KOBELCO®

DIESEL ENGINE
SHOP MANUAL

MODEL: LK600A
ENGINE MODEL: NISSAN NE6T

KOBE STEEL, LTD.

KOBELCO AMERICA INC.

ENGINE SERVICE MANUAL

MODEL
NE6

Applicable Engine Numbers
NE6-000001 ~

QUICK REFERENCE INDEX

NISSAN DIESEL MOTOR CO., LTD.
TOKYO, JAPAN

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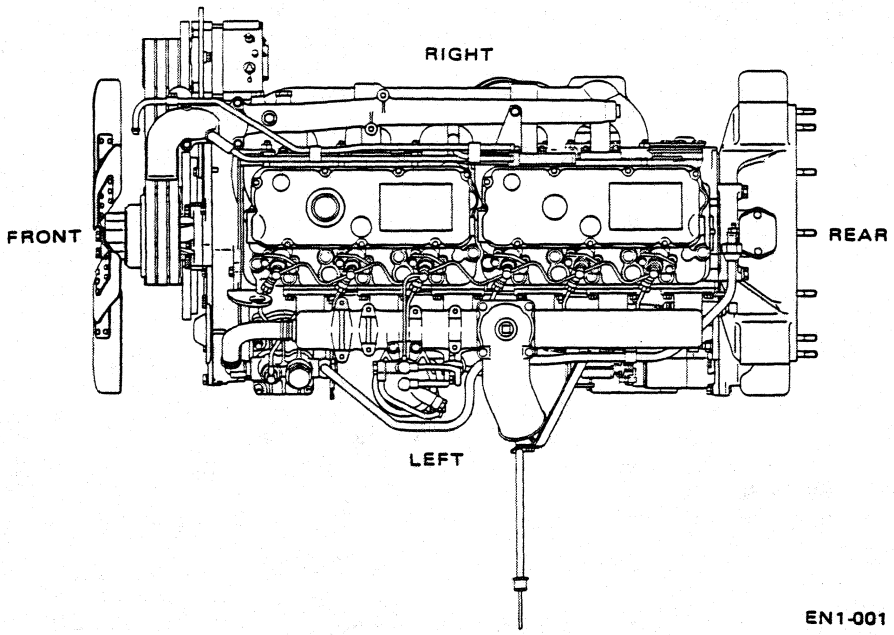
1. GENERAL

This chapter describes handling cautions of this manual and engine general. Therefore, when repairing the NE6 engine by using this manual, first read this chapter.

METHOD OF USING THIS MANUAL

STANDARDIZATION OF TERMS

ENGINE POSITION



EN1-001

1 mm	0.0394 in.
1 kg	2.205 lb.
1 kgm	7.23 lb. ft.
1 kg/cm^2	14.223 psi.
1 liter	0.220 Imp. gal.
1 liter	0.264 U.S. gal.

$$t\,(°F) = 32 + \frac{9}{5}\,T\,(°C)$$

However, the unit of horsepower uses France horsepower.

ABBREVIATION

In this manual, the following abbreviations are used.

O.D.	Outside Diameter
I.D.	Inside Diameter
O.S.	Over Size
U.S.	Under Size
B.T.D.C.	Before Top Dead Center
A.B.D.C.	After Bottom Dead Center
B.B.D.C.	Before Bottom Dead Center
A.T.D.C.	After Top Dead Center
P.T.O.	Power Take Off

MAINTENANCE STANDARD TERMS

Maintenance standard

"Maintenance standard" indicates the standard clearance when parts are assembled or the standard performances of assembly parts.

Repair limit

"Repair limit" indicates that repair is necessary if the clearance between parts or the parts are to meet the values given in the repair limit are to be attained.

Wear limit

"Wear limit" indicates that the part has exceeded the given wear limit and must be replaced.

UNITS

The units of measures used throughout this manual, are in accordance with the metric system. When conversion to the corresponding English units (Foot pound system) is necessary, utilize the following.

USING THIS MANUAL

This manual consits of each chapter. When the trouble points are unclear, refer to chapter 2 "Disassembly judgement" and locate the trouble point. Then, refer to chapter 3 "Engine disassembly and reassembly" and remount the trouble components, and repair by referring to the chapter for each components (chapter 4 to chapter 11). For check of the engine performance, refer to chapter 12 "Engine test procedures". Moreover, maintenance standards and tightening torque are collected in the chapter 13 "Service data".

ENGINE SPECIFICATIONS

Model			NE6
Type			Diesel
Cooling system			Water cooled
Number of cylinders and cylinder configuration			6, in-line
Number of circles			4
Type of combustion chamber			Direct fuel injection
Valve mechanism			Overhead
Type of cylinder liner			Dry
Bore x stroke [mm]			110 x 130
Total displacement [cm^3]			7,412
Compression ratio			16.2 : 1
Cylinder compression [kg/cm^2-rpm]			30 - 200 ±20
Number of piston rings		Compression ring	2
		Oil ring	1
Intake valve timing		Open	16° B.T.D.C.
		Close	54° A.B.D.C.
Exhaust valve timing		Open	50° B.B.D.C.
		Close	20° A.T.D.C.
Valve clearance [mm]		Intake	0.4
		Exhaust	0.4
Fuel system	Ignition system		Compression ignition
	Fuel injection timing [B.T.D.C.]		17°
	Ignition order		1-4-2-6-3-5
	Fuel injection pump	Type	Bosch P type
		Plunger diameter [mm]	9
		Cam lift (Feed pump side) [mm]	8 (6)
		Governor	Centrifugal
		Timer	Centrifugal
	Fuel injection nozzle	Nozzle holder	Flange type
		Nozzle	Multi-hole type
		Number of injection nozzle	4
		Injection pressure [kg/cm^2]	200

Model				NE6
Intake system	Air cleaner		Type	Cyclone
			Element	Dry paper element
	Air heater		Type	Ribbon type
			Voltage [V] x Current [A] x number	22 x 110 x 1
Lubricating system	Type			Forced circulation
	Oil pump			Gear pump
	Oil filter		Fullflow	Paper element
			By-pass	Centrifugal
	Lubrication oil total capacity [ℓ]			25
	Oil pan lubrication oil capacity [ℓ]		H level	12
			L level	9
	Oil cooler			Water cooled flat tube type
Cooling system	Type			Forced circulation
	*Cooling water capacity [ℓ]		Without water tank	19
	Water pump			Centrifugal
	Thermostat			Wax pellet type
Electrical system	Charging system	Type		AC, diode-rectified
		Output [V-A]	LR235-59	24 - 35
		Voltage regulator	LR235-59	IC type
	Starting motor	Type		Shift type
		Output [V-kW]	S25-115A	24 - 3.7
			S-X018	24 - 5.0

* with radiator

LUBRICATION AND FUEL

ENGINE OIL

The use of proper engine oil for heavy duty is essential. NISSAN DIESEL engine should be lubricated with oil of a performance level not less than the requirements based on API service classification CD or CC class oil and SAE viscosity grades. However, use classification CD class oil in engines equipped with a turbocharger.

Recommended Viscosity (SAE) Grades

Atmospheric temperature	Recommended SAE viscosity	
–18 to +10°C	10W	10W/30
–7 to +25°C	20W/20	
–12 to +40°C	15W/40, 20W/40	
+5 to +40°C	30	
More than + 30°C	40	

A.P.I.: American Petroleum Institute
S.A.E.: Society of Automotive Engineers

Recommended class-CD engine oils (ML-L-2104C)

Petrolcum Maker	Brand	SAE Viscosity
CALTEX	CALTEX RPM DELO 300 OIL	10W, 20W/20, 30, 40
	CALTEX RPM DELO 400 OIL	15W/40, 20W/20, 10W, 30, 40
TEXACO	URSA OIL LA-3	10W, 20W/20, 30, 40
	TEXACO URSA SUPER PLUS	10W, 15W/40, 20W/20, 30, 40
	TEXACO URSA OIL SUPER 3	10W, 20W/20, 30, 40
ESSO	ESSOLUBE D-3 SERIES	10W, 20W, 30 40
	ESSOLUBE XD-3	10W, 10W/30, 15W/40, 20W/20, 30, 40
	ESSOLUBE XD-3 EXTRA	10W, 10W/30, 15W/40, 20W/20, 30, 40
MOBIL	MOBIL DELVAC 1300 SERIES	30, 40
GULF	GULF SUPER DUTY MOTOR OIL	10W, 15W/40, 20W/20, 30, 40
SHELL	SHELL RIMULA CT OIL or SHELL RIMULA X OIL	10W, 20W/20, 30, 40
	SHELL MYRINA OIL	15W/40, 20W/20, 30, 40
BP	BP VANELLUS C3	10W, 20W, 30, 40
	BP VANELLUS C3 MULTIGRADE	15W/40
CASTROL	CASTROL OR DEUSOL CRD	10, 20W/20, 30 40
	CASTROL OR DEUSOL RX SUPER	10W, 15W/40, 20W/20, 30, 40
	CASTROL OR DEUSOL CRF	10W, 20W/20, 30, 40
AGIP	AGIP F.1 DIESEL SIGMA	10W, 20W/20, 30, 40
VALVO-LINE	SUPER 1000 S-3 MOTOR OIL OR ALL FLEET MOTOR OIL	10W, 20W, 30, 40
CHEV-RON	CHEVRON DELO 300 MOTOR OIL	10W, 20W/20, 30, 40
	CHEVRON DELO 400 MOTOR OIL	10W, 15W/40, 20W/20, 30, 40
VEEDOL	VEEDOL DIESEL HDC	10W, 15W/40, 20W/20, 30, 40
	VEEDOL DIESEL STER	10W, 15/40, 20W/20, 30, 40

Recommended class-CC engine oils (MIL-L-2104B or MIL-L46152)

Petroleum Maker	Brand	SAE Viscosity
CALTEX	CALTEX RPM DELO 100 OIL	10W, 20W/20, 30, 40
	CALTEX RPM DELO 200 OIL	10W, 10W/30, 20W/20, 20W/40, 30, 40
TEXACO	URSA OIL EXTRA DUTY	10W, 20W/20, 30, 40
	TEXACO HAVOLINE MOTOR OIL	10W, 20W/20, 30, 40
	TEXACO URSATEX	10W/30, 20W/40
ESSO	ESSOLUBE HDX SERIES	10W, 20W, 30, 40
	ESSOLUBE HDX PLUS	10W/30, 15W/40
MOBIL	MOBIL DELVAC 1100 SERIES	10W, 20W/20, 30, 40
	MOBIL DELVAC 1200 SERIES	10W, 20W/20, 30, 40
GULF	GULFLUBE MOTOR OIL XHD	10W, 20W/20, 30, 40
	GULF SUPER DUTY MOTOR OIL	10W, 15W/40, 20W/20, 30, 40
SHELL	SHELL ROTELLA SX OIL	10W, 10W/30, 20W/20, 20W/40, 30, 40
	SHELL ROTELLA TX OIL	10W, 10W/30, 20W/20, 20W/40, 30, 40
BP	BP VANELLUS M	10W, 10W/30, 20W/20, 30, 40
CASTROL	CASTROL OR DEUSOL CRX	10W, 10W/30, 20W/20, 30, 40
AGIP	AGIP F.1 DIESEL GAMMA	10W, 20W/20, 30, 40
VALVO-LINE	HD SUPER HPO MOTOR OIL	10W, 20W, 30, 40
CHEV-RON	CHEVRON DELO 100 MOTOR OIL	10W, 20W/20, 30, 40
	CHEVRON DELO 200 MOTOR OIL	10W, 20W/20, 30, 40
VEEDOL	VEEDOL DIESEL HD PLUS	10W, 20W/20, 30, 40
	VEEDOL DIESEL HDB PLUS	10W, 10W/30, 20W/20, 30, 40

BEARING GREASE

(Brand recommended: N.L.G.I. No. 2, Li, -Soap base)

This grease may be used on generator, fan pulley bracket, starting motor, and etc. Be careful of contamination while grease is in storage.

Petroleum Maker	Brand
CALTEX	CALTEX MARFAK MULTIPURPOSE NO. 2
	CALTEX MARFAK ALL PURPOSE NO. 2
TEXACO	TEXACO MARFAK MULTIPURPOSE NO. 2
	TEXACO MARFAK ALL PURPOSE NO. 2
ESSO	ESSO MULTIPURPOSE GREASE
	ESSO RONEX MP
MOBIL	MOBIL GREASE MP
GULF	GULFLEX A
SHELL	SHELL RETINAX A
	SHELL ALVANIA RA
	SHELL ALVANIA EP2
BP	BP ENERGREASE L2
CASTROL	CASTROL LM GREASE
AGIP	AGIP F.1 GREASE 1530
VALVO-LINE	VAL-LITH NO. 2 EP GREASE
	GLO GREASE
CHEV-RON	CHEVRON MULTI-MOTIVE GREASE NO. 2
	CHEVRON POLYUREA EP GREASE NO. 2
VEEDOL	VEEDOL MULTIPURPOSE or ALL PURPOSE GREASE NO. 2

N.L.G.I.: National Lubricating Grease Institute

COOLING SYSTEM WATER

Be sure to use clean, soft water such as city water in the cooling system. Do not use hard water such as well water or river water, because such water can easily form scale in the system. Note that scale attached to the water passage in the cooling system (particularly in the radiator) can cause engine overheating.

FUEL

The Nissan Diesel engine is designed to produce power by using light oil as fuel. Do not use any fuel except light oil; otherwise, engine trouble will result.

The light oil should have a cetane number greater than 45, specific gravity of 0.81 to 0.85, boiling point ranging from 180 to 350°C, sulfer content of less than 0.5%, and should prove neutral in a chemical reaction test. It should be clean, possess the proper viscosity, and contain no water or sediment.

CAPACITIES OF UNIT

Engine oil sump
- Total capacity
  - 25 liters
- Oil pan capacity
  - H level 12 liters
  - L level 9 liters

Cooling system water (Engine only)
- 19 liters

2. DISASSEMBLY JUDGMENT

This chapter covers the judgment of disassembling the engines.

DETERMINING THE NEED FOR ENGINE OVERHAUL

Whether an engine needs overhauling or not is determined by considering various factors including reduction in output, difficulty in starting, deterioration in oil or fuel consumption, reduction in oil pressure, and the increased need for periodic maintenance. It is desirable, however, to judge whether or not the engine actually requires overhauling by conducting various checks, as many of the above factors can often be corrected through minor service operation rather than a complete overhaul.

REDUCTION IN COMPRESSION PRESSURE

The compression pressure of the engine lowers as the cylinder liner, piston, piston rings and valves become worn. If compression pressure drops to the repair limit, the engine must be overhauled.

Compression pressure (Warm engine and engine rpm; 180 to 220)
Maintenance standard
30.0 kg/cm^2
Repair limit
20.0 kg/cm^2
Difference between cylinders
Maintenance standard
4.0, max. kg/cm^2

DETERIORATION IN FUEL CONSUMPTION (FC)

Deterioration of FC is also attributable to the operating conditions of the vehicle (including road condition, load weight, driving habits) and poor maintenance of parts. Therefore, deterioration of FC is not always a sign that engine overhaul is required. However, if the operating conditions are unchanged from the new car period, it is possible to determine whether or not the engine requires overhauling by using the FC value of the new car period as a reference. If the FC value drops below 60% of the reference value, the engine should be overhauled.

DETERIORATION IN ENGINE OIL CONSUMPTION (OC)

The OC value changes according to various factors including operating conditions of vehicle, quality of engine oil, etc. However, if the OC value drops below 40% of its initial value during the new car period, it can be regarded as a sign that engine overhaul is required. Before making the final decision to overhaul, it is also necessary to check compression pressure, blowby gas pressure and other factors, and to thoroughly inspect the engine.

REDUCTION IN ENGINE OIL PRESSURE

If the engine oil pressure drops to the maintenance standard, the engine including the lubricating system should be overhauled.

Engine oil pressure
(Oil temperature; 70 to 80°)
At idling
Maintenance standard
More than
0.5 kg/cm^2
At 2,000 rpm
Maintenance standard
More than
3.5, min. kg/cm^2

TROUBLESHOOTING TESTS

MEASURING COMPRESSION PRESSURE

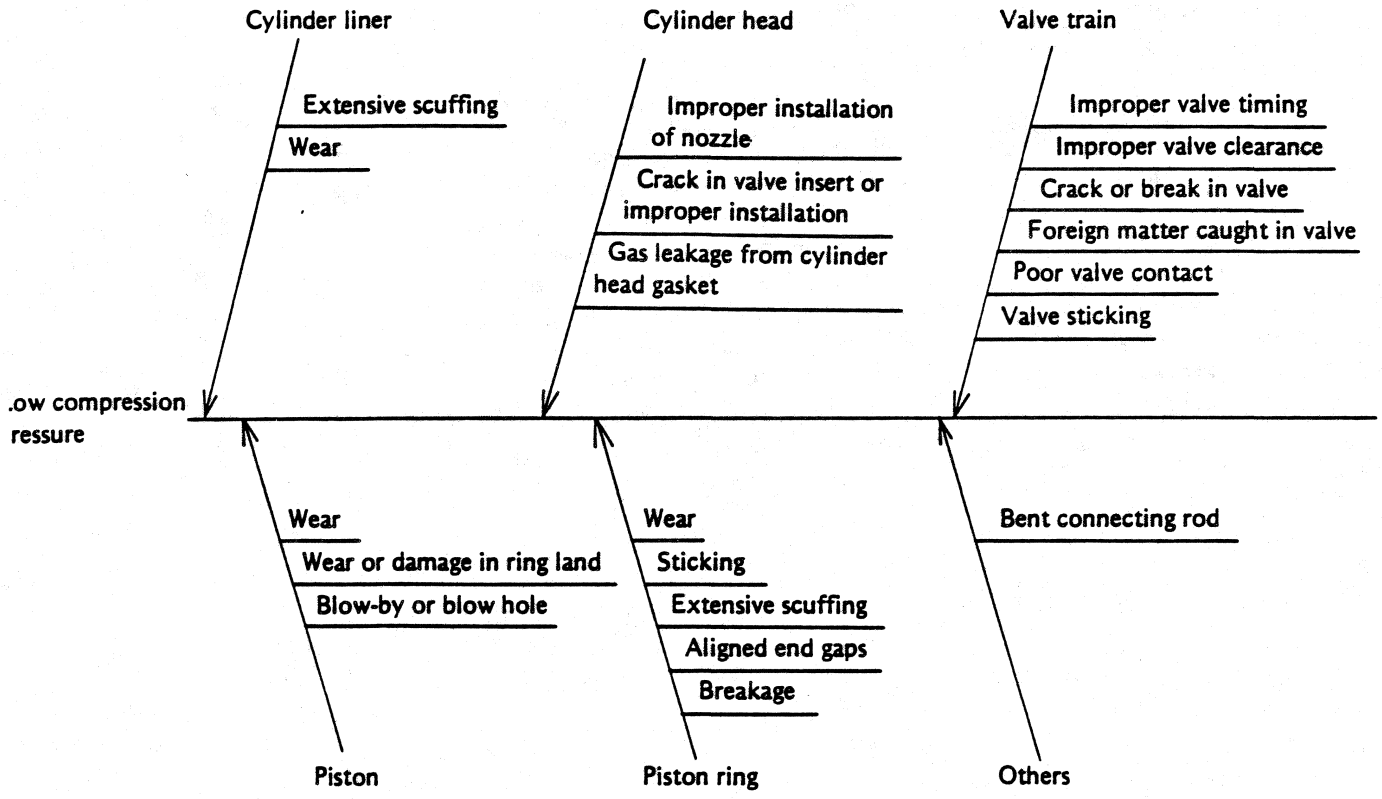
The measurement value of the compression pressure is important in determining the time that engine overhaul is needed. It is therefore necessary to periodically measure and record engine compression pressure.

Compression pressure (Warm engine and engine rpm; 180 to 220)
Maintenance standard
More than 28.0 kg/cm²
Repair limit
Less than 20.0 kg/cm²
Difference between cylinders
Maintenance standard
4.0, max. kg/cm²

Examples of trouble

Trouble symptoms that are attributable to incorrect compression pressure are: low engine output, deteriorated oil consumption, deteriorated fuel consumption, emission of white smoke during high speed travelling, difficulty in starting, irregular engine operation, diesel knock, overheating, etc. If compression pressure drops below the repair limit, the cause must be examined, and the engine overhauled.

Factors that may cause reduction in compression pressure



MEASURING BLOW-BY GAS PRESSURE

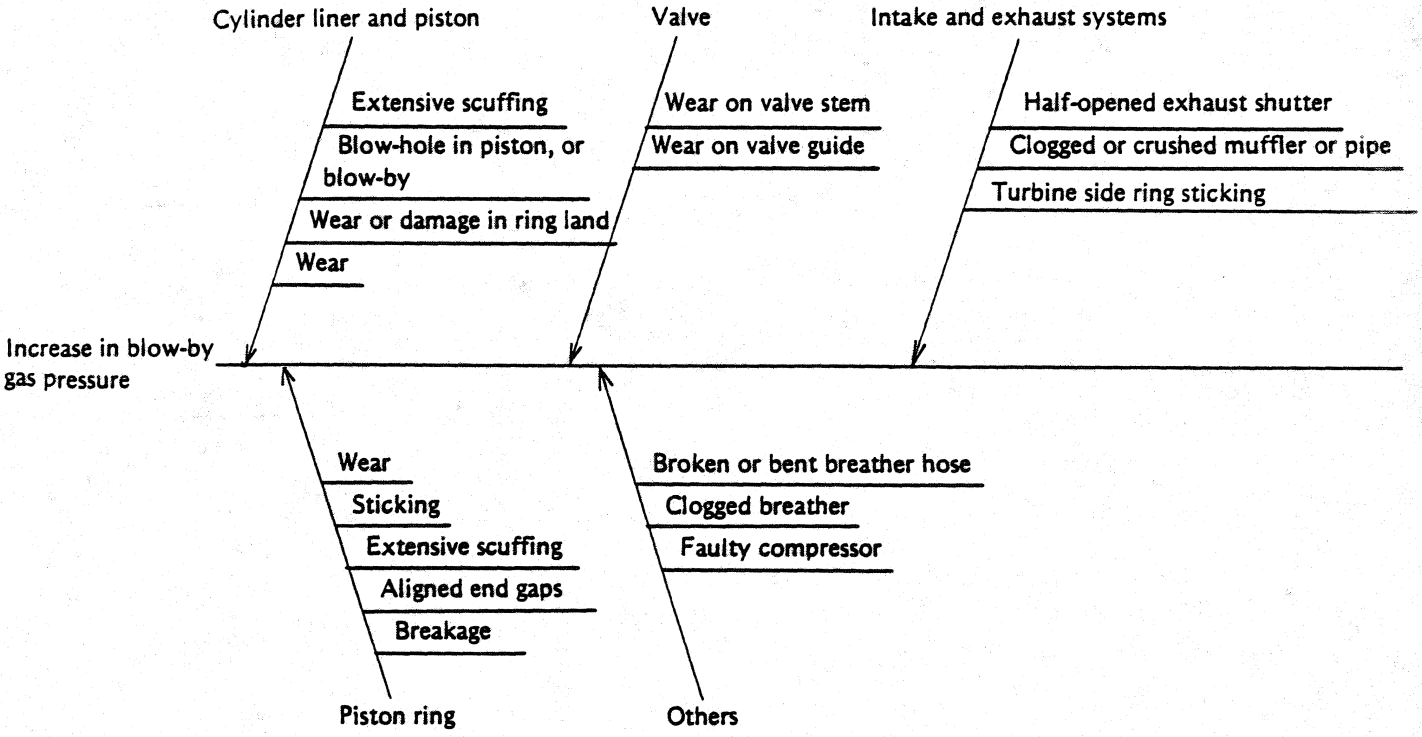
Measurement of blow-by gas pressure like measurement of compression pressure provides an important information, in deciding whether or not an engine should be overhauled.

Blow-by gas pressure (Warm engine at maximum rpm under no-load)
Maintenance standard
15, max. mmAq

Trouble symptom

Trouble symptoms that are attributable to excessive blow-by gas pressure are: low engine output, deterioration in oil or fuel consumption, emission of white smoke during high speed travelling, difficulty in starting, irregular engine operation, diesel knock, overheating, oil leakage from air breather or other areas, etc. If the blow-by gas pressure exceeds the service standard, compression pressure should also be measured, and then a decision should be made whether the engine requires overhauling.

Factors that may cause an increase in blow-by gas pressure



NO-LOAD ACCELERATION AND DECELERATION TEST

The condition of an engine can be judged by checking its acceleration and deceleration speeds. This test is performed under a no-load condition.

No-load acceleration and deceleration test (Warm engine)
- **Acceleration**
  - **Maintenance standard**
    - **2.0, max. sec.**
  - **Deceleration**
    - **Maintenance standard**
      - **3.5, max. sec.**

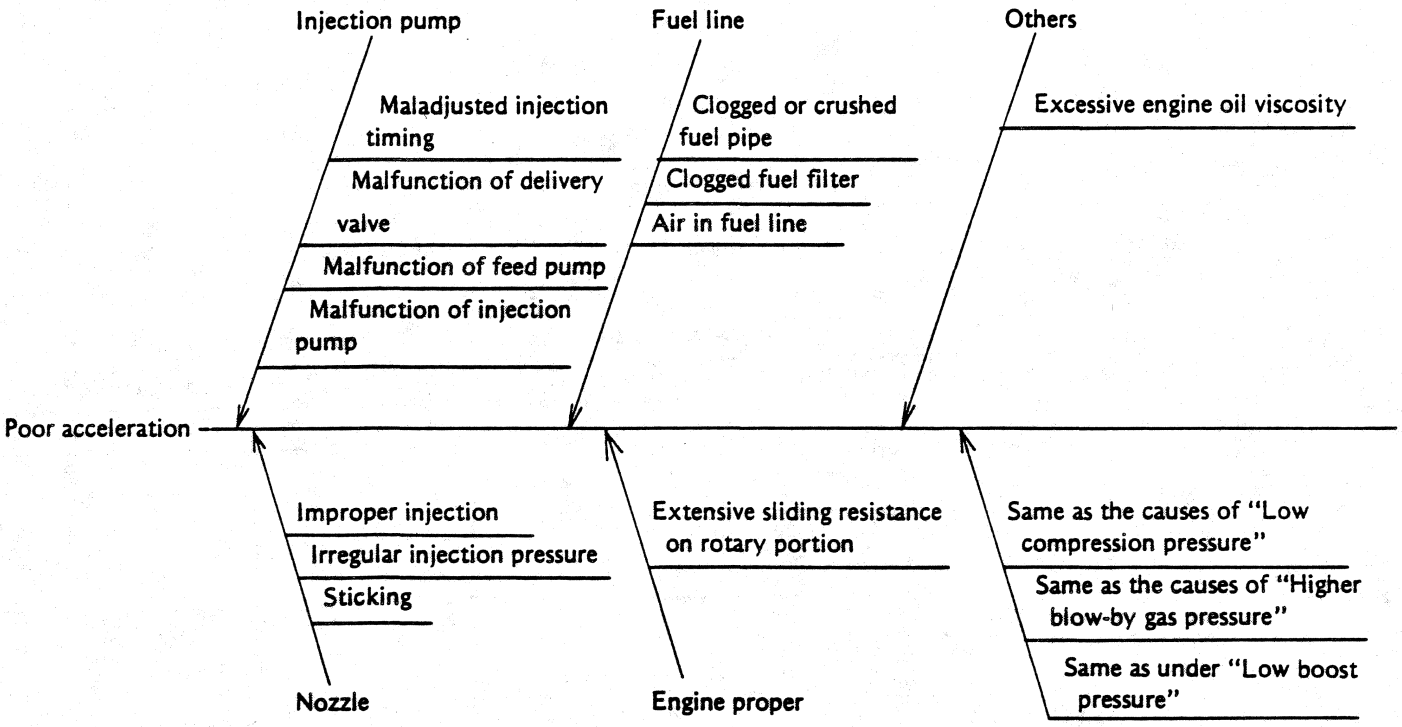
Trouble symptom

Trouble symptoms relating to improper acceleration or deceleration are as follows: low engine output, deteriorated fuel consumption and difficulty in shifting of transmission.

Causes of slow acceleration or deceleration

Slow acceleration is caused by low compression pressure, increase in blow-by gas pressure, and failure in fuel system.

Slow deceleration is generally caused by poor governor performance, such as improper adjustment of damper spring, or idle spring, or too high idling adjustment by control knob.



MEASURING WATER TEMPERATURE DIFFERENCE BETWEEN RADIATOR INLET AND OUTLET

This test is performed to check whether the radiator is functioning normally. It is desirable to examine temperature during the running state using a thermister.

Water temperature difference between radiator inlet and outlet
Maintenance standard
Approx. 5 to 7°C

Trouble symptom

Excessive temperature differences can cause engine overheating.

Possible causes

1) Extreme water temperature differences are caused by water scale or foreign matter obstructing normal water flow in the radiator.
2) Slight water temperature differences are caused by foreign matter such as mud and insects accumulated on the radiator core fin, obstructing smooth flow of air through the fins.

LITMUS TEST OF COOLING WATER

Check the pH value of the cooling water using the litmus paper. (Use blue litmus paper.)

Trouble symptom

If the acidity of cooling water is excessively high, engine overheating or reduction in the quantity of cooling water may result.

Causes of higher acidity

If the burnt gases leak through the cylinder head gasket into cooling water, the sulfurous acid gas in the burnt gases dissolves into water, thus increasing the acidity of the water.

PRESSURE TEST OF WATER TANK CAP

Faulty water tank cap can cause the amount of cooling water to be reduced or the engine to overheat. Therefore, the water tank cap should be checked periodically.

Water tank cap open valve pressure (Pressure side)
Maintenance standard
0.4 to 0.6 kg/cm^2
Repair limit
0.7 min. kg/cm^2

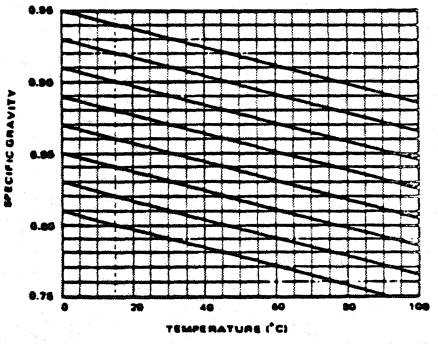
ENGINE OIL SPOT TEST

The engine oil spot test is performed to evaluate the condition of the engine oil, thereby judging whether or not the engine oil requires changing.
A spot test kit is available from the petroleum manufacturer, and the spot test should be performed by referring to the Instructions given in the kit.

MEASURING SPECIFIC GRAVITY OF FUEL

Poor quality fuel not only causes reduction in engine output, but also causes failure in the nozzle and plunger and clogging in the fuel filter element. If any of these failures is observed, it is also necessary to measure the viscosity of fuel in order to judge whether fuel quality is acceptable. Generally speaking, reduction of 10% in the specific gravity can cause 5 to 7% increase in the fuel consumption, and alike decrease in engine output.

Relation between temperature and specific gravity



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