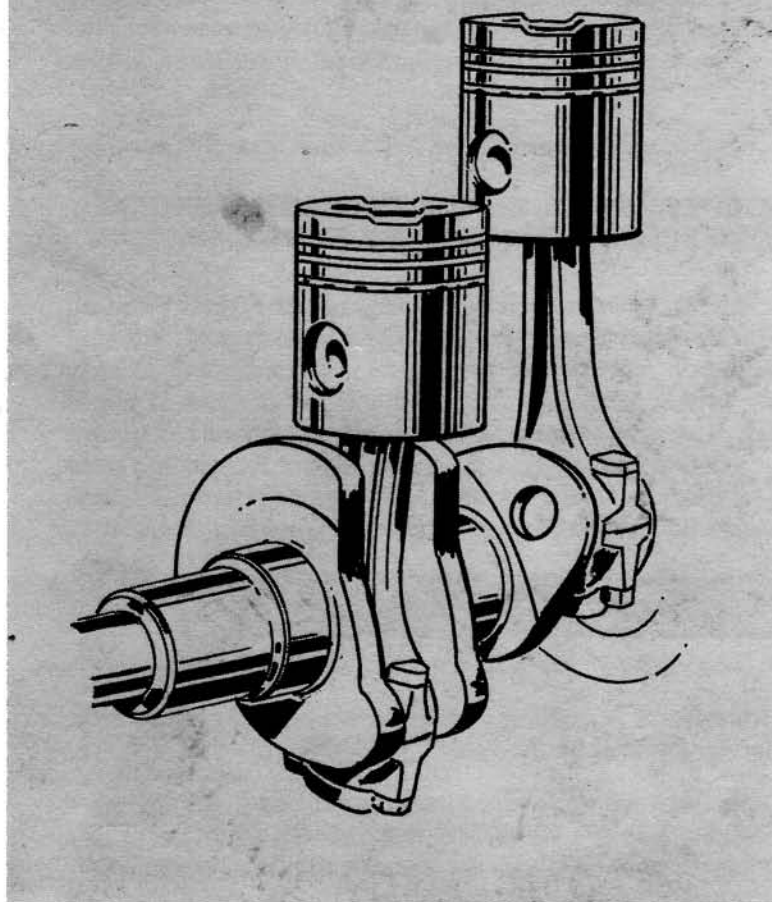


FORM NO. SENR7591-01

FOR USE IN SERVICE MANUALS:
D4 TRACTOR, REG00632
D4E TRACTOR, SENR7624
D4 TRACTOR, SPECIAL APPLICATION,
REG00784
D4E TRACTOR, SPECIAL APPLICATION,
SENR7636
NO. 112F MOTOR GRADER, REG00885
120G MOTOR GRADER, REG01654
130G & 140G MOTOR GRADERS,
REG01652
225 EXCAVATOR, REG01578
518 SKIDDER, REG00971
920 & 930 WHEEL LOADERS, REG00514
941 TRACK-TYPE LOADER, REG00527
950 WHEEL LOADER, REG00548
951 TRACK-TYPE LOADER, REG00783
955 TRACK-TYPE LOADER, REG00634
955L TRACK-TYPE LOADER, SENR7364
955L TRACK-TYPE LOADER, SENR7672



SYSTEMS OPERATION
TESTING AND ADJUSTING

3304 VEHICULAR ENGINE

ENGINE SERIAL NUMBERS

43V 7Z, 12Z—Engines with
46V Sleeve Metering
48V Fuel Systems
78P
9Z

NOTICE
This book also includes information for all 4.75" bore, four
cylinder vehicle engines with vehicle serial numbers. This
book supersedes Form REG01349-01

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NOTE: This book has been completely changed from the former issue.

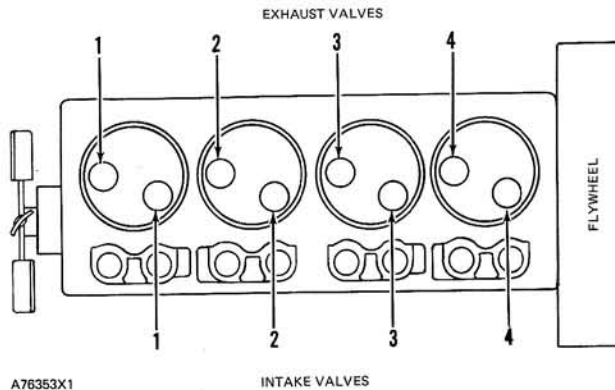
SPECIFICATIONS

NOTE: For Specifications with illustrations, make reference to SPECIFICATIONS for 3304 VEHICULAR ENGINE, Form No. SENR7590. If the Specifications in Form SENR7590 are not the same as in the Systems Operation and the Testing and Adjusting, look at the printing date on the back cover of each book. Use the Specifications given in the book with the latest date.

GENERAL INFORMATION

ENGINE DESIGN

Bore 4.75 in. (120.7 mm)
 Stroke 6.0 in. (152.4 mm)
 Number of Cylinders 4
 Cylinder Arrangement *in-line
 Firing Order (Injection Sequence) 1, 3, 4, 2
 Direction of Rotation
 (when seen from flywheel end) Counterclockwise
 *No. 1 Cylinder Is Opposite Flywheel End.



CYLINDER AND VALVE IDENTIFICATION

FUEL SYSTEM USAGE CHART			
MODEL	*FUEL SYSTEM APPLICATIONS		
	Scroll (PC)	Sleeve Metering (PC)	Sleeve Metering (DI)
D4, D4 (SA)	Earlier	Later	—
D4E**, D4E (SA)	Japan	Earlier	Later
120G, 130G	—	Earlier	Later
112F	All	—	—
225	—	Earlier	Later
518	Earlier	Intermediate	Later
920, 930, 950	Earlier	Later	—
941, 951, 955	Earlier	Later	—
955L	—	All	—

*See the appropriate PARTS BOOK for effective Serial Numbers.
 **Later ENGINES built in Japan are (DI) with a scroll fuel system.

SLEEVE METERING FUEL SYSTEM

INTRODUCTION

The Sleeve Metering Fuel System is a pressure type fuel system. The name for the system is from the method used to control the amount of fuel in the fuel injection charge. This system has an injection pump and an injection valve for each cylinder. The injection pumps are in the fuel injection pump housing on the right side of the engine. The injection valves are in the precombustion chambers for PC engines and in adapters in the cylinder head for DI engines.

The drive gear for the fuel transfer pump is on the front of the camshaft for the injection pumps. The carrier for the governor weights is bolted to the rear of the camshaft for the injection pumps. The injection pump housing has a bearing at each end to support the camshaft. The camshaft for the sleeve metering fuel system is driven by the timing gears at the front of the engine.

The injection pumps, lifters and rollers, and the camshaft are all inside of the pump housing. The pump housing and the governor housing are full of fuel at transfer pump pressure (fuel system pressure).

CAUTION

Diesel fuel is the only lubrication for the moving parts in the transfer pump, injection pump housing and the governor. The injection pump housing must be full of fuel before turning the camshaft.

FUEL SYSTEM TIMING

Injection timing before TC (top center):

Sleeve Metering-PC:

(fuel pump serial numbers
thru 44,899) $12^{\circ} 30' \pm 1^{\circ}$

(fuel pump serial numbers
44,900 and up) $13^{\circ} 30' \pm 1^{\circ}$

Sleeve Metering-DI:

Engines with turbocharger $23 \pm 1^{\circ}$

Engines without turbocharger $29 \pm 1^{\circ}$

FUEL INJECTION VALVES

Fuel, under high pressure from the injection pumps, is sent through 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 the precombustion chambers in engines equipped with precombustion chambers. An adapter takes the place of the precombustion chamber in engines equipped with direct injection. The precombustion chambers or adapters are installed in the cylinder heads.

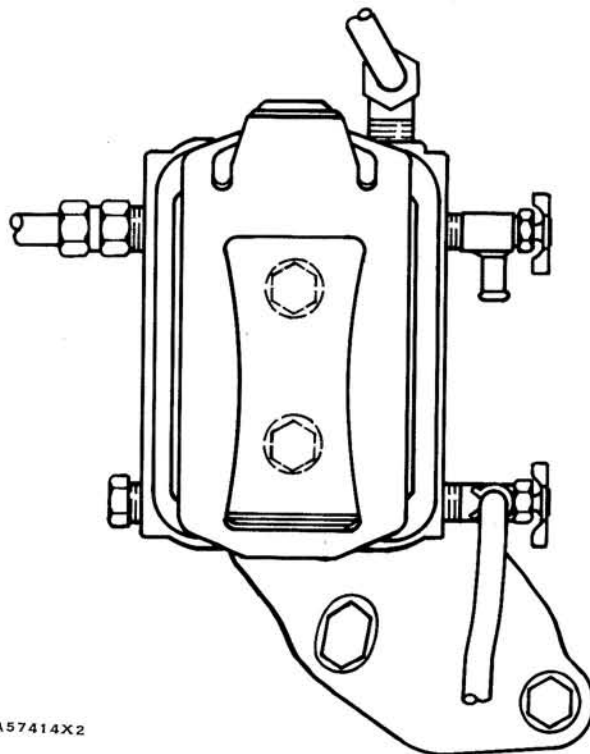
WATER SEPARATOR

Some engines have a water separator. The water separator is installed between the fuel tank and the rest of the fuel system. For efficiency in the action of the water separator, the fuel flow must come directly from the fuel tank and through the water separator. This is because the action of going through a pump or valves before the water separator lowers the efficiency of the water separator.

The water separator can remove 95% of the water in a fuel flow of up to 33 gph (125 liter/hr) if the concentration of the water in the fuel is 10% or less. It is important to check the water level in the water separator frequently. The maximum amount of water which the water separator can hold is 0.8 pt (0.4 liter). At this point the water fills the glass to 3/4 full. Do not let the water separator have this much water before draining the water. After the water level is at 3/4 full, the water separator loses its efficiency and the water in the fuel can go through the separator and cause damage to the fuel injection pump.

Drain the water from the water separator every day or when the water level gets to 1/2 full. This gives the system protection from water in the fuel. If the fuel has a high concentration of water, or if the flow rate of fuel through the water separator is high, the water separator fills with water faster and must be drained more often.

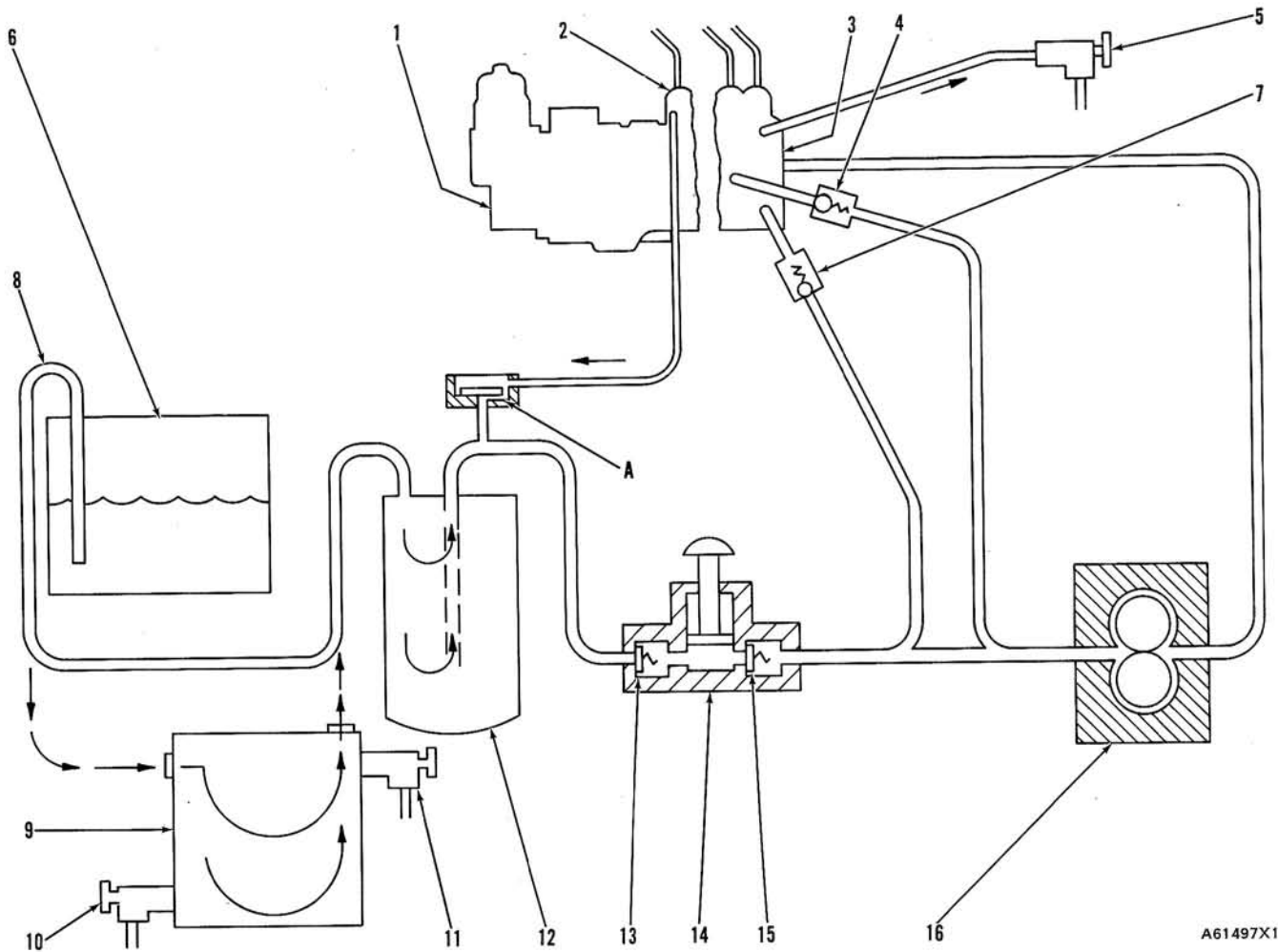
To drain the water separator, open the valve in the drain line and the valve at the top of the water separator. Let the water drain until it is all out of the water separator. Close both valves.



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FUEL FLOW WITH ENGINE RUNNING

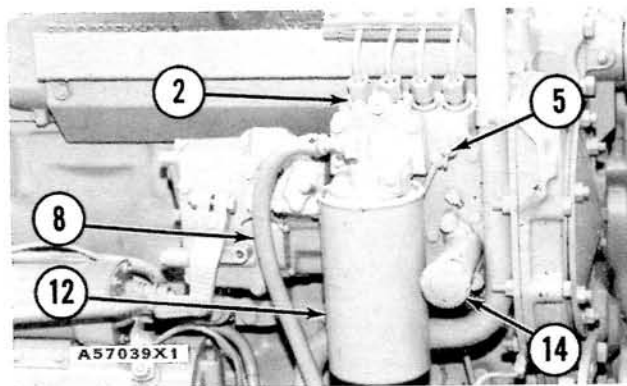
System With Siphon Break



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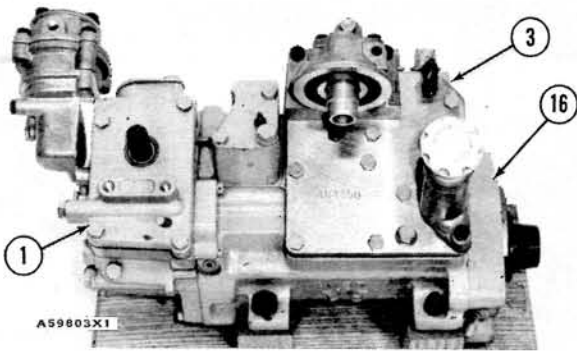
SCHMATIC OF FUEL SYSTEM

1. Governor housing. 2. Fuel injection pump. 3. Fuel injection pump housing. 4. Bypass valve. 5. Bleed valve. 6. Fuel tank. 7. Check valve. 8. Fuel supply line. 9. Water separator (if so equipped). 10. Drain valve. 11. Vent valve. 12. Fuel filter. 13. Check valve. 14. Priming pump. 15. Check valve. 16. Fuel transfer pump. A. Siphon break orifice.



FUEL SYSTEM INSTALLED

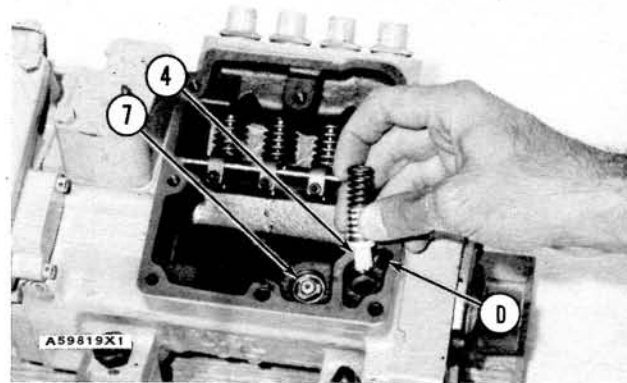
2. Fuel injection pump. 5. Bleed valve. 8. Fuel supply line. 12. Fuel filter. 14. Priming pump.



GOVERNOR AND FUEL INJECTION PUMP

1. Governor housing. 3. Fuel injection pump housing. 16. Fuel transfer pump.

When the engine is running fuel transfer pump (16) pulls fuel from fuel tank (6) through fuel supply line (8). The fuel goes through water separator (9) (if so equipped), fuel filter (12) and into channel (17) behind cover (18).

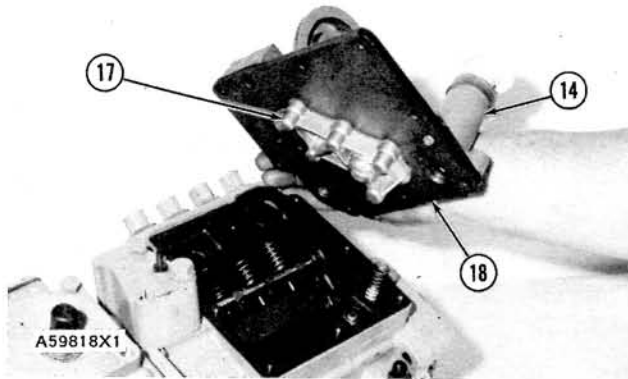


FUEL INJECTION PUMP HOUSING

4. Bypass valve. 7. Check valve. D. Passage to fuel transfer pump.

From fuel transfer pump (16) fuel under pressure fills fuel injection pump housing (3). Pressure of the fuel in housing (3) is controlled by bypass valve (4). Pressure of the fuel at full load is 30 ± 5 psi (205 ± 35 kPa). If the pressure of the fuel in housing (3) gets too high, bypass valve (4) will move (open) to let some of the fuel return to the transfer pump (16).

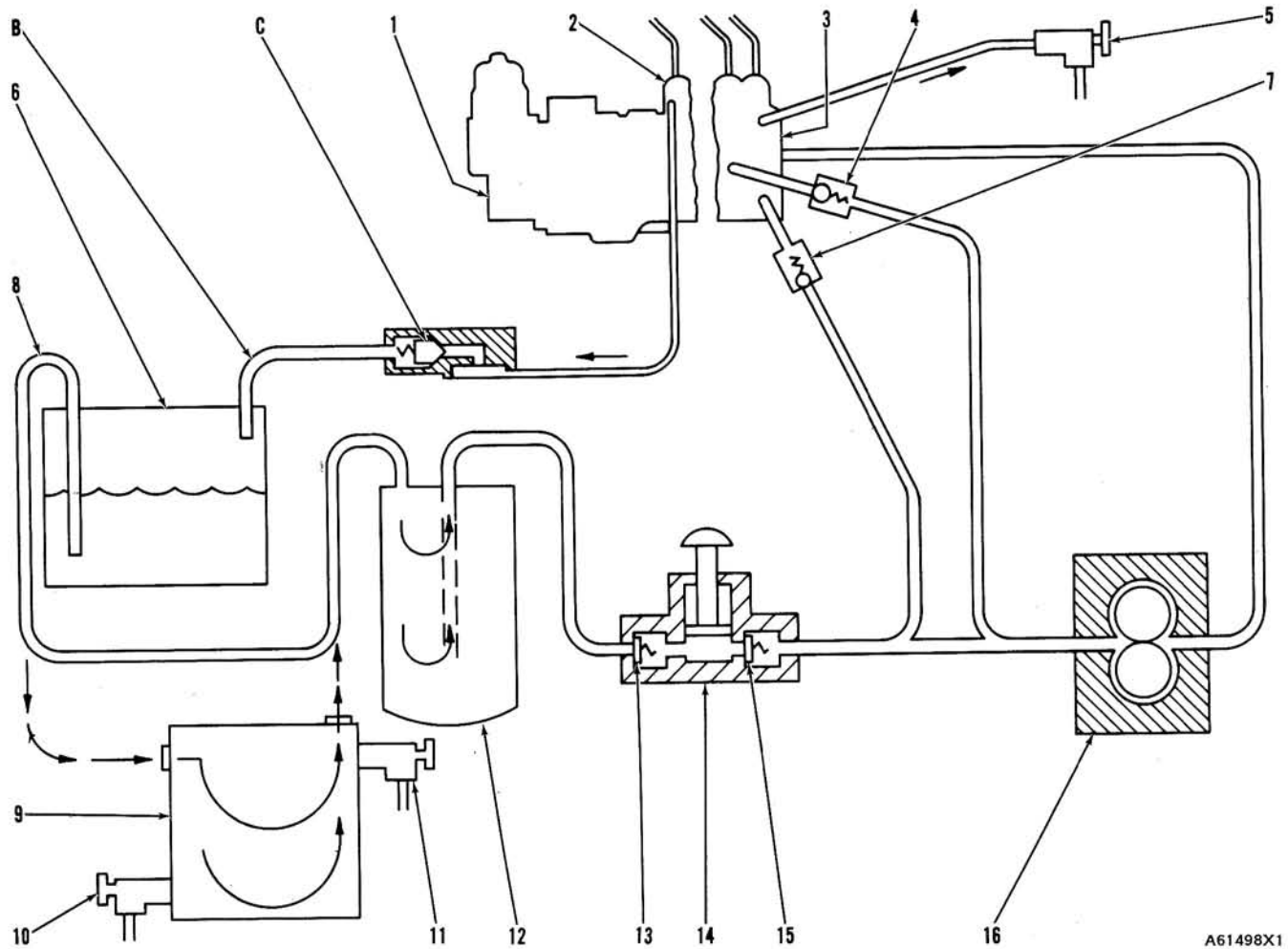
Fuel injection pumps (2) send fuel, under high pressure, out of housing (3) into the fuel injection lines during injection. The fuel goes through the lines to the fuel injection valves in the precombustion chambers.



FUEL INJECTION PUMP HOUSING COVER

14. Priming pump. 17. Channel. 18. Cover.

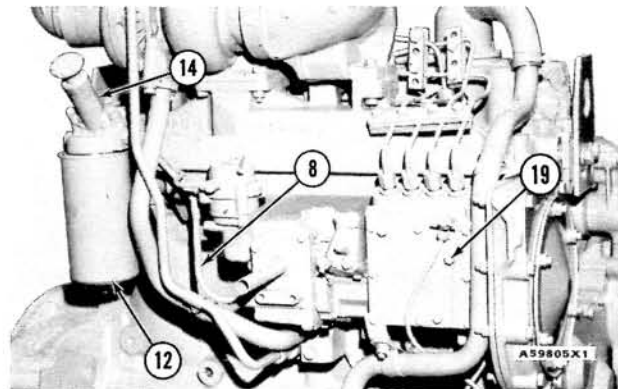
System With Constant Bleed



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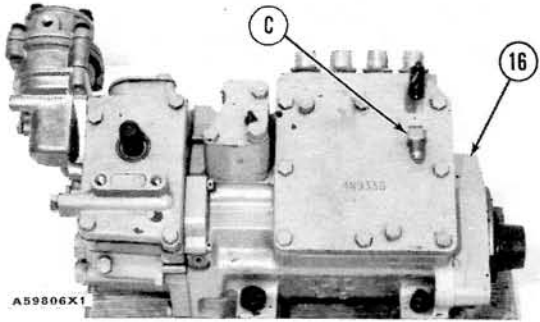
SCHMATIC OF FUEL SYSTEM

1. Governor housing. 2. Fuel injection pump. 3. Fuel injection pump housing. 4. Bypass valve. 5. Bleed valve. 6. Fuel tank. 7. Check valve. 8. Fuel supply line. 9. Water separator (if so equipped). 10. Drain valve. 11. Vent valve. 12. Fuel filter. 13. Check valve. 14. Priming pump. 15. Check valve. 16. Fuel transfer pump. B. Fuel return line. C. Constant bleed valve.



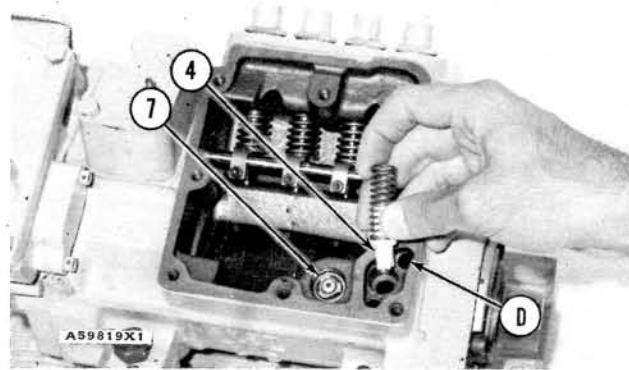
FUEL SYSTEM INSTALLED

8. Fuel supply line. 12. Fuel filter. 14. Priming pump. 19. Plug in hole for constant bleed valve (C).



GOVERNOR AND FUEL INJECTION PUMP

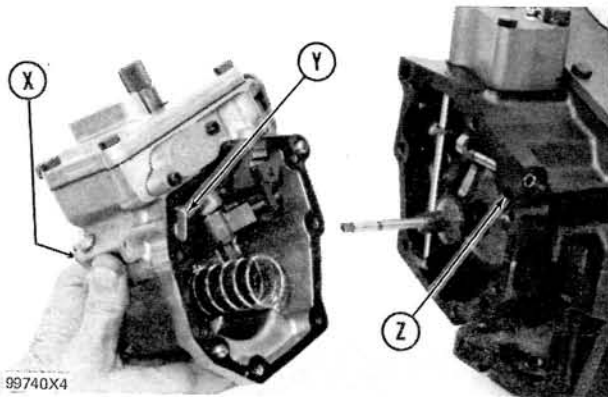
16. Fuel transfer pump. C. Constant bleed valve.



FUEL INJECTION PUMP HOUSING

4. Bypass valve. 7. Check valve. D. Passage to fuel transfer pump.

When the engine is running fuel transfer pump (16) pulls fuel from fuel tank (6) through fuel supply line (8). The fuel goes through water separator (9) (if so equipped), fuel filter (12) and priming pump (14). From priming pump (14) the fuel goes through line (8) to connection (X) on the governor housing. The fuel goes through passages (Y) and (Z) to passage (D).



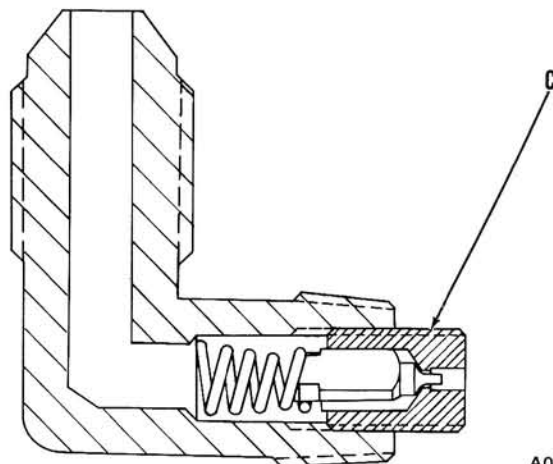
FUEL FLOW THROUGH HOUSINGS

X. Connection for fuel supply line (8). Y. Passage. Z. Passage.

The fuel goes through passage (D) to fuel transfer pump (16). From fuel transfer pump (16) fuel under pressure fills fuel injection pump housing (3). Pressure of the fuel in housing (3) is controlled by bypass valve (4). Pressure of the fuel at full load is 30 ± 5 psi (205 ± 35 kPa). If the pressure of the fuel in housing (3) gets too high, bypass valve (4) will move (open) to let some of the fuel return to the transfer pump (16).

Fuel injection pumps (2) send fuel, under high pressure, out of housing (3) into the fuel injection lines during injection. The fuel goes through the lines to the fuel injection valves in the precombustion chambers.

The constant bleed valve (C) lets approximately 9 gal./hr. (34.1 liter/hr) of fuel go back to the tank through return line (B) when the pressure in the housing is 25 to 32 psi (170 to 220 kPa). This flow takes air and heat away from the housing.

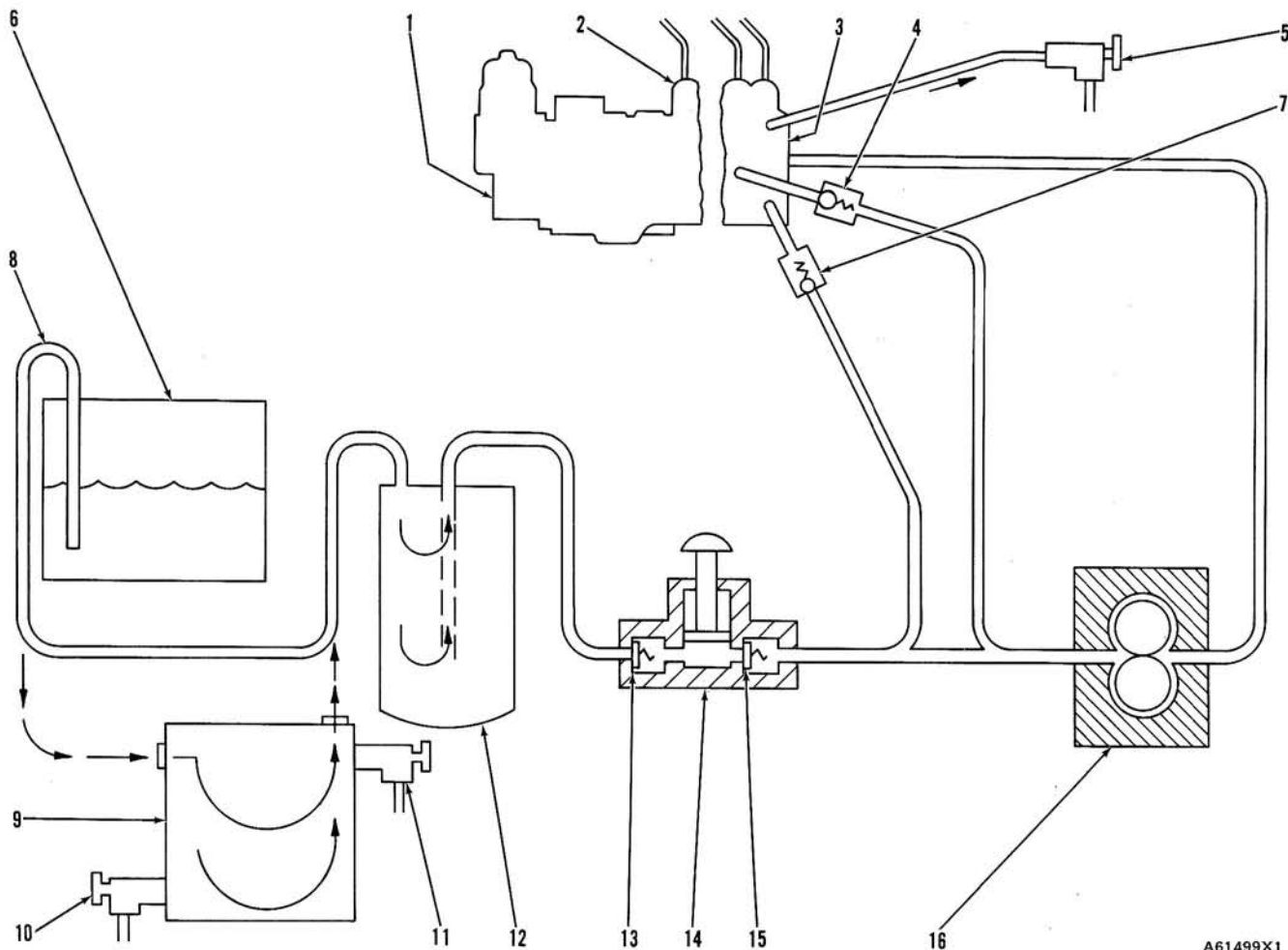


CONSTANT BLEED VALVE

C. Constant bleed valve.

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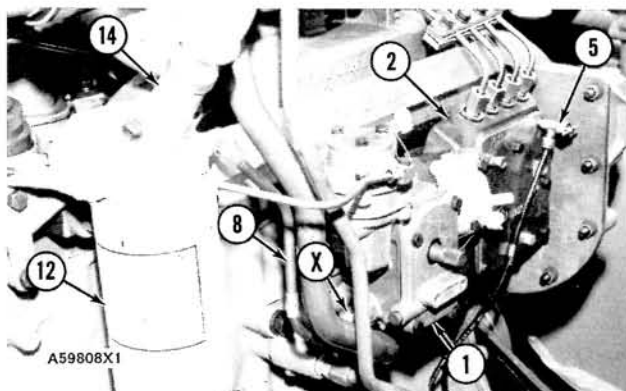
System Without Siphon Break
Or Constant Bleed



A61499X1

SCHEMATIC OF FUEL SYSTEM

- 1. Governor housing. 2. Fuel injection pump. 3. Fuel injection pump housing. 4. Bypass valve. 5. Bleed valve. 6. Fuel tank.
- 7. Check valve. 8. Fuel supply line. 9. Water separator (if so equipped). 10. Drain valve. 11. Vent valve. 12. Fuel filter. 13. Check valve. 14. Priming pump. 15. Check valve. 16. Fuel transfer pump.



A59808X1

FUEL SYSTEM INSTALLED

- 1. Governor housing. 2. Fuel injection pump housing. 5. Bleed valve. 8. Fuel supply line. 12. Fuel filter. 14. Priming pump. X. Connection for fuel supply line.