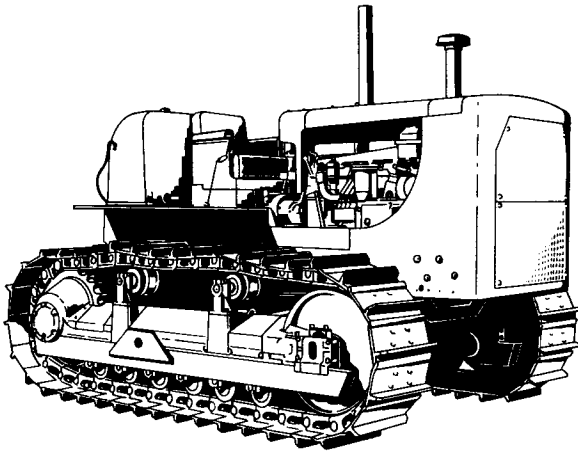


**OPERATION AND
MAINTENANCE
INSTRUCTIONS**

**CATERPILLAR
D7 TRACTOR**



**SERIAL NUMBERS
48A1-UP**

Avoid Accidents

Most accidents, whether they occur in the air, in industry, on the farm, at home, on the highways, or at sea, are caused by someone's failure to follow simple and fundamental safety rules or precautions. For this reason most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident.

The complete observance of one simple rule would prevent many thousands of serious injuries each year. That rule is: "Never attempt to clean, oil or adjust a machine while it is in motion."

Foreword

Caterpillar products are a result of advanced engineering, skilled manufacturing, and the finest materials metallurgical science can select. Thousands of satisfying, economical working hours are built into each machine.

Whether or not the owner derives the maximum service from his machine depends largely on the care exercised in its operation and maintenance. This book is written to give the operator essential information regarding the day-to-day operation, lubrication and adjustment of the machine. Careful adherence to these instructions will result in assured economy.

More and more Caterpillar owners are depending upon their dealer for service other than the care and adjustments described in this book. This practice is recommended because Caterpillar dealers have stocks of genuine Caterpillar parts and are equipped with tools designed and built by Caterpillar. Their servicemen are factory-trained and are kept closely informed by the factory regarding advanced methods of servicing Caterpillar products — thus, in all ways they are equipped to render the best of service.

Altitude Operation Warning Plate

WARNING			
THE ENGINE HAS BEEN CORRECTLY SET TO OPERATE AT THE ALTITUDE LIMIT SHOWN.			
<input type="text"/>	FT. OR BELOW	<input type="text"/>	FT. OR BELOW
<input type="text"/>	FT. OR BELOW	<input type="text"/>	FT. OR BELOW
<input type="text"/>	FT. OR BELOW	<input type="text"/>	FT. OR BELOW
THE RACK SETTING MUST BE CHANGED BY YOUR CATERPILLAR DEALER BEFORE OPERATING AT A HIGHER ALTITUDE.			

THIS PLATE IS MOUNTED IN FULL VIEW OF THE OPERATOR. A WARNING PLATE SHOWING THE RACK SETTING OF THE GOVERNOR IS MOUNTED ON THE ENGINE.

For additional information concerning safe altitude operation, see the topic, ALTITUDE OPERATION.

T 86350

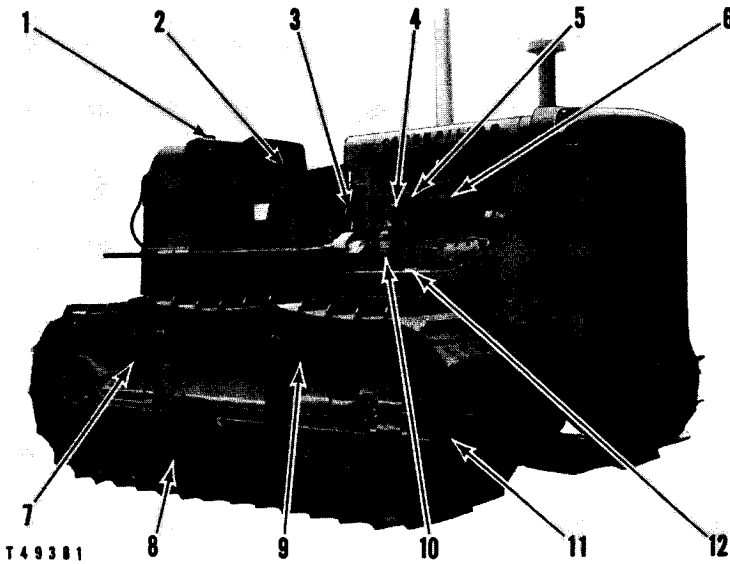
Railroad Loading Rules

For domestic customers within continental limits of the United States.

The loading rules and specifications published in Association of American Railroads Pamphlet No. MD-6, must be complied with when shipping Tractors, Road Grading, Road Making, and Farm Equipment Machinery, on open top cars. Contact the local railroad agent or inspector for these specifications.

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D7 TRACTOR — RIGHT FRONT VIEW

1—Diesel fuel tank filler cap. 2—Brake lock control. 3—Decelerator pedal. 4—Diesel engine crankcase filler cap. 5—Diesel engine crankcase breather. 6—Final fuel filter. 7—Sprocket. 8—Track roller. 9—Track carrier roller. 10—Crankcase lubricating oil filter. 11—Front idler. 12—Primary fuel filter.

Lubrication Instructions

SERVICE METER

The Service Meter is located on the right side of the engine near the bottom of the governor housing. It is geared to the engine, and when the crankshaft turns as many revolutions as are made in an hour at average operating speeds on an average job application, the dial advances one number. There are some applications that will result in either a lower or higher than normal average engine speed. Under this condition, the advance in the Service Meter reading will differ from the number of clock hours of operation.

The purpose of the Service Meter is to indicate when to perform the recommended maintenance and lubrication operations. The established intervals in the lubrication chart and maintenance instructions are given in service hours, so daily readings will tell when to service the tractor. Rely on the Service Meter and not on the clock to measure service intervals.

SERVICE METER



GENERAL LUBRICATING INFORMATION

Naturally, any precautions taken during cold weather to house the tractor, cover it with a tarpaulin, or warm it before starting, will cause more rapid oil distribution.

Lubricate all miscellaneous points, not equipped with fittings, with crankcase lubricating oil every 50 service hours.

It is extremely important in handling the oil to keep it clean. Every precaution should be taken to use only clean filler cans and to be sure that all dirt is removed from the filler cap before it is taken off for filling. The operator should take every precaution to prevent dirt from getting into any system to extend the life of the tractor.

Careful attention to the following information on lubricants and their proper selection will add much to performance, economy and long life of your tractor. The lubrication chart specifies the lubricants to be used, the points to be serviced and the intervals of servicing according to service hours.

DESCRIPTION OF LUBRICANTS

The lubricants recommended for use in this tractor can be identified by the sub-heading preceding their descriptions that follow. The proper selection of one of these types of crankcase lubricating oils, and SAE grade of oils can be made from the information in the topic, TYPE OF LUBRICANTS AND SAE GRADES TO USE.

Crankcase Lubricating Oils

Superior Lubricants (Series 3): These are additive-type oils that have been identified as meeting a rigid, high quality standard and certified for use in all Caterpillar Diesel Engines. See your Caterpillar dealer for brand names of products conforming to this specification.

MIL-L-2104A Specification Oils: These oils are additive-type but are milder than Superior Lubricants (Series 3) Oils. They can be used as specified for various compartments satisfactorily. Your oil supplier is familiar with those oils meeting the MIL-L-2104A Specification.

Straight Mineral Crankcase Lubricating Oil: Most of these oils will contain a very small concentration of engine oil additives. Oils without additives can be used in certain compartments as specified.

Lubricating Grease

Ball and Roller Bearing Lubricant: This lubricant is a mixture of mineral oil and metallic soaps. Use No. 2 grade for most temperatures. For extremely low temperatures use No. 0 or No. 1 grade.

This grease can be applied to all bearing points — plain bearings, ball bearings and roller bearings — where equipped with hydraulic pressure fittings or when bearings are hand packed.

Use only a high grade short fiber grease. This grease must be satisfactory in anti-friction bearings at speeds up to 3000 RPM at a maximum temperature of 300°F. It is a grease with sufficient adhesive qualities to cling to the bearings in all extremes of high and low operating temperatures.

The oil specification chart will aid in the proper oil grade selection for the various compartments. The proper SAE grade of oil to select is determined by the atmospheric temperature at which the machine **is started**. However, during **operation** SAE 10W oil can be used successfully in the diesel engine crankcase when atmospheric temperatures are as high as 70° F.

Crankcase Lubricating Oil Change Periods

The crankcase lubricating oil change periods for these engines have been carefully established for the purpose of protecting the service life of the engine as economically as possible.

Change the oil and filter elements after the first 10 service hours of operation of a reconditioned engine.

DIESEL ENGINE CRANKCASE LUBRICATING OIL CHANGE PERIOD CHART
Use Only Superior Lubricants (Series 3)

FUEL SULPHUR CONTENT	OIL CHANGE PERIOD*	FILTER ELEMENT CHANGE PERIOD*
0.4% or less	250 Service Hrs.	250 Service Hrs.
0.4% to 1.0%	125 Service Hrs.**	250 Service Hrs.

*Regardless of time operated, the crankcase oil and filter elements should be changed at least every six months.

**Reduce crankcase oil change periods one half when sulphur content is greater than 1.0%.

LUBRICATION CHART

CATERPILLAR

D7 TRACTOR

The illustration on the following page indicates the approximate locations of all points requiring servicing.

The chart is keyed to this illustration and to the related detailed topics and illustrations on the succeeding pages. The service intervals are measured in service meter hours.

D7 TRACTOR LUBRICATION

SEE OPERATION AND MAINTENANCE INSTRUCTIONS FOR DETAILED INFORMATION

Point and Identification	Lubri- cant	Approximate Quantity (U.S. Measure)	No. of Service Points	SERVICE HOURS							Point
				10	50	125	250	500	1000	2000	
1 TRANSMISSION, BEVEL GEAR & STEERING CLUTCH COMPARTMENT	CO	31 GAL.	1	X					†C	C	1
BREATHERS			2						WO		
FILTER ELEMENTS			2		††C				C		
MAGNETIC STRAINER			2		††W				W		
2 TRANSMISSION SPEED SELECTOR SHAFT BEARINGS	BR	NOTE A	1								L 2
3 STEERING CLUTCH CONTROL LEVER BEARINGS	BR	NOTE A	6								L 3
4 BRAKE CONTROL SHAFT BEARINGS	BR	NOTE A	4								L 4
5 STARTING ENGINE PINION AND CARBURETOR CONTROLS	BR	NOTE A	3				L				5
6 STARTING ENGINE TRANSMISSION BREATHER	CO	1 ¼ QT.	1	X						CW	6
7 STARTING ENGINE CRANKCASE BREATHER	CO	3 QT.	1	X					††C		7
8 FAN & ADJUSTING PULLEY BEARINGS	BR	NOTE A	2						L		8
9 CHARGING GENERATOR	BR	NOTE D	2								L 9
10 FAN BELT ADJUSTING PULLEY BRACKET	BR	1 OR 2 STROKES	1				L				10
11 DIESEL ENGINE CRANKCASE OIL SYSTEM OIL FILTER ELEMENT BREATHER	CO	26 QT.	1	X					*C	C	11
12 ELECTRIC STARTING MOTOR	CO	NOTE C	3								12
13 UNIVERSAL JOINT	BR	NOTE A	2							L	13
14 TRACK ROLLER FRAME OUTER BEARINGS	BR	5 STROKES	2	L							14
15 FINAL DRIVES BREATHERS	CO	9 GAL. (EA.)	2			X			**CW	CW	15
16 TRACK ROLLER FRAME INNER BEARINGS TRACK ROLLERS, TRACK CARRIER ROLLERS AND FRONT IDLERS	BR	NOTE A	2	L							16

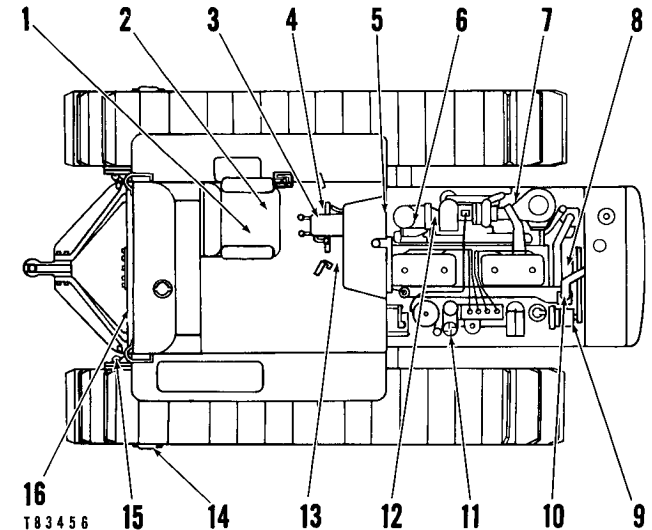
Key to Lubricants:

CO CRANKCASE OIL

BR BALL AND ROLLER BEARING LUBRICANT

Key to Symbols:

C — CHANGE W — WASH CW — CHANGE AND WASH COMPARTMENT WO — WASH AND OIL
L — LUBRICATE X — CHECK, ADD OIL WHEN NEEDED



STROKES SHOWN IN THE QUANTITY COLUMN OF CHART ARE TO BE INTERPRETED AS THE AMOUNT OF GREASE REQUIRED FROM THE LEVER-TYPE GREASE GUN IN THE ATTACHMENT TOOL GROUP.

NOTE A: LUBRICATE SLOWLY UNTIL EXCESS LUBRICANT IS OBSERVED.

NOTE B: TRACK ROLLERS, TRACK CARRIER ROLLERS AND FRONT IDLERS ARE LUBRICATED FOR LIFE WITH CRANKCASE OIL. AFTER RECONDITIONING, USE SPECIAL LUBRICATOR NOZZLE FOR REFILLING WITH SUPERIOR LUBRICANTS (SERIES 3) SAE 30 OIL.

NOTE C: LUBRICATE WHEN DISASSEMBLED FOR RECONDITIONING.

NOTE D: REPACK GENERATOR BEARINGS.

*WHEN FUEL SULPHUR CONTENT IS 0.4% OR LESS, WHEN FUEL SULPHUR CONTENT IS 0.4% TO 1.0% CHANGE EVERY 125 SERVICE HOURS — ABOVE 1.0%, REDUCE CHANGE PERIOD ONE-HALF. USE SUPERIOR LUBRICANTS (SERIES 3) IN THE DIESEL ENGINE CRANKCASE.

**WHEN OPERATING IN EXTREMELY DUSTY CONDITIONS OR DEEP MUD OR WATER.

†WHEN OIL BECOMES EXTREMELY THICK AND BLACK IN CONDITIONS OF EXTREME LOADS AND HIGH TEMPERATURES.

††MORE OFTEN IN DUSTY CONDITIONS.

†††INITIAL SERVICE INTERVALS FOR NEW MACHINES OR RECONDITIONED UNITS.

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Type of Lubricants and SAE Grades to Use

The grade of oil is classified in terms of viscosity (fluidity or flow ability) and is identified with numbers called SAE numbers. Oils with lower SAE numbers are more fluid and flow more readily than do those with the higher numbers. Crankcase lubricating oils are recommended for use in gear compartments because of their superior oxidation and corrosion inhibitors. See the following chart for these recommendations.

OIL SPECIFICATION CHART

Compartment	SAE GRADE OF OIL TO USE AT STARTING ATMOSPHERIC TEMPERATURES			
	Above +32°F.	+32°F. to +10°F.	+10°F. to -10°F.	-10°F. and Lower
Lubricated for life track rollers, track carrier rollers and front idlers	Superior Lubricants (Series 3) SAE 30 SAE 30 SAE 30 SAE 30			
Diesel Engine Crankcase	Superior Lubricants (Series 3) ‡SAE 30 ‡SAE 10W SAE 10W *Dilute SAE 10W			
Starting Engine Crankcase	Superior Lubricants (Series 3) or MIL-L-2104A Oils SAE 10W SAE 10W SAE 10W *Dilute SAE 10W			
Starting Engine Transmission	Superior Lubricants (Series 3) SAE 30 SAE 10W SAE 10W *Dilute SAE 10W			
Starting Engine Air Cleaner† (Oil bath type)	Superior Lubricants (Series 3), MIL-L-2104A or Straight Mineral Oil SAE 30 SAE 10W SAE 10W SAE 10W			
Transmission, Bevel Gear and Steering Clutch Compartment	Superior Lubricants (Series 3) SAE 30 SAE 30 SAE 10W SAE 10W			
Final Drives	SAE 30 SAE 30 SAE 30 SAE 10W			

*In lower temperatures it may be necessary to dilute oil with kerosene so it will be fluid enough to insure free circulation. This should be done before stopping, then operate the machine for a few minutes to mix the kerosene and oil. Evaporation in the engine crankcase under steady operation may make it necessary to again add kerosene to maintain proper fluidity.

†For oil bath air cleaners it is permissible to use clean undiluted reclaimed oil or the most inexpensive straight mineral oil. Be sure to change oil in the air cleaner regularly.

‡In seasons or locations where starting atmospheric temperatures are below 32°F., SAE 10W oil should be used to insure free circulation, even though daytime operating atmospheric temperatures may rise as high as 70° F.

To determine if the oil in the compartments will flow in cold weather, remove the oil level gauge or dip a finger into the oil before starting and if the oil will flow off, the oil is fluid enough to circulate properly.

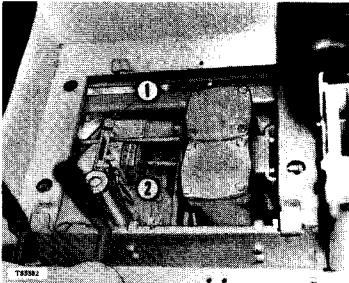
The oil that has been diluted for cold weather starting should be drained and replaced with undiluted oil at the end of the cold season when dilution is no longer required.

CO Crankcase Lubricating Oil

1

TRANSMISSION, BEVEL GEAR AND STEERING CLUTCH COMPARTMENTS

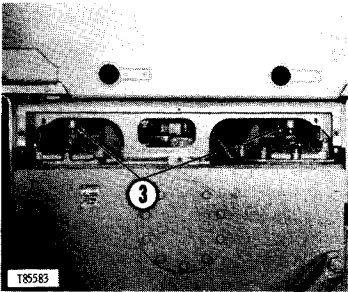
Use Superior Lubricants (Series 3) Only



Raise the seat and check the transmission oil level every 10 service hours with the engine running at low idle speed, transmission in neutral, the safety lock lever in the "on" position and the tractor level. Oil should be up to the full mark on the gauge (1). Add oil at (2) if needed. See Note A.

Tractors equipped with 171 Hydraulic Control using transmission oil supply: Raise the bulldozer blade and extend the tilt cylinder rod fully before checking the transmission oil level. 181 Hydraulic Controls having an oil supply tank are not connected to the transmission oil system.

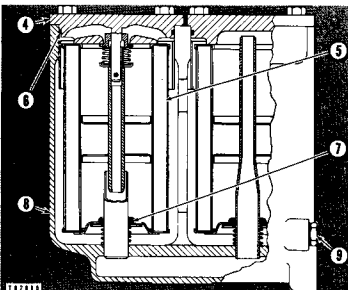
Wash and oil the breathers (3) every 250 service hours.



On tractors effective with 48A6393, the oil system includes one filter containing two elements located under the operator's seat, and two magnetic strainers: one located at the right rear of the diesel engine and the other at the left front of the diesel engine near the transmission oil cooler. On tractors before 48A6393, the oil system includes two filters containing one element each, one located under the operator's seat and the other under the right front floor plate. Tractors 48A2428 to 48A6393 and earlier tractors so equipped have one magnetic strainer located at the right rear of the diesel engine.

After the first 50 service hours operation of a new tractor or of a reconditioned transmission or steering clutch, and every 250 service hours thereafter, change the filter elements and clean the magnetic strainers.

To change filter elements on tractors effective with 48A6393, remove the drain plug (9), the cover (4), and the element (5) from the housing (8). Inspect the retainer seal (7) and install a new one if it is damaged. Install a new Caterpillar element and the cover, using a new seal (6) if necessary. Clean and inspect the drain plug, washer and seal and replace if necessary. Install the drain plug. Start and run the diesel engine for two minutes with the transmission in neutral and the tractor level to fill the filter with oil. Check the oil level and add oil if necessary.



Tractors effective with 48A6393

NOTE A: When operating under extreme conditions of tilt, a higher oil level may be required. See the "Capacities" and the topic, "Driving the Tractor."

CO Crankcase Lubricating Oil

1

TRANSMISSION, BEVEL GEAR AND STEERING CLUTCH COMPARTMENTS

To change the element in either filter on tractors before 48A6393, remove drain cover (9), filter cover (4) and bypass valve (7). Remove element (5) from housing (8) and install a new Caterpillar element. Replace seal (6) if necessary and install the filter cover. Clean and install the drain cover. Start and run the diesel engine for two minutes at low idle speed with the speed selector lever in neutral position, the safety lock lever "on" and the tractor level to fill the filters with oil. Check the oil level and add oil at (2) if necessary.

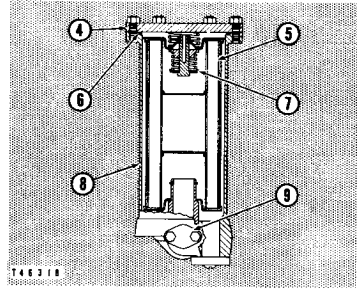
To clean each magnetic strainer, remove cover (11) and then remove tube, magnets and screen as a unit from housing (15). Remove tube (13) with magnets attached, from screen (14). Clean with a clean cloth or a stiff brush, being careful not to drop or rap the magnets sharply against any hard object. Wash screen (14) with kerosene. Install the tube, magnets and screen as a unit in the housing (15) with small end of tube up. Be sure the screen is piloted on top of tube. Install spring (12) and cover (11). Install a new seal (10) in the housing if seal is damaged.

Every 1000 service hours, drain the compartments by removing the bevel gear compartment drain plug (16), each steering clutch compartment drain plug (17), torque converter housing drain plug (18) and oil cooler drain plug (19).

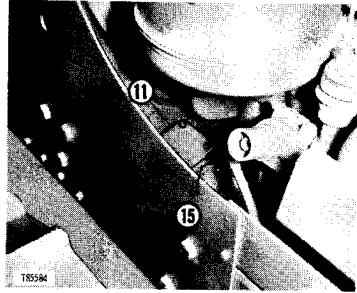
Clean and install the drain plugs.

When extreme loads and high temperatures are encountered, it may be necessary to change oil every 500 service hours. This can be determined by examining the oil on the oil level gauge and if it appears to be extremely thick and black the oil should be changed.

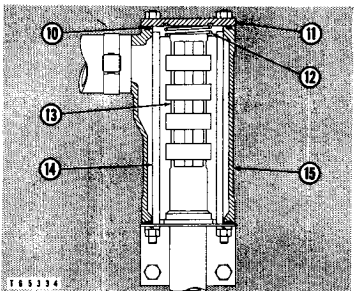
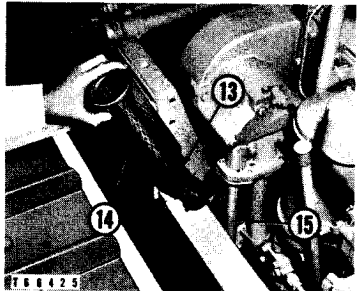
Tractors equipped with 171 Hydraulic Control using transmission oil supply: Before draining the compartment, raise the bulldozer blade and operate the hydraulic control to fully extend the tilt cylinder rod. Block up the lower end of the bulldozer blade so that the tilt cylinder rod can be fully retracted by lowering the blade with the engine stopped. Stop the engine and drain the compartment as instructed. While the oil is draining, operate the controls to lower the blade and retract the tilt cylinder rod. This will satisfactorily drain the tilt cylinder. 171 Hydraulic Controls having an oil supply tank are not connected to the transmission oil system.



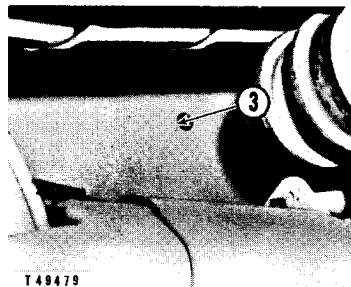
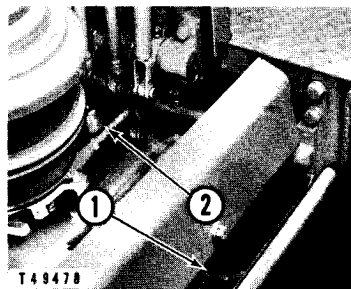
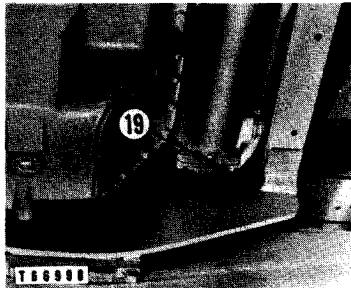
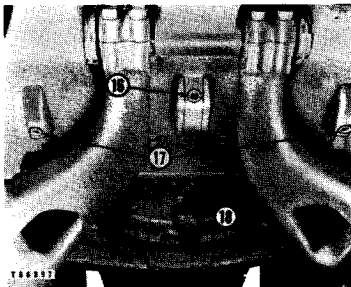
Tractors before 48A6393



Tractors effective with 48A6393



CO Crankcase Lubricating Oil



1

TRANSMISSION, BEVEL GEAR AND STEERING CLUTCH COMPARTMENTS

When the transmission is drained on tractors 48A2428 to 48A6393, remove oil line (20) and screen (21). Wash the screen and install screen and oil line using new gaskets if necessary. Machines before 48A2428, not equipped with a magnetic strainer, have two suction screens, one in each oil line at the lower front side of the transmission, both requiring washing at each oil change period.

Fill the compartments at (2) until the oil level reaches the "full" mark on the gauge. Then check after 5 minutes operation with the engine running at low idle speed and the transmission in neutral, and add oil until the level reaches the "full" mark on the oil level gauge. See Note A.

Tractors equipped with 171 Hydraulic Control using transmission oil supply: Raise the bulldozer blade, fully extend and retract the tilt cylinder rod three times, then check the oil level with the tilt cylinder fully extended and add oil if necessary. 171 Hydraulic Controls having an oil supply tank are not connected to the transmission oil system.

6

STARTING ENGINE TRANSMISSION

Every 10 service hours check oil level. Oil should be up to "full" mark on gauge (1). Every 250 service hours, remove, wash and oil the breather (2).

Every 1000 service hours drain at (3). Wash and refill at (2) to "full" mark on gauge. See the topic, "Washing Gear Compartments."

CO Crankcase Lubricating Oil

7

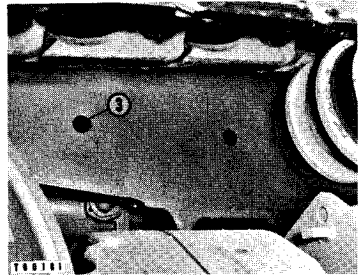
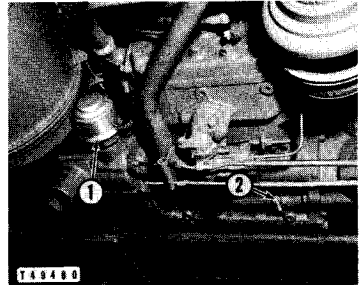
STARTING ENGINE CRANKCASE

Check the oil level every 10 service hours before starting the engine. Oil should be up to "full" mark on gauge (2).

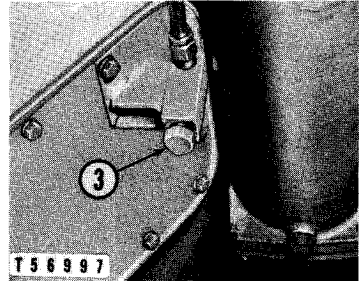
Every 125 to 250 service hours, depending on dust conditions, drain the crankcase at (3). When draining, the engine must be level so all the oil in the starting engine will drain. On machines so equipped, remove and clean the magnetic plug (4) every 500 service hours while the crankcase is drained.

Wash and oil the crankcase breather at each oil change period. Refill the crankcase at (1) to the "full" mark on the gauge.

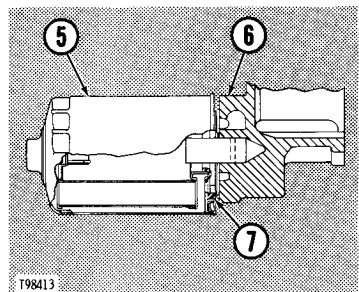
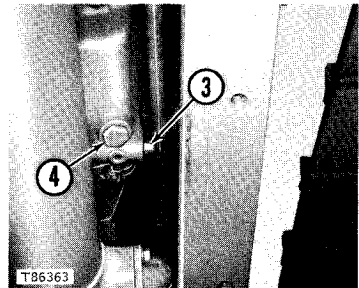
On machines so equipped, replace oil filter every 1000 service hours or first 10 service hours after installing a reconditioned starting engine. Remove filter (5) from filter base (6). Clean mounting base surface. Seat gasket (7) and apply a film of clean oil. Install new filter and tighten to 15 pounds feet or one turn past gasket contact. Overtightening will cause oil leakage.



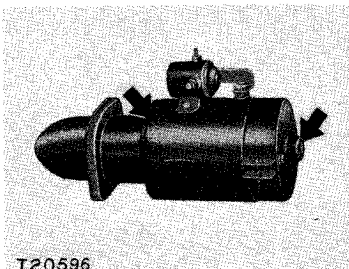
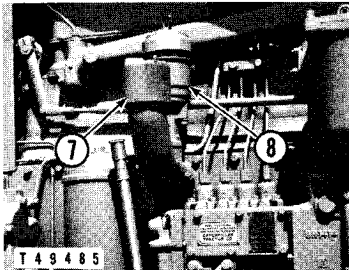
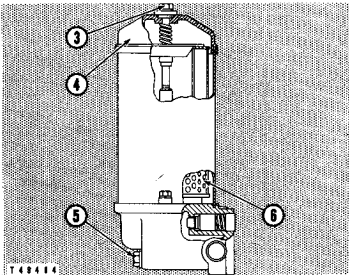
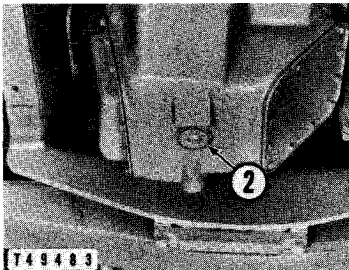
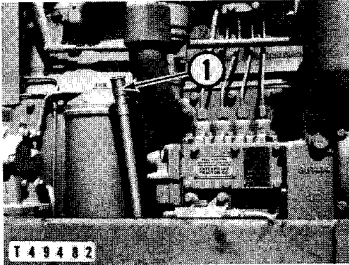
Later Machines



Earlier Machines



CO Crankcase Lubricating Oil



11

DIESEL ENGINE CRANKCASE LUBRICATING OIL SYSTEM

Check oil level every 10 service hours with engine running. Oil level should be between the "full" and "add oil" marks on the gauge (1). Add oil when the oil level falls to the "add oil" mark. Do not overfill.

The oil level may be considerably higher than the "full" mark on the gauge if the full capacity of crankcase oil is checked after the engine has been stopped for several minutes. The diesel engine has a guard to protect the gauge from spray so the oil level should be checked when hot with the engine running at low idle speed. Always check the oil level with the engine in a level position. See the topic, "Crankcase Lubricating Oil."

Drain the crankcase at (2) while the engine is hot. For recommended oil change periods see the "Diesel Engine Crankcase Lubricating Oil Change Period Chart." Also see the topic, "Crankcase Lubricating Oil."

While oil is draining from the crankcase, remove the drain plug (5), loosen cover bolt (3), and remove cover (4). Remove the element (6) from the housing and install a new Caterpillar element. Clean and install the drain plug and filter housing cover.

After draining the crankcase, refill at (7) and start the diesel engine. Run the engine until it is thoroughly warm, then add oil to bring level to "full" mark on gauge while the engine is running.

Disassemble breather (8) and wash the elements each time crankcase oil is drained.

12

ELECTRIC STARTING MOTOR

Electric starting motors are equipped with bearings of a type that make lubrication necessary only when the starter is disassembled for cleaning or servicing. Two or three drops of oil for each bearing is sufficient.

CO Crankcase Lubricating Oil

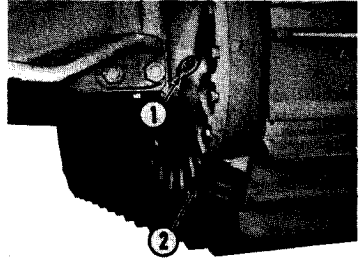
15

FINAL DRIVES

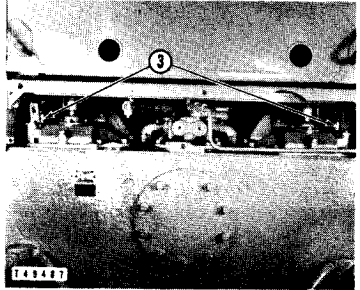
Check oil level at (1) by removing two filler plugs, one for each side, every 125 service hours. Keep lubricant to level of filler opening.

Remove, wash and oil breathers (3) every 250 service hours.

Drain each compartment at (2), wash and re-fill every 1000 service hours (500 service hours when operating in either extremely dusty conditions or deep mud or water). See the topic, "Washing Gear Compartments."



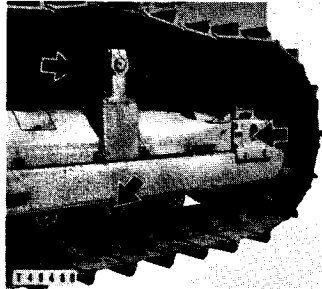
T 42470



T 42470

TRACK ROLLERS, TRACK CARRIER ROLLERS AND FRONT IDLERS

Track rollers, track carrier rollers and front idlers are lubricated with crankcase lubricating oil when assembled and do not require additional lubrication except when they have been disassembled for reconditioning. A special lubricator nozzle complete with instructions is available from your Caterpillar dealer.



T 42470

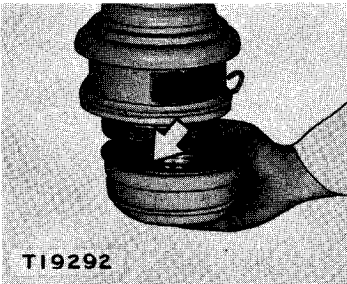
INSTRUCTIONS FOR USING THE 5M2080 LUBRICATOR NOZZLE

THIS NOZZLE IS USED WITH A VOLUME COMPRESSOR TO FILL LUBRICATED-FOR-LIFE TRACK ROLLERS, TRACK CARRIER ROLLERS AND FRONT IDLERS AFTER THEY HAVE BEEN RECONDITIONED.

1. USE SAE 30 SUPERIOR LUBRICANTS (SERIES 3) OIL FOR ALL TEMPERATURE RANGES.
2. THOROUGHLY CLEAN THE NOZZLE, FITTING AND AROUND THE PLUG IN ONE END OF THE SHAFT.
3. REMOVE PLUG AND INSERT THE LUBRICATOR NOZZLE.
 - A- IF THE PLUG IS A 5/8 INCH PLUG (18 NF THREAD) REMOVE THE O-RING SEAL FROM THE END OF THE NOZZLE AND SCREW THE NOZZLE TIGHTLY AGAINST THE BOTTOM OF THE SHAFT BORE.
 - B- IF THE PLUG IS A 3/4 INCH PLUG (16 NF THREAD) LEAVE THE O-RING SEAL IN PLACE AND SCREW THE NOZZLE IN BY HAND AS FAR AS IT WILL GO.
4. POSITION THE ROLLER OR IDLER SO THAT THE SHAFT IS IN THE SAME POSITION AS ON THE TRACTOR. (IDLERS SHOULD BE IN THE LOW POSITION WHEN LUBRICATED.)
5. FORCE OIL SLOWLY THROUGH THE NOZZLE AND INTO THE SHAFT UNTIL OIL WITHOUT AIR BUBBLES IS OBSERVED LEAKING PAST THE FLATS ON THE NOZZLE.
6. REMOVE THE NOZZLE AND INSTALL THE PLUG.

T 42470

CO Crankcase Lubricating Oil



STARTING ENGINE AIR CLEANER

(Dry Type)

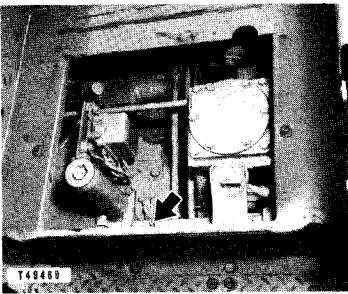
Dry type air cleaners used on later machines require no oil. See the topic, "Air Cleaners."

(Oil Bath Type)

Inspect the oil in the air cleaner cup every 50 service hours. Wash and refill cup to oil level bead when oil will not flow freely or if the sediment in the cup is $\frac{1}{4}$ inch deep. See the topic, "Air Cleaners."

Refill the cup with the same SAE grade and same type of oil that is used in the diesel engine crankcase. However, clean, undiluted reclaimed oil or the most inexpensive straight mineral oil may be used. See the topic, "Crankcase Lubricating Oil."

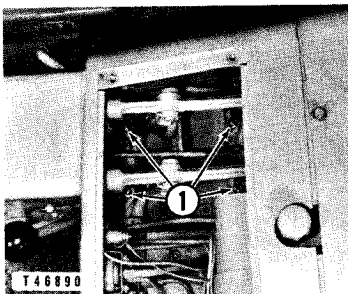
BR Ball and Roller Bearing Lubricant



2

TRANSMISSION SPEED SELECTOR SHAFT BEARINGS

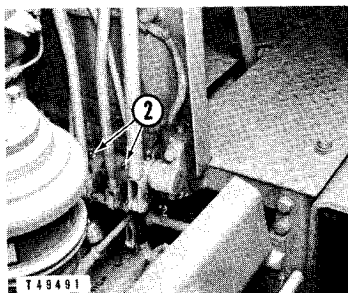
Every 2000 service hours lubricate the speed selector shaft bearings. Access to the single fitting is gained by raising the operator's seat.



3

STEERING CLUTCH CONTROL LEVER BEARINGS

Every 2000 service hours, lubricate the four points (1) in the control tower at the top of the dash and the two points (2) at the bottom.

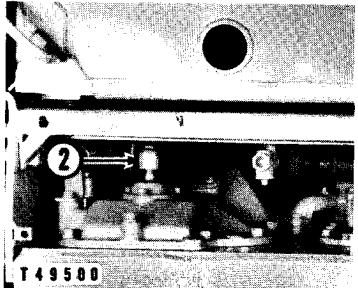
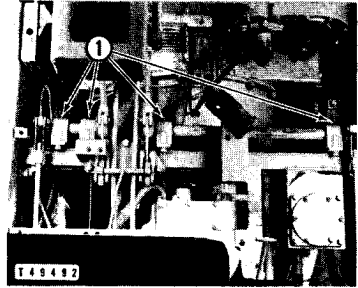


BR Ball and Roller Bearing Lubricant

4

BRAKE CONTROL SHAFT BEARINGS

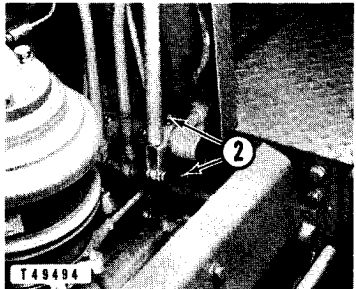
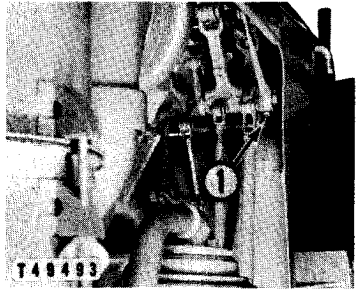
Every 2000 service hours, remove the floor plates and lubricate four points on the brake control shafts at (1). Tractors before 48A646 have two points on the steering clutch compartment covers at (2).



5

STARTING ENGINE PINION AND CARBURETOR CONTROLS

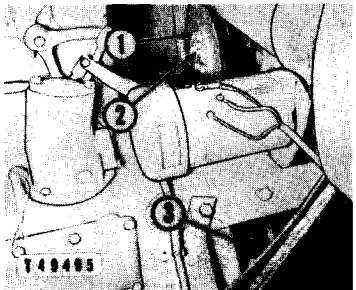
Lubricate every 125 service hours through the upper fitting at (1) and the lower fittings at (2).



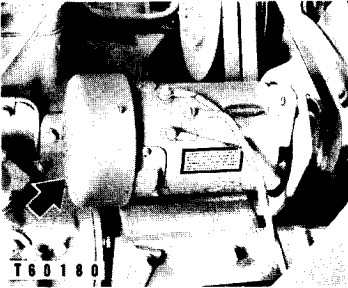
8

FAN AND ADJUSTING PULLEY BEARINGS

Every 250 service hours, lubricate the fan bearings through fitting (1) until grease appears at relief valve (2), and the adjusting pulley bearing through fitting (3). Wipe off excess lubricant.



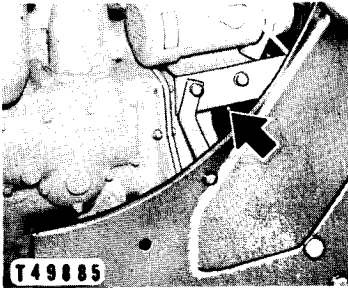
BR Ball and Roller Bearing Lubricant



9

CHARGING GENERATOR

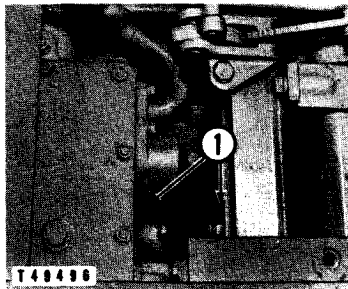
Generators have bearings that require lubrication only every 2000 service hours, or when the generator is disassembled for cleaning or servicing. See the topic, "Generator."



10

FAN BELT ADJUSTING PULLEY BRACKET

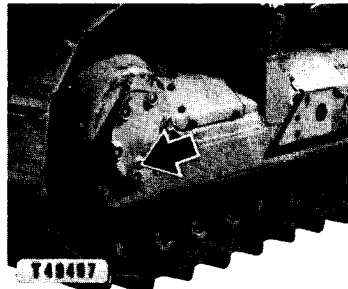
Every 125 service hours, lubricate the fan belt adjusting pulley bracket with one or two strokes. Wipe off excess lubricant.



13

UNIVERSAL JOINT

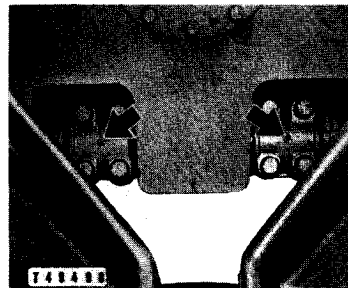
Every 1000 service hours lubricate the universal joint through two fittings (1).



14

TRACK ROLLER FRAME OUTER BEARINGS

Lubricate each bearing with five strokes every 10 service hours, one fitting on each side of the tractor.



16

TRACK ROLLER FRAME INNER BEARINGS

Lubricate two bearings every 10 service hours.

Operation Instructions

PREPARING THE TRACTOR FOR USE

New Tractor Initial Service: The first duty of anyone charged with the care and operation of a tractor is to give it a detailed inspection, and to lubricate all parts as directed in the LUBRICATION INSTRUCTIONS section of this book.

Fill the diesel fuel tank, taking care no dirt, water, or other foreign substances are admitted with the fuel. Give particular attention to the details of fuel handling as outlined under the topic, CARE OF THE FUEL SUPPLY. Fill the starting engine fuel tank with gasoline.

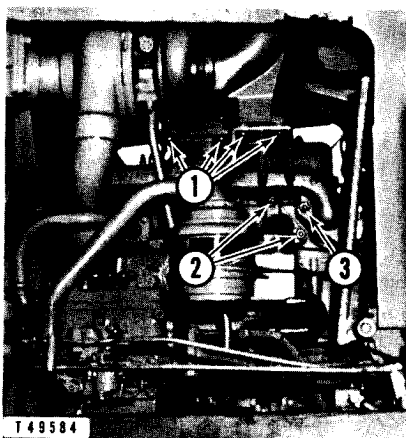
Fill the cooling system with clean soft water and rust inhibitor, or with the correct anti-freeze solution if temperatures below freezing are likely to be encountered. See the topic, COOLING SYSTEM.

During the initial operation of the tractor, the track roller end collar bolts, track shoe bolts, inlet and exhaust manifold stud nuts, and turbo-charger mounting bolts and nuts should be checked and tightened if necessary. Since these parts are subject to continued stress, daily checks should be made to prevent forced stops. See the topic, DAILY CARE.

New Tractor Recheck: After the first 50 service hours, re-torque bolts (standard torque for bolt size) on all hydraulic split clamps. After the first 100 to 125 service hours of operation tighten inlet manifold stud nuts (2), exhaust manifold stud nuts (3), carburetor elbow bolts and the turbo-charger mounting bolts and nuts (1) if necessary.

POINTS TO BE SERVICED AT RECHECK PERIOD

- 1-Turbocharger mounting bolts and nuts.
- 2-Inlet manifold stud nuts.
- 3-Exhaust manifold stud nuts.



T 49584

New Operator's Responsibility: The operator who is given the responsibility of care and operation of a tractor already in service, should first, check it for necessary lubrication, fuel supply and coolant in the radiator. Second, the tractor should have any necessary adjustments made to obtain satisfactory performance. If the tractor has been removed to a new altitude, see the topic, ALTITUDE OPERATION.

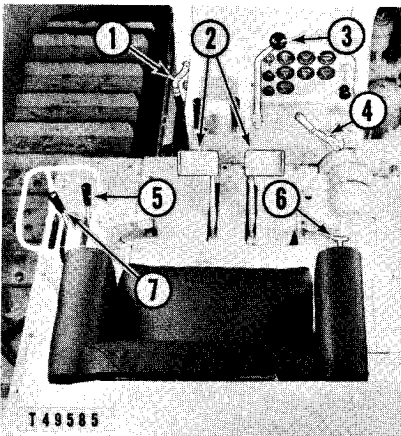
STARTING THE ENGINES

Before attempting to start the starting engine check the diesel engine and tractor controls as well as the starting engine controls to see that they are in the correct position for starting.

Before Starting: Check the diesel engine crankcase oil level to be sure it is considerably above the "add oil" mark on the gauge. Check the oil level in the starting engine crankcase to be sure it is to the "full" mark on the gauge. Check the oil level in the starting engine transmission to be sure it is to the "full" mark on the gauge. Check the oil level in the transmission, bevel gear and steering clutch compartments to be sure it is to the proper level.

Position Controls for Starting

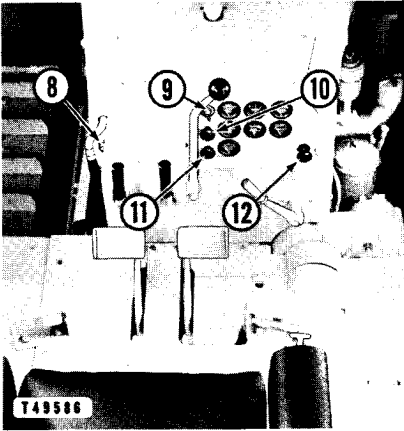
1. Push down the steering clutch brake pedals (2) and push down the brake lock control lever (6).
2. Shift the speed selector lever (5) to the neutral position.
3. Set the safety lock control lever (7) in the ON position to lock the speed selector lever (5).
4. Push the governor control lever (3) forward as far as possible.
5. Move the compression release control lever (4) to the START position.
6. See that the starting engine transmission control lever is in HIGH speed position.
7. Disengage the starting engine clutch by pushing forward the clutch and starter pinion control lever (1).



POSITION CONTROLS FOR STARTING

- 1—Starting engine clutch and pinion control lever. 2—Steering clutch brake pedals. 3—Governor control lever. 4—Compression release lever. 5—Speed selector lever. 6—Brake lock control lever. 7—Safety lock control lever.





POSITION CONTROLS FOR STARTING

8—Electric starter switch. 9—Magneto switch. 10—Throttle control. 11—Choke control. 12—Starting engine fuel valve control.

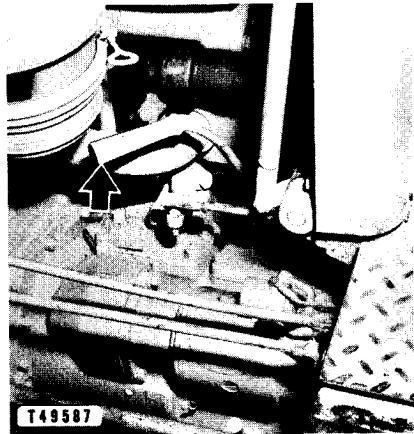


8. Open the starting engine fuel valve by unscrewing the starting engine fuel valve control (12).
9. Pull out the starting engine choke control (11).
10. Pull out the starting engine throttle control (10) to the $\frac{1}{4}$ to $\frac{1}{2}$ engine speed position.
11. Turn the magneto switch (9) to the ON position.
12. Turn ON the disconnect switch located on the left side of the seat on later machines, or under the seat cushion on earlier machines.

CAUTION

Never turn disconnect switch **OFF** when engine is running or damage to the generator, regulator and lights may result.

STARTING ENGINE TRANSMISSION CONTROL LEVER IN HIGH SPEED POSITION



Starting Engine

Press the starting engine electric starter switch (8).

Do not run the starter more than thirty seconds at a time. Then, allow two minutes intermission for cooling before using it again.

As soon as the engine starts, release the starter button.

When the engine starts keep the speed low until the crankcase lubricating oil has a chance to warm up and better lubricate the engine.

If the electric starter pinion disengages for any reason before the engine starts, release the starter switch, wait until the starter stops rotating, and again press the starter switch.

If it is necessary for any reason to start the starting engine manually, insert the crank in position and crank until the engine starts.

Pull the crank through a compression stroke. Do not attempt in any manner to spin or push the crank through a cranking arc.

Push in the choke control as soon as the engine will run with the choke off. Temperature and altitude will vary the length of time it is necessary to have the choke on. Actual experience in starting will determine this interval.

Helpful suggestions for starting the starting engine in cold weather are in the topic, STARTING IN COLD WEATHER.

Diesel Engine

The following steps should be carefully followed to prevent damage to the starter pinion or flywheel ring gear.

1. The starting engine should be running smoothly at high idle speed.
2. Apply sufficient pressure to the starting engine clutch brake to **stop the starter pinion from rotating** by pushing the clutch and starter pinion control lever all the way forward, then hold it in the brake applied position for 5 seconds.
3. Engage the starter pinion with the flywheel ring gear and engage the clutch by quickly pulling on the clutch and starter pinion control lever until the clutch snaps over center.
4. If the engine slows to the stalling point when the clutch is engaged, as it might in cold weather, disengage the clutch and let the engine pick up speed again. See the topic, STARTING IN COLD WEATHER.

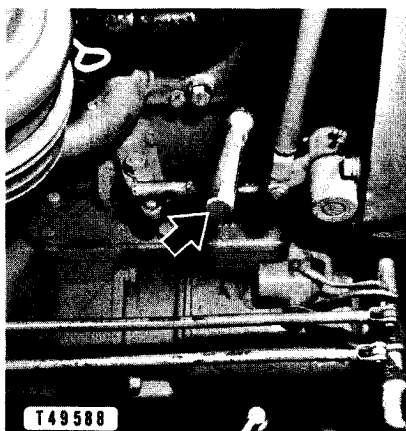
During cold weather, or whenever the normal cranking speed cannot be reached with the transmission control lever in HIGH speed position, move the control to the LOW speed position.

To use the starting engine transmission for starting a cold engine proceed as follows:

1. Disengage the starting engine clutch.
2. Shift the starting engine transmission into LOW.
3. Engage the starting engine clutch and after the cranking effort required is reduced, move the compression release lever to the RUN position.

**STARTING ENGINE TRANSMISSION
CONTROL LEVER IN LOW
SPEED POSITION**

◆



4. Allow the starting engine to turn the diesel engine for several minutes as the heat of compression will assure easy starting.
5. Move the compression release lever to the **START** position, disengage the starting engine clutch, shift the starting engine transmission to **HIGH** and engage the clutch.

Move the compression release lever to the **RUN** position as soon as the starting engine is cranking the diesel engine at normal cranking speed. The heat generated when the starting engine is cranking the diesel engine against compression, and the circulation of the starting engine exhaust through the tube in the diesel engine inlet manifold warms the cylinders, pistons, and combustion chambers to the starting temperature. Actual experience will determine the length of time necessary to crank the diesel engine to warm it sufficiently to assure easy starting.

After the starting engine has cranked the diesel engine against compression until the diesel engine is sufficiently warm, move the governor control lever until it snaps over the detent to turn on the fuel injection pumps. If the diesel engine does not start after it has turned several revolutions, move the governor control lever to the shut-off position and let the starting engine crank the diesel engine a little longer to raise its temperature.

CAUTION

On later machines, an oil pressure actuated stop inside the governor limits movement of the governor control linkage in a direction to increase engine speed until normal oil pressure is reached to prevent damage from excessive engine speed when starting. Do not attempt to force the governor control linkage past the stop.

If the diesel engine is thoroughly heated but does not start, make an inspection to see that everything is correctly set for starting. If smoke has been coming from the diesel engine exhaust, fuel has been reaching the cylinders. If no smoke has been evident with the fuel injection pumps turned on, check the fuel supply. If the diesel fuel tank is empty or the fuel tank valve is closed, it will be necessary to prime the system as outlined under the topic, PRIMING THE FUEL SYSTEM. In case there may be water or dirt in the fuel system, or if the fuel injection equipment is suspected, see the topic, FUEL INJECTION EQUIPMENT.

When the diesel engine begins to run, the starting engine clutch and starter pinion automatically disengage.

Stop the starting engine by closing the starting engine fuel valve, allowing the engine to burn all the fuel in the carburetor. Then turn OFF the magneto switch.

After the engine starts, reduce engine speed to low idle until the oil pressure gauge indicates normal oil pressure. When the gauge indicates normal oil pressure, the engine should be allowed to run for five minutes with the governor control lever in approximately half engine speed position before applying the load. During this period the engine gauges should be observed for proper readings as explained in the topic, GAUGES. Avoid unnecessary accelerating of the engine speed before operating temperatures are obtained.

GAUGES

After the engine has started, and at frequent intervals while the engine is operating, the engine gauges should be observed for proper readings as explained in the following paragraphs.

Oil Pressure Gauge: Immediately after the engine has started, check the crankcase lubricating oil pressure gauge (2) to see that it is registering pressure. When the engine is running at rated engine speed the gauge should register in the NORMAL or OPERATING range. A lower pressure reading is normal at low idling speeds. If no pressure is indicated, investigate at once.

Water Temperature Gauge: When the engine is warm, the water temperature gauge (1) should register in the operating range.

On later machines, the gauge has color ranges to determine the approximate maximum permissible temperature during operation. First observe water **pressure** gauge (6) to see the highest color range indicated, then observe the water **temperature** gauge to see that it is within the corresponding color range. Do not operate when the temperature gauge indicator is beyond this color range, and never allow the coolant to boil.

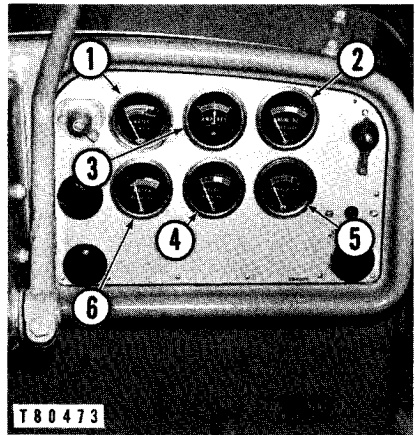
Water Pressure Gauge: When the engine is warm the water pressure gauge (6) indicates the pressure in the cooling system which is normally 8 to 12 PSI, and the color range to use when determining maximum permissible temperature on the water **temperature** gauge (1). Since higher pressure permits higher operating temperature, always use the highest color range indicated on the gauge.

Fuel Pressure Gauge: The fuel pressure gauge (4) should register in the NORMAL range. See the topic, FUEL SYSTEM.

Ammeter: Check the ammeter (3) to see that the indicator is registering in the charging range (indicator on the + side of zero). If the indicator registers in the discharging range (indicator on the - side of zero) investigate at once. See the topic, GENERATOR.

GAUGES

- 1-Water temperature gauge. 2-Crankcase lubricating oil pressure gauge.
3-Ammeter. 4-Fuel pressure gauge.
5-Torque converter temperature gauge.
6-Water pressure gauge.



Torque Converter Temperature Gauge: The torque converter temperature gauge (5) should register in the NORMAL range. It is permissible to operate with the gauge registering low in the hot (red) range for short periods, however, if the temperature continues in the hot (red) range, shift to a lower speed, or reduce the load.

Torque Converter Pressure Gauge (Earlier Tractors Only): When the engine is running at high idle speed, the torque converter pressure gauge should be in the NORMAL range. If not in this range, investigate at once.

Transmission Oil Pressure Gauge (Earlier Tractors Only): The indicator should register in the NORMAL range after the oil is warm. If the indicator registers in low red range, there is insufficient pressure to hold the clutches engaged. If the indicator registers in the high red range, the transmission filter may be dirty. If either high or low oil pressure persists consult your Caterpillar dealer.

DRIVING THE TRACTOR

The tractor is equipped with a power shift transmission having three speeds in forward or reverse and is controlled by the speed selector lever mounted at the left of the operator's seat. The lever, when moved actuates a hydraulic control which directs oil into the chambers of the various clutches, of which there are five, thus producing the desired speed and direction of travel.

Two of the five clutches control direction of travel and are called directional clutches, one clutch controlling forward direction, the other reverse.

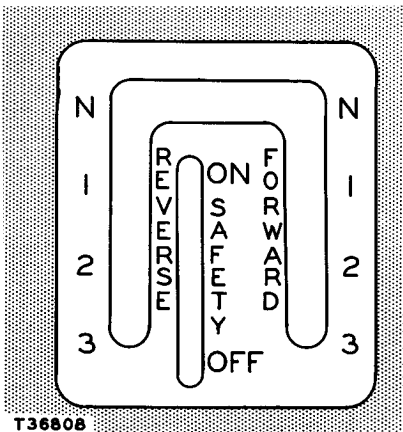
Three clutches control the speed in either direction and are called speed clutches. Shifting from one speed to another while traveling in either direction can be accomplished with the diesel engine running at any speed and with the tractor operating under light or heavy load conditions. Normally the decelerator would be depressed to reduce engine speed when making a directional change but it is permissible to make directional changes at full engine speed. Detents within the transmission hold the control lever in the desired position.

CAUTION

The safety lock lever should be placed in the ON position whenever the tractor is allowed to stand with the engine running. The safety lock prevents the accidental engagement of the transmission.

The transmission speed selector lever positions are shown here and appear on the control housing.

Before applying any load allow the diesel engine to warm by running the engine five minutes with the governor control lever in half engine speed position. During the warming period the power shift transmission speed selector control lever should be in neutral (N) position.



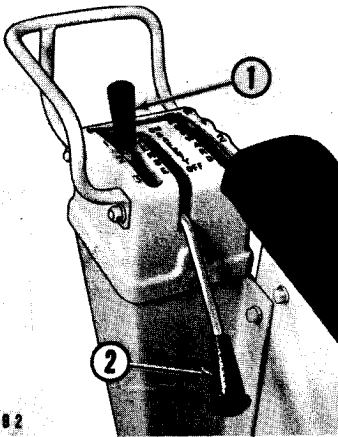
SPEED SELECTOR LEVER
POSITION DIAGRAM



To drive the tractor, move the governor control lever to the desired position. Disengage the brake lock by depressing both brake pedals, allowing the brake lock control lever to release, thereby moving to the unlocked position. Move the safety lock control lever (2) back to the OFF position, then move the speed selector control lever (1) to the desired direction and speed as shown on the control housing.

CAUTION

Before driving the tractor after transmission oil drain and fill periods, the transmission lubricating oil system should be completely filled. To do this, start the diesel engine and run it at half engine speed for 2 minutes. Recheck transmission oil level gauge and add oil if necessary.



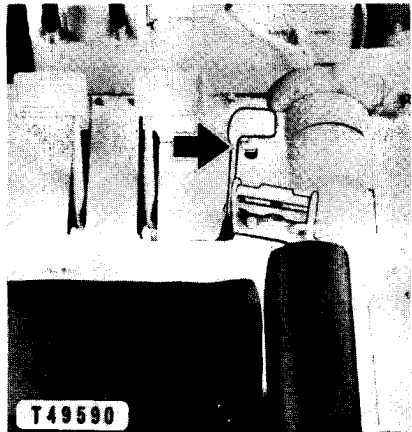
SPEED SELECTOR CONTROL LEVER AND SAFETY LOCK CONTROL LEVER

1-Speed selector control lever. 2-Safety lock control lever.



Decelerator: Tractors are equipped with a foot operated decelerator. This provides the operator with a control pedal to change the engine speed.

DECELERATOR



Extreme Tilt Operation: When operating under extreme conditions of tilt, such as very steep hillsides, the transmission oil pressure may drop

due to insufficient oil at the pump inlet. A drop in oil pressure will cause the transmission to shift to neutral.

If these problems are encountered under such conditions, it is permissible to raise the transmission oil level above the "full" mark on the gauge by adding oil up to 10% of the capacity of the compartment. Do not add more oil than necessary, and reduce the level when the tractor is again operated under normal conditions. See the LUBRICATION INSTRUCTIONS and CAPACITIES.

STEERING THE TRACTOR

The tractor is steered by hand levers that actuate control valves in the hydraulic control, which in turn operates the steering clutches. Pedals control the steering clutch brakes. Release the steering clutch on the side toward which the turn is to be made by pulling back on that steering clutch control lever. Apply the brake on the same side by pressing down on the pedal just hard enough to turn at the desired radius. Both controls should be handled smoothly so the turn will be made evenly and not in a series of jerks. Just before the turn is completed, release the brake. Then engage the steering clutch by releasing the control lever smoothly.

When the tractor is pulling a load it is seldom necessary to use the brakes in steering, except for sharp turns, since the load acts as a brake. The brakes may also be used to hold the tractor back when going down grade. The pedals may be locked in brake applied position to hold the tractor on slopes or when doing stationary work.

The pedals must be in the fully released position during normal operation of the tractor. **Keep the feet off the pedals except when it is necessary to apply the brakes.**

Operating Down Grade: When going down grade with the tractor pulling the load, steer in the usual manner. If the load is pushing the tractor, the operation of the steering clutches is reversed. For example, to turn to the right under these conditions, release the steering clutch on the left, but do not apply the brake. This allows the left track to travel faster while the right track is held back by the engine which acts as a brake.

Do not place the transmission in neutral when operating downgrade. When the tractor speed increases, due to down hill operations, excessively high engine speeds can be encountered regardless of the transmission speed selection. To avoid overspeeding the engine, both steering clutch brakes should be applied at the same time.

OPERATING OVER AN OBSTRUCTION

The fact that the steering clutches are controlled by separate levers may be used to advantage in running over an obstruction, such as a log or a ditch bank. Both of the clutches may be released slightly until the tractor balances on top of the obstruction. Then one clutch may be en-

gaged gradually so that the tractor moves forward at an angle, over and down. If the tractor is being operated without a load it may be necessary to use the brakes.

OPERATING IN DEEP MUD OR WATER

If the tractor must be operated for any length of time in deep mud or water, certain precautions are necessary. Inspect the oil in the final drives frequently for mud or water and drain, wash and refill if the oil shows the presence of any mud or water. The presence of mud in the final drives or the excessive leakage of oil indicates the seals should be repaired or replaced. See the topic, LUBRICATION CHART.

CONTINUOUS OPERATION ON STATIONARY WORK

The speed selector lever should be placed in the neutral position and the safety lock control lever in the ON position while the diesel engine is running. Lock both steering clutch brakes in the applied position.

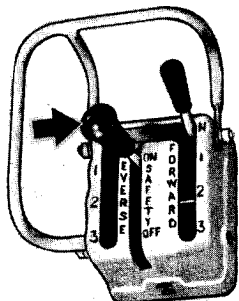
STOPPING THE TRACTOR

To stop the tractor when it is desired to allow the engine to run move the speed selector lever forward to the neutral (N) position, move the safety lock control lever to the ON position, lock both steering clutch brakes in the applied position and move the governor control lever to reduce engine speed.

Reduce engine speed as described in the topic, STOPPING THE DIESEL ENGINE.

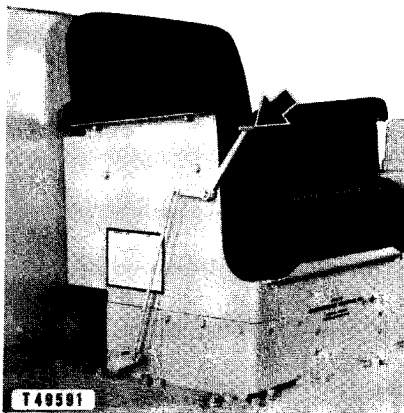
Before leaving the tractor all raised equipment should be lowered to the ground.

A brake lock control is provided to lock both steering clutch brakes in the applied position to hold the tractor on slopes or when doing stationary work. Either the right or left brake pedal or both may be locked in the applied position by applying the brake and pushing down the



T46093

SAFETY LOCK CONTROL LEVER
IN "ON" POSITION



T49501

BRAKE LOCK CONTROL

brake lock control lever. To release the brake push down on the brake pedals. This allows the brake lock control lever to return to the unlocked position.

STOPPING THE DIESEL ENGINE

Correctly stopping the diesel engine will allow some of the hot areas in the engine to gradually cool, thus extending engine service life. The correct diesel engine stopping procedure is as follows:

1. After the normal load is removed from the engine allow it to idle five minutes with the governor control lever at half engine speed position.
2. Reduce engine speed to low idle speed and allow the engine to run for thirty seconds.
3. Stop the diesel engine while it is running at low idle speed by moving the governor control lever to the shut-off position. Do not accelerate the engine speed above low idle before stopping the engine.

When the diesel engine is stopped, place the disconnect switch in the OFF position to open the circuit between the battery and the remainder of the electrical system. The disconnect switch is provided for four reasons: First to prevent actuating the starting motor. Second, to prevent damaging the electrical system when performing service operations on the equipment. Third, to prevent discharging the batteries when the machine is not in operation. Fourth, to prevent unauthorized starting of the tractor.

If the tractor must stand without shelter, cover the exhaust pipe (including starting engine exhaust pipe) to exclude rain or snow. If the temperature is below freezing, or if freezing weather is expected before the engine will be started again, check to see that the system is adequately protected against freezing. See the topic, COOLING SYSTEM, for information about anti-freeze solutions and cooling system draining.

DAILY CARE

Attention should be given to the operations mentioned in this topic every 10 service hours or daily, whichever occurs first.

A daily check of the tractor should be made to see if there are any loose nuts, bolts, or parts worn to such an extent that they are no longer serviceable. Points to be checked daily for tightness or leaks are listed as follows:

1. Gasketed joints of final drive cases, track shoe bolts, track roller end collar bolts, equalizer bar mounting bolts, exhaust and inlet manifold stud nuts, air cleaner connections and turbocharger mounting bolts are some of the points that should be checked daily for tightness.
2. Diesel engine, starting engine, transmission, final drives, hydraulic oil systems, track rollers, track carrier rollers, and front idlers should be checked for oil leaks.

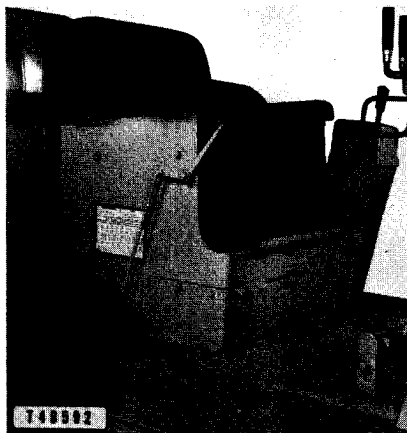
3. Cooling system, clean trash from radiator and add coolant if necessary.
4. Fuel pressure gauge, inspect with engine running to see that the indicator is not in the red range.
5. Diesel engine dust collector cup, inspect for dirt in the dust collector cup when operating in extremely dusty conditions.
6. Turbocharger, check to see that no vibration or excessive noise is present. The "muffled high pitch whine" is the normal sound. If turbocharger is defective it will usually be noisy only under load.

Fill the fuel tank at the end of the day's run. See the topic, **CARE OF THE DIESEL FUEL TANK** for other periodic care.

When the diesel engine is operating continuously, the starting engine should be run for a few minutes each day to dissipate condensation and renew the oil film on the bearing surfaces and cylinder walls.

Dirt should not be allowed to accumulate on the tractor. A few minutes spent daily in keeping it clean are well repaid in improved appearance, and greater ease and safety in operation, lubrication and maintenance.

**SEAT CUSHION TIPPED TO
PROTECT PADDING**



If the tractor must stand without shelter, the operator's seat on later tractors should be left in its normal position. On earlier tractors, the seat cushion should be tipped as shown. When this is done the waterproof covering prevents moisture entering the padding. If the cushion is turned bottom side up in rainy weather the padding may become damp. This will shorten the life of the cushion.

STARTING IN COLD WEATHER

If the starting engine and the diesel engine are both in good mechanical condition, and precautions necessary for cold weather operation are taken, ordinary cold weather will not cause difficulty in starting or loss of efficiency.

Lubricants: As the starting atmospheric temperatures become lower, where warm housing facilities are not available, lubricants of lower vis-

cosity should be used. See the LUBRICATION INSTRUCTIONS section of this book.

Coolant: When the temperature is below freezing, sufficient anti-freeze solution should be used in the cooling system to prevent freezing. See the topic, COOLING SYSTEM.

The liquid in the cooling system may be warmed to make starting easier and quicker. When warming anti-freeze solutions, keep away from flames, as some of these solutions may be inflammable. Avoid getting the solution hot, and even a warm solution should be poured very slowly into a cold cooling system to prevent damage by sudden expansion.

Fuel: Fuel must be "free flowing" enough to flow readily through the fuel lines at the lowest temperature at which the tractor will be started and operated. For additional information, see the topics, FUELS and CARE OF THE DIESEL FUEL TANK.

Electrical Equipment: During cold weather, more attention should be given the condition of the battery. It should be tested frequently and charged as often as necessary to insure sufficient power for starting. All switches and connections in the electrical system should be inspected and kept in good condition to prevent losses through improper contacts. See the topic, BATTERY.

Starting the Starting Engine: If the tractor has been standing without shelter in extremely cold weather, the following suggestions will materially assist starting.

Crank the starting engine several revolutions with the magneto switch OFF, and the starting engine clutch disengaged. This will better distribute oil to the bearings and cylinder walls.

Sometimes moisture, or fuel which has not vaporized, collects on the starting engine spark plugs. They may be dried out by removing them and pouring gasoline over the electrodes. Ignite the gasoline and allow it to burn. **Use care to prevent fire.**

Pouring a small amount of gasoline on the electrodes before they are replaced in the engine is more effective in promoting combustion than priming the cylinders with gasoline. A small amount of gasoline in the cylinders will remove the film of oil from the cylinder walls and interfere with compression.

Sometimes the starting engine can be started more quickly by pulling out the throttle control to the HIGH IDLE position. **When the engine starts push in the throttle control to keep the engine speed low until the crankcase lubricating oil has a chance to warm up and better lubricate the engine.**

Starting the Diesel Engine: It is very important to keep low viscosity crankcase lubricating oil up to the full mark on the gauges, in the diesel engine crankcase and starting engine crankcase to provide proper lubrication when starting. Refer to the topic, DESCRIPTION OF LUBRICANTS.

In cold weather, if the starter pinion clashes and will not engage with the ring gear, proceed as follows:

1. Stop the starting engine after the lubricating oil is thoroughly warm.
2. Engage the starter pinion by pulling the clutch and starter pinion control lever out as far as it will go. (It may be necessary to rotate the starter pinion by the use of the electrical starter or hand crank.)
3. Disengage the starting engine clutch by pushing the control lever forward.
4. Restart the starting engine.
5. With the starting engine running at high idle speed, engage the starting engine clutch by pulling the control lever out, to start the diesel engine.

STORAGE

Lubricate all points mentioned in the lubrication chart if the tractor is to be stored or left standing for any length of time. This will protect against rusting.

Starting Engine and Diesel Engine: If the tractor is to be stored or left standing for a long period of time, the lubricating oil may drain away from the cylinder walls and piston rings. This lack of lubricant permits the rings and liners to rust. It also permits unnecessary wear caused by metal-to-metal contact between the pistons, rings and liners when the engine is started before fresh oil has reached these surfaces. The lack of lubricant may not cause any noticeable change in engine operation after it has been started but it does contribute to shorter engine life.

The oil film should be renewed once a week by running the starting engine and diesel engine until they are thoroughly warm. This will circulate the oil and prevent rusting from condensation.

Transmission and Final Drive Compartments: Drive the tractor every 30 days a short distance to renew the oil film on shafts, gears, and bearings. A convenient time to do this would be when starting the engine to renew the oil film on the cylinder walls and piston rings.

Cooling System: If the temperature will be below freezing, the cooling system should be drained if it has not been serviced as instructed in the topic, COOLING SYSTEM.

Battery: Periods of two weeks or more when the engine is not operated necessitates provisions being made to keep the battery charged. This may be done by running the engine once a week or taking the battery to your Caterpillar dealer for charging.

Fuel Tank: If the machine is to be stored or left standing longer than a normal work day, fill the tank with clean fuel to keep out moisture laden air. This will prevent condensation and rust from forming inside of the tank. If the machine is to be stored with the fuel tank not completely filled,

commercially available rust preventive Vapor Phase Inhibitor crystals should be placed in the tank filler strainer to prevent moisture and rust from collecting. Remove the crystals before the fuel tank is to be refilled with fuel.

ALTITUDE OPERATION

The maximum turbocharger speed is determined by the fuel rack setting, the high idle speed, the turbine nozzle and the altitude at which the engine is operated. The rack and high idle speed settings have been established to permit the engine to be operated at the altitude marked on the warning plate on the dash. The turbine nozzle is the same for all altitudes, but the engine fuel rack setting and high idle speed vary with altitude. If the fuel rack setting is greater than specified for the altitude at which the engine is being operated or the high idle speed is too high, **serious damage or injury due to turbocharger overspeeding may result.**

The maximum altitude at which the engine may be operated at the present setting is marked on the warning plate on the dash plate. The governor housing and turbocharger are sealed for your protection. **Changes to the turbocharger, fuel rack setting, or high idle speed should be made only by your Caterpillar dealer.**

The engine can be operated at a lower altitude than marked on the warning plate without danger of turbocharger overspeeding, but with slightly less than maximum performance, however the fuel rack setting must be changed when operated at a lower altitude to get full power. **When operated at a higher altitude, the fuel rack setting must be changed by your Caterpillar dealer.** After making any changes, new altitude limit will be marked on the warning plate and the governor housing will be resealed for your protection. This will assure you that correct settings have been made.

IMPORTANT: Consult your Caterpillar dealer before operating at a higher altitude than marked on the warning plate.



Maintenance Instructions

The foregoing paragraphs have been devoted to instructions which are necessary for day-to-day operation of the tractor. The following topics give detailed instructions regarding the care and adjustment of the various parts.

AIR CLEANERS

Service the air cleaner element when any one of the following situations occur:

1. Excessive exhaust smoking and/or loss of power.
2. The red piston of the air cleaner service indicator locks in the raised position.
3. If not equipped with a service indicator, every 125 - 250 service hours.

Service the air cleaner only while the engine is stopped. Clean and inspect all parts just prior to their installation. Air leakage past any gasket, seal, element end or pleat could permit dirt to enter the engine.

To reduce service time, install a replacement element, and then thoroughly **clean, dry** and **inspect** the used filter element. If the element is undamaged, wrap and store it for use as a replacement element. If the element is damaged, discard it, and procure a new packaged element.

Operating the diesel engine with the exhaust stack removed will allow exhaust gases to be drawn into the air cleaner, plugging the filter elements. If the exhaust stack is removed, be sure to install it in its original position.

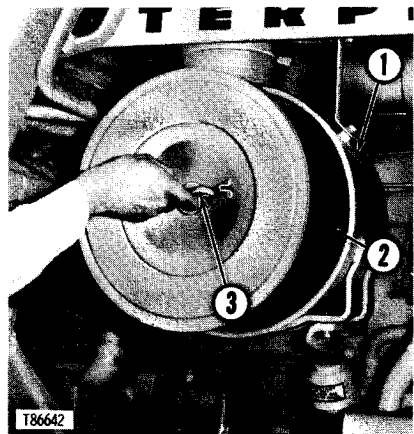
Two Element Single Stage Air Cleaner With Self Cleaning Precleaner

Primary Filter Element:

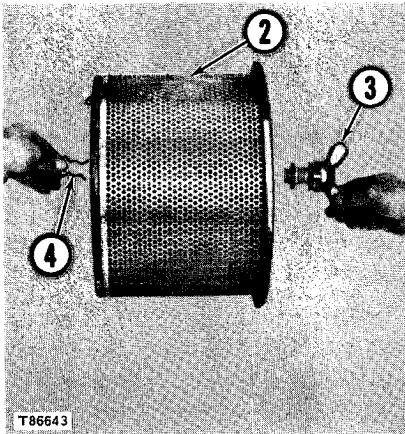
1. Unlock and loosen wing nut (3).

REMOVING PRIMARY ELEMENT

- 1-Air cleaner body. 2-Primary element.
3-Wing nut.

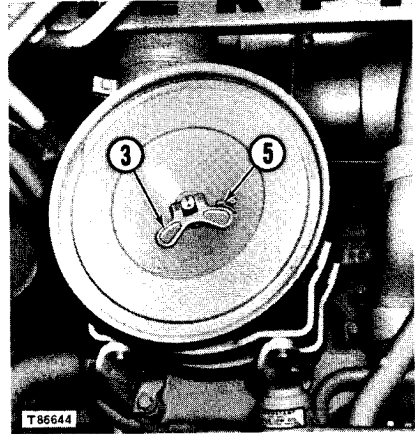


2. Remove primary element (2). If the secondary element appears dirty, service both elements; see the topic SECONDARY FILTER ELEMENT.
3. Carefully remove the dirt from inside air cleaner body (1).
4. Clean the used filter element, see the relating topic.
5. Inspect the ends, gaskets and pleats of the replacement filter element. Replace the element if damaged.
6. If a replacement element is installed, use retaining clip (4) and wing nut (3) from the element being replaced.



REMOVING WING NUT

2-Primary element. 3-Wing nut.
4-Retaining clip.



LOCKING WING NUT

3-Wing nut. 5-Keeper.

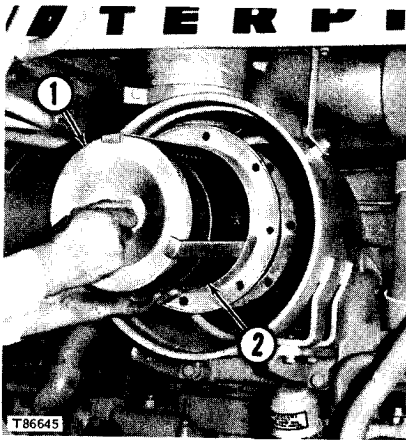
7. Install the element, tighten wing nut (3) past keeper (5). Flip and lock the wing against keeper (5) to prevent the wing nut from loosening.
8. Reset the plunger in the bottom of the air cleaner service indicator.

If the service indicator piston locks in the raised position shortly after servicing, and if the primary element has been cleaned several times, replace the primary element with a new element.

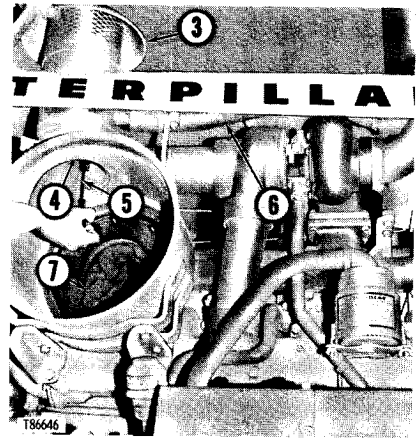
Secondary Filter Element:

If the secondary element is dirty or the service indicator piston locks in the raised position after replacing the primary filter element:

1. Remove the primary element.
2. Remove retainer (1) and secondary element (2).
3. Cover the engine air inlet.
4. Thoroughly clean the air cleaner body.
5. Clean the used filter element, see the relating topic.
6. Clean the precleaner tubes (4) and tubing (6), as necessary, by using a stiff fiber brush.



REMOVING SECONDARY ELEMENT
 1-Retainer. 2-Secondary element.



CLEANING PRECLEANER TUBES
 3-Precleaner. 4-Precleaner tubes.
 5-Stiff fiber brush. 6-Tubing.
 7-Clean rag covering the
 engine air inlet.

7. Inspect the ends, gasket and pleats of the elements for damage. Replace any damaged elements.
8. Uncover the engine air inlet and install the secondary element and retainer.
9. Install the primary element and lock the wing nut. Reset the plunger in the bottom of the air cleaner service indicator.

Replace cleaned primary and secondary filter elements with new elements if the service indicator piston locks in the visible position shortly after servicing.

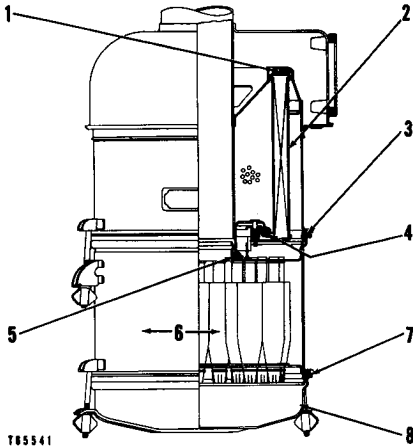
Two Stage Air Cleaner

Dust Collector Cup: Every 10 to 50 service hours remove the dust collector cup.

1. Loosen the wing nuts and remove the dust collector cup (8).
2. Empty the dust from the dust collector cup.
3. Inspect the lower body seal (7), replace if necessary, and install the dust collector cup. Use no oil in the dust collector cup.

Lower Body: Inspect the lower body every 10 to 50 service hours when the dust collector cup is removed. If an accumulation of dirt is found in the tubes, they should be cleaned by pushing a round bottle brush through the tubes from the bottom. It is not necessary to remove the lower body except when filter element inspection and cleaning is desired. When the lower body is removed it should be thoroughly cleaned.

1. Loosen the wing nuts and remove the lower body (6).
2. Thoroughly clean the tubes.



AIR CLEANER

1-Element upper seal. 2-Filter element. 3-Upper body seal. 4-Element lower seal. 5-Lower body gasket. 6-Lower body. 7-Lower body seal. 8-Dust collector cup.



FILTER ELEMENT WING NUT LOCKING RING

9-Locking ring.

3. While the lower body is removed for cleaning inspect the air cleaner inlet tube and remove any accumulation of dust.
4. Inspect the upper body seal (3) and lower body gasket (5), replace them if they are damaged, then install the lower body.

Filter Element:

1. Remove the dust collector cup and lower body.
2. Remove the wing nuts and the filter element (2).
3. Clean the filter element by using one of the methods in the topic, FILTER ELEMENT CLEANING.
4. Thoroughly clean all parts of the air cleaner. Inspect all replaceable seals (3) and (7) and gaskets (5) and replace with new ones if damaged.
5. Inspect the element. If upper seal (1), lower seal (4), or the element are damaged, install a new element.
6. Install the filter element and the filter element retaining wing nuts. Tighten the wing nuts securely to prevent dust from by-passing the air cleaner filter element.
7. Align the filter element retaining wing nuts so locking ring (9) will slip over the wing nuts when the lower body is installed to prevent the wing nuts from turning.
8. Make sure the upper body seal (3) and lower body gasket (5) are in place and install the lower body. Complete the assembly by installing the dust collector cup. This type of air cleaner requires no oil.

Filter Element Cleaning

Do not bump or tap the filter element in an attempt to clean it. The element ends and pleats can be damaged by such handling and can allow unfiltered air to enter the engine.

1. Clean the filter element using either dry air at a pressure below 100 psi, or clean water at a pressure below 40 psi. Do not use a nozzle on the water hose.

Some oily or sooty deposits can be removed by washing the element in a solution of warm water and a good household nonsudsing detergent, and then rinsing it in clean water.

2. Hold the hose at least an inch from the **clean side** of the element. Move it so the air or water stream is directed at a slight angle along the complete length of each pleat so as to flow through the pleats and loosen the dirt from the **dirty side** of the element.

Then, blow or wash the loose dirt from the "dirty side" of the element.

3. If necessary, repeat this procedure until the element is clean.
4. Thoroughly dry the element.
5. Thoroughly inspect the pleats, gaskets and seals. If the element is undamaged, wrap the element in heavy protective paper and store it in a safe place for future use as a replacement element.

Discard the filter element after cleaning it about 6 - 8 times.

Install a new element at least once a year.

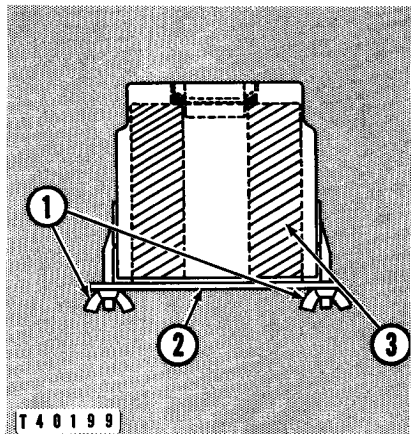
Starting Engine Dry Type Air Cleaner

Every 250 service hours, clean the element in the starting engine air cleaner. The element may have to be cleaned more often during dusty conditions or whenever hard starting and/or loss of speed and power is observed. To service the element proceed as follows:

1. Unscrew the wing nuts (1) which retain the assembly.
2. Remove the air cleaner cover (2) and the filter element (3).

STARTING ENGINE AIR CLEANER

1-Wing nuts. 2-Cover. 3-Filter element.



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3. Clean the element by directing clean dry air under pressure (not to exceed 100 PSI) against the inside of the element forcing air through the element to the outside.
4. While the filter is removed inspect and clean all parts of the cleaner before assembly.

If the element is damaged or if after cleaning, the engine is hard to start and/or loss of power has not been corrected, install a new Caterpillar element.

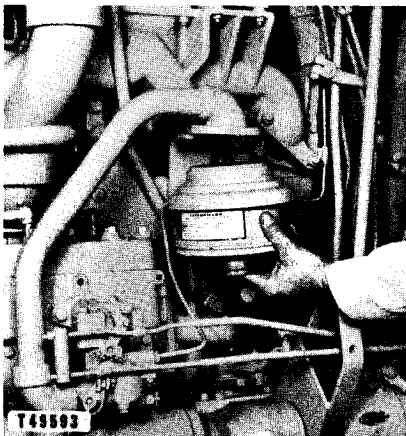
Replace the element at least once a year.

Starting Engine Oil Bath Air Cleaner

Inspect the Oil in the Starting Engine Air Cleaner Cup: Every 50 service hours, inspect the oil in the starting engine air cleaner cup. The air cleaner cup should be washed and refilled every 50 service hours or when the sediment is $\frac{1}{4}$ inch deep, whichever occurs first.

Wash Starting Engine Air Cleaner: Every 1000 service hours wash the starting engine air cleaner.

1. Loosen the screw clamp and remove the oil cup.
2. Remove the cleaner body by taking out the bolts at the top of the cleaner.
3. Wash the filter by shaking the air cleaner body in a pan of kerosene or some non-inflammable cleaning fluid.
4. Wash and refill the oil cup.
5. Assemble and install the air cleaner, but be sure the mating faces of the air cleaner and the cleaner pipe are clean, the gasket between them is in place and all connections are air tight.



**REMOVING STARTING ENGINE
AIR CLEANER**



WASHING THE CRANKCASE

Whenever the diesel or starting engine oil pan is removed for any reason it should be thoroughly cleaned before it is reinstalled. The oil pump screen should also be cleaned while the oil pan is off the engine.

FUELS

As a source of power the diesel engine has two outstanding advantages over the gasoline engine. The first is its lower rate of fuel consumption — and second its ability to use less expensive fuels. In selecting a fuel, it should be pointed out that distillates are especially desirable because, in refining, they are heated to a vaporous state and condensed in another container; thus, all the sediment and residue remain in the still. Always buy the **lowest priced distillate fuel giving satisfactory operation.**

In the United States and Canada, there are two general classes of fuel available for diesel engines. The American Society for Testing Materials (ASTM) has established these classes in their specifications. One class is that group of fuels marketed as fuel oil (domestic furnace oil); the other is that marketed as diesel fuel oil. No. 2 fuel oil and No. 2D diesel fuel oil are recommended for use in Caterpillar Diesel Engines. More expensive "premium" fuels such as No. 1 fuel oil and No. 1D diesel fuel oil are not necessary or recommended for normal operating conditions.

There is considerable variation in the composition of fuels distributed under the No. 2 grade classifications. For desirable engine service, it is most important to give special attention to pour point, cloud point, filterability, sulphur content and cetane number of the fuel.

Pour Point: The pour point of the fuel has no effect on engine performance, so long as the fuel is fluid enough to flow from the diesel fuel tank to the engine fuel transfer pump. The pour point of the fuel should be at least 10°F. below the lowest atmospheric temperature at which the engine must start and operate. This will generally provide a fuel that will flow readily from the fuel tank to the engine fuel transfer pump. In sub-zero (—18°C.) weather it may be necessary to use No. 1 fuel oil or No. 1D diesel fuel oil to obtain unusually low pour point fuels.

Cloud Point: Cloud point is a low temperature property frequently not reported in fuel characteristics. It is the temperature at which wax crystals become visible, and it is generally above the pour point of the fuel. The cloud point should be below the lowest atmospheric temperature at which the engine will be operated so the filter will not be plugged with the wax formation.

Filterability: A good clean fuel should contain no more than .1% sediment and water. Dirty fuels lead to early filter plugging and in addition, with some fuels, fuel stability and fuel compatibility can result in the formation of gums and resins which also reduce filter life.

Sulphur Content: As the sulphur content of the fuel increases, the oil change periods should be reduced as indicated in the topic, DIESEL ENGINE CRANKCASE LUBRICATING OIL CHANGE PERIODS.

Cetane Number: This is an indication of a fuel's ignition quality and should never be less than 35 for Caterpillar Engines. A higher cetane number is required at higher altitudes and for easier starting at low temperatures.

There is no world-wide standardization of diesel fuels and the ASTM classifications are not used in many export territories. Therefore, for best results, consult your Caterpillar dealer because he is familiar with fuels that are marketed in his particular area. He will be glad to advise you.

CARE OF THE FUEL SUPPLY

Keep the Fuel Clean: Too much emphasis cannot be placed on the importance of using only clean diesel fuel. It is important to buy clean fuel, and keep it clean. The best fuel can be rendered unsatisfactory by inadequate storage facilities or careless handling. The clearance between the fuel injection pump plunger and the barrel is very small, actually less than .0001 inch (0,00254 mm.), which makes it evident that the invisible particles of dirt which might pass through the filters can damage these finely finished parts.

Effort should be constantly expended to prevent contamination of the fuel. Important steps are to use clean containers and funnels and to reduce the number of times the fuel must be handled. When the fuel can be delivered by the distributor to fuel storage tanks and then pumped from the fuel storage tank to the diesel fuel tank, the handling is reduced to a minimum.

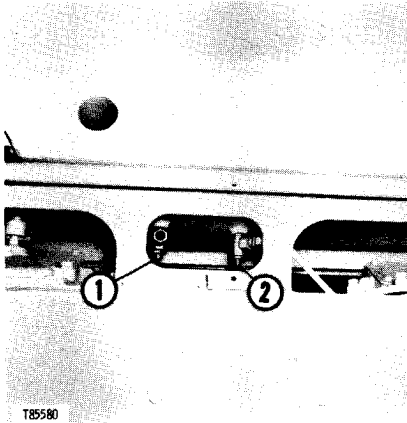
Since natural settling is an effective method of cleaning diesel fuel, the fuel should be allowed to stand at least 24 hours in the fuel storage tank after it has been filled before fuel is transferred to the diesel fuel tank. Be sure to drain all water and sediment that has settled to the bottom of the tank before the tank is refilled. Occasionally, drain all of the fuel and clean the tank thoroughly.

CARE OF THE DIESEL FUEL TANK

Diesel Fuel Tank: Fill the diesel fuel tank at the end of the day, because the incoming fuel will drive out the moisture-laden air and prevent condensation. The fuel level in the diesel fuel tank may be checked with the plunger gauge in the filler opening. Every 125 service hours before starting the engine, open the drain under the diesel fuel tank and drain off any sediment or water which may have accumulated. The strainer in the diesel fuel tank filler opening should be removed and cleaned regularly. Remove the retainer ring and lift out the strainer.

Diesel Fuel Tank Needle Valves: The diesel fuel tank drain needle valve (1) is opened by turning the needle counterclockwise approximately three turns or until tight. To close the needle valve, turn the needle clockwise approximately three turns or until tight. The diesel fuel tank fuel line needle valve (2) is opened or closed the same way.

On earlier tractors, turn either valve $\frac{1}{4}$ turn to open or close.



DIESEL FUEL TANK NEEDLE VALVES

- 1-Diesel fuel tank drain needle valve.
- 2-Diesel fuel tank fuel line needle valve.



Diesel Fuel Tank Filler Cap: The diesel fuel tank filler cap elements should be washed every 50 to 250 service hours depending upon the amount of dust in the air. To do this, remove the bolt and take out the baffle plate and gaskets. Wash the cap and elements in kerosene or some non-inflammable cleaning fluid. After the cap is washed pour a small amount of crankcase lubricating oil on the filter elements.

FUEL FILTERING SYSTEM

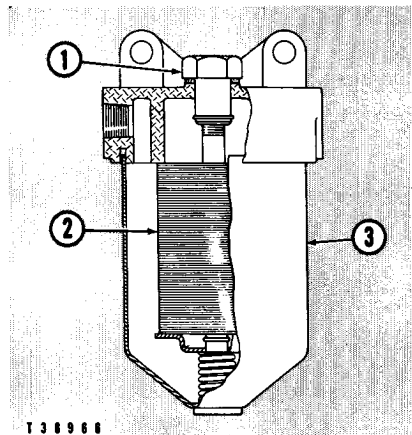
As the metallic filter element in the primary filter or the resin impregnated cellulose material type fuel filter elements in the fuel filter housing gradually become clogged with foreign material, the fuel gauge indicator will work back from its original position in the NORMAL range, to the CAUTION range and later into the OUT (red) range. When the indicator shows in the OUT (red) range, the metallic element should be removed and washed. If the indicator still shows in the OUT (red) range, the final fuel filter elements should be replaced. See the topic, FINAL FUEL FILTER.

Primary Fuel Filter

To remove the filter element (2), stop the engine and shut off the

PRIMARY FUEL FILTER

- 1-Nut. 2-Filter element. 3-Filter case.

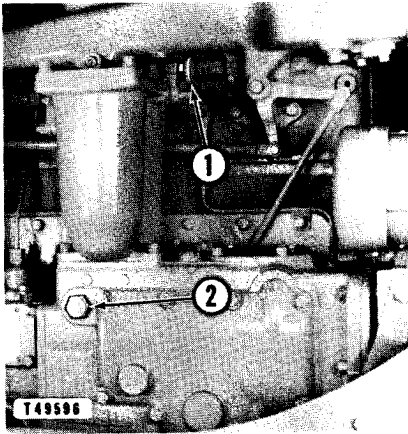


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diesel fuel line valve. Loosen the nut (1), on the filter cover and lower the case (3). Remove the element and wash in clean kerosene or diesel fuel. Replace the element.

Final Fuel Filter

Draining Fuel Filter Housing: Every 50 service hours, drain the filter housing of sediment and water which settles to the bottom of the compartment. Close the diesel fuel line valve located under the fuel tank, remove the filter housing drain plug (2) and open the vent (1) in the housing. Replace the drain plug and prime the system. See the topic, PRIMING THE FUEL SYSTEM.



DRAINING FUEL FILTER HOUSING

1-Vent. 2-Drain plug.



Fuel Filter Elements: When the elements have collected enough contamination to interfere with engine performance, they must be replaced with new elements. These elements will continue to collect particles until fuel will no longer flow through them at a rate to maintain maximum engine performance. They will not discharge their burden into the clean fuel.

The final fuel filter elements collect and hold contaminants and cannot be washed or otherwise restored.

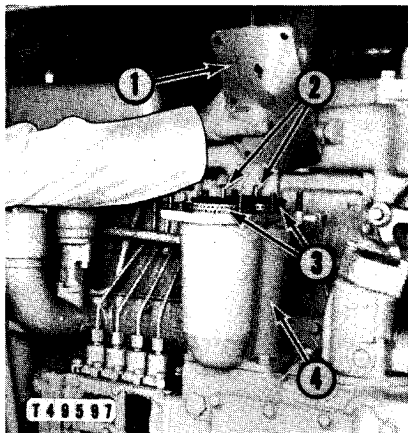
Removing Used Filter Elements: To remove the used filter elements, proceed as follows:

1. Close the diesel fuel line valve.
2. Remove the filter housing drain plug.
3. Open the vent in the filter housing.
4. Thoroughly clean the top of the cover and around the edges of the gasket joint between the filter housing and cover to prevent dirt dropping into the filter housing when it is removed.
5. Remove the cover from the filter housing.
6. Lift the filter elements out of the housing.

7. Lift the rods and rod springs out of the housing and thoroughly clean the inside of the housing.

Installing Filter Elements in Housing: To install the elements in the housing proceed as follows:

1. Replace the springs and then the rods (2) in the housing. Make certain the rod ends enter the drilled holes in the bottom of the housing and that the springs are piloted on the bosses of the housing and rods.
2. Place the filter elements (3) over the rods.



INSTALLING FUEL FILTER ELEMENTS

1-Cover. 2-Rods. 3-Elements. 4-Housing.



3. Place a new gasket on the filter housing.
4. Install the cover (1) on the housing (4), making certain that the rods enter the drilled holes in the cover.

Keep New Filter Elements on Hand: An extra set of filter elements should be kept on hand for replacement. Always keep the elements wrapped in their original cartons to insure against dust and dirt accumulation which will shorten the life of the elements if it gets on the outside or may cause damage to the fuel injection equipment if it gets on the inside.

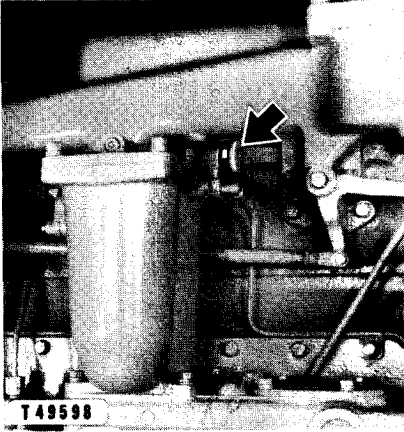
PRIMING THE FUEL SYSTEM

Any time the fuel flow is broken and air is allowed to get into the fuel system, the fuel system must be primed. If air is left in the lines, the fuel system may become air bound, resulting in inability to start the diesel engine or the misfiring of one or more cylinders.

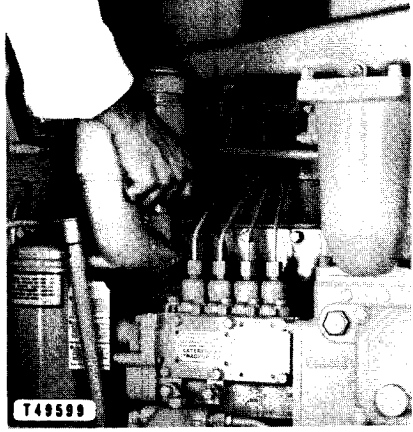
Priming the Fuel System: Priming the fuel system will allow the fuel transfer pump to force air and fuel through the fuel filters and the fuel injection pump vents if the engine is level. Prime the system as follows:

1. Check to see that the diesel fuel line valve is open.
2. Move the governor control lever to the stop position, so the fuel injection pumps are closed.

3. Move the compression release lever to the START position.
4. Start the starting engine, engage the starter pinion and clutch. Allow the starting engine to crank the diesel engine at starting engine low idle speed.
5. Open the fuel filter vent valve and fuel injection pump vents. When the flow of fuel from the vents is continuous and contains no air bubbles, close the vent valves.



FUEL FILTER VENT VALVE



FUEL INJECTION PUMP VENTS

6. Open and close the vent valves several times in succession to be sure all air is bled from the system.

FUEL INJECTION EQUIPMENT

When improper fuel injection is affecting the diesel engine operation, a systematic check should be made to determine the cause. The most likely cause is dirt or water in the fuel. Drain the sediment from the diesel fuel tank and drain the fuel filter housing. Check the fuel pressure gauge as mentioned in the topic, FUEL FILTERING SYSTEM. Replace the filter elements if necessary. Then prime the fuel system until clean fuel passes through the vents on the fuel injection pumps. If the fuel system is air bound, priming the system will overcome the difficulty.

When the engine is running irregularly, and smoking, a fuel injection valve may not be spraying the fuel properly.

As the clearance between the plunger and the barrel of a fuel injection pump increases, due to wear, fuel leakage occurs. When the leakage increases to the point where insufficient fuel is injected into the cylinder, a loss of power is noticeable. With the loss of power, hard starting is also encountered.

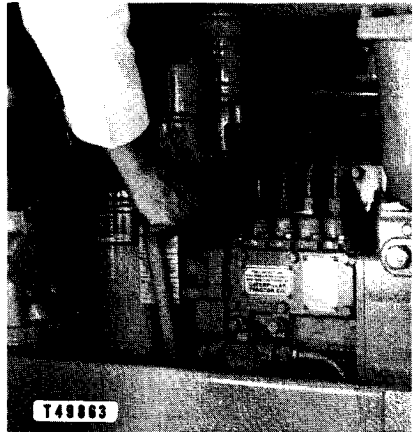
Fuel Injection Valves

Testing Fuel Injection Valves: Whenever an engine performs in such a manner that a fuel injection valve is suspected of causing trouble, test

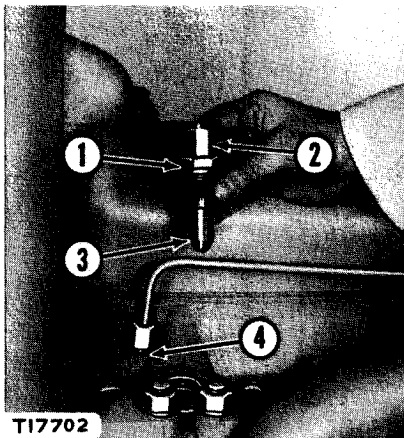
all fuel injection valves. To test the injection valves, loosen the fuel injection line nuts at the fuel injection pumps, one at a time, while the engine is running. When a nut is loosened and the exhaust smoking is completely or partially eliminated and the irregularity in running is not affected, this identifies the probable location of a defective valve, and a new one should be installed in that cylinder to definitely determine if the valve removed was defective.

Never wire brush or scrape a fuel injection valve nozzle assembly as this will damage the finely machined orifice. Your Caterpillar dealer has the proper tools for cleaning and testing fuel injection valves.

**LOOSENING FUEL INJECTION
LINE NUT TO TEST VALVE**

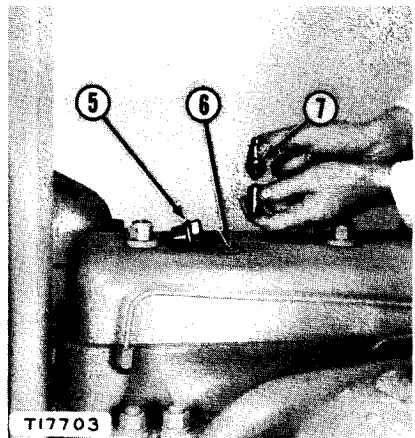


Removing Fuel Injection Valves: Before removing a valve clean the dirt from around the valve and connections.



**REMOVING FUEL INJECTION
VALVE**

1-Retainer nut. 2-Cover. 3-Fuel injection valve nozzle assembly. 4-Plug.



**INSTALLING FUEL INJECTION
VALVE**

5-Large seal. 6-Small seal. 7-Injection valve body.

Disconnect the fuel injection line from the injection valve and pump. Install the plug (4) and cover (2). Remove the valve retainer nut (1) and lift out the nozzle assembly (3) and body as a unit.

Installing Fuel Injection Valves: Before installation of a fuel injection valve, be sure the wrench is clean. Put the dust cover on the valve body as soon as possible to prevent dirt entering the fuel passage. Install the fuel injection valve in the following manner:

1. Screw the valve body (7) into the fuel injection valve nozzle assembly only finger tight. The threads of the body and nozzle assembly are made to fit loosely. The clearance between the threads provides a passage for fuel to enter the nozzle assembly from the body.
2. Insert the nozzle assembly and valve body as a unit into the pre-combustion chamber opening. Turning the body in a clockwise direction and at the same time pressing down will assure alignment of the serrations.
3. Install a new large seal (5) on the retainer nut. A light coating of lubricant on the seal will permit it to seat properly.
4. Tighten the retainer nut to torque of 100 to 110 pounds feet to prevent leaks between the nozzle assembly and the nozzle assembly seats.
5. Place a new small seal (6) over the threads on the top of the valve body and on the retainer nut.
6. Connect the fuel injection line and tighten the nuts.

Fuel Injection Pumps

Testing Fuel Injection Pumps: It is not usual for one pump on an engine to require replacement unless all the pumps are worn. Worn fuel injection pumps will result in loss of power and hard starting. When loss of power and hard starting is accompanied with a clear exhaust, good compression and no blow-by gasses from the crankcase breather it indicates fuel injection pumps may be worn. These pumps can be checked by your Caterpillar dealer.

When installing a new pump, see the instructions accompanying it. When installing a used pump that has been checked and found to be in satisfactory operating condition, see your Caterpillar dealer for installation instructions.

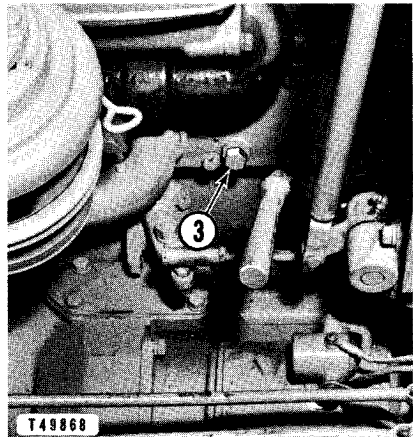
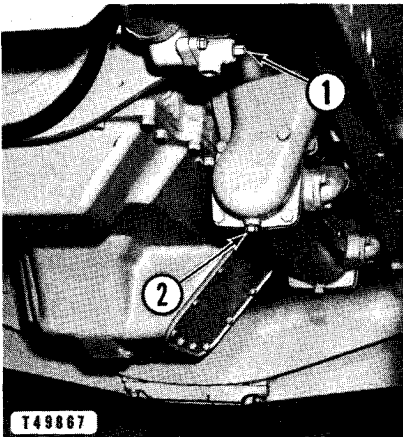
COOLING SYSTEM

Coolants: Water used in the cooling system should be soft, or as free as possible from scale forming minerals. If it is impossible to obtain soft water it is advisable to treat the available water with Caterpillar Rust

Inhibitor. The use of this rust inhibitor in the cooling system will prevent the formation of rust. It will also retard, and in some cases completely eliminate mineral deposits within the engine. Most commercial anti-freeze solutions contain rust inhibitors, therefore, it is not necessary to use rust inhibitor with those anti-freeze solutions which do contain rust inhibitor. Your Caterpillar dealer stocks Caterpillar Rust Inhibitor in convenient one quart cans. Directions for its use are printed on each can.

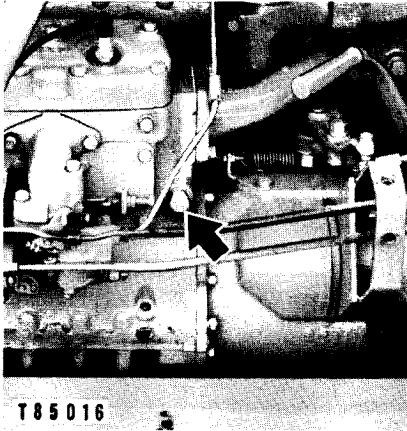
When the temperature is below freezing sufficient anti-freeze should be used in the cooling system to prevent freezing. Various anti-freeze mixtures such as ethylene glycol (Prestone, G.M., Permaguard, Zerex, etc.), denatured ethyl alcohol, methanol (synthetic wood or methyl alcohol) and glycerine are all suitable for use. Alcohol can be used successfully but, because it readily evaporates at the normal operating temperature of the diesel engine, the solution should be tested frequently — even daily — and kept up to correct strength. This loss by evaporation is objectionable **but the temperature regulators should not be removed.** Doing so might make the solution run cooler and save the alcohol, but is not desirable for good performance. It is essential, therefore, that the coolant be tested frequently to assure adequate protection.

Draining: The cooling system is drained by opening the radiator drain valve (1) in the radiator outlet elbow at the bottom of the radiator, removing the drain plug (2) in the transmission oil cooler, and removing the diesel engine cylinder block drain plug (3). On tractors effective with 48A2935, also remove the drain plug from the starting engine cylinder block. Draining should be done at the end of a day's run when all the material is in suspension and will drain with the liquid.



COOLING SYSTEM DRAINS

1—Radiator drain valve. 2—Transmission oil cooler drain plug. 3—Diesel engine cylinder block drain plug.



**STARTING ENGINE
CYLINDER BLOCK DRAIN PLUG**
(Tractors effective with 48A2935)



Cleaning the Radiator: Every 10 service hours clean dirt and trash from in between the tubes of the radiator which may cause excessively high operating temperature. This dirt may be easily removed by removing the bolts which hold the perforated guards in place. Then wash, brush or blow the dirt out with whichever method is available and most effective.

Cleaning the Cooling System: Wash the cooling system periodically. To wash, stop the engine when it is at normal operating temperature and drain as quickly as possible. Flush thoroughly, then fill with a solution of one pound of Oxalic Acid or Sodium Bisulfate per five gallons of water. Run the engine at operating temperature one-half to one hour, then drain and flush until water is clear. Fill with a solution of one-half pound of Sal Soda per ten gallons of water and run the engine ten minutes. Drain, flush and fill with water, adding corrosion inhibitor or the desired amount of anti-freeze.

Filling: To fill the cooling system, pour the coolant into the filler opening until the coolant level is even with the bottom of the filler opening pipe. When filling after draining or when excessive coolant has been lost, fill the cooling system, install filler cap, and run the engine at half speed for a period of 5 to 10 minutes to purge air from the cooling system. Check coolant level and if it has lowered, refill to the bottom of filler opening pipe.

The cooling system is equipped with a radiator top tank designed so as to trap air in the top of the tank when filling. This trapped air compresses, as the coolant expands due to heat, or is vented through a sealed pressure overflow valve. Because of this feature, the operator can fill the cooling system to the bottom of the filler opening pipe and automatically allow for coolant expansion.

PRESSURE CONTROL VALVE

The sealed pressure overflow unit should be cleaned every 1000 service hours to remove lime deposits and other accumulations which might hold the valve in the "open" position. Such deposits are not so noticeable where inhibitors are used in the cooling system, but, even so, regular cleaning of the unit should be encouraged.

To clean the unit, disassemble by removing the screws which hold the cover in position. Lift off the cover, then remove the seal assembly and brush the parts thoroughly until all of the foreign matter has been removed. **Caution: Do not wash the unit in any kind of cleaning solution because so doing may damage the seal.**

BELT ADJUSTMENT

Fan belts are equipped with a spring-loaded belt tightener, operate under the proper tension and require no adjustment. The generator belt should be checked for proper adjustment every 250 service hours.

If the belts are operated too loose, they will slap against the pulleys, causing unnecessary wear to the belts. If the belts are too tight, unnecessary stresses are placed upon the pulley bearings and belts, which may shorten the life of both.

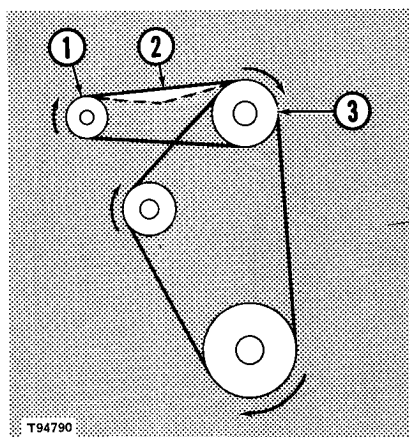
When a fan belt (or belts) need replacing, a matched set which is available from your Caterpillar dealer should be used. Always install a matched set—never only one.

Checking Generator Belt Adjustment

CHECKING GENERATOR BELT ADJUSTMENT

(Arrows Beside Each Pulley Indicate Direction of Rotation as Viewed From Front of Engine)

1-Pulley. 2-Correct generator belt adjustment allows approximately 9/16 to 13/16 inch (14 to 20 mm.) slack at this point. 3-Fan pulley.



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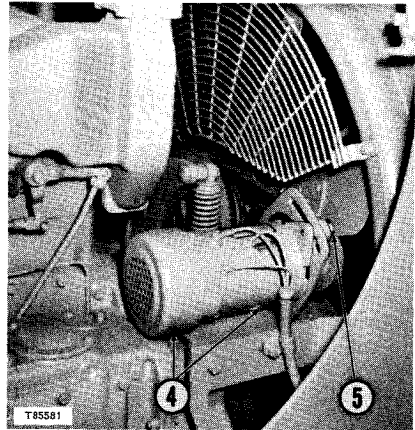
Correct adjustment exists when the belt can be pushed downward 9/16 to 13/16 inch (14 to 20 mm.) with approximately 25 pounds pressure exerted at (2) midway between the pulley (1) and the fan pulley (3).

Adjusting Generator Belt

Loosen the generator hinge bolts (4) and retaining bolt (5). Move the generator until the belt can be pushed downward $9/16$ to $13/16$ inch (14 to 20 mm.) with a force of approximately 25 pounds exerted midway between the pulleys. Tighten the retaining bolt and hinge bolts.

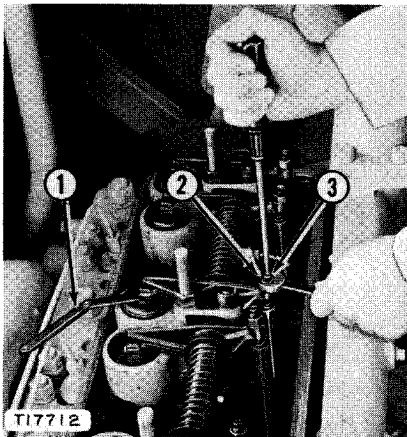
GENERATOR BELT ADJUSTMENT

4-Hinge bolts. 5-Retaining bolt.



DIESEL ENGINE VALVE CLEARANCE ADJUSTMENT

Check the valve clearance, adjust if necessary, every 1000 service hours with the engine stopped and the compression release in the RUN position. Turn the engine until the valve closes and the push rod is at its lowest point.



VALVE CLEARANCE ADJUSTMENT

1-Thickness gauge. 2-Locknut.
3-Adjusting screw.

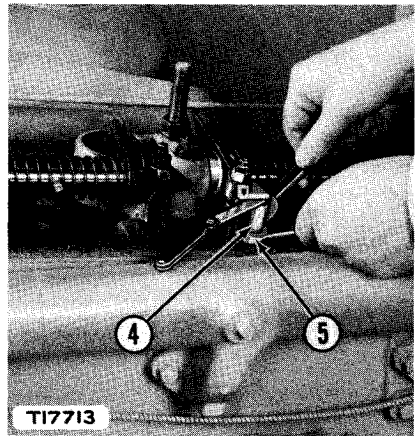


To Adjust: Loosen the valve adjusting screw locknut (2), turn the adjusting screw (3) to allow the thickness gauge (1) to pass between the top of the valve sleeve and the end of the valve rocker at the correct clearance. Set the clearance for the inlet valves at .016 inch (.41 mm.) and for the exhaust valves at .020 inch (.51 mm.). Tighten the adjusting screw locknut and check the adjustment.

After adjusting the clearance on the valves, and while the compression release lever is still in the RUN position, with the engine stopped, check the clearance between the upper end of the compression release push rod and the end of the valve rocker. This clearance should be .025 to .030 inch (0.64 to 0.76 mm.). To adjust, loosen the adjusting screw locknut (5) on the compression release push rod and turn the adjusting nut (4) until the

**COMPRESSION RELEASE PUSH
ROD ADJUSTMENT**

4-Adjusting nut, 5-Locknut.

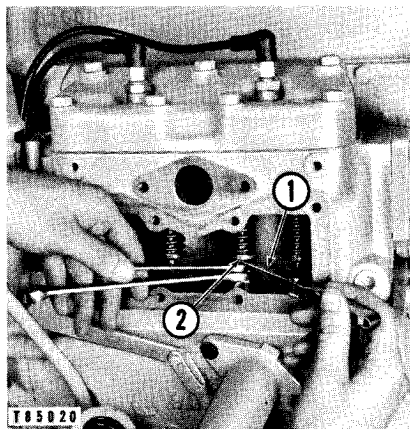


correct clearance is obtained. If the compression release push rod turns when adjusting, hold the push rod with a wrench on the two flat surfaces below the locknut. Recheck the adjustment after the locknut is tightened. Check this clearance every time the valve clearance is changed or checked.

Check Valve Rotators: Check the valve rotators with the engine running, after the valve clearance adjustment check has been made, to see if the valves rotate. The rotating of valves decreases carbon build up and uneven wear, thereby increasing the life of the valves. To check the rotation of the valves, observe the lines on the spring retainer through one of the three holes in the valve sleeve. If the valves do not turn the valve rotators should be replaced. See your Caterpillar dealer.

STARTING ENGINE VALVE CLEARANCE ADJUSTMENT

The valve clearance adjustment should be checked every 2000 service hours. To check the adjustment remove the carburetor and valve cover. The valve clearance check or adjustment should be made when the engine is cold. To check, crank the engine until the valve closes and the valve-lifter is at its lowest position.



STARTING ENGINE VALVE CLEARANCE ADJUSTMENT

1-Thickness gauge. 2-There should be .008 inch (0.2 mm.) clearance at this point.



To Adjust: Turn the adjusting screw until there is .008 inch (0.2 mm.) clearance at (2) between the adjusting screw and the end of the valve stem. Check this clearance with a thickness gauge (1).

STARTING ENGINE IGNITION AND FUEL SYSTEMS

The starting engine ignition system and fuel system must be maintained in good condition to obtain maximum performance and easy starting, especially in cold temperatures. The carburetor, spark plugs, and magneto contact points should be kept clean and properly adjusted. These components should be serviced when starting and performance are affected. More frequent service will be required in conditions of high humidity which causes condensation and corrosion, or conditions of frequent and extended use of the starting engine such as cold weather and intermittent diesel engine operation. When the starting engine is used at short, infrequent intervals in warm weather and dry climates, less frequent service may be required.

Starting Engine Fuel System

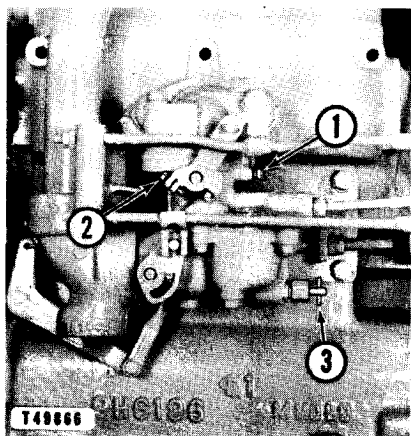
Keep the starting engine fuel tank filled with a good grade of clean gasoline to prevent moisture condensation. Periodically clean the fuel filter bowl of any sediment or water accumulation.

Occasionally remove the drain filter from the bottom of the carburetor air inlet tube and inspect the element. Replace the element if it is deteriorated.

Carburetor Adjustment: To make a preliminary adjustment after disassembly, turn both needles in gently against their seats. Then open main

jet needle (3) one turn and idling jet needle (1) one-half turn, and start the starting engine. When the engine is warm, make final adjustments as follows:

1. With the engine operating at full governed speed, turn main jet needle (3) in to make the mixture leaner, or out to make it richer, until the engine delivers the greatest amount of power with a clear exhaust.
2. With the throttle control in idling position, adjust the idling speed by turning idling speed screw (2) to the right to increase speed, or to the left to decrease speed.
3. With the engine operating at idle speed, turn idling jet needle (1) in to make the mixture leaner, or out to make it richer, until the engine idles smoothly without emitting black smoke from the exhaust. Readjust idling speed if necessary.



CARBURETOR ADJUSTMENT

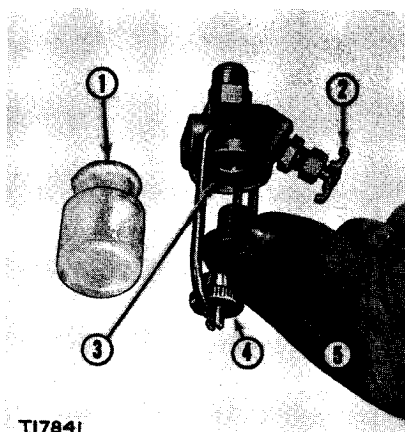
1-Idling jet needle. 2-Idling speed screw. 3-Main jet needle.



Starting Engine Fuel Filter: To service the filter, close valve (2) and unscrew nut (4) which clamps bowl (1) in place. Swing aside the bail and remove the bowl. Then unscrew filter element (5). Clean the element

STARTING ENGINE FUEL FILTER

1-Bowl. 2-Valve. 3-Gasket. 4-Nut.
5-Filter element.



by shaking it in kerosene or a nonflammable cleaning fluid, and install it. Clean and install the bowl, using a new gasket (3) if necessary.

Starting Engine Ignition System

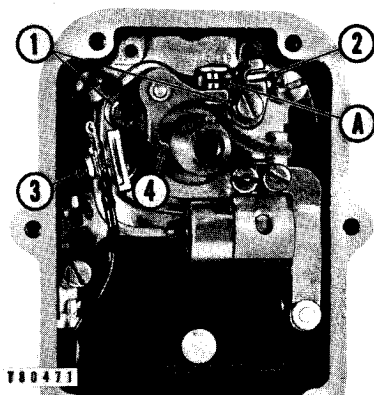
Spark Plug Adjustment: To adjust the spark plug gap, bend the outer electrode only. The correct gap is approximately .030 inch (.76 mm.).

Magneto Bearings: The bearings are packed with a ball and roller bearing grease when assembled and are repacked only when magneto is reconditioned.

Magneto Contact Points: Remove the magneto cap and rotor, using care to avoid damage to the gasket or parts. Clean the cap and rotor thoroughly, using a soft cloth dampened with a nonflammable cleaning fluid. Inspect the contact surfaces of the points, clean if necessary, and adjust the gap (A) to .015 inch (.38 mm.). To adjust the gap:

1. Crank the engine until the contact point bumper block (4) is at the highest elevation on one of the cam lobes.
2. Loosen the adjustable contact point bracket fastening screws (1).
3. Insert a screwdriver in slot (2) and move the contact point bracket to adjust the gap.
4. Tighten bracket fastening screws (1) and recheck the gap.

To remove the contact points, remove spring clamp screw (3) and bracket fastening screws (1).



MAGNETO CONTACT POINTS

- 1-Bracket fastening screws. 2-Slot.
3-Spring clamp screw. 4-Contact
point bumper block. A-Gap.



Testing: A magneto can be tested when coupled to the engine. Remove the cable from a spark plug (rotate the terminal to facilitate removal), insert a 1/4 inch (6 mm.) bolt or similar metal object into the terminal to contact the wire, and hold the terminal so the end of the bolt is 1/8 inch (3.17 mm.) away from the metal base of the spark plug. Turn the magneto switch ON and crank the engine. If no spark occurs between the bolt and the spark plug base, disconnect the switch wire from the ter-

minal on the magneto and test again. If a spark now occurs with the switch wire removed, the wire from the magneto to the switch has become grounded or the switch requires replacement. If, with the switch wire off, the magneto still does not fire, remove the magneto as instructed in the next paragraph and take it to your Caterpillar dealer for testing.

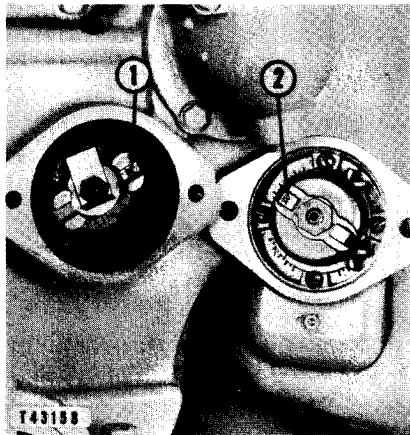
To Remove the Magneto for Testing: Disconnect the cables from the magneto. Tag or mark the cables for assembly identification. Remove the two bolts that hold the magneto to the timing gear cover and lift off the magneto.

To Time the Magneto to the Engine:

1. Locate the "X" mark (1) on the starting engine magneto drive.
2. Turn the magneto impulse coupling until the "X" mark (2) on the tang will line up with the mark on the magneto drive.
3. Install the magneto with the "X" marks together and tighten the bolts.

TIMING MARKS

1-Mark "X" on magneto drive. 2-Mark "X" on the impulse coupling tang.



To Install Magneto Wires:

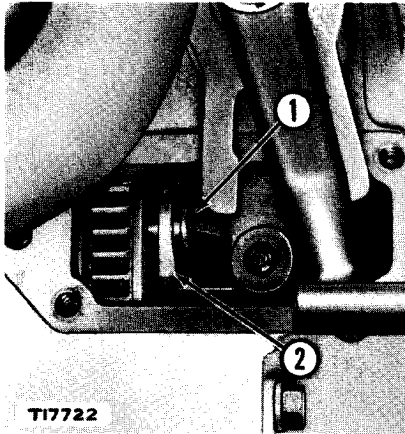
1. Place the spark plug wire from No. 1 cylinder (the cylinder farthest away from the flywheel) into the No. 1 wire receptacle of the magneto cap.
2. Install the other spark plug wire.
3. Reconnect ground wire.

STARTING ENGINE CLUTCH

To Test the Adjustment: Pull the clutch lever to the engaged position. The lever should go into this position with a distinct snap, and should require a reasonably hard pull. The clutch should be checked every 500 service hours for proper adjustment.

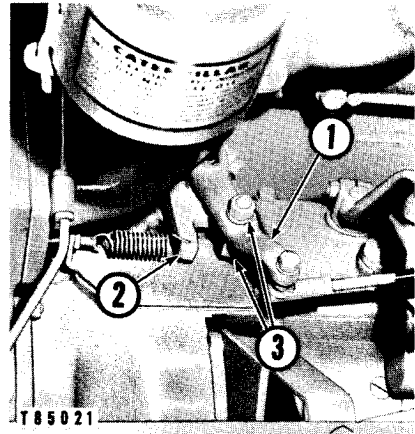
To Adjust: Remove the plate from the top of the clutch compartment. Turn the clutch adjusting collar (2) until the lock pin (1) is accessible. Pull the lock pin out and turn the collar to the right until the lock pin drops into the next hole.

Test the adjustment by engaging the clutch. If one hole gives a slightly loose adjustment and the next gives too tight an adjustment, use the looser adjustment.



**STARTING ENGINE CLUTCH
ADJUSTMENT**

1-Lock pin. 2-Adjusting collar.



**STARTING ENGINE CLUTCH AND
PINION CONTROL LEVER ADJUSTMENT**

1-Starting engine pinion control lever.
2-Clutch control lever.
3-Block and nut.

Clutch and Pinion Control Lever Adjustment: The clutch and pinion control lever should be checked every 500 service hours for proper engagement of the starting engine clutch and pinion. Failure to check this adjustment may result in the clutch being engaged before the pinion is engaged with the flywheel ring gear or excessive clutch slippage. After the starting engine clutch has been tested for proper adjustment the control lever adjustment may be checked by grasping the control lever (1) and engaging the clutch and pinion. With control lever and lever (2) held as far toward the front of the engine as it will go, measure the gap between the flat on the block (3) and the finished flat, nearest the front of the engine, on the lever (2). The clearance should be 1/64 to 1/32 inch (.40 - .80 mm.) for correct adjustment.

If the clearance is greater or less than 1/64 to 1/32 inch (.40 - .80 mm.) the correct clearance should be obtained as follows:

1. Move the clutch lever (2) toward the front of the engine until the clutch snaps into engagement.
2. Remove the nut and block (3) from the pinion control lever (1).
3. Engage the pinion by moving the lever (1) toward the front of the engine until the latches hold the pinion in engagement.

4. Assemble the nut and block to the lever and rotate the block until a flat on the block has 1/64 to 1/32 inch (.40 - .80 mm.) gap between it and the finished flat nearest the front of the engine on the clutch lever, when both the clutch and pinion control levers are as far toward the front of the engine as they will go.

Pinion Engagement Adjustment

The starter pinion should turn only after it is engaged with the diesel engine flywheel ring gear and the starting engine clutch is engaged.

Occasionally the ring gear of the diesel engine may be positioned so as to have the pinion teeth butt against the ring gear teeth, making engagement impossible.

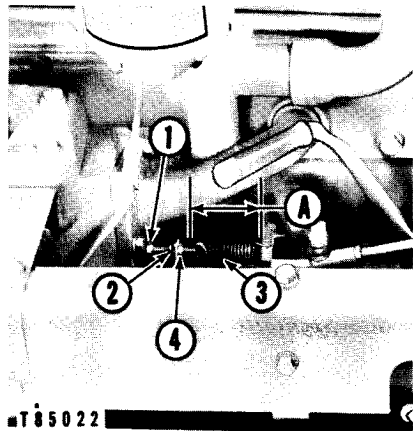
To remedy this problem, an adjustable spring (3) is attached to the clutch lever for the purpose of maintaining a light load on the starting engine clutch. This will provide a slight spinning or indexing motion to the pinion gear as it is engaged or disengaged.

If the spring tension is too great, the clutch will be too heavily loaded and produce a definite gear clashing whenever engagement is attempted. To reduce the spring tension on the clutch lever when gear clashing occurs, proceed as follows:

1. Loosen locknut (4) while holding bolt (1).
2. Turn adjusting nut (2) in the direction to reduce distance (A).
3. Tighten locknut (4) while holding bolt (1).
4. Start the starting engine.
5. Quickly engage the starting engine pinion with the diesel engine ring gear. A rapid motion is required.
6. Readjust if necessary.

PINION ENGAGEMENT ADJUSTMENT

1-Bolt. 2-Adjusting nut. 3-Adjustable spring. 4-Locknut. A-Distance between ends of spring.



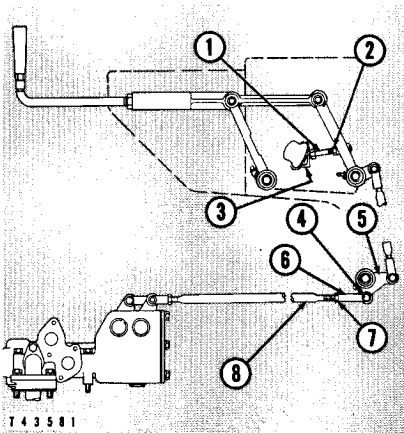
With insufficient spring tension, the pinion may not turn; if one butt engagement occurs, it may continue to occur on successive engagement attempts. If butt-engagement continues to occur on successive attempts, the spring tension must be increased.

STEERING CLUTCHES AND BRAKES

The steering clutches are hydraulically actuated and require no adjustment. There is a steering clutch linkage adjustment and a steering clutch brake adjustment.

Steering Clutch Linkage Adjustment: Every 2000 service hours the linkage between the control levers and the hydraulic control should be adjusted as follows:

1. Remove the pins (4) from the linkage lever (5) and loosen the locknut (7) on the control rod end (6).
2. With the steering clutch control levers in the full forward position, move the control rods (8) forward to take up clearance in the linkage. After clearance is removed from the linkage, spring resistance will be felt. **Do not** move the rods forward to the extent that the spring in the steering clutch hydraulic control valve is compressed.
3. Adjust the rod end on the control rod so the pin can be easily installed in the rod end and linkage lever (5), then turn the rod ends one-half turn clockwise to shorten the reach of the rod and install the pins.

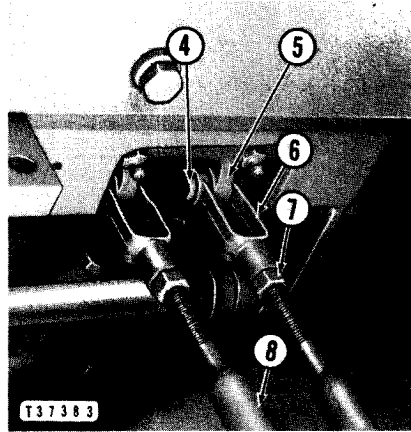


SCHEMATIC OF STEERING CLUTCH LINKAGE ADJUSTMENT

1-Stop bolt. 2-Stop bolt locknut. 3-Bumper mounting angle. 4-Pin. 5-Linkage lever. 6-Control rod end. 7-Locknut. 8-Control rods.



4. Loosen the stop bolt locknut (2).
5. Pull the steering clutch control lever to the rear as far as it will go and hold. Turn the stop bolt (1) in (clockwise) until there is clearance between the stop bolt and the bumper mounting angle (3). At this point the hydraulic control is preventing further movement of the control lever. Hold the lever in this position until step 6 is completed.



STEERING CLUTCH LINKAGE ADJUSTMENT

1-Stop bolt. 2-Stop bolt locknut. 3-Bumper mounting angle. 4-Pin. 5-Linkage lever. 6-Control rod end. 7-Locknut. 8-Control rods.

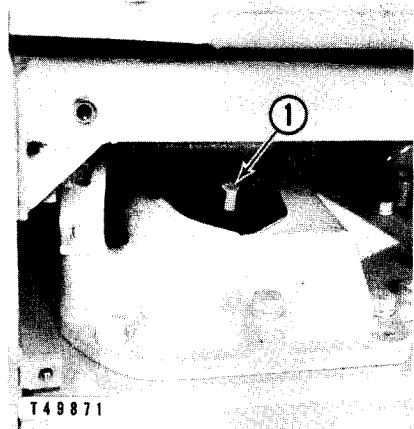
6. Turn the stop bolt out (counterclockwise) until it contacts the angle (3) then turn it an additional 1/2 turn. Release the control lever and lock the stop bolt with the locknut.

Steering Clutch Brake Adjustment: Every 250 service hours check and adjust the steering clutch brakes as follows:

1. Remove the brake adjusting screw cover, taking care not to damage the gasket.

STEERING CLUTCH BRAKE ADJUSTMENT

1-Adjusting screw.



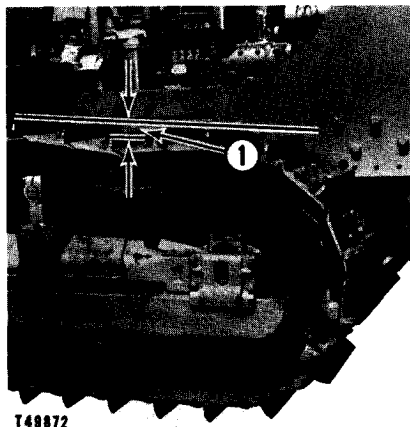
2. Turn the adjusting screw (1) in (clockwise) until the brake band is tight on the brake drum.
3. Turn the adjusting screw out (counterclockwise) 1 turn to provide proper clearance between the brake lining and the brake drum.

TRACKS

Proper care of the tracks, especially when operating the machine under adverse conditions, will greatly extend their service life.

After operating in mud or slush and below freezing temperatures are anticipated, park the machine on solid dry ground, planks, logs or brush to prevent the machine from freezing to the ground. Snow or mud should also be cleaned from around the track links, sprockets, idlers, rollers, and guards to prevent freezing of the tracks.

The tracks should be operated without tension, to avoid undue wear of moving parts. When properly adjusted, there should be no less than 1 to 1½ inches (2.5 to 3.8 cm.) slack measured at a point half way between the carrier roller and front idler as shown at (1). Looser adjustment may be required to prevent tension on the tracks when operating in material which will pack around the track parts and between pins and bushings.



T48872

CHECKING TRACK ADJUSTMENT

1—There should be 1 to 1½ inches (2.5 to 3.8 cm.) sag at this point.



Machines Effective With 48A4242

To Adjust: If the slack or sag in the track is greater than 1½ inches (38 mm.), proper adjustment can be obtained by proceeding as follows:

1. Raise the inspection plate on the track roller frame guard.
2. Apply ball and roller bearing lubricant, with a grease gun, into the fill valve (4) until the track is at the correct adjustment.
3. Operate the machine backward and forward to equalize the adjustment.
4. Recheck the adjustment.

As continued track adjustment becomes necessary through service, the following precaution should be observed to prevent damage. Do not attempt to make an adjustment if the minimum measurement at (2) is less than 4 inches (10.16 cm.). When this limiting measurement is reached, see your Caterpillar dealer for track reconditioning service.

To Loosen Track Adjustment: If the track is too tight, release some of the pressure in the hydraulic track adjuster cylinder, with caution, as given in the following steps:

1. Remove all dirt, sticks and other debris that may prevent retraction of front idler.

WARNING

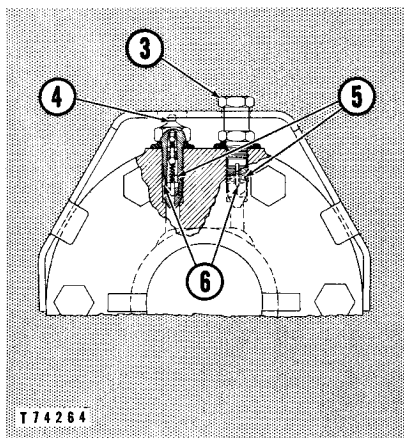
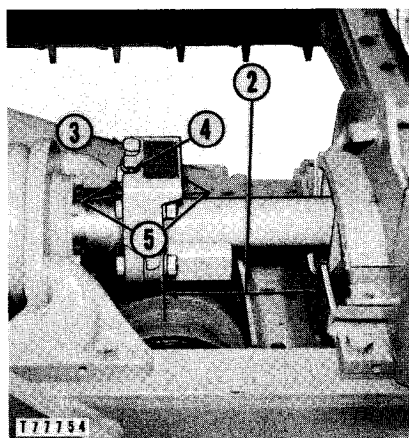
Because of the high pressure in the track adjuster cylinder, never visually inspect the relief valve (3) or the fill valve (4) to see if grease is escaping. Always observe the track to see if it has loosened.

2. Turn the relief valve (3) one turn counterclockwise and allow grease to escape from vent hole (5) just below the relief valve.
3. Tighten the relief valve when more than 1½ inches (38 mm.) slack or sag has developed in the track.

Adjust to obtain correct slack or sag in the track.

If the track does not loosen in the above procedure, proceed as follows, in order, as needed.

1. Turn the fill valve (4) one turn counterclockwise and allow grease to escape from vent hole (5) just below the fill valve.
2. Start the machine and move backward and forward slightly.
3. Loosen the relief valve until the lower hexagonal shoulder contacts the underneath side of the guard. This will expose the unthreaded portion between the upper and lower threaded sections of the relief valve, allowing grease to escape through the slot (6) in the lower section of the threads.



ADJUSTING TRACK WITH BALL CHECK TYPE HYDRAULIC TRACK ADJUSTER
 (Guard removed for illustration purposes).
 2-Minimum measurement. 3-Relief valve. 4-Fill valve. 5-Vent holes.
 6-Slot in lower section of thread.

4. Loosen the fill valve until the hexagonal shoulder contacts the underneath side of the guard. This will expose the unthreaded portion between the upper and lower section of the fill valve, allowing grease to escape through the slot (6) in the lower section of threads.
5. Tighten the relief valve and/or fill valve when more than 1½ inches (38 mm.) slack or sag has developed in the track.

Adjust to obtain correct slack or sag in the track.

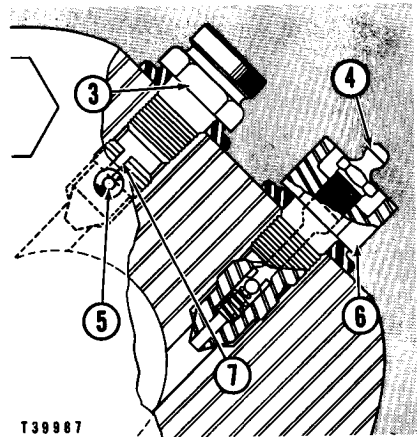
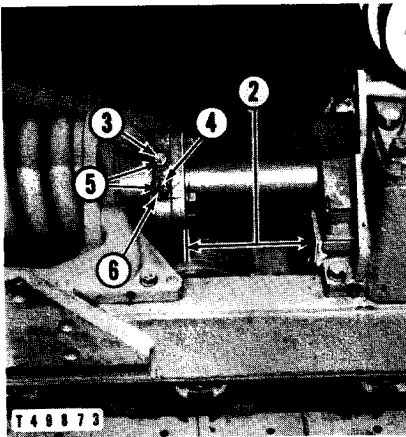
See your Caterpillar dealer if pressure cannot be relieved by following the above procedure.

Machines Before 48A4242

To Adjust: If the slack or sag in the track is greater than 1½ inches, proper adjustment can be obtained by proceeding as follows:

1. Raise the inspection plate on the track roller frame guard.
2. Apply ball and roller bearing lubricant, with a grease gun, into the fitting (4) until the track is at the correct adjustment.
3. Operate the machine backward and forward to equalize the adjustment.
4. Recheck the adjustment.

As continued track adjustment becomes necessary through service, the following precaution should be observed to prevent damage. Do not attempt to make an adjustment if the minimum measurement at (2) is less than 4 inches (10.16 cm.). When this limiting measurement is reached, see your Caterpillar dealer for track reconditioning service.



ADJUSTING TRACK WITH BALL CHECK TYPE HYDRAULIC TRACK ADJUSTER
(Guard removed for illustration purposes.)

- 2-This measurement should not be less than 4 inches (10.16 cm.). 3-Relief valve.
4-Fitting. 5-Vent holes. 6-Ball check assembly. 7-Slot in lower section of threads.

To Loosen Track Adjustment: If the track is too tight, release some of the pressure in the hydraulic track adjuster cylinder, with caution, as given in the following steps:

1. Turn the relief valve (3) one turn counterclockwise and allow grease to escape from the vent hole (5) just below the relief valve. If grease does not appear when this relief valve is backed off one turn, proceed to turn the ball check assembly (6) one turn counterclockwise. If grease does not appear at either vent hole and the vent holes appear to be open and the track appears to have tension, the machine should be started and moved forward slightly.

WARNING

If loosening both the relief valve and the ball check assembly one turn does not relieve track tension, then continue loosening the relief valve until the unthreaded portion between the upper and lower threaded section is exposed. Grease should then relieve through slot (7) in the lower section of threads.

2. Tighten the relief valve and ball check assembly when sufficient slack has developed in the track.
3. Check the adjustment.
4. Repeat the above steps until the adjustment is correct.

Two Position Idler:

The tractor is equipped with a two position idler. The high position can be used successfully for practically all types of work. The low position is used when the tractor is performing fine grading or finishing work. The idler will be set in the low position when leaving the factory unless otherwise specified. For further information, see your Caterpillar dealer.

FINAL DRIVE SPROCKET HUB BEARINGS

On a new or reconditioned machine, check the sprocket hub bearing adjustment if leakage is noted before the first 125 service hours operation, and every 125 service hours during the first 500 service hours operation. Thereafter check the adjustment every 1000 service hours.

To check, stop the machine on a firm, flat surface and be sure the sprocket is free of any weight. Then pry between the track roller frame and the sprocket with a four or five foot bar. If the sprocket moves, bearing adjustment is required.

When adjustment is required, contact your Caterpillar dealer.

WASHING GEAR COMPARTMENTS

Washing the Final Drives: Remove the drain plugs from both cases after a run, when the oil is warm, and allow the old oil to drain. Replace the plugs and fill the compartments to the proper level with kerosene or clean diesel fuel. Drive the tractor back and forth for five minutes. Drain the cleaning fluid, replace the drain plugs and refill the final drives with fresh lubricant as instructed in the LUBRICATION INSTRUCTIONS section of this book.

Washing the Starting Engine Transmission: The starting engine transmission should be washed every 1000 service hours. Open the drain valve after the starting engine has been turning the transmission gears and has warmed the oil. After the oil has drained, close the drain valve and fill the compartment to the proper level with kerosene or clean diesel fuel. Set the starting and diesel engine controls in the positions as outlined in the topic, STARTING THE ENGINES, then start the starting engine and engage the starting engine clutch and pinion. Allow the starting engine to turn the diesel engine for several minutes. Disengage the starting engine clutch, stop the starting engine and open the transmission drain valve. After all the cleaning fluid has drained, close the drain valve and fill the transmission with fresh oil to the correct level as instructed in the LUBRICATION INSTRUCTIONS section of this book.

ELECTRICAL SYSTEM

The basic electrical system is composed of the following:

1. Battery.
2. Generator.
3. Generator regulator.
4. Wiring.

These components function together to produce and store electricity for the electrical equipment on the machine and each is dependent upon the others for satisfactory operation. In the event of failure or improper operation it is essential to check the entire electrical system, as a defect in one component can cause damage to another.

The topics which follow describe the proper maintenance of the components to assure satisfactory operation of the electrical system.

Battery

Every 50 service hours, or more often when continuous operation without the use of the battery is encountered, the following attention should be given to the battery to insure high efficiency and maximum operating life.

Testing: The battery should be tested with a hydrometer and kept to a specific gravity of 1.250 or above. Always test a battery for state of charge before adding water. A dangerously low point of charge is indicated by a hydrometer reading of 1.150 or less which will permit the

battery to freeze at temperatures only a few degrees below the freezing point of water.

When the specific gravity difference between cells of the battery exceeds .025, it indicates the battery may soon need replacing.

Water Addition: The electrolyte level should be maintained $\frac{3}{8}$ inch (9.5 mm.) above the separators or insulators by addition of distilled water or "approved water" (water free from impurities by analysis). Do not overfill or underfill the cells of the battery as either has a detrimental effect on battery life.

Charging: The charging rate is correct when the battery maintains a minimum specific gravity of 1.250 and does not require the addition of more than 1 ounce of water per cell per week or 50 service hours.

When there is evidence of either overcharging or undercharging, the cause should be found and corrected as soon as possible to protect the service life of the battery. See the topics, GENERATOR, GENERATOR REGULATOR and WIRING.

Cleanliness: Keep the top of the battery clean and dry to prevent current losses and keep the terminals clean and tight. To clean corrosion from the battery terminals, scrub them with a weak solution of bicarbonate of soda (baking soda) and water. Dry the battery thoroughly, then coat the terminals with lubricant to prevent corrosion. Keep the battery securely fastened in its compartment at all times.

Installation: When installing a battery in its compartment, fasten it securely and be sure to attach the cables to the correct battery terminals. Incorrect grounding of the battery will reverse the polarity of the electrical system and cause damage to the generator regulator. See the topic, GENERATOR REGULATOR.

Generator

Never operate a generator with an open circuit between it and the battery.

General Reconditioning: Every 2000 service hours, the generator should be removed and the commutator and brushes checked for glaze or darkening. At the same time the generator should be completely disassembled, washed and have all worn parts replaced. It is suggested that this cleaning and reconditioning be entrusted to your Caterpillar dealer.

Generator Removal: Remove all wires from the generator and tag them so that they may be connected correctly when the generator is reinstalled. Remove the bolts or stud nuts that hold the generator in position and lift off the generator.

Generator Installation: Whenever a generator is installed, or reconnected to the generator regulator, it must be polarized **before** starting the engine. Follow the instructions carefully to prevent damage to the generator, generator regulator, or both, due to incorrect polarizing.

1. Place the generator in position and install the bolts or stud nuts.

2. Connect all wires to the generator, regulator and battery. See the topic, WIRING.
3. Polarize the generator.

Polarizing Generator: Turn the disconnect switch ON. Connect a jumper wire momentarily between the regulator terminals marked BAT and GEN.

Make sure all connections are clean and tight. See the topics, BATTERY, GENERATOR REGULATOR and WIRING.

Generator Regulator

The generator regulator is adjusted at the factory for average operating conditions. The regulator may have to be readjusted to provide the proper charging rate for the particular operating conditions of the machine. In case of failure of either the regulator or generator, both units should be taken to your Caterpillar dealer, where the output of the generator can be checked and the regulator adjusted accordingly.

Charging Rate: The normal function of the generator regulator is to adjust the generator charging rate by sensing the electrical system voltage. As the battery becomes fully charged, voltage rises and the charging rate should drop until the ammeter indicates a rate only perceptibly above zero.

When improper charging of the battery is encountered, the entire electrical system should be carefully checked. Loose or dirty connections, worn or broken wires, or a faulty generator can prevent a good regulator from functioning properly. See the topics, BATTERY, GENERATOR, and WIRING.

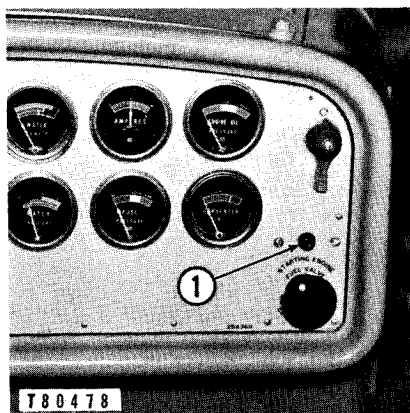
Polarity: Electrical systems may have either the positive or negative battery terminal grounded. When connecting the battery be sure to ground the same battery terminal that was originally grounded. On new installations or where the battery grounding is questioned, check the generator regulator to determine the polarity of the system. The battery must be grounded as indicated on the regulator or damage will result.

The voltage and polarity of the electrical system are marked either on the cover or on the base of the regulator near a mounting hole. These marks may appear in any of the following forms: "12 VOLTS - NEGATIVE GROUND," "12V - NEG," or "12 V N." Similar marks are used for other voltages and for POSITIVE ground systems.

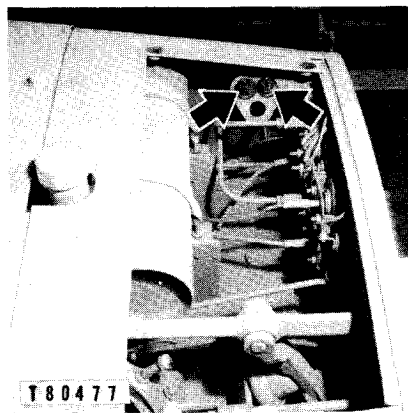
Wiring

The wiring forms an important part of the electrical system and care should be used to protect it from damage. On later machines, the wiring is enclosed in conduit. When the electrical system is being serviced, check the wiring for loose or dirty connections, worn insulation or broken wires. Inspect the battery terminals and cables. Poor connections or wiring can cause trouble or damage in other parts of the electrical system. See the topics, BATTERY, GENERATOR and GENERATOR REGULATOR.

The wiring is protected by a manual reset circuit breaker located on the instrument panel. The circuit breaker is reset by pressing in on the button (1). On machines equipped with lights, separate fuses are also used for front and rear lights. The fuses are located on a bracket behind the light switch and are accessible by removing the plate from the top of the dash.



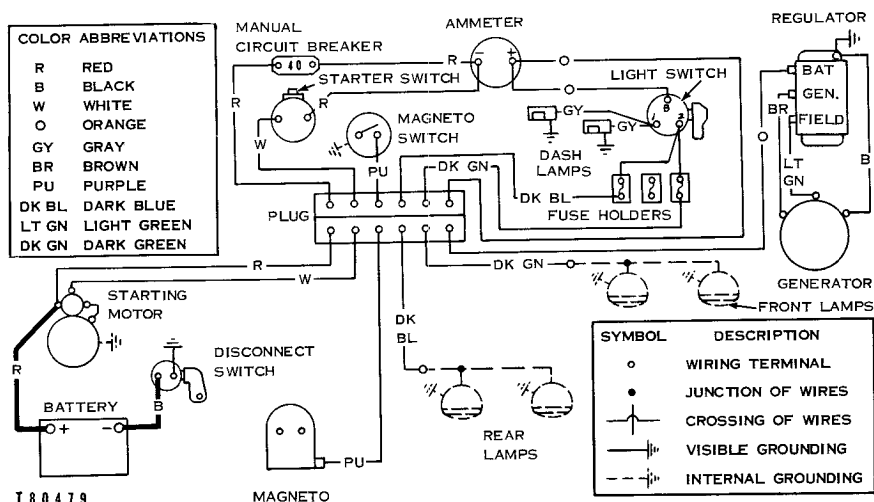
CIRCUIT BREAKER
1-Button.



LOCATION OF FUSES

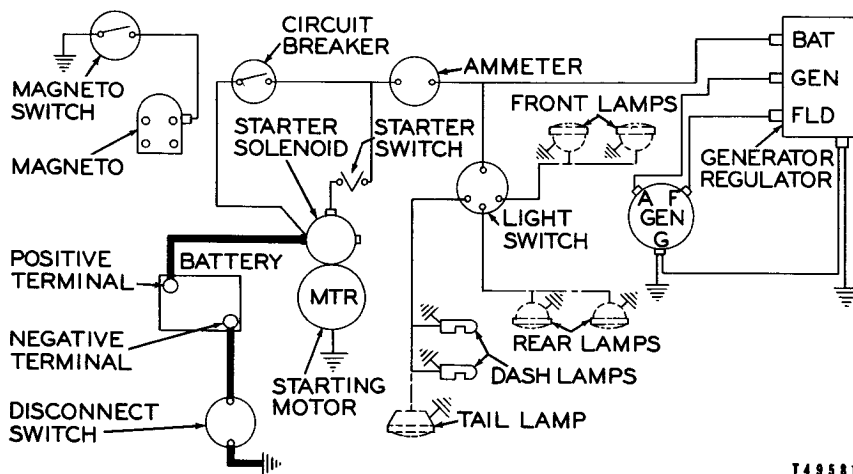
If the flow of current is shut off by any of the protective devices, the wiring should be carefully inspected to determine the cause. When replacing a damaged fuse, always use a new fuse having the same capacity as the original fuse.

Wiring Diagrams: The diagrams are furnished so that when it becomes necessary to disturb the electrical equipment for purpose of recondition-



12 VOLT DIAGRAM WITH CONDUIT WIRING

The dotted lines indicate the connections for lighting groups that are available as attachments.



12 VOLT DIAGRAM WITHOUT CONDUIT WIRING
 The dotted lines indicate the connections for lighting groups
 that are available as attachments.

ing or parts replacement, reassembling may be accomplished without difficulty.

The battery terminal to be grounded is determined by the generator regulator. See the topic, GENERATOR REGULATOR.

ELECTRIC STARTER

Cleaning Electric Starter: No periodic service is indicated for the electric starter brushes between general reconditioning periods. The brushes should only be inspected after removal of the starter from the engine and removal of the commutator end bearing frame.

General Reconditioning: Approximately every 4,000 service hours, the starter should be removed so that it may be completely disassembled, washed and have all parts replaced that show evidence of being unsatisfactory for reason of wear. Do not use a degreaser or high temperature cleaning method when cleaning parts of the starter or overrunning clutch. If the overrunning clutch turns roughly when rotated in the overrunning direction or slips in the cranking direction, after the clutch has been washed, it must be replaced with a new clutch. It is suggested that cleaning and reconditioning be entrusted to your Caterpillar dealer.

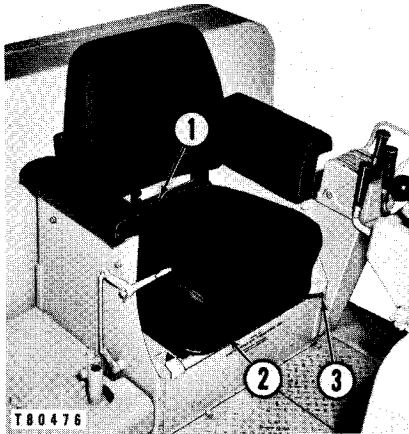
SEAT ADJUSTMENT

(Machines effective with 48A6393)

The operator's seat can be adjusted forward or backward approximately four inches. To adjust the seat, disengage the latch by moving the lever (3), and slide the seat to the desired position, then release the lever to engage the latch.

The seat back cushion can be raised or lowered to any of three positions. To adjust, move the back latch handle (1) to disengage the latch, and move the cushion up or down to the desired position, then release the handle to engage the latch.

The entire seat can be tipped forward by pulling out the seat latch rod (2) and lifting upward and forward on the seat back. A brace rod which is attached to the bottom of the seat mounting plate can be positioned to support the seat while it is tipped forward.



SEAT ADJUSTMENT

- 1-Back latch handle. 2-Seat latch rod.
- 3-Lever.

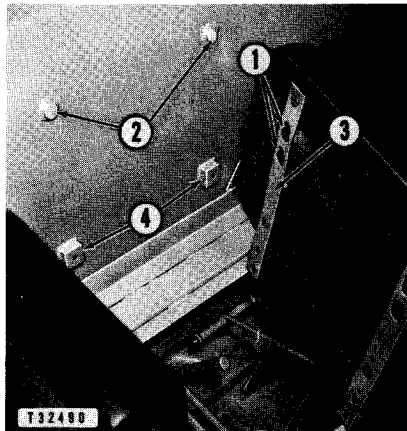


**Seat Back Cushion Adjustment
(Machines before 48A6393)**

The seat back cushion may be adjusted to two different heights for the operator's comfort. To do this, remove the seat cushion; then remove the bolts that hold the lower end of fastener strips (3) in place. Then lift the seat back cushion off buttons (2) located on the fuel tank. Relocate the seat back cushion in the position desired by placing the cushion over the buttons. Make certain that the button heads are fastened securely in the adjusting holes (1), then install the bolts that hold the lower end of fastener strips to the lugs (4).

ADJUSTING SEAT BACK CUSHION

- 1-Adjusting holes. 2-Buttons. 3-Fastener strips.
- 4-Lugs.



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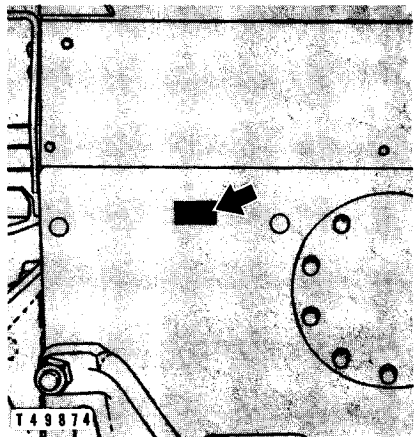
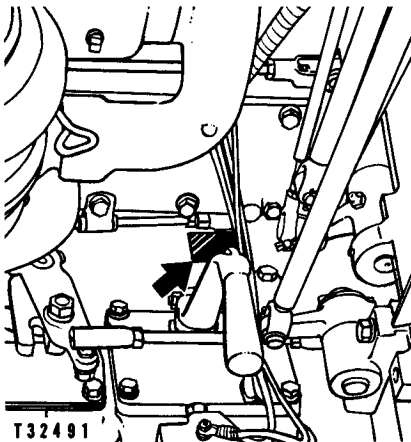
Capacities

Approximate Quantities

	U.S. Measure	Metric Measure (Liters)	Imperial Measure
Diesel Engine Crankcase Lubricating Oil System Tractors effective with 48A2642	26 qt.	24,5	21.5 qt.
Tractors before 48A2642	24 qt.	23	20 qt.
Starting Engine Crankcase	2½ qt.	2,4	2.1 qt.
Air Cleaner, Starting Engine	¾ qt.	0,8	0.7 qt.
Fuel Tank, Diesel Tractors effective with 48A1306	115 gal.	435,3	95.8 gal.
Tractors before 48A1306	102 gal.	386	85 gal.
Fuel Tank, Starting Engine	5 qt.	4,7	4.2 qt.
Cooling System	22 gal.	83,3	18.3 gal.
Final Drive (each)	9 gal.	34	7.5 gal.
Transmission, Bevel Gear and Steering Clutch Compartment* (Without 171 Hydraulic Control)	31 gal.	117,3	25.8 gal.
(With 171 Hydraulic Control)	34 gal.	128	28.5 gal.
Transmission, Starting Engine ..	1¼ qt.	1,2	1.1 qt.

*This capacity may be increased up to 10% only when operating under extreme conditions of tilt. See the LUBRICATION INSTRUCTIONS and the topic, DRIVING THE TRACTOR.

Location of Serial Number



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