

ENGINE SERVICE MANUAL

MODELS
PE6 and PE6T

Applicable Engine Numbers

PE6 056700-

PE6T 015474T-

FOREWORD

This service manual covers service procedures for the PE6 and PE6T diesel engines. In order for the engine to display 100% performance at all times, and to expand the life of each part, daily inspection and servicing must, of course, be performed according to plan, but proper overhaul and repair in accordance with the maintenance standards is also vital.

Keep this manual in the shop for everyone engaging in servicing of the engine.

QUICK REFERENCE INDEX

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2. DISASSEMBLY JUDGMENT

3. ENGINE DISASSEMBLY
AND REASSEMBLY

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9. AIR INTAKE AND
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10. ELECTRICAL SYSTEM

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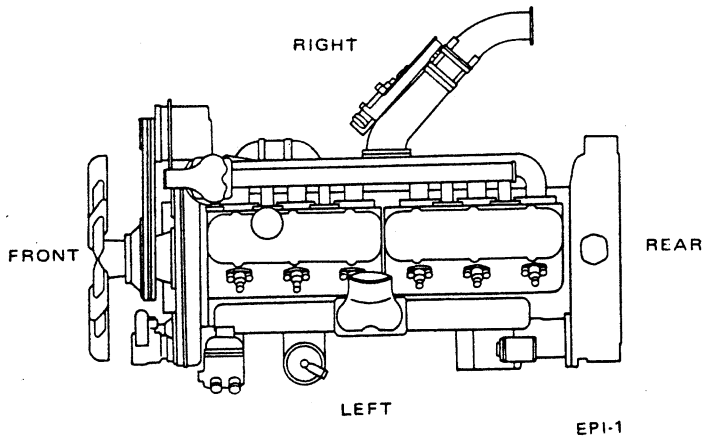
13. SERVICE DATA

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METHOD OF USING THIS MANUAL

STANDARDIZATION OF TERMS

ENGINE POSITION



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.

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.
$t (^{\circ}\text{F}) = 32 + \frac{9}{5}T (^{\circ}\text{C})$	

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

USING THIS MANUAL

This manual consists 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 4 "Engine proper" to chapter 11 "Auxiliary equipment" for each component. 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		PE6	PE6T		
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]	133.0 x 140.0			
Total displacement	[cc]	11,670			
Compression ratio		17.6 : 1	16.5 : 1		
Cylinder compression		[kg/cm ² -rpm]	33 - 200±20	31 - 200±20	
Number of piston rings	Compression ring	2			
	Oil ring	1			
Intake valve timing	Open	16° B.T.D.C.	14° B.T.D.C.		
	Close	56° A.B.D.C.	34° A.B.D.C.		
Exhaust valve timing	Open	52° B.B.D.C.	68° B.B.D.C.		
	Close	20° A.T.D.C.	16° A.T.D.C.		
Valve clearance	Intake	0.4			
	Exhaust	0.4			
Fuel system	Ignition system		Compression ignition		
	Fuel injection timing		[B.T.D.C.]	16°	14°
	Ignition order		1-4-2-6-3-5		
	Fuel injection pump	Type	Bosch P type		
		Plunger diameter	[mm]	10.0	11.0
		Cam lift (Feed pump side)	[mm]	10.0 (4.0)	
		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	230	

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Model			PE6	PE6T	
Intake system	Air cleaner	Type	Cyclone or oil bath		
		Element	Cyclone type	Paper	
			Oil bath type	Steel wool	
		Oil capacity [ℓ]	5 (oil bath type only)		
		Number	1		
	Air heater	Type	Ribbon type		
		Voltage [V] x Current [A] x number	22 x 130 x 1		
	Turbocharger	Type	—	T45	
		External dimensions (Length x Width x Height)	—	230 x 275 x 284	
		Max. permissible continuous speed (rpm) at 650°C (gas temperature)	—	110,000	
		Direction of rotation	—	Counterclockwise as viewed from the exhaust turbine side	
		Air volume (maximum) [kg/min]	—	28	
		Compression (maximum)	—	3.6	
		Weight [kg]	—	14.0	
	Lubricating system	Type		Forced circulation	
		Oil pump		Gear pump	
		Oil filter	Fullflow	Filter paper	
By-pass			Filter paper		
Lubrication oil capacity [ℓ]		25			
Oil cooler		Water cooled flat tube type			
Cooling system	Type		Forced circulation		
	Radiator		Corrugated fin		
	Cooling water capacity [ℓ]		51 (crane: 42)		
	Water pump		Centrifugal		
	Thermostat		Wax pellet type		
Electrical system	Charging system	Type	AC, diode-rectified		
		Output [V-A]	24 - 35, 24 - 25, 24 - 40		
		Voltage regulator	IC-transistorized, Tirrill type		
	Starting motor	Type	Shift type		
		Output [V-kW]	24 - 5.5		

LUBRICATIONS 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.

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

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	

Recommended CD class oil (MIL-L-2104C)

Petroleum 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
VALVOLINE	SUPER 1000 S-3 MOTOR OIL OR ALL FLEET MOTOR OIL	10W, 20W, 30, 40
CHEVRON	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, 15W/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
VALVOLINE	HD SUPER HPO MOTOR OIL	10W, 20W, 30, 40
CHEVRON	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

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.

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
VALVOLINE	VAL-LITH NO. 2 EP GREASE
	GLO GREASE
CHEVRON	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

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, sulfur 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

H level 25 liters

L level 21 liters

Oil pan capacity

H level 18 liters

L level 14 liters

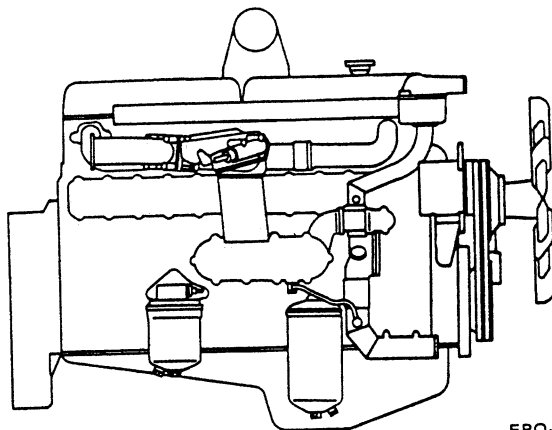
Cooling system water:

Except crane 51 liters

crane 42 liters

2. DISASSEMBLY JUDGMENT

DISASSEMBLY JUDGMENT



This chapter covers the judgement of disassembling the PE6 and PE6T engines.

DETERMINING THE NEED FOR ENGINE OVERHAUL	2-1
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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

33 kg/cm² (PE6)

31 kg/cm² (PE6T)

Repair limit

23 kg/cm² (PE6)

21 kg/cm² (PE6T)

Difference between cylinders

Maintenance standard

4.0, max. kg/cm²

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 repair limit, the engine including the lubricating system should be overhauled.

**Engine oil pressure
(Oil temperature 70 to 80°C)**

At idling

Maintenance standard

1.0, min. kg/cm²

Repair limit

0.5 kg/cm²

At 2,200 rpm

Maintenance standard

3.5, min. kg/cm²

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

33 kg/cm² (PE6)

31 kg/cm² (PE6T)

Repair limit

23 kg/cm² (PE6)

21 kg/cm² (PE6T)

Difference between cylinders

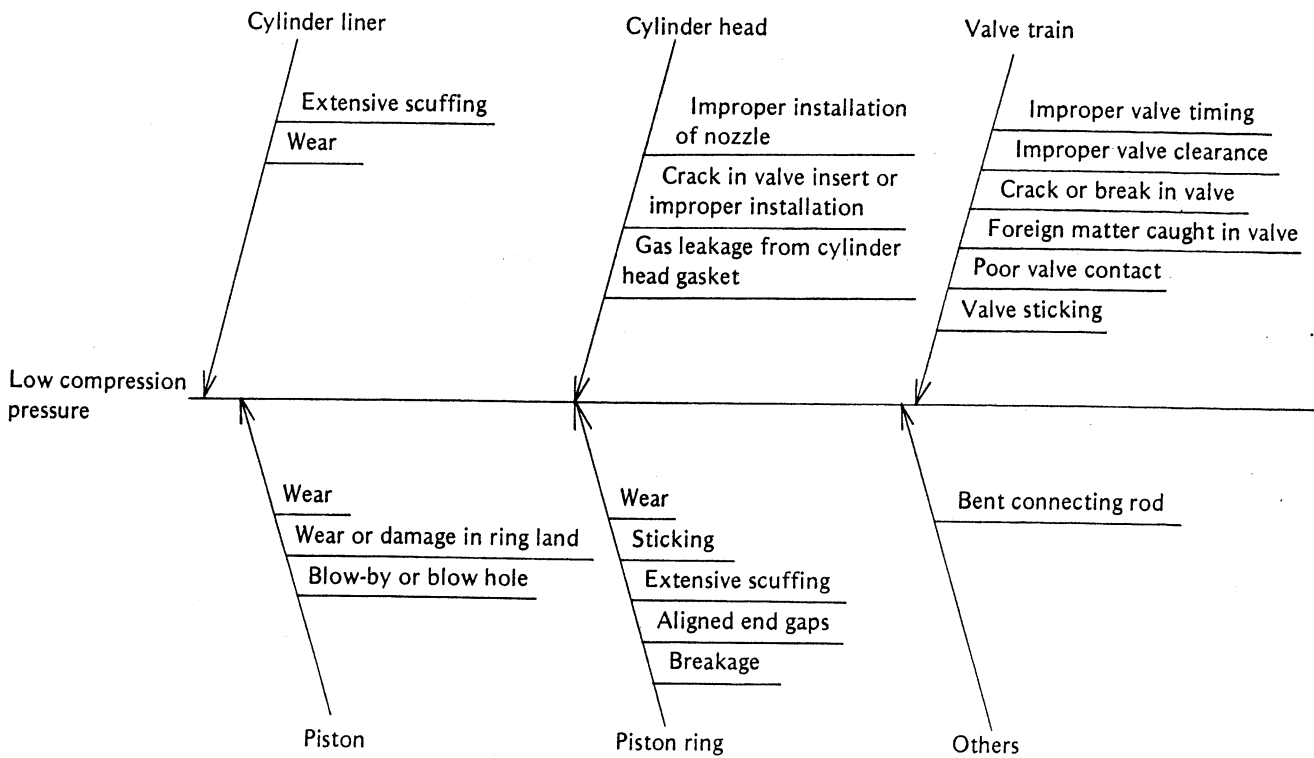
Maintenance standard

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.

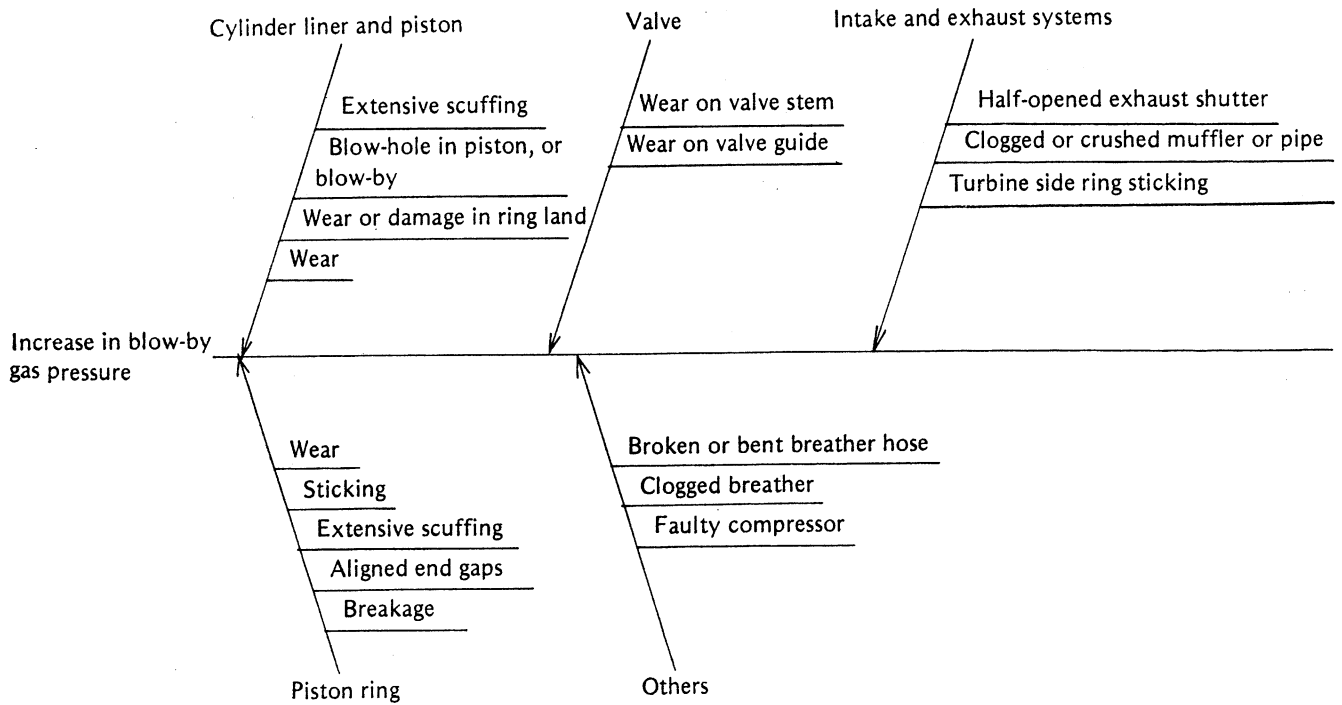
Blow-by gas pressure (Warm engine at maximum rpm under no-load)
Maintenance standard
 15, max. mmAq

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



MEASUREMENT OF BOOST PRESSURE

Should the turbocharger become inoperative, boost pressure should be measured to diagnose the intake and exhaust systems.

Boost pressure

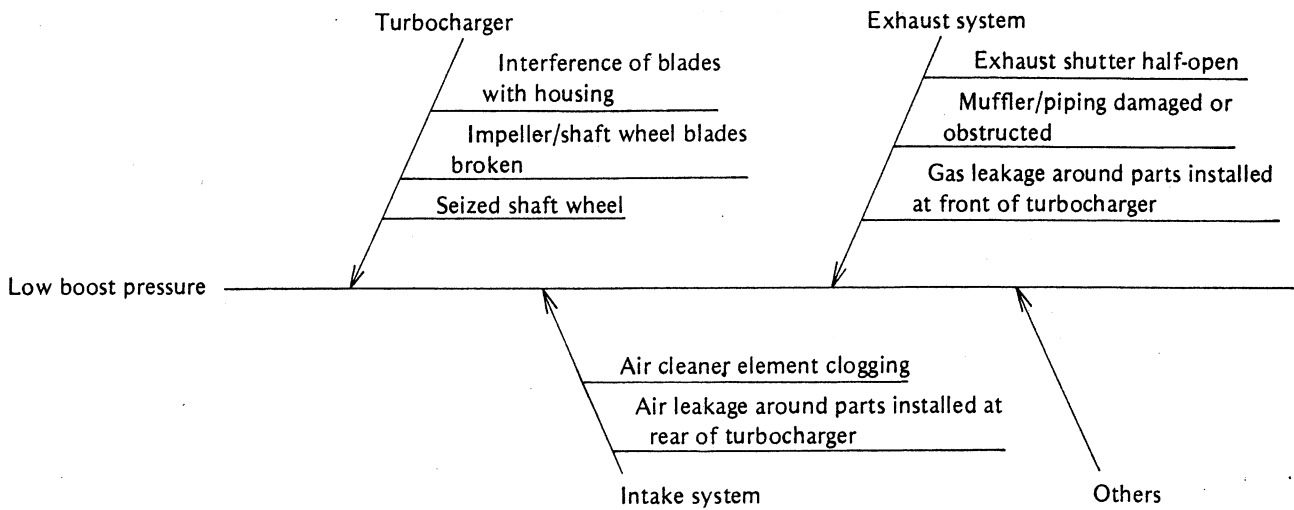
Greater than 80 mmHg

[max. engine rpm under no load after warmup]

Examples of turbocharger failure

Turbocharger failure is evidenced by decreased engine output, excessive fuel consumption or black exhaust smoke. Abnormal boost pressure indicates the necessity of inspection and possible overhaul of the turbocharger intake and exhaust systems.

Factors which may cause low boost 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

5.0, max. sec.

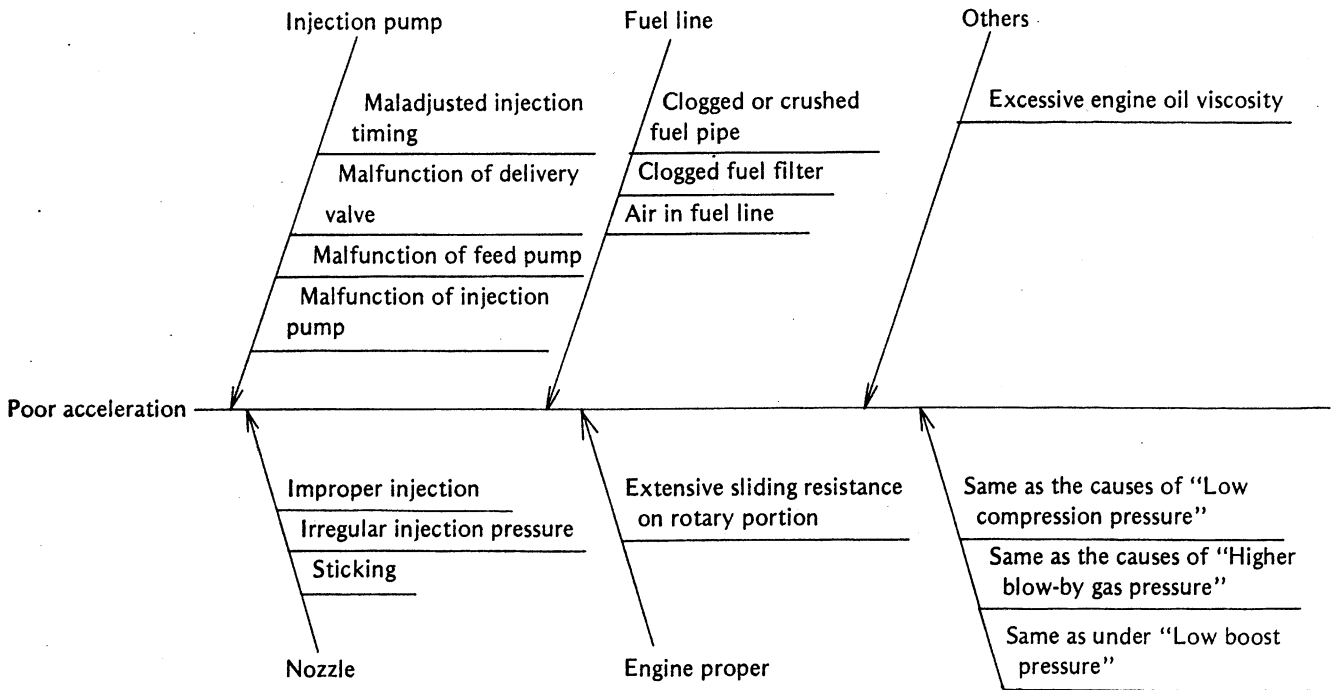
Trouble symptom

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

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.

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.





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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
 0.30 to 0.55 kg/cm²
Repair limit
 0.7, min. kg/cm²

ENGINE OIL SPOT TEST

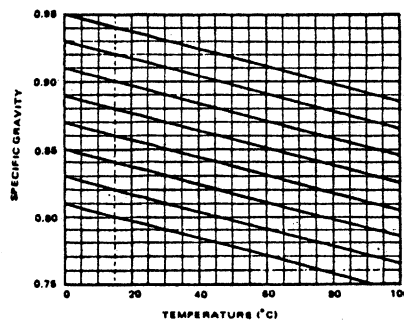
The engine oil spot test is performed to evaluate the condition of the engine oil, thereby judging whether or not the engine oil requires changing.

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



BP2-1

CAUSE OF TROUBLE AND ITS CORRECTION

PRECAUTIONS ON TROUBLE-SHOOTING AND REPAIRING

- 1) Prior to disassembly, confirm the nature of the problem. Determine the following points and the conditions before and after the occurrence of trouble by asking the user.
 1. Did the trouble occurred suddenly?
 2. Was there anything unusual before occurrence of the trouble?
 3. Under what condition did the trouble occur?
 4. Was there any repair work done recently?
 5. Is there any other unusual phenomenon?
- 2) Confirm the nature of the problem in the shop (by the service mechanic himself).
Reconfirm the nature of the problem complained of by user, and perform tests using various testing equipment in the shop. Then, make a guess as to the cause of the trouble.

3) Thorough investigation of the trouble prior to disassembly can prevent unnecessary procedures, enabling quick and efficient repair work. Note that disassembly without preliminary investigation often makes reproduction of the problem difficult, thus making trouble-shooting impossible.

4) Always start with a simple operation.

After making a guess as to the cause of the trouble, perform investigation or repair work starting with the simplest operation.

5) Always consider the cause of the trouble.

The same problem will occur repeatedly if the symptoms only are corrected without removing the real cause of the trouble. Be sure to seek out the origin of the trouble and remove it completely.

Example: An engine was brought to the shop because of oil leakage from the crankshaft front oil seal,

and the problem was repaired by simply replacing the oil seal.

If the cause of this problem is faulty oil seal, there is no problem. However, oil leakage is often a secondary problem resulting from another primary cause, and the primary cause must be removed without fail.

In the case of the above example, the cause of the trouble may be one of the following:

- The blow-by gas pressure is excessively high, and engine oil spurts out due to the high pressure.
- Mis-aligned crankshaft due to wear on main bearing shell.

DIAGNOSIS GUIDE

HOW TO USE THE GUIDE

- 1) Open the page of the guide corresponding to the trouble symptom complained of by the user.
- 2) Check all of the points listed in the page.
- 3) If there is any applicable item in the checking points, the cause of the trouble may be assumed in the following manner.
 - Each item in the "Symptoms and checking points" section corresponds to one or more items in the "Cause of trouble"

section through the dot mark "●". If there are more than one applicable "Cause of trouble" items, the item having the largest number of dot marks should be regarded as the central cause of the trouble.

- The "cause" items having no dot mark can be regarded as not being the cause of the trouble.

Note

If more than one cause is assumed, repair operation should begin with the simplest operation.

The diagnosis guide is a table which can be used for seeking out the cause of trouble without disassembling the engine on the basis of the symptoms of the problem and the result of checks performed in the shop.

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