555 TRACTOR SERVICE MANUAL

40055520

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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 1: SERVICING

Table of Contents

SECTION 1: SERVICING

1 Introduction

This section contains general information about specifications, capacities, lubricants, fluids and fuels for the tractor.

2 Towing/Transporting

2.1 TOWING

NOTE

Tractor cannot be tow started; the clutch requires hydraulic power.

Take the following precautions when towing:

1. Use a strong chain, cable or towbar and attach securely to the front plate or drawbar of tractor.
2. Let engine run, if possible, so that full use is made of power steering.
3. Tow tractor slowly to allow operator to control it.

NOTE

If engine cannot be started, pull tractor in a gradual arc across the field. Steering tractor will be difficult, because the hydraulics will be inoperative.

IMPORTANT

Do not tow tractor faster than 10 mph (17 km/h).

4. Disconnect drivelines when any drive train system requires repair or overhaul.

2.2 TRANSPORTING

Use the following procedures when transporting the tractor:

1. Check with local authorities regarding laws, permits required and other information required to transport the tractor.
2. Use a flatbed trailer with a carrying capacity of 30,000 lb (13 608 kg).
3. Use "wide load" signs.
4. Equip trailer with a winch (minimum 10 ton (9 t) capacity) to pull tractor onto trailer.
5. Securely chain tractor to trailer to prevent movement.
6. Block wheels and engage parkbrake to prevent movement.
7. Pin center articulation lock to prevent movement.
8. Inspect chains for cracks, wear, bent links, worn or bent hooks. Repair any damaged links or hooks.

3 Hoists and Jacks

3.1 JACKS

Improper use of jacks or lifting devices can result in a serious accident. Follow these recommendations when raising the tractor with a jack:

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

2. Do not use a leaking jack.

3. Stabilize tractor by engaging parkbrake and chocking wheels.

4. Engage the articulation lock to prevent movement.

5. Always park the tractor on level ground.

6. Place jack securely under axle tube or frame.

7. Use a heavy block as a base for the jack if working on the ground. It should be long and wide enough to keep jack from tipping, sinking or shifting.

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

9. Jack up front or rear frame just enough to install steel safety stand under axle tube or frame.

10. Place support stands under tractor. Lower jack and let tractor rest on stands.

3.2 HOISTS

Improper capacity hoisting equipment can cause accidents and injuries. Practice the following:

1. Use a chain hoist and frame to lift tractor. The minimum capacity is 10 tons (9 t).

2. Never overload a hoist or frame beyond its capacity.

3. Inspect chain and hooks regularly for cracks, wear or bent links. Repair any damaged links or hooks.

4. Select a suitable lift point on tractor frame. Place hoist and frame directly over the point of lift.

5. Connect chain to tractor ensuring that the chain cannot slip.

6. Stand well clear of tractor as it is raised.

7. Raise the tractor just high enough to position support stands.

8. Immediately lower tractor onto support stand(s).

9. Do not go under tractor until it is held by support stand(s).

4 Specifications

4.1 DIMENSIONS

Length (including three-point hitch)	249.6 in. (6340 mm)
Width (single tires)	100 in. (2540 mm)
Height	Ref. Table 1-1
Wheelbase	120 in. (3050 mm)
Turning radius (nominal to centerline of tractor)	152 in. (3860 mm)
(with 18.4 x 38 single tires at 100 in. 2540 mm tread)	202 in. (5130 mm)
(with 18.4 x 38 dual tires at 125 in. 3177 mm tread)	227.5 in. (5779 mm)

IMPORTANT

When using dual wheels, ensure that pressure of outside tires is two psi (14 kPa) less than that of inside tires.

4.2 TIRE INFLATION

For correct tire inflation pressure, refer to Table 1-2.

4.3 WEIGHTS

Maximum operating weight	26 000 lb (11 793 kg)
Recommended range	22 000 to 25 000 lb (9980 to 11 340 kg)

TABLE 1-1: Dimensions with Tire Options

Tire Sizes, Singles	16.9x38 R-1		18.4x34 R-1		18.4x38 R-1		23.1x30 R-1		23.1x34 R-1		15.5x38 R-1	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Cab Height	120.9	3071	120	3048	122	3099	120.3	3056	122.3	3106	119	3023
Stack Height	134.9	3426	134	3404	136	3454	134.3	3411	136.3	3462	133	3378
Maximum Height[1]	150.9	3833	150	3810	152	3860	164.5	4173	166.3	4224	149	3785

Singles — minimum tread width — 60 in. (1524 mm)
— maximum tread width — 100 in. (2540 mm)

Duals — maximum tread width — 125 in. (3175 mm)

[1]**Height with antenna extended — 30 in. (760 mm)**

TABLE 1-2: Tire Inflation Chart

TIRE SIZE	PLY RATING	LITTLE OR NO BALLAST	MAX. BALLAST OR HEAVY LOAD
18.4 x 38	8	16 psi (110 kPa)	22 psi (151 kPa)
16.9 x 38	8	20 psi (138 kPa)	Do not use
15.5 x 38[1]	10	26 psi (178 kPa)	26 psi (178 kPa)
23.1 x 34	8	16 psi (110 kPa)	18 psi (125 kPa)
18.4 x 34	8	16 psi (110 kPa)	24 psi (165 kPa)
23.1 x 30	8	16 psi (110 kPa)	16 psi (110 kPa)

[1]**15.5 x 38 tires are to be used as duals only**

4.4 ENGINE

Type ..... Cummins Diesel (turbocharged)
Model VT-555-C
Maximum brake horsepower at
2850 rpm (r/min) ..... 210 hp (156.6 kW)
Maximum torque at 1800 rpm
(r/min) ..... 473 lb ft (641.4 N·m)
Full-load governed speed ..... 2850 rpm (r/min)
Full-throttle no-load speed ..... 3300 rpm (r/min)
Idle speed ..... 1000 rpm (r/min)
Bore ..... 4.625 in. (117 mm)
Stroke ..... 4.125 (104.7 mm)
Displacement ..... 555 cu in. (9.1 L)
Compression 17.1:1
Oil capacity ..... 26 qt US (24 L)
Oil pan angular capability ..... 45 degrees
Lubrication system:
Full-flow filter, bypass oil filter, oil-to-water cooler.
Engine mounts ..... Full rubber isolation

4.5 COOLING SYSTEM

Capacity ..... 44 qt US (42.6 L)
Radiator area ..... 858.1 sq in. (5536 cm^2)
Radiator fins ..... 8 fins/in. (3.1 fins/cm)
Pressure cap ..... 7 psi (48 kPa)
System reservoir ..... Surge Tank
Fan:
Type ..... Six-blade, sucker
Diameter ..... 26 in. (660 mm)

4.6 AIR CLEANER

Diameter ..... 12 in. (305 mm)
Elements ..... Two
Aspiration ..... By exhaust system
Restriction indicator ... Instrument panel gauge

4.7 EXHAUST SYSTEM

Type ..... Single muffler
Muffler dimensions ..... 6.12 x 10.12 x 38 in. (155 x 257 x 965 mm)

4.8 CLUTCH

Diameter ..... 7.75 in. (197 mm)
Number of plates ..... Eight
Location ..... Transmission
Actuation ..... Hydraulic, mechanical linkage to foot pedal
Engine drive ..... Shock-cushioned drive plate, mounted on flywheel

4.9 BRAKES

Disc diameter ..... 15 in. (381 mm)
Road brake ..... Dual piston, self-adjusting caliper, hydraulically actuated
Parkbrake ..... Integrated with road brake, mechanical

4.10 TRANSMISSION

Type ..... Constant mesh
Shifting ..... Sliding collars
Speeds ..... 15 forward, 5 reverse
Range of ratios ..... 1.20:1 to 10.56:1
Oil capacity ..... 26 qt US (24.6 L)
Ground speeds ..... Ref. Table 1-3
Controls ..... Floor-mounted
Oil pressure warning ..... Panel light
Oil level ..... Dipstick at filler
Lubrication system:
Transmission driven pump, 10-micron filter, cooler, steel lines, wire braid hose.

4.11 DRIVELINES

Engine to transmission ..... 1550 Series
Transmission to axles ..... 1550 Series
Transmission to PTO ..... 1480 Series
Steady bearings:
Main driveline ..... Center frame
PTO driveline ..... Rear frame

4.12 AXLES

Differential:
Type ..... Spiral bevel
Ratio 4.62:1
Oil capacity ..... 28 qt US (27 L)

TABLE 1-3: Ground Speeds with 18.4 x 38 tires, 31.4 in. Loaded Radius at 2850 rpm

GEAR	LOW RANGE		MEDIUM RANGE		HIGH RANGE		REVERSE	
	mph	km/h	mph	km/h	mph	km/h	mph	km/h
1	1.9	3.1	4	6.5	9.4	15.1	3	4.8
2	2.2	3.5	4.6	7.4	10.8	17.3	3.4	5.5
3	2.6	4.2	5.5	8.8	12.8	20.6	4.1	6.6
4	3	4.8	6.2	10	14.5	23.3	4.6	7.4
5	3.6	5.8	7.4	11.9	17.2	27.8	5.5	8.8

Planetaries:
Location ..... Inboard
Ratio 5.625:1
Lubrication ..... SAE 90 MIL 2105-B gear oil
Total axle ratio 25.99:1
Shaft diameter ..... 4 in. (102 mm)
Wheel hubs ..... Adjustable, taper-lock

4.13 STEERING

Type ..... Articulated frames
Articulation, left or right ..... 43 degrees
Actuation ..... Hydrostatic
Actuators:
Two 3 in. (76 mm) x 16.5 in. (419 mm) stroke cylinders, mounted with 1.25 in. (32 mm) self-aligning ball bushings
Control Valve:
Five-port, 45 cu in./rev (737 mL/rev), rubber mounted

4.14 HYDRAULIC SYSTEM

Type ..... Open center
Pump ..... Engine driven dual pump. 2.6 cu in./rev (42.6 mL/rev) for steering and implement circuit. 1.94 cu in./rev (31.8 mL/rev) for master clutch circuit
Steering (nominal) ..... 23.2 gal US/min (87.8 L/min) at 2850 rpm
Implements (nominal) ..... 4 to 25 gal US/min (30.3 to 90.8 L/min), adjustable from inside cab
Relieve valve setting (steering and implement) ..... 2300 ± 50 psi (15.8 MPa ± 345 kPa)
Master clutch (nominal) ..... 17.3 gal US/min (65.5 L/min) at 2850 rpm
Relief valve setting (master clutch) ..... 500 psi (3.45 kPa)
Implement control valve ..... Three spool, two 4-way self-cancelling spools set at 2100 + 0 to 100 psi (14 480 + 0 to 690 kPa); one spool with float position
Filter (suction) ..... 100 mesh, reusable screen
Filter (return) .... 33 micron replaceable element
Reservoir capacity ..... 56 qt US (52.9 L)
Cooler ..... Connected into return line mounted in front of radiator
Couplers ..... Push to connect under pressure

4.15 ELECTRICAL SYSTEM

Type ..... 12 volts, negative ground
Alternator ..... 12 volts, 75 amperes
Batteries ..... Two 8D, 12 volts, 900 amperes
Starting cables ..... Four AWG 00
Worklights ..... Eight 60 watt

4.16 FRAMES

Articulation ..... Front frame - subframe - rear frame
Vertical oscillation ..... 15 degrees
Thickness:
Front frame ..... 3/8 in. (10 mm)
Rear frame, sides ..... 3/8 in. (10 mm)
Rear frame, back ..... 1/2 in. (13 mm)

4.17 DRAWBAR

Type ..... Swinging clevis
Dimensions ..... 1.5 x 4 in. (38 x 101 mm)
Height (18.4 x 38 tires) ..... 17 in. (533 mm)

4.18 CAB

Type:
Independent module, rollover protective structure
Shock mounts ..... Rubber
Interior insulation ..... Acoustic
Outside height ..... 63 in. (1600 mm)
Outside width ..... 56 in. (1420 mm)

4.19 INSTRUMENT PANEL

Gauges ..... Tachometer/hour meter, engine oil pressure, coolant temperature, voltmeter, fuel level, air cleaner restriction
Warning lights ..... Transmission oil pressure, alternator, parkbrake, turn signals, warning light with warning buzzer for low clutch oil pressure
Controls ..... Keyswitch, start button, manual override button, lightswitch, turn signal switch, cold start button
Safety systems ..... Transmission neutral switch, PTO neutral switch, clutch, interlock system

4.20 ENVIRONMENTAL CONTROL ROOF UNIT

Pressurization/recirculation ..... Operator-controlled, three-speed fan
Air conditioning ..... Engine-driven compressor, cooling rate of 24 000 BTU/h (7 kW)
Windshield wiper ..... Two-speed

4.21 RADIO

Type ..... AM/FM cassette player, two stereo speakers, local/distance selection, spring-mounted antenna

4.22 POWER TAKE-OFF

Type ..... Live PTO
Standard speed at
2670 engine rpm ..... 1000 rpm (r/min)
Speed at maximum governed
engine speed ..... 1068 rpm (r/min)
Standard shaft diameter ..... 1-3/4 in. (44 mm)
Optional shaft ..... 1-3/8 in. (35 mm)

Clutch:
Multiple discs, 5.25 in. (133 mm) diameter, built into main transmission, hydraulically controlled.

4.23 OPTIONS

1. Three-point hitch (Categories II, III and III N)
2. Dual wheel spacers; 14 in. (356 mm)
3. No-Spin differential, front only
4. No-Spin differential, front and rear
5. Engine coolant heater
6. Rear window wiper kit
7. Fourth spool for implement control valve
8. Hydraulic proportionator

5 Fuel, Fluids and Lubricants

– CAUTION

REFER TO OPERATOR'S MANUAL, SECTION 1, SAFETY. APPLY ALL INFORMATION RELATING TO THE HANDLING OF FUELS, AND VOLATILE FLUIDS.

DO NOT HANDLE FUELS OR FILL FUEL TANKS NEAR AN OPEN FLAME, WHILE SMOKING OR UNDER ANY CONDITION THAT COULD CAUSE A SPARK.

DO NOT USE AN OPEN PAIL OR CAN FOR TRANSPORTING FUEL. USE ONLY AN APPROVED CONTAINER MANUFACTURED FOR THAT PURPOSE.

IF CLOTHES SHOULD BECOME SPLASHED WITH FUEL, CHANGE IMMEDIATELY. FUEL SOILED CLOTHES ARE AN EXTREME FIRE HAZARD.

DISPOSE OF ALL FUEL SOAKED RAGS. DO NOT LEAVE THEM LAYING AROUND A WORK AREA WHERE THEY MAY BE EXPOSED TO FLAME, SPARK OR CIGARETTE SMOKING.

BE ALERT

5.1 FUELS

The quality of fuel is an important factor in getting dependable performance and satisfactory engine life. Suitable fuels must be clean, completely distilled, well refined and non-corrosive to the fuel system.

Cummins engines take advantage of the high energy content and generally lower cost of No. 2 diesel fuels. They will also operate satisfactorily on No. 1 fuels or other fuels within the following specifications:

1. Less than one percent sulfur content

2. Sediment and water content less than 0.1 percent

3. Cetane number of at least 40. A higher cetane number fuel may be necessary at low temperatures or high altitudes

4. Pour point below the lowest expected temperature

5. Ash content of less than 0.02 percent

6. Viscosity of 14 to 58 mm^2/s at 100° F (37.8° C)

Further details about the fuel specifications are contained in the Cummins Operation and Maintenance Manual.

5.2 FLUIDS

The tractor requires coolant, ballast, and hydraulic fluids of the following types and specifications:

Coolant

The tractor's cooling system contains the following from the factory:

1. Water

2. Glycol-base antifreeze

3. Dry chemical additive (DCA)

The tractor comes with a 1:1 ratio of water/ antifreeze mix which is circulated through the corrosion resistor filter when the engine is running. This filter has a precharge element which contains the DCA. The coolant liquid should be a water-antifreeze mix. The DCA is imperative to keep the cooling system conditioned.

ADDING COOLANT

It is recommended that a closed container of coolant be premixed for topping up the radiator level. Prepare the make-up coolant in the following ratio: one bottle (4 oz, 113.6 ml) of DCA to 4 gal US (15.1 L) of coolant.

REPLACING COOLANT

Anytime the cooling system is completely drained and filled with new coolant, a precharged dry chemical element (not a service element) must be installed. It is not necessary to mix DCA with the liquid coolant in this case as it is mixed through the precharge element during circulation.

SPECIFICATIONS OF COOLANT

Water: Clean and preferably soft. Generally any water that is suitable for drinking is adequate.

Antifreeze: Select a good commercial grade glycol base antifreeze. Use it in the proportions recommended by the manufacturer.

IMPORTANT

Do not use Dow Chemical Dowtherm 209 brand antifreeze in the tractor. It is not compatible with the corrosion inhibitor.

Dry Chemical Additive: The DCA mixes with the liquid coolant in one of three ways:

1. Via a filter precharge element (as during installation of new coolant).

2. Via a filter service element (as during 200 hour filter servicing).

3. Via addition of DCA directly to the coolant (as during premixing of make-up coolant for topping up the system). The DCA bottle (about 40 oz, 113.6 ml) is a Cummins Fleetguard product available as follows:

   VERSATILE® part no. 26204

   Cummins part no. 299050

Liquid Ballast

The amount of liquid required will have to be determined as outlined in the calculation of wheel slippage (Ref. Operator's Manual).

The tire ballast shown in the following chart consists of commercial Type 1 (77 percent) Calcium Chloride Flake ($CaCl_2$) mixed with water. If Type 2 (94 percent) Flake is used, the "Pounds $CaCl_2$" weights in the chart can be reduced by 25 percent (Ref. Table 1-4).

Plain water freezes solid at 32° F (0° C). The 3-1/2 lb calcium chloride solution is slush free to −12° F (−24° C) and freezes solid at −52° F (−47°C). The five lb calcium chloride solution is slush free to −52° F (−47° C) and freezes solid at −62° F (−52° C).

5.3 LUBRICANTS

Lubricant Grades

SE (Service grade) oil is designed to protect against oxidation, high-temperature engine deposits and oxidation.

CD (Commercial grade) oil provides service typical of supercharged diesel engines in high output, high speed duty. These oils provide protection from bearing corrosion and high temperature deposits in supercharged engines using fuels of a wide quality range. Turbocharged tractors require CD oils.

TABLE 1-4: Liquid Ballast Calculations

US MEASURE

	Water Only		TYPE 1 (77% Solution) 3-1/2 LB $CaCl_2$ Solution per Gal			TYPE 2 (94% Solution) 5 LB $CaCl_2$ Solution per Gal		
TIRE SIZE	US GALLONS WATER	TOTAL WEIGHT	US GALLONS WATER	POUNDS $CaCl_2$	TOTAL WEIGHT	US GALLONS WATER	POUNDS $CaCl_2$	TOTAL WEIGHT
15.5-38	66	550	56	196	663	53	265	707
18.4-34	100	834	85	298	1007	81	405	1081
18.4-38	110	917	94	329	1113	89	445	1187
23.1-30	143	1193	123	431	1456	116	580	1547
23.1-34	159	1326	136	476	1610	128	640	1708

METRIC MEASURE

	Water Only		TYPE 1 (77% Solution) 419.4 g $CaCl_2/H_2O$			TYPE 2 (94% Solution) 599.3 g $CaCl_2/H_2O$		
TIRE SIZE	WATER LITRE	WT KG	WATER LITRE	$CaCl_2$ KG	TOTAL WT, KG	WATER LITRE	$CaCl_2$ KG	TOTAL WT, KG
15.5-38	250	250	212	89	301	201	120	321
18.4-34	378.5	378.3	321.7	135.1	456.7	306.6	183.7	490.3
18.4-38	416.3	416.3	355.8	149.2	504.8	336.8	201.8	538.4
23.1-30	541.2	541.1	465.5	195.5	660.4	439	263	701.7
23.1-34	601.8	601.8	514.8	215.9	730.2	484.5	290.3	774.7

Engine Oil

SAE 10W30 motor oil of grade CD or SE/CD is recommended for temperatures above 10° F (– 12° C).

SAE 30 motor oil of grades SE and CD are recommended for ambient temperature above 40°F (4°C).

SAE 20-20W or SAE 10-20W motor oils of grades CD are recommended for ambient temperature from 20° to 60°F (– 7° to 16°C).

10W motor oil of grades SE and DC are recommended for ambient temperatures from – 10° to 30°F (– 23° to – 1°C).

Below – 10°F (– 23°C), refer to Arctic Oil Recommendations in the Cummins Manual.

Transmission Oil

Dexron II is recommended for all temperatures.

Differentials and Axle Planetary Gears

SAE 90 gear oil is recommended for all temperatures.

Hydraulic Fluid

Dexron II is recommended for all temperatures.

Brake Fluid

SAE 70R3 Atlas Super Duty fluid is recommended for all temperatures.

Grease

SAE High-Temperature Multi-Purpose Grease is recommended for all pressure grease fittings.

6 Lubrication

6.1 GENERAL

Table 1-5 lists the lube points on the 555 tractor. Along with the table are lube point illustrations (Ref. Figure 1-1).

Refer to subsection 4, SPECIFICATIONS, for capacities and requirements.

Know the lubricants to be used. Refiners produce a wide range of products to suit every lubrication need. Refer to subsection 5, FUELS, FLUIDS AND LUBRICANTS, for a description of the petroleum products required by the tractor. Use as indicated in the lubrication points figure and according to the lubrication schedule chart following.

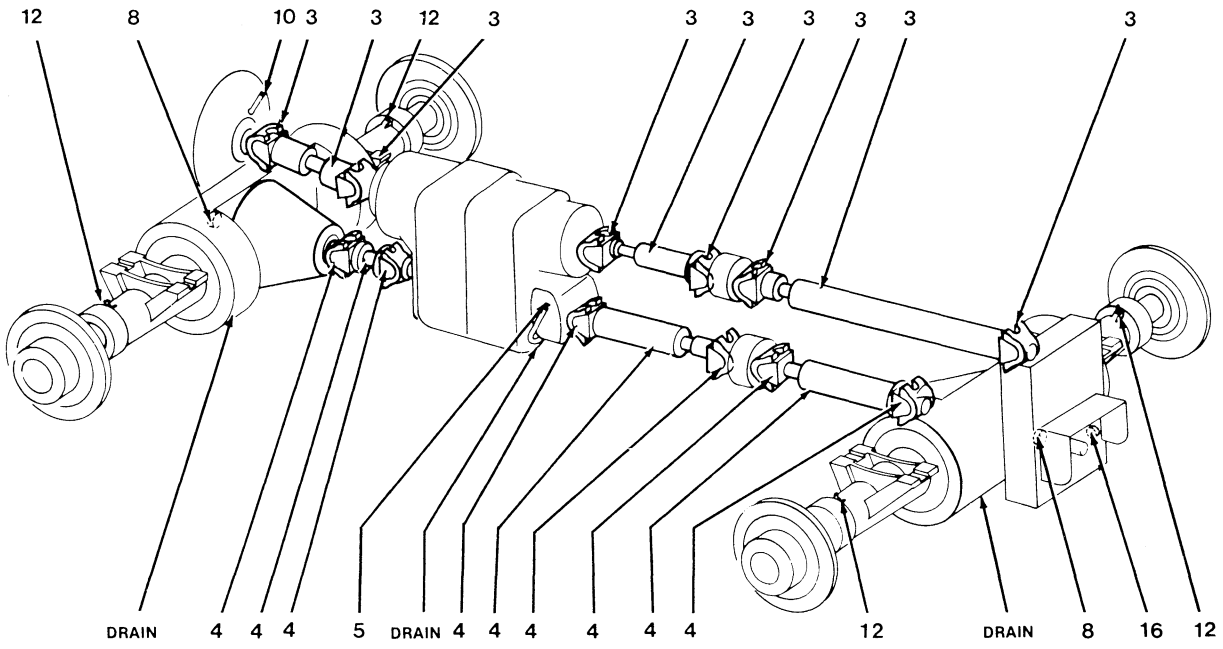
TABLE 1-5: Lubrication Points
Refer to Figure 1-1

LUBE POINT	DESCRIPTION	LUBRICANT	NO. OF POINTS
1	Check engine oil level	See lubricants	1
2	Change engine oil	See Lubricants	1
3	Upper drivelines (including PTO)	SAE multi-purpose grease	9
4	Lower drivelines	SAE multi-purpose grease	9
5	Check transmission oil	See Lubricants	1
6	Steering cylinder pivots	SAE multi-purpose grease	4
7	Upper main frame pivot	SAE multi-purpose grease	1
8	Differential/Planetary oil (front and rear differentials)[1]	See lubricants	2
9	Drag link pivot bearings	SAE multi-purpose grease	4
10	Housing drive disc[2]	SAE multi-purpose grease	1
11	Drawbar rollers (optional)	SAE multi-purpose grease	2
12	Axle outboard bearings	SAE multi-purpose grease	4
13	Three-point hitch (optional)	SAE multi-purpose grease	6
14	Three-point hitch (oil metal-to-metal parts)[3]	SAE 30 oil	—
15	Door and window hinge pins	SAE 30 oil	5
16	PTO dropbox		

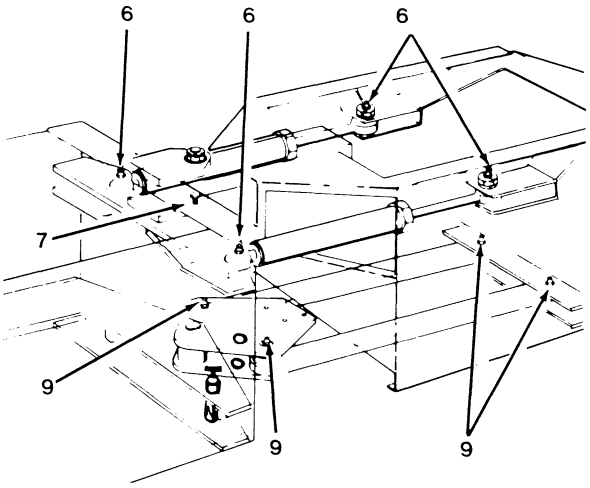
[1]Planetaries and Differentials — Planetary drives are located within the axle housing. The axle differential level plugs are located opposite the input shaft side of the differential housings. When changing differential/planetary oil, flush with a good quality petroleum based solvent before installing new oil.

[2]Housing Drive Disc — Apply four strokes of gun grease to the shaft support bearing. Too frequent greasing could rupture the bearing seal and allow lubrication to enter the drive disc assembly, or dirt to enter housing.

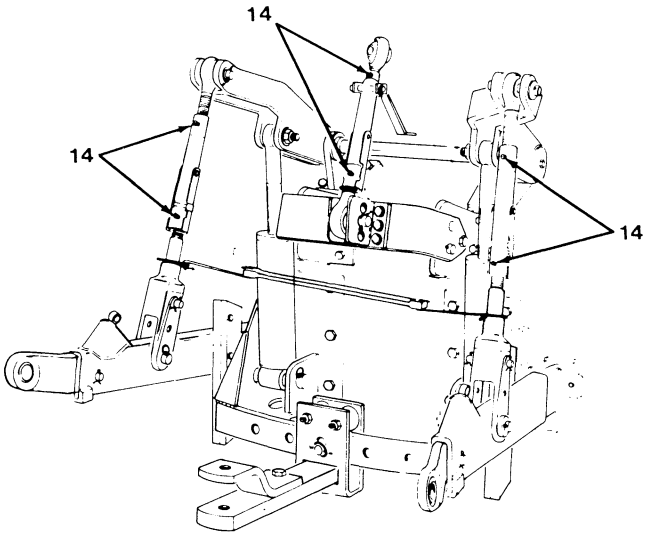
[3]Three-Point Hitch (optional) — The three-point hitch requires regular service. It is advisable to oil metal-to-metal parts of the hitch regularly and apply grease to the grease lube points. Once a year, or every 400 hours, the draft arm pins (at the tractor frame) must be removed, cleaned and greased.



Drive Train



Steering Cylinders and Articulation Joint



Three-Point Hitch

FIGURE 1-1: Lubrication Points

Lubrication Schedule

LUBE POINT	LUBRICANTS	POINTS
Daily Lubrication (Every 10 hours)		
Engine oil level	See Lubricants	1
Weekly Lubrication (Every 50 hours) Plus 10 hour items		
Upper drivelines (including PTO)	Multi-purpose grease	9
Lower drivelines	Multi-purpose grease	9
Check PTO dropbox oil level	See Lubricants	1
Check transmission oil level	See Lubricants	1
Steering cylinder pivots	Multi-purpose grease	4
Upper main frame pivot	Multi-purpose grease	1
Differential planetary	See Lubricants	2
Drag link pivot bearings	Multi-purpose grease	4
Housing drive disc	Multi-purpose grease	1
Drawbar rollers	SAE 30 oil	2
Axle outboard bearings	Multi-purpose grease	4
Three-point hitch	Multi-purpose grease	6
Monthly Lubrication (Every 200 hours) Plus 10 and 50 hour items		
Change engine oil	See Lubricants	1
Brakes (fluid level)	See Lubricants	1
Seasonal Lubrication (Every 400 hours) Plus 10, 50, 200 hour items		
Change transmission oil	See Lubricants	1
Change differential oil	See Lubricants	2
Door and window hinge pins	SAE 30 oil	
Change PTO dropbox oil	See Lubricants	1

7 Belts and Filters

7.1 GENERAL

Refer to Tables 1-6 and 1-7 for correct replacement belts and filters. Refer to Figure 1-2 for location of filters on the tractor.

7.2 BELT REPLACEMENT

Table 1-6 lists the belts used on the 555 tractor. Purchase and replace belts as sets to ensure proper matching and to avoid overloading the new belt.

7.3 FILTER REPLACEMENT

Table 1-7 lists the filters used.

TABLE 1-6: Belt Replacement

BELT	PART NO.
Alternator (2 per set)	56701
Compressor (2 per set)	55266
Fan (2 per set)	56700

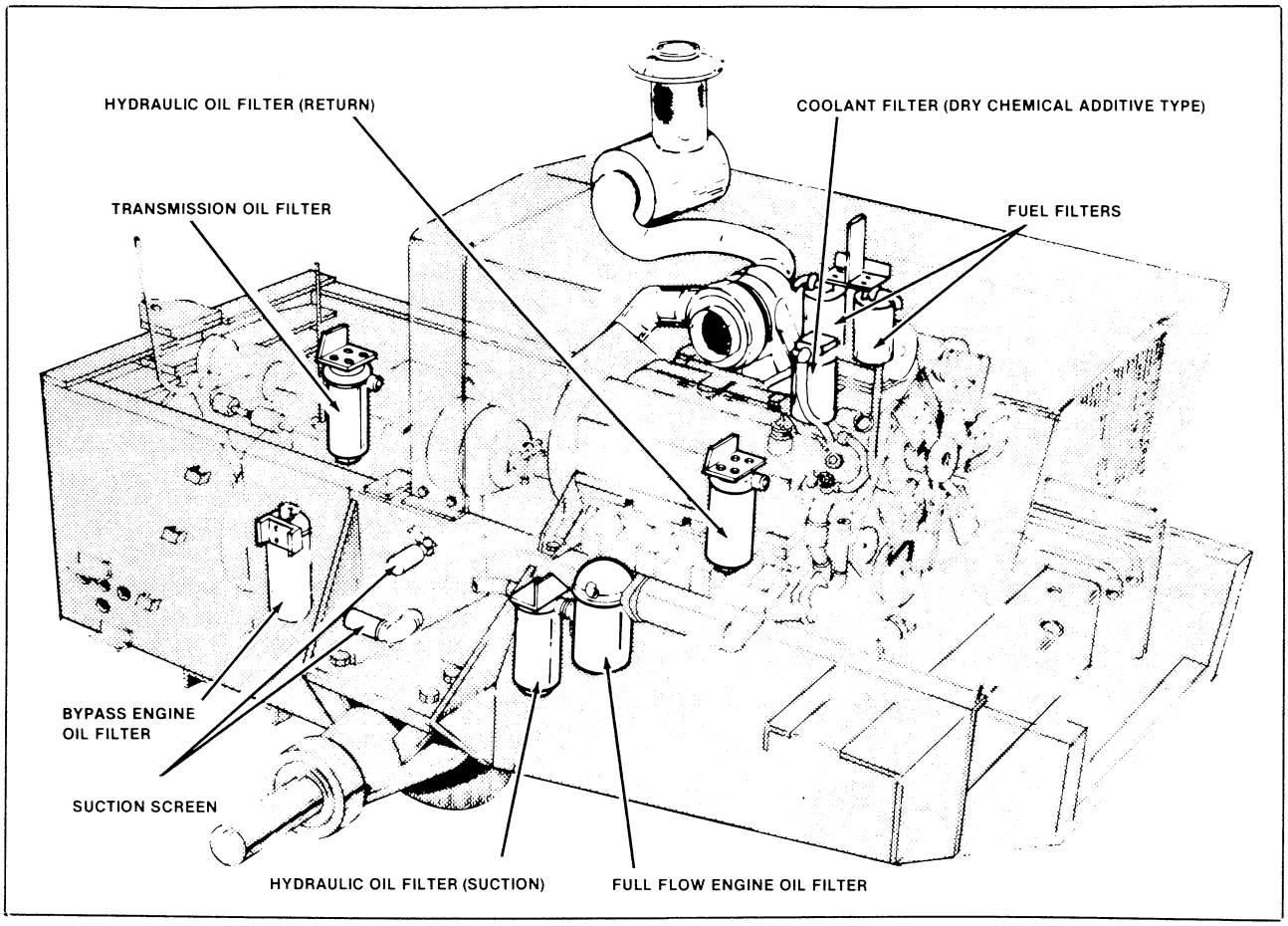


FIGURE 1-2: Internal Filter Locations

TABLE 1-7: Filters

LOCATION	PART NO.	LOCATION	PART NO.
Engine air cleaner element		Fuel filter	608T118
Inner (safety)	57994		
Outer	57993	Hydraulic fluid filter element steering, side (return)	36169
Cab air conditioner element			
Inner	30988	Hydraulic fluid filter element implement side (suction)	15799
Outer	30986		
Coolant (DCA) element (to be installed only with complete coolant change)	25881	Transmission oil filter element	36169
Engine bypass oil filter	57124	Transmission oil suction screens	20199
Engine full-flow oil filter	58125		

8 Storage

8.1 GENERAL

When the tractor is not to be used for several months, it must be prepared for storage to prevent damage to components. Prepare a kit for the storage period including plastic bags and tape to seal off openings; paint for scratched and chipped surfaces; grease and rust preventative; cleaning cloths and various fluids to refill all systems to proper level.

8.2 PREPARATION OF TRACTOR FOR STORAGE

After warming the engine, stop the engine and proceed as follows:

1. Drain crankcase.
2. Install new engine oil filters.
3. Fill crankcase with new oil.
4. Drain and flush cooling system. Refill with a correct mixture of water and glycol base antifreeze. Install new DCA precharge element.
5. Drain oil from axle housing. Refill with recommended lubricant (See Lubricants).
6. Drain oil from hydraulic circuit reservoir. Refill with recommended fluid (See Lubricants).
7. Drain oil from PTO gearbox. Refill with recommended lubricant (See Lubricants).
8. Drain oil from transmission circuit. Refill with recommended lubricant (See Lubricants).
9. Run engine to circulate coolant.
10. Operate transmission, hydraulic system and steering to distribute oil to all components.
11. Stop engine.
12. Relieve tension of drive belts and inspect for condition including alternator, air conditioner, compressor and fan.
13. Remove both batteries, charge them fully. Store in a cool, dry place. Keep batteries fully charged. Bring them to a full charge monthly.
14. Clean tractor and touch up all painted surfaces which are scratched or chipped.
15. Jack up tractor and block up axles to remove weight from tires. Cover tires if they are exposed to heat or sunlight.
16. Coat all exposed hydraulic cylinder shafts with grease or rust preventative.
17. Using plastic bags or tape, seal the following tractor openings: air cleaner inlet, exhaust muffler, fuel tank breather tube and cap and air conditioning air intake screens.
18. Store tractor in a dry, protected place. If tractor is to be stored outside, cover with a protective material.

8.3 PREPARATION OF ENGINE FOR STORAGE

Before storing the tractor, start the engine and run until coolant temperature is at least 160° F (70° C). Shielding the radiator may be necessary to achieve this temperature. Shutdown the engine while the temperature is up to prevent condensation from forming during storage.

8.4 STORING BATTERIES

NOTE

Charge to a full charge state every 30 days.

If the tractor is to be stored for more than 30 days, proceed as follows:

1. Remove batteries from tractor.
2. Check electrolyte level to make sure it is at bottom of cell filler necks.

3. Charge battery before storing it.

4. Store batteries in as cool and dry a place as possible.

5. Clean battery tops and keep batteries dry to reduce self-discharge.

8.5 PREPARATION AFTER STORAGE

When the tractor is taken out of storage, the following steps are to be taken:

1. Inflate tires to recommended pressure.

2. Check cooling system level.

3. Check oil levels in crankcase, axles, hydraulic reservoir, PTO dropbox and transmission reservoir.

4. Install batteries.

8.6 STARTUP OF ENGINE AFTER STORAGE

Initial startup can place abnormal loads on the engine cranking system. To reduce cranking loads, the following steps should be taken.

- CAUTION

BEFORE STARTING ENGINE, ENSURE ALL OPERATING CONTROLS ARE IN THE NEUTRAL POSITION.

OPERATE CONTROLS ONLY FROM THE OPERATOR'S SEAT.

STOP ENGINE BEFORE PERFORMING ANY WORK OR MAINTENANCE ON THE TRACTOR.

BE ALERT

KEEP ALL SHIELDS IN PLACE.

1. Electrical cables must be clean, tight and in good condition. They should be cleaned at all connection points (including battery terminals) before any attempt is made to start the unit.

2. If fuel filter has been changed prior to start up, prime filter lines.

3. Never crank engine for longer than a 30 second period. Allow two minutes for starting motor to cool between cranking cycles.

4. Battery must be fully charged. This reading should not be taken immediately after charging or discharging battery.

5. Use cold starting aid. If temperature is below 50° F (10° C).

6. Avoid high rpm after engine starts. Bearings are dry after storage and can be damaged by high rpm. Pressure priming the engine oil system is highly recommended if an external source of oil pressure is available. Make certain oil is clean.

7. If new batteries are installed, they must be of equivalent or higher capacity than the original batteries.

8. Tension all V-belts.

9. If engine does not start within 30 seconds (assuming starting aids are used as necessary and cranking speed is ample) engine is most likely not receiving fuel.

10. If white smoke is coming from exhaust, engine is receiving fuel but more starting aid is needed.

11. If exhaust is clear, fuel system is not delivering fuel to combustion chambers and the following checks should be made:

    a) Check that fuel system is primed adequately.
    b) Check operation of fuel shutoff valve solenoid.
    c) Check fuel pump delivery by loosening ferrule nut on line between fuel pump and engine. Fuel should flow from the fitting when engine is cranked.

SECTION 2: ENGINE SYSTEMS

Table of Contents

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,

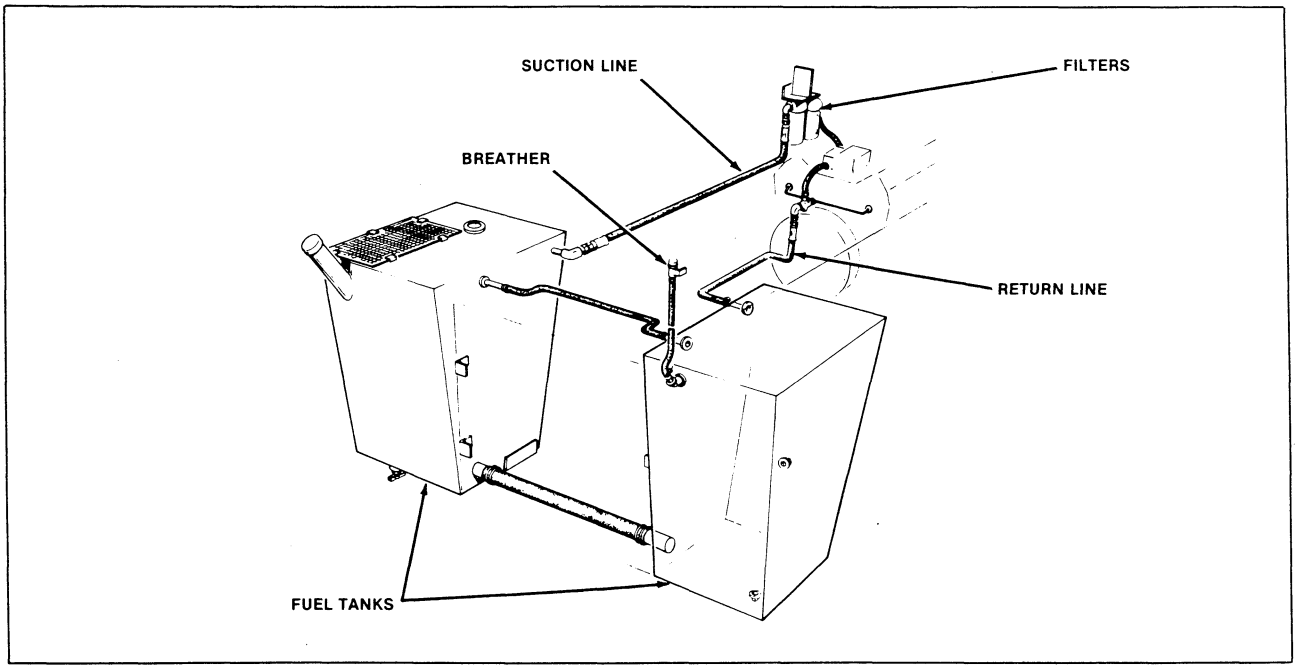


FIGURE 2-1: Fuel System Components

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.

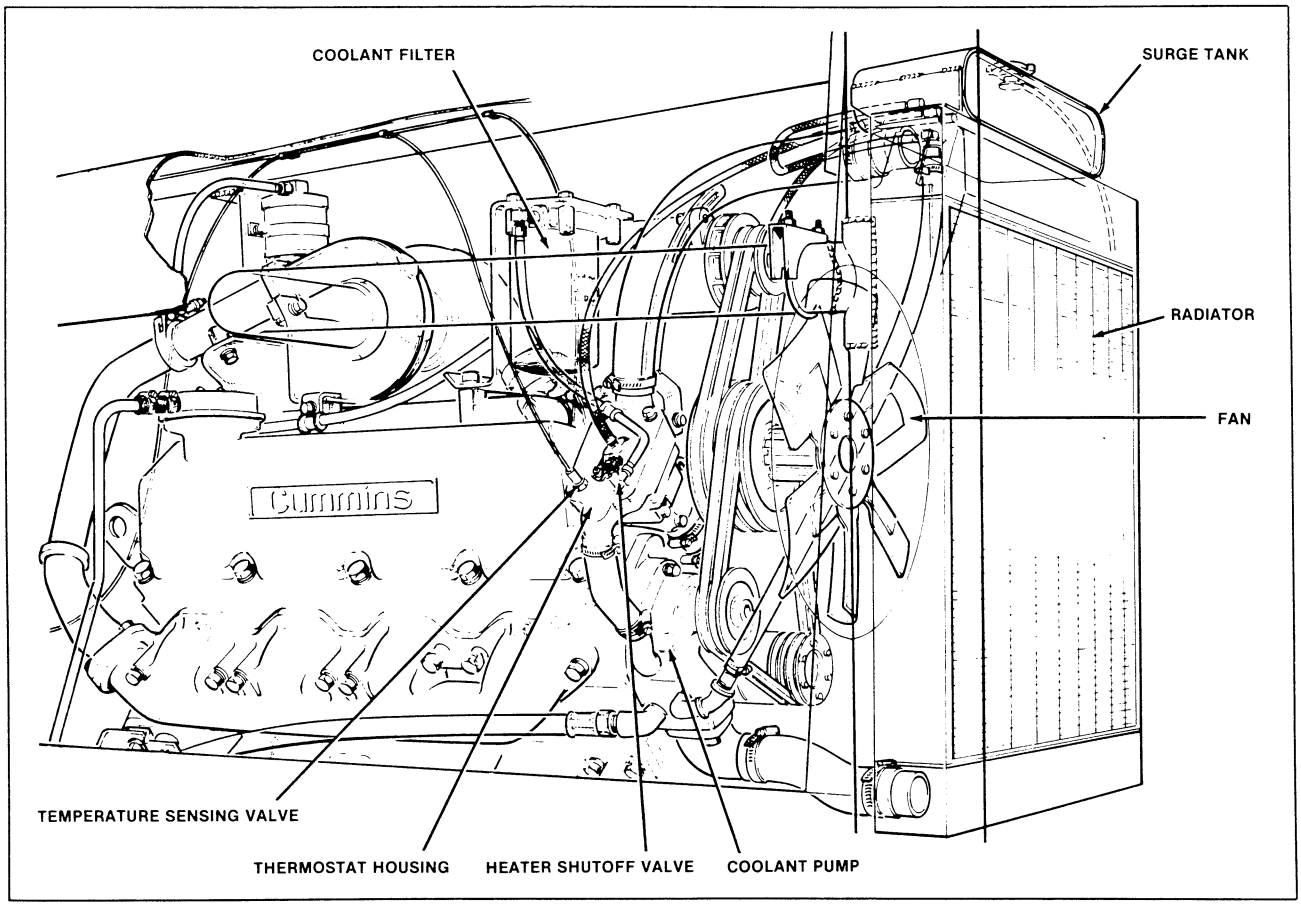


FIGURE 2-2: Engine Cooling System Components