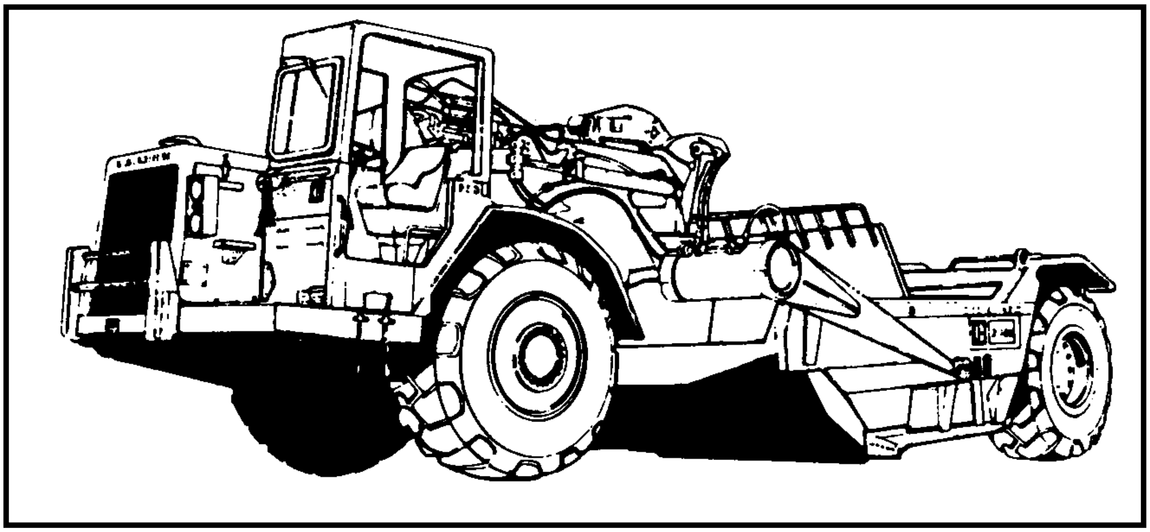
TECHNICAL MANUAL
FOR
SCRAPER, EARTH MOVING, MOTORIZED
DIESEL ENGINE DRIVEN
NSN 3805-01-153-1854



MAINTENANCE

HEADQUARTERS, DEPARTMENT OF THE ARMY
AUGUST 1985

TECHNICAL MANUAL

NO. 5-3805-248-14&P-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC *19 Aug 1985*

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REPORTING OF ERRORS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Tank-Automotive Command, ATTN: AMSTA-MBP, WARREN, MI 48397-5000. A reply will be furnished direct to you.

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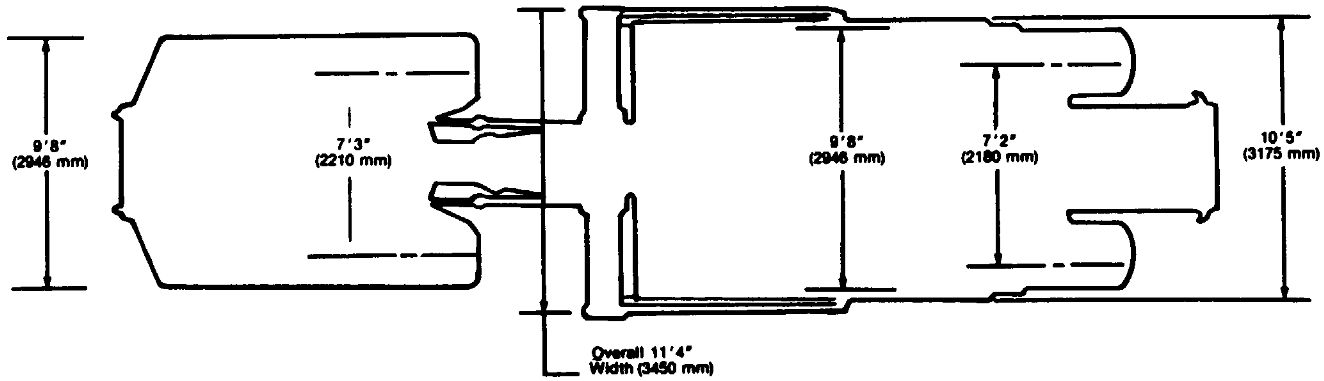
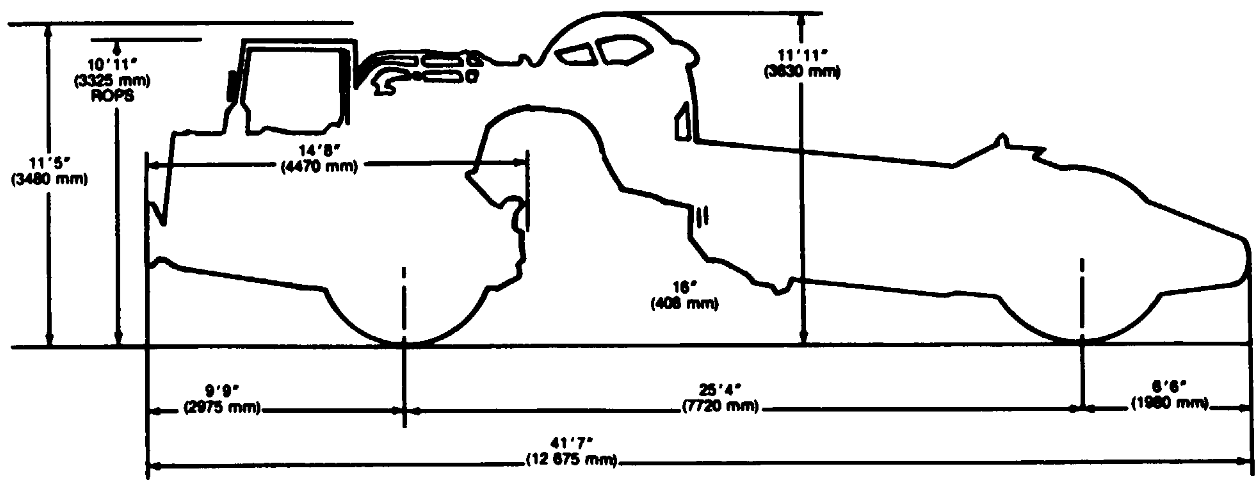
This technical manual is an authentication of the manufacturers commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.


9'8"
(2946 mm)
7'3"
(2210 mm)
9'8"
(2946 mm)
7'2"
(2180 mm)
10'5"
(3175 mm)
Overall 11'4"
Width (3450 mm)


10'11"
(3325 mm)
ROPS
11'5"
(3480 mm)
14'8"
(4470 mm)
11'11"
(3630 mm)
16"
(406 mm)
9'9"
(2975 mm)
25'4"
(7720 mm)
6'6"
(1980 mm)
41'7"
(12 675 mm)

TECHNICAL DATA VEHICLE CHARACTERISTICS

1. NAME: SCRAPER, EARTH MOVING, MOTORIZED
2. DESIGN TYPE: WHEELED
3. WHEEL QUANTITY: 4
4. TIRE TYPE: PNEUMATIC
5. SCOOP OPERATION METHOD: HYDRAULIC
6. SCOOP CUT WIDTH: 119"/3022 mm
7. SCOOP MAXIMUM CUT DEPTH: 13.4"/340 mm
8. SCOOP STUCK CAPACITY: 14 cu. yds."/10.7 cu. m
9. SCOOP BOWL TYPE: OPEN
10. MAXIMUM SPREAD DEPTH: 18"/457 mm
11. HAULING GROUND CLEARANCE: 20.6"/523 mm
12. PRIME MOVER TYPE: DIESEL ENGINE
13. ENGINE MANUFACTURER'S NAME: CATERPILLAR TRACTOR CO.
14. ENGINE MODEL NUMBER: 3406
15. STEERING CONTROL METHOD: HYDRAULIC
16. VEHICULAR TURN RADIUS: 18'3" or 5.56 m
17. BOWL CAPACITY: 15.3 cu. m or 20 cu. yds.
18. MANUFACTURER'S MODEL NUMBER FOR THIS SCRAPER: 621B

INTRODUCTION

This publication has instructions and procedures for the subject on the front cover. The information and specifications in this publication are on the basis of information that was current at the time this issue was written.

Some photographs in this publication show details that may be different from your machine. Also, for some photographs, guards or covers may have been removed for illustrative purposes.

Correct operation, maintenance, test and repair procedures will give this product a long service life. Before starting a test, repair or rebuild job, the serviceman must read the respective chapters of the Service Manual, and know all the components he will work on.

Your safety, and the safety of others is at all times very important. When you see this symbol ⚠ in the manual, you must know that caution is needed for the procedure next to it. The symbol is a warning. To work safely, you must understand the job you do. Read all instructions to know what is safe and what is not safe.

It is very important to know the weight of parts. Do not lift heavy parts by hand. Use a hoist. Make sure heavy parts have good stability on the ground. A sudden fall can cause an accident. When lifting part of a machine, make sure the machine has blocks at front and rear. Never let the machine hang on a hoist, put blocks or stands under the weight.

When using a hoist, follow the recommendation in the manual. Use correct lift tools as shown in illustrations to get the correct balance of the component you lift. This makes your work safer at all times.

The specifications, torques, pressures of operation, measurements, adjustments, and other items can change at any time. These changes can effect the service given to the product. Get the complete and most current information before you start any job.

When the words "use again" are in the description, the specification given can be used to determine if a part can be used again. If the part is equal to or within the specification given, use the part again.

When the word "permissible" is in the description, the specification given is the "maximum or minimum" tolerance permitted before adjustment, repair and/or new parts are needed.

A comparison can be made between the measurements of a worn part, and the specifications of a new part to find the amount of wear. A part that is worn can be safe to use if an estimate of the remainder of its service life is good. If a short service life is expected, replace the part.

WARRANTY STATEMENT

The Caterpillar 621B Tractor-Scraper is warranted by Caterpillar Tractor Co. for 15 months or 1500 hours of operation, whichever occurs first. The warranty starts on the date found on the DA form 2408-9 in the log book. Report all defects in material or workmanship to your supervisor, who will take appropriate action through your organizational maintenance shop.

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PART ONE
ENGINE

PART TWO
POWER TRAIN

PART THREE
VEHICLE SYSTEMS

CHAPTER 1
ENGINE
SYSTEMS OPERATION, TESTING AND ADJUSTING

TORQUE SPECIFICATIONS: You will find instances in this publication where the manufacturer has used "Meter-Kilograms" or "Centimeter-Kilograms" In page of "Newton-Meters" for the metric torque. In these Instances, use the following conversion factors to obtain the metric torque in "Newton-Meters."

lb. ft. x 1.355819 = N•m
lb. in. x 0.1129848 - N•m

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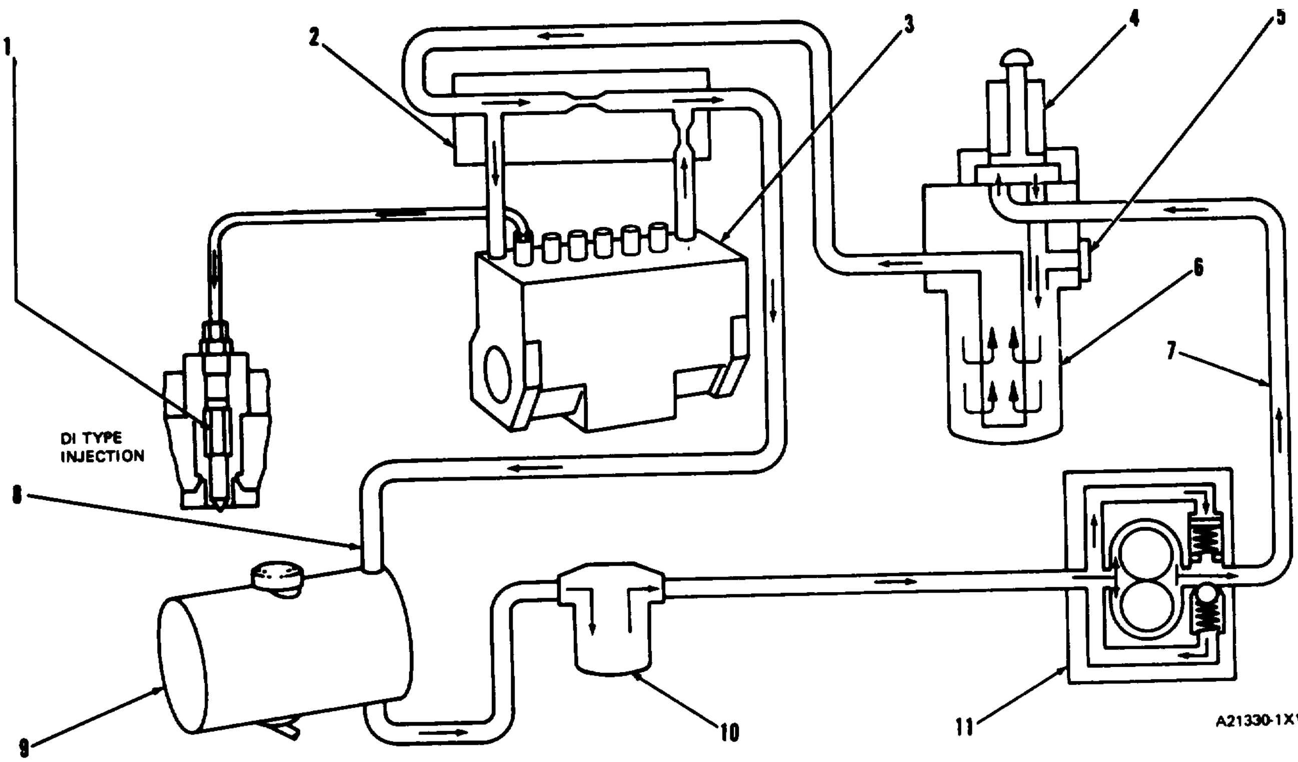
SYSTEM OPERATION

TESTING AND ADJUSTING

Page

FUEL SYSTEM



FUEL SYSTEM

1. Injection valve. 2. Anti-siphon block. 3. Injection pump housing. 4. Priming pump. 5. Plug. 6. Secondary filter. 7. Fuel line. 8. Return line to tank. 9. Fuel tank. 10. Primary filter. 11. Transfer pump.

This engine has a pressure type fuel system. There is a single injection pump and injection valve (1) for each cylinder. The injection pumps are in the pump housing (3) on the left side of the engine. The injection valves are in the precombustion chambers or adapters, under the valve cover.

The transfer pump (11) pulls fuel from the fuel tank (9) through the primary filter (10) and sends it through the base of the priming pump (4) and the secondary filter (6), through the anti-siphon block (2) and to the manifold of the injection pump housing. When priming pump (4) is not used, the position of fuel line (7) and plug (5) are reversed. The fuel in the manifold of the injection pump housing goes to the injection pumps. The injection pumps are in time with the engine and send fuel to the injection valves under high pressure.

Some of the fuel in the manifold is constantly sent back through the anti-siphon block (2) and through the return line (8) to the fuel tank to remove air from the system. Orifices in the anti-siphon block control the amount of fuel that goes back to the fuel tank.

The priming pump (4) is used to remove air from the fuel filter, fuel lines and components.

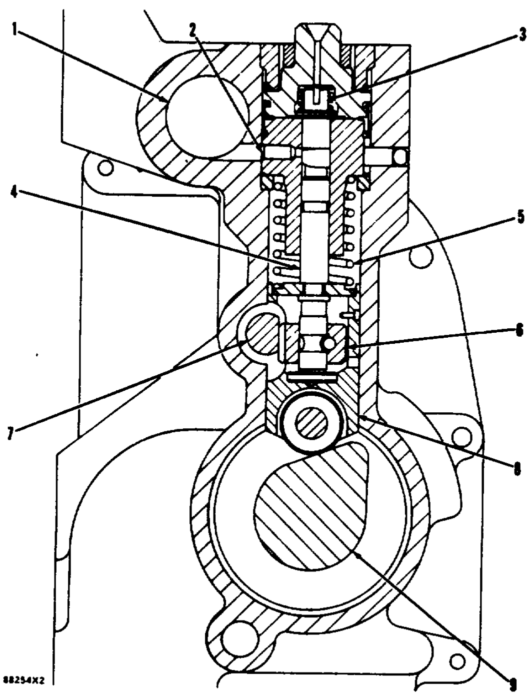
The transfer pump has a bypass valve and a check valve. The bypass valve (lower side) gives control to the pressure of the fuel. The extra fuel goes to the inlet of the pump.

FUEL INJECTION PUMP OPERATION

Injection pump plungers (4) and lifters (8) are lifted by cams on camshaft (9) and always make a full stroke. The force of springs (5) hold the lifters (8) against the cams of the camshaft.

Fuel from fuel manifold (1) goes through inlet passage (2) in the barrel and then into the chamber above plunger (4). During injection, the camshaft cam moves plunger (4) up in the barrel. This movement will close inlet passage (2) and push the fuel out through the fuel lines to the injection valves.

The amount of fuel sent to the injection valves is controlled by turning plunger (4) in the barrel. When the governor moves fuel rack (7), the fuel rack moves gear (6) that is fastened to the bottom of plunger (4).



CROSS SECTION OF THE HOUSING FOR THE FUEL INJECTION PUMPS

1. Fuel manifold. 2. Inlet passage in pump barrel. 3. Check valve. 4. Pump plunger. 5. Spring. 6. Gear. 7. Fuel rack. 8. Lifter. 9. Camshaft.

FUEL INJECTION VALVE

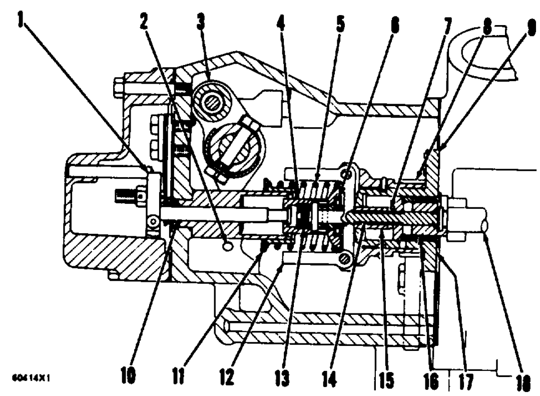
Fuel, under high pressure from the injection pumps, is sent through the injection lines to the injection valves. The injection valves change the fuel to the correct fuel characteristic (spray pattern) for good combustion in the cylinders.

The fuel injection valves are installed in an adapter. The adapters are installed in the cylinder heads.

HYDRA-MECHANICAL GOVERNOR

The accelerator pedal, or governor control, is connected to the control lever on the engine governor. The governor controls the amount of fuel needed to keep the desired engine rpm.

The governor has governor weights (12), driven by the engine, governor spring (5), valve (14) and piston (15). The valve and piston are connected to fuel rack (18). The pressure oil for the governor comes from the engine oil pump. Pressure oil goes through passage (17) and around sleeve (16). The accelerator pedal, or governor control, controls only the compression of governor spring (5). Compression of the spring always pushes to give more fuel to the engine. The centrifugal force (rotation) of governor weights (12) is always pulling to get a reduction of fuel to the engine. When these two forces are in balance, the engine runs at the desired rpm (governed rpm).



HYDRA-MECHANICAL GOVERNOR
(Typical Example Shown at Full Load Condition)

1. Collar. 2. Speed limiter plunger. 3. Lever assembly. 4. Seat. 5. Governor spring. 6. Thrust bearing. 7. Oil passage. 8. Drive gear (weight assembly). 9. Cylinder. 10. Bolt. 11. Spring seat. 12. Governor weights. 13. Spring. 14. Valve. 15. Piston. 16. Sleeve. 17. Oil passage. 18. Fuel rack.

Governor valve (14) is shown in the position when the force of the governor weights and the force of the governor spring are in balance.

When there is an increase in engine load, there will be a decrease in engine rpm and the rotation of governor weights (12) will get slower. (The governor weights will move toward each other.) Governor spring (5) moves valve (14) forward (toward the right in picture shown). When valve (14) moves forward, an oil passage around valve (14) opens to pressure oil. Oil now flows through passage (7) and fills the chamber behind piston (15) (the rear end of the valve stops oil flow through the rear of the cylinder, around the valve). This pressure oil pushes the piston and rack forward to give more fuel to the engine. Engine rpm goes up until the rotation of the governor weights is fast enough to be in balance with the force of the governor spring.

there is a reduction in engine load, there will be an increase in engine rpm and the rotation of governor weights (12) will get faster. This will move valve (14) backwards (toward the left in picture shown). This movement stops oil flow from the forward passage through piston (15) and allows the oil behind the piston to go out through a passage at the rear of the piston, around valve (14). Now, the pressure oil between sleeve (16) and piston (15) pushes the piston and fuel rack backwards. There is now a reduction in the amount of fuel to the engine. Engine rpm goes down until the centrifugal force (rotation) of the governor weights is in balance with the force of the governor spring. When these two forces are in balance, the engine will run at the desired rpm (governed rpm).

When engine rpm is at LOW IDLE, a spring-loaded plunger in lever assembly (3) comes in contact with a shoulder on the adjustment screw for low idle. To stop the engine, pull back on the governor control. This will let the spring-loaded plunger move over the shoulder on the low idle adjusting screw and move the fuel rack to the fuel closed position. With no fuel to the engine cylinders, the engine will stop.

After the engine has stopped, spring (13) moves valve (14) and piston (15) to the full load position. This moves the rack to full travel position and gives full fuel flow through the fuel injection pump when starting the engine.

Oil from the engine gives lubrication to the governor weight bearing. The other parts of the governor get lubrication from "splash-lubrication" (oil thrown by other parts). Oil from the governor runs back into the housing for the fuel injection pumps.

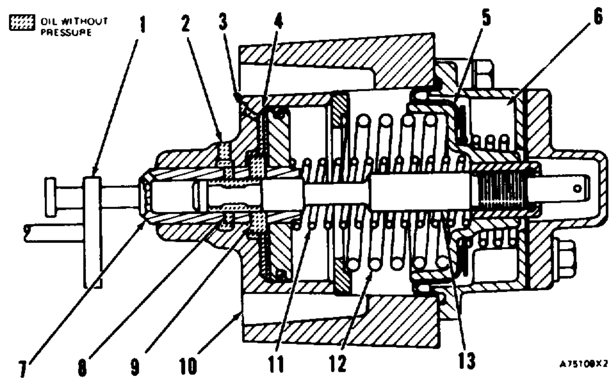
A small force from spring (13) moves fuel rack (18) to give a little more fuel for engine start. With the engine running, the rotation of governor weights (12) will put spring (13) in compression and cause fuel rack (18) to move back. (Spring (13) is extended only when the engine is stopped or at start.) When the engine is running, spring (13) is in compression.

HYDRAULIC AIR-FUEL RATIO CONTROL

The hydraulic air-fuel ratio control automatically controls the amount of travel of the fuel rack, in the FUEL-ON direction, until the air pressure in the inlet manifold is high enough to give complete combustion.

The hydraulically operated fuel ratio control has two valves (7 and 13). A hose assembly connects inlet air chamber (6) to the inlet manifold. Air pressure from the inlet manifold works against diaphragm (5) which moves valve (13) to control oil pressure against valve (7). Engine oil pressure works against valve (7) to control movement of the fuel rack.

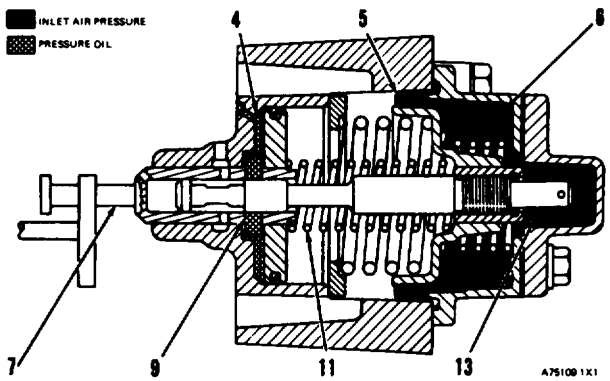
When the engine is stopped, there is no pressure on either of the valves. Springs (11 and 12) move both valves to the ends of their travel. In this position, there is no restriction to fuel rack movement. Also in this position, oil outlet passage (2) is open to let oil away from valve (7).



AIR-FUEL RATIO CONTROL (Engine Stopped)

1. Fuel rack linkage. 2. Oil outlet. 3. Oil inlet. 4. Pressure oil chamber. 5. Diaphram assembly. 6. Inlet air chamber. 7. Valve. 8. Small oil passages. 9. Large oil passages. 10. Oil drains. 11. Spring. 12. Spring. 13. Valve.

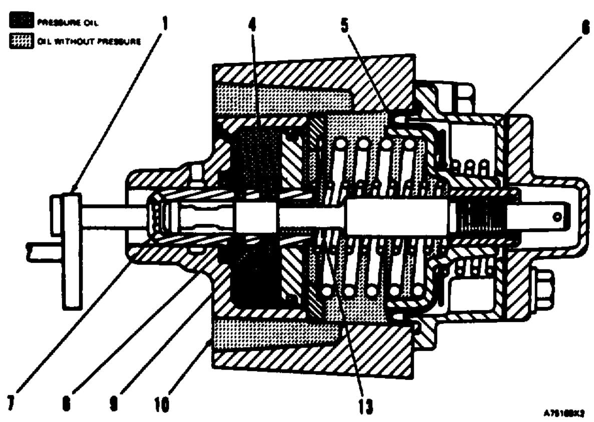
When the engine is started, engine oil flows through oil inlet (3) into pressure oil chamber (4), through large oil passages (9) to inside of valve (7), and out small oil passages (8) to oil outlet passage (2). Oil outlet passage (2) prevents oil pressure against valve (7) until air pressure from the inlet manifold is high enough to move valve (13) to close large oil passages (9). The control will not activate until there is some boost (inlet air pressure) available from the inlet manifold. This boost is made by the turbocharger when a load is applied during engine acceleration.



AIR-FUEL RATIO CONTROL (Engine Started)

4. Pressure oil chamber. 5. Diaphram assembly. 6. Inlet air chamber. 7. Valve. 9. Large oil passages. 11. Spring. 13. Valve.

As the inlet air pressure increases, it causes diaphragm assembly (5) to move left against spring (12). Valve (7), connected to diaphragm assembly (5), also moves left to close large oil passages (9). With these passages closed, chamber (4) is now charged with pressure oil, and valve (7) is pushed to the right against spring (1). The control is now activated, and will continue to operate until the engine is stopped. In the activated position, excess oil will go out pressure oil chamber (4) through large oil passages (9) past the land of valve (13) and then out through oil drains(10).

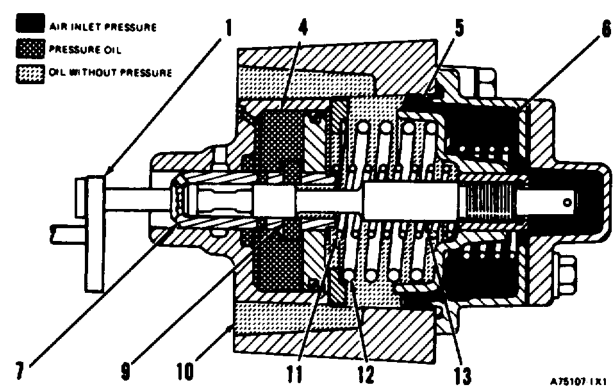


AIR-FUEL RATIO CONTROL (Control Activated)

1. Fuel rack linkage. 4. Pressure oil chamber. 5. Diaphram assembly. 6. Inlet air chamber. 7. Valve. 8. Small oil passages. 9. Large oil passages. 10. Oil drains. 13. Valve.

When the governor control is moved to increase fuel to the engine with the control activated, valve (7) limits the movement of fuel rack linkage (1) in the FUEL-ON direction. Charged oil pressure chamber (4) acts as a restriction to the movement of valve (7) until inlet air pressure increases.

As inlet air pressure increases, valve (7) moves to the left [away from springs (11 and 12)] and lets pressure oil from chamber (4) drain through large oil passages (9) past the land of valve (13), through inside of valve (7), and out through oil drains (10). This reduction of oil pressure behind the piston of valve (7) lets spring (12) move valve (7) to the left so that fuel rack linkage (1) can move gradually to increase fuel to the engine. The control is designed not to let the fuel increase until the air pressure in the inlet manifold is high enough for complete combustion. This prevents large amounts of black exhaust smoke caused by an air-fuel mixture with too much fuel.



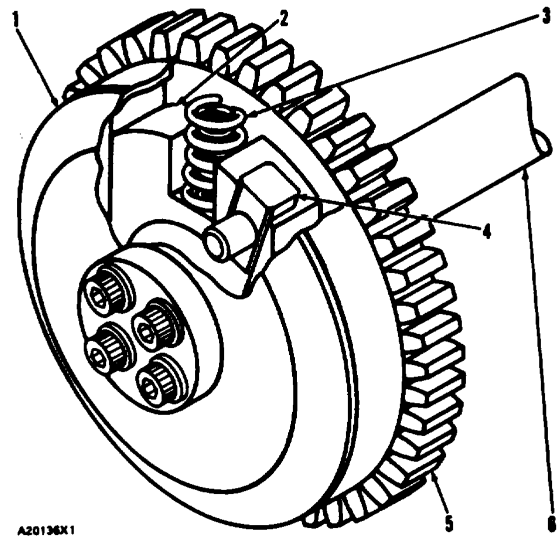
AIR-FUEL RATIO CONTROL (Engine Acceleration)

1. Fuel rack linkage. 4. Pressure oil chamber. 5. Diaphram assembly. 6. Inlet air chamber. 7. Valve. 9. Large oil passages. 10. Oil drains. 11. Spring. 12. Spring. 13. Valve.

These movements of the control take a very small amount of time. No change in engine acceleration (rate at which speed increases) can be felt.

AUTOMATIC TIMING ADVANCE UNIT

The automatic timing advance unit is installed on the front of the drive shaft (6) for the fuel injection pump and is gear driven through the timing gears. The drive gear (5) for the fuel injection pump is connected to the drive shaft for the fuel injection pump through a system of weights (2), springs (3), slides (4) and a flange (1). Two slides that are fastened to the flange fit into notches made on an angle in the weights. As centrifugal force (rotation) moves the weights outward against spring pressure, the movement of the notches in the weights causes the slides to make the flange turn through a small angle in relation to the gear. Since the flange is connected to the drive shaft for the fuel injection pump, the fuel injection timing is also changed. The automatic timing advance unit is held in place on the drive shaft (6) by four bolts.

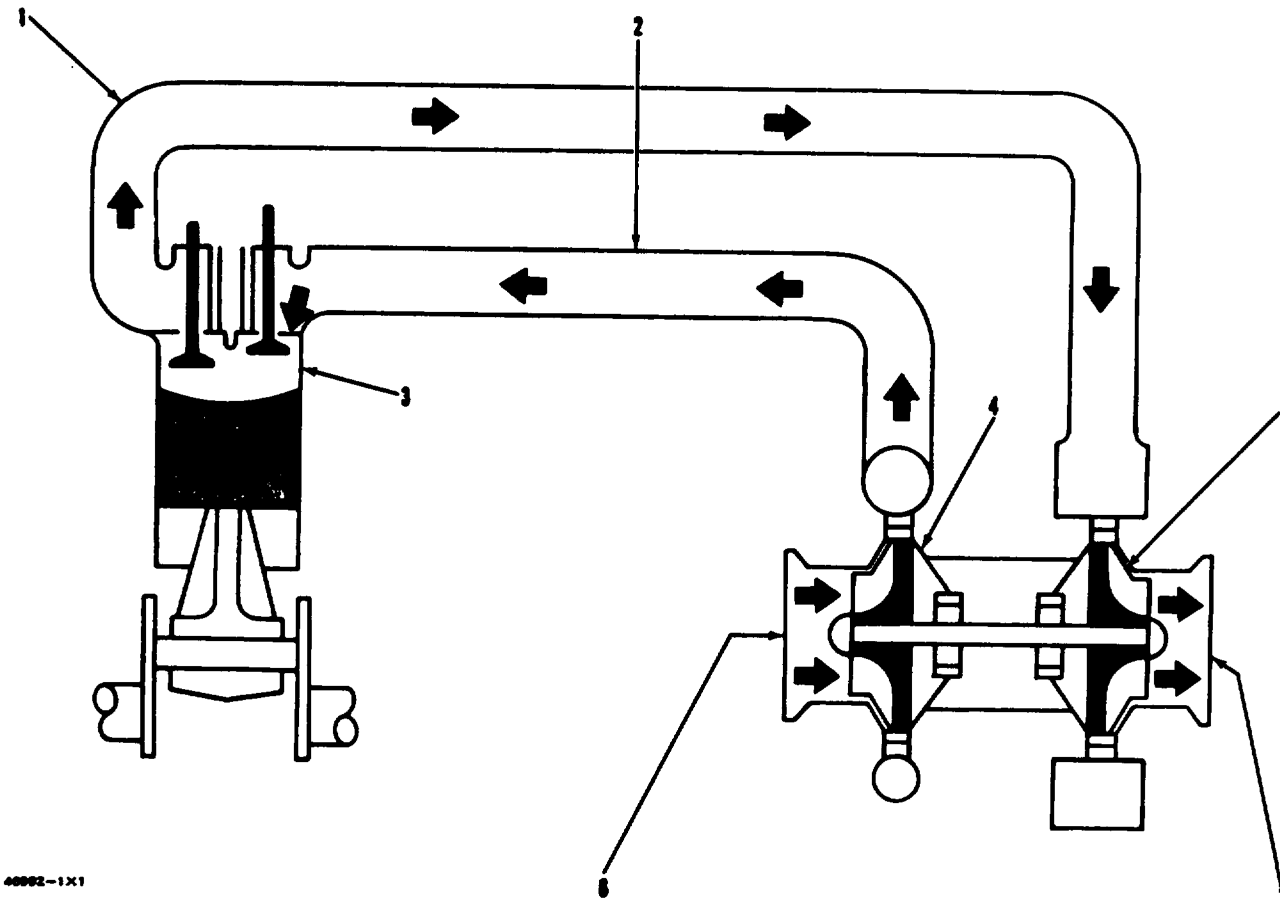


AUTOMATIC TIMING ADVANCE UNIT

1. Flange. 2. Weight. 3. Springs. 4. Slide. 5. Drive gear. 6. Drive shaft.

The unit advances the timing 2 1/40 between approximately low idle and I100 rpm. No adjustment can be made to the automatic timing advance units.

AIR INLET AND EXHAUST SYSTEM

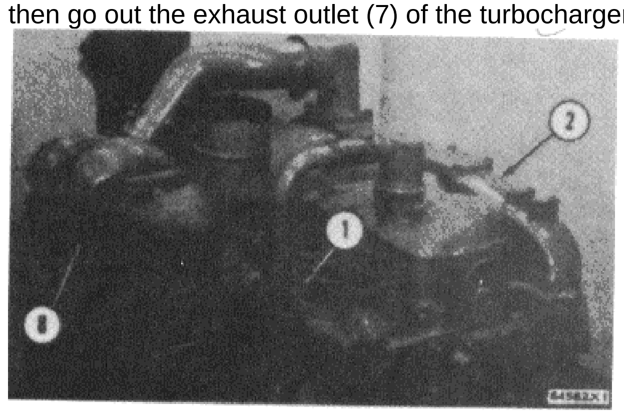


AIR INLET AND EXHAUST SYSTEM

1. Exhaust manifold. 2. Inlet manifold. 3. Engine cylinder. 4. Turbocharger compressor wheel. 5. Turbocharger turbine wheel. 6. Air inlet. 7. Exhaust outlet.

The air inlet and exhaust system components are: air cleaner, inlet manifold, cylinder head, valves and valve system components, exhaust manifold, and turbocharger.

Clean inlet air from the air cleaner is pulled through the air inlet (6) of the turbocharger by the turning compressor wheel (4). The compressor wheel causes a compression of the air. The air then goes to the inlet manifold (2) of the engine. When the intake valves open, the air goes into the engine cylinder (3) and is mixed with the fuel for combustion. When the exhaust valves open, the exhaust gases go out of the engine cylinder and into the exhaust manifold (1). From the exhaust manifold, the exhaust gases go through the blades of the turbine wheel (5). This causes the turbine wheel and compressor wheel to turn. The exhaust gases then go out the exhaust outlet (7) of the turbocharger.



AIR INLET AND EXHAUST SYSTEM
1. Exhaust manifold. 2 Inlet manifold. a Turbocharger.