500 SERVICE MANUAL

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FOREWORD

This Service Manual is issued to provide sufficient instructions for a qualified service mechanic to carry out Basic Servicing, Troubleshooting, Maintenance (removal, inspection and replacement of component assemblies,) and Overhaul (disassembly, inspection, repair and replacement of sub-assemblies).

A summary of the contents of each Section is provided in the main Table of Contents and a detailed coverage will be found in the Table of Contents preceding each Section.

The Service Manual should be used in conjunction with the Parts Manual for the specific Model year of Tractor. For the Serviceman's convenience and for reference to engine data and service, a list of Cummins Distributors is provided as Appendix 1 following Section 8: Structures.

REVISIONS AND ADDITIONS TO THE MANUAL

When changes are made in the unit covered in this service manual, pages will be marked to indicate whether they are replacement, or added pages. Replacement pages will show the revision number and carry the same page number as the original issue.Discard the original pageand insert the replacement page in its place. Added pages will carry the revision number, an existing page number, and an alphabetical suffix (for example A, B, etc.). Insert these pages after the existing page.

A new revision record page will also be issued with every update as a check sheet so that the reader can determine if the manual is complete. The purpose of a loose-leaf Service Manual is to enable us to keep the book updated, and to revise it if it is found necessary to provide additional information. This purpose will be defeated if additional or revised pages are omitted. Please insert them immediately.

A 'feed-back' page has been inserted at the back of this Service Manual. After using this book, it would be appreciated if the user fills in this form and returns it to Versatile Manufacturing Limited. Such information will help us to improve our manuals if required, and give the user better 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

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SECTION 1: SERVICING

1 Introduction

This section contains general information about specifications, capacities, lubricants, fluids and fuels for the tractor as a whole. A trouble-shooting subsection will make reference to other service sections in the manual, which cover the tractor in greater detail.

2 Towing/Transporting

2.1 GENERAL

Towing or transporting a large four wheel drive tractor is a big job. Below are listed some recommendations to follow.

NOTE

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

2.2 TOWING

Take the following precautions when towing is necessary:

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 hydrostatic steering.

3. Tow tractor slowly to allow operator to control it.

NOTE

If engine can not be started, pull tractor in a gradual arc across the field. Steering tractor will be difficult.

IMPORTANT

Do not tow tractor faster than 10 mph (17 km/h)
Do not slide tractor from side to side to maneuver into place for repair. Damage to drivetrain will result.

4. Use a strong front end loader to pick up either front or rear of tractor and push (and articulate) into the service area.

5. Disconnect drivelines when transmission or axles need repair or overhaul.

2.3 TRANSPORTING

For long distances, hauling the tractor on a trailer is best. Use the following procedures when hauling the tractor:

1. Check with local authorities as to laws, permits required and other information required to transport large machinery.

2. Use a trailer having the carrying capacity (30,000 lbs.) to haul tractors and other large machinery.

3. Use "wide load" signs and equip trailer with clearance lights to indicate load to passersby.

4. Equip trailer with a winch (minimum 10-ton capacity) to pull tractor onto trailer.

5. Securely chain tractor to trailer to prevent tractor movement or tipping.

6. Block wheels and/or engage parkbrake to prevent tractor movement.

7. Inspect chains regularly, looking for cracks, gouges, wear, bent links, worn or bent hooks. Repair any damaged links and hooks.

3 Hoists and Jacks

3.1 GENERAL

Hoists and jacks are most useful in servicing the tractor. Take the following precautions when working on the tractor.

3.2 JACKS

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

1. Select a jack strong enough to carry the load. The minimum jack required is of five ton capacity.

2. Use jack carefully. Dropping or tossing distorts or cracks the jack housing, causing jack to fail.

3. Take care of jack by using proper lubricants as specified in the operating instructions. Do not use leaky jacks to lift heavy equipment.

4. Stabilize tractor by placing transmission in gear, engaging park brake, chocking or blocking wheels securely.

5. Brace up the center pivot frame by applying a strong wedge on the frame pivot to prevent jackknifing of tractor. Lock front and rear frames by jamming wooden blocking in articulating joint.

6. Use a level ground or floor surface, so that jack will lift straight up and down.

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

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

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

10. 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.

11. Keep tractor stable by not raising so high it will slide off jack saddle.

12. Remove jack handle from mechanical jacks, when not in use, to prevent being struck by handle.

13. Hold handle of mechanical jack firmly to prevent kicking as tractor is being raised or lowered.

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

3.3 HOISTS

Improper hoisting equipment can cause accidents and injuries. These accidents are caused by overloading the hoist or rigging the lift chains so that they slip. Practice the following:

1. Use a proper chain hoist and frame to lift tractor. The minimum capacity required for the hoist is ten tons; for the A-frame or overhead support is seven and one-half tons; and for the support stands is three tons.

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

3. Inspect chains regularly, looking for cracks, gouges, wear, or bent links. Repair any damaged links.

4. Inspect hooks regularly and replace any that are bent, cracked or worn. If in doubt, compare the dimensions of a new hook with the old one. Replace if there are any differences in the size or shape.

5. Select suitable, balanced lift point on tractor frame. Place hook and frame directly over the point of lift.

6. Set chain to prevent the pull point from slipping.

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

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

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

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

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

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

4 Specifications and Capacities

4.1 GENERAL

The following specifications and capacities apply to the Model 500 tractors.

4.2 DIMENSIONS

Length .....234 in. (5940 mm)

Width .....95 in. (2410 mm)

Heights .....Ref. Table 1-1

Wheelbase .....120 in. (3050 mm)

Wheel Tread Adjustment Range
(Single tires):

18.4 x 34, 18.4 x 38 .....60-95 in. (1520-2410 mm)
23.1 x 30, 23.1 x 34 ....66.5-95 in. (1690-2410 mm)
15.5 x 38, 16.9 x 38 .....60-95 in. (1520-2410 mm)

Dual tires:

Maximum allowable .....120 in. (3050 mm)

Turning Radius

Nominal, to centerline of
tractor .....152 in. (3860 mm)
With 18.4 x 38 single tires
@ 100 in. (2540 mm) tread ...202 in. (5130 mm)
With 18.4 x 38 dual tires
@ 120 in. (3050 mm) tread
(to centerline of outerwheel . 212 in. (5280 mm)

TABLE 1-1: Tire Sizes vs Tractor Dimensions

TIRE SIZE	CAB HEIGHT	STACK HEIGHT	MAXIMUM HEIGHT*	MINIMUM TREAD
		Canadian and US Measure		
23.1 x 30	119.4 in.	123.7 in.	149.4 in.	66.5 in.
23.1 x 30 R2	121.0	125.2	151.0	66.5
18.4 x 34	119.0	123.0	149.0	60.0
18.4 x 34 R2	119.4	123.7	149.4	60.0
23.1 x 34	121.4	125.7	151.4	66.5
15.5 x 38	118.0	122.2	148.0	60.0
16.9 x 38	119.5	123.6	149.5	60.0
18.4 x 38	121.0	125.2	151.0	60.0
18.4 x 38 R2	121.4	125.7	151.4	60.0
		Metric (SI) Measure		
23.1 x 30	3030 mm	3140 mm	3790 mm	1690 mm
23.1 x 30 R2	3070	3180	3840	1690
18.4 x 34	3020	3120	3780	1520
18.4 x 34 R2	3030	3140	3790	1520
23.1 x 34	3080	3190	3850	1690
15.5 x 38	3000	3100	3760	1520
16.9 x 38	3040	3140	3800	1520
18.4 x 38	3070	3180	3840	1520
18.4 x 38 R2	3080	3190	3850	1520

*Maximum allowable height (clearance for bridges, overpasses, etc.) is specified with antenna extended to 30 in. (762 mm).

4.3 TIRE INFLATION

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

IMPORTANT

When using dual wheels, ensure that pressure of outside tires is 2 psi (14 kPa) less than that of inside tires.

TABLE 1-2: Tire Inflation Chart

TIRE SIZE	PLY RATING	LITTLE OR NO BALLAST	MAX. BALLAST OR OR HEAVY LOAD
18.4 x 38*	8	16 (110 kPa)	16 (110 kPa)
16.9 x 38*	8	20 (138 kPa)	22 (152 kPa)
15.5 x 38*	10	32 (221 kPa)	32 (221 kPa) Duals only
23.1 x 34	8	16 (110 kPa)	16 (110 kPa)
18.4 x 34*	8	16 (110 kPa)	18 (124 kPa)
23.1 x 30	8	16 (110 kPa)	16 (110 kPa)

*When used as duals, minimum tire pressure is 12 psi (82.5 kPa) and 14 psi (96 kPa) for 15.5 x 38. Use ballast on duals only.

4.4 WEIGHTS

Maximum operating weight . 22 000 lb (10 000 kg)
Recommended range . . . . . 17 000-19 000 lb (7730-8640 kg)

4.5 ENGINE

Type . . . . . Cummins Diesel

Model V504-C210

Maximum brake horsepower @ 2850 rpm (r/min) 192 hp (143 kW)

Maximum torque @ 1900 rpm (r/min) . . . . . 387 ft lb (525 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 . . . . . 3.75 in. (95 mm)

Displacement . . . . . 504 cu. in. (8.26 L)

Compression ratio 17.0:1

Oil capacity . . . . . 28 qt US, 22.4 qt Cdn (26.5 L)

Oil pan angular capability . . . . . 30 degrees

Lubrication system: Full-flow filter, bypass oil conditioner and filter, oil-to-water cooler.

Engine mounts . . . . . VERSATILE design, full rubber isolation

4.6 COOLING SYSTEM

Capacity . . . . . 40 qt US, 32 qt Cdn (37.8 L)

Radiator area . . . . . 779.3 sq in. (4030 cm^2)

Radiator fins . . . . . 8.5 fins/in. (3.1 fins/cm)

Pressure cap . . . . . 7 psi (48 kPa)

System reservoir . . . . . Independent surge tank

Fan:

Type . . . . . Six-blade, sucker
Diameter . . . . . 22 in. (560 mm)

4.7 AIR CLEANER

Type ..... Strata System

Diameter ..... 10 in. (254 mm)

Elements ..... Two

Aspiration ..... By exhaust system

Restriction indicator ... Instrument panel gauge

4.8 EXHAUST SYSTEM

Type ..... Single muffler

Muffler dimensions ..... 8.5 x 11.5 x 24 in. (220 x 290 x 610 mm)

Muffler mounting ..... Directly to engine

Regional option ..... Built-in spark arrestor

4.9 CLUTCH

Diameter ..... 7.75 in. (200 mm)

Number of plates ..... Eight

Location ..... Transmission

Actuation ..... Hydraulic, mechanical linkage to foot pedal

Engine drive ..... Shock-cushioned drive plate, mounted on flywheel

4.10 BRAKES

1977 MODELS: Brake disc, 15 in. (381 mm) diameter, mounted on transmission output shaft. Road brake is engaged by single piston and self-adjusting caliper, hydraulically actuated by foot pedal. Parkbrake caliper, also mounted on disc, is engaged by mechanically actuated overcenter lever.

1978-79 MODELS: Brake disc, 15 in. (381 mm) diameter, mounted on transmission output shaft. Road brake is engaged by dual piston and self-adjusting caliper, hydraulically actuated by foot pedal. Parkbrake, occupying same caliper, is engaged by mechanically actuated overcenter lever.

4.11 TRANSMISSION

Design ..... VERSATILE

Type ..... Constant mesh

Shifting ..... Sliding collars

Speeds ..... 15 forward, 5 reverse

Range of ratios ..... 1.20:1 to 11.56:1

Oil capacity ..... 24 qt US, 19.2 qt Cdn (22.7 L)

Ground speeds ..... Ref. Table 1-3

Controls ..... Floor-mounted

Oil pressure warning ..... Panel light

Oil level monitoring ..... Dipstick at filler

Lubrication system: transmission driven pump, 10-micron filter, cooler, steel lines, wire braid hose.

4.12 DRIVELINES

Engine to transmission ..... 1480 Series

Transmission to axles ..... 148 Series

Carrier bearings:

Main Driveline ..... Center frame
PTO Driveline ..... Rear frame

4.13 AXLES

Design ..... VERSATILE

Differential:

Type ..... Spiral bevel
Ratio 4.56:1
Oil capacity ..... 19 qt US, 15.8 qt Cdn (18 L)

TABLE 1-3

Ground speeds with 18.4 x 38 tires, 31.5 in. loaded radius

RANGE	LOW		MEDIUM		HIGH		REVERSE	
GEAR	mph	km/h	mph	km/h	mph	km/h	mph	km/h
1	1.9	3.1	4.0	6.4	9.4	15.1	3.0	4.8
2	2.2	3.5	4.6	7.4	10.8	17.4	3.4	5.5
3	2.6	4.2	5.5	8.8	12.8	20.6	4.0	6.4
4	3.0	4.8	6.2	10.0	14.5	23.3	4.6	7.4
5	3.6	5.8	7.4	11.9	17.2	27.7	5.5	8.8

Planetaries:

Location ..... Inboard
Ratio 5.625:1

Lubrication ..... SAE 90 MIL 2105-B gear oil

Total axle ratio 25.65:1

Shaft diameter ..... 4 in. (102 mm)

Wheel hubs ..... Adjustable, taper-lock

4.14 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 1.125 in. (29 mm) self-aligning ball bushings

Control valve: five-port, 45 cu in./rev (737 mL/rev), rubber mounted

4.15 HYDRAULIC SYSTEM

Open center type, operated by engine-driven gear pump of 1.94 cu in./rev (31.8 mL/rev) capacity

Steering circuit served by front section of gear pump; master clutch and implement hydraulics served by rear section of pump

Flows and pressures:

Steering, nominal — 24 gpm US, 20 gpm Cdn (90.8 L/min). Implements, nominal — 8 to 24 gpm US, 6.7 to 20 gpm Cdn (30.3 to 90.8 L/min) ± 10 percent (flow adjustable from cab)

Relief valve setting ... 2300 ± 50 psi (15 860 ± 340 kPa)

Filtration:

100-mesh reusable screen filter on suction line; 33-micron replaceable element filter on return line.

Implement control valve:

Three-spool with built-in flow control valve; two 4-way self-cancelling spools set at 2100 + 0 - 100 psi (14 480 + 0 - 690 kPa); one 4-way spool with float position

Capacity ..... 48 qt US, 38.4 qt Cdn (45.5 L)

Couplers ..... Push to connect under pressure

4.16 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 (1977 models) . . . . . Six 60-watt

Worklights (1978/79 models) . . . . . Eight 60-watt

4.17 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)

4.18 DRAWBAR

Type . . . . . Swinging clevis

Dimensions . . . . . 1.5 x 40 in. (38 x 101 mm)

Height (18.4 x 38 tires) . . . . . 21 in. (533 mm)

4.19 CAB

Type: Independent module, rollover protective structure (ASAE S336.1)

Shock mounts . . . . . Rubber

Interior insulation . . . . . Acoustic

Exits . . . . . Door, side windows

Outside height . . . . . 63 in. (1600 mm)

Outside width . . . . . 56 in. (1420 mm)

4.20 INSTRUMENT PANEL

Gauges: Tachometer with hour meter, engine oil pressure, coolant temperature, voltmeter, fuel level, air cleaner restriction

Warning lights: Transmission oil pressure, alternator, parkbrake, turn signal indicators

Controls: Keyswitch, start button, manual override button for automatic engine shutdown system, light switch, turn signal switch, cold start knob

4.21 ENVIRONMENTAL CONTROL ROOF UNIT

Pressurization/Recirculation:

Operator-controlled recirculation; pressurization by 3-speed fan (no OFF); fan runs as long as keyswitch is ON

Heating:

Heated engine coolant flows through heat exchanger core in roof; heated air circulated by pressurizer fan through heating and defrosting ducts; control valve in ceiling-mounted panel.

Air conditioning:

Engine-driven compressor, evaporator core in roof; system cooling rate is 24 000 BTU/h (7 kW); automatic shutdown when system senses high or low pressure of refrigerant; thermostatic temperature control and high/low pressure indicator lamps in ceiling-mounted panel

Windshield wiper:

Two-speed motor mounted in roof; control switch in ceiling-mounted panel; motor returns wiper blade to parked position when switched OFF

4.22 RADIO

AM-FM multiplex stereo receiver with two speakers; controls for tone, volume, tuning, local/distant station selection; five pushbuttons for individual stations; spring-mounted antenna; 1979 model has incorporated cassette player

4.23 POWER TAKE OFF (PTO)

Type . . . . . Live PTO

Standard speed
@ 2765 engine rpm . . . . . 1000 rpm (r/min)

Speed at maximum
governed engine speed . . . . . 1030 rpm (r/min)

Standard shaft diameter . . . . . 1-3/4 in. (44 mm)

Optional speed
(2820 engine rpm) . . . . . 540 rpm (r/min)

Optional 540 rpm shaft . . . . . 1-3/8 in. (35 mm)

Clutch:

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

4.24 OPTIONS

1. Three-point hitch (Categories II and III)
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. Spark arresting exhaust muffler
7. Air intake extension stack
8. Rear window wiper kit
9. Fourth spool for implement control valve
10. Hydraulic proportionator

5 Fuels, Fluids and Lubricants

5.1 GENERAL

The following information lists fuels, fluids and lubricants used on the Model 500 tractor. Lubricant capacities are also listed.

5.2 FUEL

No. 2 diesel fuel is recommended. No. 1 diesel fuel is also satisfactory. Any other fuel should meet the following specifications:

Sulfur content less than one percent.

Sediment and water content less than 0.1 percent.

Cetane number 40 or greater. A higher Cetane number fuel may be required at low temperatures or high altitudes.

Pour point below the lowest expected temperature

Ash content less than 0.02 percent

Viscosity range 0.021 - 0.089 sq in./sec. at 100°F

Fuel capacity — 106 gal US, 84.8 gal Cdn, (400 L)

Refuelling

Observe all cautions and warnings in the Operator's Manual. Refer to 'Tractor Safety' (or 'Safety Rules') and 'Operation' section of Operator's Manual for more information on refuelling.

5.3 FLUIDS

Coolant Mixture

Water: clean and preferably soft. Water suitable for drinking is adequate as a coolant.

Antifreeze: Commercial grade, ethylene glycol base, used in proportions recommended by the manufacturer.

IMPORTANT

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

Coolant Conditioner Filter: (Dry Chemical Additive) used when coolant is replaced.

Engine Coolant capacity — 40 qt US, 32 qt Cdn, (37.8 L)

Brake Fluid

SAE Specification 70R3.

Hydraulic Fluid

Temperatures above 40°F (4°C) - Esso Hydraul 56 or SAE 20 MS Motor Oil

Temperatures below 40°F (4°C) - Dexron or 5W-20MS Motor Oil

Liquid Ballast

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

The 3-½ lb/gal (0.4 kg/L) calcium chloride solution is slush-free to 12°F (-24°C) and freezes solid at -52°F (-47°C). The 5 lb/gal (0.6 kg/L) solution is slush-free to -52°F (-42°C) and will freeze solid at -62°F (-52°C).

5.4 LUBRICANTS

Table 1-5 lists the recommended lubricants for the tractor for varying temperature conditions.

American Petroleum Institute Lubricant Grades

CC Service typical of lightly supercharged diesel engines operating in moderate to severe duty. These oils provide protection from high temperature deposits.

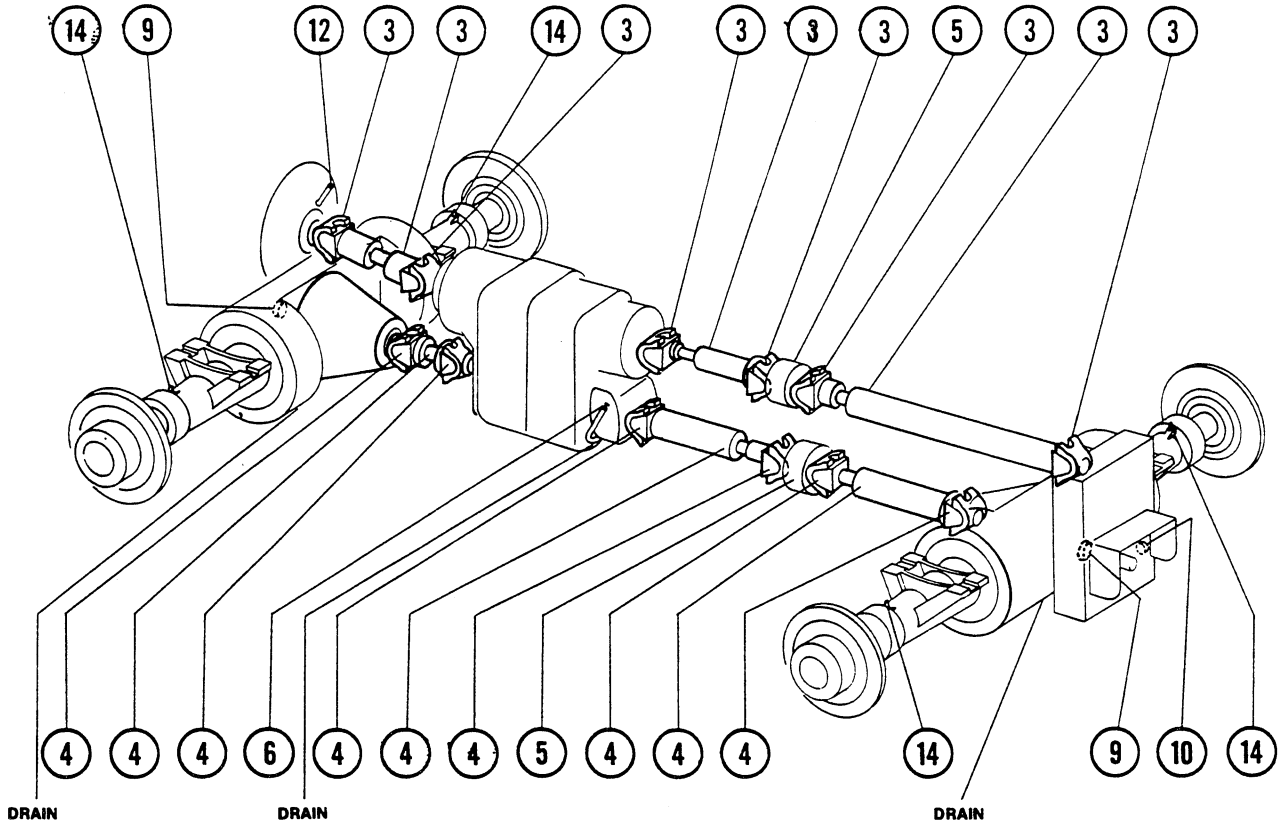
TABLE 1-4: Liquid Ballast Calculations

LIQUID BALLAST CALCULATIONS

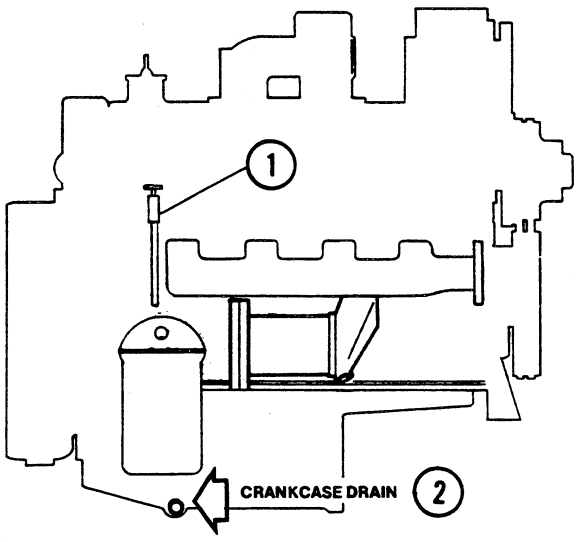
US Measure	Water Only		3½ LB $CaCl_2$ Solution per Gal			5 LB $CaCl_2$ Solution per Gal		
TIRE SIZE	U.S. GALLONS WATER	TOTAL WEIGHT	U.S. GALLONS WATER	POUNDS $CaCl_2$	TOTAL WEIGHT	U.S. GALLONS WATER	POUNDS $CaCl_2$	TOTAL WEIGHT
14.9-35	67	559	58	203	687	55	275	733
16.9-30	73	609	63	221	746	59	295	787
18.4-30	89	742	77	270	912	72	360	960
23.1-30	143	1193	123	431	1456	116	580	1547
16.9-34	82	684	70	245	829	66	330	880
18.4-34	100	834	85	298	1007	81	405	1081
20.8-34	128	1068	109	382	1291	103	515	1374
23.1-34	159	1326	136	476	1610	128	640	1708
16.9-38	90	751	77	270	912	73	365	974
18.4-38	110	917	94	329	1113	89	445	1187
20.8-38	140	1168	120	420	1420	114	570	1521

LIQUID BALLAST CALCULATIONS FOR DRIVE TIRES

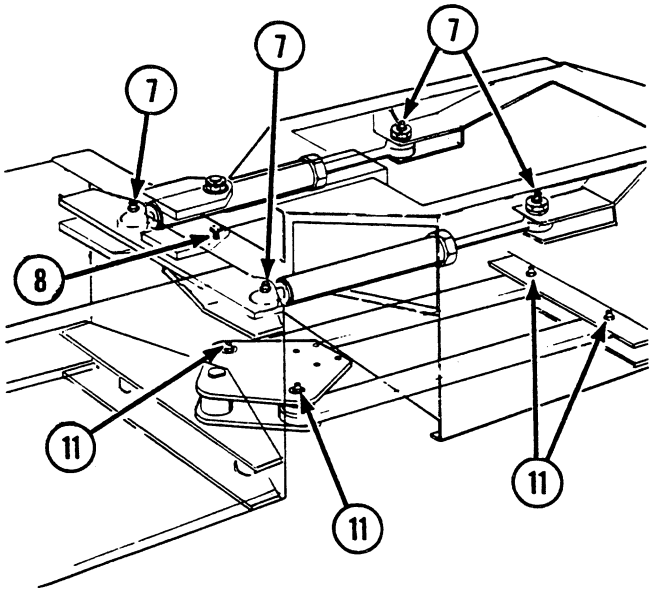
Metric (S1) Measure		Water		419.4 g $CaCl_2$/L H_2O			599.3 g $CaCl_2$/L H_2O	
TIRE SIZE	LITRE	WT KG	WATER L	$CaCl_2$ KG	TOTAL WT, KG	WATER L	$CaCl_2$ KG	TOTAL WT, KG
14.9-30	216	216	182	76	258	174	104	279
16.9-30	276	276	238	100	338	223	132	357
18.4-30	337	337	291	123	414	273	163	436
23.1-30	541	541	466	196	661	439	263	702
16.9-34	310	310	265	111	376	250	150	399
18.4-34	379	378	322	135	457	307	184	490
20.8-34	485	485	413	173	586	390	234	623
23.1-34	602	602	515	216	730	485	290	775
16.9-38	341	341	291	123	414	276	166	442
18.4-38	416	416	356	149	505	337	202	539
20.8-38	530	530	454	191	645	432	259	690



Drive Train

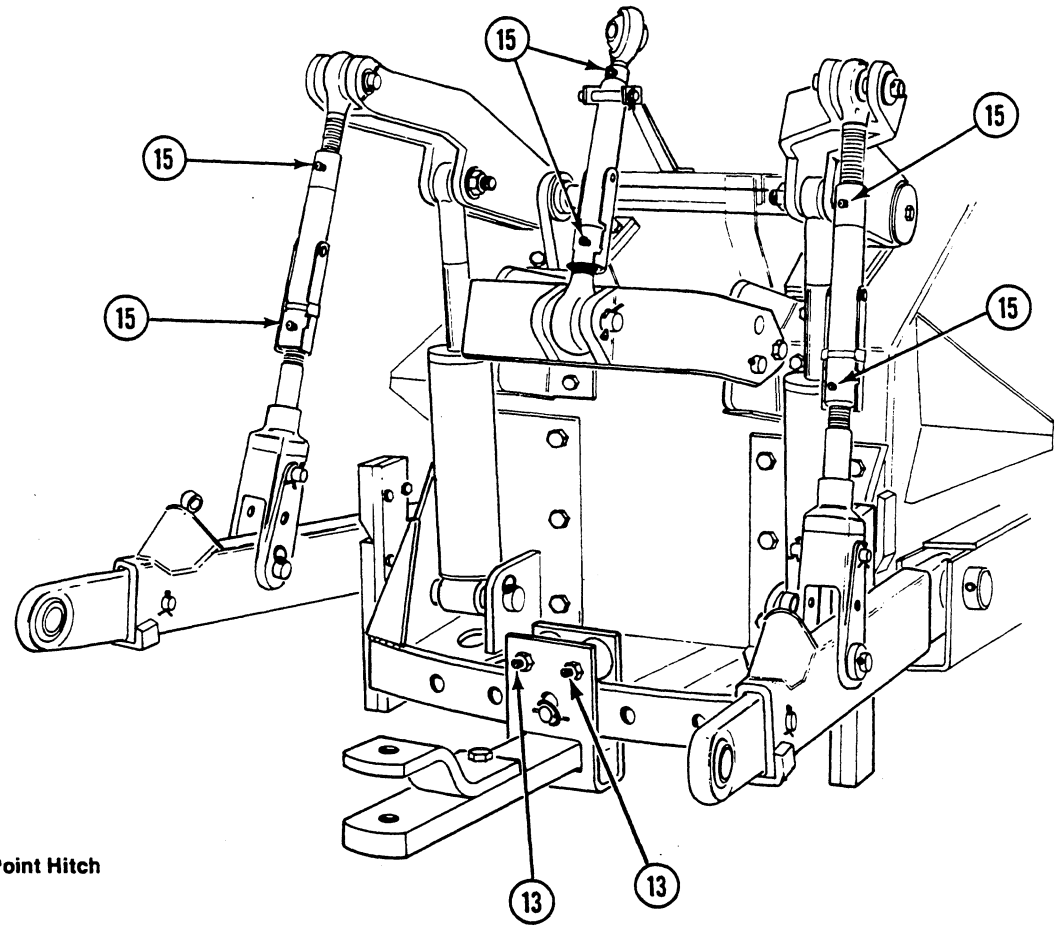


Engine

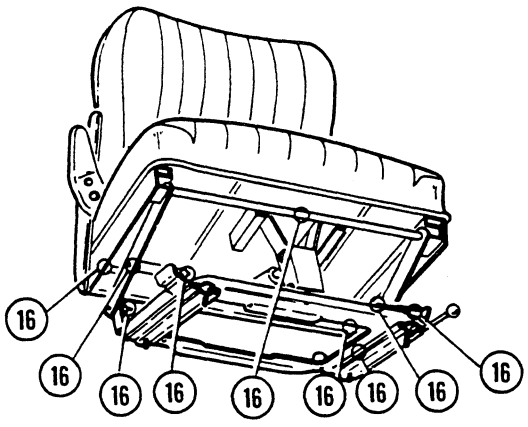


Steering Cylinders and Articulation Joint

FIGURE 1-1: Lube Points, Sheet 1



3 Point Hitch



Seat — 1977 Production Models

FIGURE 1-1: Lube Points, Sheet 2

CD 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.

GL5 (MIL2105B) or (MIL2105C) — Gear lubricant for service GL5 (Hypoid Gears) meeting specification MIL2105B and MIL2105C with no zinc additives.

Lubricant Capacities

Engine oil — 28 qt US, 22.4 qt Cdn, (26.5 L)

Hydraulic System - 48 qt US, 38.4 qt Cdn,(45.5 L)

Transmission — 24 qt US, 19.2 qt Cdn, (22.7 L)

Axle with Planetaries — 18 qt US, 14.4 qt Cdn, (19 L)

PTO Drop Box — 4 qt US, 3.2 qt Cdn, (3.8 L)

TABLE 1-5: Lubricant Chart

LOCATION	CONDITIONS	TYPE	GRADE*
		— Oils —	
Engine Crankcase	Above 32°F (0°C) to 100°F (+ 38°C)	SAE 15-40	CC or CD
		SAE 20-20W	CC or CD
	Below 32°F (0°C) to -10°F (-23°C)	SAE 10W-30	CC or CD
	Below -10°F (-23°C)	See 'Arctic Oil Recommendations' in Cummins Manual	
Transmission	All Temperatures	DEXRON II, HI-TRAN or Esso Hydraul 56 - See Note:	
Differentials and Axle Planetary Gears; P.T.O.	Above 90°F (32°C)	SAE 90-140	GL5 (MIL 2105B)** or GL5 (MIL 2105C)**
	Below 90°F (32°C)	SAE 90	
Hydraulic Fluid	Above 40°F (4°C)	Esso Hydraul 56 or SAE 20 MS Motor Oil	
	Below 40°F (4°C)	DEXRON II or 5W-20 MS Motor Oil	
Brake Fluid	All Temperatures	Atlas Super Duty	SAE 70-R3
		— GREASE —	
Pressure Grease Fittings	All	SAE High Temperature Multi-Purpose	

* American Petroleum Institute Lubricant Grades
** No Zinc Additives

NOTE: Recommended Lubricants, Gulf, Duratran; Mobil, Mobilfluid 423; Phillips (Pacific) HG; Shell, Donax T-4 or T-6.

6 Lubrication

6.1 GENERAL

Table 1-6 lists the lube points on the Model 500 tractors. Along with the table are lube point illustrations (Ref. Figure 1-1).

Refer to subsection 5 for capacities and requirements.

NOTE

Too frequent greasing could rupture the bearing seal and allow lubricant to enter the clutch assembly or dirt to enter housing.

TABLE 1-6: Lubrication Points

LUBE POINT	DESCRIPTION	SERVICE POINTS	LUBRICANT
		Ref. Fig. 1-1	
1	Check Engine Oil Level	1	See 'Lubricant Chart'
2	Change Engine Oil	1	See 'Lubricant Chart'
3	Upper Drive Lines (incl. P.T.O.)	9	SAE Multi-Purpose Grease
4	Lower Drive Lines	9	SAE Multi-Purpose Grease
5	Drive Line Steady Bearing [3]	2	SAE Multi-Purpose Grease
6	Check Transmission Oil	1	See 'Lubricant Chart'
7	Steering Cylinder Pivots	4	SAE Multi-Purpose Grease
8	Upper Main Frame Pivot	1	SAE Multi-Purpose Grease
9	Differential/Planetary oil (front and rear Differentials) [1]	2	See 'Lubricant Chart'
10	Gear Oil P.T.O. Drop Box	1	See 'Lubricant Chart'
11	Drag Link Pivot Bearings	4	SAE Multi-Purpose Grease
12	Drive Disc Shaft Support Bearing [2]	1	SAE Multi-Purpose Grease
13	Draw Bar Rollers	2	SAE Multi-Purpose Grease
14	Axle Outboard Bearings	4	SAE Multi-Purpose Grease
15	Three-Point Hitch (Option)	6	SAE Multi-Purpose Grease
16	Seat (1977 Models)	9	SAE Multi-Purpose Grease
17	Three-Point Hitch (oil metal to metal parts)	-	SAE 30
18	Door and Window Hinge Pins	5	SAE 30

NOTES

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 before installing new oil.

2. Drive Disc Shaft Support Bearing Lubrication

Apply four strokes of grease gun 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. Drive Line Steady Bearings

These bearings are located in the swing frame between the front and rear sections. Grease with three shots of high grade multi-purpose grease. The grease fittings on the bearing housing can be reached from under the rear frame section.

4. 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 lube points. Once a year or every 400 hours, the draft arm pins (at the tractor frame) must be removed, cleaned and greased.

7 Belts and Filters

7.1 GENERAL

Refer to Tables 1-7 and 1-8 for correct replacement belts and filters. Refer to Figures 1-2, 1-3, 1-4, and 1-5 for location of filters on the tractor.

7.2 BELT REPLACEMENT

Table 1-7 lists the belts used on the Model 500 tractors. Purchase and replace belts as sets to ensure proper matching and avoid overloading the new belt.

7.3 FILTER REPLACEMENT

Table 1-8 lists the filters used on the Model 500 tractors.

TABLE 1-7: Belt Replacement

BELT	PART NO.
Alternator (2 per set)	33503
Compressor	33375
Fan (2 per set)	33504

8 Storage

8.1 GENERAL

When your tractor is not going to be used for several months, it must be prepared for storage to prevent damage to components. Prepare a kit for the long period of storage. Include 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, 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 it with a correct mixture of water and glycol base antifreeze.
5. Drain oil from axle housing. Refill with recommended lubricant (Ref. Table 1-5).
6. Drain oil from hydraulic circuit reservoir. Refill with recommended fluid. (Ref. Table 1-5).
7. Drain oil from transmission circuit. Refill with recommended lubricant (Ref. Table 1-5). Run engine to circulate coolant.
8. Operate transmission, hydraulic system, steering and brakes to distribute oil to all components.
9. Relieve tension of drive belts; e.g. alternator, air conditioner, compressor.
10. Remove both batteries, charge them fully. Store in a cool, dry place. Keep batteries fully charged. Bring them to a full charge monthly.

TABLE 1-8: Filters - 500 Tractors

LOCATION	PART NO.
Air Cleaner Element — Inner (safety)	33748
Air Cleaner Element — Outer	33747
Cab Pressurizer Element — Inner	30988
Cab Pressurizer Element — Outer	30986
Corrosion (DCA) Element	25881
Engine By-pass Oil Filter	711T106
Engine Crankcase Oil Filter	602T121
Fuel Filter	608T118
Hydraulic Filter, Steering Side (Return)	36169
Hydraulic Filter, Implement Side (Suction)	15799
Transmission Filter	SW2854
Transmission Oil Suction Screens	20199

11. Clean tractor entirely of all dirt, grease and other foreign matter. Touch up all painted surfaces which are scratched or chipped.
12. Jack up tractor and block up axles to remove weight from tires. Cover tires if they are exposed to heat and sunlight.
13. Coat all exposed hydraulic cylinder shafts with grease or rust preventative.
14. Using plastic bags or tape, seal the following tractor openings: air cleaner inlet, exhaust muffler, fuel tank breather tube and cap, radiator inlet hose, and air conditioning air intake screens.
15. Store tractor in dry, protected place. If tractor is to be stored outside, cover with a waterproof canvas or protective material to protect components.

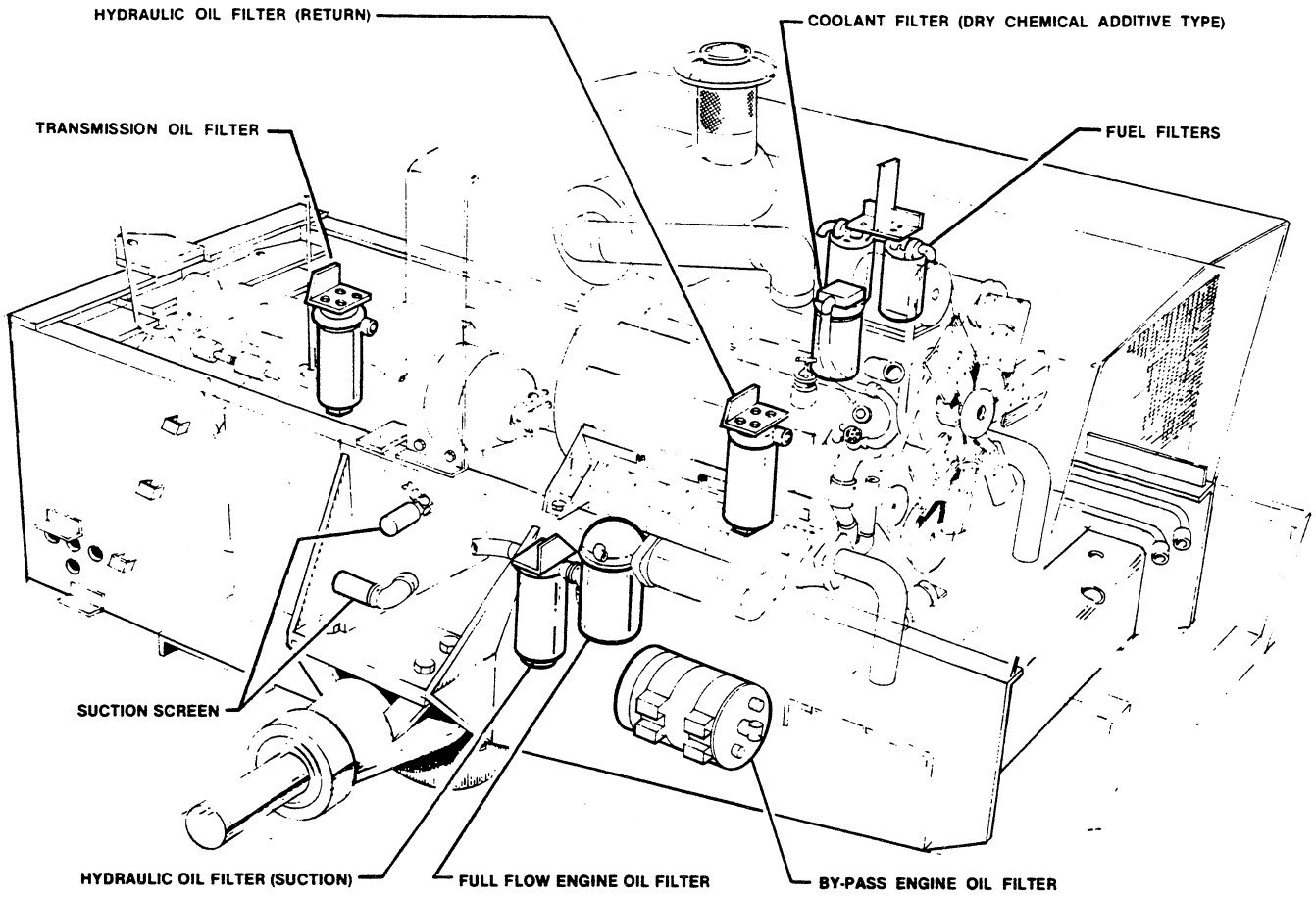


FIGURE 1-2: Internal Filter Locations

8.3 PREPARATION OF ENGINE FOR STORAGE

Before storing the tractor, start the engine and run it until coolant temperature is up to at least 160°F (70°C). (Shielding the radiator may be necessary to achieve this temperature under no load). Shutting the engine down while the temperature is up, helps to prevent condensation from forming during storage.

8.4 STORING BATTERIES

NOTE

Every 30 days the battery is in storage, charge to a full charge state.

If the tractor is to be stored for more than 30 days, do the following:

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 so long as the electrolyte does not freeze.
5. Clean battery tops and keep batteries dry to reduce self-discharge.

8.5 PREPARATION AFTER STORAGE

When tractors are 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 and transmission reservoir.
4. Install batteries.

8.6 STARTUP OF ENGINE AFTER STORAGE

– CAUTION ———————————

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

OPERATE ALL CONTROLS ONLY FROM THE OPERATORS SEAT.

STOP ENGINE BEFORE PERFORMING ANY WORK OR MAINTENANCE ON TRACTOR.

BE ALERT

KEEP ALL SHIELDS IN PLACE.

———————————————

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

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 startup, 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 (1.254 hydrometer reading). This reading should not be taken immediately after charging or discharging battery.
5. Use cold start equipment 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. Tighten all V-belts. Alternator belt must be tight and in good condition to keep batteries charged.
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:
    - Check that fuel system is primed adequately.
    - Check operation of electric solenoid switch. This switch has a manual opening knob that overrides the fuel solenoid.
    - Check fuel pump delivery by loosening ferrule nut on line between fuel pump and engine. Clear, solid fuel should flow from the fitting when engine is cranked.
    - Check for a water freeze blockage at a low point in fuel line.

9 Troubleshooting

9.1 GENERAL

A troubleshooting subsection at the system level is included with each section in the service manual. Troubleshooting information is in chart form to help identify the problem so that a possible remedy can be found. The sections are arranged as follows:

1. Engine System - Section 2
2. Drive Train - Section 3
3. Controls - Section 4
4. Hydraulic System - Section 5
5. Electrical System - Section 6
6. Environmental Systems - Section 7
7. Structures - Section 8

9.2 TROUBLESHOOTING GUIDE

Do the easiest and obvious checks first when troubleshooting problems on the tractor.

Each of the sections generally is divided into five parts:

1. Introduction
2. Description and Operation
3. Troubleshooting
4. Maintenance
5. Repair and Overhaul

Table 1-9 troubleshoots simple problems and remedies concerning the engines. Further information is in Section 2 — Engine Systems and/or Cummins Maintenance and Operation Manual.

TABLE 1-9: Engine (Section 2)

TROUBLE	PROBABLE CAUSE	REMEDY	REFERENCE
Difficult to start or will not start.	No fuel in tank.	Fill tanks with proper fuel.	
	Improper fuel.	Drain wrong fuel and refill.	
	Dirty or watery fuel.	Drain tanks, bleed system and fill with clean fuel.	
	Override switch.	Check and/or replace.	Cummins Operation and Maintenance Manual. Section 5.
	Air in fuel system.	Bleed fuel system.	
	Improper timing.	Check injector pump by skilled serviceman.	
	Dirty injector nozzles.	Clean and repair by skilled serviceman.	