

[TABLE 1] STD ADJUSTING DIMENSIONS

Unit: mm (in)		
No.	Item	Standard Dimensions
1	Valve clearance (INTAKE) (Cold)	W04D 0.30 (0.0118)
		W04C-T 0.30 (0.0118)
		W04C-TI 0.35 (0.0138)
2	Valve clearance (EXHAUST) (Cold)	W04D 0.40 (0.0157)
		W04C-T 0.45 (0.0177)
		W04C-TI 0.50 (0.0197)
3	Injection timing	W04D 14° W04C-T 17° W04C-TI
4	Engine idling speed	775 — 825 rpm
5	V-belt tension	10 — 15 (0.40 — 0.59)
6	Alternator brush length	LIMIT: 5.5 (0.22)
7	Starter brush length	LIMIT: 13.0 (0.51)

[TABLE 2] TIGHTENING TORQUE

Unit: kg-cm (lb.ft)

No.	Tightening Position	Tightening Torque	Remarks
1	Cylinder head bolt	1,300 — 1,400 (95 — 101)	
		450 — 500 (33 — 36)	Additional bolt
2	Intake manifold bolt & nut	190 — 260 (14 — 18)	
3	Heat exchanger bolt	350 — 400 (26 — 28)	
4	Nozzle holder bolt	130 — 190 (10 — 13)	
5	Timer drive gear bolt	300 — 350 (22 — 25)	
6	Glow plug	225 — 275 (17 — 19)	

[TABLE 3] LUBRICANTS CAPACITY

No.	Item	Capacity	Remarks
1	Engine oil	7 — 9 liters (1.85 — 2.37 US.gal) (1.54 — 1.98 Imp.gal)	

[TABLE 4] PRESSURE

Unit: kg/cm² (psi)

No.	Item	Pressure	Remarks
1	Engine oil pressure	above 0.5 (7)	After warming up
2	Fuel injection nozzle pressure	220 (3,129)	
3	Engine compression pressure	W04D W04C-T 33 — 36 (470 — 511)	At engine speed 270 — 310 rpm
		W04C-TI 30 — 33 (427 — 469)	

HINO W04D W04C-T W04C-TI

**DIESEL ENGINE FOR
MARINE USE**

OPERATION HANDBOOK

W04D: 4.009-liter, 4-cycle, 4-cyl., water-cooled

**W04C-T: 3.839-liter, 4-cycle, 4-cyl., water-cooled
and turbocharged**

**W04C-TI: 3.839-liter, 4-cycle, 4-cyl., water-cooled,
turbocharged and intercooled**

Hino

HINO MOTORS, LTD.

OPERATION HANDBOOK

**MARINE USE
ENGINE**

Model

**WO4D
WO4C-T
WO4C-TI**

2nd Edition

HINO MOTORS, LTD.

GENERAL INTRODUCTION

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1-1 Specifications

1) Specification of Hino diesel engine

(1) MODEL: W04D

● ENGINE DESCRIPTION

1. Max. output, pleasure craft 82kW (110HP)/3,000 rpm
2. Max. output, work boat 69kW (92HP)/3,000 rpm
(light duty)
3. Type Diesel, 4-cycle, 4-cyl., in-line, over head
valve, water-cooled
4. Aspiration Natural aspirate
5. Combustion system Direct injection
6. Cylinder
Bore x Stroke 104 x 118 mm (4.09 x 4.65 in.)
7. Piston displacement 4,009 liter (244.6 cu.in.)
8. Compression ratio 17.9
9. Direction of rotation Counter-clockwise viewed from flywheel
10. Dimensions without marine gear Approx. 1,026 x 691 x 790 mm
(L x W x H) (40.4 x 27.2 x 31.1 in.)
11. Dry weight without marine gear Approx. 370 kg (816 lb)

● FEATURES

1. Cylinder block Mono block cast iron with replaceable
dry liner
2. Cylinder head Single piece cast iron
3. Crankshaft Induction hardened die forged special
steel with counter weights
4. Piston and rings Heat resistance aluminum alloy
Two compression rings, chrome plated
One oil ring, chrome plated with coil expander
5. Camshaft Induction hardened carbon steel
6. Valves Heat resistance steel

● EQUIPMENT

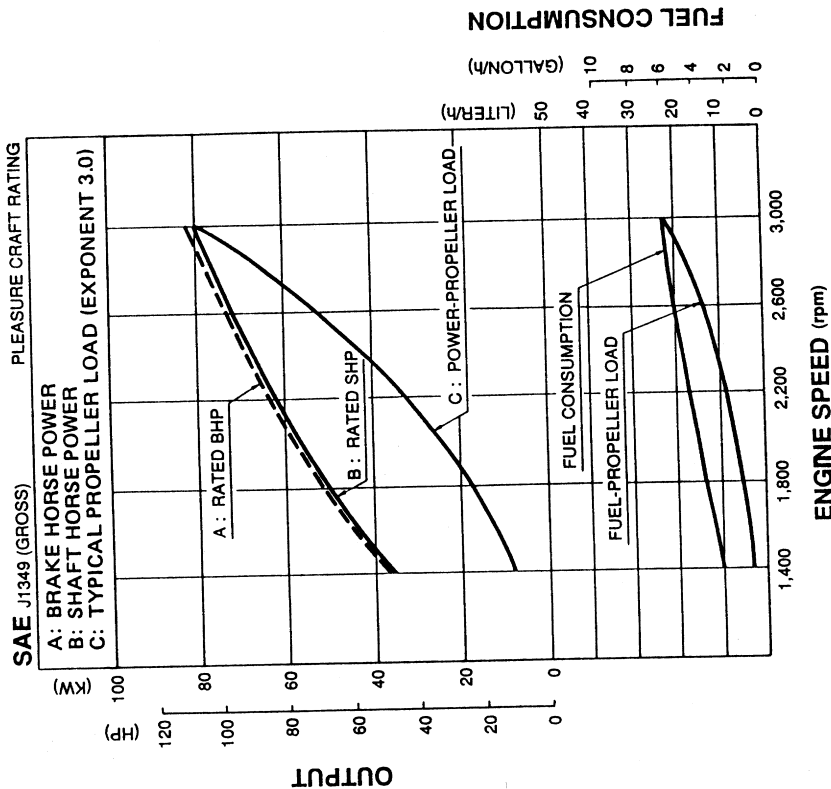
● ENGINE

1. Flywheel housing SAE No.3
2. Flywheel SAE 11 1/2
3. Fuel injection pump BOSCH "A" type with all speed governor
4. Fuel filter Paper element type
5. Water separator Equipped
6. Lube oil pump Full forced pressure feed by gear pump
7. Lube oil filter Paper element type (Full flow)
8. Lube oil cooler Multi plate type, Fresh water cooled
9. Fresh water pump Forced-circulation by volute pump
10. Raw water pump Self priming, Rubber impeller type
11. Intake manifold Inlet position at left side, with air cleaner
12. Exhaust manifold Fresh water-cooled exhaust manifold,
integrated heat exchanger
with expansion tank
13. Starter 12V, 2.5kW
14. Alternator 12V, 50A, with built-in voltage regulator
15. Engine stop solenoid Equipped
16. Emergency stop relay Equipped
17. Starter block relay Equipped
18. Glow plug Equipped
19. Rigid mount bracket Equipped
20. Exhaust riser Cooled by raw water

● INSTRUMENT PANEL

1. Battery switch
2. Starter switch with key
3. Instrument panel lamp switch
4. Tachometer with hourmeter
5. Coolant temperature gauge
6. Oil pressure gauge
7. Fuel gauge
8. Volt meter
9. Pre-heater indicator lamp
10. Coolant temperature warning lamp
11. Charge warning lamp
12. Oil pressure warning lamp

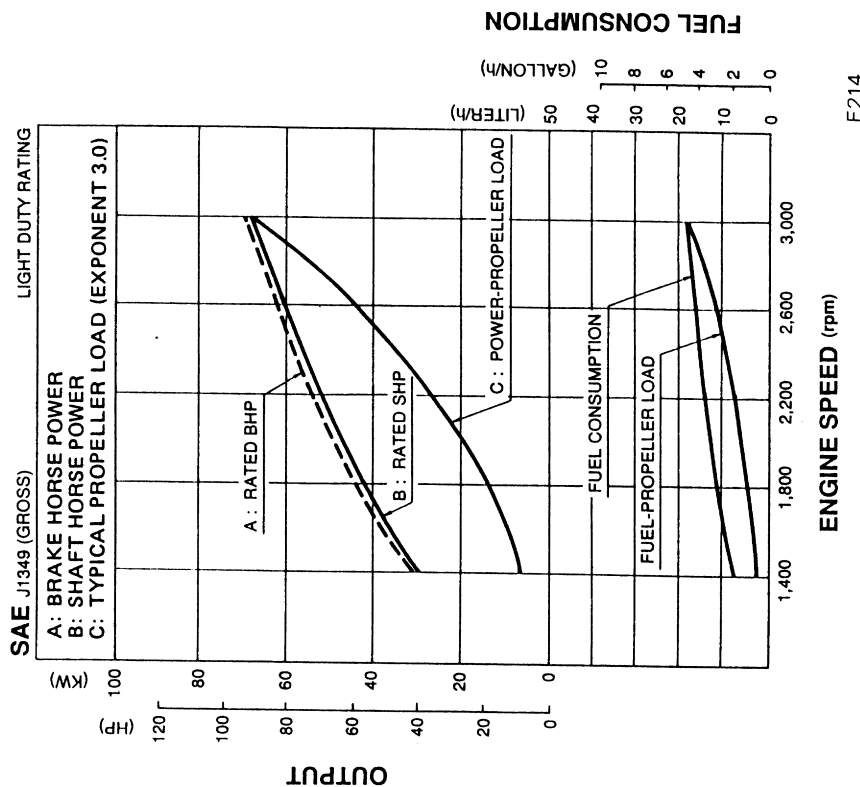
● ENGINE PERFORMANCE CURVE (STD. specs.)



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Note: Engine performance at SAE standard J1349 conditions of 90 m (300 ft.) altitude [100 kPa (29.61 inches Hg) barometric pressure], 25°C (77°F) air intake temperature, and 1 kPa (0.30 inches Hg) water vapor pressure with No. 2 diesel fuel will be within 5% of that shown at the time of engine shipment. Actual performance may vary with different ambient conditions.

Note: These specifications are subject to change without notice.



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(2) MODEL: W04C-T**● ENGINE DESCRIPTION**

1. Max. output, pleasure craft 112kW (150HP)/3,000 rpm
2. Max. output, work boat 93kW (125HP)/3,000 rpm
(light duty)
3. Type Diesel, 4-cycle, 4-cyl., in-line, over head
valve, water-cooled
4. Aspiration Turbocharged
5. Combustion system Direct injection
6. Cylinder
Bore x Stroke 104 x 113 mm (4.09 x 4.45 in.)
7. Piston displacement 3.839 liter (234.2 cu.in.)
8. Compression ratio 17.9
9. Direction of rotation Counter-clockwise viewed from flywheel
10. Dimensions with marine gear Approx. 1,134 x 661 x 790 mm
(L x W x H) (44.6 x 26.0 x 31.1 in.)
11. Dry weight with marine gear Approx. 465 kg (1,025 lb)

● FEATURES

1. Cylinder block Mono block cast iron with replaceable
dry liner
2. Cylinder head Single piece cast iron
3. Crankshaft Induction hardened die forged special
steel with counter weights
4. Piston and rings Heat resistance aluminum alloy
Two compression rings, chrome plated
One oil ring, chrome plated with coil expander
5. Camshaft Induction hardened carbon steel
6. Valves Heat resistance steel

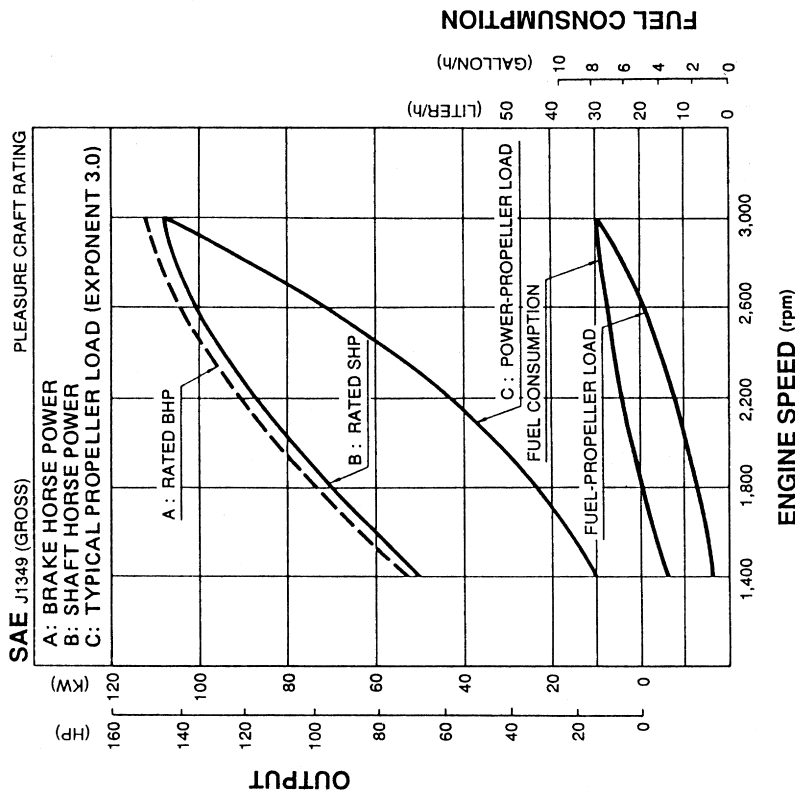
● EQUIPMENT**● ENGINE**

1. Flywheel housing SAE No.3
2. Flywheel SAE 11 1/2
3. Fuel injection pump BOSCH "A" type with all speed governor
4. Fuel filter Paper element type
5. Water separator Equipped
6. Lube oil pump Full forced pressure feed by gear pump
7. Lube oil filter Paper element type (Full flow)
8. Lube oil cooler Multi plate type, Fresh water cooled
9. Fresh water pump Forced-circulation by volute pump
10. Raw water pump Self priming, Rubber impeller type
11. Intake manifold Inlet position at rear
12. Exhaust manifold Fresh water-cooled exhaust manifold,
integrated heat exchanger
with expansion tank
13. Turbocharger Cooled by fresh water, with air cleaner
14. Starter 12V, 2.5kW
15. Alternator 12V, 50A, with built-in voltage regulator
16. Engine stop solenoid Equipped
17. Emergency stop relay Equipped
18. Starter block relay Equipped
19. Glow plug Equipped
20. Rigid mount bracket Equipped
21. Exhaust riser Cooled by raw water
22. Marine gear Equipped

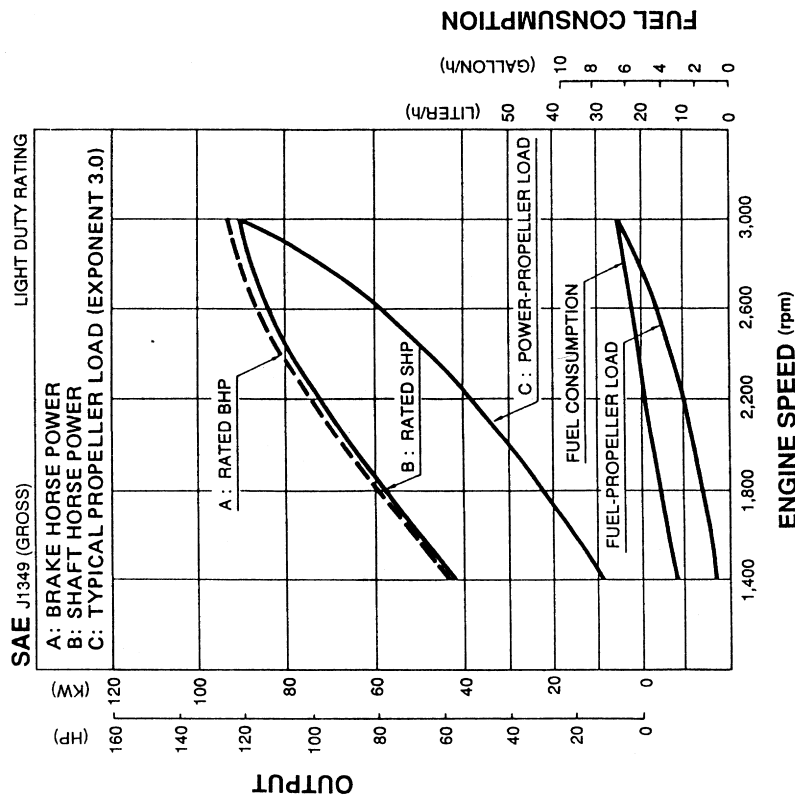
● INSTRUMENT PANEL

1. Battery switch
2. Starter switch with key
3. Instrument panel lamp switch
4. Tachometer with hourmeter
5. Coolant temperature gauge
6. Oil pressure gauge
7. Fuel gauge
8. Volt meter
9. Pre-heater indicator lamp
10. Coolant temperature warning lamp
11. Charge warning lamp
12. Oil pressure warning lamp

● ENGINE PERFORMANCE CURVE (STD. specs.)



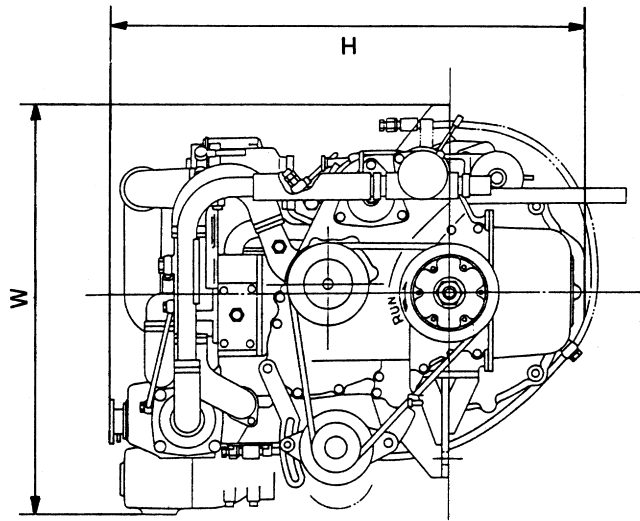
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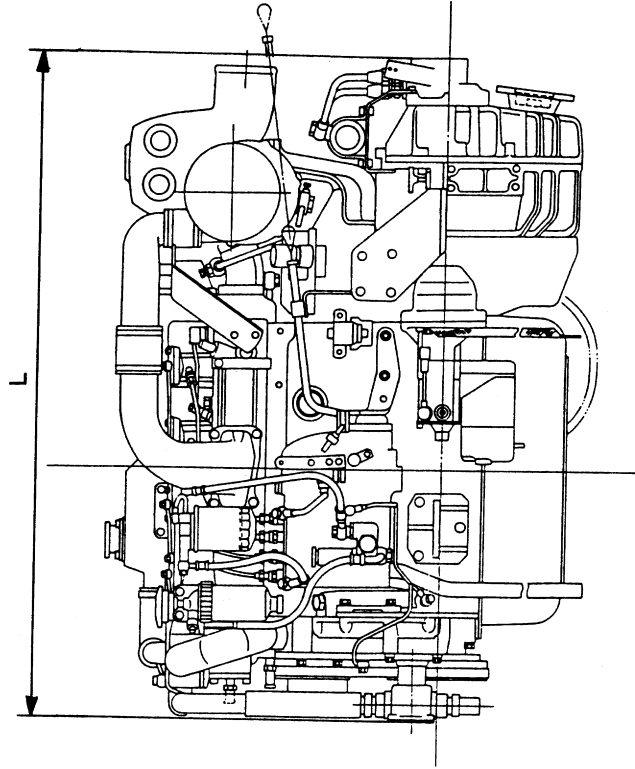
F216

Note: Engine performance at SAE standard J1349 conditions of 90 m (300 ft.) altitude [100 kPa (29.61 inches Hg) barometric pressure], 25°C (77°F) air intake temperature, and 1 kPa (0.30 inches Hg) water vapor pressure with No. 2 diesel fuel will be within 5% of that shown at the time of engine shipment. Actual performance may vary with different ambient conditions.

● Illustration of the External View



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Note: These specifications are subject to change without notice.

(3) MODEL: W04C-TI**● ENGINE DESCRIPTION**

1. Max. output, pleasure craft 157kW (210HP)/3,000 rpm
2. Max. output, work boat 138kW (185HP)/3,000 rpm
(light duty)
3. Type Diesel, 4-cycle, 4-cyl., in-line, over head
valve, water-cooled
4. Aspiration Turbocharged and intercooled
5. Combustion system Direct injection
6. Cylinder
Bore x Stroke 104 x 113 mm (4.09 x 4.45 in.)
7. Piston displacement 3.839 liter (234.2 cu.in.)
8. Compression ratio 16.5
9. Direction of rotation Counter-clockwise viewed from flywheel
10. Dimensions with marine gear Approx. 1,152 x 694 x 790 mm
(L x W x H) (45.4 x 27.3 x 31.1 in.)
11. Dry weight with marine gear Approx. 540 kg (1,191 lb)

● FEATURES

1. Cylinder block Mono block cast iron with replaceable
dry liner
2. Cylinder head Single piece cast iron
3. Crankshaft Induction hardened die forged special
steel with counter weights
4. Piston and rings Heat resistance aluminum alloy
Two compression rings, chrome plated
One oil ring, chrome plated with coil
expander
5. Camshaft Induction hardened carbon steel
6. Valves Heat resistance steel

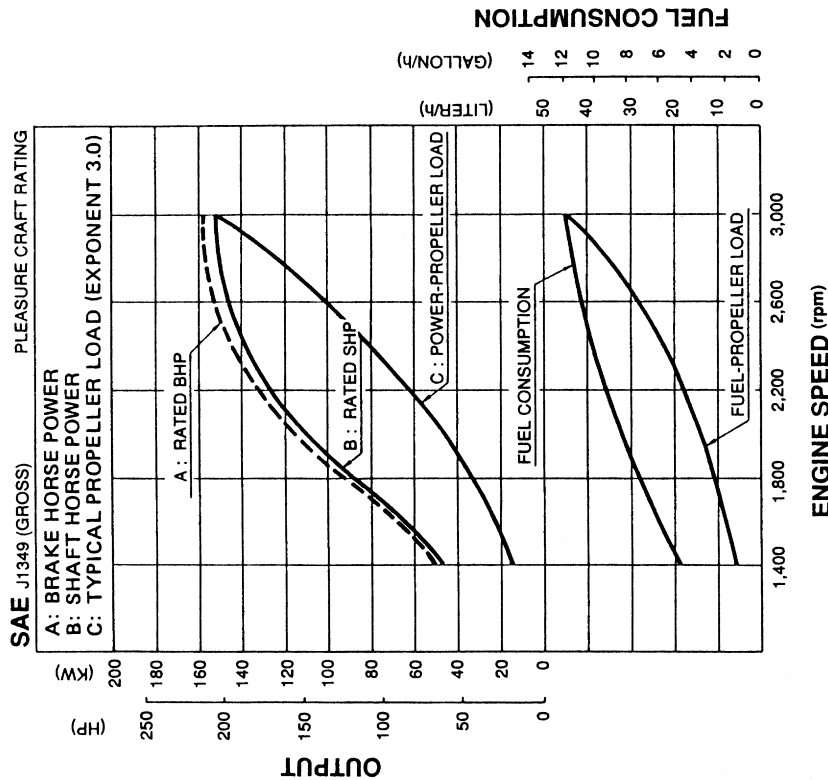
● EQUIPMENT**● ENGINE**

1. Flywheel housing SAE No.3
2. Flywheel SAE 11 1/2
3. Fuel injection pump BOSCH "AD" type with all speed governor
4. Fuel filter Paper element type
5. Water separator Equipped
6. Lube oil pump Full forced pressure feed by gear pump
7. Lube oil filter Paper element type (Full flow)
8. Lube oil cooler Multi plate type, Fresh water cooled
9. Fresh water pump Forced-circulation by volute pump
10. Raw water pump Self priming, Rubber impeller type
11. Intake manifold Inlet position at rear
12. Exhaust manifold Fresh water-cooled exhaust manifold,
integrated heat exchanger
with expansion tank
13. Turbocharger Cooled by fresh water, with air cleaner
14. Intercooler Cooled by raw water
15. Starter 12V, 2.5kW
16. Alternator 12V, 50A, with built-in voltage regulator
17. Engine stop solenoid Equipped
18. Emergency stop relay Equipped
19. Starter block relay Equipped
20. Glow plug Equipped
21. Rigid mount bracket Equipped
22. Exhaust riser Cooled by raw water
23. Marine gear Equipped

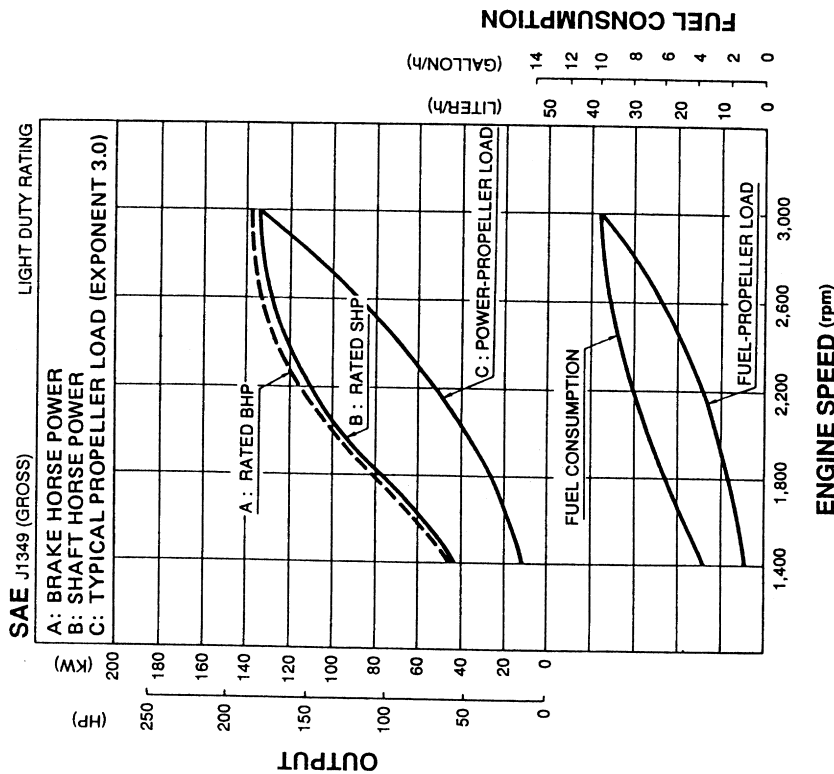
● INSTRUMENT PANEL

1. Battery switch
2. Starter switch with key
3. Instrument panel lamp switch
4. Tachometer with hour meter
5. Coolant temperature gauge
6. Oil pressure gauge
7. Fuel gauge
8. Volt meter
9. Pre-heater indicator lamp
10. Coolant temperature warning lamp
11. Charge warning lamp
12. Oil pressure warning lamp

● ENGINE PERFORMANCE CURVE (STD. specs.)



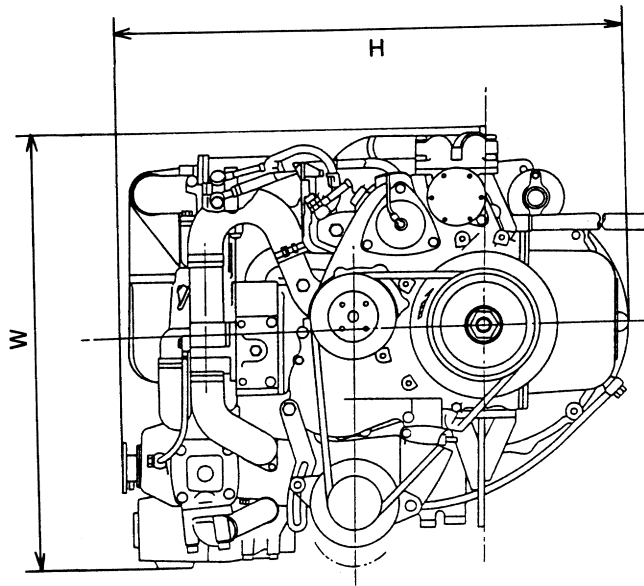
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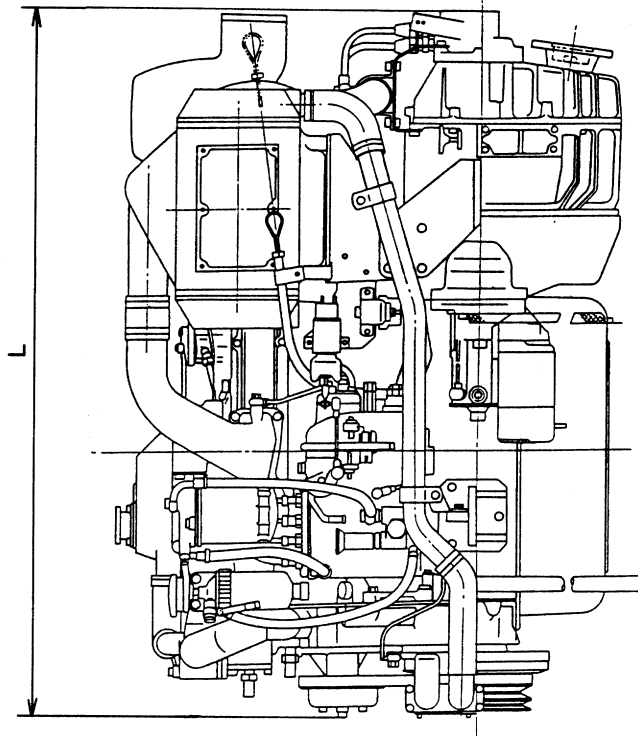
F218

Note: Engine performance at SAE standard J1349 conditions of 90 m (300 ft.) altitude [100 kPa (29.61 inches Hg) barometric pressure], 25°C (77°F) air intake temperature, and 1 kPa (0.30 inches Hg) water vapor pressure with No. 2 diesel fuel will be within 5% of that shown at the time of engine shipment. Actual performance may vary with different ambient conditions.

● Illustration of the External View



F228

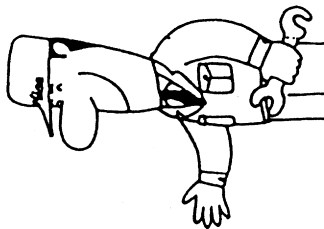
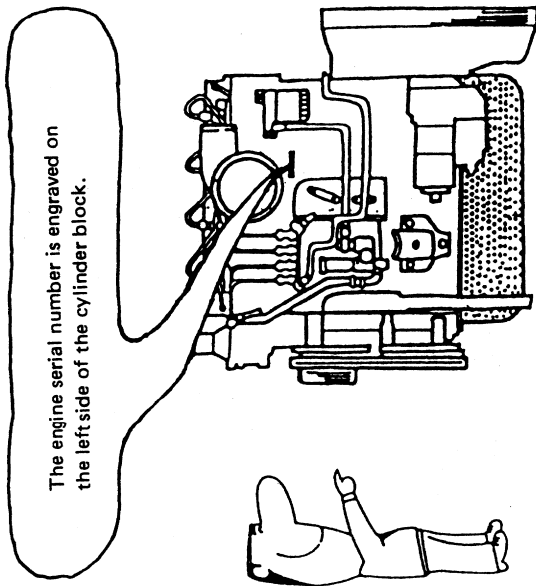


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Note: These specifications are subject to change without notice.

1-2 Engine Serial Number

This number is used for identification purpose when you have your engine inspected. Please quote this number when ordering spare parts or requesting repair work, as this will help you to get prompt service attention.



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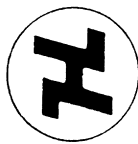
1-3 Regular Maintenance

Even though original parts are of the highest quality, they will deteriorate if they are not inspected and maintained thoroughly at regular intervals. Conduct maintenance as described under **REGULAR MAINTENANCE**.

1-4 Guarantee

1. NO GUARANTEE ON NON GENUINE PARTS

Be sure to use genuine parts. The Hino guarantee does not cover failure or accidents caused by the use of non-genuine, or any trouble with genuine parts stemming from the use of such products.



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2. CARELESS HANDLING NULLIFIES GUARANTEE

The guarantee does not cover failure and accident caused by careless handling. Therefore, read the contents of this book carefully and follow the instructions for correct handling and daily maintenance.

1-5 Warning Related to the Fuel Injection Pump

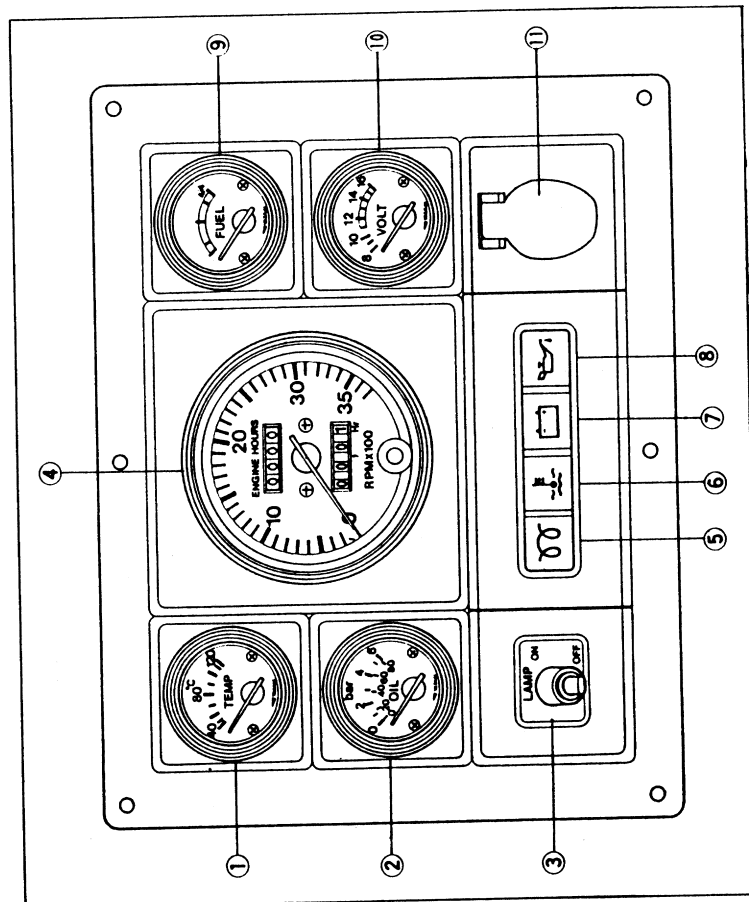
The injection pump is adjusted and sealed to provide the engine optimum performance. Breaking the seal and tampering with the standard adjustment can adversely effect engine performance and function, cause non-conformance with exhaust noise emission regulations, and result in engine damage. The Hino warranty does no cover failures caused by such above-mentioned tampering. When adjustment of the injection pump is necessary, have your qualified service shop to adjust it.

OPERATION

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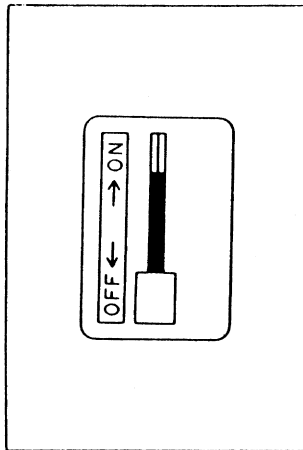
2-1 Instruments Necessary for Operation

1. INSTRUMENT PANEL



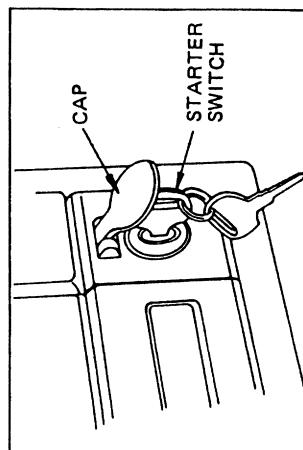
1. Coolant temperature gauge
2. Oil pressure gauge
3. Instrument panel lamp switch
4. Tachometer with hour-meter
5. Pre-heater indicator lamp
6. Coolant temperature warning lamp
7. Charge warning lamp
8. Oil pressure warning lamp
9. Fuel gauge
10. Voltmeter
11. Starter switch

2. BATTERY SWITCH



The switch serves to disconnect the electrical circuit at the positive terminal of the battery. Before operating the starter switch, it is necessary to turn this switch ON. After stopping the engine with the starter switch OFF, be sure to turn this switch OFF.

3. STARTER SWITCH



You may turn the starter switch to the ON, ST, or PH resulting in the following operations.

OFF position

The key can be inserted or removed at this position. After removing the key, be sure to cover the switch with its cap.

ON position

Turning the key to this position closes all circuits except the starter and preheating circuits.

ST position

Turning the key to this position applies power to the starter allowing the starter to crank the engine. The key automatically returns to ON when released.

- (1) Leave the key at ON as long as the engine is running.
- (2) After the engine stops, be sure to turn the key to OFF.

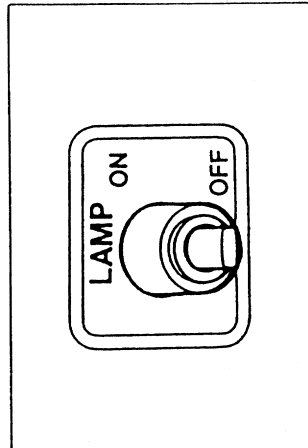
PH position

This position is used during cold weather to heat the glow plugs. Turn the key to this position, hold it until the pre-heat indicator lamp goes out, the engine has been pre-heated and is ready to start.

NOTE:

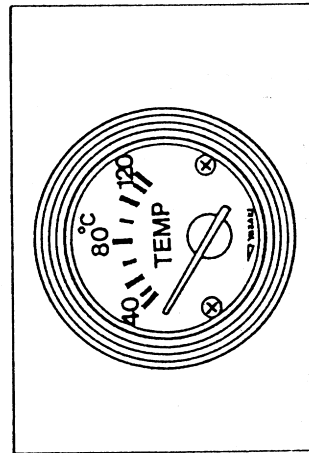
Time required for preheating is usually 15 – 20 seconds.

4. INSTRUMENT PANEL LAMP SWITCH



F088

5. COOLANT TEMPERATURE GAUGE



F129

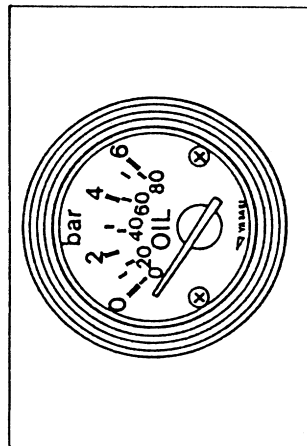
This gauge indicates the engine coolant temperature.

If the indicator marks the dangerous range, idle the engine until the temperature drops. Then stop the engine and examine the cause.

Do not stop the engine immediately.

Normal temperature range	75 – 95°C (167 – 203°F)
Dangerous temperature range	Above 98°C (208°F)

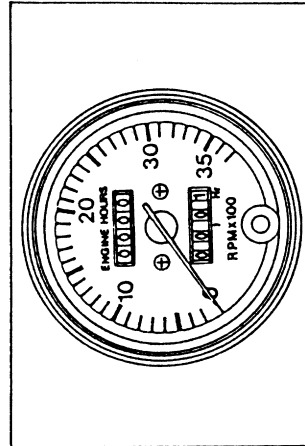
6. OIL PRESSURE GAUGE



F130

This gauge indicates the engine oil pressure. Standard pressure is above 0.5 bar (7 psi) at engine idling speed. The indicated value rises as the engine speed increases. At rated speed: 4 bar (57 psi)

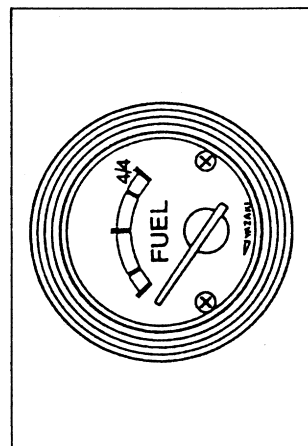
7. TACHOMETER WITH HOURMETER



F131

By this tachometer, the engine revolution speed per minute is indicated. On the other hand, the hourmeter (Operation time accumulation) is incorporated with the internal part of the tachometer. This gauge indicates the accumulated operating time of engine, and referring to operating time shown in this gauge, the inspection and maintenance for each part should be executed.

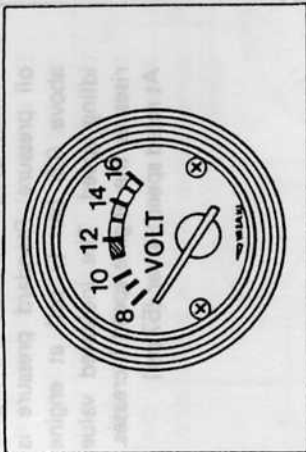
8. FUEL GAUGE



F132

The fuel gauge indicates the approximate level of fuel in the fuel tank. Fill the tank with diesel fuel when the pointer gets near "RED" zone.

9. VOLTMETER

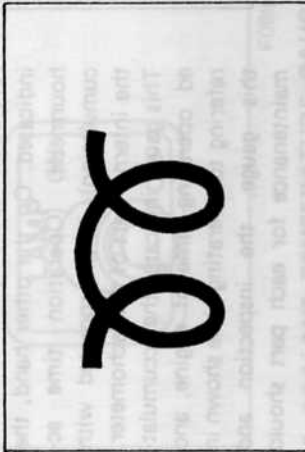


F133

This gauge indicates the battery voltage. With normal operating, the indication should be in the "GREEN" zone.

Indication in the "RED" zone when the starter switch is switched on means that the battery has been discharged excessively or that the generated voltage is not sufficient.

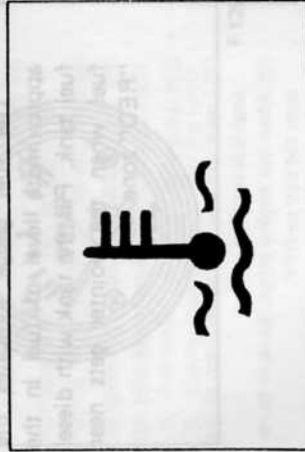
10. PRE-HEATER INDICATOR LAMP



B901

The pre-heater indicator lamp lights when the glow plugs are heating. The lamp will go off, when the glow plugs are hot enough.

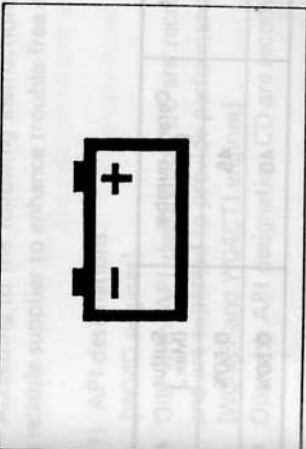
11. COOLANT TEMPERATURE WARNING LAMP



F134

If the coolant temperature becomes too high, the warning lamp lights up and the engine automatically stops.

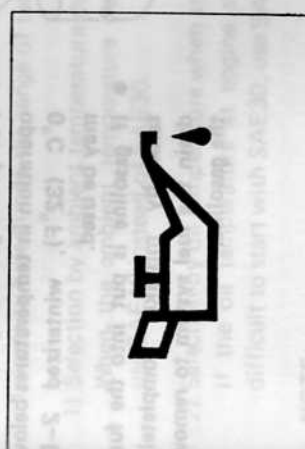
12. CHARGE WARNING LAMP



F135

The charge warning lamp indicates the state of the charging circuit. The lamp is operating normally if it lights with the starter switch in the "ON" position before starting and goes off once the engine is started.

13. OIL PRESSURE WARNING LAMP



F136

If the oil pressure is abnormally low, the warning lamp lights up and the engine automatically stops. The lamp is operating normally if it lights with the starter switch in the "ON" position before starting and goes off once the engine is started.

3) Brand of lubricants:

Refer to **TABLE 5, "Recommended Lubricants"** for brands of engine oil.

4) Additives:

Engine oil additives or break-in oils should not be used.

3. COOLANT,

(1) Regular replacement of coolant

- 1) Every 6 months, drain, flush, and fill the cooling system with a new coolant.
- 2) Before each winter and summer drain, flush and fill the cooling system with a new coolant. At the same time, adjust the concentration of antifreeze solution to provide required freezing and corrosion protection.

(2) Antifreeze and water conditioner

1) Engine coolant

Use the water and the water conditioner as the engine coolant.

Using only water may cause corrosion of the cooling system and engine parts and clogging of the heat exchanger.

2) Water

Water for the cooling system should be clean, free from deposit and scale forming materials, and corrosive chemicals.
Do not use pre-softened water.

3) Antifreeze

Use ethylene glycol base antifreeze conforming to ASTM D3306.

Do not use methanol base, methoxypropanol base antifreeze, etc.

WARNING

Be careful not to spill antifreeze over the hot exhaust system which can cause fire, personal injury and/or property damage.

Concentration of antifreeze

The freezing point of the coolant varies with the concentration of antifreeze. Select the appropriate concentration to protect against freezing according to the following table.

Antifreeze-Water Mixing Table

Safe temperature °C (°F)	Antifreeze %	Water %	Freezing temperature °C (°F)
-11 (12)	30	70	-16 (3)
-16 (3)	35	65	-20 (- 5)
-20 (- 4)	40	60	-25 (-13)
-26 (-15)	45	55	-31 (-24)
-33 (-27)	50	50	-37 (-36)
-40 (-40)	55	45	-45 (-49)
-48 (-54.4)	60	40	-53 (-63.4)

Cooling system capacity 16.5 liters (4.4 US gal), (3.6 Imp.gal)

NOTE:

Do not mix more than 60 percent or less than 30 percent antifreeze.

Concentration over 60 percent result in a loss of freezing protection.

Concentration under 30 percent result in a loss of corrosion protection.

4) Thermostat

The thermostat controls the coolant flow to the heat exchanger, and thereby maintains the proper coolant temperature.

2-3 Procedure for Engine Starting and Stopping

1. CHECK BEFORE STARTING

Before starting the engine, make the following checks.

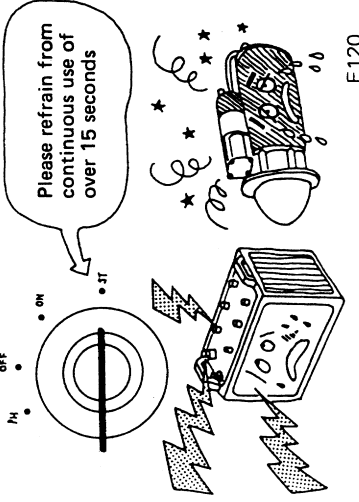
- (1) Engine oil level
- (2) Coolant amount and heat exchanger cap function
- (3) Fuel level (Include opening fuel valve)
- (4) Tension of accessory parts drive belts
- (5) Fuel, oil, coolant and exhaust system for leaks
- (6) Electrical connections
- (7) Shut-off system

WARNING

Before closing the engine room hatch, make sure that there is no one around the engine or in the engine room. Also be sure that hand tools, gloves, waste, etc. are not-left on or around the engine.

2. ENGINE STARTING

- (1) Turn the battery switch on.
- (2) Place the transmission selector lever in the neutral position.
- (3) Insert the key into the starter switch. Turn the key to ON and check the meter to work properly. If there is anything wrong, turn off the starter switch and determine the cause of malfunction.
- (4) When the temperature is low [below -10°C (14°F)], use the pre-heater system. Turn the starter key to "PH", hold it in this position until the pre-heat indicator lamp goes out, before starting the engine. This procedure must be repeated several times in a cold weather.
- (5) As W04CT and W04CT1 engines are provided with a turbo charger, if the engine has not been used for a prolonged period of time, the inside of the turbo charger should be lubricated before running. For the lubrication, keeping the accelerator lever in the STOP state, idle the engine for 10 to 15 seconds.
- (6) Set the accelerator lever (fuel and speed control lever) to the START position, then start the engine by turning the key to the "ST" position. As soon as the engine starts, release the key. It will automatically return to the "ON" position.
- (7) After the engine starts, set the accelerator lever to the proper position.
- (8) If the initial firing does not occur though above starting action is repeated by two times, check fuel and electric systems.



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- (9) Do not operate the starter continuously for more than 15 seconds at a time.
When the engine does not start on the first attempt, wait more than 30 seconds before trying again.

3. INSPECTION WITH ENGINE IDLING

Allow the engine to warm up at idling speed (800 r.p.m.). After ample time has been allotted to warm-up, check the following points in preparation for engine operation.

- (1) Instrument gauges and lamps function (oil pressure, battery charge, coolant temperature, etc.)
- (2) Engine operating condition
The exhaust gas should be colorless or light blue. The engine should not emit any unusual noises.
- (3) Battery charge
Make sure that the charge warning lamp goes off.

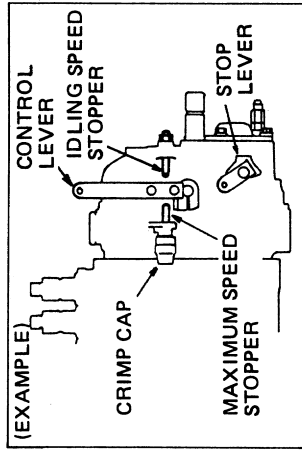
NOTE:

Do not race the engine during the warm-up period since this can reduce the engine life.

4. ADJUSTMENT OF ENGINE IDLING SPEED SETTING

When straight drive navigation is not smoothly made at the time of a sea trial in idle rotation, adjust it according to the following procedures.

- (1) Disconnect the throttle control cable from engines of the port side (left) and the starboard side (right).



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- (2) Adjust through varying the engine speed using the idling speed stopper bolt of the injection pump so that straight drive navigation is made.

Increase in engine speed:

Tighten the idling speed stopper bolt clockwise.

Decrease in engine speed:

Loosen the idling speed stopper bolt counterclockwise.

- (3) Upon completion of adjustment of engine idling speed, lock the nut and apply paint on the nut.

NOTE: All adjusting devices on the fuel injection pump governor, except the idling speed stopper, are sealed with crimp caps as a protection for the customer. This is to prevent unauthorized readjustment which may cause engine malfunction and/or engine failure. Periodically check to insure that these seals are not broken, as this will void the warranty.

5. CAUTION AFTER OPERATION

- (1) Before stop the engine, idle the engine for more than 5 minutes. When the engine seems to be overheated, stop it after the temperature of the engine coolant would drop properly. You can stop the engine by turning the starter key to OFF position.
- (2) You should repair abnormal points which you would find out during operation.

2-4 Handling in Cold Weather

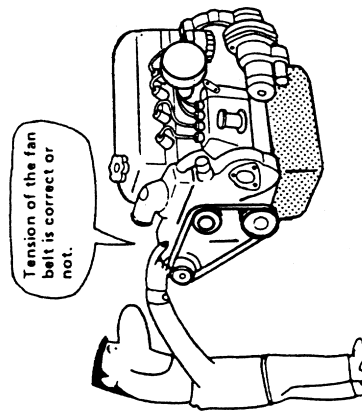
When the atmospheric temperature drops, change the lubricating oil and coolant. Bear in mind the following points during cold weather.

1. Use a lubricating oil with a low viscosity. For details, refer to the **Recommended Lubricants list** at the end of this Handbook.
2. Use antifreeze in the cooling system. For further information, refer to the **Recommended Lubricants list**.
3. Keep the battery as fully charged as possible.
4. When distilled water has been added to the battery, be sure to charge the battery immediately.
5. Keep the fuel tank full to avoid moisture accumulation. As the fuel is consumed, air is drawn through the vent and moisture may accumulate in the fuel tank.

Antifreeze

- (1) Make sure that there are no leaks in the cooling system.
 - (2) Remove the heat exchanger cap. Loosen the heat exchanger plug and the engine drain plug. Drain all coolant from the system.
 - (3) If the drain is dirty, flush the cooling system.
 - (4) Drain the complete system and tighten the heat exchanger plug. Also tighten the drain plug on the cylinder block, if it is loose.
 - (5) Fill the system with appropriate concentration of antifreeze solution.
- When topping up the cooling system, it is essential that only antifreeze solution (of the correct strength) is used. Plain water dilutes the solution in the system and reduces the degree of protection. Do not overfill the system.
- (6) Properly close the heat exchanger cap.
 - (7) Hino Motors recommends only an ethylene glycol antifreeze. Alcohol or methanol based antifreeze and plain water are not recommended.
 - (8) Recommended antifreeze solution can be used for six months normal operation without draining. After six months the coolant must be drained, and the system should be flushed with flushing agent and then refilled with fresh antifreeze solution.

2-5 Handling in Hot Weather



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Pay close attention to the cooling system during hot weather.

1. Change the coolant often. Make sure that the cooling system is always clean.
2. Check and adjust the fan belt tension.

3. If the coolant temperature gauge pointer swings into dangerous temperature range, idle the engine until the temperature drops. Do not stop the engine immediately. Overheating is usually indicated by boiling and loss of coolant. In such cases, never fill up right away with cold coolant as the sudden change of temperature may crack the cylinder head. Always allow the engine to cool down first.

4. Handling when the engine is overheating

The heat exchanger cap is of the pressure type and so bear the following points in mind:

- (1) Do not stop the engine immediately but keep it idling until the temperature drops sufficiently.
- (2) Turn the cap of the heat exchanger.
- (3) Next, make sure that the overflow pipe has stopped blowing out hot water and steam. Then remove the heat exchanger cap.
Do not run the engine with the heat exchanger cap turned.
- (4) For refitting the cap, turn the cap clockwise until it stops.

WARNING

The heat exchanger cap should not be removed while the engine and cooling system are still hot.
If the heat exchanger cap is removed right after the engine is shut off, scalding water and steam blown out under pressure may cause personal injury.

2-6 Engine Shut Down

1. Return throttle lever to idling position.
Idle the engine for more than 5 minutes before stopping the engine.
2. To stop the engine, turn the starter key to OFF position.
3. Battery switch to OFF position.
4. Carefully inspect engine for any signs of oil, fuel, water or exhaust leakage.
5. Take appropriate corrective action for any indicated leakage, and for any trouble noticed during operation.

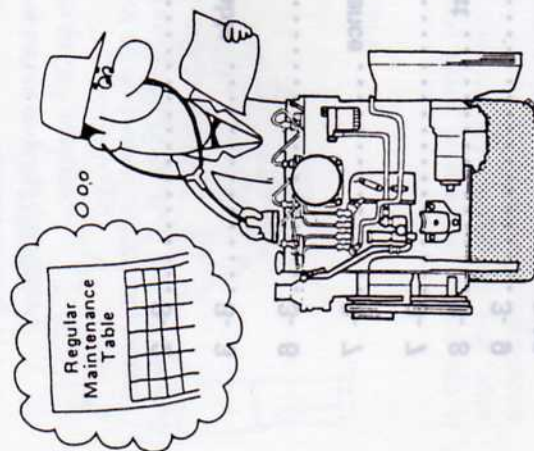
MAINTENANCE

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3-1 Regular Maintenance

Regular maintenance assures you the efficient operation and the normal life of the engine.

As the inspection and maintenance period shown here is only standard ones, it may be necessary to shorten the period according to the operating condition and environment.



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3-2 Regular Maintenance Table

Item	Action service	Checking timing (by the operation hours)					Remarks
		For new engine, 30 hours	Every 120 hours	Every 250 hours	Every 500 hours	Every 1000 hours	
Engine							
Valve clearance	Check & adjust	○			○		
Compression pressure	Check					○	
Cylinder head bolts	Check & retighten	○				○	
Engine mounting bracket bolts	Check & retighten					○	
Air intake and exhaust							
Intake and exhaust manifold mounting bolts	Check & retighten	○				○	
Oil pan bolts, etc.	Check & retighten	○				○	
Air cleaner	Check & clean		○				
Inter cooler [W04CTI engines]	Replace			○			Every 1 year
	Check & clean						
Turbocharger [W04CT and W04CTI engines]							
Security of bolts, nuts and other fasteners	Check	○	○				
Rotation of rotor and impeller	Check			○			
Play in rotor	Check			○			
Leak inspection of lubrication system of turbo charger	Check		○				
Lubrication system							
Oil level	Check						Daily inspection
Oil filter	Replace		○				Whenever changing the oil, replace.

No.	Item	Action service	Checking timing (by the operation hours)					Remarks
			For new engine, 30 hours	Every 120 hours	Every 250 hours	Every 500 hours	Every 1000 hours	
7	Coolant pump rubber hose	Replace						Every two (2) years
8	Sea water pump	Check & clean				○		Or every one (1) year
Electrical system								
1	Electrolyte level of battery	Check	○					Every 30 hours
2	Specific gravity of the electrolyte of battery	Check		○				Or every six (6) months
3	Starter	Check						Every one (1) year
4	Alternator	Check						Every one (1) year
5	Glow plug	Check						Before winter season check the function
6	Emergency stop relay system	Check						Every six (6) months

No.	Item	Action service	Checking timing hours					Remarks
			For new engine, 30 hours	Every 120 hours	Every 250 hours	Every 500 hours	Every 1000 hours	
Fuel system								
1	Fuel injection nozzle pressure	Check, clean & adjust	○			○		
2	Injection timing	Check & adjust	○			○		
3	Water separator	Check & drain						Daily drain water
4	Fuel injection pump coupling	Check	○			○		
5	Fuel filter	Replace		○				
6	Fuel feed pump strainer	Check & clean		○				
7	Fuel tank	Check & clean				○		Strainer at the suction port of the fuel tank
		Check & drain		○				Drain water in the tank
8	Fuel tank level	Check						Daily inspection
9	Fuel hose	Replace						Every two (2) years
Cooling system								
1	V-belt	Check & adjust	○					Every 30 hours
2	Replacing of the coolant	Replace						Every six (6) months
3	Cooling system	Clean						Every six (6) months
4	Heat Exchanger	Check & clean						Every one (1) year
5	Coolant amount	Check						Daily Inspection
6	Thermostat function	Check				○		

3-3 Lubrication Table

In order to assure the engine normal life, it is necessary for you to make the lubrication at proper timing. Please do it according to the lubrication table below.

Item	Timing & others	Timing (by operation hours)					Remarks
		For new engine, 30 hours	Every 120 hours	Every 250 hours	Every 500 hours	Every 1000 hours	
1. Engine		●	●				Every one (1) year Check before starting ○
2. Engine control joint			⊕				
3. Coolant pump				⊕			
4. Alternator						●	Lithium bearing grease (*)
5. Starter						●	Suitable amount After disassembly (*)

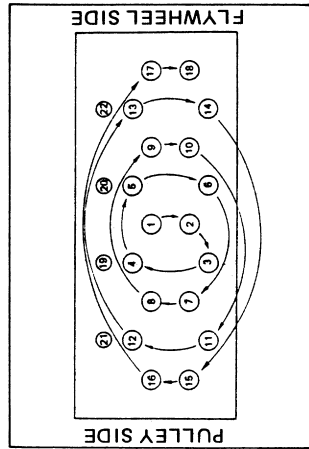
CAUTION:

- 1) Clean the grease fittings
- 2) Replace the grease fittings whose head is deformed with new one.
- *) Kind of lubricant for alternator and starter are shown in the page.
- 3) At the same time, replace the oil filter.

3-4 Inspection and Maintenance

1. ENGINE

(1) Retighten the cylinder head bolts



Order of tightening bolts F284

First 30 hours on new and overhauled engine. After that every 1,000 hours.

- 1) Remove the rocker cover.
 - 2) Tighten the cylinder head bolts to the specified torque with the specified sequence by using a torque wrench.
- First loosen the cylinder head bolt only 1/8-1/4 of a turn, and retighten it with the final torque. Perform this procedure one by one, never loosen and retighten all bolts at a time.

NOTE: ● No. 1 - No. 18 Bolts : Cylinder head bolt
● No. 19 - No. 22 Bolts : Cylinder head additional bolt

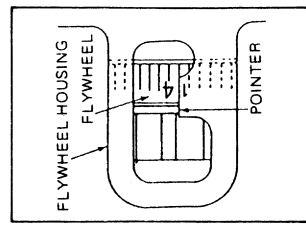
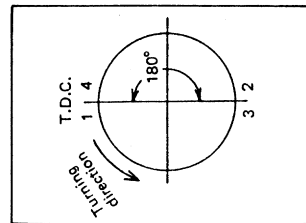
(2) Check and adjustment of the valve clearance

First 30 hours on a new and overhauled engine. After that every 500 hours.

Valve clearance (cold)

Unit: mm (in.)

	W04D	W04C-T	W04C-Ti
Intake	0.30 (0.0118)	0.30 (0.0118)	0.35 (0.0138)
Exhaust	0.40 (0.0157)	0.45 (0.0177)	0.50 (0.0197)



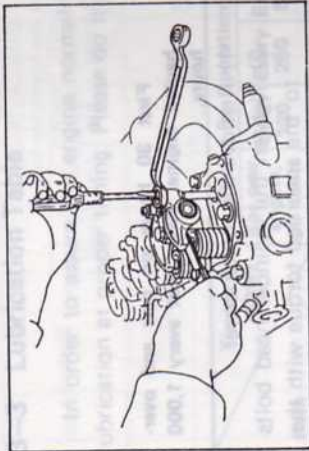
F162

SM3-885

Check and adjust the valve clearance as follows.

- 1) Remove the rocker arm cover.
- 2) Rotate the flywheel counter-clockwise (viewed from flywheel side) and align the timing mark, 1-4 on the flywheel, to the pointer so that either No. 1 or No. 4 piston will be located at the top dead center.

- 3) Decide that either No. 1 or No. 4 piston, of which rocker arms have the free up and down movement, is at the top dead center of compression stroke



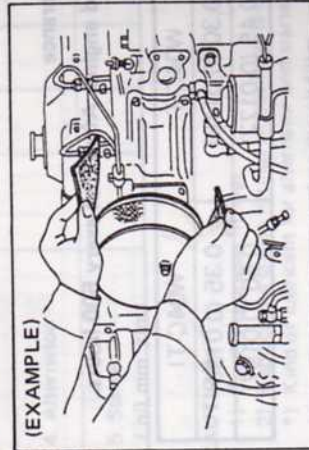
SM3-715

4) Insert the thickness gauge between the valve stem and the rocker arm and adjust the valve clearance to the specified value by screwing or unscrewing the adjusting screw. Tighten the adjusting screw lock nuts.

5) Rotate the flywheel counterclockwise (viewed from flywheel side) and align the timing mark 3-2 to the pointer and adjust the valve clearance in the same manner. Do this adjustment for the remaining pistons following to the injection order, 1-3-4-2.

2. AIR INTAKE AND EXHAUST

(1) Air cleaner

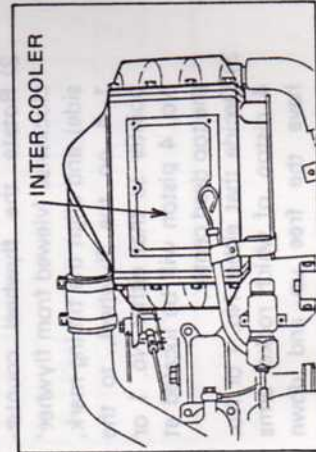


(EXAMPLE)

Replacement of the element should be done at **every 250 hours** operation.

F164

(2) Inter cooler [W04CTI engines]



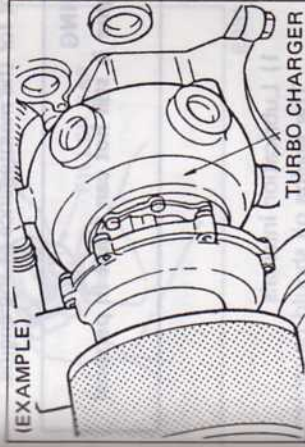
F165

1) Check and clean intercooler fins. Since the cooling fin pitch is very small, carbon, ash, etc. may accumulate on fins.

2) Check inside of raw water pipe and remove accumulated seaweed, salt, and deposit from the pipe.

3. TURBO CHARGER [W04CT and W04CTI engines]

(1) Check on rotating condition of rotor



TURBO CHARGER

F094

Rotating condition of rotor is diagnosed by unusual noise while rotation. Gradually accelerate the engine while the end of stethoscope is applied to the turbocharger case. High pitch noise every 2 to 3 seconds indicates faulty condition of the rotor on the bearing.

Disassemble and repair the defective parts or replace the turbocharger assembly if necessary.

(2) Caution for installation of turbocharger.

To install the turbocharger to the engine, follow the undermentioned points. Be careful to keep the turbocharger from the foreign matter getting into it.

1) Lubrication system

- Before installation, pour new engine oil into the oil inlet port of turbocharger and rotate the turbine shaft by hand to lubricate journal bearing and thrust bearing.
- Wash and clean oil feed and return pipes. Check these pipes for any damage or clogging.
- Install the pipes securely. Check connections for oil leakage.

2) Intake system

- Be sure that the intake system has no dirt nor foreign matter.
- Install the rubber hoses. Connections with air duct and air cleaner should be tight.

3) Exhaust system

- Be sure that the exhaust system is free from any dirt or foreign matter.
- Since bolts and nuts are of heat-resisting steel, be careful not to mix them with ordinary bolts and nuts. Apply seizure preventing compound to the threads of the bolts and nuts before installing them.
- Gas should not leak from connections of the exhaust system.

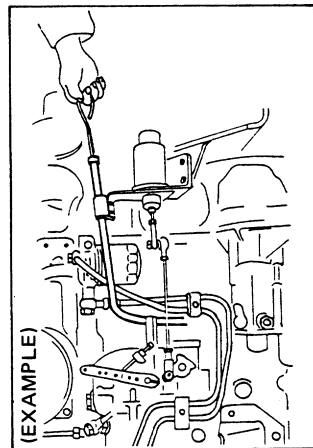
4. LUBRICATING SYSTEM

Lubrication of the engine with proper lubricant following appropriate procedures at correct intervals is very important for the maintenance of the engine.

WARNING

Doing replacement work while the engine is still hot can result in personal injury.

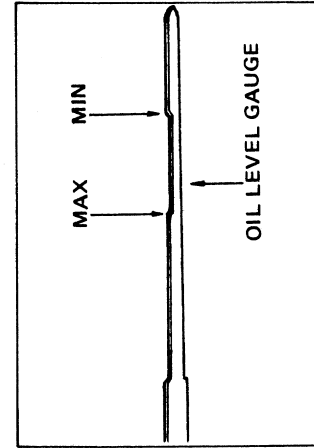
(1) Engine oil



F166

1) Lubrication intervals

The engine oil should be replaced at **first 30 hours** operation for a new engine or after overhaul. Then, at **every 120 hours** operation, change the engine oil. At the same time, replace the filter element.

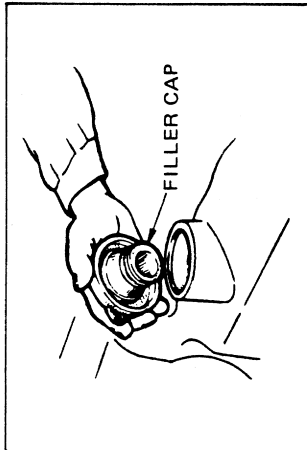


F071

The oil level should be kept between the Max. and Min. marks on the gauge. Check the oil level of the engine before starting the engine or at least 30 minute after the engine has been stopped.

2) Replenishment of the oil

Remove the filler cap then fill the oil. Measure the oil level 6 minutes later after completion of filling. Do not mix the engine oil, either by brand or type. Do not overfill oil to the cylinder block. Excessive oil will increase the oil consumption or be blown out the cylinder block breather.

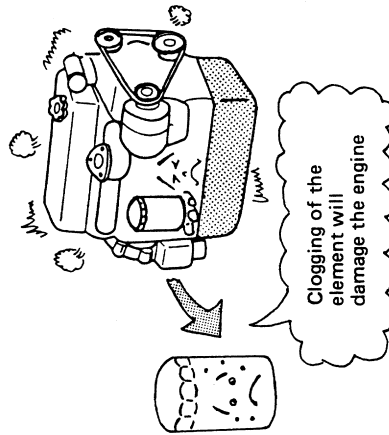


E031

WARNING

When adding oil, be careful not to spill oil. When the exhaust system is still hot, spilled oil on the hot exhaust system can cause personal injury and/or property damage due to fire. Do not spill oil on the electric system. If oil is spilled, carefully wipe it off with a cloth.

(2) Oil filter

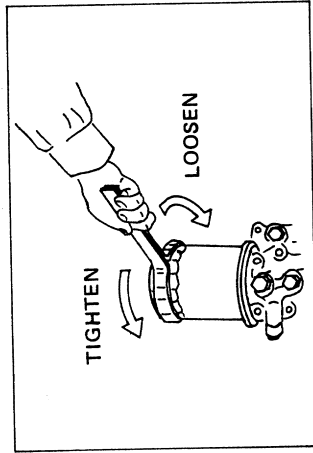


F167

The full-flow type oil filter (Spin-on type filter) is equipped. Replacement of the element should be done at the same time when the engine oil is replaced.

Every 120 hours

For engine with 9 liters (2.37 US.gal) (1.98 Imp.gal) oil pan.



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Replacement:

- Remove the drain plug and allow the oil in the filter to drain fully.
- Remove the element with special tool (09553-1010) or suitable band wrench.
- Install the element by hand to stop. Apply the engine oil to the oil filter gasket.
- Tighten it about 3/4-1 turn with tool. After installing, turn the engine and check the oil filter for oil leakage.
- Operate the engine for a few minutes and check the oil leakage from the filter.
- When replacing engine oil filter, check the engine oil level after engine stopping.

WARNING

Using an inappropriate filter may shorten engine life and can result in personal injury and/or property damage due to fire.

5. FUEL SYSTEM

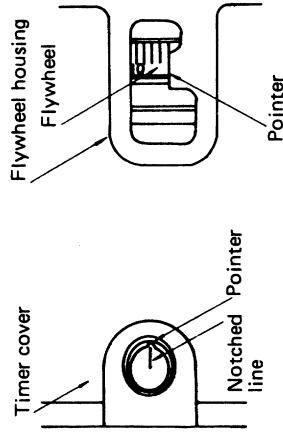
(1) Fuel injection nozzle

First 30 hours on a new and overhauled engine. After that every 500 hours. Check the nozzle for injection pressure and spraying condition and adjust it if necessary. This check and adjustment should be performed by your qualified service shop.

(2) Fuel injection pump

First 30 hours on a new and overhauled engine. After that every 500 hours.

Check and adjust the injection timing as follows.



Rotate the flywheel counterclockwise (viewed from flywheel side) and set the specified timing of No. 1 piston on compression stroke. Then make sure that the pointer of the injection pump's timer cover inspection port is matched with the notched line located along the circumference of the coupling.

Injection timing:

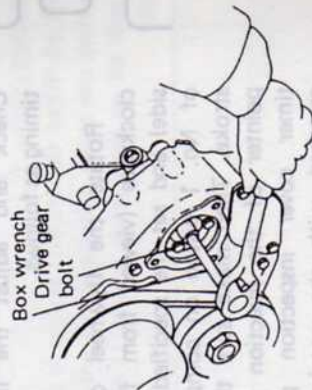
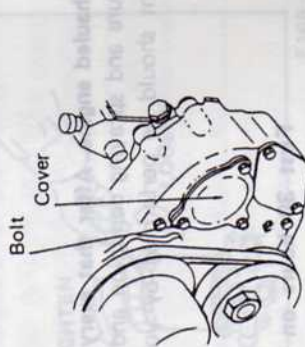
B.T.D.C. of No. 1 piston on compression stroke

W04D	14°
W04CT and W04CTI	17°

Adjustment:

When the timing on the timer outer circumference is not aligned with the pointer, adjust it as follows.

1. Remove the cover.
 2. Loosen the drive gear bolts. Do not drop the bolt into the gear cover.
 3. Align the pointer and notched line by turning the timer.
 4. Tighten the drive gear bolts.
- Tightening torque:
300—350 kg-cm (22—25 lb.ft)
5. Install the cover.



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WARNING

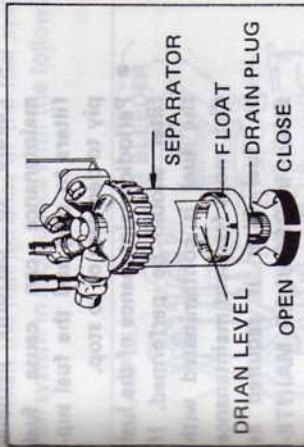
Seals on the injection pump

The injection pump is adjusted so as to demonstrate optimum performance of the engine and sealed. To change the standard adjustment by removing the seals can adversely affect the engine performance and cause the engine failure. In such case, you are not entitled to be covered by Hino warranty. If the injection pump adjustment is required, it should be performed by your qualified service shop.

(3) Water separator

Daily inspection and maintenance should be performed properly. Water collected in the separator could enter the fuel line and cause damage to the injection pump.

Check the water separator for accumulated water indicated by the float. Drain the water from the separator by loosening the drain plug before the float reaches the drain level.



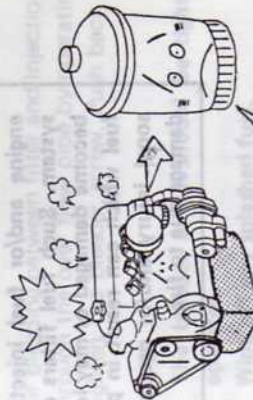
E-259

(4) Fuel filter

The full-flow type fuel filter (Spin-on type filter) is equipped.

Dust and/or water in the fuel cause premature wear to the injection pump and nozzles.

The element should be replaced with new one **at every 120 hours operation.**



Clogging of the fuel filter element will cause lack of the power.

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(EXAMPLE)



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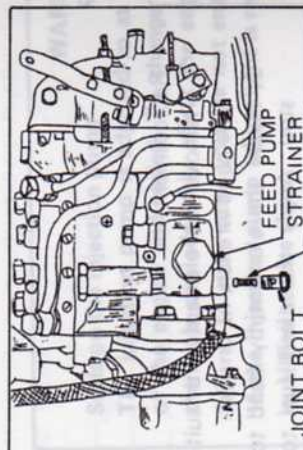
- Replacement:
1. Remove the element with suitable band wrench.
 2. Install the element by hand to stop. Apply the diesel fuel to the gasket.
 3. Tighten it about 2/3 turn with tool. After installing, turn the engine and check the fuel filter for fuel leakage.

NOTE:

- Failure to perform periodic maintenance can cause fuel filters to clog and the fuel supply to decrease or to stop.
- Periodic maintenance of the fuel filter should be performed. If the fuel is contaminated with dirt, more frequent maintenance on fuel filter is required as shown in **REGULAR MAINTENANCE TABLE**.

WARNING

Using improper fuel filters can shorten the life of the engine and/or fuel injection system. Such fuel filters can become damaged or may leak fuel which can result in personal injury and/or property damage due to fire.

(5) Fuel feed pump

E-152

Every 120 hours

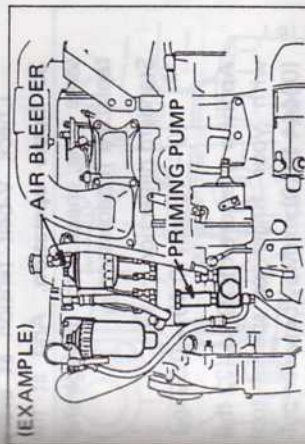
Disconnect the line from the feed pump and take out the strainer. Clean the strainer with fuel.

Reinstall the strainer with new gaskets.

Be careful not to let dirt enter the fuel line.

(6) Air bleeding from the fuel system

When the maintenance of the fuel system has been made, bleed the air from the fuel system in accordance with the following procedure.



F-171

- 1) Loosen the air bleeder screw of the fuel filter, and operate the priming pump knob until the air will not come out from the bleeder screw.
After that, tighten the screw.

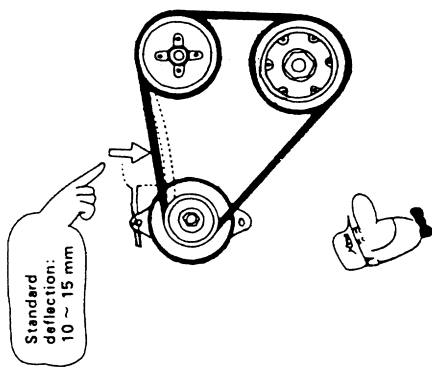
- 2) Air bleeding between filter and injection pump can be conducted automatically through the over flow pipe by operating the priming pump knob several times. Tighten the bleeder screw. Push back the priming pump knob and tighten it.

NOTE:

- The bleeder screw should be tightened while the priming pump knob is operated.
- Wipe off any splashed fuel.

6. COOLING SYSTEM

(1) V-belt



1) V-belt tension

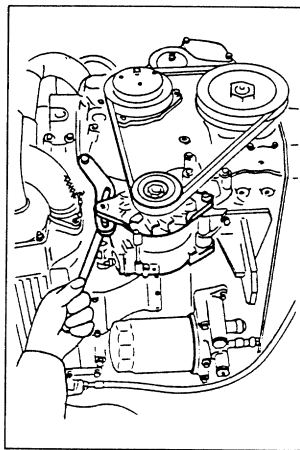
Check V-belt tension **at every 30 hours operation**. And at the same time, check it for damage and replace it if necessary.

Standard deflection:

10 — 15 mm (0.40 — 0.59 in.)

Apply a pressure of 10 kg (22 lbs) with your finger or special tool (09444-1210) midway between pulleys.

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2) Adjustment

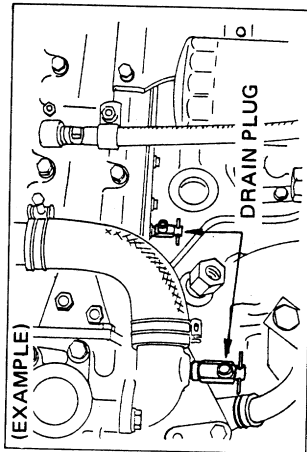
Loosen the alternator brace adjusting bolt and move the alternator by prying the alternator to adjust the tension.

NOTE:

- When a new V-belt is installed or the tension is adjusted, run the engine for several minutes after installation or adjustment. Then check and adjust the tension again. Repeat this operation several times.
- Do not pry the alternator body directly with a lever, since this can damage the alternator.
- Belt too tight will cause short belt life and may damage alternator bearings. Belt too loose may jump out of pulley grooves or slip and cause short belt life.

(2) Heat exchanger

The pressure type heat exchanger is used. This pressurizes the heat exchanger by 0.5 kg/cm² (7 psi) raising the boiling point of the water to 106 — 110°C (223 — 230°F), and finally increasing the cooling performance.

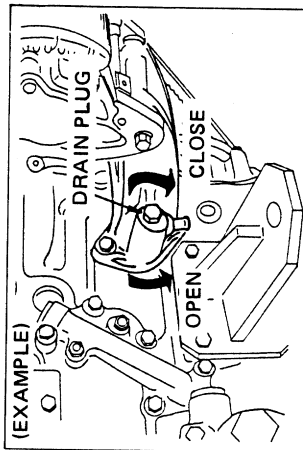


Heat exchanger

F174

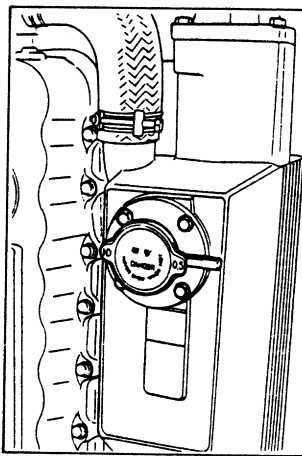
1) Draining the coolant

The drain plug are located at the lower of the heat exchanger and the generator bracket of engine right side. The coolant can be drained by opening the drain plug after removing the heat exchanger cap.



Engine

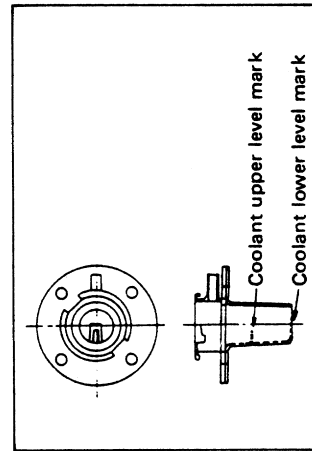
F175



F108

2) Pressure type cap

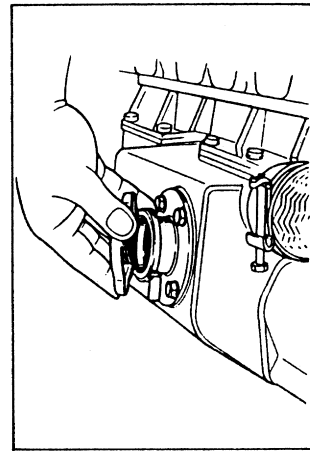
- Turn the cap to release cooling system pressure.



F070

- b. Check the coolant level and add coolant if required (Coolant must be filled as far as its level, between upper and lower marks, can be seen from the filler port.)
- c. When replace the coolant, pour coolant slowly into the heat exchanger inlet until it is filled up to the upper level.

Then run the engine at idle for several minutes and bleed off air. Check the coolant level and add coolant if required.



F109

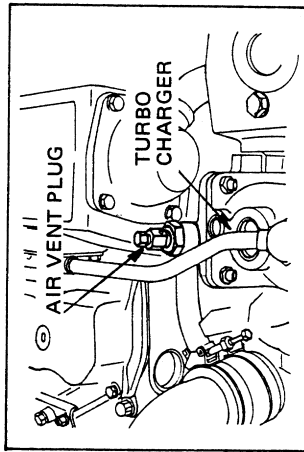
- 3) Inspect and clean heat exchanger [Every one (1) year]
- a. Remove the cap from heat exchanger and inspect for deposit.
- b. Reverse flush with clean water.
- c. Use new gaskets and O-rings when reinstalling the cap.

WARNING

When filling the coolant

- If the heat exchanger cap is removed while the heat exchanger is still hot, scalding water and steam under pressure will be blown out. To protect yourself from being burned, do not remove the heat exchanger cap while the heat exchanger is still hot.
- Fill the coolant slowly. If you fill the coolant quickly, the coolant may overflow before the cooling system is filled.
- Make sure that the system is filled up to the filler opening.

[W04CT and W04CTI engines]

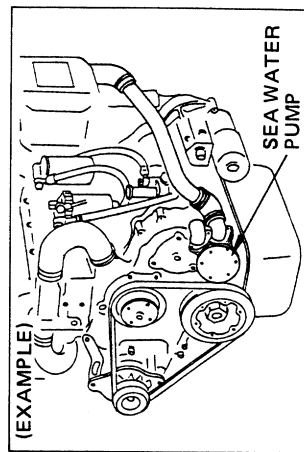


F176

NOTE:

Changing the coolant, perform the air bleeding the engine from the air vent plug. After tightening it wait for a while with engine idling to warm up the engine. Raise the engine speed up (Slightly higher than normal idling speed) and down several times, then check the coolant level in the heat exchanger and refill if required.

(3) Sea water pump



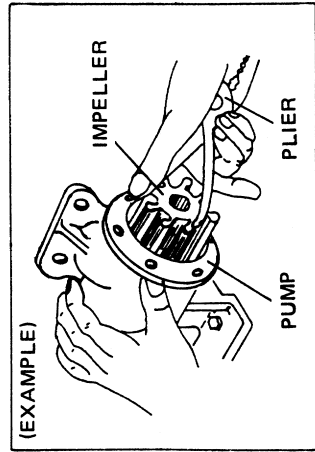
F177

- 1) Inspect and clean sea water pump [Every 500 hours or one (1) year]
- a. Remove the pump from the engine.
- b. Disassemble the pump, and inspect the impeller for wear, cuts or set of vanes. Check the pump housing for wear, pitting or cracks.

- c. Inspect the bearings for wear or free rotation.
- d. Use new gasket when assembling the pump.

NOTE:

- Failed sea water pump impellers can clog tubes and must be cleaned out.
- If inspection is taking place at time of laying up, leave the pump apart. Allowing the pump to remain assembled for extended period without use can cause impeller vanes to take a set.
- Never rotate the sea water pump in reverse direction (Clockwise viewed from pulley side). Reverse rotation may damage the impeller in sea water pump.



F178

3) Operation of sea water pump

- a. The sea water pump is of self-priming, rotary type with a synthetic rubber impeller. The priming head is 6 – 7 m (19.69 – 22.96 ft).
- b. Since lubrication of the pump is made by water, do not operate the pump without water or it can damage impeller and seal.
- c. When laying up or the engine is not operated for an extended period, remove the impeller from the pump and store it.

- 2) Replacing the sea water pump impeller
Remove the cover plate by unscrewing the bolts. Turn the impeller in a counter-clockwise direction while holding it with grips of a plier as shown and pull it out. Install a new impeller to the shaft. Install the cover plate by evenly tightening the bolts.

7. ELECTRICAL SYSTEM

(1) Battery

Two batteries, 12V each, parallel-connection and the negative grounding is applied. To make the life of the batteries longer, make the following maintenance.

1) Specific gravity of electrolyte

Check the specific gravity of the battery electrolyte by the hydrometer at **every 120 hours or six (6) months** operation.

Specific gravity 1.27 – 1.29 at 20°C (68°F)

Specific gravity varies with the temperature.

The 20°C (68°F) level is used as reference. Use the following equation for conversion:

$$S20 = St + 0.0007 (t - 20)$$

S20 : Effective specific gravity at 20°C (68°F)

St : Measured specific gravity at t°C.

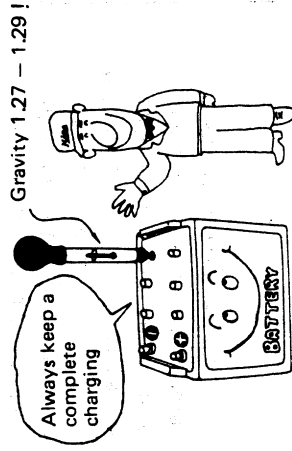
Specific gravity at 20°C (68°F)	Diagnosis	Correction
Over 1.300	Too high	Adjust specific gravity
1.220 to 1.300	Good	
1.100 to 1.220	Under charged	Charge battery
Below 1.100	Too low	After charging battery remeasure specific gravity

NOTE:

Don't allow the temperature of battery liquid to raise above 45°C (113°F) when charging the battery.

2) Cleaning the batteries

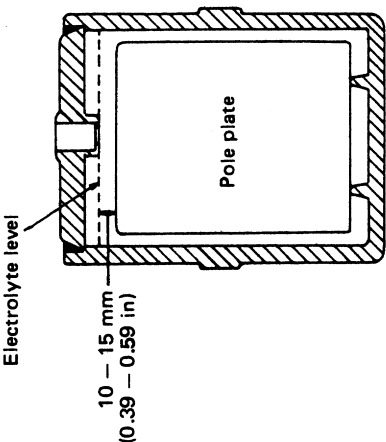
Wash and clean the batteries with water. Apply thinly the terminal with the vaseline or grease to prevent rust.



F118

NOTE:

Self discharging of the batteries. As the battery is discharged even while it is not being used. So even before the specified checking interval, it is necessary for you to make the above mentioned check and maintenance at every one month (every two weeks in summer season.)



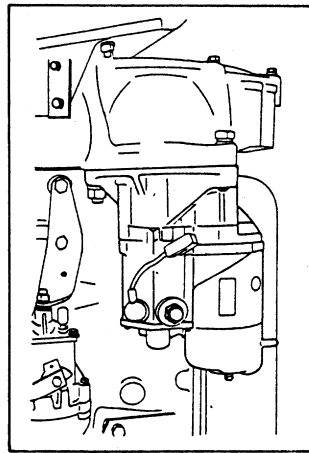
Check of the electrolyte surface

F 119

WARNING

- Since the battery produces explosive hydrogen gas, do not bring an open flame or electric sparks close to the battery.
- Always shield your eyes or wear safety goggles when working on batteries. Do not let electrolyte, which is sulfuric acid, come in contact with eyes, skin, or clothing. Since electrolyte is a corrosive acid, it can damage skin and clothing.
- If acid should contact your skin, eyes or clothing, thoroughly flush the contact area with water promptly and get medical treatment immediately.
- When working on the battery, be sure to remove any metal accessories from your arms. Do not lean over the battery.

(2) Starter

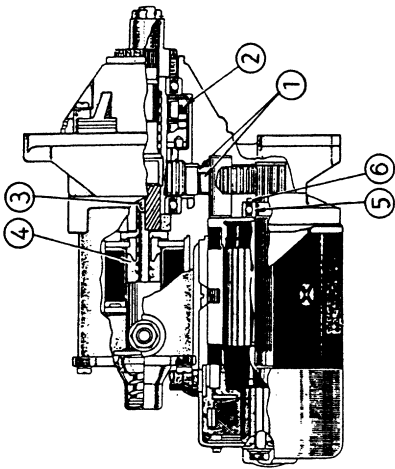


F 179

- 3) Check the commutator and brush **at every one (1) year** operation. If the surface of the commutator becomes defective, the sparks become larger. So polish it with the sand paper of No. 400 and clean off it with waste.
Check brush length, and replace it if necessary.
Brush length: Limit : 13 mm (0.51 in)

- 4) At **every 1,000 hours** operation, disassemble the starter and apply the grease to the following points.

- ① Retainer and rollers
- ② Overrunning clutch
- ③ Steel ball
- ④ Return spring
- ⑤ Armature bearing
- ⑥ Felt washer

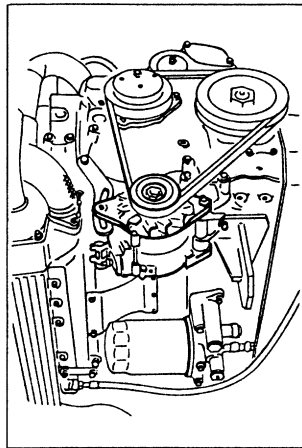


F 180

Grease: Refer to **Recommended Lubricant List** at end of this handbook.

NOTE: Nippon Denso No. 50 grease or equivalent (ESSO beacon 325) are recommended.

(3) Alternator

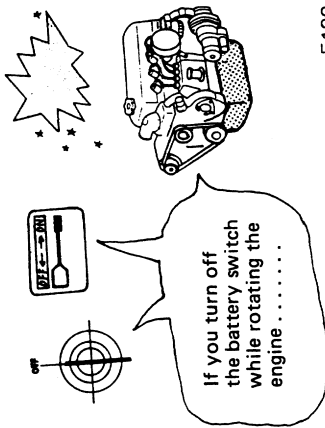


F 181

Every one (1) year:

Check and clean the alternator brushes.

Limit : 5.5 mm (0.22 in)



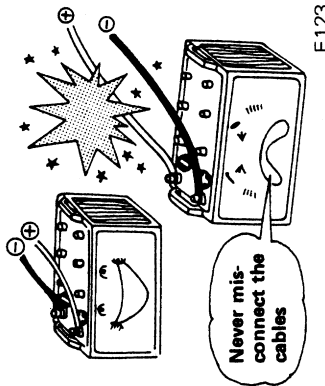
F182

- 1) While the engine is running, do not turn off the battery switch and the starter switch. If turn off the switches while the engine is running, high voltage arises, and the diode may be damaged.
- 2) When stopping the engine, turn off the battery switch and the starter switch without fail.

- 3) While the engine is running, neither remove the regulator cover nor touch the circuit.

- 4) Be careful not to make wrong connection of the alternator, relay, the battery and so on.

If the batteries are connected in reverse polarity, it will cause the short circuit by the diodes, and the diodes and the harnesses will be damaged by excessive current.



F123

- 5) In case of charging the battery, disconnect the battery cable without fail.

If you charge without disconnecting the cable, the diode may be damaged.

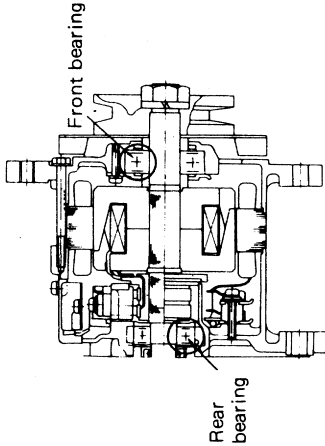
- 6) Be careful not to get the alternator wet, when cleaning the engine.

- 7) Use the correct fuses, and fit them surely.

- 8) Lubrication should be made at **every 1,000 hours** operation.

Lubricate both the front and rear bearings with the specified grease.

If the grease is dirty or bearing does not rotate smoothly, change with new one or lubricate, even before regular maintenance timing above.



Grease:

- Refer to our Recommended Lubricant List.
- O mark position: Lubrication position.

(4) Glow plug

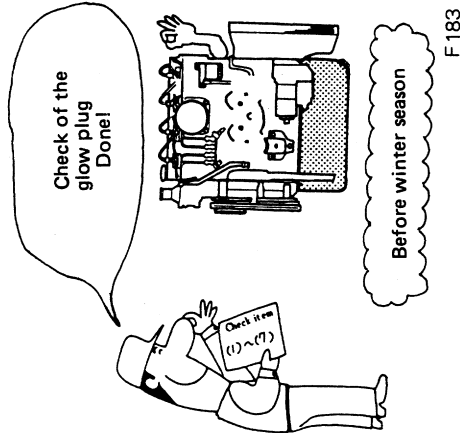
You should make the following check and inspection before the winter season comes in order to obtain good engine starting.

Check the glow plugs and signal for connection of the harness and looseness of the terminal, and retighten if any looseness is found out.

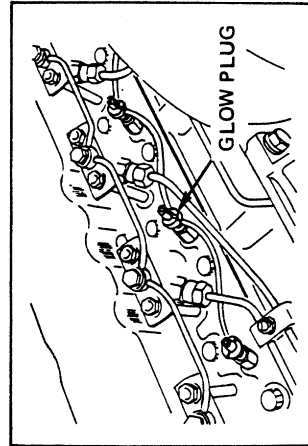
Tightening torque

Glow plug: 225—275 kg·cm
(17—19 lb·ft)

Glow plug terminal:
15 kg·cm
(1.08 lb·ft)



F183



F184

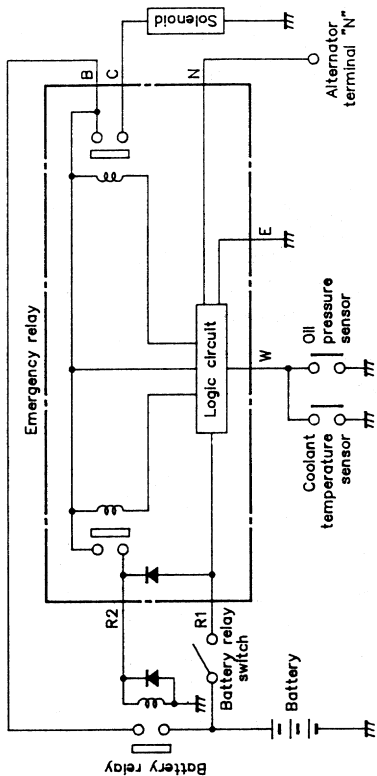
(5) Emergency stop relay

1) Description

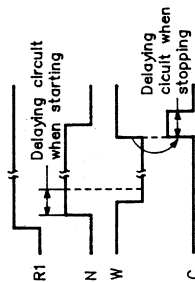
This system functions to sense abnormal oil pressure and abnormal coolant temperature, shutting off the fuel supply to the injection pump by the solenoid to stop the engine. Though this system has a function to stop the engine by sensing the abnormality of the oil pressure and coolant temperature, it does not mean that it can perfectly protect the engine from damage. Only aiming to minimizing the damage of engine, do not consider that it is a perfect safety device for the engine.

There should be any cause for emergency stopping of the engine, so it is more important to detect the causes and take proper measurement.

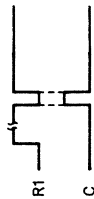
Emergency stop circuit



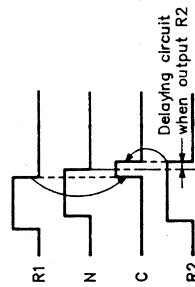
Time chart



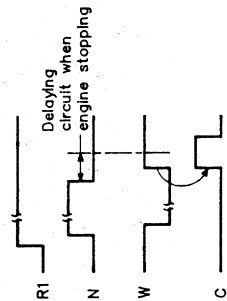
EMERGENCY FUNCTION



RESET FUNCTION (KEY ON POSITION "ON")



ONE-KEY STOP FUNCTION



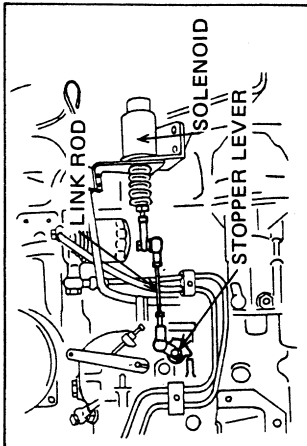
PREVENTIVE REVERSAL FUNCTION

2) Cautions when handling

- Prevent it from water, oil and dust.
- Use it under a condition that the ambient temperature is within $-30^{\circ}\text{C} \sim +80^{\circ}\text{C}$ ($-22 \sim 176^{\circ}\text{F}$).
- Be careful not to give severe vibration (to be less than 6.8 G).
- When checking, do it after disconnecting the battery cable.

3) Adjustment of solenoid link

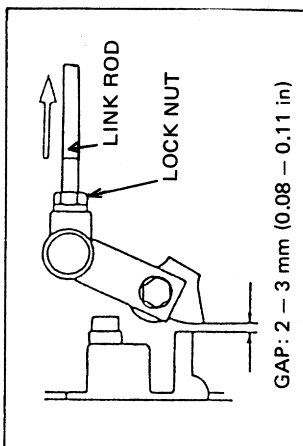
[W04D and W04C-T engines]



F185

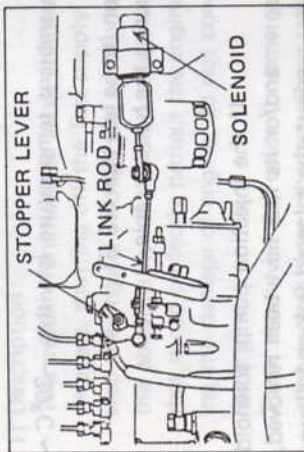
Note that the solenoid can be burned if there is no gap.

- After the above adjustment is over, move the link rod by hand and make sure that it moves lightly.
- Turn the starter key to OFF position and check that the engine stops.

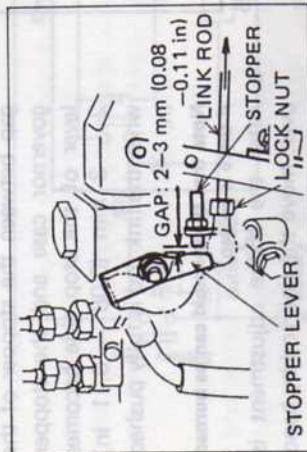


F-262

[W04C-T1 engine]



F253



F254

- 4) Maintenance and check of this system
Maintenance: Check it **every six (6) months**.

3-5 Storing the Engine

If proper treatment is done, the engine can rest well.



F187

1. RUST PREVENTIVE TREATMENT FOR THE ENGINE PROPER.

- (1) Drain the lubricating oil from the oil pan and fuel injection pump and fill them with #2 rust preventive oil (for lubrication), up to the prescribed level.
- (2) Start and run the engine with prescribed fuel for approx. 15 minutes. Then stop the engine temporarily.
- (3) Change the fuel oil to #1 rust preventive oil (for fuel), using an auxiliary tank, and idle the engine until the oil reaches the fuel lines.
- (4) In the final few seconds of idling, be sure to turn the fuel feed (injection) lever to "STOP" and simultaneously inject #2 rust preventive oil (for lubrication) into the intake manifold. In doing this, the engine may suddenly race (turn over quickly).
- (5) After the engine is cooled down to approx. 38°C (100°F), remove the nozzle, adjust so that the piston heads are positioned in the middle of the cylinder liners, and inject #2 rust preventive oil (for lubrication) into the inside of the cylinder liners. After the engine has been completely lubricated with #2 rust preventive oil (for lubrication), install the nozzle.
- (6) Then remove the cylinder head cover and apply rust preventive #2 oil (for lubrication) on all moving parts such as the rocker arms. Then loosen the adjusting screw and install the cylinder head cover.
- (7) Completely drain the coolant. Then close the drain cocks.
- (8) After completely treating with rust preventive oil, close all opening such as fuel injection ports, lubricating oil, air, and coolant ports and openings, with water-proof tape.
- (9) Repaint the painted portion, and thinly apply the surface of the metallic portion with #2 rust preventive (for lubrication).

2. RUST PREVENTIVE TREATMENT FOR THE ACCESSORY PARTS.

- (1) After cleaning the air cleaner, apply #2 rust preventive oil (for lubrication) and seal all openings with water-proof tape.
- (2) Clean the inside of the alternator, starter, and relay with dry compressed air, and seal them with water-proof, dust coverings.
- (3) Loosen the belts.
- (4) Add distilled water to the batteries and fully charge them. Then disconnect the battery cables. Recharge the batteries at least once a month.

Maker.	#1 Rust Preventive Oil (for fuel)	#2 Rust Preventive Oil (for lubrication)
CALTEX	564 Rust Proof Oil	Preservative 30
ESSO	Rust-Ban 337	P1010 Anti Rust P1020 P1030
MOBILE	Mobil Kote 501	Mobil Kote 503
SHELL	—	Shell Ensis Engine Oil 30

- * When the engine is being stored for only a short period (less than one month) Cover all opening such as the fuel, lubricating oil, air and coolant ports and openings. It is recommended that the engine is completely treated and covered so as to be protected against moisture.

3. PRECAUTIONS FOR RE-USING THE ENGINE AFTER LONG-TERM STORAGE.

No trouble should be encountered if the engine is warmed up and operated for a short period of time each week while the engine is in storage. However, if the engine has not been properly warmed-up and operated while in storage, the following inspections and adjustment should be provided.

- (1) Disassemble the oil filter, and replace the element with new one if any foreign matter sticks to the surface of the element.
- (2) Change the lubricating oil in the oil pan and fuel injection pump. Make sure engine oil is up to the prescribed level.
- (3) Before test operation, rotate the engine for approx. 10 seconds by operating the starter, to circulate lubricants to the various engine components. Also remove the cylinder head cover and lubricate the rocker arm bearings and push rods.
- (4) During the test operation, check for water leakage from worn or damaged cylinder liner packing, and also check for fuel leakage.

TABLE 2) TIGHTENING TORQUE MEMO

No.	tightening Position	enrichment (g/min)	unit
1	Cylinder head bolt	0.8-1.0 (11.0-13.0)	kgf/cm ²
2	Intake manifold nut	0.8-1.0 (11.0-13.0)	kgf/cm ²
3	Water pump bolt	0.8-1.0 (11.0-13.0)	kgf/cm ²
4	Water pump nut	0.8-1.0 (11.0-13.0)	kgf/cm ²
5	Timing drive gear bolt	0.8-1.0 (11.0-13.0)	kgf/cm ²
6	Oil pan plug	0.8-1.0 (11.0-13.0)	kgf/cm ²

TABLE 3) LUBRICANTS CAPACITY

No.	Lubricant	Capacity (liters)	Capacity (quarts)
1	Engine oil	4.0 (4.3)	4.3 (4.5)
2	Fuel injection nozzle pressure	0.8-1.0 (11.0-13.0)	11.0-13.0 (13.0-15.0)
3	Engine compression pressure	0.8-1.0 (11.0-13.0)	11.0-13.0 (13.0-15.0)

TABLE 4) PRESSURE

No.	Item	Pressure	Unit
1	Engine oil pressure	0.8-1.0 (11.0-13.0)	kgf/cm ²
2	Fuel injection nozzle pressure	0.8-1.0 (11.0-13.0)	kgf/cm ²
3	Engine compression pressure	0.8-1.0 (11.0-13.0)	kgf/cm ²

Hino

RECOMMENDED LUBRICANTS

[TABLE 5]

LUBRICANTS	POSITIONS	ATMOS- PHERIC TEMP.	S.A.E. NO.	BP	CALTEX
ENGINE OIL (A P I CCI) Previous Classification (A P I DSI) (MIL-L-2104C) (MIL-L-45198B)	Cylinder Block Injection Pump Air Cleaner	Above 32°C (90°F)	40	Vanellus C-3 40	RPM DELO 400 OIL SAE 40 or 15W/40 RPM DELO 300 OIL SAE 40
		32°-40°C (90°-104°F)	30	Vanellus C-3 30	RPM DELO 400 OIL SAE 30 or 15W/40 RPM DELO 300 OIL SAE 30
		0°-12°C (32°-54°F)	20	Vanellus C-3 20W	RPM DELO 400 OIL SAE 20/20W, 15W/40 RPM DELO 300 OIL SAE 20/20W
ENGINE OIL (A P I CCI) Previous Classification (A P I DSI) (MIL-L-46152) (MIL-L-2104B)	Coolant Pump Bearing Starter Bearing	Above 32°C (90°F)	40	Vanellus M 40	RPM DELO 200 OIL SAE 40 RPM DELO 100 OIL SAE 40
		32°-40°C (90°-104°F)	30	Vanellus M 30	RPM DELO 200 OIL SAE 30 RPM DELO 100 OIL SAE 30
		0°-12°C (32°-54°F)	20	Vanellus M 20W	RPM DELO 200 OIL SAE 20/20W RPM DELO 100 OIL SAE 20/20W
COOLANT PUMP BEARING GREASE (MIL-G-10924B)	Coolant Pump Bearing			Energol L 2	Marfak Multipurpose 2 or Marfak All Purpose 2
STARTER GREASE	Bushing, Clutch, Drive Shaft Pinion Shift Lever & Reduction Gear				Molytex Grease EP2
GENERATOR & STARTER BEARING GREASE	Generator Bearing Starter Bearing			Energol LT 2	RPM Grease SRI 2
INJECTION PUMP TIMER GREASE (MIL-G-10924B)	Injection Pump Timer			Energol L 2	Marfak Multipurpose 2 or Marfak All Purpose 2
ANTI-FREEZE (MIL-A-5300B)	Engine Radiator			Anti Frost	AF Engine Coolant

Note: Lubricants were amended according to new classification by A P I (American Petroleum Institute)

FOR ALL HINO ENGINE

CARSTOL	ESSO	GULF	MOBIL	SHELL	TOTAL
Castrol or Deisel CRD 40, Turbomax Castrol or Deisel RX Super 40, 15W/40	Esso D-3 40, XD-3 40	Gulf Super Duty Motor Oil 40, 15W-40	Mobil Delvac 1340 Mobil Delvac Super 15W-40	Myrina Oil 40, 20W-40, 15W-40 Rimula SX Oil 40, Rimula CT 40	TOTAL Rubea S 40 TOTAL Rubea TM 15W40
Castrol or Deisel CRD 40, Turbomax Castrol or Deisel RX Super 40, 15W/40	Esso D-3 30, XD-3 30	Gulf Super Duty Motor Oil 30, 15W-40	Mobil Delvac 1330 Mobil Delvac Super 15W-40	Myrina Oil 30, 20W-40, 15W-40 Rimula SX Oil 30, Rimula CT 30	TOTAL Rubea S 30 TOTAL Rubea TM 15W40
Castrol or Deisel CRD 20W/20 Castrol or Deisel RX Super 20, 15W/40	Esso D-3 20W, XD-3 15W-40	Gulf Super Duty Motor Oil 20, 15W-40	Mobil Delvac 1310 Mobil Delvac Super 15W-40	Myrina Oil 20, 20W-40, 15W-40 Rimula SX Oil 20, Rimula CT 20	TOTAL Rubea S 20 TOTAL Rubea TM 15W40
Castrol or Deisel CRD 40, Turbomax Castrol or Deisel RX Super 40, 15W/40	Esso HDX 40, HDX Plus 40	Gulfube Motor Oil XHD 40, 15W-40	Mobil Delvac 1240 Mobil Delvac 1140	Rotella TX40, 20W-50 Rotella SX Oil 40, 20W-40	TOTAL Rubea H 40
Castrol or Deisel CRX 30 Castrol or Deisel RX Super 30, 15W/40	Esso HDX 30, HDX Plus 30	Gulfube Motor Oil XHD 30, 15W-40	Mobil Delvac 1230 Mobil Delvac 1130	Rotella TX30, 20W-50 Rotella SX Oil 30, 20W-40	TOTAL Rubea H 30
Castrol or Deisel CRX 20W/20 Castrol or Deisel RX Super 20W/20, 15W/40	Esso HDX 20, HDX Plus 20W-20 15W/40	Gulfube Motor Oil XHD 20, 15W-40	Mobil Delvac 1220 Mobil Delvac 1120	Rotella TX20, 20W-50 Rotella SX Oil 20, 20/20W, 20W-40	TOTAL Rubea H 20
Castrol LM Grease	Esso Multipurpose Grease	Gulflex Poly	Mobilgrease MP 77 MS	Retinax A Alvania Grease R2	TOTAL MULTIS 2
—	—	—	Mobilgrease 29	Aero Shell Grease 17	—
—	—	—	Mobilgrease 28	Aero Shell Grease 7	—
Castrol LM Grease	Esso Multipurpose Grease	Gulflex Poly	Mobilgrease MP 77 MS	Retinax A Alvania Grease R2	TOTAL MULTIS EP 1
Castrol Anti-Freeze Coolant	Esso Anti-Freeze Coolant	Cruise Master Antifreeze And Summer Coolant	Mobil Permazone	Shellzone(U.S.A.) Shellzone Plus (European Countries) Shellsafe Anti-Freeze P281 Coolguard	TOTAL ANTIGEL

82-12 200 (T S D) (8)