ISUZU DIESEL ENGINE
6BG1

INSTRUCTION MANUAL

ISUZU MOTORS LIMITED

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1. ENGINE EXTERNAL VIEWS

1. A-6BG1T EXTERNAL VIEW (LH)

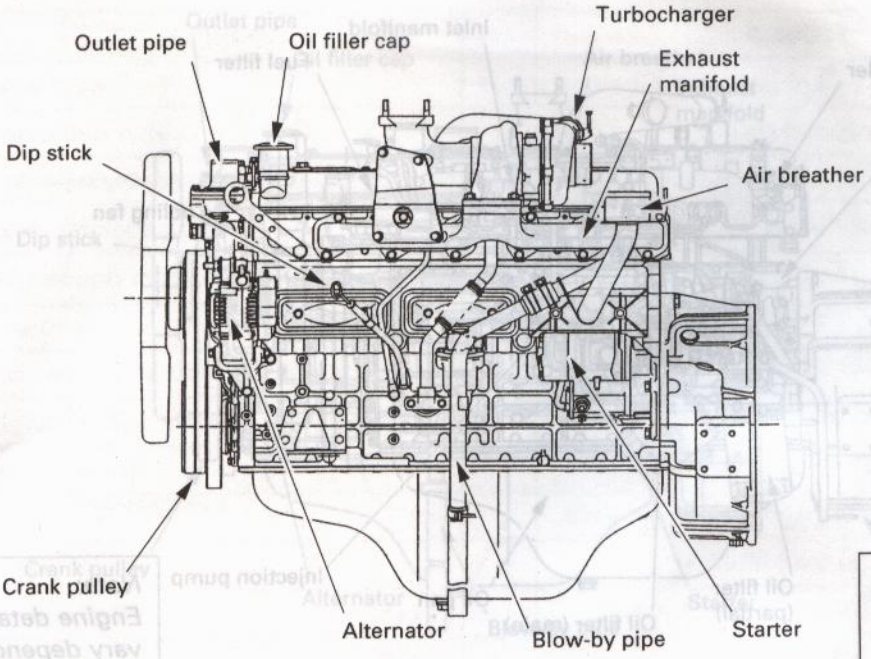
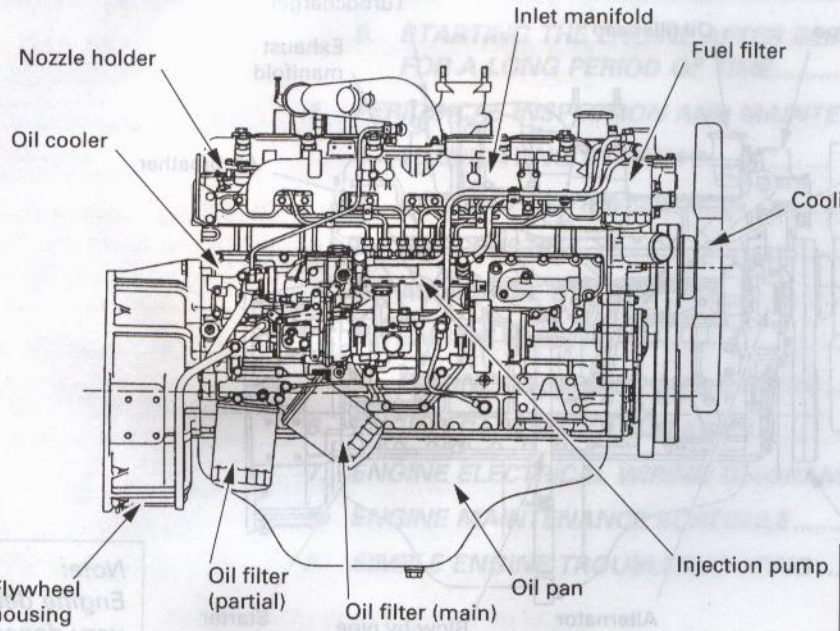


Fig. 1

Note:
Engine details may vary depending on the specifications.

2. A-6BG1T EXTERNAL VIEW (RH)



Note:
Engine details may vary depending on the specifications.

Fig. 2

3. A-6BG1 EXTERNAL VIEW (LH)

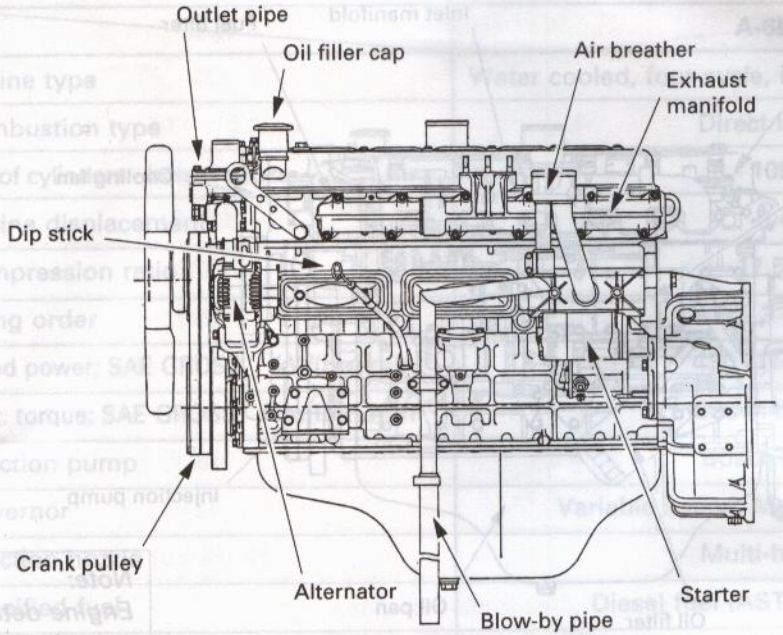
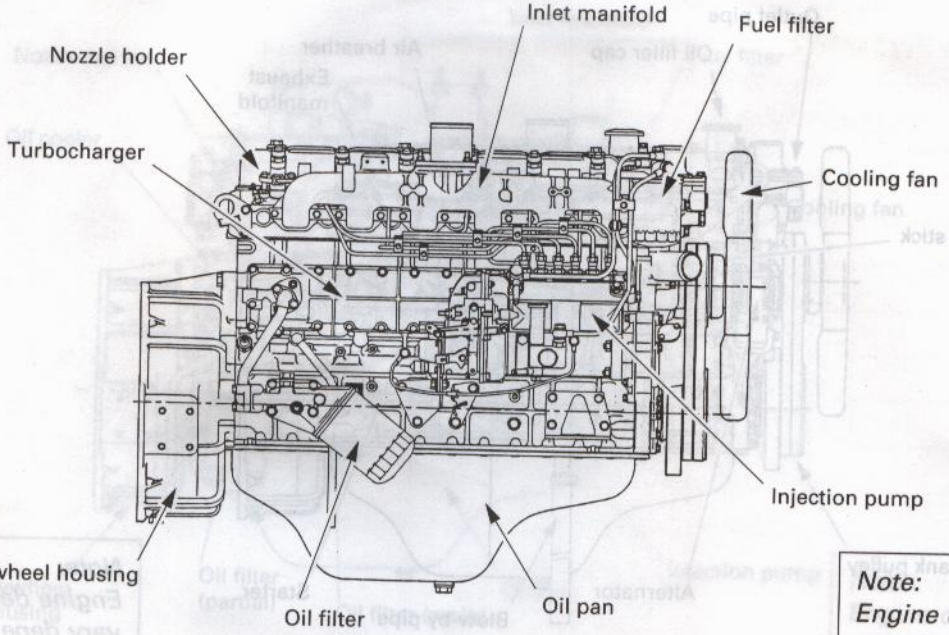


Fig. 3

Note:
Engine details may vary depending on the specifications.

4. A-6BG1 EXTERNAL VIEW (RH)



Note:
Engine details may vary depending on the specifications.

Fig. 4

2. GENERAL INFORMATION

1. STANDARD ENGINE DATA AND SPECIFICATIONS

(1) Model A-6BG1T

Exp. STD spec

	A-6BG1T
Engine type	Water cooled, four cycle, in line overhead valve type
Combustion type	Direct injection
No. of cylinders - bore × stroke mm	6 - 105 × 125
Engine displacement L	6.494
Compression ratio	17.5 to 1
Firing order	1 – 5 – 3 – 6 – 2 – 4
* Rated power; SAE GROSS kW(hp)/min^{-1}	130 (174) / 2500
* Max. torque; SAE GROSS Nm(lbft)/min^{-1}	600 (443) / 1800
Injection pump	Bosch AD type
Governor	Variable speed, Mechanical type (RSV)
Injection nozzle	Multi-hole type
Specified fuel	Diesel fuel (ASTM D975 No. 2–D)
* Starter V-kW	12 – 2.5
* Alternator V-A	12 – 60

			A-6BG1T
Specified engine oil (API grade)			CD
* Lub. oil volume (Oil pan)		L	21.5 – 17.5
Coolant volume (Engine only)		L	12.0
* Engine dry weight		kg	485.0
* Engine dimensions	Overall length	mm	1082
	Overall width	mm	691
	Overall height	mm	951
Valve clearance (cold)		mm	0.4
Nozzle injection pressure		MPa	18.1
* Injection timing B.T.D.C			12°
Maker and type of turbocharger			IHI (RHE6)

NOTE: 1. These specifications are based on the standard engine.
2. Specifications for items marked with an asterisk (*) will vary according to the type of equipment in which the engine is installed.
If you are unable to locate these data applicable to your engine, please contact your equipment supplier.

(2) Model A-6BG1

Exp. STD spec

	A-6BG1
Engine type	Water cooled, four cycle, in line overhead valve type
Combustion type	Direct injection
No. of cylinders - bore × stroke mm	6 - 105 × 125
Engine displacement L	6.494
Compression ratio	17.0 to 1
Firing order	1 – 5 – 3 – 6 – 2 – 4
* Rated power; SAE GROSS kW(hp)/min^{-1}	95.5 (128) / 2500
* Max. torque; SAE GROSS Nm(lbft)/min^{-1}	420 (310) / 1500
Injection pump	Bosch A type
Governor	Variable speed, Mechanical type (RSV)
Injection nozzle	Multi-hole type
Specified fuel	Diesel fuel (ASTM D975 No. 2–D)
* Starter V-kW	12 – 2.5
* Alternator V-A	12 – 60

			A-6BG1
Specified engine oil (API grade)			CC or CD
* Lub. oil volume (Oil pan)		L	21.5 – 17.5
Coolant volume (Engine only)		L	12.0
* Engine dry weight		kg	465.0
* Engine dimensions	Overall length	mm	1082
	Overall width	mm	691
	Overall height	mm	875
Valve clearance (cold)		mm	0.4
Nozzle injection pressure		MPa	18.1
* Injection timing B.T.D.C			14°
Maker and type of turbocharger			NA

NOTE: 1. These specifications are based on the standard engine.

2. Specifications for items marked with an asterisk (*) will vary according to the type of equipment in which the engine is installed.
If you are unable to locate these data applicable to your engine, please contact your equipment supplier.

2. EPA AND CARB CERTIFIED ENGINE DATA AND SPECIFICATIONS

Se rapporter à la fin de ce document pour les informations EPA en français.

(1) Model A-6BG1T

ISUZU engine model name	A-6BG1T
Engine family	*SZXL06. 5BTA
Engine code	6BG1XXXXX-XX
Engine type	Water cooled, four cycle, in line overhead valve type
Combustion type	Direct injection
No. of cylinders - bore × stroke mm(in)	6 - 105 × 125 (4.13 × 4.92)
Engine displacement L(cid)	6.494 (396.3)
Compression ratio	17.5 to 1
Firing order	1 – 5 – 3 – 6 – 2 – 4
Max. rated power; SAE NET hp/min^{-1}	169.2 / 2500
Fuel flow at max. rated power mm^3/stroke	82.33
Exhaust emission control system	EM TC DFI
Injection pump	Bosch AD type
Governor	Variable speed, Mechanical type

* Mark ; Put a letter codes for model year on the top of the letters.
Y : 2000, 1 : 2001, 2 : 2002 Model Year

Engine code varies depending on each engine.

ISUZU engine model name			A-6BG1T
Injection nozzle			Multi-hole type
Specified fuel			Diesel fuel (ASTM D975 No. 2–D)
Starter		V-kW	24 – 4.5
Alternator		V-A	24 – 25
Specified engine oil (API grade)			CD
Lub. oil volume (Oil pan)		L (qts)	21.5 (22.7) – 17.5 (18.5)
Coolant volume (Engine only)		L (qts)	12.0 (12.7)
Engine dry weight		kg (lb)	470.0 (1,036.2)
Engine dimensions	Overall length	mm (in)	1162.0 (45.75)
	Overall width	mm (in)	778.0 (30.63)
	Overall height	mm (in)	952.0 (37.48)
Valve clearance (cold)		mm (in)	0.4 (0.0157)
Nozzle injection pressure		MPa (psi)	18.1 (2630)
Injection timing B.T.D.C			12°
Maker and type of turbocharger			IHI (RHE6)

(2) Model A-6BG1

ISUZU engine model name		A-6BG1	
Engine family		*SZXL06. 5BNA	*SZXL06. 5CNA
Engine code		6BG1XXXXX-XX	
Engine type		Water cooled, four cycle, in line overhead valve type	
Combustion type		Direct injection	
No. of cylinders - bore × stroke	mm(in)	6 - 105 × 125 (4.13 × 4.92)	
Engine displacement	L (cid)	6.494 (396.3)	
Compression ratio		17.0 to 1	
Firing order		1 – 5 – 3 – 6 – 2 – 4	
Max. rated power; SAE NET	hp/min^{-1}	123.2 / 2500	94.6 / 2000
Fuel flow at max. rated power	mm^3/stroke	60.11	49.6
Exhaust emission control system		EM DFI	
Injection pump		Bosch A type	
Governor		Variable speed, Mechanical type	

* Mark ;Put a letter codes for model year on the top of the letters.
Y : 2000, 1 : 2001, 2 : 2002, 3 : 2003 Model Year

Engine code varies depending on each engine.

ISUZU engine model name			A-6BG1	
Engine family			*SZXL06. 5BNA	*SZXL06. 5CNA
Injection nozzle			Multi-hole type	
Specified fuel			Diesel fuel (ASTM D975 No. 2–D)	
Starter		V-kW	24 – 4.5	
Alternator		V-A	24 – 25	
Specified engine oil (API grade)			CC or CD	
Lub. oil volume (Oil pan)		L (qts)	21.5 (22.7) – 17.5 (18.5)	
Coolant volume (Engine only)		L (qts)	12.0 (12.7)	
Engine dry weight		kg (lb)	450.0 (992.1)	
Engine dimensions	Overall length	mm (in)	1156.0 (45.51)	
	Overall width	mm (in)	750.0 (29.53)	
	Overall height	mm (in)	946.0 (37.24)	
Valve clearance (cold)		mm (in)	0.4 (0.0157)	
Nozzle injection pressure		MPa (psi)	18.1 (2630)	14.7 (2135)
Injection timing B.T.D.C			14°	16°
Maker and type of turbocharger			NA	

(3) Model CC-6BG1T, AA-6BG1T and BB-6BG1T

ISUZU engine model name	CC-6BG1T	AA-6BG1T	BB-6BG1T
Engine family	*SZXL06. 5EXA	*SZXL06. 5FXA	*SZXL06. 5FTA
Engine code	6BG1XXXXX-XX		
Engine type	Water cooled, four cycle, in line overhead valve type		
Combustion type	Direct injection		
No. of cylinders - bore × stroke mm(in)	6 - 105 × 125 (4.13 × 4.92)		
Engine displacement L(cid)	6.494 (396.3)		
Compression ratio	18.0 to 1		
Firing order	1 – 5 – 3 – 6 – 2 – 4		
Max. rated power; SAE NET hp/min^{-1}	188.4 / 2200	149.3 / 2100	170.7 / 2200
Fuel flow at max. rated power mm^3/stroke	92.3	79.1	89.8
Exhaust emission control system	EM TC CAC DFI		EM TC DFI
Injection pump	Bosch AD type		
Governor	Variable speed, Mechanical type/Electrical type		

* Mark ; Put a letter codes for model year on the top of the letters.
Y : 2000, 1 : 2001, 2 : 2002, 3 : 2003 Model Year

Engine code varies depending on each engine.

ISUZU engine model name			CC-6BG1T	AA-6BG1T	BB-6BG1T
Injection nozzle			Multi-hole type		
Specified fuel			Diesel fuel (ASTM D975 No. 2–D)		
Starter		V-kW	24 – 4.5		
Alternator		V-A	24 – 25		
Specified engine oil (API grade)			CD		
Lub. oil volume (Oil pan)		L (qts)	21.5 (22.7) – 16.5 (17.4)		
Coolant volume (Engine only)		L (qts)	12.0 (12.7)		
Engine dry weight		kg (lb)	490 (1080)		
Engine dimensions	Overall length	mm (in)	1206 (47.5)		
	Overall width	mm (in)	815 (32.1)		
	Overall height	mm (in)	996 (39.2)		
Valve clearance (cold)		mm (in)	0.4 (0.0157)		
Nozzle injection pressure		MPa (psi)	18.1 (2630)		16.7–19.6 (2415–2845)
Injection timing B.T.D.C			9°	10°	9°
Maker and type of turbocharger			IHI (RHG6)		

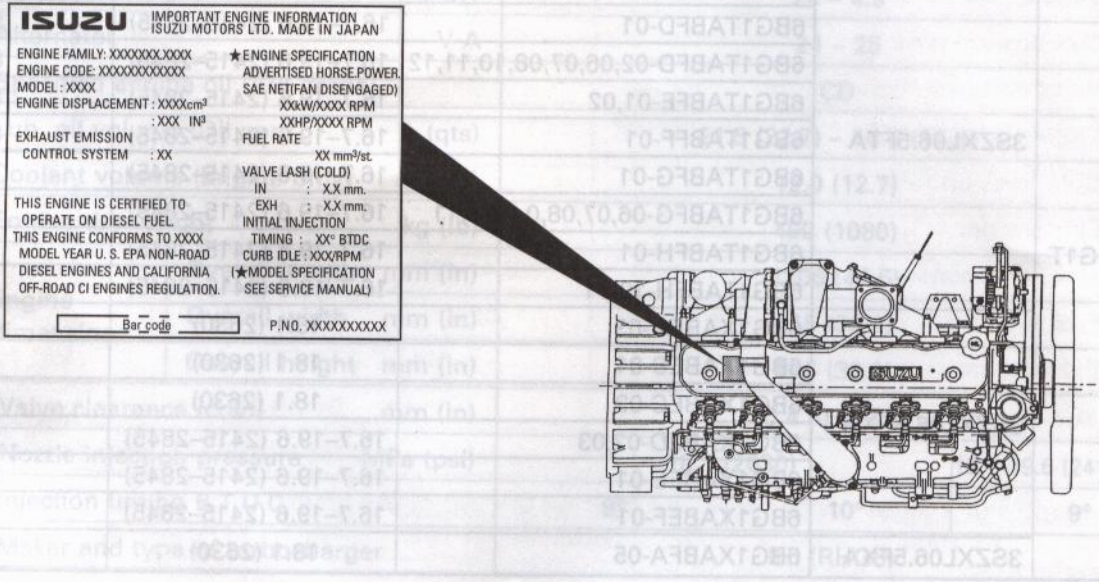
(4) Engine family index

Engine	Engine family	Engine code	Injection nozzle opening pressure MPa(psi)	Injection timing B.T.D.C. (Static)
6BG1	3SZXL06.5CNA	6BG1NAABA-05	18.1 (2630)	14°
		6BG1NAABB-01	14.7 (2135)	16°
		6BG1NAABE-01	18.1 (2630)	16°
6BG1T	3SZXL06.5FTA	6BG1TABFC-01	18.1 (2630)	8°
		6BG1TABFD-01	16.7–19.6 (2415–2845)	9°
		6BG1TABFD-02,06,07,08,10,11,12	16.7–19.6 (2415–2845)	8°
		6BG1TABFE-01,02	16.7–19.6 (2415–2845)	8°
		6BG1TABFF-01	16.7–19.6 (2415–2845)	8°
		6BG1TABFG-01	16.7–19.6 (2415–2845)	7°
		6BG1TABFG-06,07,08,0-9,10,11	16.7–19.6 (2415–2845)	6°
		6BG1TABFH-01	16.7–19.6 (2415–2845)	7°
		6BG1TABFH-10,11	16.7–19.6 (2415–2845)	6°
	3SZXL06.5EXA	6BG1XABEA-03	18.1 (2630)	9°
		6BG1XABEB-01	18.1 (2630)	9°
		6BG1XABEC-03	18.1 (2630)	9°
		6BG1XABED-02,03	16.7–19.6 (2415–2845)	9°
		6BG1XABEE-01	16.7–19.6 (2415–2845)	9°
		6BG1XABEF-01	16.7–19.6 (2415–2845)	9°
	3SZXL06.5FXA	6BG1XABFA-05	18.1 (2630)	10°

EMISSION CONTROL LABEL: ENGINE LABEL (FOR EPA)

Emission control label is attached on the rear, upper side of cylinder head cover. But the same emission control label is attached at a visible point on the equipment when the label that is attached to the engine is not visible due to the structure of the equipment.

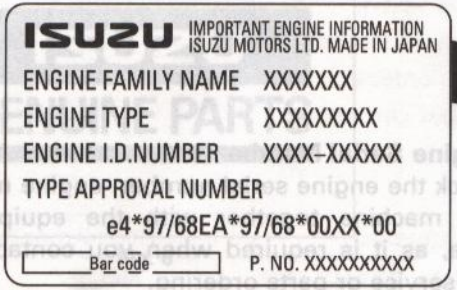
The following is the sample of a label required for engine emission control information, along with location.



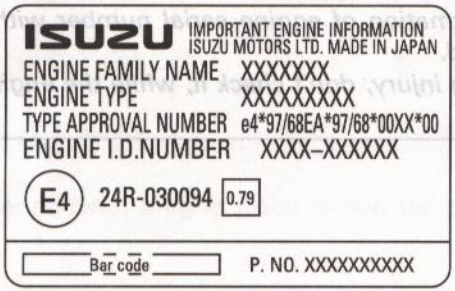
3. EC EMISSION CONTROL LABEL: ENGINE LABEL

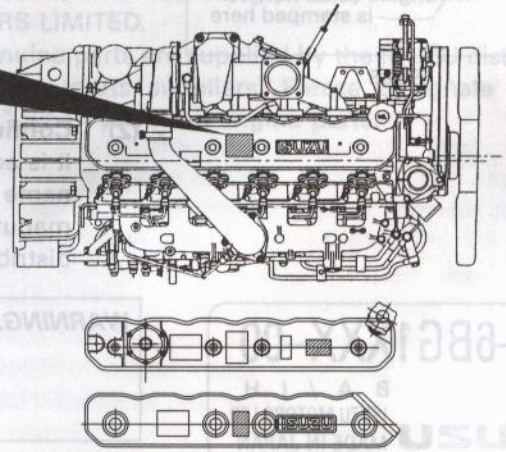
Emission control label is attached on the upper side of cylinder head cover.
The location of emission control label attached on the engine may vary depending on the engine specification.

The following is the sample of a label required for engine emission control information, along with location.



or





: EC LABEL

4. ENGINE IDENTIFICATION

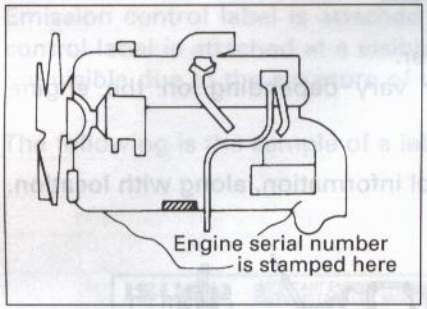


Fig. 5

(1) Position of Display

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

Further, engine model is described also on an ID label on the top of the cylinder head cover.

(2) Confirmation of Engine Serial Number

It is advisable to check the engine serial number, engine model name and type of machine together with the equipment manufacturer's name, as it is required when you contact the distributor for repair service or parts ordering.

ID LABEL

WARNING: *Conduct confirmation of engine serial number with the engine stopped.*
To avoid being injury, don't check it, while the engine is still hot.

5. ISUZU ENGINE AFTER SERVICE

(1) Isuzu Engine After Service

Please feel free to contact your ISUZU dealer for periodical inspection and maintenance.

(2) Isuzu Genuine Parts

The ISUZU genuine parts are identical with those of used in the engine production, and accordingly, they are warranted by ISUZU MOTORS LIMITED.

The ISUZU genuine parts are supplied by the ISUZU distributors or the authorized parts suppliers. Please designate "ISUZU Genuine Parts" when you need engine parts.

Fig. 6

3. FUEL, LUBRICANT, AND COOLANT

1. FUEL

(1) Fuel Selection

The following specific advantages are required for the diesel fuel.

1) Must be free from minute dust particles.
2) Must have adequate viscosity.
3) Must have high cetane value.
4) Must have high fluidity at low temperature.
5) Must have low sulfur content.
6) Must have little residual carbon.

Diesel fuels

Applicable Standard	Recommendation
JIS (JAPANESE INDUSTRIAL STANDARD)	NO. 2
DIN (DEUTSCHE INDUSTRIE NORMEN)	DIN 51601
SAE (SOCIETY OF AUTOMOTIVE ENGINEERS) Based on SAE-J-313C	NO. 2-D
BS (BRITISH STANDARD) Based on BS/2869-1970	Class A-1

If fuel other than the specified one is used, engine function will be lowered.

(2) Fuel Requirements

CAUTION: *The fuel injection pump, injector or other parts of the fuel system and engine can be damaged if you use any fuel or fuel additive other than those specifically recommended by Isuzu.*

Such damage is not Isuzu's responsibility, and is not covered by the Warranty. To help avoid fuel system or engine damage, please heed the following:

- *Some service stations mix used engine oil with diesel fuel. Some manufacturers of large diesel engines allow this; however, for your diesel engine, do not use diesel fuel which has been contaminated with engine oil. Besides causing engine damage, such fuel can also affect emission control. Before using any diesel fuel, check with the service station operator to see if the fuel has been mixed with engine oil.*
- *Do not use any fuel additive (other than as recommended under "Biocide" in this section). At the time this manual was printed, no other fuel additive was recommended. (See your authorized dealer to find out if this has changed.)*

Your engine is designed to use either Number 1-D or Number 2-D diesel fuel. However, for better fuel economy, use Number 2-D diesel fuel whenever possible. At temperatures less than –7°C, (20°F), Number 2-D fuel may pose operating problems (see "Cold Weather Operation" which follows). At colder temperatures, use Number 1-D fuel (if available) or use a "winterized" Number 2-D (a blend of Number 1-D and Number 2-D). This blended fuel is usually called Number 2-D also, but can be used in colder temperatures than Number 2-D fuel which has not been "winterized." Check with the service station operator to be sure you get the properly blended fuel. Note that diesel fuel may foam during a fill-up. This can cause the automatic pump nozzle to shut off even though your tank is not fulls.

CAUTION: *Do not use home heating oil or gasoline in your diesel engine; either may cause engine damage.*

(3) Handling of the Fuel

The fuel containing dust particles or water will cause engine failure.

Therefore, the following notice must be observed.

1) Take care to prevent the fuel from entry of dust particles or water when filling the fuel tank.
When fueling is done from an oil drum directly, keep the drum stationary over a long time so that clean fuel can be used after the dust particles or water is completely sedimented.

2) Always fully fill the fuel tank. Drain the sedimented particles in the fuel tank frequently by opening the tank draining hole.

(4) Water in Fuel

During refueling, it is possible for water (and other contaminants) to be pumped into your fuel tank along with the diesel fuel. This can happen if a service station does not regularly inspect and clean its fuel tanks, or if a service station receives contaminated fuel from its supplier(s).

To protect your engine from contaminated fuel, there is a fuel filter system on the engine which allows you to drain excess water.

WARNING: *The water/diesel fuel mixture is flammable, and could be hot. To help avoid personal injury and/or property damage, do not touch the fuel coming from the drain valve, and do not expose the fuel to open flames or sparks. Be sure you do not overfill the container. Heat (such as from the engine) can cause the fuel to expand. If the container is too full, fuel could be forced out of the container. This could lead to a fire and the risk of personal injury and/or vehicle or equipment damage.*

(5) Biocides

In warm or humid weather, fungus and/or bacteria may form in diesel fuel if there is water in the fuel.

CAUTION: *Fungus or bacteria can cause fuel system damage by plugging the fuel lines, fuel filters or injector. They can also cause fuel system corrosion.*

If fungus or bacteria has caused fuel system problems, you should have your authorized dealer correct these problems. Then, use a diesel fuel biocide to sterilize the fuel system (follow the biocide manufacturer's instructions). Biocides are available from your dealer, service stations, parts stores and other automotive places. See your authorized dealer for advice on using biocides in your area and for recommendations on which biocides you should use.

(6) Smoke Suppressants

Because of extensive testing of treated fuel versus untreated fuel, the use of a smoke suppressant additive is not recommended because of the greater possibility of stuck rings and valve failure, resulting from excessive ash deposits.

2. LUBRICANT

The quality of engine oil may largely affect engine performance, startability and engine life.

Use of unsuitable engine oil will result in piston ring, piston and cylinder seizure and accelerate the sliding surface wear causing increased oil consumption, lowered output and, finally engine failure. To avoid this, use the specified engine oil.

(1) Engine Oil Selection

6BG1T ..... API, CD grade

6BG1 ..... API, CC or CD grade

(2) Oil Viscosity

Engine oil viscosity largely affect engine startability, performance, oil consumption, speed of wearing and occurence of seizure, etc. Using lubricants whose viscosity selected according to the atmospheric temperature is important.

CAUTION: *1. Using a mixture of different brand or quality oils will adversely affect the original oil quality; therefore, never mix up different brand or different type oils.*

2. Don't use API, CA, CB grade and reconstituted engine oil.

3. Engine damage due to improper maintenance, or using oil of the improper quality and/or viscosity, is not covered by the warranty.

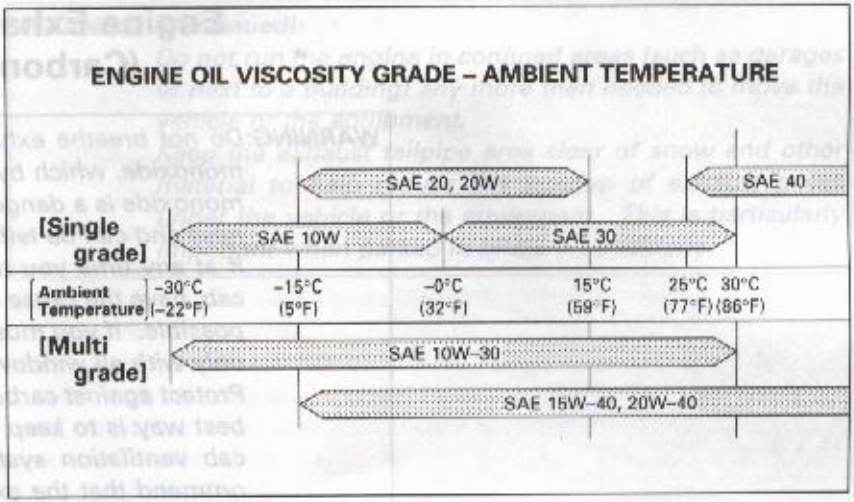


Fig. 7

3. COOLANT

Use drinking water for coolant and replace it periodically.

Engine Exhaust Gas Caution (Carbon Monoxide)

WARNING: *Do not breathe exhaust gas because it contains carbon monoxide, which by itself has no color or odor. Carbon monoxide is a dangerous gas. It can cause unconsciousness and can be lethal.*

If at any time you think exhaust fumes are entering the cab, have the cause determined and corrected as soon as possible. If you must drive under these conditions, drive only with all windows fully open.

Protect against carbon monoxide entry into the cab. The best way is to keep the engine exhaust system, cab and cab ventilation system properly maintained. We recommend that the exhaust system and cab be inspected by competent technician:

- *Each time the vehicle has an oil change.*
- *Whenever a change is noticed in the sound of the exhaust system.*
- *Whenever the exhaust system, underbody or cab is damaged or becomes corroded.*

See "Maintenance Schedule" in Section 8 of this manual for parts requiring inspection.

To allow proper operation of your vehicle's ventilation system, keep the air inlet grille clear of snow, leaves or other obstructions at all times.

WARNING (Continued):

Do not run the engine in confined areas (such as garages or next to a building) any more than needed to move the vehicle or the equipment.

Keep the exhaust tailpipe area clear of snow and other material to help reduce the buildup of exhaust gases under the vehicle or the equipment. This is particularly important when parked in blizzard conditions.

1. CHECK BEFORE OPERATION

WARNING: *For Safety's sake, conduct the inspection before start-up with the engine stopped.*

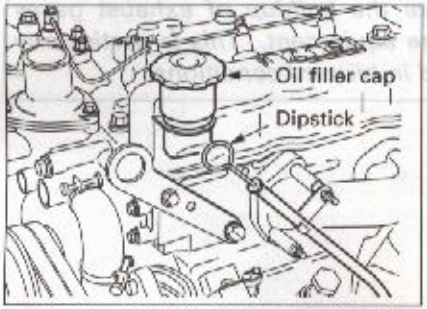


Fig. 8

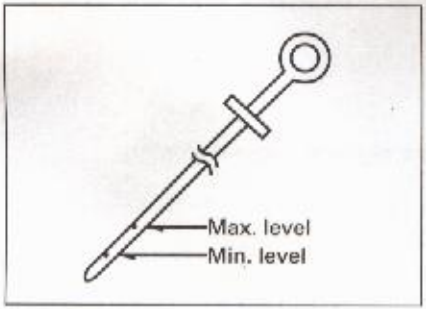


Fig. 9

(1) Engine Oil Level

1) Place the engine on a level surface.
2) Remove the dipstick from the crankcase, wipe it with clothing. Insert it fully and take out it gently again.
   Check the oil level by the level marks on the dipstick. The oil level must be between the "Max." level mark and the "Min." level mark as illustrated.
   Take care not to add too much engine oil.
   - Drain oil to the max. oil level if oil level is above the max. level mark.
   - Add oil to the max. oil level if oil level is below the min. level mark.

3) Also check the sample oil on the dipstick for fouling and degrees of viscosity.

CAUTION: *Oil level check must be made ten or twenty minutes later after the engine has been stopped. When the oil level check is necessary while the engine is running, stop the engine and keep it stationary ten or twenty minutes until the oil thoroughly flows down to the crankcase.*

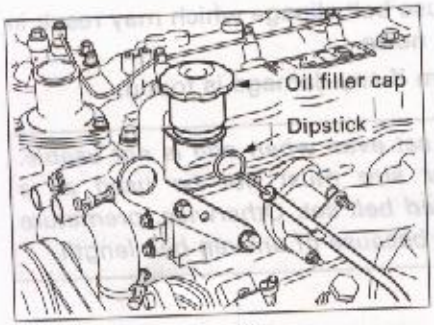


Fig. 10

4) Oil is poured through the oil filler at the front of the cylinder head cover.
A certain period of time is required before the engine oil completely flows down from the oil filler to the crankcase. Check the oil level ten or twenty minutes after oil replenishment.

CAUTION: *If the engine oil is splashed on the fan drive belt, it causes belt slipage or slackness; therefore, take care to avoid it.*

WARNING: *In adding oil, take care not to spill it. If you spill oil on engine or equipment, wipe it properly, or this could lead to a fire and the risk of personal injury and/or equipment damage.*

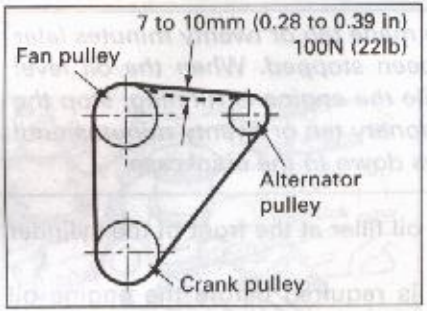


Fig. 11

(2) Fan Belt Check

Check the fan belt for tension and abnormalities.

1) When the belt is depressed **about 7 to 10 mm (0.28 to 0.39 in)** with the thumb [about 100 N (10 kgf/22 lb) pressure] at midway between the fan pulley and alternator pulley, the belt tension is correct.

   When the belt tension is too high, it will result in alternator failure.

   Contrarily, loose belt will cause belt slipage which may result in damaged belt and abnormal noise.

2) Check the belts. Replace them if any damage is found.

CAUTION: *Replace all belts as a set even when one is not usable. Single belt of similar size must not be used as a substitute for a matched belt set. Otherwise, premature belt wear would result because of uneven belt length.*

(3) Coolant Level Check

1) Remove the radiator filler cap, and check the coolant level as well as the degrees of fouling.

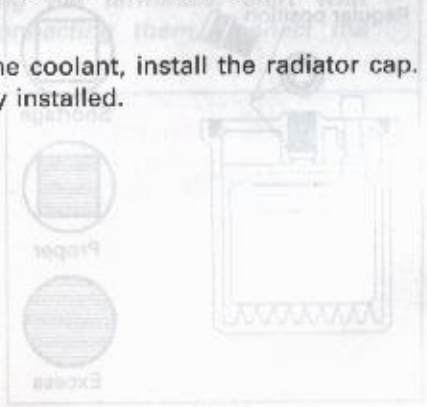
   Proper coolant level is about 10 mm (0.394 in) higher from the radiator core top.

> ***WARNING:*** *When removing the radiator filler cap while the engine is still hot, cover the cap with clothing, then turn it slowly to gradually release the internal steam pressure. This will prevent you from getting burnt with hot steam spouted out from the filler port.*

2) Use clean drinking water as coolant. When an anti-freeze solution is required, keep to the specified mixing ratio.

(4) Radiator Cap Condition

After the replenishment of the coolant, install the radiator cap. Make sure the cap is securely installed.



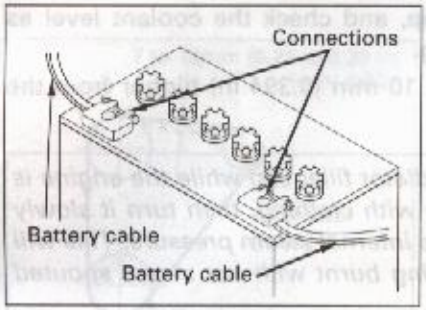


Fig. 12

(5) Battery Cable Connection

Check the battery cable connections for looseness or corrosion. The loosened cable connection will result in hard engine starting or insufficient battery charge.
The battery cables must be tightened securely.
Never reverse "+" and "–" terminals when reconnecting cables after disconnection.
Even a short period of reverse connection will damage the electrical parts.

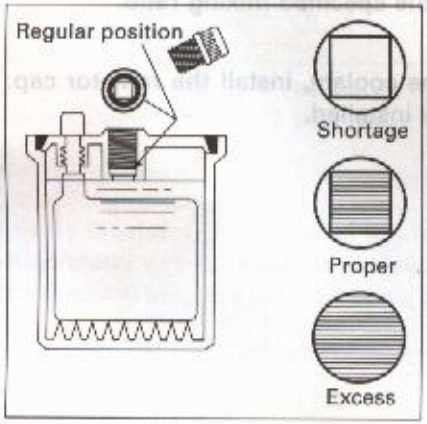


Fig. 13

(6) Battery Electrolyte Level

The amount of electrolyte in the batteries will be reduced after repeated discharge and recharge.
Check the electrolyte for the level in the batteries, replenish with a commercially available electrolyte such as distilled water, if necessary.
The battery electrolyte level checking procedure will vary with battery type. Follow the equipment manufacturer's instructions.

CAUTION: *Do not replenish with dilute sulfuric acid in the daily service.*

WARNING:

1. *When inspecting the batteries, be sure to stop the engine.*
2. *As diluted sulfuric acid is used as electrolyte, be careful not to stain your eyes, hands, clothes, and metals with the electrolyte. If it gets in your eye, wash with a large amount of water at once. Then go and see a doctor.*
3. *As highly flammable hydrogen gas is rising from the batteries, do not make a spark or use fire in any other way near the batteries.*
4. *When handling such metallic articles as a tool near the batteries, be sure not to contact ⊕ terminal. As the vehicle body is ⊖, it may cause a big danger.*
5. *When disconnecting the terminals, start with ⊖ terminal. When connecting them, connect the ⊖ terminal last.*

2. ENGINE STARTING

(1) Pre-starting Preparation

1) Make sure that all hydraulic control levers etc. on the equipment are in the NEUTRAL position.
2) Set the engine stop knob in the START position.
3) Switch ON the battery switch (if so equipped).
4) Insert the starter switch key into the switch key hole.
Turn the key clockwise to DRIVE position and, make sure that the meters and warning lamps are actuated.

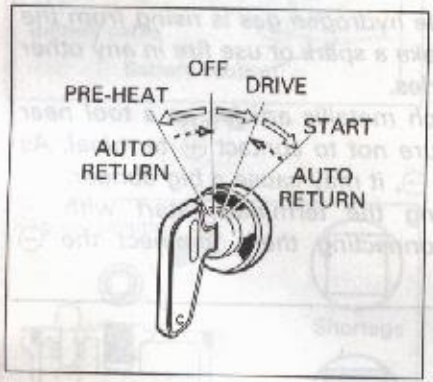


Fig. 14

(2) Pre-heating Procedures

As an engine starting aid, pre-heating is required in a cold engine starting.

1) Turn the starter switch key counterclockwise to PRE-HEAT position in order to heat the glow plugs on the engine.

   The pre-heating time varies depending on the types of pre-heating system as follows:

   - The type with an indication lamp 20 seconds are required until the indication lamp at the instrument board goes off.
   - The type with a control resistance 25 to 30 seconds are required until the control resistance coil red heats.

2) Turn the starter switch key clockwise to START position as soon as the indication lamp goes off or the control resistance coil red heats.

WARNING: *Don't touch the red (hot) control resistance coil or allow combustible materials such as paper, cloth or leaves on it. This could lead to a fire and the risk of personal injury and/or equipment damage.*

(3) Engine Starting

1) Depress the engine throttle lever or throttle pedal and turn the starter switch key clockwise to START position.
The cranking period must not exceed ten seconds.
Continuous starter operation of more than ten seconds will lead to overdischarge of the batteries as well as starter seizure.
If the engine cannot be started in one time attempt, keep the batteries and the starter stationary at least 30 seconds for their functional recovery, then repeat the pre-heating and the starting operations.

> ***CAUTION:*** *Continuous re-engagement of the starter to the flywheel ring gear without giving them a break will result in the damaged starter pinion gear and flywheel ring gear.*

2) If, despited repeated operations, the engine does not start, wait for a minute or more until the functions of the batteries and starter are recovered and then repeat pre-heating and starting operations.
3) When repeating starting operation, return the key to the OFF position and then pre-heat and start the engine once again.
If the engine still remains unstarted, something may be wrong with the engine. Check the repeated parts to locate the cause.

> ***CAUTION:*** *Do not use starting "aids" in the air intake system. Such aids can cause immediate engine damage.*

3. CHECK AND OPERATION AFTER THE ENGINE START-UP

(1) Warming-up Operation

Do the warming-up operation at 1000 min^{-1} about ten minutes after the engine has started.

As the lubrication for the entire engine systems will be done in this warming-up, do not speed up and load it abruptly. Particularly, observe this in cold season operation.

(2) Check after the Engine Start-up

Check the following items in the engine warming-up operation.

Engine oil pressure

Although the engine oil pressure gauge readings vary depending on ambient temperature or a type of oil, the gauge registers around 390 to 690 kPa (57 to 100 psi) in the warming-up.

In the oil pressure warning lamp type, make sure that the lamp is off.

Charge condition

The charge condition is normal when once the ammeter registers plus side greatly in the engine starting, then gradually the meter registering will be minimized.

In the warning lamp type, make sure that the lamp is completely off during the warming-up.

Engine noise and exhaust smoke colour

Pay attention to engine noise and, if any abnormal noise is heard, check the engine to detect the cause.

Check the fuel combustion condition by exhaust smoke colour.

The exhaust smoke colour after engine warming-up and at no-load operation:

- Colourless or light blue.....Normal (Perfect combustion)
- Black colour .....Abnormal (Imperfect combustion)
- White colour.....Abnormal (Imperfect combustion)

CAUTION: *Engine noise after start-up might be noisy than that of warmed-up engine and, the exhaust smoke colour also being more blackish than the normal condition. However, it will be normalized after warming-up engine.*

Leakage in the systems

Check the following items:

- Lube oil leakage

  Check both sides and bottom of the engine assembly for lube oil leaks, paying particular attention to the lube oil pressure gauge pipe joint, lube oil filter and lube oil pipe joints.
- Fuel leakage

  Check the fuel injection pump, fuel lines and fuel filter for leakage.

- Coolant leakage
  Check the radiator and water pump hose connections also the water drain cocks on the radiator and cylinder body for leakage.
- Exhaust smoke or gas leakage

Checking coolant level

The coolant level could drop depending on the equipment because the mixed air is expelled in about 5 minutes after the engine started.

Stop the engine, remove radiator cap, and add coolant.

WARNING: *Hot steam will rush out and you could get burnt, if the radiator cap is removed when the engine is hot. Cover the radiator cap with a thick cloth and loosen the cap slowly to reduce the pressure, then remove the cap.*

4. CARE IN THE ENGINE OPERATION

In the engine operation, always pay attention to the following items if the engine indicates any sign of abnormalities.

(1) Engine Oil Pressure

Engine oil pressure is normal when the oil pressure gauge shows 290 to 590 kPa (43 to 85 psi) in the engine warmed-up condition, although the oil pressure may vary depending on a type of oil or the engine specification.

In the continuous engine operation, engine oil pressure is slightly lower than the pressure at start-up time.

If, in continuous engine operation, the engine oil pressure warning lamp is off, engine oil pressure is normal.

When the engine oil pressure gauge shows the following abnormal conditions, stop the engine immediately and check the engine oil amount in the oil sump and oil leakage:

- The engine oil pressure gauge shows below 196 kPa (2 kgf/cm^2/28 psi) though the engine speed is raised.
- The oil pressure gauge indicator oscilates greatly in the engine low speed range.
- When the engine oil pressure warning lamp goes on and off repeatedly.

When no lack of engine oil or no oil leakage is found, contact your equipment supplier to determine the cause of the abnormal reading.

(2) Coolant Temperature

The engine performance will be adversely affected if engine coolant temperature is too hot or too cold.

The normal coolant temperature is 75 to 85°C (167 to 185°F).

Overheating

WARNING: *If the Engine Coolant Temperature Gage shows an overheat condition or you have other reason to suspect the engine may be overheating, continued operation of the engine (other than as spelled out here) even for a short period of time may result in a fire and the risk of personal injury and severe vehicle or equipment damage. Take immediate action as outlined following.*

If you see or hear escaping steam or have other reason to suspect there is a serious overheat condition, stop and park the vehicle or equipment as soon as it is safe to do so and then turn off the engine immediately and get out of the vehicle or equipment.

The engine cooling system may overheat if the engine coolant level is too low, if there is a sudden loss of engine coolant (such as hose splitting), or if other problems occur. It may also temporarily overheat during severe operating condition such as:

- Climbing a long hill on a hot day.
- Stopping after high rpm.

If the Engine Coolant Temperature gage shows an overheat condition, or you have reason to suspect the engine may be overheating, take the following step:

- If your air conditioner (if equipped) is on, turn it off. And turn on the heater.
- Don't turn off your engine.
- With the transmission in Neutral, increase the engine speed to about one-half full operating speed or 1200 RPM, maximum. Bring the idle speed back to normal after two or three minutes.

If the engine coolant temperature does not start to drop within a minute or two:

- Let the engine run at normal idle speed for two or three minutes.

If the engine coolant temperature does not start to drop, turn off the engine and get out of the vehicle or equipment then proceed as follows:

WARNING: *To help avoid being burned-*

- *Do not open the engine access cover if you see or hear steam or engine coolant escaping from the engine compartment. Wait until no steam or engine coolant can be seen or heard before opening the engine cover.*
- *Do not remove the radiator cap or engine coolant reserve tank cap if the engine coolant in the tank is boiling. Also do not remove the radiator cap while the engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if either cap is taken off too soon.*

If no steam or engine coolant can be seen or heard, tilt the cab or open the engine access cover. If the engine coolant is boiling, wait until it stops before proceeding. Look at the see-through reserve tank. The engine coolant level should be between the "MAX" and "MIN" marks on the reserve tank. If necessary, pour engine coolant into the reserve tank only, never directly into the radiator. Also, do not check engine coolant level at the radiator.

Make sure the fan belts are not broken, or off the pulleys, and that the fan turns when the engine is started.

If the engine coolant level in the reserve tank is low, look for leaks at the radiator hoses and connections, heater hoses and connections, radiator, and water pump. If you find major leaks, or spot other problems that may have caused the engine to overheat, do not run the engine until these problems have been

corrected. If you do not find a leak or other problem, carefully add engine coolant to the reserve tank. (Engine coolant is a mixture of ethylene glycol antifreeze and water. See "Engine Care in cold season" in Section 6 for the proper antifreeze and mixture.)

WARNING: *To help avoid being burned, do not spill antifreeze or engine coolant on the exhaust system or hot engine parts. Under some conditions the ethylene glycol in engine coolant is combustible.*

If the engine coolant level in the reserve tank is at the correct level but there is still an indication on the instrument panel of an overheat condition:

- YOU MUST LET ENGINE COOL FIRST. You may then add engine coolant directly to the radiator.

Once the Engine Coolant Temperature Gage no longer signals an overheat condition, you can resume operating at a reduced speed. Return to normal operating after about ten minutes if the gage pointer does not again show an overheat condition.

If no cause for the overheat condition was found, see a qualified service technician.

Overcooling

The engine operation at low coolant temperature will not only increase the oil and fuel consumption but also will lead to premature parts wear which may result in engine failure.

(3) **Engine Hourmeter** (Engine Operation Hour Indicating) (If so equipped)

This meter indicates the engine operation hours. Make sure that the meter is always working during engine operation.

Periodical engine maintenance is scheduled on the operation hours indicated on the hourmeter.

(4) **Liquid and Exhaust Smoke Leakage**

Be careful with lubricant, fuel, coolant and exhaust smoke leakage.

(5) **Abnormal Engine Noise**

Pay attention to the noise from the engine or other related parts, checking if the noise is normal.

(6) **State of the Exhaust Smoke**

Be careful with exhaust smoke colour, check if it is whitish or blackish.

(7) **Electrical System**

Don't turn the key to OFF position during engine running. This may cause electrical parts damage.

5. ENGINE STOPPING

1) Make sure that all of the control levers on the equipment are in NEUTRAL position.
2) Before stopping the engine, cool down the engine by operating it at low idle speed about five minutes.
   In this operation, check the engine noise and the engine oil pressure for abnormalities.
   In the turbocharged engine, if the engine is stopped instantaneously, a dry condition produced by high temperature will take place in the turbocharger rotating parts which may cause lack of lubrication. This will result in turbocharger failure.
3) To stop the engine, turn the starter switch key to OFF position. Switch off the battery (if so equipped).

CAUTION: *Leaving the starter switch key in the DRIVE position for a long while after the engine has been stopped, will discharge the batteries wastefully.*

6. OPERATION AND CARE FOR NEW ENGINE

Your ISUZU engine is carefully tested and adjusted in the factory, however, further, thorough run-in (i.e. break-in) operation is necessary.

If the new engine is harshly operated, lubricating oil film will be reduced leading to abnormal wear or seizure. Particularly, avoid a harsh engine operation within the initial 100 operation hours observing the following notice.

1) Do the warming-up operation continuously until the engine is warmed-up. In this operation, do not race the engine.
2) Also do not operate the engine with rapid acceleration, rapid machine starting and continuous high speed operation.

7. ENGINE CARE FOR OVER-COOLING

Engine over-cooling cause premature wear and increased fuel consumption. When the coolant temperature is not raised to 75 to 85°C (167 to 185°F) indefinitely, take an action to recover this with means of radiator curtain or such like.

8. OPERATION AND CARE FOR TURBOCHARGED ENGINE

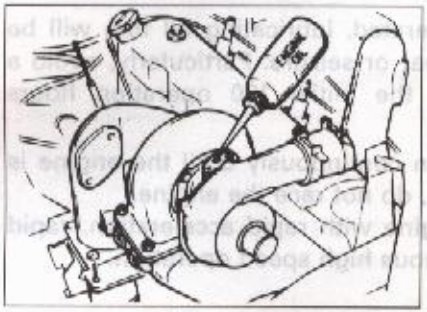


Fig. 15

(1) Engine Starting

The warming-up operation of the engine should be done in the way separately described. In addition, ensure the bearings supporting the rotating parts of the turbocharger are sufficiently lubricated.

1) Do not race a cold engine.

2) When starting the engine after a long period (more than one month) of standing, proceed as follows:
Pour engine oil into the turbocharger through the oil inlet port with the air intake duct and oil inlet side pipe removed. Then turn the impeller by hand to thoroughly lubricate the bearings.

3) When pouring oil in, do not allow dust particles and other foreign materials to enter through the opening.
On completion of this operation, securely install the oil pipe and air intake duct.

(2) Engine Stopping

Whenever stopping the engine, the last about 3 minutes of operation should be at idle. After hard operation, at least 5 minutes of operation should be at idle until the turbocharger cools down. This allows the turbocharger to return to idle speed while engine oil pressure is available for lubrication.

CAUTION: *Failure to cool down turbocharger at idle could result in insufficient lubrication of its bearings and their shortened life.*

9. STARTING THE ENGINE AFTER BEING LEFT UNUSED FOR A LONG PERIOD OF TIME

When the vehicle or equipment is left unused for "more than three months" without running the engine (warming up), conduct a thorough inspection of the vehicle before starting the engine.

After starting the engine, be sure to warm it up for more than ten minutes at 1000 rpm.

5. PERIODICAL INSPECTION AND MAINTENANCE

1. LUBRICATING SYSTEM

Servicing of the engine oil or the oil filter element will affect on the engine performance as well as the engine life.
Change the engine oil and the oil filter element periodically with the specified ones. (Refer to 3.2. LUBRICANT.)

(1) **Engine Oil and Oil Filter Element Change**

Engine oil change and oil filter element change must be made simultaneously according to the following change schedule.
In the engine operation, when the oil filter warning lamp lights on, the filter element is clogging. In such a case change the filter element regardless the specified change schedule.

Change interval

Engine Oil..... Initial 50 and thereafter without partial oil filter **every 250** operating hours with partial oil filter **every 500** operating hours

Oil Filter Element ..... Initial 50 and therefore without partial oil filter **every 250** operating hours with partial oil filter **every 500** operating hours

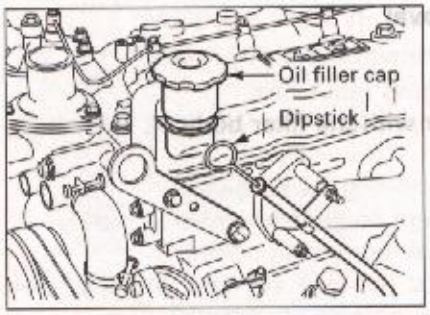


Fig. 16

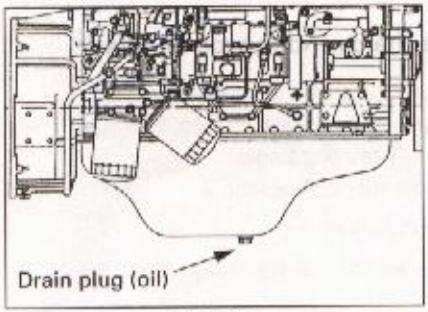


Fig. 17

Engine oil draining

WARNING: *To help avoid the damage of being burned, do not drain oil while the engine is still hot.*

1) Wipe clean around the oil filler cap taking care so that no foreign particles entry. Remove the filler cap.

2) Remove the drain plug of oil pan and oil filter and drain the engine oil completely.
It is advisable that draining be done while the engine is warm, to minimize the draining time.

CAUTION: *Use a receptacle to receive the drained oil so that the engine and equipment may not be stained with the drained oil.*

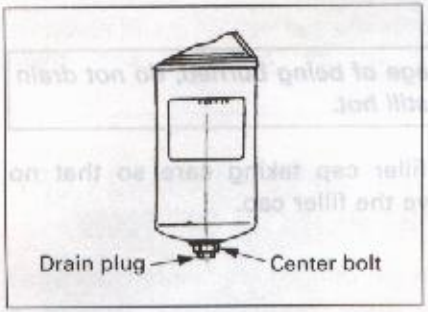


Fig. 18

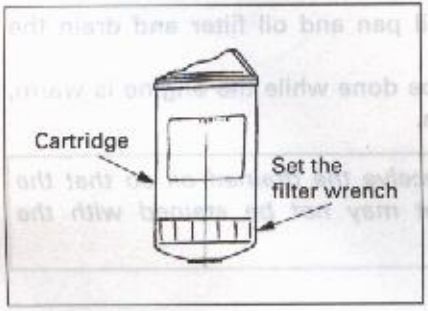


Fig. 19

Main oil filter element removal

Center bolt type

Loosen the center bolt.

Remove the element together with the filter body.

Cartridge type

Use a filter wrench to remove the cartridge type oil filter.

Main oil filter element installation

Center bolt type

Clean the filter body and insert the new element into the filter body.

Install the filter body together with the element and fix them with tightening the center bolt.

Be sure to use new gaskets so that no any oil leak will take place.

Cartridge type

Apply a coat of engine oil to the O-ring.

Turn in the new cartridge until the sealing face is fitted against the O-ring.

Use the filter wrench to turn in the cartridge an additional **3/4 or one turns.**

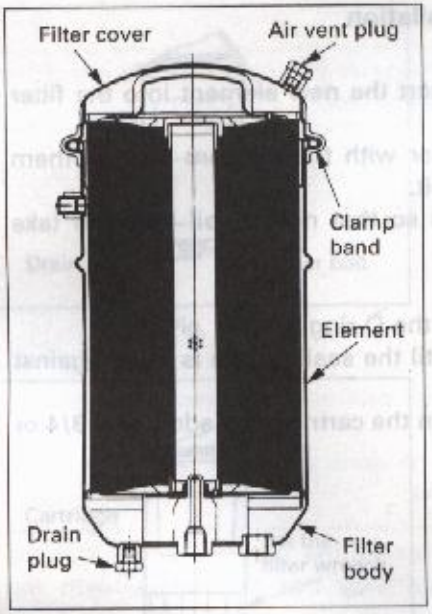


Fig. 20

Changing partial oil filter (depth-type) (If equipped)

1) Change the partial oil filter element **every 500** hours.
2) Partial oil filter element changing procedure.
   a. Drain oil completely by removing air vent plug and drain plug.
   b. Remove filter cover by removing clamp band.
   c. Turn the screw type element counterclockwise to remove.
   d. Clean the nozzle inside filter body with a wire.
   e. Insert gently a new ISUZU genuine element into the filter body and turn it clockwise manually to secure.
   f. Tighten drain plug and lock filter cover with clamp band.
   g. Tighten air vent plug by one or two turns and start the engine. Make sure oil comes out from the air vent plug, then tighten the plug completely.
   h. Make sure no oil leaks, then stop the engine.
   Wait until oil goes down into the oil pan (10 to 15 min), then check oil quantity with an oil level gauge.
   Oil capacity of the partial oil filter: Approx. 4 liters.

Changing partial oil filter (cartridge)

A changing procedure is same as that of cartridge type main oil filter. Refer to that procedure.

Engine oil refilling

1) Reinstall the drain plugs.
2) Fill with new engine oil by the oil filler port.
   Wait about fifteen minutes until the oil gets down to the oil pan. Then check the oil level with a dipstick.

(2) Check after Oil and Filter Changes

Oil leakage check

Idle the engine to raise the oil pressure, then check for oil leakage.

Oil level recheck

Stop the engine and keep it stationary about twenty minutes.
Use the dipstick to recheck the oil level.
Replenish with engine oil, if necessary, to the specified level.

CAUTION: *When the engine is started, the oil level will slightly drop from the initial level as the oil fully comes into the entire oil circuit.*

(3) Engine Oil Additives

Engine oils contain a variety of additives. Your engine should not need any extra additives if you use the recommended oil quality and change intervals.

(4) Used Oil Disposal

Do not dispose of used engine oil (or any other oil) in a careless manner such as pouring it on the ground, into sewers, or into streams or bodies of water. Instead, recycle it by taking it to a used oil collection facility which may be found in your community. If you have a problem disposing of your used oil, it is suggested that you contact your dealer or service station. (This also applies to diesel fuel which is contaminated with water. See "Diesel Fuel" in Section 3.)

(5) Used Engine Oil

WARNING: *Used engine oil contains harmful contaminants that have caused skin cancer in laboratory animals. Avoid prolonged skin contact. Clean skin and nails thoroughly using soap and water - not mineral oil, fuels, or solvents. Launder or discard clothing, shoes, or rags containing used engine oil.*

Discard used engine oil and other oils properly.

2. COOLING SYSTEM

(1) Fan Belt Tension Adjustment

Adjust fan belt tension when belt slackness is greater than the specified amount and when the belts are replaced.

WARNING: *To help avoid being injury, check and adjust fan belt tension with engine stopped.*

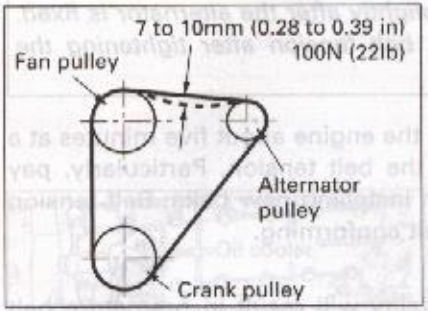


Fig. 21

Belt tension

Belt tension is normal when it is depressed 7 to 10 mm (0.28 to 0.39 in) with the thumb at the midway between the fan pulley and alternator pulley. [about 100 N (22 lb) depressing force.]

Fan belt slackness : **About 7 to 10 mm (0.28 to 0.39 in)**

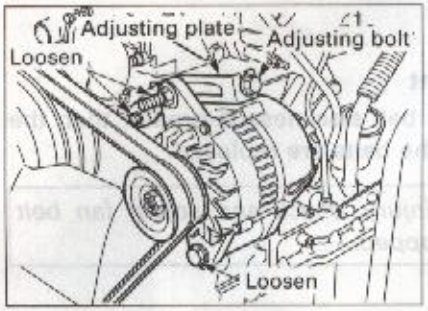


Fig. 22

Adjusting procedure

Belt tension adjustment is made by pivoting the alternator at the alternator mounting bolt.

1) Loosen the alternator adjusting plate bolt and the alternator mounting bolt.
2) Pivot the alternator at the mounting bolt toward the engine left or right hand side as required.
3) Tighten the mounting bolt and the adjusting bolt.

CAUTION: *Belt tension may vary slightly after the alternator is fixed. Therefore, recheck the belt tension after tightening the bolts.*

4) After the adjustment, operate the engine about five minutes at a low idle speed and recheck the belt tension. Particularly, pay attention to this matter when installing new belts. Belt tension may vary due to the initial belt conforming.

(2) Fan Belt Change

Use of fan belt with poor quality will result in premature belt wear or belt elongation leading to engine damage such as overheat. Therefore use of the ISUZU genuine fan belts are highly recommended.

(3) Coolant Change

The coolant must be changed at intervals of **six months.**

If the coolant is being fouled greatly, it will lead to engine overheat or coolant blow-off from the radiator.

Coolant draining

1) Remove the radiator cap.
   Open the drain cock at the radiator lower part to drain the coolant in the radiator.

> ***WARNING:*** *When removing the radiator filler cap while the engine is still hot, cover the cap with a rag, then turn it slowly to release the internal steam pressure. This will prevent a person from scalding with hot steam spouted out from the filler port.*

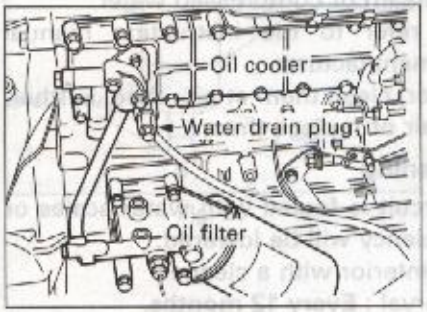


Fig. 23

2) Drain away the coolant from the engine by loosening the water drain plug on the right hand of cylinder block (oil cooler low).

Filling with coolant

1) Close or tighten the coolant drain plug.
2) Use clean drinking water as a coolant. Fill up the radiator with the coolant until the level comes up to the filler port neck.
   Fill gradually to prevent air entry.
   Coolant volume (Engine only) :
   Refer to "Main Data Specifications"
3) With the coolant poured, operate the engine about five minutes at a low idle speed, then the air contained in the coolant circuit is bled. The coolant level will drop.
   Stop the engine to replenish with the coolant.

(4) Cleaning outside of Radiator

Mud or dried grass caught between radiator fins will block the air flow, resulting in lower cooling efficiency.
Clean the radiator fins with steam or compressed water.
For the cleaning interval, refer to the instruction manual prepared by the equipment manufacturer.
If the fins are stuffed, however, clean them at any time. Further, if the fins are deformed, repair or replace them.

(5) Cooling System Circuit Cleaning

When the cooling system circuit is fouled with water scales or sludge particles, cooling efficiency will be lowered.
Periodically clean the circuit interior with a cleaner.
Cooling system cleaning interval : **Every 12 months.**

3. FUEL SYSTEM

The fuel injection pump and fuel injection nozzles are precisely manufactured, and therefore, using the fuel which contains water or dust particles will result in either injection pump plunger seizure or injection nozzle seizure, and the fouled fuel filter element with sludge or dust particles lead to decreased engine output.
In addition, clogged filter element can cause low output or automatic air bleeding failure.
Perform inspection and maintenance periodically as follows:

(1) Removal of Water from the Fuel

1) **The fuel system with the water sedimenter.**
The water sedimenter is provided to separate the water contained in the fuel.
The sedimenter housing contains a float which moves up and down in accordance with level change of the sedimented water.
Be sure to drain the sedimented water when the float has come up to the warning level line marked on the transparent sedimenter housing.

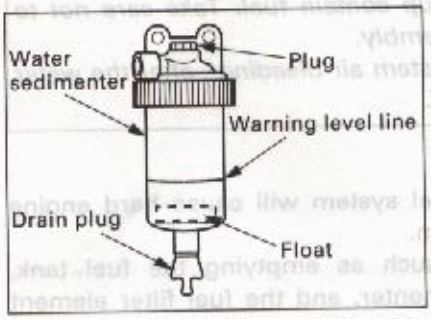


Fig. 24

Draining procedure:
Loosen the drain plug and drain the sedimented water.
Be sure to tighten the drain plug on completion of draining.
A packing of the "plug" which is provided at the upper portion of the water sedimenter is not reusable. When the "plug" is loosened, be sure to replace the packing with a new one.

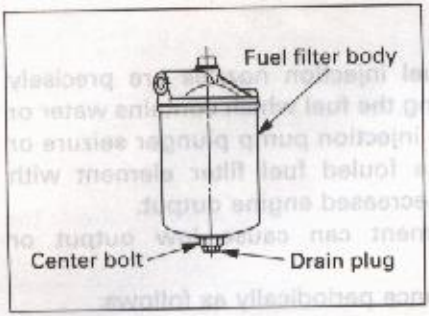


Fig. 25

2) **The fuel system without the water sedimenter**

Drain the sedimented water in the fuel filter body **every 250** operation hours.

Center bolt type

a. Loosen the drain plug at the lower top of the fuel filter. Drain the fuel in the fuel body together with the mixed water.

b. Be sure to tighten the drain plug on completion of draining.

Cartridge type

Use a filter wrench to remove the cartridge of draining.

CAUTION: *1. The cartridge and cup contain fuel. Take care not to spill it during disassembly.*
2. Perform the "fuel system air bleeding" after the water in the fuel is drained.

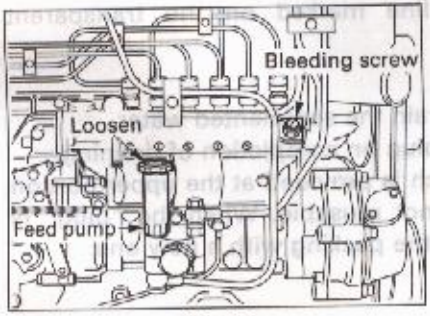


Fig. 26

(2) Fuel System Air Bleeding

The entry of air into the fuel system will cause hard engine starting or engine malfunction.

When once the servicing such as emptying the fuel tank, draining for the water sedimenter, and the fuel filter element change is done, be sure to air bleeding.

Air bleeding procedure:

1) Loosen the bleeding screws on the fuel injection pump.
2) Turn the feed pump knob counterclockwise until the pump knob is forced up by spring.
3) Depressing the pump knob will cause to drain out the air mixed fuel from the loosened bleeding screws.

4) Repeat the pumping action until no bubbles are visible in the flowing fuel.
No more bubble in the fuel indicates that air bleeding is completed.
Tighten the bleeding screws and the feed pump knob on completion of bleeding.
5) Start the engine and check the fuel system for fuel leak.

(3) Fuel Filter Element Change

Change interval

Fuel filter element change interval: **Every 500** operating hours

Change procedure

CAUTION: *1. During removal, be careful not to stain the parts around with the fuel in the cup.*
2. After changing the fuel filter element, conduct fuel air bleeding.

Spin-on type filter

1) Loosen the fuel filter turning it counterclockwise with a filter wrench.
2) With a rag wipe clean the fitting face on the upper cover, so that new fuel filter can be seated properly.
3) Lightly oil the O-ring. To reinstall, turn the filter assembly clockwise carefully to prevent the fuel from spilling until the O-ring is fitted against the sealing face of the filter cover. Turn 2/3 turn further with the filter wrench.

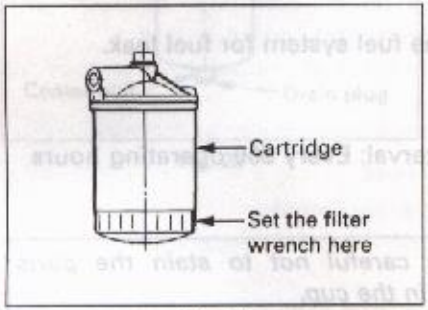


Fig. 27

Center bolt type fuel filter

1) Loosen the drain plug at the lower top of the center bolt and drain the fuel in the fuel filter.
2) Loosen the center bolt to remove the fuel filter body and the element.
   The filter body will be removed together with the element.
3) Clean the filter body. Use the new element and the new gaskets.
4) Install the filter body together with the element and tighten the center bolt securely.

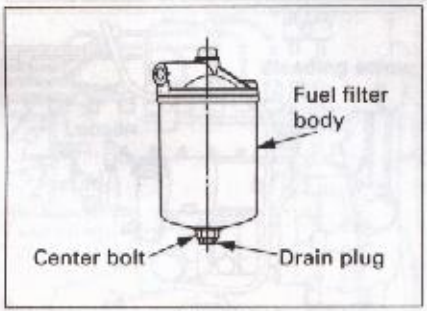


Fig. 28

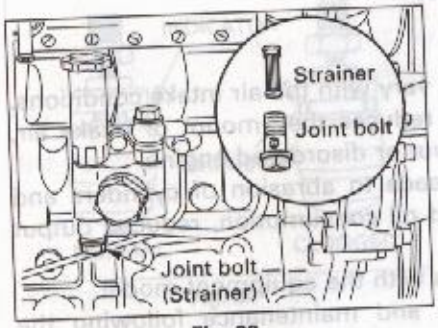


Fig. 29

(4) Feed Pump Strainer Cleaning

Clean the feed pump strainer **every 500** operating hours.
The strainer is incorporated in the feed pump inlet side joint bolt.
Clean the strainer with the compressed air and rinse it in the fuel oil.

(5) Fuel Injection Pump Control Seals

As the fuel injection pump is precisely adjusted, most of the controls are sealed, please do not break them. When the adjustment is necessary, contact with your machine supply source.

***CAUTION**: The manufacturer does not warrant the claim on the engine with the broken governor seals.*

4. AIR INTAKE SYSTEM

(1) Air Cleaner

Engine performance and life vary with the air intake conditions. A dirty air cleaner element reduces the amount of intake air, causing reduced engine output or disordered engine.
Also, a damaged element leads to abrasion of cylinders and valves, resulting in increased oil consumption, reduced output and shortened engine life.
Handling of air cleaner varies with the equipment model.
Perform periodic inspection and maintenance following the equipment manufacturer's instructions.

CAUTION: *1. Shorten the cleaning or change interval when the equipment is used in dusty areas.*
2. Change the element, if element damage is found during air cleaner cleaning.
3. Take care not to cause air leakage (sucking) when reassembling the air cleaner.

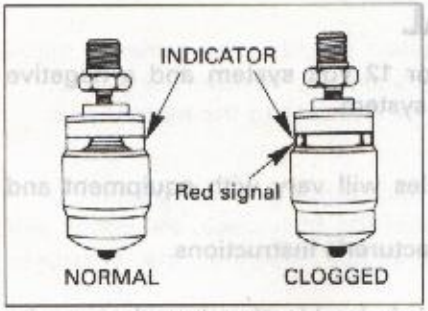


Fig. 30

(2) Air Cleaner with Dust Indicator

This indicator is attached to the air cleaner. When the air cleaner element is clogged, air intake resistance becomes greater and the dust indicator signal turns into red indicating the element change timing.

When the signal turns into red, clean the air cleaner or replace the element. Then press the dust indicator button to reset the indication.

5. ENGINE ELECTRICAL

The ISUZU engines uses a 24 or 12 volt system and a negative grounding type for the electrical system.

(1) Battery Servicing

Battery maintenance schedules will vary with equipment and battery types.
Follow the equipment manufacturer's instructions.

Gravity of the batteries

The battery charge condition is judged by the electrolyte gravity measurement.
Periodically measure the electrolyte gravity of the batteries.
For the internal check follow the equipment manufacturer's standard.
The relationship between the electrolyte specific gravity and the battery conditions are as follows:

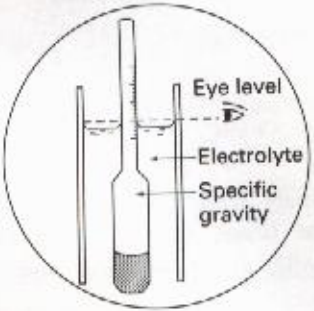


Fig. 31

Electrolyte Specific Gravity	Battery Conditions
Over 1.300	Over 100% (Over charged)
1.290 – 1.270	100%
1.260 – 1.240	75%
Below 1.230	Below 50% (Insufficiently charged)

Fig. 32

WARNING: *The battery electrolyte is dilute sulfuric acid. So, be careful not to stain your body and clothes with it. If stained, rinse portion in clean water.*

Gravity conversion

The specified electrolyte temperature for the gravity measurement is 20°C (68°F).

Measure the electrolyte temperature and do the conversion in accordance with the following formula when the temperature does not fall to the specified temperature.

$S_{20} = St + 0.0007 (t - 20)$

S_{20} ; gravity at 20°C

St ; gravity measured

t ; electrolyte temperature whe measured

Battery terminal connections

Periodically, check the battery terminals for loose connection and corrosion.

For the check interval, follow the machine manufacturer's standard. Loose connection will cause hard engine starting or deficient battery charging.

If the terminals are excessively corroded, disconnect the battery cables and polish them with a wire brush or sandpaper.

Never reverse the "+" and "–" terminals when reconnecting the cables. Even a short period of reverse connection could damage the electrical parts.

Cleaning of Battery

When the battery is fouled clean it with clean water or tepid water and wipe them with a dry cloth to remove the water.
Apply a light coat of vaseline or a grease to the battery post.

(2) Alternator Servicing

1) The polarity of the alternator is negative grounding type.
When an inverted circuit connection take place, the circuit will be in short circuit instantaneously resulting the alternator failure.
2) Do not put water directly on the alternator. Entry of water into the alternator leads an electrolyte corrosion causing an alternator failure.
Pay attention particularly when cleaning the engine.
3) When the battery is charged with a external electric source, be sure to disconnect the battery cables.

(3) Wiring Connections

Check all of the electric wiring connections for looseness and damage.

6. ENGINE ASSEMBLY AND OTHERS

To continue trouble free engine operation over a long period of time, the servicing items need a skilled maintenance technician, therefore, consult your machine supply source on the following items when necessary.

(1) Fuel Injection Nozzle

Use an injection nozzle tester to check the static injection starting pressure and the fuel spray conditions.

Injection nozzle pressure test interval : **Every 500** operation hours

When the injection starting pressure is too high or too low or the fuel spray pattern is improper, an abnormal fuel combustion take place in the engine leading a lowered output and blackish exhaust smoke. Further, it causes a piston seizure or piston damage etc. In such cases, the injection nozzle test or the nozzle replacement is required.

Injection starting pressure ..... Refer to the Engine Family Index.

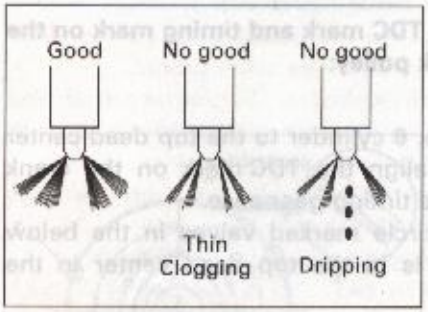


Fig. 33

WARNING: *While using a nozzle tester, it may happen that high pressure blow off the fuel oil and injure the worker. Keep off the nozzle end.*

(2) Valve Clearance Adjustment

The valve clearance must be adjusted **every 1000** operating hours, or whenever the valve rocker is abnormally noisy, or in an engine malfunction though the fuel system is properly working.

Valve clearance : 0.40 mm (0.0157 in) (When the engine is cold.)

The model 6BG1 engine has two types of the valve clearance adjusting method.

Confirm the aligning marks (mark grooves) on the outside diameter of the crank pulley.

Type I method with the only TDC mark and timing mark on the outside diameter of the crank pulley:

Adjustment Procedure

1) In order to bring No. 1 or No. 6 cylinder to the top dead center in the compression stroke, align the TDC mark on the crank pulley with the pointer on the timing gear case.
2) Do the adjustment on the circle marked valves in the below table where No. 1 cylinder is in the top dead center in the compression stroke.

After the above steps, do the adjustment on the double circle marked valves where No. 6 cylinder is on the top dead center in the compression stroke.

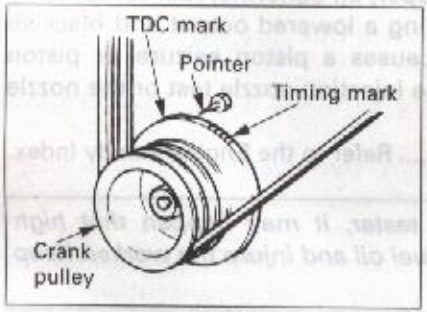


Fig. 34

I : Intake E : Exhaust

Cylinder No.	1		2		3		4		5		6	
Valve arrangement	I	E	I	E	I	E	I	E	I	E	I	E
When No. 1 cylinder is at TDC in the compression stroke	○	○	○			○	○			○		
When No. 6 cylinder is at TDC in the compression stroke				◎	◎			◎	◎		◎	◎

Fig. 35

3) After the adjustment started from either piston top dead center, turn the crankshaft 360° to align the TDC mark and the pointer to do the adjustment again on the remaining valve.

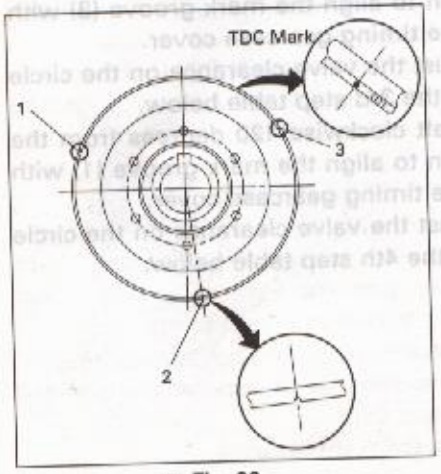


Fig. 36

Type II method with the three addional aligning marks at point 120 degrees apart other than the TDC mark and timing mark on the outside diameter of the crank pulley:

Adjustment Procedure

1) Turn the crankshaft clockwise so that theTDC mark groove on the crank pulley is aligned with the pointer on the timing gearcase cover.
2) Remove the cylinder head cover and check that the cylinder No.1 is at TDC in the compression stroke or at TDC in the exhaust stroke. When the intake and exhaust valves are closed, the cylinder is at TDC in the compression stroke, and when the intake and exhaust valve are open , it is at TDC in the exhaust stroke.

3) Valve clearance is adjusted on 4 progressive steps as following.

1st Step: After bringing the cylinder No.1 to the TDC in the compression stroke, turn the crankshaft clockwise viewed from front to align the mark groove (1) with the pointer on the timing gearcase .
Measure and adjust the valve clearance on the circle marked valves in the 1st step table below.

2nd step: Turn the crankshaft clockwise 120 degrees from the 1st step condition to align the mark groove (2) with the pointer on the timing gearcase cover.
Measure and adjust the valve clearance on the circle marked valves in the 2nd step table below.

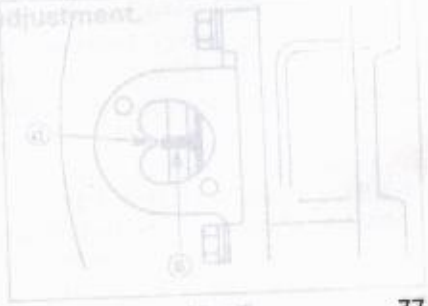
3rd step: Turn the crankshaft clockwise 120 degrees from the 2nd step condition to align the mark groove (3) with the pointer on the timing gearcase cover.
Measure and adjust the valve clearance on the circle marked valves in the 3rd step table below.

4th step: Turn the crankshaft clockwise 120 degrees from the 3rd step condition to align the mark groove (1) with the pointer on the timing gearcase cover.
Measure and adjust the valve clearance on the circle marked valves in the 4th step table below.

I : Intake E : Exhaust

Cylinder No.	1		2		3		4		5		6	
Valve arrangement	I	E	I	E	I	E	I	E	I	E	I	E
1st step : Aligning mark groove (1) with pointer							○			○		○
2nd step : Aligning mark groove (2) with pointer	○				○	○						
3rd step : Aligning mark groove (3) with pointer								○	○		○	
4th step : Aligning mark groove (1) with pointer		○	○	○								

Fig. 37



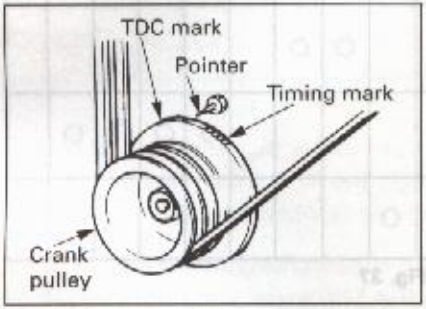


Fig. 38

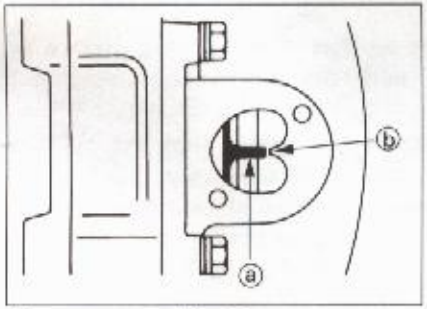


Fig. 39

(3) Injection Timing Check and Adjustment

Flange Mount Type
Injection pump

Improper injection timing causes serious engine failure such as blackish exhaust smoke, poor engine output and engine breakage etc.

In normal servicing, this check and adjustment is unnecessary, however, it might be necessary in conjunction with a related works.

Check procedure

1) Bring No. 1 cylinder to the top dead center on the compression stroke.
   Turn the crankshaft pulley clockwise (viewed at engine front) and align the TDC mark on the crankshaft pulley with the pointer on the timing gear case cover.
   Remove the timing check hole cover at the front of injection pump to check the alignment between the pointer a on the injection pump gear lock plate and the projected area mark b on the timing gear case.
   If a and b are in alignment, the timing is set correctly.
   If they are in alignment, No. 1 cylinder is at the TDC on the compression stroke. If it is in misalignment, recheck with turning the crankshaft pulley one more turn to repeat the aforegoing procedure to make sure that it is in alignment.
   Next, inspect the crankshaft position of the injection starting.
2) Reversely turn the crankshaft pulley counterclockwise viewed at the engine front about 30° crank angle.
3) Remove No. 1 injection pipe from the engine.

4) Remove the injection pump No. 1 delivery valve holder, delivery valve and spring and reinstall the delivery valve holder on the original place.
Delivery valve holder tightening torque:
39 – 44 N·m (29 – 33 ft.lb)

5) Slowly turn the crankshaft pulley clockwise and at the same time, continue to feed the fuel with pumping the feed pump. When the fuel stop to flow out from No. 1 delivery valve holder, stop the pumping instantaneously.

6) Observe and make sure that which mark (injection starting angle line) on the crankshaft pulley is aligning with the pointer.
The timing line shows the injection starting crank angle of the engine.
The injection starting crank angle differs depending on the engine model.
Refer to the main data and specifications on the injection timing angle for the respective model engine. If the timing is incorrect, do the following adjustment.

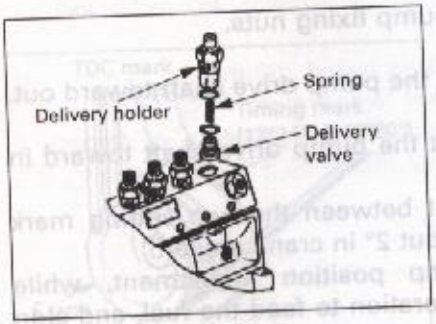


Fig. 40

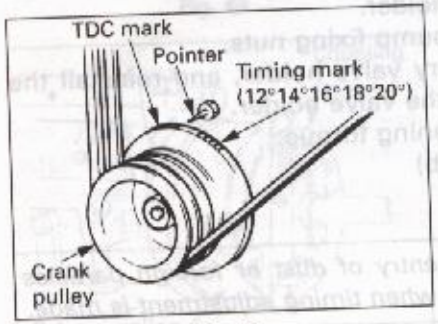


Fig. 41

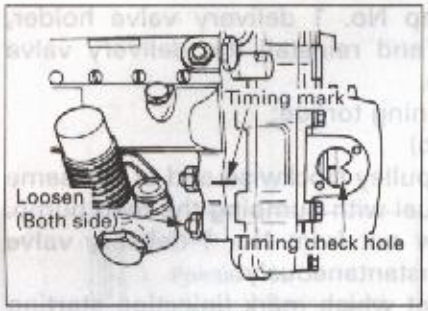


Fig. 42

Adjustment procedures

1) Align the pointer and the specified timing mark on the crankshaft pulley.
(Refer to the injection timing angle shown in the main data and specifications.)
2) Loosen the four injection pump fixing nuts.
3) To advance the timing.
Pivot the injection pump at the pump drive shaft toward out.
To retard the timing.
Pivot the injection pump at the pump drive shaft toward in (toward the cylinder block).
   - The 1mm misalignment between the two setting mark lines corresponds to about 2° in crank angle.
4) Do a fine injection pump position adjustment, while continuing the pumping operation to feed the fuel, and stop to pivot the injection pump when the fuel stop to flow out from No. 1 delivery valve holder.
5) Tighten the four injection pump fixing nuts.
6) Once remove No. 1 delivery valve holder, and reinstall the delivery valve, spring and the valve holder.
Delivery valve holder tightening torque:
39 – 44 N·m (29 – 33 ft.lb)
7) Install No. 1 injection pipe.

CAUTION: *Take care to prevent entry of dust or foreign particles into the pump interior when timing adjustment is made.*

Center Mount Type

Injection pump

Improper injection timing causes serious engine failure such as blackish exhaust smoke, poor engine output and engine breakage etc.

In normal servicing, this check and adjustment is unnecessary, however, it might be necessary in conjunction with a related works.

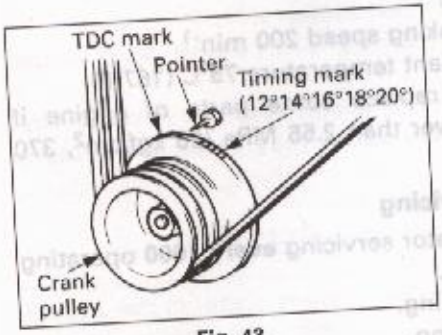


Fig. 43

Check procedure

1) Turn the crankshaft pulley clockwise to align the fuel injection timing mark on the crankshaft pulley and the pointer as illustrated. (The fuel timing crank angle differs depending on the engine.)
2) Check the injection pump notched line and the injection pump drive coupling notched line for alignment.
   When the two notched lines are in alignment, the injection timing is correct.

Adjustment procedures

When the two notched lines are not aligned with each other, loosen the injection pump coupling drive side bolts to disengage the pump drive line.

Turn the drive coupling to align the two notched lines, then tighten the coupling bolts.

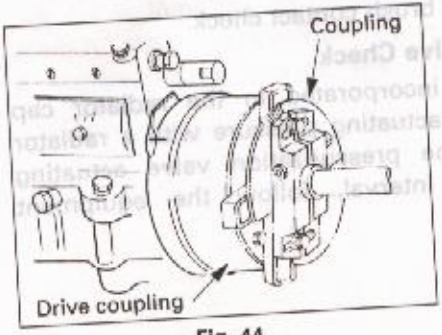


Fig. 44

CAUTION: *Take care to prevent entry of dust or foreign particles into the pump interior when timing adjustment is made.*

(4) Cylinder Compression Pressure Measurement

The cylinder compression pressure measurement must be done **every 1000** operation hours, or whenever the engine output is reduced.

Compression pressure	3.04 MPa (31 kgf/cm^2, 441 psi) at sea level
Test condition:	Cranking speed 200 min^{-1}
	Coolant temperature 75°C (167°F)

Repair the engine and/or replace some parts of engine if compression pressure is lower than 2.55 MPa (26 kgf/cm^2, 370 psi)

(5) Starter and Alternator Servicing

Do the starter and the alternator servicing **every 1000** operating hours on the following items.

- Starter commutator cleaning.
- Alternator slip ring cleaning.
- Carbon brushes and the brush contact check.

(6) Radiator Pressurization Valve Check

A pressurization valve is incorporated in the radiator cap assembly. Check the valve actuating pressure with a radiator compression tester. For the pressurization valve actuating pressure and the check interval, follow the equipment manufacturer's standards.

6. ENGINE CARE IN COLD SEASON

1. FUEL

(1) Fuel Selection

In the cold zone, the fuel might be frozen resulting in hard engine starting; therefore, select a suitable fuel for such engine operation.

Use ASTM 975 No. 2-D fuel if you expect temperature above –7°C (20°F).

Use Number 1-D if you expect temperatures below –7°C (20°F).

If Number 1-D is not available, a "winterized" blend of 1-D and 2-D is available in some areas during the winter months.

Check with the service station operator to be sure you get the properly blended fuel.

2. COOLANT

Where the atmospheric temperature falls below freezing point, the cooling system should be drained after engine operation, but to eliminate the need for repeated draining and refilling, the use of anti-freeze solution is highly recommended.

A 50/50 Ethylene glycol base antifreeze/water mix.
(which provides protection to –37°C (–34°F) is recommended for use in these ISUZU diesel engines).

Concentrations over 65% adversely affect freeze protection, heat transfer rates, and silicate stability which may cause water pump leakage.

Never exceed a 60/40 antifreeze/water mix.
(which provides protection to about –50°C (–58°F).

WARNING: *Under some conditions the ethylene glycol in the engine coolant is combustible. To help avoid being burned when adding engine coolant, do not spill it on the exhaust system or engine parts that may be hot. If there is any question, have this service performed by a qualified technician.*

CAUTION: *1. Methyl alcohol base antifreeze is not recommended because of its effect on the non-metallic components of the cooling system and because of its low boiling point.*
2. High silicate antifreeze is not recommended because of causing serious silica gelation problems.
3. Usage and mixing ratio etc. should be followed to the antifreeze manufacture's recommendations.

3. ENGINE OIL

Engine oil viscosity largely affects engine startability, so the use of lubricant with selected viscosity according to the atmospheric temperature is important. (Refer to 3.2. LUBRICANT)
At low atmospheric temperature, engine oil viscosity will increase to cause hard engine starting.

4. BATTERY

(1) Always pay attention to charging the batteries completely in cold season.
As the discharge current from the battery is large in cold engine starting, it takes a comparatively long while to recharge the batteries than the recharge after the normal engine starting.
Particularly, as the gravity of the insufficiently charged battery's electrolyte is low, it will easily be frozen.
Pay attention to keep the batteries warm in the cold season.

(2) To replenish the battery with distilled water, do it immediately before the engine operation.
If the work is done after the engine has already been in an operation, the distilled water replenished will not be mixed with the original electrolyte, allowing the danger of freezing the not mixed distilled water staying in the battery cell upper part.

5. ENGINE STARTING

In cold engine starting at atmospheric temperature of below 0°C (32°F), pay attention to the following items:

(1) Do the preheating operation before cranking the engine with the starter.

(2) Set the engine throttle lever or pedal to the 1/3 position of the full lever or pedal stroke.

(3) If the engine does not start with the initial cranking, keep the batteries stationary a while to recover their power and, reattempt the preheating and the cranking operation.

(4) In order to protect the starter, one time cranking must be limited to within 10 seconds.

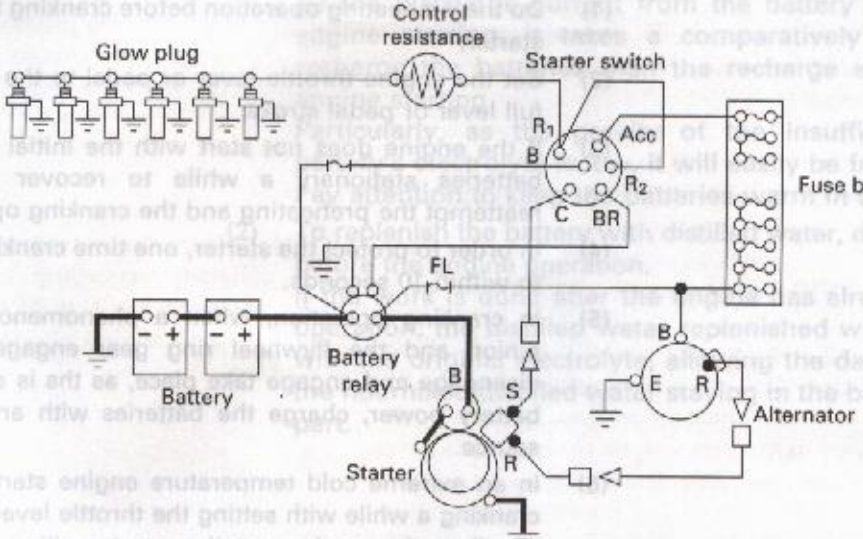
(5) In cranking operation, when a phenomenon, that the starter pinion and the flywheel ring gear engagement to repeated disengage and engage take place, as ths is a sign of weakened battery power, charge the batteries with an external electrical source.

(6) In an extreme cold temperature engine starting, do the engine cranking a while with setting the throttle lever at no fuel position to allow the engine rotating or travelling parts come to an unrestricted condition from the adhesive cold lubricant, after then do preheating and cranking to start the engine.

***CAUTION**: Do not use starting "aids" in the air intake system. Such aids can cause immediate engine damage.*

7. ENGINE ELECTRICAL WIRING DIAGRAMS

As the electrical wiring differs depending on the respective equipment, merely standard wirings are shown in the diagrams.



Note: FL = Fusible link

Fig. 45

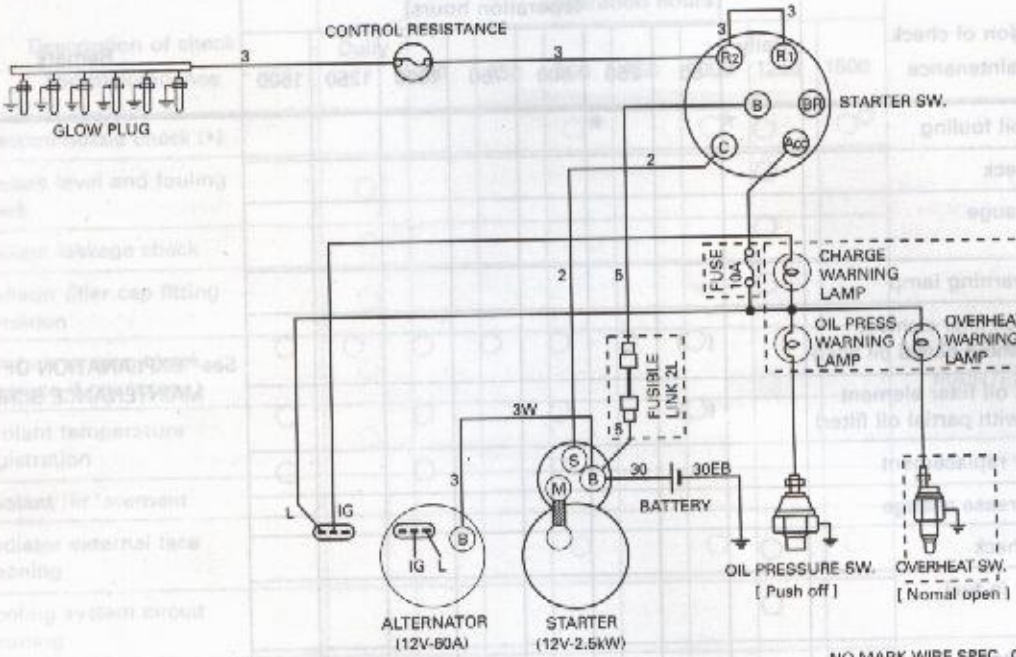

CONTROL RESISTANCE
GLOW PLUG
STARTER SW.
CHARGE WARNING LAMP
OIL PRESS WARNING LAMP
OVERHEAT WARNING LAMP
FUSE 10A
FUSIBLE LINK 2L
3W
30
30EB
BATTERY
IG
L
ALTERNATOR (12V-60A)
STARTER (12V-2.5kW)
OIL PRESSURE SW. [Push off]
OVERHEAT SW. [Nomal open]
NO MARK WIRE SPEC. 0.85
RECOMENDED APPLICATION.
IMPROPER CONNECTION OF TERMINALS WILL CAUSE FAILURE OF ELECTRIC PARTS.

Fig. 46

8. ENGINE MAINTENANCE SCHEDULE

When performing the following items, the daily inspection items should also be carriedout.

NO.	Description of check and maintenance	Daily	(operation hours)							Remark
			50	250	500	750	1000	1250	1500	
1.	Oil level and oil fouling	○								See "EXPLANATION OF MAINTENANCE SCHEDULE"
2.	Oil leakage check	○								
3.	Oil pressure gauge registration	○								
4.	Oil pressure warning lamp	○								
5.	Engine oil and oil filter element replacement(without partial oil filter)		(○)	○	○	○	○	○	○	
6.	Engine oil and oil filter element replacement (with partial oil filter)		(○)		○		○		○	
7.	Partial oil filter replacement				○		○		○	
8.	Water pump grease change									
9.	Fuel leakage check	○								
10.	Draining water in fuel filter	○								
11.	Fuel filter element replacement				○		○		○	
12.	Feed pump strainer cleaning				○		○		○	

NO.	Description of check and maintenance	Daily	(operation hours) 50	250	500	750	1000	1250	1500	Remark
13.	Injection nozzle check (*)				◎★		◎★		◎◎	
14.	Coolant level and fouling check	○								
15.	Coolant leakage check	○								
16.	Radiator filler cap fitting condition	○								
17.	Fan belt tension check (Replace if necessary.)	○								See "EXPLANATION OF MAINTENANCE SCHEDULE"
18.	Coolant temperature registration	○								
19.	Coolant replacement									
20.	Radiator external face cleaning				○		○		○	
21.	Cooling system circuit cleaning									
22.	Radiator filler cap function check (*)									

★ This is a recommended maintenance. The failure to perform this maintenance item will not nullify the emission warranty or limit recall liability prior to the completion engine useful life. Isuzu, however, urges that recommended maintenance service is performed at the indicated intervals.

◎ This is required maintenance. The failure to perform this required maintenance item may nullify the emission warranty.

NO.	Description of check and maintenance		Daily	(operation hours) 50	250	500	750	1000	1250	1500	Remark
23.	Electrolyte level check		○								
24.	Battery cleaning		○								
25.	Battery charge condition	Ammeter registration	○								
		Charge warning lamp	○								
26.	Electrolyte gravity check										See "EXPLANATION OF MAINTENANCE SCHEDULE"
27.	Starter and alternator check and cleaning (*)							○			
28.	Wiring and connection check										
29.	Preheating condition check		○								
30.	Air cleaner element replacement					(○)		(○)		(○)	

NO.	Description of check and maintenance	Daily	(operation hours) 50	250	500	750	1000	1250	1500	Remark
31.	Engine starting conditions and noise conditions	○								See "EXPLANATION OF MAINTENANCE SCHEDULE"
32.	Exhaust smoke condition	○								
33.	Cylinder compression pressure (*)						○			
34.	Valve clearance check (*)						○			

Note:

1. The service intervals after 1500 operation hours should also be made every 250 operation hours in accordance with this check and maintenance schedule.
2. When the servicing on the asterisked (*) items are necessary, consult the equipment supplier.

EXPLANATION OF MAINTENANCE SCHEDULE

The following is a brief explanation of the services listed in the preceding Engine Maintenance schedule.

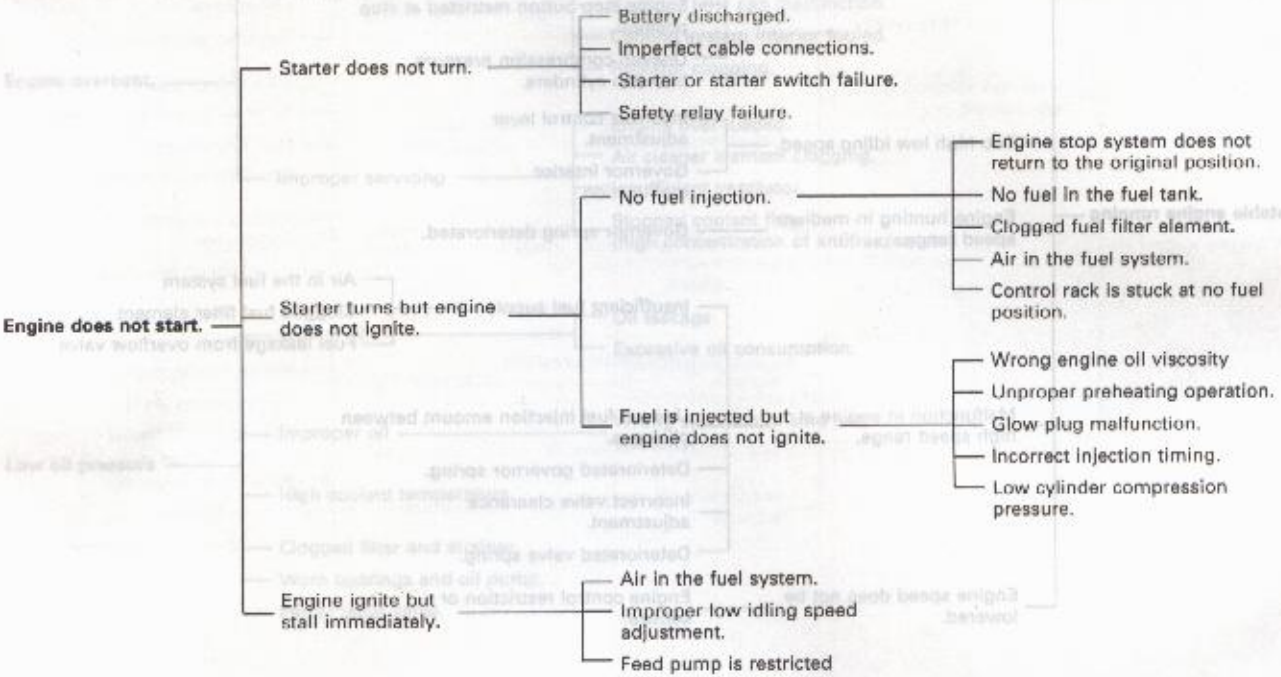
1.	**Oil level and oil fouling**	Check that the oil level is between the max. level mark and the min. level mark. Drain oil to the max. level mark if oil level is above the max. level mark. Add oil to the max. level mark if oil is below the min. level mark.
2.	**Oil leakage check**	Replace any damaged or malfunctioning parts which could cause leakage.
3.	**Oil pressure gauge registration**	Engine oil pressure is normal at about 290 to 590 kPa (42 to 85 psi) in warmed-up condition. Check and repair the lubrication oil system, if it is abnormal.
4.	**Oil pressure warning lamp**	Warning lamp is off while engine running. If it stays on, check and repair the lubrication system.
5.	**Engine oil and oil filter element replacement (without partial oil filter)**	Change oil every 250 hours.
6.	**Engine oil and oil filter element replacement (with partial oil filter)**	Change oil and element every 500 hours.
7.	**Partial oil filter replacement**	Change element every 500 hours.
8.	**Water pump grease change**	Change grease (BESCO L-2) every 4000 hours
9.	**Fuel leakage check**	Inspect the fuel lines for damage which could cause leakage. Replace any damaged or malfunctioning parts.
10.	**Draining water in fuel filter**	The fuel system without water sedimenter: Drain the sedimented water in the fuel filter body every 200 hours.

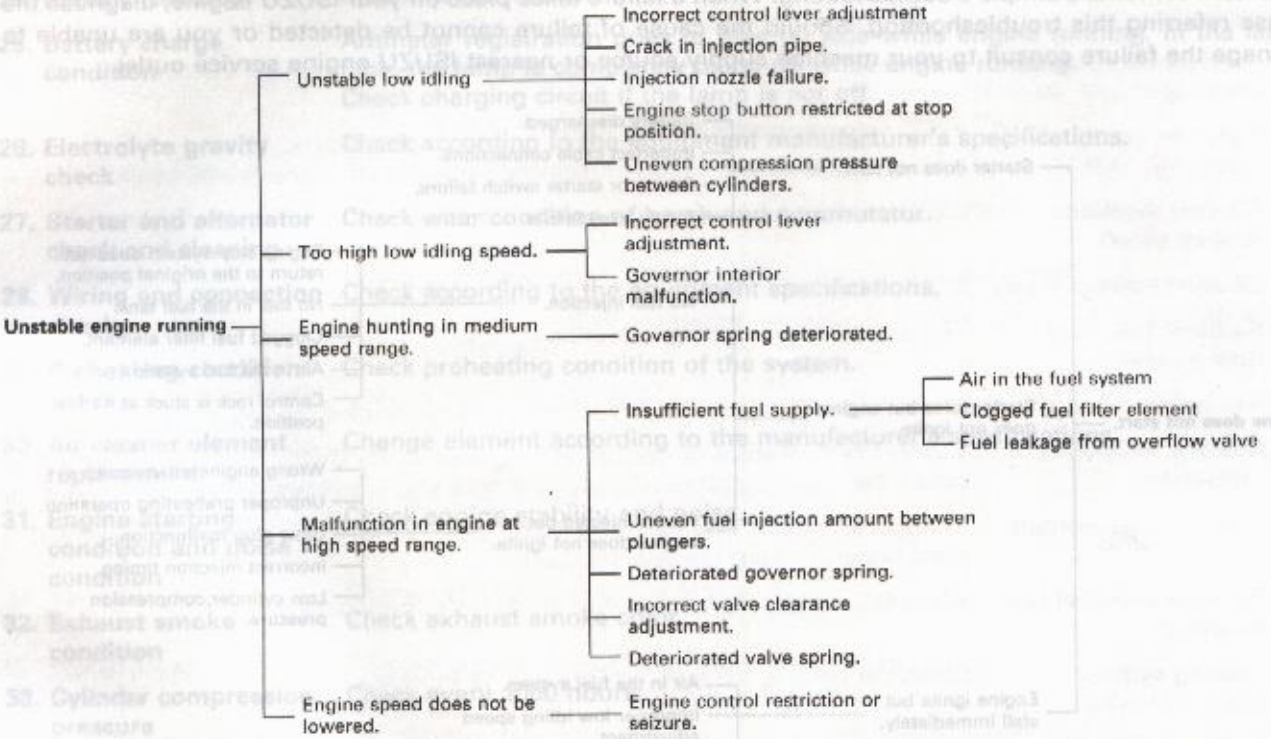
11. Fuel filter element replacement	Change element every 500 hours.
12. Feed pump strainer clearing	Clean the feed pump strainer every 500 hours.
13. Injection nozzle check	Clean the injection nozzle tips every 1500 hours. (This is a required maintenance) Check injection opening pressure and spray condition.
14. Coolant level and fouling check	Check coolant level and add coolant if necessary.
15. Coolant leakage check	Repair part for coolant leakage.
16. Radiator filler cap fitting condition	The radiator cap must be installed tightly.
17. Fan belt tension check	Check and adjust fan belt deflection. Look for cracks, fraying and wear.
18. Coolant temperature registration	Coolant temperature is normal at about 75 to 85°C (167 to 185°F). Check and repair the cooling system if coolant temperature is abnormal.
19. Coolant replacement	Change coolant at intervals of 6 months or 12 months respectively if coolant is plain water, or long life coolant (LLC).
20. Radiator external face cleaning	According to the equipment manufacturer's specification.
21. Cooling system circuit cleaning	Clean the cooling system circuit every 12 months.
22. Radiator filling cap function check	Check radiator pressure cap perodically for proper operation according to the equipment manufacturer's specifications.
23. Electrolyte level check	Replenish with distilled water if necessary.

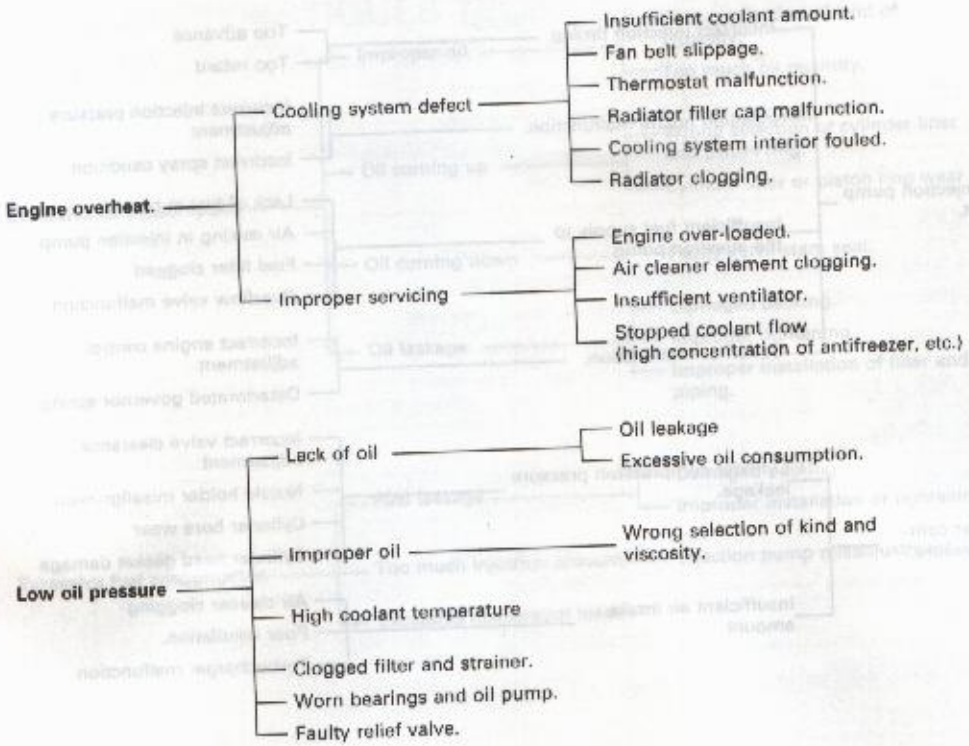
24. Battery cleaning	Clean the terminals.
25. Battery charge condition	Ammeter registration goes to plus (+) side while engine running. In the lamp type, the lamp is completely being off while engine running. Check charging circuit if the lamp is not off.
26. Electrolyte gravity check	Check according to the equipment manufacturer's specifications.
27. Starter and alternator check and cleaning	Check wear condition of brush and commutator.
28. Wiring and connection check	Check according to the equipment specifications.
29. Preheating condition check	Check preheating condition of the system.
30. Air cleaner element replacement	Change element according to the manufacturer's specifications.
31. Engine starting condition and noise condition	Check engine stability and noise.
32. Exhaust smoke condition	Check exhaust smoke color.
33. Cylinder compression pressure	Check every 1000 hours.
34. Valve clearance check	Incorrect valve clearance will result in increased engine noise and lower engine output. Thereby adversely affecting engine performance. Check and adjust every 1000 hours.

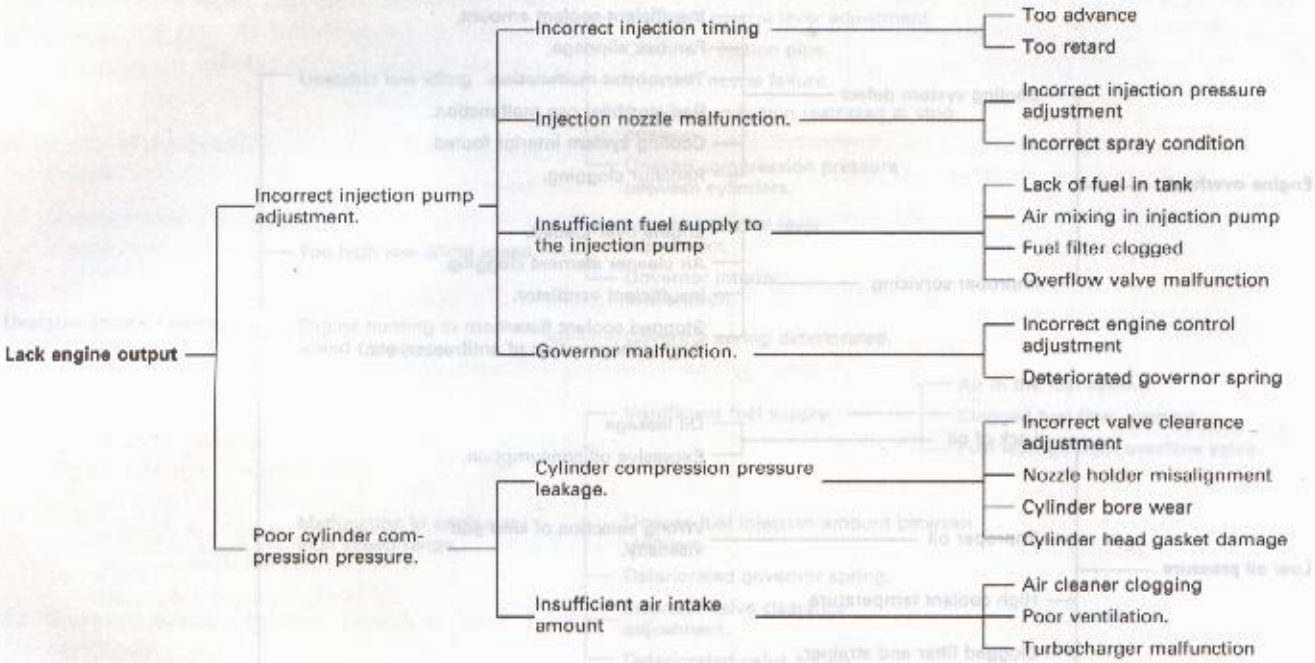
9. SIMPLE ENGINE TROUBLESHOOTING

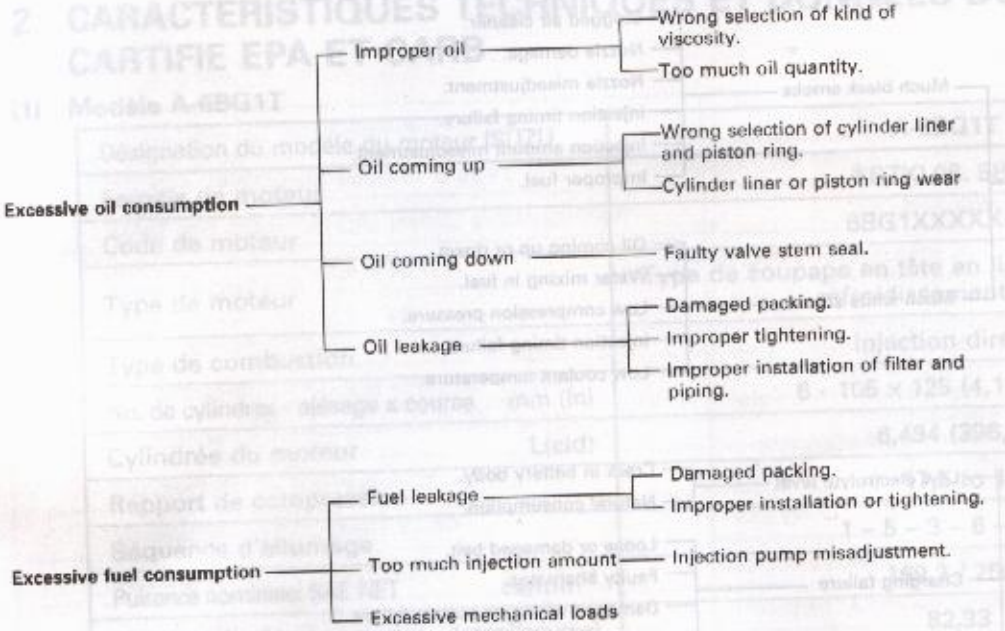
This item contents a simple troubleshooting. When a failure takes place on your ISUZU engine, diagnose the cause referring this troubleshooting. Should the cause of failure cannot be detected or you are unable to manage the failure consult to your machine supply source or nearest ISUZU engine service outlet.

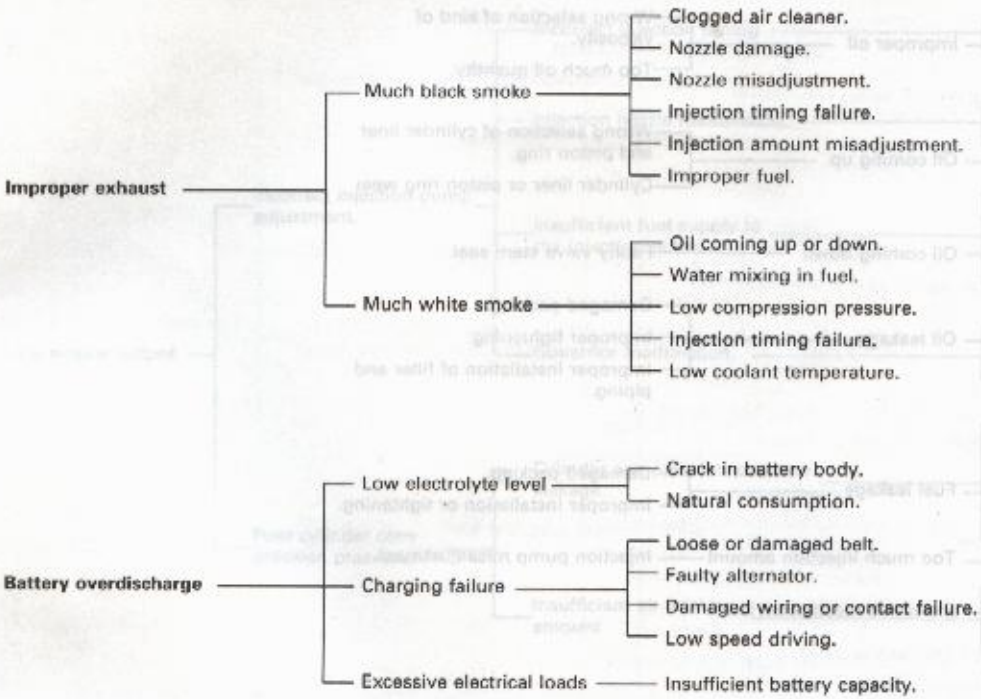



Unstable engine running
Unstable low idling
Incorrect control lever adjustment
Crack in injection pipe.
Injection nozzle failure.
Engine stop button restricted at stop position.
Uneven compression pressure between cylinders.
Too high low idling speed.
Incorrect control lever adjustment.
Governor interior malfunction.
Engine hunting in medium speed range.
Governor spring deteriorated.
Malfunction in engine at high speed range.
Insufficient fuel supply.
Air in the fuel system
Clogged fuel filter element
Fuel leakage from overflow valve
Uneven fuel injection amount between plungers.
Deteriorated governor spring.
Incorrect valve clearance adjustment.
Deteriorated valve spring.
Engine speed does not be lowered.
Engine control restriction or seizure.


Engine overheat.
Cooling system defect
Insufficient coolant amount.
Fan belt slippage.
Thermostat malfunction.
Radiator filler cap malfunction.
Cooling system interior fouled.
Radiator clogging.
Improper servicing
Engine over-loaded.
Air cleaner element clogging.
Insufficient ventilator.
Stopped coolant flow (high concentration of antifreezer, etc.)
Low oil pressure
Lack of oil
Oil leakage
Excessive oil consumption.
Improper oil
Wrong selection of kind and viscosity.
High coolant temperature
Clogged filter and strainer.
Worn bearings and oil pump.
Faulty relief valve.


Lack engine output
Incorrect injection pump adjustment.
Incorrect injection timing
Too advance
Too retard
Injection nozzle malfunction.
Incorrect injection pressure adjustment
Incorrect spray condition
Insufficient fuel supply to the injection pump
Lack of fuel in tank
Air mixing in injection pump
Fuel filter clogged
Overflow valve malfunction
Governor malfunction.
Incorrect engine control adjustment
Deteriorated governor spring
Poor cylinder compression pressure.
Cylinder compression pressure leakage.
Incorrect valve clearance adjustment
Nozzle holder misalignment
Cylinder bore wear
Cylinder head gasket damage
Insufficient air intake amount
Air cleaner clogging
Poor ventilation.
Turbocharger malfunction


Excessive oil consumption
Improper oil
Wrong selection of kind of viscosity.
Too much oil quantity.
Oil coming up
Wrong selection of cylinder liner and piston ring.
Cylinder liner or piston ring wear
Oil coming down
Faulty valve stem seal.
Oil leakage
Damaged packing.
Improper tightening.
Improper installation of filter and piping.
Excessive fuel consumption
Fuel leakage
Damaged packing.
Improper installation or tightening.
Too much injection amount
Injection pump misadjustment.
Excessive mechanical loads


Improper exhaust
Much black smoke
Clogged air cleaner.
Nozzle damage.
Nozzle misadjustment.
Injection timing failure.
Injection amount misadjustment.
Improper fuel.
Much white smoke
Oil coming up or down.
Water mixing in fuel.
Low compression pressure.
Injection timing failure.
Low coolant temperature.
Battery overdischarge
Low electrolyte level
Crack in battery body.
Natural consumption.
Charging failure
Loose or damaged belt.
Faulty alternator.
Damaged wiring or contact failure.
Low speed driving.
Excessive electrical loads
Insufficient battery capacity.

2. CARACTERISTIQUES TECHNIQUES ET DONNEES DU MOTEUR CARTIFIE EPA ET CARB

(1) **Modèle A-6BG1T**

	A-6BG1T
Désignation du modéle du moteur ISUZU	*SZXL06. 5BTA
Famille de moteur	6BG1XXXXX-XX
Code de moteur	Type de soupape en tête en ligne, quatre temps, à refroidissement à eau
Type de moteur	Injection directe
Type de combustion	6 - 105 × 125 (4,13 × 4,92)
No. de cylindres - alésage x course mm (in)	6,494 (396,3)
Cylindrée du moteur L(cid)	17,5 to 1
Rapport de compression	1 – 5 – 3 – 6 – 2 – 4
Séquence d'allumage	169,2 / 2500
Puisance nominale: SAE NET cv/min^{-1}	82,33
Débit de combustible au couple max. (mm^3/course)	Midification du moteur
Système de commande d'émission d'échappement	Type AD, Bosch
Pompe à injection	Type mécanique, vitesse variable
Régulateur	

* Marque ; Placer un code de lettres pour l'année du modèle sur la partie supérieure des lettres.
Année du modèle Y : 2000, 1 : 2001, 2 : 2002

Le code du moteur varie selon chaque moteur.

Désignation du modéle du moteur ISUZU		A-6BG1T
Buses à injection		Type à orifices multiples
Combustible spécifié		Combustible Diesel (ASTM D975 No. 2-D)
Démarreur V-kW		24 – 4,5
Alternateur V-A		24 – 25
Huile moteur spécifiée (API grade)		CD
Volume d'huile de lubrication L (qts)		21,5 (22,7) – 17,5 (18,5)
Volume du liquide de refroidissement (seulement moteur) L (qts)		12,0 (12,7)
Poids à sec du moteur kg (lb)		470,0 (1036,2)
Dimesions du moteur	Longueur hors-tout mm (in)	1162,0 (45,75)
	Largeur hors-tout mm (in)	778,0 (30,63)
	Hauteur hors-tout mm (in)	952,0 (37,48)
Jeu de soupape (à froid) mm (in)		0,4 (0,0157)
Pression d'injection d'injecteur MPa (psi)		18,1 (2630)
Calage d'injection B.T.D.C		12°
Fabricant et type de turbochargeur		IHI (RHE6)

(2) Modèle A-6BG1

Désignation du modèle du moteur ISUZU	A-6BG1	
Famille de moteur	*SZXL06. 5BNA	*SZXL06. 5CNA
Code de moteur	6BG1XXXXX-XX	
Type de moteur	Type de soupape en tête en ligne, quatre temps, à refroidissement à eau	
Type de combustion	Injection directe	
No. de cylindres - alésage x course mm (in)	6 - 105 × 125 (4,13 × 4,92)	
Cylindrée du moteur L (cid)	6,494 (396,3)	
Rapport de compression	17,0 to 1	
Séquence d'allumage	1 – 5 – 3 – 6 – 2 – 4	
Puisance nominale: SAE NET cv/min^{-1}	123,2 / 2500	94,6 / 2000
Débit de combustible au couple max. mm^3/course	60,11	49,6
Système de commande d'émission d'échappement	Midification du moteur	
Pompe à injection	Type AD, Bosch	
Régulateur	Type mécanique, vitesse variable	

* Marque ; Placer un code de lettres pour l'année du modèle sur la partie supérieure des lettres.
Année du modèle Y : 2000, 1 : 2001, 2 : 2002, 3 : 2003

Le code du moteur varie selon chaque moteur.

Désignation du modéle du moteur ISUZU			A-6BG1	
Famille de moteur			*SZXL06. 5BNA	*SZXL06. 5CNA
Buses à injection			Type à orifices multiples	
Combustible spécifié			Combustible Diesel (ASTM D975 No. 2–D)	
Démarreur		V-kW	24 – 4,5	
Alternateur		V-A	24 – 25	
Huile moteur spécifiée (API grade)			CC or CD	
Volume d'huile de lubrication		L (qts)	21,5 (22,7) – 17,5 (18,5)	
Volume du liquide de refroidissement (seulement moteur)		L (qts)	12,0 (12,7)	
Poids à sec du moteur		kg (lb)	450,0 (992,1)	
Dimesions du moteur	Longueur hors-tout	mm (in)	1156,0 (45,51)	
	Largeur hors-tout	mm (in)	750,0 (29,53)	
	Hauteur hors-tout	mm (in)	946,0 (37,24)	
Jeu de soupape (à froid)		mm (in)	0,4 (0,0157)	
Pression d'injection d'injecteur		MPa (psi)	18,1 (2630)	14,7 (2135)
Calage d'injection B.T.D.C			14°	16°
Fabricant et type de turbochargeur			NA	

(3) Modèle CC-6BG1T, AA-6BG1T et BB-6BG1T

Désignation du modèle du moteur ISUZU	CC-6BG1T	AA-6BG1T	BB-6BG1T
Famille de moteur	*SZXL06. 5EXA	*SZXL06. 5FXA	*SZXL06. 5FTA
Code de moteur	6BG1XXXXX-XX		
Type de moteur	Type de soupape en tête en ligne, quatre temps, à refroidissement à eau		
Type de combustion	Injection directe		
No. de cylindres - alésage x course mm (in)	6 - 105 × 125 (4,13 × 4,92)		
Cylindrée du moteur L(cid)	6,494 (396,3)		
Rapport de compression	18,0 to 1		
Séquence d'allumage	1 – 5 – 3 – 6 – 2 – 4		
Puisance nominale: SAE NET hp/min^{-1}	188,4 / 2200	149,3 / 2100	170,7 / 2200
Débit de combustible au couple max. (mm^3/course)	92,3	79,1	89,8
Système de commande d'émission d'échappement	Midification du moteur, TC CAC DFI		EM TC DFI
Pompe à injection	Type AD, Bosch		
Régulateur	Type mécanique, vitesse variable/Type électrique		

* Marque ; Placer un code de lettres pour l'année du modèle sur la partie supérieure des lettres.
Année du modèle Y : 2000, 1 : 2001, 2 : 2002, 3 : 2003

Le code du moteur varie selon chaque moteur.

Désignation du modéle du moteur ISUZU		CC-6BG1T	AA-6BG1T	BB-6BG1T
Buses à injection		Type à orifices multiples		
Combustible spécifié		Combustible Diesel (ASTM D975 No. 2-D)		
Démarreur V-kW		24 – 4,5		
Alternateur V-A		24 – 25		
Huile moteur spécifiée (API grade)		CD		
Volume d'huile de lubrication L (qts)		21,5 (22,7) – 16,5 (17,4)		
Volume du liquide de refroidissement (seulement moteur) L (qts)		12,0 (12,7)		
Poids à sec du moteur kg (lb)		490 (1080)		
Dimesions du moteur	Longueur hors-tout mm (in)	1206 (47,5)		
	Largeur hors-tout mm (in)	815 (32,1)		
	Hauteur hors-tout mm (in)	996 (39,2)		
Jeu de soupape (à froid) mm (in)		0,4 (0,0157)		
Pression d'injection d'injecteur MPa (psi)		18,1 (2630)		16,7–19,6 (2415–2845)
Calage d'injection B.T.D.C		9°	10°	9°
Fabricant et type de turbochargeur		IHI (RHG6)		

(4) Famille indice de moteur

Moteur	Famille de moteur	Code de moteur	Pression d'injection d'injecteur MPa(psi)	Catage d'injection B.T.D.C. (Statique)
6BG1	3SZXL06.5CNA	6BG1NAABA-05	18,1 (2630)	14°
		6BG1NAABB-01	14,7 (2135)	16°
		6BG1NAABE-01	18,1 (2630)	16°
6BG1T	3SZXL06.5FTA	6BG1TABFC-01	18,1 (2630)	8°
		6BG1TABFD-01	16,7–19,6 (2415–2845)	9°
		6BG1TABFD-02,06,07,08,10,11,12	16,7–19,6 (2415–2845)	8°
		6BG1TABFE-01,02	16,7–19,6 (2415–2845)	8°
		6BG1TABFF-01	16,7–19,6 (2415–2845)	8°
		6BG1TABFG-01	16,7–19,6 (2415–2845)	7°
		6BG1TABFG-06,07,08,0-9,10,11	16,7–19,6 (2415–2845)	6°
		6BG1TABFH-01	16,7–19,6 (2415–2845)	7°
		6BG1TABFH-10,11	16,7–19,6 (2415–2845)	6°
	3SZXL06.5EXA	6BG1XABEA-03	18,1 (2630)	9°
		6BG1XABEB-01	18,1 (2630)	9°
		6BG1XABEC-03	18,1 (2630)	9°
		6BG1XABED-02,03	16,7–19,6 (2415–2845)	9°
		6BG1XABEE-01	16,7–19,6 (2415–2845)	9°
		6BG1XABEF-01	16,7–19,6 (2415–2845)	9°
	3SZXL06.5FXA	6BG1XABFA-05	18,1 (2630)	10°

ETIQUETTE DE COMMANDE D'EMISSION : ETIQUETTE DU MOTEUR (POUR EPA)

L'étiqutte de contôle d'émission est fixée au côté arrière et supérieur du couvercle de la culasse. Mais la même étiquette de contrôle est fixée à un point visible sur l'étiquette fixée au moteur n'est pas visible à cause de la construction de l'équippement.

Voici-ci après un échatillon requis pour les informations concernant la commande d'émission du moteur, ensemble avec son emplacement.

Ces étiquettes sont traduites de l'anglais en français.

ISUZU INFORMATION IMPORTANTE SUE LE MOTEUR
ISUZU MOTORS LTD. FABRIQUE AU JAPON

FAMILLE DE MOTEUR: XXXXXXX.XXXX
CODE DE MOTEUR: XXXXXXXXXXXX
MODELE : XXXX
CYLINDREE : XXXXcm³
: XXX IN³
SYSTEME DE COMMANDE D'EMISSION D'ECHAPPEMENT : XX

IL EST CERTIFIE QUE CE MOTEUR FUNCTIONNE AVEC COMBUSTIBLE DIESEL.

CE MOTEUR EST EN CONFORMITE AVEC LES REGLEMENTS DES MOTEURS A ALLUMAGE PAR COMPRESSION "OFF-ROAD" DE CALIFORNIE ET DES MOTEURS DIESEL "NON-ROAD" EPA ETATS-UNIS, MODELE DE L'ANNEE XXXX.

Le code de barres

★SPECIFICATION DU MOTEUR
PUISSANCE NOMINALE EN CHEVAUX
SAE NET
(VENTILATEUR LIBERE)
XXkW/XXXX TR-MN
XXHP/XXXX TR-MN
TAUX DE COMBUSTIBLE
XX mm³/st.
JEU DE SOUPARE (A FROID)
ADMISSION : X.X mm.
ECHAPPEMENT : X.X mm.
INJECTION INITIALE
CALAGE : XX° BTDC
RALENTI EN COURBE :
XXXmin⁻¹/TR-MN
(★SPECIFICATION DU MODELE VOIR LE MANUEL DE SERVICE)

NO. P XXXXXXXXXX