Model 35AWS Tractor Shovel

CLARK EQUIPMENT

MICHIGAN

OPERATORS MANUAL

No. 2475

Model 35AWS Tractor Shovel

Information contained herein pertains to Machine Serial Numbers listed below:

Continental: C3WCO9-10 and after
Waukesha: C3WA9-10 and after
G.M.: C3WG9-10 and after
G.M.: 7WG-101 and after

CLARK EQUIPMENT COMPANY
Construction Machinery Division

1966

Warranty

Clark Equipment Company (CLARK) has warranted to the Distributor (Seller) who, pursuant to agreement with CLARK, hereby, on its own behalf, warrants to the Buyer each new CLARK product to be free from defects in material and workmanship under normal use and maintenance as herein provided.

Distributor's sole obligation under this warranty shall be limited to repairing, replacing or allowing credit for, at Distributor's option, any part which under normal and proper use and maintenance proves defective in material or workmanship within six (6) months after delivery to or one thousand (1,000) hours of use by Buyer, whichever shall occur first; provided, however, that (i) the product is placed in use not later than one year after shipment from CLARK'S plant; (ii) that notice of any such defect and satisfactory proof thereof is promptly given by Buyer to Distributor; and (iii) such material shall have been returned to Distributor, with transportation charges prepaid and found by Distributor to have been defective.

This warranty does not apply in respect of damage to or defects in any product caused by overloading or other misuse, neglect or accident, nor does this warranty apply to any product which has been repaired or altered in any way which, in the sole judgment of Distributor, affects the performance, stability or general purpose for which it was manufactured.

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This warranty does not apply to parts or trade accessories not manufactured by CLARK, or attachments not manufactured or sold by CLARK. Buyer shall rely solely on the existing warranties, if any, of the respective manufacturers thereof.

CLARK EQUIPMENT

IMPROVEMENTS

It is CLARK'S policy to constantly strive to improve its products. The right therefore is reserved to make changes in design and improvements whenever it is believed the efficiency of the product will be improved thereby, but without incurring any obligation to incorporate such improvements in any product which has been shipped or is in service.

Revised May 1, 1966

MICHIGAN

OPERATORS MANUAL

No. 2475

MODEL 35AWS TRACTOR SHOVEL

Information contained herein pertains to Machine Serial Numbers listed below:

Continental: C3WCO9-10 and after
Waukesha: C3WA9-10 and after
G.M.: C3WG9-10 and after
G.M.: 7WG-101 and after

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

Machine Serial C-5WG9-51

Engine Model _____

Engine Serial _____

CLARK EQUIPMENT COMPANY
Construction Machinery Division

2M697BSPR441

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

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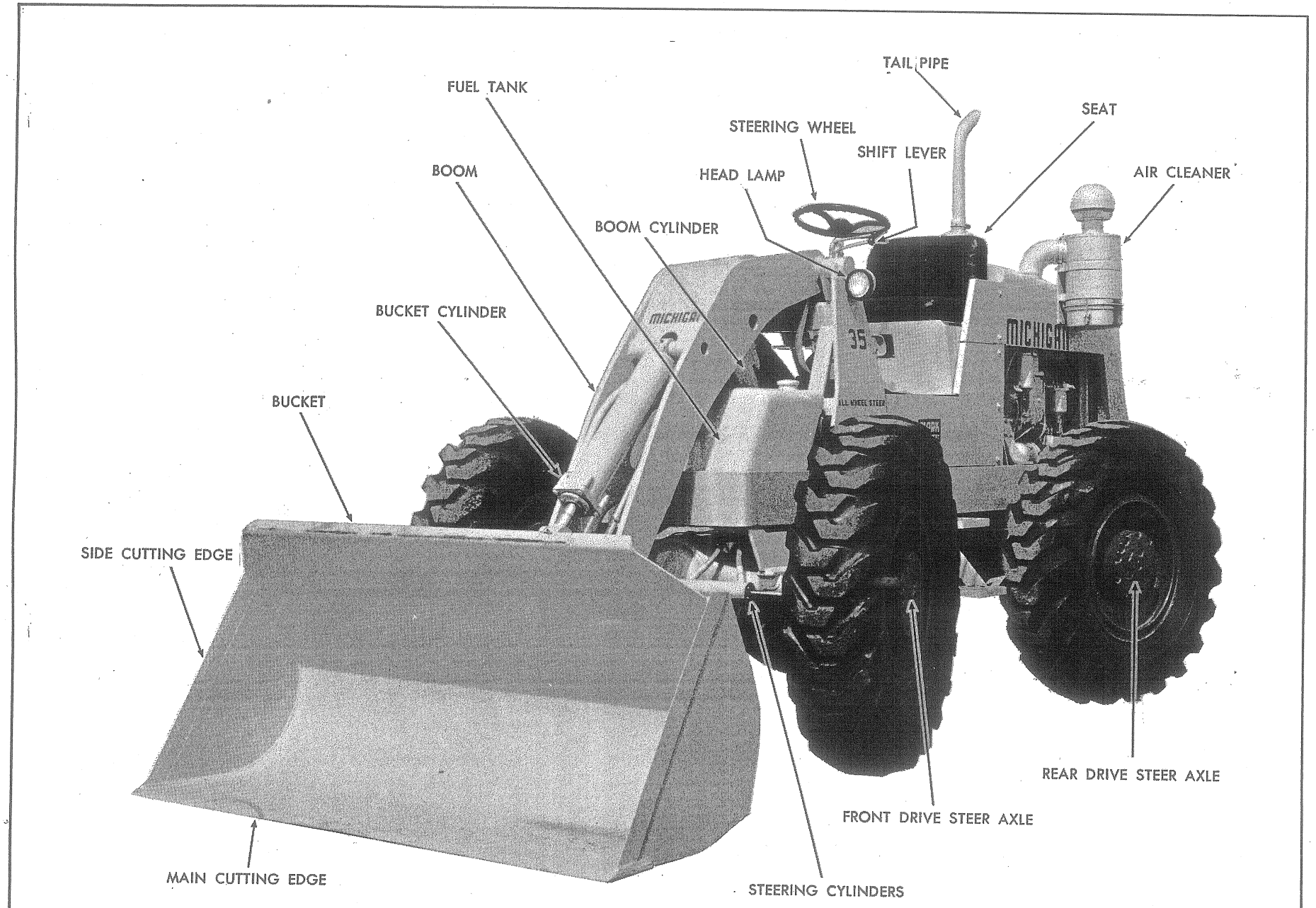


MODEL 35AWS TRACTOR SHOVEL (G.M. DIESEL)

TS-9248

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 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 all wheel drive, all 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 shift ranges in both forward and reverse. Effortless hydraulic power steering is provided, utilizing four double acting steering cylinders, one at each wheel. Service brakes are hydraulic actuated by a single stage master cylinder. Parking brake is the internal expanding type operating on a drum mounted on the companion flange of the transmission.

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 55 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 in the center of the seat support plate located in the operator's compartment 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 side of frame at the rear.

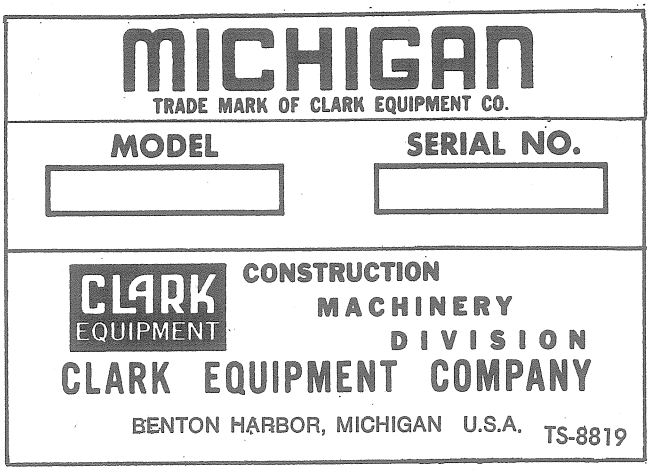


Fig. 1. Machine Serial Number Plate

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 right rear side of transmission. The torque converter serial number plate is centrally located at top 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.

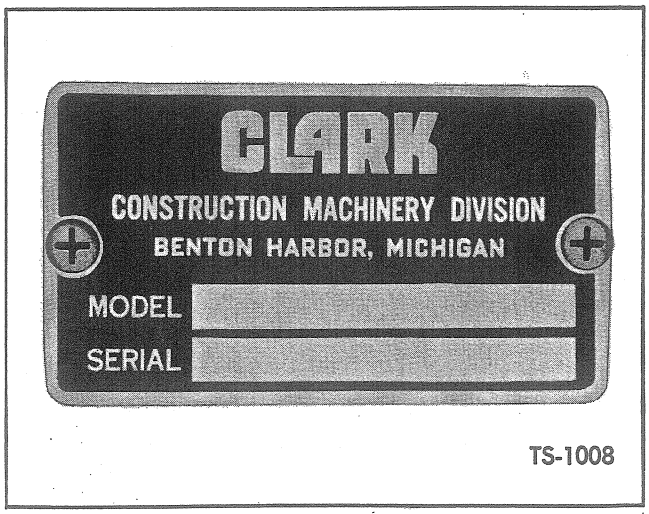


Fig. 2. Torque Converter or Transmission Serial Number Plate

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 damages in transit or storage.

2. Check fluid level in the following to specifications outlined in Lubrication Section:
   a. Engine crankcase
   b. Transmission case (with engine idling)
   c. Front steer axle differential
   d. Front steer axle planetary hubs
   e. Rear steer axle differential
   f. Rear steer axle planetary hubs
   g. Hydraulic system reservoir
   h. Steering gear
   i. Brake master cylinder
   j. Air cleaner

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.

INSTRUMENTS AND OPERATING CONTROLS

Before operating a machine of this type 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

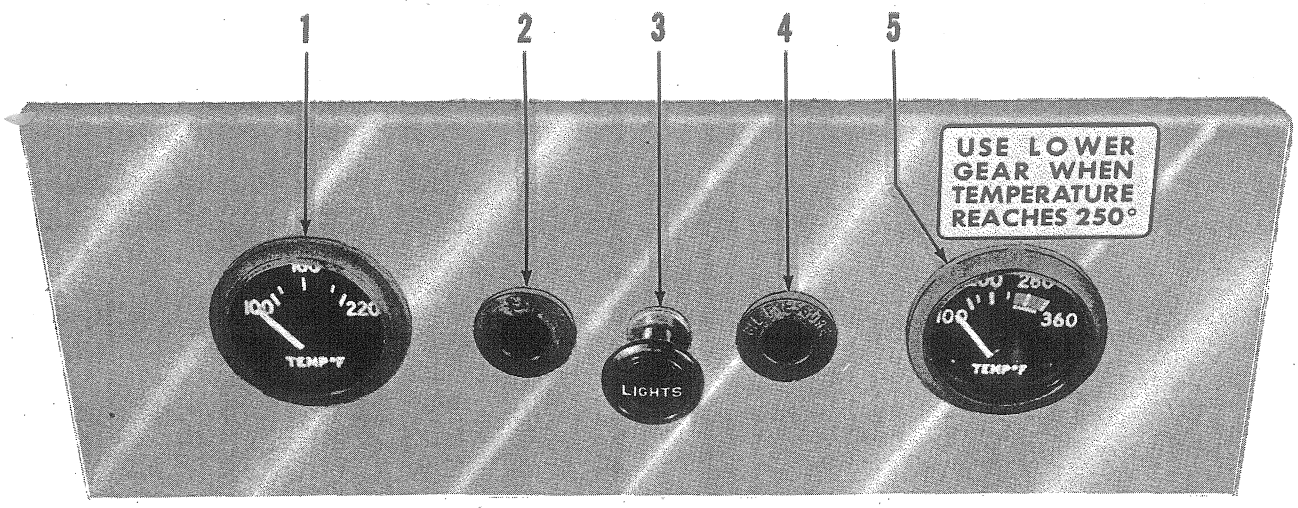
All instruments, switches and warning lights are conveniently located on the front instrument panel directly in front of the operator and on the side panels at right and left side of operator. It is good practice to observe gauges frequently while working the machine.

Each gauge and warning light 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 or warning lights are not functioning properly.

Figures 3 and 4 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.



1. Engine Temperature Gauge
2. Generator or Alternator Warning Light
3. Light Switch
4. Engine Oil Pressure Warning Light
5. Torque Converter Temperature Gauge

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Fig. 3. Front Instrument Panel

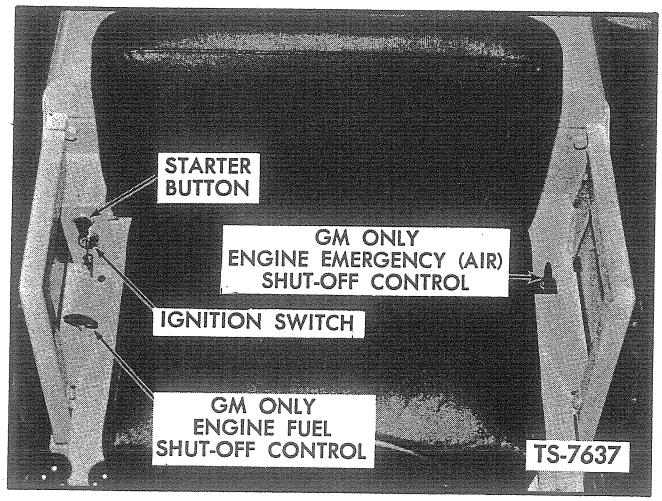


Fig. 4. Side Instrument Panels

Engine Oil Pressure Warning Light indicates oil pressure in engine lubricating system. Under normal operation, at idle and governed rpm, the warning light will not light. This will indicate oil pressure is sufficiently obtained in the lubricating system. If abnormal operation of the engine lubricating system exists, the warning light will light. If this condition exists, shut down engine immediately and determine cause.

Fuel Gauge is located on top right side of fuel tank. Gauge indicates quantity of fuel in tank.

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.

Light Switch operates head lights, and tail lights. Pull switch to operate.

Alternator or Generator Warning Light indicates current flow to and from battery. When sufficient electrical current is released from the alternator or generator to the battery the warning light will not light. This will indicate a charge (+) condition. When more electrical energy is being consumed than received from the alternator or generator, the warning light will light. This will indicate a discharge (—) condition.

SIDE INSTRUMEIT PANELS

Starter Switch is located on right side panel above ignition switch beside operator's seat. 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 10.

Ignition Switch is located on right side panel below starter switch beside operator's seat. Ignition switch energizes all gauges and warning lights on the instrument panel, and starting motor circuit. Turn key to left for ON position.

Engine Fuel Shut-Off Control—G.M. Diesel is the 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 the T-handle located at left 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.*

OPERATING CONTROLS

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

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

Refer to Figure 5 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 into HI speed range, and accelerate slightly when shifting into LO speed range.

Range Shift Lever is inner lever located on lower right side of rear floorboard. This lever provides two positions, WORKING RANGE and TRAVEL RANGE to control high and low range of the Transmission. Pulling lever to the up position engages TRAVEL RANGE (transmission high range). Pushing lever to the down position engages WORKING RANGE (transmission low range).

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 at right hand side of the seat. 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.

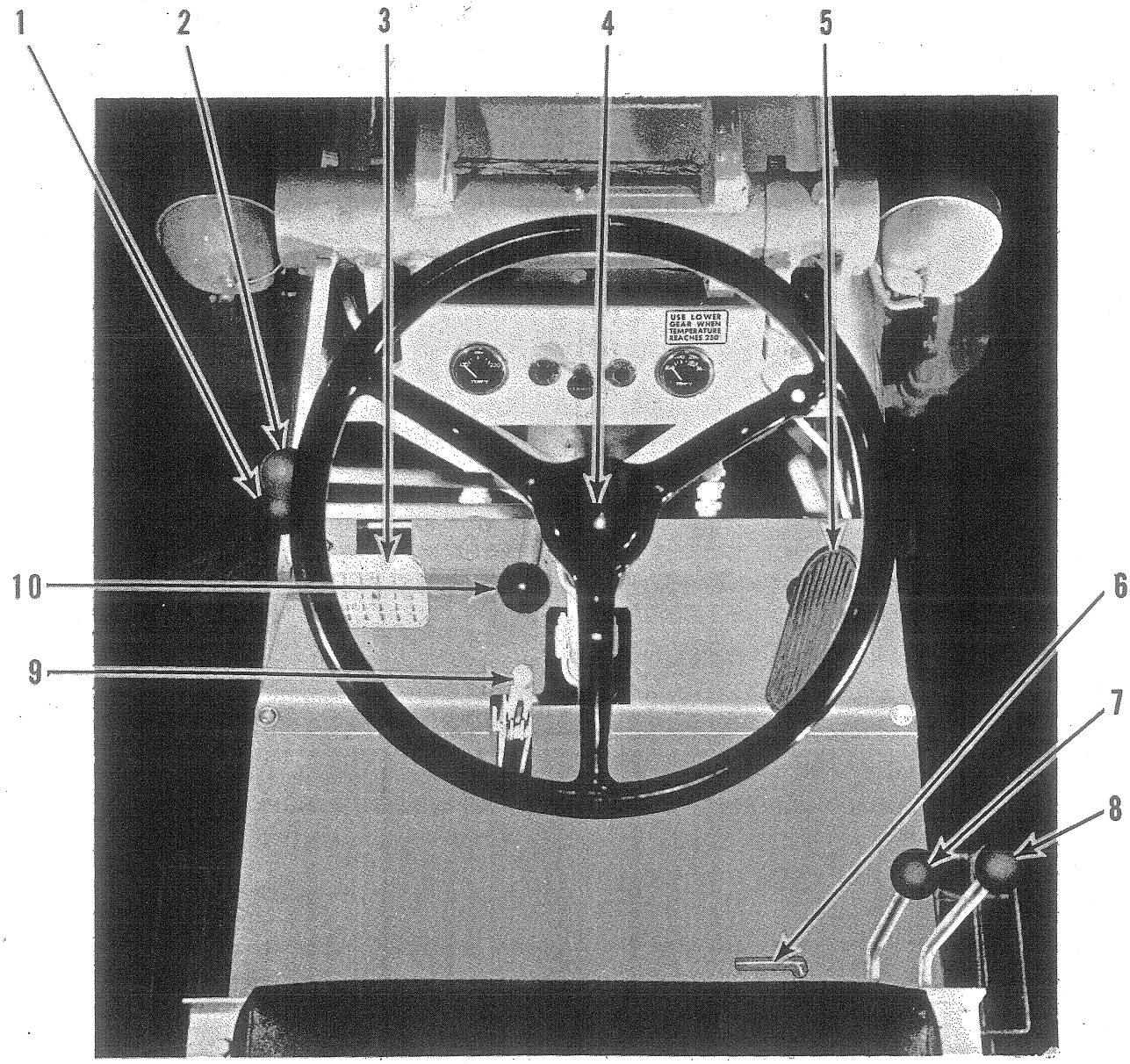
To raise boom and bucket, pull boom lever backward to last detent position. Boom and bucket will raise in direct proportion to engine speed.

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 cylinder, through the control valve and into the top of the cylinder, keeping it 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.



1. Speed Range Lever
2. Directional Shift Lever
3. Brake Pedal
4. Horn Button
5. Accelerator Pedal
6. Range Shift Lever
7. Bucket Control Lever
8. Boom Control Lever
9. Parking Brake Lever
10. Steering Selector Lever

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Fig. 5. Operating Controls

Bucket Control Lever is inner lever at right hand side of the seat. 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. Release lever and it will return to HOLD (neutral) 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.

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

Brake Pedal is designed to permit brake application with left foot of operator.

Parking Brake Lever applies internal expanding type brake on transmission output shaft. To set brake pull lever up and back. To release brake push lever forward and down.

Choke Control Knob is located on left side panel beside operator's seat. Choke regulates fuel-air mixture entering engine for easier starting and smoother running of a cold engine during the warm-up period. Pulling knob restricts air resulting in rich mixture. Choke should be used only in cold weather. When engine runs smoothly, discontinue use of choke. Gasoline engines only.

Steering Selector Valve incorporates a selector valve lever, mounted just forward of the steering column. Refer to Operating Controls Diagram, Figure 6.

The steering selector valve provides the operator with the versatility of two-wheel steer (front wheels only) for road travel and four-wheel steer for job application. Place the selector valve lever in the DOWN position for two-wheel steering and in the UP position for four-wheel steering.

Caution: *For two-wheel steer operation position rear wheels parallel to machine before moving selector valve lever to the* DOWN *position. Disconnecting steering on rear wheels with wheels other than parallel to frame can result, due to independent steering of front wheels, in a condition wherein machine will steer only in one direction without ability to recover.*

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 remove key from ignition switch.

Never Lift Bucket Over Ground Crew: Carefully observe all personnel on foot before setting machine in motion, while machine is in motion and when approaching service areas. Never swing bucket over a truck cab or ground crew.

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 em-

phasized 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.

Do Not Operate Machine Without Instruments: Each gauge and warning light 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.

Continental and 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 light. 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 or leakage.

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

Continental and 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 minutes perform the following checks:

1. Engine oil pressure warning light
2. Generator or alternator warning light
3. Engine temperature gauge
4. Torque converter temperature gauge
5. Transmission fluid level (engine idling)
6. Lights
7. 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 (right T-handle) up and hold until engine stops rotating. After engine stops running, replace T-handle in its original position.

If after pulling the right T-handle engine

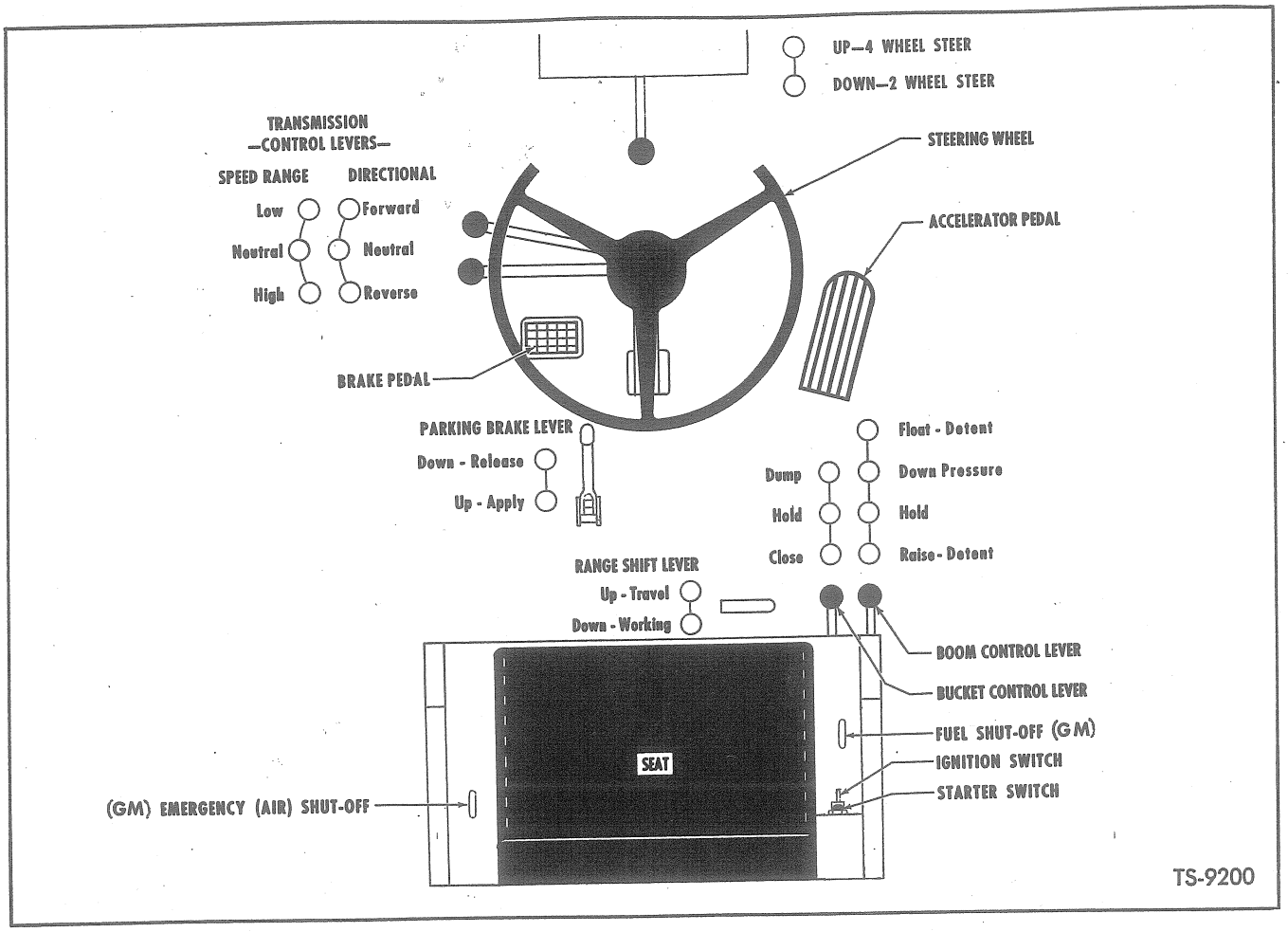


Fig. 6. Operating Controls Diagram

continues to operate, the engine emergency air shut-off control (left 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.

Continental and Waukesha Gas

A gasoline 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 6.

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 range shift lever in working range. Place speed range lever in low and directional lever in forward position. With bucket control lever, adjust bucket until pointer on right-hand side of bucket 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. 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 pointer indicates 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, 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 and 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 to CLOSE position to return bucket to level position before backing 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. Readjust bucket to level position with bucket control lever until bucket pointer is aligned with arrow point on bucket, so that when boom is down all the way, bucket cutting edge will be level with the ground. Bucket automatically adjusts itself level relative to the ground as boom is raised, so that when boom is raised to maximum height, bucket maintains load in a level position.

TRAVELING WITHOUT A LOAD IN BUCKET

When driving machine from job to job, shift into travel 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 55 ft. lbs. torque.

NOTES

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 recorded hours of normal operation. 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. 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 dipstick 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 with Lithium Soap Multi-Purpose Grease. Use grade of lubricant specified below according to ambient temperature.

Temperature Range	Grease Consistency
0° F. and Above	Heavy Oil Base–Grade 2
Below 0° F.	Light Oil Base–Grade 0

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:

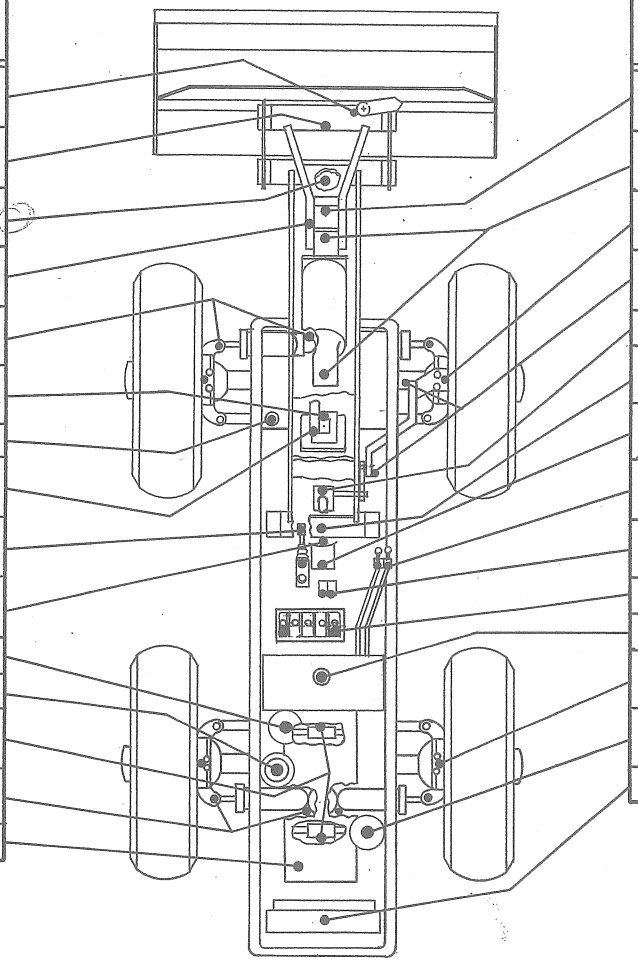
1. Machine must be LEVEL.
2. Fluid must be HOT (operating temperature of 180° F. to 200°F.).
3. Engine must be IDLING (550 to 600 rpm).
4. Area around oil level check plugs must be CLEAN.

Check and maintain fluid level between HI and LO level plug openings at lower right rear face of transmission.

Remove HI level plug to check if fluid escapes, allowing any excess to drain. If no fluid escapes remove LO level plug to check that fluid level is above this opening. If this is not the case, replace plug and refill as necessary with recommended fluid through opening in torque converter to bring fluid level to lower edge of HI level plug.

MICHIGAN
CHASSIS LUBRICATION

DESCRIPTION	HOURS 500	250	100	50	8	KEY
BUCKET INDICATOR 1 Fitting					X	LBG
LINK PIVOT SHAFT 1 Fitting					X	LBG
BUCKET PIVOT SHAFT 1 Fitting					X	LBG
BUCKET LEVELER ROD — LOWER 1 Fitting					X	LBG
STEERING CYLINDERS 2 Fittings Each Cylinder					X	LBG
BOOM CYLINDER TO BOOM 1 Fitting					X	LBG
(See Text) FUEL TANK				X	X	
BUCKET LEVELER ROD — UPPER 1 Fitting					X	LBG
BRAKE PEDAL PIVOT 1 Fitting				X		LBG
SELECTOR VALVE LEVER 1 Fitting				X		LBG
(See Text) STEERING SYSTEM FILTER	X					
(See Text) AIR CLEANER	X		X	X	X	
AXLE CRADLE BUSHINGS 2 Fittings					X	LBG
STEERING CYLINDERS 2 Fittings Each Cylinder					X	LBG
(See Text) ENGINE & ACCESSORIES					X	



KEY	HOURS 8	50	100	250	500	DESCRIPTION
LBG	X					CONNECTING LINK 2 Fittings
LBG	X					BUCKET CYLINDER 1 Fitting Each End
LBG					X	STEERING TRUNNION BEARINGS. 1 Fitting Each Side
LBG	X					STEERING DRAG LINK 1 Fitting Each End
GL		X				STEERING GEAR (See Text)
LBG	X					BOOM PIVOT SHAFT 1 Fitting
LBG	X					BOOM CYLINDER TO LOWER PIVOT 1 Fitting
LBG	X					BOOM & BUCKET CONTROL LEVERS 2 Fittings
LBG	X					TRANSMISSION BELL CRANKS 2 Fittings
		X				BATTERY (See Text)
HF	X	X				HYDRAULIC RESERVOIR & BREATHER
LBG					X	STEERING TRUNNION BEARINGS. 1 Fitting Each Side
				X		TRANSMISSION & TORQUE CONVERTER FILTER (See Text)
	X					RADIATOR (See Text)

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 or *DEXRON AUTOMATIC TRANS FLUID		
	BELOW 0°F.	TYPE A, SUFFIX A, AUTOMATIC TRANS FLUID or *DEXRON AUTOMATIC TRANS FLUID		

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

* DEXRON is completely compatable with Type A , and may be used as a make up or refill oil in any quantity.

◇ SEQUENCE TESTED

MODEL - 35AWS
TRACTOR SHOVEL

TS-9206

MICHIGAN

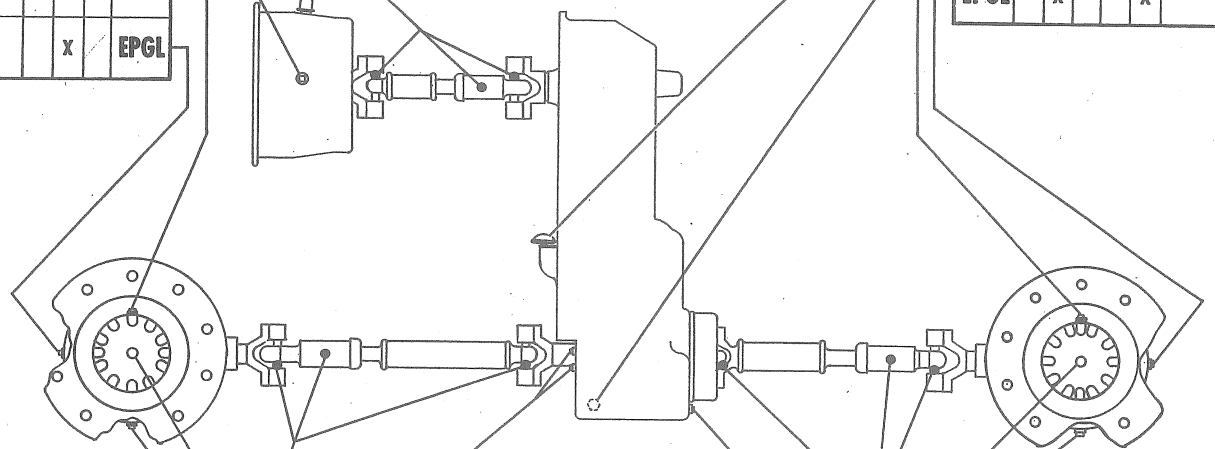
KEY	
LBG	LITHIUM BASE MULTI—PURPOSE GREASE 0°F. & Above — Grade 2 Below 0°F. — Grade 0
EPGL	SAE-90 EXTREME PRESSURE GEAR LUBE (*SCL TYPE)
HF	AMBIENT TEMP RANGE — LUBRICANT TO BE USED: SAE GRADE / API CLASS / MILITARY SPEC 1) ABOVE 0°F. — 10W / ◇MS DM / MIL-L-2104A, SUPP. 1 OR NEW MIL-L-2104B 2) ABOVE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

* DEXRON is completely compatable with Type A , and may be used as a make up or refill oil in any quantity.

◇ SEQUENCE TESTED

DESCRIPTION	HOURS 1000	500	100	50	8	KEY
PROP SHAFT (See Text) 3 Fittings				X		LBG
TORQUE CONVERTER BREATHER (See Text)					X	
TORQUE CONVERTER & (See Text) TRANSMISSION FILL PLUG			X			HF
PLANETARY FILL LEVEL & (See Text) DRAIN PLUG	X				X	EPGL
DIFFERENTIAL FILL & LEVEL PLUG (See Text)	X				X	EPGL

KEY	HOURS 8	50	100	500	1000	DESCRIPTION
		X				TRANSMISSION BREATHER (See Text)
				X		TRANSMISSION SUMP SCREEN (See Text)
EPGL		X			X	PLANETARY FILL LEVEL & DRAIN PLUG (See Text)
EPGL		X			X	DIFFERENTIAL FILL & LEVEL PLUG (See Text)



FRONT OF MACHINE

DESCRIPTION	HOURS 1000	500	100	50	8	KEY
DIFFERENTIAL DRAIN PLUG (See Text)	X					
AXLE BREATHERS (See Text)		X				
PROP SHAFT (See Text) 3 Fittings			X			LBG
TRANSMISSION LEVEL PLUGS (See Text)		X			X	

KEY	HOURS 8	50	100	500	1000	DESCRIPTION
					X	DIFFERENTIAL DRAIN PLUG (See Text)
				X		AXLE BREATHERS (See Text)
LBG			X			PROP SHAFT 3 Fittings (See Text)
				X		TRANSMISSION DRAIN PLUG (See Text)

DRIVE LINE LUBRICATION

MODEL - 35AWS
TRACTOR SHOVEL

TS-9205

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

See Lubrication Charts for recommended fluid.

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 breather cap opening must be CLEAN.

Check and maintain oil level to indicated mark on sight glass. Refill as necessary through breather cap opening adding only recommended fluid.

See "Every 50 Operating Hours" for Breather Service, "Every 500 Operating Hours" for Filter Change, and "Every 1000 Operating Hours" for Drain and Refill.

See Lubrication Charts for recommended fluid.

SERVICE WEEKLY

(Every 50 Operating Hours)

Grease Fittings: Lubricate all points indicated on Chassis Lubrication chart for 50 hour intervals with Lithium Soap Multi-Purpose Grease. Use grade of lubricant specified below according to ambient temperature.

Temperature Range	Grease Consistency
0° F. and Above	Heavy Oil Base—Grade 2
Below 0° F.	Light Oil Base—Grade 0

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 below floorboard at left side of machine. Check and maintain fluid level to within ¼ inch from top of reservoir. Add only recommended brake fluid. Vent hole in filler cap must be open at all times.

See Specifications and Service Data.

Battery: Battery is located under operator's seat. 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 Steer Axle Differential: Check lubricant level each 50 operating hours at the differential level plug. Add SAE-90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening. See "Every 1000 Operating Hours" for Drain and Refill.

Front Steer Axle Planetary Hubs: Check lubricant level each 50 operating hours. Position wheel so that fill, level and drain plug in outer diameter of hub and drum assembly is at 3 or 9 o'clock position.

Remove plug and check level, adding SAE-90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening.

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 SAE-90 Extreme Pressure Gear Lube (*SCL Type) 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. Position wheel so that fill, level and drain plug in outer diameter of hub and drum assembly is at 3 or 9 o'clock position.

Remove plug and check level, adding SAE-90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening.

See "Every 1000 Operating Hours" for Drain and Refill.

Steering Gear: Check oil level each 50 operating hours. Keep reservoir filled to plug opening with SAE-90 Straight Mineral Oil.

**"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.*

SERVICE PERIODICALLY

Check and service the following items at intervals as specified.

(Every 100 Operating Hours)

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

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 sparingly. Use grade of lubricant specified below according to ambient temperature.

Temperature Range	Grease Consistency
0° F. and Above	Heavy Oil Base—Grade 2
Below 0° F.	Light Oil Base—Grade 0

(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 located inside engine compartment on right side of machine.

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 cover before inserting new element. Using new gasket in cover, tighten center bolt to 25 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 with Lithium Soap Multi-Purpose Grease. Use grade of lubricant specified below according to ambient temperature.

Temperature Range	Grease Consistency
0° F. and Above	Heavy Oil Base—Grade 2
Below 0° F.	Light Oil Base—Grade 0

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 screen, clean in solvent, dry, and reinstall, using new "O" ring. Clean magnetic drain plug and reinstall.

4. Replace element in transmission and torque converter filter assembly (filter located inside engine compartment on right side of machine). Thoroughly clean filter case and cover before inserting new element. Using new gasket in cover, tighten center bolt to 25 ft. lbs. torque.

5. Remove breather caps located on top of transmission control valve, and on top of torque converter. Clean in solvent, blow dry with compressed air and reinstall.

6. Refill torque converter and transmission with recommended fluid through fill plug opening in

converter housing until fluid level is at lower edge of HI level plug in transmission case. 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 approximately 2 gallons of 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. Recheck transmission fluid level when it is at operating temperature (180° F. to 200° F.). Add recommended fluid or drain excess quantity as necessary to maintain level between HI and LO level plug openings.

See Lubrication Charts for recommended fluid. *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.

Steering System Filter: The steering hydraulic system is protected by a full flow replaceable element type filter assembly. Filter is located at top left side of hydraulic reservoir under hood assembly. All steering hydraulic oil is filtered as it returns to the reservoir. Since the steering and main hydraulic systems draw oil from a common reservoir, oil in both systems is filtered.

Every 500 operating hours replace filter element. Thoroughly clean filter case and cover before inserting new element. Using new gasket in cover, tighten center bolt to 25 ft. lbs. torque. Run engine 5 minutes at approximately 1500 rpm, checking filter installation for leaks.

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 hydraulic system and cause costly repairs and down time.*

(Every 1000 Operating Hours)

Radiator: Twice a year, drain, flush and refill cooling system. Refill with 13 qts. permanent anti-freeze for G.M., 9 qts. for Waukesha or Continental plus necessary amount of clean soft water to fill 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.	6.5 gals.
	Waukehsa, Continental	4.5 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 to full height with bucket dumped. Securely block or chain boom and bucket in raised position. Then shut down engine.

3. Remove filler cap and breather from top of reservoir, clean in solvent, blow dry with compressed air and reinstall.

4. Disconnect control valve to pump hose and drain reservoir.

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

6. Remove sight glass and clean all foreign material from bottom of reservoir, being careful

not to force dirt into lines and valve. Remove magnet from bottom of reservoir and clean thoroughly. Replace magnet and reinstall sight glass securely.

7. Reconnect all hoses and unions.

8. Replace element in steering system filter assembly (located at top left side of hydraulic reservoir). Thoroughly clean filter case and cover before inserting new element. Using new gasket in cover, tighten center bolt to 25 ft. lbs. torque

9. Refill reservoir to indicated level mark on sight glass.

   Capacity (approx.) .....15 gals.

10. Be sure all control levers are in NEUTRAL position. Start engine and run it at idle speed (550-600 rpm) for a few minutes.

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

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

13. After oil has ceased to aerate, add oil to reservoir to bring it to level mark on sight glass. This will replace oil drawn into the cylinders and hoses.

14. Check all connections for leaks and make certain reservoir filler cap is securely in place.

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

Front Steer Axle Differential: Drain differential every 1000 operating hours. Refill with SAE-90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening at center of axle assembly.

Capacity (approx.) .....7 qts.

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

Rotate wheel until fill, level and drain plug is at 3 or 9 o'clock position.

Add SAE-90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening.

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

Rear Steer Axle Differential: Drain Differential every 1000 operating hours. Refill with SAE-90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening at center of axle assembly.

Capacity (approx.) .....7 qts.

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

Rotate wheel until fill, level and drain plug is at 3 or 9 o'clock position.

Add SAE-90 Extreme Pressure Gear Lube (*SCL Type) until level with plug opening.

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

**"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.*

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 Oil Cup	●	●	●	●	●	●
	Check Cooling System for Leaks		●	●	●	●	●
	Drain Fuel Tank Sediment		●	●	●	●	●
	Check Anti-freeze Protection		●	●	●	●	●
	Tighten Air Cleaner Connections		●	●	●	●	●
	Check and Adjust Belt Tension		●	●	●	●	●
	Clean Air Cleaner			●	●	●	●
	Check Engine RPM				●	●	●
	Check Engine Shut-Off Controls					●	●
	Service Air Cleaner					●	●
	Clean Radiator Core					●	●
Torque Converter and Transmission System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Transmission and Torque Converter Breathers		●	●	●	●	●
	Check and Adjust Transmission Shift Linkage					●	●
	Check Transmission Clutch and Converter Out Pressures					●	●
Boom and Bucket System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Hydraulic Reservoir Breather		●	●	●	●	●
	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 Battery		●	●	●	●	●
	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					●	●
	Bleed Steering System					●	●
	Adjust Drag Link Ball Joints					●	●
	Check Steer Axle Stops					●	●
	Adjust Steering Gear						●
Brake System	Adjust Service (Wheel) Brakes				●	●	●
	Adjust Parking Brake				●	●	●
General Maintenance	Visually Inspect Machine	●	●	●	●	●	●
	Clean Cylinder Rods		●	●	●	●	●
	Adjust Cylinder Packing Glands				●	●	●
	Tighten Mounting Bolts					●	●
	Steam Clean Machine					●	●
	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 OIL CUP
- CHECK TIRE PRESSURE AND CASING
- VISUALLY INSPECT MACHINE

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

Clean Air Cleaner Oil Cup: 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.

Machines are equipped with an oil bath air cleaner. Under no circumstances should more than ½ inch of foreign material be allowed to collect in either section of the dual cup mounted at the base of the cleaner.

Remove and empty oil cup, and scrape out sediment. Wash cup in clean kerosene or cleaning solvent and dry thoroughly with compressed air.

Inspect and clean lower screen and center tube when oil cup is serviced. Refill inner and outer oil cup with clean oil to level mark with same grade oil used in engine crankcase. Reassemble oil cup to air cleaner body.

Check Tire Pressure and Casings: Check air pressure in all tires. See Specifications and Service Data on Page 56 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.

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.

Visually Inspect Machine: Visually inspect general condition of the machine, operating controls, instruments and switches, control rods 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 TRANSMISSION AND TORQUE CONVERTER BREATHERS
- CLEAN HYDRAULIC RESERVOIR BREATHER
- CHECK LIGHTS AND FUSE
- SERVICE BATTERY
- TIGHTEN WHEEL NUTS AND INSPECT RIMS
- 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: Each 50 operating hours open drain cock at bottom of fuel tank to drain accumulated water and sediment.

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

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

All new belts will loosen after operating for a day or two and must be rechecked and retensioned if necessary. Whenever new belts are installed and

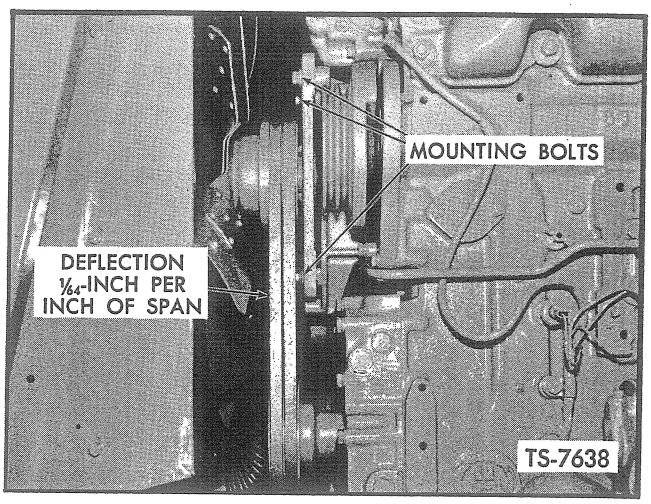


Fig. 7. Check Belt Tension — G.M. Only

at specified intervals check and retension belts as follows:

G.M. Diesel:

1. Measure the span length.
2. Refer to Figure 7 for G.M. Diesel; loosen three mounting bolts and adjust belt tension to obtain 1/64-inch deflection per inch of belt span. Tighten mounting bolts.
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 rechecked 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.

Continental and Waukesha Gas:

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 8.
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 rechecked and retensioned if necessary.

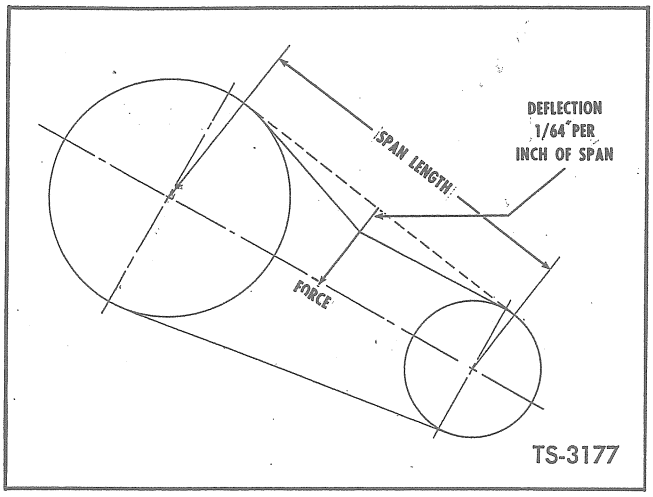


Fig. 8. Check Belt Tension

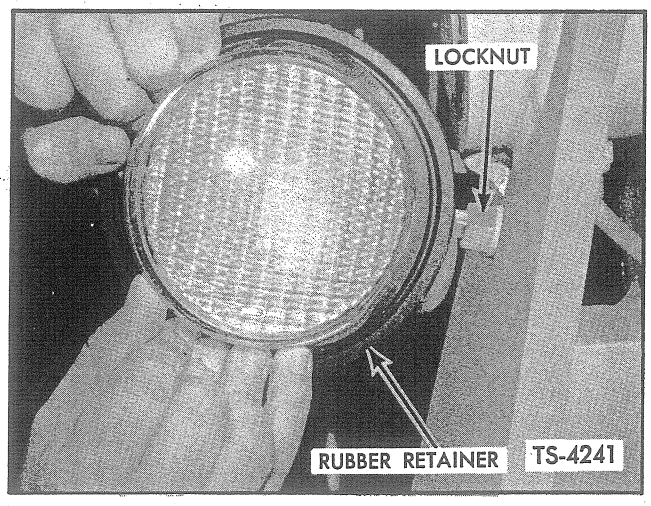


Fig. 9. Aim or Replace Floodlamps

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.

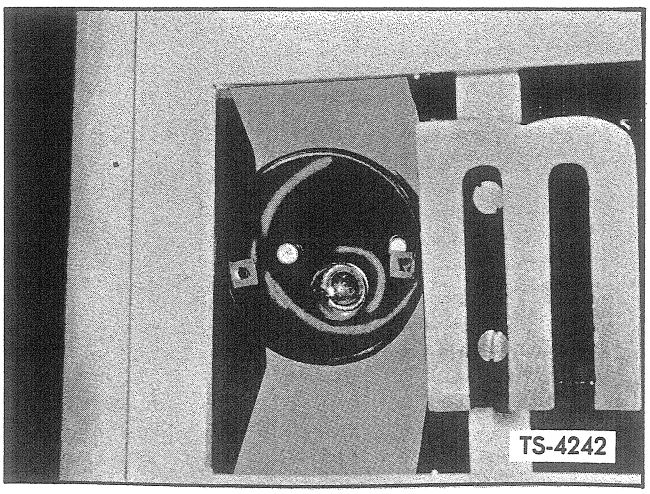


Fig. 10. Replace Tail Lamps

Clean Transmission and Torque Converter Breathers: The transmission and torque converter hydraulic system is equipped with mesh type breathers located on transmission control valve and on top of torque converter.

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

Clean Hydraulic Reservoir Breather: The boom and bucket, and steering hydraulic systems draw oil from a common reservoir. The reservoir, open to atmospheric pressure, is protected by a mesh type breather serving as a filler cap to admit only clean filtered air. Breather cap is located at top of reservoir.

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

Check Lights and Fuse: One SFE 4 amp fuse provides protection for the gauge circuit. The fuse is contained in a plastic connector behind the instrument panel. Remove three mounting bolts securing panel and pull panel back toward operator. Push and twist to open and lock connector. The light circuit is not equipped with a fuse.

(a) **Floodlamps:** The machine is equipped with two floodlamps that disperse light in a horizontal pattern. The floodlamps are mounted in shock resistant rubber retainers located at each side of the boom-pivot tube assembly. See Figure 9.

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

1. Loosen locknut securing floodlamp to boom pivot tube assembly.
2. Raise or lower floodlamp as necessary to obtain desired beam and retighten locknut securely.

If necessary to replace floodlamps, depress lamp and spread lip of rubber retainer outward forcing lamp out as shown in Figure 9 and disconnect terminals. Reconnect terminals on new lamp and reinstall in retainer.

(b) **Tail Lamps:** The 12 volt tail lamps can be easily replaced by a push and twist. Two screws retain reflectors on the tail lamp assemblies as shown in Figure 10.

Service Battery: Battery is located under the operator's seat. Keep terminals clean and tight, and be sure that distilled water is added to cover plates and separators in each cell. Do not overfill.

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 190 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.

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

100 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CLEAN AIR CLEANER**

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

Clean Air Cleaner: If operating conditions are extremely dusty, check center tube for dust and oil accumulation. Pass a clean, lint-free cloth through the center tube to clean the walls.

250 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CHECK ENGINE RPM**
- **ADJUST BUCKET INDICATOR**
- **ADJUST SERVICE (WHEEL) BRAKES**
- **ADJUST PARKING BRAKE**
- **ADJUST CYLINDER PACKING GLANDS**

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 55.

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 WITHOUT CONSULTING OPERATION AND MAINTENANCE MANUAL OF ENGINE MANUFACTURER.

G.M. Diesel

1. Unhook spring from accelerator linkage and disconnect ball joint 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 full throttle position and adjust ball joint 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 Figure 11.
4. Reinstall and secure ball joint to governor throttle lever and reconnect accelerator spring.

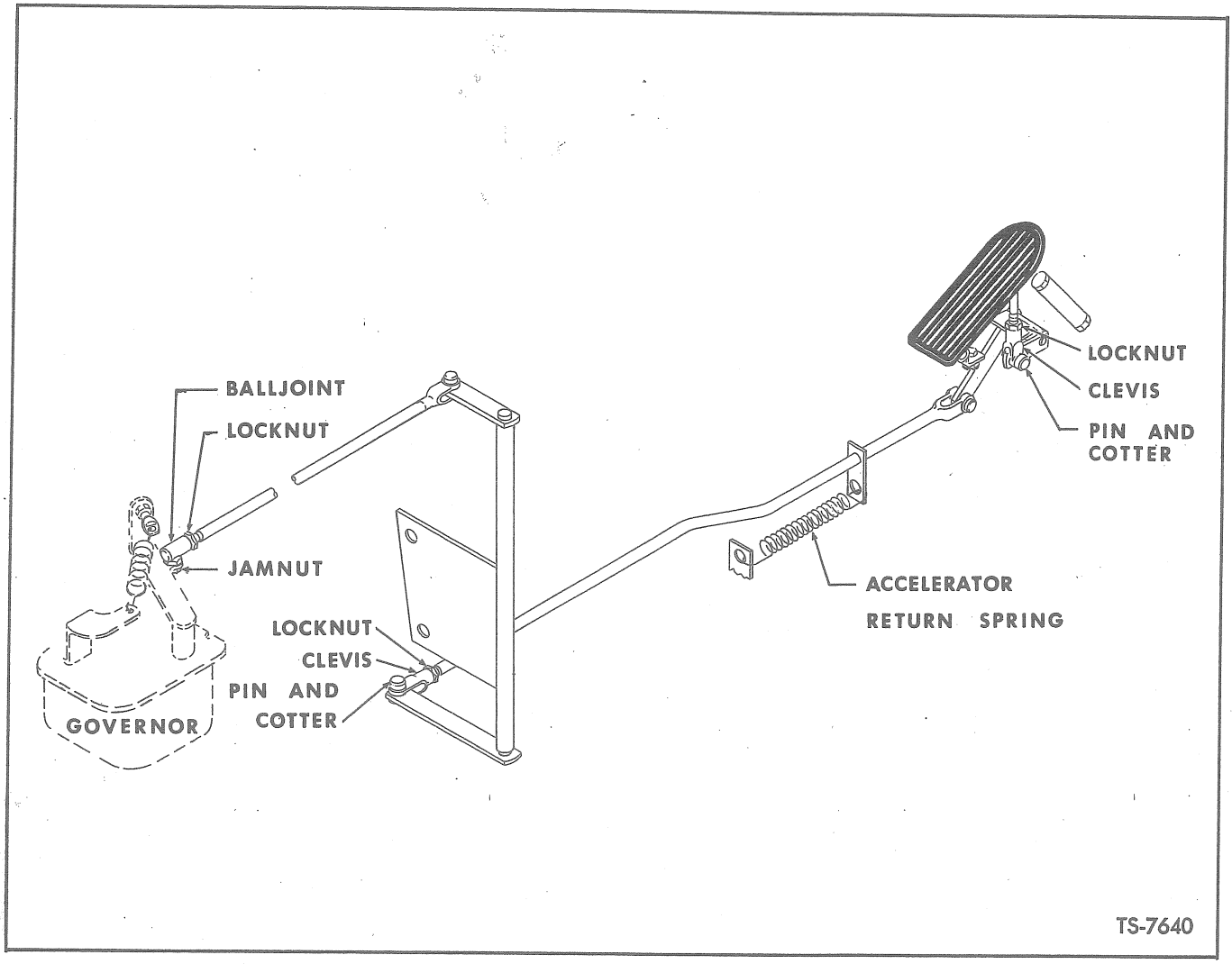


Fig. 11. Adjust Throttle Linkage — G.M. Diesel

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.

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

Continental and Waukesha Gas:

DO NOT ADJUST CARBURETOR WITHOUT CONSULTING OPERATION AND MAINTENANCE MANUAL OF ENGINE MANUFACTURER.

Linkage adjustment that follows is for linkage between accelerator and throttle lever on carburetor. Choke adjustment is also given in this section.

Throttle Adjustment

1. Unhook spring from accelerator linkage and disconnect clevis at bell crank end. Rotate throttle lever on carburetor to extreme forward position as shown in Figure 12.
2. Depress accelerator until it contacts stop on floorboard.

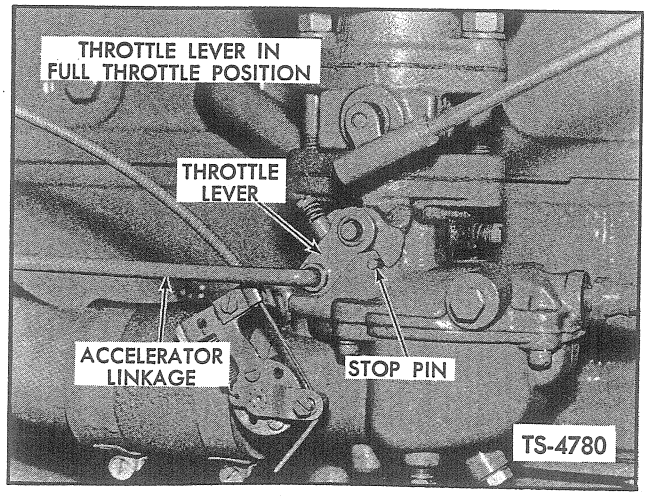


Fig. 12. Adjust Throttle Linkage

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

4. Reinstall and secure clevis to accelerator bell crank and reconnect accelerator spring.

5. Release accelerator, and check that linkage will return throttle lever to idle position.

6. If sufficient adjustment is not available at rear clevis, adjust clevis under accelerator pedal.

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

Choke Adjustment

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 13.

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.

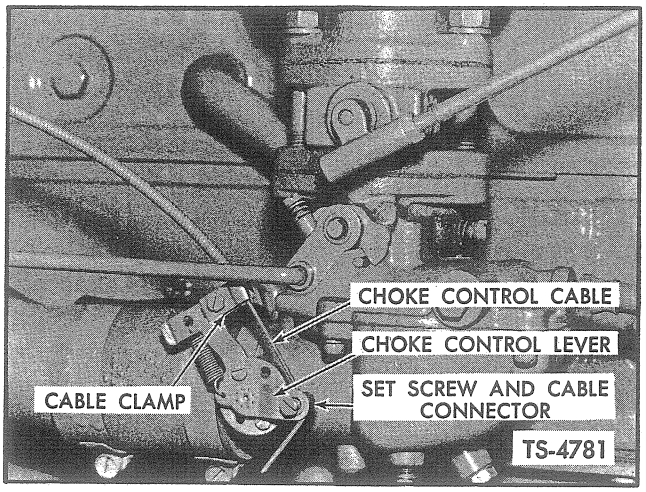


Fig. 13. Adjust Choke Control

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–4th (HI and TRAVEL RANGE) and accelerate engine. When engine reaches maximum rpm–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 55.

Note: *Stall rpm specified on Page 55 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: An adjustment is provided on indicator rod to maintain alignment between pointer and arrow point on bucket. Pointer should be horizontal when bucket is level.

Loosen locknut on indicator rod and remove

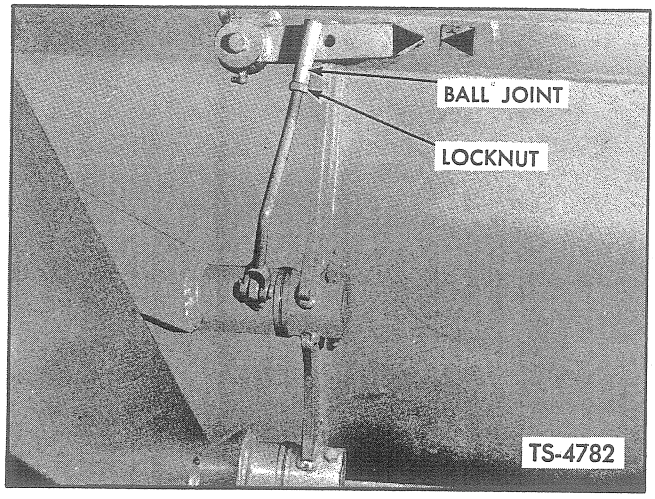


Fig. 14. Adjust Bucket Indicator

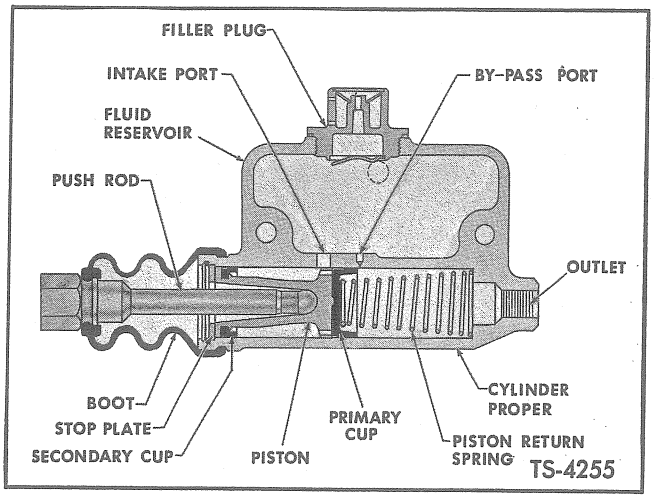


Fig. 15. Master Cylinder — Cutaway

nut securing ball joint assembly to pointer. Adjust ball joint assembly so that pointer is properly aligned when viewed from operator's seat. See Figure 14. Reassemble and tighten locknuts securely.

Adjust Service (Wheel) Brakes: The hydraulic, double shoe, internal-expanding service brakes are operated by an automotive type foot pedal. Two internal expanding brake shoes operate in each of the rear wheels. The shoes in both rear brakes are expanded by opposed pistons acting in the wheel cylinder and operating directly on each shoe.

The function of the master cylinder assembly (Figure 15) is to displace fluid for brake applications, to constantly maintain the correct volume of fluid in the system under all temperature conditions, to automatically replace fluid lost through gravity seepage or slight leaks, and to add fluid or super-charge the system on the return stroke of the pedal after each brake application.

Inadequately braking may indicate a need to replenish fluid in the master cylinder, adjust pedal free travel, bleed brake lines or to adjust the brake shoes.

(a) Pedal Free Travel

Brake pedal free travel is the distance the pedal moves before the push rod touches the master cylinder piston. Excessive free motion reduces the effective travel of the master cylinder piston, and results in poor braking effort. Insufficient free travel may cause blocking of the compensating port and prevent the brakes from releasing. Always check and adjust pedal free travel as follows before making any brake adjustment. Refer to Figure 16.

1. Depress pedal by hand, noting distance pedal moves before resistance is offered. Proper travel is ¾ inch free travel.

2. Loosen locknut and turn adjusting nut clockwise to decrease travel, counterclockwise to increase travel.

3. Tighten locknut securely and recheck pedal free travel.

(b) Bleed Brake Lines

Proper operation of hydraulic brakes require a solid column of fluid without air bubbles at all points in the pressure system. Because of loose fittings, leaking cylinders or low fluid level in master cylinder it is necessary to "bleed" the system in order to expel air bubbles which have become mixed with the fluid. The necessity of bleeding is indicated by a soft or spongy pedal.

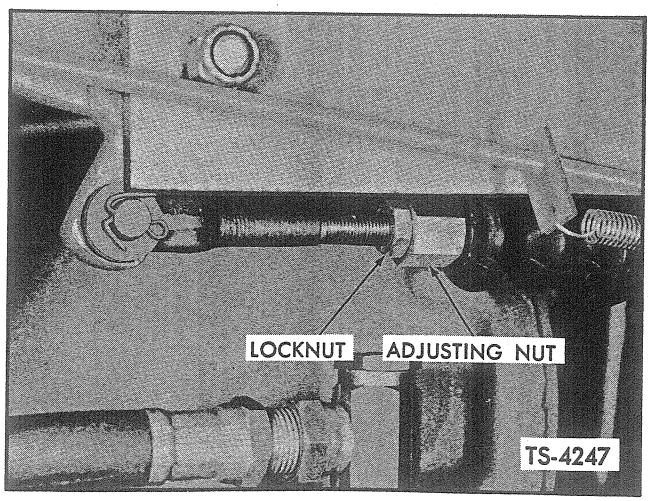


Fig. 16. Adjust Brake Pedal Free Travel

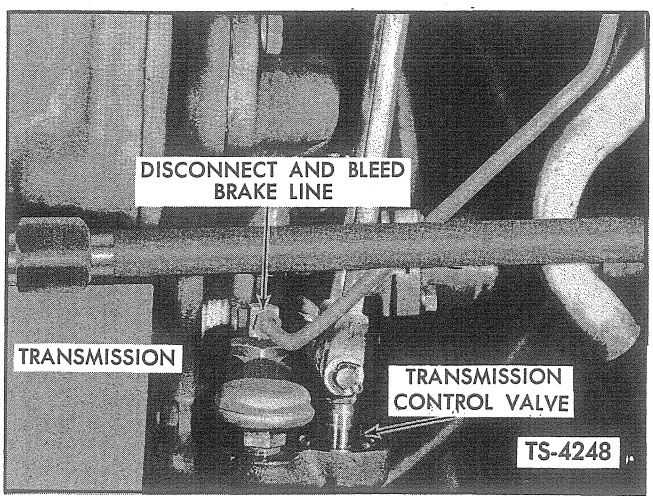


Fig. 17. Bleed Brakes — Transmission

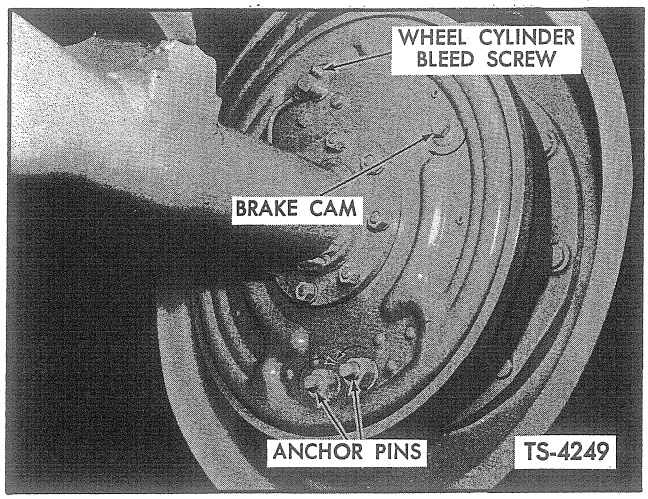


Fig. 18. Adjust Brake Shoes

The transmission and both rear wheel cylinders must be bled in the following order. Refer to Figures 17 and 18.

1. Transmission
2. Right rear wheel cylinder
3. Left rear wheel cylinder
4. Transmission (again)

Two methods of bleeding brakes are commonly used: manual bleeding and pressure bleeding. Pressure bleeding introduces fluid under pressure into the master cylinder and does not require depressing pedal during the bleeding operation. Manual bleeding is as follows:

1. Fill master cylinder with fluid.
2. With the aid of a helper disconnect brake line from transmission control valve as shown in Figure 17 and depress brake pedal to expel air and fluid from lines.
   When pedal reaches maximum stroke, reconnect brake line before releasing pedal.
3. Repeat this procedure until solid fluid, free from bubbles, flows from brake line, checking master cylinder frequently to insure ample supply of fluid.
4. Open bleed screw on right rear wheel as shown in Figure 18 and depress brake pedal to expel air and fluid from lines.

   When pedal reaches maximum stroke, close bleed screw before releasing pedal.
5. Repeat this procedure until solid fluid, free from bubbles, comes from bleed screw, checking master cylinder frequently to insure ample supply of fluid.
6. Repeat Steps 4 and 5 in sequence to bleed left rear wheel.
7. Repeat Steps 2 and 3 to bleed transmission again.

(c) **Shoe Adjustment – Minor:** When brake lining becomes worn allowing the brake pedal too much travel, it is necessary to adjust brake lining in closer relation with brake drums. This adjustment changes the toe adjustment only. The anchor adjustments are not moved.

A brake adjustment also should be made after a wheel cylinder is removed for reconditioning as previous adjustment is lost when shoes are moved out for wheel cylinder removal.

It will also be necessary to bleed brakes, by referring to that paragraph of this section, as air will have entered the system with the wheel cylinder removed.

Adjustment is made at the outside of the brake backing plate as shown in Figure 18.

1. Raise wheels off the ground.
2. Rotate shoe adjusting cam in direction of arrow until lining drags on drum.
3. Back off cam until drum runs free.
4. Adjust both cams at both rear wheels in same manner.
5. Test brakes for proper application and release.

(d) **Shoe Adjustment – Major:** A major shoe adjustment must be performed whenever new brake linings are installed.

1. Raise wheels off the ground.
2. Rotate shoe adjusting cam in direction of arrow until lining drags on drum.

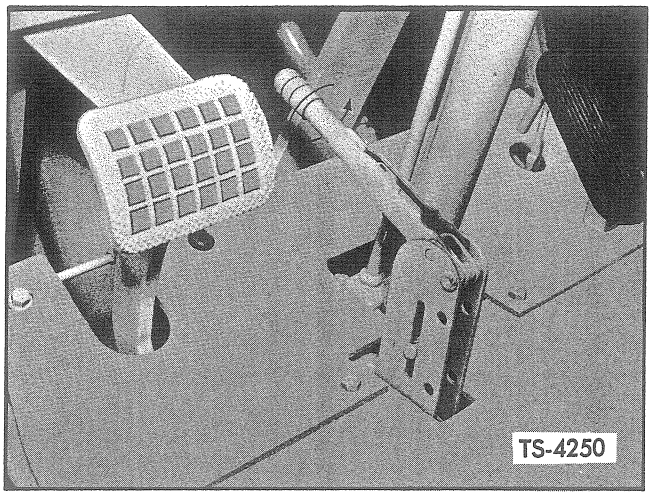


Fig. 19. Adjust Parking Brake at Handle

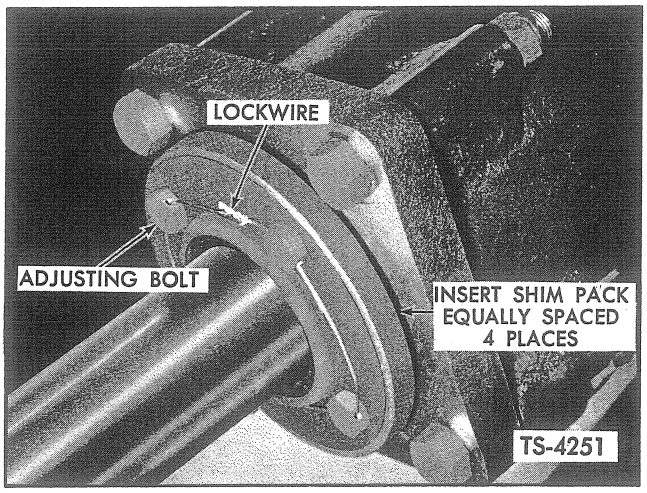


Fig. 20. Adjust Packing Gland (Bucket Cylinder Shown)

3. Rotate eccentric shoe anchor in direction of arrow until drag is relieved.
4. Repeat Steps 2 and 3 in sequence until drag cannot be relieved.
5. Back off shoe adjusting cam and then anchor adjustment just enough to relieve drag. (Lining to drum clearance as indicated by feeler gauge should be .010 at toe of shoe and .005 at heel.)
6. Adjust both shoes at both rear wheels in same manner.
7. Tighten anchor pin nuts to 150 foot pounds torque making sure no pin rotation occurs during tightening.
8. Complete the minor adjustment as outlined in preceding paragraph. Check the operation of wheels and brakes to see if brakes will set but that there is no bind when brakes are released.

If new linings have been installed, complete a major and minor adjustment at the time of installation. *After machine has been operated for 50 hours, recheck brake adjustment.*

Adjust Parking Brake: When parking brake requires adjustment, set lever in released position and turn acorn on end of handle clockwise to increase tension, and counterclockwise to reduce tension as shown in Figure 19.

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

Adjust Cylinder Packing Glands: The packing gland on boom, bucket or steering cylinders occasionally may require adjustment to prevent excessive leakage past the wiper seal. A certain amount of leakage is desirable to keep the rod and seal lightly lubricated and clean. See Figure 20.

1. Clip lockwire and tighten down bolts until packing is snug.
2. Check with feeler gauge shim pack in at least four places that all bolts are tightened evenly.
3. Lockwire bolts.

500 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **SERVICE AIR CLEANER**
- **CHECK ENGINE SHUT-OFF CONTROLS**
- **CLEAN RADIATOR CORE**
- **CHECK AND ADJUST TRANSMISSION SHIFT LINKAGE**
- **CHECK TRANSMISSION CLUTCH AND CONVERTER OUT PRESSURES**
- **CHECK BOOM AND BUCKET PRESSURE**
- **ADJUST BOOM AND BUCKET CONTROL LEVERS**
- **CLEAN AND TIGHTEN ELECTRICAL CONNECTIONS**
- **CLEAN AXLE BREATHERS**
- **CHECK STEERING PRESSURE**
- **BLEED STEERING SYSTEM**
- **ADJUST DRAG LINK BALL JOINTS**
- **CHECK STEER AXLE STOPS**
- **TIGHTEN MOUNTING BOLTS**
- **STEAM CLEAN MACHINE**

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

Air Cleaner: Inspect the lower portion of the body assembly. If there is any sign of build-up or plugging, remove entire air cleaner. Service the oil cup as usual.

Pump solvent through the air outlet with sufficient force and volume to produce a hard, even stream out of the bottom of the body assembly.

Reverse flush until all foreign material is removed. Air dry cleaner thoroughly before further use. Always cover the engine intake pipe while the cleaner is being serviced.

Reassemble and tighten all connections securely.

Check Engine Shut-Off Controls: G.M. Diesels are equipped with two shut-off controls; a fuel shut-off for normal shut down, and an air shut-off for emergency purposes. Both of these controls must operate freely to shut down the engine.

Check and adjust shut-off controls as follows:

(a) **Fuel Shut-Off Control**

1. Start engine; then pull engine fuel shut-off control T-handle located at right side of operator to the UP position and hold to shut down engine.

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 rotates engine fuel shut-off lever on governor assembly sufficiently to shut down engine.

4. Adjust cable tension if necessary at engine fuel shut-off lever on governor assembly by loosening set screw from cable connector, and increasing cable tension as necessary. Resecure cable in cable connector by retightening set screw. See Figure 21.

5. Recheck operation of engine fuel shut-off control to insure proper engine shut down.

(b) **Emergency (Air) Shut-Off Control**

Perform this check with engine shut down as frequent usage may damage seals in blower assembly.

1. Pull engine emergency (air) shut-off control T-handle located at left side of operator and check that cable operation releases shut down latch assembly enabling engine air shut-off valve to completely close inside air intake housing.

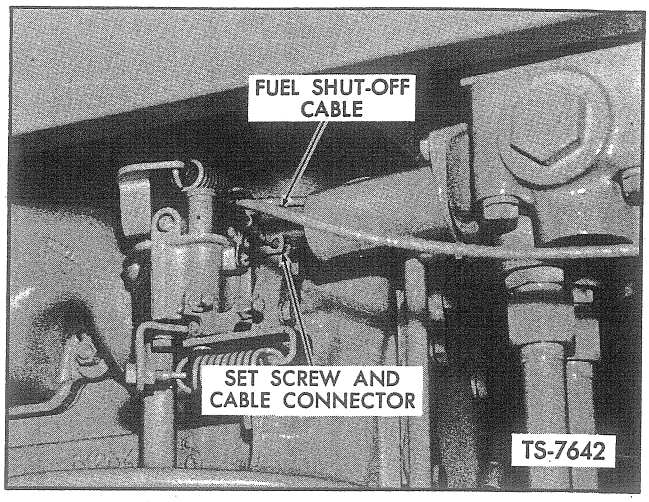


Fig. 21. Adjust Engine Fuel Shut-Off Control — G.M. Diesel

2. If cable binds or sticks, eliminate kinks or free with penetrating oil. Remove excess oil to prevent dirt accumulation.

3. Adjust cable tension if necessary at engine air shut down latch assembly by loosening set screw from cable connector, and increasing cable tension as necessary. Resecure cable in cable connector by retightening set screw. See Figure 22.

4. Reset engine emergency (air) shut-off control in its original position and manually reset the latch assembly after each use before attempting to restart the engine.

5. Recheck operation of engine emergency (air) shut-off control to insure proper release of the shut down latch assembly and valve inside air intake housing.

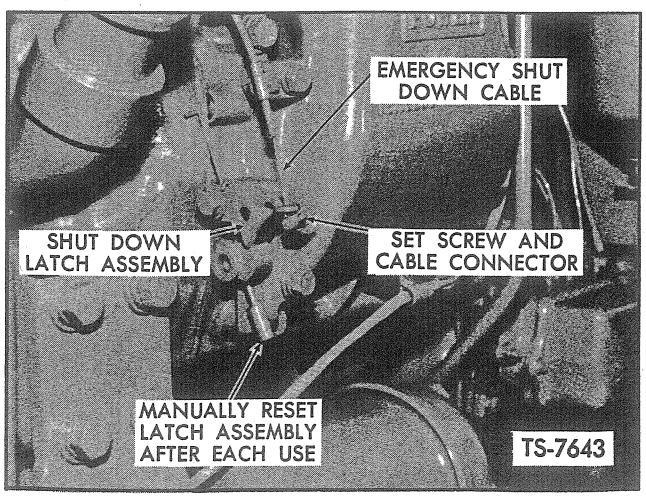


Fig. 22. Adjust Engine Air (Emergency) Shut-Off Control — G.M. Diesel

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.

1. Check and tighten U-bolts holding shift lever support plates to steering column. See Figure 23. These bolts should be snug. Support plates are keyed into steering column which prevents their rotation.
2. Place speed range and directional shift levers in NEUTRAL position.
3. Loosen locknut on shift rod, and remove nut securing ball joint assembly as shown in Figure 24.
4. Adjust ball joint assembly on both shift rods as necessary until levers in operator's compartment are properly aligned.

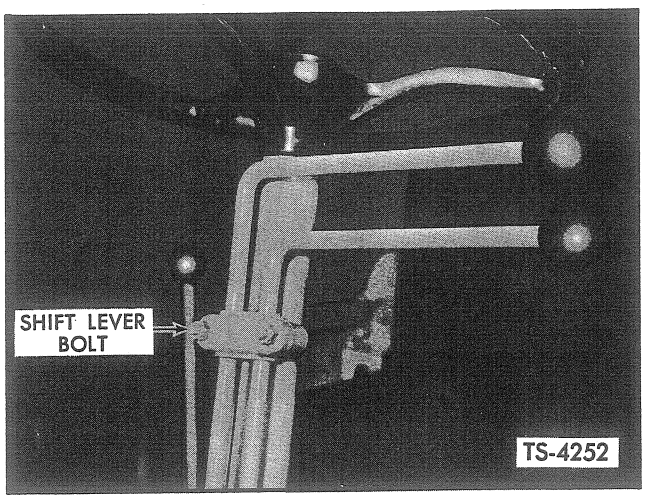


Fig. 23. Tighten Shift Lever Mounting Bolts

5. Reassemble and tighten locknuts.
6. Check that levers will shift into all detent positions without interference from steering column or transmission.

(b) **Range Shift Lever**

Range shift lever engages working range (transmission low range) and travel range (transmission high range).

This lever installation requires no adjustments. However, inspection of the linkage and attaching hardware for any signs of damage is recommended.

Check Transmission Clutch and Converter Out Pressures: Check transmission clutch and converter out pressures at specified intervals, or whenever machine evidences overheating or no power in any one of the four speeds in forward or reverse direction.

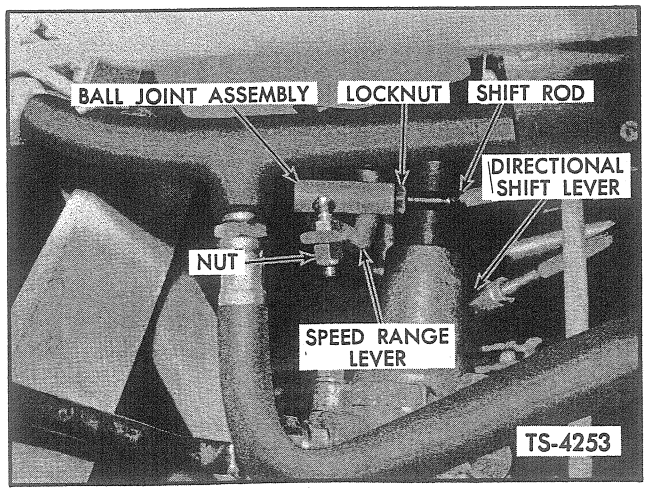


Fig. 24. Adjust Directional and Speed Range Shift Levers — Steering Column

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

(a) **Transmission Clutch Pressure**

Periodically or whenever machine evidences improper operation in any one of the four speed ranges in forward or reverse direction, a check of the clutch operating pressure should be made.

Using a test gauge of at least 400 psi capacity, check should be made at the pressure regulator valve assembly by removing pipe plug and inserting test gauge line as shown in Figure 25.

Pressure check should be taken with fluid at operating temperature (180°F. to 200°F.). Wheels of machine should be securely blocked and parking brake applied. Pressure check should be made in all speed ranges in both forward and reverse direction. With engine idling (550 to 600 rpm) and at operating temperature (180°F. to 200°F.), pressure should be as follows:

Minimum 180 p.s.i.

Maximum 200 p.s.i.

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

(b) **Converter Out Pressure Check**

Periodically or whenever machine evidences an overheating condition, inspect and check for collapsed or ruptured hoses that might cause overheating. Correct as necessary. If overheating condition still exists, check converter OUT pressure to determine whether oil cooler at bottom of radiator has or is becoming plugged with foreign material.

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

1. Check engine speed. Install gauge at converter OUT pressure port as shown in Figure 26.
2. Apply parking brake; shift directional and speed range levers into NEUTRAL position.
3. With the aid of a helper, read gauge at steady 2000 rpm. Gauge reading must not exceed 80 psi.

If the pressure reading exceeds 80 psi it will be necessary to thoroughly clean or replace the oil cooler and/or the radiator assembly.

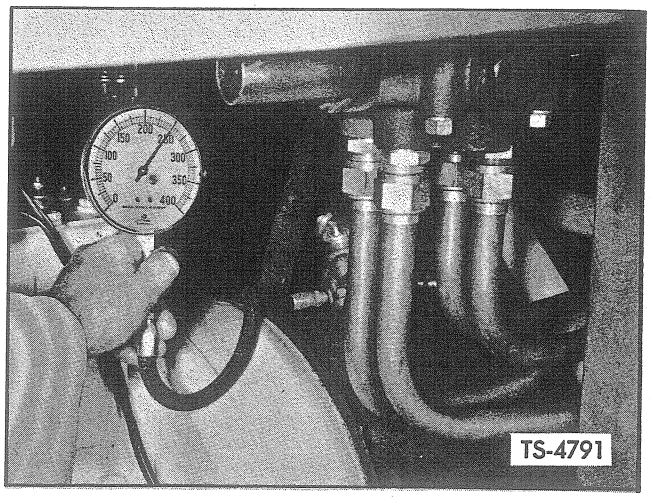


Fig. 25. Check Pressure — Transmission Clutches

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 27. Apply parking brake and block wheels.

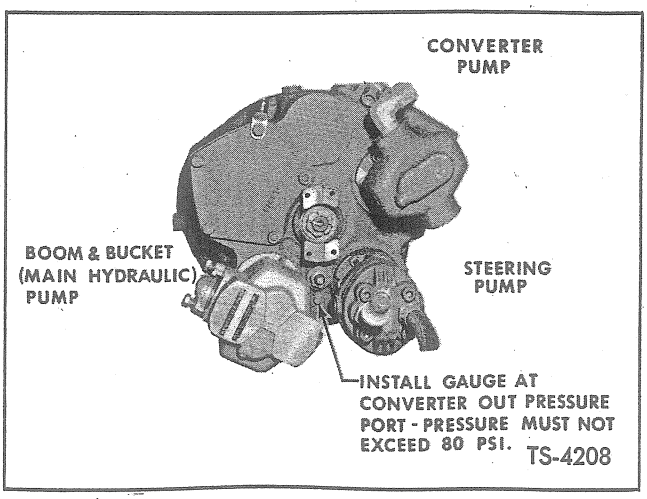


Fig. 26. Check Converter OUT Pressure

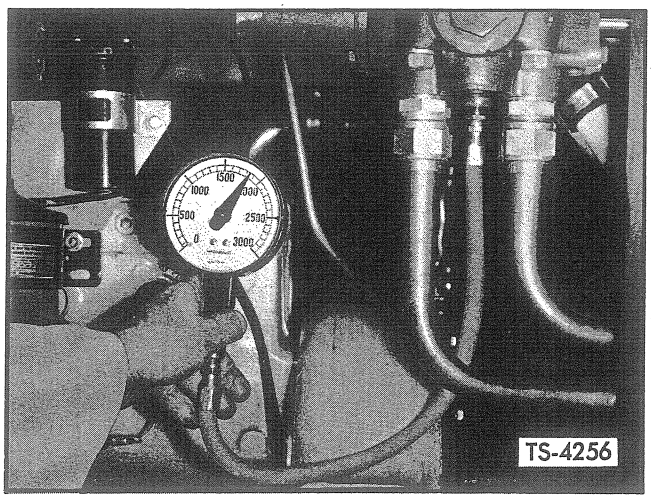


Fig. 27. Check Pressure — Boom and Bucket Control Valve

3. Start and accelerate engine. When maximum rpm is reached, rotate bucket to full close position. When engine rpm drops to its lowest point – gauge should read 1825 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 28. Turn screw in increments of approximately ¼ revolution or less, set locknut, and retake reading. Repeat until gauge reads 1825 psi.

5. Shut down engine, set locknut, and replace acorn nut. Lower boom and bucket, remove gauge line from valve, and reinstall plug.

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

With engine shut down, and bucket on the ground, place levers in HOLD (neutral) position. The adjustment can be made as follows: See Figure 29.

1. Loosen locknut on control rod.

2. Remove cotter and clevis pin.

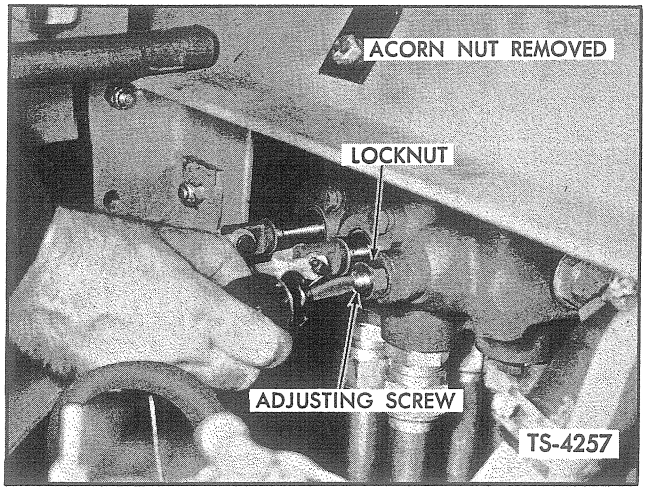


Fig. 28. Adjust Pressure — Boom and Bucket Control Valve

3. Turn clevis clockwise to move lever forward away from operator; counterclockwise to move lever backward 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 battery, cranking motor, voltage regulator, alternator, solenoid switch, relays, instruments and switches for worn, cracked, broken or frayed insulation and loose terminal connections. Check for frayed or corroded external ground straps and corrosion on battery terminal posts.

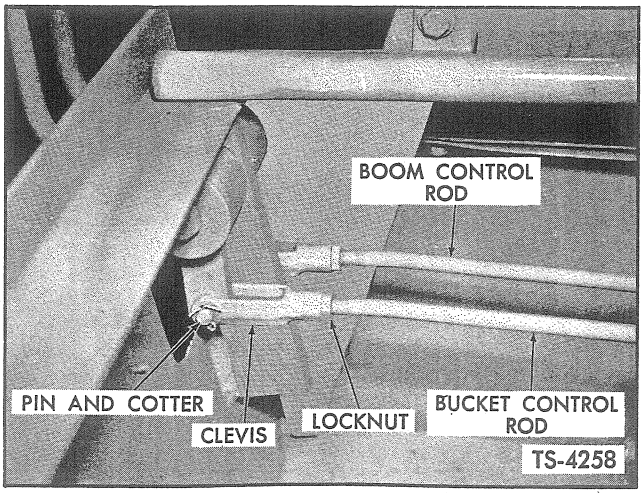


Fig. 29. Adjust Boom and Bucket Control Levers

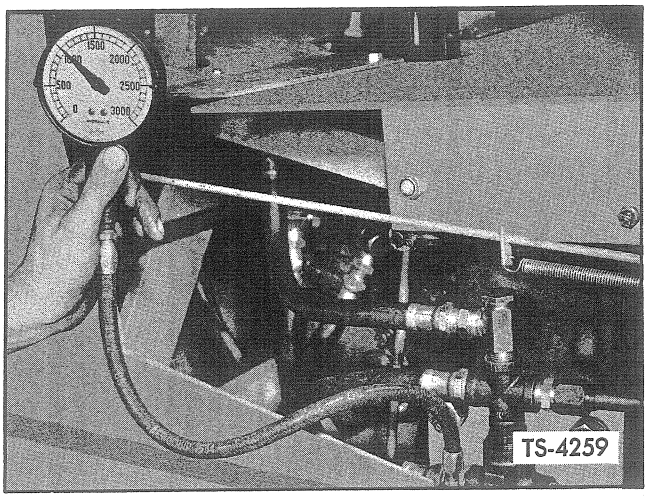


Fig. 30. Check Pressure — Steering Pressure Relief Valve

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 front 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 above 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 30.

2. Start engine and accelerate to maximum rpm.

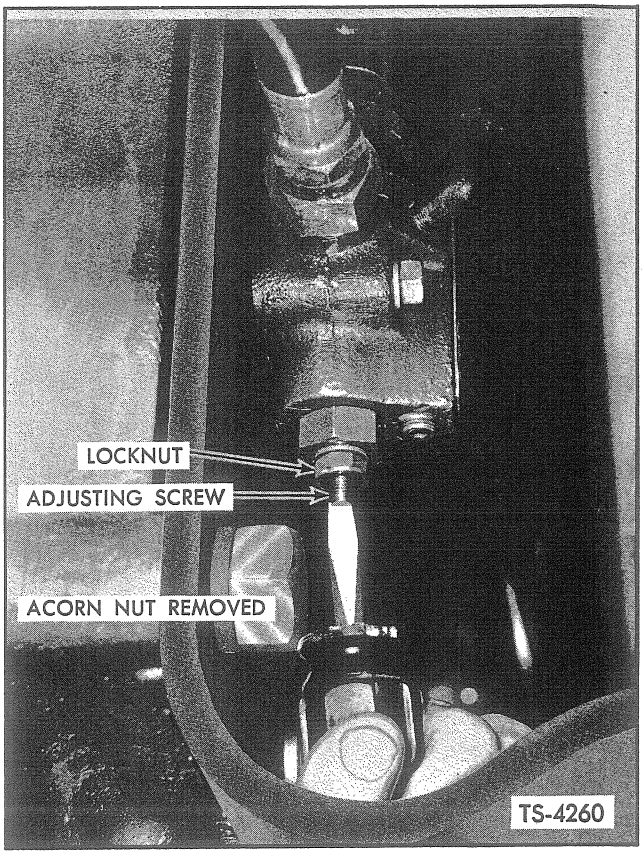


Fig. 31. Adjust Pressure — Steering Pressure Relief Valve

3. Turn wheels right or left and hold against the axle stops. Take a pressure gauge reading which should be 1000 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 31. Turn screw in increments of approximately ¼ revolution or less, set locknut, and retake reading. Repeat until gauge reads 1000 psi.

5. Shut down engine, set locknut, and replace acorn nut. Remove gauge from valve, and reinstall plug.

Bleed Steering System: With engine idling (550 to 600 rpm) and at operating temperature (180° F. to 200° F.) bleed the steering system as follows:

Proper operation of the steering system requires that it be free of air. Therefore, any time a cylinder, hose, or other unit of the system is found

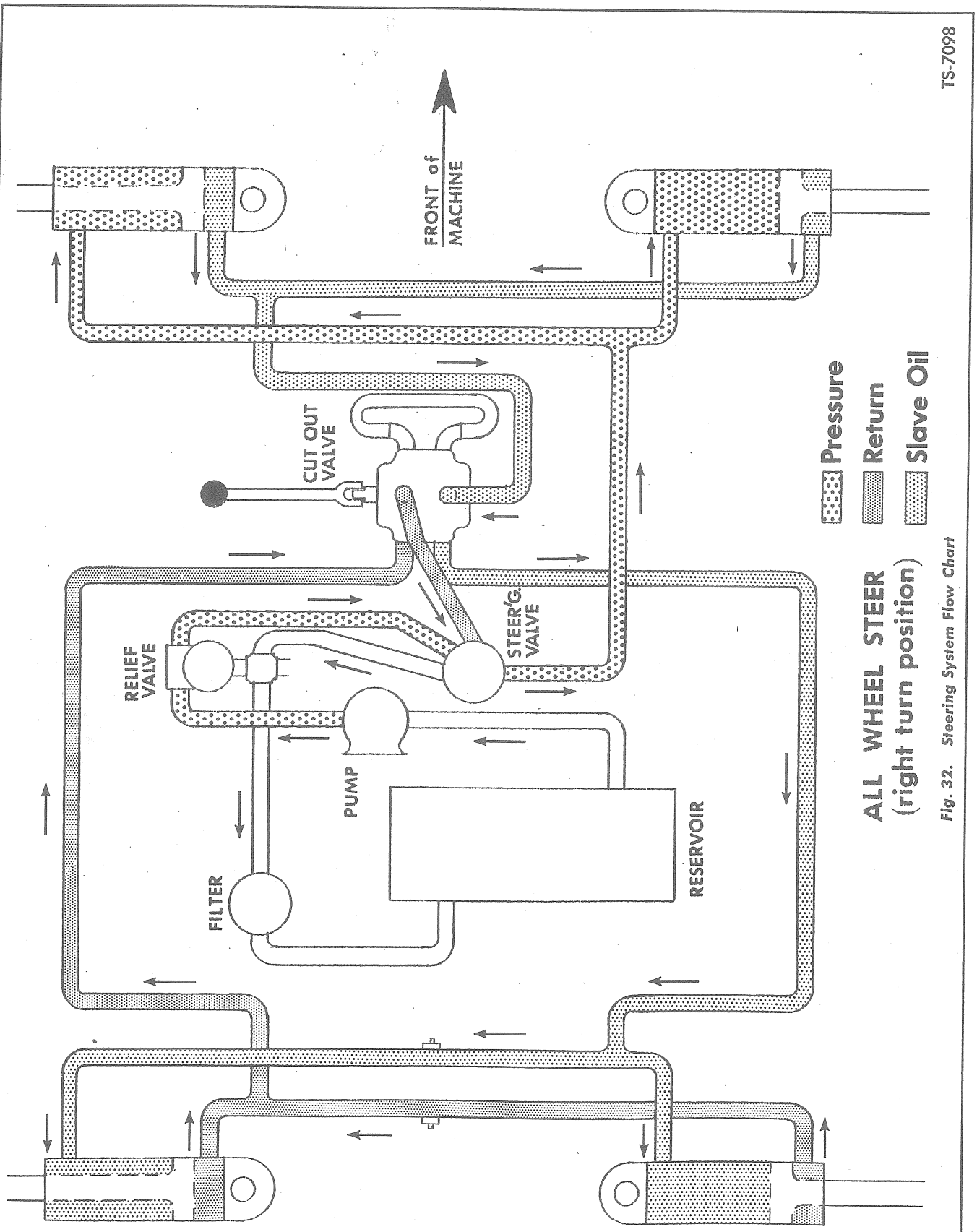


Fig. 32. Steering System Flow Chart

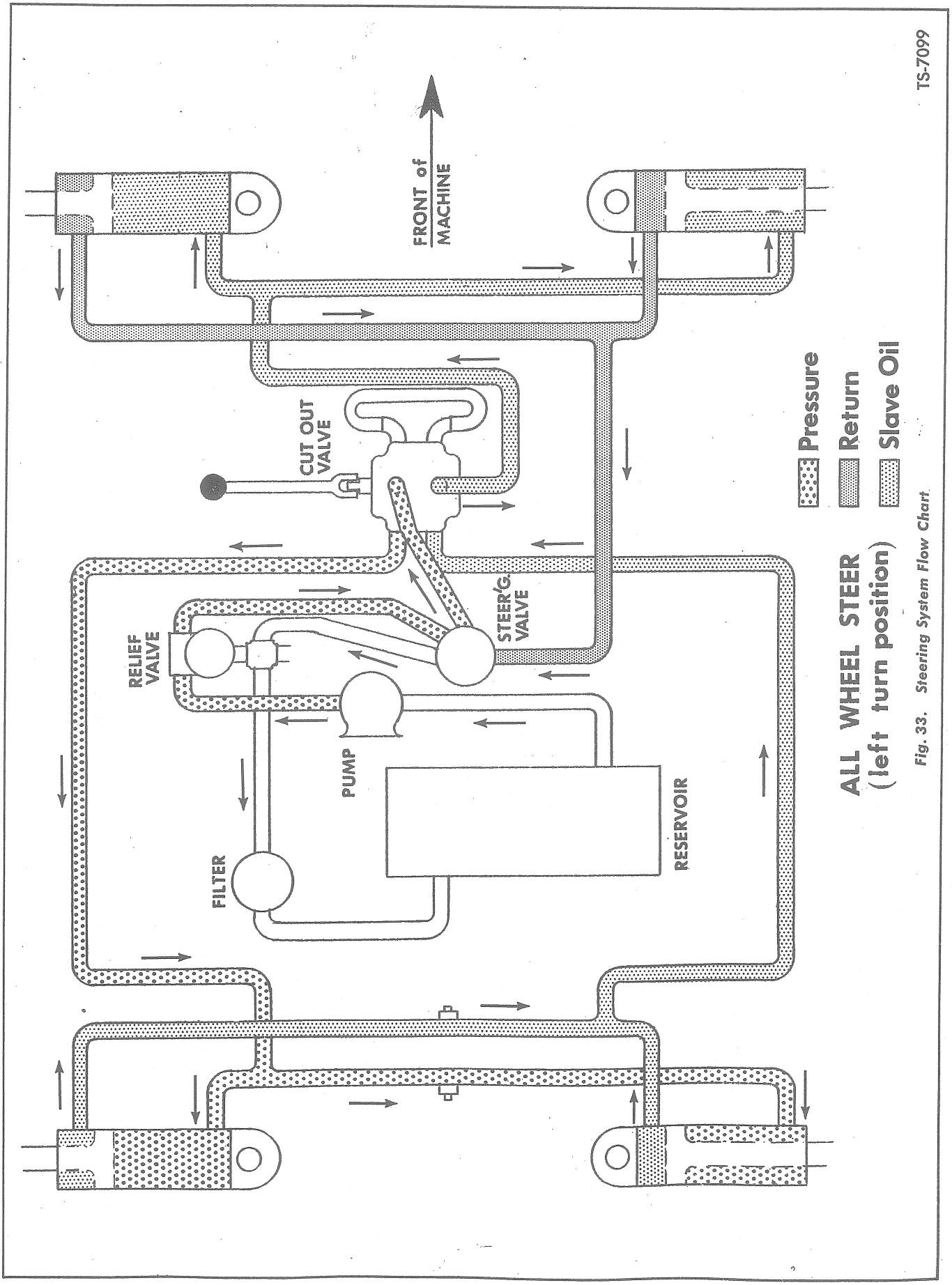


Fig. 33. Steering System Flow Chart

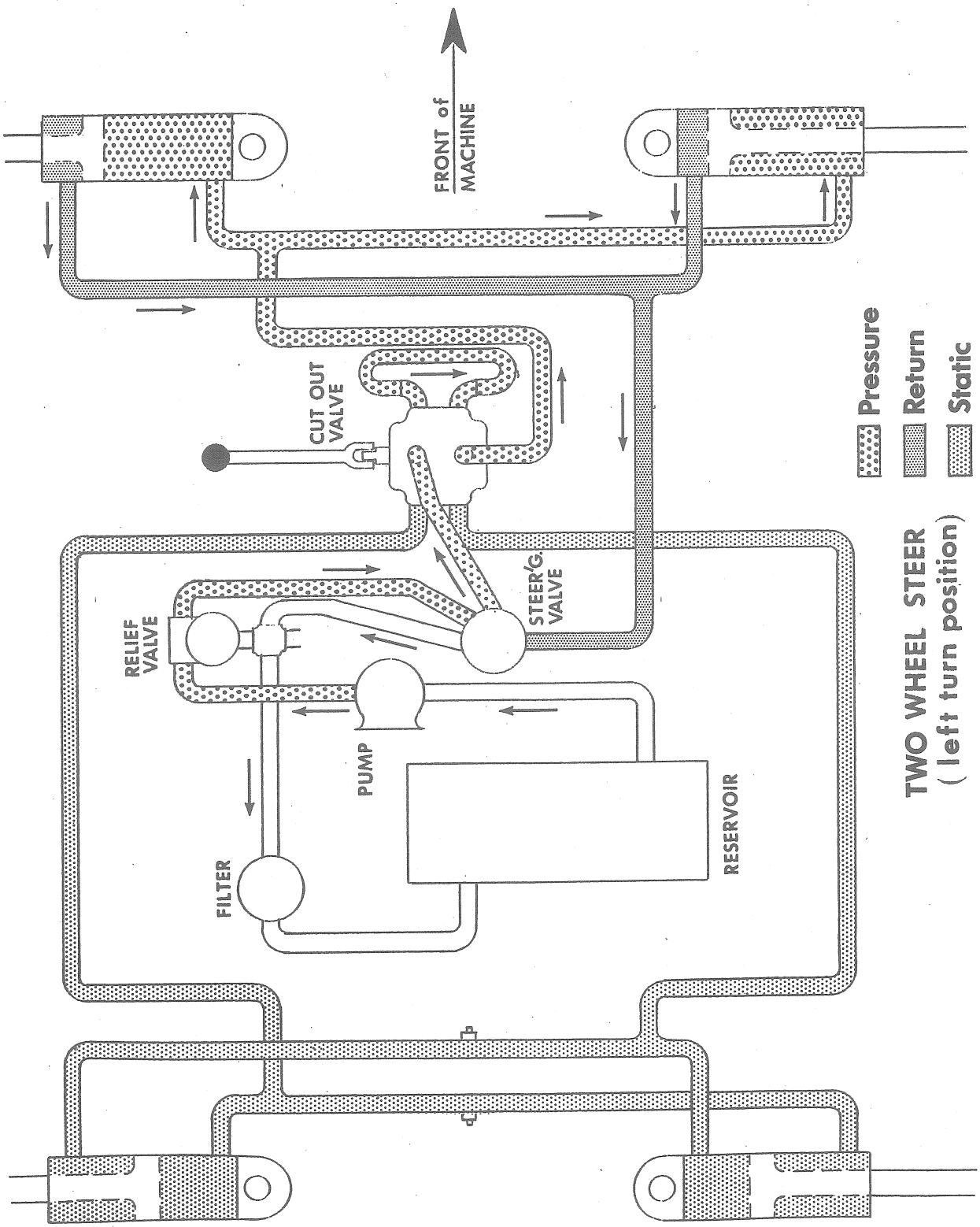


Fig. 34. Steering System Flow Chart

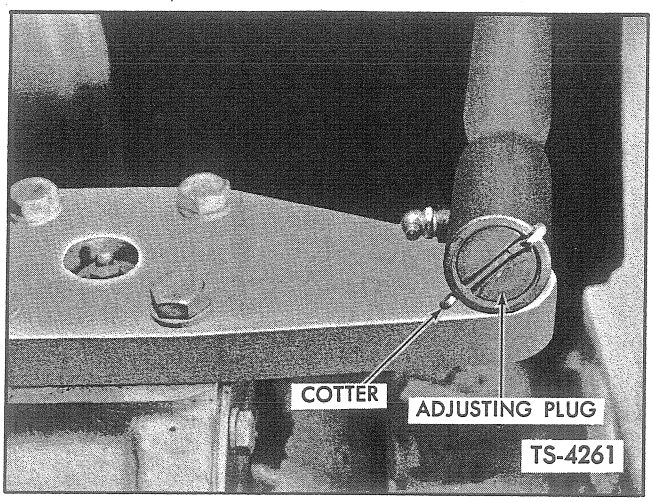


Fig. 35. Adjust Drag Link Ball Joint

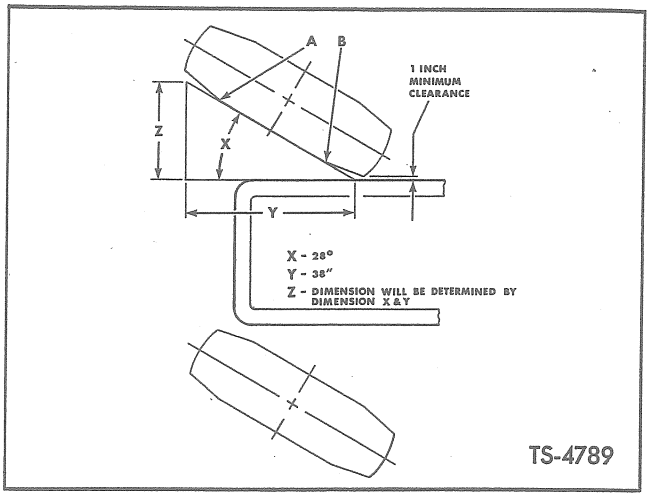


Fig. 36. Check Steering Stops

to be leaking or is replaced due to maintenance it will be necessary to bleed the steering system. Flow diagrams of the steering system are included to aid in understanding the system. See Figures 32, 33, 34.

1. Place steering selector valve lever in two wheel steer position — DOWN.

2. Turn steering wheel from full right to full left turn several times — Stop in full left turn position.

3. Move steering selector valve lever to four wheel steer position — UP.

4. Open both bleed screws and hold steering wheel in full left turn position. When a solid stream of fluid, free of air, flows from bleed port, close bleed screws.

5. Repeat Steps 1 through 4 as necessary to purge air from steering system.

   To align wheels set selector valve in four wheel steer position and then turn wheels until axle stops contact.

   Place selector valve in two wheel steer position and turn front wheels until axle stops contact.

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 35.

Check Steering Stops: Steering 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 front 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 right turn position and hold, and check that right rear stops are contacting with a minimum clearance of 1 inch between tire and machine frame.

3. Continue to hold wheels in full right turn position and insert template between tire and machine frame as shown in Figure 36.

   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 hardwood cut to the dimensions tabulated.*

   For desired condition, template must be flush with tire across points A and B with rear 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

rear 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.
5. Repeat check for left hand turn.
6. To adjust, shims should be inserted behind the Steering Stop Plate (See Figure 37).
7. Care must be taken to ensure 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 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 54.

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.

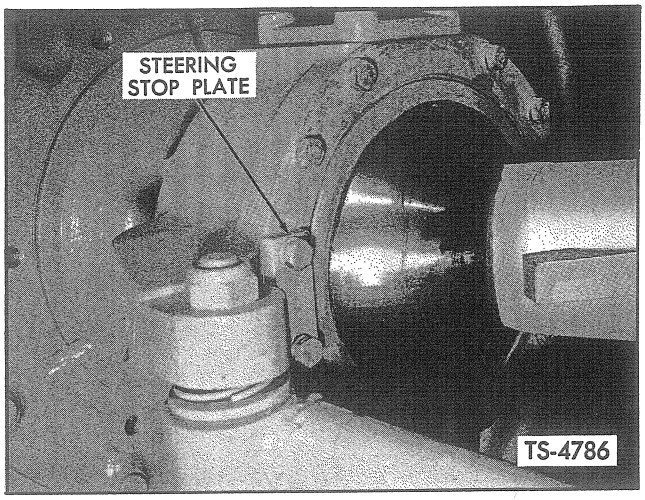


Fig. 37. Steering Stop Plate Adjustment

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**
- **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.

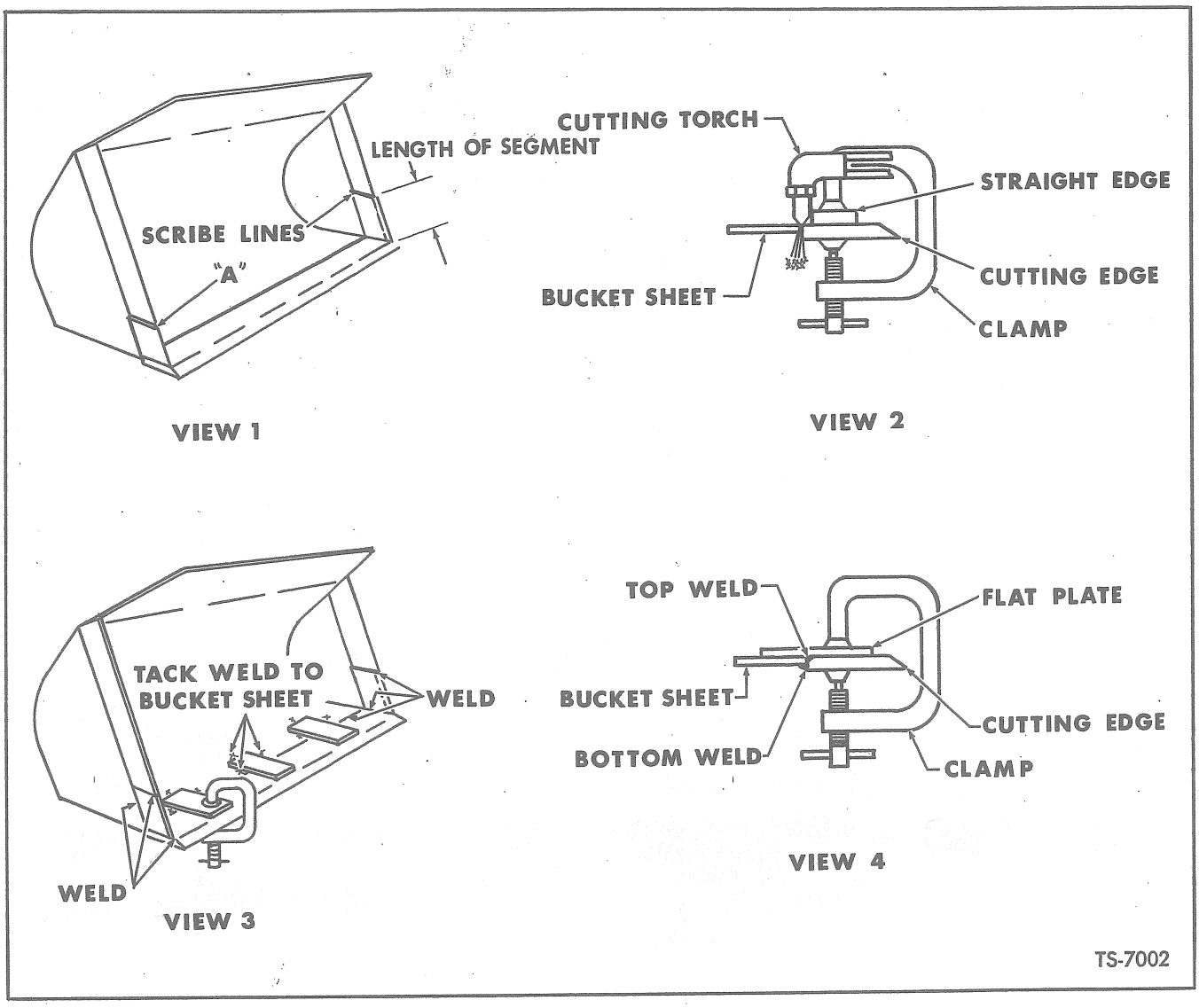


Fig. 38. Repair Bucket Cutting Edge

To replace bucket cutting edges, follow the procedure outlined below and as shown in Figure 38.

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 segment length dimension up 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 along bottom side as shown in view 4.

8. Clamp side cutting edges flush against bucket sheet and bottom cutting edge and weld securely.

9. Grind the residue of tack welds inside the bucket to present a smooth surface for entry of material.

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 or alternator and cranking motor sparingly. Excessive lubrication can result in premature failure.

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

In general, proper functioning of the generator or alternator and voltage regulator can usually be determined by the following battery conditions: (1) if battery is kept fully charged, except when under unusually severe loads, and (2) if no more than the usual amount of water is required to keep it filled.

When testing generator or 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 above 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.

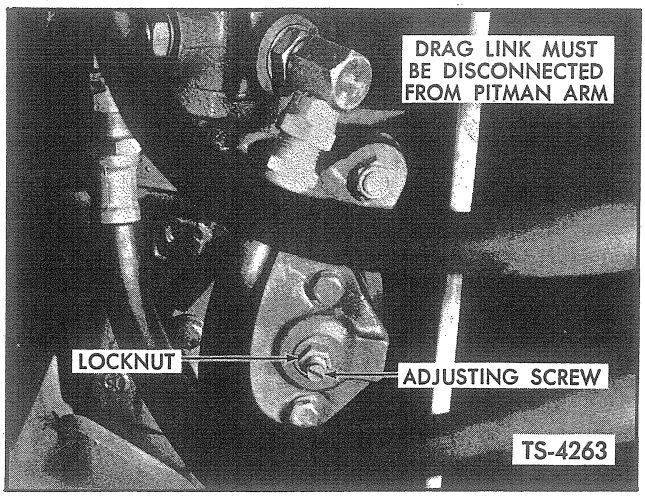


Fig. 39. Adjust Steering Gear

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 39. 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.

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.

Front axle versus rear axle can be checked by disconnecting prop shaft to rear axle. If the noise continues it may be in the front axle, transmission or the steering components. If the noise stops, trouble may be in the rear axle. Brakes will be indicated by a dragging condition or pulling to one side.

Transmission can be checked by disconnecting prop shaft to both axles. Check gear train in both work and travel ranges. 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, boom and bucket, upper 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

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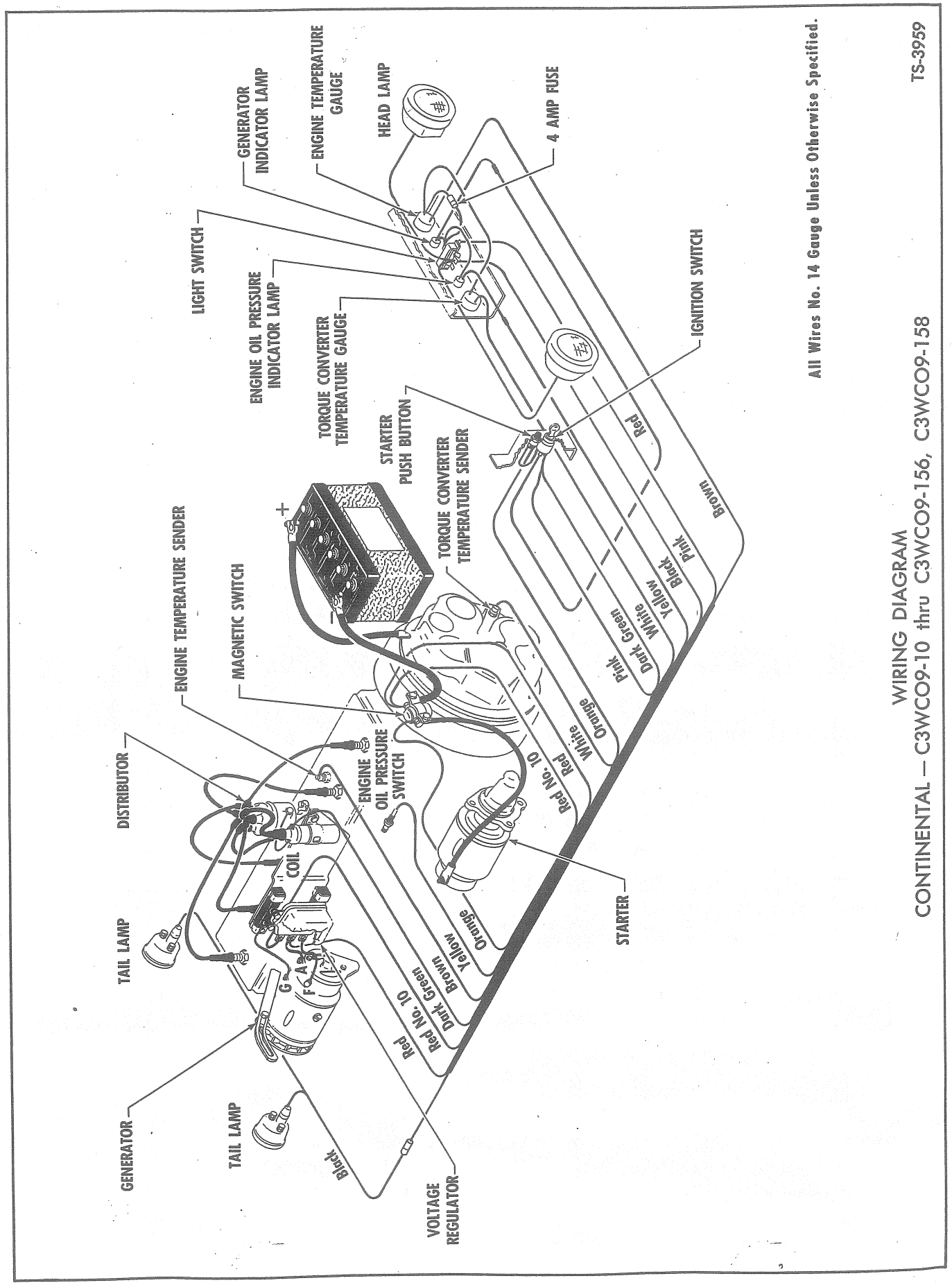
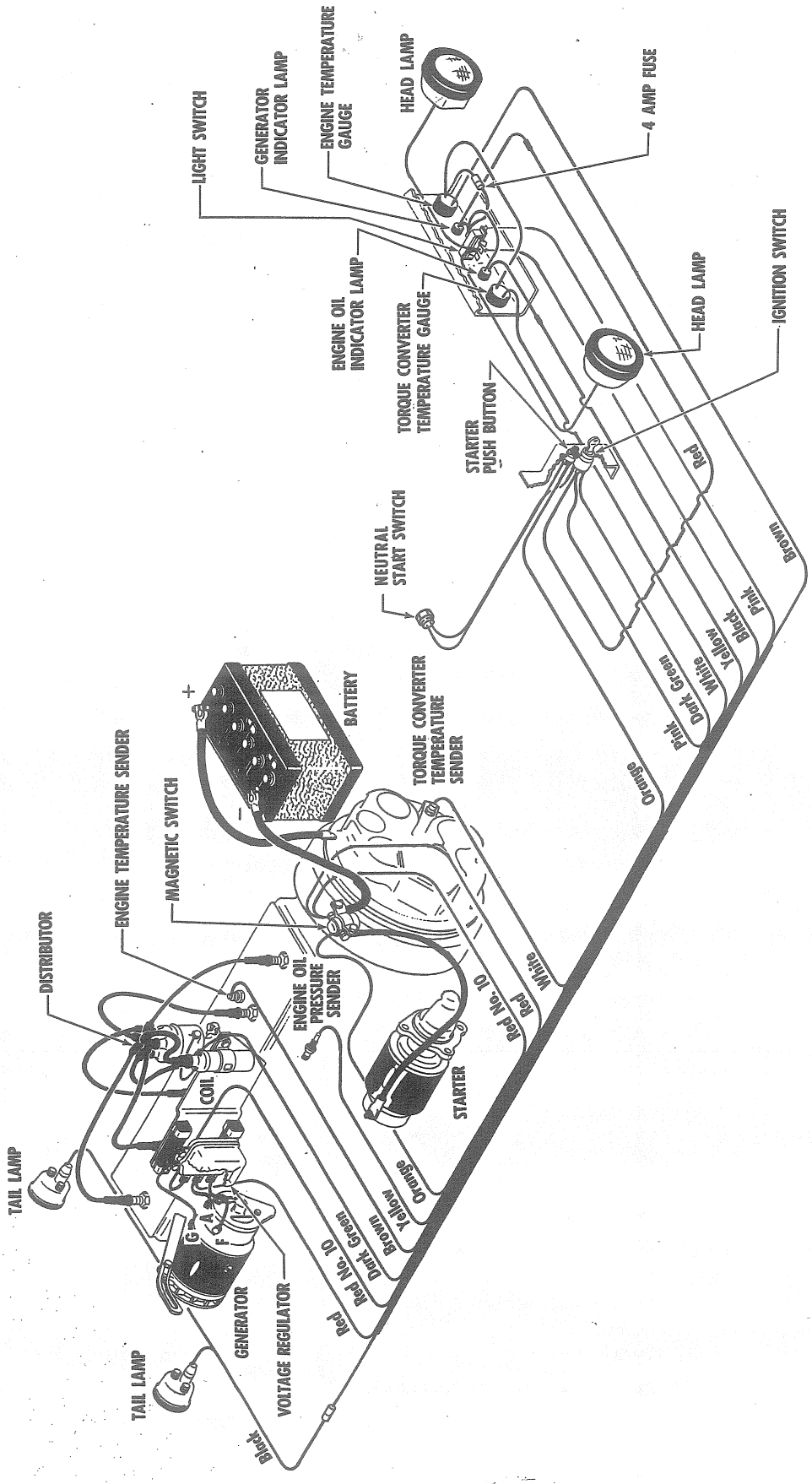


All Wires No. 14 Gauge Unless Otherwise Specified.

WIRING DIAGRAM
CONTINENTAL — C3WCO9-10 thru C3WCO9-156, C3WCO9-158

TS-3959



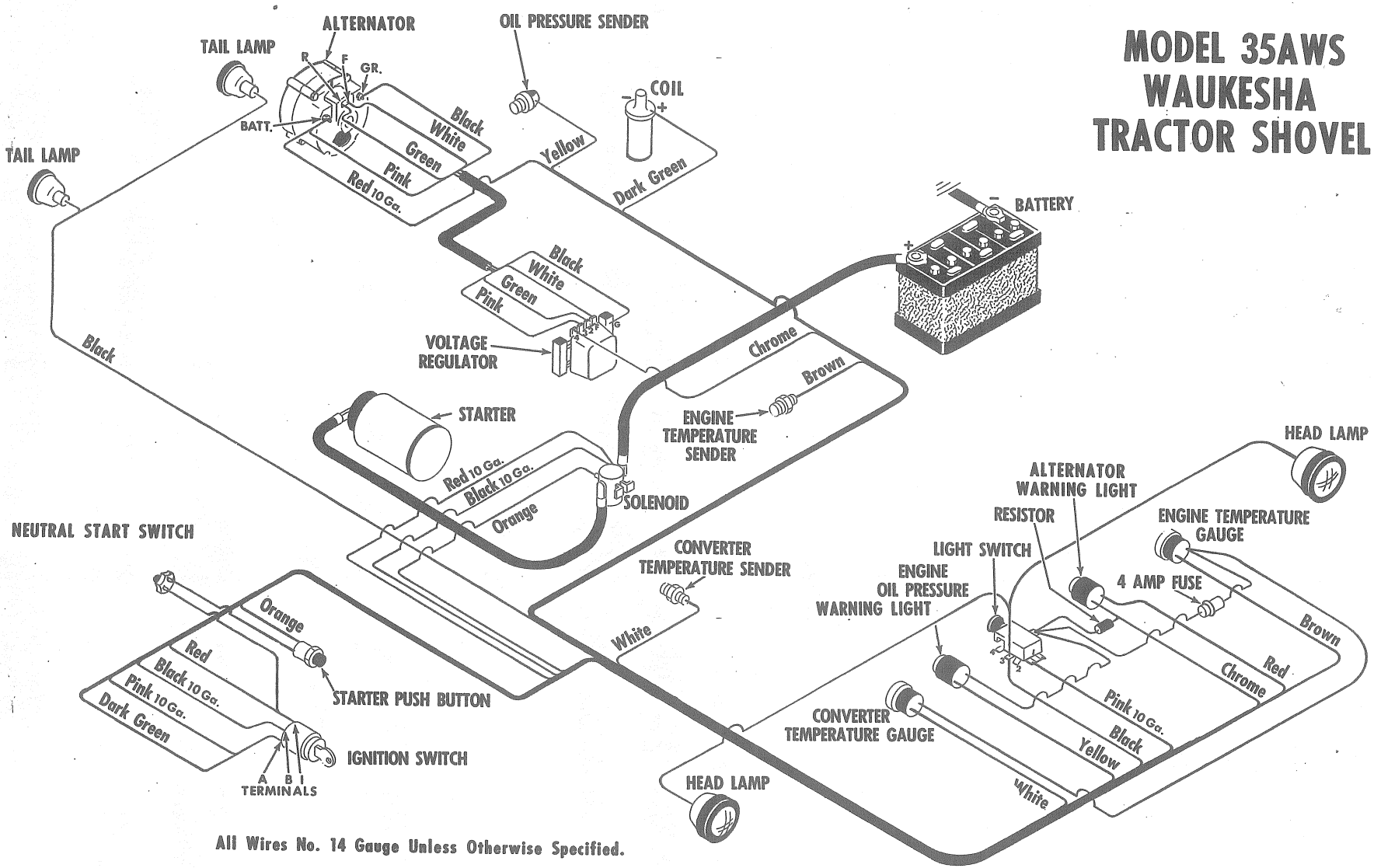
WIRING DIAGRAM

CONTINENTAL — C3WCO9-157, C3WCO9-159 and after

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

TS-7930

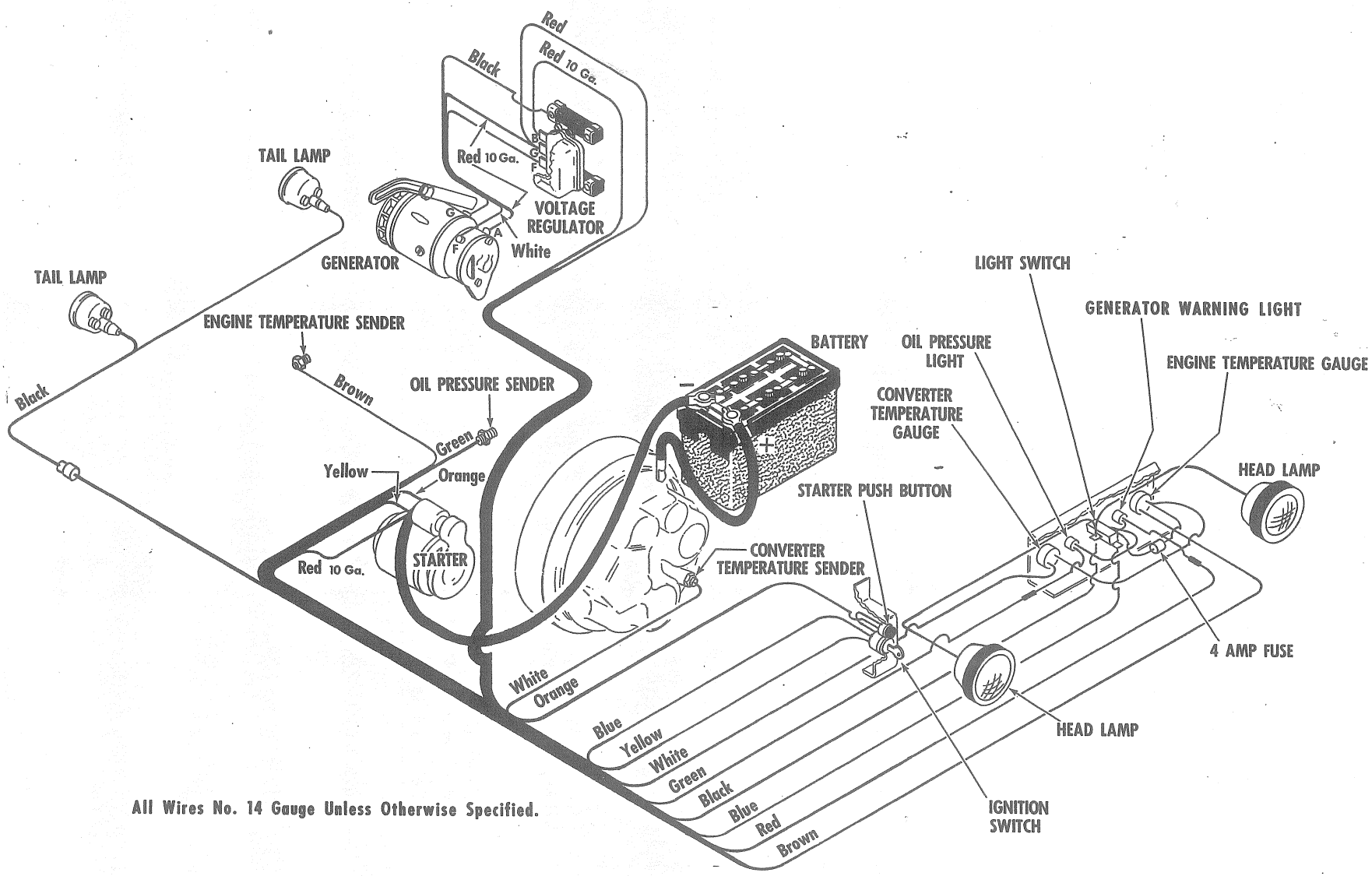
MODEL 35AWS WAUKESHA TRACTOR SHOVEL



All Wires No. 14 Gauge Unless Otherwise Specified.

WIRING DIAGRAM — WAUKESHA

TS-8367

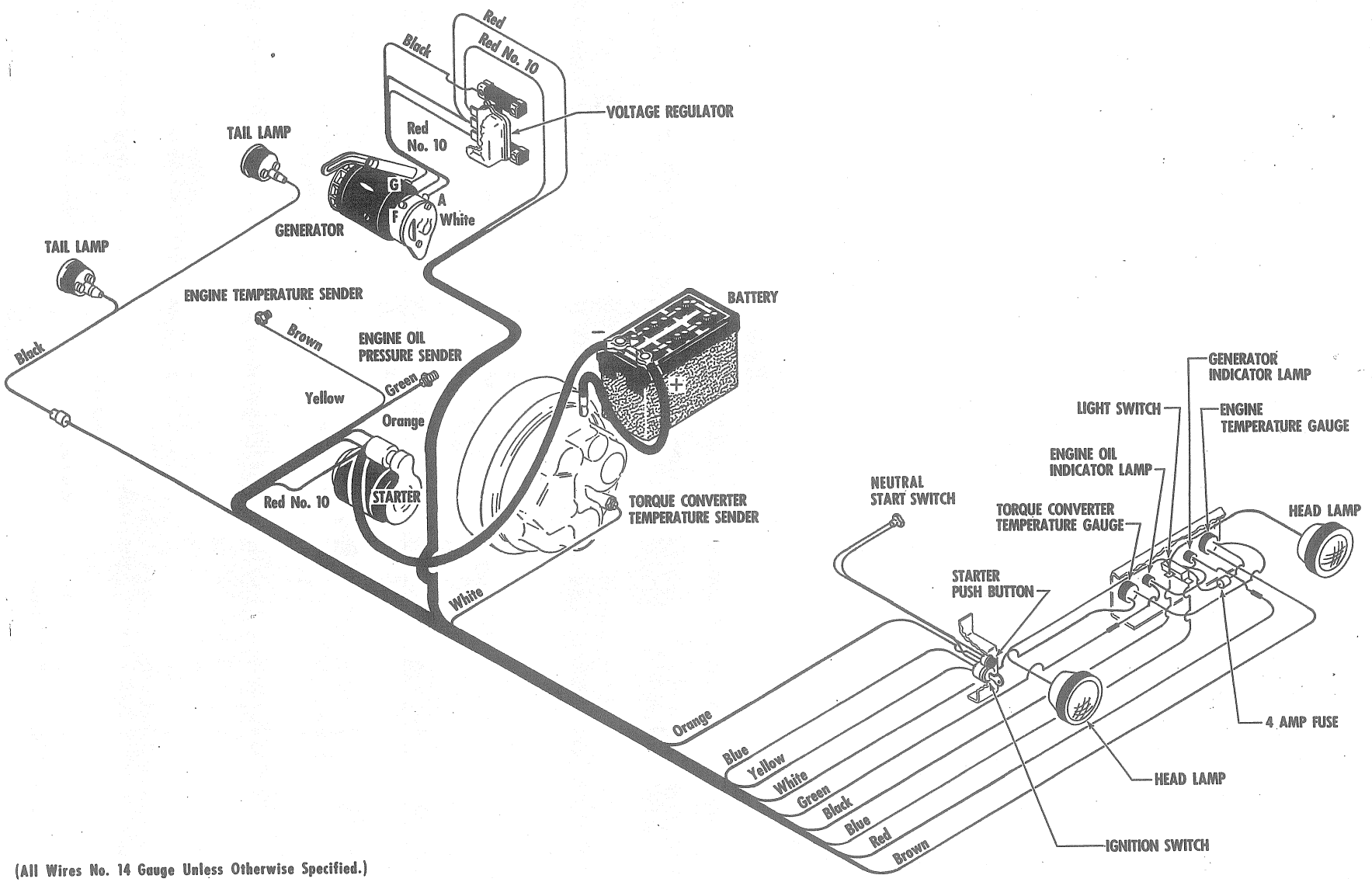


All Wires No. 14 Gauge Unless Otherwise Specified.

WIRING DIAGRAM

G.M. — C3WG9-10 thru C3WG9-999, C5WG9-10 thru C5WG9-101, C5WG9-111 thru C5WG9-114

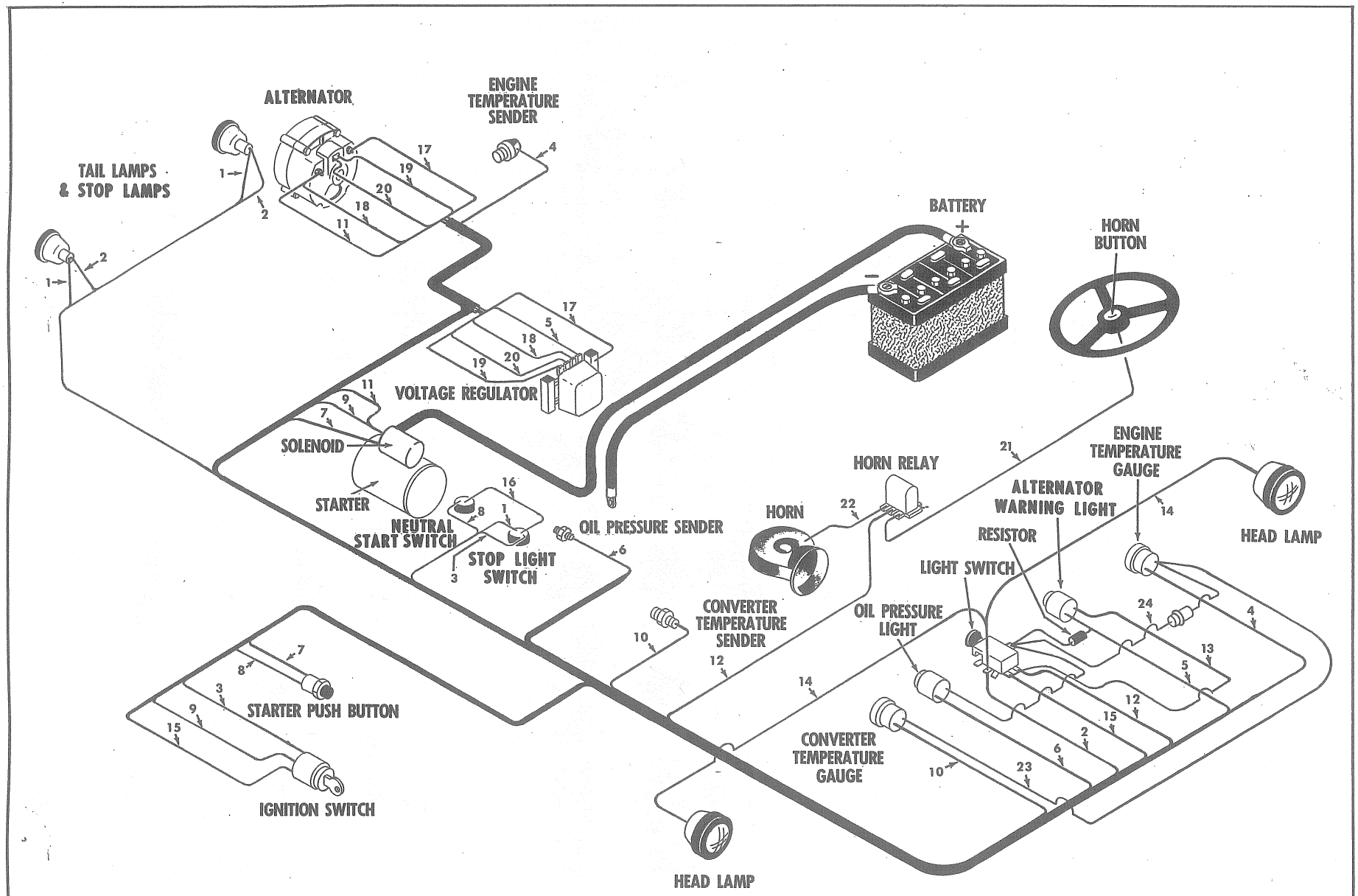
TS-6940



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

WIRING DIAGRAM
G.M. — C5WG9-102 thru C5WG9-110, C5WG9-115 and after

TS-7932



WIRING DIAGRAM
G.M. — 7WG101 and after

TS-9234

WIRING DIAGRAM COLOR CODE CHART FOR USE WITH TS-9234

Ref. No.	Color	Circuit
1.	Lt. Green	Brake Switch to Stoplights
2.	Black	Light Switch to Tail Lights
3.	Tan	Ignition Switch to Brake Switch
4.	Brown	Engine Temp. Sender to Engine Temp. Gauge
5.	Gray	Voltage Regulator to Dash Resistor
6.	Green	Engine Oil Press. Sender to Warning Light
7.	Orange	Starter Button to Starter Solenoid
8.	Pink	Starter Button to Neutral Start Switch
9.	Yellow	Starter to Ignition Switch
10.	White	Converter Temp. Sender to Converter Temp. Gauge
11.	Red	Alternator Batt. Terminal to Starter
12.	Yellow	Light Switch to Horn Relay
13.	Blue	Light Switch to Alternator Warning Light
14.	Black	Light Switch to Head Lamps
15.	Blue	Ignition Switch to Light Switch
16.	Tan	Brake Switch to Neutral Start Switch
17.	Black	Alternator Ground to Regulator Ground
18.	Pink	Alternator Batt. Terminal to Regulator #3
19.	White	Alternator Field to Regulator #1
20.	Green	Alternator Relay to Regulator #2
21.	White	Horn Button to Horn Relay
22.	Black	Horn Relay to Horn
23.	Red	Converter Temp. Gauge to Engine Temp. Gauge
24.	White	Light Switch to Engine Temp. Gauge

BOLT TORQUE CHART
FT. — LBS.

Location	Thread	Grade	Torque
Converter Filter Center Bolt			25
Converter Housing Mounting	3/8"–16	8	23
Counterweight	3/4"–16	8	200
Engine Support to Flywheel Housing	1/2"–13	8	33
Engine Support to Frame	1/2"–20	8	50
Prop Shaft – Upper			25
Prop Shaft – Lower			55
Steering Filter Center Bolt			25
Transmission Bracket to Frame	1/2"–20	8	90
Transmission to Bracket	3/4"–10	8	123
*Wheel Nuts	5/18"–18		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	GASOLINE	DIESEL
Make	Continental	Waukesha	G.M.
Model	F-226	190 GLB	3-53
Number of cylinders	6	6	3
Bore and stroke	3.13 x 4.38	3.75 x 4.00	3.88 x 4.50
Displacement, cu. inches	226	265	159.2
Maximum torque, ft. lbs.	180 @ 1500	220 @ 1200	208 @ 1200
Maximum horsepower	70	77	77
Governed rpm	2200	2200	2200
Low idle rpm	550-600	550-600	550-600
High idle rpm	2450	2450	2250-2350
*Stall rpm	1900-2000	2050-2150	2050-2150

*Note: Stall rpm is the maximum obtainable with oil at operating temperature (180° F. to 200° F.), parking brake applied, wheels blocked, directional and speed range levers in FORWARD — 4th (HI).

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

Gauge circuit fuse ..... SFE 4 amp
Instruments:
- Panel gauges ..... 12 volt
- Sender units ..... 12 volt

Lamps:
- Tail ..... 12 volt
- Head ..... 12 volt
- Generator indicator ..... 12 volt, 2 c.p.
- Oil indicator ..... 12 volt, 2 c.p.

Alternator ..... 12 volt
Generator ..... 12 volt
Voltage regulator ..... 12 volt, 30 amp
Starting motor ..... 12 volt

BATTERIES

Make and Part No.:
Continental & Waukesha ... Clark 1800613
G.M. ..... Clark 1310121
Number ..... 1-12 volt
Electrical System ..... 12 volt
Grounded Terminal:
Generator ..... Positive
Alternator ..... Negative
Specific Gravity 1.230-1.260
(Not over 0.050 variance between adjacent cells)

PRESSURES

Engine oil	Idle rpm	Governed rpm
G.M. Diesel	11 psi min.	Approx. 30 psi
Continental & Waukesha Gas ...	10 psi min.	Approx. 30 psi

Boom and bucket hydraulic system ..... 1825 psi at converter stall rpm and one cylinder against stops

Steering hydraulic system ..... 1000 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 ..... 70 Octane min.

BRAKE FLUID

SAE 70R3, Clark No. 850487

Materials and Specifications Subject to Change Without Notice or Obligation

CAPACITIES
(Approximate Quantities)

		U. S. MEASURE	METRIC MEASURE LITERS	IMPERIAL MEASURE
Engine crankcase	Continental	5.5 qt.	5,2	4.6 qt.
	G.M.	13.5 qt.	12,8	11.2 qt.
	Waukesha	7.0 qt.	6,6	5.8 qt.
Air cleaner (use engine crankcase oil)		3.0 qt.	2,8	2.5 qt.
Cooling system	Continental	4.5 gal.	17,0	3.7 gal.
	G.M.	6.5 gal.	24,6	4.9 gal.
	Waukesha	4.5 gal.	17,0	3.7 gal.
Front drive steer axle differential		7.0 qt.	6,6	5.8 qt.
Front drive steer axle planetary hubs (each)		3.0 qt.	2,8	2.5 qt.
Fuel tank		28.0 gal.	106,0	23.3 gal.
Hydraulic tank		15.0 gal.	56,7	12.5 gal.
Rear drive steer axle differential		7.0 qt.	6,6	5.8 qt.
Rear drive steer axle planetary hubs (each)		3.0 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
14.00-24	8	30	30	Traction

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

TIRE SIZE	USE $CACL_2$ (POUNDS)	DISSOLVE IN WATER (GALLONS)	TOTAL GALLONS SOLUTION	WEIGHT INCREASE EACH TIRE (POUNDS)
13.00-24	105	30	37	370
14.00-24	151	43	50	510

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.