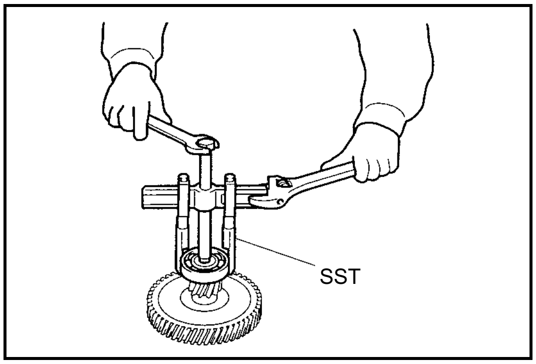
Check complete reassembly of the reduction gear No. 1, reduction gear No. 2 and differential case ASSY W/ reduction gear No. 3 in the drive unit case by tapping with a plastic hammer.



[Point 3]

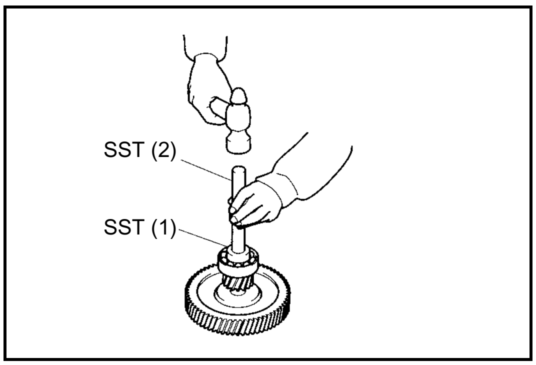
Disassembly:

Remove the differential ASSY W/reduction gear No. 3 and reduction gear No. 2 together using a screwdriver.



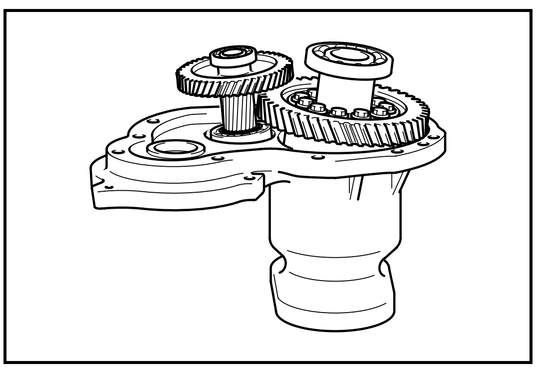
Disassembly:

Remove the bearing for reduction gear No. 2.
SST 09950-76014-71
(SST 09950-40011)



Reassembly:

Install the bearing for reduction gear No. 2.
SST 09950-76018-71 .... (1)
(SST 09950-60010)
SST 09950-76020-71 .... (2)
(SST 09950-70010)

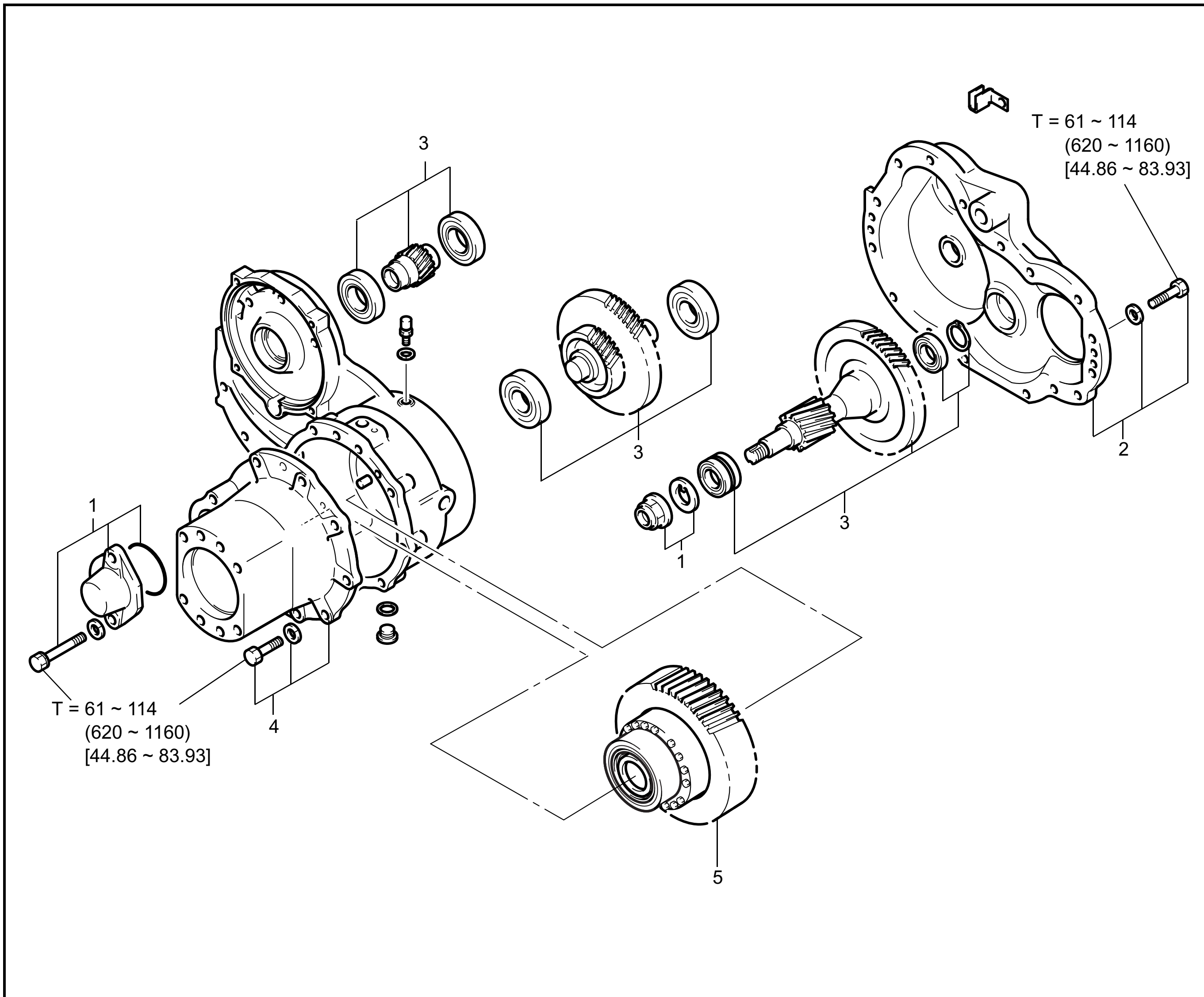


Reassembly:

Place the differential ASSY W/reduction gear No. 3 and reduction gear No. 2 obliquely into the drive unit case, and assemble them by aligning the gear portion.

DISASSEMBLY·INSPECTION·REASSEMBLY (15·18 MODEL (DEAD-MAN BRAKE), 20 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

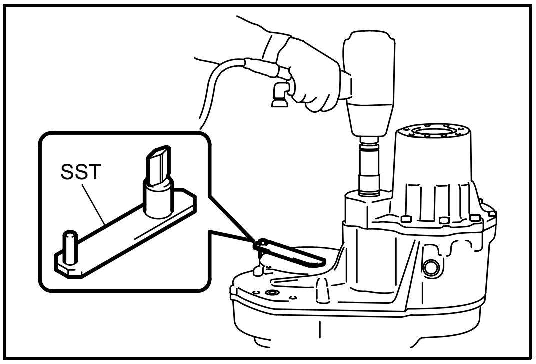
1 Remove the drive unit cap and lock nut. **[Point 1]**
2 Erect the housing with the gear case cover LH on the upper side, remove the gear case cover LH. **[Point 2]**
3 Remove the reduction gears No.1, 2 and 3. **[Point 3]**
4 Face the drive unit gear case cover RH upward, and remove the gear case cover RH. **[Point 4]**
5 Remove differential ASSY W/reduction gear shaft No. 1.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

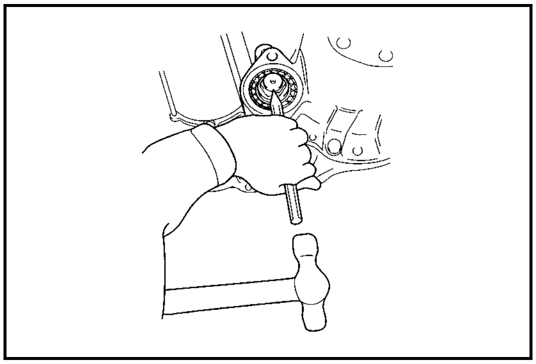
Point Operations

[Point 1]



Disassembly·Reassembly:

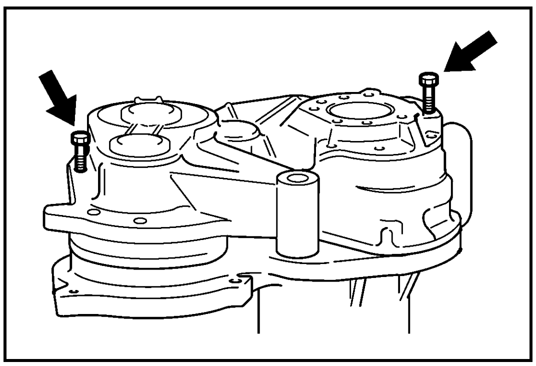
Set the SST on the spline of the input shaft, and remove the lock nut.
Take care not to give harm on the oil seal when setting SST.
SST 09330-21440-71
Tightening torque T = 167 ~ 225 N·m
(1700 ~ 2300 kgf-cm) [123 ~ 166 ft-lbt]



Reassembly:

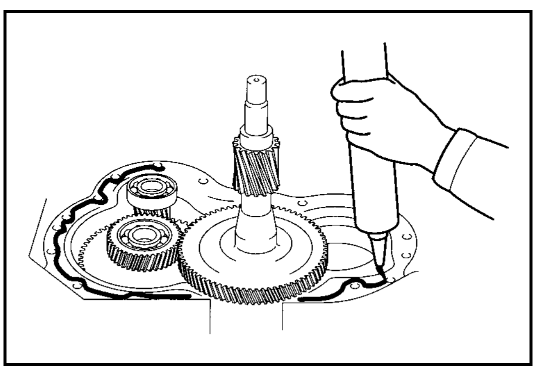
Use a punch and caulk the lock nut securely (at 2 places).

[Point 2]



Disassembly:

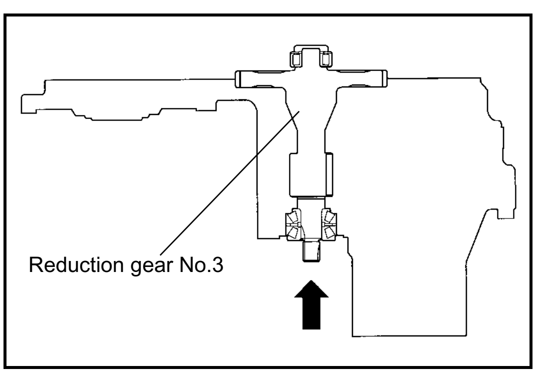
Use a service bolt and remove the gear case cover LH.
Service bolt: M14 × 1.5



Reassembly:

Apply liquid gasket (08826-76002-71 (08826-00090)) on the surface to be in contact with the gear case cover LH.

[Point 3]

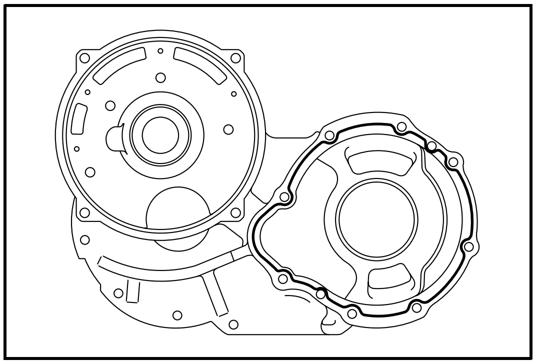


Disassembly:

As a bearing exists on the nut side end of reduction gear No.3, remove the gear by pulling it up while tapping the nut side end with a hammer.

Reassembly:

Install reduction gear No. 1 with the bearing seal facing the motor.



[Point 4]

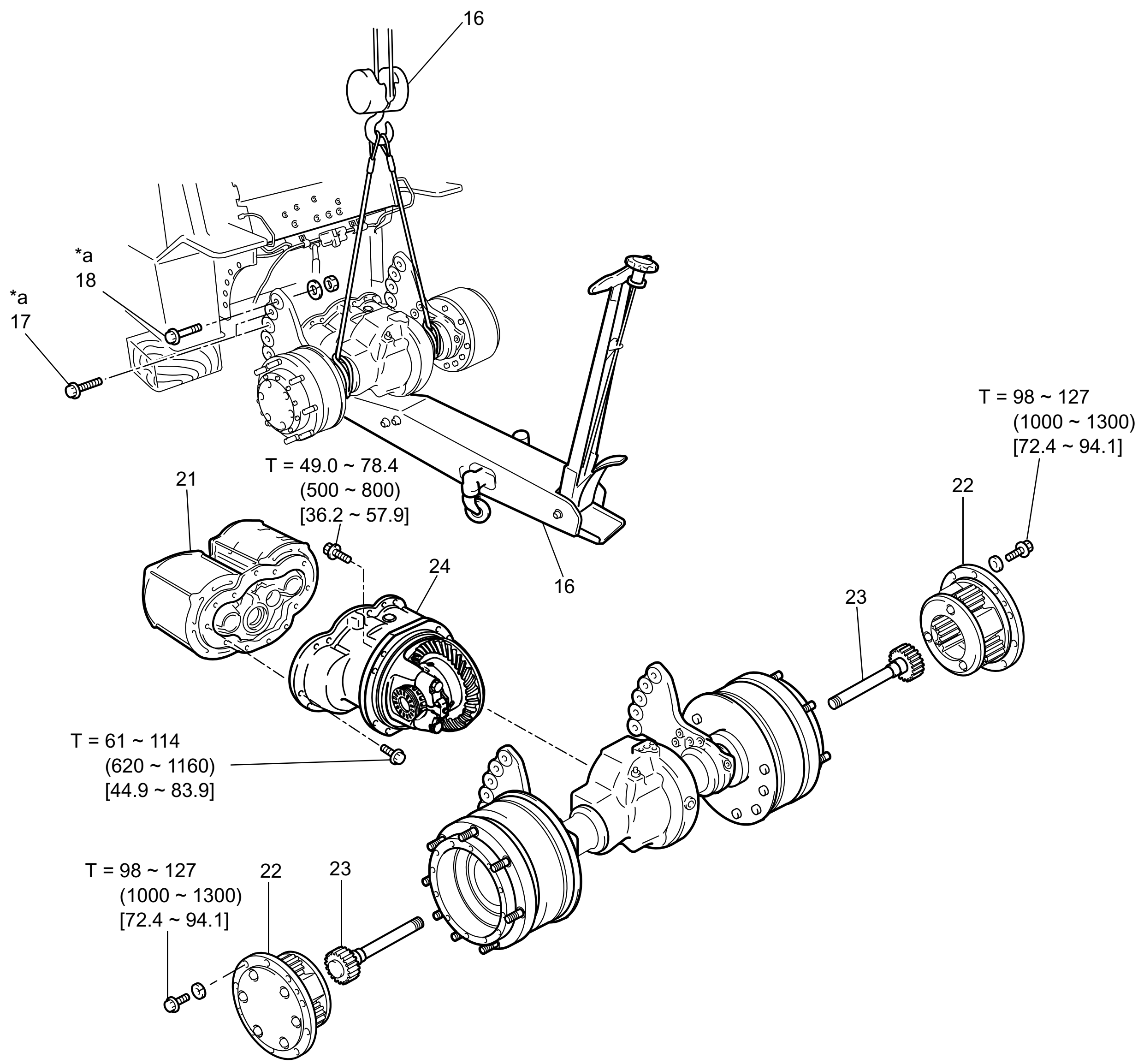
Reassembly:

Apply liquid gasket (08826-76002-71 (08826-00090)) on the surface to be incontact with the gear case cover RH.

DRIVE UNIT ASSY (35 ~ 55 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



*a Front axle bracket set bolt	35·45 model	T = 245 ~ 324 (2500 ~ 3300) [180.8 ~ 238.8]
	55 model	T = 343 ~ 441 (3500 ~ 4500) [253.2 ~ 326.6]

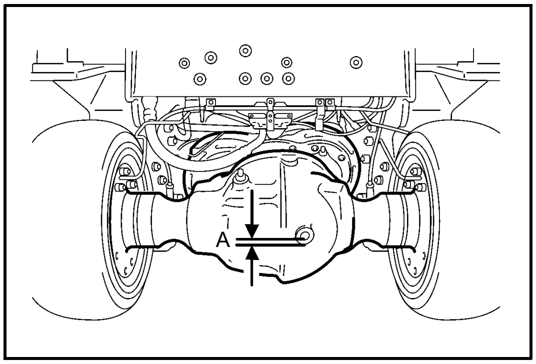
Removal Procedure

1 Remove the mast ASSY. (See page 13-10)
2 Remove the battery. (See page 1-5)
3 Drain differential oil. **[Point 1]**
4 Drain drive unit (transmission) oil. **[Point 2]**
5 Drain planetary oil. **[Point 3]**
6 Remove the toe board (front and rear), lower panel and battery stand plate.
7 Disconnect the wiring and piping from the pump motor ASSY No. 1 W/oil pump.
8 Remove the pump motor ASSY No.1 W/oil pump. **[Point 4]**
9 Remove the pump motor No. 1 bracket.
10 Jack up the vehicle, and remove the front wheels. **[Point 5]**
11 Disconnect the wiring from the drive motor ASSY.
12 Disconnect the drive motor speed sensor connector and temperature sensor connector.
13 Disconnect the parking brake wire (35·45 model: front axle side).
14 Disconnect the dead-man brake wire. (OPT) **[Point 6]**
15 Disconnect the brake piping.
16 Hoist the drive unit ASSY and support it with a garage jack. **[Point 7]**
17 Remove the front axle bracket set bolt. (through bolts)
18 Remove the front axle bracket set bolt. (reamer bolts) **[Point 8]**
19 Remove the drive unit ASSY. **[Point 9]**
20 Support the drive unit ASSY with wooden blocks and remove the hoist and garage jack.
21 Remove the drive motor ASSY. (See page 5-12)
22 Remove the planet gear carrier ASSY W/carrier cover.
23 Remove the front axle shaft.
24 Remove the differential gear case ASSY.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
After the end of installation, perform air bleeding from the brake system (See page 10-38), parking brake inspection adjustment (See page 10-56) and dead-man brake wire inspection adjustment. (See page 10-58)



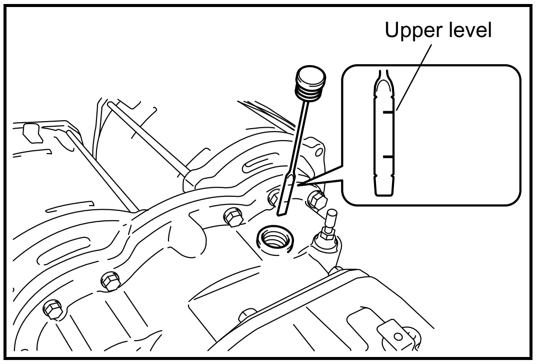
Point Operations

[Point 1]

Installation:

After installation, fill hypoid gear oil to the specified level.

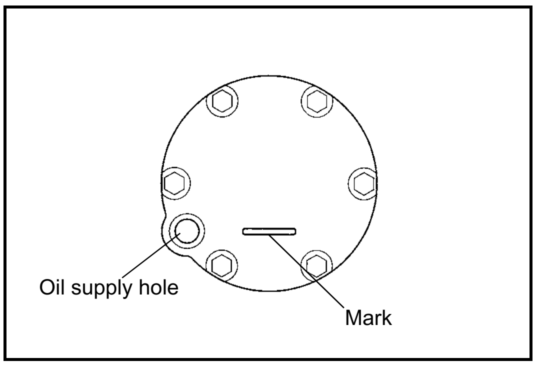
A = 20 ~ 30 mm (0.79 ~ 1.18 in)



[Point 2]

Installation:

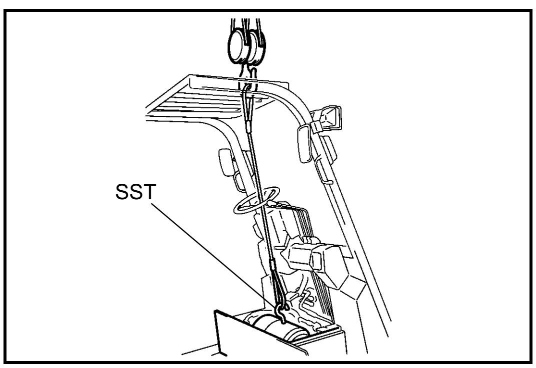
After installation, fill hypoid gear oil.
Never exceeds the upper level.



[Point 3]

Installation:

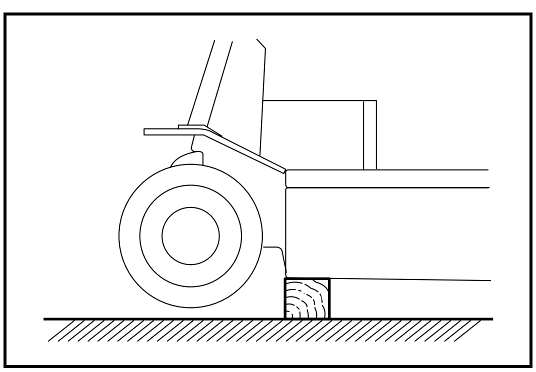
After reassembly, set the "—" mark on the carrier cover in horizontal state and fill planetary gear oil full to the brim of the oil supply hole.



[Point 4]

Installation:

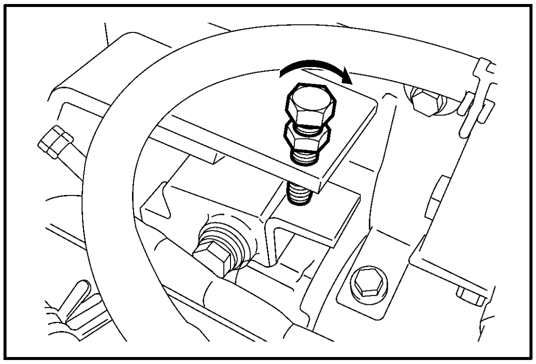
Install the SST on the pump motor and hoist it.
SST 09010-10260-71



[Point 5]

Removal·Installation:

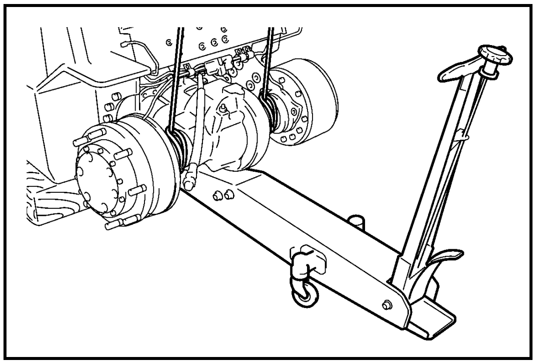
Jack up the vehicle and support the front side with wooden blocks under the frame on both sides.



[Point 6]

Removal:

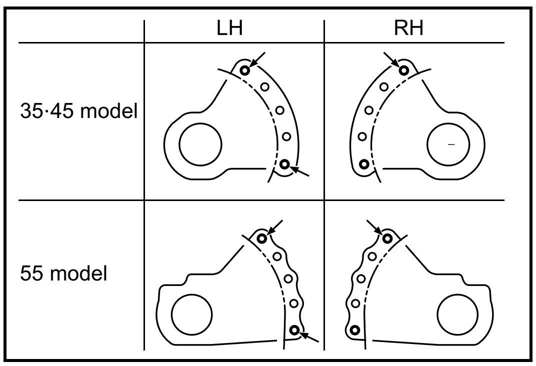
After slackening the deadman brake wire by tightening the assist bolt, disconnect the wire.



[Point 7]

Removal:

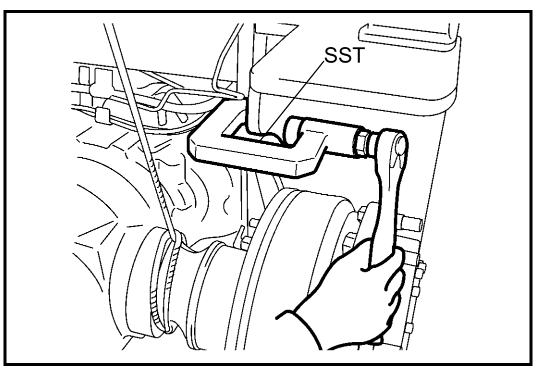
Hoist the drive unit ASSY and support it with a garage jack.



[Point 8]

Removal:

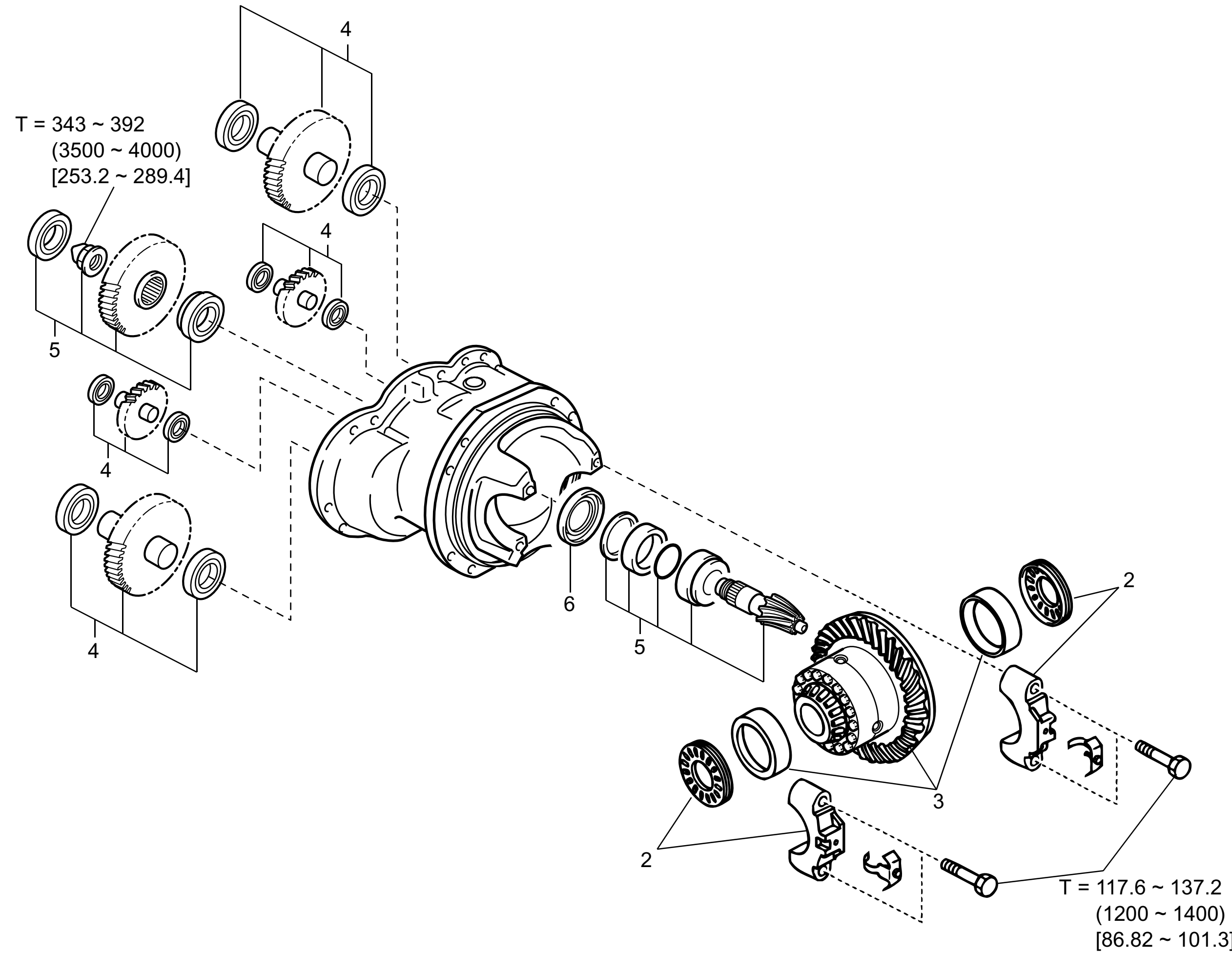
Use the SST to remove the reamer bolts in the illustrated positions.



SST 09310-23320-71

DISASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]

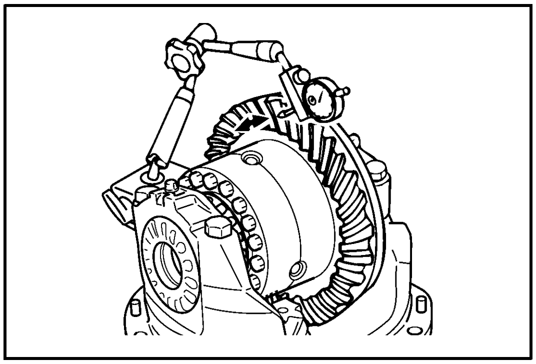


Disassembly Procedure

1 Measure the ring gear backlash. **[Point 1]**
2 Remove the bearing cap and adjusting nut. **[Point 2]**
3 Remove the differential case ASSY.
4 Remove the reduction gear No.1 and No.3. **[Point 3]**
5 Remove the drive pinion pilot bearing, lock nut, reduction gear No.2 rear drive pinion bearing and shim. **[Point 4]**
6 Remove the oil seal. **[Point 5]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.



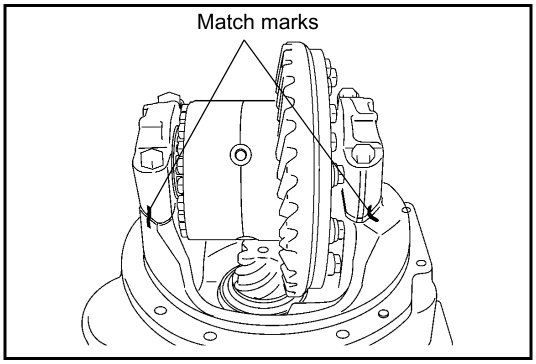
Point Operations

[Point 1]

Inspection:

Measure the ring gear backlash.

Standard: 0.2 ~ 0.3 mm (0.008 ~ 0.012 in)



[Point 2]

Disassembly:

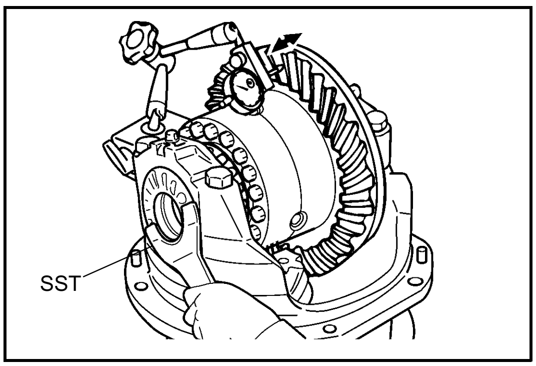
Put match marks on the bearing cap and differential housing.

Reassembly:

Install the adjusting nuts and bearing cap.

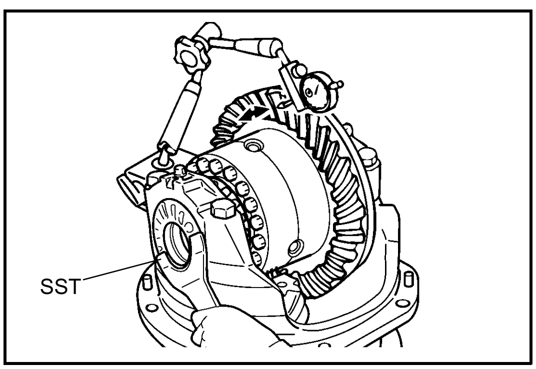
1. Install the adjusting nuts.
2. Install the bearing cap by aligning the match marks and temporarily tighten the set bolt.

   T = 19.6 N·m (200 kgf-cm) [14.5 ft-lbf]



3. Set the dial gauge in the thrust direction of the differential case.
4. Use the SST and tighten until the thrust clearance is eliminated.
   SST 09630-10110-71
5. Tighten adjusting nuts on both sides by one notch each.
6. Set the dial gauge vertical to the ring gear tooth surface, and measure the backlash.

   Standard: 0.2 ~ 0.3 mm (0.008 ~ 0.012 in)



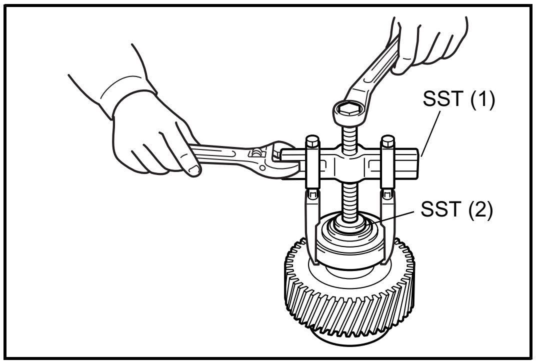
If the standard is not satisfied, adjust by turning the adjusting nut to move the differential case ASSY in the thrust direction.

(1) When the backlash is excessive:
Loosen the adjusting nut on the ring gear teeth side and tighten the adjusting nut on the rear side as much to bring the ring gear closer to the drive pinion.

(2) When the backlash is insufficient:
Loosen the adjusting nut of the rear side of the ring gear and tighten the adjusting nut on the teeth side as much to bring the ring gear away from the drive pinion.

7. Tighten the adjusting nut on the rear side of the ring gear further by 1.5 to 2 notches.
8. Install the adjusting nut lock plate.
9. Finally tighten the bearing cap set bolts.

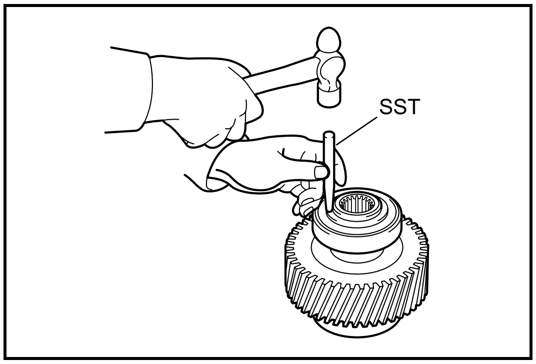
   T = 117.7 ~ 137.3 N·m (1200 ~ 1400 kgf-cm) [86.82 ~ 101.3 ft-lbf]



[Point 3]

Disassembly:

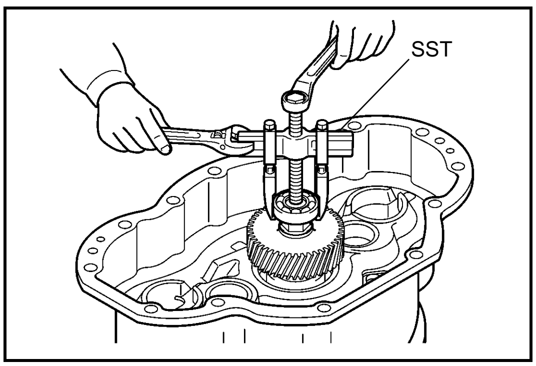
Remove the bearings from reduction gears No. 1 and No. 3.
SST 09950-76014-71 .... (1)
(SST 09950-40011)
SST 09950-76018-71 .... (2)
(SST 09950-60010)



Reassembly:

Install the bearing for reduction gears No. 1 and No. 3.
SST 09700-30200-71

Install reduction gear No. 1 with the bearing seal facing the motor.



[Point 4]

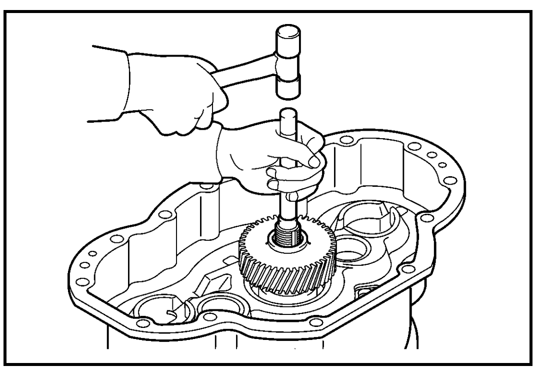
Disassembly:

Remove the drive pinion pilot bearing, lock nut, reduction gear No. 2, rear drive pinion bearing, shim(s) and drive pinion.

1. Remove the drive pinion pilot bearing.
   SST 09950-76014-71
   (SST 09950-40011)

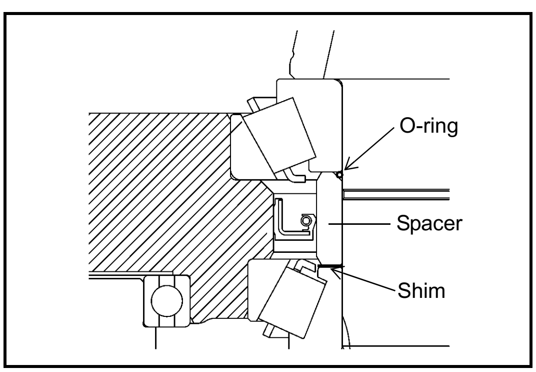
2. Remove the caulk from the lock nut.

3. Apply a wooden block to prevent the gear from rotating.



4. Remove the lock nut.

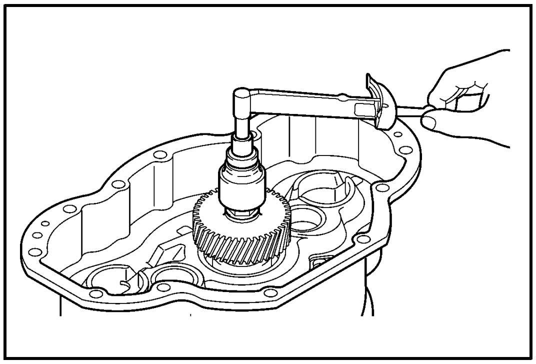
5. Use a plastic hammer to remove the drive pinion bearing and the drive pinion.



Reassembly:

Install the drive pinion, shims, rear drive pinion bearing, reduction gear No. 2, lock nut and drive pinion pilot bearing.

1. While supporting the drive pinion, install the O-ring, spacer, shim(s), rear drive pinion bearing, reduction gear No. 2 and lock nut.



2. Apply a wooden block to prevent the gear from rotating.

3. Tighten the lock nut to the specified torque.

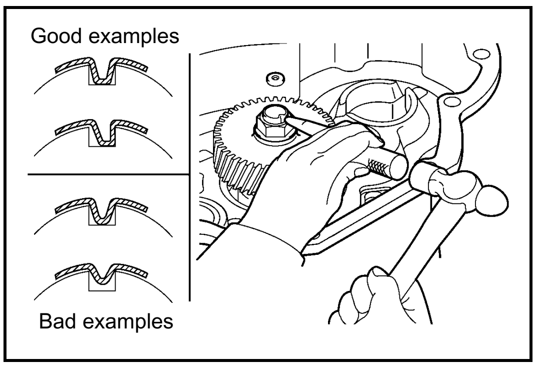
4. Remove the wooden block.

5. Measure the drive pinion starting torque.

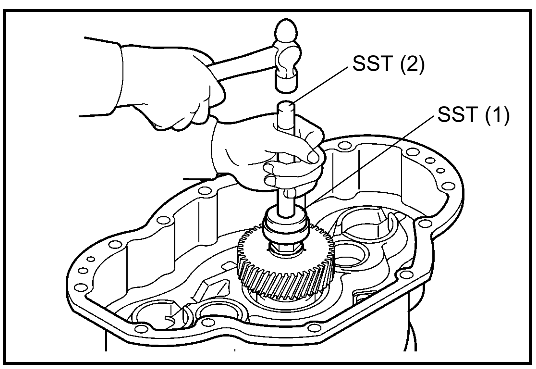
   Standard: 4.90 ~ 8.82 N·m (50 ~ 90 kgf·cm)

   If the standard is not satisfied, make adjustment by increasing or decreasing the shim thickness:

   Shim thickness:
   0.13, 0.10, 0.15, 0.35 and 0.40 mm
   (0.0051, 0.0039, 0.0059, 0.018 and 0.016 in)

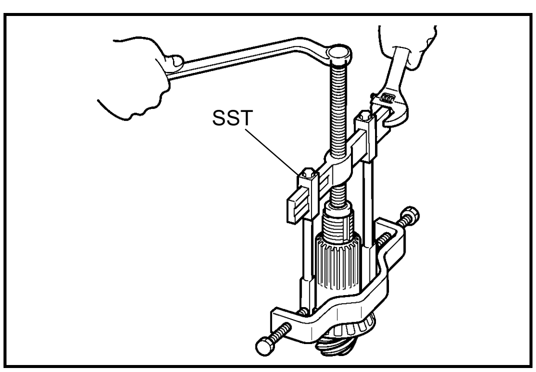


6. Securely caulk the lock nut.

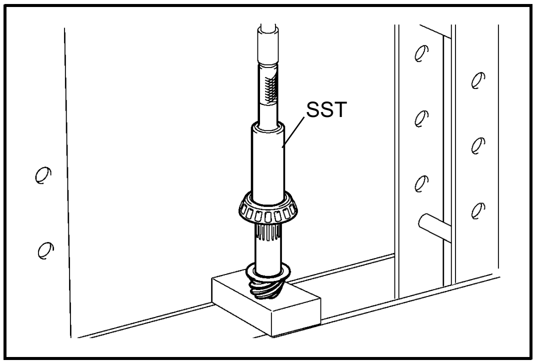


7. Install the drive pinion pilot bearing.

   SST 09950-76018-71..... (1)
   (SST 09950-60010)
   SST 09950-76020-71..... (2)
   (SST 09950-70010)

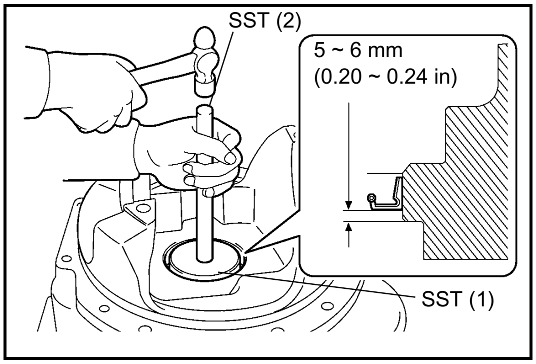


Disassembly:
Remove the front drive pinion bearing.
SST 09950-76014-71
(SST 09950-40011)



Reassembly:

Install the front drive pinion bearing.
SST 09316-76008-71
(SST 09316-60011)



[Point 5]

Reassembly:

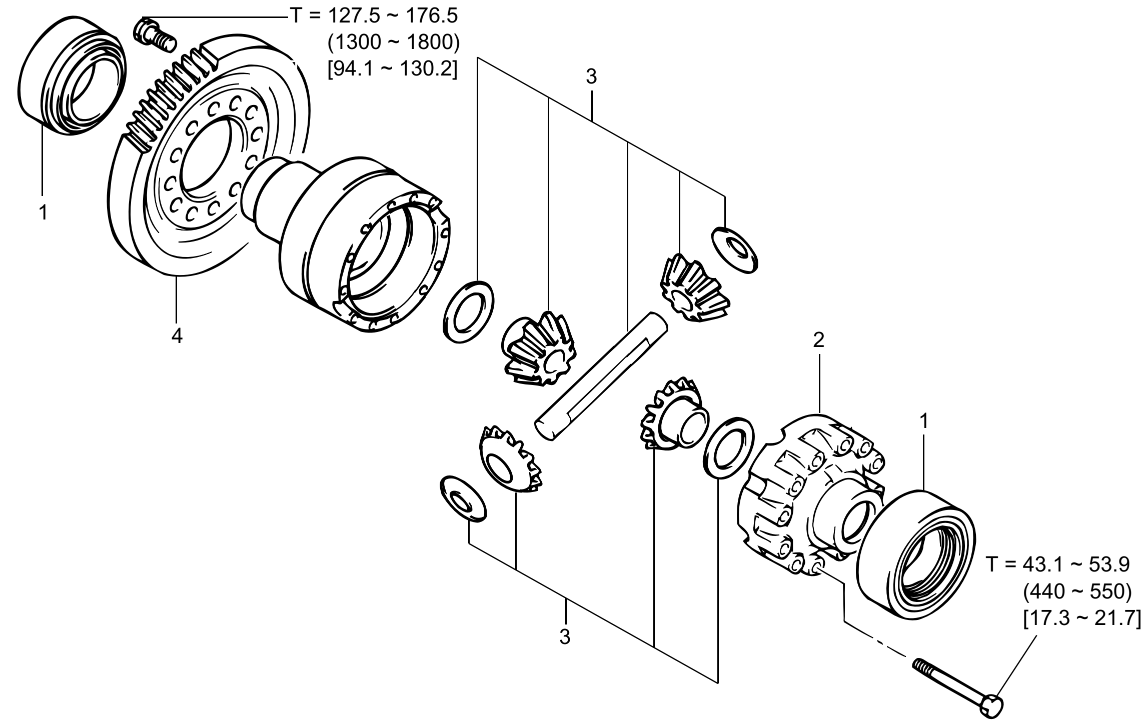
Install the oil seals in correct positions.
SST 09950-76018-71 .... (1)
(SST 09950-60010)
SST 09950-76020-71 .... (2)
(SST 09950-70010)

DIFFERENTIAL CASE ASSY

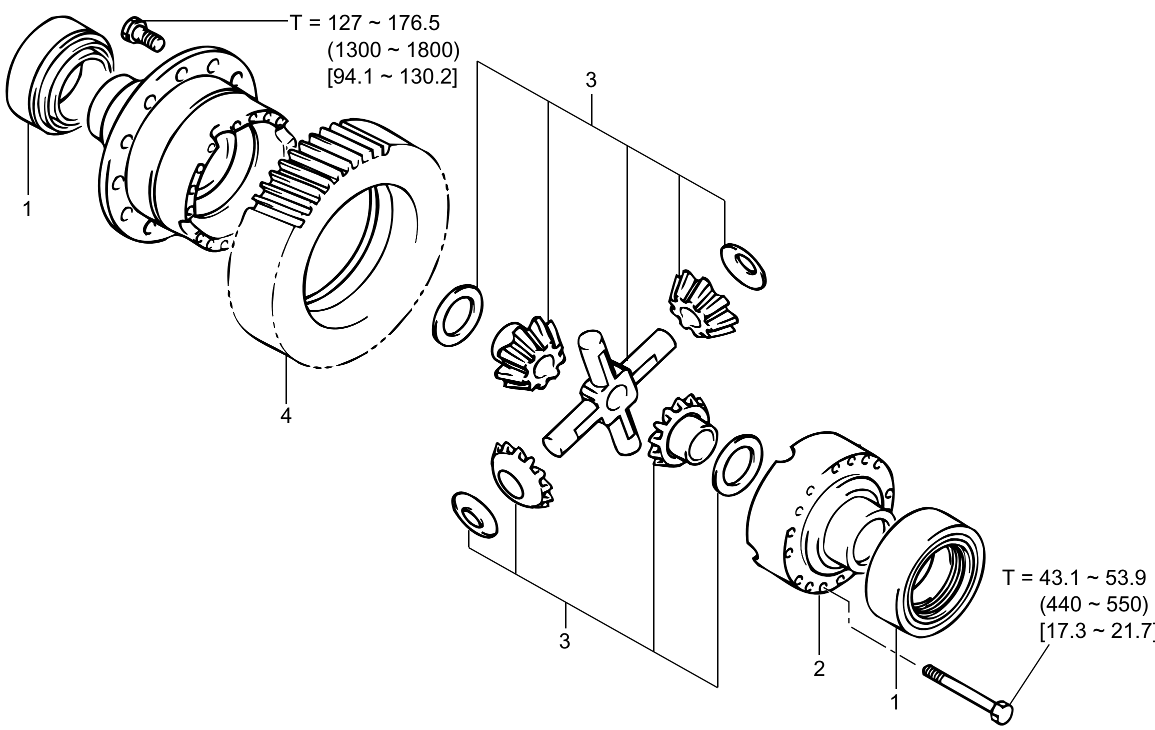
DISASSEMBLY·INSPECTION·REASSEMBLY (15 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]

15·18 model



20 ~ 32 model

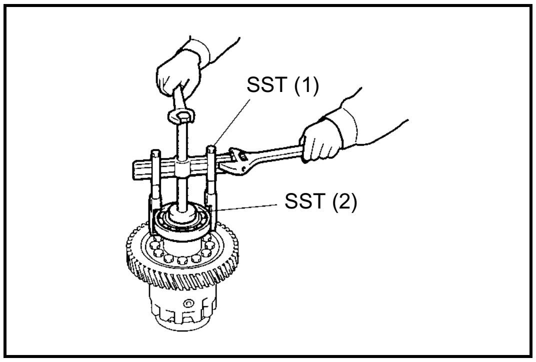


Disassembly Procedure

1 Remove the differential case bearings. **[Point 1]**
2 Remove the differential upper case. **[Point 2]**
3 Remove the side gear and pinion gear. **[Point 3]**
4 Remove the ring gear. **[Point 4]**

Reassembly Procedure

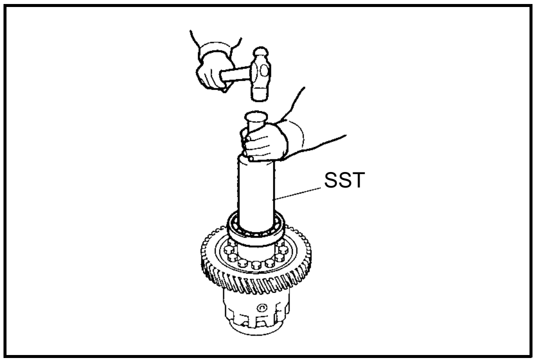
The reassembly procedure is the reverse of the disassembly procedure.



Point Operations

[Point 1]

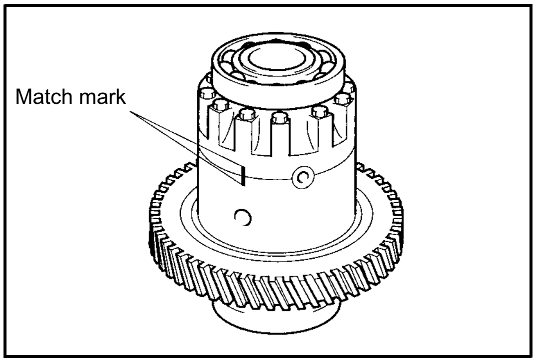
Disassembly:
SST 09950-76013-71 .... (1)
(SST 09950-40010)
SST 09950-76018-71 .... (2)
(SST 09950-60010)



Reassembly:
Install the side bearing.

1. Use the SST and install the side bearing up to the end face of the case.
   SST 09370-10410-71

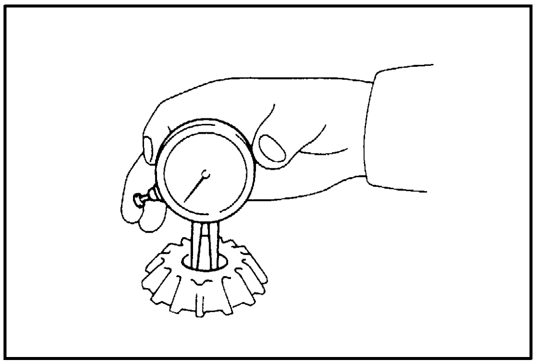
2. Use an appropriate tool and hammer to drive the bearing fully in.



[Point 2]

Disassembly·Reassembly:
Check the match mark.

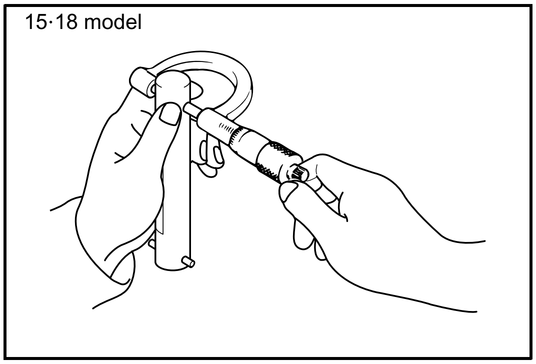
Reassembly:
Apply locking agent (08833-76001-71 (08833-00070)) on the threaded portion of the set bolt.

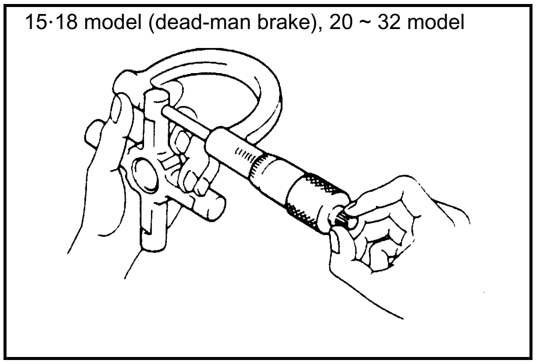


[Point 3]

Inspection:
Measure the differential pinion inside diameter.

Standard: 22.12 mm (0.8709 in)
Limit: 22.22 mm (0.8748 in)

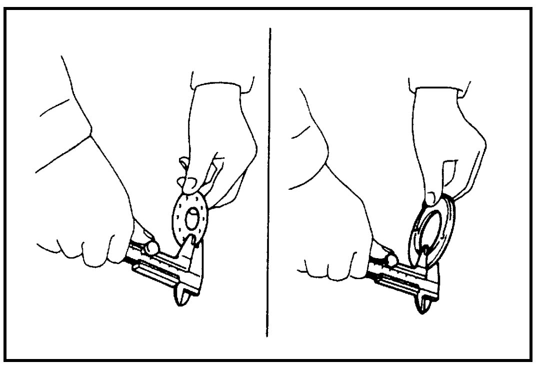




Inspection:

Measure the spider outside diameter.

Standard: 22.00 mm (0.8661 in)
Limit: 21.75 mm (0.8563 in)



Inspection:

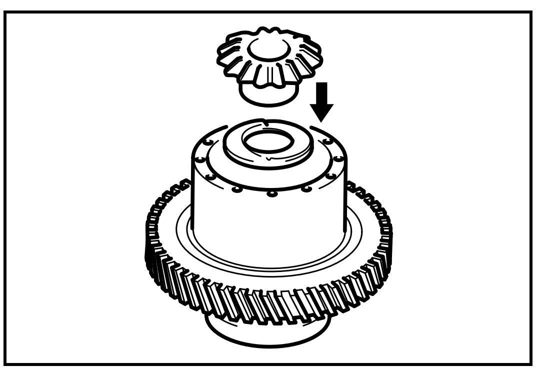
Measure the side gear thrust washer thickness.

Standard: 1.6 mm (0.063 in)
Limit: 1.3 mm (0.051 in)

Inspection:

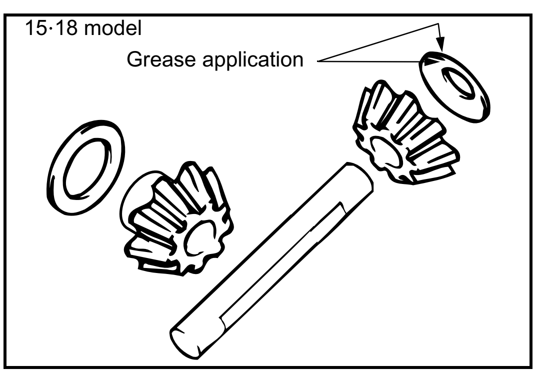
Measure the pinion gear thrust washer thickness.

Standard: 1.6 mm (0.063 in)
Limit: 1.0 mm (0.039 in)



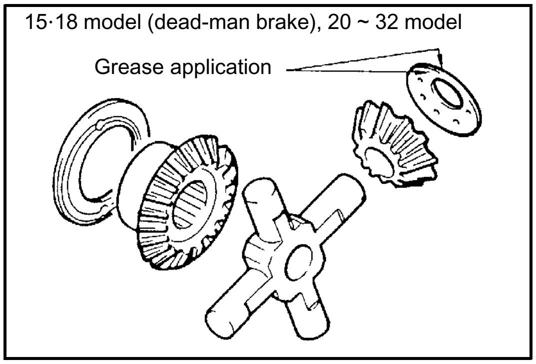
Reassembly:

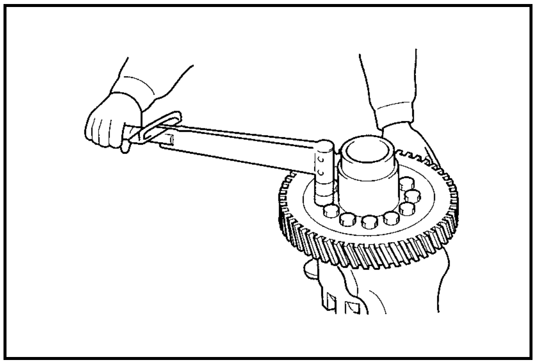
Install the side gear thrust washer with its oil groove facing the tooth flank.



Reassembly:

Apply chassis grease (molybdenum disulfide grease) on both sides of the spider pinion thrust washer before reassembly.





[Point 4]

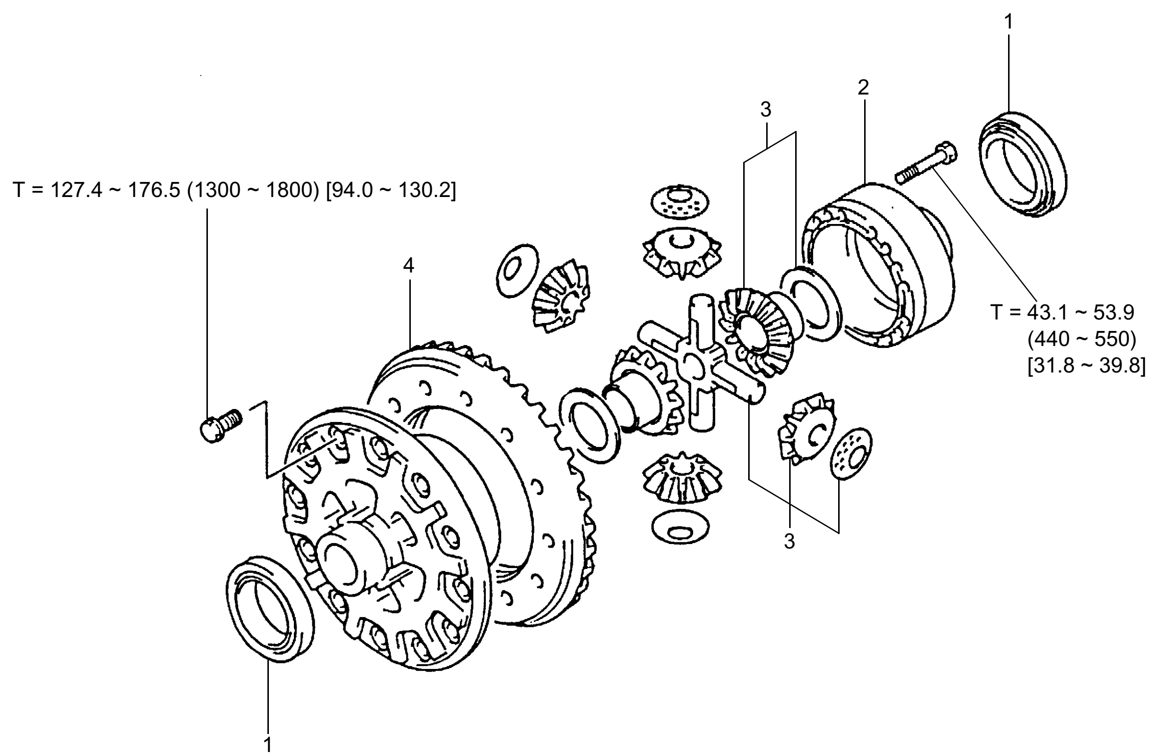
Reassembly:

Apply locking agent (08833-76001-71 (08833-00070)) on the threaded portion of the set bolts. Tighten them gradually first in the diagonal order, and finally tighten them in the circular order to the specified torque.

T = 127.5 ~ 176.5 N·m
(1300 ~ 1800 kgf-cm)
[94.1 ~ 130.2 ft-lbf]

DISASSEMBLY·INSPECTION·REASSEMBLY (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]

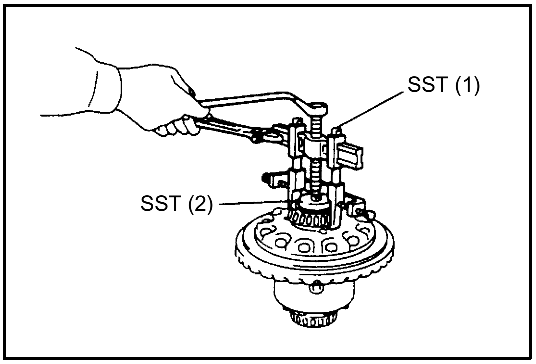


Disassembly Procedure

1 Remove the differential case bearings. **[Point 1]**
2 Remove the differential upper case. **[Point 2]**
3 Remove the side gear and pinion gear. **[Point 3]**
4 Remove the ring gear. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

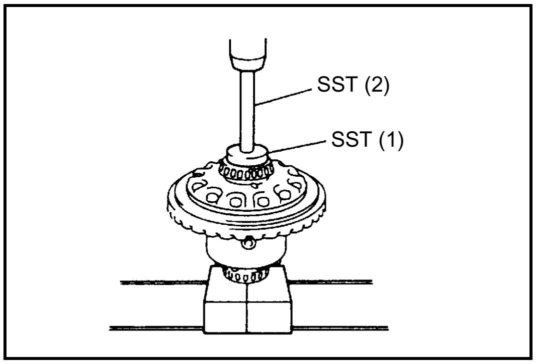


Point Operations

[Point 1]

Disassembly:

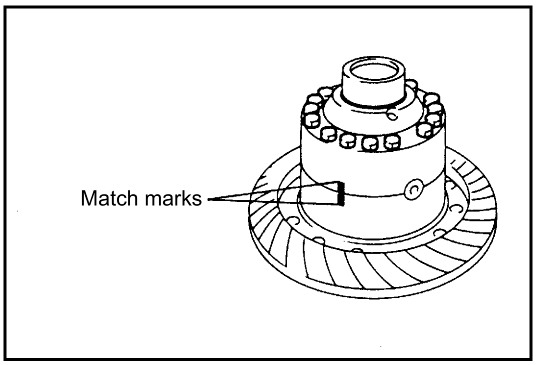
SST 09950-76014-71 .... (1)
(SST 09950-40011)
SST 09950-76018-71 .... (2)
(SST 09950-60010)



Reassembly:

Install the side bearing.

1. Use the SST and drive in the side bearing to the end surface.
   SST 09950-76019-71..... (1)
   (SST 09950-60020)
   SST 09950-76020-71..... (2)
   (SST 09950-70010)
2. Use a striking driver and fully drive in the bearing.



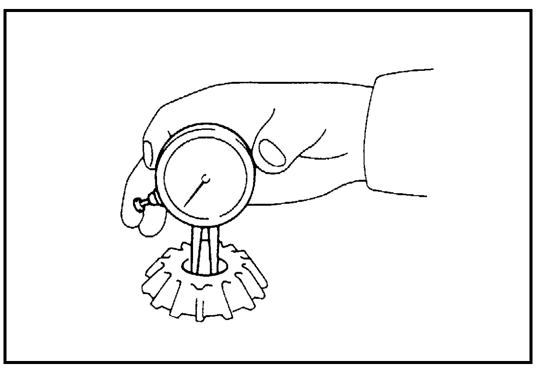
[Point 2]

Disassembly·Reassembly:

Check the match marks.

Reassembly:

Apply locking agent (08833-76001-71 (08833-00070)) on the set bolt threaded portion before reassembly.

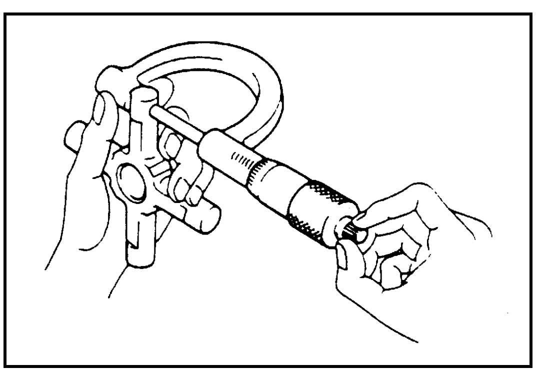


[Point 3]

Inspection:

Measure the inside diameter of the differential pinion.

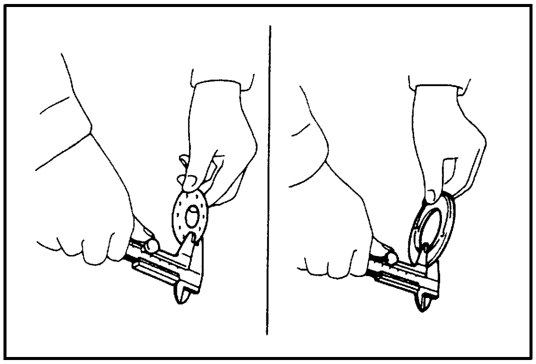
Standard: 22.12 mm (0.8709 in)
Limit: 22.22 mm (0.8748 in)



Inspection:

Measure the spider outside diameter.

Standard: 22.00 mm (0.8661 in)
Limit: 21.75 mm (0.8563 in)

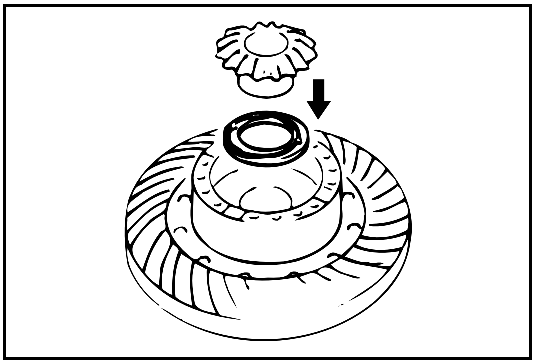


Inspection:
Measure the side gear thrust washer thickness.

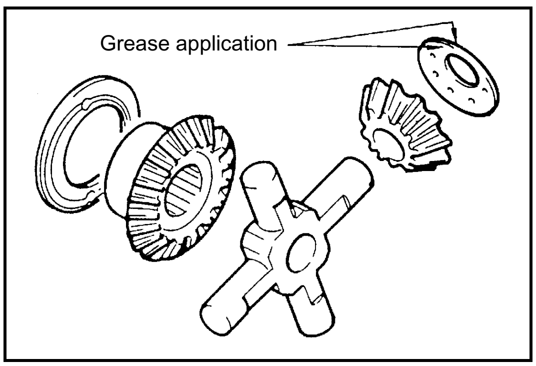
Standard: 1.6 mm (0.063 in)
Limit: 1.3 mm (0.051 in)

Inspection:
Measure the pinion gear thrust washer thickness.

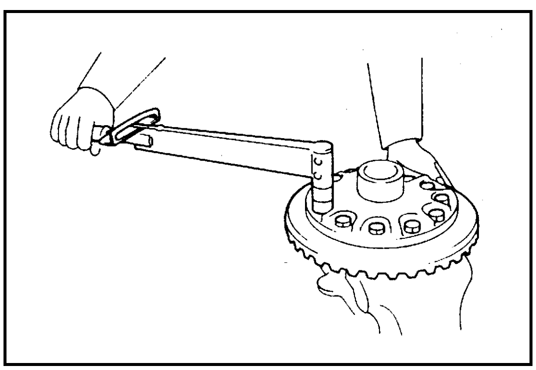
Standard: 1.6 mm (0.063 in)
Limit: 1.0 mm (0.039 in)



Reassembly:
Install the side gear thrust washer with its oil groove facing the gear.



Reassembly:
Apply chassis grease (molybdenum disulfide grease) on both sides of the spider pinion thrust washer before reassembly.



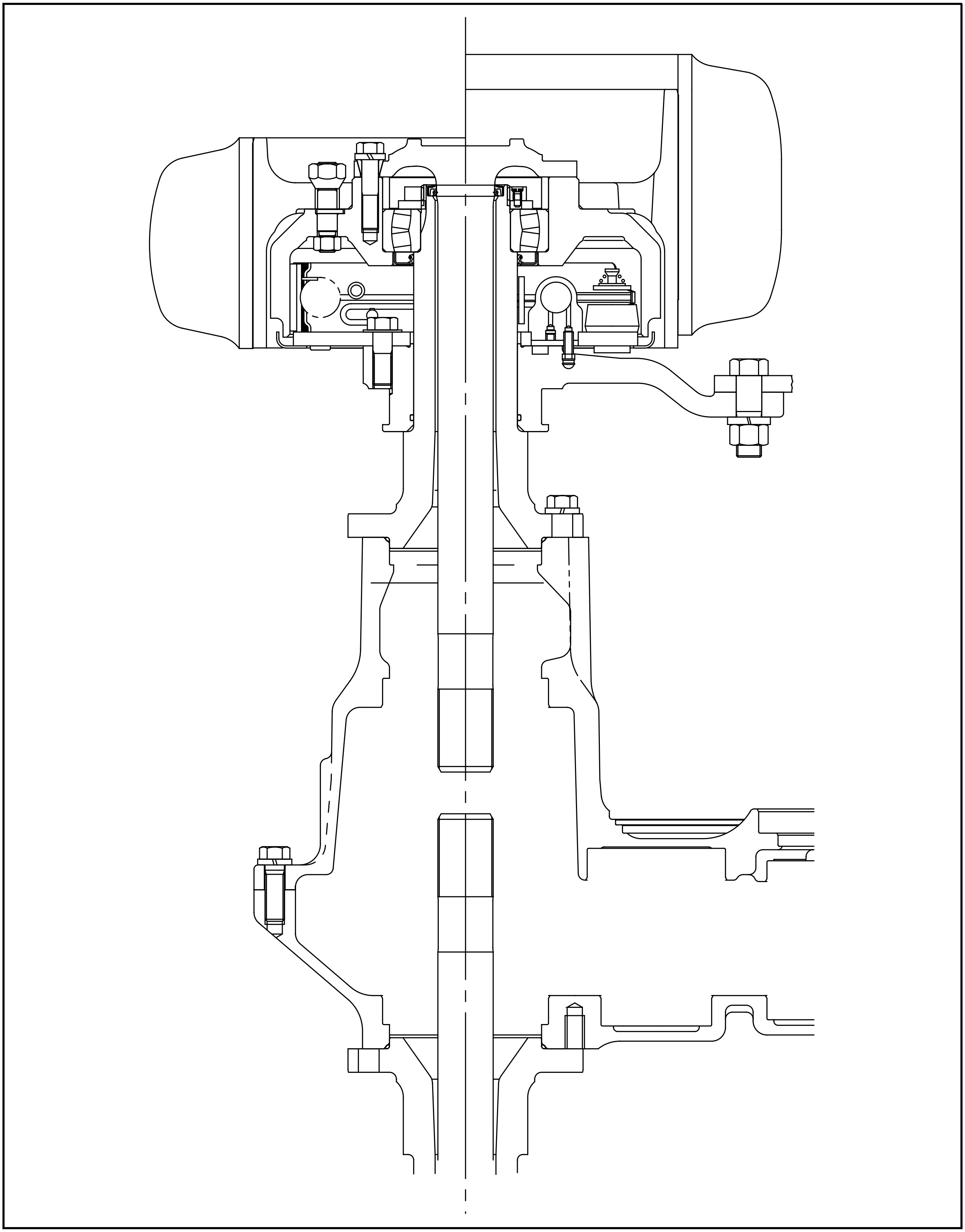
[Point 4]

Reassembly:
Apply locking agent (08833-76001-71(08833-00070)) on the set bolt threaded portion before reassembly. Tighten the set bolts gradually in the diagonal order, and finally tighten in the circular order to the specified torque.

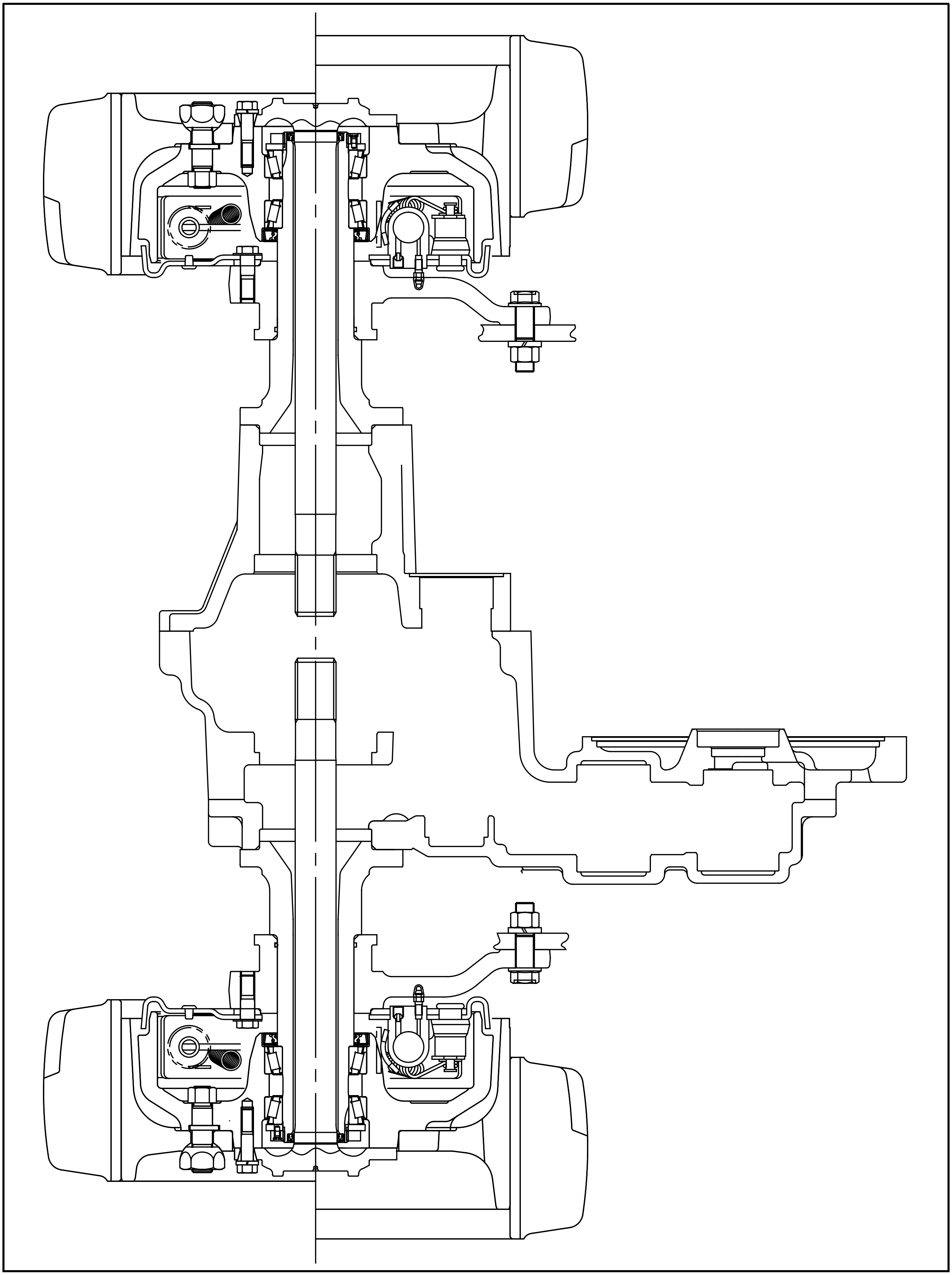
FRONT AXLE

GENERAL

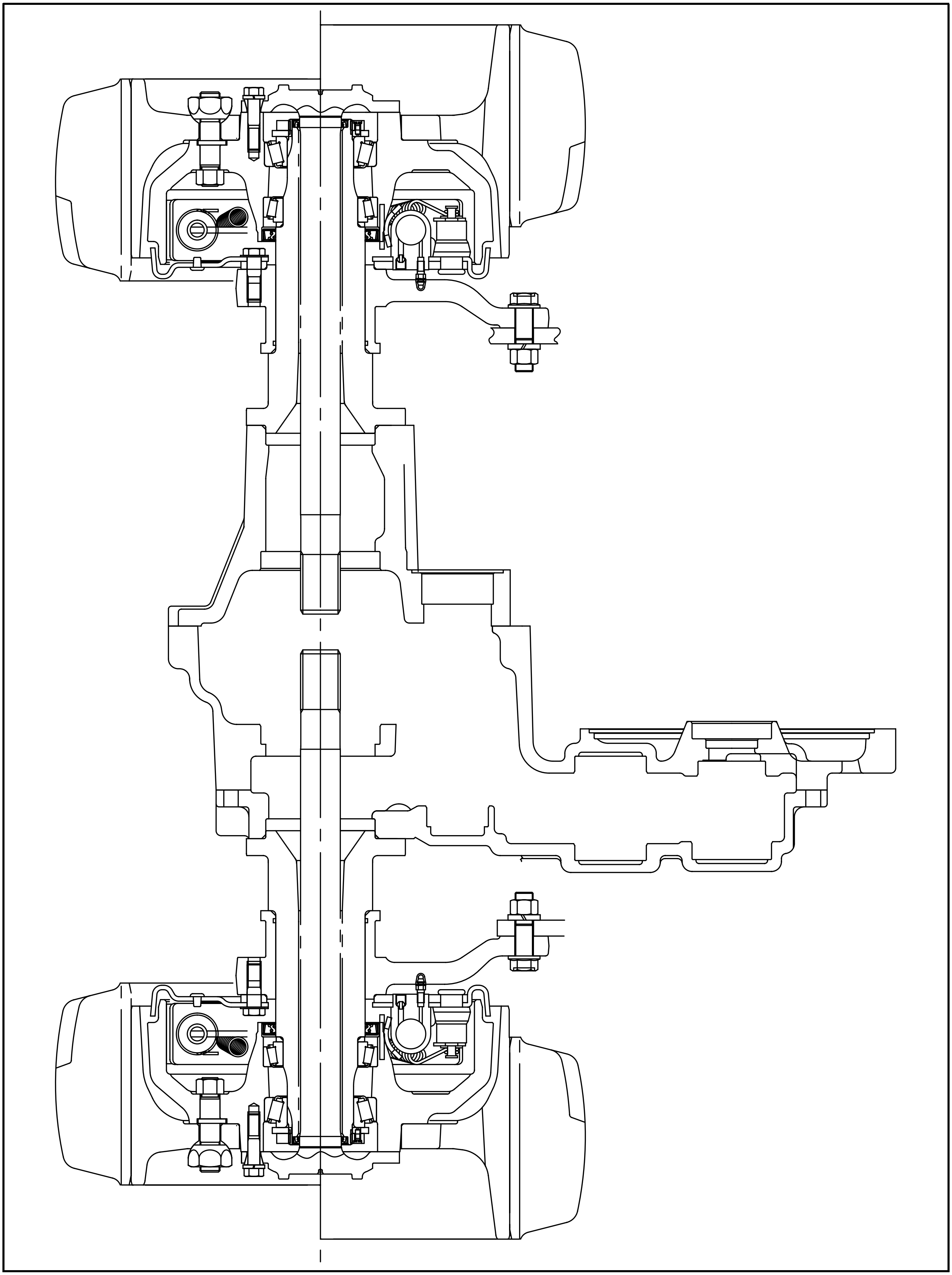
15·18 Model



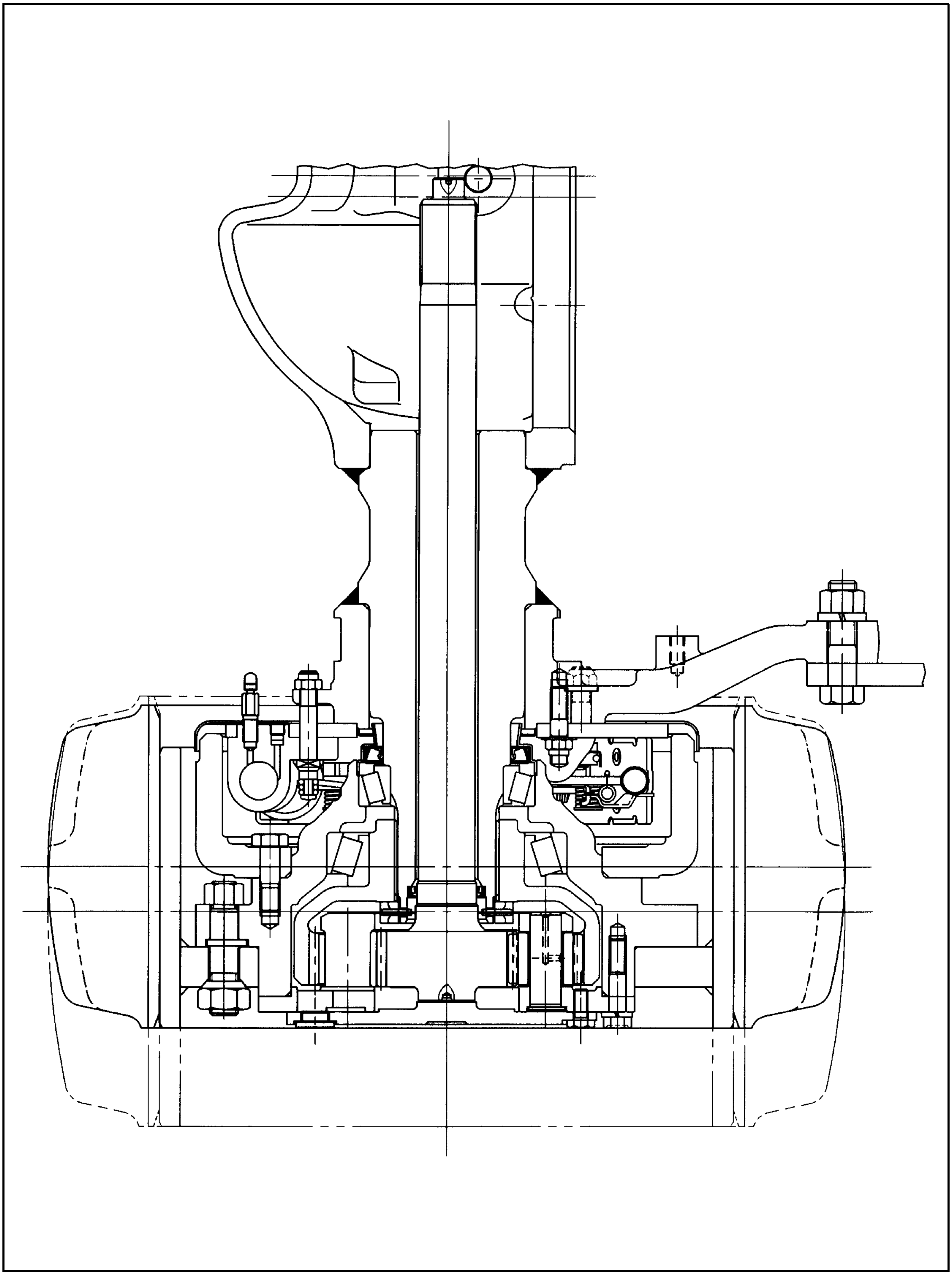
20·25 Model



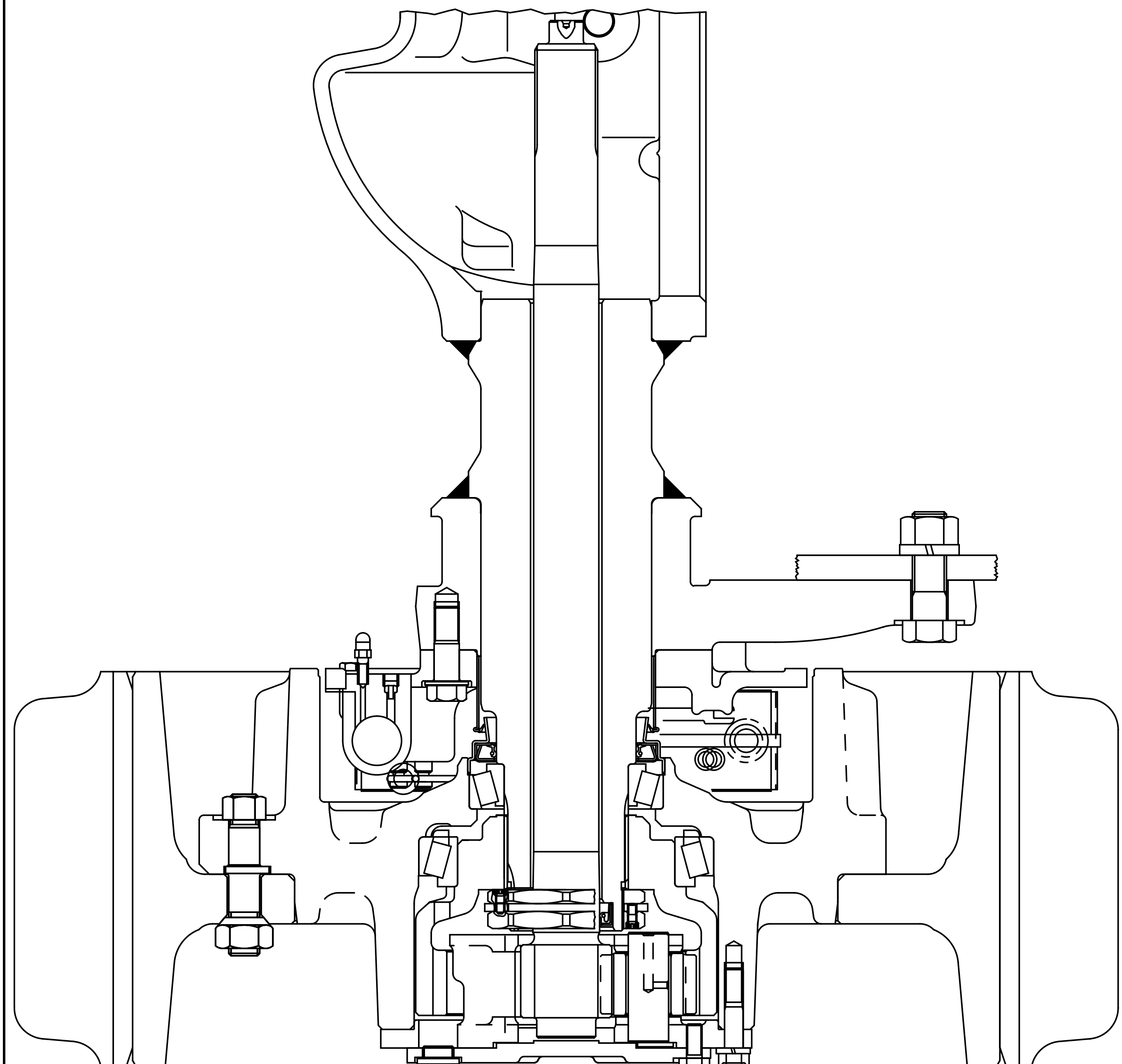
30·32 Model



35·45 Model



55 Model



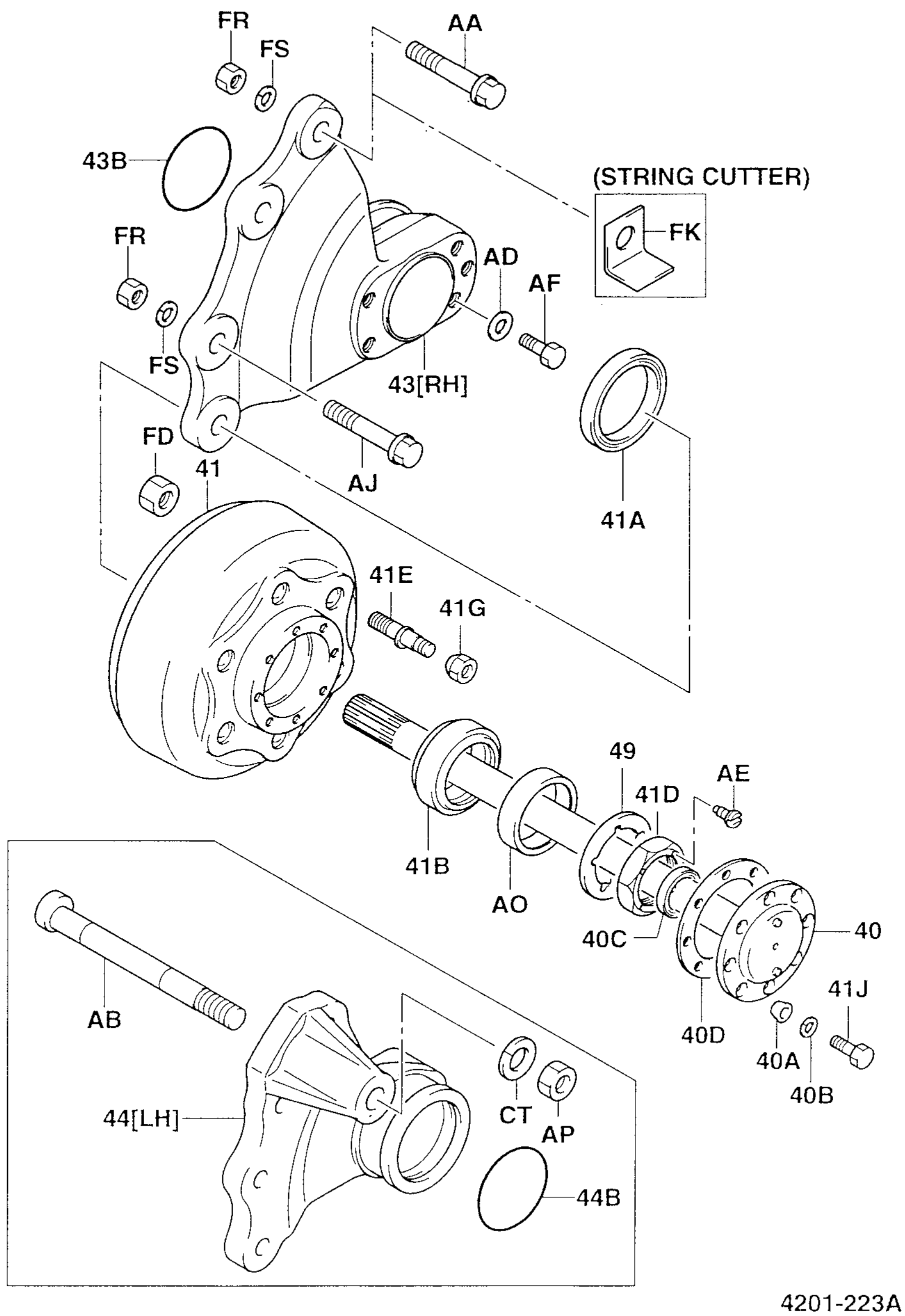
SPECIFICATIONS

Item \ Model	15 ~ 32	35·45	55
Front axle type	Full-floating		
Suspension type	Fixed to frame		
Reduction gear type	—	Planetaty gear reduction	
Reduction ratio	—	3.0	4.25

COMPONENTS

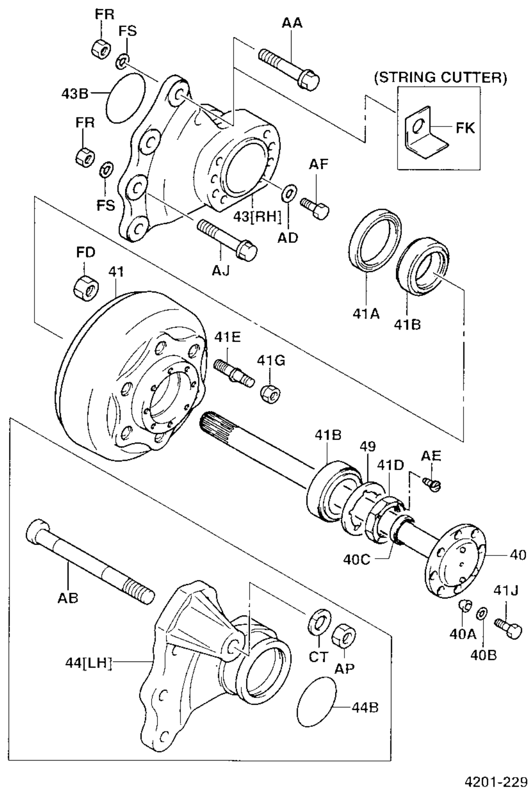
15·18 model

4201

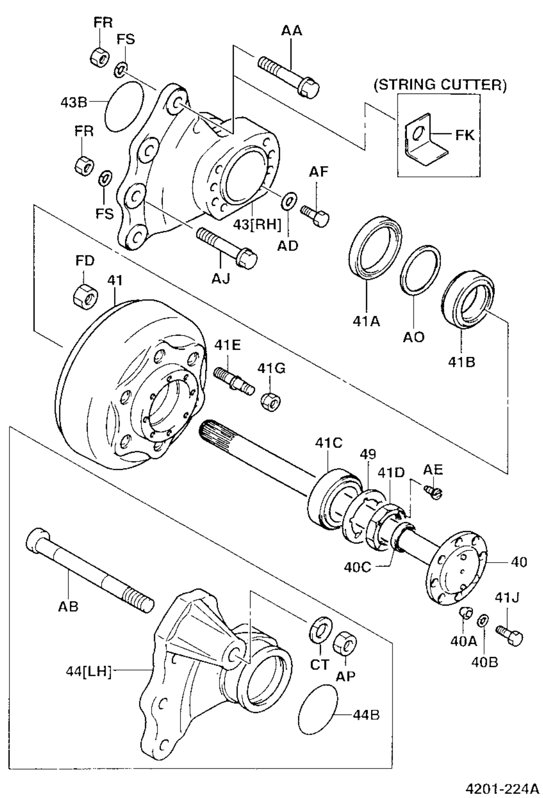


20·25 model

4201

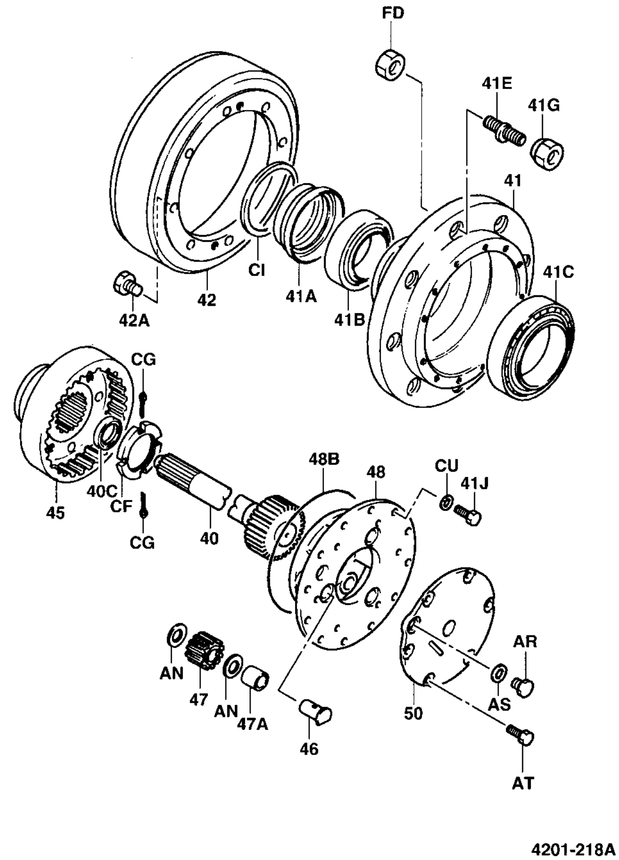


30·32 model

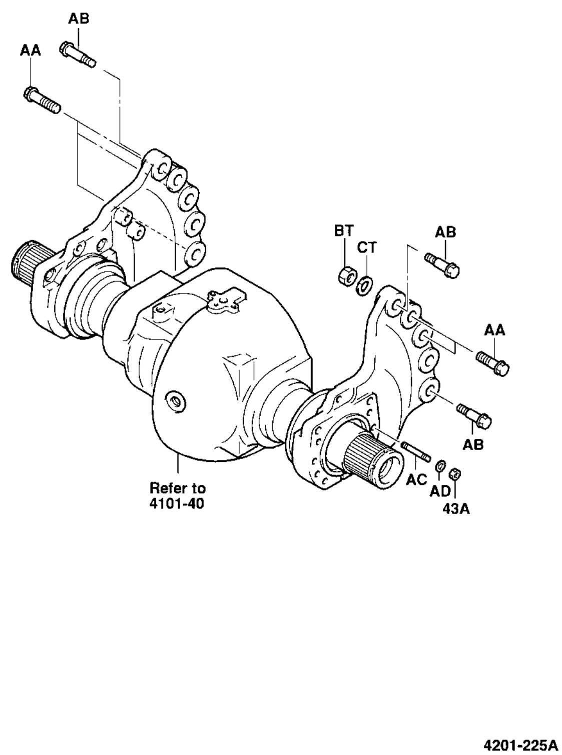


35·45 model

4201

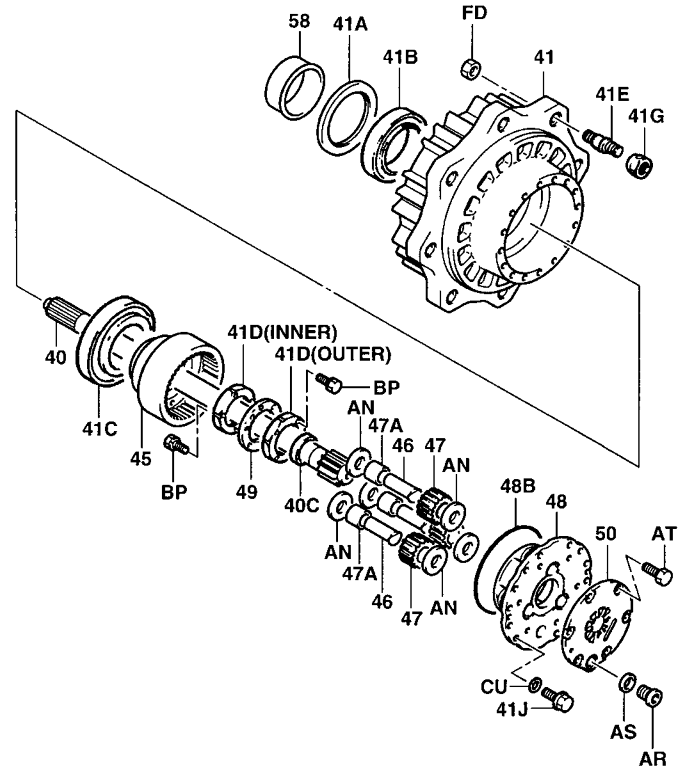


35·45 model



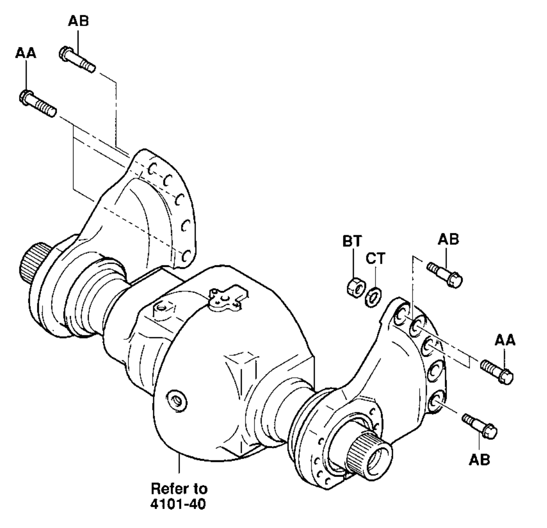
55 model

4201



4201-219A

55 model



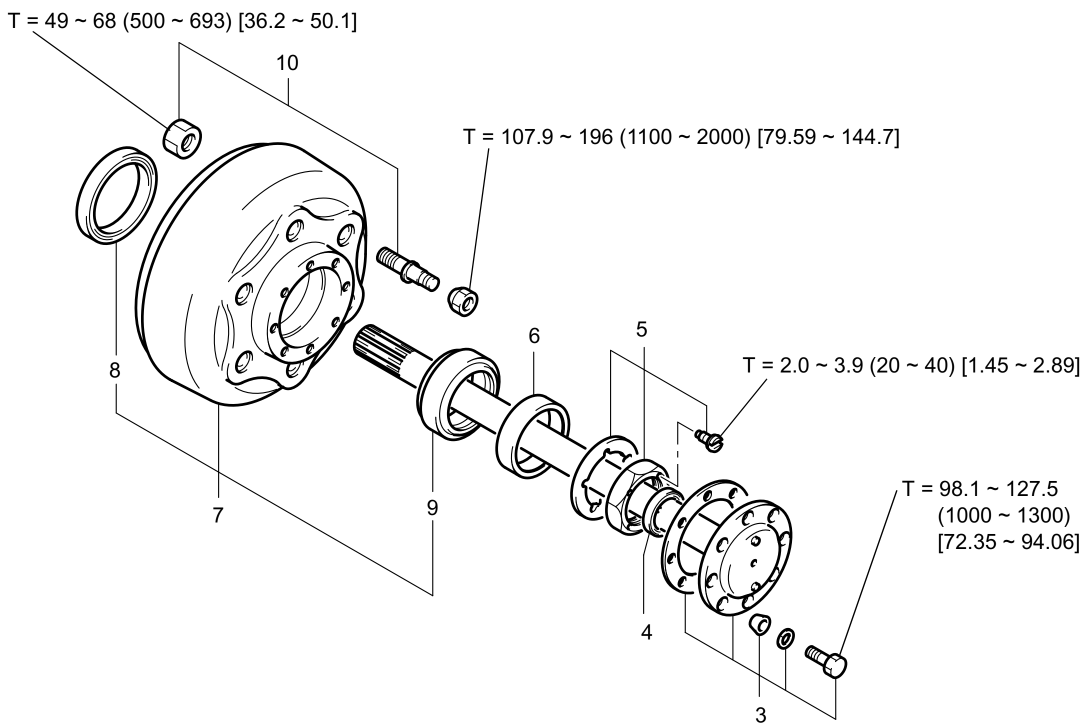
4201-226A

FRONT AXLE SHAFT·AXLE HUB (15 ~ 32 MODEL)

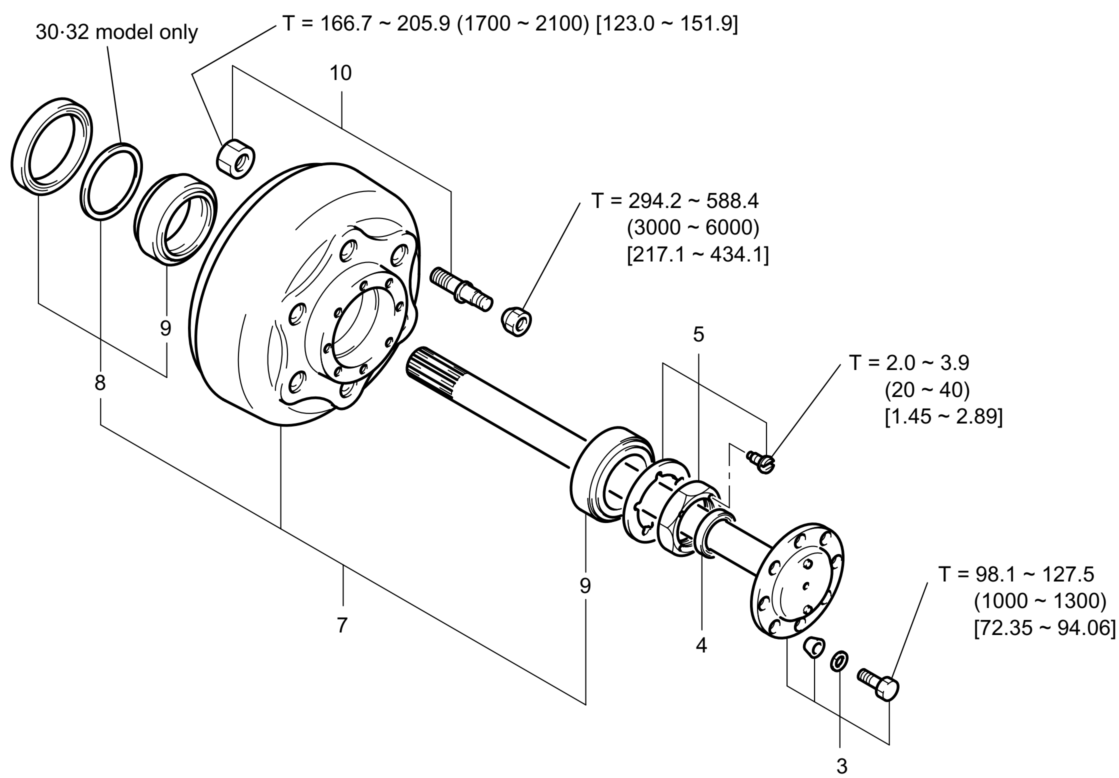
REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]

15·18 model



20 ~ 32 model



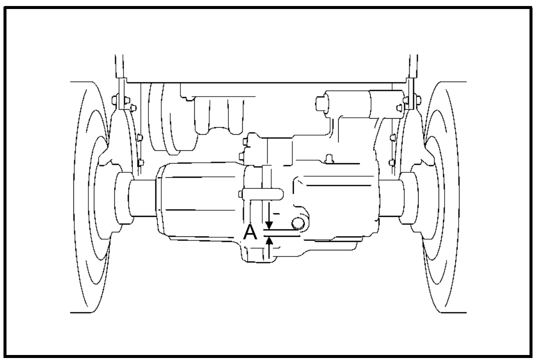
Removal Procedure

1 Drain drive unit oil. **[Point 1]**
2 Jack up the vehicle and remove front wheel.
3 Remove the front axle shaft. **[Point 2]**
4 Remove the axle shaft oil seal. **[Point 3]**
5 Remove the bearing lock nut and plate. **[Point 4]**
6 15·18 model: Remove the spacer.
7 15·18 model: Remove the front axle hub W/bearing. **[Point 5]**
20 ~ 32 model: Remove the outer bearing roller and front axle hub. **[Point 5]**
8 15·18 model: Remove the oil seal. **[Point 6]**
20 ~ 32 model: Remove the oil seal and inner bearing roller. **[Point 6]**
9 15·18 model: Remove the bearing. **[Point 6]**
20 ~ 32 model: Remove the bearing outer race. **[Point 6]**
10 Remove the hub bolt.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

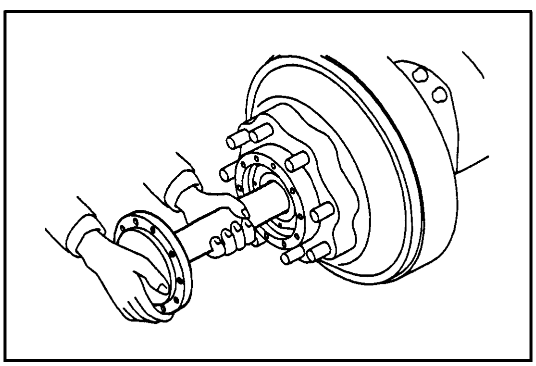
Point Operations



[Point 1]

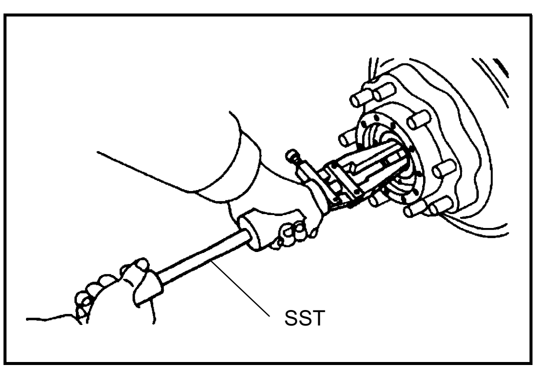
Installation:
Fill Hypoid gear oil to the specified level after installation.

A = within 15 mm (0.059 in)



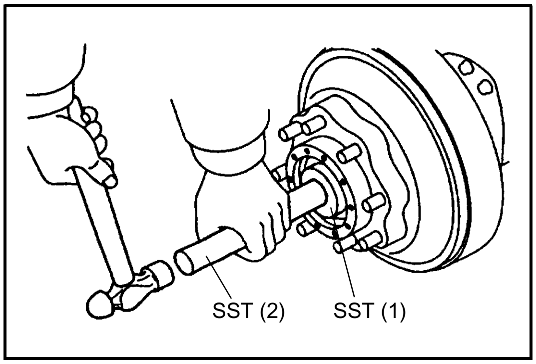
[Point 2]

Removal·Installation:
Carefully operate so as not to damage the oil seal by contact with the axle shaft.

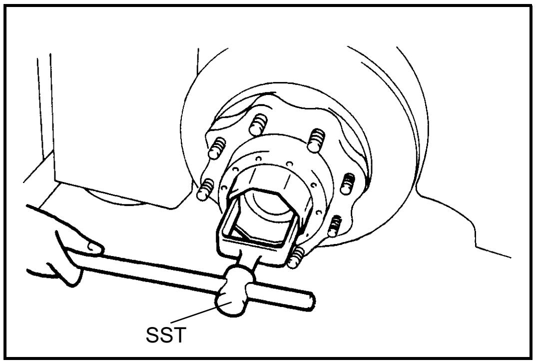


[Point 3]

Removal:
SST 09320-23000-71



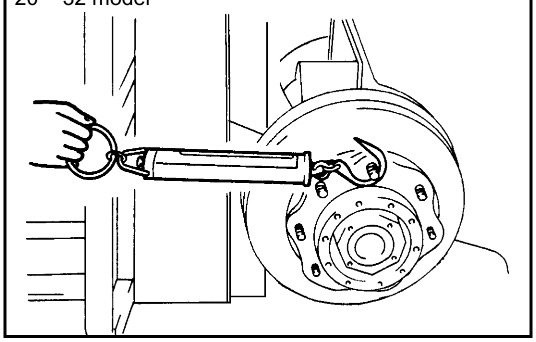
Installation:
SST 09950-76018-71 ....(1)
(SST 09950-60010)
SST 09950-76020-71 ....(2)
(SST 09950-70010)



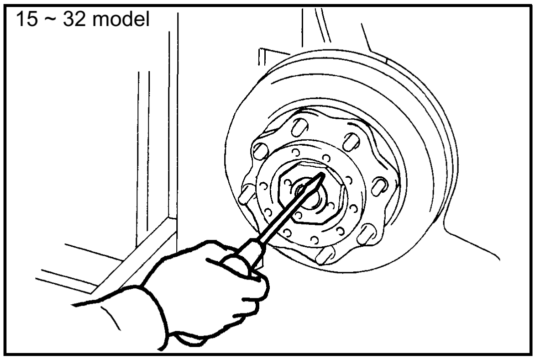
[Point 4]

Removal·Installation:
SST 09509-76002-71
(SST 09509-55020)

20 ~ 32 model



15 ~ 32 model



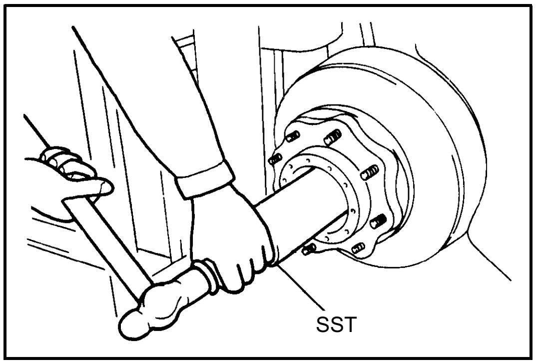
Installation:
20 ~ 32 model
Adjust the front axle hub starting force.

1. Install the plate.
2. Fully tighten the bearing lock nut, and rotate the hub by 4 to 5 turns to run in the bearing.
3. Return the bearing lock nut by 1/12 to 1/6 turn (30 to 60°), and rotate the hub by 4 to 5 turns again.
4. Set a spring scale on a hub bolt, and measure the starting force.

   Standard:
   25.5 ~ 72.6 N (2.6 ~ 7.4 kgf) [5.7 ~ 16.3 lbf]

5. If the standard is not satisfied, adjust the degree of bearing lock nut tightening for adjustment.
6. Install the nut lock screw.
   Coat thread tightener (08833-76002-71 (08833-00080)), on the nut lock screw before tightening.

Installation:
15·18 model
Install the nut lock screw.
Coat thread tightener (08833-76002-71 (08833-00080)), on the nut lock screw before tightening.



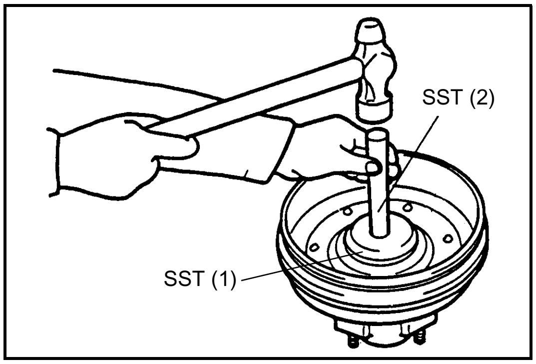
[Point 5]

Installation:

Fill MP grease in the hub before installing the front axle hub.

Installation:

SST 09370-10410-71



[Point 6]

Removal:

Use a screwdriver or the like to remove the oil seal.

Removal:

Use a brass bar to remove the bearing.

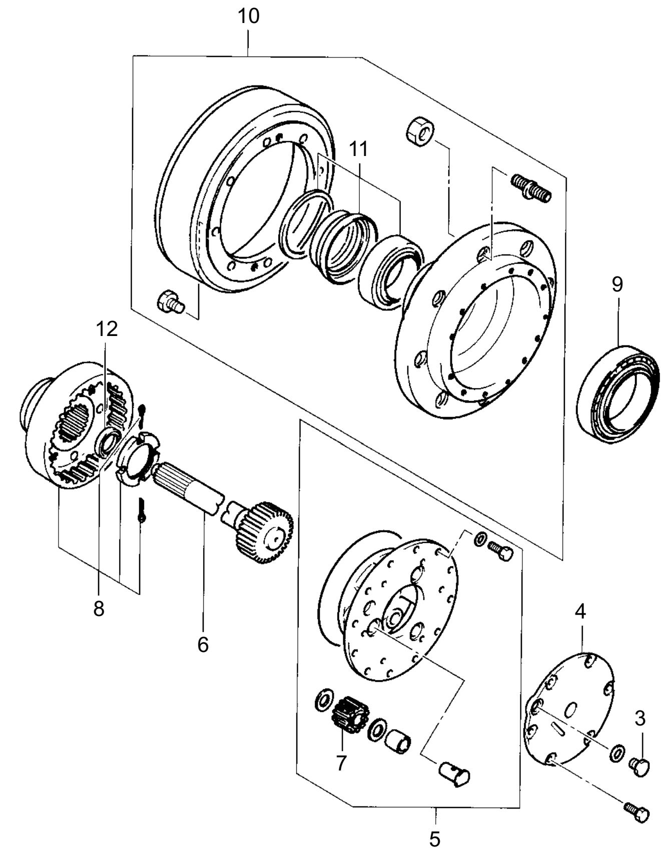
Installation:

SST 09950-76019-71 ....(1)
(SST 09950-60020)
SST 09950-76020-71 ....(2)
(SST 09950-70010)

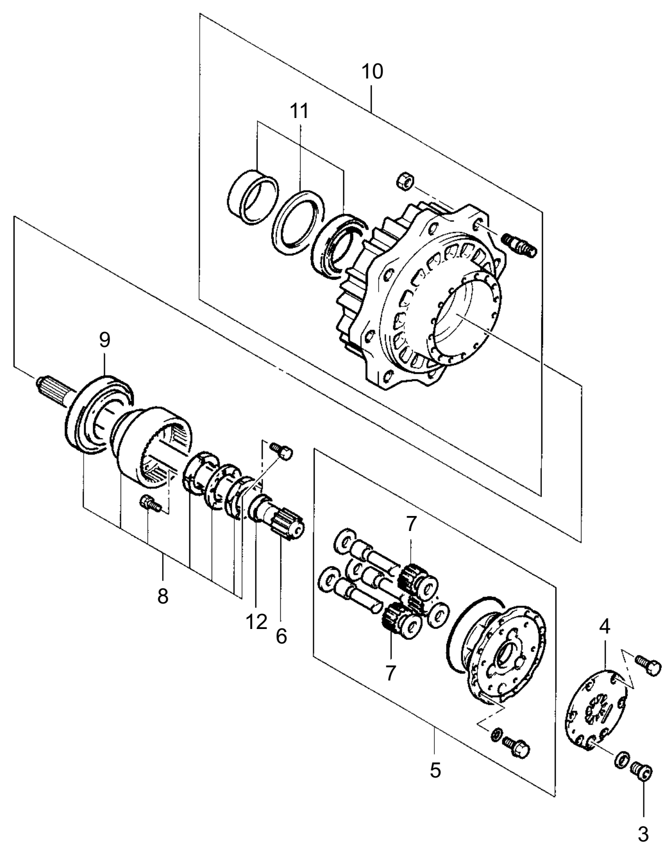
FRONT AXLE SHAFT·AXLE HUB (35 ~ 55 MODEL)

REMOVAL·INSTALLATION

35·45 model



55 model



Removal Procedure

1 Jack up the frame and support it with stand or wooden blocks.
2 Remove front wheel.
3 Drain the planetary gear oil. **[Point 1]**
4 Remove the planet gear carrier cover. **[Point 2]**
5 Remove the planet gear carrier assembly. **[Point 3]**
6 Remove the front axle shaft. **[Point 4]**
7 Remove the planet gear. **[Point 5]**
8 Remove the internal gear hub. **[Point 6]**
9 Remove the outer bearing. **[Point 7]**
10 Remove the front axle hub W/brake drum. **[Point 8]**
11 Remove the inner bearing and oil seal. **[Point 9]**
12 Remove the front axle shaft oil seal. **[Point 10]**

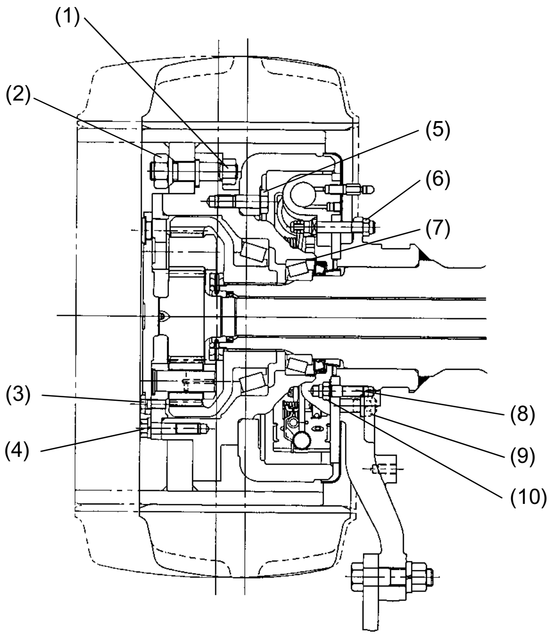
Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
The tightening torque for each portion is as follows:

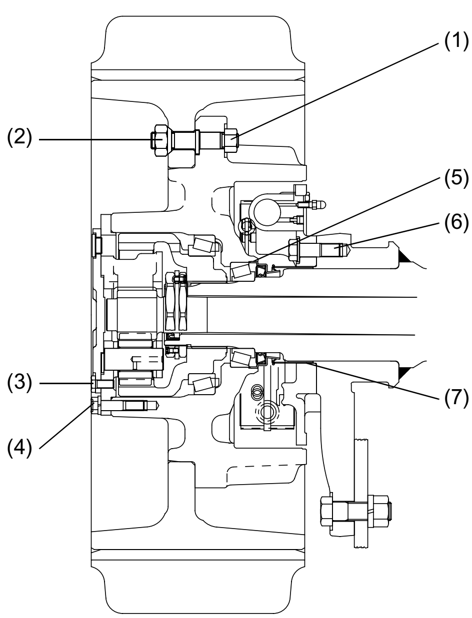
T = N·m (kgf-cm) [ft-lbf]

35·45 model

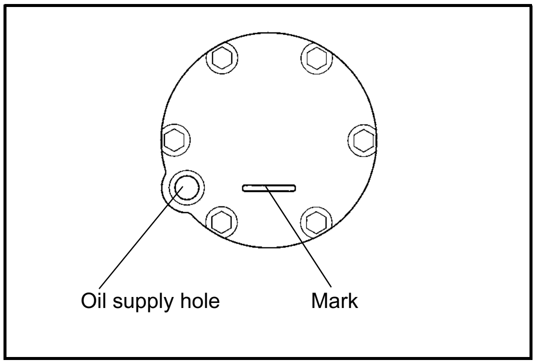


(1) Apply locking agent (08833-76001-71 (08833-00070))
T = 264.8 ~ 294.2 (2700 ~ 3000) [195.3 ~ 217.1]
(2) T = 294.2 ~ 323.6 (3000 ~ 3300) [217.1 ~ 238.8]
(3) Apply locking agent (08833-76002-71 (08833-00080))
T = 20.4 ~ 30.6 (208 ~ 312) [15.0 ~ 22.6]
(4) T = 98.1 ~ 127.5 (1000 ~ 1300) [72.4 ~ 94.1]
(5) T = 88.3 ~ 137.3 (900 ~ 1400) [65.1 ~ 101.3]
(6) T = 88.3 ~ 117.7 (900 ~ 1200) [65.1 ~ 86.8]
(7) Apply sealing agent (08833-76002-71 (08826-00080))
(8) Apply locking agent (08833-76001-71 (08833-00070))
(9) T = 88.3 ~ 137.3 (900 ~ 1400) [65.1 ~ 101.3]
(10) T = 88.3 ~ 117.7 (900 ~ 1200) [65.1 ~ 86.8]

55 model



(1) Apply locking agent (08833-76001-71 (08833-00070))
T = 264.8 ~ 294.2 (2700 ~ 3000) [195.3 ~ 217.1]
(2) T = 294.2 ~ 323.6 (3000 ~ 3300) [217.1 ~ 238.8]
(3) Apply locking agent (08833-76002-71 (08833-00080))
T = 20.4 ~ 30.6 (208 ~ 312) [15.0 ~ 22.6]
(4) T = 98.1 ~ 127.5 (1000 ~ 1300) [72.4 ~ 94.1]
(5) Apply sealing agent (08833-76002-71 (08826-00080))
(6) Apply locking agent (08833-76001-71 (08833-00070))
T = 300.0 ~ 400.0 (3060 ~ 4080) [221.4 ~ 295.2]
(7) Apply sealing agent (08833-76002-71 (08826-00080))

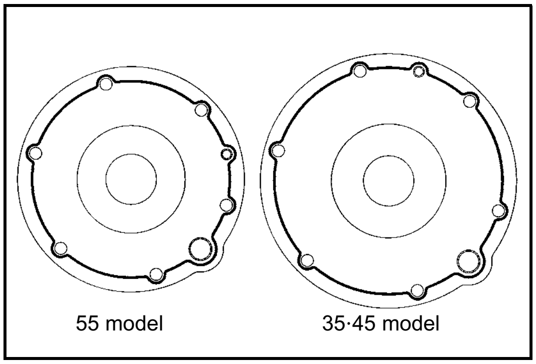


Point Operations

[Point 1]

Installation:

After installation, set the “-” mark on the carrier cover in horizontal state and fill planetary gear oil full to the brim of the oil supply hole.



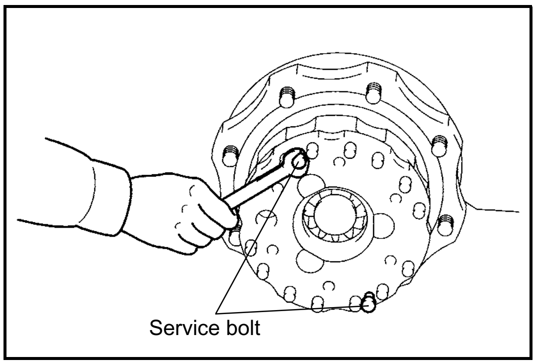
[Point 2]

Removal:

Using a service bolt, remove the planet gear carrier cover.
Service bolt size: M8 × 1.25

Installation:

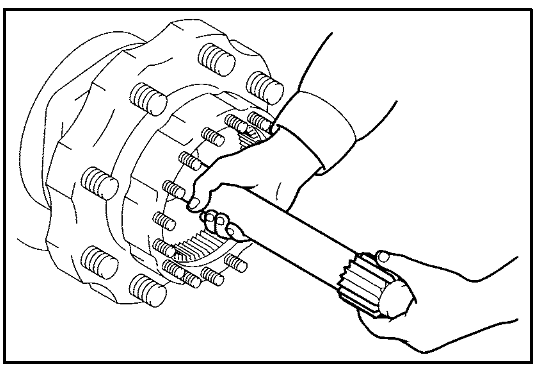
Apply sealing agent (08826-76002-71 (08826-00090)) on the mating surfaces of the planet gear carrier and carrier cover before installation.



[Point 3]

Removal:

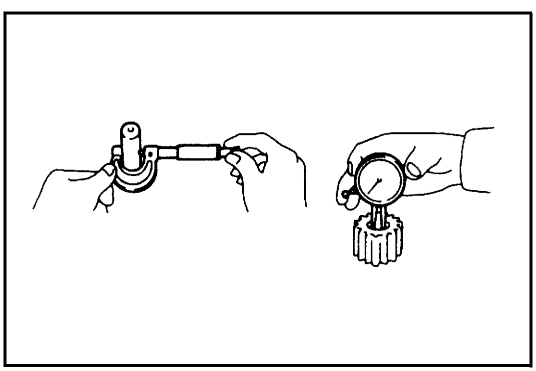
Use 2 service bolts and remove the planet gear carrier ASSY.
Service bolt size: M10 × 1.25



[Point 4]

Removal·Installation:

Operate carefully so as not to bring the axle shaft into contact with the oil seal lip to damage it.



[Point 5]

Inspection:

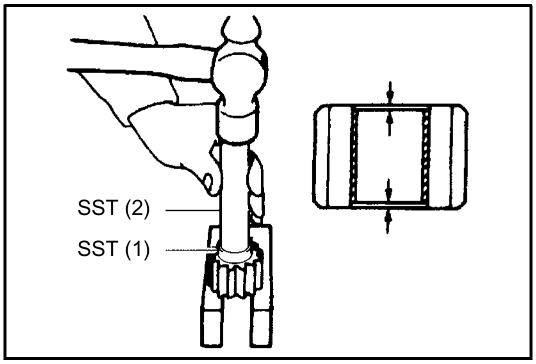
Measure the planet gear shaft outside diameter.

Standard: 26.0 (1.024 in)
Limit: 25.85 (1.018 in)

Inspection:

Measure the planet gear bushing inside diameter.

Standard: 26.0 (1.024 in)
Limit: 26.18 (1.031 in)

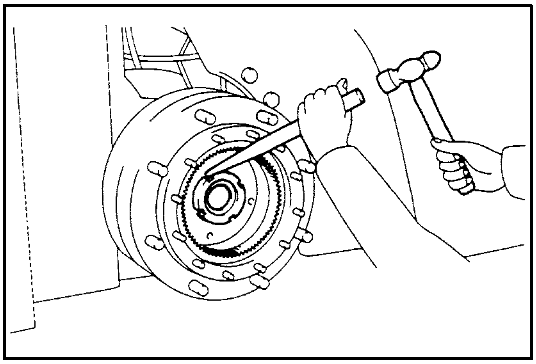


Disassembly·Reassembly:

SST 09950-76018-71 ....(1)
(SST 09950-60010)
SST 09950-76020-71 ....(2)
(SST 09950-70010)
Install to make the dimension from the bushing end face to the gear end face equal.

Reassembly:

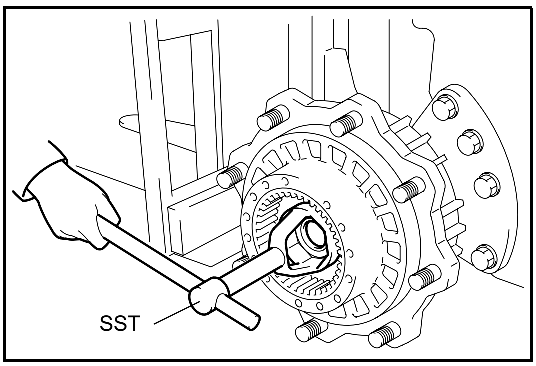
Apply a thin coat of molybdenum disulfide grease on the planet gear bushing inside surface and shaft outside surface.



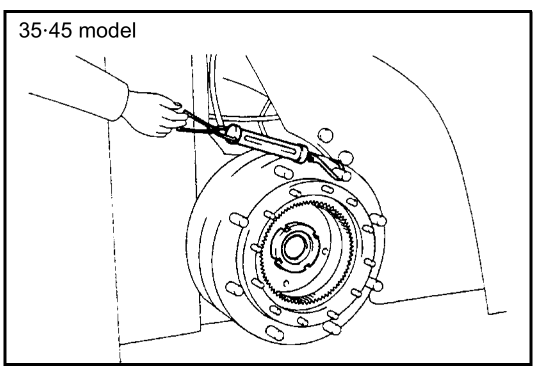
[Point 6]

Removal·Installation:

35·45 model
Use a brass bar and remove/install the bearing lock nut.



55 model
Use the SST and remove/install the bearing lock nut.
SST 09509-76003-71
(SST 09509-55030)



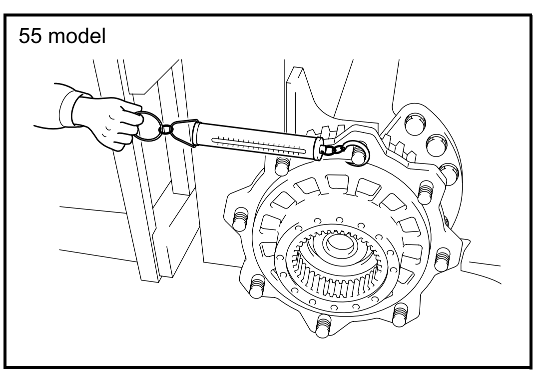
Installation:

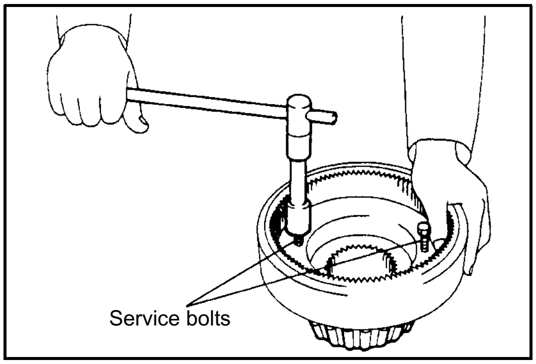
Adjust the front axle hub starting force.

1. 35·45 model
   Install the bearing lock nut.
   55 model
   Install the bearing lock nut (inner) W/screw.
2. Fully tighten the bearing lock nut, and rotate the hub by 4 to 5 turns to run in the bearing.
3. Return the bearing lock nut by 1/12 to 1/6 turn (30 to 60°), and rotate the hub by 4 to 5 turns again.
4. Set a spring scale on a hub bolt, and measure the starting force.

Standard:
35 ~ 55 model
49 ~ 118 N (5 ~ 12 kgf) [11 ~ 26 lbf]

5. If the standard is not satisfied, adjust the degree of bearing lock nut tightening for adjustment.

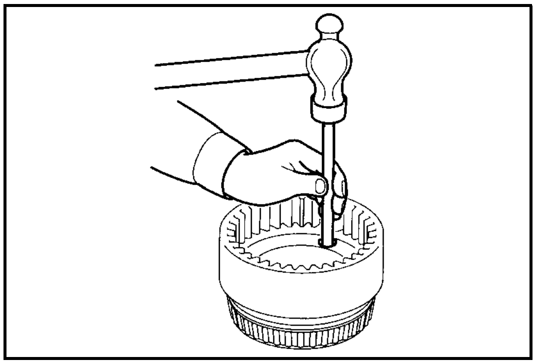




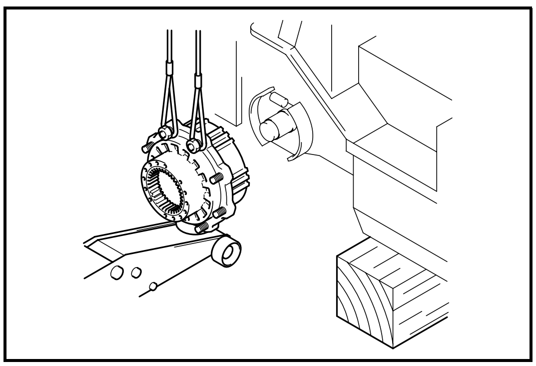
[Point 7]

Removal:

35·45 model
Use 2 service bolts and remove the outer bearing.
Service bolt size: M12 × 1.25



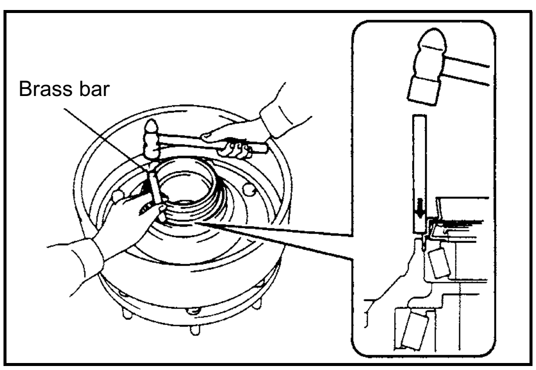
55 model
Use a brass bar and remove the outer bearing.



[Point 8]

Removal·Installation:

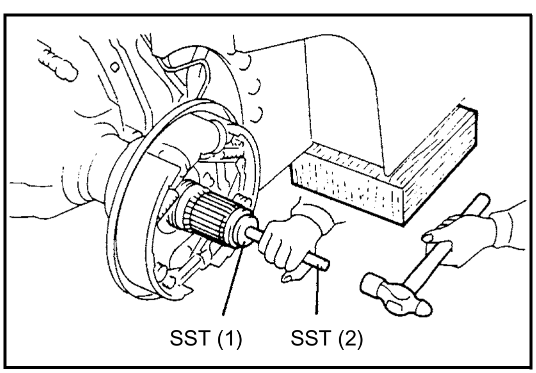
Sling the hub bolts with a wire rope. Operate the hoist and garage jack to remove or install the front axle hub W/brake drum.



[Point 9]

Installation:

Use a brass bar and drive in equally around the oil seal outer circumference.
After installation, apply MP grease to the oil seal lip.



[Point 10]

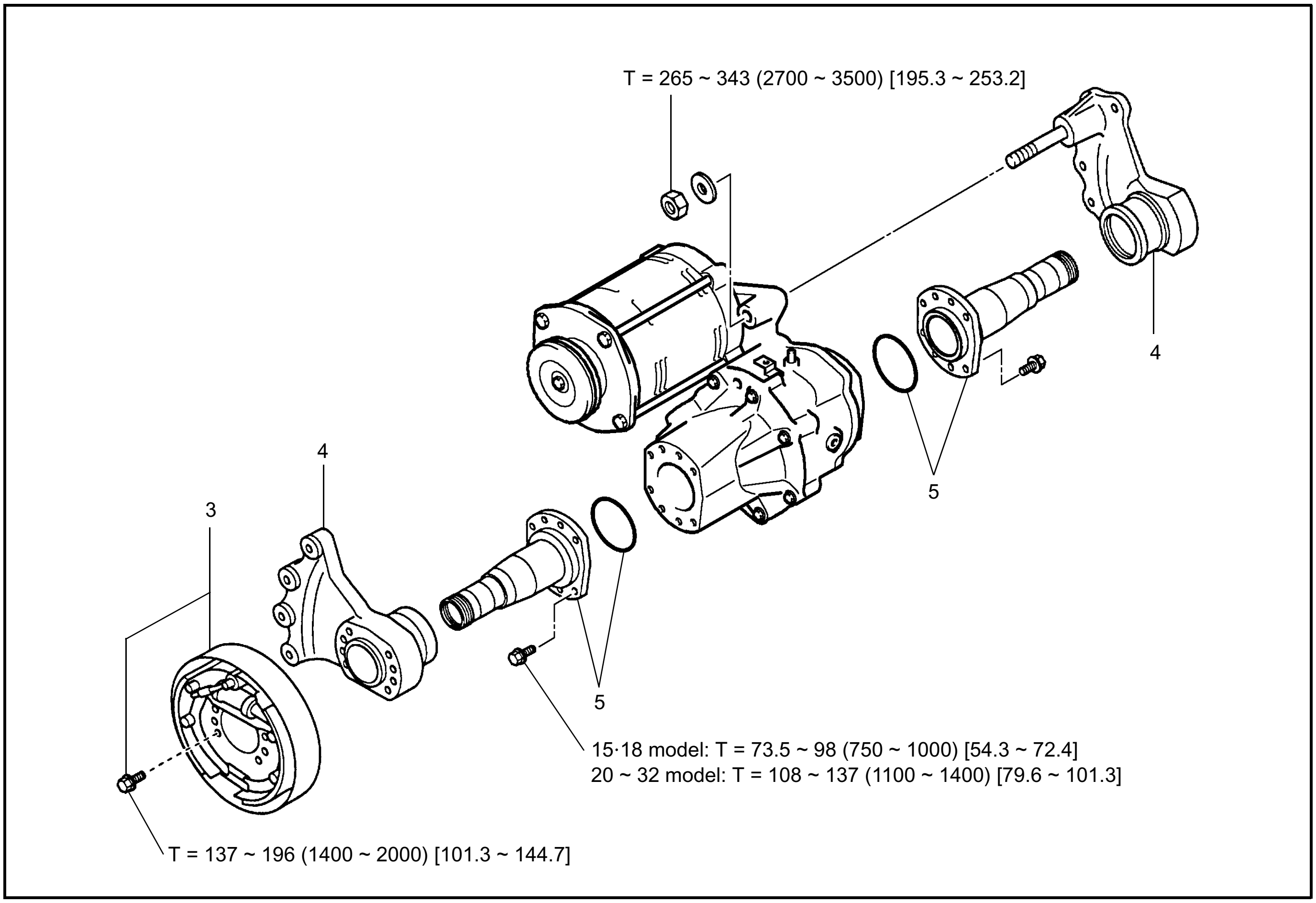
Installation:

SST 09950-76018-71 ....(1)
(SST 09950-60010)
SST 09950-76020-71 ....(2)
(SST 09950-70010)
After installation, apply MP grease to the oil seal lip.

FRONT AXLE BRACKET·AXLE HOUSING (15 ~ 32 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



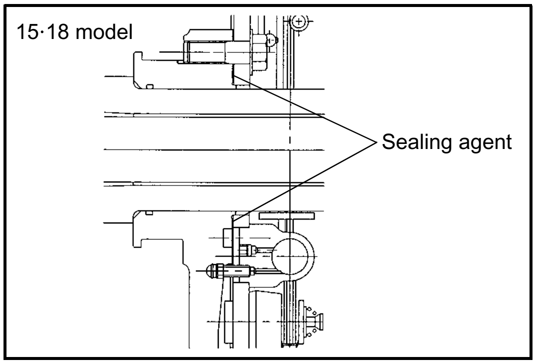
Removal Procedure

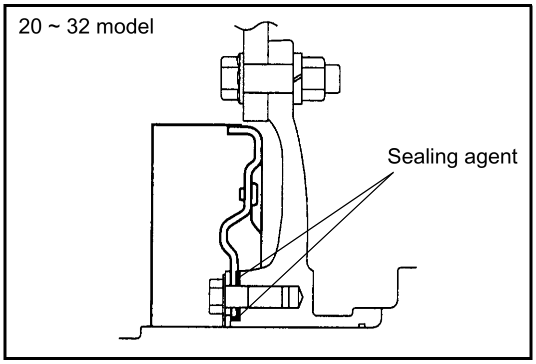
1 Remove the front axle W/drive motor ASSY. (See page 6-10)
2 Remove the front axle shaft and axle hub. (See page 7-11)
3 Remove the brake ASSY. **[Point 1]**
4 Remove the front axle bracket and O-ring.
5 Remove the axle housing and O-ring.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
Apply grease on the O-ring before installation.





Point Operation

[Point 1]

Installation:

Apply sealing agent (08826-76001-71 (08826-00080)) on the mating surfaces of the brake backing plate and front axle bracket before installation.

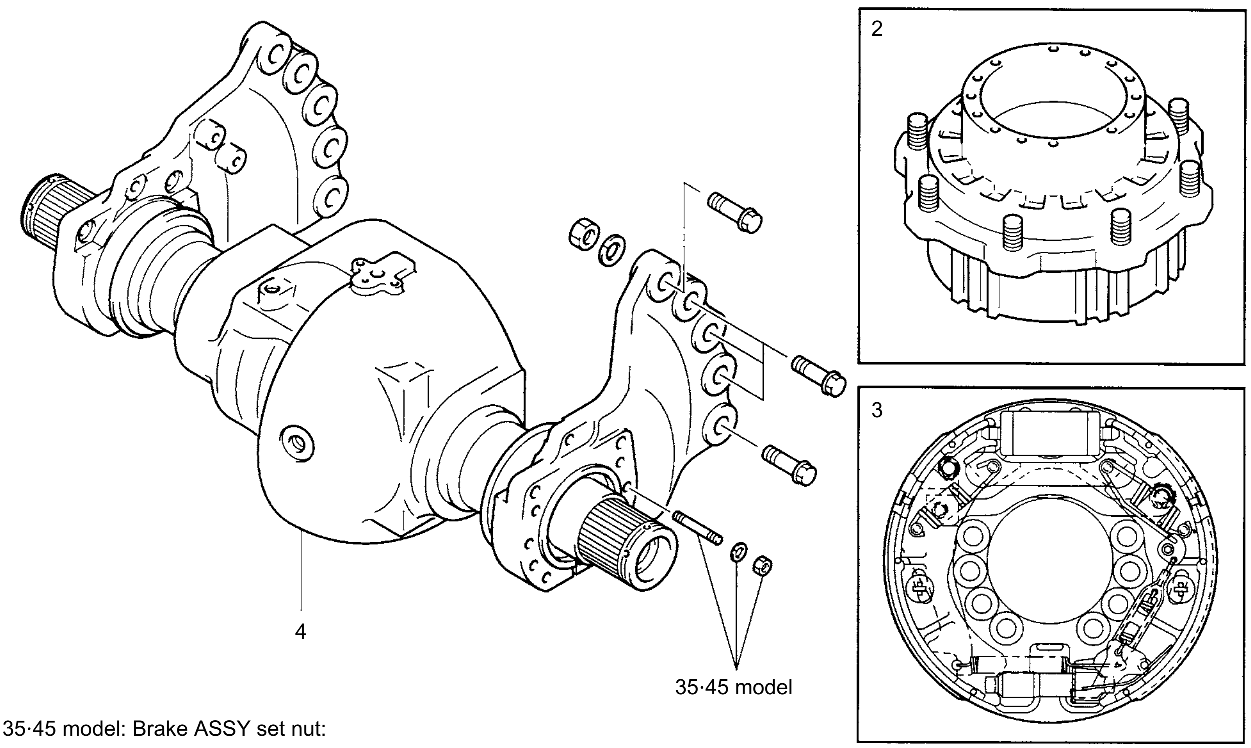
Installation:

Apply locking agent (08833-76001-71 (08833-00070)) on the set bolts before tightening.

DIFFERENTIAL HOUSING (35 ~ 55 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



35·45 model: Brake ASSY set nut:
T = 88 ~ 118 (900 ~ 1200) [65.1 ~ 86.8]
55 model: Brake ASSY set bolt:
T = 300 ~ 400 (3060 ~ 4080) [221.4 ~ 295.2]

Removal Procedure

1 Remove the differential ASSY. (See page 6-19.)
2 35·45 model: Remove the front axle hub W/brake drum. (See page 7-15.)
55 model: Remove the front axle hub. (See page 7-15.)
3 Remove the brake ASSY.
4 Remove the differential housing.

Installation Procedure

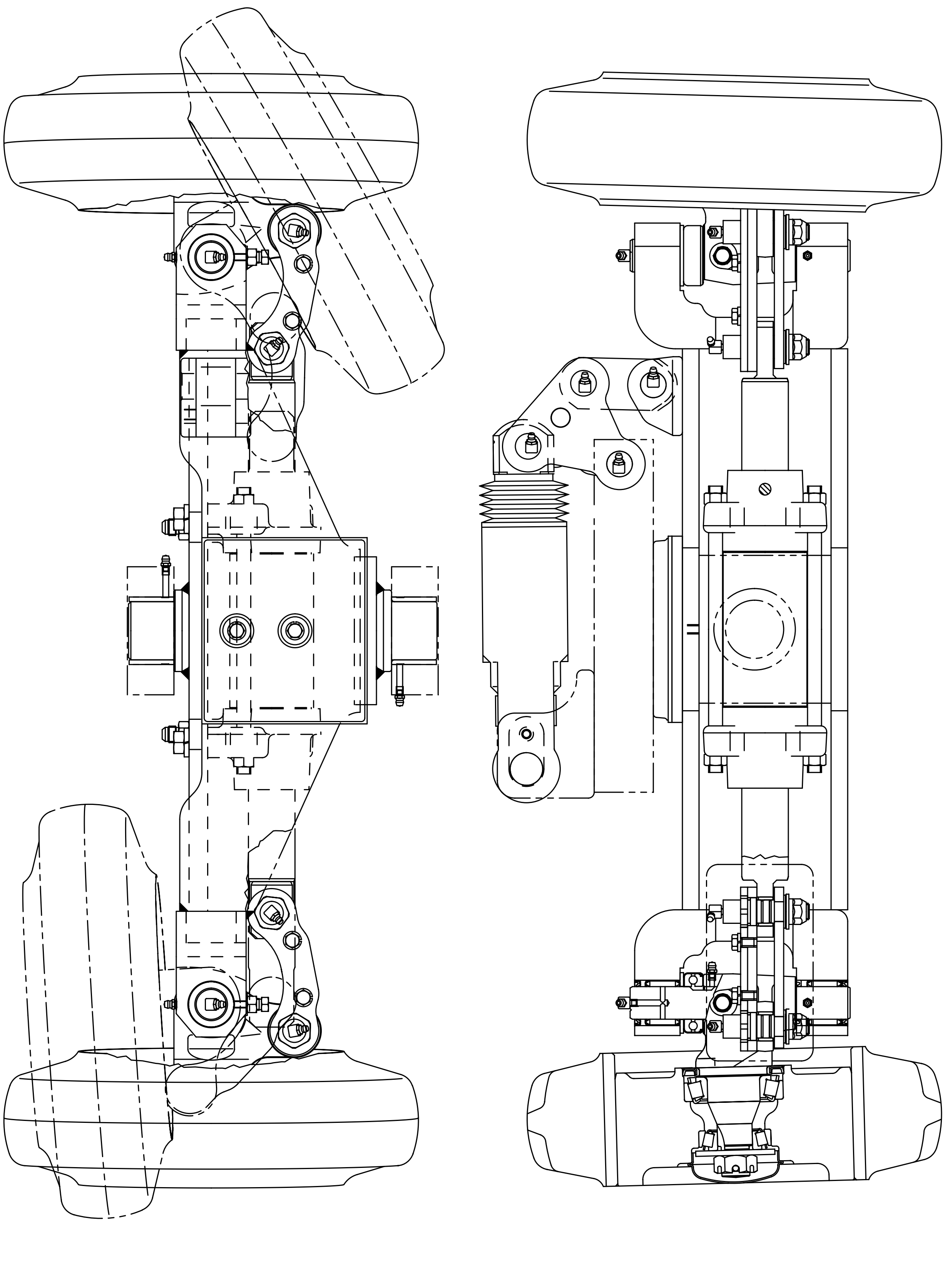
The installation procedure is the reverse of the removal procedure.

Note:
Apply thread tightener (08833-76001-71 (08833-00070)) on the brake ASSY set bolt befor tightening. (55 model)

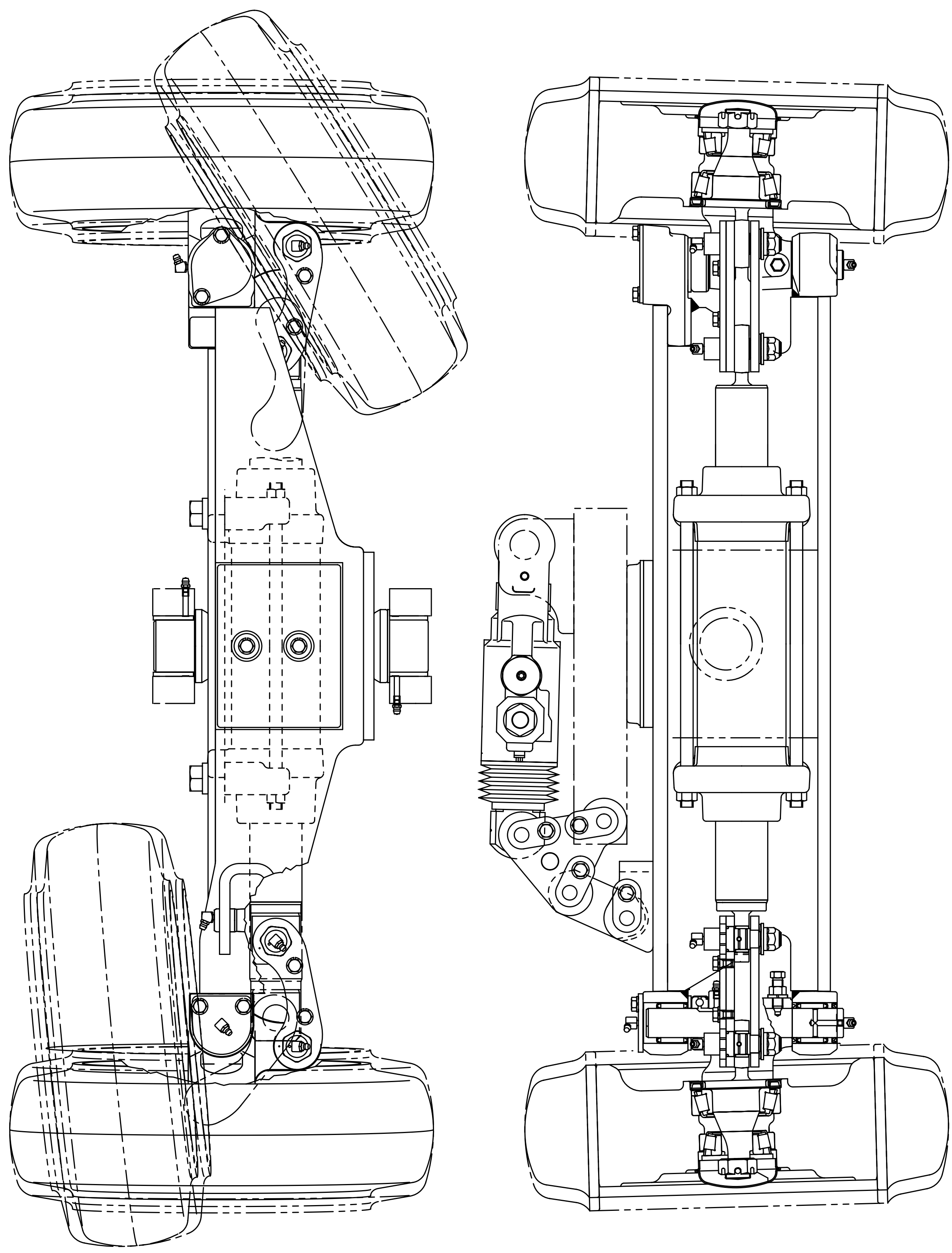
REAR AXLE

GENERAL

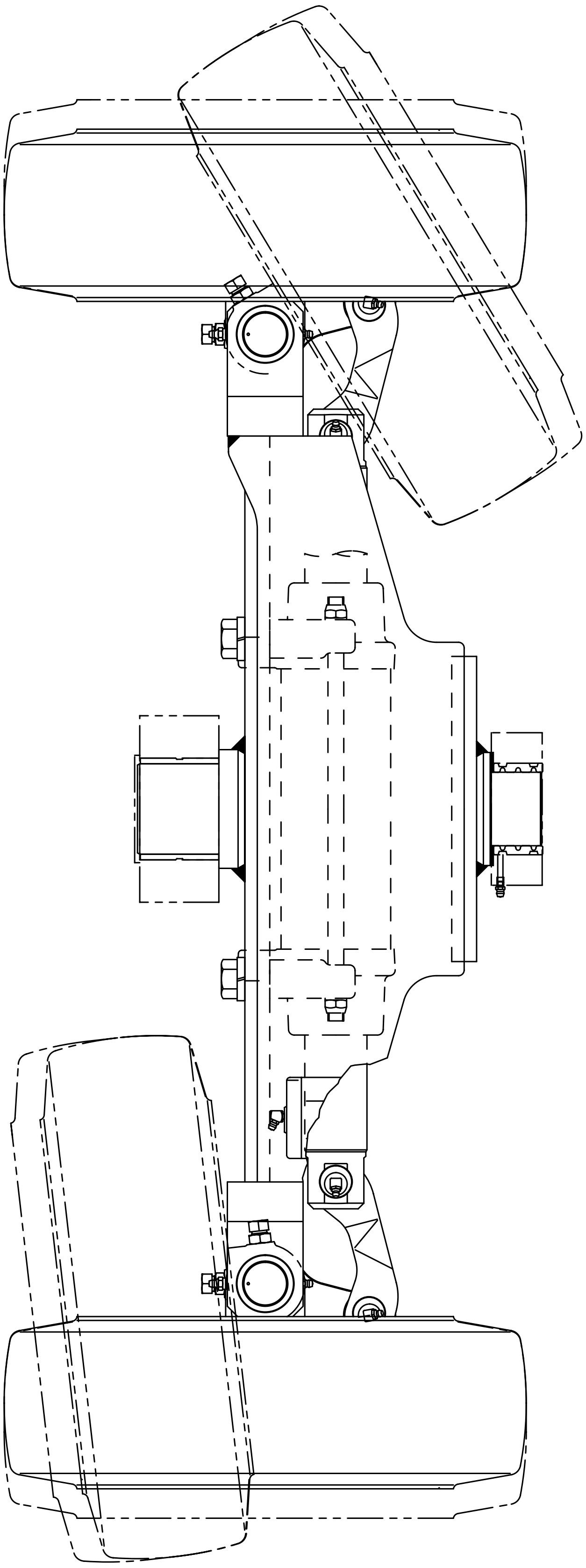
15·18 model

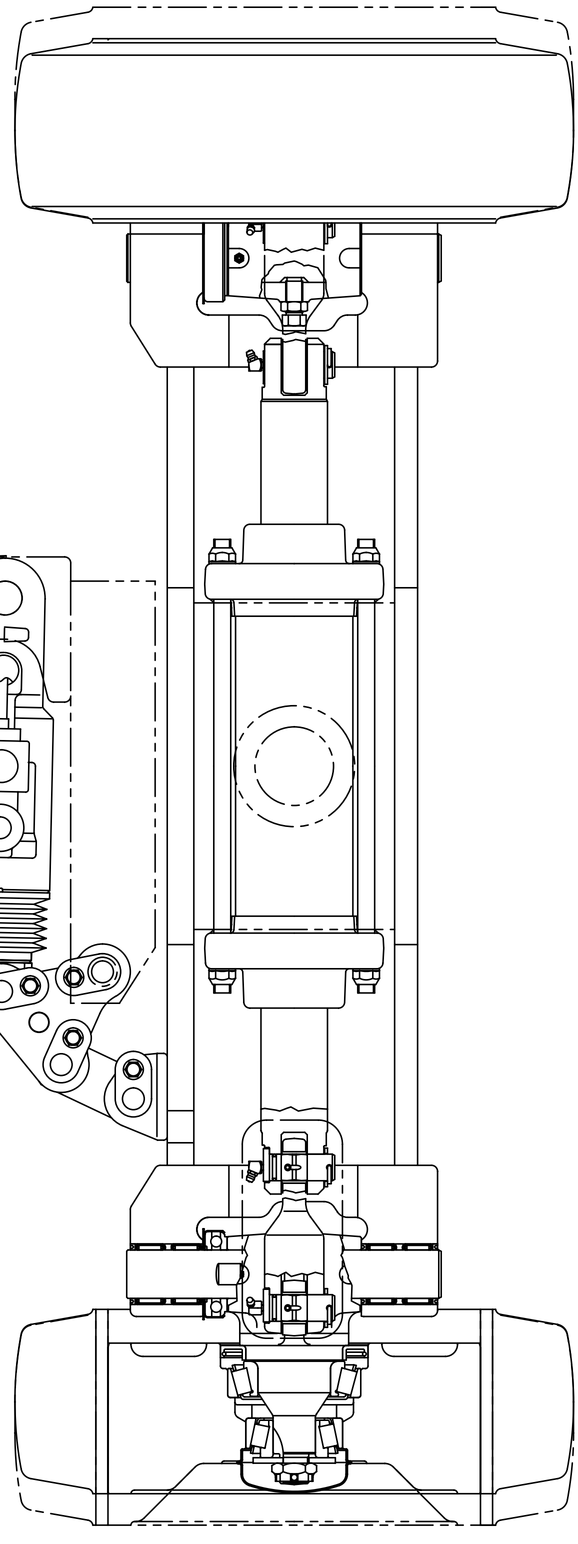


20 ~ 32 model

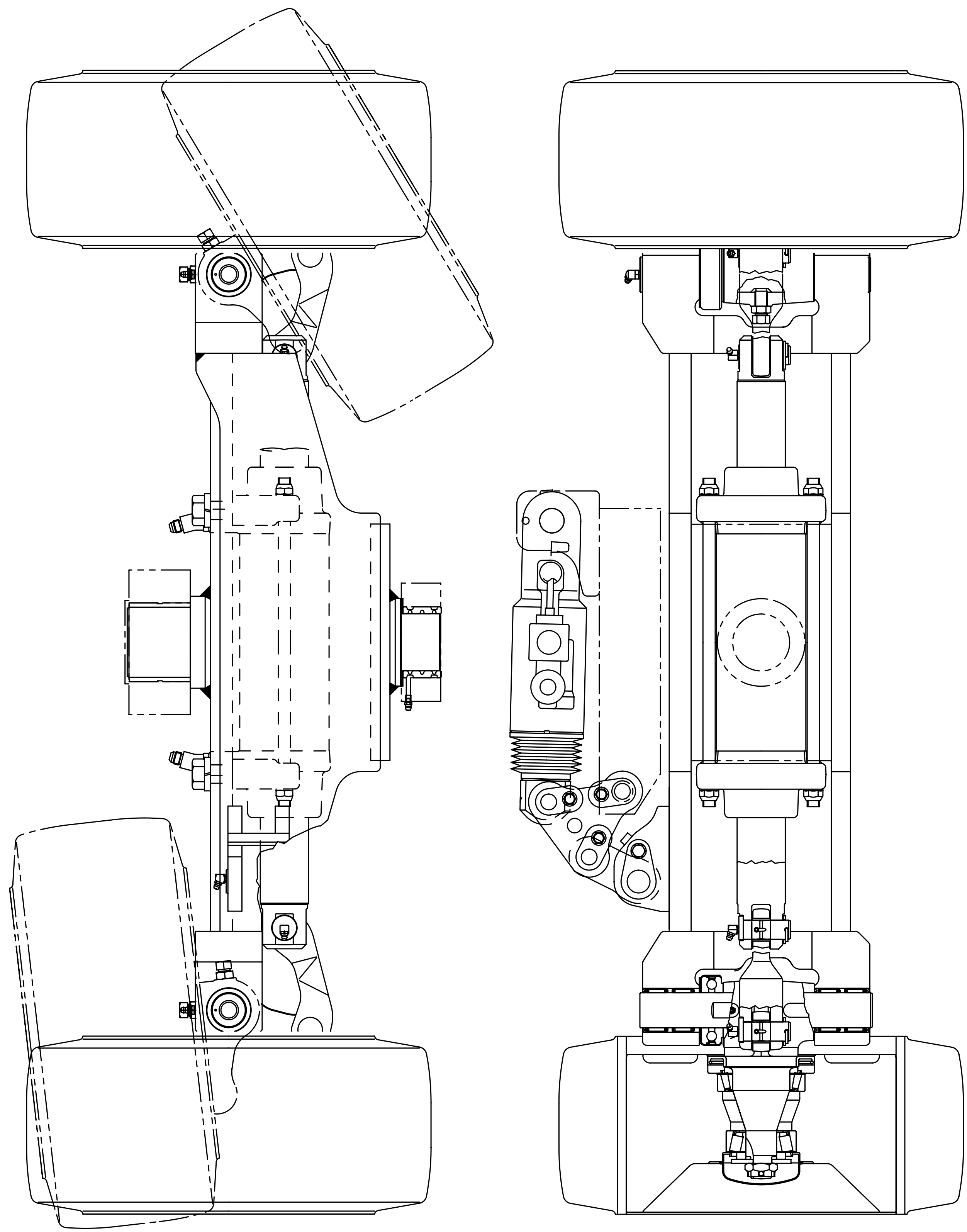


35·45 model



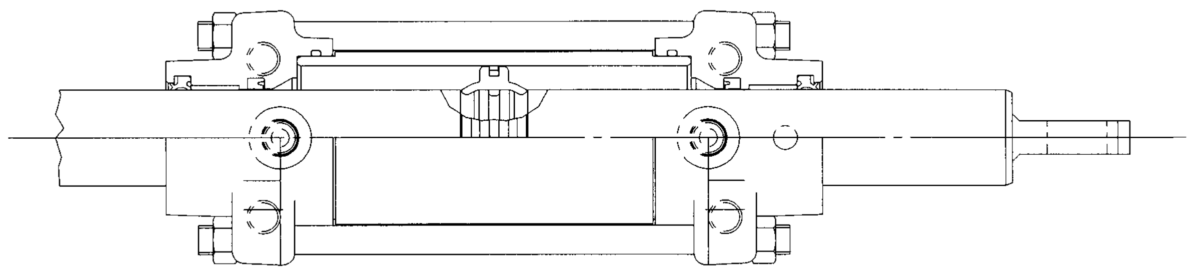


55 model

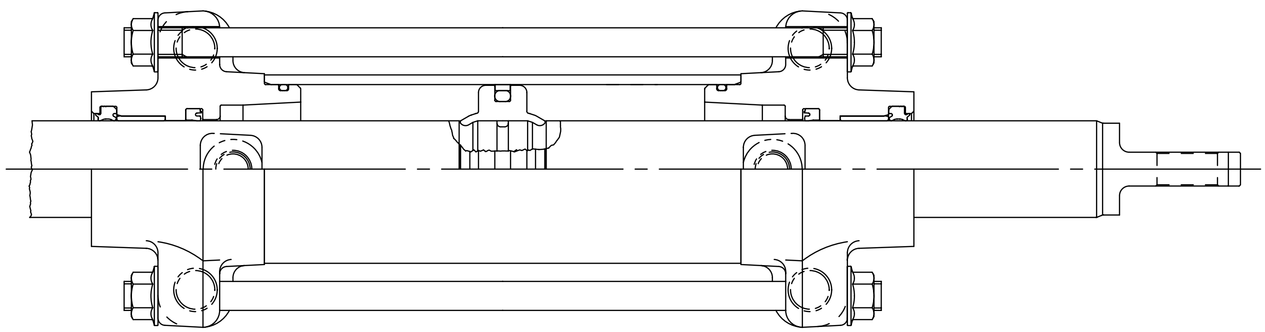


Rear Axle Cylinder

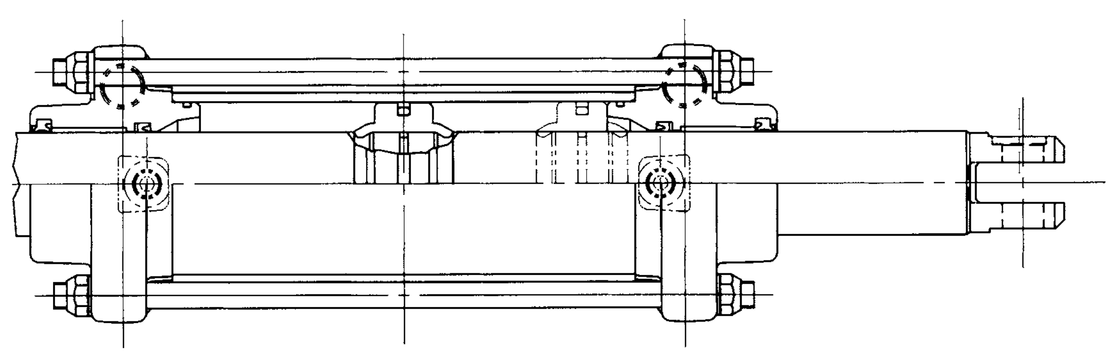
15·18 model



20 ~ 32 model



35 ~ 55 model



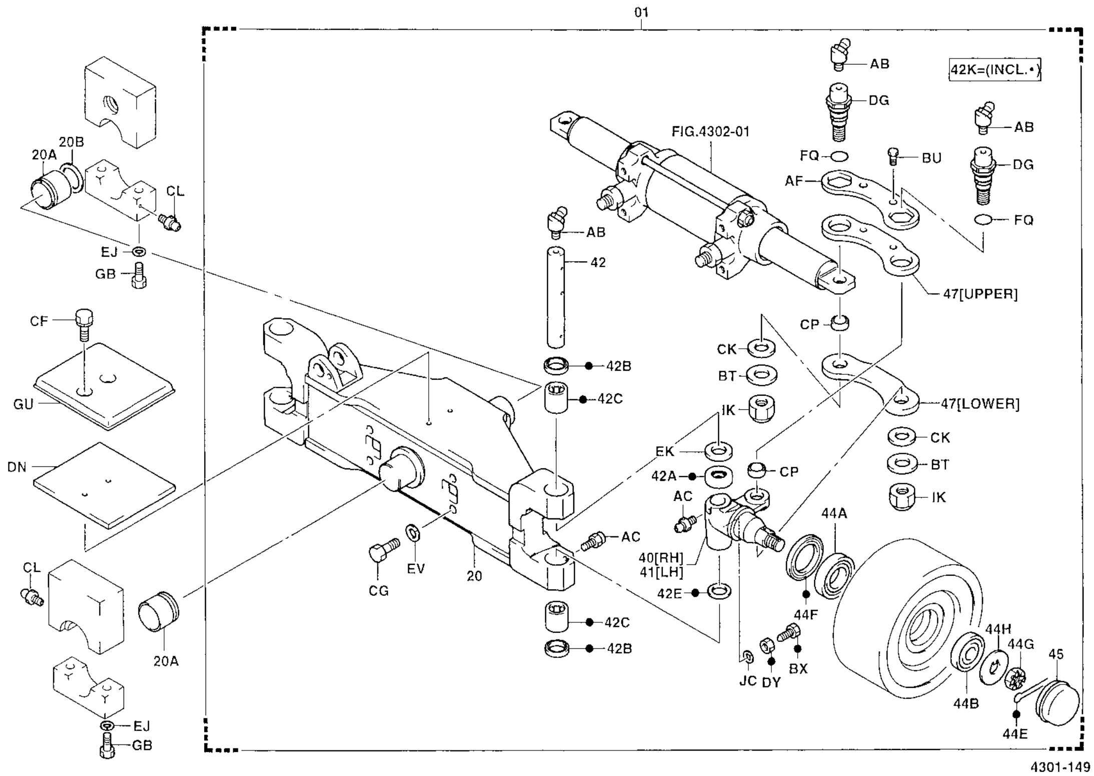
SPECIFICATIONS

Rear axle type		Elliot type
Rear axle suspension type		Center-supported right-left rocking type
Wheel alignment	Toe-in mm (in)	0 (0)
	Camber degree	18 ~ 32 model : 1.5°, 35 ~ 55 model : 0°
	Caster degree	0°
	King pin angle	0°
Minimum turning radius (outermost) mm (in)		15·18 model : 1685 (66.3)
		20 model : 1790 (70.5)
		7FBCU25, 30-7FBCU25 : 1800 (70.9)
		7FBCHU25, 30-7FBCHU25 : 1940 (76.4)
		30 model : 1960 (77)
		32 model : 2000 (78.7)
		35 model : 2140 (84.3)
		45 model : 2225 (87.6)
		55 model : 2440 (96.1)
Rear axle cylinder	Cylinder type	Double acting
	Piston rod outside diameter mm (in)	15 ~ 25 model : 40.0 (1.575)
		30·32 model : 50.0 (1.969)
		35 ~ 55 model : 55.0 (2.165)
	Cylinder bore mm (in)	15·18 model : 60.0 (2.362)
		20·25 model : 70.0 (2.756)
		30·32 model : 76.0 (2.992)
		35·45 model : 87.0 (3.425)
		55 model : 90.0 (3.543)

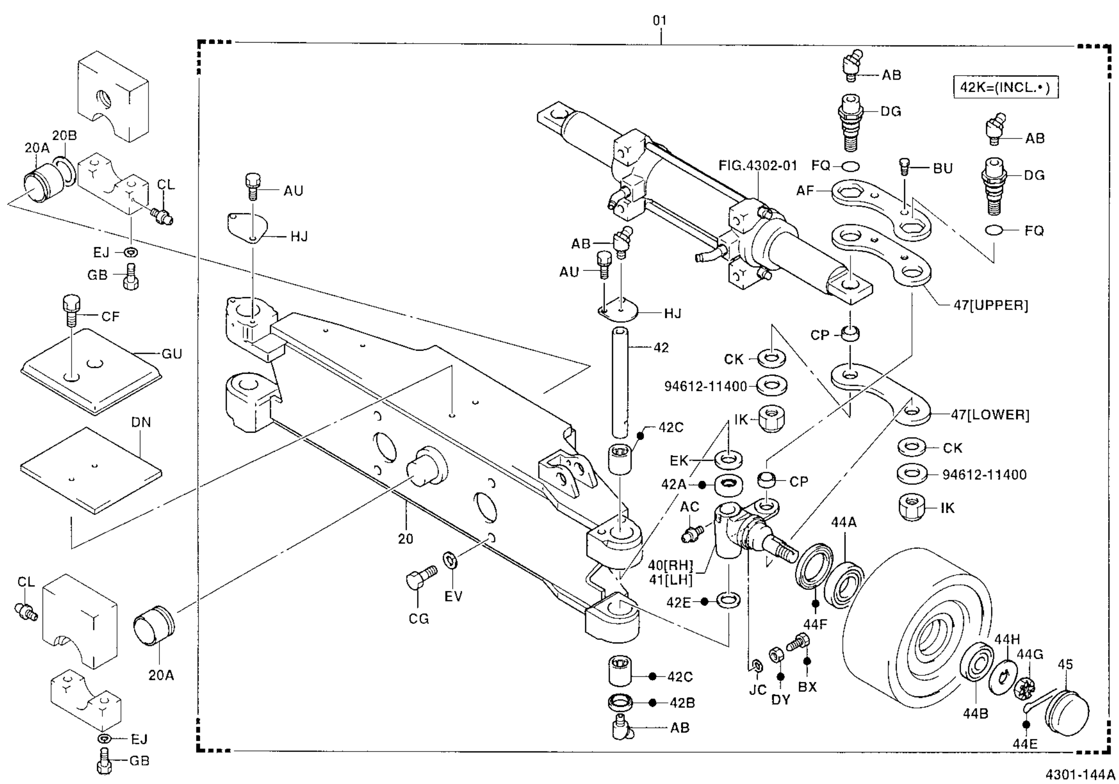
COMPONENTS

15·18 model

4301

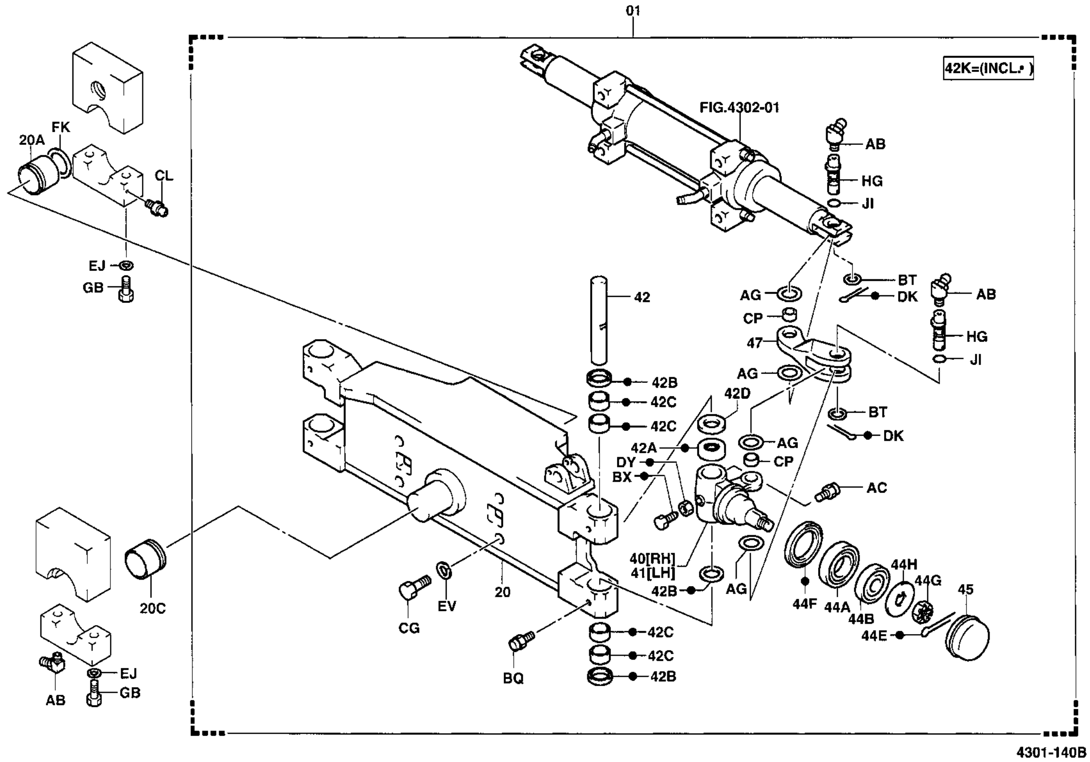


20 ~ 32 model



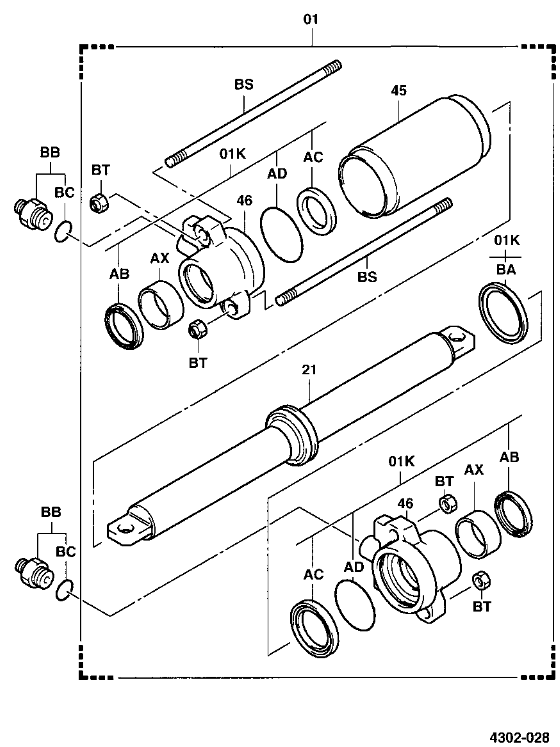
35 ~ 55 model

4301



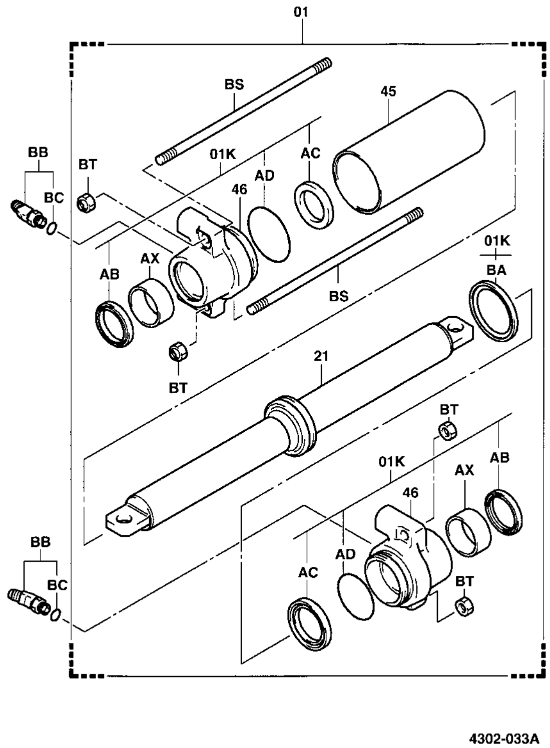
15·18 model

4302

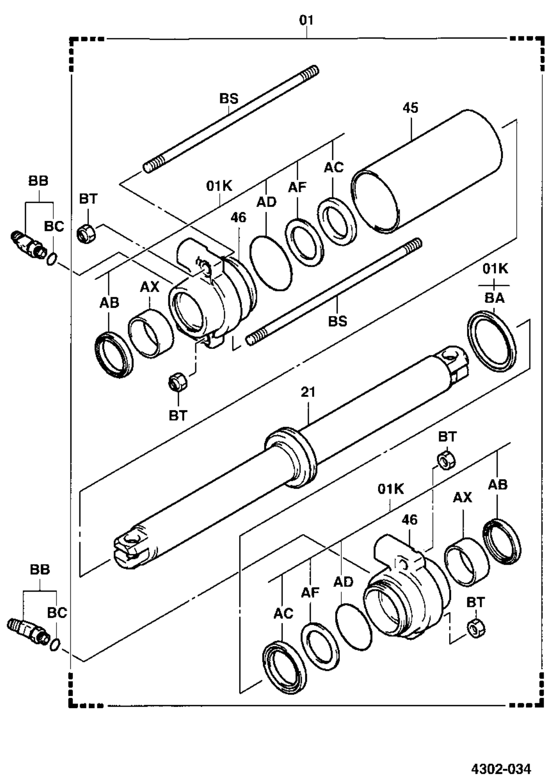


20 ~ 32 model

4302



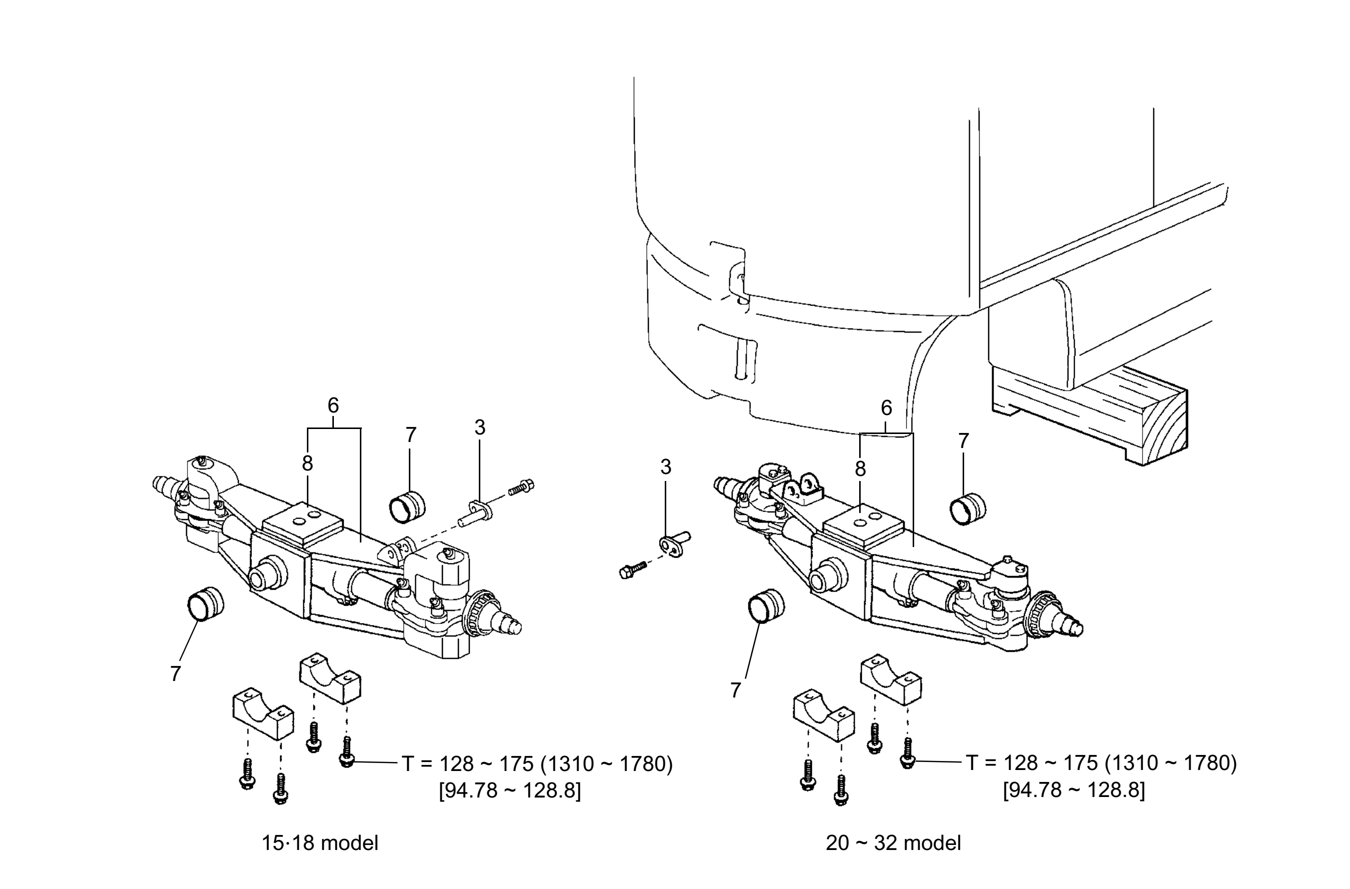
35 ~ 55 model



REAR AXLE ASSY (15 ~ 32 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



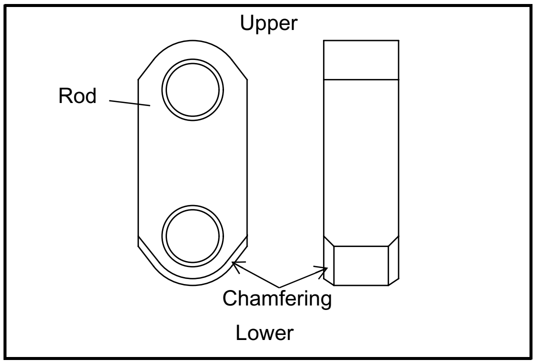
Removal Procedure

1 Chock the front wheels.
2 Jack up the vehicle and remove rear wheels. (See removal procedure steps 2 to 4 in steering knuckle removal-installation section on page 8-16.)
3 Remove the swing crank rod pin (lower) of swing lock cylinder. **[Point 1]**
4 Disconnect the rear axle cylinder hose.
5 Support the rear axle ASSY with a garage jack.
6 Remove the rear axle ASSY. **[Point 2]**
7 Remove the center pin bushing. **[Point 3]**
8 Remove the rear axle damper. (Lifting height 5000 mm (198 in) or above)

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
After installation, add grease through each grease fitting. Add molybdenum disulfide grease at the rear axle beam center pins (two places) and swing lock cylinder crank rod pin. Use MP grease to other grease fittings.

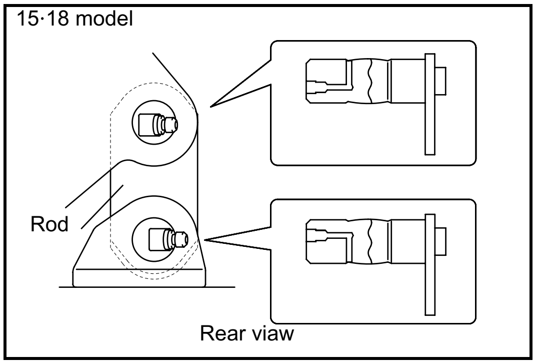


Point Operations

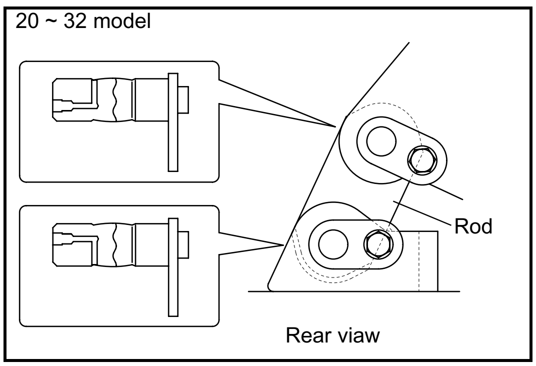
[Point 1]

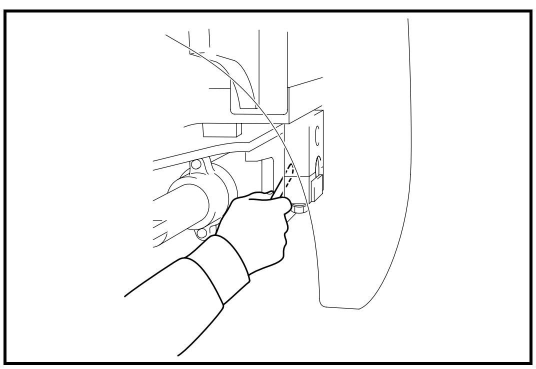
Installation:

Install the rod with its chamfered side down.



Make sure that the upper and lower sides of the rod pin are positioned correctly. (The upper and lower grooves are in different locations.)





[Point 2]

Inspection:

Measure the rear axle front to rear clearance.

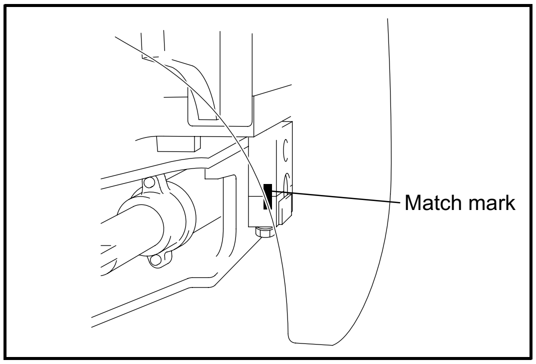
1. Before removing the rear axle ASSY, measure the front to rear clearance on the rear side.

   Standard clearance: 0.7 mm (0.028 in) or less

2. If the measured value does not satisfy the standard, remove the rear axle ASSY and make adjustment by selecting the spacer.

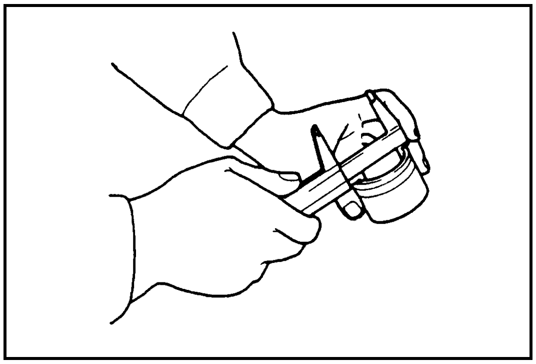
   Spacer thickness:

   0.6·1.2·2.3·3.0·3.5·4.0·4.5 and 5.0 mm (0.024·0.047·0.091·0.118·0.138·0.157·0.177 and 0.197 in)



Removal:
Draw different match marks on the rear axle bracket caps front and rear to prevent confusion.

Installation:
Install after aligning the match mark.

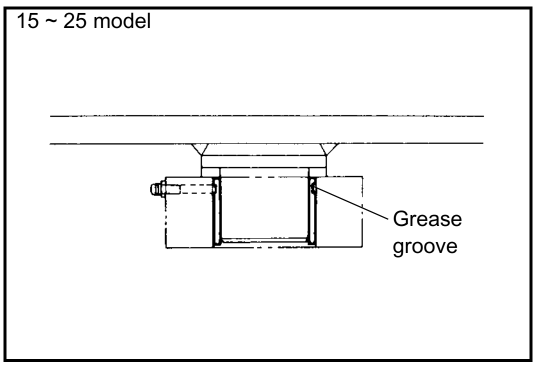


[Point 3]

Inspection:
Inspect the inside diameter of the rear axle center pin bushing.

Limit: 52.0 mm (2.047 in)

Installation:
Apply molybdenum disulfide grease to the bushing before installation.

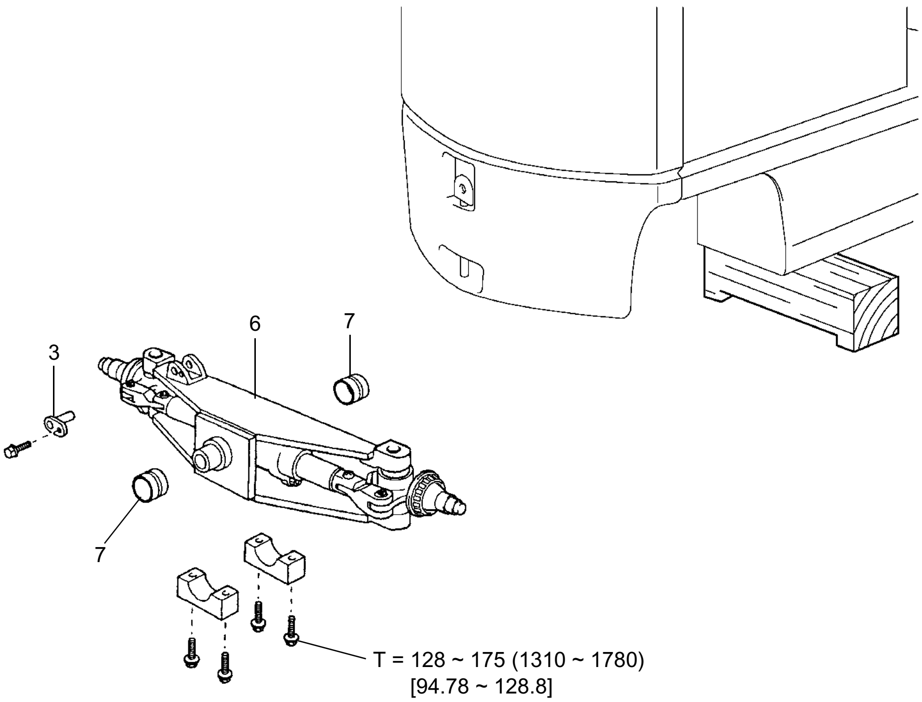


Installation:
Install the bushing by aligning the grease groove in the bushing with the grease fitting position. (15 ~ 25 model)

REAR AXLE ASSY (35 ~ 55 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

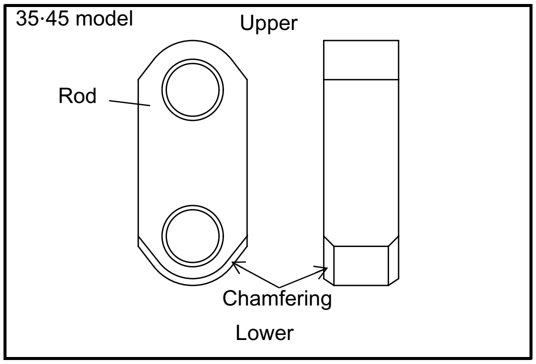
1 Chock the front wheels.
2 Jack up the vehicle and remove rear wheels. (See removal procedure steps 2 to 4 in steering knuckle removal-installation section on page 8-21.)
3 Remove the swing crank rod pin (lower) of swing lock cylinder. **[Point 1]**
4 Disconnect the rear axle cylinder hose.
5 Support the rear axle ASSY with a garage jack.
6 Remove the rear axle ASSY. **[Point 2]**
7 Remove the center pin bushing. **[Point 3]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.

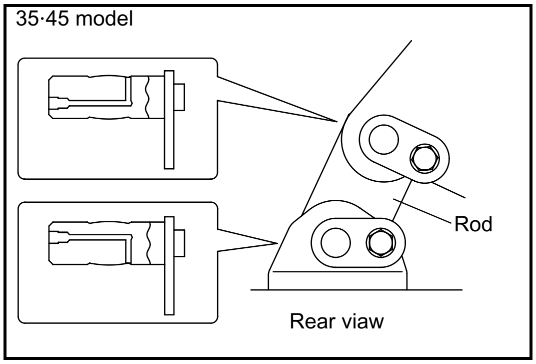
Note:
After installation, add grease through each grease fitting. Add molybdenum disulfide grease at the rear axle beam center pins (two places) and swing lock cylinder crank rod pin. Use MP grease to other grease fittings.

Point Operations

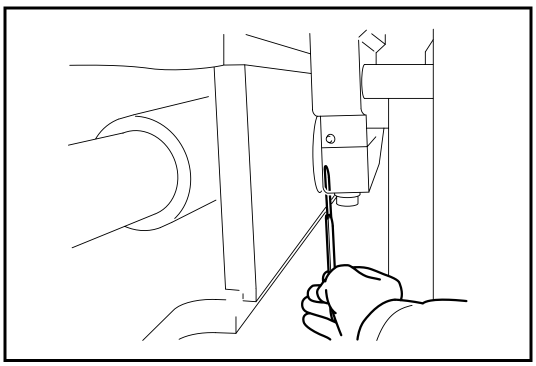


[Point 1]

Installation:
Install the rod with its chamfered side down. (35·45 model)



Make sure that the upper and lower sides of the rod pin are positioned correctly. (The upper and lower grooves are in different locations.) (35·45 model)



[Point 2]

Inspection:
Measure the rear axle front to rear clearance.

1. Before removing the rear axle ASSY, measure the front to rear clearance on the rear side.

   Standard clearance: 1.0 mm (0.039 in) or less

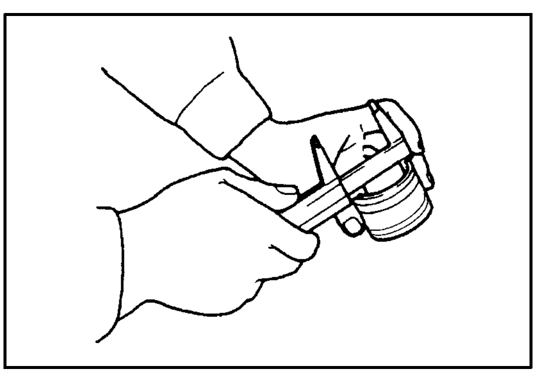
2. If the measured value does not satisfy the standard, remove the rear axle ASSY and make adjustment by selecting the spacer.

   Spacer thickness:
   0.6·1.2·2.3·3.2 and 4.5 mm
   (0.024·0.047·0.091·0.125 and 0.177 in)

3. Install the spacer at the rear side center pin.

[Point 3]

Inspection:
Inspect the inside diameter of the rear axle center pin bushing.



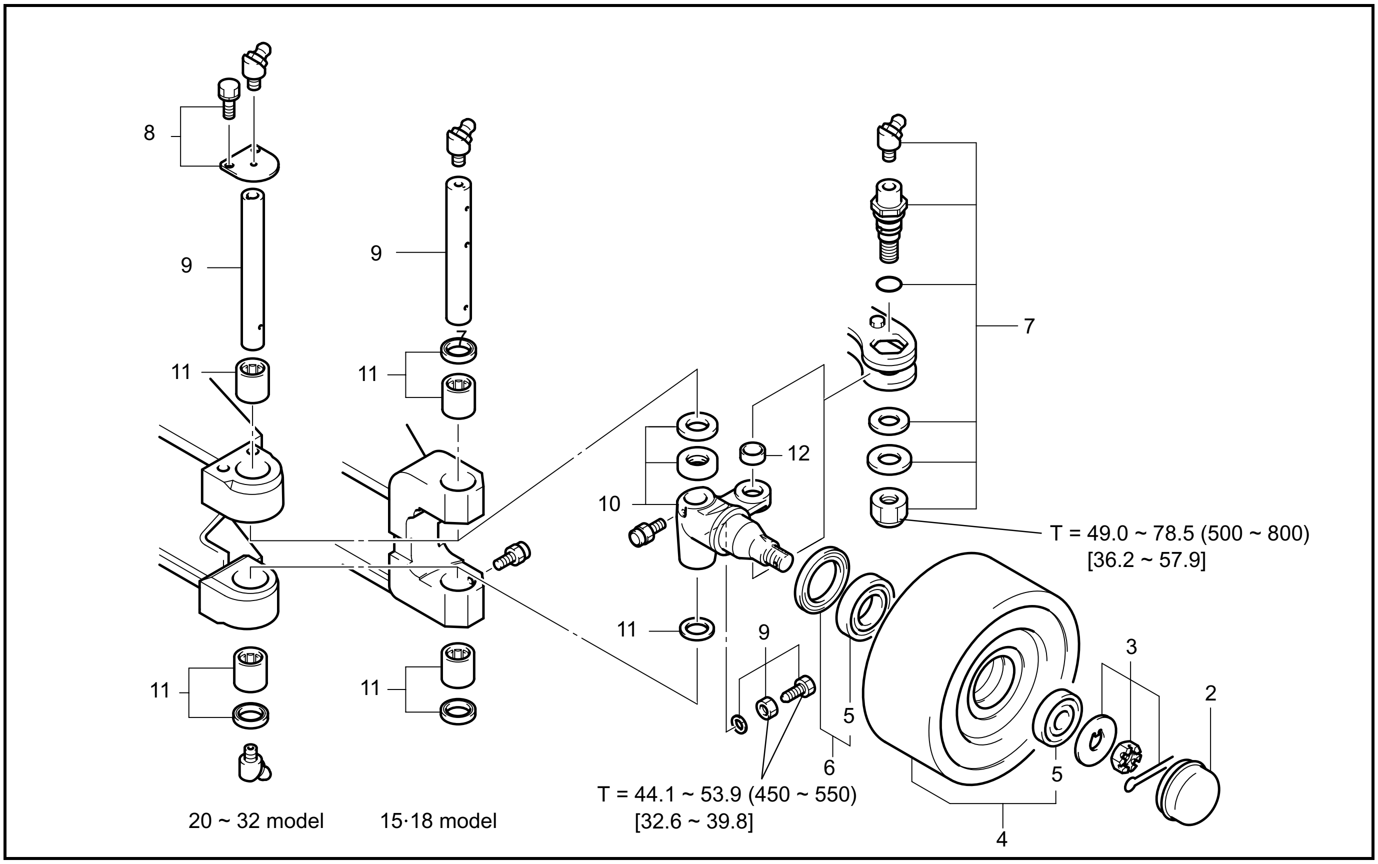
Limit:
Front pin bushing   82.0 mm (3.228 in)
Rear pin bushing   67.0 mm (2.638 in)

Installation:
Apply molybdenum disulfide grease to the bushing before installation.

STEERING KNUCKLE (15 ~ 32 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



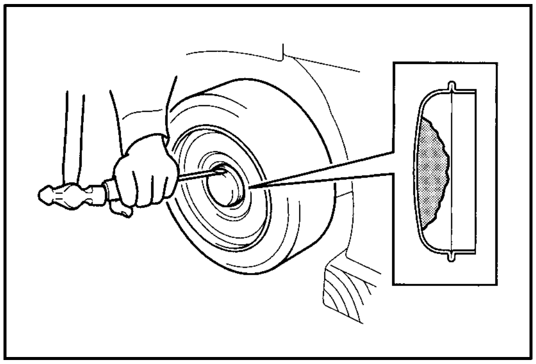
Removal Procedure

1 Jack up the vehicle.
2 Remove the hub cap. **[Point 1]**
3 Remove the castle nut and claw washer. **[Point 2]**
4 Remove the outer bearing and rear wheel. **[Point 3]**
5 Remove the bearing outer race from the rear wheel. **[Point 4]**
6 Remove the inner bearing roller and oil seal. **[Point 5]**
7 Disconnect the tie rod (on the knuckle side). **[Point 6]**
8 Remove the king pin cover. (20 ~ 32 model)
9 Remove the king pin lock bolt and king pin. **[Point 7]**
10 Remove the thrust bearing, spacer and steering knuckle.
11 Remove the king pin oil seal and needle roller bearing. **[Point 8]**
12 Remove the bushing from the steering knuckle. **[Point 9]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
After installation, add MP grease through grease fittings.

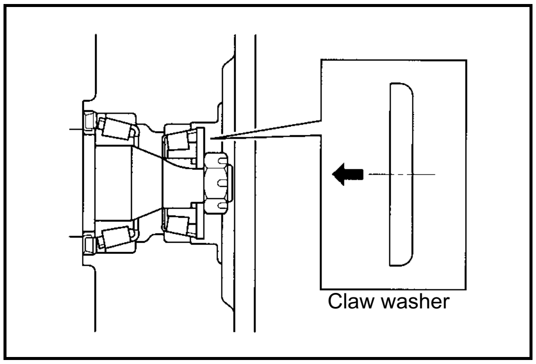


Point Operations

[Point 1]

Installation:

Fill MP grease in the hub cap, and install by tapping the flange portion.
(Instead of MP grease filling, spraying grease over the castle nut is also usable.)

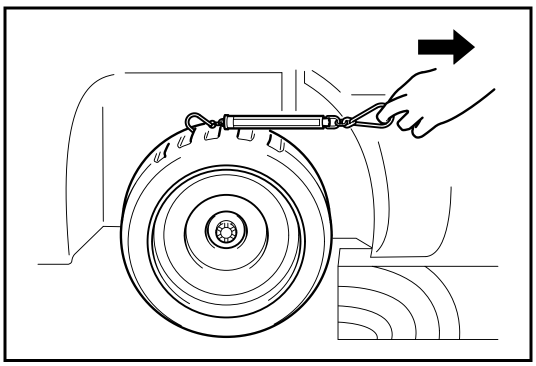


[Point 2]

Installation:

Adjust the rear wheel starting force.

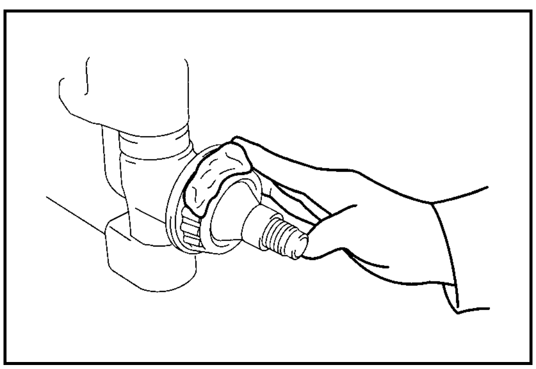
1. Install the claw washer in the correct direction.
2. Install the castle nut and temporarily tighten it to a torque of 15 to 32 N·m (150 to 330 kgf-cm) [10.9 to 23.9 ft-lbf].
3. Rotate the hub by 3 to 5 turns to run in the bearing.



4. Set a spring scale at the outer periphery of the wheel, and measure the starting force.

Standards:
15·18 model
6.9 ~ 20 N (0.7 ~ 2.0 kgf) [1.5 ~ 4.4 lbf]
20 ~ 32 model
9.8 ~ 29 N (1.0 ~ 3.0 kgf) [2.2 ~ 6.6 lbf]

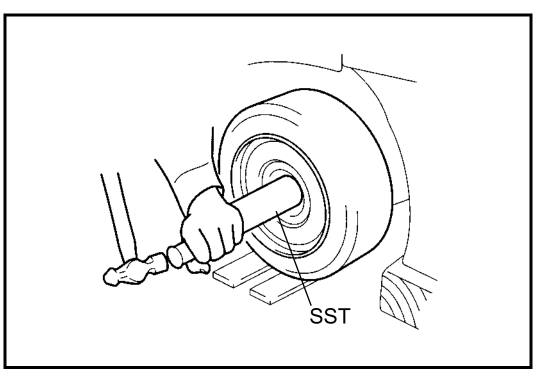
5. If the standard is not satisfied, adjust the degree of castle nut tightening for adjustment.
6. Install a new cotter pin.



[Point 3]

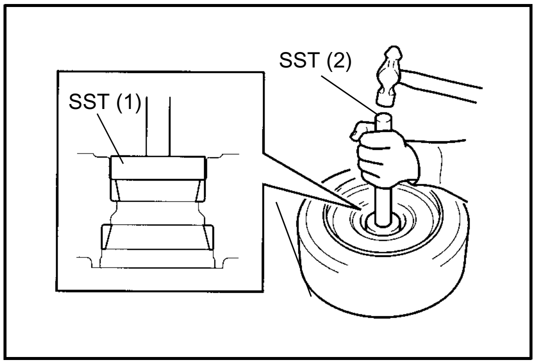
Installation:

Fill MP grease in the hub and knuckle spindle.



Installation:

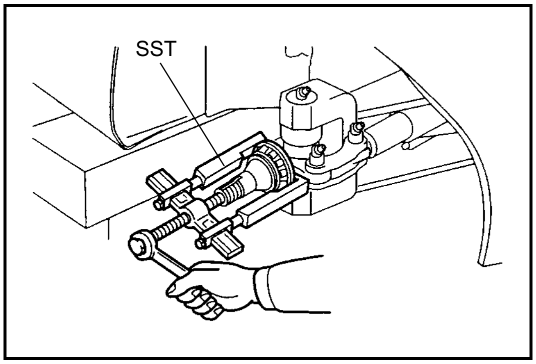
Install the rear wheel and outer bearing.
SST 09370-20270-71



[Point 4]

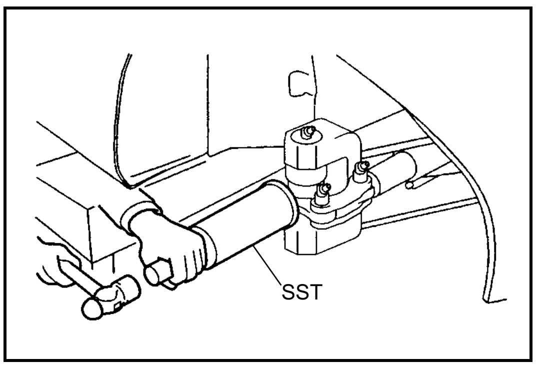
Removal:
Use a brass bar and remove the bearing outer race.

Installation:
SST 09950-76019-71 .... (1)
(SST 09950-60020)
SST 09950-76020 .... (2)
(SST 09950-70010)



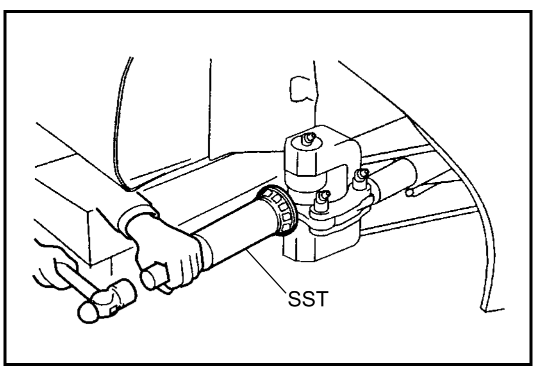
[Point 5]

Removal:
SST 09950-76014-71
(SST 09950-40011)

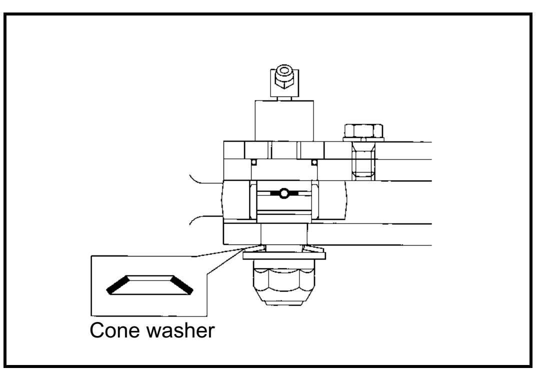


Installation:
Install the oil seal and inner bearing roller.

1. Use the SST and install the oil seal.
   SST 09370-10410-71



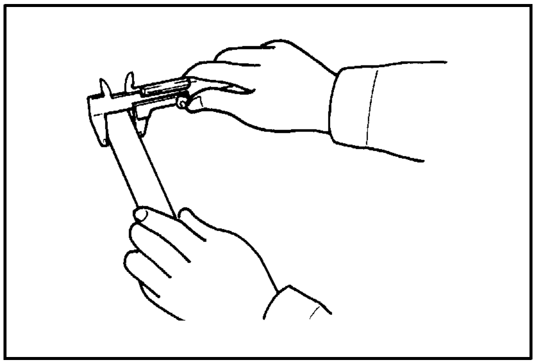
2. Use the SST and install the inner bearing roller.
   SST 09370-20270-71



[Point 6]

Installation:
To install the end pin lock nut, install the cone washer in the illustrated direction and tighten to a specified torque.

T = 49.0 ~ 78.5 N·m (500 ~ 800 kgf-cm)
[36.2 ~ 57.9 ft-lbf]

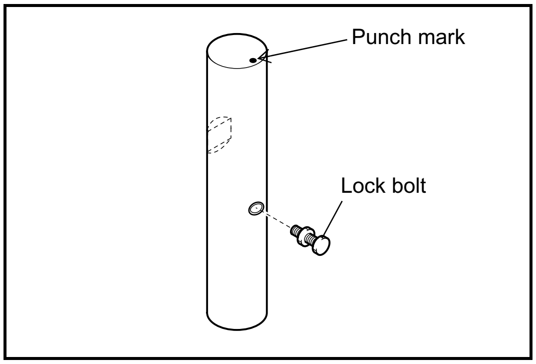


[Point 7]

Inspection:

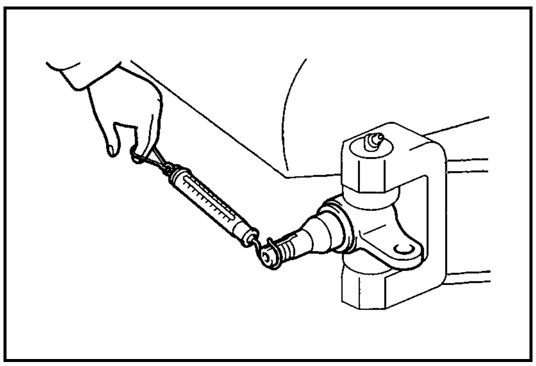
Measure the king pin outside diameter.

Limit: 27.8 mm (1.094 in)



Installation:

Before installation, check the positional relationships between the punch mark on top of the king pin and the king pin lock bolt.

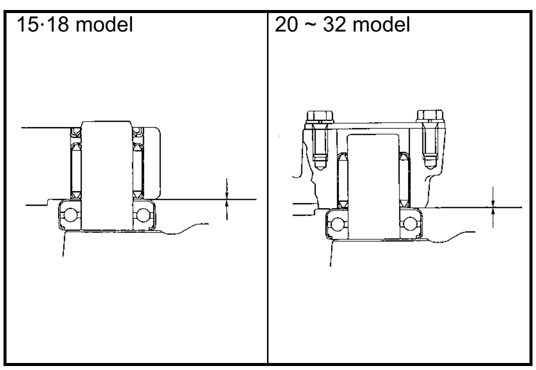


Installation:

Measure the steering knuckle starting force.

1. Temporarily install the king pin and king pin lock bolt. Select the spacer so as to minimize vertical looseness of the knuckle, and install it on top of the thrust bearing.
2. Set a spring scale at the tip end of the knuckle spindle, and measure the starting force.

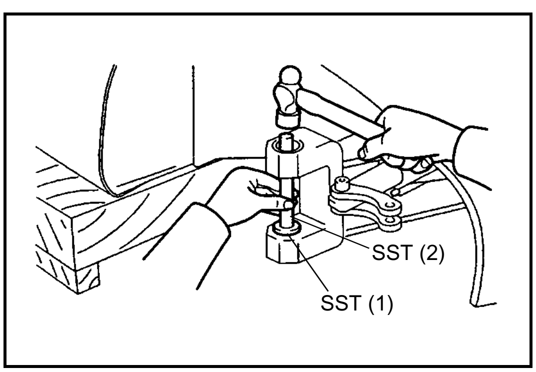
   Standard: 19.3 N (2.0 kgf) [4.4 lbf] or less



3. If the standard is exceeded, check the king pin for bend, the needle bearing for damage and axle beam for deformation.

   Spacer thickness: 3.0, 3.5, 4.0 and 4.5 mm (0.118, 0.138, 0.157 and 0.177 in)

4. Tighten the lock nut for the king pin lock bolt.

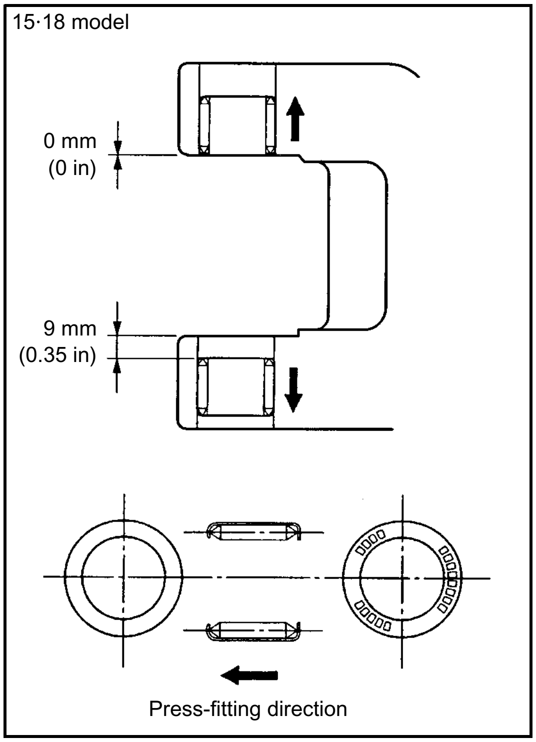


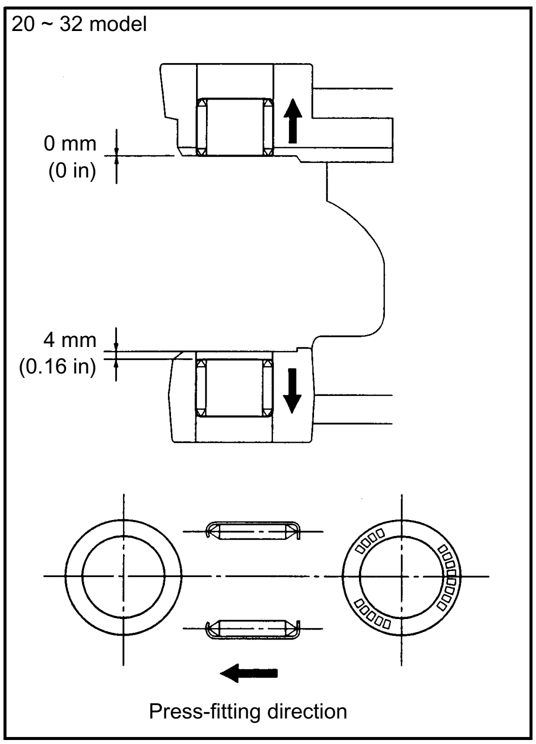
[Point 8]

Removal:

Remove the king pin oil seal and needle roller bearing.

1. Use a straight-edge screwdriver to remove the dust seal and oil seal.
2. Use the SST and remove the needle roller bearing.
   SST 09950-76018-71 .... (1)
   (SST 09950-60010)
   SST 09950-76020-71 .... (2)
   (SST 09950-70010)

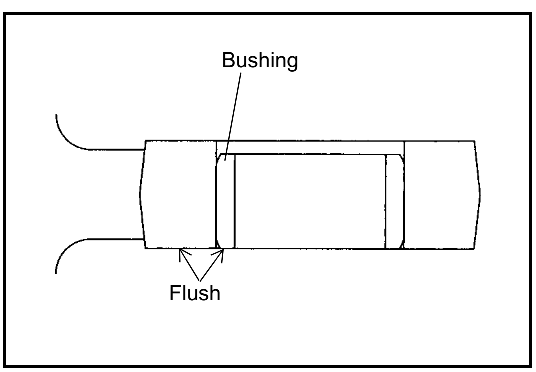




Installation:

Install the needle roller bearing and king pin oil seal.

1. Use the SST and install the needle bearing.
   Check the needle roller bearing press-fitting surface, pressing direction and installation depth.
   SST 09950-76018-71 .... (1)
   (SST 09950-60010)
   SST 09950-76020-71 .... (2)
   (SST 09950-70010)
2. Install the dust seal.
3. Use the SST and install the oil seal.
   SST 09950-76018-71 .... (1)
   (SST 09950-60010)
   SST 09950-76020-71 .... (2)
   (SST 09950-70010)



[Point 9]

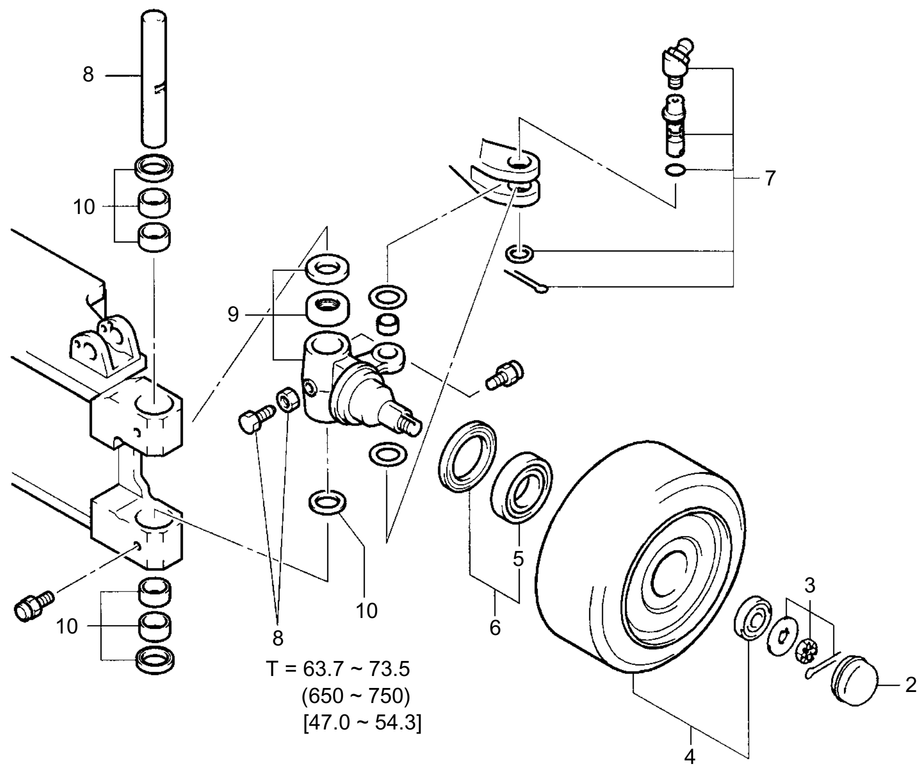
Installation:

Press-in the bushing flush to the lower surface of the knuckle. (Clearance on the upper side will be used for the grease well.).

STEERING KNUCKLE (35 ~ 55 MODEL)

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



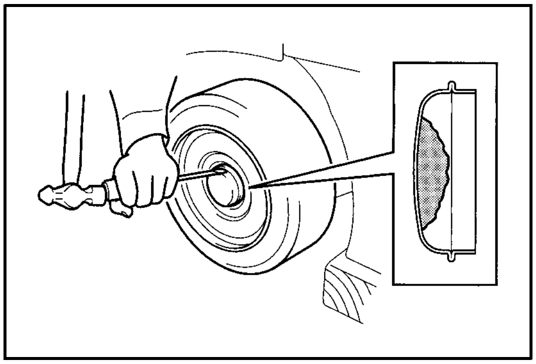
Removal Procedure

1 Jack up the vehicle.
2 Remove the hub cap. **[Point 1]**
3 Remove the castle nut and claw washer. **[Point 2]**
4 Remove the outer bearing and rear wheel. **[Point 3]**
5 Remove the bearing outer race from the rear wheel. **[Point 4]**
6 Remove the inner bearing roller and oil seal. **[Point 5]**
7 Disconnect the tie rod (on the knuckle side).
8 Remove the king pin lock bolt and king pin. **[Point 6]**
9 Remove the thrust bearing, spacer and steering knuckle.
10 Remove the king pin oil seal and needle roller bearing. **[Point 7]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
After installation, add MP grease through grease fittings.

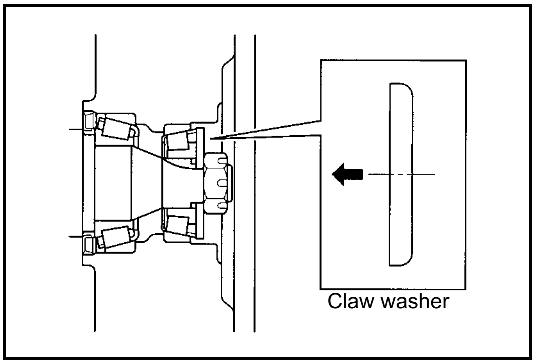


Point Operations

[Point 1]

Installation:

Fill MP grease in the hub cap, and install by tapping the flange portion.
(Instead of MP grease filling, spraying grease over the castle nut is also usable.)

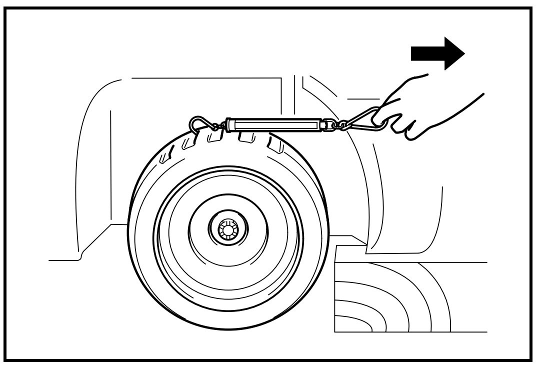


[Point 2]

Installation:

Adjust the rear wheel starting force.

1. Install the claw washer in the correct direction.
2. Install the castle nut and temporarily tighten it to a torque of 15 to 32 N·m (150 to 330 kgf-cm) [10.9 to 23.9 ft-lbf].
3. Rotate the hub by 3 to 5 turns to run in the bearing.



4. Set a spring scale at the outer periphery of the wheel, and measure the starting force.

   Standards:

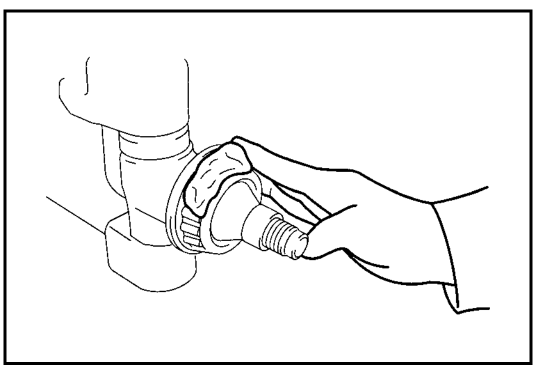
   35·45 model

   29 ~ 44 N (3.0 ~ 4.5 kgf) [6.6 ~ 9.9 lbf]

   55 model

   31 ~ 63 N (3.2 ~ 6.4 kgf) [7.1 ~ 14.1 lbf]

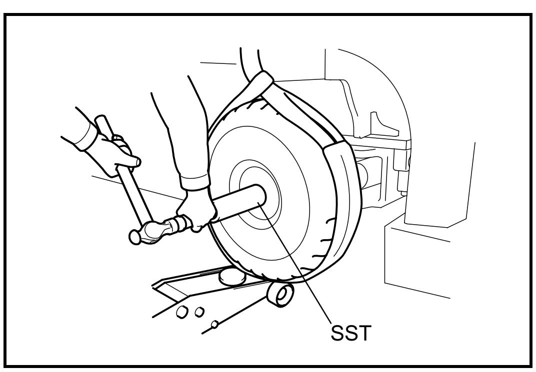
5. If the standard is not satisfied, adjust the degree of castle nut tightening for adjustment.
6. Install a new cotter pin.



[Point 3]

Installation:

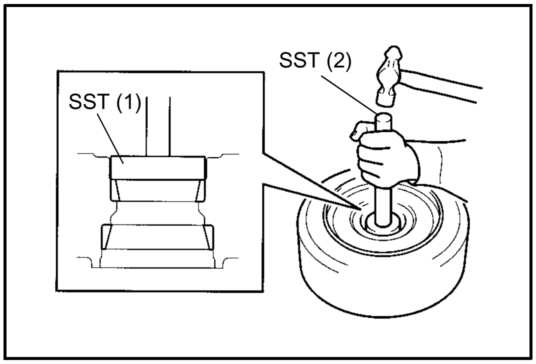
Fill MP grease in the hub and knuckle spindle.



Installation:

Install the rear wheel and outer bearing.

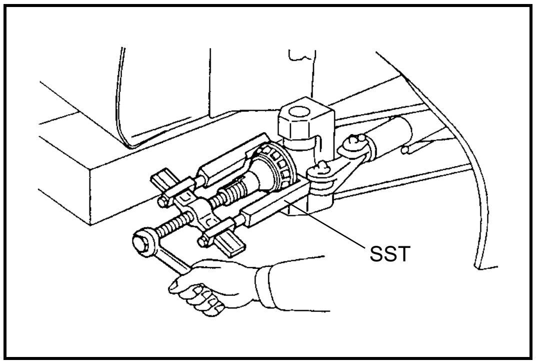
SST 09370-20270-71



[Point 4]

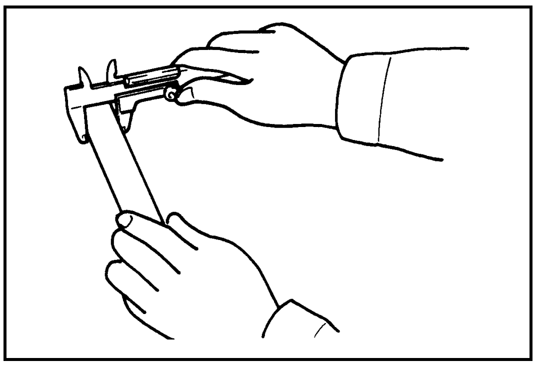
Removal:
Use a brass bar and remove the bearing outer race.

Installation:
SST 09950-76019-71 .... (1)
(SST 09950-60020)
SST 09950-76020-71 .... (2)
(SST 09950-70010)



[Point 5]

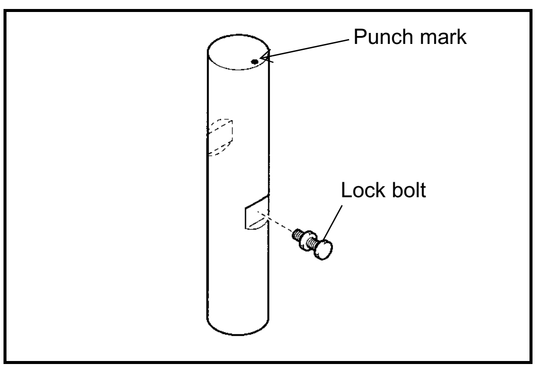
Removal:
SST 09950-76014-71
(SST 09950-40011)



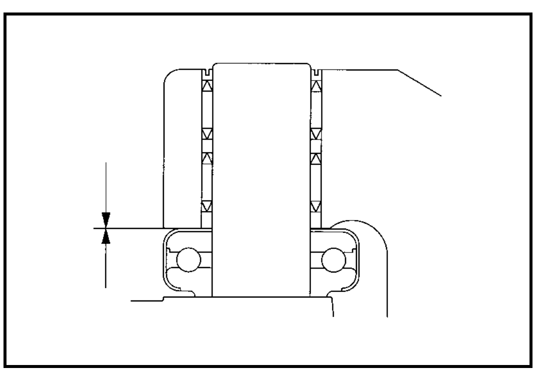
[Point 6]

Inspection:
Measure the king pin outside diameter.

Limit: 39.8 mm (1.567 in)

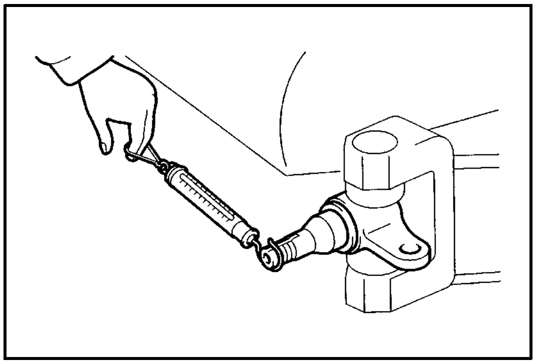


Installation:
Before installation, check the positional relationships between the punch mark on top of the king pin and the king pin lock bolt.



Installation:
Measure the steering knuckle starting force.

1. Temporarily install the king pin and king pin lock bolt. Select the spacer so as to minimize vertical looseness of the knuckle, and install it on top of the thrust bearing.



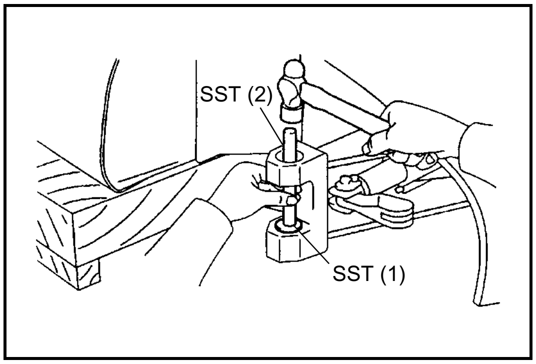
2. Set a spring scale at the tip end of the knuckle spindle, and measure the starting force.

   Standard: 19.3 N (2.0 kgf) [4.4 lbf] or less

3. If the standard is exceeded, check the king pin for bend, the needle bearing for damage and axle beam for deformation.

   Spacer thickness:
   0.15, 0.25, 0.35, 0.5 and 1.0 mm
   (0.006, 0.010, 0.014, 0.020 and 0.039 in)

4. Tighten the lock nut for the king pin lock bolt.

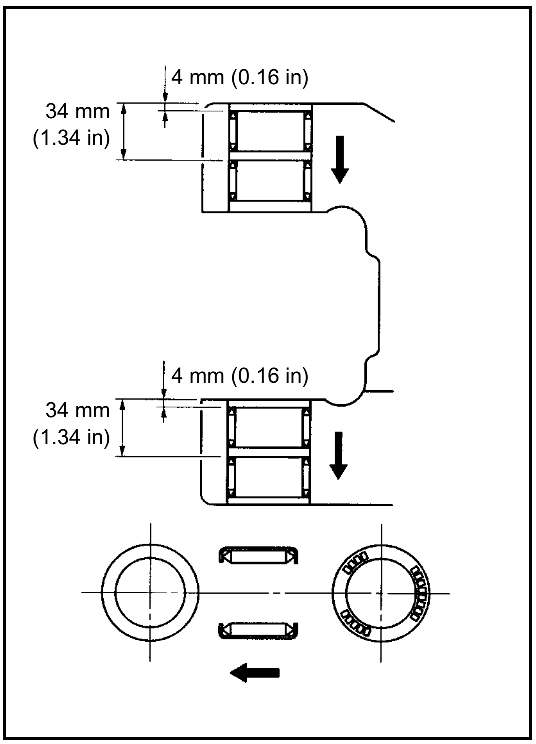


[Point 7]

Removal:

Remove the king pin oil seal and needle roller bearing.

1. Use a straight-edge screwdriver to remove the dust seal and oil seal.
2. Use the SST and remove the needle roller bearing.
   SST 09950-76018-71 .... (1)
   (SST 09950-60010)
   SST 09950-76020-71 .... (2)
   (SST 09950-70010)



Installation:

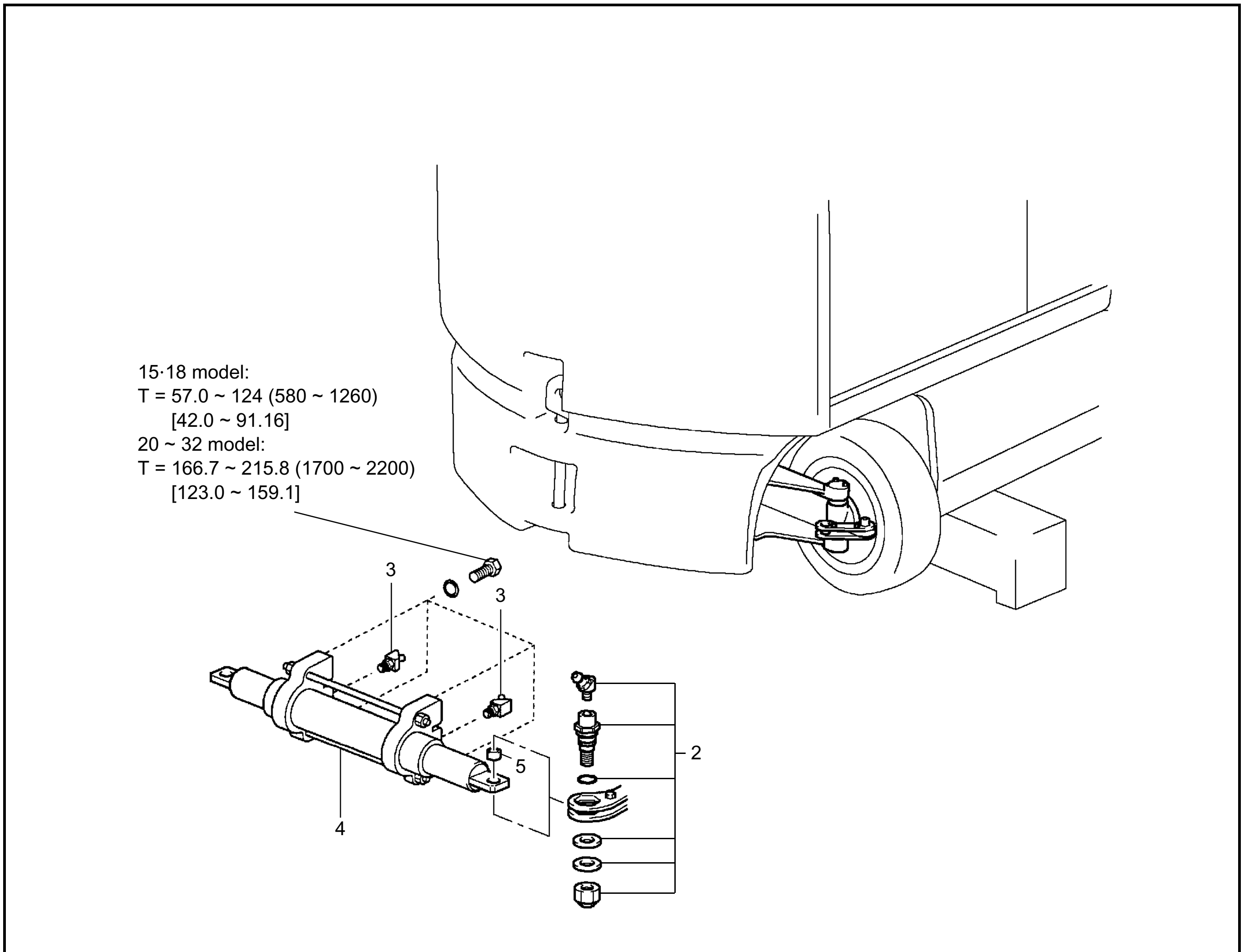
Install the needle roller bearing and king pin oil seal.

1. Use the SST and install the needle bearing.
   Check the needle roller bearing press-fitting surface, pressing direction and installation depth.
   SST 09950-76018-71 .... (1)
   (SST 09950-60010)
   SST 09950-76020-71 .... (2)
   (SST 09950-70010)
2. Install the dust seal.
3. Use the SST and install the oil seal.
   SST 09950-76018-71 .... (1)
   (SST 09950-60010)
   SST 09950-76020-71 .... (2)
   (SST 09950-70010)

REAR AXLE CYLINDER

REMOVAL·INSTALLATION (15 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

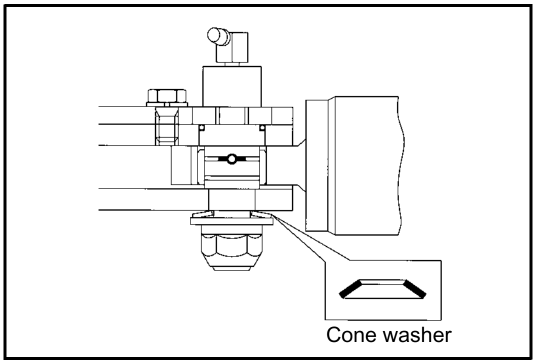
1 Jack up the vehicle.
2 Disconnect the tie rod (on the piston rod side). **[Point 1]**
3 Disconnect the rear axle cylinder hose and remove the fitting. **[Point 2]**
4 Remove the rear axle cylinder. **[Point 3]**
5 Remove the bushing from the piston rod. **[Point 4]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Point Operations

[Point 1]

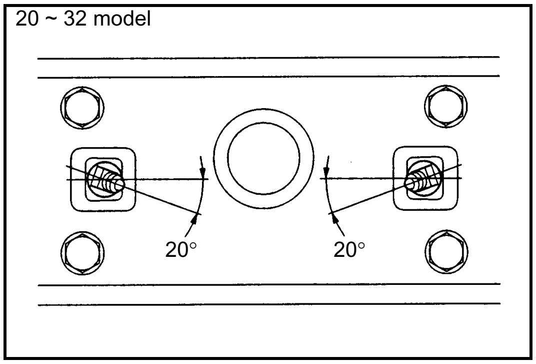


Installation:

To install the end pin lock nut, install the cone washer in the illustrated direction and tighten to a specified torque.

T = 49.0 ~ 78.5 N·m (500 ~ 800 kgf-cm)
[36.2 ~ 57.9 ft-lbf]

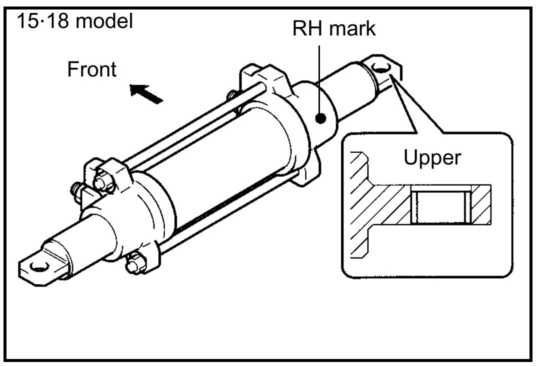
[Point 2]



Installation:

20 ~ 32 model
Install the fitting in the illustrated direction.

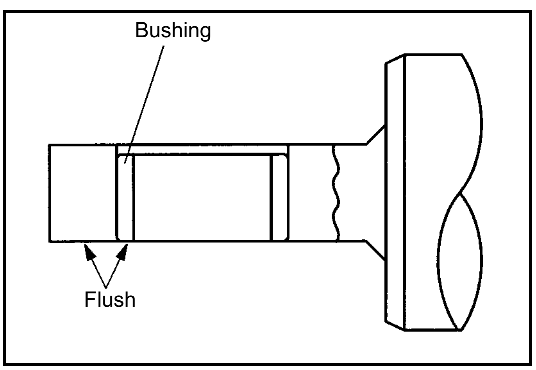
[Point 3]



Installation:

15·18 model
Check the RH mark (colored paint).
Check the vertical direction of the rod when installing the cylinder.

[Point 4]

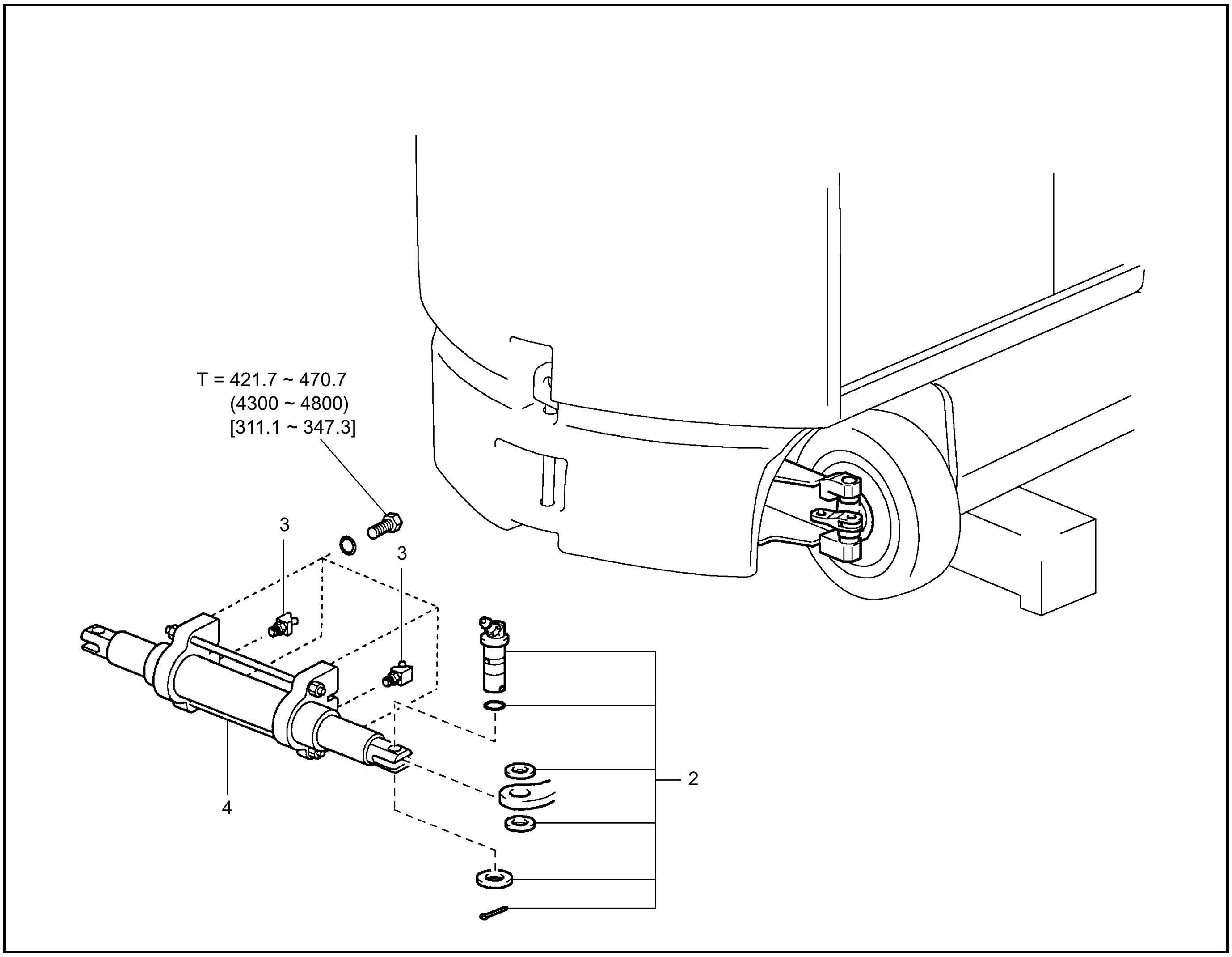


Installation:

Press-in the bushing flush to the lower surface of the rod on both ends. (Clearance on the upper side will be used for the grease well.)

REMOVAL·INSTALLATION (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]

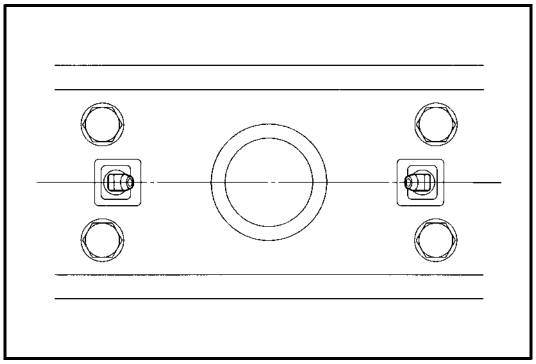


Removal Procedure

1 Jack up the vehicle.
2 Disconnect the tie rod (on the piston rod side).
3 Disconnect the rear axle cylinder hose and remove the fitting. **[Point 1]**
4 Remove the rear axle cylinder.

Installation Procedure

The installation procedure is the reverse of the removal procedure.



Point Operation

[Point 1]

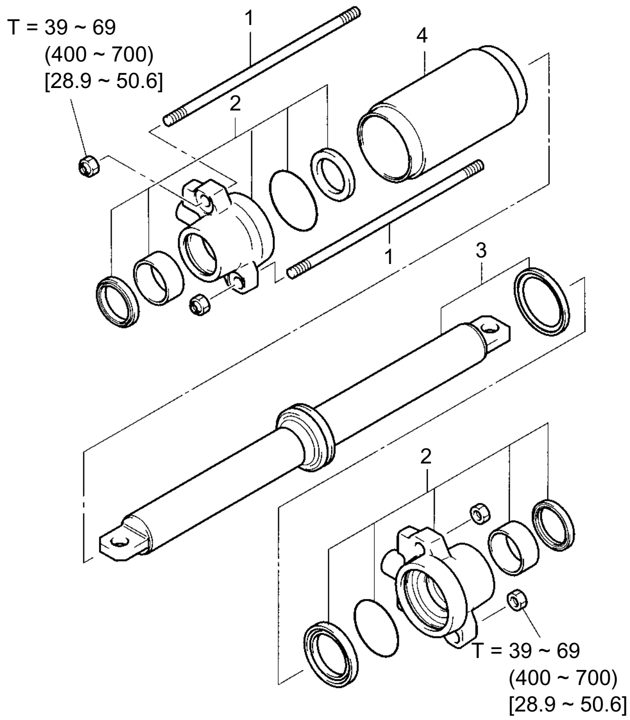
Installation:

Install the fitting in the illustrated direction.

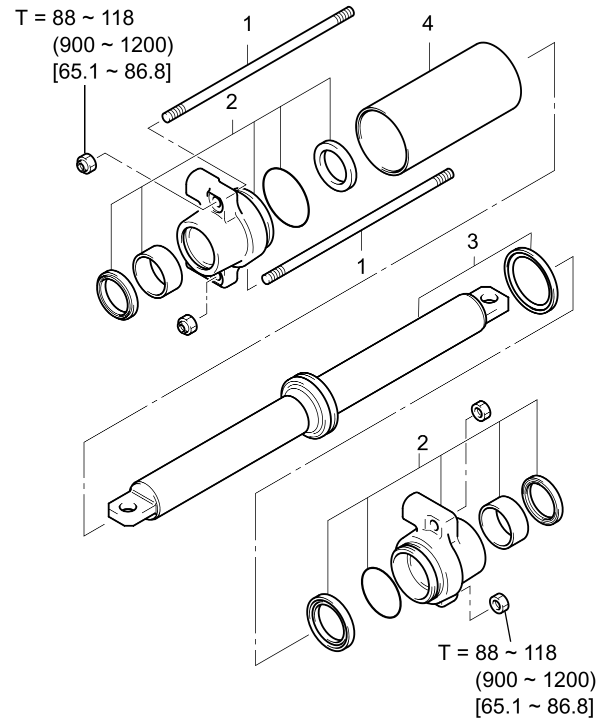
DISASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]

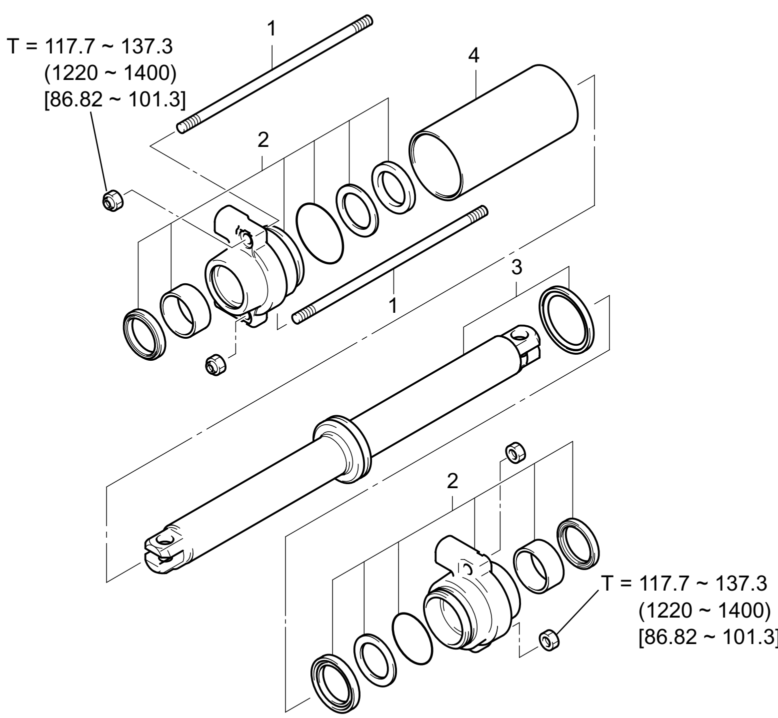
15·18 model



20 ~ 32 model



35 ~ 55 model



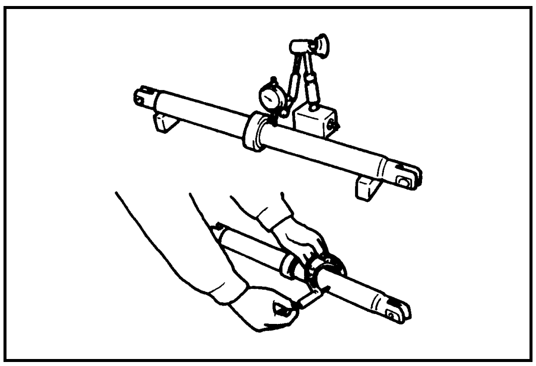
Disassembly Procedure

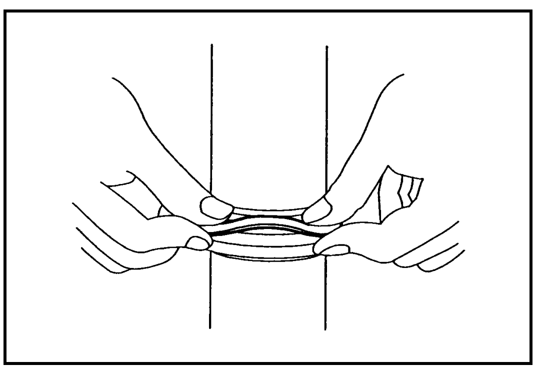
1 Remove the through bolt.
2 Remove the piston rod guide.
3 Remove the piston rod. **[Point 1]**
4 Inspect the cylinder. **[Point 2]**

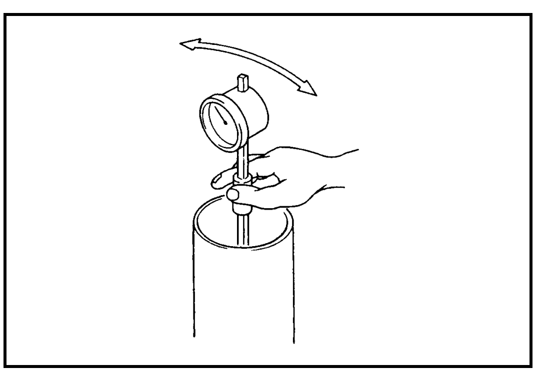
Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
Coat hydraulic oil before reassembly.







Point Operations

[Point 1]

Inspection:
Measure the piston rod outside diameter.

Limit:
15 ~ 25 model: 39.92 (1.5717 in)
30·32 model : 49.92 (1.9654 in)
35 ~ 55 model: 54.91 (2.1618 in)

Inspection:
Measure the bend of the piston rod.

Limit: 0.5 mm (0.020 in)

Reassembly:
Warm the seal ring to a little below 80°C (176°F) in hot oil or water before installation.
Do not stretch it excessively.

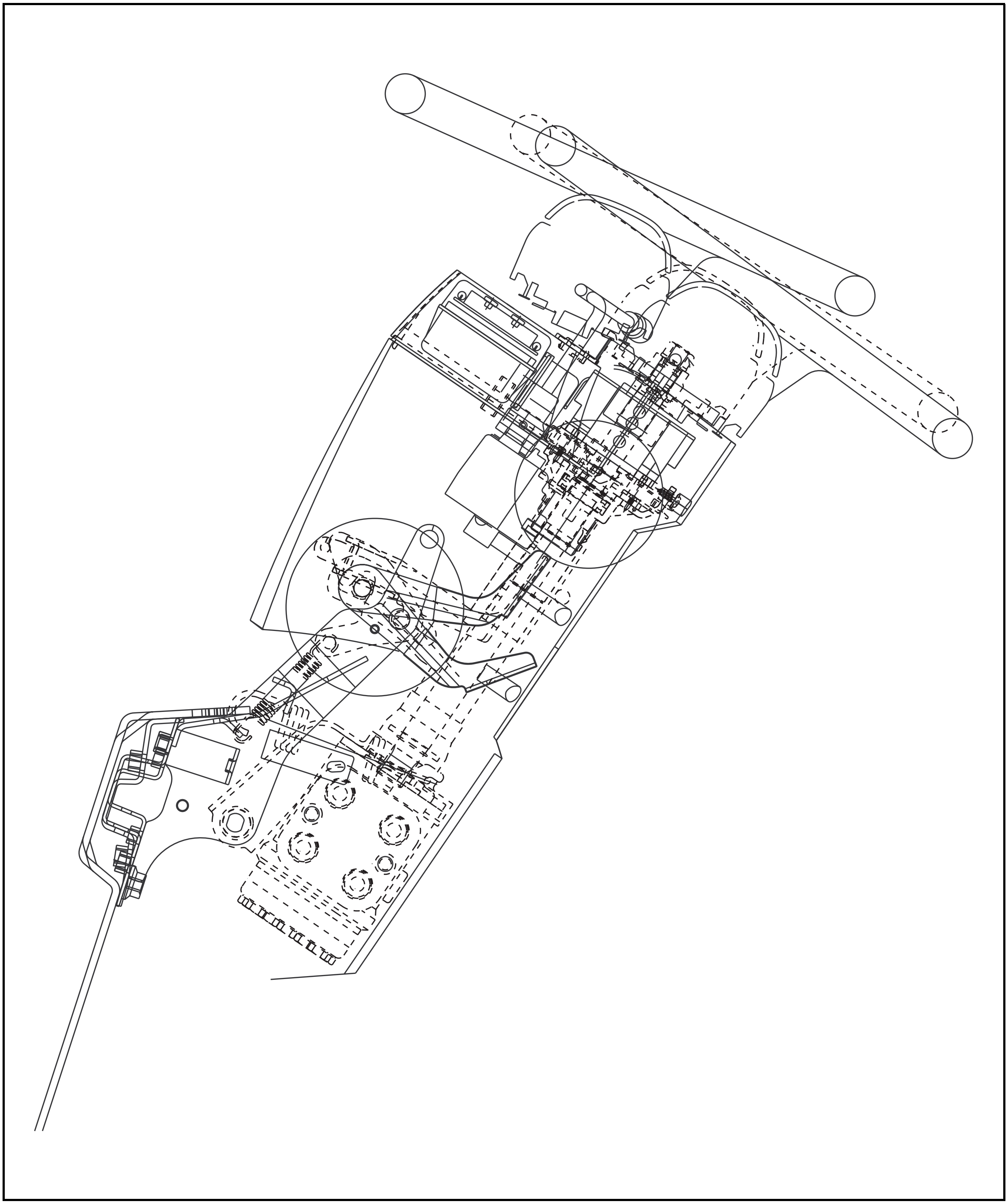
Caution:
Operate carefully to avoid scalding.
[Point 2]

Inspection:
Measure the rear axle cylinder bore.

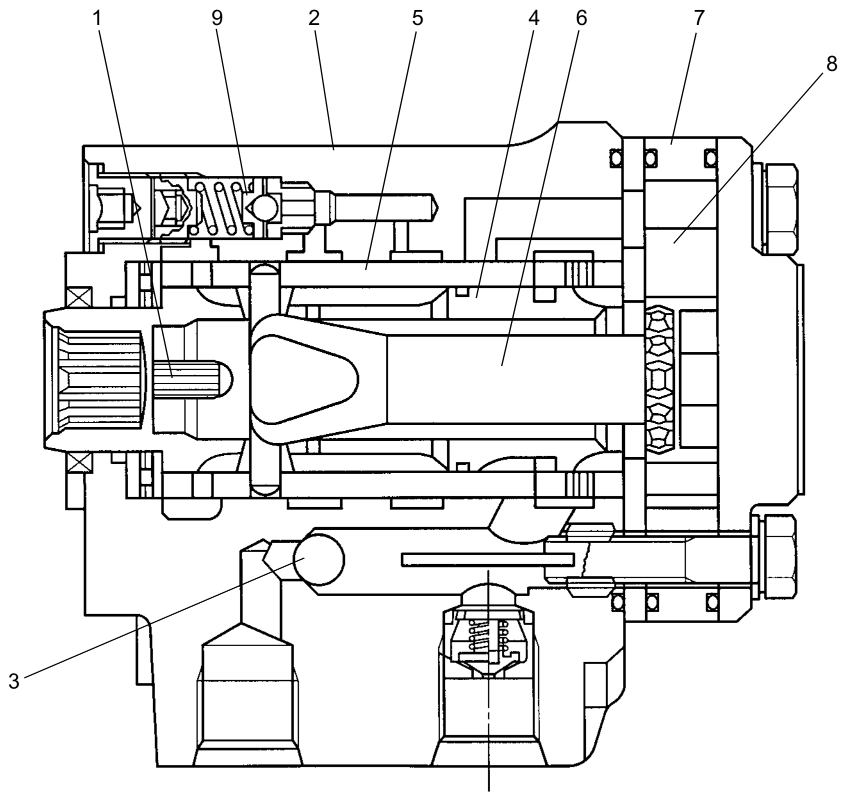
Limit:
15·18 model : 60.35 mm (2.3760 in)
20·25 model : 70.35 mm (2.7697 in)
30·32 model : 76.35 mm (3.0059 in)
35·45 model : 87.40 mm (3.4409 in)
55 model : 90.40 mm (3.5591 in)

STEERING

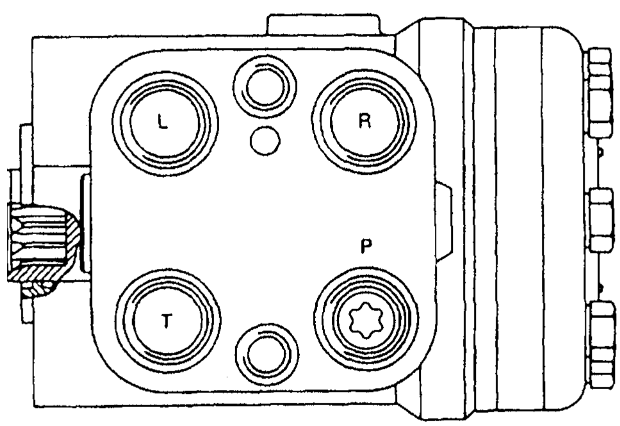
GENERAL

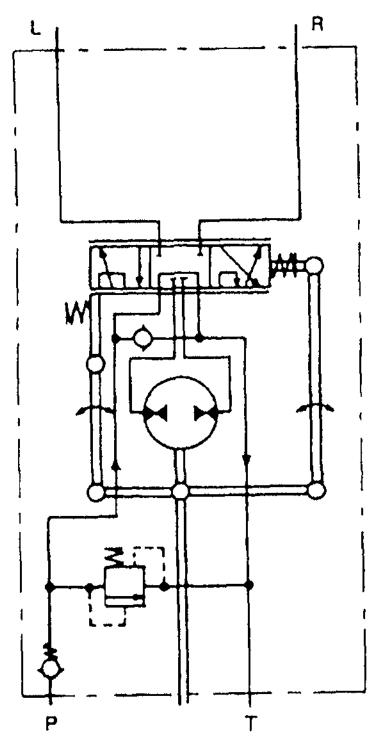


Hydrostatic Steering Valve



1. Neutral position spring
2. Housing
3. Check valve
4. Spool
5. Sleeve
6. Cardan shaft
7. Gear rim
8. Gear wheel (rotor)
9. Relief valve





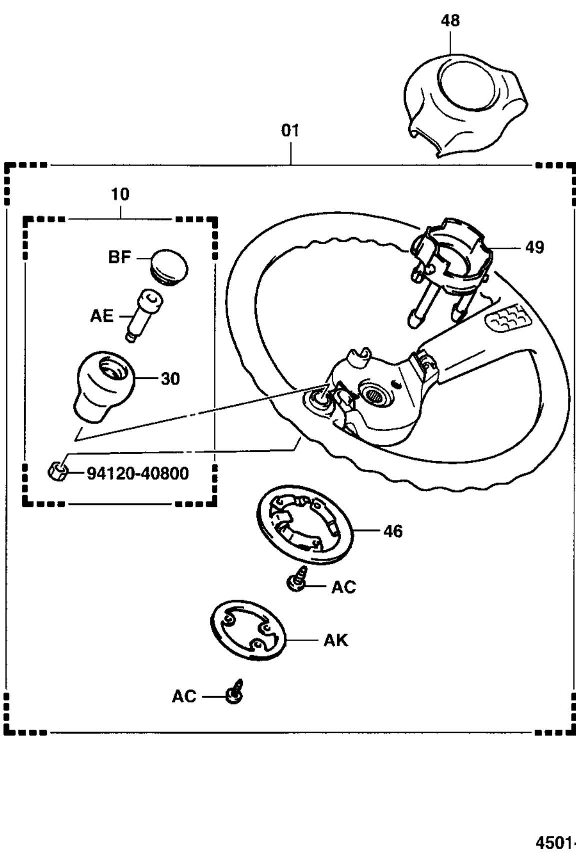
SPECIFICATIONS

Item / Model		15·18	20·25	30·32	35 ~ 55
Steering wheel diameter mm (in)		360 (14.2)			
Steering wheel play (at idling) mm (in)		20 ~ 50 (0.79 ~ 1.97)			
Power steering type		Hydrostatic steering			
Hydrostatic steering valve	Type (manufacturer)	ospc (Danfoss)			
	Delivery cm^3 (in^3)/rev	50 (3.05)	70 (4.27)	←	140 (8.54)
	Rated flow rate ℓ (US gal)/min	9.5 (2.51)	12 (3.2)	←	15 (4.0)
	Relief set pressure kPa (kgf/cm^2) [psi]	5790 (59) [840]	7060 (72) [1020]	7650 (78) [1110]	10100 (103) [1460]

COMPONENTS

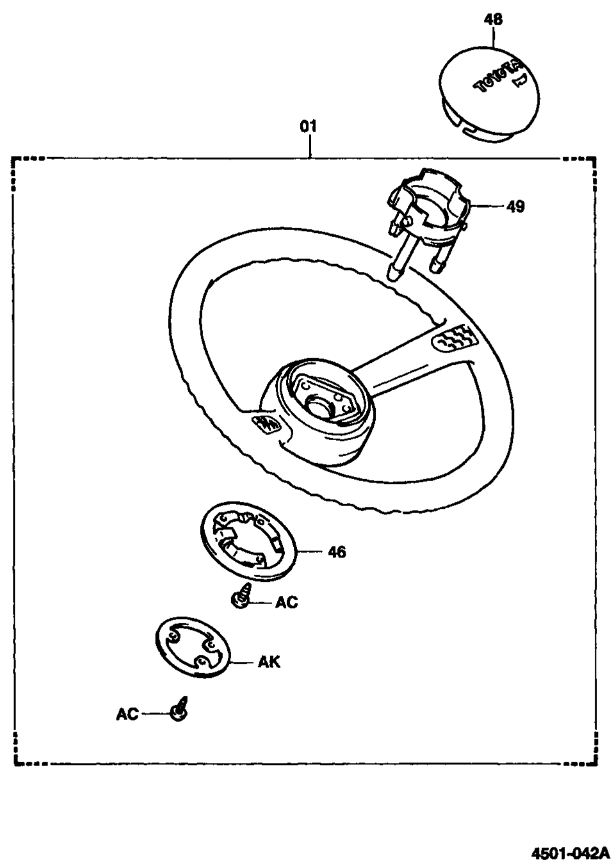
4501

15 ~ 32 model



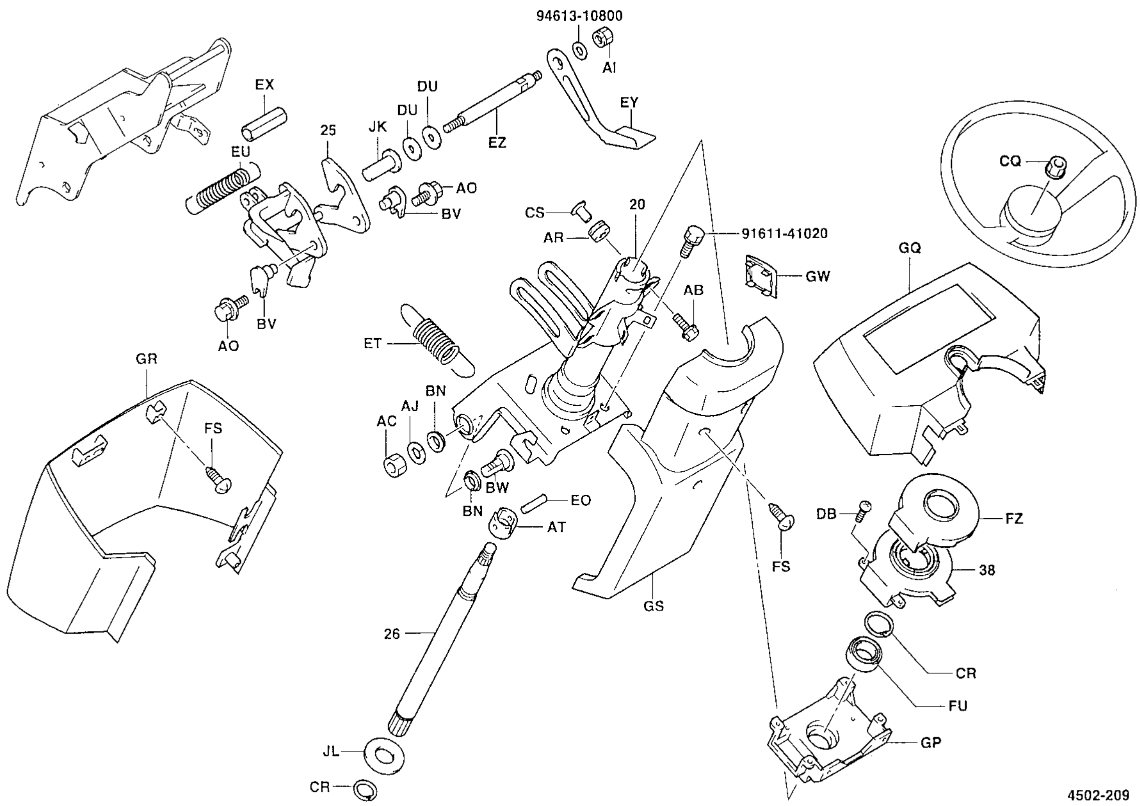
4501-050A

35 ~ 55 model



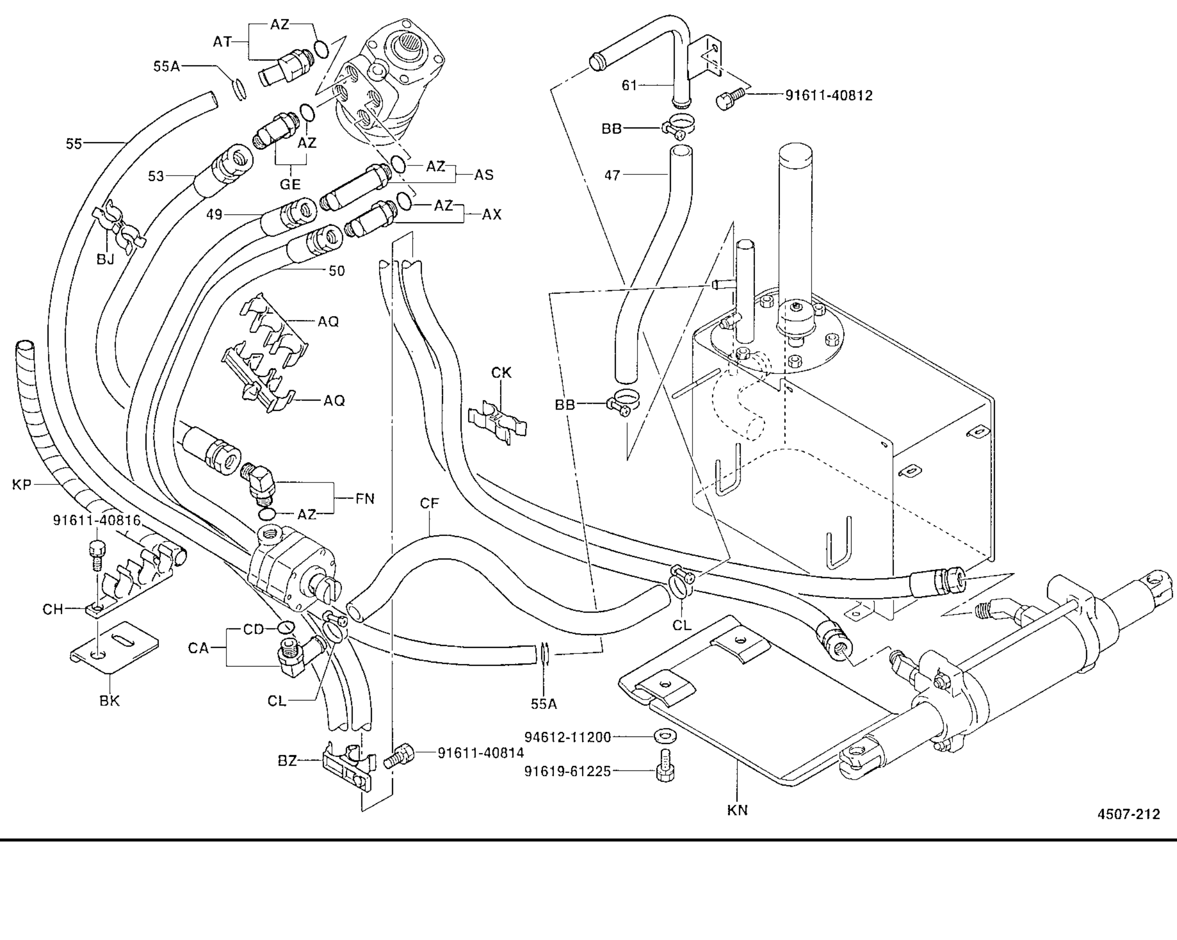
4501-042A

4502



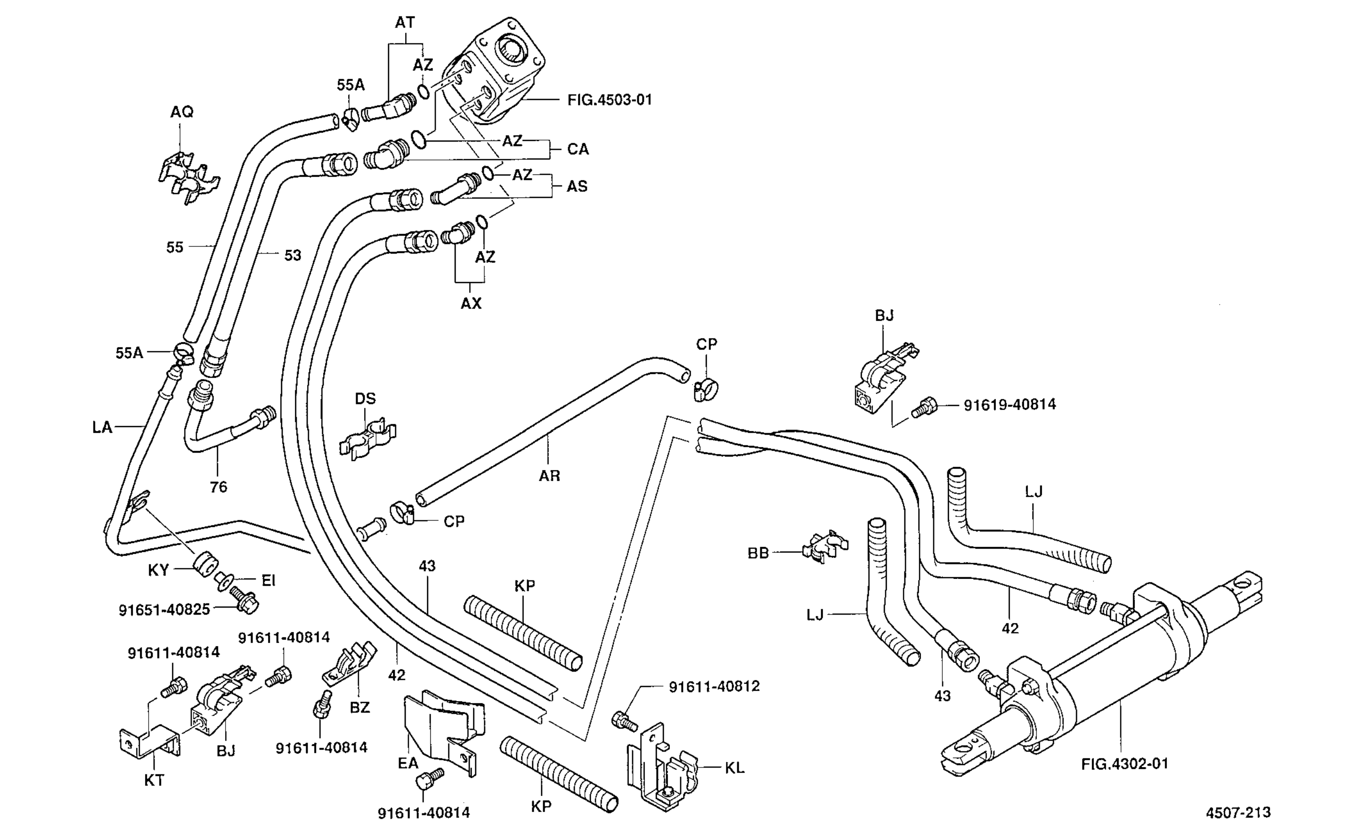
15 ~ 32 model

4507

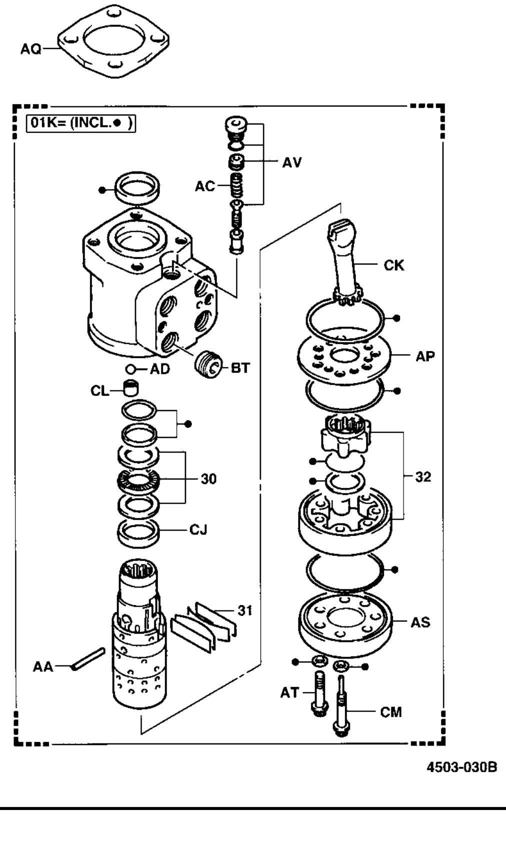


35 ~ 55 model

4507



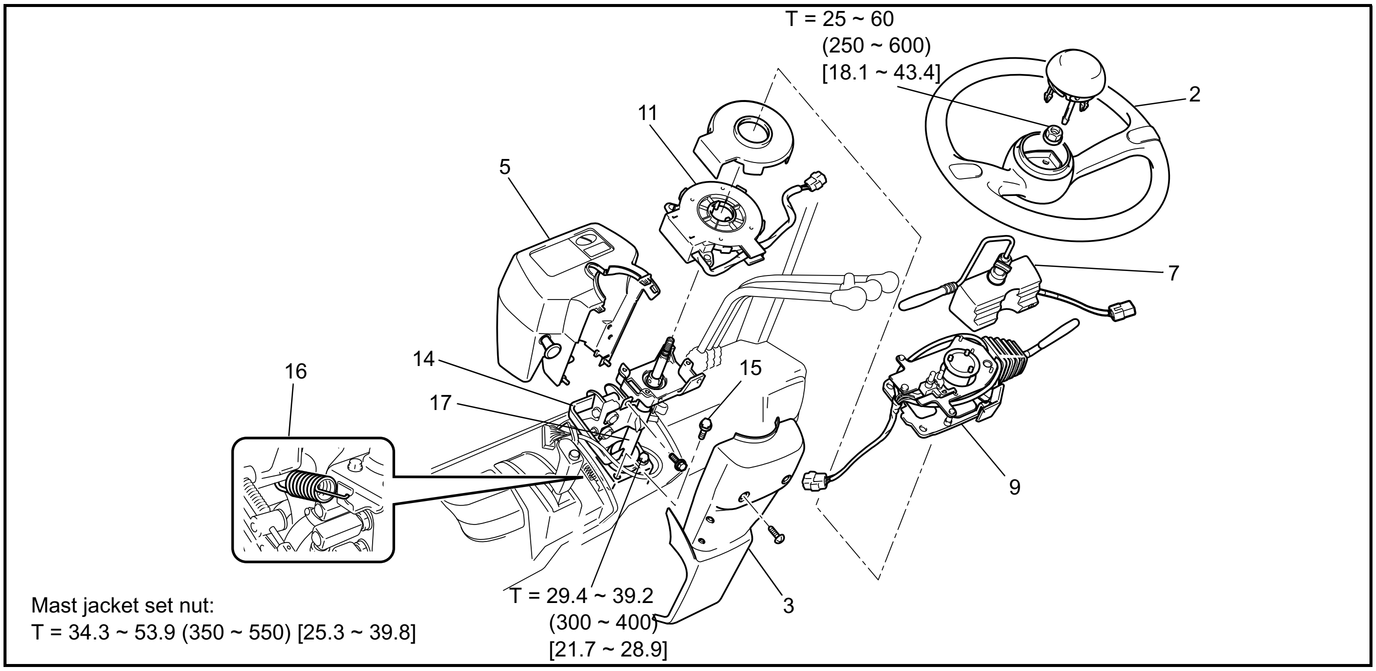
4503



STEERING WHEEL·MAST JACKET

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

1 Disconnect the battery plug.
2 Remove the steering wheel. **[Point 1]**
3 Remove the steering column cover.
4 Disconnect the connectors of the display, key switch and lamp switch.
5 Remove the meter cover with display.
6 Disconnect the direction switch connector.
7 Remove the direction switch.
8 Disconnect the turn signal switch connector.
9 Remove the turn signal switch.
10 Disconnect the steering sensor connector. (15 ~ 32 model (EHPS), 35 ~ 55 model)
11 Remove the steering sensor ASSY. (15 ~ 32 model (EHPS), 35 ~ 55 model) **[Point 2]**
12 Remove the spring pin and collar. (15 ~ 32 model (EHPS), 35 ~ 55 model) **[Point 3]**
13 Remove the tilt lock mechanism. **[Point 4]**
14 Disconnect the tilt lock device and tilt lock spring.
15 Remove the steering valve set bolt and keep the valve free.
16 Remove the return spring.
17 Remove the mast jacket ASSY.

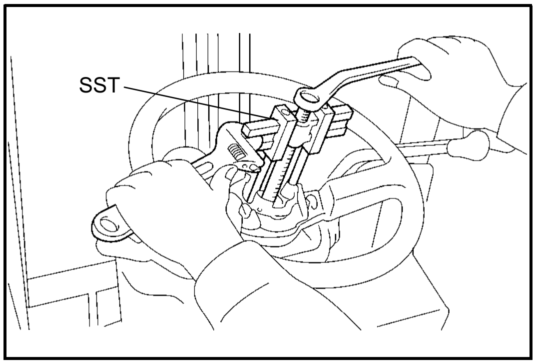
Installation Procedure

The installation procedure is the reverse of the removal procedure.

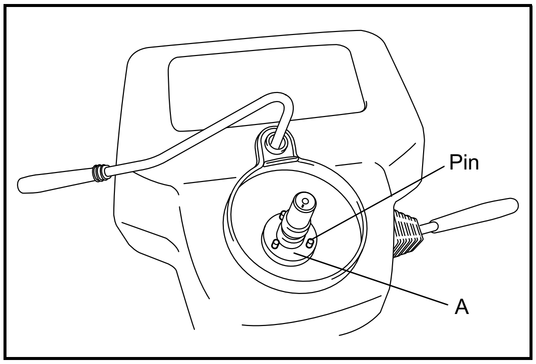
Note:
- **Apply MP grease on each sliding portion of the tilt lock mechanism.**
- **Fill MP grease at the coupling between the tilt steering shaft and steering valve.**

Point Operations

[Point 1]



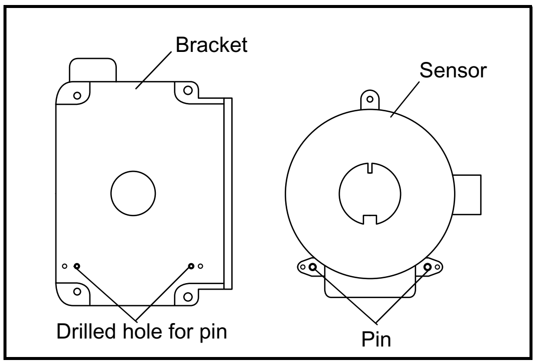
Removal:
SST 09950-76003-71
(SST 09950-50012)



Installation:
Steering wheel installation procedure

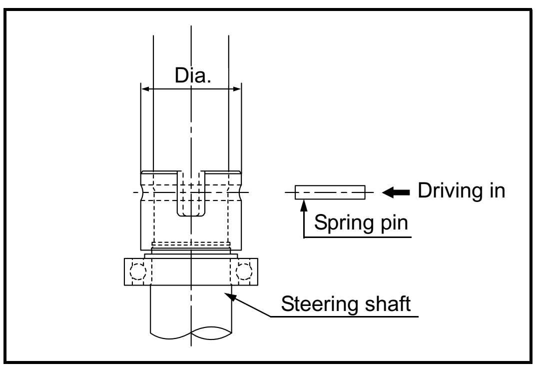
1. Apply rubber grease on sliding face A of the turn signal switch.
2. After installation, rotate the steering wheel. When the steering wheel is rotated, pins (3 pcs.) on the turn signal switch are automatically set in the holes on the steering wheel side.

[Point 2]



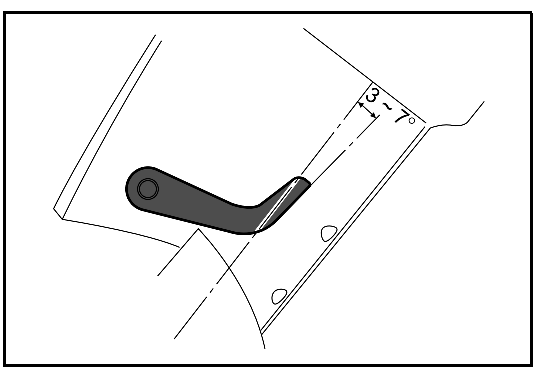
Installation:
Fix the installed sensor by tightening the tapping screw after inserting the positioning pin on the sensor side into the hole on the bracket side.
Fixing without pin insertion may damage the sensor due to concentricity error. Tighten the tapping screw carefully so as not to damage the plastic portion by overtightening.

[Point 3]



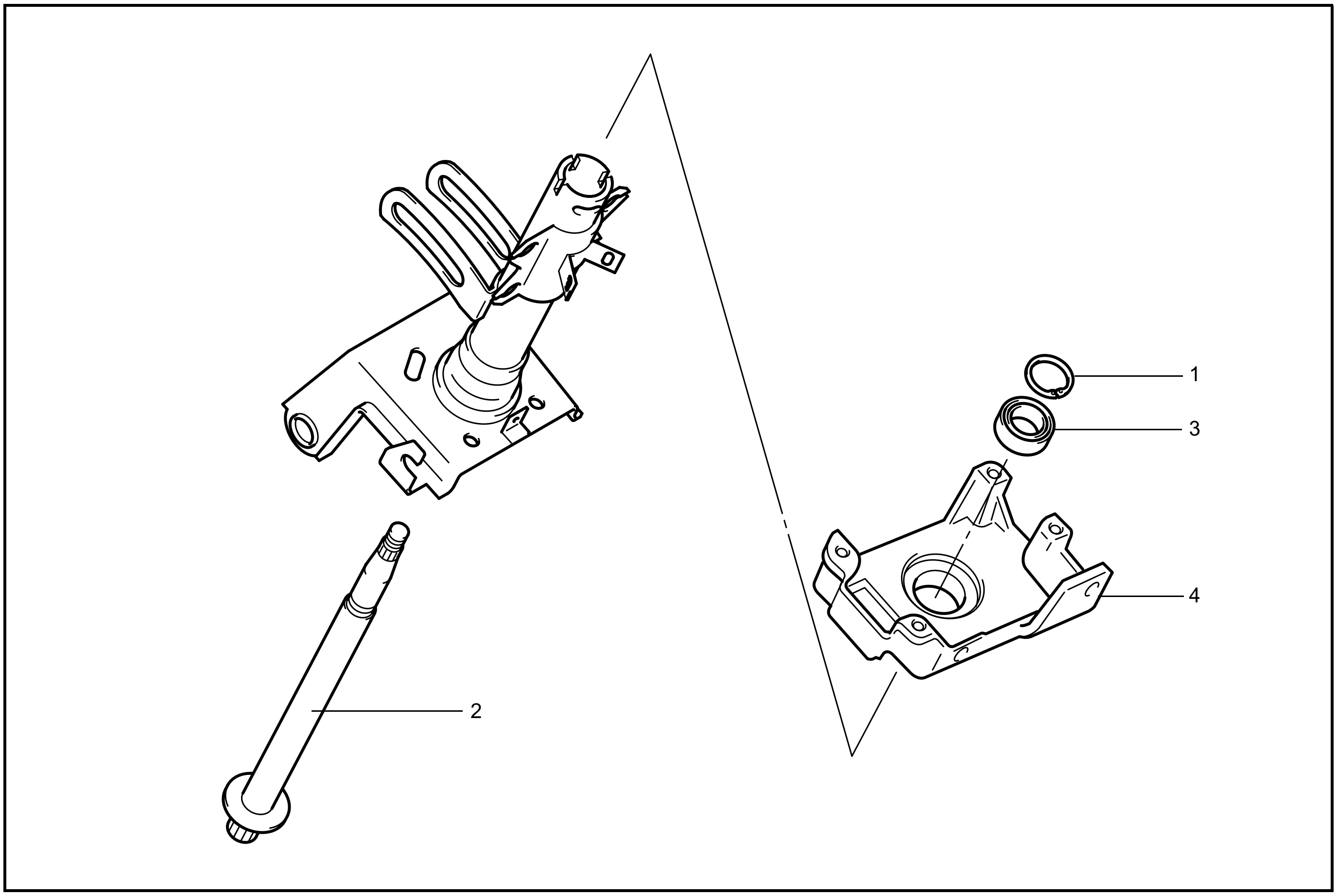
Removal Installation:
15 ~ 32 model (EHPS), 35 ~ 55 model:
Pay sufficient attention so as not to damage the collar when the spring pin is removed and installed.
Drive in the spring pin so as not to allow it to come out of collar diameter.

[Point 4]



Installation:
Install so that the tilt lever and column cover lines make an angle of 3 to 7 degrees.

DISASSEMBLY·INSPECTION·REASSEMBLY



Disassembly Procedure

1 Remove the snap ring.
2 Remove the steering shaft.
3 Remove the bearing.
4 Remove the turn signal switch bracket.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

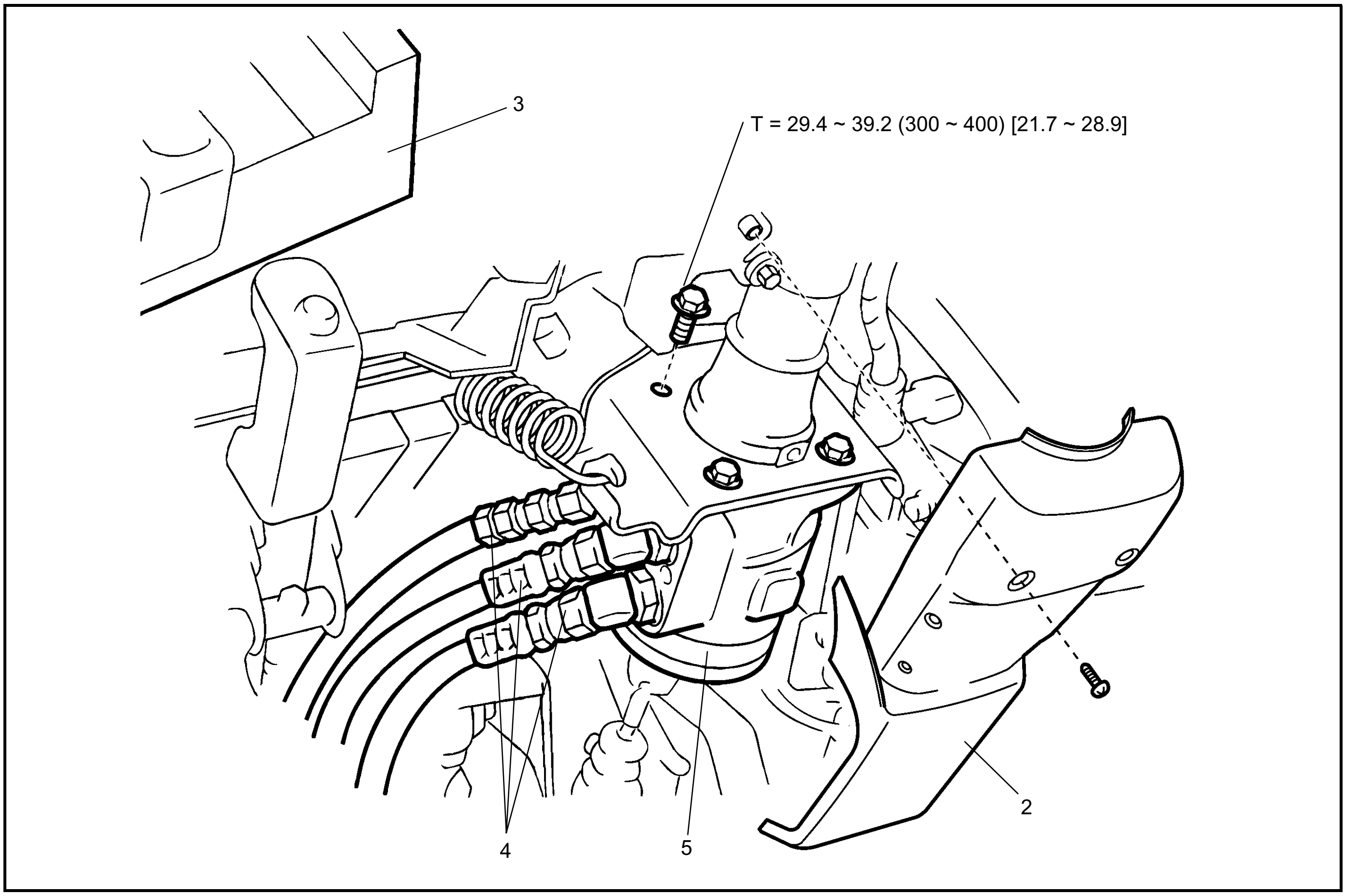
HYDROSTATIC STEERING VALVE ASSY

TROUBLESHOOTING

Fault	Possible cause	Remedy
1. Steering wheel is heavy to turn	1.1 No or insufficient oil pressure	• Repair or replace oil pump. • Repair or replace flow divider valve.
	1.2 Pressure relief valve is stuck in open position or setting pressure is too low.	• Repair or clean pressure relief valve. • Adjust the valve to the correct pressure.
	1.3 Too much friction at mechanical parts of the vehicle	• Lubricate joints of steering link or repair if necessary. • Check steering column installation.
2. Regular adjustments of the steering wheel are necessary. ("meandering")	2.1 Leaf spring without sufficient spring force or broken	• Replace leaf springs.
	2.2 Worn gear wheel set	• Replace gear wheel set.
	2.3 Seized cylinder or worn piston seal.	• Replace defects parts.
3. The steering wheel can turn on its own.	3.1 Leaf springs are stuck or broken and have therefore reduced spring force.	• Replace leaf springs.
	3.2 Inner and outer spools are stuck, possibly due to dirt.	• Clean steering unit.
4. Backlash	4.1 Cardan shaft worn or broken	• Replace Cardan shaft.
	4.2 Leaf springs without spring force or broken	• Replace leaf springs.
	4.3 Worn splines on the steering column	• Replace steering column.
5. Steering wheel can be turned wholly without moving the steered wheels.	5.1 Gear wheel set worn	• Replace gear wheel set.
6. Steering is too slow and heavy when operated quickly.	6.1 Insufficient oil supply to steering unit	• Repair or replace oil pump.
	6.2 Relief valve setting too low	• Adjust valve to correct setting.
	6.3 Relief valve stuck due to dirt	• Clean the valve.
7. Heavy kick-back in steering wheel in both directions	7.1 Wrong setting of Cardan shaft and gear-wheel set	• Correct setting as shown in Repair Manual.
8. Turning the steering wheel moves the steered wheels in opposite direction.	8.1 Hydraulic hoses for the steering cylinders have been connected reversely.	• Reverse the hoses.
9. Leakage at either input shaft, end cover, gear-wheel set, housing or top part.	9.1 Shaft seal defective	• Replace shaft seal.
	9.2 Screws loose	• Tighten screws.
	9.3 O-rings defective	• Replace O-ring.

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

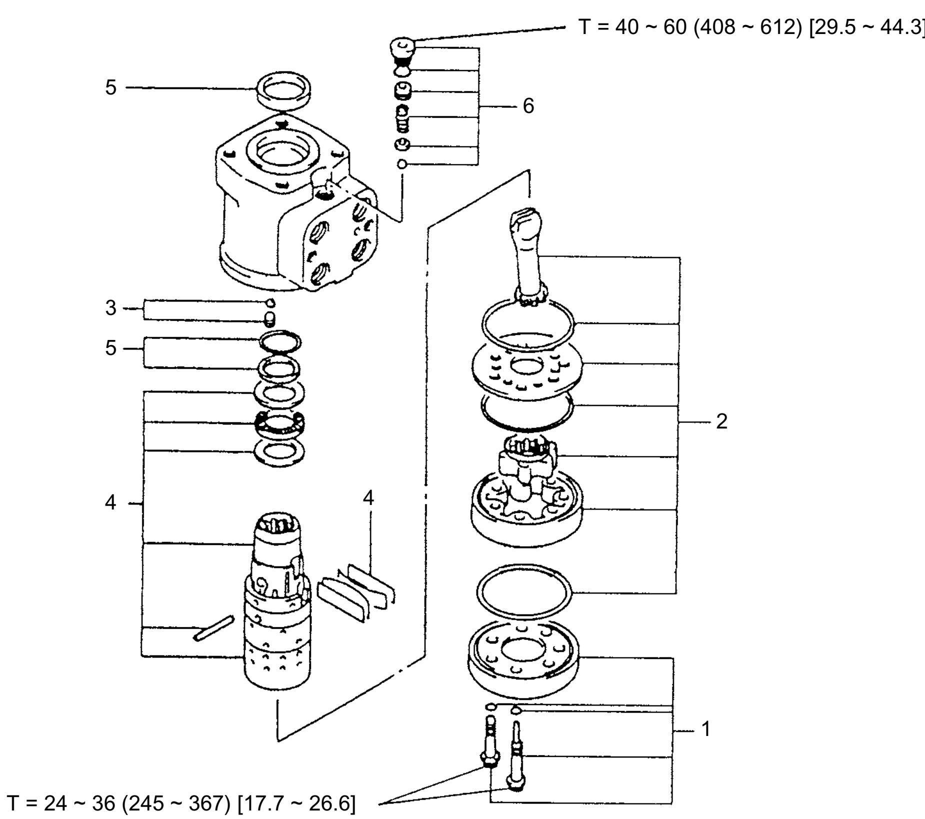
1 Remove the toe board (front and rear) and lower panel.
2 Remove the steering column cover.
3 Remove the instrument panel LH.
4 Disconnect the piping.
5 Remove the steering valve ASSY.
6 Remove the steering valve spacer.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

DISASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]



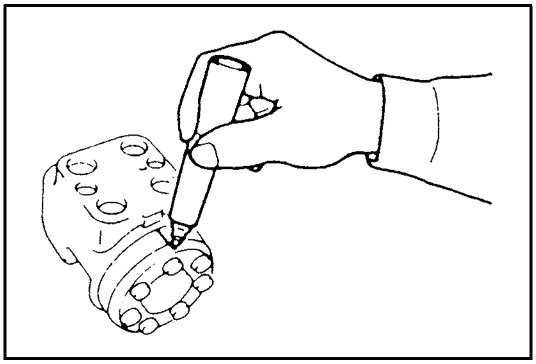
Disassembly Procedure

1 Remove the end cover. **[Point 1]**
2 Remove the gear wheel set, cardan shaft and distributor plate. **[Point 2]**
3 Remove the check valve.
4 Remove the sleeve W/spool and bearing. **[Point 3]**
5 Remove the O-ring, kin-ring and dust seal ring. **[Point 4]**
6 Remove the rerief valve. **[Point 5]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

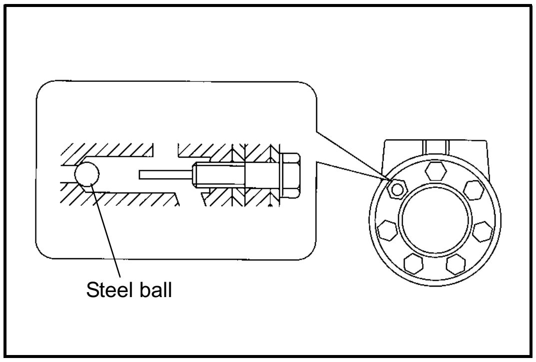
Note:
Wash each part with clean hydraulic oil before assembly.



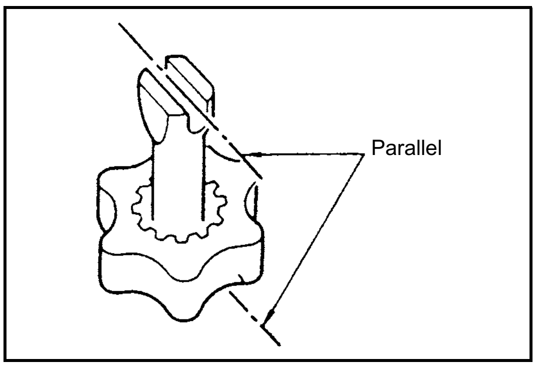
Point Operations

[Point 1]

Disassembly:
Put a match mark.
Reassembly:
Align the match marks.



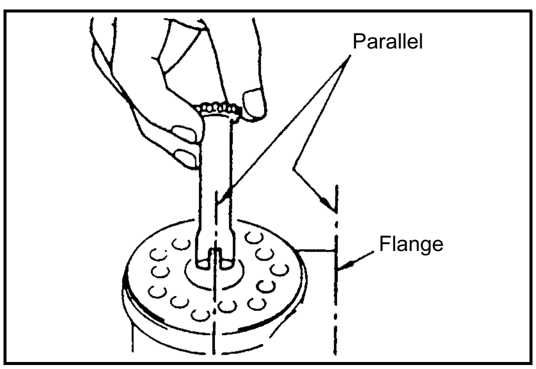
Disassembly:
When removing each set bolts, carefully operate so as not to lose the steel ball.
Reassembly:
Put a steel ball in the illustrated position before installing each set bolts.
Reassembly:
As one out of seven set bolts is a bolt with pin, install it in the correct position.



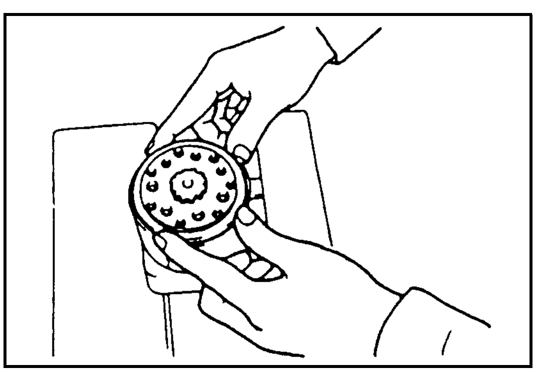
[Point 2]

Reassembly:
Pay attention to the following points at the time of reassembly.

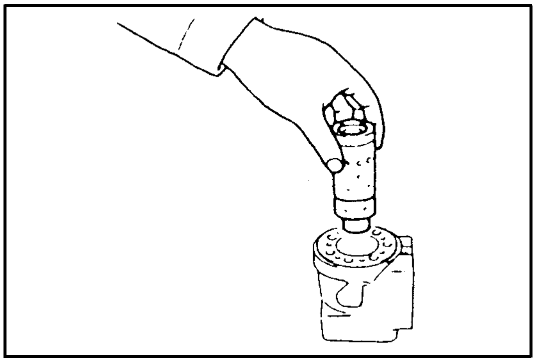
1. Fit the gearwheel (rotor) and cardan shaft so that a tooth base in the rotor is positioned in relation to the shaft slot as shown. Turn the gear rim so that the seven through holes match the holes in the housing.



2. Guide the carden shaft down into the bore so that the slot is parallel with the connection flange.



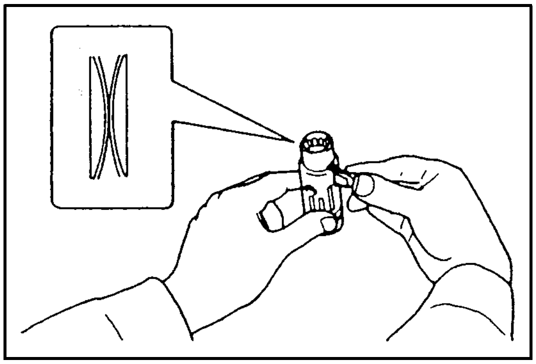
3. Align the match marks on the distributor plate and gear wheel made at the time of disassembly.
   When these parts are replaced, match the holes in the housing and plate at the time of reassembly.



[Point 3]

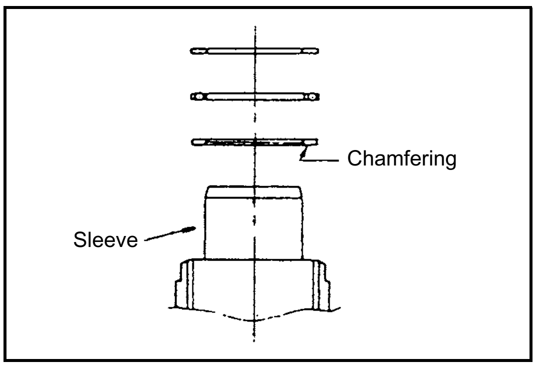
Disassembly:

Extract the spool W/sleeve upward. Otherwise, the spool cross pin may move during extraction to cause sticking.



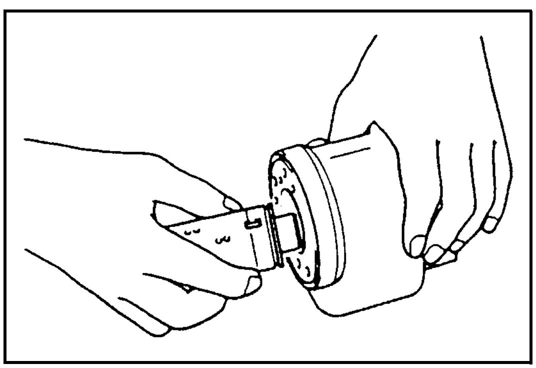
Reassembly:

Set and install the neutral position spring correctly.



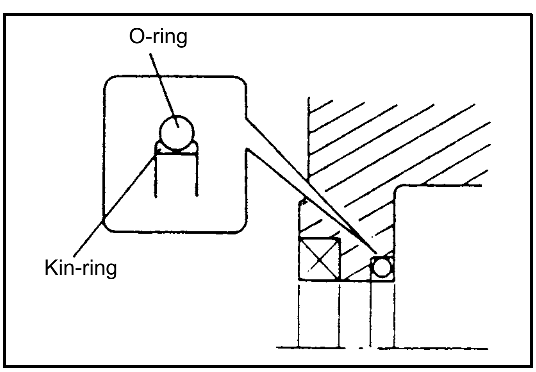
Reassembly:

Pay attention to the bearing direction for installation. (See the figure.)



Reassembly:

Place the housing with its flanged side facing down, and insert the spool W/sleeve into the housing. Set the cross pin of the spool in horizontal state during insertion.

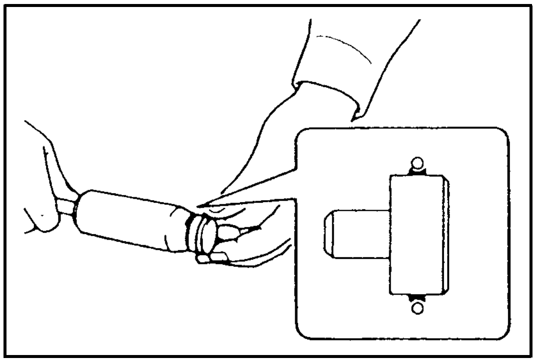


[Point 4]

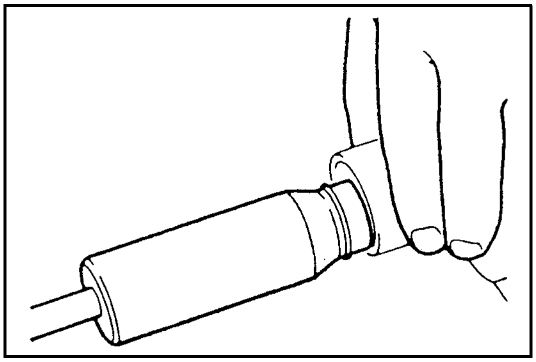
Reassembly:

Install the kin-ring and O-ring correctly.

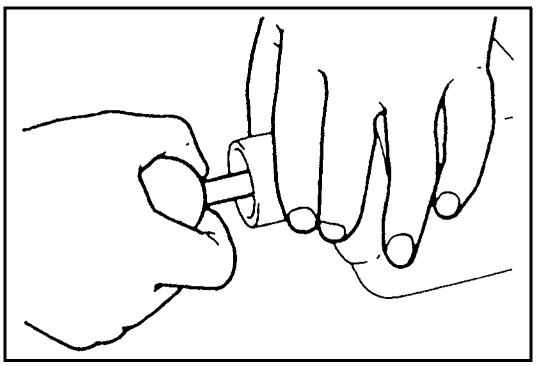
Note:
For SST No. SJ150-9000-11, please inquire at the nearest Danfoss service shop.
(Refer to Parts & Service News Ref. No. GE-7022 of July 1, 1997 for detail.)



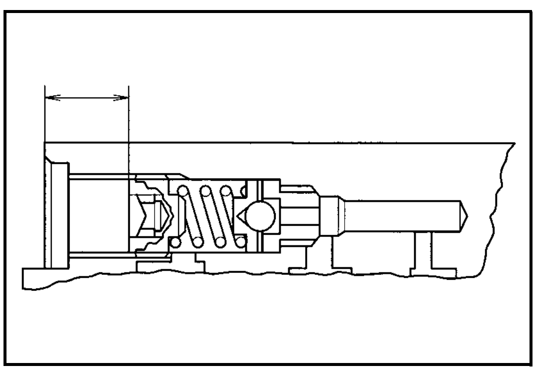
1. Turn the steering unit until the bore is horizontal. Guide the outer part of the assembly tool into the bore for the spool/sleeve.
2. Apply O-ring and kin-ring with hydraulic oil and place them on the tool.



3. Hold the outer part of the assembly tool in the bottom of the steering unit housing and guide the inner part of the tool right to the bottom.



4. Press and turn the O-ring/kin-ring into position in the housing.
5. Draw the inner and outer parts of the assembly tool out of the steering unit bore, leaving the guide from the inner part in the bore.



[Point 5]

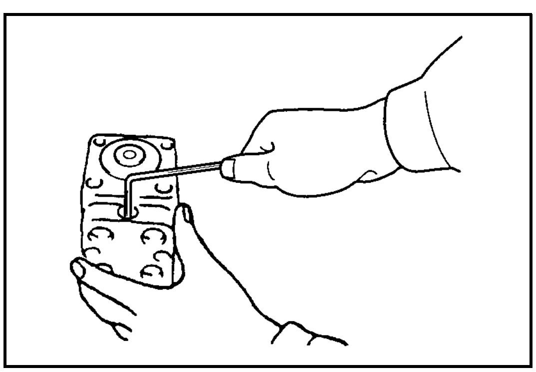
Disassembly:

Do not remove the relief valve unless it is judged defective.

The valve seat cannot be removed.

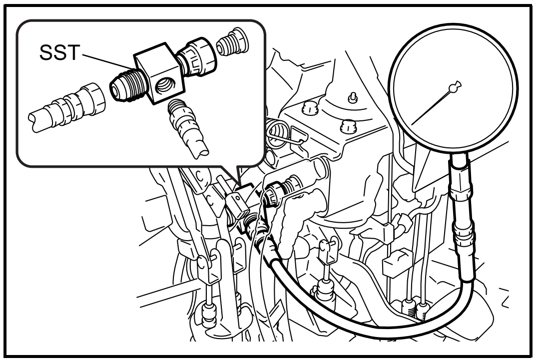
Disassembly:

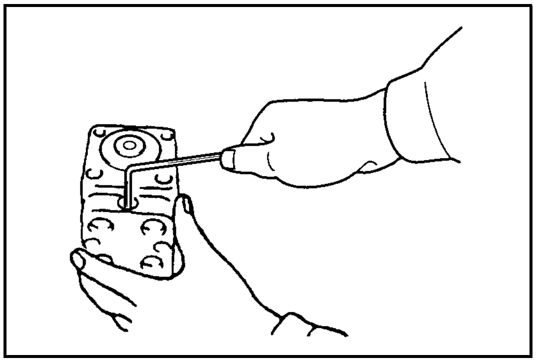
Measure the screwed-in depth of the relief valve adjusting screw before starting disassembly.



Reassembly:

Reassemble by adjusting to the screwed-in depth of the valve spring retainer measured before disassembly. After installing the steering valve ASSY on the vehicle, measure the relief pressure. If it is not within the standard range, adjust it by changing the screwed-in depth of the retainer.





RELIEF PRESSURE INSPECTION·ADJUSTMENT

1. Install a pressure gauge on the P port of the steering valve.
   (1) Disconnect the hose from the P port and connect the adapter.
   SST 09450-23320-71
   (2) Install the pressure gauge.
   Plug size: PT1/8
2. When the steering wheel is rotated beyond the end, relief state is obtained. Read the pressure on the pressure gauge at the time.

Standard:

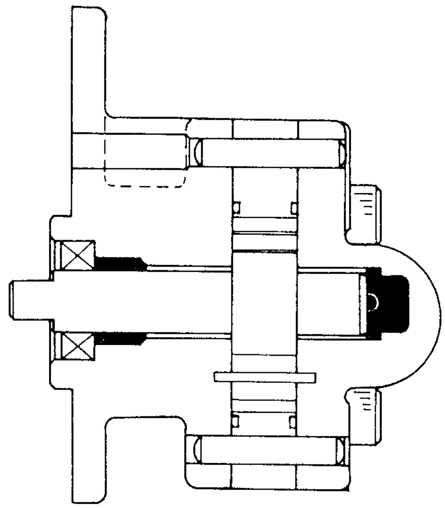
kPa (kg/cm^2) [psi]

15·18 model	5790^{+490}_{0} (59^{+5}_{0}) $[840^{+70}_{0}]$
20·25 model	7060^{+490}_{0} (72^{+5}_{0}) $[1020^{+70}_{0}]$
30·32 model	7650^{+490}_{0} (78^{+5}_{0}) $[1110^{+70}_{0}]$
35 ~ 55 model	10100^{+490}_{0} (103^{+5}_{0}) $[1460^{+70}_{0}]$

3. If the standard is not satisfied, remove the steering valve and make adjustment by turning the steering valve adjusting screw.

POWER STEERING PUMP ASSY (15 ~ 32 MODEL)

GENERAL

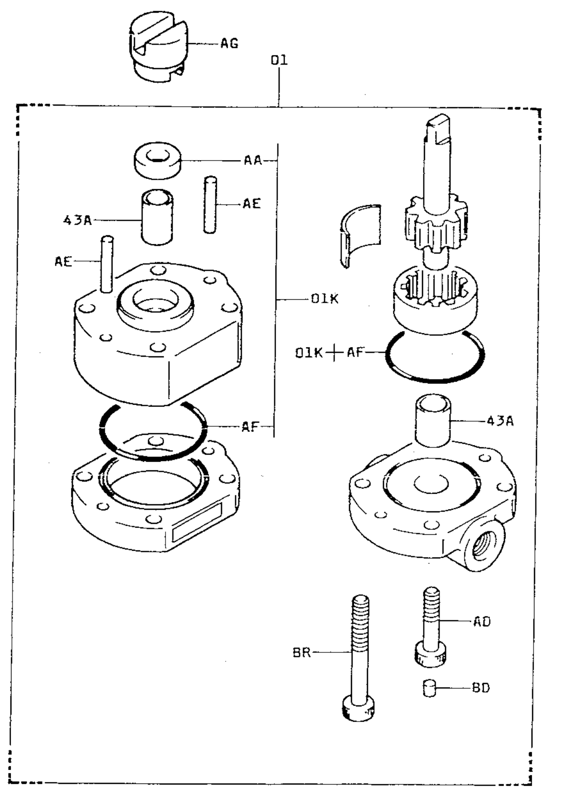


SPECIFICATIONS

Pump model	15·18 model	TCP-031-A
	20 ~ 32 model	TCP-031-C
Theoretical delivery	$cm^3(in^3)$/rev.	15·18 model: 3.15 (0.192), 20 ~ 32 model: 4.0 (0.244)

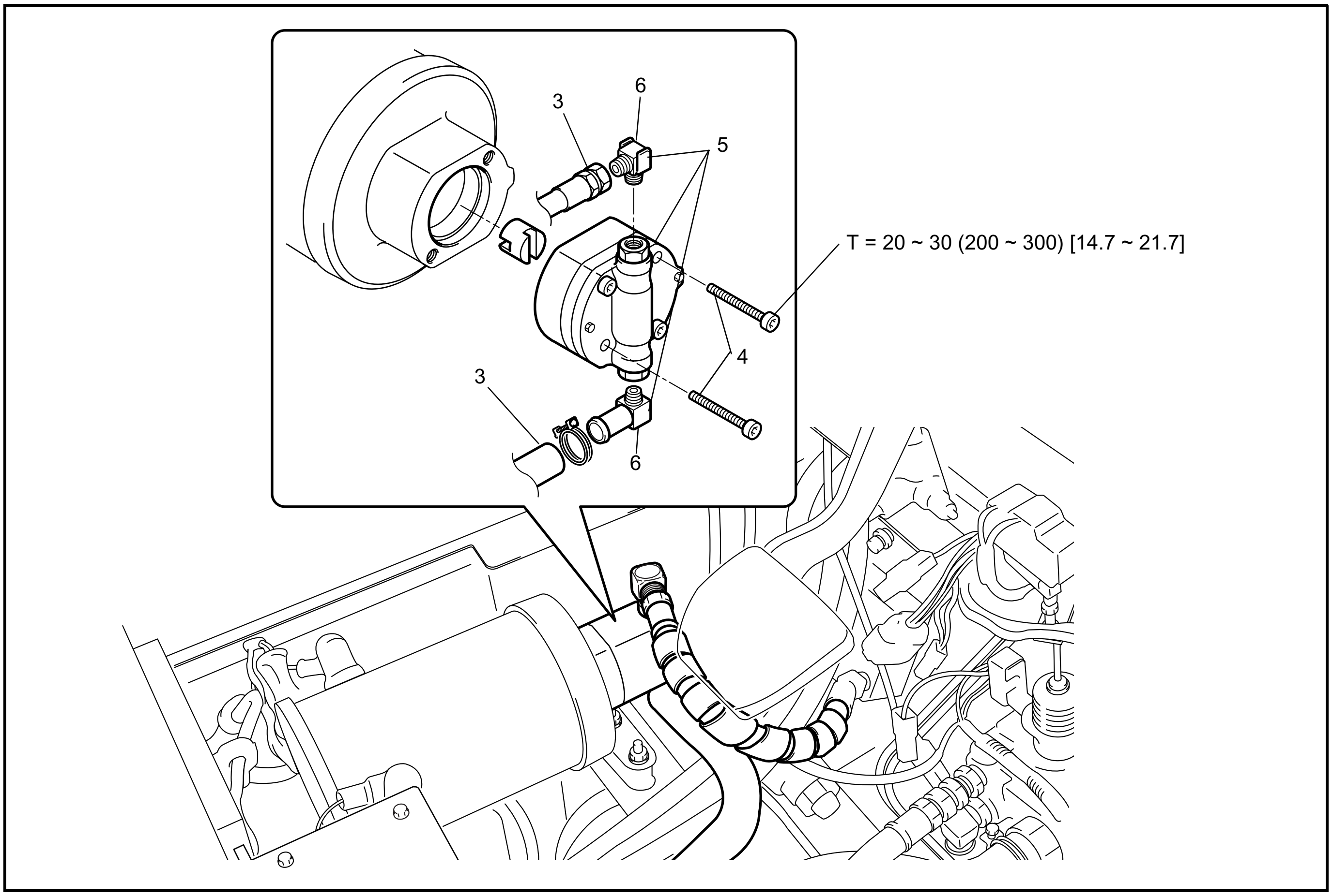
COMPONENTS

4510



REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]

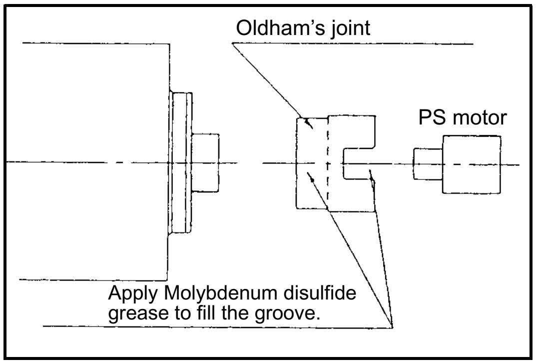


Removal Procedure

1 Disconnect the battery plug.
2 Remove the toe board (front and rear) and lower panel.
3 Disconnect hoses from both ends of the PS pump ASSY.
4 Remove the PS pump set bolt.
5 Remove the PS pump ASSY W/fitting. **[Point 1]**
6 Remove the fitting.

Installation Procedure

The installation procedure is the reverse of the removal procedure.



Point Operation

[Point 1]

Installation:

When assembling the PS motor and pump, fill molybdenum disulfide grease in the groove on the oldham's joint.

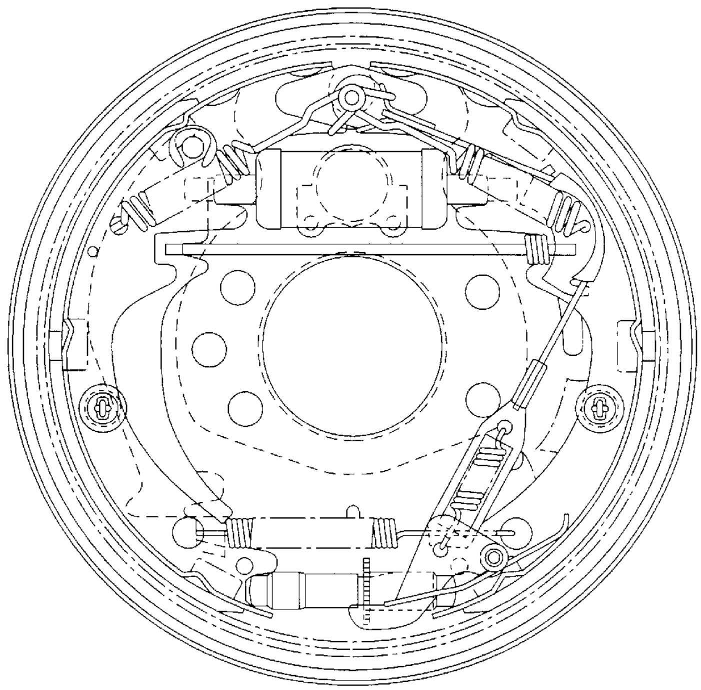
BRAKE

10

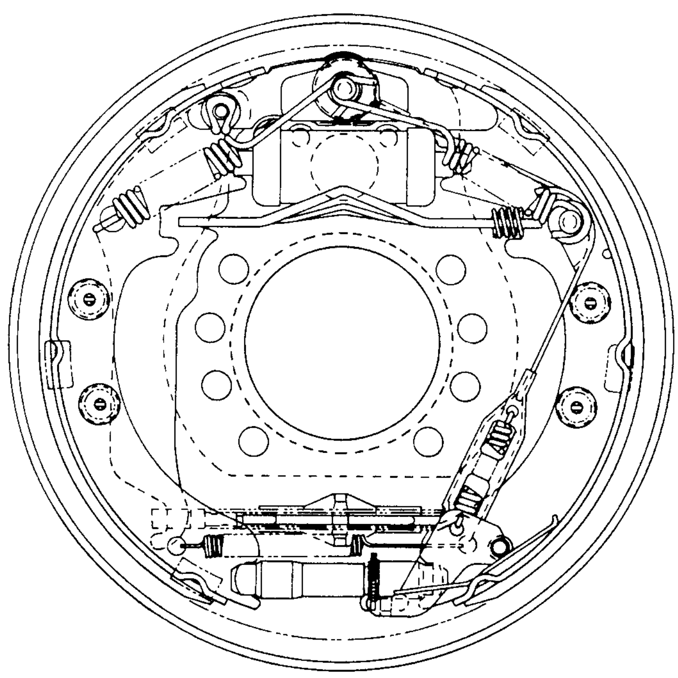
GENERAL

Front Brake

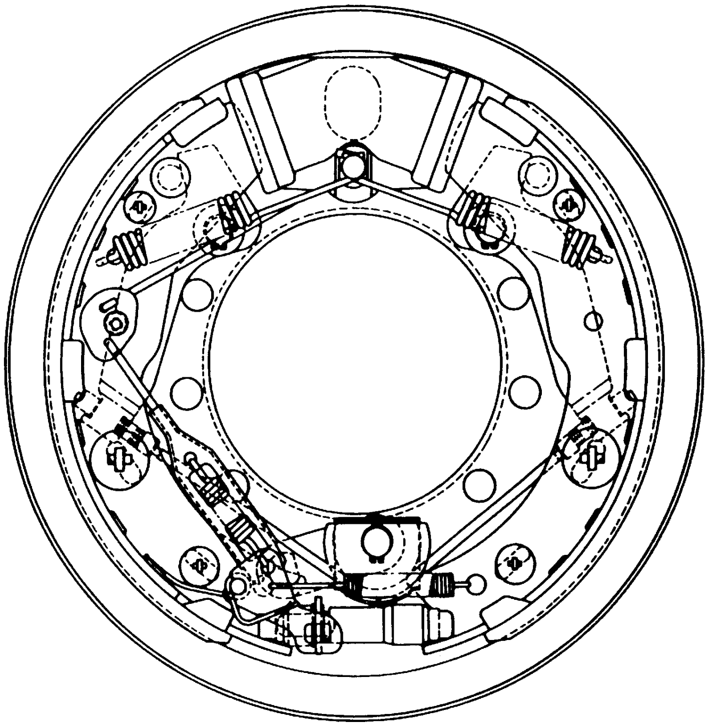
15 ~ 18 model



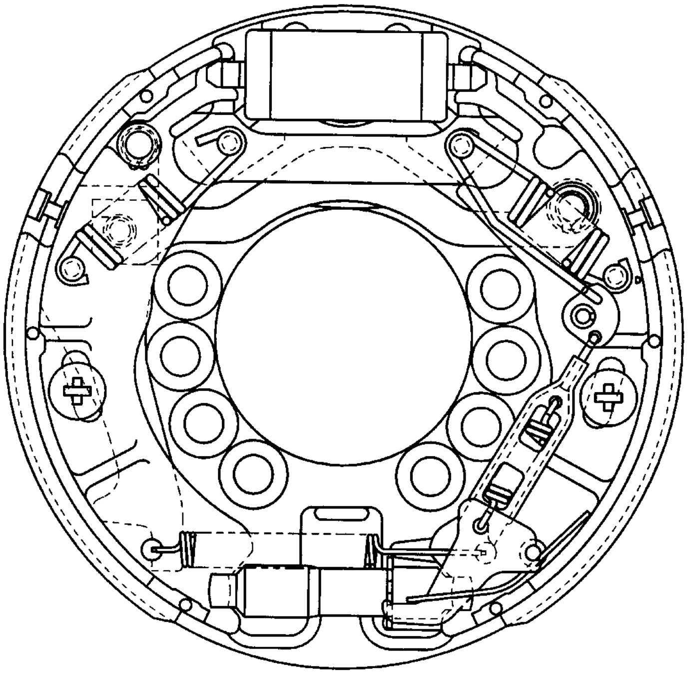
20 ~ 32 model



35·45 model

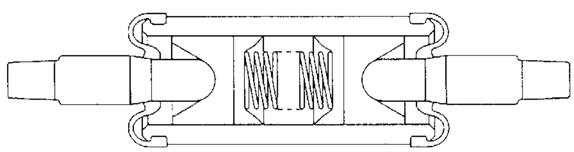


55 model

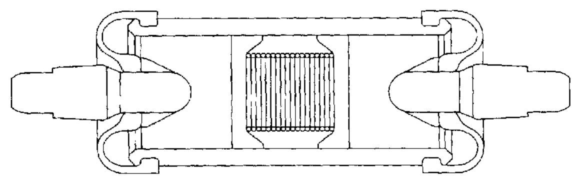


Wheel Cylinder

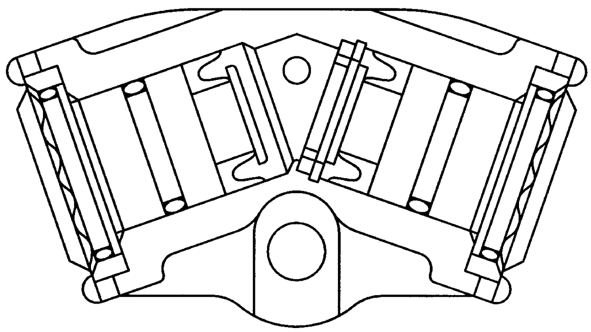
15 ~ 18 model



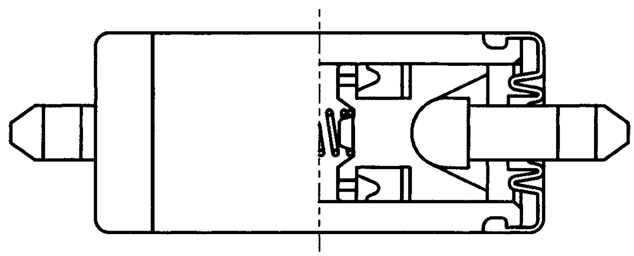
20 ~ 32 model



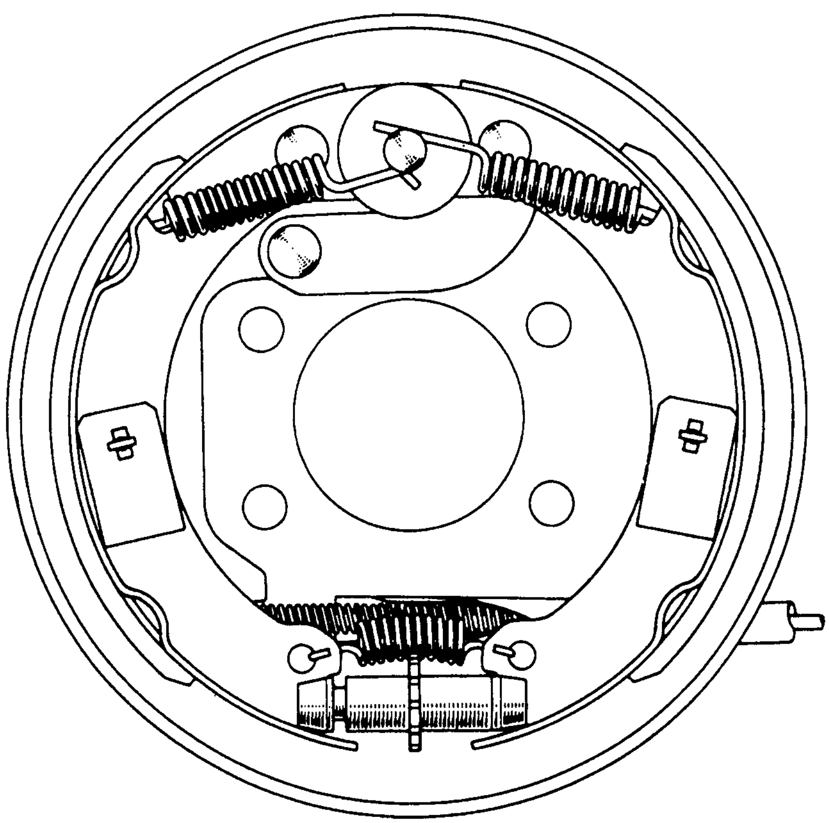
35·45 model



55 model

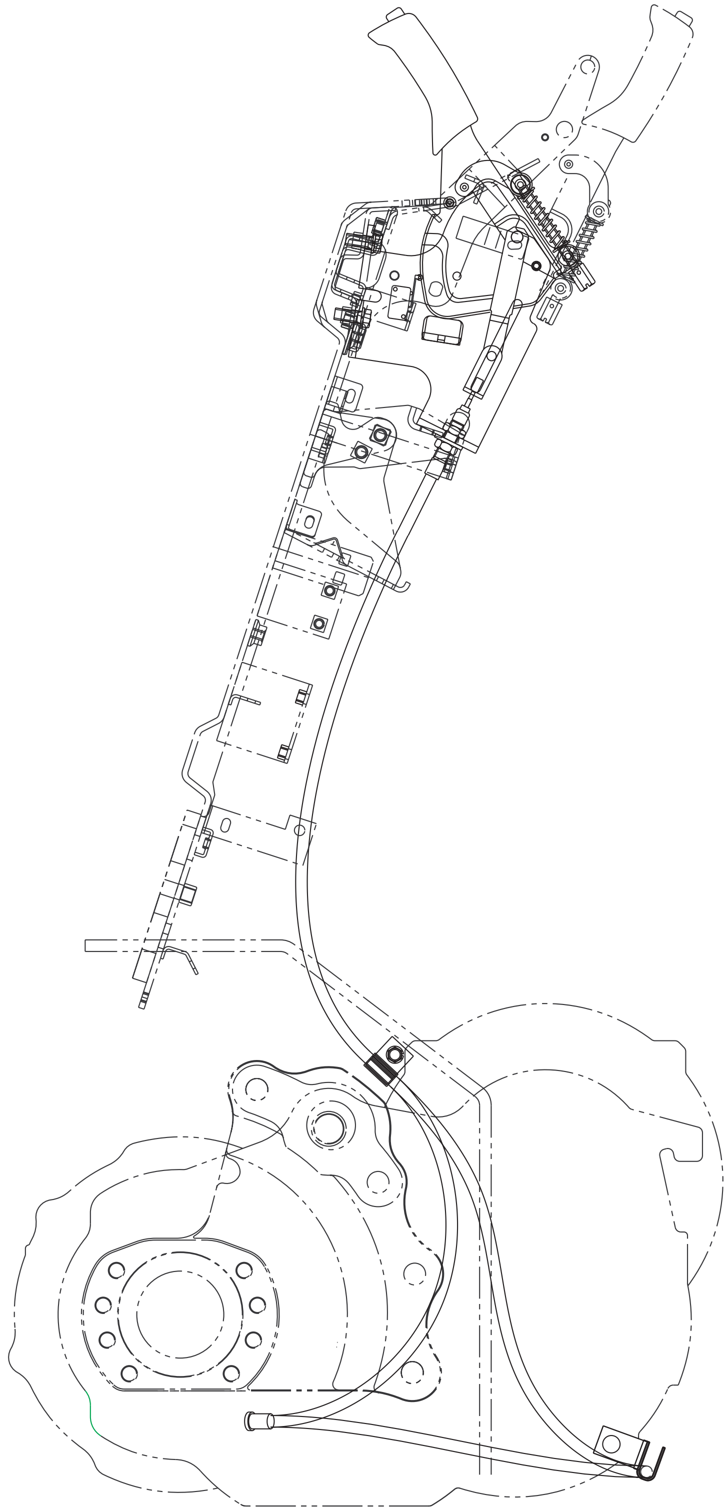


Dead-man Brake (OPT)

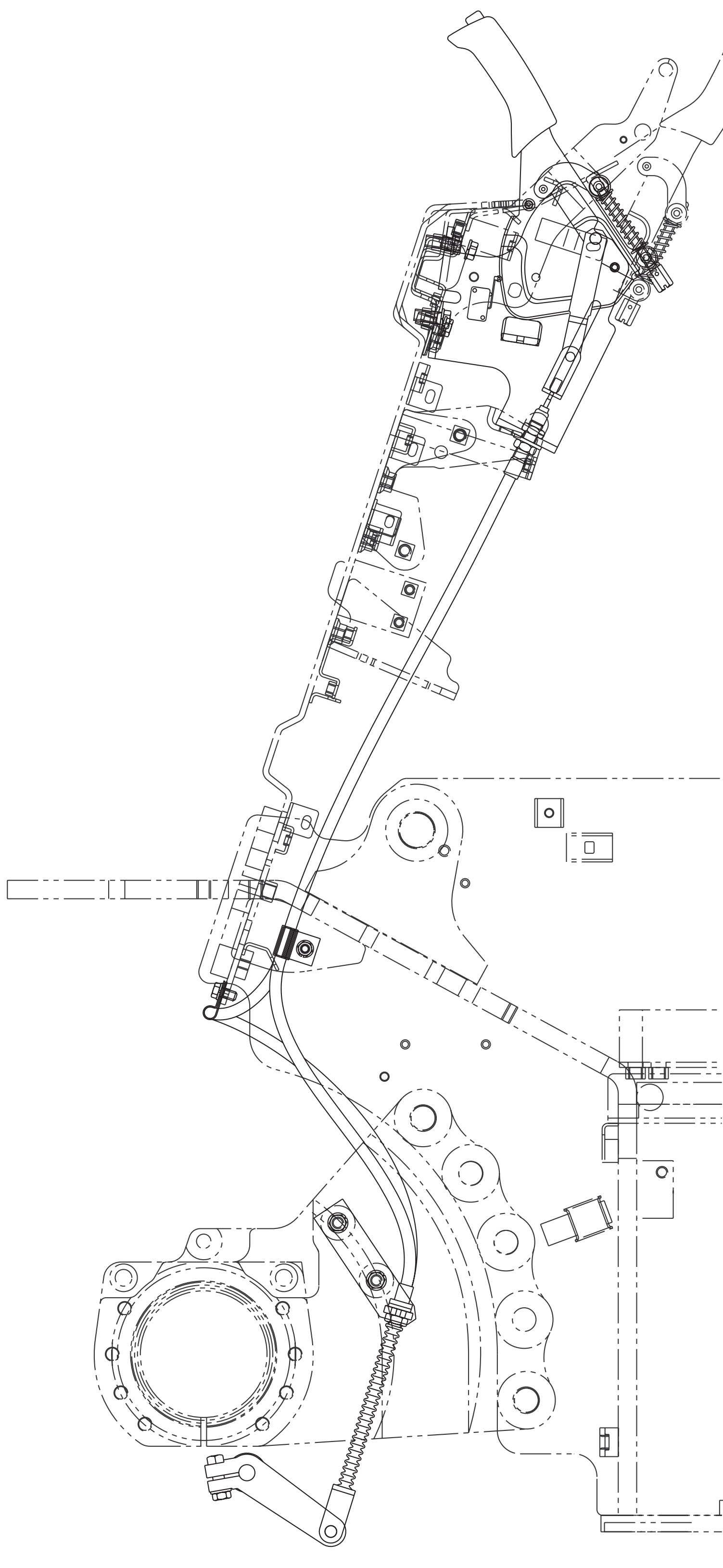


Parking Brake

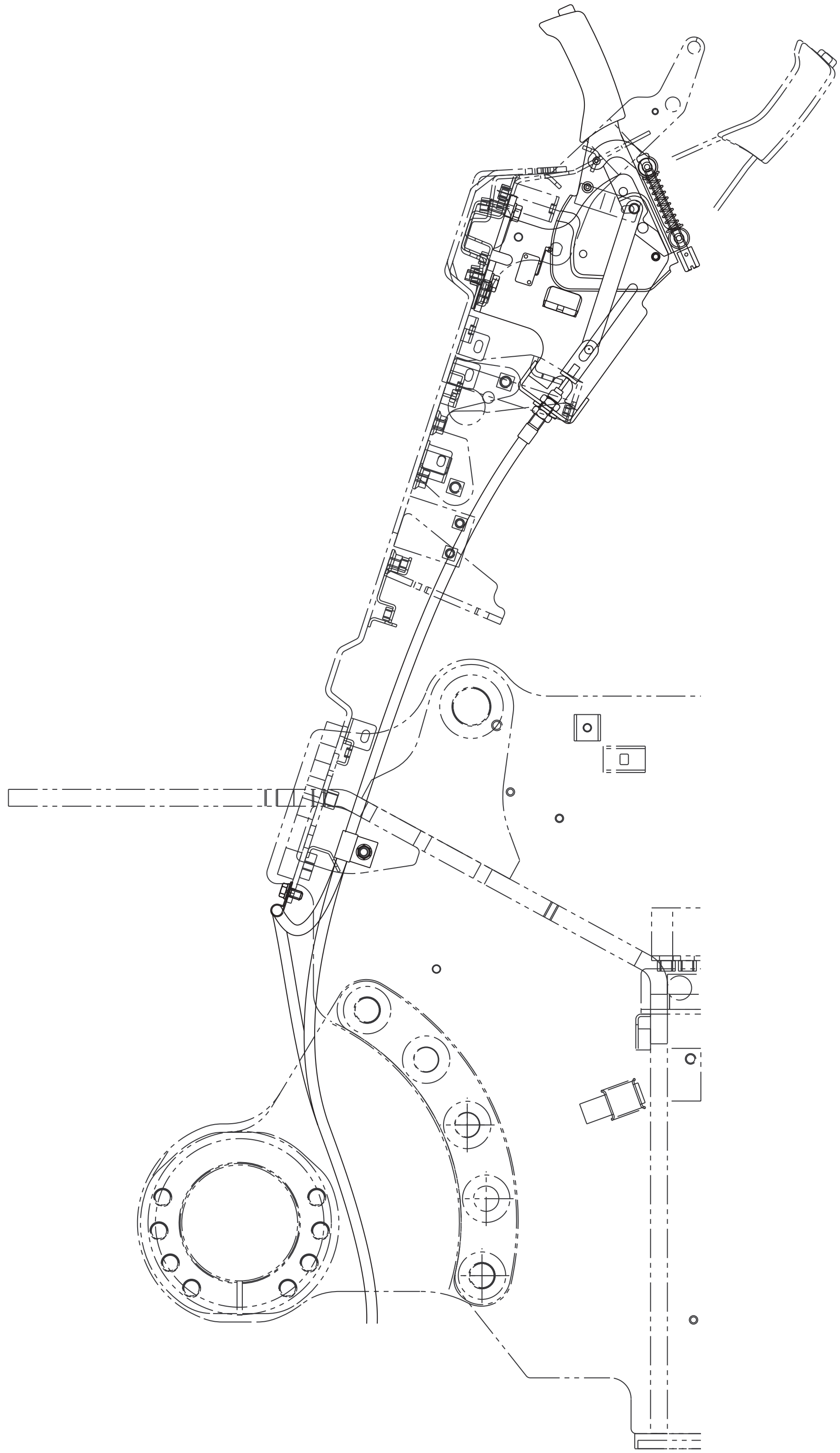
15 ~ 32 model



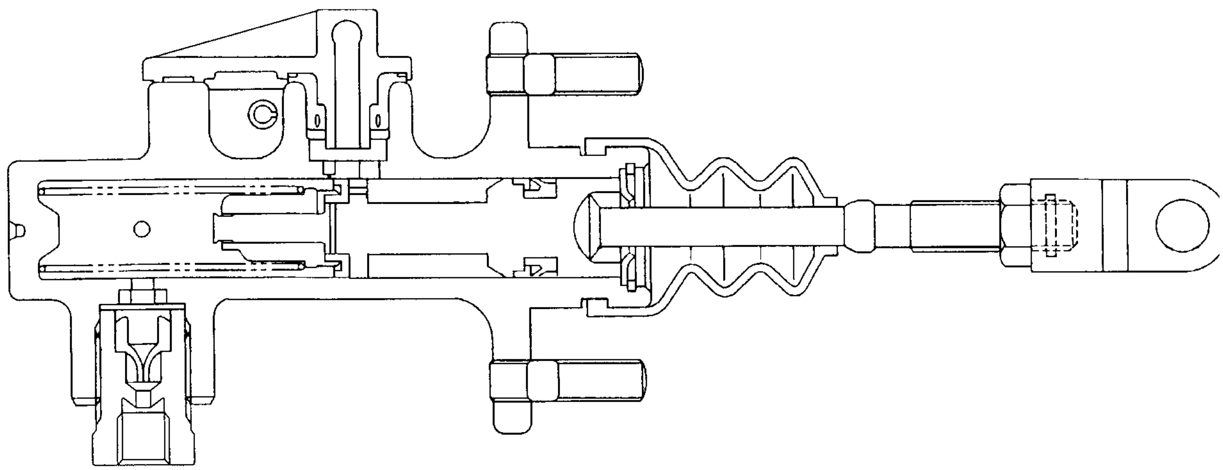
35·45 model



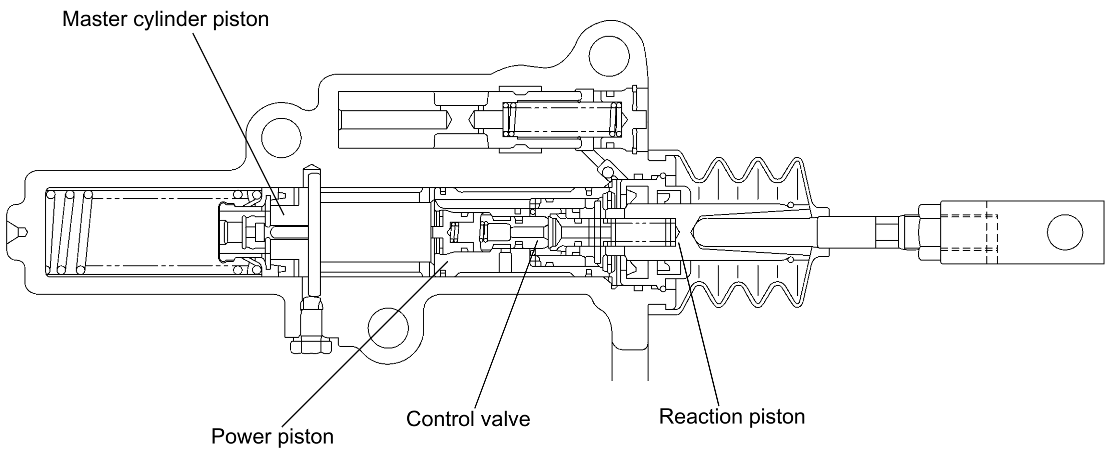
55 model



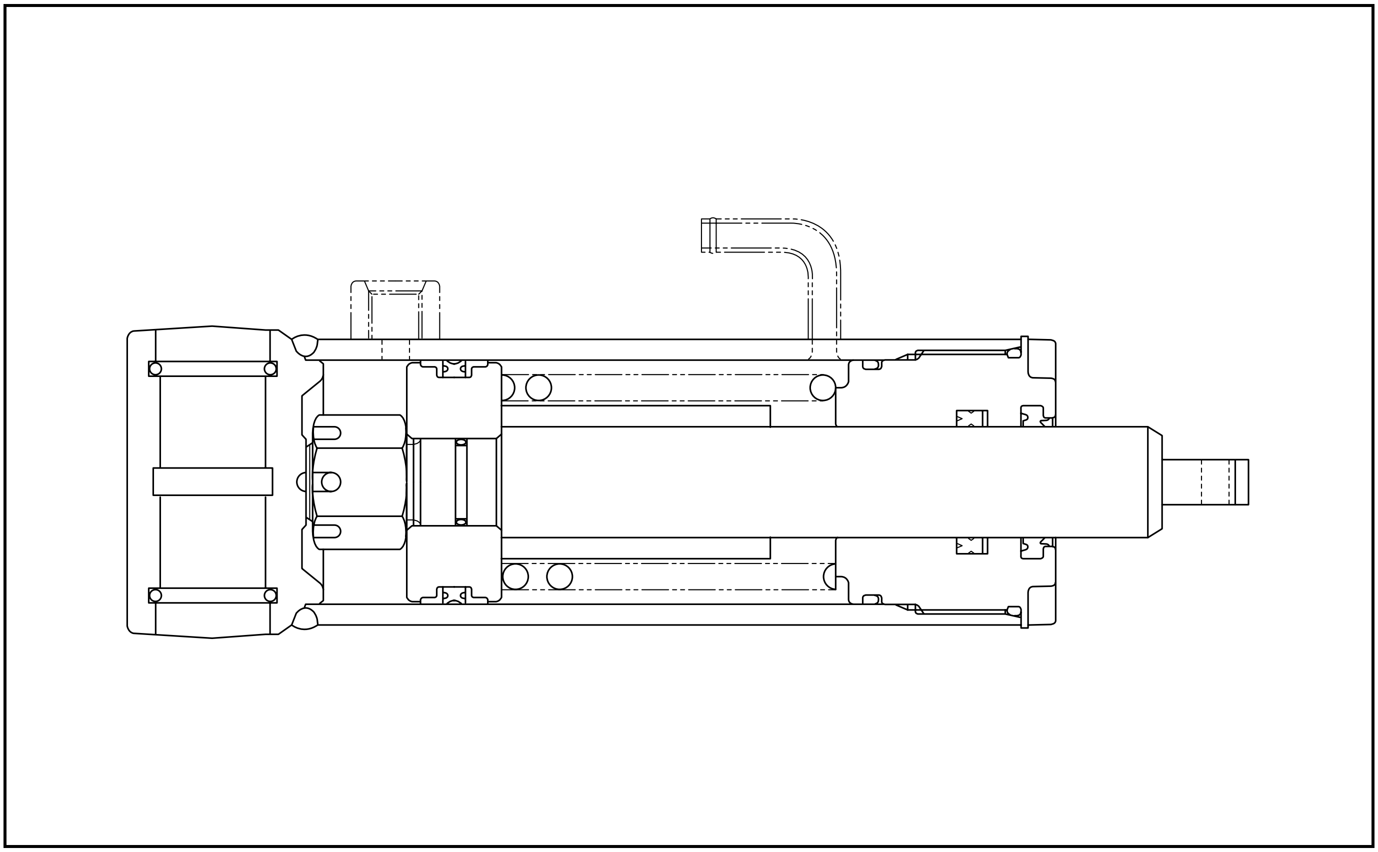
Master Cylinder (15 ~ 32 Model)



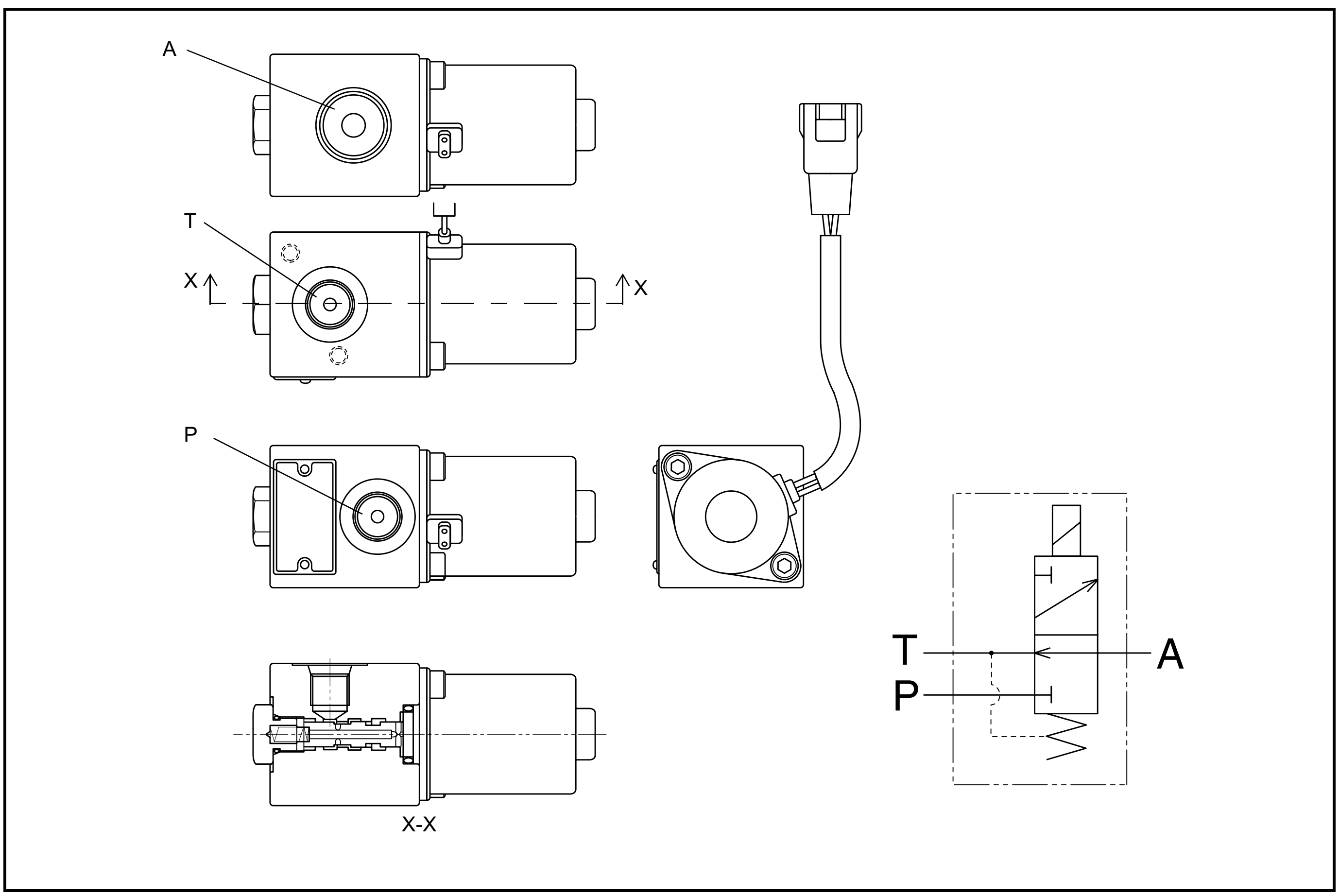
Brake Boostor (35 ~ 55 Model)



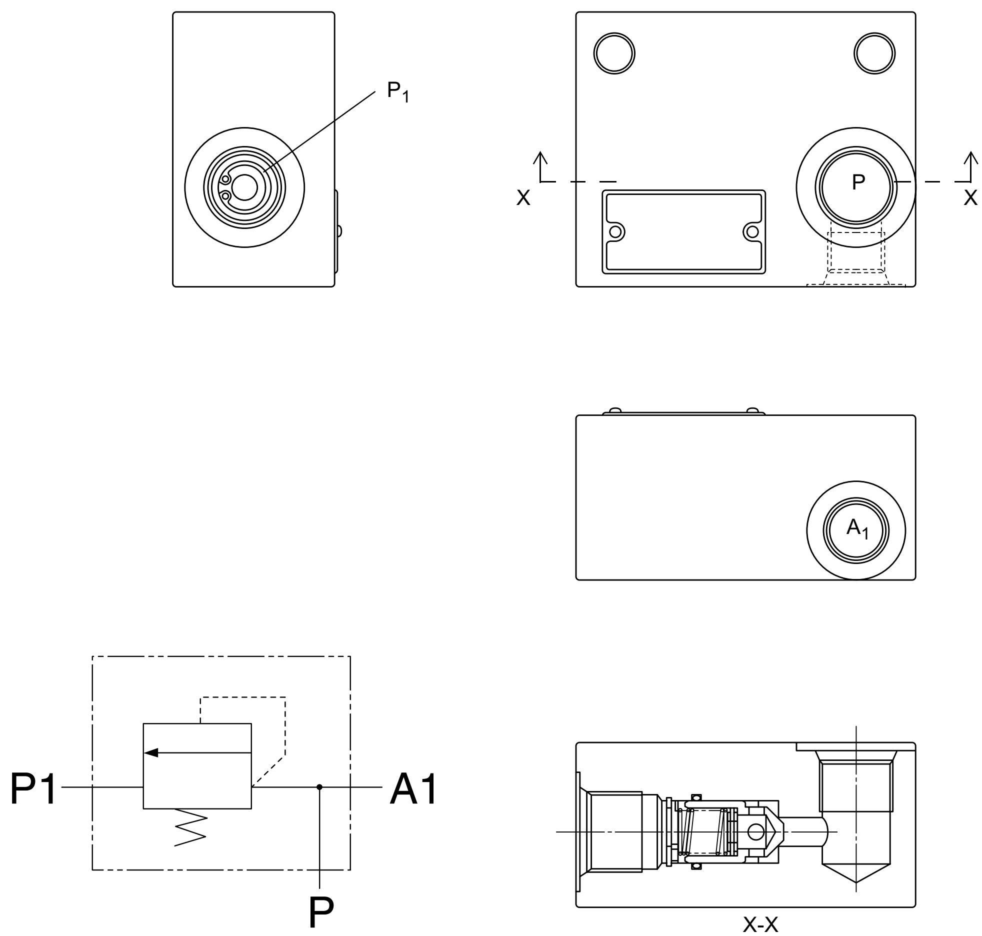
Dead-man Brake Cylinder



Dead-man Brake Solenoid



Dead-man Brake Relief Valve (15 ~ 32 Model)



SPECIFICATIONS

15 ~ 32 Model

Item \ Model		15·18	20 ~ 32
Foot brake type		Hydraulic internal expanding duo servo brake	
Parking brake type		Internal expanding mechanical brake	
Brake drum inside diameter mm (in)		254 (10.0)	310 (12.2)
Brake lining material		Resin mold (asbestos-free)	
Brake lining dimensions Thickness × width × length mm (in)		4.9 × 48.5 × 271 (0.19 × 1.91 × 108)	5.7 × 60 × 343 (0.22 × 2.36 × 13.5)
Wheel cylinder bore mm (in)		22.2 (0.87)	28.5 (1.12)
Brake master cylinder	Bore mm (in)	19.05 (0.75)	
	Stroke mm (in)	30 (1.18)	
Applicable oil		SAE J-1703-DOT-3	

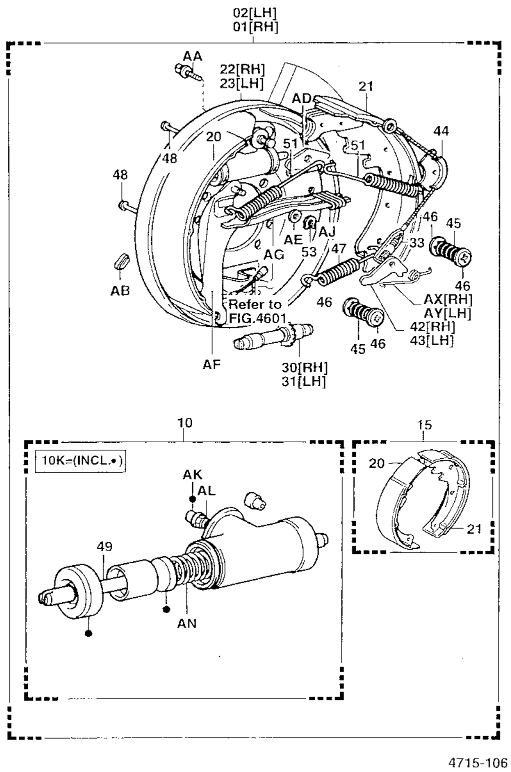
35 ~ 55 Model

Item \ Model			35·45	55
Foot brake type			Hydraulic internal expanding duo servo brake	
Parking brake type			Internal expanding mechanical brake	
Brake drum inside diameter mm (in)			317.5 (12.50)	
Brake lining material			Resin mold (asbestos-free)	
Brake lining dimensions Thickness × width × length mm (in)			9.3 × 60 × 343 (0.37 × 2.36 × 13.50)	10.0 × 63 × 332 (0.39 × 2.48 × 13.07)
Wheel cylinder bore mm (in)			31.75 (1.25)	
Brake booster	Master cylinder piston	Diameter mm (in)	25.4 (1.00)	
		Full stroke mm (in)	28 (1.10)	
	Maximum servo pressure (power relief pressure) kPa (kgf/cm^2) [psi]		12750 (130) [1849]	
Applicable oil			Hydraulic oil ISO VG32	

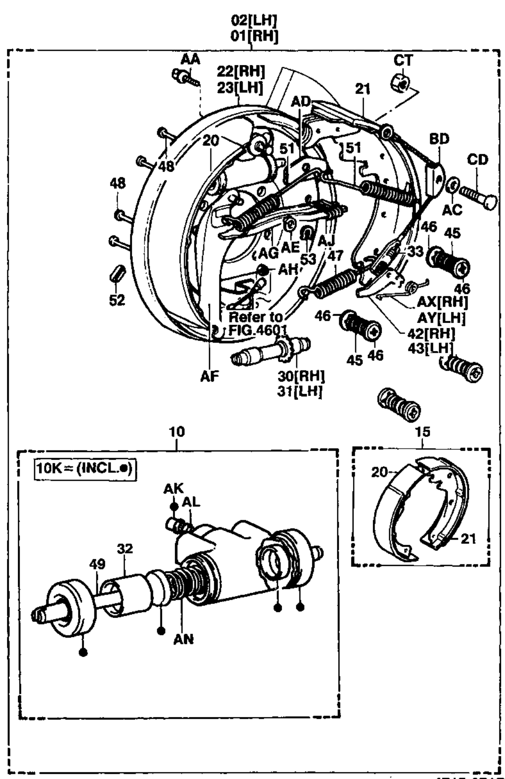
COMPONENTS

Front Brake

15·18 model	4715

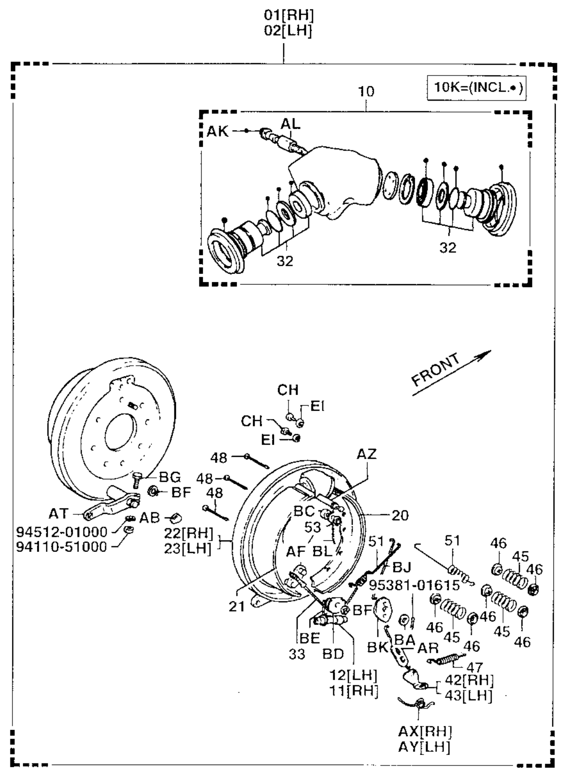


20 ~ 32 model

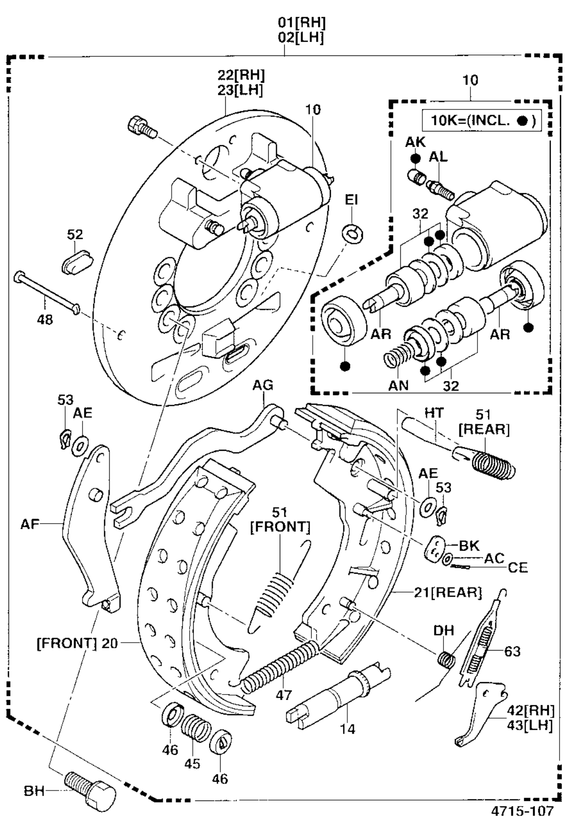


35·45 model

4715

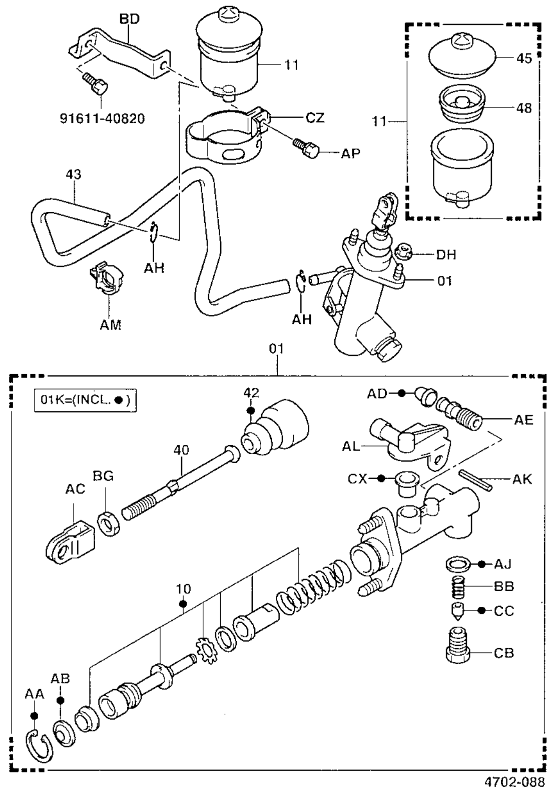


55 model



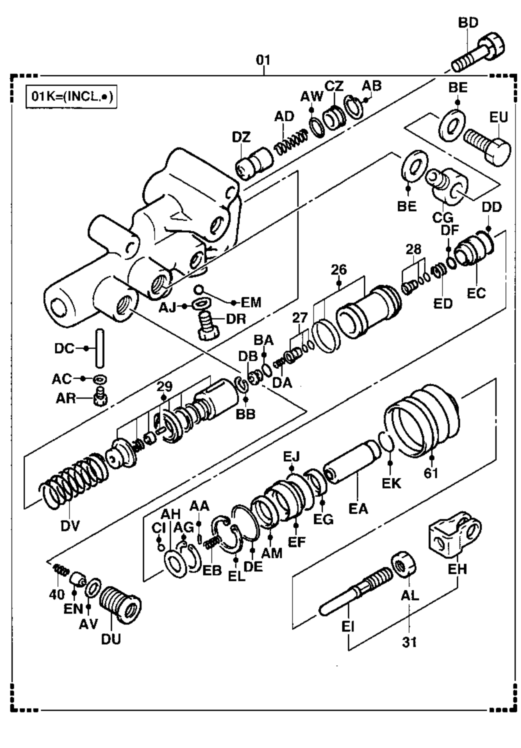
Brake Master Cylinder (15 ~ 32 Model)

4702



Brake Booster (35 ~ 55 Model)

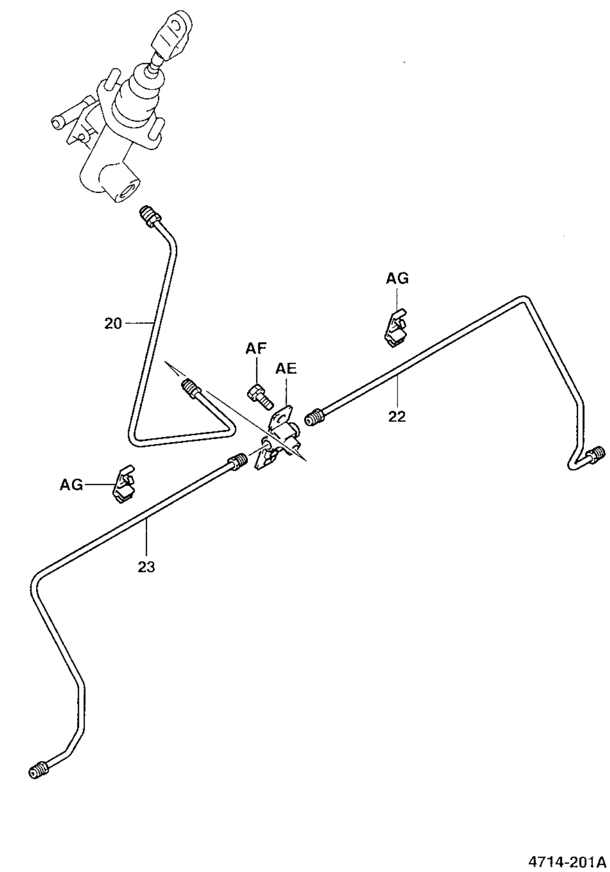
4707



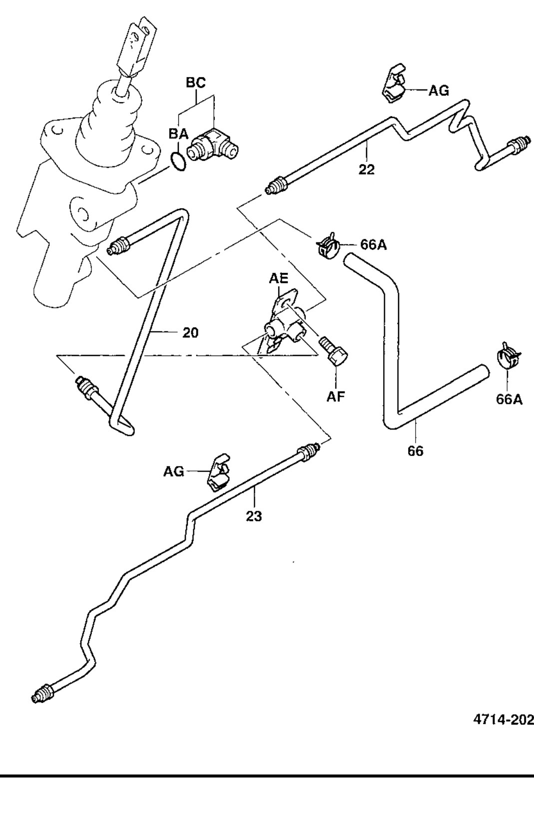
Brake Pipe

15 ~ 32 model

4714

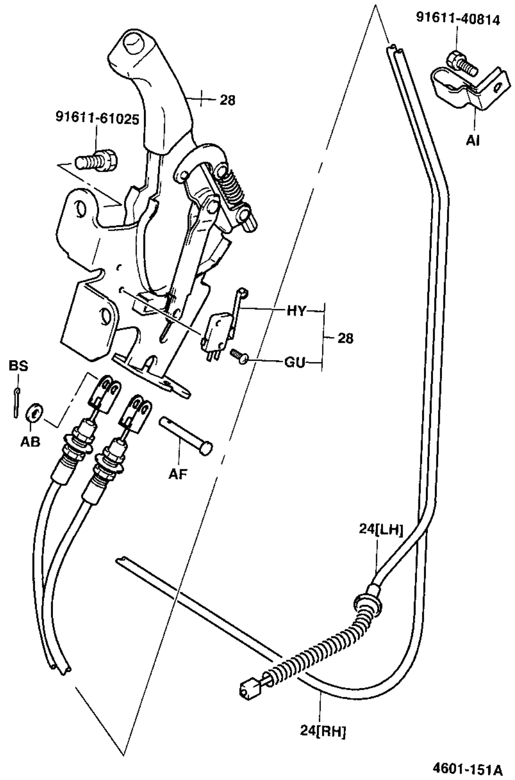


35 ~ 55 model

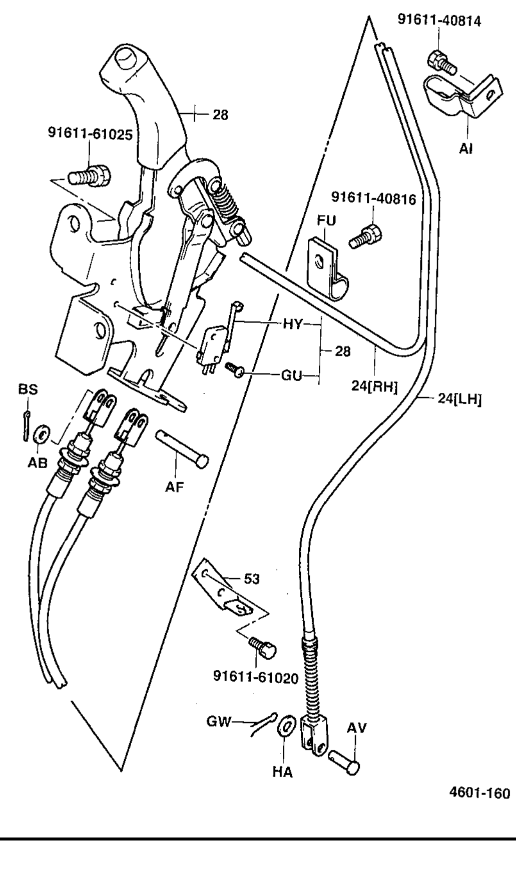


Parking Brake

15 ~ 32 model	4601

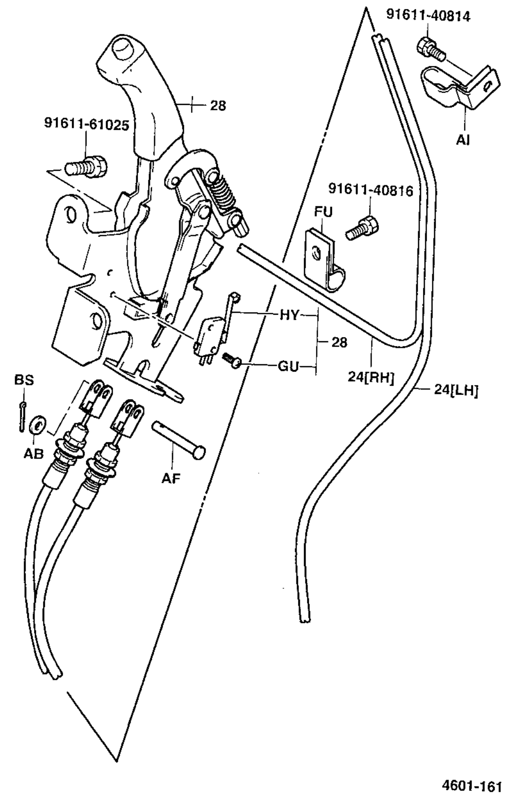


35·45 model



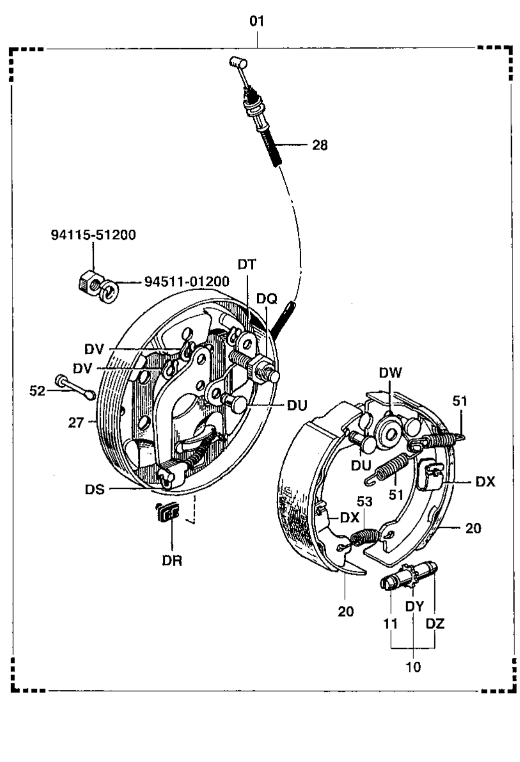
55 model

4601



Dead-man Brake (OPT)

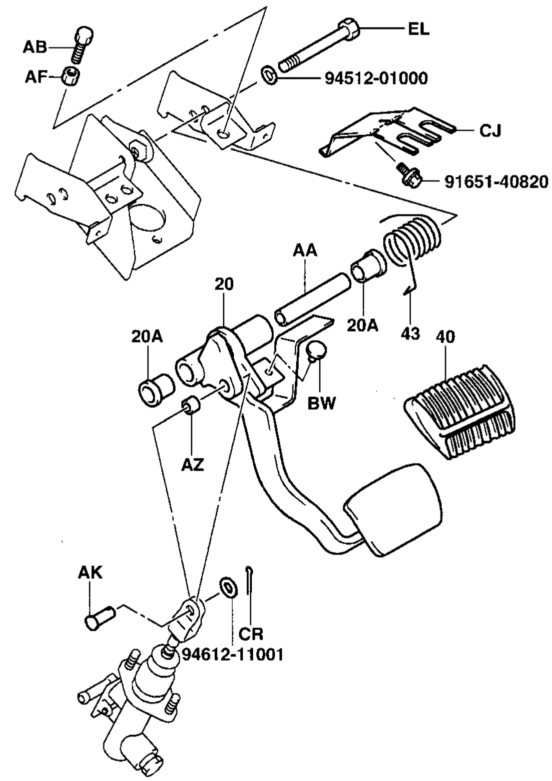
4602



Brake Pedal

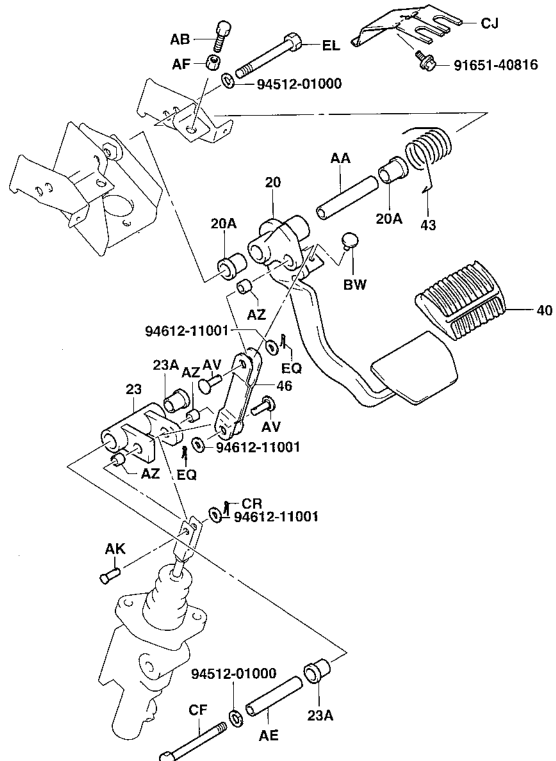
15 ~ 32 model

4701



4701-188

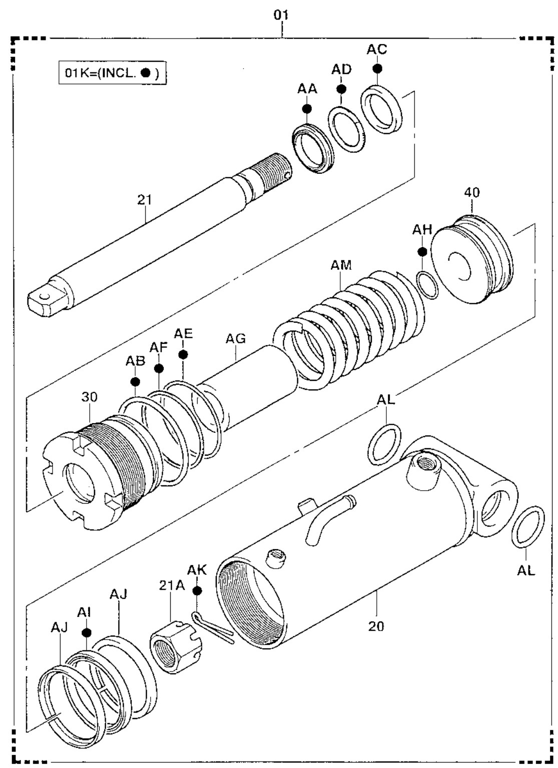
35 ~ 55 model



4701-202

Dead-man Brake Cylinder

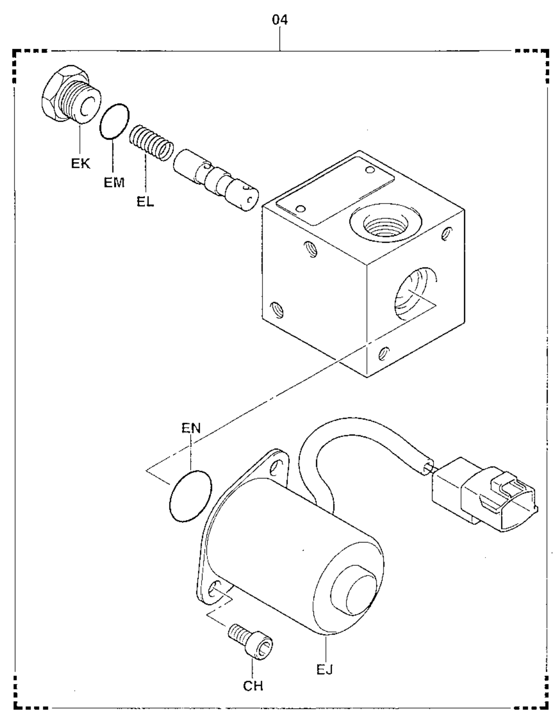
4603



4603-001

Dead-man Brake Solenoid

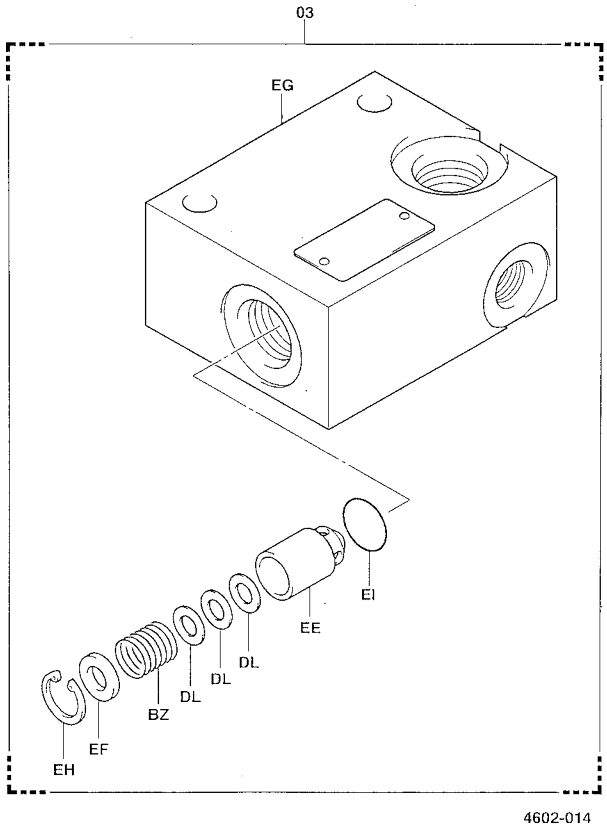
4602



4602-015

Dead-man Brake Relief Valve (15 ~ 32 model)

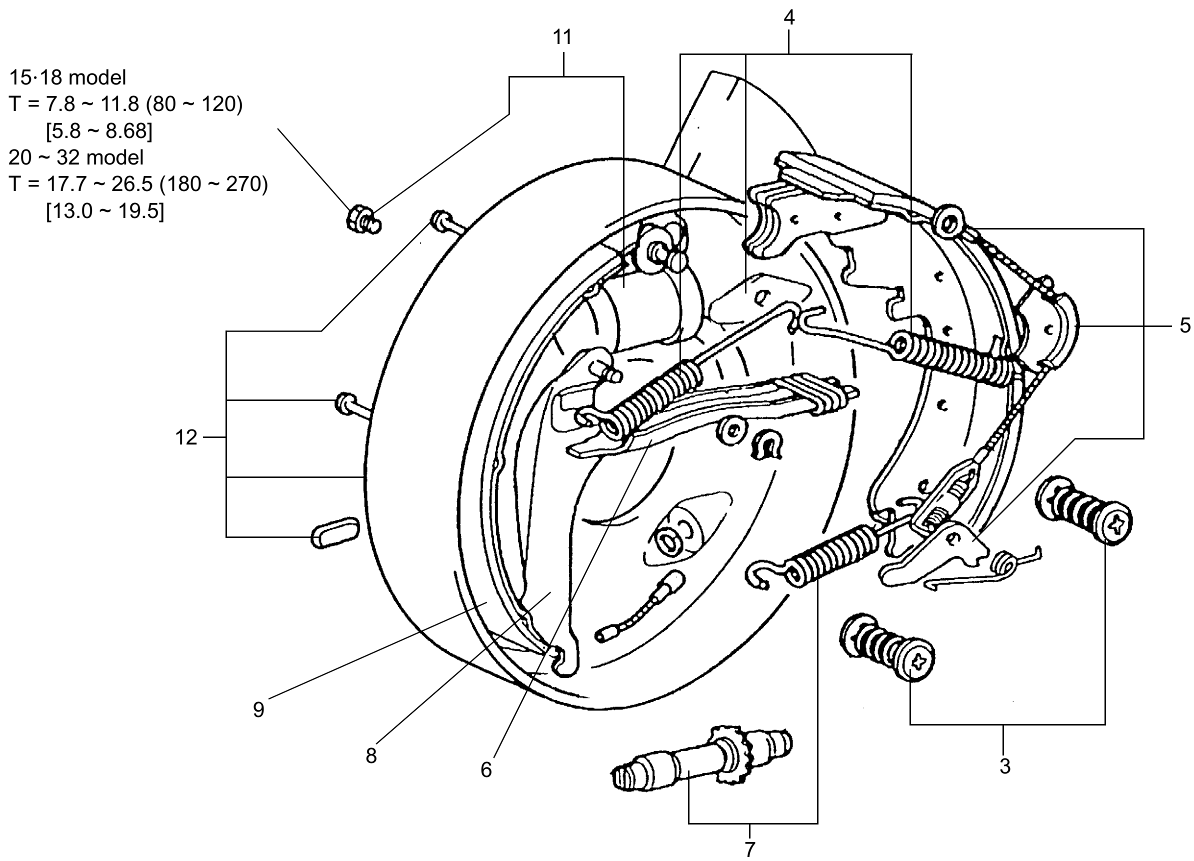
4602



FRONT BRAKE

DISASSEMBLY·INSPECTION·REASSEMBLY (15 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Brake backing plate set bolt	T = 137 ~ 196 (1400 ~ 2000) [101.3 ~ 144.7]

Disassembly Procedure

1 Drain brake fluid.
2 Remove the front axle hub. (See page 7-11.)
3 Remove the shoe hold down spring and cup. **[Point 1]**
4 Remove the anchor to shoe spring and shoe guide plate. **[Point 2]**
5 Remove the cable and cable guide.
6 Remove the lever strut. **[Point 3]**
7 Remove the adjuster spring and adjusting screw. **[Point 4]**
8 Disconnect the parking brake cable. **[Point 5]**
9 Remove the brake shoe. **[Point 6]**
10 Disconnect the brake pipe.
11 Remove the wheel cylinder ASSY. **[Point 7]**
12 Remove the backing plate. **[Point 8]**
13 Inspect the front axle hub (brake drum). **[Point 9]**

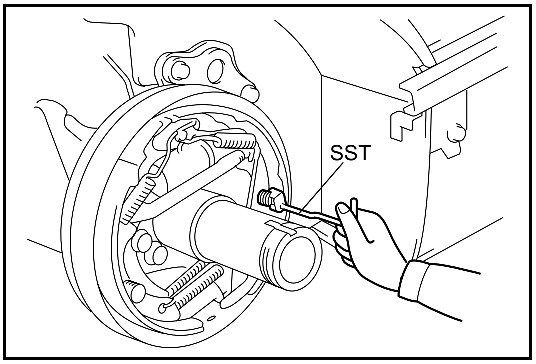
Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

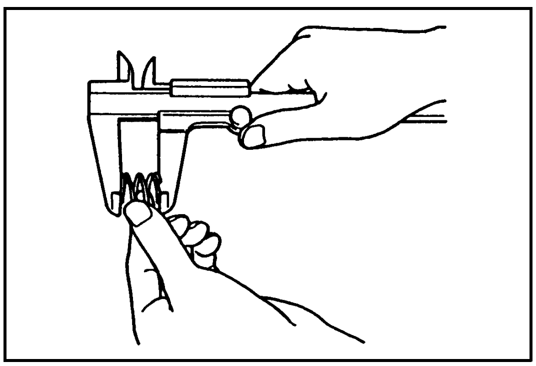
Note:
- **See that the brake lining and brake drum interior surface are free from grease or oil before installation.**
- **Before reassembly, decrease the brake drum outside diameter for installation to approx. 1 mm (0.04 in) less than the drum inside diameter by tightening the adjusting screw.**
- **After reassembly, perform brake air bleeding (see page 10-38) and braking force inspection (see page 10-38).**

Point Operations

[Point 1]

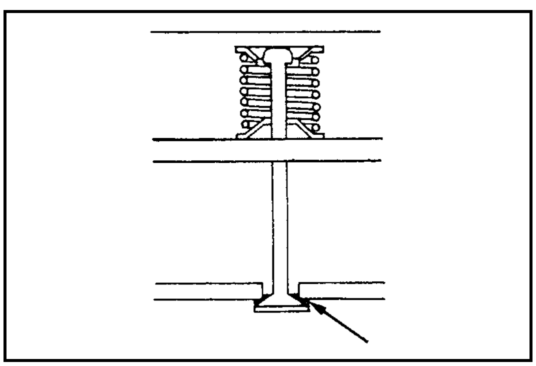


Disassembly·Reassembly:
SST 09510-31960-71



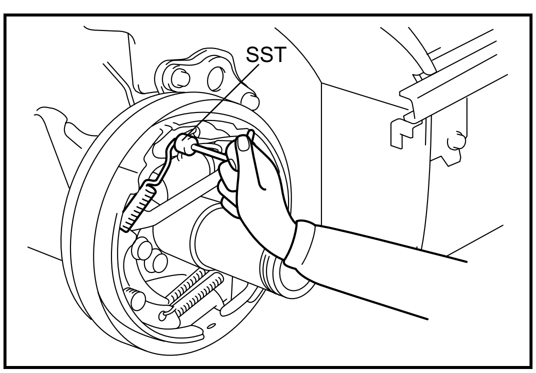
Inspection:
Measure the free length of the hold down spring.

Standard: 25.5 mm (1.004 in)

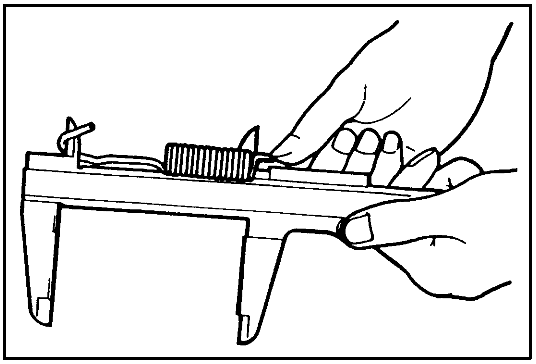


Reassembly:
Apply liquid packing (08826-76001-71 (08826-00080)) on the shoe hold down pin and the contact surface on the back side of the backing plate to eliminate any clearance.

[Point 2]



Disassembly:
SST 09717-76001-71
(SST 09717-20010)



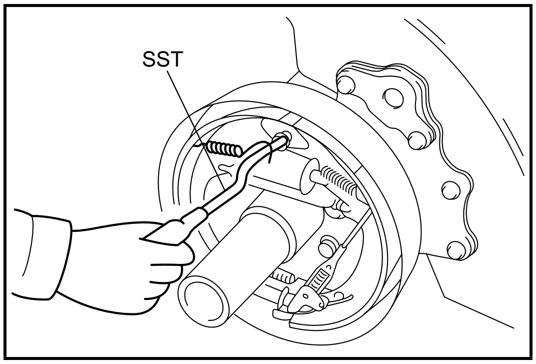
Inspection:

Measure the free length of the anchor to shoe spring.

Standard:

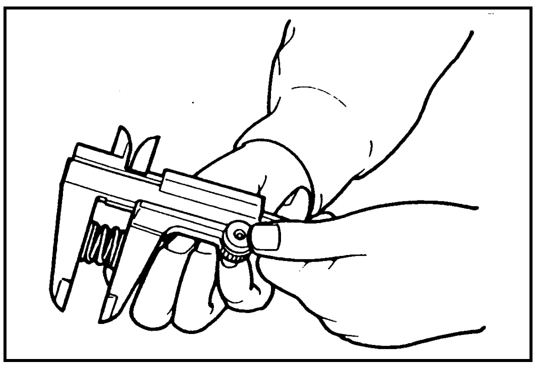
15·18 model:	**102.2 mm (4.024 in)**
20 ~ 32 model:	**On the side of lining W/pin 139.3 mm (5.484 in) On the side of lining L/pin 121.8 mm (4.795 in)**

Limit: No clearance between coil turns



Reassembly:

SST 09718-76001-71
(SST 09718-20010)



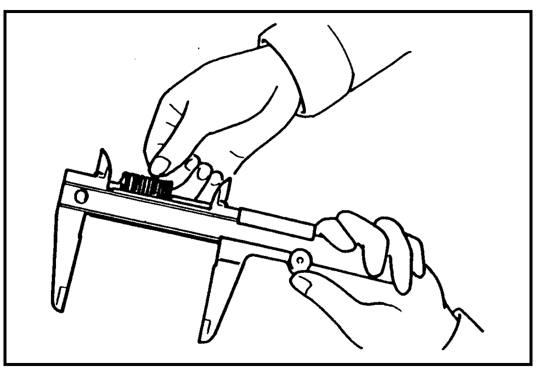
[Point 3]

Inspection:

Measure the free length of the strut to shoe spring.

Standard:

15·18 model:	**19.7 mm (0.776 in)**
20 ~ 32 model:	**29.8 mm (1.173 in)**



[Point 4]

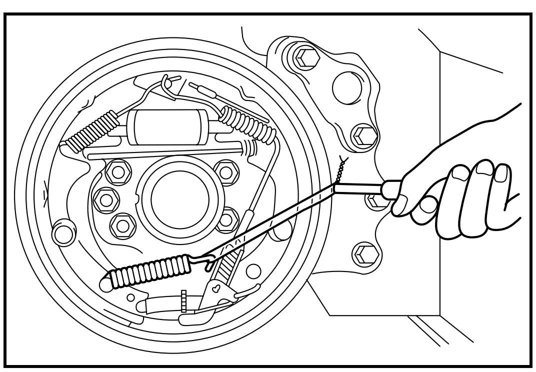
Inspection:

Measure the free length of the adjuster spring.

Standard:

15·18 model:	**99.4 mm (3.913 in)**
20 ~ 32 model:	**126.0 mm (4.961 in)**

Limit: No clearance between coil turns

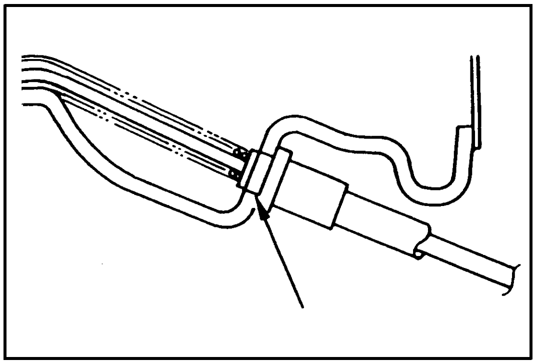


Reassembly:

Apply grease on the adjusting screw threaded portion and fill grease in the cap.

Reassembly:

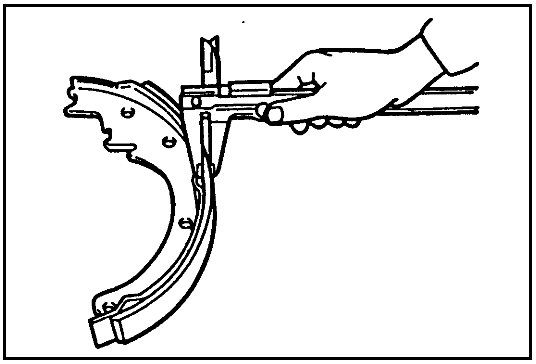
Tie a wire to the free end of the adjuster spring and set by pulling with a screwdriver.



[Point 5]

Reassembly:

Apply liquid packing (08826-76001-71 (08826-00080)) on the parking brake cable outlet in the backing plate to eliminate any clearance.

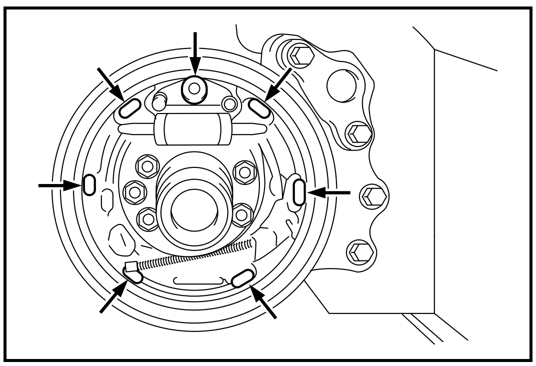


[Point 6]

Inspection:

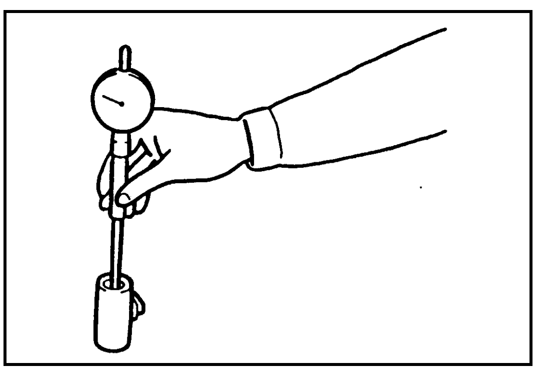
Measure the brake lining thickness.

Standard:
15·18 model: 4.9 mm (0.193 in)
20 ~ 32 model: 5.7 mm (0.224 in)
Limit: 1.0 (0.039 in)



Reassembly:

Before brake shoe installation, apply grease on illustrated portions of the backing plate (6 places in contact with the shoe rim and the anchor pin).

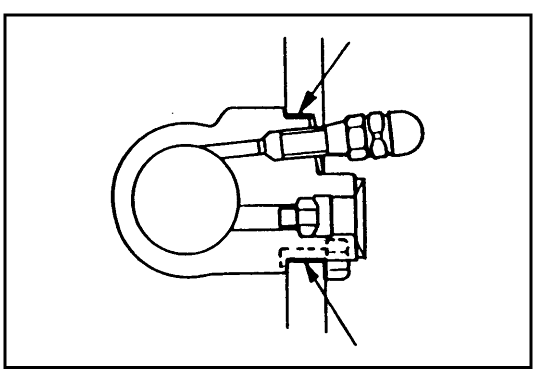


[Point 7]

Inspection:

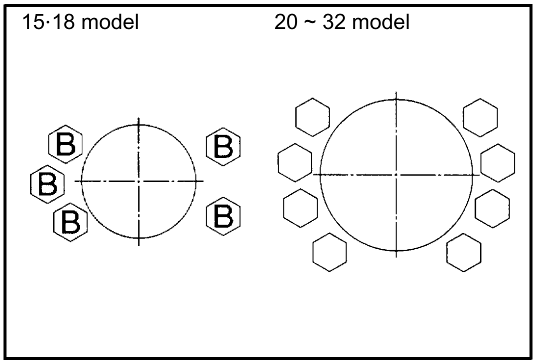
Measure the clearance between the wheel cylinder and piston.

Limit: 0.125 mm (0.00492 in)



Reassembly:

Apply liquid packing (08826-76001-71 (08826-00080)) to backing plate fitting portion of the wheel cylinder and on whole periphery of the set bolts to eliminate any clearance.

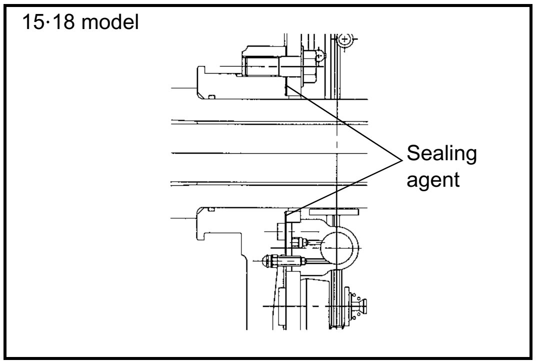


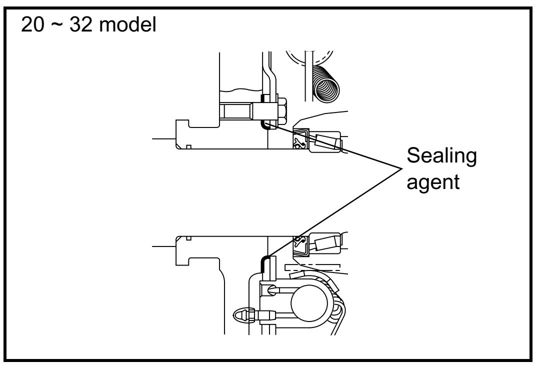
[Point 8]

Reassembly:

Apply thread tightener (08833-76001-71 (08833-00070)) on the set bolts before reassembly.

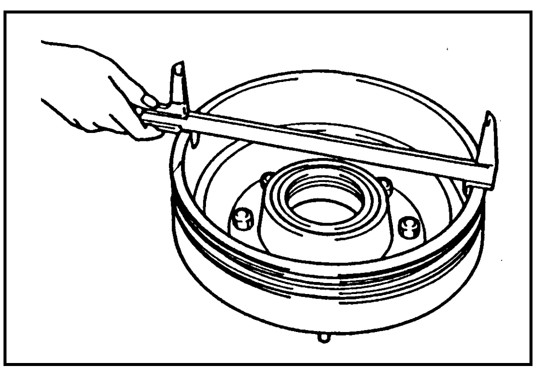
Bolt length
B:l = 40 mm (1.57 in)





Reassembly:

Apply liquid packing (08826-76001-71 (08826-00080)) on the backing plate surface in contact with the front axle bracket to eliminate any clearance.



[Point 9]

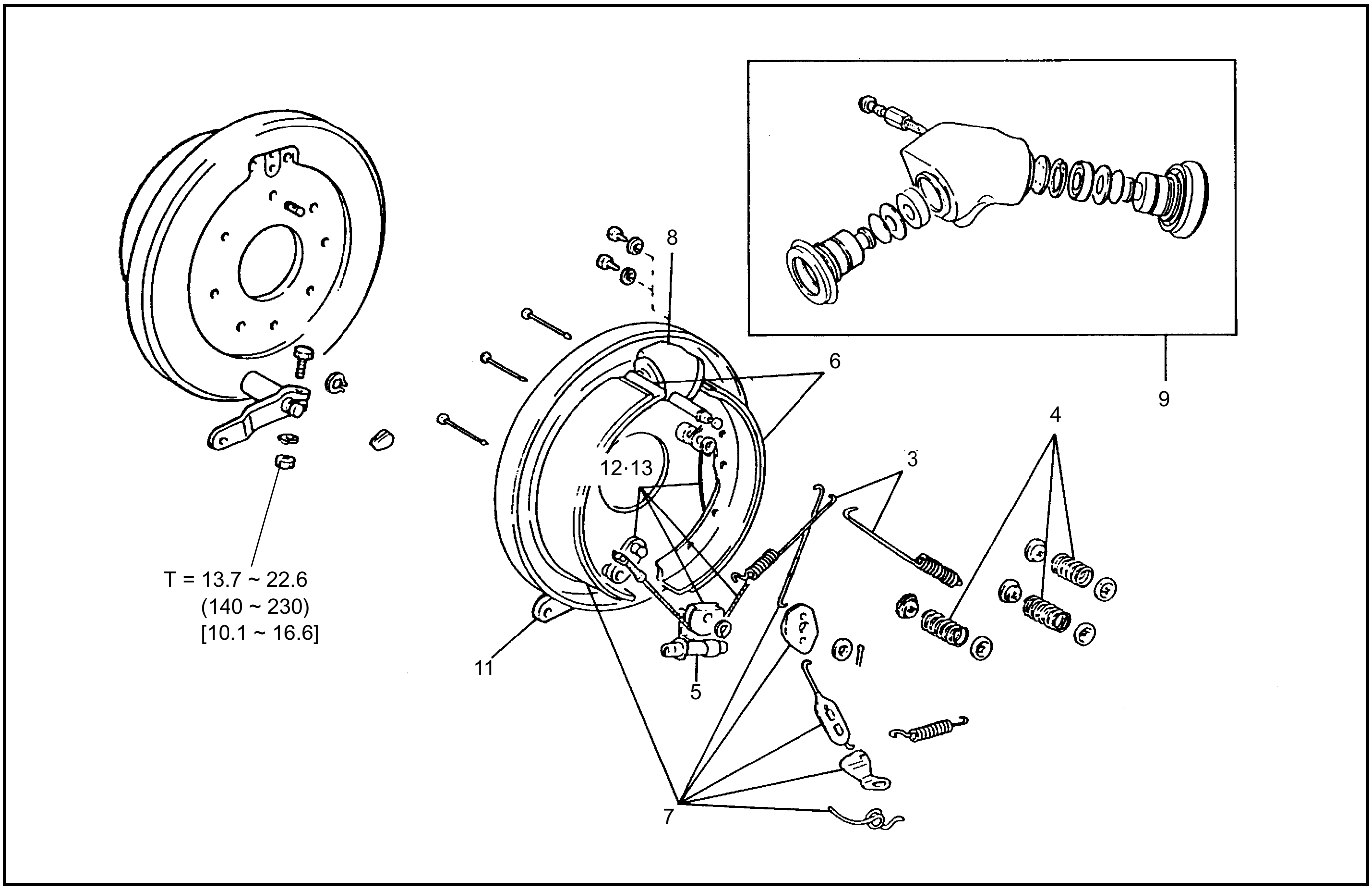
Inspection:

Measure the brake drum inside diameter.

Standard:
15·18 model: 254 mm (10.0 in)
20 ~ 32 model: 310 mm (12.20 in)
Limit:
15·18 model: 256 mm (10.1 in)
20 ~ 32 model: 312 mm (12.28 in)

DISASSEMBLY·INSPECTION·REASSEMBLY (35·45 MODEL)

T = N·m (kgf-cm) [ft-lbf]



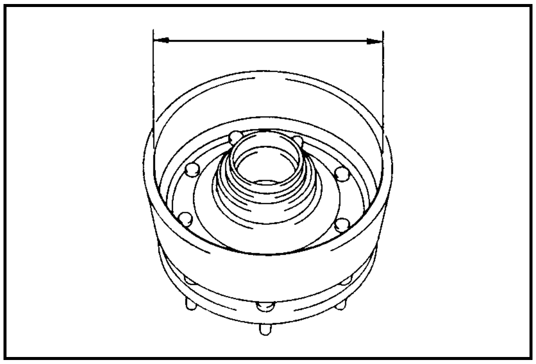
Disassembly Procedure

1 Remove the front wheel.
2 Remove the front axle hub W/brake drum. (See page 7-15.) **[Point 1]**
3 Remove the shoe return spring. **[Point 2]**
4 Remove the shoe hold down spring. **[Point 3]**
5 Remove the brake shoe adjuster. **[Point 4]**
6 Remove the brake shoe. **[Point 5]**
7 Disassemble the brake shoe (secondary). **[Point 6]**
8 Remove the wheel cylinder. **[Point 7]**
9 Disassemble the wheel cylinder.
10 Disconnect the parking brake cable.
11 Remove the actuator lever. **[Point 8]**
12 Remove the parking brake lever ASSY. **[Point 9]**
13 Disassemble the parking brake lever ASSY.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **See that the brake lining and brake drum interior surface are free from grease or oil before installation.**
- **Before reassembly, decrease the brake drum outside diameter for installation to approx. 1 mm (0.04 in) less than the drum inside diameter by tightening the adjusting screw.**
- **After reassembly, perform brake air bleeding (see page 10-38) and braking force inspection (see page 10-38).**

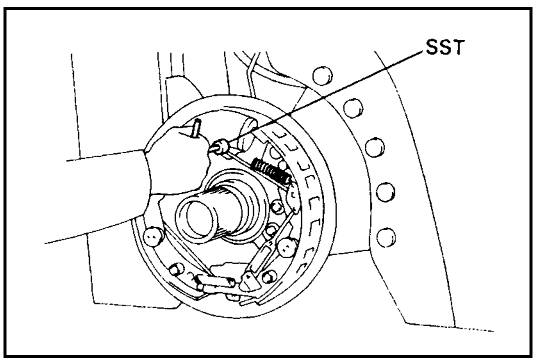


Point Operations

[Point 1]

Inspection:
Measure the brake drum inside diameter.

Standard: 317.5 mm (12.50 in)
Limit: 319.5 mm (12.58 in)

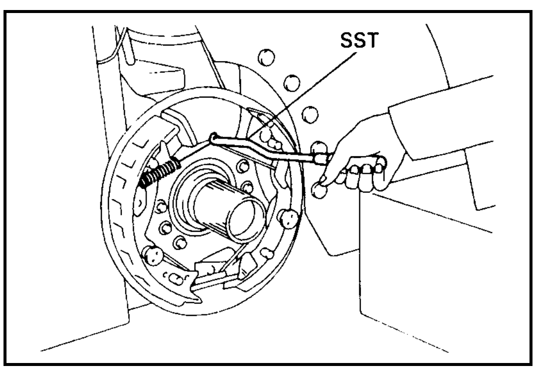


[Point 2]

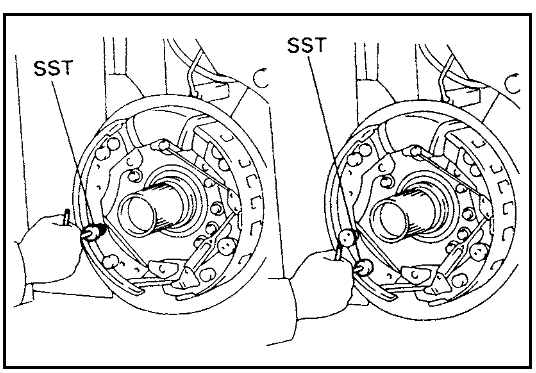
Disassembly:
SST 09717-76001-71
(SST 09717-20010)

Inspection:
Measure the free length of the spring.

Limit: No clearance between coil turns.

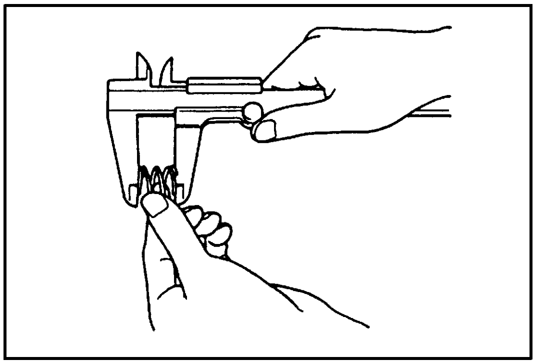


Reassembly:
SST 09718-76001-71
(SST 09718-20010)



[Point 3]

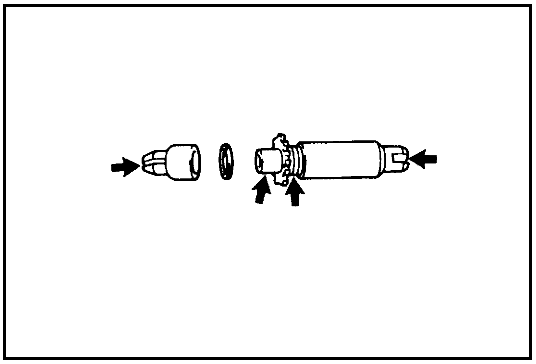
Disassembly·Reassembly:
SST 09510-31960-71



Inspection:
Measure the free length of the shoe hold down springs.

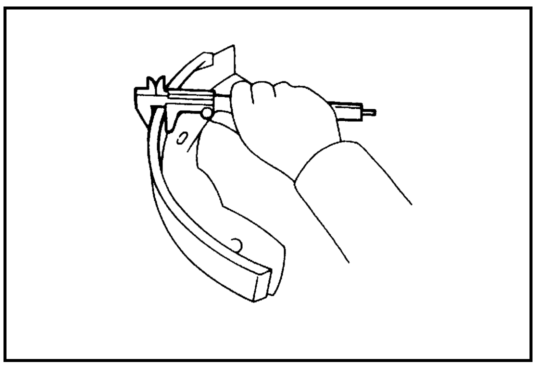
Standard:

Upper spring	**25.4 mm (1.00 in)**
Center spring	**43.7 mm (1.72 in)**
Lower spring	**27.8 mm (1.09 in)**



[Point 4]

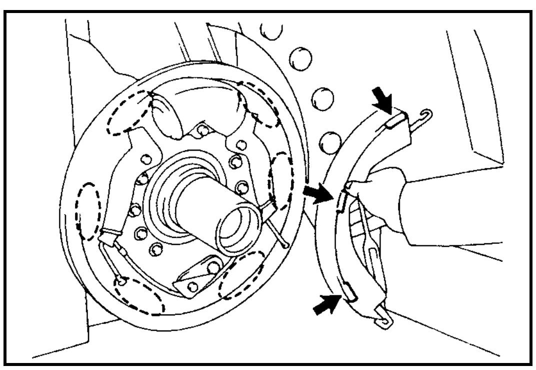
Reassembly:
Apply grease on the illustrated portion of the brake shoe adjuster.



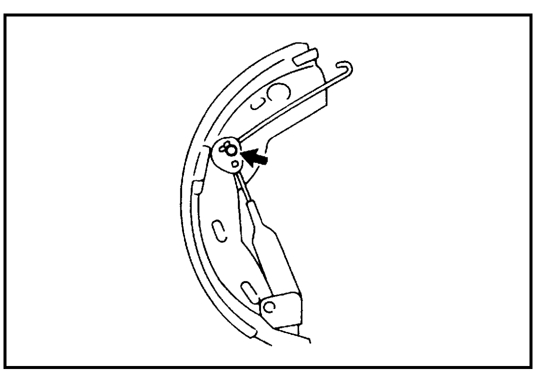
[Point 5]

Inspection:
Measure the brake lining thickness.

Standard: 9.3 mm (0.36 in)
Limit: 4.3 mm (0.17 in)
(Each dimension does not include the rim thickness.)

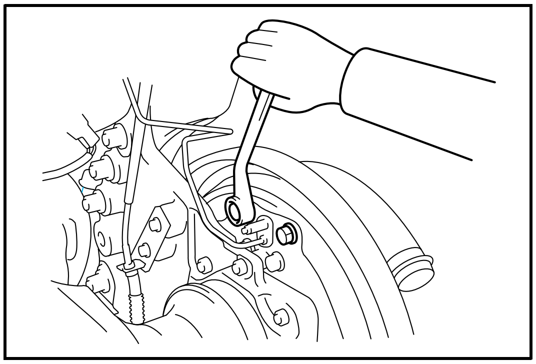


Reassembly:
Apply grease on the brake shoe rim and backing plate sliding contact portion before reassembly.



[Point 6]

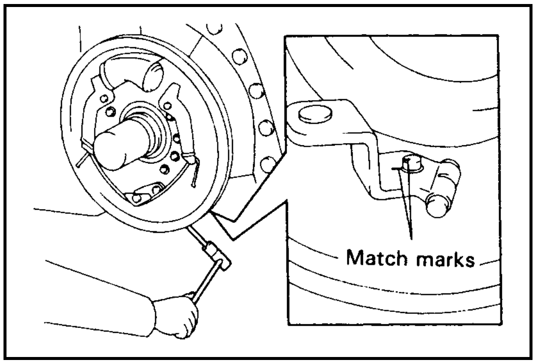
Reassembly:
Apply grease on the illustrated portion of the adjuster lever link.



[Point 7]

Reassembly:

Apply locking agent (08833-76001-71 (08833-00070)) on the threaded portion of the set bolts before reassembly.

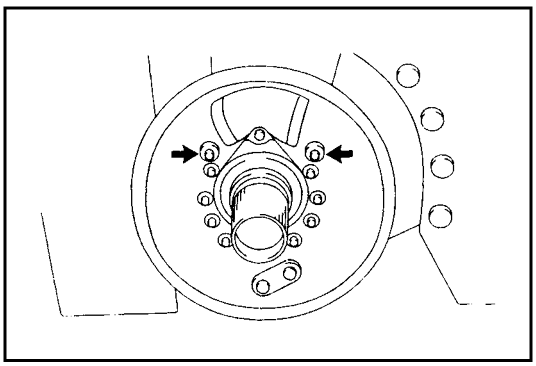


[Point 8]

Reassembly:

Install the actuator lever.

1. Apply grease to the spline and lever sliding contact portion.
2. Align the match marks for installation.



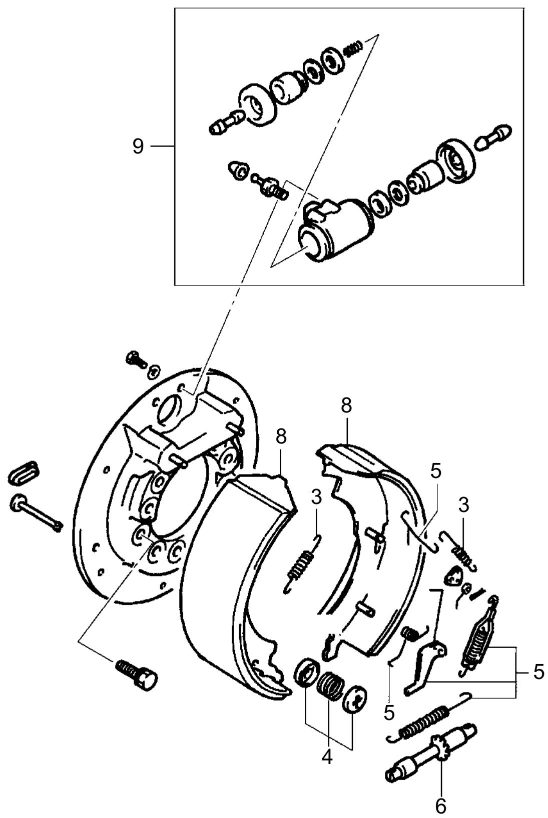
[Point 9]

Reassembly:

Apply grease on two parking brake lever shaft portions.

DISASSEMBLY·INSPECTION·REASSEMBLY (55 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

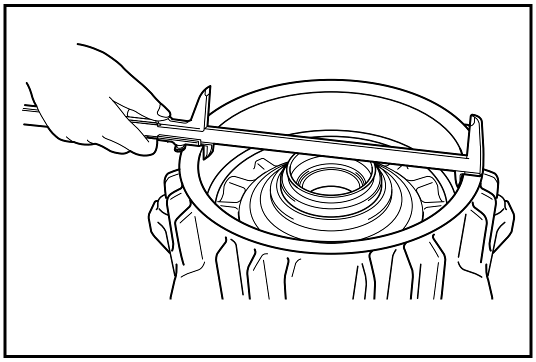
1 Remove the front wheel.
2 Remove the front axle hub W/brake drum. (See page 7-15.) **[Point 1]**
3 Remove the shoe return spring. **[Point 2]**
4 Remove the shoe hold down spring. **[Point 3]**
5 Remove the adjuster lever, link and spring.
6 Remove the brake shoe adjuster. **[Point 4]**
7 Disconnect the parking brake cable.
8 Remove the brake shoe. **[Point 5]**
9 Remove the wheel cylinder.
10 Disassemble the wheel cylinder.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:

- **See that the brake lining and brake drum interior surface are free from grease or oil before installation.**
- **Before reassembly, decrease the brake drum outside diameter for installation to approx. 1 mm (0.04 in) less than the drum inside diameter by tightening the adjusting screw.**
- **After reassembly, perform brake air bleeding (see page 10-38) and braking force inspection (see page 10-38).**



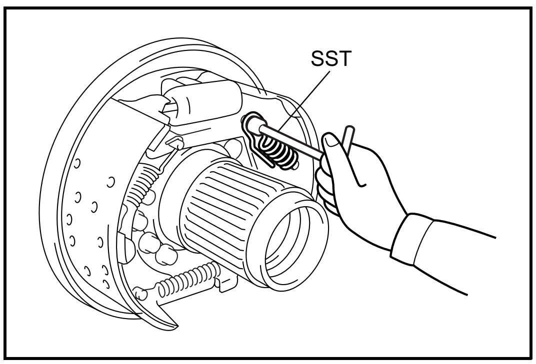
Point Operations

[Point 1]

Inspection:

Measure the brake drum inside diameter.

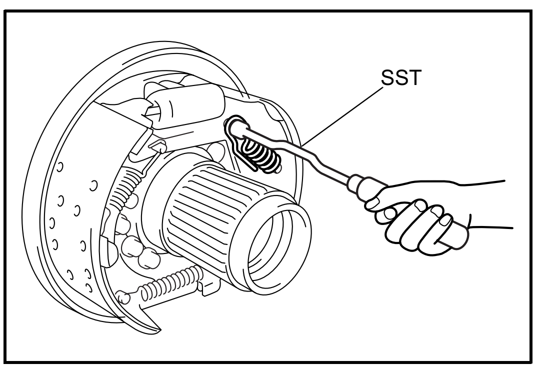
Standard: 317.5 mm (12.50 in)
Limit: 319.5 mm (12.58 in)



[Point 2]

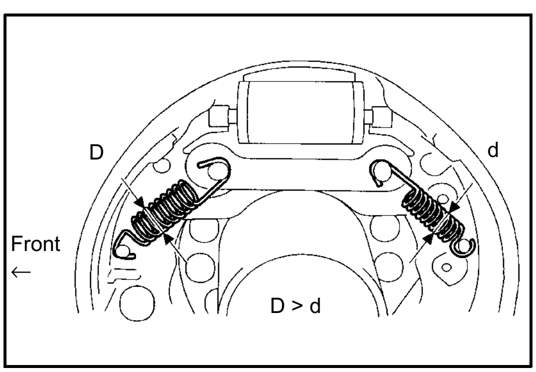
Disassembly:

SST 09717-76001-71
(SST 09717-20010)



Reassembly:

SST 09718-76001-71
(SST 09718-20010)



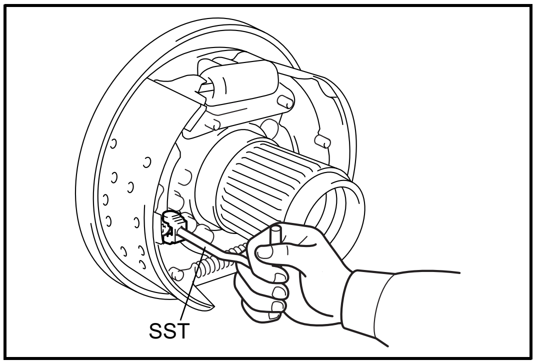
Reassembly:

Pay attention to the mounting position of the shoe return spring.
The end of the spring greater in diameter shall be on the front side.

Inspection:

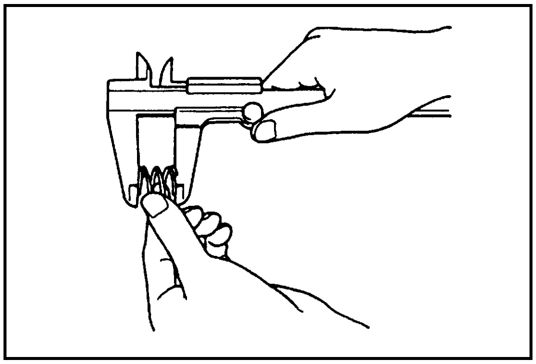
Measure the free length of the spring.

Limit: No clearance between coil turns.



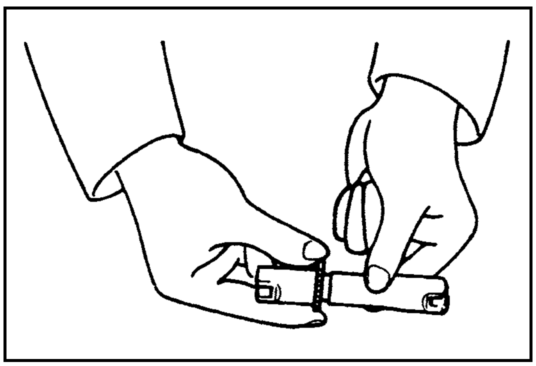
[Point 3]

Disassembly·Reassembly:
SST 09510-31960-71



Inspection:
Measure the free length of the shoe hold down springs.

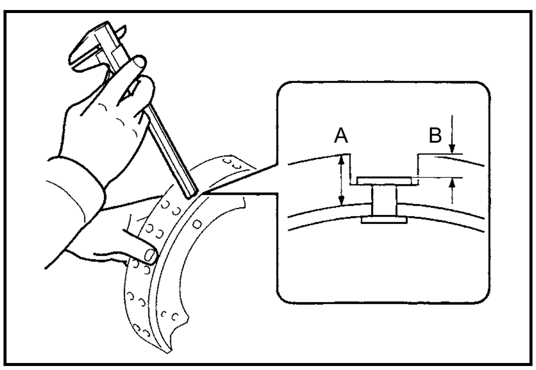
Standard: 29.2 mm (1.15 in)



[Point 4]

Inspection:
Inspect if the adjusting screw rotates smoothly.

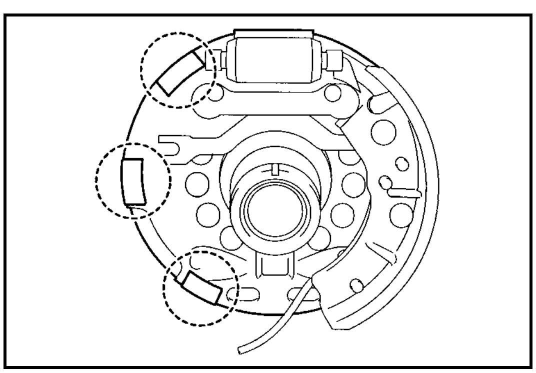
Reassembly:
Apply grease on the threaded portion of the brake shoe adjuster.



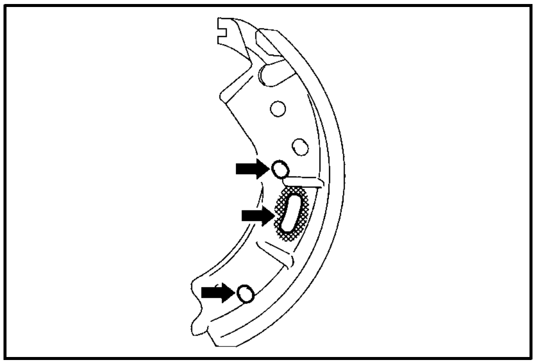
[Point 5]

Inspection:
Measure the brake lining thickness.

Standard: A = 10.0 mm (0.39 in)
Limit: B = 1.0 mm (0.039 in)



Reassembly:
Apply grease on the brake shoe rim and backing plate sliding contact portion before reassembly.



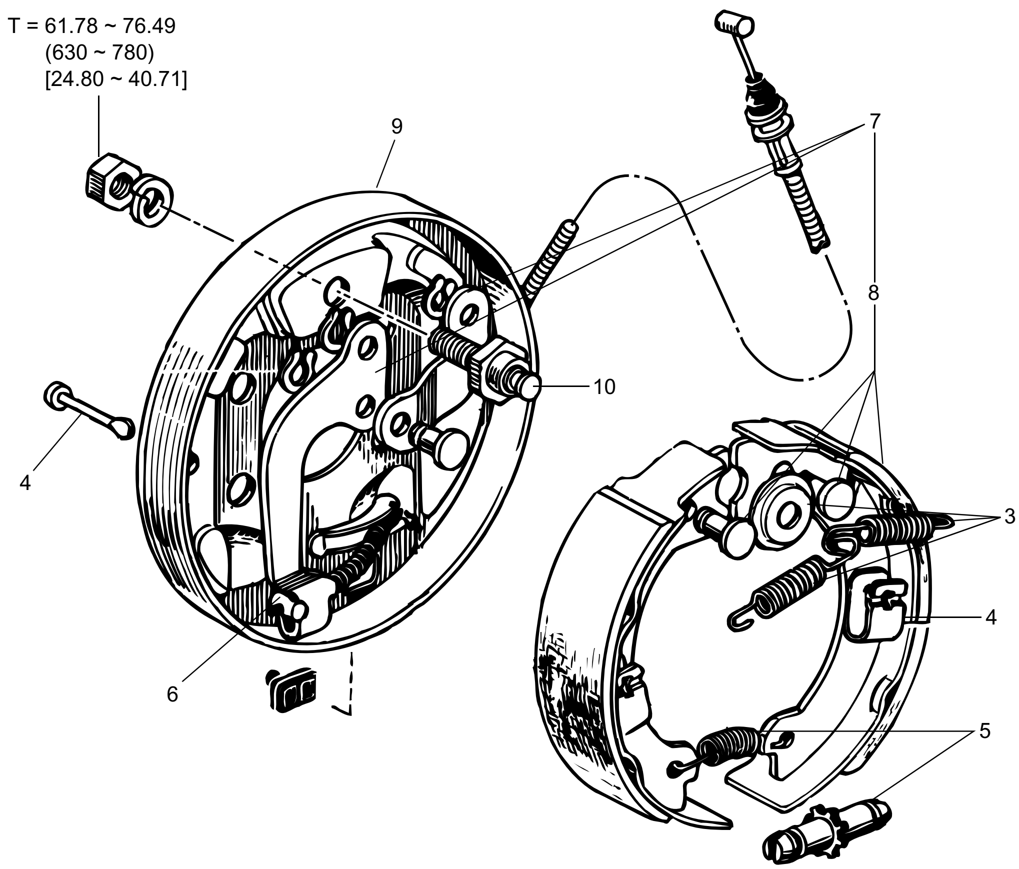
Reassembly:

Apply grease on the illustrated portion of the brake shoe.

DEAD-MAN BRAKE (OPT)

DISASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]



Brake dram lock nut	T = 157 ~ 216 (1600 ~ 2200) [115.8 ~ 159.2]
Brake backing plate set bolt	T = 29.4 ~ 44.1 (300 ~ 450) [21.7 ~ 32.6]

Disassembly Procedure

1 Remove the drive motor ASSY. (See page 5-10 (15 ~ 32 model), 5-12 (35 ~ 55 model))
2 Remove the dead-man brake drum.
3 Remove the shoe return spring. **[Point 1]**
4 Remove the brake shoe fixing spring. **[Point 2]**
5 Remove the adjusting screw and adjuster spring. **[Point 3]**
6 Disconnect the brake cable from the lever.
7 Remove the brake shoe W/strut lever and parking lever.
8 Remove the brake lever pin and brake shoe. **[Point 4]**
9 Remove the backing plate. **[Point 5]**
10 Remove the anchor pin. **[Point 6]**

Reassembly Procedure

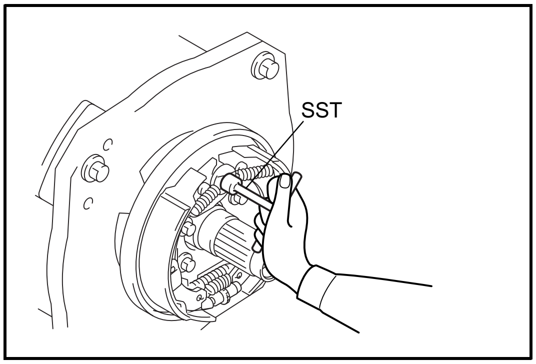
The reassembly procedure is the reverse of the disassembly procedure.

Note:

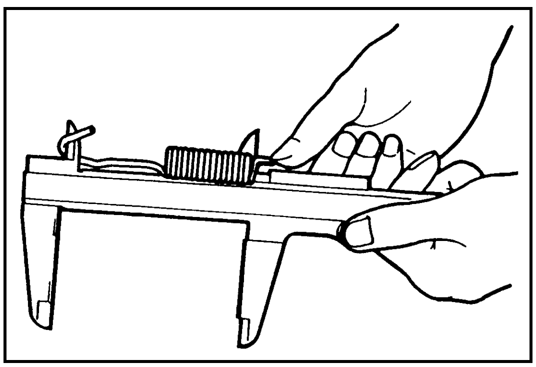
- **See that the brake lining and brake drum interior surface are free from grease or oil before installation.**
- **After reassembly, dead-man brake adjustment (See page 10-39).**

Point Operations

[Point 1]

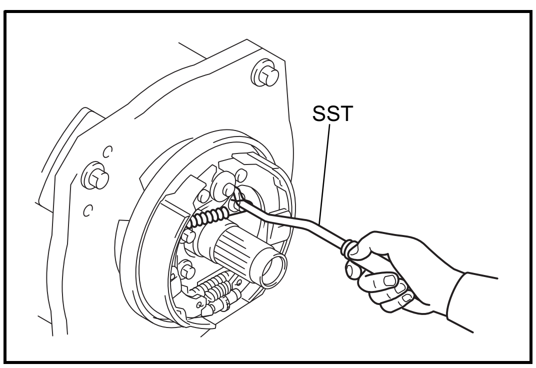


Disassembly:
SST 09717-76001-71
(SST 09717-20010)



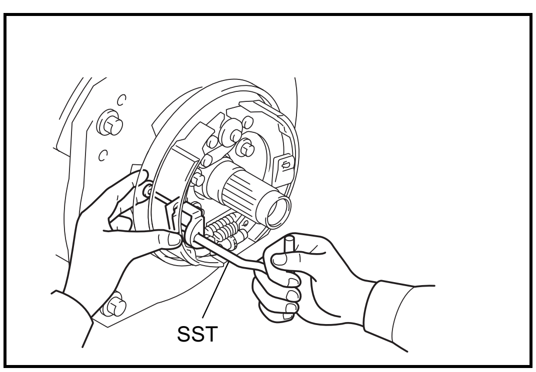
Inspection:
Measure the free length of the shoe return spring

Standard: 53.2 mm (2.09 in)
Limit: Replace if there is clearance between coils.

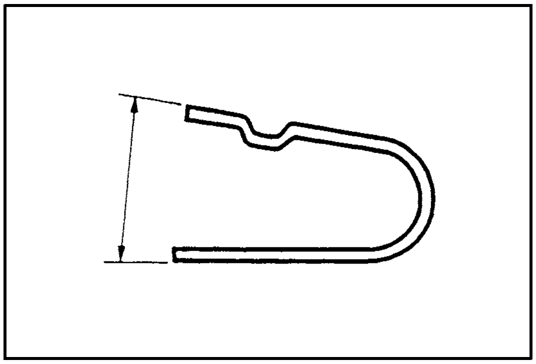


Reassembly:
SST 09718-76001-71
(SST 09718-20010)

[Point 2]

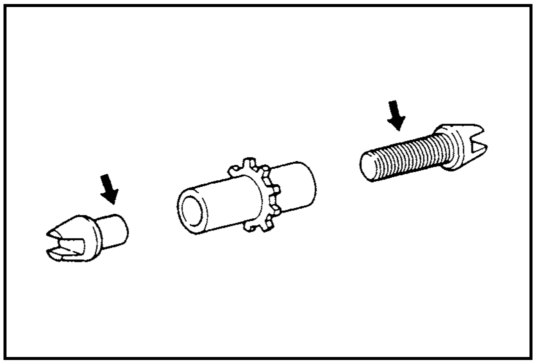


Disassembly·Reassembly:
SST 09510-31960-71



Inspection:
Measure the free height of the brake shoe fixing spring.

Standard: 20mm
Limit: 18mm

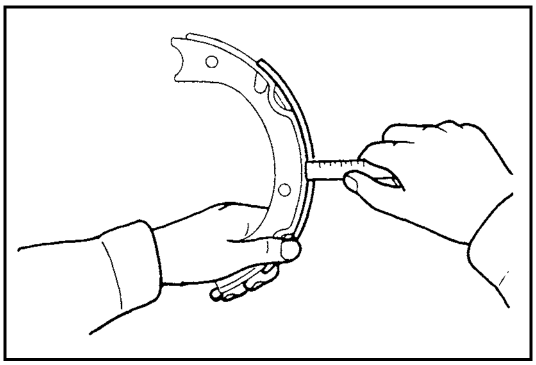


[Point 3]

Inspection:
Inspect the adjuster spring.

Limit: Replace if there is clearance between coils.

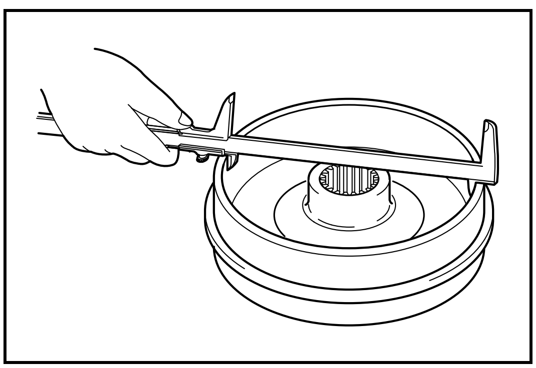
Reassembly:
Apply grease to the threaded portion of the adjusting screw and the piece.



[Point 4]

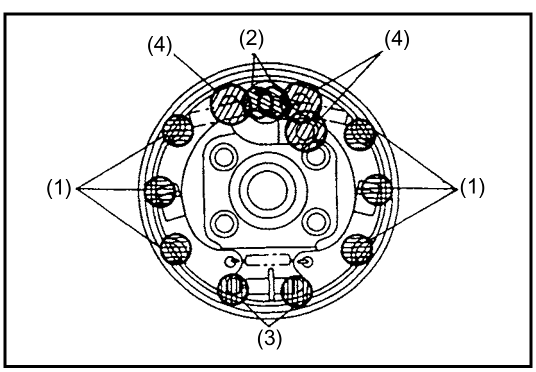
Inspection:
Measure the brake lining thickness.

Standard: 4.0 mm (0.16 in)
Limit: 1.0 mm (0.04 in)



Inspection:
Measure the brake drum inside diameter.

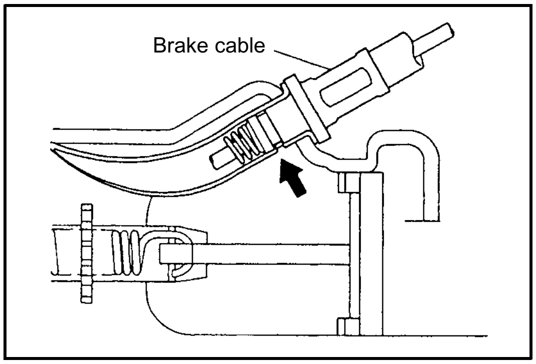
Standard: 160 mm (6.30 in)
Limit: 162 mm (6.38 in)



[Point 5]

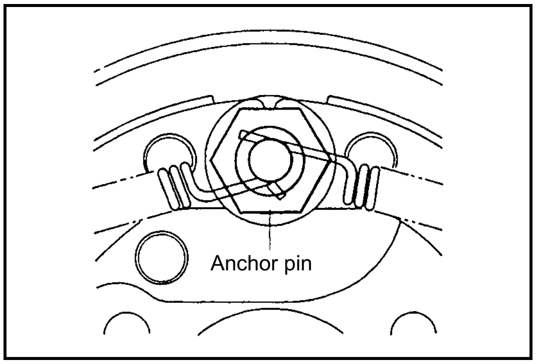
Reassembly:
Apply grease to on the following places on the backing plate before installing the brake shoe.

(1) Six contacting portions between the backing plate and shoe.
(2) Two contacting portions between the shoe and anchor pin.
(3) Two fitting portions of the adjusting screw and sleeve.
(4) Three contacting portions between the brake lever pin, shoe, brake lever and cross strut.



Reassembly:

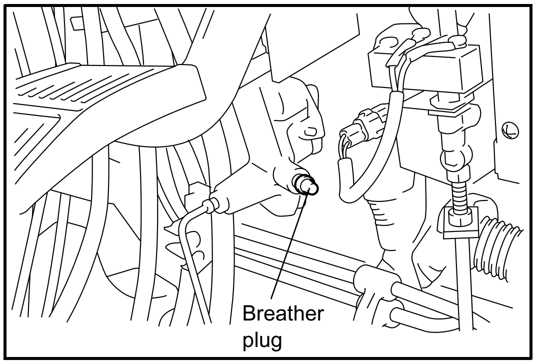
Caulk the illustrated portion to prevent brake cable disconnection.

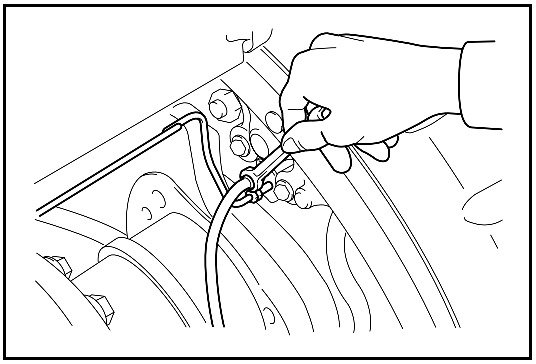


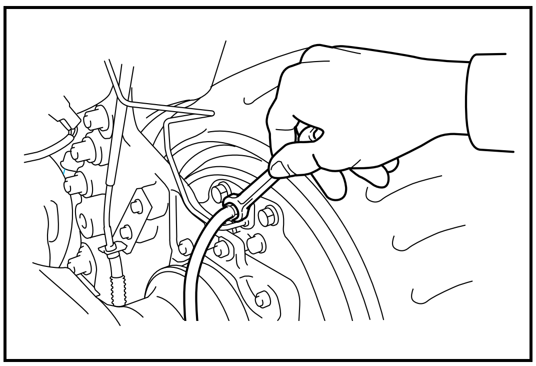
[Point 6]

Reassembly:

Install the hexagonal portion of the anchor pin to position as illustrated.







BRAKE AIR BLEEDING (15 ~ 32 MODEL)

Note:
Add brake fluid to the reservoir tank during air bleeding to prevent it from becoming insufficient.
Perfrom air bleeding by two operators.

1. Bleed air from the brake master cylinder.
   (1) Depress the brake pedal several times to compress the air in the piping, and hold that state.
   (2) Loosen the breather plug to discharge air in the piping with the brake fluid, and tighten the plug immediately before the fluid stops to run out.
   (3) Repeat steps (1) and (2) above until no air bubbles are seen in the discharged brake fluid.
2. Bleed air from wheel cylinders RH and LH.
   (1) Operate as described in step 1 above for each of the RH and LH side at a time.
3. Add brake fluid to the specified level.
   (1) Add brake fluid through the filter provided at the reservoir tank.
   (2) Add brake fluid up to the staged portion in the reservoir tank.

BRAKE AIR BLEEDING (35 ~ 55 MODEL)

Note:
Perform air bleeding by two operators.

1. Jack up the vahicle.
2. Turn the key switch to ON.
3. Set the direction switch in the forward or reverse position. If the EZ pedal (OPT) is installed, keep the pedal switch in the forward or reverse position.
   Caution:
   Never depress the accelerator pedal during air bleeding.
4. Loosen the wheel cylinder breather plug with the brake pedal kept depressed.
5. Tighten the breather plug when no air bubble is seen in the discharged hydraulic oil.

BRAKING FORCE INSPECTION·ADJUSTMENT

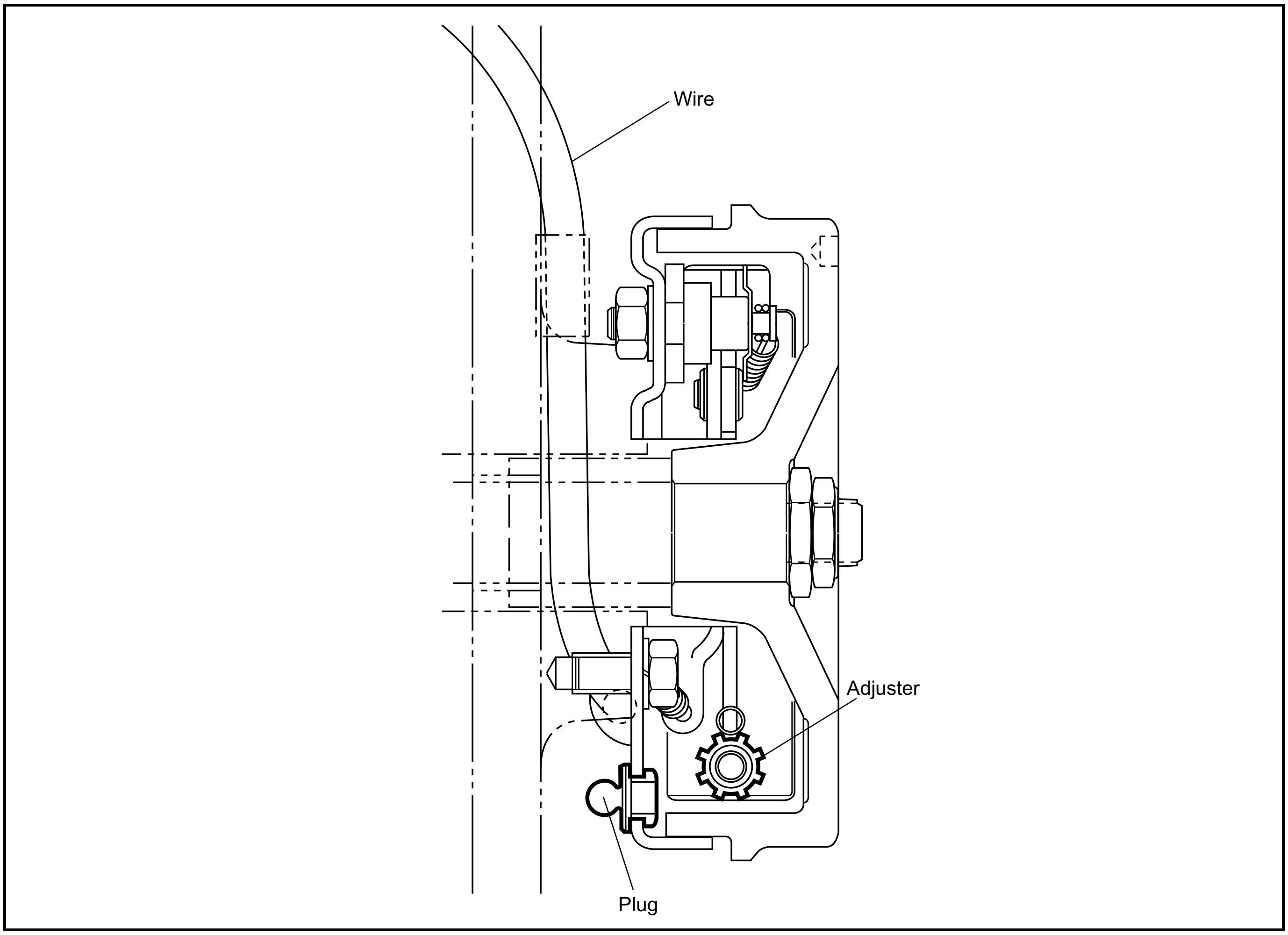
1. Inspect the braking force by means of a brake tester or traveling test.
   Braking distance (without load)

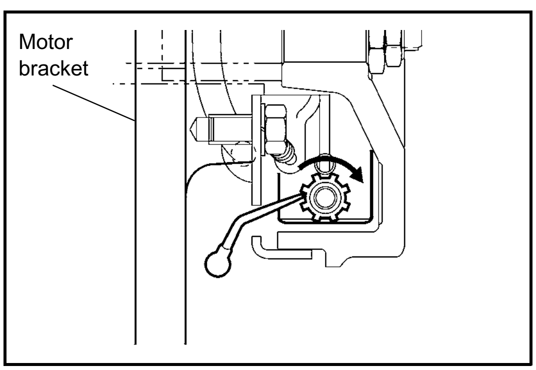
Initial speed of braking	km/h (mph)	Max.speed
Braking distance	m (ft)	5.0 (16.4) or less

2. Adjust the braking force.
   (1) Repeat traveling in the forward and reverse directions to adjust the brake shoe clearance.
   The adjusting screw adjusts the clearance automatically when the brake pedal is depressed in reverse traveling.
   (2) If the braking force is insufficient, adjuster malfunction, lining contact defect, foreign matter adhesion on the lining or brake fluid leakage is assumed. Remove and inspect the brake drum.
   (3) When the brake shoe is replaced with a new one, repeat traveling in the forward and reverse directions for running in.

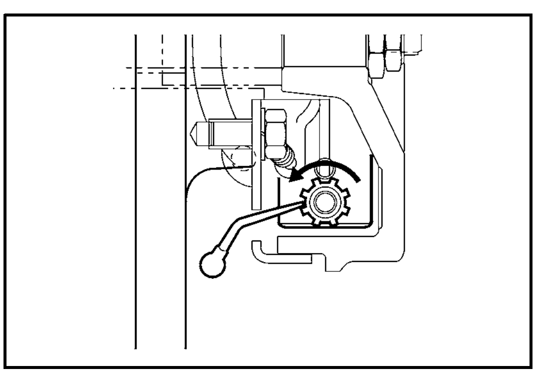
DEAD-MAN BRAKE ADJUSTMENT

If the deadman brake is removed or disassembled, adjust the brake shoe as follows:





1. Remove the plug and turn the adjuster in the shoe expanding direction with a straight-head screwdriver to bring the brake shoe into close contact with the drum inside surface.

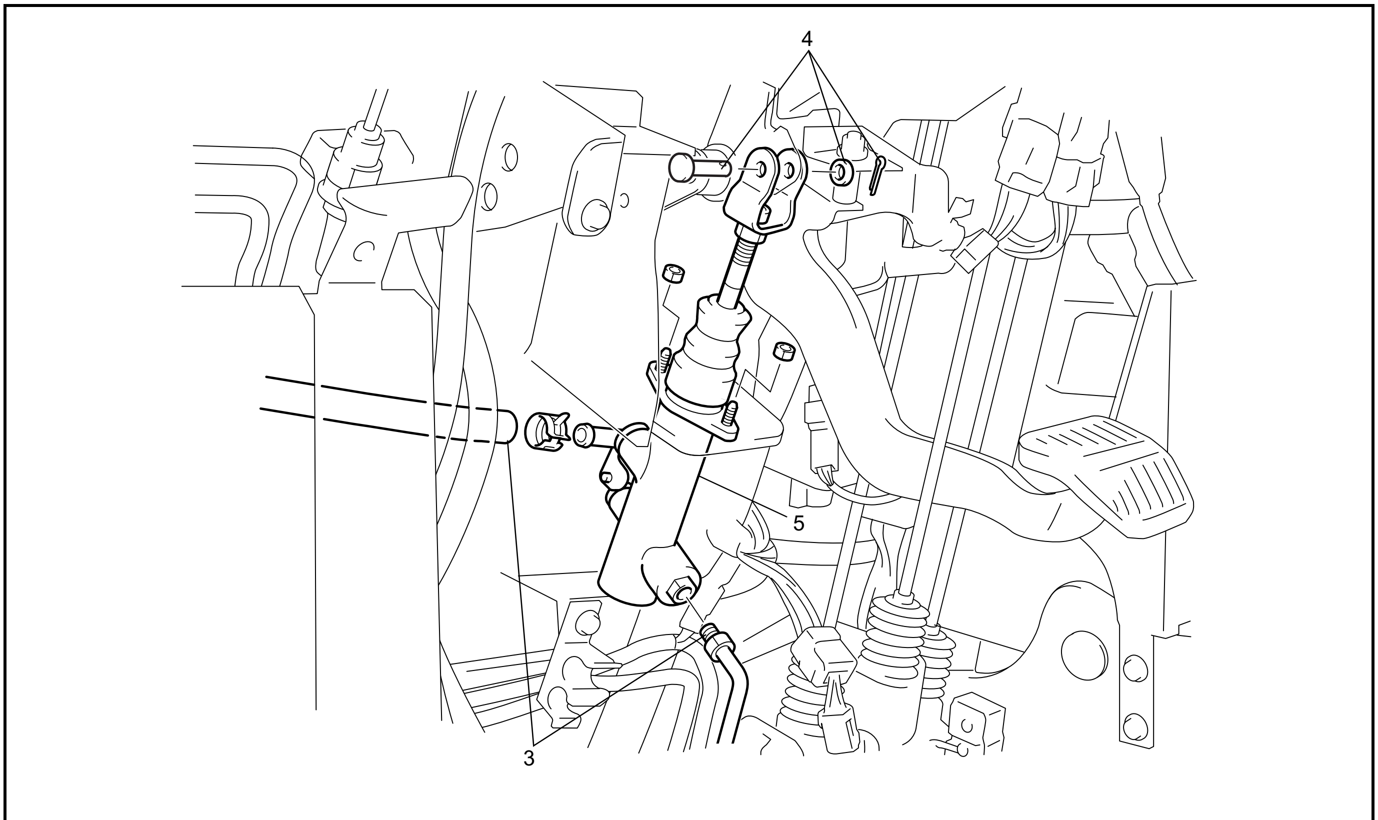


2. Return the adjuster by 4 ~ 8 notches in the shoe contracting direction.

3. Rotate the drum to make sure that it is not in contact with the shoe.

BRAKE MASTER CYLINDER (15 ~ 32 MODEL)

REMOVAL·INSTALLATION



Removal Procedure

1 Remove the toe board (front and rear) and lower panel.
2 Disconnect the brake side hose from the reservoir tank and drain brake fluid.
3 Disconnect the piping.
4 Remove the push rod clevis pin.
5 Remove the brake master cylinder.

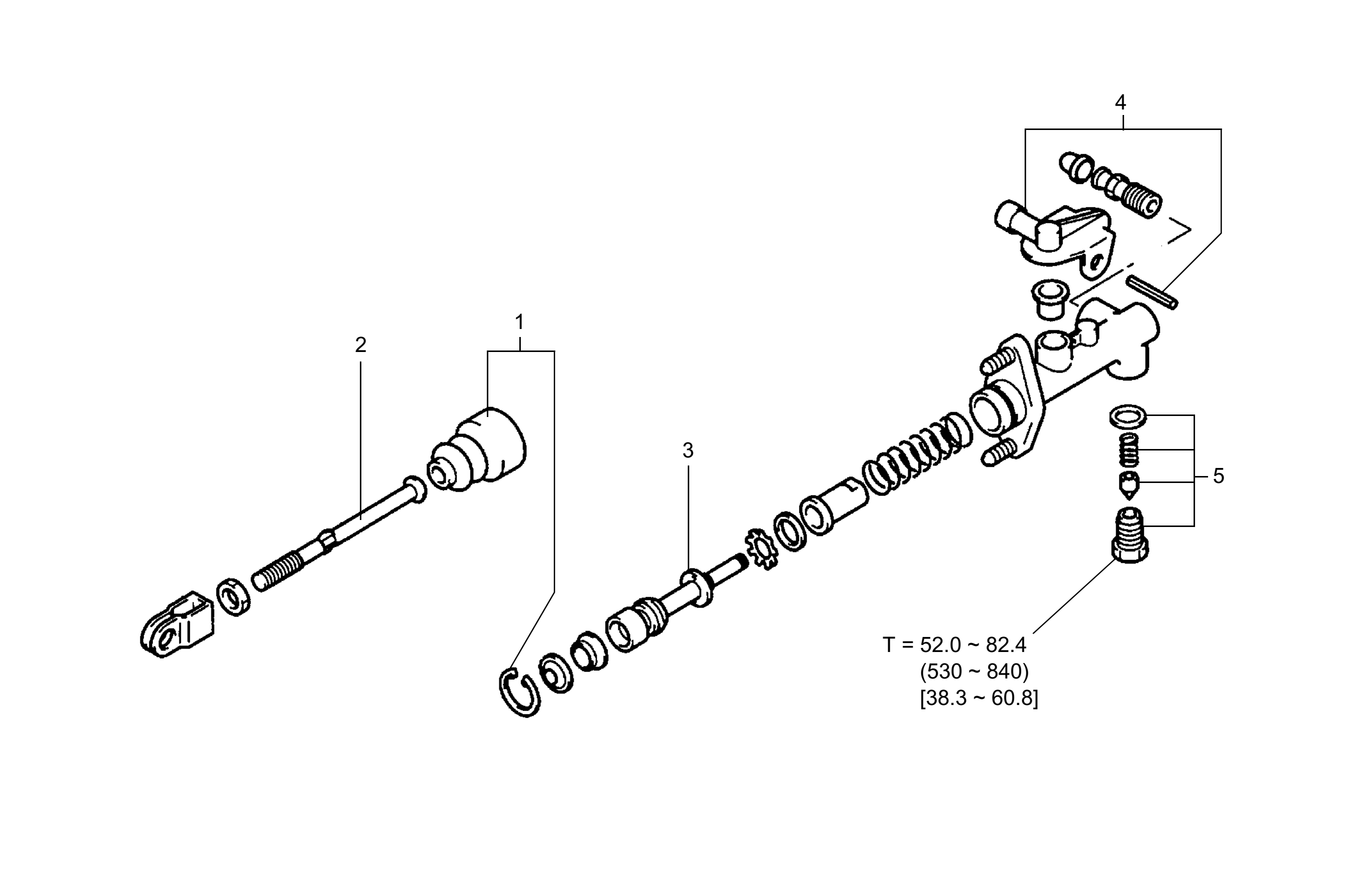
Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
After installation, perform brake pedal adjustment (See page 10-59 (15 ~ 32 model), 10-60 (35 ~ 55 model)) and air bleeding (page 10-38).

DISASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]

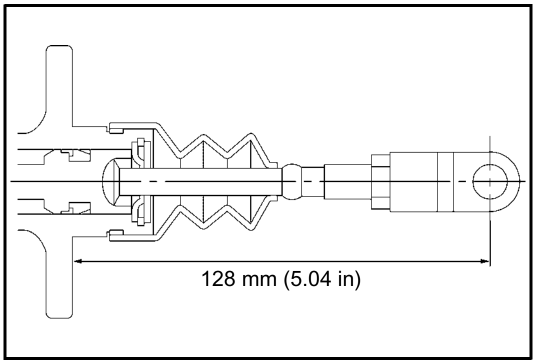


Disassembly Procedure

1 Turn the boot up and remove the snap ring.
2 Remove the push rod. **[Point 1]**
3 Remove the piston. **[Point 2]**
4 Remove the pin and the fluid inlet elbow.
5 Remove the outlet plug and valve.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

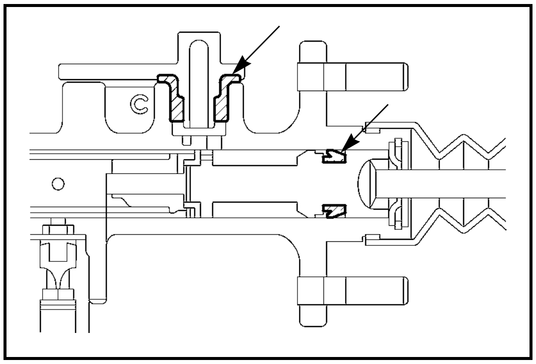


Point Operations

[Point 1]

Reassembly:

Temporarily set the push rod length to the illustrated dimension, and make readjustment after installation.



[Point 2]

Reassembly:

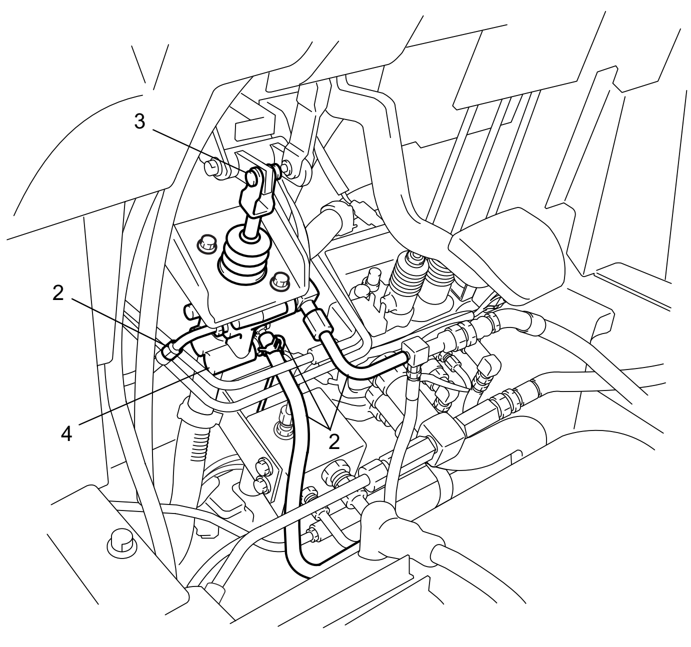
Apply rubber grease on the piston cup and whole periphery of the cup before reassembly.

BRAKE BOOSTER

TROUBLESHOOTING

Phenomenon	Estimated cause	Corrective action
Poor braking performance	• Oil leak from hydraulic piping or insufficient oil level in tank • Damaged O-ring for reaction piston • Foreign matter trapping by piston • Increases play by loosened clevis lock nut • Air entrance in wheel cylinder circuit	• Repair or replacement • Replacement • Cleaning or correction • Clevis adjustment • Air bleeding
Brake dragging	• Continuous spool holding by loosening of clevis lock nut • Foreign matter trapping by spool	• Adjustment • Cleaning or correction

REMOVAL·INSTALLATION



Removal Procedure

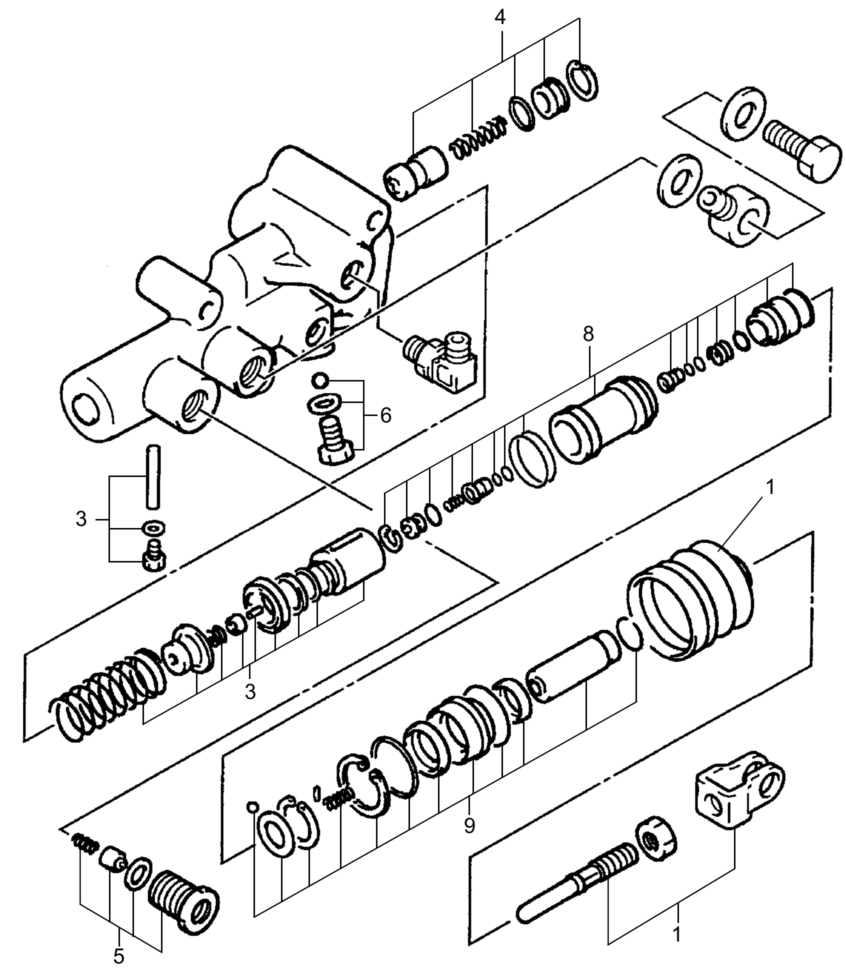
1 Remove the toe board (front and rear) and lower panel
2 Disconnect the brake booster piping.
3 Remove the push rod clevis pin.
4 Remove the brake booster.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

DISASSEMBLY·INSPECTION·REASSEMBLY

Note:
When setting the brake booster on a vise, carefully operate so as not to damage the piping joint.



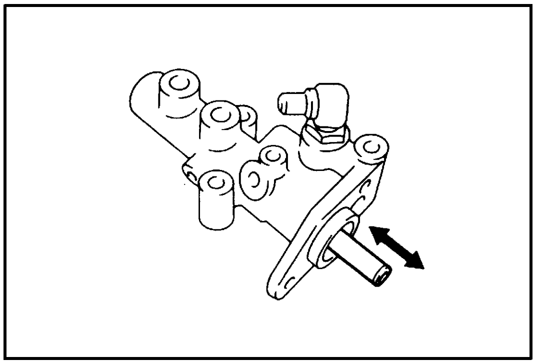
Disassembly Procedure

1 Remove the push rod and boot.
2 Remove the reaction piston & power piston. **[Point 1]**
3 Remove the master cylinder pistion. **[Point 2]**
4 Remove the flow divider spool.
5 Remove the outlet check valve.
6 Remove the check ball.
7 Separate the reaction piston & power piston. **[Point 3]**
8 Disassemble the reaction piston. **[Point 4]**
9 Disassemble the power piston. **[Point 5]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

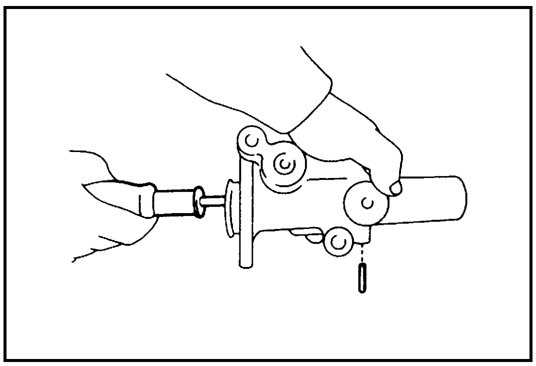
Note:
Wash each part in new hydraulic oil, dry it by blowing compressed air and apply hydraulic oil at the time of installation. Apply silicone grease on the cylinder cup at the time of installation.



Point Operations

[Point 1]

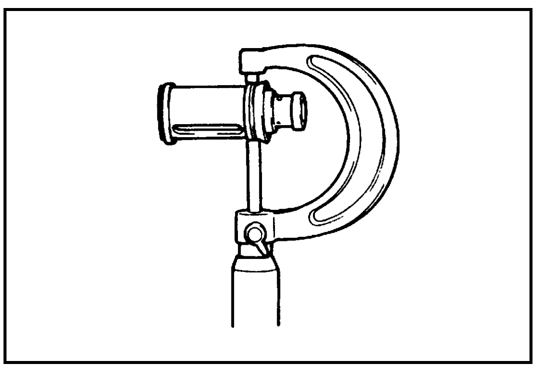
Reassembly:
Check smooth movement of the reaction pistion & power piston after reassembly.



[Point 2]

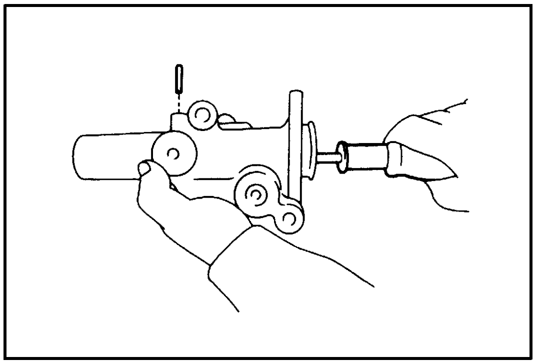
Disassembly:
Master cylinder piston removal

1. Remove the plug and gasket.
2. Drop the pin while holding the master cylinder piston with a screwdriver wrapped with waste cloth at the tip end.
   Carefully operate so as not to damage the inside.
3. Remove the master cylinder piston and return spring.



Inspection:
Inspect the master cylinder piston for wear at the sliding contact surface.

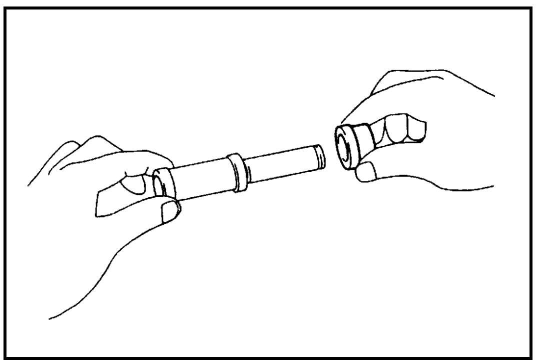
Limit: 0.032 mm (0.0013 in)
(Diametrical clearance)



Reassembly:

Master cylinder piston installation

1. Insert the master cylinder piston and return spring slowly by pushing with a screwdriver wrapped with waste cloth at the tip end.
   Before installation align the piston slit and pin hole directions. Carefully operate so as not to damage the cylinder bore.
2. Check the piston slit through the pin hole and install the pin securely.
3. Install the gasket and plug.



[Point 3]

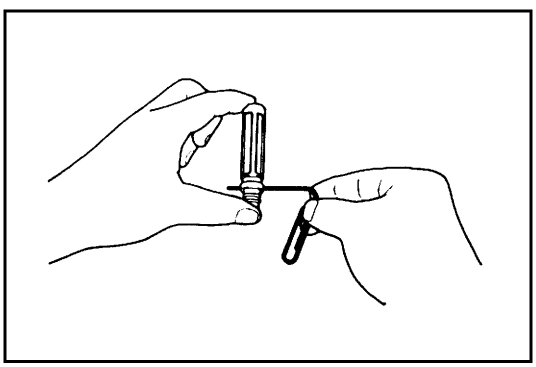
Reassembly:

Apply silicone grease to both cylinder cups.

Reassembly:

Check the reaction piston guide mounting direction.

[Point 4]



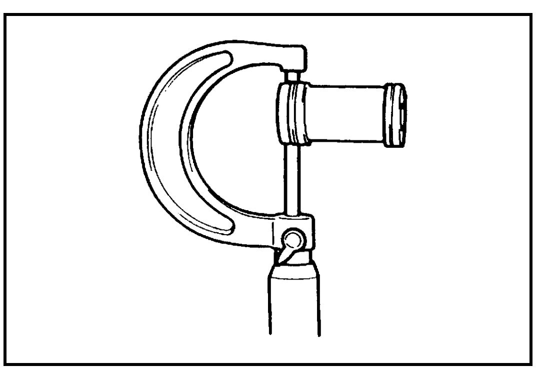
Disassembly:

While pushing the control valve seat with a round bar, remove the pin by pushing with a wire.

Reassembly:

Reaction piston installation

1. Align the piston pin hole and valve seat pin hole directions before insertion.
2. Insert the control valve seat slowly by pushing with a round bar.
3. Check the valve seat oil hole through the piston pin hole and install the pin so as not to protrude from the outer circumference.



[Point 5]

Inspection:

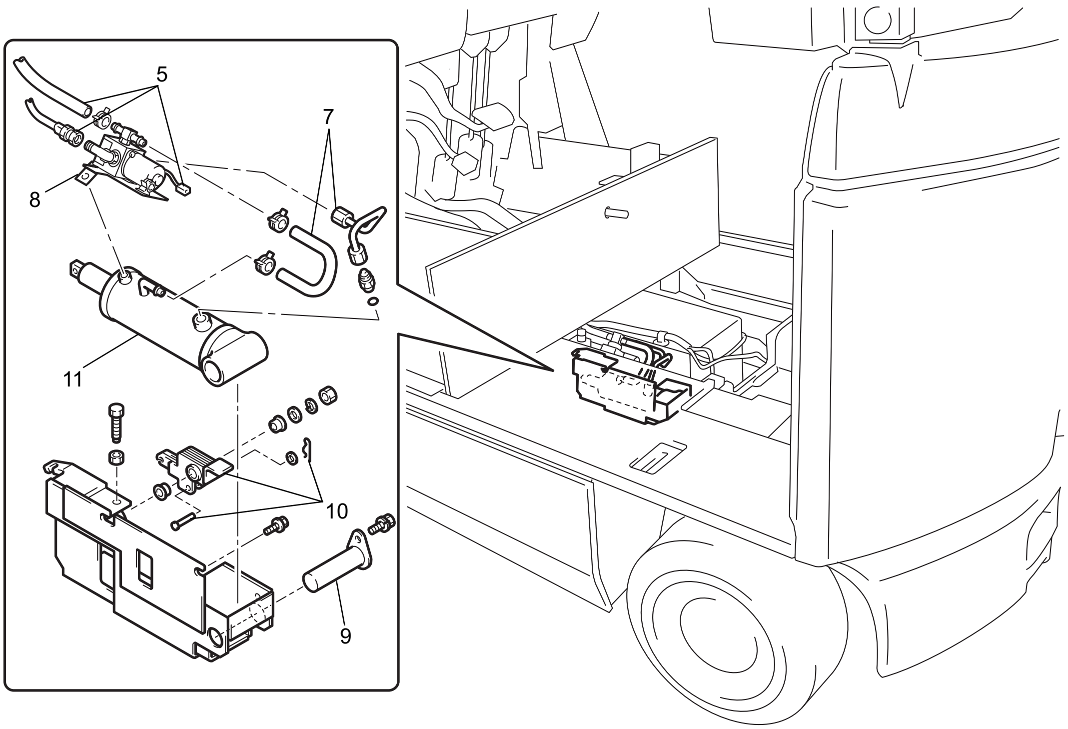
Inspect the power piston sliding surface for wear.

Limit: 0.032 mm (0.0013 in)
(Diametrical clearance)

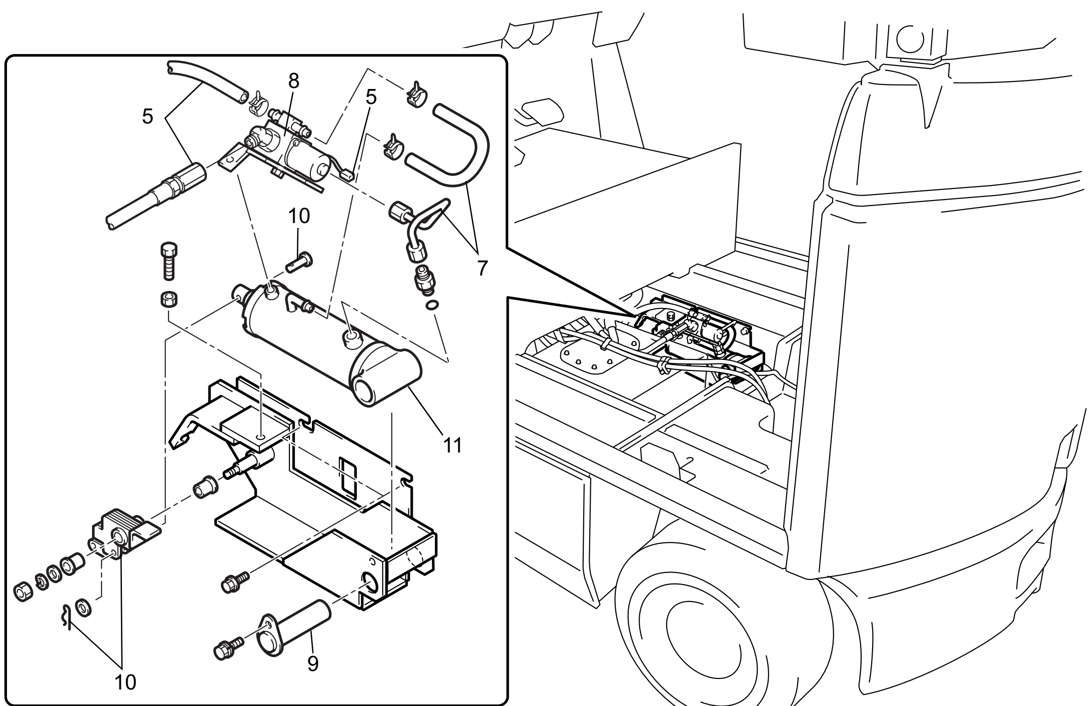
DEAD-MAN BRAKE CYLINDER

REMOVAL·INSTALLATION

15 ~ 32 model



35 ~ 55 model



Removal Procedure

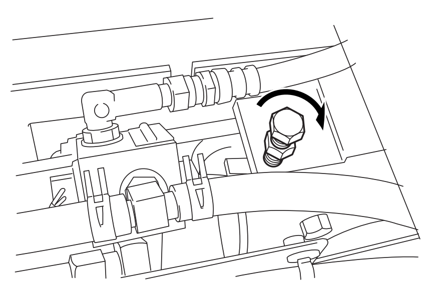
1 Remove the battery. (See page 1-5)
2 15 ~ 32 model: Remove the toe board. (front and rear)
3 15 ~ 32 model: Remove the PS controller.
4 Disconnect the dead-man brake wire. **[Point 1]**
5 Disconnect the piping and wiring.
6 Remove the dead-man brake cylinder W/bracket ASSY.
7 Disconnect the piping.
8 Remove the solenoid valve ASSY.
9 Remove the dead-man brake cylinder rear pin.
10 Remove the dead-man brake front pin and dead-man brake lever.
11 Remove the dead-man brake cylinder.

Installation Procedure

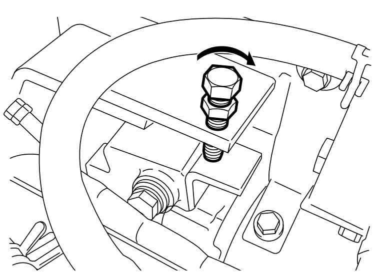
The installation procedure is the reverse of the removal procedure.

Note:
- **Apply MP grease to the deadman brake wire connecting portion and deadman brake lever pin before installation.**
- **Check the hydraulic oil level, and add if insufficient.**
- **Adjust the deadman brake wire after installation. (See page 10-57 (15 ~ 32 model), 10-58 (35 ~ 55 model))**

15 ~ 32 model



35 ~ 55 model



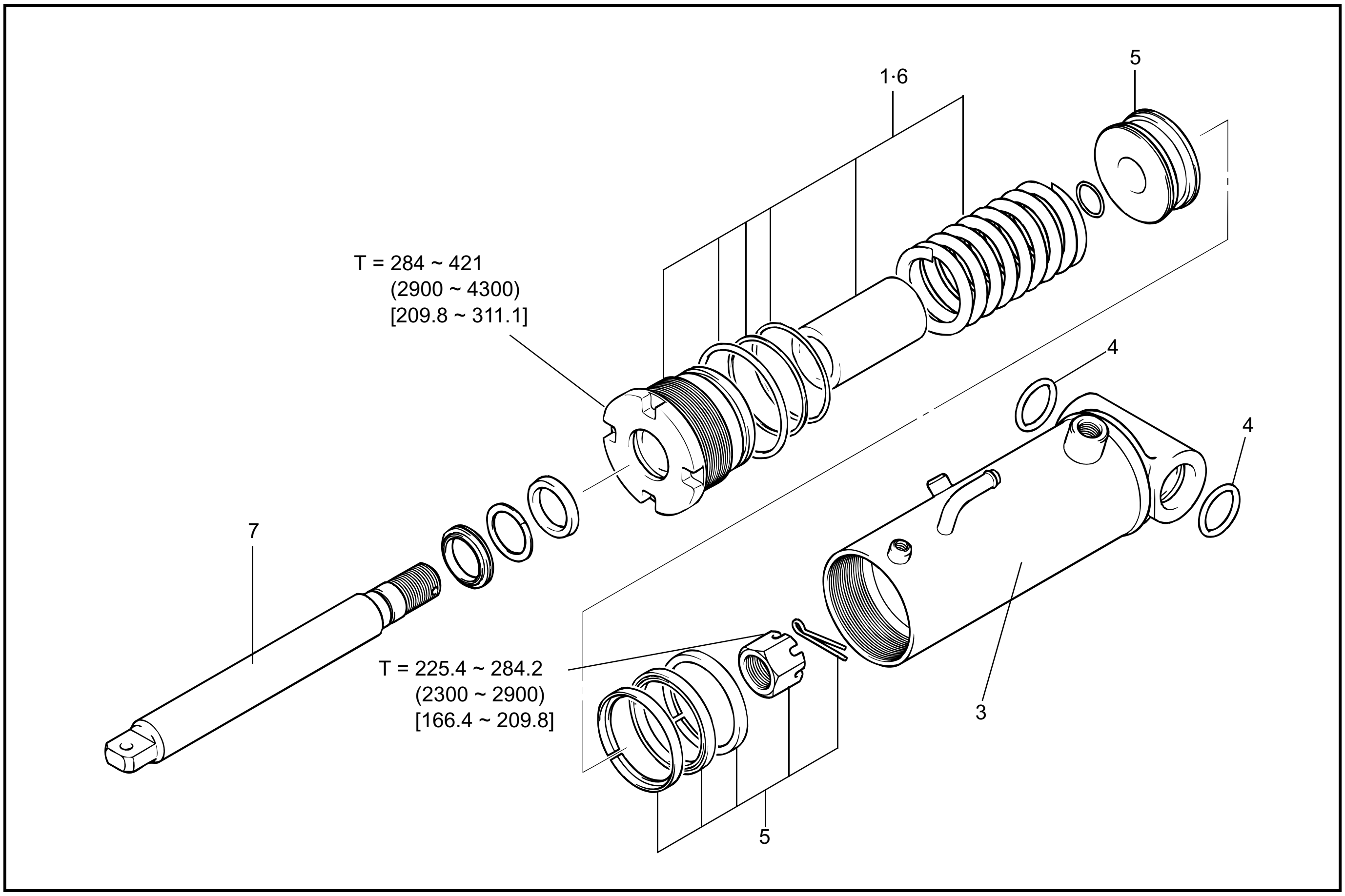
Point Operation

[Point 1]

Removal:
Disconnect the deadman brake wire after slackening it by tightening the assist bolt.

DISASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

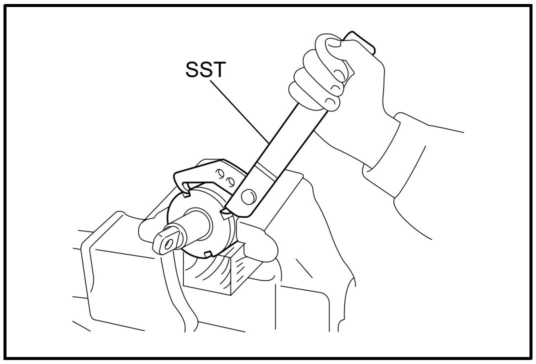
1 Loosen the rod guide. **[Point 1]**
2 Extract the piston rod W/piston.
3 Remove the cylinder. **[Point 2]**
4 Remove the O-ring. **[Point 3]**
5 Remove the piston.
6 Remove the rod guide.
7 Remove the piston rod. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

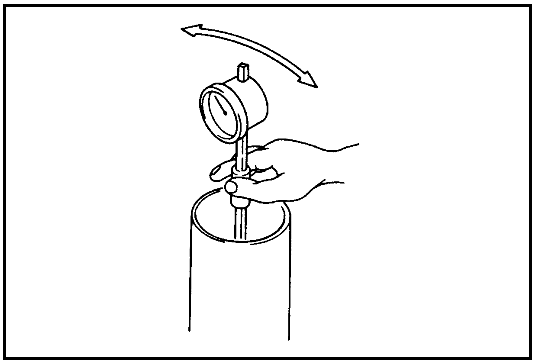
Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the rod guide before reassembly.**

Point Operations



[Point 1]

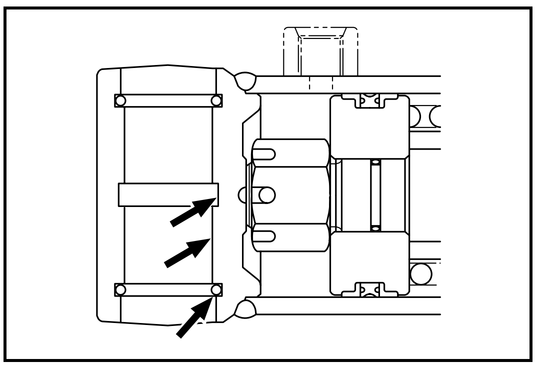
Disassembly·Reassembly:
SST 09620-10100-71



[Point 2]

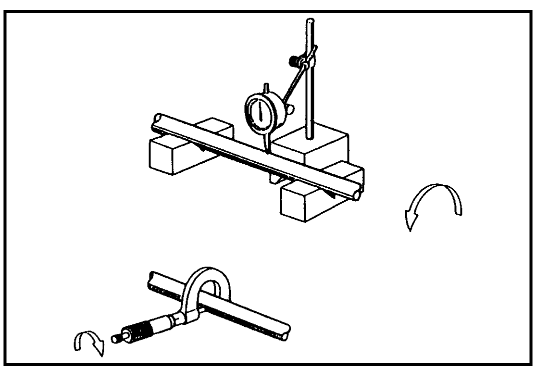
Inspection:
Measure the cylinder bore.

Standard: 70.0 mm (2.756 in)
Limit: 70.35 mm (2.7697 in)



[Point 3]

Reassembly:
Apply MP grease on the illustrated portion.



[Point 4]

Inspection:
Measure the piston rod outside diameter.

Standard: 30.0 mm (1.181 in)
Limit: 29.92 mm (1.1780 in)

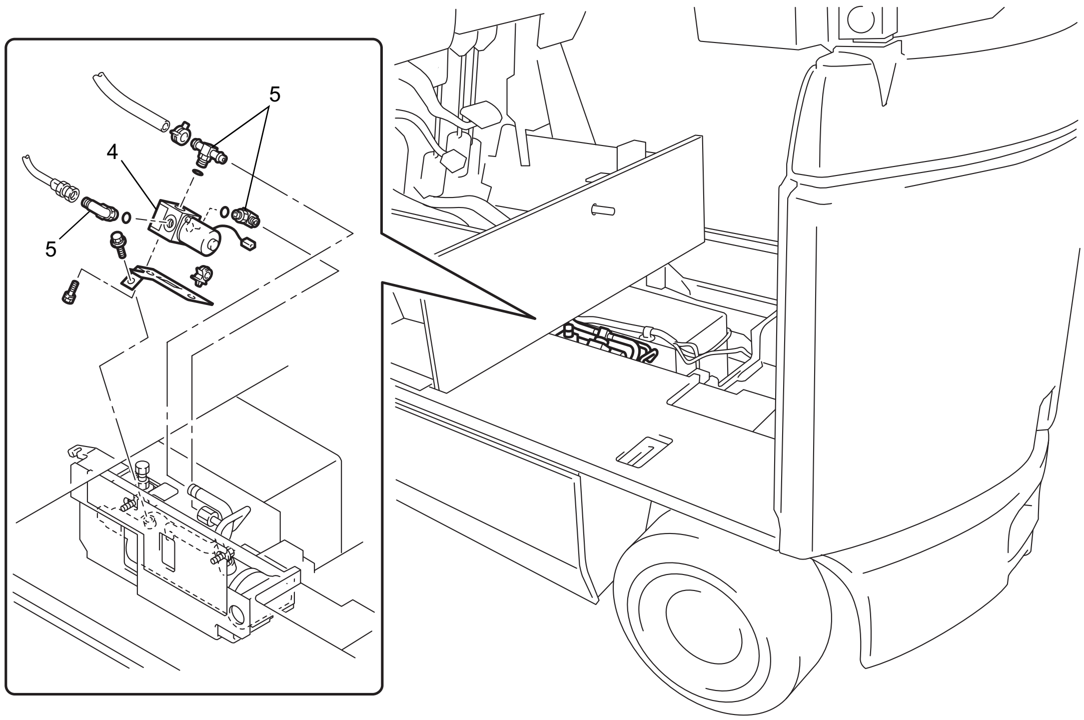
Inspection:
Measure the bend of the piston rod.

Limit: 1.0 mm (0.039 in)

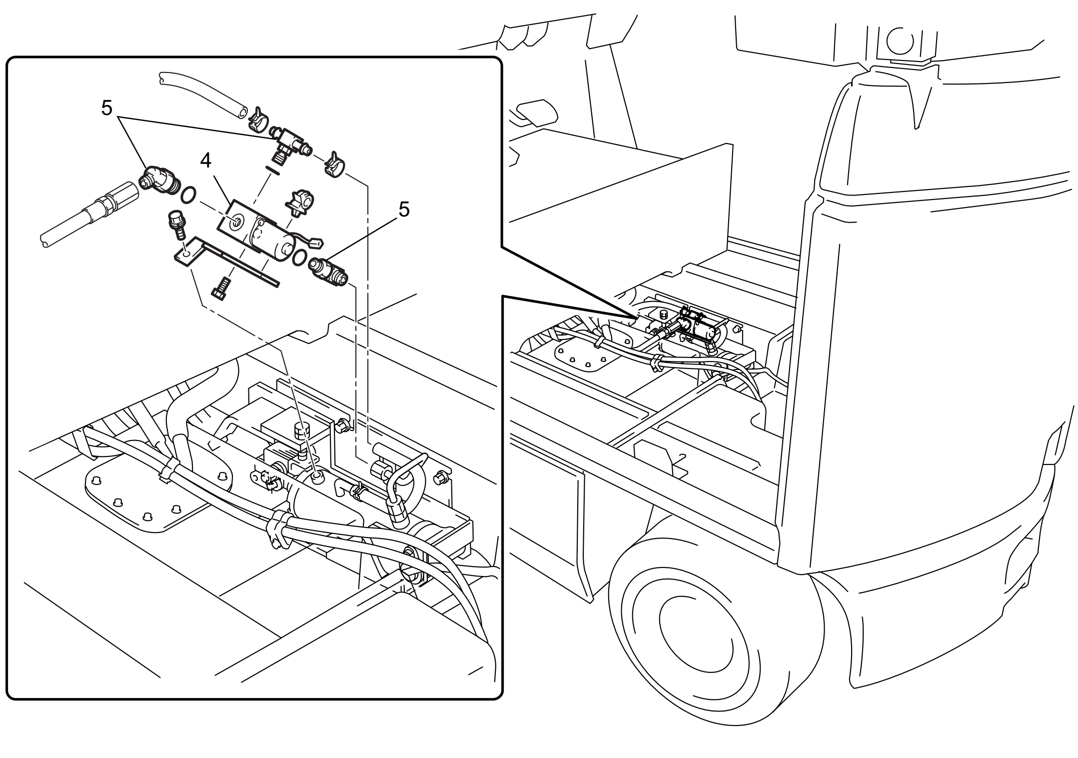
DEAD-MAN BRAKE SOLENOID

REMOVAL·INSTALLATION

15 ~ 32 model



35 ~ 55 model



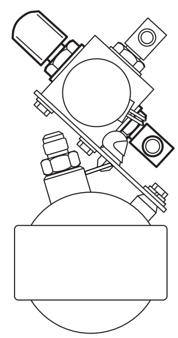
Removal Procedure

1 Remove the battery. (See page 1-5)
2 Disconnect the piping and wiring.
3 Remove the dead-man brake solenoid valve ASSY W/bracket.
4 Remove the dead-man brake solenoid valve ASSY.
5 Remove the fitting **[Point 1]**

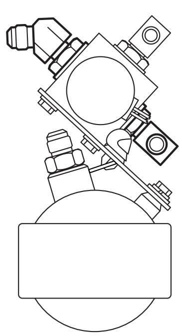
Installation Procedure

The installation procedure is the reverse of the removal proedure.

15 ~ 32 model



35 ~ 55 model

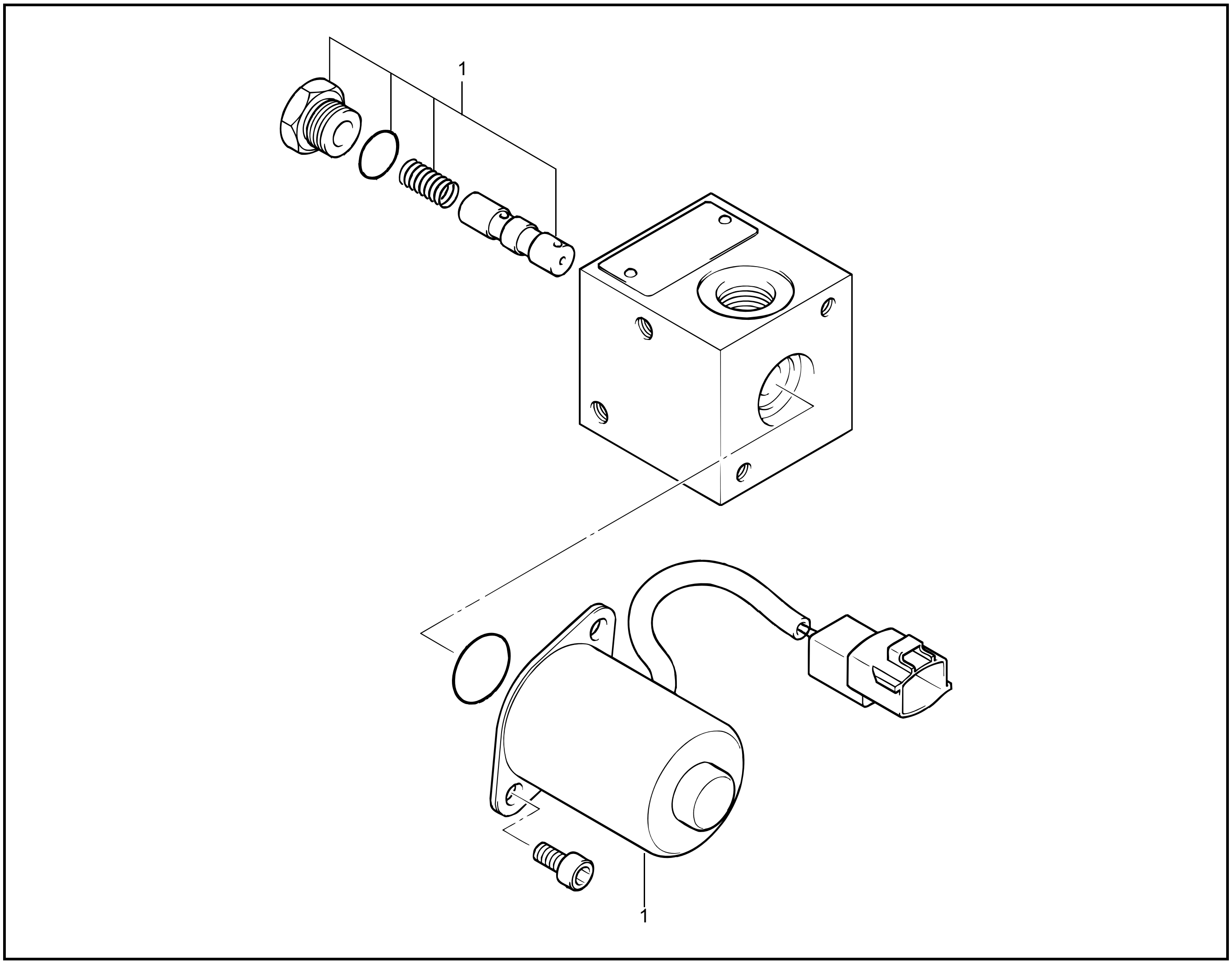


Point Operation

[Point 1]

Installation:
Install the fitting in the illustrated direction.

DISASSEMBLY·INSPECTION·REASSEMBLY

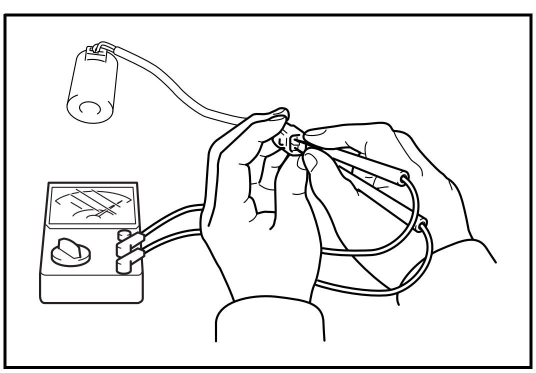


Disassembly Procedure

1 Remove the solenoid valve. **[Point 1]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.



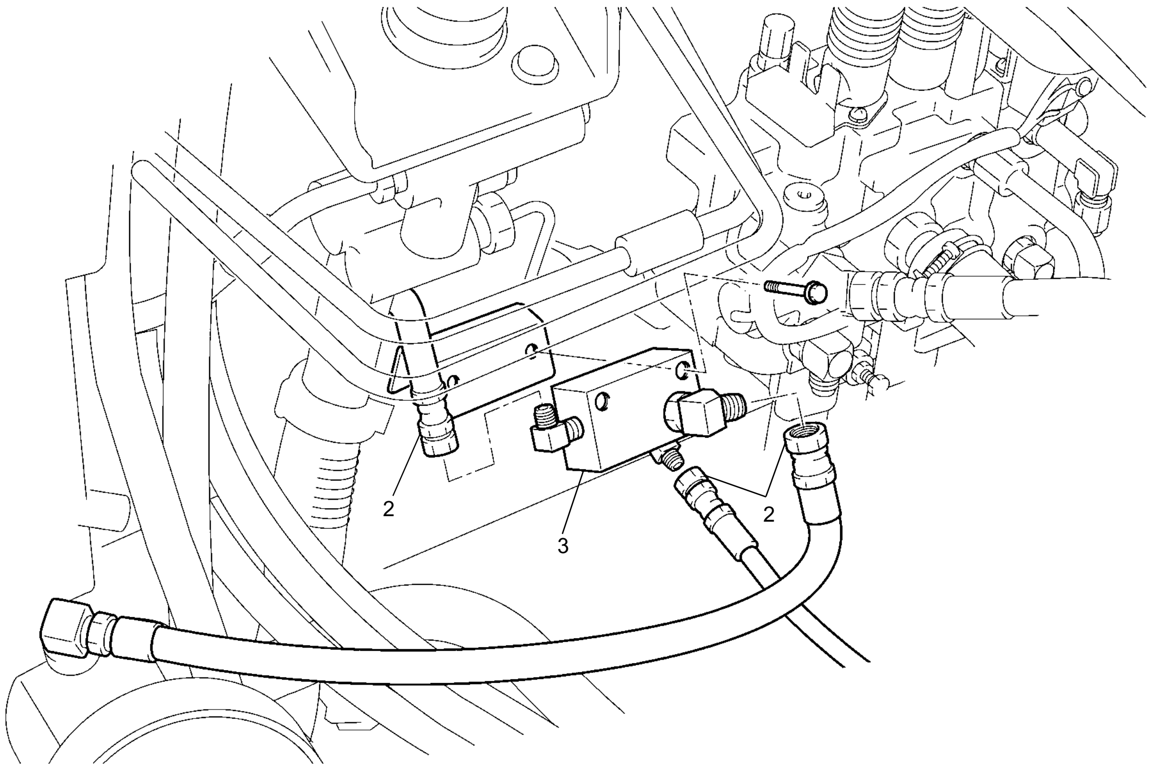
Point Operation

[Point 1]

Inspection:
  Check continuity of solenoid.

DEAD-MAN BRAKE RELIEF VALVE (15 ~ 32 MODEL)

REMOVAL·INSTALLATION



Removal Procedure

1 Remove the toe board (front and rear) and lower panel.
2 Disconnect the piping.
3 Remove the relief valve.

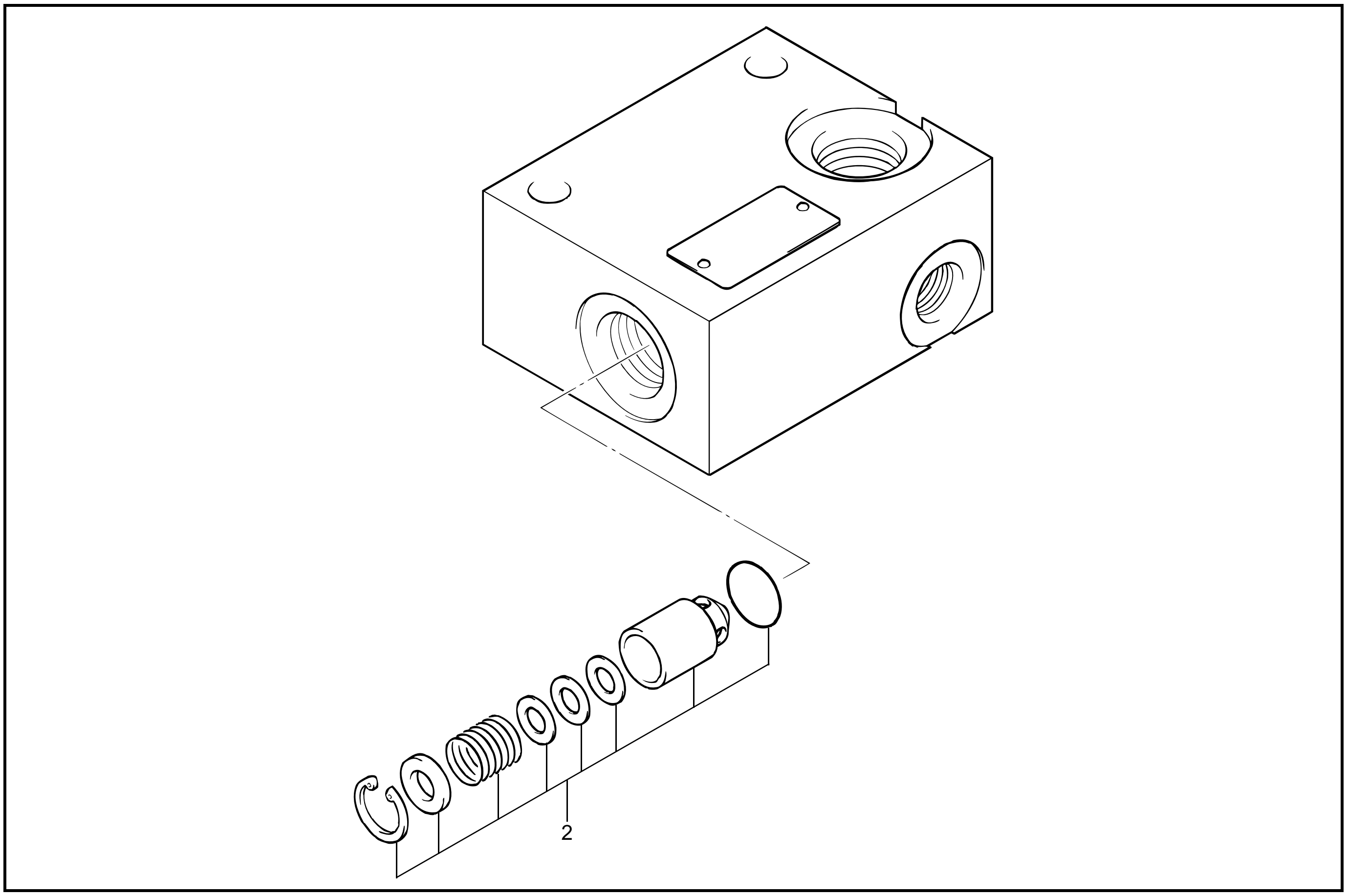
Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
Check the hydraulic oil level, and add if insufficient

DISASSEMBLY·INSPECTION·REASSEMBLY

Note:
- **Since parts are finished with high precision, carefully disassemble and reasemble them to prevent any damage.**
- **Use a clean location for the job.**



Disassembly Procedure

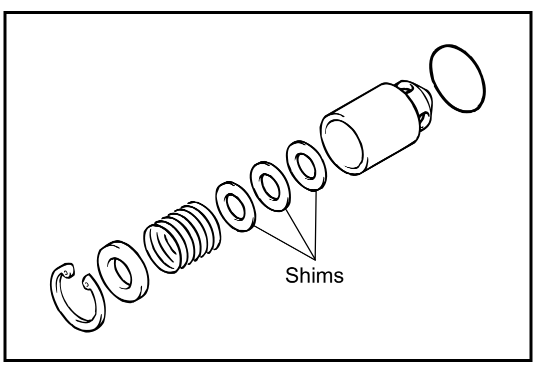
1 Remove the fitting.

2 Remove the valve. **[Point 1]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
Wash each part thoroughly, blow compressed air for drying and apply hydraulic oil before reassembly

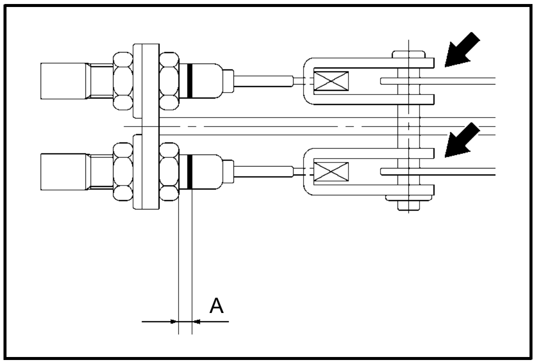


Point Operation

[Point 1]

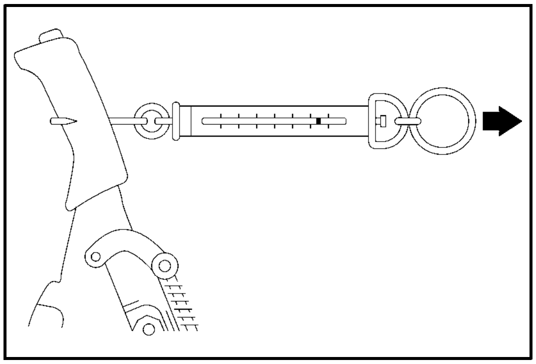
Reassembly:
As the number of shims is fixed, do not change it.

PARKING BRAKE INSPECTION·ADJUSTMENT



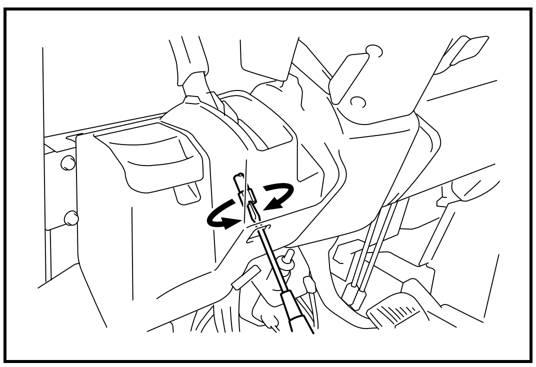
1. Check the parking brake cable set position.

   Standard:
   15 ~ 32 model
   A = 0 ~ 2 mm (0 ~ 0.08 in)
   35 ~ 55 model
   A = 3 ~ 5 mm (0.12 ~ 0.20 in)



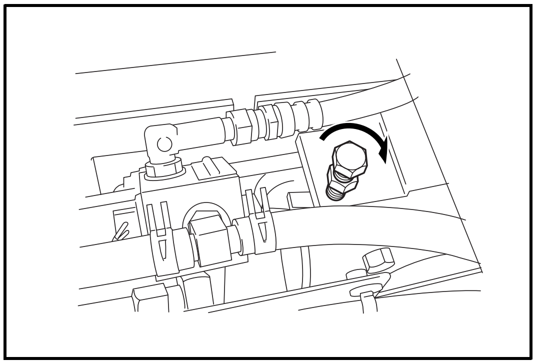
2. Apply chassis grease on the portions indicated by arrows.
3. Inspect and adjust the parking brake lever operating force.
   (1) Set a spring scale at the center of the lever knob, and measure the operating force by pulling it backward.

   Standard:
   15 ~ 32 model
   147 ~ 196 N (15 ~ 20 kgf) [33 ~ 44 lbf]
   35 ~ 55 model
   196 ~ 245 N (20 ~ 25 kgf) [44 ~ 55 lbf]



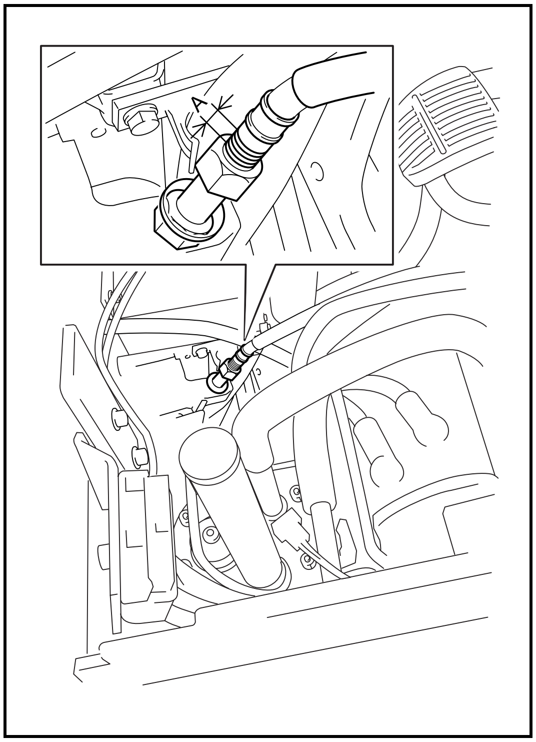
   (2) If the operating force is out of the standard range, release the parking brake and make adjustment at the adjusting portion.

   Clockwise turn: Increases the operating force.
   Counterclockwise turn: Decreases the operating force.



DEAD-MAN BRAKE WIRE INSPECTION·ADJUSTMENT (15 ~ 32 MODEL)

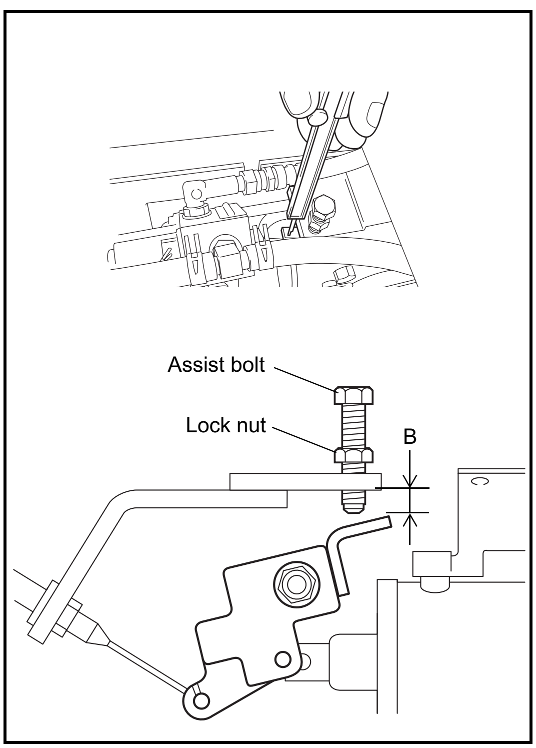
1. Loosen the assist bolt lock nut and tighten the assist bolt.



2. Set the wire adjusting bolt to satisfy the following standard, and fix it by the lock nut.

   Standard: A = 5 threads (approx. 7 mm (0.28 in))

3. Rotate the deadman brake drum and make sure that the drum is not in contact with the brake shoe.(If in contact, readjust by turning the wire adjusting bolt.)

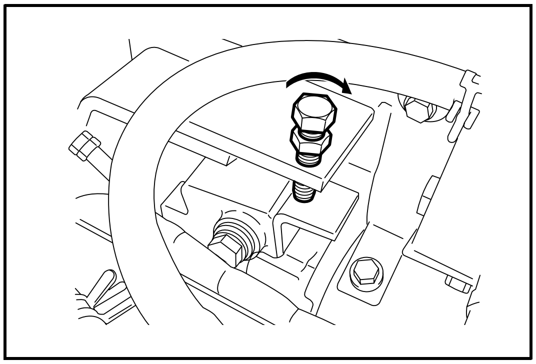


4. Loosen the assist bolt and measure the clearance between the lever and bracket when the assist bolt leaves the lever.

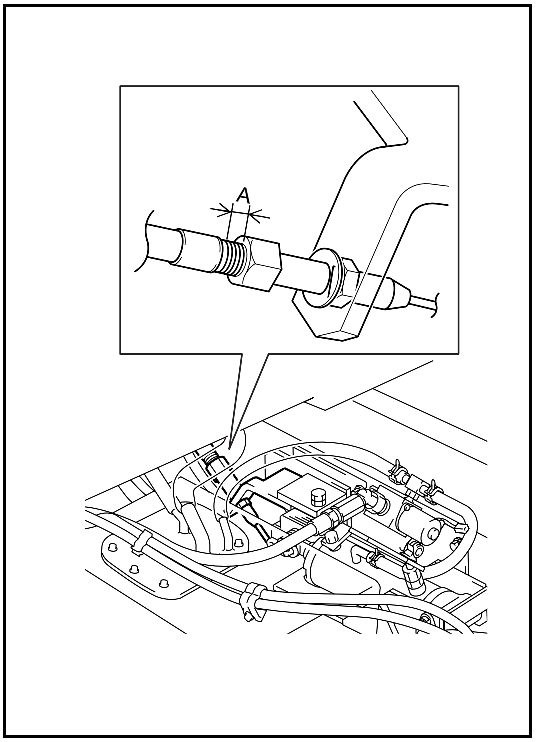
   Standard (reference): B = Approx. 20 mm (0.79 in)

5. Tighten the assist bolt lock nut.

DEAD-MAN BRAKE WIRE INSPECTION·ADJUSTMENT (35 ~ 55 MODEL)



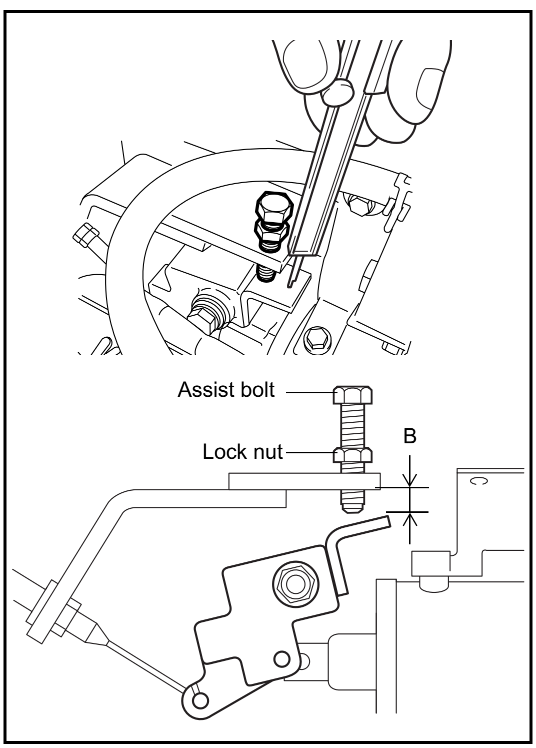
1. Loosen the assist bolt lock nut and tighten the assist bolt.



2. Set the wire adjusting bolt to satisfy the following standard, and fix it by the lock nut.

   Standard: A = 5 threads (approx. 7 mm (0.28 in))

3. Rotate the deadman brake drum and make sure that the drum is not in contact with the brake shoe. (If in contact, readjust by turning the wire adjusting bolt.)

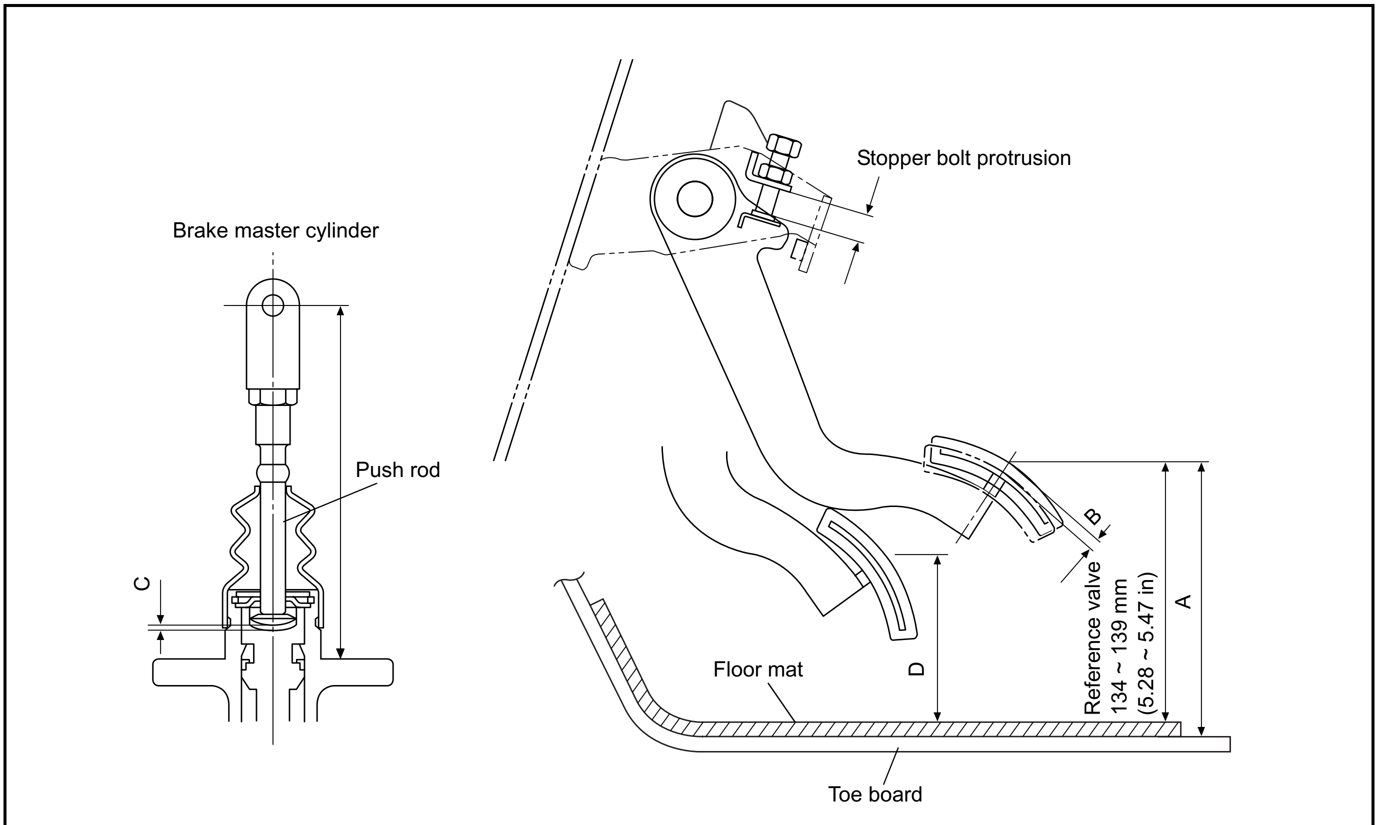


4. Loosen the assist bolt and measure the clearance between the lever and bracket when the assist bolt leaves the lever.

   Standard (reference): B = Approx. 20 mm (0.79 in)

5. Tighten the assist bolt lock nut.

BRAKE PEDAL INSPECTION·ADJUSTMENT (15 ~ 32 MODEL)



1. Inspect brake pedal height A. (From toe board to top of pedal)

   Standard: A = 144 ~ 149 mm (5.67 ~ 5.87 in) (with pedal pad)

   If the standard is not satisfied, make adjustment by changing the stopper bolt protrusion.

2. Inspect brake pedal play B.

   Standard: B = 5 ~ 9 mm (0.2 ~ 0.35 in)

   If the standard is not satisfied, make adjustment by changing the master cylinder push rod length.

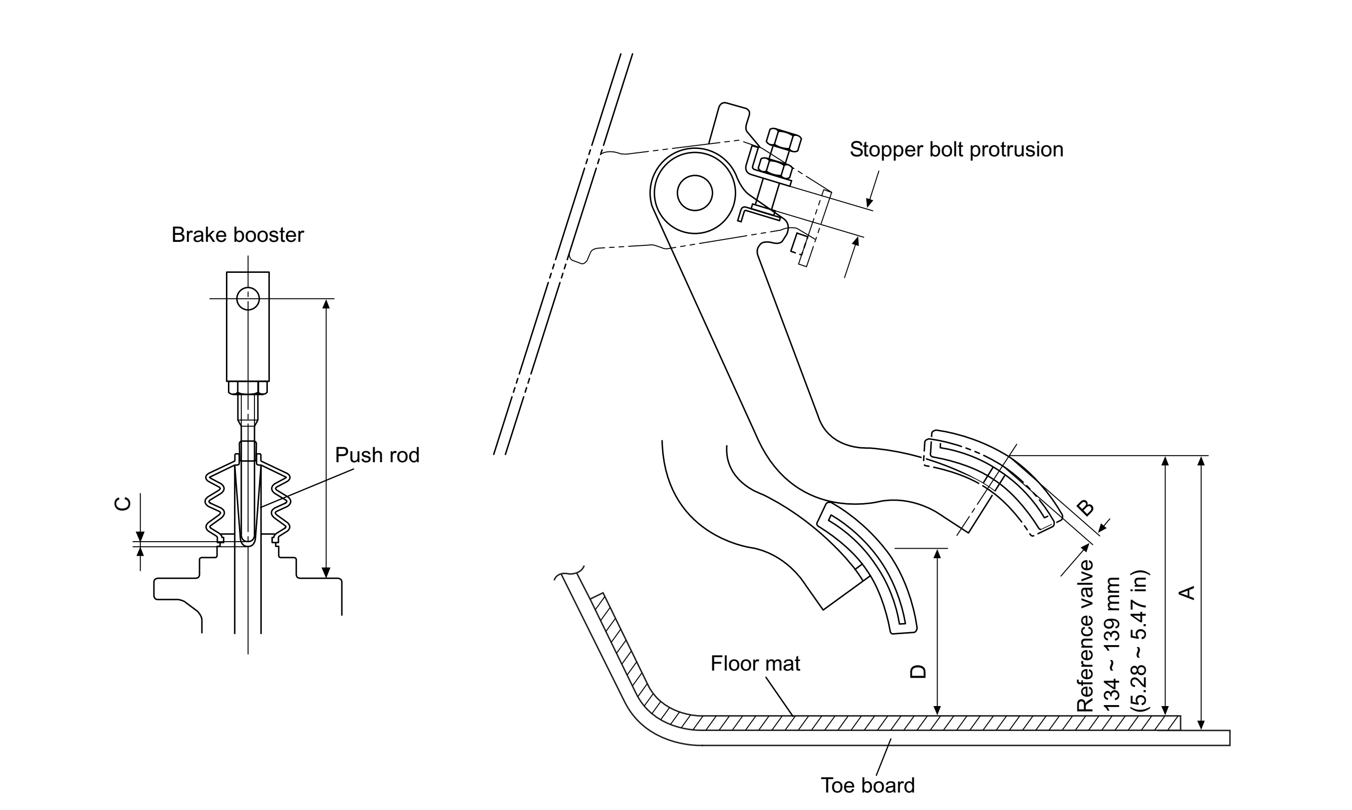
3. Check master cylinder push rod play C with the brake pedal in the above state.

   Standard: C = 1 ~ 2 mm (0.04 ~ 0.08 in)

4. After the adjustment, fully depress the brake pedal D and inspect the pedal height in that state.

   Standard: D = 84 mm (3.31 in) or more

BRAKE PEDAL INSPECTION·ADJUSTMENT (35 ~ 55 MODEL)



1. Inspect brake pedal height A. (From toe board to top of pedal)

   Standard: A = 144 ~ 149 mm (5.67 ~ 5.87 in) (with pedal pad)

   If the standard is not satisfied, make adjustment by changing the stopper bolt protrusion.

2. Inspect brake pedal play B.

   Standard: B = 5 ~ 9 mm (0.2 ~ 0.35 in)

   If the standard is not satisfied, make adjustment by changing the master cylinder push rod length.

3. Check master cylinder push rod play C with the brake pedal in the above state.

   Standard: C = 1 mm (0.04 in)

4. After the adjustment, fully depress the brake pedal D and inspect the pedal height in that state.

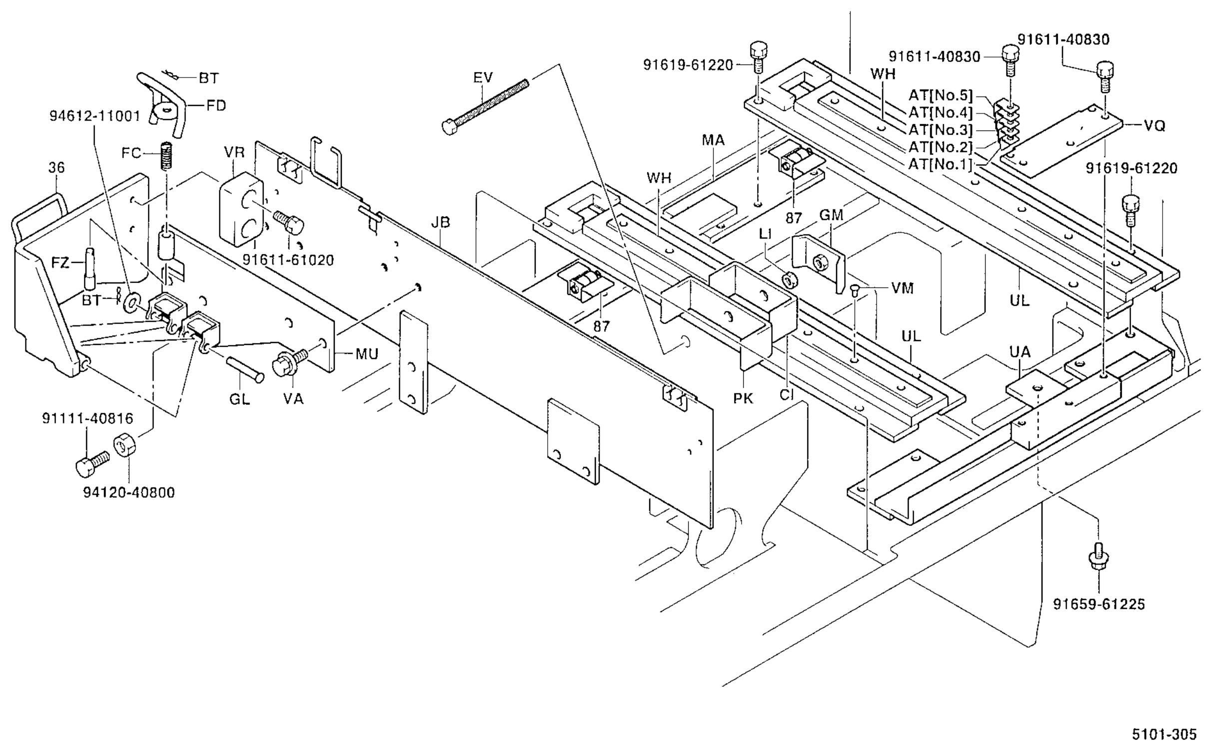
   Standard: D = 84 mm (3.31 in) or more

BODY

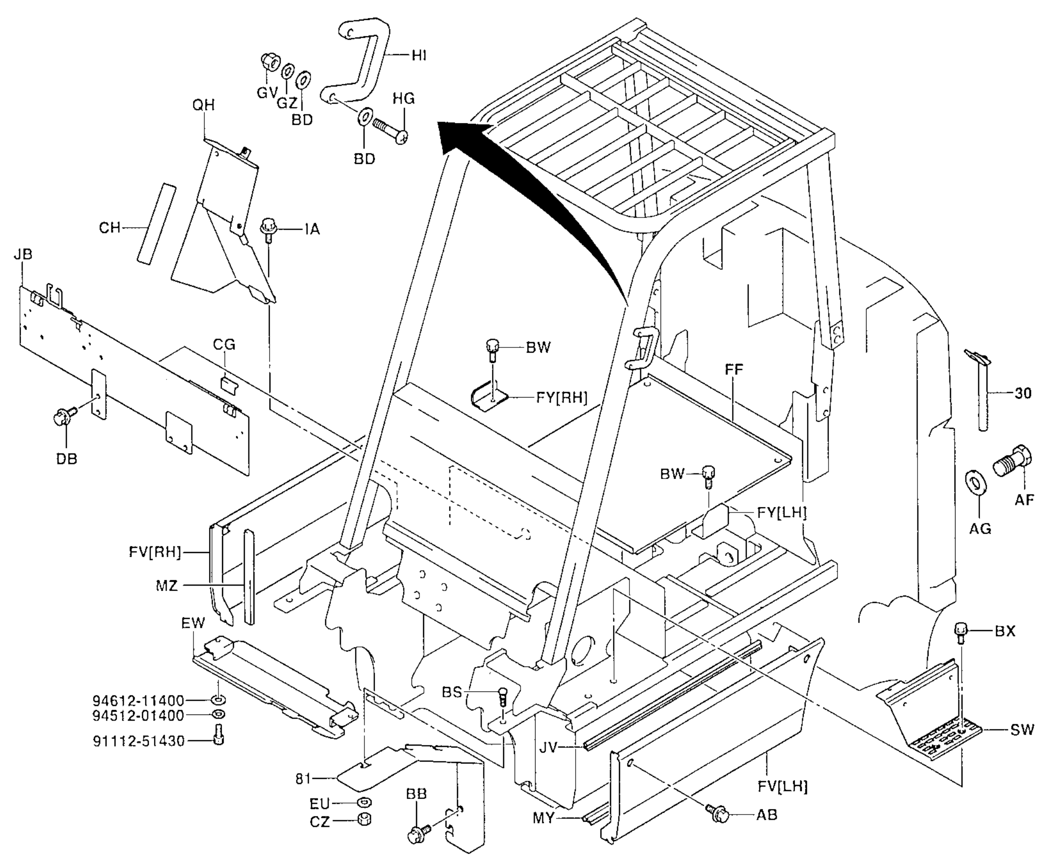
COMPONENTS

15 ~ 32 model

5101

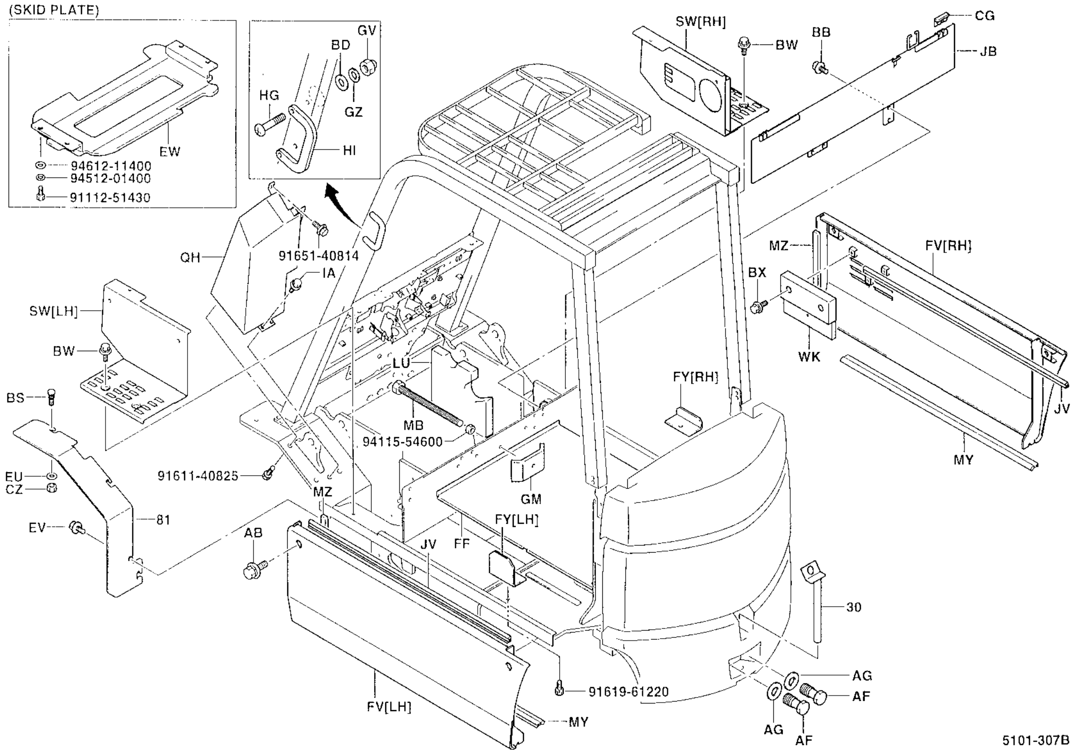


15 ~ 32 model

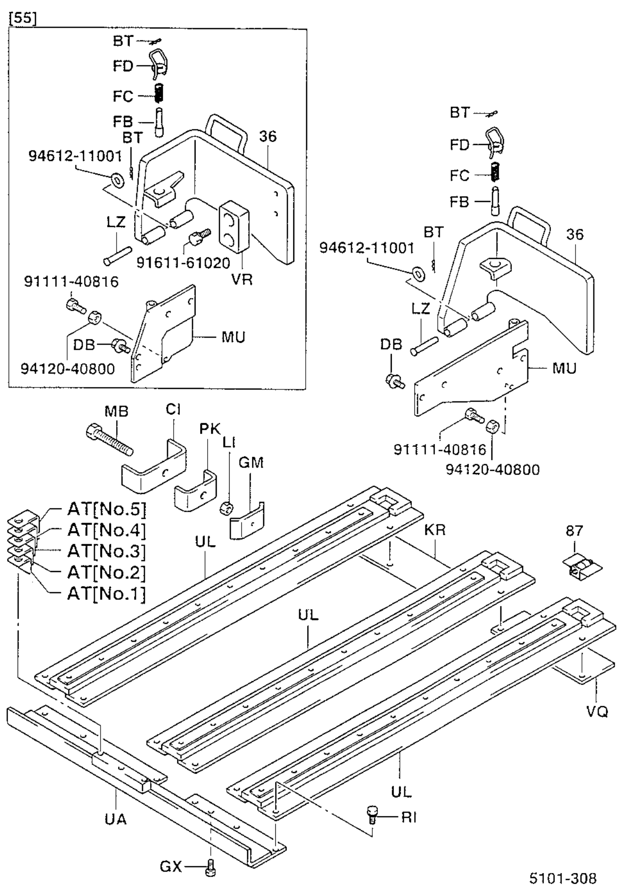


35 ~ 55 model

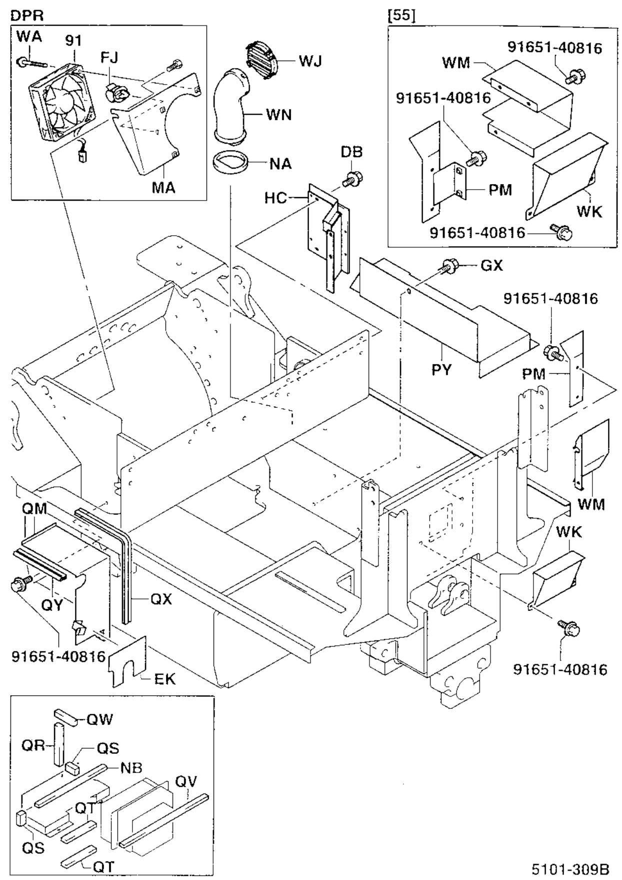
5101



35 ~ 55 model

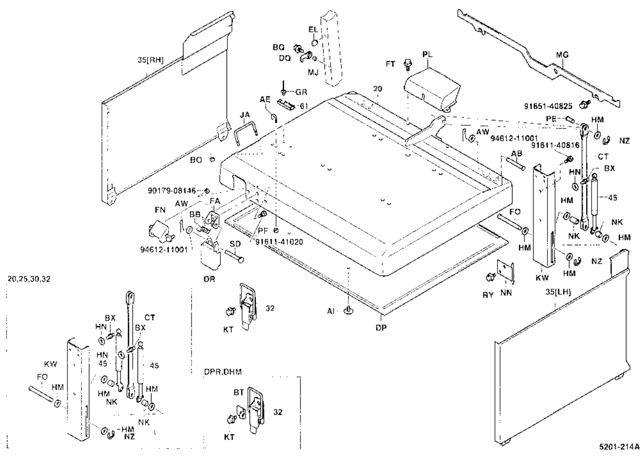


35 ~ 55 model

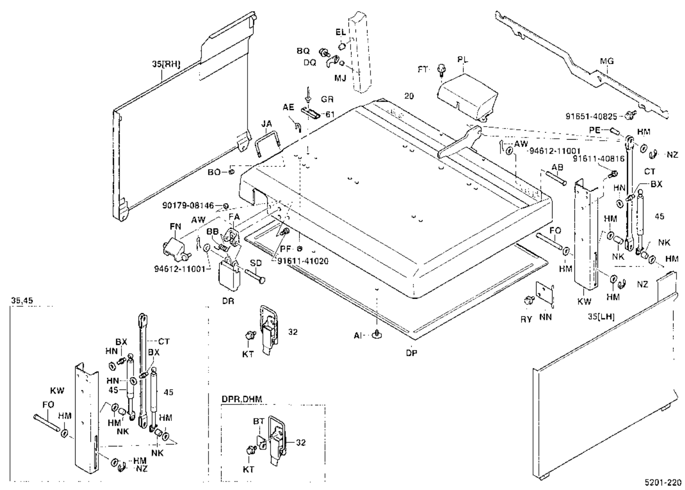


11

15 ~ 32 model | 35·45 model | 5201

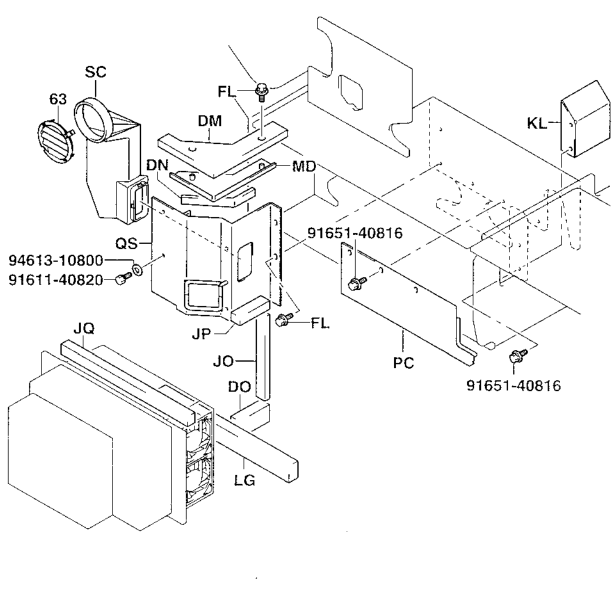


5201-214A

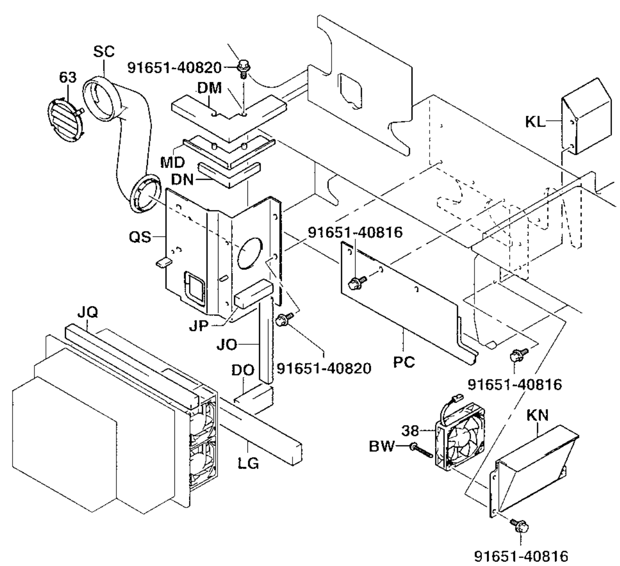


5201-220

15·18 model | 20 ~ 32 model



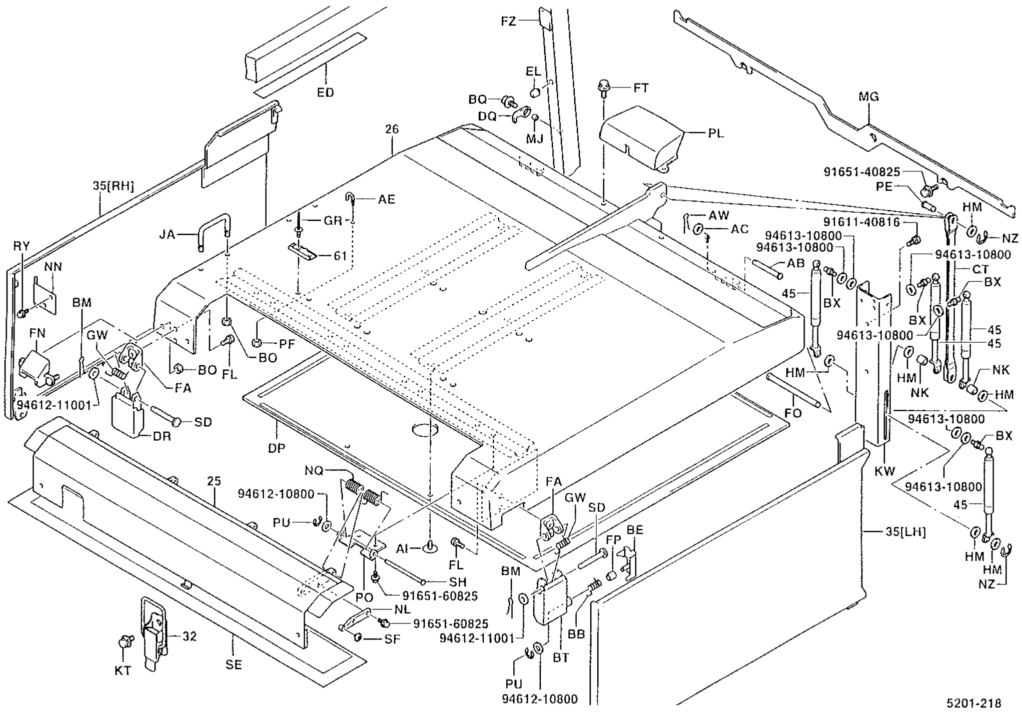
5201-215B



5201-216A

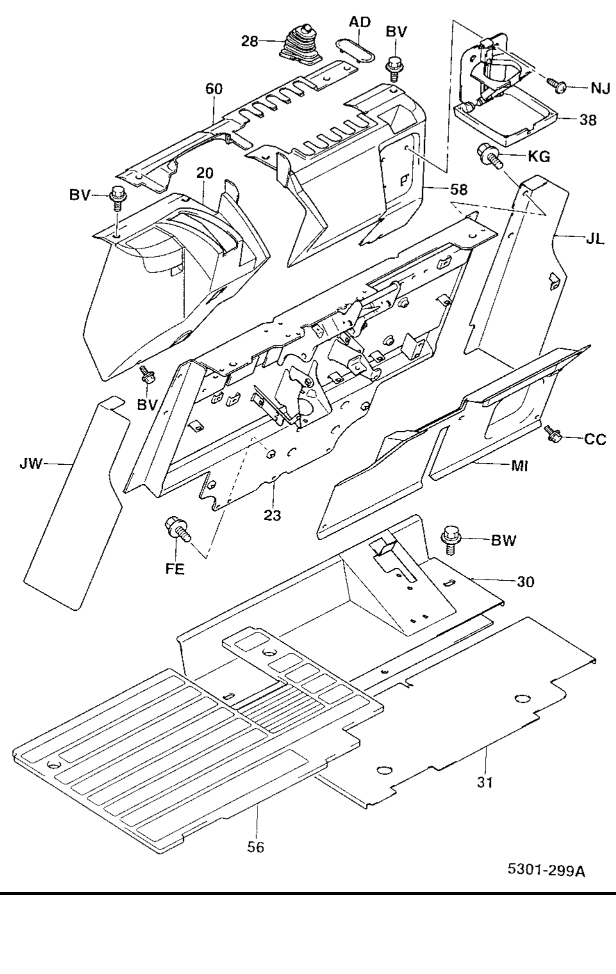
55 model

5201



15 ~ 32 model

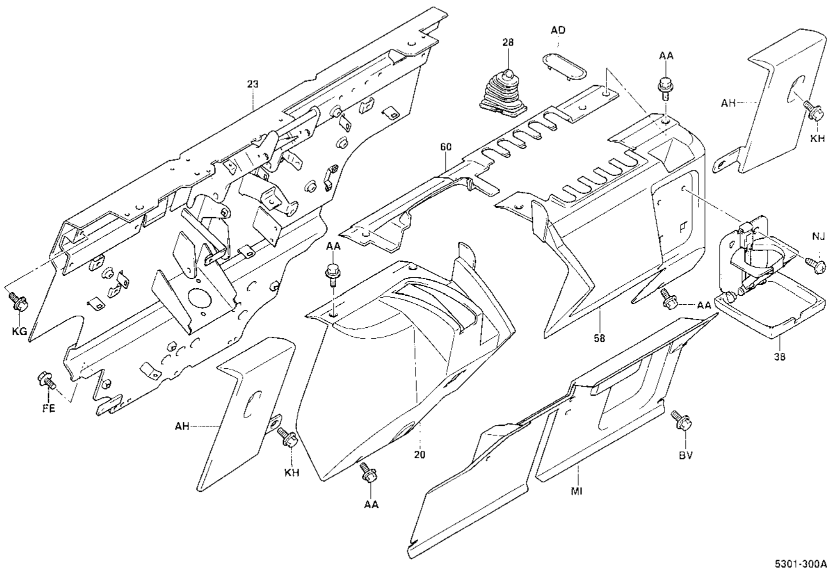
5301

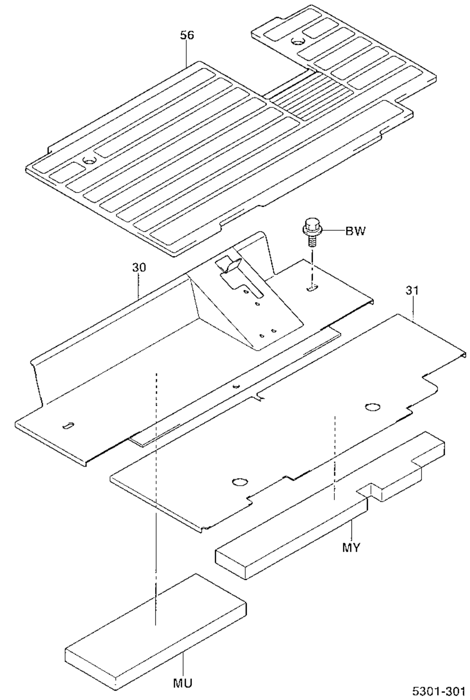


35 ~ 55 model

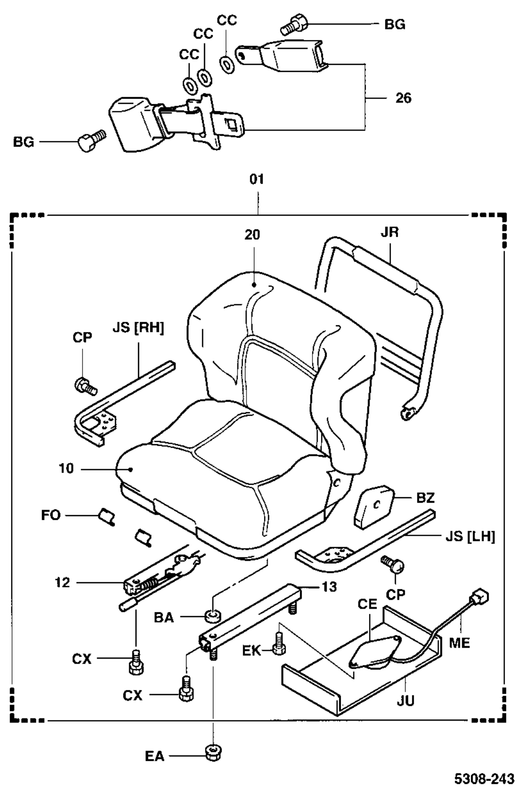
35 ~ 55 model

5301



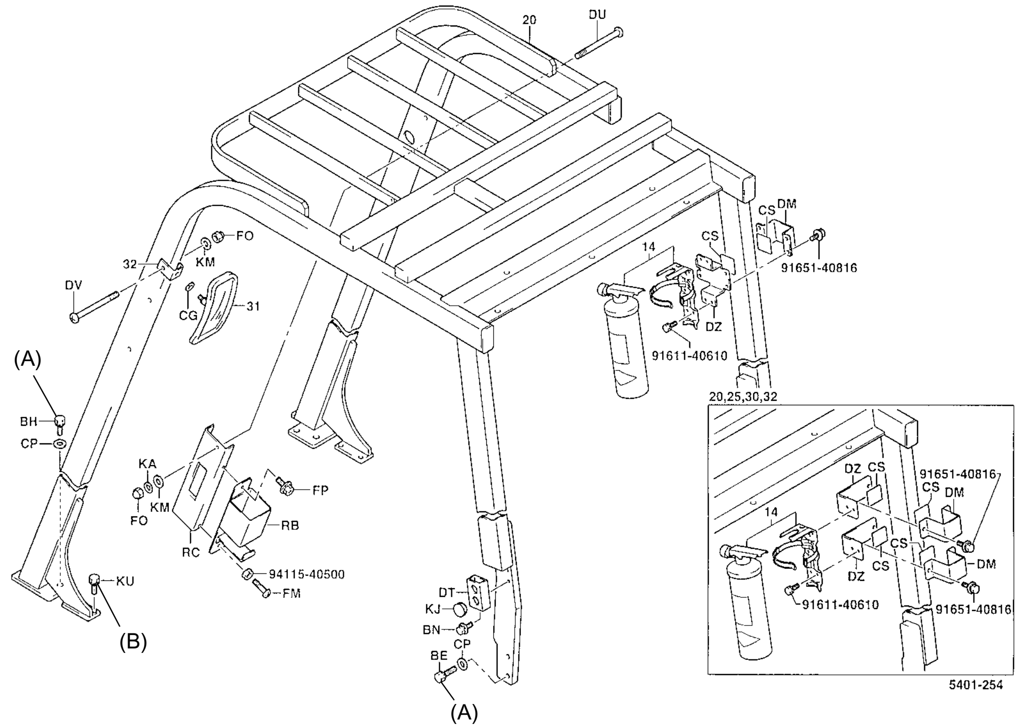


5308

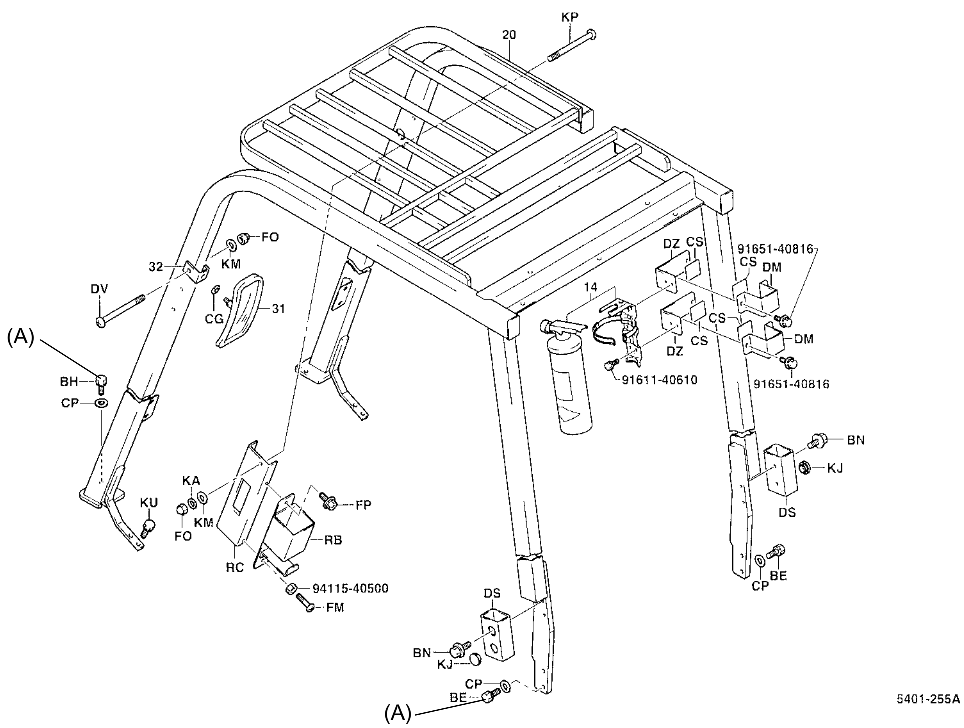


15 ~ 32 model

5401



35 ~ 55 model

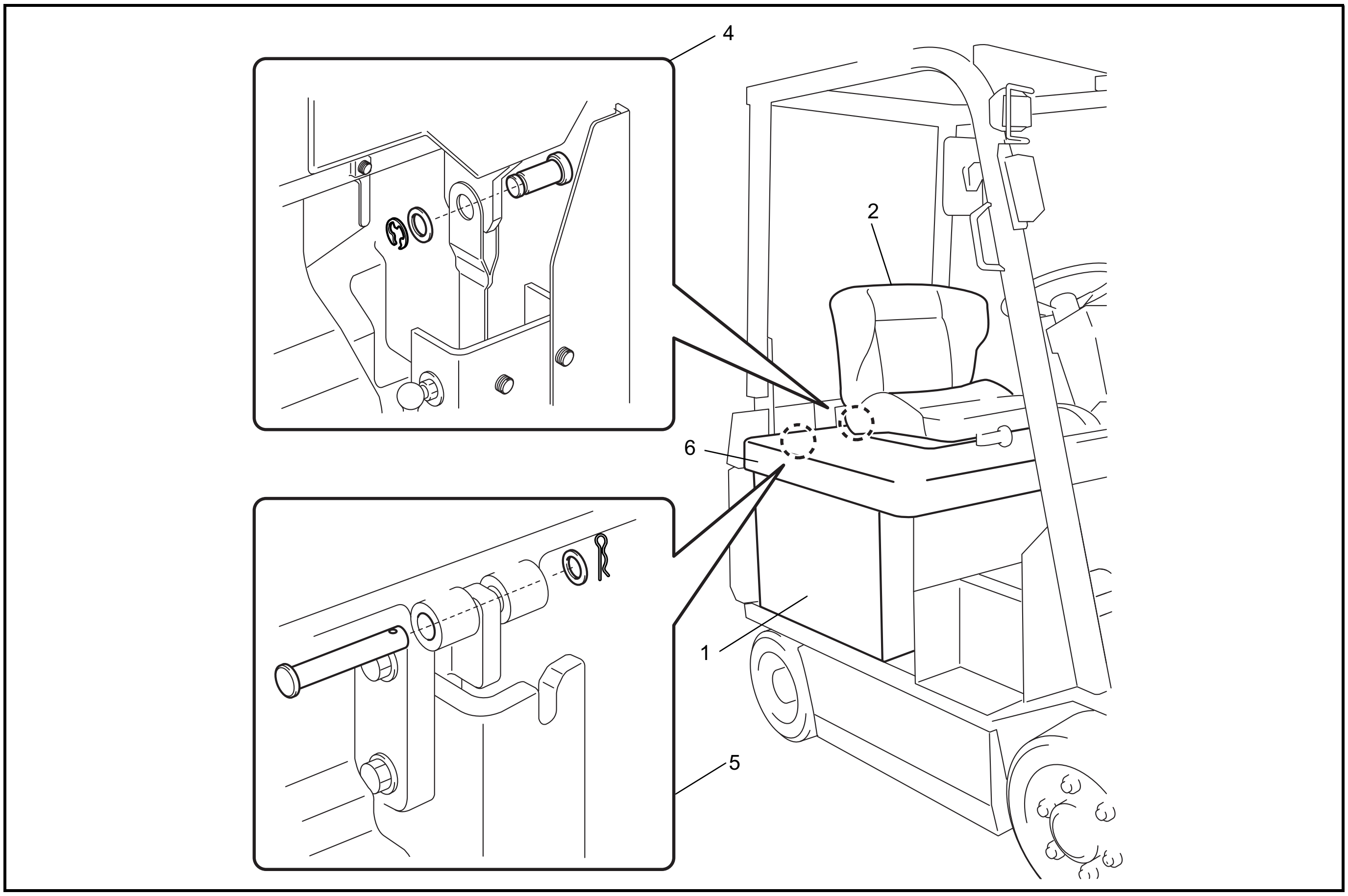


Caution:

- **Renew all the warning and caution indicators or labels when replacing the overhead guard.**
- **Overhead guard set bolts tightening torque**
  (A): T = 58.8 ~ 88.3 N·m (600 ~ 900 kgf-cm) [43.4 ~ 65.1 ft-lbf]
  (B): T = 39.2 ~ 54.9 N·m (400 ~ 560 kgf-cm) [28.9 ~ 40.5 ft-lbf]

BATTERY HOOD ASSY

REMOVAL·INSTALLATION



Removal Procedure

1 Remove the battery. (See page 1-5)
2 Remove the driver's seat. (See page 11-10)
3 Remove the damper stay cover.
4 Open the battery hood and disconnect the damper stay.
5 Close the battery hood and remove the battery hood set pin.
6 Remove the battery hood ASSY.

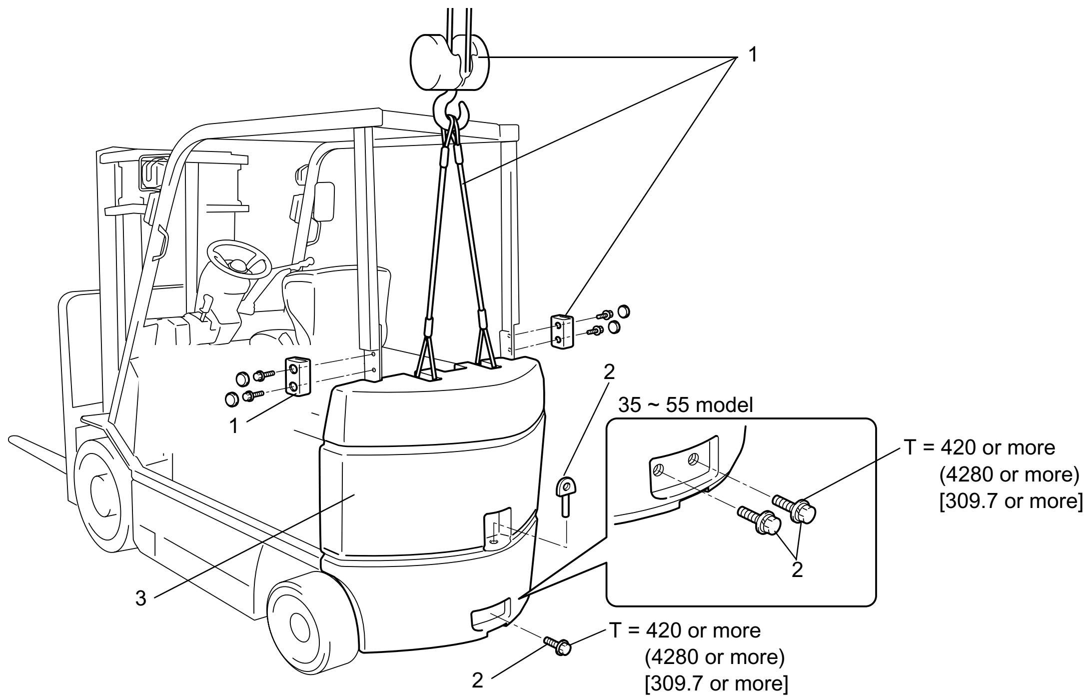
Installation Procedure

The installation procedure is the reverse of the removal procedure.

COUNTERWEIGHT

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

1 Remove the rear pillar cover and temporarily hoist the counterweight slinging with a wire rope.

2 Remove the drawbar, and remove the counterweight set bolt.

3 Remove the counterweight.

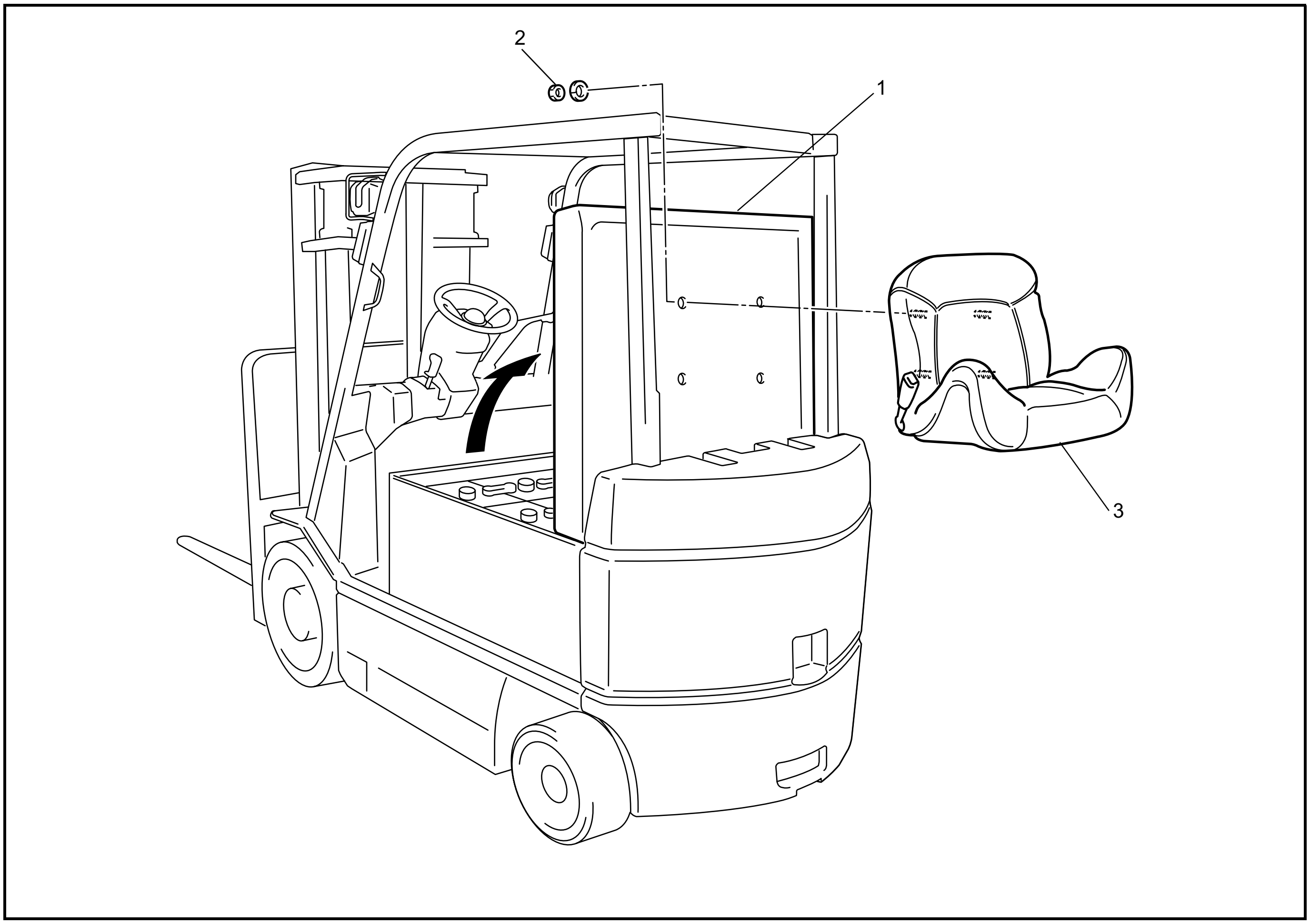
Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
See page 0-17 for the mass of the counterweight.

DRIVER’S SEAT

REMOVAL·INSTALLATION

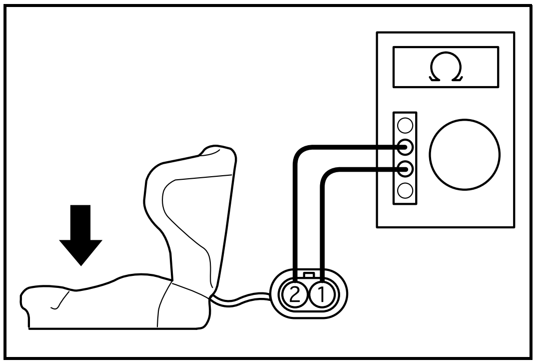


Removal Procedure

1 Open the seat stand.
2 Disconnect the seat switch connector. (Dead-man brake spec.)
3 Remove the driver’s seat set nuts.
4 Remove the driver’s seat. **[Point 1]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.



Point Operation

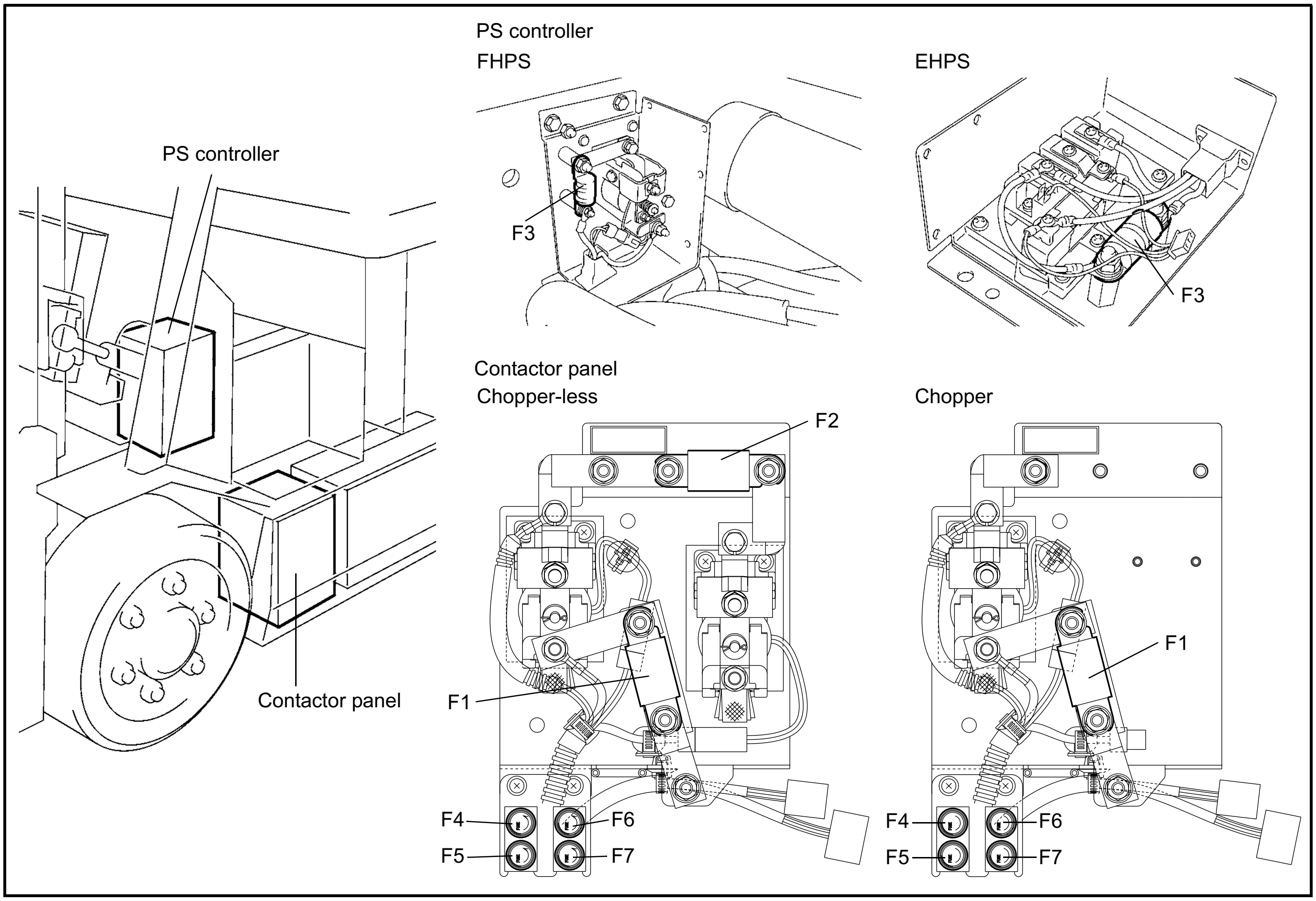
[Point 1]

Inspection:
Dead-man brake spec:
Push on the seat cushion and cheak continnity of the seat switch.
Standard seat switch: Between CN22-1 and CN22-2
Free : OFF (∞Ω)
Push : ON (0Ω)

FUSE (15 ~ 32 MODEL)

FUSE MOUNTING POSITION

Fuse F3 is installed on the PS controller. All other fuses are installed on the contactor panel.



NAMES (APPLICABLE PORTIONS) AND CAPACITIES

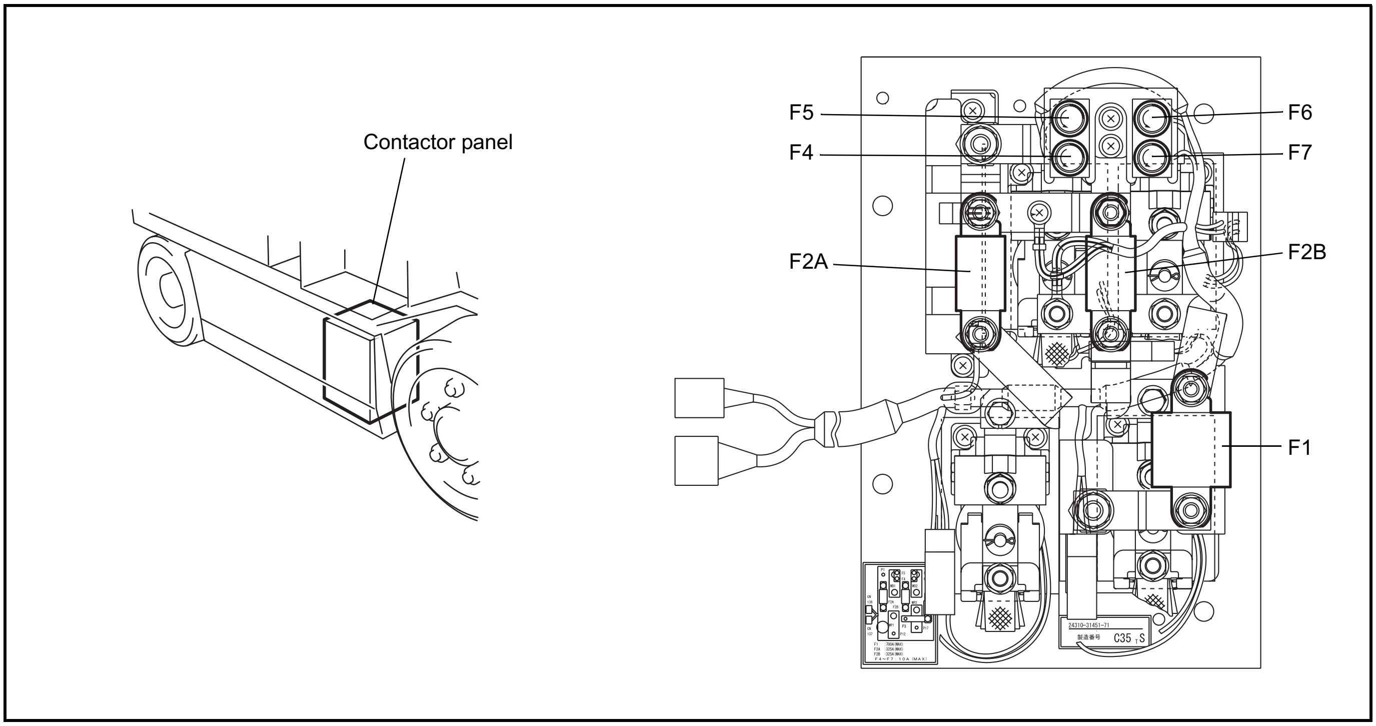
		15 ~ 32 model (chopper-less)		15 ~ 32 model (chopper)				15 ~ 32 model (chopper-less)	15 ~ 32 model (chopper)
		15·18 model	20 ~ 32 model	15·18 model	20 ~ 32 model				
F1	For drive	275A	325A	500A	600A	F5	For control circuit	10A	←
F2	For pump	225A	325A	—	—	F6	For controller	10A	←
F3	For PS	75A	←	←	←	F7	For SAS controller	10A	←
F4	For lamps	10A	←	←	←				

Caution for fuse replacement
Always disconnect the battery plug and discharge CO (overall capacitor) by connection between P4 and N1 with a resistance of about 100Ω before replacing any fuse.

FUSE (35 ~ 55 MODEL)

FUSE MOUNTING POSITION

All fuses are installed in the contactor panel.



NAMES (APPLICABLE PORTIONS) AND CAPACITIES

		35 ~ 55 model			35 ~ 55 model
F1	For drive	700A	F5	For control circuit	10A
F2A	For pump No.1	325A	F6	For controller	10A
F2B	For pump No.2	325A	F7	For SAS controller	10A
F4	For lamps	10A			

Caution for fuse replacement

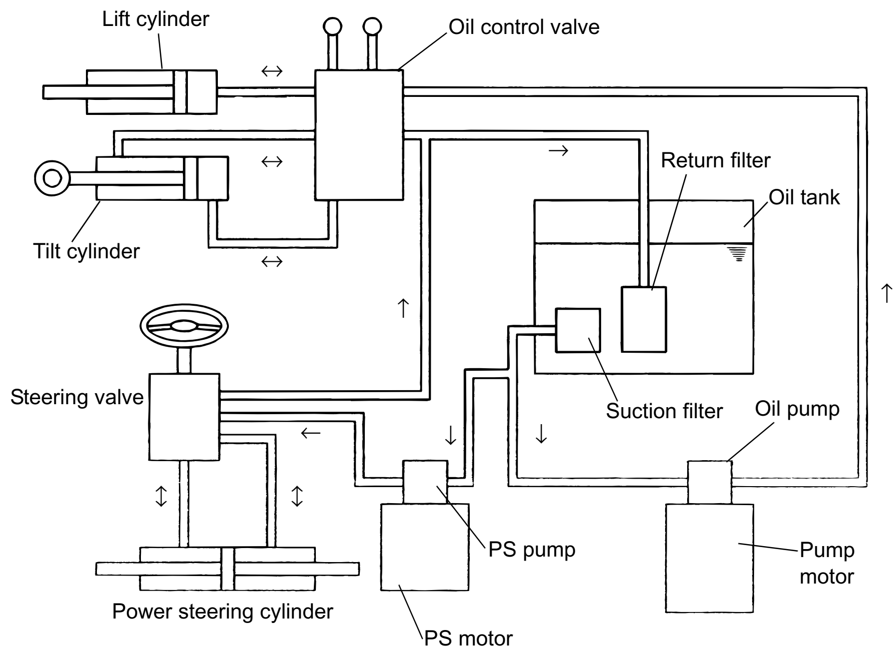
Always disconnect the battery plug and discharge CO (overall capacitor) by connection between P4 and N1 with a resistance of about 100Ω before replacing any fuse.

MATERIAL HANDLING SYSTEM

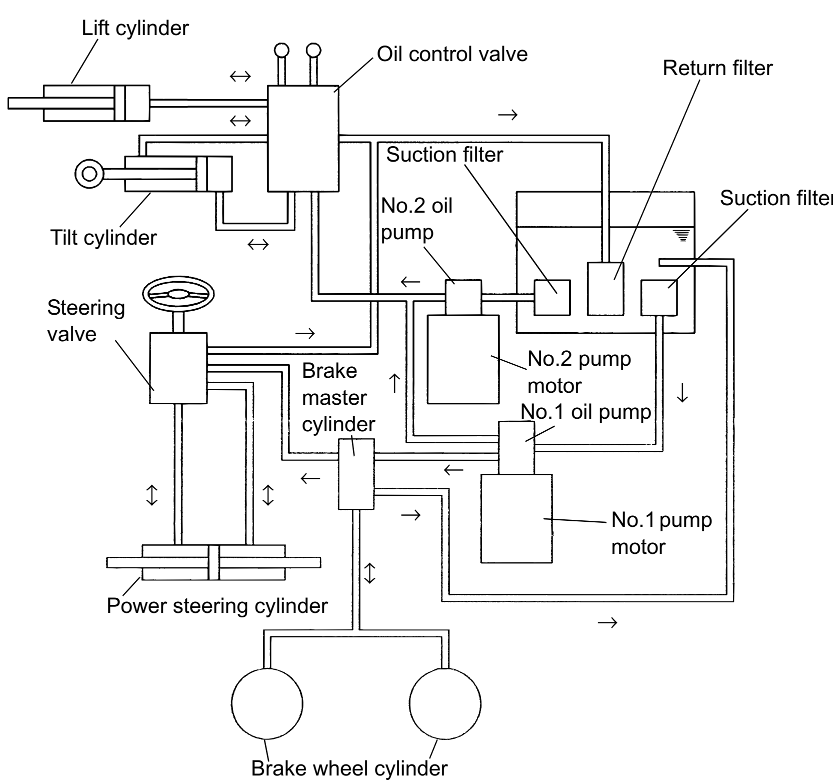
Page

HYDRAULIC SYSTEM DIAGRAM

15 ~ 32 model



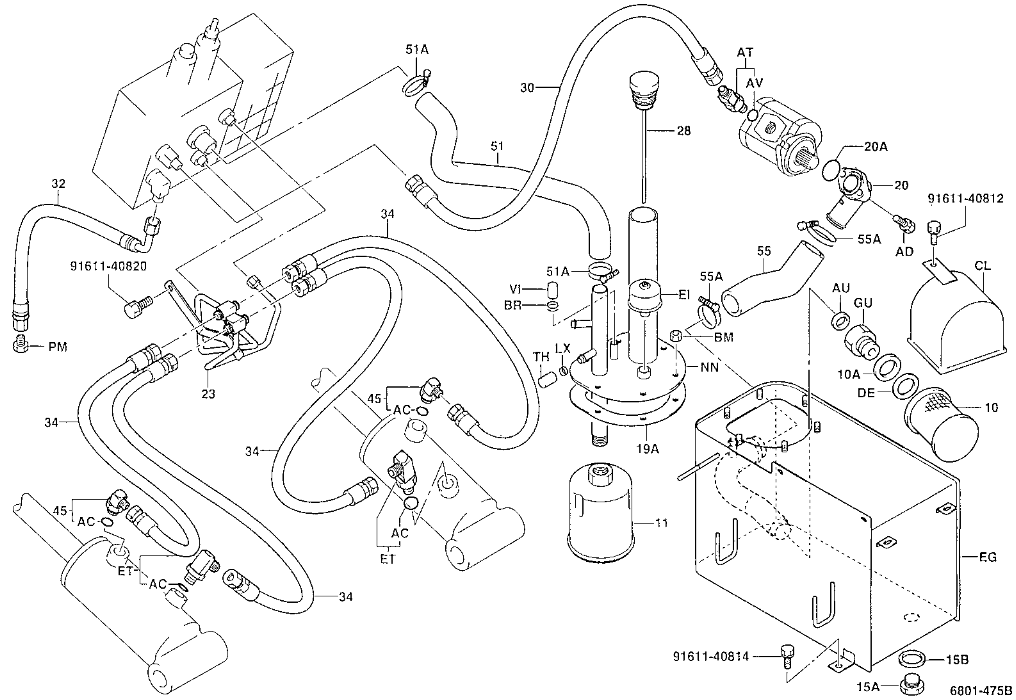
35 ~ 55 model



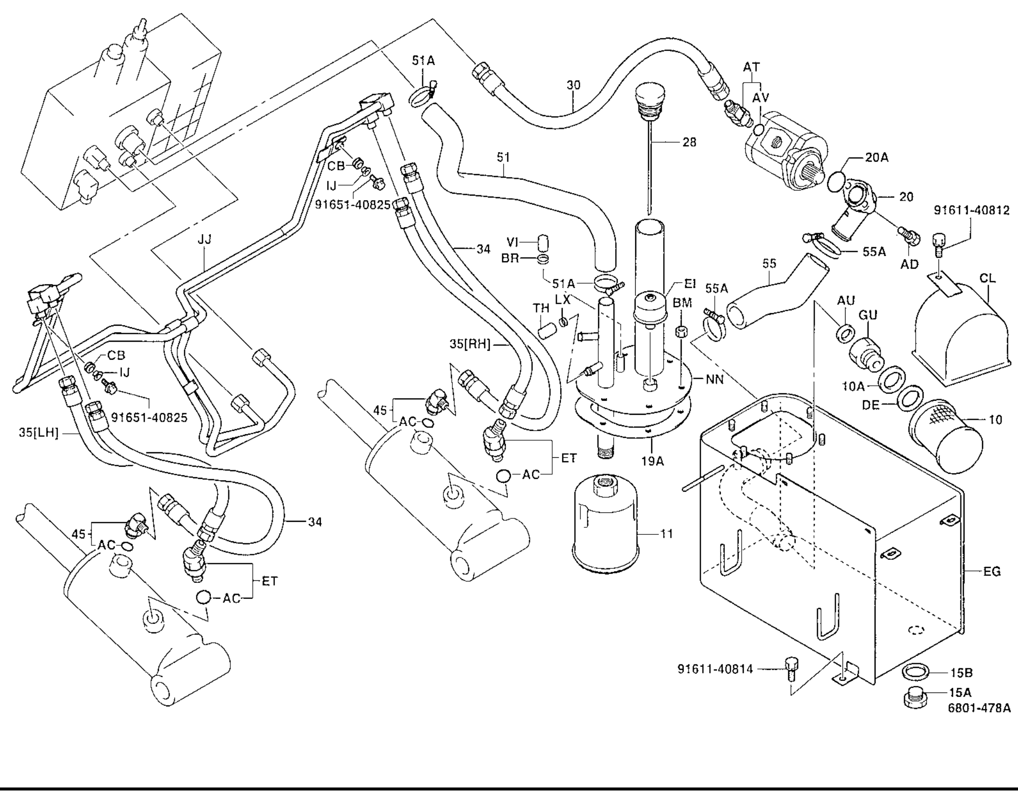
COMPONENTS

15·18 model

6801



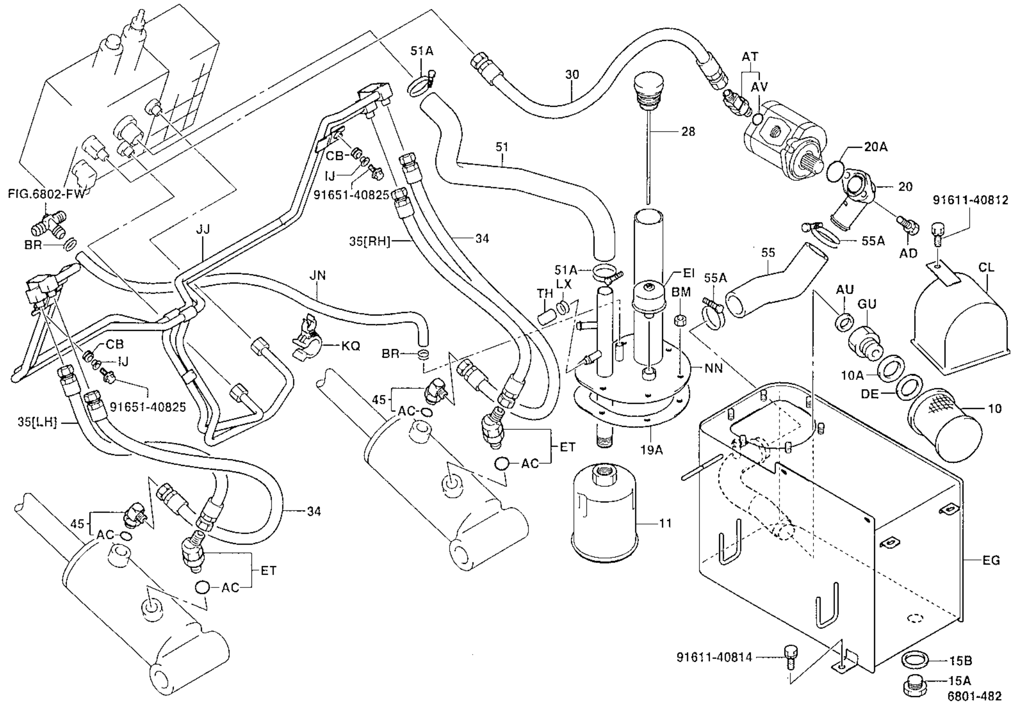
20 ~ 32 model (V, FV, FSV)



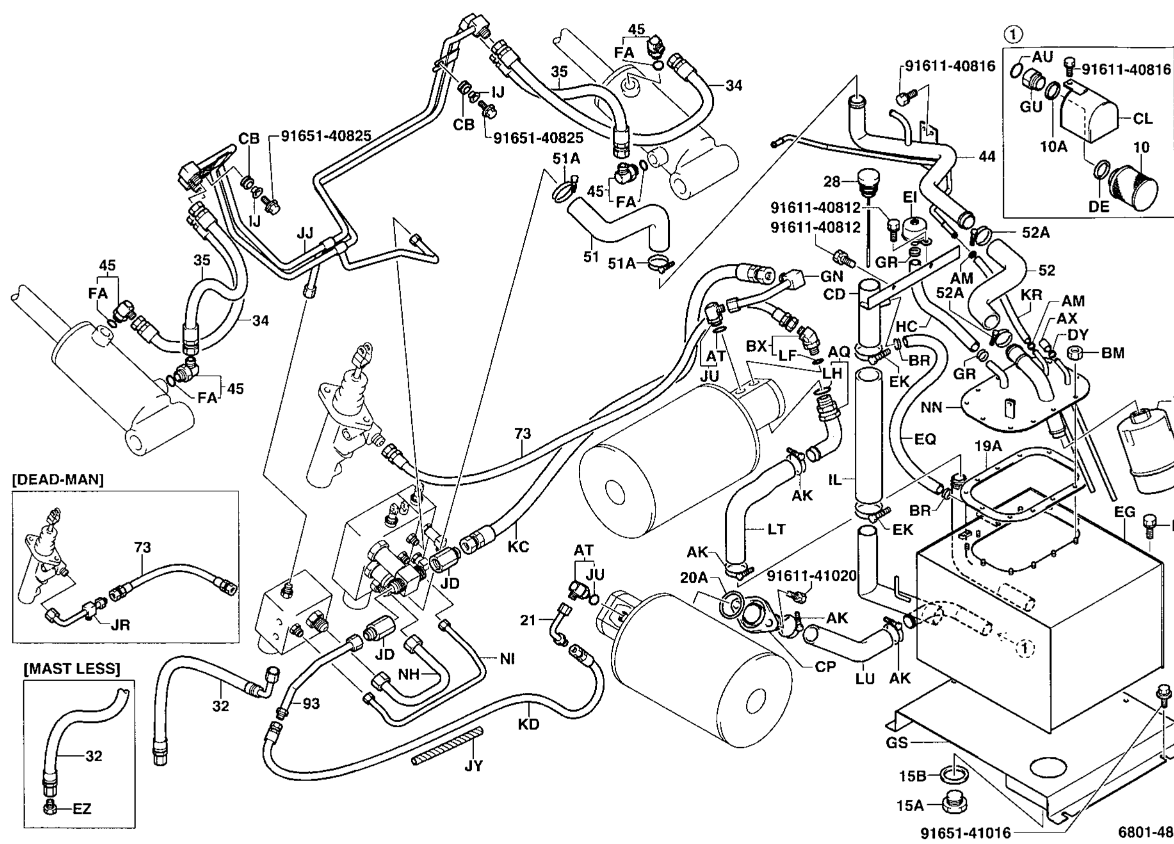
12

20 ~ 32 model (QFV)

6801

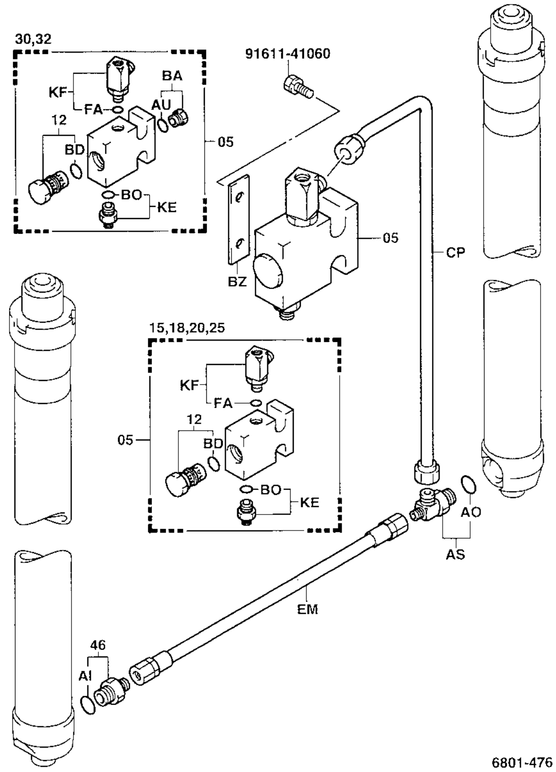


35 ~ 55 model

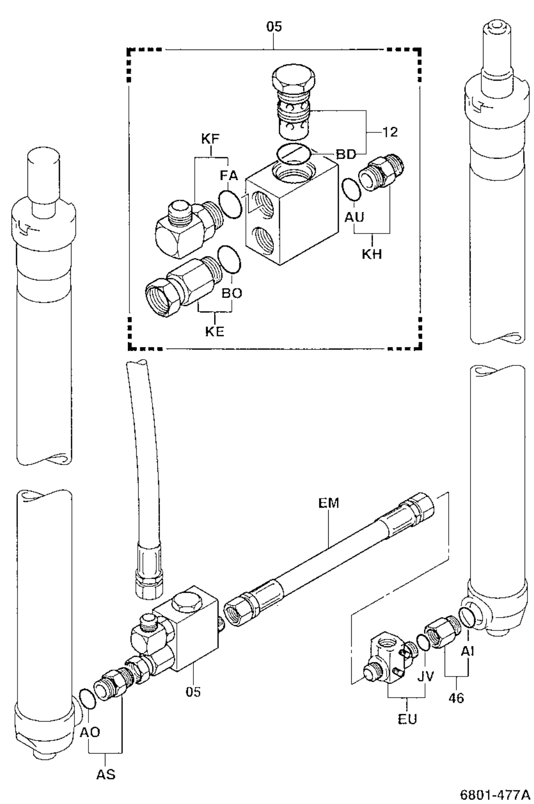


15 ~ 32 model (V)

6801

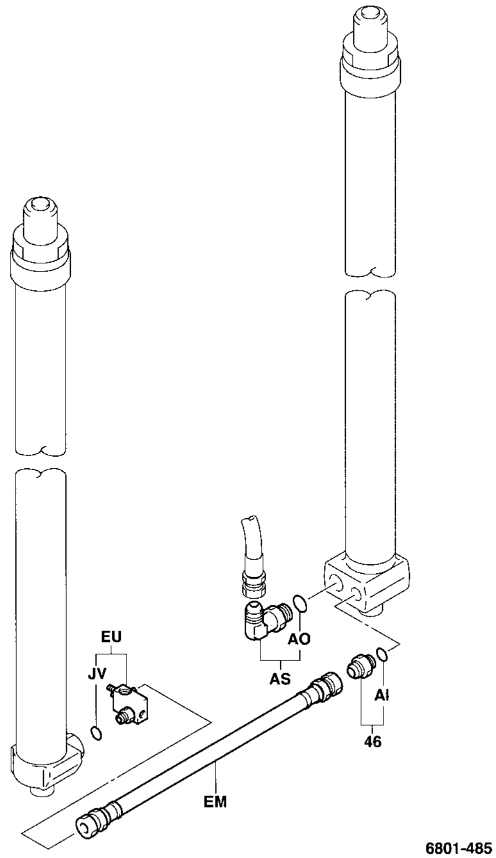


15 ~ 32 model (FV)

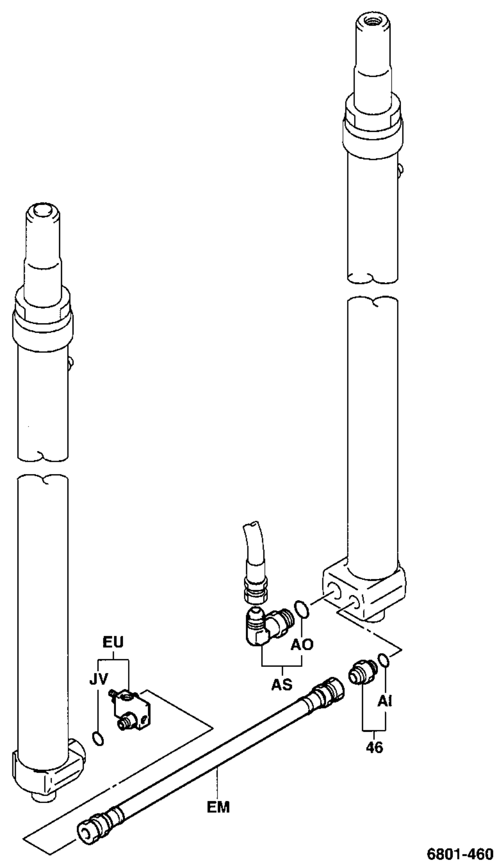


35·45 model (V)

6801

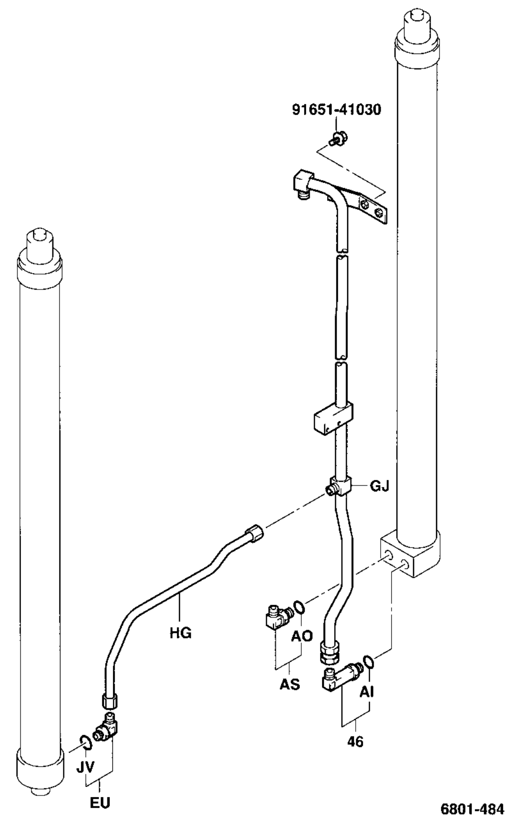


35·45 model (FV)



35 ~ 55 model (FSV)

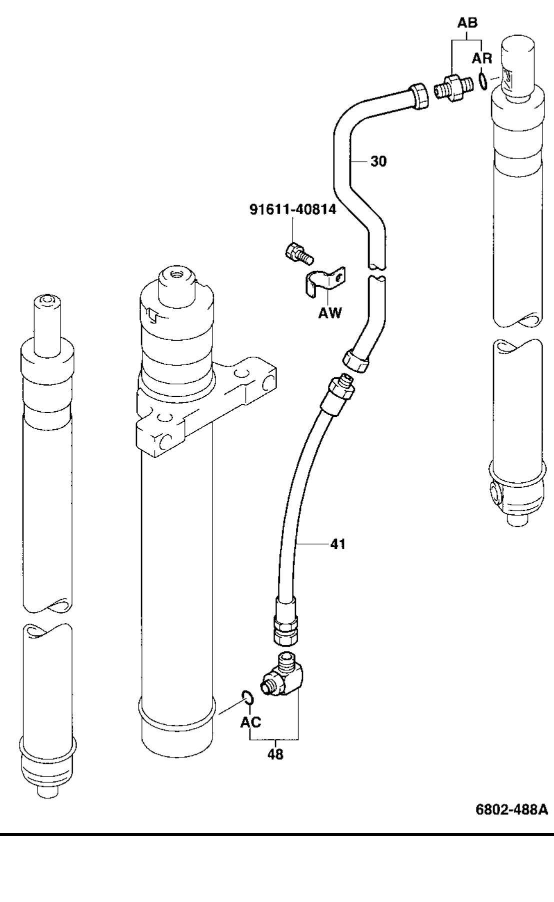
6801



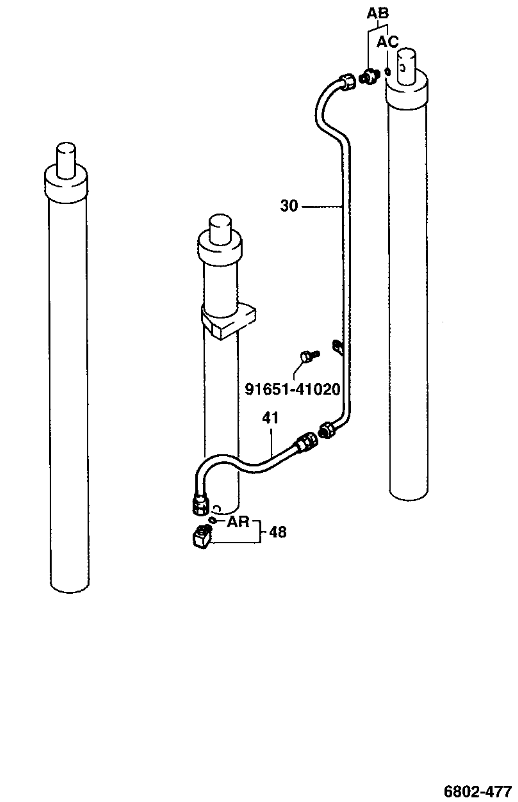
FV Mast

15 ~ 32 model

6802

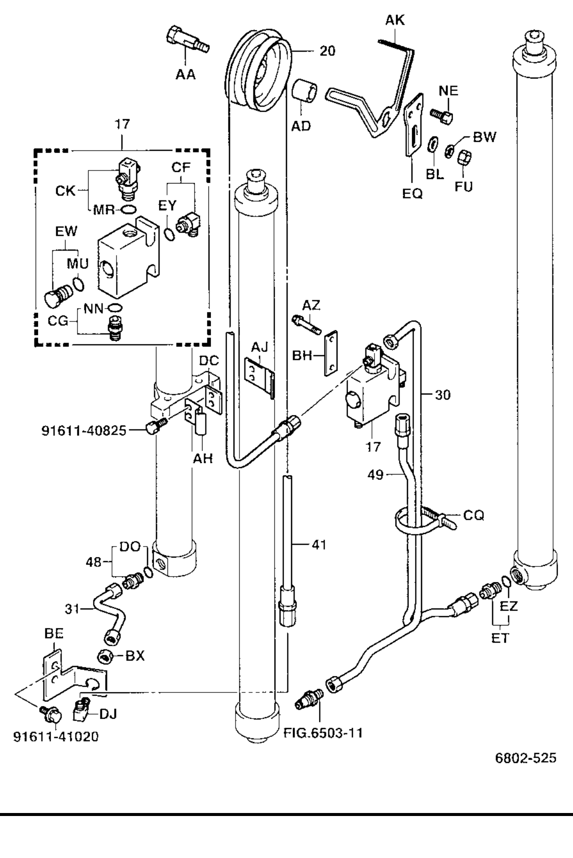


35 ~ 55 model | 6802



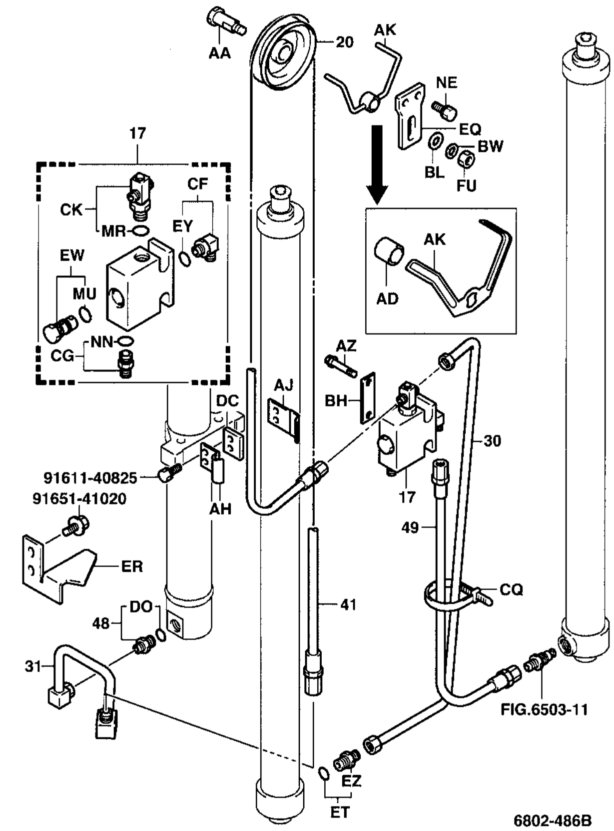
FSV Mast

15·18 model | 6802

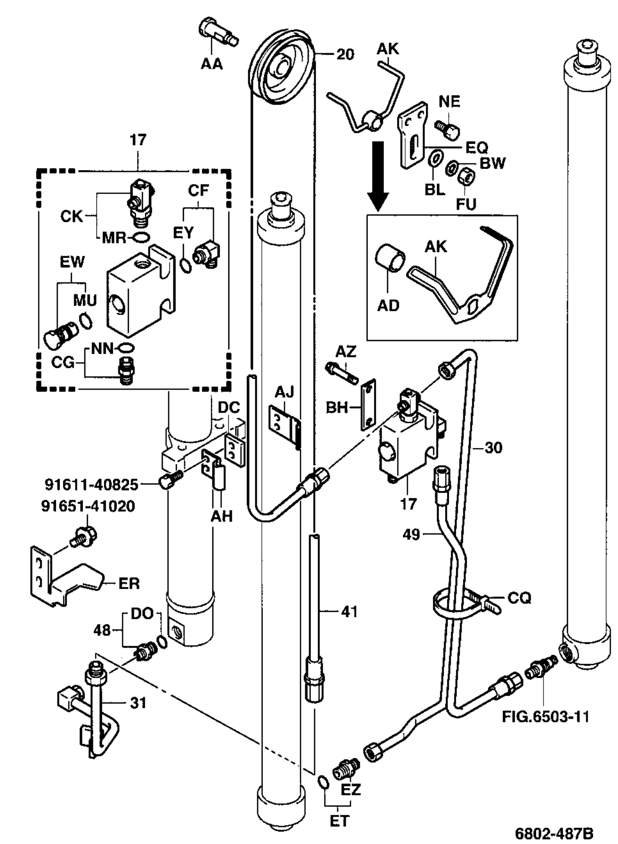


20·25 model

6802

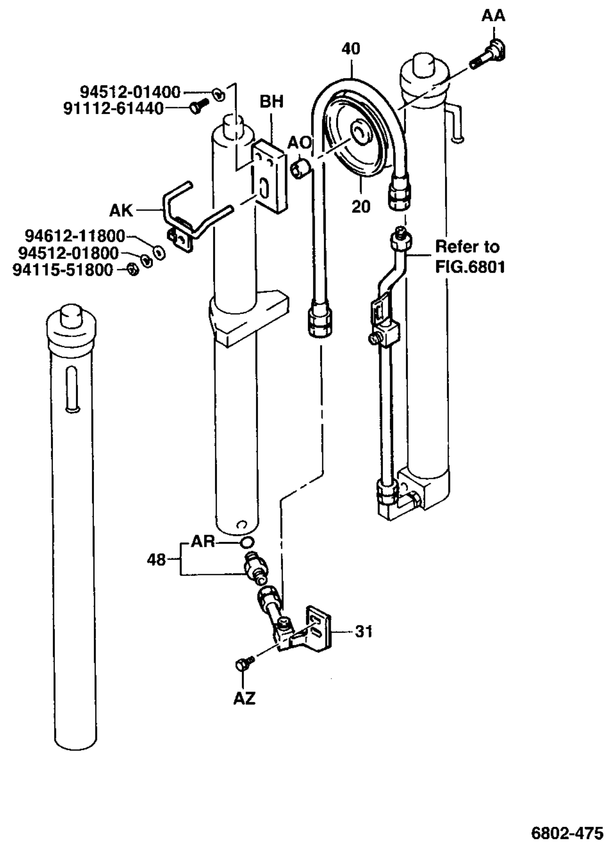


30·32 model

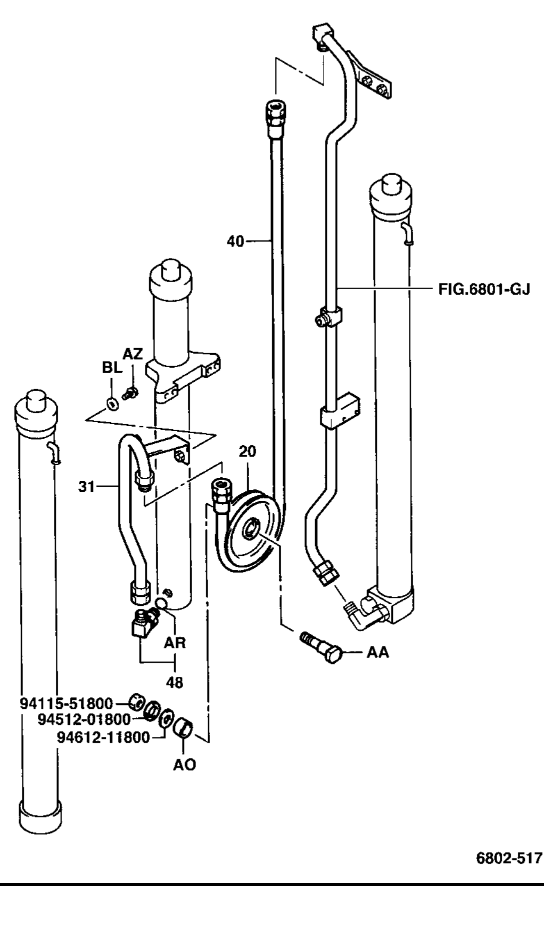


35 model

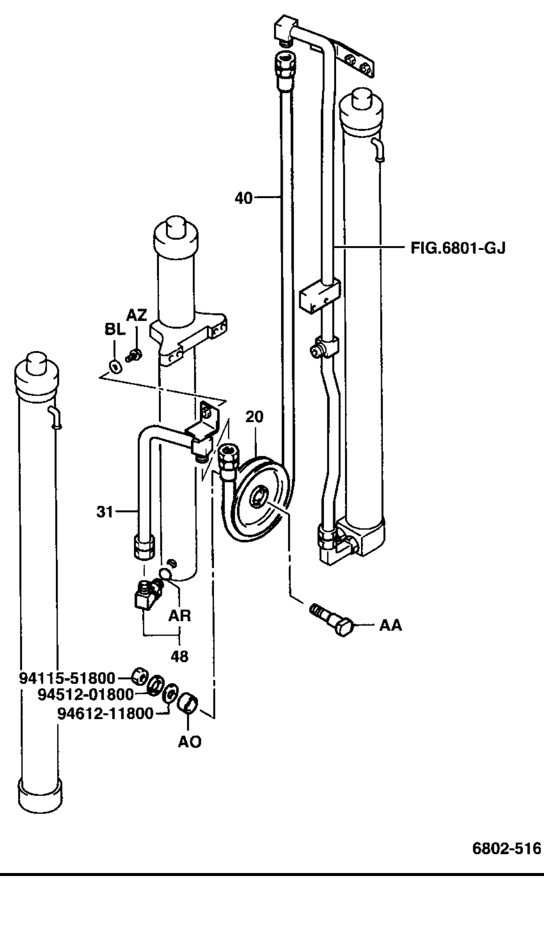
6802



45 model



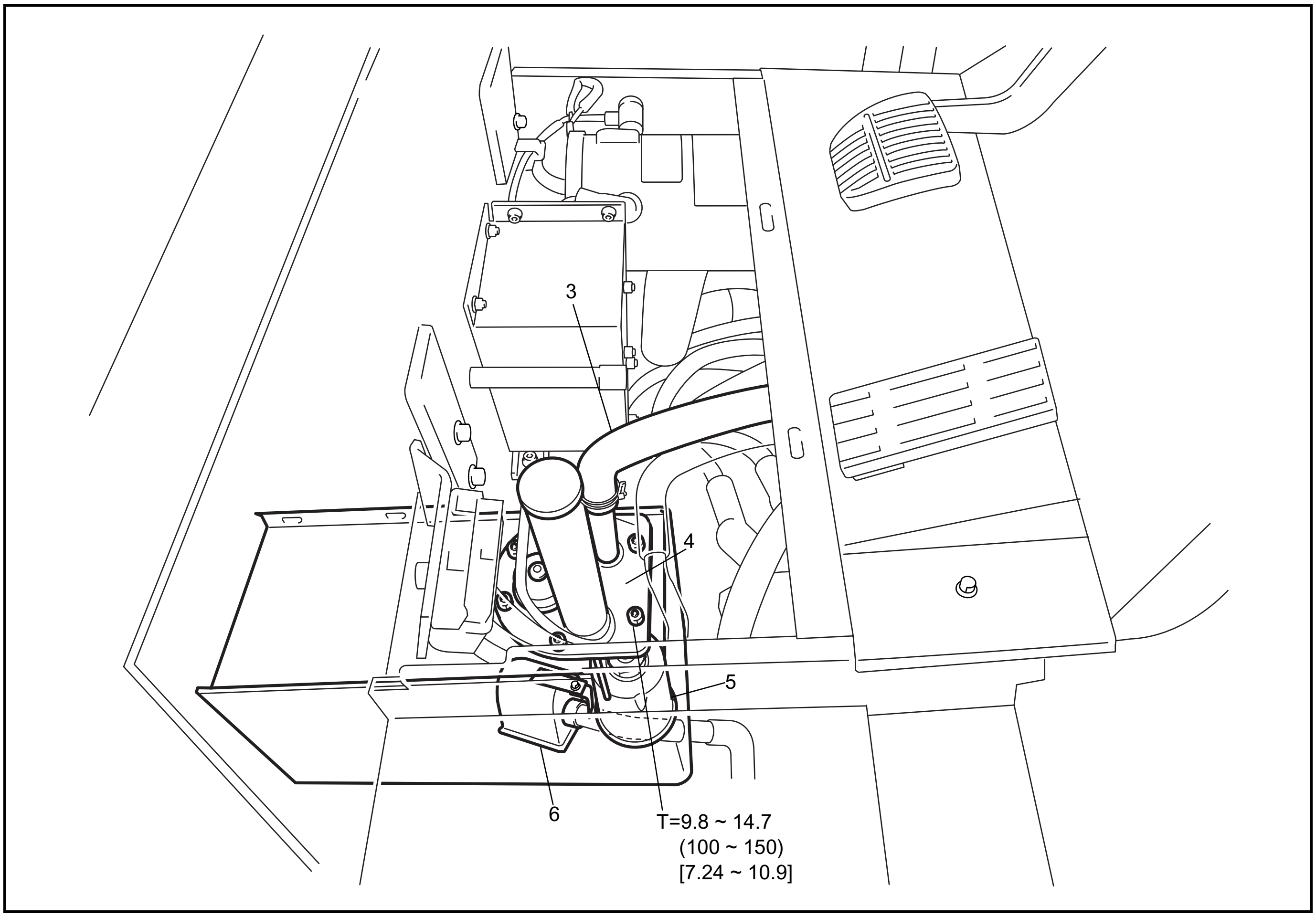
55 model



RETURN FILTER·SUCTION FILTER

REMOVAL·INSTALLATION (15 ~ 32 MODEL)

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

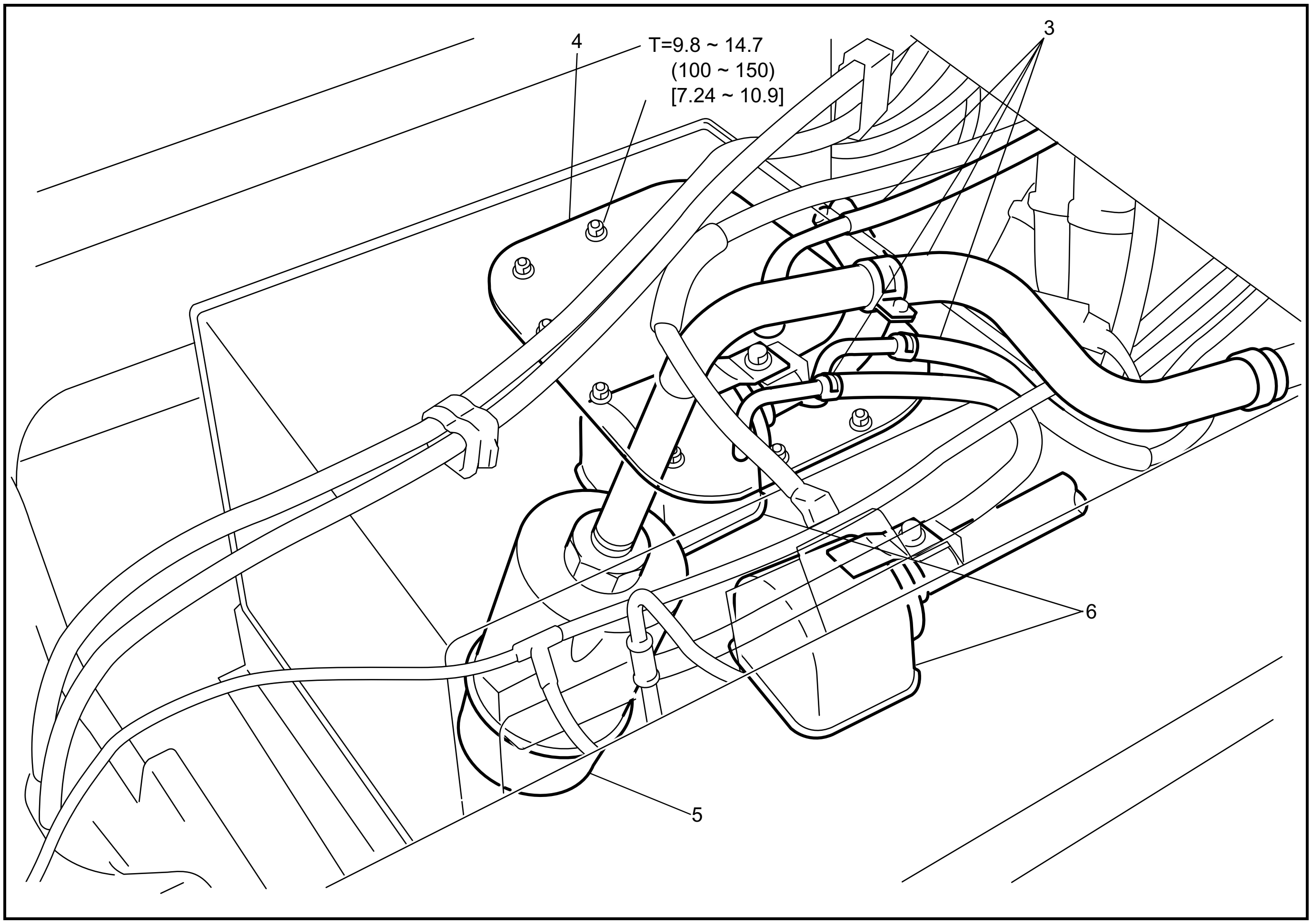
1 Drain hydraulic oil.
2 Remove the toe board (rear).
3 Disconnect the piping.
4 Remove the tank cover W/return filter.
5 Remove the return filter.
6 Remove the suction filter.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

REMOVAL·INSTALLATION (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]

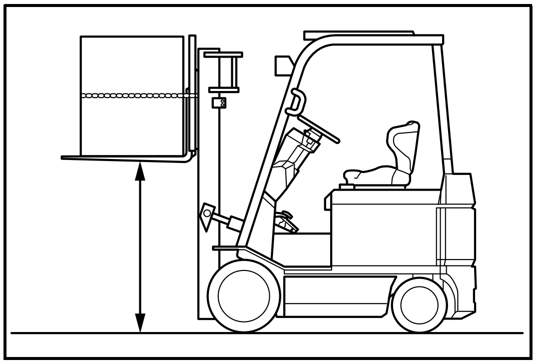


Removal Procedure

1 Remove the battry. (See page 1-5)
2 Drain hydraulic oil.
3 Disconnect the piping.
4 Remove the tank cover W/return filter.
5 Remove the return filter.
6 Remove the suction filter.

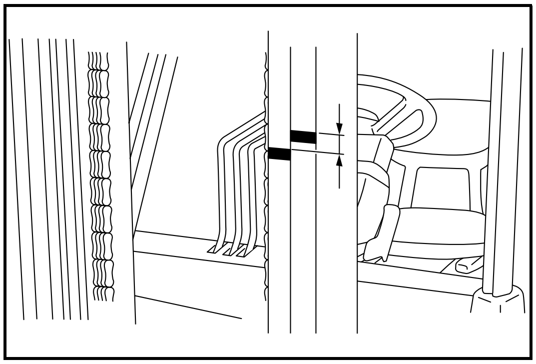
Installation Procedure

The installation procedure is the reverse of the removal procedure.



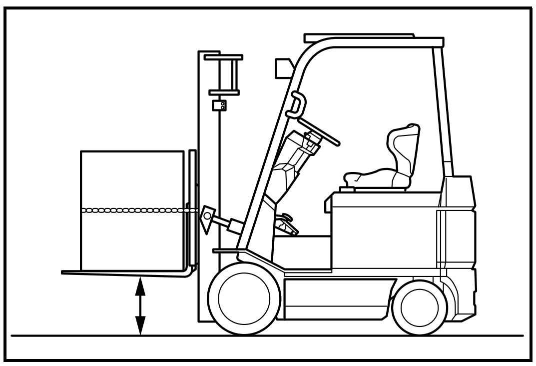
NATURAL DROP TEST

1. Set the mast in the vertical position with the standard load on the fork. Lift the fork by 1 to 1.5 m (40 to 59 in), and turn the key switch to OFF.



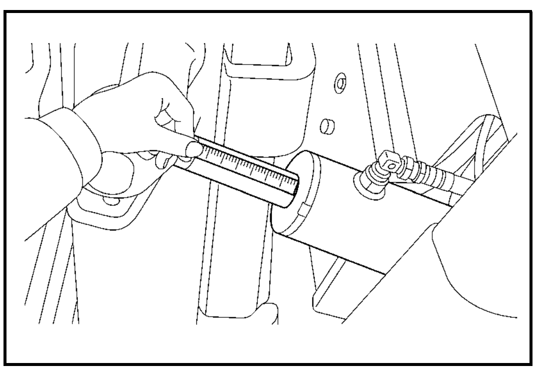
2. Draw datum lines on the inner and outer masts, and measure the drop in 15 minutes.

   Limit: 45 mm (1.77 in)



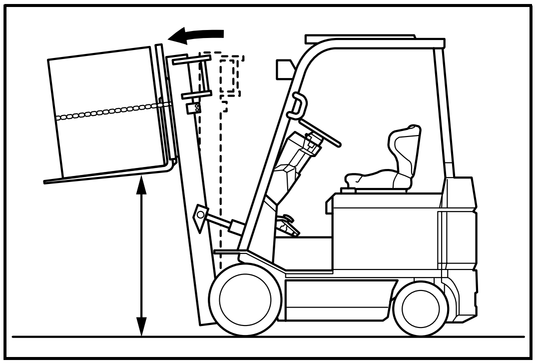
NATURAL FORWARD TILT TEST

1. Set the mast in the vertical position with standard load on the fork. Lift the fork by about 50 cm (19.7 in) and turn the key switch to OFF.



2. Measure the tilt cylinder rod extension in 15 minutes.

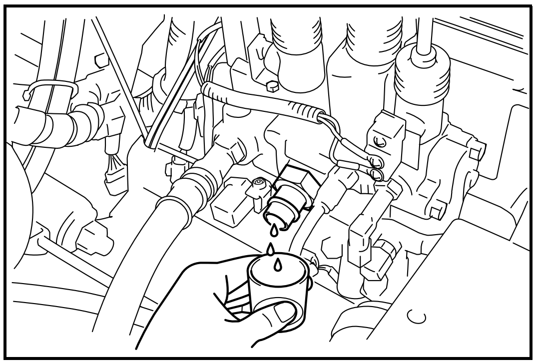
Model	Natural forward tilt amount mm (in)
15·18	10 (0.39) or less
20 ~ 45	15 (0.59) or less
55	20 (0.79) or less



OIL LEAK TEST

LIFT CYLINDER

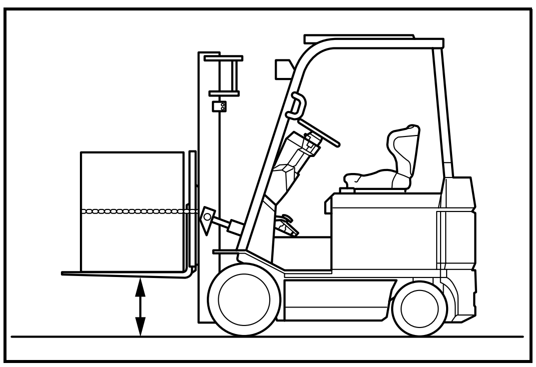
1. Set the mast in the vertical position with the standard load on the fork. Lift the fork by 1 to 1.5 m (40 to 59 in).



2. Slowly tilt the mast fully forward, and turn the key switch to OFF. After 5 minutes, disconnect the oil control valve to oil tank hose. Place a measuring cylinder under the elbow and measure the amount of oil leaking in one minute.

   Standard (at lift port):
   15 ~ 32 model: 8 cm^3 (0.49 in^3) or less
   35 ~ 55 model: 10 cm^3 (0.61 in^3) or less

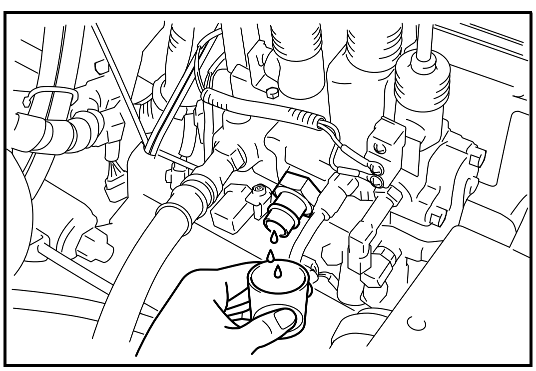
   Note:
   If the natural drop is great even though the oil leak amount is within the standard, the lift lock valve or lift cylinder packing is defective.



TILT CYLINDER

1. Set the mast in the vertical position with standard load on the fork. Lift the fork by about 50 cm (19.7 in) and turn the key switch to OFF.
2. After waiting for 5 minutes, disconnect the oil control valve to oil tank hose. Place a measuring cylinder under the elbow and measure the amount of oil leaking in one minute.

   Standard (total for lift and tilt):
   15 ~ 32 model: 16 cm^3 (0.98 in^3) or less
   35 ~ 55 model: 20 cm^3 (1.22 in^3) or less



3. The leak amount at the tilt port is the total leak amount less the leak amount from the lift port.

   Note:
   If the natural forward tilt is great even though the oil leak amount is within the standard, either the tilt lock valve or the tilt cylinder packing is defective.

MAST

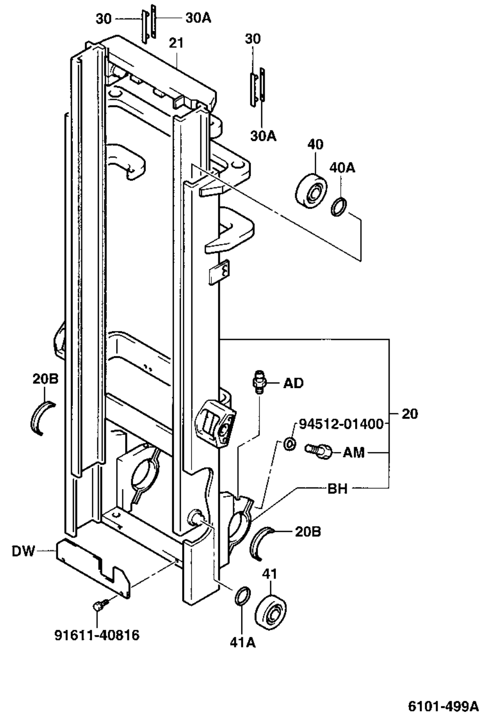
13

V MAST ASSY

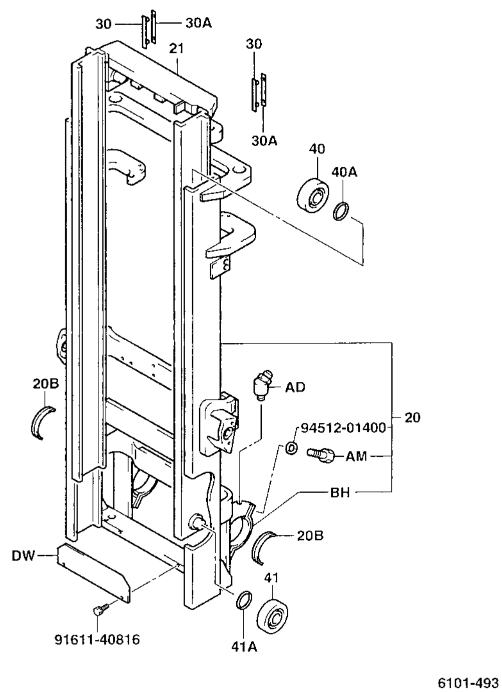
COMPONENTS

6101

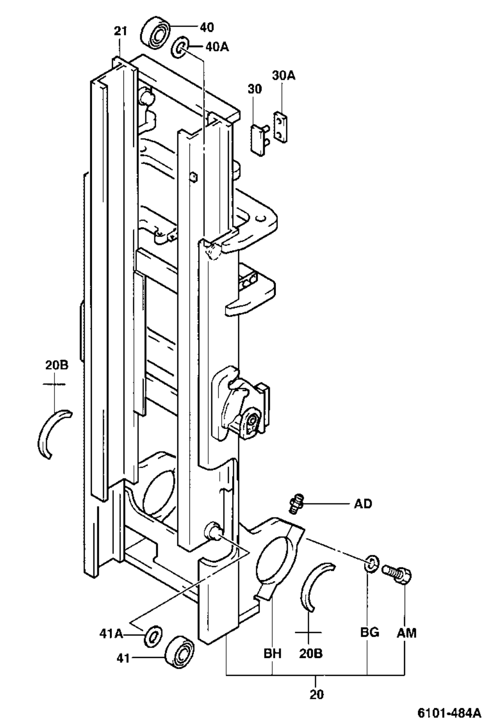
15·18 model



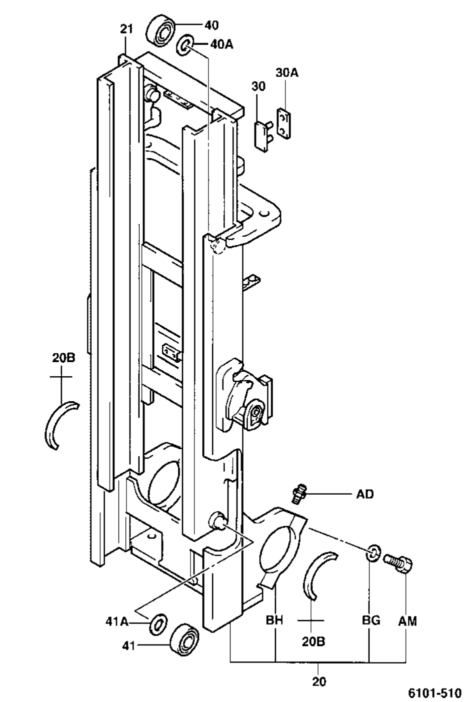
20 ~ 32 model



35 model

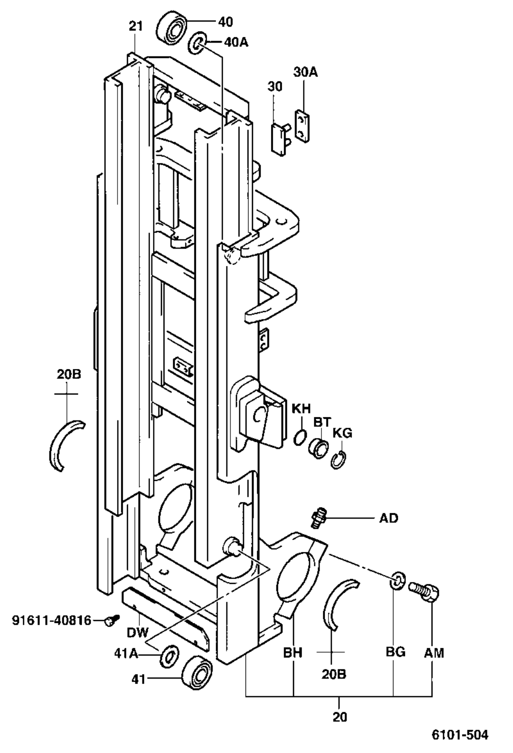


45 model



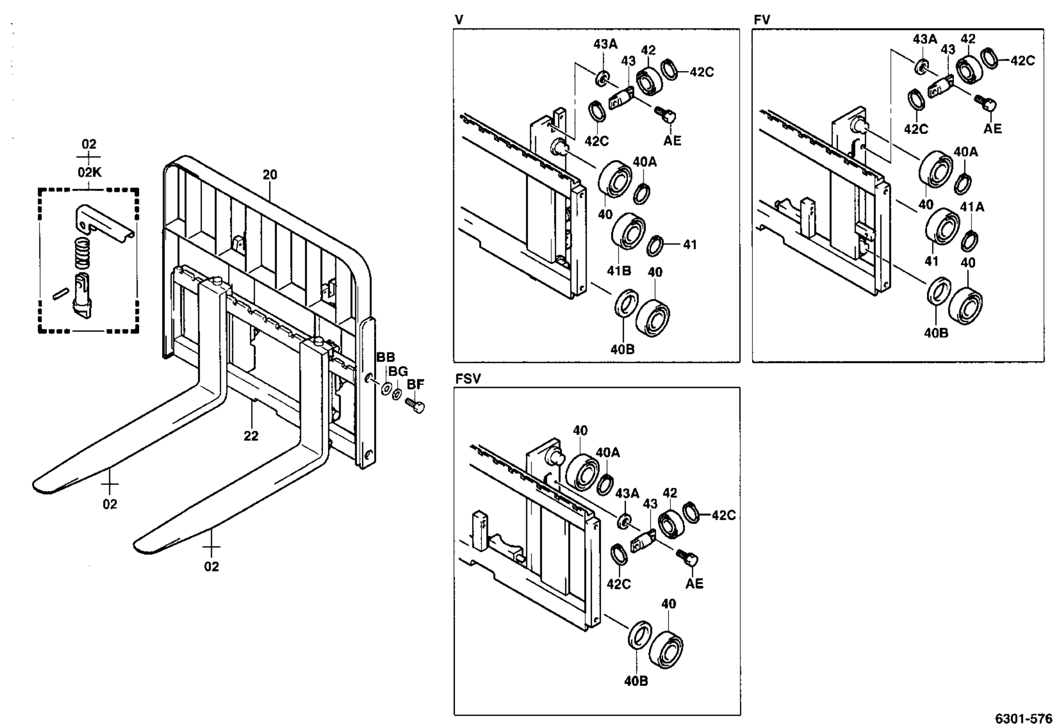
55 model

6101



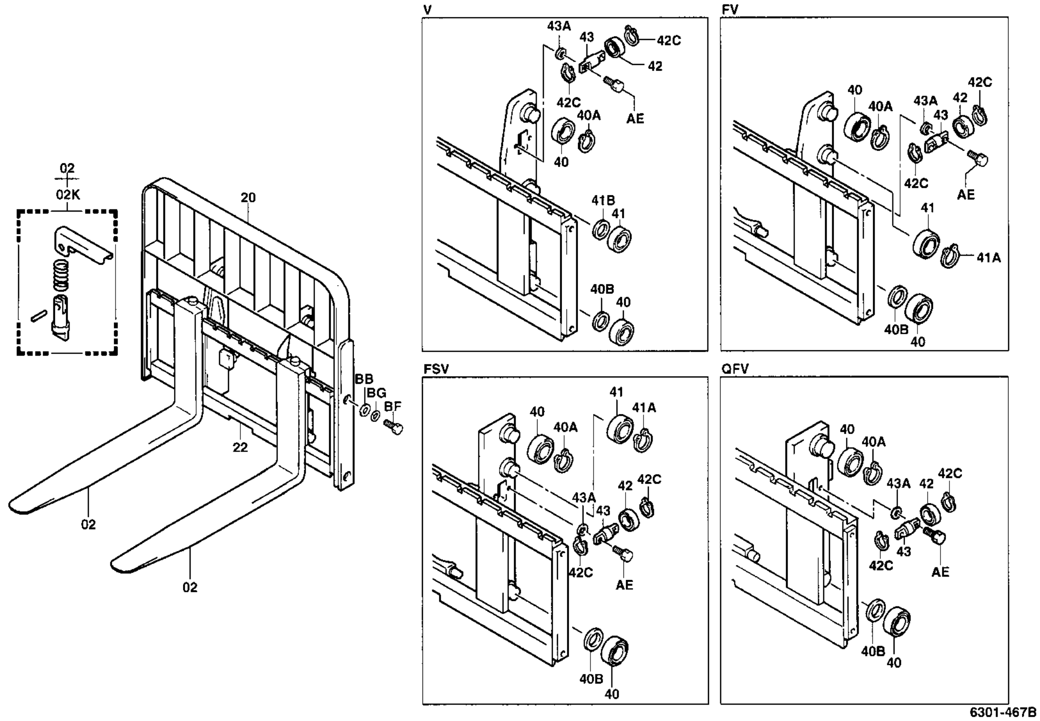
15·18 model

6301

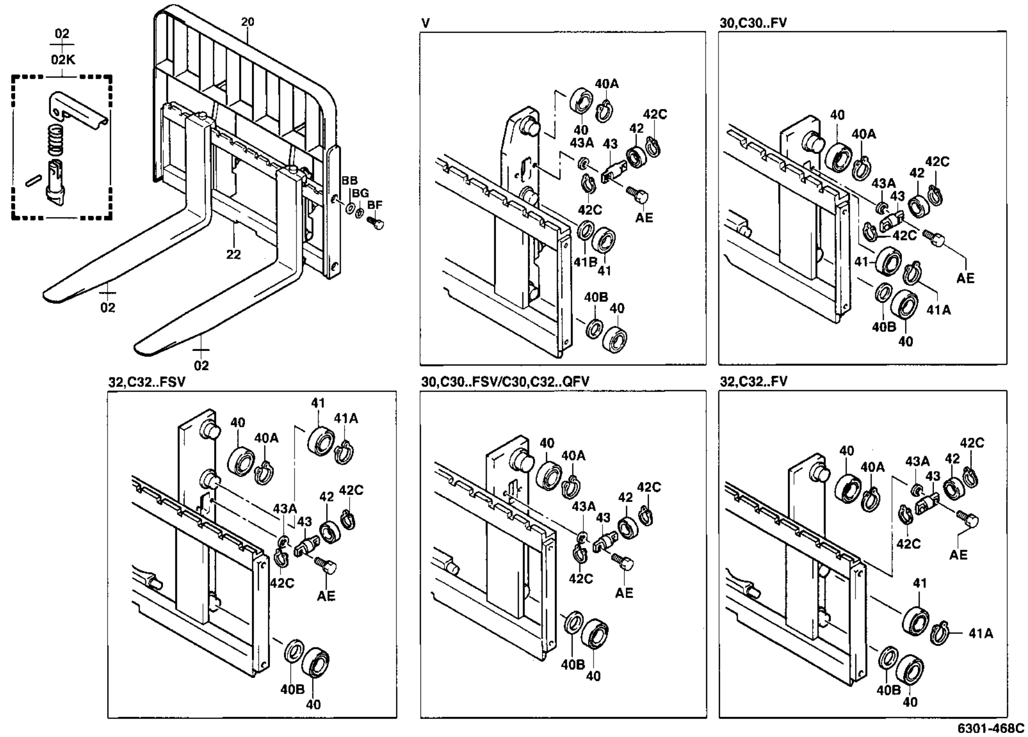


20·25 model

6301

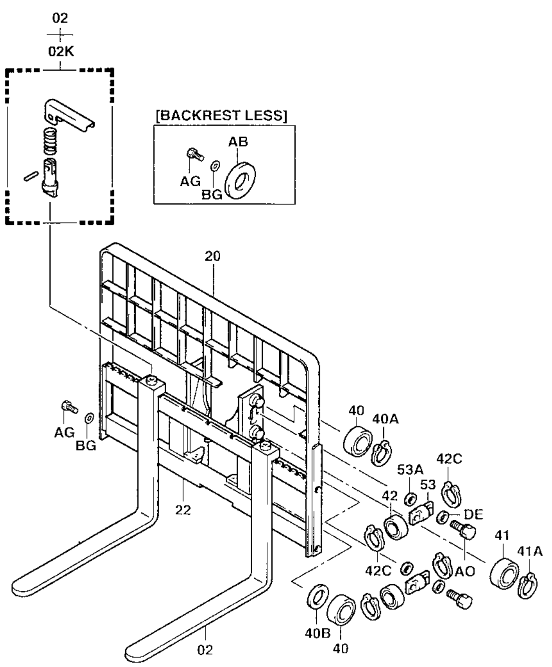


30·32 model



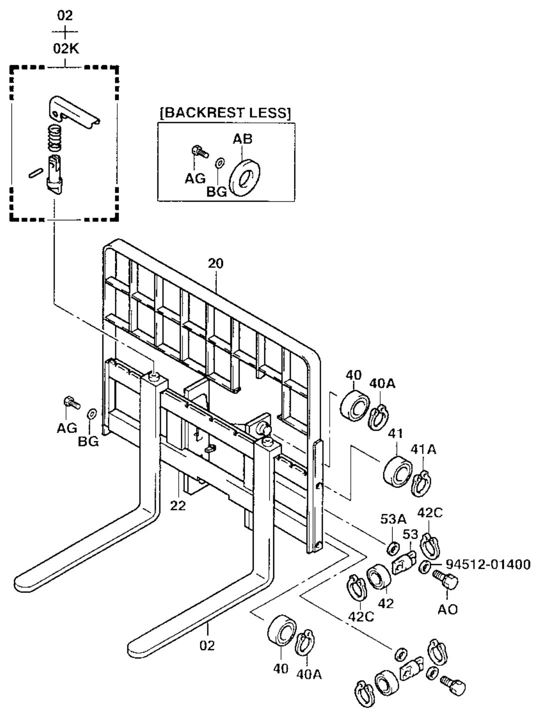
6301

35·45 model



6301-581

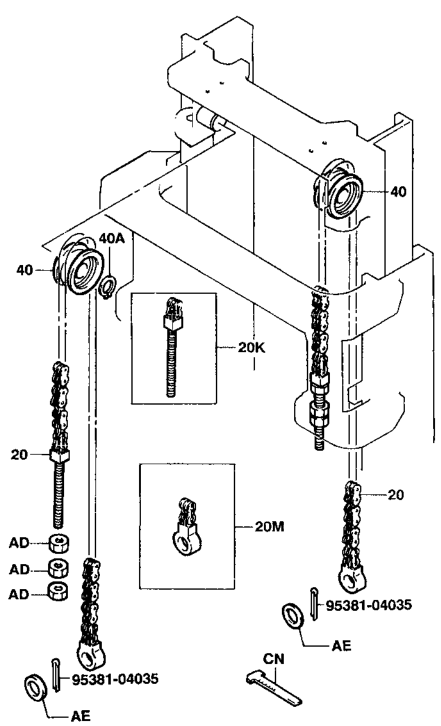
55 model



6301-582

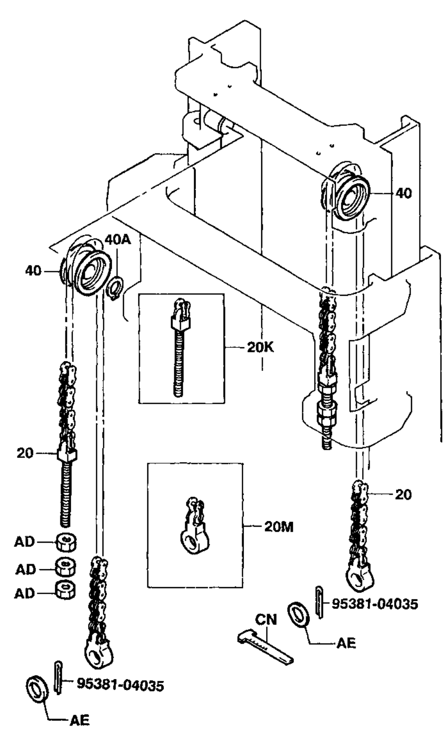
6302

15 ~ 25 model



6302-295

30·32 model

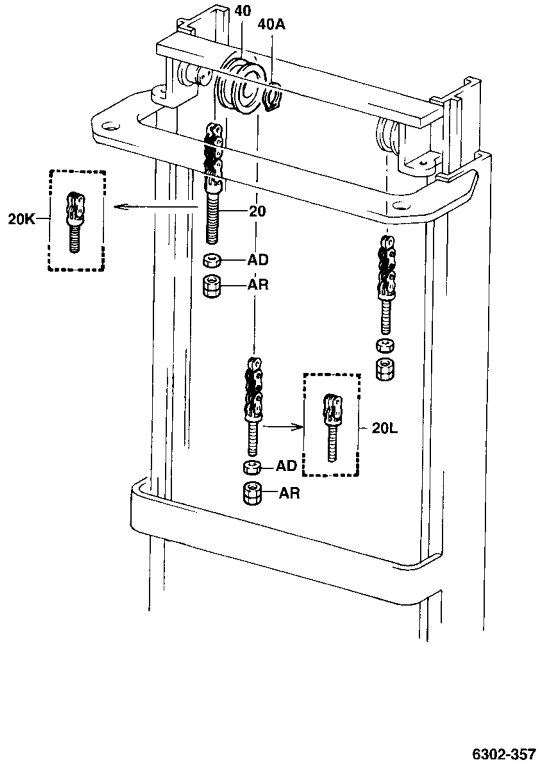


6302-298

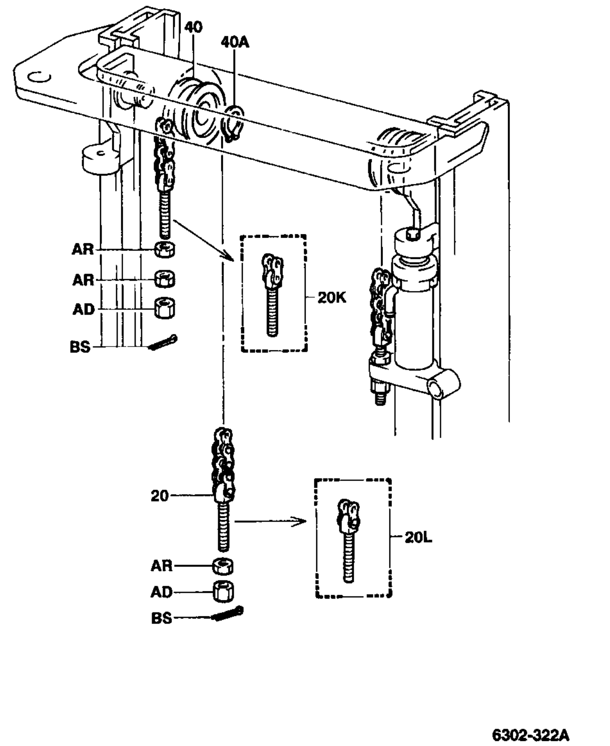
13

6302

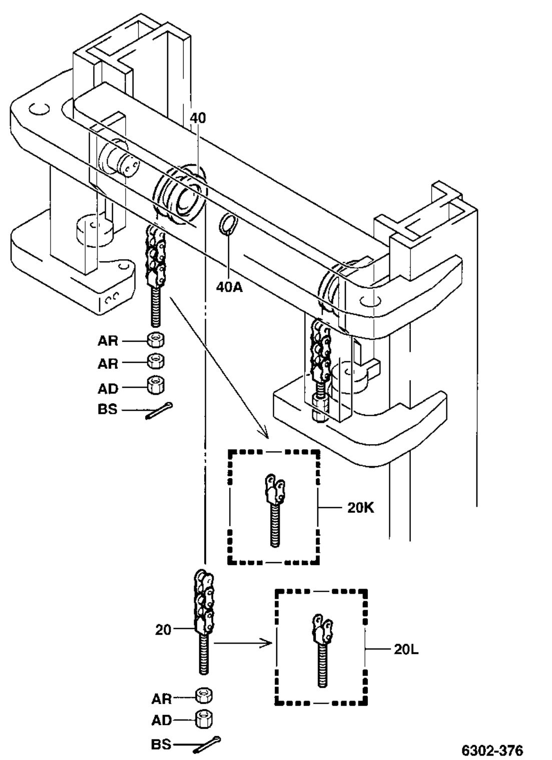
35 model



45 model

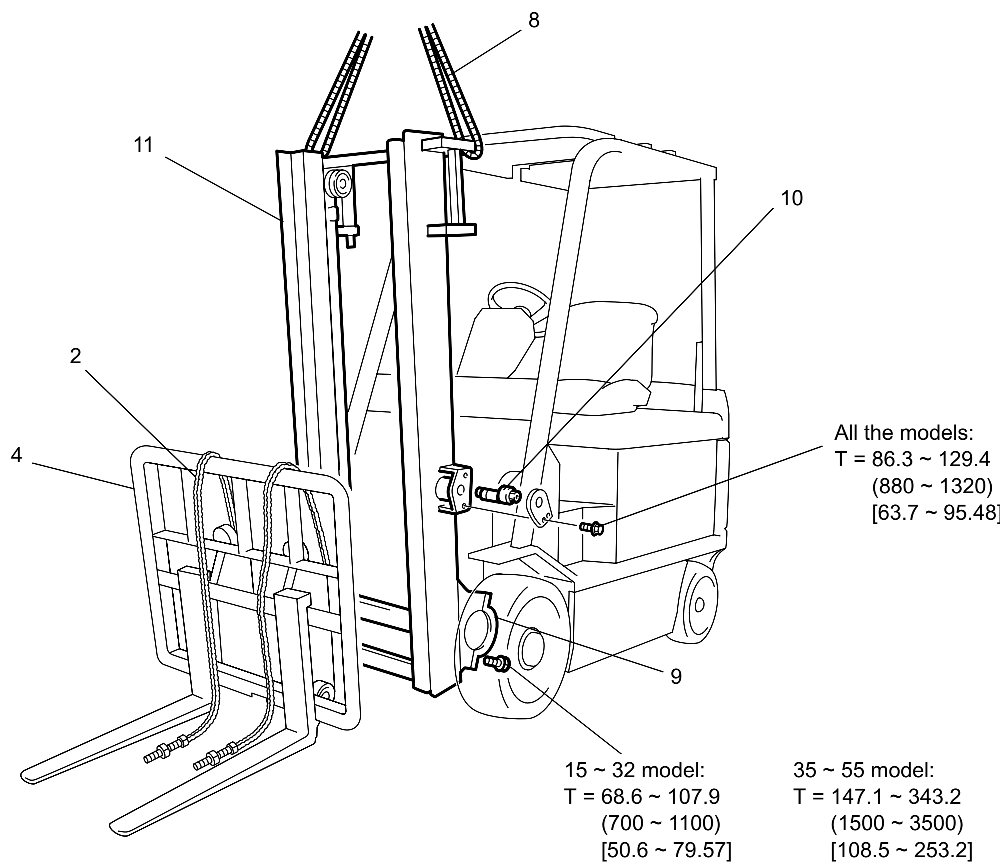


55 model



REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

1 Set the mast vertical and fully lower the fork.
2 Disconnect the chain. **[Point 1]**
3 Remove the chain wheel. **[Point 2]**
4 Remove the lift bracket. (For lift bracket removal, raise the inner mast until it comes off from the lift bracket, and slowly run the vehicle backward to depart from the lift bracket.)
5 Remove the toe board (front and rear).
6 Disconnect the fork height switch and load sensor wiring.
7 Disconnect the overflow hose and high pressure hose. (Before hose disconnection, fully lower the inner mast, operate the lift lever several times to release the residual pressure in the lift cylinder.)
8 Slightly hoist the mast.
9 Remove the mast support cap. **[Point 3]**
10 Remove the tilt cylinder front pin. **[Point 4]**
11 Remove the mast ASSY.

Installation Procedure

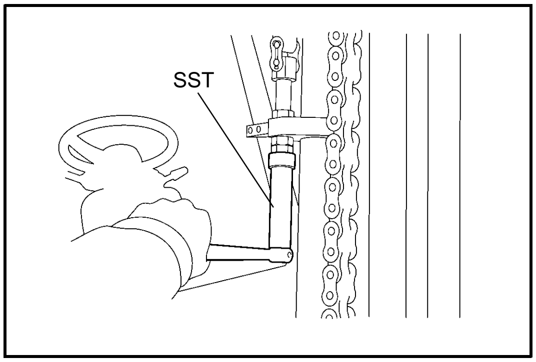
The installation procedure is the reverse of the removal procedure.

Note:

- **Apply molybdenum disulfide grease on the mast support bushing and mast support cap interior surfaces. Apply MP grease on the tilt cylinder front pin.**
- **Adjust lift cylinder uneven movement when the mast ASSY, outer mast, inner mast or either lift cylinder is replaced. (See page 13-61.)**
- **Adjust the chain tension after installation. (See page 13-31 and 13-35.)**
- **When the mast is replaced, perform SAS matching after installation. (See section 3.)**

Point Operations

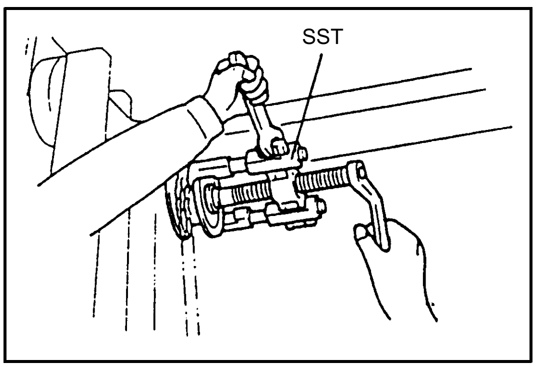
[Point 1]



Removal-Installation:

15 ~ 32 model
SST 09630-23600-71
35 model
SST 09630-31720-71
45·55 model
SST 09630-33900-71

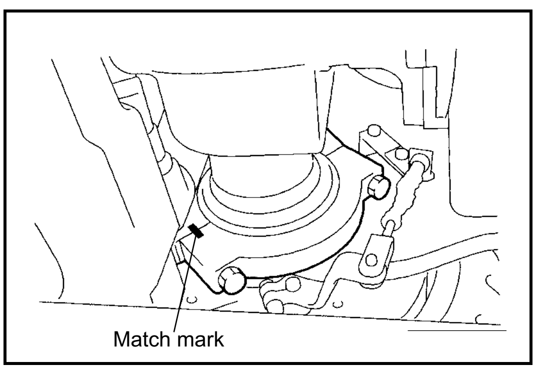
[Point 2]



Removal:

If the fitting is hard, use the SST for removal.
SST 09950-76014-71
(SST 09950-40011)

[Point 3]



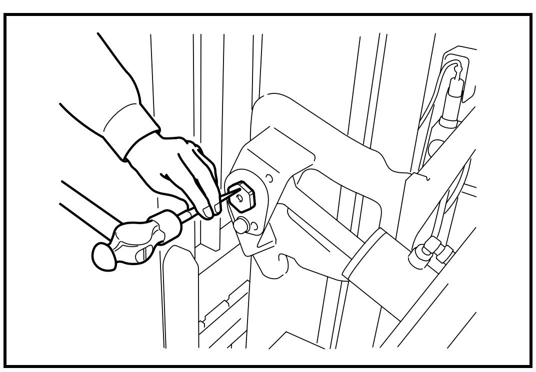
Removal:

35 ~ 55 model
Make a match mark.

Installation:

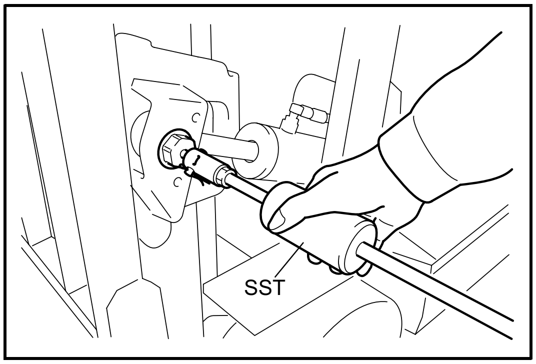
35 ~ 55 model
Align the match mark.

[Point 4]



Removal:

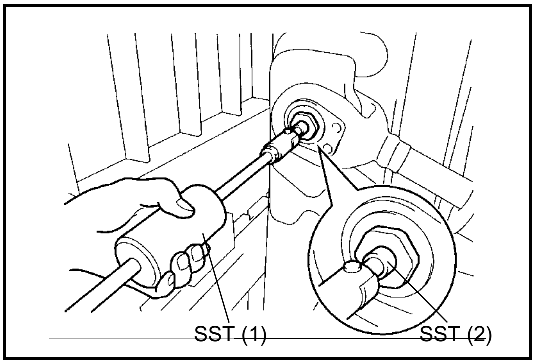
Put match marks to clarify relative positions of the front pin, stopper plate and lock bolt. Match marks, however, are unnecessary when the mast or mast ASSY is replaced since mast tilt angle adjustment is to be done after the replacement.



Removal:

15 ~ 45 model

SST 09810-20172-71



55 model

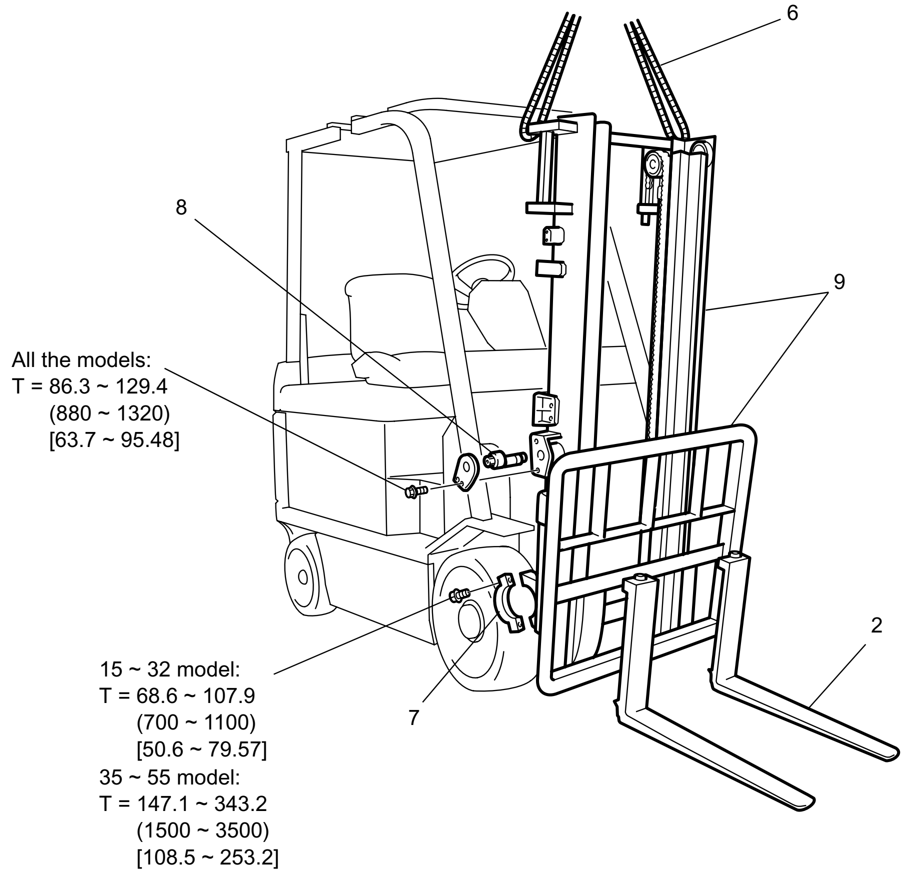
Support the tilt cylinder with a wooden brock before removing the front pin so as to prevent the tilt angle sensor from sustaining damage.

SST 09810-20172-71 .... (1)

SST 09820-31040-71 .... (2)

REMOVAL·INSTALLATION (W/LIFT BRACKET)

T = N·m (kgf-cm) [ft-lbf]



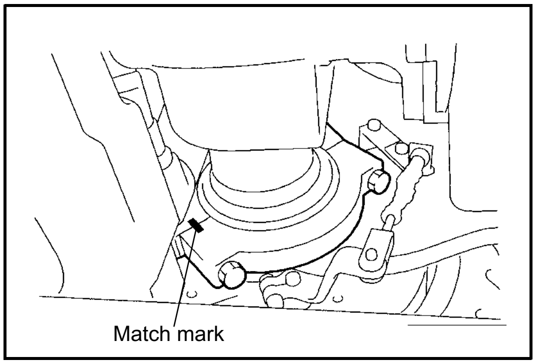
Removal Procedure

1 Set the mast vertical.
2 Remove the fork. (See page 13-35.)
3 Remove the toe board (front and rear).
4 Disconnect the wiring of the fork height switch and load sensor.
5 Disconnect the overflow hose and high pressure hose. (Before hose disconnection, fully lower the inner mast and operate the lift lever several times to release the residual pressure from the lift cylinder.)
6 Slightly hoist the mast.
7 Remove the mast support cap. **[Point 1]**
8 Remove the tilt cylinder front pin. **[Point 2]**
9 Remove the mast ASSY W/lift bracket.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
- **Apply MP grease on the mast support bushing and mast support cap interior surfaces and on the tilt cylinder front pin.**
- **Correct lift cylinder uneven lifting, if any, when the mast ASSY, outer mast, inner mast or either lift cylinder is replaced. (See page 13-61.)**
- **When the mast is replaced, perform SAS matching after installation. (See section 3.)**

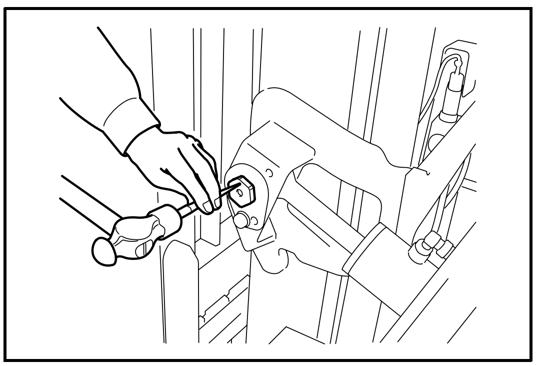


Point Operations

[Point 1]

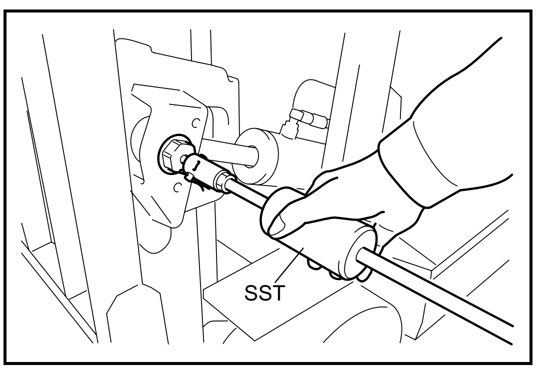
Removal:
35 ~ 55 model
Make a match mark.

Installation:
35 ~ 55 model
Align the match mark.

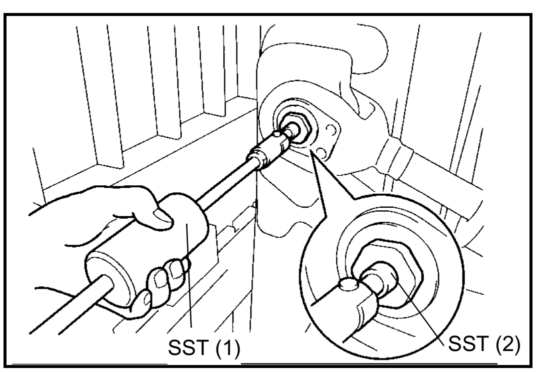


[Point 2]

Removal:
Put match marks to clarify relative positions of the front pin, stopper plate and lock bolt. Match marks, however, are unnecessary when the mast or mast ASSY is replaced since mast tilt angle adjustment is to be done after the replacement.

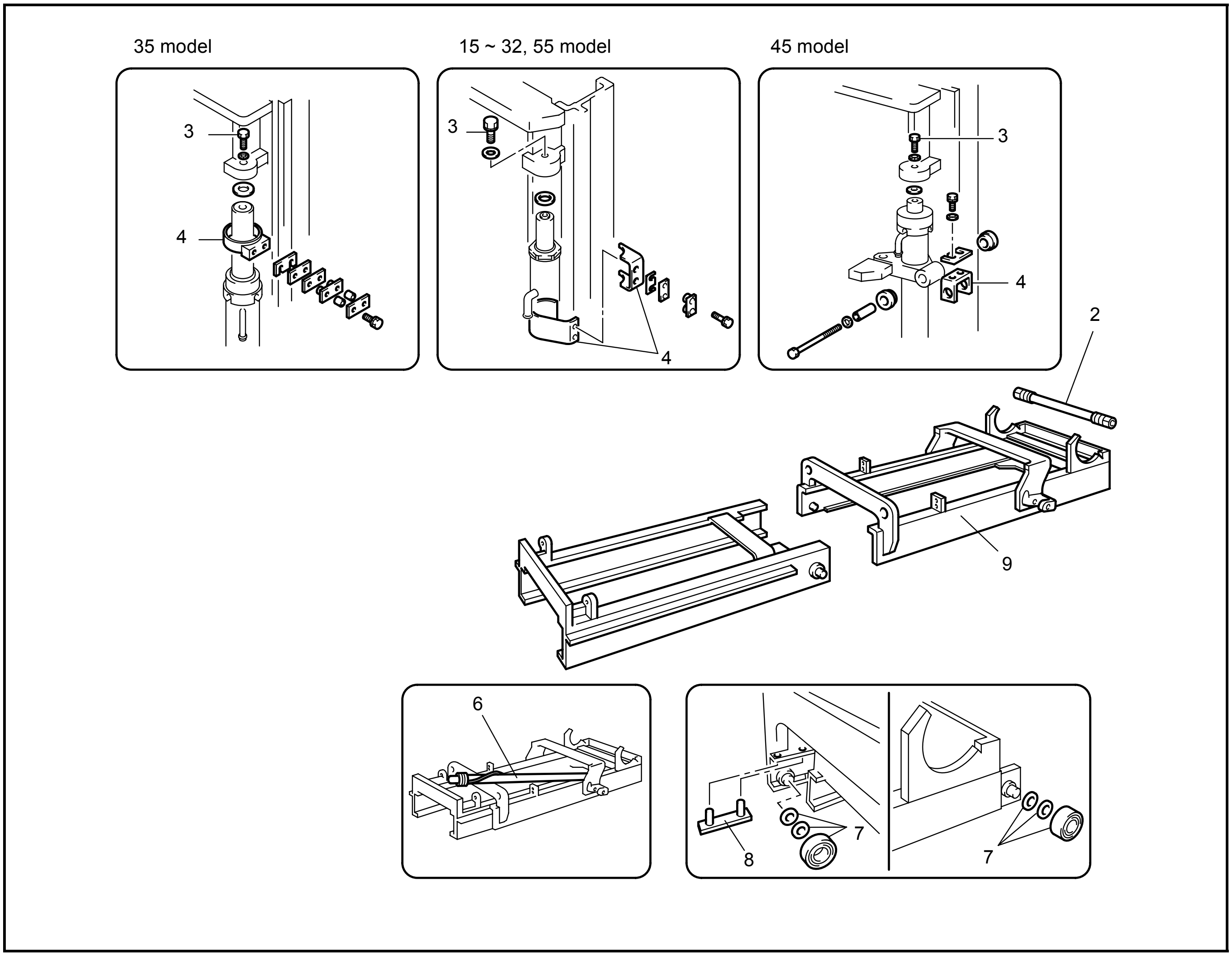


Removal:
15 ~ 45 model
SST 09810-20172-71



55 model
Support the tilt cylinder with a wooden brock before removing the front pin so as to prevent the tilt angle sensor from sustaining damage.
SST 09810-20172-71 .... (1)
SST 09820-31040-71 .... (2)

MAST DISASSEMBLY·INSPECTION REASSEMBLY

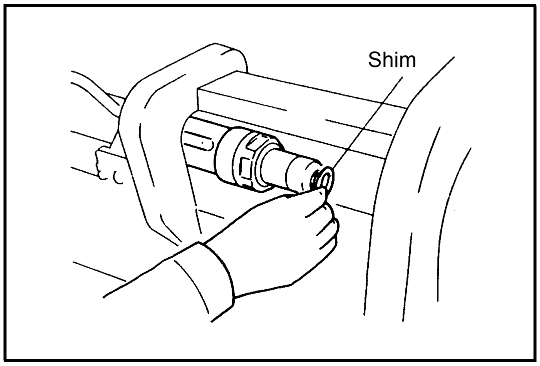


Disassembly Procedure

1 Remove the fork height switch.
2 Disconnect the overflow hose and high pressure hose.
3 Remove each cylinder rod end set bolt, and take each rod end off. **[Point 1]**
4 Remove each cylinder support. **[Point 2]**
5 Remove each cylinder bottom set bolt. (16 ~ 32, 55 model)
6 Remove each lift cylinder.
7 Slide the inner mast in the lowering direction, and remove the lift rollers.
8 Remove the mast strip. **[Point 3]**
9 Remove the outer mast.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.



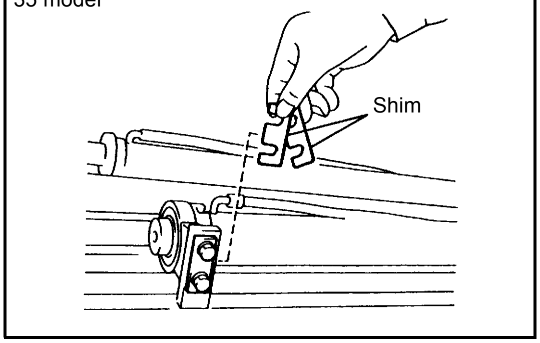
Point Operations

[Point 1]

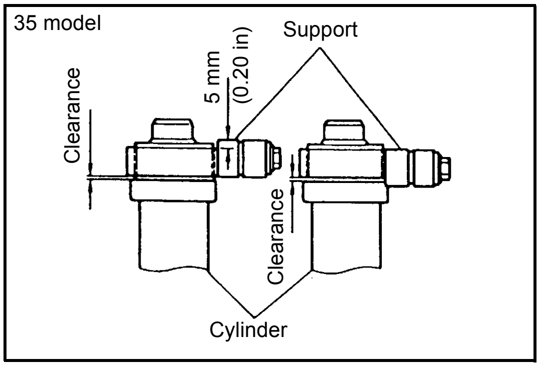
Disassembly:

Shim adjustment has been made at the lift cylinder rod end for prevention of cylinder uneven motion between the left and right sides. Take a note on which side the shim adjustment is made and the number of shims in use.

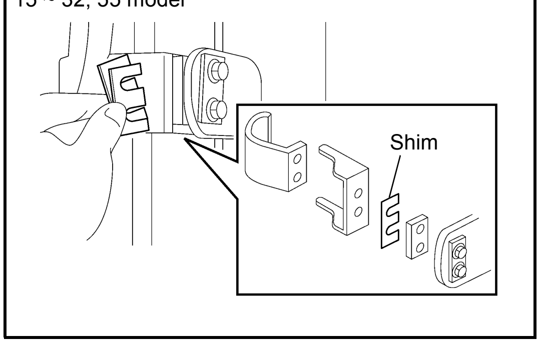
35 model



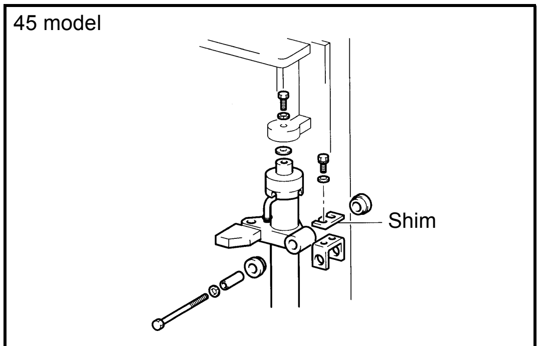
35 model



15 ~ 32, 55 model



45 model



[Point 2]

35 model

Disassembly:

Take a note on the number of cylinder support shims used.

Reassembly:

When the mast or cylinder is replaced, make shim adjustment at the cylinder support. With the cylinder rod end inserted to the inner mast, eliminate the clearance between the cylinder support and outer mast by inserting shims. The shim thickness should be slightly thicker.

Reassembly:

The supports can be used in either the upper or lower direction. Since a level difference of 5 mm (0.20 in) will arise depending on the direction, install in the direction for less clearance with the cylinder.

16 ~ 32, 55 model

Disassembly:

Take a note on the number of cylinder support shims in use.

Reassembly:

Make cylinder support shim adjustment if the mast or either cylinder is replaced.

With the cylinder rod end inserted to the inner mast, insert shim(s) between the cylinder support and outer mast to eliminate the clearance. The shim thickness should be slightly greater than the clearance.

45 model

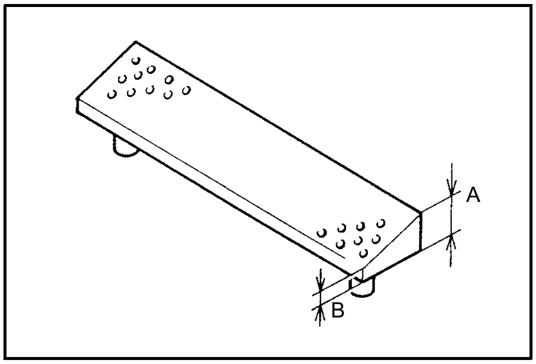
Disassembly:

Take a note on the number of cylinder support shims in use.

Reassembly:

Make cylinder support shim adjustment if the mast or either cylinder is replaced.

With the cylinder rod end inserted to the inner mast, insert shim(s) between the cylinder support and outer mast to eliminate the clearance. The shim thickness should be slightly greater than the clearance.



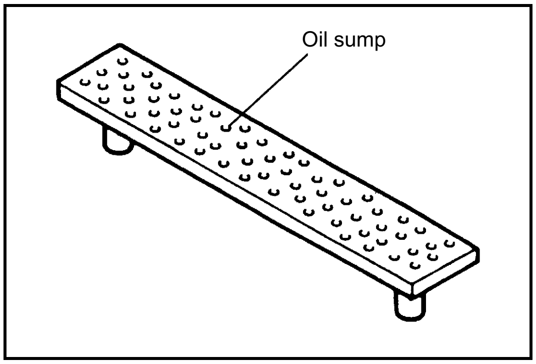
[Point 3]

Inspection:

15 ~ 32 model

Measure the mast strip thickness.

Thickness limit: A = 2.7 mm (0.106 in)
B = 1.3 mm (0.051 in)



35 ~ 55 model

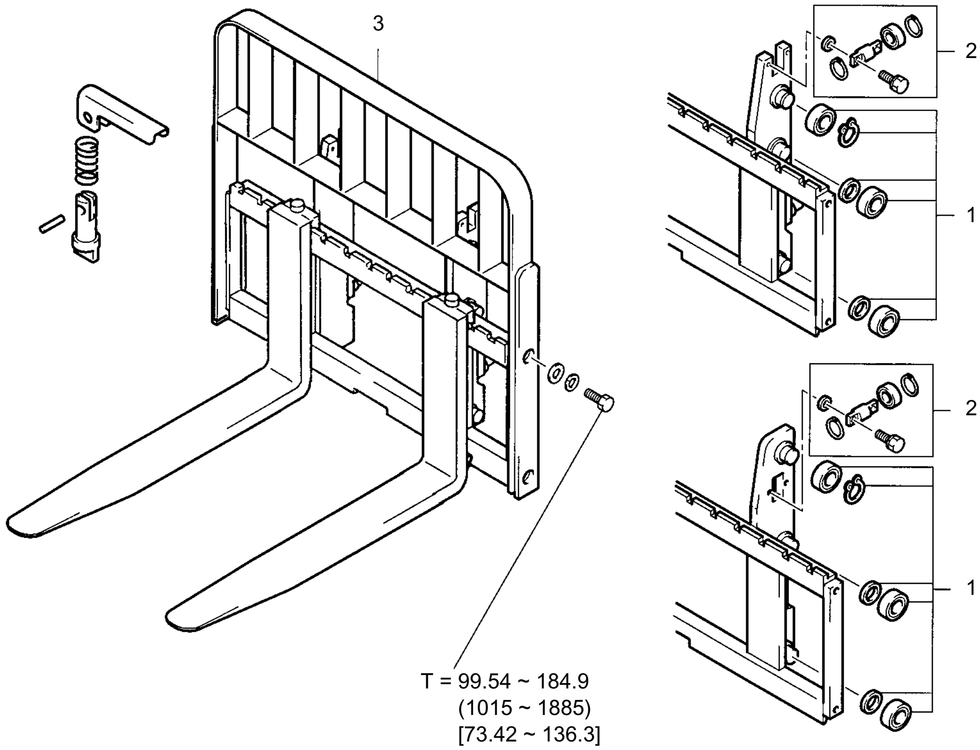
Inspect the mast strip for wear.

Limit: Worn to leave no oil sump

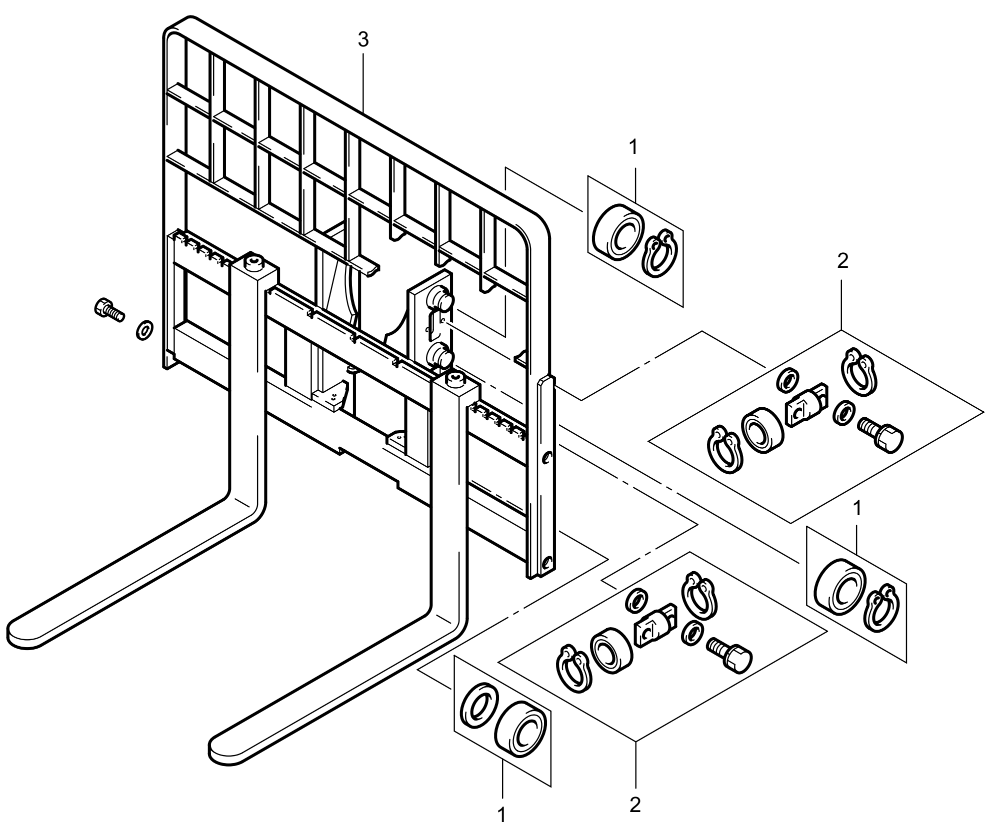
LIFT BRACKET DISASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]

15 ~ 32 model



35 ~ 55 model

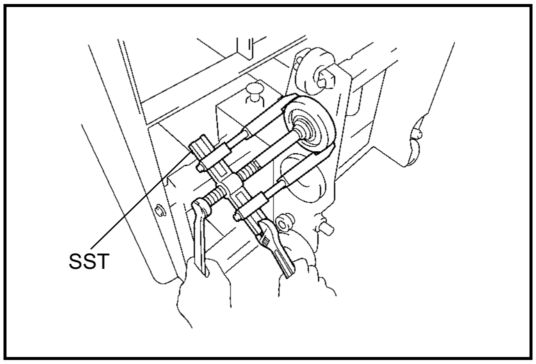


Disassembly Procedure

1 Remove lift rollers. **[Point 1]**
2 Remove side rollers. **[Point 2]**
3 Remove the back rest.

Reassembly Procedure

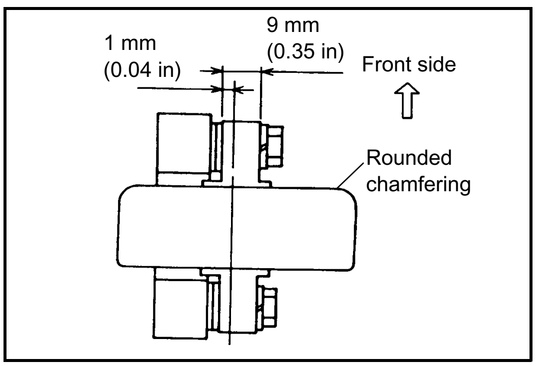
The reassembly procedure is the reverse of the disassembly procedure.



Point Operations

[Point 1]

Disassembly:
SST 09950-76014-71
(SST 09950-40011)



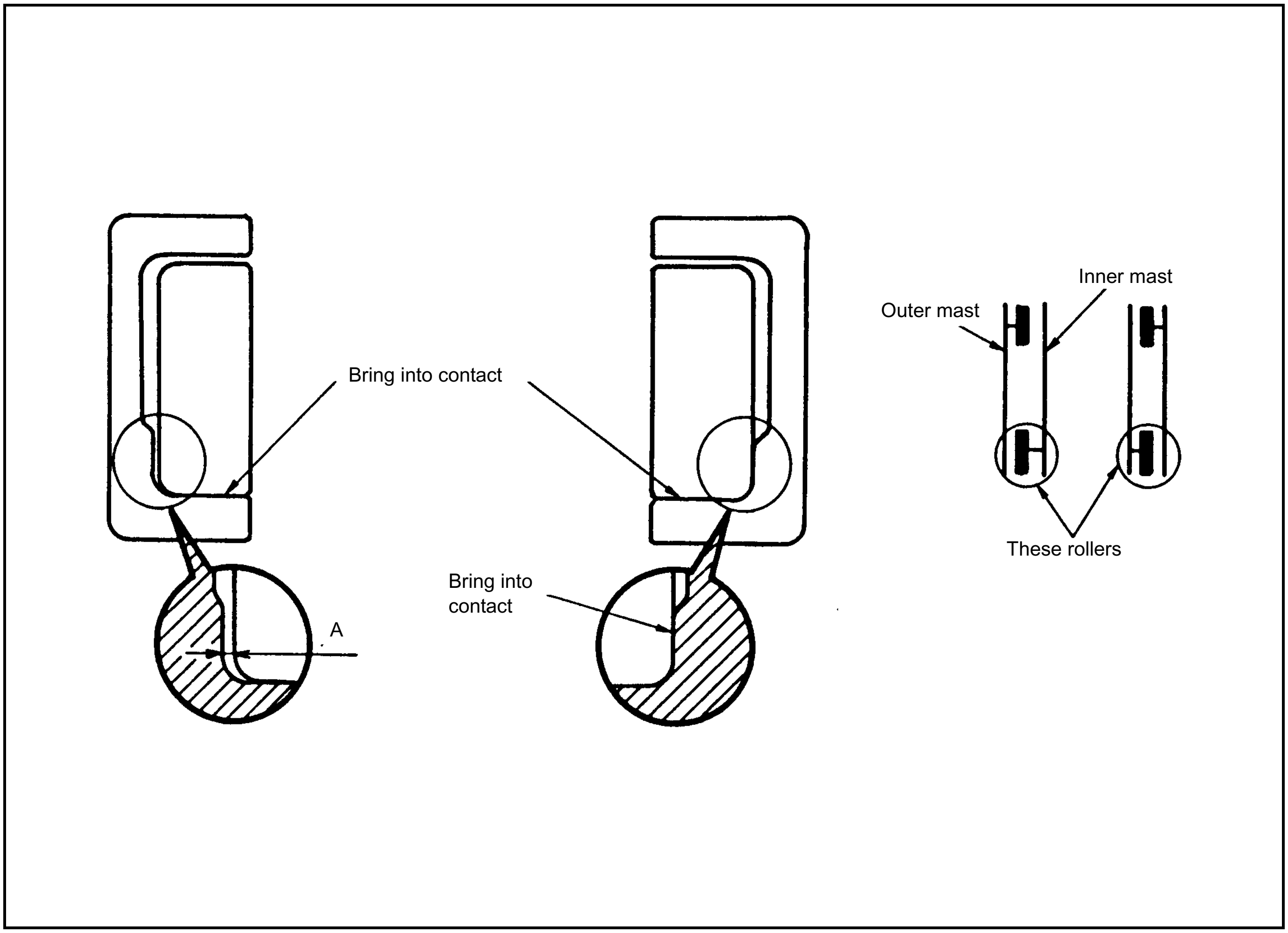
[Point 2]

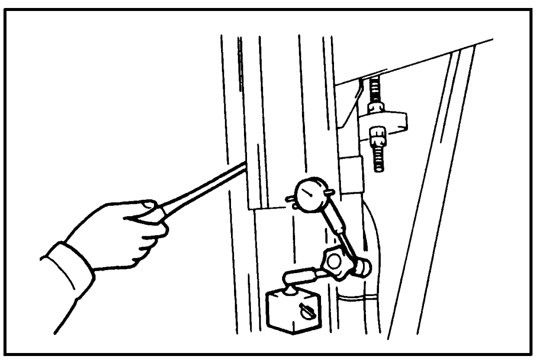
Reassembly:
Install the side roller in the correct direction.
The side chamfered with a greater radius of the roller shall be on the front side of the vehicle.

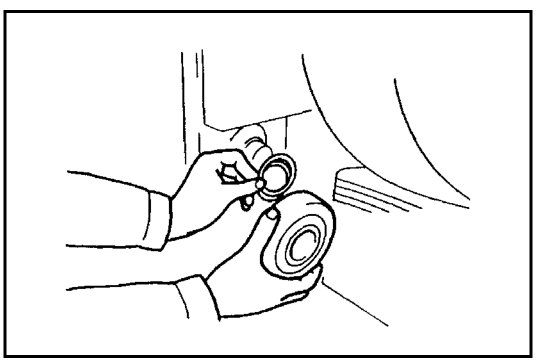
MAST ADJUSTMENT (V MAST, 15 ~ 32 MODEL)

Lift Roller Adjustment at Mast

1. Clearance between inner mast roller and outer mast







(1) Adjust the mast overlap to approx. 450 mm (17.72 in).

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and inspect the clearance between the roller side face and mast where they are the closest.

Standard: A = 0 ~ 0.8 mm (0 ~ 0.031 in)

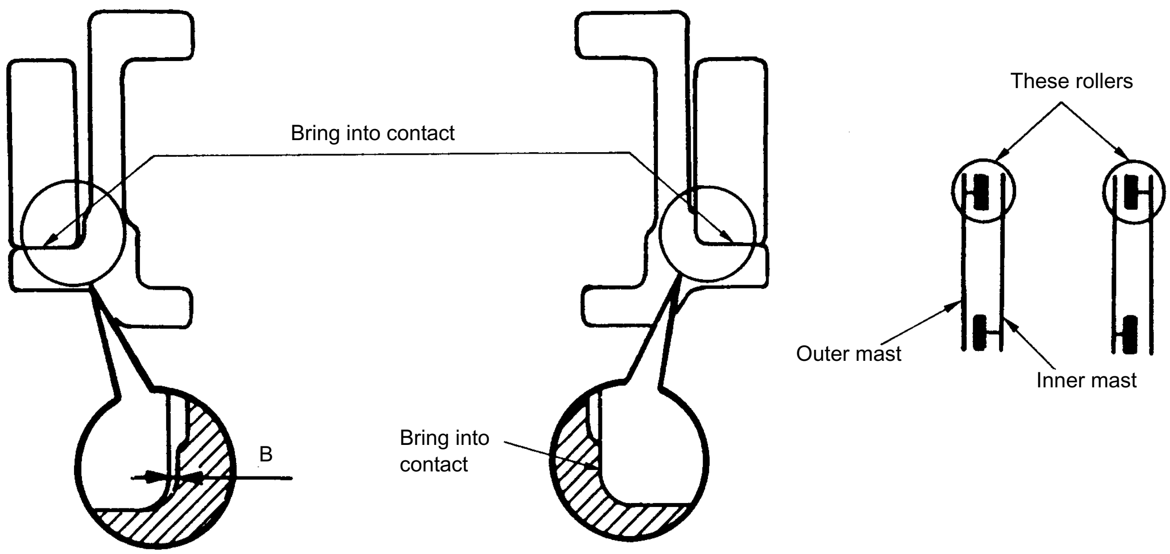
If the standard is not satisfied, make adjustment by changing the inner mast roller shim thickness. (See page 13-28 for the mast roller removal and installation.)

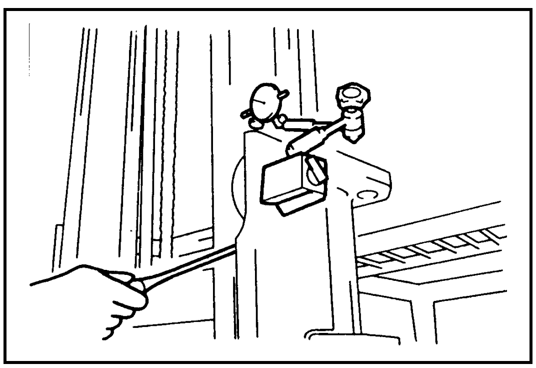
Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

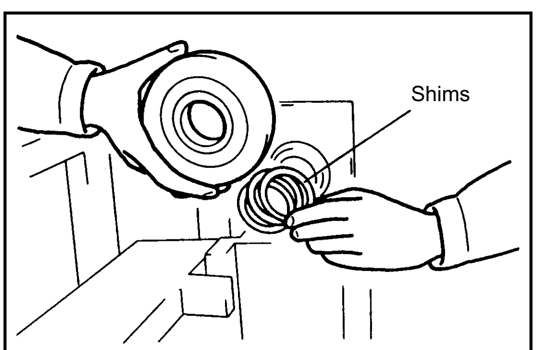
(3) Distribute shims equally to the rollers on the left and right side.

(4) After the adjustment, see that the inner mast moves smoothly in the outer mast.

2. Clearance between outer mast roller and inner mast







(1) Adjust the mast overlap to approx. 450 mm (17.72 in).

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and inspect the clearance between the roller side face and mast where they are the closest.

Standard: B = 0 ~ 0.5 mm (0 ~ 0.020 in)

If the standard is not satisfied, make adjustment by changing the outer mast roller shim thickness.
(See page 13-28 for the mast roller removal and installation.)

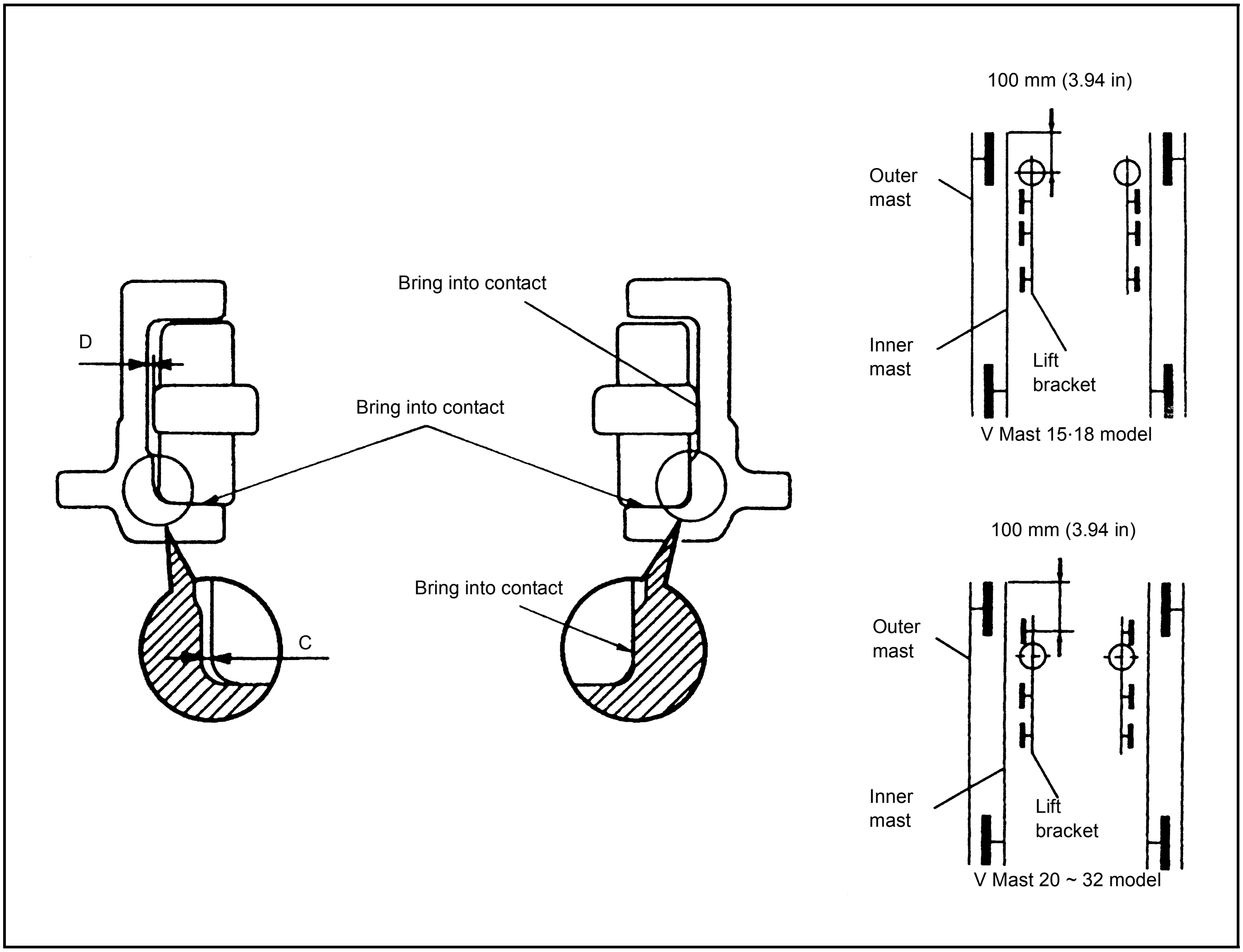
Shim thickness: 0.5 and 1.0 mm
(0.020 and 0.039 in)

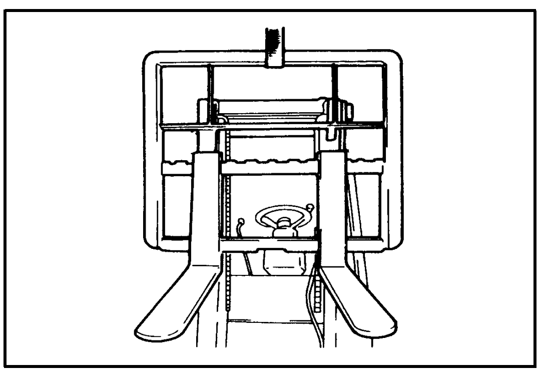
(3) Distribute shims equally to the rollers on the left and right side.

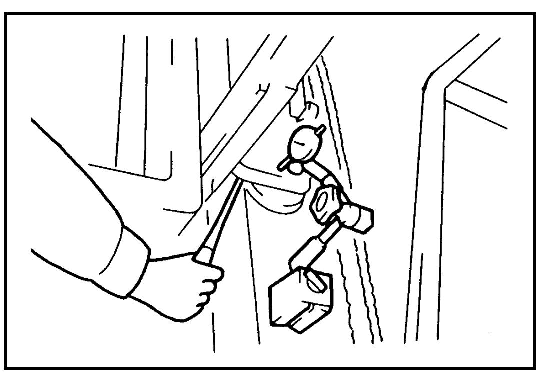
(4) After the adjustment, see that the inner mast moves smoothly in the outer mast.

Roller Adjustment at Lift Bracket

1. Middle/lower lift roller and side roller clearance adjustment





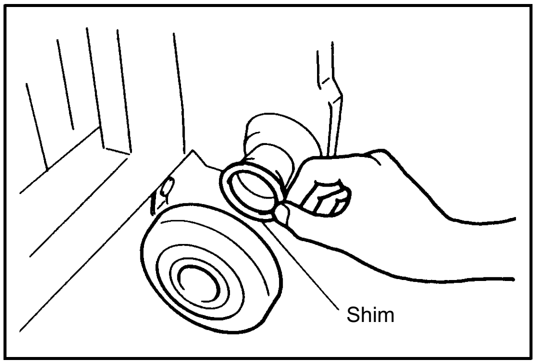


(1) Bring the center of the roller in the upper part of the lift bracket to approx. 100 mm (3.94 in) from the top of the inner mast.
(2) Remove side rollers.
(3) Shift the lift bracket to one side to bring the roller into contact with the inner mast, and inspect on the opposite side the clearance between the roller side face and the mast where they are the closest. (No adjustment is necessary for the upper lift rollers since they are fastened by snap rings.)

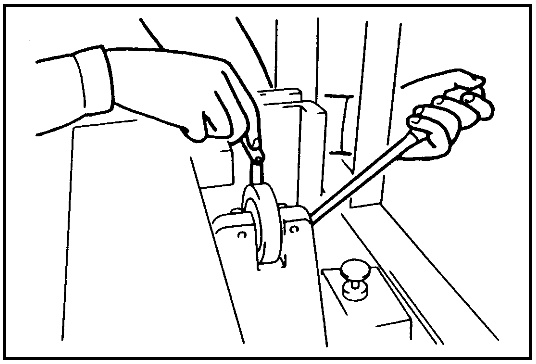
Standard
15·18 model:
C = 0 ~ 0.8 mm (0 ~ 0.031 in)
20 ~ 32 model:
C = 0 ~ 0.5 mm (0 ~ 0.020 in)

If the standard is not satisfied, make adjustment by changing the lift roller shim thickness.

Shim thickness: 0.5 and 1.0 mm
(0.020 and 0.039 in)



(4) Distribute shims equally to the left and right side.
(5) Install side rollers.

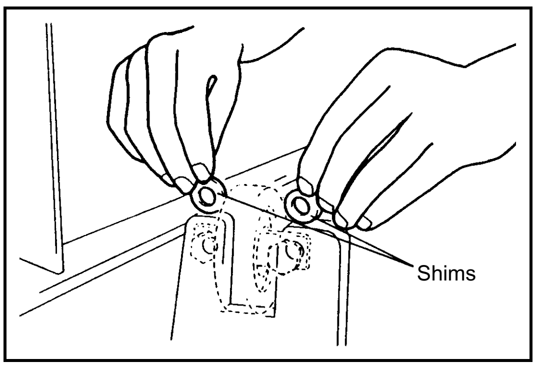


(6) After adjusting the middle and lower lift rollers, bring the side roller on one side into contact with the outer mast and measure on the opposite side the clearance between the side roller and inner mast surface.

Standard
15·18 model:
D = 0 ~ 0.6 mm (0 ~ 0.024 in)
20 ~ 32 model:
D = 0 ~ 0.5 mm (0 ~ 0.020 in)

If the standard is not satisfied, make adjustment by changing the side roller shim thickness.

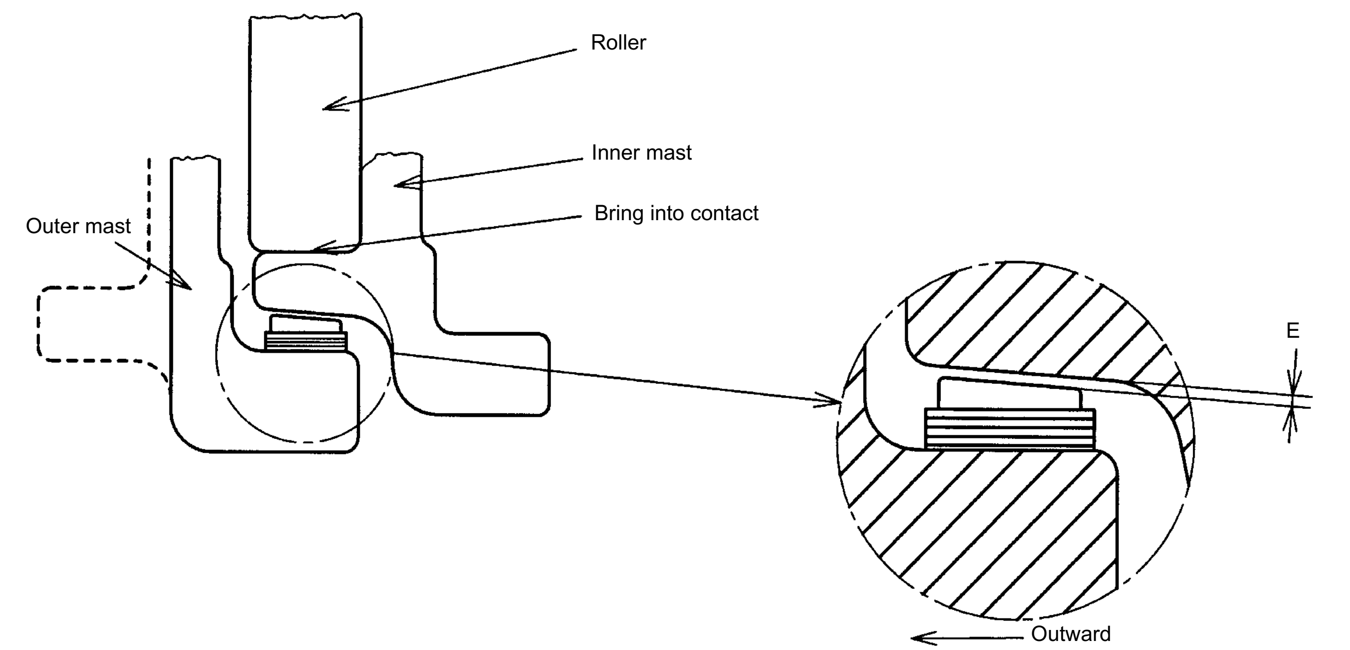
Shim thickness: 0.5 and 1.0 mm
(0.020 and 0.039 in)



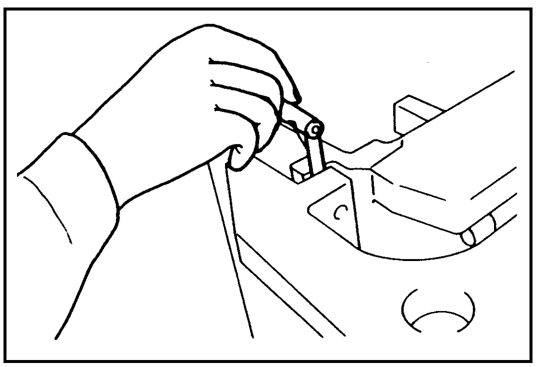
(7) Distribute shims equally to the left and right side. (See Lift Bracket Disassembly-Inspection-Reassembly section for the side roller installation method. Shim replacement is possible on the vehicle.)
(8) After the adjustment, see that the lift bracket moves smoothly over the entire length of the mast.

Mast Strip Adjustment

1. Mast strip clearance adjustment



Note: The strip is of tapered shape, thicker side of the width must be placed outward.



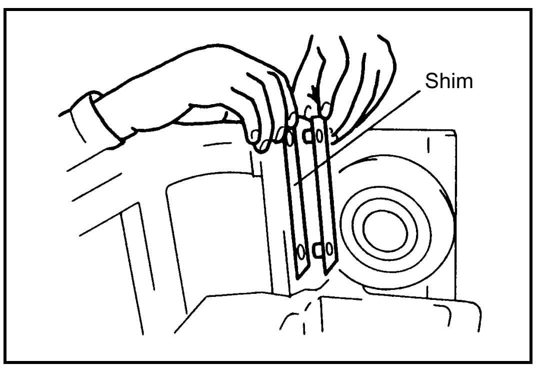
(1) Lower the inner mast fully.

(2) With the inner mast in contact with the outer mast roller, measure the clearance between the mast strip and inner mast.

Standard: E = 0.5 ~ 1.0 mm (0.020 ~ 0.039 in)

If the standard is not satisfied, make adjustment by changing the mast strip shim thickness. (See page 13-28 for the mast roller removal/installation method.)

Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

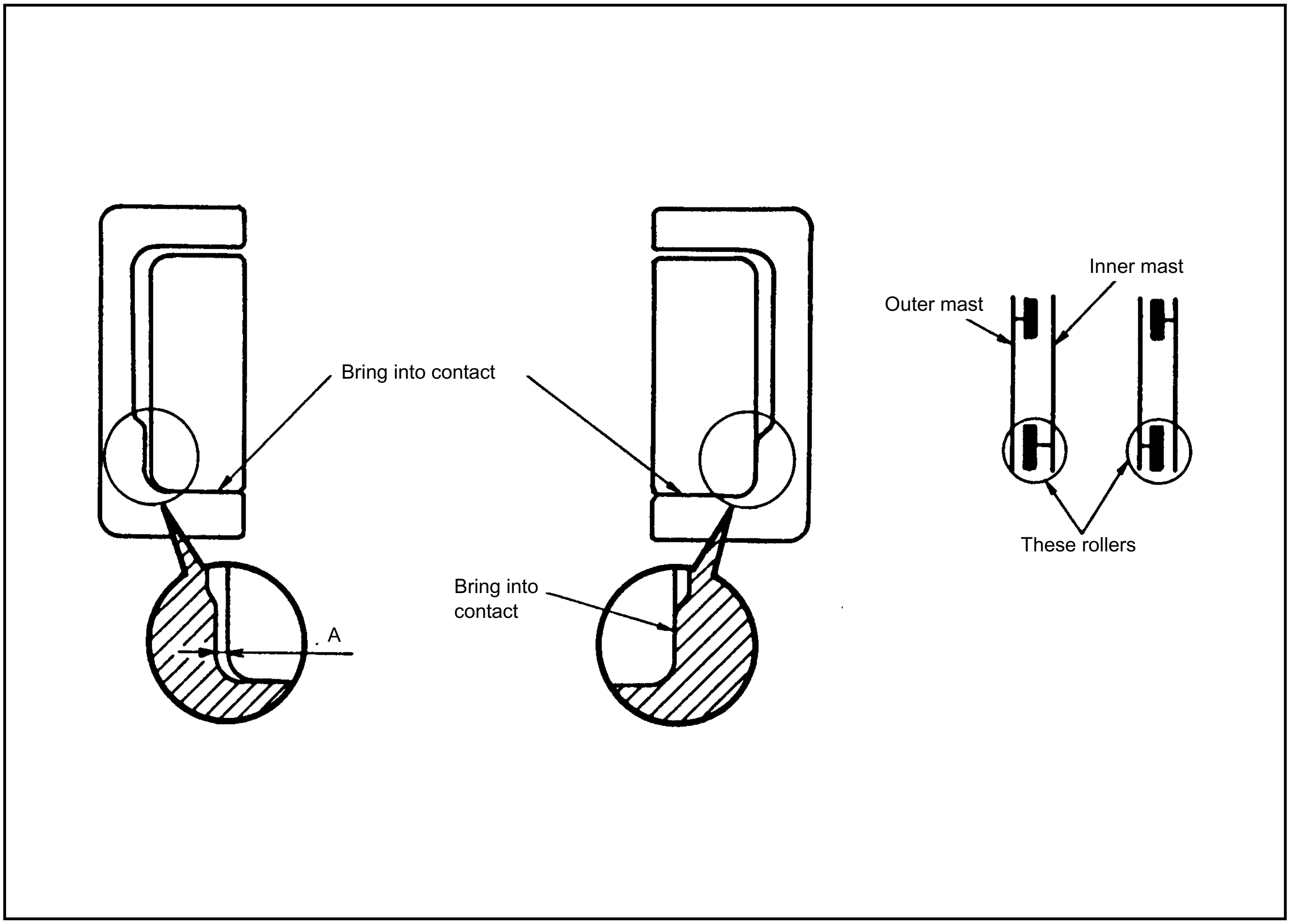


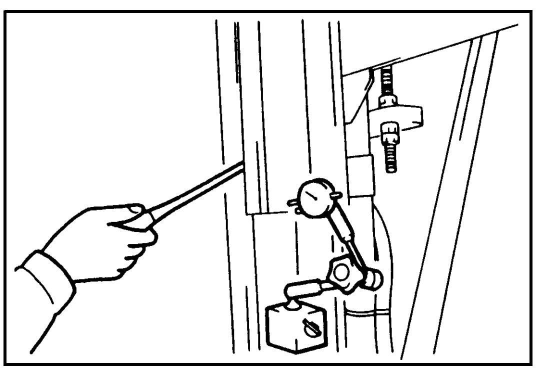
(3) After the adjustment, check the mast for smooth movement.

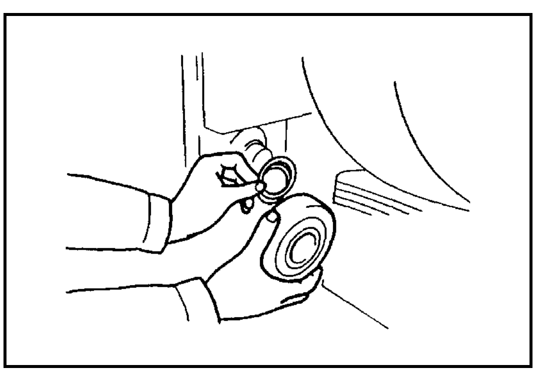
MAST ADJUSTMENT (V MAST, 35 ~ 55 MODEL)

Lift Roller Adjustment at Mast

1. Inner mast roller clearance adjustment







(1) Adjust the mast overlap to approx. 500 mm (19.69 in).

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and measure the clearance between the roller side face and mast on the opposite side where they are the closest.

Standard: A = 0 ~ 0.8 mm (0 ~ 0.031 in)

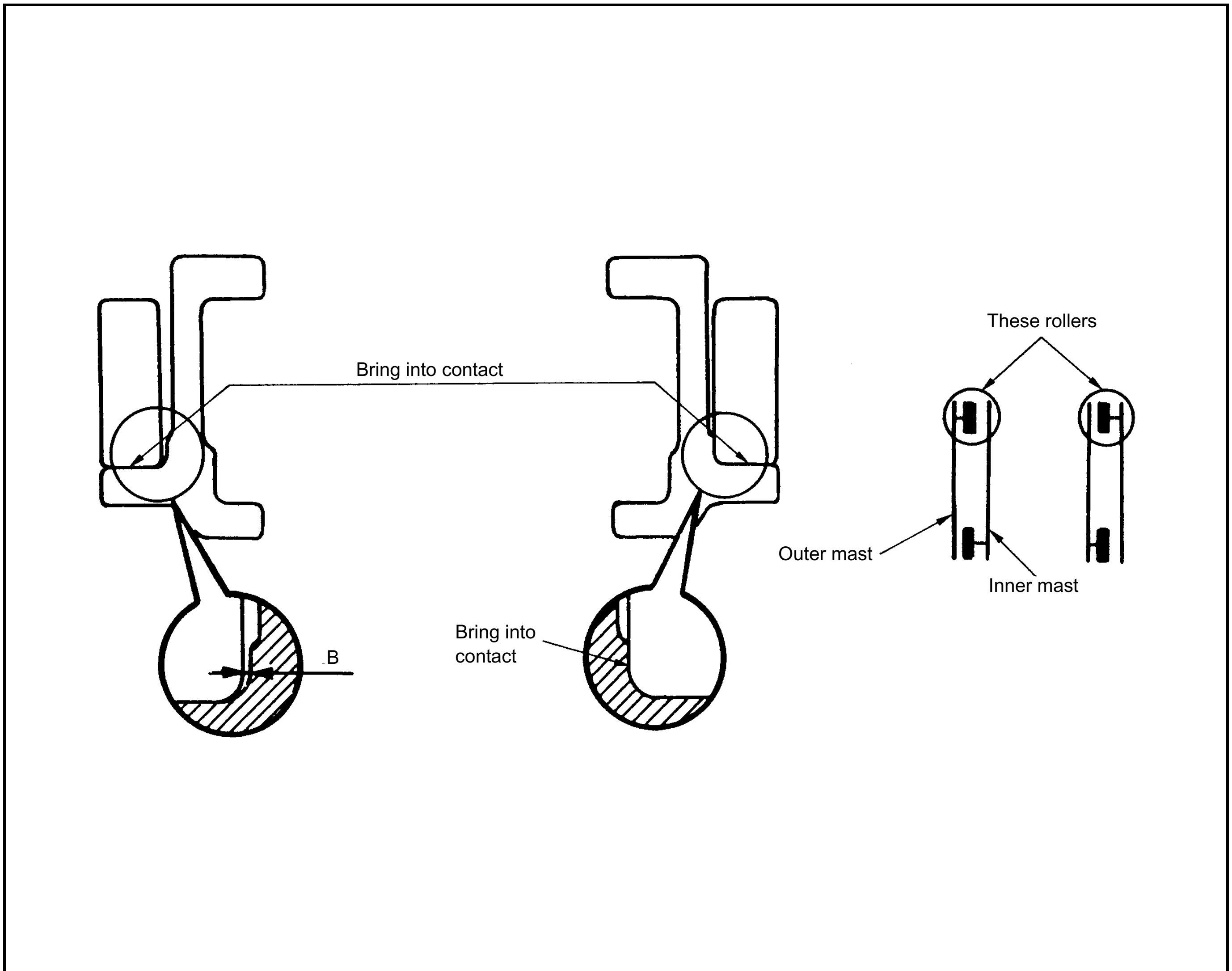
If the standard is not satisfied, make adjustment by changing the inner mast roller shim thickness. (See page 13-28 for the mast roller removal and installation.)

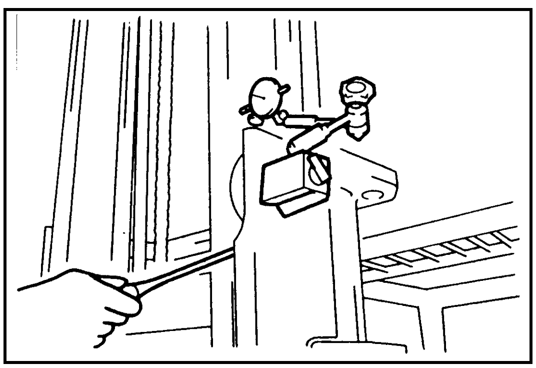
Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

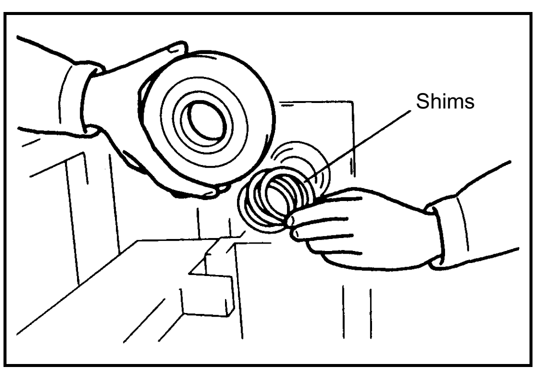
(3) Distribute shims equally to the rollers on the left and right side.

(4) After the adjustment, see that the inner mast moves smoothly in the outer mast.

2. Outer mast roller clearance adjustment







(1) Adjust the mast overlap to approx. 500 mm (19.69 in).

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and measure the clearance between the roller side face and mast on the opposite side where they are the closest.

Standard: B = 0 ~ 0.8 mm (0 ~ 0.031 in)

If the standard is not satisfied, make adjustment by changing the outer mast roller shim thickness.
(See page 13-28 for the mast roller removal and installation.)

Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(3) Distribute shims equally to the rollers on the left and right side.

(4) After the adjustment, see that the inner mast moves smoothly in the outer mast.

3. Roller selection

(1) In 35·45 models, use oversize No. 2 as a rule for the inner mast roller. Use No. 1 only when the mast inside width (rolling contact surface) is narrow. The roller size may be different between the right and left sides.

Inner mast roller

Model	No.	Outside diameter mm (in)	Outer mast inside width mm (in)	Remarks
35·45 model	No. 1	124.5 (4.902)	125.0 (4.921)	—
	No. 2	125.2 (4.929)		Oversize
55 model	No. 1	164.5 (6.476)	165.0 (6.496)	—

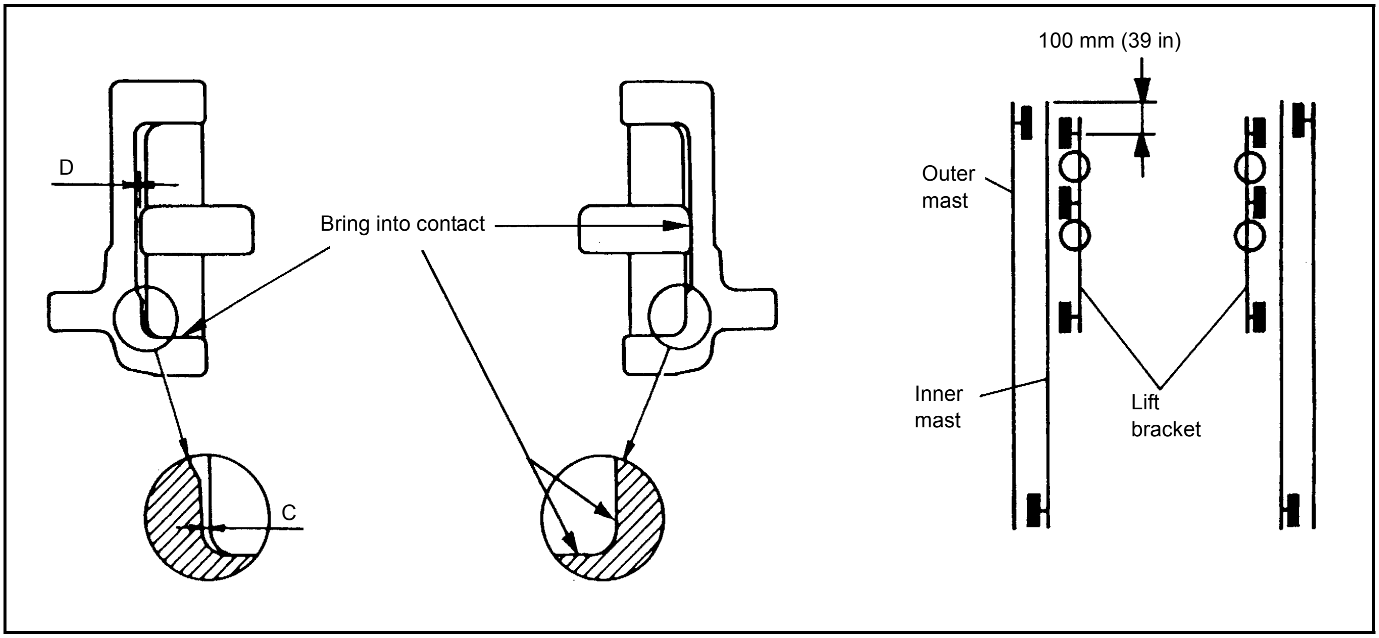
Outer mast roller

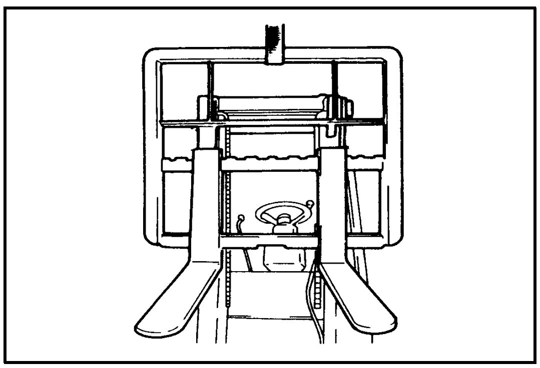
Model	Outside diameter mm (in)
35·45 model	124.5 (4.902)
55 model	164.5 (6.476)

Lift Bracket Roller Adjustment

1. Lift roller and side roller clearance adjustment

35·45 model



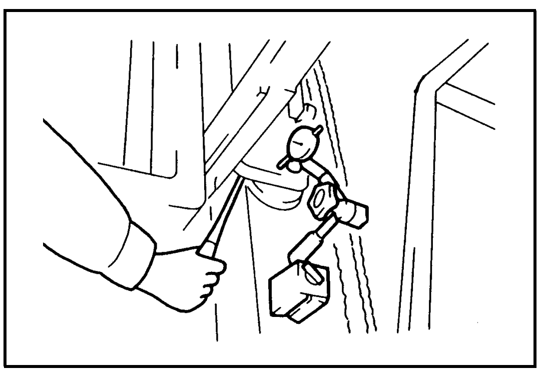


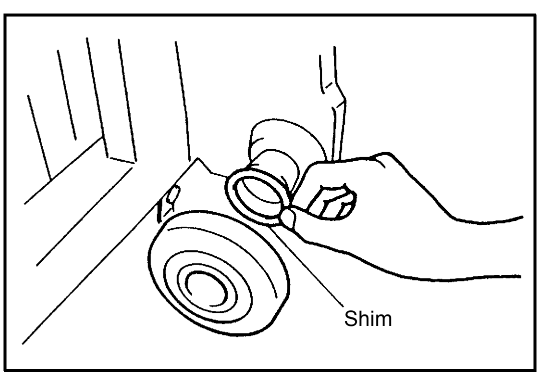
(1) Measure the clearance when the center of the lift bracket upper roller is 100 mm (3.9 in) from the top of the inner mast.

(2) The upper lift rollers and the middle lift rollers need no adjustment because they are fixed by snap rings.

(3) Measure the clearances at the lower lift rollers after removing the side rollers.
Shift the lift bracket to one side to bring the roller into contact with the inner mast, and measure the clearance between the roller side face and the mast at the closest position on the opposite side to the following value by inserting the lift roller shim.

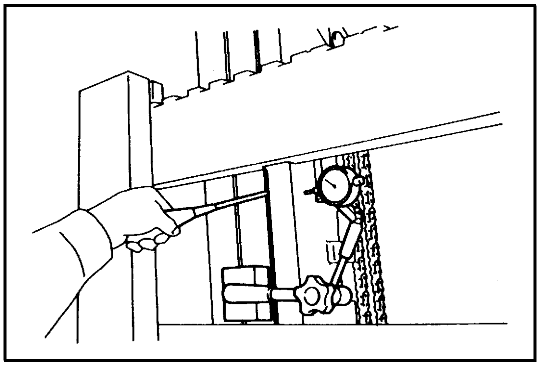
Standard clearance: C = 0 ~ 0.5 mm (0 ~ 0.020 in)
Shim thickness:
0.5 and 1.0 mm (0.020 and 0.039 in)





(4) Distribute the shim thickness equally to the left and right sides. (For the shim replacement procedure, see the lift bracket disassembly section on page 13-28.)

(5) Install the side rollers.



(6) Adjust the upper side rollers after adjusting the lower lift rollers.
Bring the side roller on one side into contact with the mast side surface and make adjustment by changing the side roller shims to make the clearance between the side roller and inner mast side surface on the opposite side satisfy the following standard:

Standard: D = 0 ~ 0.5 mm (0 ~ 0.020 in)
Shim thickness: 0.5·1.0 mm (0.020·0.039 in)

(7) Distribute shims equally between the side rollers RH and LH.

(8) Adjust the lower side rollers after adjusting the lower lift rollers and upper side rollers. Shift the lift bracket to one side to bring the upper side roller into contact with the mast side surface on that side, and make side roller shim adjustment to make the clearance between the side roller and mast side surface on the opposite side satisfy the following standard:

Standard: D = 0.5 ~ 1.0 mm (0.020 ~ 0.039 in)

Shim thickness: 0.5·1.0 mm (0.020·0.039 in)

(9) At the time of adjustment, see that the lift bracket moves smoothly along the entire length of the mast. Check that the lower side roller does not rotate in contact with the mast side surface. If the lower side roller rotates in contact, repeat adjustment in step (8) to widen the clearance between the roller and mast side surface so that the lower side roller does not rotate over the entire mast length.

55 model

(1) Perform measurement where the center of lift bracket upper lift roller is 100 mm (3.94 in) from the top end of the inner mast.

(2) Lift rollers out of lift bracket rollers do not require adjustment because of fastening with snap rings.
For side rollers, bring the side roller on one side into contact with the mast side surface, and make side roller shim adjustment to make the clearance between the side roller and mast surface.

Standard: 0 ~ 0.8 mm (0 ~ 0.031 in)

(3) After the adjustment, the lift bracket shall move smoothly along the entire length of the mast.

2. Roller selection

(1) As a rule, use only middle roller No. 1. (35 model)

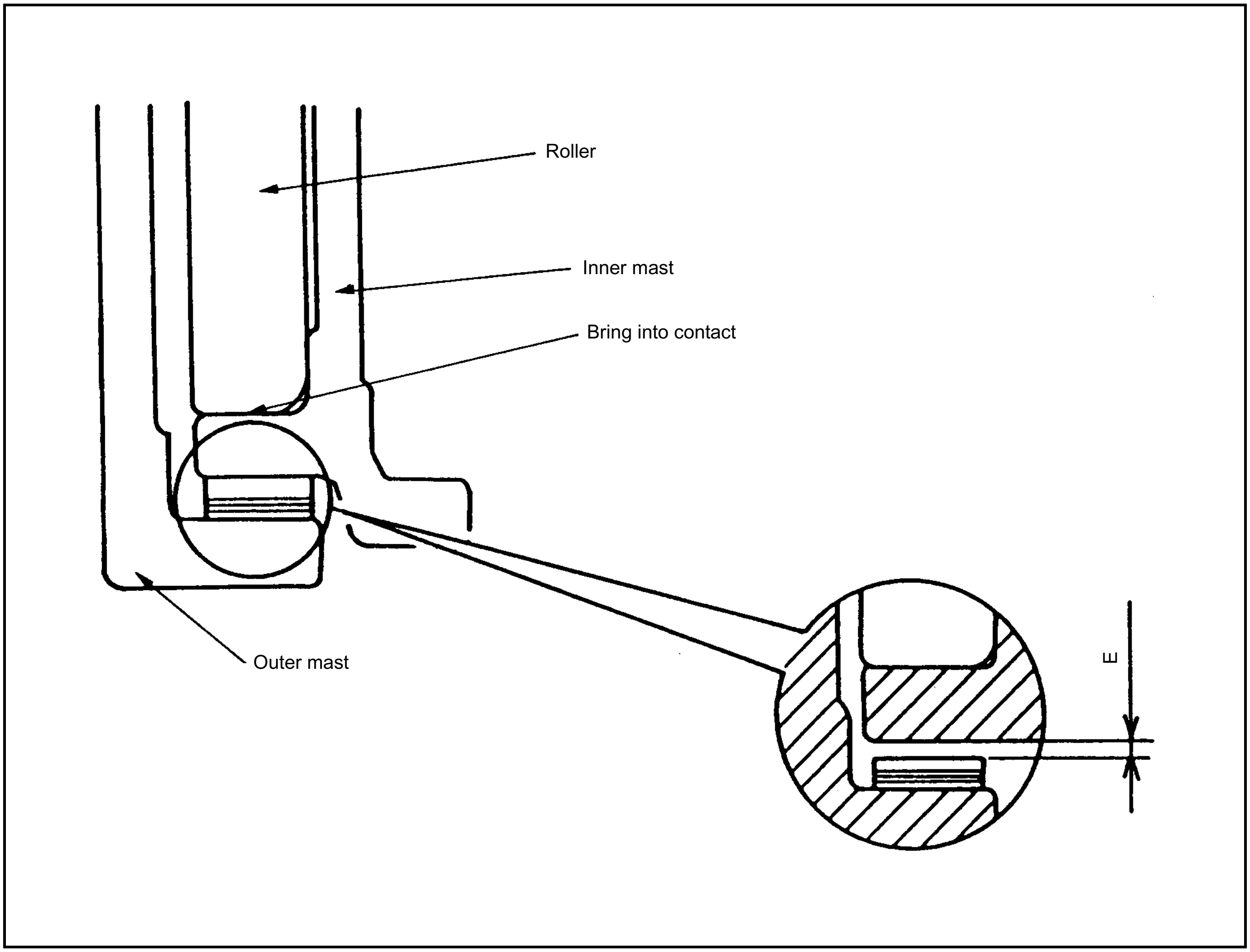
(2) As a rule, use upper and lower rollers No. 2 (oversize). Use No. 1 only when the mast inside width (at rolling contact surface) is narrow. The roller size may be different between the left and right or between the upper and lower side. (35 model)

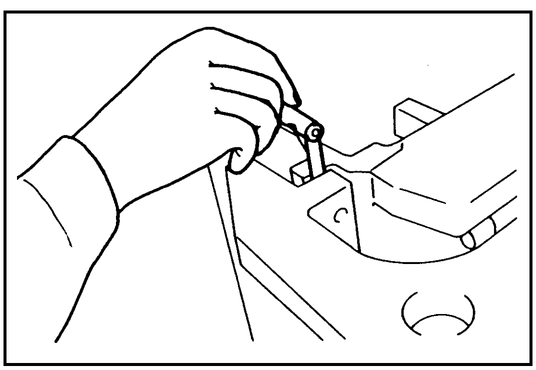
Lift bracket roller list

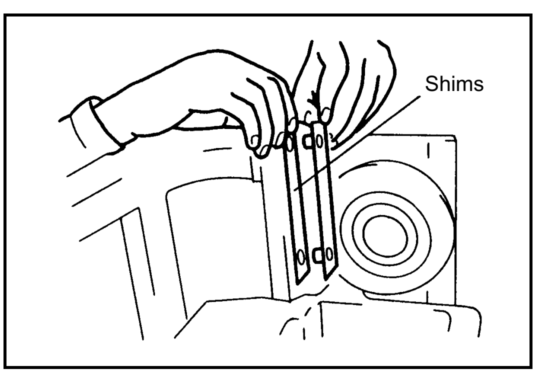
Model	No.	Outside diameter mm (in)	Place used	Remarks
35 model	No. 1	124.5 (4.902)	Lift roller	—
	No. 2	125.2 (4.929)	Lift roller	Oversize
	No. 3	93.3 (3.673)	Side roller	—
45 model	No. 4	124.5 (4.902)	Lift roller	—
	No. 5	100.0 (3.937)	Side roller	—

Mast Strip Adjustment

1. Mast strip clearance adjustment







(1) Lower the inner mast fully.

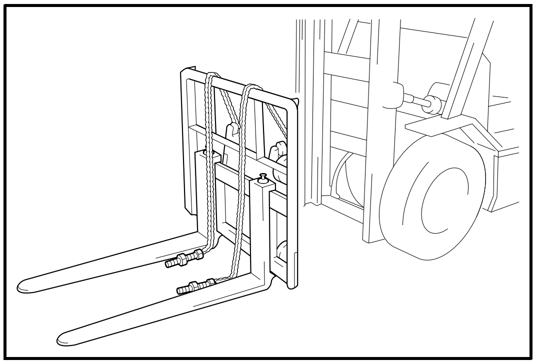
(2) With the inner mast in contact with the outer mast roller, measure the clearance between the mast strip and inner mast.

Standard: E = 0 ~ 0.8 mm (0 ~ 0.031 in)

If the standard is not satisfied, make adjustment by changing the mast strip shim thickness. (See page 13-28 for the mast roller removal/installation method.)

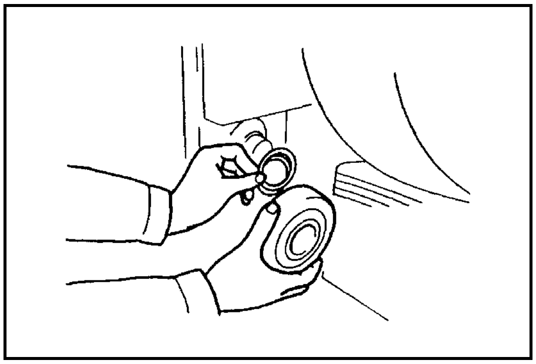
Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(3) After the adjustment, check the mast for smooth movement.

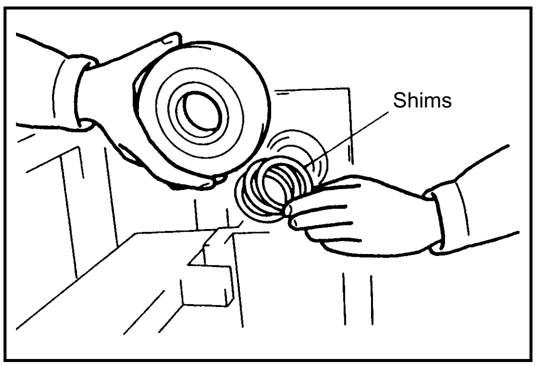


MAST ROLLER REMOVAL·INSTALLATION

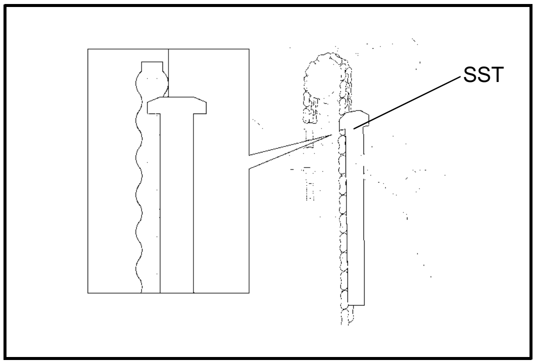
1. Remove the lift bracket. (See steps 1 to 4 of the mast ASSY removal procedure on page 13-7.)
2. Jack up the vehicle, and support tires with wooden blocks. Also lock the front and rear tires from rotation.
3. Remove the lift cylinders. (See page 14-20, 22.)

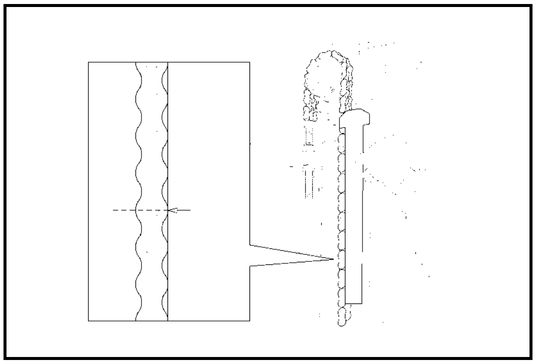


4. Remove mast rollers.
   (1) Remove wooden blocks under the inner mast, and lower the hoisted inner mast slowly until mast rollers appear.
   (2) Support the bottom of the inner mast with wooden blocks.
   (3) Remove the inner mast rollers and shims.



   (4) Remove the outer mast rollers and shims.
5. The installation procedure is the reverse of the removal procedure.





CHAIN (15 ~ 32 MODEL)

INSPECTION

1. Inspect the chain elongation according to the following procedure:
   SST 09631-22000-71
   (1) Since the SST measurement line varies with the chain type, set the corresponding line on the chain as illustrated.
   (2) Check the number of the chain to be inspected, and check the pin center position.
   If the pin center is at the arrow mark on the chain gauge, it is the limit.

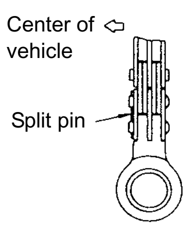
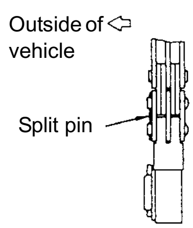
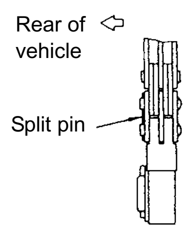
Chain Link Pitch Standard (V·FV·FSV·QFV)

Model	Pitch mm (in)	Type	Chain No.
15·18 model	15.88 (0.6252)	BL534	50
20·25 model QFV inner and middle chain	19.05 (0.7500)	BL634	60
30·32 model	25.4 (1.0)	BL823	80
QFV outer chain	25.4 (1.0)	BL834	80

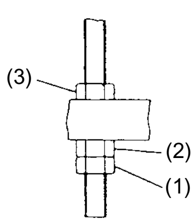
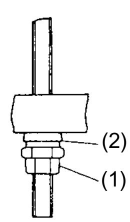
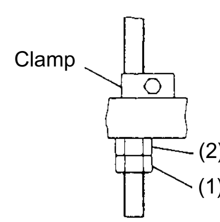
Note:
- **Perform measurement without removing the chain from the vehicle.**
- **Inspect elongation over the entire chain length since it may be localized.**

REASSEMBLY (V·FV·FSV)

1. Installing direction

Applicable mast and portion	V: Lift bracket	FV: Lift bracket FSV: Lift bracket	FSV: Inner mast
Sketch	 Install with the split pin on the vehicle center side.	 Install with the split pin on the vehicle outside.	 Install with the split pin on the vehicle rear side.

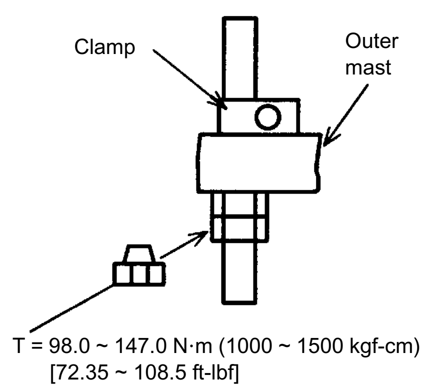
2. Chain adjusting nut tightening order
   (1) Tighten nuts (1) and (2). T = 49.0 ~ 78.0 N·m (500 ~ 800 kgf-cm) [36.1 ~ 57.5 ft-lbf]
   (2) Tighten nut (3).

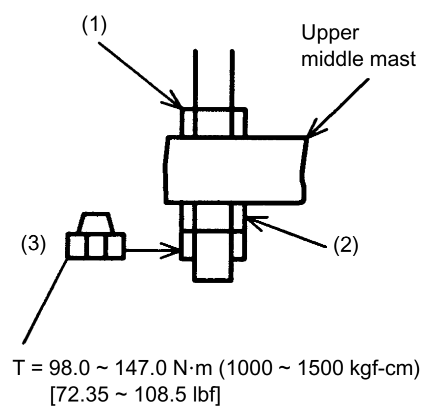
Applicable mast and portion	V: Outer mast FV: Front cylinder (15 ~ 25 model) FSV: Front cylinder (15 ~ 25 model)	FV: Front cylinder (30·32 mode) FSV: Front cylinder (30·32 mode)	FSV: Outer mast
Sketch			

REASSEMBLY (QFV)

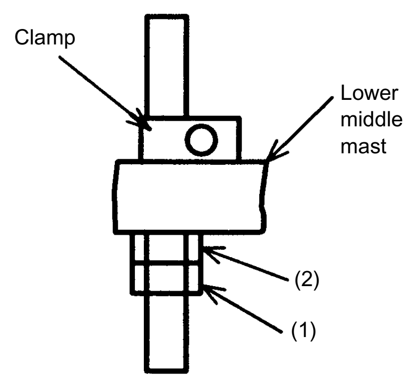
1. Installing direction
   As shown in the table below.
2. Chain adjusting nut tightening order
   (1) Tighten nuts (1) and (2). T = 49.0 ~ 78.0 N·m (500 ~ 800 kgf-cm) [36.1 ~ 57.5 ft-lbf]
   (2) Tighten nut (3).

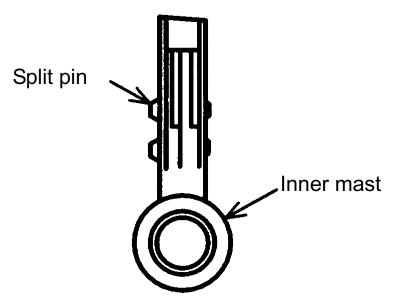
Outer chain





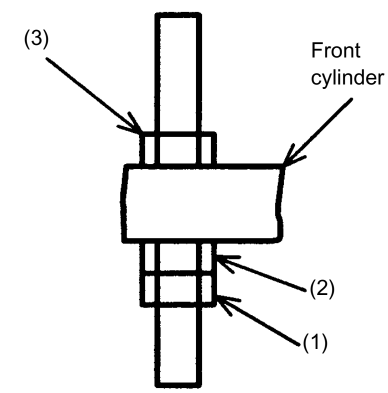
Middle chain

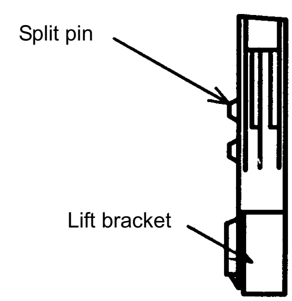




Installation side of split pin is at center side of the truck.

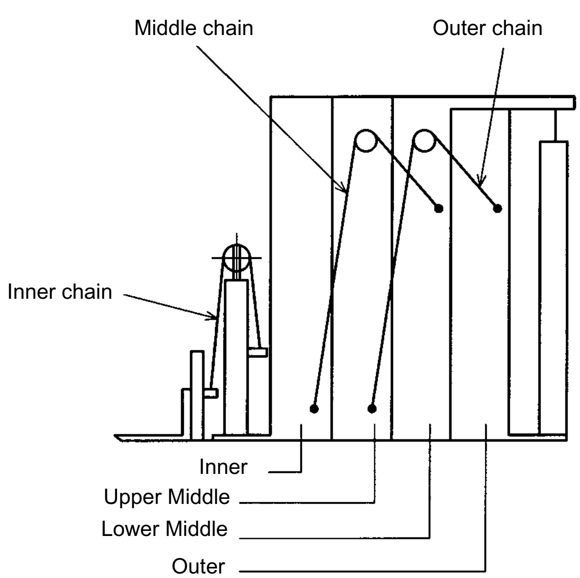
Inner chain





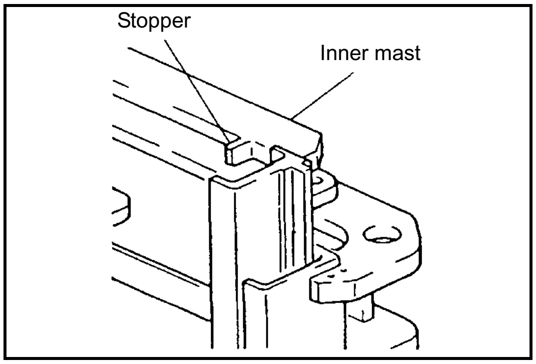
Installation side of split pin is outward of the truck center.

Chain connection

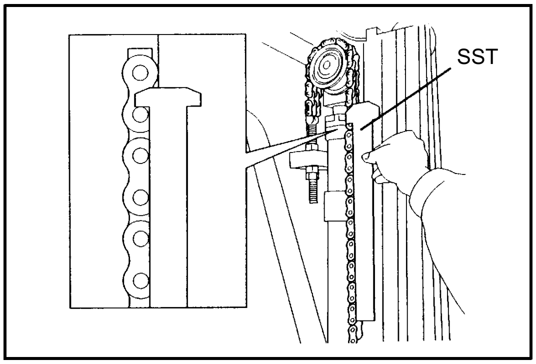


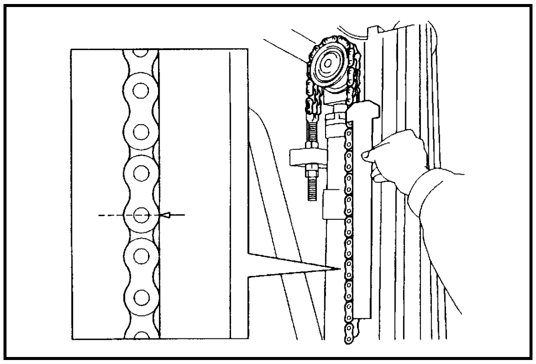
ADJUSTMENT

1. Park the vehicle on a flat ground and set the mast vertical.
2. Lower the fork to the ground, and make adjustment to eliminate any chain sag by turning the adjusting nut.
3. Check to see that the chain tension is equal on the left and right side.
4. Check to see no chain twist.
5. See that the fork height is the standard.
6. With the fork raised fully, check to see that the lift bracket freeing prevention stopper at the inner mast is not in contact with the lift bracket.



Note:
The stopper shows the instance of the V mast. Depending on the models, the type of the stopper differs although the principal of the stopper means is the same.





CHAIN (35 ~ 55 MODEL)

INSPECTION

1. Inspect the chain elongation according to the following procedure:
   SST 09631-22000-71
   (1) Since the SST measurement line varies with the chain type, set the corresponding line on the chain as illustrated.
   (2) Check the number of the chain to be inspected, and check the pin center position.
   If the pin center is at the arrow mark on the chain gauge, it is the limit.

Chain Link Pitch Standard

Model	Pitch mm (in)	Type	Chain No.
35 model	25.4 (1.0)	BL834	80
45·55 model	31.75 (1.2500)	BL1034	100

Note:
- **Perform measurement without removing the chain from the vehicle.**
- **Inspect elongation over the entire chain length since it may be localized.**

REASSEMBLY (V·FV·FSV)

Note:
- **Assemble in the order of the fixed side and adjusting side.**
- **Tighten (or install) in the order of illustrated numbers so as not to twist the chain.**

Tightening order & Tightening torque.

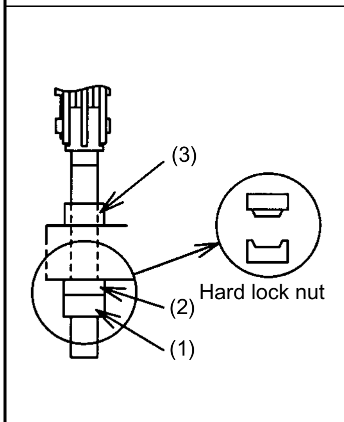
1. The chain stud bolt nuts (1), (2) should be tightened to the specified torque, as shown:

T = N·m (kgf-cm) [ft-lbf]

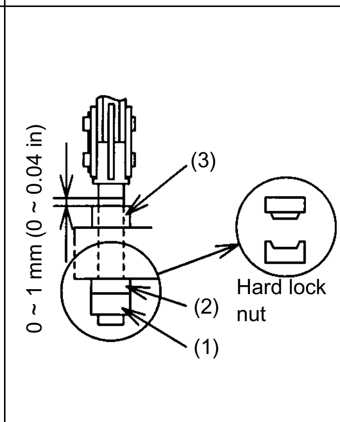
<table>
<tr><th rowspan="2">Mast / Model</th><th colspan="4">V</th><th colspan="4">FV</th></tr>
<tr><th colspan="2">Outer mast</th><th colspan="2">Lift bracket</th><th colspan="2">Front cylinder</th><th colspan="2">Lift bracket</th></tr>
<tr><td>35 model</td><td>A</td><td>98 ~ 147
(1000 ~ 1500)
[72 ~ 108]</td><td>B</td><td>98 ~ 147
(1000 ~ 1500)
[72 ~ 108]</td><td>A</td><td>98 ~ 147
(1000 ~ 1500)
[72 ~ 108]</td><td>B</td><td>98 ~ 147
(1000 ~ 1500)
[72 ~ 108]</td></tr>
<tr><td>45 model</td><td rowspan="2">D</td><td rowspan="2">167 ~ 225
(1700 ~ 2300)
[123 ~ 166]</td><td rowspan="2">E</td><td rowspan="2">167 ~ 225
(1700 ~ 2300)
[123 ~ 166]</td><td>D</td><td>167 ~ 225
(1700 ~ 2300)
[123 ~ 166]</td><td>E</td><td>167 ~ 225
(1700 ~ 2300)
[123 ~ 166]</td></tr>
<tr><td>55 model</td></tr>
</table>

Model \ Mast	FSV							
	Outer mast		Inner mast		Front cylinder		Lift bracket	
35 model	A G	98 ~ 147 (1000 ~ 1500) [72 ~ 108]	C	—	A	98 ~ 147 (1000 ~ 1500) [72 ~ 108]	B	98 ~ 147 (1000 ~ 1500) [72 ~ 108]
45·55 model	D	167 ~ 225 (1700 ~ 2300) [217 ~ 239]	J: 45 model F: 55 model	167 ~ 225 (1700 ~ 2300) [217 ~ 239]	D	167 ~ 225 (1700 ~ 2300) [217 ~ 239]	F	167 ~ 225 (1700 ~ 2300) [217 ~ 239]

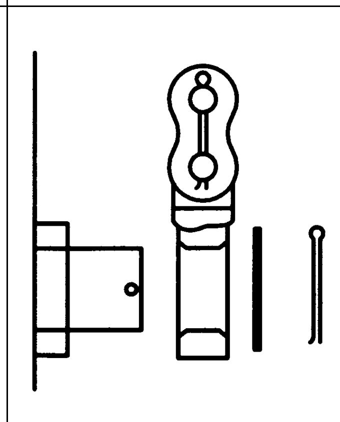
A



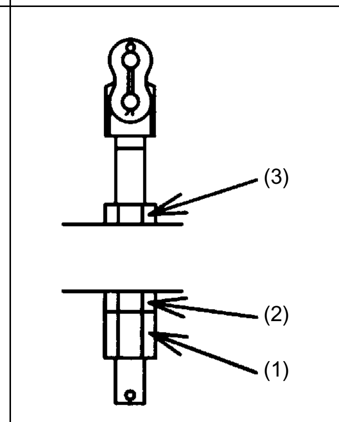
B



C



D



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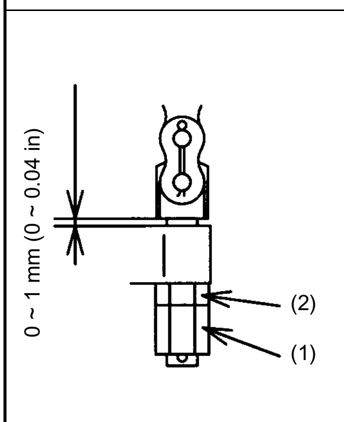

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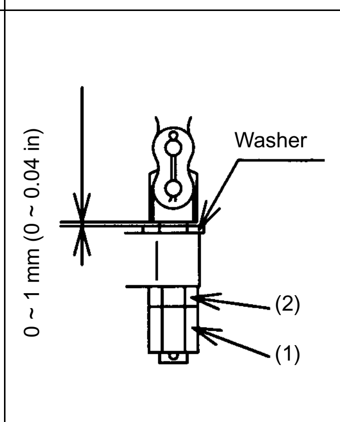

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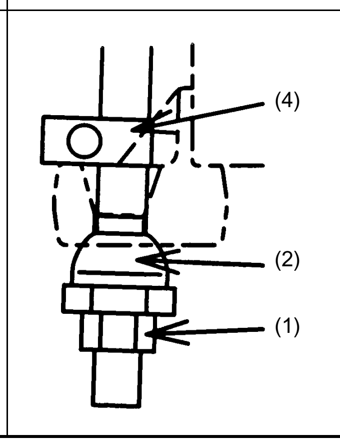
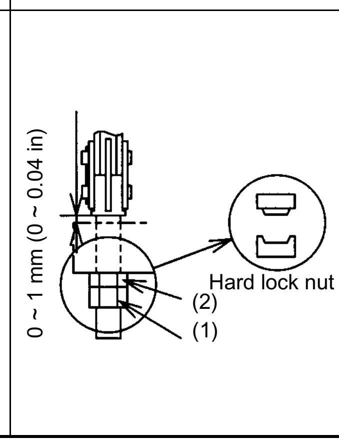
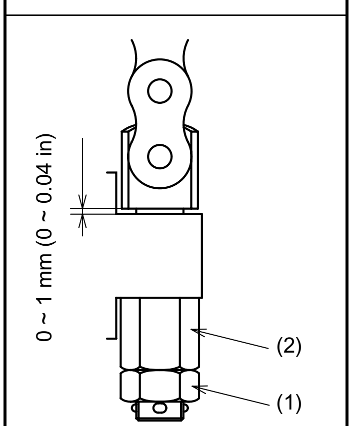


H



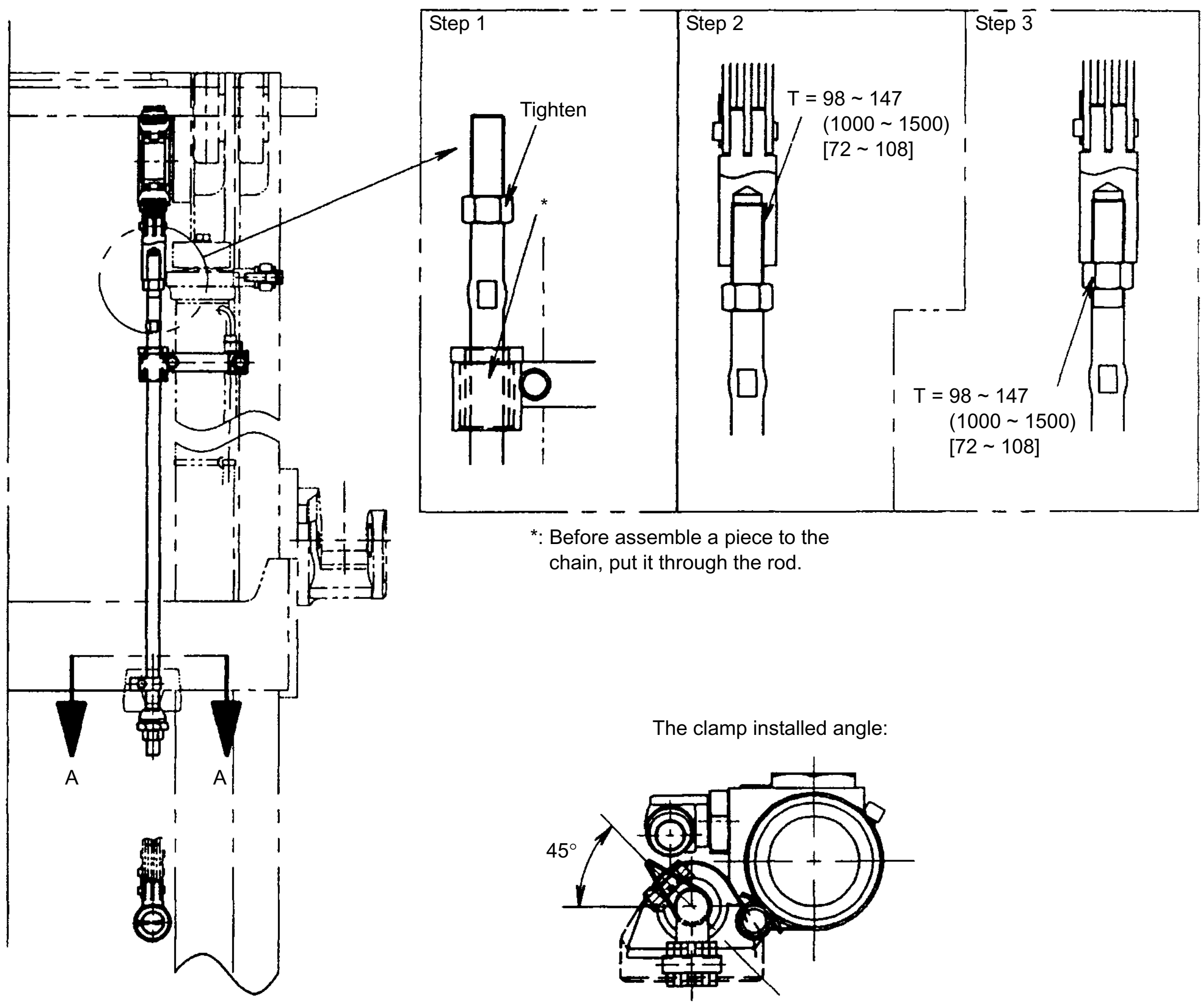
J



2. Tighten the nut (3), or (4)

3. 35 model FSV H3700 ~ H5500 mm (145 ~ 216.5 in)

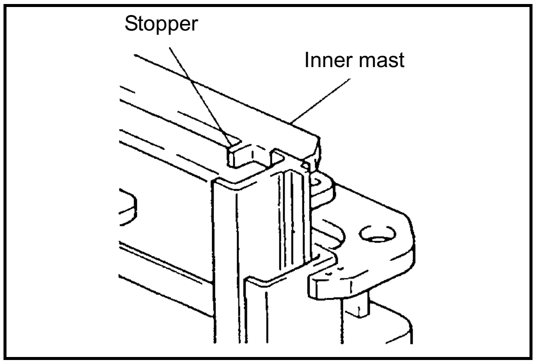
T = N·m (kgf-cm) [ft-lbf]



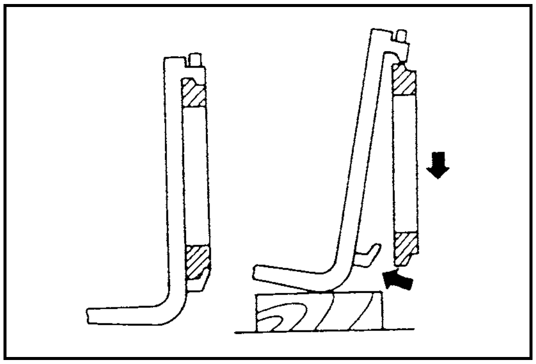
A — A

ADJUSTMENT

1. Park the vehicle on a flat ground and set the mast vertical.
2. Lower the fork to the ground, and make adjustment to eliminate any chain sag by turning the adjusting nut.
3. Check to see that the chain tension is equal on the left and right side.
4. Check to see no chain twist.
5. See that the fork height is the standard.
6. With the fork raised fully, check to see that the lift bracket freeing prevention stopper at the inner mast is not in contact with the lift bracket.



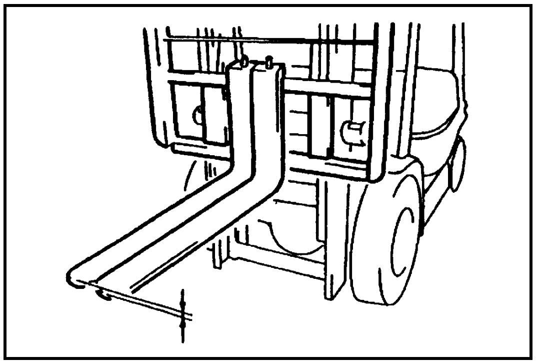
Note:
The stopper shows the instance of the V mast. Depending on the models, the type of the stopper differs although the principal of the stopper means is the same.



FORK

REMOVAL

1. Set the fork at approx. 20 cm (7.9 in) above the ground.
2. Place a wooden block under the knotched portion of the fork rail.
3. Unlock the fork by lifting the fork stopper pin, and shift the fork blades, one at a time, to the center.
4. Slowly lower the fork for removal.



INSTALLATION

The installation procedure is the reverse of the removal procedure.

INSPECTION

1. Inspect misalignment of the fork tip ends.

   Limit: 10 mm (0.39 in)

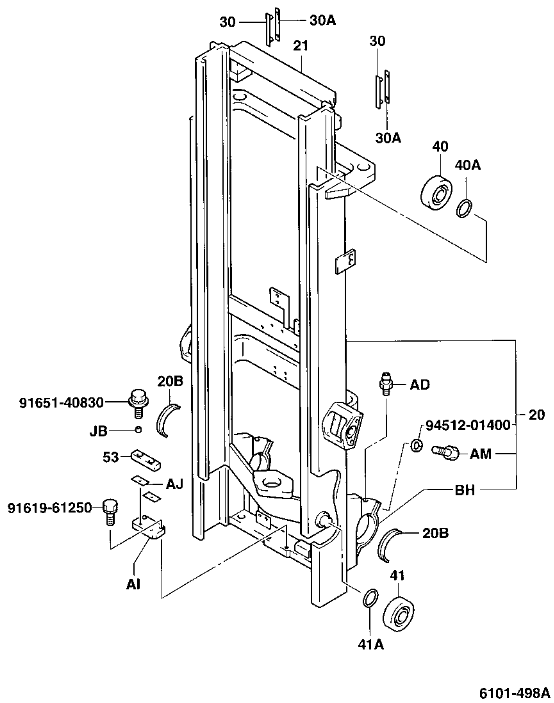
   If the limit is exceeded, inspect individual fork bend, looseness of fork installation and lift bracket finger bar distortion.

FV·FSV MAST ASSY

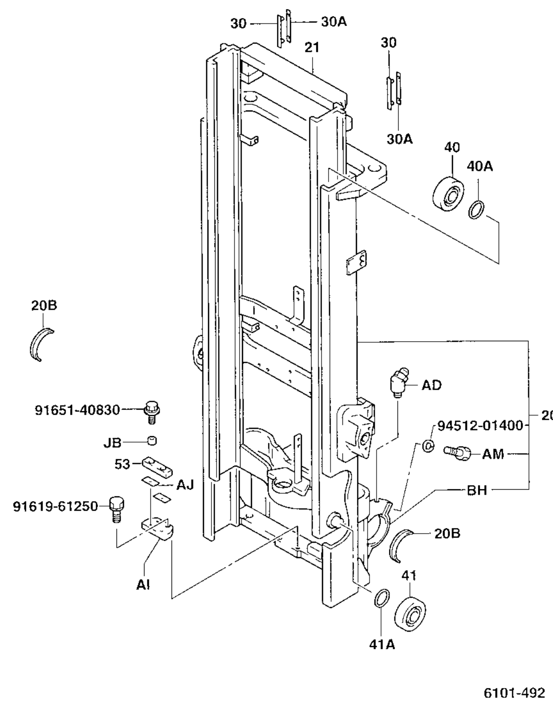
COMPONENTS

6101

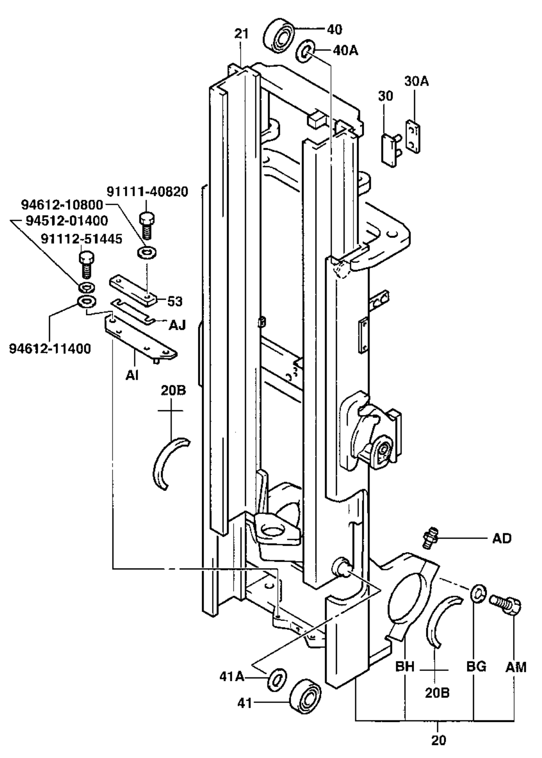
FV: 15·18 model



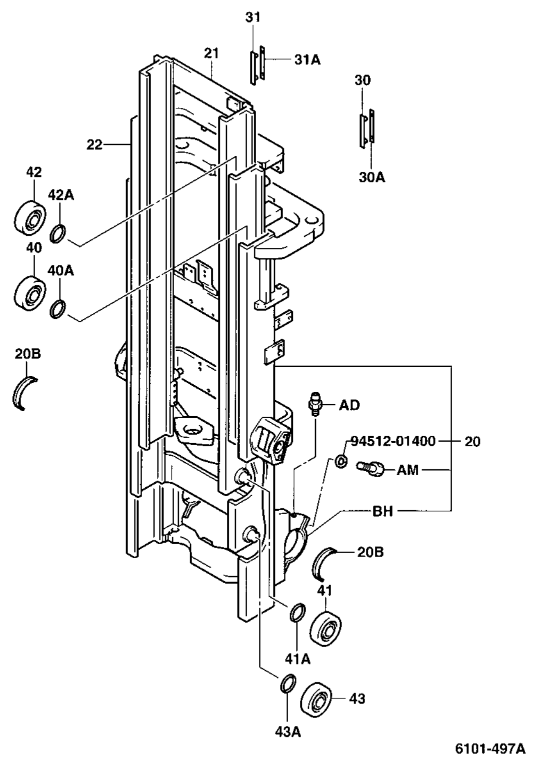
FV: 20 ~ 32 model

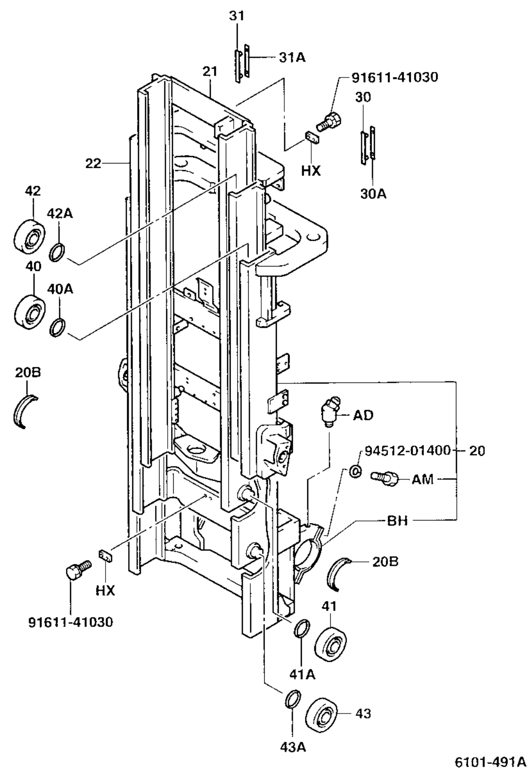


FV: 35·45 model

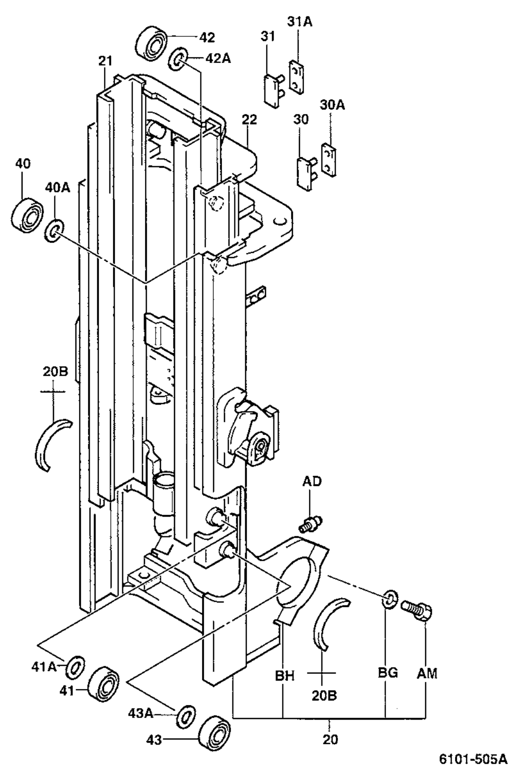


FSV: 15·18 model	FSV: 20 ~ 32 model	6101

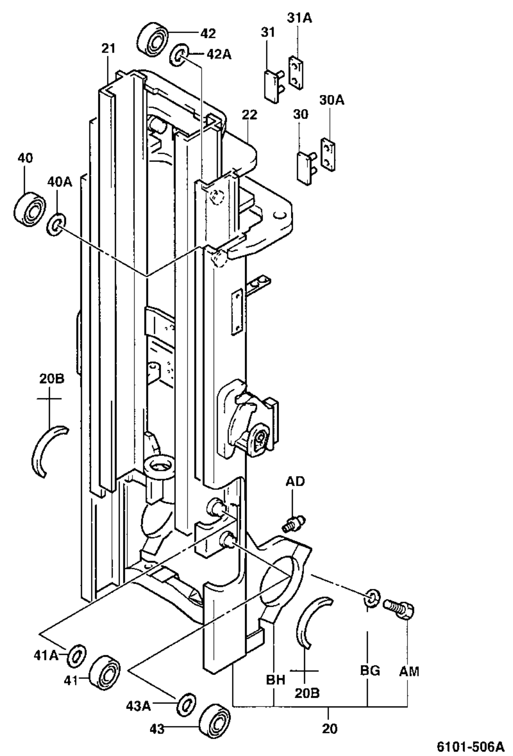




FSV: 35 model

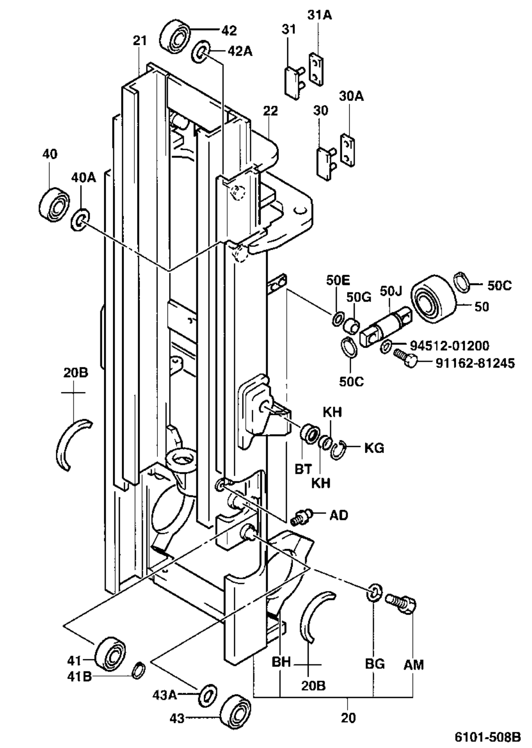


FSV: 45 model



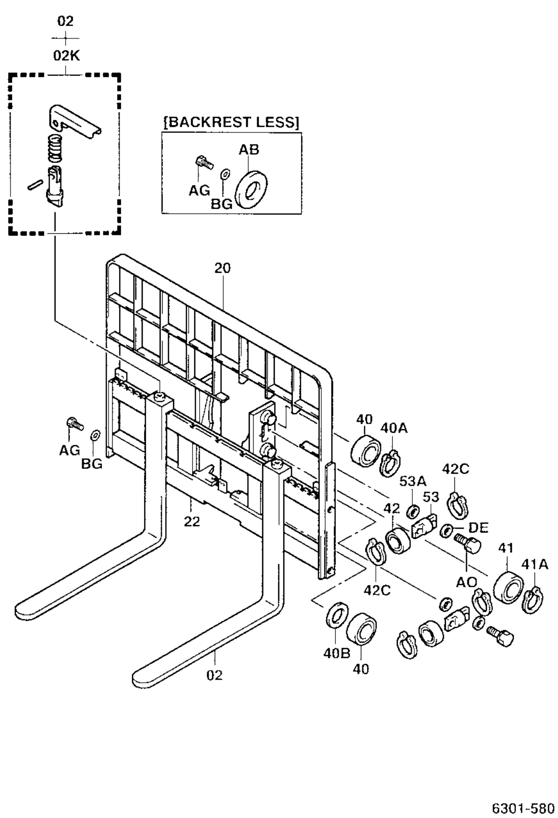
FSV: 55 model

6101



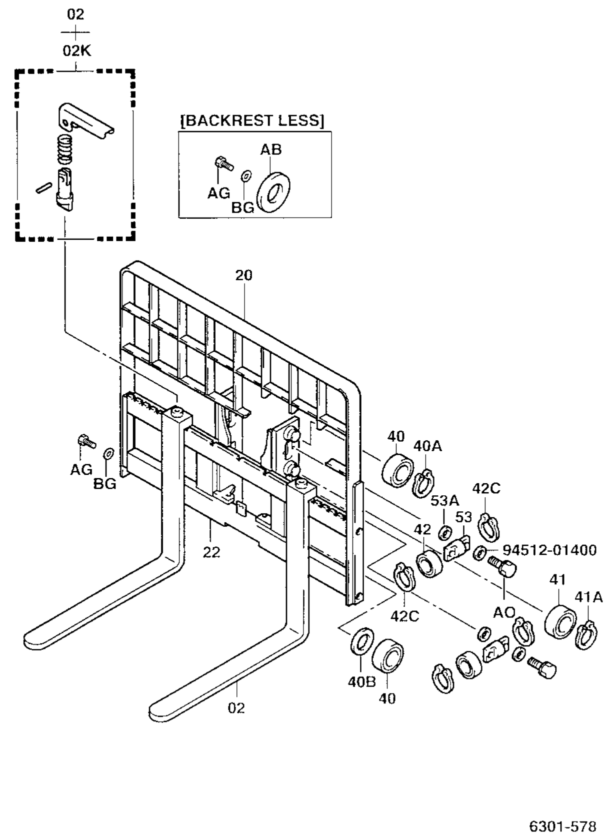
FV: 35·45 model

6301

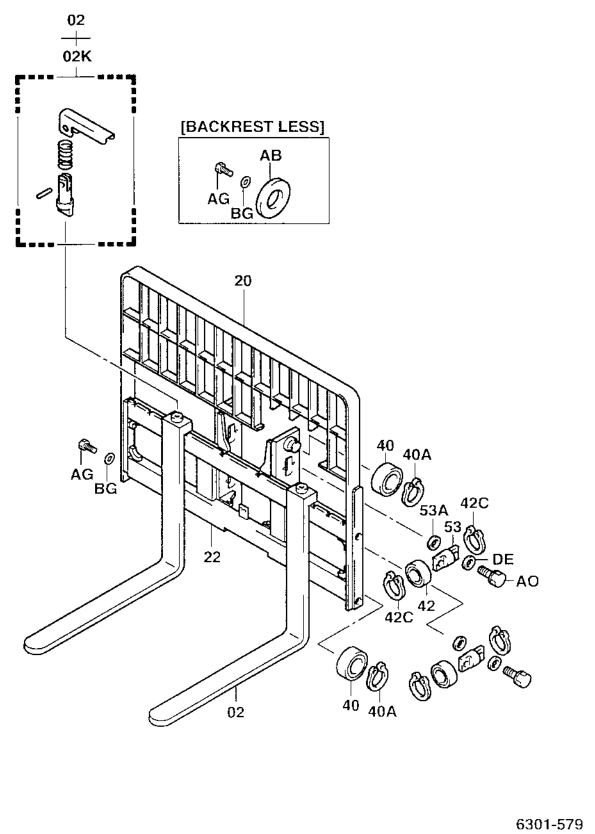


FSV: 35·45 model

6301

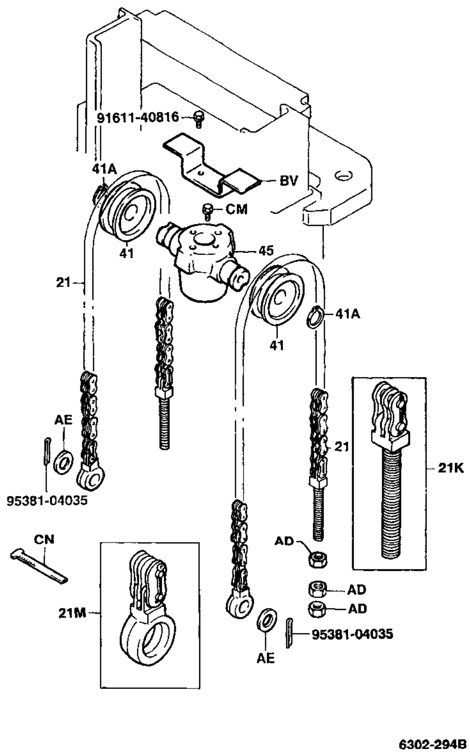


FSV: 55 model

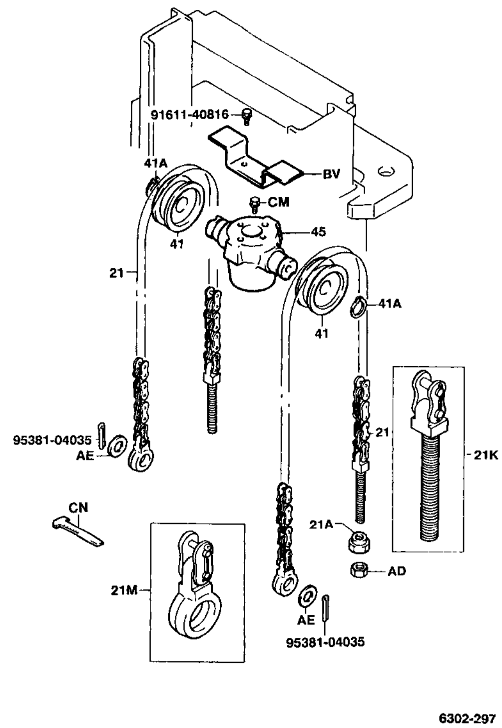


6302

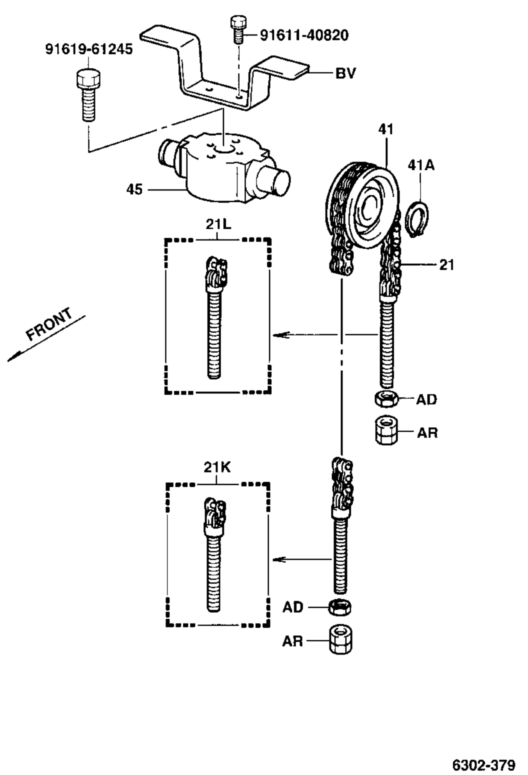
FV: 15 ~ 25 model



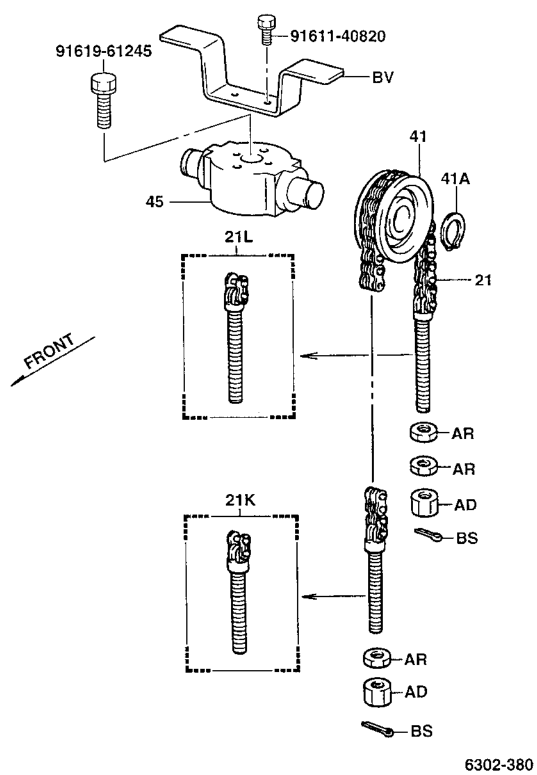
FV: 30·32 model



FV: 35 model

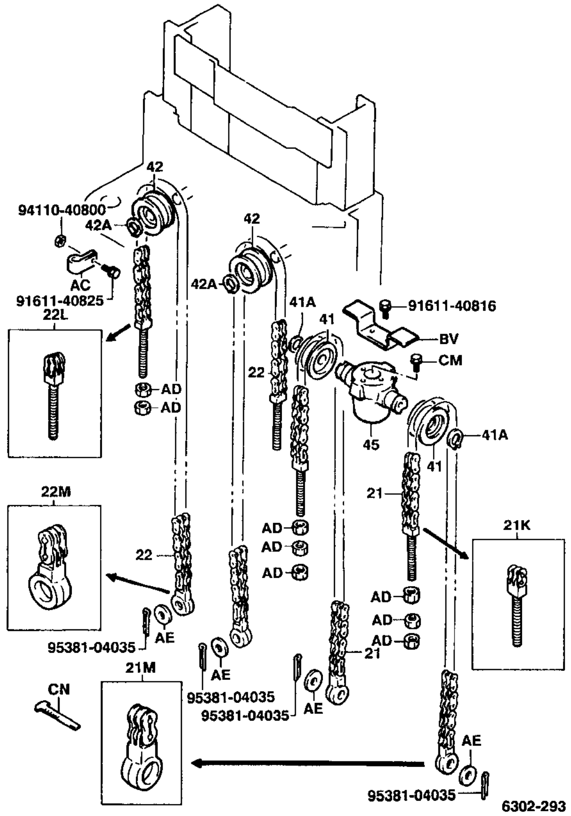


FV: 45 model

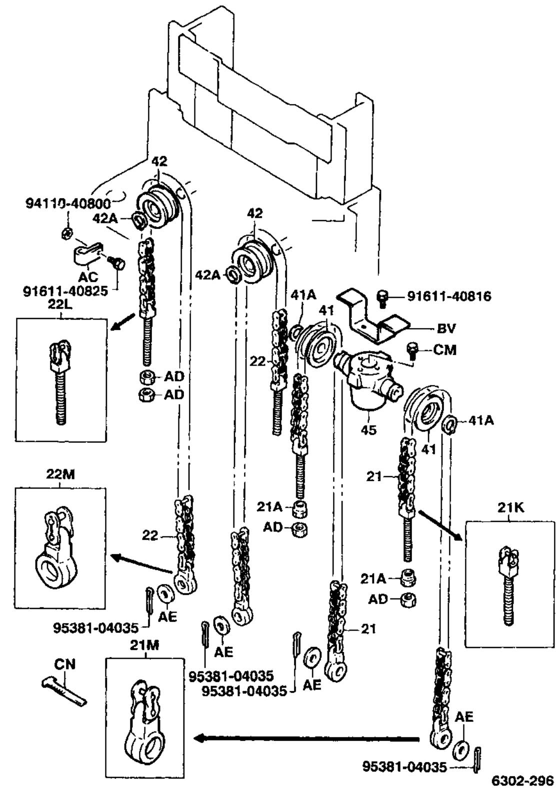


6302

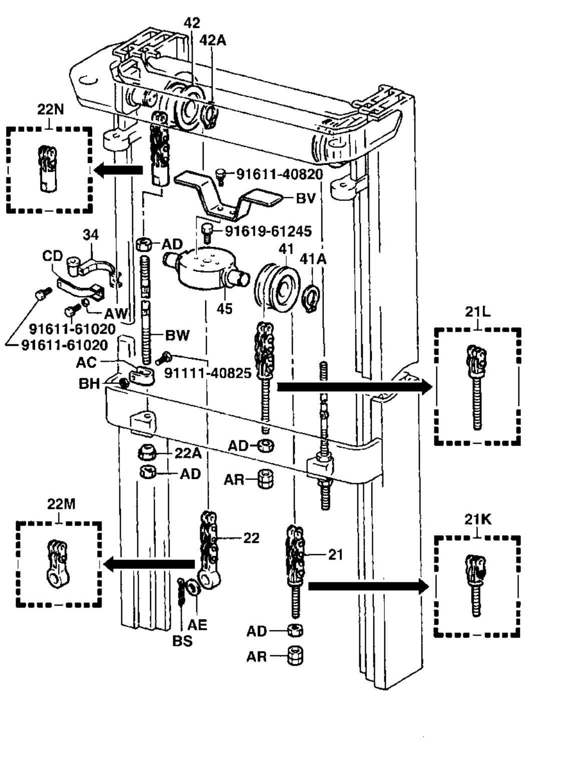
FSV: 15 ~ 25 model



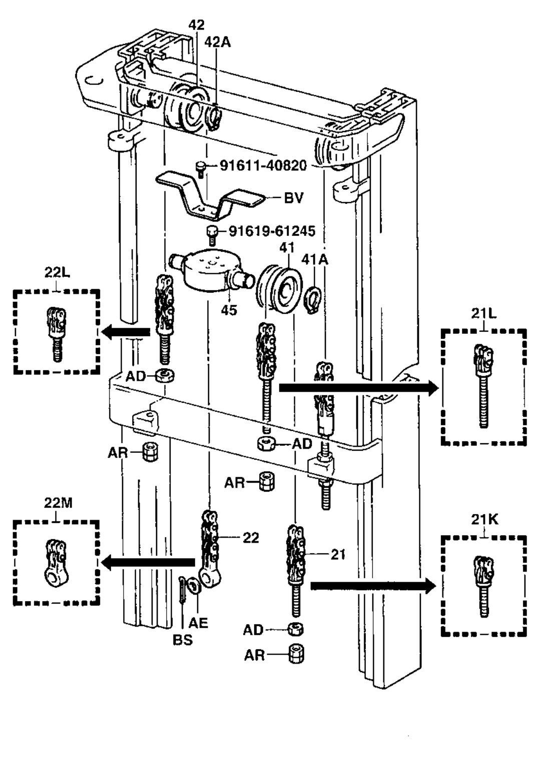
FSV: 30·32 model



FSV: 35 model (H3700 ~ H5500)

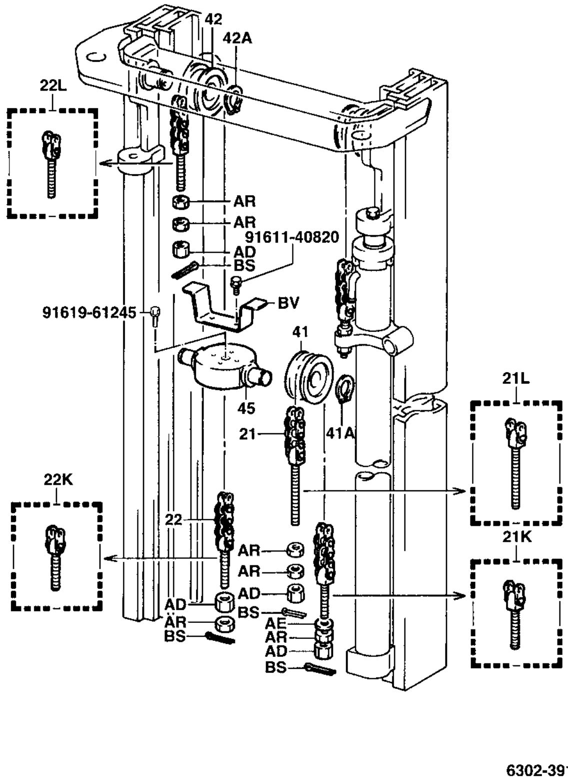


FSV: 35 model (H6000 ~ H6500)

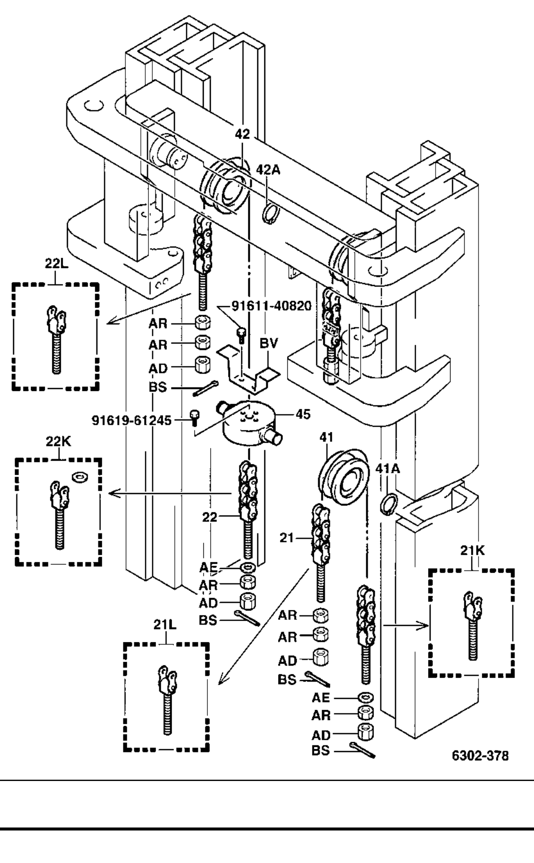


FSV: 45 model

6302



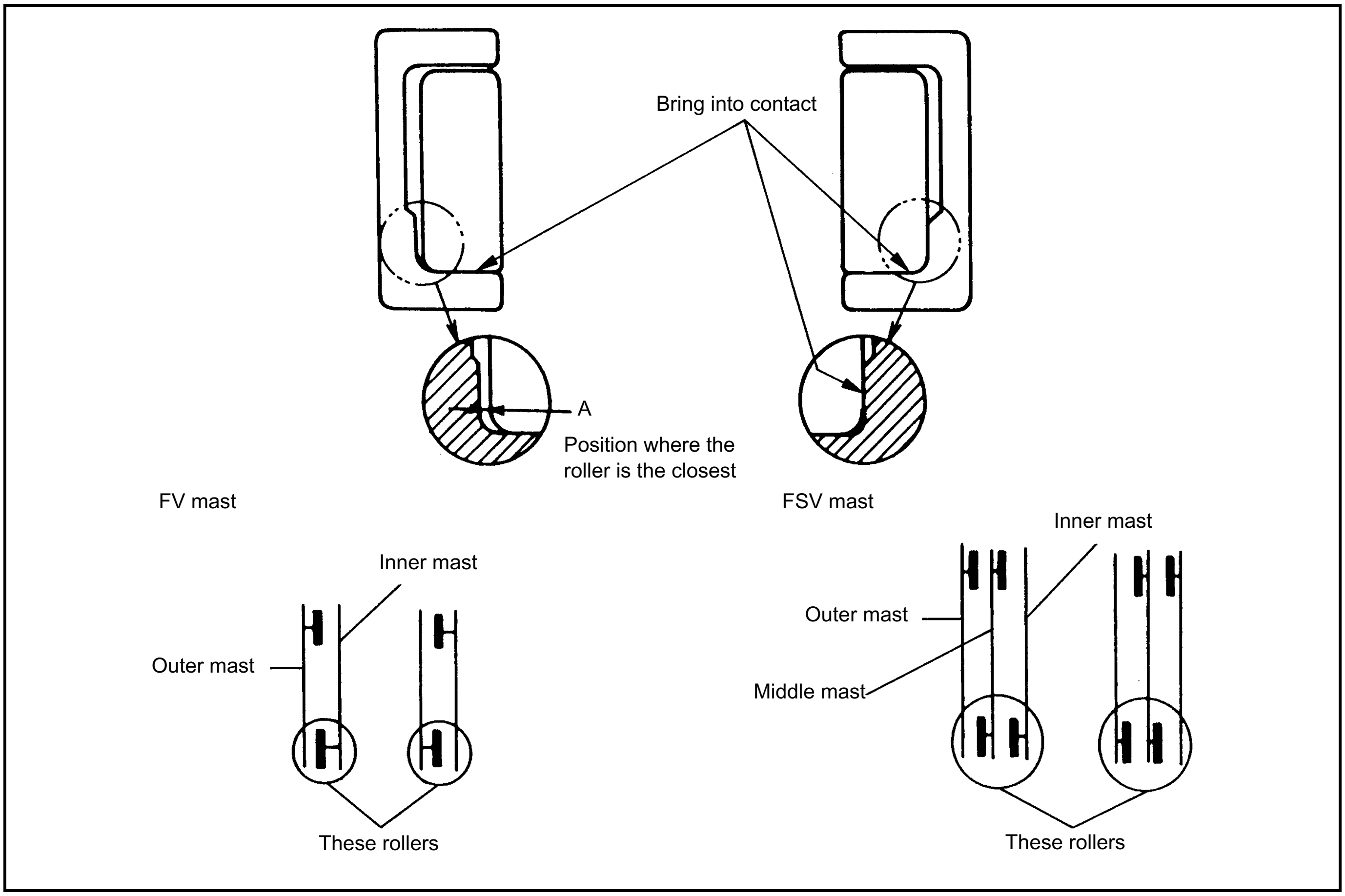
FSV: 55 model



MAST ADJUSTMENT (FV·FSV, 15 ~ 32 MODEL)

Lift Roller Adjustment at Mast

1. Clearance between:
   Inner mast roller and outer mast (FV).
   Inner mast lower roller and middle mast (FSV).
   Middle mast lower roller and outer mast (FSV).



(1) Adjust the mast overlap to approx. 450 mm (17.72 in).

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and inspect the clearance between the roller side face and mast where they are the closest.

Standard: A = 0 ~ 0.8 mm (0 ~ 0.031 in)

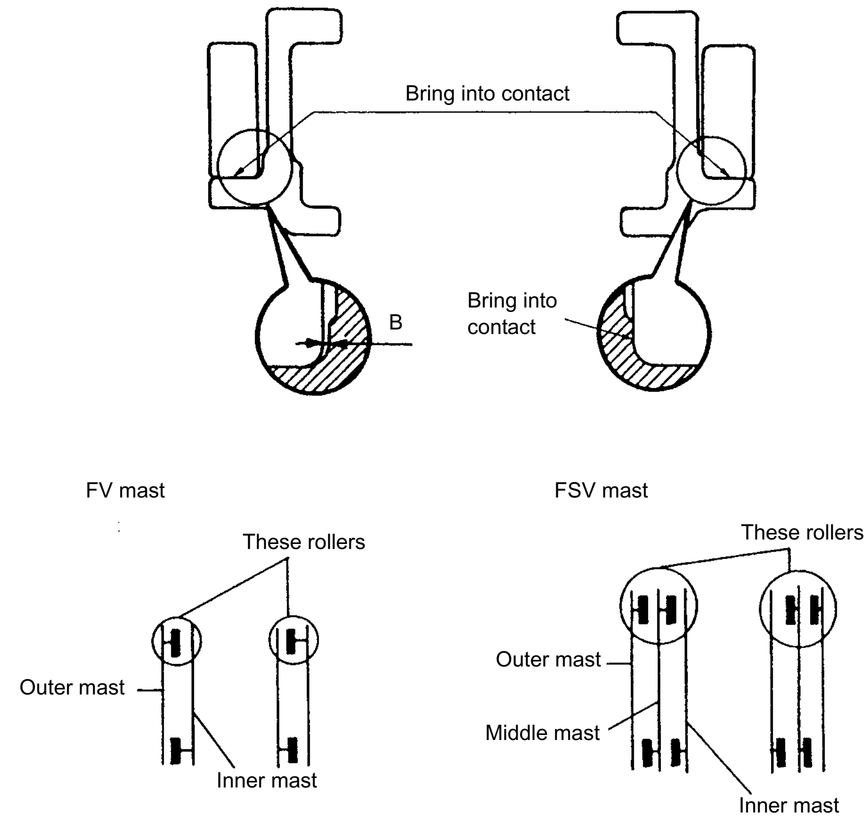
If the standard is not satisfied, make adjustment by changing the inner mast roller shim thickness.

Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(3) Distribute shims equally to the rollers on the left and right sides.

(4) After the adjustment, see that mutual mast movement is smooth.

2. Clearance between:
   Outer mast roller and inner mast (FV).
   Middle mast upper roller and inner mast (FSV).
   Outer mast upper roller and middle mast (FSV).



(1) Adjust the mast overlap to approx. 450 mm (17.72 in).

(2) Shift the inner mast to one side to bring the roller into contact with the inner mast, and measure on the opposite side the clearance between the roller side face and mast where they are the closest.

Standard: B = 0 ~ 0.5 mm (0 ~ 0.020 in)

If the standard is not satisfied, make adjustment by changing the outer mast roller shim thickness.

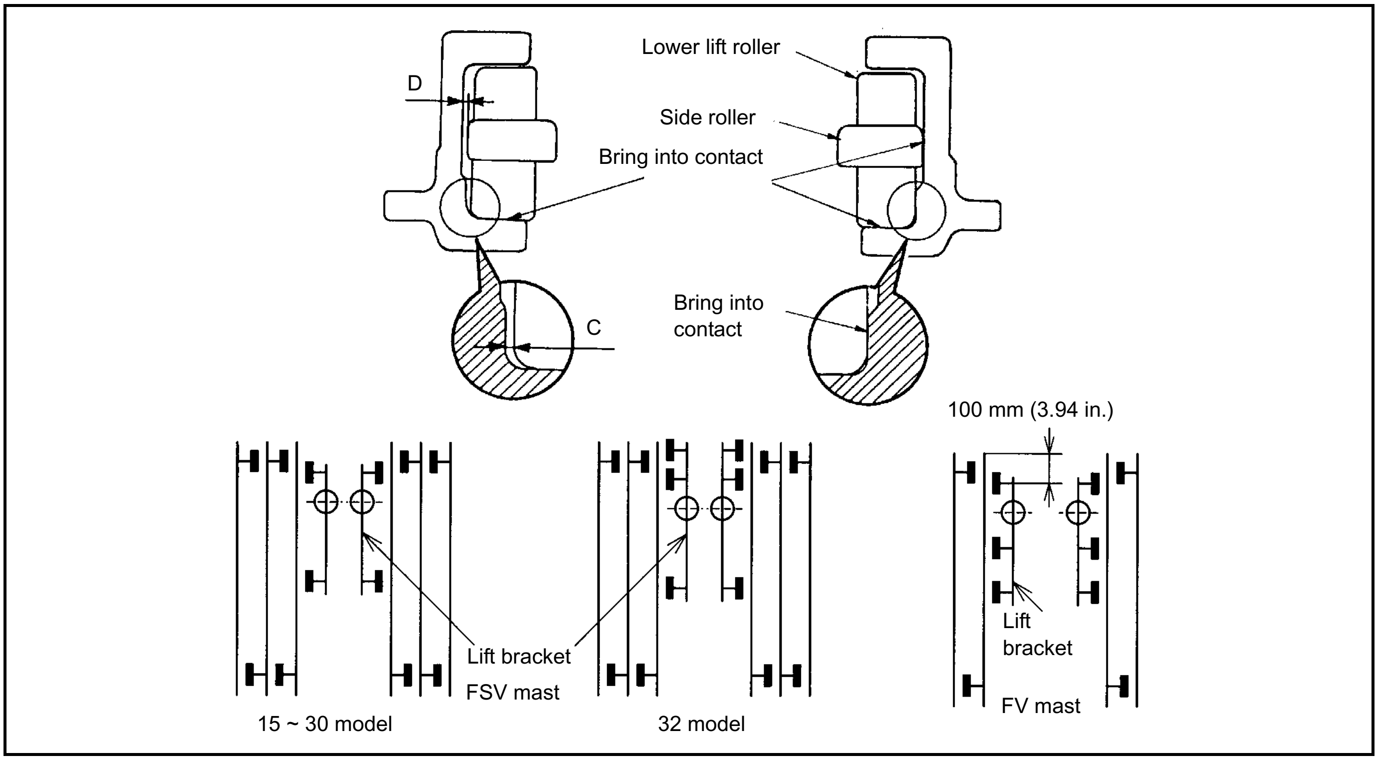
Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(3) Distribute shims equally to the rollers on the left and right sides.

(4) After the adjustment, see that mutual mast movement is smooth.

Lift/Side Roller Adjustment at Lift Bracket

FV·FSV mast



(1) Raise the lift bracket to the uppermost position for the FSV mast, and bring the center of the upper lift roller to approx. 100 mm (3.94 in) from the top of the inner mast for FV mast.

(2) No adjustment is necessary for the upper lift rollers and intermediate rollers (FV and FSV on 32 model only) since they are fastened by snap rings.

(3) Shift the lift bracket to one side to bring the lower lift roller, and measure on the opposite side the clearance between the roller side face and the mast where they are the closest.

Standard: C = 0 ~ 0.5 mm (0 ~ 0.020 in)

If the standard is not satisfied, make adjustment by changing the shim thickness. (Distribute shims equally to the rollers on the left and right sides.)

Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(4) After the inspection and adjustment in step (3) above, inspect and adjust the side rollers.
Bring the side roller on one side into contact with mast side surface, measure on the opposite side the clearance between the side roller and the inner mast side surface where they are the closest.

Standard: D = 0 ~ 0.5 mm (0 ~ 0.020 in)

If the standard is not satisfied, make adjustment by changing the shim thickness. (Distribute shims equally to the rollers on the left and right sides.)

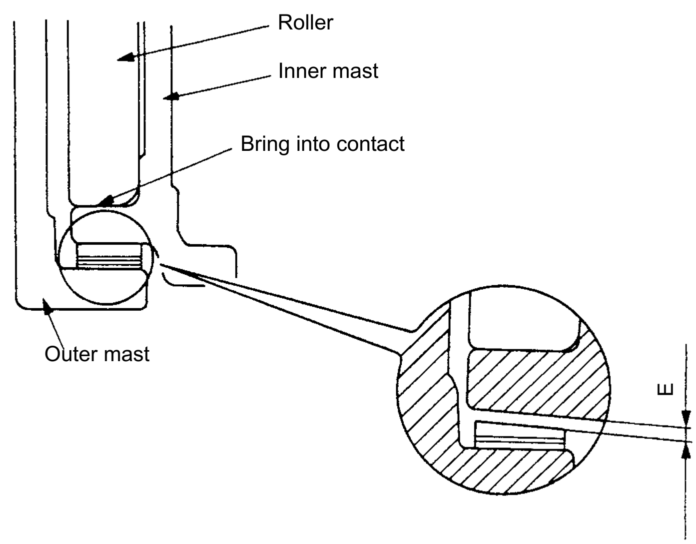
Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(5) After the adjustment, check to see that the lift bracket moves smoothly over the entire length of the mast.

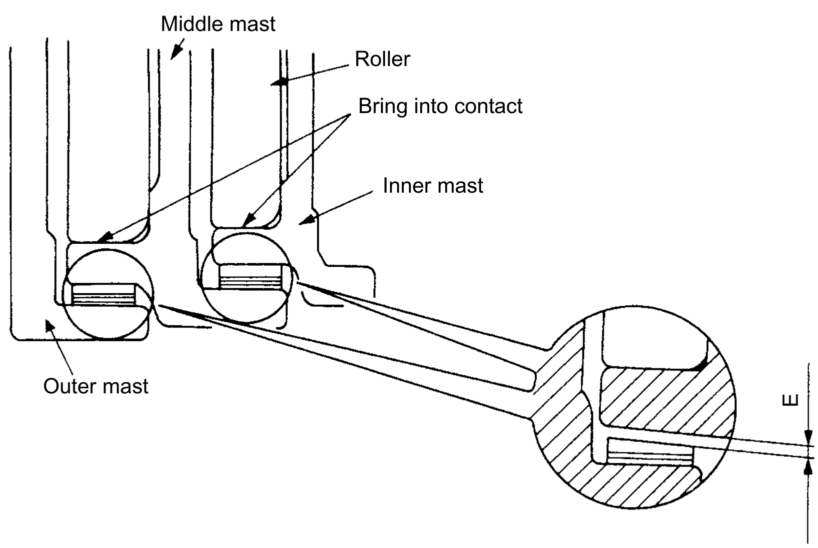
Mast Strip Adjustment

Mast strip clearance adjustment

FV mast



FSV mast



(1) Lower the inner (or middle) mast fully.

(2) With the inner (or middle) mast in contact with the outer mast roller (or middle mast upper roller), measure the clearance between the mast strip and mast.

Standard: E = 0.5 ~ 1.0 mm (0.020 ~ 0.039 in)

If the standard is not satisfied, make adjustment by changing the mast strip shim thickness.

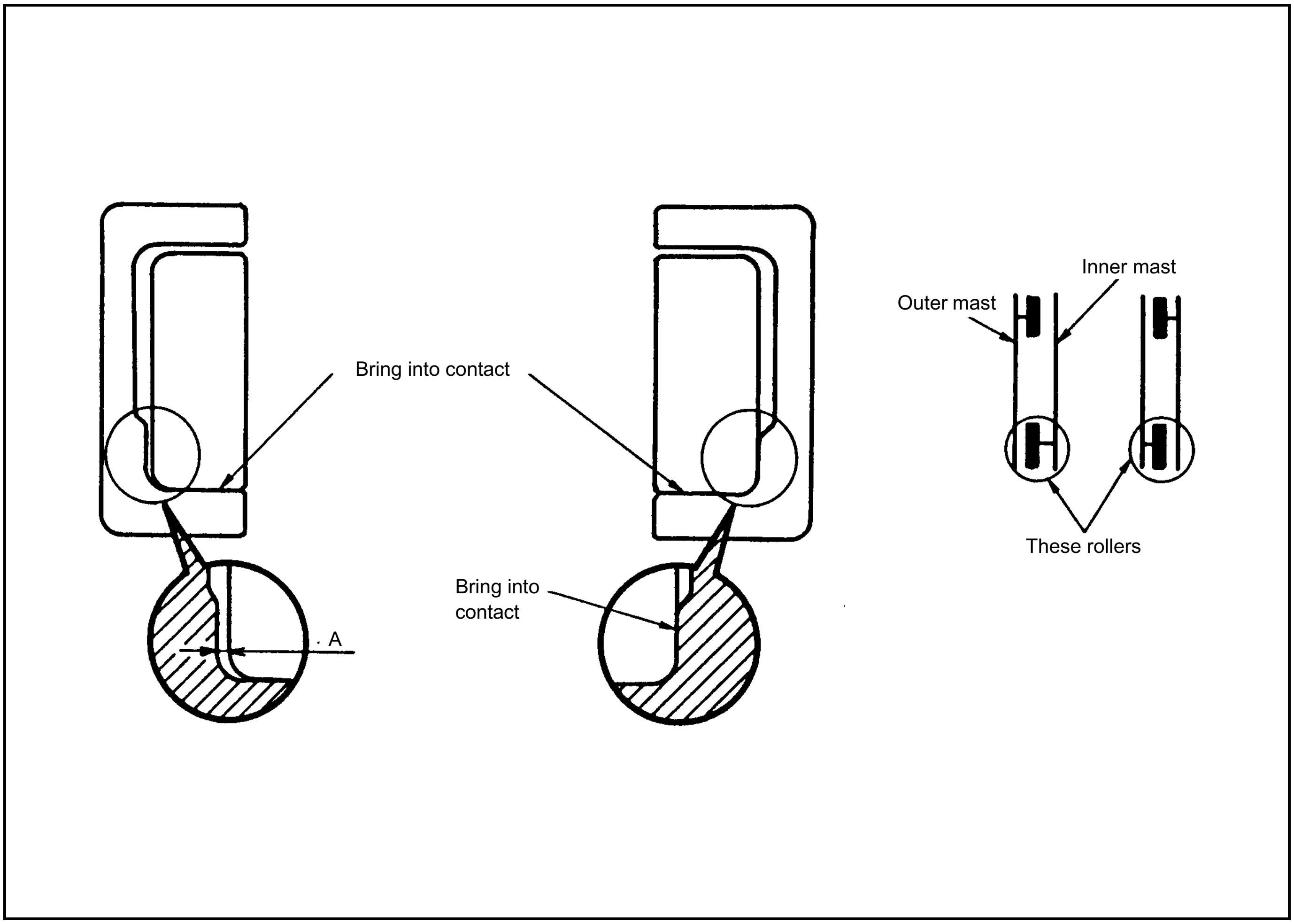
Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

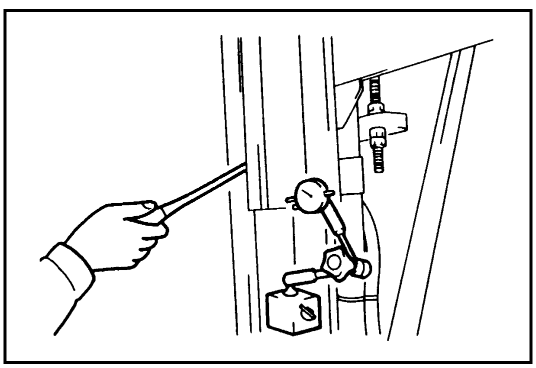
(3) After the adjustment, check the mast for smooth movement.

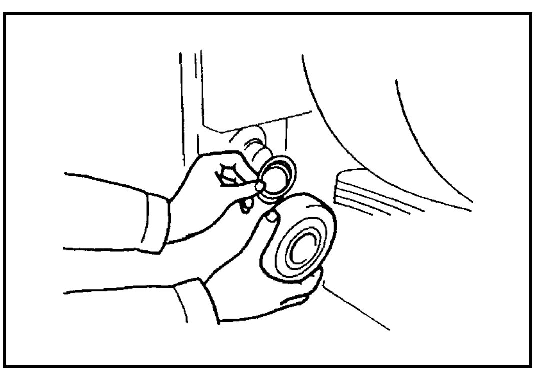
MAST ADJUSTMENT (FV·FSV MAST, 35 ~ 55 MODEL)

Lift Roller Adjustment at Mast (FV)

1. Inner mast roller clearance adjustment







(1) Adjust the mast overlap to approx. 500 mm (19.69 in).

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and measure the clearance between the roller side face and mast where they are the closest.

Standard: A = 0 ~ 0.8 mm (0 ~ 0.031 in)

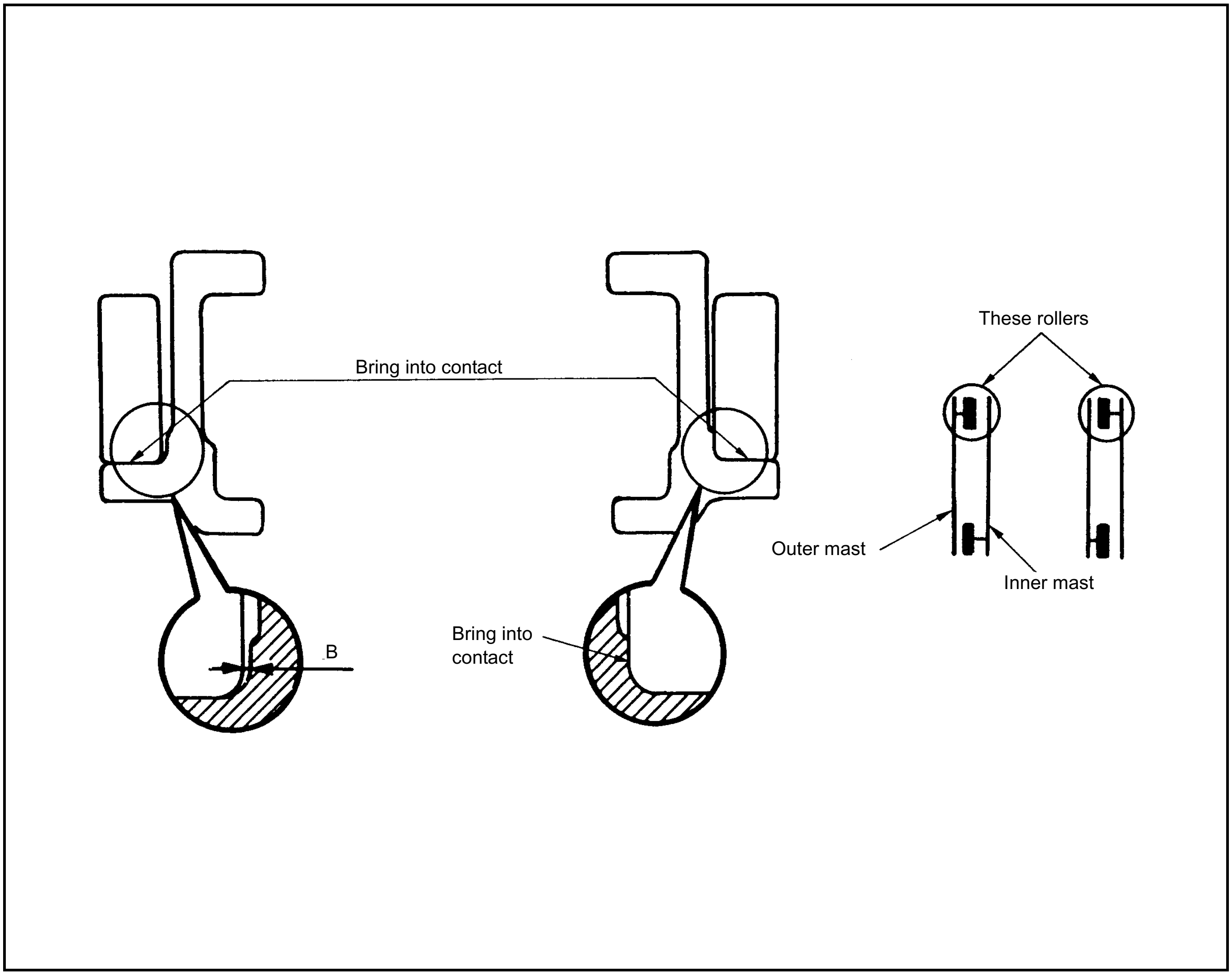
If the standard is not satisfied, make adjustment by changing the inner mast roller shim thickness.

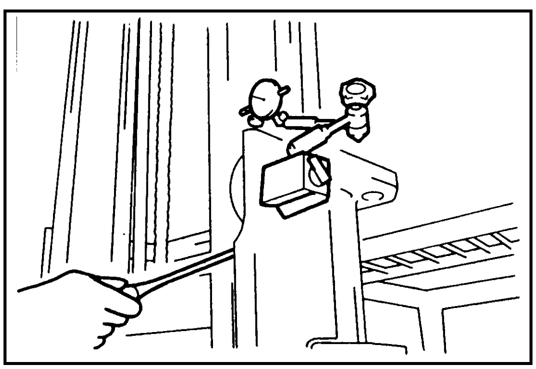
Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

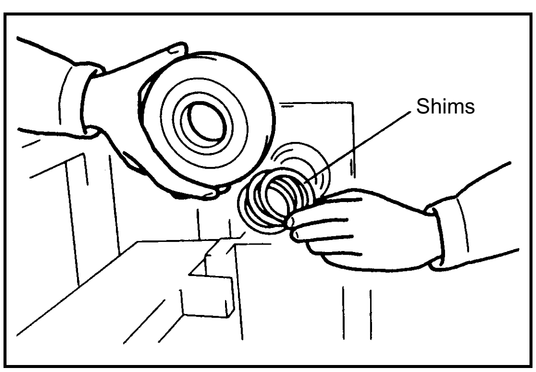
(3) Distribute shims equally to the rollers on the left and right side.

(4) After the adjustment, see that the inner mast moves smoothly in the outer mast.

2. Outer mast roller clearance adjustment







(1) Adjust the mast overlap to approx. 500 mm (19.69 in).

(2) Shift the inner mast to one side to bring the roller into contact with the outer mast, and measure the clearance between the roller side face on the opposite side and mast where they are the closest.

Standard: B = 0 ~ 0.8 mm (0 ~ 0.031 in)

If the standard is not satisfied, make adjustment by changing the outer mast roller shim thickness.

Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(3) Distribute shims equally to the rollers on the left and right side.

(4) After the adjustment, see that the inner mast moves smoothly in the outer mast.

3. Roller selection

(1) In 35·45 models, use oversize No. 2 as a rule for the inner mast roller. Use No. 1 only when the mast inside width (rolling contact surface) is narrow. The roller size may be different between the right and left sides.

Inner mast roller

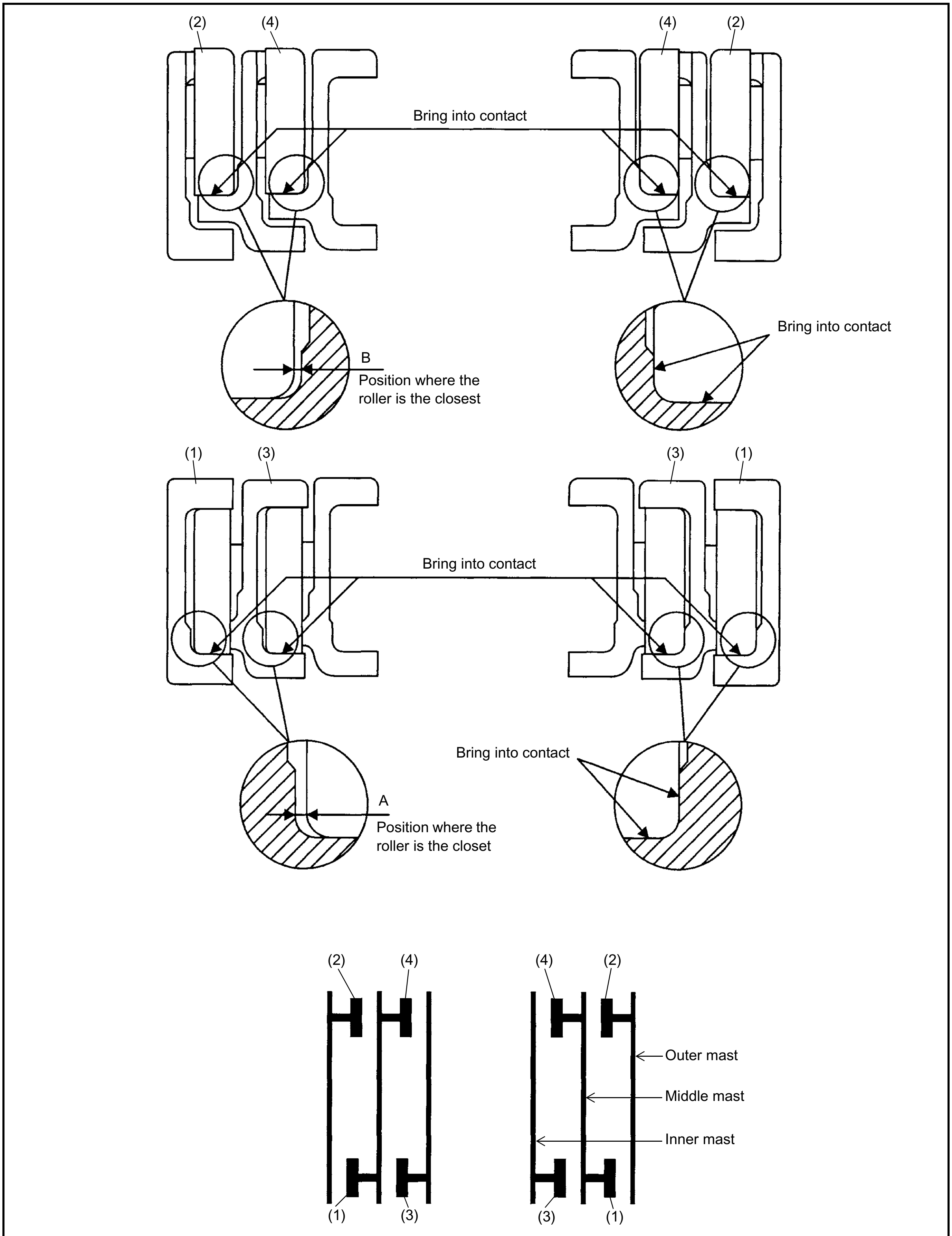
Model	No.	Outside diameter mm (in)	Outer mast inside width mm (in)	Remarks
35·45 model	No. 1	124.5 (4.902)	125.0 (4.921)	—
	No. 2	125.2 (4.929)		Oversize
55 model	No. 1	164.5 (6.476)	165.0 (6.496)	—

Outer mast roller

Model	Outside diameter mm (in)
35·45 model	124.5 (4.902)
55 model	164.5 (6.476)

Lift Roller Adjustment at Mast (FSV)

1. 35·45 model



Adjustment Sequence

The encircled Nos. (1) ~ (4) mean the rollers to be adjusted in due order in accordance with the following steps:

(1) Adjust the mast overlap to approx. 500 mm (19.69 in).

(2) Shift the mast to one side to bring the roller into contact with the mast, and measure the clearance on opposite side between the roller and the mast where they are the closest.

Standard: A = 0 ~ 0.8 mm (0 ~ 0.031 in)
B = 0 ~ 0.8 mm (0 ~ 0.031 in)

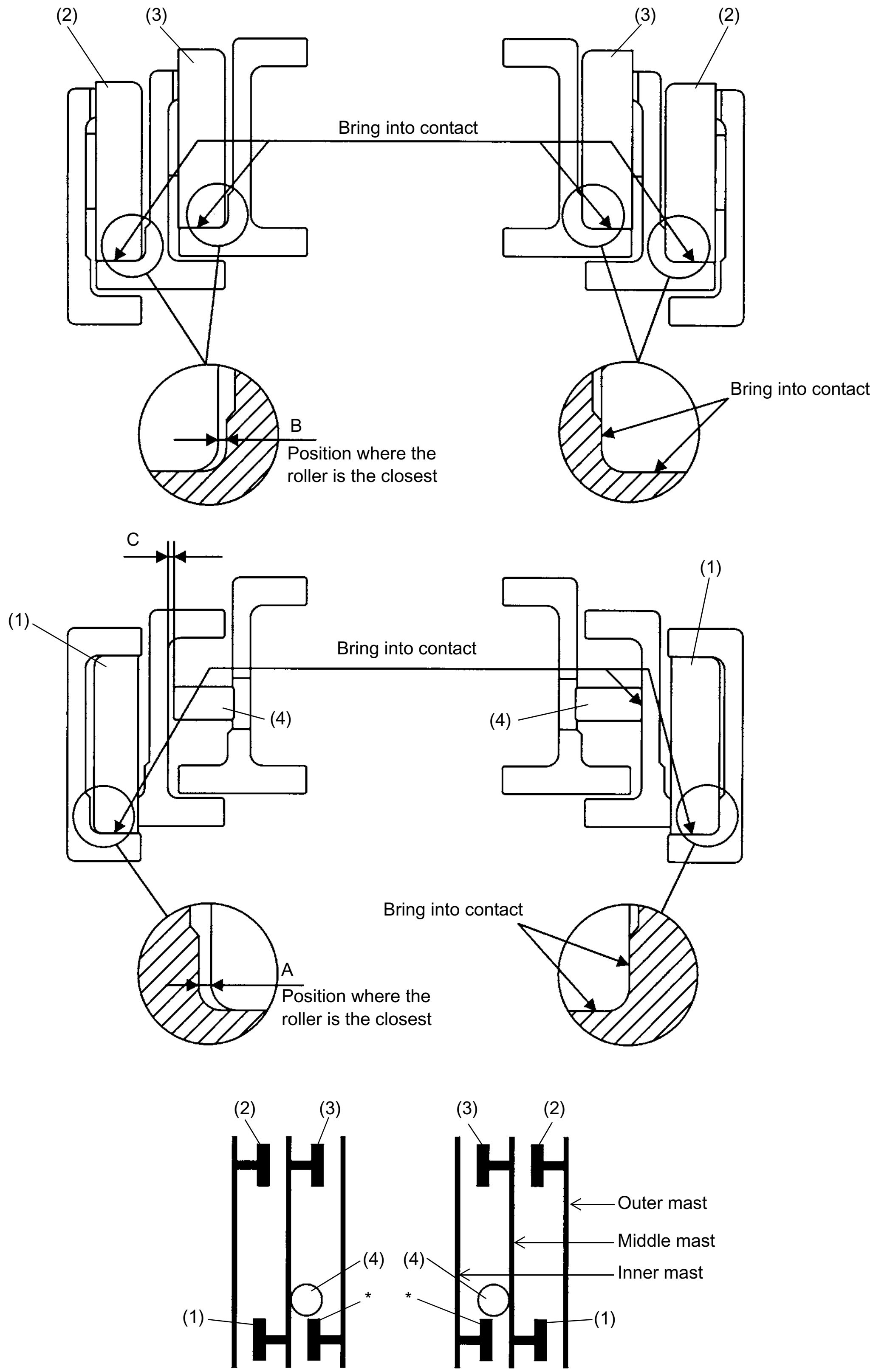
If the standard is not satisfied, make adjustment by changing the mast roller shim thickness.

Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

(3) Distribute shims equally to the rollers on the left and right side.

(4) After the adjustment, see that mutual mast movement is smooth.

2. 55 model



*: No adjustment due to snap ring fitting

Adjustment Sequence

The encircled Nos. (1) ~ (4) mean the rollers to be adjusted in due order in accordance with the following steps:

(1) Adjust the mast overlap to approx. 500 mm (19.69 in).

(2) Shift the mast to one side to bring the roller into contact with the mast, and measure the clearance on opposite side between the roller and the mast where they are the closest.

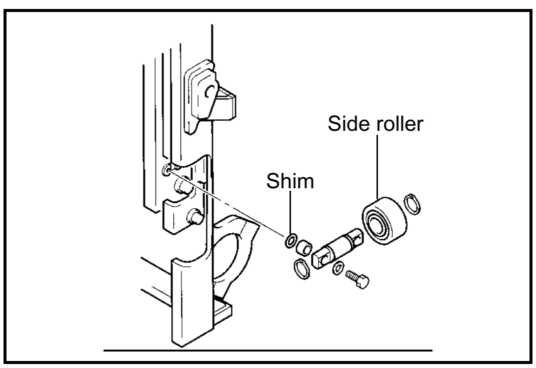
For lift rollers ((1) ~ (3))
Standard: A = 0 ~ 0.8 mm (0 ~ 0.031 in)
B = 0 ~ 0.8 mm (0 ~ 0.031 in)

For side rollers ((4))
Standard: C = 0 ~ 0.8 mm (0 ~ 0.031 in)

If the standard is not satisfied, make adjustment by changing the mast roller shim thickness.

Shim thickness:
For lift rollers ((1) ~ (3))
0.5 and 1.0 mm (0.020 and 0.039 in)

For side rollers ((4))
0.5 and 1.0 mm (0.020 and 0.039 in)



(3) Distribute shims equally to the rollers on the left and right sides.

(4) After the adjustment, see that mutual mast movement is smooth.

3. Roller selection
   Inner mast rollers and middle mast lower rollers
   - In the case of 35·45 models, use oversize No. 2 rollers as a rule, and use No. 1 only when the mast inside width (rolling contact surface) is narrow. The roller size may be different between the left and right sides.

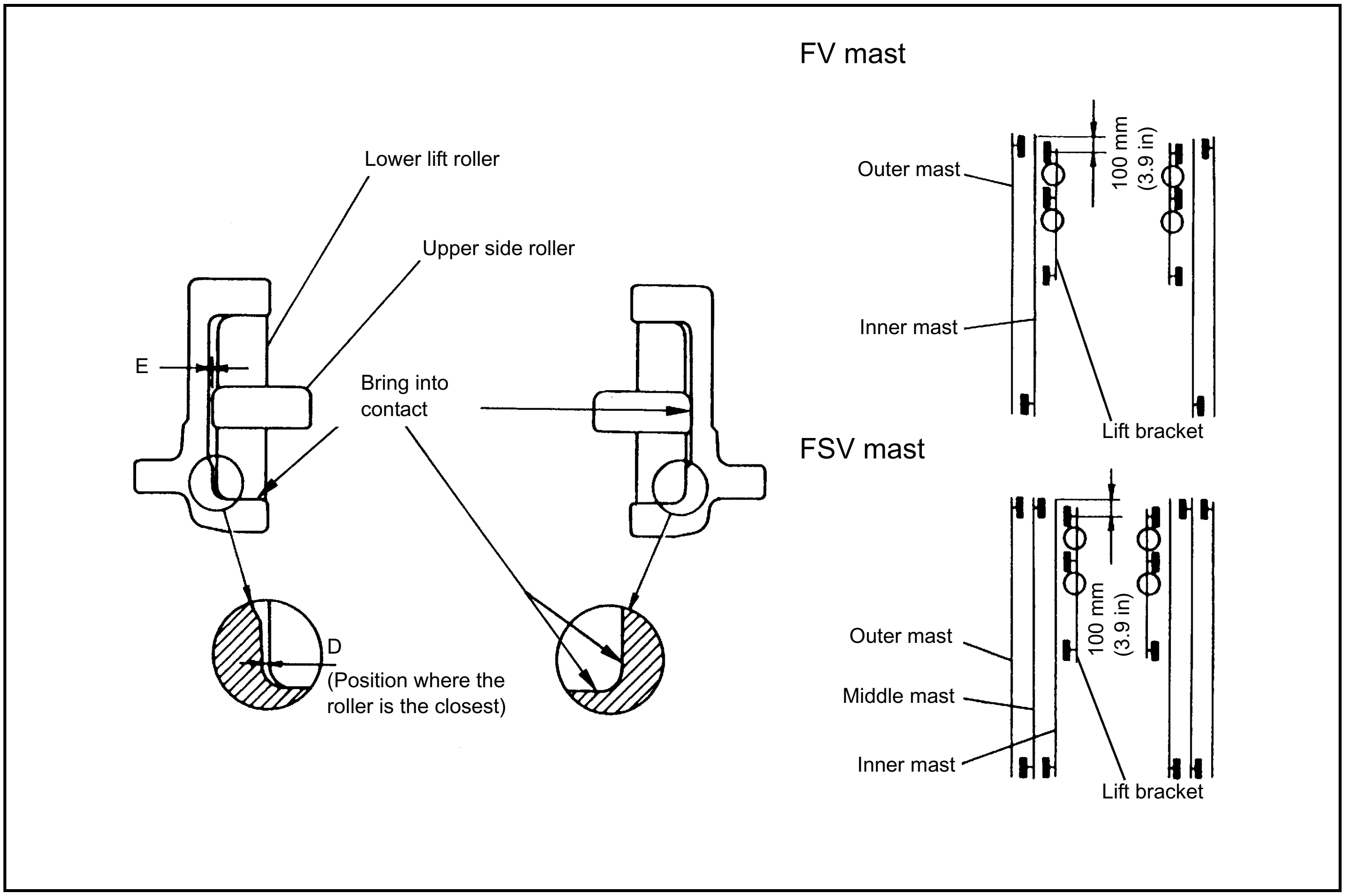
Model	No.	Outside diameter mm (in)	Mast inside width mm (in)	Remarks
35·45 model	No. 1	124.5 (4.902)	125.0 (4.921)	—
	No. 2	125.2 (4.929)		Oversize
55 model	No. 1	164.5 (6.476)	165.0 (6.496)	—

Outer mast rollers and middle mast upper rollers

Model	Outside diameter mm (in)
35·45 model	124.5 (4.902)
55 model	164.5 (6.476)

Lift Bracket Portion Lift/Side Roller Adjustment

1. 35·45 model



(1) Perform adjustment where the lift bracket upper lift roller is 100 mm (3.9 in) from the top end of the inner mast.

(2) No adjustment is needed for the upper and middle lift rollers since they are fastened by snap rings.

(3) For lower lift rollers, shift the lift bracket to one side to bring the roller on one side into contact with the mast and adjust the clearance between the lift roller and mast on the opposite side,

Standard: D = 0 ~ 0.5 mm (0 ~ 0.020 in)

(4) Adjust the upper side rollers after adjusting the lower lift rollers (in step 3 above). Bring the side roller on one side into contact with the mast side surface, and adjust the clearance between the side roller and mast on the opposite side.

Standard: E = 0 ~ 0.5 mm (0 ~ 0.020 in)

(5) Adjust lower side rollers after adjusting the lower lift rollers and upper side rollers (in steps 3 and 4). Shift the lift bracket to one side to bring the upper side roller and lower lift roller into contact with the mast, and adjust the clearance between the mast and lower side roller to 0.5 to 1.0 mm (0.02 to 0.04 in). Repeat the same on the opposite side.

(6) After adjustments in steps 3 to 5, the lift bracket shall move smoothly along the entire mast length. See that the lower side roller does not rotate in contact with the mast in this state. If the side roller rotates in contact, repeat step 5 to widen the clearance between the roller and mast to prevent the lower side roller from being rotated in contact along the entire mast length.

2. 55 model
   (1) Perform adjustment where the center of the lift bracket upper roller is 100 mm (3.94 in) from the inner mast top end.
   (2) Out of lift bracket rollers, lift rollers need no adjustment since they are fastened by snap rings. For side rollers, bring the side roller on one side into contact with the mast, and adjust the clearance between the side roller and mast on the opposite side.

   Standard: 0 ~ 0.8 mm (0 ~ 0.031 in)

   (3) After the adjustment, the lift bracket shall move smoothly along the entire length of the mast.

3. Roller selection
   - Use only No. 1 as middle rollers. (35 model)
   - As a rule, use No. 2 (oversize) as upper and lower rollers. Use No. 1 only when the mast inside width (rolling contact surface) is narrow. The roller size may be different between the left and right or between the upper and lower sides. (35 model)

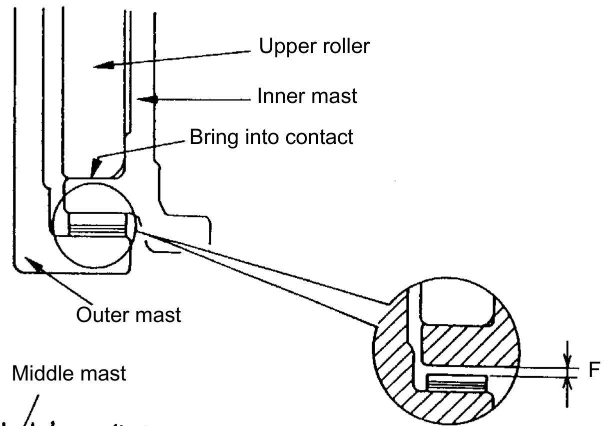
Lift bracket roller list

Model	No.	Outside diameter mm (in)	Place used	Remarks
35 model	No. 1	124.5 (4.902)	Lift roller	—
	No. 2	125.2 (4.929)	Lift roller	Oversize
	No. 3	93.3 (3.673)	Side roller	—
45 model	No. 4	124.5 (4.902)	Lift roller	—
	No. 5	100.0 (3.937)	Side roller	—

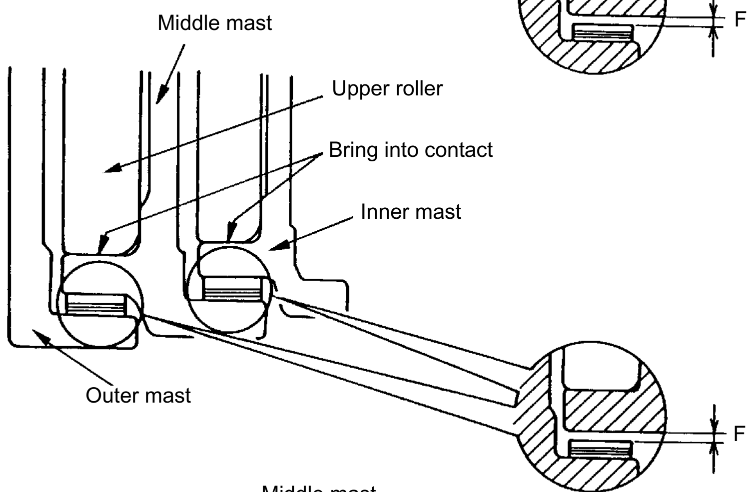
Mast Strip Adjustment

1. Mast strip clearance adjustment

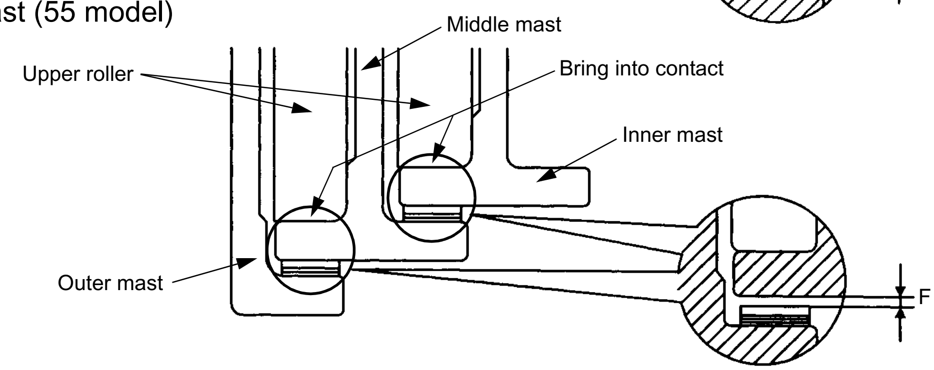
FV mast



FSV mast (35·45 model)



FSV mast (55 model)



(1) Lower the inner (or middle) mast fully.

(2) With the inner (or middle) mast in contact with the outer mast roller (or middle mast upper roller), measure the clearance between the mast strip and mast.

Standard: F = 0 ~ 0.8 mm (0 ~ 0.031 in)

If the standard is not satisfied, make adjustment by changing the mast strip shim thickness.

Shim thickness: 0.5 and 1.0 mm (0.020 and 0.039 in)

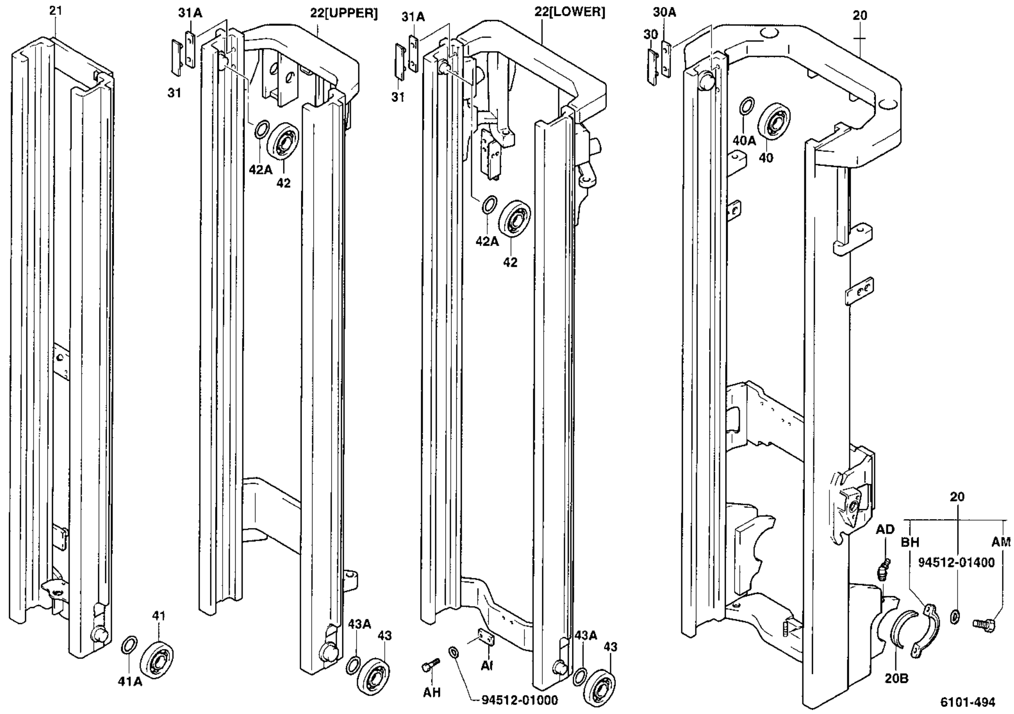
(3) After the adjustment, check the mast for smooth movement.

QFV MAST ASSY

COMPONENTS

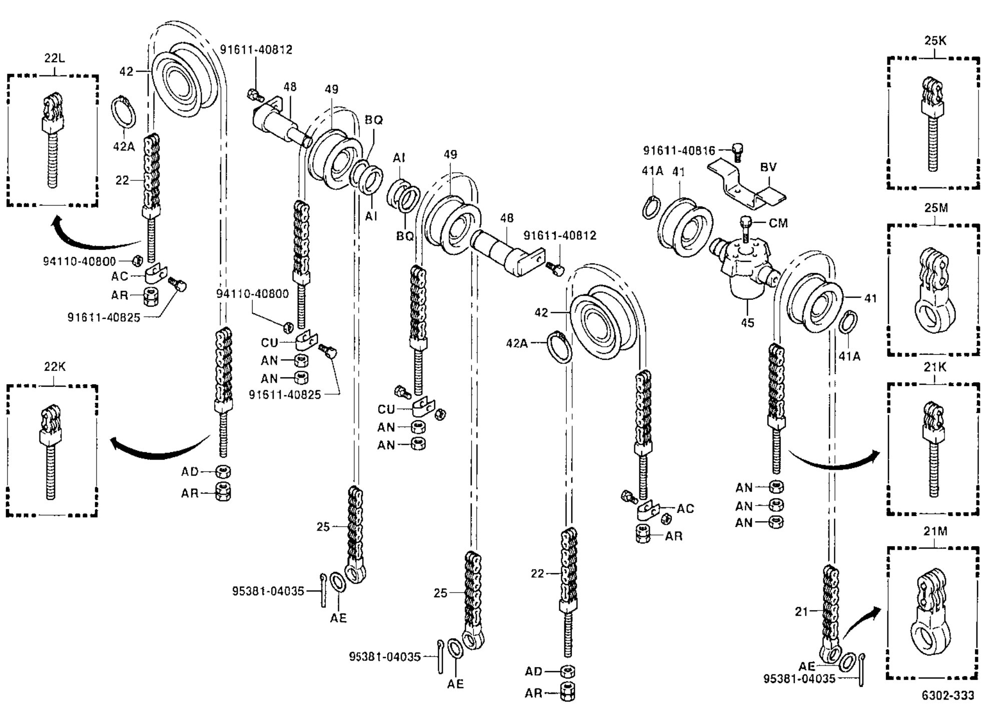
20 ~ 32 model

6101



20 ~ 32 model

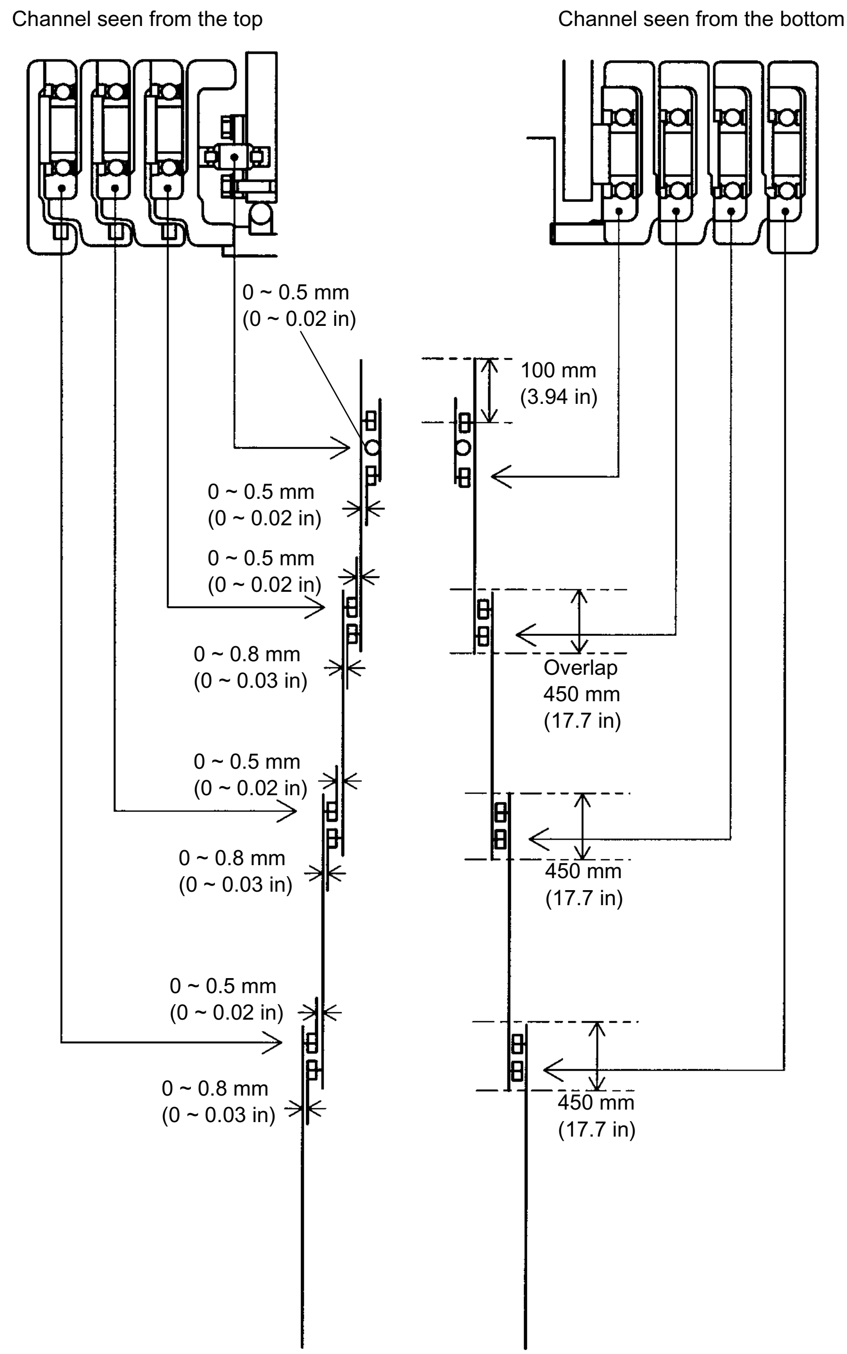
6302



MAST ADJUSTMENT (QFV)

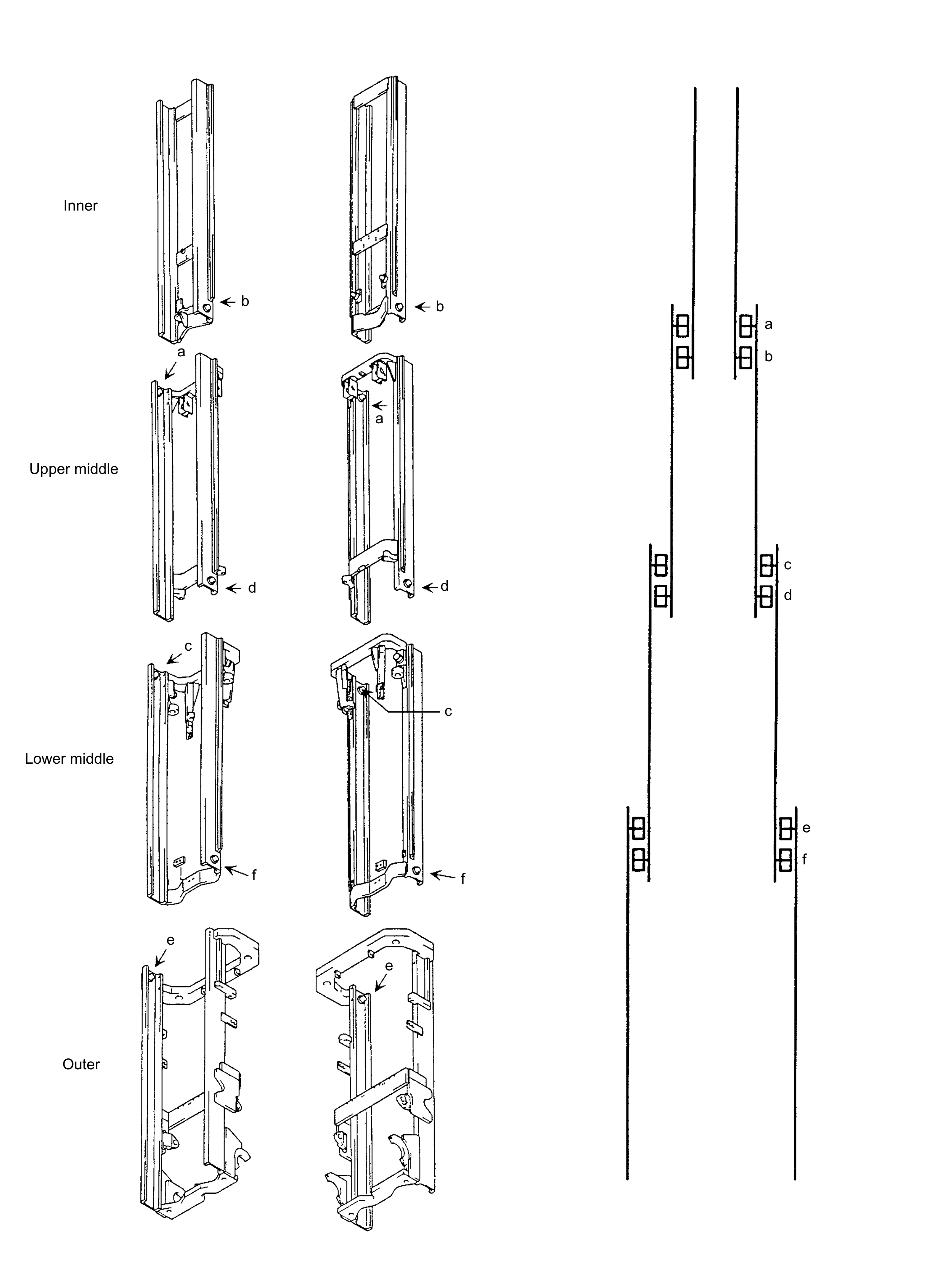
Lift Roller Adjustment

The lift roller adjustments, for most part, are same with FSV mast. Where to be adjusted are as shown:



Note:
The mast strip & shim adjustment between the mast channels can also be performed in the same sequence with those of V·FV·FSV.

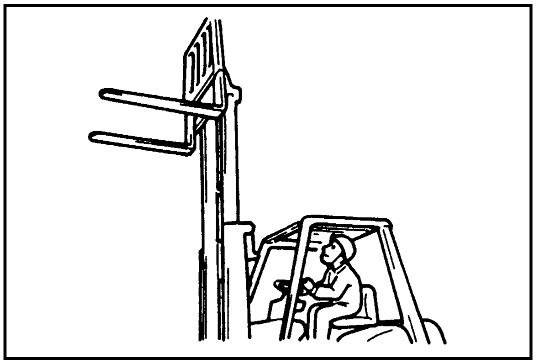
Lift Roller Position on Each Upright:

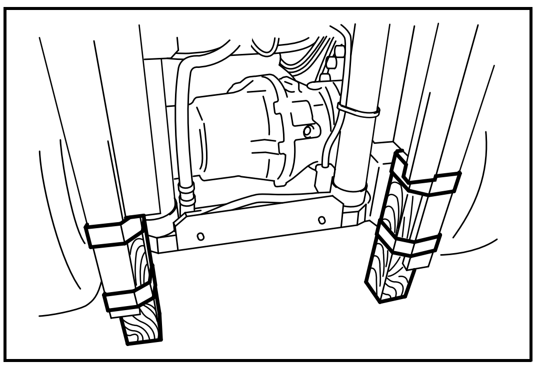


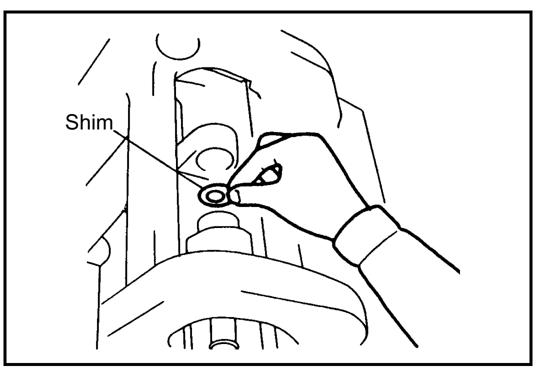
LIFT CYLINDER ROD SHIM ADJUSTMENT (PREVENTION OF UNEVEN LIFTING)

Note:

- **For double lift cylinders, inspection and adjustment are required to prevent uneven lifting on the left and right side due to tolerances of parts, etc.**
- **The inspection and adjustment must be made whenever any of the following parts is replaced: Lift cylinder ASSY, lift cylinder rod SUB-ASSY, lift cylinder SUB-ASSY, mast ASSY, outer mast SUB-ASSY, and inner mast SUB-ASSY**







1. Inspection method
   Slowly raise the inner mast, and observe the stopping states of the left and right cylinder rod at the moment when the inner mast reaches the maximum height.
   (1) Normal case
   Both the left and right rod stop almost simultaneously with almost no shaking of the inner mast.
   (2) Abnormal case
   The rods stop with slight difference and the top of the inner mast shakes at the time of stopping. To correct this, add shims to the cylinder that stops first.

2. Adjustment method
   (1) Raise the inner mast.
   Support the bottom of the inner mast with wooden blocks and fix the blocks by taping onto the outer mast.
   (2) Remove the set bolt of the cylinder rod end on the side requiring shim adjustment.
   (3) Slowly lower the lift cylinder rod and disconnect the cylinder rod end.
   (4) Place shims on the cylinder rod end. Slowly raise the cylinder rod end into the inner mast.
   (5) Fix the set bolt of the cylinder rod end.
   (6) Raise the inner mast for reinspection.
   (7) Repeat the inspection and adjustment until the number of shims is determined.

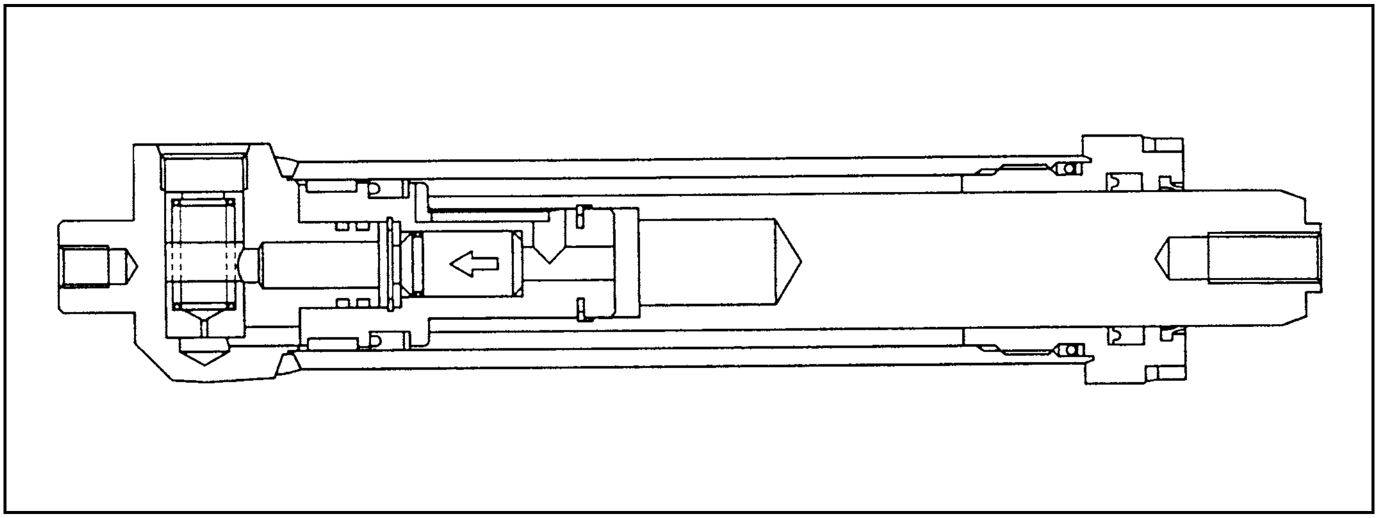
   Shim thickness:
   0.5 and 1.0 mm (0.020 and 0.039 in)

CYLINDER

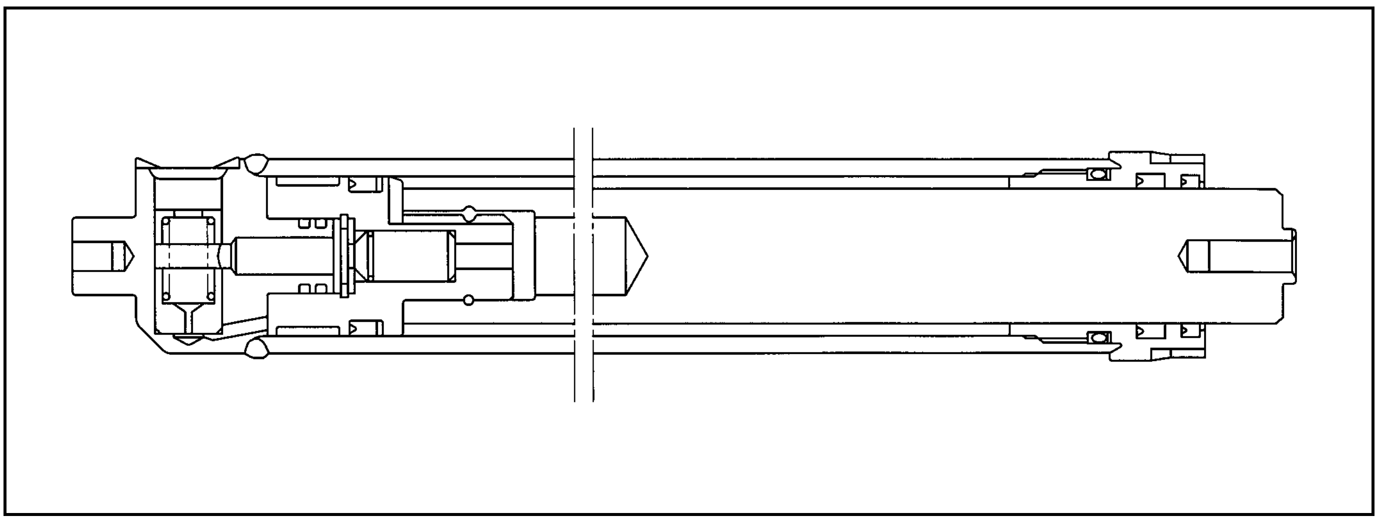
LIFT CYLINDER (V)·REAR LIFT CYLINDER (FV·FSV·QFV)

GENERAL

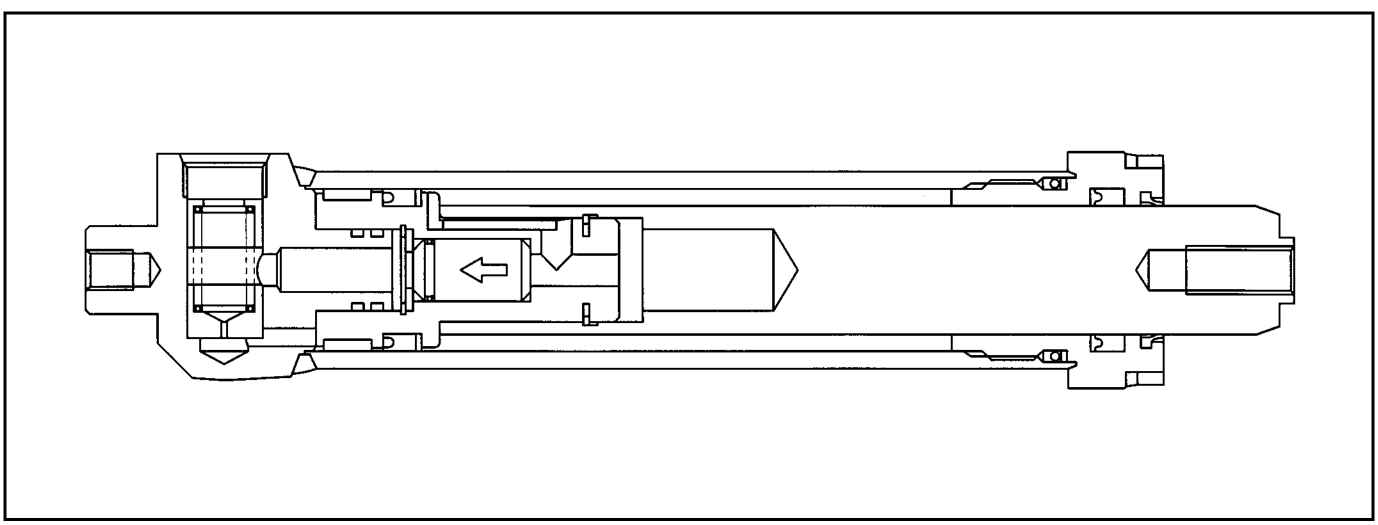
Lift Cylinder (V/15·18 Model)



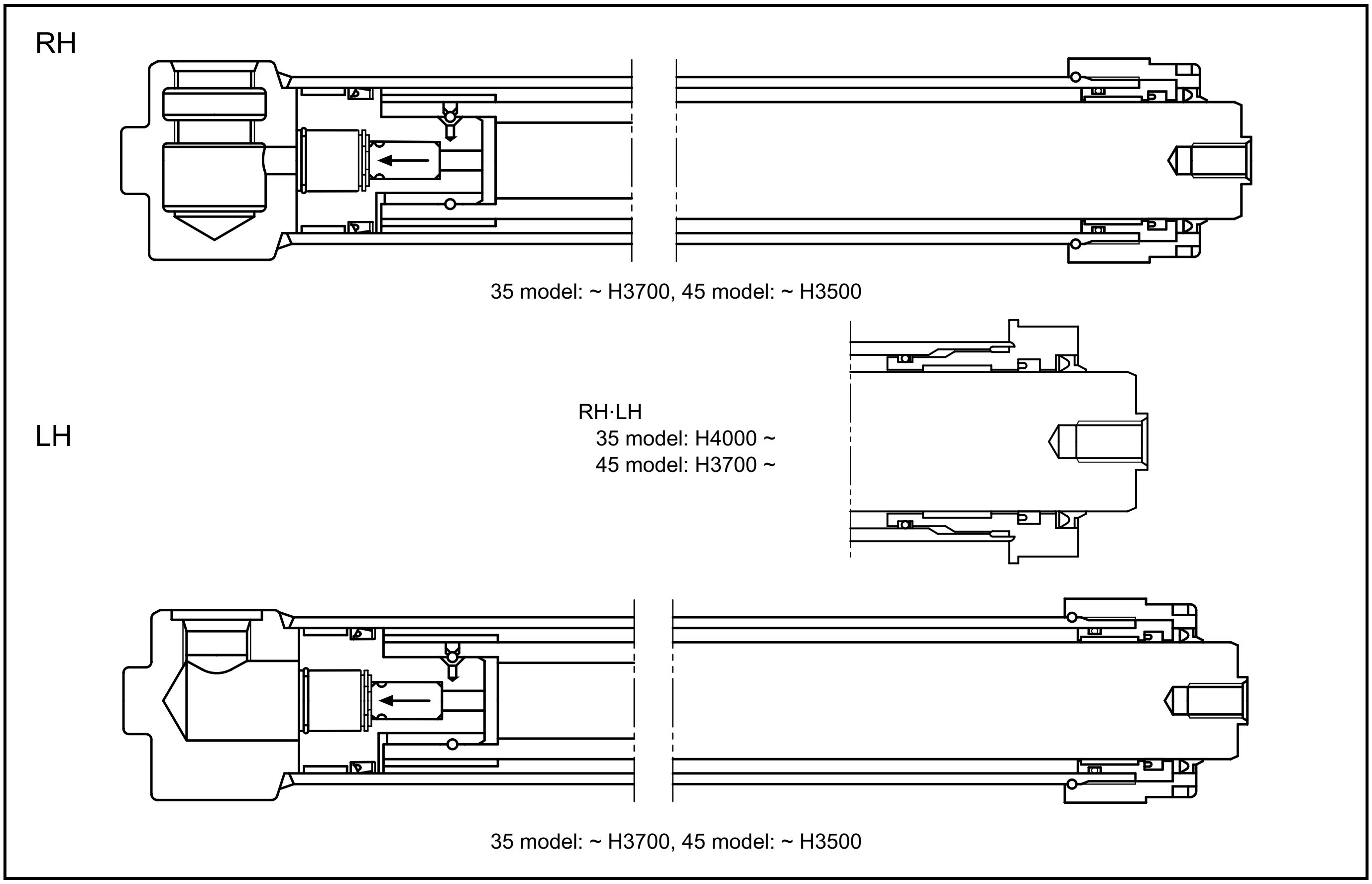
Lift Cylinder (V/20·25 Model)



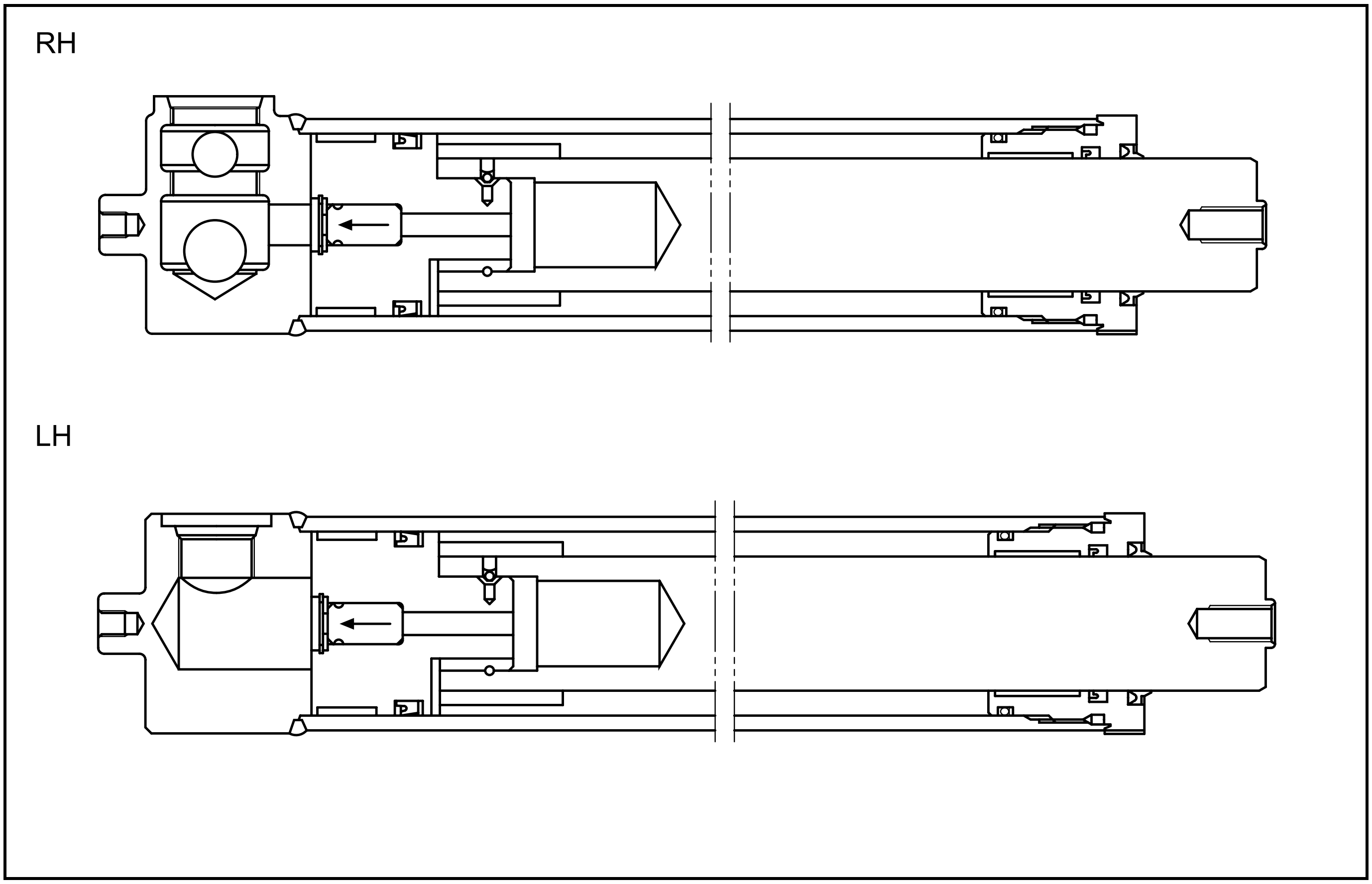
Lift Cylinder (V/30·32 Model)



Lift Cylinder (V/35·45 Model)

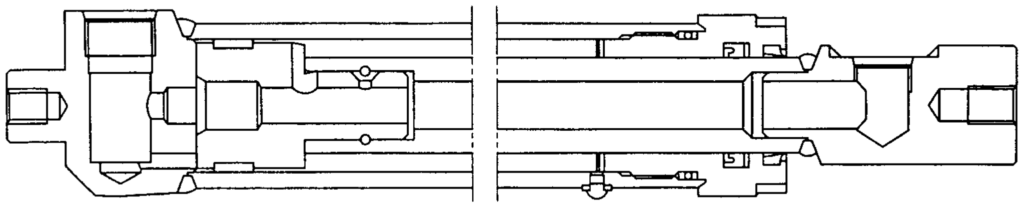


Lift Cylinder (V/55 Model)

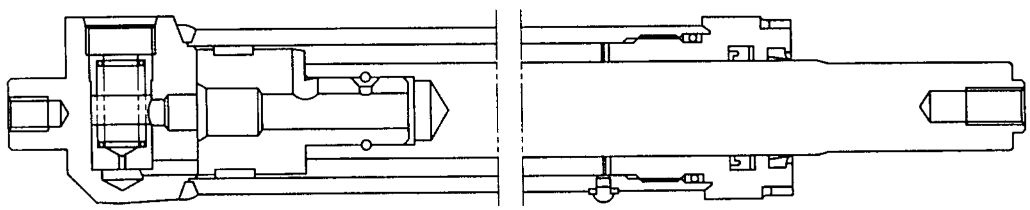


Rear Lift Cylinder (FV/15·18 Model)

RH

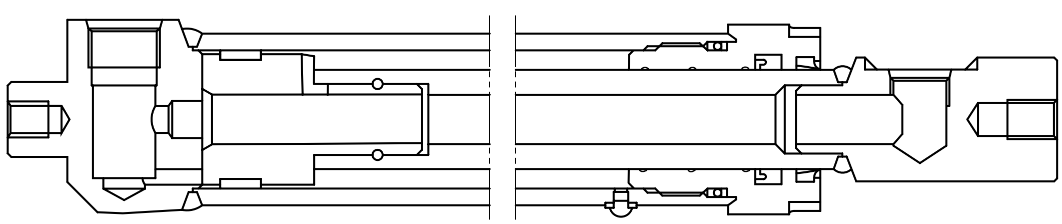


LH

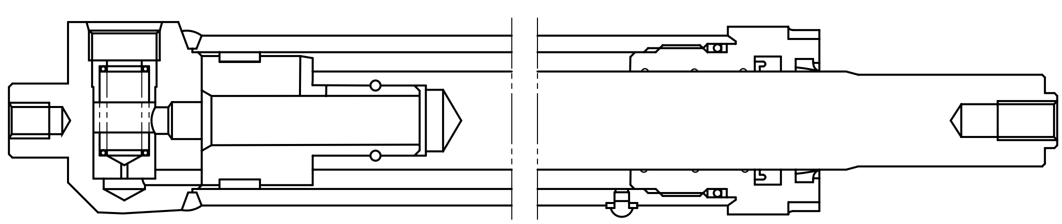


Rear Lift Cylinder (FV/20 ~ 32 Model)

RH

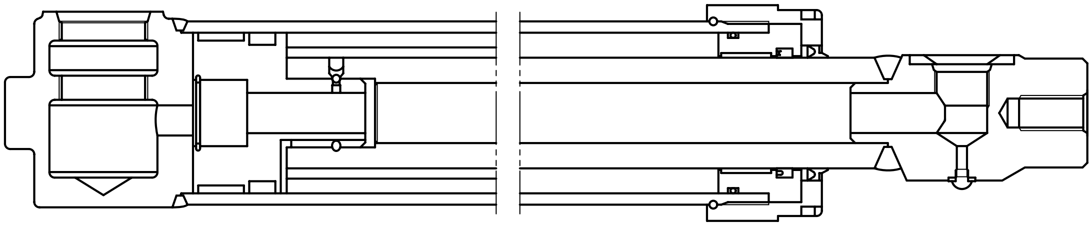


LH

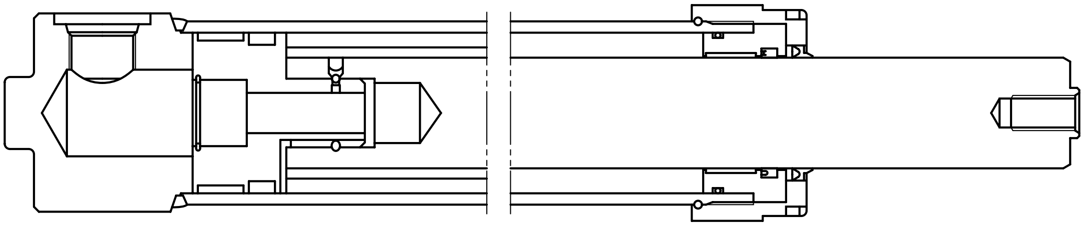


Rear Lift Cylinder (FV/35 Model)

RH

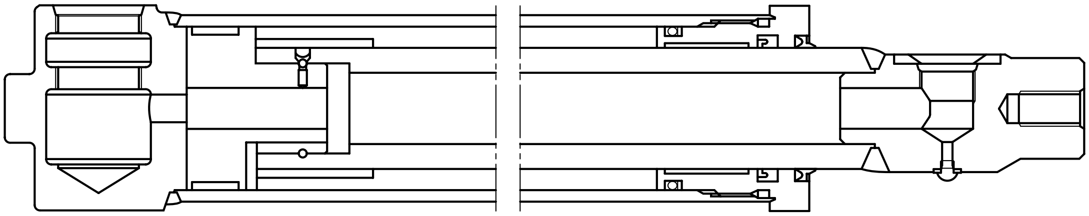


LH

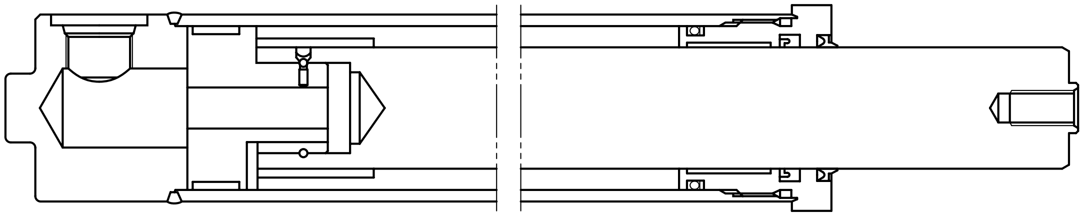


Rear Lift Cylinder (FV/45 Model)

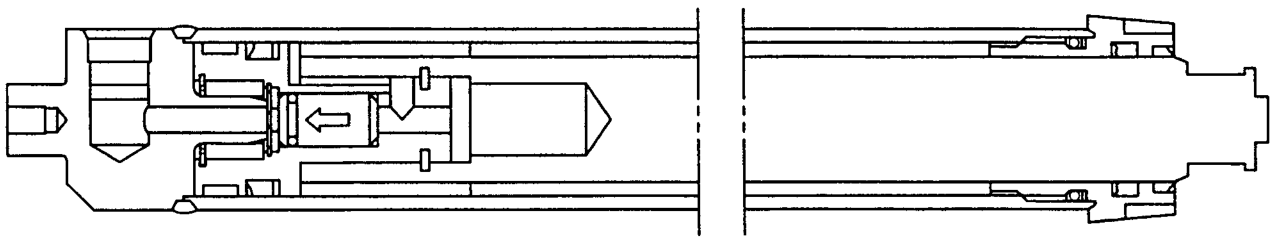
RH



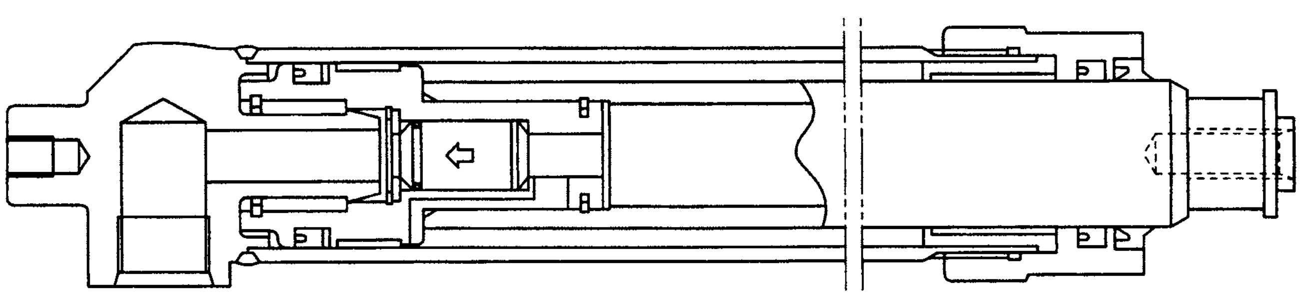
LH



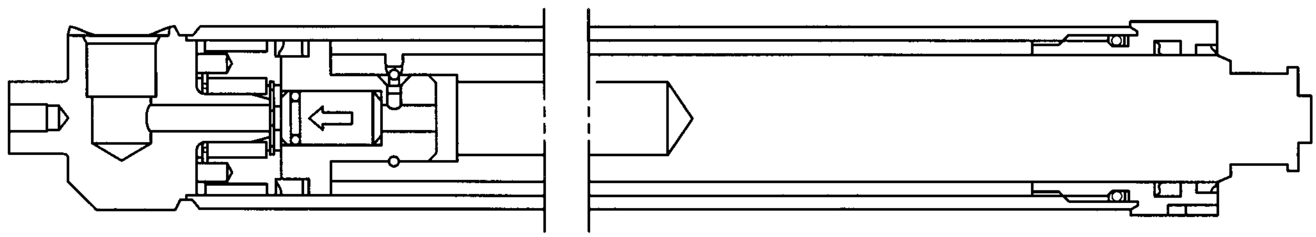
Rear Lift Cylinder (FSV/15·18 Model: Except Fork Height 4800 mm (189 in))



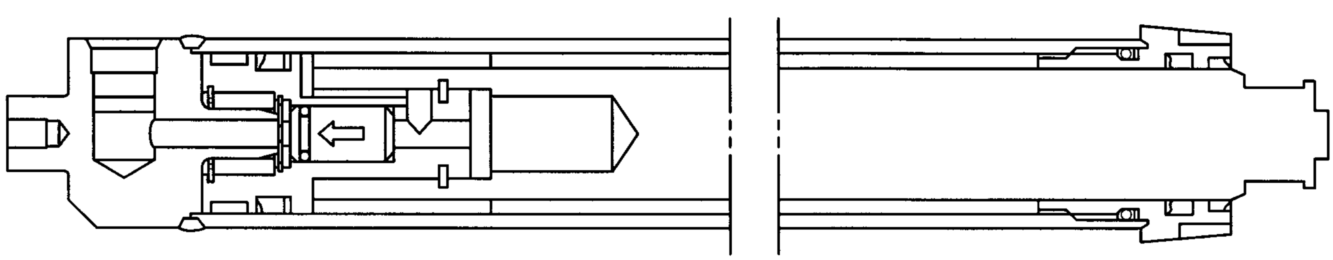
Rear Lift Cylinder (FSV/15·18 Model: Fork Height 4800 mm (189 in))



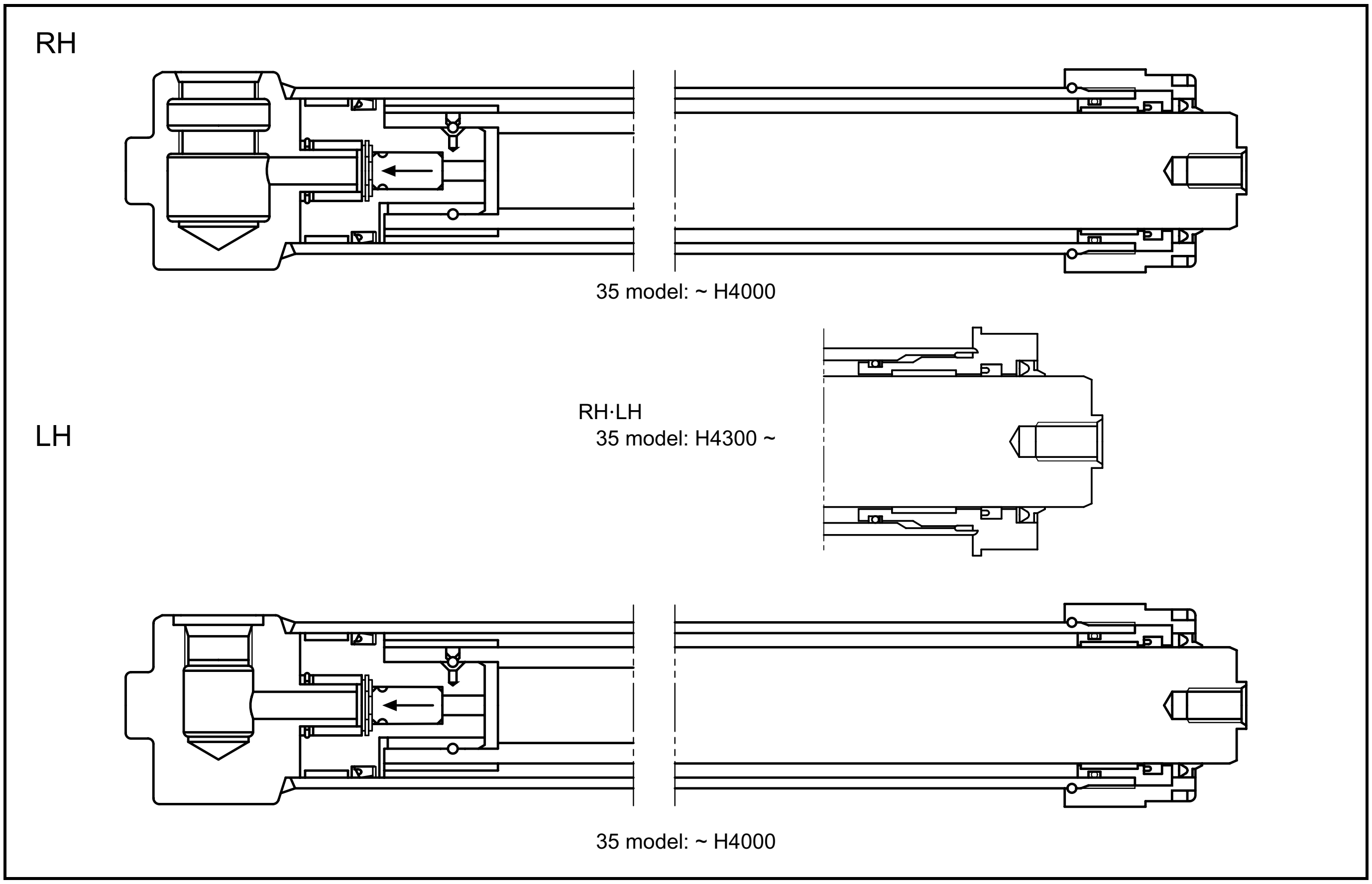
Rear Lift Cylinder (FSV/20·25 Model)



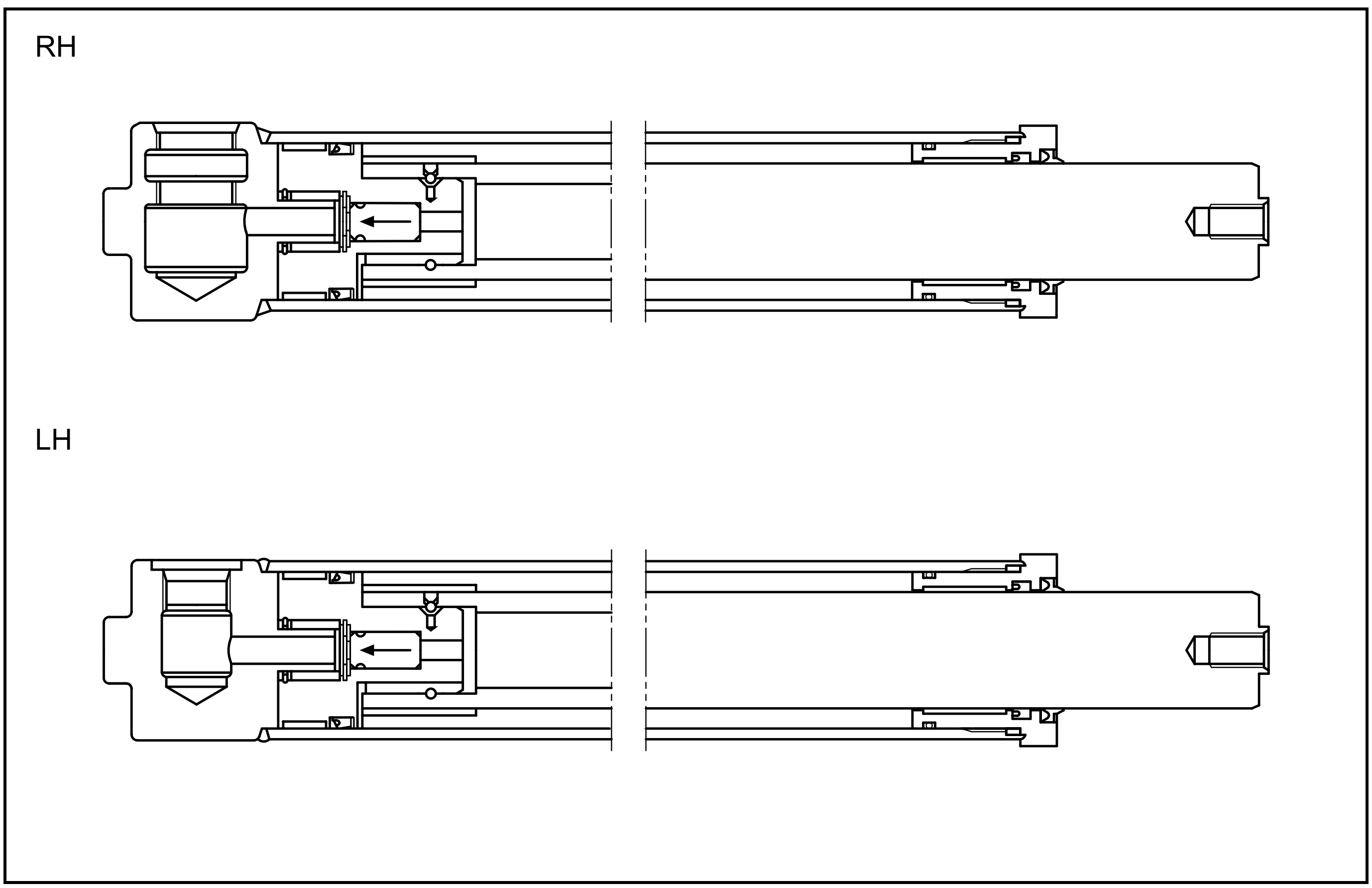
Rear Lift Cylinder (FSV/30·32 Model)



Rear Lift Cylinder (FSV/35 Model)

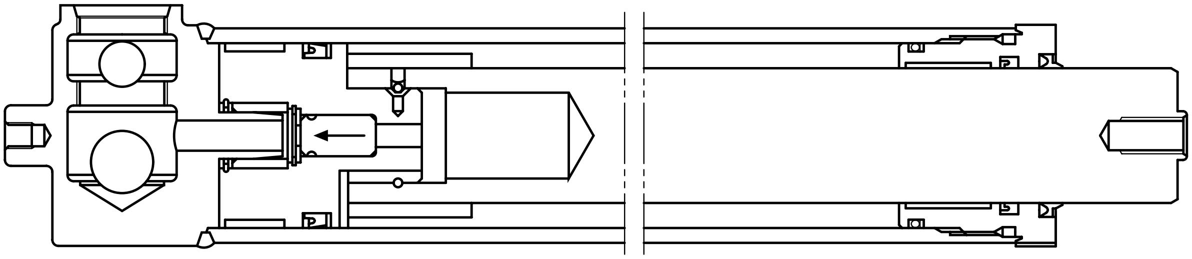


Rear Lift Cylinder (FSV/45 Model)

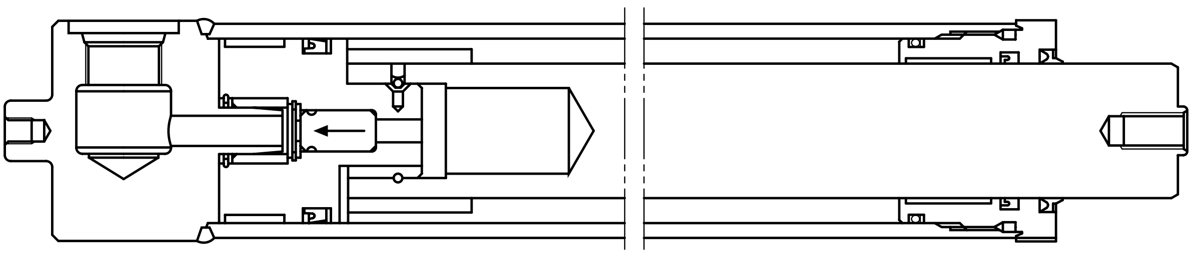


Rear Lift Cylinder (FSV/55 Model)

RH

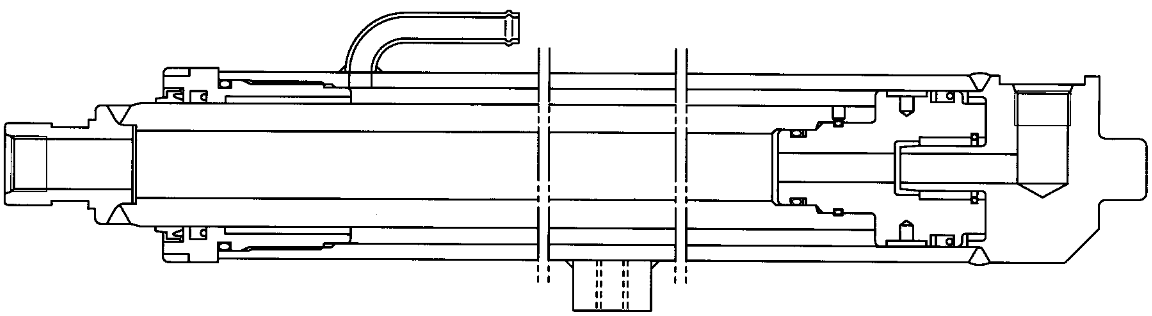


LH

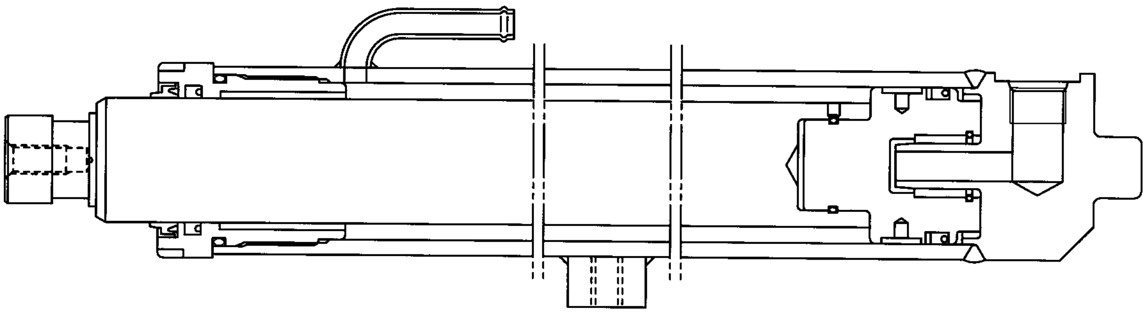


Rear Lift Cylinder (QFV)

RH



LH



SPECIFICATIONS

Lift Cylinder (V/15 ~ 32 Model)

Item \ Model		15·18	20·25	30·32
Cylinder type		Single-acting	←	←
Cylinder bore	mm (in)	44.45 (1.75)	50.0 (1.97)	55.0 (2.17)
Piston rod outside diameter	mm (in)	34.93 (1.38)	42.0 (1.65)	45.0 (1.77)
Piston seal type		U packing	←	←
Rod seal type		U packing	←	←
Others		Built-in safety down valve (RH, LH)		

Lift Cylinder (V/35 ~ 55 Model)

Item \ Model		35	45	55
Cylinder type		Single-acting	←	←
Cylinder bore	mm (in)	65 (2.56)	70 (2.76)	75 (2.95)
Piston rod outside diameter	mm (in)	50.8 (2.00)	←	55 (2.17)
Piston seal type		U packing	←	←
Rod seal type		U packing	←	←
Others		Built-in flow regulator valve (RH) Built-in safety down valve (LH)		

Rear Lift Cylinder (FV/15 ~ 32 Model)

Item \ Model		15·18	20·25	30·32
Cylinder type		Single-acting	←	←
Cylinder bore	mm (in)	45.0 (1.77)	50.0 (1.97)	55.0 (2.17)
Piston rod outside diameter	mm (in)	32.0 (1.26)	34.9 (1.37)	40.0 (1.57)
Rod seal type		U packing	←	←
Others		Built-in safety down valve (LH)		

Rear Lift Cylinder (FV/35·45 Model)

Item \ Model		35	45
Cylinder type		Single-acting	←
Cylinder bore	mm (in)	65 (2.56)	70 (2.76)
Piston rod outside diameter	mm (in)	45 (1.77)	50.8 (2.00)
Piston seal type		—	—
Rod seal type		U packing	←
Others		Built-in flow regulator valve (RH) Built-in safety down valve (LH)	

Rear Lift Cylinder (FSV/15·18 Model)

Item \ Model		15·18	
		All except H4800 mm (189 in)	H4800 mm (189 in) only
Cylinder type		Single-acting	←
Cylinder bore	mm (in)	44.45 (1.75)	45.0 (1.77)
Piston rod outside diameter	mm (in)	34.93 (1.38)	35.0 (1.38)
Piston seal type		U packing	←
Rod seal type		U packing	←
Others		Built-in safety down valve (LH)	

Rear Lift Cylinder (FSV/20 ~ 32 Model)

Item \ Model		20·25	30·32
Cylinder type		Single-acting	←
Cylinder bore	mm (in)	50.2 (1.98)	55.0 (2.17)
Piston rod outside diameter	mm (in)	42.0 (1.65)	45.0 (1.77)
Piston seal type		U packing	←
Rod seal type		U packing	←
Others		Built-in safety down valve (RH)	

Rear Lift Cylinder (FSV/35 ~ 55 Model)

Item \ Model		35	45	55
Cylinder type		Single-acting	←	←
Cylinder bore	mm (in)	65 (2.56)	70 (2.76)	75 (2.95)
Piston rod outside diameter	mm (in)	50.8 (2.00)	←	55 (2.17)
Piston seal type		U packing	←	←
Rod seal type		U packing	←	←
Others		Built-in flow regulator valve (RH) Built-in safety down valve (LH)		

Rear Lift Cylinder (QFV)

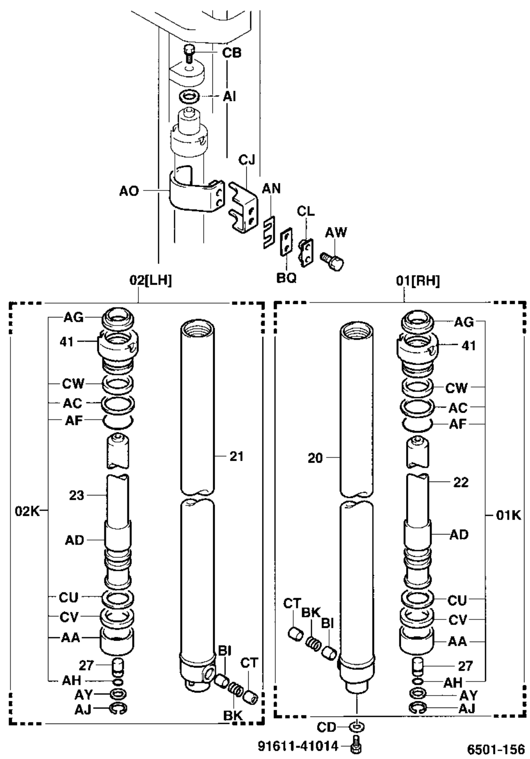
Item \ Model		20 ~ 32
Cylinder type		Single-acting type
Cylinder bore	mm (in)	63 (2.48)
Piston rod outside diameter	mm (in)	50 (1.97)
Rod seal type		U packing
Others		Built-in safety down valve (LH)

COMPONENTS

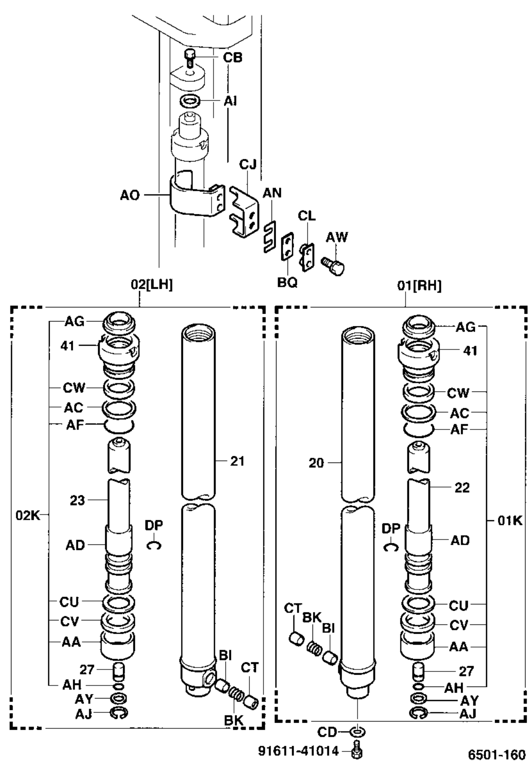
Lift Cylinder (V)

15·18·30·32 model

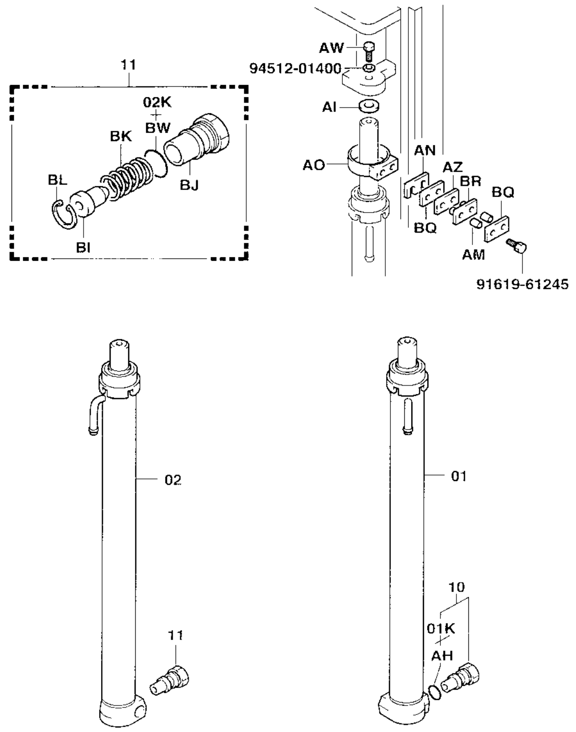
6501



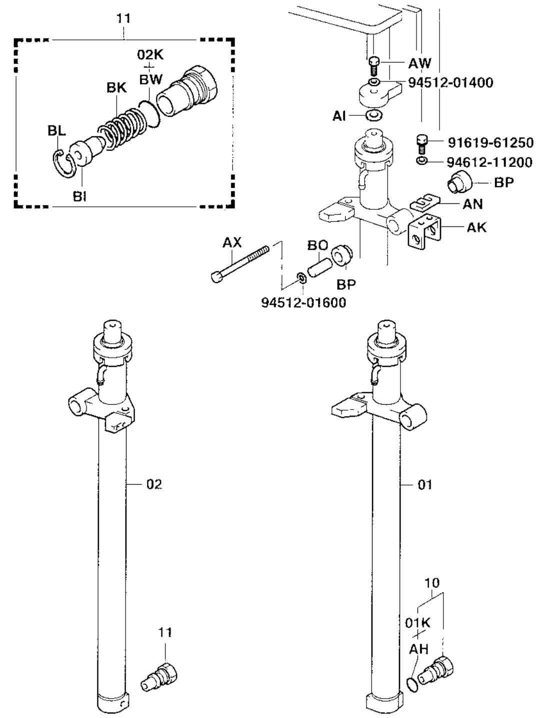
20·25 model



35 model | 45 model | 6501

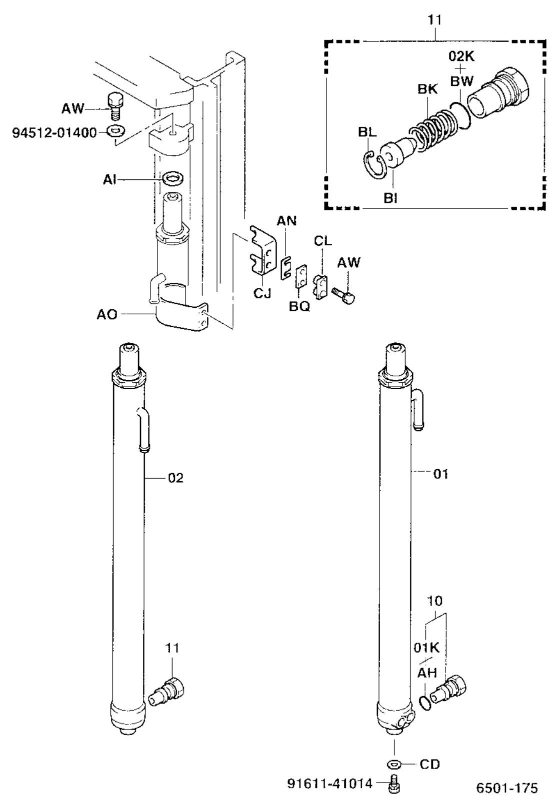


6501-173



6501-174

55 model

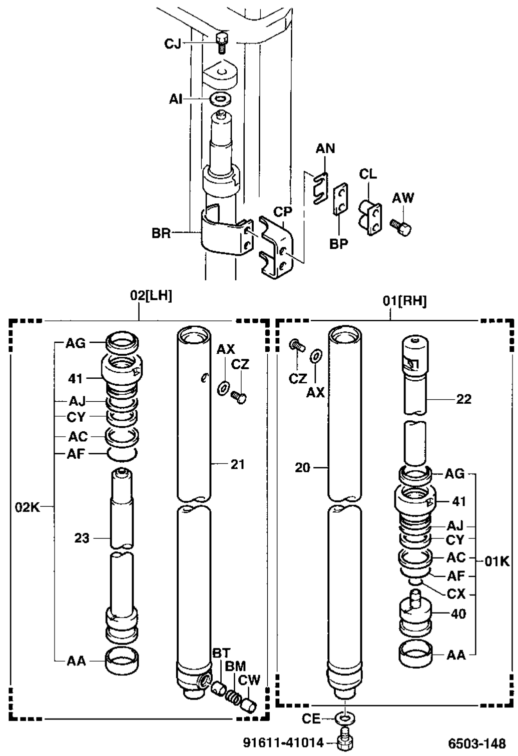


6501-175

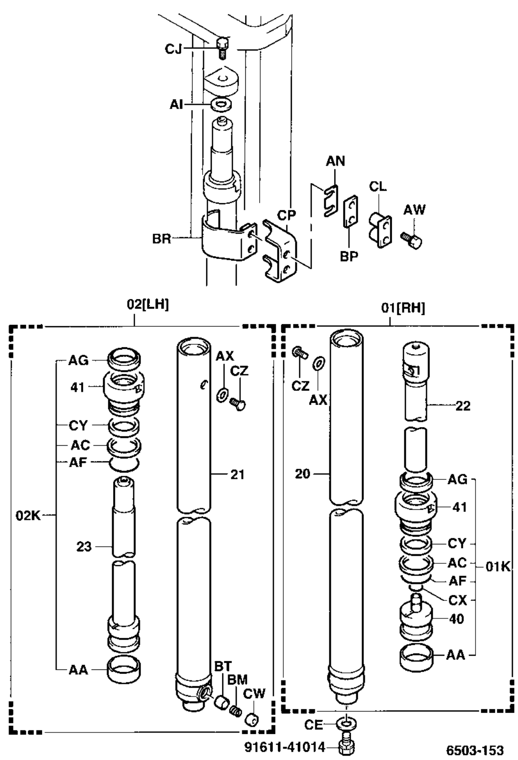
Rear Lift Cylinder (FV)

15·18 model

6503

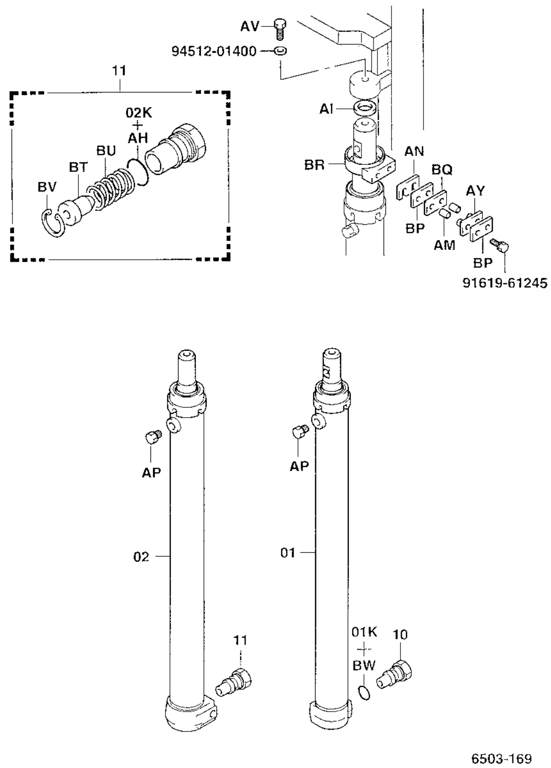


20 ~ 32 model

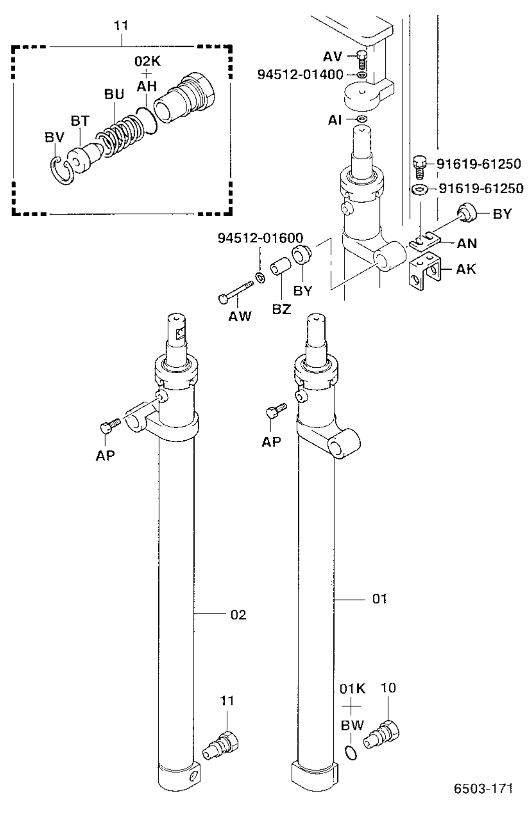


35 model

6503



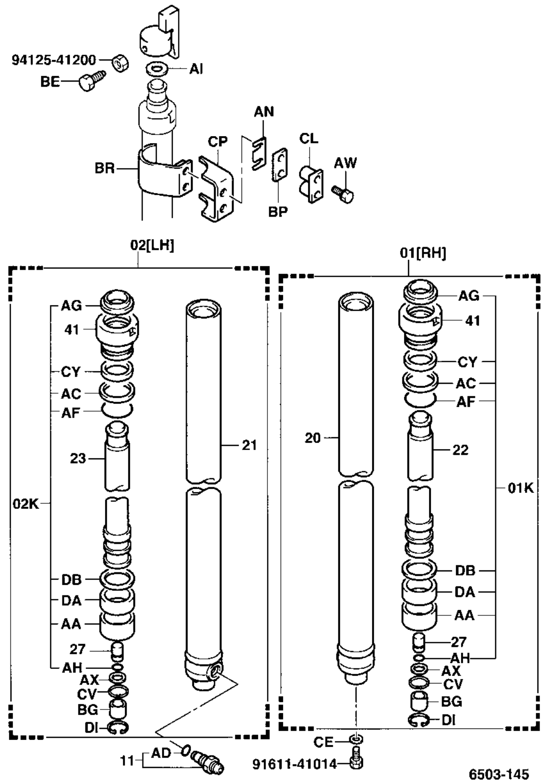
45 model



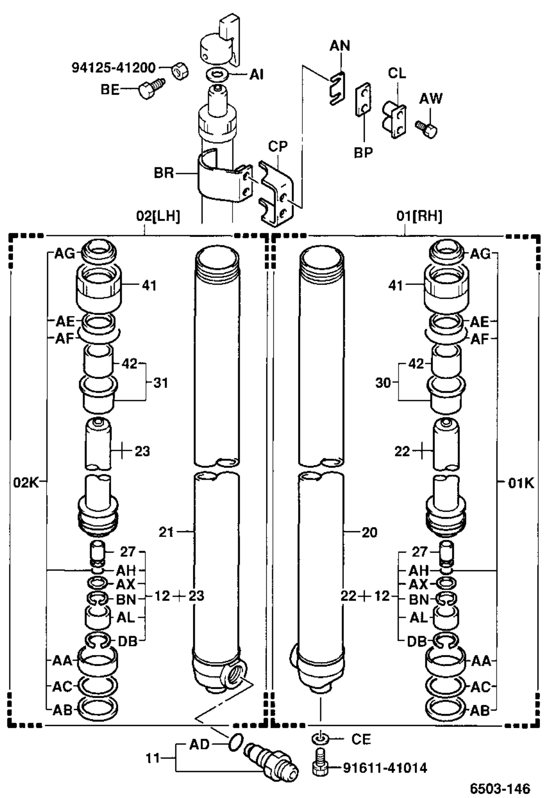
Rear Lift Cylinder (FSV)

15·18 model (Except H4800)

6503

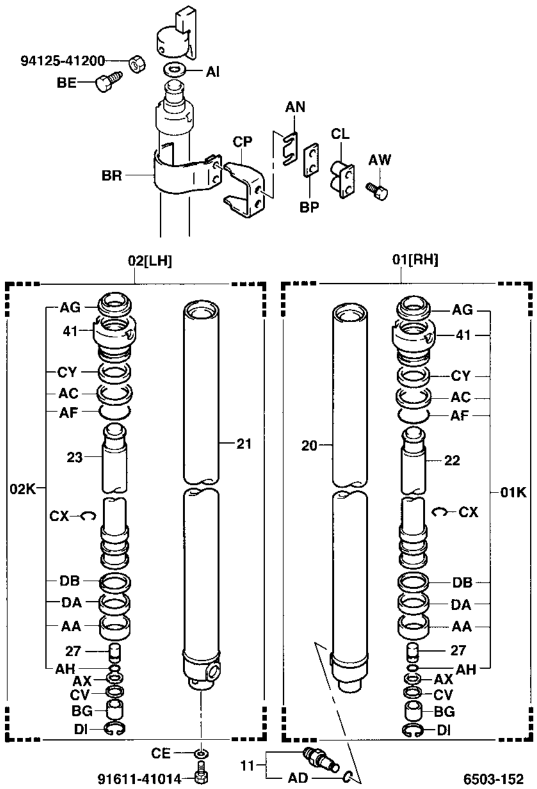


15·18 model (H4800)

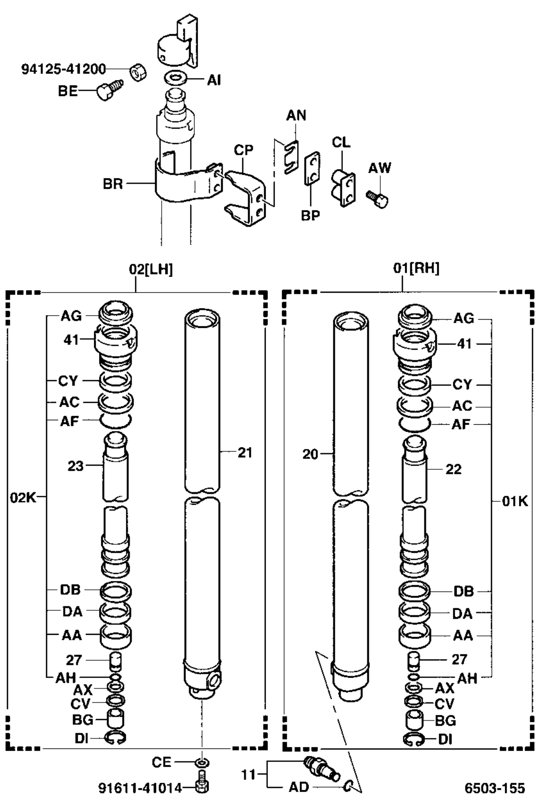


20·25 model

6503

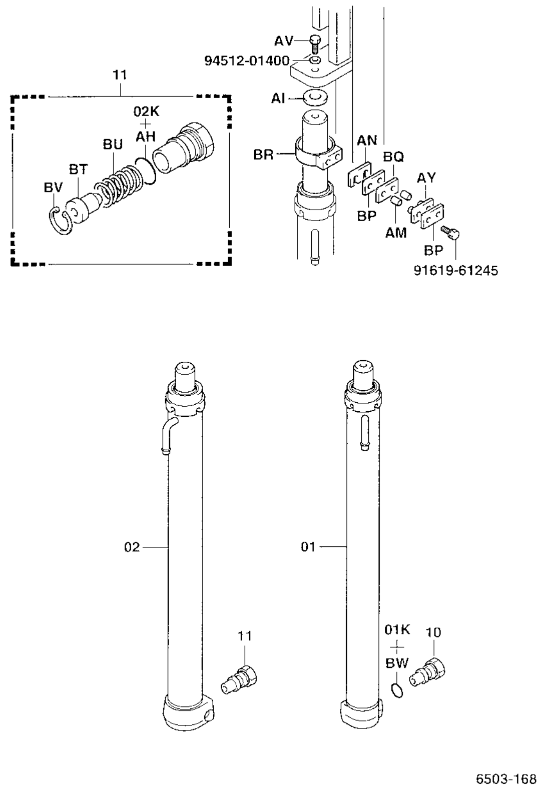


30·32 model

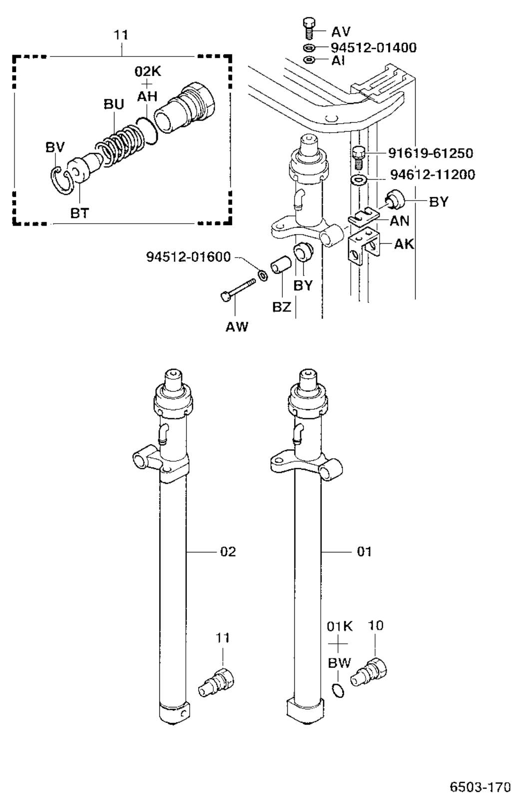


35 model

6503

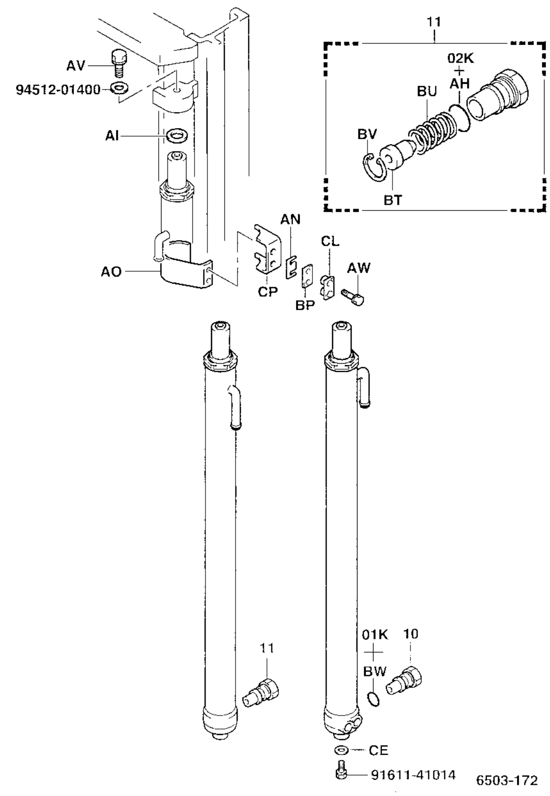


45 model



55 model

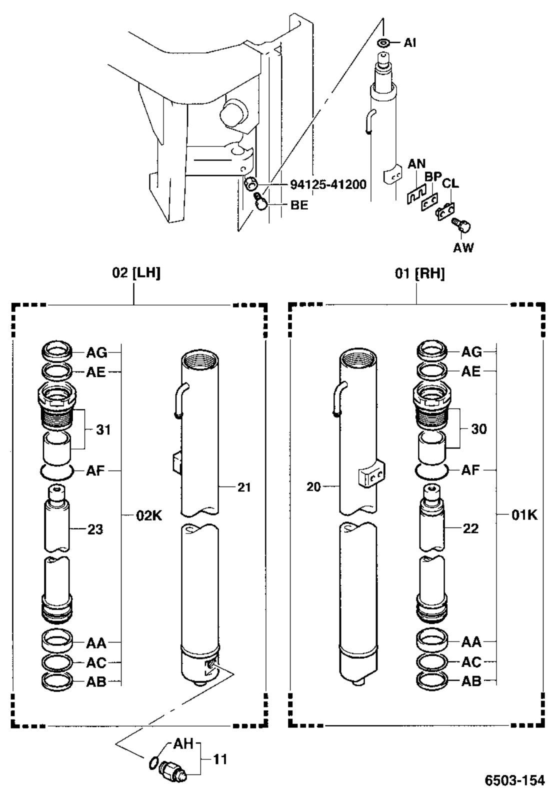
6503



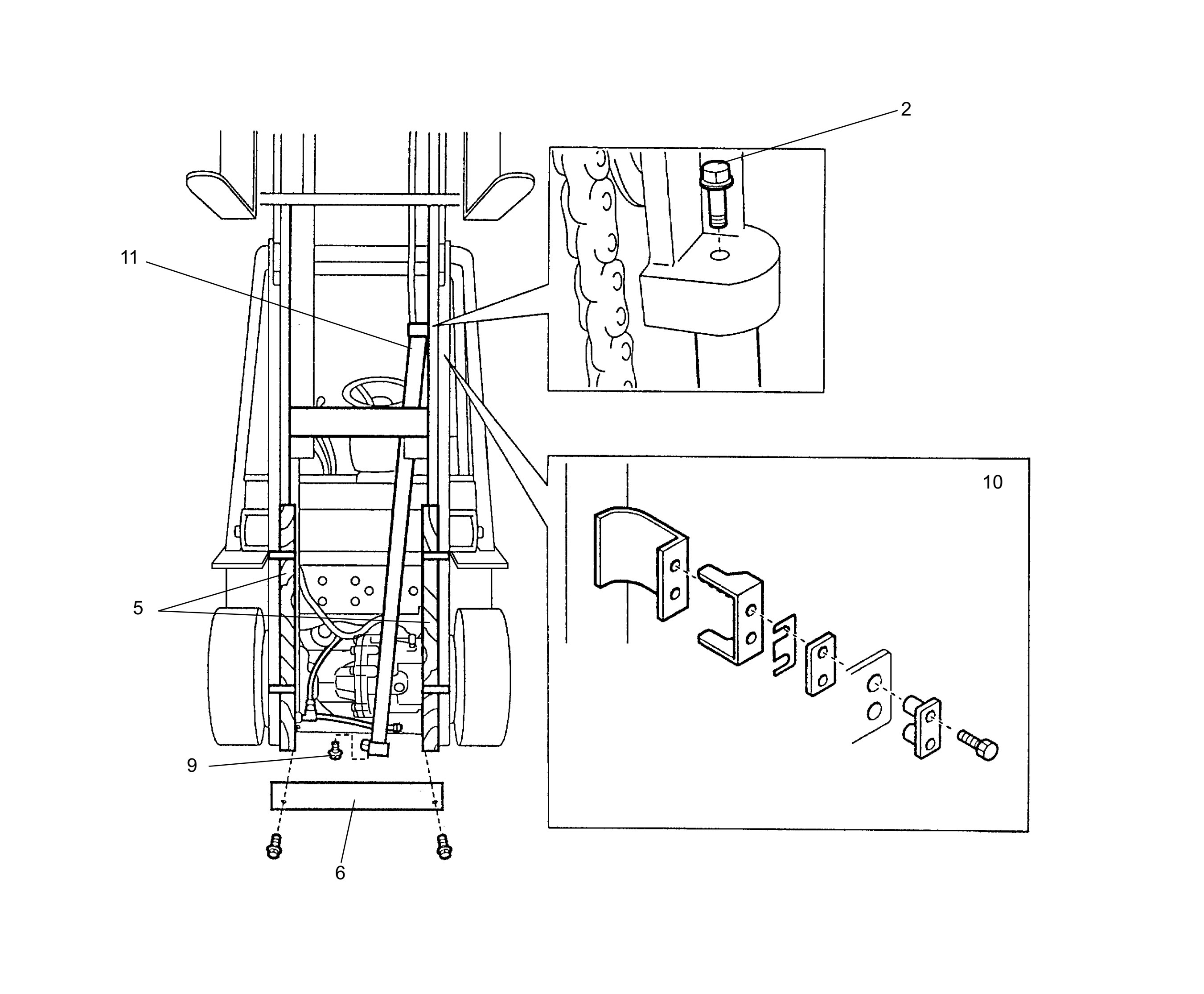
Rear Lift Cylinder (QFV)

20 ~ 32 model

6503



REMOVAL·INSTALLATION (15 ~ 32 MODEL)



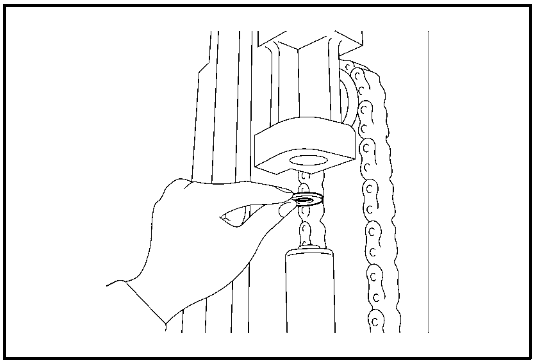
Removal Procedure

1 Set the mast vertical and lower the fork fully.
2 Remove the lift cylinder rod end set bolt.
3 Hoist the inner mast by slinging with a wire and disconnect the lift cylinder rod end. **[Point 1]**
4 Hoist the inner mast further so that the lift cylinder ASSY can be removed from the front space.
5 Support the bottom of the inner mast with wooden blocks and fix the blocks by taping onto the outer mast.
6 Remove the hose cover.
7 Disconnect the hose.
8 Disconnect the load sensor wiring.
9 Remove the lift cylinder bottom end set bolt.
10 Remove the lift cylinder support. **[Point 2]**
11 Remove the lift cylinder ASSY.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

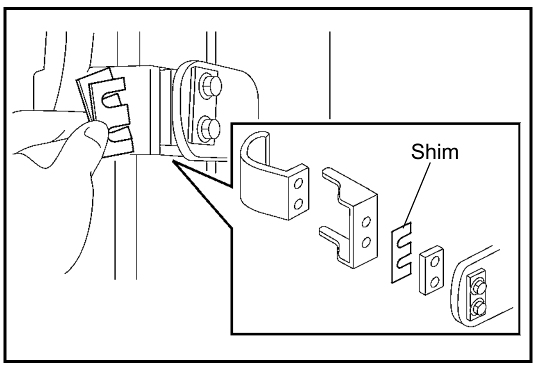
Note:
After installing the lift cylinder, follow the steps below.
- **Repeat full-stroke raising and lowering of the cylinder to bleed air and check normal functioning.**
- **Check the hydraulic oil level and add if insufficient.**
- **Inspect lift cylinders for uneven lifting, and make necessary adjustment. (See page 13-61.)**



Point Operations

[Point 1]

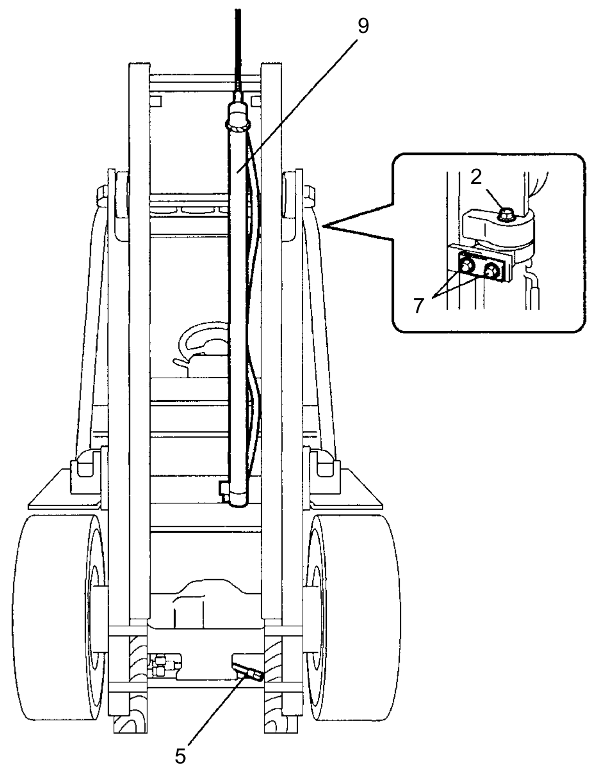
Removal:
Shim adjustment is made at the lift cylinder rod end to prevent uneven lifting by lift cylinders LH and RH. Take notes on the cylinder where adjustment is made and the number of shims used.



[Point 2]

Installation:
Temporarily fasten the cylinder support here, and eliminate any clearance between the cylinder support and outer mast by shim insertion after connecting the rod end. (Use shim (s) slightly thicker than the clearance.)

REMOVAL·INSTALLATION (35 ~ 55 MODEL)



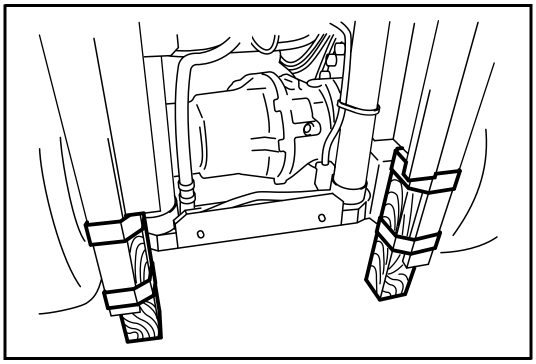
Removal Procedure

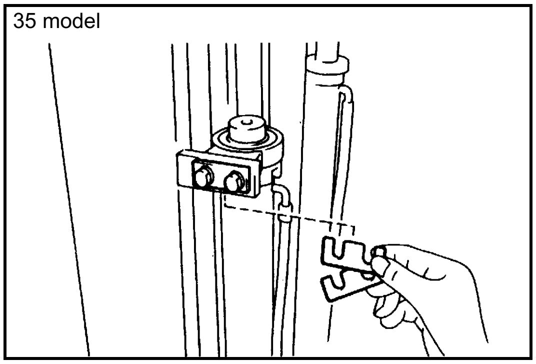
1 Remove the lift bracket. (See removal procedure steps 1 to 4 in mast removal-installation section on page 13-7.)
2 Remove the cylinder rod end set bolt.
3 Disconnect the cylinder rod end. **[Point 1]**
4 Remove the front hose cover. (V: 55 model)
5 Disconnect the hose.
6 Disconnect the load sensor wiring.
7 Remove the lift cylinder support. **[Point 2]**
8 Remove the cylinder bottom set bolt. (55 model)
9 Remove the lift cylinder ASSY.

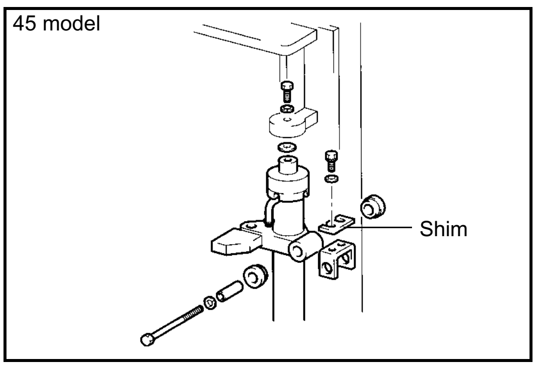
Installation Procedure

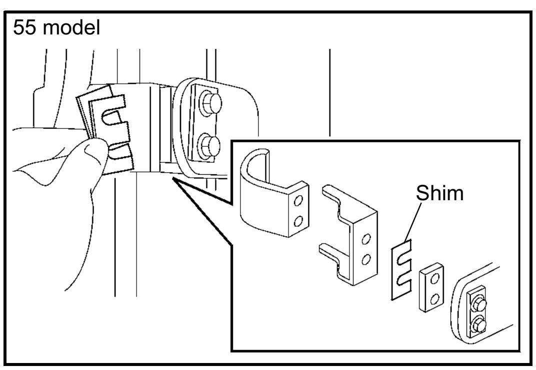
The installation procedure is the reverse of the removal procedure.

Note:
Perform the following operations after installing the lift cylinder:
- **Repeat lifting and lowering to stroke ends without load to bleed the air and to check normal operation.**
- **After the operation check, check the hydraulic oil level and add oil if insufficient.**
- **Inspect the lift cylinders for uneven movements and make adjustment if necessary. (See the lift cylinder rod shim adjustment section on page 13-61.)**









Point Operations

[Point 1]

Removal:

Hoist the inner mast.
Support the bottom of the inner mast with wooden blocks and fix the blocks by taping onto the outer mast.

Removal:

Shim adjustment is made at the lift cylinder rod end to prevent uneven movements of the lift cylinders RH and LH. Take a note on which side the adjustment is made and the number of shims used.

[Point 2]

Installation:

The cylinder support shall be tightened temporarily here and make shim adjustment after rod end connection.

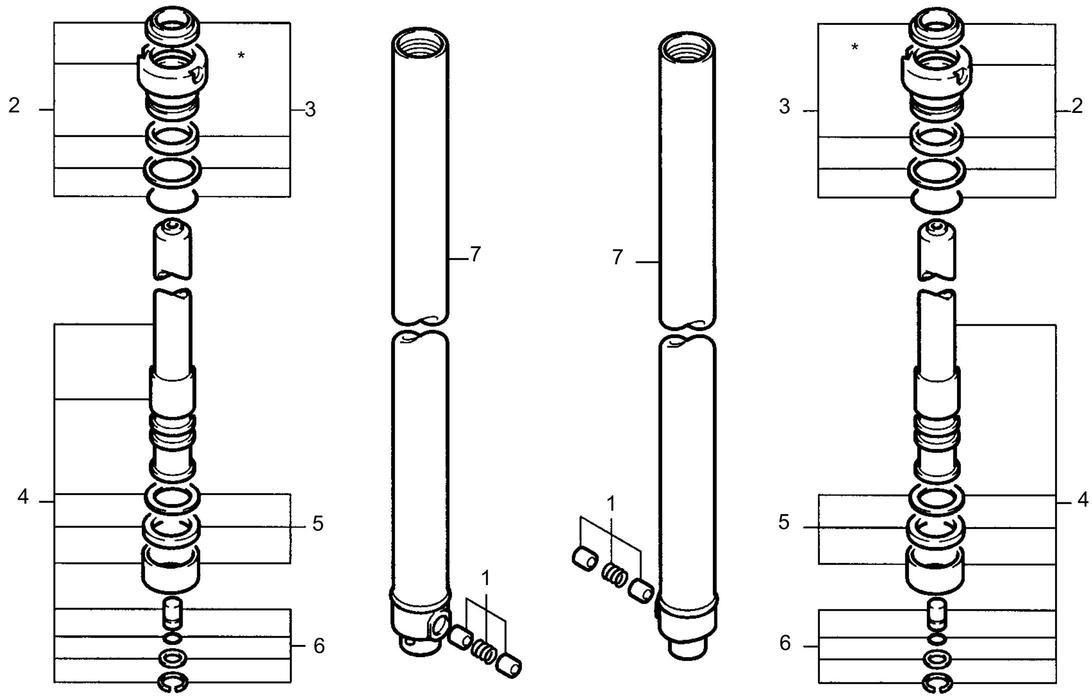
Adjustment:

With the rod end connected, insert shims between the cylinder support and outer mast to eliminate the clearance. The shim thickness shall be slightly on the thicker side.

DISASSEMBLY·INSPECTION·REASSEMBLY (15 ~ 32 MODEL)

Lift Cylinder (V)

T = N·m (kgf-cm) [ft-lbf]



* Cylinder cover
15·18 model
T = 170 ~ 237 (1730 ~ 2419) [125 ~ 175]
20·25 model
T = 230 ~ 265 (2345 ~ 2703) [170 ~ 195]

30·32 model
T = 264 ~ 305 (2695 ~ 3110) [175 ~ 225]

Disassembly Procedure

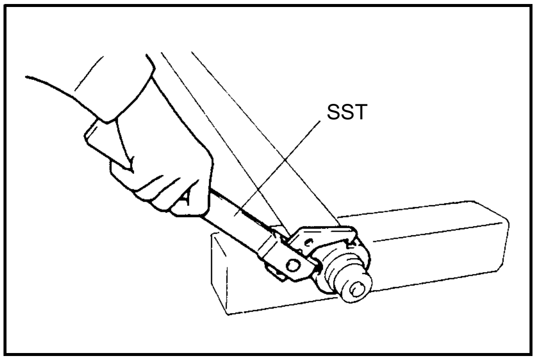
1 Remove the safety down valve.
2 Remove the cylinder cover. **[Point 1]**
3 Remove the seals from the cylinder cover.
4 Remove the piston rod. **[Point 2]**
5 Remove the seals on the piston rod.
6 Remove the check valve from the piston rod. **[Point 3]**
7 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

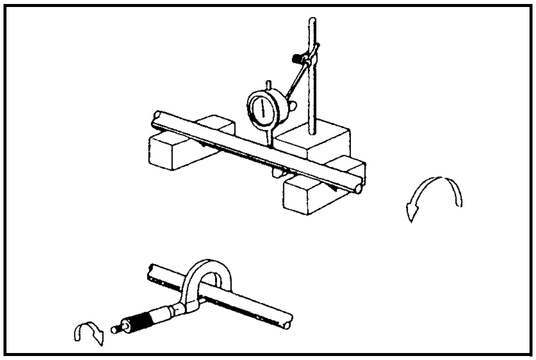
Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**

Point Operations



[Point 1]

Disassembly·Reassembly:
SST 09620-10100-71



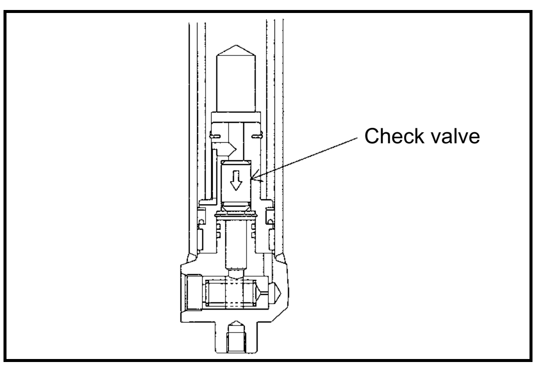
[Point 2]

Inspection:
Measure the piston rod outside diameter.

15·18 model
Standard: 34.93 mm (1.375 in)
Limit: 34.85 mm (1.3720 in)
20·25 model
Standard: 42.0 mm (1.654 in)
Limit: 41.92 mm (1.6504 in)
30·32 model
Standard: 45.0 mm (1.772 in)
Limit: 44.92 mm (1.7685 in)

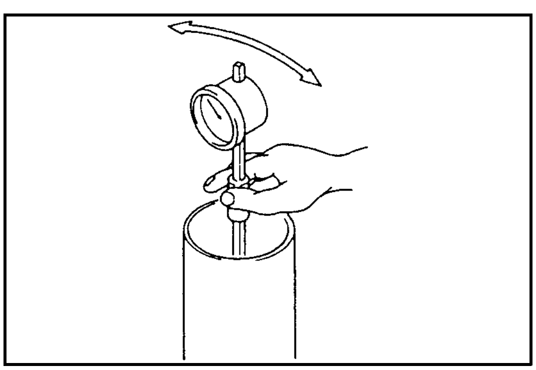
Inspection:
Measure the piston rod bend.

Limit: 2.0 mm (0.079 in)



[Point 3]

Reassembly:
Install the check valve arrow pointing to the lower side of the cylinder.



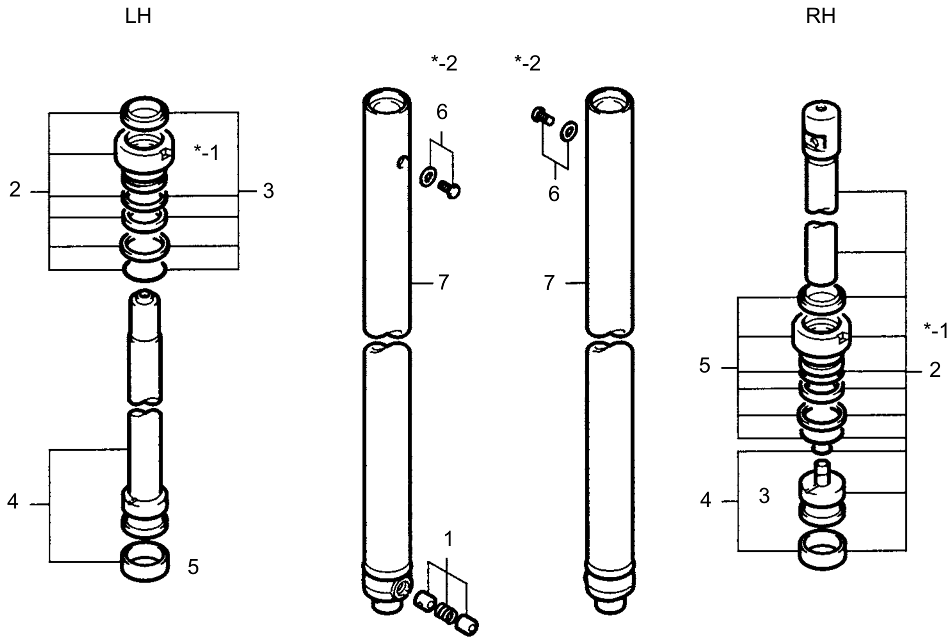
[Point 4]

Inspection:
Measure the cylinder bore.

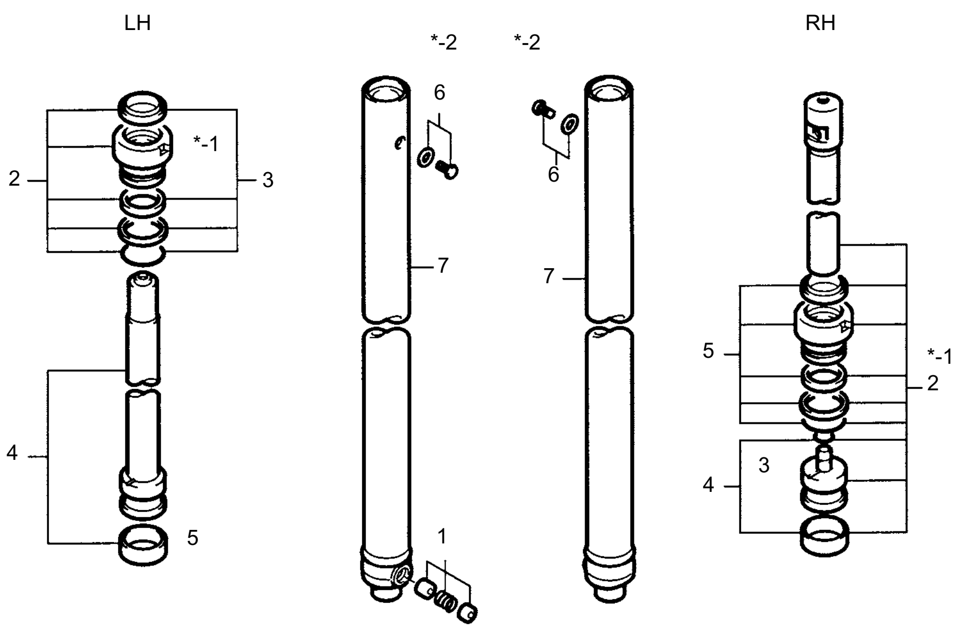
15·18 model
Standard: 44.45 mm (1.750 in)
Limit: 44.65 mm (1.7579 in)
20·25 model
Standard: 50.0 mm (1.969 in)
Limit: 50.20 mm (1.9764 in)
30·32 model
Standard: 55.0 mm (2.165 in)
Limit: 55.35 mm (2.1791 in)

Rear Lift Cylinder (FV)

T = N·m (kgf-cm) [ft-lbf]



15·18 model



20 ~ 32 model

*-1 Cylinder cover
15·18 model
T = 169 ~ 237 (1728 ~ 2419) [125 ~ 175]
20·25 model
T = 203 ~ 271 (2073 ~ 2764) [150 ~ 200]
30·32 model
T = 237 ~ 305 (2419 ~ 3110) [175 ~ 225]

*-2 Air bleed screw:
T = 4.5 ~ 5.0 (46 ~ 51) [3.33 ~ 3.69]

Disassembly Procedure

(1) LH Rear Lift Cylinder.

1 Remove the safety down valve.
2 Remove the cylinder cover. **[Point 1]**
3 Remove the seals from the cylinder cover.
4 Remove the piston rod. **[Point 2]**
5 Remove the wear ring.
6 Remove the bleed screw.
7 Remove the cylinder. **[Point 4]**

(2) RH Lift Cylinder.

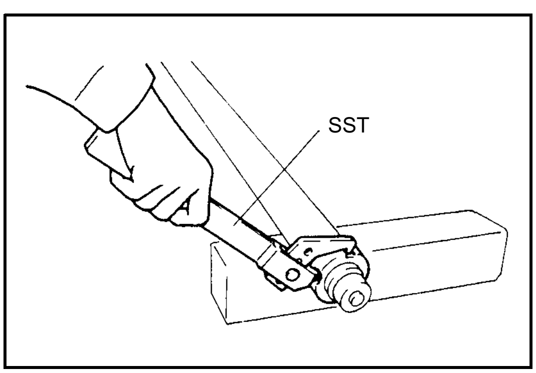
1 Loosen the cylinder cover. **[Point 1]**
2 Remove the piston rod. **[Point 2]**
3 Remove the piston. **[Point 3]**
4 Remove the piston seals.
5 Remove the cover and the seals.
6 Remove the bleed screw.
7 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:

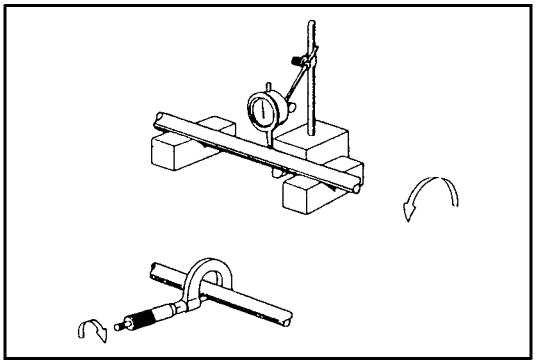
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**
- **Upon completing the installation of the FV rear lift cylinder, perform air bleeding in the following sequence:**
  (1) Extend the FV rear lift cylinder.
  (2) Set the key switch to OFF.
  (3) Loosen the bleed screw by the time oil will come out and tighten the bleed screw again.



Point Operations

[Point 1]

Disassembly·Reassembly:
SST 09620-10100-71



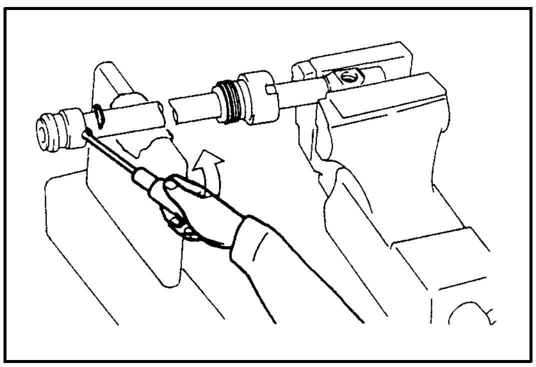
[Point 2]

Inspection:
Measure the piston rod outside diameter.

15·18 model
Standard: 32.0 mm (1.260 in)
Limit: 31.92 mm (1.2567 in)
20·25 model
Standard: 34.9 mm (1.374 in)
Limit: 34.82 mm (1.3709 in)
30·32 model
Standard: 40.0 mm (1.575 in)
Limit: 39.92 mm (1.5717 in)

Inspection:
Measure the piston rod bend.

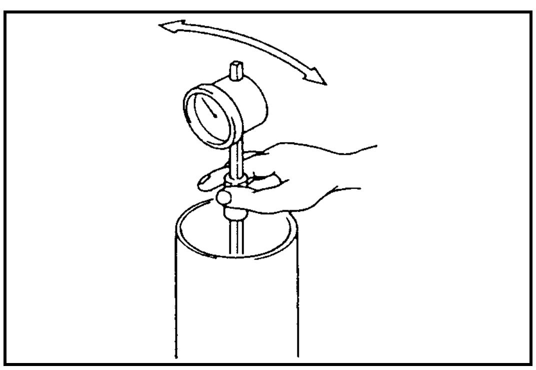
Limit: 2.0 mm (0.079 in)



[Point 3]

Disassembly·Reaseembly:
Follow the procedure view.

1. Fix the boss portion at the tip end of the piston rod in a vise.
2. Use a screwdriver and rotate the piston to remove the wire.
3. The installation is the reverse.



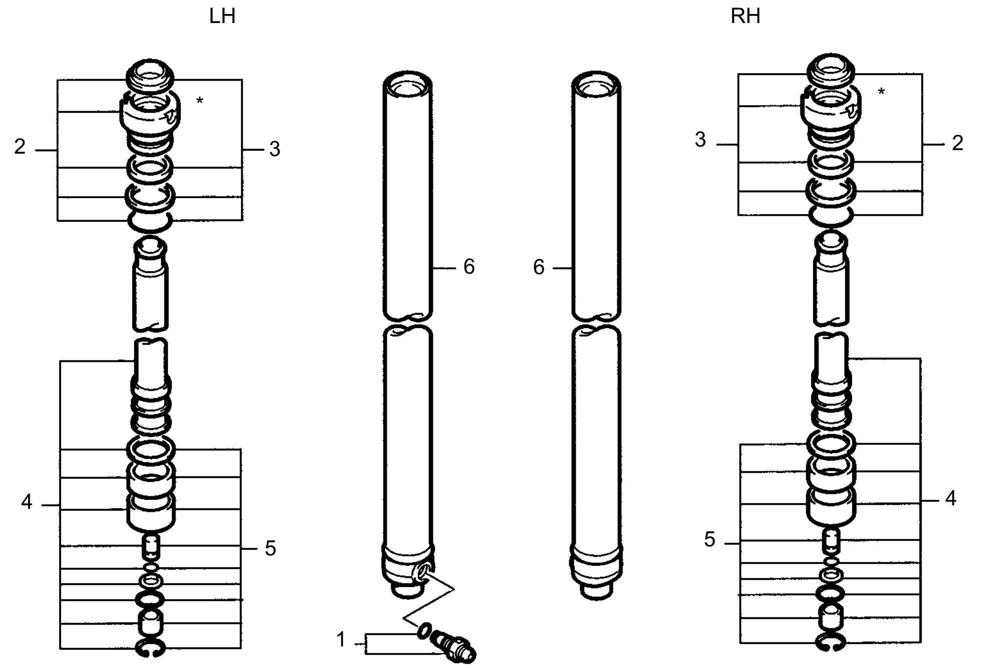
[Point 4]

Inspection:
Measure the lift cylinder bore.

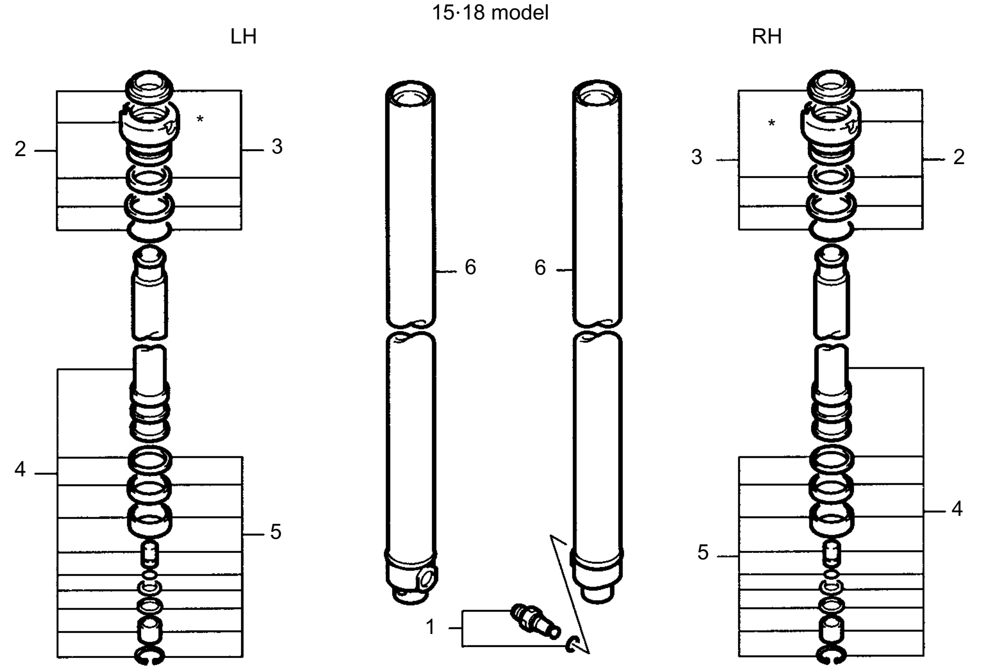
15·18 model
Standard: 45.0 mm (1.772 in)
Limit: 45.20 mm (1.7795 in)
20·25 model
Standard: 50.0 mm (1.969 in)
Limit: 50.20 mm (1.9764 in)
30·32 model
Standard: 55.0 mm (2.165 in)
Limit: 55.35 mm (2.1791 in)

Rear Lift Cylinder (FSV: Except Fork Height 4800 mm (189 in) on 15·18 model)

T = N·m (kgf-cm) [ft-lbf]



15·18 model



20 ~ 32 model

* Cylinder cover

15·18 model	T = 169 ~ 237 (1728 ~ 2419) [125 ~ 175]
20·25 model	T = 230 ~ 265 (2345 ~ 2702) [170 ~ 195]
30·32 model	T = 237 ~ 305 (2419 ~ 3110) [175 ~ 225]

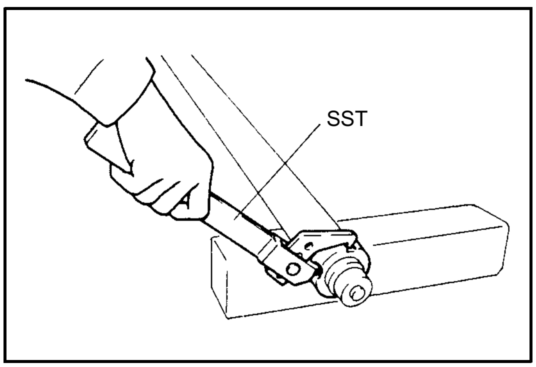
Disassembly Procedure

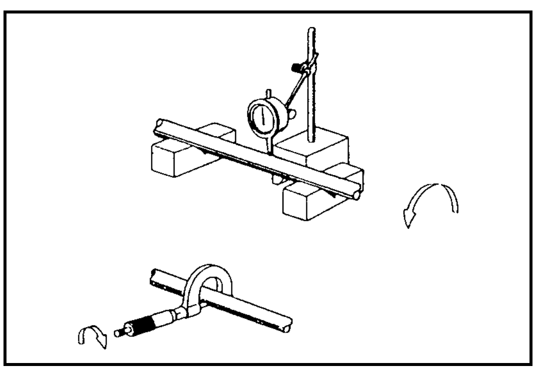
1 Remove the safety down valve.
2 Remove the cylinder cover. **[Point 1]**
3 Remove the seals from the cylinder cover.
4 Remove the piston rod. **[Point 2]**
5 Remove the piston seals, and the check valve. **[Point 3]**
6 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**





Point Operations

[Point 1]

Disassembly·Reassembly:
SST 09620-10100-71

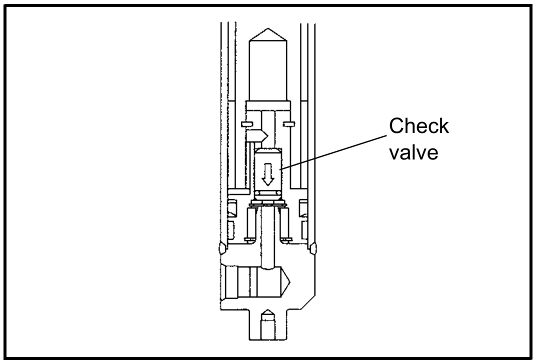
[Point 2]

Inspection:
Measure the piston rod outside diameter.

15·18 model
Standard: 34.93 mm (1.375 in)
Limit: 34.85 mm (1.3720 in)
20·25 model
Standard: 42.0 mm (1.654 in)
Limit: 41.92 mm (1.6504 in)
30·32 model
Standard: 45.0 mm (1.772 in)
Limit: 44.92 mm (1.7685 in)

Inspection:
Measure the piston rod bend.

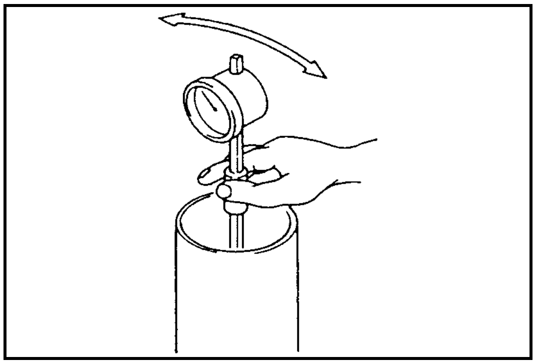
Limit: 2.0 mm (0.079 in)



[Point 3]

Reassembly:

Install the check valve so that the arrow directs to downward of the lift cylinder.



[Point 4]

Inspection:

Measure the lift cylinder bore.

15·18 model

Standard: 44.45 mm (1.750 in)

Limit: 44.65 mm (1.7579 in)

20·25 model

Standard: 50.2 mm (1.976 in)

Limit: 50.40 mm (1.9843 in)

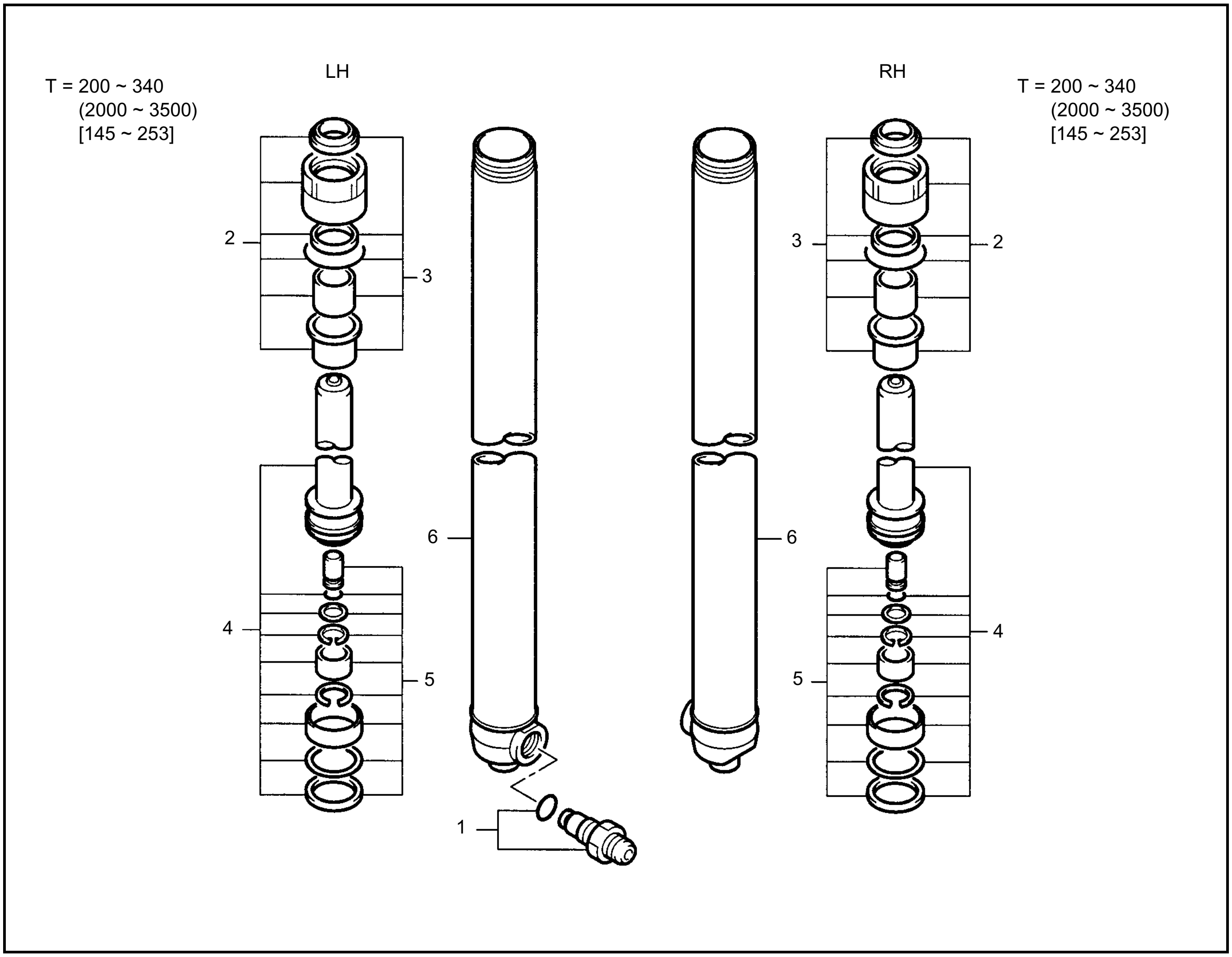
30·32 model

Standard: 55.0 mm (2.165 in)

Limit: 55.20 mm (2.1732 in)

Rear Lift Cylinder (FSV: Fork Height 4800 mm (189 in) on 15·18 model)

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

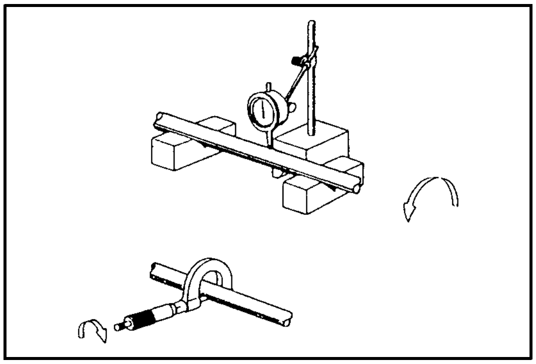
1 Remove the safety down valve.
2 Remove the cylinder cover.
3 Remove the seals from the cylinder cover.
4 Remove the piston rod. **[Point 1]**
5 Remove the piston seals, and the check valve. **[Point 2]**
6 Remove the cylinder. **[Point 3]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**

Point Operations



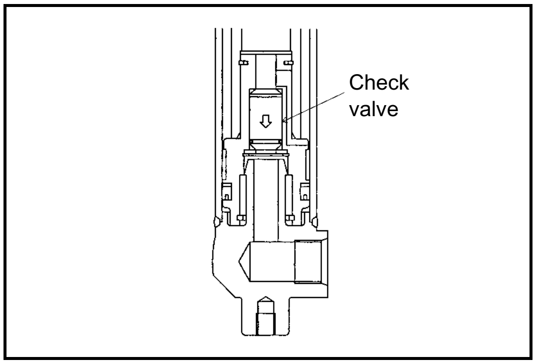
[Point 1]

Inspection:
Measure the piston rod outside diameter.

Standard: 35.0 mm (1.378 in)
Limit: 34.92 mm (1.3748 in)

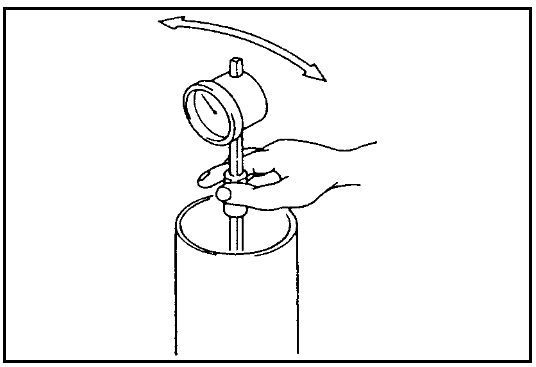
Inspection:
Measure the piston rod bend.

Limit: 2.0 mm (0.079 in)



[Point 2]

Reassembly:
Install the check valve so that the arrow directs to downward of the lift cylinder.

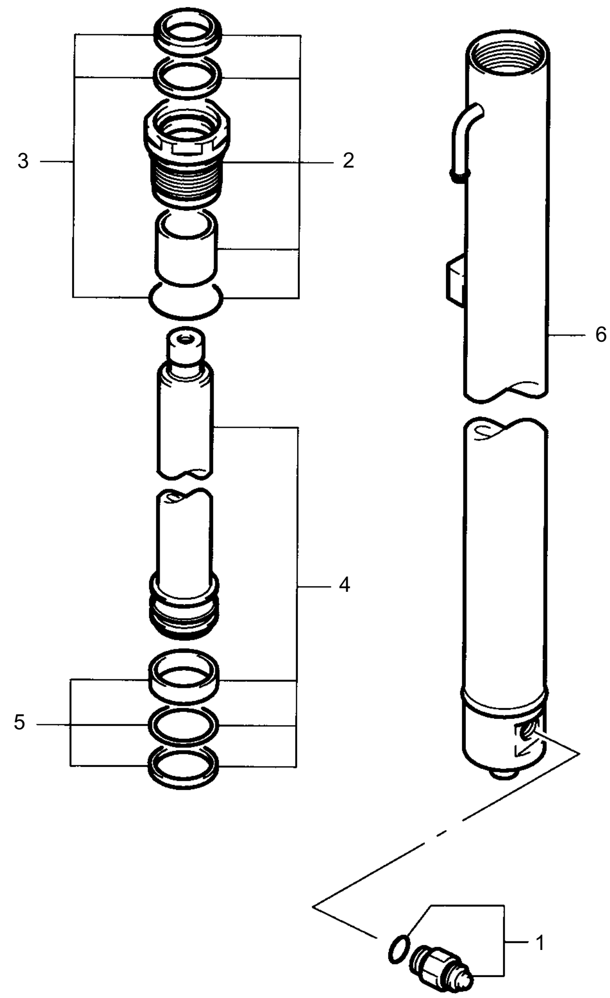


[Point 3]

Inspection:
Measure the lift cylinder bore.

Standard: 45.0 mm (1.772 in)
Limit: 45.20 mm (1.7795 in)

Rear Lift Cylinder (QFV)



Disassembly Procedure

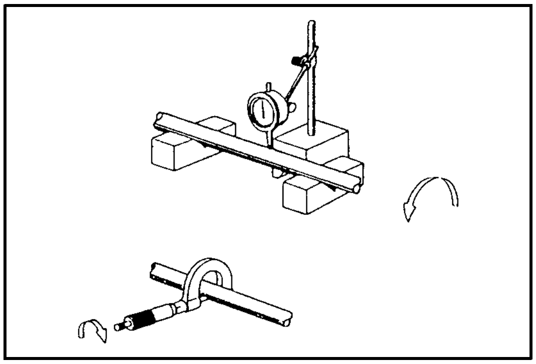
1 Remove the safety down valve. (LH only)
2 Remove the cylinder cover.
3 Remove the seals from the cylinder cover.
4 Remove the piston rod. **[Point 1]**
5 Remove the piston seals.
6 Remove the cylinder. **[Point 2]**

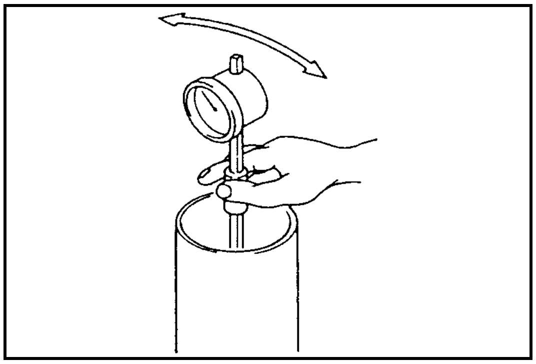
Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:

- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**





Point Operations

[Point 1]

Inspection:
Measure the piston rod outside diameter.

Standard: 50.0 mm (1.97 in)
Limit: 49.92 mm (1.9654 in)

Inspection:
Measure the piston rod bend.

Limit: 2.0 mm (0.079 in)

[Point 2]

Inspection:
Measure the lift cylinder bore.

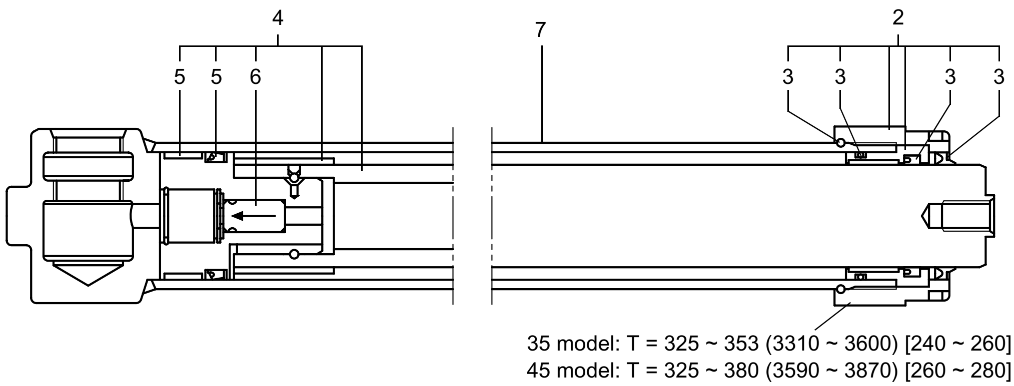
Standard: 63.0 mm (2.48 in)
Limit: 63.35 mm (2.4941 in)

DISASSEMBLY·INSPECTION·REASSEMBLY (35 ~ 55 MODEL)

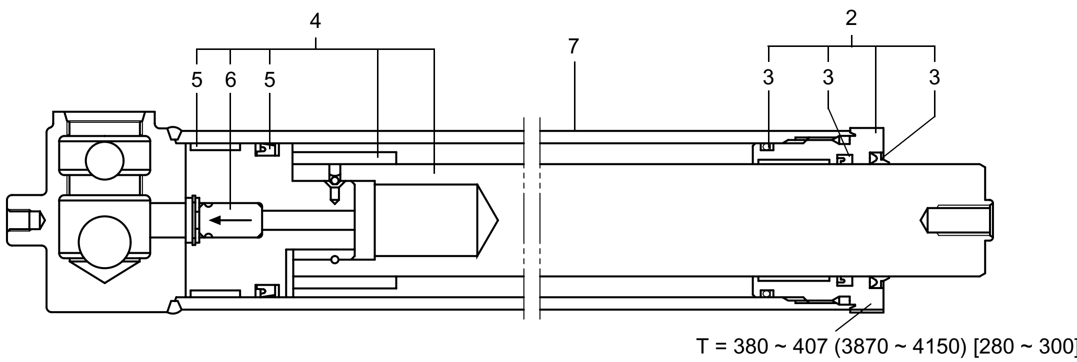
Lift Cylinder (V)

T = N·m (kgf-cm) [ft-lbf]

35·45 model



55 model



Disassembly Procedure

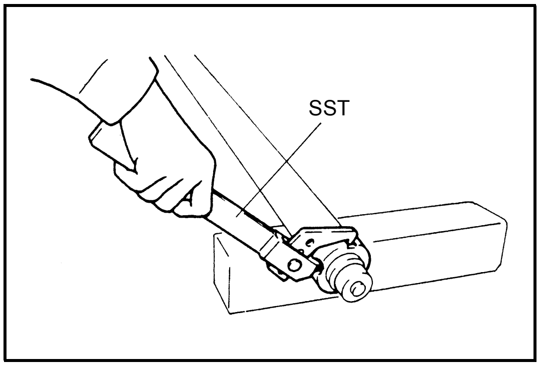
1 Remove the flow regulator valve or the safety down valve.
2 Remove the cylinder cover & rod guide. **[Point 1]**
3 Remove the seals from the cylinder cover & rod guide.
4 Remove the piston rod. **[Point 2]**
5 Remove the seals on the piston rod.
6 Remove the check valve from the piston rod. **[Point 3]**
7 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

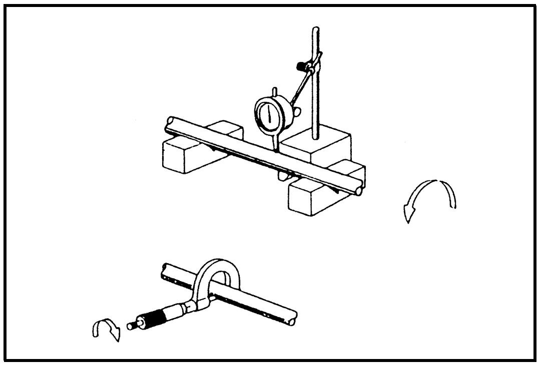
Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**

Point Operations



[Point 1]

Disassembly·Reassembly:
SST 09620-10100-71



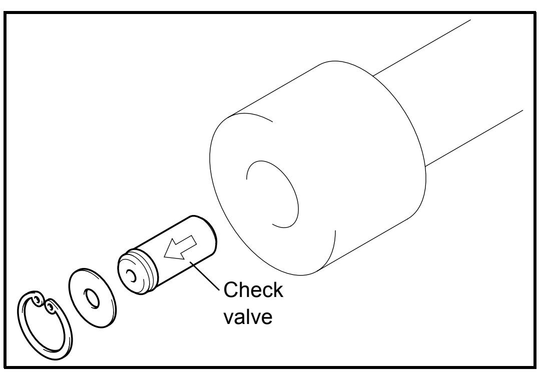
[Point 2]

Inspection:
Measure the piston rod outside diameter.

35·45 model
Standard: 50.8 mm (2.00 in)
Limit: 50.72 mm (1.9969 in)
55 model
Standard: 55 mm (2.17 in)
Limit: 54.91 mm (2.1618 in)

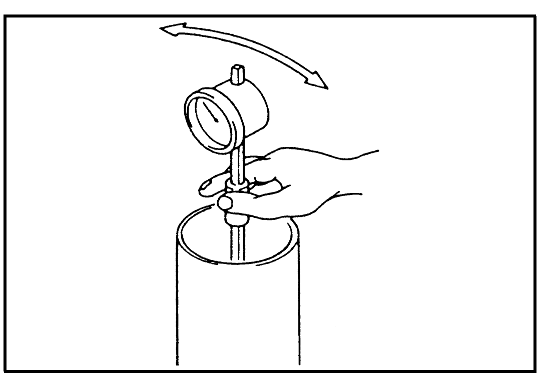
Inspection:
Measure the piston rod bend.

Limit: 2.0 mm (0.079 in)



[Point 3]

Reassembly:
Install the check valve arrow pointing to the lower side of the cylinder.



[Point 4]

Inspection:
Measure the cylinder bore.

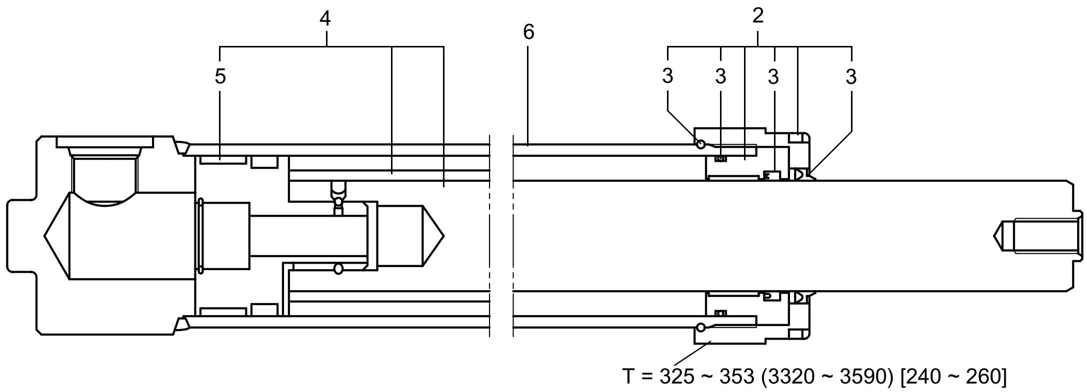
35 model
Standard: 65 mm (2.56 in)
Limit: 65.35 mm (2.5728 in)
45 model
Standard: 70 mm (2.76 in)
Limit: 70.35 mm (2.7697 in)
55 model
Standard: 75 mm (2.95 in)
Limit: 75.35 mm (2.9665 in)

Rear Lift Cylinder (FV)

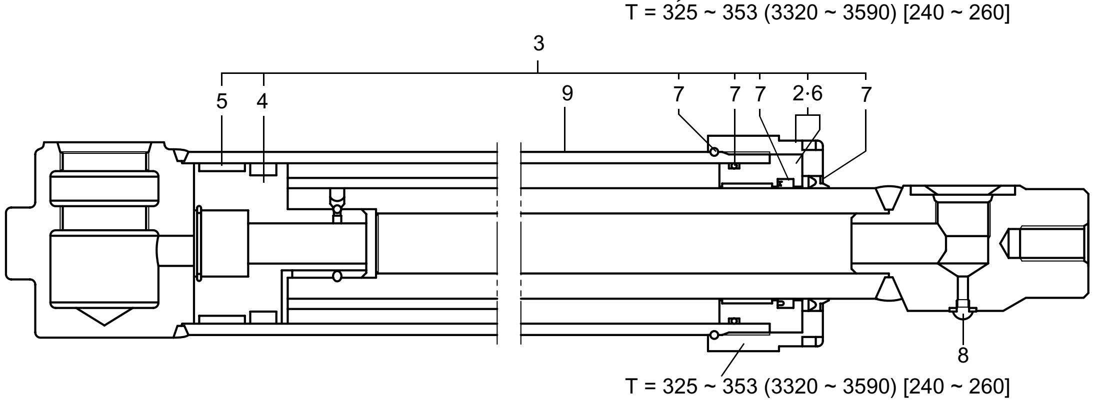
T = N·m (kgf-cm) [ft-lbf]

35 model

LH

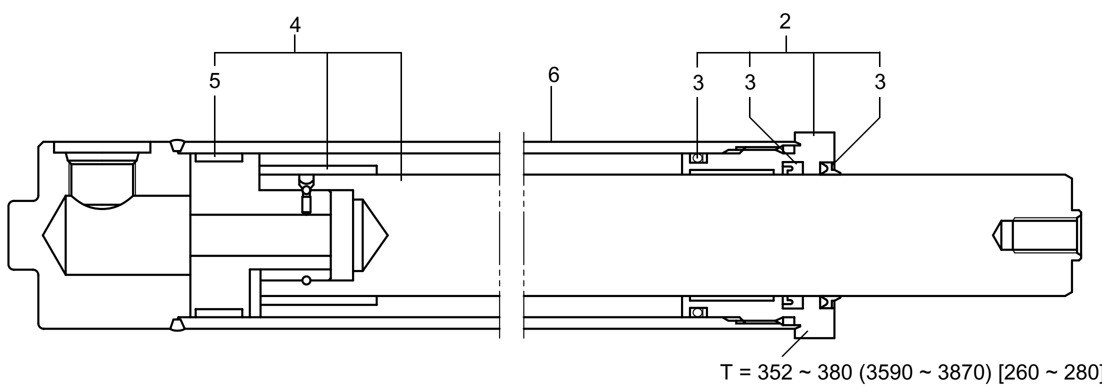


RH

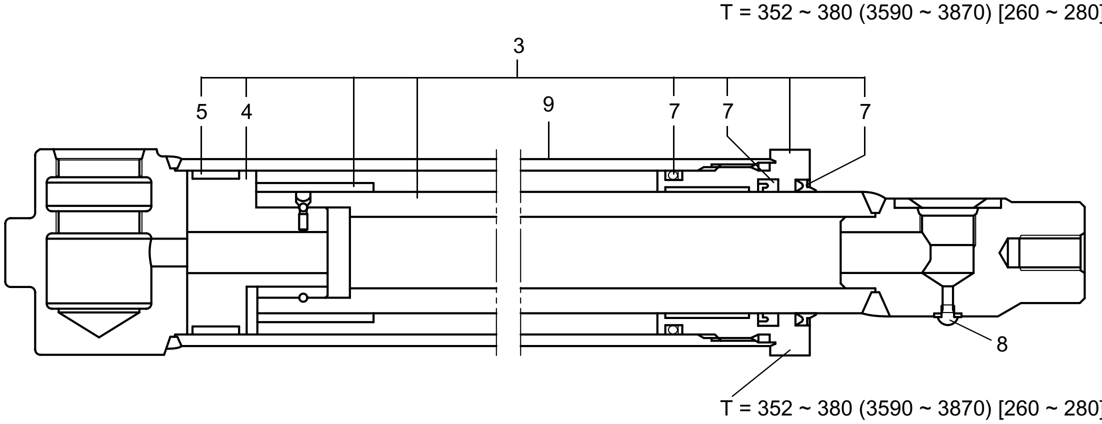


45 model

LH



RH



Disassembly Procedure

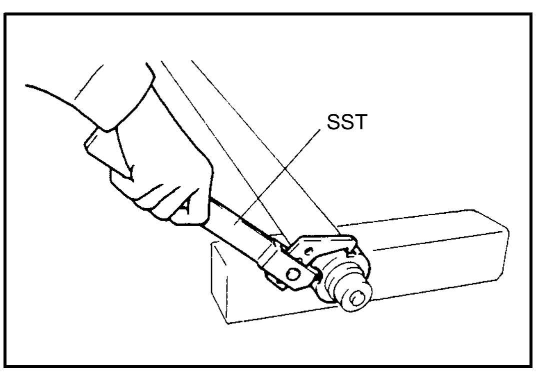
(1) LH Rear Lift Cylinder.
1 Remove the safety down valve.
2 Remove the cylinder cover. **[Point 1]**
3 Remove the seals from the cylinder cover.
4 Remove the piston rod. **[Point 2]**
5 Remove the wear ring.
6 Remove the cylinder. **[Point 4]**

(2) RH Lift Cylinder.
1 Remove the flow regulator valve.
2 Loosen the cylinder cover. **[Point 1]**
3 Remove the piston rod W/cylinder cover. **[Point 2]**
4 Remove the piston. **[Point 3]**
5 Remove the wear ring.
6 Remove the cylinder cover.
7 Remove the seals from the cylinder cover.
8 Remove the bleed screw.
9 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

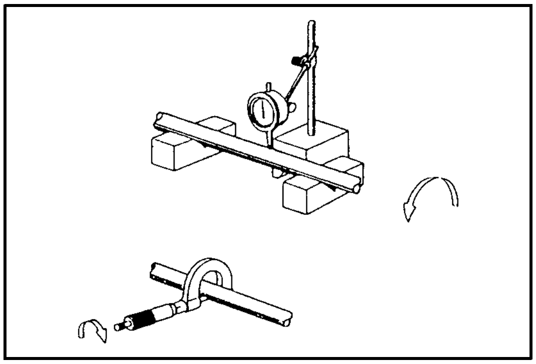
Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**
- **Upon completing the installation of the FV rear lift cylinder, perform air bleeding in the following sequence:**
  (1) Extend the FV rear lift cylinder.
  (2) Set the key switch to OFF.
  (3) Loosen the bleed screw by the time oil will come out and tighten the bleed screw again.



Point Operations

[Point 1]

Disassembly·Reassembly:
SST 09620-10100-71



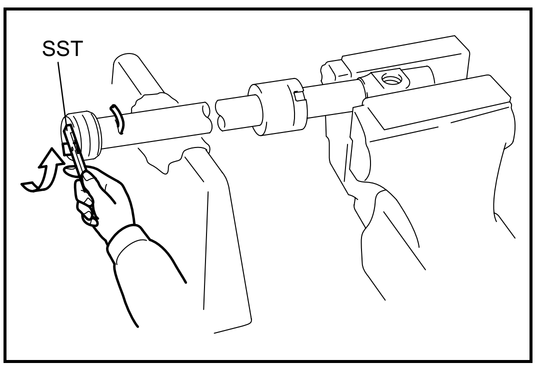
[Point 2]

Inspection:
Measure the piston rod outside diameter.

35 model
Standard: 45 mm (1.77 in)
Limit: 44.92 mm (1.7685 in)
45 model
Standard: 50.8 mm (2.00 in)
Limit: 50.72 mm (1.9969 in)

Inspection:
Measure the piston rod bend.

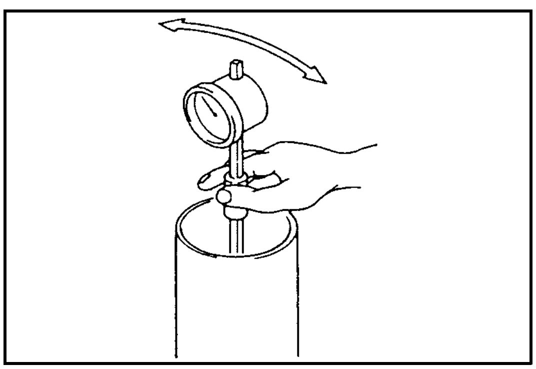
Limit: 2.0 mm (0.079 in)



[Point 3]

Disassembly·Reaseembly:
RH cylinder only:
Follow the procedure view.

1. Fix the boss portion at the tip end of the piston rod in a vise.
2. Use a SST and rotate the piston to remove the wire.
   SST 09610-20170-71
3. The installation is the reverse.



[Point 4]

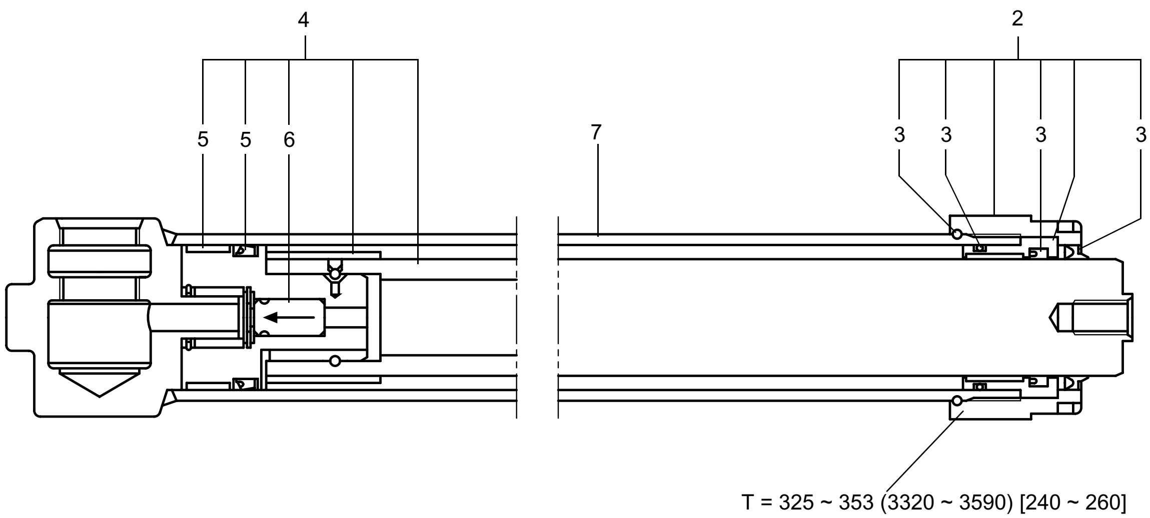
Inspection:
Measure the lift cylinder bore.

35 model
Standard: 65 mm (2.56 in)
Limit: 65.35 mm (2.5728 in)
45 model
Standard: 70 mm (2.76 in)
Limit: 70.35 mm (2.7697 in)

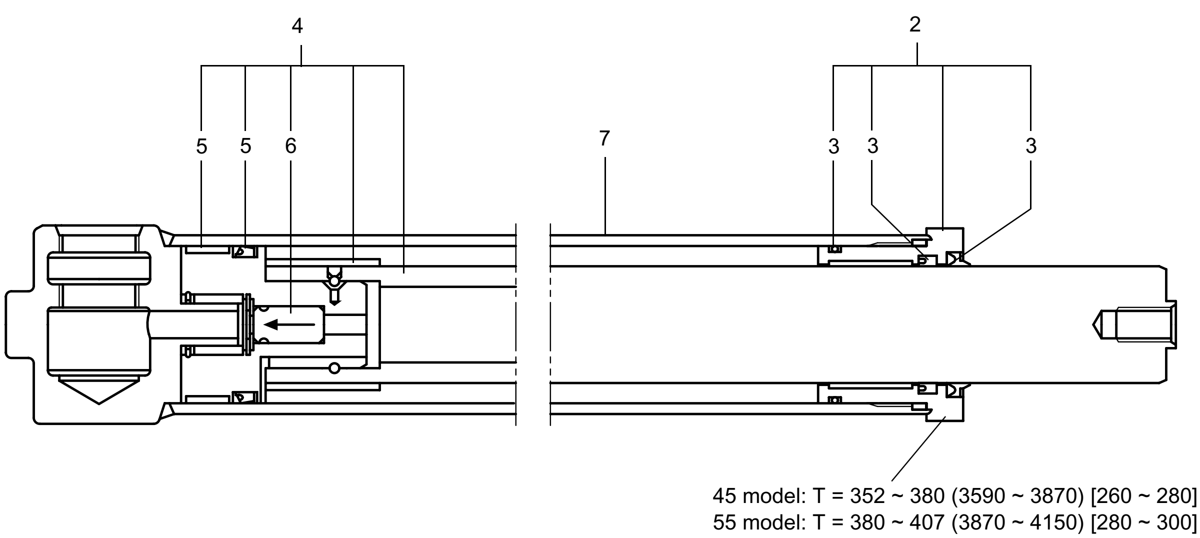
Rear Lift Cylinder (FSV)

T = N·m (kgf-cm) [ft-lbf]

35 model



45·55 model



Disassembly Procedure

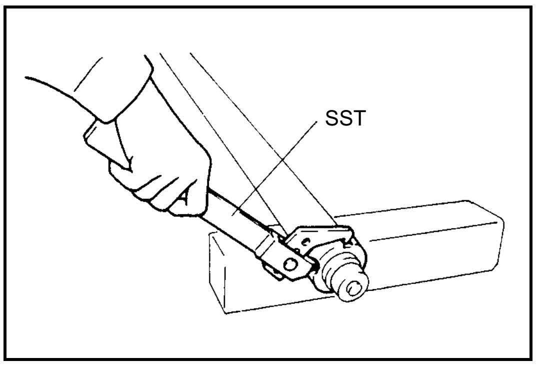
1 Remove the flow regulator valve or the safety down valve.
2 Remove the cylinder cover & rod guide. **[Point 1]**
3 Remove the seals from the cylinder cover & rod guide.
4 Remove the piston rod. **[Point 2]**
5 Remove the piston seals.
6 Remove the check valve. **[Point 3]**
7 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

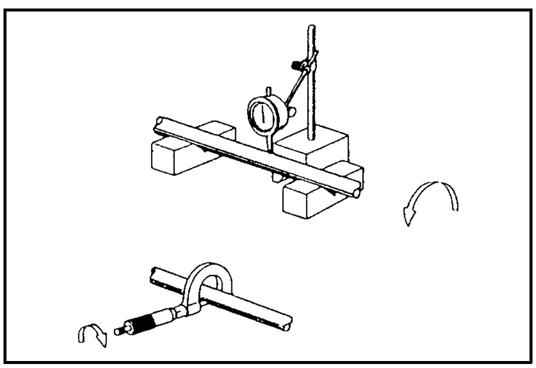
Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**

Point Operations



[Point 1]

Disassembly·Reassembly:
SST 09620-10100-71



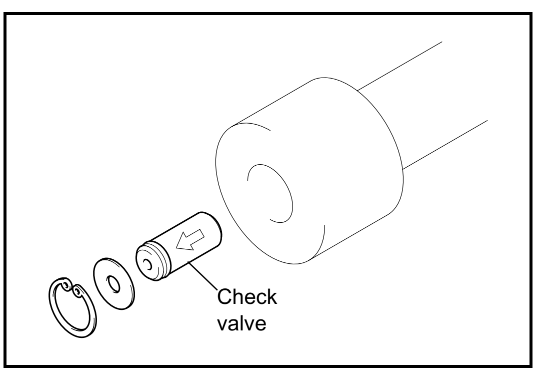
[Point 2]

Inspection:
Measure the piston rod outside diameter.

35·45 model
Standard: 50.8 mm (2.00 in)
Limit: 50.72 mm (1.9969 in)
55 model
Standard: 55 mm (2.17 in)
Limit: 54.91 mm (2.1618 in)

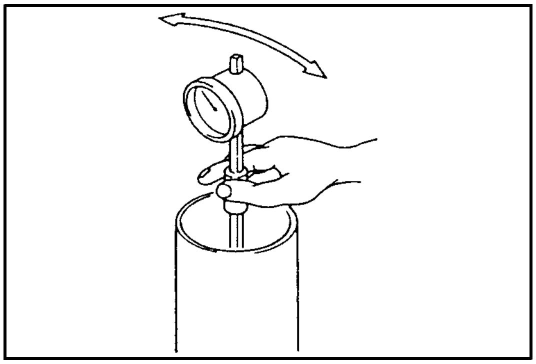
Inspection:
Measure the piston rod bend.

Limit: 2.0 mm (0.079 in)



[Point 3]

Reassembly:
Install the check valve so that the arrow directs to downward of the lift cylinder.



[Point 4]

Inspection:

Measure the lift cylinder bore.

35 model

Standard: 65 mm (2.56 in)

Limit: 65.35 mm (2.5728 in)

45 model

Standard: 70 mm (2.76 in)

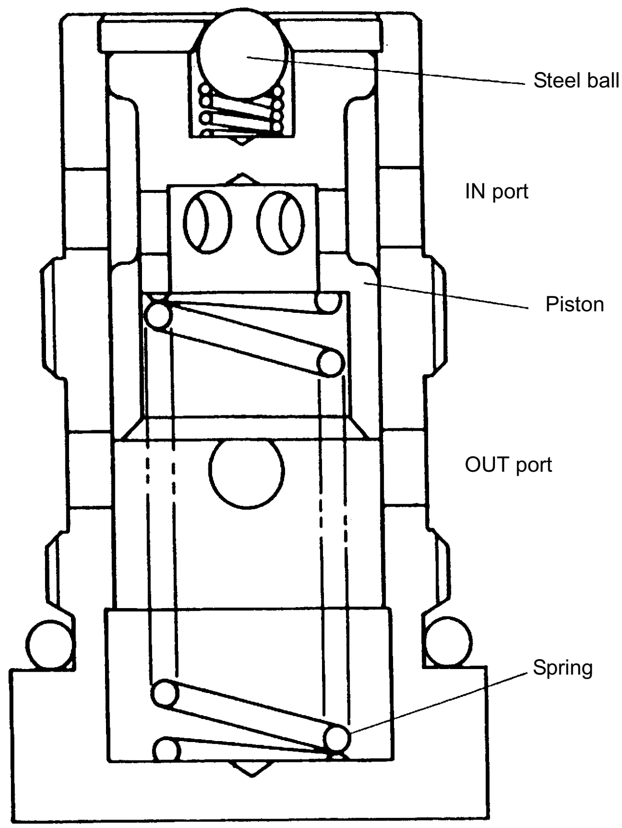
Limit: 70.35 mm (2.7697 in)

55 model

Standard: 75 mm (2.95 in)

Limit: 75.35 mm (2.9665 in)

FLOW REGULATOR VALVE



Lowering Speed Specifications

Unit: mm/sec (fpm)

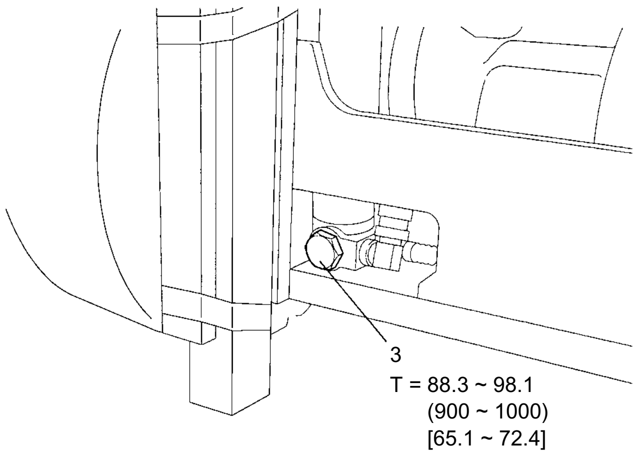
Model	V mast		FV mast		FSV mast		QFV mast	
	No load	Full load	No load	Full load	No load	Full load	No load	Full load
15	550 (108)	500 (98)	450 (89)	480 (94)	450 (89)	480 (94)	—	—
18	↑	↑	↑	↑	↑	↑	—	—
20	500 (98)	500 (98)	420 (83)	↑	↑	↑	400 (79)	510 (100)
25	↑	↑	↑	↑	↑	↑	↑	↑
30	↑	↑	390 (77)	460 (91)	420 (83)	460 (91)	↑	↑
32	↑	↑	↑	↑	↑	↑	↑	↑
35	550 (108)	500 (98)	500 (98)	450 (89)	500 (98)	450 (89)	—	—
45	500 (98)	↑	400 (79)	400 (79)	400 (79)	400 (79)	—	—
55	550 (108)	↑	—	—	470 (93)	500 (98)	—	—

REMOVAL·INSTALLATION (35 ~ 55 MODEL)

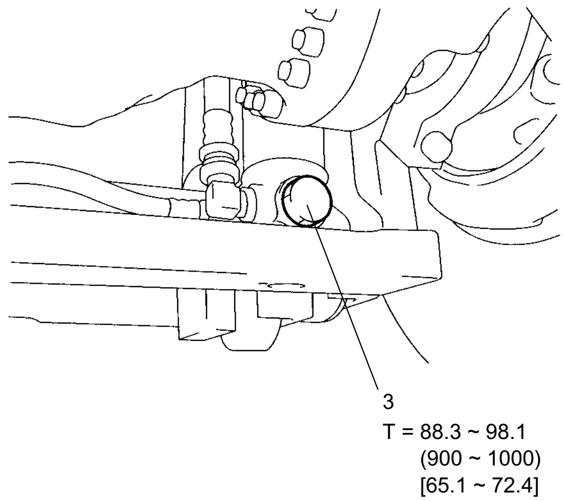
Note:
The explanation here is for the flow regulator valve for use on 35 to 55 models.
In the case of 15 to 32 models, the flow regulator valve is installed on the outer mast.

T = N·m (kgf-cm) [ft-lbf]

35·45 model



55 model

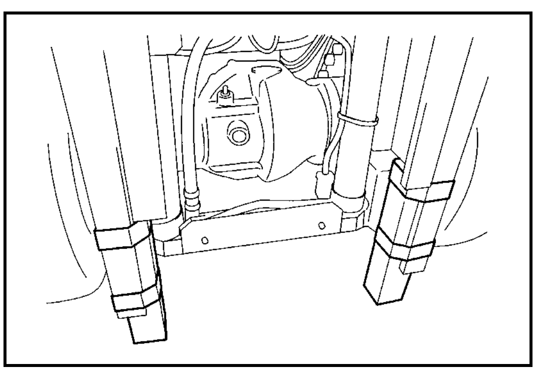


Removal Procedure

1 Hoist the inner mast. (35·45 model) **[Point 1]**
2 Fully lower the fork. (55 model)
3 Remove the flow regulator valve.

Installation Procedure

The installation procedure is the reverse of the removal procedure.



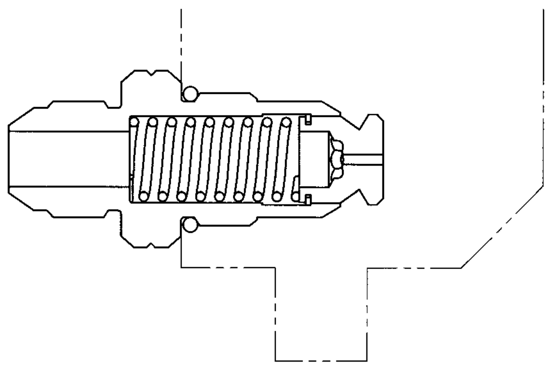
Point Operation

[Point 1]

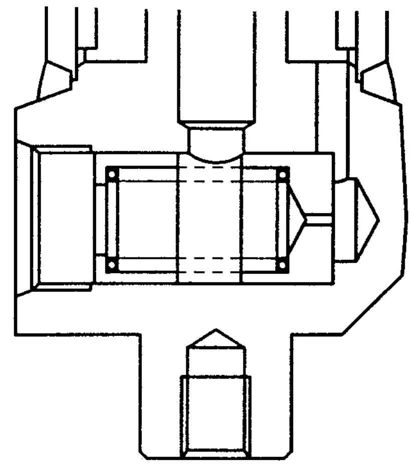
Removal:
Hoist the inner mast.
Support the bottom of the inner mast with wooden blocks and fix the blocks by taping onto the outer mast.

SAFETY DOWN VALVE

15 ~ 32 Model



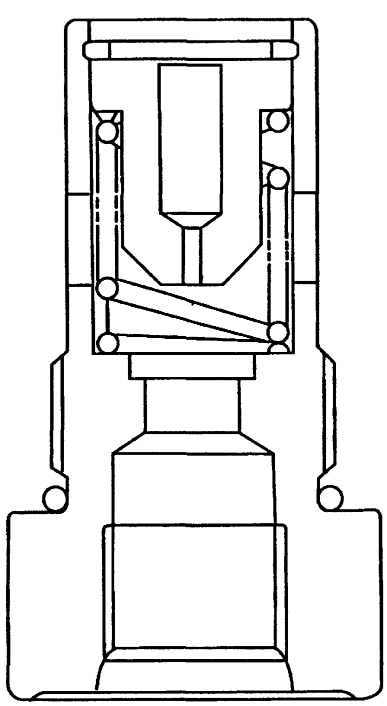
Cartridge type



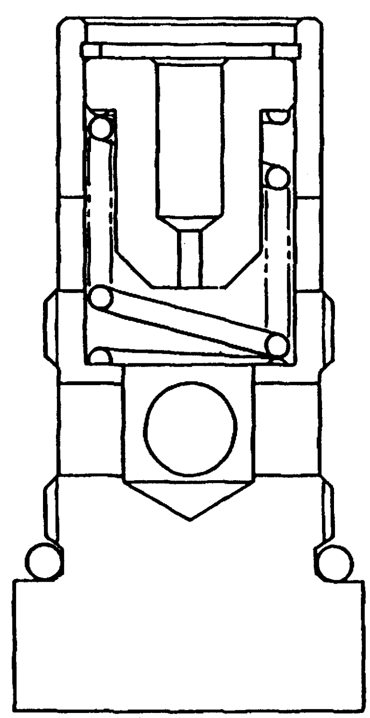
Internal type

35 ~ 55 Model

For rear lift cylinder

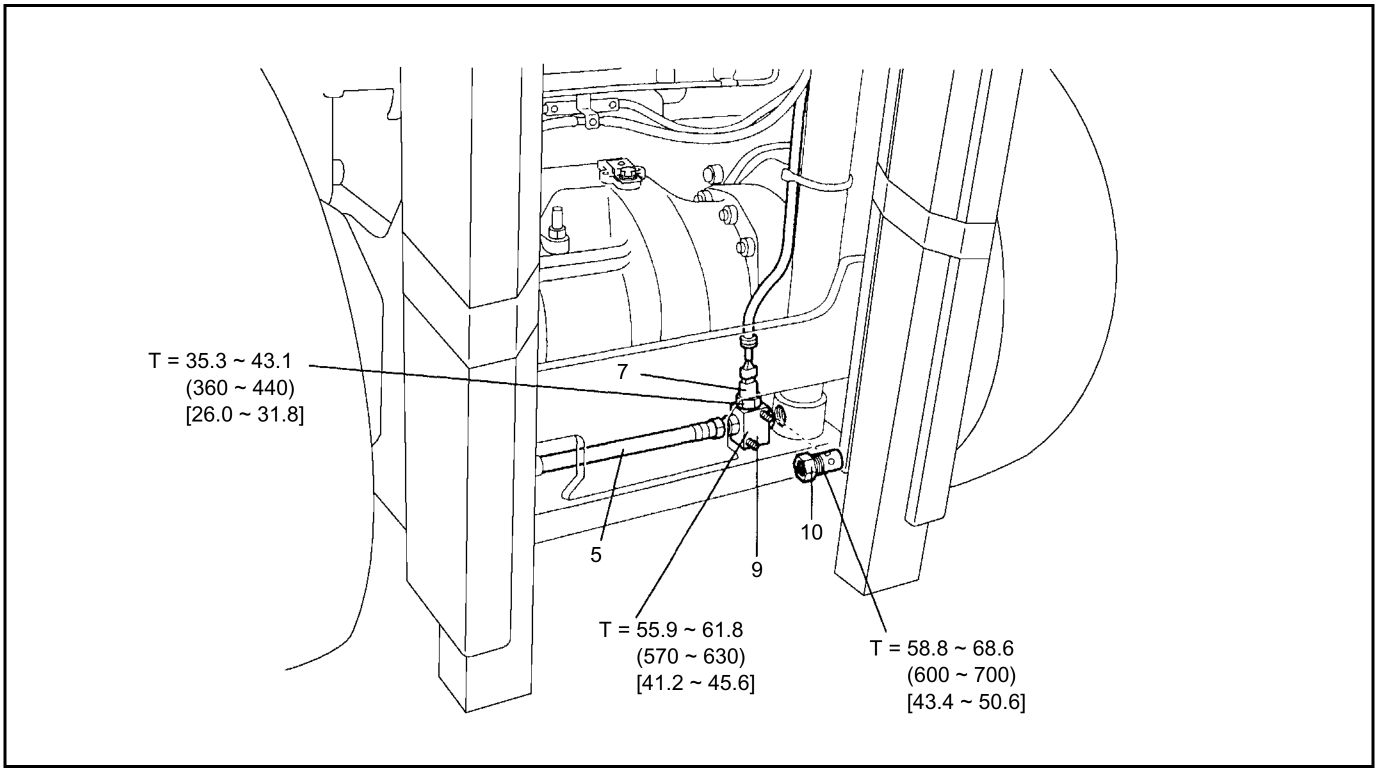


For front lift cylinder



REMOVAL·INSTALLATION (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]

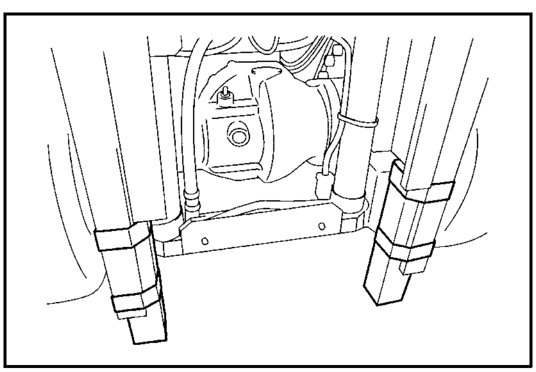


Removal Procedure

1 Remove the lift cylinder rod end set bolt.
2 Hoist the inner mast. **[Point 1]**
3 Remove the lift cylinder (LH) support.
4 Remove the front hose cover. (V: 55 model)
5 Disconnect the hose.
6 Remove the load sensor cover.
7 Disconnect the load sensor connector and remove the load sensor.
8 Remove the cylinder bottom set bolt. (55 model)
9 With the lift cylinder (LH) hoisted slightly upward, remove the three-way.
10 Remove the safety down valve.

Installation Procedure

The installation procedure is the reverse of the removal procedure.



Point Operation

[Point 1]

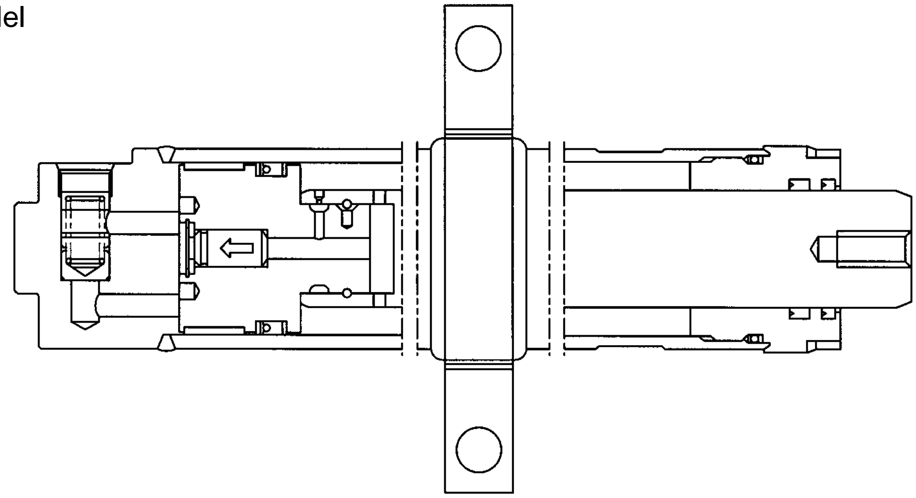
Removal:

Hoist the inner mast.
Support the bottom of the inner mast with wooden blocks and fix the blocks by taping onto the outer mast.

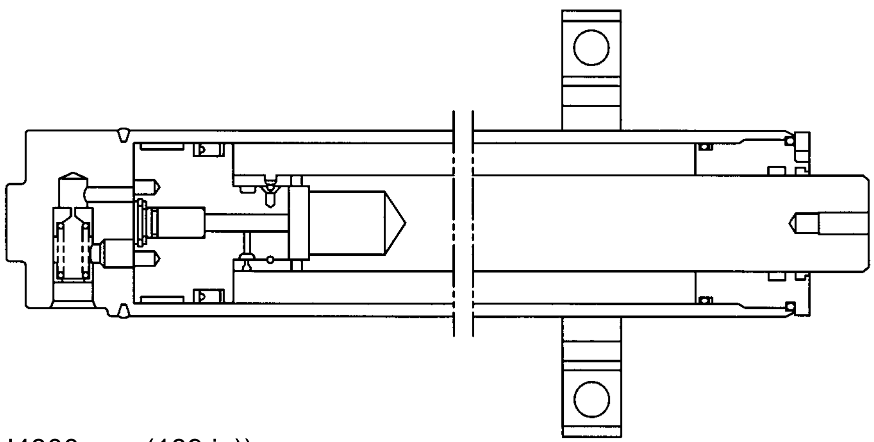
FRONT LIFT CYLINDER (FV·FSV·QFV)

GENERAL

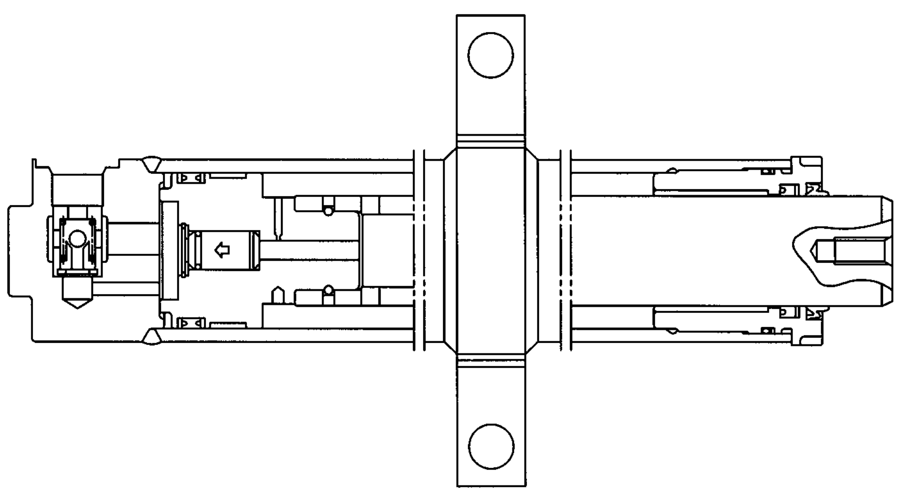
FV: 15 ~ 25 model
FSV: 15·18 model (except H4800 mm (189 in)), 20·25 model
QFV: 20 ~ 32 model



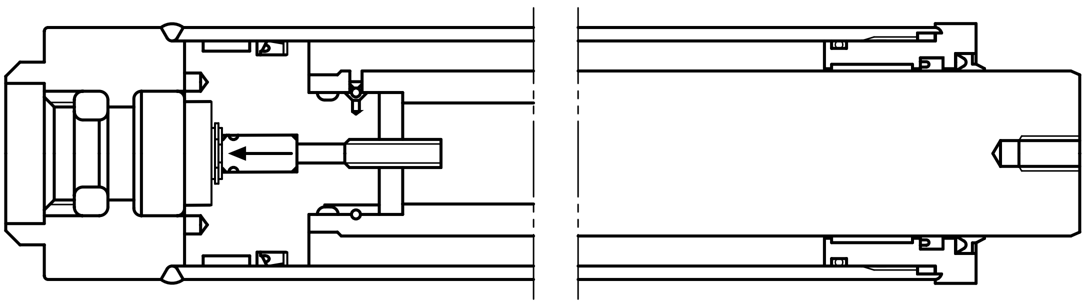
FV: 30·32 model
FSV: 30·32 model



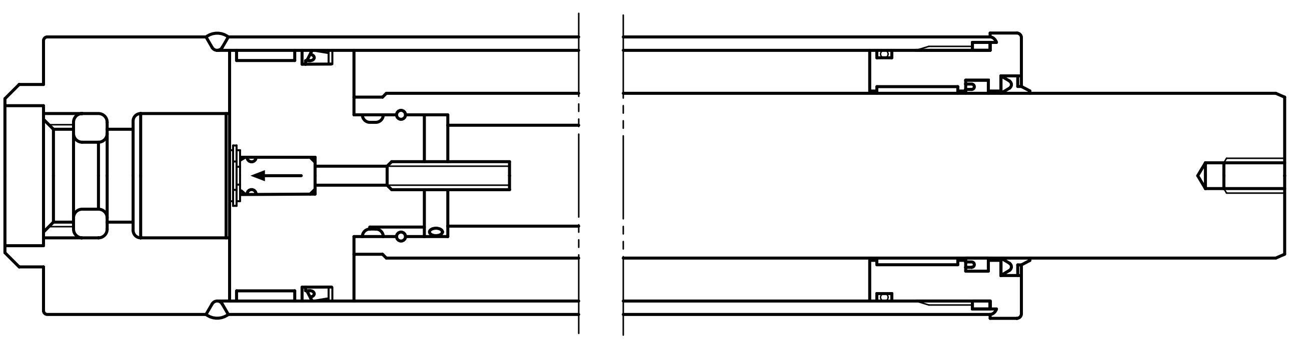
FSV: 15·18 model (H4800 mm (189 in))



FV: 35 model
FSV: 35·45 model



FV: 45 model
FSV: 55 model



SPECIFICATIONS

15 ~ 32 Model (FV)

Item \ Model	15·18	20·25	30·32
Cylinder type	Single-acting	←	←
Cylinder bore mm (in)	70 (21.76)	75.0 (2.95)	85.0 (3.35)
Piston rod outside diameter mm (in)	50.8 (2.00)	←	←
Rod seal type	U packing	←	←
Piston seal type	U packing	←	←
Others	Built-in safety down valve		

15 ~ 32 Model (FSV·QFV)

Item \ Model	15·18		20·25	30·32	20 ~ 32 QFV
	All except H 4800 mm (189 in)	H 4800 mm (189 in)			
Cylinder type	Single-acting	←	←	←	←
Cylinder bore mm (in)	70.0 (2.76)	←	75.0 (2.95)	85.0 (3.35)	75.0 (2.95)
Piston rod outside diameter mm (in)	50.8 (2.00)	50.0 (1.969)	50.8 (2.00)	←	←
Rod seal type	U packing	←	←	←	←
Piston seal type	U packing	←	←	←	←
Others	Built-in safety down valve				

35 ~ 55 Model (FV·FSV)

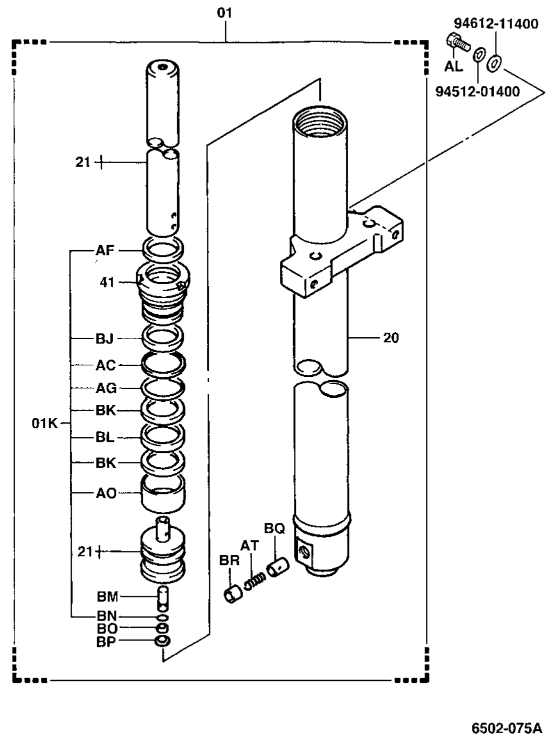
Item \ Model	35	45	55
	FV·FSV	FV·FSV	FSV
Cylinder type	Single-acting	←	←
Cylinder bore mm (in)	95 (3.74)	105 (4.13)	110 (4.33)
Piston rod outside diameter mm (in)	70 (2.76)	←	←
Rod seal type	U packing	←	←
Piston seal type	U packing	←	←
Others	Built-in safety down valve		

COMPONENTS

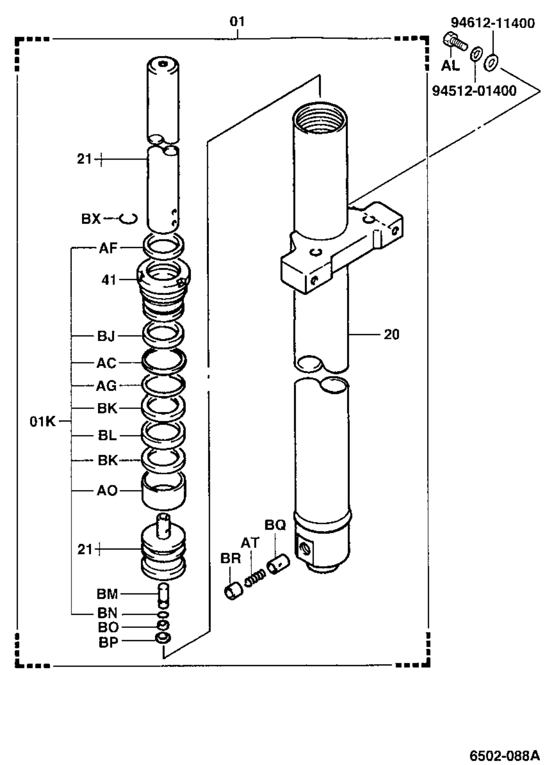
Front Lift Cylinder (FV)

15·18·30·32 model

6502

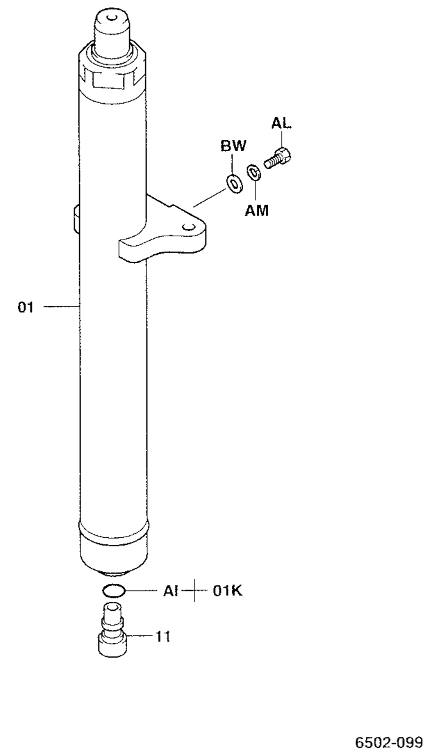


20·25 model



35·45 model

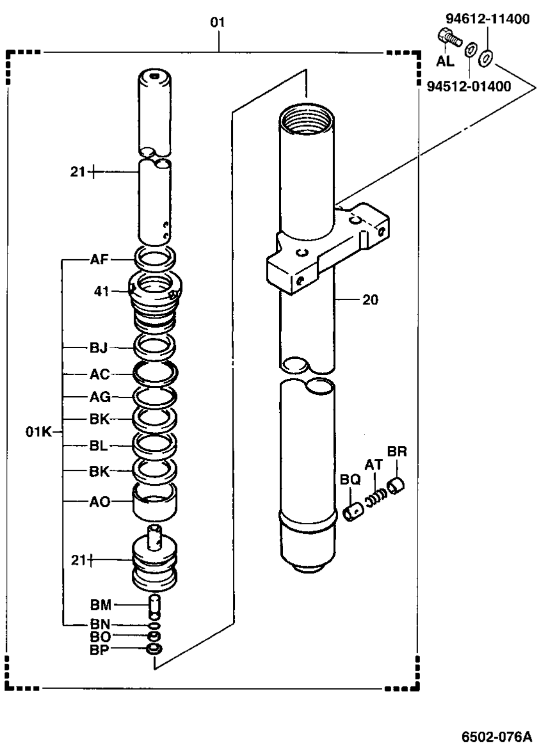
6502



Front Lift Cylinder (FSV)

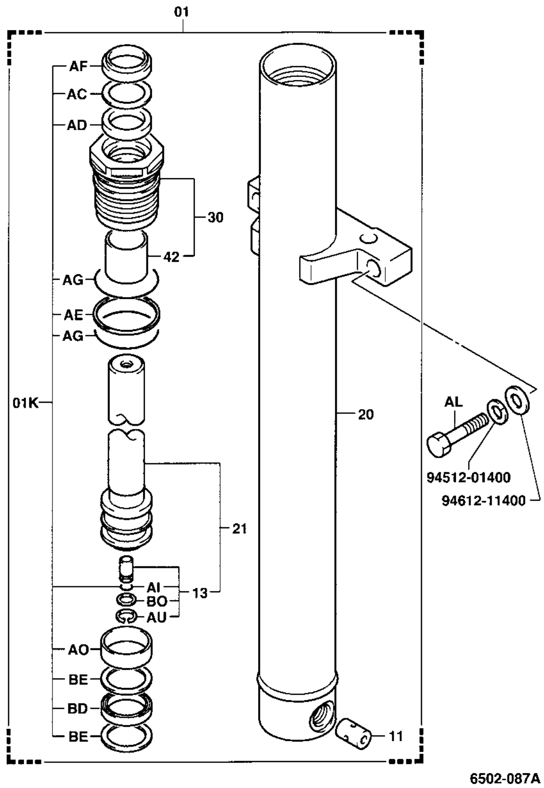
15·18 model (Except H4800 mm (189 in)), 30·32 model

6502

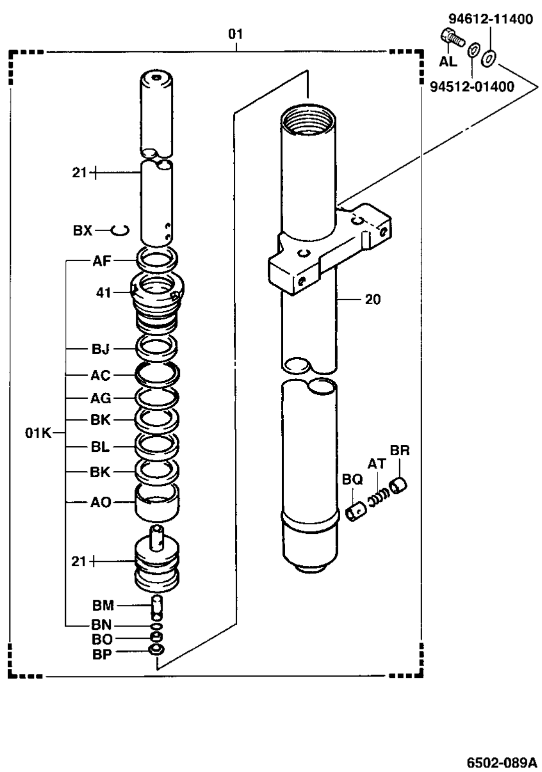


15·18 model (H4800 mm (189 in))

6502



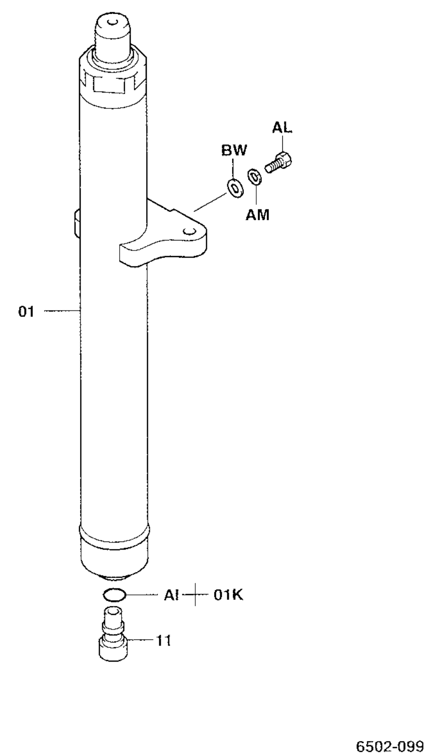
20·25 model

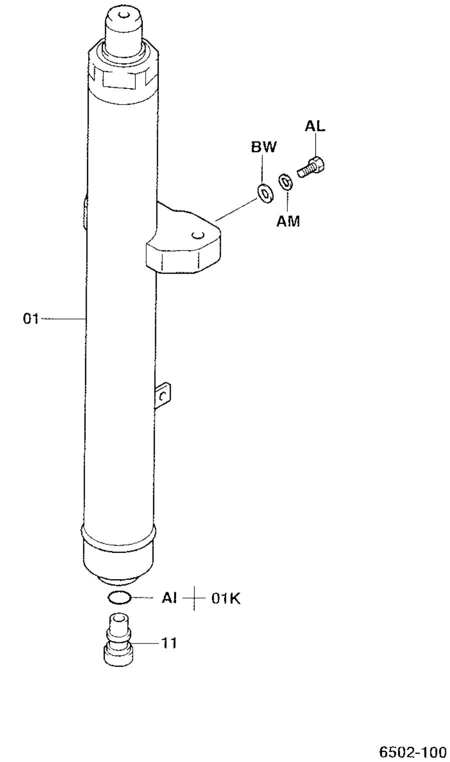


35·45 model

55 model

6502

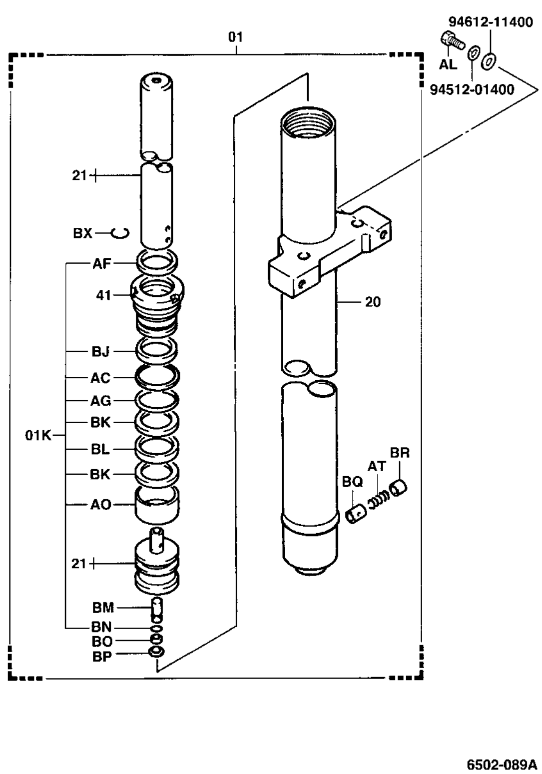




Front Lift Cylinder (QFV)

20 ~ 32 model

6502



REMOVAL·INSTALLATION

Removal Procedure

1 Remove the lift bracket W/fork.
2 Disconnect the pipng.
3 Remove the front lift cylinder.

Installation Procedure

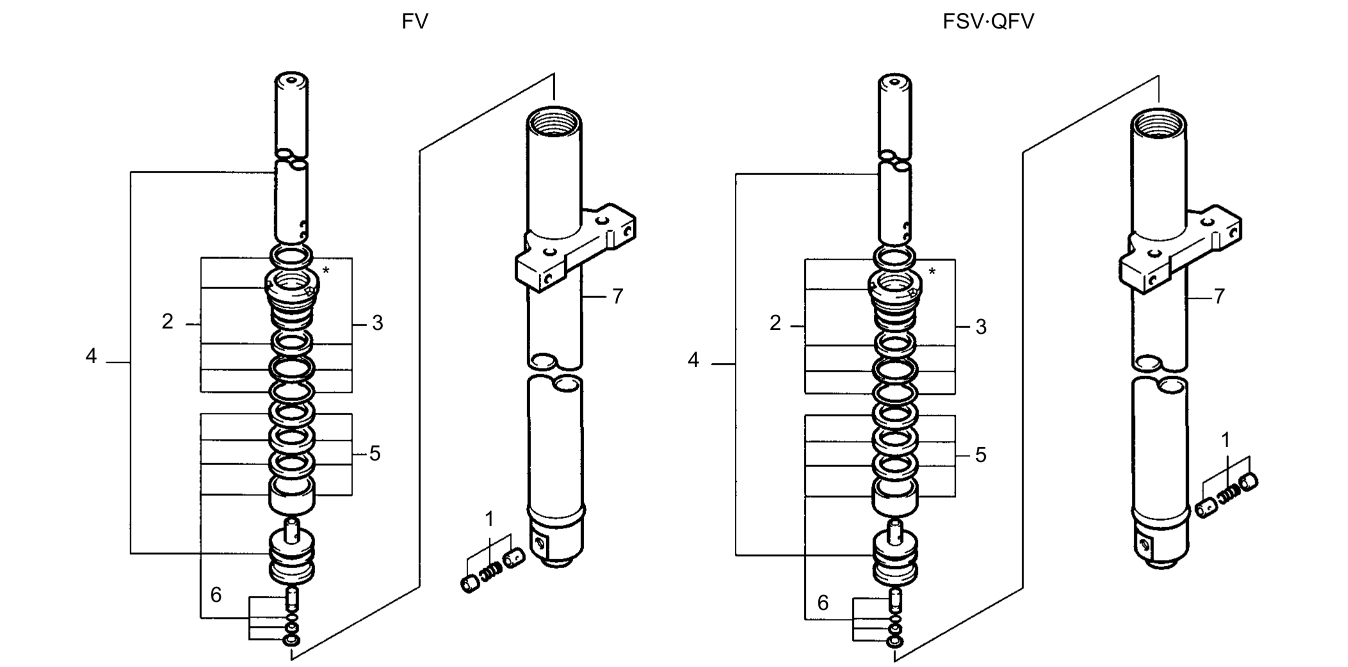
The installation procedure is the reverse of the removal procedure.

Note:
After installing the lift cylinder, follow the steps below.
- **Repeat full-stroke raising and lowering without load to bleed air and check normal functioning.**
- **Check the hydraulic oil level, and add if insufficient.**
- **Adjust the lift chain tension equally on the left and right side.**

DISASSEMBLY·INSPECTION·REASSEMBLY (15 ~ 32 MODEL)

Front Lift Cylinder (FV·FSV (Except FSV H4800 mm (189 in) on 15·18 Model·QFV)

T = N·m (kgf-cm) [ft-lbf]



* Cylinder cover

FV/FSV on 15·18 model	T = 305 ~ 373 (3110 ~ 3801) [225 ~ 275]
FV/FSV/QFV on 20·25 model	T = 339 ~ 407 (3455 ~ 4147) [250 ~ 300]
FV/FSV on 30·32 model	T = 420 ~ 454 (4283 ~ 4630) [310 ~ 335]

Disassembly Procedure

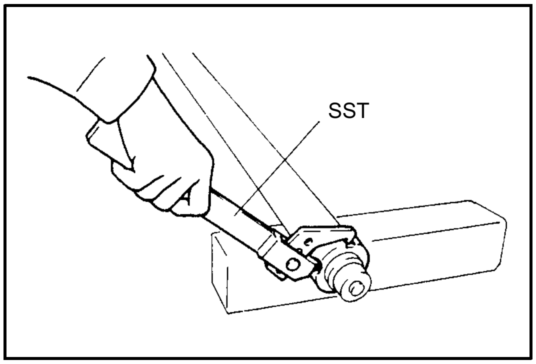
1 Remove the safety down valve.
2 Remove the cylinder cover. **[Point 1]**
3 Remove the cover seals.
4 Remove the piston rod. **[Point 2]**
5 Remove the piston seals.
6 Remove the check valve. **[Point 3]**
7 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**
- **Fill the amount of hydraulic oil specified below into the cylinder from its top before installing the cylinder cover.**

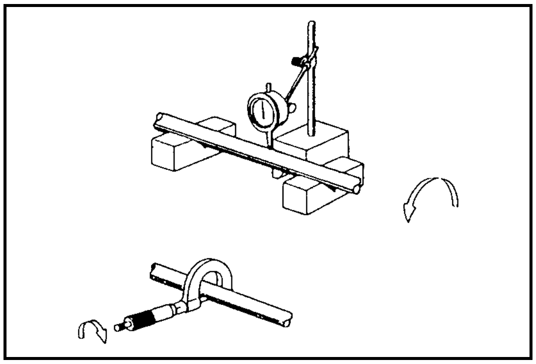
Filling amount cm^3 (in^3): FV/FSV 15·18 model 80 (4.88)
FV/FSV 20·25 model 100 (6.10)
FV/FSV 30·32 model 75 ~ 80 (4.57 ~ 4.88)



Point Operations

[Point 1]

Disassembly·Reassembly:
SST 09620-10100-71

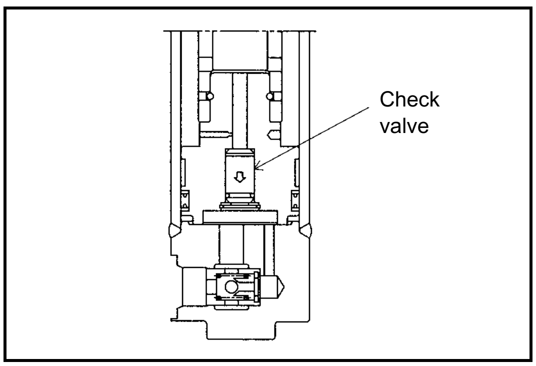


[Point 2]

Inspection:
Measure the piston rod outside diameter.

Standard: 50.8 mm (2.0 in)
Limit: 50.72 mm (1.9969 in)

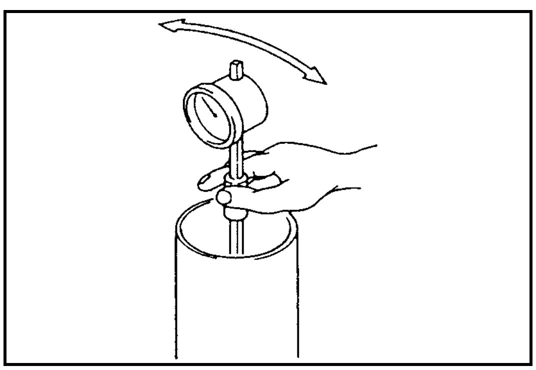
Inspection:
Measure the piston rod bend.



Limit: 2.0 mm (0.079 in)

[Point 3]

Reassembly:
Install the check valve so that the arrow will direct downward of the front lift cylinder.



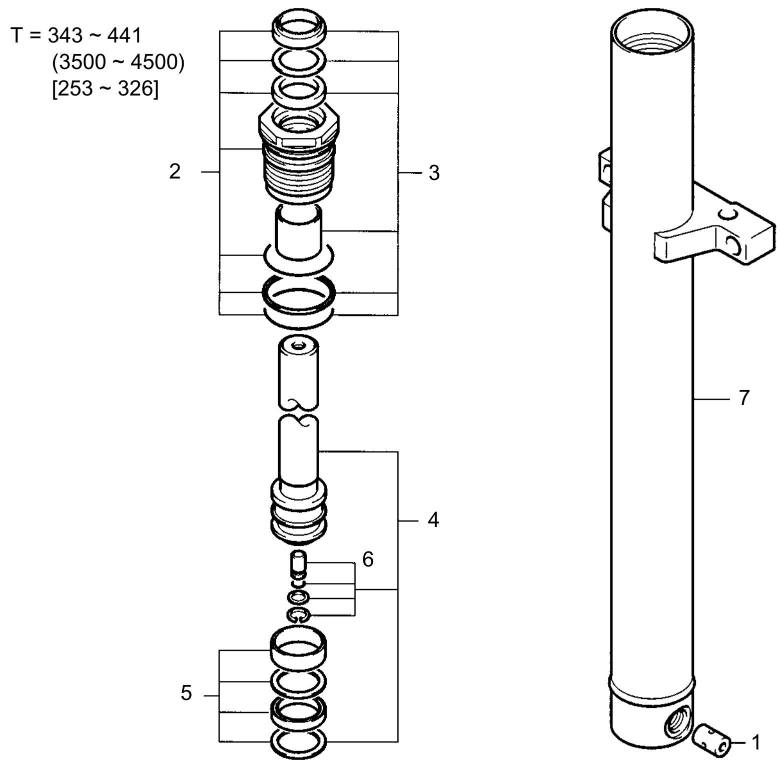
[Point 4]

Inspection:
Measure the lift cylinder bore.

15·18 model
Standard: 70.0 mm (2.756 in)
Limit: 70.35 mm (2.7697 in)
20·25 model, 20 ~ 30 model (QFV)
Standard: 75.0 mm (2.953 in)
Limit: 75.35 mm (2.9665 in)
30·32 model
Standard: 85.0 mm (3.346 in)
Limit: 85.40 mm (3.3622 in)

Front Lift Cylinder (FSV H4800 mm (189 in) on 15·18 Model)

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

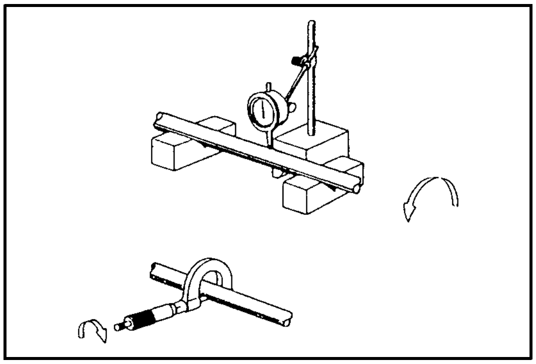
1 Remove the safety down valve.
2 Remove the rod guide.
3 Remove the rod guide seals.
4 Remove the piston rod. **[Point 1]**
5 Remove the piston seals.
6 Remove the check valve. **[Point 2]**
7 Remove the cylinder. **[Point 3]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the rod guide before tightening.**
- **Fill the amount of hydraulic oil specified below into the cylinder from its top before installing the rod guide.**

Filling amount cm^3 (in^3): 30 (1.83) ~ 60 (3.66)

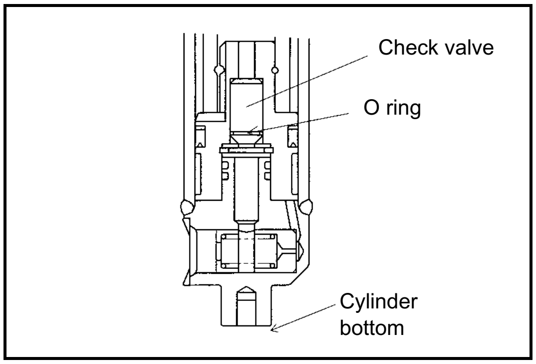


Point Operations

[Point 1]

Inspection:
Measure the piston rod outside diameter.

Standard: 50.0 mm (1.969 in)
Limit: 49.92 mm (1.9654 in)

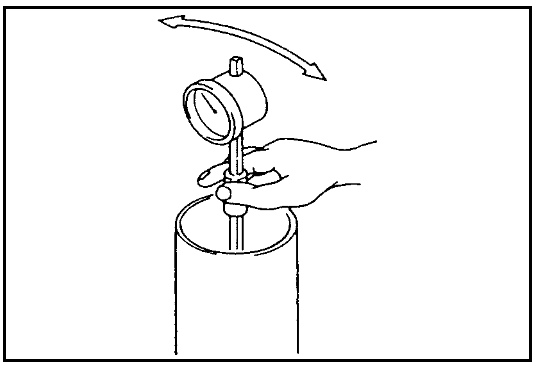


Inspection:
Measure the piston rod bend.

Limit: 2.0 mm (0.079 in)

[Point 2]

Reassembly:
Install the check valve so that O-ring side of the check valve will locate downward in the cylinder.



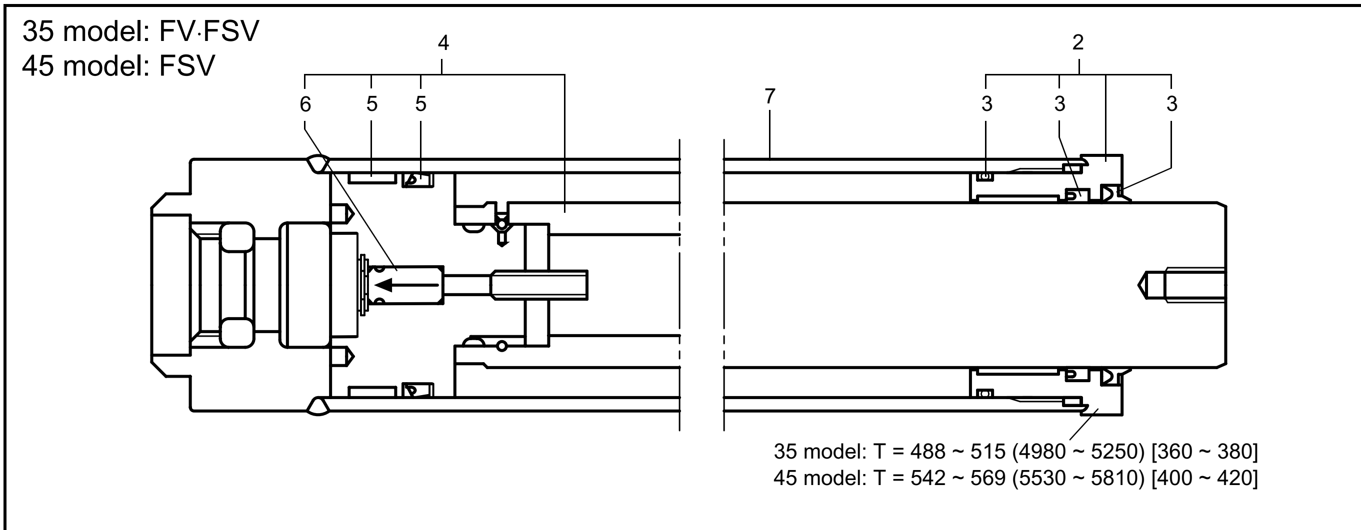
[Point 3]

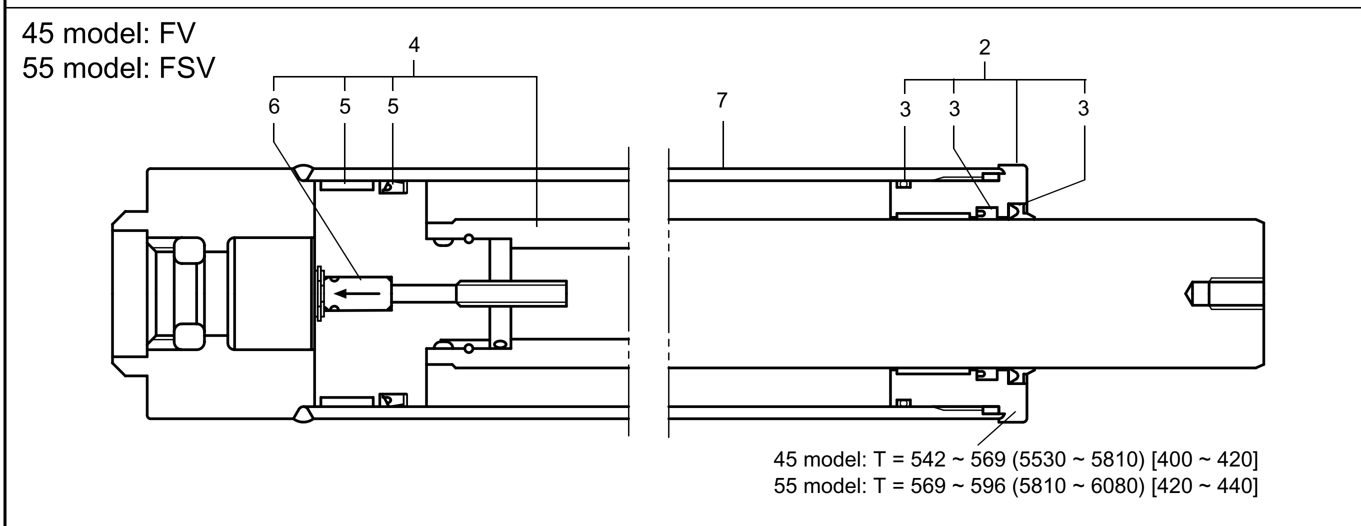
Inspection:
Measure the lift cylinder bore.

Standard: 70.0 mm (2.756 in)
Limit: 70.35 mm (2.7697 in)

DISASSEMBLY·INSPECTION·REASSEMBLY (35 ~ 55 MODEL)

T = N·m (kgf-cm) [ft-lbf]





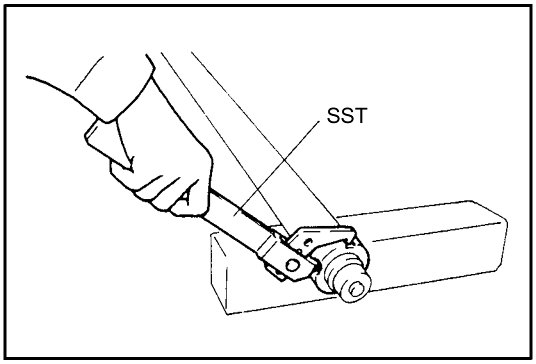
Disassembly Procedure

1 Remove the safety down valve.
2 Remove the cylinder cover. **[Point 1]**
3 Remove the cover seals.
4 Remove the piston rod. **[Point 2]**
5 Remove the piston seals.
6 Remove the check valve. **[Point 3]**
7 Remove the cylinder. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

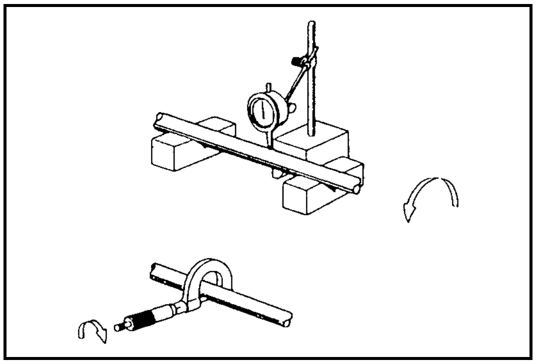
Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the cylinder cover before tightening.**



Point Operations

[Point 1]

Disassembly·Reassembly:
35·45 model
SST 09620-10100-71
55 model
SST 09620-10160-71



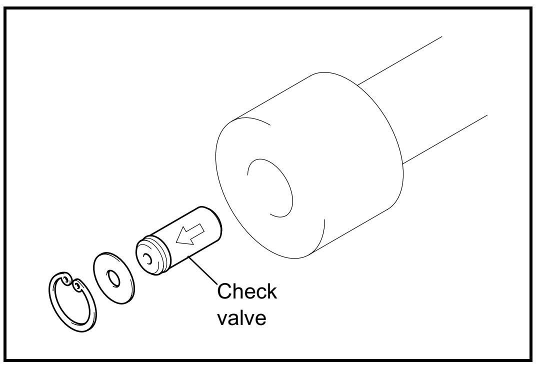
[Point 2]

Inspection:
Measure the piston rod outside diameter.

Standard: 70 mm (2.76 in)
Limit: 69.91 mm (2.7524 in)

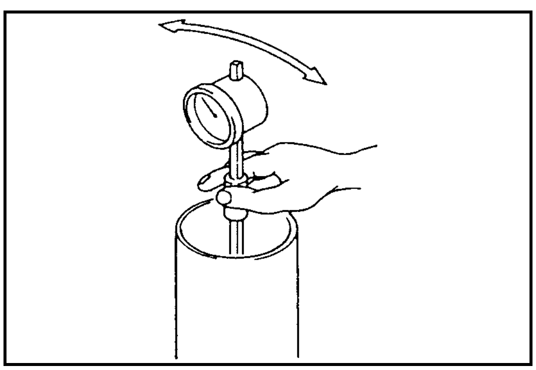
Inspection:
Measure the piston rod bend.

Limit: 2.0 mm (0.079 in)



[Point 3]

Reassembly:
Install the check valve so that the arrow will direct downward of the front lift cylinder.



[Point 4]

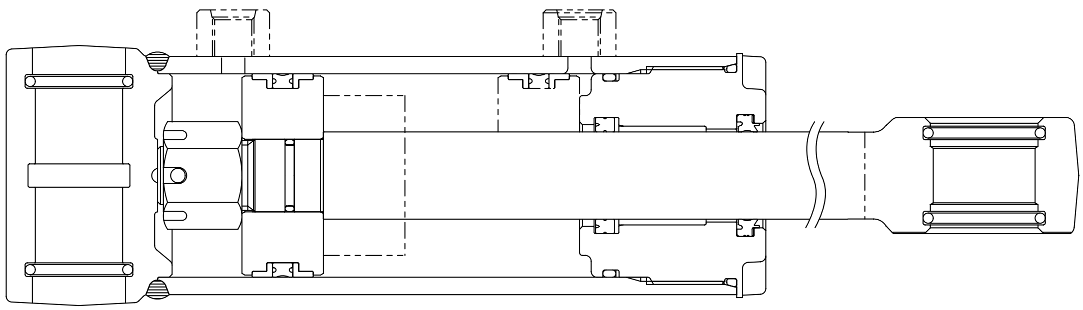
Inspection:
Measure the lift cylinder bore.

35 model
Standard: 95 mm (3.74 in)
Limit: 95.40 mm (3.7559 in)
45 model
Standard: 105 mm (4.13 in)
Limit: 105.40 mm (4.1496 in)
55 model
Standard: 110 mm (4.33 in)
Limit: 110.40 mm (4.3465 in)

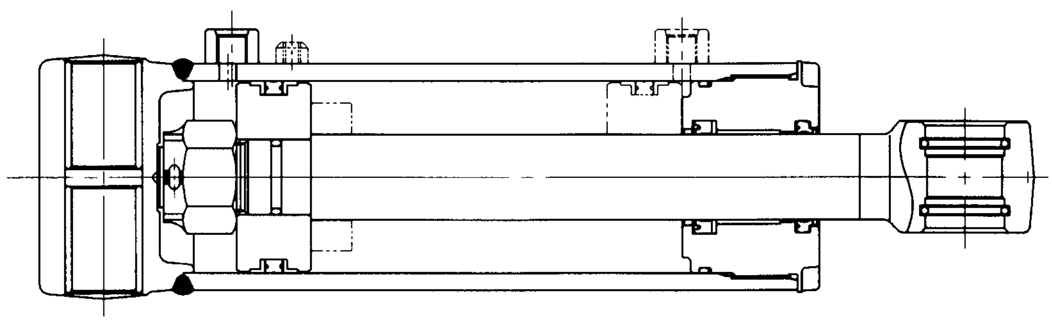
TILT CYLINDER

GENERAL

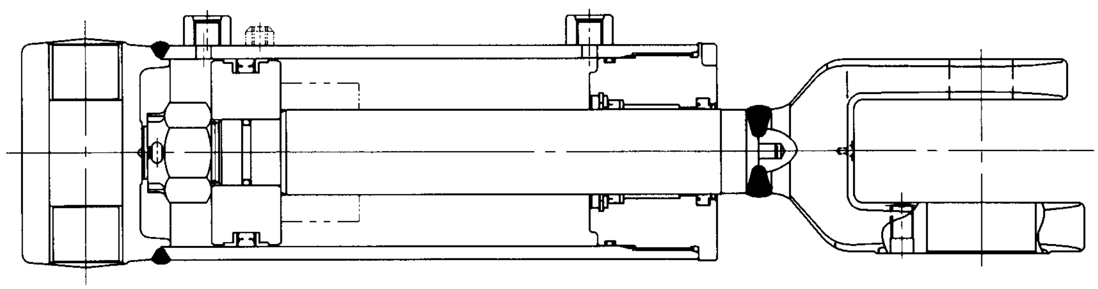
15 ~ 32 model



35·45 model



55 model



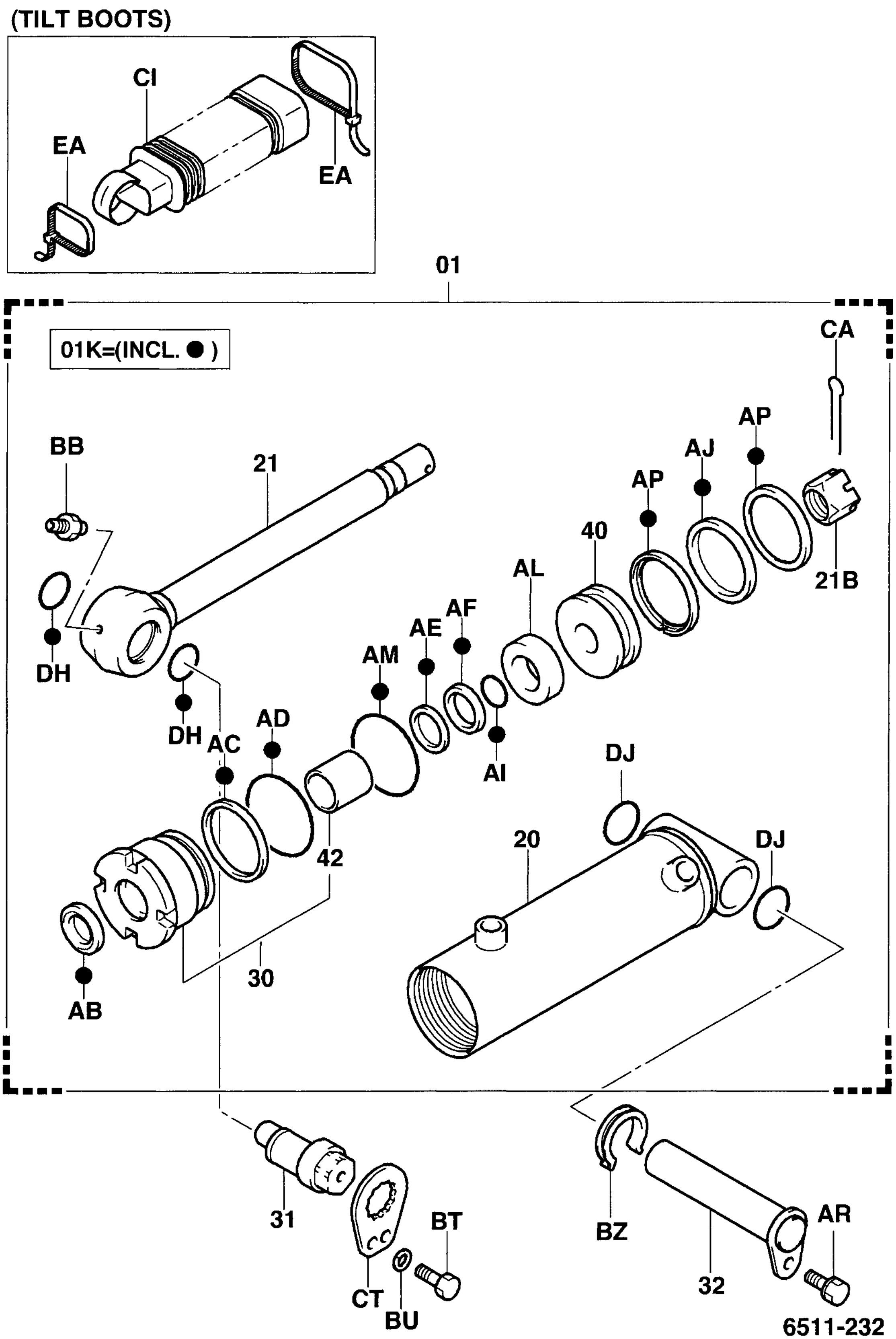
SPECIFICATIONS

Item \ Model		15 ~ 32	35·45	55
Cylinder type		Double acting type		
Cylinder bore	mm (in)	70 (2.76)	90 (3.54)	100 (3.94)
Piston rod outside diameter	mm (in)	30 (1.18)	40 (1.57)	45 (1.77)
Piston seal type		U packing	←	←
Rod seal type		U packing	←	←

COMPONENTS

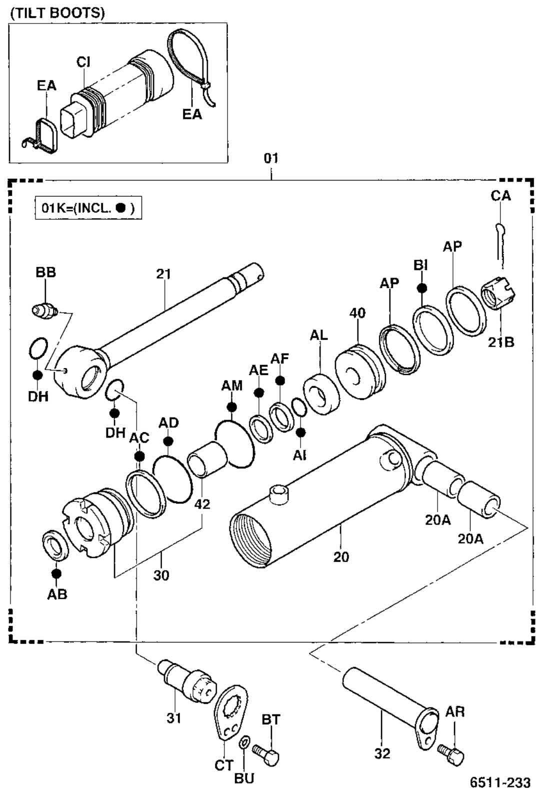
15 ~ 32 model

6511

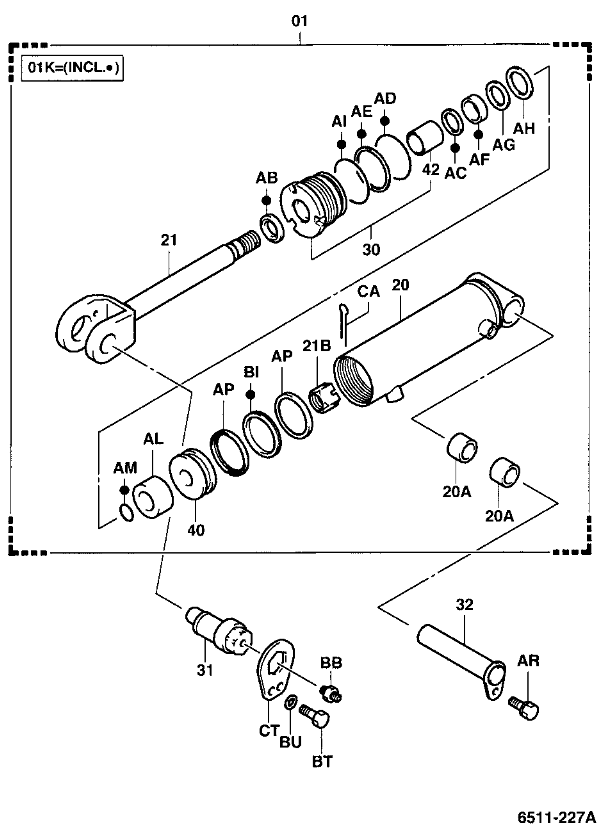


35·45 model

6511

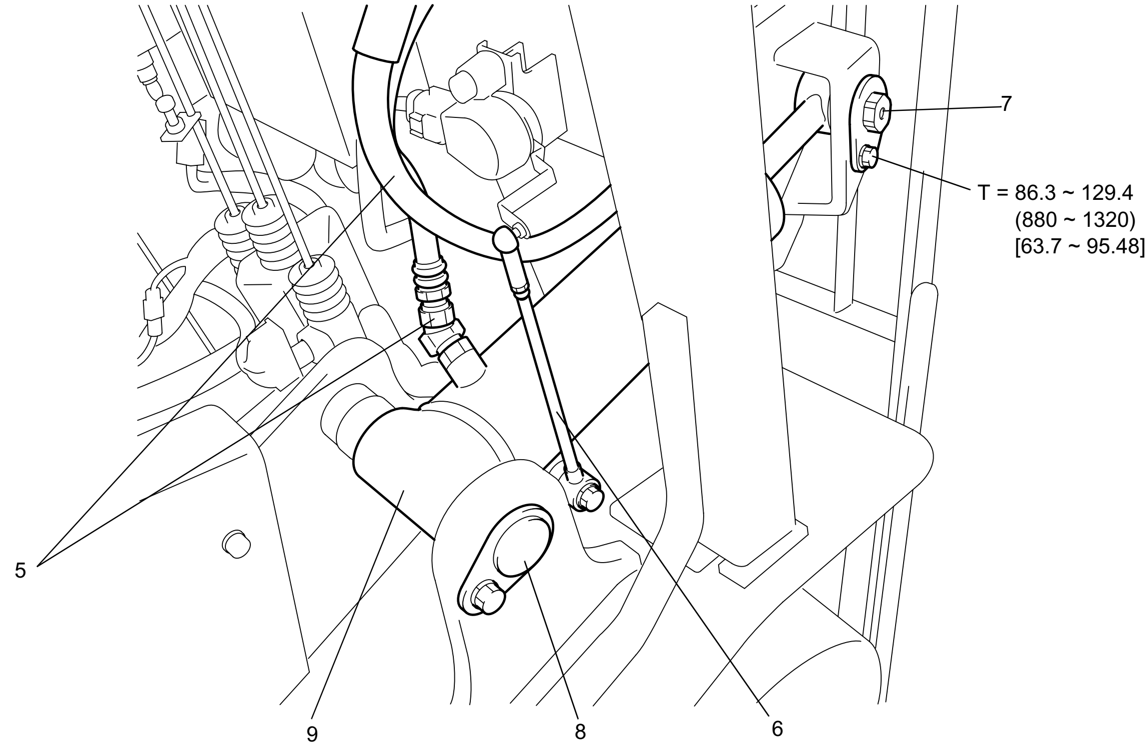


55 model



REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



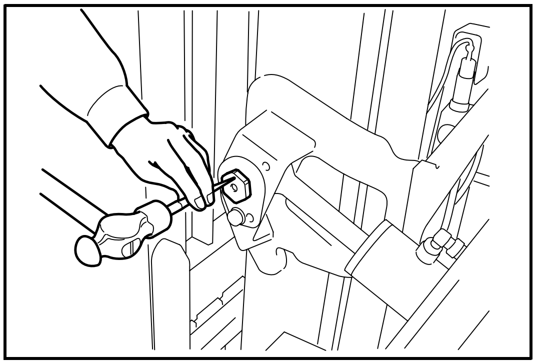
Removal Procedure

1 Remove the toe board and lower panel.
2 Remove the instrument panel.
3 Remove the front piller cover.
4 Hoist the mast slightly.
5 Disconnect the hose.
6 Disconnect the tilt angle sensor link (RH).
7 Remove the tilt cylinder front pin. **[Point 1]**
8 Remove the tilt cylinder rear pin.
9 Remove the tilt cylinder ASSY.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

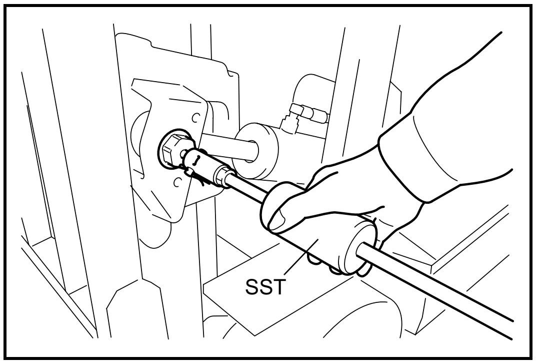
Note:
- **Apply MP grease on the portions for inserting tilt cylinder front and rear pins before installation.**
- **After installation, slowly tilt the mast forward and backward a few times to check normal functioning.**
- **Check the hydraulic oil level, and add if insufficient.**
- **After installation, perform SAS matching. (See VOL.2 page 3-54.)**



[Point 1]

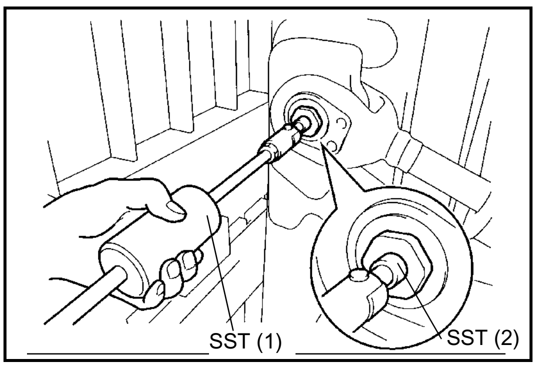
Removal:

Put match marks to clarify relative positions of the front pin, stopper plate and lock bolt. Match marks, however, are unnecessary when the mast or mast ASSY is replaced since mast tilt angle adjustment is to be done after the replacement.



Removal:

15 ~ 45 model
SST 09810-20172-71

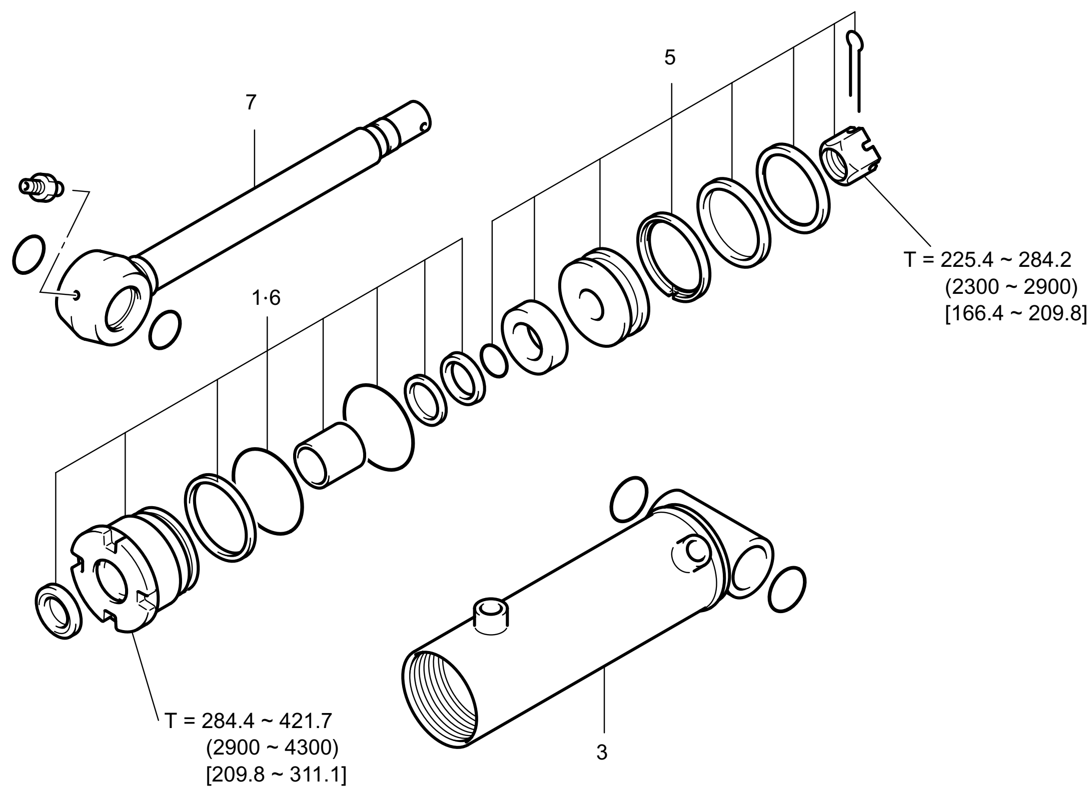


55 model
SST 09810-20172-71 .... (1)
SST 09820-31040-71 .... (2)

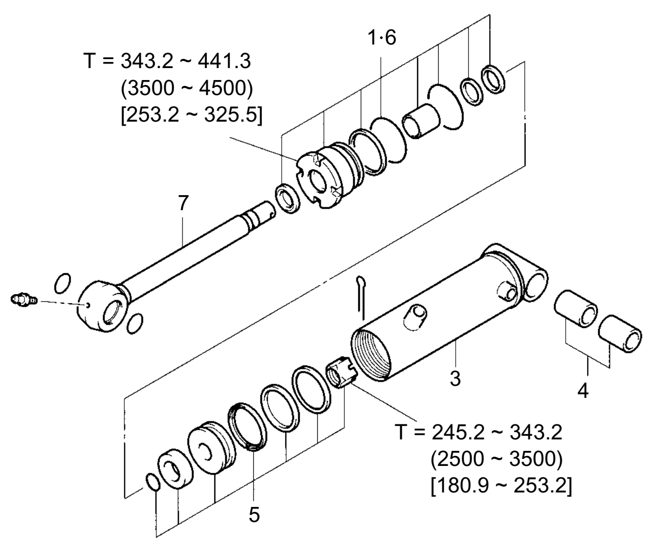
DISSASSEMBLY·INSPECTION·REASSEMBLY

T = N·m (kgf-cm) [ft-lbf]

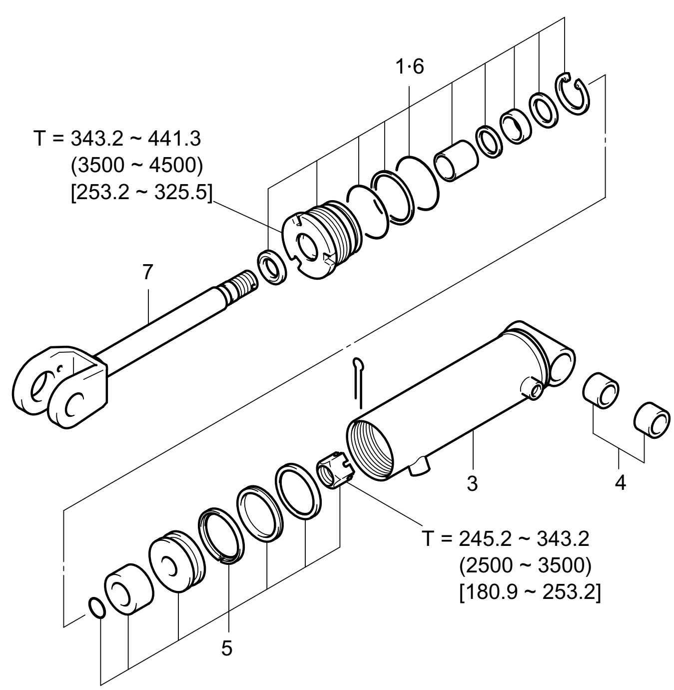
15 ~ 32 model



35·45 model



55 model



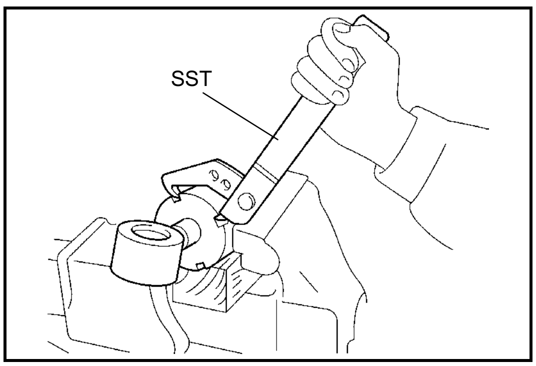
Disassembly Procedure

1 Loosen the rod guide. **[Point 1]**
2 Extract the piston rod W/piston.
3 Remove the tilt cylinder. **[Point 2]**
4 Remove the bushing. (35 ~ 55 model) **[Point 3]**
5 Remove the piston.
6 Remove the rod guide.
7 Remove the piston rod. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

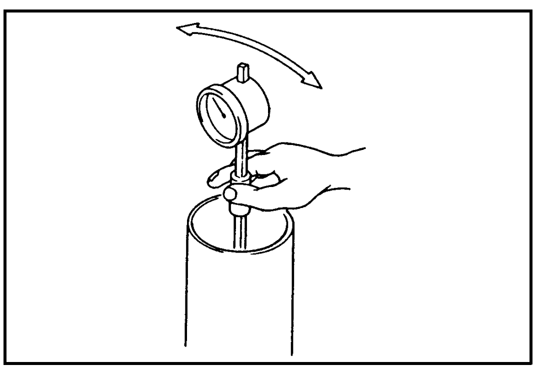
Note:
- **Apply MP grease or hydraulic oil on the packing, O-ring, and dust seal lip portion.**
- **Apply sealant (08833-76002-71 (08833-00080)) on the threaded portion of the rod guide before reassembly.**
- **Apply MP grease to front and rear pin insertion portions of the cylinder.**



Point Operations

[Point 1]

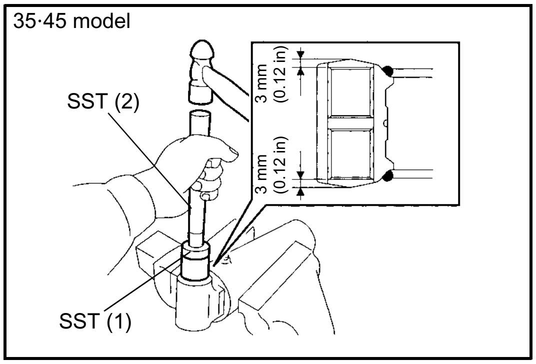
Disassembly·Reassembly:
SST 09620-10100-71

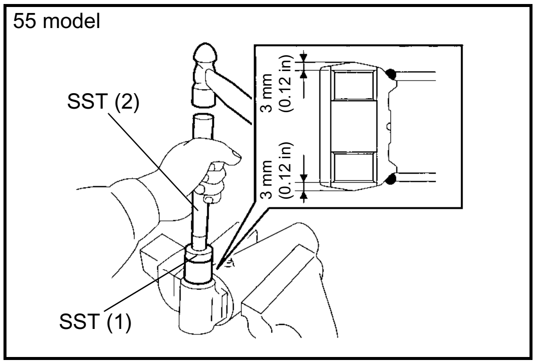


[Point 2]

Inspection:
Measure the cylinder bore.

15 ~ 32 model
Standard: 70.0 mm (2.756 in)
Limit: 70.35 mm (2.7697 in)
35·45 model
Standard: 90.0 mm (3.543 in)
Limit: 90.40 mm (3.5591 in)
55 model
Standard: 100.0 mm (3.937 in)
Limit: 100.40 mm (3.9528 in)

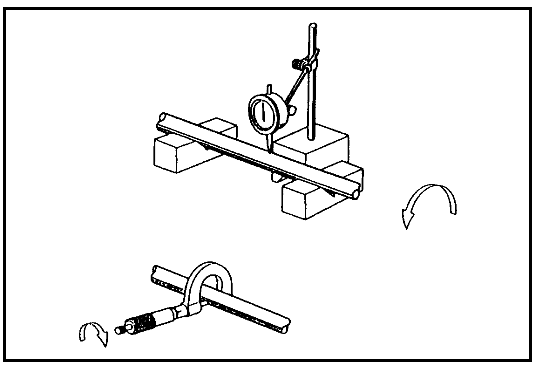




[Point 3]

Removal·Installation:

SST 09950-76018-71 .... (1)
(SST 09950-60010)
SST 09950-76020-71 .... (2)
(SST 09950-70010)



[Point 4]

Inspection:

Measure the piston rod outside diameter.

15 ~ 32 model
Standard: 30.0 mm (1.181 in)
Limit: 29.92 mm (1.1780 in)
35·45 model
Standard: 40.0 mm (1.575 in)
Limit: 39.92 mm (1.5717 in)
55 model
Standard: 45.0 mm (1.772 in)
Limit: 44.92 mm (1.7685 in)

Inspection:

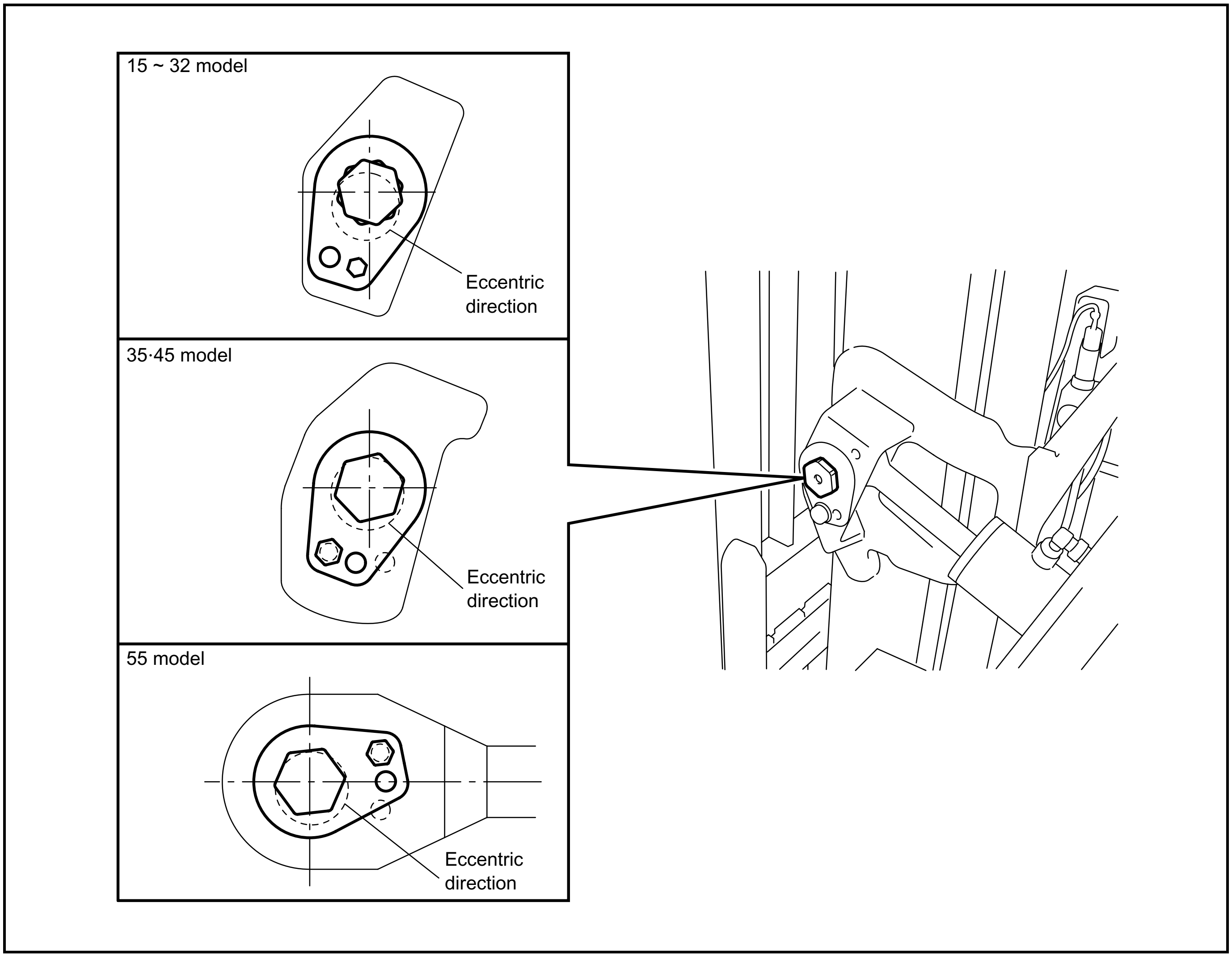
Measure the bend of the piston rod.

Limit: 1.0 mm (0.039 in)

MAST FORWARD BACKWARD TILTING ANGLE ADJUSTMENT (PREVENTION OF UNEVEN TILTING)

Note:
Adjust the mast forward and backward tilting angles (to prevent uneven tilting) when the tilt cylinder and mast ASSY are replaced or overhauled.
After adjustment, perform SAS matching. (See VOL.2 page 3-54.)

1. With the mast in the neutral position, install the stopper with the tilt cylinder pin eccentric direction on the lower side.



2. Inspect the forward and backward tilting angles and unevenness in tilting at the pin position above.

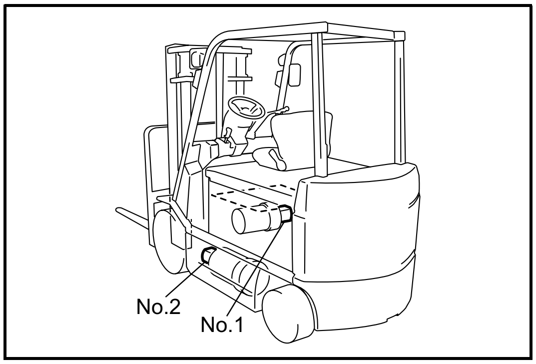
   Standard:
   Mast forward tilting angle: Standard set angle -0.6° ~ +1.6°
   Mast backward tilting angle: Standard set angle -0.8° ~ +0.6°
   Unevenness: 1 mm (0.04 in) or less

3. If the standard is not satisfied, make adjustment by turning the fixation angle of the eccentric pin in alliance with the stopper bolt hole matching in the stopper plate. To align the hole with the tapped hole in the tilt bracket, either of two holes in the plate is selective and the plate is reversible on side to find desirous position.
4. After the adjustment, tighten the stopper set bolt to lock the front pin.

OIL PUMP

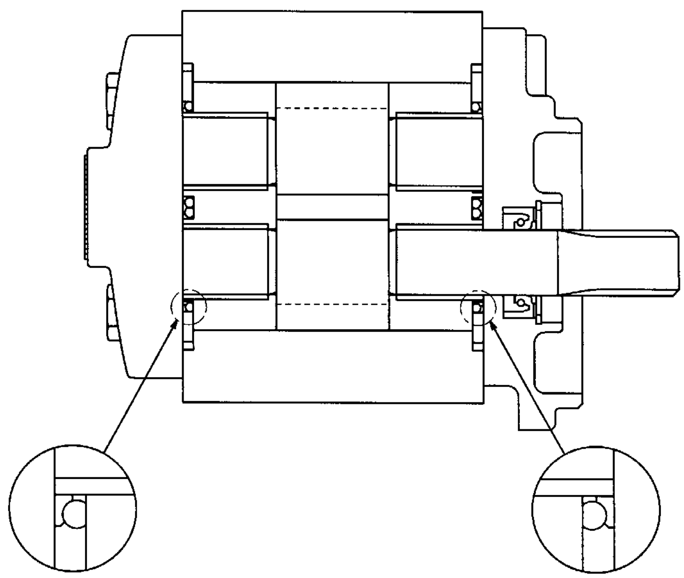
Page

GENERAL

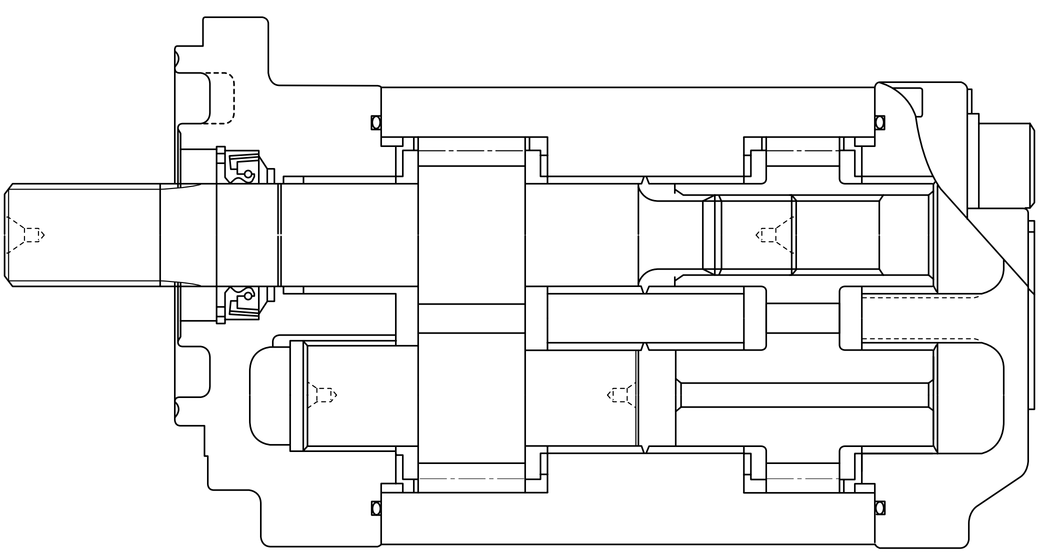


Note:
Since two oil pumps are used on models 35 to 55, the one on the material handling·PS motor side is described as pump No. 1 and the one on the motor exclusively for material handling as pump No. 2.

Single gear pump (Kayaba)
15 ~ 32 model, 35 ~ 55 model No.2 pump



Double gear pump (Shimadzu)
35 ~ 55 model No.1 pump



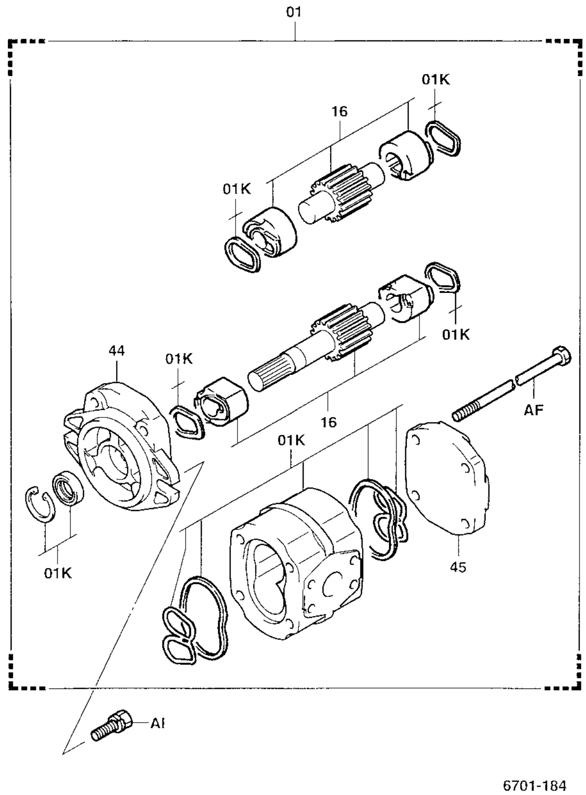
SPECIFICATIONS

Model		Manufacturer (Model)	Pump type	Displacement cm^3 (in^3)/rev
15·18		KAYABA (KSP4-20C)	Single gear	20.0 (1.220)
20 ~ 32	48 V: Dustproof model	↑	↑	↑
	Other	KAYABA (KSP4-25C)	↑	25.5 (1.556)
35 ~ 55 (No.1 pump)	Dustproof model	SHIMADZU (DDG1A16·9)	Double gear	16.2 (0.989), 9.5 (0.580)
	Other	SHIMADZU (DDG1A18·9)	↑	18.3 (1.117), 9.5 (0.580)
35 ~ 55 (No.2 pump)	Dustproof model	KAYABA (KSP4-20C)	Single gear	20.0 (1.220)
	Other	↑	↑	↑

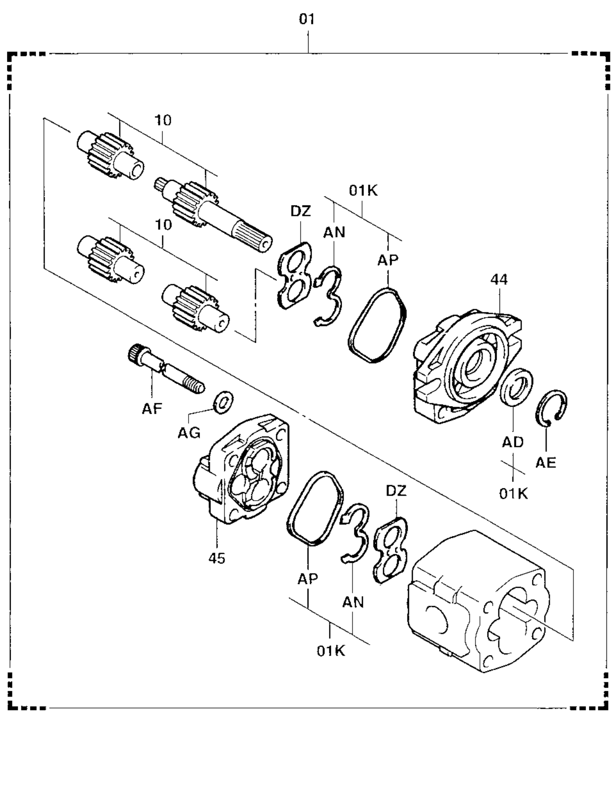
COMPONENTS

Single gear pump (Kayaba)
15 ~ 32 model, 35 ~ 55 model No.2 pump

6701

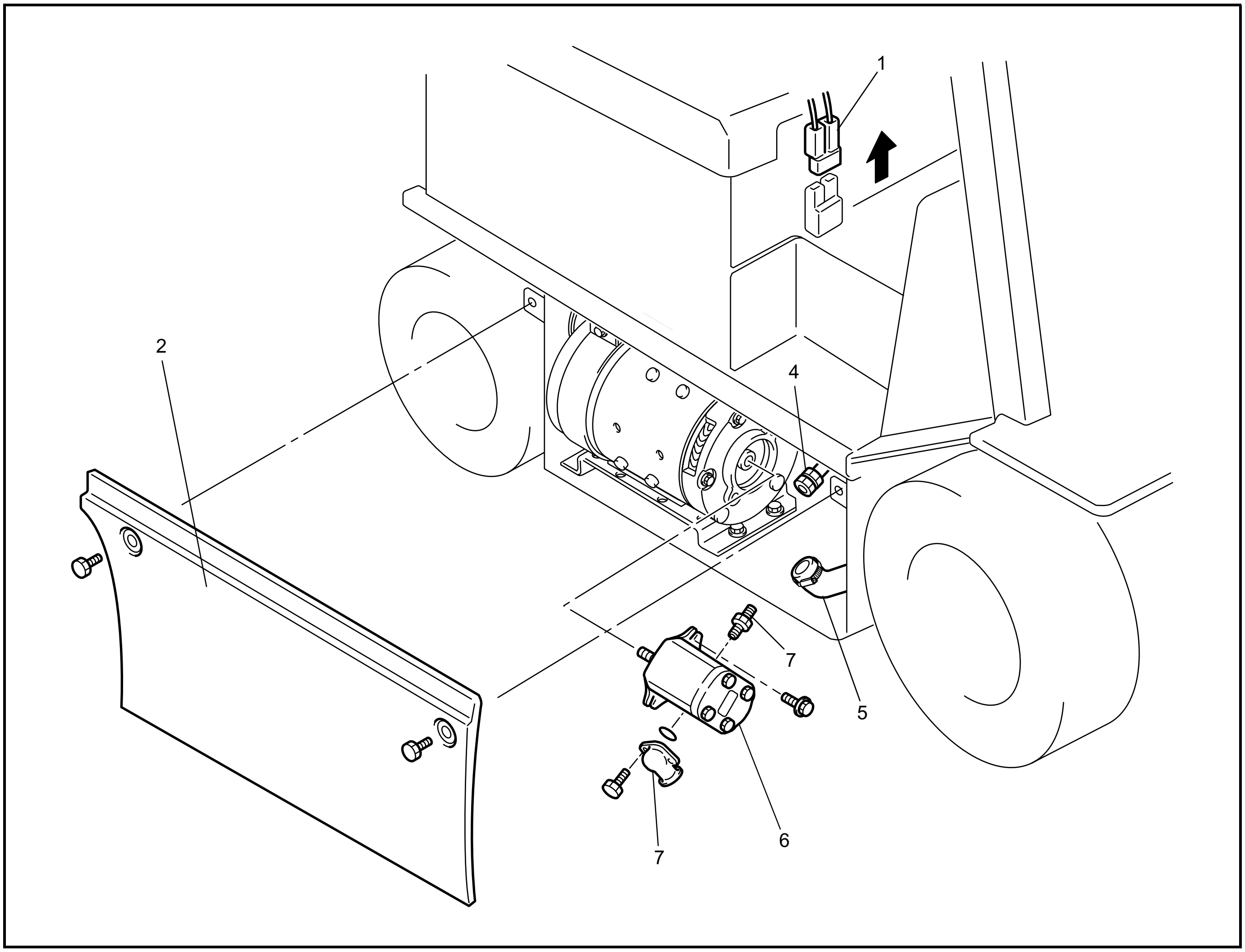


Double gear pump (Shimadzu)
35 ~ 55 model No.1 pump



OIL PUMP ASSY

REMOVAL·INSTALLATION (15 ~ 32 MODEL)



Removal Procedure

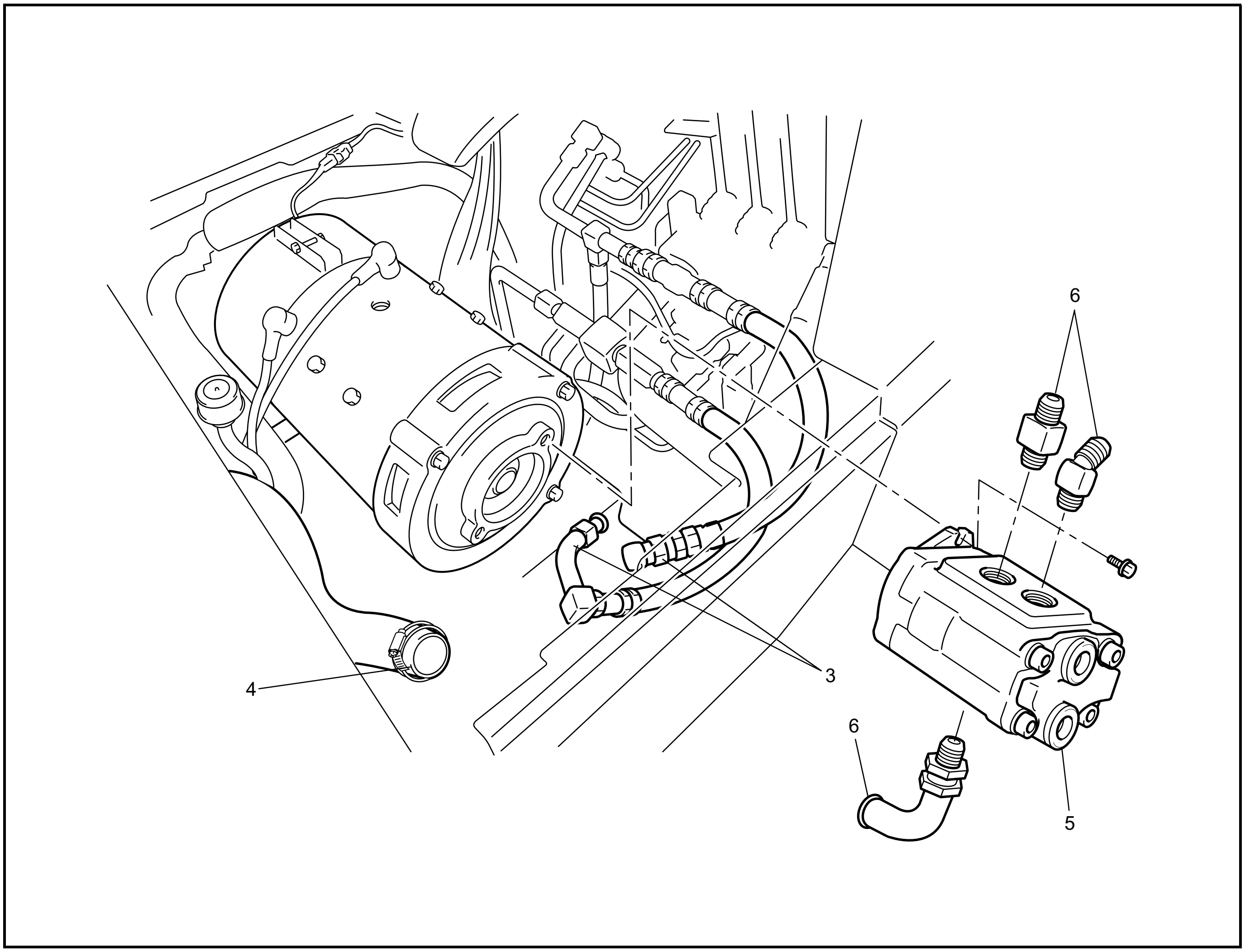
1 Disconnect the battery plug.
2 Remove the side cover RH.
3 Drain hydraulic oil.
4 Disconnect the outlet hose.
5 Disconnect the inlet hose.
6 Remove the oil pump ASSY.
7 Remove the fitting.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
- **Apply grease (molybdenum disulfide grease) on the pump shaft spline portion before installation.**
- **Clean the fitting mounting portion thoroughly to prevent damage to the O-ring.**

REMOVAL·INSTALLATION (35 ~ 55 MODEL NO.1 PUMP)



Removal Procedure

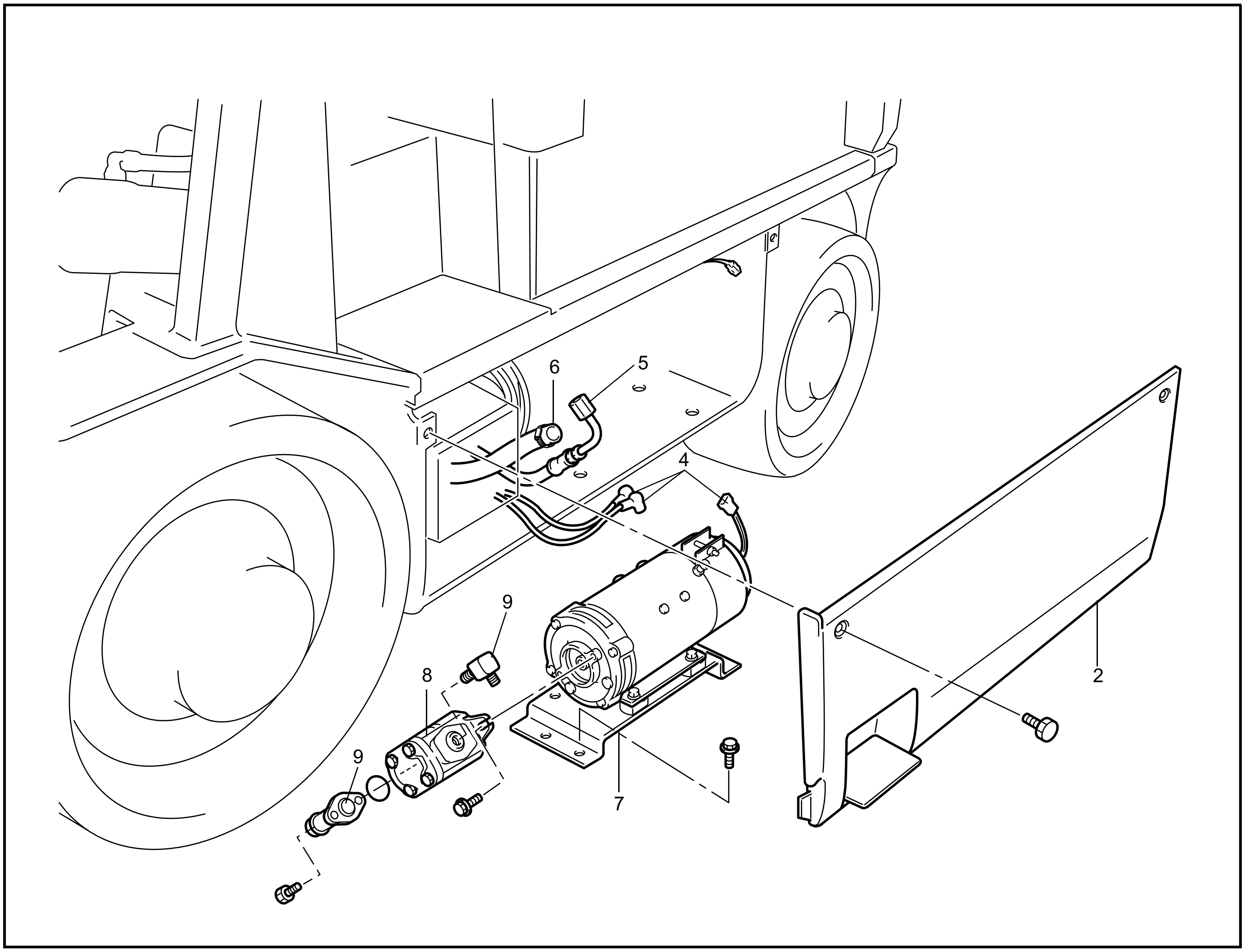
1 Disconnect the battery plug.
2 Remove the toe board (front and rear) and lower panel.
3 Disconnect the outlet hose.
4 Disconnect the inlet hose.
5 Remove the oil pump ASSY.
6 Remove the fitting.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
- **Apply grease (molybdenum disulfide grease) on the pump shaft spline portion before installation.**
- **Clean the fitting mounting portion thoroughly to prevent damage to the O-ring.**

REMOVAL·INSTALLATION (35 ~ 55 MODEL NO.2 PUMP)



Removal Procedure

1 Disconnect the battery plug.
2 Remove the side cover LH.
3 Drain hydraulic oil.
4 Disconnect the wiring.
5 Disconnect the outlet hose.
6 Disconnect the inlet hose.
7 Remove the pump motor ASSY & oil pump ASSY W/pump motor set plate.
8 Remove the oil pump ASSY.
9 Remove the fitting.

Installation Procedure

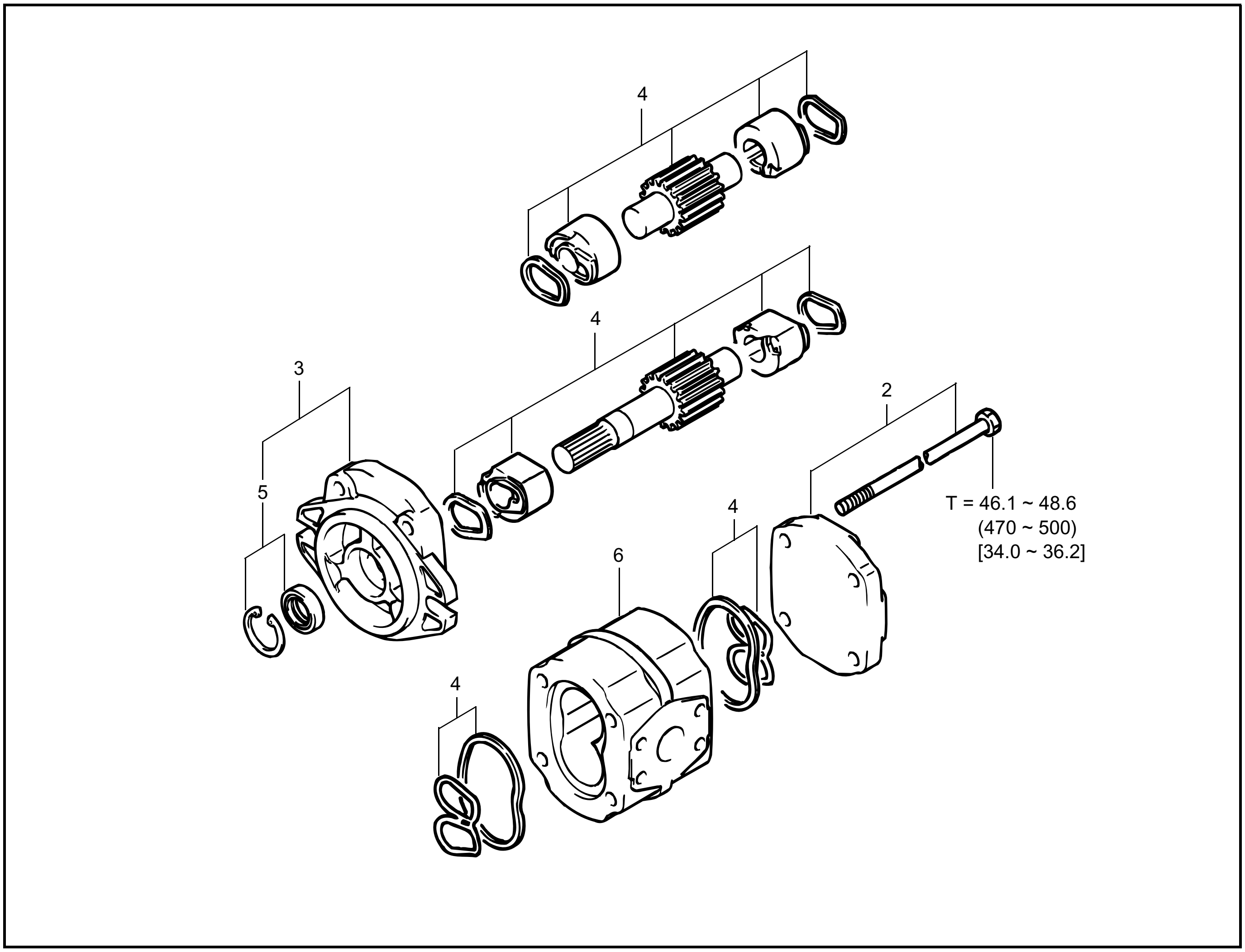
The installation procedure is the reverse of the removal procedure.

Note:

- **Apply grease (molybdenum disulfide grease) on the pump shaft spline portion before installation.**
- **Clean the fitting mounting portion thoroughly to prevent damage to the O-ring.**

DISASSEMBLY·INSPECTION·REASSEMBLY
(15 ~ 32 MODEL, 35 ~ 55 MODEL NO.2 PUMP)

T = N·m (kgf-cm) [ft-lbf]



Disassembly Procedure

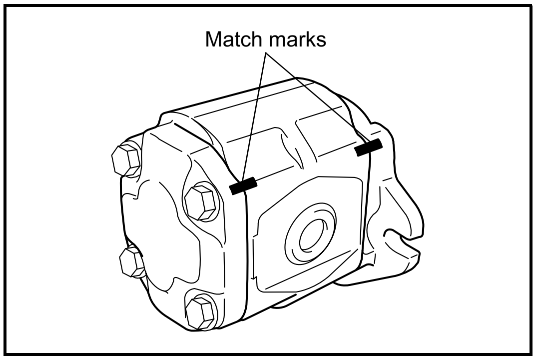
1 Put match marks on the cover, body and mounting flange. **[Point 1]**
2 Remove the cover.
3 Remove the mounting flange.
4 Remove the bushing set and pump gear set. **[Point 2]**
5 Remove the oil seal. **[Point 3]**
6 Inspect the body. **[Point 4]**

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **Use new seals for reassembly.**
- **Apply the hydraulic oil before reassembly.**

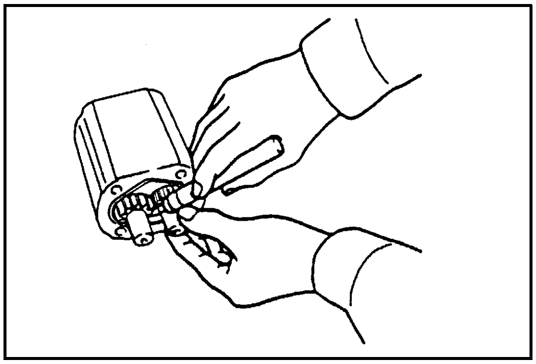
Point Operations



[Point 1]

Disassembly:
Provide a match marks between the front cover and body, and between the rear cover and body.

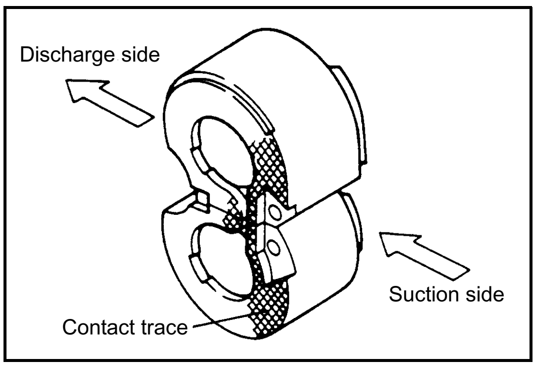
Reassembly:
Assembly by aligning the match marks.



[Point 2]

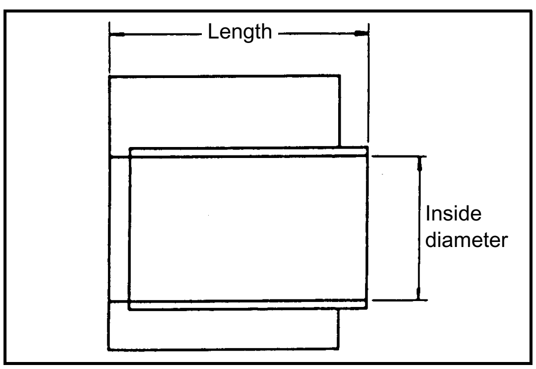
Disassembly:
Put match marks on the teeth of the drive and driven gears.

Reassembly:
Align match marks at the time of reassembly.



Inspection:
Inspect the bushing set contact trace.

Standard:
Relatively stronger contact trace on the suction side, with slight trace on the discharge side.

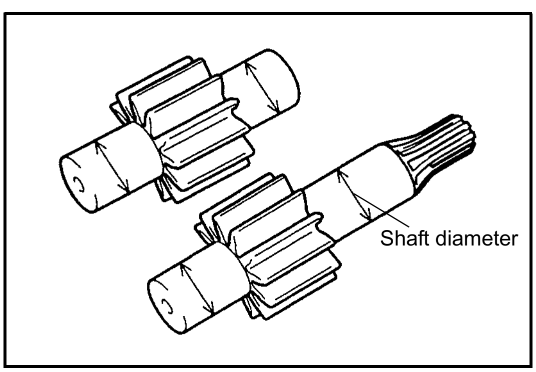


Inspection:
Measure the bushing set length.

Limit: 26.411 mm (1.03980 in)

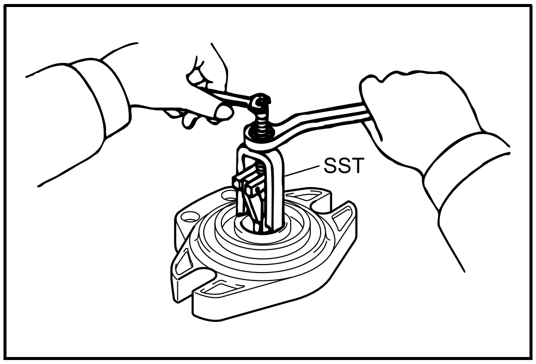
Inspection:
Inspect the bushing set for wear at the interior surface.

Limit:
Replace if the teflon coating layer is worn out even locally.



Inspection:
Measure the outside diameter of each gear shaft.

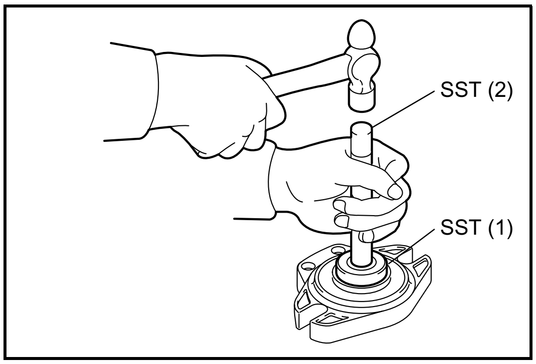
Limit: 18.935 mm (0.74547 in)



[Point 3]

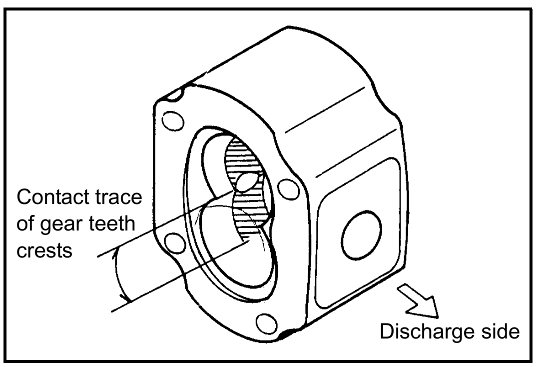
Disassembly:

SST 09319-76001-71
(SST 09319-60020)



Reassembly:

SST 09950-76018-71 ....(1)
(SST 09950-60010)
SST 09950-76020-71 ....(2)
(SST 09950-70010)
After installation, apply MP grease on the oil seal lip portion.



[Point 4]

Inspection:

Inspect the contact trace on the inner surface of the body (suction side).

Limit: Contact trace covers more than half of the circumference.

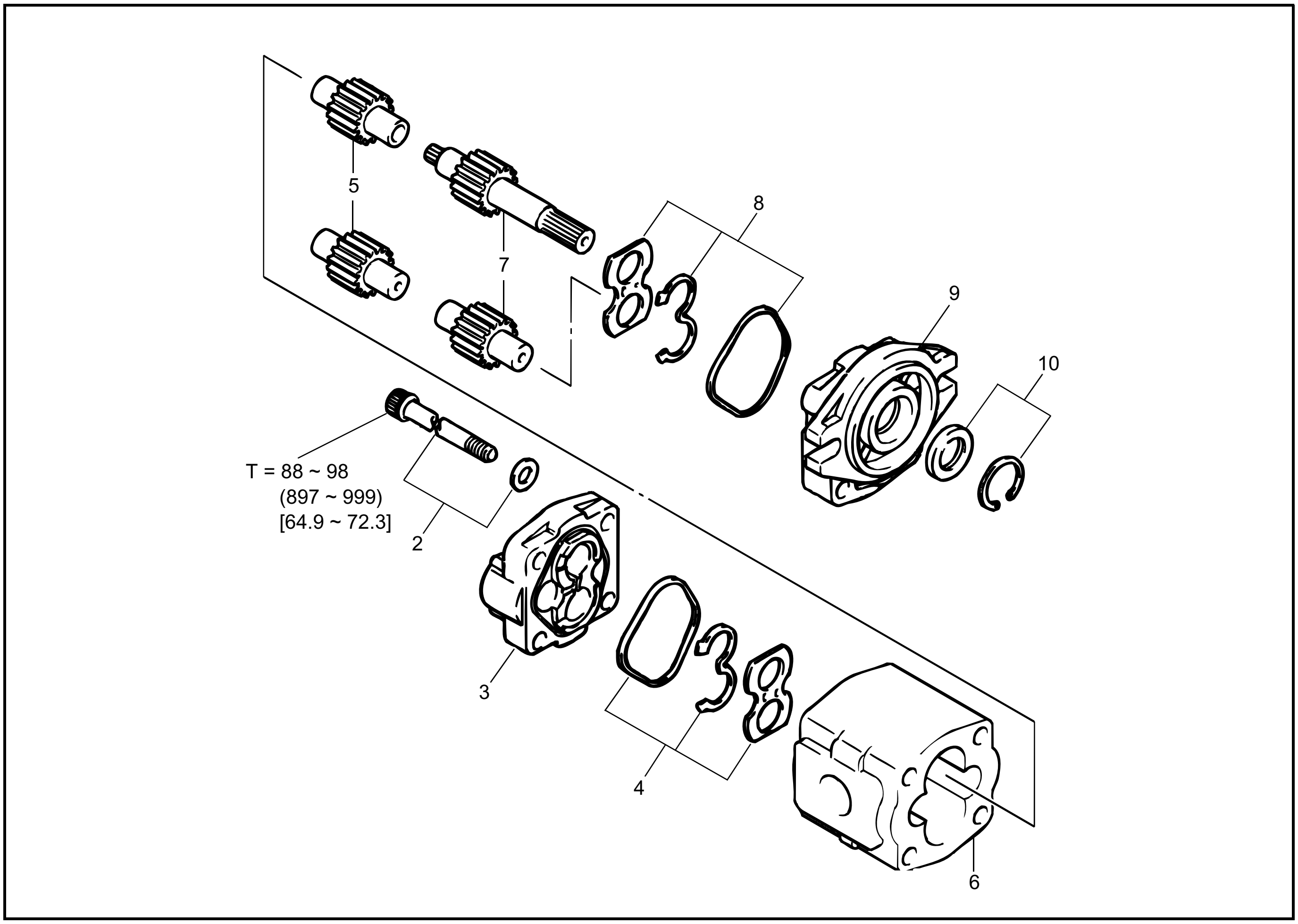
Inspection:

Measure the depth of flaw on the inner surface of the body.

Limit: 0.1 mm (0.004 in)

DISASSEMBLY·INSPECTION·REASSEMBLY (35 ~ 55 MODEL NO.1 PUMP)

T = N·m (kgf-cm) [ft-lbf]



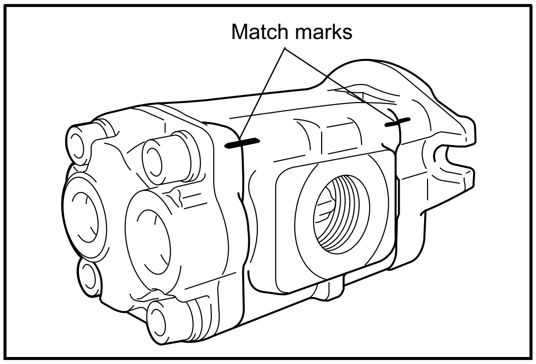
Disassembly Procedure

1 Put match marks between the front cover and body and between the rear cover and body. **[Point 1]**
2 Place the front cover to face downward, and remove the bolts.
3 Remove the rear cover. **[Point 2]**
4 Remove the gasket, “3” in shape gasket and side plate. **[Point 3]**
5 Remove the drive gear and driven gear. **[Point 4]**
6 Remove the body. **[Point 5]**
7 Remove the drive gear No.2 and driven gear No.2. **[Point 4]**
8 Remove the gasket, “3” in shape gasket and side plate. **[Point 3]**
9 Remove the front cover.
10 Remove the oil seal from front cover. **[Point 6]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
- **Wash each part, blow compressed air and apply hydraulic oil before installation.**
- **Always use new seals for reassembly.**



Point Operations

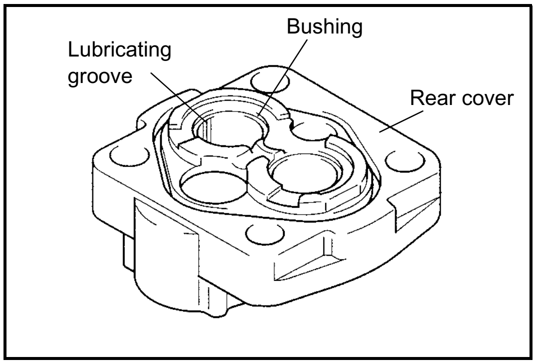
[Point 1]

Disassembly:

Put match marks between the front cover and body and between the rear cover and body.

Reassembly:

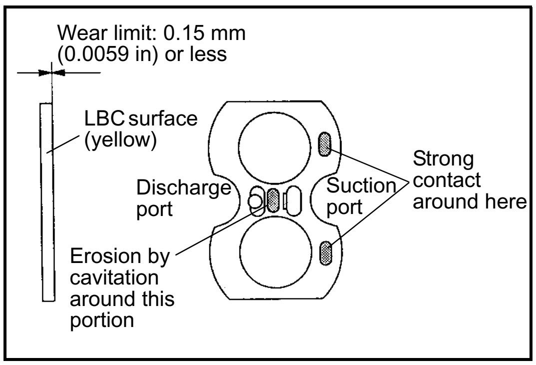
Align match marks when reassembling.



[Point 2]

Inspection:

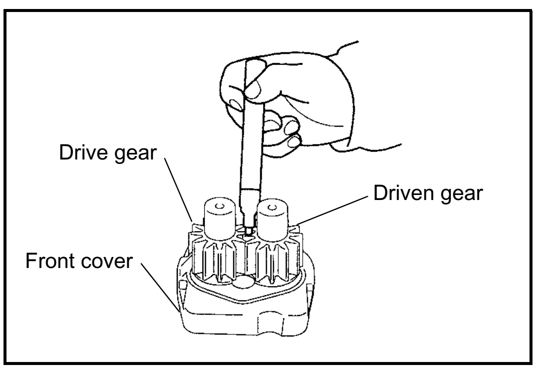
The bushing inner surface shall not be roughened and shall not be worn to make the metal on the rear side visible.



[Point 3]

Inspection:

The side plate surface (LBC surface) in contact with gears shall not be worn beyond the limit shown at left.



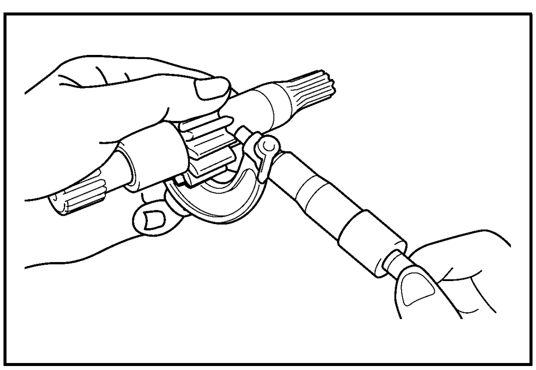
[Point 4]

Disassembly:

Put a match mark on tooth flanks of the drive and driven gears.

Reassembly:

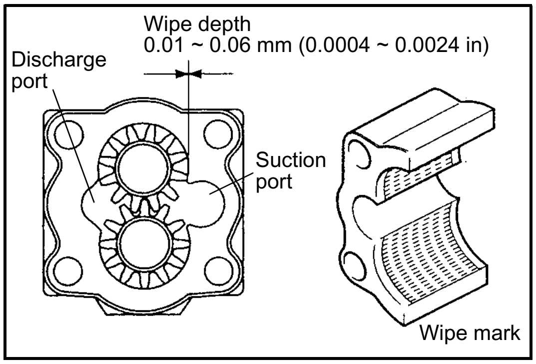
Align match marks when reassembling.



Inspection:

Check the gear side surface for no wear and the tooth flanks for no roughening of each gear shaft.

Shaft diameter wear limit: 21.997 mm (0.86602 in)
Tooth width wear limit: 33.3 mm (1.311 in)

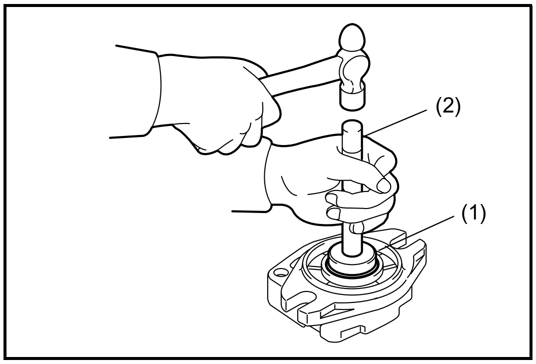


[Point 5]

Inspection:

Inspect the body inner surface for the wipe mark.

Normal wipe depth: 0.01 ~ 0.06 mm (0.0004 ~ 0.0024 in)



[Point 6]

Reassembly:

SST 09950-76018-71 ....(1)
(SST 09950-60010)
SST 09950-76020-71 ....(2)
(SST 09950-70010)
After reassembly, apply a thin coat of MP grease on the oil seal lip portion.

TEST METHOD

A bench test should be conducted for strict testing, but as it is generally impossible in practical service operation, install the oil pump on the vehicle and judge the oil pump discharge performance by means of cylinder operation.

- Check that the battery charge is sufficient by observing the battery charge indicators.
- Check that the oil control valve set relief pressure is as specified.(See page 16-25.)
- Measure the lift cylinder full stroke operation time when the hydraulic oil temperature is 50 to 55°C (122 to 131°F), and calculate the lifting speed.
  Because of the soft start by the material handling chopper circuit, the lifting speed is 10 to 20 mm/sec (2.0 to 3.9 fpm) lower than the value obtained from the table below. The precision of the lifting speed, therefore, is higher if measured excluding the soft start period.
  Chopper-less models, therefore, uneven speed.

The lifting speed depends slightly on the battery, hydraulic oil temperature and mast adjustment.
The value below is for the case where given conditions are satisfied.

Liffting Speed Table (Approx.value)

Liffting speed mm/sec (fpm)

Vehicle model		V mast		FV mast		FSV mast		QFV mast	
		No-load	Loaded	No-load	Loaded	No-load	Loaded	No-load	Loaded
7FBCU15	36(V)	560 (110)	310 (61)	540 (106)	300 (59)	500 (98)	300 (59)	-	-
	48(V)	720 (142)	430 (85)	690 (136)	390 (77)	640 (126)	400 (79)	-	-
7FBCU18	36(V)	560 (110)	310 (61)	540 (106)	280 (55)	500 (98)	280 (55)	-	-
	48(V)	720 (142)	410 (81)	690 (136)	390 (77)	640 (126)	390 (77)	-	-
7FBCU20	36(V)	530 (104)	320 (63)	510 (100)	310 (53)	460 (91)	300 (59)	450 (89)	300 (59)
	48(V)	640 (126)	430 (85)	620 (122)	410 (81)	580 (114)	400 (79)	560 (110)	400 (79)
7FBCU25	36(V)	530 (104)	280 (55)	510 (100)	270 (53)	460 (91)	270 (53)	450 (89)	270 (53)
	48(V)	640 (126)	380 (75)	620 (122)	370 (73)	580 (114)	370 (73)	560 (110)	370 (73)
7FBCU30	36(V)	450 (89)	240 (47)	410 (81)	250 (49)	380 (75)	230 (45)	370 (73)	230 (45)
	48(V)	530 (104)	320 (63)	510 (100)	320 (63)	470 (93)	310 (61)	450 (89)	310 (61)
7FBCU32	36(V)	450 (89)	230 (45)	410 (81)	240 (47)	380 (75)	220 (43)	370 (73)	220 (43)
	48(V)	530 (104)	320 (63)	500 (98)	310 (61)	470 (93)	300 (59)	450 (89)	300 (59)
7FBCU35	36(V)	460 (91)	260 (51)	430 (85)	260 (51)	420 (83)	260 (51)	-	-
	48(V)	600 (118)	370 (73)	550 (108)	360 (71)	530 (104)	370 (73)	-	-
7FBCU45	36(V)	350 (69)	220 (43)	330 (65)	200 (39)	330 (65)	200 (39)	-	-
	48(V)	450 (89)	290 (57)	420 (83)	270 (53)	410 (81)	270 (53)	-	-
7FBCU55	36(V)	330 (65)	190 (37)	-	-	300 (59)	180 (35)	-	-
	48(V)	410 (81)	270 (53)	-	-	390 (77)	250 (49)	-	-

Dustproof model (Approx.value)

Liffting speed mm/sec (fpm)

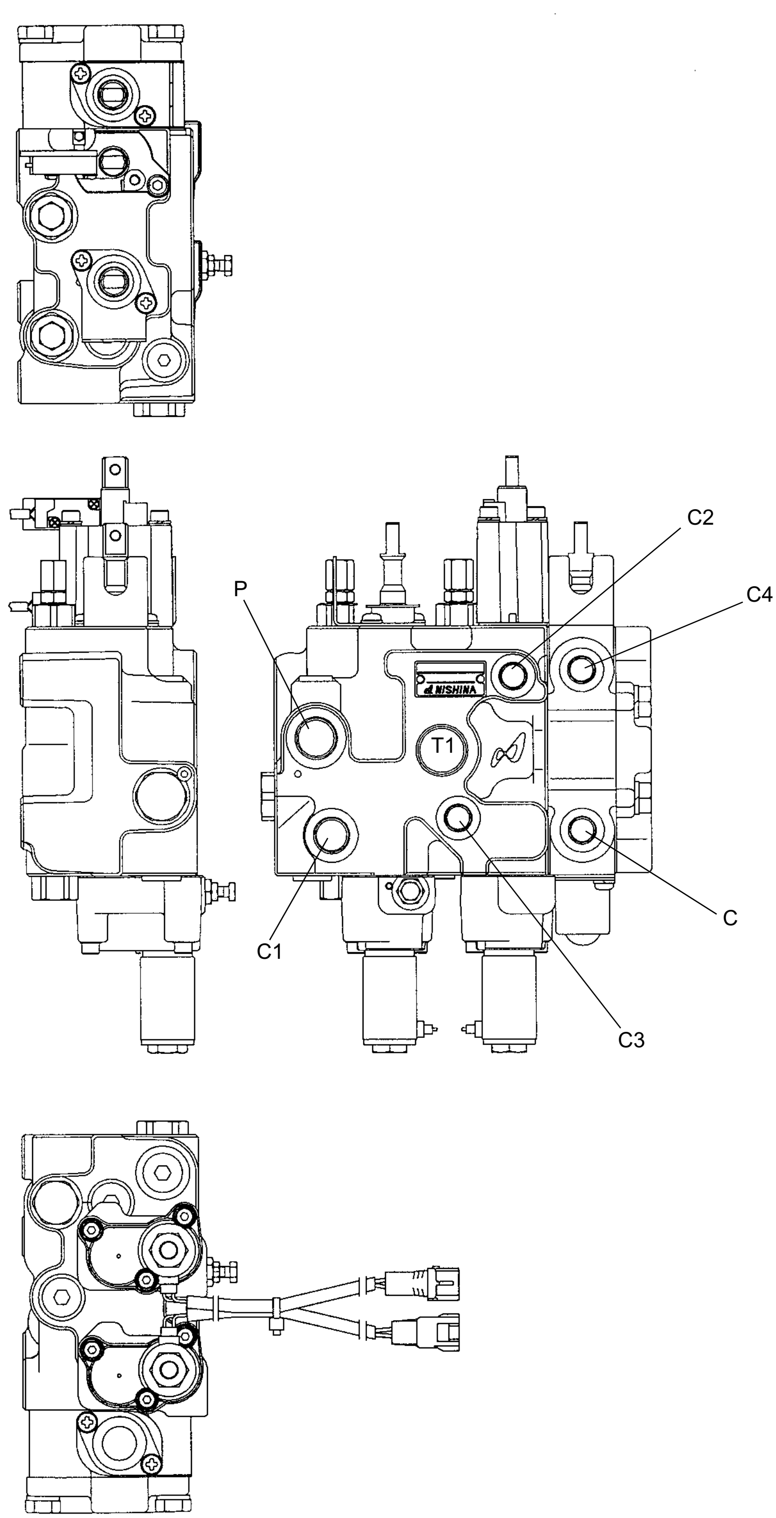
Vehicle model		V mast		FV mast		FSV mast		QFV mast	
		No-load	Loaded	No-load	Loaded	No-load	Loaded	No-load	Loaded
7FBCU15	36(V)	450 (89)	240 (47)	490 (96)	240 (47)	380 (75)	210 (41)	-	-
	48(V)	560 (110)	320 (63)	500 (98)	330 (65)	480 (94)	290 (57)	-	-
7FBCU18	36(V)	450 (89)	220 (43)	490 (96)	220 (43)	380 (75)	190 (37)	-	-
	48(V)	560 (110)	310 (61)	500 (98)	300 (59)	480 (94)	260 (51)	-	-
7FBCU20	36(V)	470 (93)	250 (49)	430 (85)	250 (49)	420 (83)	250 (49)	410 (81)	250 (49)
	48(V)	510 (100)	300 (59)	560 (110)	320 (63)	440 (87)	280 (55)	420 (83)	280 (55)
7FBCU25	36(V)	470 (93)	230 (45)	430 (85)	220 (43)	420 (83)	220 (43)	410 (81)	220 (43)
	48(V)	510 (100)	280 (55)	560 (110)	280 (55)	440 (87)	260 (51)	420 (83)	260 (51)
7FBCU30	36(V)	400 (79)	190 (37)	370 (73)	190 (37)	340 (67)	190 (37)	330 (65)	190 (37)
	48(V)	430 (85)	230 (45)	460 (91)	250 (49)	360 (71)	220 (43)	340 (67)	220 (43)
7FBCU32	36(V)	400 (79)	170 (33)	360 (71)	190 (37)	340 (67)	180 (35)	330 (65)	180 (35)
	48(V)	430 (85)	220 (43)	460 (91)	240 (47)	360 (71)	210 (41)	340 (67)	210 (41)
7FBCU35	36(V)	380 (75)	210 (41)	390 (77)	210 (41)	400 (79)	210 (41)	-	-
	48(V)	480 (94)	300 (59)	440 (87)	290 (57)	400 (79)	290 (57)	-	-
7FBCU45	36(V)	330 (65)	180 (35)	320 (63)	170 (33)	290 (57)	170 (33)	-	-
	48(V)	410 (81)	250 (49)	410 (81)	240 (47)	360 (71)	240 (47)	-	-
7FBCU55	36(V)	270 (53)	150 (30)	-	-	240 (47)	150 (30)	-	-
	48(V)	340 (67)	210 (41)	-	-	310 (61)	210 (41)	-	-

OIL CONTROL VALVE

GENERAL

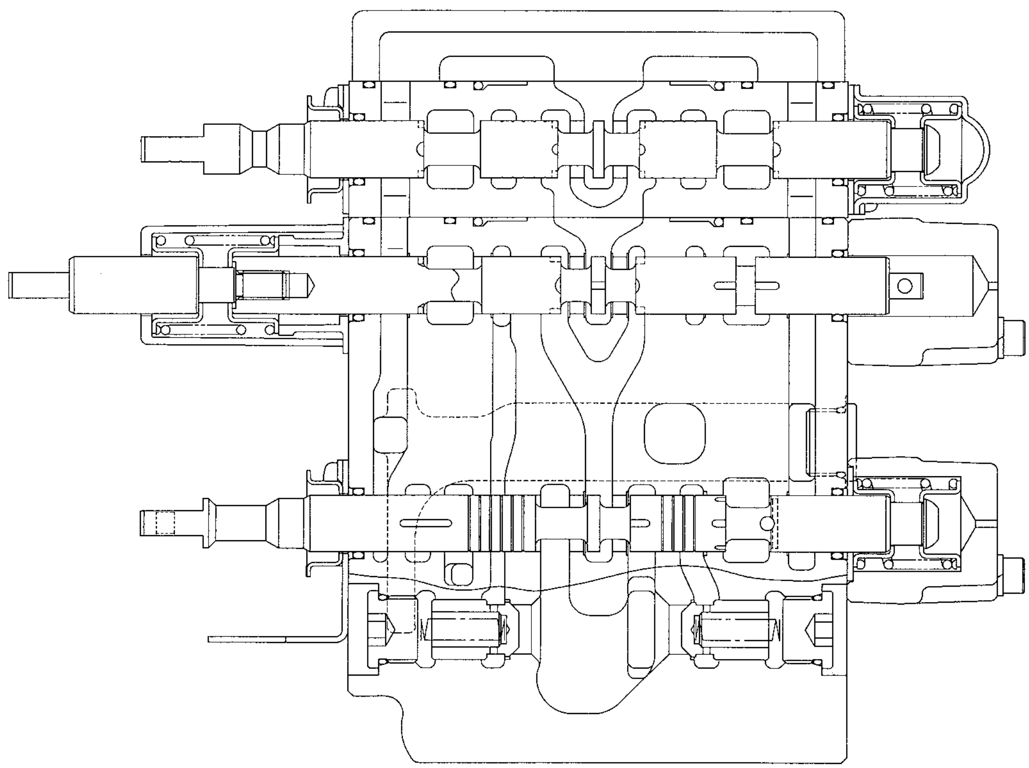
Oil Control Valve

15 ~ 32 model



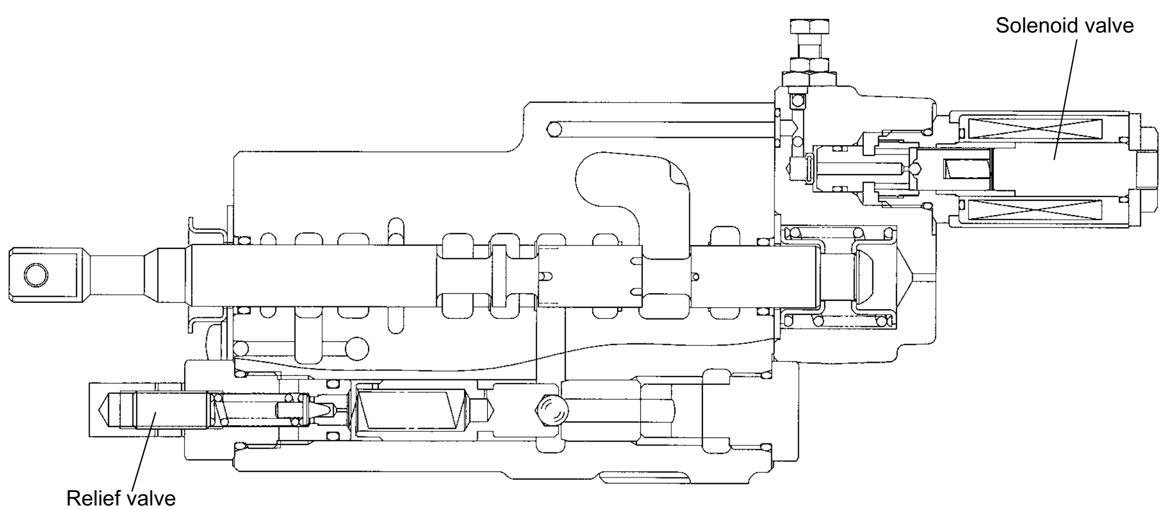
Control Valve Section

15 ~ 32 model



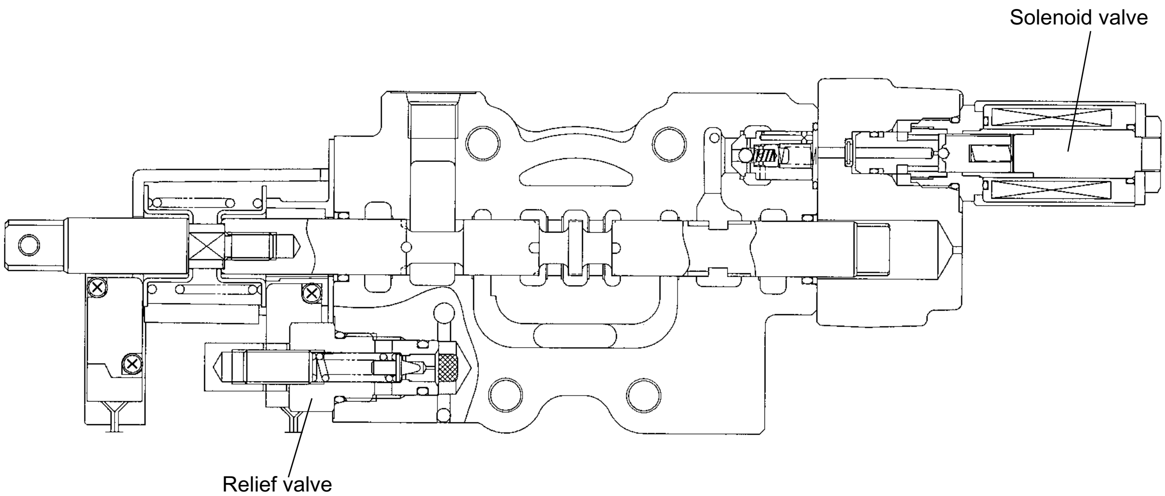
Lift Block Section

15 ~ 32 model



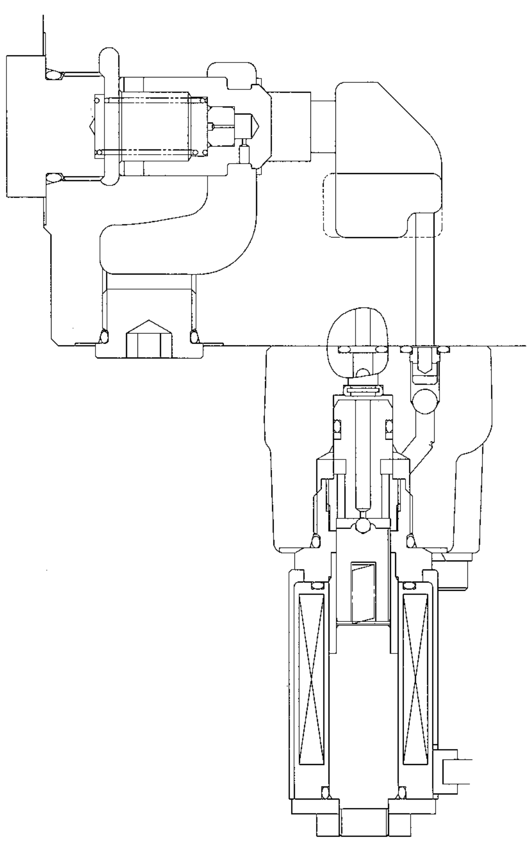
Tilt Block Section

15 ~ 32 model



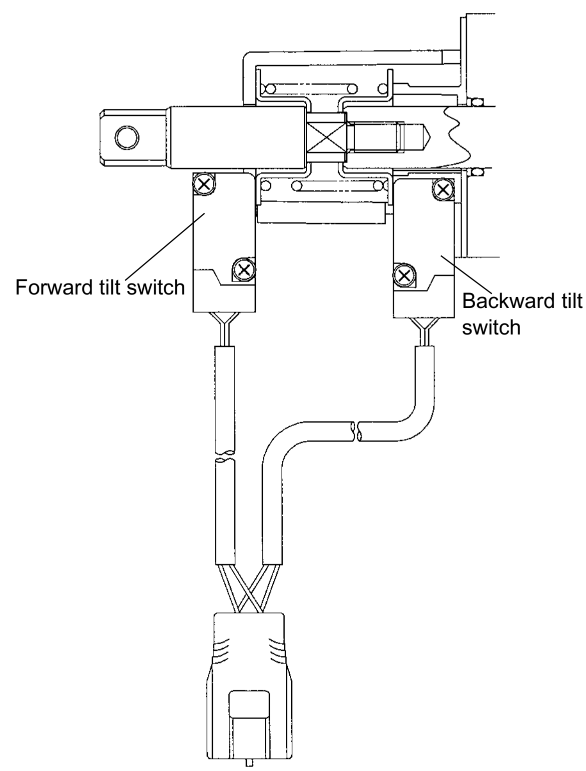
Lift Cheak Valve

15 ~ 32 model



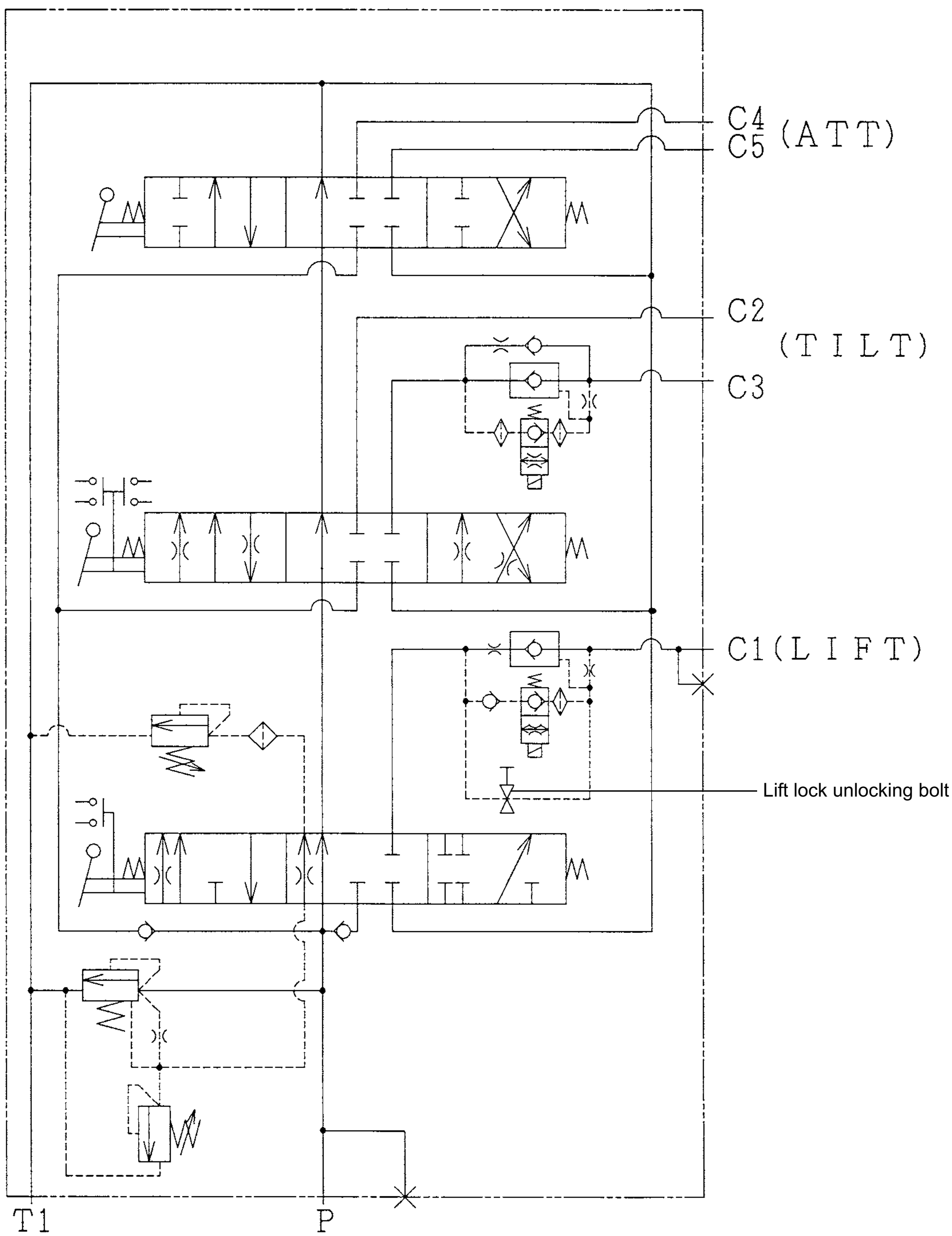
Tilt Limit Swith Portion

15 ~ 32 model



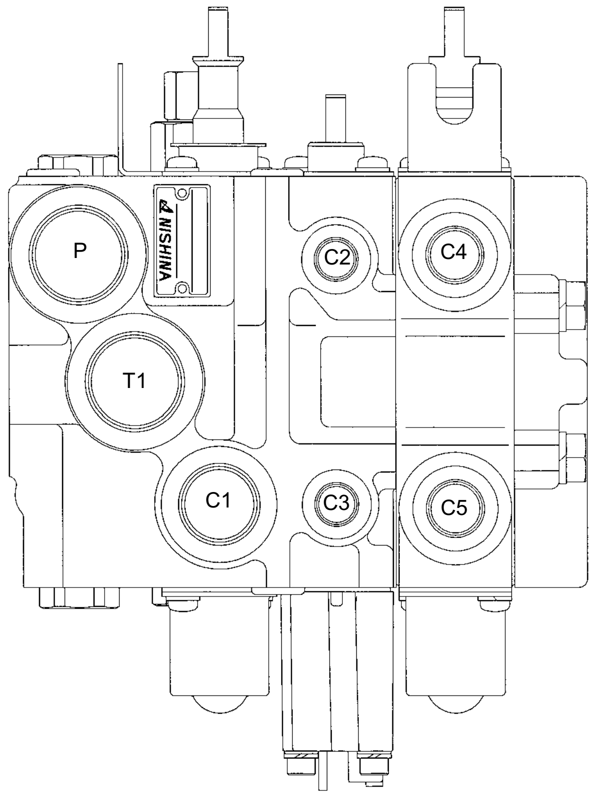
Hydraulic Circuit Diagram

15 ~ 32 model



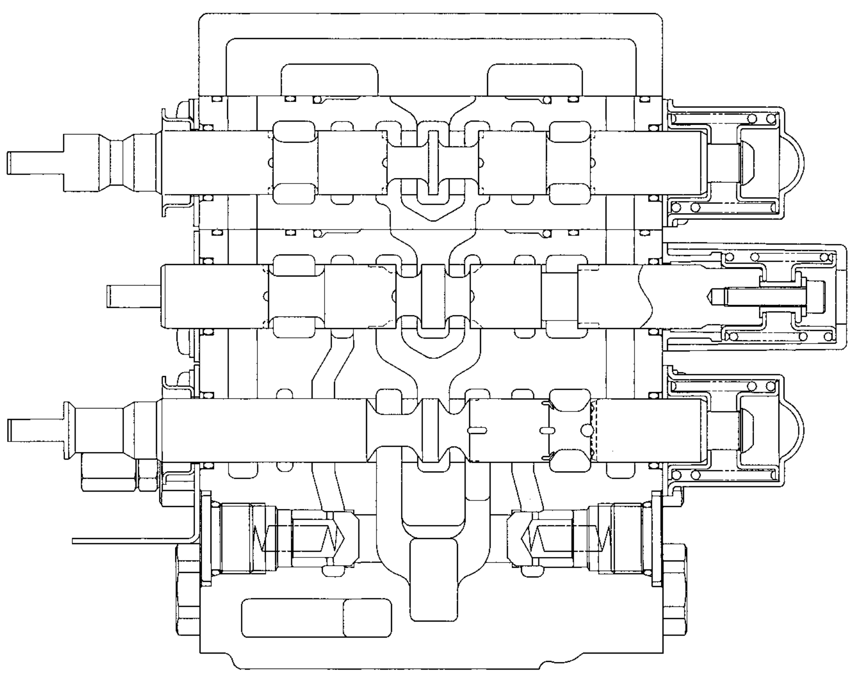
Oil Control Valve

35 ~ 55 model



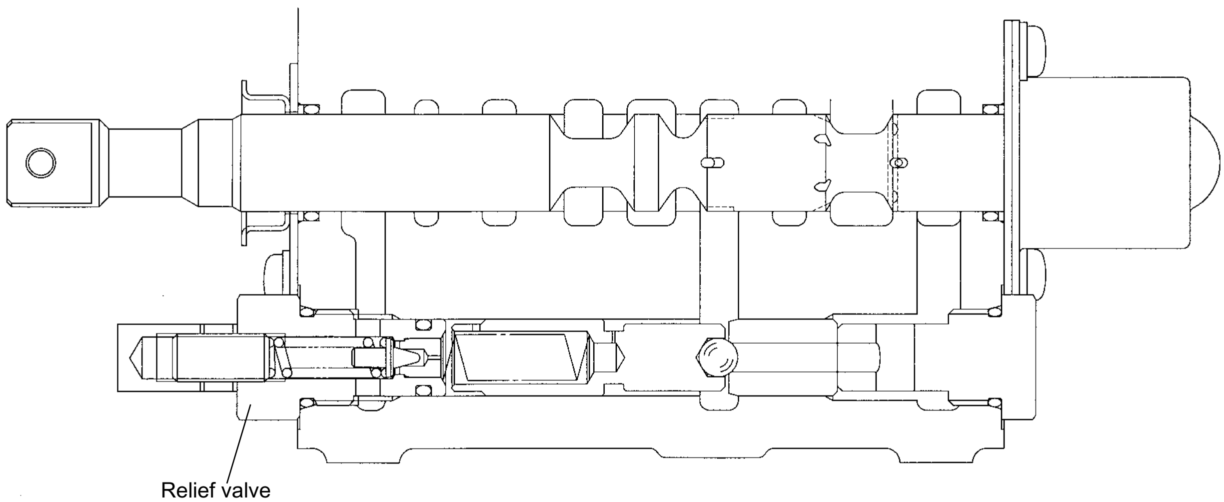
Control Valve Section

35 ~ 55 model



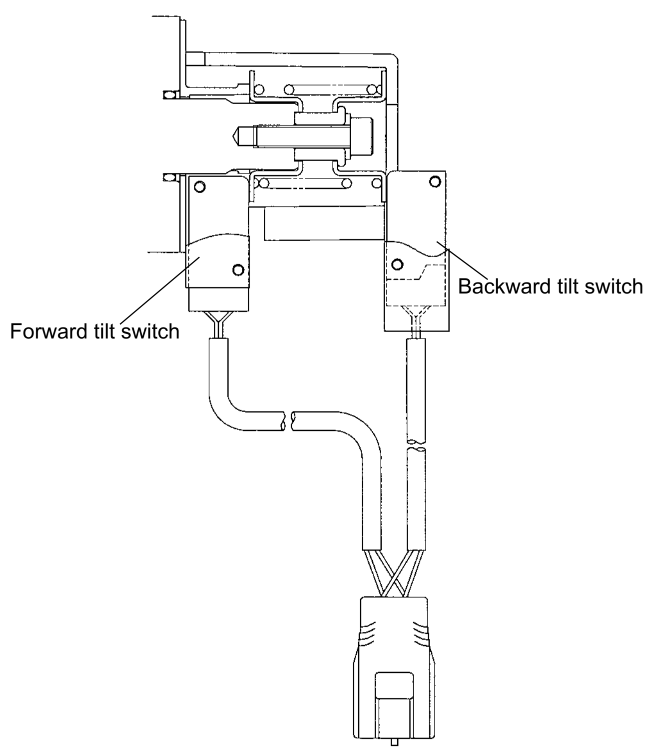
Relief Valve Section

35 ~ 55 model



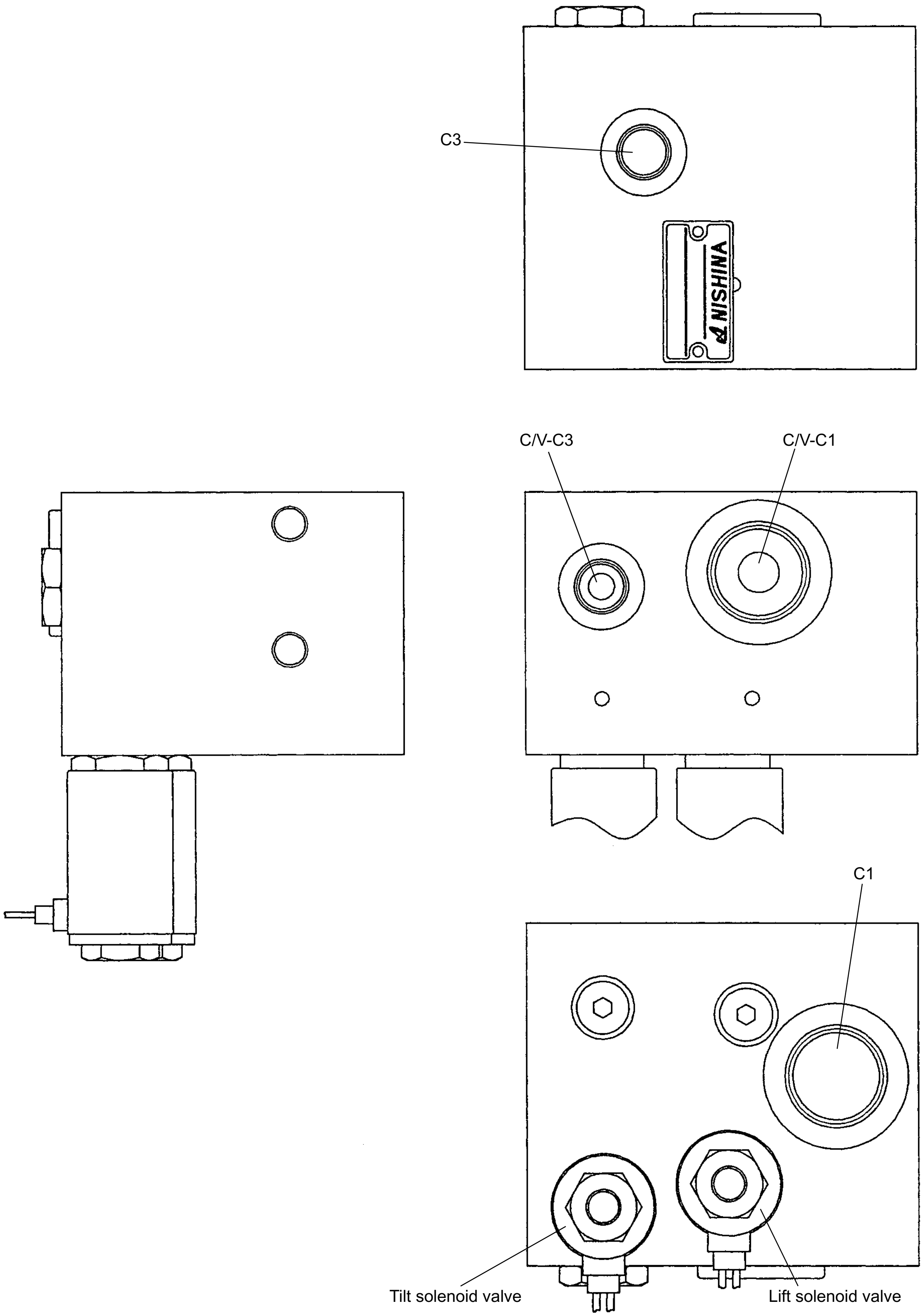
Tilt Limit Switch Portion

35 ~ 55 model



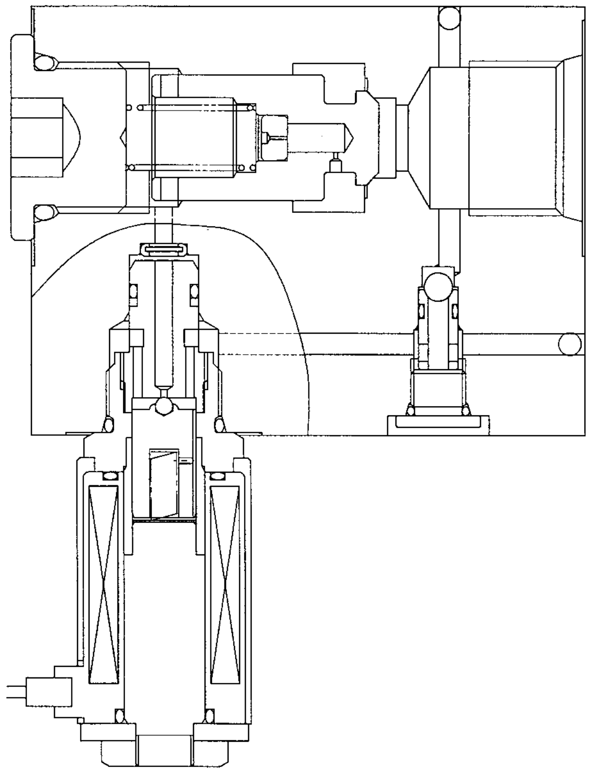
Lift & Tilt Lock Valve ASSY

35 ~ 55 model



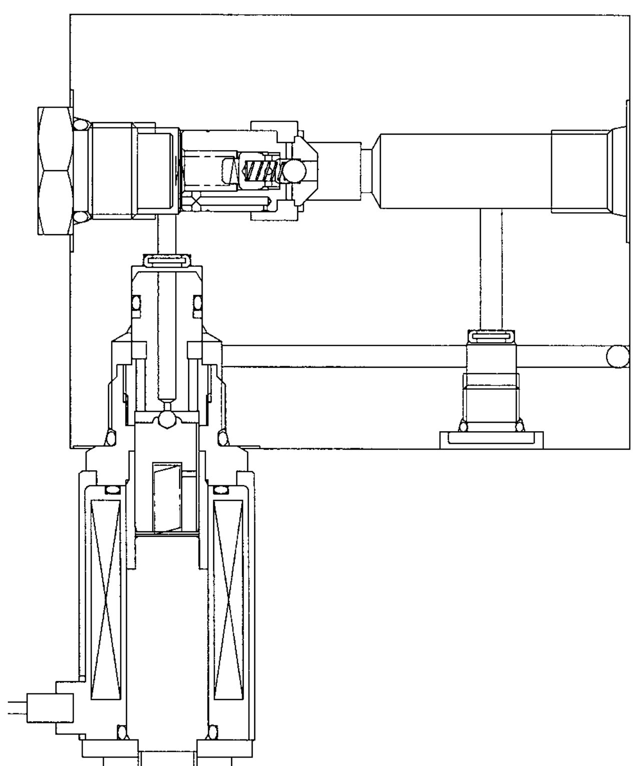
Lift Lock Valve & Solenoid Valve Section

35 ~ 55 model



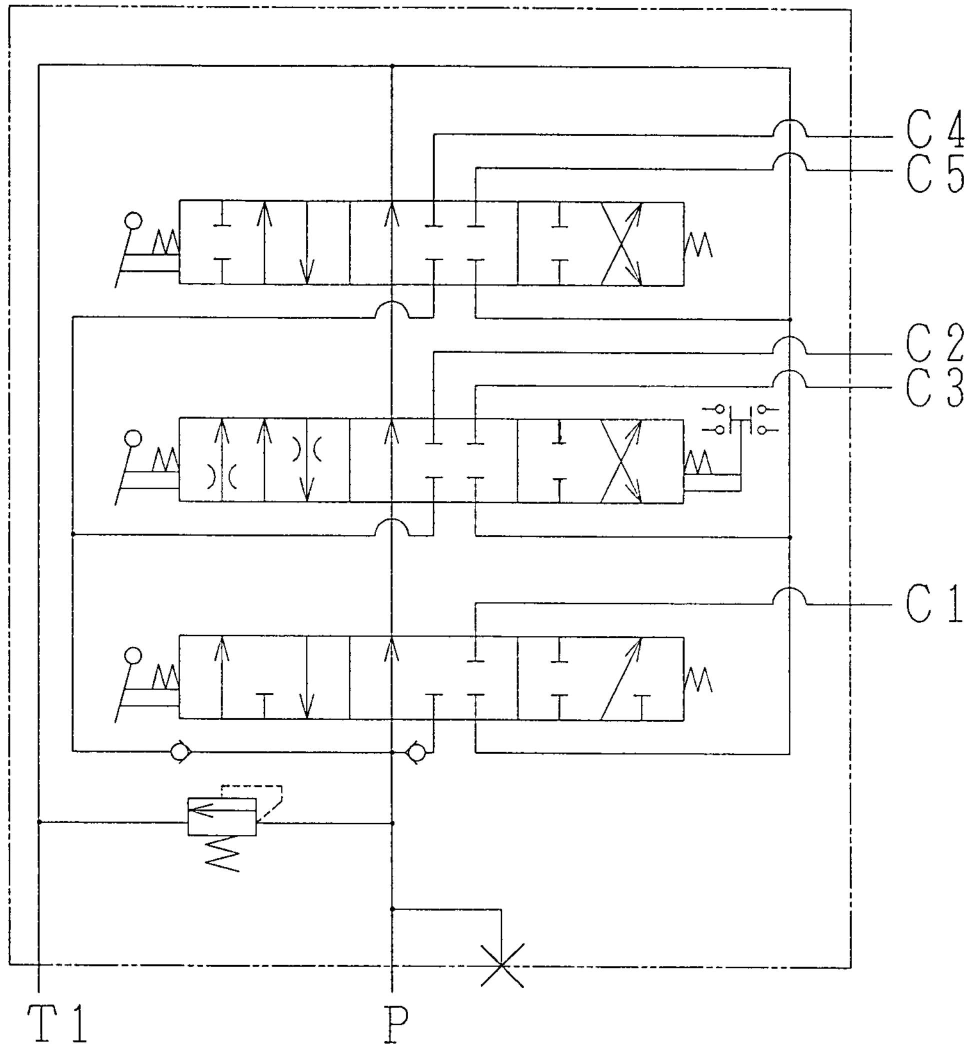
Tilt Lock Valve & Solenoid Valve Section

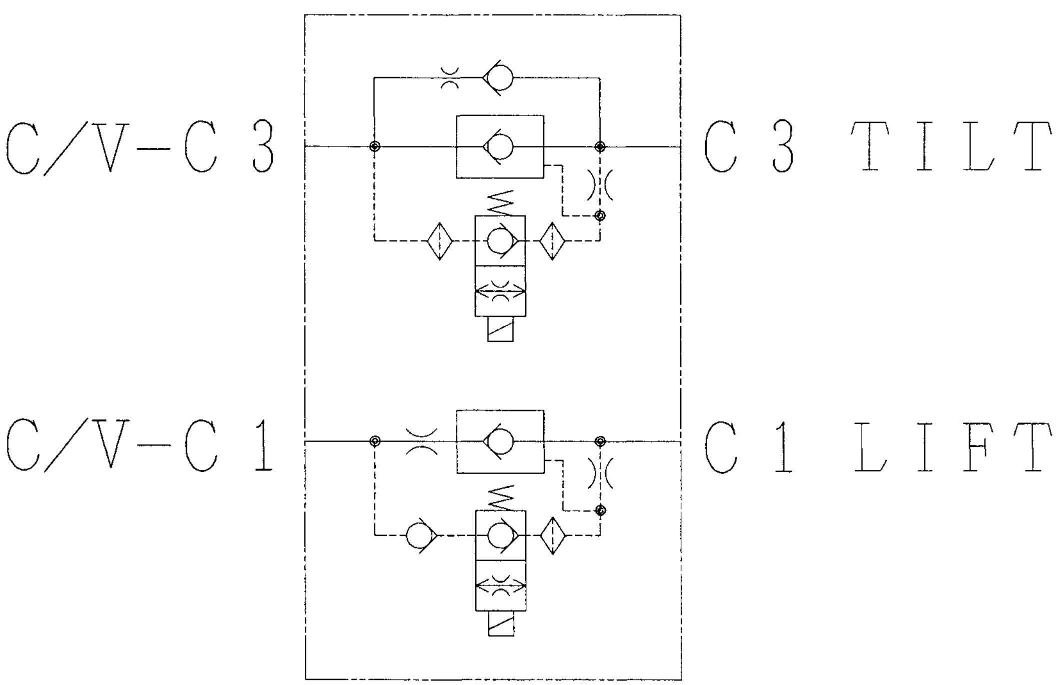
35 ~ 55 model



Hydraulic Circuit Diagram

35 ~ 55 model



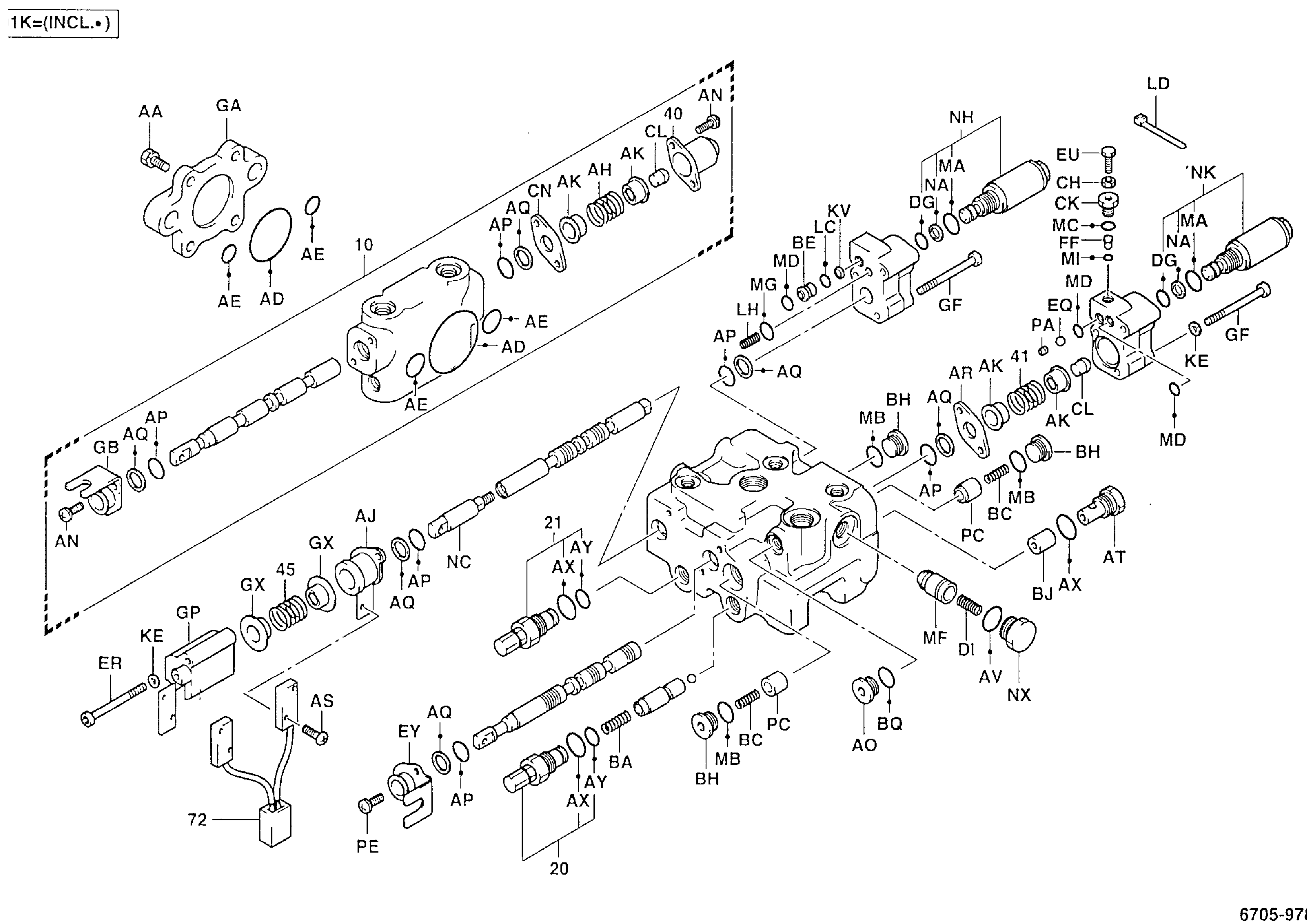


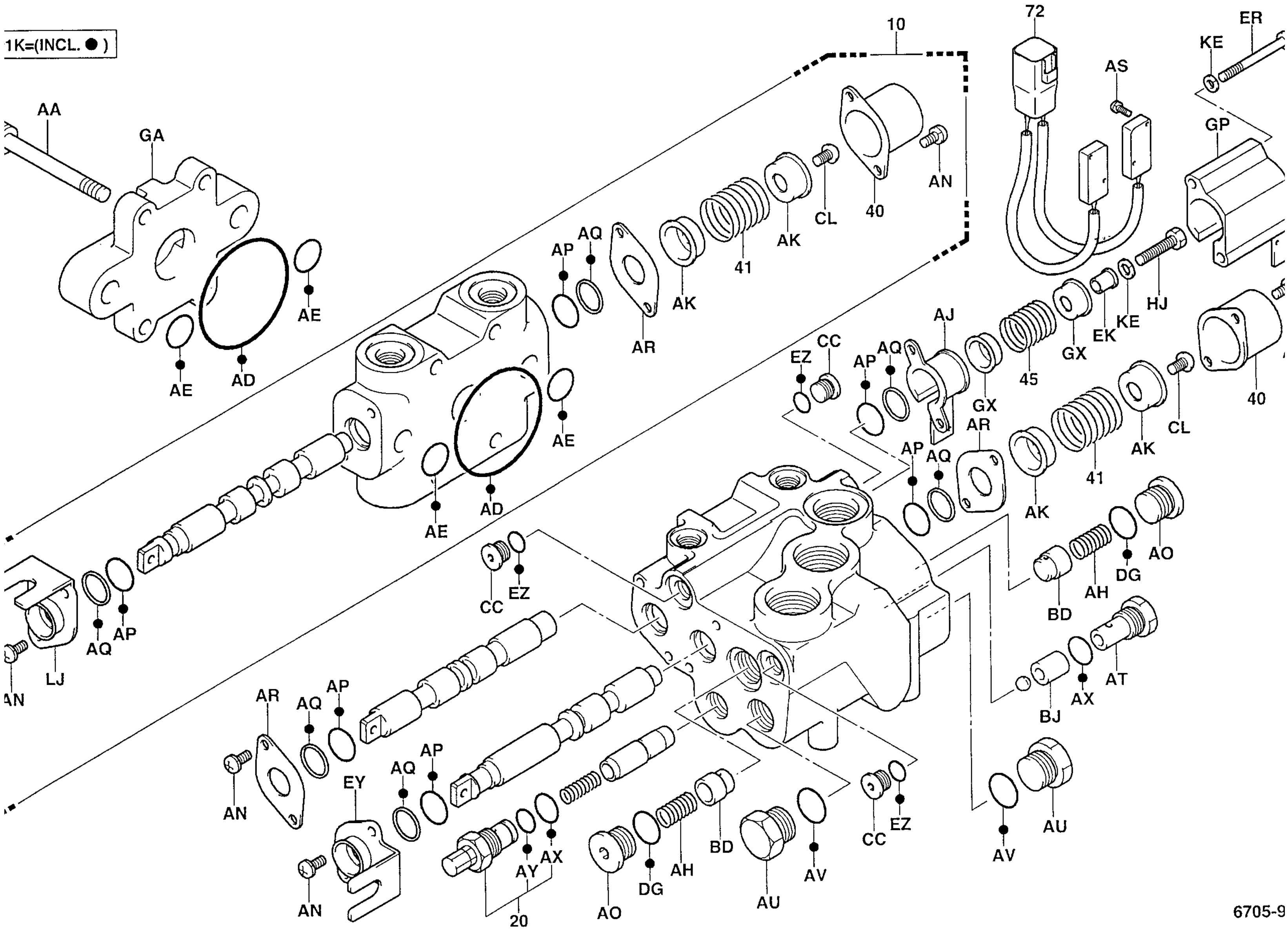
SPECIFICATIONS

Item \ Model		15 ~ 32	35 ~ 55
Type		Add-on type (1-, 2- spool monoblock)	
Relief pressure kPa (kgf/cm^2)[psi]	Lift	17160 (175) [2490]	18140 (185) [2630]
	Tilt	15690 (160) [2280]	—
Other		Built-in lift & tilt lock valves	Independ type, lift & tilt lock valve

COMPONENTS

15 ~ 32 model




1K=(INCL. ●)
10
72
AS
KE
ER
AA
GA
GP
AN
40
CL
AK
41
AQ
AP
AE
AD
AR
HJ
KE
EK
GX
45
AJ
CC
EZ
AP
AQ
GX
AR
40
CL
AK
41
AK
AE
AD
AE
AO
DG
AH
BD
AT
AX
BJ
LJ
AN
AQ
AP
CC
EZ
AR
AQ
AP
AN
EY
AQ
AP
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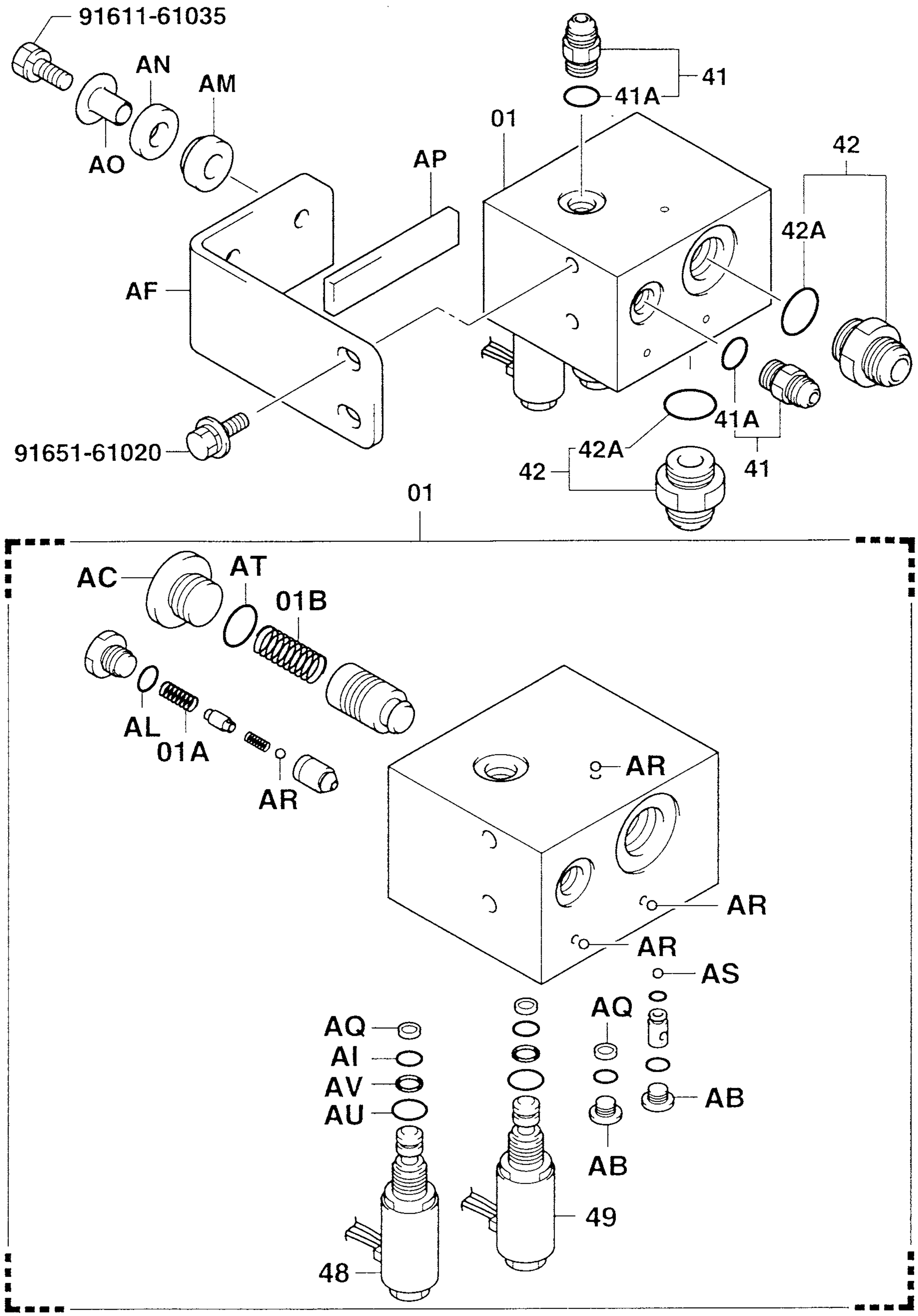
EZ
AV
AU
6705-9

6705

35 ~ 55 model

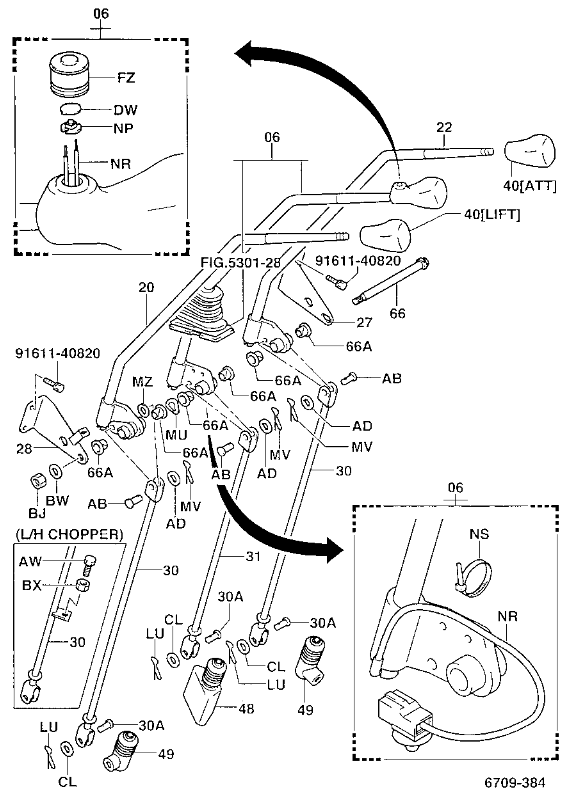
6821



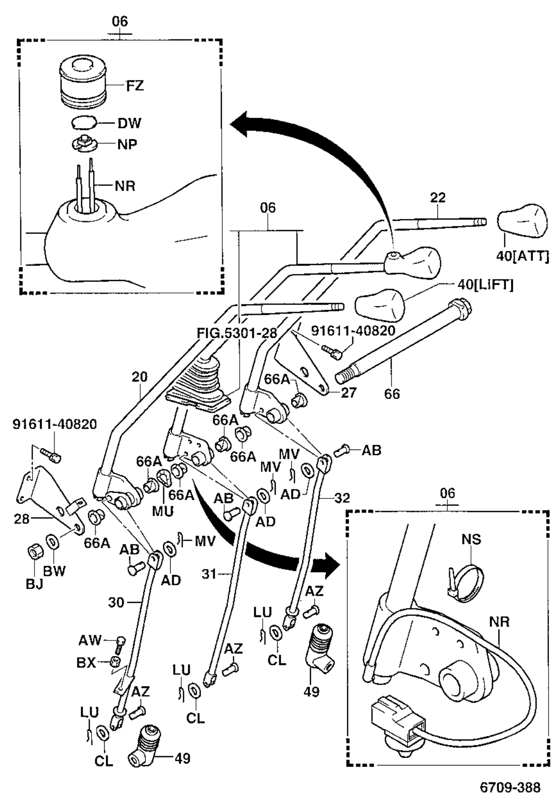
6821-013

15 ~ 32 model

6709



35 ~ 55 model

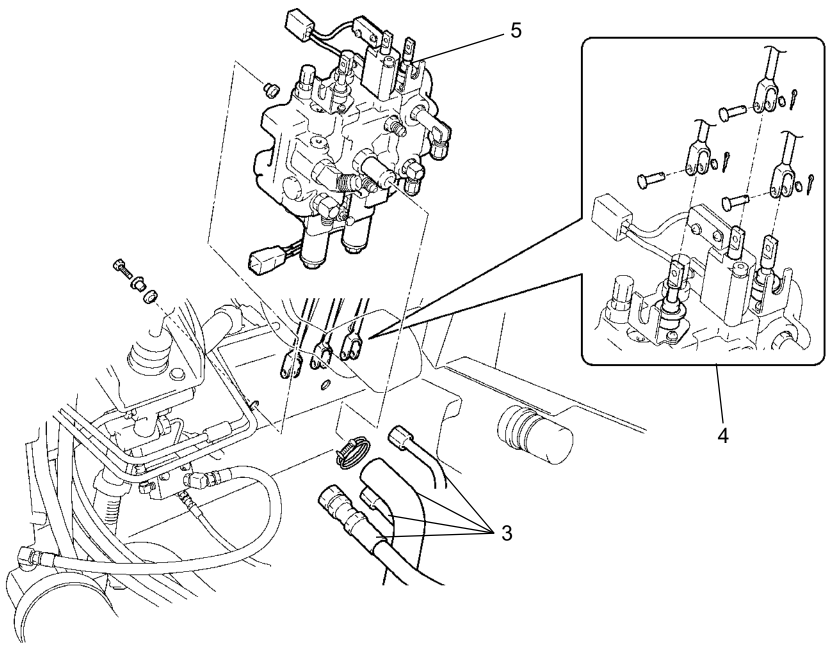


OIL CONTROL VALVE ASSY

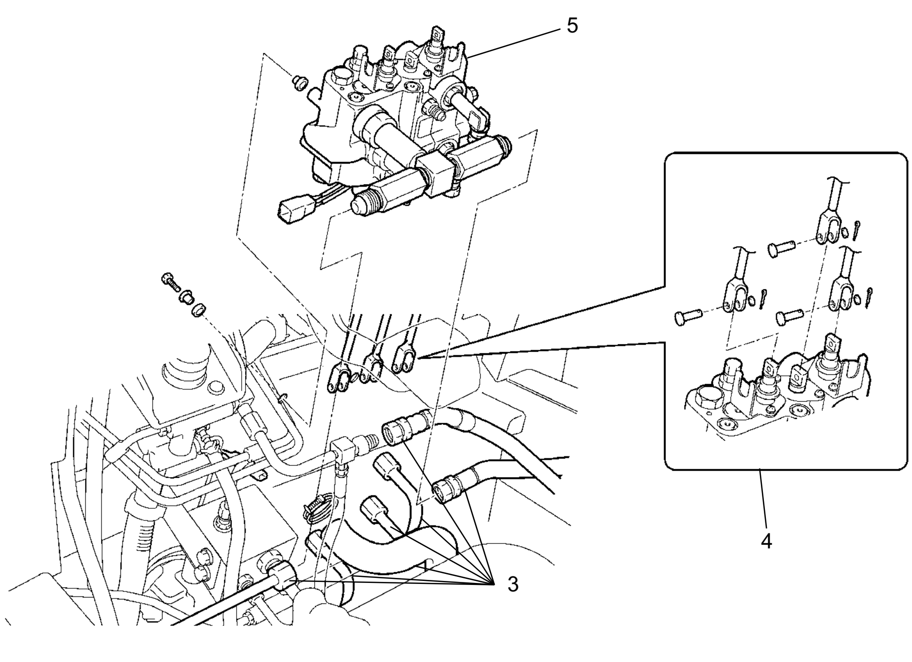
REMOVAL·INSTALLATION

Note:
Operate the control lever and bring the mast and fork to the vertical and lowermost positions, respectively, to release the residual pressure in the material handling system before starting removal.

15 ~ 32 model



35 ~ 55 model



Removal Procedure

1 Disconnect the battery plug.
2 Remove the toe board (front and rear) and lower panel.
3 Disconnect the piping and wiring.
4 Remove the set pin for the oil control valve and lever.
5 Remove the oil control valve ASSY.
6 Remove the fitting.

Installation Procedure

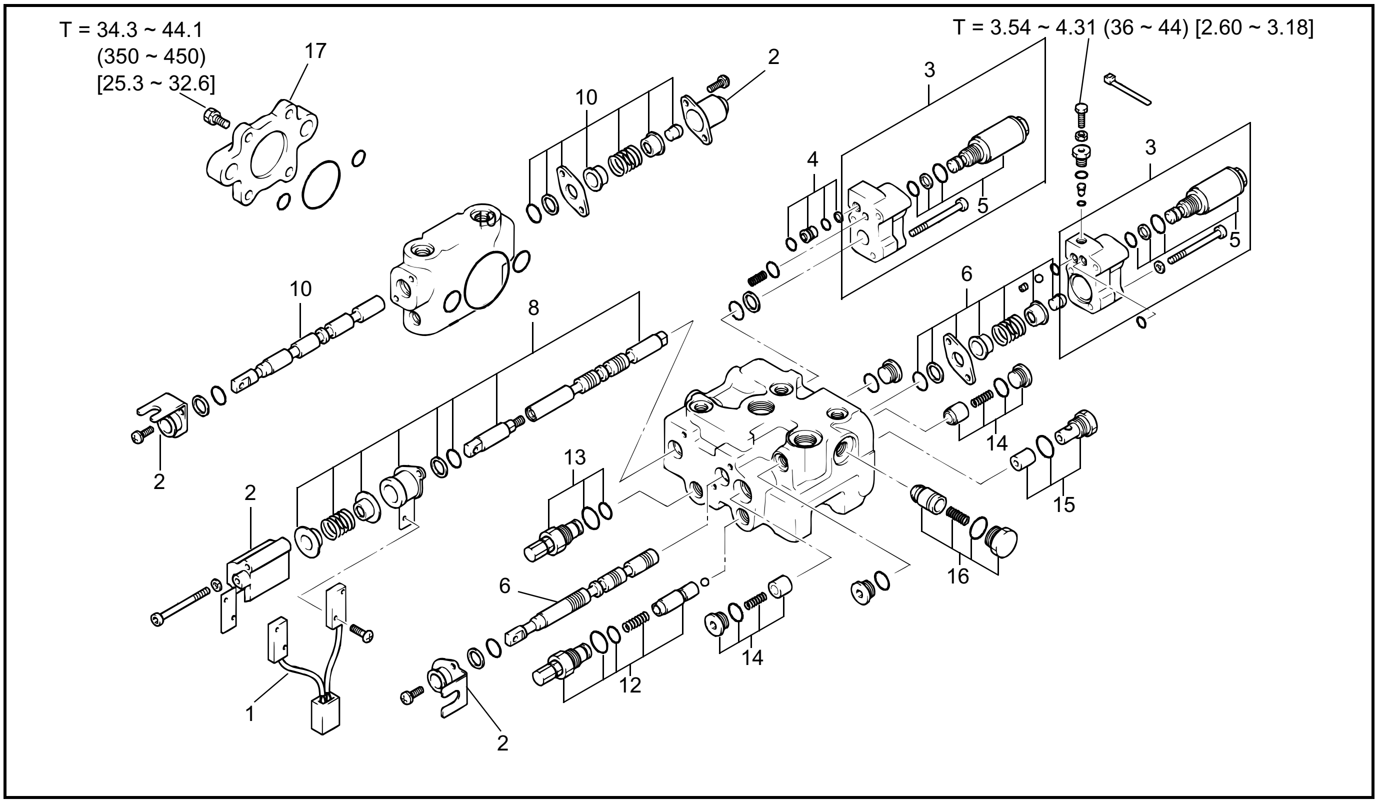
The installation procedure is the reverse of the removal procedure.

Note:
- **Adjust the limit switch after installing the oil control valve. (See VOL.2 page 2-85.)**
- **Apply grease at oil control valve lever link portions.**
- **Check the hydraulic oil level, and add if insufficient.**

DISASSEMBLY·INSPECTION·REASSEMBLY (15 ~ 32 MODEL)

Note:
- **Since parts are finished with high precision, carefully disassemble and reassemble them to prevent any damage.**
- **Use a clean location for the job.**

T = N·m (kgf-cm) [ft-lbf]



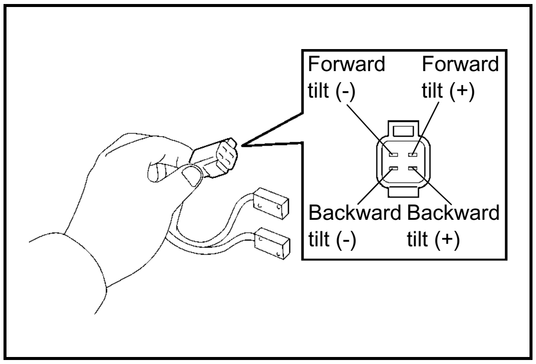
Disassembly Procedure

1 Remove the limit switch. **[Point 1]**
2 Remove the limit switch holder and spring cover.
3 Remove the solenoid ASSY. **[Point 2]**
4 Remove the tilt lock cheak valve.
5 Remove the solenoid valve.
6 Remove the lift spool ASSY.
7 Disassemble the lift spool ASSY. **[Point 3]**
8 Remove the tilt spool ASSY.
9 Disassemble the tilt spool ASSY. **[Point 3]**
10 Remove the additional spool ASSY.
11 Disassemble the additional spool ASSY. **[Point 3]**
12 Remove the lift pilot relief valve set.
13 Remove the tilt pilot relief valve set.
14 Remove the cheak plunger.
15 Remove the valve seat.
16 Remove the lift lock cheak valve.
17 Remove the outlet honsing.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **Wash each part thoroughly, blow compressed air for drying and apply hydraulic oil before reassembly.**
- **Fully loosen the relief valve adjust screw at the time of reassembly.**



Point Operations

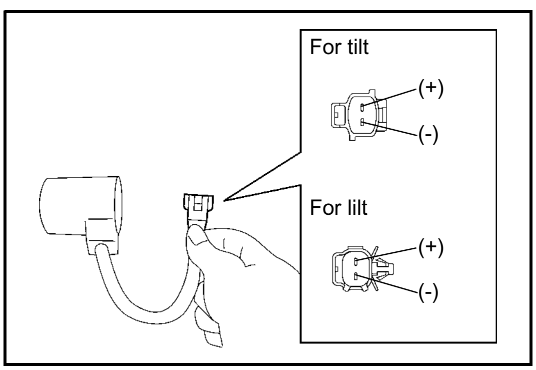
[Point 1]

Inspection:
Check continuity of limit switches.

Forward tilt side:
No continuity when the switch is pressed.

Backward tilt side:
No continuity when the switch is pressed.

Reassembly:
Carefully connect the limit switches on the forward and backward tilt sides in correct positions. Install the one for the forward tilt on the upper side. (It is regular that the both switches must be in pressed state when installed.)

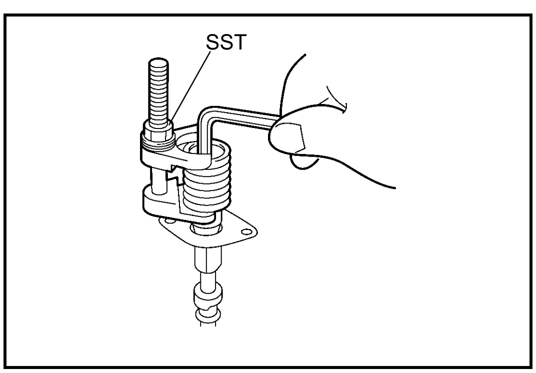


[Point 2]

Inspection:
Check continuity of each solenoid.

Inspection:
Inspect and wash each orifice to eliminate clogging.

Reassembly:
Carefully install lift and tilt spools in correct positions.



[Point 3]

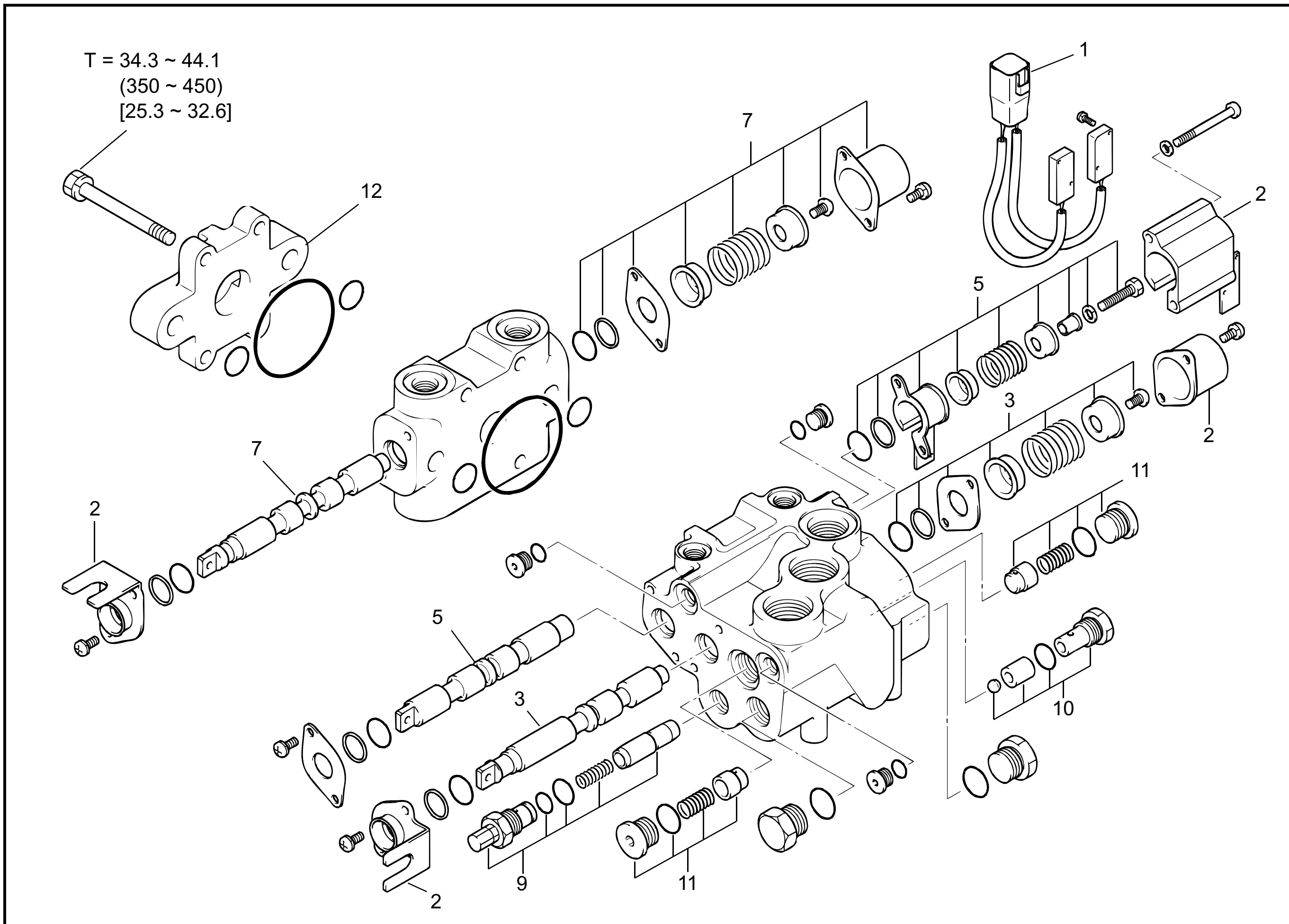
Disassembly·Reassembly:
SST 09610-10161-71
Use the SST with a washer.

DISASSEMBLY·INSPECTION·REASSEMBLY (35 ~ 55 MODEL)

Note:

- **Since parts are finished with high precision, carefully disassemble and reassemble them to prevent any damage.**
- **Use a clean location for the job.**

T = N·m (kgf-cm) [ft-lbf]



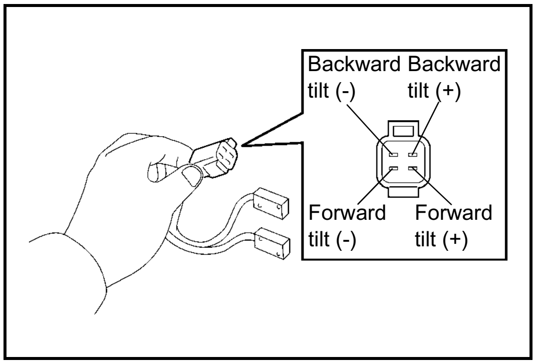
Disassembly Procedure

1 Remove the limit switch . **[Point 1]**
2 Remove the limit switch holder and spring cover.
3 Remove the lift spool ASSY.
4 Disassemble the lift spool ASSY. **[Point 2]**
5 Remove the tilt spool ASSY.
6 Disassemble the tilt spool ASSY. **[Point 2]**
7 Remove the additional spool ASSY.
8 Disassemble the additional spool ASSY. **[Point 2]**
9 Remove the relief valve set.
10 Remove the valve seat.
11 Remove the cheak plunger.
12 Remove the outlet housing.

Reassembly Procedure

The reassembly procedure is the reverse of the disassembly procedure.

Note:
- **Wash each part thoroughly, blow compressed air for drying and apply hydraulic oil before reassembly.**
- **Fully loosen the relief valve adjust screw at the time of reassembly.**



Point Operations

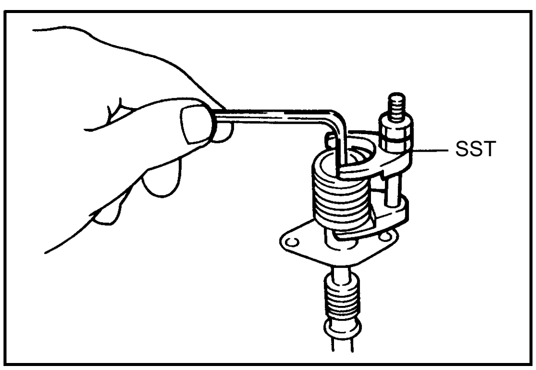
[Point 1]

Inspection:
Check continuity of limit switches.

Forward tilt side:
No continuity when the switch is pressed.

Backward tilt side:
No continuity when the switch is pressed.

Reassembly:
Carefully connect the limit switches on the forward and backward tilt sides in correct positions. Install the one for the forward tilt on the upper side. (It is regular that the both switches must be in pressed state when installed.)



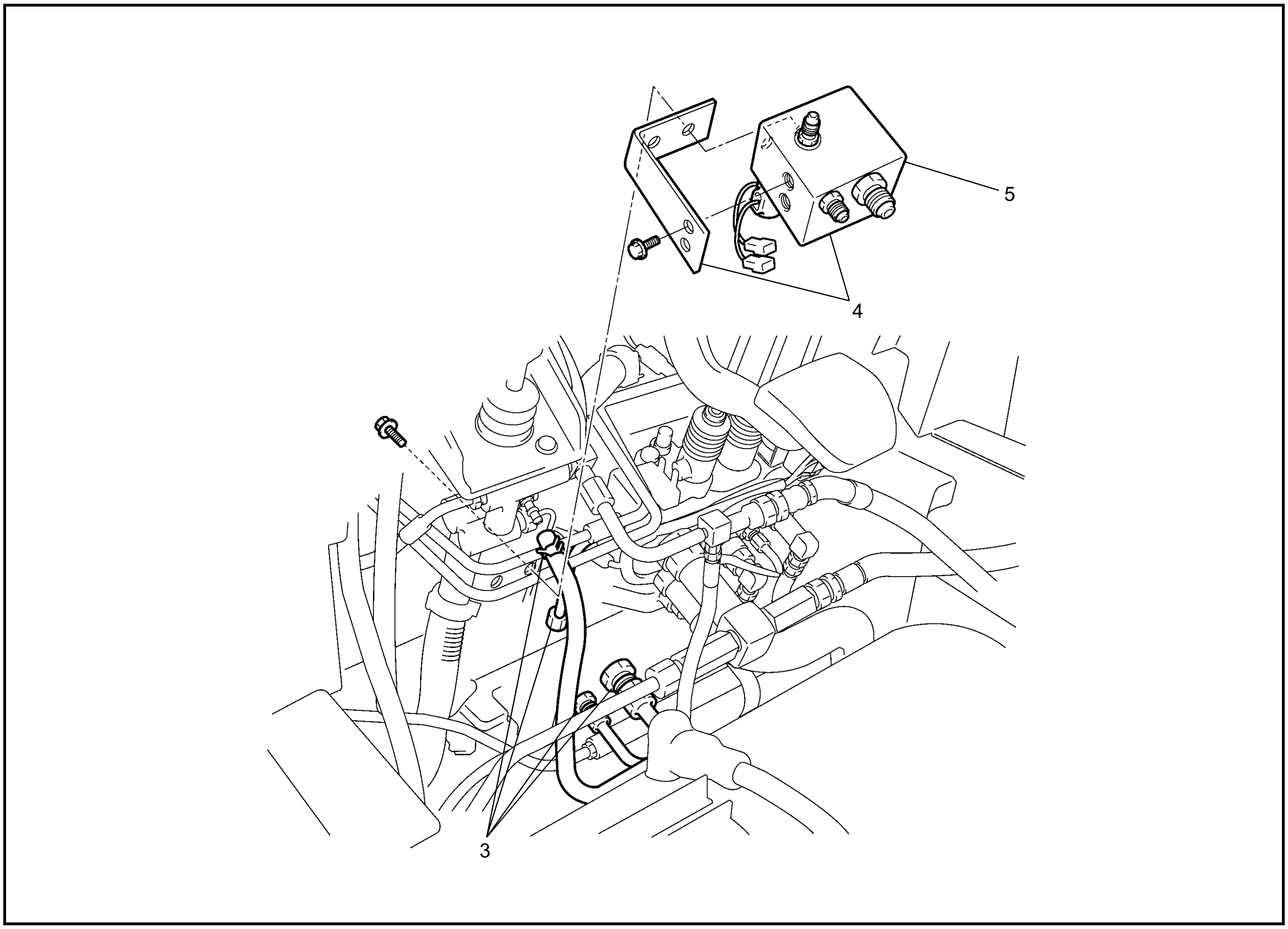
[Point 2]

Disassembly·Reassembly:
Remove the compression spring.
SST 09610-10160-71

LIFT & TILT LOCK VALVE ASSY (35 ~ 55 MODEL)

REMOVAL·INSTALLATION

Note:
Operate the control lever and bring the mast and fork to the vertical and lowermost positions, respectively, to release the residual pressure in the load handling system before starting removal.



Removal Procedure

1 Disconnect the battery plug.
2 Remove the toe board (front and rear) and lower panel.
3 Disconnect the piping and wiring.
4 Remove the lift & tilt lock valve ASSY W/bracket.
5 Remove the lift & tilt lock valve ASSY.
6 Remove the fitting.

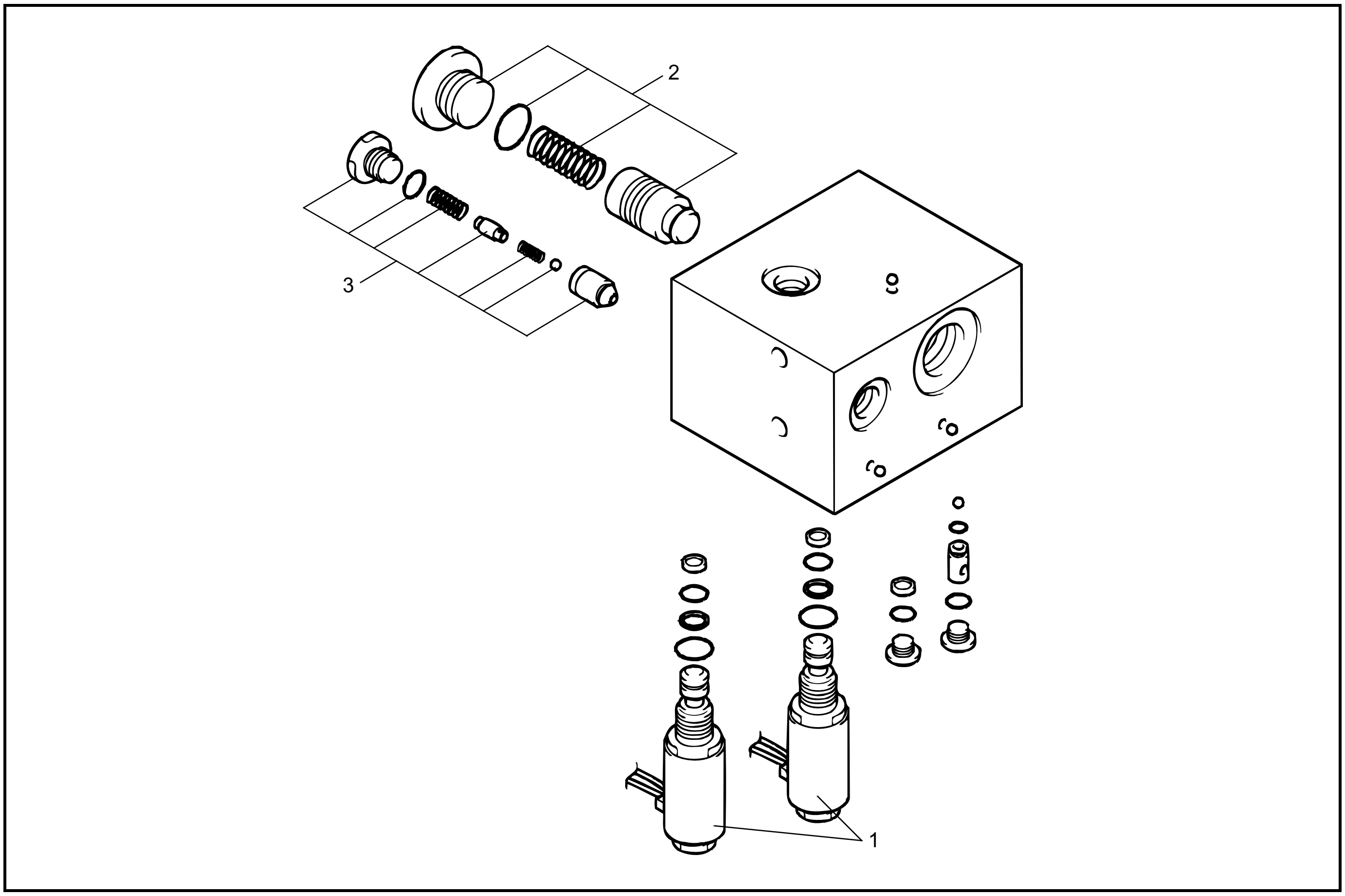
Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
- **Check the hydraulic oil level, and add if insufficient.**

DISASSEMBLY·INSPECTION·REASSEMBLY

Note:
- **Since parts are finished with high precision, carefully disassemble and reassemble them to prevent any damage**
- **Use a clean location for the job**

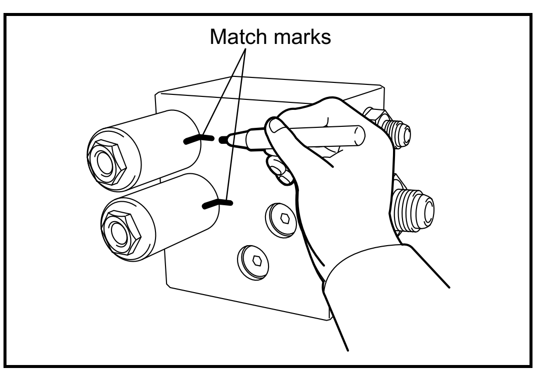


Disassembly Procedure

1 Remove the solenoid ASSY. **[Point 1]**
2 Remove the lift lock valve. **[Point 2]**
3 Remove the tilt lock valve. **[Point 3]**

Reassembly Procedure

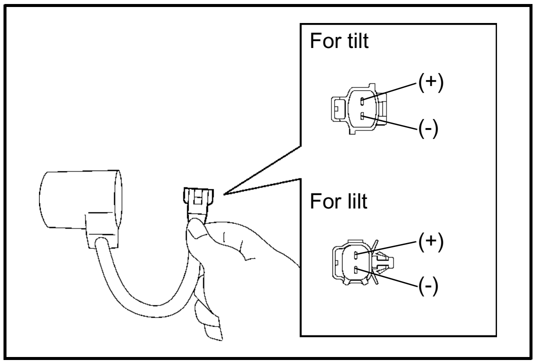
The reassembly procedure is the reverse of the disassembly procedure.



Point Operations

[Point 1]

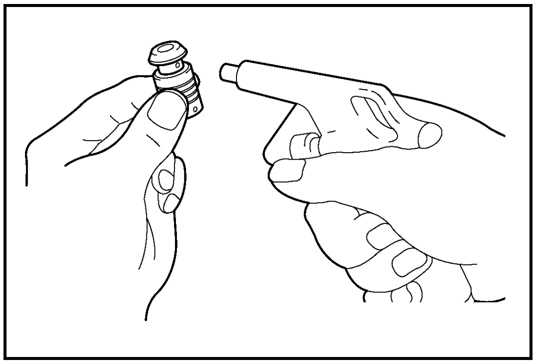
Disassembly:
Put a match mark to ensure installation of each solenoid in the correct position.



Inspection:
Check continuity of each solenoid.

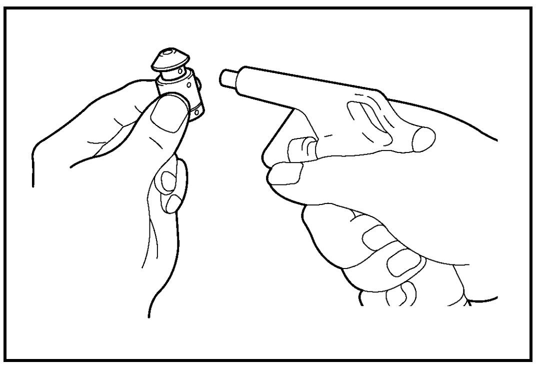
Inspection:
Inspect and wash each orifice to eliminate clogging.

Reassembly:
Carefully install lift and tilt spools in correct positions.



[Point 2]

Inspection:
Inspect the plunger and clean if clogged.



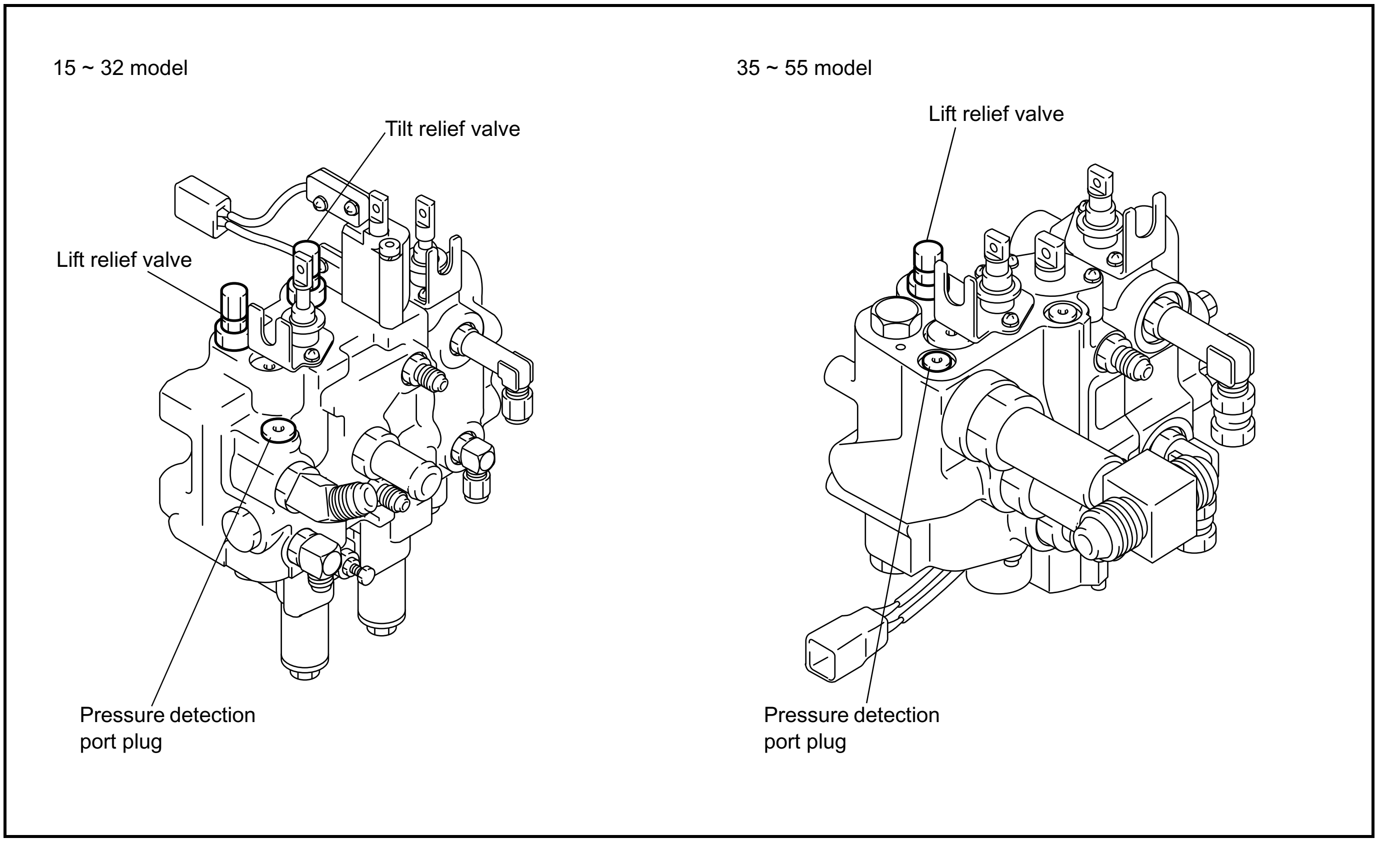
[Point 3]

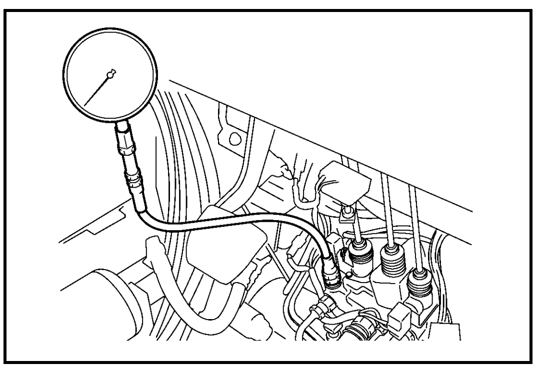
Inspection:
Inspect the plunger and clean if clogged.

RELIEF PRESSURE ADJUSTMENT

Note:

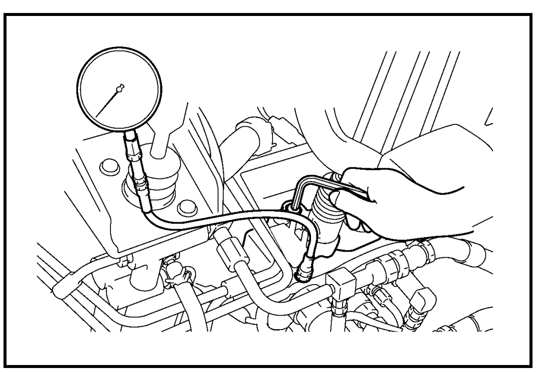
- **Always follow the procedure below for adjustment. Careless adjustment may cause high-pressure generation, resulting in damage to hydraulic units such as the oil pump.**
- **No adjustment is needed when the relief valve is not disassembled or is replaced with a new one.**



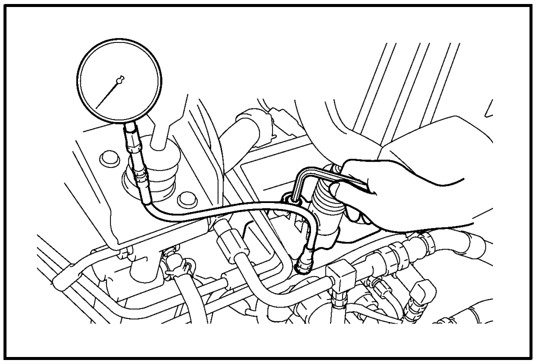


1. Install an oil pressure gauge.
   (1) Remove the oil pressure detection port plug (illustrated) installed on the top of the oil control valve, and install the oil pressure gauge.
   Pressure gauge:
   Pressure resistance = 19600 kPa (200 kgf/cm^2) or above

   Plug size: 9/16-18UNF-2B



2. Loosen the lift relief valve adjusting screw
   (1) Loosen the lock nut and loosen the adjusting screw to just before the point where it comes off from the body.



3. Adjust the oil pressure as follows
   (1) Turn the key switch to ON.
   (2) Slowly pull the lift lever and gradually tighten the adjusting screw until the fork starts to rise.
   (3) Lift the fork fully and read the oil pressure at the position. Tighten the adjusting screw for the normal pressure reading.
   (4) Tighten the lock nut and re-check the oil pressure.

4. Adjust the tilt relief valve oil pressure in the same way as for the lift relief valve. (15 ~ 32 model only)
   (1) Tilt the mast fully backward in this case when measuring the oil pressure.

5. Remove the oil pressure gauge, and install the plug.

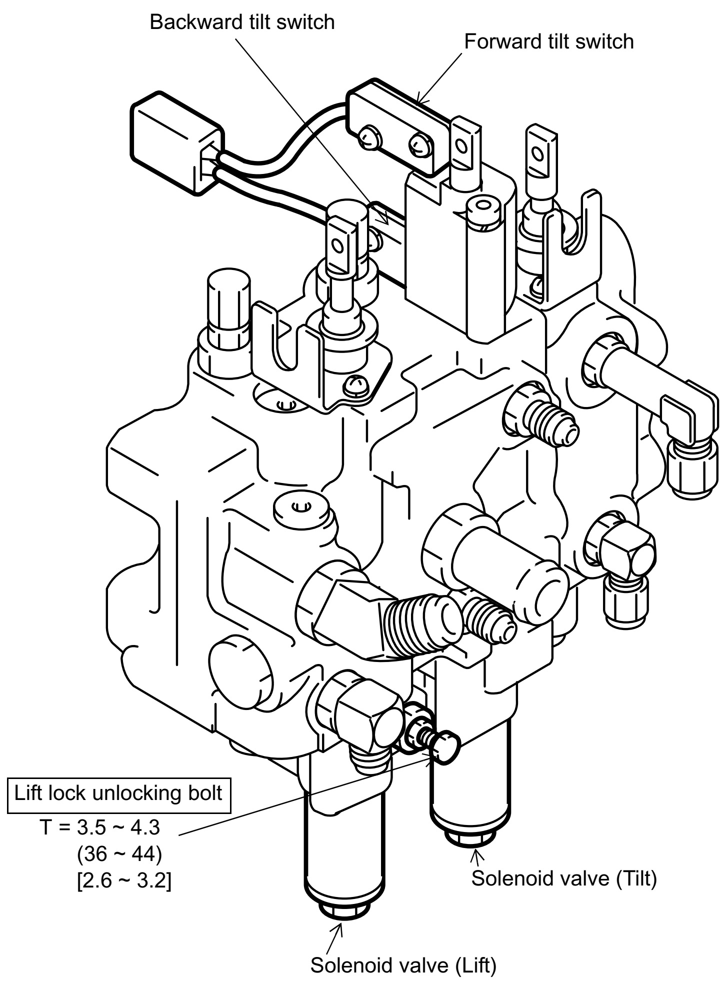
Relief Pressure Standards

Unit: kPa (kgf-cm^2) [psi]

	15 ~ 32 model	35 ~ 55 model
Lift relief pressure	17160^{+490}_{0} (175^{+5}_{0}) [2490^{+70}_{0}]	18140^{+490}_{0} (185^{+5}_{0}) [2630^{+70}_{0}]
Tilt relief pressure	15690^{+490}_{0} (160^{+5}_{0}) [2280^{+70}_{0}]	—

LIFT LOCK UNLOCKING BOLT (15 ~ 32 MODEL)

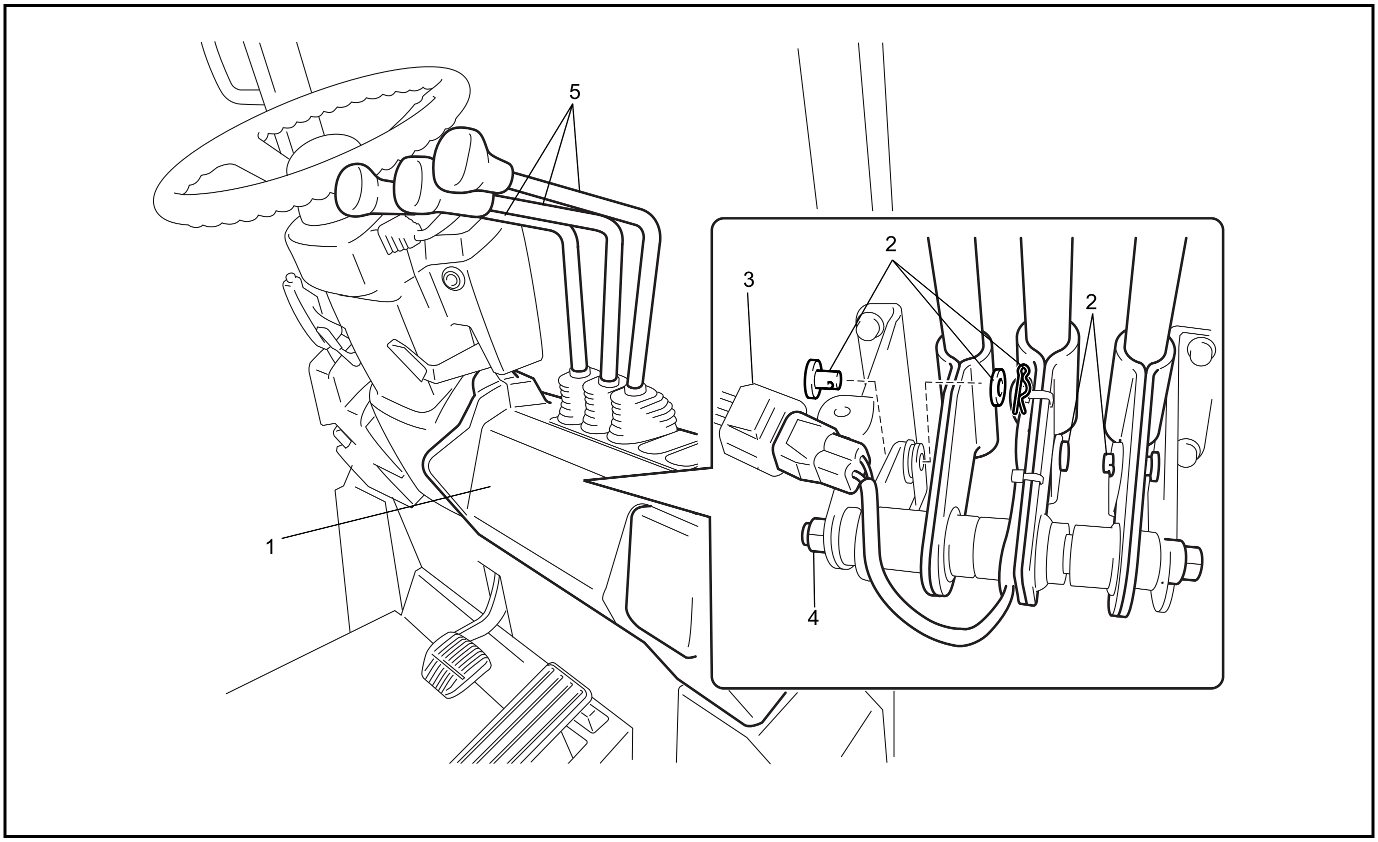
T = N·m (kgf-cm) [ft-lbf]



If the fork does not come down due to a failure of the solenoid valve, for example, the fork can be lowered manually by operating the lift lever to the down side after loosening the lock nut and the lift lock unlocking bolt. Always retighten the unlocking bolt after the end of repair. Otherwise, most of the hydraulic oil from the oil pump is relieved to slow down lifting extremely, resulting in difficulty in load handling.

CONTROL VALVE LEVER ASSY

REMOVAL·INSTALLATION



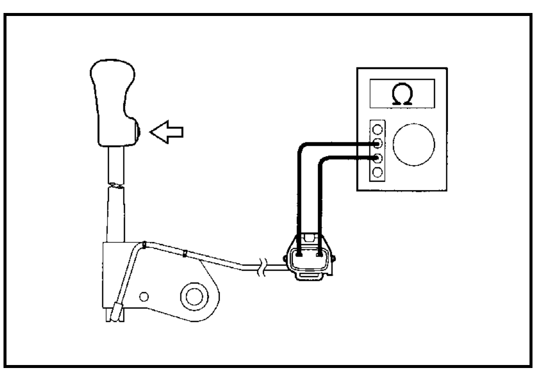
Removal Procedure

1 Remove the instrument panel.
2 Remove the set pin and disconnect the lever rod.
3 Tilt lever: Disconnect the knob switch wiring.
4 Remove the set bolt.
5 Remove the control valve lever. **[Point 1]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:
Apply grease at control valve lever link portions.



Point Operation

[Point 1]

Inspection:
Inspect the knob switch for continuity.

SAS FUNCTIONS

GENERAL

SAS (System of Active Stability) Configuration

Sensors and switches installed in various places on the vehicle detect the motions of the vehicle and send respective signals to the controller. According to these signals, each actuator is driven to effect rear wheel swing control (S) and mast tilting control (T).

Control		Functional part
S	T	
○	○	Lifting height switch
	○	Tilting angle sensor
	○	Forward tilt switch
	○	Backward tilt switch
○	○	Load sensor
	○	Tilt knob switch
○		Speed sensor
○		Yaw rate sensor

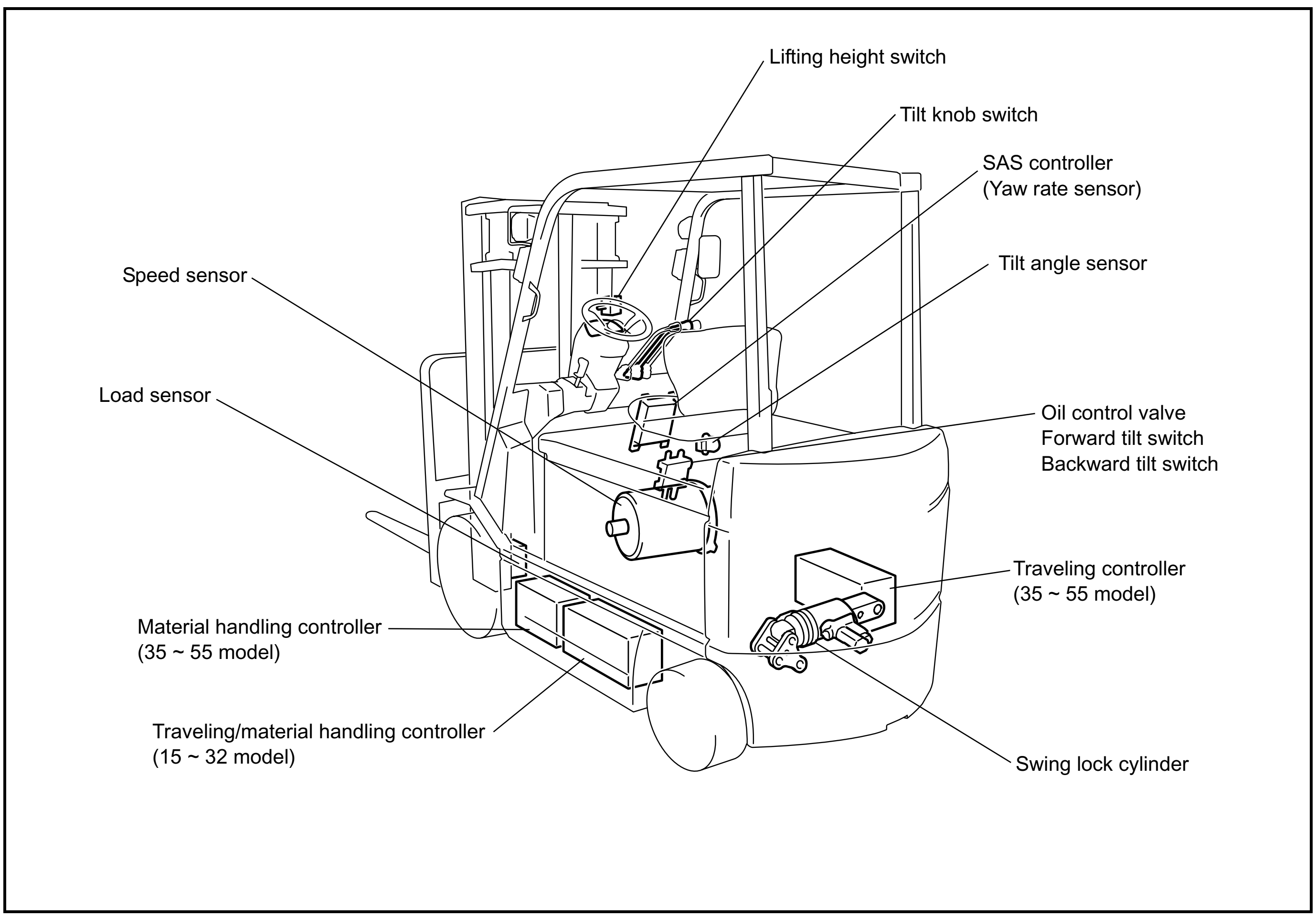
Input

SAS controller/Traveling and material handling controller

Output

Functional part	Control	
	S	T
Swing lock cylinder	○	
Oil control valve		○

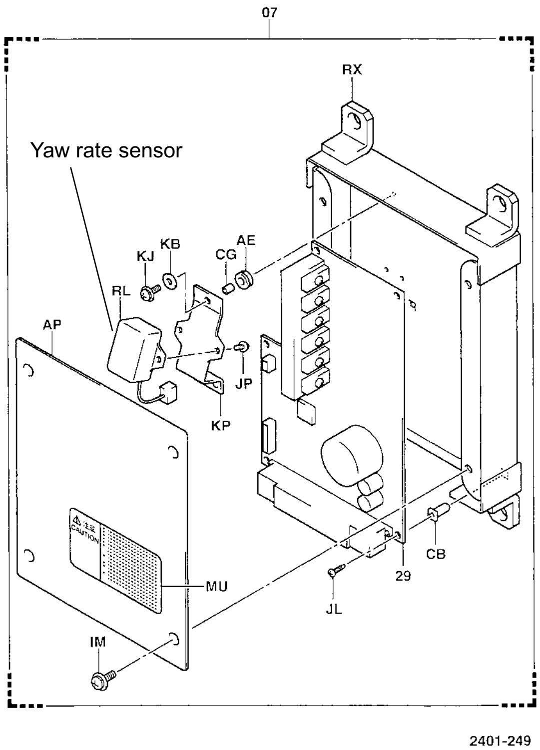
LCD display	Swing lock indicator	○	○
	Diagnosis	○	○



COMPONENTS

Yaw rate sensor

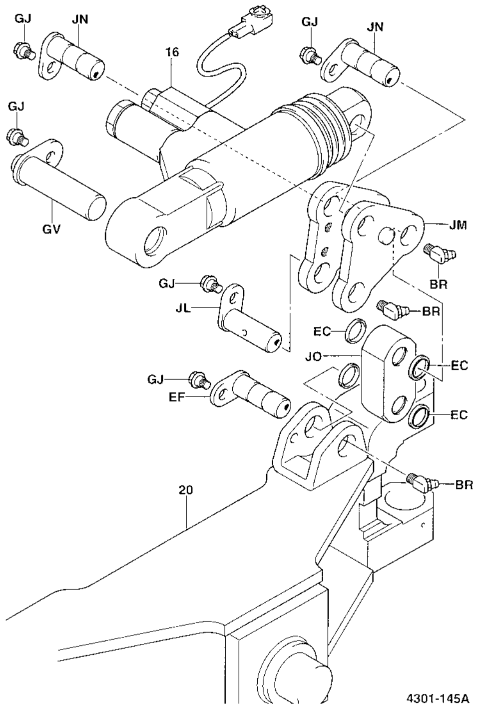
2401



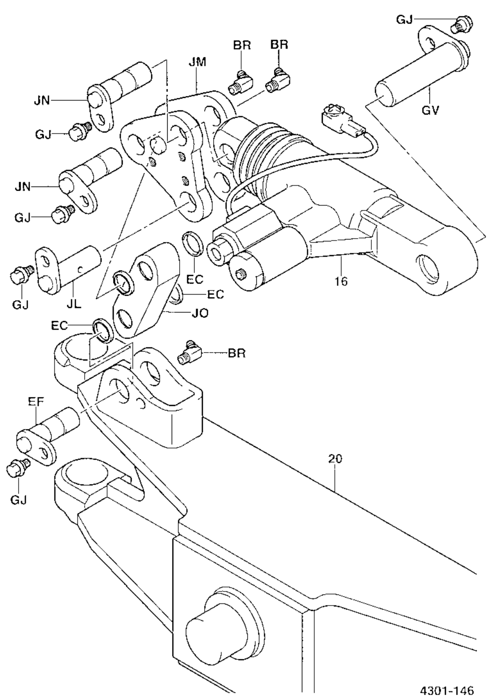
Swing lock cylinder

4301

15,18 model



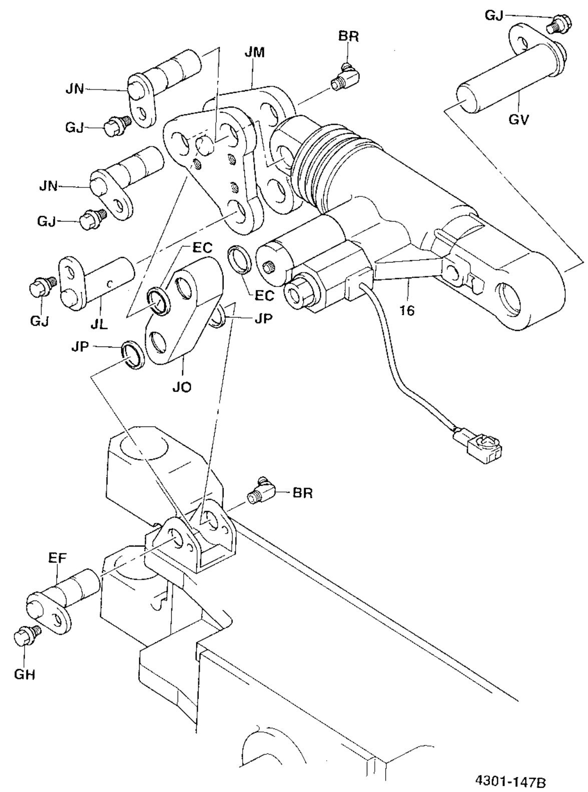
20 ~ 32 model



Swing lock cylinder

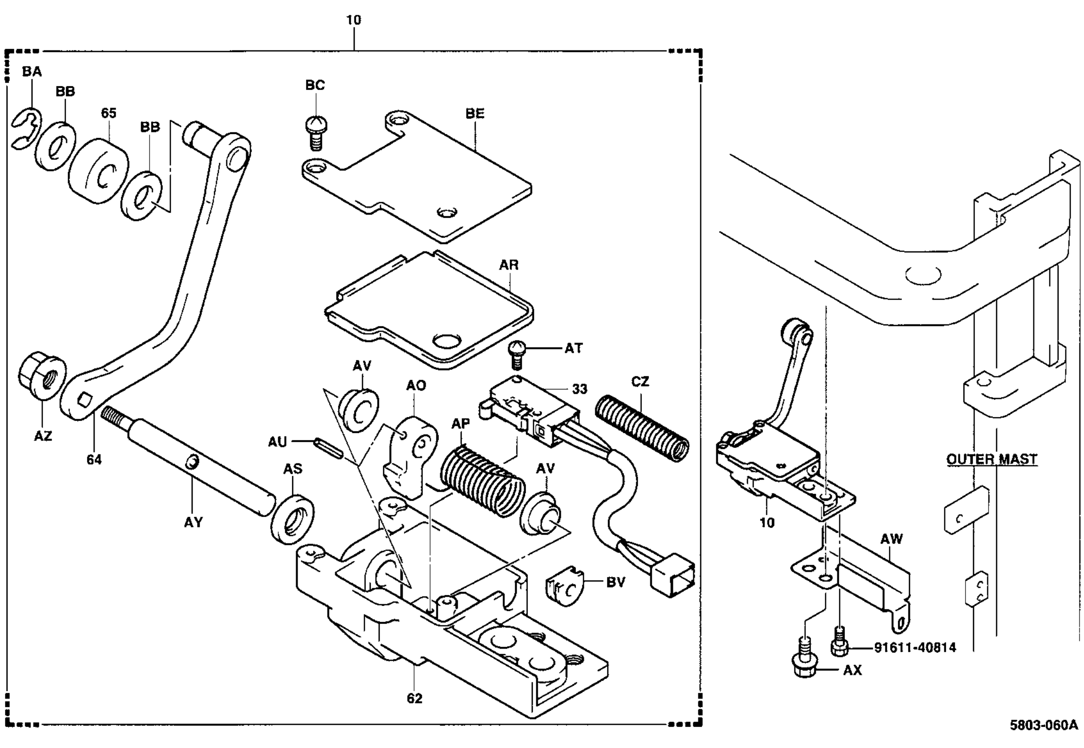
4301

35 ~ 55 model



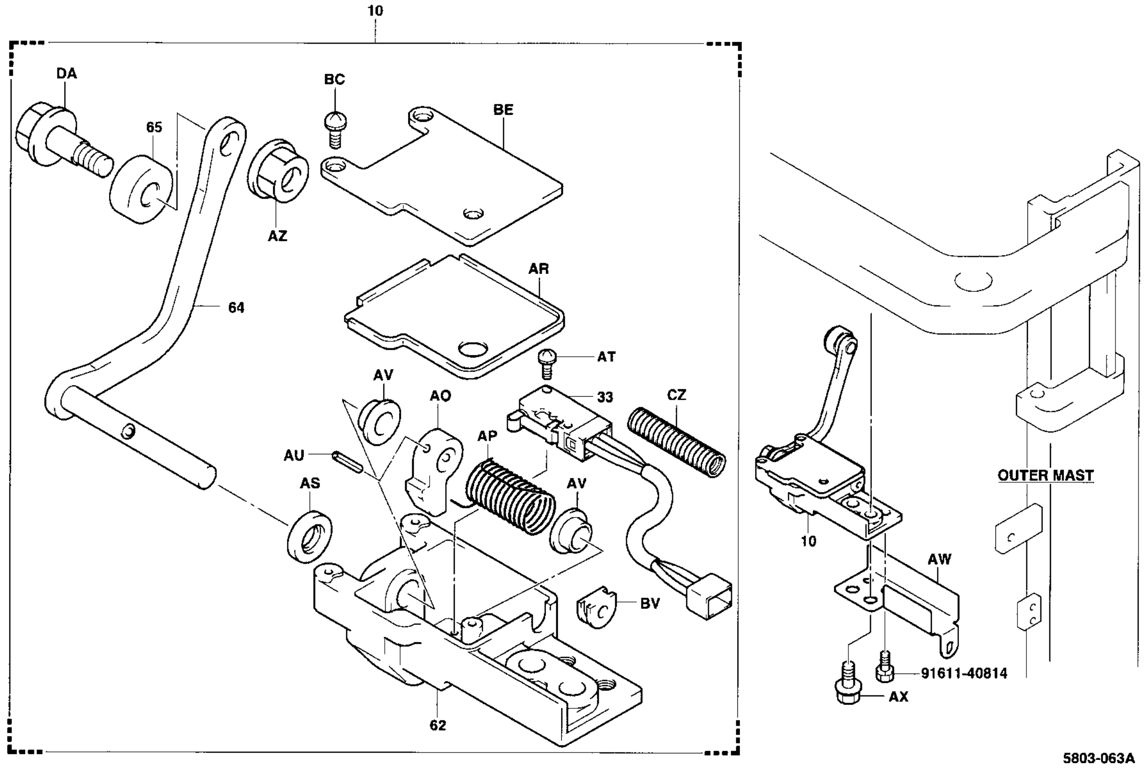
Lifting height switch (FV (15·18 model)·QFV)

5803

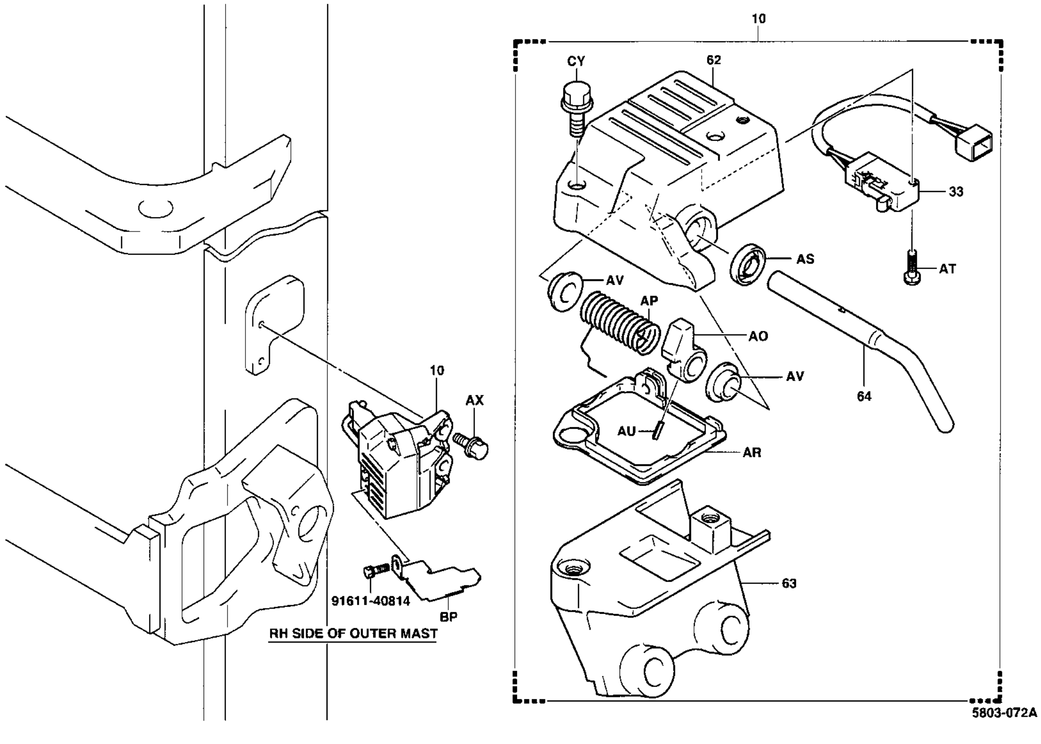


Lifting height switch (FV (20 ~ 32 model)·FSV (15 ~ 32 model))

5803

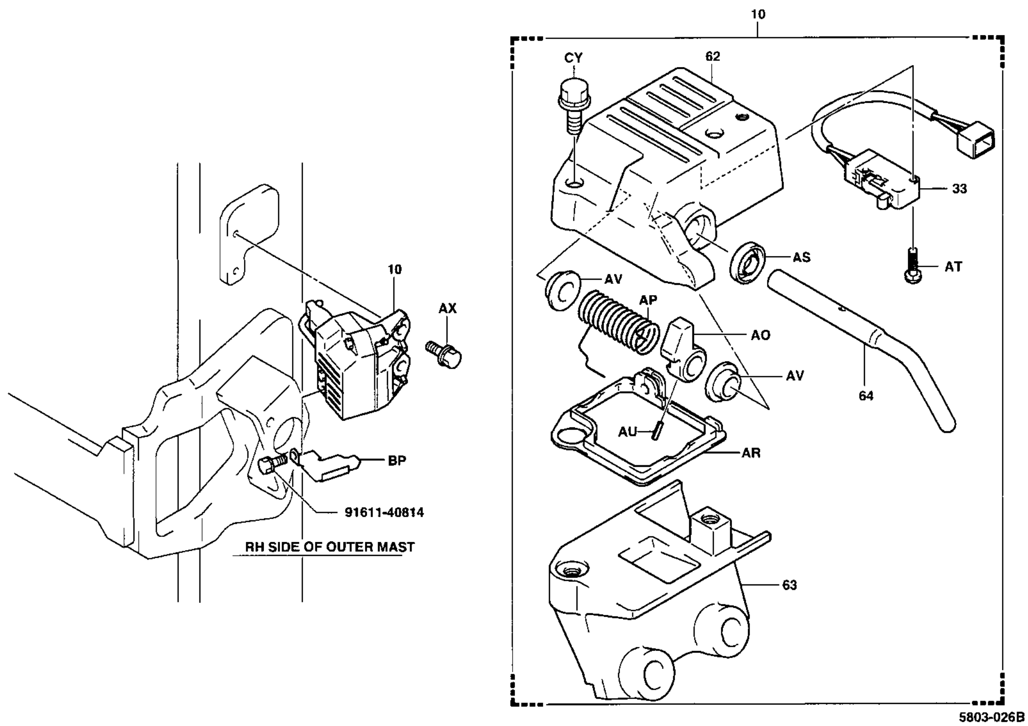


Lifting height switch (V (15 ~ 32 model))

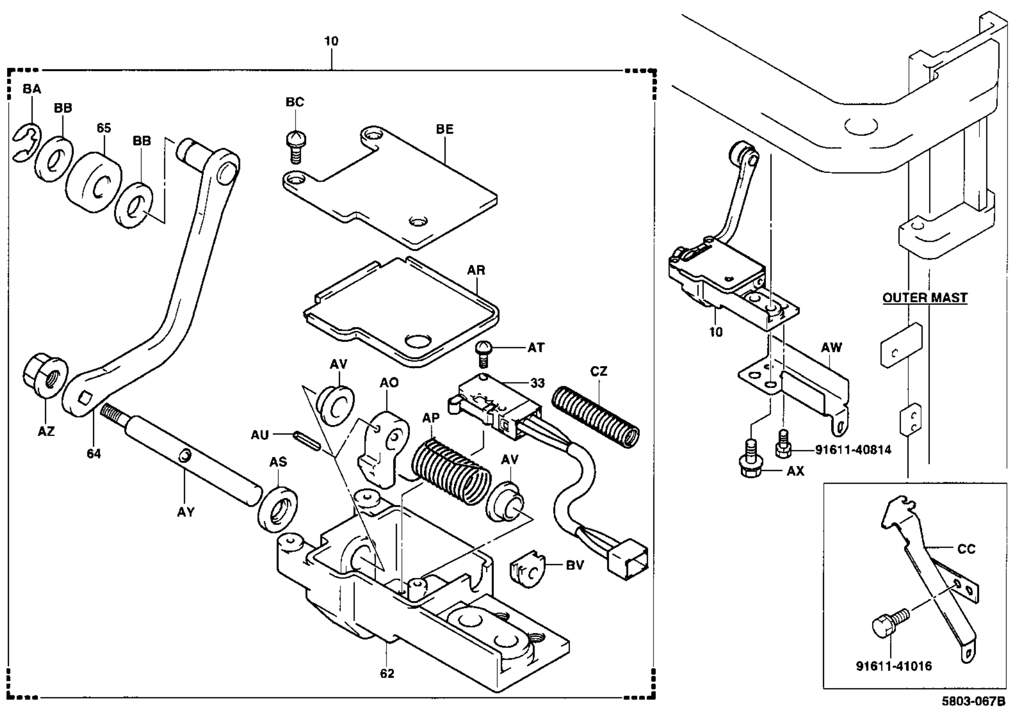


Lifting height switch (V (35 ~ 55 model))

5803

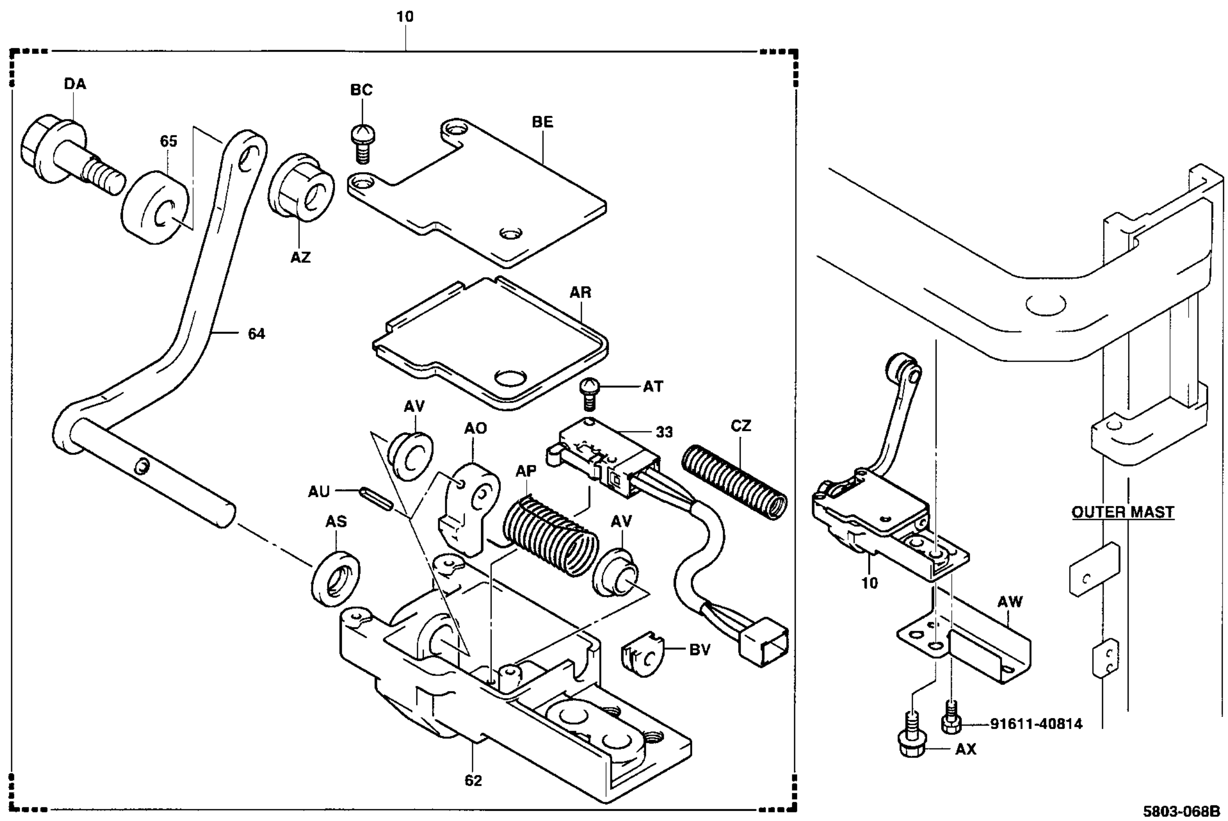


Lifting height switch (FSV (35 ~ 55 model))

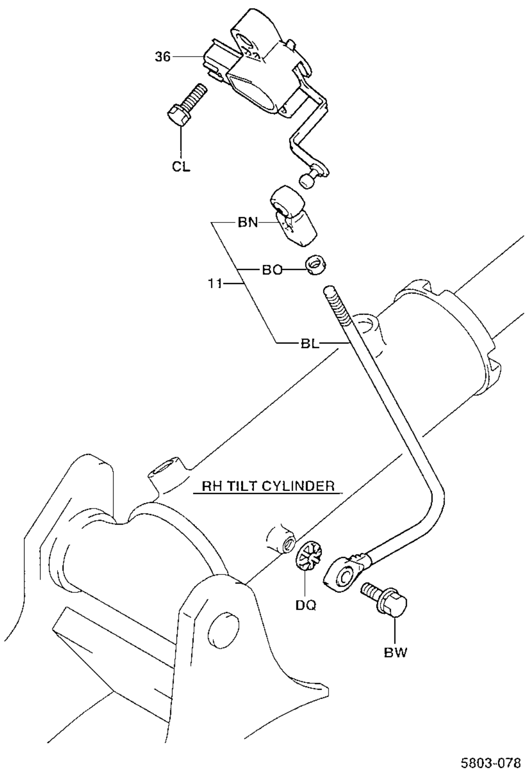


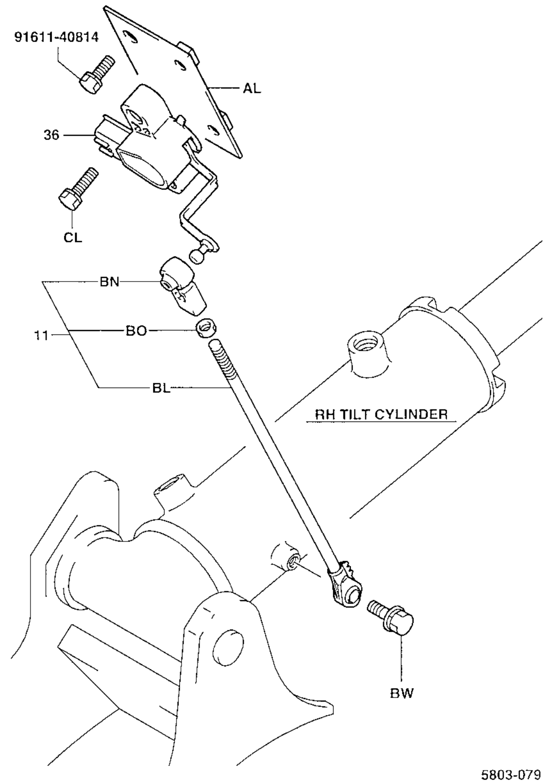
Lifting height switch (FV (35·45 model))

5803

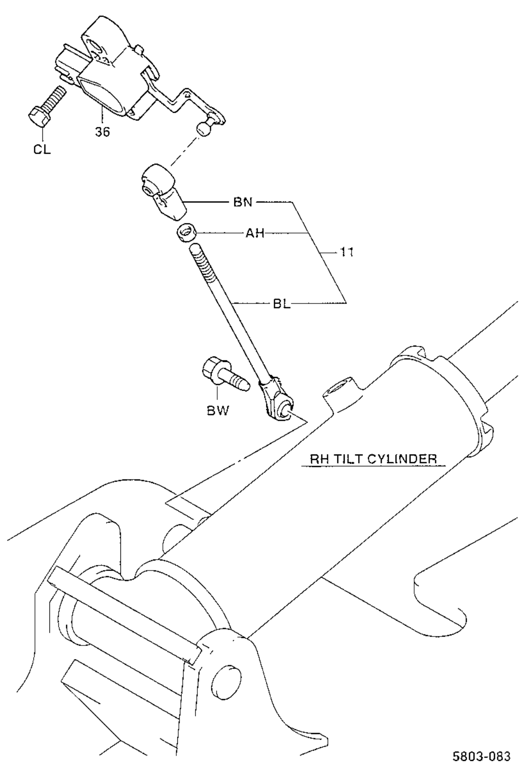


Tilt angle sensor (15·18 model)	Tilt angle sensor (20 ~ 32 model)	5803

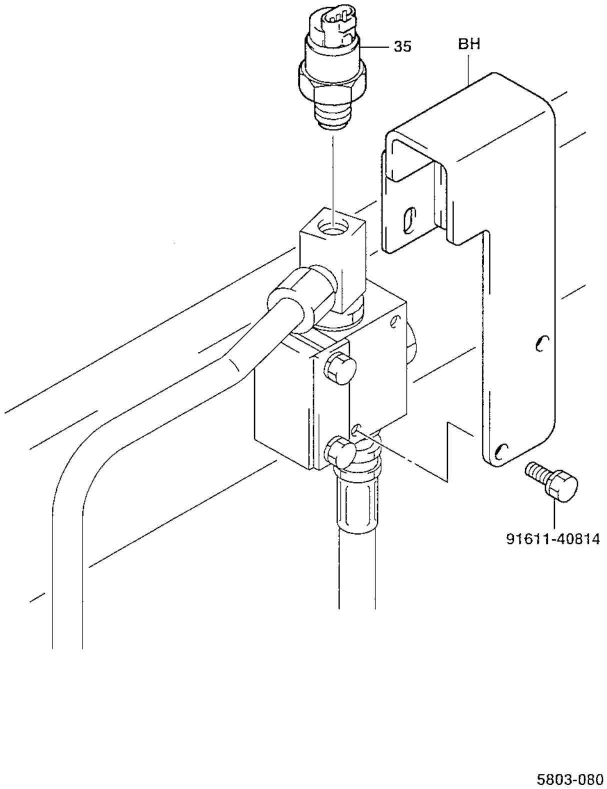


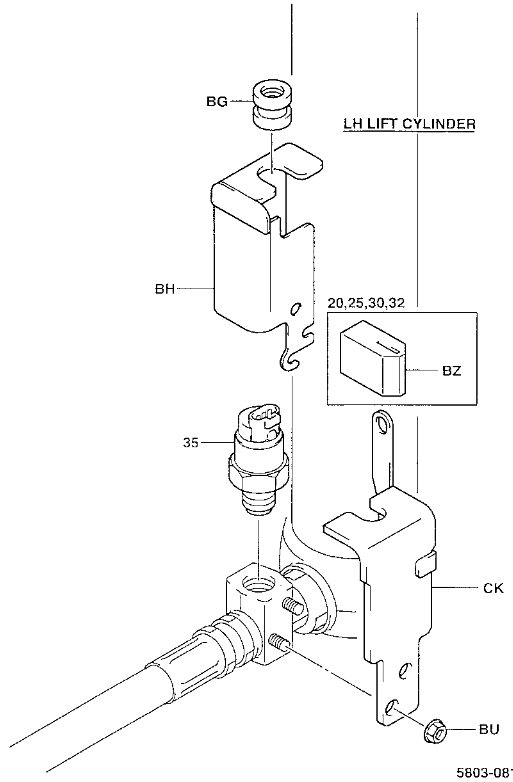


Tilt angle sensor (35 ~ 55 model)

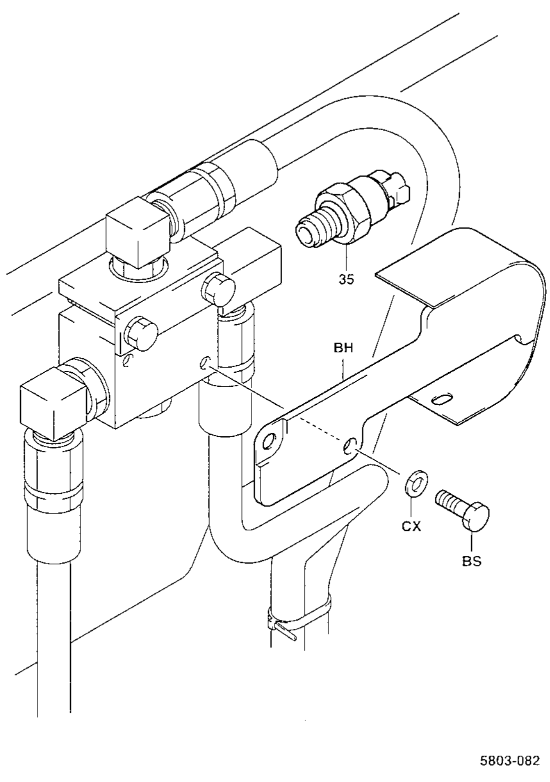


Load sensor (V (15 ~ 32 model)·FSV (15 ~ 32 model))	Load sensor (FV (15 ~ 32 model))	5803



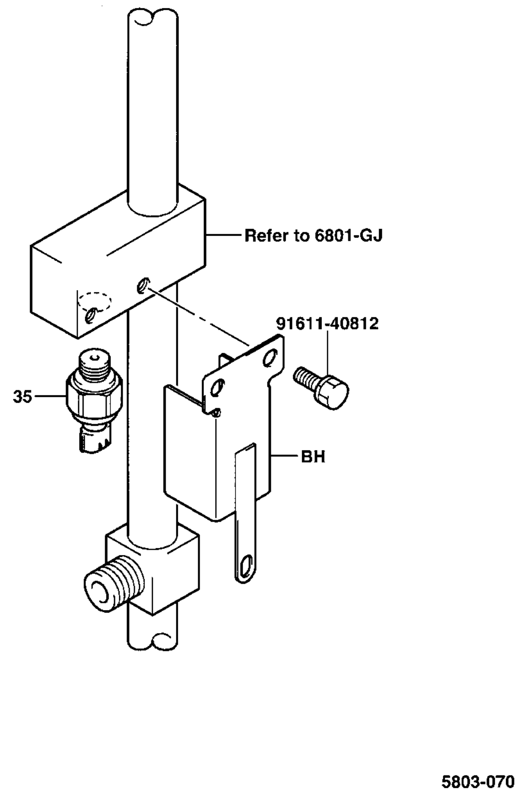


Load sensor (QFV)

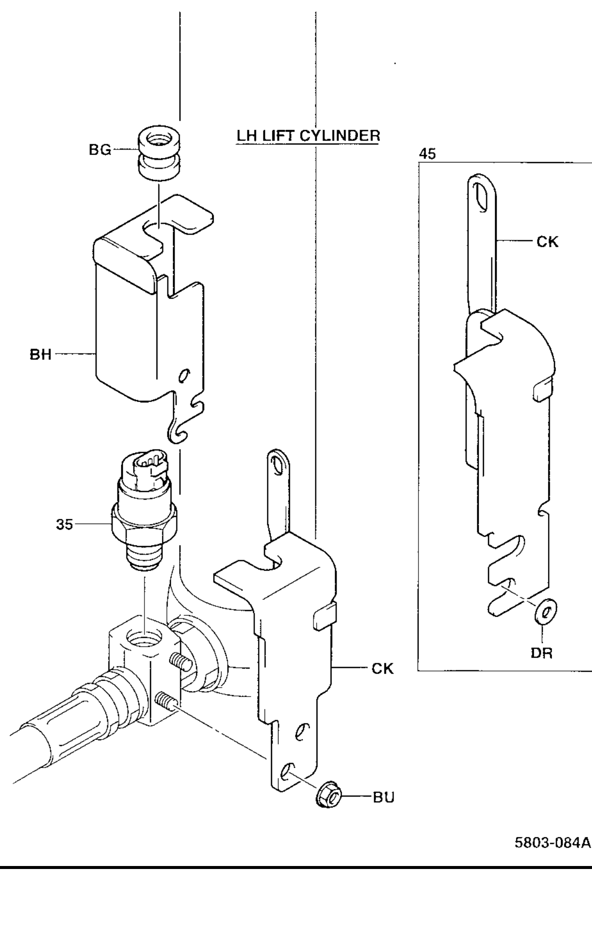


Load sensor (FSV (35 ~ 55 model))

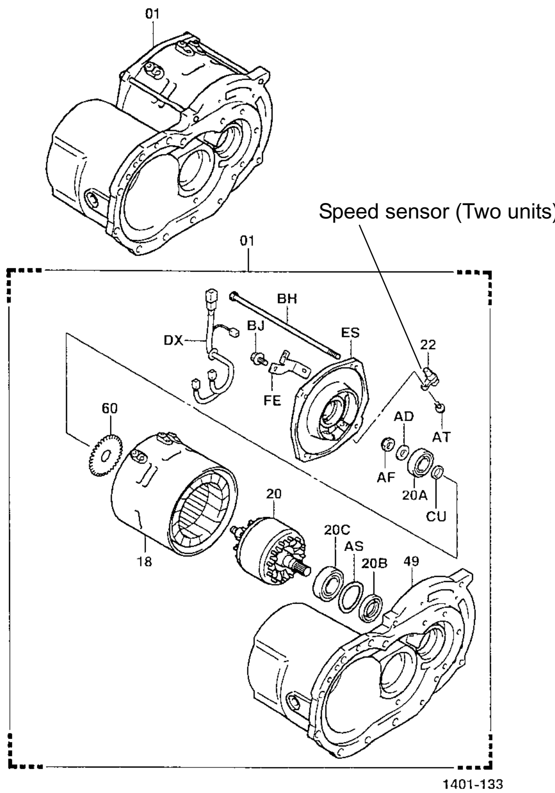
5803



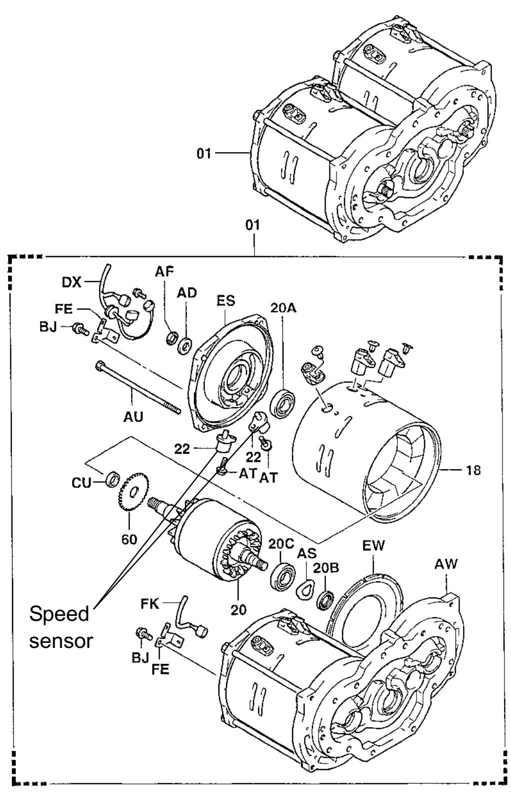
Load sensor (V (35 ~ 55 model)·FV (35·45 model))



Speed sensor (Revolution sensor) (15 ~ 32 model)	1401



Speed sensor (Revolution sensor) (35 ~ 55 model)



BEFORE STARTING REPAIR WORK

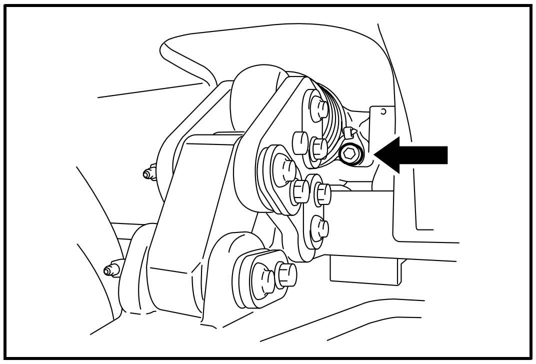
Before starting SAS repair, fully understand the SAS function.

1. Preparation for repairing
   (1) Avoid vehicle washing as far as possible. For cleaning, blow compressed air. If washing with water is required, avoid water jet washing. Always blow compressed air to remove water after washing.
   (2) Transport the SAS controller in packed state. Keep it packed until installation. Never transport it in exposed state. Full care should be taken not to drop the controller, allow contact with elsewhere or impact against it.
   (3) If matching is required, park the vehicle in a flat place in advance.
   (4) Provide necessary tools and instruments, SST 09230-21440-71, SST 09240-23400-71, and SST 09230-13700-71.

2. During repair work
   (1) Never use an impact wrench for removing or installing the SAS controller. Full care should be taken not to drop SAS controller by mistake avoid impact from dropping that may damage parts inside.
   (2) Don’t turn the key switch to ON or OFF carelessly when the sensor wiring is disconnected. Key switch ON in this state may cause an error and the error code will be stored in the controller. Error codes cannot be cleared and up to ten error codes can be stored. Beyond ten, older error codes will be eliminated sequentially.
   (3) During matching, SAS function will stop. Don’t operate the vehicle.
   (4) Don’t turn the key switch to ON with one side (either right- or left-hand side) of the vehicle jacked up. Turning the key switch to ON unlocks the swing lock and causes the vehicle to be tilted suddenly, leading to great danger.
   (5) If the hydraulic piping is disconnected, apply a cap to each fitting and hose to keep dirt off.
   (6) If the oil control valve lift lock release bolt is loosened, tighten it properly to the specified torque to the initial state before the repair work. (15 ~ 32 model)
   (7) Tighten the set bolts of respective functional parts to the specified torque levels.
   (8) Though sensors do not require adjustment upon installation, initialize them by matching.
   (9) When disconnecting a connector, don’t pull it at the harness.
   (10) When inspecting the harness, care should be taken not to damage the connector terminals.
   (11) Swing lock cylinder cannot be disassembled. If disassembled, the air will enter, making it non-reusable.
   (12) The meanings of high and low fork heights in the troubleshooting section are as follows:

   Low fork height: From the lowermost position to immediately before actuation of the fork height switch

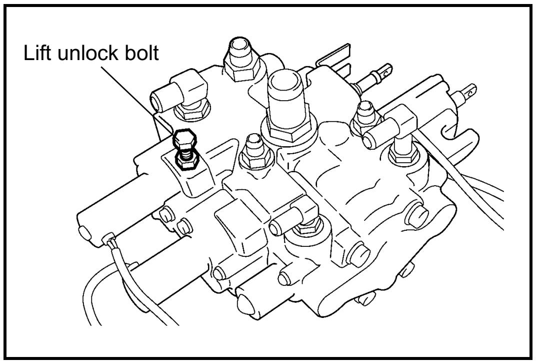
   High fork height: Height above the position where the fork height switch is actuated



3. Emergency Action

(1) If swing lock cannot be unlocked because of a trouble when the key switch is turned to ON, it can manually be unlocked as an emergency action as follows:
Loosen the illustrated plug of the swing lock cylinder (by 1 to 2 turns). Don't overloosen it, though.

T = 8.0 ~ 10.0 N·m 80 ~ 100 kgf-cm
[5.8 ~ 7.24 ft-lbf]



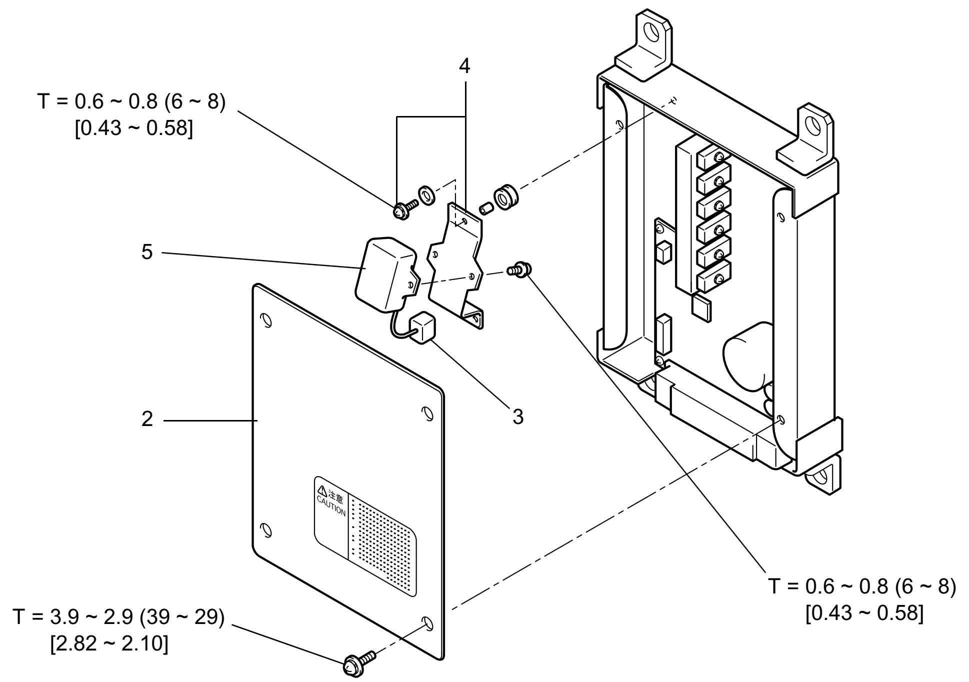
(2) If the mast fails to be lowered because of a trouble when so operated, it can be lowered manually as follows:
Loosen the lift unlock bolt and operate the lift lever to the down side.
After repair, do not forget to re-tighten the lift unlock bolt. If forgotten, the lift speed becomes remarkably delayed.
(15 ~ 32 model)

YAW RATE SENSOR

REMOVAL·INSTALLATION

Note:
Take the utmost care so as not to give a shock or impact on the yaw rate sensor. Don’t use an air impact wrench on controller parts wholly. If dropped, replace with a new one.

T = N·m (kgf-cm) [ft-lbf]

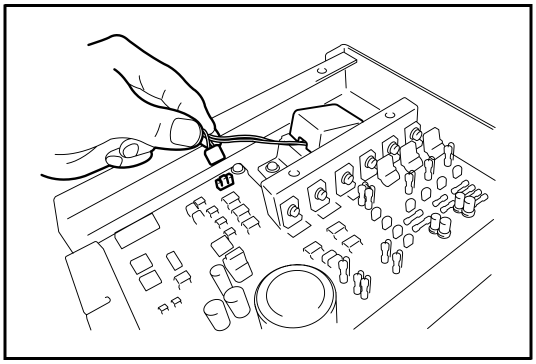


Removal Procedure

1 Remove SAS controller. (See VOL.2 page 2-29.)
2 Remove the cover.
3 Disconnect the jumper on the base print board connector. **[Point 1]**
4 Loosen the sensor set plate mount screw, and remove the yaw rate sensor together with the sensor set plate.
5 Remove the yaw rate sensor mount screw, and separate the yaw rate sensor from the set plate. **[Point 2]**

Installation Procedure

The installation procedure is the reverse of the removal procedure.



Point Operations

[Point 1]

Removal·Installation:

When removing or installing the jumper, take care so as not to harm the base plate connector.

Insert firmly when installing. And avoid adverse contact such as to element.

[Point 2]

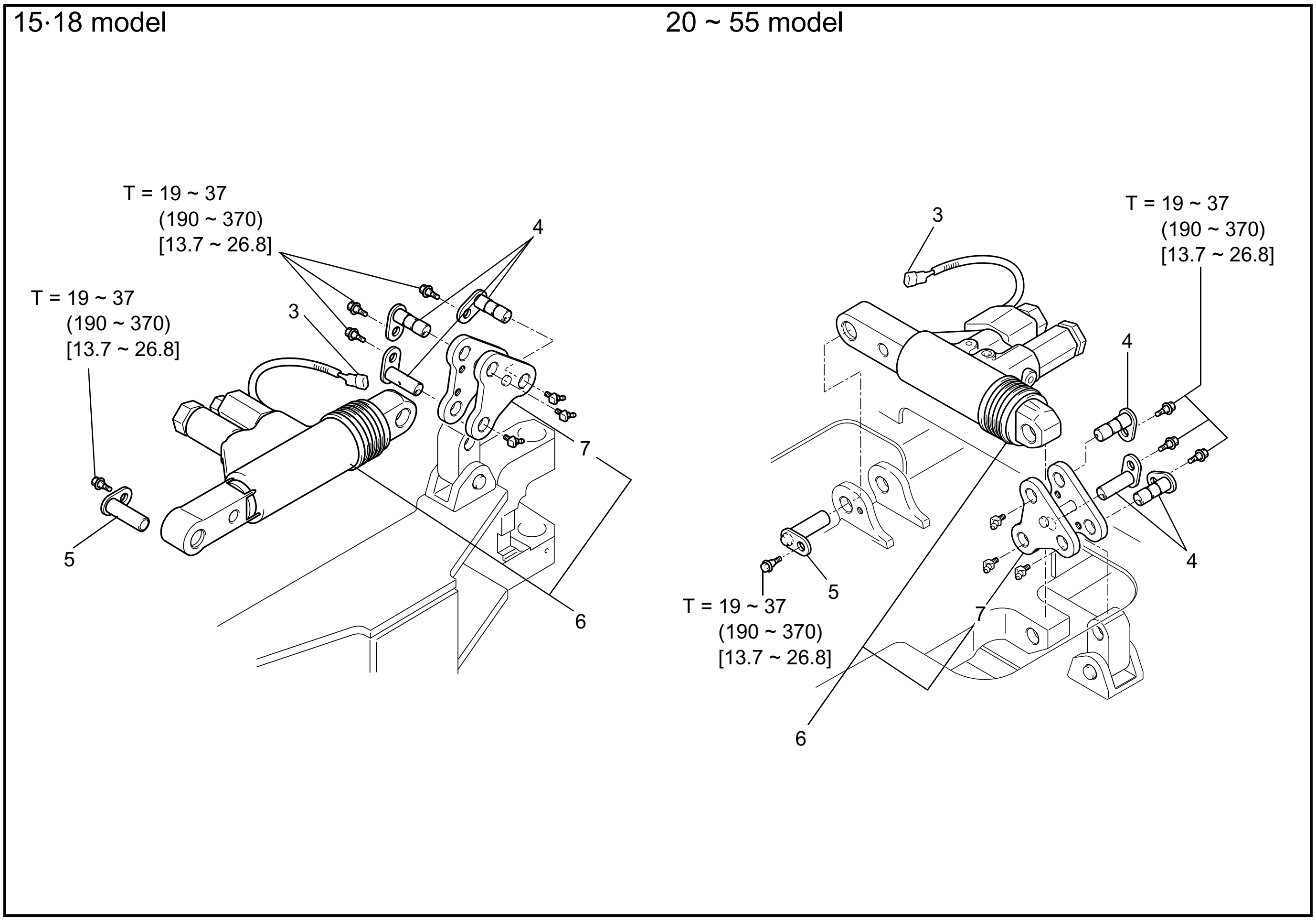
Installation:

Don’t change the direction (or orientation) of the yaw rate sensor when re-installing.

SWING LOCK CYLINDER

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

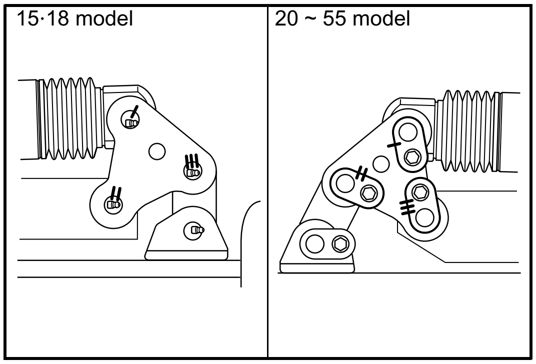
1 Remove the battery Assy (See page 1-5)
2 Jack up the vehicle until the rear wheels leave the ground.
3 Disconnect the swing lock solenoid connector.
4 Remove the swing lock cylinder crank pin. **[Point 1]**
5 Remove the swing lock cylinder pin. **[Point 2]**
6 Remove the swing lock cylinder ASSY W/crank. **[Point 3]**
7 Remove the swing crank from the swing lock cylinder.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

Note:

- **Apply molybdenum disulfide grease on the spherical portion of the cylinder pin before installation.**
- **Apply thread tightener (08833-76001-71 (08833-00070)) to the threaded portions of the cylinder pin and crank pin set bolts before tightening them.**
- **Add molybdenum disulfide grease through the grease fitting after installation.**



Point Operations

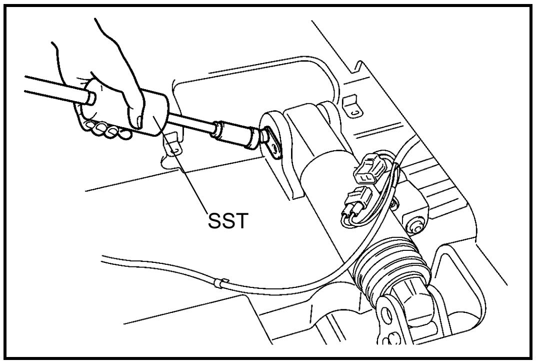
[Point 1]

Removal:

Make match marks on the swing crank and crankpin.

Installation:

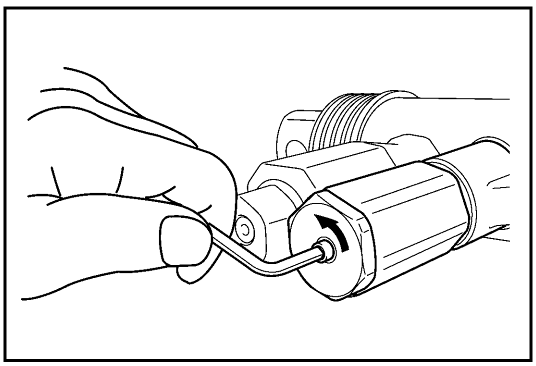
Install by aligning the match marks.



[Point 2]

Removal:

SST 09810-20172-71



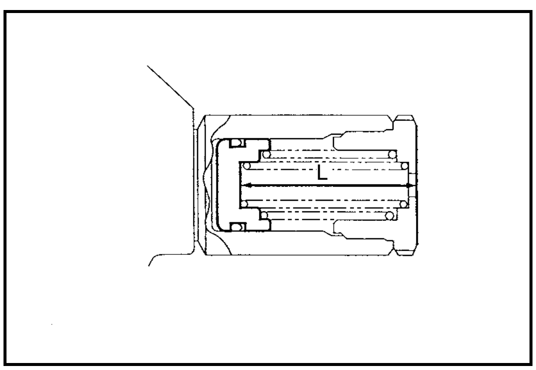
[Point 3]

15 ~ 32 model

Inspection:

Accumulator inspection

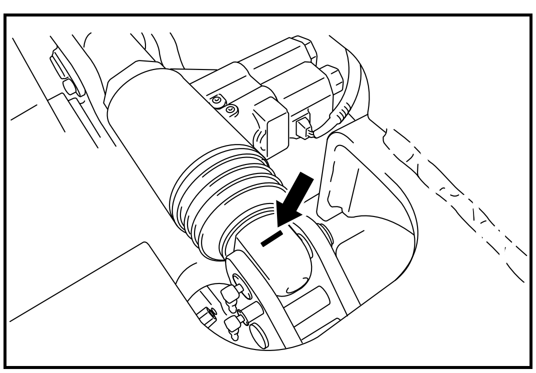
1. Remove the plug from the tip end of the accumulator.



2. Measure accumulator depth L.

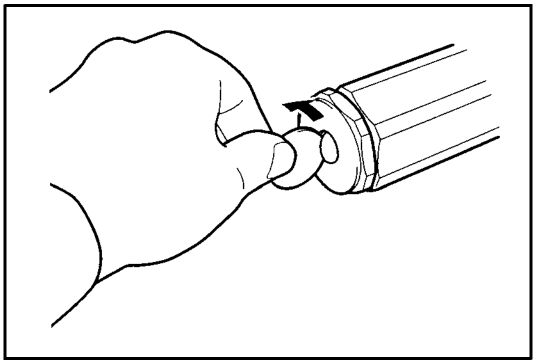
   Standard : L = 46 mm (1.81 in) (20°C (68°F))
   Limit : L = 52 mm (2.05 in) (20°C (68°F))

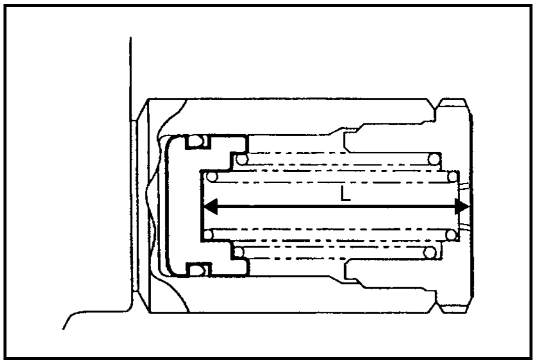
   If the limit value is exceeded, replace the swing lock cylinder ASSY.
3. After inspection, tighten the plug to be flush with the end face of the accumulator (do not tighten it excessively).

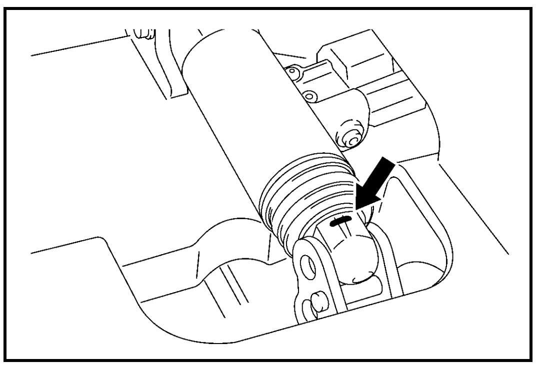


Installation:

Install with the mark (protruded portion) at the rod end facing upside.







35 ~ 55 model

Inspection:

1. Use a coin or screwdriver, remove the plug from the tip end of the accmulator.
2. Measure accumulator depth L.

   Standard : L = 45 mm (1.77 in) (40°C (104°F))
   Limit : L = 52 mm (2.05 in) (40°C (104°F))

   Correct judgment on the standard is difficult at low temperatures because of much variation due to the oil temperature in the lock cylinder.
   Perform inspection after raising the oil temperature (to approx. 40°C (104°F) or the cylinder body at near your temperature) by traveling back and forth on a rough road (or by heating with an external heater).

   If the limit value is exceeded, replace the swing lock cylinder ASSY.

3. After the inspection, install the plug by pushing it with a finger.

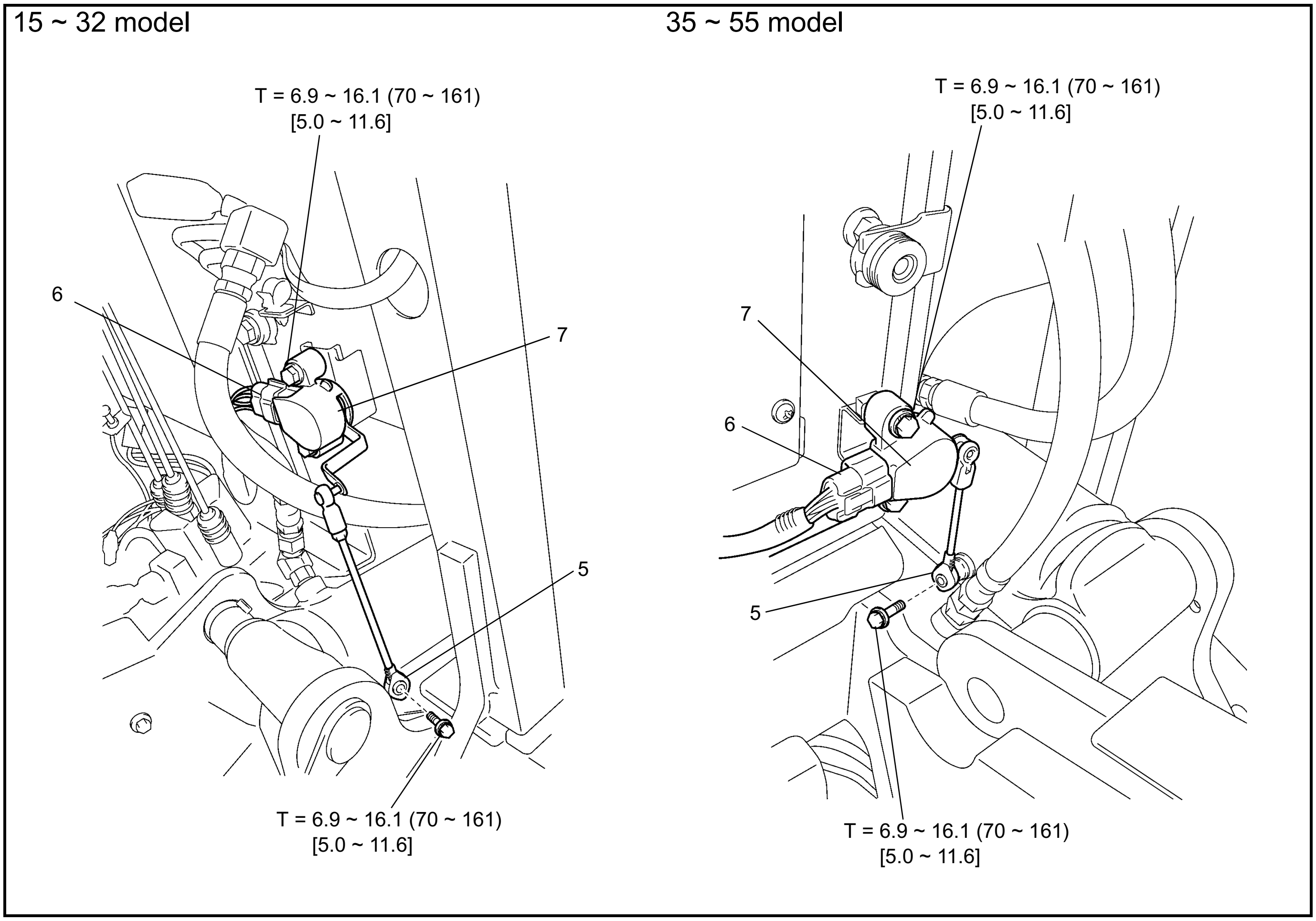
Installation:

Install with the mark (protruded portion) at the rod end facing upside.

TILT ANGLE SENSOR

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Removal Procedure

1 Remove the toe boards (front and rear).
2 Remove the lower panel.
3 Remove the instrument panel RH.
4 Remove the front pillar cover RH.
5 Disconnect the tilt angle sensor link.
6 Disconnect the connector.
7 Remove the tilt angle sensor.

Installation Procedure

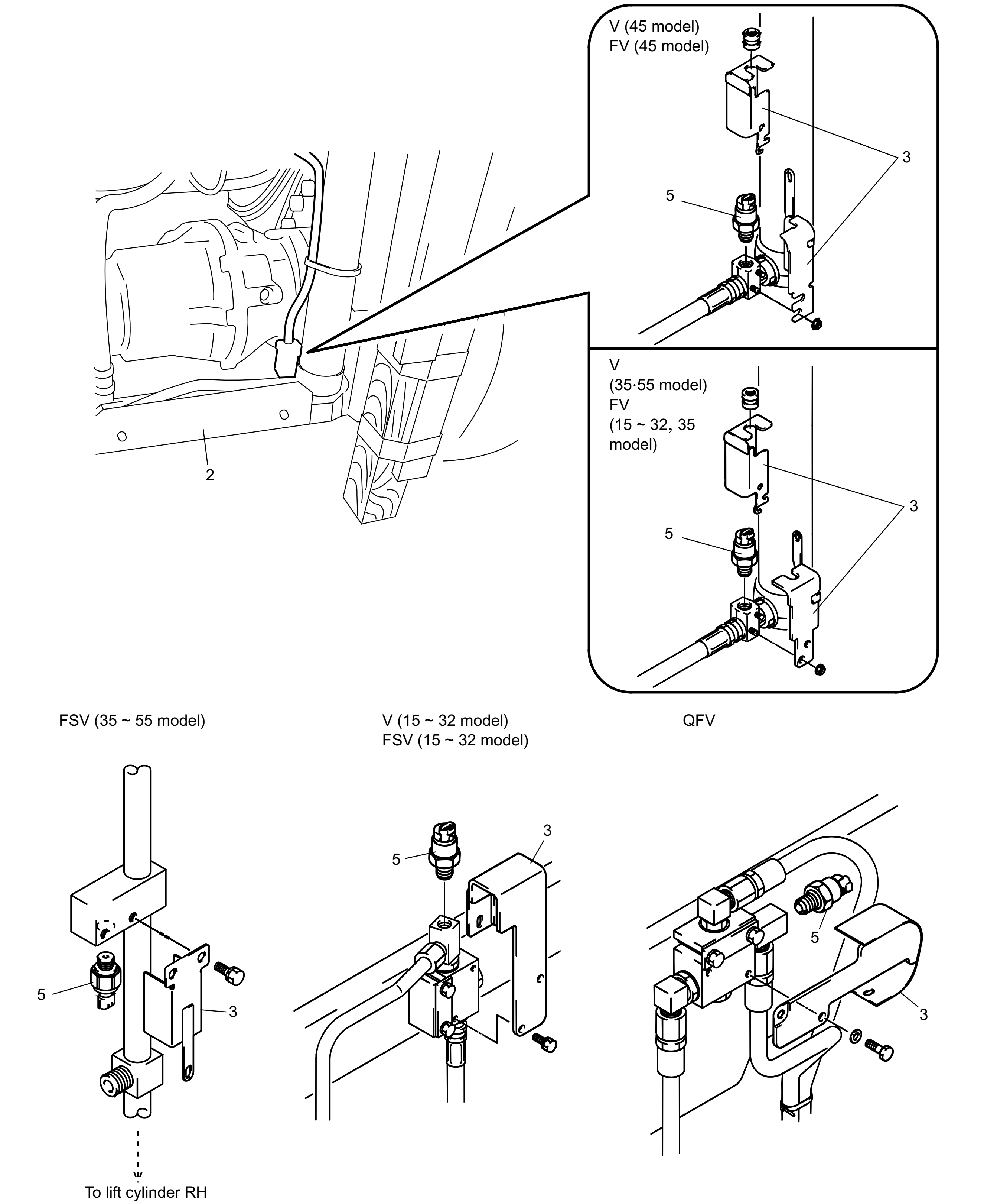
The installation procedure is the reverse of the removal procedure.

Note:
Carry out matching if the tilt angle sensor is removed or replaced or the tilt angle sensor link is adjusted in length or replaced.

LOAD SENSOR

REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]



Load sensor T = 35.3 ~ 43.1 (360 ~ 440) [26.0 ~ 31.8]

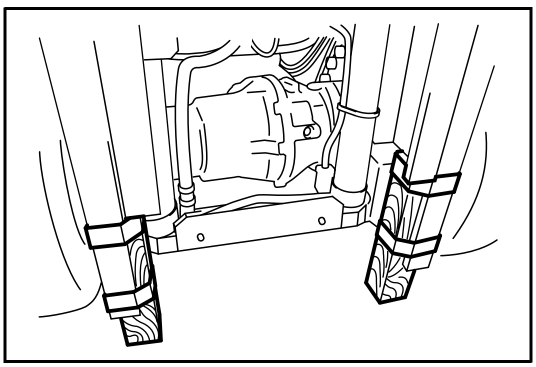
Removal Procedure

1 Hoist the inner mast. (V (35 ~ 55 model·FV)) **[Point 1]**
2 Remove the front hose cover. (V (15 ~ 32, 55 model))
3 Remove the sensor cover.
4 Disconnect the connector.
5 Remove the load sensor.

Installation Procedure

Reverse the removal procedure.

Note:
When the load sensor is replaced, proceed with the matching procedure. (See VOL.2 page 3-54.)



Point Operation

[Point 1]

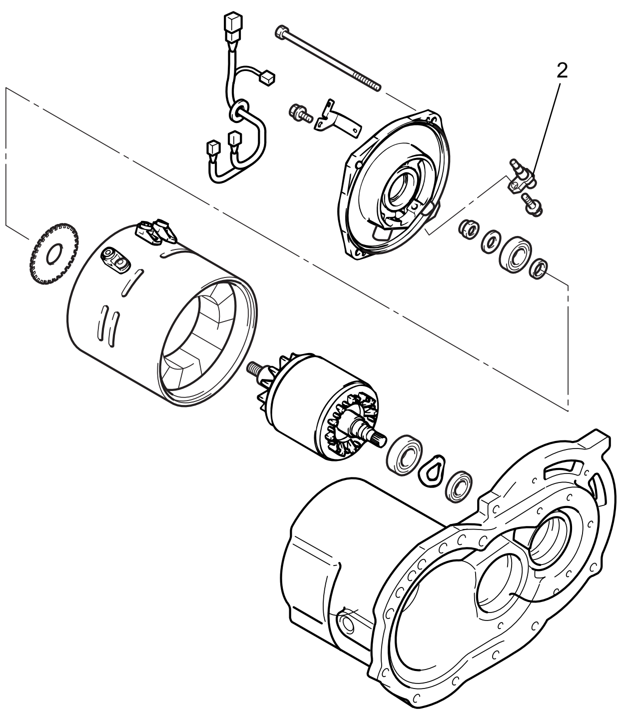
Removal·Installation:
Support the bottom of the inner mast with wooden blocks and fix the blocks by taping onto the outer mast.

SPEED SENSOR

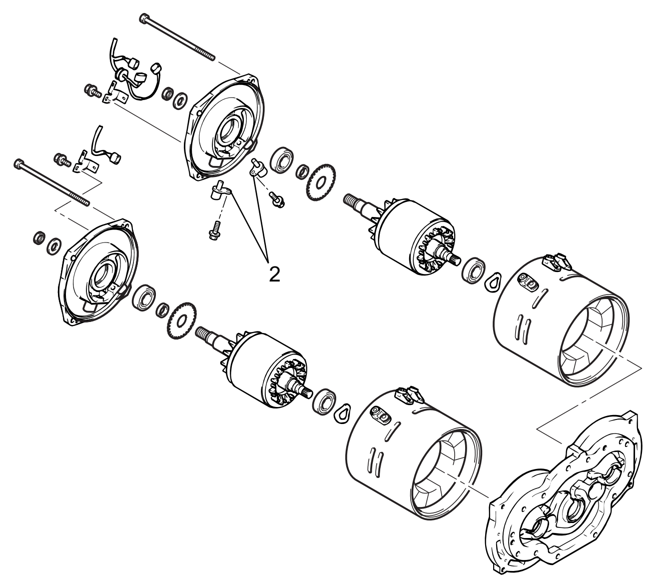
REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]

15 ~ 32 model



35 ~ 55 model



Removal Procedure

1 Remove the drive motor. (See page 5-10 (15 ~ 32 model), 5-12 (35 ~ 55 model))
2 Disassemble the drive motor and remove the speed sensor.

Installation Procedure

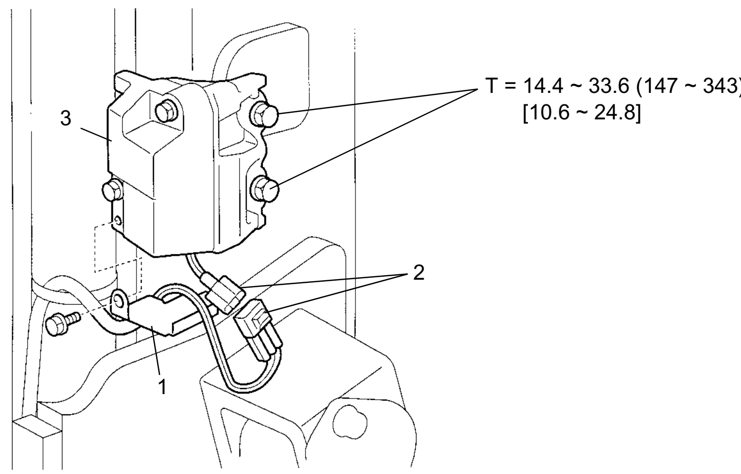
The installation procedure is the reverse of the removal procedure.

MAST LIFTING HEIGHT SWITCH

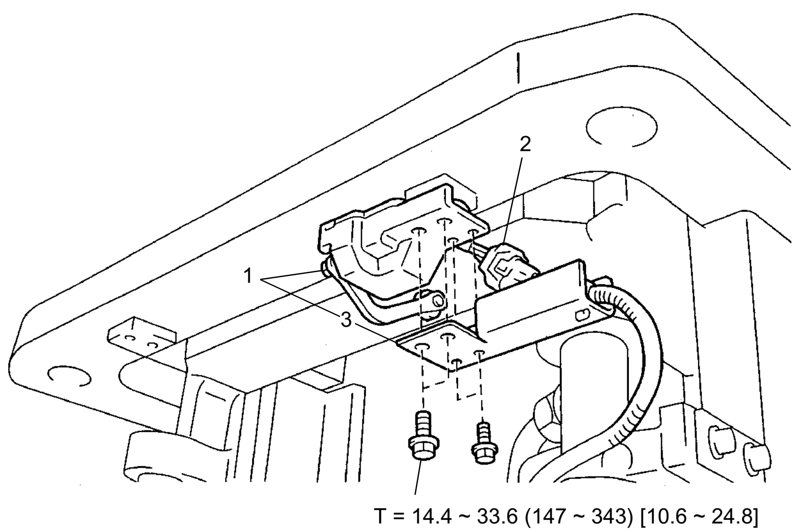
REMOVAL·INSTALLATION

T = N·m (kgf-cm) [ft-lbf]

V mast



FV·FSV·QFV mast



Removal Procedure

1 Remove the lower cover.
2 Disconnect the connector.
3 Remove the mast lifting height switch.

Installation Procedure

The installation procedure is the reverse of the removal procedure.

MATCHING

For the tilt angle sensor and load sensor, among sensors used for SAS, the signal voltage values for the mast vertical state and no-load state, respectively, are stored in the SAS controller as the bases for control. Therefore, if maintenance or parts replacement related to these sensors is made, matching (updating sensor signal voltage values of the vehicle in the standard state) becomes necessary. Matching is also required for the tilt angle sensor if the vehicle posture changes greatly, and for the load sensor if the weight is changed because of addition/removal of an attachment.
Matching can be done by selecting “MATCHING” of the display service function.

Content of matching	Automatic fork leveling	Forward tilt restriction position	No-load standard load
Matching condition	Mast in vertical position	Mast in vertical position*1	No-load
Analyzer indication	TILTL	TILTF	LOAD
Object sensor	Tilt angle sensor	Tilt angle sensor	Load sensor
Maintenance operation examples:			
1 Main controller replacement	○	○	○
2 Tilt angle sensor removal-installation or replacement	○	○	
3 Sensor rod length change or replacement	○	○	
4 Load sensor replacement			○
5 Change to another attachment	○	○	○
6 Mast replacement	○	○	○
7 Tilt cylinder replacement	○	○	
8 Tilt cylinder uneven movement adjustment	○	○	

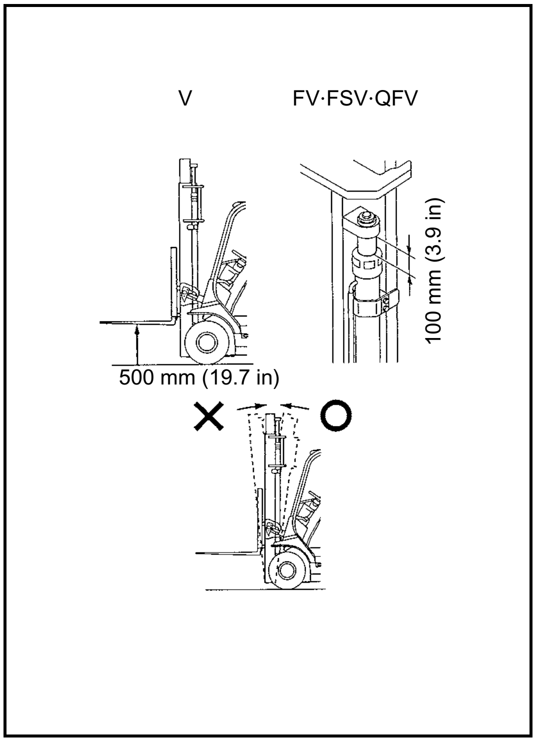
*1: Since the forward tilt control stop position is calculated by the controller, carry out matching by holding the mast in vertical position.

Note:
The matching value for the tilt angle sensor determines the mast stop position in fork automatic leveling. If the fork does not stop horizontally because of the site condition (such as inclined floor), perform matching by holding the mast in vertical position (in this case the mast stop angle will be deviated on the horizontal floor surface).

STANDARD STATE OF VEHICLE

If the surface on which matching is to be performed is slanted, error occurs to the standard state. Select a level floor without irregularity for matching.

Note:
The finishing accuracy of the floors for factories, warehouses and buildings in general calls for the floor inclination to be 0.5° or under. Therefore, matching on these floors is not affected. Don't perform matching on a floor that is inclined for over 0.5° for draining purpose.



Fork stop position with automatic leveling and forward tilting limit position

- Set the vehicle in the following condition so as to have the tilt angle sensor signal voltage value stored with the mast held vertical to the floor surface:Load sensor

No-load standard load

- Set the vehicle in the following condition so as to have the load sensor signal voltage value stored under no-load condition:

Standard:

- **Raise the fork to a height of 500 mm (19.7 in) for the V mast or raise the rear lift cylinder to a height of 100 mm (3.9 in) for the FV, FSV or QFV mast. Place a level (goniometer) at a height of 1200 to 1500 mm (47.2 to 59.1 in) on the front or rear side of the outer mast and set the mast in the vertical position.**
- **In the case of a special vehicle with a heavy attachment (exceeding the additional weight shown in the table below), adjust the perpendicularity of the mast with the attachment height at 500 mm (19.7 in), and perform relief at the topmost position.**

Note:

- **Keep the fork or attachment installed on the vehicle.**
- **Set the mast vertical from a backward tilted position (not from the forward tilted position).**
- **In case of a detachable attachment, keep the attachment installed on the vehicle.**

Additional Weight Table kg (lbs)

Lift height mm (in)	15 model	18 model	20 model	25 model	30·32 model	35 model	45 model	55 model
3000 (118) or less	700 (1544)	800 (1764)	950 (2095)	950 (2095)	1200 (2646)	1400 (3086)	1800 (3968)	2200 (4850)
3300 (130) ~ 4000 (157.5)	700 (1544)	700 (1544)	950 (2095)	950 (2095)	1200 (2646)	1400 (3086)	1600 (3527)	2000 (4409)
4300 (169) ~ 5000 (197)	600 (1323)	650 (1433)	700 (1544)	900 (1985)	1000 (2205)	1000 (2205)	1500 (3307)	1800 (3968)
5500 (216.5) ~ 6000 (236)	450 (992)	550 (1213)	450 (992)	650 (1433)	800 (1764)	1000 (2205)	1500 (3307)	1500 (3307)
6500 (256) ~ 7000 (275.5)	—	—	300 (662)	500 (1103)	500 (1103)	—	—	—

CAUTIONS ON MODIFYING VEHICLES

H (fork height): mm (in)

No.	Content of modification	Condition	Content of work
1	Mast replacement	Between two H2000 (79) s	Change the mast.
		H2000 (79) → H2500 (98.5) or above	Change the mast. Install the lifting height switch. Install the mast harness. Install the rear axle damper. (Lifting height 5000 mm (198 in) or above) (See page 8-11)
		H2500 (98.5) or above → H2000 (79)	Change the mast. Remove the lifting height switch. Remove the mast harness.
2	Installation/Removal of attachment	—	Install or remove attachment.
3	Mast installation (Mast less spec. model)	—	Install the mast. Install the lifting height switch. Install the mast harness.

Note:

- **Proceed with the alignment (matching) procedure after the above-mentioned modification. (See VOL.2 page 3-54.)**
- **After modification, replace the caution label affixed on the vehicle with the one matching the new SAS function.**
- **When placing a supply order for a mast ASSY, place order for sensors (for lifting height switch, load sensor, mast harness and other SAS related parts) simultaneously if such parts are required.**

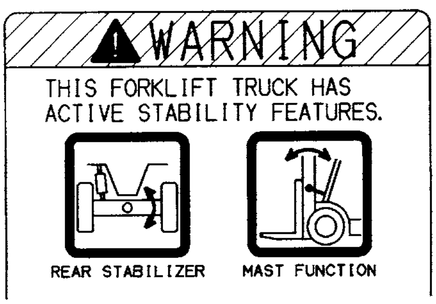
RENEWAL OF SAS CAUTION LABEL

The warning instructions on the SAS caution label affixed to each truck must always agree with the SAS features that particular model owns. You must be strictly careful because the SAS caution label must be changed to the one with different warning in case that the modification on your side may vary the SAS features.
Notice that the caution label must be changed in the following cases:

The selective function of the mast forward tilt angle control was switched to either of Validation and Invalidation.*
(*: See VOL.2 Page 3-50 Option set for the switching method.)

1. Case of Switching "Mast forward tilt control Valid/Invalid."

Label (1)



Valid Invalid
(1) ⟶ (2)
(1) ⟵ (2)
Valid Invalid

Label (2)

Label (1) for use on the SINGLE TIRE models having the following SAS features:
- Equipped with swing lock control
- Mast forward tilt angle control "VALID".

Label (2) for use on the SINGLE TIRE models having the following SAS features:
- Equipped with swing lock control
- Mast forward tilt angle control "INVALID".

2. Case of Mast Installation for Mast-Less Spec. models.
When you install the mast to the mastless models, make sure the specification features with the mast assembled.
Take note that the proper caution label must be chosen to be affixed to the truck.
The proper label can be found from the label numbering (1) - (2) in the illustration.

APPENDIX

SST LIST

★: Newly adopted SST

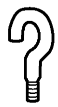
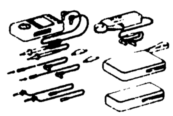
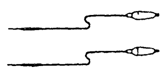
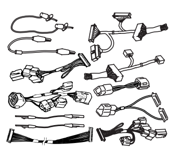
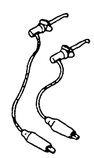
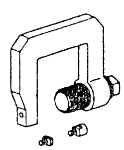
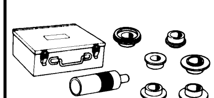
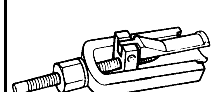
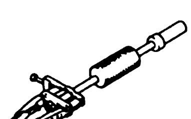
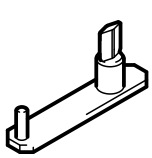
Illustration	Part No.	Part Name	Section											
			1	5	6	7	8	9	10	13	14	15	16	17
	09010-10260-71	Motor hook		O	O									
	09082-76002-71 (09082-00050)	TOYOTA elec- trical tester												O
	09230-13700-71	IC check pin												O
	★ 09230-21440-71	AC controller diagnosis kit												O
	09240-23400-71	IC clip												O
	09310-23320-71	Reamer bolt remover			O									
	09316-76008-71 (09316-60011)	Transfer bear- ing replacer			O									
	09319-76001-71 (09319-60020)	Output shaft needle roller bearing remover										O		
	09320-23000-71	Bearing remover				O								
	★ 09330-21440-71	Stopper pin			O									

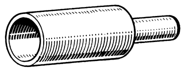
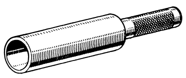
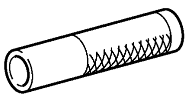
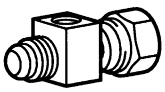
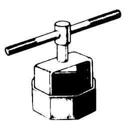
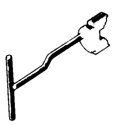
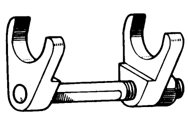
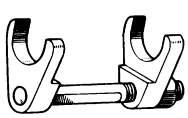
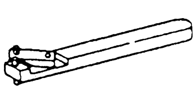
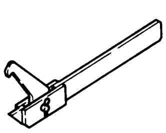
Illustration	Part No.	Part Name	Section											
			1	5	6	7	8	9	10	13	14	15	16	17
	09370-10410-71	Front axle bearing replacer			O	O	O							
	09370-20270-71	Drive pinion bearing replacer					O							
	09381-41950-71	H.S.T pump bearing replacer		O										
	09450-23320-71	Adapter						O						
	09509-76002-71 (09509-55020)	Rear wheel bearing nut wrench				O								
	09510-31960-71	Brake hold down spring remover and replacer							O					
	09610-10160-70	Oil control valve spring remover and replacer											O	
	09610-10161-71	Oil control valve spring remover and replacer											O	
	09610-20170-71	Tilt lock valve cup remover & replacer									O			
	09620-10100-71	Cylinder cap remover and replacer							O		O			

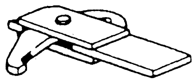
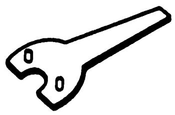
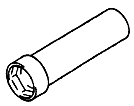
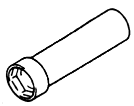
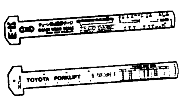
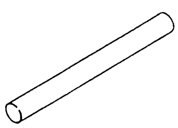
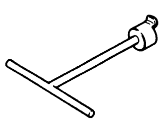
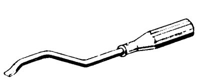
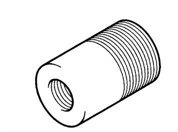
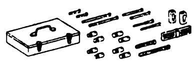
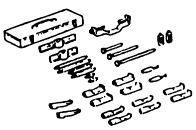
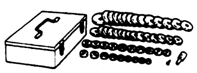
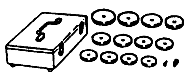
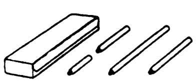
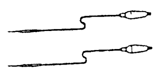
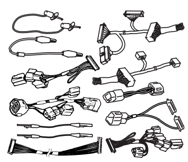
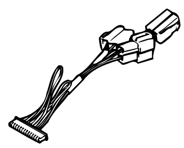
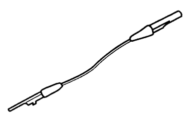
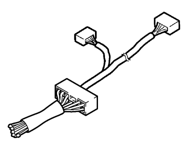
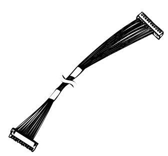
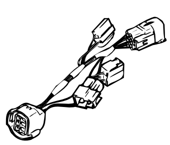
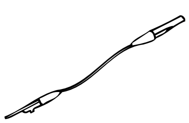
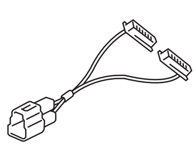
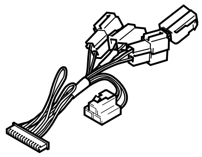
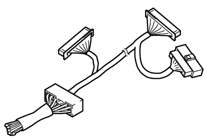
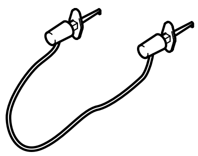
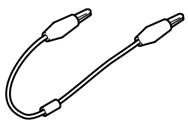
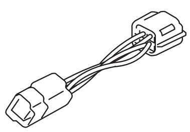
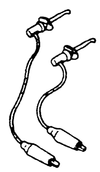
Illustration	Part No.	Part Name	Section											
			1	5	6	7	8	9	10	13	14	15	16	17
	09620-10160-71	Cylinder cap remover & replacer									O			
	09630-10110-71	Tilt cylinder cap remover and replacer			O									
	09630-31720-71	Deep socket C								O				
	09630-33900-71	Deep socket B								O				
	09631-22000-71	Wear scale chain								O				
	09700-30200-71	Spring pin tool remover		O	O									
	09717-76001-71 (09717-20010)	Brake shoe return spring remover							O					
	09718-76001-71 (09718-20010)	Brake shoe return spring replacer							O					
	09810-20172-71	Joint pin remover								O	O			O
	09820-31040-71	Joint bolt								O	O			

Illustration	Part No.	Part Name	Section											
			1	5	6	7	8	9	10	13	14	15	16	17
	09950-76003-71 (09950-50012)	Puller C set						O						
	09950-76014-71 (09950-40011)	Puller B set		O	O	O				O				
	09950-76018-71 (09950-60010)	Replacer set			O	O	O				O	O		
	09950-76019-71 (09950-60020)	Replacer set No.2			O	O	O							
	09950-76020-71 (09950-70010)	Handle set			O	O	O				O	O		
	25009-13201-71	Battery hanger	O											

SST LIST

Illust.	Part No.	Part Name	Use
	09230-13700-71	IC check pin	
	09230-21440-71	AC controller diagnosis kit	
	(09231-13130-71)	Sub-harness for CN105	• To check the traveling system fan ON/OFF signal • To check MOS drive power supply ON/OFF signal
	(09232-13130-71)	For CN1, 86, 90	
	(09233-13130-71)	Sub-harness for CN113 (15 ~ 32 model), CN111, 112 (35 ~ 55 model)	To check if the CPU board and DC/MD board drives the MOS normally
	(09234-13130-71)	Sub-harness for CN106, 110	To check in combination with SST3 If the check result in connection with SST3 is NG, this sub-harness is used to discriminate if the cause of NG lies in the CPU or DC/MD.
	(09237-13130-71)	Sub-harness for CN19	• To discriminate whether the steering angle sensor or the harness/ CPU board is defective by replacing STS1 and STS2 signals • To check steering angle sensor power supply
	(09238-13130-71)	Sub-harness for CN25	To check the acceleration potentiometer short harness, harness from the CPU board to the acceleration potentiometer and the CPU board
	(09239-13130-71)	Sub-harness for CN106, 107	• To check the traveling/material handling system fan ON/OFF signal • To check MOS drive power supply ON/OFF signal

Illust.	Part No.	Part Name	Use
	(09231-13900-71)	Sub-harness for fan check	For CN105
	(09232-13900-71)	Sub-harness for CPU•DC/ MD check	For CN106, 107
	(09234-13900-71)	Short harness	For CN104 (15 ~ 32 model), CN148 and CN154 (35 ~ 55 model)
	(09235-13900-71)	Harness for material handling main circuit check	For between P14 and P15
	(09231-21440-71)	Sub-harness for speed sen- sor check	For CN57
	09240-23400-71	IC clip	

SERVICE STANDARDS

CONTROLLER

ITEM		15 ~ 32 model (chopper-less)	15 ~ 32 model (chopper)	35 ~ 55 model
F1 (For drive) A		15·18 model: 275 20 ~ 32 model: 325	15·18 model: 500 20 ~ 32 model: 600	700
F2 (For pump) A		15·18 model: 225 20 ~ 32 model: 325	-	-
F2A (For pump No.1) A		-	-	325
F2B (For pump No.2) A		-	-	325
F3 (For PS) A		75	75	-
F4 (For lamps) A		10	10	10
F5 (For control circuit) A		10	10	10
F6 (For controller) A		10	10	10
F7 (For SAS controller) A		10	10	10
FD (For DC/DC converter) A		8	8	8
Control panel insulation MΩ		The greater, the better. the insulation resistance, however, depends greatly on the vehicle operating state, place, environment and weather. (Approx. 1 or more)		
TMD and TMP (traveling and load handling transistors) [Tester range: Ω× 1k] kΩ	D1(D2) (+) - S1(S2) (-) D1(D2) (+) - G1 (-) S1(S2) (+) - D1(D2) (-) S1(S2) (+) - G (-) G (+) - D1(D2) (-) G (+) - S1(S2) (-)	Approx. 2 Approx. 12 ∞ Approx. 10 ∞ Approx. 1		
MB (power supply contactor) coil resistance Ω		Approx. 20 (at 20°C)		
CO (overall capacitor) resistance		The pointer shall first deflect to 0 Ω side, shall gradually return to ∞ then, and shall indicate ∞ finally.		
TMPS (transistor for PS) kΩ	C2E1-E2	C2E1 (-) - E2 (+) : ∞ C2E1 (+) - E2 (-) : Continuity shall exist.		
	G2-E2	G2 (-) - E2 (+) : ∞ G2 (+) - E2 (-) : ∞		
	C2E1-C1	C2E1 (-) - C1 (+) : Continuity shall exist. C2E1 (+) - C1 (-) : ∞		
SH (shunt)		Continuity shall exist.		
Driver motor input voltage difference (V) between phases		2 or less		

ACCELERATION POTENTIOMETER

Acceleration switch (SW_{AC}) Ω	When pedal is operated	∞
	When pedal is not operated	0
Acceleration potentiometer resistance kΩ	51 - 52	Shall vary gradually from 0 to approx. 2 to 4.

DIRECTION SWITCH

	Lever position		
	Forward	Neutral	Reverse
DS_F	0 Ω	∞ Ω	∞ Ω
DS_R	∞ Ω	∞ Ω	0 Ω
DS_{BU}	∞ Ω	∞ Ω	0 Ω

EZ PEDAL (OPT)

	Pedal position		
	Forward	Neutral	Reverse
DS_F	0 Ω	∞ Ω	∞ Ω
DS_R	∞ Ω	∞ Ω	0 Ω
DS_{BU}	∞ Ω	∞ Ω	0 Ω

SERVICE STANDARDS LIST

BATTERY

Specific gravity upon full charge	(at 20°C)	1.280 [20°C (68°F)]
Specific gravity upon end of discharge	(at 20°C)	1.150 [20°C (68°F)]
Voltage upon end of discharge	V	36 V vehicle: 32.0 48 V vehicle: 42.5
Insulation resistance	MΩ	1 or more

DRIVE MOTOR

Stator ASSY insulation resistance MΩ		Standard	1 or more
Terminals continuity Ω		Standard	0
Temperature sensor resistance kΩ		Standard	Approx. 11 ~ 15
Tightening torque Unit:N·m (kgf-cm) [ft-lbf]			
Drive motor set bolt	35 ~ 55 model	Standard	61 ~ 114 (620 ~ 1160) [44.9 ~ 83.9]
Drive motor throught bolt		Standard	47.2 ~ 70.8 (480 ~ 720) [34.7 ~ 52.1]

PUMP MOTOR

Commutator outside diameter	mm (in)	15·18 model	Standard	85 (3.35)
			Limit	82 (3.23)
		20 ~ 55 model	Standard	100 (3.94)
			Limit	97 (3.82)
Undercut depth	mm (in)		Standard	1.0 (0.039)
			Limit	0.5 (0.02)
Commutator runout	mm (in)		Standard	0.03 (0.00118)
Armature coil insulation resistance	MΩ		Standard	1 or more
Brush spring force	N (gf) [lb]	15·18 model	Standard	11.7 ~ 14.3 (1.19 ~ 1.46) [2.63 ~ 3.22]
		20 ~ 55 model	Standard	12.15 ~ 14.85 (1.24 ~ 1.52) [2.74 ~ 3.35]
Insulation resistance between brush holder and bracket	MΩ		Standard	1 or more
Brush length	mm (in)	15·18 model	Standard	27 (1.06)
			Limit	13 (0.51)
		20 ~ 55 model	Standard	34 (1.33)
			Limit	13 (0.51)
Field coil continuity			Standard	0
Field coil insulation resistance	MΩ		Standard	1 or more
Over heat alarm device resistance	kΩ		Standard	100 ~ 500 [Atmospheric temperature: 45°C (113°F) ~ 10°C (50°F)

POWER STEERING MOTOR

15 ~ 32 Model

Brush spring forse N (kgf) [lbf]	Standard	4.9 ~ 8.8 (0.5 ~ 0.9) [1.1 ~ 2.0]
Insulation resistance between brush holder and yoke ASSY MΩ	Standard	1 or more
Brush lenght mm (in)	Standard	28.4 (1.118)
	Limit	15.5 (0.606)
Commutator outside diameter mm (in)	Standard	57.2 (2.252)
	Limit	54.6 (2.150)
Under cut mm (in)	Standard	0.8 (0.031)
	Limit	0.3 (0.012)
Commutator runout mm (in)	Limit	0.03 (0.0012)
Armature coil insulation resistance MΩ	Standard	1 or more
Fierd coil insulation resistance MΩ	Standard	1 or more

DRIVE UNIT

15 ~ 32 Model

Spider outside diameter mm (in)		Standard	22.00 (0.8661)
		Limit	21.75 (0.8563)
Differential pinion inside diameter mm (in)		Standard	22.12 (0.8709)
		Limit	22.22 (0.8748)
Side gear thrust washer thickness mm (in)		Standard	1.6 (0.063)
		Limit	1.3 (0.051)
Pinion gear thrust washer thickness mm (in)		Standard	1.6 (0.063)
		Limit	1.0 (0.039)
Tightening torque N·m (kgf-cm) [ft-lbf]			
Front axle bracket set bolt	15·18 model	Standard	156.8 ~ 215.6 (1600 ~ 2200) [115.8 ~ 159.2]
	15·18 model (dead-man brake) 20 ~ 32 model	Standard	235 ~ 294 (2400 ~ 3000) [173.6 ~ 217.1]
Front axle housing set bolt	15·18 model	Standard	73.5 ~ 98.0 (750 ~ 1000) [54.3 ~ 72.4]
	15·18 model (dead-man brake) 20 ~ 32 model	Standard	108 ~ 137 (1100 ~ 1400) [79.6 ~ 101.3]
Gear case set bolt		Standard	60.8 ~ 113.8 (620 ~ 1160) [44.8 ~ 83.9]
Ring gear set bolt		Standard	127.5 ~ 176.5 (1300 ~ 1800) [94.0 ~ 13.0]

DRIVE UNIT

35 ~ 55 Model

Differential			
Ring gear backlash mm (in)		Standard	0.2 ~ 0.3 (0.008 ~ 0.012)
Differential pinion bore mm (in)		Standard	22.12 (0.8709)
		Limit	22.22 (0.8748)
Spider outside diameter mm (in)		Standard	22.00 (0.8661)
		Limit	21.75 (0.8563)
Side gear thrust washer thickness mm (in)		Standard	1.6 (0.063)
		Limit	1.3 (0.051)
Pinion gear thrust washer thickness mm (in)		Standard	1.6 (0.063)
		Limit	1.0 (0.039)
Drive pinion bearing starting torque N·m (kgf-cm) [ft-lbf]		Standard	4.90 ~ 8.82 (50 ~ 90) [3.62 ~ 6.51]
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Differential gear case set bolt		Standard	49.0 ~ 78.4 (500 ~ 800) [36.2 ~ 57.9]
Front axle bracket set bolt	35·45 model	Standard	245 ~ 324 (2500 ~ 3300) [180.8 ~ 238.8]
	55 model	Standard	343 ~ 441 (3500 ~ 4500) [253.2 ~ 326.6]
Drive pinion lock nut		Standard	343.2 ~ 392.3 (3500 ~ 4000) [253.2 ~ 289.4]
Ring gear set bolt		Standard	127.4 ~ 176.5 (1300 ~ 1800) [94.06 ~ 130.2]
Differential upper case set bolt		Standard	43.1 ~ 53.9 (440 ~ 550) [31.8 ~ 39.8]
Differential case bearing cap set bolt		Standard	117.7 ~ 137.3 (1200 ~ 1400) [86.82 ~ 101.3]

FRONT AXLE

15 ~ 32 Model

FRONT AXLE SHAFT·AXLE HUB			
Front axle bearing staring forse N (kgf) [lbf]	20 ~ 32 model	Standard	25.5 ~ 72.6 (2.6 ~ 7.4) [5.7 ~ 16.3]
Tightening torque N·m (kgf-cm) [ft-lbf]			
Hub bolt set nut	15·18 model	Standard	49 ~ 68 (500 ~ 693) [36.2 ~ 50.1]
	20 ~ 32 model	Standard	166.7 ~ 205.9 (1700 ~ 2100) [123.0 ~ 151.9]
Bearing lock nut stopper bolt		Standard	2.0 ~ 3.9 (20 ~ 40) [1.45 ~ 2.89]
Axle shaft set bolt		Standard	98.1 ~ 127 (1000 ~ 1300) [72.35 ~ 94.06]
Front wheel hub nut	15·18 model	Standard	107.9 ~ 196 (1100 ~ 2000) [79.59 ~ 144.7]
	20 ~ 32 model	Standard	294.2 ~ 588.4 (3000 ~ 6000) [217.1 ~ 434.1]
Brake ASSY set bolt		Standard	137 ~ 196 (1400 ~ 2000) [101.3 ~ 144.7]
Axle housing set bolt	15·18 model	Standard	73.5 ~ 98 (750 ~ 1000) [54.3 ~ 72.4]
	20 ~ 32 model	Standard	108 ~ 137 (1100 ~ 1400) [79.6 ~ 101.3]

35·45 Model

Front axle shaft·axle hub			
Planet gear bush inside diameter	mm (in)	Standard	26.0 (1.024)
		Limit	25.85 (1.018)
Planet gear shaft outside diameter	mm (in)	Standard	26.0 (1.024)
		Limit	26.18 (1.031)
Front axle hub starting force (Measured at hub bolt)	N (kgf) [lbf]	Standard	49 ~ 118 (5 ~ 12) [11 ~ 26]
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Brake ASSY set nut			88.3 ~ 117.7 (900 ~ 1200) [65.1 ~ 86.8]
Hub bolt lock nut			264.8 ~ 294.2 (2700 ~ 3000) [195.3 ~ 217.1]
Front axle bracket set bolt (for fixing on frame)			245 ~ 324 (2500 ~ 3300) [180.9 ~ 238.8]
Front wheel hub nut			294.2 ~ 323.6 (3000 ~ 3300) [217.1 ~ 238.8]
Brake drum set bolt			88.3 ~ 137.3 (900 ~ 1400) [65.1 ~ 101.3]
Planet gear carrier cover set bolt			20.4 ~ 30.6 (208 ~ 312) [15.0 ~ 22.6]
Planet gear carrier set bolt			98.1 ~ 127.5 (1000 ~ 1300) [72.4 ~ 94.1]

55 Model

Front axle shaft·axle hub			
Planet gear bush inside diameter	mm (in)	Standard	26.0 (1.024)
		Limit	25.85 (1.018)
Planet gear shaft outside diameter	mm (in)	Standard	26.0 (1.024)
		Limit	26.18 (1.031)
Front axle hub starting force (Measured at hub bolt)	N (kgf) [lbf]	Standard	49 ~ 118 (5 ~ 12) [11 ~ 26]
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Brake ASSY set bolt			300.0 ~ 400.0 (3060 ~ 4080) [221.4 ~ 295.2]
Hub bolt lock nut			264.8 ~ 294.2 (2700 ~ 3000) [195.3 ~ 217.1]
Front axle bracket set bolt (for fixing on frame)			343 ~ 441 (3500 ~ 4500) [253.2 ~ 325.6]
Front wheel hub nut			294.2 ~ 323.6 (3000 ~ 3300) [217.1 ~ 238.8]
Planet gear carrier cover set bolt			20.4 ~ 30.6 (208 ~ 312) [15.0 ~ 22.6]
Planet gear carrier set bolt			98.1 ~ 127.5 (1000 ~ 1300) [72.4 ~ 94.1]

REAR AXLE

15 ~ 32 Model

Rear axle ASSY			
Rear axle ASSY front to rear clearance mm (in)		Standard	0.7 (0.028) or less
Rear axle center pin bushing inside diameter mm (in)		Limit	52.0 (2.047)
Steering knuckle			
Rear axle wheel starting force (at outer periphery of the wheel) N (kgf) [lbf]	15·18 model	Standard	6.9 ~ 20 (0.7 ~ 2.0) [1.5 ~ 4.4]
	20 ~ 32 model	Standard	9.8 ~ 29 (1.0 ~ 3.0) [2.2 ~ 6.6]
King pin outside diameter mm (in)		Limit	27.8 (1.094)
Steering knuckle starting force (at front end of knuckle) N (kgf) [lbf]		Standard	19.3 (2.0) [4.4] or less
Rear axle cylinder			
Rear axle cylinder piston rod outside diameter mm (in)	15 ~ 25 model	Limit	39.92 (1.5717)
	30·32 model	Limit	49.92 (1.9654)
Rear axle cylinder piston rod bend mm (in)		Limit	0.5 (0.020)
Rear axle cylinder inside diameter mm (in)	15·18 model	Limit	60.35 (2.3760)
	20·25 model	Limit	70.35 (2.7697)
	30·32 model	Limit	76.35 (3.0059)
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Axle bracket cap set bolt		Standard	128 ~ 175 (1310 ~ 1780) [94.78 ~ 128.8]
King pin lock bolt and lock nut		Standard	44.1 ~ 53.9 (450 ~ 550) [32.6 ~ 39.8]
Rear axle cylinder rod guide set nut	15·18 model	Standard	39 ~ 69 (400 ~ 700) [28.9 ~ 50.6]
	20 ~ 32 model	Standard	88 ~ 118 (900 ~ 1200) [65.1 ~ 86.8]
Rear axle cylinder set bolt	15·18 model	Standard	57.0 ~ 124 (580 ~ 1260) [42.0 ~ 91.16]
	20 ~ 32 model	Standard	166.7 ~ 215.8 (1700 ~ 2200) [123.0 ~ 159.1]
Steering knuekle tie rod end pin lock nut		Standard	49.0 ~ 78.5 (500 ~ 800) [36.2 ~ 57.9]
Rear axle cylinder tie rod end pin lock nut		Standard	49.0 ~ 78.5 (500 ~ 800) [36.2 ~ 57.9]

35 ~ 55 Model

Rear axle ASSY			
Rear axle ASSY front to rear clearance mm (in)		Standard	1.0 (0.039) or less
Rear axle center pin bushing inside diameter mm (in)		Limit	Front: 82.0 (3.228) Rear: 67.0 (2.638)
Steering knuckle			
Rear axle hub starting force (at tire periphery) N (kgf) [lbf]	35·45 model	Standard	29 ~ 44 (3.0 ~ 4.5) [6.6 ~ 9.9]
	55 model	Standard	31 ~ 63 (3.2 ~ 6.4) [7.1 ~ 14.1]
King pin outside diameter mm (in)		Limit	39.8 (1.567)
Steering knuckle starting force (at front end of knuckle) N (kgf) [lbf]		Standard	19.3 (2.0) [4.4] or less
Rear axle cylinder			
Rear axle cylinder piston rod outside diameter mm (in)		Limit	54.91 (2.1618)
Rear axle cylinder piston rod bend mm (in)		Limit	0.5 (0.017)
Rear axle cylinder inside diameter mm (in)	35·45 model	Limit	87.40 (3.4409)
	55 model	Limit	90.40 (3.5591)
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Axle bracket cap set bolt		Standard	128 ~ 175 (1310 ~ 1780) [94.78 ~ 128.8]
King pin lock bolt and lock nut		Standard	63.7 ~ 73.5 (650 ~ 750) [47.0 ~ 54.3]
Rear axle cylinder rod guide set nut		Standard	117.7 ~ 137.3 (1200 ~ 1400) [86.82 ~ 101.3]
Rear axle cylinder set bolt		Standard	421.7 ~ 470.7 (4300 ~ 4800) [311.1 ~ 347.3]

STEERING

Hydrostatic steering valve ASSY			
Relief pressure kPa (kgf/cm^2) [psi]	15·18 model	Standard	5790^{+490}_{0} (59^{+5}_{0}) [840^{+70}_{0}]
	20·25 model	Standard	7060^{+490}_{0} (72^{+5}_{0}) [1020^{+70}_{0}]
	30·32 model	Standard	7650^{+490}_{0} (78^{+5}_{0}) [1110^{+70}_{0}]
	35 ~ 55 model	Standard	10100^{+490}_{0} (103^{+5}_{0}) [1460^{+70}_{0}]
Tightening torque N·m (kgf-cm) [ft-lbf]			
Mast jacket set nut		Standard	34.3 ~ 53.9 (350 ~ 550) [25.3 ~ 39.8]
Steering wheel set nut		Standard	24.5 ~ 58.8 (250 ~ 600) [18.1 ~ 43.4]
Steering valve ASSY set bolt		Standard	29.4 ~ 39.2 (300 ~ 400) [21.7 ~ 28.9]
Steering valve end cap set screw		Standard	24 ~ 36 (245 ~ 367) [17.7 ~ 26.6]

BRAKE

Front brake (15·18 model)			
Hold down spring free length	mm (in)	Standard	25.5 (1.004)
Anchor to shoe spring free length	mm (in)	Standard	102.2 (4.024)
		Limit	No clearance between coil turns
Strut to shoe spring free length	mm (in)	Standard	19.7 (0.776)
Adjuster spring free length	mm (in)	Standard	99.4 (3.913)
		Limit	No clearance between coil turns
Brake lining length	mm (in)	Standard	4.9 (0.193)
		Limit	1.0 (0.039)
Wheel cylinder to piston clearance	mm (in)	Limit	0.125 (0.00492)
Brake drum inside diameter	mm (in)	Standard	254 (10.00)
		Limit	256 (10.08)
Front brake (20 ~ 32 model)			
Hold down spring free length	mm (in)	Standard	25.5 (1.004)
Anchor to shoe spring free length (On the side of lining W/pin)	mm(in)	Standard	139.3 (5.484)
		Limit	No clearance between coil turns
Anchor to shoe spring free length (On the side of lining L/ pin)	mm(in)	Standard	121.8 (4.795)
		Limit	No clearance between coil turns
Strut to shoe spring free length	mm (in)	Standard	29.8 (1.173)
Adjuster spring free length	mm (in)	Standard	126.0 (4.961)
		Limit	No clearance between coil turns
Brake lining thickness	mm (in)	Standard	5.7 (0.224)
		Limit	1.0 (0.039)
Wheel cylinder to piston clearance	mm (in)	Limit	0.15 (0.0059)
Brake drum inside diameter	mm (in)	Standard	310 (12.20)
		Limit	312 (12.28)
Front brake (35 ~ 45 model)			
Brake drum bore	mm (in)	Standard	317.5 (12.50)
		Limit	319.5 (12.58)
Hold down spring free lenght	mm (in)	Standard	Upper spring: 25.4 (1.00) Center spring: 43.7 (1.72) Lower spring: 27.8 (1.09)
Brake lining thickness	mm (in)	Standard	9.3 (0.36)
		Limit	4.3 (0.17)
Front brake (55 model)			
Brake dram bore	mm (in)	Standard	317.5 (12.50)
		Limit	319.5 (12.58)
Hold down spring free lenght	mm (in)	Standard	29.2 (1.15)
Brake lining thickness	mm (in)	Standard	10.0 (0.39)
Brake lining livet sinking	mm (in)	Limit	1.0 (0.039)
Dead-mn brake (OPT)			
Shoe return spring free lenght	mm (in)	Standard	53.2 (2.09)

Brake shoe spring free length	mm (in)	Standard	20.0 (0.79)
		Limit	18.0 (0.71)
Brake lining thickness	mm (in)	Standard	4.0 (0.16)
		Limit	1.0 (0.04)
Brake drum bore	mm (in)	Standard	160 (6.30)
		Limit	162 (6.38)
Brake booster (35 ~ 55 model)			
Master cylinder piston side clearance	mm (in)	Limit	0.032 (0.0013)
Power piston side clearance	mm (in)	Limit	0.032 (0.0013)
Parking brake (15 ~ 32 model)			
Parking brake operating force (measured at center of lever knob)	N (kgf) [lbf]	Standard	147 ~ 196 (15 ~20) [33 ~ 44]
Parking brake (35 ~ 55 model)			
Parking brake operating force (measured at center of lever knob)	N (kgf) [lbf]	Standard	196 ~ 245 (20 ~25) [44 ~ 55]
Dead-man brake cylinder			
Cylinder bore	mm (in)	Standard	70.0 (2.756)
		Limit	70.35 (2.7697)
Piston rod outside diameter	mm (in)	Standard	30.0 (1.181)
		Limit	29.92 (1.1780)
Piston rod bend	mm (in)	Limit	1.0 (0.039)
Tight tening torque Unit: N·m (kgf-cm) [ft-lbf]			
Cylinder piston castle nut		Standard	225.4 ~ 284.2 (2300 ~ 2900) [166.4 ~ 209.8]
Cylinder cover		Standard	284 ~ 421 (2900 ~ 4300) [209.8 ~ 311.1]
Brake pedal (15 ~ 32 model)			
Brake pedal height (from toe board: with pad)	mm (in)	Standard	144 ~ 149 (5.67 ~ 5.87)
Brake pedal play	mm (in)	Standard	5 ~ 9 (0.197 ~ 0.354)
Brake master cylinder push rod play	mm (in)	Standard	1 ~ 2 (0.039 ~ 0.079)
Brake pedal depressed height (with pad)	mm (in)	Standard	71 (2.80) or more
Brake pedal (35 ~ 55 model)			
Brake pedal height (from toe board: with pad)	mm (in)	Standard	144 ~ 149 (5.67 ~ 5.87)
Brake pedal play	mm (in)	Standard	5 ~ 9 (0.197 ~ 0.354)
Brake master cylinder push rod play	mm (in)	Standard	1 (0.039)
Brake pedal depreessed height (with pad)	mm (in)	Standard	71 (2.80) or more

Tightening torque Unit: N·m (kgf-cm) [ft-llf]			
Backing plate set bolt		Standard	137 ~ 196 (1400 ~ 2000) [101.3 ~ 144.7]
Wheel cylinder set bolt	1 ton series (excluding 40-7FB15)	Standard	7.85 ~ 11.77 (80 ~ 120) [5.79 ~ 8.68]
	2 ton series, 3 ton 40-7FB15	Standard	14.7 ~ 19.6 (150 ~ 200) [10.85 ~ 14.47]
	J3.5 ton	Standard	17.7 ~ 26.5 (180 ~ 270) [13.0 ~ 19.5]
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Backing plate set bolt (15 ~ 32 model)		Standard	137 ~ 196 (1400 ~ 2000) [101.3 ~ 144.7]
Wheel cylinder set bolt	15·18 model	Standard	7.85 ~ 11.77 (80 ~ 120) [5.79 ~ 8.68]
	20 ~ 32 model	Standard	17.7 ~ 26.5 (180 ~ 270) [13.0 ~ 19.5]
	55 model	Standard	17.7 ~ 26.5 (180 ~ 270) [13.0 ~ 19.5]
Brake master cylinder set nut		Standard	6.8 ~ 15.8 (69 ~ 161) [5.0 ~ 11.6]
Brake drum lock nut (dead-man brake)		Standard	157 ~ 216 (1600 ~ 2200) [115.8 ~ 159.2]
Brake backing plate set bolt (dead-man brake)		Standard	29.4 ~ 44.1 (300 ~ 450) [21.7 ~ 32.6]
Anchor pin set nut (dead-man brake)		Standard	61.78 ~ 76.49 (630 ~ 780) [24.80 ~ 30.71]

MATERIAL HANDLING SYSTEM

Natural drop test				
Natural drop	mm (in)		Limit	45 (1.77)
Natural forward tilt test				
Natural forward tilt	mm (in)	15·18 model	Standard	10 (0.39) or less
		20 ~ 45 model	Standard	15 (0.59) or less
		55 model	Standard	20 (0.79) or less
Oil leak test				
Lift cylinder oil leak amount (at lift port)	cm^3 (in^3)	15 ~ 32 model	Standard	8 (0.49) or less
		35 ~ 55 model	Standard	10 (0.61) or less
Tilt cylinder oil leak amount (total for lift and tilt)	cm^3 (in^3)	15 ~ 32 model	Standard	16 (0.98) or less
		35 ~ 55 model	Standard	20 (1.22) or less

MAST

Mast adjustment (V mast, 15 ~ 32 model)					
Mast lift roller	Inner mast roller clearance	mm (in)		Standard	0 ~ 0.8 (0 ~ 0.031)
	Outer mast roller clearance	mm (in)		Standard	0 ~ 0.5 (0 ~ 0.017)
Lift bracket roller	Middle and lower lift roller clearance	mm (in)	15·18 model	Standard	0 ~ 0.8 (0 ~ 0.031)
			20 ~ 32 model	Standard	0 ~ 0.5 (0 ~ 0.017)
	Side roller clearance	mm (in)	15·18 model	Standard	0 ~ 0.6 (0 ~ 0.024)
			20 ~ 32 model	Standard	0 ~ 0.5 (0 ~ 0.020)
Mast strip to inner mast clearance		mm (in)		Standard	0.5 ~ 1.0 (0.020 ~ 0.039)
Mast adjustment (V mast, 35 ~ 55 model)					
Mast lift roller	Inner mast roller clearance	mm (in)		Standard	0 ~ 0.8 (0 ~ 0.031)
	Outer mast roller clearance	mm (in)		Standard	0 ~ 0.8 (0 ~ 0.031)
Lift bracket roller	Lower lift roller clearance	mm (in)	35·45 model	Standard	0 ~ 0.5 (0 ~ 0.020)
	Upper side roller clearance	mm (in)		Standard	0 ~ 0.5 (0 ~ 0.020)
	Lower side roller clearance	mm (in)		Standard	0.5 ~ 1.0 (0.020 ~ 0.039)
	Side roller clearance	mm (in)	55 model	Standard	0 ~ 0.8 (0 ~ 0.031)
Mast strip to inner mast clearance		mm (in)		Standard	0 ~ 0.8 (0 ~ 0.031)
Fork					
Front end misalignment		mm (in)		Limit	10 (0.39)
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]					
Mast support cap set bolt			15 ~ 32 model	Standard	68.6 ~ 107.9 (700 ~ 1100) [50.6 ~ 79.57]
			35 ~ 55 model	Standard	147.1 ~ 343.2 (1500 ~ 3500) [108.5 ~ 253.2]

CYLINDER

Lift cylinder (V) (15 ~ 32 model)				
Piston rod outside diameter	mm (in)	15·18 model	Limit	34.85 (1.3720)
		20·25 model	Limit	41.92 (1.6504)
		30·32 model	Limit	44.92 (1.7685)
Cylinder bore	mm (in)	15·18 model	Limit	44.65 (1.7579)
		20·25 model	Limit	50.20 (1.9764)
		30·32 model	Limit	55.35 (2.1791)
Piston rod bend	mm (in)		Limit	2.0 (0.079)

Rear lift cylinder (FV·FSV·QFV)				
Piston rod outside diameter mm (in)	15·18 model	FV	Limit	31.92 (1.2567)
		FSV	Limit	Except H 4800 mm (189 in): 34.85 (1.3720) H 4800 mm (189 in): 34.92 (1.3784)
	20·25 model	FV	Limit	34.82 (1.3709)
		FSV	Limit	41.92 (1.6504)
	30·32 model	FV	Limit	39.92 (1.5717)
		FSV	Limit	44.92 (1.7685)
		QFV	Limit	49.92 (1.9654)
Cylinder bore mm (in)	15·18 model	FV	Limit	45.20 (1.7795)
		FSV	Limit	Except H 4800 mm (189 in): 44.65 (1.7579) H 4800 mm (189 in): 45.20 (1.7795)
	20·25 model	FV	Limit	50.20 (1.9764)
		FSV	Limit	50.40 (1.9843)
	30·32 model	FV	Limit	55.35 (2.1791)
		FSV	Limit	55.20 (2.1732)
		QFV	Limit	63.35 (2.4941)
Piston rod bend mm (in)			Limit	2.0 (0.079)
Lift cylinder (V) (35 ~ 55 model)				
Piston rod outside diameter mm (in)	35·45 model		Limit	50.72 (1.9969)
	55 model		Limit	54.91 (2.1618)
Cylinder bore mm (in)	35 model		Limit	65.35 (2.5728)
	45 model		Limit	70.35 (2.7697)
	55 model		Limit	75.35 (2.9665)
Piston rod bend mm (in)			Limit	2.0 (0.079)
Rear lift cylinder (FV·FSV·QFV)				
Piston rod outside diameter mm (in)	35 model	FV	Limit	44.92 (1.7685)
		FSV	Limit	50.72 (1.9969)
	45 model	FV	Limit	50.72 (1.9969)
		FSV	Limit	50.72 (1.9969)
	55 model	FSV	Limit	54.91 (2.1618)
Cylinder bore mm (in)	35 model	FV	Limit	65.35 (2.5728)
		FSV	Limit	65.35 (2.5728)
	45 model	FV	Limit	70.35 (2.7697)
		FSV	Limit	70.35 (2.7697)
	55 model	FSV	Limit	75.35 (2.9665)
Piston rod bend mm (in)			Limit	2.0 (0.079)

Front lift cylinder (FV·FSV·QFV) (15 ~ 32 model)				
Piston rod outside diameter mm (in)	15·18 model	FV	Limit	50.72 (1.9969)
		FSV	Limit	Except H 4800 mm (189 in):50.72 (1.9969) H 4800 mm (189 in): 49.92 (1.9654)
	20 ~ 32 model	FV	Limit	50.72 (1.9969)
		FSV	Limit	↑
Cylinder bore mm (in)	15·18 model	FV	Limit	70.35 (2.7697)
		FSV	Limit	Except H 4800 mm (189 in):70.35 (2.7697) H 4800 mm (189 in): 70.35 (2.7697)
	20·25 model	FV	Limit	75.35 (2.9665)
		FSV	Limit	↑
	30·32 model	FV	Limit	85.40 (3.3622)
		FSV	Limit	↑
	20 ~ 30 model	QFV	Limit	75.35 (2.9665)
Piston rod bend mm (in)			Limit	2.0 (0.079)
Front lift cylinder (FV·FSV) (35 ~ 55 model)				
Piston rod outside diameter mm (in)			Limit	69.91 (2.7524)
Cylinder bore mm (in)	35 model		Limit	95.40 (3.7559)
	45 model		Limit	105.40 (4.1496)
	55 model		Limit	110.40 (4.3465)
Piston rod bend mm (in)			Limit	2.0 (0.079)
Tilt cylinder				
Cylinder bore mm (in)	15 ~ 32 model		Limit	70.35 (2.7697)
	35·45 model		Limit	90.40 (3.5591)
	55 model		Limit	100.40 (3.9528)
Piston rod outside diameter mm (in)	15 ~ 32 model		Limit	29.92 (1.1780)
	35·45 model		Limit	39.92 (1.5717)
	55 model		Limit	44.92 (1.7685)
Piston rod bend mm (in)			Limit	1.0 (0.039)
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]				
Lift cylinder cover	15·18 model		170 ~ 237 (1730 ~ 2419) [125 ~ 175]	
	20·25 model		230 ~ 265 (2345 ~ 2703) [170 ~ 195]	
	30·32 model		264 ~ 305 (2695 ~ 3110) [175 ~ 225]	
	35 model		325 ~ 353 (3310 ~ 3600) [240 ~ 260]	
	45 model		352 ~ 380 (3590 ~ 3870) [260 ~ 280]	
	55 model		380 ~ 407 (3870 ~ 4150) [280 ~ 300]	

Rear lift cylinder cover (FV)	15·18 model	169 ~ 237 (1728 ~ 2419) [125 ~ 175]
	20·25 model	203 ~ 271 (2073 ~ 2764) [150 ~ 200]
	30·32 model	237 ~ 305 (2419 ~ 3110) [175 ~ 225]
	35 model	325 ~ 353 (3320 ~ 3590) [240 ~ 260]
	45 model	352 ~ 380 (3590 ~ 3870) [260 ~ 280]
Rear lift cylinder cover (FSV)	15·18 model	Except H 4800 mm (189 in): 169 ~ 237 (1728 ~ 2419) [125 ~ 175]
		H 4800 mm (189 in): 200 ~ 340 (2000 ~ 3500) [145 ~ 253]
	20·25 model	230 ~ 265 (2345 ~ 2702) [170 ~ 195]
	30·32 model	237 ~ 305 (2419 ~ 3110) [175 ~ 225]
	35 model	325 ~ 353 (3320 ~ 3590) [240 ~ 260]
	45 model	352 ~ 380 (3590 ~ 3870) [260 ~ 280]
	55 model	380 ~ 407 (3870 ~ 4150) [280 ~ 300]
Flow regulator valve	35 ~ 55 model	88.3 ~ 98.1 (900 ~ 1000) [65.1 ~ 72.4]
Safety down valve	35 ~ 55 model	58.8 ~ 68.6 (600 ~ 700) [43.4 ~ 50.6]
Front lift cylinder cover (FV)	15·18 model	305 ~ 373 (3110 ~ 3801) [225 ~ 275]
	20·25 model	339 ~ 407 (3455 ~ 4147) [250 ~ 300]
	30·32 model	420 ~ 454 (4283 ~ 4630) [310 ~ 335]
	35 model	488 ~ 515 (4976 ~ 5252) [360 ~ 380]
	45 model	542 ~ 569 (5523 ~ 5802) [400 ~ 420]
Front lift cylinder cover (FSV)	15·18 model	Except H 4800 mm (189 in): 305 ~ 373 (3110 ~ 3801) [225 ~ 275]
		H 4800 mm (189 in): 343 ~ 441 (3500 ~ 4500) [253 ~ 326]
	20·25 model	339 ~ 407 (3455 ~ 4147) [250 ~ 300]
	30·32 model	420 ~ 454 (4283 ~ 4630) [310 ~ 335]
	35 model	488 ~ 515 (4976 ~ 5252) [360 ~ 380]
	45 model	542 ~ 569 (5530 ~ 5810) [400 ~ 420]
	55 model	569 ~ 596 (5810 ~ 6080) [420 ~ 440]
Front lift cylinder cover (QFV)	20·25 model	339 ~ 407 (3455 ~ 4147) [250 ~ 300]
Tilt cylinder piston castle nut	15 ~ 32 model	225.4 ~ 284.2 (2300 ~ 2900) [166.4 ~ 209.8]
	35 ~ 55 model	245.2 ~ 343.2 (2500 ~ 3500) [180.9 ~ 253.2]
Tilt cylinder cover	15 ~ 32 model	284.4 ~ 421.7 (2900 ~ 4300) [209.8 ~ 311.1]
	35 ~ 55 model	343.2 ~ 441.3 (3500 ~ 4500) [253.2 ~ 325.5]

OIL PUMP

Oil pump ASSY (15 ~ 32 model, 35 ~ 55 model No.2 pump)			
Bushing axial length	mm (in)	Limit	26.411 (1.03980)
Gear shaft outside diameter	mm (in)	Limit	18.935 (0.74547)
Body inside surface flaw depth	mm (in)	Limit	0.1 (0.004)
Oil pump ASSY (35 ~ 55 model No.1 pump)			
Side plate thickness	mm (in)	Limit	0.15 (0.0059) or less at LBC surface
Gear shaft outside diameter	mm (in)	Limit	21.997 (0.86602)
Gear tooth width	mm (in)	Limit	33.3 (1.311)
Body inside surface flaw depth	mm (in)	Standard	0.01 ~ 0.06 (0.0004 ~ 0.0024)
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Outlet housing set bolt (15 ~ 32 model, 35 ~ 55 model No.2 pump)		Standard	46.1 ~ 48.6 (470 ~ 500) [34.0 ~ 36.2]
Outlet housing set bolt (35 ~ 55 model No.1 pump)		Standard	88 ~ 98 (897.4 ~ 999.3) [64.9 ~ 72.3]

OIL CONTROL VALVE

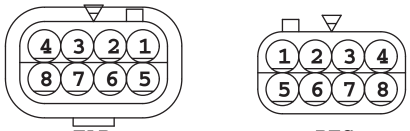
Oil control valve			
Relief set pressure KPa (kgf/cm^2) [psi]	Lift	15 ~ 32 model	17160^{+490}_{0} (175^{+5}_{0}) $[2490^{+70}_{0}]$
		35 ~ 55 model	18140^{+490}_{0} (185^{+5}_{0}) $[2630^{+70}_{0}]$
	Tilt	15 ~ 32 model	15690^{+490}_{0} (160^{+5}_{0}) $[2280^{+70}_{0}]$
Tightening torque Unit: N·m (kgf-cm) [ft-lbf]			
Outlet housing set bolt		All model	34.3 ~ 44.1 (350 ~ 450) [25.3 ~ 32.6]
Lift lock unlocking bolt		15 ~ 32 model	3.54 ~ 4.31 (36 ~ 44) [2.60 ~ 3.18]

SAS

Tightening torque Unit: N·m (kgf-cm) [ft-lbf]		
SAS controller set bolt	Standard	10 ~ 15 (102 ~ 153) [7.3 ~ 11.1]
Swing lock cylinder pin set bolt	Standard	19 ~ 37 (190 ~ 370) [13.7 ~ 26.8]
Tilt angle sensor set bolt	Standard	6.9 ~ 16.1 (70 ~ 161) [5.0 ~ 11.6]
Load sensor	Standard	35.3 ~ 43.1 (360 ~ 440) [26.0 ~ 31.8]
Fork height switch ASSY set bolt	Standard	14.4 ~ 33.6 (147 ~ 343) [10.6 ~ 24.8]

CONNECTOR DRAWING (15 ~ 32 MODEL)

CN1



TAB

NO	P	C	J
1	14	BR	CN70-30
2	16	GR	CN70-14
3	141	LG	CN70-22
4	143	O	CN70-24
5	138	Y	CN70-5
6	137	G	CN70-4
7	144	SL	CN70-23
8	142	P	CN70-21

REC

NO	P	C	J
1	14	BR	CN111-13
2	16	GR	CN111-5
3	141	LG	CN103-8
4	143	O	CN103-6
5	138	Y	CN141-10
6	137	G	CN141-1
7	144	SL	CN103-5
8	142	P	CN103-7

CN3

TAB

NO	P	C	J
1	101	R	B
2	104	G	T
3	102	R-G	HS
4	107	R-Y	HM

REC

NO	P	C	J
1	101	R	CN29-1
2	104	G	CN29-2
3	102	Y	CN29-4
4	107	V	CN29-5

CN4

TAB

NO	P	C	J
1	41	-	AM
4	43	-	IG

REC

NO	P	C	J
1	41	Y	CN29-3
4	43	L	CN29-6

CN4 (OPT)

TAB

NO	P	C	J
2	41	-	AM
4	43	-	IG

REC

NO	P	C	J
2	41	Y	CN29-3
4	43	L	CN29-6

CN5

TAB

NO	P	C	J
1	101	R	LS_{ST}
2	111	SL	LS_{ST}

REC

NO	P	C	J
1	101	R	J10
2	111	SL	CN38-2

CN6

TAB

NO	P	C	J
1	51	R	LS_B
2	65	BR	LS_B

REC

NO	P	C	J
1	51	R	CN37-1
2	65	BR	CN101-3

CN8

TAB

NO	P	C	J
1	41	GY	$SW_{H(+)}$
2	48	WB	$SW_{H(-)}$
3	110	GW	$SW_{F(B)}$
4	108	G	$SW_{F(R)}$
5	109	GR	$SW_{F(L)}$
6			

REC

NO	P	C	J
1	41	Y	J3
2	48	P	H
3	110	GR	CN12-2
4	108	BR	CN13-4
5	109	G-Y	CN17-4
6			

CN9

TAB

NO	P	C	J
1	51	O	DSF,DSR
2	120	B	DSFO
3	103	G	DSBU
4	46	W-O	DSR
5	45	W-BR	DSF
6	43	R	DSFO,DSBU

REC

NO	P	C	J
1	51	R	CN37-12
2	120	G-Y	CN24-1
3	103	O	CN23-1
4	46	SL	CN101-2
5	45	G	CN101-1
6	43	L	J2

CN11

TAB

NO	P	C	J
1	60	G-Y	LS_L
2	51	R	NO
3	63	L	LS_{ATT}

REC

NO	P	C	J
1	60	G-Y	CN101-8
2	51	R	CN37-3
3	63	L	CN101-6

CN12

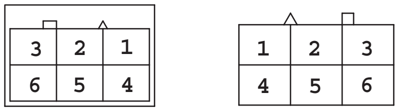
TAB

NO	P	C	J
1	43	-	FRY
2	110	-	FRY

REC

NO	P	C	J
1	43	L	J2
2	110	GR	CN8-3

CN13



TAB

NO	P	C	J
1	N1	W	CN14-3
2	104	G	CN14-4
3	102	Y	CN16-1
4	108	G-Y	CN14-1
5	N1	W	CN14-2
6	101	R	CN96-7

REC

NO	P	C	J
1	N1	W	CN37-16
2	104	G	J11
3	102	Y	J12
4	108	BR	CN8-4
5	N1	W	CN37-15
6	101	R	J10

CN14

TAB

NO	P	C	J
1	108	G	LF-R
2	N1	Y	LF-R
3	N1	W	LC-R
4	104	R	LC-R

REC

NO	P	C	J
1	108	G-Y	CN13-4
2	N1	W	CN13-5
3	N1	W	CN13-1
4	104	G	CN13-2

CN15

TAB

NO	P	C	J
1	51	-	LS_{PB}
2	66	-	LS_{PB}

REC

NO	P	C	J
1	51	R	CN37-2
2	66	V	CN101-4

CN16

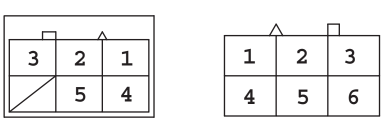
TAB

NO	P	C	J
1	102	B	H/L
2	N1	B	H/L

REC

NO	P	C	J
1	102	Y	CN13-3
2	N1	W	J24

CN17



TAB

NO	P	C	J
1	N1	W	CN18-3
2	104	G	CN18-4
3	102	Y	CN20-1
4	109	G-Y	CN18-1
5	N1	W	CN18-2
6			

REC

NO	P	C	J
1	N1	W	CN37-7
2	104	G	CN29-2
3	102	Y	CN29-4
4	109	G-Y	CN8-5
5	N1	W	CN37-6
6			

CN18

TAB

NO	P	C	J
1	109	G	LF-L
2	N1	Y	LF-L
3	N1	W	LC-L
4	104	R	LC-L

REC

NO	P	C	J
1	109	G-Y	CN17-4
2	N1	W	CN17-5
3	N1	W	CN17-1
4	104	G	CN17-2

CN19

TAB

NO	P	C	J
1	338	R	STS+
2			
3	315	B	STS-
4	312	W	STS1
5	313	G	STS2
6			

REC

NO	P	C	J
1	338	GR	CN111-3
2			
3	315	BR	CN111-9
4	312	G	CN28-2
5	313	P	CN28-3
6			

CN20

TAB

NO	P	C	J
1	102	B	H/L
2	N1	B	H/L

REC

NO	P	C	J
1	102	Y	CN17-3
2	N1	W	J24

CN22

TAB

NO	P	C	J
1	304	P	LS_{DS}
2	320	R	LS_{DS}

REC

NO	P	C	J
1	304	P	CN94-1
2	320	R	CN94-2

CN23

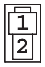
TAB

NO	P	C	J
1	103	R-W	CHI
2	N1	B	CHI

REC

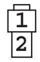
NO	P	C	J
1	103	O	CN9-3
2	N1	W	N1

CN23-2



TAB

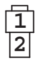
NO	P	C	J
1	103	R	BZ
2	N1	B	BZ



REC

NO	P	C	J
1	103	O	CN33-3
2	N1	W	J25

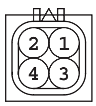
CN24



REC

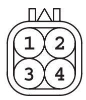
NO	P	C	J
1	120	G-Y	CN9-2
2	N1	W	CN37-5

CN25



TAB

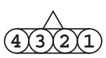
NO	P	C	J
1	52	SL	CN26-3
2	53	Y	CN26-4
3	50	R	CN26-1
4	64	GR	CN26-2



REC

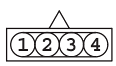
NO	P	C	J
1	52	SL	CN102-2
2	53	Y	CN102-11
3	50	R	CN102-8
4	64	GR	CN102-1

CN26



TAB

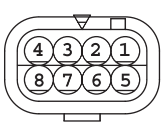
NO	P	C	J
1	50	-	E2
2	64	-	IDL
3	52	-	VTA
4	53	-	VC



REC

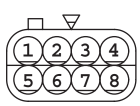
NO	P	C	J
1	50	R	CN25-3
2	64	GR	CN25-4
3	52	SL	CN25-1
4	53	Y	CN25-2

CN28



TAB

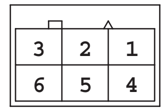
NO	P	C	J
1	43	L	CN145-1
2	312	G	CN145-3
3	313	P	CN145-4
4	315	BR	CN145-5
5	342	LG	CN145-8
6	343	SL	CN145-9
7	345	Y	CN145-10
8	346	V	CN145-11



REC

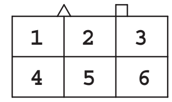
NO	P	C	J
1	43	L	J2
2	312	G	CN19-4
3	313	P	CN19-5
4	315	BR	J1
5	342	LG	CN101-15
6	343	SL	CN101-14
7	345	Y	CN103-12
8	346	V	CN103-13

CN29



TAB

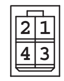
NO	P	C	J
1	101	R	CN3-1
2	104	G	CN3-2
3	41	Y	CN4-1
4	102	Y	CN3-3
5	107	V	CN3-4
6	43	L	CN4-4



REC

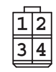
NO	P	C	J
1	101	R	CN136-1
2	104	G	CN17-2
3	41	Y	CN136-2
4	102	Y	CN17-3
5	107	V	CN38-5
6	CN	L	CN38-3

CN31



TAB

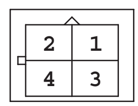
NO	P	C	J
1	104	L	TL
2	111	L	STP
3	109	L	TRN
4	N1	L	E



REC

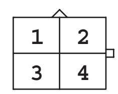
NO	P	C	J
1	104	G	CN38-4
2	111	SL	CN38-2
3	109	G-Y	CN38-6
4	N1	W	CN38-8

CN33



TAB

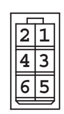
NO	P	C	J
1	107	V	CN35-1
2	N1	W	CN35-2
3	103	O	CN23-2-1
4	43	L	LR



REC

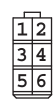
NO	P	C	J
1	107	V	CN38-7
2	N1	W	J23
3	103	O	J21
4	43	L	CN38-1

CN34



TAB

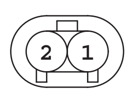
NO	P	C	J
1	104	R	TL
2	111	R	STP
3	103	R	B/U
4			
5	108	R	TRN
6	N1	R	E



REC

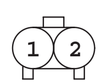
NO	P	C	J
1	104	G	J22
2	111	SL	J20
3	103	O	CN38-3
4			
5	108	BR	CN38-5
6	N1	W	J23

CN35



TAB

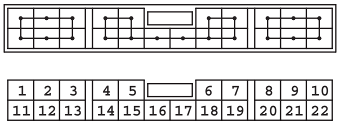
NO	P	C	J
1	107	B	W/L
2	N1	B	W/L



REC

NO	P	C	J
1	107	V	CN33-1
2	N1	W	CN33-2

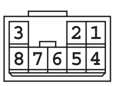
CN37



REC

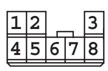
NO	P	C	J
1	51	R	CN6-1
2	51	R	CN15-1
3	51	R	CN11-2
4	N1	W	J13
5	N1	W	CN24-2
6	N1	W	CN17-5
7	N1	W	CN17-1
8	320	R	CN87-4
9	320	R	CN87-2
10	320	R	CN94-2
11	51	R	CN39-2
12	51	R	CN9-1
13	51	R	CN101-12
14			
15	N1	W	CN13-5
16	N1	W	CN13-1
17	N1	W	CN38-4
18	N1	W	H
19			
20	320	R	CN90-8
21	320	R	CN90-2
22	320	R	CN141-11

CN38



TAB

NO	P	C	J
1	43	L	CN29-6
2	111	SL	CN5-2
3	103	O	J7
4	104	G	J11
5	108	BR	J8
6	109	G-Y	J9
7	107	V	CN29-5
8	N1	W	CN37-17



REC

NO	P	C	J
1	43	L	CN33-4
2	111	SL	CN31-2
3	103	O	CN34-3
4	104	G	CN31-1
5	108	BR	CN34-5
6	109	G-Y	CN31-3
7	107	V	CN33-1
8	N1	W	CN31-4

CN39

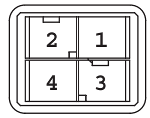
TAB

NO	P	C	J
1	68	V	LSL2
2	51	R	LSL2

REC

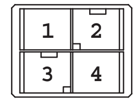
NO	P	C	J
1	68	O	CN101-10
2	51	R	CN37-11

CN40



TAB

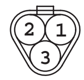
NO	P	C	J
1	P22	W	MPS terminal
2	P1	R	F3 fuse
3	9	G	MPS(-)
4	10	Y	MPS(+)



REC

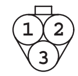
NO	P	C	J
1	P22	G	CN50-1
2	P1	R	P1 terminal
3	9	O	CN55-2
4	10	G	CN55-1

CN41



TAB

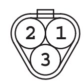
NO	P	C	J
1	89	V	CN44-1
2	88	L	CN44-2
3	193	G	CN44-3



REC

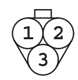
NO	P	C	J
1	89	V	CN102-7
2	88	L	CN102-6
3	193	G	CN101-17

CN44



TAB

NO	P	C	J
1	89	-	DM_P
2	88	-	DM_P
3	193	-	DM_P



REC

NO	P	C	J
1	89	V	CN41-1
2	88	L	CN41-2
3	193	G	CN41-3

CN45

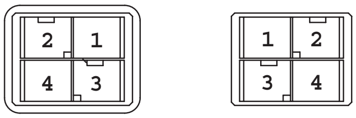
TAB

NO	P	C	J
1	196	GR	CN55-3

REC

NO	P	C	J
1	196	-	DM_{PS}

CN51



TAB

NO	P	C	J
1	P21	W	FET/C1
2	P1	R	F3 fuse
3	P23	G	FET/C2E1
4	N1	B	shunt

REC

NO	P	C	J
1	P21	G	CN50-1
2	P1	R	P1 terminal
3	P23	W	CN50-2
4	N1	B	N1 terminal

CN52

TAB

NO	P	C	J
1	87	-	STMD
2	86	-	STMD

REC

NO	P	C	J
1	87	P	CN57-6
2	86	O	CN57-4

CN53

TAB

NO	P	C	J
1	81	-	SSD1
2	80	-	SSD1

REC

NO	P	C	J
1	81	G	CN57-2
2	80	B	CN57-1

CN54

TAB

NO	P	C	J
1	82	-	SSD2
2	80	-	SSD2

REC

NO	P	C	J
1	82	BR	CN57-3
2	80	B	J26

CN55

TAB

NO	P	C	J
1	10	G	CN40-4
2	9	O	CN40-3
3	196	GR	CN45-1

REC

NO	P	C	J
1	10	G	CN111-2
2	9	O	CN111-8
3	196	GR	CN101-16

CN57

TAB

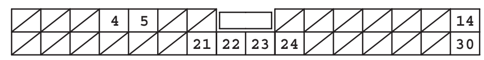
NO	P	C	J
1	80	B	CN53-2
2	81	G	CN53-1
3	82	BR	CN54-1
4	86	O	CN52-2
5			
6	87	P	CN52-1

REC

NO	P	C	J
1	80	B	CN102-3
2	81	G	CN102-5
3	82	BR	CN102-4
4	86	O	CN102-9
5			
6	87	P	CN102-10

CN70

REC



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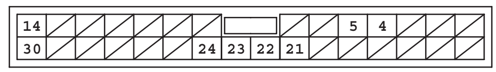


TAB

NO	P	C	J
4	137	-	SL/L+
5	138	-	SL/L-
14	16	-	D15V
21	142	-	SDTMA
22	141	-	SMTDA
23	144	-	SMTDK
24	143	-	SDTMK
30	14	-	GNDD

REC

NO	P	C	J
4	137	G	CN1-6
5	138	Y	CN1-5
14	16	GR	CN1-2
21	142	P	CN1-8
22	141	LG	CN1-3
23	144	SL	CN1-7
24	143	O	CN1-4
30	14	BR	CN1-1

CN82

TAB

NO	P	C	J
1	331	-	SOLLD+
2	334	-	SOLD-

REC

NO	P	C	J
1	331	GR	CN94-5
2	334	O	CN94-6

CN85

TAB

NO	P	C	J
1	70	-	SW_{TK}
2	320	-	SW_{TK}

REC

NO	P	C	J
1	70	BR	CN142-4
2	320	R	J4

CN86

TAB

NO	P	C	J
1	57	-	POTT+
2	56	-	POTT
3	320	-	SPOT-

REC

NO	P	C	J
1	57	V	CN141-2
2	56	G	CN141-3
3	320	R	J4

CN87

TAB

NO	P	C	J
1	305	G-R	STLSTF
2	320	R-L	SPOT-
3	306	L	STLSTR
4	320	R-L	SPOT-

REC

NO	P	C	J
1	305	G	CN142-9
2	320	R	CN37-9
3	306	L	CN142-10
4	320	R	CN37-8

CN88

TAB

NO	P	C	J
1	331	R	SOLLD+
2	332	B	SOLL-

REC

NO	P	C	J
1	331	GR	CN143-8
2	332	BR	CN143-5

CN89

TAB

NO	P	C	J
1	327	R	SOLTS+
2	330	B	SOLT-

REC

NO	P	C	J
1	327	L	CN143-7
2	330	P	CN143-1

CN90

TAB

NO	P	C	J
1	91	GR	CN92-3
2	320	R	CN92-1
3	59	Y	CN91-2
4	58	L	CN91-3
5			
6	90	SL	CN92-2
7			
8	320	R	CN91-1

REC

NO	P	C	J
1	91	GR	CN142-3
2	320	R	CN37-21
3	59	Y	CN141-12
4	58	L	CN141-4
5			
6	90	SL	CN142-2
7			
8	320	R	CN37-20

CN91

TAB

NO	P	C	J
1	320	-	STPOT-
2	59	-	SPL
3	58	-	SPL+

REC

NO	P	C	J
1	320	R	CN90-8
2	59	Y	CN90-3
3	58	L	CN90-4

CN92

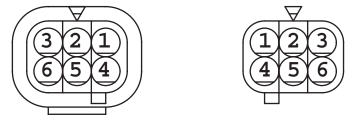
TAB

NO	P	C	J
1	320	R	CN90-2
2	90	SL	CN90-6
3	91	GR	CN90-1

REC

NO	P	C	J
1	320	-	SWMH1
2	90	-	SWMH1
3	91	-	SWMH1

CN94



TAB

NO	P	C	J
1	304	P	CN22-1
2	320	R	CN22-2
3	327	L	CN95-1
4	328	Y	CN95-2
5	331	GR	CN82-1
6	334	O	CN82-2

REC

NO	P	C	J
1	304	P	CN142-8
2	320	R	CN37-10
3	327	L	J5
4	328	Y	CN143-2
5	331	GR	J6
6	334	O	CN143-3

CN95

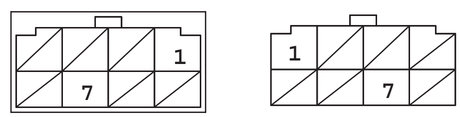
TAB

NO	P	C	J
1	327	-	SOL_S
2	328	-	SOL_S

REC

NO	P	C	J
1	327	L	CN94-3
2	328	Y	CN94-4

CN96



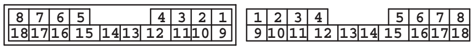
TAB

NO	P	C	J
1	320	-	STPOT-
7	59	-	SPL

REC

NO	P	C	J
1	112	SL	CLMP
7	59	Y	CN13-6

CN101



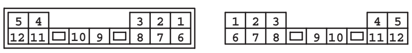
TAB

NO	P	C	J
1	45	_	DSF
2	46	_	DSR
3	65	_	LSB
4	66	_	LSPB
5	67	_	LSD
6	63	_	LSAT1
7	61	_	LST
8	60	_	LSL1
9			
10	68	_	DSL2
11	69	_	DSAT2
12	51	_	LS-
13			
14	343	_	ISPS-
15	342	_	ISPS+
16	196	_	BMPS
17	193	_	BMP
18			

REC

NO	P	C	J
1	45	G	CN9-5
2	46	SL	CN9-4
3	65	BR	CN6-2
4	66	V	CN15-2
5	67	G-Y	CN141-17
6	63	L	CN11-3
7	61	LG	CN141-15
8	60	G-Y	CN11-1
9			
10	68	O	CN39-1
11			
12	51	R	CN37-13
13			
14	343	SL	CN28-6
15	342	LG	CN28-5
16	196	GR	CN55-3
17	193	G	CN41-3
18			

CN102



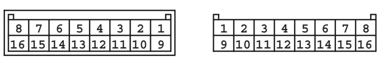
TAB

NO	P	C	J
1	64	_	SWAC
2	52	_	POTA
3	80	_	SSD+
4	82	_	SSD2
5	81	_	SSD1
6	88	_	TP+
7	89	_	TP-
8	50	_	POT-
9	86	_	TD+
10	87	_	TD-
11	53	_	POTA+
12			

REC

NO	P	C	J
1	64	GR	CN25-4
2	52	SL	CN25-1
3	80	B	CN57-1
4	82	BR	CN57-3
5	81	G	CN57-2
6	88	L	CN41-2
7	89	V	CN41-1
8	50	R	CN25-3
9	86	O	CN57-4
10	87	P	CN57-6
11	53	Y	CN25-2
12			

CN103



TAB

NO	P	C	J
1	307	_	SMTSA
2	308	_	SMTSK
3	309	_	SSTMA
4	310	_	SSTMK
5	144	_	SMTDK
6	143	_	SDTMK
7	142	_	SDTMA
8	141	_	SMTDA
9	326	_	SS0-
10	324	_	SS0+
11			
12	345	_	ERR+
13	346	_	ERR-
14			
15			
16			

REC

NO	P	C	J
1	307	SL	CN141-6
2	308	V	CN141-8
3	309	P	CN141-5
4	310	LG	CN141-7
5	144	SL	CN1-7
6	143	O	CN1-4
7	142	P	CN1-8
8	141	LG	CN1-3
9	326	GR	CN141-14
10	324	BR	CN141-13
11			
12	345	Y	CN28-7
13	346	V	CN28-8
14			
15			
16			

CN111

TAB

NO	P	C	J
1	41	-	B48V
2	10	-	MPS+
3	338	-	(H15V+)
4	11	-	S20V+
5	16	-	D15V
6	43	-	VBKY
7			
8	9	-	MPS-
9	315	-	V20V-(H15V-)
10	338	-	B20V+
11	44	-	VBMB
12	12	-	S20V-
13	14	-	GNDO
14			

REC

NO	P	C	J
1	41	Y	J3
2	10	G	CN55-1
3	338	GR	CN19-1
4	11	G-Y	CN142-5
5	16	GR	CN1-2
6	43	L	J2
7			
8	9	O	CN55-2
9	315	BR	CN19-3
10			
11			
12	12	V	CN142-11
13	14	BR	CN1-1
14			

CN136

TAB

NO	P	C	J
1	101	R	CN29-1
2	41	Y	CN29-3
3	N2	O	CN142-7
4	303	LG	CN142-1

REC

NO	P	C	J
1	101	R	F4
2	41	Y	F5
3	N2	O	CN137-2
4	303	LG	F7

CN137

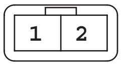
TAB

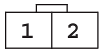
NO	P	C	J
1	2		MB-
2	N2		N2
3	1		MB+
4	6		MP-
5	5		MP+
6	44		F6

REC

NO	P	C	J
1	2		MB-
2	N2		N2
3	1		MB+
4	6		MP-
5	5		MP+
6	44		F6

CN139





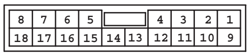
TAB

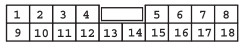
NO	P	C	J
1	18		FAN3+
2	N2		FAN3-

REC

NO	P	C	J
1	18		FAN3+
2	N2		FAN3-

CN141





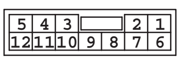
TAB

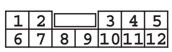
NO	P	C	J
1	137	-	SL/L+
2	57	-	POTT+
3	56	-	POTT
4	58	-	SPL+
5	309	-	SSTMA
6	307	-	SSTSA
7	310	-	SSTMK
8	308	-	SMTSK
9	51	-	OLSD-
10	138	-	SL/L-
11	320	-	STPOT-
12	59	-	SPL
13	324	-	SS+
14	326	-	SS-
15	61	-	OLST+
16	51	-	OLST-
17	67	-	OLSD+
18			

REC

NO	P	C	J
1	137	G	CN1-6
2	57	V	CN86-1
3	56	G	CN86-2
4	58	L	CN90-4
5	309	P	CN103-3
6	307	SL	CN103-1
7	310	LG	CN103-4
8	308	V	CN103-2
9	51	R	J14
10	138	Y	CN1-5
11	320	R	CN37-22
12	59	Y	CN90-3
13	324	BR	CN103-10
14	326	GR	CN103-9
15	61	LG	CN101-7
16	51	R	J14
17	67	G-Y	CN101-5
18			

CN142





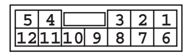
TAB

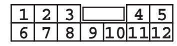
NO	P	C	J
1	303	-	VBMB2
2	90	-	MH1
3	91	-	MH2-1
4	70	-	SWTK
5	11	-	S20V+
6	(N2)	-	(N2)
7	N2	-	N2
8	304	-	STLSD
9	305	-	STLSTF
10	306	-	STLSTR
11	12	-	S20V-
12	(12)	-	(S20V-)

REC

NO	P	C	J
1	303	LG	CN136-4
2	90	SL	CN90-6
3	91	GR	CN90-1
4	70	BR	CN85-1
5	11	G-Y	CN111-4
6			
7	N2	O	CN136-3
8	304	P	CN94-1
9	305	G	CN87-1
10	306	L	CN87-3
11	12	V	CN111-12
12			

CN143





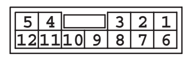
TAB

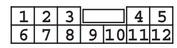
NO	P	C	J
1	330	-	SOLT-
2	328	-	SOLS-
3	334	-	SOLD-
4		-	
5	332	-	SOLL-
6	(327)	-	(SOLTS+)
7	327	-	SOLTS+
8	331	-	SOLLD+
9		-	SXTSA
10		-	SSTXA
11		-	SXTSK
12		-	SSTXK

REC

NO	P	C	J
1	330	P	CN89-2
2	328	Y	CN94-4
3	334	O	CN94-6
4			
5	332	BR	CN88-2
6			
7	327	L	CN89-1
8	331	GR	CN88-1
9			
10			
11			
12			

CN145 (OPT)





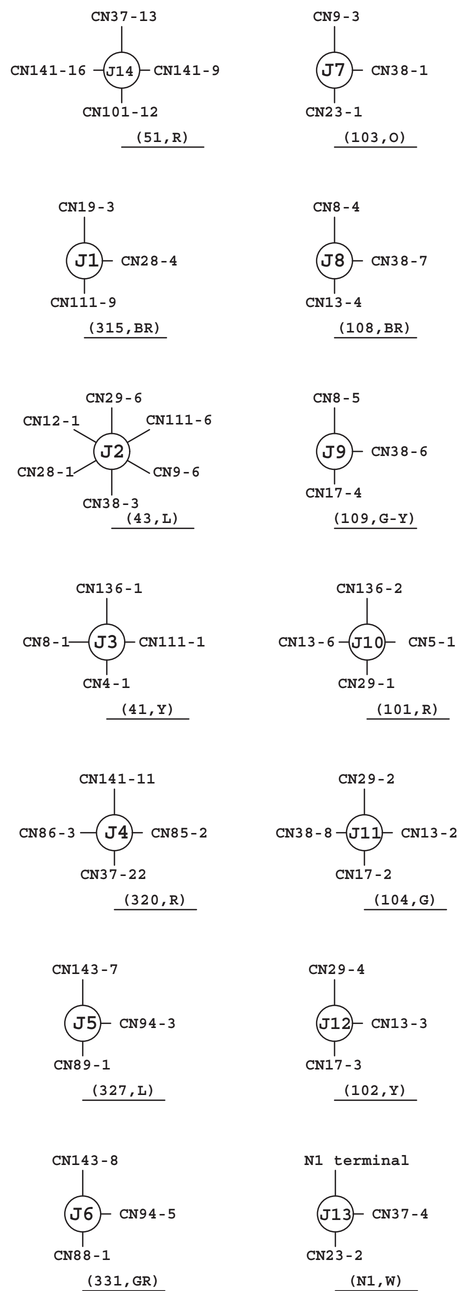
TAB

NO	P	C	J
1	43	-	VBKY
2			
3	312	-	STS1
4	313	-	STS2
5	315	-	STS-
6			
7			
8	342	-	ASTPA
9	343	-	ASTPK
10	345	-	ERR+
11	346	-	ER-
12			

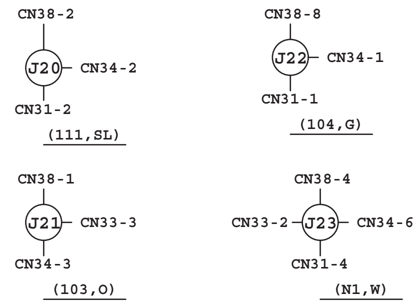
REC

NO	P	C	J
1	43	L	CN28-1
2			
3	312	G	CN28-2
4	313	P	CN28-3
5	315	BR	CN28-4
6			
7			
8	342	LG	CN28-5
9	343	SL	CN28-6
10	345	Y	CN28-7
11	346	V	CN28-8
12			

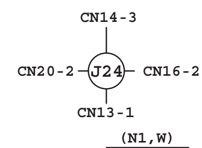
Main harness joint



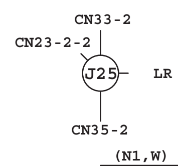
Rear-upper harness joint



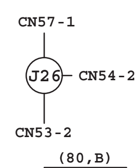
Front pillar harness joint



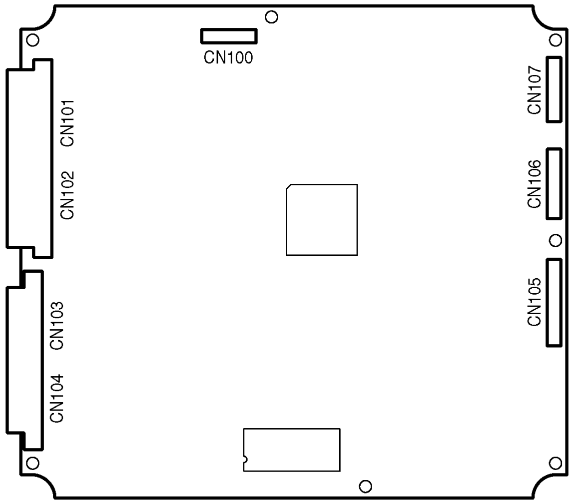
Rear option harness joint



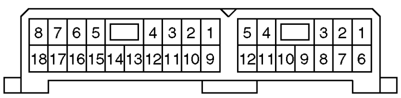
Drive motor harness joint



CPU BOARD CONNECTOR



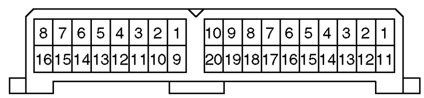
CN 101 CN 102



No.	P	J
1	45	DSF
2	46	DSR
3	65	LSB
4	66	LSPB
5	67	LSD
6	63	LSAT1
7	61	LST
8	60	LSL1
9	—	LSOPT1
10	68	LSL2
11	69	LSAT2
12	51	LS-
13	—	OPT0
14	343	ISPS-
15	342	ISPS+
16	196	BMPS
17	193	BMP
18	—	LSOPT2

No.	P	J
1	64	SWAC
2	52	POTA
3	80	SSD+
4	82	SSD2
5	81	SSD1
6	88	TP+
7	89	TP-
8	50	POT-
9	86	TD+
10	87	TD-
11	53	POTA+
12	—	—

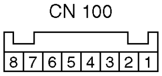
CN 103 CN 104



No.	P	J
1	307	SMTSA
2	308	SMTSK
3	309	SSTMA
4	310	SSTMK
5	144	SMTDK
6	143	SDTMK
7	142	SDTMA
8	141	SMTDA
9	326	SSO16-
10	324	SSO+
11	—	—
12	345	ERR+
13	346	ERR-
14	—	—
15	—	—
16	—	—

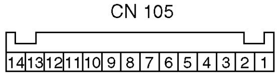
No.	P	J
1	44	VBMB
2	15	C15V
3	P4	VBP4
4	75	CSD+
5	75	CSP+
6	71	CSDA
7	72	CSDB
8	73	CSP
9	54	CSBATT
10	79	THCP
11	—	—
12	76	CSP-
13	76	CSD-
14	14	GNDC
15	77	THC+
16	41	VBBT
17	N2	N2
18	43	VBKY
19	78	THCD
20	—	—

CN 100



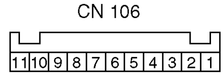
No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	MD2
6	—	FRES
7	—	FRXD
8	—	SELR

CN 105



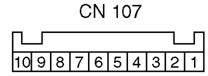
No.	P	J
1	38	FAN+
2	38	FAN+
3	36	FANCD
4	19	20VNO, 20N
5	—	—
6	39	DDC
7	40	PDC
8	94	CKFAND+
9	97	CKFAND-
10	13	20VNO, 10N
11	37	CK20V
12	—	—
13	—	—
14	—	—

CN 106



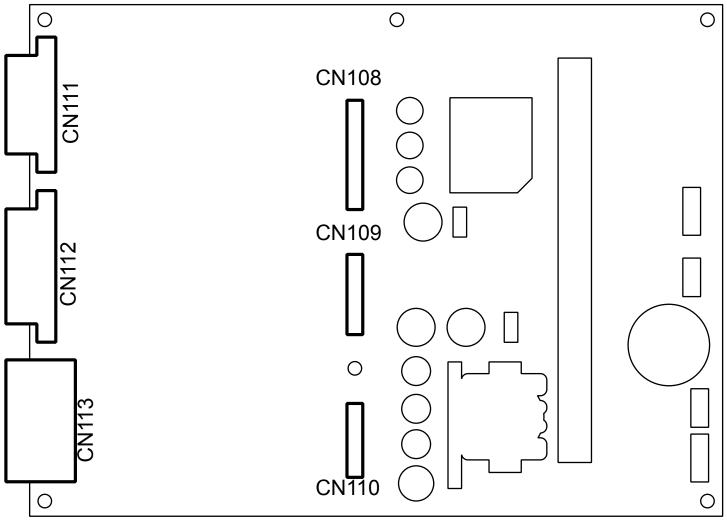
No.	P	J
1	—	—
2	27	CHOPB
3	28	CHOPP
4	29	CHOPS
5	31	OCL
6	—	—
7	32	TMPAD-
8	33	TMPD+
9	35	CKPV
10	—	—
11	—	—

CN 107

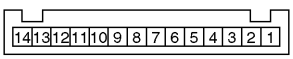


No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

DC/MD BOARD CONNECTOR

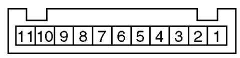


CN 108



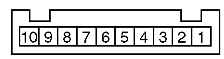
No.	P	J
1	38	FAN+
2	38	FAN+
3	36	FANCD
4	19	20VNO, 20N
5	—	—
6	39	DDC
7	40	PDC
8	94	CKFAND+
9	97	CKDAND-
10	13	20VNO, 10N
11	37	CK20V
12	—	—
13	—	—
14	—	—

CN 109



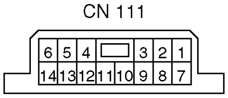
No.	P	J
1	—	—
2	27	CHOPB
3	28	CHOPP
4	29	CHOPS
5	31	OCL
6	—	—
6	32	TMPAD-
7	33	TMPD+
8	35	CKPV
10	—	—
11	—	—

CN 110



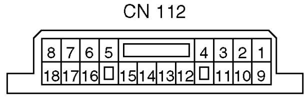
No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

CN 111



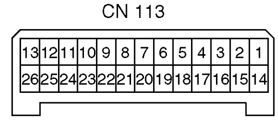
No.	P	J
1	41	B48V
2	10	MPS+
3	338	(H15V+)
4	11	S20V+
5	16	D15V
6	43	VBKY
7	—	—
8	9	MPS-
9	339	V20V- (H15V-)
10	338	B20V+
11	44	VBMB
12	12	S20V-
13	14	GNDD
14	—	—

CN 112



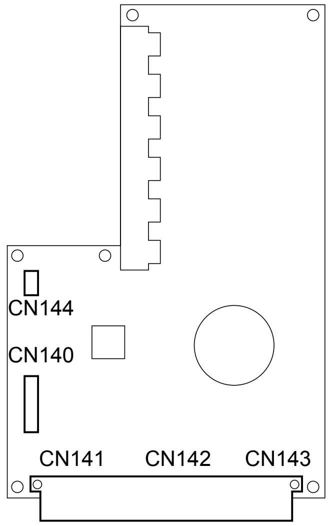
No.	P	J
1	162	TMPD2+
2	N2	TMPD-SD
3	153	TMPD-G
4	162	TMPD1+
5	15	C15V
6	41	B48V
7	43	VBKY
8	44	VBMB
9	—	—
10	1	MB+ (MD+)
11	2	MB- (MD-)
12	7	FAND+
13	8	FAND-
14	14	GNDC
15	5	MP+
16	6	MP-
17	N2	N2
18	N2	N2

CN 113

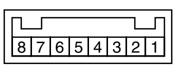


No.	P	J
1	150	TMDAU1+
2	152	TMDAD1+
3	154	TMDBU1+
4	151	TMDAU-G
5	153	TMDAD-G
6	155	TMDBU-G
7	157	TMDBD-G
8	159	TMDCU-G
9	161	TMDCD-G
10	—	—
11	156	TMDBD1+
12	158	TMDCU1+
13	160	TMDCD1+
14	P5	TMDAU-SD
15	N2	TMDAD-SD
16	P6	TMDBU-SD
17	150	TMDAU2+
18	152	TMDAD2+
19	154	TMDBU2+
20	156	TMDBD2+
21	158	TMDCU2+
22	160	TMDCD2+
23	—	—
24	N2	TMDBD-SD
25	P9	TMDCU-SD
26S	N2	TMDCD-SD

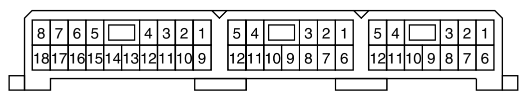
ST BOARD CONNECTOR



CN140



CN141 CN142 CN143



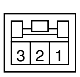
No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	FBUSY
6	—	FRES
7	—	FRXD
8	—	SELR
9	—	FCLK

No.	P	J
1	137	SL/L+
2	57	POTT+
3	56	POTT
4	58	SPL+
5	309	SSTMA
6	307	SMTSA
7	310	SSTMK
8	308	SMTSK
9	51	OLSD-
10	138	SL/L-
11	320	STPOT-
12	59	SPL
13	324	SS+
14	326	SS-
15	61	OLST+
16	51	OLST-
17	67	OLSD+
18	—	—

No.	P	J
1	303	VBMB2
2	90	MH1
3	91	MH2-1
4	70	SWTK
5	11	S20V+
6	(N2)	(N2)
7	N2	N2
8	304	STLSD
9	305	STLSTF
10	306	STLSTR
11	12	S20V-
12	(12)	(S20V-)

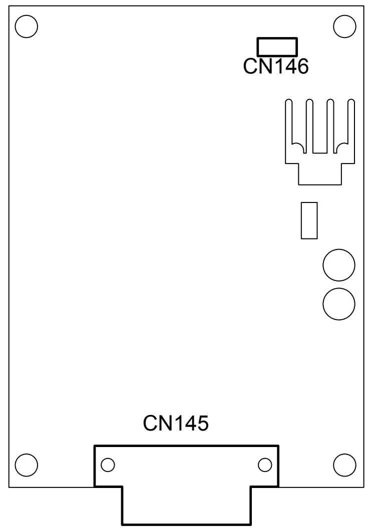
No.	P	J
1	330	SOLT-
2	328	SOLS-
3	334	SOLD-
4	—	—
5	332	SOLL-
6	(327)	(SOLTS+)
7	327	SOLTS+
8	331	SOLLD+
9	—	SXTSA
10	—	SSTXA
11	—	SXTSK
12	—	SSTXK

CN144

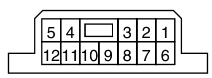


No.	P	J
1	321	SYR+
2	323	SYR-
3	322	SYR

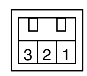
EHPS BOARD CONNECTOR



CN145



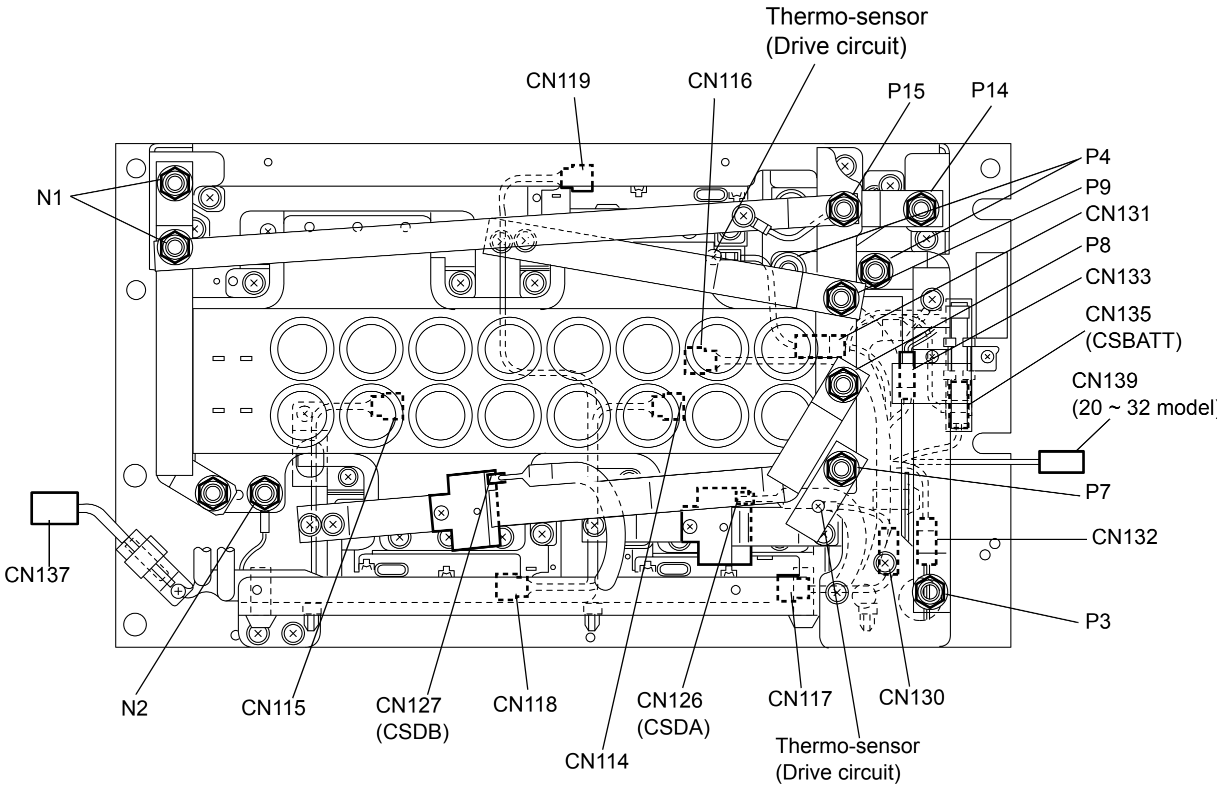
CN146

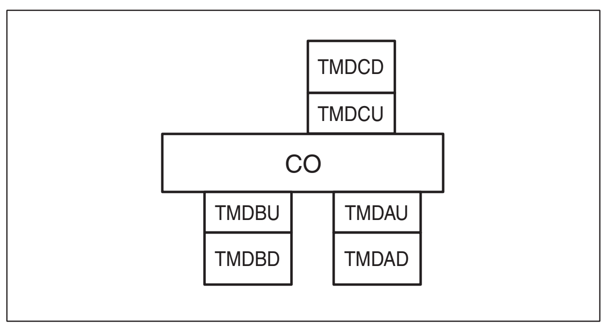


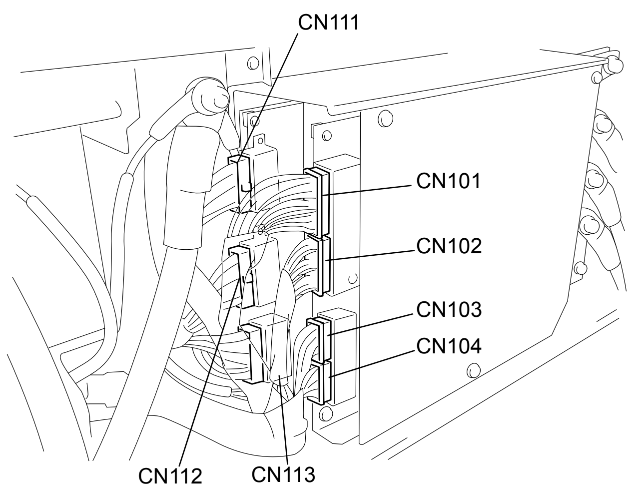
No.	P	J
1	43	VBKY
2	—	—
3	312	STS1
4	313	STS2
5	315	STS-
6	—	—
7	—	—
8	342	ISTPA
9	343	ISTPK
10	345	ERR+
11	346	ERR-
12	—	—

No.	P	J
1	340	TMPSG
2	P24	SH+
3	N1	SH-

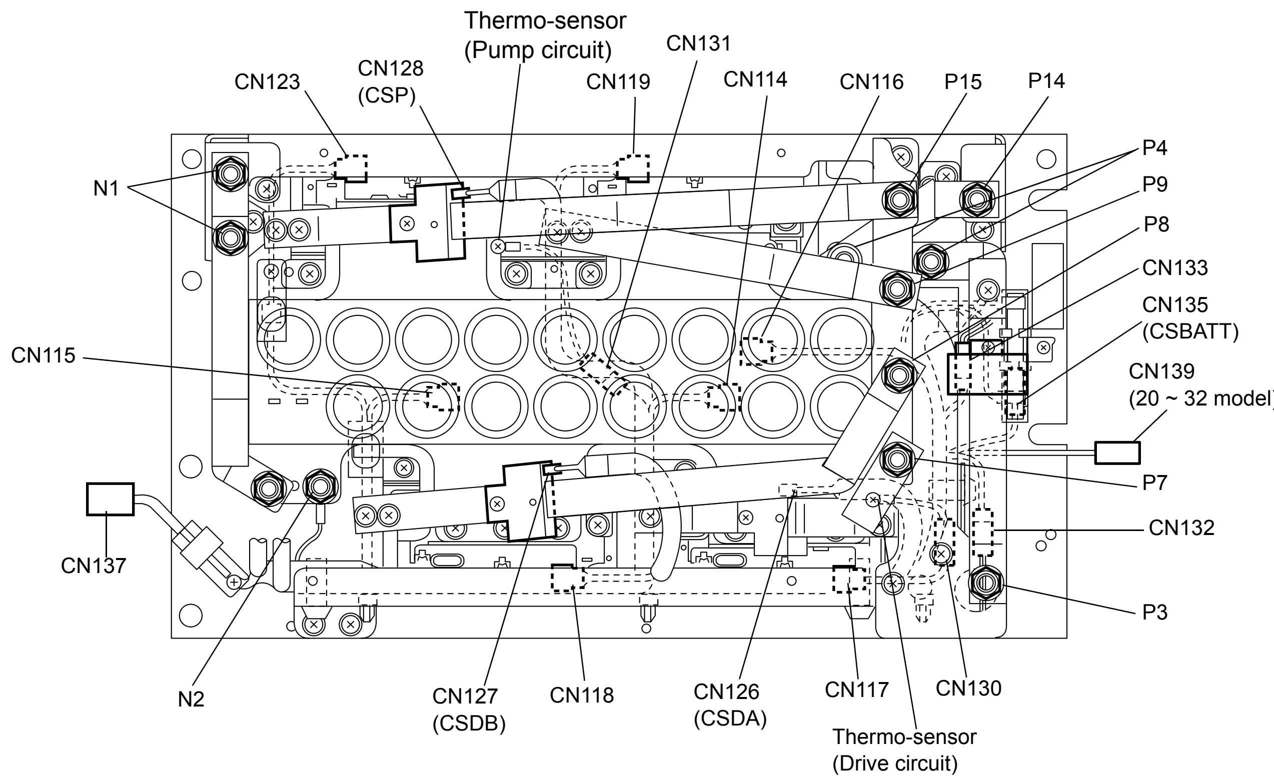
TRAVELING/MATERIAL HANDLING CONTROLLER (CHOPPER-LESS) CONNECTOR·COMPONENT

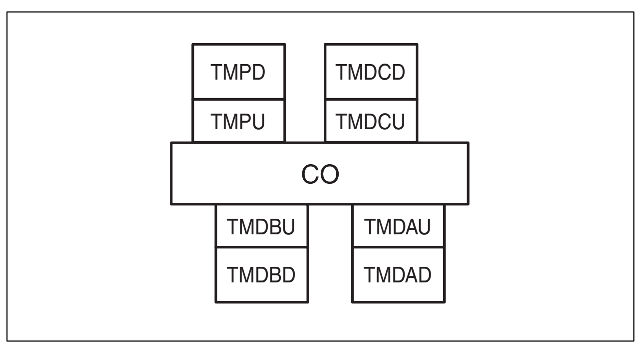


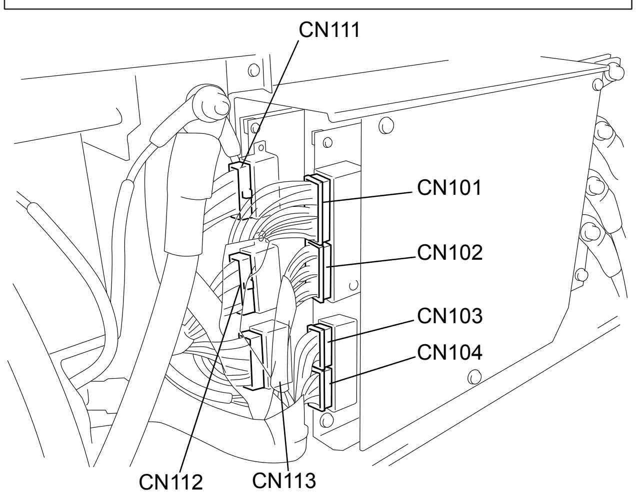




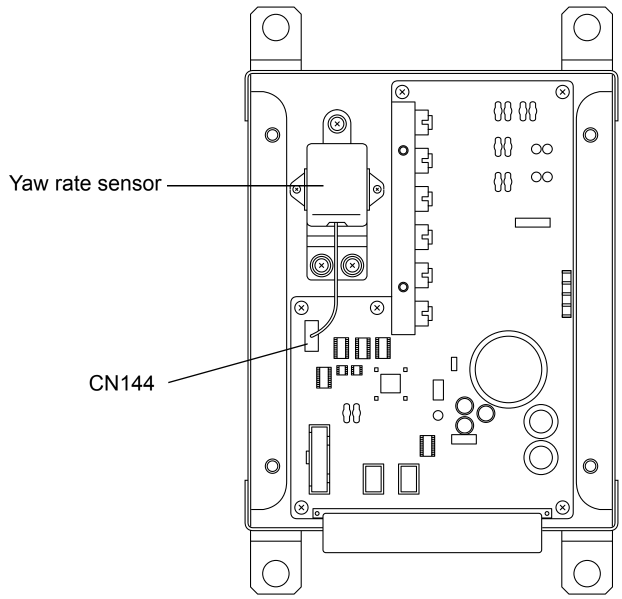
TRAVELING/MATERIAL HANDLING CONTROLLER (CHOPPER) CONNECTOR·COMPONENT

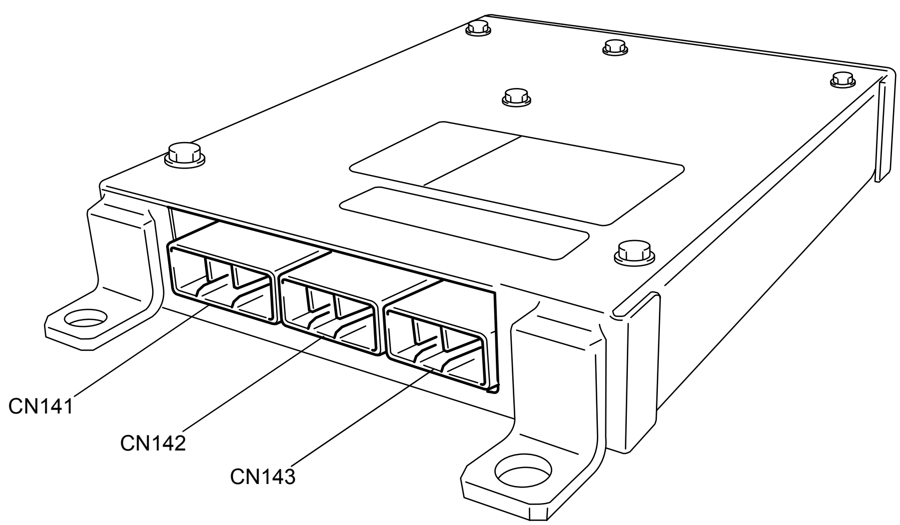




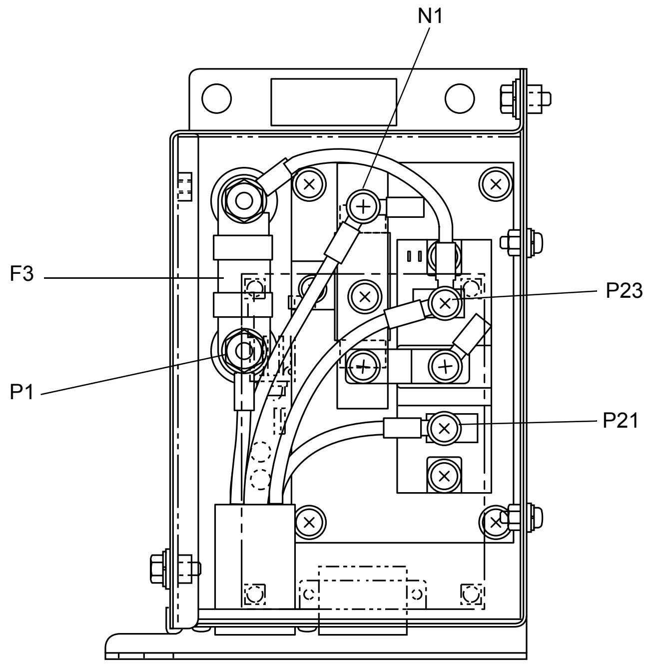


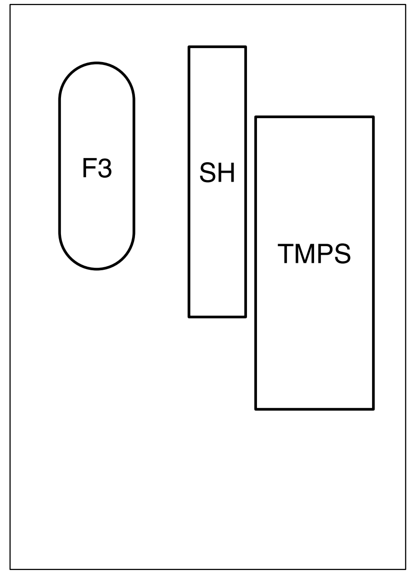
SAS CONTROLLER CONNECTOR·COMPONENT

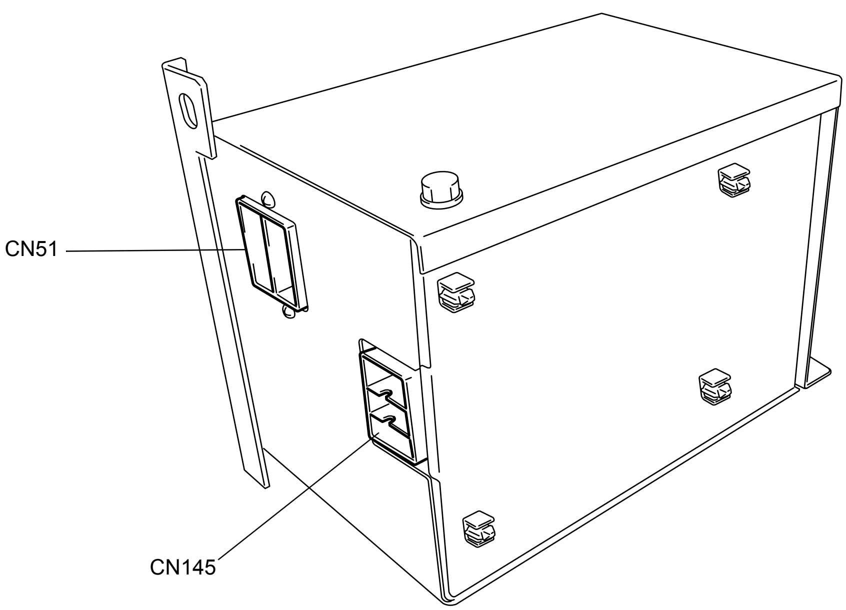




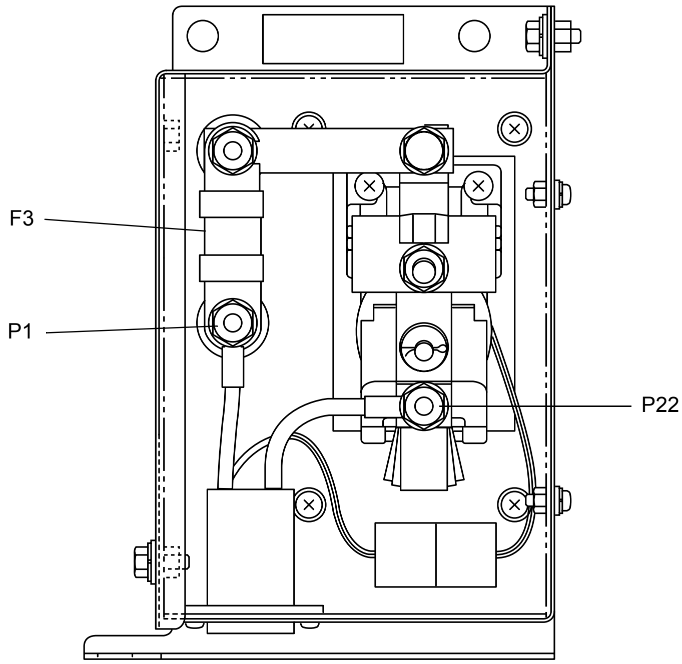
EHPS CONTROLLER CONNECTOR·COMPONENT

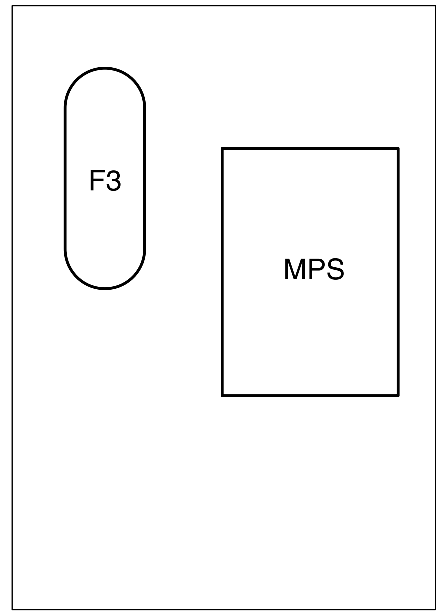


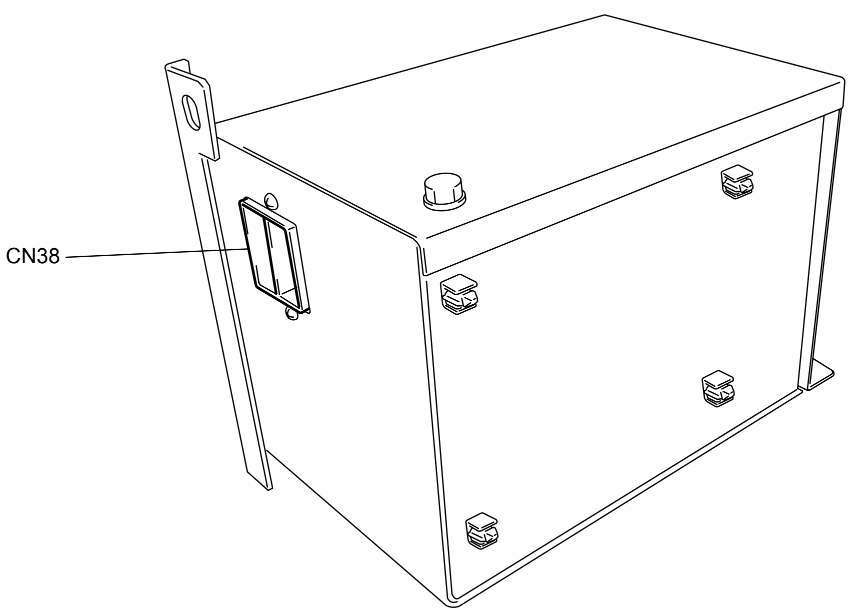




EHPS CONTROLLER CONNECTOR·COMPONENT

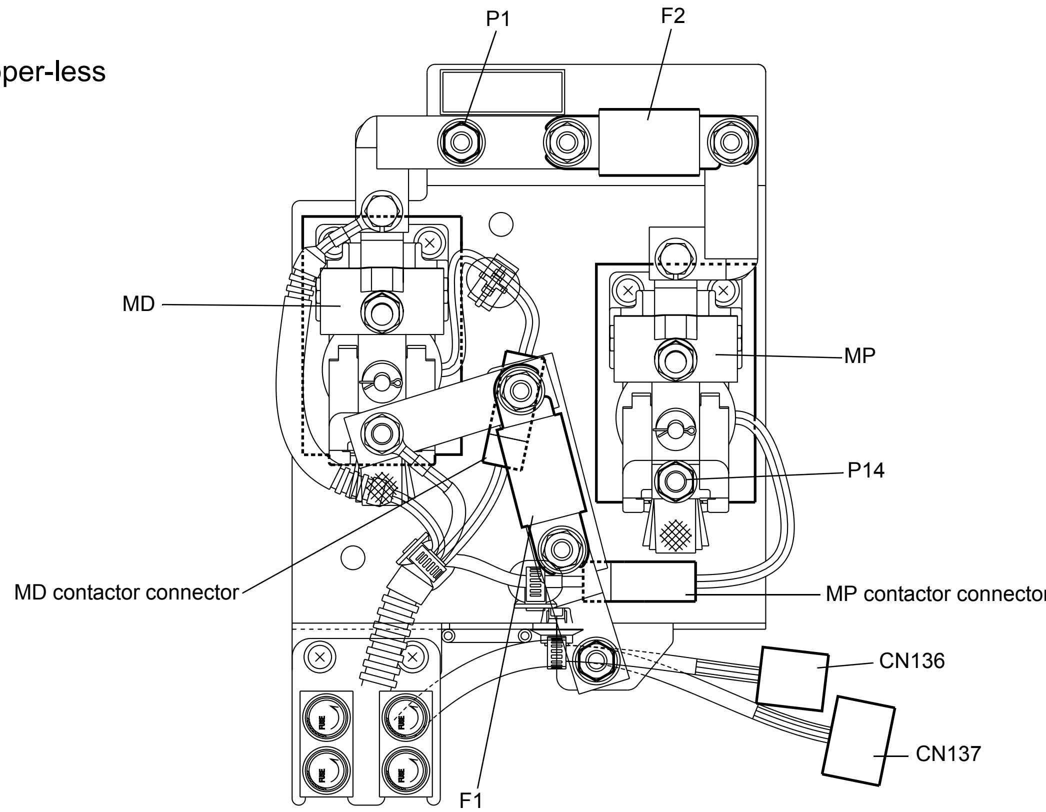




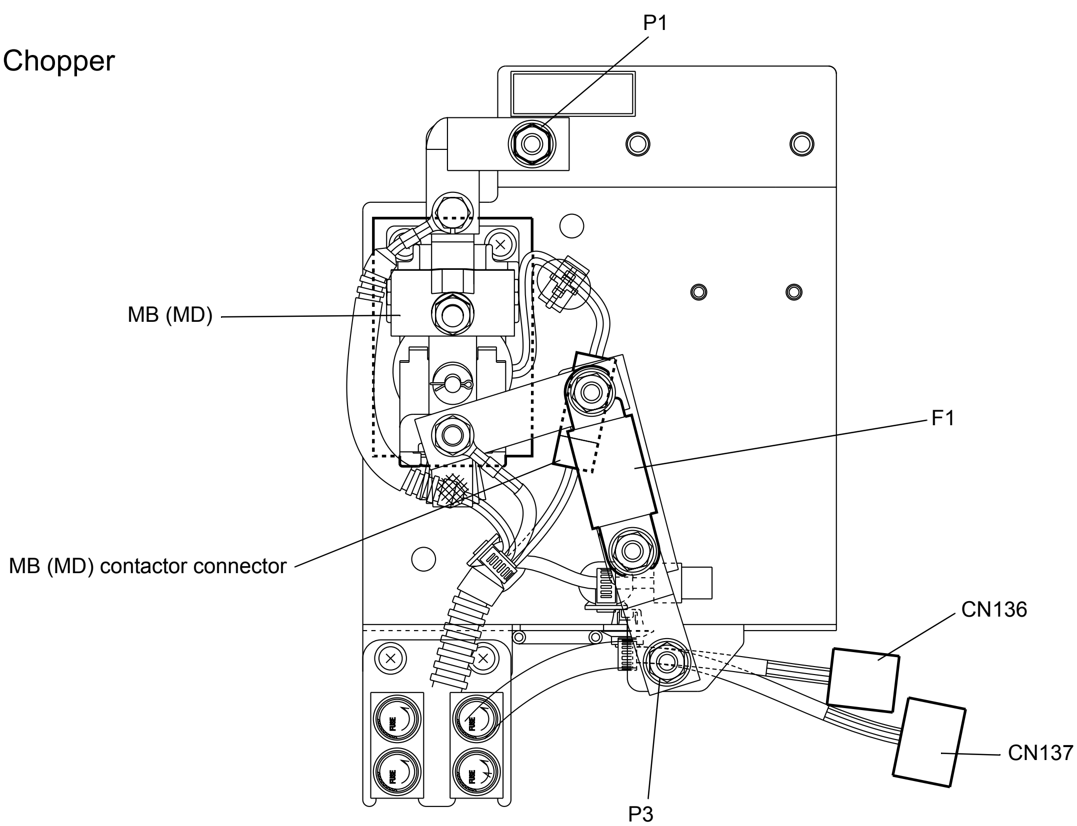


CONTACTOR PANEL CONNECTOR·COMPONENT

Chopper-less

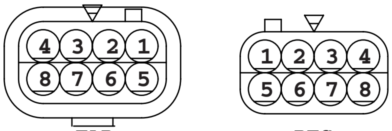


Chopper



CONNECTOR DRAWING (35 ~ 55 MODEL)

CN1



TAB

NO	P	C	J
1	14	BR	CN70-30
2	16	GR	CN70-14
3	141	LG	CN70-22
4	143	O	CN70-24
5	138	Y	CN70-5
6	137	G	CN70-4
7	144	SL	CN70-23
8	142	P	CN70-21

REC

NO	P	C	J
1	14	BR	CN162-6
2	16	GR	CN162-16
3	141	LG	CN162-4
4	143	O	CN162-13
5	138	Y	CN141-10
6	137	G	CN141-1
7	144	SL	CN162-3
8	142	P	CN162-12

CN3

TAB

NO	P	C	J
1	101	R	B
2	104	G	T
3	102	R-G	HS
4	107	R-Y	HM

REC

NO	P	C	J
1	101	R	CN29-1
2	104	G	CN29-2
3	102	Y	CN29-4
4	107	V	CN29-5

CN4

TAB

NO	P	C	J
1	41	-	AM
4	43	-	IG

REC

NO	P	C	J
1	41	Y	CN29-3
4	43	L	CN29-6

CN4 (OPT)

TAB

NO	P	C	J
2	41	-	AM
4	43	-	IG

REC

NO	P	C	J
2	41	Y	CN29-3
4	43	L	CN29-6

CN5

TAB

NO	P	C	J
1	101	R	LS_{ST}
2	111	SL	LS_{ST}

REC

NO	P	C	J
1	101	R	J10
2	111	SL	CN38-2

CN6

TAB

NO	P	C	J
1	51	R	LS_B
2	65	BR	LS_B

REC

NO	P	C	J
1	51	R	CN37-1
2	65	BR	CN161-3

CN8

TAB

NO	P	C	J
1	41	GY	$SW_{H(+)}$
2	48	WB	$SW_{H(-)}$
3	110	GW	$SW_{F(B)}$
4	108	G	$SW_{F(R)}$
5	109	GR	$SW_{F(L)}$
6			

REC

NO	P	C	J
1	41	Y	J3
2	48	P	H
3	110	GR	CN12-2
4	108	BR	CN13-4
5	109	G-Y	CN17-4
6			

CN9

TAB

NO	P	C	J
1	51	O	DSF,DSR
2	120	B	DSFO
3	103	G	DSBU
4	46	W-O	DSR
5	45	W-BR	DSF
6	43	R	DSFO,DSBU

REC

NO	P	C	J
1	51	R	CN37-12
2	120	G-Y	CN24-1
3	103	O	CN23-1
4	46	SL	CN161-2
5	45	G	CN161-1
6	43	L	J2

CN11

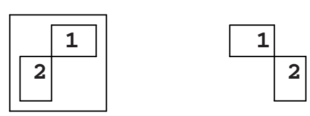
TAB

NO	P	C	J
1	351	G-Y	LS_L
2	350	R	NO
3	355	L	LS_{ATT}

REC

NO	P	C	J
1	351	G-Y	CN155-3
2	350	P	J16
3	355	L	CN155-9

CN12



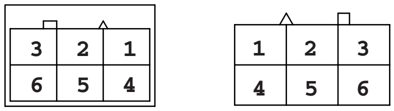
TAB

NO	P	C	J
1	43	-	FRY
2	110	-	FRY

REC

NO	P	C	J
1	43	L	J2
2	110	GR	CN8-3

CN13



TAB

NO	P	C	J
1	N1	W	CN14-3
2	104	G	CN14-4
3	102	Y	CN16-1
4	108	G-Y	CN14-1
5	N1	W	CN14-2
6	101	R	CN96-7

REC

NO	P	C	J
1	N1	W	CN37-16
2	104	G	J11
3	102	Y	J12
4	108	BR	CN8-4
5	N1	W	CN37-15
6	101	R	J10

CN14

TAB

NO	P	C	J
1	108	G	LF-R
2	N1	Y	LF-R
3	N1	W	LC-R
4	104	R	LC-R

REC

NO	P	C	J
1	108	G-Y	CN13-4
2	N1	W	CN13-5
3	N1	W	CN13-1
4	104	G	CN13-2

CN15

TAB

NO	P	C	J
1	51	-	LS_{PB}
2	66	-	LS_{PB}

REC

NO	P	C	J
1	51	R	CN37-2
2	66	V	CN161-4

CN16

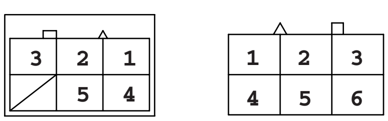
TAB

NO	P	C	J
1	102	B	H/L
2	N1	B	H/L

REC

NO	P	C	J
1	102	Y	CN13-3
2	N1	W	J24

CN17



TAB

NO	P	C	J
1	N1	W	CN18-3
2	104	G	CN18-4
3	102	Y	CN20-1
4	109	G-Y	CN18-1
5	N1	W	CN18-2
6			

REC

NO	P	C	J
1	N1	W	CN37-7
2	104	G	CN29-2
3	102	Y	CN29-4
4	109	G-Y	CN8-5
5	N1	W	CN37-6
6			

CN18

TAB

NO	P	C	J
1	109	G	LF-L
2	N1	Y	LF-L
3	N1	W	LC-L
4	104	R	LC-L

REC

NO	P	C	J
1	109	G-Y	CN17-4
2	N1	W	CN17-5
3	N1	W	CN17-1
4	104	G	CN17-2

CN19

TAB

NO	P	C	J
1	311	R	STS+
2			
3	315	B	STS-
4	312	W	STS1
5	313	G	STS2
6			

REC

NO	P	C	J
1	311	GR	CN147-17
2			
3	315	BR	CN147-16
4	312	G	CN147-6
5	313	P	CN147-7
6			

CN20

TAB

NO	P	C	J
1	102	B	H/L
2	N1	B	H/L

REC

NO	P	C	J
1	102	Y	CN17-3
2	N1	W	J24

CN22

TAB

NO	P	C	J
1	304	P	LS_{DS}
2	320	R	LS_{DS}

REC

NO	P	C	J
1	304	P	CN94-1
2	320	R	CN94-2

CN23

TAB

NO	P	C	J
1	103	R-W	CHI
2	N1	B	CHI

REC

NO	P	C	J
1	103	O	CN9-3
2	N1	W	N1

CN23-2

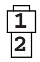
TAB

NO	P	C	J
1	103	R	BZ
2	N1	B	BZ

REC

NO	P	C	J
1	103	O	CN33-3
2	N1	W	J25

CN24



REC

NO	P	C	J
1	120	G-Y	CN9-2
2	N1	W	CN37-5

CN25

TAB

NO	P	C	J
1	52	SL	CN26-3
2	53	Y	CN26-4
3	51	R	CN26-1
4	64	GR	CN26-2

REC

NO	P	C	J
1	52	SL	CN162-2
2	53	Y	CN162-11
3	51	R	CN162-5
4	64	GR	CN162-1

CN26

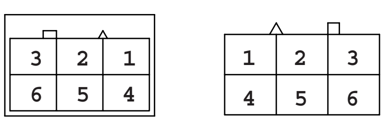
TAB

NO	P	C	J
1	50	-	E2
2	64	-	IDL
3	52	-	VTA
4	53	-	VC

REC

NO	P	C	J
1	50	R	CN25-3
2	64	GR	CN25-4
3	52	SL	CN25-1
4	53	Y	CN25-2

CN29



TAB

NO	P	C	J
1	101	R	CN3-1
2	104	G	CN3-2
3	41	Y	CN4-1
4	102	Y	CN3-3
5	107	V	CN3-4
6	43	L	CN4-2

REC

NO	P	C	J
1	101	R	CN136-1
2	104	G	CN17-2
3	41	Y	CN136-2
4	102	Y	CN17-3
5	107	V	CN38-5
6	43	L	CN38-3

CN31

TAB

NO	P	C	J
1	104	L	TL
2	111	L	STP
3	109	L	TRN
4	N1	L	E

REC

NO	P	C	J
1	104	G	CN38-4
2	111	SL	CN38-2
3	109	G-Y	CN38-6
4	N1	W	CN38-8

CN33

TAB

NO	P	C	J
1	107	V	CN35-1
2	N1	W	CN35-2
3	103	O	CN23-2-1
4	43	L	LR

REC

NO	P	C	J
1	107	V	CN38-7
2	N1	W	J23
3	103	O	J21
4	43	L	CN38-1

CN34

TAB

NO	P	C	J
1	104	R	TL
2	111	R	STP
3	103	R	B/U
4			
5	108	R	TRN
6	N1	R	E

REC

NO	P	C	J
1	104	G	J22
2	111	SL	J20
3	103	O	CN38-3
4			
5	108	BR	CN38-5
6	N1	W	J23

CN35

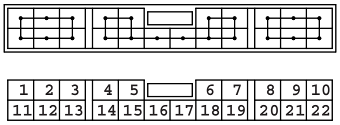
TAB

NO	P	C	J
1	107	B	W/L
2	N1	B	W/L

REC

NO	P	C	J
1	107	V	CN33-1
2	N1	W	CN33-2

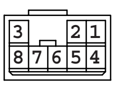
CN37



REC

NO	P	C	J
1	51	R	CN6-1
2	51	R	CN15-1
3	51	R	CN141-9
4	N1	W	J13
5	N1	W	CN24-2
6	N1	W	CN17-5
7	N1	W	CN17-1
8	320	R	CN87-2
9	320	R	CN87-4
10	320	R	CN94-2
11	51	R	CN39-2
12	51	R	CN9-1
13	51	R	CN161-16
14			
15	N1	W	CN13-5
16	N1	W	CN13-1
17	N1	W	CN38-4
18	N1	W	H
19			
20	320	R	CN90-8
21	320	R	CN90-2
22	320	R	CN141-11

CN38



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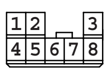


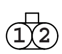
REC

NO	P	C	J
1	43	L	CN29-6
2	111	SL	CN5-2
3	103	O	J7
4	104	G	J11
5	108	BR	J8
6	109	G-Y	J9
7	107	V	CN29-5
8	N1	W	CN37-17

NO	P	C	J
1	43	L	CN33-4
2	111	SL	CN31-2
3	103	O	CN34-3
4	104	G	CN31-1
5	108	BR	CN34-5
6	109	G-Y	CN31-3
7	107	V	CN33-1
8	N1	W	CN31-4

CN39

TAB

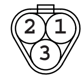


REC

NO	P	C	J
1	68	V	LSL2
2	51	R	LSL2

NO	P	C	J
1	68	O	CN161-11
2	51	R	CN37-11

CN41



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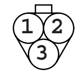
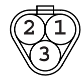


REC

NO	P	C	J
1	341		STP1-
2	340		STP1+
3	193		BMP

NO	P	C	J
1	341	V	CN148-2
2	340	L	CN148-10
3	193	G	CN155-1

CN42



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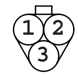


REC

NO	P	C	J
1	343		STP2-
2	342		STP2+
3	194		BMP2

NO	P	C	J
1	343	BR	CN148-3
2	342	O	CN148-11
3	194	SL	CN155-6

CN52

TAB

REC

NO	P	C	J
1	87	-	STMD
2	86	-	STMD

NO	P	C	J
1	87	P	CN57-6
2	86	O	CN57-4

CN53

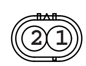
TAB

REC

NO	P	C	J
1	81	-	SSD1
2	80	-	SSD1

NO	P	C	J
1	81	G	CN57-2
2	80	B	CN57-1

CN54



TAB

REC

NO	P	C	J
1	82	-	SSD2
2	80	-	SSD2

NO	P	C	J
1	82	BR	CN57-3
2	80	B	J26

CN57

TAB

NO	P	C	J
1	80	B	CN53-2
2	81	G	CN53-1
3	82	BR	CN54-1
4	86	O	CN52-2
5			
6	87	P	CN52-1

REC

NO	P	C	J
1	80	B	CN162-18
2	81	G	CN162-7
3	82	BR	CN162-8
4	86	O	CN161-17
5			
6	87	P	CN161-18

CN58

TAB

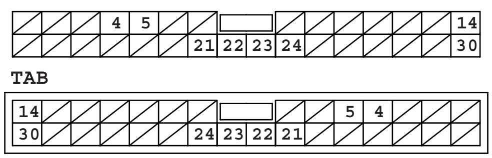
NO	P	C	J
1	89	G	CN52-1
2	88	L	CN52-2

REC

NO	P	C	J
1	89	G	CN162-10
2	88	L	CN162-9

CN70

REC



TAB

NO	P	C	J
4	137	-	SL/L+
5	138	-	SL/L-
14	16	-	D15V
21	142	-	SDTMA
22	141	-	SMTDA
23	144	-	SMTDK
24	143	-	SDTMK
30	14	-	GNDD

REC

NO	P	C	J
4	137	G	CN1-6
5	138	Y	CN1-5
14	16	GR	CN1-2
21	142	P	CN1-8
22	141	LG	CN1-3
23	144	SL	CN1-7
24	143	O	CN1-4
30	14	BR	CN1-1

CN82

TAB

NO	P	C	J
1	331	-	SOLLD+
2	334	-	SOLD-

REC

NO	P	C	J
1	331	GR	CN94-5
2	334	O	CN94-6

CN85

TAB

NO	P	C	J
1	70	-	SW_{TK}
2	320	-	SW_{TK}

REC

NO	P	C	J
1	70	BR	CN142-4
2	320	R	J4

CN86

TAB

NO	P	C	J
1	57	-	POTT+
2	56	-	POTT
3	320	-	SPOT-

REC

NO	P	C	J
1	57	V	CN141-2
2	56	G	CN141-3
3	320	R	J4

CN87

TAB

NO	P	C	J
1	305	G-R	STLSTF
2	320	R-L	SPOT-
3	306	L	STLSTR
4	320	R-L	SPOT-

REC

NO	P	C	J
1	306	L	CN142-10
2	320	R	CN37-8
3	305	G	CN142-9
4	320	R	CN37-9

CN88

TAB

NO	P	C	J
1	331	R	SOLLD+
2	332	B	SOLL-

REC

NO	P	C	J
1	331	GR	CN143-8
2	332	BR	CN143-5

CN89

TAB

NO	P	C	J
1	327	R	SOLTS+
2	330	B	SOLT-

REC

NO	P	C	J
1	327	L	CN143-7
2	330	P	CN143-1

CN90

TAB

NO	P	C	J
1	91	GR	CN92-3
2	320	R	CN92-1
3	59	Y	CN91-2
4	58	L	CN91-3
5			
6	90	SL	CN92-2
7			
8	320	R	CN91-1

REC

NO	P	C	J
1	91	GR	CN142-3
2	320	R	CN37-21
3	59	Y	CN141-12
4	58	L	CN141-4
5			
6	90	SL	CN142-2
7			
8	320	R	CN37-20

CN91

TAB

NO	P	C	J
1	320	-	STPOT-
2	59	-	SPL
3	58	-	SPL(+)

REC

NO	P	C	J
1	320	R	CN90-8
2	59	Y	CN90-3
3	58	L	CN90-4

CN92

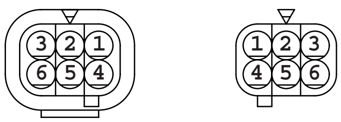
TAB

NO	P	C	J
1	320	R	CN90-2
2	90	SL	CN90-6
3	91	GR	CN90-1

REC

NO	P	C	J
1	320	-	SWMH1
2	90	-	SWMH1
3	91	-	SWMH1

CN94



TAB

NO	P	C	J
1	304	P	CN22-1
2	320	R	CN22-2
3	327	L	CN95-1
4	328	Y	CN95-2
5	331	GR	CN82-1
6	334	O	CN82-2

REC

NO	P	C	J
1	304	P	CN142-8
2	320	R	CN37-10
3	327	L	J5
4	328	Y	CN143-2
5	331	GR	J6
6	334	O	CN143-3

CN95

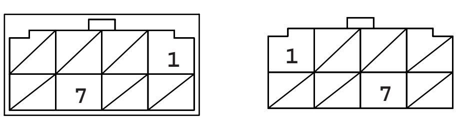
TAB

NO	P	C	J
1	327	-	SOL$_{S}$
2	328	-	SOL$_{S}$

REC

NO	P	C	J
1	327	L	CN94-3
2	328	Y	CN94-4

CN96



TAB

NO	P	C	J
1	112	-	SW
7	101	-	SW

REC

NO	P	C	J
1	112	SL	L CMP
7	101	R	CN13-6

CN97

TAB

NO	P	C	J
1	18	R	FAN
2	N2	O	FAN

REC

NO	P	C	J
1	18	R	CN159-1
2	N2	O	CN159-2

CN136

TAB

NO	P	C	J
1	101	R	CN29-1
2	41	Y	CN29-3
3	N2	O	CN142-7
4	303	LG	CN142-1

REC

NO	P	C	J
1	101	R	F4
2	41	Y	F5
3	N2	O	CN137-6
4	303	LG	F7

CN137

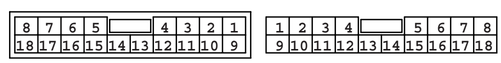
TAB

NO	P	C	J
1	2		MB-
2	1		MB+
3	6		MP-
4	5		MP+
5	44		VBMB
6	N2		N2
7	4		MBP-
8	3		MBP+

REC

NO	P	C	J
1	2		MB-
2	1		MB+
3	6		MP-
4	5		MP+
5	44		VBMB
6	N2		N2
7	4		MBP-
8	3		MBP+

CN141



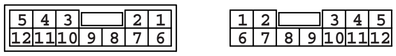
TAB

NO	P	C	J
1	137	-	SL/L+
2	57	-	POTT+
3	56	-	POTT
4	58	-	SPL+
5	309	-	SSTMA
6	307	-	SSTSA
7	310	-	SSTMK
8	308	-	SMTSK
9	51	-	OLSD-
10	138	-	SL/L-
11	320	-	STPOT-
12	59	-	SPL
13	324	-	SS+
14	325	-	SS-
15	354	-	OLST+
16	350	-	OLST-
17	67	-	OLSD+
18			

REC

NO	P	C	J
1	137	G	CN1-6
2	57	V	CN86-1
3	56	G	CN86-2
4	58	L	CN90-4
5	309	P	CN161-19
6	307	SL	CN161-8
7	310	LG	CN161-20
8	308	V	CN161-9
9	51	R	CN37-3
10	138	Y	CN1-5
11	320	R	CN37-22
12	59	Y	CN90-3
13	324	BR	CN161-15
14	325	GR	CN162-14
15	354	LG	CN155-2
16	350	P	CN155-10
17	67	G-Y	CN161-5
18			

CN142



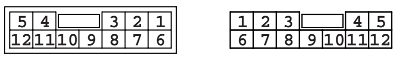
TAB

NO	P	C	J
1	303	-	VBMB2
2	90	-	MH1
3	91	-	MH2-1
4	70	-	SWTK
5	11	-	S20V+
6	(N2)	-	(N2)
7	N2	-	N2
8	304	-	STLSD
9	306	-	STLSTR
10	305	-	STLSTF
11	12	-	S20V-
12	(12)	-	(S20V-)

REC

NO	P	C	J
1	303	LG	CN136-4
2	90	SL	CN90-6
3	91	GR	CN90-1
4	70	BR	CN85-1
5	11	G-Y	CN155-7
6			
7	N2	O	CN136-3
8	304	P	CN94-1
9	305	G	CN87-3
10	306	L	CN87-1
11	12	V	CN155-8
12			

CN143



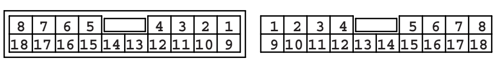
TAB

NO	P	C	J
1	330	-	SOLT-
2	328	-	SOLS-
3	334	-	SOLD-
4		-	
5	332	-	SOLL-
6	(327)	-	(SOLTS+)
7	327	-	SOLTS+
8	331	-	SOLLD+
9	316	-	SXTSA
10	318	-	SSTXA
11	317	-	SXTSK
12	319	-	SSTXK

REC

NO	P	C	J
1	330	P	CN89-2
2	328	Y	CN94-4
3	334	O	CN94-6
4			
5	332	BR	CN88-2
6			
7	327	L	CN89-1
8	331	GR	CN88-1
9	316	LG	CN147-3
10	318	O	CN147-4
11	317	SL	CN147-11
12	319	V	CN147-12

CN147



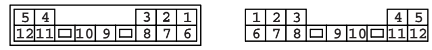
TAB

NO	P	C	J
1		-	SSTYA
2		-	SYTSA
3	316	-	SXTSA
4	318	-	SSTXA
5		-	
6	312	-	STS1
7	313	-	STS2
8		-	
9		-	SSTYK
10		-	SYTSK
11	317	-	SXTSK
12	319	-	SSTXK
13		-	
14		-	
15		-	
16	315	-	STS-
17	311	-	STS+
18			

REC

NO	P	C	J
1			
2			
3	316	LG	CN143-9
4	318	O	CN143-10
5			
6	312	G	CN19-4
7	313	P	CN19-5
8			
9			
10			
11	317	SL	CN143-11
12	319	V	CN143-12
13			
14			
15			
16	315	BR	CN19-3
17	311	GR	CN19-1
18			

CN148



TAB

NO	P	C	J
1		-	
2	341	-	STP1-
3	343	-	STP2-
4		-	
5	51	-	OLSL-
6		-	
7		-	
8		-	
9		-	
10	340	-	STP1+
11	342	-	STP2+
12	60	-	OLSL+

REC

NO	P	C	J
1			
2	341	V	CN41-1
3	343	BR	CN42-1
4			
5	51	R	J1
6			
7			
8			
9			
10	340	L	CN41-2
11	342	O	CN42-2
12	60	G-Y	CN161-7

CN155

TAB

NO	P	C	J
1	193	-	BMP
2	354	-	PLST
3	351	-	PLSL1
4		-	PLSAT2
5		-	CKT-G
6	194	-	BMP2
7	11	-	S20V+
8	12	-	S20V-
9	355	-	PLSAT1
10	350	-	PLS-

REC

NO	P	C	J
1	193	G	CN141-3
2	354	LG	CN141-15
3	351	G-Y	CN11-1
4			
5			
6	194	SL	CN42-3
7	11	G-Y	CN142-5
8	12	V	CN142-11
9	355	L	CN11-3
10	350	P	CN141-16

CN156

TAB

NO	P	C	J
1	41	Y	CN154

REC

NO	P	C	J
1	41	Y	J3

CN159

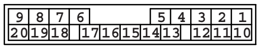
TAB

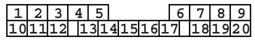
NO	P	C	J
1	18	R	CN97-1
2	N2	O	CN97-2

REC

NO	P	C	J
1	18	R	R_{FAN}
2	N2	O	N2

CN161





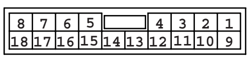
TAB

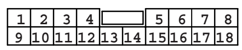
NO	P	C	J
1	45	_	DSF
2	46	_	DSR
3	65	_	LSB
4	66	_	LSPB
5	67	_	LSD
6			
7	60	_	LSL
8	307	_	SMTSA
9	308	_	SMTSK
10			
11	68	_	LSL2
12			
13			
14			
15	324	_	SSO+
16	51	_	LS-
17	86	_	TD+
18	87	_	TD-
19	309	_	SSTMA
20	310	_	SSTMK

REC

NO	P	C	J
1	45	G	CN9-5
2	46	SL	CN9-4
3	65	BR	CN6-2
4	66	V	CN15-2
5	67	G-Y	CN141-17
6			
7	60	G-Y	CN148-12
8	307	SL	CN141-6
9	308	V	CN141-8
10			
11	68	O	CN39-1
12			
13			
14			
15	324	BR	CN141-13
16	51	R	CN37-13
17	86	O	CN57-4
18	87	P	CN57-6
19	309	P	CN141-5
20	310	LG	CN141-7

CN162





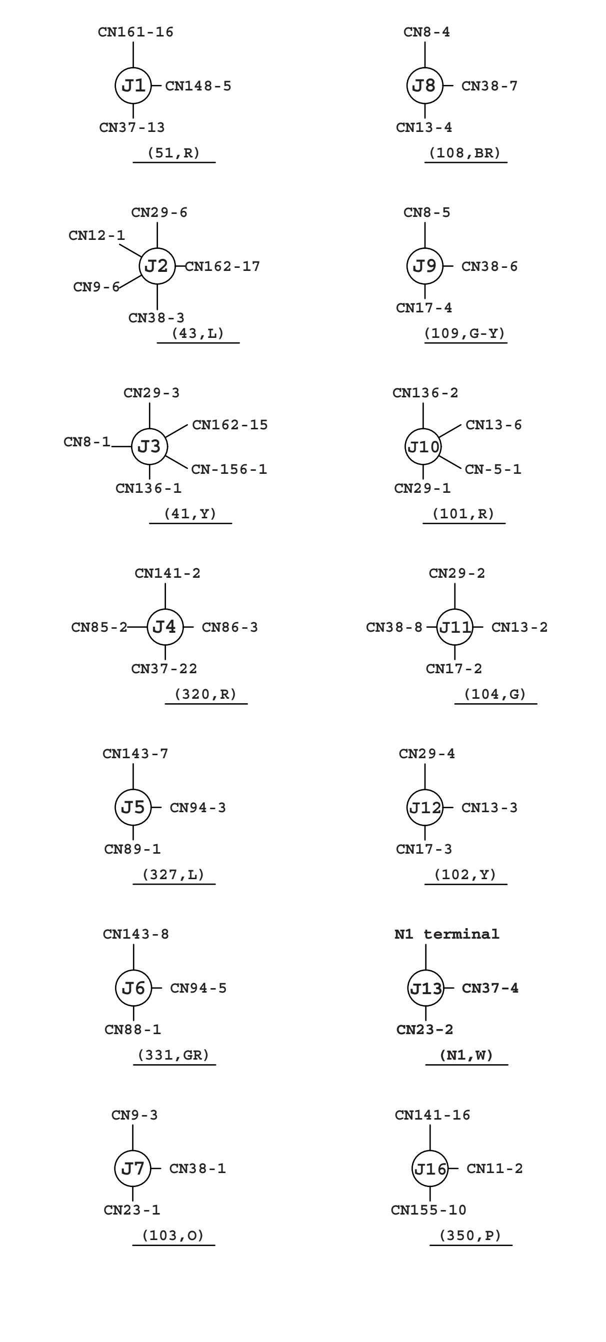
TAB

NO	P	C	J
1	64	-	SWAC
2	52	-	POTA
3			
4			
5	51	-	POT-
6			
7	81	-	SSD1
8	82	-	SSD2
9	88	-	TD2+
10	89	-	TD2-
11	53	-	POTA+
12			
13			
14	325	-	SSD-
15	41	-	VBBT
16			
17			
18	80	-	SSD+

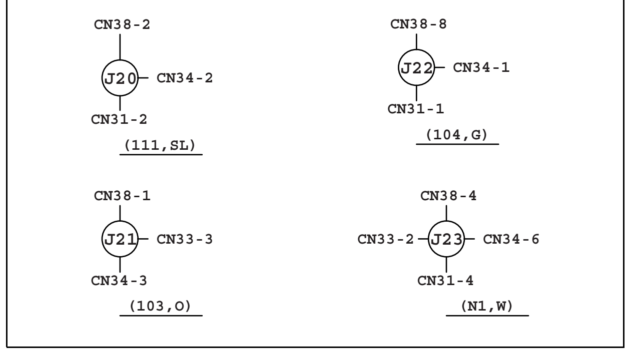
REC

NO	P	C	J
1	64	GR	CN25-4
2	52	SL	CN25-1
3	144	SL	CN1-7
4	141	LG	CN1-3
5	51	R	CN25-3
6	14	BR	CN1-1
7	81	G	CN57-2
8	82	BR	CN57-3
9	88	L	CN58-2
10	89	G	CN58-1
11	53	Y	CN25-2
12	142	P	CN1-8
13	143	O	CN1-4
14	325	GR	CN141-14
15	41	Y	J3
16	16	GR	CN1-2
17	43	L	J2
18	80	B	CN57-1

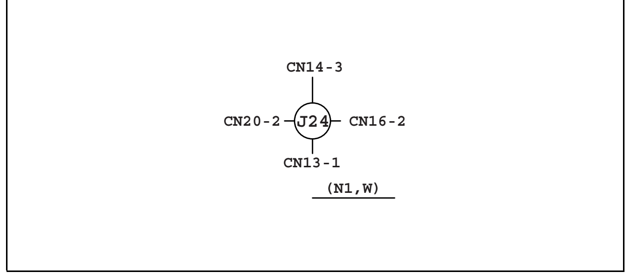
Main harness joint



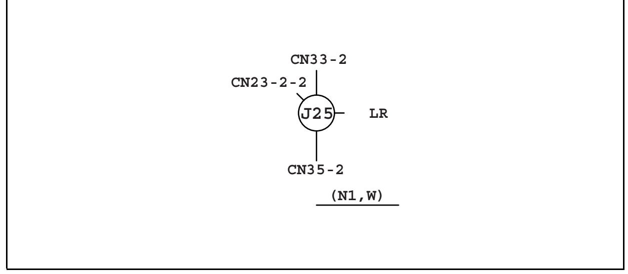
Rear-upper harness joint



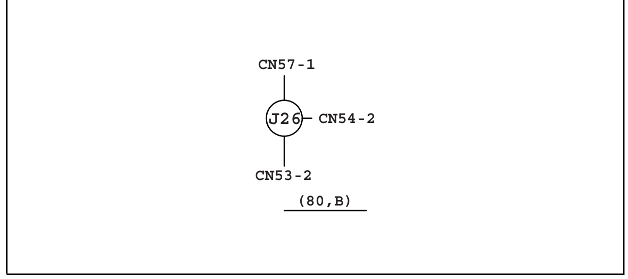
Front pillar harness joint



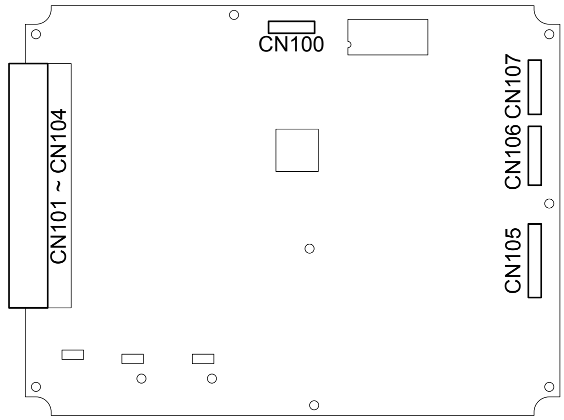
Rear option harness joint

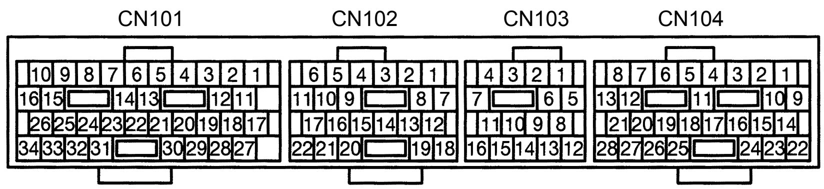


Drive motor harness joint



CPU BOARD CONNECTOR





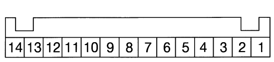
No.	P	J
1	45	DSF
2	46	DSR
3	65	LSB
4	66	LSPB
5	67	LSD
6	—	—
7	—	—
8	—	—
9	307	SNTSA
10	308	SMTSK
11	—	—
12	309	SSTMA
13	310	SSTMK
14	—	—
15	—	—
16	—	—
17	—	—
18	—	—
19	—	—
20	—	—
21	—	—
22	—	—
23	68	LSL2
24	—	—
25	—	—
26	51	LS-
27	—	—
28	—	—
29	—	—
30	—	—
31	—	—
32	60	LSL
33	324	SSO+
34	325	SSO-

No.	P	J
1	64	SWAC
2	52	POTA
3	—	AOPT
4	—	—
5	—	—
6	81	SSD1
7	82	SSD2
8	—	—
9	—	—
10	86	TD+
11	87	TD-
12	88	TD2+
13	89	TD2-
14	53	POTA+
15	—	—
16	—	—
17	—	—
18	80	SSD+
19	—	—
20	—	—
21	—	—
22	51	POT-

No.	P	J
1	3	MP1+
2	4	MP1-
3	41	B48V
4	43	VBKY
5	5	MP2+
6	6	MP2-
7	41	VBBT
8	—	—
9	—	—
10	16	D15V
11	—	—
12	14	GNDD
13	144	SMTDK
14	143	SDTMK
15	142	SDTMA
16	141	SMTDA

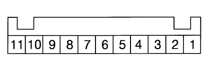
No.	P	J
1	N2	N2C
2	54	CSBATT
3	19	CHOPD2-
4	—	—
5	75	CSD+
6	75	CSD2+
7	71	CSDA
8	72	CSDB
9	13	C20V
10	N2	N2
11	2	MD1-
12	P4	VBP4
13	1	MD1+
14	44	VBMB
15	41	B48V
16	16	D15V
17	15	C15V
18	73	CSDA2
19	74	CSDB2
20	78	THCD
21	77	THC+
22	44	VBMB
23	14	GNDD
24	14	GNDC
25	79	THCD2
26	—	—
27	76	CSD-
28	76	CSD2-

CN105



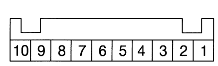
No.	P	J
1	38	FAN+
2	38	FAN+
3	36	FANCD
4	37	FANCD2
5	—	—
6	39	DDC
7	40	D2DC
8	94	CKFAND+
9	97	CKFAND-
10	98	CKFAND2+
11	99	CKFAND2-
12	—	—
13	—	—
14	100	CHGFAN

CN106



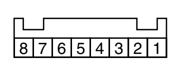
No.	P	J
1	33	TMDU2+
2	27	TMDAU2-
3	28	TMDBU2-
4	29	TMDCU2-
5	30	TMDAD2-
6	31	TMDBD2-
7	32	TMDCD2-
8	33	TMDD2+
9	35	CKDV2
10	—	—
11	—	—

CN107



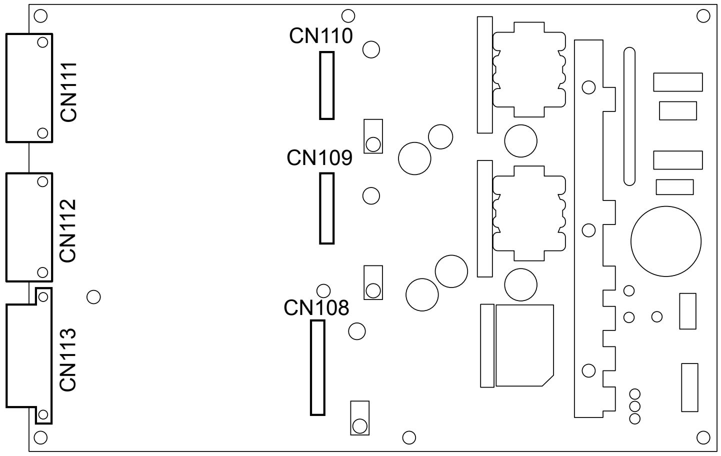
No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

CN100

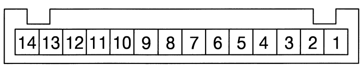


No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	MD2
6	—	FRES
7	—	FRXD
8	—	SELR

DC/MD BOARD CONNECTOR

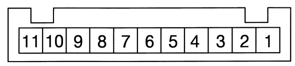


CN108



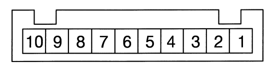
No.	P	J
1	100	CHGFAN
2	—	—
3	—	—
4	99	CKFANP-
5	98	CKFANP+
6	97	CKFAND-
7	94	CKFAND+
8	40	PDC
9	39	DDC
10	—	—
11	37	FANCP
12	36	FANCD
13	38	FAN+
14	38	FAN+

CN109



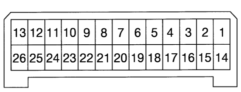
No.	P	J
1	33	TMDU2+
2	27	TMDAU2-
3	28	TMDBU2-
4	29	TMDCU2-
5	30	TMDAD2-
6	31	TMDBD2-
7	32	TMDCD2-
8	33	TMDD2+
9	35	CKDV2
10	—	—
11	—	—

CN110



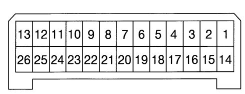
No.	P	J
1	26	TMDU+
2	20	TMDAU-
3	21	TMDBU-
4	22	TMDCU-
5	23	TMDAD-
6	24	TMDBD-
7	25	TMDCD-
8	26	TMDD+
9	34	CKDV
10	—	—

CN111



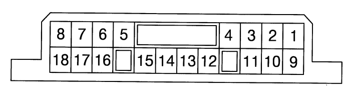
No.	P	J
1	150	TMDAU1+
2	152	TMDAD1+
3	154	TMDBU1+
4	151	TMDAU-G
5	153	TMDAD-G
6	155	TMDBU-G
7	157	TMDBD-G
8	159	TMDCU-G
9	161	TMDCD-G
10	—	—
11	156	TMDBD1+
12	158	TMDCU1+
13	160	TMDCD1+
14	P3	TMDAU-SD
15	N2	TMDAD-SD
16	P5	TMDBU-SD
17	150	TMDAU2+
18	152	TMDAD2+
19	154	TMDBU2+
20	156	TMDBD2+
21	158	TMDCU2+
22	160	TMDCD2+
23	—	—
24	N2	TMDBD-SD
25	P7	TMDCU-SD
26	N2	TMDCD-SD

CN112



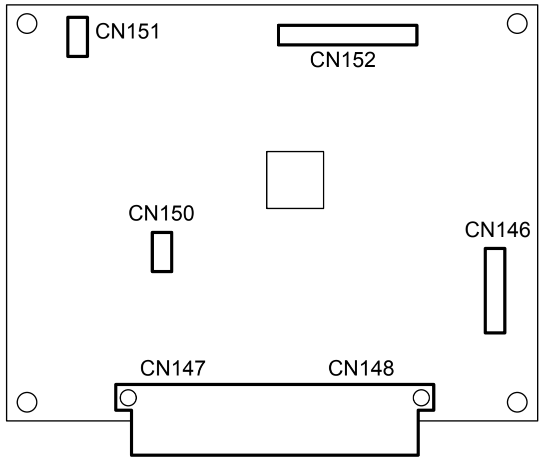
No.	P	J
1	162	TMDAU21+
2	164	TMDAD21+
3	166	TMDBU21+
4	163	TMDAU2-G
5	165	TMDAD2-G
6	167	TMDBU2-G
7	169	TMDBD2-G
8	171	TMDCU2-G
9	173	TMDCD2-G
10	—	—
11	168	TMDBD21+
12	170	TMDCU21+
13	172	TMDCD21+
14	P51	TMDAU2-SD
15	N2	TMDAD2-SD
16	P61	TMDBU2-SD
17	162	TMDAU22+
18	164	TMDAD22+
19	166	TMDBU22+
20	168	TMDBD22+
21	170	TMDCU22+
22	172	TMDCD22+
23	—	—
24	N2	TMDBD2-SD
25	P91	TMDCU2-SD
26	N2	TMDCD2-SD

CN113

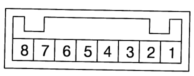


No.	P	J
1	41	B48V
2	44	VBMB
3	—	Q601G
4	7	FAND+
5	8	FAND-
6	9	FANP+
7	10	FANP-
8	—	Q701G
9	—	—
10	—	—
11	—	Q501G
12	14	GNDD
13	14	GNDC
14	16	D15V
15	15	C15V
16	13	C20V
17	N2	N2
18	N2	N2

SCPU BOARD CONNECTOR

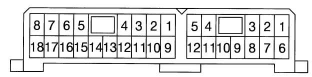


CN146



No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	MD1
6	—	FRES
7	—	FRXD
8	—	SELR

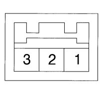
CN147 CN148



No.	P	J
1	—	SSTYA
2	—	SYTSA
3	316	SXTSA
4	318	SSTXA
5	—	—
6	312	STS1
7	313	STS2
8	314	STSC
9	—	SSTYK
10	—	SYTSK
11	317	SXTSK
12	319	SSTXK
13	—	—
14	—	—
15	—	—
16	315	STS-
17	311	STS+
18	—	—

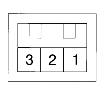
No.	P	J
1	—	—
2	341	STP1-
3	343	STP2-
4	—	SSN+
5	51	SSN-
6	—	—
7	—	—
8	—	—
9	—	—
10	340	STP1+
11	342	STP2+
12	60	OLSL+

CN150



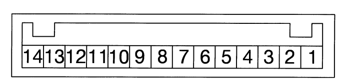
No.	P	J
1	—	—
2	—	—
3	349	OUTAD

CN151



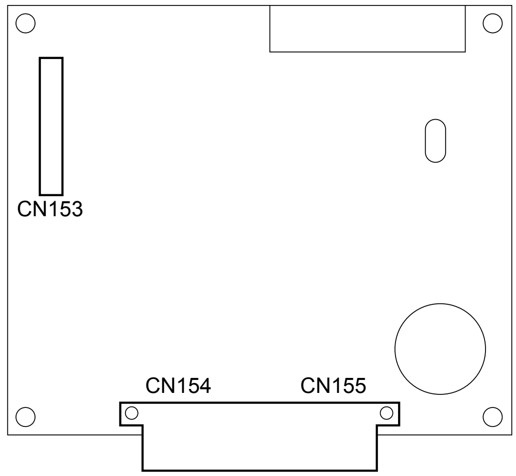
No.	P	J
1	—	—
2	—	—
3	—	—

CN152

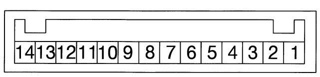


No.	P	J
1	—	—
2	P12	VBMBP
3	—	—
4	—	—
5	352	SC15V
6	353	GNDSC
7	—	—
8	344	PDUTY
9	347	DATA1
10	348	DATA2
11	335	DRPMOS
12	345	SELT1
13	346	SELT2
14	—	—

DC/PD BOARD CONNECTOR

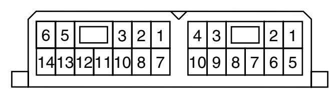


CN153



No.	P	J
1	—	—
2	P12	VBMBP
3	—	—
4	—	—
5	352	SC15V
6	353	GNDSC
7	349	OUTAD
8	344	PDUTY
9	347	DATA1
10	348	DATA2
11	335	DRPMOS
12	345	SELT1
13	346	SELT2
14	—	—

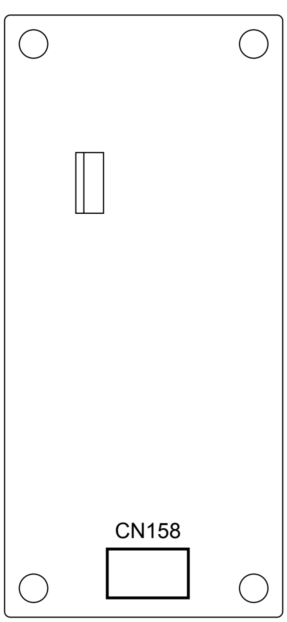
CN154 CN155



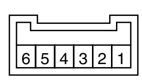
No.	P	J
1	41	B48V
2	P12	VBMBP
3	352	PCSP+
4	337	PCSP
5	353	PCSP-
6	338	THP+
7	—	CK20V
8	N1	N1
9	356	TMPD1+
10	357	TMPD2+
11	358	TMPD-G
12	359	TMPD-SD
13	339	THP
14	—	—

No.	P	J
1	193	BMP
2	354	PLST
3	351	PLSL1
4	—	PLSAT2
5	—	CKT-G
6	194	BMP2
7	11	S20V+
8	12	S20V-
9	355	PLSAT1
10	350	PLS-

CD BOARD CONNECTOR

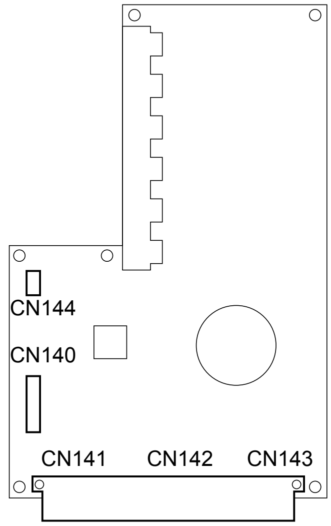


CN158

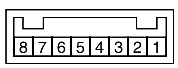


No.	P	J
1	44	VBMB
2	47	CD+
3	49	CD-
4	N2	N2
5	77	CHOPCD+
6	19	CHOPCD-

ST BOARD CONNECTOR

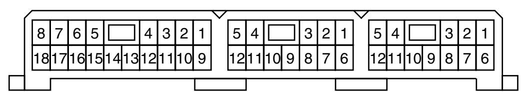


CN140



No.	P	J
1	—	C5V
2	—	GNDC
3	—	FTXD
4	—	VPP
5	—	FBUSY
6	—	FRES
7	—	FRXD
8	—	SELR
9	—	FCLK

CN141 CN142 CN143

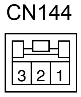


No.	P	J
1	137	SL/L+
2	57	POTT+
3	56	POTT
4	58	SPL+
5	309	SSTMA
6	307	SMTSA
7	310	SSTMK
8	308	SMTSK
9	51	OLSD-
10	138	SL/L-
11	320	STPOT-
12	59	SPL
13	324	SS+
14	325	SS-
15	61	OLST+
16	51	OLST-
17	67	OLSD+
18	—	—

No.	P	J
1	303	VBMB2
2	90	MH1
3	91	MH2-1
4	70	SWTK
5	11	S20V+
6	(N2)	(N2)
7	N2	N2
8	304	STLSD
9	305	STLSTF
10	306	STLSTR
11	12	S20V-
12	(12)	(S20V-)

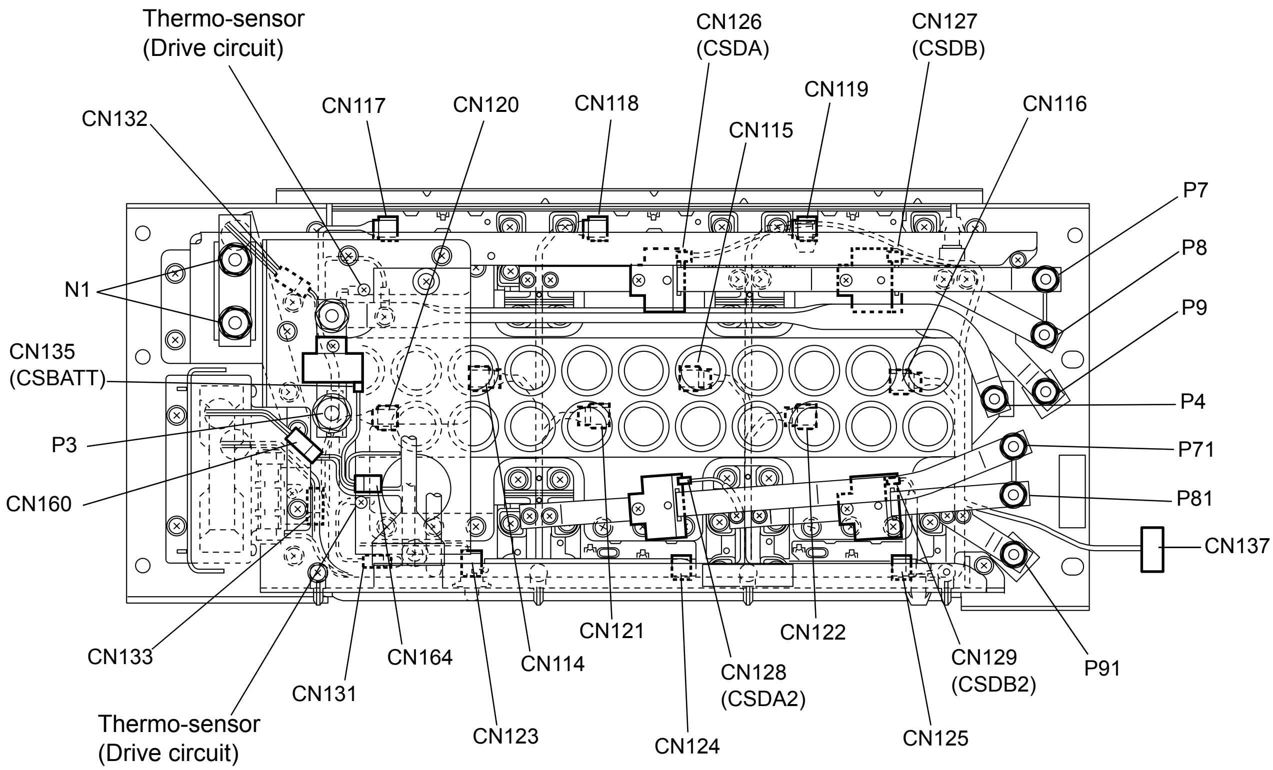
No.	P	J
1	330	SOLT-
2	328	SOLS-
3	334	SOLD-
4	—	—
5	332	SOLL-
6	(327)	(SOLTS+)
7	327	SOLTS+
8	331	SOLLD+
9	—	SXTSA
10	—	SSTXA
11	—	SXTSK
12	—	SSTXK

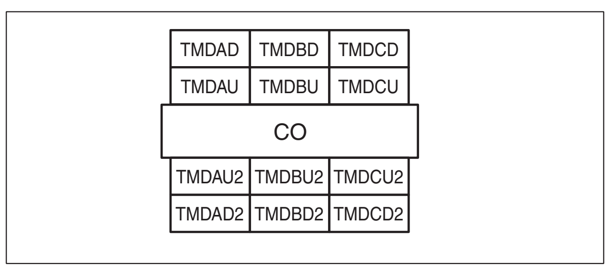
CN144

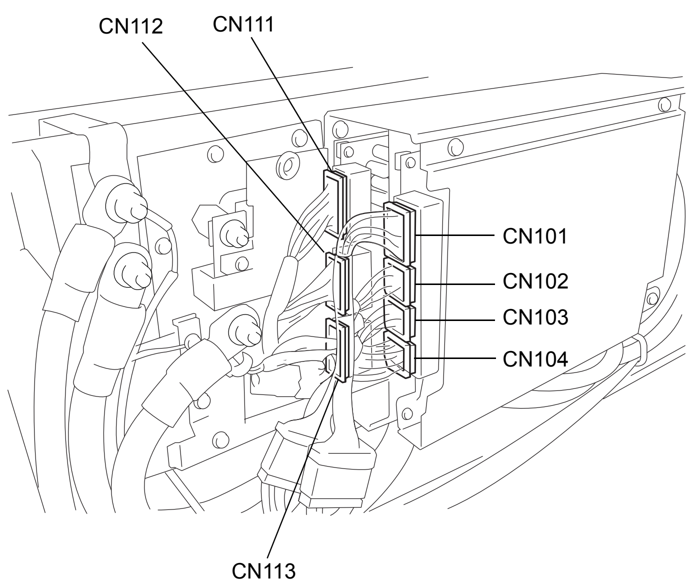


No.	P	J
1	321	SYR+
2	323	SYR-
3	322	SYR

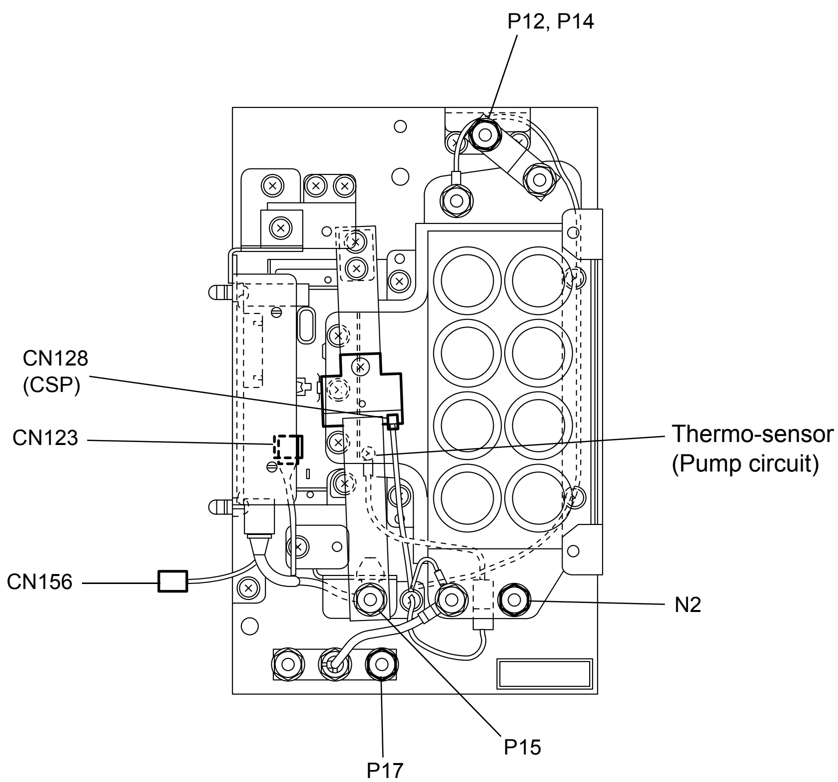
TRAVELING CONTROLLER CONNECTOR·COMPONENT

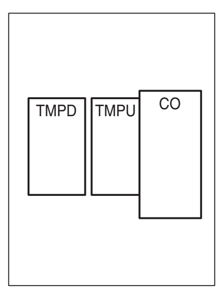


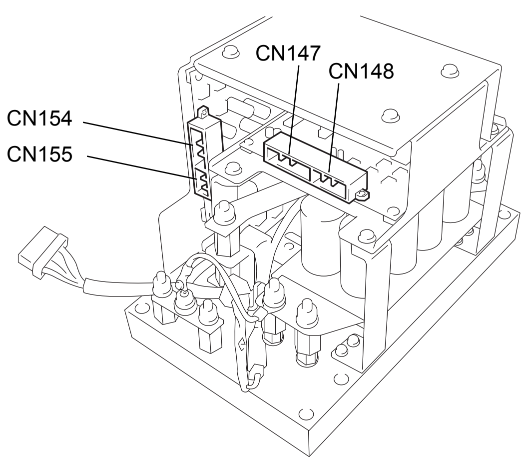




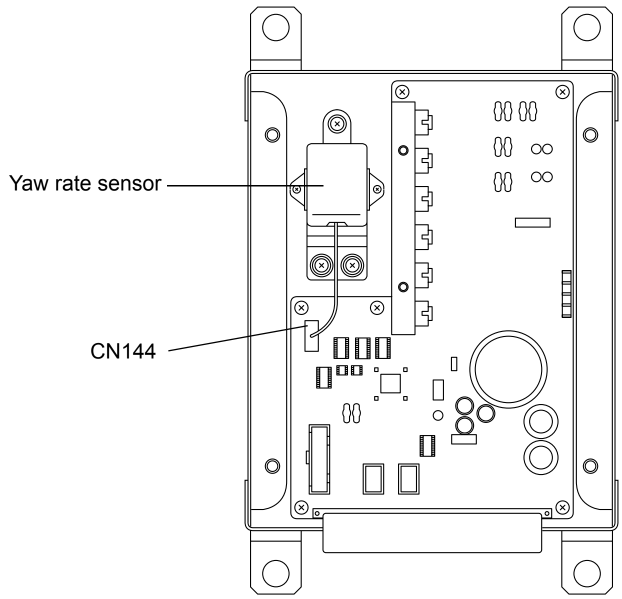
MATERIAL HANDLING CONTROLLER CONNECTOR·COMPONENT

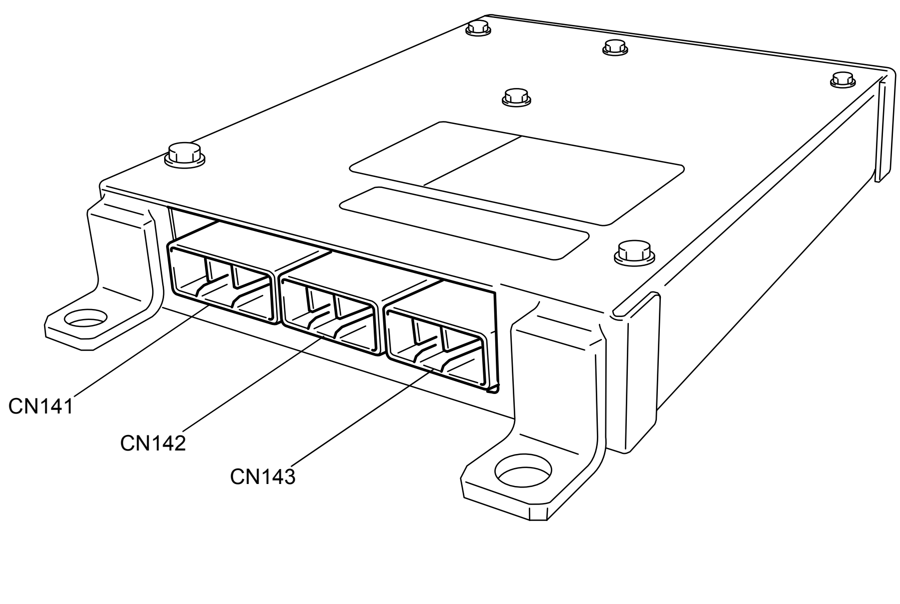




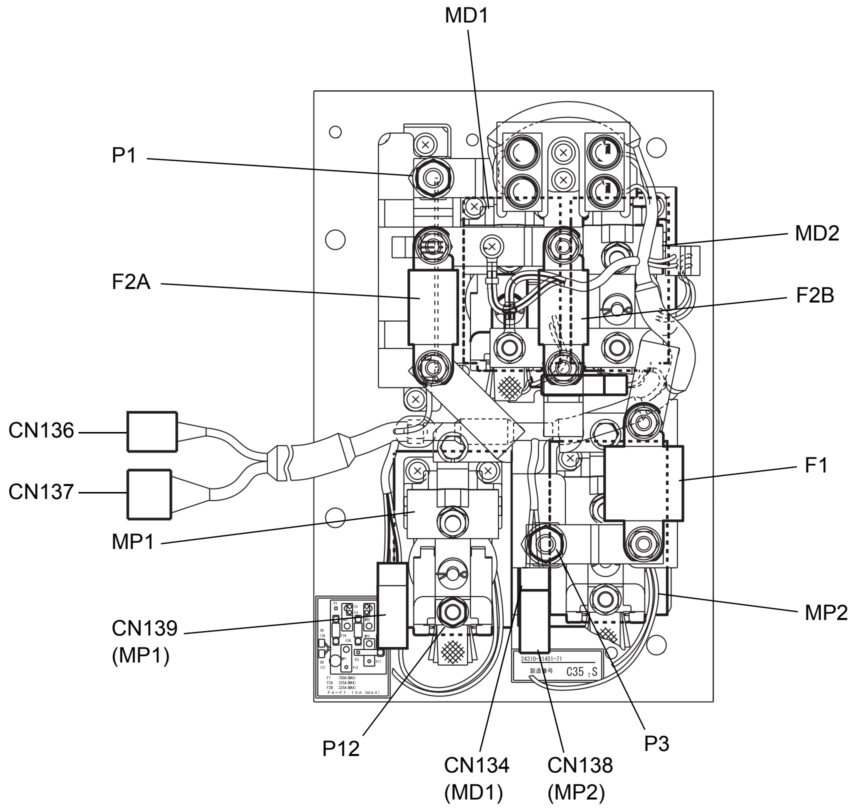


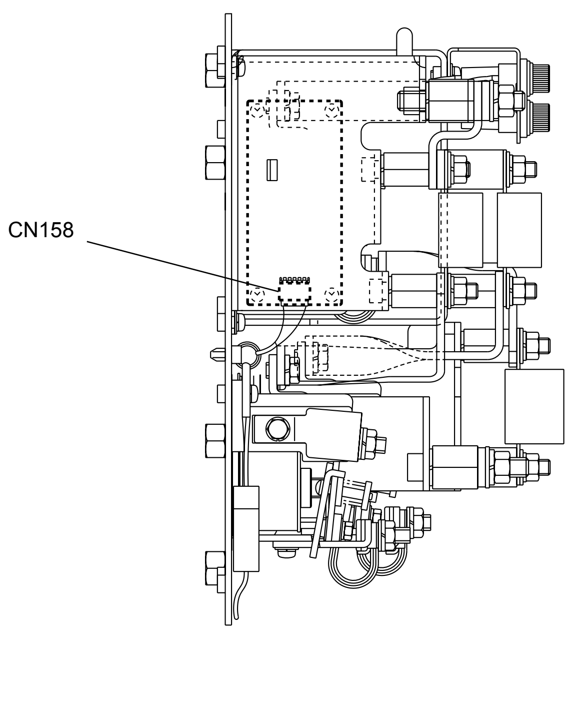
SAS CONTROLLER CONNECTOR·COMPONENT



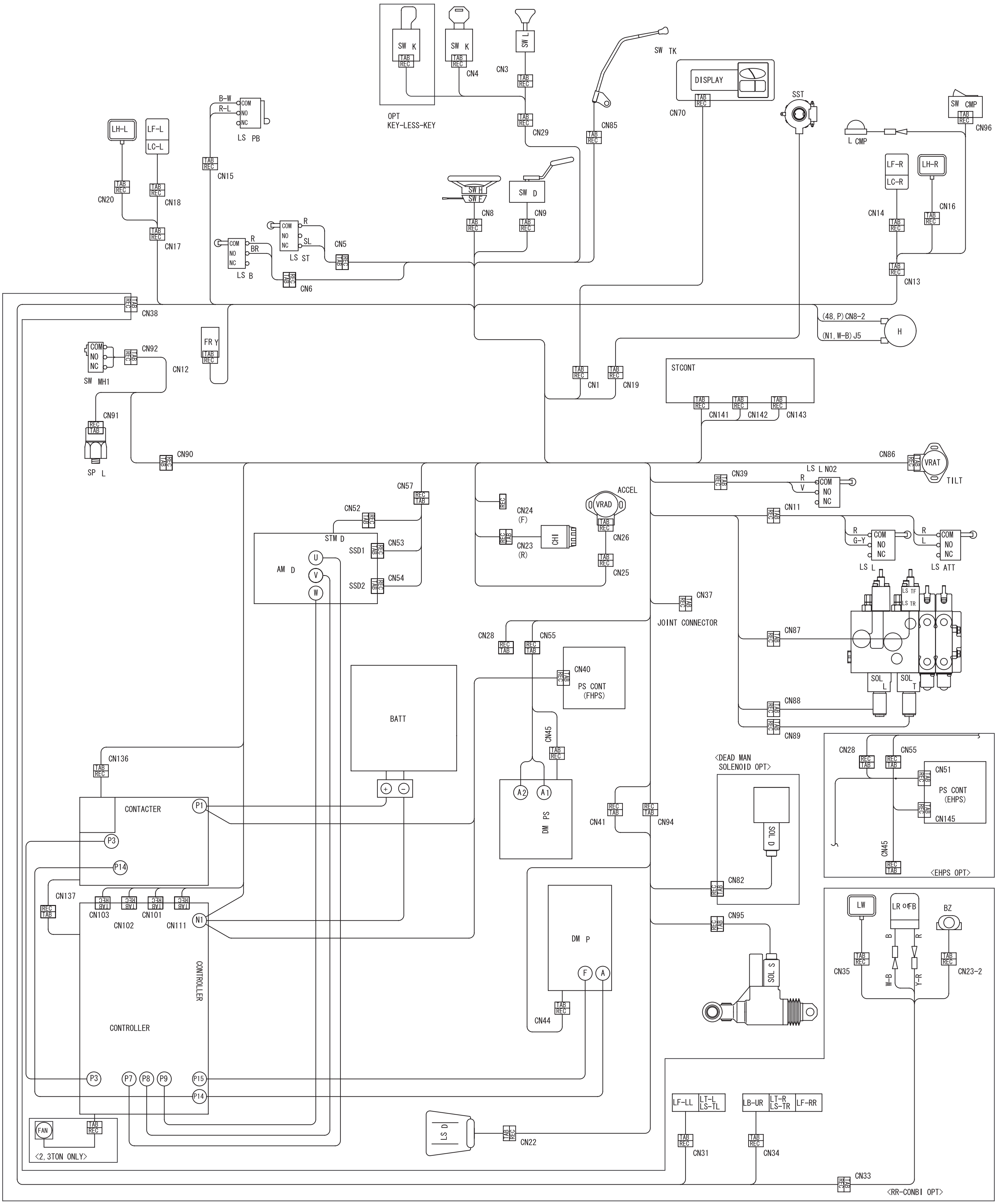


CONTACTOR PANEL CONNECTOR·COMPONENT

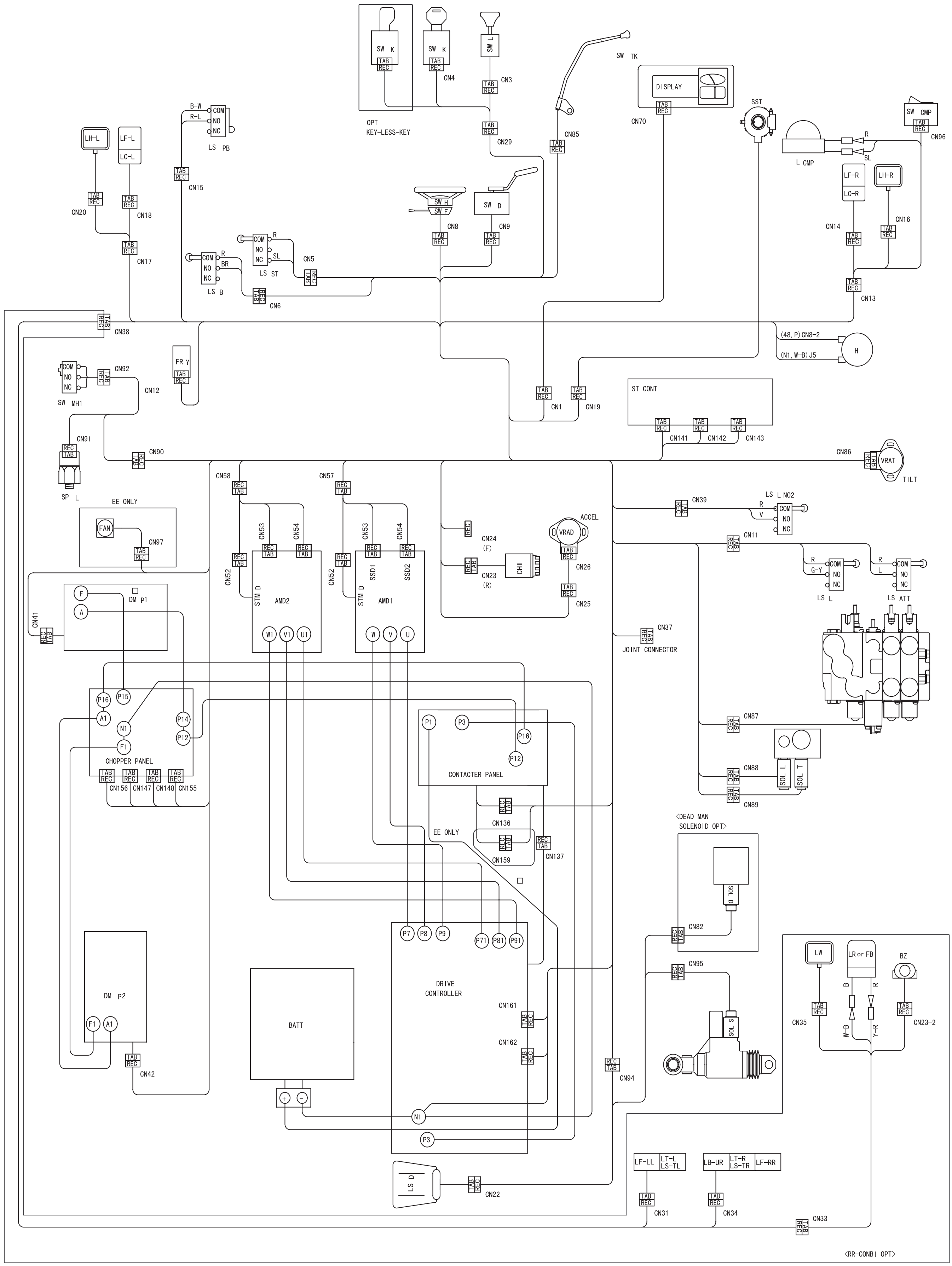


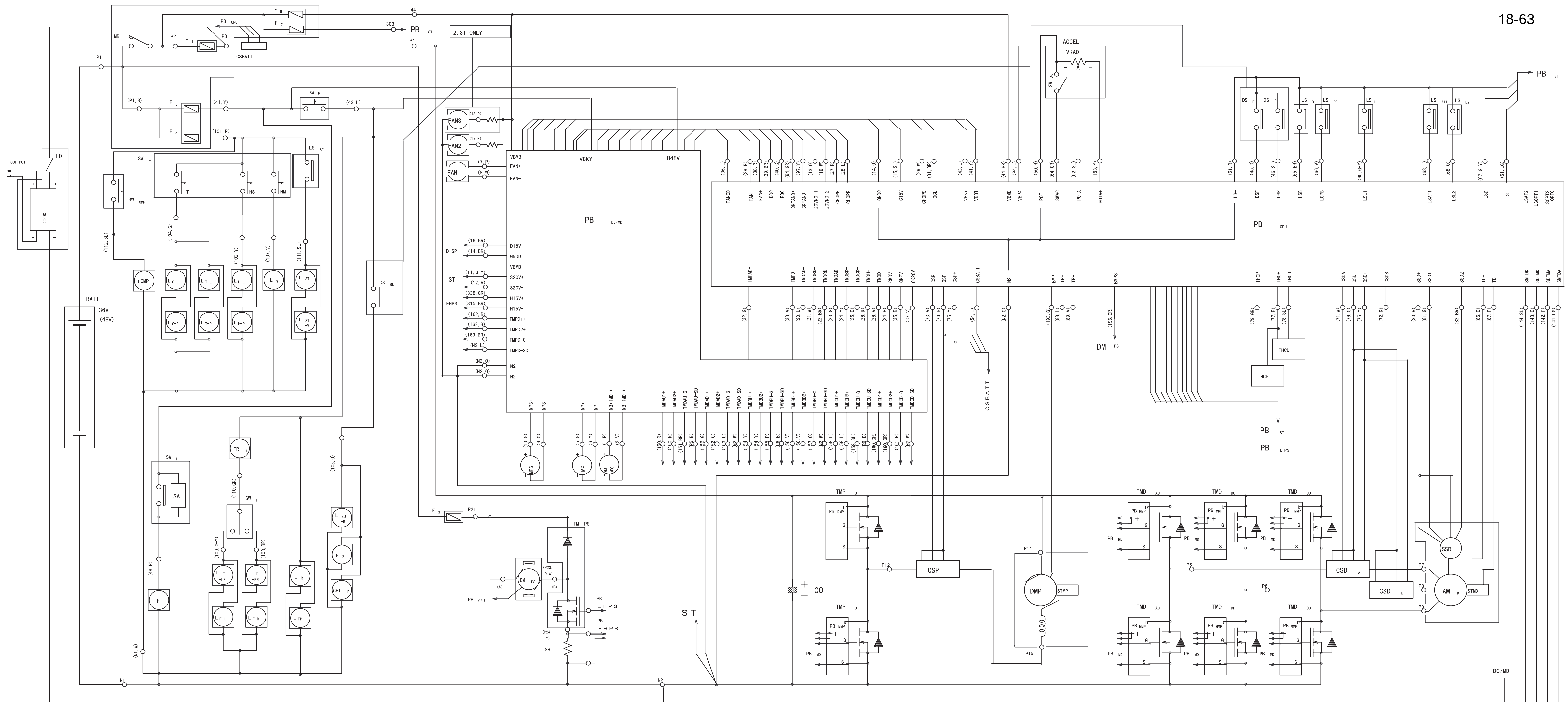


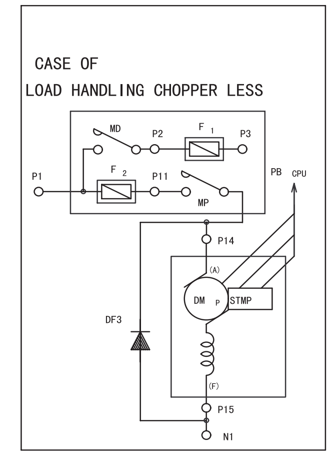
CONNECTING DIAGRAM (15 ~ 32 MODEL)

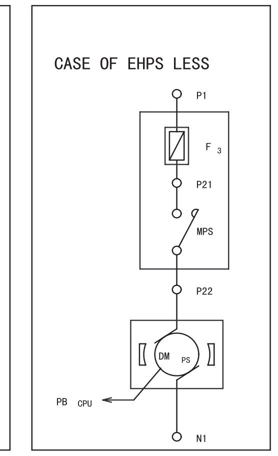


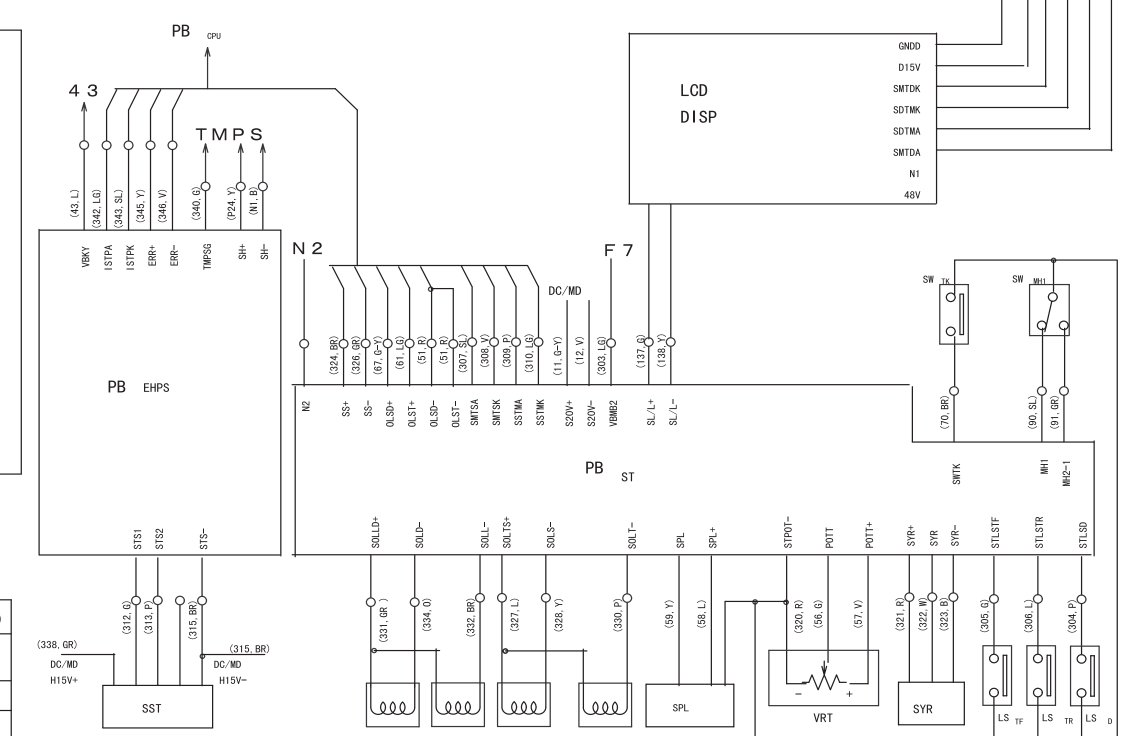
CONNECTING DIAGRAM (35 ~ 55 MODEL)











BATT	BATTERY
F1	FUSE, DRIVE
F2	FUSE, PUMP
F3	FUSE, POWER STEERING
F4	FUSE, LAMP
F5	FUSE, CONTROL CIRCUIT
F6	FUSE, CONTROLLER
F7	FUSE, ST CONTROLLER
FD	FUSE, DC/DC CONVERTER
LCD DISP	LCD DISPLAY
DC/DC	DC/DC CONVERTER
THCD	THERMO, DRIVE
THCP	THERMO, PUMP
AM_{D}	MOTOR, DRIVE
DM_{P}	MOTOR, PUMP
DM_{PS}	MOTOR, POWER STEERING
SOL_{S}	SOLENOID, SWING
SOL_{D}	SOLENOID, DEAD MAN
SOL_{L}	SOLENOID, LIFT
SOL_{T}	SOLENOID, TILT
FAN1	FAN
FAN2	FAN
FAN3	FAN
VRAD	VARI-OHM, ACCEL, DRIVE
VRT	VARI-OHM, TILT

PB_{CPU}	PRINT BOARD, COMPUTER
$PB_{DC/MD}$	PRINT BOARD, DC/MD
PB_{MMP}	PRINT BOARD, MMP
PB_{DMP}	PRINT BOARD, DMP
PB_{ST}	PRINT BOARD, ST COMPUTER
PB_{EHPS}	PRINT BOARD, EHPS
TMD_{AU}	TRANSISTOR, MAIN, DRIVE, PHASE A UPR
TMD_{BU}	TRANSISTOR, MAIN, DRIVE, PHASE B UPR
TMD_{CU}	TRANSISTOR, MAIN, DRIVE, PHASE C UPR
TMD_{AD}	TRANSISTOR, MAIN, DRIVE, PHASE A LWR
TMD_{BD}	TRANSISTOR, MAIN, DRIVE, PHASE B LWR
TMD_{CD}	TRANSISTOR, MAIN, DRIVE, PHASE C LWR
TMP_{U}	TRANSISTOR, MAIN, PUMP, PHASE UPR
TMP_{D}	TRANSISTOR, MAIN, PUMP, PHASE LWR
TMPS	TRANSISTOR, MAIN, POWER STEERING
SH	SHANT, POWER STEERING
CO	CAPACITOR, OVERALL
CSBATT	CURRENT SENSOR, BATTERY
CSD_{A}	CURRENT SENSOR, DRIVE, PHASE A
CSD_{B}	CURRENT SENSOR, DRIVE, PHASE B
CSP	CURRENT SENSOR, PUMP, PHASE
SSD	SENSOR, SPEED, DRIVE
SYR	SENSOR, YAWRATE
SPL	SENSOR, PRESSURE LIFT
SST	SENSOR, STEERING
MPS	CONTACTOR, POWER STEERING
MP	CONTACTOR, PUMP
MB(MD)	CONTACTOR, BATTERY (DRIVE)

DS_{F}	DIRECTION SWITCH, FORWARD
DS_{R}	DIRECTION SWITCH, REVERSE
DS_{BU}	DIRECTION SWITCH, BACK-UP
LS_{L}	LIMIT SWITCH, LIFT
LS_{ATT}	LIMIT SWITCH, ATTACHMENT
LS_{ST}	LIMIT SWITCH, STOP LAMP
LS_{B}	LIMIT SWITCH, BRAKE
LS_{PB}	LIMIT SWITCH, PARKING BRAKE
LS_{TF}	LIMIT SWITCH, TILT FR
LS_{TR}	LIMIT SWITCH, TILT RR
LS_{D}	LIMIT SWITCH, DEAD MAN
LS_{L2}	LIMIT SWITCH, LIFT NO2
SW_{AC}	SWITCH, ACCEL
SW_{K}	SWITCH, KEY
SW_{L}	SWITCH, LIGHT
SW_{F}	SWITCH, FLASHER
SW_{H}	SWITCH, HORN
SW_{TK}	SWITCH, TILT KNOB
SW_{MH1}	SWITCH, HIGHT NO.1
SW_{CMP}	SWITCH, COMPARTMENT
L_{H-L}	LAMP, HEAD LH
L_{H-R}	LAMP, HEAD RH
L_{C-L}	LAMP, CLEARANCE LH
L_{C-R}	LAMP, CLEARANCE RH
L_{T-L}	LAMP, TAIL LH
L_{T-R}	LAMP, TAIL RH
L_{W}	LAMP, WORKING
L_{F-LR}	LAMP, FLASHER LH (REAR)
L_{F-RR}	LAMP, FLASHER RH (REAR)
L_{F-L}	LAMP, FLASHER LH
L_{F-R}	LAMP, FLASHER RH

NOTE)
. THIS DRAWING SHOWS
CASE OF FULL OPTION.

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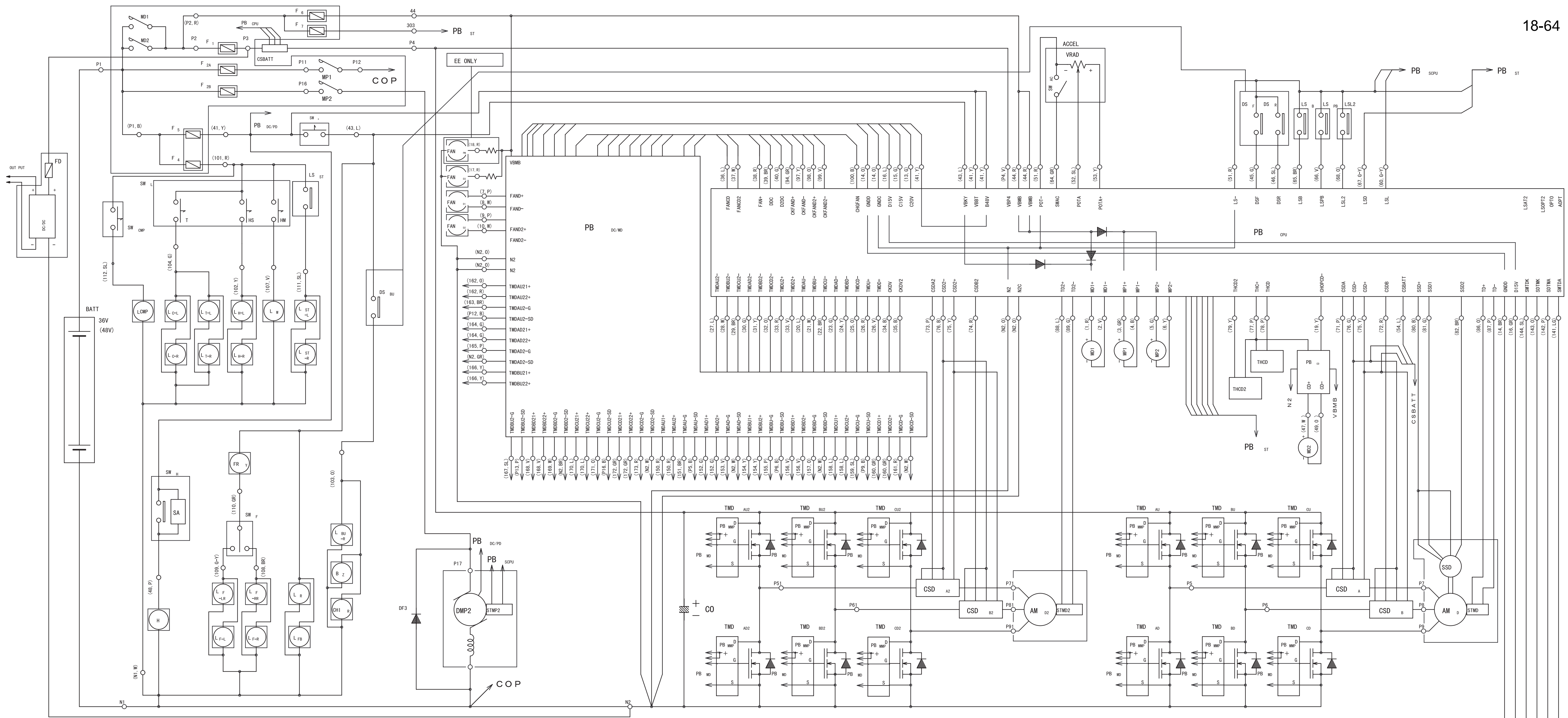
L_{CMP}	LAMP, COMPARTMENT
L_{ST-L}	LAMP, STOP LH
L_{ST-R}	LAMP, STOP RH
L_{R}	LAMP, ROTALY
L_{BU-R}	LAMP, BACK-UP RH
L_{FB}	LAMP, FLASH BEACON
B_{Z}	BUZZER
CHI_{R}	CHIME, REVERSE
H	HORN
FR_{Y}	RELAY, FLASHER

WIRING DIAGRAM (15 ~ 32 MODEL)

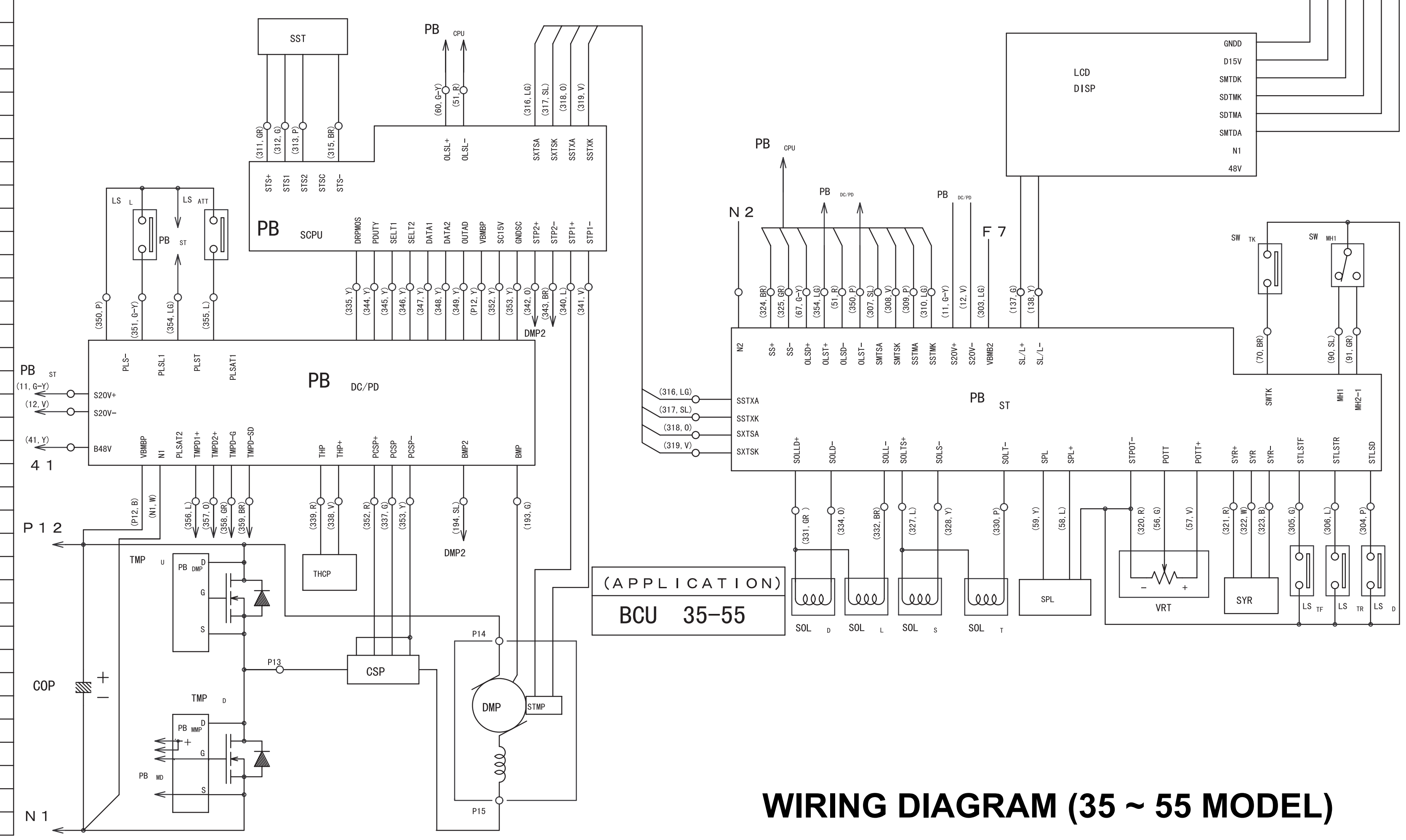


NOTE)
.THIS DRAWING SHOWS
CASE OF FULL OPTION.

BATT	BATTERY
F1	FUSE, DRIVE
F2A	FUSE, PUMP NO.1
F2B	FUSE, PUMP NO.2
F4	FUSE, LAMP
F5	FUSE, CONTROL CIRCUIT
F6	FUSE, CONTROLLER
F7	FUSE, ST CONTROLLER
FD	FUSE, DC/DC CONVERTER
LCD DISP	LCD DISPLAY
THCD	THERMO, DRIVE
THCD2	THERMO, DRIVE 2
THCP	THERMO, PUMP
AM$_{D}$	MOTOR, DRIVE
AM$_{D2}$	MOTOR, DRIVE 2
DM$_{P}$	MOTOR, PUMP
DM$_{P2}$	MOTOR, PUMP 2
SOL$_{S}$	SOLENOID, SWING
SOL$_{D}$	SOLENOID, DEAD MAN
SOL$_{L}$	SOLENOID, LIFT
SOL$_{T}$	SOLENOID, TILT
FAN$_{D1}$	FAN, DRIVE 1
FAN$_{D2}$	FAN, DRIVE 2
FAN$_{D3}$	FAN, DRIVE 3
FAN$_{PM}$	FAN, PUMP MOTOR
VRAD	VARI-OHM, ACCEL, DRIVE
VRT	VARI-OHM, TILT
PB$_{CPU}$	PRINT BOARD, COMPUTER
PB$_{DC/MD}$	PRINT BOARD, DC/MD
PB$_{CD}$	PRINT BOARD, CD
PB$_{MMP}$	PRINT BOARD, MMP
PB$_{DMP}$	PRINT BOARD, DMP
PB$_{SCPU}$	PRINT BOARD, SK/PS COMPUTER
PB$_{DC/PD}$	PRINT BOARD, DC/PD
PB$_{ST}$	PRINT BOARD, ST
SYR	SENSOR, YAWRATE

SSD	SENSOR, SPEED, DRIVE
SPL	SENSOR, PRESSURE LIFT
SST	SENSOR, STEERING
TMD$_{AU}$	TRANSISTOR, MAIN, DRIVE, PHASE A UPR
TMD$_{BU}$	TRANSISTOR, MAIN, DRIVE, PHASE B UPR
TMD$_{CU}$	TRANSISTOR, MAIN, DRIVE, PHASE C UPR
TMD$_{AD}$	TRANSISTOR, MAIN, DRIVE, PHASE A LWR
TMD$_{BD}$	TRANSISTOR, MAIN, DRIVE, PHASE B LWR
TMD$_{CD}$	TRANSISTOR, MAIN, DRIVE, PHASE C LWR
TMD$_{AU2}$	TRANSISTOR, MAIN, DRIVE, PHASE A UPR 2
TMD$_{BU2}$	TRANSISTOR, MAIN, DRIVE, PHASE B UPR 2
TMD$_{CU2}$	TRANSISTOR, MAIN, DRIVE, PHASE C UPR 2
TMD$_{AD2}$	TRANSISTOR, MAIN, DRIVE, PHASE A LWR 2
TMD$_{BD2}$	TRANSISTOR, MAIN, DRIVE, PHASE B LWR 2
TMD$_{CD2}$	TRANSISTOR, MAIN, DRIVE, PHASE C LWR 2
TMPU	TRANSISTOR, MAIN, PUMP, PHASE UPR
TMPD	TRANSISTOR, MAIN, PUMP, PHASE LWR
CO	CAPACITOR, OVERALL
COP	CAPACITOR, OVERALL PUMP
CSBATT	CURRENT SENSOR, BATTERY
CSD$_{A}$	CURRENT SENSOR, DRIVE, PHASE A
CSD$_{B}$	CURRENT SENSOR, DRIVE, PHASE B
CSD$_{A2}$	CURRENT SENSOR, DRIVE, PHASE A2
CSD$_{B2}$	CURRENT SENSOR, DRIVE, PHASE B2
CSP	CURRENT SENSOR, PUMP, PHASE
MD1	CONTACTOR, DRIVE 1
MD2	CONTACTOR, DRIVE 2
MP1	CONTACTOR, PUMP 1
MP2	CONTACTOR, PUMP 2
SW$_{AC}$	SWITCH, ACCEL
SW$_{K}$	SWITCH, KEY
SW$_{L}$	SWITCH, LIGHT
SW$_{F}$	SWITCH, FLASHER
SW$_{H}$	SWITCH, HORN
SW$_{TK}$	SWITCH, TILT KNOB
SW$_{MH1}$	SWITCH, HIGHT NO.1

SW$_{CMP}$	SWITCH, COMPARTMENT
DC/DC	DC/DC CONVERTER
DS$_{F}$	DIRECTION SWITCH, FORWARD
DS$_{R}$	DIRECTION SWITCH, REVERSE
DS$_{BU}$	DIRECTION SWITCH, BACK-UP
LS$_{L}$	LIMIT SWITCH, LIFT
LS$_{L2}$	LIMIT SWITCH, LIFT NO2
LS$_{ATT}$	LIMIT SWITCH, ATTACHMENT
LS$_{ST}$	LIMIT SWITCH, STOP LAMP
LS$_{B}$	LIMIT SWITCH, BRAKE
LS$_{PB}$	LIMIT SWITCH, PARKIG BRAKE
LS$_{TF}$	LIMIT SWITCH, TILT FR
LS$_{TR}$	LIMIT SWITCH, TILT RR
LS$_{D}$	LIMIT SWITCH, DEAD MAN
L$_{H-L}$	LAMP, HEAD LH
L$_{H-R}$	LAMP, HEAD RH
L$_{C-L}$	LAMP, CLEARANCE LH
L$_{C-R}$	LAMP, CLEARANCE RH
L$_{T-L}$	LAMP, TAIL LH
L$_{T-R}$	LAMP, TAIL RH
L$_{W}$	LAMP, WORKING
L$_{F-LR}$	LAMP, FLASHER LH (REAR)
L$_{F-RR}$	LAMP, FLASHER RH (REAR)
L$_{F-L}$	LAMP, FLASHER LH
L$_{F-R}$	LAMP, FLASHER RH
L$_{ST-L}$	LAMP, STOP LH
L$_{ST-R}$	LAMP, STOP RH
L$_{R}$	LAMP, ROTALY
L$_{BU-R}$	LAMP, BACK-UP RH
L$_{FB}$	LAMP, FLASH BEACON
L$_{CMP}$	LAMP, COMPARTMENT
B$_{Z}$	BUZZER
CHI$_{R}$	CHIME, REVERSE
H	HORN
FR$_{Y}$	RELAY, FLASHER



(APPLICATION)
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WIRING DIAGRAM (35 ~ 55 MODEL)