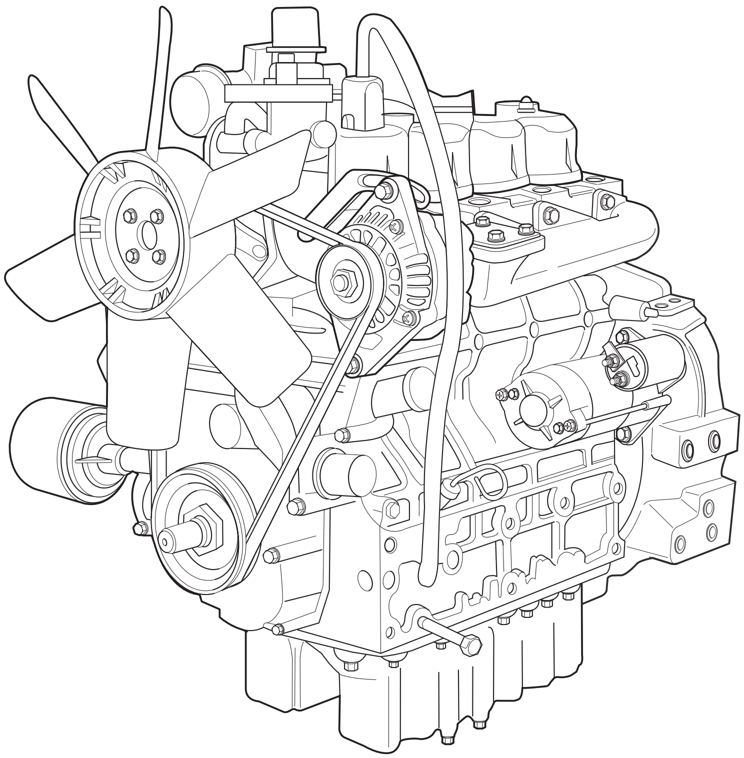
CHAPTER 2

ENGINE SYSTEM

1. GENERAL

1.1 APPEARANCE



643W201A

The DAEDONG A series engines are vertical, water-cooled, 4-cycle, three or four cylinders diesel engines, they concentrate DAEDONG's foremost technologies.

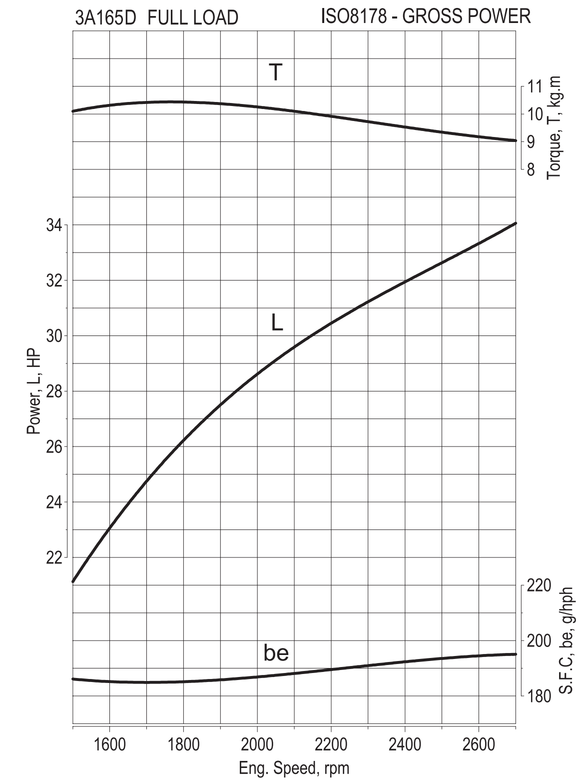
With swirl combustion chamber, bosch K type fuel injection pump, well-balanced designs, they feature greater power, low fuel consumption, less vibration and noise, and low emission.

1.2 SPECIFICATIONS

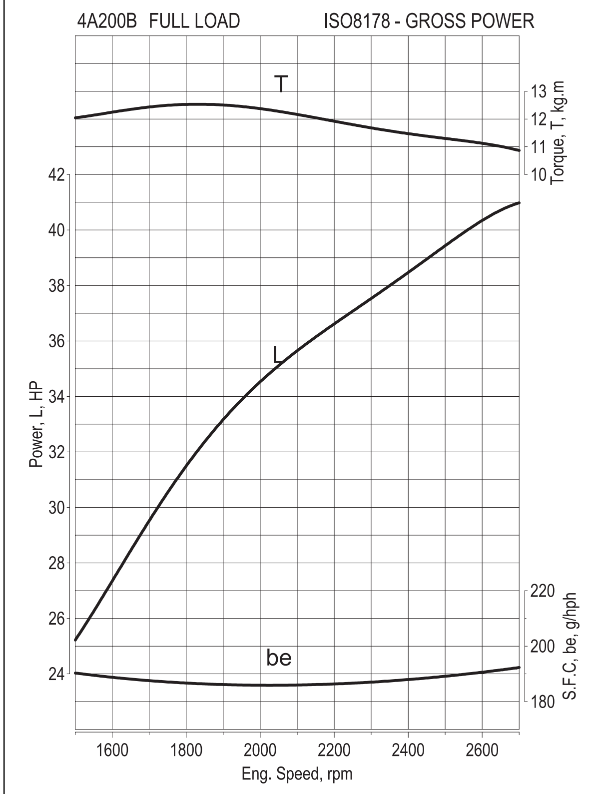
Model	3A165D	4A200B	4A220L
Type	Vertical, water-cooled, 4-cycle diesel engine	Vertical, water-cooled, 4-cycle diesel engine	Vertical, water-cooled, 4-cycle diesel engine
Number of cylinder	3	4	4
Bore and stroke	87 x 92.4 mm 3.43 x 3.64 in.	83 x 92.4 mm 3.27 x 3.64 in.	87 x 92.4 mm 3.43 x 3.64 in.
Total Displacement	1,647 ℓ 100.5 in^3.	1,999 ℓ 120.0 in^3.	2,197 ℓ 134.1 in^3.
Combustion Chamber	Spherical type	Spherical type	Spherical type
Gross power	33.5/2,700 HP/rpm 30.0/2,700 kW/rpm	40.4/2,700 HP/rpm 36.2/2,700 kW/rpm	44.4/2,700 HP/rpm 39.7/2,700 kW/rpm
Maximum idling speed	2,900 rpm	2,900 rpm	2,900 rpm
Minimum idling speed	850 ~ 900 rpm	850 ~ 900 rpm	850 ~ 900 rpm
Order of firing	1 - 2 - 3	1 - 3 - 4 - 2	1 - 3 - 4 - 2
Direction of rotation	Counterclockwise (viewed from flywheel side)	Counterclockwise (viewed from flywheel side)	Counterclockwise (viewed from flywheel side)
Injection pump	Bosch K TYPE mini pump	Bosch K TYPE mini pump	Bosch K TYPE mini pump
Injection pressure	140 ~ 150 kgf/cm^2 13.73 ~ 14.71 MPa 1,991 ~ 2,133 psi	140 ~ 150 kgf/cm^2 13.73 ~ 14.71 MPa 1,991 ~ 2,134 psi	140 ~ 150 kgf/cm^2 13.73 ~ 14.71 MPa 1,991 ~ 2,134 psi
Injection timing (Before T.D.C)	18 °	18 °	18 °
Compression Ratio	22 : 1	22 : 1	22 : 1
Fuel	Diesel fuel	Diesel fuel	Diesel fuel
Lubricant	Engine oil SAE 15W-40	Engine oil SAE 15W-40	Engine oil SAE 15W-40
Dimensions (lenght x width x height)	722.3 x 488.1 x 729.9 mm 28.4 x 19.2 x 28.7 in.	817.3 x 488.1 x 735.8 mm 32.2 x 19.2 x 29.0 in.	805.3 x 502.6 x 736 mm 31.7 x 19.79 x 28.98 in.
Dry weight	179 kg 395 lbs.	183 kg 403 lbs.	207 kg 456 lbs.

* **NOTE:** Change of parts are not subject to advance notice.

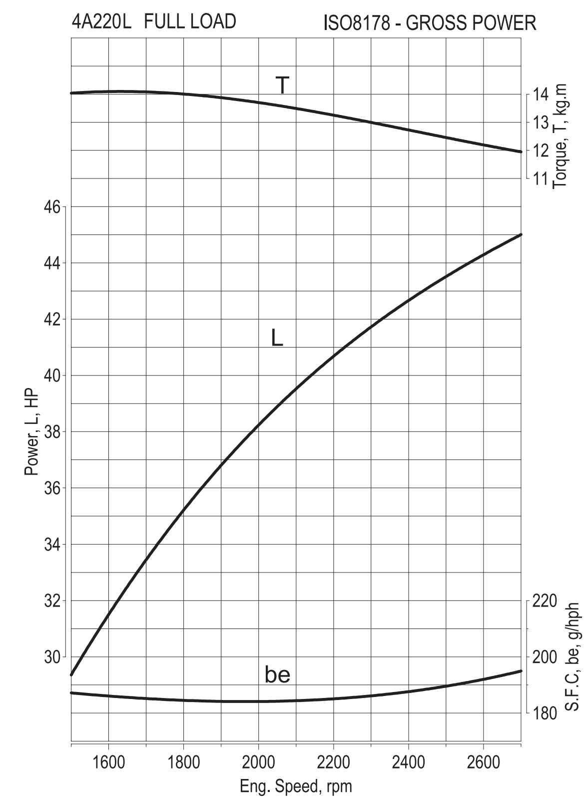
1.3 PERFORMANCE CURVE



643W203A

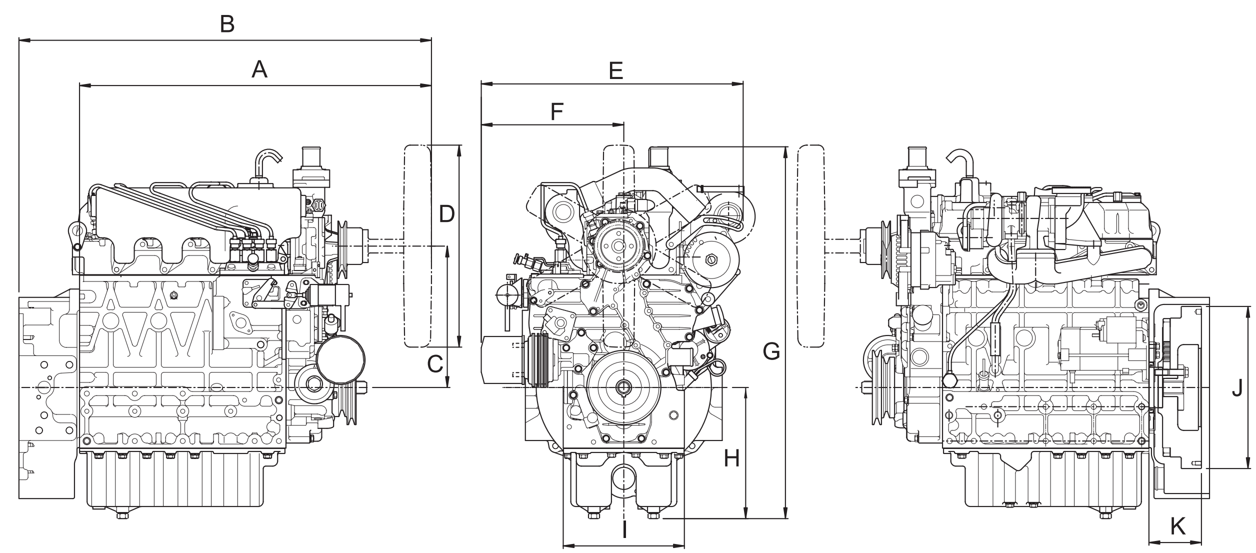


643W204A



643W205A

1.4 DIMENSIONS



	A	B	C	D	E	F	G	H	I	J	K
3A165D (mm)	602.3	722.3	280.0	400.0	488.1	251.6	729.9	259.7	240.0	315.0	95.0
(in.)	23.71	28.44	11.02	15.75	19.22	9.91	28.74	10.00	9.45	12.40	3.74
4A200B (mm)	697.3	817.3	280.0	400.0	488.1	251.6	735.8	259.7	240.0	321.0	92.0
(in.)	27.45	32.18	11.02	15.75	19.22	9.91	28.97	10.22	9.45	12.64	3.62
4A220L (mm)	697.3	805.3	280.0	400.0	502.6	262.5	736.0	260.0	240.0	321.0	104.5
(in.)	27.45	31.70	11.02	15.75	19.79	10.33	28.98	10.24	9.45	12.64	4.11

1.5. GENERAL WARNING

- When disassembling, arrange each part on a clean place. Do not mix them up. Replace bolts and nuts where they were.
- When servicing electrical parts or connecting instruments to electrical equipment, first disconnect the battery negative terminal.
- Replace gaskets or O-rings with new ones when reassembling, and apply grease on a O-ring and the oil seal when reassembling.
- When exchanging parts, use DAEDONG parts to maintain engine performance and safety.
- To prevent oil and water leakage, apply non-drying adhesive to the gaskets according to this manual before reassembling.
- When hoisting up the engine, use the hook provided on the cylinder head.
- When reinstalling the engine, use the hook provided on the cylinder head.
- When installing external cir-clips or internal cir-clips, direct corner end to the non-loosening direction.

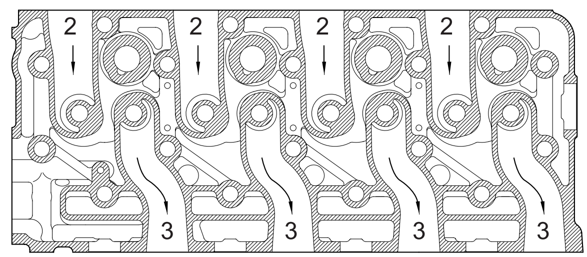
2. STRUCTURE AND FUNCTION

2.1 BODY

A. CYLINDER HEAD

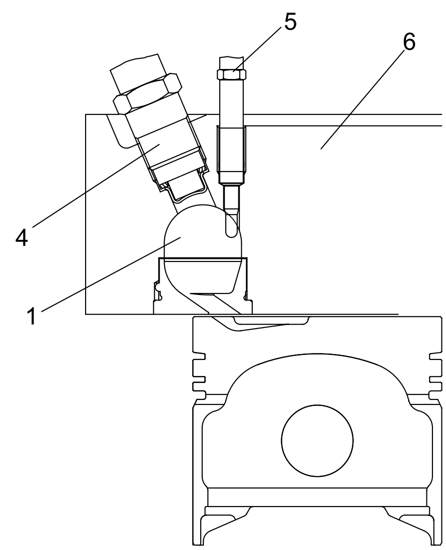
The cylinder head is made of special alloy cast iron which can resist high temperature and pressure caused by combustion. The inlet and exhaust ports are arranged cross-flow type to get high combustion efficiency by protecting the suction air from being heated and expanded by heated exhaust air.

The DAEDONG vortex type combustion chamber is designed for high combustion efficiency and reducing fuel consumption. The glow plug assures easier than ever engine starts even at -15 °C (5 °F).



643W207A

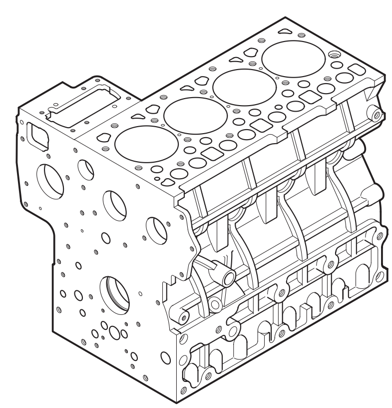
(1) Combustion Chamber
(2) Inlet Port
(3) Exhaust Port
(4) Injection Nozzle
(5) Glow Plug
(6) Cylinder Head



643W208A

B. CYLINDER BLOCK

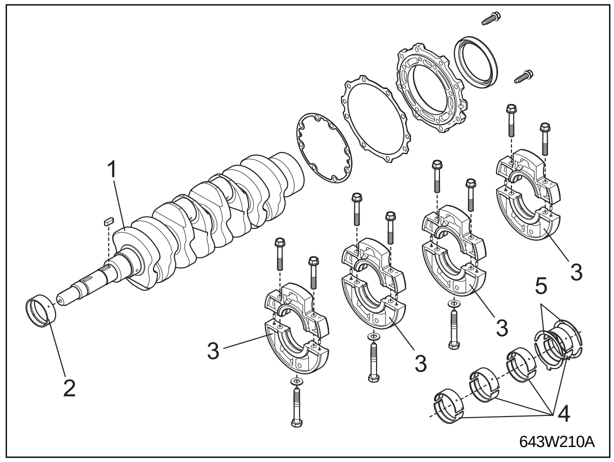
The engine has a high durability tunnel-type cylinder block. Furthermore, liner less type, allows effective cooling, less distortion, and greater wear-resistance using special material. The noise is reduced to a minimum because each cylinder has its chamber.



643W209A

C. CRANKSHAFT

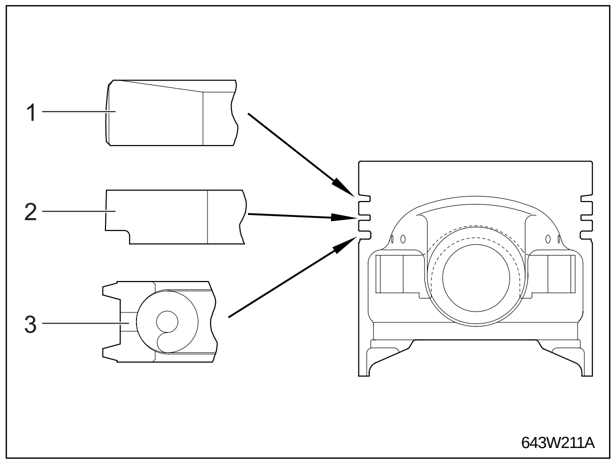
The crankshaft is made of forged steel and the journals, the crankpins and the bearing surface for the oil seal are induction-hardened to increase wear resistance. Each crankshaft journal is supported by the main bearing case (3) having a bearing inside. The front bearing-crankshaft bearing (2) is a solid type bushing and rear and intermediate bearings are a split type. The crankshaft, crankshaft bearings have oil holes for lubricant flow.



(1) Crankshaft
(2) Crankshft Bearing 1
(3) Main Bearing Case
(4) Crankshft Bearing 2
(5) Thrust Bearing

D. PISTON AND PISTON RINGS

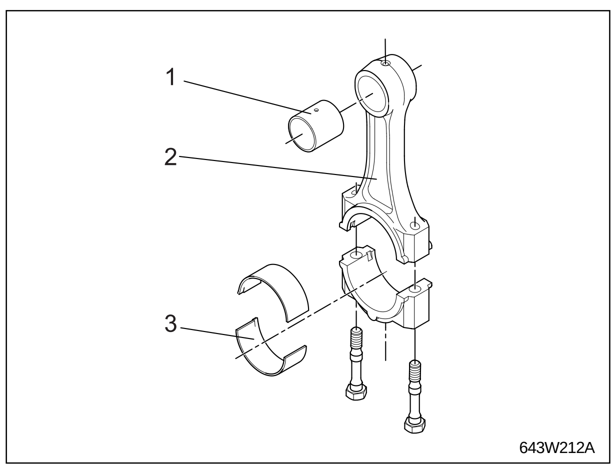
The piston is made of an aluminum alloy which is temperature and pressure resistant. Three rings are installed in the grooves of the piston. The top ring (1) is a keystone type, which can withstand heavy loads, and the barrel face on the ring fits well to the cylinder wall. The second ring (2) is an undercut type, which prevents the oil from being carried up. The oil ring (3) has chambered contact faces and an expander ring, which increase the pressure of the oil ring against the cylinder wall to scrape the oil. The top ring is plated with hard chrome to increase wear resistance (The ring of 4A200T engine is made of a special steel).



(1) Top Ring
(2) Second Ring
(3) Oil Ring

E. CONNECTING ROD

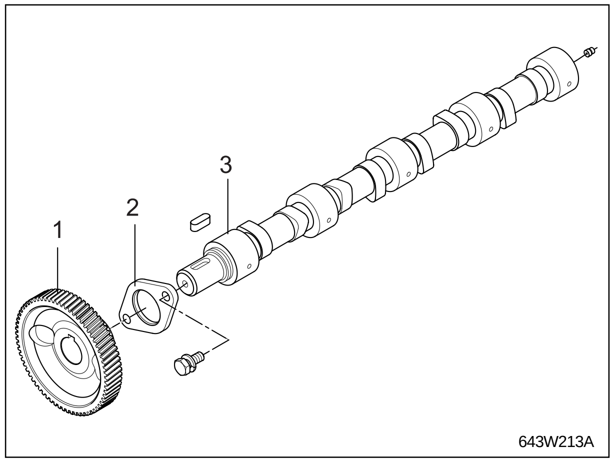
The connecting rod (2), which converts the reciprocating motion of the pistons caused by the fuel combustion into the rotating motion of the crankshaft, is made of hard forged steel. The connecting rod has bearings at both ends. The small end has a solid type bearing (small end bushing (2)) and the big end has a split type bearing (crankpin bearing (3)).



(1) Small End Bushing
(2) Connecting Rod
(3) Crankpin Bearing

F. CAMSHAFT

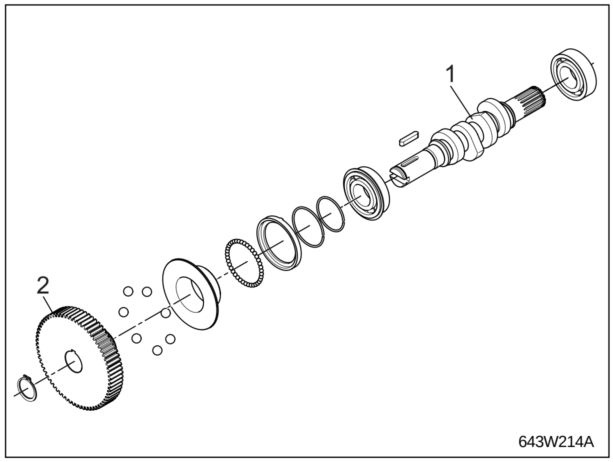
The camshaft (3) is made of forged steel and its journal and cams are hardened to increase wear resistance. The cams on the camshaft open and close the inlet and exhaust valves with the push rods and rocker arms. The journals and their bearings are force-lubricated.



(1) Cam Gear (3) Camshaft
(2) Camshaft Stopper

G. FUEL CAMSHAFT

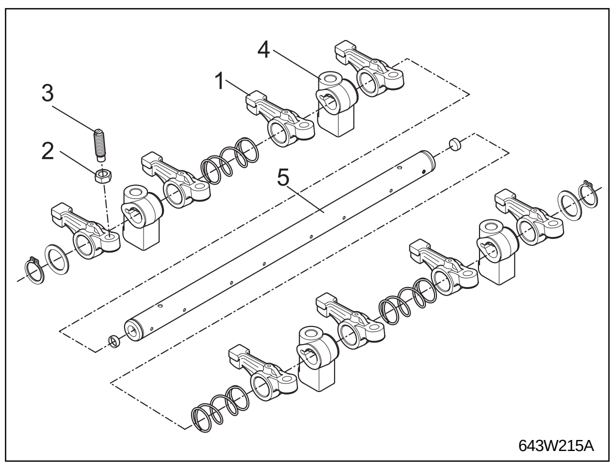
This fuel camshaft is made of forged steel and its cams are hardened and tempered to increase wear resistance. The cams on the fuel camshaft (1) drive the injection pump and the fuel transfer pump. The governor balls are installed on the fuel camshaft to control the engine speed.



(1) Fuel Camshaft (2) Injection Pump Gear

H. ROCKER ARM ASSEMBLY

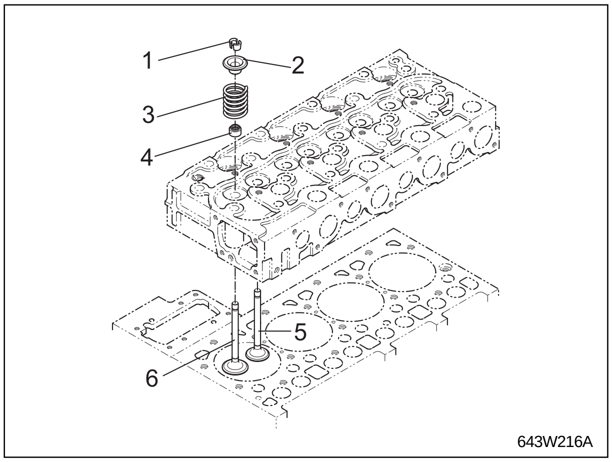
The rocker arm assembly includes the rocker arms (1) and an adjusting screw (3), which is at the end of rocker arm and rests on the push rod, rocker arm brackets (4) and rocker arm shaft (5). The rocker arms are activated by the reciprocating motion of the push rods and open or close the inlet and exhaust valves. The rocker arm and other parts are lubricated through the drilled holes of the brackets and the rocker arm shaft.



(1) Rocker Arm (4) Rocker Arm Bracket
(2) Lock Nut (5) Rocker Arm Shaft
(3) Adjusting Screw

I. INLET AND EXHAUST VALVES

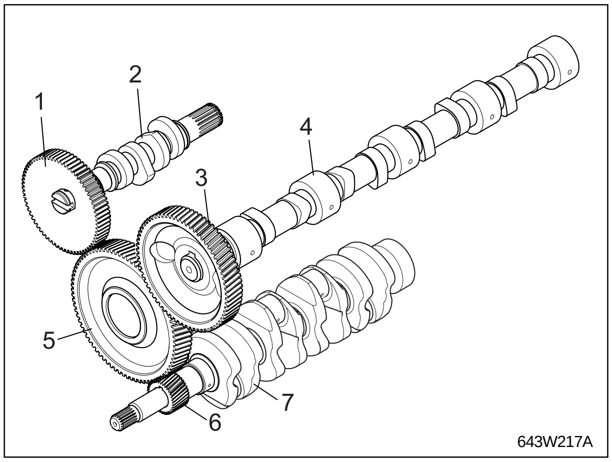
The valve and its guide of the inlet are different from those for the exhaust. Other parts, such as the spring, spring retainers, valve spring collets, valve stem seals are the same for both the inlet and the exhaust. All contact or sliding surfaces are hardened to increase wear resistance.



(1) Valve Spring Collet
(2) Valve Spring Retainer
(3) Valve Spring
(4) Valve Stem Seal
(5) Exhaust Valve
(6) Inlet Valve

J. TIMING GEARS

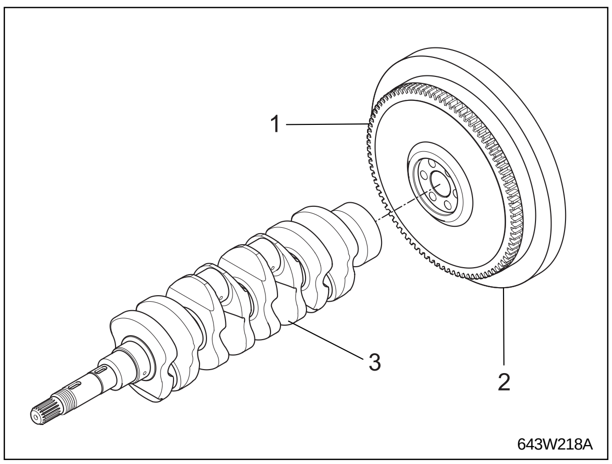
The crankshaft drives the oil pump and the idle gear engaged fuel camshaft and camshaft. The timings for opening and closing the valves is extremely important to achieve effective air inlet and sufficient gas exhaust. The appropriate timing can be obtained by aligning the mark on the crankshaft gear (6) with one the idle gear (5), idle gear with camshaft gear, idle gear with injection pump gear, when assembling.



(1) Injection Pump Gear
(2) Fuel Camshaft
(3) Camshaft Gear
(4) Camshaft
(5) Idle Gear
(6) Crankshaft Gear
(7) Crankshaft

K. FLYWHEEL

The flywheel is installed on the rear end of the crankshaft. Its inertia keeps the flywheel turning at a constant speed, while the crankshaft tends to speed up during the power stroke and to slow down during other stokes. The flywheel has a ring gear (1), which mesh with the drive pinion of the starter. The flywheel has also marks “TC” and “FI” on its outer rim. The mark TC shows the piston’s top dead center and the mark FI shows the fuel injection timing, when they are aligned with the mark of window on the clutch housing.

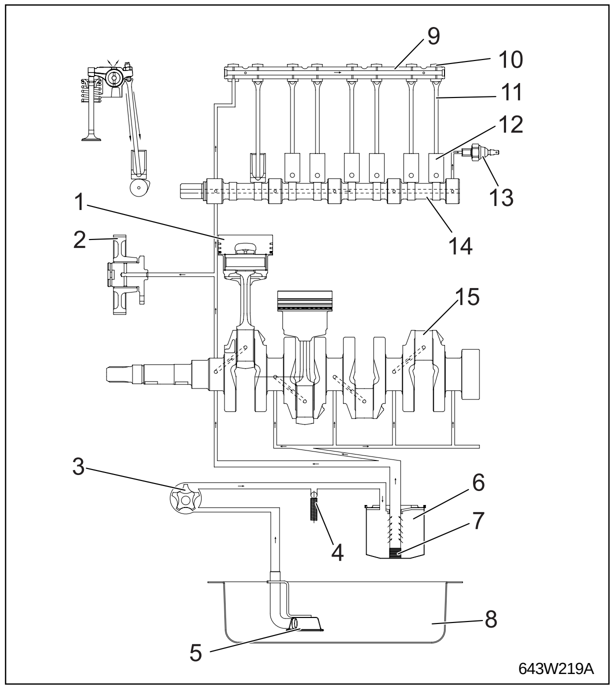


(1) Ring Gear
(2) Flywheel
(3) Crankshaft

2.2 LUBRICATING SYSTEM

A. FLOW OF LUBRICATING OIL

The lubricating oil is forced to each journal through the oil passages of the cylinder block, cylinder head and shafts. The oil, splashed by the crankshaft or thrown off from the bearings, lubricates other engine parts such as the push rods (11), tappets (12), camshaft (14), and crankshaft (15).



(1) Piston
(2) Idle Gear
(3) Oil Pump
(4) Relief Valve
(5) Strainer
(6) Oil Filter Element
(7) Bypass Valve
(8) Oil Pan
(9) Rocker Arm Shaft
(10) Rocker Arm
(11) Push Rod
(12) Tappet
(13) Oil Pressure Switch
(14) Camshaft
(15) Crankshaft

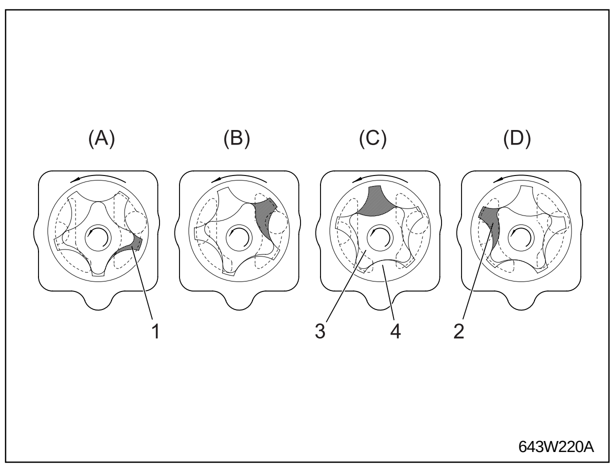
B. OIL PUMP

The oil pump is a gear type. Whose rotors have trochoid lobes. The inner rotor (3) has 4 lobes and the outer rotor (4) has 5 lobes, and they are eccentrically engaged with each other. The inner rotor, which is driven by the crankshaft through the gears, rotates the outer rotor in the same direction, varying the space between the lobes.

While the rotors rotate from (A) to (B), the space leading to the inlet port increases, which causes the oil to flow through the inlet port.

When the rotors rotate to (C), the port to which the space leads is changed from inlet to outlet.

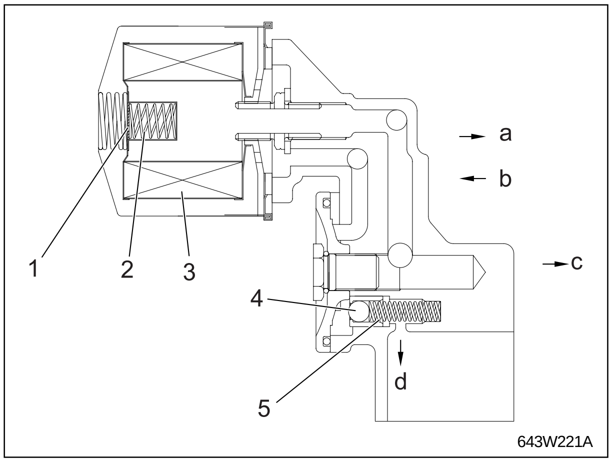
At (D), the space decreases and oil is discharged through the outlet port.



(1) Inlet
(2) Outlet
(3) Inner Rotor
(4) Outer Rotor

C. OIL FILTER AND RELIEF VALVE

The lubricating oil force-fed by the pump is filtered by the filter cartridge, passing through the filter element from the outside to the inside. When the filter element accumulates dirt and the pressure difference between the inside and the outside rises more than 98 kPa (1.0 kgf/cm², 14 psi), the bypass valve (1) opens to allow the oil to flow from the inlet line to outlet line, bypassing the filter element. The relief valve ball (4) in the inlet line allows oil to prevent damage to the lubricating system, when the oil pressure rises more than 441 kPa (4.5 kgf/cm², 64 psi).

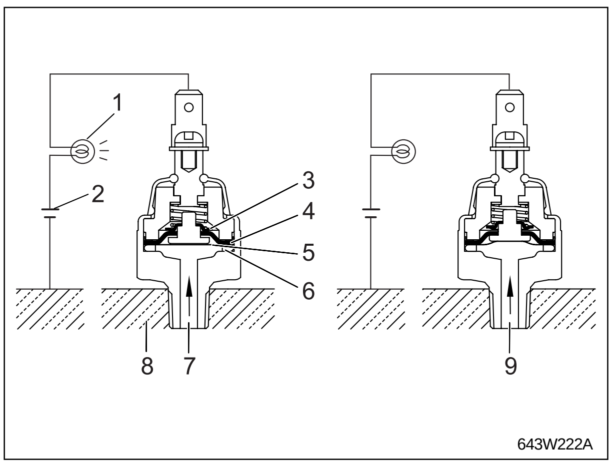


(1) Bypass Valve
(2) Bypass Adjusting Spring
(3) Filter Element
(4) Relief Valve Ball
(5) Relief Adjusting Spring

(a) To Idle Gear, Camshaft and Rocker Arm
(b) From Oil Pump
(c) To Crankshaft Journal Crankpin
(d) Drain of Relief Valve

D. OIL PRESSURE SWITCH

The oil pressure switch is installed on the cylinder block and leads to the oil passage of the lubricating oil. When the oil pressure falls below the specified value, the contacts of the oil pressure switch closes to turn on the warning lamp (1).



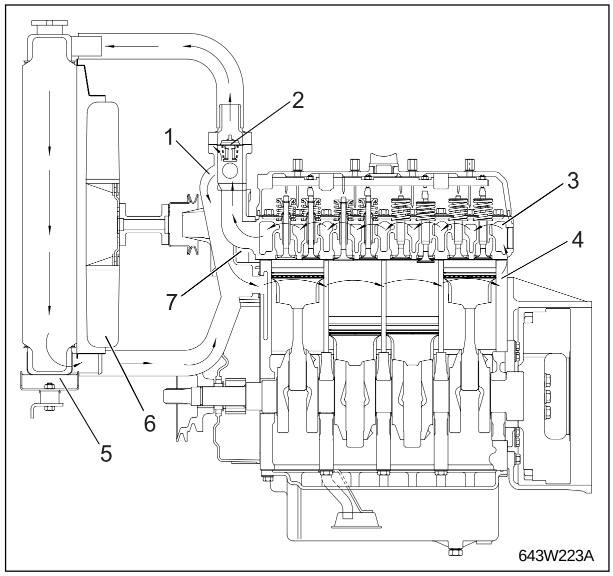
(A) At Lower Oil Pressure
(49 kPa (0.5 kgf/cm², 7 psi) or less)
(B) At Proper Oil Pressure

(1) Warning Lamp
(2) Battery
(3) Contact Movable
(4) Contact Cup
(5) Diaphragm
(6) Rubber Washer
(7) Oil Pressure
(8) Cylinder Block
(9) Pressure

2.3 COOLING SYSTEM

A. FLOW OF COOLING WATER

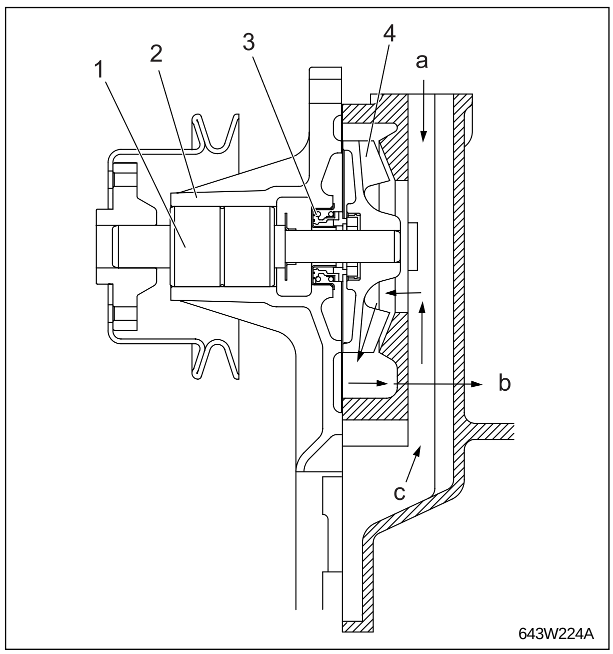
The cooling system consists of a radiator (5), a centrifugal water pump (7), a cooling fan (6) and a thermostat (2). The water is cooled as it flows through the radiator core, and the fan behind the radiator pulls the cooling air through the radiator core. The water pump receives water from the radiator or from the cylinder head and forces it into cylinder block. The thermostat open or closes according to the water temperature. When the water temperature is high, the thermostat opens to allow the water to flow from the cylinder block to the radiator. When the water temperature is low, the thermostat closes and the flow stays within the block. The opening temperature of the thermostat is approx. 71 °C (160 °F).



(1) Water Return Pipe
(2) Thermostat
(3) Cylinder Head Water Jacket
(4) Cylinder Block Water Jacket
(5) Radiator
(6) Cooling Fan
(7) Water Pump

B. WATER PUMP

The water pump is driven with the fan drive pulley, which is on the water pump shaft and driven by the crankshaft with a belt. The water pump sucks the cooled water, forces into the cylinder block and draws out the hot water to the radiator repeatedly. The mechanical seal (3) prevents the water from entering the bearing (1).



(a) From the Thermostat
(b) To the Cylinder Block
(c) From the Radiator

(1) Bearing
(2) Pump Body
(3) Mechanical Seal
(4) Pump Impeller

C. THERMOSTAT

The thermostat is wax pellet type, which controls the flow of the cooling water to the radiator to keep the proper temperature. The case has a seat (1) and the pellet has a valve (2). The spindle attached to the case is inserted into the synthetic rubber in the pellet. The pellet is charged with wax.

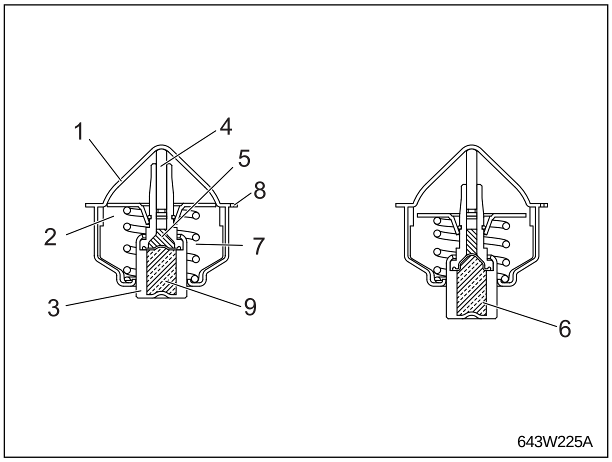
(A) At Low Temperature (Lower than 71 °C (160 °F)).

The valve (2) is seated by the spring (7) and the cooling water circulates in the engine through the water return pipe but does not enter the radiator.

(B) At High Temperature (Higher than 71 °C (160 °F)).

As the water temperature rises, the wax in the pellet (3) turns liquid and expands, repelling the spindle.

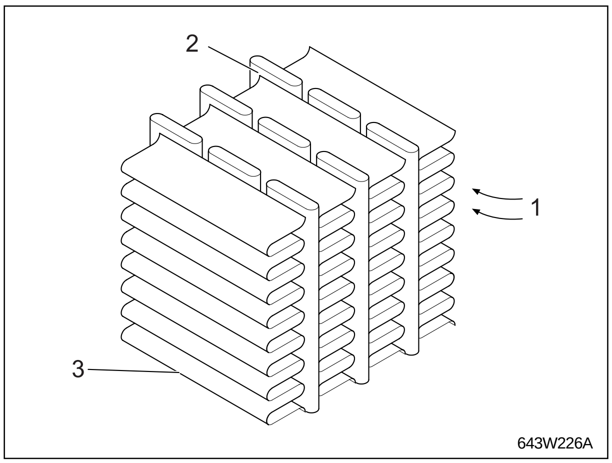
The pellet lowers and the valve (2) opens to send the cooling water to the radiator.



(1) Seat
(2) Valve
(3) Pellet
(4) Spindle
(5) Synthetic Rubber
(6) Wax (Solid)
(7) Spring
(8) Leak Hole
(9) Wax (Liquid)

D. RADIATOR

The radiator core consists of water carrying tubes (2) with fins (3) at a right angle to it. The water in the radiator is cooled by the air flowing through between the tube wall and the fin.



(1) Cooling Water
(2) Tube
(3) Fin

E. RADIATOR CAP

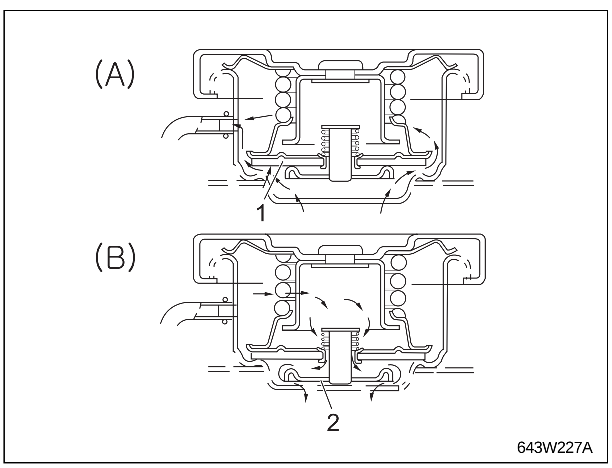
The pressure type cap is installed on the radiator, which prevents the pressure difference between the inside and the outside of the radiator from deforming the radiator.

(A) At High Pressure
(Higher than 88 kPa (0.9 kgf/cm², 13 psi)

When the water temperature rises and the pressure in the radiator increases above the specified pressure, the pressure valve (1) opens to reduce the internal pressure.

(B) At Low Pressure.

When the water temperature falls and a vacuum is formed in the radiator, the vacuum valve (2) opens to allow the water to enter the radiator.

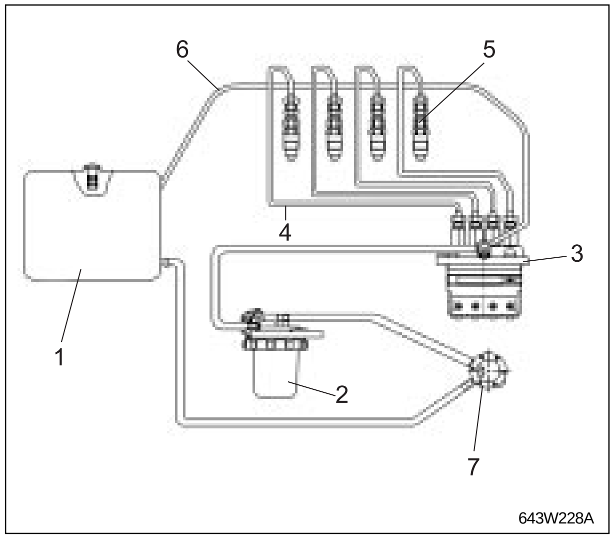


(1) Pressure Valve
(2) Vacuum Valve

2.4 FUEL SYSTEM

A. FLOW OF FUEL

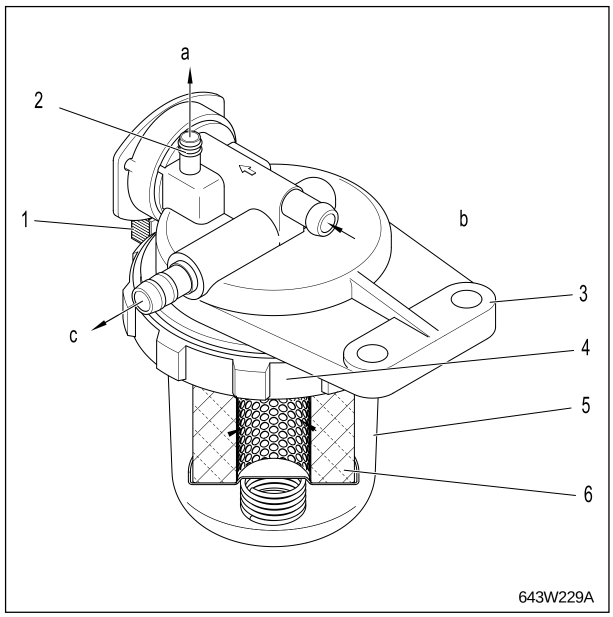
The fuel is fed from the fuel tank (1) through the fuel feed pump (7) to the injection pump (3) by the fuel filter (2). The injection pump force-feds the fuel through the injection nozzles (5), which inject the fuel into the cylinders for combustion. The excessive fuel from the injection pump to the injection nozzles (5), which inject the fuel into the cylinders for combustion. The excessive fuel from the injection pump to the injection nozzles is collected in the fuel overflow pipes (6) and returns to the fuel tank.



(1) Fuel Tank
(2) Fuel Filter
(3) Injection Pump
(4) Injection Pipe
(5) Injection Nozzle
(6) Fuel Overflow Pipe
(7) Fuel Feed Pump

B. FUEL FILTER

The fuel filter removes dirt and water with its fine filter paper, which collects particles of 90 microns (0.0034 in.) at 20 kPa (0.2 kgf/cm², 3 psi). The fuel from the fuel feed pump is filtered by the filter element (6), while flowing through the filter body (3) has an air vent (2) to return the air tin the fuel to the fuel tank to prevent the engine from stopping or running irregularly.



(a) To Fuel Tank
(b) From Fuel Feed Pump
(c) To Injection Pump

(1) Cock
(2) Air Vent
(3) Filter Body
(4) Retainer Ring
(5) Pot
(6) Filter Element

C. FUEL FEED PUMP

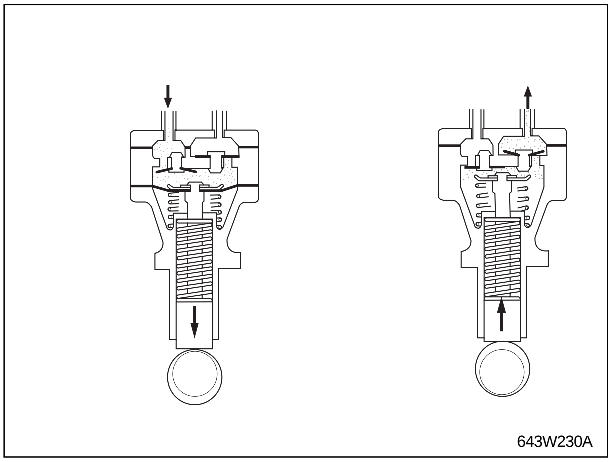
The diaphragm (6) is linked to the tappet (3) with the push rod (2). The tappet is reciprocated by the eccentric cam on the fuel camshaft (7).

(A) Inlet Stroke

When the diaphragm is pulled down by the spring, vacuum in the chamber (5) causes the outlet valve (4) to close and the atmospheric pressure in the fuel tank to force the fuel into the chamber, opening the inlet valve (1).

(B) Discharge Stroke

When the diaphragm is pushed up by the cam, the pressure in the chamber causes the inlet valve to close and forces out the fuel, opening the outlet valve.

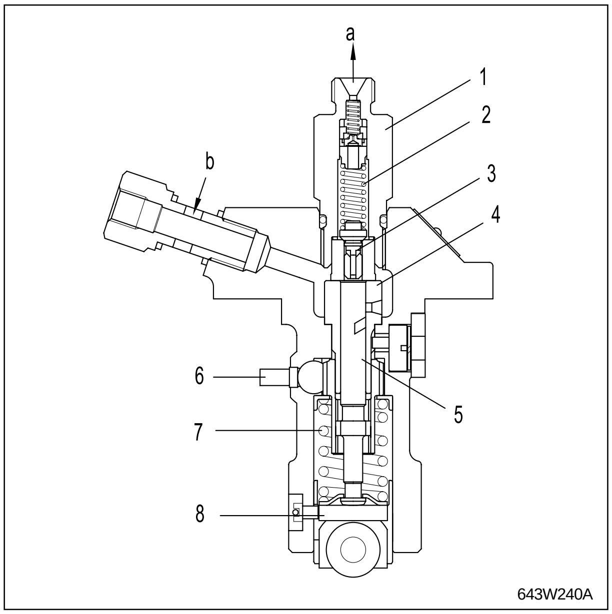


(a) From Fuel Tank
(b) To Fuel Filter

(1) Inlet Valve
(2) Push Rod
(3) Tappet
(4) Outlet Valve
(5) Chamber
(6) Diaphragm
(7) Fuel Camshaft

D. FUEL INJECTION PUMP

The injection pump is Bosch K type mini injection pump. It features a compact and light weight design.

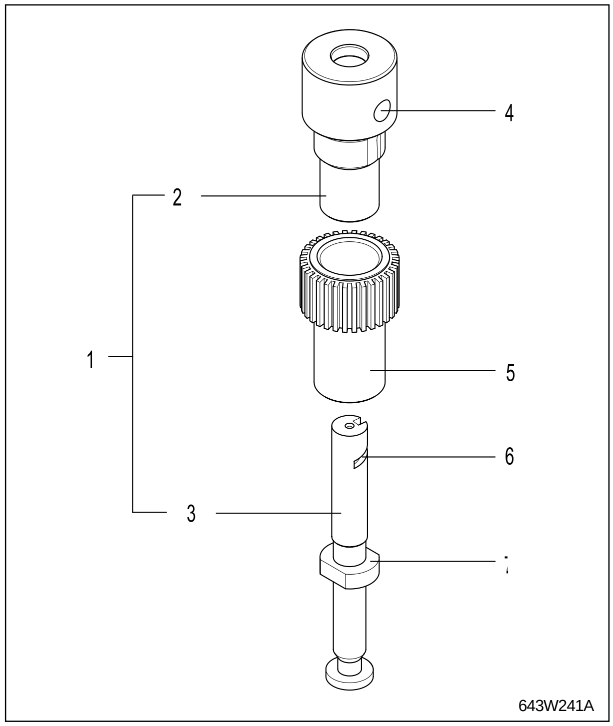


(a) To Injection Nozzle
(b) From Fuel Filter

(1) Delivery Valve Holder
(2) Delivery Valve Spring
(3) Delivery Valve
(4) Cylinder
(5) Plunger
(6) Control Rack
(7) Plunger Spring
(8) Tappet

a. Pump Element

The pump element (1) consists of a plunger (3) and cylinder (2), their sliding surfaces are precision machined to maintain fuel tightness. The plunger (3) fits in the control sleeve (5) at the driving surface (7). The sleeve is engaged with the control rack, which rotate the plunger in the cylinder to control the amount of fuel delivery.



(1) Pump Element
(2) Cylinder
(3) Plunger
(4) Feed Hole
(5) Control Sleeve
(6) Control Groove
(7) Driving Surface

b. Operation of Pump Element

(A) Before Delivery

As the taper lowers, the plunger (2) lowers and fuel is drawn into the delivery chamber (1) through the feed hole (4) from the fuel chamber (5).

(B) Beginning of Delivery

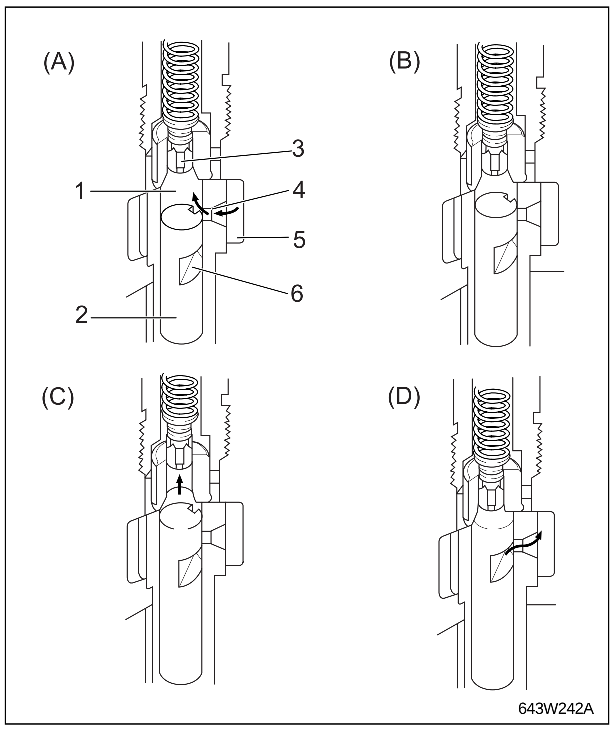
When the plunger is pushed up by the cam and the head of the plunger closes the feed hole (4), the pressure in the delivery chamber (1) rises to push the delivery valve (3) open.

(C) Delivery

While the plunger (2) is rising, delivery of fuel continues.

(D) End of Delivery

When the plunger rises further and the control groove (6) on its periphery meets the feed hole, the fuel returns to the fuel chamber (5) from the delivery chamber (1) through the control groove (6) and the feed hole (4).



(1) Delivery Chamber
(2) Plunger
(3) Delivery Valve
(4) Feed Hole
(5) Fuel Chamber
(6) Control Groove

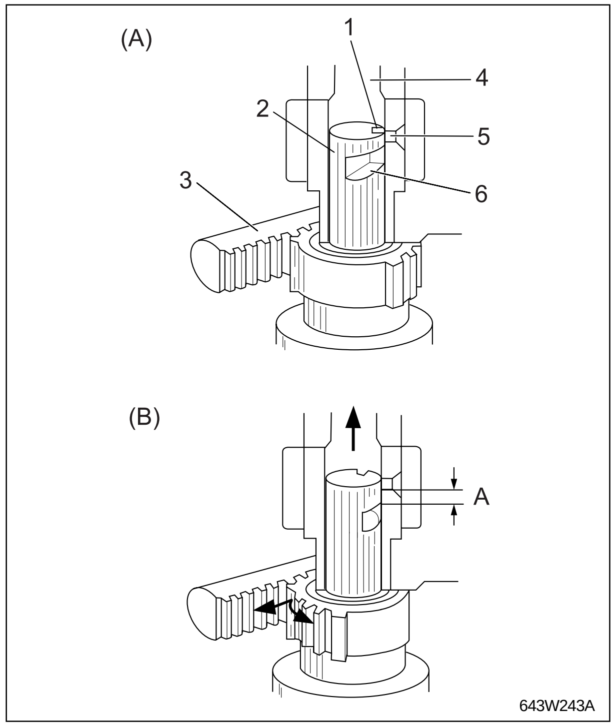
c. Amount of Fuel Delivery

(A) No Fuel Delivery

At the engine stop position of the control rack (3), the lengthwise slot (1) on the plunger (2) aligns with the feed hole (5). The delivery chamber (4) is led to the feed hole during the entire stroke of the plunger. The pressure in the delivery chamber does not build up and no fuel is forced to the injection nozzle.

(B) Fuel Delivery

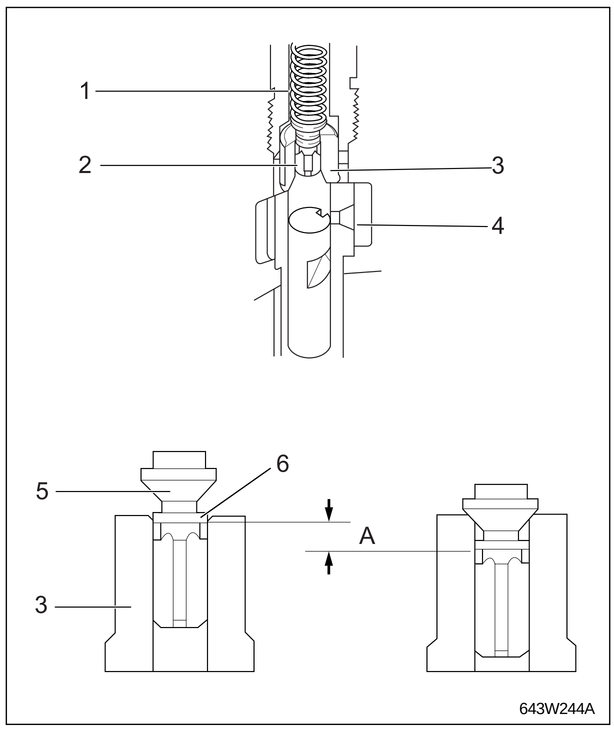
The plunger is rotated by the control rack and the feed hole is not aligned with the lengthwise slot. When the plunger is pushed up, the feed hole is closed by the plunger. The pressure in the delivery chamber builds up and forces the fuel to the injection nozzle until the control groove (6) meets the feed hole. The amount of the fuel to be forced into the nozzle corresponds to distance A.



(1) Slot
(2) Plunger
(3) Control Rack
(4) Delivery Chamber
(5) Feed Hole
(6) Control Groove

d. Delivery Valve

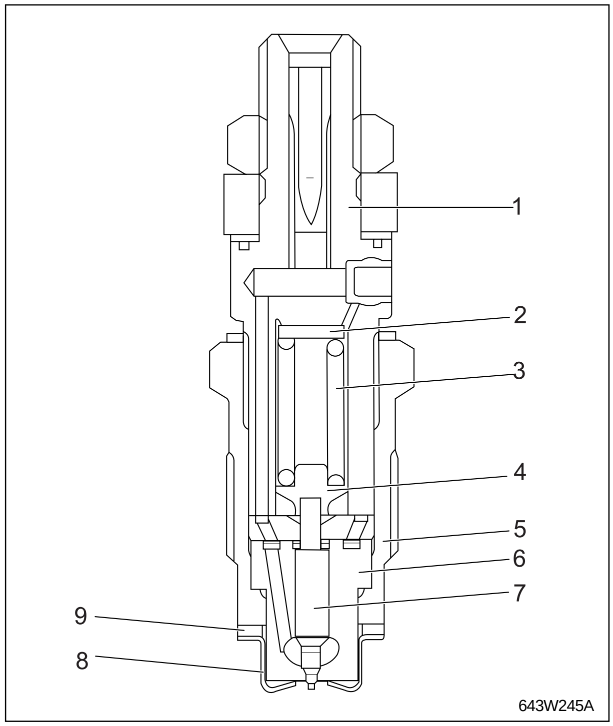
The delivery valve prevents the fuel in the injection pipe from flowing back into the delivery chamber and the fuel in the injection nozzle from dribbling after injection.



(1) Valve Spring
(2) Valve
(3) Valve Seal
(4) Fuel Chamber
(5) Valve Face
(6) Relief Plunger

E. FUEL INJECTION NOZZLE

The nozzle is a throttle-type one. It features low fuel consumption and works well with DAEDONG combustion chamber. The nozzle valve opening pressure is about 13.7 to 14.7 MPa (140 to 150 kgf/cm², 1991 to 2134 psi), the pressure overcomes the counterforce of nozzle valve spring, and push the valve up instantly, the fuel is then injected in a proper quantity into the swirling air in the combustion chamber for combustion. Addition or reduction of adjusting can adjust the opening pressure. A washer of 0.1 mm corresponds to 980 kPa (10 kgf/cm², 142 psi) change in opening pressure. The heat seal is employed to improve the durability and reliability of the nozzle.

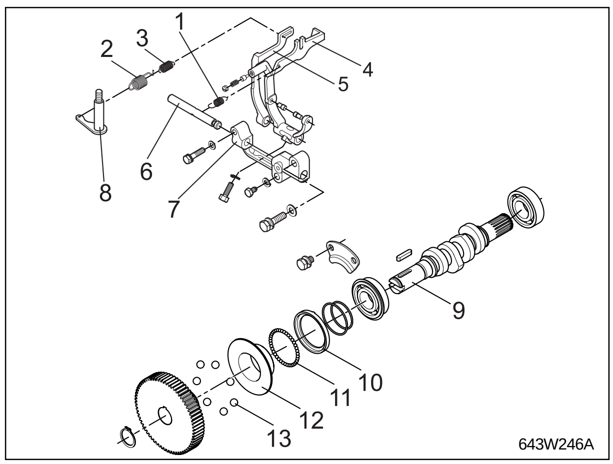


(1) Nozzle Holder Ass'y
(2) Adjusting Washer
(3) Nozzle Spring
(4) Push Rod
(5) Retaining Nut
(6) Nozzle Body
(7) Needle Valve
(8) Heat Seal
(9) Packing

F. GOVERNOR AND IDLE COMPENSATING

a. Disassembled View

The governor serves to keep engine speed constant by automatically adjusting the amount of fuel supplied to the engine according to changes in the load. The engine employs an all-speed governor which controls centrifugal force of the steel ball (13) weight, produced by rotation of the fuel camshaft (9), and tension of the governor spring 1 (2) and 2 (3) are balanced.

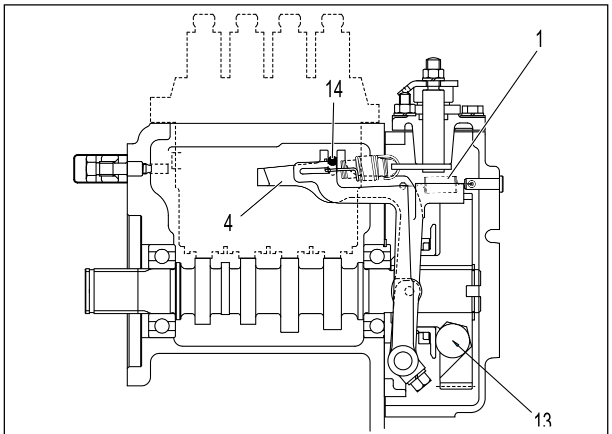


(1) Start Spring
(2) Governor Sping 1
(3) Governor Sping 2
(4) Fork Lever 1
(5) Fork Lever 2
(6) Fork Lever Shaft
(7) Fork Lever Holder
(8) Governor Lever
(9) Fuel Camshaft
(10) Governor Ball Case
(11) Steel Ball
(12) Governor Sleeve
(13) Steel Ball

b. Operation of Governor

1) At start

The steel ball (13) has no centrifugal force. As the fork lever 1 (4) is pulled by the start spring (1), the control rack (14) moves to the maximum injection position. At start, the sufficient injection of the fuel enables easy starting.



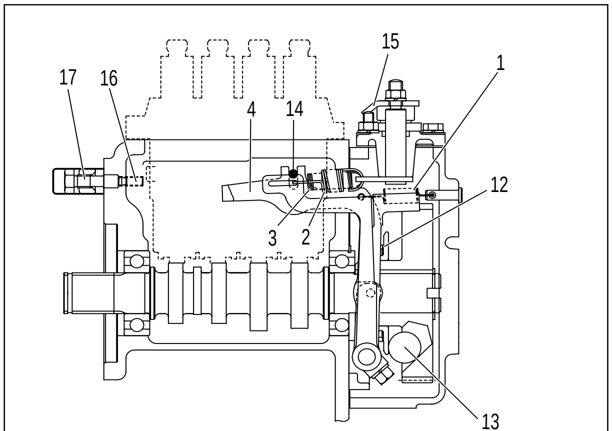
643W247A

2) At idling

At the idling position of the speed control lever (15), the governor spring 1 (2) is free and the governor spring 2 (3) does only act slightly. The governor sleeve (12) is pushed leftward by a centrifugal force of steel ball (13). Therefore, the fork lever 1 (4) and control rack (14) are moved to the left by the governor sleeve (12) and then the idling adjusting spring (16) is compressed by the control rack (14). As a result, the control rack is kept at a position here a centrifugal force of steel ball (13) and forces start spring (1), governor spring 2 (3) and idling limit spring are balanced, providing stable idling.

IMPORTANT:

- *The idling speed has been factory-set. The idling adjusting screw (20) and spring (16) should not be disassembled and readjusted.*

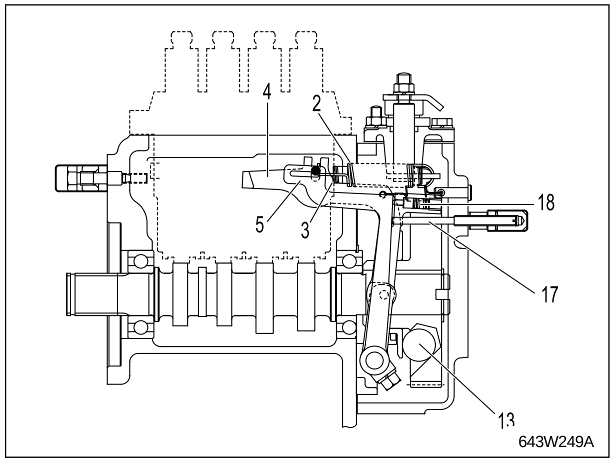


643W248A

(1) Start Spring
(2) Governor Spring 1
(3) Governor Spring 2
(4) Fork Lever 1
(12) Governor Sleeve
(13) Steel Ball
(14) Control Rack
(15) Speed Control Lever
(16) Idle Adjusting Spring
(17) Idle Adjusting Screw

3) At high speed running with overload

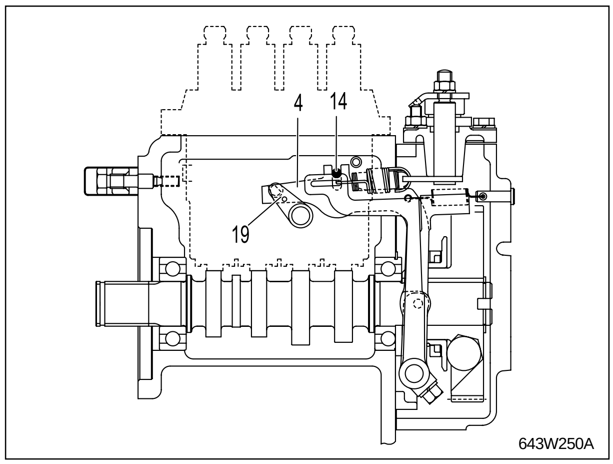
When an overload is applied to the engine running at a high speed, the centrifugal force of steel ball (13) becomes small as the engine speed is dropped, and fork lever 2 (5) is pulled to the right by the governor spring 1 (2) and 2 (3), increasing fuel injection. Though, fork lever 2 becomes ineffective in increasing fuel injection when it is stopped by the adjusting bolt (17). After that, when the force of torque spring (18) becomes greater than the centrifugal force of the steel ball, fork lever 1 (4) moves rightward to increase fuel injection, causing the engine to run continuously at a high torque.



(2) Governor Spring 1
(3) Governor Spring 2
(4) Fork Lever 1
(5) Fork Lever 2
(13) Steel Ball
(17) Adjusting Bolt
(18) Torque Spring

4) To stop engine

When the stop lever (19) is moved to the STOP position, fork lever 1 (4) is moved leftward and the control rack (14) is moved to the non-injection position, stopping the engine.



(4) Fork Lever 1
(14) Control Rack
(19) Stop Lever