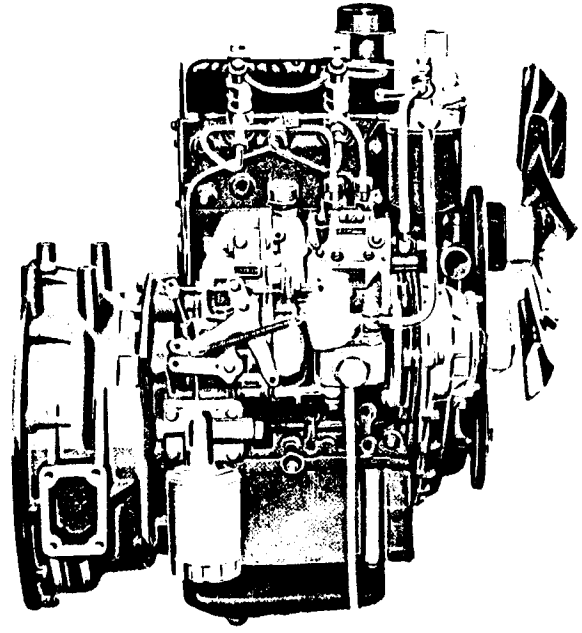
OPERATING INSTRUCTION
for
Models 2AA1, 2AB1,
3AA1 and 3AB1
Diesel Engine

CONTENTS

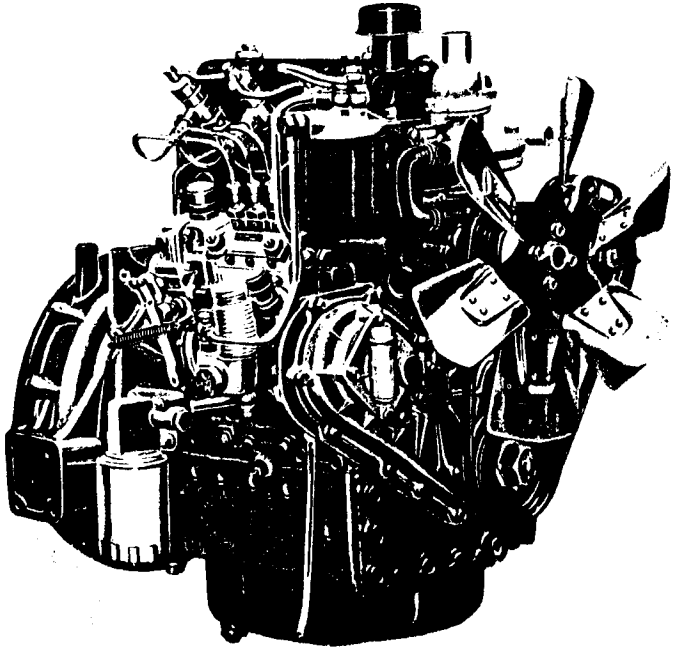
ISUZU DIESEL ENGINES

2AA1 and 2AB1



ISUZU DIESEL ENGINES

3AA1 and 3AB1



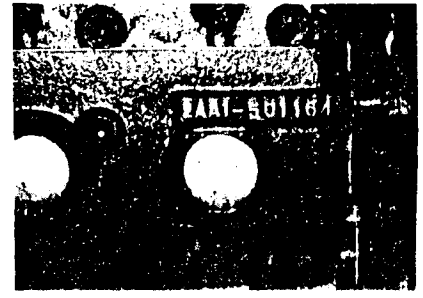
1. MAIN DATA AND SPECIFICATIONS

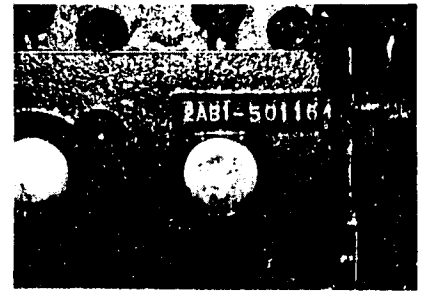
Data \ Engine models	2AA1	2AB1	3AA1	3AB1
Type	Water-cooled, 4-cycle in line 2-cylinder overhead valve type		Water cooled, 4-cycle in line 3-cylinder overhead valve type	
Cylinder bore x stroke mm	86 x 84 3.39inx3.31in.	86 x 102 3.39inx4.02in.	86 x 84 3.39inx3.31in.	86 x 102 3.39inx4.02in.
Piston displacement (cc)	975 (59.5 cu. in.)	1184 (72.3 cu. in.)	1464 (89.4 cu. in.)	1777 (108.5 cu. in.)
Compression pressure kg/cm^2	31 or more	31 or more	31 or more	31 or more
Intermittent rating (DIN 6270B) $kW(PS)/min^{-1}$	14.5(19.5)/ 2800	19(25.5)/ 2800	21.5(29.5)/ 2800	28 (38)/ 2800
Maximum torque $Nm(kgfm)/min^{-1}$	53(5.4)/2000	69(7.0)/2000	80(8.2)/2000	103(10.5)/2000
Type of combustion	Swirl combustion chamber type			
Firing order	1 – 2		1 3 2	
Engine dimensions length x width x height mm	610x520x672 547x505.5x668	610x520x697 545x505.5x693	716x527x697 653x515x668	716x529x722 653x515x693
Engine weight kg	160 (dry)	165 (dry)	197 (dry)	217 (dry)
Fuel injection timing	18° BTDC			
Injection pump type	Bosch A type			
Nozzle type	NP- DNOSD211 (Throttle type)			
Governor type	Mechanical type			
Starter motor V–kW	12 – 1.8			
Alternator V–A	AC 12 – 35			

Note: These specifications are subject to change without notice.

2. LOCATION OF ENGINE NUMBER

The engine number is stamped on the right front part of the cylinder body.





If you are in need of replacement parts, clearly identify the type and serial number of the engine unit to be sure you are getting the right parts.

SECTION 1
OPERATION

1-1 BEFORE OPERATION CHECKS

1) Check the level of engine oil.

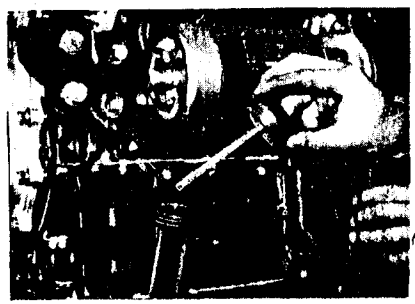


Fig. 1 – 1

2) With the oil level gauge check to see if the oil level is within the MAX level mark and MIN mark on the oil level gauge.

Also check viscosity and contamination of oil sampled with the oil level gauge.

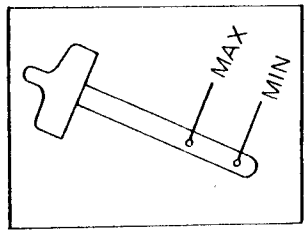


Fig. 1 – 2

3) Check the level of cooling water and if necessary, replenish to bring up the level to the face of the emergency cock.

Note: Removing the filler cap from the hot radiator will cause dangerous hot steam to blow out. To prevent this, slowly turn the filler cap to the left with a cloth to release the internal pressure.

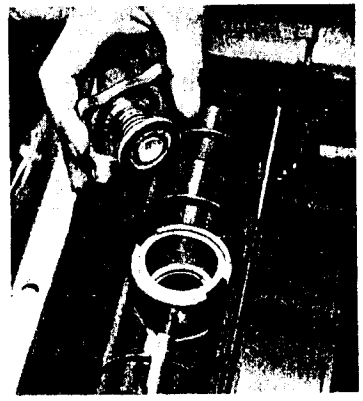


Fig. 1 – 3

1-2 STARTING OF ENGINE

(1) "OFF" Position

The key can be inserted and removed into or from the switch only with the switch in OFF position.

(2) Preheating

With the key, turn the switch all way to the left for operating the glow plugs. The state of preheating can be checked against the CONTROL RESISTOR. With the glow plug circuit in normal function, about 30 seconds are taken for the control resistor to get red hot. When the key is released, the switch automatically returns to OFF position (1).

(3) Starting

When the glow plugs are heated, crank the engine by turning the switch all way to the right with the wide open throttle. Do not operate the cranking motor continuously for more than 10 seconds.

(4) Drive (Operation)

As soon as the engine started, release the key so that it returns automatically to ON position (drive).

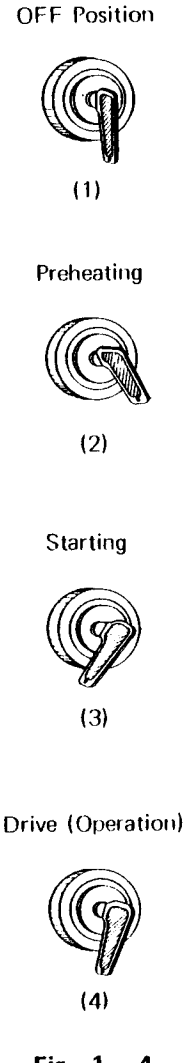


Fig. 1 – 4

1-3 POINT TO BE AFTER STARTING ENGINE.

Do not abruptly accelerate the engine speed immediate after starting but hold the engine running at fast idle until normal operating temperature has been reached. Scan the instruments and indicator lights and check for abnormal engine vibration, noise and color of exhaust. Also check the engine olfactorily.

1) Oil pressure

The oil pressure is normal if the oil pressure indicator pointer comes around the intermediate part of the dial (about 4kg/cm²) while the engine is idling. If the oil pressure indicator pointer fails to reach the intermediate point of the dial when the engine speed is increased or if the indication is erratic while the engine is operated at low speeds, bring the engine to a stop immediately and check the level of oil and around the engine for a sign of oil leakage. The oil pressure indicator light (red) is normal if the light goes out when the engine is started.

Oil Pressure Indicator

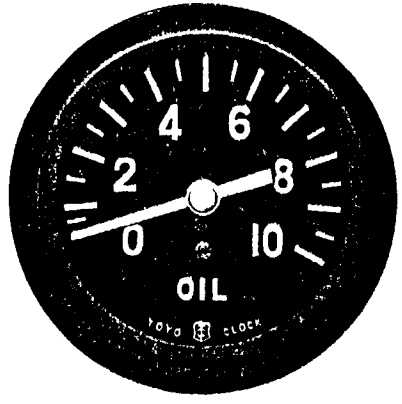


Fig. 1 – 5

Thermometer

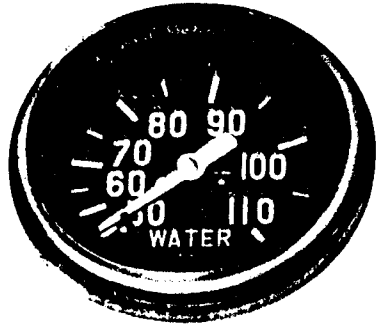


Fig. 1 – 6

2) Cooling water temperature

The cooling water temperature is normal if the thermometer indication falls within 70–85°C (or 158–185°F).

The engine fails to provide maximum performance if the temperature of cooling water is higher or lower than the above mentioned value and particularly, over-cooling of the engine will result in unnecessary increase in the fuel consumption.

If the engine evidences overheating or over-cooling, check the cooling system for failure.

3) State of charging

The function of the generator circuit may be regarded as normal if the ammeter pointer swing toward "+" or if the charge indicator light (on model so equipped) goes out when the engine speed is increased.

Ammeter

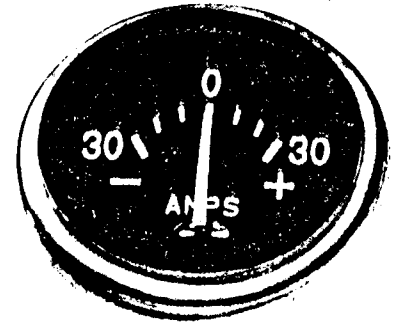


Fig. 1 – 7

4) Cooling water leakage

With the engine stationary or running, visually check the radiator, water pump hose joint and drain cocks for a sign of leakage.

5) Oil leakage

With the engine running, check around the engine for an evidence of oil leakage, paying close attention to the oil filter oil piping and jointing face of the oil pan.

6) Fuel leakage

Visually checked the fuel injection pump, fuel pipes and fuel filter for an evidence of leakage. Also check the joint for leakage.

1-4 STOPPING OF ENGINE

To bring the engine to a stop, hold it running at idle and pull the engine stop button all way out. Pulling the speed control lever to the stop position will shut off the fuel supply thereby causing the engine to stall. (The engine cannot be brought to a stop by merely turning

the switch to the OFF position). Make sure to turn the switch to the OFF position after stopping the engine. After bringing the engine to a stop, check and correct the troubles that may be found through the engine operation. In area where the ambient temperature falls below the freezing point, drain the cooling system completely to eliminate the possibility of freezing unless anti-freeze solution is used.

* Rotation of diesel engine in reverse derection.
If the diesel engine is so started accidentally and allowed to run in reverse direction, the engine oil is not forced to the vital parts of the engine thereby leading to serious engine trouble.

(1) The following condition will exist when the engine is run in reverse direction:
1) Oil pressure indicator light turns on and remains on.
2) The engine produces abnormal noise as the gases are exhausted through the intake side, causing the air cleaner to spew out exhaust gas.
3) The engine produces a high knocking sound immediately after starting.
(2) Immediate stops to be taken when the engine is started running in reverse direction.
1) Bring the engine to an immediate stop by pulling the speed control lever to the stop position.
2) After bringing the engine to a stop, check the air cleaner and intake rubber tubes and replace the parts if necessary.

1-5 TREATMENT OF NEW ENGINE

In the early life of a new engine, the working face of the parts are bedding down so that early of the parts will result if the protective oil films are distroyed and prevent this, carefully observe the following:
(1) Avoid over-loading and operation of engine continuously at high speed.

(2) Keep the engine running at fast idle until normal operating temperature is reached and also avoid racing the engine.
(3) Keep the engine periodically inspected and serviced.

1-6 PRECAUTIONS TO BE OBSERVED WHEN STARTING COLD ENGINE IN COLD WEATHER

1) Freezing of cooling water

After the engine operation, it is necessary to completely drain the cooling system to prevent freezing of water which often causes the cylinder block or the cylinder head to crack. The use of anti-freeze solution eliminates the trouble of draining the cooling system every after the engine operation. However, anti-freeze solution of inferior quality have adverse effects on the components of the cooling system. To give your cooling system maximum protection, the use of ISUZU Genuine anti-freeze solution is highly recommended. (For cooling water-to-anti-freeze solution mixing ratio, refer to the subparagraph P.18 Fig. 2-12)

2) Battery care

The capacity of the battery tends to decline with lowering temperature and to prevent possible troubles resulting from under-charged battery, check and keep the battery sufficiently charged.

3) Over-cooling of engine

Over-cooling of the engine will cause the thermal efficiency of the engine to deteriorate considerably. If the engine should fail to reach to normal operating temperature (intermediate part of the thermometer dial) after continuous operation, check the thermostat for failure.

SECTION 2

DAILY CHECK AND MAINTENANCE

2-1 LUBRICATING SYSTEM

In order to obtain maximum performance and longer service life for the engine, it is extremely important to use the lubricating oil of recommended quality and to replace the oil at the specified intervals.

(1) Engine Oil

Since the engine oil has a decided effect on the service life of the engine, it is strongly advisable to use good quality mineral base oil carefully selected according to the type of engine and temperature conditions under which the engine is operated. Your Isuzu diesel engine can be best protected with the API service CD or CC grade oil of the viscosity selected according to the atmospheric temperature conditions.

	Diesel Engine
Recommended viscosity Grade	API Service CC (S – Below 20°F (–7°C) SAE 10W 10°F ~ 50°F (–12°C ~ –10°C) SAE 20W or 20 32°F ~ 90°F (0°C ~ 32°C) SAE 30 Above 80°F (27°C) SAE 40 Below 32°F (0°C) SAE 10W–30 Below 50 50°F (10°C) SAE 20W–40
Caltex	Caltex Super RPM DELO Special (10W, 20W–20, 30, 40)
Shell	Shell Rotella T Oil (10W, 20W–20, 30, 40) Shell Rotella T Multigrade (10W–30, 20W–40)
Mobil	Delvac 1100 (1110, 1120, 1130, 1140) Delvac 1200 (1210, 1220, 1230, 1240) Note: 1210: SAE 10W 1220: SAE 20W 1230: SAE 30 1240: SAE 40
Esso	Essolube HDX (10W, 20, 30, 40)
BP	BP Energol Diesel CC (10W, 20W, 30, 40)
Union	T5X (10W, 20, 30, 40)

(2) Replacement of Engine Oil

1) Replace the engine oil crankcase after the initial 50 hours of operation and the after at every 100-hour interval.

Drain the engine crankcase and oil filter unit while the engine oil is hot.

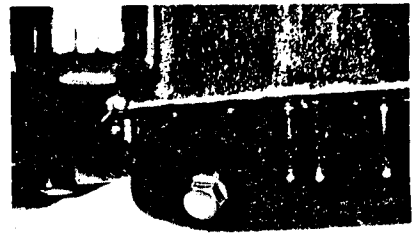


Fig. 2 – 1

2) Fill the engine crankcase to the specified level, start and hold the engine running at idle for a few minutes and then bring it to a stop.

Recheck the oil level after leaving the engine stationary for about (10) minutes and replenish, if necessary.

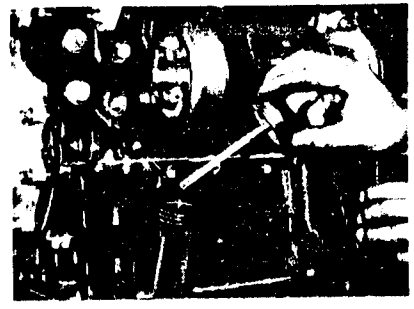


Fig. 2 – 2

(3) Servicing of Oil Filter

The oil filter should be changed with new one at 300-hour interval.

As this oil filter is cartridge type, to remove the oil filter, proceed as follow:

Removing; turn the oil filter case to the counterclockwise with wrench.

Remounting; when the surface of rubber-seal contact to oil filter cover, tighten the oil filter by 2/3 turn with hand.

(4) Replacement of Injection Pump Oil

1) The injection pump oil should be drained and refilled at every 300-hour interval.

2) Drain the injection pump completely by removing the drain plug and refill with new oil through the air breather hole. -A proper quantity; 110 cc-

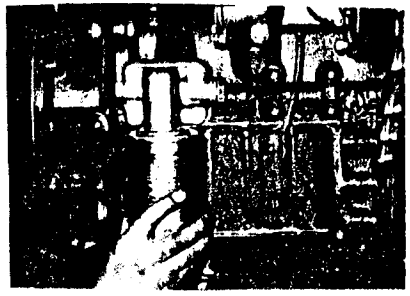


Fig. 2 – 3

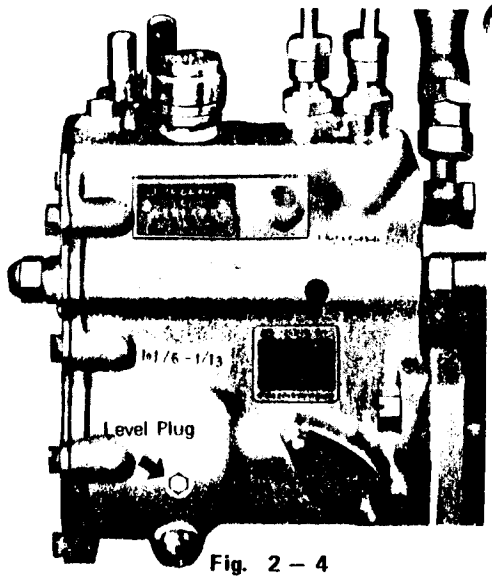


Fig. 2 – 4

3) Mechanical governor

At every 300 hour interval, drain the oil through the drain plug hole on the lower part of the governor chamber and fill the governor through the oil dipstick hole.

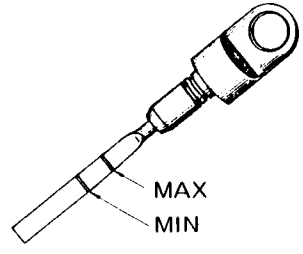


Fig. 2 – 7

Fig. 2 – 5

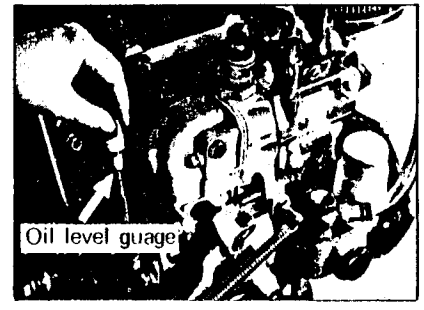


Fig. 2 – 6

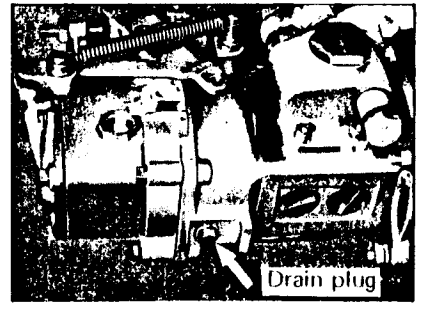


Fig. 2 – 8

2-2 COOLING SYSTEM

(1) Fan Belt Tension

When correctly adjusted, the cooling fan belt should give a lateral deflection of about 5mm when a good finger pressure is applied between the water pump pulley and generator pulley. For adjustment of the fan belt tension, turn loose the bolts on the adjust plate and on a generator bracket and incline the generator as required. When adjusting the fan belt tension, also check the belt for fraying and damage.

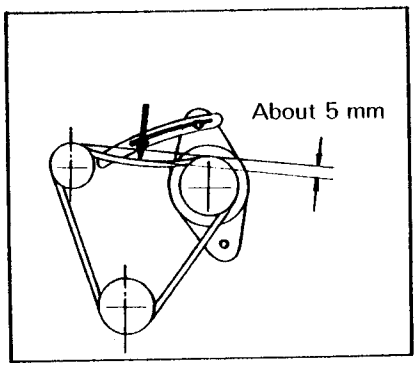


Fig. 2 – 9

(2) Replacement of Cooling Water

To drain the cooling system, proceed as follows:–

Remove the radiator filler cap and turn loose the drain cock on the lower part of the radiator and on the cylinder body.

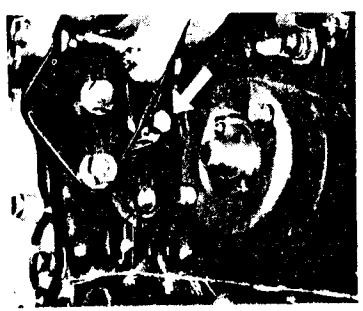


Fig. 2 – 10

It is recommended to use soft water (city water or clean rain water) in the cooling system. At every 600-hour interval, replace the cooling water. If the cooling system is drained and refilled, the cooling water level may lower slightly when the engine is operated. To ensure that the cooling system is filled to the specified level, operate the engine for a few minutes and bring it to a stop, check the cooling water level and replenish, if necessary.

(3) Flushing of Cooling System

Flush the internal part of the cooling system once a year to remove rusts, scales and other deposits. Use only neutralized cleanser for flushing and use generous amount of running water to remove all traces of cooling system cleansers. The use of alkaline base cleansers is not recommended since they are harmful to the parts in the cooling system.

(4) Cleaning of the External Part of Radiator

At every 600-hour interval, clean the external part of the radiator in the following manner: Apply compressed air or pressurized water to the cooling fins and upper and lower tanks of the radiator to remove foreign matters.

(5) Anti-Freeze Solution

Where the atmospheric temperature falls below freezing point, the cooling system should be drain every after the engine operation and eliminate the need for repeated draining and refilling, the use of anti-freeze solution is highly recommended. The freezing temperature of the coolant varies depending on the cooling water to anti-freeze solution mixing ratio and to give the engine an extra protection, the mixing ratio should be determined according to the lowest temperature anticipated plus –5°C (23°F).

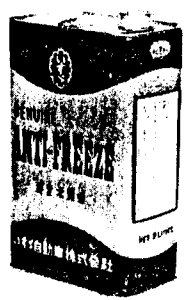


Fig. 2 – 11

Relationship between mixing ratio of cooling water anti-freeze solution and freezing point.

Mixing %		Freezing point °C (°F)	Mixing %		Freezing point °C (°F)
Water	Anti-freeze	Permanent type	Water	Anti-freeze	Permanent type
90	10	− 4.0(24.8)	60	40	−24.0(−11.2)
85	15	− 6.0(21.2)	55	45	−30.0(−22.0)
80	20	− 9.0(15.8)	50	50	−36.0(−32.8)
75	25	−12.0(10.4)	45	55	−43.0(−45.8)
70	30	−16.0(3.2)	40	60	−45.0(−49.0)
65	35	−19.0(−2.2)			

Relationship between mixing ratio and Freezing temperature.

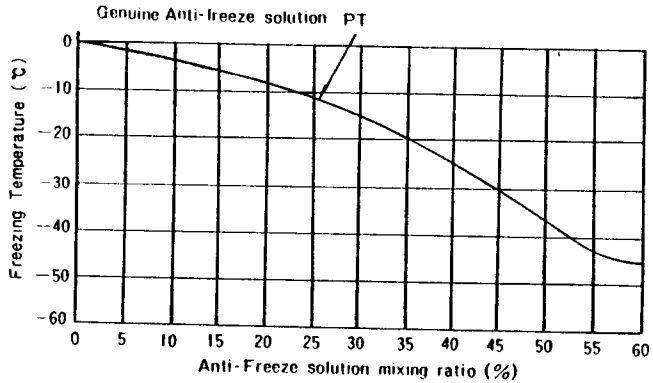


Fig. 2 – 12

Cautions for use

1) Before using the anti-freeze solution, drain the cooling system completely and flush with suitable cleanser to remove scales and other foreign matters from the internal part of the cooling system.

2) Using city water when preparing the coolant with anti-freeze solution.

3) Before replacing the coolant with plain water, wash clean the internal part of the cooling system with cleanser.

4) When handling the anti-freeze solution, use an extra care as it is harmful to the paint finish.

2-3 INTAKE SYSTEM

(1) Air Cleaner

Foreign matters that cling to the air cleaner filter will cause the air intake resistance to increase, thereby leading to engine troubles. It is therefore, important to clean the air cleaner in the following manner:-

1) Servicing of oil bath type air cleaner

At every 100-hour interval, disassemble the air cleaner and wash clean the parts in detergent oil, paying particular attention to the element (screen).

After reassembling, fill the air cleaner oil pan to the specified level with engine oil. Do not overfill or the air intake resistance will be increased unnecessary, leading the engine to trouble. If the engine is operated under very dusty conditions, shorten the air cleaner service intervals.

2) Viscous type

The viscous type filter element consists of a paper filter coated with a layer of viscous oil. The viscous type filter element should not be cleaned but replaced when the air cleaner indicator turns red in color. When replacing the filter element, check the packing for damage.

After servicing the filter element, move the dust indicator rod back into normal position by pushing the lever in direction of the arrow.

3) Servicing of paper element type air cleaner

At every 100-hour interval, clean the air cleaner element by bringing the compressed air nozzle into the center hole to blow out foreign matters.

If the engine is operated under very dusty condition, shorten the air cleaner service intervals. Replace the air cleaner element at every 600-hour interval.

Note: Replace the air cleaner element if it is damaged or contaminated with oil or grease.

4) Cyclone type (optional)

This is a specifically designed air cleaner installed on the air cleaner of the conventional design to filter coarse foreign particles. At every 100-hour interval, take out the cap and remove the foreign matters deposited inside of the cleaner.

A transparent casing permits quick check on the state of the filter. However, it is important to disassemble and clean the air cleaner before the foreign matters reach the dust level.

(2) Air Breather

The air breather is a ventilation device through which the internal part of the engine is freely communicated with open air. The filter element in the breather is to filter the air taken into the engine. Heavily contaminated air breather will give a rise to the wear of the engine components. At every 100-hour interval, remove the air breather, wash clean the filter element with gasoline, soak the element with clean engine oil and reinstall the air breather.

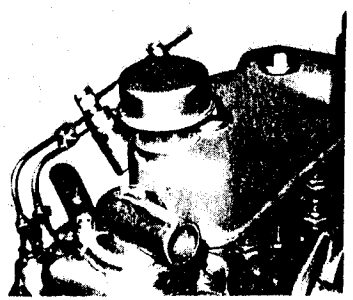


Fig. 2 – 13

Fig. 2 – 14

2-4 FUEL SYSTEM

(1) Fuel Filter

1) Since the fuel injection pump consists principally of delicate parts which are precision-finished, foreign matters carried in the fuel will cause damage to the plungers and in an extreme case, leads the internal parts of the injection pump to seizure. To prevent such troubles, the fuel filter should be cleaned very carefully.

At every 300-hour interval, clean the filter by removing the filter body. At every 600-hour interval, replace the filter element with new one.

2) At every 1,200-hour interval, wash clean the strainer fitted into the joint bolt on the inlet side of the fuel feed pump.

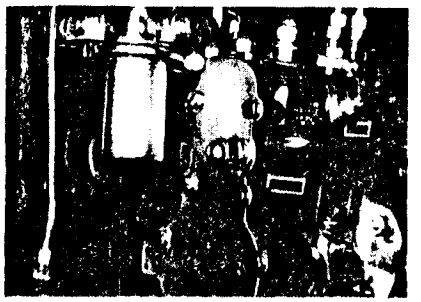


Fig. 2 – 15

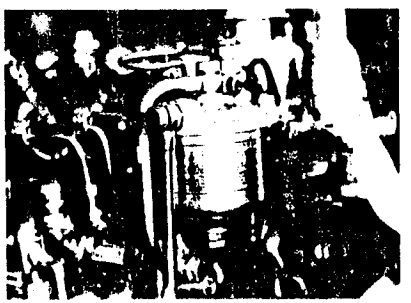


Fig. 2 – 16

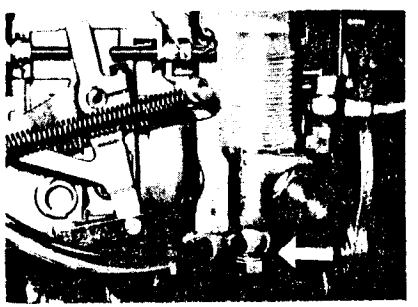


Fig. 2 – 17

(2) Servicing of Fuel Tank Strainer

At every 600-hour interval, service the strainer in the fuel tank. Clogged strainer will cause the engine to stall because of the limit supply of fuel. Unexpected engine trouble may also result from the clogged strainer because of the deteriorated filtering efficiency.

(3) Air Bleeding

If the engine is stalled due to lack of fuel supply or if the fuel filter is drained for cleaning, the fuel system should be bled in the following manner: Turn loose the air bleeder screw on the fuel injection pump, manually operate the fuel feed pump on the injection pump to bleed the air through the bleeder screw. After checking to make sure that the fuel system is completely bled, securely tighten the air bleeder screw. Bleeding operation should be commenced with the screw on the front side of the pump. After bleeding operation, make sure to screw in the feed pump handle.

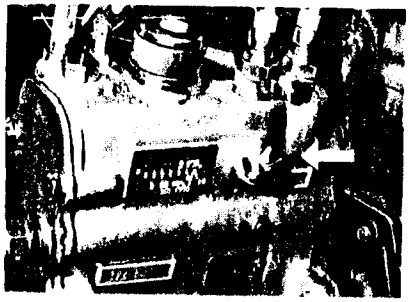


Fig. 2 – 18

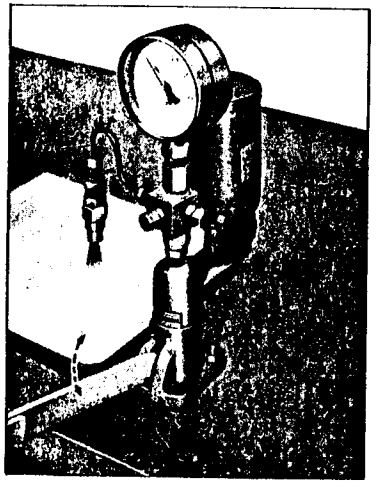


Fig. 2 – 19

(4) Fuel Injection Nozzles

1) At every 300-hour interval, check the nozzle injection pressure ane spraying condition and make necessary adjustment. If the nozzle pressure is lowered or if the spraying condition is deteriorated, it causes the exhaust smoke to turn black with a reduction in the engine output and an increase in the engine noise. To make adjustment on the injection pressure, check the pressure with a nozzle tester and add or remove the adjusting washers to or from the nozzle holder.

The standard injection pressure is 120kg/cm² (1,706 PSI).

2) If the injection pattern is distorted or otherwise out of normal condition, or if the injection nozzle dribbles, it indicates that the needle valve is poorly seated against the valve seat. Correction here is to remove the nozzle from the holder, remove the carbon deposite with a piece of wood or other soft material, wash clean them in kerosene and reface the valve.

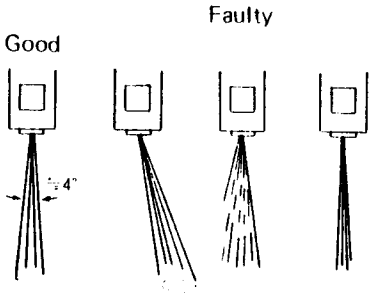


Fig. 2 – 20

(5) Adjustment of injection timing

The standard injection timing is as listed in the table below. The adjustment of the in-

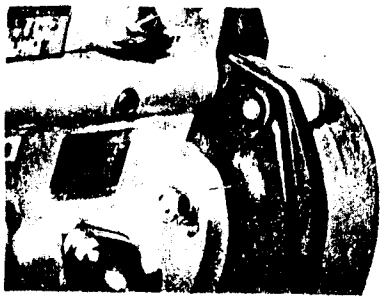


Fig. 2 – 21

(7) Glow Plugs

The glow plugs, when brought into function, preheat the combustion chambers, thereby to facilitate engine starting. This type of diesel engine comes equipped with the sheathed type glow plugs that are connected in parallel. Accordingly, if any one of the glow plugs is disconnected, it causes the time taken for the control resistor to get red-hot to increase. Similarly, if any one of the glow plugs is shorted, it causes the time taken for the control resistor to get red-hot to shorten extremely.

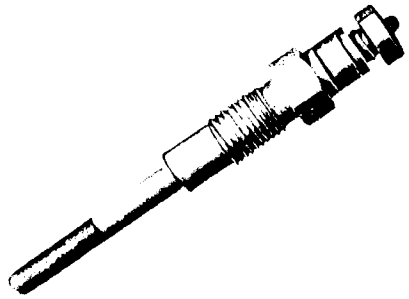


Fig. 2 – 25

If the glow plug circuit is found to be out of normal function, make a test on each of the glow plugs and replace, if found to be defective.

(8) Cautions to be Observed When Handling the AC Generator

(a) Make absolutely certain that the negative terminal (–) of the battery is grounded.

(b) Do not operate the generator with the output terminal ("A" terminal) of the generator disconnected.

(c) Make sure the generator terminals are connected properly.

(d) Do not bring the output terminal and "I" terminal of the generator into contact with the ground

(e) Do not bring the "F" terminal of the generator into contact with the ground while the generator is working.

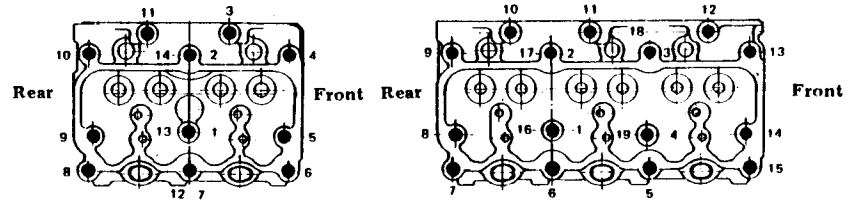
(f) Do not turn off the battery switch (Starter switch in the case of the generator incorporating a battery relay) while the generator is working.

2-6 ENGINE COMPONENTS

(1) Retightening of Cylinder Head Bolts

After the initial 100-hour operation, check and retighten the cylinder head bolts.

Tightening torques	8 kgfm



2AA1
2AB1

3AA1
3AB1

Fig. 2 – 26

With the torque wrench, retighten all the cylinder head bolts evenly to the 8m-kg torques in sequence specified in Fig. 2-26.

The valve clearance should be checked and adjusted whenever the cylinder head bolts are retightened. And, check the manifold clamping nuts and tighten them to the specified torques, if found to be loosened.

(2) Valve Clearance Adjustment

If the noise of the valve lifters is excessive or if the engine is out of normal operating condition without any trouble in the fuel system, adjust the valve clearance while the engine is cold.

Fig. 2 – 27

Method of Adjustment;

2AA1, 2AB1,

Hand crank the engine and bring it to a stop when the exhaust valve on the No. 2 cylinder is about ready to open and align the Top-mark on the crank pulley with the pointer on the timing gear cover so that the piston in the No. 1 cylinder is at the top dead center on the compression stroke.

Hold the engine stationary and adjust the intake valve and exhaust valve clearances on the No. 1 cylinder and intake valve on the No. 2 cylinder.

Turn the crankshaft one full turn so that the piston of the No. 2 cylinder is at the bottom dead center on the intake stroke, and hold the engine stationary, adjust the exhaust valve clearance on the No. 2 cylinder.

3AA1, 3AB1

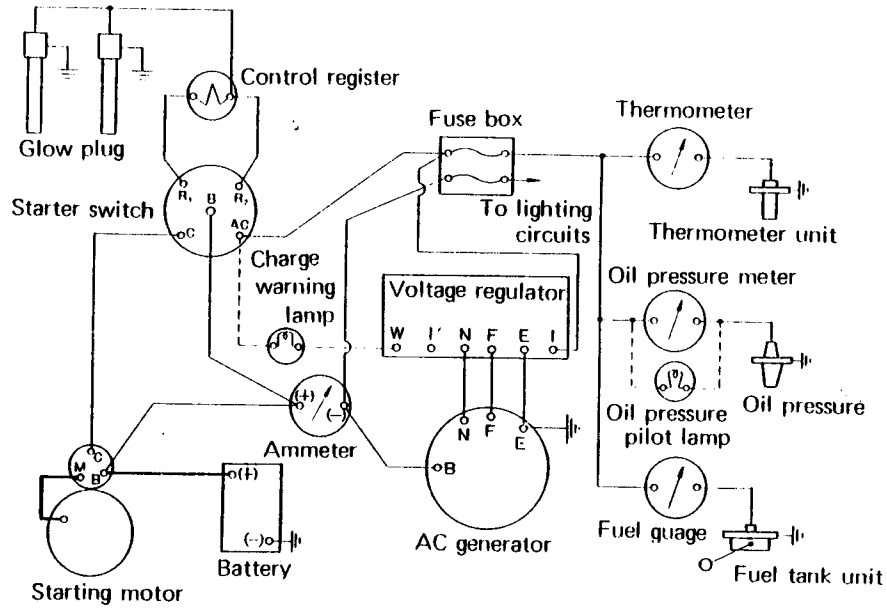
Hand crank the engine and bring it to a stop when the intake valve on the No. 3 cylinder is opening and align the Top-mark on the crank pulley with the pointer on timing gear cover so that the piston in the No. 1 cylinder is at top dead center on the compression stroke. Hold the engine stationary and adjust the intake and exhaust valve clearances on the No. 1 cylinder, intake valve on the No. 2 cylinder and exhaust valve on the No. 3 cylinder.

Turn the crankshaft on full turn so that the piston of the No. 1 cylinder is at the top dead center on the exhaust stroke. At this position, adjust the exhaust valve clearance on the No. 2 cylinder and intake valve on the No. 3 cylinder.

SECTION 3

WIRING DIAGRAM

AC Generator wiring diagram



SECTION 4

PERIODIC INSPECTION AND MAINTENANCE TABLE

Classification	Points to be checked	Adjustment standard	Daily check	At every 100 hours interval	At every 300 hours interval	At every 600 hours interval	At every 1200 hours interval
Engine unit	Check for leakage of oil, cooling water and fuel		○				
	Check and retighten cylinder head bolt	8 kgfm		only initial 100 hours ○			
	Check parts for loseness in mount			○			
	Check and adjust valve clearance	Both intake and exhaust valves 0.45 mm(cold)					△
	Check compression pressure						△
	Check condition of exhaust			○			
Fuel system	Check injection nozzle pressure and spray patterns	120kg/cm²			○		
	Replace fuel filter element					●	
	Service the fuel strainer in the intake port of feed pump						○
Lubricating system	Check level of oil in engine			○			
	Replace oil filter element				●		
	Drain oil filter (replacing engine oil)		○				

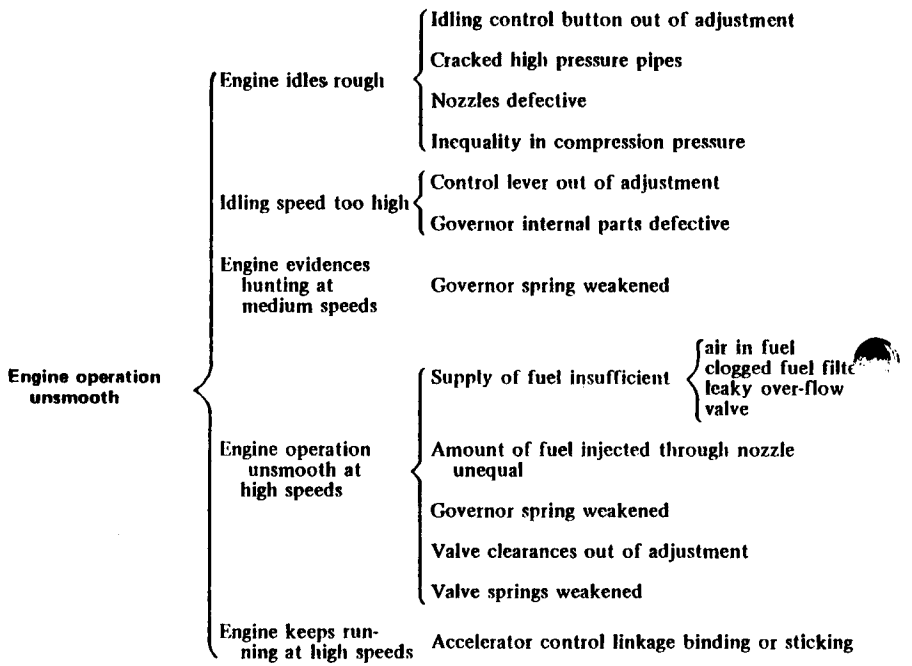
Classification	Points to be checked	Adjustment standard	Daily check	At every 100 hours interval	At every 300 hours interval	At every 600 hours interval	At every 1200 hours interval
Cooling system	Check fan belt for damage and looseness	Deflection 5 mm (in.)	○				
	Check level of cooling water		○				
	Flush internal part of cooling system					●	
	Clean external part of radiator					○	
Intake system	Replace air cleaner element (Viscous element)					●	
	Replace oil in oil-bath type air cleaner			○			
	Clean air breather			○			
Lubrication	Replace engine oil			After initial 50 hours of operation ●			
	Replace oil in injection pump				●		
	Apply oil to injection pump			○			
	Apply oil to engine control linkage			○			
Electrical system	Check level of battery electrolyte		○				
	Check specific gravity of battery electrolyte	Standard specific gravity 1.26			○		
	Check carbon brushes and commutator in generator and starting motor for wear and fouling				○		

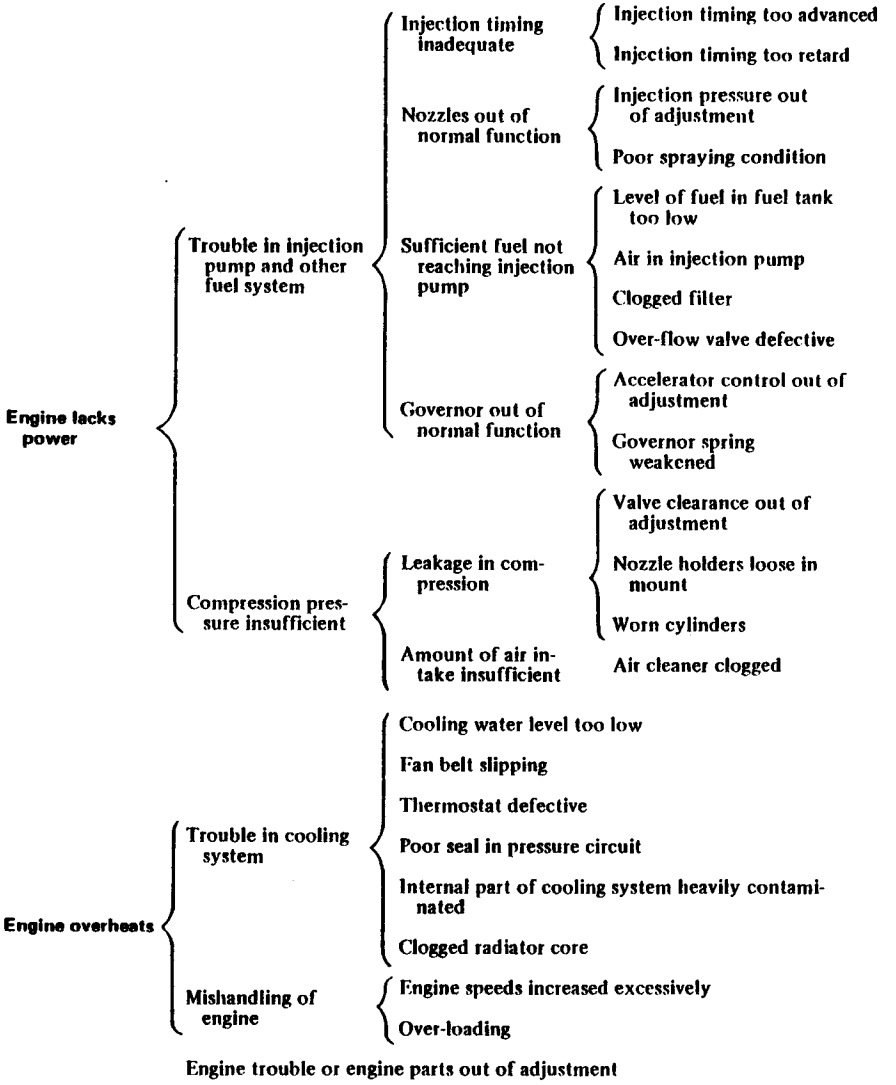
In the table the symbols ● indicates "replacement" while the symbol △ represents "inspection" to be made at the time of engine overhauling or when engine is found to be out of normal operating condition.

SECTION 5

TROUBLE-SHOOTING

- **Engine does not start**
  - Starting motor does not turn over
    - Run-down battery
    - Poor battery connections
    - Starting motor or switch defective
  - Starting motor turns over
    - Fuel not injected
      - Fuel tank empty
      - Fuel filter clogged
      - Air in injection pump
      - Fuel feed pump out of normal function
      - Control rack binding in no-fuel position
    - Fuel injected
      - Pre-combustion chambers not sufficiently heated
      - Glow plugs defective
      - Injection timing out of adjustment
      - Engine lacks compression
  - Engine starts but stalls
    - Feed pump defective
    - Air in injection pump
    - Poorly adjusted engine idling


Engine operation unsmooth
Engine idles rough
Idling control button out of adjustment
Cracked high pressure pipes
Nozzles defective
Inequality in compression pressure
Idling speed too high
Control lever out of adjustment
Governor internal parts defective
Engine evidences hunting at medium speeds
Governor spring weakened
Engine operation unsmooth at high speeds
Supply of fuel insufficient
air in fuel
clogged fuel filte
leaky over-flow valve
Amount of fuel injected through nozzle unequal
Governor spring weakened
Valve clearances out of adjustment
Valve springs weakened
Engine keeps running at high speeds
Accelerator control linkage binding or sticking


Engine lacks power
Trouble in injection pump and other fuel system
Injection timing inadequate
Injection timing too advanced
Injection timing too retard
Nozzles out of normal function
Injection pressure out of adjustment
Poor spraying condition
Sufficient fuel not reaching injection pump
Level of fuel in fuel tank too low
Air in injection pump
Clogged filter
Over-flow valve defective
Governor out of normal function
Accelerator control out of adjustment
Governor spring weakened
Compression pressure insufficient
Leakage in compression
Valve clearance out of adjustment
Nozzle holders loose in mount
Worn cylinders
Amount of air intake insufficient
Air cleaner clogged
Engine overheats
Trouble in cooling system
Cooling water level too low
Fan belt slipping
Thermostat defective
Poor seal in pressure circuit
Internal part of cooling system heavily contaminated
Clogged radiator core
Mishandling of engine
Engine speeds increased excessively
Over-loading
Engine trouble or engine parts out of adjustment

SECTION 6

AUXILIARY EQUIPMENT

EMERGENCY ENGINE STOPPING DEVICE

The emergency engine stopping device is so designed that it is brought into function when the temperature of the cooling water reaches as high as 95°C (203°F) or when the lubricating oil pressure falls below 1.0kg/cm² (14 PSI), thereby bringing the engine to a quick stop. Refer to another instruction book "MOTOR-DRIVEN EMERGENCY ENGINE STOPPER" in detail.

6-1 POWER DRIVE

The power drive unit which is coupled to the rear end of the engine serves to carry the engine torque to a unit to be driven. It consists principally of the clutch, mainshaft and bearings.

Type of power drive	Clutch size	Type of bearings	Number of bearings	Method of driving
XL 095A	9.5 in.	Ball	2	V belt, Chain
XL 095B		Ball	1	V belt, Chain

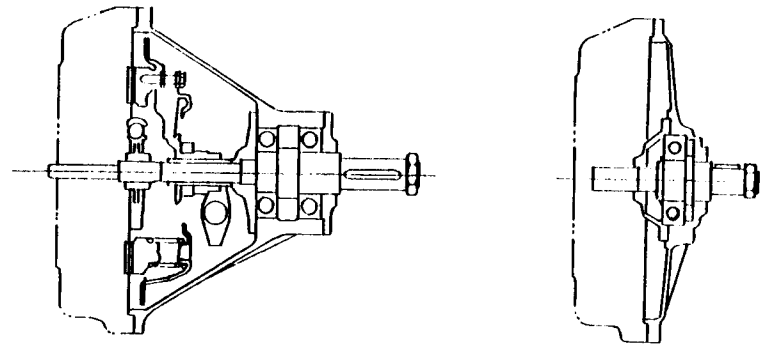


Fig. 6 – 2

6-2 TACHOMETER

The tachometer indicates the revolution of the engine per minute. The tachometer drive system is joined the rear end of the injection pump, but Type A injection pump is joined the front end of timing gear case.

Fig. 6 – 3