555 TRACTOR SERVICE MANUAL

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VERSATILE*

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FOREWORD

This service manual provides instructions for troubleshooting, removal, inspection, replacement and overhaul of 1980 model 555 VERSATILE® tractor components.

The service manual should be used in conjunction with the parts manual for the specific model year.

A table of contents precedes each section providing detailed coverage of the information contained within that section. The index at the end of the book should ease location of specific information, and an up-to-date list of Cummins Distributors is provided following the index.

REVISIONS AND ADDITIONS

The purpose of a loose-leaf service manual is to enable us to keep the book updated.

When changes are made, pages will be forwarded to you marked either as replacement or additional pages.

Replacement pages will carry the same page number as the original. Discard the original page and insert the replacement page in its place. Added pages will carry the original page number plus an alphabetical suffix. Insert these pages after the existing page.

Please fill in the feedback page at the back of the book and return it to Versatile Manufacturing Company. Such information you can supply will help us improve our service manuals in the future.

SAFETY

This section contains general safety precautions which should be thoroughly studied, and practiced, by all service personnel.

GENERAL SAFETY

1. Mount a fire extinguisher near the service area. Maintain it as recommended by the manufacturer and be familiar with its use.

2. Never operate the tractor in a closed building. If it is absolutely necessary to do so, be sure the building is well ventilated.

3. Always keep sleeves, jackets or other clothing relatively tight and belted, since loose clothing might catch in moving tractor parts.

4. Do not jump from the tractor cab. There is a danger of catching clothing on protruding parts. Use steps and handholds when mounting and dismounting tractor.

5. Before beginning any maintenance procedure, park the tractor on a level, clear area. Shut down the engine and remove the ignition key; set the parkbrake and chock the front and back of at least two wheels. Ensure that all operating controls are in the neutral position. Always disengage the PTO clutch and three-point hitch.

6. Never leave an implement in the raised position; always lower it to the ground.

7. Never attempt to start or operate tractor controls except from the operator's seat.

TOWING AND TRANSPORT SAFETY

1. Use a strong chain, cable or towbar and attach securely to the front frame plate or drawbar of tractor. Do not tow tractor faster than 15 mph (25 km).

2. Use a trailer having a carrying capacity of at least 30,000 lb (13 600 kg) to haul tractors.

3. Securely chain the tractor to the trailer, block the wheels and engage the parkbrake and articulation lock to prevent tractor movement.

JACKING SAFETY

1. Select a jack strong enough to carry the load. The minimum jack required is five ton capacity (4.5 t).

2. Stabilize the tractor by engaging the parkbrake and articulation lock, and chocking or blocking the wheels securely.

3. Brace the center pivot frame by applying a strong wedge on the frame pivot and engaging the articulation lock to prevent jackknifing.

4. Place the jack securely under the axle tube, frame, or drawbar where it is strong enough to support the lifted weight.

5. Use a heavy block as a base for the jack if working on the ground. It should be long enough to keep the jack from tipping, sinking or shifting. Any additional blocking should be under the jack.

6. Jack up the front and/or rear frame just enough to install steel safety stands under the axle tubes or frame.

7. Check the jack position after it has started to lift. Lower the jack immediately if it starts to lean. Reset the jack; block the tractor more securely and lift again.

8. Keep the tractor stable by not raising it so high that it will slide off the jack saddle.

9. Place support stands under the tractor. Lower the jack and let the tractor rest on the stands. This provides solid support for the tractor when the jack is removed.

HOIST SAFETY

1. Use a chain hoist and frame to lift the tractor properly. The minimum capacity required for the hoist is 10 tons (9 t); for the A-frame or overhead support, 7-1/2 tons (6.8 t); and for the support stands, three tons (2.7 t).

2. Protect yourself from injury as the tractor is being raised by doing the following:

   a) Do not stand on the tractor as you are lifting.

   b) Keep hands away from pinch points where the chain links tighten or the chain is against the tractor frame.

   c) Do not let the tractor swing and strike personnel or the frame as it leaves the ground.

   d) Keep support stands nearby and place under the tractor when proper height is reached.

   e) Do not go under a tractor supported by a chain hoist. Place support stands under the tractor before working under tractor.

3. The transmission alone weighs approximately 1 200 lb (550 kg). Extreme care must be exercised when hoisting, lowering or moving the transmission.

MAINTENANCE SAFETY

1. Shut down the engine before performing any maintenance procedure.

2. Be alert when approaching the tractor while it is running, especially the PTO, articulation joint and three-point hitch.

3. Use the articulation lock on the tractor during overhaul operations.

4. Do not oil, grease or adjust the tractor while it is in motion. Do not leave the engine running while the tractor is being adjusted, cleaned or repaired.

5. Before beginning work on any hydraulic system component, move all implement control levers to the full forward position several times to dissipate all pressure. If a three-point hitch is fitted, select the DOWN position. Disconnect any component that may be connected to the hoses.

6. Wear a face shield or goggles to protect your eyes, and heavy gloves to protect your hands, when searching for hydraulic leaks or charging the air conditioning system.

7. Escaping hydraulic oil under pressure can penetrate the skin, causing severe personal injury. Use a piece of cardboard or wood when searching for leaks. If injured, get immediate medical attention.

8. Do not smoke and avoid open flames when filling the batteries.

9. Shut down the engine and remove the ignition key before disconnecting or servicing PTO drivelines.

10. Do not remove the cooling system pressure cap while the engine is hot. Allow it to cool to less than 165°F (74°C).

11. Stop the engine before making any linkage adjustments.

12. Welding fuel tanks is dangerous and is not recommended.

13. Repair adhesive is a petroleum distillate and easily flammable. Keep the adhesive and its vapours from heat, sparks and flame. During application, and until the vapour is gone, avoid using spark-producting electrical equipment. Keep the container tightly closed when not in use.

FUEL AND FLUID SAFETY

1. Do not smoke and avoid open flame when:

   a) filling the fuel tanks

   b) filling the batteries

   c) working near a disassembled air conditioning system. Refrigerant vapour and flame combined produce lethal phosgene gas.

2. Add coolant to the radiator only when the engine is stopped. Turn the radiator cap slightly to relieve pressure before removing the cap.

3. Do not use an open pail or can for transporting fuel. Use only an approved container manufactured for that purpose.

4. If clothes should become splashed with fuel, change immediately. Fuel-soiled clothes are an extreme fire hazard.

5. Dispose of all fuel-soaked rags. Do not leave them lying around a work area where they may be exposed to flame, spark or cigarette smoking.

SECTION 2: ENGINE SYSTEMS

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SECTION 2: ENGINE SYSTEMS

1 Introduction

This section contains description and operation, troubleshooting tables, maintenance procedures and repair/overhaul procedures for the engine systems.

2 Description and Operation

2.1 GENERAL

Because of the close integration between the engine and certain engine systems, some repetition of information in the Cummins Operation and Maintenance Manual is unavoidable. Refer to the Cummins manual for detailed information.

2.2 ENGINE

The engine is a Cummins Model VT-555-C. Refer to the Cummins Operation and Maintenance Manual for description and operation of the engine.

2.3 FUEL SYSTEM

Description

The fuel system (Ref. Figure 2-1) consists of two fuel tanks mounted on either side of the front frame behind the front axle; remote breather located beside the implement control valve in the compartment behind the cab; two fuel filters, mounted on a bracket under the engine hood; a fuel pump; a fuel shutoff valve and hoses connecting these components.

Operation

The fuel pump creates a vacuum (Ref. Figure 2-1) in the supply hose leading to the left tank, when engine is running. This causes fuel to rise in the suction pipe and flow into the fuel supply hose connected to the fuel filters. The fuel then flows through the suction hose to the suction side of the fuel pump. Fuel passes into the pump,

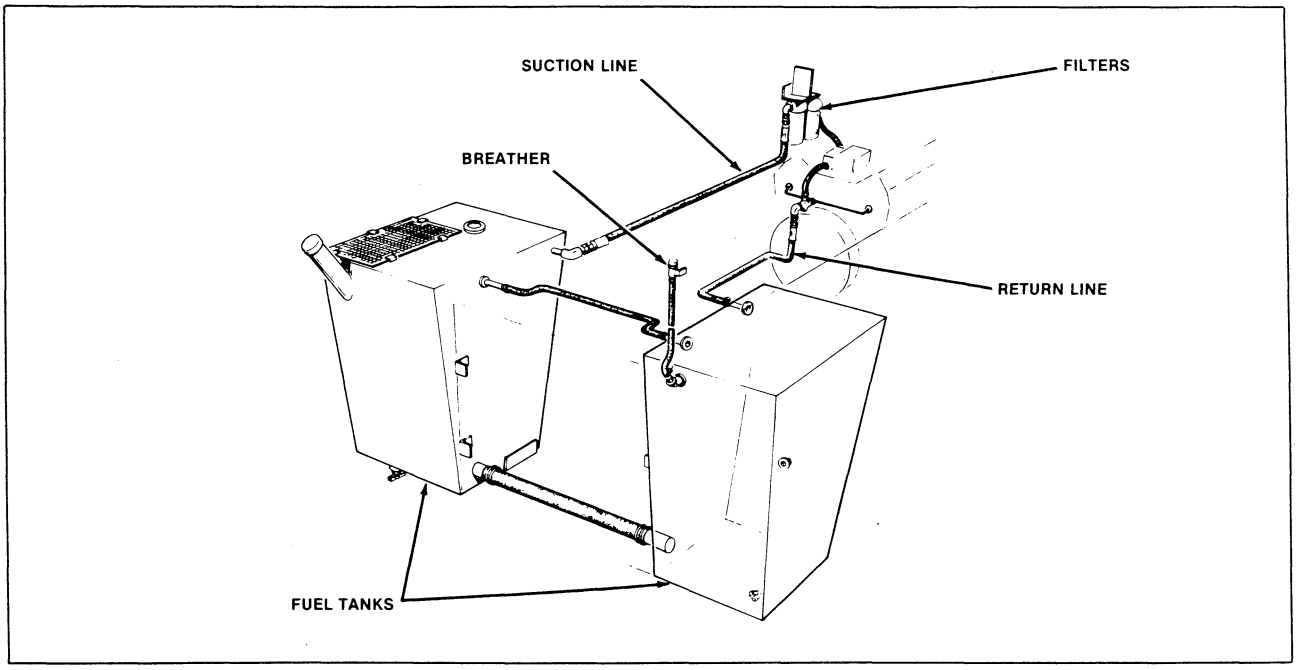

FIGURE 2-1: Fuel System Components

through an internal screen, and is discharged through the throttle, governor and fuel shutoff valve. When the fuel shutoff valve is open, fuel passes through it to a short delivery line into a passage in the engine distributing it to the individual injectors. When the fuel shutoff valve is closed, (mechanically or electrically) it shuts off the fuel flow, thereby stopping the engine. The fuel shutoff valve is opened/closed by the manual override of the valve, the electrical override switch under the dash panel in the cab, or high temperature of engine oil or engine coolant.

NOTE

One of the override devices must be used for engine starting.

At each injector, the fuel is screened and metered with approx 1/5 being injected into the cylinder and the remainder flowing through passages and collector lines to the fuel return hose. The return hose drains the fuel to the right fuel tank. This fuel cools the injectors and purges vapors from the injector chambers.

2.4 ENGINE COOLING SYSTEM

Description

The cooling system (Ref. Figure 2-2) consists of a radiator mounted on the tractor frame in front of the engine, a belt-driven fan behind the radiator, a belt-driven pump at the front of the engine, water jackets in the cylinder block and heads, a thermostat in the engine coolant outlet and a temperature-sensing bulb threaded into the engine. This bulb is connected by a capillary tube to the indicator in the cab. A coolant filter on the right side of the engine, a surge tank mounted above the radiator shroud together with the plumbing connecting these components, completes the system.

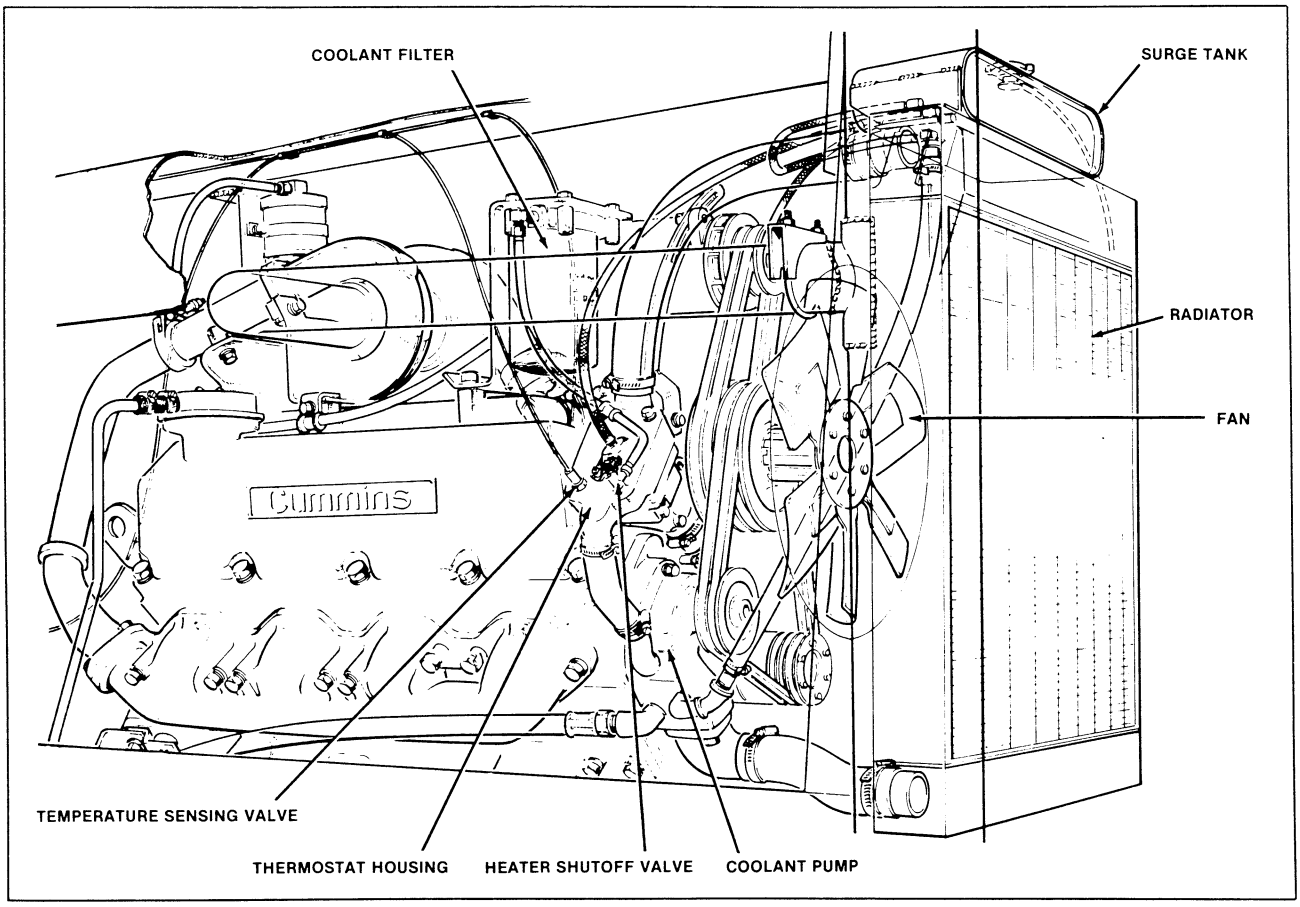

FIGURE 2-2: Engine Cooling System Components

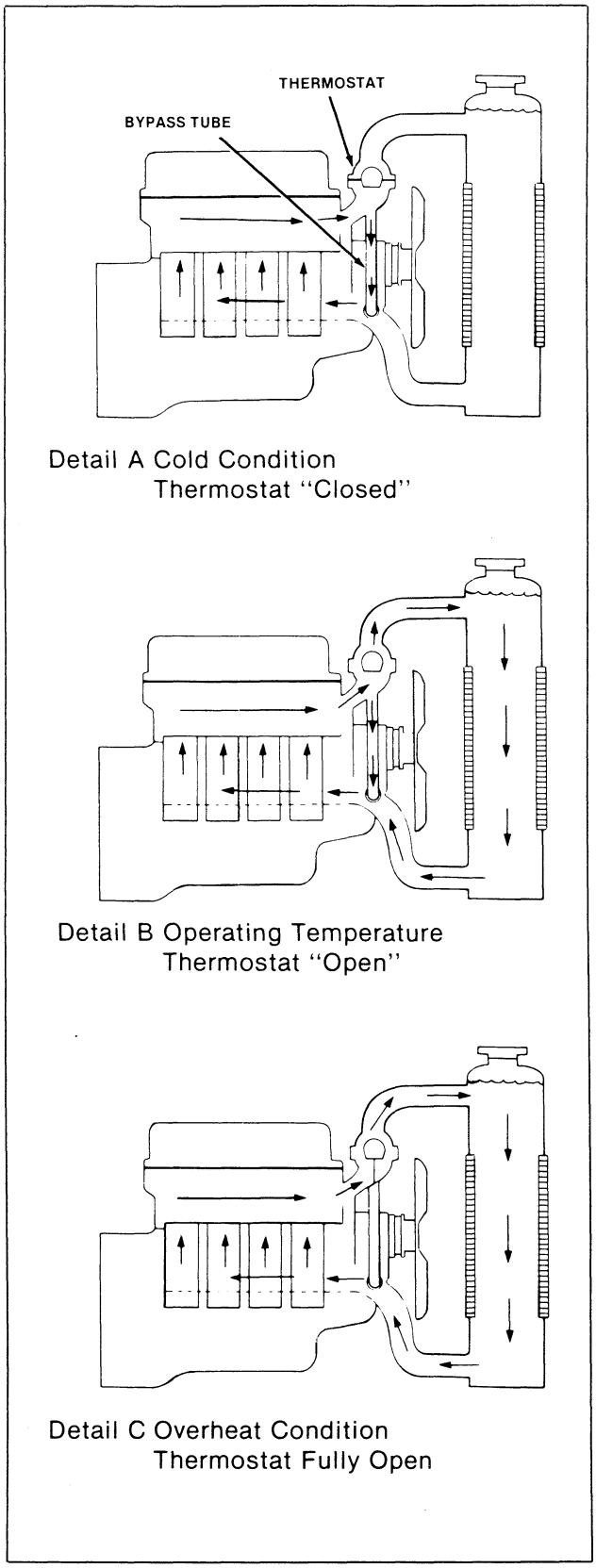

FIGURE 2-3: Cooling System Operation

Operation

When the engine is started, the coolant pump starts to circulate the coolant. If the coolant (engine) temperature is below the normal operating temperature of 165°F (74°C), the thermostat partially blocks and restricts the flow of coolant into the radiator. Coolant can circulate via a bypass tube from the engine outlet to the inlet side of the pump (Ref. Figure 2-3). Coolant circulates through engine and pump, but not through the radiator. As the temperature approaches normal, the thermostat will open. The coolant will circulate through the radiator core to the bottom outlet and back to the pump inlet at the right front corner of the engine. The thermostat regulates the coolant flow to maintain a normal temperature. It does this by diverting a greater or lesser portion of the coolant flow to the radiator, where its heat is transferred to passing air drawn by the fan. In the engine, coolant is circulated through the chambers (water jackets) of the engine block and cylinder heads, cooling the cylinders, valve seats, fuel injectors, engine block and heads. Some of the coolant flows to the surge tank through vent hoses, and returns to the pump inlet via a coolant make-up hose from the bottom of the surge tank (Ref. Figure 2-4). The cooling system is full when the surge tank fluid level depth is 5.5 in. (140 mm) with the coolant hot, and four in. (102 mm) when cold. The top chambers of the radiator and the cylinder head water jackets are vented to the surge tank

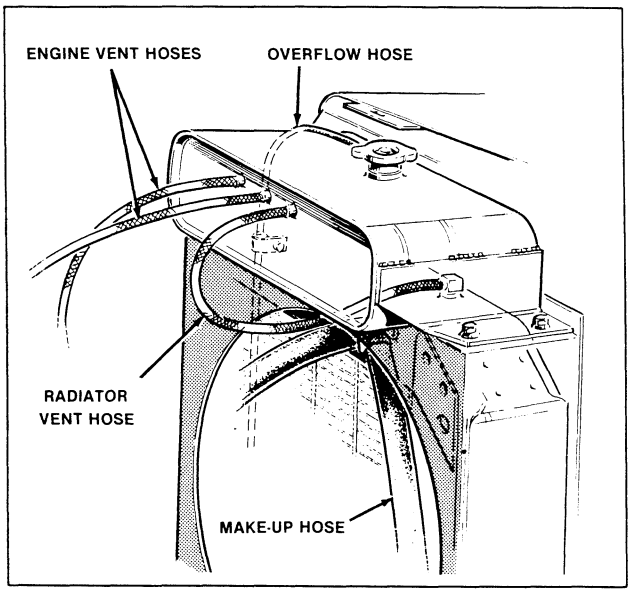

FIGURE 2-4: Surge Tank Circulation

through vent hoses which enter the tank above the fluid level. An overflow hose in the neck of the surge tank expels excess vapors and coolant down the edge of the engine hood to be exhausted. The surge tank provides coolant deaeration and is the reservoir for expansion and contraction of the coolant. Coolant from the engine is partially diverted through a dry chemical additive filter, filtering the coolant, and dissolving the anti-corrosive elements of the filter into the coolant. The treated coolant is returned by hose to the inlet side of the pump.

Coolant for cab heating purposes is taken from the left cylinder head and flows via hoses and metal lines to the heater core in the cab roof and is returned to the inlet side of the pump by return hoses and lines. A shutoff valve is located on the cylinder head outlet (Ref. Figure 2-2) for isolating the heater system when it is not required. The temperature gauge in the cab has switch contacts which close if the coolant temperature reaches 205° F (96° C). When this occurs, the electrical circuit for the fuel shutoff valve solenoid is opened and the engine will stop. Refer to Section 6, ELECTRICAL.

2.5 AIR INTAKE/EXHAUST SYSTEM

Description

The engine air intake/exhaust system consists of two interrelated subsystems, their component parts, hoses, pipes and mounting brackets (Ref. Figure 2-5). The air cleaner is mounted on the left front fender. It consists of a weathercapped air

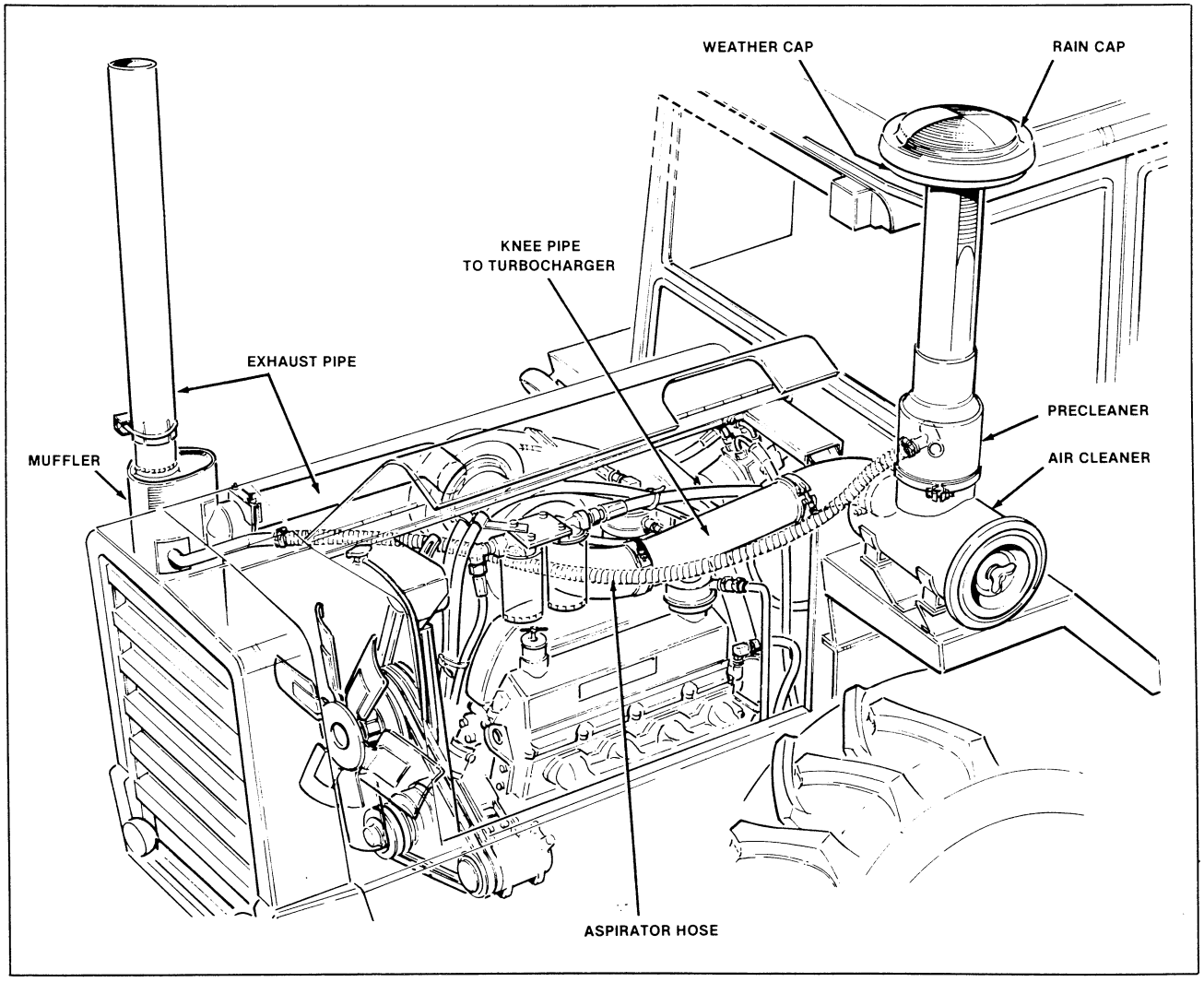

FIGURE 2-5: Air/Exhaust System Components

intake, a self-cleaning precleaner, a port for an aspirator hose, two paper element filters and an outlet which is connected by tube to the engine turbocharger. The exhaust system consists of a muffler at the right front of the tractor and an aspirating exhaust pipe with a port for the aspirator hose.

Operation

Air is drawn into the air cleaner through the weathercap and the precleaner, which swirls the air, causing dirt particles to separate by centrifugal action. The separated foreign matter drops into an aspiration chamber from which it is drawn via the aspirator hose to the exhaust pipe. The clean air enters the filter section and passes through two filter elements toward the center of the air cleaner where it leaves via the engine air intake tube. The air must pass through both filters to reach the air cleaner outlet. The inner filter (safety element) is a safeguard in case the outer element ruptures. An air cleaner restriction gauge indicates (in inches of water) the vacuum in the air intake tube.

A reading greater than 20 in. indicates an air flow restriction usually caused by dirty outer filter elements.

Exhaust gases are pipe led to the turbocharger and to the muffler. The gases then pass through the muffler chambers connected to a top stack attached to the exhaust stack.

The muffler contains a venturi section connected by hose to the aspiration chamber of the precleaner. This venturi creates a vacuum when the engine is running, causing dirt particles to be sucked from the aspiration chamber, through the aspirator hose to the muffler and expelled with the exhaust gases.

2.6 ENGINE OIL FILTER

Description

Two filters are connected into the engine oil lubrication system (Ref. Figure 2-6); the full-flow filter located at the engine's right rear, and the bypass filter mounted inside the right tractor frame, behind the front axle.

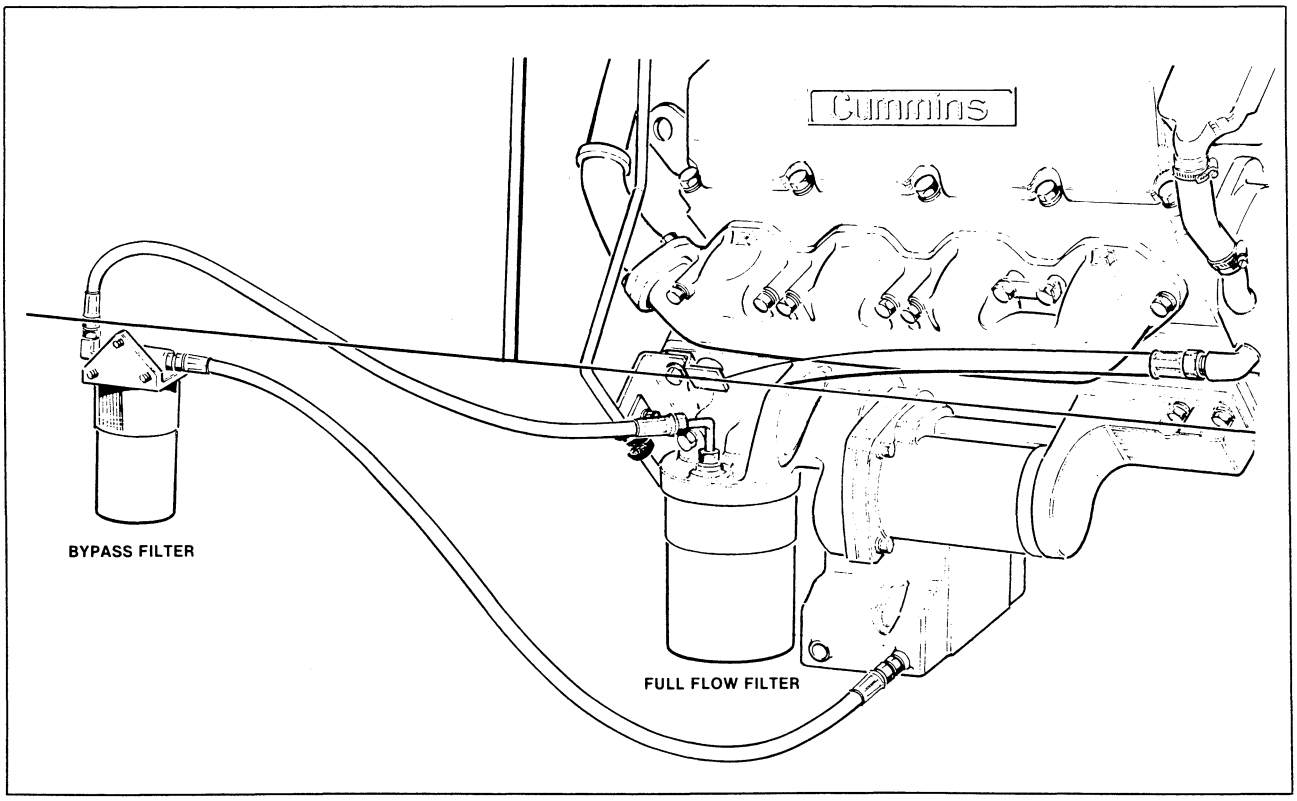

FIGURE 2-6: Oil Filter Components

Operation

During circulation, all the oil is passed through the full-flow filter. Most of the filtered oil goes to the engine but a portion is directed by hose to the bypass oil filter. This cleaned oil is returned by hose to the engine crankcase. The full-flow and bypass filters have replaceable spin on filters. For filter servicing instructions, refer to Operator's Manual.

2.7 COLD STARTING AID SYSTEM

Description

The ether injection system aids starting when engine temperature is below 50°F (10°C).

The system comprises an electric switch located on the cab instrument panel, a solenoid, a metering valve, a cylinder of ethyl ether with mounting hardware and capillary tube and atomizer, a protective thermoguard switch connected at the engine manifold and metering valve. The outlet part of the metering valve is connected to the atomizer, which is mounted in the intake manifold of the engine, by the capillary tube (Ref. Figure 2-7).

Operation

When the switch in the cab is pressed, solenoid action at the metering valve allows a charge of ethyl ether to flow from the cylinder into a metered chamber in the metering valve. The ethyl ether in the metered chamber will now flow via the capillary tube to the atomizer which injects it into the engine intake manifold.

The thermoguard prevents the operation of the system at engine temperatures above 81° F (27° C) where cold starting aid is not required.

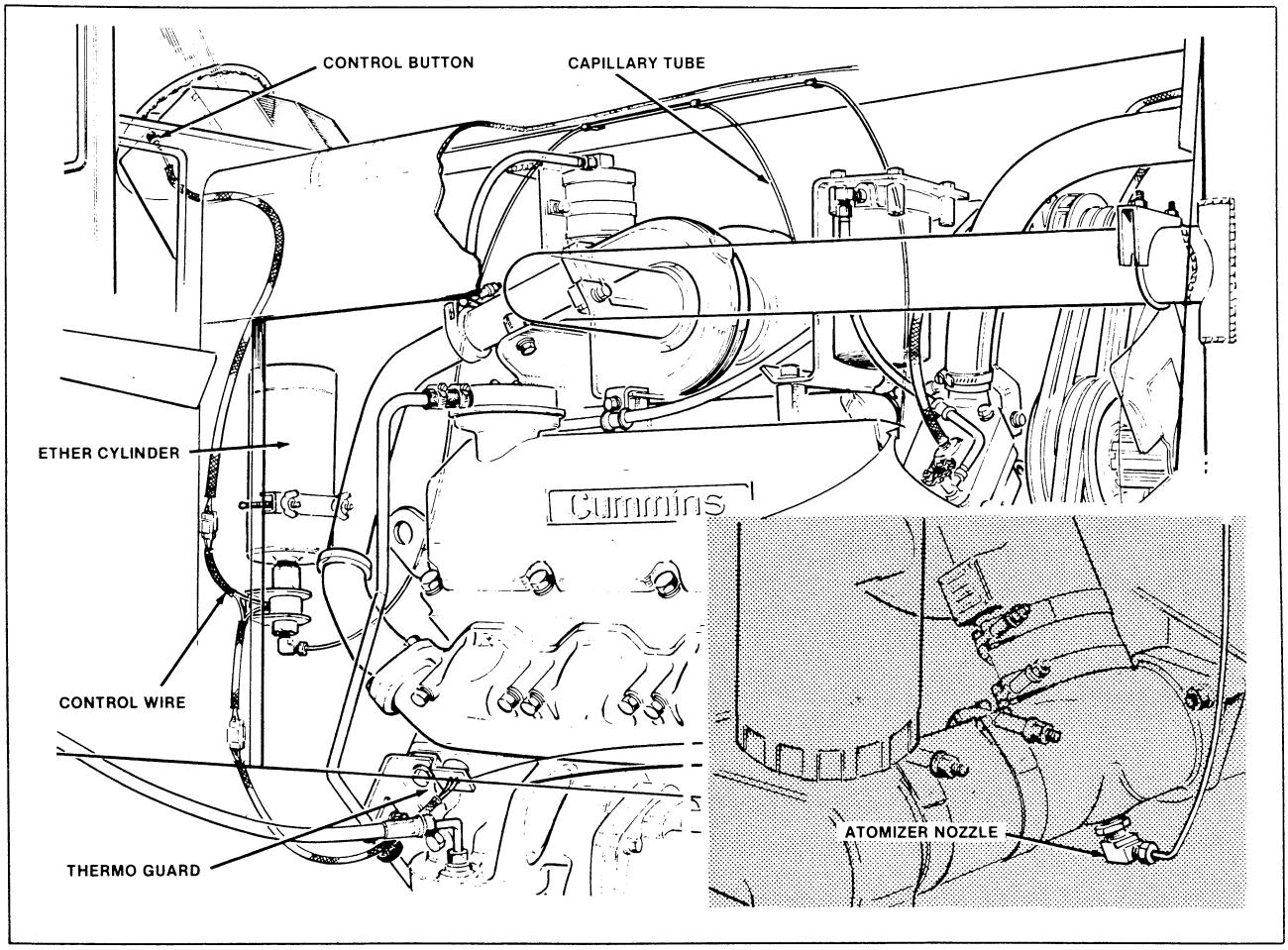

FIGURE 2-7: Cold Start Components

TABLE 2-6: Cold Start System

TROUBLE	PROBABLE CAUSE	REMEDY
Failure of engine to start when cranked	Cylinder empty	Replace cylinder
	Cylinder not fully seated	Screw cylinder down, hand tighten
	Solenoid defective	Check solenoid action
	Defective valve	Actuate the valve and observe ether release. Replace if not working
	Capillary tube or atomizer plugged	Examine tube for damage, replace Remove and clean atomizer

4 Inspection/Check of Subsystems

4.1 GENERAL

The following lists the steps to be taken when determining the serviceability of a component. They include the minimum required corrective action where the reason for malfunction is determined. They do not contain instructions for removal, installation, disassembly, inspection, or overhaul of major components. For removal and installation, refer to subsection 5, Repair and Overhaul.

4.2 FUEL SYSTEM

Special Tools and Equipment

1. Sight glass (Cummins part no. ST-998 or equivalent).

Priming of Fuel Filters

To check fuel filters for priming, remove both filters and completely fill with clean diesel fuel. Install filters; refer to Operator's Manual.

Fuel Shutoff Valve

To check operation of the valve solenoid, proceed as follows (Ref. Figure 2-8):

1. Examine wire terminal connection for tightness.
2. Examine wire insulation for any evidence of short-circuiting and deterioration.
3. Turn manual override knob to full clockwise position.
4. Crank engine with keyswitch ON.

NOTE

If engine starts, circuit test solenoid. If engine does not start, check fuel, refer to Cummins Manual (Ref. Section 6).

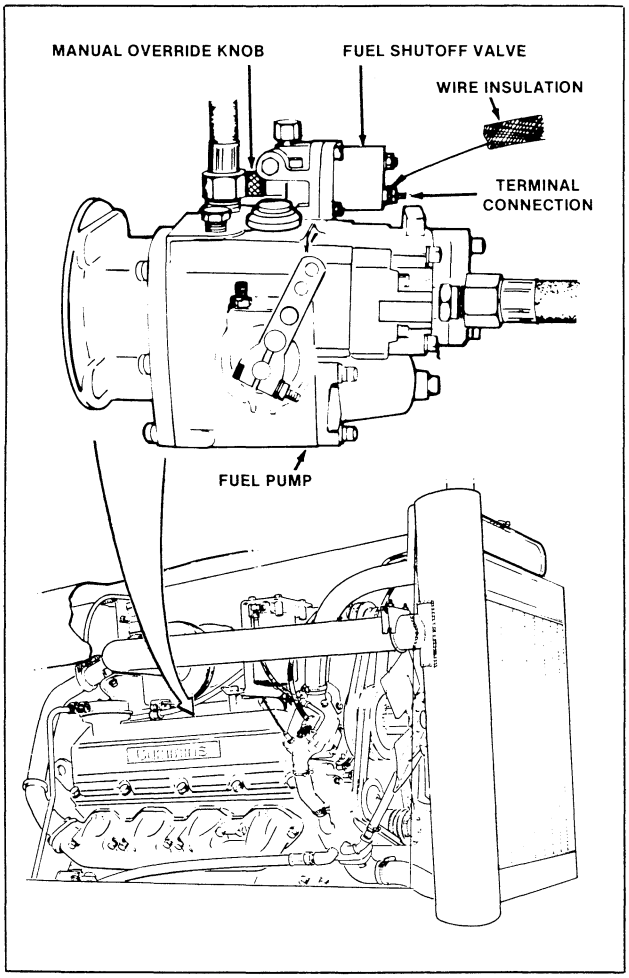

FIGURE 2-8: Fuel Shutoff Valve

Air Leak(s) in Fuel Suction Line

To locate air leak(s) in the suction lines, proceed as follows (Ref. Figure 2-9):

NOTE

Before starting test, check fuel level in tanks.

1. Check all fuel suction hoses and connections and fuel filters for leakage. If hose(s) are leaking, replace (refer to para 5-2). If connections are loose, tighten. If filters leak, tighten.

2. Disconnect suction hose at fuel pump inlet (position one). Connect sight glass to pump inlet. Connect suction hose to sight glass. Tighten connections.

3. Run or crank engine using fuel shutoff valve override. Observe sight glass for air bubbles.

NOTE

If there are no bubbles and fuel fills glass, test is completed. If there are bubbles, proceed to Step 4.

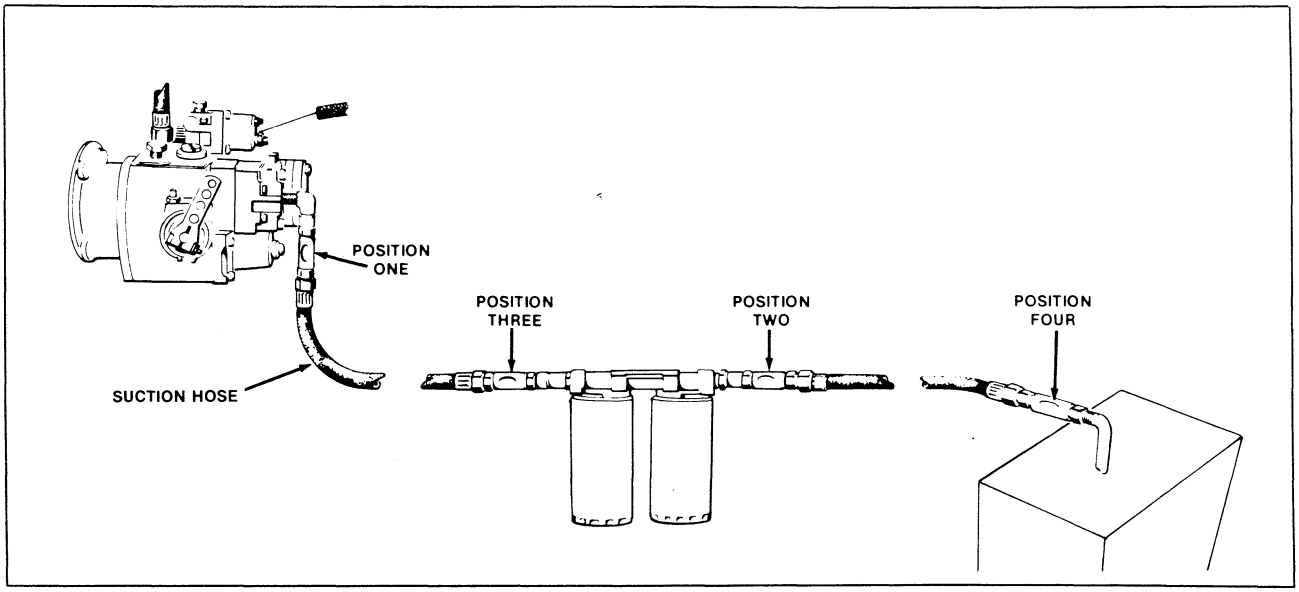

FIGURE 2-9: Locating Leaks in Fuel Suction Lines

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4. Remove sight glass and connect at inlet to filters (position two). Tighten connections and repeat Step 3.

NOTE

If bubbles appear at this location, the leak is in fuel supply hose or tank suction pipe. Proceed to Step 5 to isolate it. If no bubbles appear, proceed to Step 6.

5. Repeat Step 3 with sight glass at position four.

NOTE

If there are bubbles with sight glass at position four, the cause is either a very low fuel level or a leak in the suction pipe in the left fuel tank, remove fuel tank (refer to para 5.3).

6. Connect sight glass to position three and repeat Step 3.

NOTE

Bubbles indicate a leak in the filter assembly. Replace defective seals and fittings. No bubbles indicate leak was at filter outlet and was corrected during connection of sight glass. Leave glass in this position to aid in isolation of leak in case it recurs.

Water in Fuel

To remove water from the fuel system proceed as follows:

1. Drain and catch approx one pint of fuel from the draincock of each fuel tank.
2. Inspect fuel samples for water.
3. Continue to sample fuel until there is no water.
4. Remove drain plug from each fuel filter and catch draining fuel.

IMPORTANT

Fuel filters must be filled with clean fuel to prime the system.

5. Inspect drained fuel for water. If water is present, fill a new filter with clean fuel and install; refer to Section 1.
6. Drain fuel pump; refer to Cummins Manual.

Hose Restrictions

To inspect hoses proceed as follows:

1. Remove hoses and inspect for blockage (Refer to para 5.2).
2. Inspect or probe the hose base for blockage where it joins the metal end. Any damage, interior or exterior, is reason for hose replacement.
3. Use forced air to purge hoses; install hoses.
4. Start engine. If engine runs improperly, refer to Cummins Manual for troubleshooting fuel pump and injectors.

4.3 ENGINE COOLING SYSTEM

Special Tools and Equipment

1. 5 gal (23 L) container
2. Water container and electric heat source
3. Transparent flexible tubing, 1/2 in. (12 mm) ID
4. Direct reading thermometer to 210°F (100°C)
5. Regulated air supply 100 psi (690 kPa) max

WARNING

DO NOT REMOVE COOLING SYSTEM FILLER CAP WHILE ENGINE IS HOT; COOL TO LESS THAN 165°F (74°C).