MICHIGAN

OPERATORS MANUAL

No. 2115

MODEL 55 III

TRACTOR SHOVEL

Information contained herein pertains to Machine Serial Numbers listed below:

55 III G. M. — 6BG 101 thru 6BG 999

55 III Waukesha — 6BA 101 thru 6BA 999

Data covering Machine Serial Ranges prefixed with designations 7BG, 8BG, 7BA, 8BA, etc. will be found contained in Supplements at rear of this Manual.

ALWAYS GIVE SERIAL NUMBER OF MACHINE WHEN ORDERING PARTS

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

Machine Serial_

Engine Model_

Engine Serial_

CLARK EQUIPMENT

CLARK EQUIPMENT COMPANY
Construction Machinery Division
BENTON HARBOR, MICHIGAN, U.S.A.
In Canada: Canadian Clark, Ltd., St. Thomas, Ontario

MICHIGAN

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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
Construction Machinery Division
BENTON HARBOR, MICHIGAN, U.S.A.

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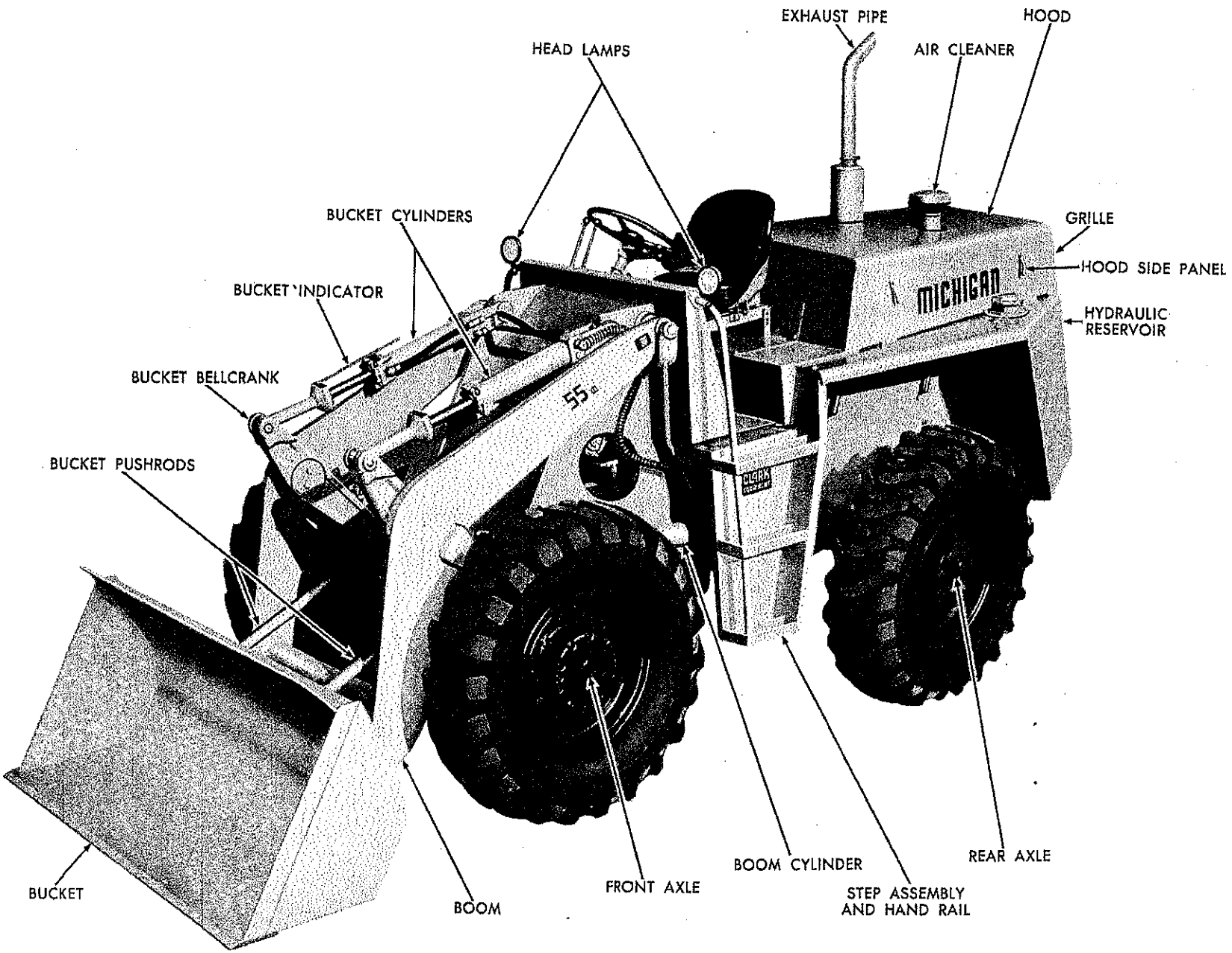


MODEL 55 III TRACTOR SHOVEL

TS-6911

GENERAL DESCRIPTION

MICHIGAN 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 having a 3.0-1 torque multiplication factor, to a power shifted, four speed, full reversing type transmission, to the axle assemblies. Universal slip-joint drive shaft assemblies are used between power transfer units.

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

The tractor shovel has four speeds in both forward and reverse. Effortless hydraulic power steering is provided, utilizing two double acting steering cylinders, one at each rear wheel.

Service brakes at each wheel are hydraulic actuated power assisted by a vacuum booster, with a cable controlled mechanical parking brake mounted on propeller shaft on rear driveline.

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

For more complete specifications refer to Specifications and Service Data on Page 52 of this manual.

DATA PLATES

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

MACHINE SERIAL NUMBER PLATE

The machine serial number plate is mounted at left rear side of operator's compartment on cockpit panel, giving model number and serial number of machine. See Figure 1. Serial number of machine also is stamped in one-half inch numerals on right-hand upper pivot assembly.

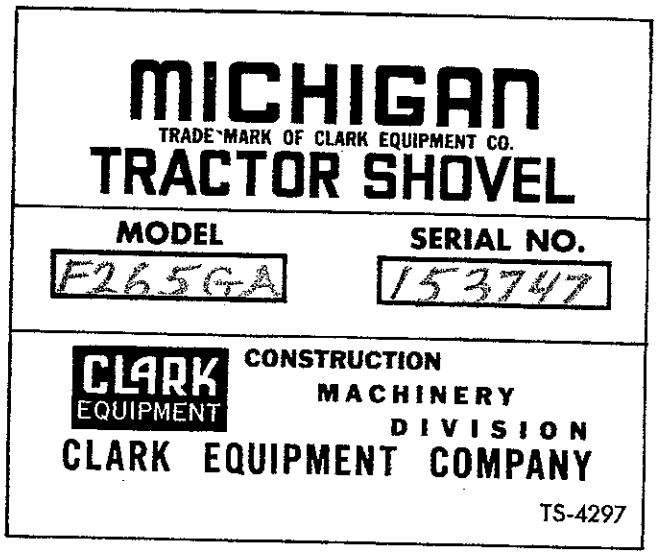


Fig. 1. Machine Serial Number Plate

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

TRANSMISSION OR TORQUE CONVERTER SERIAL NUMBER PLATE

The transmission serial number plate is located on left front side of transmission. The torque converter serial number plate is located on right side of 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 2.

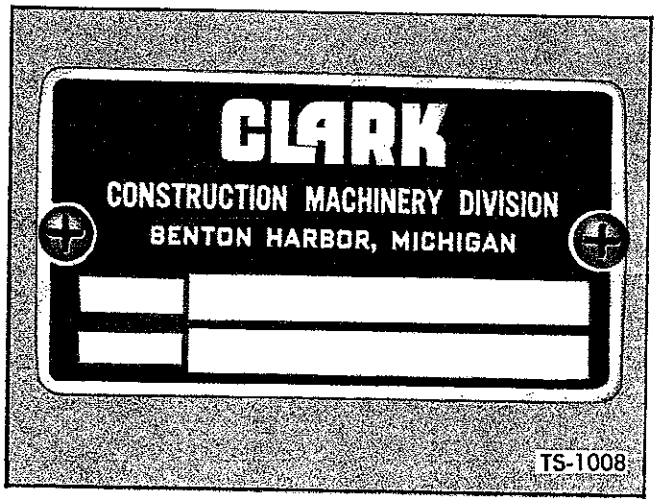


Fig. 2. Torque Converter or Transmission Serial Number Plate

LUBRICATION INSTRUCTIONS

ITEM	SHOVEL	DOZER	SCRAPER	CHECK	CHANGE	LUBRICANT
FRONT AXLE DIFFERENTIAL	X	X	X	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL
REAR AXLE DIFFERENTIAL	X	X	—	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL
FRONT AXLE PLANETARY HUBS	X	X	X	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL
REAR AXLE PLANETARY HUBS	X	X	—	50 HRS.	1000 HRS. - 6 MO.	SAE 90 EPGL
REAR AXLE WHEEL BEARINGS	—	—	X	—	1000 HRS. - 6 MO.	WB
REAR AXLE WHEEL BRGS. & CENTER STEER ARM BRGS. (Non-Driving Axles)	X	—	—	—	1000 HRS. - 6 MO.	WB
TORQUE CONVERTER & TRANSMISSION	X	X	X	8 HRS.	500 HRS.	HF
HYDRAULIC RESERVOIR	X	X	X	8 HRS.	1000 HRS.	HF
HYDROVAC	X	—	—	—	1000 HRS.	VCO
STEERING GEAR	X	X	X	50 HRS.	—	SAE 90 GL
FAN DRIVE GEAR BOX (Where Applicable)	—	X	—	50 HRS.	1000 HRS. - 6 MO.	SAE 90 GL
BUCKET LEVELER MASTER CYLINDER	X	—	—	50 HRS.	—	HF
BOOM POSITIONER MASTER CYL. (Optional)	X	—	—	50 HRS.	—	HF
BRAKE MASTER CYLINDER (Hydraulic & Air Over Hydraulic Brakes)	X	—	—	50 HRS.	—	BF
BRAKE MASTER CYLINDER AIR CHAMBER (Air Over Hydraulic Brakes)	X	—	—	—	1000 HRS.	HF
CONVERTER & TRANSMISSION OIL FILTER(S)	X	X	X	—	250 HRS.	—
STEERING SYSTEM OIL FILTER(S)	X	X	X	—	250 HRS.	—
ALL GREASE FITTINGS EXCEPT:	X	X	X	—	8 HRS.	LBG
PROPELLER SHAFT FITTINGS	X	X	X	—	100 HRS.	LBG
BRAKE CAMSHAFT FITTINGS	X	X	X	—	50 HRS.	LBG
HYDRAULIC SYSTEM BREATHER	X	X	X	REMOVE, CLEAN & REPLACE EVERY 50 HRS.		
TRANSMISSION BREATHER	X	X	X	REMOVE, CLEAN & REPLACE EVERY 50 HRS.		
AIR CLEANER(S)	X	X	X	SERVICE EVERY 8 HRS. OR OFTENER AS REQUIRED. SEE OPERATORS MANUAL FOR DETAILED INSTRUCTIONS		
ENGINE, FUEL & OIL FILTERS & ACCESSORIES	X	X	X	SEE ENGINE OPERATORS MANUAL FOR INSTRUCTIONS		

LUBRICANT KEY

LBG	LITHIUM BASE MULTI-PURPOSE GREASE 0°F & ABOVE — GRADE 2 BELOW 0°F — GRADE 0
EPGL	EXTREME PRESSURE GEAR LUBE — SCL TYPE
GL	STRAIGHT MINERAL OIL GEAR LUBE
BF	SAE 70R3, CLARK NO. 850487
WB	WHEEL BEARING GREASE
VCO	BENDIX VACUUM CYLINDER OIL

HF

AMBIENT TEMPERATURE RANGE	LUBRICANT TO BE USED		
	SAE GRADE	API CLASS	MILITARY SPECIFICATION
ABOVE 0°F 1)	10W	§MS DM	MIL-L-2104A, SUPP. 1 OR NEW MIL-L-2104B
ABOVE 0°F 2)	TYPE A, SUFFIX A, AUTOMATIC TRANSMISSION FLUID		
0°F & BELOW	TYPE A, SUFFIX A, AUTOMATIC TRANSMISSION FLUID		

§Sequence Tested

SEE APPLICABLE OPERATORS MANUAL FOR DETAILED INSTRUCTIONS

MICHIGAN

CLARK EQUIPMENT COMPANY
Construction Machinery Division
PIPESTONE ROAD, BENTON HARBOR, MICHIGAN, U. S. A.
in Canada: Canadian Clark, Ltd., St. Thomas, Ontario

TS-6813

Fig. 3. Lubrication Instruction Plate

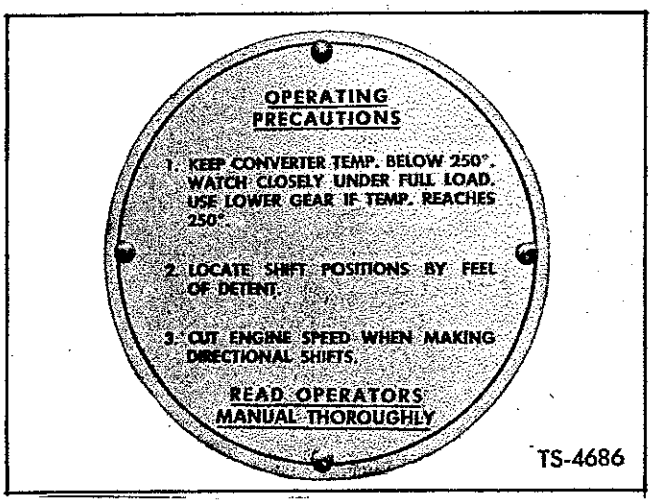


Fig. 4. Operating Precaution Plate

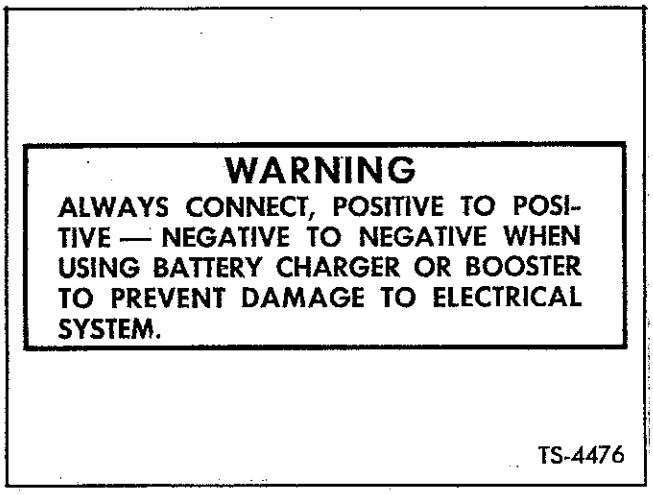


Fig. 5. Safety Wiring Decal

LUBRICATION INSTRUCTION PLATE

The lubrication instruction plate as shown in Figure 3 is located at right rear side of operator's compartment on cockpit panel. This plate 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, capacities and detailed instructions pertaining to lubrication.

OPERATING PRECAUTION PLATE

The operating precaution plate as shown in Figure 4 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.

SAFETY WIRING DECAL

The safety wiring decal as shown in Figure 5 is located on right front panel in operator's compartment. This indicates that 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.*

NOTES

PREPARATION FOR OPERATION

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

Refer to the Lubrication Charts to locate items referred to 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 steer axle differential
   f. Rear drive steer axle planetary hubs
   g. Hydraulic system reservoir
   h. Steering gear
   i. Brake master cylinder

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 battery that plates are covered with water. Add only clean distilled water.

5. Check fuel level in tank. Handle fuel in clean containers. Use No. 2 Diesel fuel oil, Cetane 40 minimum for G.M. Diesel engines. For gasoline engines use gasoline of 75 Octane rating or higher.

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. See Specifications Section for proper air pressure. 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, type and quantity of lubricant.

NOTES

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 familiarity with the machine and its operation.

The terms "right-hand" and "left-hand" referred to below are determined by sitting in the operator's seat and facing toward front of machine.

INSTRUMENTS AND SWITCHES

All instruments and switches with the exception of the hour meter and foot operated horn switch are conveniently located on instrument panel at left front side of operator's compartment. The hour meter is bracket mounted inside the engine compartment on engine firewall at left side of machine. 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 6 and 7 give identification of instruments and switches.

FRONT 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 cooling system. When temperature lowers, shut down engine and trouble shoot 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, gauge pressure is as follows.

	Idle	Governed RPM
G.M. Diesel	11 psi. min.	Approx. 45 psi
Waukesha Gas	15 psi. min.	Approx. 40 psi

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. Gauge should read between 90 and 105 psi. Never operate machine with less than 60 psi pressure.

Torque Converter Temperature Gauge indicates 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.

Ammeter shows current flow to and from battery. Electrical current going from alternator to battery registers on the charge (+) side. Gauge will show discharge (—) when more electrical energy is being consumed than received from alternator.

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, head lights and tail lights in first position, with addition of back-up lights in second position. Pull switch to operate.

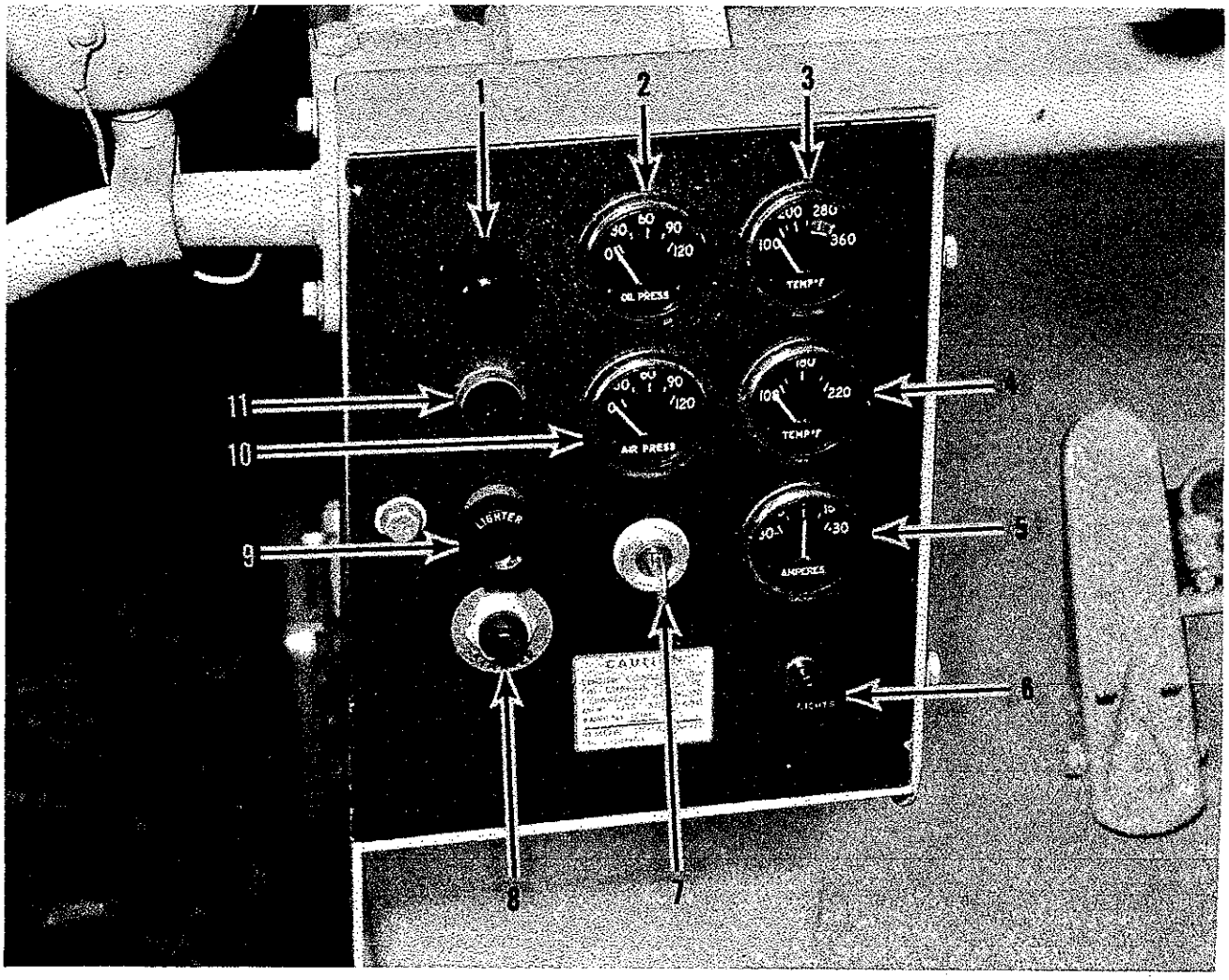
Starter Switch energizes cranking motor to start engine. Press to operate; release when engine starts. Do not crank engine continuously for more than 30 seconds to avoid damage to cranking motor. Pause a few minutes between cranking cycles, if difficulty is encountered, to let windings cool. See Starting Procedure on Page 12.

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

Reservoir Filter Warning Light – continued illumination of the warning light is an indication that the filter element located inside the hydraulic reservoir is excessively plugged with foreign material and must be cleaned.

FRONT FLOORBOARD

Horn Switch is located on left side of front floorboard and is foot operated. Machine is equipped with an electric horn.



1. Dash Lamp
2. Engine Oil Pressure Gauge
3. Torque Converter Temperature Gauge
4. Engine Temperature Gauge
5. Ammeter
*6. Starter Switch
7. Ignition Switch
*8. Light Switch
9. Lighter
10. Air Pressure Gauge
11. Reservoir Filter Warning Light

*Starter and light switch positions are reversed on some machines. Refer to wiring diagrams.

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Fig. 6. Instrument Panel

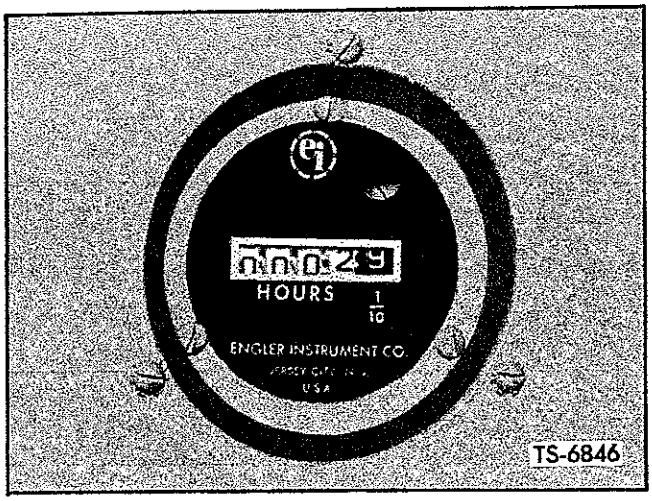


Fig. 7. Hour Meter

ENGINE COMPARTMENT

Hour Meter is bracket mounted inside the engine compartment on engine firewall at left side of machine. The hour meter indicates working time of machine in hours and tenths of an hour. Use this gauge to schedule lubrication and maintenance periods.

Choke Control Knob – Waukesha Gas is located on right side of operator. Choke regulates fuel-air mixture entering engine for easier starting and smoother running of a cold engine during the warm up period. Pulling choke control knob out restricts air, resulting in rich mixture. Choke should be used only in cold weather. When engine runs smoothly, discontinue use of choke.

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. Move lever on left-hand side of seat forward, and shift seat to desired position.

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

Refer to Figure 8 for location and identification of operating controls.

Directional Shift Lever is 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 bottom lever on steering column. This lever provides three positions, LO, NEUTRAL and HI to control travel speed of the machine. Pushing lever into forward position engages LO speed range; pulling lever into the rear position engages HI speed range. Lever is in NEUTRAL when in its central position.

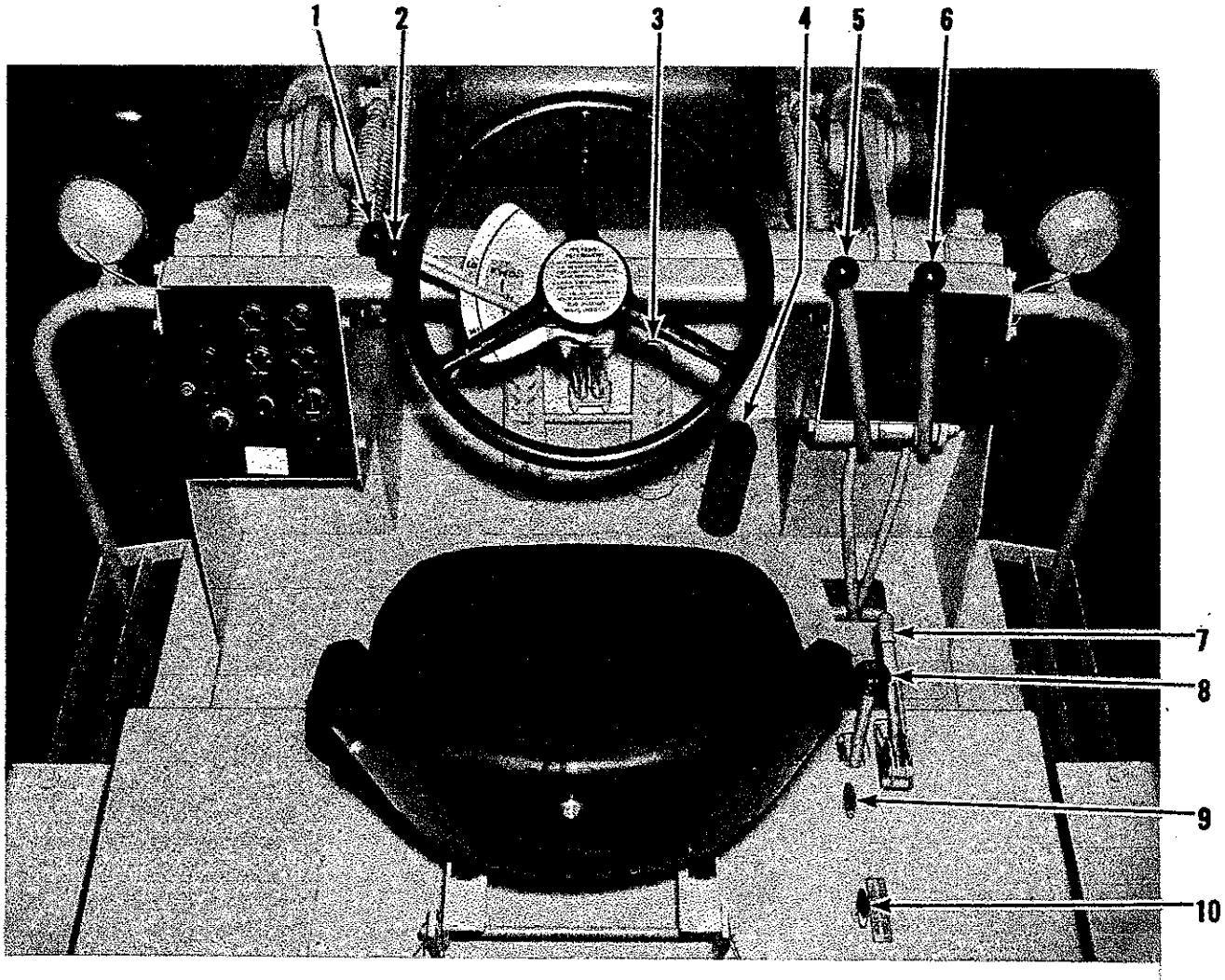
Speed range lever and range shift lever make available to the operator a choice of four speed ranges, providing selective power requirements for any operating condition. First and second speed ranges are obtained by shifting speed range lever into LO and HI when range shift lever is in WORKING RANGE; third and fourth are obtained by shifting into LO and HI with range shift lever in TRAVEL RANGE. See chart below.

Speed Range	Speed Range Lever	Range Shift Lever
1st	LO	WORKING RANGE
2nd	HI	WORKING RANGE
3rd	LO	TRAVEL RANGE
4th	HI	TRAVEL RANGE

Speed range and directional shift levers are so arranged that it is convenient to load in LO range FORWARD, and back away from pile in HI range REVERSE by gripping both levers at the same time. HI range should always be used when traveling machine for comparatively long distances without a load.

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 when shifting



1. Directional Shift Lever
2. Speed Range Lever
3. Brake Pedal
4. Accelerator Pedal
5. Bucket Control Lever
6. Boom Control Lever
7. Parking Brake Lever
8. Range Shift Lever
9. Engine Fuel Shut-Off Control (G.M. Diesel)
10. Engine Emergency (Air) Shut-Off Control (G.M. Diesel)

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Fig. 8. Operating Controls

into HI speed range, and accelerate slightly when shifting into LO speed range.

Range Shift Lever is inner lever at right side of operator on seat support plate. This lever provides three positions, WORKING RANGE, NEUTRAL and TRAVEL RANGE to control high and low range of the transmission. Pushing lever into forward position engages WORKING RANGE (transmission low range). Pulling lever into the rear position engages TRAVEL RANGE (transmission high range). Lever is in NEUTRAL when in its central position.

Range shift lever and speed range lever make available to the operator a choice of four speed ranges providing tractive power requirements for any operating condition. HI or LO speed can be selected in both WORKING RANGE and TRAVEL RANGE.

WORKING RANGE should always be used when loading and dumping bucket. TRAVEL RANGE should always be used when driving machine from job site to job site; or from one portion of the job to another without a load.

Shifting from WORKING RANGE to TRAVEL RANGE or vice versa should be performed when machine is stationary, and with speed range and directional levers in NEUTRAL.

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. Each position can be distinctly felt by the operator as lever is moved.

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

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

To lower boom and bucket, push lever forward one notch ahead of HOLD position, to DOWN PRESSURE position. Placing boom lever in this position will lower boom and bucket and provide penetration to dig below grade level.

Pushing lever all the way forward into detent located FLOAT position permits hydraulic oil to pass from the bottom of boom cylinders, through the control valve and into the top of the cylinders, keeping them free of air, and allowing the bucket to move freely following variations in grade level for back-dragging.

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

Bucket Control Lever is inner lever on right hand side of operator. This lever has three positions: HOLD, CLOSE and DUMP to control bucket operation.

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

To CLOSE bucket, pull lever backward into a detent position. Release lever and it will return to HOLD position, allowing bucket to remain in closed position.

Bucket may be stopped and held in any position of its dumping arc by releasing lever for return to HOLD (neutral) position.

Engine Fuel Shut-Off Control - G.M. Diesel is forward T-handle located at right side of operator. This control is used for normal engine shut down. After turning ignition switch off, pulling T-handle will manually position the injector racks in the no fuel position to shut down the engine.

Engine Emergency (Air) Shut-Off Control - G.M. Diesel is rear T-handle located at right side of operator. This control should be used only in an emergency or if normal shut down procedure fails to shut down the engine. Pulling T-handle will immediately cut off engine air supply at the air intake housing thus stopping the engine.

Note: *Replace engine emergency (air) shut-off control in its original position and manually reset the latch assembly after each use at the air intake housing before attempting to restart the engine.*

Parking Brake Lever applies brake on rear

drive line. To set brake pull up and back on lever. To release brake push lever forward and down.

Accelerator Pedal increases fuel supply to engine thus increasing its rpm.

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.

NOTES

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.

The following are a few of the primary sources of injury to operators and other 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 and speed range shift levers 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 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 off or on 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 and turn off ignition switch.

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 into motion.

Keep Brakes Properly Adjusted: At first signs of brake slippage, stop machine and adjust them promptly.

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 PROCEDURE

PRE-STARTING CHECKS

Before starting engine at beginning of the 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 level (maintain level between check plugs)
7. Tire pressures

Service units at this time if inspection indicates the necessity.

NORMAL STARTING

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

G.M. Diesel (Above 40°F.)

1. Set shift quadrant levers (directional and speed range) 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 the 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 off engine and determine cause.
5. Allow engine to reach operating temperature before driving machine.

Waukesha Gas (Above 40°F.)

1. Set shift quadrant levers (directional and speed range) 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, 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.*

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

MICHIGAN machines do not require extensive 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 boom and bucket system to Type "A", Suffix A, Automatic Transmission Fluid will aid starting by reduction of resistance in the boom and bucket 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 of a battery 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 more inefficient. 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 material into cells.
4. Check specific gravity regularly with a hydrometer, and recharge or replace batteries that continually show 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 connections on cranking motor, alternator, voltage regulator, solenoid switch, magnetic switch, ignition coil, ignition distributor, relays and sender units.
3. Clean and tighten external ground straps, and replace if badly frayed or corroded.
4. Clean and regap spark plugs, replacing those having cracked or chipped porcelain, or loose center electrodes.
5. Replace points and condenser in ignition distributor, and check for proper operation of automatic advance mechanism.
6. Check high tension leads between coil, distributor and spark plugs. Replace leads that are cracked or deteriorated, or show other signs of leakage.
7. Check ignition coil for opens or shorts, and replace if defective.

To avoid unnecessary cranking because of air locks in cold fuel oil, change fuel filters only when engine is hot; then start and run engine after filter change, and check that there is no fuel restriction nor 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.

Cold starting procedure for the various makes of engines is as follows, after first placing all control levers in their NEUTRAL position.

If difficulty is experienced in starting engines, please refer to Operator's Manual of respective engine manufacturer for further trouble shooting procedures.

G.M. Diesel (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 stops 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.

Waukesha Gas (When Colder Than 40°F.)

1. Set all control levers in NEUTRAL position and turn ignition switch ON.
2. Depress accelerator to full throttle position.
3. Press starter switch and pull choke control knob out simultaneously to enrich fuel-air mixture entering the engine.

   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 stops 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.
6. Release choke control knob when engine runs smoothly.

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 minute perform the following checks:

1. Engine oil pressure gauge
2. Ammeter
3. Air pressure gauge
4. Engine temperature gauge
5. Fuel gauge
6. Torque converter temperature gauge
7. Horn
8. Lights
9. 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 the 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 lists above. Service units at this time if inspection indicates the necessity.

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 evaporation of the lighter ends. 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.

G.M. Diesel

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

Waukesha Gas

A Waukesha gas engine can be shut down completely by turning the ignition switch OFF.

OPERATING TRACTOR SHOVEL

The steps below give proper procedure for setting machine into motion. Refer to Operating Controls Diagram, Figure 9.

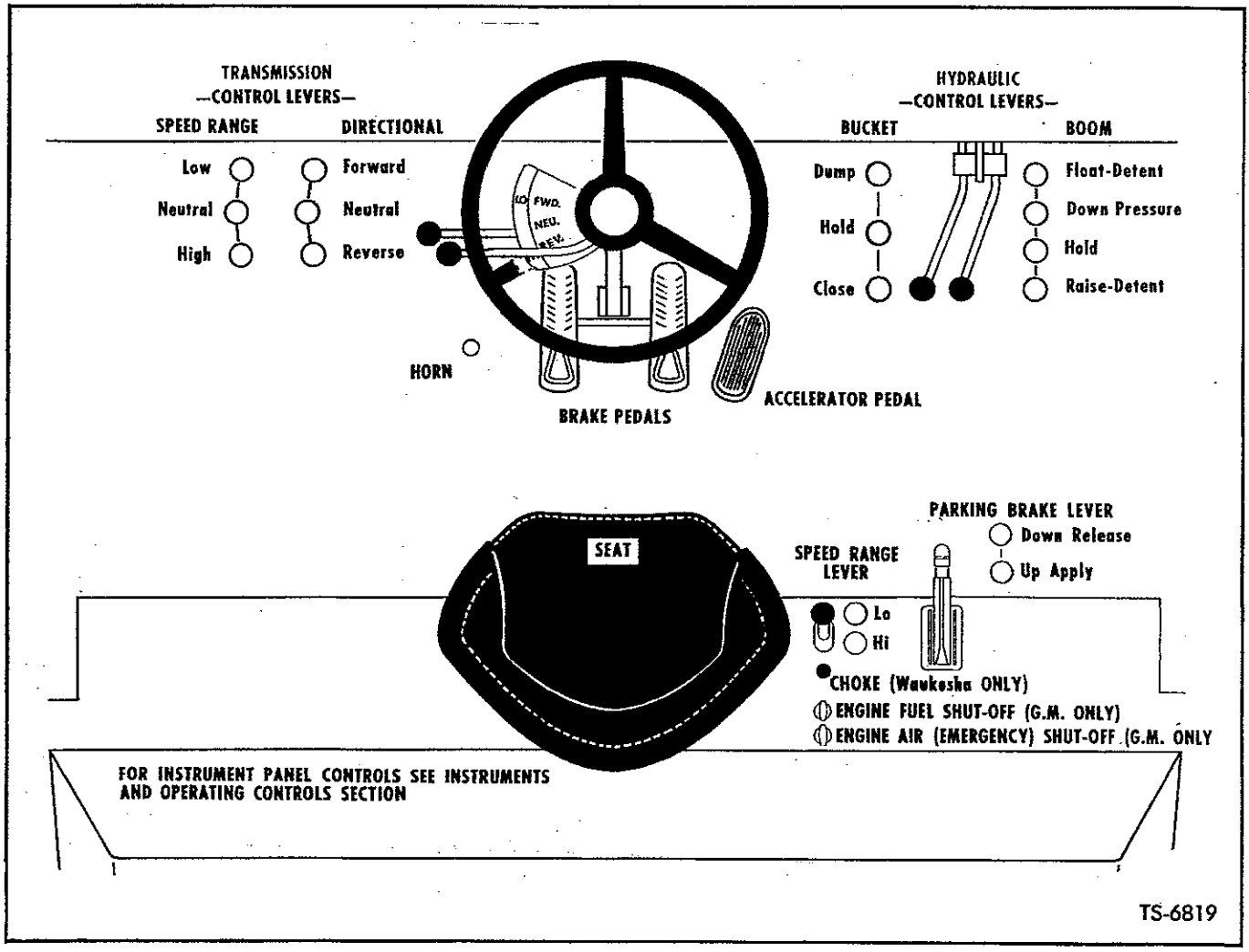


Fig. 9. Operating Controls Diagram

1. Raise boom and bucket approximately 15 inches above ground by pulling backward on boom control lever.
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 the shift.
3. Select high or low 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 low range to high 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 downshift, accelerate engine to synchronize engine and drive shaft speeds when transmission clutch re-engages.
4. Select by use of range shift lever the speed range desired – working range for all normal work operations; travel range for moving relatively long distances without load.

   The range shift lever should be shifted only when machine is stationary, and with speed range and directional levers in neutral.

   There are available to the operator a selection of four speeds in both forward and reverse directions. This is accomplished by use of range shift lever and speed range lever. In other words a choice of low or high speed is possible in both working range and in travel range.
5. Release parking brake.
6. Gradually apply pressure on accelerator pedal until desired travel speed is reached.

LOADING THE BUCKET

Place speed range lever in low, directional lever in forward, and range shift lever in working range. With bucket control lever, adjust bucket until indicator on right hand bucket cylinder indicates it is in 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 also be adjusted so that indicator shows it is in level position. Place boom control lever in DOWN PRESSURE position to force bucket cutting edge down 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 prevent 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 gear at about half throttle to make an accurate cut. When bucket is full, or 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 the kind of surface over which the machine must pass. Rough terrain calls for a fairly slow speed. When bucket is full, it should be carried approximately 15 inches off the ground. Never transport load with bucket fully raised. The nearer the ground that bucket is held, the better the stability, especially on slopes or when turning machine.

DUMPING THE BUCKET

Approach truck, railroad car or hopper raising boom until bucket safely clears top edge of

the 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 pressure 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 releasing control lever at any time for spring return 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 position while returning for another load. Stop bucket at carrying height by placing boom control lever in HOLD position. The bucket control lever automatically returns to HOLD (neutral) position.

BACKFILLING AND BULLDOZING

The bucket can be removed and replaced with a dozer blade for bulldozing operations. Use the dozer blade to spread material, strip, level, or to backfill ditches and foundations. Again, one of the slower speed ranges is best when working with a dozer blade, since dozing requires more power and slow speed.

The dozer blade pivots at the same points as the bucket, and may be dumped and retracted similarly. This feature will be helpful when working wet clay or other sticky material.

TRAVELING WITHOUT A LOAD IN BUCKET

When driving machine from job to job, shift into travel range. Shift the speed range lever 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 any time it is necessary to tow the machine any appreciable distance, observe the following precautions:

1. Set all control levers in NEUTRAL.
2. Remove both propeller shafts from the transmission to the axle assemblies.

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 torque 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.

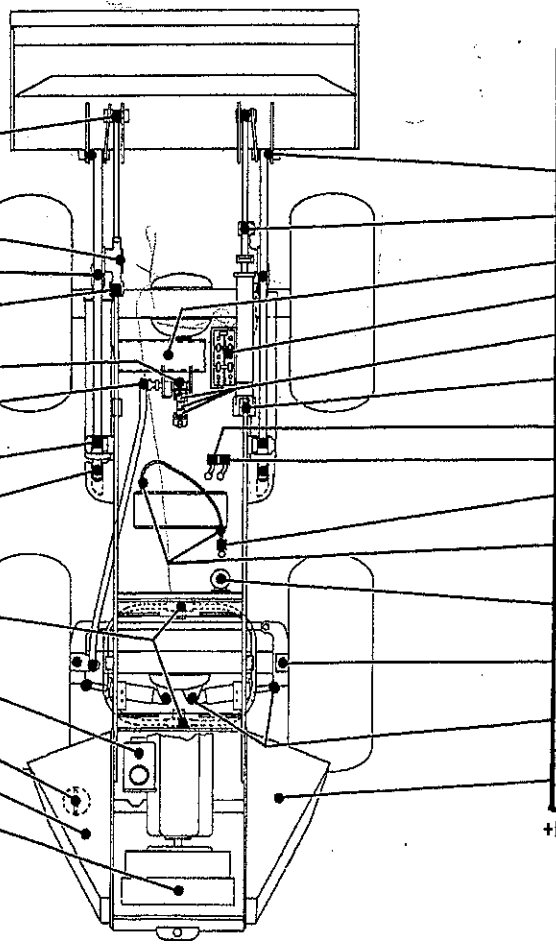
When replacing propeller shaft assemblies use only the special heat treated nuts and bolts provided. Tighten attaching bolts to the torque specified in Bolt Torque Chart, Page 51.

NOTES

MICHIGAN
CHASSIS LUBRICATION

DESCRIPTION	HOURS 500	250	100	50	∞	KEY
1 Fitting Each Side PUSHROD TO BUCKET					X	LBG
BELL CRANK TO BELL CRANK PIVOT CASTING 1 Fitting Each Side					X	LBG
BOOM CYLINDER TO BOOM 1 Fitting Each Side					X	LBG
PUSHROD TO BELL CRANK 1 Fitting Each Side					X	LBG
(See Text) STEERING GEAR				X		GL
STEERING DRAG LINK 1 Fitting Each FRONT & REAR					X	LBG
BOOM TO UPPER PIVOT TUBE 1 Fitting Each Side					X	LBG
BOOM CYLINDER TO LOWER PIVOT TUBE 1 Fitting Each Side					X	LBG
2 Fittings AXLE CRADLE BUSHINGS					X	LBG
(See Text) AIR CLEANER	X		X	X	X	
(See Text) HYDRAULIC SYSTEM FILTER						
HYDRAULIC SYSTEM RESERVOIR (See Text) *(CAP. 45 GAL.)				X	X	HF
*(CAP. 6 GAL. GM) *(CAP. 8 GAL. WAUK.) RADIATOR (See Text)					X	

KEY				
LBG	LITHIUM BASE MULTI—PURPOSE GREASE 0°F. & Above Grade 2 Below 0°F. Grade 0			
GL	SAE-90 STRAIGHT MINERAL OIL			
HF	AMBIENT TEMP RANGE	LUBRICANT TO BE USED SAE GRADE	API CLASS	MILITARY SPEC
	ABOVE 0°F. 1)	10W	†MS DM	MIL-L-2104A, SUPP. 1 OR NEW MIL-L-2104B
	ABOVE 0°F. 2)	TYPE A, SUFFIX A, AUTOMATIC TRANS FLUID		
	0°F. & BELOW	TYPE A, SUFFIX A, AUTOMATIC TRANS FLUID		
	† SEQUENCE TESTED			



KEY	HOURS ∞	50	100	250	500	DESCRIPTION
LBG	X					BOOM TO BUCKET 1 Fitting Each Side
LBG	X					BUCKET CYLINDER TO BELL CRANK 1 Fitting Each Side
	X					AIR RESERVOIR (See Text)
		X				BATTERY (See Text)
LBG			X			STEERING SLIP SHAFT 3 Fittings
LBG	X					BUCKET CYLINDER TO FRAME 1 Fitting Each Side
LBG	X					BUCKET CONTROL LEVER 1 Fitting
LBG	X					BOOM CONTROL LEVER 1 Fitting
LBG		X				+SPEED RANGE LEVER 1 Fitting
LBG		X				SPEED RANGE CONTROL CABLE 2 Fittings (See Text)
				X		TRANSMISSION & TORQUE CONVERTER SYSTEM FILTER (See Text)
LBG					X	STEERING TRUNNION BEARINGS 1 Fitting Each Side
LBG	X					STEERING CYLINDERS 2 Fittings Each Cylinder (See Text)
	X	X				FUEL TANK *(CAP. 45 GAL.)

+NOTE: Some machines not equipped with this feature.

* NOTE: Capacities listed are approximate U.S. measures. Refer to specifications and service data for Metric and Imperial measures.

MODEL - 55III
TRACTOR SHOVEL

TS-6811

MICHIGAN
DRIVE LINE LUBRICATION

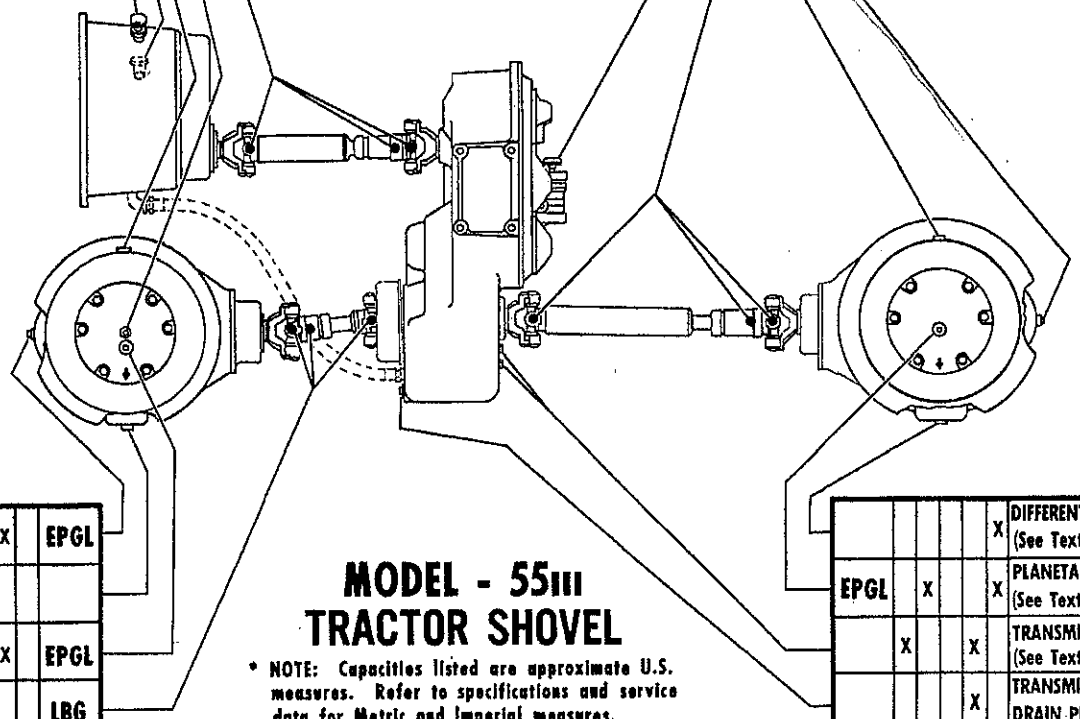
KEY			
LBG	LITHIUM BASE MULTI—PURPOSE GREASE 0°F. & Above Grade 2 Below 0°F. Grade 0		
EPGL	SAE-90 EXTREME PRESSURE GEAR LUBE (**SCL TYPE)		
HF	AMBIENT TEMP RANGE	LUBRICANT TO BE USED	
		SAE GRADE	API CLASS	MILITARY SPEC
	ABOVE 0°F. 1)	10W	†MS DM	MIL-L-2104A, SUPP. 1 OR NEW MIL-L-2104B
	ABOVE 0°F. 2)	TYPE A, SUFFIX A, AUTOMATIC TRANS FLUID		
	0°F. & BELOW	TYPE A, SUFFIX A, AUTOMATIC TRANS FLUID		

† SEQUENCE TESTED

**"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.

DESCRIPTION	HOURS 1000	500	100	50	8	KEY
PROP SHAFT 3 Fittings (See Text)			X			LBG
AXLE BREATHER (See Text)		X				
PLANETARY DRAIN PLUG (See Text)	X					
TRANSMISSION & TORQUE CONVERTER FILL PLUG *(CAP. 4.5 GAL.) (See Text)		X			X	HF
TORQUE CONVERTER BREATHER (See Text)				X		

KEY	HOURS 8	50	100	500	1000	DESCRIPTION
		X				TRANSMISSION BREATHER (See Text)
LBG			X			PROP SHAFT 3 Fittings (See Text)
					X	PLANETARY DRAIN PLUG (See Text)
EPGL		X			X	DIFFERENTIAL FILL & LEVEL PLUG (See Text) *(CAP. 7 QT.)



TS-6812

DIFFERENTIAL FILL & LEVEL PLUG *(CAP. 7 QT.) (See Text)	X			X		EPGL
DIFFERENTIAL DRAIN PLUG (See Text)	X					
PLANETARY FILL & LEVEL PLUG *(CAP. 3 QT. EA.) (See Text)	X			X		EPGL
PROP SHAFT 3 Fittings (See Text)			X			LBG

					X	DIFFERENTIAL DRAIN PLUG (See Text)
EPGL		X			X	PLANETARY FILL & LEVEL PLUG (See Text) *(CAP. 4 QT. EA.)
	X			X		TRANSMISSION LEVEL PLUGS (See Text)
				X		TRANSMISSION & TORQUE CONVERTER DRAIN PLUG (See Text)

MODEL - 55III
TRACTOR SHOVEL

* NOTE: Capacities listed are approximate U.S. measures. Refer to specifications and service data for Metric and Imperial measures.

LUBRICATION AND MAINTENANCE

This section of the manual is divided into two major categories — LUBRICATION and MAINTENANCE.

The LUBRICATION portion contains the Chassis Lube Chart, the Drive Line Lube Chart, and 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 mechanical checks and adjustments over and above those listed in the Lubrication portion.

The maintenance schedule is based on hours of normal operation recorded on the hour meter. 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 the 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 diagrams to locate the various points to be serviced, and recommended lubricant. 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.

When checking various lubricant levels, machine must be level and areas around all fill, level and plug openings cleaned. Systems requiring draining at specific intervals should always be drained after working machine when fluid is at operating temperature. Hot oil flows more freely and carries more foreign material with it.

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 procured from a reliable company.

(a) **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.

(b) **Gasoline Engine:** Use gasoline of 75 Octane rating or higher.

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.).
3. Engine must be IDLING (550 to 600 rpm).
4. Area around transmission check plug openings must be CLEAN.

Refill as necessary adding fluid through the torque converter 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. Bucket must be on GROUND.
3. Engine must be SHUT DOWN.
4. Area around reservoir cap must be CLEAN.

Loosen reservoir cap at left rear 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 to check oil level. Maintain oil level to FULL mark on dipstick.

Refill as necessary adding only premium quality hydraulic oil. Refer to lubrication charts for recommended hydraulic fluid.

See "Every 1000 Operating Hours" for Filter Change.

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 Cylinder: Master cylinder is located at left side of steering gear assembly. Check and maintain fluid level to within ¼ inch from top of reservoir each 50 operating hours.

Battery: 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 at level plug located slightly off center of thrust cap. Fill plug is located on external diameter of hub and drum assembly. Rotate wheel until fill plug is at top center; this will position level plug slightly below center of wheel.

Remove fill plug and add lubricant until level with opening in thrust cap. See "Every 1000 Operating Hours" for Drain and Refill.

Rear Steer 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 Steer Axle Planetary Hubs: Check lubricant level each 50 operating hours at level plug located slightly off center of thrust cap. Fill plug is located on external diameter of hub and drum assembly. Rotate wheel until fill plug is at top center; this will position level plug slightly below center of wheel. The breather in the thrust cap will be on top.

Remove fill plug and add lubricant until level with opening in thrust cap. See "Every 1000 Operating Hours" for Drain and Refill.

Steering Gear: Check oil 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.

SERVICE PERIODICALLY

Check and service the following items at intervals as specified.

(Every 100 Operating Hours)

Propeller Shafts: There are three propeller shafts – one from torque converter to transmission, one from transmission 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 slip yoke assembly. Total 9 points. Use a hand gun and apply grease until it is visible at all four bearing caps on each spider and bearing assembly. Use grade

of lubricant specified on lubrication charts according to ambient temperature.

Steering Slip Shaft: The slip shaft assembly connecting the steering column to the steering gear has 3 points of lubrication – one on each spider assembly, and one on slip yoke assembly. Every 100 operating hours apply grease until it is visible at all four bearing caps on each spider and bearing assembly. Use grade of lubricant specified above 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 a full flow replaceable element type filter assembly. Filter is mounted on bracket located on engine firewall.

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

Replace filter element every 250 operating hours and whenever converter pump, transmission or torque converter is repaired or overhauled for any reason. Thoroughly clean filter case and base casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft. lbs. torque.

Run engine 5 minutes at approximately 1500 rpm checking filter assembly, 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 element is especially designed to withstand pressure and flow rate requirements. Use only replacement filter element called for in applicable parts manual. Use of "will-fit" or substitute element will endanger proper operation of transmission and torque converter and cause costly repairs and down time.*

(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. Remove transmission sump and screen, clean in solvent, dry, and reinstall, using new gaskets. Clean magnetic drain plugs and reinstall.
4. Replace element in transmission and torque converter filter assembly (filter located on bracket on engine firewall). Thoroughly clean filter case and base casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft. lbs. torque.
5. Remove breather caps and elements from front of transmission and 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 filler extension in left side of torque converter case. Refer to lubrication charts for correct fluid. Approximate capacity – 4.5 gallons.
7. Disconnect return oil cooler hose from cooler line (located forward of radiator on right-hand side of machine) and direct open end into waste drum or on the ground. Securely block wheels of machine and apply parking brake. With range shift lever in TRAVEL RANGE, position speed range selector lever in HI speed range and directional shift lever in FORWARD.

8. Start engine and maintain idle speed (550 to 600 rpm) 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 filter assembly, 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 level between the check plugs on front of transmission housing.

This check is to be performed with engine idling (550 to 600 rpm).

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

(Every 1000 Operating Hours)

Radiator: Twice a year, drain, flush and refill cooling system. Add permanent type 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 plugging external core of radiator and blow out with compressed air.

Capacity (approx.) { G.M. Diesel .....6 gals. / Waukesha Gas ....8 gals.

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 actuate bucket to full dump position. **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 at lower front face of reservoir and drain reservoir.
5. Disconnect boom and bucket cylinder hoses at lowest points to drain cylinders.
6. Remove and clean hydraulic reservoir filter assembly as specified under "1000 Hour Maintenance Operations" on Page 44.
7. Remove hand hole cover at lower inside face of reservoir and clean all foreign material from bottom of tank. Remove magnet inside reservoir and clean thoroughly. Replace 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 lubrication charts for recommended fluids.

   Capacity (approx.) .....45 gals.
10. Be sure all control levers are in NEUTRAL position. Start engine and run it at idle speed (550 to 600 rpm) 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 the 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 the 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.

Front 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.

Capacity .....7 qts.

Front Axle Planetary Hubs: Drain planetary hubs every 1000 operating hours through fill and drain plug opening in external diameter of hub and drum assembly.

Rotate wheel until fill and drain plug is at top center; this will position level plug in thrust cap slightly below center of wheel.

Add lubricant recommended on lubrication chart until level with plug opening in thrust cap.

Capacity (each hub) .....4 qts.

Rear Steer 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.

Capacity .....7 qts.

Rear Steer Axle Planetary Hubs: Drain planetary hubs every 1000 operating hours through fill and drain plug opening in external diameter of hub and drum assembly.

Rotate wheel until fill and drain plug is at top center; this will position level plug in thrust cap slightly below center of wheel. The breather in the thrust cap will be on top.

Add lubricant recommended on lubrication chart until level with opening in thrust cap.

Capacity (each hub) .....3 qts.

NOTES

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					
	Clean Air Cleaner Precleaner	●	●	●	●	●	●
	Check Cooling System for Leaks		●	●	●	●	●
	Drain Fuel Tank Sediment		●	●	●	●	●
	Check Antifreeze Protection		●	●	●	●	●
	Tighten Air Cleaner Connections		●	●	●	●	●
	Check and Adjust Belt Tension		●	●	●	●	●
	Clean Air Cleaner Element			●	●	●	●
	Check Engine RPM				●	●	●
	Check Engine Shut-Off Controls					●	●
	Service Air Cleaner Element and Body					●	●
	Clean Radiator Core					●	●
Torque Converter and Transmission System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Torque Converter and Transmission Breathers		●	●	●	●	●
	Check and Adjust Transmission Shift Linkage					●	●
	Check Transmission Clutch and Oil Cooler Pressures					●	●
Boom and Bucket System	Check Hydraulic System for Leaks		●	●	●	●	●
	Adjust Bucket Indicator				●	●	●
	Check Boom and Bucket Pressure					●	●
	Adjust Boom and Bucket Control Levers					●	●
	Check and Repair Bucket Cutting Edge						●
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		●	●	●	●	●
	Check Steering Pressure					●	●
	Adjust Drag Link Ball Joints					●	●
	Check Steer Axle Stops					●	●
	Adjust Steering Gear						●
Brake System	Bleed Air Reservoir	●	●	●	●	●	●
	Check Air Chamber and Lines for Leaks		●	●	●	●	●
	Lubricate Brake Pedal and Roller			●	●	●	●
	Adjust Service (Wheel) Brakes				●	●	●
	Adjust Parking Brake				●	●	●
General Maintenance	Visually Inspect Machine	●	●	●	●	●	●
	Clean Cylinder Rods		●	●	●	●	●
	Adjust Cylinder Packing Glands				●	●	●
	Adjust and Lubricate Operator's Seat				●	●	●
	Tighten Mounting Bolts					●	●
	Steam Clean Machine					●	●
	Clean Hydraulic Reservoir Filter Assembly						●
	Check and Repair Drive Line Noises						●
	Inspect Frame						●

MAINTENANCE

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

Procedures 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**
- **CLEAN AIR CLEANER PRECLEANER**
- **CHECK TIRE PRESSURE AND CASING**
- **BLEED AIR RESERVOIR**
- **VISUALLY INSPECT MACHINE**

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

Clean Air Cleaner: Air cleaner should be serviced as frequently as required dependent upon operating conditions. Certain operating conditions may require servicing air cleaner several times each day.

Determine the service interval by frequent inspection and adjust the cleaning schedule accordingly.

The dry type air cleaner is a dual stage cleaner utilizing a synthetic fiber batt element for the primary or precleaner stage, and a filtronic paper element for the secondary stage. Under normal service the precleaner element is to be replaced at 100 hour intervals, however, under extreme dust conditions it may be necessary to service air cleaner daily or more often as required.

Remove cover and entire element assembly. See Figure 10. Inspect precleaner element for foreign material accumulation. If concentration is not severe, service period can be safely extended.

Check Tire Pressure and Casings: Check air pressure in all tires. See Specifications and Service Data on Page 54 for proper 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.

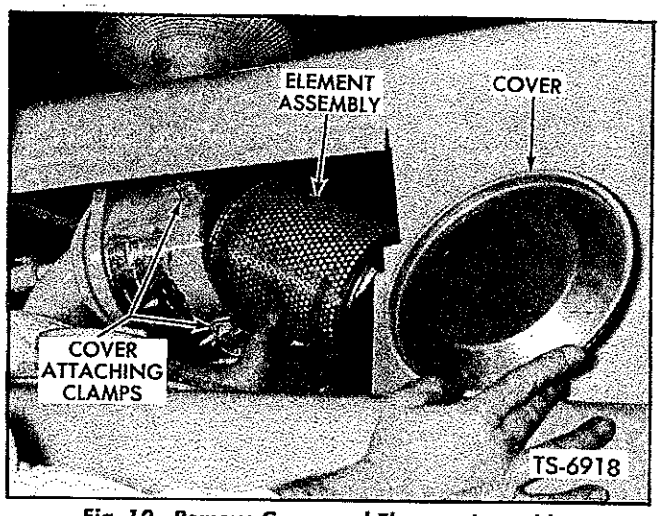


Fig. 10. Remove Cover and Element Assembly

Keep tires free from oil and grease, and repair cuts immediately to prolong tire life. Check tire pressure in the morning when the tires are cold. Do not remove increased pressure caused by operation.

Bleed Air Reservoir: Each day open drain cock at bottom of reservoir and bleed accumulated condensation.

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 and 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 and 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 SYSTEM FOR LEAKS
- CLEAN TORQUE CONVERTER AND TRANSMISSION BREATHERS
- 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 at lower inside face 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.

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 or ball bearing failures, as well as short belt life.

At specified intervals check and retension belts as follows:

1. Measure the span length.
2. At the center of the span, apply force with a spring scale (at right angles to the span) large enough to deflect the belt 1/64 inch per inch of span. Refer to Figure 11.
3. For a properly tensioned drive, the force should be within the listed range. New belts should initially be tensioned to the upper limit of the range. All new belts will loosen after operating for a day or two and must be re-

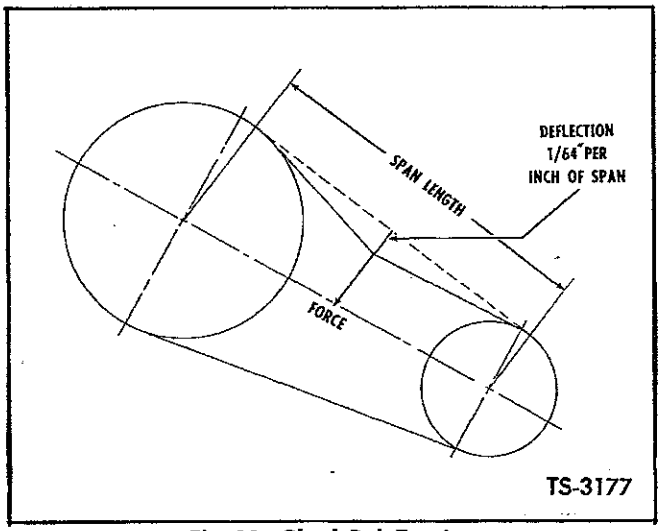


Fig. 11. Check Belt Tension

checked and retensioned if necessary.

Outside Diameter of Small Sheave	Deflection Force
7″ to 11″	8 to 12 lbs.
11½″ to 16″	10 to 15 lbs.

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.

Check Hydraulic System For Leaks: Check oil reservoir, valve, pumps, cylinders, all hydraulic hose lines and connections for leaks, correcting where necessary. Particular attention should be paid to hoses employed 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 Breathers: The torque converter and transmission hydraulic system is equipped with breathers at two points. Breathers are located on right top of torque converter and front face of transmission.

Each 50 operating hours unscrew breathers, 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 provides protection for the lighter element. All fuses are located behind the instrument panel as shown in the Cockpit Wiring Diagrams on Pages 47 and 48.

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.

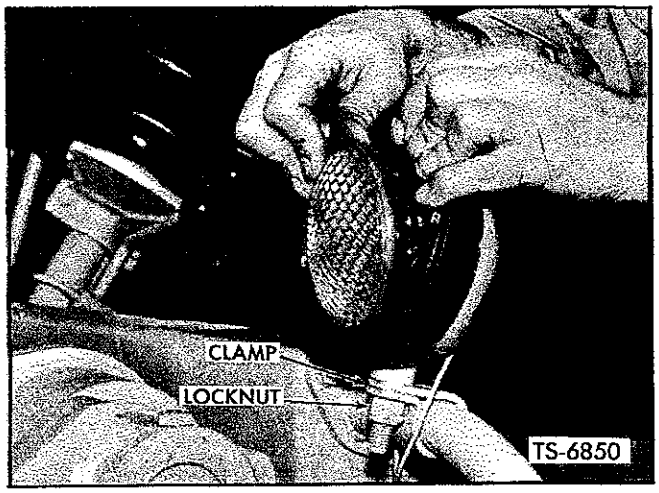


Fig. 12. Replace Headlamps or Back-Up Lamps

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 .. (self contained) 20 Amp

(a) **Headlamps and Back-Up Lamps:** The machine is equipped with four lamps mounted in shock resistant rubber retainers. The headlamps and back-up lamps are floodlamps that disperse light in a horizontal pattern.

Headlamps are set at the factory, but if it is desired to reset beam for personal preference, proceed as follows:

1. Loosen locknut on clamp securing floodlamp to handle assembly as shown in Figure 12.
2. Raise or lower floodlamp as necessary to obtain desired beam, then resecure floodlamp by retightening locknut.

If necessary to replace floodlamps, depress lamp and spread lip of rubber retainer outward forcing lamp out as shown in Figure 12 and disconnect terminals. Reconnect terminals on new lamp and reinstall in retainer.

(b) **Dash, Warning, 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

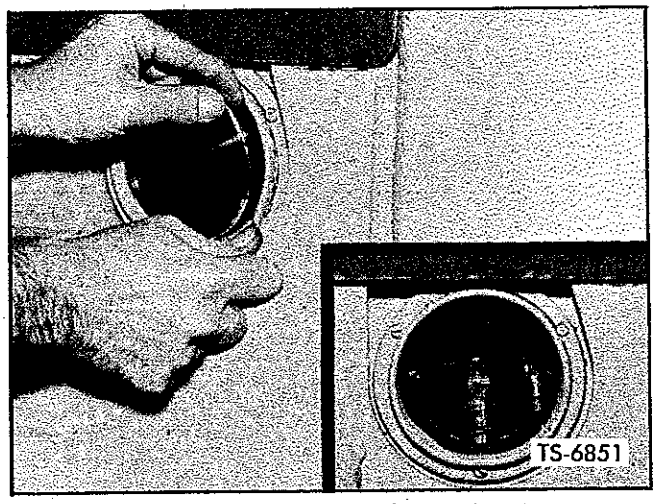


Fig. 13. Remove Reflectors and Replace Tail and Stop Lamps

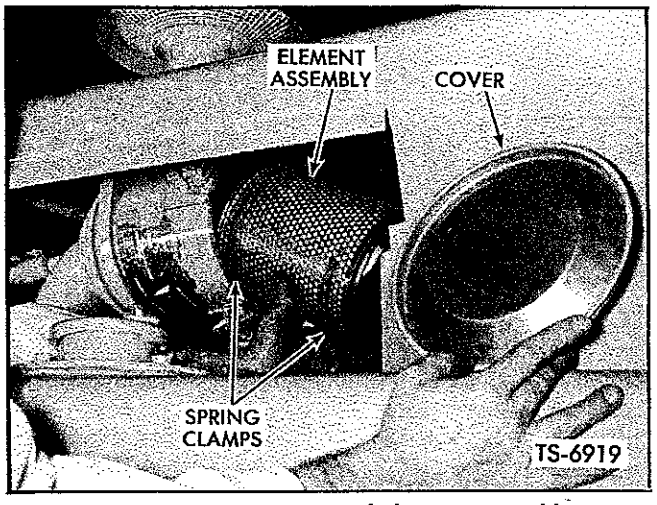


Fig. 14. Remove Cover and Element Assembly

retain. To remove warning lamp reflector from lamp assembly screw out to remove and screw on to retain. Reflectors for the shock mounted tail and stop lights must be removed by spreading the lip of the rubber retainer outward as shown in Figure 13 and carefully forcing the reflectors out. To reinstall reflectors carefully depress reflectors into retainers.

Service Battery: The battery is located in the battery compartment at right side of machine. Keep terminals clean and tight, and be sure that 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** paralleled.
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 effect steering and load distribution. Apply lubricant on threads of wheel studs only and tighten wheel nuts to 175-200 ft. lbs. torque. Do not lubricate the spherical seat or threaded portion of the wheel nuts.

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

Check Air Chamber 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 lines and fittings until leakage is eliminated, as no leakage is permissible.

Clean Cylinder Rods: Wipe boom, bucket and steering rods with clean cloth saturated in hydraulic oil. Check the 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**
- **CLEAN AIR CLEANER ELEMENT**
- **LUBRICATE BRAKE PEDAL AND ROLLER**

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

Clean Air Cleaner Element: Remove cover and entire element assembly. Unhook spring clamps and remove outer shell. Remove and discard pre-

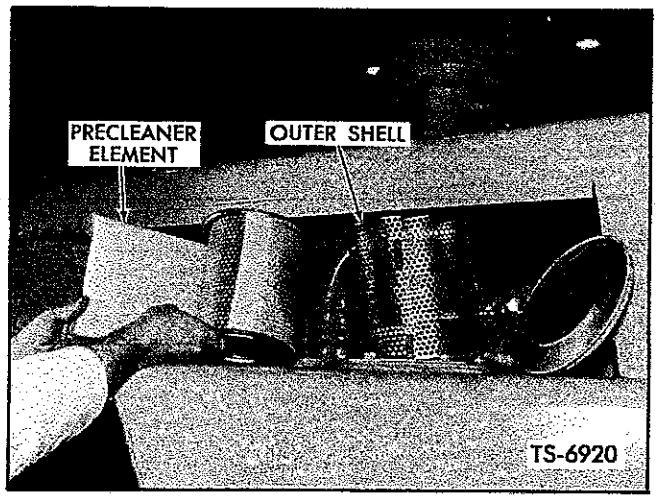


Fig. 15. Remove Precleaner Element

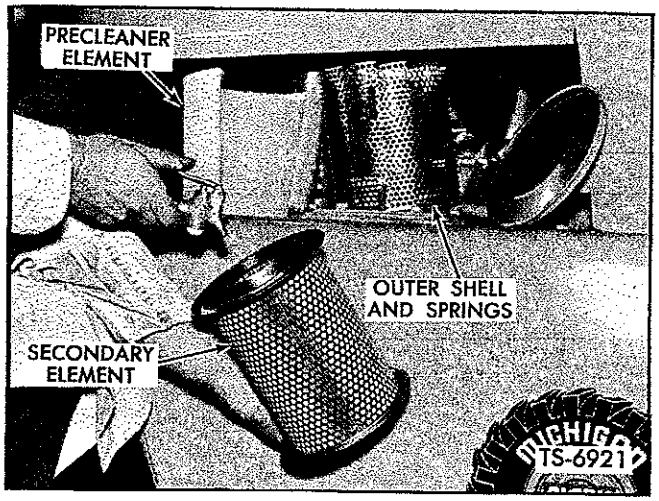


Fig. 16. Clean Secondary Element

cleaner element (fiber batt material). Blow or shake out secondary element (pleated paper). See Figures 14 through 16.

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 element pleats.*

Install new precleaner element around secondary element, bring outer shell together and hook spring clamps in original position. Place entire element assembly in housing and install cover. Tighten down cover clamps securely.

If operating conditions are extremely dusty, check rain cap and inside air cleaner body for dust accumulation. Wash rain cap in clean solvent. Clean inside air cleaner body with a dry, lint-free cloth, and reassemble air cleaner.

Lubricate Brake Pedal and Roller: Remove dirt and foreign material from around brake pedals and top of brake valve assembly.

Use engine oil and lubricate pedal pivot pins and brake roller to keep them operating freely.

250 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CHECK ENGINE RPM**
- **ADJUST BUCKET INDICATOR**
- **ADJUST SERVICE (WHEEL) BRAKES**
- **ADJUST PARKING BRAKE**
- **ADJUST CYLINDER PACKING GLANDS**
- **ADJUST AND LUBRICATE OPERATOR'S SEAT**

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 fuel delivered to the engine. See Specifications and Service Data on Page 52.

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.

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

DO NOT ADJUST G.M. GOVERNOR ASSEMBLY OR WAUKESHA CARBURETOR WITHOUT CONSULTING OPERATION AND MAINTENANCE MANUAL OF RESPECTIVE ENGINE MANUFACTURER.

Linkage adjustment for the respective engines is as follows: Choke adjustment for Waukesha Gas is also given in this section.

G.M. Diesel

1. Unhook spring from accelerator linkage and disconnect clevis from governor throttle control lever. This will enable governor throttle lever to return to spring loaded idle position.

2. Depress accelerator until it contacts stop on floorboard.

3. Rotate governor throttle control lever to extreme forward (full throttle) position and adjust clevis to obtain a slip fit in governor throttle lever just before accelerator bottoms. If a slip fit cannot be obtained adjust clevis at lower bell crank arm. See Figures 17 and 18.

4. Reinstall and secure clevis to governor throttle lever and reconnect accelerator spring.

5. Release and depress accelerator, and check that linkage will properly rotate throttle control lever from idle to full throttle position without interference.

6. Additional adjustment can be made by adjusting clevis under accelerator pedal.

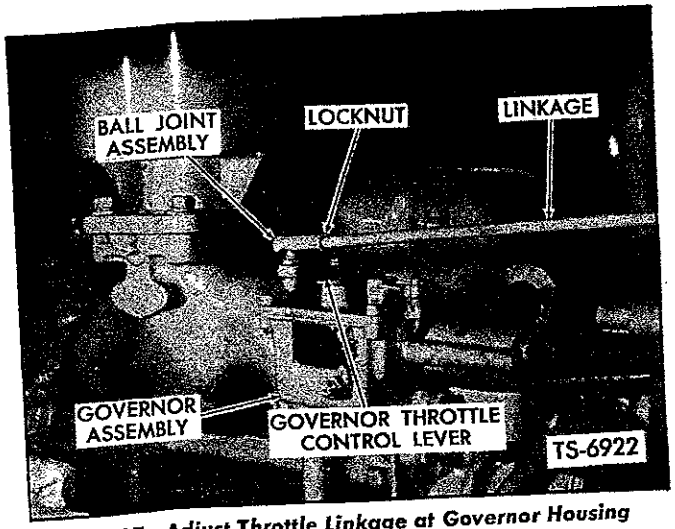


Fig. 17. Adjust Throttle Linkage at Governor Housing — G.M. Diesel

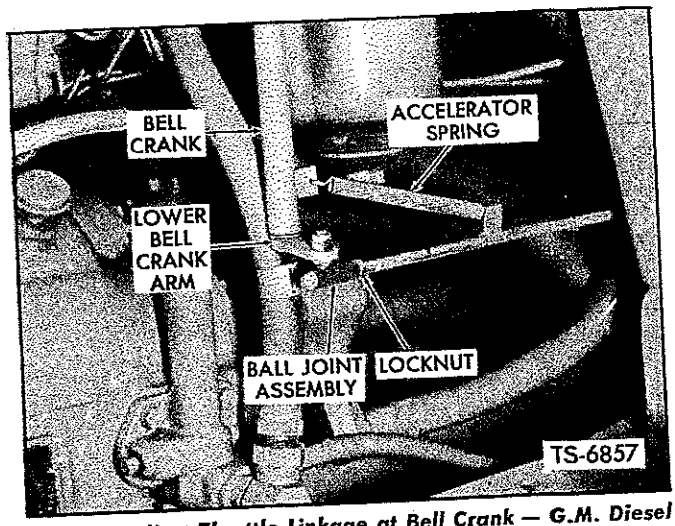


Fig. 18. Adjust Throttle Linkage at Bell Crank — G.M. Diesel

Pressure required to depress accelerator is controlled by a spring attached from bell crank to front accelerator linkage. This spring also insures that engine will return to idle speed when accelerator pedal is released.

Waukesha Gas — Throttle

1. Unhook spring from accelerator linkage and disconnect ball joint assembly from throttle lever on carburetor. Rotate lever to extreme forward (full throttle) position.

2. Depress accelerator until it contacts stop on floorboard.

3. Adjust ball joint so that throttle lever is against stop just before accelerator bottoms.

4. Reinstall and secure ball joint to carburetor throttle lever and reconnect accelerator spring.

5. Release accelerator, and check that linkage will return throttle lever to idle position as shown in Figure 19.

6. If sufficient adjustment is not available at ball joint assembly, adjust clevis under accelerator pedal.

Pressure required to depress accelerator is controlled by a spring attached from bracket on intake to accelerator linkage. This spring also

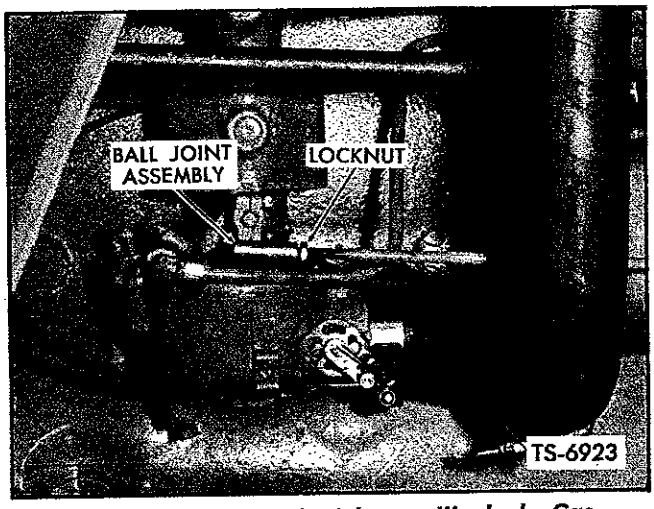


Fig. 19. Adjust Throttle Linkage — Waukesha Gas

insures that engine will return to idle speed when accelerator pedal is released.

Waukesha Gas — Choke

1. Pull choke control knob to the up position in operator's compartment to rotate valve.
2. If cable binds or sticks, eliminate kinks or free with penetrating oil. Remove excess oil to prevent dirt accumulation.
3. Check that cable operation completely closes and reopens choke valve at carburetor.
4. Adjust cable tension as necessary at choke lever on carburetor by loosening cable clamp and set screw from cable connector and increasing cable tension as necessary. Resecure cable in cable connector by retightening set screw and cable clamp. See Figure 20.

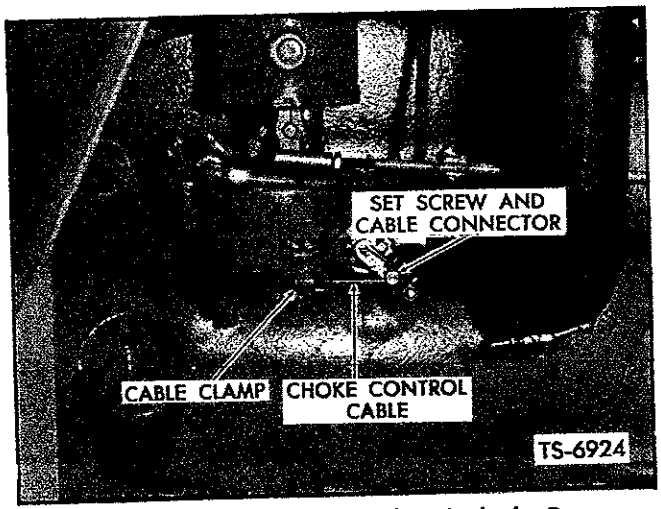


Fig. 20. Adjust Choke Control — Waukesha Gas

5. Recheck operation of choke control knob to insure proper operation.

(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 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 200° F.) 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, and place directional and speed range levers in NEUTRAL.
3. Start engine and raise bucket a few inches above the ground.
4. Shift levers into FORWARD — HI and TRAVEL RANGE and accelerate engine. When engine reaches maximum rpm pull back on bucket control lever to rotate bucket to full close position against the carrier stops. When engine rpm drops to its 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 on Page 52.

Note: *Stall rpm specified on Page 52 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.*

Adjust Bucket Indicator: Elongated holes in the indicator bar base provide the adjustment necessary to maintain alignment between indicator bar marker and marker on bucket cylinder. The indicator bar marker must be aligned with marker on bucket cylinder when bucket is level.

Make sure machine is on level surface with

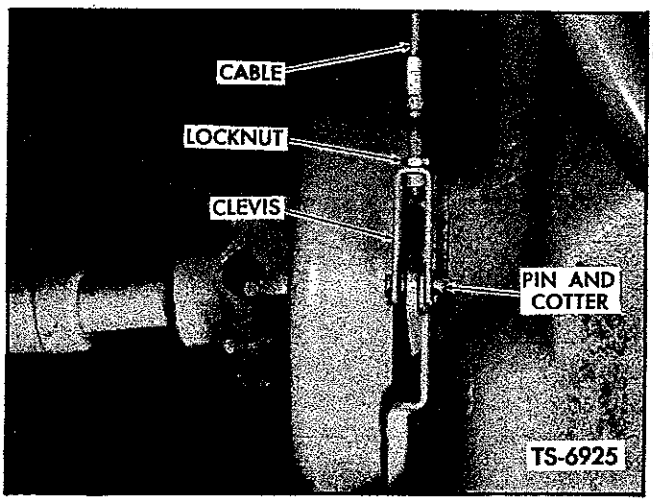


Fig. 25. Adjust Parking Brake at Brake Arm

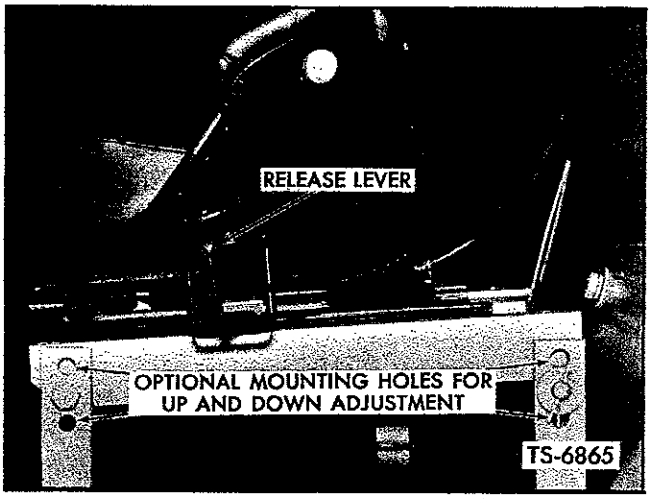


Fig. 27. Adjust Operator's Seat

Adjust and Lubricate Operator's Seat: The operator's seat can be shifted forward or rearward to suit the individual by moving the lever on left-hand side of seat forward and shifting seat to desired position. The seat can also be adjusted up and down by relocating the seat assembly in the adjusting holes in the seat mounting brackets. Another set of holes in the rails is provided for optional mounting if desired. See Figures 27 and 28.

Oiling of release mechanism, track assemblies and pivot points will keep them operating freely.

Tilt seat over steering wheel when shutting down machine at end of work shift.

500 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CHECK ENGINE SHUT-OFF CONTROLS**
- **SERVICE AIR CLEANER ELEMENT AND BODY**
- **CLEAN RADIATOR CORE**
- **CHECK AND ADJUST TRANSMISSION SHIFT LINKAGE**
- **CHECK TRANSMISSION CLUTCH AND OIL COOLER PRESSURES**
- **CHECK BOOM AND BUCKET PRESSURE**
- **ADJUST BOOM AND BUCKET CONTROL LEVERS**
- **CLEAN AND TIGHTEN ELECTRICAL CONNECTIONS**
- **CLEAN AXLE BREATHERS**
- **CHECK STEERING PRESSURE**
- **ADJUST DRAG LINK BALL JOINTS**

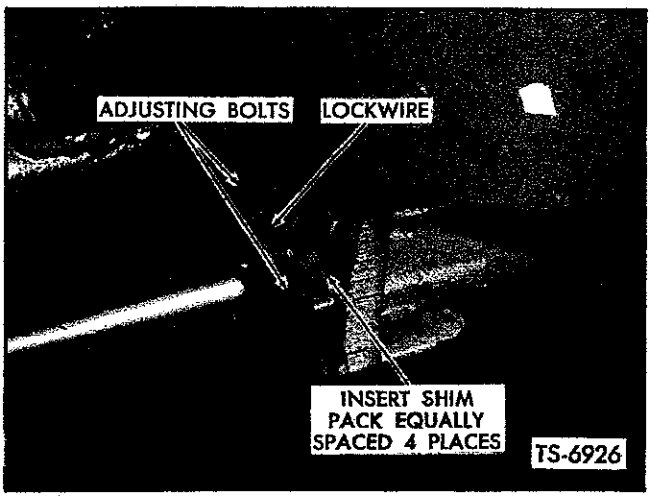


Fig. 26. Adjust Packing Gland (Steering Cylinder Shown)

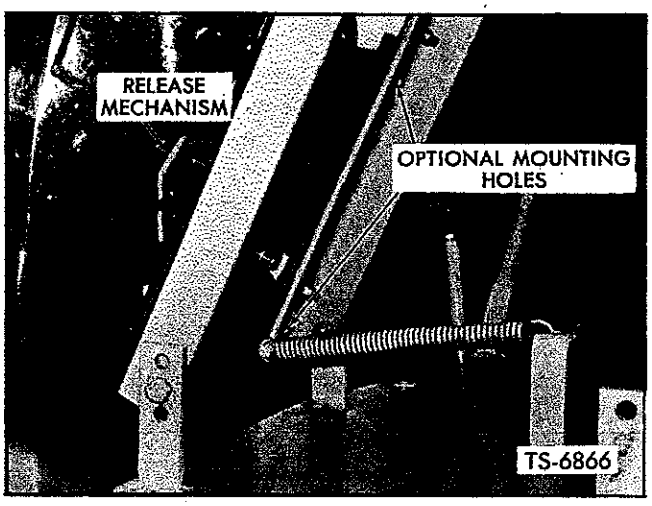


Fig. 28. Lubricate Operator's Seat

Service Air Cleaner Element and Body: Replace entire precleaner and secondary elements. This can be ordered as a replacement assembly. Wipe inside cleaner with a clean lint-free cloth. Check condition of gasket inside cleaner.

Clean intake stack and outlet tube leading to the engine. If service period has been too long, or if dust laden air has been leaking past air cleaner, outlet tube will be dirty. This will serve as a good check on proper service periods for the air cleaner.

Reassemble and tighten all connections securely.

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.

Check and Adjust Transmission Shift Linkage: Inspect all mechanical control linkages to make sure all rods, cross shafts, bell cranks, ball joints and operating arms are in 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 linkage components.

Adjustments for the various shift linkages are as follows:

(a) **Directional and Speed Range Shift Levers**

Check and adjust directional and speed range shift levers to insure full engagement into all detent positions without interference.

Levers should be positioned at approximately right angles to steering column, and in line with one another so that it is convenient to shift by gripping both levers at the same time. Levers line up with markings on shift quadrant only when in neutral position.

1. Check and tighten shift quadrant mounting bolts.
2. Check and tighten U-bolts securing shift levers and mounting supports to steering column so that bolts are snug.
3. Place speed range and directional shift levers in NEUTRAL position.
4. Adjust lever positions at the ball joint assemblies at each end of the lever control rods.
5. Resecure ball joint assemblies.
6. Check that levers will shift into all detent positions without interference.

(b) **Range Shift Lever**

Range shift lever engages transmission working range or travel range. Lever position may be changed at the clevis on the shift lever arm or at the clevis at transmission end of the shift lever cable.

Reassemble and tighten the applicable clevis locknut securely.

Check shift lever operation to insure positive engagement in both work and travel range positions without interference.

Check Transmission Clutch and Oil Cooler Pressures: Check transmission clutch and oil cooler pressures at specified intervals, or whenever machine evidences overheating or no power in any one of the four speeds in forward or reverse direction.

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

(a) **Transmission Clutch Pressure**

1. Install an accurate gauge (0 to 400 psi capacity) at the pressure regulator valve assembly as shown in Figure 31.
2. Check pressure with engine at IDLE (550 to 600 rpm).
3. Read gauge in NEUTRAL; then engage clutches

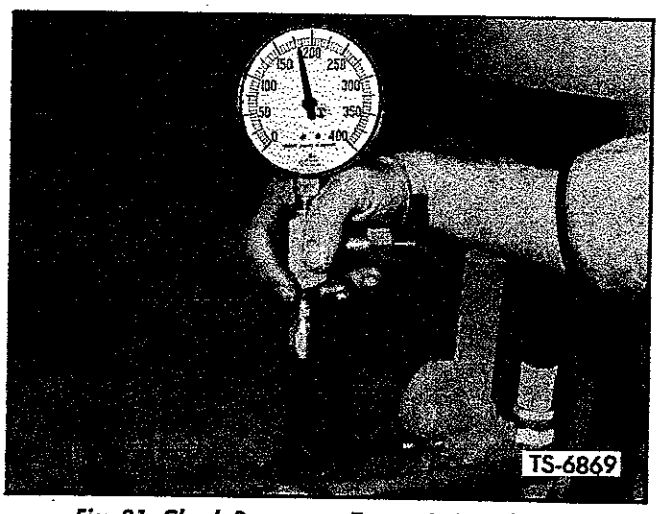


Fig. 31. Check Pressure — Transmission Clutches

one at a time. Pressure should be between 180 psi and 200 psi.

If pressure is not within specifications, further trouble shooting of the TRANSMISSION, TORQUE CONVERTER and allied hydraulic system by a qualified mechanic is required.

(b) **Oil Cooler Pressure Drop**

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 pressure ports on inlet and outlet piping to oil cooler as shown in Figures 32 and 33.

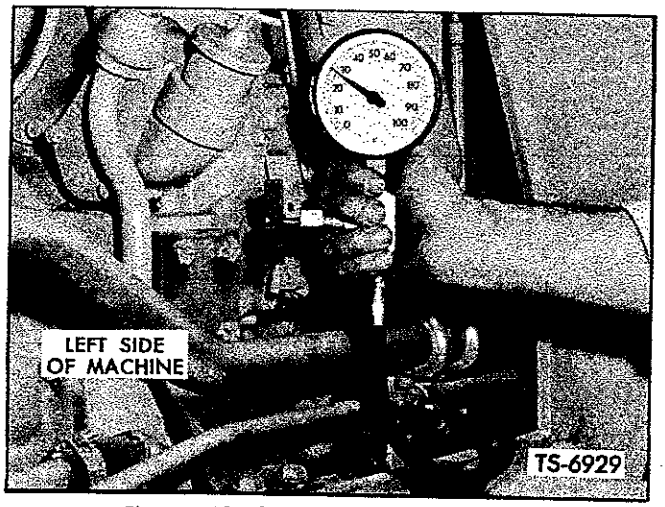


Fig. 32. Check Pressure — Oil Cooler IN

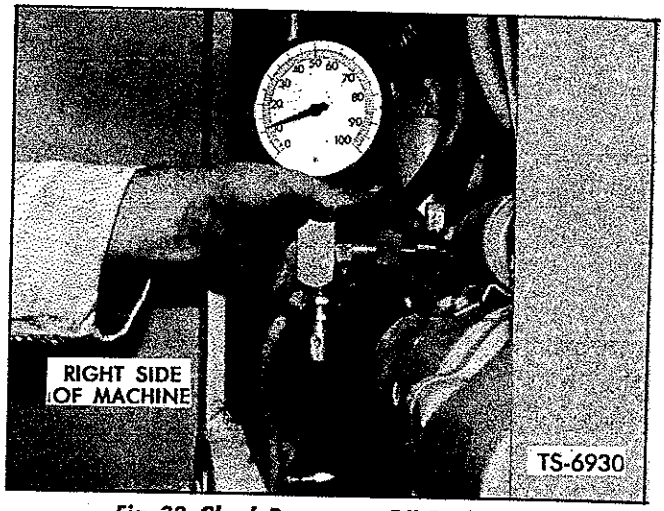


Fig. 33. Check Pressure — Oil Cooler OUT

2. Apply parking brake; shift directional and speed range levers into NEUTRAL.

3. With aid of a helper, read gauges at steady 2000 rpm, and subtract oil cooler OUT from oil cooler IN to get the pressure drop. Pressure drop should be between 20 psi and 40 psi.

If the pressure difference equals or exceeds 40 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 is started. The pump draws fluid from the reservoir and forces it under pressure into the boom and bucket control valve.

Maintenance consists of periodically checking the pressure in the system.

1. Use a hydraulic pressure gauge of at least 3000 psi capacity. With engine shut down, move boom control lever into RAISE position to prevent hydraulic oil draining while attaching gauge.

2. Remove pipe plug from control valve, and attach gauge as shown in Figure 34. Apply parking brake and block wheels.

3. Start engine, shift levers into FORWARD, HI and TRAVEL RANGE and accelerate engine to maximum rpm to stall converter. Rotate bucket into full close position to engage hydraulic system.

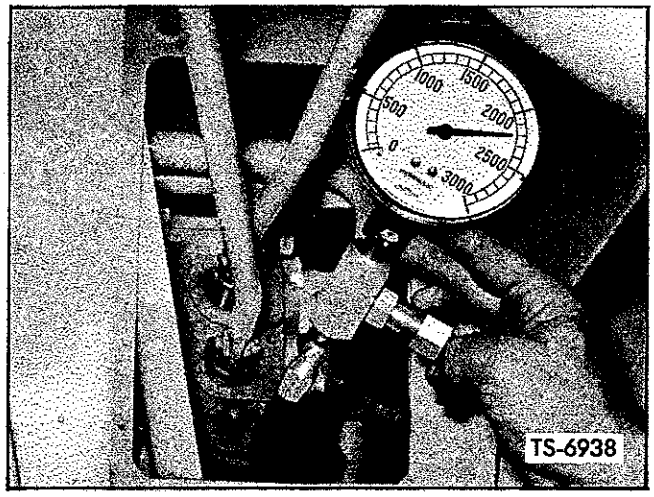


Fig. 34. Check Pressure — Boom and Bucket Control Valve

When engine rpm drops to its lowest point — gauge should read 2200 psi. If reading is not as specified, shut down engine and adjust valve.

4. Remove acorn nut on end of adjusting screw, and loosen locknut. Insert screwdriver and turn screw clockwise to increase pressure, counterclockwise to decrease pressure. See Figure 35. Turn screw in increments of approximately one revolution or less, set locknut, and retake reading. Repeat until gauge reads 2200 psi.
5. Shut down engine, set locknut, and replace acorn nut; then move boom control lever into RAISE position to prevent hydraulic oil draining while removing gauge. Remove gauge line from valve, and reinstall plug.

Adjust Boom and Bucket Control Levers: The control levers are properly set at the factory.

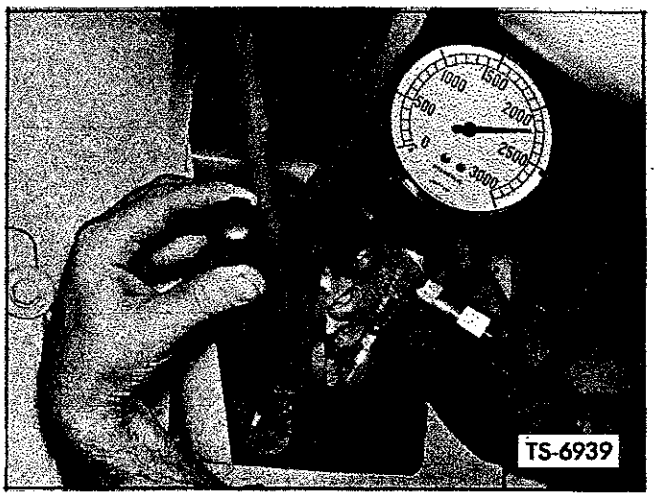


Fig. 35. Adjust Pressure — Boom and Bucket Control Valve

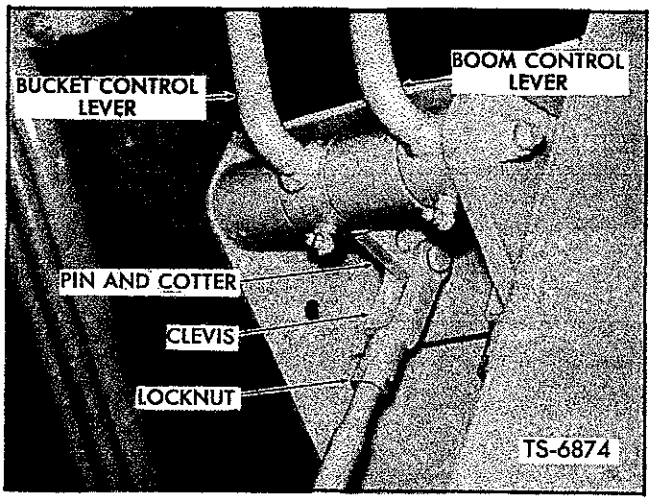


Fig. 36. Adjust Boom and Bucket Control Levers

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 on control rod.
2. Remove cotter and clevis pin.
3. Turn clevis clockwise to move lever away from operator; counterclockwise to move lever toward operator.
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, generator, 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 posts.

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

Clean Axle Breathers: Each 500 operating hours inspect breathers on front and rear axle housings, and on rear planetary thrust caps.

Housing breathers have a loose fitting cap that should be rotated. Thrust cap breathers are the pressure relief type opening against spring pressure between 7½ to 15 psi.

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.

1. Use a hydraulic pressure gauge of at least 3000 psi capacity. With engine shut down, remove plug on side of relief valve and connect gauge as shown in Figure 37.
2. Start engine and accelerate to maximum rpm.
3. Turn wheels right or left and hold against the axle stops. Take a pressure gauge reading which should be 1500 psi.
4. If reading is not as specified, remove acorn nut on valve, and loosen locknut. Insert screwdriver and turn clockwise to increase pressure, counterclockwise to decrease pressure. See Figure 38. Turn screw in increments of approximately one revolution or less, set locknut, and retake reading. Repeat until gauge reads 1500 psi.
5. Shut down engine, set locknut, and replace acorn nut. Remove gauge from valve, and reinstall plug.

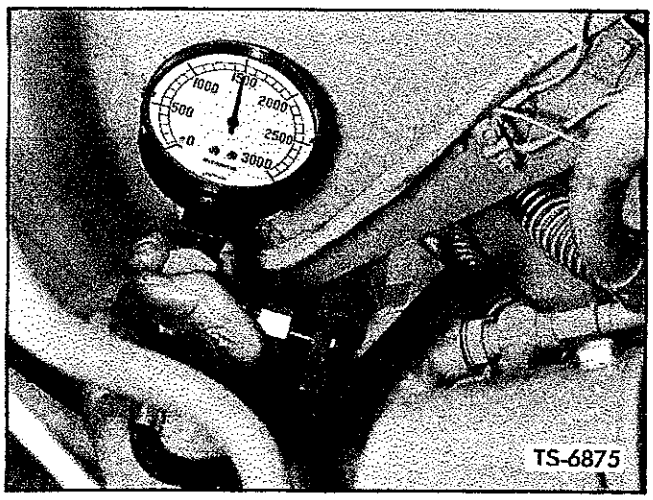


Fig. 37. Check Pressure — Steering Relief Valve

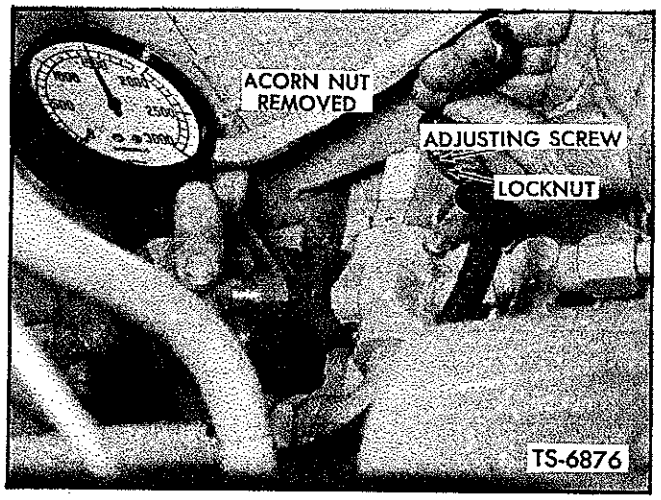


Fig. 38. Adjust Pressure — Steering Relief Valve

Adjust Drag Link Ball Joints. Adjust front and rear ball joints on drag link whenever excess looseness develops. This condition will be indicated by an increase of free play at the steering wheel before wheels respond to turning action.

Remove cotter and turn slotted adjusting plug to remove all slack in ball joints at each end of drag link as shown in Figure 39.

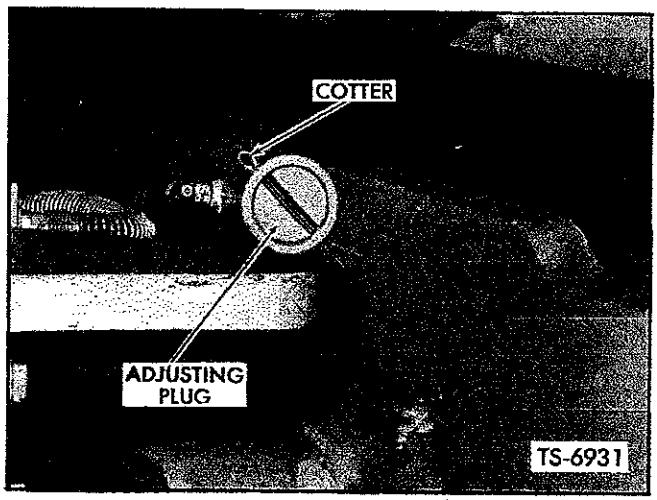


Fig. 39. Adjust Drag Link Ball Joint

Check Steer Axle Stops: Steer axle stops limit the turning radius to prevent interference between tire and machine frame and possible tire damage.

Periodically inspect and check the steer axle stops for proper contacting and clearance between tire and machine frame as outlined below:

1. Check for evidence of rear tires having rubbed frame in either direction of turn. Tires should be equally inflated and to correct pressures.
2. With machine sitting on level surface, turn steering wheel to extreme left turn position and hold, and check that left front stops are contacting with a minimum clearance of 1 inch between tire and machine frame.
3. Continue to hold wheels in full left turn position and insert template between tire and machine frame as shown in Figure 40.

   Note: *Template can be purchased locally from a Building and Supply Company. The template should be made of ½ inch or heavier plywood, or ¼ inch tempered hardboard, cut to the dimensions tabulated.*

   For desired condition, template must be flush with tire across points A and B with front stops contacting and a minimum clearance of 1 inch between tire and machine frame.

   Due to the possibility of a tolerance stack-up in the various components, it is permissible if template contacts tire at point A or B with front stops contacting and a minimum clearance of 1 inch between tire and machine frame.

   NEVER UNDER ANY CIRCUMSTANCES SHOULD THE TIRES CONTACT THE MACHINE FRAME.

4. If clearance between tire and machine frame is less than the specified 1 inch minimum clearance, inspect and check for:
   a. Bent drag link or tie rod.
   b. Worn drag link or tie rod ball joints.
   c. Proper adjustment of the steering gear worm and sector shaft.
   d. Steering gear loosely mounted.
   e. Loose wheel nuts (ream studs in wheel disc if necessary).

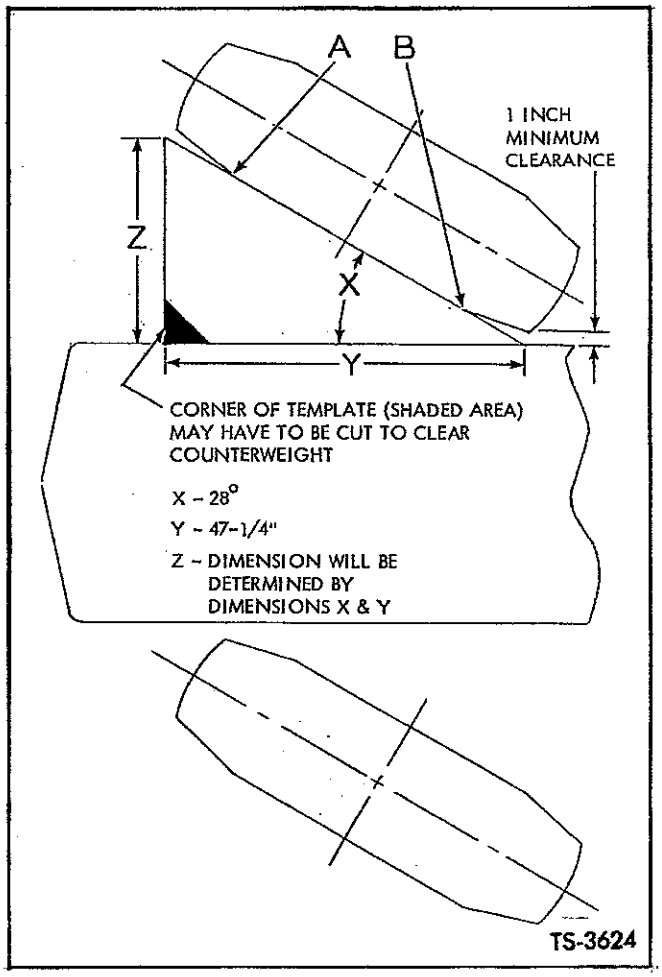


Fig. 40. Check Steer Axle Stops

   f. Building up and refacing front steering stops.
5. Repeat check for right hand turn.
6. Stops should be built up with Lincoln Mangjet or Manganweld-C hardface welding rods or equivalent and ground smooth. A. O. Smith and Airco are other sources which manufacture high manganese electrodes for resistance to impact.
7. Extreme care must be exercised when building up and grinding stops to insure a smooth flat surface. The entire area of stop must contact its mating stop simultaneously. Care must also be taken to insure that degree of turn is equal in both left and right hand turns.

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.

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

Remove and replace damaged or missing mounting bolts and tighten all loose mounting bolts as necessary. Refer to Bolt Torque Chart on Page 51.

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 causing serious damage and downtime.

Dirt packed on or around the axle, transmission, torque converter, engine and reservoir 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 generator and cranking motor openings to protect them from the force of the steam jet.*

1000 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CHECK AND REPAIR BUCKET CUTTING EDGE**
- **INSPECT, TEST AND LUBRICATE ELECTRICAL UNITS**
- **ADJUST STEERING GEAR**
- **CLEAN HYDRAULIC RESERVOIR FILTER ASSEMBLY**
- **CHECK AND REPAIR DRIVE LINE NOISES**
- **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 inspected 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 as shown in Figure 41.

1. Align and clamp straight edge so that back edge will line up with front edge of bucket sheet as shown in View 2.
2. Measure up 10 inches on each side cutting edge from bottom cutting edge and scribe lines A as shown in View 1.
3. Guide cutting torch through scribe lines A and down rear edge of side cutting edges to bottom cutting edge as shown in View 1; then continue cutting along back edge of straight edge as shown in View 2. Remove and discard cut-out 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 3.
5. Position and align new cutting edge flush against bucket sheet and flat plates and secure in place with clamps as shown in View 3.
6. Alternately tack weld cutting edge to bucket sheet on top and bottom.
7. Remove flat plates and continuously weld cutting edge to bucket sheet on both top and bottom sides as shown in Views 3 and 4.
8. Clamp side cutting edges flush against bucket sheet and bottom cutting edge and weld securely.
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.

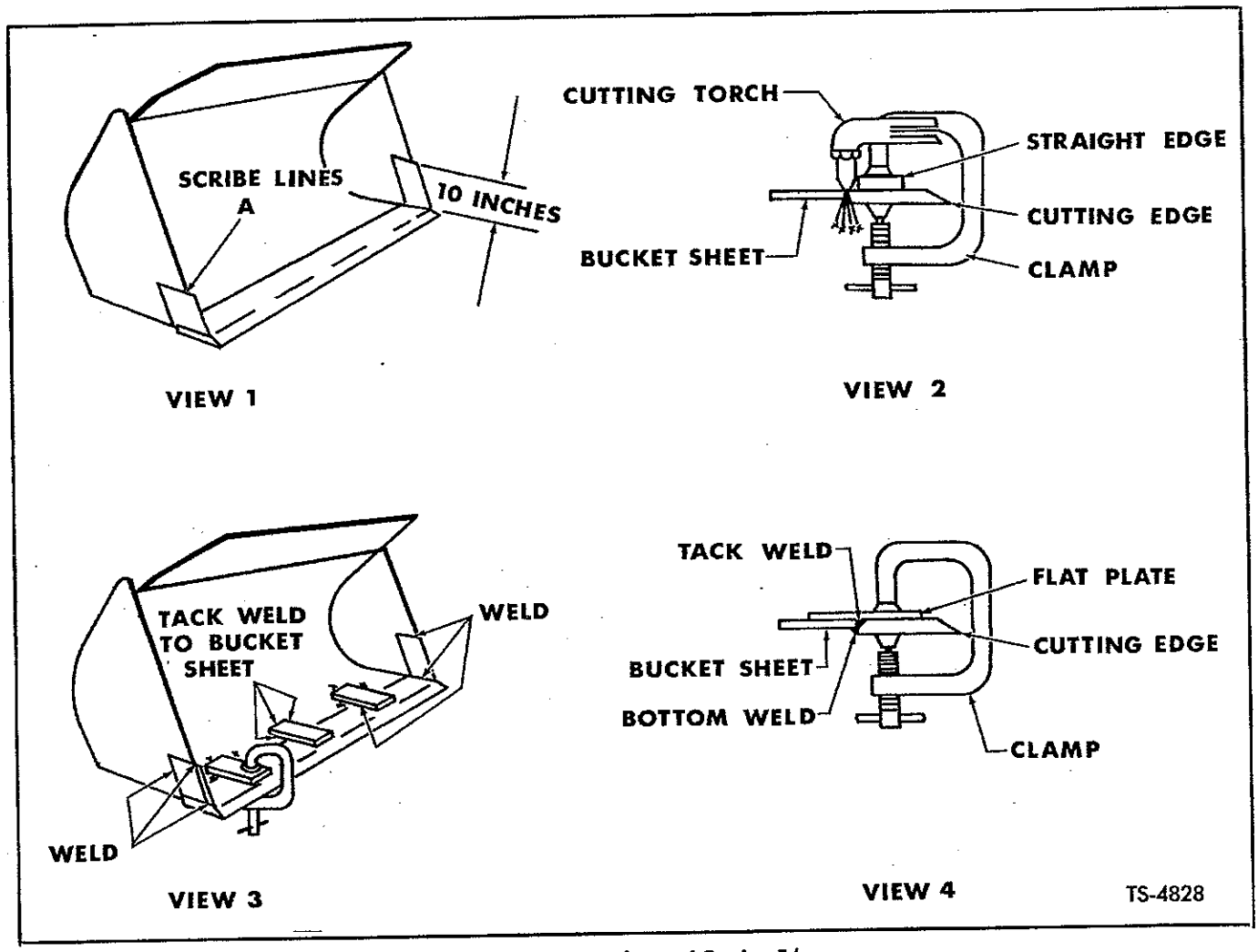


Fig. 41. Repair Bucket and Cutting Edge

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

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 generator 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 functioning of the alternator and voltage regulator can usually be determined by the following battery conditions: (1) if batteries are kept fully charged, except when under unusually severe loads, and (2) if no more than the usual amount 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.

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) worm bearing adjustment, (2) overcenter or pitman shaft adjustment. The worm 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 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 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 wheel, counterclockwise to decrease the pull. See Figure 42. Reset locknut and recheck pull, as it must be within the specified limits after the locknut is tightened.
5. Reassemble drag link to pitman arm and adjust drag link ball joints.

Clean Hydraulic Reservoir Filter Assembly: The hydraulic reservoir filter assembly installed inside the hydraulic reservoir consists of a pleated metal filter element with sealing gaskets secured between a mounting base and cover type relief valve.

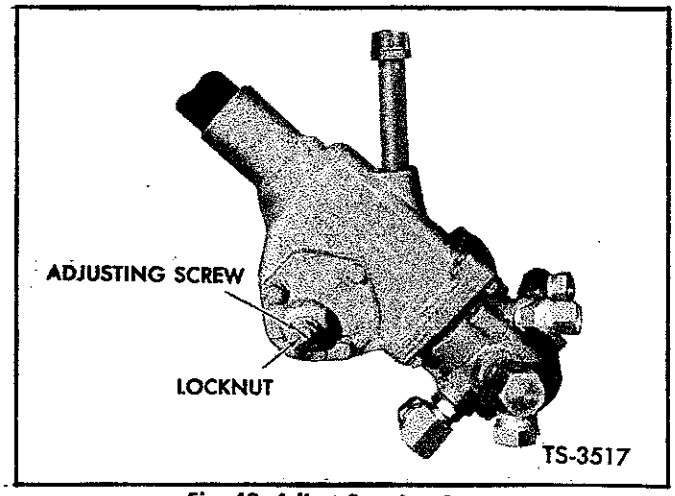


Fig. 42. Adjust Steering Gear

Recommended servicing procedures and intervals for cleaning the reservoir filter element are described below, but it should be understood that no set rule can be established for cleaning intervals because the cleaning interval is automatically established by the filter element itself in conjunction with an electric vacuum indicator (installed in the reservoir outlet tube between reservoir and main hydraulic pump) and a warning indicator light (installed on the instrument panel inside operator's compartment).

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 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 bypass the plugged filter element entering directly into the hydraulic system. This same difference in pressure will immediately activate the electric vacuum indicator completing a circuit to the warning indicator light on the instrument panel. Illumination of the warning light is an indication that the filter element is dirty and requires cleaning.

Note: *Illumination of the warning light might occur when engine is started especially during cold weather when hydraulic oil is cold and remain on until oil in the system becomes warm. However, continued illumination of the warning*

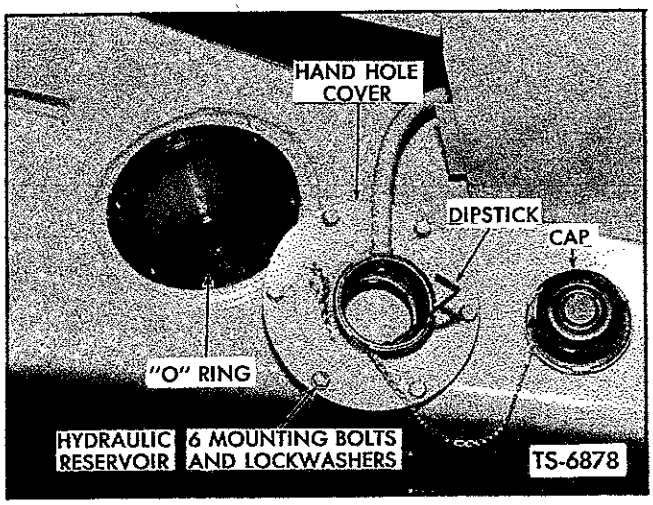


Fig. 43. Remove Reservoir Cap, Dipstick and Hand Hole Cover

Fig. 45. Cleaning Filter Element with Stiff Bristled Brush

light after system oil becomes warm indicates that filter element is plugged with foreign material and should be cleaned immediately.

1. Loosen reservoir cap **slowly** to relieve pressure in hydraulic reservoir. Remove reservoir cap, dipstick, and hand hole cover as shown in Figure 43.

2. Unscrew extension handle (incorporating cover type relief valve and components) from element mounting base and remove handle and filter element as shown in Figure 44.

3. Immerse filter element and extension handle (incorporating cover type relief valve and components) 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 45. Flush element and relief valve components with clean hot water until drain water is clear.

4. Air dry element and relief valve components with filtered low pressure air as shown in Figure 46. Examine general condition of filter element checking for element cleanliness, deteriorated sealing gaskets, or screen damage. Replace deteriorated sealing gaskets with new gaskets using RUSCOE EPOXY CEMENT to secure new gaskets on element. 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.

Note: RUSCOE EPOXY CEMENT can be obtained in 5 and 10 Cent Stores or by ordering

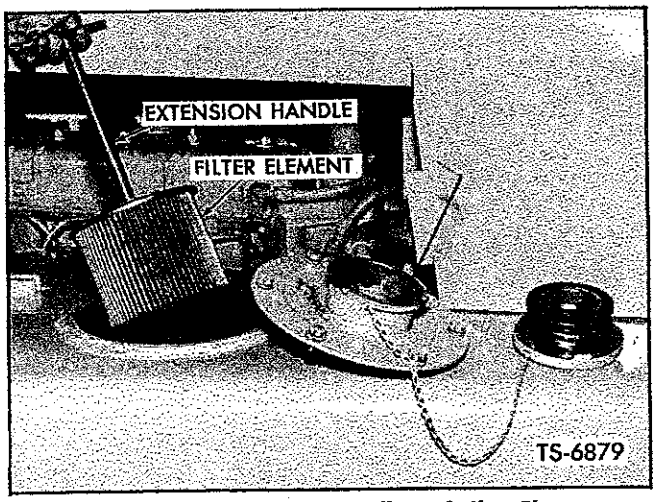


Fig. 44. Remove Extension Handle and Filter Element

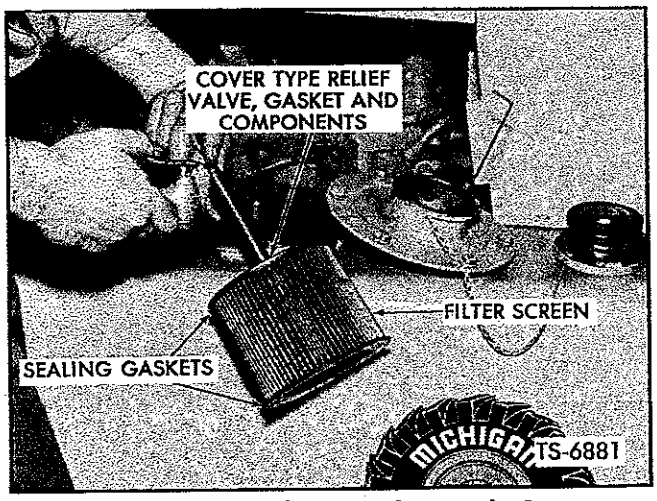


Fig. 46. Air Dry Filter Element and Inspect for Damage

directly from the W. J. RUSCOE COMPANY in Akron, Ohio. RUSCOE EPOXY CEMENT is available in various sizes and can be ordered by the following assigned Catalog Numbers. 1½ oz. Tubes (Cat. # x - 1), and Piggy-Back Cans of 6 ozs. (Cat. # x - 24), 12 ozs. (Cat. # x - 48) and 18 ozs. (Cat. # x - 612). Directions for use are printed on each container. Because raw materials in Ruscoe Epoxy have a minimum degree of toxicity, precautions such as avoiding direct contact with the skin, and washing hands thoroughly after use is recommended.

Check and Repair Drive Line Noises: Unusual operating noises in drive line components can usually be found by a process of elimination. In general the unit cause or source of most noises will be quite evident.

When any such noise develops, note travel speed of machine; did it occur going forward or in reverse; was machine traveling straight or in a turn; was machine being braked, coasting, under acceleration, or being worked stationary; did any gauges indicate overheating; was noise progressive, or did it just happen; was there any vibration, chattering or shaking of machine; did machine pull to one side.

Prop shaft failures are generally indicated by excessive noise or vibration only at certain speeds. Above or below these speeds the noise lessens or completely disappears.

Transmission can be checked by disconnecting prop shaft to front axle. Check gear train in both work and travel ranges with hydraulic controls (speed range and directional shift levers) in neutral. Engage control levers one at a time to apply the clutches and connect them to the gear train.

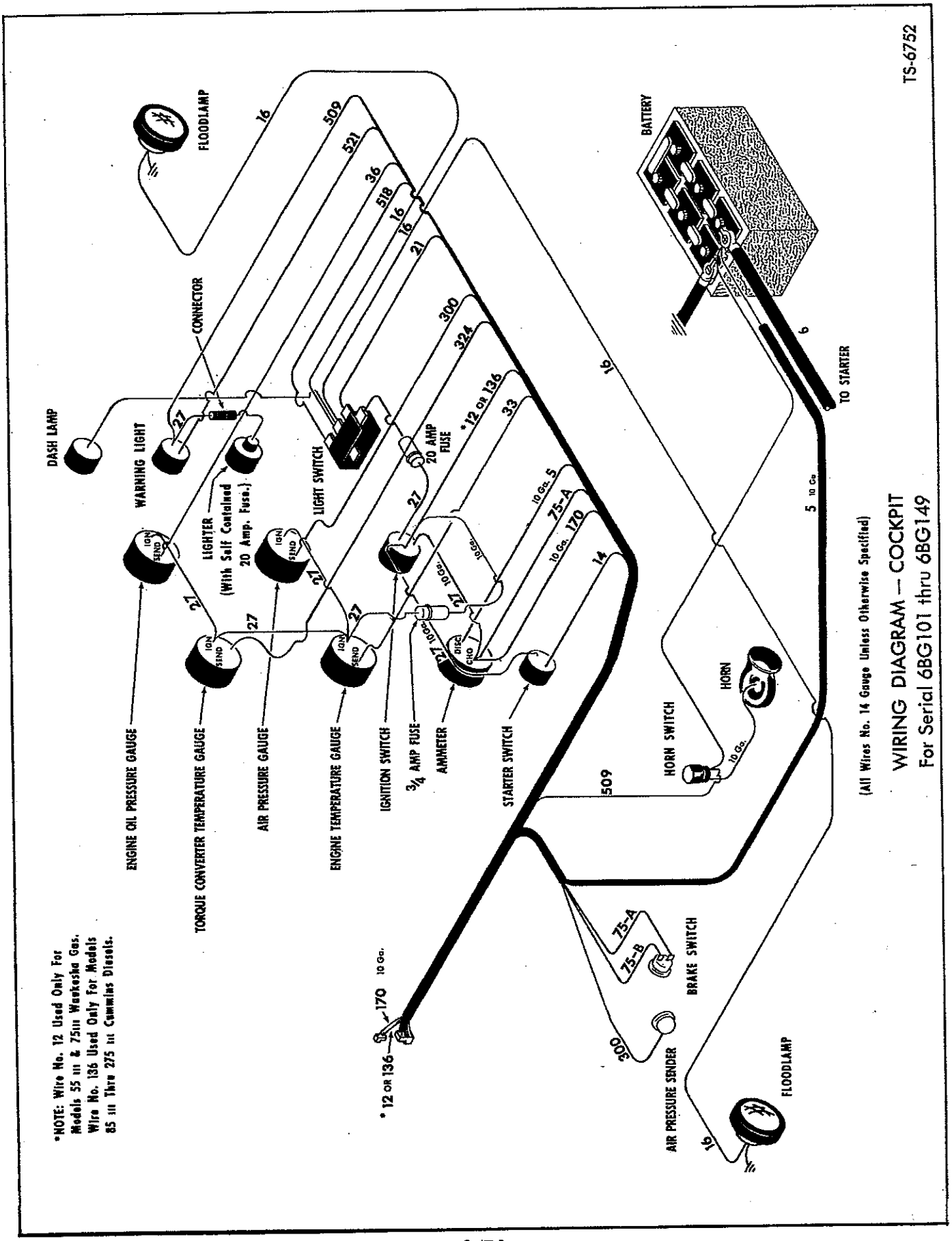
Engine and torque converter noises can be isolated by removing the prop shaft from the torque converter to the transmission. Most engine and torque converter problems are generally preceded by low power and overheating. These indications should be observed at the time and corrected before mechanical difficulties arise.

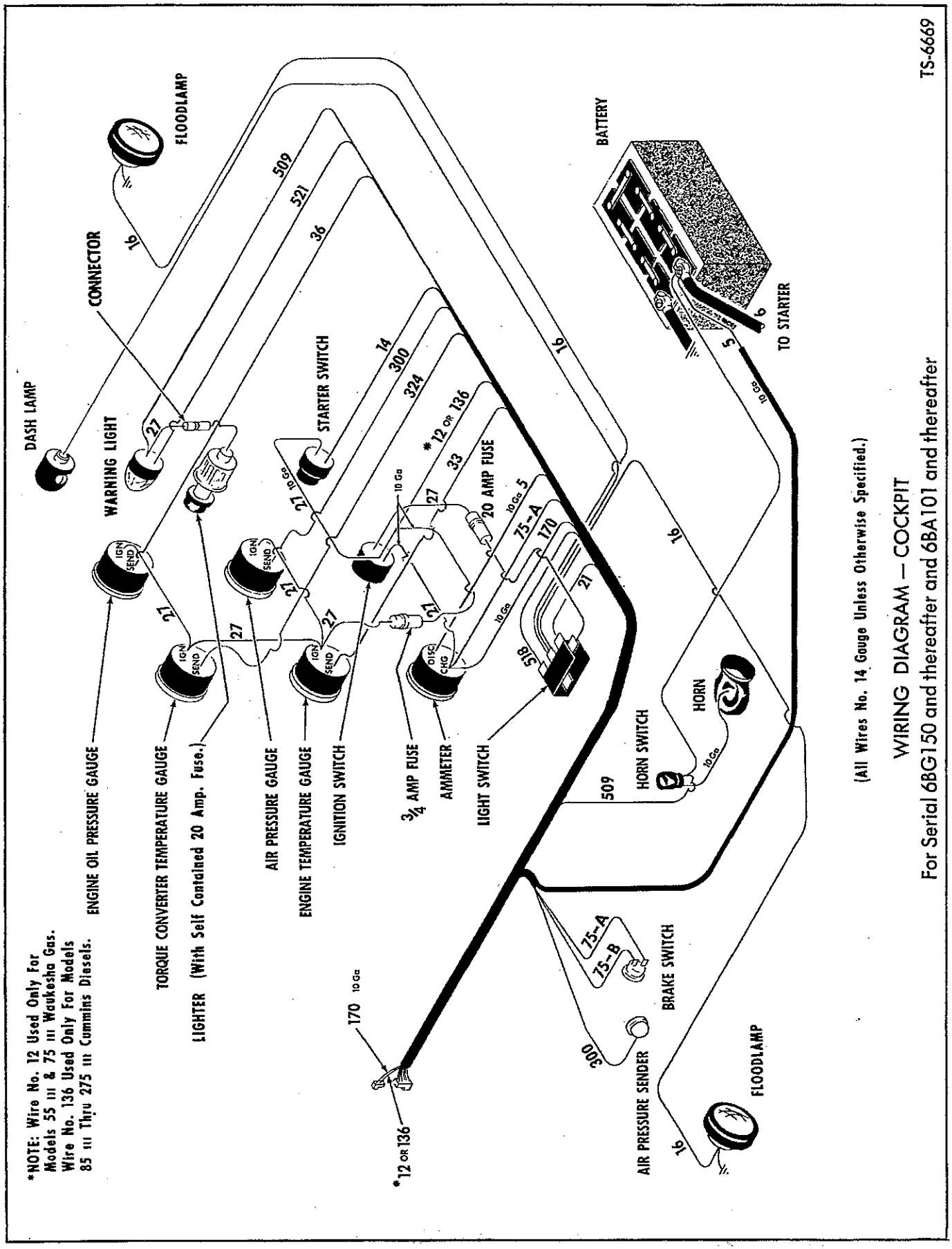
Inspect Frame: The frame is the basic backbone of the entire machine that provides structural support directly or indirectly for completely mounting all assemblies, sub-assemblies and individual components necessary for machine construction and operation.

The frame structure and all supporting assemblies such as cradle, guide bar, boom and bucket, carrier, upper and lower pivot tubes, crossmembers, 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.

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

NOTES


TS-6752
WIRING DIAGRAM — COCKPIT
For Serial 6BG101 thru 6BG149
(All Wires No. 14 Gauge Unless Otherwise Specified)
*NOTE: Wire No. 12 Used Only For Models 55 III & 75III Waukesha Gas. Wire No. 136 Used Only for Models 85 III Thru 275 III Cummins Diesels.
FLOODLAMP
CONNECTOR
DASH LAMP
WARNING LIGHT
LIGHTER (With Self Contained 20 Amp. Fuse.)
LIGHT SWITCH
20 AMP FUSE
*12 OR 136
BATTERY
TO STARTER
ENGINE OIL PRESSURE GAUGE
TORQUE CONVERTER TEMPERATURE GAUGE
AIR PRESSURE GAUGE
ENGINE TEMPERATURE GAUGE
IGNITION SWITCH
3/4 AMP FUSE
AMMETER
STARTER SWITCH
HORN SWITCH
HORN
BRAKE SWITCH
AIR PRESSURE SENDER
FLOODLAMP
16
509
521
36
518
16
16
21
300
324
33
27
10 Ga.
5
75-A
170
14
6
5 10 Ga.
509
75-A
75-B
300
170
* 12 OR 136 10 Ga.
10 Ga.

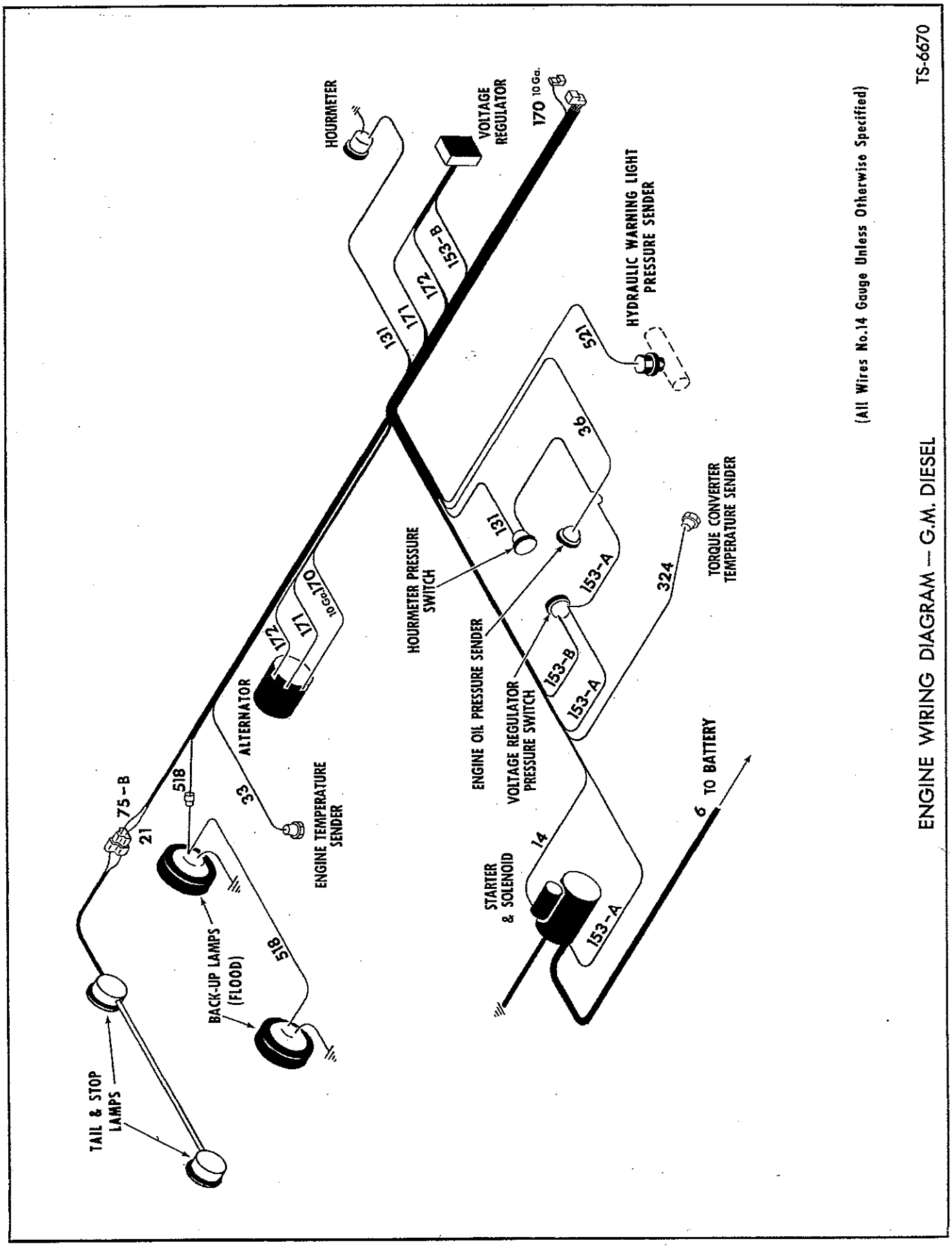


(All Wires No. 14 Gauge Unless Otherwise Specified.)

WIRING DIAGRAM — COCKPIT

For Serial 6BG150 and thereafter and 6BA101 and thereafter

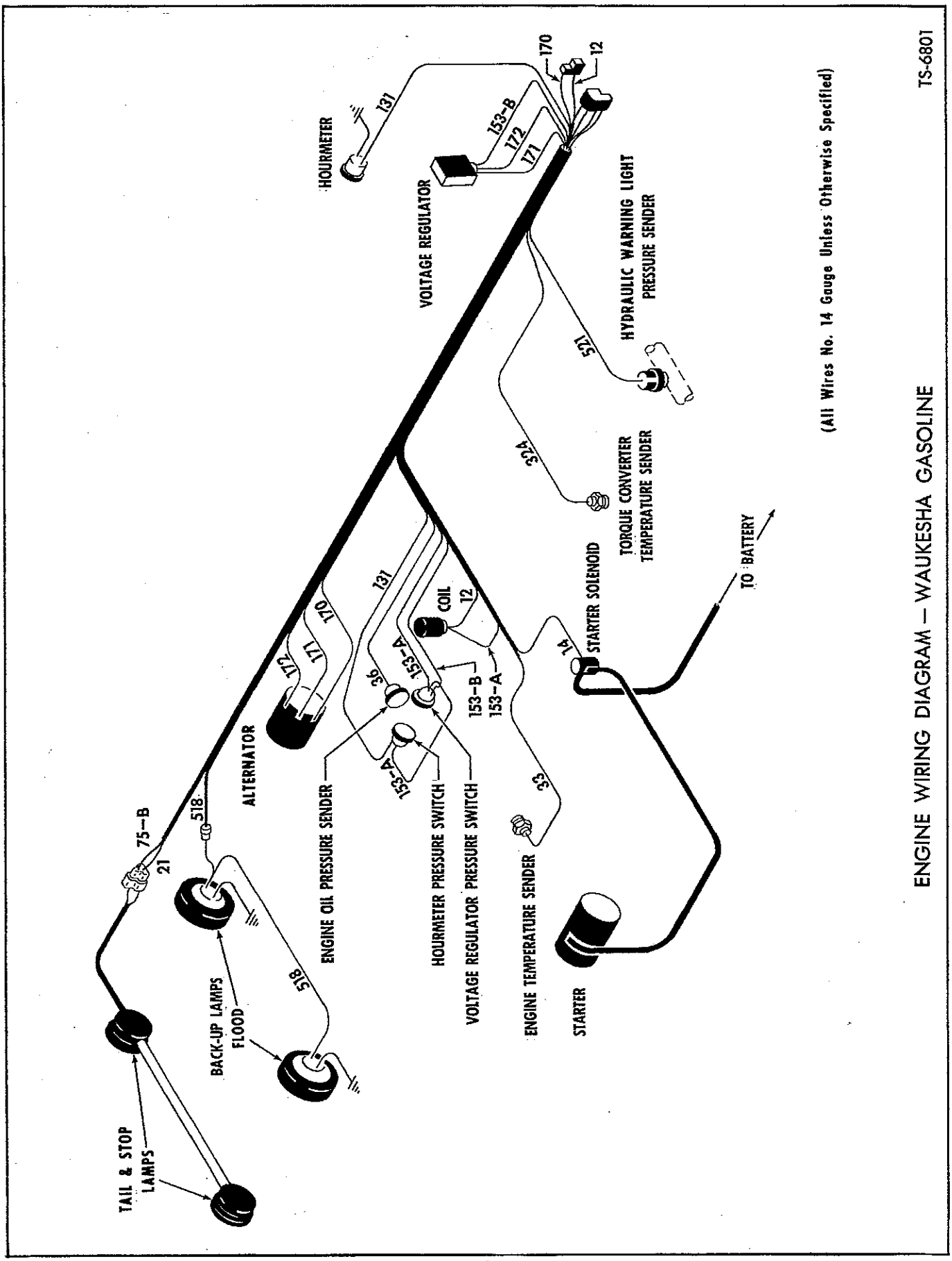
TS-6669



ENGINE WIRING DIAGRAM — G.M. DIESEL

(All Wires No.14 Gauge Unless Otherwise Specified)

TS-6670


ENGINE WIRING DIAGRAM — WAUKESHA GASOLINE
TS-6801
(All Wires No. 14 Gauge Unless Otherwise Specified)
HOURMETER
131
VOLTAGE REGULATOR
153-B
172
171
170
12
HYDRAULIC WARNING LIGHT PRESSURE SENDER
521
TORQUE CONVERTER TEMPERATURE SENDER
324
STARTER SOLENOID
14
TO BATTERY
COIL
12
131
170
171
172
ALTERNATOR
36
153-A
153-B
153-A
ENGINE OIL PRESSURE SENDER
HOURMETER PRESSURE SWITCH
VOLTAGE REGULATOR PRESSURE SWITCH
ENGINE TEMPERATURE SENDER
33
STARTER
75-B
21
518
518
BACK-UP LAMPS
FLOOD
TAIL & STOP LAMPS

BOLT TORQUE CHART
FT. — LBS.

Location	Thread	Grade	Torque
Converter Filter			50±5
Converter, Housing Mounting	3/8"–16	8	23
Counterweight, Rear	3/4"–16	8	320
Drag Link Ball Stud Nuts	5/8"–18	5	105
Engine Support to Flywheel Housing	1/2"–13	5	75
Engine Support to Frame	1/2"–20	8	90
Engine Trunnion Mounting	1/2"–20	8	90
Prop Shaft – Upper 4C			25
Prop Shaft – Lower 5C			50
Transmission Bracket to Frame	5/8"–18	8	185
Transmission to Bracket	3/4"–10	8	123
*Wheel Nuts	5/8"–18	5	175-200

BOLTS NOT LISTED ARE TO BE DRAWN UP TIGHT IN MANNER CONSISTENT WITH GOOD WORKMANSHIP.

*Wheel nut spherical seat in disc must be concentric with stud — ream if necessary.

SPECIFICATIONS AND SERVICE DATA

ENGINE

	Gasoline	Diesel
Make	Waukesha	G.M.
Model	F-265-G	3-53
Number of cylinders	6	3
Bore and stroke	3¾" x 4"	3⅞" x 4½"
Displacement, cu. inches	265	159.2
Maximum torque, ft. lbs.	225 @ 1800	208 @ 1200
Governed horsepower	89	77
Governed rpm	2300	2200
Low idle rpm	550-600	550-600
High idle rpm	2300-2400	2300-2400
*Stall rpm	2100-2200	2100-2200

*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.

ELECTRICAL SYSTEM

Fuses:
- Gauge circuit ..... AGC ¾ amp
- Light circuit ..... SFE 20 amp
- Lighter circuit ..... (Self contained) 20 amp

Instruments:
- Panel gauges ..... 12 volt
- Sender units ..... 12 volt

Lamps:
- Back-up ..... 12 volt, 35 watt
- Dash ..... 12 volt, 4 C.P.
- Tail and stop ..... 12 volt, 32/4 C.P.
- Head ..... 12 volt, 35 watt
- Warning ..... 12 volt, 4 C.P.

Alternator ..... (150 Delcotron) 12 volt, 42 amp

Starting motor ..... 12 volt

Voltage regulator ..... 12 volt

BATTERIES

Make and Part No. .....Clark, 655054
Number .....1-12 volt
Electrical system .....12 volt
Grounded terminal .....Negative
Specific gravity .....1.230 - 1.260

(Not over 0.050 variance between adjacent cells)

PRESSURES

Engine oil	Idle rpm	Governed rpm
G.M.	11 psi min.	Approx. 45 psi
Waukesha	15 psi min.	Approx. 40 psi

Air compressor governor range ...90-105 psi

Boom and bucket hydraulic system .....2200 psi at converter stall rpm and one set of cylinders against stops

Steering hydraulic system .....1500 psi at maximum engine rpm and steer wheels turned against stops

Transmission clutches .....180 psi minimum at idle (550-600 rpm) in all speed ranges in both forward and reverse direction and oil temperature 180° F. - 200° F.

FUEL SPECS

Fuel Oil .....No. 2 Cetane 40 min.
Gasoline .....75 Octane, minimum

BRAKE FLUID

SAE 70R3, Clark No. 850487

CAPACITIES
(Approximate Quantities)

	U. S. MEASURE	METRIC MEASURE LITERS	IMPERIAL MEASURE
Engine crankcase and system:			
G.M.	12 qt.	11.3	10 qt.
Waukesha	7 qt.	6.6	5.8 qt.
Cooling system:			
G.M.	6 gal.	22.7	4.9 gal.
Waukesha	8 gal.	30.2	6.7 gal.
Front drive axle differential	7 qt.	6.6	5.8 qt.
Front drive axle planetary hubs (each)	4 qt.	3.8	3.3 qt.
Fuel tank	45 gal.	171.1	37.4 gal.
Hydraulic tank	45 gal.	171.1	37.4 gal.
Rear drive steer axle differential	7 qt.	6.6	5.8 qt.
Rear drive steer axle planetary hubs (each)	3 qt.	2.8	2.5 qt.
Torque converter and transmission	4.5 gal.	17.0	3.7 gal.

TIRE OPTIONS

SIZE	PLY RATING	INFLATION PSI FRONT	INFLATION PSI REAR	TYPE
13.00-24	8	30	30	Traction
13.00-24	16	30	30	Rock
14.00-24	8	30	30	Traction
14.00-24	12	30	30	Traction
14.00-24	12	30	30	Rock
15.5 -25	12	30	30	Traction

The following table indicates the amount of calcium chloride and water which may be added to rear tires where increased weight and tractive ability are desired. It is recommended that only the rear tires be hydro-inflated.

TIRE SIZE	USE $CaCl_2$ (POUNDS)	DISSOLVE IN WATER (GALLONS)	TOTAL GALLONS SOLUTION	WEIGHT INCREASE EACH TIRE (POUNDS)
13.00-24	105	30	37	370
14.00-24	151	43	50	510
15.5 -25	133	38	44	450

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 should be understood that the above listed figures are for maximum values and that this data should not be construed as a statement that all machines should be hydro-inflated. Hydro-inflation should be added only as needed on the basis of working conditions.