Engine

4LE2 Engine Mechanical

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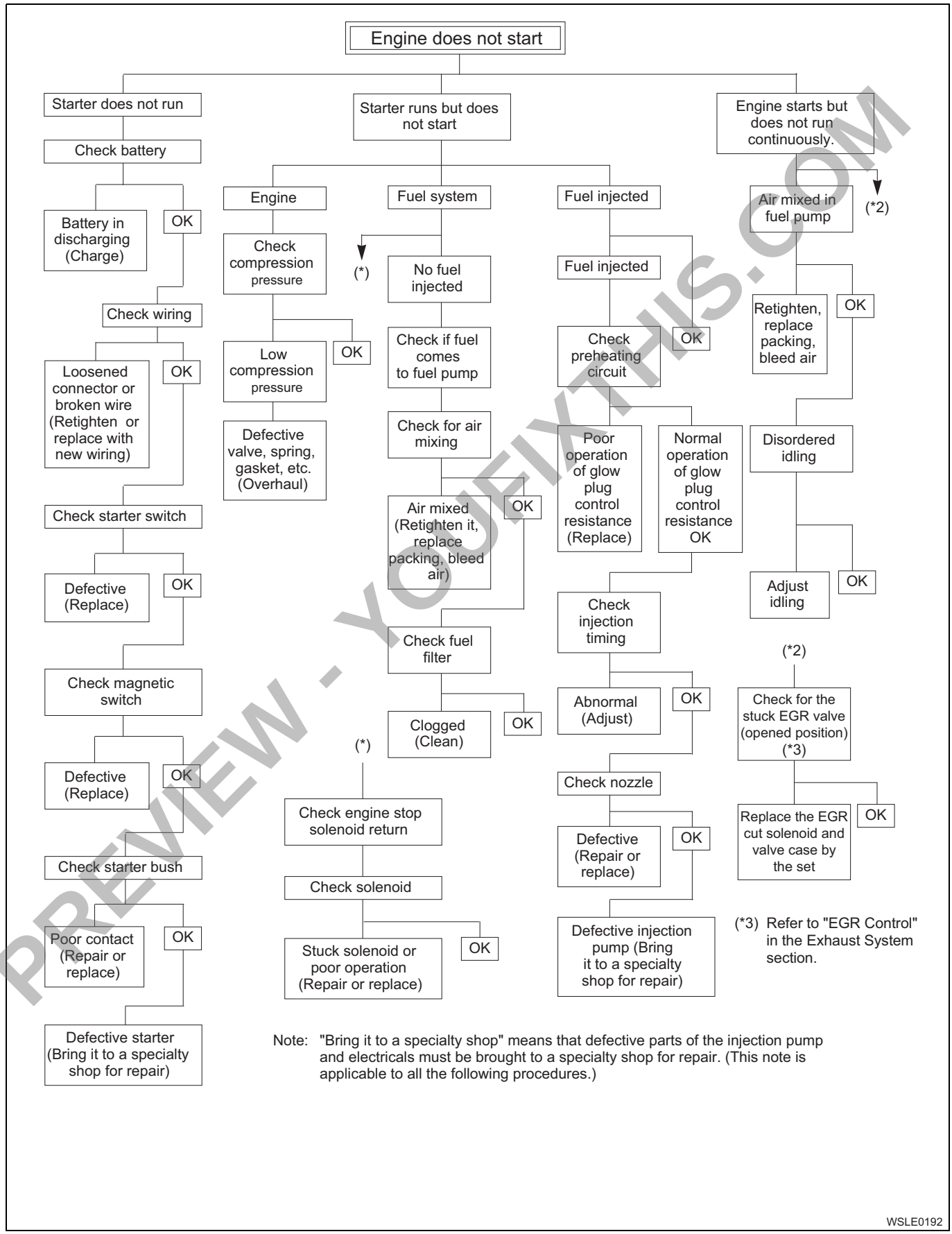
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List of Trouble Symptom

Engine does not start

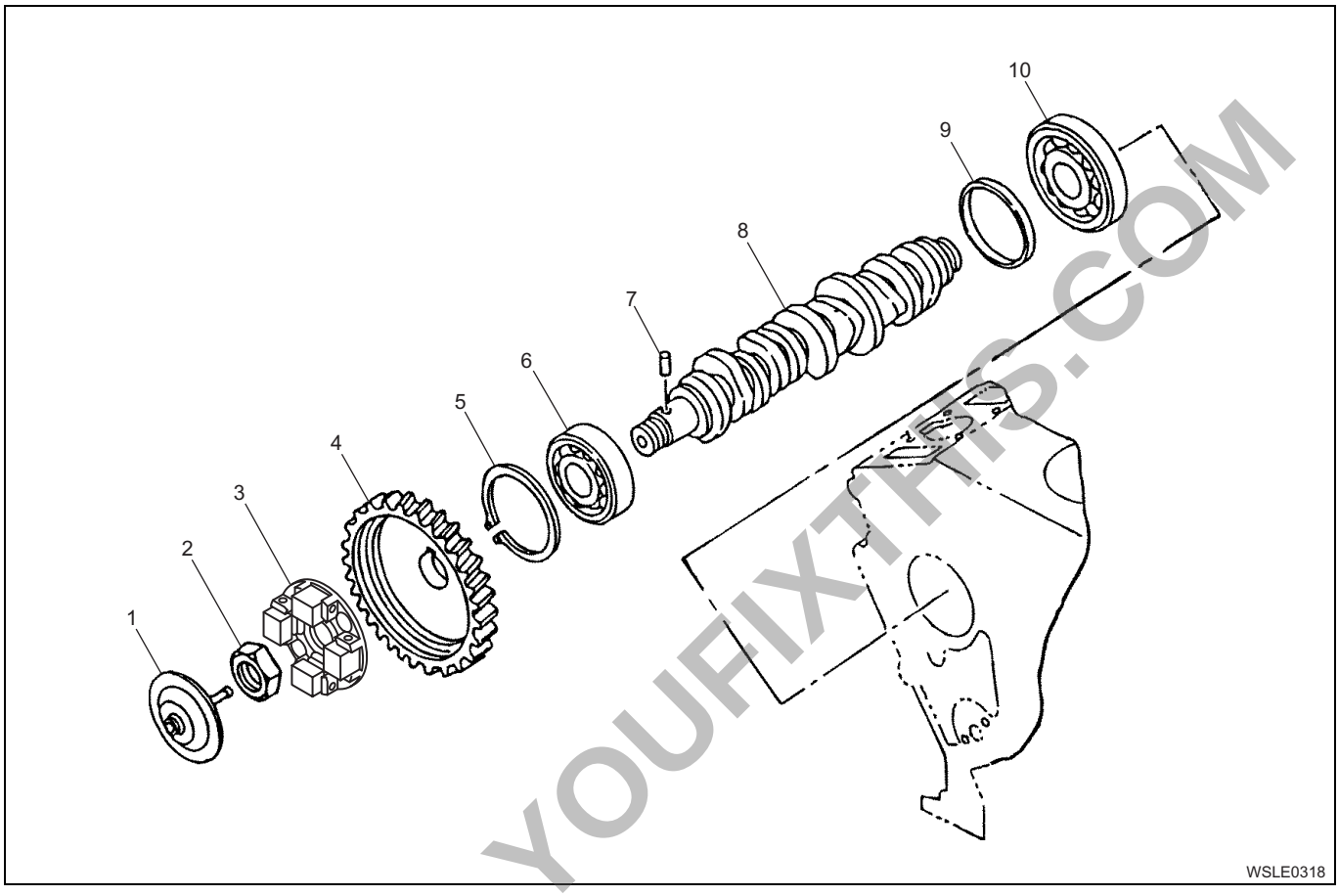


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Camshaft

Components



Name

1. Sleeve
2. Lock Nut
3. Flyweight ASM
4. Camshaft Gear
5. Snap Ring
6. Bearing
7. Pin
8. Camshaft
9. Wear Ring
10. Bearing

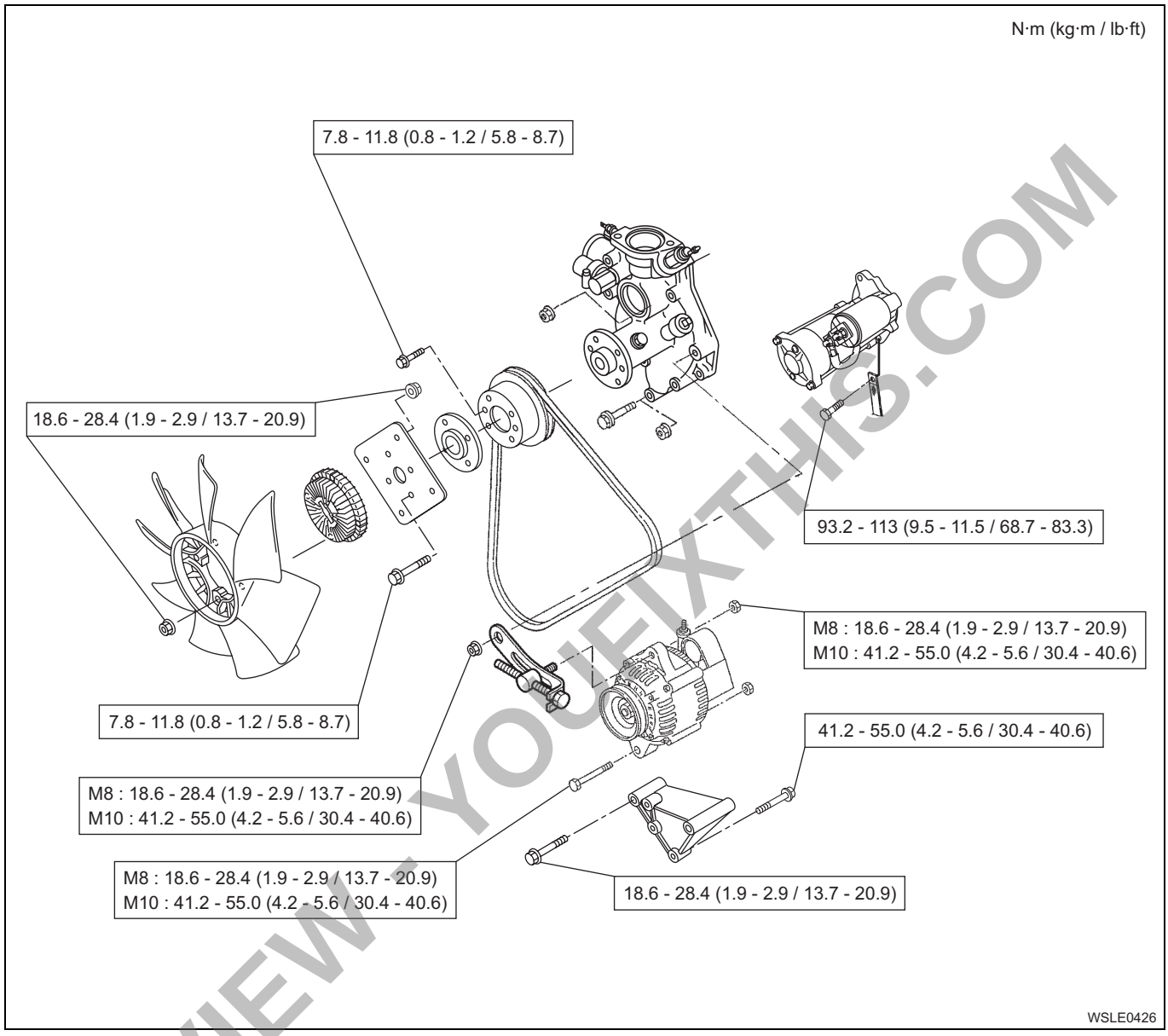
Removal

1. Remove the EGR cooler and the bracket.
   Refer to 1A-23, “Removal, Engine Exterior Equipment”.
2. Remove the cylinder head cover.
   Refer to 1A-23, “Removal, Engine Exterior Equipment”.
3. Remove the rocker arm bracket.
   Refer to 1A-40, “Removal, Rocker Arm Shaft”.
4. Remove the cylinder head.
   Refer to 1A-47, “Removal, Cylinder Head”.
5. Remove the tappet.
   Refer to 1A-47, “Removal, Cylinder Head”.
6. Remove the timing gear case.
   Refer to 1A-73, “Removal, Crankshaft Front Oil Seal”.
7. Remove the camshaft gear.
   a. Pull out the sleeve from the end of the camshaft.
   b. Remove the lock nut from the camshaft gear, and remove the flyweight ASM and the camshaft gear.
8. Remove the camshaft.
   a. Remove the snap ring which holds the front bearing of the camshaft from the ring groove of the cylinder block.
   b. Pull out the camshaft with the bearing from the cylinder block.

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Torque Specifications



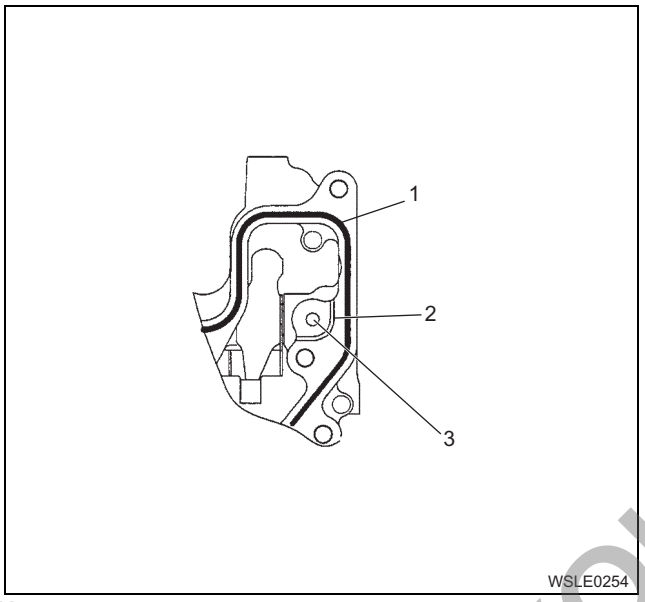
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Installation

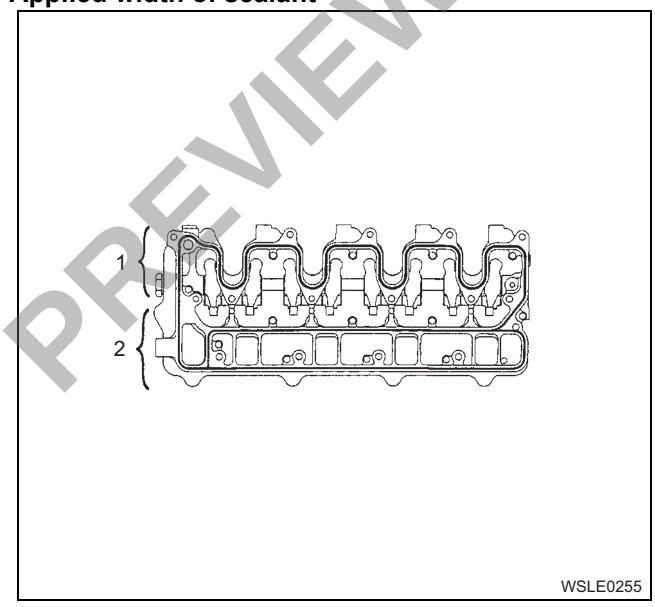
1. Put the push rod through the cylinder block and insert it to the tappet.
2. Align it with a groove on the bottom of the rocker arm bracket and apply liquid gasket (TB1207B).

Note:
Do not apply the liquid gasket to a groove around the oil gallery.



Name
1. Liquid Gasket Applied Area
2. Do not apply the liquid gasket to the groove. (important)
3. Oil Gallery

Applied width of sealant

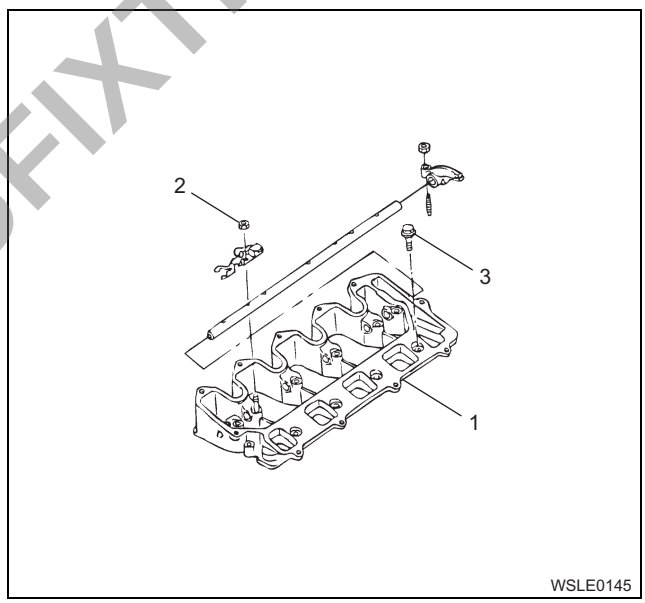


Name
1. Approx. 4 mm {0.157 in}
2. Approx. 2 mm {0.079 in}

3. Contact the rocker arm to the rocker spring, rotate the crank, and set the No.1 cylinder to the exhaust top dead center.
4. Install the rocker arm bracket ASM along with the stud bolt of the cylinder head, and tighten it to the specified torque.

   Tightening torque:
   7.8 — 11.8 N·m {0.8 — 1.2 kgf·m/5.8 — 8.7 lb·ft}

Note:
- Remove paint and sealant attached to the top of the cylinder head and the bottom of the rocker arm bracket with a PKG scraper etc., and degrease sufficiently.
- Assemble it to the cylinder head within 5 minutes after applying the sealant.
- When assembling, align the saucer part of the push rod and the rocker arm adjusting screw.



Name
1. Rocker Arm Bracket
2. Nut
3. Bolt

5. Adjustment of valve clearance
   Refer to 1A-4, “Function Check, ISUZU Diesel Engine”.
6. Install the water pipe.
   Refer to 1A-29, “Installation, Engine Exterior Equipment”.
7. Install the cylinder head cover.
   Refer to 1A-29, “Installation, Engine Exterior Equipment”.
8. Install the EGR cooler.
   Refer to 1A-29, “Installation, Engine Exterior Equipment”.

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Specifications

Item \ Engine name			4LE2X	4LE2N
Engine structure type			4-cycle, water cooled-type, inline four-cylinder, OHV type	
Cylinder number – bore × stroke (mm {in})			4 – 85{3.35} × 96{3.78}	
Total displacement (L {cu·in})			2.179 {133}	
Compression ratio			18.3:1	18.8:1
Combustion chamber type			Direct injection	
Overall length × overall width × overall height (mm {in})			* 756.3{29.78} × 557{21.93} × 747.3{29.42}	675.4{26.6} × 455.7{17.9} × 620.7{24.4}
Dry weight (kg {lb})			* 210 {463}	* 160 {352.8}
Firing order			1 — 3 — 4 — 2	
Fuel injection timing (BTDC) (at stop)			* 2°	* 3°
Compression pressure (MPa {psi})			3.04 {441} / 250 rpm	
Valve clearance (at cold condition) (mm {in})		Intake air	0.40 {0.016}	
		Exhaust	0.40 {0.016}	
Opening/closing period of valve	Intake valve	Open (before top dead center)	15°	
		Closed (after bottom dead center)	29°	
	Exhaust valve	Open (before bottom dead center)	40°	
		Closed (after top dead center)	16°	
Injection pump type			Bosch type, PFR1KX model, four	
Governor type			Centrifugal type, all speeds controlled	
Nozzle type			Hole type (KBDL model)	
Injection pressure (MPa {psi})			* First step: 16.7 {2422} Second step: 25.0 {3626}	
Fuel type			Diesel (JIS K2204)	
Cooling method			Forced circulation, water cooling pressurization type	
Cooling fan			* ϕ500 × 8 pieces	
Coolant amount (L {qts})			Approx. 4.3 {4.5} (Engine only)	Approx. 2.8 {3.0} (Engine only)
Lubrication oil amount: total (L {qts})			* Approx. 12.1 {12.8} at MAX, 9.3 {9.8} at MIN	* Approx. 8.4 {8.9} at MAX, 5.9 {6.2} at MIN
Lubricant type (API service category)			CD or CF-4 * (CE, CF, CH-4, CI-4 or CI-4 Plus)	
Generator output (V — A)			* 24 — 30 (Mitsubishi) * 24 — 50 (Nikko)	* 12 — 20 (Hitachi)
Starter output (V — kW)			* 24 — 3.2 (Mitsubishi)	* 12 — 2.0 (DENSO)
Recommended battery (rating)			95D31R 64 (five hour rating), the machine manufacturer arrangement	

Caution: This specification may be changed partially without notice.
* mark may vary depending on each machine. Refer to the machine manufacturer specification.

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Lubrication System

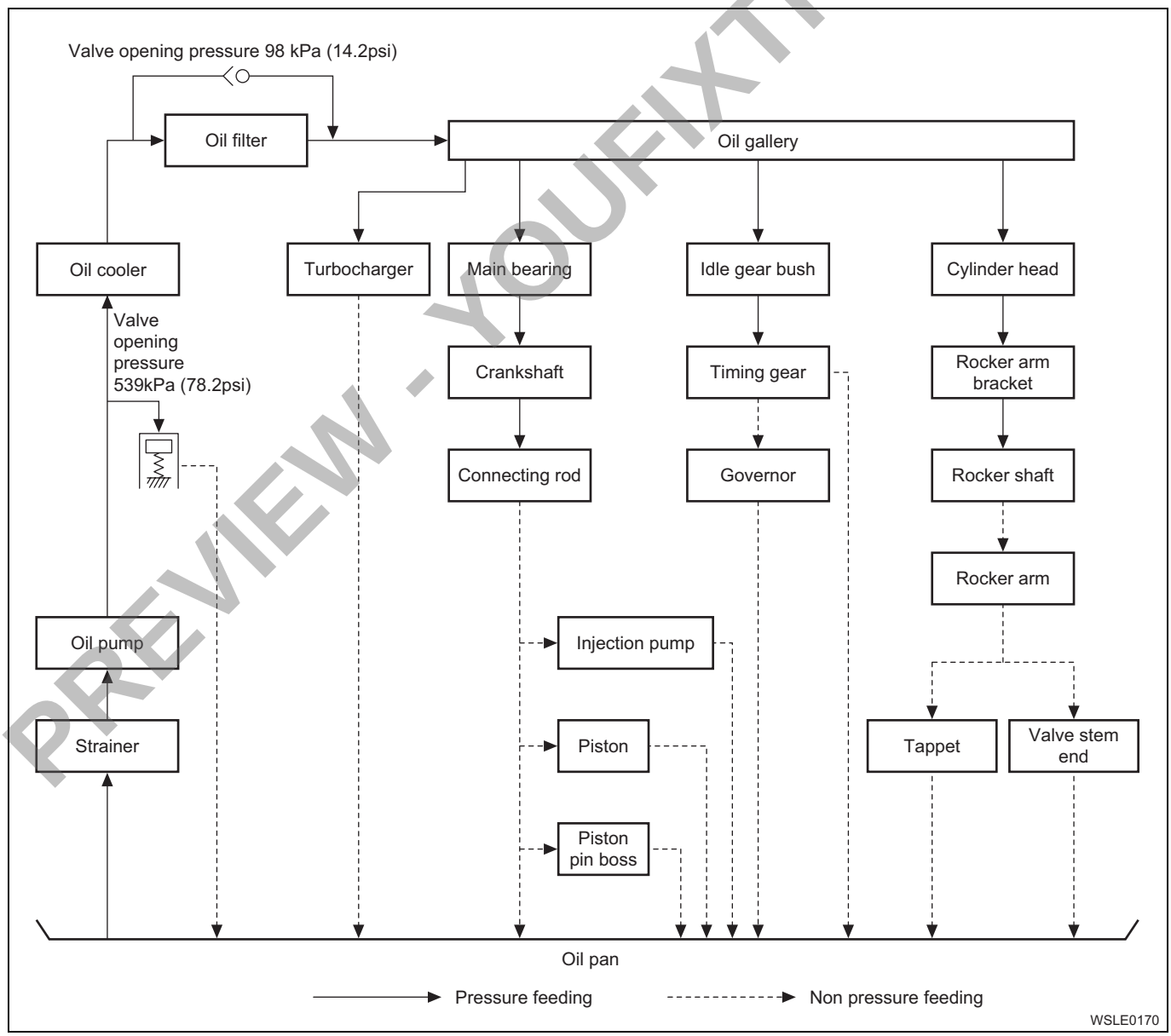
Service Precautions

- During each disassembly, remove the old gasket adhering to each part and mating part completely using a scraper at the location, where the fluid gasket is to be used, clean the traces of oil, moisture and dirt completely using a cloth, and apply the specified new fluid gasket at each location.
- Avoid excessive or insufficient coating volume. Note that seizure may occur in case of excessive coating due to clogging of the oil gallery and oil jet, and oil and water leakage may occur if the coating is insufficient.
- Always, the start and end of the application should be overlapped.

Explanations on Functions and Operation

The lubrication system uses the filter element combined with a full flow bypass, water-cooled oil cooler, and oil jet for piston cooling.

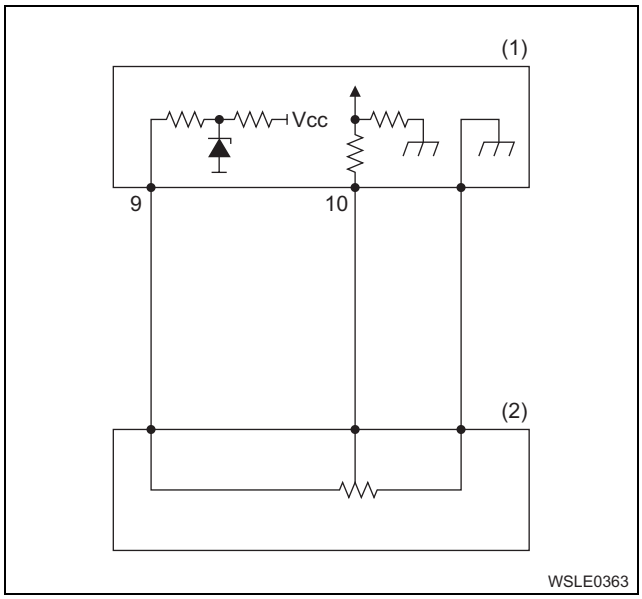
Lubricating system diagram



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Boost Pressure Sensor Circuit Diagram



Name

1. EGR Cut Controller
2. Boost Pressure Sensor

Engine Coolant Temperature Control

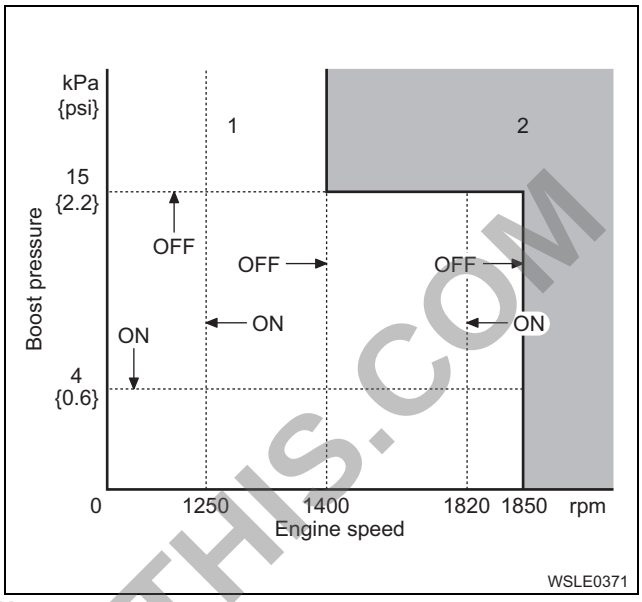
The EGR valve is opened when the engine coolant temperature becomes 60°C {140°F} or more, and is closed when 55°C {131°F} or less.

Control When the Sensor Has an Open Circuit

The following sensors perform backup control when they have an open circuit. In this case, EGR valve operates according to other normal sensors.

Sensor	Backup control when open circuit occurs
Engine coolant temperature sensor	Control as the engine coolant temperature is 60°C {140°F} or more.
Tachosensor	Control as the engine speed is between 1,400 and 1,850 rpm.
Boost pressure sensor	Control as the boost pressure is 15 kPa {2.2 psi} or more.

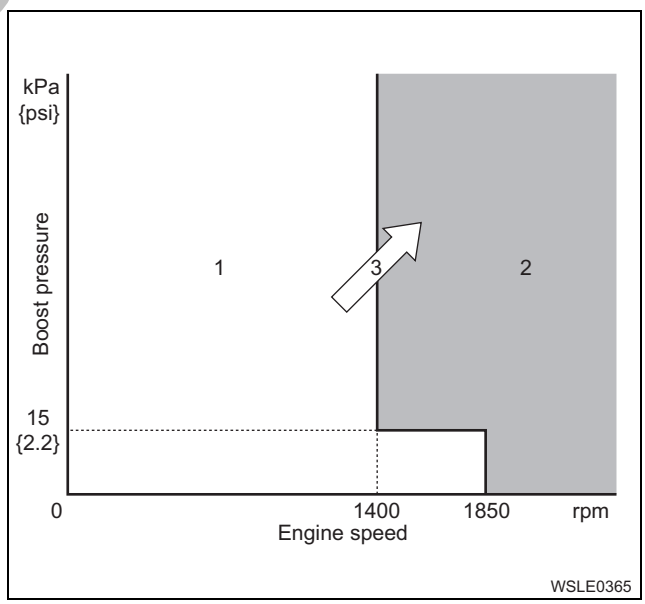
Engine Speed and Boost Pressure Control



Name

1. EGR Valve Closed
2. EGR Valve Open

When the engine speed and boost pressure increase



Name

1. EGR Valve Closed
2. EGR Valve Open
3. Engine Speed and Boost Pressure Increase

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Cylinder head

Item to be checked		Standard value	Service limit	Repairing procedure	Remarks
Valve seat depression	IN	0.7 {0.028}	1.2 {0.047}	Replace the valve and insert.	Valve seat angle is 45°
	EX	0.9 {0.035}	1.5 {0.059}		
Contact width of the valve seat		2.0 {0.079}	2.5 {0.098}	Repair with the valve seat cutter.	Wrap the contact surface sufficiently after repair.
Distortion (flatness) of the under surface (installation surface) of the cylinder head		0.075 {0.00295} or less	0.15 {0.006}	Repair with a surface grinder.	Maximum amount of repaired value; 0.3 {0.012} The total amount of repaired values of the cylinder block and of the cylinder head.
Distortion of exhaust manifold installation surface		0.05 {0.002} or less	0.2 {0.008}	Repair.	
Water pressure test (three minutes) (kPa {psi})		490 {71}		Repair or replace the one with water leakage.	
Tightening torque of the cylinder head bolt: (N·m {kgf·m/lb·ft}) (Angle method)	M12 × 1.5	83.4 — 93.2 {8.5 — 9.5/ 61.5 — 68.7} ↓ 60° — 90°		- Clean the seating surface and thread of the bolt. - Apply engine oil to the seating surface and thread of the bolt. - Never retighten after angle method tightening.	
	M8 × 1.25	24.5 — 34.3 {2.5 — 3.5/ 18.1 — 25.3}			

Piston

Connecting rod small end diameter (ϕ25 mm {0.9843 in})

Item to be checked		Standard value	Service limit	Repairing procedure	Remarks
Clearance with the cylinder Grade position from the top surface: 54.85 {2.159}		0.040 — 0.085 {0.0016 — 0.0033}			
Clearance between piston pins and piston pin holes		0.004 — 0.017 {0.00016 — 0.0007}		If significant knocking sound occurs, replace the piston pin or the piston.	
Wear of the pin		ϕ25 {0.9843}	ϕ24.970 {0.9449}		
Piston ring end gap	Top ring	0.20 — 0.35 {0.008 — 0.014}	1.5 {0.059}	Replace piston ring. When overhauling the engine, replace the piston ring.	
	Second ring	0.35 — 0.50 {0.014 — 0.020}			
	Oil ring	0.20 — 0.40 {0.008 — 0.016}	1.0 {0.039}		

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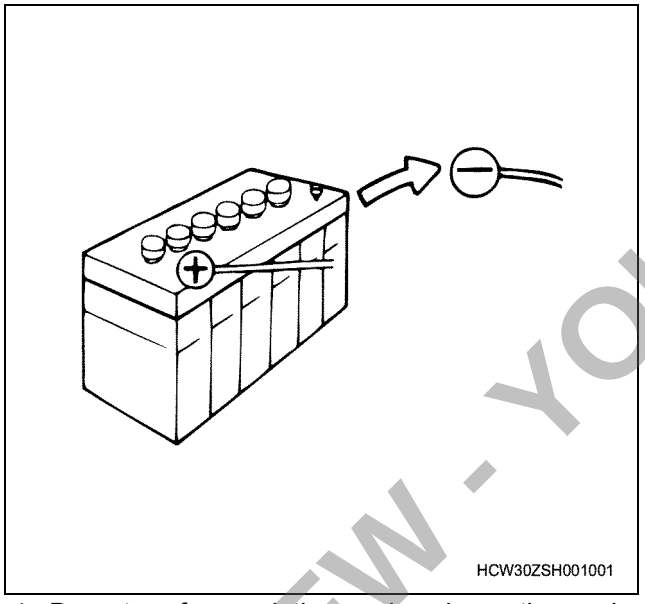
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General Information

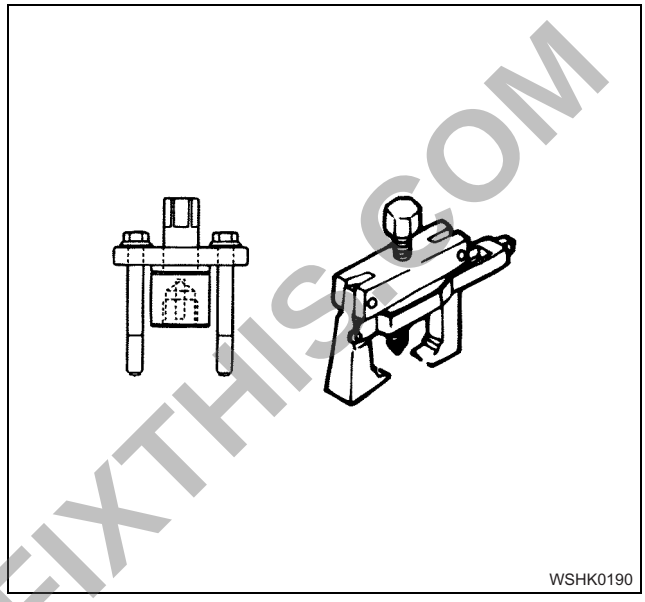
Service Precautions

In order to carry out work safely

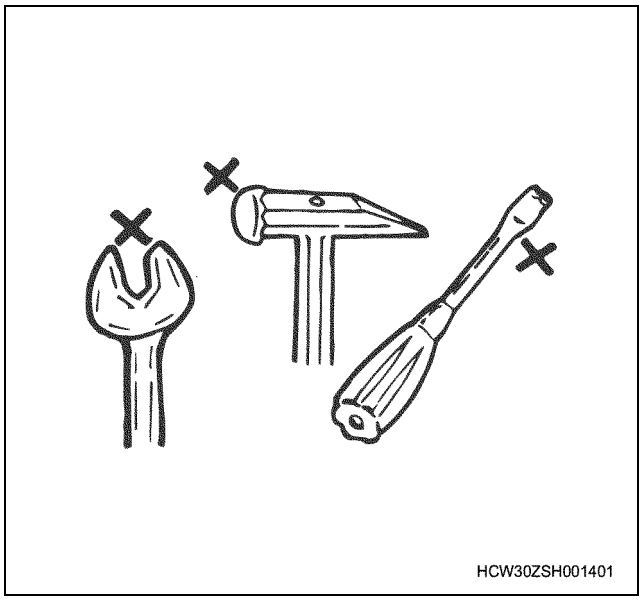
1. Always use an engine stand when taking the engine down from the vehicle.
   Do not place the engine directly onto the ground, or place in a manner that interferes with the oil pan.
2. If you are working together with others, always pay attention to each other's safety.
3. If you are repairing any part of the electrical system, always remove the minus side cable from the battery terminal before starting work. If you are removing the battery cover, always remove the cover in a place that is away from sources of fire/ heat.



4. Do not perform painting work or leave the engine running for long periods of time in an enclosed or badly ventilated indoor workshop.
5. Always use the correct specialized tool indicated in the instructions. Using the incorrect tool may cause damage to the parts or injury to the person using the tool.



6. All regular tools, gauges and special tools should be regularly inspected, and prepared before starting work. Do not use bent spanners, hammers with damaged edges, chipped chisels, or any other faulty or damaged tools.



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Recommended Lubricant

Engine oil

Use the engine oil below.

Engine oil grade

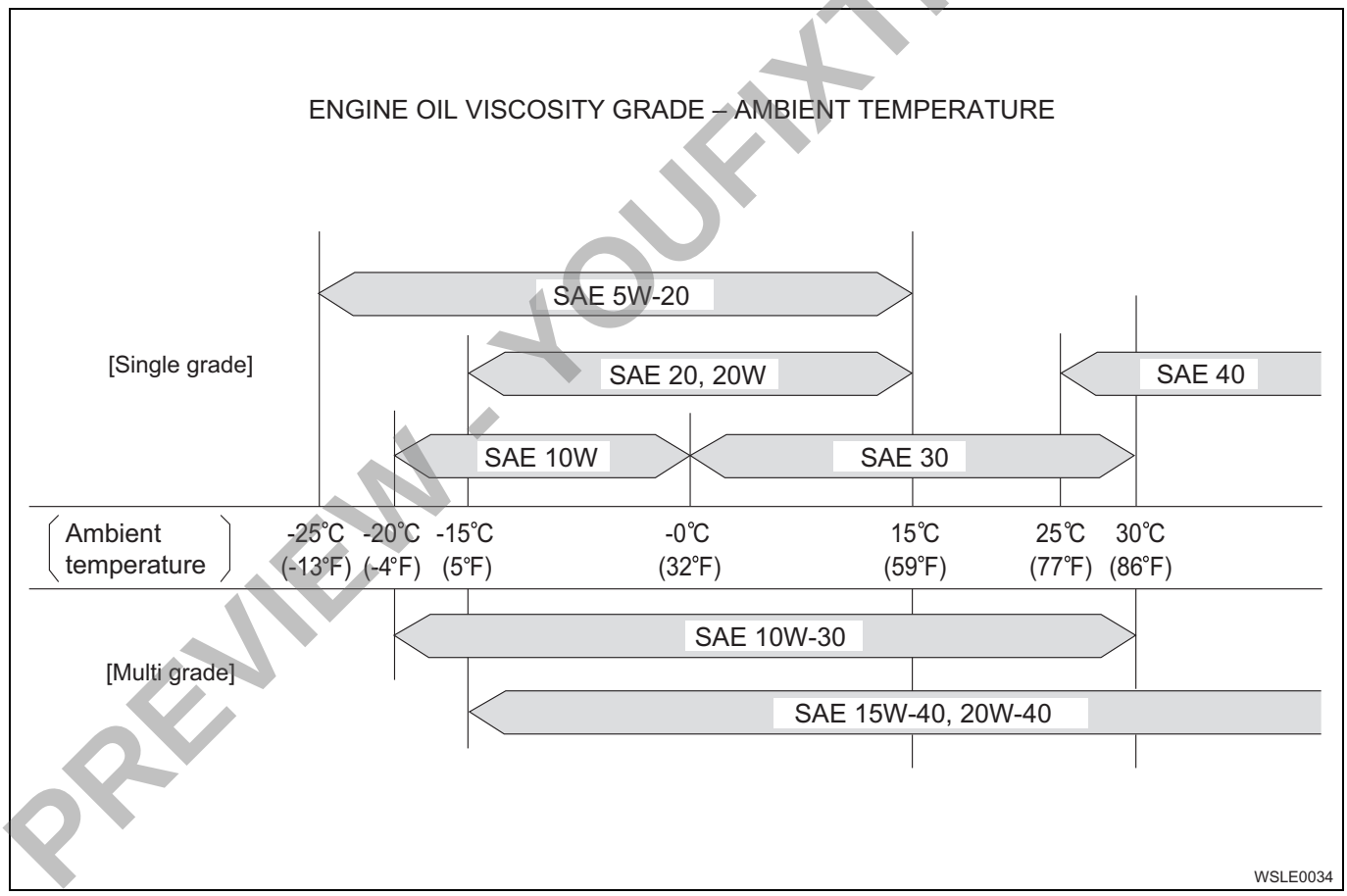
Engine classification	Engine oil grade (API service category)
With turbocharger	CD or CF-4 * (CE, CF, CH-4, CI-4 or CI-4 Plus)

* mark may vary depending on each machine. Refer to the machine manufacturer specification.

ISUZU genuine engine oil

Besco Super: CC
Besco S — 3: CD
Besco Multi Z: CD

Engine oil viscosity chart



The engine oil affects the startability, driving performance, oil consumption, wear of the sliding part, and seizure, depending on the viscosity. You should select the engine oil depending to a temperature and the chart above.

Engine oil level

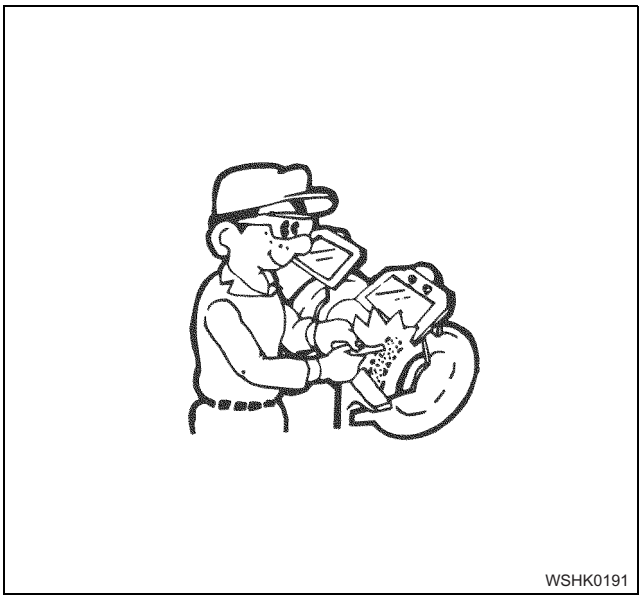
4LE2X model: Approx. 9.3 — 12.1 L {9.8 — 12.8 qts}
4LE2N model: Approx. 5.9 — 8.4 L {6.2 — 8.9 qts}

Note:
Engine oil level may vary depending on the machine specification.

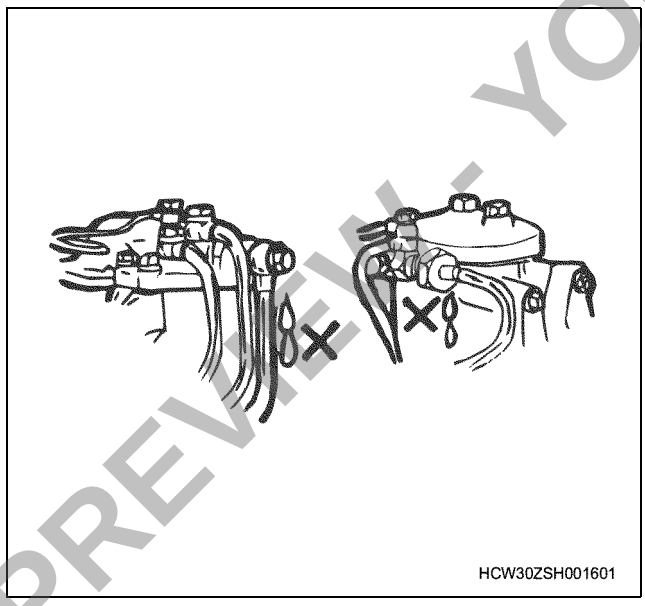
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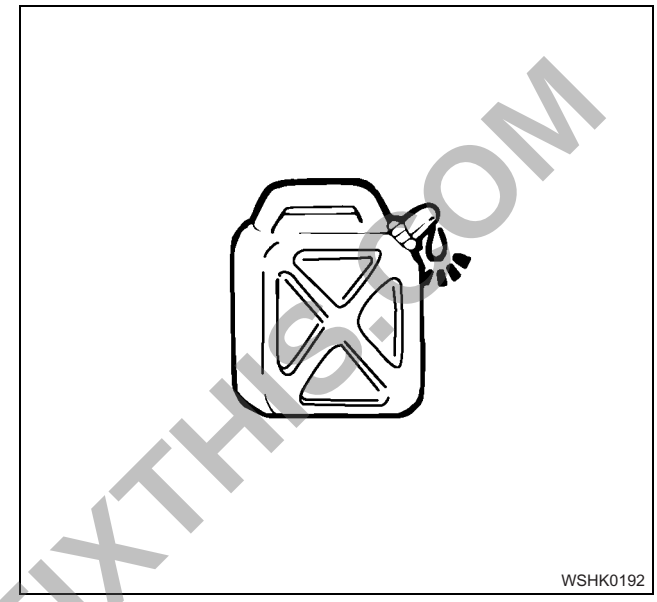
7. Always pay close attention to safety and handling requirements when using grinders, cranes, welders, and other such equipment.
   Moreover, always wear the correct protective garments and use the necessary safety tools for the job in hand.


WSHK0191

8. Always check that there are no fuel leaks when performing maintenance work on the fuel system. (It may cause a fire.)


HCW30ZSH001601

9. Pay close attention to the risk of ignition if you are handling parts that carry a high voltage.
   Furthermore, any oil or grease spilt onto rubber parts must be wiped off immediately, as it will cause deterioration of the rubber.


WSHK0192

Replacement parts and part numbers

1. Always replace packing, oil seals, O-rings, caulking lock nuts, folding lock plates, split pins and other such parts with brand new parts.
2. The parts numbers contained in this manual may not represent the supply condition of the parts, and the part numbers may be changed due to revisions. Therefore, parts should always be checked against a parts catalogue before use.

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