MICHIGAN

OPERATORS MANUAL

No. 3005

MODEL 175B Articulated TRACTOR SHOVEL

Information contained herein pertains to Machine Serial Numbers listed below:

175B G.M. — 427C101 and After

175B CUMMINS — 438C101 and After

Record Your Machine Serial Number and Engine Model Specification and Serial Number Here

Machine Serial_____

Engine Model_____

Engine Serial_____

CLARK EQUIPMENT COMPANY

2M751BSPR606

Printed in U.S.A.

TO OWNERS

The purpose of this manual is to serve as a guide to the proper operation, lubrication and minor adjustment of the MICHIGAN Tractor Shovel. Study this manual carefully before starting or operating the machine the first time. Become familiar with all controls and procedures, and keep the manual on the machine for handy reference.

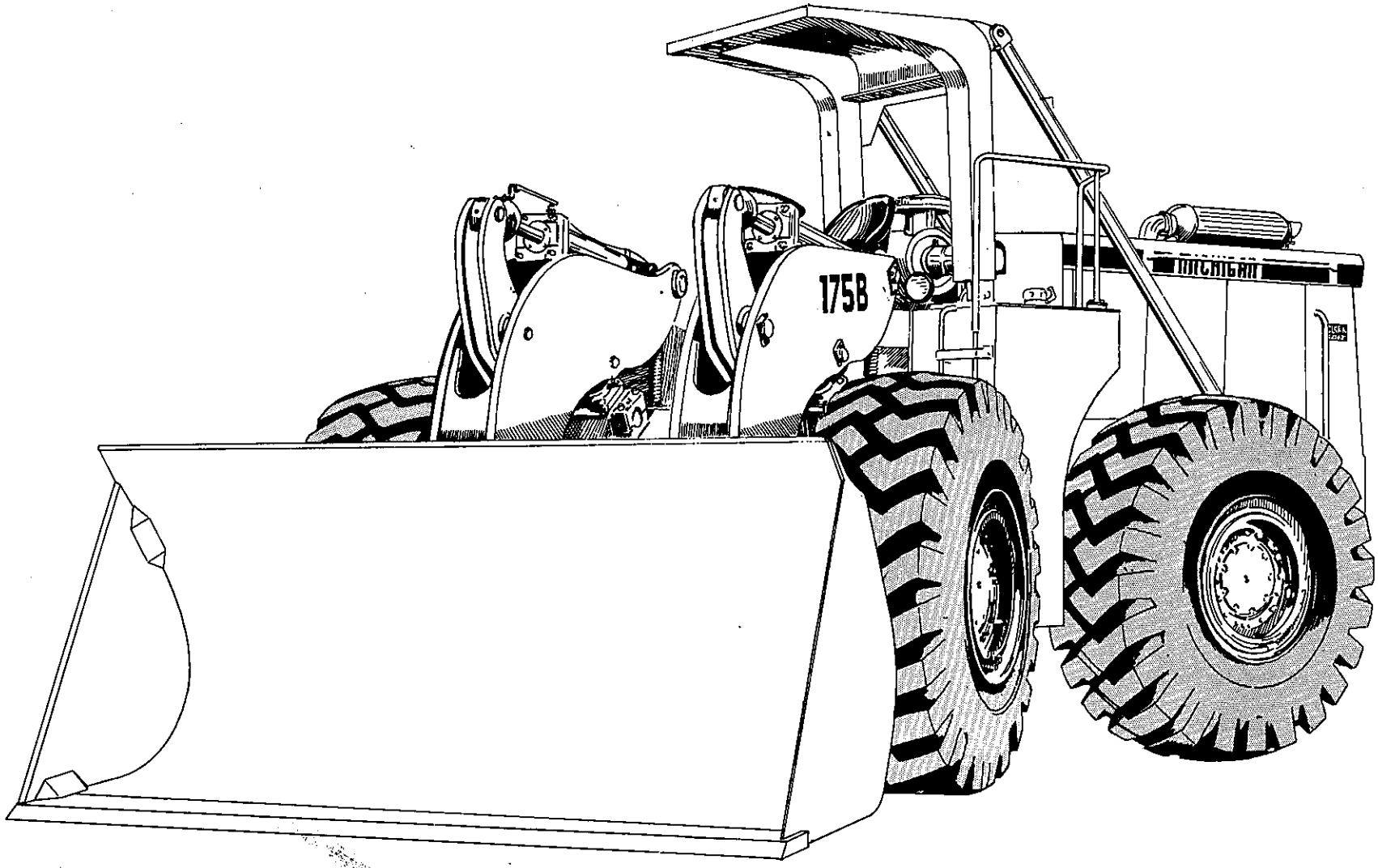
You have purchased this MICHIGAN Tractor Shovel with the expectation that it would give you long and faithful service. In its construction we have taken every precaution to see that you get an efficient, long lived, satisfactory machine. It is our sincere hope that you derive from its operation the full measure of value and utility which you looked forward to when purchasing it.

For these reasons, we take the liberty of suggesting that your MICHIGAN Tractor Shovel will always respond at its best with considerate treatment and care. The slight outlay in personal attention and cost required to give it regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated, will repay you many times in low cost operation and trouble-free service.

Whenever repair or replacement of component parts is required, only Clark-approved parts as listed in the applicable parts manual should be used. Use of "will-fit" or non-approved parts may endanger proper operation and performance of the equipment. The Clark Equipment Company does not warrant repair or replacement parts, nor failures resulting from the use thereof, which are not supplied by or approved by the Clark Equipment Company.

CLARK EQUIPMENT COMPANY

TABLE OF CONTENTS



MODEL 175B TRACTOR SHOVEL

TS-13974

GENERAL DESCRIPTION

MICHIGAN Articulated Tractor Shovels are constructed for rugged heavy-duty industrial and commercial applications. They are specifically engineered for maximum ease of operation to move the greatest amount of material in the shortest possible time.

Drive power is from the engine through a Clark torque converter, to a Clark power shifted transmission, to Clark axle assemblies. Universal slip-joint drive shaft assemblies are used between power transfer units.

Axle assemblies are Clark all wheel drive, spiral bevel ring gear and pinion, with further gear reduction provided by planetary gear sets within the wheel hubs.

Constant four-wheel drive provides additional tractive effort and power for any operating condition. Effortless hydraulic power steering is provided, utilizing two double acting steering cylinders, one at each side between front and rear frames.

Service brakes provide braking effort on all four wheels, with a cable controlled mechanical parking brake mounted on the drive line.

Numerous quick-change attachments are available as optional accessory equipment, enabling one to increase the usefulness of the machine for a variety of different operations.

For more complete specifications refer to Specifications and Service Data in the rear of this manual.

DATA PLATES

Data plates and decals used throughout the machine aid in its safe efficient operation; others give service instructions. Read all instruction plates before starting and operating the machine.

AREA WARNING DECAL

The warning decal as shown in Figure 1 is located on the surfaces of both fuel tank and hydraulic reservoir. Safety links should be attached between front and rear frames when servicing the machine. Service personnel must stay out of these areas when the engine is running, or the machine is in motion, as there is not enough space for a man in the area when machine is turned.

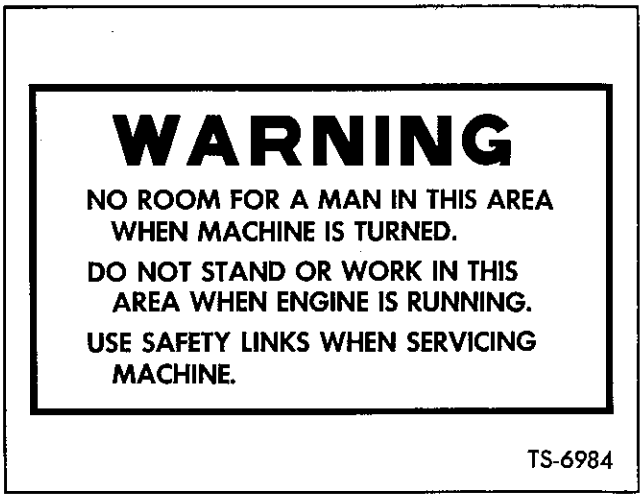


Fig. 1. Area Warning Decal

MACHINE SERIAL NUMBER PLATE

The machine serial number plate gives model number and serial number of machine. See Figure 2. Serial number of machine also is stamped in one-half inch numerals beneath right hand upper pivot assembly, and on the rear beneath the wrap around.

IMPORTANT: ALWAYS GIVE SERIAL NUMBER OF MACHINE WHEN ORDERING PARTS.

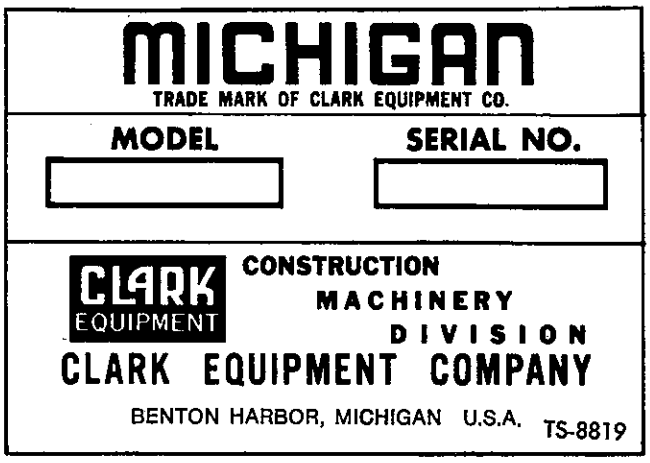


Fig. 2. Machine Serial Number Plate

LUBRICATION INSTRUCTIONS

ITEM	SHOVEL	DOZER	SCRAPER	CHECK	LUBRICATION OR CHANGE PERIOD	LUBRICANT KEY
AIR CLEANER(S)	X	X	X	SEE OPERATORS MANUAL FOR DETAILED INSTRUCTIONS.		
HYDRAULIC RESERVOIR	X	X	X	8 HRS.	1000 HRS.	HF
TORQUE CONVERTER & TRANSMISSION	X	X	X	8 HRS.	500 HRS.	HF
ALL GREASE FITTINGS EXCEPT:	X	X	X	—	8 HRS.	LBG-1
AUTOMATIC LUBE SYSTEM RESERVOIR**	X	X	X		8 HRS.	LBG-2
BOOM & BUCKET SEALED LINKAGE PINS**	X	—	—	—	*100 HRS.	LBG-1
BRAKE CAMSHAFT FITTINGS	X	X	X	—	50 HRS.	LBG-1
PROPELLER SHAFT FITTINGS	X	X	X	—	*100 HRS.	LBG-1
ELEVATOR MOTOR CIRCUIT SWIVEL JOINTS	—	—	X	—	250 HRS.	LBG-1
FRONT AXLE DIFFERENTIAL	X	X	X	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL-1
REAR AXLE DIFFERENTIAL	X	X	—	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL-1
FRONT AXLE PLANETARY HUBS	X	X	X	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL-1
REAR AXLE PLANETARY HUBS	X	X	—	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL-1
REAR AXLE WHEEL BEARINGS	—	—	X	—	1000 HRS. - 6 MO.	WB
REAR AXLE WHEEL BEARINGS & CENTER STEER ARM BEARINGS (Non-Driving Axles)	X	—	—	—	1000 HRS. - 6 MO.	WB
STEERING GEAR**	X	X	X	50 HRS.	—	LBG-1
FAN DRIVE GEAR BOX**	—	X	—	50 HRS.	1000 HRS. - 6 MO.	SAE 90 GL
ELEVATOR GEARBOX	—	—	X	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL-2
MIDMOUNT BEARING ASSEMBLY:						
A — Equipped with level & drain plug	X	X	—	50 HRS.	1000 HRS. - 6 MO.	HF
B — Equipped with grease fittings (2)	X	X	—	—	100 HRS.	LBG-1
BRAKE MASTER CYLINDER (Hydraulic & Air Over Hydraulic Brakes)	X	—	X	50 HRS.	—	BF
BRAKE POWER CLUSTER AIR CHAMBER (Air Over Hydraulic Brakes)	X	—	X	—	1000 HRS.	HF
CAB PRESSURIZER FILTER**	X	X	X	REMOVE, CLEAN & REPLACE EVERY 8 HRS. OR OFTENER AS REQUIRED		
HYDRAULIC SYSTEM BREATHER	X	X	X	REMOVE, CLEAN & REPLACE EVERY 50 HRS.		
CONVERTER BREATHER	X	X	X	REMOVE, CLEAN & REPLACE EVERY 50 HRS.		
TRANSMISSION BREATHER	X	X	X	REMOVE, CLEAN & REPLACE EVERY 50 HRS.		
CONVERTER & TRANSMISSION OIL FILTERS	X	X	X	—	250 HRS.	—
STEERING SYSTEM OIL FILTERS	X	X	X	—	250 HRS.	—
BRAKE SYSTEM AIR DRYER CARTRIDGE**	X	X	X	*CHANGE CARTRIDGE EVERY 500 HRS.		
HYDRAULIC RESERVOIR SUCTION & RETURN FILTERS	X	X	X	CLEAN OR REPLACE EVERY 250 HRS.		
AXLE BREATHERS	X	X	X	REMOVE, CLEAN & REPLACE EVERY 500 HRS.		
ENGINE, FUEL & OIL FILTERS & ACCESSORIES				SEE ENGINE OPERATORS MANUAL FOR INSTRUCTIONS.		

*LUBRICATION OR CHANGE PERIOD IS AS INDICATED, EXCEPT WHEN DIFFERENT ON DECAL BELOW. **WHERE APPLICABLE.

LUBRICANT KEY

LBG-1	LITHIUM BASE MULTI-PURPOSE GREASE 0°F & ABOVE — GRADE 2 BELOW 0°F — GRADE 0	GL	STRAIGHT MINERAL OIL GEAR LUBE — API CLASS GL1	
		BF	SAE J1703 (70R-3) BRAKE FLUID	
LBG-2	LITHIUM BASE MULTI-PURPOSE GREASE 30°F (—1°C) & ABOVE — GRADE 0 —30°F (—34°C) TO 30°F (—1°C) — GRADE 00	WB	WHEEL BEARING GREASE — EP GRADE 1 (Lithium Soap or Lithium Lead Type — 40 lbs. Min. Lever Load, Timken Test)	
		HF	AMBIENT TEMP. RANGE	LUBRICANT TO BE USED
EPGL-1	EXTREME PRESSURE GEAR LUBE — SCL TYPE		ABOVE 0°F (—18°C)	SAE 10W Engine Oil, API Class SD or SE MIL-L-2104B or MIL-L-2104C. (For Optional Lubricants See Operators Manual).
EPGL-2	EXTREME PRESSURE GEAR LUBE — API CLASS GL4 (Military Spec. MIL-L-2105B)		0°F (—18°C) & BELOW	See Operators Manual

SEE APPLICABLE OPERATORS MANUAL FOR DETAILED INSTRUCTIONS. TS-13907

Fig. 3. Lubrication Instruction Decal

LUBRICATION INSTRUCTION PLATE

The lubrication instruction plate as shown in Figure 3 provides a list of items to be lubricated on specific models, intervals of lubrication, and types of lubricant to be used. However, in addition to the lubrication instruction plate, it will be necessary to refer to the Lubrication Section in applicable Operator's Manual for location of lubricating points and detailed instructions pertaining to lubrication.

SAFETY WIRING DECAL

The safety wiring decal as shown in Figure 4 indicates that the machine is equipped with an alternator having a negative grounded electrical system.

The alternator is a continuous output diode rectified alternating current (a.c.) generator that develops a continuous output of electrical energy at all engine operating speeds (high, low and idle). The trade name for this unit manufactured by Delco-Remy is "Delcotron". The output of the alternator is controlled by a transistorized voltage regulator.

Note: *To prevent serious injury to personnel or extreme damage to electrical system components, it should be noted that information contained in this manual pertaining to electrical system components will emphasize certain precautions that must be followed when servicing the "Delcotron" charging system.*

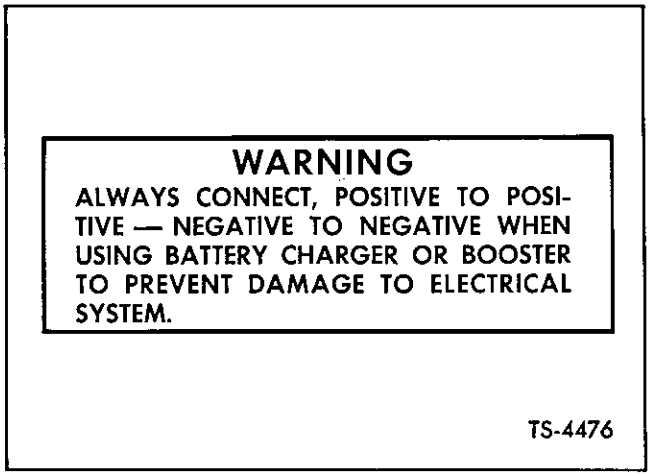


Fig. 4. Safety Wiring Decal

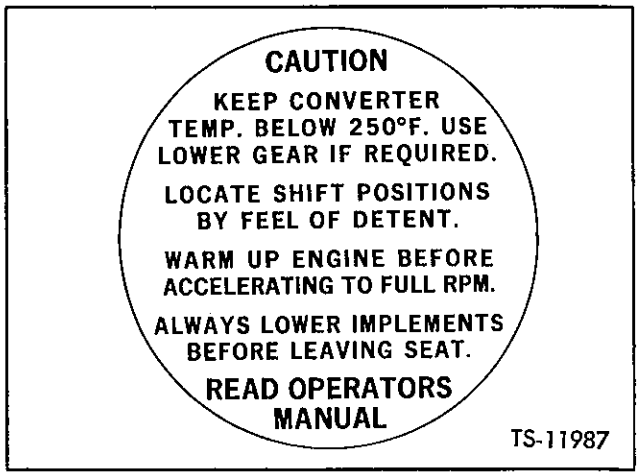


Fig. 5. Operating Precaution Plate

OPERATING PRECAUTION PLATE

The operating precaution plate as shown in Figure 5 is located in the center of the steering wheel. This plate provides a few precautions to follow during machine operation, and also reminds the operator to refer to the Operator's Manual for additional information that is necessary for proper operation of the machine.

TRANSMISSION OR TORQUE CONVERTER SERIAL NUMBER PLATE

The transmission serial number plate is located on the transmission. The torque converter serial number plate is located on the torque converter. Both plates are identical except for model number and serial number stamped on each plate to properly identify the units. Plate is shown in Figure 6.

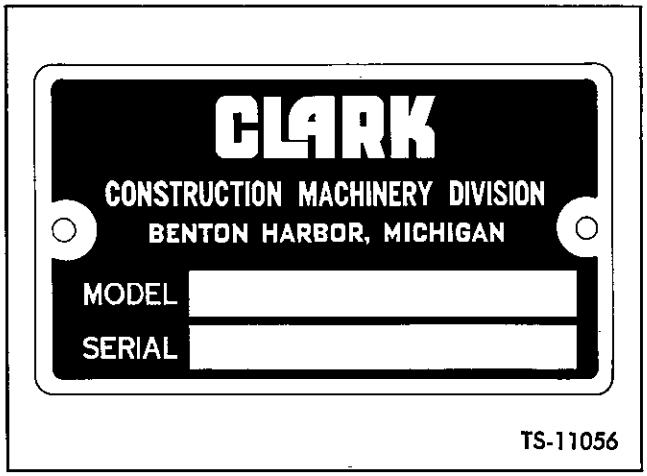


Fig. 6. Torque Converter or Transmission Serial Number Plate

PREPARATION FOR OPERATION

It is essential that the following points be checked with machine in a level position before operating this MICHIGAN Tractor Shovel.

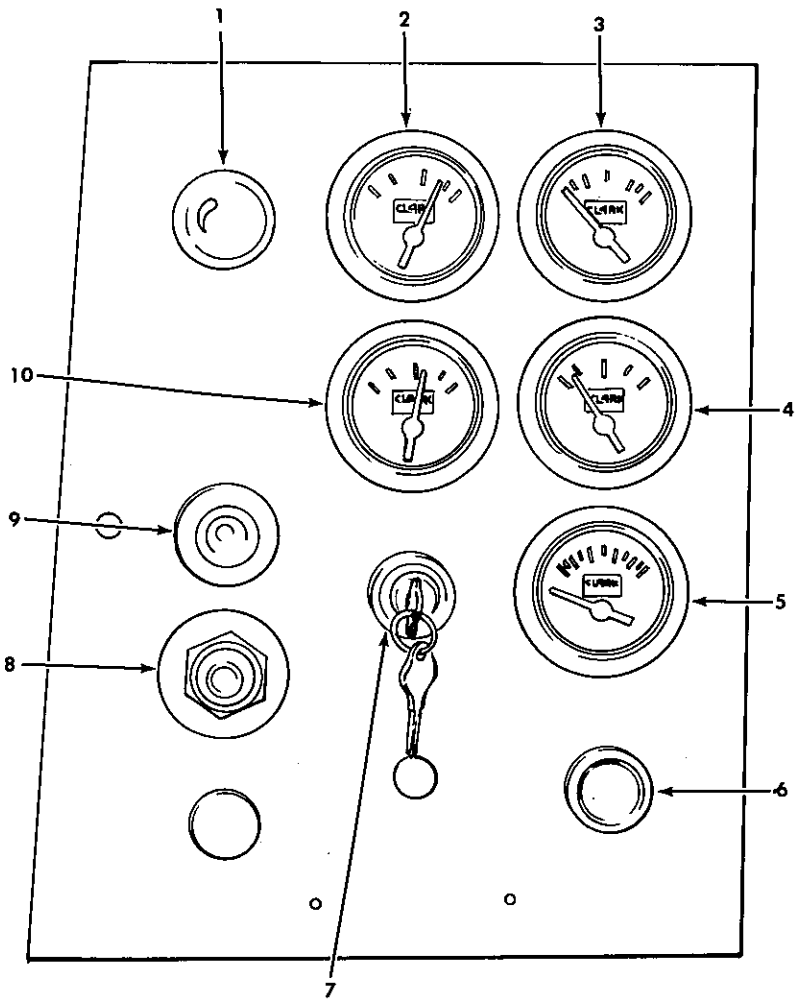
Refer to the Lubrication Charts to locate items listed below.

1. Check entire machine for damage in transit or storage.
2. Check oil level in the following to specifications outlined in Lubrication Section.
   a. Engine crankcase
   b. Transmission case (with engine idling)
   c. Front drive axle differential
   d. Front drive axle planetary hubs
   e. Rear drive axle differential
   f. Rear drive axle planetary hubs
   g. Hydraulic system reservoir
   h. Steering gear
   i. Midmount bearing
3. Check cooling system to make sure radiator is filled and that radiator drain cock and engine block drain cock are closed. When there is danger of water freezing in the cooling system, use a reliable brand of permanent type anti-freeze according to manufacturer's instructions. For further information, please refer to Operation and Maintenance Manual of engine manufacturer.
4. Check batteries that plates are covered with water. Add only clean distilled water. Do not overfill.
5. Check fuel level in tank. Handle fuel in clean containers. Use No. 2 Diesel fuel oil, Cetane 40 minimum.
6. Check that all drain plugs, drain cocks, filler openings, fuel lines, oil lines, hydraulic lines, cooling system and air cleaner connections are tight and do not leak.
7. Check tire pressures and hydroinflation. See Specifications and Service Data for air pressure and hydroinflation data. Be sure valve caps are in place to prevent dirt, moisture and foreign material from damaging valve core.
8. Grease all lubrication points of the entire unit. Refer to Lubrication Section as a guide for location and type of lubricant.

INSTRUMENTS AND OPERATING CONTROLS

Before operating a machine of this type it is essential that the operator become thoroughly familiar with the location and function of the various controls and instruments. Reference to, and study of the illustrations of the operator's compartment, controls, and instruments, together with the following paragraphs will aid in acquiring this information.

The operator should work slowly and carefully until he has become thoroughly accustomed to the machine. Speed and skill will be attained much easier if the necessary time is spent to acquire complete familarity with the machine and its operation.



1. Dash Lamp
2. Engine Oil Pressure Gauge
3. Torque Converter Temperature Gauge
4. Engine Temperature Gauge
5. Voltmeter
6. Light Switch
7. Ignition Switch
8. Starter Switch
9. Lighter
10. Air Pressure Gauge

TS-11057

Fig. 7. Instrument Panel

INSTRUMENTS AND SWITCHES

All instruments and switches with the exception of the hourmeter and foot operated horn switch are conveniently located on instrument panel at left front side of operator's compartment. The hourmeter is mounted at the rear of the operator's compartment. The foot operated horn switch is located at left side of front floorboard.

It is good practice to observe gauges frequently while working the machine. Each gauge serves as an important check point for operating conditions of torque converter and transmission, and of the engine and accessories. Do not operate machine if gauges are not functioning properly.

Figures 7 and 8 give identification of instruments and switches.

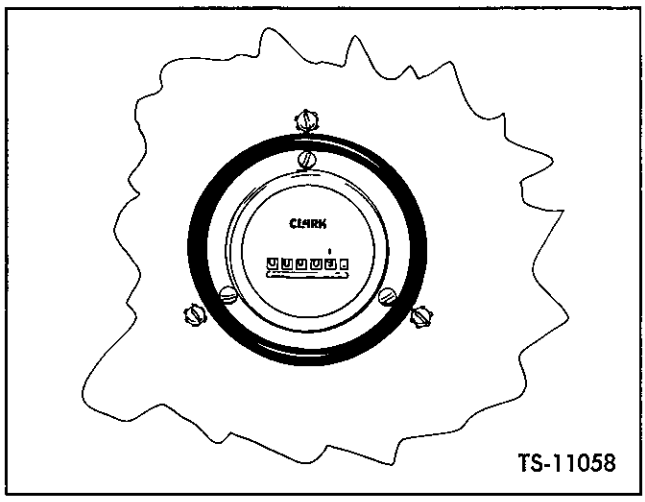


Fig. 8. Hourmeter

INSTRUMENT PANEL

Engine Temperature Gauge indicates temperature of engine coolant. Under normal operating conditions gauge should register between 165°F. and 185°F. If gauge indicates temperature to be at boiling point, idle engine, and add water to the system. When temperature lowers, shut down engine and troubleshoot cooling system for cause of overheating.

Engine Oil Pressure Gauge indicates oil pressure in engine lubricating system. Under normal operation, at idle and governed rpm, check gauge pressure. Refer to Specifications and Service Data for normal pressure readings under these conditions. If gauge fails to register within 10 to 15 seconds, stop engine immediately and determine cause.

Dash Lamp lights when light switch is pulled out to the first position.

Air Pressure Gauge indicates pressure in air reservoir for operating brakes. Never operate machine unless gauge indicates adequate pressure for actuating brakes. Refer to Specifications and Service Data for air pressure specifications.

Torque Converter Temperature Gauge indicates the temperature of fluid in torque converter and transmission lubricating system. When temperature approaches 250°F. or red portion of gauge, shift to a lower operating speed range.

Voltmeter indicates the condition of the batteries. When the ignition switch is turned on, the voltmeter will indicate the voltage available from the batteries. A reading lower than rated system voltage would indicate low batteries. When the engine is running, a reading above rated system voltage indicates the batteries are charging.

Ignition Switch energizes all gauges and switches on instrument panel, and starting motor circuit. Turn switch to right for ON position.

Light Switch operates dash lamp, headlights, and tail lights in first position, with the addition of back-up lights in second position. Pull switch to operate.

Starter Button energizes cranking motor to start engine. Press to operate; release when engine starts. Do not crank engine continuously for more than 30 seconds to avoid damage to cranking motor. Pause a few minutes between cranking cycles, if difficulty is encountered to let windings cool. See Starting Procedure in rear of manual.

Cigarette Lighter is a push button type conveniently located on instrument panel. With ignition switch in the ON position, push lighter to operate.

OPERATING CONTROLS

All controls are conveniently located to provide maximum ease of operation of the machine.

The operator's seat can be shifted forward or rearward to suit the individual. The height and angle of the seat can also be adjusted by repositioning the seat in the adjusting holes in seat mounting brackets.

If enclosed parking is not available when shutting down machine at end of shift, spread tarpaulin over operator's compartment to give protection from inclement weather. A cab enclosure kit is available as optional accessory equipment.

Refer to Figure 9 for location and identification of operating controls.

Directional Shift Lever is the top lever on steering column. This lever provides three positions, FORWARD, NEUTRAL and REVERSE to control direction of machine travel. Pushing lever into forward position engages FORWARD travel. Pulling lever into rear position engages REVERSE travel. Lever is in NEUTRAL when in its central position.

When shifting from FORWARD into REVERSE or vice versa, always decrease engine rpm and stop machine momentarily while making the shift.

Speed Range Lever is the bottom lever on steering column. This lever controls the travel speed of the machine. Pushing the lever forward engages LO (First) speed range. Pulling the lever to the rear engages progressively higher speed ranges in consecutive order.

Observe torque converter temperature gauge when working machine. If gauge approaches 250°F., shift to a lower operating speed range.

Shifting from one speed range to another can be made at any time during the working cycle. Momentarily let up on accelerator pedal when shifting to a higher speed range, and accelerate slightly when shifting to a lower speed range.

It is not good driver practice to skip speed ranges when shifting, if machine is in motion. It is better to make progressive shifts engaging each speed range before proceeding to the next.

Boom Control Lever is the outer lever on right hand side of operator. This lever has four positions: RAISE, HOLD, DOWN PRESSURE and FLOAT to control boom operation. Of the four positions, RAISE, HOLD and FLOAT are detent located and can be destinctly felt by the operator. The DOWN PRESSURE position is not detent located and must be located by "feathering" the lever between the HOLD and FLOAT positions.

To raise boom and bucket, pull boom lever backward to the last detent position. Boom and bucket will raise in proportion to engine speed.

Push lever forward, one notch ahead of RAISE position to reach the HOLD (neutral) position. Placing boom control lever in this position will stop and hold boom and bucket at any height desired.

Push lever all the way forward to reach the FLOAT position. In this detent position, hydraulic oil will pass from the base end of the boom cylinders through the control valve and into the rod end of the cylinders, keeping them free of air. FLOAT position may be used for lowering the bucket or back dragging.

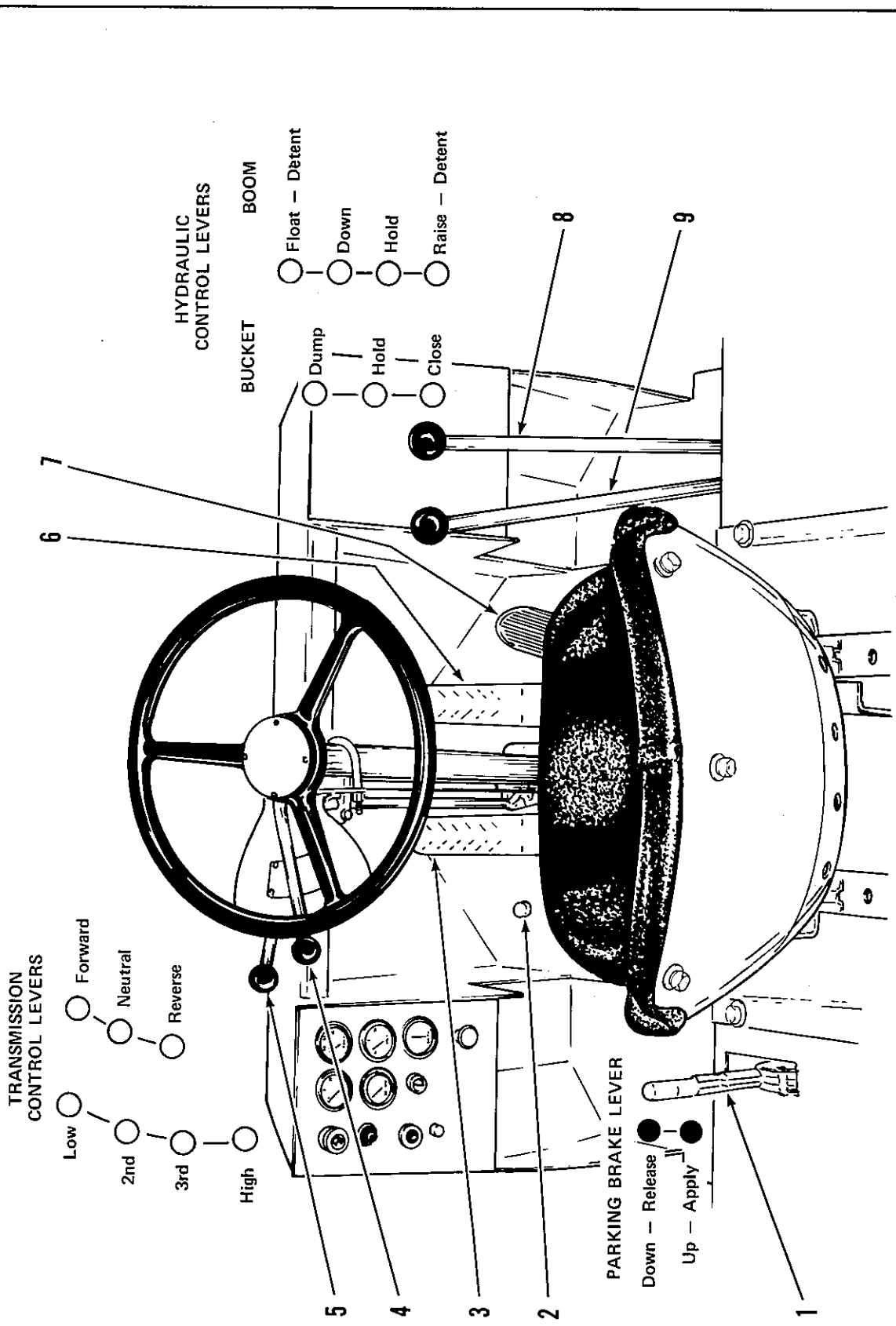
The DOWN PRESSURE position found between the HOLD and FLOAT positions by "feathering" the lever. This position may be used for lowering the boom and bucket or to provide penetration to dig below grade level.

Always place boom control lever in HOLD (neutral) position before starting or shutting down engine. This lever will lower boom and bucket even though engine has been shut down.

Bucket Control Lever is the inner lever on right hand side of operator. This lever has three positions: CLOSE, HOLD and DUMP to control bucket operation. Since lever is connected to a spring loaded plunger in the control valve, it returns to the HOLD position automatically when released.

To DUMP bucket, push lever forward. Release the lever and it will return to the HOLD (neutral) position, allowing the bucket to remain in the DUMP position.

To CLOSE bucket, pull lever backward. Release the lever and it will return to the HOLD (neutral) position when the bucket reaches a level attitude



1. Parking Brake Lever
2. Horn Switch
3. Brake Pedal (Declutch)
4. Directional Shift Lever
5. Speed Range Lever
6. Brake Pedal (Declutch By-Pass)
7. Accelerator Pedal
8. Boom Control Lever
9. Bucket Control Lever

Fig. 9. Operating Controls

as it is being rotated back from the DUMP position.

The bucket may be stopped and held at any position of its dumping arc by placing lever in the HOLD (neutral) position.

Parking Brake Lever applies mechanical brake on drive line. To set brake, pull up and back on lever. To release brake push lever forward and down.

Brake Pedal design permits brake application with either left or right foot of operator. Pedal actuates an air valve for applying brakes at all wheels. As pedal pressure increases, air valve opens wider, and brake application becomes more severe.

The left hand brake pedal also operates a de-clutch or shut-off valve in the transmission control cover which blocks off hydraulic pressure to the forward clutch in all speed ranges, thus disengaging the forward clutch and establishing a transmission neutral when the left hand brake pedal is applied. The reverse clutch is not affected.

The right hand brake pedal by-passes the de-clutch valve, making it possible to apply the service brakes without de-clutching if so desired. This permits inching the machine forward using service brakes and throttle.

The purpose of the de-clutching feature is to prevent the machine from creeping forward when loading or dumping the bucket, yet permits backing away if operating on a sloping grade. It also increases boom and bucket hydraulic system working power by blocking the power transmitted to the wheels.

Circuit Breaker Reset Button is located on right rear frame rail next to starter motor assembly. Press button and hold momentarily to reset circuit breaker whenever circuit breaker has been tripped.

Safety Brakes: A safety feature has been incorporated in the air over hydraulic disc brake system on Model 175B Tractor Shovels. It consists of automatically applied, low pressure actuated, front and rear axle braking systems, with a manual control feature.

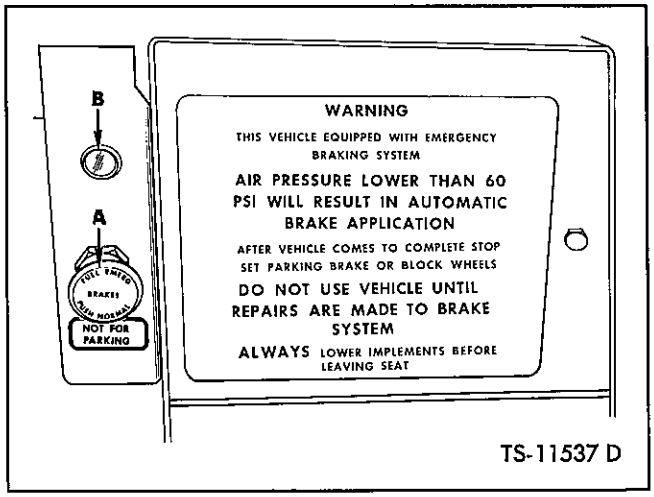
Each axle is equipped with independent components so that an appilcation of the service brake pedal actuates both systems simultaneously. If air pressure is lost in either the front, rear or both systems, the safety brake for that system is automatically applied to bring the machine to a safe controlled stop.

Additional braking protection is provided by an emergency system, manually controlled by a hand valve located in the operator's compartment. A dash mounted light and buzzer warn the operator when air pressure reaches the minimum safe limit, see Figure 10. If the operator does not stop, the brakes are automatically applied when air pressure drops below safe operating limit.

CAUTION: *When safety brakes are actuated, the machine must not be moved until air pressure is returned to safe operating level.*

The emergency brake button is located to the immediate left of the right hand instrument panel. It is a push-pull type control used to actuate the manually controlled emergency system. Pull button out to apply brakes, push in to release brakes.

WARNING: *The emergency brake is not to be used as a parking brake since air pressure in the emergency system bleeds down about 15 minutes after the engine has been shut down.*



A. Brake Hand Valve B. Warning Light

Fig. 10. Brake Manual Control & Warning Light

OPTIONAL EQUIPMENT

Windshield Wiper Switch: The windshield wiper switch is a three position switch located at the upper right hand corner of the windshield above the wiper motor assembly. Turn the switch knob clockwise to the first position for low speed wiper operation and clockwise to the second position for high speed operation. Turn switch knob to the maximum counter-clockwise position to turn wiper off.

Defroster Fan Switch: The defroster fan switch is located at the upper right hand front corner of cab, above the defroster fan assembly. Turn switch knob clockwise to operate defroster fan, or counter-clockwise to shut defroster fan off.

Heater Controls: The heater controls are located below the left hand front corner of the operator's seat. Operation of heater controls is as follows.

1. Temperature Control: The temperature control knob is a push-pull type control and is the upper left hand heater control knob. Pull knob out to increase temperature or push knob in to decrease temperature.
2. Vent Control: The vent control knob is a push-pull type control and is the upper right hand heater control knob. Push knob in or pull out to obtain desired heater vent position.
3. Fan Switch: The heater fan switch is a three position switch located between and below the temperature control and vent control knobs. Pull knob out to the first position to operate heater fan at low speed. Pull knob out to second position to operate heater fan at high speed. Push knob all the way in to turn heater fan off.

OM 3005
Printed in U.S.A.

OPERATING INSTRUCTIONS

After the machine has been properly checked and the operator has familiarized himself with location and function of the various controls, the machine should be operated according to instructions in the following paragraphs.

SAFETY PRECAUTIONS

A careful and efficient operator of heavy equipment must be guided by simple and fundamental rules of safety. He must take the necessary precautions to insure the safety of others as well as himself, and must avoid careless operating habits which cause damaging accidents to machinery and equipment.

The use of this machine is subject to certain hazards that cannot be met by mechanical means, but only by the exercise of intelligence, care and common sense.

Warning: *Use safety links when servicing machine. Do not stand or work in step area(s) when machine is running. There is no room in this area for a man when machine is turned.*

The following are a few of the primary sources of injury to workmen.

1. Repairing and servicing equipment in dangerous positions.
2. Striking other persons or vehicles with the machine.
3. Unexpected violent tipping of the equipment.
4. Unexpected violent shocks or jars to the machine.
5. Uncontrolled traffic involving other vehicles.
6. Hazards from limbs of trees or overhead obstructions.
7. Leaving earth-moving or other equipment in dangerous positions unattended.

In order to help prevent accidents the following safety rules should be observed at all times.

Do Not Leave Machine Unattended: Do not leave machine unattended with engine running. Always place directional shift lever in neutral, lower bucket, set parking brake, and shut down engine before leaving operator's seat.

Never Leave Machine with Bucket in Air: Never leave machine without first lowering bucket so that it rests on the ground. Make sure all control levers are in neutral position and engine shut down.

Watch Bucket and Direction at All Times: Keep your eye on the load and always face or look in the direction machine is traveling.

Avoid Greasy Hands and Floors: Keep hands, floors and controls free from water, grease and mud to insure non-slip control.

Never Get On or Off a Machine in Motion: Never get on or off a machine that is in motion. Positively in no case should anyone ride in the bucket, or on the outside of the machine.

Stop Machine to Lubricate or Adjust: Stop all operation and shut down engine when cleaning, adjusting, or lubricating the machine. Tie red WARNING tag on steering wheel, turn off ignition switch and remove key.

Never Lift Bucket Over Ground Crew: Watch for ground crew and other workers on foot while machine is in motion. Never swing bucket over a truck cab. Sound horn as a warning when approaching ground crew, and before setting machine in motion.

Keep Brakes in Proper Working Order: At the first signs of brake slippage, stop machine, inspect and repair brakes promtply.

Never Transport Load With Bucket Fully Raised: The nearer the ground that the bucket is held, the better the stability, especially on slopes or when turning machine. Approximately 15 inches from the ground is best.

Bucket Position for Travel: Raise bucket approximately 15 inches off the ground and tip back to afford maximum visibility.

Always Set Brake to Hold Machine When Parked: Set parking brake lever when parking machine. If on a grade, block wheels.

Maintain Proper Tire Inflation: Check tire inflation pressure daily to provide best operation and longest tire life. Particular attention must be emphasized when checking hydro-inflated tires as there is less volume of air to provide cushioning.

Select Proper Speed Range: Operate machine at speeds consistent with conditions on the particular job. Extra caution should be used if wet or icy conditions exist.

Maintain Shovel Balance: Keep bucket close to the ground for balance when tractor shovel is traveling up a steep grade.

Do Not Use Bucket as a Brake: When going down a steep slope do not use bucket as a brake.

Check Before Moving Shovel: Walk around machine to make certain that no one is in "danger area" before entering operator's compartment. Sound horn before moving machine.

Do Not Operate Machine Without Instruments: Each gauge on the instrument panel serves as an important check point for operating conditions of the machine. Do not operate machine if gauges are not functioning properly.

Be Courteous: Always give loaded equipment the right of way.

Portions of above safety precautions taken from Data Sheet D-256 by permission of National Safety Council.

STARTING PROCEDURES

Refer to starting instructions for make of engine involved located at rear of this section.

PRE-STARTING CHECKS

Before starting engine at beginning of work shift, or at any time machine has been shut down for adjustment or time-off period, perform the following checks.

1. Engine oil level.
2. Engine air cleaner.
3. Hydraulic system oil level.
4. Cooling system.
5. Fuel supply.
6. Transmission fluid.
7. Tire pressures.

Service units at this time if inspection indicates the necessity.

Caution: *Disconnect safety links before moving machine.*

COLD WEATHER STARTING

MICHIGAN machines do not require extension preparation for cold weather operation beyond addition of a permanent type anti-freeze to the cooling system, and a change of engine oil to a viscosity suitable for anticipated temperatures in which the machine is to operate. At temperatures below 0°F. a change of oil in the main hydraulic system to the fluid recommended for this temperature, will aid starting by reduction of resistance in the main pump. Probably the most important item to insure prompt starting is proper maintenance of the electrical system, especially the batteries.

Batteries must be kept fully charged at all times, since in cold weather the capacity to deliver full power is greatly reduced. A fully charged battery at 15°F. is capable of delivering only 70% of its rated amperage, and at lower temperatures becomes even less efficient. Service batteries weekly as follows:

1. Add distilled water to cover plates and separators but do not overfill. Overfilling causes dilution of the electrolyte, and sputtering during the charging cycle. This may result in battery freezing and corroded terminals.
2. Keep terminals clean and tight. Dirty or loose connections offer high resistance.
3. Keep vent plugs in place, and tight to prevent entrance of foreign materials into cells.
4. Check specific gravity regularly with a hydrometer, and recharge or replace batteries that continually show a low reading.

Service other electrical components as follows:

1. Visually check all wiring for worn or cracked insulation and loose terminal connections.
2. Clean and tighten loose connections on cranking motor, alternator, voltage regulator, solenoid switch, relays and sender units.
3. Clean and tighten external ground straps, and replace if badly frayed or corroded.

To avoid unnecessary cranking because of air locks in cold fuel oil, change fuel oil only when engine is hot; then start and run engine after filter change, and check that there is no fuel restriction or leakage.

When not in use, machine should be parked or stored in a closed garage or building during cold weather to reduce cranking effort when starting a cold engine. It is particularly important in starting the engine that it is not accelerated to governed speed or a load applied until the oil has become warm enough to circulate to all bearing surfaces.

WARM-UP CHECKS

Hold engine at idle speed for approximately two minutes after starting; then while engine continues to warm up for the next few minutes perform the following checks.

1. Engine oil pressure gauge.
2. Ammeter.
3. Air pressure gauge.
4. Engine temperature gauge.

5. Torque converter temperature gauge.

6. Horn.

7. Lights.

8. Hydraulic system – boom and bucket control levers.

Visually check for leaks at drain and fill plugs in axle assemblies, torque converter and transmission, and at hose couplings and fittings in hydraulic, fuel, air intake, brake and cooling systems. Correct all leaking conditions, and repair or replace gauges that are not functioning before continuing operation of the machine.

PARKING AREA CHECKS

As a final check before leaving the parking area, set machine into motion and test the following:

1. Steering gear.

2. Service brakes.

3. Parking brake.

Remember, the safety of the operator and other workmen, and the efficient operation of the machine depend upon the performance of all items in the check list above. Service units at this time if inspection indicates the necessity.

G.M. DIESEL

STARTING INSTRUCTIONS

NORMAL STARTING

Caution: *Walk around machine. Make certain that no one is in "danger area" before entering the operator's compartment.*

1. Set directional shift lever in NEUTRAL.
2. Depress and release accelerator to reset governor throttle control lever in IDLE position.
3. Turn ignition switch ON; press starter switch firmly, and very lightly depress accelerator to feed additional fuel. Operate cranking motor no more than 30 seconds at a time to avoid overheating motor.

   Caution: *If engine fails to start, wait until cranking motor stops rotating before repressing starter switch. Serious damage to the cranking motor may result if this precaution is not complied with.*

   If engine fails to start after four periods of cranking, refer to Operation and Maintenance Manual of engine manufacturer.
4. After engine starts, check oil pressure gauge. If no pressure is indicated within 15 seconds, shut down engine immediately and determine cause.
5. Allow engine to reach operating temperature before driving or operating machine.

COLD WEATHER STARTING
(When Colder Than 40°F.)

G.M. Diesels are not equipped with cold weather starting aids. However, starting fluid (pressurized can type) sprayed into air cleaner intake is recommended as engine is being started.

Ether starting fluid is available in 16 ounce pressurized can from your authorized MICHIGAN Distributor under part number 945152.

A fluid starting aid (capsule form) can be installed by any authorized G.M. Diesel Distributor.

1. Set all control levers in NEUTRAL position and turn ignition switch ON.
2. Depress accelerator to full throttle position.
3. Press starter switch firmly and simultaneously use starting fluid directed into air cleaner intake.

   Do not operate cranking motor for more than 30 seconds at a time to avoid overheating motor.

   Caution: *If engine fails to start, do not repress starter until cranking motor has stopped rotating. Serious damage to cranking motor may result if above procedure is not complied with.*
4. After engine starts, check oil pressure gauge.

   If no pressure is indicated within 15 seconds shut off engine and determine cause.
5. Allow engine to warm up for a few minutes before driving or operating machine.

OPTIONAL
QUICK START COLD WEATHER STARTING AID

The "Quick Start" cold weather starting aid is controlled by a push button mounted on the left hand instrument panel. When the button is pushed, ether is injected into the engine's intake manifold to aid in cold weather starting.

Caution: *Do not attempt to inject additional ether by pushing button after engine is running. This could result in detonation and severe damage to the engine.*

Cold weather, below 50°F. (10°C.) may require use of the "Quick Start" starting aid. With control levers in the NEUTRAL position, proceed as follows:

1. Turn ignition switch ON, then push "Quick Start" button for one second and release.
2. Wait two seconds and engage starter.
3. Below 0°F. (–18°C.) repeat steps 1 & 2.

CAUTION: *USE ONLY FOR STARTING.*

MAINTENANCE

A. Periodically remove cylinder and oil valve.

1. Use care in wiping dirt from valve inlet when

removing cylinder to prevent dirt from entering valve.

2. Check valve gasket for damage and replace if needed.

3. With cylinder removed, actuate system to distribute lubricant.

B. When replacing empty cylinder, follow steps 1, 2 & 3 in Instruction A.

C. Periodically check all connections for leaks. Also check valve mounting bolts and cylinder studs for tightness.

D. Periodically test unit for proper functioning. Disconnect tube from atomizer and remove atomizer. Reassemble atomizer to tube, then actuate the system. A fine mist-like spray should be emitted from each orifice of the atomizer.

E. If system is subjected to moisture, spray valve with a plastic coating.

INITIAL HOOK-UP OF CYLINDER

The ether cylinder is disconnected from the valve and the valve and cylinder end are capped as a safety precaution during shipment of tractor. It will be necessary to hook-up the cylinder in the following manner prior to initial use of the system.

1. Remove cap from valve and cap from end of cylinder.

2. Loosen cylinder mounting bracket and lower cylinder to valve.

3. Screw cylinder into valve and tighten cylinder mounting bracket.

TROUBLE SHOOTING THE SYSTEM

If the system fails to function it may be necessary to trouble shoot the system as follows:

A. Check the cylinder for tightness and fuel supply.

1. If cylinder is loose, it should be tightened finger tight.

2. If the cylinder is not loose, it should be removed and weighed. (Empty cylinder weight is 17 ounces).

B. If system still fails to function, remove tubing at valve and actuate valve.

1. If valve is not functioning, it must be replaced. See Parts Manual.

2. If valve is functioning remove tubing and clean thoroughly. Then reinstall tube at valve end and actuate valve.

3. If fuel is discharged from tube, remove and disassemble atomizer and clean screen and blow out orifices. Then connect tubing to atomizer and actuate valve. Fuel should be emitted from each orifice of atomizer. This indicates proper functioning of the system.

4. Disconnect tubing from atomizer and reinstall atomizer. Reconnect tubing to atomizer.

SHUTTING DOWN ENGINE

It is important to idle an engine 3 to 5 minutes before shutting it down. This will allow lubricating oil and water to carry heat away from combustion chambers, cylinder head, bearings and shafts.

Residual heat can damage many parts ranging from valves to fuel pumps. The latter suffer from gums and deposits remaining after residual evaporation. In addition, the physical stresses from expansion and contraction can cause distortion, permanent warping and gasket failures. In some cases, oil seals and cylinder sleeve seals suffer badly, although the results may not appear until much later.

To shut down a G.M. Diesel, turn ignition switch OFF; then pull engine fuel shut-off control (forward T-handle) up and hold until engine stops rotating. After engine stops running, replace T-handle in its original position.

If after pulling fuel shut-off control, engine continues to operate, the engine emergency air shut-off control (rear T-handle) must be pulled to the up position. This T-handle will trip the latch assembly securing air shut-off valve inside air intake housing, thus starving the engine of air and preventing further combustion of fuel. Replace control T-handle in its original position and manually reset latch assembly at air intake housing before restarting engine.

CUMMINS DIESEL

STARTING INSTRUCTIONS

NORMAL STARTING

Caution: *Walk around machine. Make certain that no one is in "danger area" before entering operator's compartment.*

1. Set directional shift lever in NEUTRAL.

2. Turn ignition switch ON; and press starter switch firmly. Very lightly depress accelerator to feed additional fuel. Operate cranking motor no more than 30 seconds at a time to avoid overheating motor.

   Caution: *If engine fails to start within the first 30 seconds, wait two to five minutes before recranking.*

   If engine fails to start after four periods of cranking, refer to Operation and Maintenance Manual of engine manufacturer.

3. After engine starts, check oil pressure gauge. If no pressure is indicated within 15 seconds, shut off engine and determine cause.

4. Allow engine to reach operating temperature before driving machine.

COLD WEATHER STARTING
(When Colder Than 50°F.)

(a) Use of Ether without Metering Equipment

Cummins Diesels are not equipped with cold weather starting aids. However, two men can use the following procedure as a cold weather starting aid.

Caution: *Ether is highly flammable. Do not use with preheater or near open flame. Do not breathe ether fumes.*

1. Pour three tablespoonfuls of ether on a cloth; hold cloth close to air cleaner intake while second man cranks the engine.

2. As an alternate method, spray ether into air cleaner intake while second man cranks the engine.

3. Ether fumes will be drawn into the air intake manifold and the cold engine should start without difficulty.

Caution: *Do not use excessive amounts of ether. Excessive amounts of ether will cause unusually high pressures and detonation.*

OPTIONAL
QUICK START COLD WEATHER STARTING AID

The "Quick Start" cold weather starting aid is controlled by a push button mounted on the left hand instrument panel. When the button is pushed, ether is injected into the engine's intake manifold to aid in cold weather starting.

Caution: *Do not attempt to inject additional ether by pushing button after engine is running. This could result in detonation and severe damage to the engine.*

Cold weather, below 50°F. (10°C.) may require use of the "Quick Start" starting aid. With control levers in the NEUTRAL position, proceed as follows:

1. Turn ignition switch ON, then push "Quick Start" button for one second and release.

2. Wait two seconds and engage starter.

3. Below 0°F. (–18°C.) repeat steps 1 & 2.

CAUTION: *USE ONLY FOR STARTING.*

MAINTENANCE

A. Periodically remove cylinder and oil valve.

   1. Use care in wiping dirt from valve inlet when removing cylinder to prevent dirt from entering valve.

   2. Check valve gasket for damage and replace if needed.

   3. With cylinder removed, actuate system to distribute lubricant.

B. When replacing empty cylinder, follow steps 1, 2 & 3 in Instruction A.

C. Periodically check all connections for leaks. Also check valve mounting bolts and cylinder studs for tightness.

D. Periodically test unit for proper functioning. Disconnect tube from atomizer and remove atomizer. Reassemble atomizer to tube, then ac-

tuate the system. A fine mist-like spray should be emitted from each orifice of the atomizer.

E. If system is subjected to moisture, spray valve with a plastic coating.

INITIAL HOOK-UP OF CYLINDER

The ether cylinder is disconnected from the valve and the valve and cylinder end are capped as a safety precaution during shipment of tractor. It will be necessary to hook-up the cylinder in the following manner prior to initial use of the system.

1. Remove cap from valve and cap from end of cylinder.
2. Loosen cylinder mounting bracket and lower cylinder to valve.
3. Screw cylinder into valve and tighten cylinder mounting bracket.

TROUBLE SHOOTING THE SYSTEM

If the system fails to function it may be necessary to trouble shoot the system as follows:

A. Check the cylinder for tightness and fuel supply.
   1. If cylinder is loose, it should be tightened finger tight.
   2. If the cylinder is not loose, it should be removed and weighed. (Empty cylinder weight is 17 ounces).

B. If system still fails to function, remove tubing at valve and actuate valve.
   1. If valve is not functioning, it must be replaced. See Parts Manual.
   2. If valve is functioning remove tubing and clean thoroughly. Then reinstall tube at valve end and actuate valve.
   3. If fuel is discharged from tube, remove and disassemble atomizer and clean screen and blow out orifices. Then connect tubing to atomizer and actuate valve. Fuel should be emitted from each orifice of atomizer. This indicates proper functioning of the system.
   4. Disconnect tubing from atomizer and reinstall atomizer. Reconnect tubing to atomizer.

SHUTTING DOWN ENGINE

It is important to idle an engine 3 to 5 minutes before shutting it down. This will allow lubricating oil and water to carry heat away from combustion chambers, cylinder head, bearings, and shafts.

Residual heat can damage many parts, ranging from valves to fuel pumps. The latter suffer from gums and deposits remaining after residual evaporation. In addition, the physical stresses from expansion and contraction can cause distortion, permanent warping, and gasket failures. In some cases, oil seals and cylinder sleeve seals suffer badly, although the results may not appear until much later.

IT IS GOOD PRACTICE TO IDLE ANY ENGINE LONG ENOUGH TO REDUCE EXTREME TEMPERATURES.

To shut down a Cummins Diesel, turn ignition switch off.

OPERATING TRACTOR SHOVEL

SETTING MACHINE IN MOTION

The following steps give proper procedure for setting the machine in motion. Refer to Operating Controls Diagram, Figure 9.

1. Raise boom and bucket approximately 15 inches above the ground by pulling backward on boom control lever. Then roll bucket back to afford maximum visibility.

2. Place directional shift lever in position for direction of travel desired. When shifting from forward into reverse, or vice versa, always decrease engine rpm and stop machine momentarily while making shift.

3. Select applicable speed range for operating machine. Speed range and directional shift levers are so positioned that it is convenient to load in low range forward, and back away from pile in high range reverse by gripping both levers at the same time.

   High range should be used when traveling machine for comparatively long distances without a load.

   A shift from a low speed range to a higher speed range can be made when machine is in motion, by momentarily letting up on accelerator, making the shift, and again depressing accelerator.

   When making a down shift, accelerate engine to syncronize engine and drive shaft speeds when transmission clutch re-engages.

4. Release parking brake.

5. Gradually apply pressure on accelerator pedal until desired travel speed is reached.

LOADING THE BUCKET

Place speed range lever in low, and directional lever in forward. With bucket control lever, adjust bucket to the level position.

When loading from a stockpile, drive into pile with cutting edge parallel to the ground, and push cutting edge into pile until bucket is nearly full. Then pull boom control lever back to raise bucket. As bucket raises, pull bucket lever back to tip bucket back against stops. Continue to raise bucket with boom lever until it breaks out of pile. Back out of pile keeping load low, and deliver load to desired dumping position.

When grading or excavating, bucket should be in the level position. Feather boom control lever to the DOWN PRESSURE position to face bucket cutting edge against the ground as machine moves forward.

If cutting edge does not penetrate the ground immediately, use bucket control lever to incline the angle of the cutting edge slightly to give better penetration. When cutting edge penetrates, use bucket control lever to adjust bucket to level position to avoid excessive penetration. The operator may manipulate boom and bucket control levers slightly to maintain a good grade as machine moves forward.

When maintaining a grade, machine should be driven in low speed range at sufficient throttle to make an accurate cut. When the end of the cut is reached, pull backward on bucket control lever to tip bucket back against the stops, then raise boom so that bucket is approximately 15 inches off the ground for carrying to dumping position.

TRANSPORTING THE LOAD

When transporting the load, travel speed of machine will depend upon the length of haul, and kind of surface over which the machine must pass. Rough terrain calls for a fairly slow speed. When the bucket is full, it should be carried approximately 15 inches off the ground. Never transport load with bucket fully raised. The nearer the ground the bucket is held, the better the stability, especially on slopes or when turning machine.

DUMPING THE BUCKET

Approach truck, railroad car or hopper raising the boom until bucket safely clears top edge of unit. At proper clearance height, place boom control lever in HOLD (neutral) position. Move machine up to place bucket inside the dumping area, positioning Tractor Shovel perpendicular to side of unit to avoid spillage, and to distribute material evenly. Apply service brakes, which will automatically disengage transmission FORWARD clutch. This not only prevents machine from creeping forward when engine is accelerated, but also provides maximum hydraulic working power for bucket cylinders.

Push bucket control lever forward slowly to dump bucket. Control rate of material discharge with accelerator, and by manipulating control lever between DUMP and HOLD positions. Bucket can be maintained in full dump or partial dump position by returning control lever to HOLD position. Dumping load slowly will minimize shock loading of a truck body or other transporting vehicle.

When bucket is empty, pull backward on bucket control lever into detent located CLOSE position, and back away from loaded unit. Place boom control lever in DOWN PRESSURE or FLOAT position while returning for another load. Bucket will stop in a level position automatically. The bucket control lever automatically returns to the HOLD (neutral) position.

BACKFILLING AND SPREADING

The bucket is used for backfilling and spreading operations. Lower the bucket in an attitude parallel to the surface of the ground and proceed forward in one of the lower speed ranges allowing the bucket to fill. The material will form its own dozer blade. Best results are obtained when a shallow bite is used. Caution must be used in controlling the depth of the bite as too deep a bite will cause wheel spin and an uneven working surface.

TRAVELING WITHOUT A LOAD IN BUCKET

When driving machine from job to job, shift into high speed range. The bucket should be raised approximately 15 inches off the ground and tipped back to afford maximum visibility.

TOWING THE MACHINE

If at anytime it is necessary to tow the machine any appreciable distance, observe the following precautions:

1. Set all control levers in NEUTRAL.
2. Remove the propeller shaft from the transmission to the rear axle assembly, and one of the propeller shafts from between the transmission and the front axle assembly.
3. Attach safety links.

   Important: *Note correct assembly of propeller shafts before removing them. Reassemble them in the same position. The tubular end is always the driving end. Do not separate the two ends of the assembly due to wear pattern and balancing characteristics. Wire the spider and bearing assemblies to the prop shaft flanges and wrap the assemblies in lint free cloths.*

When the machine is being towed, the converter charging pump is not operating. There is danger of bearing or gear damage in the torque converter and transmission if propeller shafts are not removed.

When reinstalling propshaft assemblies use only the special heat treated nuts and bolts provided. Tighten attaching bolts to the torque specified on Bolt Torque Chart.

4. When towing an articulated machine it may be best to raise one end of machine with safety links attached since machine cannot be steered without engine operating.

LUBRICATION AND MAINTENANCE

This section of the manual is divided into two major categories — LUBRICATION and MAINTENANCE. The LUBRICATION portion is to be used in conjunction with Chassis and Drive Line Lube Charts found in the rear of this section. This section contains the recommended intervals at which the machine should be serviced such as Daily or Shift, Weekly or 50 Operating Hours, up through a 1000 Operating Hour schedule.

Lubrication is maintenance, but the items described in the Lubrication portion are only those that pertain to the actual greasing or oiling of the machine, including the level checks and the drain and refill procedures.

The MAINTENANCE portion contains recommended checks and adjustments over and above those found in the LUBRICATION portion.

The maintenance schedule is based on hours of normal operation recorded on the hourmeter. A more practical schedule should be developed for each job application. Make changes in the basic schedule as required based on the type of work machine is doing, the rate at which it is worked, and how it is being worked.

LUBRICATION

The importance of proper lubrication cannot be overemphasized. It is the most essential single factor in a well planned preventive maintenance program. Refer to lubrication charts to locate the various points to be serviced.

Before servicing machine always wipe dirt and foreign material from grease fittings, clips, plugs or covers to prevent dirt, grit or foreign material from entering into mechanisms. When checking various lubricant levels, machine must be level and areas around all fill and level plug openings cleaned. Systems requiring draining at specific intervals when fluid is at operating temperature. Hot oil flows more freely and carries more foreign material with it.

Cleanliness of the oil used and of the system cannot be overemphasized. Oil added to the reservoir should be poured through a 100 mesh screen. Filters and breathers should be serviced regularly. should always be drained after working machine

Additions required to maintain fluid level in the system should be made with the same fluid as is in the system, however, on occasions may be made with another approved lubricant for a given temperature range. Preferably the lubricants being mixed should be from the same manufacturer. The original fluid should not be diluted more than 50% by adding another fluid. When these conditions cannot be met, the system should be completely drained and refilled.

Lubricant changes for the different prevailing ambient temperature ranges specified should be made by complete drainage and refill. Occasional startups in temperatures above or below the prevailing ambient temperature ranges specified, for a given lubricant, will not require a complete change of lubricant. When the temperature, however, at startup is consistently above or below the range specified for the lubricant in the system, a complete change of lubricant is required, using the lubricant specified for the prevailing temperature range.

The lubrication charts herein specify the recommended lubricants for the various points to be serviced. NOTE: Lubricant specified on lube charts for use in the Transmission/Converter and Main/Steering Hydraulic Systems are for use in prevailing ambient temperature ranges above 0°F. (–18°C.). For additional approved lubricants for use in various ambient temperature ranges refer to charts below.

A — TRANSMISSION & CONVERTER HYDRAULIC SYSTEM:

PREVAILING AMBIENT TEMPERATURE	LUBRICANT TO BE USED
30°F. (–1°C.) & Above	SAE 30 Engine Oil, API Class SD or SE, MIL-L-2104B or MIL-L-2104C.
–10°F. (–23°C.) & Above	1. SAE 10W Engine Oil, API Class SD or SE, MIL-L-2104B or MIL-L-2104C. 2. Type C-2 Hydraulic Transmission Fluid.

–30°F. (–34°C.) & Above	DEXRON* Automatic Transmission Fluid – (This does not include fluids referred to as Dexron II).
* * * *	
0°F. (–18°C.) & Below	See Section titled Optional Lubricants.

B – MAIN/STEERING HYDRAULIC SYSTEM:

PREVAILING AMBIENT TEMPERATURE	LUBRICANT TO BE USED
Above 0°F. (–18°C.)	1. SAE 10W Engine Oil, API Class SD or SE, MIL-L-2104B or MIL-L-2104C.
–30°F. (–34°C.) & Above	2. See Section titled Optional Lubricants. DEXRON* Automatic Transmission Fluid – (This does not include fluids referred to as Dexron II) – See Sub-Note I.
* * * *	
0°F. (–18°C.) & Below	See Section titled Optional Lubricants

NOTE 1: DEXRON* Fluid is suitable for use only if it meets the following specifications:

A) Contain the type and content of anti-wear compounding found in API Class SD or SE engine oils, or have passed pump tests similar to those used in developing anti-wear type hydraulic oils.

B) Have sufficient chemical stability for mobile hydraulic system service.

C) Meet the viscosity requirements of API Class SD or SE engine oils – Grade SAE 10W.

*DEXRON is a registered trademark of General Motors Corporation.

OPTIONAL LUBRICANTS:

The following optional lubricants, in addition to the standard recommendations given above, are approved for use in the Transmission/Converter Hydraulic System and/or Main/Steering Hydraulic System.

PREVAILING AMBIENT TEMPERATURE	LUBRICANT TO BE USED
0°F. (–18°C.) & Below	The following should be used as a guide in consultation with a reputable oil supplier. *Any lubricant may be used which meets the following requirements*: 1. Oil to be used must contain anti-wear properties and rust and oxidation inhibitors plus anti-foam agents equivalent to that found in API Class SD or SE engine oils or have passed pump tests similar to those used in developing anti-wear type hydraulic oils. 2. Oil must have a Saybolt Universal Viscosity of 145 to 225 seconds at 100°F. (38°C.), and a vis-

cosity of not less than 42 seconds at operating temperature. The oil selected should have a high shear stability to insure that the viscosity remains within recommended limits. Viscosity Index should not be less than 90.

3. Have a pour point of 20°F. (11°C.) below start-up temperature.

4. Diesel fuel, kerosene, transformer oil, etc., *must not be used* to dilute normal fluids.

NOTE: Lubricants to the above specification may be used in prevailing ambient temperature range of Above 0°F. (–18°C.) in the Main/Steering Hydraulic System ONLY.

* * * *

There are literally hundreds of commercial brands of oil marketed today. Obviously, it is not physically possible or practical to test and evaluate each one of these brands of oil. Satisfactory OIL QUALITY is the responsibility of the oil supplier, therefore, the selection of a suitable lubricant should be made in consultation with a reputable oil supplier. Strict observance of oil change recommendations and proper filter maintenance will provide the best assurance of satisfactory performance.

SERVICE DAILY (Every 8 Operating Hours)

Grease Fittings: Lubricate all points indicated on Chassis Lubrication Chart for 8 hour intervals. Use grade of lubricant specified on lubrication charts according to ambient temperature.

Engine and Accessories: Refer to Operation and Maintenance Manual of engine manufacturer for lubrication instructions of engine and accessories.

Fuel Tank: Fill fuel tank with clean fuel handled in clean containers. Use a good brand of fuel procured from a reliable company.

Diesel Engine: For most operating conditions, a No. 2 Diesel Fuel Oil Cetane 40 minimum is recommended. For unusual operating conditions with regard to load, speed, idling time, or ambient air temperature, refer to fuel oil specifications recommended by engine manufacturer.

Radiator: Check daily and refill as required with clean, soft water. See "Every 1000 Operating Hours" for Drain and Refill.

Torque Converter and Transmission: Check fluid level daily observing the following conditions.

1. Machine must be LEVEL.
2. Fluid must be HOT (operating temperature of 180°F. to 200°F.) (82°C. to 94°C.).
3. Engine must be IDLING.
4. Area around transmission dipstick opening must be CLEAN.
5. Maintain fluid level to indicated FULL mark on dipstick.

Refill as necessary adding fluid through the transmission fill plug.

See "Every 250 Operating Hours" for Filter Change, and "Every 500 Operating Hours" for Drain and Refill.

Hydraulic Reservoir: Check oil level daily observing the following conditions:

1. Machine must be LEVEL.
2. Blade must be on GROUND.
3. Engine must be SHUT DOWN.
4. Area around reservoir cap must be CLEAN.

Loosen reservoir cap at right side of machine SLOWLY to relieve pressure in reservoir tank; then

remove cap. Remove reservoir dipstick located inside reservoir and wipe with clean lint-free cloth. Reinsert and remove to check oil level. Maintain oil level to FULL mark on dipstick.

Refill as necessary using only premium quality fluid. Refer to Chassis Lubrication Chart for recommended hydraulic fluid.

See "500 Hour Maintenance Operations" for Filter Change and "Every 1000 Operating Hours" for Drain and Refill.

SERVICE WEEKLY (Every 50 Operating Hours)

Grease Fittings: Lubricate all points indicated on Chassis Lubrication Chart for 50 hour intervals. Use grade of lubricant specified on lubrication charts according to ambient temperature.

Engine and Accessories: Refer to Operation and Maintenance Manual of engine manufacturer for lubrication instructions of engine and accessories.

Brake Master Cylinders: On machines equipped with disc brakes, check and maintain fluid level to within ¼ inch from top of master cylinder reservoir. See Specifications and Service Data for recommended brake fluid.

Initial Filter Change: Remove and replace all replaceable filter elements in the converter/transmission, main and steering hydraulic systems after the first 50 operating hours. Remove and clean hydraulic reservoir suction filter and converter cooler line strainer. Subsequent filter changes may then be made at regular prescribed intervals.

Batteries: Keep terminals clean and tight, and be sure that distilled water is added to cover plates and separators in each cell. Do not overfill.

Front Axle Differential: Check lubricant level each 50 operating hours at the differential level plug. Add lubricant until level with plug opening. See "Every 1000 Operating Hours" for Drain and Refill.

Front Axle Planetary Hubs: Check lubricant level each 50 operating hours. Rotate wheel until arrow on sun gear thrust cap points downward. This will position plug slightly below centerline of hub. Remove plug and check level.

Add lubricant until level with plug opening. See "Every 1000 Operating Hours" for Drain and Refill.

Rear Axle Differential: Check lubricant level each 50 operating hours at the differential level plug. Add lubricant until level with plug opening. See "Every 1000 Operating Hours" for Drain and Refill.

Rear Axle Planetary Hubs: Check lubricant level each 50 operating hours. Rotate wheel until arrow on sun gear thrust cap points downward. This will position plug slightly below centerline of hub. Remove plug and check level.

Add lubricant until level with plug opening. See "Every 1000 Operating Hours" for Drain and Refill.

Steering Gear: Check lubricant level each 50 operating hours. Keep reservoir filled. When adding lubricant, use of hand pump or gun is recommended to force lubricant into housing and up through bearing, since weight of lubricant alone in filler extension is insufficient to raise level above bearing.

Midmount Bearing: Check oil level of midmount bearing assembly connecting prop shafts between the transmission and front axle every 50 operating hours. Keep reservoir full to level plug opening on front face of reservoir. Add lubricant as required through combination breather and filler plug opening located on top of mid-mount reservoir. See "Every 1000 Operating Hours" for Drain and Refill.

SERVICE PERIODICALLY

Check and service the following items at intervals as specified.

(Every 100 Operating Hours)

Propeller Shafts: There are four propeller shafts – one from torque converter to transmission, one from transmission to midmount bearing, one from midmount bearing to front drive axle, and one from transmission to rear drive axle. Each shaft has 3 points of lubrication – one on each spider assembly, and one on each slip yoke assembly. Total 12 points. Use a hand gun and apply grease until it is visible at all four bearing caps on each spider and bearing assembly. The grade of lubricant specified is on Drive Line Lubrication Chart according to ambient temperature.

(Every 250 Operating Hours)

Engine and Accessories: Refer to Operation and Maintenance Manual of engine manufacturer for lubrication instructions of engine and accessories.

Torque Converter and Transmission Filter: The torque converter and transmission hydraulic system is protected by full flow replaceable element type filter assemblies.

All fluid leaving the converter pump first passes through the filters providing clean fluid to the torque converter and transmission.

Replace filter elements every 250 operating hours and whenever converter pump, transmission or torque converter is repaired or overhauled for any reason. Thoroughly clean filter cases and base castings before inserting new elements. Using new gasket in base castings, tighten center bolts to specified torque. See Bolt Torque Chart in rear of manual.

Converter Cooler Line Strainer: The converter cooler line strainer is located on the cooler line between converter and radiator oil cooler. Remove screen from strainer and wash in hot soapy water, rinse in clean hot water and reinstall in strainer. Repeat strainer cleaning procedure every 250 operating hours.

Run engine 5 minutes at approximately 1500 rpm checking filter assemblies, hoses and connections for leaks. Recheck transmission fluid level when it is at operating temperature (180°F. to 200°F.) as described under "Service Daily".

Note: *Filter elements are especially designed to withstand pressure and flow rate requirements. Use only replacement filter elements called for in applicable parts manual. Use of "will-fit" or substitute elements will endanger proper operation of torque converter and transmission and could cause costly repairs and down time.*

Hydraulic Reservoir Suction and Return Filters: Hydraulic reservoir suction and return filters are to be serviced at this time. See 250 Hour Maintenance Operations for the detailed instructions.

(Every 500 Operating Hours)

Grease Fittings: Lubricate all points indicated on Chassis and Drive Line Lubrication Charts for 500 hour intervals. Use grade of lubricant specified on lubrication charts according to ambient temperature.

Engine and Accessories: Refer to Operation and Maintenance Manual of engine manufacturer for lubrication instructions of engine and accessories.

Torque Converter and Transmission: Drain and refill torque converter and transmission every 500 operating hours and whenever converter pump, transmission or torque converter is repaired or overhauled for any reason.

1. Always drain system while fluid is at operating temperature (180°F. to 200°F.). Hot oil flows more freely and carries more foreign material with it.

2. Remove drain plug from transmission housing and drain thoroughly.

3. Clean magnetic drain plugs and reinstall.

4. Replace elements in transmission and torque converter filter assemblies. Thoroughly clean filter cases and base castings before inserting new elements. Using new gaskets in base castings, tighten center bolts to specified torque. See Bolt Torque Chart in rear of manual. Remove, clean and reinstall cooler line strainer screen.

5. Remove breather cap from top of torque converter housing. Clean parts in solvent, blow dry with compressed air and reassemble.

6. Refill torque converter and transmission with fluid through transmission filler extension. Refer to Drive Line Lubrication Chart for recommended fluid. Refer to Specifications and Service Data for capacity.

7. Disconnect return oil cooler hose from cooler line and direct open end into waste drum or on ground. Securely block wheels of machine and apply parking brake.

8. Start engine, shift speed range selector lever in HI speed range and directional shift lever in FORWARD and maintain idle speed to force trapped oil in torque converter and oil cooler out through open end of return oil cooler hose. Drain sufficient fluid to insure clean fluid flow; then shut down engine and reconnect return oil cooler hose.

9. Restart and run engine for 5 minutes at approximately 1500 rpm checking filters, drain plugs, hoses and connections for leaks.

10. Recheck transmission fluid level when it is at operating temperature (180°F. to 200°F.). Add transmission fluid as necessary to maintain FULL mark on dipstick. (This check is to be performed with engine idling).

NEVER UNDER ANY CIRCUMSTANCES USE ANY FLUSHING OIL OR COMPOUNDS FOR CLEANING SYSTEM.

(Every 1000 Operating Hours)

Radiator: Twice a year, drain flush and refill cooling system. Add permanent anti-freeze according to manufacturer's instructions when air temperature is 32°F. or lower, or when there is danger of water freezing in the system. Always use a hydrometer to check freezing point of solution when it is at operating temperature.

Check for evidence of foreign material blocking radiator core and blow out with compressed air.

Refer to Specifications and Service Data for capacity.

Hydraulic Reservoir: Drain, clean and refill hydraulic oil system every 1000 hours of operation or oftener if required. When operating under severe dusty and dirty conditions, clean the system more often to prevent excessive wear or premature failure of valve, pump, or cylinder parts.

1. Always drain system after working machine, and while oil is at operating temperature. Hot oil flows more freely and carries more foreign material with it.

2. To thoroughly drain cylinders and hoses, raise boom and bucket to full height and extend bucket cylinders. *Securely block or chain boom and bucket in raised position.* Then shut down engine.

3. Loosen reservoir cap *slowly* to relieve pressure in hydraulic reservoir.

4. Remove drain plug in hand hole cover in bottom of reservoir and drain reservoir.

5. Disconnect boom and bucket cylinder hoses at lowest points to drain cylinders.

6. Remove and clean reservoir suction filter assembly as specified under "250 Maintenance Operations". Replace reservoir return filter assembly.

7. Remove hand hole cover from bottom of reservoir and clean all foreign material from bottom of tank. Remove magnet and clean thoroughly. Reinstall magnet; then reinstall hand hole cover and drain plug securely.

8. Reconnect all hoses and unions.

9. Refill reservoir to indicated FULL mark on dipstick. Reinsert dipstick and secure reservoir cap. Refer to Chassis Lubrication Chart for recommended fluids.

   Refer to Specifications and Service Data for capacity.

10. Be sure all control levers are in NEUTRAL position. Start engine and run it at idle speed for a few minutes.

11. Place boom lever in RAISE position to pump oil into boom cylinders. Then remove blocks or chains securing boom and bucket. *Do not stand or work under boom and bucket after removing blocks or chains.*

12. Operate unit by raising, lowering, dumping, and closing bucket until oil ceases to foam. This will "bleed" the system, forcing trapped air to escape through reservoir drain hose.

13. After oil has ceased to aerate, add oil to reservoir to bring level to indicated FULL mark on dipstick. This will replace oil drawn into cylinders and hoses.

14. Check all connections for leaks and make certain reservoir cap is properly secured.

NEVER UNDER ANY CIRCUMSTANCES USE ANY FLUSHING OIL OR COMPOUNDS FOR CLEANING THE SYSTEM.

Transmission Sump and Screen: When servicing transmission at every 1000 operating hours remove transmission sump and screen. Wash in solvent, dry and reinstall using new gaskets.

Front Axle Differential: Drain differential every 1000 operating hours. Refill with lubricant recommended on Drive Line Lubrication Chart until level with plug opening at center of axle assembly.

Refer to Specifications and Service Data for capacity.

Front Axle Planetary Hubs: Drain planetary hubs every 1000 operating hours; then rotate wheel until arrow on sun gear thrust cap points downward.

. Add lubricant recommended on Drive Line Lubrication Chart until level with plug opening slightly below centerline of hub.

Refer to Specifications and Service Data for capacity.

Rear Axle Differential: Drain differential every 1000 operating hours. Refill with lubricant recommended on lubrication chart until level with plug opening at center of axle assembly.

Refer to Specifications and Service Data for capacity.

Rear Axle Planetary Hubs: Drain planetary hubs every 1000 operating hours; then rotate wheel until arrow on sun gear thrust cap points downward.

Add lubricant recommended on Drive Line Lubrication Chart until level with plug opening slightly below centerline of hub.

Refer to Specifications and Service Data for capacity.

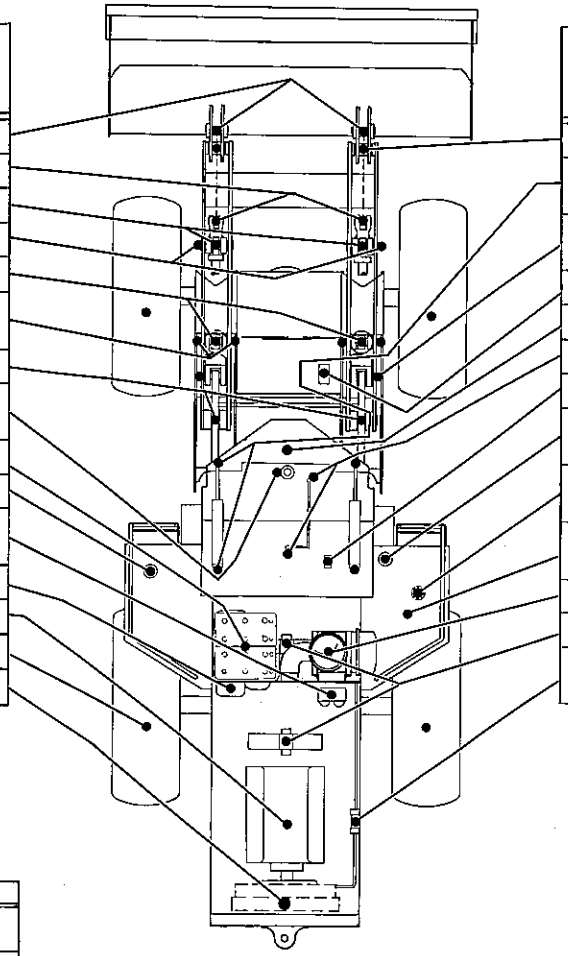
Midmount Bearing: Drain and refill every 1000 operating hours. Remove drain plug located in bottom of midmount bearing and allow all fluid to drain out. Reinstall drain plug. Remove check plug from side and breather fill cap from top of midmount bearing. Add fluid through breather-fill cap hole until level reaches check plug hole. Reinstall check plug. Wash breather-fill cap in solvent, dry and reinstall. See Drive Line Lubrication Chart for recommended fluid.

Refer to Specifications and Service Data for capacity.

MICHIGAN

CHASSIS LUBRICATION CHART

DESCRIPTION	HOURS 500	250	100	50	8	KEY
2 Fittings PUSHROD TO BUCKET			X			LBG
2 Fittings PUSHROD TO BELL CRANK					X	LBG
2 Fittings BUCKET CYL TO BELL CRANK					X	LBG
2 Fittings BELL CRANK PIVOT					X	LBG
2 Fittings BOOM CYL TO BOOM					X	LBG
2 Fittings Each Side BOOM CYLINDER TO TRUNNION MOUNT					X	LBG
2 Fittings BOOM TO UPPER PIVOT					X	LBG
1 Fitting Each Pin TRACTOR PIVOT UPPER & LOWER HINGE PIN					X	LBG
(See Text) BATTERIES				X		
(See Text) FUEL TANK					X	
(See Text) TRANSMISSION & TORQUE CONVERTER SYSTEM FILTERS		X				
(See Text) AIR RESERVOIR				X		
(See Text) ENGINE & ACCESSORIES					X	
(See Text) TIRES-FRONT & REAR					X	
(See Text) RADIATOR					X	



KEY	HOURS 8	50	100	250	500	DESCRIPTION
LBG			X			BOOM TO BUCKET 1 Fitting Each Side
LBG	X					STEERING CYLINDERS 2 Fittings Each Cylinder
LBG	X					BUCKET CYLINDER TO FRAME 1 Fitting Each Cylinder
BF		X				BRAKE MASTER CYLINDER (See Text)
LBG		X				STEERING GEAR (See Text)
LBG	X					STEERING DRAGLINK 2 Fittings
BF		X				BRAKE MASTER CYLINDER (See Text)
					X	HYDRAULIC SYSTEM RETURN FILTER (See Text)
					X	HYDRAULIC SYSTEM SUCTION FILTER (See Text)
HF	X					HYDRAULIC SYSTEM OIL RESERVOIR (See Text)
	X					AIR CLEANER (See Text)
	X					AXLE CRADLE BUSHINGS 2 Fittings
LBG	X					TRANSMISSION & TORQUE CONVERTER COOLER LINE STRAINER (See Text)

KEY		
LBG	LITHIUM BASE MULTI-PURPOSE GREASE 0°F. & Above Grade 2 Below 0°F. Grade 0	
HF	AMBIENT TEMP. RANGE	LUBRICANT TO BE USED
	ABOVE 0°F	SAE 10W Engine Oil, API Class SD or SE MIL-L-2104B or MIL-L-2104C (For Optional Lubricants See Operators Manual Text)
	0°F & BELOW	See Operators Manual Text
BF	SAE J1703 (70R-3) BRAKE FLUID	

MODEL 175
Articulated
Tractor Shovel

TS-13985

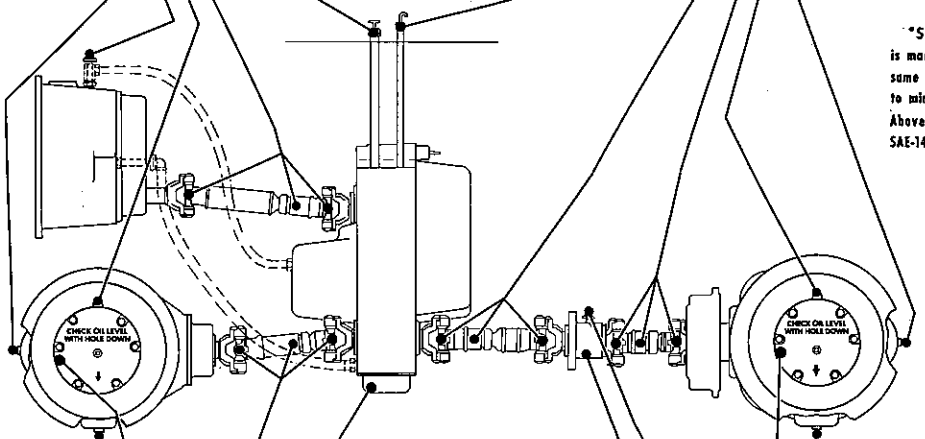
MICHIGAN
DRIVE LINE LUBRICATION

DESCRIPTION	HOURS 1000	500	100	50	∞	KEY
TRANSMISSION & TORQUE CONVERTER FILL PLUG (See Text)		X			X	HF
PROP SHAFT 3 Fittings (See Text)			X			LBG
PLANETARY DRAIN PLUG (See Text)	X					
TRANSMISSION & TORQUE CONVERTER BREATHER (See Text)				X		
DIFFERENTIAL FILL & LEVEL PLUG (See Text)	X			X		EPGL-1

KEY		
LBG	LITHIUM BASE MULTI-PURPOSE GREASE 0°F. & Above Grade 2; Below 0°F. Grade 0	
EPGL-1	EXTREME PRESSURE GEAR LUBE —*SCL TYPE	
HF	AMBIENT TEMP. RANGE	LUBRICANT TO BE USED
	ABOVE 0°F	SAE 10W Engine Oil, API Class SD or SE MIL-L-2104B or MIL-L-2104C (For Optional Lubricants See Operators Manual Text)
	0°F & BELOW	See Operators Manual Text

KEY	HOURS ∞	50	100	500	1000	DESCRIPTION
	X			X		TRANSMISSION DIPSTICK (See Text)
LBG			X			PROP SHAFT 3 Fittings (See Text)
LBG			X			PROP SHAFT 3 Fittings (See Text)
					X	PLANETARY DRAIN PLUG (See Text)
EPGL-1		X			X	DIFFERENTIAL FILL & LEVEL PLUG (See Text)

*SCL signifies sulfo-chloro-lead type. Factory fill is made with SCL type lube and it is recommended that same type be used when adding or refilling. Below 0°F. to minus 10°F. use SAE-80. Up to 100°F. use SAE-90. Above 100°F. consistently, use SAE-140. SAE-80 and SAE-140 should contain additives similar to SAE-90.



MODEL 175
Articulated
Tractor Shovel

TS-13986

DESCRIPTION	HOURS 1000	500	100	50	∞	KEY
DIFFERENTIAL DRAIN PLUG (See Text)	X					
PLANETARY FILL & LEVEL PLUG (See Text)	X			X		EPGL-1
PROP SHAFT 3 Fittings (See Text)			X			LBG
TRANSMISSION & TORQUE CONVERTER DRAIN PLUG (See Text)		X				

KEY	HOURS ∞	50	100	500	1000	DESCRIPTION
					X	DIFFERENTIAL DRAIN PLUG (See Text)
EPGL-1		X			X	PLANETARY FILL & LEVEL PLUG (See Text)
HF		X			X	MIDMOUNT BEARING FILL PLUG (See Text)
					X	MIDMOUNT BEARING DRAIN PLUG (See Text)

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MAINTENANCE SCHEDULE

SYSTEM	OPERATION	DAILY or SHIFT	TIME INTERVAL (HOURS)				
			50	100	250	500	1000
Engine, Controls, Cooling System and Accessories	Engine Maintenance		See Engine Manufacturer's Manual				
	Check Air Cleaner Service Indicator	●	●	●	●	●	●
	Check Cooling System for Leaks		●	●	●	●	●
	Drain Fuel Tank Sediment		●	●	●	●	●
	Check Anti-Freeze Protection		●	●	●	●	●
	Tighten Air Cleaner Connections		●	●	●	●	●
	Check and Adjust Belt Tension		●	●	●	●	●
	Check Engine RPM				●	●	●
	Clean Radiator Core					●	●
	Service Air Cleaner Element and Body					●	●
Torque Converter and Transmission System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Torque Converter and Transmission Breather			●	●	●	●
	Check and Adjust Transmission Shift Lever Linkage					●	●
	Check Transmission De-Clutch Valve					●	●
	Check Converter Internal Pressure					●	●
	Check Transmission Clutch, Lubricating and Oil Cooler Pressures					●	●
Boom and Bucket System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Cylinder Rods		●	●	●	●	●
	Adjust Bucket Leveler				●	●	●
	Check Boom and Bucket Pressure					●	●
	Check and Adjust Main Hydraulic Pump					●	●
	Adjust Boom and Bucket Control Levers					●	●
	Service Reservoir Return Filter Assembly				●	●	●
	Clean Reservoir Suction Filter Assembly				●	●	●
	Check and Repair Bucket Cutting Edge						●
	Check Boom to Bucket Linkage						●
Electrical System	Check Lights and Fuses		●	●	●	●	●
	Service Batteries		●	●	●	●	●
	Clean and Tighten Electrical Connections					●	●
	Inspect, Test and Lubricate Electrical Units						●
Axles, Prop Shafts, Wheels and Tires	Check Tire Pressure and Casings	●	●	●	●	●	●
	Tighten Wheel Nuts and Inspect Rims		●	●	●	●	●
	Clean Axle Breathers					●	●
Steering System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Cylinder Rods		●	●	●	●	●
	Check Steering Pressure					●	●
	Check and Adjust Steering Pump					●	●
	Bleed Steering Relief Valve					●	●
	Adjust Drag Link Ball Joints					●	●
	Adjust Steering Gear						●
Brake System	Inspect Brakes	●	●	●	●	●	●
	Check Air Chamber and Lines for Leaks		●	●	●	●	●
	Tighten Brake Disc Mounting Bolts				●	●	●
	Bleed Brake System (Disc Type)				●	●	●
	Adjust Parking Brake				●	●	●
Maintenance	Visually Inspect Machine	●	●	●	●	●	●
	Tighten Mounting Bolts					●	●
	Steam Clean Machine					●	●
	Inspect Frame						●

MAINTENANCE

The Maintenance Schedule lists checks or adjustments within machine systems or related components.

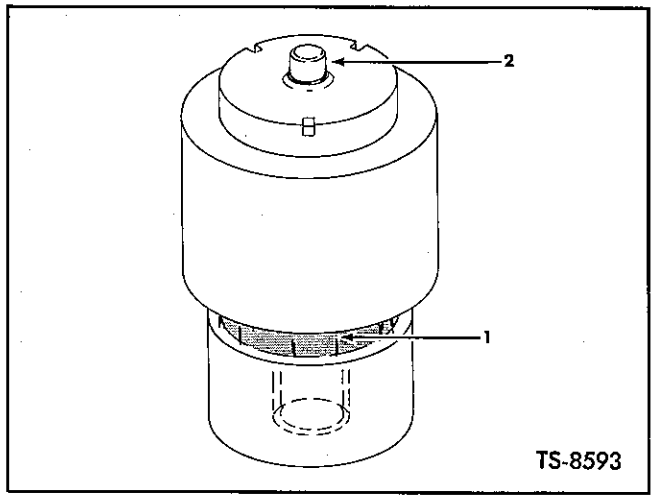
Procedure from each system listed at a specified interval are described in sequence. They should be performed at the same time as the lubrication intervals.

DAILY OR SHIFT MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CHECK AIR CLEANER SERVICE INDICATOR**
- **CHECK TIRE PRESSURE AND CASINGS**
- **INSPECT BRAKES**
- **VISUALLY INSPECT MACHINE**

Engine Maintenance: Refer to Operation and Maintenance Manual of engine manufacturer for maintenance instructions of engine and acessories.

Check Air Cleaner Service Indicator: Mounted on the air cleaner oulet to the engine, the service indicator is factory set to signal when servicing of the filter element is required. Refer to Figure 11.



1. Red Flag 2. Reset Button

Fig. 11. Air Cleaner Service Indicator

Dirt trapped by the filter element gradually increases the pressure drop across the cleaner. As the resistance increases, the Red Flag of the indicator gradually rises in the window. When the flag reaches the top position it will lock in place regardless of whether or not the engine is running. Service filter element at this time. Press reset button (Item 2, Figure 11) to reset service indicator.

Check Tire Pressure and Casings: Check air pressure in all tires. See Specifications and Service Data for recommended air pressure. Particular attention must be emphasized when checking hydro-inflated tires as there is less volume of air to provide cushioning. Be sure valve caps are in place to prevent dirt, moisture, and foreign material from damaging valve core.

Inspect Brakes: On machines equipped with disc brakes, visually inspect to insure that all bolts are tight and that boot deterioration or excessive lining wear has not occured. Linings worn to ⅛" thickness should be replaced. Discs worn to less than .450 inch should be replaced. Inspect brake hydraulic system to be certain that no leakage is evident.

Visually Inspect Machine: Visually inspect general condition of the machine, operating controls, instruments and switches, control rods, cable controls and linkage, fuel pump, filters and the radiator for any noticeable damage.

Special attention must be emphasized when inspecting components of the oil system, fuel system, and cooling system. If unusual, or unexplained traces of oil, fuel, or water are found on or below components of the respective systems locate and correct such leaks immediately.

Unexplained oil streaks on or below the engine, transmission, torque converter, or axle assemblies must be carefully investigated. Such indications may be evidence of cracks, loose mounting bolts, damaged seals or gaskets, which (if neglected) may result in complete failure and major damage to the engine and drive line.

50 HOUR MAINTENANCE OPERATIONS

- ENGINE MAINTENANCE
- CHECK COOLING SYSTEM FOR LEAKS
- DRAIN FUEL TANK SEDIMENT
- CHECK ANTI-FREEZE PROTECTION
- TIGHTEN AIR CLEANER CONNECTIONS
- CHECK AND ADJUST BELT TENSION
- CHECK HYDRAULIC SYSTEMS FOR LEAKS
- CLEAN TORQUE CONVERTER AND TRANSMISSION BREATHER
- CHECK LIGHTS AND FUSES
- SERVICE BATTERIES
- TIGHTEN WHEEL NUTS AND INSPECT RIMS
- CHECK AIR CHAMBERS AND LINES FOR LEAKS
- CLEAN CYLINDER RODS

Engine Maintenance: Refer to Operation and Maintenance Manual of engine manufacturer for maintenance instructions of engine and accessories.

Check Cooling System for Leaks: Check radiator, hoses, oil cooler, water pump and drain cocks for leaks and correct where necessary. Loss of coolant due to ruptured hoses, loose clamps, leaking pump or drain cocks can and will result in expensive repairs or replacement of engine components.

Drain Fuel Tank Sediment: Every 50 operating hours loosen drain plug in hand hole cover on bottom of fuel tank and drain off any accumulated water.

Check all fuel lines, fuel pump, filters, and shut-off cocks for leaks and correct where necessary. Open drain cock at bottom of filters, when provided, and drain off accumulated water and sediment.

Check Anti-Freeze Protection: At specified intervals, or whenever anticipating extremely cold weather, use a hydrometer to check freezing point of solution (permanent type anti-freeze) when it is at operating temperature. If necessary add additional anti-freeze according to manufacturer's instructions to maintain a safe level beyond the freezing point.

Tighten Air Cleaner Connections: Tighten all hose clamps and air cleaner mounting bracket bolts. Check all hoses and pipes between air cleaner and engine for cracks or leaks, which will permit dust laden air to by-pass air cleaner entering directly into engine. Serious and costly damage to the engine will result. See "500 Hour Maintenance Operations" for servicing air cleaner filter element.

Check and Adjust Belt Tension: Each 50 operating hours inspect all drive belts for serviceable condition and proper tension. Neglect and improper tension often leads to inadequate cooling, bearing failure of the driven part and short belt life. Belts should be just tight enough to drive the moving parts without slipping.

Note: *Due to older belts having been stretched, through use, beyond their original length and preventing newer belts from carrying most of the load, it will be necessary to replace all belts as a matched set when one or two belts in the set are worn or damaged beyond serviceable condition.*

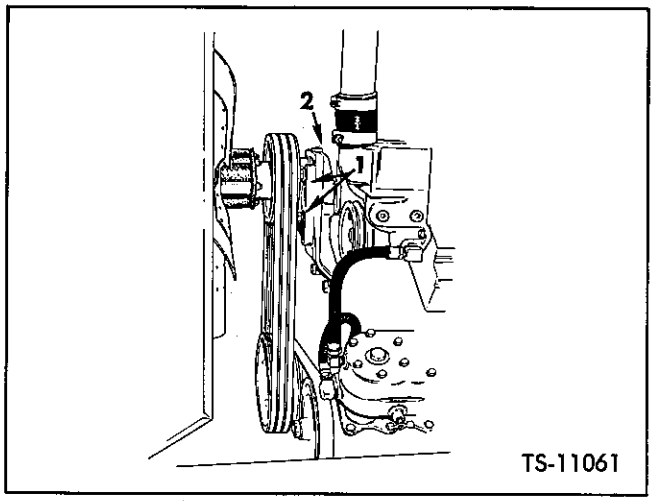
All new belts will loosen after operating for a day or two and must be rechecked and retensioned if necessary. At specified intervals check and retension fan belts as follows:

G.M. ADJUSTMENT

1. Loosen the four mounting bolts securing the fan drive pulley bracket as shown in Figure 12.
2. Turn fan bracket adjusting bolt clockwise to raise fan drive pulley (increasing belt tension) or counterclockwise to lower fan drive pulley (decreasing belt tension) depending on the existing condition.
3. Turn the adjusting bolt so that ¾ inch maximum deflection is obtained on the belts midway between the pulleys as shown in Figure 12.
4. When belts are properly adjusted, retighten the four mounting bolts securing the fan drive pulley.

CUMMINS ADJUSTMENT

1. Loosen locknut securing fan drive pulley to



1. Mounting Bolts 2. Adjusting Bolt

Fig. 12. Check Fan Belt Tension — G.M.

bracket as shown in Figure 13.

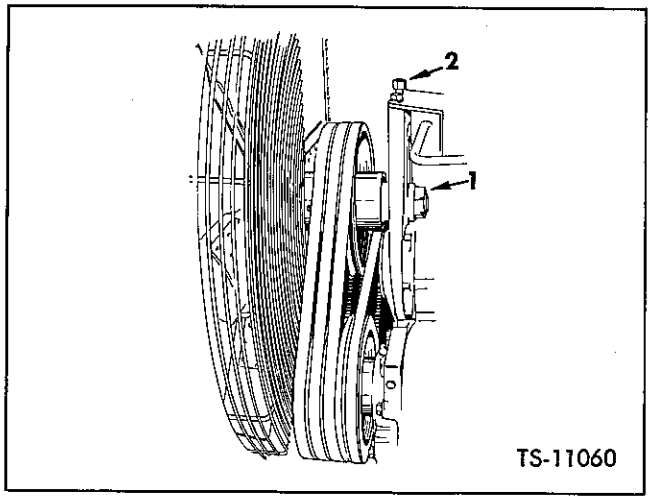
2. Turn fan drive pulley adjusting bolt clockwise to raise fan drive pulley (increasing belt tension) or counterclockwise to lower fan drive pulley (decreasing belt tension) depending on the existing condition.

3. Turn the adjusting bolt so that 7/16 inch maximum deflection is obtained on the belts midway between the pulleys.

4. When belts are properly adjusted, retighten locknut to 400-500 ft.-lbs. torque. Rotate torque one more hex.

5. Back-off adjusting screw one-half turn.

Periodically belts should be cleaned to remove grease and glaze by wiping with a cloth saturated with brake fluid. This in most instances will eliminate squeak and extend the service life of the belts.



1. Locknut 2. Adjusting Bolt

Fig. 13. Check Fan Belt Tension — Cummins

Check Hydraulic System for Leaks: Check oil reservoirs, valve, pumps, cylinders, all hydraulic hose lines and connections for leaks, correcting where necessary. Particular attention should be paid to hoses on the intake or suction side of the pumps. Hose clamps and connections employed must be securely tightened to prevent entrance of foreign material or air into the system. Air drawn into the system at this point will cause cavitation of the pump with resultant malfunctioning and early failure. All hoses should be checked for abrasions which could result in ruptures of same. Replace hoses found in this condition.

Clean Torque Converter and Transmission Breather: The torque converter and transmission system is equipped with a breather located on top of torque converter.

Each 50 operating hours unscrew breather, wash in solvent, blow dry with compressed air and reinstall.

Check Lights and Fuses: Two fuses provide protection for the electrical system, one in gauge circuit and one in light circuit. An additional self contained fuse which is part of the lighter base and cord assembly provdes protection for the lighter element. All fuses are located behind the instrument panel as shown on the Wiring Diagram.

The light circuit fuse and gauge circuit fuse are contained in plastic connectors. Push and twist to open and lock plastic connectors for fuse replacement. The self contained lighter fuse is a screw on type fuse secured between the lighter base and cord assembly.

To replace fuses remove instrument panel mounting bolts and swing panel outward.

The circuits and fuse protection are:

Gauge Circuit .....AGC ¾ Amp.

Light Circuit .....SFE 20 Amp.

Lighter Circuit .....10 Amp.

(a) **Headlamps and Back-Up Lamps:** The machine is equipped with headlamps and back-up lamps mounted in shock resistant rubber retainers.

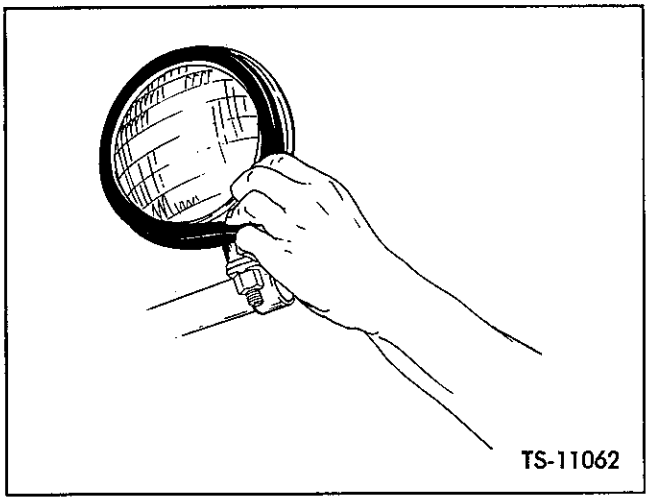


Fig. 14. Replace Headlamps or Back-Up Lamps

The headlamps and back-up lamps are floodlamps that disperse light in a horizontal pattern.

Headlamps are factory adjusted, but may be re-adjusted at the headlamp mounting bolts or nuts to obtain a desired light pattern.

If necessary to replace floodlamps, depress lamp and spread lip of rubber retainer outward forcing lamp out as shown in Figure 14, and disconnect terminals. Reconnect terminals on new lamp and reinstall in retainer.

(b) **Dash, Tail and Stop Lamps:** These lights are easily replaced by a push and a twist. To remove dash lamp reflector from dash lamp assembly pull out to remove and push on to retain. Reflectors for the tail and stop lights must be removed by removing three screws shown in Figure 15 and carefully forcing reflectors out. To reinstall reflectors carefully depress reflectors and fasten in place with retaining screws.

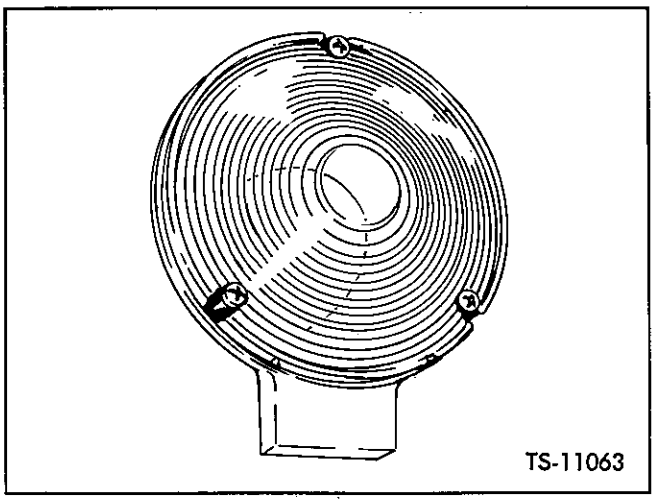


Fig. 15. Remove Reflectors and Replace Tail or Stop Lamps

Service Batteries: Keep terminals clean and tight, and be sure distilled water is added to cover plates and separators in each cell. Do not overfill.

To prevent serious damage to electrical system components when recharging or replacing batteries in the "Delcotron" charging system.

. . . REMEMBER . . .

1. When installing batteries, *make sure* batteries and "Delcotron" polarities are the same.
2. Booster batteries *must be* paralled.
3. Battery-charger and battery polarities *must agree.*
4. Before doing any welding, *disconnect ground cable from batteries and electrical lead from battery terminal on alternator.*

Tighten Wheel Nuts and Inspect Rims: Wheel nuts should be checked regularly and kept tight. Loose wheel nuts will cause undue tire wear, strain axle assemblies and affect steering and load distribution. Apply lubricant on threads of wheel studs only and tighten wheel nuts to torque specified on Bolt Torque Chart.

Check rims for bent or damaged flanges and repair or replace as needed.

Check Air Chambers and Lines for Leaks: Periodically check connecting lines and fittings to be sure they are air tight. Air chambers occasionally should be painted with soap solution to detect leakage. Tighten clamping ring bolts uniformly until leakage is eliminated, as no leakage is permissible.

Check and securely tighten air chamber to mounting bracket bolts and mounting bracket to axle bolts.

Clean Cylinder Rods: Wipe boom, bucket, and steering cylinder rods with clean cloth saturated in hydraulic oil. Check rods for nicks or burrs which would damage packings or seals. Remove such nicks or burrs with a fine grained hand stone or crocus cloth.

100 HOUR MAINTENANCE OPERATIONS

• ENGINE MAINTENANCE

Engine Maintenance: Refer to Operation and Maintenance Manual of engine manufacturer for maintenance instructions of engine and accessories.

OM 3005
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250 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CHECK ENGINE RPM**
- **ADJUST BUCKET LEVELER**
- **ADJUST BOOM KICKOUT**
- **BLEED BRAKE SYSTEM**
- **ADJUST PARKING BRAKE**
- **CHECK BRAKE DISC MOUNTING BOLTS**
- **SERVICE RESERVOIR RETURN FILTER ASSEMBLIES**
- **CLEAN HYDRAULIC RESERVOIR SUCTION FILTER ASSEMBLIES**

Engine Maintenance: Refer to Operation and Maintenance Manual of engine manufacturer for maintenance instructions of engine and accessories.

Check Engine RPM: Engine speeds should be checked regularly against specifications to determine engine efficiency and machine performance. Proper speeds insure safe operating limits for the engine and maintain correct operating speeds for torque converter and transmission.

(a) **Low Idle and High Idle RPM:** These speeds are the free operating limits of the engine under no load conditions. They are determined by the amount of the amount of fuel delivered to the engine. See Specifications and Service Data.

Caution: *Do not accelerate to maximum rpm until engine is at operating temperature.*

Check throttle linkage to insure wide open throttle when accelerator is fully depressed, also closed throttle when accelerator is fully released. Accelerator and linkage should operate freely in all positions.

Occasionally control rods, control levers or bell cranks loosen or become damaged, impairing the operating efficiency of the engine. Insufficient power is frequently caused by throttle linkage being out of adjustment. Adjust linkage if necessary.

Fuel controls are accurately calibrated at the factory to insure correct idle and high idle speeds.

Adjust Throttle Linkage: If throttle linkage requires adjustment, proceed as follows.

1. Unhook spring and disconnect ball joint assembly from throttle control lever.
2. Depress accelerator until it contacts stop on floorboard.
3. Rotate throttle control lever to the extreme full throttle position and adjust ball joint to obtain a slip fit on throttle control lever just before accelerator pedal bottoms.
4. Reinstall ball joint assembly and reconnect spring.
5. Depress and release accelerator, and check that accelerator control rods will properly rotate throttle control lever from idle to full throttle position with out interference.
6. Additional adjustments may be made at the other ball joint or at accelerator pedal.

Pressure required to depress accelerator is controlled by the spring on the throttle control lever. This spring also insures that the engine will return to idle speed when accelerator pedal is released.

(b) **Stall RPM:** The engine and torque converter act as a unit to deliver power to the transmission. A stall check should be performed to insure that the engine is developing rated power and that the torque converter is operating efficiently.

Caution: *Check stall rpm only when torque converter fluid is hot (180°F. to 200F.), engine is at operating temperature, and boom and bucket relief valve setting is at proper specification.*

1. Install tachometer on engine.
2. Apply parking brake, block wheels, attach safety links, and place directional lever in NEUTRAL.
3. Start engine and raise bucket a few inches above the ground.
4. Shift levers into FORWARD, HI speed range, and accelerate engine. When engine reaches maximum rpm, pull back on bucket control lever to rotate bucket to full close position. When engine rpm drops off to lowest point read tachometer.

DO NOT STALL CONVERTER MORE THAN 30 SECONDS AT ANY ONE TIME.

If stall rpm is not within specifications, trouble shooting of engine or torque converter by a qualified mechanic is required. See Specifications and Service Data.

Note: *Stall rpm specified in Specifications and Service Data at rear of this manual is applicable to altitude of 600 ft. and ambient temperature of 70°F. Do to many combinations of altitude and temperature possible in the field, space does not permit publishing here all the corrections necessary to the stall rpm indicated to accommodate such variations. It is suggested the engine manufacturer's distributor be contacted to determine the correction necessary for altitude and temperature in your application.*

Adjust Bucket Leveler: The bucket leveler mechanism consists of a leveler cam and an electric switch mounted on the right hand bucket cylinder, and a solenoid operated air valve. The electric switch is wired to the solenoid operated air valve, which in turn is connected to the air tank and main hydraulic valve by piping.

The roller arm on the electric switch rolls off the leveler cam as the bucket is rotated back from the DUMP position. This action closes the electric switch and completes the circuit, sending a flow of electricity to the solenoid operated air valve. This releases a flow of air from the tank to the main control valve causing the bucket lever to move from the detent located CLOSE position to the HOLD (neutral) position. The bucket will then stop in a level position.

Servicing and adjustment procedures are as follows: Refer to Figure 16 for correct position of leveler cam in relation to roller on electric switch when bucket is in a level position.

Caution: *Leveler cam must be parallel to bucket cylinder rod at all times.*

1. Start engine, position bucket level on ground, shut down engine and pull bucket lever into detent located CLOSE position.
2. Adjustment is provided at the leveler cam bracket. Elongated holes in the leveler cam bracket allow adjustment either in or out to maintain proper roller arm stroke, ⅛ inch to actuate. (Figure 16 Item 1).
3. The roller on the electric switch should be just off, but nearly touching the leveler cam when bucket is in a level position.

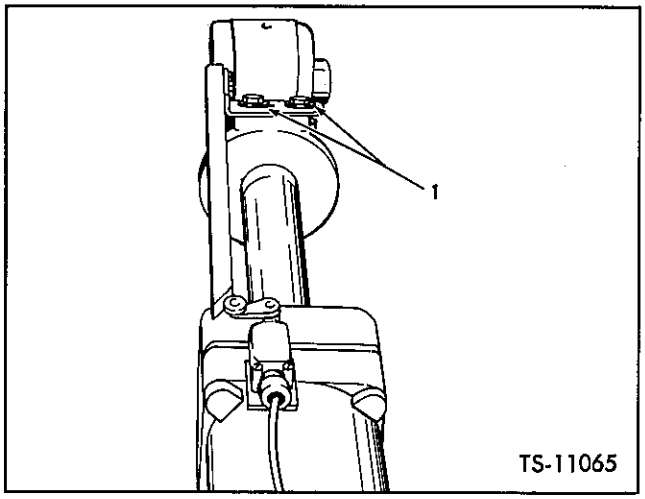


Fig. 16. Adjust Bucket Leveler

4. Additional adjustment is provided at the roller arm on the electric switch. Maximum stroke of roller arm is 7/16 inch.
5. Start engine. Raise bucket to a number of different heights and cycle bucket slowly at each of these various heights to check proper operation. Each time bucket is rotated back from the DUMP position, the bucket lever should return automatically to the HOLD (neutral) position.

Adjust Boom Kickout: The boom kickout mechanism consists of a boom cylinder mounted kickout cam, a frame mounted electric switch and solenoid mounted at the control valve boom spool.

To obtain maximum height kickout switch bracket should be installed in bottom slots of frame bracket. The roller on the electric switch should just contact cylinder mounted kickout cam. This will cause boom kickout to occur at approximately 1 foot (30,5 cm) from maximum height. Lower boom kickout positions may be obtained by raising switch bracket in mounting slots.

Bleed Brake System: Occasionally it may be necessary to bleed brake system to remove air trapped in the system due to a leak in the line or the installation of new parts in the system. Air trapped in the system will be indicated by a soft spongy brake pedal.

Note: *It is recommended to use a bleeder hose on bleeder valves whenever possible to keep fluid away from linings. Keep master cylinder(s) filled during bleeding process.*

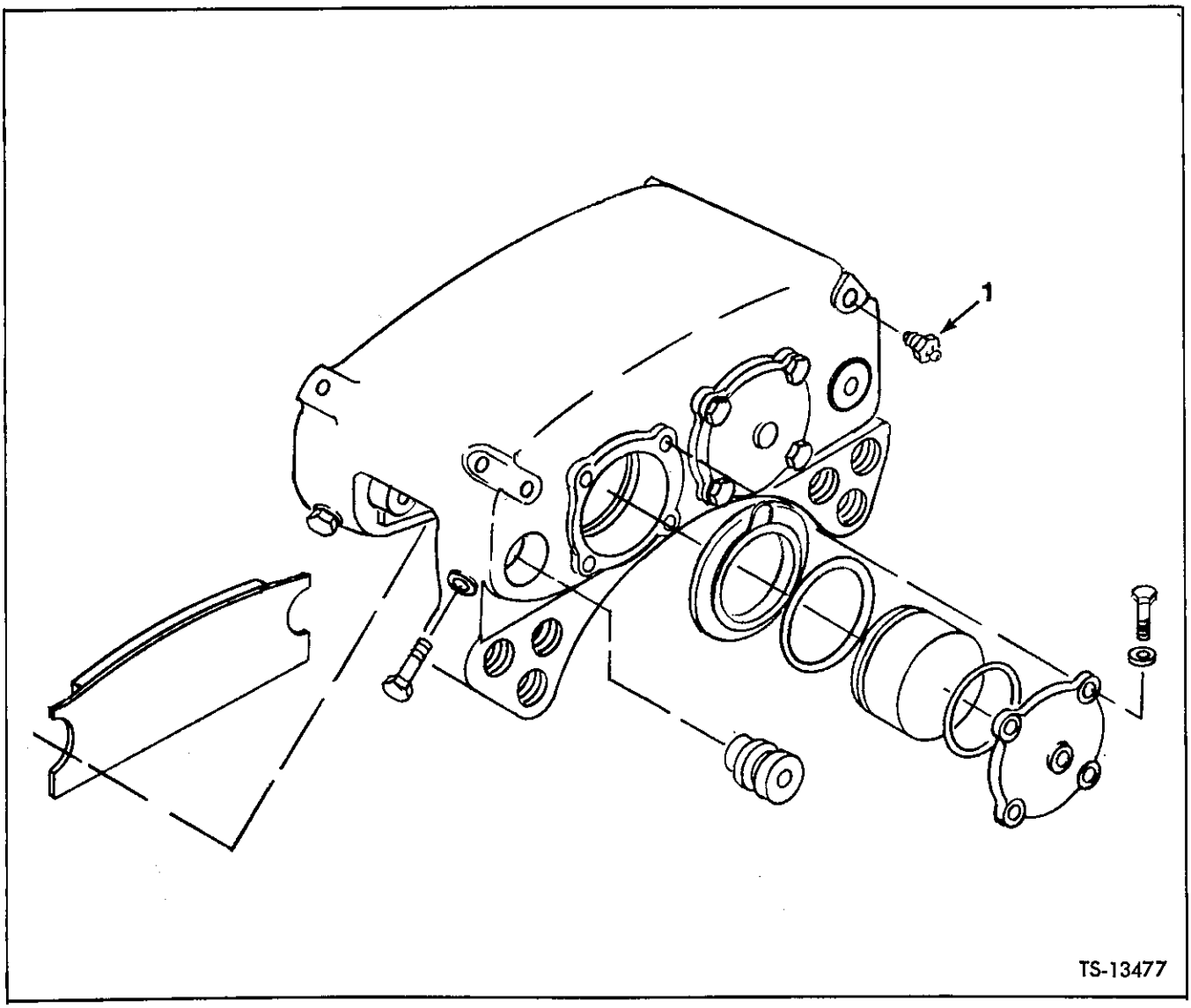


Fig. 17. Disc Brake Head (Exploded View)

1. Open bleeder valve, (See Item 1 Figure 17), and actuate brakes several times until fluid coming from bleeder valve is free of bubbles. Depress brake pedal and close bleeder valve, then release brake pedal.

2. Actuate brakes several times.

3. Repeat step 1, until no bubbles are observed in fluid from bleeder valves.

4. Repeat entire process at each brake head to finish bleeding system.

Note: *Master cylinder(s) must be kept full at all times.*

See Specifications and Service Data section in rear of this manual for recommended brake fluid.

Adjust Parking Brake: When slack develops in parking brake cable, perform the following adjustments.

1. With lever in released position, turn acorn on end of handle clockwise as shown in Figure 18.

2. Test for good resistance over center as handle is pulled up to applied position.

The parking brake consists of a mechanical disc brake mounted on the front axle. Maintenance consists of occasional adjustment of the parking brake whenever linings become partially worn down or new pad and lining assemblies are installed.

To adjust parking brake, use a feeler gauge and tighten adjusting lever nut, see Figure 19, until

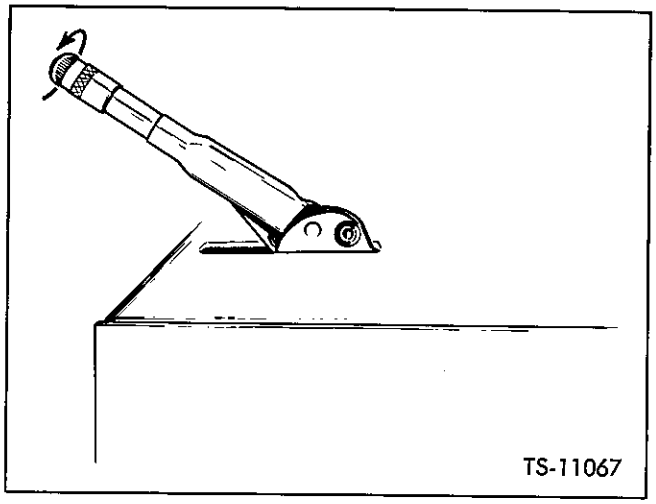


Fig. 18. Adjust Parking Brake at Handle

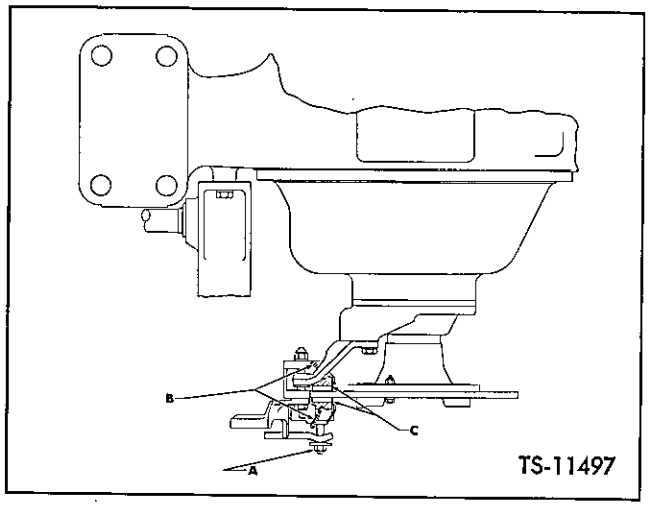


Fig. 19. Parking Brake

A. Adjusting Lever Nut B. Return Spring
C. Pad & Lining Assembly

.010 (0,3) clearance is obtained between disc and lining pad on one side only.

Brake Disc Mounting Bolts: Check brake disc mounting bolts after first 250 operating hours. If any bolts show evidence of loosening, all brake disc mounting bolts should be re-tightened as follows:

1. Tighten all brake disc mounting bolts to 159 to 175 ft. lbs.

2. Repeat entire procedure so that each individual bolt is checked twice. Subsequent checking should not be necessary until brake disc is replaced.

Replacement of Brake Disc: If at any time it is necessary to replace the brake disc, all mounting bolts should be tightened in the following manner:

1. Tighten all brake disc mounting bolts to 159-175 ft. lbs.

2. Repeat entire procedure so that each individual bolt is checked twice.

3. After first 250 operating hours on new disc, check brake disc mounting bolts. If any bolts show evidence of loosening, all brake disc mounting bolts should be retightened as described in Steps 1 and 2 above.

Service Reservoir Return Filter Assemblies: The hydraulic reservoir return filter assemblies installed inside the hydraulic reservoir consist of a head and handle assembly, o-ring, filter elements secured between a holder assembly with retaining plates (center and bottom), a spring and attaching hardware. The reservoir return filter assemblies are designed and installed in a manner that permits the filter assembly to act as a relief valve so that oil can be by-passed if the filter element becomes excessively plugged with foreign material.

During normal operation, hydraulic system oil flows through the return filter assemblies from inside to outside before entering the reservoir. However, when the filter elements become excessively plugged with foreign material or contaminants, a difference in pressure within the inner side of the filter elements and reservoir will be created. When the pressure differential reaches approximately 11 psi, the filter assembly is forced downward permitting the hydraulic oil to by-pass the plugged filter elements entering directly into the hydraulic reservoir.

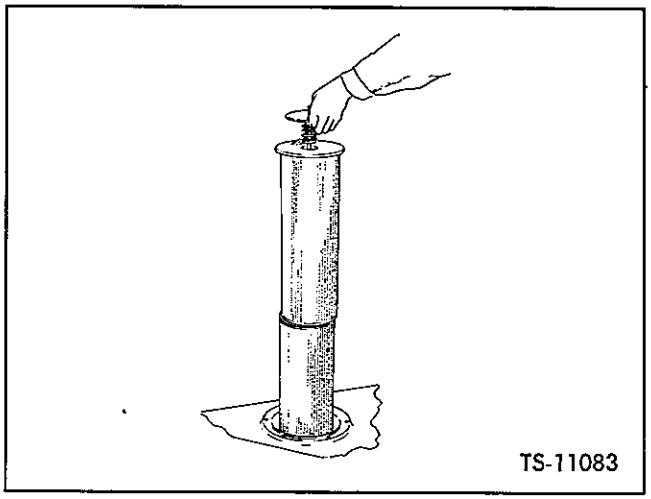


Fig. 20. Reservoir Return Filter Assembly

Remove the hydraulic reservoir return filter assemblies and replace filter elements as follows, See Figure 20:

Caution: *Extreme care must be exercised when removing filter while oil is hot to prevent hands from getting burned.*

1. Remove filter assembly from hydraulic reservoir by removing mounting bolts and lockwashers holding cover plate in place.

2. Remove attaching hardware securing the bottom retaining plate and filter elements in the holder assembly. Discard the retaining plate sealing washer.

3. Remove filter elements and center retaining plate from holder assembly. Discard the filter elements.

   Note: *Do not attempt to clean or re-use the dirty filter elements.*

4. Install new filter elements in holder assembly with the center retaining plate positioned between the top and bottom filter elements. Resecure the elements in the holder assembly with bottom retaining plate, using a new sealing washer, and attaching hardware.

5. Reinstall and secure the return filter assemblies in the hydraulic reservoir with coverplate, mounting bolts and lockwashers.

Clean Hydraulic Reservoir Suction Filter Assemblies: The hydraulic reservoir suction filter assemblies installed inside the hydraulic reservoir consist of a pleated metal filter element with sealing gaskets secured between a mounting base and cover type relief valve.

Recommended servicing procedures for cleaning the suction filter element are described below.

During normal operation, oil is drawn from the reservoir through the filter element under equal pressure by the main hydraulic pump before entering the hydraulic system. However, when the filter element becomes excessively plugged with foreign material or contaminants, a difference in pressure within the reservoir and the inner side of the filter element will be created. When the pressure difference reaches 2.4 psi, the cover type relief valve incorporated at the top of the filter assembly will open permitting the hydraulic oil to by-pass the plugged filter element entering directly into the hydraulic system.

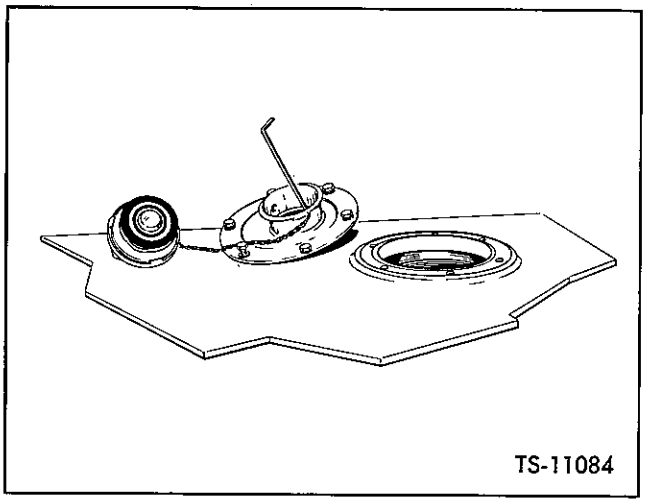


Fig. 21. Remove Reservoir Cap, Dipstick and Hand Hole Cover

1. Loosen reservoir cap **slowly** to relieve pressure in hydraulic reservoir. Remove reservoir cap, dipstick, and hand hole cover as shown in Figure 21.

2. Unscrew filter element from element mounting base and remove filter element as shown in Figure 22.

3. Immerse filter element in hot soapy water. Soak and intermittently agitate element and relief valve components for approximately 30 minutes to loosen dirt particles. Remove any remaining deposits between element pleats with a stiff bristled non-metallic brush as shown in Figure 23. Flush element and relief valve components with clean hot water until drain water is clear.

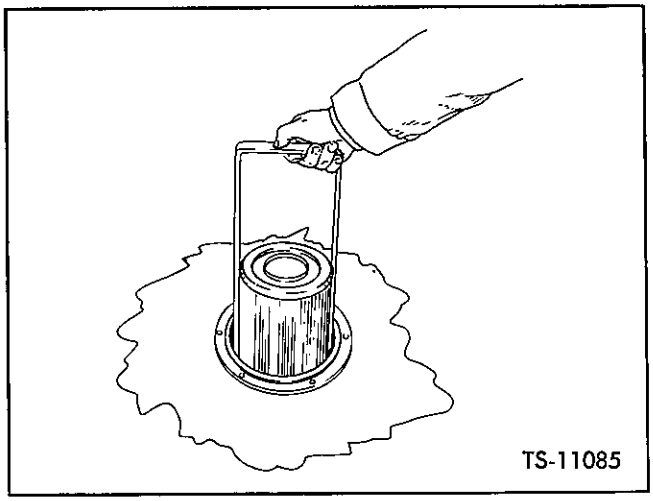


Fig. 22. Remove Filter Element

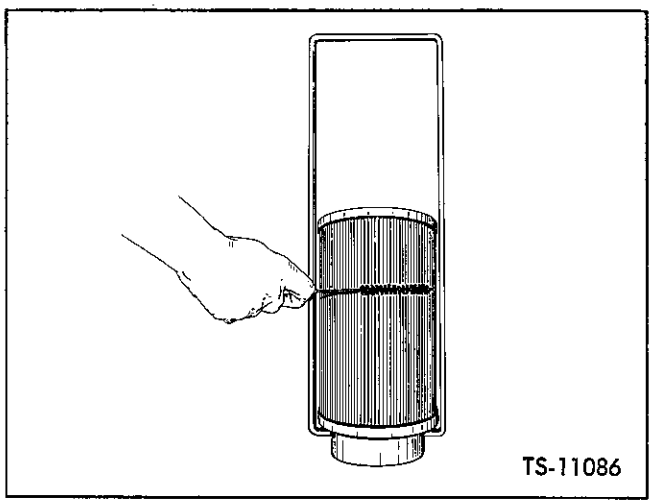


Fig. 23. Clean Filter Element with Stiff Bristled Brush

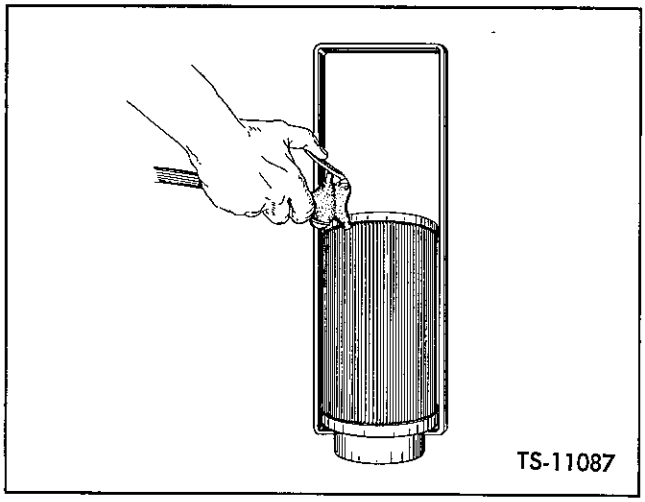


Fig. 24. Air Dry Filter Element and Inspect for Damage

4. Air dry element and relief valve components with filtered low pressure air as shown in Figure 24. Examine general condition of filter element checking for element cleanliness, or screen damage. If filter screen is damaged, replace with new element. Check relief valve components for any sign of damage replacing any component not in good serviceable condition.

500 HOUR MAINTENANCE OPERATIONS

- ENGINE MAINTENANCE
- CLEAN RADIATOR CORE
- CHECK AND ADJUST TRANSMISSION SHIFT LEVER LINKAGE
- CHECK TRANSMISSION DE-CLUTCH VALVE
- CHECK CONVERTER INTERNAL PRESSURE
- CHECK TRANSMISSION CLUTCH, LUBRICATING AND OIL COOLER PRESSURES
- CHECK AND ADJUST BOOM AND BUCKET PRESSURES
- CHECK AND ADJUST MAIN HYDRAULIC PUMP
- ADJUST BOOM AND BUCKET CONTROL LEVERS
- CLEAN AND TIGHTEN ELECTRICAL CONNECTIONS
- CLEAN AXLE BREATHERS
- CHECK STEERING PRESSURE
- CHECK AND ADJUST STEERING PUMP
- ADJUST DRAGLINK BALL JOINTS
- TIGHTEN MOUNTING BOLTS
- STEAM CLEAN MACHINE
- SERVICE RESERVOIR RETURN FILTER ASSEMBLY
- SERVICE AIR CLEANER ELEMENT AND BODY

Engine Maintenance: Refer to Operation and Maintenance Manual of engine manufacturer for maintenance instructions of engine and accessories.

Clean Radiator Core: External surfaces of radiator core must be kept clean, straight, and unobstructed to prevent blocking the air flow and causing overheating.

Flying objects such as sand, dust, leaves, twigs, bugs or other debris that plug the core or adhere to water or oil streaks impair the cooling efficiency.

Use compressed air, steam, or a high pressure water stream and remove such objects opposite the air flow through the core assembly. Oil streaks should be removed using a solvent non-harmful to hoses and wiring insulation. Straighten bent fins being careful not to puncture or enlarge the openings.

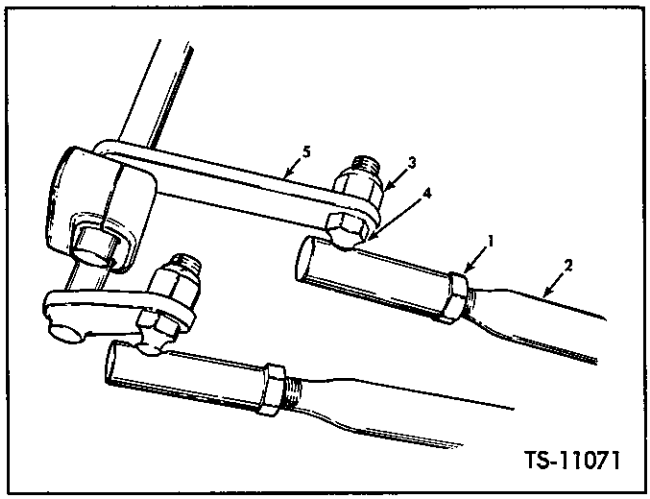


Fig. 25. Adjust Directional and Speed Range Levers

Check and Adjust Transmission Shift Lever Linkage: Inspect all mechanical control linkage to make sure all shift rods, bell cranks, ball joint assemblies and shift levers are in good serviceable condition and properly adjusted. Correct any questionable condition such as loose or bent linkage, worn pins or evidence of binding or rubbing of any of the shifting components.

The directional and speed range shift levers must be properly adjusted to insure full engagement into all detent positions without interference.

1. Check and tighten bolts securing the shift levers, shift quadrant, and steering column so that bolts are snug.
2. Place speed range lever in LO (first) and directional lever in NEUTRAL.
3. Loosen jam nut, (Item 1 Figure 25), on shift rod, (Item 2 Figure 25), and remove locknut, (Item 3 Figure 25) securing ball joint assembly (Item 4 Figure 25), to shift lever arm, (Item 5 Figure 25).
4. Adjust ball joint assembly as necessary to correct existing condition, then check lever alignment on shift quadrant in operator's compartment. If sufficient adjustment is not available, adjust ball joint assembly at opposite end of shift rod (bell crank end).

5. Reinstall ball joint assembly in lever arm and secure with locknut, then tighten jam nut on shift rod.

6. Check that levers will shift into all detent positions without interference from the steering column, bell cranks, bell crank mounting support or transmission control cover and valve housing.

Check Transmission De-Clutch Valve: The transmission de-clutch valve is an air operated valve consisting of a piston, piston stop plug, and the necessary o-rings to provide an air tight body. This valve is installed in a housing bore containing a shut-off valve spool located in the transmission control cover and connected to the brake valve by a hose line.

The function of the de-clutch valve is to automatically establish a transmission neutral using air pressure from the brake system when the left brake pedal is applied.

When the left brake pedal is applied, the brake valve releases air pressure from the brake system into the de-clutch valve forcing the de-clutch valve piston to contact the shut-off valve spool inside the transmission control cover. This forces the shut-off valve spool to shift into a position that prevents oil flow to the forward clutch, disengaging the clutch and establishing a transmission neutral. *The reverse clutch is not affected.*

This arrangement prevents the machine from creeping forward when loading or dumping the bucket; yet permits backing away if operating on a sloping grade. It also increases the boom and bucket hydraulic system working power by utilizing the power contained at the transmission, which is normally used for engaging the forward clutch to drive the wheels.

Maintenance consists of periodically checking the de-clutch valve or proper operation as described below:

1. Place directional shift lever in NEUTRAL position and start engine.

2. Accelerate engine to approximately half throttle, lightly apply left brake pedal and shift directional shift lever to FORWARD position. There should be no clutch engagement (causing the machine to move forward) or drop in engine rpm as would be noticed when shifting lever into REVERSE position. A steady rpm will give a more pronounced indication. However, if forward movement of the machine does occur, this is an indication that the de-clutch valve is not functioning properly and must be replaced.

3. Shut down engine and remove and replace de-clutch valve.

4. Recheck valve operation as described in Steps 1 and 2.

Check Converter Internal Pressure: The torque converter internal pressure must be maintained within the specified limits listed below to insure proper operation of the torque converter and converter regulator valve assembly.

Periodically check the converter internal pressure when fluid is at operating temperature (180°F. to 200°F.) and engine operating at maximum rpm.

1. Shut down engine and remove pipe plug from converter regulator valve assembly.
2. Install an accurate gauge (0 to 100 psi capacity) in regulator valve pressure port as shown in Figure 26, Item 1.

3. Place directional lever in NEUTRAL and apply parking brake.

4. Start engine and accelerate to maximum rpm. Gauge reading should be between a maximum of 60 psi and a minimum of 30 psi.

If pressure is not within the specified limits, further trouble shooting of the torque converter,

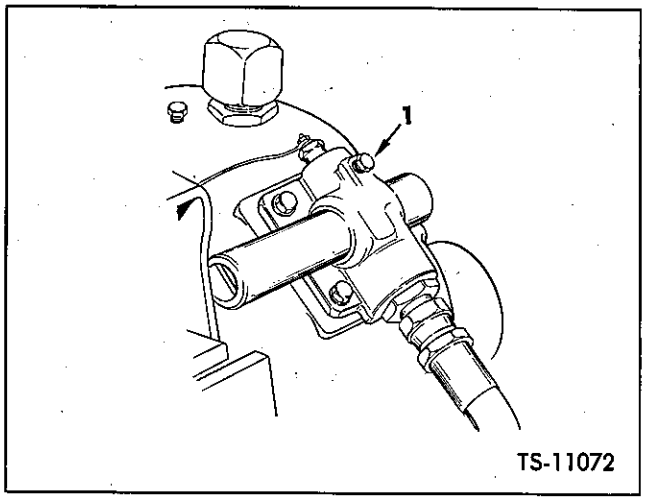


Fig. 26. Check Converter Internal Pressure

transmission and allied hydraulic system by a qualified mechanic will be required.

Check Transmission Clutch, Lubricating, and Oil Cooler Pressures: Check transmission clutch, transmission lubricating and oil cooler pressures at specified intervals, or whenever machine evidences overheating or no power in any speed range in forward or reverse direction.

Pressure checks must be taken with fluid hot (180°F. to 200°F.).

(a) **Transmission Clutch Pressure:** Pressure check should be made in all speed ranges in both forward and reverse directions. Wheels of machine should be securely blocked and parking brake applied.

1. Install an accurate gauge (0 to 400 psi capacity) on the transmission clutch pressure port quick release fitting in the rear of cockpit.

2. Check pressure with engine at IDLE.

3. Read gauge in NEUTRAL; then engage clutches one at a time. Minimum pressure reading should be as specified in Specifications and Service Data section at rear of manual.

If pressure is not as specified, further trouble shooting of the transmission, torque converter and allied hydraulic system by a qualified mechanic is required.

(b) **Transmission Lubricating Pressure:** The transmission lubricating manifold insures proper lubrication of the transmission clutches, bearings and shafts. Periodically, lubricating pressure should be checked when fluid is at operating temperature (180°F. to 200°F.) and engine operating at maximum rpm.

1. Shut down engine and remove pipe plug from transmission lubricating manifold. Install an accurate gauge (0 to 100 psi capacity) as shown in Figure 27, Item 1.

2. Place directional shift lever in NEUTRAL and apply parking brake.

3. Start engine and accelerate to maximum rpm. Gauge reading must not exceed the pressure given in Specifications and Service Data section at rear of this manual.

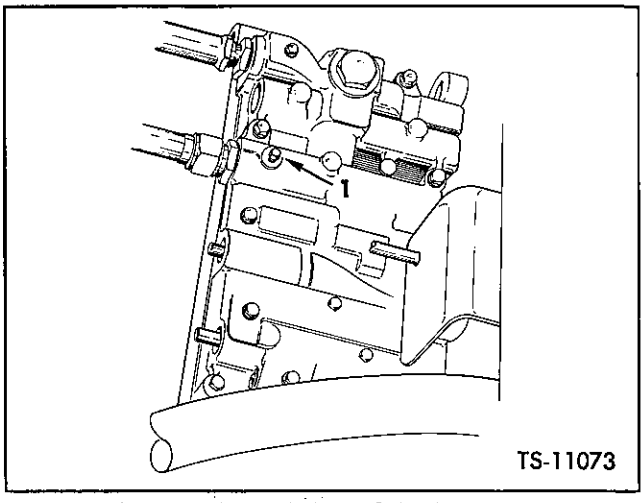


Fig. 27. Transmission Lubricating Pressure

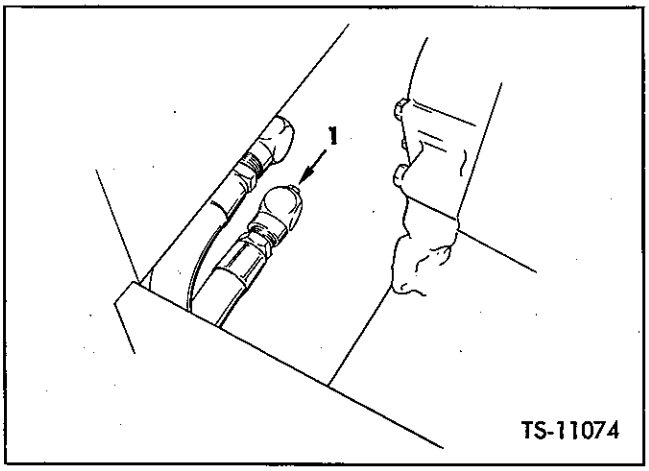
If pressure is not as specified, further trouble shooting of torque converter and transmission by a qualified mechanic will be required.

(c) **Oil Cooler Pressure:** The drop in pressure across the oil cooler at bottom of radiator will indicate whether oil cooler has or is becoming plugged with foreign material causing overheating.

Pressure check must be made with fluid hot (180°F. to 200°F.) using accurate gauges (0 to 100 psi capacity) at 2000 rpm.

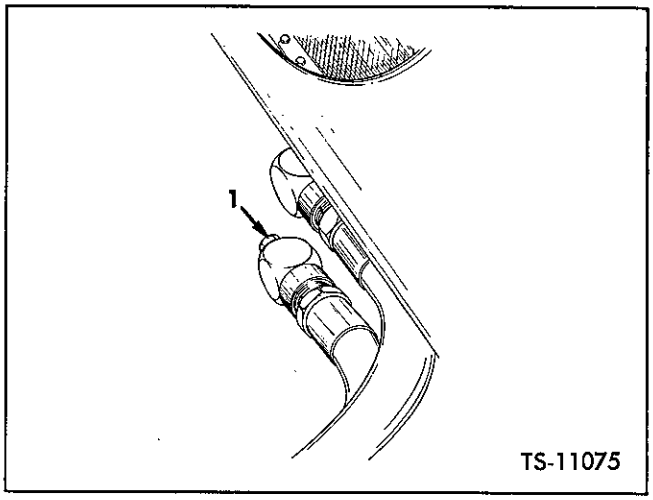
1. Install tachometer on engine. Install gauges at cooler IN and cooler OUT pressure ports as shown in Figures 28 and 29.

2. Attach safety links, apply parking brake and shift directional lever into NEUTRAL position.



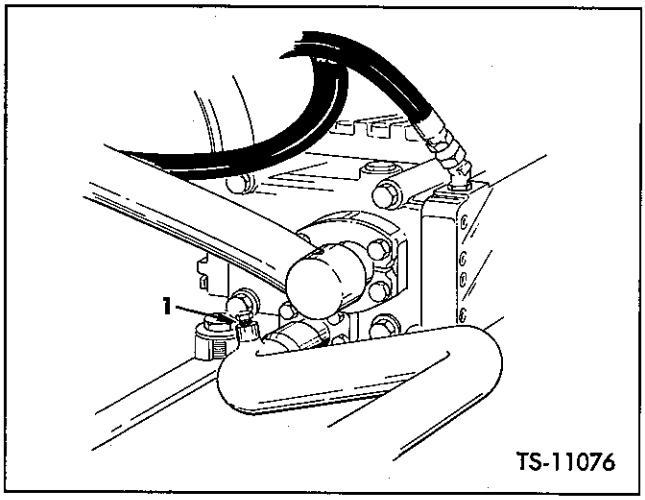
1. Pressure Port

Fig. 28. Check Pressure — Oil Cooler IN



1. Pressure Port

Fig. 29. Check Pressure — Oil Cooler OUT



1. Pipe Plug

Fig. 30. Main Hydraulic Pressure Gauge Port

3. With the aid of a helper, read gauges at steady 2000 rpm, and subtract oil cooler OUT pressure from oil cooler IN pressure to get pressure drop. Pressure drop should be between 10 psi and 30 psi.

If pressure difference equals or exceeds 30 psi it will be necessary to thoroughly clean or replace the oil cooler and/or the radiator assembly.

Check Boom and Bucket Pressure: The boom and bucket hydraulic pump is coupled to the drive line and operates as soon as the engine starts. The pump draws fluid from the reservoir and forces it under pressure into the main hydraulic valve, from which a small supply of fluid is directed to the pilot valve, routing the fluid back to the main valve, operating the desired circuit in the main valve, supplying the flow of fluid to the cylinders. Preset overload relief cartridges on the pilot valve protect the system and components.

Maintenance consists of periodically checking the pressure in the system. All pressure checks are to be made with fluids at operating temperature. (150°F. minimum).

1. Attach safety links and block wheels.
2. Use a hydraulic test gauge of at least 3000 psi capacity. With engine shut down, loosen cap on hydraulic reservoir until pressure escapes, to minimize oil loss while attaching gauge, then retighten cap.
3. Remove pipe plug from pressure port on main pressure tube, and attach gauge. Refer to Figure 30 for typical gauge installation.
4. Place transmission directional shift lever in NEUTRAL, start engine and apply parking brake.
5. If it is necessary during any of the following steps to replace any of the relief valve cartridges on the pilot valve, remove seat and seat support plate to gain access to pilot valve.
6. With transmission directional and speed range levers in FORWARD, and HI, actuate bucket control lever to ull ROLLBACK position and accelerate engine to maximum rpm. Record gauge reading and proceed to Step 7.
7. With transmission directional and speed range levers in FORWARD, and HI, actuate boom control lever to the full RAISE position and accelerate engine to maximum rpm. Record gauge reading and proceed to Step 8.

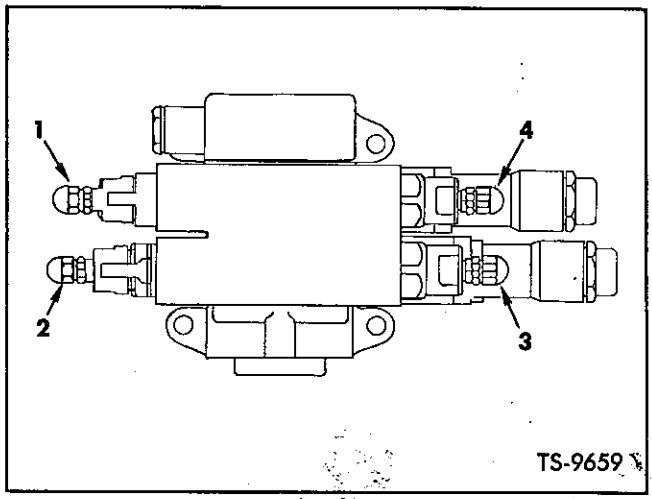


Fig. 31. Pressure Relief Cartridges — Pilot Valve

8. If bucket ROLLBACK and boom RAISE are not the same within 50 psi, the circuit with the lower reading must have the relief valve cartridge on the pilot valve changed. Figure 31 Item 1 is bucket rollback cartridge Item 2 is boom raise cartridge.

9. After either relief cartridge is changed, repeat Steps 6, 7, 8 and 9 until recorded pressure readings for bucket ROLLBACK and boom RAISE are the same within 50 psi.

10. If gauge pressure readings or bucket ROLLBACK and boom RAISE are the same within 50 psi, but not to specification of 2200 ±50 psi, the main relief valve, (located in the main control valve assembly) must be adjusted. See Steps 11 thru 13 for procedure.

11. Remove eight bolts retaining cover (Figure 32, Item A) and remove cover. Refer to Figure 33 and remove spring (Item 2) and main relief valve assembly (Item 1), which protrude from fafce of main control valve aftfer cover is removed. Refer to Figure 33 and loosen hex locknut portion (Item 4) of relief valve and turn adjusting screw (Item 3) clockwise to increase pressure or counter-clockwise to decrease pressure. Each complete turn of adjusting screw changes setting approximately 1600 psi. Example: If pressure reading recorded in Step 9 was 1400 psi, ½ turn (clockwise) of adjusting screw would raise relief valve pressure to 2200 psi. After adjusting, tighten locknut.

12. Reinstall relief valve assembly and spring in position in main valve assembly.

IMPORTANT: *Adjusting screw and locknut portion of relief valve must be toward outside of valve.*

13. Reinstall cover using two bolts in diagonally opposite holes in cover. Springs under cover must be compressed to start bolts into hole threads. Turn bolts finger tight. Install remaining bolts finger tight. Using a torque wrench with adapter for ⅜ inch Allen wrench, torque all bolts to 60-75 ft. lbs.

14. Place transmission directional and speed range levers in FORWARD, HI, actuate bucket control lever to full ROLLBACK position and accelerate to maximum rpm. Gauge should read 2200 ±50 psi.

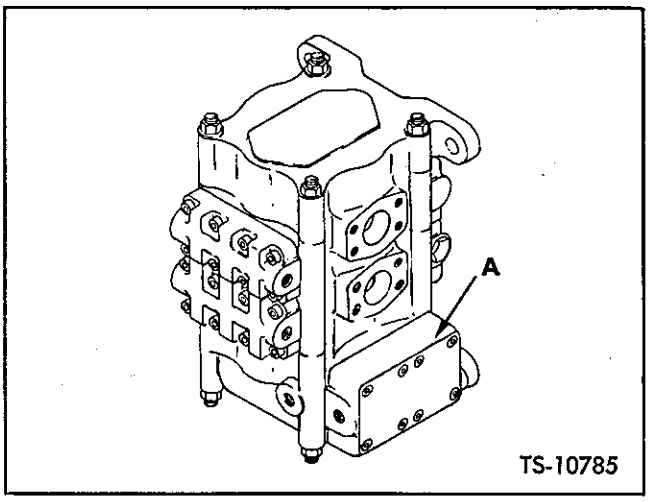
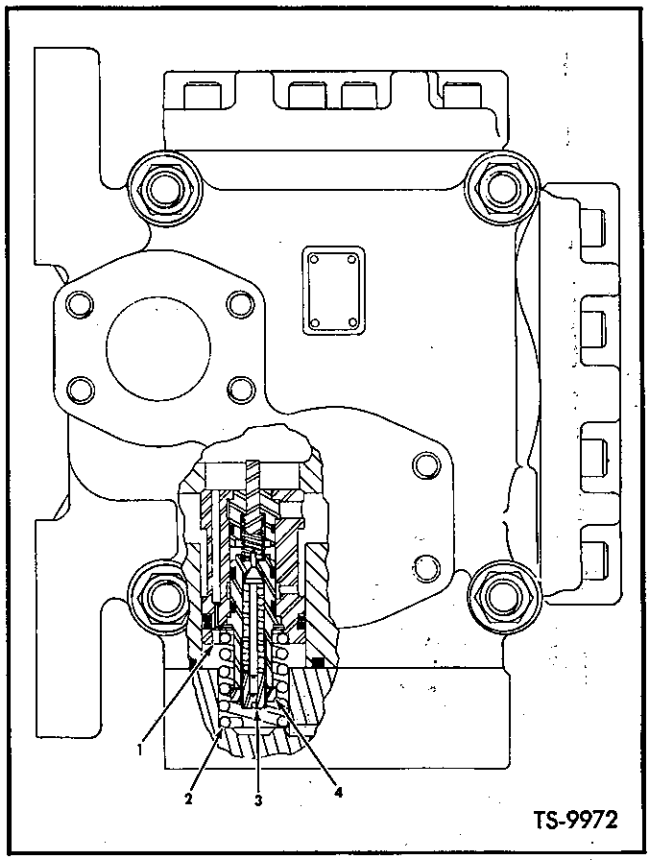


Fig. 32. Remove Cover — Main Relief

15. With transmission directional lever in NEUTRAL, feather boom control lever to the DOWN PRESSURE position, maintaining low idle rpm. Gauge should read 1750 to 2200 psi. If reading is not as specified, replace down pressure relief valve cartridge (Item 3 Figure 31).



1. Relief Valve Assy.
2. Spring
3. Adjusting Screw
4. Locknut

Fig. 33. Main Relief Valve

16. With transmission directional lever in NEUTRAL, actuate bucket control lever to the full DUMP position, maintaining low idle rpm. Gauge should read 1750 to 2200 psi. If reading is not as specified, replace bucket dump relief valve cartridge (Item 4 Figure 31).

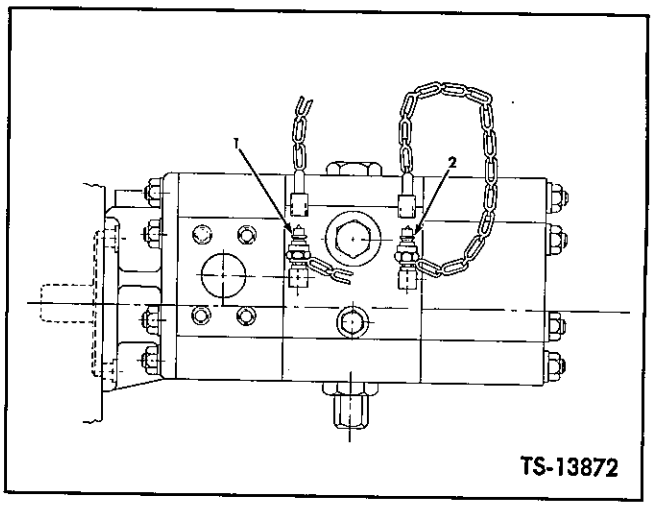
IMPORTANT: OVERLOAD RELIEF VALVES ARE PRESET AND SEALED AT THE FACTORY. DO NOT BREAK THE SEAL. IF THE SEAL IS BROKEN, REPLACE RELIEF VALVE CARTRIDGE IMMEDIATELY. ADJUSTMENTS ARE TO BE MADE ONLY AT THE MAIN RELIEF.

Check and Adjust Main Hydraulic Pump: The main hydraulic pump is a double pump, consisting of a primary section and a secondary section. At lower pressures, up to by-pass pressure setting, both sections supply the main hydraulic system. From by-pass pressure setting up to system relief, the pressure sensitive valve attached to the pump causes the secondary section to unload by-passing back to the suction side, leaving the primary section to supply the system.

Maintenance consists of periodically checking, and adjusting if necessary, the pressure at which the secondary section of the pump unloads and by-passes.

1. Attach safety links and apply parking brake.
2. Install two 3000 psi capacity gauges, one at the pressure port on the primary section and one at the pressure port on the secondary section of the main pump as shown in Figure 34, Item 1 & 2.
3. With transmission directional shift lever in neutral, start engine and follow normal warm up procedure.
4. Actuate boom control lever to the lift position, maintaining low idle rpm. Raise boom to stop, feathering lever as boom approaches stop. Observe both gauges. As pressure increases, the gauge attached to the secondary section of the pump will indicate a sudden drop-off in pressure. The highest pressure indicated is the unloading pressure.
5. Observe the indicated pressure on the gauge attached to the main hydraulic pressure port. When the unloading pressure is reached, this gauge should read as specified in Specifications and Service Data section at rear of manual.

If the secondary pump section does not unload

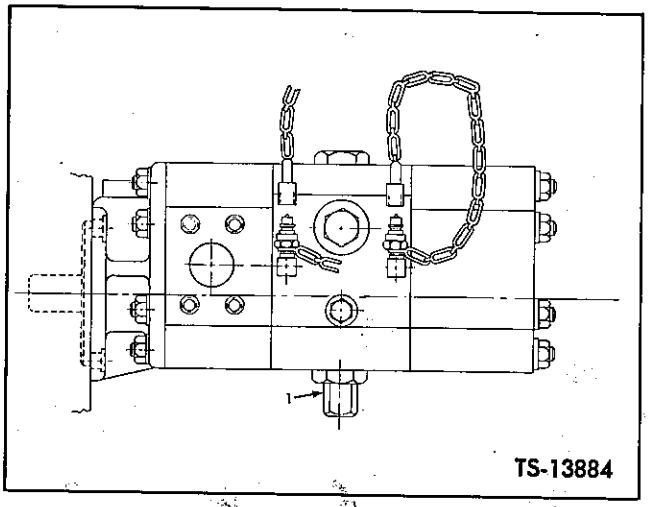


1. Primary Port 2. Secondary Port

Fig. 34. Main Hydraulic Pump Pressure Ports

at specified pressure, it will be necessary to adjust the pressure sensing valve on the main pump. Proceed with valve adjustment as follows:

1. Remove acorn nut and o-ring covering adjusting screw on pressure sensing valve. See Figure 35.
2. Actuate boom control lever to the raise position maintaining low idle rpm. Feather the lever as boom approaches stop, observing the pressure at which the secondary section unloads, then return lever to the neutral position.
3. Turn pressure adjusting screw in increments of ¼ turn, clockwise to increase or counter-clockwise to decrease unloading pressure. Recheck unloading pressure as described in Step 2. Repeat this procedure until secondary section of main pump unloads at specified pressure.



1. Acorn Nut

Fig. 35. Main Hydraulic Pump Adjustment

4. Reinstall acorn nut and o-ring, then recheck the unloading pressure to be certain pressure setting was not disturbed while installing acorn nut and o-ring.

5. Shut down engine, remove gauges and detach safety links.

Adjust Boom and Bucket Control Levers: The control levers are properly set at the factory. An adjustment is provided by clevises connected directly to the levers to permit changing angle of levers if desired and to insure that spools shift into all positions.

With engine shut down, and bucket on the ground, place levers in HOLD (neutral) position. The adjustment can be made as follows: See Figure 36.

1. Loosen locknut (Item 1 Figure 36) on control rod.

2. Remove cotter and clevis pin (Item 2 Figure 36).

3. Turn clevis clockwise to move lever toward the rear; counter-clockwise to move lever forward.

4. When lever is set where desired, attach clevis with pin and cotter and tighten locknut securely.

5. Check that levers shift into all positions without interference.

Clean and Tighten Electrical Connections: Periodically inspect and check all wiring and connections on electrical components such as the batteries, cranking motor, voltage regulator, alternator, solenoid switch, relays, instruments and switches for worn, cracked, broken or frayed insulation and loose terminal connections. Check for frayed or corroded external ground straps and corrosion on battery terminal ports.

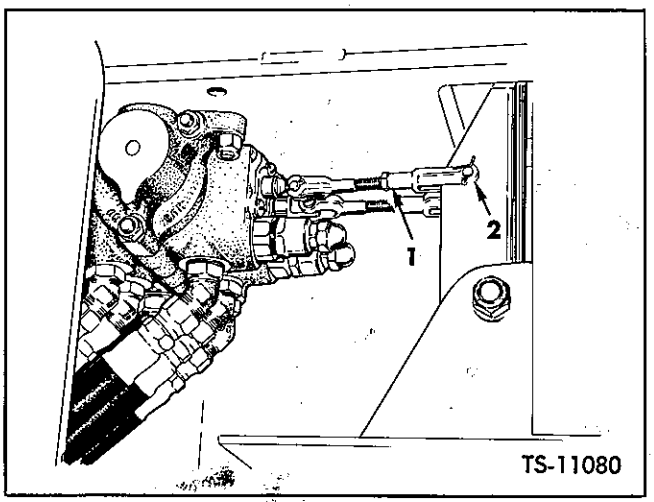


Fig. 36. Adjust Boom and Bucket Control Levers

Where inspection reveals dirt, looseness or damage; clean, tighten and adjust or replace as necessary depending on existing conditions.

Note: *Maintenance personnel must observe the following precautions to prevent the possibility of serious injury or excessive damage to electrical system components when servicing the "Delcotron" charging system.*

1. WHEN INSTALLING BATTERIES, MAKE SURE BATTERIES AND "DELCOTRON" POLARITIES ARE THE SAME—

When installing a battery, always make absolutely sure the ground polarity of the battery and the ground polarity of the "Delcotron" are the same. If a battery of the wrong polarity is connected into the charging system or if a battery is reversed when installing it, the battery is directly shorted through the diodes. Consequently the diodes and machine wiring are endangered by high current flow. Burned wiring harness and burned "open" diodes probably will result.

2. BOOSTER BATTERIES MUST BE PARALLELED—

When connecting a booster or "slave" battery, make certain to connect the negative terminals together and the positive terminals together. Failure to observe this precaution will result in the same damage as described above.

3. BATTERY CHARGER AND BATTERY POLARITIES MUST AGREE—

When connecting a charger to the battery, connect the charger positive lead to the battery positive terminal and the charger negative lead to the battery negative terminal. Failure to follow this procedure will result in the same damage as described in the first caution.

4. NEVER OPERATE "DELCOTRON" ON OPEN CIRCUIT—

Never operate the "Delcotron" on open circuit. With no battery or electric load in the circuit (open circuit), the "Delcotron" can build up high voltages which could be extremely dangerous to anyone who might accidentally touch the "Delcotron" battery terminal. Before making tests or "on the machine" checks, it is prudent to make sure all connections in the circuit are tight and secure.

5. DO NOT SHORT ACROSS OR GROUND ANY TERMINALS OF THE "DELCOTRON" OR REGULATOR—

Do not short across or ground any of the terminals on the "Delcotron" or regulator. Any artificial circuit set up by purposely grounding or shorting any of the "Delcotron" or regulator terminals can cause serious electrical malfunctions that might endanger components of the electrical system.

6. DO NOT POLARIZE THE "DELCOTRON"—

Do not attempt to polarize the "Delcotron". Polarizing the d.c. type of generator is necessary to insure that generator and battery polarity are the same. "Delcotron" polarizing however is not necessary since the voltage developed within the "Delcotron" is of both polarities and the diode rectifier automatically controls the direction of current flow. It is of vital importance as discussed in the first precaution that the battery ground and the "Delcotron" ground be of the same polarity for diode protection.

7. BEFORE DOING ANY WELDING, DISCONNECT GROUND CABLE FROM BATTERY AND ELECTRICAL LEAD FROM BATTERY TERMINAL ON ALTERNATOR—

Before doing any welding on machines equipped with an alternator, disconnect the ground cable from the battery and the electrical lead from the battery terminal on the alternator.

Clean Axle Breathers: Each 500 operating hours inspect breathers on front and rear axle housings. Housing breathers have a loose fitting cap that should be rotated.

Oil leakage past breathers, thrust caps, carrier housing or pinion cap seals indicates that breathers may be clogged. Unscrew breathers, wash in solvent, dry and reinstall.

Check Steering Pressure: The steering hydraulic pump is coupled to the drive line and operates as soon as the engine is started. The pump draws fluid from the reservoir and forces it under pressure into the control valve mounted at the base of the steering gear.

Maintenance consists of periodically checking the pressure in the system.

Note: *Remove safety links, if attached between front and rear frames.*

Warning: *Do not stand or work in step area(s) when machine is running — No room for a man in this area when machine is turned.*

1. Use hydraulic pressure gauge of at least 3000 psi capacity. With engine shut down, install gauge line on quick release fitting on steer pump as shown in Figure 37, Item 1.

2. Start engine and accelerate to maximum rpm; then turn tractor to the right and hold against stops.

3. With the aid of a helper read gauge. Pressure reading should be as specified in Specifications and Service Data section at rear of this manual.

If pressure reading is not as specified, shut down engine, and inspect and check for collapsed or ruptured hoses, proper function of steering cylinder packing glands, defective steering pump or steering control valve.

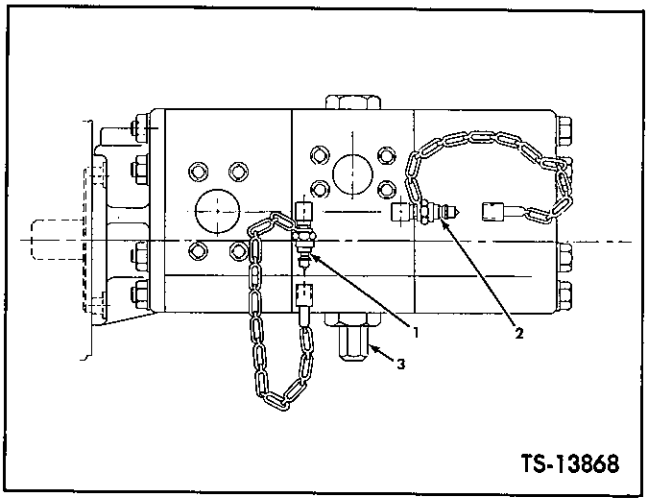
If the above items are in satisfactory operating condition it will be necessary to adjust the steering pressure at the steering control valve.

1. Loosen locknut on steering control valve adjusting screw.

2. Turn tractor to extreme right or left and hold against stops.

3. With transmission in neutral, accelerate to maximum rpm.

4. Turn adjusting screw in increments of ¼ rev-



1. Primary Port 2. Secondary Port
3. Acorn Nut

Fig. 37. Steering Pump Pressure Ports and Adjustment

olution or less, clockwise to increase pressure or counter-clockwise to decrease pressure.

5. When pressure reading on gauge reaches that specified in Specifications and Service Data section at rear of this manual, tighten locknut, release throttle and steering wheel, shut down engine, remove gauge.

Check and Adjust Steering Pump: The steering pump is a double pump consisting of a primary section and a secondary section. From low idle to approximately 1600 rpm, both primary and secondary sections are supplying the steering system. From approximately 1600 to maximum rpm, the primary section continues to supply the steering system, but the secondary section by-passes.

Maintenance consists of periodically checking, and adjusting if necessary, the rpm at which the secondary steering pump section by-passes.

1. Install tachometer on engine.
2. Install two 3000 psi capacity gauges, one at the steering pump primary section port, and one at the secondary section port. See Figure 37.
3. Remove safety links if attached between frames.

   WARNING: *Do not stand or work in stop area(s) when engine is running. No room for a man in this area when machine is turned.*

4. Start engine and maintain low idle rpm, turn steering against stops and hold. At this point, both gauges should read steering relief pressure or slightly below.
5. Accelerate engine rpm observing gauges and tachometer. Note the rpm at which the gauge attached to the secondary port indicates a large pressure drop off. At this point, tachometer should read approximately 1600 rpm.
6. Accelerate to maximum rpm with steering held against stops. The gauge attached to the primary port should read system relief pressure while the gauge attached to the secondary port indicates very little pressure.

If secondary pump section does not show a pressure drop-off at approximately 1600 rpm, it will be necessary to adjust the valve on the steering pump. Proceed with valve adjustment as follows.

1. Turn steering to extreme right or left and hold against stops. Accelerate to maximum rpm. The gauge attached to the primary section pressure port should read system relief pressure.
2. If gauge reading is not as specified, adjust main steering relief valve located at base of steering gear as described under 500 HOUR MAINTENANCE OPERATIONS.
3. With steering against stops, increase engine rpm slowly starting at low idle.
4. Carefully watching tachometer and pressure gauge attached to steer pump secondary pressure port, note the rpm at which pressure drop-off occurs.
5. Remove acorn nut and o-ring on steer pump valve. See Figure 37.
6. Turn adjusting screw clockwise to increase or counter-clockwise to decrease pressure drop-off rpm.
7. After correct setting has been obtained, reinstall acorn nut and o-ring. Recheck pressure drop-off rpm to be certain adjustment was not disturbed while installing acorn nut and o-ring.
8. Shut down engine, remove gauges and tachometer.

Bleed Steering Relief Valve: Whenever steering pressure is checked or if chattering occurs in the steering valve, the steering relief valve must be bled to remove air trapped in the valve. To bleed relief valve, open bleed screw and turn steering wheel until a solid stream of oil flows from the bleed screw. Then close bleed screw.

Adjust Draglink Ball Joints: Adjust front and rear ball joints on drag link whenever excessive play develops. This condition will be indicated by an increase of free play at the steering wheel before tractor responds to turning action.

Remove cotter (Item 1) and turn slotted adjusting plug (Item 2) to remove all slack in ball joints at each end of drag link as shown in Figure 38.

Tighten Mounting Bolts: Mounting bolts on such components as engine, torque converter, transmission, steering gear, axles and prop shafts will occasionally work loose and cause supports and brackets to wear rapidly. Alignment difficulty may also develop.

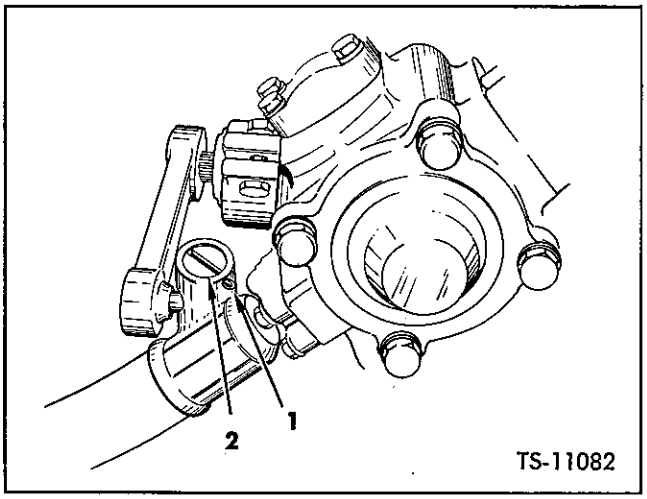


Fig. 38. Adjust Draglink Ball Joints

Inspect all mounting bolts for evidence of looseness, stripped threads, cracked or broken heads or any other signs of damage.

Note: *Where spring bolts are used on engine mounts, bolts should be tightened to compress spring, and then backed-off two full turns.*

Remove and replace damaged or missing mounting bolts and tighten all loose mounting bolts as necessary. Refer to Bolt Torque Chart.

Steam Clean Machine: Periodically or whenever working machine in muddy or swampy areas or when machine begins to cake up with excessive dirt, the entire machine should be steam cleaned. If allowed to accumulate, dirt will find its way into the various systems when plugs, covers or caps are removed or during unit replacement eventually cause serious damage and down time.

Dirt packed on or around the axle, transmission, torque converter and engine breathers will cause oil losses.

Steam is the most effective and recommended method of cleaning a dirty machine. If unavailable use a spray of mineral spirits or a similar solvent non-harmful to exposed hoses, lines and electrical wiring.

Note: *Prior to steam cleaning, cover all alternator and cranking motor openings to protect them from the force of the steam jet.*

Service Air Cleaner Element: Recommended servicing procedures and intervals for replacing the air cleaner filter element are described below, but it should be understood that no set rule can be established for replacing the filter element because the replacement interval is automatically established by a service indicator installed on the air cleaner outlet to the engine. The service indicator insures maximum engine efficiency by providing the operator with a fast, safe and efficient method of determining when the filter element should be replaced. This is accomplished by a WARNING SIGNAL (red band) which is actuated by the pressure drop across the air cleaner.

Dirt trapped by the filter element gradually increases the pressure drop across the air cleaner. As the resistance increases, a WARNING SIGNAL (red band) inside the indicator will become visible in the indicator window. This indicates the life reserve of the filter element. When restriction of the air flow through the filter reaches the upper limit for efficient filter element performance, the WARNING SIGNAL (red band) will lock and remain in a position visible to the operator regardless of whether or not the engine is running. This is an indication that the filter must be serviced.

Note: *Extended operation of machine without replacing filter element when indicated by the service indicator will create excessive restriction resulting in high fuel consumption, excessive smoke, lower horsepower and poor acceleration.*

Figures 39 thru 41 illustrate the removal and cleaning procedure of the air cleaner element.

Loosen clamp assembly, (Item 1 Figure 40), and remove dust cup, (Item 2 Figure 40). Unscrew the wing nut, (Item 3 Figure 40), and remove element, (Item 4 Figure 40). Pat sides of element

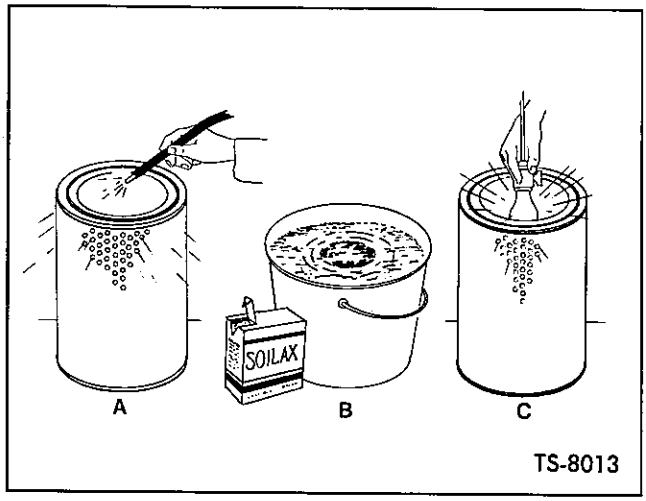


Fig. 39. Clean and Inspect Filter Element

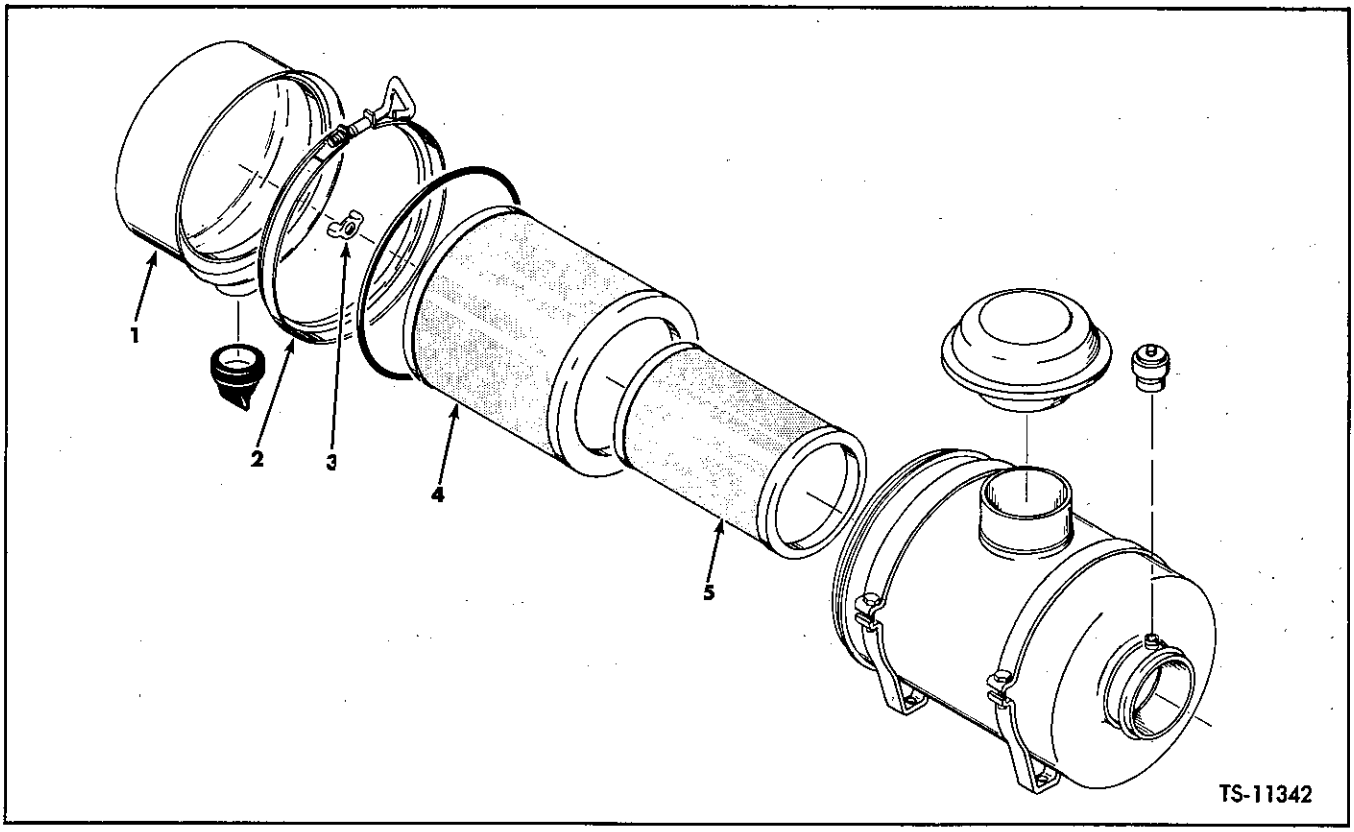


Fig. 40. Air Cleaner Assembly

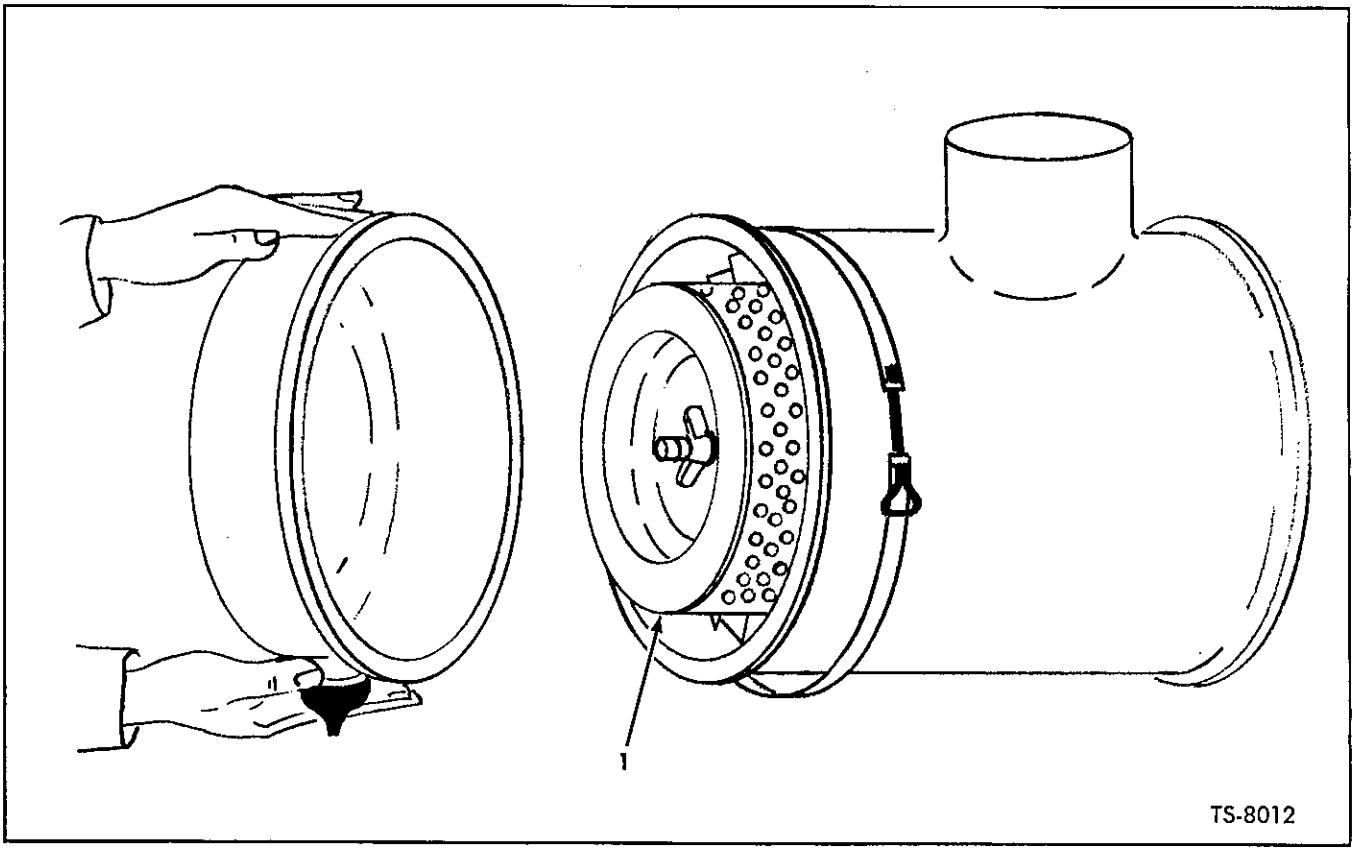


Fig. 41. Remove Dust Cup and Element

with palm of hand to remove dust trapped in the pleats. Tapping element against hand surface or with hard objects may dent or break the element end cap seals (Figure 41 Item 1). This would affect improper sealing when the element is reassembled and result in rapid engine wear. Using low pressure air (see Figure 39 Item A), not over 100 psi, blow out remaining dust from inside out, opposite normal air flow through the element.

Caution: *Be careful not to rupture filter element. Maintain a reasonable distance between air nozzle and filter element when directing air up and down the clean air side of the element pleats.*

Extremely dirty element can be cleaned in warm water (120°F. to 140°F.) using a nonsudsing detergine such as SOILAX. Soak element until dirt particles are loosened (approximately 15 minutes); then brush lightly with a non metallic brush or agitate element in cleaning solution to remove dirt particles, (see Figure 39 Item B). Flush with clean water from a hose (maximum pressure 40 psi). Air dry element completely before using.

After element has been dried, check top sealing gasket for looseness or damage. A loose gasket may be recemented. Inspect the element for damage by placing a bright light inside element, (see Figure 39 Item C). Thin spots, pin holes, or the slightest rupture will render the element unfit for use. DISCARD ANY DAMAGED ELEMENT.

Clean the fins and inside of air cleaner body with a dry lint-free cloth and reassemble air cleaner. The wing nut retaining the element must always have the gasket washer around its shank.

Caution: *Do not use oil in dust cup.*

Inspect safety element (Item 5 Figure 40). If safety element becomes plugged with foreign material, discard and install new element. Do not attempt to clean and re-use plugged safety element.

1000 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CHECK AND REPAIR BUCKET CUTTING EDGE**
- **CHECK BOOM TO BUCKET LINKAGE**
- **INSPECT, TEST AND LUBRICATE ELECTRICAL UNITS**
- **ADJUST STEERING GEAR**
- **INSPECT FRAME**

Engine Maintenance: Refer to Operation and Maintenance Manual of engine manufacturer for maintenance instructions of engine and accessories.

Check and Repair Bucket Cutting Edge: The bucket should be periodically checked for badly ripped, cracked, chipped or worn-out cutting edges (bottom and sides).

If at any time it becomes necessary to replace the bucket cutting edge (bottom and or sides) replacement parts can be ordered separately. Refer to Parts Manual for applicable part numbers.

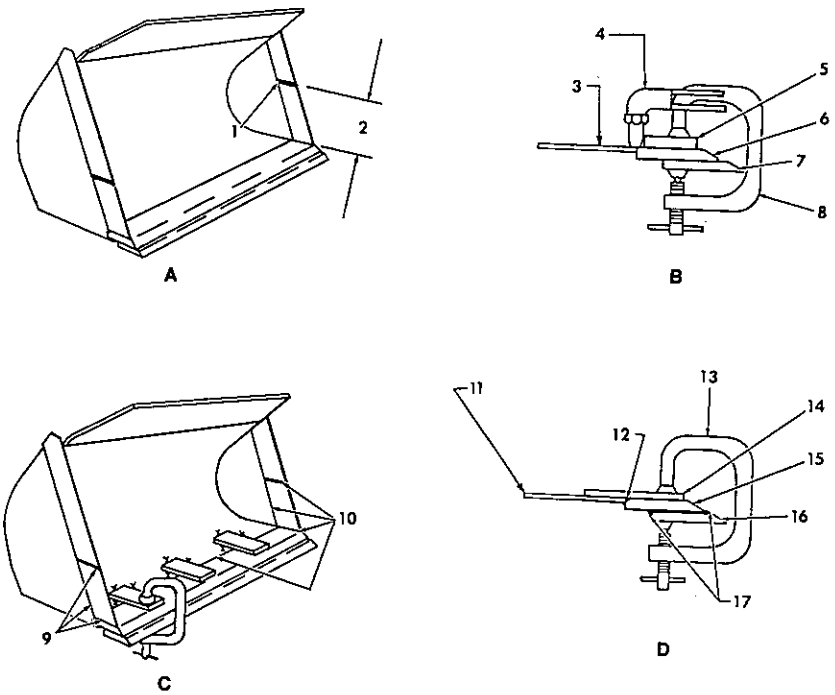
To replace bucket cutting edges, follow the procedure outlined below and refer to Figure 42.

(a) **Bottom Cutting Edge**

1. Scarf out front and rear welds Item 17 securing bottom cutting edge to top cutting edge as shown in view "D". Grind rough edges smooth.
2. Align and clamp bottom cutting edge and tack weld in place. See view "D".
3. Finish welding bottom cutting edge to top cutting edge. Front weld is a continuous ⅜ inch fillet weld along entire edge. Rear weld is a ⅜ inch intermittent fillet weld consisting of a series of 3 inch welds equally spaced on 10 inch centers.

   Note: *Use a 5/16 diameter low hydrogen electrode equivalent to AWS-E-10016.*
4. Grind front weld to present a smooth surface for entry of material.

(b) **Top, Bottom, and Side Cutting Edges**



1. Scribe Lines
2. Length of Segment
3. Bucket Sheet
4. Cutting Torch
5. Straight Edge
6. Top Cutting Edge
7. Bottom Cutting Edge
8. Clamp
9. Weld
10. Weld
11. Bucket Sheet
12. Top Weld
13. Clamp
14. Flat Plate
15. Top Cutting Edge
16. Bottom Cutting Edge
17. Front & Rear Welds

Fig. 42. Repair Bucket Cutting Edge

1. Align and clamp straight edge so that back edge will line up with front edge of bucket sheet as shown in view "B".

2. Measure up on each side cutting edge the length of the line segment (2) from top cutting edge and scribe lines (1) as shown in view "A".

3. Guide cutting torch through scribe lines (1) and down rear of side cutting edges to top cutting edge as shown in view "A"; then continue cutting along back side of straight edge(s) as shown in view "B". Remove and discard cutout section from bucket. Grind all rough edges on bucket smooth.

4. Equally space three flat plates on bucket sheet and tack weld in three places as shown in view "C".

5. Position and align new cutting edge assembly flush against bucket sheet and flat plates and secure in place with clamps as shown in view "C".

6. Alternately tack weld cutting edge to bucket sheet on top.

7. Remove flat plates and continuously weld cutting edge to bucket sheet on top, as shown in views "C" and "D". Top weld (12) is a 3/16 inch flush bevel groove weld.

8. Clamp side cutting edges flush against bucket end plate, bucket sheet and top cutting edge and weld, (9 & 10) view "C", securely. Welds to bucket end plate are 1/4 inch convex bevel groove weld inside and 3/8 inch fillet weld outside. Welds to cutting edge and bucket sheet are 3/4 inch fillet weld inside and 5/8 inch flush bevel groove weld outside. Where the side cutting edge overlaps the bucket sheet on the outside a 3/8 inch fillet weld should be made.

   Note: *Use a 3/16 inch diameter low hydrogen electrode equivalent to AWS-E-10016.*

9. Grind all welds inside bucket to present a smooth surface for entry of material; grind the residue of the tack welds from bucket sheet.

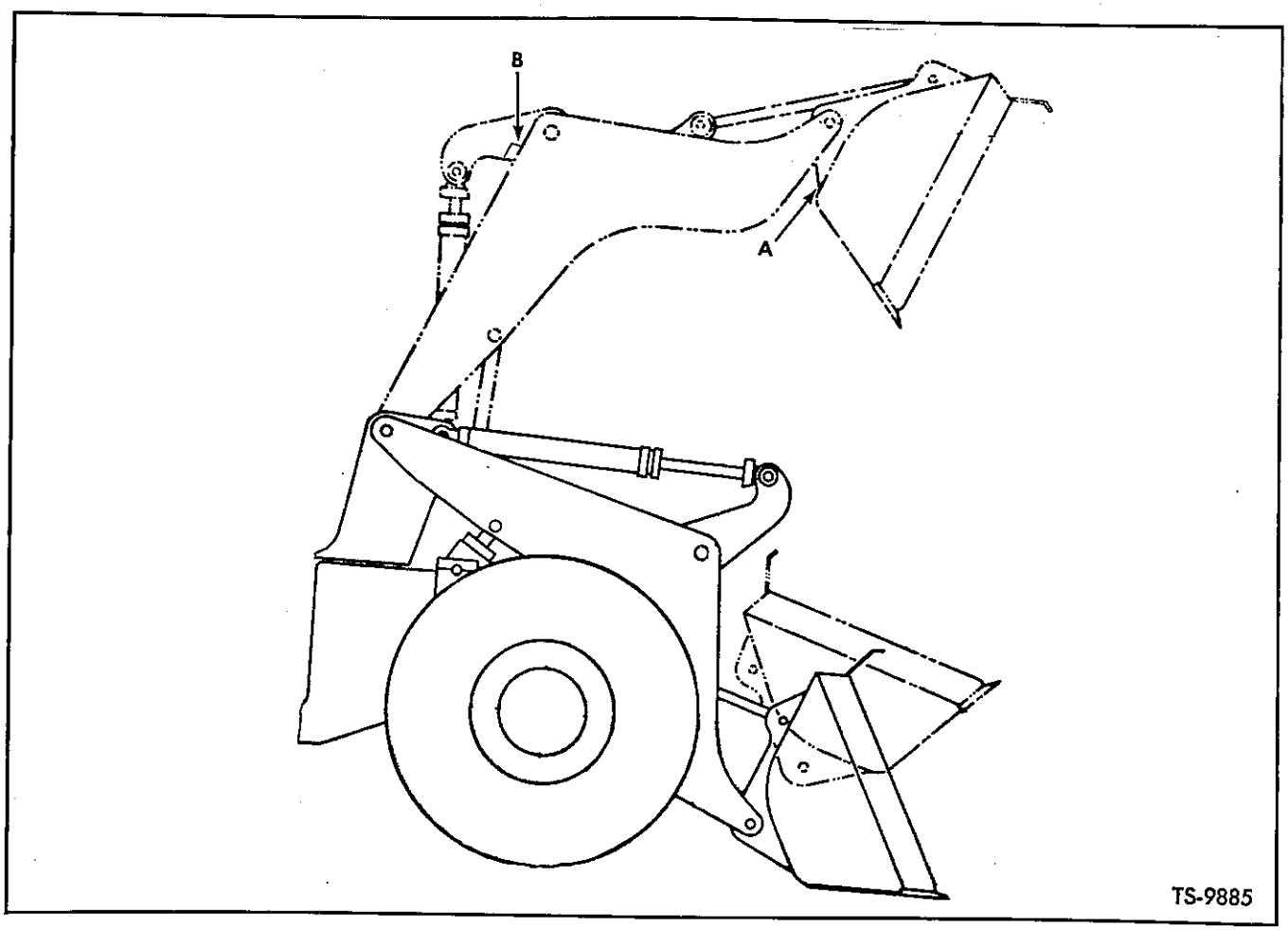


Fig. 43. Check and Adjust Boom to Bucket Linkage

Check Boom to Bucket Linkage: Boom to bucket linkage should be checked periodically and adjusted whenever inspection indicates or whenever new boom to bucket linkage parts are installed.

Refer to Figure 43, position "A" and raise boom to full up position and dump bucket until bucket stop or stops contact boom. Adjust bucket stops to no more than .125 inch, 3,2 mm, space, one stop to the other by grinding or welding on bucket stops.

With boom in full up position, and bucket fully dumped, refer to Figure 43 position "B." In this position, bellcrank stops should not contact boom and must not have more than .25 in. (6,4 mm) clearance.

Inspect, Test and Lubricate Electrical Units: Maintenance performed on the various electrical components usually consists of cleaning, lubricating, minor testing and adjusting, and replacing defective or worn out parts.

At specified intervals lubricate alternator and cranking motor sparingly. Excessive lubrication can result in premature failure.

Check cranking motor operation with a substitute battery source known to be fully charged and in good condition.

In general, proper function of the alternator and voltage regulator can usually be determined by the following conditions: (1) if batteries are kept fully charged, except when under unusually sever loads, and (2) if no more than the usual of water is required to keep them filled.

When testing alternator for charging rate use accurate test meters.

Inspect wires, cables and terminals for tight connections, cleanliness and evidence of deterioration or corrosion.

Blow out accumulated dust and dirt, and clean exterior surfaces of all electrical units.

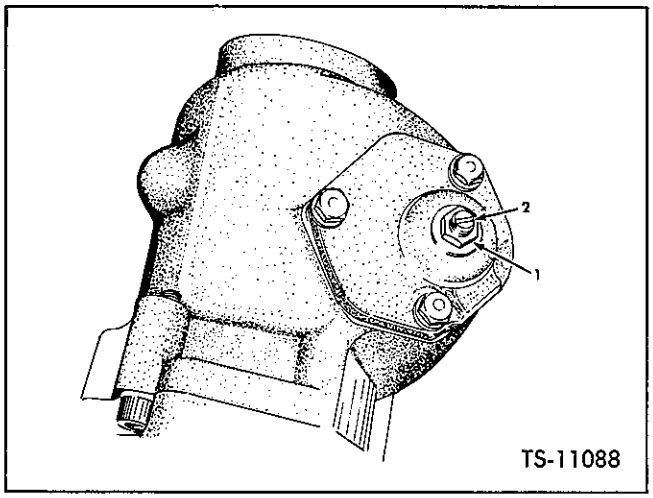
Complete service facilities for electrical system components are available at any authorized Delco-Remy or United Motors sales and service outlet.

Adjust Steering Gear: The steering gear assembly consists of a manual gear of the recirculating ball type with a hydraulic control valve mounted at the base.

The manual gear requires two adjustments to maintain proper operation: (1) worn bearing adjustment, (2) overcenter or pitman shaft adjustment. The worn bearing adjustment is performed only at the time the control valve is assembled to the gear. The adjusting nut is securely staked in place and does not require further attention.

The overcenter or pitman shaft adjustment, however, should be periodically checked and adjusted to remove lash between pitman shaft gear and the worm gear ball nut. Adjustment is indicated by too much free play at steering wheel before wheels respond to turning action. Adjustment is as follows with the engine shut off.

1. Disconnect steering drag link from pitman arm.
2. Turn steering wheel gently from one stop all the way to the other stop, carefully counting the total number of turns. Then turn wheel back exactly half way to the center position. Mark wheel at top or bottom center with piece of tape.
3. Measure the pull at the rim of the steering wheel required to keep the wheel in motion. Take the highest reading of the spring scale as the wheel is pulled through the center position. This pull can be measured by attaching a spring scale to the rim of the wheel with a piece of cord, then pulling on the spring scale to turn the wheel. The line of the scale should be kept tangent to the rim of the wheel. The proper pull at the wheel rim under these conditions should be 1⅛ to 2 lbs.
4. Loosen locknut and turn adjusting screw clockwise to increase pull at the wheel and counter clockwise to decrease the pull. See Figure 44. Reset locknut and recheck pull as it must be within the specified limits after the locknut is tightened.



1. Locknut 2. Adjusting Screw

Fig. 44. Adjust Steering Gear

5. Reassemble drag link to pitman arm and adjust drag link ball joints.

Inspect Frame: The frame is the basic backbone of the entire machine that provides structural support directly or indirectly for completely mounting all assemblies, sub-assemblies and individual components necessary for machine construction and operation. The frame structure and all supporting assemblies such as cradle, boom and bucket, bellcranks, pushrods, upper and lower pivots, cross members, reinforcing gussets and brackets, cross members, reinforcing gussets and brackets should be periodically inspected for cracks, bends, broken welds, warping or any other signs of damage that would endanger proper operation.

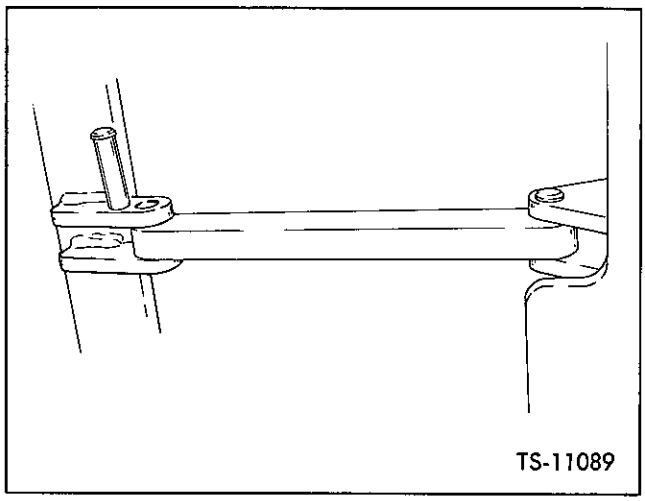


Fig. 45. Check Safety Links

Frame damage should be immediately repaired or corrected as necessary to maintain the frame assembly in good serviceable condition.

Note: *Repair or replace safety links that do not connect properly or have been damaged. See Figure 45.*

BOLT TORQUE CHART

175B

Location	Thread	Torque Ft. Lbs.
Axle Mounting Bolts	1¼"–12	1500
Bucket Cylinder Cap	¾"–16	320
Converter Drive Gear Mounting	⅜"–16	45
Converter Filter Cartridge – A.C. Units	——	50±5
Converter Housing Mounting	7/16"–14	45
Engine Support to Flywheel Housing	⅝"–11	67
Engine Support to Frame	¾"–16	320
Engine Trunnion Mounting	⅝"–18	105
Lower Pivot Hinge Cap Bolts	——	200
Prop Shaft – Upper	⅜"–24	50
Prop Shaft – Lower	7/16"–20	75
Suction Filter	3" NPTF	50
Tractor Pivot	1¼"–12	1500
Transmission Bracket to Frame	¾"–16	320
Transmission to Bracket	¾"–16	505
Wheel Nuts – Oiled Threads	⅞"–14	320

Bolts not listed are to be drawn up tight in a manner consistent with good workmanship.

MODEL CAPACITIES (Approximate)	175B G.M.	175B Cummins
U.S. MEASURE		
Engine Crankcase and System	6.5 gal.	14 gal.
Cooling System	24 gal.	24 gal.
Front Drive Axle Differential	7.5 gal.	7.5 gal.
Front Drive Axle Planetary Hubs (Ea.)	2 gal.	2 gal.
Fuel Tank	116 gal.	116 gal.
Hydraulic System	115 gal.	115 gal.
Rear Drive Axle Differential	7.5 gal.	7.5 gal.
Rear Drive Axle Planetary Hubs (Ea.)	2 gal.	2 gal.
Torque Converter and Transmission	11 gal.	11 gal.
Midmount Bearing	2 qts.	2 qts.
METRIC MEASURE (Liters)		
Engine Crankcase and System	24.6	53.0
Cooling System	90.8	90.8
Front Drive Axle Differential	28.4	28.4
Front Drive Axle Planetary Hubs (Ea.)	7.6	7.6
Fuel Tank	439.1	439.1
Hydraulic System	435.3	435.3
Rear Drive Axle Differential	28.4	28.4
Rear Drive Axle Planetary Hubs (Ea.)	7.6	7.6
Torque Converter and Transmission	41.6	41.6
Midmount Bearing	1.9	1.9
IMPERIAL MEASURE		
Engine Crankcase and System	5.4 gal.	11.7 gal.
Cooling System	20.0 gal.	20.0 gal.
Front Drive Axle Differential	6.2 gal.	6.2 gal.
Front Drive Axle Planetary Hubs (Ea.)	1.7 gal.	1.7 gal.
Fuel Tank	96.6 gal.	96.6 gal.
Hydraulic System	95.8 gal.	95.8 gal.
Rear Drive Axle Differential	6.2 gal.	6.2 gal.
Rear Drive Axle Planetary Hubs (Ea.)	1.7 gal.	1.7 gal.
Torque Converter and Transmission	9.1 gal.	9.1 gal.
Midmount Bearing	1.7 qts.	1.7 qts.

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ENGINE SPECIFICATIONS AND SERVICE DATA

ENGINE	175B	175B
Make	G.M.	Cummins
Model	8V71N	NT-855-C
No. of Cyls.	8	6
Bore (in.)	4.25	5.50
Stroke (in.)	5.00	6.00
Displacement (cu. in.)	567.4	855
Max. Torque (ft. lbs.)	800	850
@ RPM	1600	1500
Net Horsepower	273	279
Governed RPM	2100	2100
Low Idle RPM	650-750	650-750
High Idle RPM	2200-2300	2200-2300
*Stall RPM	1850-1950	1890-1990

*Note: Stall rpm is the maximum obtainable rpm with oil at operating temperature (180°F. to 200°F.), parking brake applied, wheels blocked, directional and speed range levers in FORWARD — 4th (HI), and bucket held in full close position. Stall rpm is applicable to altitude of 600 ft. and ambient temperature of 70°F. Due to the many combinations of altitude and temperature possible in the field, space does not permit publishing here all the corrections necessary to the stall rpm indicated to accommodate such variations. It is suggested the engine manufacturer's distributor be contacted to determine the correction necessary for altitude and temperature in your application.

MODEL ELECTRICAL SYSTEM	175B G.M.	175B Cummins
Fuses:		
Gauge Circuit	AGC ¾ Amp.	AGC ¾ Amp.
Light Circuit	SFE 20 Amp.	SFE 20 Amp.
Lighter	10 Amp.	10 Amp.
Instruments:		
Panel Gauges	12 Volt	12 Volt
Sender Units	12 Volt	12 Volt
Lamps:		
Back-Up	24 Volt, 60 Watt	24 Volt, 60 Watt
Dash	24 Volt, 6 C.P.	24 Volt, 6 C.P.
Tail & Stop	24 Volt, 32/6 C.P.	24 Volt, 32/6 C.P.
Head	24 Volt, 6 C.P.	24 Volt, 6 C.P.
Alternator	24V - 30A	24V - 75A
Voltage Regulator	24 Volt	24 Volt
Starting Motor	24 Volt	24 Volt
Batteries:		
Clark Part No.	1310121	1310121
No. & Voltage	2 x 12V	2 x 12V
System	24 Volt	24 Volt
Ground	Negative	Negative
Specific Gravity	1.230-1.260	1.230-1.260

MODEL *PRESSURES —	175B G.M.	175B Cummins
Engine Oil: Low Idle (minimum)	12 psi	12 psi
Gov. RPM (approximate)	45 psi	40 psi
Air Compressor	95-110 psi	95-110 psi
Main Hydraulic System — (At engine stall rpm with one set of cylinders against stops.)	2200 psi	2200 psi
Main Hydraulic Pump — (Secondary section by-pass pressure.)	1700 psi	1700 psi
Steering Hydraulic Pressure — (At maximum rpm with tractor halves against stops.)	1850 psi	1850 psi
Steering Hydraulic Pump — (Secondary section by-pass rpm.)	1500 rpm	1500 rpm
Transmission Clutches — (At idle rpm in all speed ranges, both forward and reverse.)	240 min./ 280 max. psi	240 min./ 280 max. psi
Transmission Lubricating — (Maximum at maximum rpm.)	25 psi	25 psi

*Note: All hydraulic pressure checks should be made with converter oil at operating temperature, approximately 180°F. to 200°F. and hydraulic system oil at 150°F. minimum.

FUEL SPECS — (All Models)

Fuel Oil ..... No. 2 Diesel, Cetane 40 minimum.

BRAKE FLUID SPECS — (All Models)

SAE J-1703 (70 R3) ..... Clark 850487.

TIRE DATA AND HYDROINFLATION

TIRE DATA

MODEL	SIZE	PLY RATING	INFLATION PSI FRONT	INFLATION PSI REAR	TYPE
175	26.5-25	16	45	45	Rock
175	26.5-25	20	45	45	Rock

Note: Other tire options available.

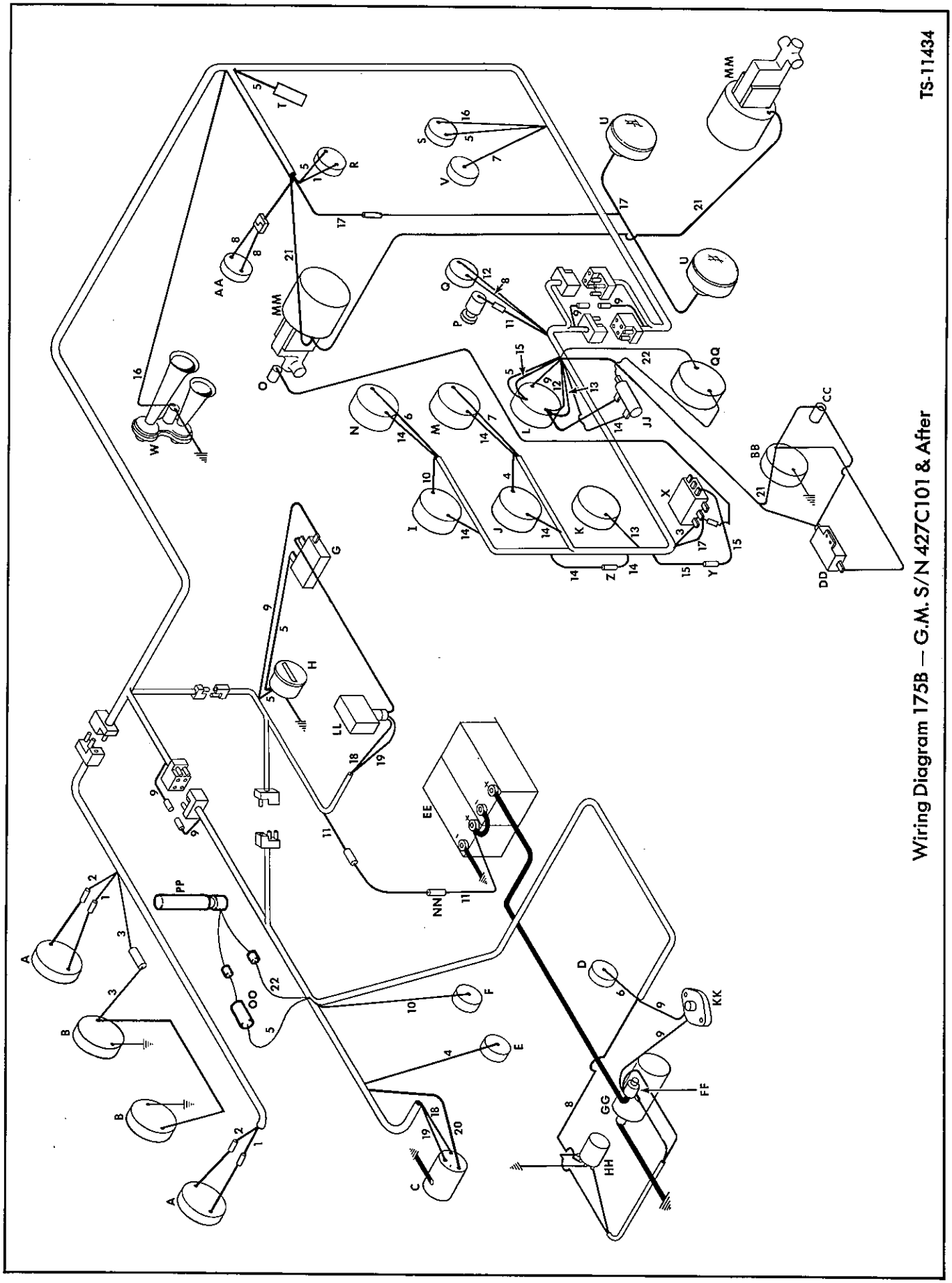
HYDROINFLATION DATA

The following table indicates the amount of calcium chloride and water which may be added to tires where increased weight and tractive ability are desired.

TIRE SIZE	USE $CACL_2$ (POUNDS)	DISSOLVE IN WATER (GALLONS)	TOTAL GALLONS SOLUTION	WEIGHT INCREASE EACH TIRE (POUNDS)
26.5-25	428	123	143	1450

The solution indicated above, when using a commercial calcium chloride flake of 77-80%, should protect the tire against freezing down to 30°F. below zero. Solution strength can be tested with a battery hydrometer. Reading at 60°F. should be 1218.

It is recommended that the rear tires be hydro-inflated to the above table if optional counterweight is not used. It is not permissible to use both hydroinflation and optional counterweight.

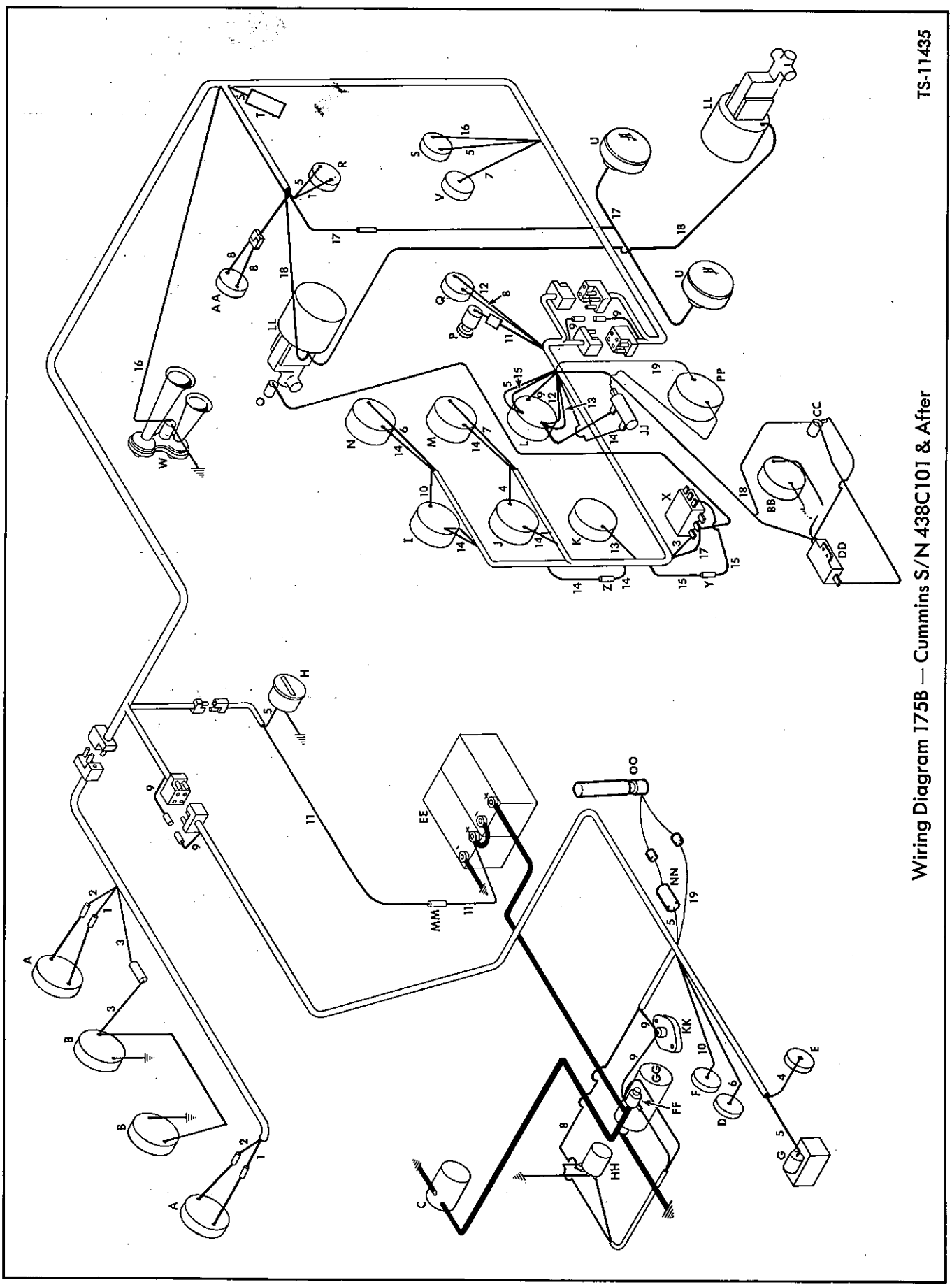

TS-11434
Wiring Diagram 175B — G.M. S/N 427C101 & After

COLOR CODE REFERENCE CHART FOR USE WITH TS-11434

Ref. No.	Color	Color Code
1.	Tan	Stop Lights to Stop Light Switch
2.	Yellow	Tail Lights to Instrument Panel Plug (Joins Pink)
3.	Dark Blue	Back-Up Lights to Light Switch
4.	Brown	Engine Temp. Sender to Engine Temp. Gauge
5.	Red & White	Ignition Switch to Hourmeter Relay, Hourmeter, Switches & Ether Injector
6.	Dark Green	Engine Oil Press. Sender to Engine Oil Press. Gauge
7.	Light Green	Air Press. Sender to Air Press. Gauge
8.	White	Starter Button to Neutral Start Switch to Starter Relay
9.	Red	Ignition Switch to Circuit Breaker to Hourmeter Relay & Starter Solenoid
10.	Grey	Converter Temp. Sender to Converter Temp. Gauge
11.	Orange	Battery to 10 Amp. Fuse to Lighter
12.	Black	Ignition Switch to Starter Button
13.	Purple & White	Ignition Switch to Voltmeter
14.	Purple	Ignition Switch to Resistor to ¾ Amp. Fuse to Gauges
15.	Violet	Ignition Switch to 20 Amp. Fuse to Light Switch
16.	Light Blue	Horn Switch to Horn
17.	Pink	Light Switch to Head Lamps (Joined by Yellow at Instrument Panel Plug)
18.	Brown & White	Alternator Terminal (Neg.) to Voltage Regulator
19.	Lt. Blue & White	Alternator Terminal (Top) to Voltage Regulator
20.	Red & Black	Alternator Terminal (Pos.) to Splice (Item 9 Red)
21.	Purple	Brake Power Clusters to Brake Low Press. Sender to Warning Light & Buzzer
22.	Brown & White	Quick Start Button to 15 Amp. Fuse to Ether Injector

175 B — G.M.

A — Stop & Tail Lights
B — Back-Up Lights
C — Alternator (See MM)
D — Engine Oil Press. Sender
E — Engine Temp. Sender
F — Converter Temp. Sender
G — Hourmeter Relay
H — Hourmeter
I — Converter Temp. Gauge
J — Engine Temp. Gauge
K — Voltmeter
L — Ignition Switch
M — Air Press. Gauge
N — Engine Oil Press. Gauge
O — Dash Lamp
P — Lighter
Q — Starter Button
R — Stop Light Switch
S — Horn Switch
T — Heater Connector
U — Head Lights
V — Air Press. Sender
W — Horn
X — Light Switch
Y — 20 Amp. Fuse
Z — ¾ Amp. Fuse
AA — Neutral Start Switch
BB — Brake Low Press. Sender
CC — Warning Light
DD — Buzzer
EE — Batteries
FF — Starter Solenoid
GG — Starter
HH — Starter Relay
JJ — Resistor
KK — Circuit Breaker
LL — Voltage Regulator
MM — Brake Power Clusters
NN — 10 Amp. Fuse
OO — 15 Amp. Fuse
PP — Ether Injector
QQ — Quick Start Button


TS-11435
Wiring Diagram 175B — Cummins S/N 438C101 & After

COLOR CODE REFERENCE CHART FOR USE WITH TS-11435

Ref. No.	Color	Color Code
1.	Tan	Stop Lights to Stop Light Switch
2.	Yellow	Tail Lights to Instrument Panel Plug (Joins Pink)
3.	Dark Blue	Back-Up Lights to Light Switch
4.	Brown	Engine Temp. Sender to Engine Temp. Gauge
5.	Red & White	Ignition Switch to Hourmeter, Fuel Solenoid, Switches & Ether Injector
6.	Dark Green	Engine Oil Press. Sender to Engine Oil Press. Gauge
7.	Light Green	Air Press. Sender to Air Press. Gauge
8.	White	Starter Button to Neutral Start Switch to Starter Relay
9.	Red	Ignition Switch to Circuit Breaker to Starter Solenoid
10.	Grey	Converter Temp. Sender to Converter Temp. Gauge
11.	Orange	Battery to Lighter
12.	Black	Ignition Switch to Starter Button
13.	Purple & White	Ignition Switch to Voltmeter
14.	Purple	Ignition Switch to Resistor to ¾ Amp. Fuse to Gauges
15.	Violet	Ignition Switch to 20 Amp. Fuse to Light Switch
16.	Light Blue	Horn Switch to Horn
17.	Pink	Light Switch to Head Lamps (Joined by Yellow at Instrument Panel Plug)
18.	Purple	Brake Power Clusters to Brake Low Press. Sender to Warning Light & Buzzer
19.	Brown & White	Quick Start Button to 15 Amp. Fuse to Ether Injector

175 B — Cummins

A — Stop & Tail Lights
B — Back-Up Lights
C — Alternator
D — Engine Oil Press. Sender
E — Engine Temp. Sender
F — Converter Temp. Sender
G — Fuel Solenoid
H — Hourmeter
I — Converter Temp. Gauge
J — Engine Temp. Gauge
K — Voltmeter
L — Ignition Switch
M — Air Press. Gauge
N — Engine Oil Press. Gauge
O — Dash Lamp
P — Lighter
Q — Starter Button
R — Stop Light Switch
S — Horn Switch
T — Heater Connector
U — Head Lamps
V — Air Press. Sender
W — Horn
X — Light Switch
Y — 20 Amp. Fuse
Z — ¾ Amp. Fuse
AA — Neutral Start Switch
BB — Brake Low Press. Sender
CC — Warning Light
DD — Buzzer
EE — Batteries
FF — Starter Solenoid
GG — Starter
HH — Starter Relay
JJ — Resistor
KK — Circuit Breaker
LL — Brake Power Clusters
MM — 10 Amp. Fuse
NN — 15 Amp. Fuse
OO — Ether Injector
PP — Quick Start Button

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