OPERATION AND MAINTENANCE INSTRUCTIONS

CATERPILLAR®

D6 TRACTOR

SERIAL NUMBERS

8U1 - up

9U1 - up

CATERPILLAR TRACTOR CO.

PEORIA - ILLINOIS - U.S.A.

Warranty

The Manufacturer warrants its products for six (6) months after the date of delivery to the initial user. This warranty is limited to the repair or replacement, as the Manufacturer may elect, at one of its factories designated by it, of such parts as shall appear to the Manufacturer upon inspection to have been defective in material or workmanship but does not include any installation or transportation costs. No warranty is made with respect to items made by others when such items are warranted by their respective makers or when they are supplied by the Manufacturer on special order. This warranty is in lieu of all other warranties, express or implied, and no other warranty of any kind is made or authorized by the Manufacturer. No recommendation by the Manufacturer of items made by others shall imply or constitute any warranty with respect to such items.

T25495

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.

T20841

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."

T24352

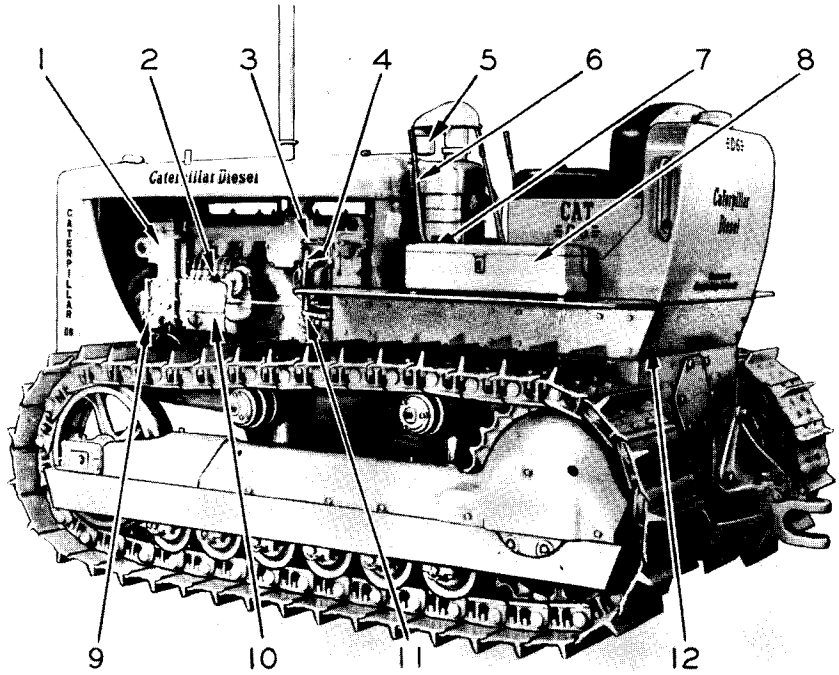
Railroad Loading Rules

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.

T24353

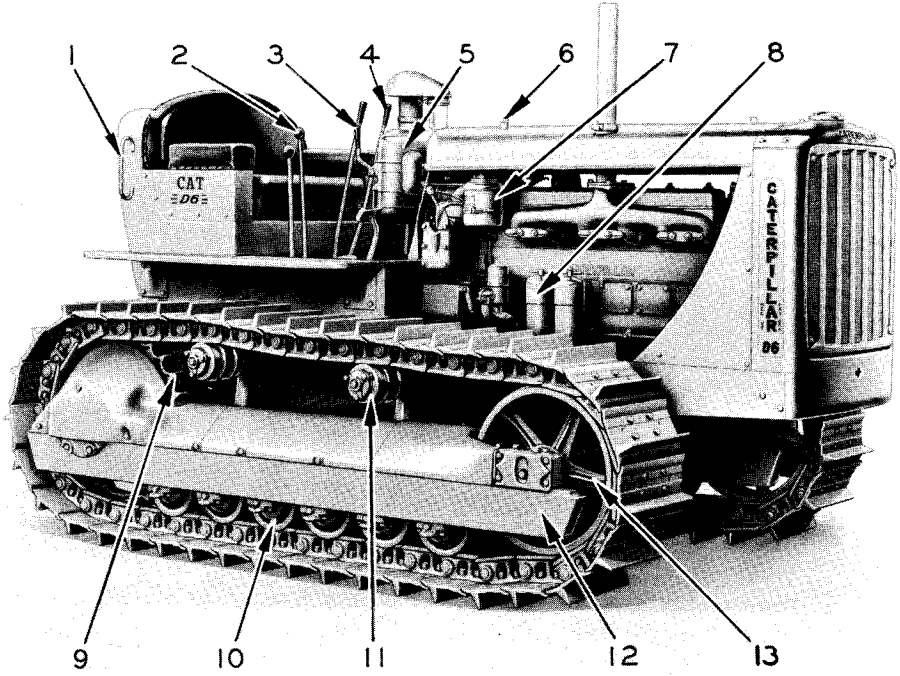
Table of Contents



T12075

D6 TRACTOR
(LEFT REAR VIEW)

1. Fuel filter housing.
2. Governor auxiliary control lever.
3. Compression release lever.
4. Starting engine clutch lever.
5. Precleaner jar.
6. Flywheel clutch control lever.
7. Starting engine flywheel.
8. Tool box.
9. Service meter.
10. Fuel injection pump housing.
11. Starter pinion control lever.
12. Fuel tank drain valve. (Inside Plate)



T11842

D6 TRACTOR
(RIGHT FRONT VIEW)

1. Handle.
2. Gear selector lever.
3. Governor control lever.
4. Steering clutch control levers.
5. Diesel engine air cleaner.
6. Starting engine fuel tank filler cap.
7. Starting engine air cleaner.
8. Crankcase lubricating oil filter housings.
9. Sprocket.
10. Track rollers.
11. Track carrier rollers.
12. Track roller frame.
13. Front idler.

Lubrication Instructions

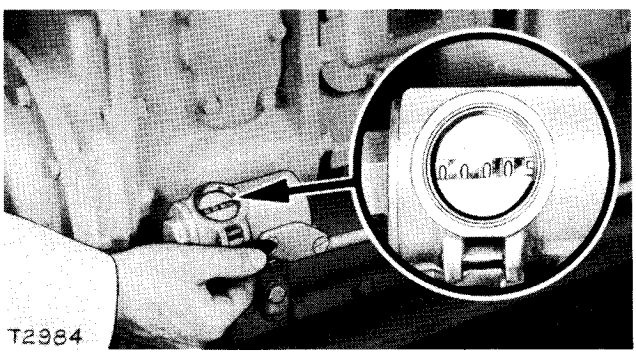
SERVICE METER

The Service Meter is located on the left side of the engine near the bottom of the fuel filter housing. It is geared to the engine, and when the crankshaft turns as many revolutions as are made in an hour at normal operating speed, the dial advances one number. There are many applications that will result in a lower than normal average engine speed. Under this condition, the advance in the Service Meter reading will be less than 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.

GENERAL LUBRICATING INFORMATION

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.



COVER ON SERVICE METER RAISED TO OBSERVE DIAL READING

Drain oil, check oil levels and refill compartments with the tractor level. It is best to drain oil when it is warm, after the tractor has run for some time. Then, most of the sediment will be in suspension, and therefore, will readily drain.

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

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 and contribute to quicker starting. The engine should always be allowed to idle at not less than half engine speed for several minutes after starting to assure adequate lubrication before operating at normal load.

The following topic recommends the types, viscosities and grades of lubricants best suited for use in your tractor for various operating temperatures.

CRANKCASE LUBRICATING OIL (Abbreviated CO)

Type of Oils

(CO) Superior Lubricants (Series 3): Only those lubricating oils known as Superior Lubricants (Series 3) for Caterpillar Diesel Engines should be used in the diesel engine crankcase. For recommended oil change periods, see the topic, CRANKCASE LUBRICATING OIL CHANGE PERIODS.

NOTE

Detergent type oils that are recommended for use in Caterpillar Diesel Engines will, within a short period of operation, become much darker in color. This should not be any cause for concern. The darkening of the oil is due to minute particles of carbon, resulting from the combustion process, being held in suspension in the oil. This ability to hold carbon particles in suspension is one of the primary functions of a detergent type lubricant. Otherwise, these particles would settle out, eventually leading to objectionable deposits in the engine. When the oil darkens therefore, it is an indication that it is keeping the engine clean and insuring satisfactory lubrication performance.

If Superior Lubricants (Series 3) are not available, crankcase lubricating oils meeting the requirements of MIL-L-2104A specifications can be used successfully in the diesel engine crankcase when the fuel sulphur content is **less** than 0.4%. For the recommended oil change periods see the topic, CRANKCASE LUBRICATING OIL CHANGE PERIODS.

(CO) Straight Mineral, MIL-L-2104A Oils Or Superior Lubricants (Series 3): In compartments other than the diesel engine crankcase where crankcase lubricating oil is recommended (such as starting engine crankcase, diesel and starting engine air cleaners† flywheel clutch (oil type) if so equipped and fuel injection pump housing) use either straight mineral

† For 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 cleaners regularly.

crankcase lubricating oil, an oil conforming to the requirements of MIL-L-2104A Specifications or Superior Lubricants (Series 3) whichever is most convenient and economical.

S.A.E. Grades

At temperatures above freezing, S.A.E. No. 30 oil should be used in all compartments.

At temperatures below freezing S.A.E. No. 10W oil should be used to provide better lubrication at low temperature and also to make cranking easier.

S.A.E. No. 10W oil should be fluid enough for easy cranking at temperatures down to at least −10° F. In lower temperatures it may be necessary to dilute S.A.E. No. 10W oil with kerosene (except in air cleaners) so it will be fluid enough to insure free circulation. Evaporation in the engine crankcase and flywheel clutch (oil type) if so equipped under steady operation may make it necessary to again add kerosene to maintain proper fluidity. This should be done before stopping, then operate the engine for a few minutes to mix the kerosene and oil.

For an approximate check to determine if the oil will flow, remove the oil level gauge and if the oil on it will flow off, the oil is fluid enough to properly circulate in the engine.

Crankcase Lubricating Oil Change Periods

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

SUPERIOR LUBRICANTS (SERIES 3) CHANGE PERIOD CHART

FUEL SULPHUR CONTENT	OIL CHANGE PERIOD ‡	FILTER ELEMENT CHANGE PERIOD FULL FLOW	BY-PASS **
0.4% or Less	500 Service Hrs.	250 Service Hrs.	250 Service Hrs.
0.4% to 1.0%	500 Service Hrs. *	250 Service Hrs.	250 Service Hrs.

MIL-L-2104A OIL CHANGE PERIOD CHART

FUEL SULPHUR CONTENT	OIL CHANGE PERIOD ‡	FILTER ELEMENT CHANGE PERIOD FULL-FLOW	BY-PASS**
0.4% or Less	250 Service Hrs.	250 Service Hrs.	250 Service Hrs.

***Reduce change period one half when sulphur content is greater than 1.0%.**

****Change by-pass filter elements every 250 service hours except under severe dusty operating conditions when changes should be made at 125 service hour intervals.**

‡Regardless of time operated, the crankcase oil should be changed at least every six months.

T26948

Change oil and filter elements after the first 10 service hours of operation of a reconditioned engine. Experience shows that dirt and foreign material is present in reconditioned engines even though best service practices have been followed.

BALL AND ROLLER BEARING LUBRICANT
(Abbreviated BR)

(BR) 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 lubricant can be applied to all bearing points — plain bushings, ball bearings and roller bearings — where equipped with hydraulic pressure fittings or when bearings are hand packed.

Use only a high grade Ball and Roller Bearing Grease of short fiber. 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. Greases of this kind have been classified by grade by the N.L.G.I. (National Lubricating Grease Institute) designated in order of "worked" penetration or consistency.

TRACK ROLLER LUBRICANT
(Abbreviated RL)

(RL) This is a stringy, tacky lubricant of a semi-fluid consistency at the prevailing atmospheric temperature. This lubricant developed for track rollers is recommended for use at points provided with button head fittings. It can be handled readily in the standard volume compressor.

In sub-zero weather, crankcase lubricating oils may be used when track roller lubricant is too heavy to be handled in the compressor.

TRANSMISSION OIL
(Abbreviated TO)

(TO) MIL-L-2105 or Straight Mineral Oil: Use either an oil conforming to the requirements of MIL-L-2105 specification or a straight mineral transmission oil, whichever is most convenient.

At temperatures above freezing use S.A.E. No. 90 oil, but when operating continuously in extremely hot temperatures, use S.A.E. No. 140 oil.

Below freezing S.A.E. No. 80 oil will be required, however, in extremely cold weather S.A.E. No. 80 oil should be diluted with sufficient kerosene to provide fluidity.

LUBRICATION CHART
CATERPILLAR®
DIESEL D6 TRACTOR

The folded page is arranged to serve two purposes:

First, it is a complete outline of all the information required to lubricate the tractor.

Second, the illustration and identification of points of lubrication can be used with the detailed illustrations and information on the pages following the chart as a reference for lubrication and service information.

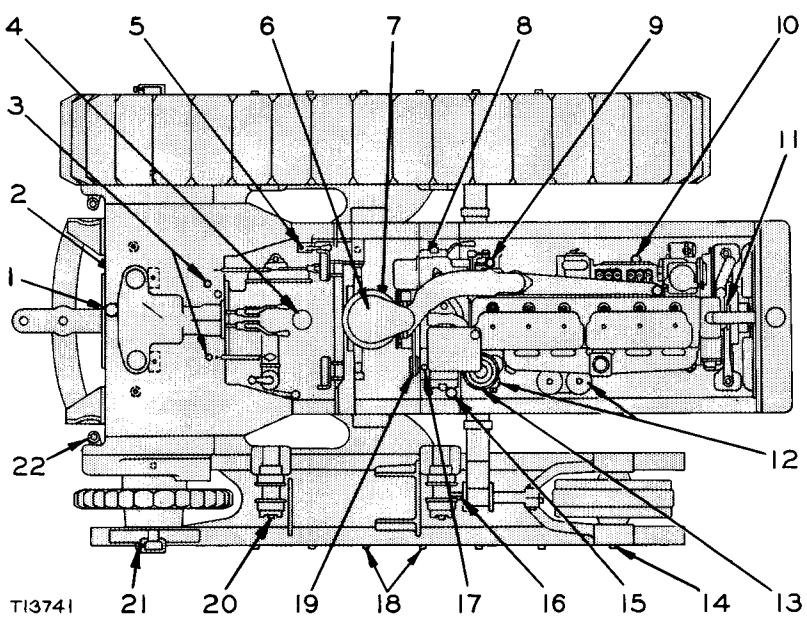
Key To Lubricants

CO Crankcase Lubricating Oil. **TO** Transmission Oil.
BR Ball and Roller Bearing Lubricants. **RL** Track Roller Lubricant.

Identification of Points of Lubrication, Lubricant to Apply and Interval of Service.

Point	and Identification	Lubri-cant	SERVICE HOURS 10	50	125	250	500	1000
1	Hydraulic Steering Clutch Housing	CO				X		X
2	Track Roller Frame Inner Bearings	BR	X					
3	Steering Clutch Release Bearings	BR	X					
4	Transmission	TO			X			X
5	Flywheel Clutch Control Lever Bushing	BR	‡X					
6	Diesel Engine Air Cleaner	CO	*X	X				
7	Universal Joints	BR						X
8	Starter Pinion Control Lever Bushing	BR			††X			
9	Starting Engine Clutch	CO			X	X		
10	Fuel Injection Pump Housing	CO			X	X		
11	Fan Bearings	BR				X		
12	Diesel Engine Crankcase Lubricating Oil System	CO	X			X	X	
13	Starting Engine Air Cleaner	CO		X				
14	Front Idlers	RL	†X		X			
15	Flywheel Clutch Compartment	CO	X			X	**X	X
16	Track Adjusting Screw Nuts	BR				X		
17	Starting Engine Crankcase	CO	X		X	X		
18	Track Rollers	RL	†X		X			
19	Starting Engine Water Pump	BR			X			
20	Track Carrier Rollers	RL	†X		X			
21	Track Roller Frame Outer Bearings	BR	X					
22	Final Drive Cases	TO			X		*†X	X

Location Of Points Of Lubrication



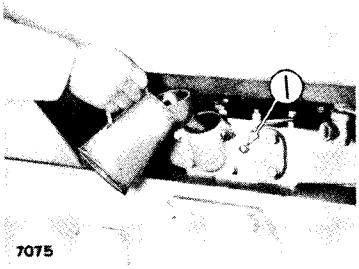
*Only when operating in extremely dusty conditions. †Only when operating in deep mud and water.

** Only if oil becomes thick and dark because of severe usage.

‡ Tractors before 8U6444 and 9U13263 lubricate the flywheel clutch release bearing, sliding collar and drive plate bearing every 10 service hours.

†† Tractors before 8U6444 and 9U13263 lubricate the starter pinion control shaft bushing every 125 service hours.

CO Crankcase Lubricating Oil

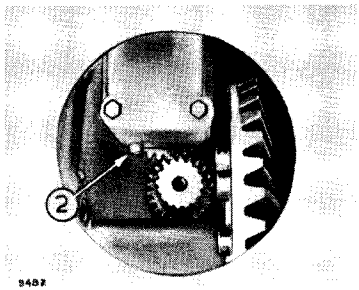


7075

1

HYDRAULIC STEERING CLUTCH HOUSING

Check oil level at level plug (1) every 250 service hours. Keep oil level up to plug opening. After filling housing to above level, move steering clutch control levers back and forth a few times to force out entrapped air; add lubricant to bring oil to proper level. Prevent any dirt from entering the housing.

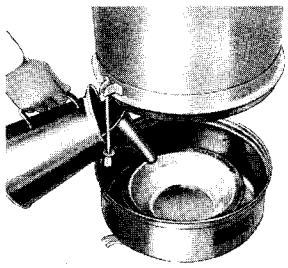


9482

1

HYDRAULIC STEERING CLUTCH HOUSING

Every 1000 service hours, drain the housing by removing the center cover on the back of the steering clutch case and the plug (2) in the bottom of the hydraulic steering pump housing. If rear mounted equipment interferes with removing the drain plug, suck out the oil through the filler opening. Use care to prevent dirt entering the housing. Fill the housing to the proper level.

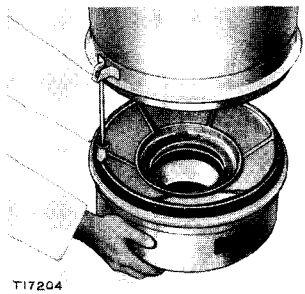

T17125

6

DIESEL ENGINE AIR CLEANER CUP

Inspect the oil in the air cleaner cup every 10 to 50 service hours depending upon dust conditions. Wash and refill both the inner and outer cups to the flat face of the inner cup on later engines and to the oil level bead on earlier engines either when the oil will not flow freely, the sediment in the cup is ½ inch deep, or every 50 service hours, whichever occurs first. See the topic, "Air Cleaners".

Refill the cup with the same S.A.E. grade of oil as is used in the diesel engine crankcase and the same type of oil may be used. However, it is permissible to use clean, undiluted reclaimed oil or the most inexpensive straight mineral oil. See the topic, "Crankcase Lubricating Oil".


T17204

6

DIESEL ENGINE AIR CLEANER SCREENS

When the oil cup is removed for inspection, remove the air cleaner screens or elements, inspect and wash if dirty. Inspect the inside of the air cleaner inlet pipe and clean if necessary. Clean the inside of the air cleaner inlet pipe every 50 service hours. See the topic, "Air Cleaners".

CAUTION

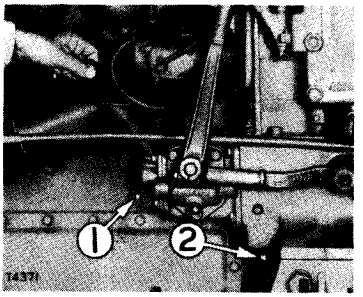
Under no circumstances should the track be lubricated. The stiffness noted between the links of a new track is not caused by a lack of clearance between the track pins and bushings, and it will disappear as the track wears in.

CO Crankcase Lubricating Oil

9

STARTING ENGINE CLUTCH

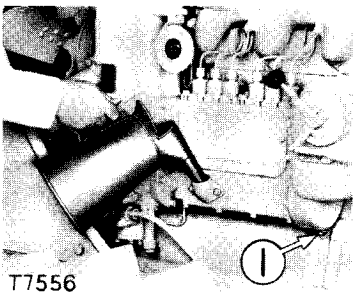
Check oil level by removing plug (1) every 125 service hours. Keep lubricant to level plug opening. Drain at (2), wash and refill housing every 250 service hours. See topic, "Starting Engine Clutch".



10

FUEL INJECTION PUMP HOUSING

Check level every 125 service hours. Keep filled to top of filler elbow. Drain at (1) and refill every 250 service hours.

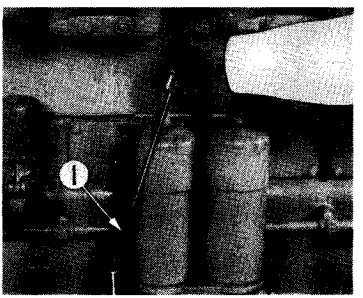


12

DIESEL ENGINE CRANKCASE

Check oil level with engine running every 10 service hours. Oil level should be between the "full" and "low" marks on gauge (1). The oil level maintained at the "full" mark is more desirable, however, any level above the "low" mark is permissible.

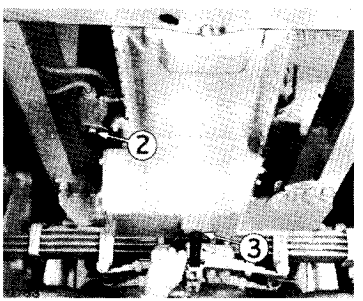
The oil level may be considerably higher than the "full" mark on the gauge if the full capacity of crankcase oil is checked after the engine has been stopped for several minutes. See the topic, "Crankcase Lubricating Oil" — Also see Note A.



12

DIESEL ENGINE CRANKCASE

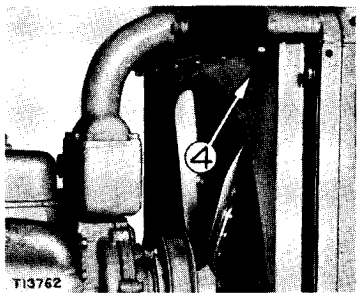
Every 250 or 500 service hours depending on type of crankcase lubricating oil used, drain crankcase (3) and filter (2) while the engine is hot. See the topics, "Crankcase Lubricating Oil" and "Crankcase Lubricating Oil System". See Note B.



NOTE A: The diesel engine has a guard to protect the gauge from spray so the oil level should be checked with the engine running. Always check the oil level with the engine in a level position.

NOTE B: Caterpillar Diesel Engines are built in a clean modern diesel engine factory and each crankcase is filled with a good quality of new crankcase oil. For these reasons the initial crankcase oil change period for this engine should be at the usual crankcase oil change period. See the Superior Lubricants (Series 3) Change Period Chart.

CO Crankcase Lubricating Oil



12

DIESEL ENGINE CRANKCASE

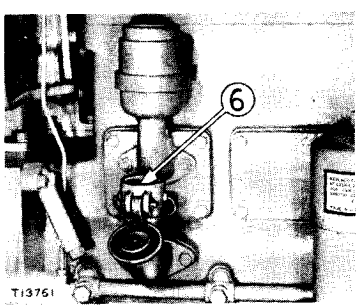
Open oil cooler vent valve (4) so the oil will drain more rapidly from the oil cooler each time the crankcase is drained.

12

DIESEL ENGINE CRANKCASE LUBRICATING OIL FILTER

On tractors effective with 8U4417 and 9U7424 or those equipped with full-flow crankcase lubricating oil filter change-over groups, remove the plug from the filter base to drain the unfiltered oil from the base and replace the filter elements (5) with new Caterpillar elements at every 250 service hour interval. See the topic, "Crankcase Lubricating Oil System".

On tractors before 8U4417 and 9U7424 equipped with by-pass crankcase lubricating oil filters, wash the metallic strainer elements and replace the inner elements with new elements at 250 service hours. When operating in extremely dusty conditions, wash the metallic strainer elements and replace the inner elements every 125 service hours. See the topic, Crankcase Lubricating Oil System".



12

DIESEL ENGINE CRANKCASE

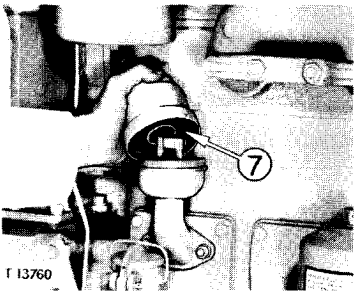
After draining crankcase refill at (6) and start the diesel engine. Run engine for two minutes then add oil to bring level to full mark on gauge, while engine is running.

CO Crankcase Lubricating Oil

12

DIESEL ENGINE CRANKCASE BREATHER

Wash breather element (7) each time crankcase oil is drained.

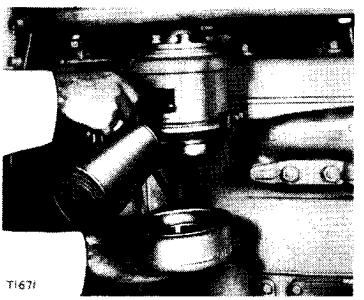


13

STARTING ENGINE AIR CLEANER

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 1/4 inch deep. See the topic, "Air Cleaners".

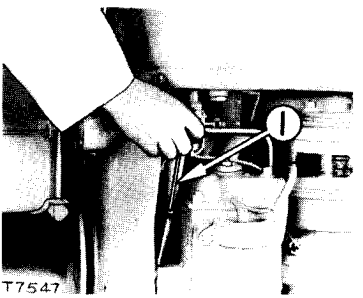
Refill the cup with the same S.A.E. grade of oil as is used in the diesel engine crankcase and the same type of oil may also be used. However, it is permissible to use clean, undiluted reclaimed oil or the most inexpensive straight mineral oil. See the topic, "Crankcase Lubricating Oil".



17

STARTING ENGINE CRANKCASE

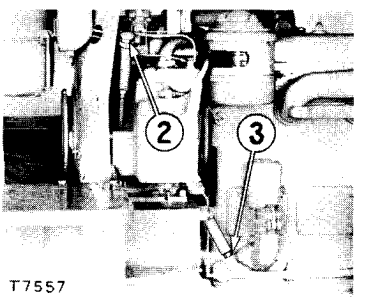
Check oil level at full mark (1) on gauge every 10 service hours with engine stopped. Every 125 to 250 service hours, drain at (3) and wash. See topic, "Crankcase Lubricating Oil System".



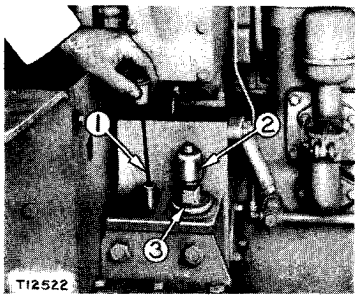
17

STARTING ENGINE CRANKCASE

Refill crankcase at (2) every 125 to 250 service hours.



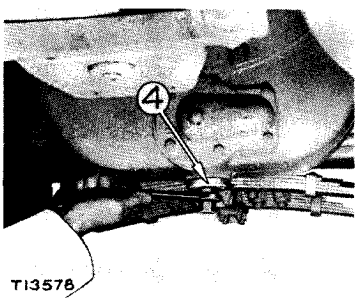
CO Crankcase Lubricating Oil



15
FLYWHEEL CLUTCH COMPARTMENT
(Effective with 8U6444 and 9U13263)

Check oil level in the clutch compartment every 10 service hours with the engine stopped. Oil should be kept up to the full mark on gauge (1). If oil level is excessively high, remove oil level plug on lower right side of the flywheel housing to drain any excess oil from the clutch compartment.

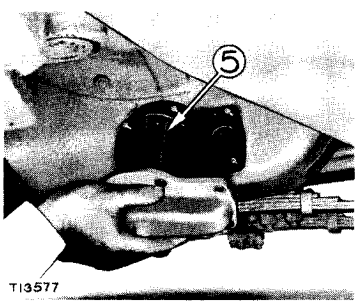
Every 250 service hours, remove, wash and oil breather at (2). Earlier models have breather with plastic impregnated paper filter element on filler plug (3). Every 1000 service hours disassemble breather and wash the element by shaking it in some non-inflammable cleaning fluid that will dry free of oil film.



15
FLYWHEEL CLUTCH COMPARTMENT
(Effective with 8U6444 and 9U13263)

Every 1000 service hours drain the clutch compartment by removing drain plug (4).

Severe working conditions and frequent usage of the flywheel clutch may necessitate the changing of the oil every 500 service hours if the oil becomes extremely thick and dark.

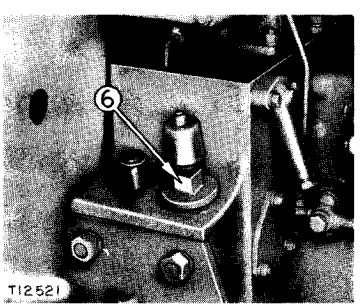


15
FLYWHEEL CLUTCH COMPARTMENT
(Effective with 8U6444 and 9U13263)

Remove and wash oil pump suction screen (5) at each oil change period.

When removing the suction screen be careful not to damage the gasket. Clean the magnetic drain plug.

Install the suction screen and drain plug.

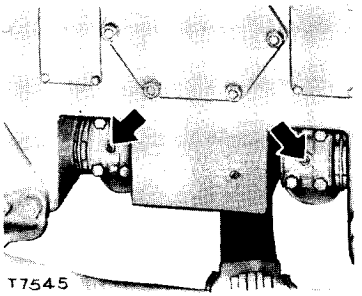


15
FLYWHEEL CLUTCH COMPARTMENT
(Effective with 8U6444 and 9U13263)

Extreme care should be taken to prevent dirt getting into the clutch compartment when removing the filler plug for filling.

After removing filler plug (6) refill clutch compartment to full mark on gauge. Approximately 9 qts. of oil is required to fill the compartment. Install filler plug tightly.

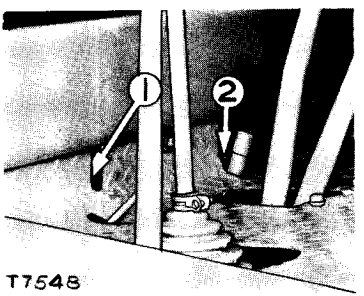
BR Ball and Roller Bearing Lubricant



2

TRACK ROLLER FRAME INNER BEARINGS

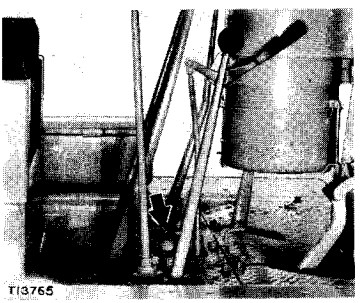
Lubricate two bearings every 10 service hours, one fitting for each bearing.



3

STEERING CLUTCH RELEASE BEARINGS

Lubricate bearings at (1) and (2) every 10 service hours.

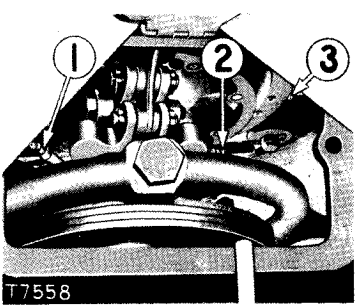


5

FLYWHEEL CLUTCH CONTROL LEVER AND CROSS SHAFT BEARINGS

Lubricate bearing through fitting every 10 service hours. Fitting is accessible through opening in the floor plate for the flywheel clutch control lever.

On tractors before 9U1415 and 8U1129 lubricate clutch cross shaft every 10 service hours. The fitting for the cross shaft is accessible from underneath the tractor.



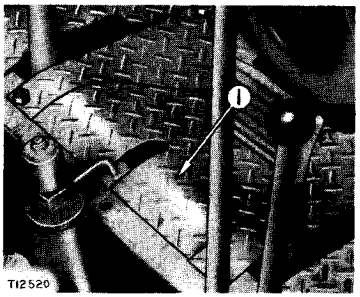
5

FLYWHEEL CLUTCH RELEASE BEARING, SLIDING COLLAR AND DRIVE PLATE BEARING

(Tractors before 8U6444 and 9U13263)

Lubricate release bearing (1) and sliding collar (2) every 10 service hours through two fittings 120° apart. Rotate flywheel to reach drive plate bearing (3) and lubricate with one or two strokes from the lever type grease gun every 10 service hours.

BR Ball and Roller Bearing Lubricant



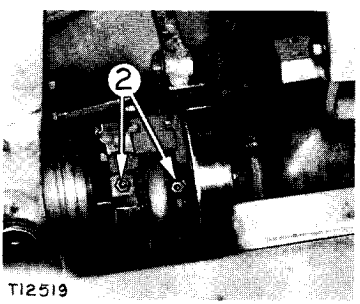
7

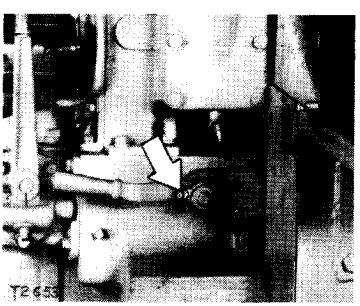
DRIVE SHAFT UNIVERSAL JOINTS

(Effective with 8U6444 and 9U13263)

Every 1000 service hours lift inspection cover (1), lubricate universal joints through fittings (2). Floor plate removed for illustration purposes only.

Care must be taken when lubricating the universal joint bearings so that the internal sealing rings are not damaged.

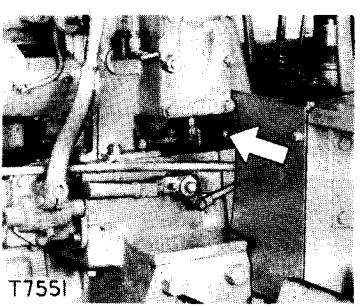




8

STARTER PINION CONTROL LEVER BEARING

Lubricate every 125 service hours.



STARTER PINION CONTROL SHAFT BEARING

(Tractors before 8U6444 and 9U13263)

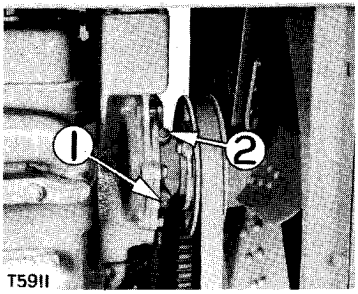
Lubricate bearing every 125 service hours.

BR Ball and Roller Bearing Lubricant

11

FAN BEARINGS

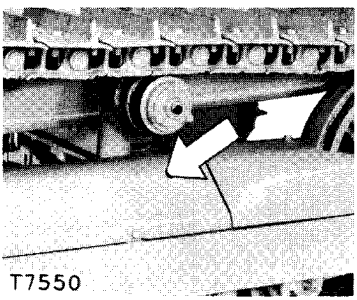
Lubricate every 250 service hours at fitting (1), until grease appears at relief valve (2). Wipe off excess grease.



16

TRACK ADJUSTING NUTS

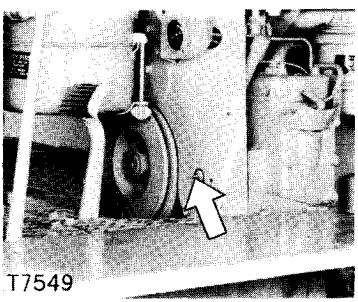
Lubricate every 250 service hours. One or two strokes will be plenty.



19

STARTING ENGINE WATER PUMP DRIVE SHAFT BEARING

Lubricate bearing every 125 service hours. Lubricate with one or two strokes from the lever type grease gun. Do not overlubricate.

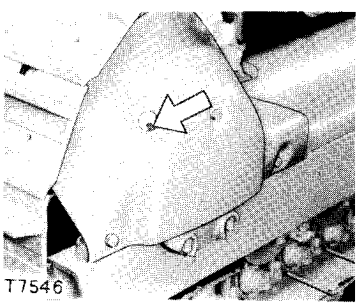


21

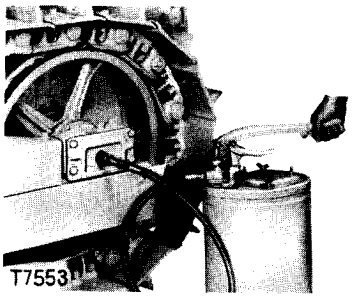
TRACK ROLLER FRAME OUTER BEARINGS

Lubricate two bearings every 10 service hours, one fitting on each side of the tractor.

On tractors before 8U3950 and 9U6501 the track roller frame outer bearings should be lubricated with TRACK ROLLER LUBRICANT.



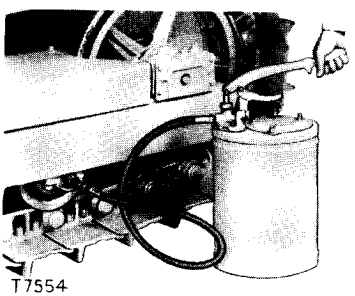
RL Track Roller Lubricant



14

FRONT IDLERS

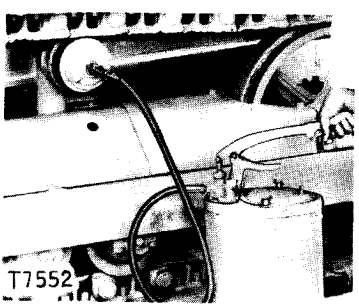
Lubricate through fitting on both sides of tractor every 125 service hours. If operating in deep mud or water, lubricate every 10 service hours. See Note C.



18

TRACK ROLLERS

Lubricate each roller on both sides of tractor every 125 service hours. If operating in deep mud or water, lubricate every 10 service hours. See Note C.



20

TRACK CARRIER ROLLERS

Lubricate rollers on both sides of tractor every 125 service hours. If operating in deep mud or water, lubricate every 10 service hours. See Note C.

NOTE C: Apply grease with the volume compressor only until resistance is felt on the handle of the compressor. Further pumping may damage the seals.

TO Transmission Oil

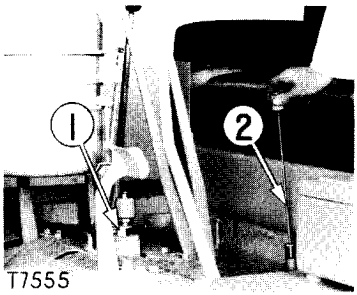
4

TRANSMISSION

Check oil level every 125 service hours. Keep oil level up to full mark on gauge (2). Refill or replenish with oil at (1).

Oil in bevel gear compartment adjusts itself to level in speed change compartment. See the topic, "Continuous Operation on Stationary Work".

On later tractors equipped with breather on filler cap, remove, wash and oil breather every 250 service hours. On earlier tractors disassemble breather and wash the element every 1000 service hours by shaking it in some non-inflammable cleaning fluid that will dry free of oil film.

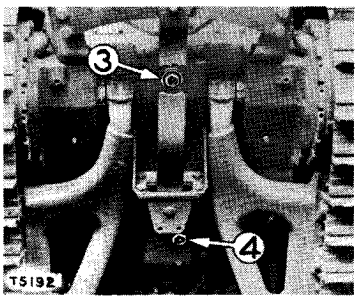


4

TRANSMISSION

Drain bevel gear compartment at (3) and speed change compartment at (4) every 1000 service hours, wash and refill. Pour 42 quarts of oil into filler opening in speed change compartment and allow time for oil level to adjust itself in bevel gear compartment before checking oil level with gauge.

Clean the collected particles from the magnetic drain plugs before replacing the plugs. See topic, "Washing Gear Compartments".

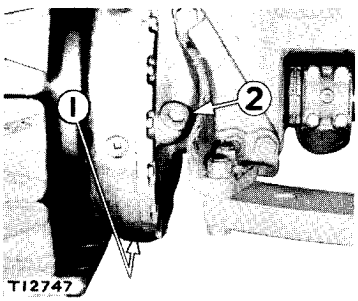


21

FINAL DRIVE

Check oil level by removing two filler plugs (2), one for each side, every 125 service hours. Keep lubricant to level of filler opening.

Drain compartment at (1), wash and refill it every 1000 service hours. (500 service hours when operating in either extremely dusty conditions or deep mud and water). See topic, "Washing Gear Compartments".



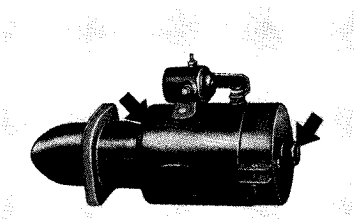
Lubrication of Attachments

The following list of identifying letters, names of attachments requiring lubrication, and type of lubricant required will help in lubrication of attachments. For further attachment information see page 97.

Identification Of Points Of Lubrication, Lubricant To Apply And Interval Of Service

Point and Identification		Lubricant	–SERVICE HOURS– 50	125	250	1000
A.	Electric Starting Motors	**CO**		**X**		
B.	Charging Generator	**CO**		**X**		
C.	Front Power Take-off	**BR**	**X**			
D.	Rear Power Take-off Housing (Direct Drive)	**TO**		**X**	**X**	**X**
E.	Rear Power Take-off and Belt Pulley Drive Control Shaft	**BR**	**X**			
F.	Belt Pulley Drive Housing	**TO**		**X**	**X**	**X**
G.	Rear Power Take-off Housing (Reduction Drive)	**TO**		**X**		**X**

CO Crankcase Lubricating Oil



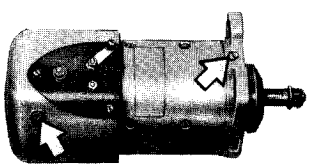
T20596

A

ELECTRIC STARTING MOTORS

Electric starting motors for the starting engine and diesel engine are equipped with bushings 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 bushing is sufficient.

Lubricate the bearings, when equipped with oil cups, with two or three drops of oil every 125 service hours.



T20612

B

CHARGING GENERATOR

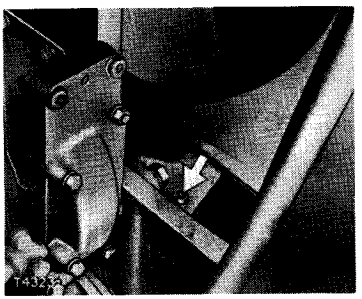
Generators have bearings packed with BALL AND ROLLER BEARING LUBRICANT making lubrication necessary only when the generator is disassembled for cleaning or servicing. Lubricate the bearings when equipped with oil cups, with two or three drops of oil every 125 service hours.

BR Ball and Roller Bearing Lubricant

C

FRONT POWER TAKE-OFF BEARING

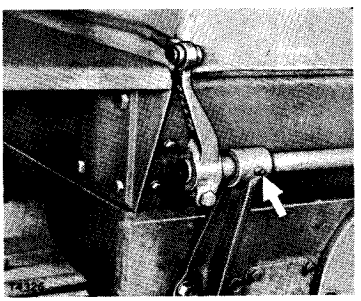
Lubricate bearing through fitting every 50 service hours. Do not over lubricate. Excess lubricant may work out on belts resulting in excessive wear.



E

REAR POWER TAKE-OFF AND BELT PULLEY DRIVE CONTROL SHAFT

Lubricate bearing every 50 service hours.



TO Transmission Oil

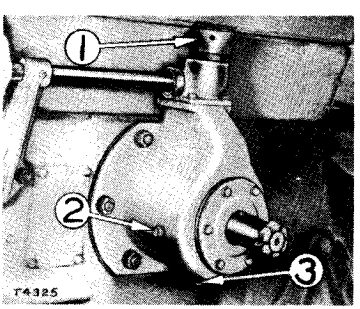
D

REAR POWER TAKE-OFF HOUSING
(Direct Drive)

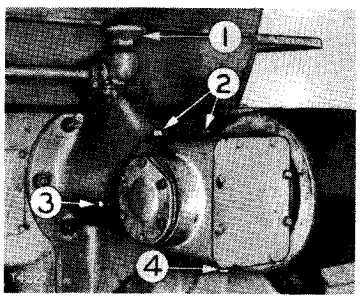
Check oil level at (2) every 125 service hours and bring level to plug opening. Over filling will cause excessive heat.

Drain housing by removing plug (3) every 1000 service hours. Wash housing and refill at opening on top of housing after removing breather (1). See the topics, "Washing Gear Compartments" and "Continuous Operation on Stationary Work".

Remove the breather (1) every 250 service hours and wash it with kerosene. Saturate element with oil and reinstall breather.



TO Transmission Oil



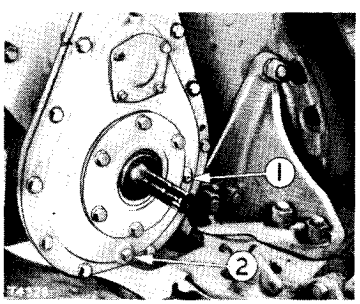
F

BELT PULLEY DRIVE HOUSING

Check oil level at level plug (3) every 125 service hours. Keep lubricant to level of plug opening. Over filling will cause excessive heat.

Remove plug (4) to drain housing every 1000 service hours, wash housing and refill at (2). See the topics, "Washing Gear Compartments" and "Continuous Operation on Stationary Work".

Remove the breather (1) every 250 service hours and wash it with kerosene. Saturate element with oil and reinstall breather.

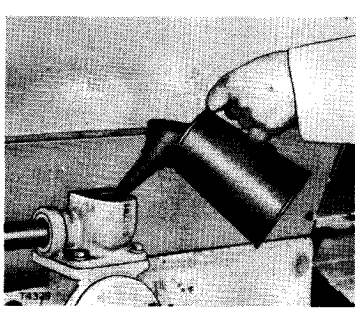


G

REAR POWER TAKE-OFF HOUSING (Reduction Drive)

Check oil level at level plug (1) every 125 service hours and bring level to plug opening. Over filling will cause excessive heat.

Drain housing by removing plug (2) every 1000 service hours, wash housing and refill at plug opening on top of housing as shown to level plug opening. See the topics, "Washing Gear Compartments" and "Continuous Operation on Stationary Work".



Operation Instructions

Information on Attachments for this Tractor begins on page 97.

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, or with the correct antifreeze solution if temperatures below freezing are likely to be encountered. See the topic, COOLING SYSTEM.

During the initial operation of the tractor, the bolts of the track roller end collars, the track shoe bolts, the inlet manifold stud nuts and the equalizer spring clips should be checked and tightened if necessary. Since these parts are subjected to continued stress, periodic checks should be made. See the topic, Daily Care.

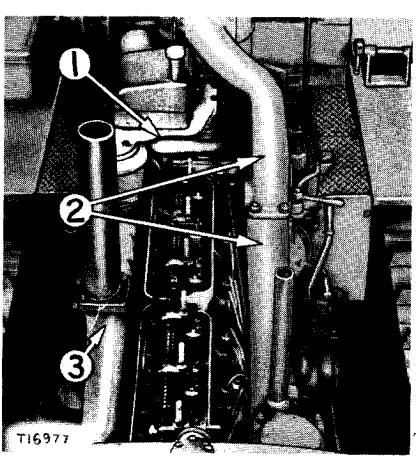
New Tractor Recheck: After the first thirty days of operation, it should be the duty of anyone charged with the care and operation of the tractor to tighten the diesel engine inlet manifold **(2)**, the exhaust manifold **(3)** and the starting engine manifold assembly **(1)**.

After the first 250 service hours of operation, the valve clearances should be checked, and adjusted if necessary, as described in the topic, VALVE CLEARANCE ADJUSTMENT.

POINTS TO BE SERVICED AT RECHECK PERIOD

1–Starting engine manifold assembly.
2–Diesel engine inlet manifold.
3–Diesel engine exhaust manifold.

◆



During the initial operation of the tractor the sprocket hub bearings are likely to require some adjustment. See the topic, FINAL DRIVE SPROCKET HUB BEARINGS.

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.

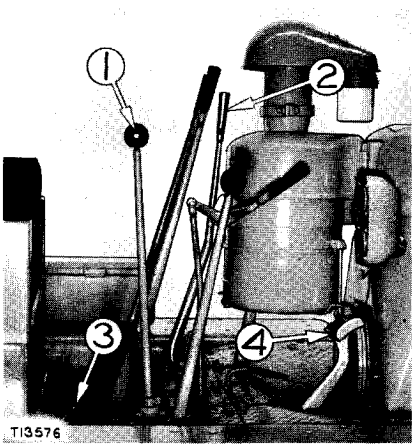
Third, if the tractor has been stored with oil in the cylinders, comply with the starting procedure under the topic, STORAGE.

STARTING THE ENGINE

There are two methods available for starting the diesel engine, gasoline starting engine and an electric starting motor. The two methods are covered in these instructions. The following topic covers the starting information required, regardless of the starting method involved.

Before Starting: Be sure to check the crankcase oil level in the diesel engine and clutch compartment (oil type) to make certain the oil is to the proper level on the gauge.

1. Disengage the flywheel clutch (lever **(2)** pushed forward).
2. Shift the gear selector lever **(1)** to the neutral position.
3. Shift the forward and reverse lever to neutral.
4. Push the governor control lever forward as far as possible.
5. Push down the right steering clutch brake pedal **(4)** and lock with the brake lock **(3)**.



CONTROLS IN STARTING POSITION

1–Gear selector lever. 2–Flywheel clutch control lever. 3–Brake lock control. 4–Right steering clutch brake.

◆

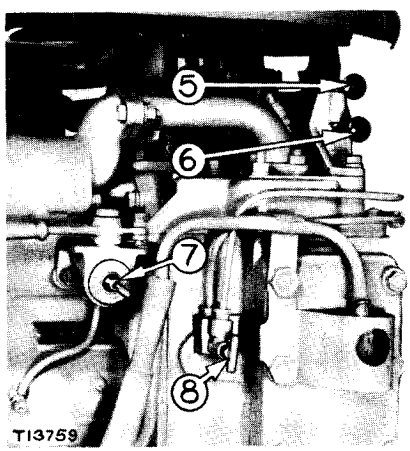
Gasoline Engine Starting

The starting engine is started with the starting engine electric starter or it may be started by cranking it manually.

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

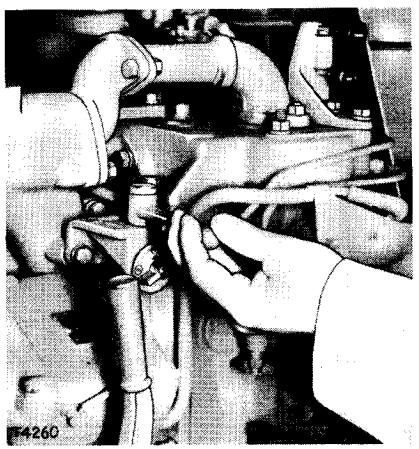
Position Controls For Starting: Before attempting to start the starting engine, position the controls of both the diesel and starting engine.

1. Check the crankcase oil level in the starting engine to make certain the oil is up to the "full" mark on the gauge.
2. Move the compression release lever to the start position.



STARTING ENGINE CONTROLS

5–Choke control. 6–Throttle control. 7–Ignition switch. 8–Fuel valve control.



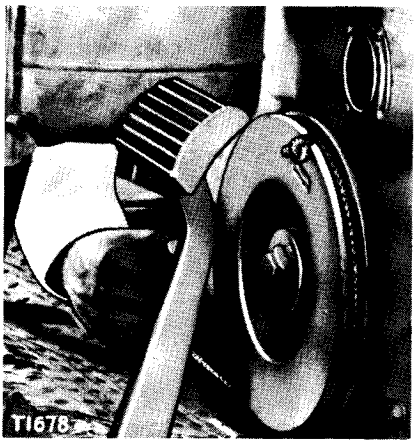
COMPRESSION RELEASE LEVER IN START POSITION

3. Disengage the starting engine clutch by pulling the lever back toward the starting engine.
4. Open the starting engine fuel valve by unscrewing the fuel valve control **(8)**.
5. Pull out the starting engine choke control **(5)**.
6. Pull out the starting engine throttle control **(6)**.
7. Turn ON the ignition switch **(7)**.

Starting the Starting Engine: After positioning the controls correctly, the starting engine may be started as follows:

1. Place the knotted end of the starting rope, with the knot to the ouside, in one of the two notches on the starting engine flywheel flange and

wind the rope around the groove in such a manner that pulling the rope will turn the flywheel in the direction indicated by the arrow on the flywheel.



PLACING STARTING ROPE ON FLYWHEEL

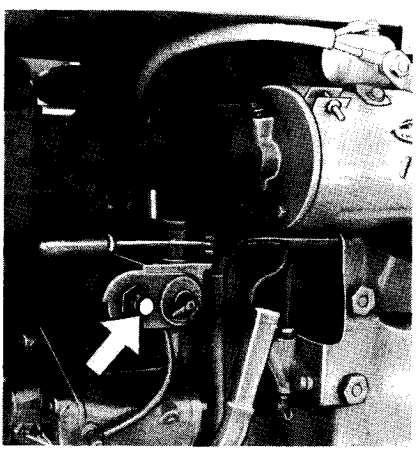
◆

2. Grasp the starting rope handle with the right hand and turn the flywheel with a quick pull on the rope. 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. Push in the choke control rod when the engine will run with the choke OFF.

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

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

Operating Starting Engine Electric Starter: To start the starting engine with electric starter, place the diesel and starting engine controls in the same position as described in the preceding topic. Then crank the engine with the electric starter by pushing the starter button.

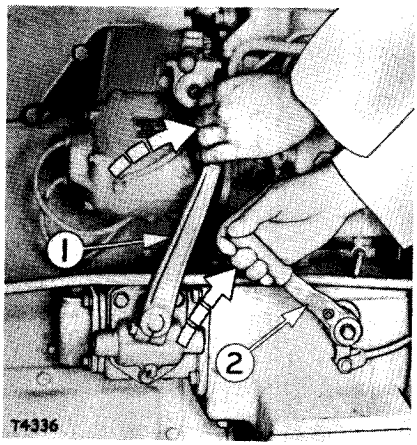


STARTING ENGINE ELECTRIC STARTER BUTTON

◆

Starting the Diesel Engine: The steps to start the diesel engine should be carefully followed to prevent damage to the starter pinion or the flywheel ring gear.

1. Check to see that the starting engine is running at high idle speed.



ENGAGING STARTER PINION

1–Clutch control lever. 2–Pinion control lever.

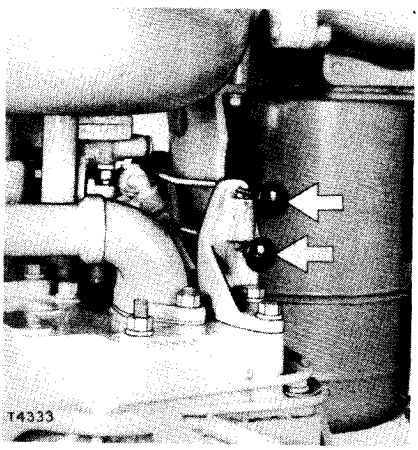
◆

2. Apply the starting engine clutch brake to stop the starter pinion from rotating by pulling the clutch control lever **(1)** all the way back and holding it there.

3. Engage the starter pinion with the flywheel ring gear by pulling up on the starter pinion control lever **(2)**, then release the clutch brake and partially engage the clutch to be sure of full engagement of the starter pinion.

POSITION STARTING ENGINE THROTTLE AND CHOKE CONTROL FOR FULL GOVERNED SPEED

◆

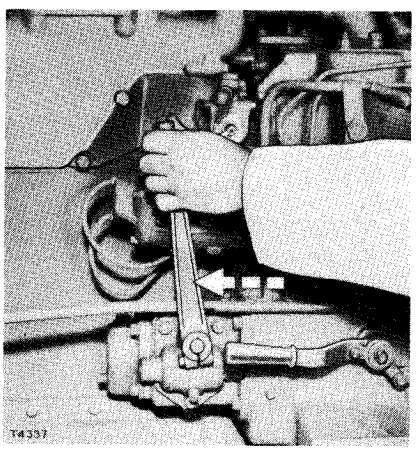


4. If the engine slows to the stalling point when the clutch is engaged, as it might in cold weather, disengage the clutch and let the engine pick up speed again. See the topic, OPERATING IN COLD WEATHER.

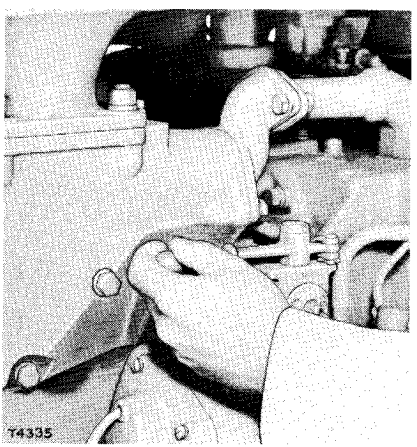
5. Move the compression release lever to the RUN position when the starting engine is cranking the diesel engine at normal cranking speed.

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 air inlet pipe warms the cylinders, pistons and combustion chambers to the starting temperature.

Allow the starting engine to crank the diesel engine against compression for a few minutes to add heat to the diesel engine before starting it. Actual experience will determine the length of time necessary to crank the diesel engine to warm it sufficiently to assure easy starting. Cold temperatures will require longer periods of cranking against compression before injecting fuel.



ENGAGING STARTING ENGINE CLUTCH

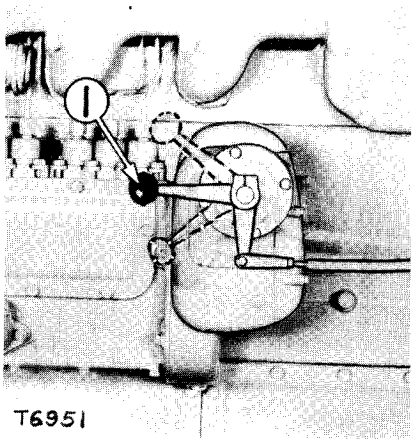


COMPRESSION RELEASE LEVER IN RUN POSITION

6. Move the auxiliary governor control lever **(1)** to approximately half engine speed position. If the diesel engine does not start after it has turned several revolutions, move the auxiliary governor control lever to the stop position so the injection pumps are shut off, and let the starting engine turn the diesel engine against compression a little longer, before repeating the procedure.

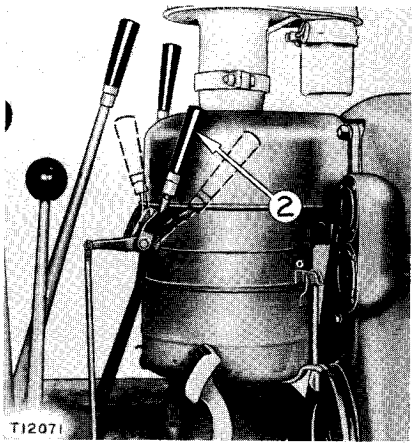
Earlier tractors not equipped with a auxiliary governor control lever can be started in a similar manner, when the governor control lever **(2)** is in the half engine speed position as shown.

If the diesel engine is thoroughly heated but does not start, see that everything is correctly set for starting. If smoke has been coming from the diesel engine exhaust pipe, fuel has been reaching the cylinders. If no smoke has been evident when the governor control lever is in the half engine speed position, check the fuel supply. If the diesel fuel tank is



AUXILIARY GOVERNOR CONTROL LEVER

1–Auxiliary governor control lever in half engine speed position.



GOVERNOR CONTROL LEVER

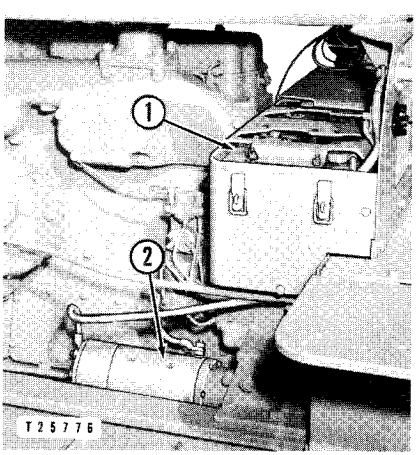
2–Governor control lever in half engine speed position.

empty, or if the fuel tank valve was 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.

7. Pull the starting engine throttle control out in the idling position. Stop the starting engine by closing the fuel valve control, allowing the engine to burn all the fuel in the carburetor, then turn OFF the ignition switch.

Direct Electric Starting

The tractor is equipped with a 24 volt electric starting motor **(2)** which is mounted on the diesel engine flywheel housing on the left side of the engine. The starter pinion automatically engages with the diesel engine



ELECTRIC STARTING SYSTEM

1–Batteries. 2–Starting motor.

◆

flywheel ring gear when the starting motor starts to turn and disengages when the diesel engine starts and the switch is released. Four 6 volt batteries **(1)** are connected in series and are mounted in front of the dash.

The diesel engine 24 volt electric starter can be used successfully in temperatures of 10° F. or above. When starting in temperatures below 32° F., it is advisable to use crankcase lubricating oil of a lower viscosity in the engine crankcase to reduce the cranking effort required. See the topic, CRANKCASE LUBRICATING OIL.

Diesel engines which depend upon electric cranking systems require certain aids when starting in lower temperatures. These engines are equipped with a glow plug in each combustion chamber and an ether starting aid to assist in cold weather starting.

The glow plug preheats the precombustion chamber so that a minimum of cranking time is required. Pressing the HEAT switch, which is located on the dash, causes the glow plugs to heat. It is recommended that the glow plugs be used to assist starting in temperatures below 60° F.

The ether starting aid provides a means of starting the engine when ambient temperatures are below 32° F. It is not advisable to use electric starting in temperatures below 10° F. without addition of some heat to the cooling system of the engine or without the use of additional batteries. If heating the cooling system is more desirable in these lower temperatures, the coolant should be maintained between 15° F. and 30° F. for easy cranking, quicker starting and rapid oil distribution.

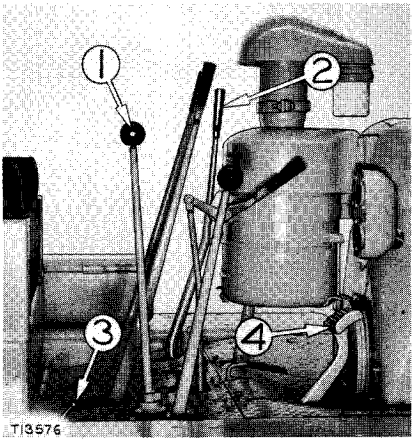
Ether capsules are of a definite size to limit the quantity of ether to be injected.

A discharger is used to inject ether into the inlet manifold. When the discharger lever is moved the metal capsule is pierced. Ether is forced out of the capsule by a small quantity of gas, under high pressure, into the inlet manifold to be taken into the cylinders for quick starting.

The engine must be kept in the best mechanical condition possible, the batteries kept fully charged and all terminals kept clean and tight for satisfactory performance of the starting system.

Position Controls For Starting: Before attempting to start the diesel engine the controls should be correctly positioned as follows:

1. Disengage the flywheel clutch by pushing the lever **(2)** forward.
2. Shift the gear selector lever **(1)** and forward and reverse lever to the neutral position.
3. Push down the right steering clutch brake pedal **(4)** and lock it with the brake lock **(3)**.
4. Move the governor control lever to approximately half engine speed position.



CONTROLS IN STARTING POSITION

1–Gear selector lever. 2–Flywheel clutch control lever. 3–Brake lock control. 4–Right steering clutch brake.

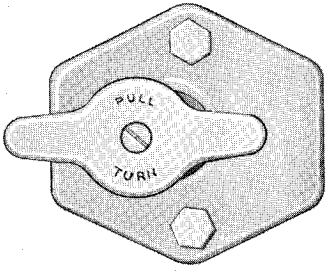
◆

5. Pull out and turn the disconnect switch handle to the horizontal position as shown and release it. A spring will then hold the switch on, in the horizontal position. The disconnect switch shoud be left in the horizontal position when the engine is running to charge the batteries.

CAUTION

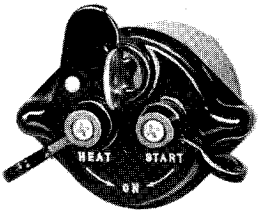
Never open disconnect switch when engine is running, or damage to the voltage regulator may result.

6. Insert the key into the HEAT and START switch and turn it to the right to unlock the switch. The key can be removed in either locked or unlocked positions.



T21406

DISCONNECT SWITCH IN ON POSITION



T22698

HEAT AND START SWITCH

Starting The Diesel Engine At 60° F. And Above: After positioning the controls correctly, the diesel engine may be started as follows:

1. Move the START switch to the ON position. As soon as the engine starts, release the switch.
2. If the engine does not start in a few seconds, continue to crank the diesel engine but shut off the fuel supply by moving the governor control lever to the shut-off position for about ten seconds to clear the cylinders of raw fuel.
3. If the diesel engine fails to start within **thirty seconds,** release the START switch and wait **two minutes** to allow the electric starter to cool before using it again.
4. If the electric starter pinion disengages for any reason before the engine starts, release the START switch and wait until the electric starter stops rotating and the diesel engine stops "rocking" before again pressing the START switch. When the engine starts, see the topic, ENGINE WARM-UP.

Starting The Diesel Engine Between 60° F. And 32° F. Using Glow Plugs: Ease of starting the diesel engine can best be obtained by following the instructions closely. Particular attention should be given to the time necessary to hold the HEAT switch ON. After positioning the controls correctly, the diesel engine may be started as follows:

1. Move the HEAT switch to the ON position for the length of time necessary as indicated in the STARTING AID CHART.

NOTE

Each glow plug uses approximately 7 amperes while the HEAT switch is in the ON position. This is actually a small amount in comparison to the starter load that is imposed on the battery when the START switch is ON.

2. Move the START switch to the ON position while continuing to hold down the HEAT switch. As soon as the engine starts, release the START switch, but hold the HEAT switch ON until the engine is running smoothly.

If the engine fails to start after 10 seconds of cranking, release the START switch and continue to hold the HEAT switch ON for about 30 seconds before cranking the engine again. When the starting motor is cranking, the battery voltage is reduced and the glow plugs cool. Reheating them after 10 seconds of cranking makes the glow plugs more effective and conserves the battery. **Do not move the glow plug switch to the ON position while the engine is warm and running.**

When the engine starts see the topic, ENGINE WARM-UP.

STARTING AID CHART

Starting Temperature Range	Glow Plug Heating Time — Heat Switch On	Number of Ether Capsules to Use
Above 60°	None	None
60° to 45°	45 Sec.	None
45° to 32°	1 Min.	None
32° to 20°	2 Min.	1 Capsule
20° to 10°	2 Min.	2 Capsules

Starting Between 32° F. and 10° F. Using Glow Plugs and Ether Starting Aid: Ease of starting the diesel engine can best be obtained by following the instructions closely. Particular attention should be given to the time necessary to hold the HEAT switch ON.

After positioning the controls correctly, the diesel engine may be started as follows:

1. Load the dischargers by unscrewing the nut **(2)**, removing the spent capsules and placing new capsules **(3)** in the dischargers as shown. Install the nuts finger tight.
2. Move the HEAT switch to the ON position for the length of time necessary as indicated in STARTING AID CHART.

NOTE

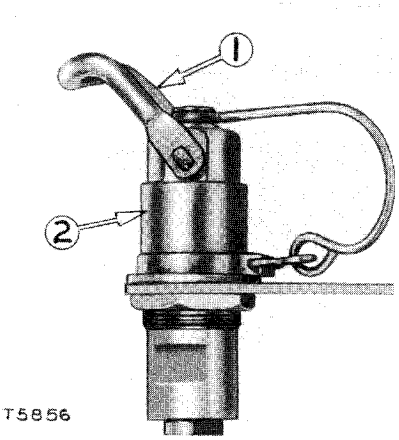
Each glow plug uses approximately 7 amperes while the HEAT switch is in the ON position. This is actually a small amount in comparison to the starter load that is imposed on the battery when the START switch is ON.

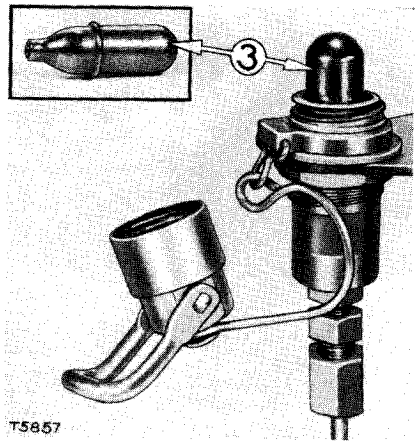
3. Discharge ether by moving the discharge lever **(1)** to pierce the capsule. See the STARTING AID CHART for the number of capsules required.

   Be sure the spent capsule is left in the discharger when the engine is running and the nut **(2)** is finger tight on the discharger to keep dirt out of the engine.

   Actual experience will determine the number of capsules required for easy starting.

   If more than one capsule is needed in the manifold, discharge the first two capsules and install the second set of capsules in the dis-





ETHER DISCHARGER
1–Discharging lever. 2–Nut. 3–Capsule.

chargers before cranking the diesel engine. Only one or two capsules should be discharged into the manifold before cranking the engine. The discharge of the second set of capsules can be performed when the engine has been cranked a few revolutions, or when it starts to stall.

4. Move the START switch to the ON position while continuing to hold down the HEAT switch, as soon as the engine starts, release the START switch, but hold the HEAT switch ON and discharge ether capsules as required, to prevent stalling, until the engine is running smoothly. **Do not move the glow plug switch to the ON position while the engine is warm and running.**

   If the engine does not start after 10 seconds of cranking, release the START switch and continue to hold the HEAT switch ON for 30 seconds then, repeat the starting procedure.

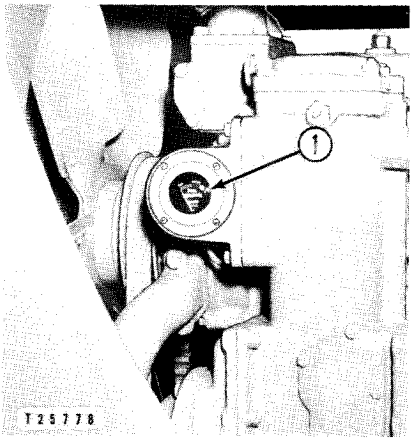
   When the engine starts see the topic, ENGINE WARM-UP.

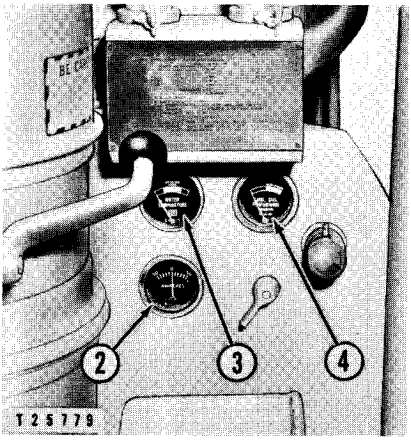
CAUTION

Do not discharge more than 2 ether capsules without cranking the engine.

ENGINE WARM-UP

After the engine has started it should be allowed to warm up for five minutes with the governor control lever in approximately half speed position before applying the load. During this warm-up period the engine gauges should be observed for proper readings as explained in the following paragraphs.





GAUGES

1–Fuel pressure gauge. 2–Ammeter. 3–Water temperature gauge. 4–Crankcase lubricating oil pressure gauge.

Oil Pressure Gauge: Immediately after the engine has started, check the crankcase lubricating oil pressure gauge **(4)** to see that it is registering pressure. When the engine is running at rated engine speed the gauge should register in the "Operating Range". A lower pressure reading is normal at low idling speeds. If no pressure is indicated, investigate at once.

Water Temperature Gauge: The indicator on the water temperature gauge **(3)** should register in the "Operating Range". The water temperature regulators within the diesel engine cooling system are designed to give an approximate minimum coolant temperature of 160° F. (71° C.). The maximum operating temperature will vary according to the air temperature and load factor, but should never exceed boiling temperature at the prevailing altitude.

Fuel Pressure Gauge: The indicator on the fuel pressure gauge **(1)** should register in the NORMAL (white) range. See the topic, CARE OF THE FUEL FILTER.

Ammeter: Check the ammeter **(2)** 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, VOLTAGE REGULATOR.

DRIVING THE TRACTOR

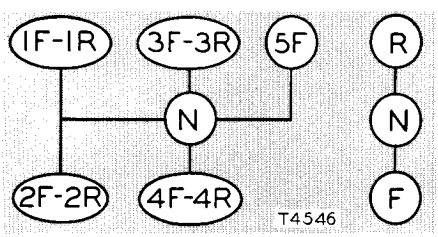
When the engine has been running long enough to warm up, move the governor control lever to the low idle speed position. Disengage the flywheel clutch by pressing the clutch control lever forward as far as it will go. This applies the clutch brake. Continue to press forward on the

lever until the clutch shaft stops turning. Carefully move the gear selector lever into position for the speed desired.

The clutch lever controls the locking mechanism that holds the sliding transmission gears in position, so the gears cannot be shifted into or out of mesh with the clutch engaged. Always shift gears completely into mesh. Unlock the steering clutch brake pedal to release the brake.

Carefully engage the flywheel clutch until the slack is taken up between the tractor and the load. When the tractor begins to move the load, pull the clutch lever all the way back so the engaging mechanism will snap over center and remain fully engaged. Never move a load with the flywheel clutch only partially engaged as this causes heating and rapid unnecessary wear on the clutch plates.

There are five forward and four reverse speeds in the transmission. Each of the four lower forward speeds has a comparable, slightly higher, reverse speed. Shifting from forward to reverse or reverse to forward in any of these four speeds is accomplished without shifting the gear selector lever. It is accomplished by disengaging the flywheel clutch and shifting the forward and reverse gear shift lever forward to operate in reverse, and backward for forward travel.



GEAR SELECTION DIAGRAM

◆

The tractor will move forward in fifth gear without the forward and reverse lever being in forward direction position. However, to insure adequate lubrication of the transmission gears and bearings, the forward and reverse lever should be in the forward direction position when operating the tractor in fifth speed.

STEERING THE TRACTOR

The tractor is steered by hand levers that operate the steering clutches, and by pedals that control the steering clutch brakes. The hydraulic control arrangement operates in conjunction with the steering clutch controls and minimizes the effort required to release the clutches during operation of the tractor. 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 angle. Both controls should be handled smoothly so the turn will be made evenly, and not as a series of jerks. Just before the turn is completed, release the brake. Then engage the steering clutch by releasing the control lever quick but gently.

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 right pedal may be locked in position to hold the tractor on slopes or when doing stationary work, by first depressing the pedal and then pushing down on the steering clutch brake lock.

Steering 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 should be 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.

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

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 engaged gradually so 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.

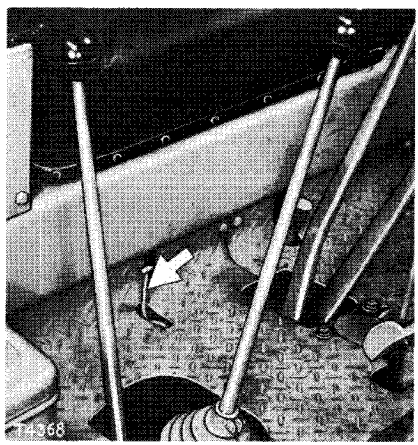
OPERATING IN DEEP MUD OR WATER

If the tractor must be operated for any length of time in deep mud or water, certain precautions are necessary. See that the plugs are in place under the steering clutch compartments. Lubricate the track rollers, track carrier rollers, the front idlers and track roller frame inner and outer bearings every 10 service hours. Inspect the oil in the final drives frequently for mud or water and drain, wash and refill as soon as the oil shows presence of mud or water. The presence of mud or water in the final drives or the excessive leakage of oil indicates the seals should be repaired. See the topic, LUBRICATION CHART.

STOPPING THE TRACTOR

To stop the tractor when it is desired to allow the engine to continue to run, disengage the flywheel clutch and move the governor control lever to reduce engine speed. Place the gear selector lever in neutral position. **With the forward and reverse lever in either forward or reverse position engage the flywheel clutch.**

The brake lock control is provided to lock one steering clutch brake in the applied position to hold the tractor on slopes or when doing stationary work. To lock the brake apply the right steering clutch brake and push forward the brake lock control.



BRAKE LOCK CONTROL

◆

CONTINUOUS OPERATION ON STATIONARY WORK

When operating any attachment which calls for stationary tractor power, or when allowing the tractor to stand with the engine idling for any long period of time, these important instructions should be followed:

1. Place the gear selector lever in neutral position.
2. Place the forward and reverse lever in either forward or reverse position.
3. Engage the flywheel clutch.

When these instructions are followed all the transmission gears, shafts and bearings are lubricated.

STOPPING DIESEL ENGINE

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 before stopping.

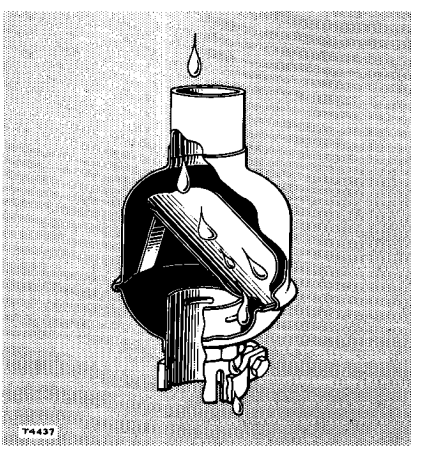
Move the governor control lever to the extreme forward position. Leave the diesel fuel tank valve open.

Machines Equipped With Direct Electric Starting: Turn the key in the HEAT and START switch to the locked position and remove the key.

When the diesel engine is stopped, pull and turn the disconnect switch either to the right or left to open the circuit between the battery and the remainder of the electrical system. The disconnect switch is provided for three reasons: first to prevent actuating the starting motor or glow plugs if the START or HEAT switches are pressed accidently. 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.

If the machine must stand without shelter, cover the exhaust pipe to exclude rain or snow. Rain traps for this purpose may be obtained from your Caterpillar dealer. If the temperature is below freezing, or if freezing weather is expected before the engine will be started again, drain the cooling system or protect it with an anti-freeze solution. See the topic, COOLING SYSTEM.

RAIN TRAP



DAILY CARE

A daily check of the machine 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, inspect for tightness.
2. Exhaust and inlet manifold and air cleaner connections, inspect for tightness.
3. Track shoe bolts, inspect for tightness.
4. Track roller end collar capscrews, inspect for tightness.
5. Cooling system, clean trash from radiator core and add coolant or anti-freeze if necessary.

6. Fuel pressure gauge, inspect with engine running to see that indicator is not in red range.

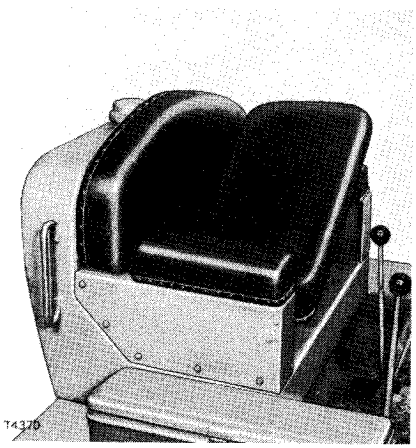
7. Diesel engine air cleaner cup, inspect for dirt in cleaner cup when operating in extremely dusty conditions.

8. Sprocket hub seals, inspect for leakage.

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

The Service Meter should be read daily. From the daily readings, the lubricating time of all parts as directed under the topic, LUBRICATION CHART, can be determined. The Service Meter readings should also be used in determining maintenance service periods.

If the machine must stand without shelter the operator's seat cushion should be tipped. When this is done the water proof covering prevents moisture entering the padding under the covering. If the cushion is turned bottom side up in rainy weather the padding under the water proof covering may become damp. This moisture with accumulated dirt and heat will shorten the life of the cushion.



SEAT CUSHION TIPPED TO PROTECT PADDING

◆

OPERATING IN COLD WEATHER

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

Lubricants: As the atmospheric temperatures become lower, where warm housing facilities are not available, lubricants of lower viscosity should be used. See the topic, CRANKCASE LUBRICATING OIL.

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 on this subject, see the topic, FUELS.

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

It is very important to keep low viscosity crankcase lubricating oil up to the full mark on the gauges, in both the diesel engine and starting engine to provide proper lubrication when starting. Refer to the topic, CRANKCASE LUBRICATING OIL.

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

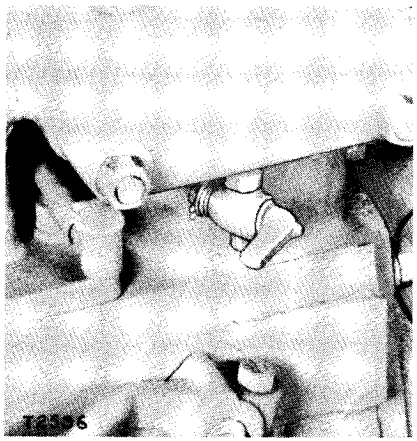
Sometimes moisture, or fuel which has not vaporized, collects on the starting engine spark plugs. They may be dried out by removing them and pouring gasoline over the electrodes. Ignite the gasoline and allow it to burn. **Use care to prevent fire.**

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 wall and interfere with compression.

Avoid over-choking and over-priming the starting engine when attempting to start it.

If the starting engine is flooded, open the drain cock on each cylinder head and turn the flywheel until the cylinders are cleared of excess fuel.

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



CYLINDER HEAD
DRAIN COCK

◆

STORAGE

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

Diesel Engine: If the machine 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. The 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.

On the diesel engine the film should be renewed by running the engine once a week until it is thoroughly warm. This will circulate the oil and prevent rusting from condensation. If it is not convenient to start the engine, remove the injection valves once a month and pour 1/8 pint (0.06 liter) of crankcase lubricating oil into each cylinder. Then turn the engine several revolutions with the compression release lever in the start position and the governor control lever in the closed position. Replace the injection valves. Thereafter, turn the engine once a week between monthly oiling intervals to distribute the oil on the cylinder walls and pistons.

CAUTION

Starting The Engine After Storage: Certain precautions should be taken when starting the engine after storage. They are:

If rusting in the diesel engine has been guarded against by pouring oil into the cylinders rather than by running the engine, release the compression and turn the engine

slowly to dissipate oil that may have accumulated in the cylinder. Then turn the engine at cranking speed **with compression released** to make sure all oil is blown out into exhaust.

If excess oil is not removed, compressing it in the small space between the piston and cylinder head will cause damage to the engine.

Starting Engine: The oil film should be renewed in the starting engine by running the engine once a week until it is thoroughly warm. If it is not convenient to start the engine, remove the spark plugs once a month and pour 1/8 pint (0.06 liter) of oil into each cylinder. Then turn the flywheel several revolutions and replace the spark plugs. Thereafter, turn the engine once a week between monthly oiling intervals to distribute the oil on the cylinder walls and pistons.

Final Drive: Allowing the tractor to stand idle for lengthy periods may permit the gasket on the final drive seals to become lightly stuck to the washer on which it operates. When this occurs the gaskets may be damaged when the tractor is operated, causing the seals to leak. For this reason, the tractor should be driven backward and forward occasionally during the storage period. 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 indicated in the topic, COOLING SYSTEM.

◆

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

The air cleaners do their work efficiently only as long as the oil in the cups flows freely at operating temperature, so it will spray into the filter sections and wash back the dirt collecting there. For this reason, the air cleaners should be inspected frequently and serviced according to the following instructions.

The interval between the oil changes and cleaning will vary with the weather and the working conditions. During the dry, dusty months, and on jobs where dust conditions are severe, it may be necessary to service the diesel engine air cleaner very frequently, possibly every 10 service hours. In damp weather, and on jobs where there is little or no dust, this operation may be necessary only once every 50 service hours. However, dependence should not be placed in visible detection of the dust, or lack of dust, in the surrounding air as a basis for servicing the air cleaner. The oil in the air cleaner may become saturated with dust, due to its fineness, much more rapidly than in instances where dust is more apparent in the incoming air.

Accumulations of sediment in the oil cup indicate that the heavier particles of dust have been satisfactorily removed from the incoming air. Some fine particles of dust become suspended in the oil without leaving any noticeable sediment in the cup. The oil in the air cleaner cup should be changed either when it will not flow freely at operating temperature, because of the fine dust particles in it, or an oil of too high a viscosity, when the accumulated sediment in the bottom of the cup is approximately ½ inch deep or every 50 service hours, whichever occurs first.

If any great amount of chaff, lint, leaves or other similar materials are present in or floating on the oil, the oil should be changed regardless of the amount of sediment in the cup. The presence of these materials in the air and oil tends to plug the separable tray screens and cause excessive oil loss from the air cleaner to the air inlet manifold. Evidence of this condition is indicated by a wet but clean air cleaner outlet and manifold. This condition should be avoided as it will shorten engine service life.

When a cleaner is operating in its normal manner, there is generally a very small amount of very fine dust which may pass through the cleaner. There may also be a slight amount of oil lost. The combination of these in time will produce a dusty dry or dirty damp air cleaner outlet. This condition is normal.

Inspect the Oil in the Diesel and Starting Engine Air Cleaner Cups: Every 10 to 50 service hours, depending upon operating conditions, inspect the oil in the diesel engine air cleaner cup. The air cleaner cup should be washed and refilled every 50 service hours or when the oil in the cup will not flow freely at operating temperature, or if the sediment in the cup is ½ inch deep (¼ inch in a starting engine air cleaner), whichever occurs first. It may be necessary to inspect the oil in the starting engine air cleaner cup only every 50 service hours.

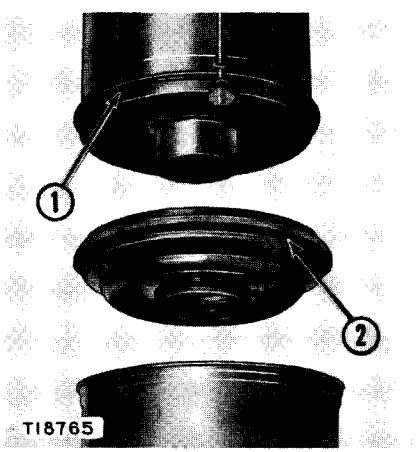
1. Loosen the wing nuts and take off the diesel engine air cleaner cup and separable tray. Earlier engines, the separable tray is fastened to the air cleaner inlet pipe by wing nuts.

   a. On starting engine air cleaners the oil cup is removed by loosening the screw clamp.

Some thickening of the oil in the cup should be no cause for alarm, actually it can be considerably thicker than the S.A.E. grade that was last put in the cup, as long as the oil at operating temperatures will flow freely. For a check to determine if the oil will flow freely, dip into the oil with a finger and if the oil on it will flow off, the oil is fluid enough to flow freely.

2. Service other parts of the air cleaner while the oil cup is removed, as indicated in the following topics.

3. When refilling the oil cup, care should be taken to see that both the inner and outer cups are filled to the flat face of the inner cup on later engines and to the oil level bead on earlier engines and starting engines. In temperatures above freezing S.A.E. No. 30 oil should be used. In temperatures below freezing use S.A.E. No. 10W oil. Do not dilute S.A.E. No. 10W oil.



AIR CLEANER SEALS

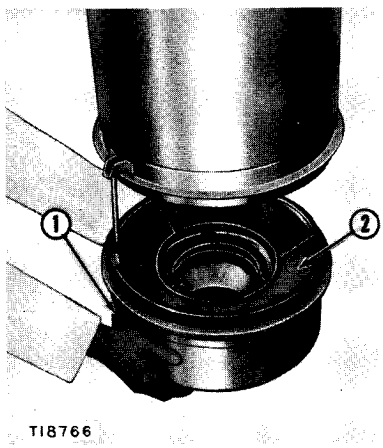
1–Seal in the groove on the body.
2–Seal in the groove on the separable tray.

◆

4 Seals between the cup, separable tray and body prevent oil running out of the cup during hillside operations. Air leakage at this point can possibly upset proper air cleaner action. When replacing the oil cup and separable tray on air cleaners, check to see that the seal **(2)** between the air cleaner cup and separable tray and the seal **(1)** between the separable tray and body are in place and in good condition. Earlier engines, there is only one seal which is located between the cup and body.

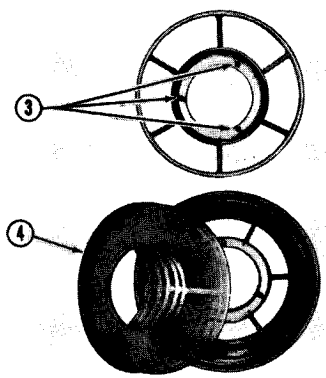
Never attempt to change the oil in the air cleaner cup when the engine is running. This will cause dirty oil to be held in the filter section by in-take action. The dirty oil held in the filter section will contaminate the fresh oil and also cause an abnormally high oil level which may allow oil in the screens to be carried into the engine resulting in overspeeding.

Wash Air Cleaner Lower Filter Section: At every air cleaner cup service period, between 10 to 50 service hours, depending on operating conditions, wash the separable tray screens or element. Air cleaners without separable tray should be serviced every 10 service hours.



TI8766

REMOVING AIR CLEANER CUP AND SEPARABLE TRAY
1–Cup. 2–Separable tray.



TI8767

AIR CLEANER SEPARABLE TRAY DISASSEMBLED (Later Models)
3–Thumb screws. 4–Screens.

1. Remove the separable tray **(2)** and cup **(1)** by loosening the wing nuts that hold them in place. Earlier engines, the separable tray and cup are removed separately.
2. Remove the tray and cup from the air cleaner body.
3. Disassemble the separable tray by loosening the thumb screws **(3)** and lift out the screens.
4. Wash the separable tray screens or element with a brush, in kerosene or some non-inflammable cleaning fluid.

5. Assemble the separable tray by placing the screens **(4)** in the tray, and tightening the thumb screws.
6. Install the separable tray and cup to the air cleaner body.
7. Make sure all connections are tight and install the air cleaner cup.

Inspect the Inside of the Air Cleaner Inlet Pipe: Every 10 to 50 service hours, depending on operating conditions, when the air cleaner cup is removed to clean the separable tray screens or element, inspect the inside of the air cleaner inlet pipe by reaching up from the bottom of the pipe. If heavy accumulations of dirt are noticed, clean the pipe.

Every 50 service hours clean the inside of the air inlet pipe by pushing a clean rag through the pipe. Where the air cleaner inlet pipe extension is used, disconnecting the pipe from the air cleaner instead of removing the precleaner will be satisfactory.

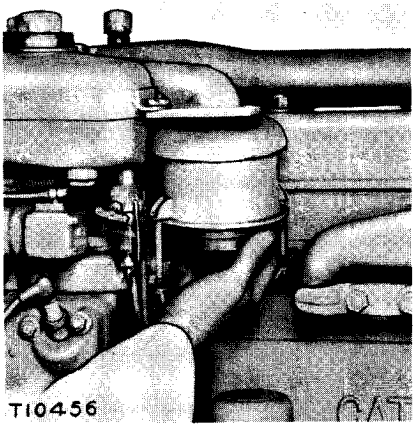
Inspect The Air Cleaner Upper Filter Section: Inspect the bottom screen of the air cleaner upper filter section whenever chaff, lint, leaves or other such material shows up in the oil or in the separable tray or element. This material must be cleaned out to maintain proper air cleaner performance.

Wash the Entire Air Cleaner: Every 2000 service hours—more often in dusty conditions—wash the entire air cleaner.

1. The entire air cleaner should be removed in order to thoroughly clean the upper filter section in the cleaner body.
2. Remove the oil cup, and separable tray.
3. Immerse the entire cleaner in kerosene or some non-inflammable cleaning fluid. Steam cleaning is not recommended because some forms of dust rolls into small balls when steam is applied, and these balls cannot be washed out of the screens.
4. Wash the oil cup and separable tray as outlined in the preceding topics.
5. Dry the air cleaner parts thoroughly and reassemble, making certain all connections are air tight.

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.



REMOVING STARTING ENGINE AIR CLEANER

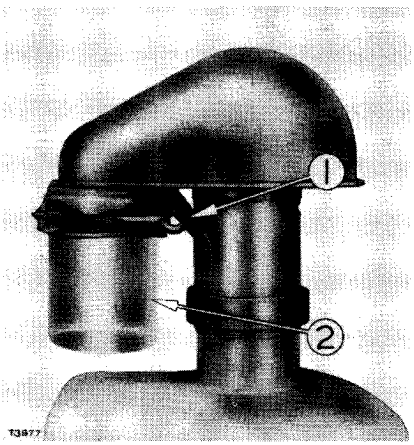
◆

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.

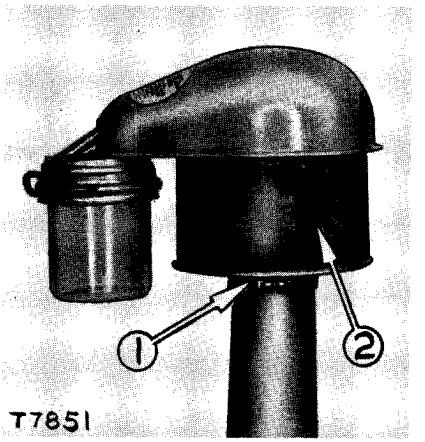
Precleaner Care: The precleaner is recommended to lengthen air cleaner service periods because it removes some of the dirt from the inlet air. For this reason, always install the jar **(2)** correctly and replace either a broken jar or gasket immediately, because the precleaner will not work properly without them. Remove and empty the jar before it becomes three-fourths full by loosening the screw clamp **(1)** that holds it in place. Inspect the fins in the precleaner regularly and when they are dirty remove the entire precleaner and wash it in water.

PRECLEANER CARE
1–Screw clamp. 2–Jar.

◆



Prescreener Care: Where the air contains objectionable foreign material, such as, cotton lint, small leaves or other particles the special prescreener should be used to prevent these materials entering the air cleaner. When the prescreener is used, inspect the screen **(2)** regularly

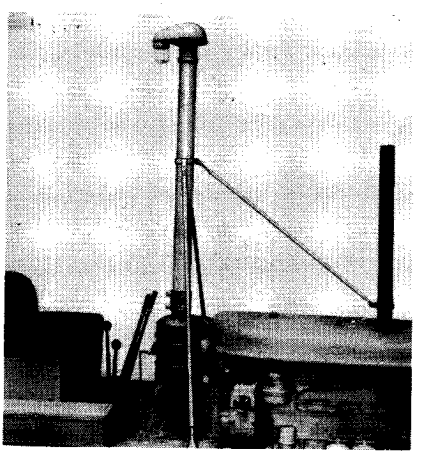


PRESCREENER
1–Clamp bolt. 2–Screen.

◆

and when it is dirty remove by loosening the clamp bolt **(1)** which holds it in place. Clean the screen with a dry brush or wash it in water.

Air Inlet Pipe Extension: Where dust conditions are severe, dust and abrasives may be carried in a heavy cloud rising to the height of the air inlet. In these conditions an air inlet pipe extension, which is available from your Caterpillar dealer, will put the precleaner up where the air is cleaner, reducing engine wear and the frequency of air cleaner service.



AIR INLET
PIPE EXTENSION

◆

CRANKCASE LUBRICATING OIL SYSTEM

Two types of crankcase lubricating oil filter systems are covered in this topic. Tractors effective with 8U4417 and 9U7424 are equipped with full-flow crankcase lubricating oil filters. The full-flow filter has one large full-flow filter element only in each filter housing. Tractors before 8U4417 and 9U7424 were equipped at the factory with by-pass crankcase lubricating oil filter system which may be converted to the full-flow system

by the installation of the field change over group. The by-pass filter has an inner element and an outer metallic strainer element in each filter housing.

Servicing the crankcase lubricating oil filter as described, should be performed each time the crankcase lubricating oil is changed, or after 10 service hours of operation of a reconditioned engine. Experience shows that a certain amount of dirt and foreign material is present in a reconditioned engine even though best service practices are followed. When equipped with a by-pass system, change the element every 125 service hours in extremely dusty operations.

Full-Flow System

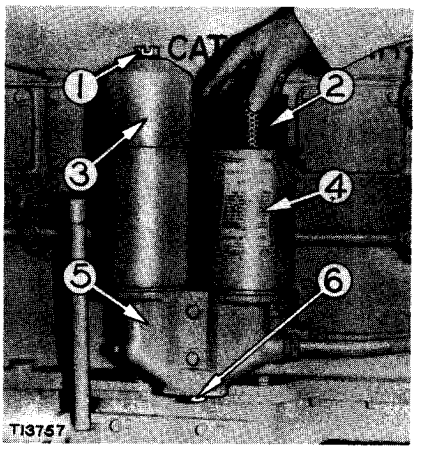
Crankcase Lubricating Oil Filter: The filter elements should be replaced with new Caterpillar elements at each filter service period as follows:

1. Remove the drain plug **(6)** from the oil filter base **(5)**. Then loosen the clamp screw **(1)** and remove the cover **(3)** and screw as a unit.
2. Lift out the element **(2)** and discard it.
3. Install a new Caterpillar full-flow element in the housing **(4)**.
4. Reinstall the cover, tighten the clamp screw and replace the drain plug.

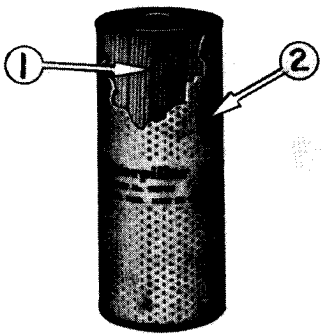
CRANKCASE LUBRICATING OIL FILTER

1–Clamp screw. 2–Element. 3–Cover. 4–Housing. 5–Filter base. 6–Drain plug.

◆



Full-Flow Crankcase Lubricating Oil Filter Element: The element is of the plastic impregnated paper type. The impregnated paper **(1)** is pleated around a center core and encased within a perforated cover **(2)**.



T7410

CRANKCASE LUBRICATING OIL FILTER ELEMENT

1–Impregnated paper.
2–Perforated cover.

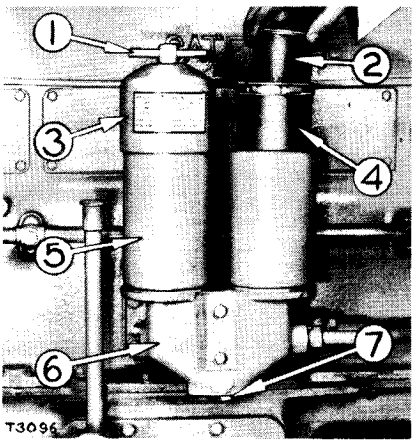
◆

The filter housing, cover and element are designed to seal unfiltered oil from the filtered oil side of the element. Sealing is accomplished by a spring loaded flat plate in the cover which holds the element against the flat plate at the bottom of the housing.

By-Pass System

Crankcase Lubricating Oil Filter: The filter elements should be replaced with new Caterpillar elements at each filter service period as follows:

1. Remove the drain plug **(7)** from the oil filter base **(6)**. Then loosen the clamp screw **(1)** and remove the cover **(3)** and screw as a unit.
2. Lift out the inner element **(2)** and discard it.
3. Remove the metallic strainer elements **(4)** and wash them in kerosene or some non-inflammable cleaning fluid. If the sludge must be brushed off, use the brush supplied in the tool equipment and stroke parallel to the winding. Eventually, gums and lacquers may clog the metallic strainer element, even though it appears clean on the outside. The openings between the windings and the internal condition of an element can be checked by comparing it with a new one. Plug the holes in the bottom of both old and new metallic strainer elements and immerse them to the top rim in diesel fuel. Compare the rate at which the fuel rises inside the elements. Discard the used one if it is not at least three-fourths full by the time the new one is completely filled.
4. Install the metallic strainer elements and new inner elements in the housing **(5)**.
5. Reinstall the covers, tighten the clamp screw and replace the drain plug.



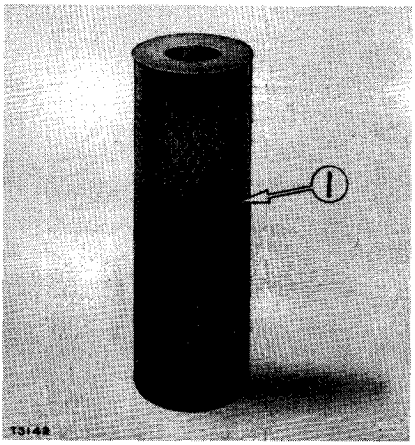
BY-PASS CRANKCASE LUBRICATING OIL FILTER

1–Clamp bolt. 2–Inner element. 3–Cover. 4–Metallic strainer element. 5–Housing. 6–Filter base. 7–Drain plug.

◆

By-Pass Crankcase Lubricating Oil Filter Element: The by-pass filter element is the plastic impregnated paper type. The perforated cover **(1)** encases the impregnated paper which is pleated around a center core.

A self-sealing action at the ends of the element is developed by a spring loaded plate in the cover which holds the element against the flat plate at the bottom of the housing.



BY-PASS CRANKCASE LUBRICATING OIL FILTER INNER ELEMENT

1–Perforated cover.

◆

Washing the Crankcase: Whenever the diesel or starting engine oil pan is removed for any reason it should be thoroughly cleaned before it is re-installed. 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 cheaper fuels. Customers should always buy the **lowest priced fuel giving satisfactory operation.**

Your Caterpillar dealer is familiar with fuels that are giving good results in Caterpillar Diesel Engines in his territory. If necessary, consult him for his recommendations. He will be glad to advise you.

Because of the lack of world-wide standardization of diesel fuel classifications, it is not possible to make specific recommendations for export territories. For best results see your Caterpillar dealer for brand names of satisfactory fuels in your particular area.

In the United States and Canada, diesel fuels are available under two general classifications. One is "premium" fuel and the other is "domestic furnace oil," No. 2 grade.

Caterpillar Diesel Engines are designed to operate on the less expensive domestic furnace oils. For a number of years, No. 3 domestic furnace oil as classified by the American Society For Testing Materials, was recommended. A change in furnace oil specifications eliminates the No. 3 grade which is now described as No. 2 grade. Fuels falling within the general class are widely available, give satisfactory results and cost considerably less than "premium" fuels.

There is appreciable variation in the composition of fuels furnished under the domestic furnace oil classification. For desirable engine service, it is most important to give special attention to two properties of the fuel which are: pour point and sulphur content.

Pour Point

In subzero (−18° C.) weather, where warm storage is not provided, fuels with unusually low pour points may be required. It is necessary that it be fluid enough to flow from the diesel fuel tank to the engine transfer pump at the lowest temperature at which the engine must start and operate.

Sulphur Content

As the sulphur content of the fuel increases, the oil change periods should be reduced as indicated in the topic, CRANKCASE LUBRICATING OIL.

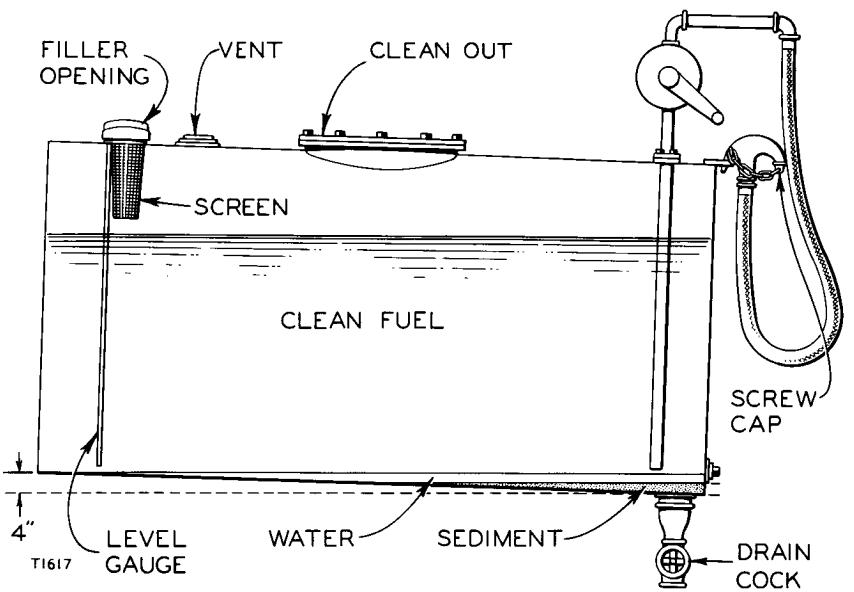
CARE OF THE FUEL SUPPLY

Keep The Fuel Clean: Too much emphasis cannot be placed on the importance of using only clean diesel fuel. 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.

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. An important step is to reduce the number of times the fuel must be handled. When the fuel can be delivered by the distributor to storage tanks and then pumped from the storage tank to the diesel fuel tank, the handling is reduced to a minimum.

The use of cans, funnels, and drums should be discouraged, since it is practically impossible to keep this equipment absolutely clean. If drums must be used, they should be allowed to stand for at least 24 hours before drawing off fuel. A pump installation similar to that shown with the storage tank should be used. The drum should stand on end and the inlet for the pump be kept several inches above the bottom to prevent stirring up the sediment that settles to the bottom.



RECOMMENDED FUEL STORAGE TANK

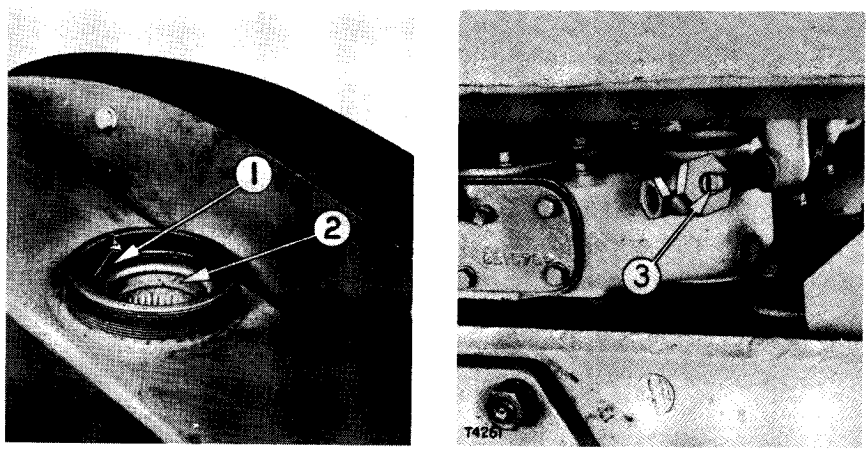
The illustration of a fuel storage tank is a typical, satisfactory installation. Since natural settling is an effective method of cleaning diesel fuel, the fuel should be allowed to stand at least 24 hours in the storage tank

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.

Whatever method is used, see that only clean fuel enters the diesel fuel tank.

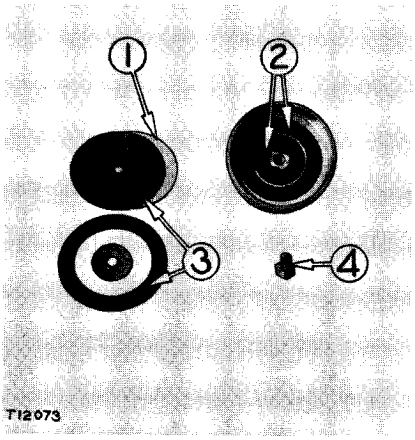
CARE OF THE DIESEL FUEL TANK

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 **(1)** in the filler opening. Every 125 service hours before starting the engine, open the drain cock **(3)** under the diesel fuel tank and drain off any sediment or water which may have accumulated. The strainer **(2)** 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
1–Plunger gauge. 2–Strainer. 3–Drain cock.

Diesel Fuel Tank Filler Cap: The diesel fuel tank filler cap elements **(2)** should be washed every 50 to 250 service hours depending upon the amount of dust in the air. To do this, remove the capscrew **(4)** and take out the baffle plate **(1)** and gaskets **(3)**. Wash the cap and elements in a can of 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 TANK FILLER CAP

1–Baffle plate. 2–Elements. 3–Gaskets. 4–Bolt.

◆

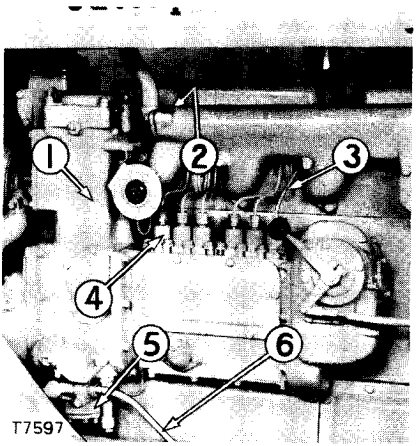
FUEL SYSTEM

The fuel flows from the diesel tank through the fuel line **(6)** to the fuel transfer pump **(5)**. The fuel transfer pump supplies the fuel under pressure to the fuel filters **(1)**, which remove the dirt and other foreign

FUEL SYSTEM

1–Fuel filter housing. 2–Fuel injection valve. 3–Fuel injection line. 4–Fuel injection pump. 5–Fuel transfer pump. 6–Fuel line from diesel tank.

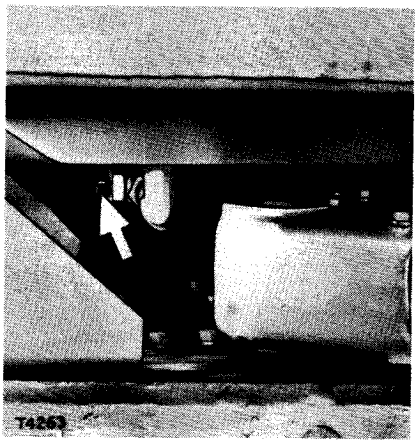
◆



particles. From here the fuel is supplied to the fuel manifold for the individual fuel injection pumps **(4)**. The fuel injection pumps meter and force the fuel through the fuel injection lines **(3)** and the fuel injection valves **(2)** in the cylinder head, into the pre-combustion chamber where it is ignited and passed into the main combustion chamber or cylinder.

CARE OF THE FUEL FILTER

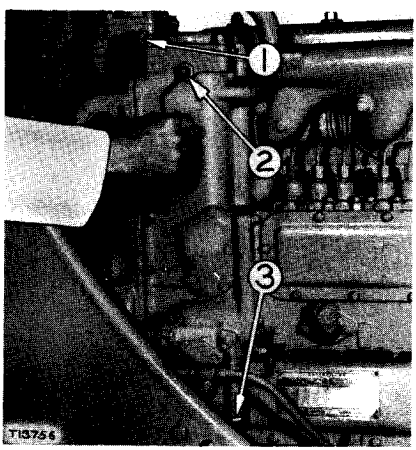
Draining Fuel Filter Housing: Every 50 service hours, drain the filter housing of sediment and water which settles to the bottom of the compartment. Close the diesel fuel tank valve, remove the filter housing drain



DIESEL FUEL TANK VALVE

◆

plug **(3)** and open the lower vent **(2)** and then the upper 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–Upper vent. 2–Lower vent. 3–Drain plug.

◆

Fuel Filter Elements: When the absorbent filter elements have collected enough contamination to interfere with engine performance, they must be replaced. These elements will continue to absorb 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; this is prevented by the fine grade filter paper at the core.

Because these filter elements absorb and hold contaminants, they cannot be washed or otherwise restored.

As the filters gradually become clogged with foreign material, the position of the fuel gauge indicator will work back from the original position in the NORMAL (white) range, to the CAUTION (green) range,

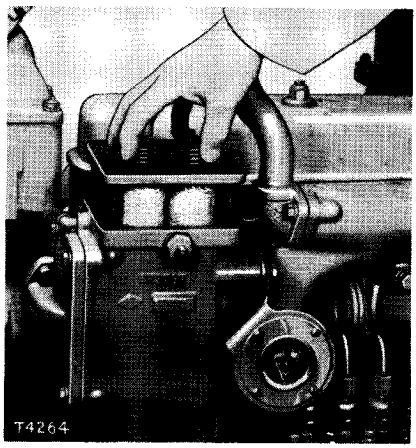
FUEL PRESSURE GAUGE

◆

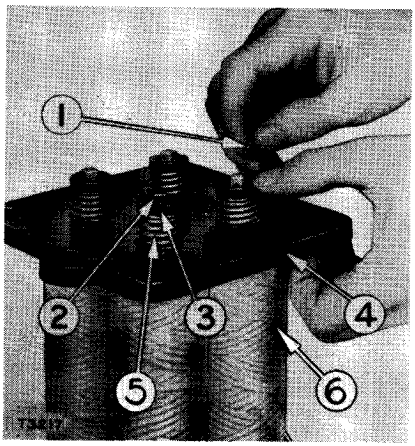
and later into the OUT (red) range. When the indicator shows in the OUT (red) range the filters should be changed and all new filter elements installed—never only one.

Removing Used Filter Elements: Remove the engine hood. Thoroughly clean the top of the filter cover and around the edges of the gasket joint between the filter body and cover, to guard against loose dirt dropping into the filter housing when the cover is removed. Close the diesel fuel tank valve, remove the filter housing drain plug, open the lower and then the upper filter housing vents.

Remove the cover, and lift the assembly of filter element plate and all filter elements out of the housing.



REMOVING FUEL FILTER ASSEMBLY



REMOVING FILTER ELEMENT
1–Pin. 2–Retainer rod. 3–Retainer. 4–Filter element plate. 5–Spring. 6–Filter element.

To remove the used filter elements, set the assembly on a flat surface and compress each spring **(5)** until the retainer **(3)** will permit removal of the pin **(1)**. Lift off the filter element plate **(4)** and remove the used elements **(6)** from the retainer rods **(2)**.

Attaching New Filter Elements To Filter Element Plate: Thoroughly wash the plate, retainer rods, retainers, pins, and springs in clean kerosene, diesel fuel or a non-inflammable cleaning fluid. Make sure that the hands are clean before attempting to install the new parts. Place the retainer rods into each new filter element and attach to the plate individually by compressing the spring and inserting the pin so it is held securely in the counterbore of the retainer. Grasp each element at the bottom end and give it approximately a half turn under light pressure to seat the end of the element against the plate and against the disc on the bottom of the retainer rod. Keep the elements parallel and square with the plate while performing this operation.

Installing Filter Elements In Housing: Exercise extreme care to see that the top side of the retainer plate, retainer assembly, and the inside of the housing cover are clean. These parts are on the clean side of the elements and if dirt is not completely removed, it will find its way into the fuel injection equipment. To install the elements in the housing proceed as follows:

1. Flush out the housing with clean fuel and replace the drain plug.
2. Install a new gasket on the housing.
3. Fill the housing approximately half full with clean fuel, so that a minimum of cranking is required to prime the system.
4. Install the elements and plate in the housing.
5. Install a new gasket on the plate.
6. Replace the cover and follow the instructions given in the topic, PRIMING THE FUEL SYSTEM.

Keep New Elements On Hand: An extra set of filter elements should be kept on hand for replacement purposes. 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 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 mis-firing of one or more cylinders.

When Equipped With Gasoline Starting Engine:

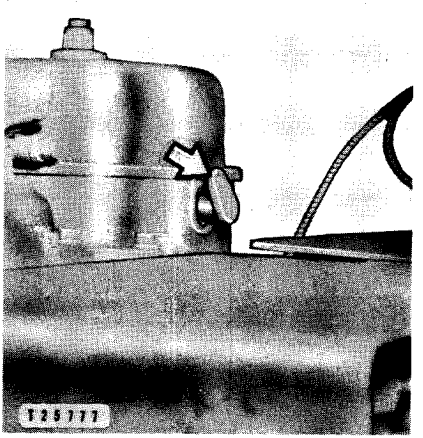
1. Check to see that the diesel fuel tank valve is open.
2. Move the governor control lever to the shut-off position, so the fuel injection pumps are closed.
3. Move the compression release lever to the START position.
4. Start the starting engine, engage the starter pinion and clutch. Allow the starting engine to crank the diesel engine at starting engine low idle speed.
5. Open the fuel filter vent valves and fuel injection pump vents. When the flow of fuel from the vent is continuous and contains no air bubbles, close the vent valves.
6. Open and close the vent valves several times in succession to be sure all air is bled from the system.

When Equipped With Direct Electric Starting Motor:

1. Check to see that the diesel fuel tank 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 right to release the compression.

COMPRESSION RELEASE LEVER IN RUN POSITION

◆

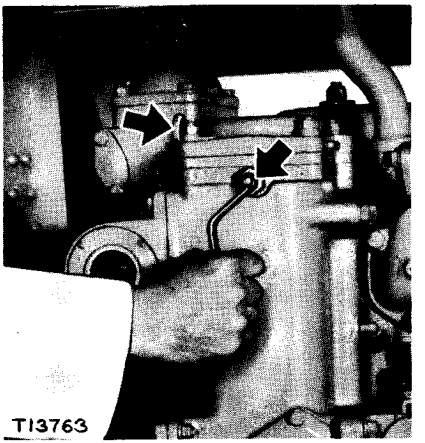


4. Open the fuel filter vent valves and fuel injection pump vents.
5. Turn the diesel engine over with the starting motor until the flow of fuel from the vents is continuous and contains no air bubbles, close the vent valves.

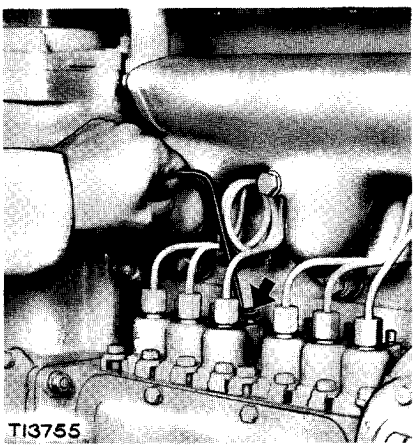
6. Place the compression release lever in the run position and then start the engine. If the engine does not run smoothly further bleeding may be necessary. Open and close the fuel injection pump vents, one at a time, several times in succession to be sure all the air is bled from the system.

FUEL FILTER VENT VALVES

◆



A fuel priming pump is available for use with direct electric starting. See the topic, FUEL PRIMING PUMP.



FUEL INJECTION PUMP VENTS

◆

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, CARE OF THE FUEL FILTER. Replace

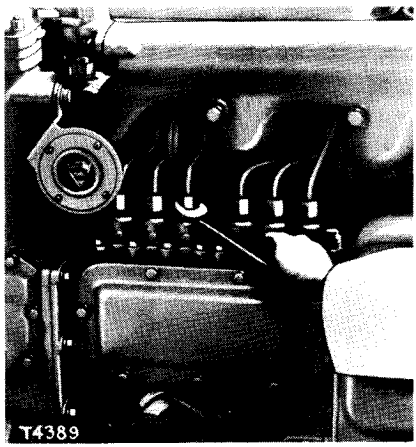
the filters if necessary. Then prime the fuel system until clean fuel passes through the vent valves on the fuel injection pumps. If the fuel system is air bound, priming the system will overcome the difficulty.

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 defective valve and a new one should be installed in that cylinder. These valves can be tested by your Caterpillar dealer.

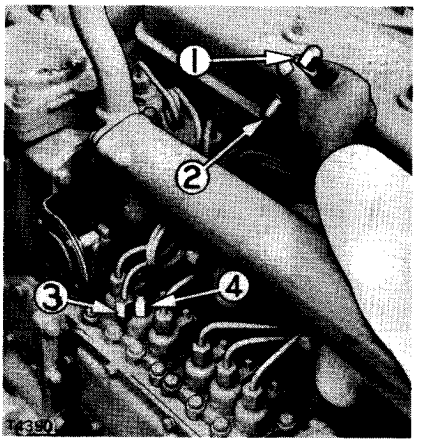


LOOSENING FUEL INJECTION LINE NUT TO TEST VALVE

◆

Removing Fuel Injection Valves: Before removing a valve, clean the dirt from around the valve and connections with the brush supplied in the tool equipment.

Disconnect the fuel injection line from the injection valve and pump. Immediately install plug **(3)** and cover **(4)** to prevent dirt entering the fuel passages. Remove the valve retainer nut **(1)** and lift out the nozzle assembly **(2)** and body as a unit.



REMOVING FUEL INJECTION VALVE

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

◆

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 precombustion 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.

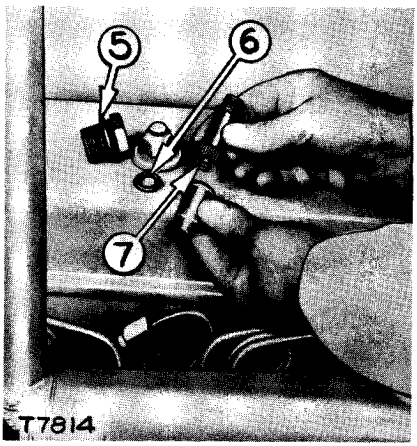
4. Tighten the retainer nut good and tight to prevent leaks between the nozzle assembly and the nozzle assembly seats. For proper installation of the valve use one of the following methods.

   a. Tighten with a torque wrench to 100 pounds feet.

   b. Tighten good and tight with a steady pull using the special wrench supplied in the tool equipment.

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.



INSTALLING FUEL INJECTION VALVE

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

◆

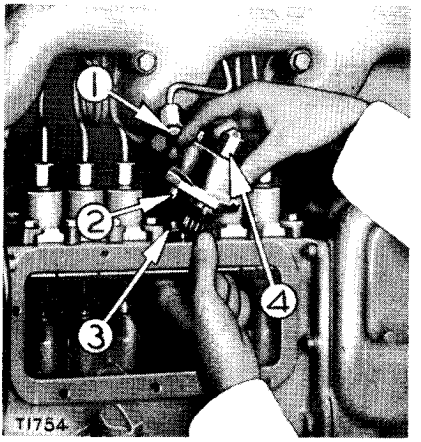
Fuel Injection Pumps

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 gases from the crankcase breather, it indicates worn injection pumps. These pumps can be tested by your Caterpillar dealer.

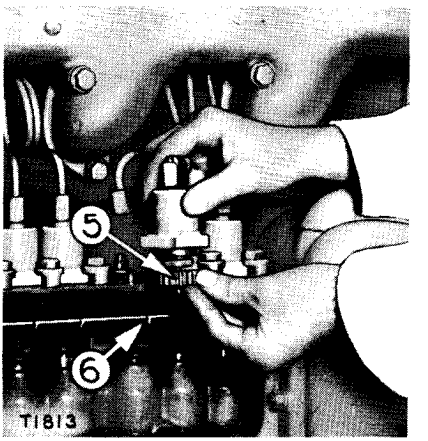
Removing Fuel Injection Pumps: Every precaution should be taken to prevent dirt from getting into the fuel injection pumps or housing. Use the brush supplied in the tool equipment to clean the top of the housing and around the inspection plate before removing. When fuel injection pumps are removed the pump plungers must not be taken from the barrels because dust or dirt will scratch these finely finished parts.

After cleaning the top of the housing, and around the inspection plate, remove the fuel injection lines from the pumps and immediately cap and plug the openings with covers **(4)** and plugs **(1)** provided in the tool equipment. Remove the inspection plate.

Remove the bolts and clamps holding the fuel injection pump to the housing and lift the pump straight up only enough to clear the dowel pins. Then insert a finger through the inspection hole, hold the plunger from dropping out and shift the pump to one side so the end of the pump plunger will free itself from the slot in the lifter. Place the ferrule cap seal **(3)** and stopper **(2)** furnished in the tool equipment over the fuel outlet of the fuel housing and in the inlet of the pump to keep out dirt.



REMOVING FUEL INJECTION PUMP
1–Fuel line plug. 2–Stopper. 3–Ferrule cap seal. 4–Cover.



INSTALLING FUEL INJECTION PUMP
5–Marked gear tooth. 6–Mark on rack.

Should the plunger accidentally be removed from the pump barrel, take every precaution to avoid nicking or scratching it since the slightest rough spot will cause undue wear in the barrel and shorten the life of the pump. The plunger should be rinsed in clean fuel before putting it back in the barrel. Be sure the plunger is replaced in the barrel from which it was withdrawn. Each fuel injection pump assembly (plunger and barrel) is machined as a unit and finished to such exact limits that it must be used, removed, and replaced as a unit.

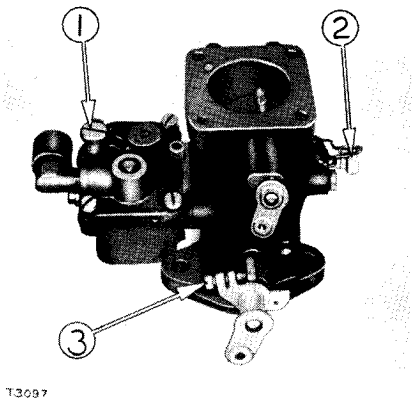
Installing Fuel Injection Pumps: Lower the pump and plunger into the housing, taking care that the pump plunger does not slide out of the pump. Line up the marked tooth **(5)** of the injection pump plunger gear with the mark **(6)** on the rack as the plunger is lowered into place. Slide the end of the plunger into the slot in the filter. Remove the ferrule cap seal and plug from the fuel passage and lower the pump onto the dowel pins. Fasten the pump in place.

STARTING ENGINE FUEL SYSTEM

Keeping the starting engine fuel tank filled will prevent condensation in the tank. Periodically drain any water which may have accumulated in the starting engine fuel tank sediment bowl. Check the carburetor for proper adjustment every 500 service hours.

Carburetor Adjustment: To obtain an approximate carburetor adjustment, turn the adjusting screws gently against their seats. Then back off the high speed screw one turn from the closed position and the idling speed adjusting screw one half turn from the closed position.

A more accurate adjustment can be obtained while the engine is running by turning the high speed screw **(1)** out to make the mixture richer or in to make it leaner. Adjust this screw to a point that will give the greatest amount of power with a clear exhaust. Turn the idling speed



T3097

CARBURETOR ADJUSTMENT

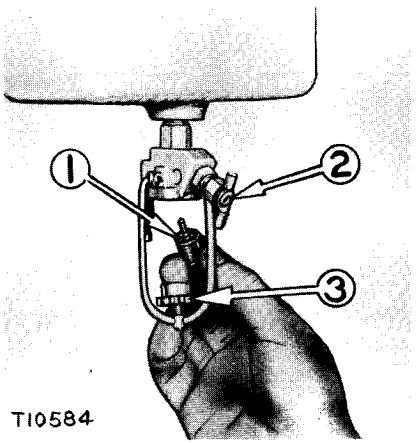
1–High speed adjustment. 2–Idling speed adjustment. 3–Idling speed control screw.

◆

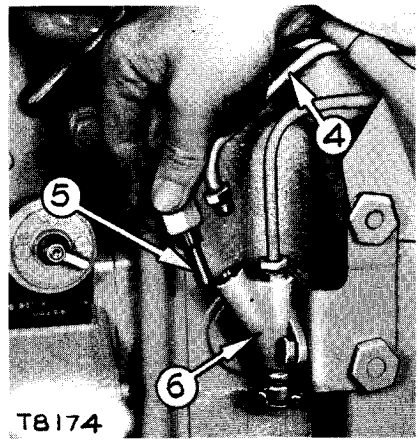
adjusting screw **(2)** until the engine will idle regularly at slow speed without emitting black smoke from the exhaust. Turn this screw in to make the mixture richer or out to make it leaner. Turn the idling speed control screw **(3)** to the left (out) to decrease idling speed or to the right (in) to increase the speed.

Sediment Bowl Filter Fuel Line Screen: The sediment bowl collects water and sediment that may be in the fuel. To remove the collected water and sediment, close the valve **(2)** under the fuel tank and remove the bowl by unscrewing the nut **(3)** that clamps it to the body of the valve. Unscrew the edge-type filter **(1)** and shake it in kerosene or some non-inflammable cleaning fluid. When the bowl is replaced see that the gasket is clean, is in the correct position, and is not broken.

Earlier tractors have a filter screen **(5)** in the starting engine fuel shut off valve which collects sediment that may be in the fuel. This collected sediment can be removed by turning off the valve, removing the fuel line **(4)** from the filter screen nut and the screen nut from the valve body **(6)**. Wash the screen in kerosene or non-inflammable cleaning fluid. The body can be washed out with the screen removed by opening the valve long enough to allow gasoline from the tank to remove the loose sediment. If water is noticed on the screen or in the fuel line loosen the plug on the bottom of the fuel tank to drain any water that has accumulated.



STARTING ENGINE SEDIMENT BOWL FILTER
(Later Tractors)
1–Edge type filter. 2–Fuel shut-off valve. 3–Nut.



REMOVING STARTING ENGINE FUEL FILTER SCREEN
(Earlier Tractors)
4–Fuel line. 5–Filter screen. 6–Filter body.

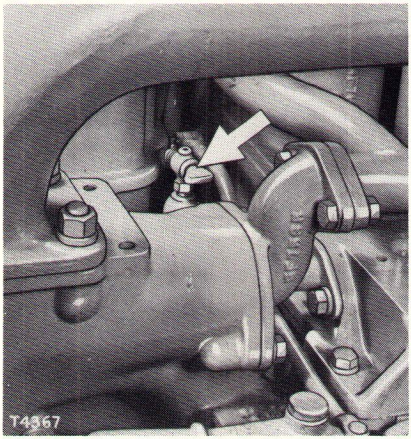
COOLING SYSTEM

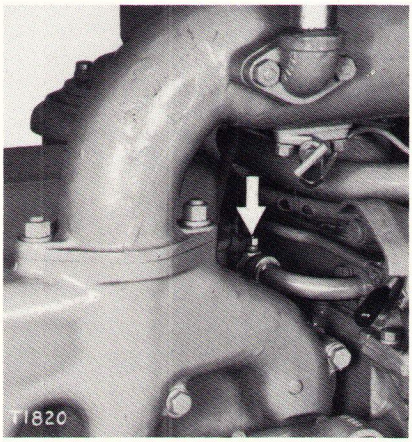
Coolants: Water used in the cooling system should be soft, or as free as possible from scale forming minerals. If it is impossible to obtain soft water it is advisable to treat the available water with Caterpillar Rust Inhibitor. The use of this rust inhibitor in the cooling system will prevent the formation 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 inhibitors with those anti-freeze solutions which do contain inhibitors. 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 regulator 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.

Filling: Fill the starting and diesel engine cooling system by pouring the coolant into the radiator filler opening. A vent cock or plug located in the starting engine water outlet elbow should be opened or removed

when filling the cooling system. This vent allows all air to escape from the system and assures complete filling. The cock should be closed or the plug replaced as soon as the cooling system is full.

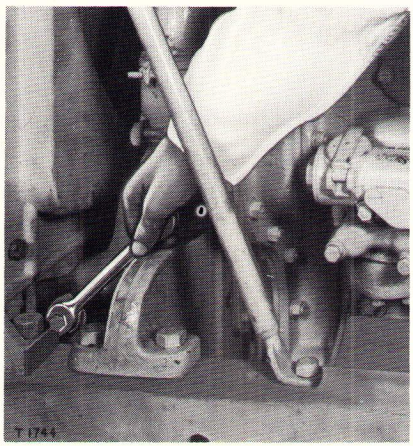




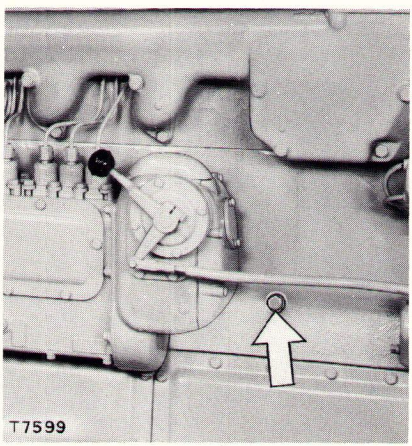
VENT COCK OR VENT PLUG IN STARTING ENGINE WATER OUTLET ELBOW
(Later Models) **(Earlier Models)**

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

Draining: Every 1000 service hours drain and refill the cooling system. The cooling system is drained by removing the radiator cap, opening the valve on the left side of the radiator bottom tank and by opening the



OPENING RADIATOR DRAIN VALVE



CYLINDER BLOCK DRAIN PLUG

diesel cylinder block drain cock at the left rear of the diesel engine block. This should be done at the end of the day's run when the material is in suspension and will drain with the liquid.

Cleaning The Cooling System: The cooling system should be drained every 1000 service hours to remove dirt and sediment which accumulates. The draining should be done at the end of the day's run, when the foreign material is in suspension and will easily drain with the liquid.

The cooling system should be washed out occasionally. To do this, run the engine until the liquid in the cooling system is at operating temperature, and the loose foreign material is stirred up. Then stop the engine, and drain as quickly as possible before the sediment has time to settle. Close the drain and pour in kerosene equal to about one-tenth the capacity of the cooling system and fill the remainder with a solution of one-half pound (226.8 grams) of washing soda to each gallon (3.8 liters or .8 Imp. Gal.) of water. Run the engine for about one-half hour, and again drain and flush the system with clean water.

In more obstinate cases, if the above treatment does not prove effective, an acid solution may be used; but acid must be used with extreme care, and only after other means have proven ineffective. Immediately after the system has been washed with the soda solution described, fill the cooling system with a solution of five parts hydrochloric (commercial muriatic) acid, one part formaldehyde and forty-eight parts water and allow it to remain in the system for a few hours at operating temperature. The formaldehyde should first be mixed with the water, then the acid added to the solution. Drain immediately after stopping the engine and thoroughly flush the system with clean water to which has been added a handful of washing soda, which acts as a neutralizing agent.

After using the acid treatment, the cooling system should be drained and flushed with clean water the second time at the end of the day's run.

CAUTION

The acid solution is also a solvent of the metals of which radiators are made, therefore, great care must be exercised to avoid continuing the operation beyond the point where the scale is dissolved. It is highly important that no trace of the acid be left in the cooling system.

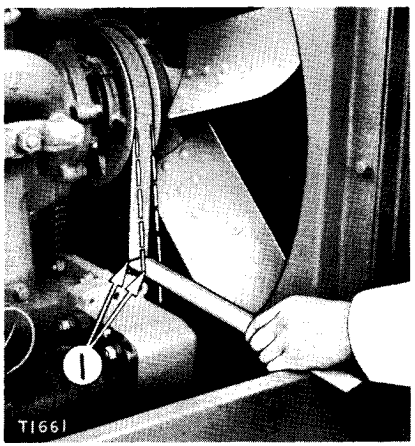
FAN BELT ADJUSTMENT

The fan belts should be checked every 250 service hours for proper adjustment.

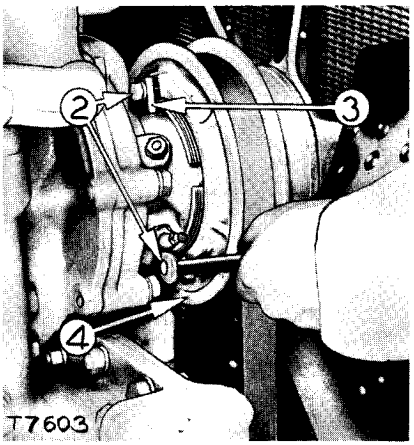
If the fan belt is operated too loose it will slip against the pulleys, causing unnecessary wear to the belt and possibly slipping to the extent that the engine will overheat. If the belts are too tight, unnecessary stresses are placed upon the fan bearings and belts, which might shorten the life

of both. Correct adjustment exists when the belts can be pushed inward 9/16 to 13/16 inch (1.4 to 2. cm.) with approximately 25 pounds pressure exerted midway between the pulleys.

Adjusting Belt: To adjust the fan belt, remove the locks **(3)** holding the adjustable rim **(4)** of the pulley in position on the hub of the fan by taking out the fastening capscrews **(2)**. Screwing the rim toward the radiator will tighten the belt. The adjustment is correct when the belt can be easily pushed inward a distance of approximately 9/16 to 13/16 inch (1.4 to 2. cm.) as shown at **(1)** with approximately 25 pounds pressure exerted midway between the pulleys. Be sure the locks are lined up with the slots in the hub before the bolts are tightened.



CHECKING FAN BELT TENSION



FAN BELT ADJUSTMENT

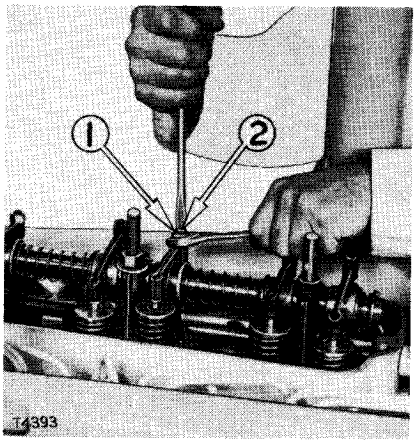
1–There should be 9/16 to 13/16 inch (1.4 to 2. cm.) slack at this point. 2–Fastening bolts. 3–Locks. 4–Adjustable rim.

VALVE CLEARANCE ADJUSTMENT

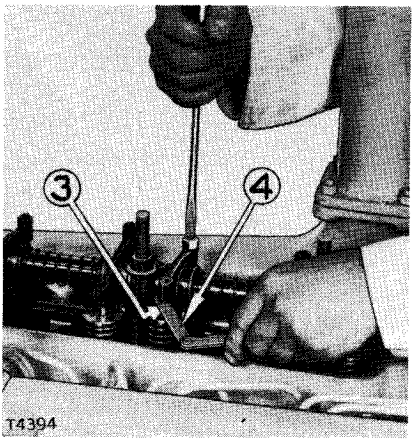
The initial valve clearance adjustment should be made after the first 250 service hours of operation. Thereafter, the clearances should be checked and adjusted if necessary after every 500 service hour operating interval.

The valve clearance adjustment should be made while the engine is hot, either while the engine is running or before it has been stopped twenty minutes after having run long enough to thoroughly warm up. If the adjustment with the engine stopped is not completed during the twenty minute interval, start the engine and allow it to warm up. The valve clearance adjustment must be made or the clearances checked, with the compression release lever in the RUN position.

To Adjust: Loosen the valve adjusting screw lock nut **(1)**, turn the adjusting screw **(2)** to allow a thickness gauge **(4)** to pass between the top of the valve stem **(3)** and the end of the valve rocker at the correct clear-



LOOSENING LOCK NUT



ADJUSTING VALVE CLEARANCE

1–Lock nut. 2–Adjusting screw. 3–Valve stem. 4–Thickness gauge.

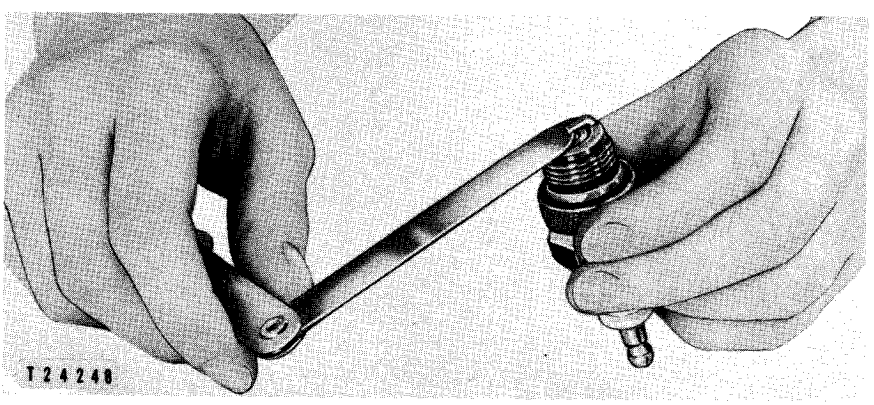
ance. Set this clearance at .010 inch (0.25 mm.) for exhaust and inlet valves. Tighten the adjusting screw lock nut and check the adjustment.

If the adjustment is made with the engine stopped, turn the engine until the valve closes and push rod is at its lowest point.

The compression release clearance is not adjustable but it should be checked when the valve clearances are checked. The normal clearance between the inlet valve rocker and flat of the compression release shaft is about .125 inch (approximately .3 cm.). If the clearance is not correct see your Caterpillar dealer.

SPARK PLUG ADJUSTMENT

The spark plugs should be examined every 1000 service hours. The gap should be kept at approximately .025 inch (0.64 mm.). Measure this gap with a thickness gauge. To adjust the gap, bend the outer electrode.

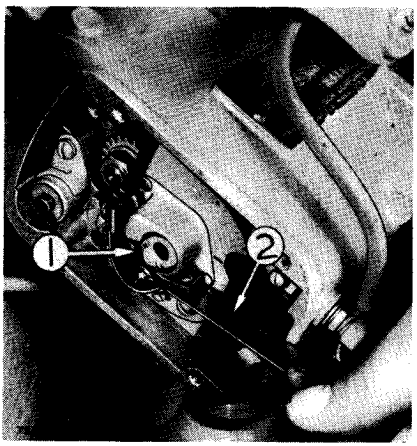


SPARK PLUG ADJUSTMENT

STARTING ENGINE MAGNETO

Do Not Lubricate The Magneto At Any Point: The bearings are packed with a ball and roller bearing lubricant when assembled, and this should be replaced only when the magneto is taken to your Caterpillar dealer for checking or reconditioning.

Checking Contact Point Opening: Every 1000 service hours check the contact point opening.



CHECKING CONTACT POINT OPENING

1–Contact point bumper block on one of the highest elevations of the cam.
2–Thickness gauge.

◆

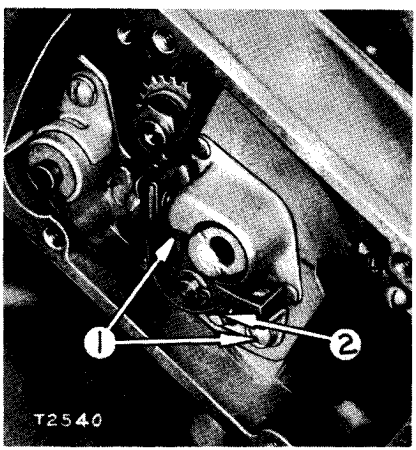
To check with magneto in place, first remove the distributor plate and pull out the distributor rotor, then turn the engine flywheel until the contact point bumper block **(1)** is on one of the highest elevations of the cam. Check the clearance with a thickness gauge **(2)**. This clearance should be .014 to .018 inch (.35 mm. to .46 mm.).

Adjusting Contact Point Opening: Loosen the screws **(1)** which hold the adjustable contact point bracket and move the bracket by inserting a

ADJUSTING CONTACT POINT OPENING

1–Bracket fastening screws.
2–Eccentric slotted-head screw.

◆



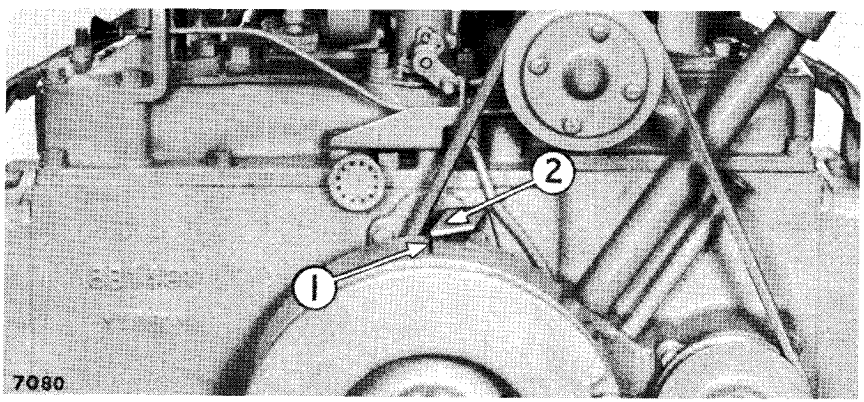
screw driver in the eccentric slotted-head screw **(2)** and turn until the correct point opening is obtained. Then tighten the fastening screws and recheck the adjustment.

Testing: A magneto may be tested when coupled to the engine by turning the switch, ON, removing the cable from a spark plug, and holding the terminal 1/8 inch (3.17 mm.) away from the metal base of the plug while turning the engine flywheel. If no spark passes from the terminal to the metal base, disconnect the magneto switch wire from the magneto which is connected to the terminal on top of the magneto housing and test again. If a spark passes from the terminal to the plug base with the switch wire removed, the wire running 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 Magneto For Testing: Disconnect the cables from the magneto. (One of the magneto outlets should be tagged or marked in some convenient manner which will designate the proper position of cables.) Remove the two stud nuts that hold the magneto to the timing gear cover and lift off the magneto.

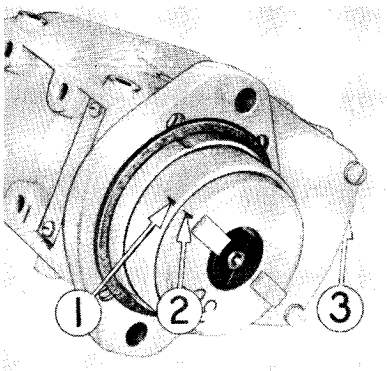
To Time The Magneto To The Engine: First check the adjustment of the contact points. Then open the cylinder head drain cock of No. 1 (rear or left) cylinder and turn the engine flywheel slowly until a rush of air is noted coming from the cylinder. This indicates that the piston is coming up on the compression stroke. Continue to turn the flywheel slowly until the mark **(1)** (MAG) is even with the pointer **(2)** on the starting engine crankcase cover.

With the magneto off of the engine, remove the distributor plate from the magneto and rotate the impulse coupling in the opposite direction from drive which is indicated by an arrow **(3)** on the top of the magneto

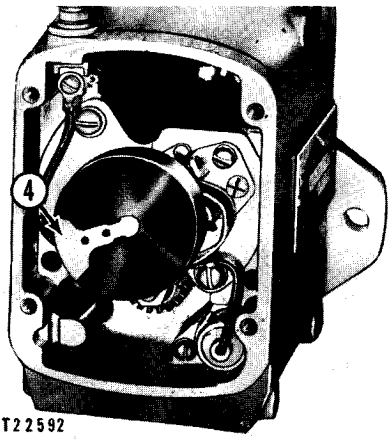


STARTING ENGINE FLYWHEEL TIMING MARK AND TIMING POINTER
1–Mark on flywheel. 2–Pointer on cover.

housing (this will prevent the coupling weights from engaging) until the red timing mark **(2)** on the coupling lines up with the red mark **(1)** on the arrester plate and the distributor rotor contact **(4)** is in the position as



TIMING MARKS
1–Timing mark on arrester plate.
2–Timing mark on coupling. 3–Arrow.



ROTOR POSITION TO TIME MAGNETO TO ENGINE
4–Distributor rotor contact.

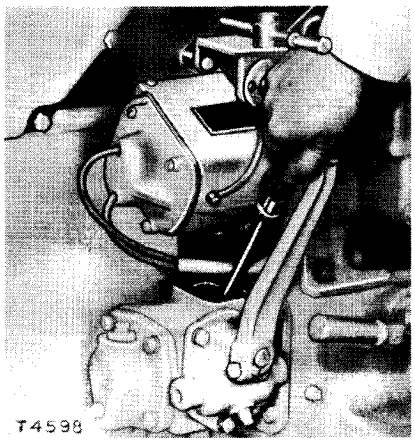
shown. The breaker points should be just beginning to open, with the coupling rotating drive direction.

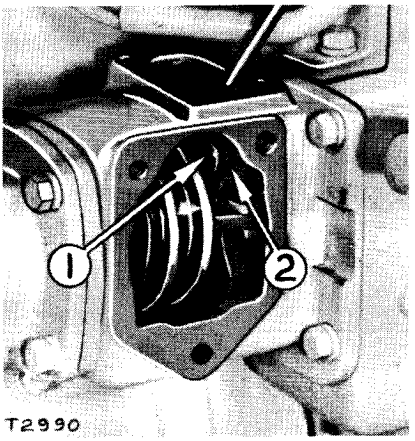
Install the magneto on the engine and replace the distributor plate.

STARTING ENGINE CLUTCH

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

To Adjust: Remove the oil filler plate or plug in the top of the housing. Insert a short screw driver in this opening and turn the clutch adjusting collar **(2)** until the lock pin **(1)** can be reached. Engage the starter pinion. Pry out the lock pin, and tighten by turning the top of the adjusting collar away from the diesel engine block 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
Cover removed to illustrate: 1–Lock pin. 2–Adjusting collar.

To Wash: Every 250 service hours, remove the drain plug while the oil is warm. Refill to the proper level with kerosene or some non-inflammable cleaning fluid and run the engine 3 minutes, engaging and disengaging the clutch. Remove the drain plug and let the housing drain thoroughly. Then fill with fresh oil.

FLYWHEEL CLUTCH

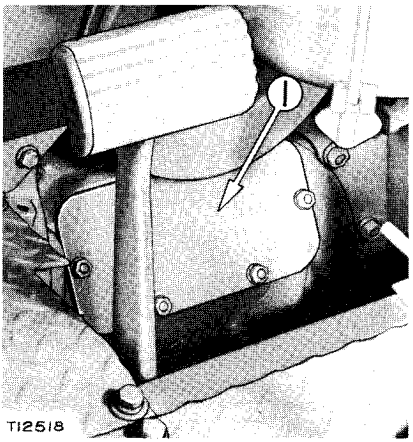
Two types of flywheel clutches are covered in this topic. Tractors effective with 8U6444 and 9U13263 are equipped with an oil type flywheel clutch. Tractors before 8U6444 and 9U13263 were equipped at the factory with a dry clutch.

Oil Type

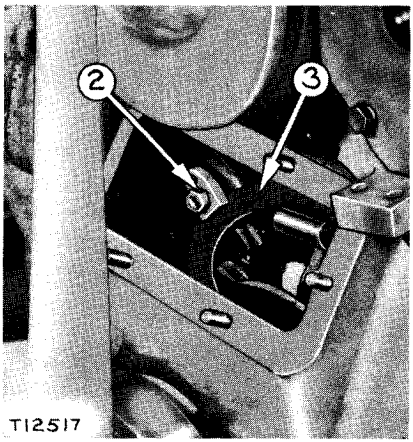
The proper clutch adjustment will give a clutch lever pull of approximately 55 pounds. This measurement is made with a spring scale placed at the bottom of the handle on the clutch control lever with the engine stopped and when the clutch is cold. Slightly higher pounds pull may be required when the clutch is warm. Clutch lever pull will reduce when the engine is running, but when the clutch is properly adjusted the lever should go into engaged position with a distinct snap. The clutch adjustment should be checked every 500 service hours and adjusted if necessary.

To Adjust: When clutch adjustment becomes necessary proceed as follows:

1. Remove the clutch inspection floor plate center section. Care should be exercised to clean any dust or dirt from the top and around edges of the clutch compartment cover **(1)**. Be sure all tools used to make the adjustment are clean. Remove the cover being careful not to damage the gasket under the cover.



CLUTCH ADJUSTMENT
1–Cover.



ADJUSTING CLUTCH
2–Lock nuts. 3–Adjusting ring.

2. Turn flywheel until one of the adjustment lock nuts **(2)** is accessible. Loosen lock nut about two turns. Tap plate slightly to be sure it is free on stud. Rotate flywheel 180° and loosen the other lock nut in same manner.

3. Turn the adjusting ring **(3)** clockwise approximately three inches to tighten.

4. Tighten the lock nuts to a torque of approximately 30 pounds feet. This can be accomplished with a steady pull on the end of the 9/16 inch L-handle socket wrench supplied.

5. Check to see that the clutch compartment cover is clean and the gasket is in good condition, then install the cover.

Clutch Brake Adjustment: The tractor is equipped with a clutch brake, which stops the clutch shaft from turning, and permits shifting gears without clashing. To apply the brake, press the flywheel clutch control lever forward as far as it will go. If the clutch shaft is slow in stopping, the clutch brake should be adjusted.

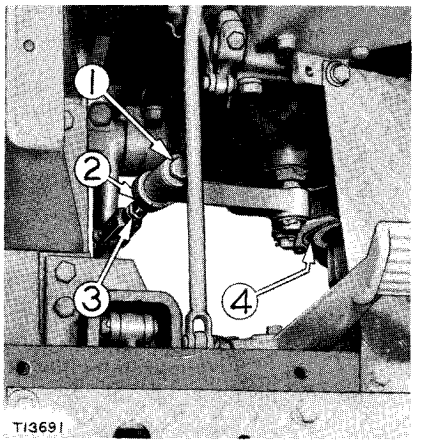
To Adjust: If the brake has become worn and adjustment becomes necessary proceed in the following manner:

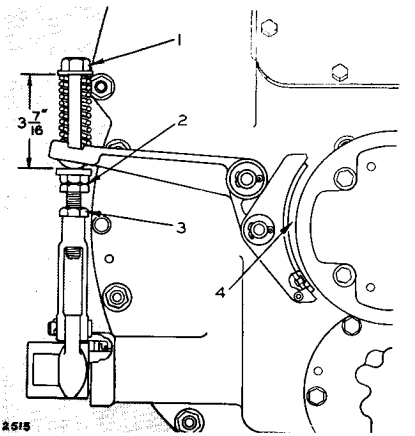
1. Loosen the clutch brake adjustment lock nut **(3)**.

2. Push clutch control lever all the way forward.

3. Hold the clutch control lever in this position and turn the adjusting capscrew **(1)** so that the brake lining touches the brake drum evenly. Turn the adjusting bolt **(1)** in (clockwise) to decrease clearance at **(4)** between the brake lining and the brake drum or out (counter-clockwise) to increase clearance.

4. Release the flywheel clutch control lever and turn the adjusting capscrew in (clockwise) 2 turns.
5. Tighten the lock nut.
6. Lock nuts **(2)** are preset and should not be altered unless the 3 7/16 inch dimension shown is incorrect when the clutch is engaged.





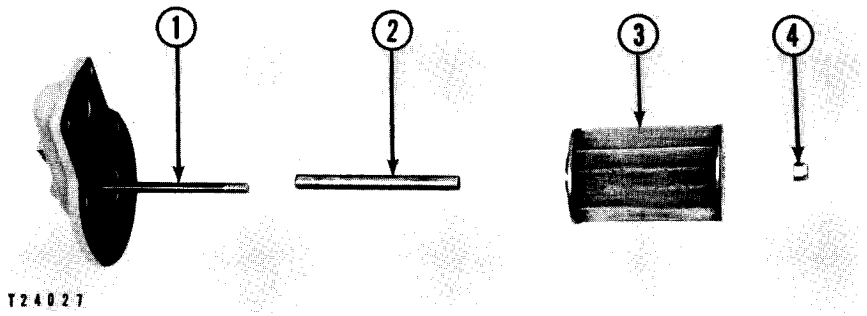
CLUTCH BRAKE ADJUSTMENT
1–Adjusting bolt. 2–Lock nuts. 3–Clutch brake adjustment lock nut. 4–Clearance at this point.

NOTE

If brake is adjusted too tight the brake will be applied before the clutch is fully released and difficult shifting and high clutch brake lining wear will result.

Oil Pump Screen Assembly: The flywheel clutch oil pump screen assembly located in the rear face at the bottom of the clutch housing should be cleaned when sludge or foreign matter is noticed in the oil when draining the flywheel clutch compartment. Clean the screen as follows:

1. Remove the bolt that holds the screen assembly to the clutch housing.
2. Use a knife between the clutch housing and screen assembly to loosen the gasket so it will not stick and become damaged.
3. Remove the oil screen assembly.
4. Remove nut **(4)** and disassemble the oil screen assembly.
5. Wash the screen by shaking it in kerosene or clean diesel fuel.
6. Install spacer **(2)** and screen **(3)** over the stud **(1)**.



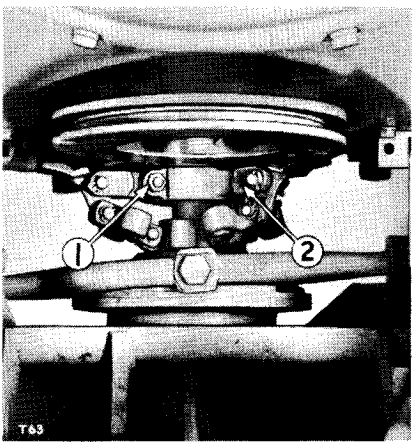
OIL SCREEN ASSEMBLY
1–Stud. 2–Spacer. 3–Screen. 4–Nut.

7. Hold the screen against cover and install nut **(4)**.
8. Install the oil screen assembly into the oil clutch and tighten the bolts.

Dry Clutch

To Test The Adjustment: Pull the clutch lever to the engaged position. For a desirable adjustment the lever should go into position with a distinct snap, requiring a reasonably hard pull.

To Adjust: Move the clutch control lever to the forward (disengaged) position, lift up the hinged cover located at the front of the floor plate and remove the clutch housing inspection cover. Loosen the nut on the adjusting collar clamp bolt **(1)** and with the transmission gears engaged, turn the collar **(2)** a few degrees in a clockwise direction; then tighten the clamp bolt before testing the adjustment. Repeat this adjustment until



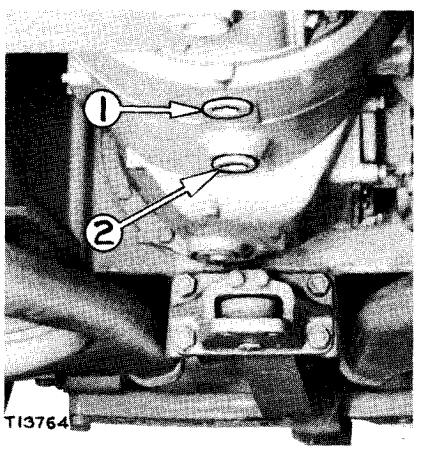
FLYWHEEL CLUTCH ADJUSTMENT
1–Clamp bolt. 2–Adjusting collar.

◆

the desired clutch snap is obtained; then disengage the transmission gears.

The length of the adjustable rod between the flywheel clutch control lever and the crank assembly that actuates the clutch yoke should not be changed as its length is set correctly at the factory.

Draining The Flywheel Clutch And Flywheel Housings: The clutch plates are designed to operate dry. The plugs on the bottom of the flywheel housing **(1)** and flywheel clutch housing **(2)** should be removed every 50 service hours to drain any lubricant that may have seeped into the compartment from the engine, transmission, or clutch bearings. If lubricant from these points is allowed to accumulate the clutch plates may become sticky and cause difficult operation of the clutch.



FLYWHEEL AND FLYWHEEL CLUTCH HOUSING DRAIN PLUGS

1–Flywheel housing drain plug.
2–Flywheel clutch housing drain plug.

◆

Washing The Flywheel Clutch Housing: Remove the flywheel housing drain plug and the cover from the housing every 1000 service hours and wash or flush the clutch housing with a non-inflammable cleaning fluid when the engine is stopped. The cleaning fluid should be forced on the housing inside surfaces, not on the clutch, with a flush type grease gun and allowed to drain with the accumulations from the housing.

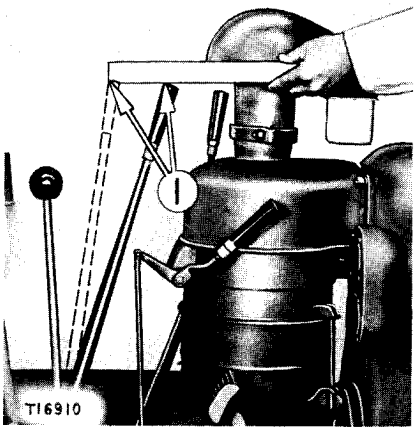
Wash The Flywheel Clutch Linkage: If difficult operation of the clutch is encountered it may be that the clutch engaging linkage has become dirty. This dirt can be removed by washing the linkage with some non-inflammable cleaning fluid. When washing, care must be taken not to get greases and oils on the clutch plates and rubber drive links. After washing the linkage the clutch release bearing and sliding collar should be lubricated as instructed in the LUBRICATION CHART.

STEERING CLUTCHES AND BRAKES

The steering clutches should be kept in proper adjustment to insure full engagement of the clutches when the levers are in the free forward position. Obstructions such as rocks, sticks and the like which hinder the

control levers traveling to the free forward position should be removed. If the tractor is operated with improper steering clutch adjustment or with obstructions to the control levers the release bearings may become damaged.

Steering Clutch Adjustment: When the steering clutch levers have 3 inches (7.6 cm.) free movement at **(1)**, the clutch adjustment is correct. This free movement reduces as the clutch facings wear and adjustment becomes necessary.

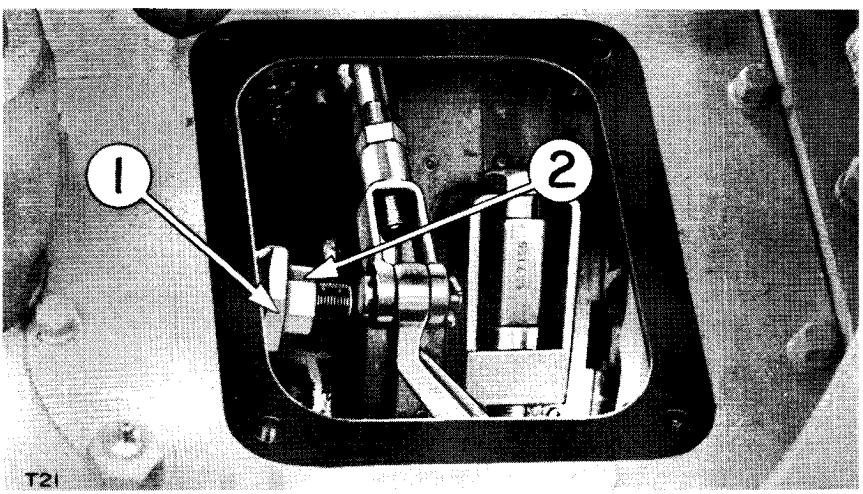


CHECKING STEERING CLUTCH CONTROL LEVER FREE MOVEMENT

1–There should be 3 inches (7.6 cm.) free movement at this point.

◆

To Adjust: Remove the inspection plate (one for each clutch) from the top of the steering clutch case. With the engine stopped or the flywheel clutch disengaged loosen the lock nut **(2)** and turn the adjusting nut **(1)** on the adjusting screw until the correct free movement is obtained at the top of the steering clutch control levers. Then retighten the lock nut.

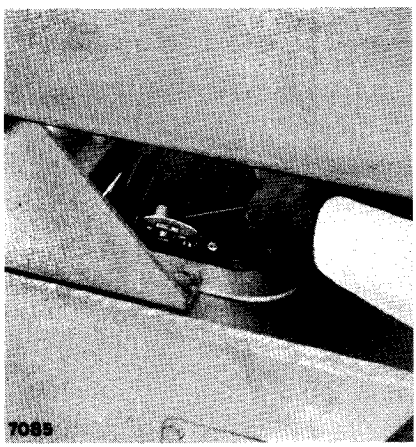


STEERING CLUTCH CONTROL ADJUSTMENT

1–Adjusting nut. 2–Lock nut.

As the steering clutches become sufficiently worn through service to prevent restoring proper control adjustment, consult your Caterpillar dealer.

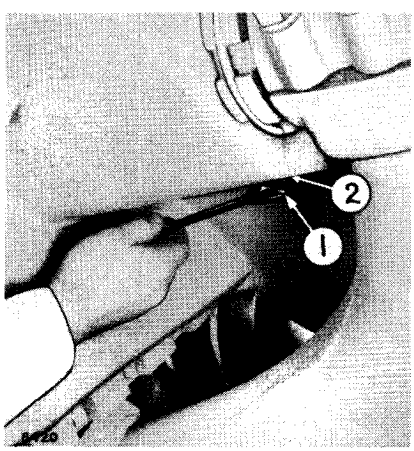
Steering Clutch Brake Adjustment: Keep the brakes adjusted just tight enough so the tractor will turn correctly when the steering clutch is released and the pedal is depressed between 3½ to 4½ inches (8.89 to 11.45 cm.). When the right brake is fully applied the brake lock latch should engage with the notches on the ratchet to lock the pedal. The band should be entirely free from the drum when the pedal is in the released position.



STEERING CLUTCH BRAKE ADJUSTMENT

◆

To Adjust: Remove the inspection plate located on either side near the back of the seat and on top of the steering clutch case. Turn the head of the adjusting nut in a clockwise direction to tighten the brakes. Loosen the lock nut **(2)** on the support screw **(1)** on the under side of the



ADJUSTING BRAKE SUPPORT SCREW
1–Support screw. 2–Lock nut.

REMOVING STEERING CLUTCH COMPARTMENT DRAIN PLUGS

steering clutch case below the brake drum. Apply the brake to draw the brake band tightly around the drum. Turn the support screw up tight against the band then back off 1½ turns and tighten the lock nut. This screw supports the brake band and maintains the correct clearance between the lining and the drum.

Draining Steering Clutch Compartment: The steering clutches are designed to operate dry. Lubricant is used only to lubricate the release bearings. **This lubricant, and any seepage from the adjoining compartments should be drained every sixty hours of operation by removing the plugs in the bottom of the case.** Failure to observe proper draining periods may result in the clutches slipping or difficulty in steering the tractor. The drain plugs should be replaced to keep out dirt and moisture during operation.

Washing The Steering Clutch Brakes: If the steering clutch compartments have not been drained at the proper interval or lubricant has accumulated on the steering clutch brakes sufficiently to cause slippage or difficult steering, some improvement in operation will result by washing the brakes. To do this proceed as follows:

1. Drain the compartments and replace the drain plugs.
2. Remove the brake adjustment covers and pour enough **non-inflammable** cleaning fluid into each compartment so that each steering clutch brake drum will dip into the fluid.

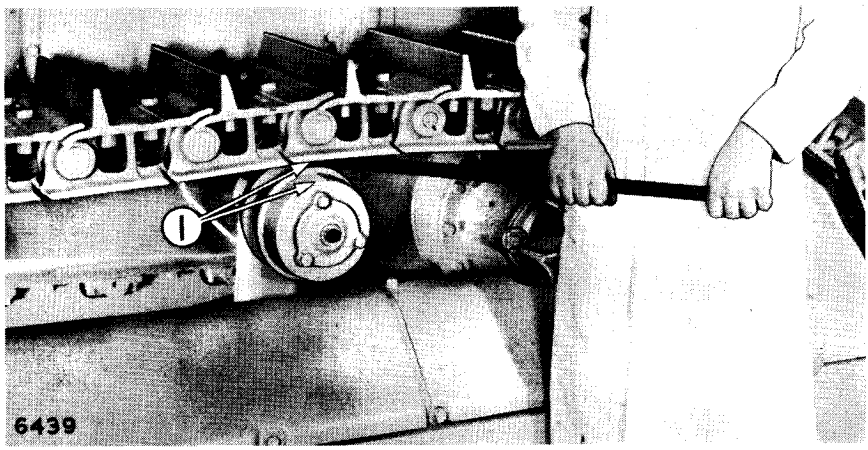
WARNING

Washing should be done when the compartments are cool and well ventilated to avoid the possibility of an explosion.

3. Operate the machine back and forth for five minutes without releasing the steering clutches. This will prevent the oil and dirt on the outside of the clutches and the inside of the cases from being washed in between the clutch discs.
4. Drain the compartments.
5. Repeat the washing procedure, this time applying the brakes occasionally.
6. Drain the compartments and replace the drain plugs.
7. Lubricate the steering clutch release bearings.

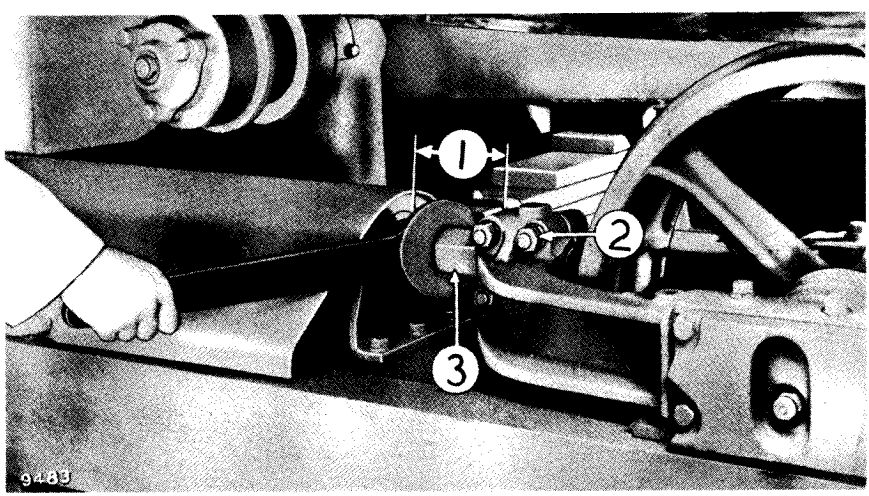
TRACK ADJUSTMENT

The track adjustment is correct when the tracks may be raised from 1½ to 2 inches (3.8 to 5.1 cm.) above the track carrier roller as shown at **(1)**.



CHECKING TRACK ADJUSTMENT
1–There should be 1½ to 2 inches (3.8 to 5.1 cm.) clearance at this point.

To adjust: Remove the cover back of the front idler and loosen the clamp nuts **(2)** on the front idler arms. Turn the adjusting screw **(3)** to obtain the correct adjustment.



ADJUSTING TRACK
1–This measurement should not exceed 8¼ inches (20.9 cm.). 2–Clamp nuts. 3–Adjusting screw.

When the adjustment has been made drive the tractor backward and forward to equalize the adjustment. Then, recheck the adjustment. Tighten the clamp nuts and replace the cover.

As continued track adjustment becomes necessary through service, the following precaution should be observed to prevent the adjusting screw being screwed out of the nut at the front of the recoil spring, with sub-

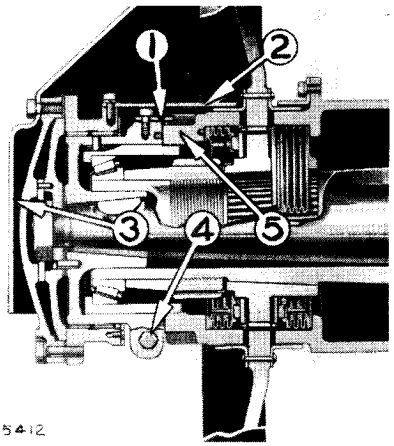
sequent damage to the threads: A maximum measurement of 8¼ inches (20.9 cm.) should not be exceeded between the adjacent faces of the guide assembly and the front idler arms as shown at **(1)**.

FINAL DRIVE SPROCKET HUB BEARINGS

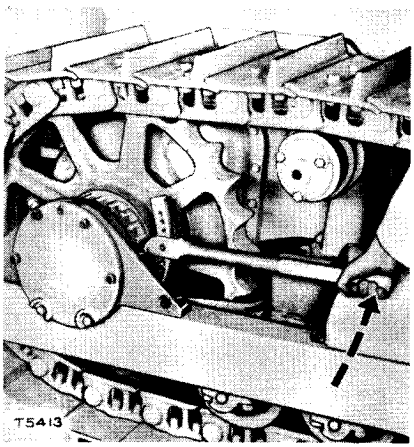
During the initial operation of the tractor the sprocket hub bearings are likely to require some adjustment. By maintaining the proper adjustment bearing life can be increased. They should be checked on a new tractor and adjusted if necessary after the first 125 service hours of operation, another check or two at 125 service hour intervals is suggested but thereafter every 1000 service hours should be sufficient. If leakage of lubricant is noticed around the sprocket hub on a new tractor before 125 service hours of operation an adjustment of the bearing may stop the leak.

To check the bearing adjustment, place a four or five foot bar between the track roller frame and the sprocket. If any looseness in the sprocket hub bearings is noticed when prying with the bar, adjustment is necessary. This checking should be made when there are no objects under the track which might put the tractor weight on the sprocket.

To Adjust: Remove the guard plates **(2)** and **(3)** from the track roller frame outer bearing, and the lock **(1)** from the notch in the adjusting nut **(5)**. Loosen the clamp bolt **(4)** on the bottom of the holder assembly. Tighten the adjusting nut by turning it **counterclockwise**. Use a five foot extension on the wrench to be sure the nut is tight. Replace the lock, tighten the clamp bolt, and replace the guard plates. A wrench for this purpose can be obtained from your Caterpillar dealer.



CROSS-SECTION OF FINAL DRIVE



TIGHTENING SPROCKET HUB BEARINGS

1–Lock. 2–Small guard plate. 3–Large guard plate. 4–Clamp bolt. 5–Adjusting nut.

WASHING GEAR COMPARTMENTS

Washing The Transmission: Remove the drain plugs from the speed change and bevel gear compartments after a run, when the oil is warm. This drains the speed change compartment and the bevel gear compartment. Replace the plug and fill to the proper level with kerosene or some non-inflammable cleaning fluid. Drive the tractor back and forth for five minutes, if it is convenient. If not, start the engine and put the gears in the highest speed. Tie back the steering clutch levers and engage the flywheel clutch. Allow the gears to run five minutes, disengage the clutch, and shift into neutral. Drain the cleaning fluid and refill with fresh lubricant to the correct level as instructed in the LUBRICATION INSTRUCTIONS section of this book.

Washing The Final Drive Cases: 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 cases to the level of the filler hole with kerosene or some non-inflammable cleaning fluid. Drive the tractor back and forth for five minutes and remove the drain plugs. After all the washing fluid has drained, replace the plugs and fill to the correct level with fresh transmission oil. See the topic, LUBRICATION CHART.

Washing Belt Pulley Drive And Rear Power Take-Off Housings: Remove the drain plug from the housing when the oil is warm, and allow the oil to drain. Replace the drain plug and fill the housing to the correct level with kerosene or some non-inflammable cleaning fluid. Operate the gears for five minutes to wash the housing. Drain the cleaning fluid and refill the housing to the proper level as instructed in the LUBRICATION INSTRUCTIONS section of this book.

GENERATOR
(6 and 24 volt systems)

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

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

Generator Removal:

1. Disconnect the wires from the generator and tag them so that they may be installed correctly.
2. Disconnect the wire from the voltage regulator field terminal.

3. Remove the bolts that hold the generator in position and remove the generator.

Generator Installation:

The generator must be polarized each time it is reinstalled.

1. Install the generator.
2. Connect all wires to the generator and regulator except the wire which connects to the voltage regulator field terminal. See the topic, WIRING DIAGRAM.

CAUTION

Always disconnect the field wire from the voltage regulator field terminal when polarizing a generator. Never short out between the field and armature or battery terminals on the voltage regulator or generator with a jumper wire.

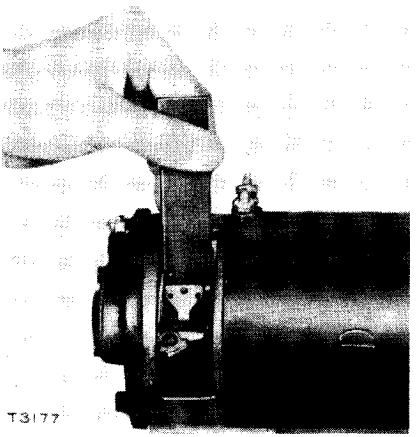
3. Close the disconnect switch if the machine is equipped with a 24 volt starting system.
4. Polarize the generator by touching the field wire, which was removed from the voltage regulator terminal, momentarily to the voltage regulator battery terminal. This correctly polarizes the generator.
5. Connect the wire to the voltage regulator field terminal.

Make sure all connections are tight. A poor connection in the charging circuit will cause the generator to build up excessive voltage which may result in burned field or armature windings. A poor connection in the generator field circuit will cause a low voltage.

ELECTRIC STARTER
(6 and 24 volt systems)

Cleaning Electric Starter: Every 2000 service hours, the inspection cover should be removed from the starter and a check made of the commutator. If it is glazed or darkened, polish it with "00" sandpaper, never emery cloth. To polish, hold the sandpaper on the commutator with a stick while the commutator is turning. The polishing should be done on the starter by pressing the starter switch with the magneto switch turned OFF. Turn the sandpaper over to clean the contact surfaces of the brushes. The commutator should not be turning when the brushes are being cleaned. Make sure all trace of sand particles is removed from the commutator, brushes, and brush holders by blowing out with air or an equally effective method.

Brush Replacement: Brushes should be inspected and replaced if badly worn. When a new brush is installed, seat it properly with the contour



SANDING STARTER BRUSH

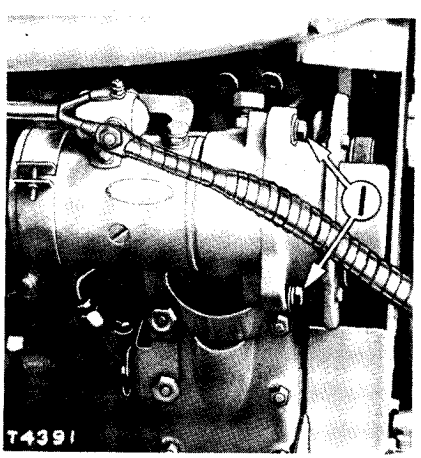
◆

of the commutator by using "00" sandpaper. Remove all sand particles and make certain the connections are all tight.

General Reconditioning: Approximately every 4000 service hours, the generator and starter should be removed so they may be completely disassembled, washed and have all parts replaced showing evidence of being unsatisfactory for reason of wear. It is suggested this reconditioning be entrusted to your Caterpillar dealer.

Starting Engine Starter Drive: If difficulty is experienced with the starter drive pinion failing to engage with the starter belt pulley drive gear, dirt in the worm drive is probably responsible. To correct, remove the starter from the mounting bracket then take off the starter drive housing. Carefully clean the spiral grooves of the drive of any dirt or grease accumulations. Wash the spiral sleeve upon which the pinion operates, also the springs, gear teeth and drive housing. This washing should be done with kerosene or some non-inflammable cleaning fluid.

Before installing the drive, lubricate the spiral sleeve and housing bushing with a few drops of light oil, then reassemble and install.



STARTING ENGINE STARTER BELT ADJUSTMENT

1–Bolts.

◆

Starting Engine Starter Belt Adjustment: The starter belt should be maintained at the proper tension at all times. To adjust, loosen the bolts **(1)** holding the starter belt drive gear housing in place, then push the starter belt pulley against the belt as tight as possible by hand, and tighten the bolts.

BATTERY CARE
(6 and 24 volt systems)

The power source for the 24 volt direct electric starting consists of four 6 volt batteries connected in series. On machines with a starting engine, one 6 volt battery is used. The battery compartment is located in front of the dash.

Particular attention should be given to these instructions if the machine is equipped with 24 volt direct electric starting, as it is the only source for starting the engine. The batteries must be kept charged and should be checked periodically to insure dependable starting.

Maintenance of a storage battery is simple. The steps to be followed appear to be many, yet each is easy to perform. If any one is neglected, it may mean premature failure of the battery. The main points to consider in storage battery maintenance are:

Cleanliness	Water addition
Charging	Testing for capacity
Specific gravity measurement	Maintenance records

Cleanliness: Storage batteries should be kept clean. Accumulation of dirt on the covers and terminals permits continuous discharge currents across the covers. A clean battery promotes longer service life. Every 10 to 50 service hours, depending on operating conditions, inspect the battery to see if dirt has accumulated on it. The battery should be kept clean and free of dirt and moisture. Every 50 service hours or when the battery is dirty it should be cleaned and washed with a diluted solution of baking soda to remove dirt and neutralize any acid which may have splashed or spilled. After washing, flush the top of the batteries with clear water, dry thoroughly and inspect the battery case for cracks. If cracks are found reseal them with a soldering iron. Intercell connectors, terminal posts and cable terminals should be cleaned and covered with a thin coat of neutral grease such as a petroleum jelly to protect them from the corrosive action of splashed or spilled electrolyte. The bare ends of cables between the insulation and the terminal lug should also be protected.

Charging: A battery can be charged by any of the following methods:

Charging generator	Manual "on-off"
Continuous "trickle" or "float"	

The cost of charging equipment and the required charging maintenance are different for the three methods. The service life of the battery can be influenced somewhat by the charging methods, but to a greater extent by the maintenance. Do not attempt to charge a battery in which the electrolyte is below the tops of the separators.

The machine is equipped with a charging generator and voltage regulator so that whenever the diesel engine is running and the disconnect switch is in the closed position, the generator will charge the battery. See the topics GENERATOR and VOLTAGE REGULATOR for care and maintenance of the charging generator and voltage regulator.

Continuous trickle charging generally represents the least investment in charging equipment since the charger is normally required to furnish only about 1 ampere for the batteries used on these models. The actual value of the charging current must be determined by experiment based upon maintaining full charge specific gravity without excessive water loss. If the temperature of the battery varies widely over a period of time longer than a day or two, the charger should be adjusted to maintain the proper charging current. When the battery gets colder, a higher voltage is required to maintain the same charging current. The self-discharge rate of a cold battery on a shelf is very low compared to a warm battery, therefore to maintain a fully charged battery, a lower current will be required for a cold battery than for a warm battery. These adjustments are very small, but can have an important effect on the battery service life. If the battery temperature is more than five degrees higher than the room temperature, the charge rate is too high.

Manual "on-off" charging requires competent supervision. The amount of battery capacity used for the start will be quite small. The recharge, however, should be made with the charging amperes equal to one-fifth of the 8-hour discharge rate amperes for at least one and one-half hours or until the specific gravity remains constant for three successive half hour periods between hydrometer readings. If, for some reason, the engine is not run for a long period of time, the battery should be recharged once a month or when the specific gravity falls .050 below the fully charged value. A battery should never be allowed to stand for an appreciable length of time at less than 1.225 specific gravity because sulphation may occur which will damage the battery.

Specific Gravity Measurement: The specific gravity of a storage battery electrolyte is an indication of the state of charge of the battery. The full charge specific gravity is usually marked on an intercell connector or on the case. The specific gravity, as read on a hydrometer and corrected to standard temperature, will indicate whether the battery is fully charged or partially discharged. The best hydrometer is the type with a thermometer in the bottom of the barrel. This type indicates on the thermometer scale what correction should be added or subtracted from the scale on the float stem to correct the specific gravity reading to standard tem-

perature conditions. This is much simpler than using a separate hydrometer and thermometer. In fact, if the dual purpose hydrometer is not available, it is doubtful that the battery temperature will be checked when hydrometer readings are taken. Specific gravity readings should not be taken if the electrolyte level is so low that trouble is experienced in floating the hydrometer. In this case, water should be added to the battery and the battery then placed on charge until the electrolyte and water are thoroughly mixed before attempting to read the specific gravity. If the electrolyte level is too low at the time specific gravity readings are to be taken, it indicates that the charge rate is too high and/or the time between maintenance operations on the battery is too long.

For accurate reading of a hydrometer the instrument should be held at eye level, the float should be free in the barrel, and the reading should be taken where the bottom of the electrolyte level intersects the scale on the float. After the scale reading has been determined, the temperature correction indicated on the thermometer should be added or subtracted to correct the specific gravity to standard conditions. The hydrometer should be kept clean to make accurate reading easy and to prevent getting dirt into the battery.

The battery should be tested with a hydrometer and kept within a margin of safety to a specific gravity of 1.275 to 1.300. The specific gravity between the cells should be within 25 points (.025 SP. GR.). A dangerously low point of charge is indicated by a hydrometer reading of 1.150 which will permit the battery to freeze at temperatures of 5° F. A specific gravity of 1.250 will permit the battery to withstand temperatures as low as −60° F. without freezing.

Water Addition: Only approved water should be added to a battery. Approved water is either distilled water or local tap water **that has been approved for use by the battery manufacturer.** Practically all storage battery manufactures will check a one quart sample of local water and advise whether it is suitable for use in the batteries. Battery water should be stored and handled in clean non-metallic containers to avoid contamination. Use of unapproved water will result in the accumulation of harmful impurities in the battery cells and considerably decreased service life. The cost of distilled water for the average diesel engine electric starting battery is insignificant compared with 1/3 to 1/2 reduction in service from the battery.

The electrolyte level should never be allowed to fall below the top of the plates. Also, the cells should not be overfilled. This is liable to close off the gas vents built into the filling openings and gas will accumulate under the covers and force electrolyte out through the vent.

Testing for Capacity: Once a year, and more often as the battery gets older, the battery should be checked for capacity. This job should be done by your authorized battery dealer.

Maintenance Records: Storage battery life is computed in months. Since few people can remember the details of battery operation for such a long time, it is a good idea to keep a maintenance record chart. Such a chart could be a sheet of paper ruled and labeled as shown.

In this manner, the history of each cell is available for study and possible failures can be detected before cells become so bad that a starting failure might occur.

Date	Cell No.	Specific Gravity	Amount of Water Added	Test Discharge Volts

VOLTAGE REGULATOR
(6 and 24 volt systems)

The voltage regulator is properly adjusted at the factory and should not be changed except in case of failure. Then both the regulator and generator should be taken to your Caterpillar dealer, where the output of the generator can be checked and the regulator adjusted accordingly.

If the ammeter shows a low charging rate, it is not an indication that the equipment is at fault unless the battery shows a low reading when checked with the hydrometer. The regulator permits a heavy flow of current from the generator to the battery only when the battery electrolyte has a low specific gravity. As the battery becomes charged, the ammeter reading decreases proportionately until at full charge practically no ammeter reading is evident.

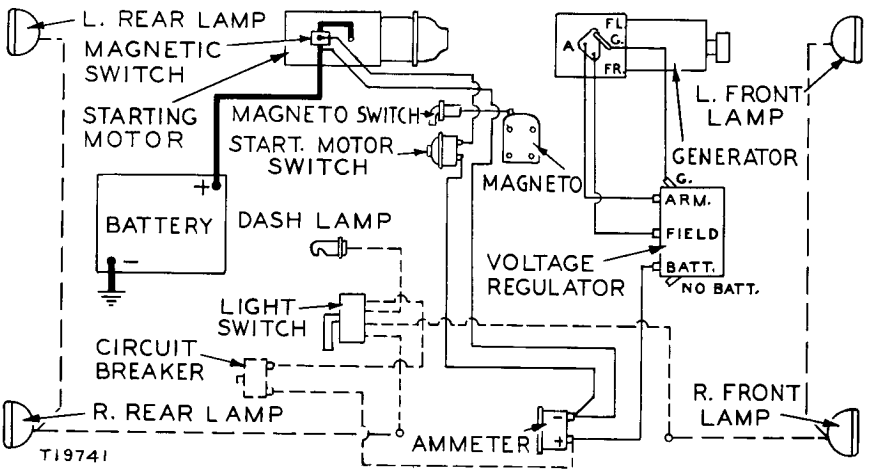
If the hydrometer reading is low and no charge is evident on the ammeter, check the entire system for loose connections or broken wires. If all connections are satisfactory, check the generator for worn, broken or poorly seated brushes; also check the commutator to determine whether it is glazed or darkened. Refer to the topics, GENERATOR AND ELECTRIC STARTER.

On the 6 volt system, four terminals are provided for connecting the regulator into the electrical system and are marked "Arm," "Field," "Bat" and "No-Bat". Whenever the machine is to be operated with a battery removed, remove the wire leading to the terminal marked "Bat" and install it to the terminal marked "No-Bat". This terminal by-passes the cut-out relay, assuring lights even at low engine idling speeds. Wrap the positive battery cable terminal, that was removed from the battery, with tape to prevent grounding the electrical system.

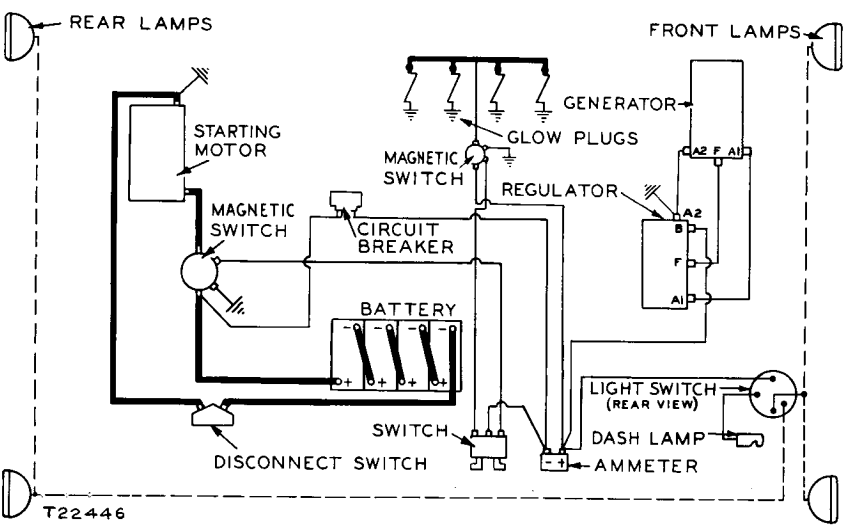
WIRING DIAGRAMS
(6 and 24 volt systems)

These diagrams are furnished so when it becomes necessary to disturb the electrical equipment for purpose of reconditioning or parts replacement, reassembling may be accomplished without difficulty.

When operating a machine with a 6 volt system, without a battery, change the battery wire leading to the voltage regulator marked "Bat" to "No-Bat." See the topic, VOLTAGE REGULATOR.



WIRING DIAGRAM FOR 6 VOLT ELECTRIC STARTING SYSTEM
Lamps indicated in diagram are special equipment



WIRING DIAGRAM FOR 24 VOLT ELECTRIC STARTING SYSTEM
Lamps indicated in diagram are special equipment

These diagrams, covering lighting system arrangements for use with 24-volt direct electric starting for the diesel engine and 6-volt electric starting for the starting engine, are furnished so if it becomes necessary to disturb the electrical equipment for purpose of reconditioning or parts replacement, reassembling may be accomplished without difficulty.

◆

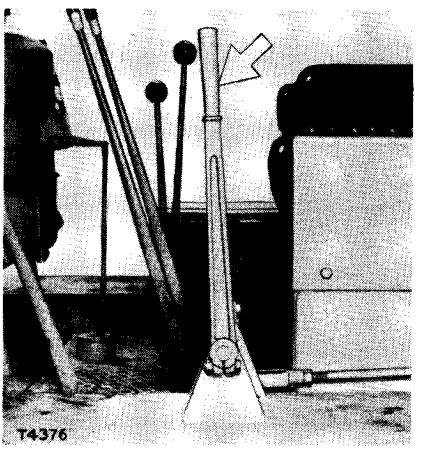
Attachment Instructions

Attachments are available from your Caterpillar dealer. Many of these attachments will add to operator comfort and convenience as well as increase the usefulness of your tractor.

REAR MOUNTED EQUIPMENT

Rear mounted equipment is driven with power from the transmission upper shaft whenever the flywheel clutch is engaged. When the forward and reverse lever is in either forward or reverse position the lower gears dip and throw oil in the transmission to lubricate the upper shaft bearings and gears. Therefore, always engage the forward and reverse lever in either forward or reverse positions when operating continuously on stationary work.

Direct Drive Rear Power Take-Off Operations: Disengage the flywheel clutch, shift the gear selector lever into neutral position and the forward and reverse lever in either forward or reverse position. Push forward the power take-off control lever to engage the sliding gear with the drive gear. Engage the flywheel clutch to deliver power through the transmission to the power take-off shaft.



REAR POWER TAKE-OFF AND BELT PULLEY DRIVE CONTROL LEVER

◆

Reduction Drive Rear Power Take-Off Operation: Disengage the flywheel clutch, shift the gear selector lever into neutral position and the forward and reverse control lever in either forward or reverse position. Pull back the power take-off control lever to engage the sliding gear with the driven gear. Engage the flywheel clutch to deliver power to the power take-off shaft.

Belt Pulley Drive Operation: Disengage the flywheel clutch, shift the gear selector lever to neutral position and the forward and reverse lever in either forward or reverse position. Push the belt pulley drive control lever forward to engage the sliding gear with the drive gear. Engage the flywheel clutch to deliver power to the belt pulley.

LIGHTING SYSTEMS

Two types of lighting systems are available for use on this tractor. They are lighting systems with and without battery. In either type the generator armature revolves whenever the diesel engine is in operation.

The lights of the lighting system with battery will light whether the engine is in operation or stopped. The switch to turn these lights on or off is mounted on the battery box. The lights of the lighting system without battery will light only when the diesel engine is running. The switch for these lights is located on the generator where a 130 watt generator is used and is built in with the voltage regulator. To operate the switch on Auto-Lite generators, turn it to OPEN position, then back to ON position to light the lights.

Lighting systems with four sealed beam lamps without battery should use a 200 watt generator. In these systems the switch to turn the lights on is located on the dash.

The generators used with lighting systems without batteries are automatically regulated to provide the amount of current required to operate the lights within the capacity of the generator.

Generators are plainly marked and those of nominally 115 to 200 watt are most commonly used for lighting systems only. If watt rating is not indicated on the generator name plate, multiply volts by ampere rating to determine the watt rating. Mazda bulbs consume approximately 1 watt per candle power. Sealed beam lamps consume 6 to 8 amperes per lamp. This being the case it is easy to add up the candle power or ampere load of the various bulbs in the circuit to determine if the lights used are within the capacity of the generator.

For this reason, the generator size should always be checked before deciding to add additional lights or to increase the light intensity by replacing standard bulbs with those of higher candle power.

GLOW PLUGS

Maintenance: If it is suspected that the glow plugs are not correctly assisting in starting, the system should be checked for defective glow plugs. The ammeter should be observed when making this check to show that each glow plug uses approximately 7 amperes.

To check, move the HEAT switch to the ON position. A reading on the ammeter should be approximately equal to the number of glow plugs in the system multiplied by 7. Any reading that varies appreciably from this may indicate one or more defective glow plugs.

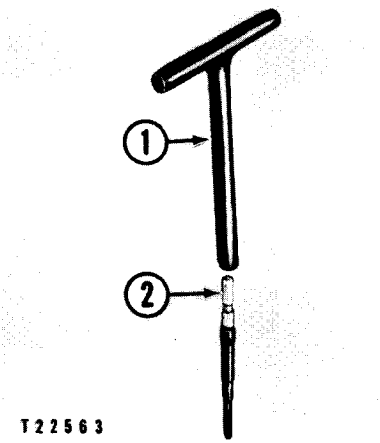
To locate the defective glow plug or plugs, check each glow plug separately by removing the leads from the glow plugs one at a time with the HEAT switch in the ON position. **Reconnect the lead to the plug before removing the lead from the next glow plug to be checked.** When a lead is removed from a glow plug, with no variation shown on the ammeter, it can be assumed that the plug is defective and should be replaced.

A check can be made of the individual glow plugs without the use of the ammeter as follows: Remove the lead from the glow plug and move the HEAT switch to the ON position. Contact the lead and glow plug for an instant. There should be a spark. If there is no sparking it can be assumed that the glow plug is defective.

To remove a defective glow plug, disconnect the lead from the glow plug; using the wrench **(1)**, unscrew the glow plug **(2)** from the precombustion chamber.

WRENCH AND GLOW PLUG
1–Glow plug wrench. 2–Glow plug.

◆



Screw the new glow plug into the pre-combustion chamber, tightening it to a torque of from 10 to 12 pounds feet.

Replacing Fuel Injection Valves: The instructions contained in the Maintenance Section should be followed with the following additions:

The glow plug should first be removed before removing and replacing a fuel injection valve to eliminate the possibility of damaging the glow plug.

Reinstall the glow plug into the pre-combustion chamber and tighten to a torque of from 10 to 12 pound feet.

ETHER STARTING AID

Handling Precautions: Capsules are filled with ether which is highly flammable. These capsules are pressurized to act as an expellant. They are made of metal and this type of packaging provides maximum safety in storage, handling and use. The principal precautions to be taken are:

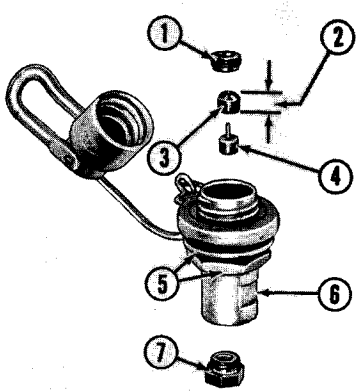
a. Do not heat the capsules.

b. When the discharger is being used for testing, inspecting or demonstrating purposes, and is not installed on an engine, the contents of capsules should **not** be discharged in confined areas or near an open flame.

Maintenance: If it is suspected that the ether starting aid is not functioning properly to assist in starting, disassemble the ether discharger **(6)**.

1. Disconnect the tubing from the bottom of the discharger.
2. Remove the screen assembly **(7)** and wash the screen.
3. Remove the nut and washer **(5)** to remove the discharger.
4. Remove the screw **(1)**, rubber washer **(3)** and pin **(4)**.
5. Inspect the pin **(4)** to see that it is sharp. If the pin is not sharp, replace it.
6. Check the small hole through the pin to see that it is clean.
7. Inspect the rubber washer **(3)**. The rubber washer should have a free length measurement of approximately 3/8 inch at **(2)** and should not be distorted, otherwise replace it.
8. Assemble the discharger and replace it.

Be sure a spent capsule is in the discharger when the engine is running and the nut is finger tight on the discharger to keep dirt out of the engine.



T21885

ETHER DISCHARGER

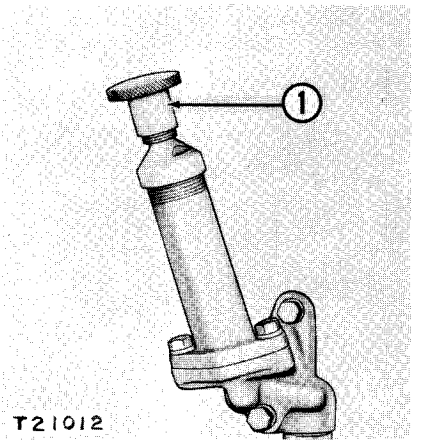
1–Screw. 2–Free length measurement of 3/8 inch. 3–Rubber washer. 4–Pin. 5–Nut and washer. 6–Ether discharger. 7–Screen assembly.

◆

FUEL PRIMING PUMP

A priming pump is available for use with direct electric starting and prevents the battery from becoming run down due to excessive cranking when priming the fuel system. To prime the system proceed as follows:

1. Check to see that the diesel fuel line valve is open.
2. Open the vent valves on the fuel filter housing and fuel injection pumps.
3. Loosen the knurled top **(1)** of the fuel priming pump.
4. Operate the pump plunger up and down until the flow of fuel from the vent valves becomes continuous and contains no air bubbles.
5. Close the vent valves.
6. Tighten the knurled top of the fuel priming pump to its original position.



FUEL PRIMING PUMP
1–Knurled top.

◆

◆

Index

INDEX—Continued

Capacities

Approximate quantities

	U.S. Measure	Metric Measure Liters	Imperial Measure
Crankcase Lubricating Oil System,			
Diesel Engine	22 qt.	21	18.5 qt.
Starting Engine	1½ qt.	1,4	1.3 qt.
Oil Type Flywheel Clutch	9 qt.	8,5	7.5 qt.
Fuel Injection Pump Housing	⅞ qt.	0,8	0.7 qt.
Air Cleaner, Diesel Engine	3 qt.	2,8	2.5 qt.
Air Cleaner, Starting Engine	½ qt.	0,5	0.5 qt.
Steering Clutch Control	6 qt.	5,6	5.0 qt.
Final Drive (each)			
60 inch gauge	9½ qt.	9	8 qt.
74 inch gauge	13 qt.	12,5	11 qt.
Transmission	42 qt.	40	35 qt.
Starting Engine Clutch Housing	⅝ qt.	0,6	0.5 qt.
Fuel Tank, Diesel	51½ gal.	195	43 gal.
Fuel Tank, Starting Engine	5½ qt.	5,2	4.6 qt.
Cooling System	14½ gal.	55	12 gal.

Location Of Serial Numbers