RUTHZIL TRATOR COMERCIAL DE PEÇAS LTDA 11 97083-6812 ROLANDO CITRANGULO

MICHIGAN

OPERATORS MANUAL

No. 2006

MODEL 55A

Series II

TRACTOR SHOVEL

Information contained herein pertains to Machine Serial Numbers listed below:

55A Continental — 3BCO101 thru 3BCO999,
4BCO101 thru 4BCO999,
5BCO101 thru 5BCO999

55A G.M. — 3BG101 thru 3BG999,
4BG101 thru 4BG999,
5BG101 thru 5BG999

Data covering Machine Serial Ranges prefixed with designations 6BG, 7BG, 6BCO, 7BCO, etc., and machines powered with optional power plants will be found contained in Suppiements at rear of this Manual.

ALWAYS GIVE SERIAL NUMBER OF MACHINE WHEN ORDERING PARTS

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

Machine Serial _____

Engine Model _____

Engine Serial _____

CLARK EQUIPMENT

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

MICHIGAN

2M654BP

Printed U.S.A.

TO OWNERS

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

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

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

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

CLARK EQUIPMENT COMPANY
Construction Machinery Division
BENTON HARBOR, MICHIGAN, U.S.A.

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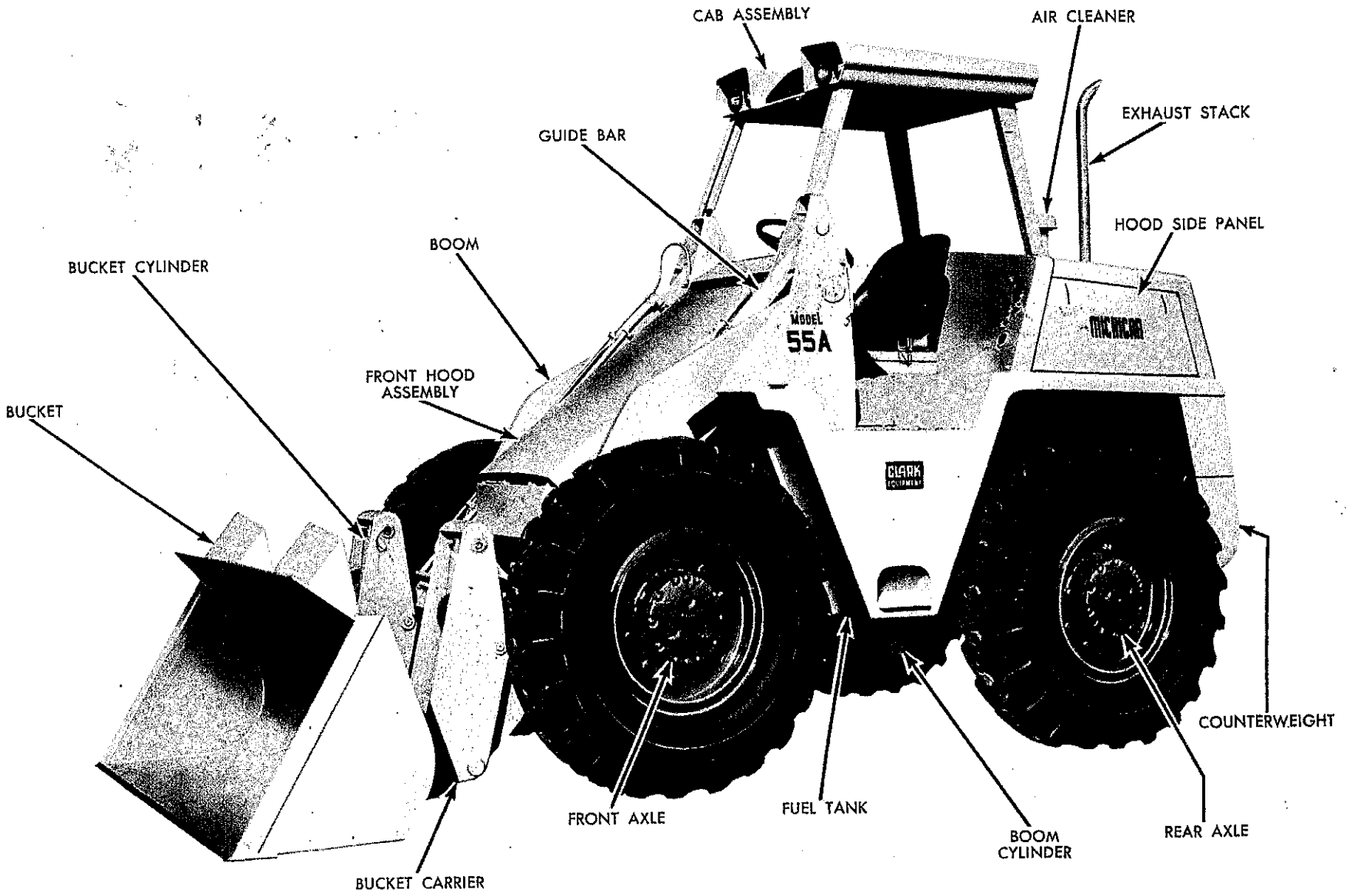


MODEL 55A SERIES II TRACTOR SHOVEL

TS-3626

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, rear wheel steer, full floating, spiral bevel ring gear and pinion, with further reduction provided by planetary gear sets within the wheel hubs.

The tractor shovel has four shift ranges in both forward and reverse. Effortless hydraulic power steering is provided, utilizing two double acting steering cylinders, one at each rear wheel. Service brakes are hydraulic actuated by a two-stage master cylinder which doubles the line pressure approximately midway of the pedal stroke, assuring maximum braking effort. Parking brake is the external contracting band type operating on a drum mounted on the companion flange of the front axle differential.

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 at left front side of operator's compartment on upper pivot cap, giving model number and serial number of machine. See Figure 1. Serial number of machine also is stamped in one-half inch numerals on top of front frame cross-member inside front hood assembly.

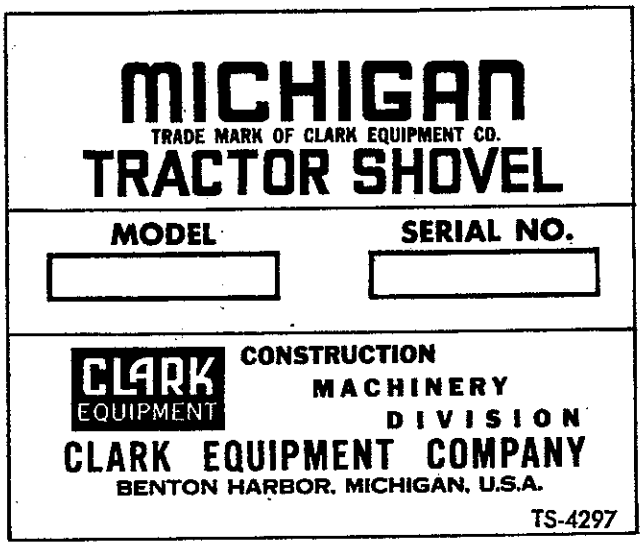


Fig. 1. Machine Serial Number Plate

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

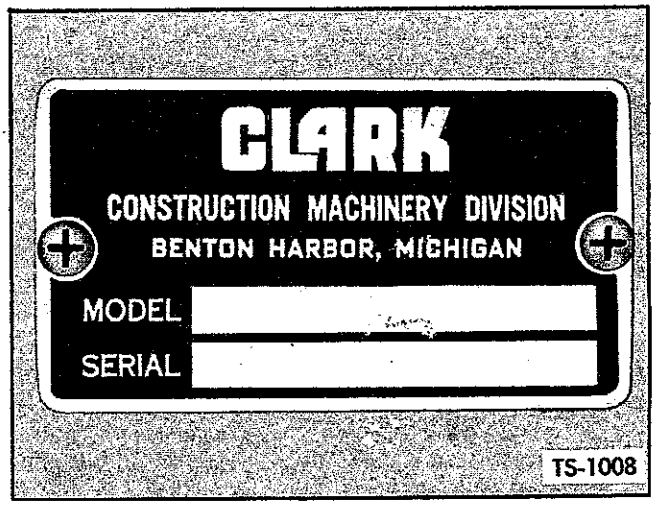


Fig. 2. Torque Converter or Transmission Serial Number Plate

TRANSMISSION OR TORQUE CONVERTER SERIAL NUMBER PLATE

The transmission serial number plate is located on right front 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.

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 oil level in the following to specifications outlined in Lubrication Section:

   a. Engine crankcase

   b. Transmission case (COLD mark on dipstick)

   c. Front axle differential

   d. Front axle planetary hubs

   e. Rear steer axle differential

   f. Rear steer axle planetary hubs

   g. Hydraulic system reservoir

   h. Steering gear

   i. Boom positioner master cylinder (optional equipment)

   j. Brake master cylinder

   k. Air cleaner (Continental Gas)

3. Check cooling system to make sure radiator is filled and that radiator drain cock and engine block drain cock are closed. When there is danger of water freezing in the cooling system, use a reliable brand of permanent type anti-freeze according to manufacturer's instructions. For further information please refer to Operation and Maintenance Manual of engine manufacturer.

4. Check batteries that plates are covered with water. Add only clean distilled water.

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

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.

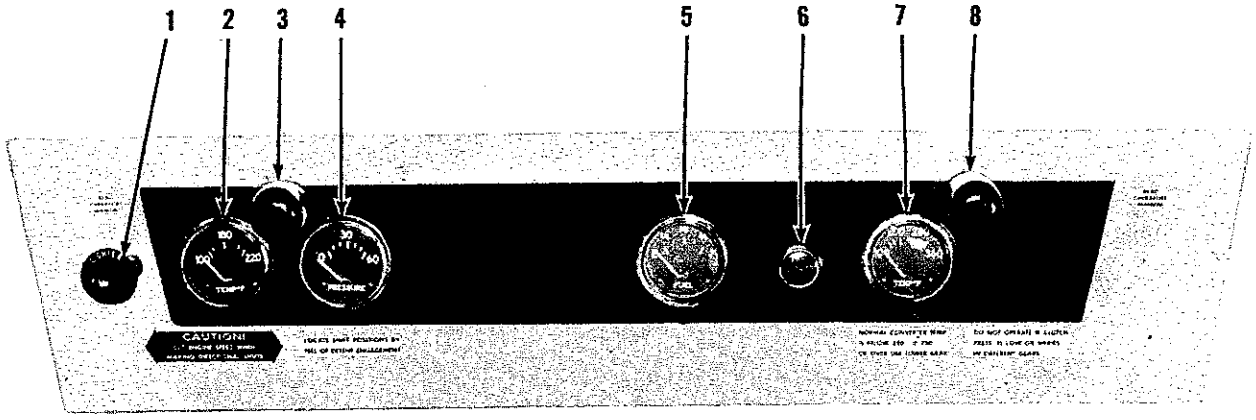
The terms "right-hand" and "left-hand" referred to below are determined by sitting in the operator's seat and facing toward front of machine.

INSTRUMENTS AND SWITCHES

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

Each gauge serves as an important check point for operating conditions of torque converter and transmission, and of the engine and accessories. Do not operate machine if gauges are not functioning properly.

Figures 3, 4 and 5 give identification of instruments and switches.



1. Lighter
2. Engine Temperature Gauge
3. Dash Lamp
4. Engine Oil Pressure Gauge
5. Fuel Gauge
6. Light Switch
7. Torque Converter Temperature Gauge
8. Dash Lamp

TS-4284

Fig. 3. Front Instrument Panel

FRONT INSTRUMENT PANEL

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

Engine Oil Pressure Gauge indicates oil pressure in engine lubricating system. Under normal operation, at idle and governed rpm, gauge pressure is as follows.

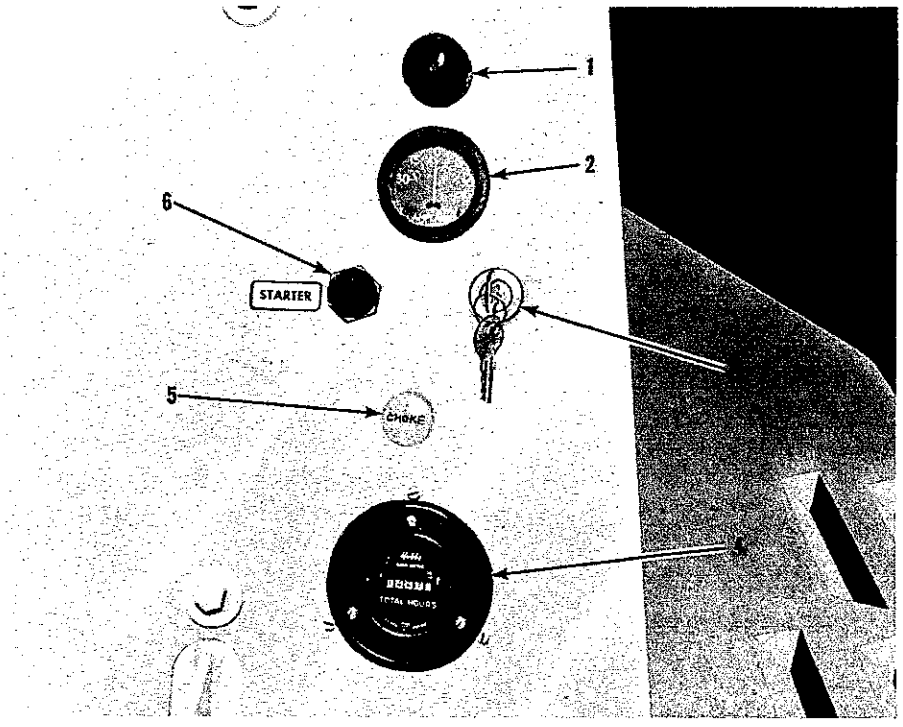
	Idle	Governed RPM
G.M. Diesel	11 psi min.	Approx. 45 psi
Continental Gas	15 psi min.	20-30 psi

Fuel Gauge indicates quantity of fuel in tank only when ignition switch is ON. When ignition switch is OFF, pointer drops back beyond "E" (Empty) mark.

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 dash lights, head lights, and tail lights in first position, with addition of flood lights in second position. Pull switch to operate.

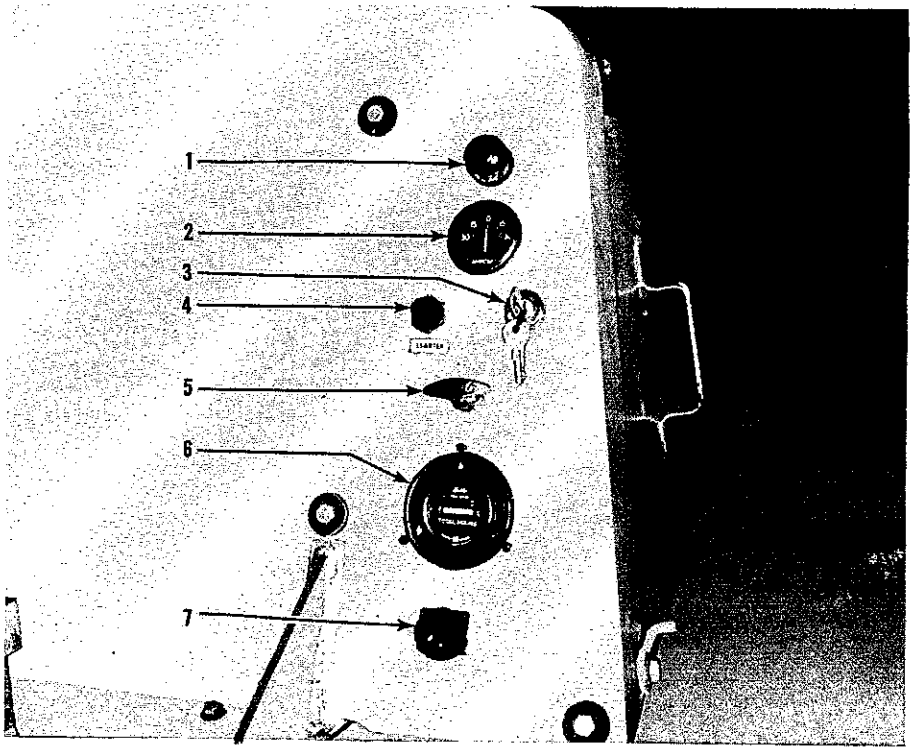
Cigarette Lighter is a push button type conveniently located on instrument panel. With ignition turned to the ON position, push lighter in to operate.



1. Dash Lamp
2. Ammeter
3. Ignition Switch
4. Hour Meter
5. Choke Control
6. Starter Switch

TS-3589

Fig. 4. Side Instrument Panel — Continental Gas



1. Dash Lamp
2. Ammeter
3. Ignition Switch
4. Starter Switch
5. Engine Fuel Shut-Off Control
6. Hour Meter
7. Engine Air (Emergency) Shut-Off Control

TS-4310

Fig. 5. Side Instrument Panel — G.M. Diesel

SIDE INSTRUMENT PANEL

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

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 11.

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

Hour Meter indicates working time of machine in hours and tenths of an hour. Use this gauge to schedule lubrication and maintenance periods.

Engine Fuel Shut-off Control — G.M. Diesel is upper T-handle or knob located on instrument panel at left side of operator. Use this control for normal engine shut down. After turning ignition switch OFF, pulling control will manually position the injector racks in the no fuel position to shut down the engine.

Engine Air (Emergency) Shut-off Control — G.M. Diesel is lower T-handle or knob located on instrument panel at left side of operator. Use this control only in an emergency or if normal shut down procedure fails to shut down the engine. Pulling control will immediately cut off engine air supply thus stopping the engine. Replace emergency control T-handle in its original position and manually reset latch assembly before restarting engine.

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

OPERATING CONTROLS

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

The operator's seat can be shifted forward or rearward to suit the individual. Move lever on left-hand side of seat forward, and shift seat to desired position.

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

Refer to Figure 6 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.

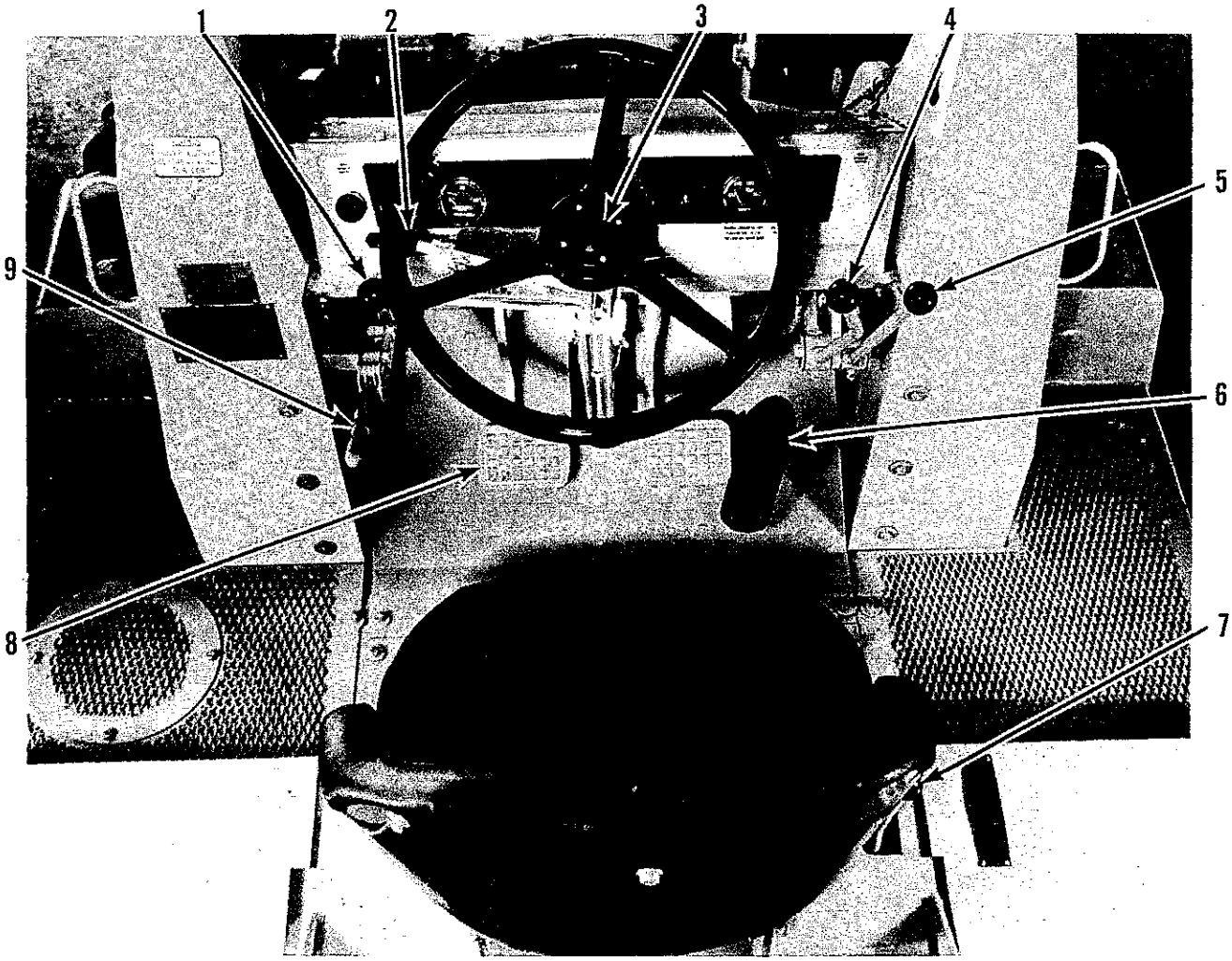
Observe torque converter temperature gauge when working machine. If gauge approaches 250° F., shift to a lower operating speed range.

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

In the WORKING RANGE position, this lever actuates a lockout control valve to automatically establish a NEUTRAL position in the transmission when the service brakes are applied. When in TRAVEL RANGE, the lockout control valve is disengaged; a transmission NEUTRAL can be obtained only by shifting the directional and speed range levers at the steering column.

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



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

TS-4285

Fig. 6. Operating Controls

selected in both WORKING RANGE and TRAVEL RANGE.

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

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

Boom Control Lever is the outer lever on right hand side of 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.

Note: *A hydraulic release, cam operated through a master cylinder is available as an optional accessory. This feature automatically stops the boom at a predetermined height adjustable at the master cylinder and cam. Where loading height is standard for a major portion of the work operation this feature has unique advantages.*

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.

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

The position directly forward of HOLD is DOWN PRESSURE, and is used to lower boom and bucket and to provide penetration to dig below grade level.

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

Bucket Control Lever is inner lever on 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 into a detent position. Release lever and it will return to HOLD position, allowing bucket to remain in closed position.

Note: *A hydraulic release is actuated by a master cylinder in conjunction with the bucket indicator cam. Hydraulic release will occur automatically any time bucket is level relative to ground on return from full dump 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 so designed as to permit brake application with either left or right foot of operator.

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

Horn Button is located in center of steering wheel.

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

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

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

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

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

Maintain Proper Tire Inflation: Check tire inflation pressure daily to provide best operation and longest tire life. If tires are hydro-inflated.

they should be checked at more frequent intervals, 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 roads are wet or icy.

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

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

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

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

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

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

STARTING PROCEDURE

PRE-STARTING CHECKS

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

1. Engine oil level
2. Engine air cleaner
3. Hydraulic system oil level
4. Cooling system
5. Fuel supply
6. Transmission fluid level (COLD mark on dipstick)
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 fuel shut-off 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 Gas

1. Set shift quadrant levers (directional and speed range) in NEUTRAL.
2. 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.

3. After engine starts, check oil pressure gauge. If no pressure is indicated within 15 seconds, shut off engine and determine cause.
4. Allow engine to reach operating temperature before driving machine.

COLD WEATHER STARTING

MICHIGAN machines do not require extensive preparation for cold weather operation beyond addition of a permanent type anti-freeze to the cooling system, and a change of engine oil to a viscosity suitable for anticipated temperatures in which the machine is to operate. At temperatures below 32° F. a change of oil in the boom and bucket system to Type "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, generator, voltage regulator, solenoid switch, relays and sender units.
3. Clean and tighten external ground straps, and replace if badly frayed or corroded.
4. Clean and regap spark plugs, replacing those having cracked or chipped porcelain, or loose center electrodes.
5. Replace points and condenser in ignition distributor, and check for proper operation of automatic advance mechanism.
6. Check high tension leads between coil, distributor and spark plugs. Replace leads that are cracked or deteriorated, or show other signs of leakage.
7. Check ignition coil for opens or shorts, and replace if defective.

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

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

Cold starting procedure 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.

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 Gas (When Colder Than 40°F.)

1. Set all control levers in NEUTRAL position and turn ignition switch ON.

2. Depress accelerator to partially open the throttle.

3. Press starter switch firmly and simultaneously pull choke control to enrich fuel-air mixture entering 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 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 gauge
2. Transmission fluid level (with engine idling)
3. Ammeter
4. Engine temperature gauge
5. Fuel gauge
6. Torque converter temperature gauge
7. Horn
8. Lights
9. Hydraulic system – boom and bucket control levers

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

PARKING AREA CHECKS

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

1. Steering gear
2. Service brakes
3. Parking brake

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

SHUTTING DOWN ENGINE

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

Residual heat can damage many parts, ranging from valves to fuel pumps. The latter suffer from gums and deposits remaining after evaporation of the lighter ends. In addition, the physical stresses from expansion and contraction can cause distortion, permanent warping, and gasket

failures. In some cases, oil seals and cylinder sleeve seals suffer badly, although the results may not appear until much later.

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

G.M. Diesel

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

If after pulling control engine continues to operate, the engine emergency air shut-off control must be pulled to the out position. This control 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 in its original position and manually reset latch assembly before restarting engine. See Figure 7.

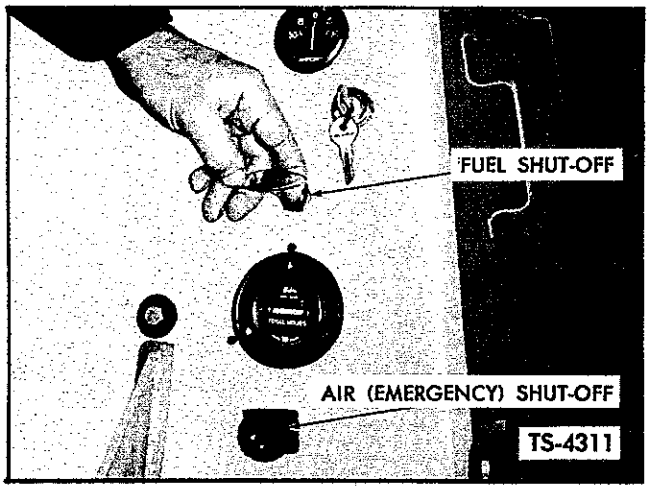


Fig. 7. Engine Shut-Off Controls — G.M. Diesel

Continental Gas

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

OPERATING TRACTOR SHOVEL

The steps below give proper procedure for setting machine into motion. Refer to Operating Controls Diagram, Figure 8.

1. Raise boom and bucket approximately 15 inches above ground by pulling backward on boom control lever.

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

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

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

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

   When making a downshift, accelerate engine to synchronize engine and drive shaft speeds when transmission clutch re-engages.

4. Select by use of range shift lever the speed range desired – working range for all normal work operations; travel range for moving relatively long distances without load.

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

   There are available to the operator a selection of four speeds in both forward and reverse directions. This is accomplished by use of range shift lever and speed range lever. In other words a choice of low or high speed is possible in both working range and in travel range.

5. Release parking brake.

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

LOADING THE BUCKET

Place speed range lever in low and directional lever in forward position. Place range shift lever in working range. With bucket control lever,

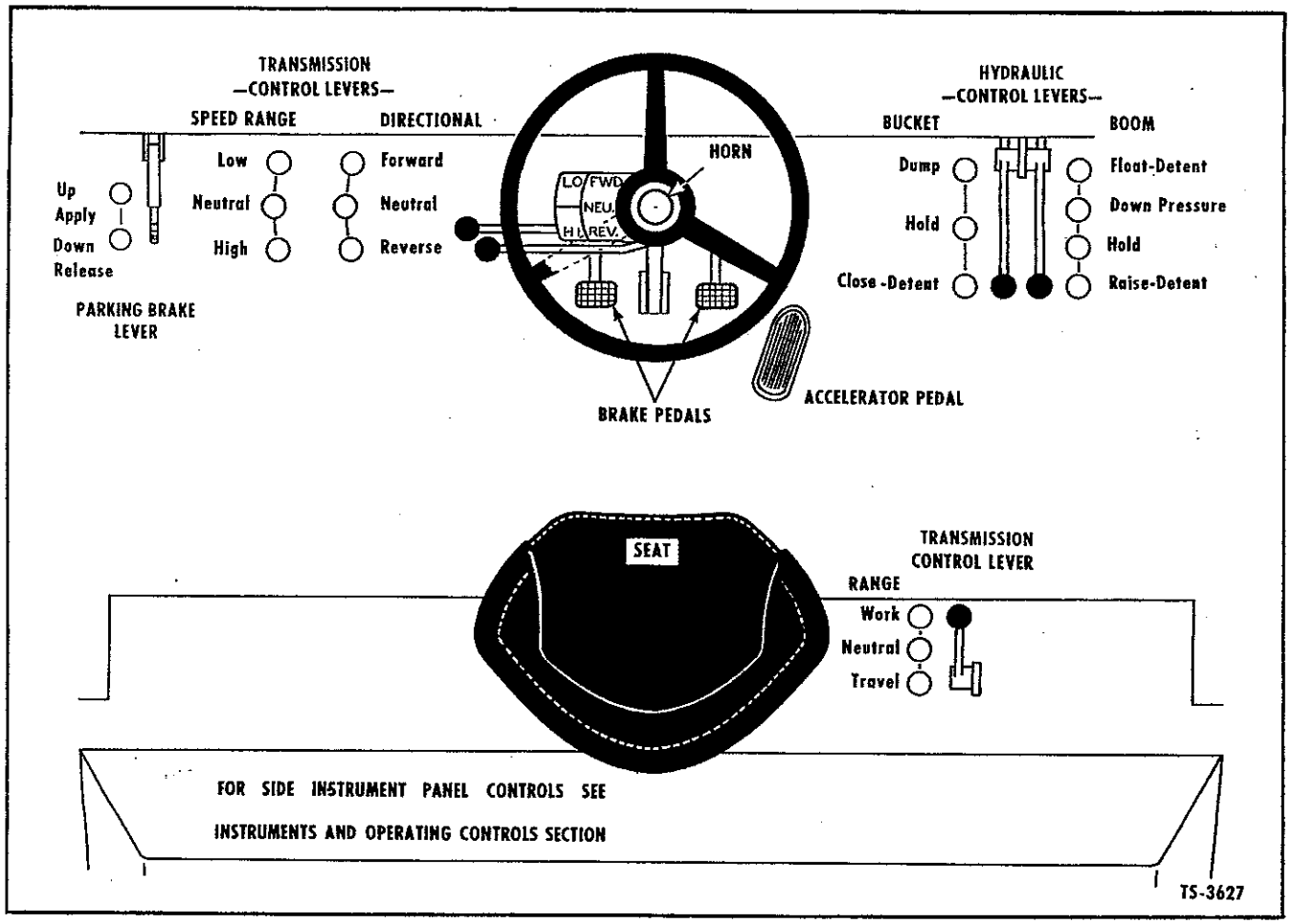


Fig. 8. Operating Controls Diagram

adjust bucket until pointer on left-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 against stops. Continue to raise bucket with boom lever until it breaks out of pile. Back out of pile, keeping load low, and deliver load to desired dumping position.

When grading or excavating, bucket should also be adjusted so that 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 against the stops, then raise boom so that bucket is approximately 15 inches off the ground for carrying to dumping position.

TRANSPORTING THE LOAD

When transporting the load, travel speed of machine will depend upon the length of haul, and the kind of surface over which the machine must pass. Rough terrain calls for a fairly slow speed.

When bucket is full, it should be carried approximately 15 inches off the ground. Never transport load with bucket fully raised. The nearer the ground that bucket is held, the better the stability, especially on slopes or when turning machine.

DUMPING THE BUCKET

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

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

When bucket is empty, pull backward on bucket control lever into detent located CLOSE position, and back away from loaded unit. Place boom control lever in DOWN PRESSURE position while returning for another load. Stop bucket at carrying height by placing boom control lever in HOLD position. Bucket automatically adjusts itself level relative to the ground as boom lowers, so that when boom is down all the way, bucket cutting edge is level with ground. The bucket control lever automatically returns to HOLD (neutral) position.

BACKFILLING AND BULLDOZING

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

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

TRAVELING WITHOUT A LOAD IN BUCKET

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

TOWING THE MACHINE

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

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

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

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

When replacing propeller shaft assemblies use only the special heat treated nuts and bolts provided. Tighten attaching bolts to 55 ft. lbs. torque.

LUBRICATION AND MAINTENANCE

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

The LUBRICATION portion contains the Chassis Lube Chart, the Drive Line Lube Chart, and the recommended intervals at which the machine should be serviced such as Daily or Shift, Weekly or 50 Operating Hours, up through a 1000 Operating Hour schedule.

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

The MAINTENANCE portion contains recommended mechanical checks and adjustments over and above those listed in the Lubrication portion.

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

LUBRICATION

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

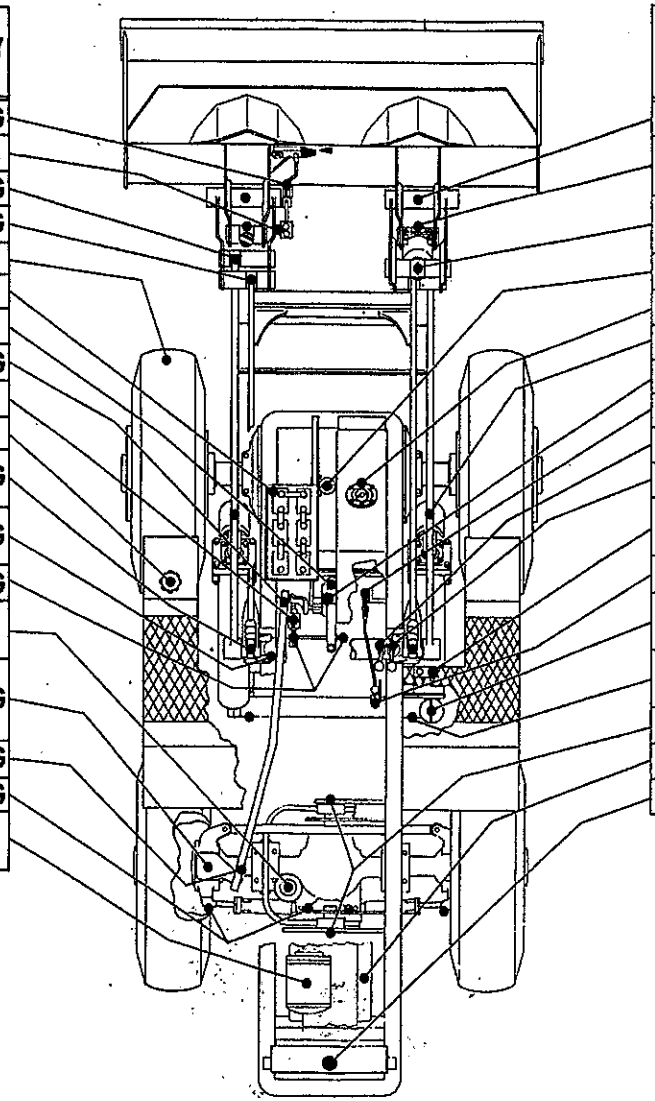
1. Machine must be LEVEL.
2. Fluid must be HOT (operating temperature of 180° F. to 200° F.).
3. Engine must be IDLING (550 to 600 rpm).
4. Area around dipstick opening must be CLEAN.

Remove access plate from floorboard in operator's compartment and pull dipstick. Wipe dipstick with clean, lint-free cloth and reinsert to check fluid level, pushing dipstick down firmly. Maintain level between "MIN. HOT" and "MAX. HOT" markings (cross hatched area) on dipstick.

MICHIGAN

DESCRIPTION	HOURS 500	250	100	50	8	KEY
1 Fitting BUCKET INDICATOR CAM					X	LBG
(See Text) BUCKET LEVELER MASTER CYLINDER				X		TA
1 Fitting Each Side BOOM TO CARRIER					X	LBG
1 Fitting Each Side GUIDE BAR TO CARRIER					X	LBG
(See Text) TIRES — FRONT & REAR					X	
(See Text) BATTERY				X		
(See Text) STEERING GEAR				X		GL
1 Fitting STEERING DRAG LINK — FRONT					X	LBG
(See Text) BRAKE MASTER CYLINDER				X		BF
(See Text) FUEL TANK				X	X	
GUIDE BAR TO UPPER PIVOT CASTING 1 Fitting Each Side					X	LBG
BOOM TO UPPER PIVOT TUBE 1 Fitting Each Side					X	LBG
2 Fittings BRAKE PEDAL SHAFT				X		LBG
(See Text) AIR CLEANER (Continental Gas Only)	X		X	X	X	
STEERING TRUNNION BEARINGS 1 Fitting Each Side (Sparingly With Hand Gun)	X					LBG
1 Fitting STEERING DRAG LINK — REAR					X	LBG
2 Fittings Each Side STEERING CYLINDERS					X	LBG
(See Text) AIR CLEANER (G.M. Diesel Only)	X		X	X	X	

KEY	
LBG	LITHIUM BASE MULTI-PURPOSE GREASE 0°F & Above Grade 2 Below 0°F Grade 0
HO	HYDRAULIC OIL
GL	SAE-90 STRAIGHT MINERAL OIL
TA	TYPE 'A' AUTOMATIC TRANSMISSION FLUID
BF	BRAKE FLUID — WAGNER 21B HEAVY DUTY

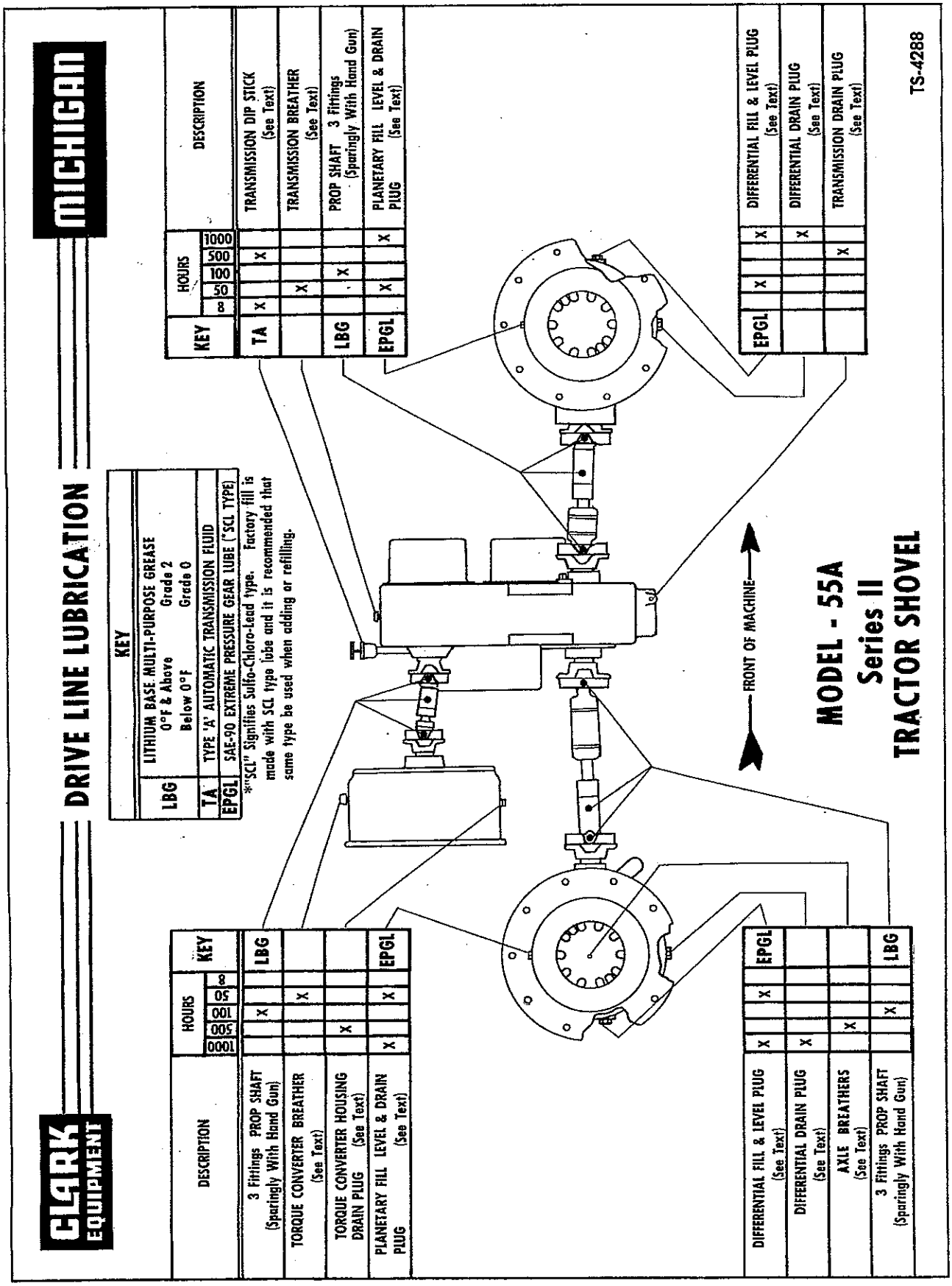


KEY	HOURS 8	50	100	250	500	DESCRIPTION
LBG	X					BUCKET PIVOT SHAFT
LBG	X					BUCKET CYLINDER TO BUCKET 1 Fitting Each Side
LBG	X					BUCKET CYLINDER TO CARRIER 1 Fitting Each Side L.S. Front; R.S. Rear
HO					X	STEERING SYSTEM FILTER (See Text)
HO	X					HYDRAULIC RESERVOIR (See Text)
LBG	X					BOOM CYLINDER TO BOOM 1 Fitting Each Side
		X				HYDRAULIC RESERVOIR BREATHER (See Text)
LBG	X					RANGE SHIFT BELL CRANK 1 Fitting
LBG	X					BUCKET CONTROL LEVER 1 Fitting
LBG	X					BOOM CONTROL LEVER 1 Fitting
TA		X				BOOM POSITIONER MASTER CYLINDER (Optional Accessory) (See Text)
LBG	X					RANGE SHIFT LEVER 1 Fitting
TA				X		TORQUE CONVERTER & TRANSMISSION SYSTEM FILTER (See Text)
LBG	X					BOOM CYLINDER TO LOWER PIVOT TUBE 1 Fitting Each Side
LBG	X					AXLE CRADLE BUSHINGS 2 Fittings
	X					ENGINE & ACCESSORIES (See Text)
	X					RADIATOR (See Text)

CHASSIS LUBRICATION

MODEL - 55A
Series II
TRACTOR SHOVEL

TS-5243



Drive Line Lubrication Chart

Refill as necessary adding only Type "A" Automatic Transmission Fluid through the dipstick opening.

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

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

1. Machine must be LEVEL.
2. Bucket must be on GROUND.
3. Engine must be SHUT DOWN.
4. Area around dipstick opening must be CLEAN.

Remove dipstick from reservoir under front hood assembly and wipe with clean, lint-free cloth. Reinsert to check oil level, pushing dipstick down firmly. Maintain level to indicated F (full) mark on dipstick.

Refill as necessary adding only premium quality hydraulic oil with following characteristics:

Viscosity Index	90-100
SSU Viscosity at 100° F. ..	190-210
Pour Point	–25° F.
Flash Point (Min.)	370° F.

Oil must contain rust and oxidation inhibitors and must not foam in service.

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

SERVICE WEEKLY

(Every 50 Operating Hours)

Grease Fittings: Lubricate all points indicated on Chassis Lubrication chart for 50 hour intervals 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 under front hood assembly. Check and maintain fluid level to within ¼ inch from top of reservoir. Add only Wagner 21-B Heavy Duty Brake Fluid. Vent hole in filler cap must be open at all times.

Boom Positioner Master Cylinder: Check and maintain fluid level to within ¼ inch from top of reservoir each 50 operating hours. Add only Type "A" Automatic Transmission Fluid.

Bucket Leveler Master Cylinder: On Continental gas powered machines serial numbers 3BCO101 thru 3BCO999, 4BCO101 thru 4BCO999, 5BCO101 thru 5BCO205 and G.M. powered machines serial numbers 3BG101 thru 3BG999, 4BG101 thru 4BG999 and 5BG101 thru 5BG225, check and maintain fluid level to within ¼ inch from top of reservoir each 50 operating hours. Add only Type "A" Automatic Transmission Fluid.

It is not necessary to perform this check on machines equipped with the pressurized line bucket leveling system.

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

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

Front Axle Planetary Hubs: Check lubricant level each 50 operating hours. 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.

**"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.*

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 with SAE-90 Straight Mineral Oil. When adding lubricant, use of hand pump or gun is recommended to force lubricant into housing and up through bearing, since weight of lubricant alone in filler extension is insufficient to raise level above bearing.

SERVICE PERIODICALLY

Check and service the following items at intervals as specified.

(Every 100 Operating Hours)

Propeller Shafts: There are three propeller shafts – one from torque converter to transmission, one from transmission to each drive axle. Each shaft has 3 points of lubrication – one on each spider assembly and one on slip yoke assembly. Total 9 points. Use a hand gun and apply grease until grease is visible on each spider and bearing assembly. Use grade of lubricant specified below according to ambient temperature. On machines equipped with pipe plugs, remove pipe plugs and install grease fittings. After lubricating prop shafts remove fittings and reinstall pipe plugs.

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 hinged access door above step plate on right side of machine. All fluid leaving the converter pump first passes through the filter providing clean fluid to the torque converter and transmission.

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

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

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

(Every 500 Operating Hours)

Grease Fittings: Lubricate all points indicated on Chassis and Drive Line Lubrication charts for 500 hour intervals 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

Axle Shaft Universal Joints: Rear drive steer axle universal joints (enclosed type), trunnion

"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.

bearings, and spindle supports, are lubricated at original assembly with a Lithium Soap Grease, Light Oil Base, No. 1 Consistency.

To compensate for lubricant loss by normal seepage, every 500 operating hours, add lubricant (as specified under grease fittings) sparingly with a hand gun through the grease fitting in the upper bearing trunnion. Lithium Base Multi-Purpose Grease (LBG Type) is compatible with the Lithium Soap Grease, Light Oil Base, No. 1 Consistency used at original fill.

When axle assembly is overhauled however, the spindle support trunnion bearings and axle shaft and universal joint should be packed with Lithium Soap Grease, Light Oil Base, No. 1 Consistency used at original fill. DO NOT at any time attempt to lubricate these members with SAE-90 Extreme Pressure Gear Lubricant as is used in Differential and Carrier Assembly and Planetary Wheel Hubs.

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 plugs from both torque converter and transmission housings, and drain thoroughly.
3. Remove transmission sump and screen, clean in solvent, dry, and reinstall, using new gaskets. Clean magnetic drain plugs and reinstall.
4. Replace element in transmission and torque converter filter assembly (filter located inside hinged access door above step assembly on right side of machine). Thoroughly clean filter case and base casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft. lbs. torque.
5. Remove breather caps and elements from top of transmission control cover and torque converter housing. Clean parts in solvent, blow dry with compressed air and reassemble.
6. Remove transmission dipstick in operator's compartment and refill torque converter and transmission with Type "A" Automatic Transmission Fluid through dipstick opening in transmission case. Reinstall dipstick. Approximate capacity – 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 Type "A" Automatic Transmission Fluid as necessary to maintain level between "MIN. HOT" and "MAX. HOT" markings (cross hatched area) on dipstick.

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 lower side of hydraulic reservoir under front hood assembly. All steering hydraulic oil is filtered as it returns to the reservoir. Since the steering and boom and bucket 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 base

casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft. lbs. torque. Run engine 5 minutes at approximately 1500 rpm, checking filter 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. Add permanent type anti-freeze according to manufacturer's instructions when air temperature is 32° F. or lower, or when there is danger of water freezing in the system. Always use a hydrometer to check freezing point of solution when it is at operating temperature.

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

Capacity (approx.) .....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 dipstick, filler cap and breather from top of reservoir. Clean filler cap screen and breather in solvent, blow dry with compressed air and reinstall.
4. Remove sump plate pipe plug and drain reservoir.
5. Disconnect boom and bucket cylinder hoses at lowest points to drain cylinders.
6. Remove sump plate 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 over drain plug opening and reinstall sump plate securely.
7. Reconnect all hoses and unions.
8. Replace element in steering system filter assembly (located at lower side of hydraulic reservoir under front hood assembly). Thoroughly clean filter case and base casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft. lbs. torque.
9. Refill reservoir to indicated F (full) mark on filler plug dipstick and secure dipstick.

   Capacity (approx.) .....20 gals.
10. Be sure all control levers are in NEUTRAL position. Start engine and run it at idle speed (550 to 600 rpm) for a few minutes.
11. Place boom lever in RAISE position to pump oil into boom cylinders. Then remove blocks or chains securing boom and bucket. Do not stand or work under boom and bucket after removing blocks or chains.
12. Operate unit by raising, lowering, dumping, and closing bucket until oil ceases to foam. This will "bleed" the system, forcing trapped air to escape through reservoir breather.
13. After oil has ceased to aerate, add oil to reservoir to bring it to level mark on dipstick. 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 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.....7 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.

casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft. lbs. torque. Run engine 5 minutes at approximately 1500 rpm, checking filter 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. Add permanent type anti-freeze according to manufacturer's instructions when air temperature is 32° F. or lower, or when there is danger of water freezing in the system. Always use a hydrometer to check freezing point of solution when it is at operating temperature.

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

Capacity (approx.) . . . . . 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 dipstick, filler cap and breather from top of reservoir. Clean filler cap screen and breather in solvent, blow dry with compressed air and reinstall.
4. Remove sump plate pipe plug and drain reservoir.
5. Disconnect boom and bucket cylinder hoses at lowest points to drain cylinders.
6. Remove sump plate 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 over drain plug opening and reinstall sump plate securely.
7. Reconnect all hoses and unions.
8. Replace element in steering system filter assembly (located at lower side of hydraulic reservoir under front hood assembly). Thoroughly clean filter case and base casting before inserting new element. Using new gasket in base casting, tighten center bolt to 50 ft. lbs. torque.
9. Refill reservoir to indicated F (full) mark on filler plug dipstick and secure dipstick.

   Capacity (approx.) . . . . . 20 gals.
10. Be sure all control levers are in NEUTRAL position. Start engine and run it at idle speed (550 to 600 rpm) for a few minutes.
11. Place boom lever in RAISE position to pump oil into boom cylinders. Then remove blocks or chains securing boom and bucket. Do not stand or work under boom and bucket after removing blocks or chains.
12. Operate unit by raising, lowering, dumping, and closing bucket until oil ceases to foam. This will "bleed" the system, forcing trapped air to escape through reservoir breather.
13. After oil has ceased to aerate, add oil to reservoir to bring it to level mark on dipstick. 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 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 . . . . . 7 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.

Front 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) .....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.....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) .....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.*

NOTES

MAINTENANCE SCHEDULE

SYSTEM	OPERATION	DAILY or SHIFT	TIME INTERVAL (HOURS)				
			50	100	250	500	1000
Engine, Controls, Cooling System and Accessories	Engine Maintenance	See Engine Manufacturer's Manual					
	Clean Air Cleaner Oil Cup or Precleaner	●	●	●	●	●	●
	Check Cooling System for Leaks		●	●	●	●	●
	Drain Fuel Tank Sediment		●	●	●	●	●
	Check Antifreeze Protection		●	●	●	●	●
	Tighten Air Cleaner Connections		●	●	●	●	●
	Check and Adjust Belt Tension		●	●	●	●	●
	Clean Air Cleaner Element and Cap			●	●	●	●
	Check Engine RPM				●	●	●
	Check Engine Shut-Off Controls					●	●
	Service Air Cleaner Element and Body					●	●
	Clean Radiator Core					●	●
Torque Converter and Transmission System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Torque Converter and Transmission Breathers		●	●	●	●	●
	Check and Adjust Transmission Shift Linkage					●	●
	Check Transmission Clutch and Oil Cooler Pressures					●	●
Boom and Bucket System	Check Hydraulic System for Leaks		●	●	●	●	●
	Clean Hydraulic Reservoir Breather		●	●	●	●	●
	Adjust Automatic Bucket Leveler				●	●	●
	Adjust Automatic Boom Positioner				●	●	●
	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					●	●
	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				●	●	●
	Adjust and Lubricate Operator's Seat				●	●	●
	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 OR PRECLEANER
- 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 or Precleaner: Air cleaners should be serviced as frequently as required dependent upon operating conditions. Certain operating conditions may require servicing air cleaners several times each day.

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

(a) **Oil Bath Air Cleaner:** Gasoline powered machines are equipped with this type 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.

(b) **Dry Type Air Cleaner:** Diesel powered machines are equipped with this type air cleaner. The dry type air cleaner is a dual stage cleaner utilizing a synthetic fiber batt element for the primary or precleaner stage, and a filtronic paper element for the secondary stage. Under normal service the precleaner element is to be replaced at 100 hour intervals, however, under extreme dust conditions it may be necessary to service air cleaner daily or more often as required.

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

Check Tire Pressure and Casings: Check air pressure in all tires. See Specifications and Service Data on Page 56 for proper air pressure. Hydro-inflated tires should be checked at more frequent intervals, 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 TORQUE CONVERTER AND TRANSMISSION BREATHERS
- CLEAN HYDRAULIC RESERVOIR BREATHER
- CHECK LIGHTS AND FUSES
- 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 inadequate cooling or ball bearing failures, as well as short belt life.

At specified intervals check and retension belts as follows:

1. Measure the span length.
2. At the center of the span, apply force with a spring scale (at right angles to the span) large enough to deflect the belt 1/64 inch per inch of span. Refer to Figure 9.

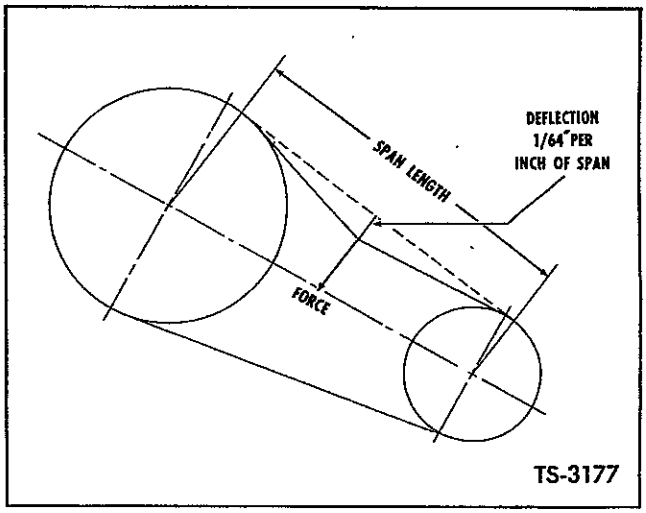


Fig. 9. Check Belt Tension

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.

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 so as to prevent entrance of foreign material or air into the system. Air drawn into the system at this point will cause cavitation of the pump with resultant malfunctioning and early failure. All hoses should be checked for abrasions which could result in ruptures of same. Replace hoses found in this condition.

Clean Torque Converter and Transmission Breathers: The torque converter and transmission hydraulic system is equipped with breathers at two points. Breathers are located on transmission control cover and torque converter housing.

Each 50 operating hours remove breather caps and elements, clean parts in solvent, blow dry with compressed air and reassemble.

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 to admit only clean filtered air. Breather is located at top of reservoir under front hood assembly.

Each 50 operating hours unscrew breather, wash in solvent, blow dry with compressed air and reinstall. A light application of oil on mesh element will aid in capturing dirt particles.

Check Lights and Fuses: Fuses are contained in a fuse block mounted on floorboard support plate under front hood assembly as shown in Figure 10.

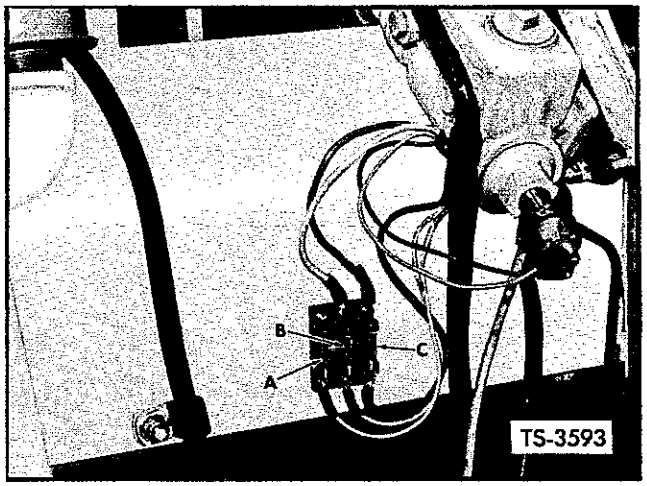


Fig. 10. Replace Fuses

Three fuses provide protection for the electrical system, one in gauge circuit, one in light circuit and one in lighter circuit. An additional fuse which is part of lighter base and cord assembly provides protection for the lighter element.

The circuits and fuse protection are:

A. GAUGE CIRCUIT .....SFE 5 AMP
B. LIGHTER CIRCUIT .....SFE 20 AMP
C. LIGHT CIRCUIT .....SFE 20 AMP

(a) **Headlamps and Floodlamps:** The cab is equipped with six identical lamps mounted in shock resistant rubber retainers. The two inside front lamps, and two rear lamps are mounted so that the light is dispersed in a horizontal pattern, thus serving as floodlamps. The two outside front cab lamps are rotated 90 degrees. Their light is dispersed in a vertical pattern, thus serving as head lamps. This effect is caused by the reflector surfaces in the lamp design.

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

1. Depress lamp and spread lip of rubber retainer outward forcing lamp out as shown in Figure 11.

2. Rotate lamp to obtain desired beam and reinstall.

If necessary to replace lamp, remove it as described in Step 1 above and disconnect terminals. Reconnect terminals on new lamp, positioning

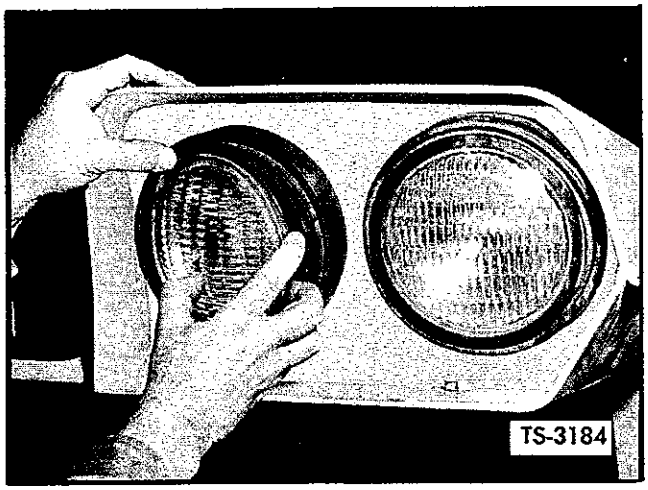


Fig. 11. Replace Headlamps or Floodlamps

lamp for desired light pattern and reinstall in retainer.

(b) **Dash, Tail and Stop Lamps:** The dash lamps on the front and side instrument panels are 12 volt single contact bulbs. The combination tail and stop lamps are 12 volt double contact bulbs. All lamps can be easily replaced by a push and a twist. Dash lamp reflectors pull off from the assemblies and push on to retain. Two screws retain reflectors on the tail lamp assemblies as shown in Figure 12.

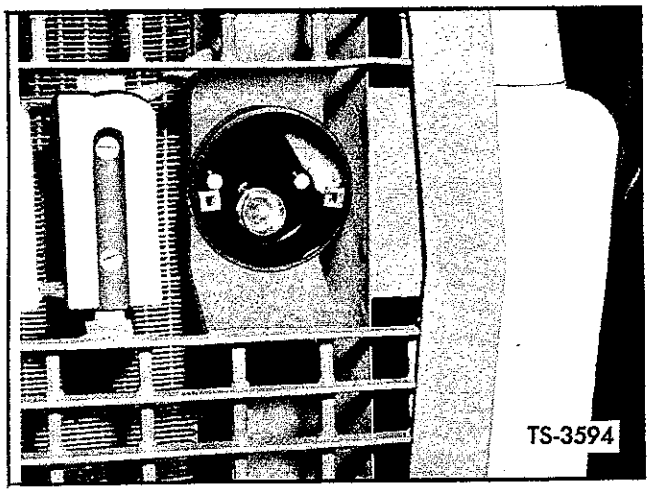


Fig. 12. Replace Tail Lamps

Service Battery: Battery is located under front hood assembly. 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 with wheels raised off the ground. 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 the rods for nicks or burrs which would damage packings or seals. Remove such nicks or burrs with a fine grained hand stone or crocus cloth.

100 HOUR MAINTENANCE OPERATIONS

- **ENGINE MAINTENANCE**
- **CLEAN AIR CLEANER ELEMENT AND CAP**

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

Clean Air Cleaner Element and Cap: Service oil bath and dry type air cleaners as follows:

(a) **Oil Bath Air Cleaner:** If operating conditions are extremely dusty, check rain cap and center tube for dust and oil accumulation. Wash cap in clean solvent. Pass a clean, lint-free cloth through the center tube to clean the walls.

(b) **Dry Type Air Cleaner:** Remove cover and entire element assembly. Unhook spring clamps and remove outer shell. Remove and discard precleaner element (fiber batt material). Blow or shake out secondary element (pleated paper).

Caution: *High air pressure can rupture filter element.*

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

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

250 HOUR MAINTENANCE OPERATIONS

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

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

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

(a) **Low Idle and High Idle RPM:** These speeds are the free operating limits of the engine under no load conditions. They are determined by the amount of fuel delivered to the engine. See Specifications and Service Data on Page 52.

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

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

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

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

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

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

G.M. Diesel

1. Unhook spring from accelerator linkage and disconnect clevis from governor throttle 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 lever to extreme forward (full throttle) position and adjust clevis to obtain a slip fit in governor throttle lever just before accelerator bottoms. If a slip fit cannot be obtained adjust clevis at lower bell crank arm and reconnect accelerator spring. See Figure 13.

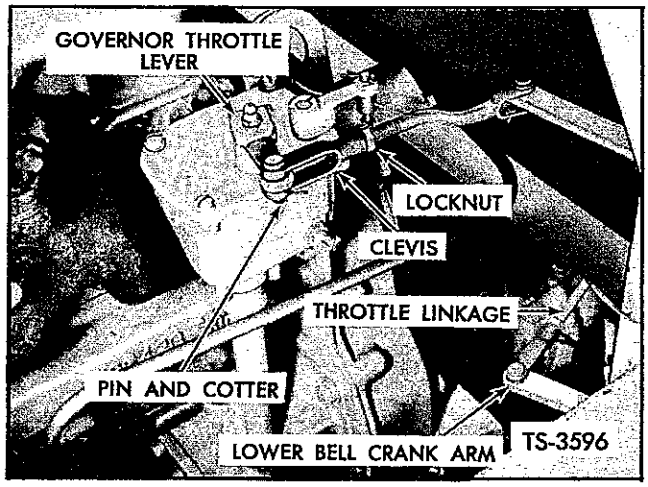


Fig. 13. Adjust Throttle Linkage — G.M. Diesel

4. Release and depress accelerator, and check that linkage will properly rotate throttle control lever from idle to full throttle position without interference.
5. Additional adjustment can be made by adjusting clevis under accelerator pedal.

Pressure required to depress accelerator is controlled by a spring on the accelerator linkage as shown in Figure 13. This spring also insures

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

Continental Gas — Throttle

1. Disconnect clevis from throttle lever on carburetor, and rotate lever to full throttle position.
2. Depress accelerator until it contacts stop on floorboard.
3. Adjust clevis so that throttle lever is against stop just before accelerator bottoms. See Figure 14.
4. Release accelerator, and check that linkage will return throttle lever to idle position.
5. If sufficient adjustment is not available at rear clevis, turn clevis beneath accelerator.

Continental Gas — Choke

1. Pull choke control knob in operator's compartment to rotate valve.
2. If cable binds, eliminate kinks or free with penetrating oil. Remove excess oil to prevent dirt accumulation.
3. Check that cable completely closes and reopens choke valve at carburetor.
4. Adjust cable length if necessary at cable clamp or at lever on carburetor. See Figure 14.

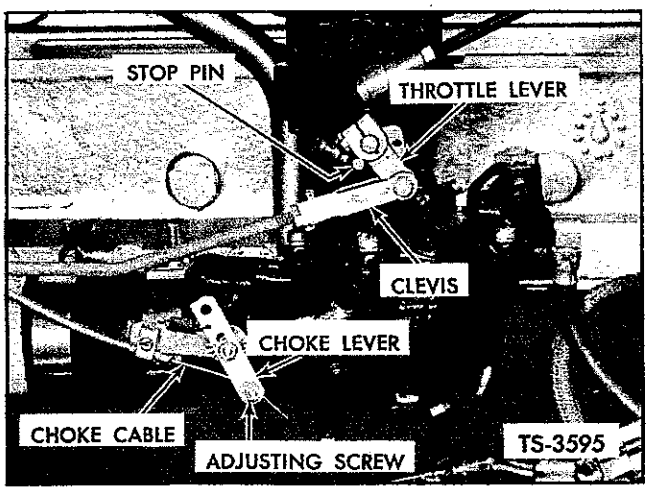


Fig. 14. Adjust Throttle and Choke Linkage — Continental Gas

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

Stall rpm is the maximum obtainable rpm with oil at operating temperature (180° F. to 200° F.) parking brake applied, wheels blocked, directional and speed range levers in FORWARD—4th (HI and TRAVEL RANGE) and bucket held against carrier stops in full close position.

Note: *Boom and bucket relief valve pressure should be at correct setting according to specifications before performing a check on the stall rpm.*

1. Install tachometer on engine.
2. Apply parking brake, block wheels, and place directional and speed range levers in NEUTRAL.
3. Start engine and raise bucket a few inches above the ground.
4. Shift levers into FORWARD—4th (HI and TRAVEL RANGE) and accelerate engine. When engine reaches maximum rpm pull back on bucket control lever to rotate bucket to full close position against the carrier stops. When engine rpm drops to its lowest point—read tachometer.

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

If stall rpm is not within specifications, trouble shooting of engine or torque converter by a qualified mechanic is required. See Specifications and Service Data on Page 55.

Note: *Stall rpm specified on Page 52 is applicable to altitude of 600 ft. and ambient temperature of 70° F. Due to the many combinations of altitude and temperature possible in the field, space does not permit publishing here all the corrections necessary to the stall rpm indicated to accommodate such variations. It is suggested the engine manufacturer's distributor be contacted to determine the correction necessary for altitude and temperature in your application.*

Adjust Automatic Bucket Leveler: The auto-

matic bucket leveler mechanism consists of a master cylinder with connecting piping to the bucket spool of the boom and bucket control valve. The master cylinder is bracket mounted on the left side carrier assembly. On Continental gas powered machines serial numbers 3BCO101 thru 3BCO999, 4BCO101 thru 4BCO999, 5BCO101 thru 5BCO205 and G.M. powered machines serial numbers 3BG101 thru 3BG999, 4BG101 thru 4BG999, 5BG101 thru 5BG225, the master cylinder has a self contained reservoir and is filled with Type "A" Automatic Transmission Fluid. On Continental gas powered machines serial numbers 5BCO206 and thereafter and G.M. powered machines 5BG226 and thereafter, the bucket leveling hydraulic system is fed by pressurized line from the main hydraulic system.

The plunger forces oil from the master cylinder to the bucket spool of the boom and bucket control valve, automatically releasing the control lever from the detent located CLOSE position to the HOLD (neutral) position.

Servicing and adjustment procedures are as follows:

(a) **Bleed Cylinder and Lines:** (Continental gas powered machines serial numbers 3BCO101 thru 3BCO999, 4BCO101 thru 4BCO999, 5BCO101 thru 5BCO205 and G.M. powered machines serial numbers 3BG101 thru 3BG999, 4BG101 thru 4BG999, 5BG101 thru 5BG225).

1. Raise boom and place bucket in full DUMP position with cutting edge resting on ground.
2. Shut down engine and set all control levers in HOLD (neutral) position.
3. Bleed master cylinder and lines with pressure tank containing Type "A" Automatic Transmission fluid. Connect tank line to master cylinder fill plug, and crack bleed screw at bucket spool of boom and bucket control valve as shown in Figures 15 and 16.
4. Check bleeding operation by rotating bucket into full close position. Lever must snap out of detent when indicator cam actuates plunger.

Bleed Cylinder and Lines: (Continental gas powered machines serial numbers 5BCO206 thru 5BCO285 and G.M. powered machines 5BG226 thru 5BG329).

1. Check oil level in hydraulic reservoir, refilling if necessary to bring level to indicated F (full) mark on dipstick.
2. Remove leveler plug on master cylinder. See Figure 17.

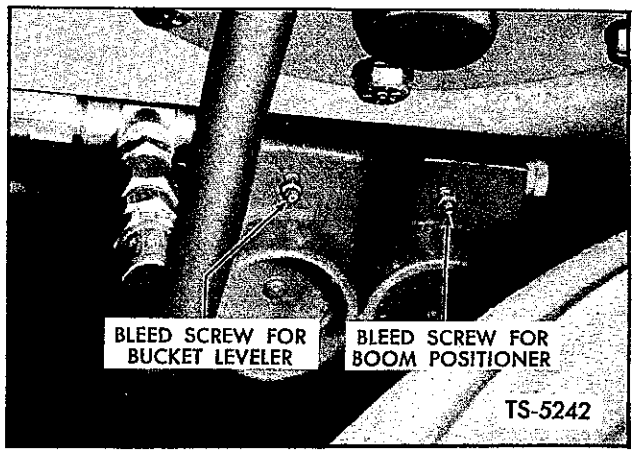


Fig. 15. Bleed Bucket Leveler Lines at Control Valve

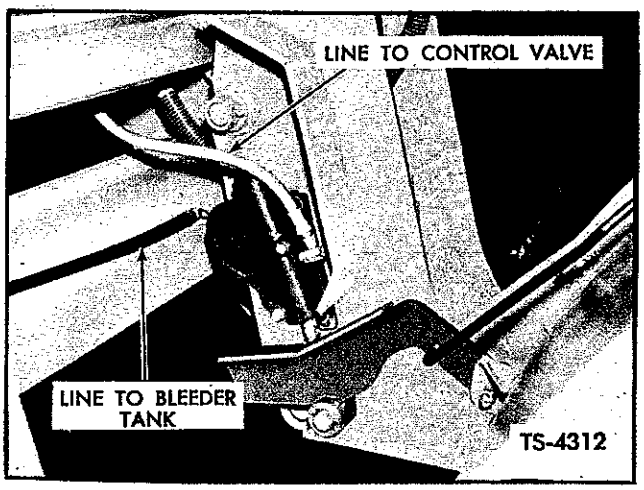


Fig. 16. Check Bleeding and Lever Release

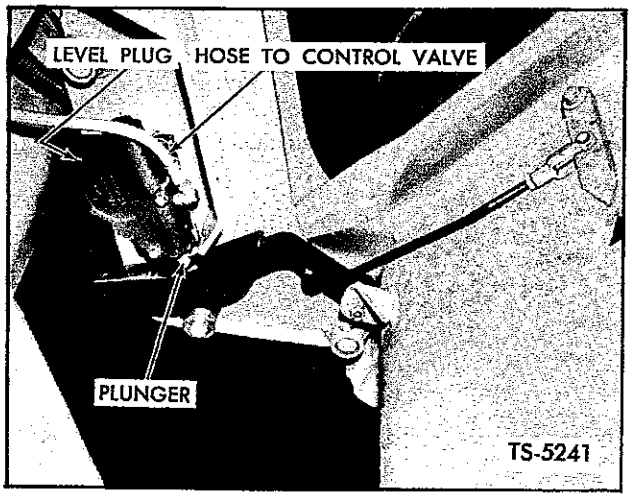


Fig. 17. Bleed Cylinder and Lines

3. Start engine, raise bucket, and roll fully forward to the DUMP position. This opens the master cylinder to the pressurized line.

4. Continue running engine until oil is expelled from the master cylinder leveler plug. (If no oil is expelled, check that plunger is in its fully extended position.)

5. Remove hose from master cylinder and run engine at maximum governed rpm (without load).

6. When all air has been expelled from line, reconnect to master cylinder and repeat Step 4.

7. Return bucket to level position. It should now be impossible to depress the leveler plunger by hand. If this is not the case, repeat bleeding sequence Steps 3 thru 6.

8. With engine at idle rpm and the bucket in level position, crack bleed screw at main control valve, retightening when all air has been expelled. See Figure 15.

9. Check bleeding operation by rotating bucket into CLOSE position. Lever must snap out of detent when indicator cam actuates plunger. If this is not the case, repeat bleeding sequence Steps 3 thru 8.

10. Shut down engine and replace leveler plug in master cylinder.

Bleed Cylinder and Lines: (Continental gas powered machines serial numbers 5BCO286 and thereafter, and G.M. powered machines serial numbers 5BG330 and thereafter).

1. Check oil level in hydraulic reservoir, refilling if necessary to bring oil level to indicated F (full) mark on dipstick.

2. Start engine, remove hose from master cylinder and run engine at maximum governed rpm (without load). See Figure 17.

3. When all air has been expelled from line, reconnect to master cylinder by approximately 2-3 threads, and with engine still at maximum governed rpm, allow air bubbles to escape out past the threads.

4. When all air bubbles have been expelled reduce engine to idle rpm and reconnect line to master cylinder securely.

5. With engine at idle rpm and the bucket in level position, crack bleed screw at main control valve, retightening when all air has been expelled. See Figure 15.

6. Check bleeding operation by rotating bucket into CLOSE position. Lever must snap out of detent when indicator cam actuates plunger. If this is not the case, repeat bleeding sequence. Steps 2 thru 5.

7. Shut down engine.

(b) **Adjust Plunger Operating Travel**

1. Loosen master cylinder mounting bolts and slide cylinder to maximum height in adjustment slots. See Figure 18.

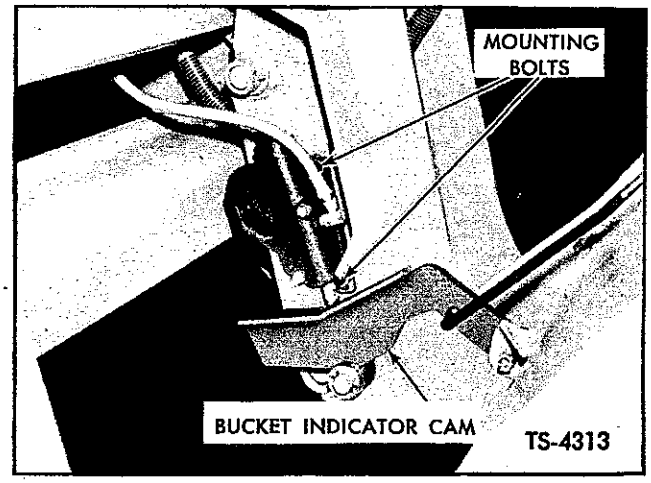


Fig. 18. Adjust Bucket Leveler Plunger Travel

2. Start engine, position bucket level on ground; then shut down engine and pull bucket lever into detent located CLOSE position.

3. Lower master cylinder to cam until lever snaps into HOLD (neutral) position. Tighten mounting bolts.

4. Restart engine and with boom raised at various heights, cycle bucket slowly several times to check proper operation. Each time bucket reaches level position relative to the ground, bucket control lever should automatically return to HOLD position. With bucket resting

level on ground, control lever will not engage in detent position. Readjust master cylinder up or down as necessary.

Adjust Automatic Boom Positioner (Optional Equipment): The automatic boom positioner mechanism consists of a master cylinder with connecting piping to the boom spool of the boom and bucket control valve. The master cylinder is mounted on the right side pivot cap. It has a self contained reservoir filled with Type "A" Automatic Transmission Fluid.

A cam and lever mechanism bolts to the pivot cap with linkage anchored to the boom arm. The cam rides on a fore and aft adjustable roller assembly which controls contact of cam with master cylinder plunger roller as the boom is raised. The plunger forces oil from the master cylinder to the boom spool of the boom and bucket control valve, automatically releasing the control lever from the detent located RAISE position to the HOLD (neutral) position. The adjustable feature permits automatic kickout at various heights as desired.

Servicing and adjustment procedures are as follows:

(a) **Bleed Cylinder and Lines**

1. Lower boom with bucket resting on ground.
2. Shut down engine and set all control levers in HOLD (neutral) position.
3. Bleed master cylinder and lines with pressure tank containing Type "A" Automatic Transmission Fluid. Connect tank line to master cylinder fill plug in similar manner as for bucket leveler. Crack bleed screw at boom spool of boom and bucket control valve as shown in Figure 19.
4. Check bleeding operation by raising boom. Lever must snap out of detent when cam actuates plunger.

(b) **Adjust Kickout Height**

The height at which the boom automatically stops is adjustable at the roller assembly. Refer to Figure 20.

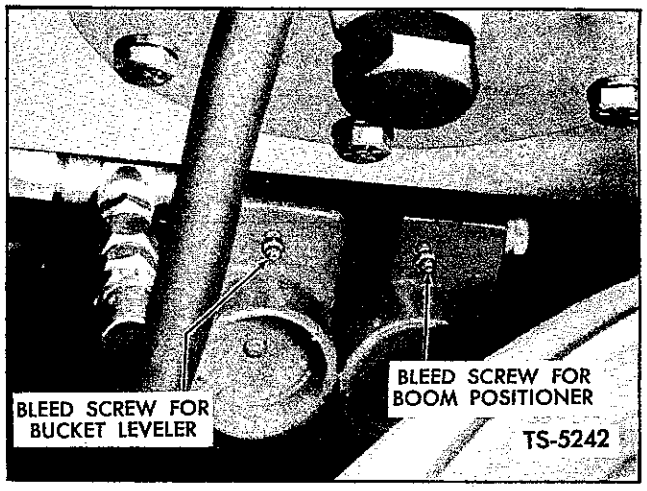


Fig. 19. Bleed Boom Positioner Lines at Control Valve

1. Turn knob clockwise to raise height of boom kickout.
2. Turn knob counterclockwise to lower height of boom kickout.
3. There is a click every 90° rotation of knob to hold adjustment by preventing screw from backing out.

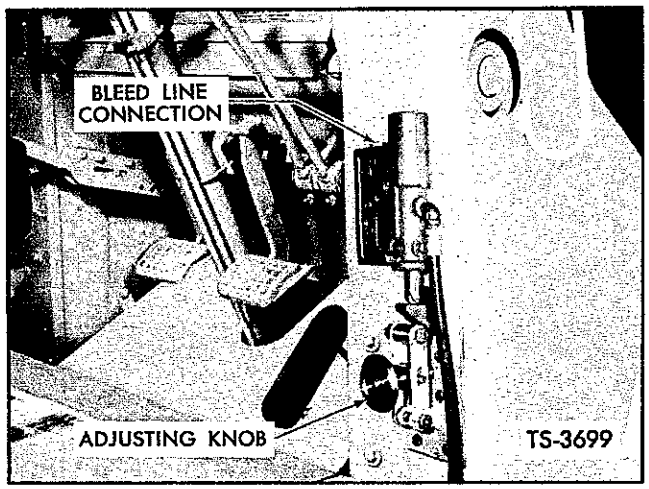


Fig. 20. Adjust Boom Positioner Kickout Height

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.

Remove cotter and clevis pin. Loosen locknut and turn clevis so that pointer is properly aligned when viewed from operator's seat. See Figure 21. Set locknut, and install pin and cotter.

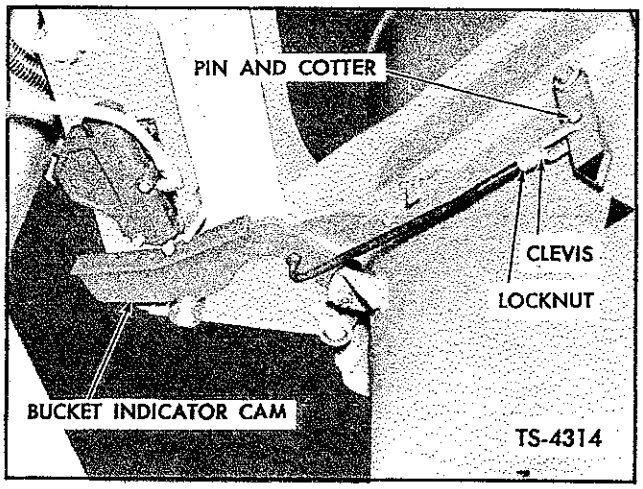


Fig. 21. Adjust Bucket Indicator

Adjust Service (Wheel) Brakes: Inadequate braking may indicate a need to replenish fluid in master cylinder, adjust pedal free travel, bleed brake lines, adjust master cylinder relief valve or to adjust the shoes.

(a) **Pedal Free Travel**

Brake pedal free travel is the distance the pedal moves before the push rod touches the master cylinder piston. Too much free motion reduces the effective travel of the master cylinder piston, and results in poor braking effort. Too little 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 22.

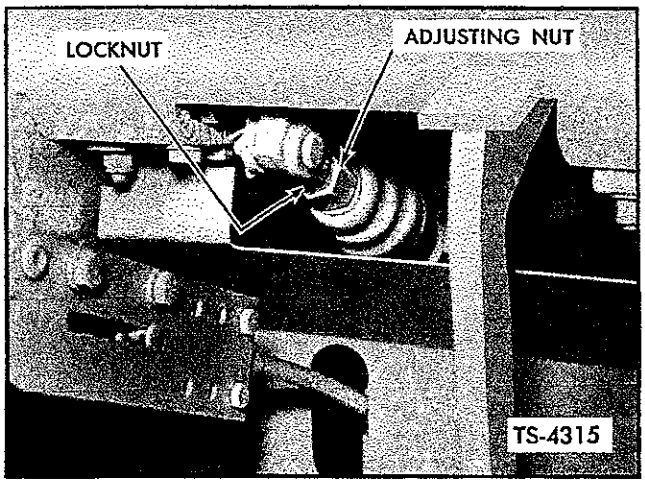


Fig. 22. Adjust Brake Pedal Free Travel

1. Depress pedal by hand, noting distance pedal moves before resistance is offered. Proper travel is 1½ inches 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 requires 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.

With range shift lever in work range, the transmission and all four wheel cylinders must be bled in the following order. Refer to Figures 23 and 25.

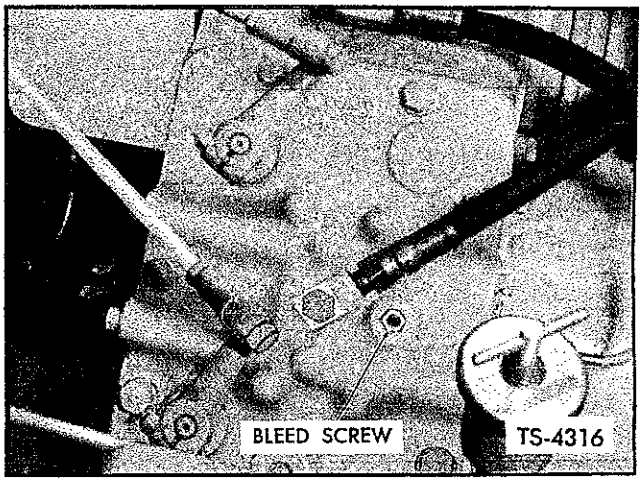


Fig. 23. Bleed Brakes — Transmission

1. Transmission
2. Left rear wheel cylinder
3. Right rear wheel cylinder
4. Left front wheel cylinder
5. Right front wheel cylinder
6. 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. Open bleed screw and depress brake pedal to expel air and fluid from lines.
3. When pedal reaches maximum stroke, close bleed screw before releasing pedal.
4. Repeat this procedure until solid fluid, free from bubbles, comes from bleed screw, checking master cylinder frequently to insure ample supply of fluid.

(c) **Master Cylinder Relief Valve**

A two stage power brake master cylinder is used consisting of low and high pressure cylinders, automatically controlled by a built-in pressure relief valve. The valve opens at a predetermined load, transferring pressure from the low to high pressure cylinders resulting in twice the line pressure with the same pedal effort.

Improper adjustment or operation of the relief valve will react in various ways against the development of a satisfactory brake, both in pedal feel and performance.

If the adjustment screw is set unnecessarily high an unsatisfactory pedal action will develop. The brake pedal with such a relief valve setting will be very heavy during the first of the pedal stroke, and then a very noticeable "pop" will be felt with a resulting pedal dive. Such an action will make smooth stops impossible at slow speeds.

Too low setting of the relief valve may cause loss of pedal, a low pedal, or an inconsistent pedal action. This is caused by the relief valve releasing the low pressure piston before full shoe extension has been attained.

Adjust relief valve as follows:

1. Remove front plug on master cylinder to gain access to the adjustment screw in the top of the relief valve assembly. See Figure 24.

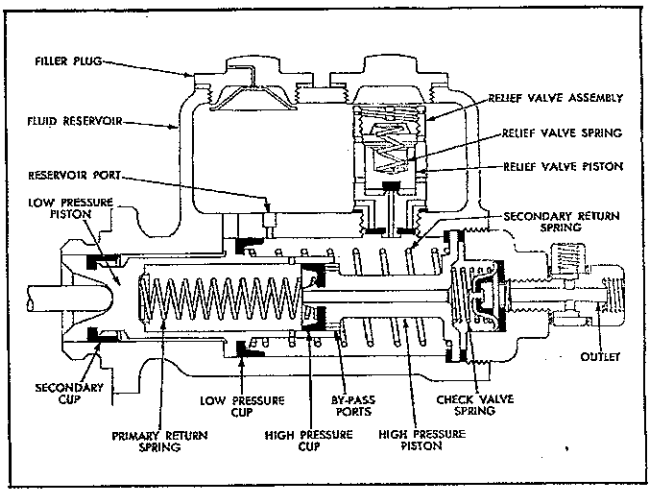


Fig. 24. Adjust Master Cylinder Relief Valve

2. If too high setting release adjustment by turning screw counterclockwise. If too low setting turn adjusting screw clockwise. Turn screw one full turn at a time.
3. After each adjustment try the brake pedal for proper feel.

   Note: *The transition from low to high pressure will always be noticeable in some degree.*
4. After adjusting relief valve, always check brakes carefully by depressing the brake pedal both rapidly and slowly. No pedal travel should be lost.

(d) **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 25.

1. Raise wheels off the ground.

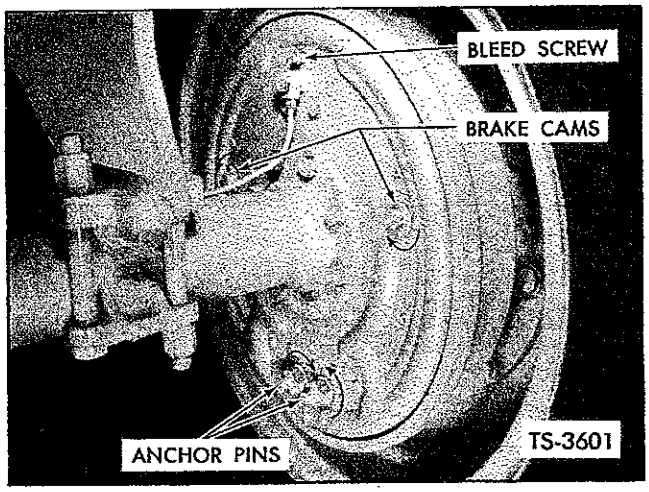


Fig. 25. Adjust Brake Shoes

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 all wheels in same manner.

5. Test brakes for proper application and release.

(e) **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.

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 all wheels in same manner.

7. Tighten anchor pin nuts to 110-125 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 slack develops in the parking brake cable, perform the following adjustments.

1. With lever in released position turn acorn on end of handle clockwise as shown in Figure 26.
2. Test for good resistance over center as handle is pulled up to applied position.

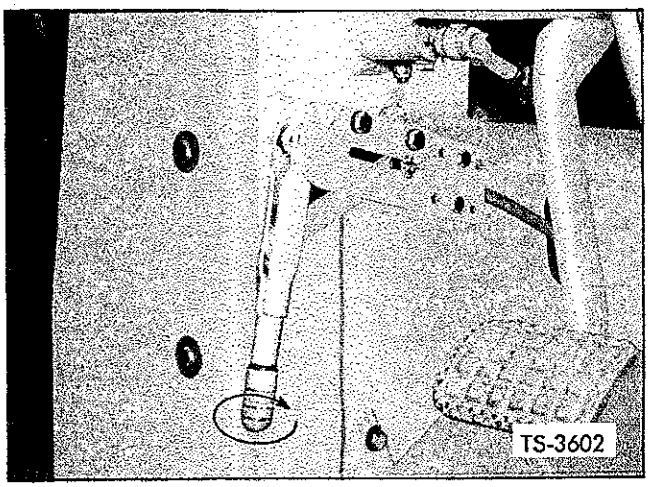


Fig. 26. Adjust Parking Brake at Handle

Further adjustment is provided at the brake assembly as shown in Figures 27 and 28. First be sure that acorn on lever is backed off, so that all slack can be taken up at the brake assembly. Brake lever should be in released position.

1. Set brake lever in fully released position.

2. Clip lockwire and turn anchor adjusting screw to produce .030 clearance between lining and drum as shown in Figure 27. Relockwire screw.

3. Loosen locknut on locating screw and turn screw until there is .010 clearance between lower portion of lining and drum. Clearance should be measured about one-half inch from

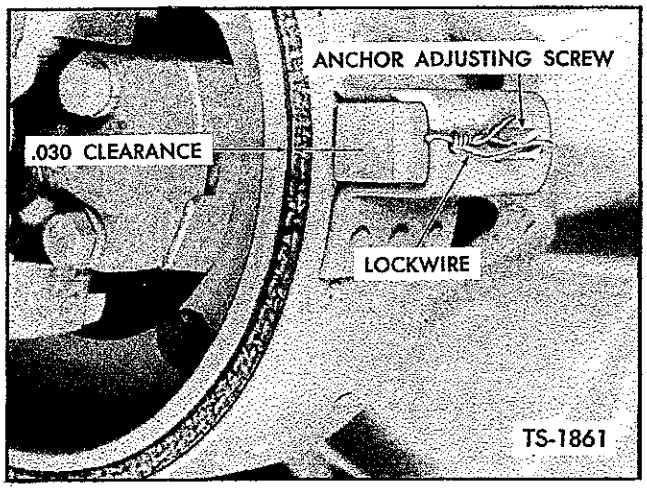


Fig. 27. Adjust Parking Brake Anchor

lower end of lining. See Figure 28. Tighten locknut when this clearance is obtained.

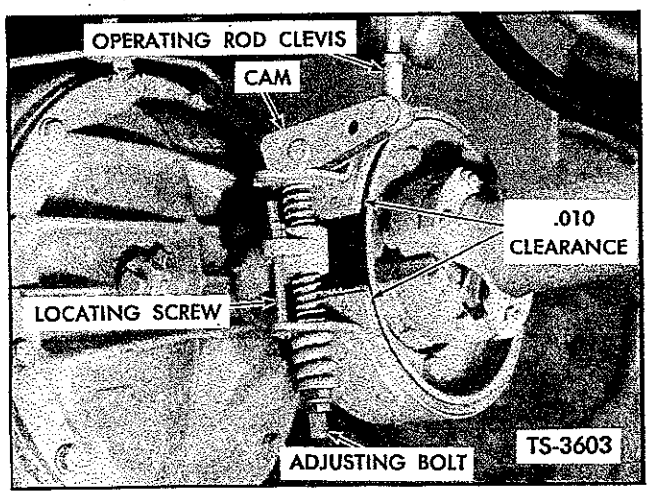


Fig. 28. Adjust Parking Brake Clevis and Cam

4. Loosen locknut on adjusting bolt and draw up bolt to give .010 clearance between upper portion of lining and drum. Measure clearance about one-half inch from top end of lining, and reset locknut.

5. With brake lever in released position adjust operating rod clevis until flat portion of cam rests on the pad of the brake band bracket.

6. Test brake for proper application and release.

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 29.

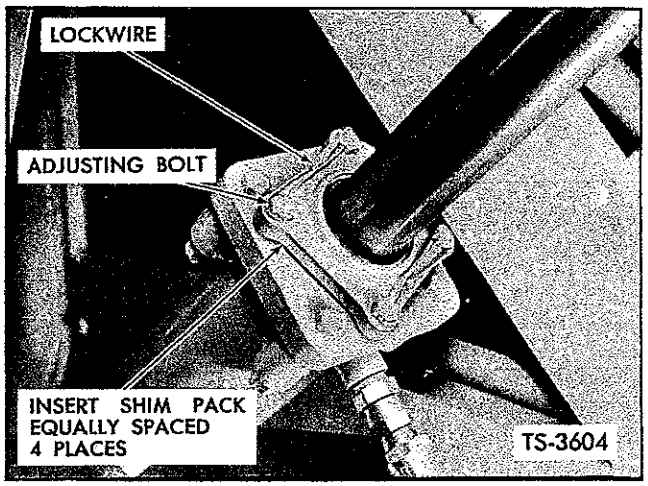


Fig. 29. Adjust Packing Gland (Boom Cylinder Shown)

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 in pairs.

Adjust and Lubricate Operator's Seat: The operator's seat can be shifted forward or rearward to suit the individual. Move lever forward on left-hand side of seat, and shift seat to desired position. Another set of holes in the rails is provided for optional mounting if desired. See Figures 30 and 31.

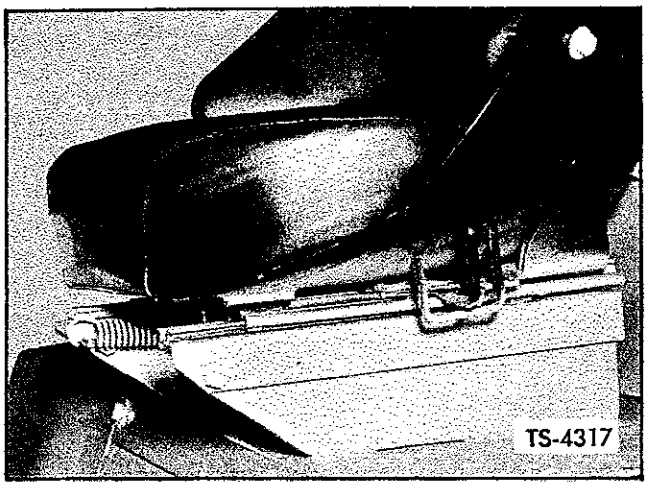


Fig. 30. Adjust Operator's Seat

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

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

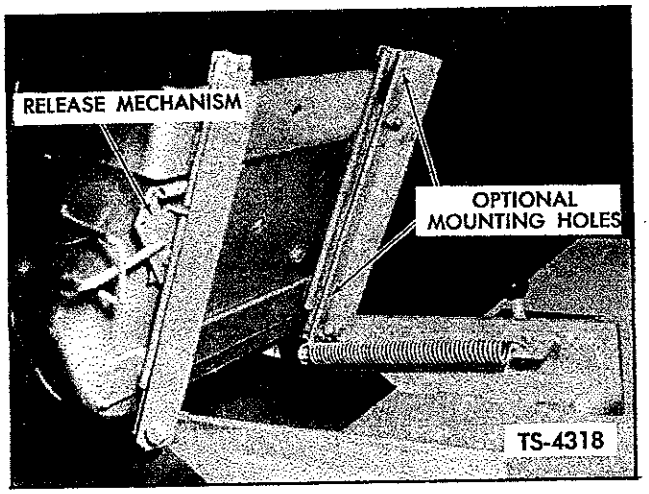


Fig. 31. Lubricate Operator's Seat

500 HOUR MAINTENANCE OPERATIONS

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

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 (upper T-handle or knob) on side instrument panel 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. Increase cable tension as necessary at shut-off lever on governor assembly by loosening set screw from cable connector. See Figure 32. Retighten set screw.

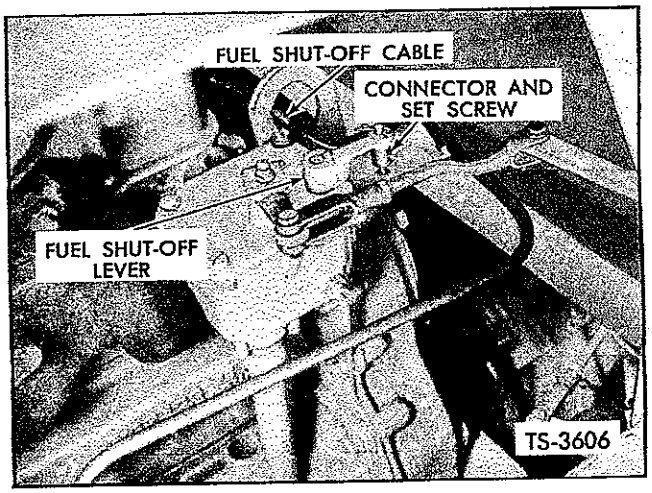


Fig. 32. Adjust Engine Fuel Shut-Off Control — G.M. Diesel

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

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

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

1. Pull engine air (emergency) shut-off control (lower T-handle or knob) on side instrument panel and check that cable operation releases valve inside air intake housing.

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

3. Increase cable tension as necessary at shut down latch assembly on air intake housing by loosening set screw from cable connector. See Figure 33. Retighten set screw.

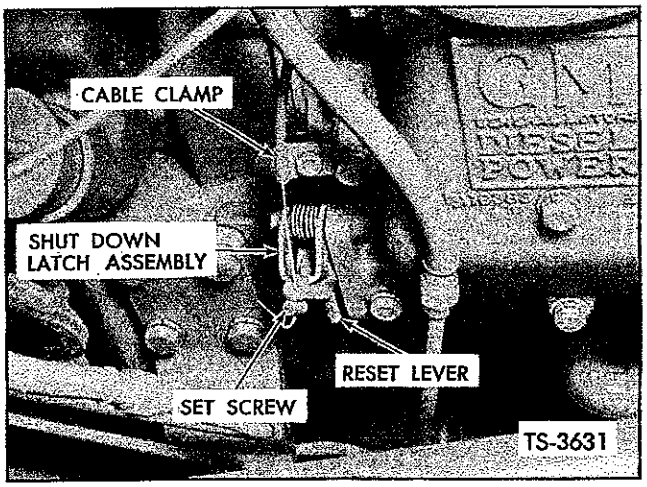


Fig. 33. Adjust Engine Air (Emergency) Shut-Off Control — G.M. Diesel

4. Reset air (emergency) shut-off control in its original position and manually reset the latch assembly.

5. Recheck operation of shut-off control to insure proper release of valve in air intake housing.

Air Cleaners: Service oil bath and dry type air cleaners as follows:

(a) **Oil Bath 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 cup as usual.

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

(b) **Dry Type Air Cleaner:** Replace entire precleaner and secondary elements. This can be ordered as a replacement assembly. Wipe inside cleaner with a clean, lint-free cloth. Check condition of gasket inside cleaner.

Reassemble and tighten all connections securely.

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

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

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

Check and Adjust Transmission Shift Linkage: Inspect all mechanical control linkages to make sure all rods, cross shafts, bell cranks, ball joints and operating arms are in serviceable condition and properly adjusted. Correct any questionable condition such as loose or bent linkage, worn pins or evidence of binding or rubbing of any of the linkage components.

Adjustments for the various shift linkages are as follows:

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

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

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

1. Check and tighten shift quadrant mounting bolts.
2. Check and tighten U-bolts holding shift lever support plates to steering column. See Figure 34. These bolts should be snug. Support plates are keyed into steering column which prevents their rotation.

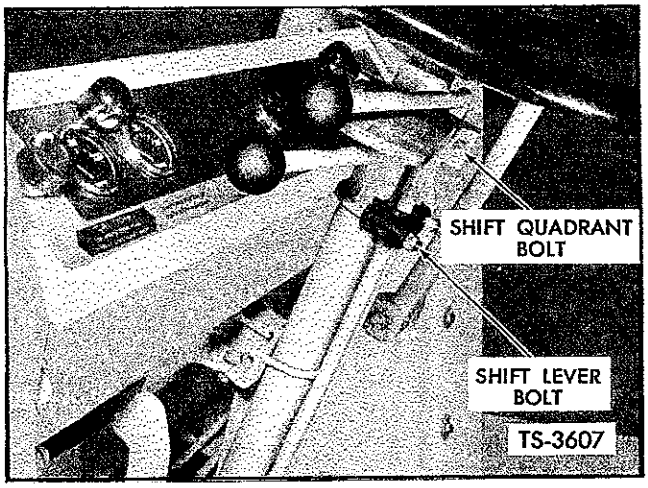


Fig. 34. Tighten Shift Quadrant and Shift Lever Mounting Bolts

3. Place speed range and directional shift levers in NEUTRAL position.
4. Loosen locknut on shift rod, and remove nut securing ball joint assembly to selector arm. See Figure 35.
5. Turn ball joint assembly, then check alignment in operator's compartment. If sufficient adjustment is not available, turn ball joint at opposite end of shift rod.
6. Reassemble and tighten locknuts.

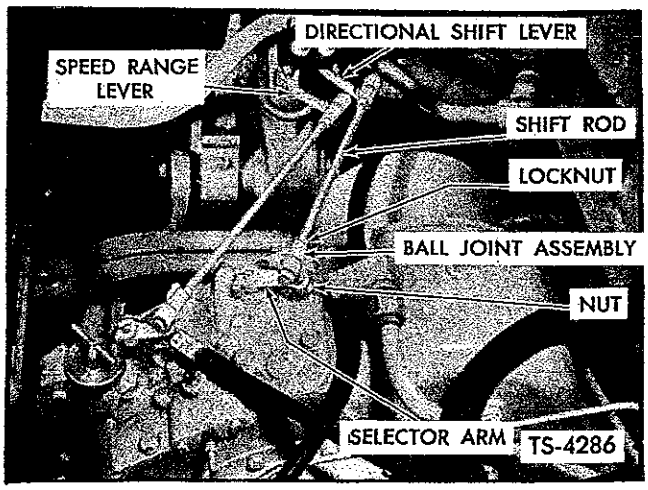


Fig. 35. Adjust Directional and Speed Range Shift Levers

7. Check that levers will shift into all detent positions without interference from steering column and transmission control cover.

(b) **Range Shift Lever**

Range shift lever engages transmission working range or travel range. It also actuates the transmission lockout control valve. If lever strikes opening in seat support plate before engagement, or if it is desired to change angle of lever to provide additional space between lever knobs for greater ease in shifting, perform the following adjustment:

1. Loosen locknut on shift rod just forward of transmission on right side of machine. See Figure 36.

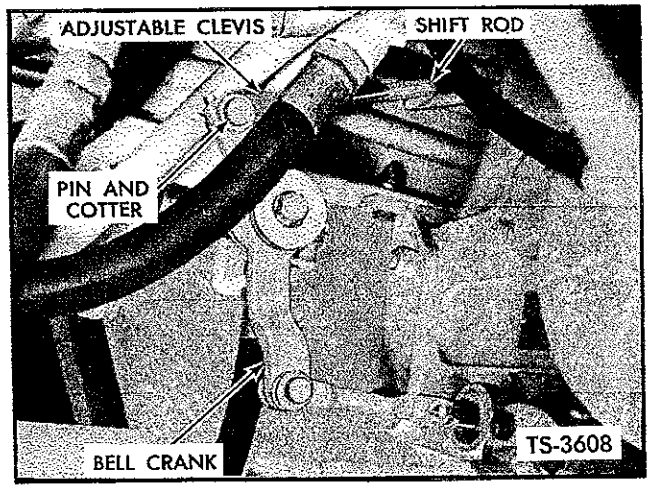


Fig. 36. Adjust Range Shift Lever

2. Remove cotter and clevis pin.
3. Turn clevis on shift rod to desired position.
4. Reassemble and tighten locknut securely.
5. Check shift lever in operator's compartment to insure positive engagement in both work and travel range positions without interference.

(c) **Transmission Lockout Control Valve**

The transmission lockout control valve is a hydraulic valve installed in the line connecting the brake master cylinder to the transmission control cover. It is an open-close type valve actuated by the range shift lever. Its function is to automatically establish a transmission neutral when the service brakes are applied.

The valve is open when the range shift lever is in working range. Consequently, when the service brakes are applied, brake fluid flows from

the master cylinder through the control valve to actuate the shut-off valve in the transmission control cover. Oil flowing to the forward clutch is blocked, disengaging the clutch and establishing a transmission neutral. The reverse clutch is not affected.

When the range shift lever is in travel range, the lockout control valve is closed. No brake fluid can flow through it; therefore transmission will not shift into neutral when the service brakes are applied.

This arrangement has several advantages:

1. It prevents machine from creeping forward when loading or dumping bucket; yet permits backing away if operating on sloping grade.
2. It increases boom and bucket hydraulic system working energy by blocking power to the wheels.
3. It does not neutralize transmission in travel range when brakes are applied while roading machine.

Check and adjust lockout control valve as follows:

1. Place directional and speed range levers in NEUTRAL position.
2. With engine idling, lightly apply service brakes and shift directional lever into forward position. There should be no clutch grab or drop in engine rpm as would be noticed when shifting lever into reverse position. A steady rpm slightly higher than idle will give a more pronounced indication.
3. Adjust for proper engagement by moving control valve in slots of mounting bracket as shown in Figure 37, or by readjusting range shift lever travel.
4. Recheck adjustment for proper operation as described in Step 2.

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

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

(a) **Transmission Clutch Pressure**

1. Install an accurate gauge (0 to 400 psi capacity) at the pressure regulator valve as shown in Figure 38.

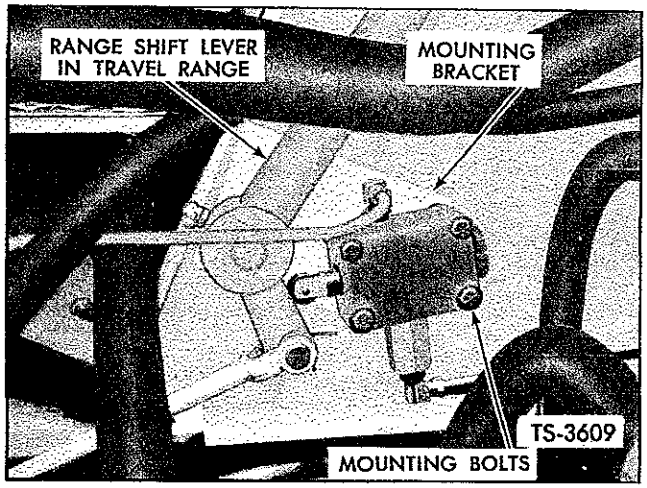


Fig. 37. Adjust Transmission Lockout Control Valve

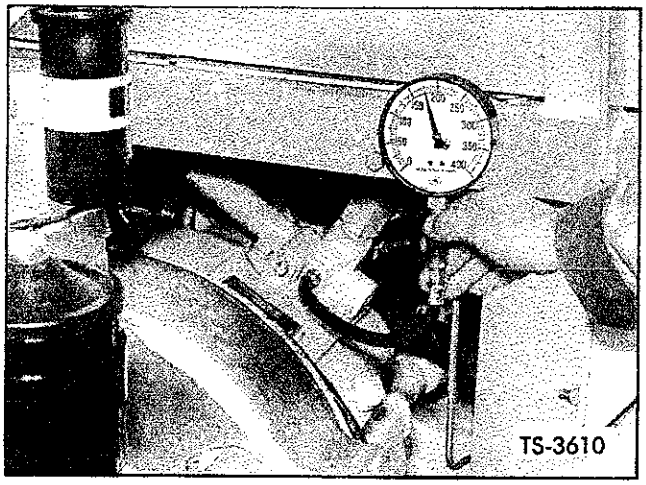


Fig. 38. Check Pressure — Transmission Clutches

2. Pressure check should be taken with oil at operating temperature (180° F to 200° F), wheels of machine securely blocked and the parking brake applied.
3. With engine at idle rpm (550 to 600 rpm) pressure check should be made in high and low speed ranges in both forward and reverse direction. Pressure readings should be as follows:

Machines having converters carrying serial numbers 93369B thru 113877B and 1C thru 120674C . . . . . 240 to 270 psi.

Machines having converters carrying serial numbers prior to 93369B, and machines having converters carrying serial numbers 120675C and thereafter . . . . . 160 to 200 psi.

The torque converter serial number is stamped on the nameplate located centrally on top of the converter. See "Data Plates" section on Page 1 of this manual.

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

(b) **Oil Cooler Pressure Drop**

The drop in pressure across the oil cooler at bottom of radiator will indicate whether oil cooler has or is becoming plugged with foreign material causing overheating.

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

1. Install tachometer on engine. Install gauges at pressure ports on inlet and outlet piping to oil cooler as shown in Figures 39 and 40.

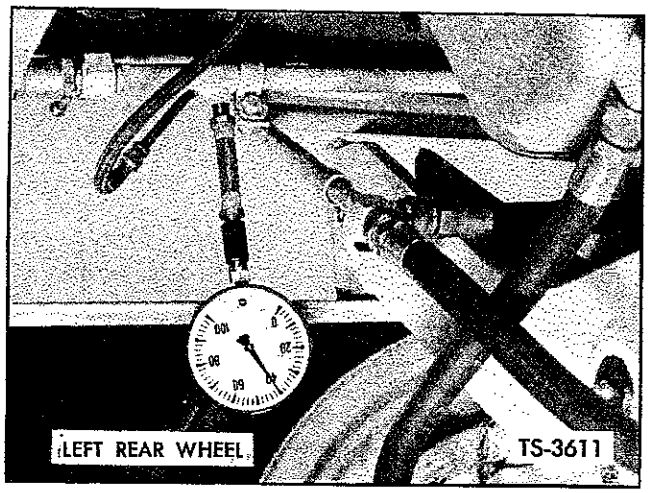


Fig. 39. Check Pressure — Oil Cooler IN

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

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

If the pressure difference equals or exceeds 40 psi it will be necessary to thoroughly clean or replace the oil cooler and/or the radiator assembly.

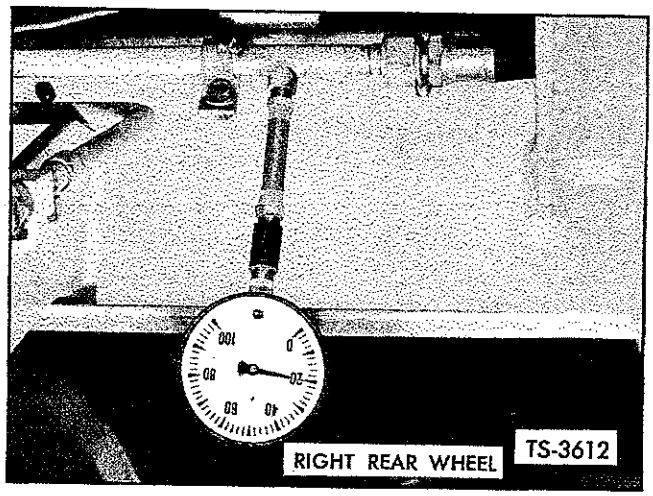


Fig. 40. Check Pressure — Oil Cooler OUT

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 41. Apply parking brake and block wheels.

3. Start engine, shift levers into FORWARD — 4th

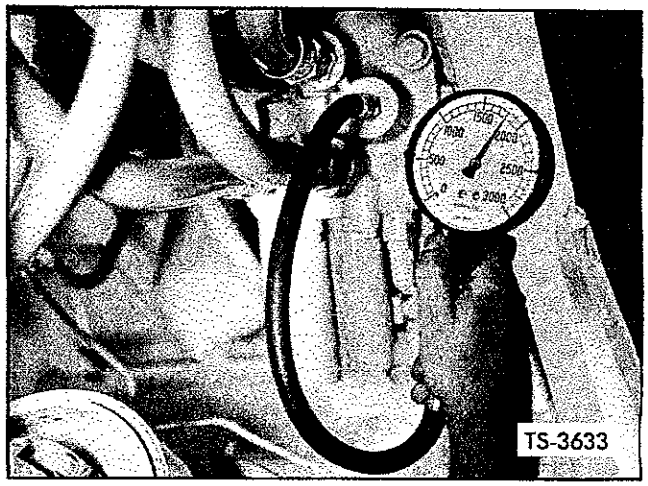


Fig. 41. Check Pressure — Boom and Bucket Control Valve

(HI and TRAVEL RANGE) and accelerate engine. When engine reaches maximum rpm rotate bucket to full close position to stall converter. When engine rpm drops to its lowest point — gauge should read 1800 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 42. Turn screw in increments of approximately one revolution or less, set locknut, and retake reading. Repeat until gauge reads 1800 psi.

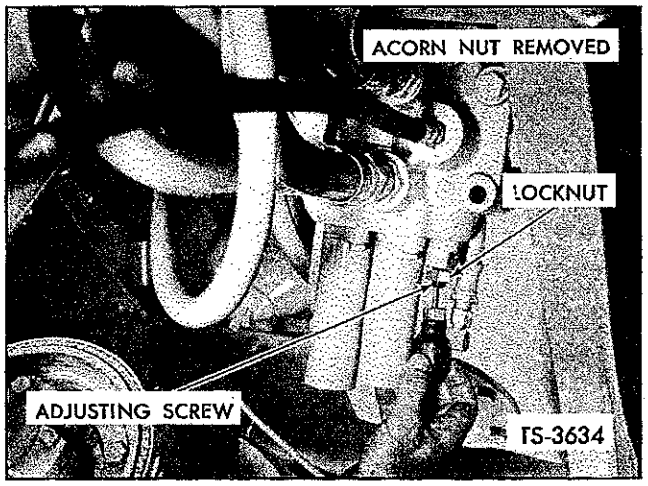


Fig. 42. Adjust Pressure — Boom and Bucket Control Valve

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 43.

1. Loosen locknut on control rod.

2. Remove cotter and clevis pin.

3. Turn clevis clockwise to move lever away from operator; counterclockwise to move lever toward operator.

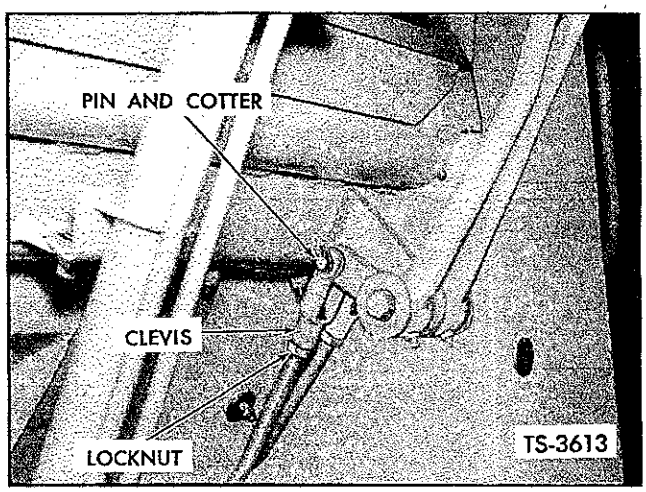


Fig. 43. Adjust Boom and Bucket Control Levers

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

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

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

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

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

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

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

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

Maintenance consists of periodically checking the pressure in the system.

1. Use a hydraulic pressure gauge of at least 3000 psi capacity. With engine shut down, remove Allen head plug on side of relief valve and connect gauge as shown in Figure 44.

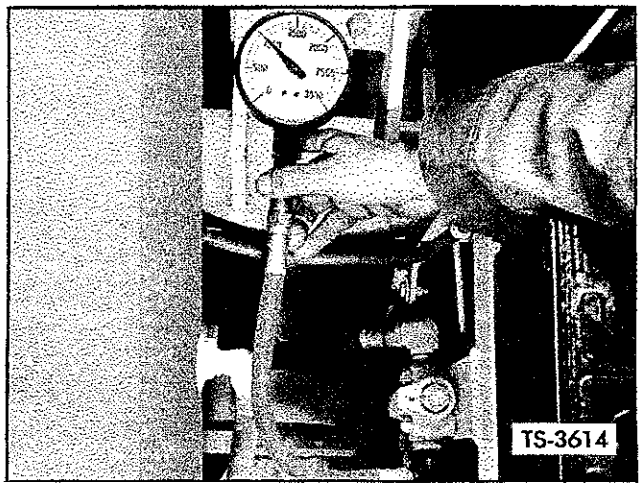


Fig. 44. Check Pressure — Steering Relief Valve

2. Start engine and accelerate to maximum rpm.

3. Turn wheels right or left and hold against the axle stops. Take a pressure gauge reading which should be 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 45. Turn screw in increments of approximately one 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 Allen head plug.

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.

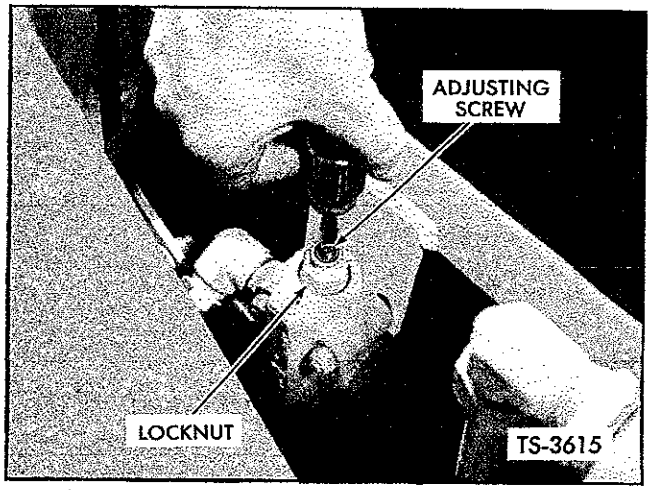


Fig. 45. Adjust Pressure — Steering Relief Valve

Remove cotter and turn slotted adjusting plug to remove all slack in ball joints at each end of drag link as shown in Figure 46.

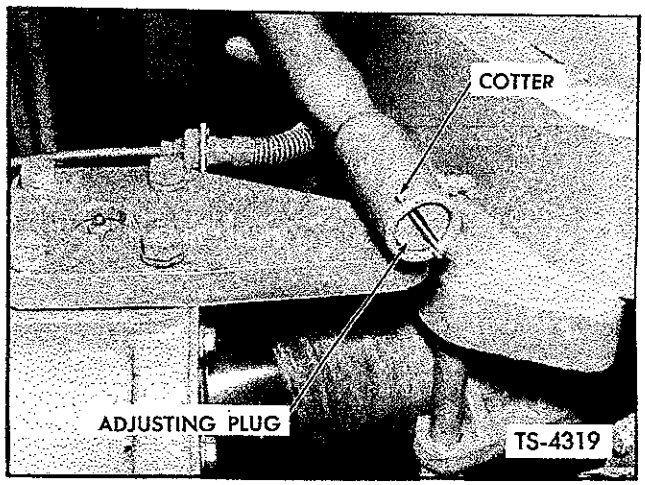


Fig. 46. Adjust Drag Link Ball Joint

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

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

1. Check for evidence of rear tires having rubbed frame in either direction of turn. Tires should be equally inflated and to correct pressures.

2. With machine sitting on level surface, turn steering wheel to extreme left turn position and hold, and check that left front stops are contacting with a minimum clearance of 1 inch between tire and machine frame.

3. Continue to hold wheels in full left turn position and insert template between tire and machine frame as shown in Figure 47.

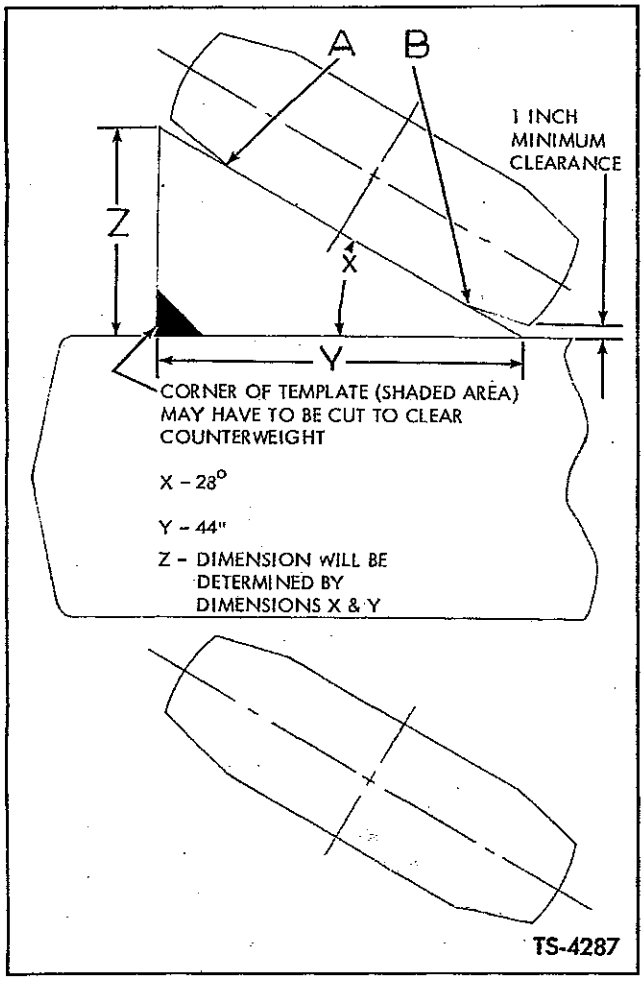


Fig. 47. Check Steer Axle Stops

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

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

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

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

4. If clearance between tire and machine frame is less than the specified 1 inch minimum clearance, inspect and check for:

   a. Bent drag link or tie rod.

   b. Worn drag link or tie rod ball joints.

   c. Proper adjustment of the steering gear worm and sector shaft.

   d. Steering gear loosely mounted.

   e. Loose wheel nuts (ream studs in wheel disc if necessary).

   f. Building up and refacing front steering stops.

5. Repeat check for right hand turn.

6. Stops should be built up with Lincoln Mangjet or Manganweld-C hardface welding rods or equivalent and ground smooth. A. O. Smith and Airco are other sources which manufacture high manganese electrodes for resistance to impact.

7. Extreme care must be exercised when building up and grinding stops to insure a smooth flat surface. The entire area of stop must contact its mating stop simultaneously. Care must also be taken to insure that degree of turn is equal in both left and right hand turns.

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

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

Remove and replace damaged or missing

mounting bolts and tighten all loose mounting bolts as necessary. Refer to 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.

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.

To replace bucket cutting edges, follow the procedure outlined below and as shown in Figure 48.

1. Align and clamp straight edge so that back edge will line up with front edge of bucket sheet as shown in View 2.
2. Measure up 10 inches on each side cutting edge from bottom cutting edge and scribe lines A as shown in View 1.
3. Guide cutting torch through scribe lines A and down rear edge of side cutting edges to bottom cutting edge as shown in View 1; then continue cutting along back edge of straight edge as shown in View 2. Remove and discard cut-out section from bucket. Grind all rough edges on bucket smooth.
4. Equally space three flat plates on bucket sheet and tack weld in three places as shown in View 3.
5. Position and align new cutting edge flush against bucket sheet and flat plates and secure in place with clamps as shown in View 3.
6. Alternately tack weld cutting edge to bucket sheet on top and bottom.
7. Remove flat plates and continuously weld cutting edge to bucket sheet on both top and bottom sides as shown in Views 3 and 4.
8. Clamp side cutting edges flush against bucket sheet and bottom cutting edge and weld securely.
9. Grind all welds inside bucket to present a smooth surface for entry of material; grind the residue of the tack welds from bucket sheet.

   Note: *Use a 5/16 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.

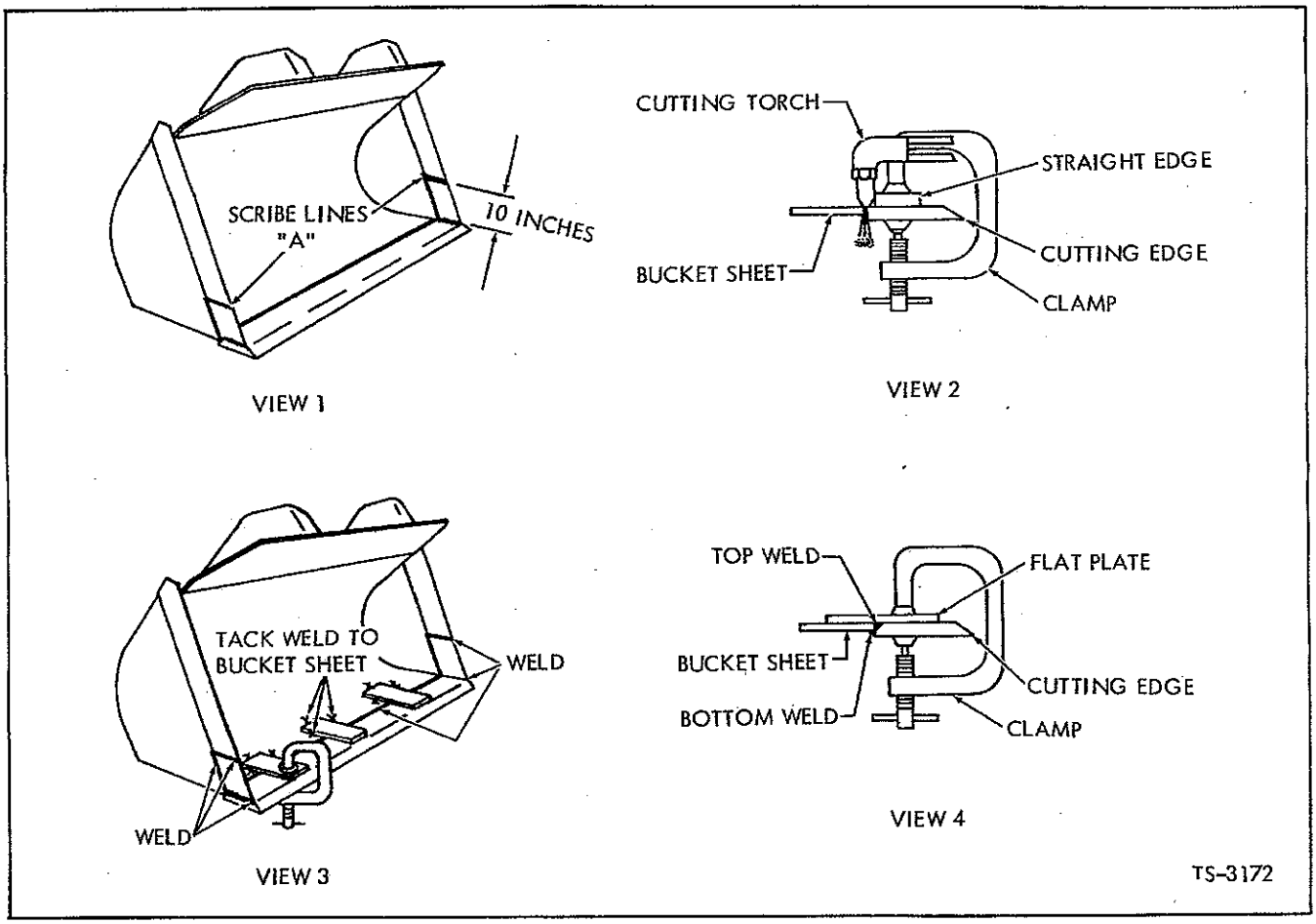


Fig. 48. Repair Bucket Cutting Edge

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

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

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

When testing generator for charging rate use accurate test meters.

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

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

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

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

The overcenter or pitman shaft adjustment, however, should be periodically checked and adjusted to remove lash between pitman shaft gear and the worm gear ball nut. Adjustment is indicated by too much free play at steering wheel

before wheels respond to turning action. Adjustment is as follows with engine shut off.

1. Disconnect steering drag link from pitman arm.

2. Turn steering wheel gently from one stop all the way to the other stop, carefully counting the total number of turns. Then turn wheel back exactly half way to center position. Mark wheel at top or bottom center with piece of tape.

3. Measure the pull at the rim of the steering wheel required to keep the wheel in motion. Take the highest reading of the spring scale as the wheel is pulled through the center position. This pull can be measured by attaching a spring scale to the rim of the wheel with a piece of cord, then pulling on the spring scale to turn the wheel. The line of the scale should be kept tangent to the rim of the wheel.

   The proper pull at the wheel rim under these conditions should be 1⅛ to 2 lbs.

4. Loosen locknut and turn adjusting screw clockwise to increase pull at wheel, counterclockwise to decrease the pull. See Figure 49. 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.

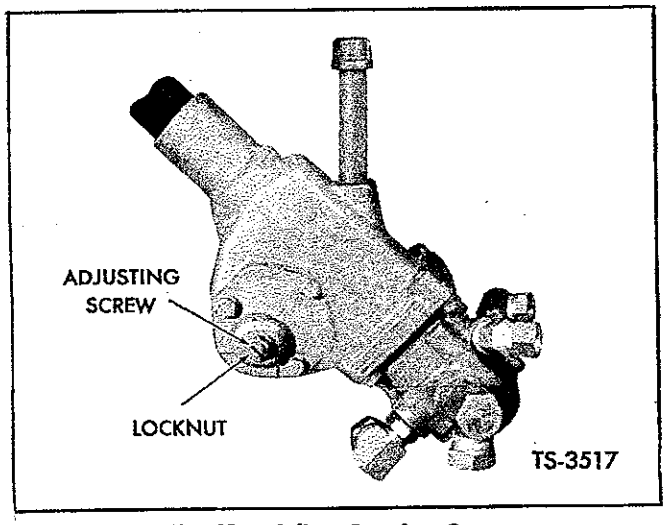


Fig. 49. Adjust Steering Gear

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 or the transmission. If the noise stops, trouble may be in the rear axle or the steering components. 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 with hydraulic controls (speed range and directional shift levers) in neutral. Engage control levers one at a time to apply the clutches and connect them to the gear train.

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

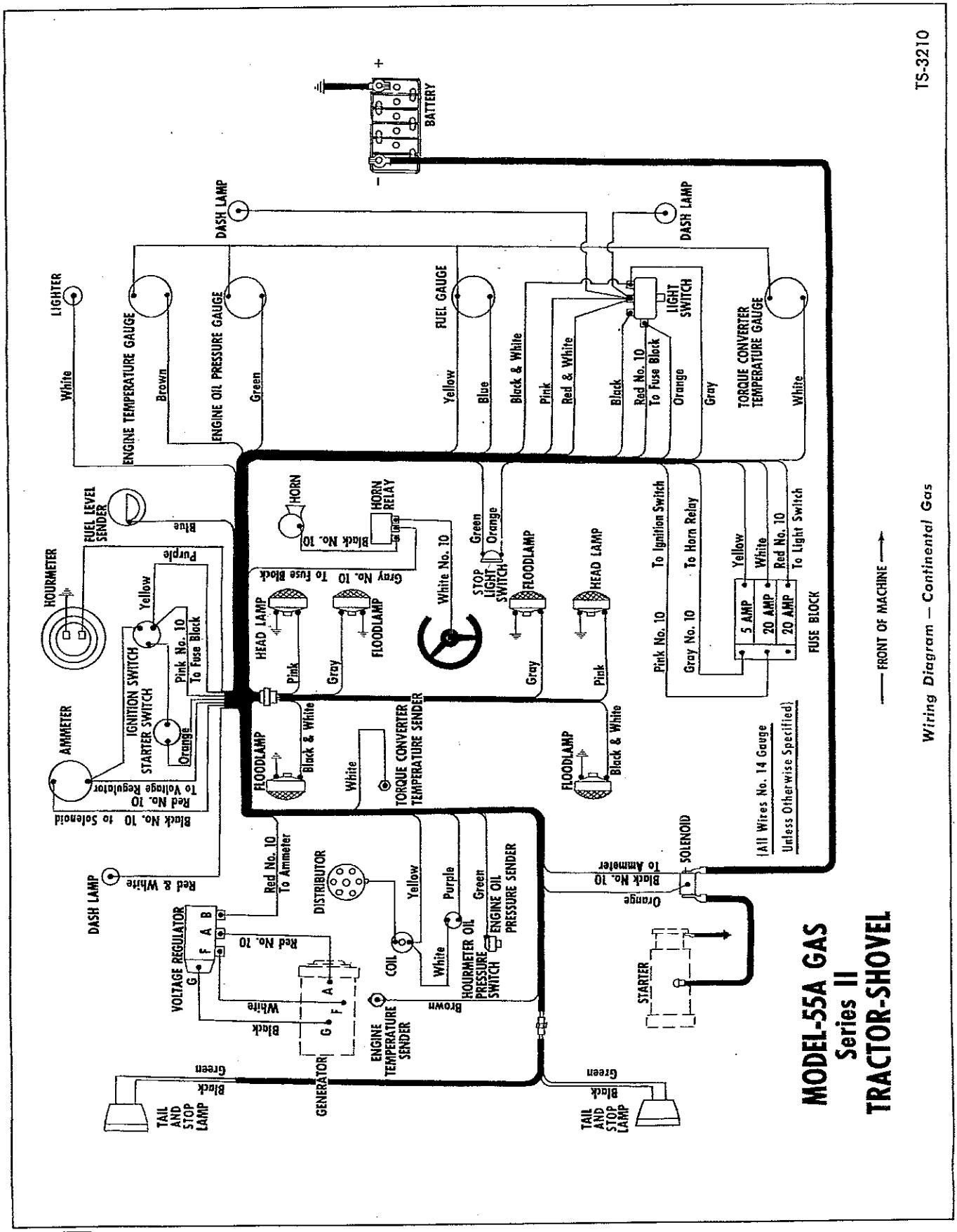
Inspect Frame: The frame is the basic backbone of the entire machine that provides structural support directly or indirectly for completely mounting all assemblies, sub-assemblies and individual components necessary for machine construction and operation.

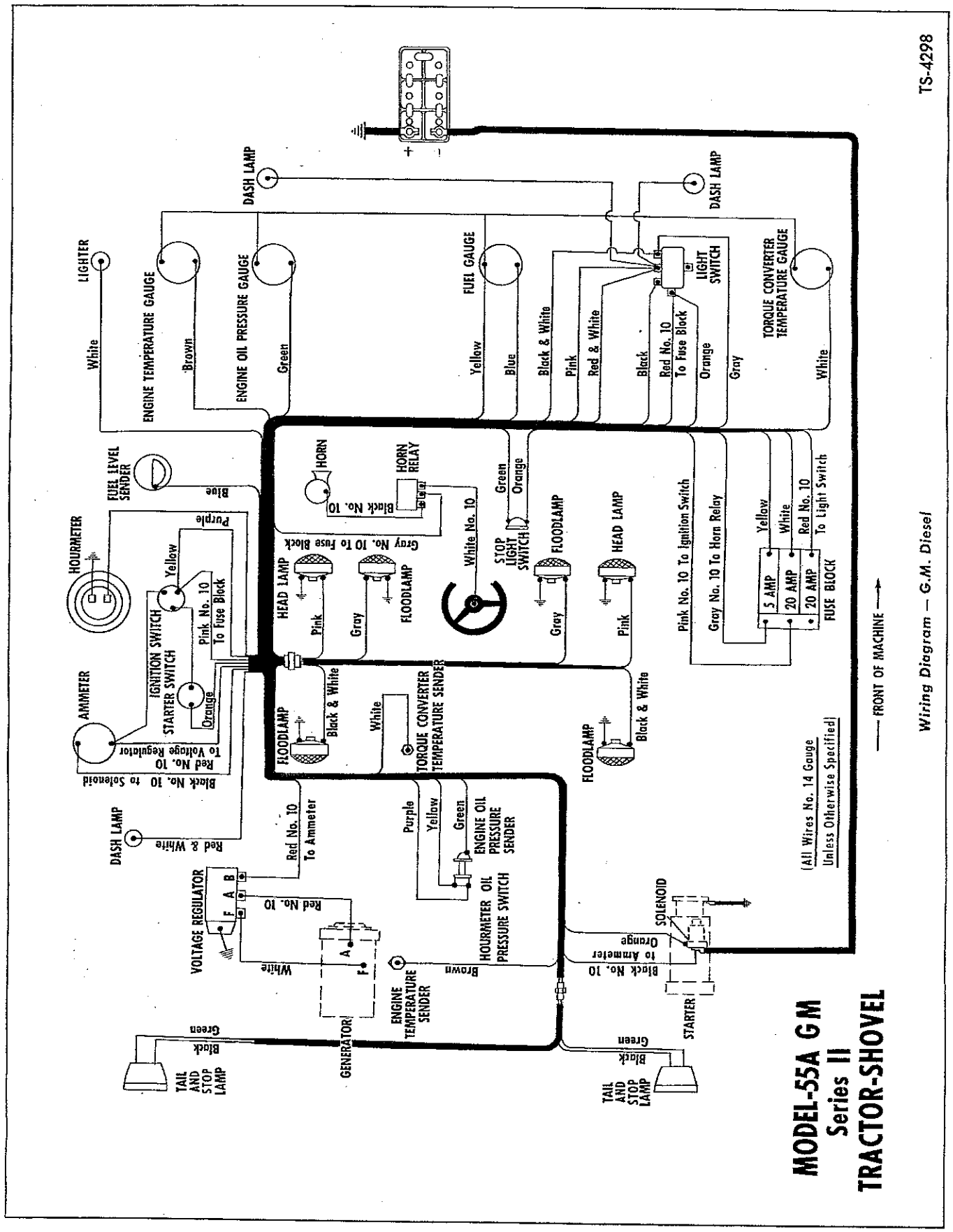
The frame structure and all supporting assemblies such as cradle, guide bar, boom and

bucket, carrier, upper and lower pivot tubes, crossmembers, reinforcing gussets and brackets should be periodically inspected for cracks, bends, broken welds, warping or any other signs of damage that would endanger proper operation.

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

NOTES


TS-3210
BATTERY
+
-
DASH LAMP
DASH LAMP
LIGHTER
White
ENGINE TEMPERATURE GAUGE
Brown
ENGINE OIL PRESSURE GAUGE
Green
FUEL GAUGE
Yellow
Blue
Black & White
Pink
Red & White
Black
LIGHT SWITCH
Red No. 10
To Fuse Block
Orange
Gray
TORQUE CONVERTER TEMPERATURE GAUGE
White
FUEL LEVEL SENDER
Blue
HOURMETER
Purple
Yellow
IGNITION SWITCH
STARTER SWITCH
Pink No. 10
To Fuse Block
AMMETER
Orange
Red No. 10
To Voltage Regulator
Black No. 10 to Solenoid
HORN
HORN RELAY
Black No. 10
Gray No. 10 To Fuse Block
White No. 10
Green
Orange
STOP LIGHT SWITCH
FLOODLAMP
HEAD LAMP
Pink
Gray
FLOODLAMP
HEAD LAMP
Gray
Pink
FLOODLAMP
Black & White
White
TORQUE CONVERTER TEMPERATURE SENDER
FLOODLAMP
Black & White
Pink No. 10
To Ignition Switch
Gray No. 10
To Horn Relay
Yellow
White
Red No. 10
To Light Switch
5 AMP
20 AMP
20 AMP
FUSE BLOCK
All Wires No. 14 Gauge
Unless Otherwise Specified
FRONT OF MACHINE
Wiring Diagram — Continental Gas
DASH LAMP
Red & White
Red No. 10
To Ammeter
DISTRIBUTOR
Yellow
Purple
Green
ENGINE OIL PRESSURE SENDER
SOLENOID
Black No. 10
To Ammeter
Orange
VOLTAGE REGULATOR
F A B
G
Red No. 10
COIL
White
HOURMETER PRESSURE SWITCH
Brown
STARTER
White
Black
ENGINE TEMPERATURE SENDER
GENERATOR
Green
Black
TAIL AND STOP LAMP
Green
Black
TAIL AND STOP LAMP
MODEL-55A GAS
Series II
TRACTOR-SHOVEL


TS-4298
DASH LAMP
DASH LAMP
LIGHTER
ENGINE TEMPERATURE GAUGE
ENGINE OIL PRESSURE GAUGE
FUEL GAUGE
LIGHT SWITCH
TORQUE CONVERTER TEMPERATURE GAUGE
White
Brown
Green
Yellow
Blue
Black & White
Pink
Red & White
Black
Red No. 10 To Fuse Block
Orange
Gray
White
FUEL LEVEL SENDER
Blue
HORN
HORN RELAY
Black No. 10
Green
Orange
Gray No. 10 To Fuse Block
White No. 10
STOP LIGHT SWITCH
FLOODLAMP
HEAD LAMP
Pink No. 10 To Ignition Switch
Gray No. 10 To Horn Relay
Yellow
White
Red No. 10
To Light Switch
5 AMP
20 AMP
20 AMP
FUSE BLOCK
HOURMETER
Purple
Yellow
Pink No. 10 To Fuse Block
IGNITION SWITCH
STARTER SWITCH
Orange
AMMETER
Red No. 10 To Voltage Regulator
Black No. 10 to Solenoid
HEAD LAMP
Pink
Gray
FLOODLAMP
FLOODLAMP
Gray
Pink
FLOODLAMP
Black & White
White
TORQUE CONVERTER TEMPERATURE SENDER
FLOODLAMP
Black & White
DASH LAMP
Red & White
Red No. 10 To Ammeter
Purple
Yellow
Green
ENGINE OIL PRESSURE SENDER
VOLTAGE REGULATOR
F A B
Red No. 10
White
A F
HOURMETER OIL PRESSURE SWITCH
Brown
ENGINE TEMPERATURE SENDER
GENERATOR
SOLENOID
Orange
to Ammeter
Black No. 10
STARTER
Green
Black
TAIL AND STOP LAMP
Green
Black
TAIL AND STOP LAMP
(All Wires No. 14 Gauge Unless Otherwise Specified)
— FRONT OF MACHINE —
Wiring Diagram — G.M. Diesel
MODEL-55A GM
Series II
TRACTOR-SHOVEL

TORQUE CHART
FT. — LBS.

Location	Thread	Grade	Torque
Axle Mounting Bolts	¾"—16	8	320
Converter Filter Center Bolt			50±5
Converter Housing Mounting	⅜"—16	8	23
Counterweight	¾"—16	8	320
Engine Support to Flywheel Housing	½"—13	8	33
Engine Support to Frame	½"—20	8	90
Engine Trunnion Mounting (G.M. only)	½"—20	8	90
Prop Shaft — Upper			25
Prop Shaft — Lower			55
Steering Filter Center Bolt			50±5
Transmission Bracket to Frame	½"—20	8	90
Transmission to Bracket	⅝"—18	8	185
*Wheel Nuts	⅝"—18		190

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

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

SPECIFICATIONS AND SERVICE DATA

ENGINE	Gasoline	Diesel
Make	Continental	G.M.
Model	F-244	3-53
Number of cylinders	6	3
Bore and stroke	3 7/16" x 4 3/8"	3 7/8" x 4 1/2"
Displacement, cu. inches	244	159.2
*Governed horsepower	75	77
Maximum torque, ft. lbs.	192 @ 1300	208 @ 1200
Low idle rpm	550 to 600	550 to 600
High idle rpm	2250 to 2350	2250 to 2350
**Stall rpm	1550 to 1650	1750 to 1850

*Rated at 60° F. and sea level.

**Stall rpm is maximum obtainable rpm with oil at operating temperature (180° F. to 200° F.) parking brake applied, wheels blocked, directional and speed range levers in FORWARD—4th (HI and TRAVEL RANGE) and bucket held against carrier stops in full close position.

Stall rpm is applicable to altitude of 600 ft. and ambient temperature of 70° F. Due to the many combinations of altitude and temperature possible in the field, space does not permit publishing here all the corrections necessary to the stall rpm indicated to accommodate such variations. It is suggested the engine manufacturers distributor be contacted to determine the correction necessary for altitude and temperature in your application.

ELECTRICAL SYSTEM

Fuses:
- Lighter ..... SFE—20 amp
- Gauge circuit ..... SFE— 5 amp
- Light circuit ..... SFE—20 amp

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

Lamps:
- Flood ..... 12 volt
- Dash ..... 12-16 volt, 4 C.P.
- Tail ..... 12 volt
- Head ..... 12 volt

Horn ..... 12 volt

Lighter ..... 12 volt
Generator ..... 12 volt
Voltage regulator ..... 12 volt
Starter motor ..... 12 volt

BATTERIES

Make and Part No.:
- Continental Gas ..... Exide 5SH
- G.M. Diesel ..... Exide 4D-1133H

Number ..... 1-12 volt
Electrical system ..... 12 volt
Grounded terminal ..... Positive
Specific gravity 1.230-1.260
(Not over 0.050 variance between adjacent cells)

HYDRAULIC SYSTEM PRESSURES

	Machine Serial Numbers
Boom and Bucket (Main Hydraulic)	
1800 psi at converter stall rpm, pump holding one set of cylinders against stops.	All machine serial numbers.
Steering Pressure Relief Valve	
1000 psi at maximum engine rpm, steer wheels turned against stops.	All machine serial numbers.
Pressure Regulator Valve	
160 to 200 psi at idle rpm (550 to 600 rpm), oil at operating temperature (180° F. to 200° F.). Check to be made in all speed ranges both forward and reverse direction.	Machines having converters carrying serial numbers prior to 93369B, and machines having converters carrying serial numbers 120675C and thereafter.
240 to 270 psi at idle rpm (550 to 600 rpm), oil at operating temperature (180° F. to 200° F.). Check to be made in all speed ranges both forward and reverse direction.	Machines having converters carrying serial numbers 93369B thru 113877B and 1C thru 120674C.

Materials and Specifications Subject to Change Without Notice or Obligation

LUBRICATION SPECS

Hydraulic Oil (HO)

Viscosity Index	90-100
SSU Viscosity at 100° F.	190-210
Pour Point	–25° F.
Flash Point (Min.)	310° F.

(Hydraulic oil must contain rust and oxidation inhibitors and must not foam in service.)

Chassis Grease (LBG)
Lithium Soap Multi-Purpose Grease

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

Drive Axle Gear Lube (EPGL)
SAE-90 Extreme Pressure Gear Lube (SCL Type)
"SCL" Signifies Sulfo-Chloro-Lead Type (Factory Fill)

Steering Gear Lube (GL)
SAE-90 Straight Mineral Oil

Transmission Fluid (TA)
Type "A" Automatic Transmission Fluid

Brake Fluid (BF)
Wagner 21B Heavy Duty

FUEL SPECS

Fuel Oil	No. 2 Cetane 40 min.
Gasoline	75 Octane rating or higher

CAPACITIES

(Approximate Quantities)

	U.S. MEASURE	METRIC MEASURE LITERS	IMPERIAL MEASURE
Engine Crankcase:			
Continental Gas	5½ qt.	5.2	4.6 qt.
G.M. Diesel	13½ qt.	12.8	11.2 qt.
Cooling System:			
Continental Gas	4½ gal.	17.0	3.8 gal.
G.M. Diesel	4½ gal.	17.0	3.8 gal.
Front drive axle differential	7 qt.	6.6	5.8 qt.
Front drive axle planetary hubs (each)	3 qt.	2.8	2.5 qt.
Rear drive steer axle planetary hubs (each)	3 qt.	2.8	2.5 qt.
Rear drive steer axle differential	7 qt.	6.6	5.8 qt.
Torque converter and transmission	5 gal.	19.0	4.2 gal.
Hydraulic system	20 gal.	75.7	16.7 gal.
Fuel tank	30 gal.	113.6	25.0 gal.
Air cleaner (Continental Gas only)	1 qt.	0.9	0.8 qt.

TIRE OPTIONS

SIZE	PLY RATING	INFLATION PSI FRONT	INFLATION PSI REAR	TYPE
13.00-24	8	30	30	Traction
15.5 -25	12	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
15.5 -25	133	38	44	450

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

Materials and Specifications Subject to Change Without Notice or Obligation