

HC-238A/238B Series – Master Keysheet
(22 Prefix On Crane Serial Number)**AREA 00 GENERAL INFORMATION**

SM00-000-000.00 Service Manual General Usage & Instructions

AREA 01 RUBBER TIRE LOWER

SM01-001-002.00 Carrier – General
SM01-002-003.00 Front Axle & Wheel Alignment
SM01-003-001.00 Front Brake Actuator
SM01-003-004.00 Front Brakes (Early)
SM01-005-001.00 Steering Gear
SM01-006-001.00 Power Steer System
SM01-007-001.00 Power Steer Cylinder
SM01-007-002.00 Power Steer Cylinder
SM01-010-001.00 Power Steer Pump
SM01-017-002.00 Carrier Clutch
SM01-018-002.00 Transmission Controls
SM01-025-003.00 Rear Axle & Brakes
SM01-025-004.00 Rear Brake Actuator
SM01-027-001.00 Air Brakes Troubleshooting
SM01-027-003.00 Air Brakes – General
SM01-027-026.00 Caging Dual Air Brake Chambers
SM01-027-040.00 Air System Schematic (Air Operated Throttle Control)
SM01-038-001.00 Hydraulic Outriggers
SM01-038-009.00 Remote Outrigger Throttle
SM01-038-014.00 Hydraulic Outriggers – General
SM01-038-015.00 Outrigger Wiring
SM01-038-016.00 Hydraulic Outrigger Control Valves
SM01-039-003.00 Hydraulic System Cleaning Procedure
SM01-040-002.00 Outrigger Pump
SM01-041-001.00 Power Takeoff
SM01-043-001.00 Solenoid Valves, General Recondition
SM01-044-003.00 Lock Valve, Recondition
SM01-045-002.00 Telescoping Tube Assembly
SM01-045-003.00 Outrigger Beam Cylinder
SM01-046-003.00 Outrigger Jacks
SM01-046-009.00 Front Bumper Jack Cylinder
SM01-061-001.00 Eaton Auxiliary Transmission, Recondition
SM01-063-001.00 Air Cleaner
SM01-066-000.00 Electrical System Wire Identification Code
SM01-066-014.00 Cummins Wiring
SM01-066-015.00 GM Wiring
SM01-067-007.00 Light Wiring
SM01-068-016.00 Cab Wiring
SM01-069-002.00 Wheels & Tires
SM01-082-001.00 Pin Removal Cylinder

AREA 03 UPPER REVOLVING FRAME

SM03-001-024.00 Undecking Machine
SM03-006-006.00 Swing Lock
SM03-010-004.00 Counterweight Remover System
SM03-010-005.00 Counterweight Remover Cylinder
SM03-010-006.00 Hydraulic Cylinder, Recondition (Counterweight Removal)

AREA 04 VERTICAL SHAFTS

SM04-003-004.00 Vertical Swing Shaft

AREA 05 HORIZONTAL SHAFTS

SM05-000-007.00 Horizontal Shafts – General
SM05-001-013.00 Reverse Shaft
SM05-002-009.00 Reduction Shaft
SM05-003-011.00 Front Or Rear Drum Shaft
SM05-005-005.00 Third Drum Shaft
SM05-007-001.00 Two Speed Planetary
SM05-007-002.00 Planetary Brake, R & I/Adjustment
SM05-008-014.00 Boom Hoist Shaft
SM05-008-017.00 Boom Hoist Pawl
SM05-009-002.00 Clutches – General
SM05-009-004.00 Clutch Assemblies
SM05-009-009.00 Rotating Joint, R & I And Recondition
SM05-012-007.00 Front & Rear Drum Brakes
SM05-012-008.00 Third Drum Brake (Mechanical)
SM05-012-009.00 Third Drum Brake (Hydraulic)
SM05-012-011.00 Boom Hoist Brake
SM05-012-053.00 Automatic Brake Adjustment (Front & Rear Drums)
SM05-014-002.00 Swing Brake

AREA 06 UPPER ENGINE

SM06-016-002.00 Twin Disc Clutch (2 Disc)
SM06-029-001.00 Storage Battery
SM06-039-006.00 Chain Case
SM06-046-001.00 Cummins Engine Wiring
SM06-046-002.00 GM Engine Wiring
SM06-047-000.00 Electrical System Wire Identification Code
SM06-048-001.00 Cab Wiring

AREA 07 HYDRAULIC POWER SUPPLY

SM07-000-005.00 S-o-M System – General
SM07-000-006.00 S-o-M Troubleshooting
SM07-001-001.00 Unloading Valve
SM07-001-002.00 Accumulator
SM07-001-004.00 External Check Valve
SM07-001-005.00 Relief Valve
SM07-001-008.00 S-o-M Filter
SM07-001-014.00 Relief Valve
SM07-003-006.00 Solenoid Valves, General Recondition
SM07-005-006.00 S-o-M Pump
SM07-009-002.00 Drum Rotation Indicator
SM07-012-011.00 Control Valves & Stand
SM07-018-001.00 Hydraulic System Tube Fittings

AREA 09 TUBULAR BOOM, FLY, & JIB

SM09-001-001.00 Boom Foot Pin Removal
SM09-001-002.00 Repairing Damaged Tubular Booms, Flys, & Jibs
SM09-002-001.00 Live Mast Cylinder
SM09-002-002.00 Live Mast Cylinder (Later)

AREA 18 SPECIAL ATTACHMENTS

SM18-000-001.00 Capscrew Torques
SM18-000-002.00 Bearing, Gear, Shaft, & Housing Inspection

How To Use This Manual, General Service Instructions, And Safety Procedures

The following information is provided to help guide the user of this manual. An explanation of how this manual is organized, as well as general information and safety considerations which should be understood when performing any service or maintenance procedure, is given. This information is general in nature and should supplement any of the specific procedures in this manual along with a constant awareness of safety and common sense.

How To Use This Manual

This Service Manual is a collection of written procedures which are used to service and maintain a specific crane model. The index, which is called a "Keysheet", is used to organize the procedures within this manual and serve as a Table Of Contents as well. Each procedure, in this manual, is written so that it can stand alone and typically covers only one procedure. Procedures are given a numerical designation, or "SM Code" Number, (Example: SM01—005—034.00) which is unique to that procedure and that procedure only. The following is a listing of the general area definitions which are designated by the first digits in the SM Code Number sequence:

General Area Descriptions

- SM01 — Rubber Tire Lower
- SM02 — Crawler Lower
- SM03 — Upper Revolving Frame & Machinery
- SM04 — Vertical Shafts
- SM05 — Horizontal Shafts
- SM06 — Upper Engine
- SM07 — Hydraulic Power Supply
- SM08 — Angle Boom
- SM09 — Tubular Boom
- SM10 — Tagline Winder
- SM11 — Fairleader
- SM12 — Shovel Attachment
- SM13 — Trench Hoe, Logger & Scraper Attachment & Prop Handler
- SM14 — Cab & House Assembly
- SM15 — Rotascope Attachment (Discontinued)
- SM16 — Wire Rope Requirements
- SM17 — Hydraulic Boom And Attachments
- SM18 — Special Attachments
- SM19 — Diesel Pile Hammer (Discontinued)
- SM20 — Tower, Climbing Assembly, Traveling Base & Gantry (Discontinued)
- SM21 — Log Skidder (Discontinued)
- SM22 — Hydraulic Hammer (Discontinued)

The procedures in this manual are collated by SM Code Number sequence. Use the Keysheet in the front of this manual, the general area descriptions shown previously, and the SM Code title shown on the

Keysheet to find the specific procedure required to service the crane.

Throughout this manual, reference is made to the left, right, front, and rear, pertaining to directions and locations. These reference directions are relative to the operator, sitting in the operator's seat, with the upper directly over the front of the carrier, unless otherwise stated. (Crawler mounted cranes: upper over the front of the crane with travel motors to the rear.)

Danger, warning, and caution captions as well as special notes are used throughout this manual and on the crane to emphasize important and critical instructions. **If any instruction, caution, warning, or danger labels, decals, or plates become lost, damaged, or unreadable, they must be replaced.** Information contained on such labels, decals, and plates is important and failure to follow the information they contain could result in an accident. Replacement labels, decals, and plates can be ordered through a Link-Belt Distributor. For the purpose of this manual, danger, warning, and caution captions and notes are defined as follows:



DANGER

An operating procedure, practice, etc. which, if not correctly followed, may result in severe personal injury, dismemberment, or loss of life.



WARNING

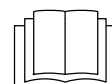
An operating procedure, practice, etc. which, if not correctly followed, may result in personal injury.

CAUTION

An operating procedure, practice, etc. which, if not correctly followed, may result in damage to, or destruction of, equipment or property.

NOTES

Note: An operating procedure step, condition, etc. which is essential in order for the process to be completed properly.



This symbol may appear in manuals or on a label on the crane to alert personnel that additional instructions are included in the crane Operator's Manual.



Figure 1
Keep hands and tools clear of moving parts.

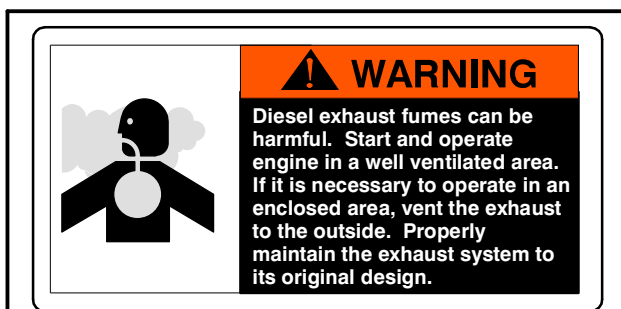
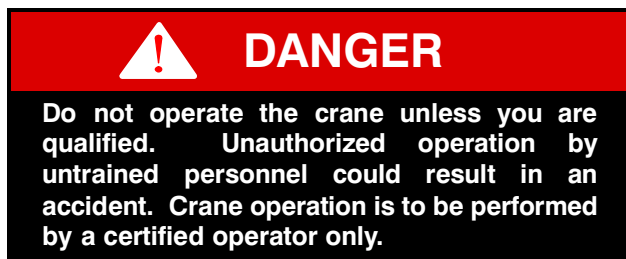


Figure 2
Diesel Exhaust Fumes.

Service Safety And Set Up Guidelines

The following is a list of safety and set up considerations which may apply to any service or maintenance procedure. Review the entire list and understand the type of things you must consider to perform a safe service procedure and then apply these guidelines to each specific service or maintenance procedure.



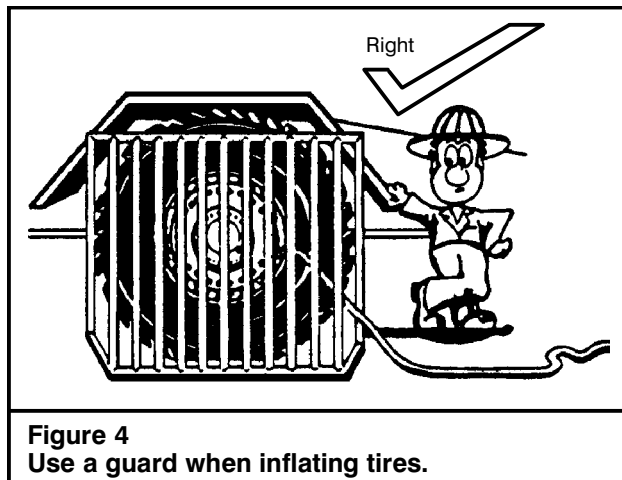
Service Safety

1. Read and understand the service or maintenance procedure to be performed before beginning work. By reading the procedure ahead of time, you can be sure to have the replacement parts and tools on hand that are required to complete the job.
2. Wear protective gear to prevent injury; hard hat, safety glasses, gloves, steel toed shoes, etc.



Figure 3
Pinch Point Label

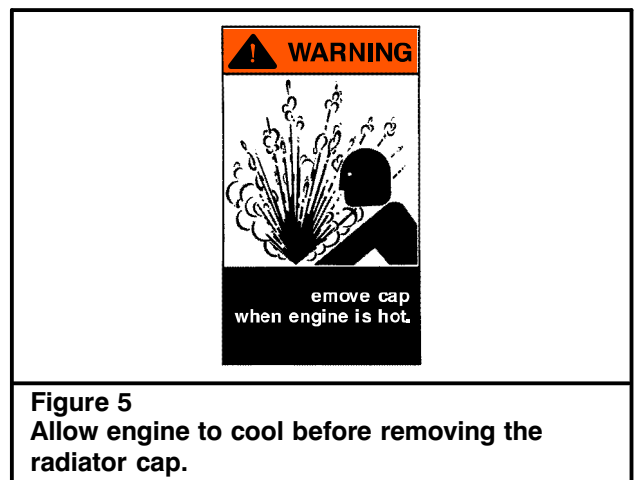
3. First aid supplies and a fire extinguisher should be on the job site to assist in an unexpected situation. The location of these items should be known to all as well as access to a telephone for emergencies.
4. Work in a clean, dry, firm, level area whenever possible. Choosing the correct work site can make a big difference on how well the job goes.
5. Use caution around flammable materials. Be aware of all the materials in the work area which are a threat. Also make others aware of volatile materials; post signs if necessary.
6. Release all trapped pressure in air and hydraulic circuits before disconnecting any line or component. Shutdown the crane, exhaust all pressure from the crane's air reservoir(s) and work the hydraulic control levers back and forth before servicing the crane.
7. Do not disconnect any hydraulic line from a crane which has its attachment in the air. Trapped pressure may be all that is suspending it. Disconnecting a line could release the trapped pressure, causing the attachment to fall. Lower the attachment to the ground or on to its rest before servicing the crane.
8. Do not work on a crane which is in motion. Fans, belts, gear trains, etc. can catch an unexpected person and quickly dismember them.
9. Do not climb on the attachment or other hard to reach areas. If the steps and/or ladders which are installed on the crane do not provide adequate access to the area of the crane which needs servicing, use a step ladder or other approved device.
10. Pinch points exist between the upper and lower frames. Death or dismemberment may result from personnel caught in these points. Learn where these pinch points are and stay clear of the rotating upper frame.



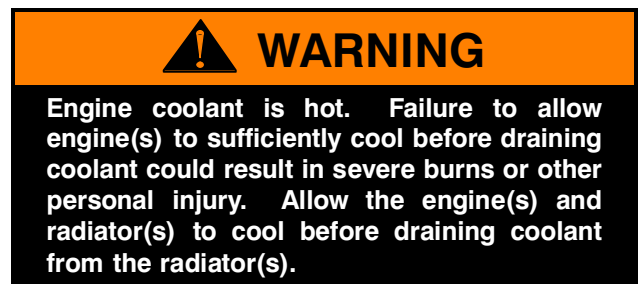
11. If working in a confined area, be sure to provide adequate ventilation when running the engine(s), using toxic solvents, welding, or any other operation which contaminates the fresh air supply.
12. Post a sign in the operator's cab to alert others that the crane is under service. Starting the crane while it is being serviced could severely injure someone. Crane damage could also occur if systems are operated prematurely. Imagine starting the engine(s) before the oil is replaced.
13. Secure access panels, doors, and machinery hoods when in the open position to ensure they do not fall or slam shut due to wind or accidental disruption.
14. Crane parts may be heavy. Always use an appropriate lifting device to support work. Do not attempt to lift an object without knowing its weight. Get help if necessary.
15. Always use a safety rim cage when inflating or deflating tires. Worn or misassembled parts can "explode" from the assembly causing serious injury. Use a safety rim cage, clip on air chuck, and stand aside when inflating or deflating tires.

Crane Set Up And Disassembly

1. Properly park the crane as described in the Operator's Manual. Park the crane in an area which provides the most comfortable working conditions. However, do not park the crane where it will be an obstruction or an intrusion to traffic, coworkers, or to the public. Keep in mind that a major service procedure, or a repair part which requires a long lead time, could have the crane disabled for an extended period of time.
2. Keep in mind the mess which is sometimes caused by a crane under repair. Oil or other fluid leaks should be contained or prevented. Consider your responsibility of maintaining a safe clean work area and a healthy environment for all.



3. If the crane is equipped with outriggers, it may be safer as well as an advantage to raise and level the crane on outriggers to provide easier access to areas underneath. Do not work under a crane that is improperly supported.
4. Shutdown the engine(s) per the instructions given in the Operator's Manual.
5. Post a sign in the operator's cab to alert others that the crane is being serviced.
6. Engines, transmissions, hydraulic systems, etc. generate extreme heat during operation. Temperatures can reach levels which may cause serious burns. Allow the crane to cool before attempting to service it.



7. Pressure is generated inside the engine's cooling system due to the heat transfer process from the engine(s) to the radiator(s). Do not attempt to open or drain the radiator(s) until it/they has/have had sufficient time to cool. Disconnecting hoses before the engine(s) and radiator(s) has/have cooled is even more dangerous. Wait until the engine(s) and radiator(s) have cooled and then drain the radiator(s) before disconnecting any hoses. Properly store or dispose of used coolant.

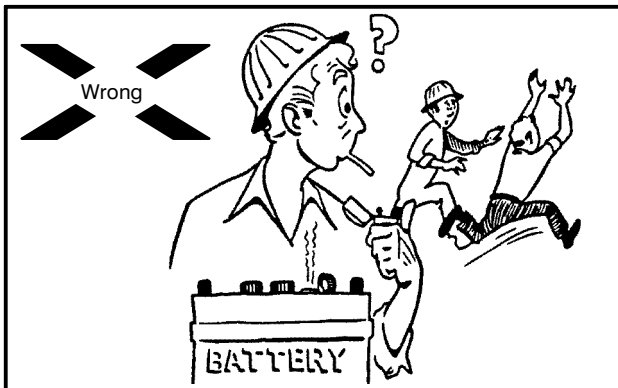


Figure 6
Do not use an open flame near the battery.

WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

8. Thoroughly clean the area of the crane which is to be serviced. Dirt or other contamination could enter the hydraulic, air, lubricating system, etc. and cause immediate and/or long term problems. Cleaning the service area not only prevents contamination problems but it also makes working on the crane easier and sometimes problems are more recognizable.
9. Before beginning any removal or disassembly procedure, take a moment to observe critical features of the assembly which may greatly simplify the installation or assembly process. Label electrical, hydraulic, air, or other connections. Index mark pump, motor, and valve sections. Lightly spray paint or count the threads of adjustment screws. Simple steps such as these can minimize the effort needed to put the crane back in service.

WARNING

Hydraulic oil is under pressure and may be hot. A sudden release of hot oil could cause severe burns and/or other serious injury. Shutdown the engine(s) and exhaust all trapped hydraulic pressure from the system before removing any line or component.

10. Hydraulic systems, while operating, are under high pressure. Even after the crane is shutdown these pressures can remain trapped in the hydraulic lines and system components. Some hydraulic systems utilize an air pressurized reservoir which maintains pressure on the system after the crane is shutdown. It is critical that all residual pressure, which is trapped in the system, be neutralized before disconnecting any line or hydraulic component. Use the following techniques to exhaust trapped hydraulic pressure from the system:

- a. Lower the attachment to the boom rest, onto blocking, or onto the ground and shutdown the engine(s).
- b. Open the drain valves on the air system reservoir(s), if equipped, to bleed the air system pressure.
- c. Relieve any residual or precharge pressure by pushing the button on the pressure relief valve, on the hydraulic reservoir, if equipped. Otherwise, loosen the filler cap 1/4 turn.
- d. Turn the ignition switch to the **ON POSITION**, but **DO NOT START THE ENGINE**.
- e. Operate the steering control(s) back and forth repeatedly until steering becomes hard. (On cranes equipped with emergency steering system, it will take several rotations of steering wheel before steering becomes hard.)
- f. Work the crane control levers and outrigger switches, if equipped, back and forth several times.
- g. Turn ignition switch to the **OFF POSITION**.
- h. When pressure is fully relieved, close the drain valves on the air system reservoir(s), if equipped.

WARNING

Air lines may contain high pressure. Opening lines and fittings before relieving air pressure may result in serious injury. Shutdown the engine(s) and drain the air system reservoir(s) before opening any line or fitting.

11. Air system circuits, like hydraulic circuits, contain high pressures also. Although the threat of a hot working fluid does not exist, highly pressurized lines and components can possibly "fly off" if lines are disconnected before the system pressure is relieved. Open the drain valve on the air system reservoir(s) to exhaust system pressure before working on the crane.



WARNING

Use care not to cause sparks at the battery terminals while disconnecting or connecting the battery. Battery gasses are volatile and could be ignited by a spark or flame causing the battery to explode. Keep the area around the battery well ventilated and disconnect the negative side of the battery first, with the ignition switch “OFF”, to minimize hazard.

Battery posts, terminals, and related accessories contain lead and lead compounds. Eating or smoking with lead residue on hands may cause lead poisoning. Wash hands after handling lead products.

12. When working on electrical circuits, disconnect the battery to minimize shock, burn, spark, or other hazard. When disconnecting the battery, confirm that the ignition switch is in the “OFF” position. Disconnect the negative side of the battery first to minimize the potential for sparks at the battery. Battery gases which are exposed to such sparks, could cause an explosion. Likewise when connecting the battery, confirm that the ignition switch is in the “OFF” position and install the positive cable(s), first and the negative connection(s) last.
13. It is a good practice when disassembling hydraulic components to lay the parts out in the order that they were disassembled. Keeping the parts in this order during disassembly, cleaning, and inspection will aid in the assembly process.

Welding

1. When making repairs which require welding, disconnect any electronic equipment (such as rated capacity limiters and engine computers) to prevent damage to them. Use the battery disconnect switch(es), if equipped.
2. Be aware of systems adjacent to areas being welded. Residual heat from the welding process could cause damage to other components. Heat may also vaporize materials which may become toxic or volatile.
3. Remove paint from areas to be welded to prevent toxic fumes.
4. The grounding connection should be within 3 feet (1 m) of the welded parts.
5. Connect the ground to the lower, if welding on the lower, or to the upper if welding on the upper. Electrical current through the turntable bearing could cause an arc which could damage it.

6. Do not position the ground connection where seals or bearing, as in transmissions or valves, will be between it and the welded parts.
7. Remove any flammable materials from the area.
8. Use the appropriate setting on the welder for the size of the welding operation. Do not use more than 200 Volts continuously.

Cleaning And Inspection



WARNING

Solvents and cleaning solutions can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all the manufacturer's recommendations concerning solvents and cleaning solutions.

1. All components should be thoroughly cleaned with an approved cleaning solvent, air dried and carefully inspected for damage, wear and corrosion.
2. All Loctite® or other sealant residue should be removed from threads of hardware and parts that are going to be reused.
3. All “soft parts”, such as seals, gaskets, back up rings, and o-rings, should be replaced.
4. Replacement of bearings and bushings is generally a good preventive maintenance measure. Even though a bearing or bushing seems to be intact and is functioning properly, its life span is limited. Replacing a simple bearing or bushing while the opportunity is at hand could save a complete component failure later.
5. In the event of severe defects, contact factory personnel for directions whether to repair or replace any major component.

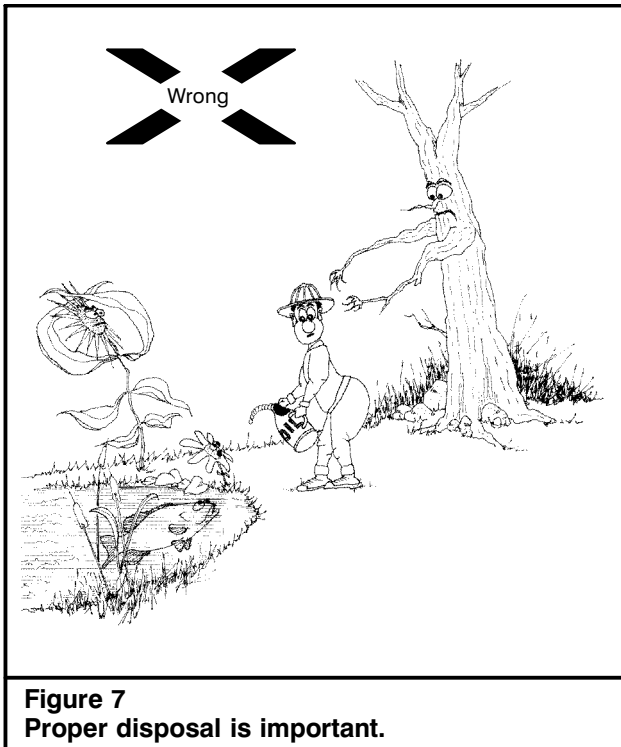
Crane Assembly

1. Loosely assemble parts to ensure all parts are in place and fasteners started before beginning torquing procedure. Always use a cross torquing sequence to ensure even and uniform installation.



WARNING

Lubricants, sealants, joint and thread locking compounds, etc. can be hazardous. Serious personal injury may result from misuse of these products. Read and follow all manufacturer's recommendations concerning these products.



2. Unless otherwise stated, torque all fasteners per the instructions given in SM Code Area 18—000.
3. When installing hydraulic hoses, lines, and fittings, use two wrenches to ensure the hoses and lines are not twisted. One wrench must be on the male fitting, the other wrench on the female fitting.
4. Unless otherwise stated, torque all hydraulic fittings per the instructions given in SM Code Area 07—018.
5. Check all fluid levels before returning the crane to service; hydraulic reservoir oil level, transmission fluid level, engine(s) oil level, etc. Add oil as required. See Operator's Manual and/or engine(s) manufacturer's manual(s) for correct type of fluids and procedures.
6. Always replace guards, grilles, and other types of protective shields. Also, be sure that any systems which were disconnected such as load indicating systems, anti-two block devices, control cables, etc. are functioning properly before returning the crane to service.
7. Start the appropriate engine and let it idle for five minutes. Inspect the connections on the hydraulic, air, transmission, etc. lines for leaks. Repair if needed.
8. Check that all hydraulic, air, and electrical functions are operating normally before returning the crane to service.
9. After crane is assembled, refer to the Operator's Manual for any periodic type of adjustments which may have been affected by the service procedure.
10. Properly dispose of any used oils, solvents, cleaners, etc.

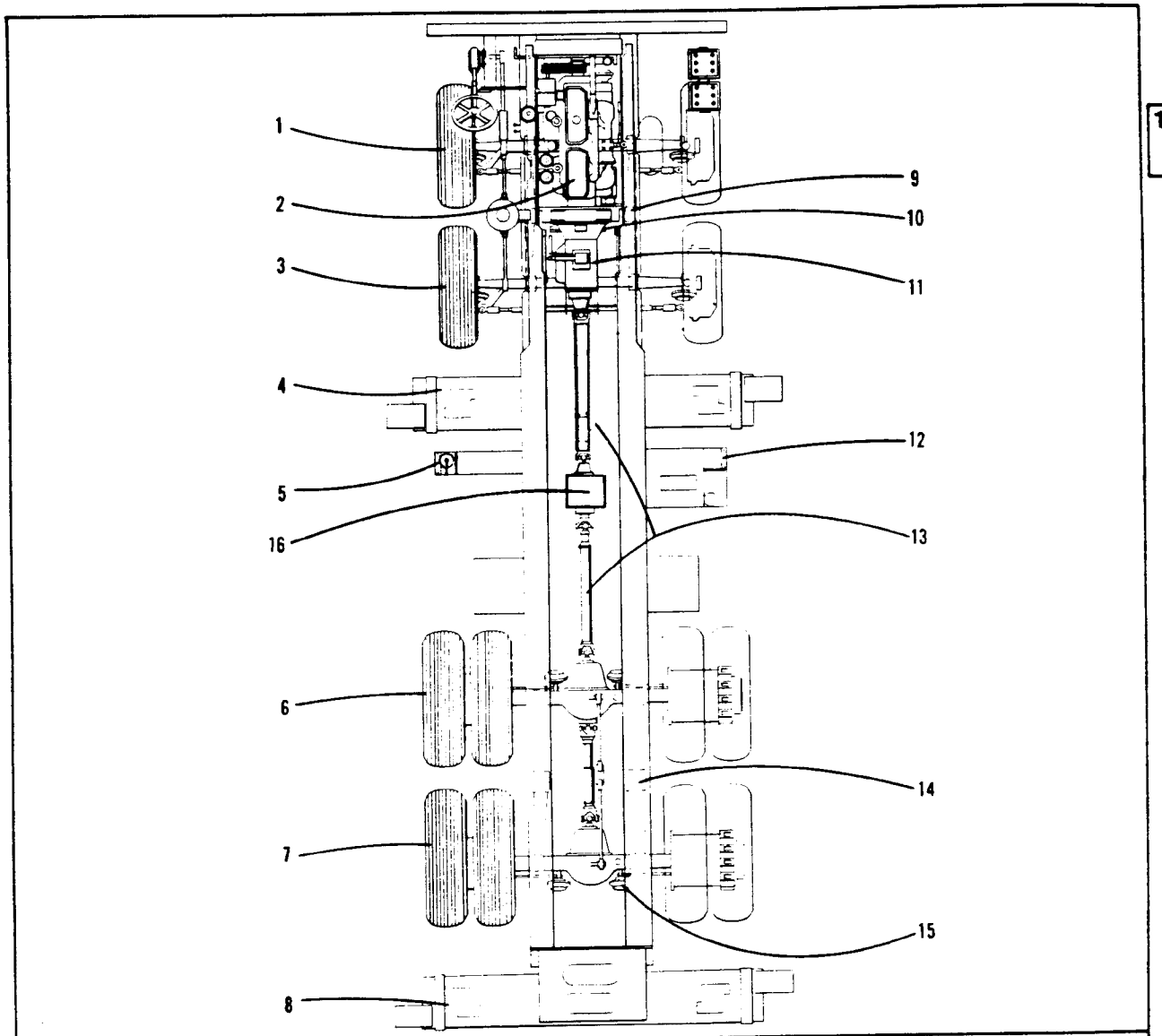


Fig. 1
Truck Carrier (218 Shown)

- | | | |
|---------------------------------|------------------------|----------------------------------|
| (1) Forward, Front Axle | (7) Rear Rear Axle | (12) Outrigger Control (138-238) |
| (2) Engine | (8) Rear Outrigger | (13) Drive Tubes |
| (3) Rear Front Axle | (9) Front Bogie Beams | (14) Rear Bogie Beams |
| (4) Front Outriggers | (10) Clutch Location | (15) Air Brake Chambers |
| (5) Outrigger Control (138-238) | (11) Main Transmission | (16) Creeper Transmission |
| (6) Forward Rear Axle | | |

HC138-258 Carrier

The carrier was designed and built by FMC Corporation. The 138-218 carriers are 8 x 4 drive. The 238 carrier is available in either 8 x 4 or 10 x 6 drive. The 258 carrier is available in 12 x 6 drive only.

In all cases, engine power is transferred through a 15 speed main transmission, to a two speed creeper transmission, and then to the rear axles.

Although the carrier uses a number of components not manufactured by the company, these "vendors" items have been specified and approved by our engineering department. Lubrication and maintenance instructions for vendor's items are published through cooperation with the vendor manufacturer and our engineering department.

Engine: We do not attempt to print lubrication and maintenance instructions on the various engines used in our equipment. Any information required on this subject may be obtained from the manufacturers manuals shipped with each machine. If additional information is required, contact the engine manufacturer or his nearest distributor. Service on the engine should be directed to the engine distributor in your area.

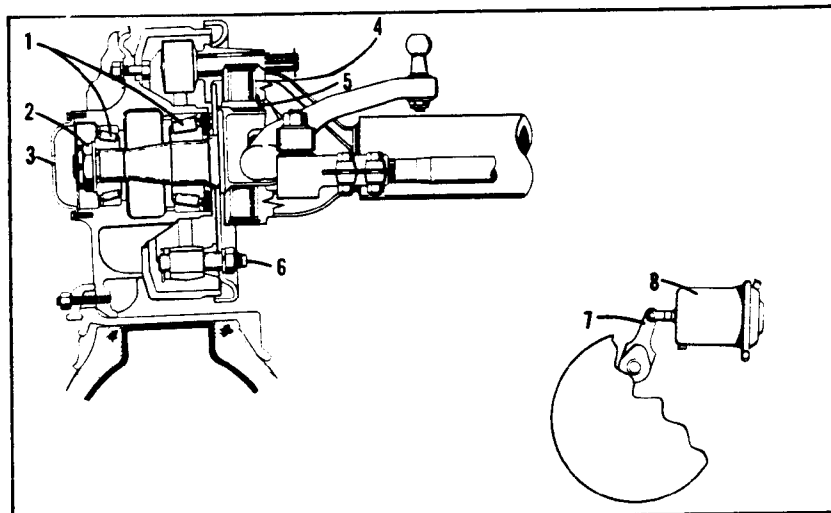


Fig. 1
Front Axle Assembly (Tube Type Axle)

(1) Bearings	(5) Thrust Washer
(2) Adjusting Nut	(6) Anchor Pin
(3) Hub Cap	(7) Slack Adjuster
(4) Bushing	(8) Brake Chamber

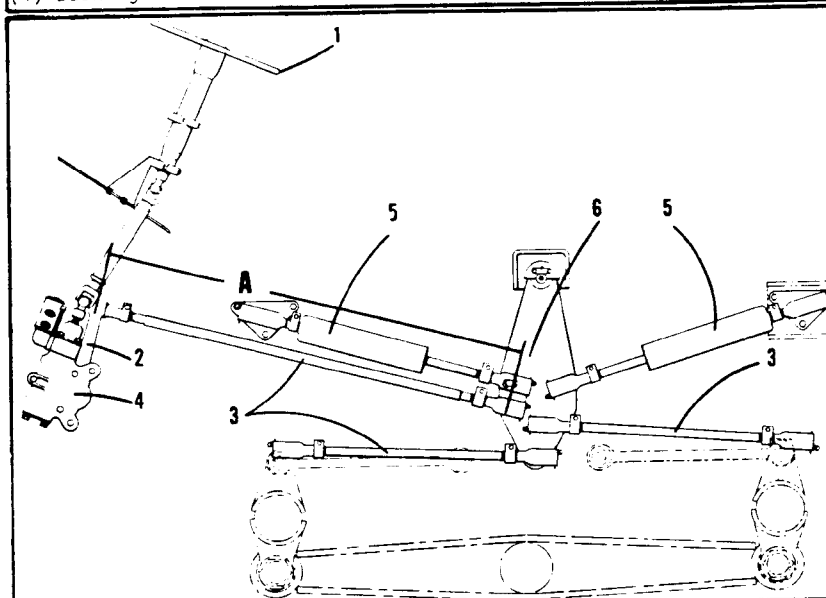


Fig. 2
Steering Mechanism (Double Axle Carrier)

A 138 52-1/2 Inches	(3) Drag Links
218-238 52 Inches	(4) Steering Gear
(1) Steering Wheel	(5) Steer Cylinders
(2) Pitman Arm	(6) Idler Arm

Front Axle Assembly

The front axles are mounted to the carrier frame on equalizer beams, one set on each side of the carrier. The equalizer beams serve

two purposes: (1) They reduce bumps and road irregularities. (2) They distribute the loadings between the front axles.

The front axles are also supported

by torque rods, two per axle. As the name implies, the torque rods absorb any torque caused by the tendency of the axles to turn forwards or backwards on their neutral axis due to starting or stopping inertia.

Front Wheel Alignment: To obtain maximum tire life, tire alignment must be checked periodically. This is more critical on a tandem axle arrangement than on a single front axle. The front axles must be aligned with respect to each other, or excessive tire wear will result. The following procedure outlines the steps necessary for checking front wheel alignment.

(a) Jack the carrier up so front wheels clear the ground.
(b) Turn steering wheel until the left tires are in line with each other and are straight ahead with respect to the carrier. Figs. 4 & 5 illustrate one method of checking step (b). This involves placing a straight edge parallel to the carrier by measuring a distance (A) at each end of the straight edge. Once the proper position of the straight edge is determined, measure the distance between the straight edge and the milled surface of the wheel hub used to locate the tire lugs. These dimensions are represented by the letters (B) & (C) in Fig. 4, and the letters (B), (C), and (D) in Fig. 5. Distances (B) must equal (B), and (C) must equal (C), but (B) doesn't necessarily have to equal (C). A drag link adjustment may be necessary to correct any misalignment.

(c) Once the front left tires are lined up, check for proper toe in. Toe in can be checked by scribing a line around the circumference of the tire tread at the centerline of the tire tread. The difference between the distances (D) on the front and (E) on the back. (E and F in Fig. 5) indicate the amount of "toe in" and should equal $1/8" + 1/32"$. A tie rod adjustment will correct any toe in variations.

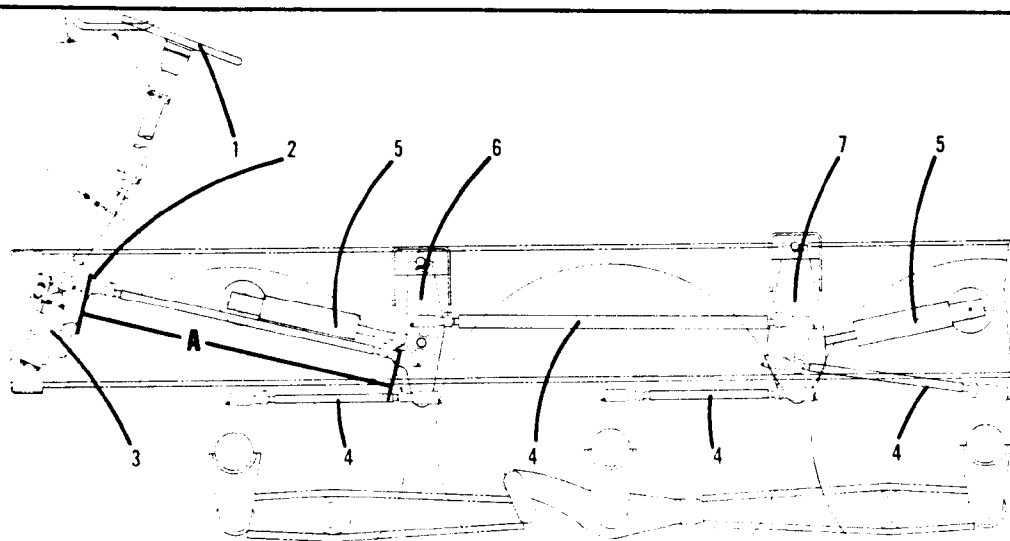


Fig. 3
Steering Mechanism (Three Axle Carrier)

A 238-258 49-3/4"

(1) Steering Wheel

(2) Pitman Arm

(3) Steering Gear

(4) Drag Lines

(5) Steer Cylinder

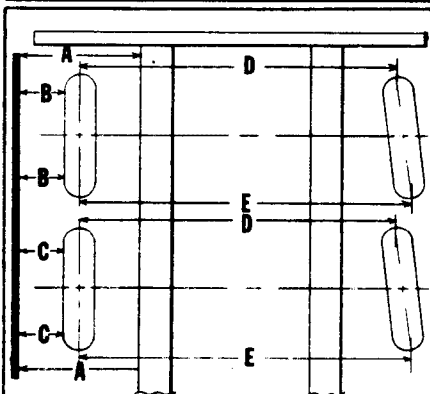


Fig. 4
Front Wheel Alignment
(Two Axle Carrier)

(d) Check the stroke of the power steering cylinders and make sure they are centered when the left wheels are straight ahead as established in step (b). A ball socket adjustment on one or both ends of the cylinder may be required.

(e) To establish a position of the steering wheel when the wheels are straight ahead, mark the steering wheel with relation to some reference point.

(f) Now count the revolutions of the steering wheel from extreme left to extreme right. Center the steering wheel. Note the position of the mark made in step (e).

It should be within one revolution of its established mark. If not, return the steering wheel to its reference point. (This again aligns the front wheels straight ahead). Remove the pitman arm from the steering gear, center the steering wheel, and reinstall the pitman arm to the steering gear.

Wheel Bearing Adjustment: The wheel bearing adjustment must be checked periodically. The carrier should never be operated with the bearings improperly adjusted. Bearing failure can result. The bearings are adjusted as follows:

- Jack up one end of the axle until the wheel clears the ground.
- Remove the hub cap.
- Remove cotter pin.
- Tighten the adjusting nut, and at the same time rotate the wheel in both directions

until there is a slight bind, thus being sure all bearing surfaces are in contact.

(e) Then back off the adjusting nut 1/6 to 1/4 of a turn, or to the nearest locking hole, or sufficiently to allow the wheel to rotate freely within limits of .001" to .010" end play.

(f) Replace cotter pin. Spread the ends of the pin to retain it.

(g) Replace the hub caps, being sure that the wheel bearings are packed with sufficient grease, and the hub cap is packed with enough grease to prevent moisture condensation.

Wheel Bearing Repacking: At the interval specified in Section 2 of the Operators Manual the wheel bearings must be removed, cleaned with kerosene, diesel fuel, or some similar approved solvent, repacked with new grease, and adjusted as explained earlier in this SM. Use only wheel bearing grease that meets or exceeds the specifications listed in Section 2 of the Operators Manual. Pack the hub cap, and the hub between the two bearing cups with grease to the level of the cups smallest diameter. The seal which retains grease in

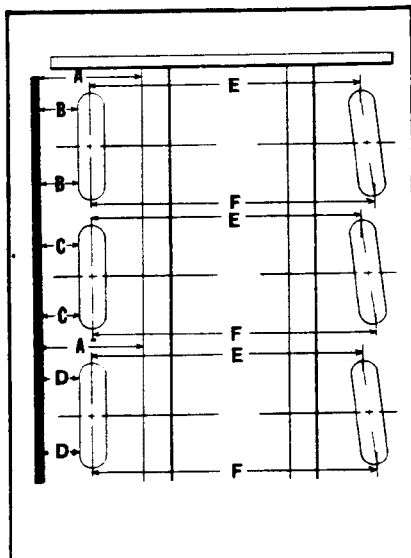


Fig. 5
Front Wheel Alignment
(Three Axle Carrier)

the inner bearing should be examined, and replaced if worn or damaged.

The tapered roller bearings, whenever removed from the axle, should be handled with great care and kept free from dirt or water. When reassembling caution should be used to prevent any foreign material from allowing metal to metal contact between the roller bearing cups and cones, the spindles on which they ride, and the shoulders against which they are intended to fit.

Wheel Torque Procedure: See SM1-69-2.0.

Wheel Bearing Adjustment:

(HC78B) The wheel bearing adjustment must be checked periodically. The carrier should never be operated with the bearings improperly adjusted. Bearing failure can result. The bearings are adjusted as follows:

- Jack up one end of the axle until the wheel clears the ground.
- Remove the hub cap.
- Remove lock nut and ring.
- While tightening adjusting nut, rotate wheel to make sure all bearingsurfaces are in contact.

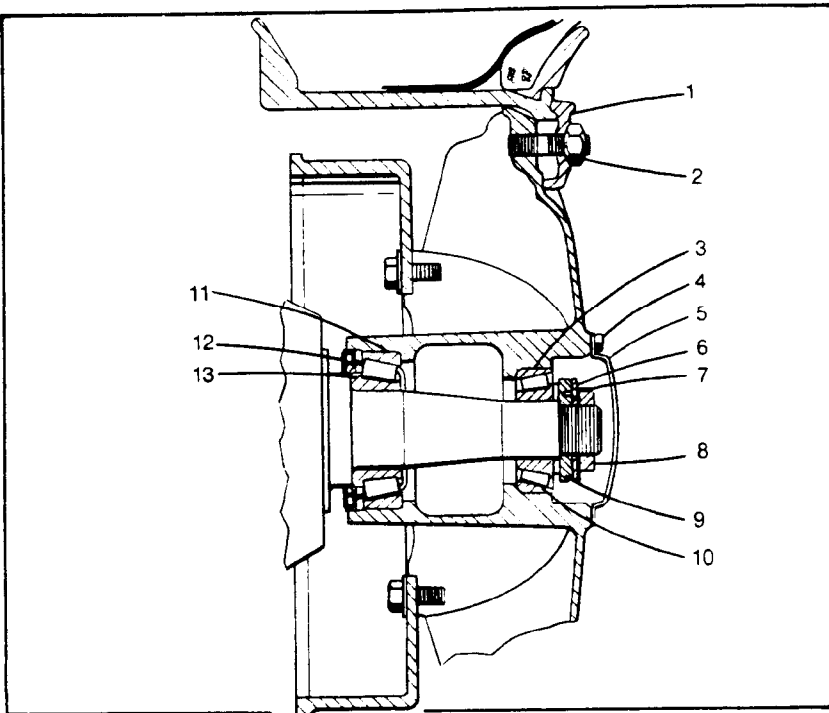


Fig. 6
Front Axle Assy. (HC78B) Old Style

- | | |
|--------------------|-------------------|
| (1) Rim Clamp | (8) Jam Nut |
| (2) Rim Stud & Nut | (9) Adj. Nut |
| (3) Bearing Cup | (10) Bearing Cone |
| (4) Capscrew | (11) Bearing Cup |
| (5) Hub Cap | (12) Oil Seal |
| (6) Lock Ring | (13) Bearing Cone |
| (7) Lock | |

- When adjusting nut is tight, check end play and wobble with dial indicator from hub to spindle end. End play should be nil at this point.
- Back adjusting nut off 1/6 to 1/4 turn to nearest point where lock ring will engage. Rotate wheel to see if it is free.
- Dial wheel again. End play must be between .001" to .010".
- Install lock ring and jam nut. Tighten with a 12" wrench to seat components.
- Recheck with dial indicator while rotating and attempting to wobble wheel. End play must remain within .001" to .010".
- Lock nuts in this position.
- Replace hub caps.

Wheel Torque Procedure: See SM1-69-2.0.

Wheel Bearing Repacking: See "Wheel Bearing Repacking", page 2.

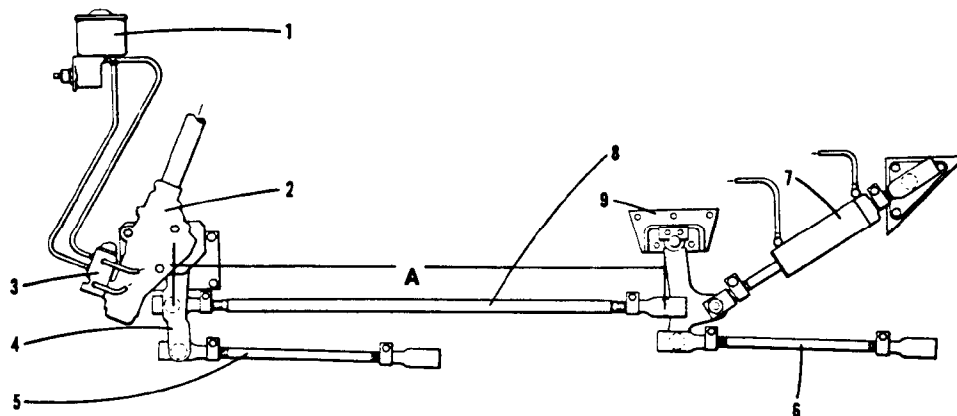


Fig. 7
Steering Mechanism (HC78B)

(A) 49-9/16"

(1) Pump & Reservoir
(2) Steering Gear
(3) Selector Valve

(4) Pitman Arm
(5) Drag Link (Front)
(6) Drag Link (Rear)

(7) Cylinder
(8) Connecting Link
(9) Bracket

Single Diaphragm Actuator

Air under pressure is admitted to port (3) when the foot brake pedal is depressed. The air pressure pushes on the diaphragm (5) and push rod assembly (10) to apply the brakes. When air is released from the actuator, the brake spring and spring (7) disengage the brake and return the diaphragm and piston assembly to their disengaged position.

Actuator Disassembly:

- (a) Block the wheel of the carrier so it cannot move.
- (b) Disconnect the air line leading to the actuator.
- (c) Remove the pin which connects the yoke (11) to the brake slack adjuster.
- (d) Remove mounting nuts, and remove actuator from the axle.
- (e) Pull out the push rod and clamp it at the non-pressure plate with a vise or vise grips. Cover or tape the vise or vise grip jaws to prevent damage to the push rod.
- (f) Remove the clamp ring nuts and bolts.
- (g) Spread the clamp ring slightly with a screw driver and remove.
- (h) Remove the pressure plate and diaphragm.
- (i) Remove the yoke and locknut from the push rod.
- (j) Release the grip on the push rod.
- (k) Remove the push rod assembly and spring.
- (l) Thoroughly clean and inspect all parts. Replace any worn parts. When the diaphragm or spring, or both are replaced, they should be replaced in the other brake chamber on the same axle.

Actuator Assembly:

- (a) Install push rod assembly and spring. Compress spring, and clamp the push rod in a vise.
- (b) Install diaphragm over push rod assembly. Install pressure plate over diaphragm.
- (c) Spread clamp ring and install on actuator. Install and tighten nuts and bolts (2).
- (d) Remove assembly from vise. Install locknut (12) and yoke (11).
- (e) Install actuator on axle. Connect yoke to slack adjuster.
- (f) Connect air line to actuator.

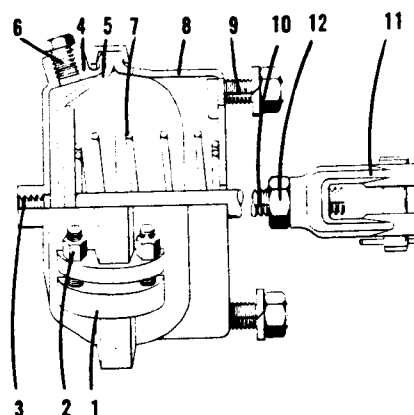


Fig. 1

Single Diaphragm Actuator

- | | |
|--------------------|------------------------|
| (1) Clamp Ring | (7) Spring |
| (2) Nuts And Bolts | (8) Non-Pressure Plate |
| (3) Inlet Port | (9) Mounting Bolts |
| (4) Pressure Plate | (10) Push Rod Assembly |
| (5) Diaphragm | (11) Yoke |
| (6) Inlet Port | (12) Locknut |

- (g) Adjust brakes as explained in SM Area 1-3.