

ISUZU DIESEL ENGINE 4JJ1

INSTRUCTION MANUAL

ISUZU MOTORS LIMITED

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FOREWORD

The ISUZU industrial diesel engines are a product of ISUZU's long years of experience, advanced technology. ISUZU takes great pride in the superior durability and operating economy of these engines.

In order to get the fullest use and benefit from your industrial engine, it is important that you operate and maintain it correctly. This manual is designed to help you do this.

Please read this Manual carefully and follow its operating and maintenance recommendations. This will ensure many years of trouble-free and economical engine operation.

Should your engine require servicing, please contact your nearest ISUZU engine outlet. He knows your engine best and is ready to meet your satisfaction.

All information, illustrations, and specifications contained in this Manual are based on the latest product information available at the time of publication.

ISUZU reserves the right to make changes in this Manual at any time without prior notice.

WARNING AND CAUTION

SAFETY WARNINGS

WARNING: These mean there is something that could hurt you or other people.

In the warning area, we tell you what the hazard is. Then we tell you what to do to help avoid or reduce the hazard. Please read these warning. If you don't, you or others could be hurt.

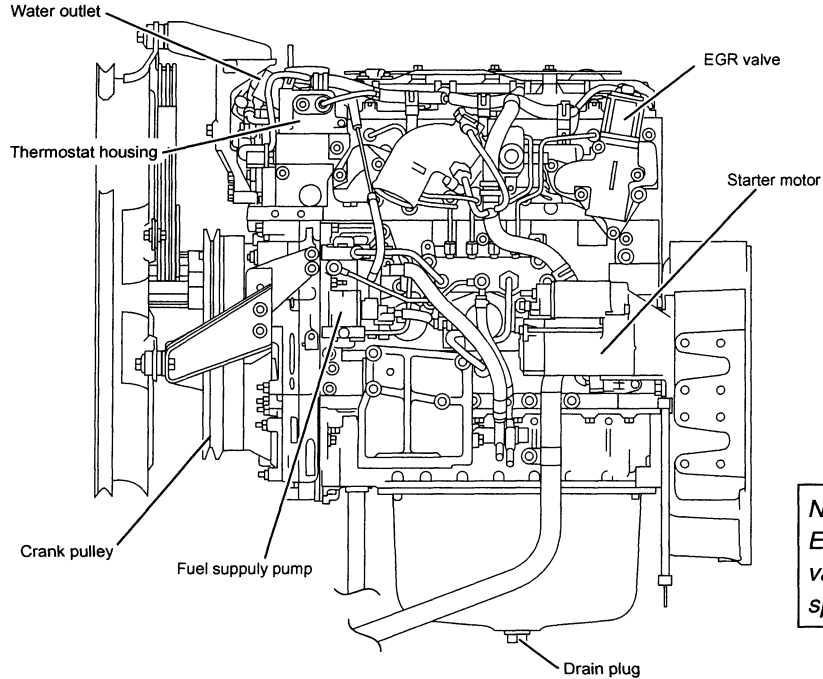
ENGINE OR EQUIPMENT DAMAGE WARNINGS

CAUTION: These mean there is something that could damage your engine or equipment.

In the caution area, we tell you about something that can damage your engine or equipment. Many times, this damage would not be covered by your warranty, and it could be costly. But the caution will tell you what to do to help avoid the damage.

1. ENGINE EXTERNAL VIEWS

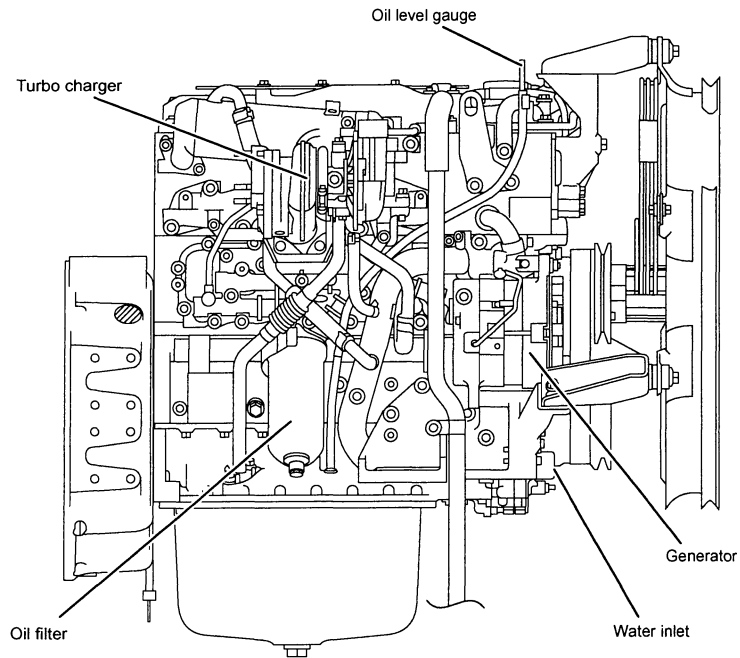
1. EXTERNAL VIEW (LH)



*Note:
Engine details may
vary depending on the
specifications.*

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2. EXTERNAL VIEW (RH)



*Note:
Engine details may
vary depending on the
specifications.*

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2. GENERAL INFORMATION

1. STANDARD ENGINE DATA AND SPECIFICATIONS

(1) Model AI-4JJ1X

ISUZU engine model name		AI-4JJ1X
Engine type		Water cooled, four cycle, in-line overhead camshaft type
Combustion type		Direct injection
No. of cylinders – bore × stroke	mm(in)	4 – 95 × 105 (3.74 × 4.13)
Engine displacement	L(cid)	2999 (183)
Compression ratio		17.5 to 1
Firing order		1 – 3 – 4 – 2
*Max. rated power	kW(hp)/min ⁻¹	92(125.1) / 1800
*Max. torque	Nm(lbft)/min ⁻¹	420 (309.8) / 1800
*Injection pump		DENSO type, Common Rail type
*Governor		Electrical control type
Injection nozzle		Multi-hole type (electrical control type)
Specified fuel		Diesel fuel (ASTM D975 No. 2-D) or equivalent
*Starter	V-kW	24 – 4.0
*Alternator	V-A	24 – 50

ISUZU engine model name		AI-4JJ1X	
Specified engine oil (API grade)		Refer to 3. LUBRICANT, Engine Oil Selection.	
*Lub. oil volume (Oil pan)	L(qts)	11.0 (11.6) – 15.0 (15.9)	
Coolant volume (Engine only)	L(qts)	6 (6.3)	
*Engine dry weight	kg(lb)	290 (639)	
*Engine dimensions	Overall length	mm(in)	963 (37.9)
	Overall width	mm(in)	813 (32.0)
	Overall height	mm(in)	918 (36.1)
Valve clearance (cold)	mm(in)	0.15 (0.006) for exhaust and intake	
Maker and type of turbocharger		IHI, RHF-5	

- NOTE:** 1. These specification are base on the standard engine.
2. Specification 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 information EPA en français.

(1) Model AI-4JJ1X

ISUZU engine model name	AI-4JJ1X
Engine family	*SZL03.0IXA
Engine code	4JJ1XXXX-XX
Engine type	Water cooled, four cycle, in-line overhead camshaft type
Combustion type	Direct Injection
No. of cylinders – bore × stroke	mm(in) 4 – 95 × 105 (3.74 × 4.13)
Engine displacement	L(cid) 2999 (183)
Compression ratio	17.5 to 1
Firing order	1 – 3 – 4 – 2
Max. rated power; SAE NET	kW(hp)/min ⁻¹ 92 (125.1) / 2200
Fuel flow at max. rated power	mm ³ /stroke 86.7
Exhaust emission control system	ECM, TC, CAC, DFI, EGR
Injection pump	DENSO type, Common Rail type
Governor	Electrical control type

* Mark ; Put a letter codes for model year on the top of the letters.

Y : 2000, 1 : 2001, 2 : 2002, 3 : 2003, 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007, 8 : 2008, Model Year

Engine code varies depending on each engine.

ISUZU engine model name			AI-4JJ1
Injection nozzle			Multi-hole type (electrical control type)
Specified fuel			Diesel fuel (ASTM D975 No. 2-D)
Starter	V-kW		24 – 4.0
Alternator	V-A		24 – 50
Specified engine oil (API grade)			Refer to 3. LUBRICANT, Engine Oil Selection.
Lub. oil volume (Oil pan)	L(qts)		11.0 (11.6) – 15.0 (15.9)
Coolant volume (Engine only)	L(qts)		About 6 (6.3)
Engine dry weight	kg(lb)		290 (639)
Engine dimensions	Overall length	mm(in)	926.4 (36.5)
	Overall width	mm(in)	763 (30.0)
	Overall height	mm(in)	891.8 (35.1)
Valve clearance (cold)	mm(in)		0.15 (0.006) for exhaust and intake
Nozzle injection pressure	MPa(psi)		—
Injection timing B.T.D.C (Static)			—
Maker and type of turbocharger			IHI, RHF-5

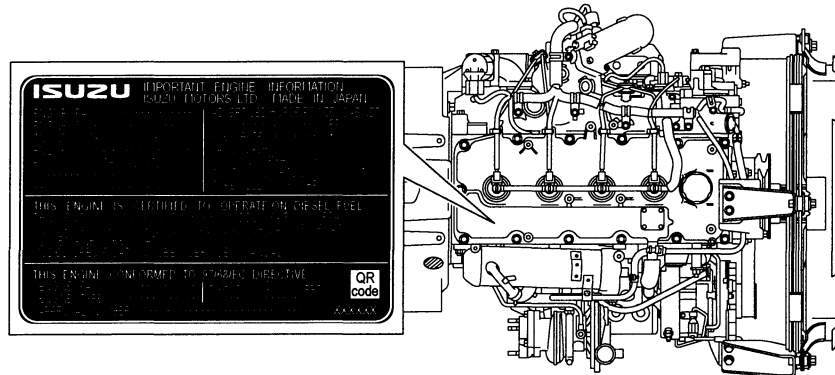
(2) Engine family index

Engine	Engine family	Engine code	Injection nozzle opening pressure MPa(psi)	Injection timing B.T.D.C. (Static)
4JJ1X	*SZL03.0IXA	ALL	—	—

3. EMISSION CONTROL LABEL: ENGINE LABEL

Emission control label is attached on the cylinder head cover.

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



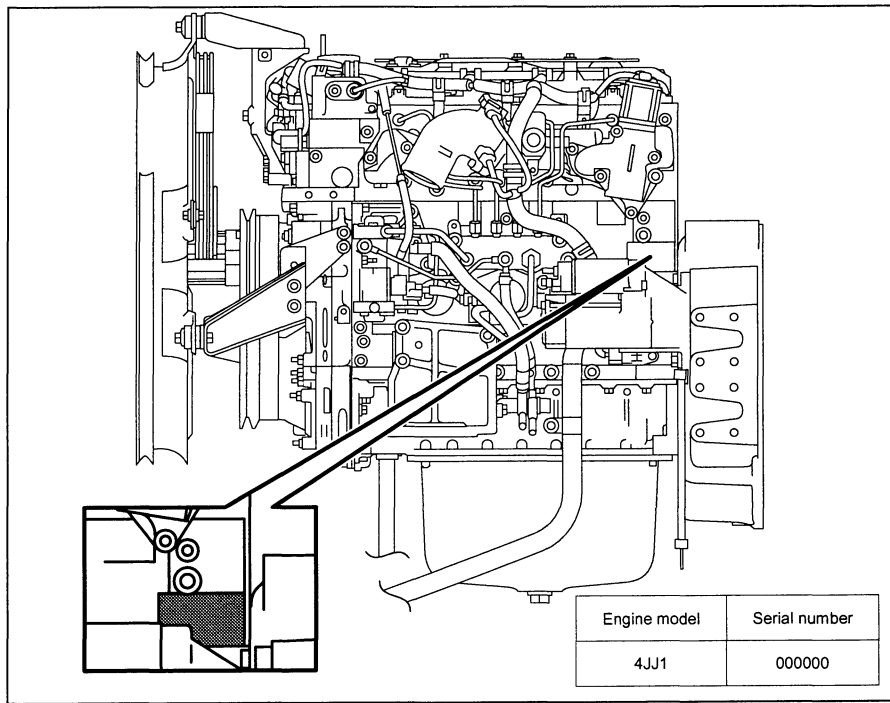
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4. ENGINE IDENTIFICATION

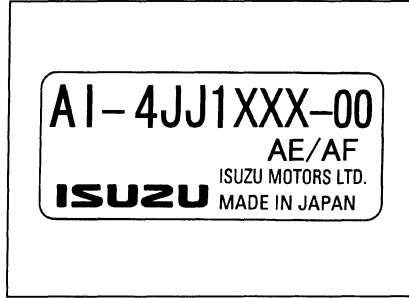
(1) Position Display

The engine serial number together with the engine model is stamped on the left hand side of the crankcase.

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



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(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.

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.



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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

In 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 full.

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 deposited.

- 2) Always fully fill the fuel tank. Drain the deposited 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 machine or equipment damage.*

(5) Fuel Filter

- 1) Be sure to use the genuine fuel filter. The fuel injection system is precision structure so that its filter has a finer mesh than conventional one to extend life of the system. Be sure to use "**Genuine fuel filter**".
- 2) Replacement interval may be shortened depending on the characteristic of fuel. Clogged fuel filter may cause to generate the engine trouble code, resulting in stopping the engine. In a place where fuel gets mixed with foreign matter, perform early inspection and periodic replacement.

The electromagnetic type fuel pump is installed in the fuel system.

When the filter exchange of this pump is necessary, please inquire at your machine supply source or contact ISUZU dealer.

(6) 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.

(7) 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.

CAUTION: *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

For engine oil, use API grade: CD,CE,CF,CF-4,CH-4,CI-4,CI-4 plus or ACEA grade: A3/B3,A3/B4,A5/B5,E2,E3,E4,E5,E7 or JASO grade: DH-1.

The brands/types of oil described below can be used regardless of specified API or ACEA grade above. Their qualities are guaranteed by ISUZU.

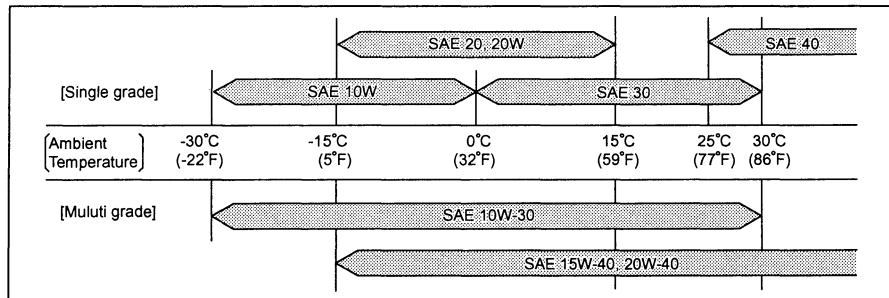
LUBRICATION	MAKER	BRAND/TYPE	GRADE		
			API	ACEA	JASO
Diesel engine crankcase	ISUZU GENUINE	BESCO MULTI-Z TYPE CE (10W-30)	CE		
	ISUZU GENUINE	*BESCO MULTI-Z (10W-30)	CD/CF/CF-4		
	ISUZU GENUINE	BESCO S-3 (10W, 20W, 30, 40)	CD		
	Caltex/Chevron	Delo CXJ (15W-40/20W-50/40)	CF		DH-1
		Delo 400 Multigrade (15W-40)	CE/CF/CI-4	E3/E5	DH-1
	Shell	Rimula X (15W-40)	CH-4	E3	DH-1
		Rimula D (15W-40/30/40)	CF		
	Elf	Perfo 3F (15W-40)	CF-4/CE	B2/E2	
	Total	Rubia XT (15W-40)	CF-4	E2	
	Castrol	RX Super Plus (15W-40)	CH-4	E3	
		Tecton J Plus (15W-40)	CH-4	E3/B3	DH-1
	BP	BP Vanellus C6 (15W-40)	CH-4	E3	
	IDEMITSU	APOLLOIL EX (10W-40)	CF		DH-1
		APOLLOIL TOUGH RUNNER (10W-30,15W-40)	CF		DH-1
		APOLLOIL MULTI RUNNER (10W-30, 15W-40)	CF-4/CE		DH-1
		*APOLLOIL SUPER WIDE DH-1 (10W-30,15W-40)	CF-4		DH-1
	ExxonMobil	Essolube XTJ (15W-40)	CF-4		DH-1
	Exxon/Essolube XD-3 (15W-40)	CI-4			
	Mobil Delvac 1300 Super (15W-40)	CI-4 Plus	E7/E5	DH-1	
	Mobil Delvac 1 (5W-40)	CI-4 Plus	E7/E5/E4/E3	DH-1	

* Initial Engine Oil from Engine plant

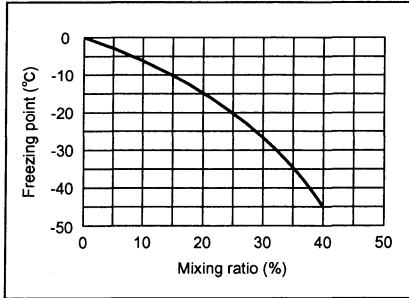
(2) Oil Viscosity

Engine oil viscosity largely affect engine startability, performance, oil consumption, speed of wearing and occurrence 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.



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3. COOLANT

Always refer to the chart to determine the correct cooling water to antifreeze solution mixing ratio.

- CAUTION:**
1. Supplement inhibitors or additives claiming to provide increases cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.
 2. When supplying or replacing coolant, do not use water of well or river, but be sure to use tap water.
 3. It is strongly recommended to use Isuzu genuine engine coolant or equivalent for addition or replacement.
 4. Coolants from other brands often do not contain anti-corrosive, and use of such products could result in corrosion of the engine and radiator.
 5. If the density of Isuzu genuine engine coolant exceeds 60%, the reduced specific heat characteristic of the coolant could result in overheating. If the density is below 20%, the anticorrosion characteristic may degrade. Adjust the coolant density in the range from 20% to 60% according to the situation.

4. ENGINE OPERATION

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.*

We recommend that the exhaust system be inspected by competent technician:

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

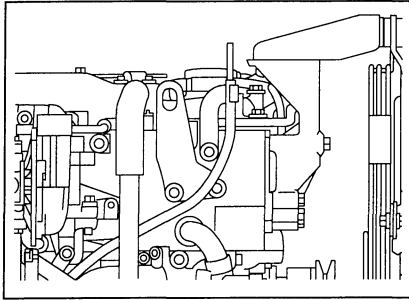
See "Maintenance Schedule" in Section 8 of this manual for parts requiring inspection.

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

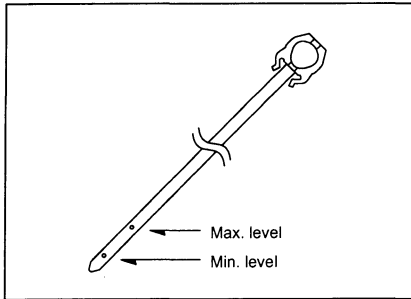
Keep the exhaust tailpipe area clear of snow and other material to help reduce the buildup of exhaust gases or the equipment. This is particularly important when parked in blizzard conditions.

1. CHECK BEFORE OPERATION

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



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(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 it out gently again.

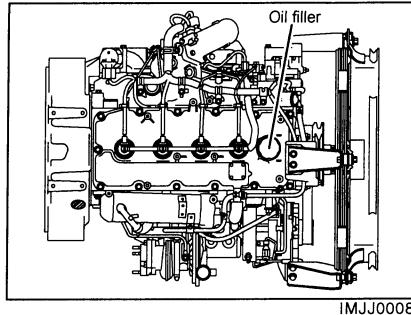
Check the oil level by the level marks on the dipstick. The oil level must be between max "Max" level mark and the "Min" level mark as illustrated.

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.*



- 4) Oil is poured through the oil filler at the cylinder head cover or the side surface of cylinder body.
- A certain period of time is required before the engine oil completely flows down from the oil filler to the crankcase.
- In adding oil, pour oil slowly to avoid pouring oil rapidly, and do not plug the oil filler port with the filler hose of an oil jug etc.
- Check the oil level ten or twenty minutes after oil replenishment.

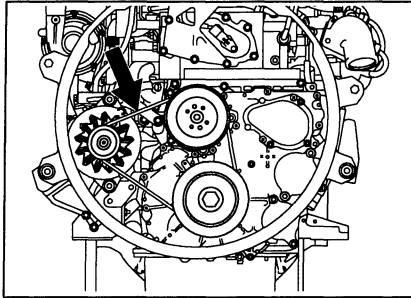
CAUTION: *If the engine oil is splashed on the alternator drive belt, it causes belt slippage or slackness; therefore, take care to avoid it.*

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.*

(2) Alternator Drive Belt Check

Check the alternator drive belt for tension and abnormalities.

WARNING: For the sake of safety, before conducting alternator drive belt check, make sure that the engine is stopped and is not be operated during check.



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- 1) When the belt is depressed with the thumb (98 N (22 lb) pressure) at the midway between the alternator pulley and idle pulley, the belt tension is correct as the following:
Alternator drive belt slackness : 7 – 8 mm (0.28 – 0.31 in)
New belt : 5 – 6 mm (0.2 – 0.24 in)
- 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

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

Proper coolant level is about 10 mm higher from the radiator core top.

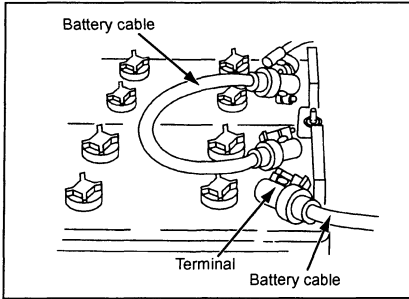
WARNING: *When removing the radiator filler cap while the engine is still hot, cover the cap with clothing, then turn it slowly to gradually release the internal steam pressure. This will prevent you from getting burnt with hot steam spouted out from the filler port.*

CAUTION: *Use Isuzu genuine anti-freeze (ethylene-glycol based) or equivalent with 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.

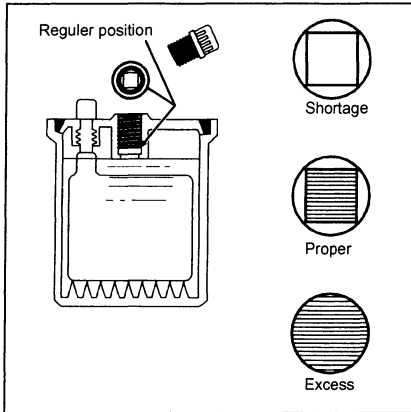


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(5) Battery Cable Connection

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.

CAUTION: Never reverse "+" and "-" terminals when reconnecting cables after disconnection. Even a short period of reverse connection will damage the electrical parts.



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(6) Battery Electrolyte Level

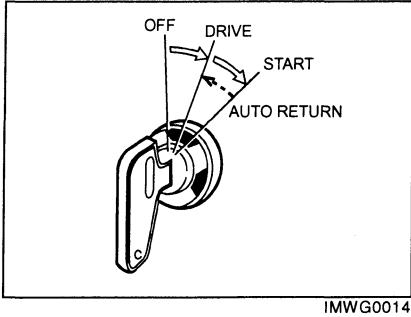
The amount of electrolyte in the batteries will be reduced after repeated discharge and recharge. Check the electrolyte for the level in the batteries, replenish with a commercially available electrolyte such as distilled water, if necessary. The battery electrolyte level checking procedure will vary 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 machine body is ⊖, it may cause a big danger.*
 5. *When disconnecting the terminals, start with ⊖ terminal. When connecting them, connect the ⊖ terminal last.*

(7) Engine Malfunction Indicator Lamp and LCD Display Panel on the Machine

If the trouble codes are indicated by the malfunction indicator lamp or LCD display on the machine, contact "ISUZU Distributor" as soon as possible.



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.

Some machines have engine emergency shutdown switch. Make sure that the engine emergency shutdown switch is off. Refer to the machine's manual for engine emergency shutdown switch.

(2) Pre-heating Procedures

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

- 1) Turn the key to the DRIVE position, and the glow plugs built in the engine will glow red-hot to pre-heat the engine.

At this time the pre-heating indicator lamp on the meterboard is actuated.

Preheating time is about 15 to 1 seconds though it depends on engine coolant temperature.

- 2) Turn the starter switch key clockwise to START position as soon as the indication lamp goes off.

WARNING: *Make sure that there is no flammable near outlet port of exhaust gas at engine starting. It is very dangerous due to deformation, discoloration or a fire.*

(3) Engine Starting

- 1) With the idling position, turn the starter switch key clockwise to START position.

The cranking period must not exceed 20 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.

In addition, if it is difficult to start the engine at cold region, turn the key switch to DRIVE position. The coolant temperature will be detected by coolant temperature sensor, and preheating will be performed automatically about 15 to 1 seconds, then preheating lamp will turn off.

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, despite 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 does not start, something may be wrong with the engine. Check the repeated parts to locate the cause.

CAUTION: *Do not use staring "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 idle 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 Malfunction Indicator Lamp and LCD Display Panel on the Machine

If the trouble codes are indicated by the malfunction indicator lamp or LCD display on the machine, contact "ISUZU Distributor" as soon as possible.

Engine oil pressure

Although the engine oil pressure gauge readings vary depending on ambient temperature or a type of oil, the gauge registers around 98 kPa (14.2 psi) at idle speed or around 340 to 690 kPa (49 to 100 psi) at rated speed.

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 color

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 color.

The exhaust smoke color after engine warming-up and at no-load operation.

- { Colorless or light blue.....Normal (Perfect combustion)
- { Black color.....Abnormal (Imperfect combustion)
- { White colorAbnormal (Imperfect combustion)

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

Leakage in the systems

CAUTION: *When checking, leaking liquid from engine may be splattered during engine operation. It may cause a burn. Approach the engine gradually from a long distance and then check it.*

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 Malfunction Indicator Lamp and LCD Display Panel on the Machine

If the trouble codes are indicated by the malfunction indicator lamp or LCD display on the machine, contact "ISUZU Distributor" as soon as possible.

(2) 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 engine 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 200 kPa (28 psi) though the engine speed is raised.
- The oil pressure gauge indicator oscillates greatly in the engine low speed range.

-
- When the engine oil pressure warning lamp goes on and off repeatedly.

When not lack of engine oil or no oil leakage is found, contact your equipment supplier to determine the cause of the abnormal reading.

(3) 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 90°C (167 to 194°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.*

Fuel amount is limited when the coolant temperature exceeds 100°C.

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

(4) 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.

(5) Liquid and Exhaust Smoke Leakage

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

(6) Abnormal Engine Noise

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

(7) State of the Exhaust Smoke

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

(8) 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 three minutes.

In this operation, check the engine noise and the engine oil pressure for abnormalities.

CAUTION: *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 that 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 90°C (167 to 194°F) indefinitely, take an action such as inspection or charge of thermostat.

8. OPERATION AND CARE FOR TURBOCHARGED ENGINE

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

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

10. HANDLING OF ELECTRICAL EQUIPMENTS

This engine is electronic control type. It has a lot of electronic control devices and electric parts. Pay special attention when performing the following works.

(1) High pressure washing

When performing high pressure washing to clean the engine, be careful not to splash water over wiring connectors or electronic control devices directly. This may cause malfunction or trouble.

(2) Welding

When welding on the machine, disconnect the connectors of electronic control devices (especially ECM) beforehand. Otherwise the devices may have trouble due to overcurrent.

5. PERIODICAL INSPECTION AND MAINTENANCE

1. LUBRICATING SYSTEM

WARNING: 1. *During inspection and service, a burn injury may occur due to hot engine body, coolant or engine oil. For the sake of safety, conduct service work after the engine is stopped and cools down sufficiently.*

2. *It is very dangerous to inspect and service the rotating parts. For the sake of safety, conduct service work after the engine is stopped. Also, make sure that it is not started during work.*

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 elements is clogging. In such a case change the filter element regardless the specified change schedule.

Change interval

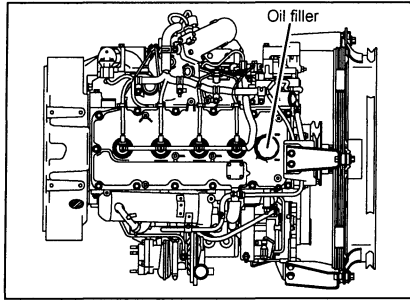
Every 500 operating hours

Engine oil draining

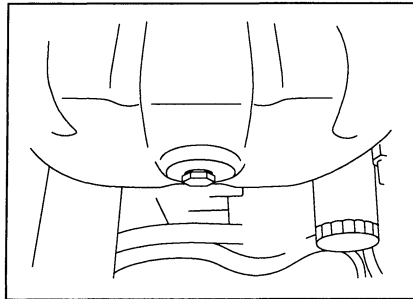
WARNING: To help avoid the damage of being burned, do not drain oil while the engine is still hot.

Standard type

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

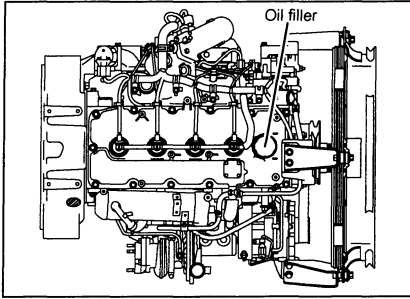


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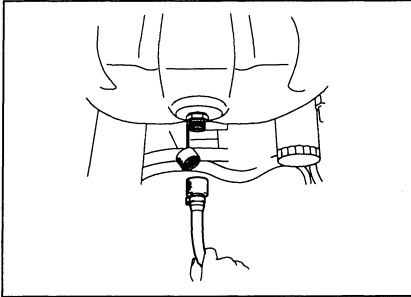


IMJJ0016

- 2) Remove the drain plug by loosening it, and then drain oil.
- 3) After oil has been drained completely, replace the packing of the drain plug with a new one, and then install the plug.
- 4) Tighten the drain plug.
Torque (drain plug) : 78.4 Nm (8.0 kgm)



IMJJ0008

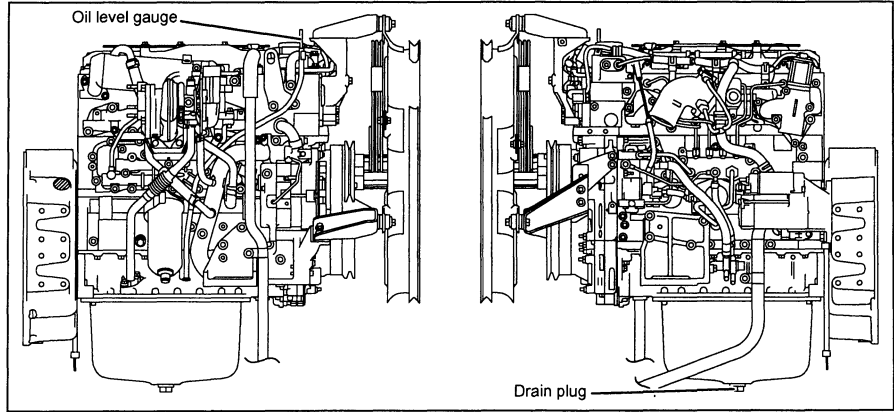


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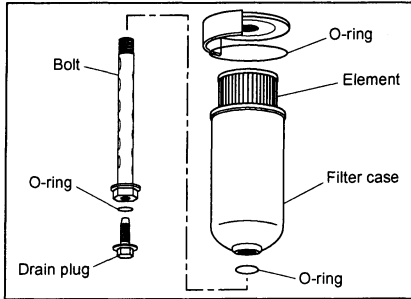
One - touch type

- 1) Wipe clean around the oil filler cap taking care so that no foreign particles entry. Remove the filler cap.
- 2) Loosen the cap of oil drain cock and remove it. Connect the oil drain hose to the oil drain cock and drain the oil.
It is advisable that draining be done while the engine is warm, to minimize the draining time.
- 3) After the completion of draining, disconnect the hose and wipe off the oil on the drain cock.
- 4) Turn the cap of oil drain cock slightly and settle it. From that position, turn more about 60 to 90 degrees.

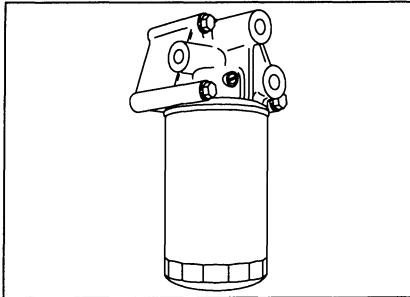
CAUTION: Use a receptacle to receive the drained oil so that the engine and equipment may not be stained with the drained oil.



1MJJ0010



1MJJ015



1MJJ018

Main oil filter element removal

Standard type

- 1) Remove the drain plug, and then drain oil from the filter case.
- 2) Loosen the bolt, and remove filter case.
- 3) Pull out element from the filter case.

Remote type

Set a wrench at the hexagonal section of the second stage above the cartridge, and remove the main oil filter.

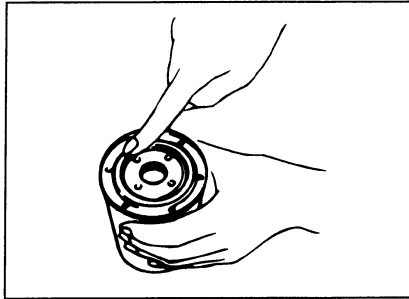
There may remain the used engine oil in the cartridge, and care should be taken not to spill it when removing the filter.

Discard the used filter.

Oil filter element installation

Standard type

- 1) Replace the O-rings of the filter case, bolt and drain plug with new ones, and then insert new element in filter case.
- 2) Apply a thin coat of engine oil to the O-ring, and then install filter case by screwing the bolt in.
- 3) Tighten the bolt and drain plug.
Torque (bolt) : 44.1 Nm (4.5 kgm)
Torque (drain plug) : 24.5 Nm (2.5 kgm)



IMWG0034

Remote type

- 1) Apply lightly engine oil to the O-ring.
- 2) Turn in new cartridge until its sealed face comes in contact with the O-ring.
- 3) Use a filter wrench to further turn in the cartridge by one full turn.

Engine oil refilling

- 1) Disconnect the oil drain hose and reinstall the cap of drain cock. (One - touch type)
Install the drain plug. (Standard type)
- 2) Remove the dipstick before adding oil, in order that oil quickly comes down to the oil pan.
- 3) Fill with new engine oil by the oil filler port.
Wait about fifteen minutes until the oil gets down to the oil pan.
In pouring oil, pour oil slowly to avoid pouring oil rapidly, and do not plug the oil filler port with the filler hose of an oil jug etc.
Then check the oil level with a dipstick.
Do not insert the dipstick by force. The dipstick may be broken.

WARNING: 1. In adding oil, take care not to spill it. If you spill oil, wipe it properly, or this could lead to a fire.
2. Do not leave any flammables such as cloth or gloves in the engine compartment. It may result in a fire.

CAUTION: 1. Prevent dust particles from entering through filler port at replenishment. Be careful, entry of dust particles may cause engine damage or accident.
2. Replenishment of oil above "Max" level or below "Min" level may cause engine damage or accident. Drain oil to the "Max" level if the oil level is above "Max" level. Also, replenish oil to the "Max" level if the oil level is below "Min" level.

(2) Check after Oil and Filter Changes

Some machines use the remote type oil filter. For this type of oil filter, it takes time to feed oil into each part of the engine after replacement. Idle approx. 30 seconds at the first start-up after oil filter is changed. Do not perform sudden loading or rapid acceleration. In addition, the time to pressure-feed oil can be shortened by filling engine oil into oil filter.

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.*

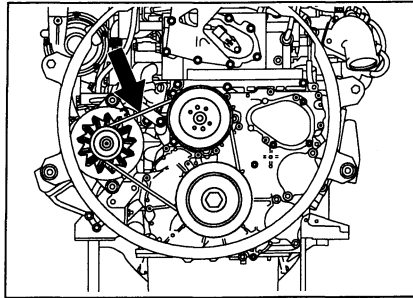
Discard used engine oil and other oils properly.

2. COOLING SYSTEM

(1) Alternator Drive Belt Tension Adjustment

Adjust alternator drive 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 alternator drive belt tension with engine stopped.



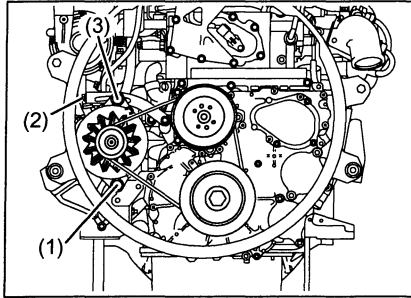
IMJJ0009

Belt tension

Belt tension is normal as follows when it is depressed with the thumb at the midway between the idle pulley and alternator pulley. (98 N (22 lb) depressing force.)

Alternator drive belt slackness : 7 – 8 mm (0.28 – 0.31 in)

New belt : 5 – 6 mm (0.2 – 0.24 in)



IMJJ0011

Adjusting procedure

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

- 1) Loosen the mounting bolt (1) of alternator and the locknuts (3). Loosen the mounting bolt (1) while holding the nut located on the back using a tool.
- 2) Adjust the belt tension with adjusting bolts (2) of alternator and secure the alternator within specified range.
- 3) Tighten the loosened mounting bolt (1) and the locknuts (3) securely. Tighten the mounting bolt (1) while holding the nut located on the back using a tool.

Torque (Mounting bolt) : 51 Nm (5.2 kgm)

Torque (Locknut) : 25 Nm (2.5 kgm)

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) Alternator Drive Belt Change

Use of alternator drive belt with poor quality will result in premature belt wear or belt elongation leading to accidents such as noise, engine stall and insufficient battery charge. Therefore used of the ISUZU genuine alternator drive belts are highly recommended.

(3) Coolant Change

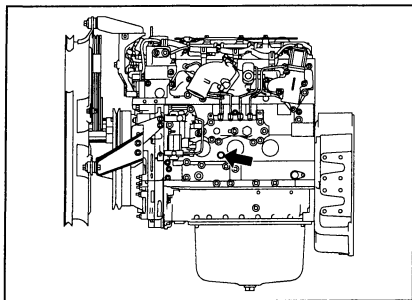
If oil is in coolant, contact "ISUZU Distributor" as soon as possible.

CAUTION: *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.*



IMJJ0026

- 2) Drain away the coolant from the engine by loosening the water drain plug on the left hand side of cylinder block.

Filling with coolant

- 1) Close or tighten the coolant drain plug.
- 2) 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.

3. FUEL SYSTEM

The fuel injection pump and fuel injector are precisely manufactured, and therefore, using the fuel which contains water or dust particles will result in either injection pump plunger seizure or injector seizure, also, clogged fuel filter element causes low engine power, engine failure, engine trouble indication, or engine stall.

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

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 separated water.

Be sure to drain the separated water when the float has come up to the aluminum body part.

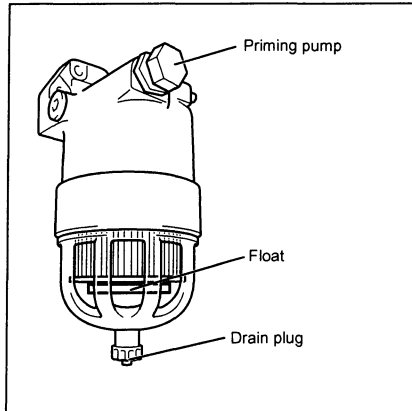
Draining procedure:

Loosen the air bleeding plug at the top of the water sedimenter, and then loosen the drain plug at the bottom of the case to drain the separated water .

After draining, be sure to tighten the plugs and conduct air bleeding of fuel.

Be careful not to over-tighten the air bleeding plug.

Torque : 7.9 to 11.7 Nm (0.8 to 1.2 kgm)



IMWG0036

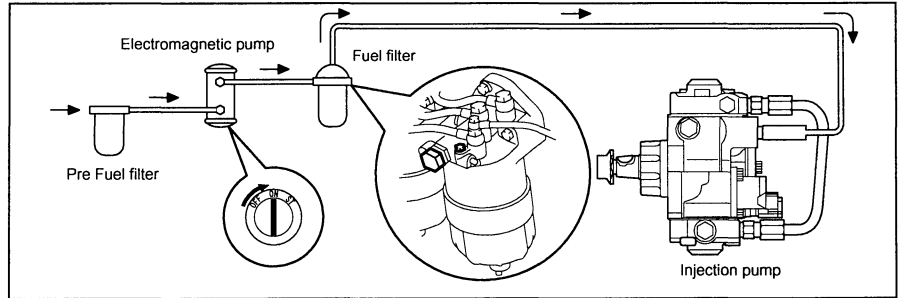
CAUTION: Do not use an alcoholic water remover. Alcohol may make plastic parts cracked. This results in low visibility of fuel level or fuel leakage in some cases.

(2) Fuel System Air Bleeding

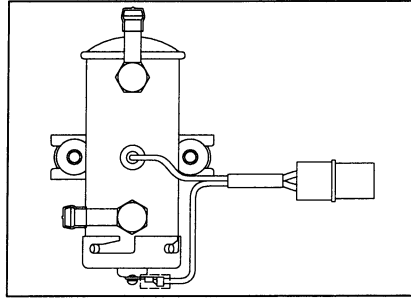
The entry of air into the fuel system will cause hard engine starting or engine malfunction.

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 conduct air bleeding.

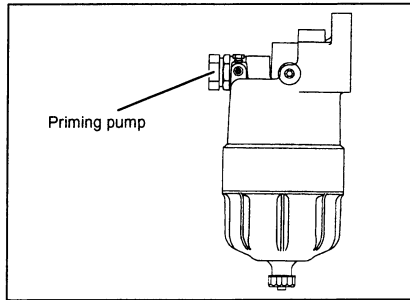
Air bleeding procedure:



IMJJ0023



IMJJ0020



IMHK0011

- 1) Turn the starter switch to the drive position to put the electromagnetic pump in the operating condition.
- 2) Loosen the air bleeder plug on fuel filter sufficiently, and operate the priming pump (more than 20 times) until fuel comes out.
- 3) Tighten the air bleeder plug, and operate the priming pump (more than 10 times) until the fuel filter is filled with fuel.
- 4) Wait approx. 1 minute and loosen the air bleeder plug to bleed air from fuel filter.
- 5) Repeat the procedures in step 1) to 3) until no air comes from air bleeder plug. (At least 3 times)

CAUTION: *On the machine with more than one fuel filter, bleed air from the filters, starting from one close to the fuel tank.*

- 6) Tighten the air bleeder plug securely and wipe off fuel around.
- 7) Start the engine, but do not control the engine speed on machine side. If the engine does not start this time, repeat the procedure from step 2).
- 8) After the engine start-up, keep idling for five seconds.

- 9) Increase the engine speed slowly and keep this for three minutes.
- 10) Operate the engine speed to the maximum on the machine side.
Repeat this operation few times.

CAUTION: Start the engine and check the fuel system for leakage.
Leakage causes a fire.

(3) Fuel Filter Element Change

Change interval

Fuel filter element change interval : Refer to 7. ENGINE MAINTENANCE SCHEDULE.

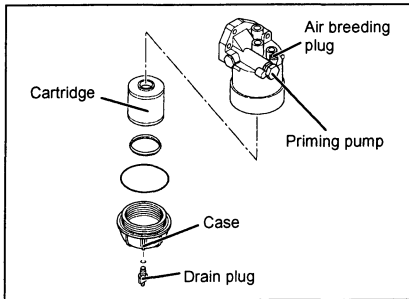
CAUTION: The fuel filter element may be clogged faster depending on the amount of dust particles in the fuel. Therefore, the element may need to change more often than Change interval above. If the low engine output or engine stall is found, the change of fuel filter element may recover them.

Change procedure

- 1) Loosen the drain plug and air bleeding plug, and drain the fuel in the fuel filter.

CAUTION: Collect the draining fuel using a container to prevent the fuel from spilling on engine.

- 2) Use a specified filter wrench to remove the cartridge.
- 3) Replace the O-rings of the cartridge and drain plug with new ones. Insert a new element into cartridge and apply fuel to the O-ring. Turn the new fuel filter until the filter O-ring comes in contact with its sealed face.



Use a specified filter wrench to turn in the fuel filter.

Torque (Cartridge) : 29.4 Nm (3 kgm)

Torque (Drain plug) : 1.5 to 2.5 Nm (0.15 to 0.25 kgm)

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

(4) Handling of fuel pipes

Do not reuse removed high-pressure inlet pipe.

Reused metal contact seal may be misaligned. This causes fuel leakage.

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 reduce 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 life.

Handling of air cleaner varies with the equipment model.

Perform periodic inspection and maintenance following the equipment manufacturer's instructions.

In dusty area, consult the equipment manufacturer for using pre-filter.

- CAUTION:**
- 1. Shorten the cleaning or change interval when the equipment it 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.*

5. ENGINE ELECTRICAL

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

CAUTION: 1. *Take care not to connect reversely the polarity of battery terminal. Reverse connection damage the electrical parts, causing a fire or accident.*

2. *When disconnecting the terminals, do the negative terminal first. When connecting the terminals, do the positive terminal first then negative terminal next.*

WARNING: 1. *When checking the battery and cables, be sure to stop the engine.*

2. *Dilute sulfuric acid is used as battery electrolyte. Be careful not to let your eyes, hands, skin, clothes or metals come in contact with it.*

If it gets on your eyes, hands or skin, wash with a large amount of water for five minutes at once. Then see a doctor for treatment.

If it gets on clothes or metal, wash with a large amount of water as well.

3. *Highly flammable hydrogen gas is generated from battery. Never make a spark or use fire near the batteries.*

4. *When handling such metallic articles as a tool near batteries, be sure not to contact positive terminal. As the machine body is negative, it may be very dangerous due to shorting causing a burn.*

(1) Battery Servicing

Battery maintenance schedules will vary with equipment and battery types.

Follow the equipment manufacturer's instructions.

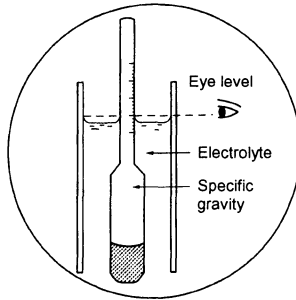
Gravity of the batteries

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:



IMWG0025

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)

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 when 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 a 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) 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 : 0.15 mm (0.006 in) (When the engine is cold.)

Adjustment Procedure

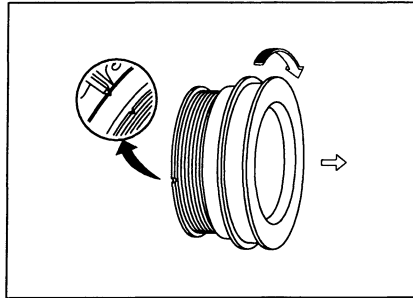
- 1) Bring the piston in either the No. 1 cylinder of the No. 4 cylinder to Top Dead Center on the compression stroke by turning the crankshaft until the TDC notched line on the crankpulley is aligned with the timing mark.

- 2) Check to see if there is play in the No. 1 intake and exhaust valve rocker arms.

If the No. 1 cylinder intake and exhaust valve rocker arms have play, the No. 1 piston is at TDC on the compression stroke.

- 3) 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.

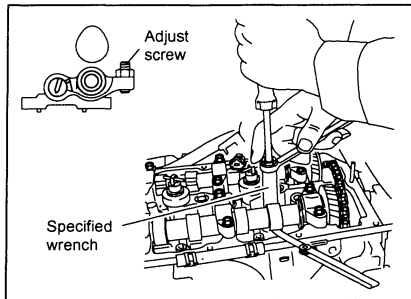
After the above steps, do the adjustment on the double circle marked valves when No. 4 cylinder is on the top dead center in the compression stroke.



1MJJ0019

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

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



IMJJ0022

- 4) Loosen each adjusting screw on the rocker arm.
Valve clearance : 0.15 mm (0.006 in)
- 5) Insert a feeler gauge between the rocker arm and the cam, and adjust by turning the adjusting screw on the rocker arm until there is a slight drag on the feeler gauge. Tighten the lock nut securely.
Torque : 18 Nm (1.8 kgm)

(2) 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: 2.84 – 3.24 MPa (29 – 33 kg/cm² / 412 – 470 psi)

Test condition: Cranking speed 200 min⁻¹

Coolant temperature 20°C (68°F)

Repair the engine and/or replace some parts of engine if compression pressure is lower than 1.96 MPa (20 kg/cm² / 284 psi)

(3) Starter and Alternator Servicing

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

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

(4) 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 manufacturer'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.

CAUTION: *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) Position the engine speed setting to increase side slightly.
- 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 20 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 this 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 traveling 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 MAINTENANCE SCHEDULE

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

NO.	Description of check and maintenance		Daily	(operation hours)						Remark
				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				○		○		○	
6.	Fuel leakage check		○							
7.	Draining water in fuel filter	w/water sedimenter	○							
8.	Fuel filter element replacement			○★	○	○★	○	○★	○	
9.	Coolant level and fouling check		○							
10.	Abnormal color change of coolant		○							
11.	Coolant leakage check		○							
12.	Radiator filler cap fitting condition		○							
13.	Alternator drive belt tension check (Replace if necessary.)		○		○		○		○	

NO.	Description of check and maintenance		Daily	(operation hours)						Remark
				250	500	750	1000	1250	1500	
14.	Check by coolant temperature gauge or monitor		○							See "EXPLANATION OF MAINTENANCE SCHEDULE"
15.	Coolant replacement									
16.	Intercooler and radiator external face cleaning									
17.	Cooling system circuit cleaning									
18.	Radiator filler cap function check (*)									
19.	Engine Malfunction Indicator Lamp and LCD Display Panel check		○							
20.	Electrolyte level check		○							
21.	Battery cleaning		○							
22.	Battery charge condition	Ammeter registration	○							
		Charge warning lamp	○							
23.	Electrolyte gravity check									
24.	Starter and alternator check and cleaning (*)					○				

NO.	Description of check and maintenance	Daily	(operation hours)						Remark
			250	500	750	1000	1250	1500	
25.	Wiring and connection check								See "EXPLANATION OF MAINTENANCE SCHEDULE"
26.	Preheating condition check	○							
27.	Air cleaner element replacement								
28.	Engine starting conditions and noise conditions	○							
29.	Exhaust smoke condition	○							
30.	Cylinder compression pressure (*)					○			
31.	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 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 filter element replacement** Change engine oil and filter element according to the following change interval:
Every 500 operating hours.
- 6. Fuel leakage check** Inspect the fuel lines for damage which could cause leakage. Replace any damaged or malfunctioning parts.
- 7. Draining water in fuel filter** The fuel system without the water sedimenter.
Drain the sedimented water in fuel filter every 250 operating hours.
- 8. Fuel filter element replacement** Change element every 500 hours.
★ Shorten depending on fuel management.
- 9. Coolant level and fouling check** Check coolant level and add coolant if necessary.

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|--|---|
| 10. Abnormal color change of coolant | If oil is in coolant, contact "ISUZU Distributor" as soon as possible. |
| 11. Coolant leakage check | Repair part for coolant leakage. |
| 12. Radiator filler cap fitting condition | According to the equipment manufacturer's specification. |
| 13. Alternator drive belt tension check | Check and adjust alternator drive belt deflection. Look for cracks, fraying and wear. |
| 14. Check by coolant temperature gauge or monitor | Coolant temperature is normal at about 75 to 90°C (167 to 194°F). Check and repair the cooling system if coolant temperature is abnormal. |
| 15. Coolant replacement | Change coolant at intervals of 6 months or 12 months respectively if coolant is plain water, or long life coolant (LLC). |
| 16. Intercooler and radiator external face cleaning | According to the equipment manufacturer's specification. |
| 17. Cooling system circuit cleaning | Clean the cooling system circuit every 12 months. |
| 18. Radiator filling cap function check | Check radiator pressure cap periodically for proper operation according to the equipment manufacturer's specifications. |

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- | | |
|--|--|
| 19. Engine Malfunction Indicator Lamp and LCD Display Panel check | If the trouble code are indicated by the malfunction indicator lamp or LCD display on the machine, contact "ISUZU Distributor" as soon as possible. |
| 20. Electrolyte level check | Replenish with distilled water if necessary. |
| 21. Battery cleaning | Clean the terminals. |
| 22. 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. |
| 23. Electrolyte gravity check | Check according to the equipment manufacturer's specifications. |
| 24. Starter and alternator check and cleaning | Check wear condition of brush and commutator. |
| 25. Wiring and connection check | Check according to the equipment specifications. |
| 26. Preheating condition check | Check preheating condition of the system. |
| 27. Air cleaner element replacement | Change element according to the manufacturer's specifications. |
| 28. Engine starting condition and noise condition | Check engine stability and noise. |

-
- 29. Exhaust smoke condition** Check exhaust smoke color.
 - 30. Cylinder compression pressure** Check every 1000 hours.
 - 31. Valve clearance check** Incorrect valve clearance will result in increased engine noise and lower engine output. Thereby adversely affecting engine performance.
Checked and adjust every 1000 hours.

8. SIMPLE ENGINE TROUBLESHOOTING

This section contents simple troubleshooting. Refer this section in case of engine failure.

If the cause can not be identified or if it is hard to correct, contact ISUZU dealer as soon as possible.

The items marked with "⊙" in "Action" are necessary to be repaired or adjusted. Contact ISUZU dealer.

Symptom		Cause	Action
Engine does not start	Starter does not turn or turns weakly.	Battery discharged.	Charge or change.
		Battery terminal is disconnected, loose or corroded.	Correct corrosive part and tighten securely.
		Starter ground terminal is disconnected, loose or corroded.	Correct corrosive part and tighten securely.
		Engine oil viscosity is too high.	Change with oil of correct viscosity.
		Starter or electrical system is failure.	⊙
	Starter turns.	Engine emergency shutdown switch is on.	Engine emergency shutdown switch is turned off.
		No fuel.	Make sure that there is no fuel leakage and replenish.
		Air is in fuel system.	Bleed air.
		Fuel filter is clogged.	Remove water and change element.
		Fuel is frozen.	Make fuel pipes warm with hot water or wait until ambient temperature rises.
		Injection pump is failure.	⊙
		The electromagnetic type fuel pump is failure.	⊙
		Engine control system is failure.	⊙

Symptom		Cause	Action
Engine does not start	Starter turns.	Engine malfunction indicator lamp and LCD Display panel shows engine failure.	◎
		Strainer is clogged.	◎
		Pre-heating device is failure.	◎
Engine starts but stops soon.		Idling is too low	Adjust by idling control equipment on the machine. If adjustment is not possible, contact ISUZU dealer.
		Fuel filter is clogged.	Remove water and change element.
		Pre-fuel filter is clogged.	Clean or change element.
		Strainer is clogged.	◎
		Engine control system is failure.	◎
		Air cleaner is clogged.	Clean or change element.
		Injection pump is failure.	◎
		The electromagnetic type fuel pump is failure.	◎
Engine running is unstable.		Fuel system is failure.	◎
		Water or air is in fuel system.	Bleed air or remove water.
		Engine control system is failure.	◎
Exhaust smoke is white.		Warming-up is not enough.	Conduct warm-up operation.
		Engine oil is too much.	Make correct oil level.
		Engine control system is failure.	◎

Symptom	Cause	Action
Exhaust smoke is white.	Injection pump is failure.	⊙
	Fuel system is failure.	⊙
	Long time idling (more than two hours).	Keep stopping the equipment, depress throttle pedal and then make sure that no white smoke is emitted.
	White smoke reduction is failure.	⊙
Exhaust smoke is black.	Engine control system is failure.	⊙
	Injection pump is failure.	⊙
	Air cleaner is clogged.	Clean or change element.
	Intercooler is clogged.	⊙
	Fuel system is failure.	⊙
	Exhaust system is clogged.	⊙
Engine overheats.	No coolant.	Replenish.
	Front of radiator is clogged with dust.	Clean with soft brush.
	Sub tank cap is not tightened properly.	Tighten securely or change sub tank cap.
	Coolant is fouled.	Clean inside of radiator and change coolant.
	Oil is in coolant.	⊙
	Thermostat is failure.	Change thermostat.
Oil pressure does not rise.	Engine oil viscosity is not correct.	Change with oil of correct viscosity.
	Engine oil level is not sufficient.	Replenish.

Symptom	Cause	Action
Oil pressure does not rise.	Inside of engine is failure.	⊙
	Meter, lamp or switch is failure.	⊙
Engine has no power.	Air cleaner is clogged.	Clean element.
	Fuel filter is clogged.	Remove water and change element.
	Pre-fuel filter is clogged.	Clean element.
	Strainer is clogged.	⊙
	Engine control system is failure.	⊙
	Engine is failure.	⊙
	Exhaust system is clogged.	⊙
	Fuel system is failure.	⊙
	Type of fuel is not correct.	⊙
	The electromagnetic type fuel pump is failure.	⊙

2. INFORMATION GENERALE

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

(1) Modèle AI-4JJ1X

Désignation du modèle du moteur ISUZU	AI-4JJ1X
Famille de moteur	*SZL03.0IXA
Code de moteur	4JJ1XXXX-XX
Type de moteur	Type à arbre à cames en tête "en ligne", quatre temps, à refroidissement par eau.
Type de combustion	Injection directe
No. de cylindres – alésage × course mm(in)	4 – 95 × 105 (3.74 × 4.13)
Cylindrée du moteur L(cid)	2999 (183)
Rapport de compression	17.5 to 1
Séquence d'allumage	1 – 3 – 4 – 2
Puissance nominale: SAE NET kW(cv)/min ⁻¹	92 (125.1) / 2200
Débit de combustible au couple max. mm ³ /course	86.7
Système de commande d'émission d'échappement	ECM, TC, CAC, DFI, EGR
Pompe à injection	DENSO type, Common Rail type
Régulateur	Type électrique de commande

* Marque ; Placer un code de lettres pour l'année du modèle sur la partie supérieure des lattes.

Année du modèle Y : 2000, 1 : 2001, 2 : 2002, 3 : 2003, 4 : 2004, 5 : 2005, 6 : 2006, 7 : 2007, 8 : 2008

Le code du moteur varie selon chaque moteur.

Désignation du modèle du moteur ISUZU		AI-4JJ1X	
Buses à injection		Type à orifices multiples (Type électrique de commande)	
Combustible spécifié		Combustible Diesel (ASTM D975 No. 2-D)	
Démarreur	V-kW	24 – 4.0	
Alternateur	V-A	24 – 50	
Huile moteur spécifiée (API grade)		Référez-vous à 3. LUBRIFIANT, choix D'Huile à moteur.	
Volume d'huile de lubrification	L(qts)	11.0 (11.6) – 15.0 (15.9)	
Volume de liquide de refroidissement (seulement moteur)	L(qts)	Environ 6 (6.3)	
Poids à sec du moteur		290 (639)	
Dimensions du moteur	Longueur hors-tout	mm(in)	926.4 (36.5)
	Largeur hors-tout	mm(in)	763 (30.0)
	Hauteur hors-tout	mm(in)	891.8 (35.1)
Jeu de soupape (à froid)	mm(in)	0.15 (0.006) pour l'échappement et l'admission	
Pression d'injection d'injecteur	MPa(psi)	—	
Calage d'injection B.T.D.C (Statique)		—	
Fabricant et type de turbochargeur		IHI, RHF-5	

(2) Famille indice de moeur

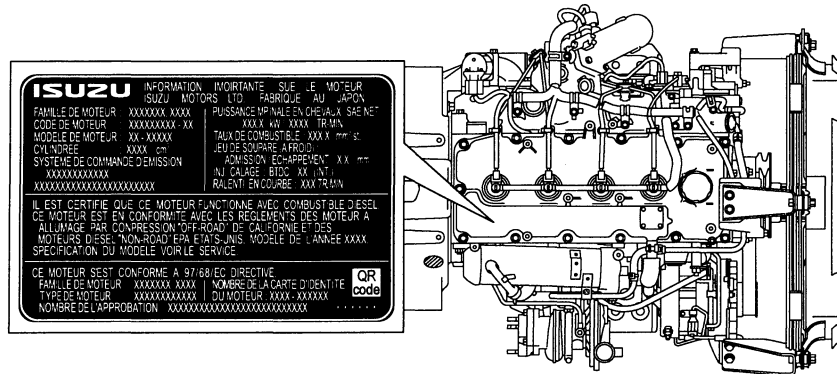
Moteur	Famille de moteur	Code de moteur	Pression d'injection d'injecteur MPa(psi)	Catage d'injection B.T.D.C. (Statique)
4JJ1X	*SZL03.0IXA	Tout	—	—

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

L'étiquette de contrôle d'émission est fixée au centre, côté supérieur du couvercle de la culasse.

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

Ces étiquettes sont traduites de l'anglais en français.



IMJJ0024

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. The right is reserved to make changes at any time without notice.

INSTRUCTION MANUAL (INDUSTRIAL)

4JJ1

IDE-6230

Issued by

ISUZU MOTORS LIMITED

Planning & Service Group

Off-highway Powertrain Operations Dept.

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ISUZU

IDE-6230