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OPERATOR'S MANUAL NO. 5602 R4

**HYDRAULIC CRANE
MODEL 150A & 150FA**

**Serial No.
07305 & Up**





NEW PRODUCT WARRANTY AND LIMITATION OF REMEDY AND LIABILITY

*EACH NEW GALION PRODUCT IS SOLD SUBJECT TO THE
GALION WARRANTY AS PRINTED BELOW AND NO OTHER.*

- A. Galion Manufacturing Division, Dresser Industries, Inc., (Galion) warrants to the first user purchaser of each new Galion product that it is free from defects in material and workmanship. Galion's obligations under this warranty shall be to repair or replace, as Galion may elect, any part which, under normal and proper use and maintenance, proves defective in material and/or workmanship within six (6) months from the date of purchase. Provided, however, that written notice of any such defect and satisfactory proof thereof is promptly given to the seller or to the most convenient Galion distributor authorized to sell and service products of the model covered by this warranty. Defective items must be held for Galion's inspection and returned to the original F.O.B. point, with transportation charges prepaid, upon request. THE FOREGOING IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS.
- B. The foregoing Warranty shall not cover damage to any products caused by overloading, negligence, neglect, improper alteration or repair, accident or other misuse.
- C. The foregoing Warranty applies only to products manufactured by Galion. It does not include, and Galion assumes no responsibility for components or parts purchased by Galion or the distributor from other manufacturers such as power units, engines, tires, rims, electrical apparatus, generators, batteries, hydraulic components, attachments or other trade accessories, and as to these, the first user purchaser's only recourse shall be against the respective manufacturers thereof, under their respective warranties, which warranties are hereby assigned to the first user purchaser.
- D. THE FOREGOING IS GALION'S AND DISTRIBUTOR'S ONLY OBLIGATION AND BUYER'S EXCLUSIVE REMEDY FOR BREACH OF WARRANTY AND, EXCEPT FOR GROSS NEGLIGENCE OR WILLFUL MISCONDUCT, THE FOREGOING IS BUYER'S EXCLUSIVE REMEDY AGAINST GALION OR DISTRIBUTOR FOR ALL CLAIMS ARISING HEREUNDER OR RELATING HERETO WHETHER SUCH CLAIMS ARE BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES. BUYER'S FAILURE TO SUBMIT A CLAIM AS PROVIDED ABOVE SHALL SPECIFICALLY WAIVE ALL CLAIMS FOR DAMAGES OR OTHER RELIEF, INCLUDING BUT NOT LIMITED TO CLAIMS BASED ON LATENT DEFECTS. IN NO EVENT SHALL BUYER BE ENTITLED TO INCIDENTAL OR CONSEQUENTIAL DAMAGES, ANY ACTION BY BUYER ARISING HEREUNDER OR RELATING HERETO, WHETHER BASED ON BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY) OR OTHER THEORIES, MUST BE COMMENCED WITHIN ONE (1) YEAR AFTER THE CAUSE OF ACTION OR IT SHALL BE BARRED. No person is authorized to give any other warranties or to assume any other liabilities on Galion's behalf unless made or assumed in writing by Galion.

GALION MANUFACTURING DIVISION

Dresser Industries, Inc., P.O. Box 647, Galion, Ohio 44833, U.S.A.



CAUTION

DO NOT OPERATE THIS MACHINE UNLESS YOU ARE QUALIFIED TO DO SO. OSHA SEC. 1926.20 (b) (4)

INSPECT THIS MACHINE PRIOR TO EACH USE AND DURING USE TO MAKE SURE IT IS IN SAFE OPERATING CONDITION. OSHA SEC. 1926.550 (a) (5)

READ AND UNDERSTAND THE OPERATOR'S MANUAL AND SAFE OPERATING RULES.

BEFORE STARTING THE UNIT, READ THE OPERATOR'S MANUAL THOROUGHLY.

1. **THIS EQUIPMENT AND MACHINERY** must be operated in compliance with the manufacturer's specifications and limitations.
2. **A THOROUGH ANNUAL INSPECTION** of the hoisting machinery shall be made by a competent person. A record should be maintained of the dates and results of inspections for each hoisting machine and piece of equipment.
3. **A COMPETENT PERSON SHALL INSPECT** all machinery and equipment prior to each use and during use to make sure it is in safe operating condition. Any deficiencies shall be repaired or defective parts replaced before continued use.
4. **WIRE ROPE** shall be taken out of service and replaced whenever there are broken wires, kinking, crushing, birdcaging or any other damage resulting in distortion of the rope structure or reduction in the nominal diameter of the rope.
5. **NO MODIFICATIONS OR ADDITIONS** shall be made to the equipment which affect the capacity or safe operation of the equipment without the manufacturer's prior approval in writing. If any modifications or additions are made, the capacity, operation and maintenance instruction plates, tags or decals shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.
6. **MAINTAIN CLEARANCE** within the swing radius of the rear of the rotating superstructure of the crane to prevent injury to any person or damage to any property.
7. **ALWAYS CONSIDER** an electrical distribution and transmission line to be energized unless the line has been actually de-energized and visibly grounded.
When operating near electrical distribution and transmission lines:
 - (a) A person shall be designated to observe clearance of the equipment and to give timely warning for all operations where it is difficult for the operator to maintain the necessary clearance by visual observation.
 - (b) For lines rated 50 KV or less, minimum clearance between the lines and any part of the crane or load shall be 10 feet.
 - (c) For lines rated over 50 KV, minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 KV over 50 KV, or twice the length of the line insulator, but never less than 10 feet.
 - (d) In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 KV, and 10 feet for voltages over 50 KV, up to and including 345 KV, and 16 feet for voltages up to and including 750 KV.
 - (e) Prior to work near transmitter towers where an electrical charge can be induced in the equipment or load, the transmitter must be de-energized, or tests must be made to determine if an electrical charge is induced in the crane. When necessary to dissipate induced voltages, precautions shall be taken to directly ground the upper rotating structure and to protect the crews from the electrical charge.
8. **SPECIAL CAUTION:** If boom, line or load come in contact with live power line **DON'T PANIC**, stay on crane and move the boom away from the lines or have current shut off. If you must leave the Crane, jump clear and don't touch any part of the Crane. Allow no one to touch the Crane. Do not touch a downed or severed power line.
9. **BEFORE STARTING ENGINE**, make sure transmission is in neutral.

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10. **USE CAUTION** when operating the Crane during gusty or heavy wind conditions which could cause the Crane to tip easily.
11. **OBSERVE** conditions around your Crane such as location of power lines, gas mains, steep embankments, unstable ground.
12. **NEVER** rest boom on any object while attempting to hoist a load.
13. **NEVER** use boom as a lever arm to move any object.
14. **CHECK** for loose outrigger foot connectors.
15. **NEVER** use outrigger cylinder as a lifting or carrying device.
16. **NEVER** use outrigger pad or arm as a towing or pushing attachment.
17. **NEVER** block up under or anchor down frame or outrigger box to pick up more payload.
18. **NEVER** attempt to lift payload without stable footing under tires and outrigger pads.
19. **NEVER** use hoist line as skidder — (skidding objects to the Crane).
20. **NEVER** lift the tires clear of the surface they are resting on unless required to level the Crane. The outrigger pads should rest firmly on the surface.
21. **WHENEVER** possible operate the Crane with all outriggers down.
22. **MAINTAIN** maximum tire pressure at all times.
23. **NEVER** swing loads over personnel.
24. **NEVER** get off the Crane while it is moving.
25. **NEVER** get out of cab while engine is running.
26. **NEVER** allow personnel to ride on any part of the Crane unless equipped with personnel carrying attachments.
27. **KNOW** the total weight of the Crane and check axle load limits on bridges, culverts, etc.
28. **KNOW** the overall height, length, width on the Crane and check clearances — above, behind and on all sides.
29. **CHECK** for leaks in hydraulic cylinders, tubes, connectors, motors, tanks and main pump.
30. **CHECK** holding of the swing and hoist brakes.
31. **NEVER** allow grease or any foreign material to collect on any part of the Crane. Poor housekeeping is not only hazardous but can shorten component life.
32. **USE THE APPROVED HAND SIGNALS** for crane operators as prescribed by ANSI Standards. (See page 29).
33. **NO MODIFICATIONS OR ADDITIONS** which affect the capacity or safe operation of the equipment shall be made, without the Manufacturer's **written** approval.
34. **TWO-BLOCKING IS PROHIBITED**, because it is an unsafe practice that could cause injury or damage. **DO NOT TWO-BLOCK**.

ALWAYS CHECK THE CRANE LOAD RATING CHART BEFORE HOISTING PAYLOAD. COMPLY WITH THE RADIUS FOR THE AMOUNT OF PAYLOAD. POSITION BOOM POINT OVER PAYLOAD, THEN HOIST.

RATINGS SHOWN ON THE CRANE LOAD RATING CHART (MOUNTED ON INSTRUMENT PANEL COVER) ARE **MAXIMUM** ALLOWABLE LOADS, **NOT** PRACTICAL WORKING LOADS. IF CRANE IS OPERATED ABOVE "HEAVY LINE" VALUES FOUND ON THE CHART, STRUCTURAL DAMAGE AND/OR TIPOVER CAN OCCUR.

PRACTICAL WORKING LOADS DEPEND ON HOW LEVEL MACHINE IS, SUPPORTING SURFACE, WIND, AND OTHER FACTORS EFFECTING STABILITY, HAZARDOUS SURROUNDINGS, EXPERIENCE OF PERSONNEL AND PROPER HANDLING MUST BE TAKEN INTO ACCOUNT BY THE OPERATOR (SEE APPLICATION SECTION IN THIS MANUAL).

ALWAYS CHECK YOUR CRANE OVER COMPLETELY BEFORE STARTING YOUR JOB.

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INTRODUCTION

MESSAGE TO THE OPERATOR

Prior to initial start up of your Galion Crane, take the time to read and understand this manual. It has been prepared to help you operate and maintain your crane properly. After you have familiarized yourself with the contents of this manual retain it on the crane so you can refer to it when needed.

The information contained herein is important and will assist in ensuring that your Galion Crane gives many hours of dependable, economical, and troublefree service.

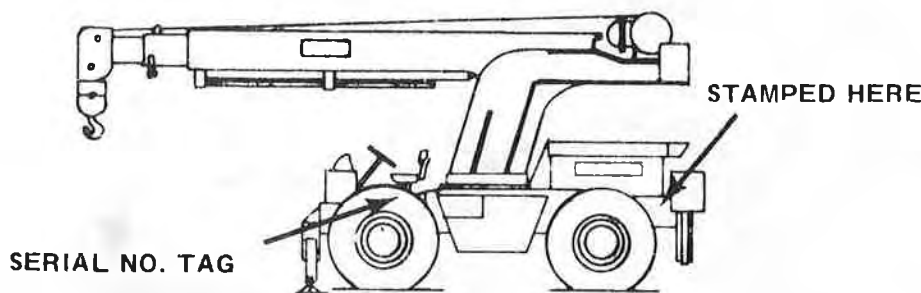
In the event repair parts are needed or correspondence with your Galion dealer is required, furnish the crane model and serial number and all other related serial numbers. Specifications, materials and design are subject to change without notice.



This CAUTION symbol is used in this manual to attract your attention to certain procedures, that must be followed for proper operation and use of this equipment.

Established and approved SAFETY rules for the operation and use of this equipment must be followed.

NOTE: Check serial number stamped on frame to ensure that it matches the number on the serial tag, located on right side of seat box.



UPON RECEIPT OF THE GALION HYDRAULIC CRANE, RECORD THE FOLLOWING INFORMATION:

DATE _____

CRANE MODEL AND SERIAL NUMBER _____

ENGINE MODEL AND SERIAL NUMBER _____

TRANSMISSION MODEL AND SERIAL NUMBER _____

FRONT AXLE MODEL AND SERIAL NUMBER _____

REAR AXLE MODEL AND SERIAL NUMBER _____

CONVERTER MODEL AND SERIAL NUMBER _____

ALTERNATOR MODEL AND SERIAL NUMBER _____

STARTER MODEL AND SERIAL NUMBER _____



150A SPECIFICATIONS

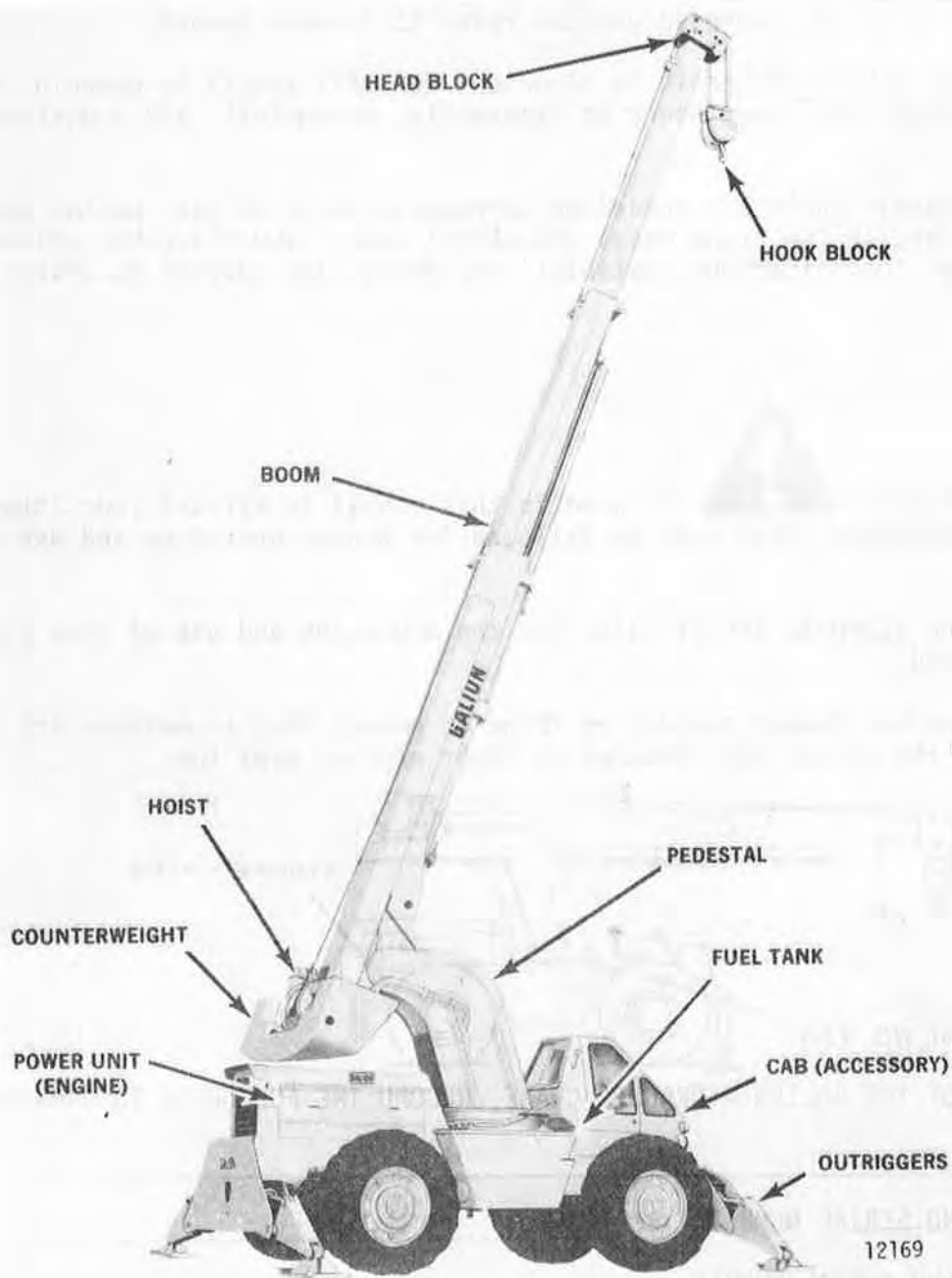


Figure 1

**BASIC UNIT**

Weight (Approx.) with 3 Section Power Boom	37,300 LBS.	(16 919 kg)
Weight on Front Axle	-----	-----
Weight on Rear Axle	-----	-----
Wheelbase	9' - 0"	(2.74 m)
Overall Length	27' - 2"	(8.28 m)
Main Frame	15' - 6.500"	(4.74 m)
Centerline Rotation to Front Outrigger	7' - 8.500"	(2.35 m)
Centerline Rotation to Rear Outrigger	8' - 7.500"	(2.63 m)
Overall Height	11' - 5.500"	(3.49 m)
Overall Width with Outrigger Pads Stowed	8' - 0"	(2.44 m)
Outrigger Ground Clearance	1' - 3"	(381.00 mm)
Axle Ground Clearance	1' - 4"	(406.40 mm)
Turning Radius	18' - 1"	(5.51 m)

BOOM

Boom Rotation	360°	
Minimum Reach (Horizontal) from Center-line Rotation	17' - 6"	(5.33 m)
Maximum Reach (Horizontal) from Center-line Rotation	37' - 6"	(11.43 m)
Tail Swing	7' - 8.750"	(2.36 m)
Height Hook to Ground (Boom Horizontal)	6' - 6.750"	(2.00 m)
Maximum Elevation	70°	
Standard Rigging	5 Part Line	

CRANE PERFORMANCE

Boom Topping Speed	17.0 Sec.	
Boom Lowering Speed	16.0 Sec.	
Swing Speed, RPM	4.0	
Outrigger Speeds;		
Down	3.5 Sec.	
Up	3.0 Sec.	
Crowd Speed (Approx.):		
Extending, FPM	50	(15.24 m/min.)
Retracting, FPM	60	(18.28 m/min.)
Average Line Speed;		
Low, FPM	150	(45.72 m/min.)
Intermediate, FPM	250	(76.20 m/min.)
High, FPM	400	(121.92 m/min.)
Maximum Hook Speed with 5 Part Line, FPM	80	(24.38 m/min.)



150FA SPECIFICATIONS

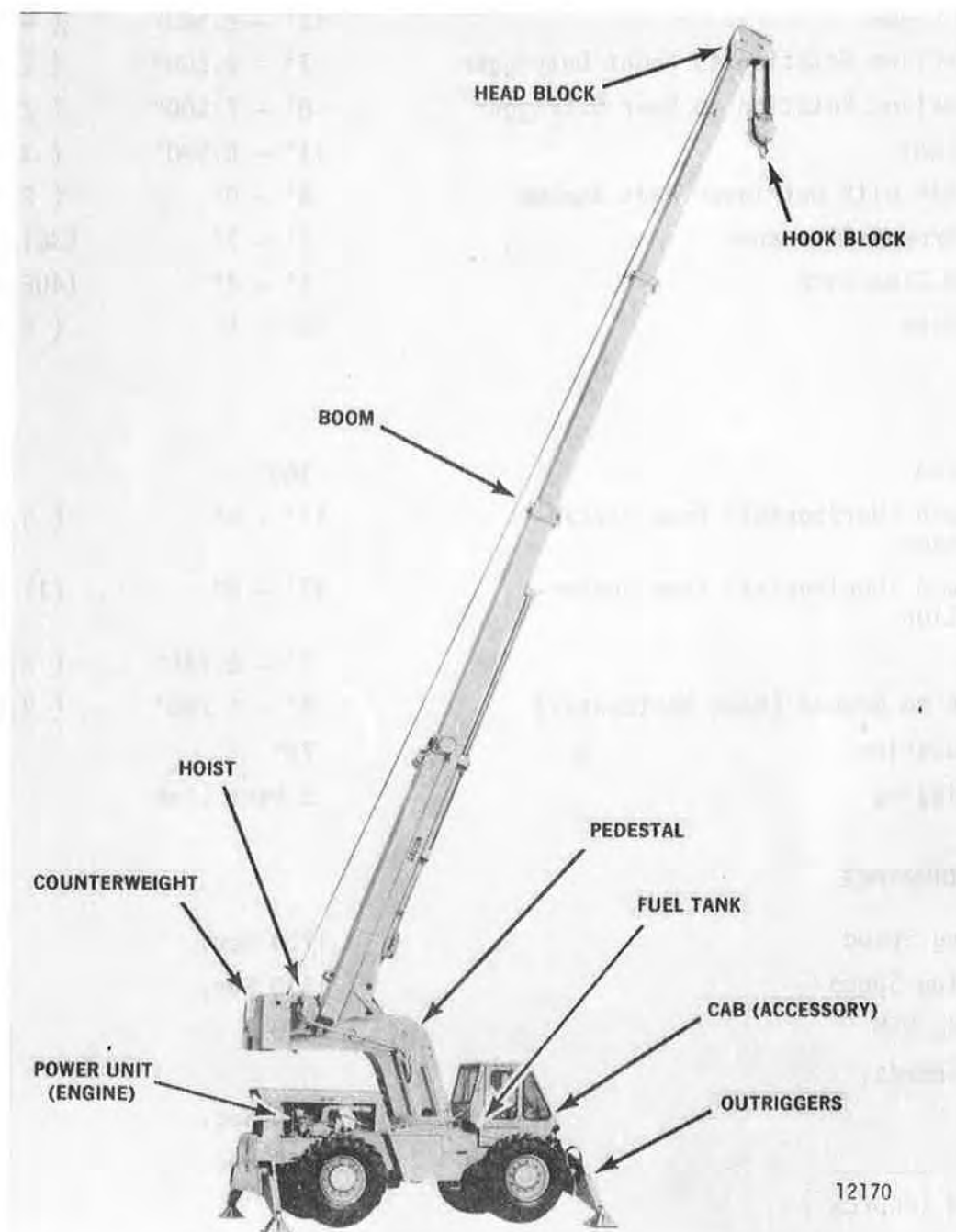


Figure 2

**BASIC UNIT**

Weight (Approx.) with 3 Section Power Boom	37,300 LBS.	(16 919 kg)
Weight on Front Axle	-----	-----
Weight on Rear Axle	-----	-----
Wheelbase	9' - 0"	(2.74 m)
Overall Length	27' - 2"	(8.28 m)
Main Frame	15' - 6.500"	(4.74 m)
Centerline Rotation to Front Outrigger	7' - 8.500"	(2.35 m)
Centerline Rotation to Rear Outrigger	8' - 7.500"	(2.63 m)
Overall Height	11' - 2.500"	(3.42 m)
Overall Width with Outrigger Pads Stowed	8' - 0"	(2.44 m)
Outrigger Ground Clearance	1' - 3"	(381.00 mm)
Axle Ground Clearance	1' - 4"	(406.40 mm)
Turning Radius	18' - 1"	(5.51 m)

BOOM

Boom Rotation	360°	
Minimum Reach (Horizontal) from Centerline Rotation	17' - 6"	(5.33 m)
Maximum Reach (Horizontal) from Centerline Rotation	37' - 6"	(11.43 m)
Tail Swing	8' - 8"	(2.64 m)
Height Hook to Ground (Boom Horizontal)	6' - 6.750"	(2.00 m)
Maximum Elevation	70°	
Standard Rigging	5 Part Line	

CRANE PERFORMANCE

Boom Topping Speed	17.0 Sec.	
Boom Lowering Speed	16.0 Sec.	
Swing Speed, RPM	4.0	
Outrigger Speeds;		
Down	3.5 Sec.	
Up	3.0 Sec.	
Crowd Speed (Approx.);		
Extending, FPM	50	(15.24 m/min.)
Retracting, FPM	60	(18.28 m/min.)
Average Line Speed;		
Low, FPM	150	(45.72 m/min.)
Intermediate, FPM	250	(76.20 m/min.)
High, FPM	400	(121.92 m/min.)
Maximum Hook Speed with 5 Part Line, FPM	80	(24.38 m/min.)



GENERAL SPECIFICATIONS FOR 150A AND 150FA

GROUND SPEEDS

CLARK 2420 TRANSMISSION (FORWARD & REVERSE)

	MPH	KMPH
First	0.0 - 3.8	0.0 - 6.1
Second	3.8 - 6.9	6.1 - 11.1
Third	6.9 - 16.0	11.1 - 25.7
Fourth	16.0 - 26.5	25.7 - 42.6

ALLISON TRANSMISSION WITH DEUTZ F6L-912

Fwd. First	0.0 - 8.1	0.0 - 13.1
Fwd. Second	8.1 - 20.2	13.1 - 32.5
Reverse	0.0 - 11.0	0.0 - 17.8

ALLISON TRANSMISSION WITH D.D. 4-53N

Fwd. First	0.0 - 8.5	0.0 - 13.7
Fwd. Second	8.5 - 22.5	13.7 - 36.2
Reverse	0.0 - 11.5	0.0 - 18.5

CLARK 18000 TRANSMISSION (FORWARD AND REVERSE)

Low Range		
First	0.0 - 3.0	0.0 - 4.8
Second	3.0 - 6.5	4.8 - 10.5
Third	6.5 - 14.4	10.5 - 23.2
High Range		
First	0.0 - 5.9	0.0 - 9.5
Second	5.9 - 12.3	9.5 - 19.8
Third	12.3 - 26.3	19.8 - 42.3

ENGINE SPECIFICATIONS

DEUTZ F6L-912

Number of Cylinders	6
Bore and Stroke	3.398" x 4.719" (100.02 mm x 119.86 mm)
Displacement	344.91 Cu. In. (5652 cc)
Horsepower (550 FPPS)	108
Horsepower (metric)	109.5
Electrical System	12 Volt 37 AMP Alternator

CONT'D. NEXT PAGE -

**IH UV-345 GAS**

Number of Cylinders	8
Bore and Stroke	3.875" x 3.656" (98.43 mm x 92.86 mm)
Displacement	345 Cu. In. (5654 cc)
Horsepower (550 FPPS)	152
Horsepower (metric)	154.1
Electrical System	12 Volt 32 AMP Alternator

DETROIT DIESEL 4-53N

Number of Cylinders	4
Bore and Stroke	3.875" x 4.500" (98.43 mm x 114.30 mm)
Displacement	212.4 Cu. In. (3481 cc)
Horsepower (550 FPPS)	127
Horsepower (metric)	128.8
Electrical System	12 Volt 32 AMP Alternator

TIRE INFLATION

14:00 x 24 - 16 Ply	75-80 PSI (0.51 - 0.55 MPa)
17:50 x 25 - 14 Ply	50-60 PSI (0.34 - 0.41 MPa)
13:00 x 24 - 10 Ply	55-70 PSI (0.37 - 0.48 MPa)
15:50 x 25 - 12 Ply	40-60 PSI (0.27 - 0.41 MPa)

LIQUID CAPACITIES

	D.D. 4-53N	I.H. UV-345	DEUTZ F6L-912
Radiator	18 U.S. QUARTS (17 LITERS)	29 U.S. QUARTS (27 LITERS)	----- -----
Engine Crankcase	15 U.S. QUARTS (14 LITERS)	8 U.S. QUARTS (8 LITERS)	14 U.S. QUARTS (13 LITERS)
with Filter	16 U.S. QUARTS	9 U.S. QUARTS	16 U.S. QUARTS
Change	(15 LITERS)	(9 LITERS)	(15 LITERS)

CONT'D. NEXT PAGE -



Planetary, Axle:

Clark FDS-12152 & DS-17220	2.5 U.S. QUARTS (PER PLANETARY) (2.37 LITERS)
Clark DS-13311	3 U.S. PINTS (PER PLANETARY) (1.47 LITERS)
Rockwell	2.5 U.S. QUARTS (PER PLANETARY) (2.37 LITERS)
Soma	2 U.S. QUARTS (PER PLANETARY) (1.89 LITERS)

Differential, Axle:

Clark FDS-12152 & DS-17220	9 U.S. QUARTS (9 LITERS)
Clark DS-1311	11 U.S. QUARTS (10 LITERS)
Rockwell	9 U.S. QUARTS (9 LITERS)
Soma	11 U.S. QUARTS (10 LITERS)
Hoist Gear Case	10 U.S. QUARTS (9 LITERS)
Swing Drive Case	14 U.S. QUARTS (13 LITERS)
Hydraulic Brake System	1 U.S. QUART (0.94 LITER)

Torque Converter & Transmission:

Clark 2420	9 U.S. GALLONS (34 LITERS)
Clark 18000 Series	5 U.S. GALLONS (19 LITERS)
Allison	* 9 U.S. GALLONS (34 LITERS)
Fuel Tank	46 U.S. GALLONS (174 LITERS)
Hydraulic System w/Tank	120 U.S. GALLONS (454 LITERS)
Hydraulic Tank	75 U.S. GALLONS (284 LITERS)
Spring Motor (Four Section Boom Only)	1 U.S. PINT (PER HOUSING) (0.47 LITER)
Steering Gear Case	1 U.S. QUART (0.94 LITER)

* 10 U.S. GALLONS (38 LITERS) with Deutz F6L-912

NOTE: Capacities listed here, are drained volumes, and do not reflect those which would be needed after the rebuild of a component. These capacities are also subject to change due to manufacturing changes in component cases, engine oil pans, internal construction changes, etc.



OPERATIONAL INSTRUCTIONS

PREPARATION FOR USE

After initial delivery or following transportation of machine from one job site to another, it is recommended that the following inspection and report be conducted.

Before unloading the crane, check it thoroughly for any damage during shipment. Inspect instruments, power unit and controls. If damage is found, contact the carrier or his agent and report the extent of damage or pilferage. Have this noted on the transportation document.

Contact your GALION distributor to advise him of the damage. He will assist you to obtain the necessary reports and to expedite any claim you might have against the transportation company.

Check for tags wired to the unit. These tags will indicate whether the radiator is drained, filled with water or filled with permanent-type antifreeze solution. This should be checked for proper protection for ambient temperatures.

Remove dirt and/or grease from exposed parts and particularly cylinder piston rods.

Lubricate and service crane fully in accordance with both the Daily/10 Hour and Weekly/50 Hour Service schedules.



READ THIS MANUAL TO BECOME FAMILIAR WITH THE OPERATION OF THE GALION HYDRAULIC CRANE.

MACHINE DAMAGE AND PERSONAL INJURY CAN BE PREVENTED BY A THOROUGH UNDERSTANDING OF THE PROPER OPERATING PROCEDURES.



OPERATION UNDER NORMAL CONDITIONS

MANIFOLD CONTROLS

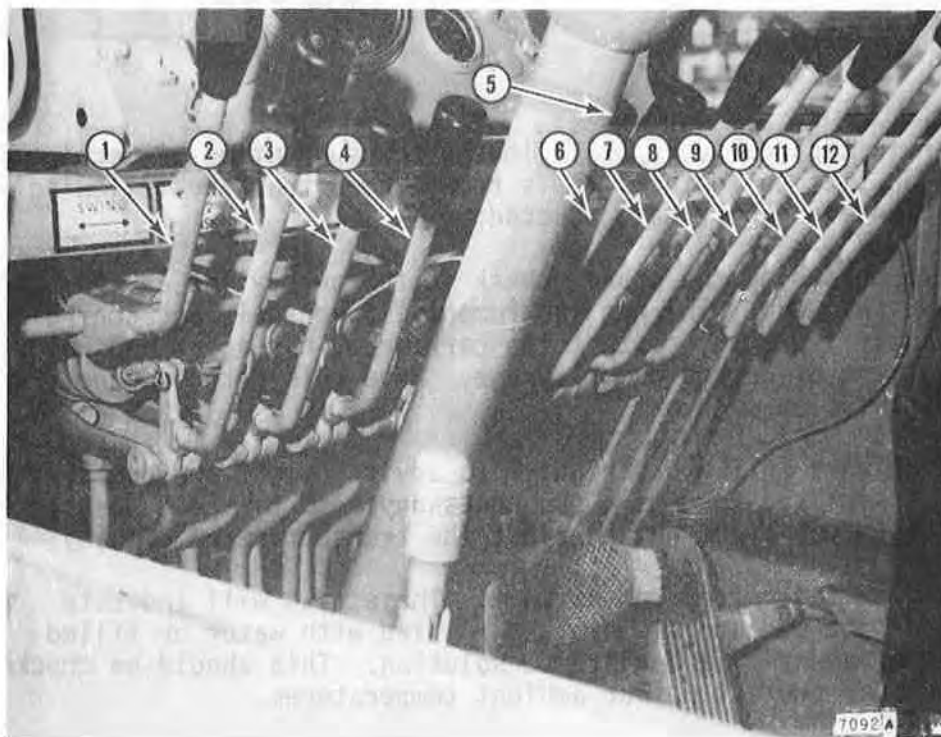


Figure 3

The Galion Hydraulic System employs open center, closed port control valves. The spools within these valves are designed with V-notches ground into them to allow the flow through the valve to be finely regulated. This allows the operator to "feather" the controls for smooth, safe operation.

1. Left Hand Swing:
 - a. Push control to rotate boom clockwise
 - b. Pull control to rotate boom counterclockwise
2. Optional Control:
3. Outrigger, Left Rear:
 - a. Push control to lower
 - b. Pull control to raise
4. Outrigger, Left Front:
 - a. Push control to lower
 - b. Pull control to raise
5. Outrigger, Right Front:
 - a. Push control to lower
 - b. Pull control to raise
6. Outrigger, Right Rear:
 - a. Push control to lower
 - b. Pull control to raise



7. Rear Steer:
 - a. Push control to turn rear wheels left
 - b. Pull control to turn rear wheels right
 - c. Signal lamp on instrument panel goes out when rear wheels are straight ahead
8. Right Hand Swing Control:
 - a. Pull control to rotate boom clockwise
 - b. Push control to rotate boom counterclockwise
9. Low Line Speed:
 - a. Pull control to raise hook
 - b. Push control to lower hook
10. Intermediate Line Speed:
 - a. Pull control to raise hook
 - b. Push control to lower hook
9. & 10. High Line Speed (Operate Together):
 - a. Pull controls to raise hook
 - b. Push controls to lower hook



WHEN OPERATING AT FULL ENGINE RPM AND HIGH HOIST SPEED IS DESIRED, ALWAYS "FEATHER" BOTH THE SLOW AND FAST CONTROLS INTO A FULLY OPEN POSITION. QUICK FULL ENGAGEMENT OF THESE CONTROL LEVERS TO RAISE OR LOWER THE HOOK BLOCK CAN CAUSE DISPLACEMENT OF THE WIRE ROPE. THIS DISPLACEMENT CAN CAUSE BACKLASHING, BIRDCAGING AND CRUSHING RESULTING IN PERMANENT DAMAGE TO THE WIRE ROPE. ALWAYS "FEATHER" BOTH LEVERS BACK TO THE NEUTRAL POSITION TO STOP HOIST. ALLOWING THE HOIST CONTROL LEVERS TO SNAP BACK TO THE NEUTRAL POSITION CAN ALSO CAUSE WIRE ROPE DISPLACEMENT, EXCESSIVE STRESS, KINKING OR BREAKING.



TWO-BLOCKING IS PROHIBITED, BECAUSE IT IS AN UNSAFE PRACTICE THAT COULD CAUSE INJURY OR DAMAGE. DO NOT TWO-BLOCK.

11. Crowd--Extend/Retract:
 - a. Push control to extend sliding section
 - b. Pull control to retract sliding section
12. Boom--Raise/Lower:
 - a. Push control to lower boom
 - b. Pull control to raise boom

NOTE: *When using control levers DO NOT let levers snap back to neutral position. This can cause jerking of the crane, load swinging, displacement of wire rope, etc.*



HYDRAULIC CRANE SYSTEMS

A tandem pump of 30 and 50 Gallons Per Minute (GPM) (114 and 189 liter per minute) (lpm) rated capacity is directly driven at the crankshaft end of the engine.

THIRTY GALLON PUMP:

Flow from the 30 GPM (114 lpm) pump is directed to a flow regulator, where 11 GPM (42 lpm) are diverted through the front wheel power booster steering valve. This provides the flow when needed for front wheel steering and power boosted brakes.

After this regulated flow passes through the steering valve it goes to a diverter valve which rejoins the oil separated for front steer with the oil that was bypassed in the regulating valve. This flow now has a volume up to 30 GPM (114 lpm) depending on engine speed.

Flow now goes to the left end of the control manifold, and through a series flow valve system becomes available for use by all valves in this manifold.

OUTRIGGER CONTROLS:

The outrigger controls will use this flow if the control valves are operated. Since the valves are of the series type; when oil is directed to the outrigger cylinder(s), the oil that is stored on the opposite side of the piston is forced out by piston movement and flows back to the manifold to be used by other controls down stream.

REAR STEERING:

The next valve in the manifold controls flow to the rear steering cylinders.

SWING:

The 30 GPM (114 lpm) flow goes from the rear steer valve to the swing valve. This valve controls the flow of oil to the swing motor to rotate the boom and pedestal.

When this valve directs a flow of oil to the swing motor, a small part of the flow goes to the swing brake cylinder. This is a single acting cylinder that releases the brake when oil is supplied during the swing motor operation.

When the swing control valve is returned to neutral, oil drains out of the brake cylinder and a spring applies the brake to the input shaft and prevents rotation of the boom pedestal.

LOW LINE SPEED:

The 30 GPM (114 lpm) flow is supplied to the hoist motor by the next valve in the manifold. This flow is piped through the rotary joint in the pedestal of the crane.

FIFTY GALLON PUMP:

The 50 GPM (189 lpm) flow is routed to the primary manifold located under the boom pedestal. Control of the valves in this manifold is made through aircraft-type cables connecting the control levers with the valves.



INTERMEDIATE LINE SPEED:

The first valve in the 50 GPM (189 lpm) system supplies 50 GPM (189 lpm) flow to the hoist motor.

HIGH LINE SPEED:

Operate both the low line speed and intermediate line speed controls together to obtain the high line speed. This will yield a combined flow of up to 80 GPM (303 lpm) to the hoist motor.

BOOM CROWD:

The 50 GPM (189 lpm) flow is then supplied to the boom crowd valve. This flow is piped to the crowd cylinder and extends or retracts the boom sliding sections.

BOOM LIFT:

Flow from the last valve in the 50 GPM (189 lpm) manifold is piped to the boom lift cylinder to raise or lower the boom.



OPERATING CONTROLS - CLARK TRANSMISSIONS

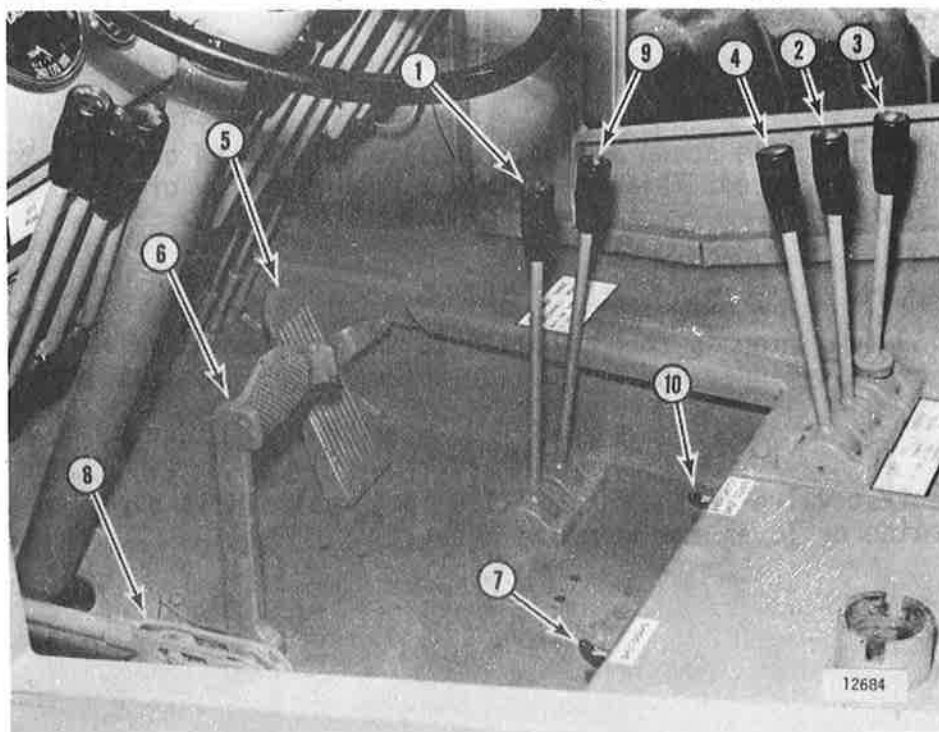


Figure 4

1. Front Axle Disconnect Lever:

- a. To engage four wheel drive, stop crane with front and rear wheels directed straight. Position the forward/reverse lever (see Ref. 2) in "NEUTRAL" and apply light hand pressure to the front axle disconnect lever toward the front of the crane. If axle disconnect does not engage, continue to apply hand pressure to the disconnect lever and turn steering wheel to the left and then to the right. When four wheel drive is engaged, the disconnect lever will remain in the forward position.
- b. To disconnect four wheel drive, stop the crane and pull the disconnect lever fully rearward. When four wheel drive is disengaged, the lever will remain in the rearward position.



DO NOT ROAD THE CRANE WITH THE FOUR WHEEL DRIVE ENGAGED.



2. Forward and Reverse Control Lever:

- a. Lever must be in center (NEUTRAL) position to start crane.
- b. When crane is started, engage powershift forward/reverse gear box by moving lever in direction of desired travel.



BRING CRANE TO A COMPLETE STOP BEFORE CHANGING DIRECTION OF TRAVEL. DO NOT SHIFT "DOWN" AT HIGH ROAD SPEED. SHIFTS MAY BE MADE "UP" OR "DOWN" UNDER LOAD OR DURING TRAVEL AT LOWER SPEEDS. RELEASE ENGINE ACCELERATOR PEDAL WHEN SHIFTING "DOWN" AT NORMAL TRAVEL SPEEDS.

3. Engine Speed Control:

- a. Pull rearward to increase speed.
- b. Twist lever clockwise to lock at desired engine speed.



DO NOT LOCK ENGINE SPEED CONTROL LEVER WHEN ROADING. BE SURE LOCK IS FULLY RELEASED BEFORE ROADING.

4. High-Low Gear Lever (with Clark 2420 Transmission):

- a. For control of speed ranges while the crane is moving.
- b. Pull lever all the way back for LOW; push lever all the way forward for HIGH.



DO NOT ATTEMPT TO USE HIGH-LOW RANGE LEVER (SEE REF. 9) WHILE CRANE IS MOVING.

- c. For speed ranges, see General Specifications in this manual.

4. Power Gear Shift Lever (with Clark 18000 Series Transmission):

- a. Pull lever all the way back for FIRST gear.
- b. Middle position is SECOND gear.
- c. Push lever all the way forward for THIRD gear.



DO NOT ATTEMPT TO USE HIGH-LOW RANGE LEVER (SEE REF. 9) WHILE CRANE IS MOVING.

- d. For speed ranges, see General Specifications in this manual.



DOWNHILL GRADES: WHEN ENCOUNTERING A DOWNHILL GRADE, SHIFT TRANSMISSION INTO A LOWER GEAR. DOWNSHIFTING WILL ALLOW ENGINE TO PROVIDE ADDITIONAL DYNAMIC BRAKING POWER. THE SLOPE OF THE GRADE, LOAD AND TYPE OF TERRAIN MUST ALWAYS BE TAKEN IN CONSIDERATION.



5. Engine Accelerator Pedal:
Foot operated. Press toward floor to increase engine speed.
6. Service Brake Pedal:
Foot operated. Press toward floor to activate brake.
7. Gasoline Engine Choke Cable or Diesel Engine Shutdown Cable:
 - a. When cable is used for choke, see "Start-up Procedure" in this manual.
 - b. When cable is used for shutdown, see "Shutdown Procedure" in this manual.
8. Parking Brake Lever:
 - a. Pull up to apply brake.
 - b. Push down (to a horizontal position) to release brake.
 - c. Turn knob on top of lever to adjust brake (see "Parking Brake Adjustment" in this manual).
9. High-Low Range Lever:
 - a. Pull lever rearward to engage "LOW" speed range.
 - b. Push lever forward to engage "HIGH" speed range.



BRING CRANE TO A COMPLETE STOP BEFORE SHIFTING
LEVER TO CHANGE SPEED RANGES.

10. Emergency Shutdown Cable:
See "Shutdown Procedure" in this manual.

NOTE: *DO NOT use emergency shutdown cable for routine shutdown.
Regular use of emergency shutdown cable could damage engine.
Use Ref. & for routine shutdown.*



OPERATING CONTROLS - ALLISON TRANSMISSION

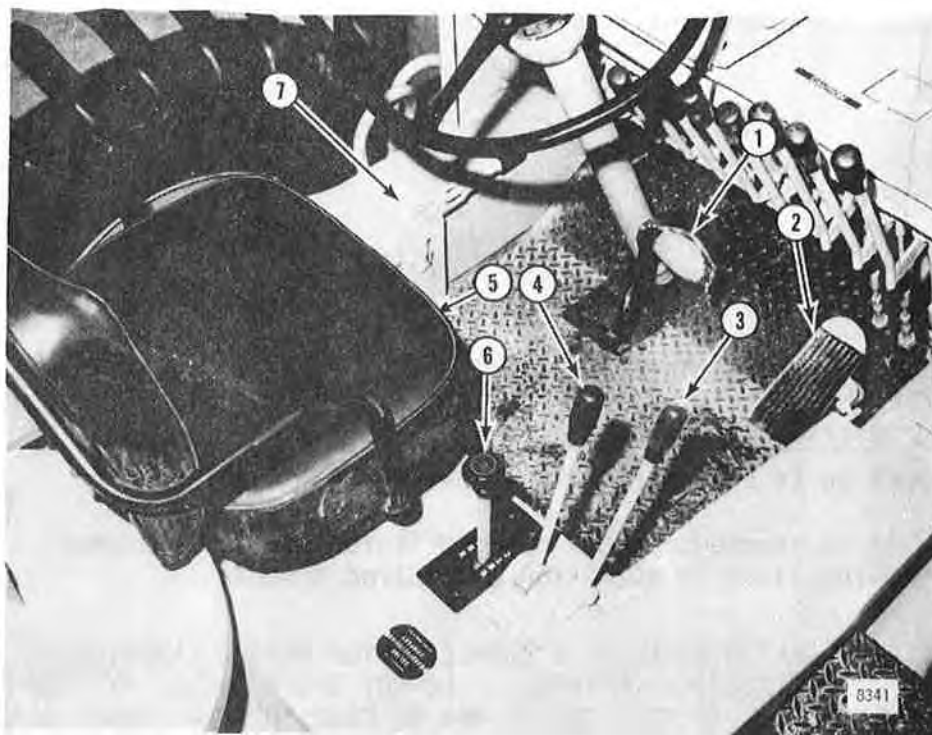


Figure 5

1. Service Brake Pedal:
Foot operated. Push toward floor to activate brake.
2. Engine Accelerator Pedal:
Foot operated. Press toward floor to increase engine speed.
3. Engine Speed Control:
 - a. Pull rearward to increase speed.
 - b. Twist lever clockwise to lock at desired engine speed.



DO NOT LOCK ENGINE SPEED CONTROL LEVER WHEN ROADING.
BE SURE LOCK IS FULLY RELEASED BEFORE ROADING.

4. Rear Axle Disconnect Lever:
 - a. To engage four wheel drive, stop the crane with front and rear wheels directed straight. Position the forward/reverse lever (see Ref. 6) in NEUTRAL and apply light hand pressure to the rear axle disconnect lever toward the front of the crane. If axle disconnect does not engage, continue to apply hand pressure to the disconnect lever and turn steering wheel to the left then to the right. When four wheel drive is engaged, the disconnect lever will remain in the forward position.

CONT'D ON NEXT PAGE -



- b. To disconnect four wheel drive, stop the crane and pull the disconnect lever fully rearward. When four wheel drive is disengaged, the lever will remain in the rearward position.



DO NOT ROAD THE CRANE WITH THE FOUR WHEEL DRIVE ENGAGED.

5. Shutdown Cable:

See "Shutdown Procedure" in this manual.

6. Forward and Reverse Control Lever:

- a. Lever must be in center (NEUTRAL) position to start crane.
- b. When crane is started, engage powershift forward/reverse gear box by moving lever in direction of desired travel.



BRING CRANE TO A COMPLETE STOP BEFORE CHANGING DIRECTION OF TRAVEL. DO NOT SHIFT "DOWN" AT HIGH ROAD SPEED. SHIFTS MAY BE MADE "UP" OR "DOWN" UNDER LOAD OR DURING TRAVEL AT LOWER SPEEDS. RELEASE ENGINE ACCELERATOR PEDAL WHEN SHIFTING "DOWN" AT NORMAL TRAVEL SPEEDS.

7. Parking Brake Lever:

- a. Pull up to apply brake.
- b. Push down (to a horizontal position) to release brake.
- c. Turn knob on top of lever to adjust brake (see "Parking Brake Adjustment" in this manual).



INSTRUMENT PANEL

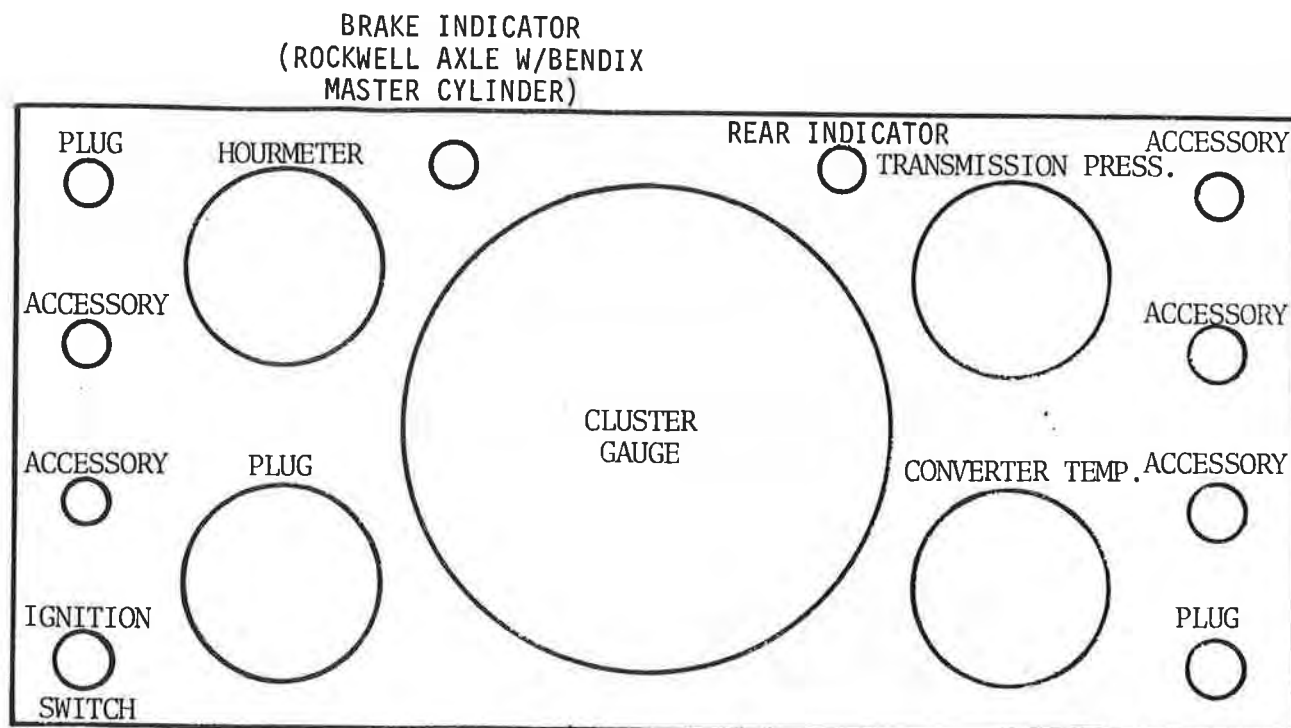


Figure 6

INTERNATIONAL HARVESTER & DETROIT DIESEL ENGINES

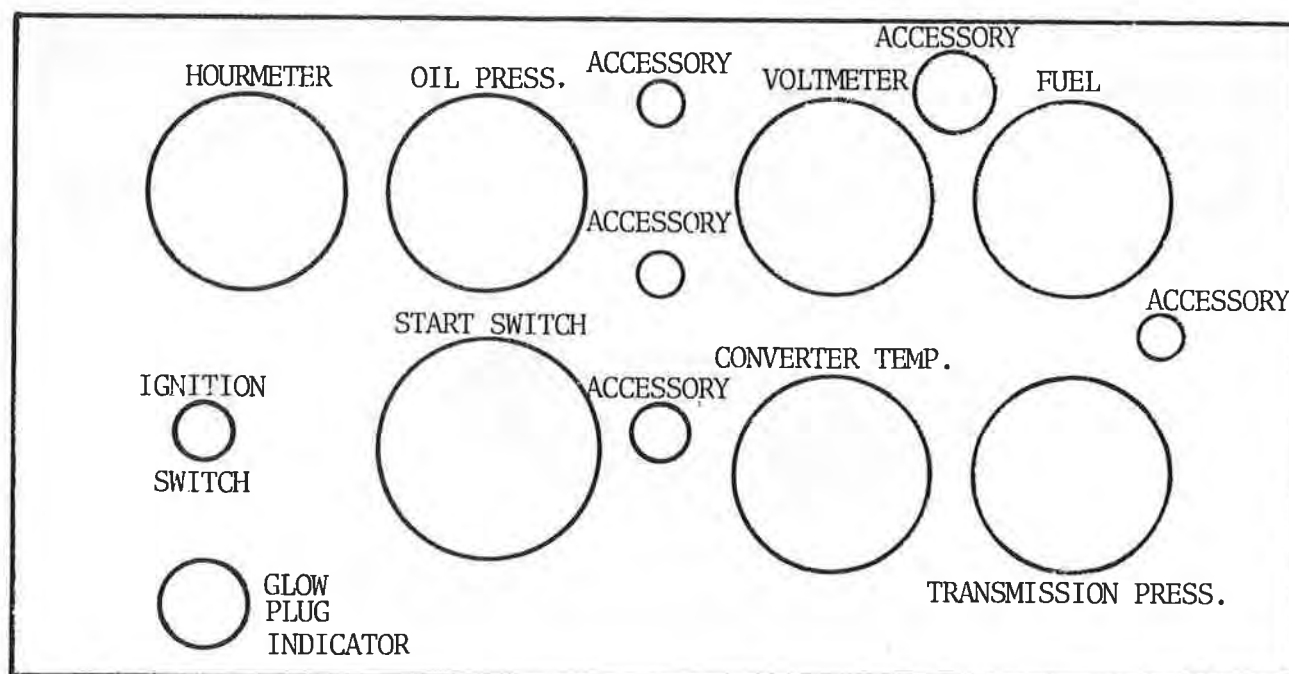


Figure 7
DEUTZ DIESEL



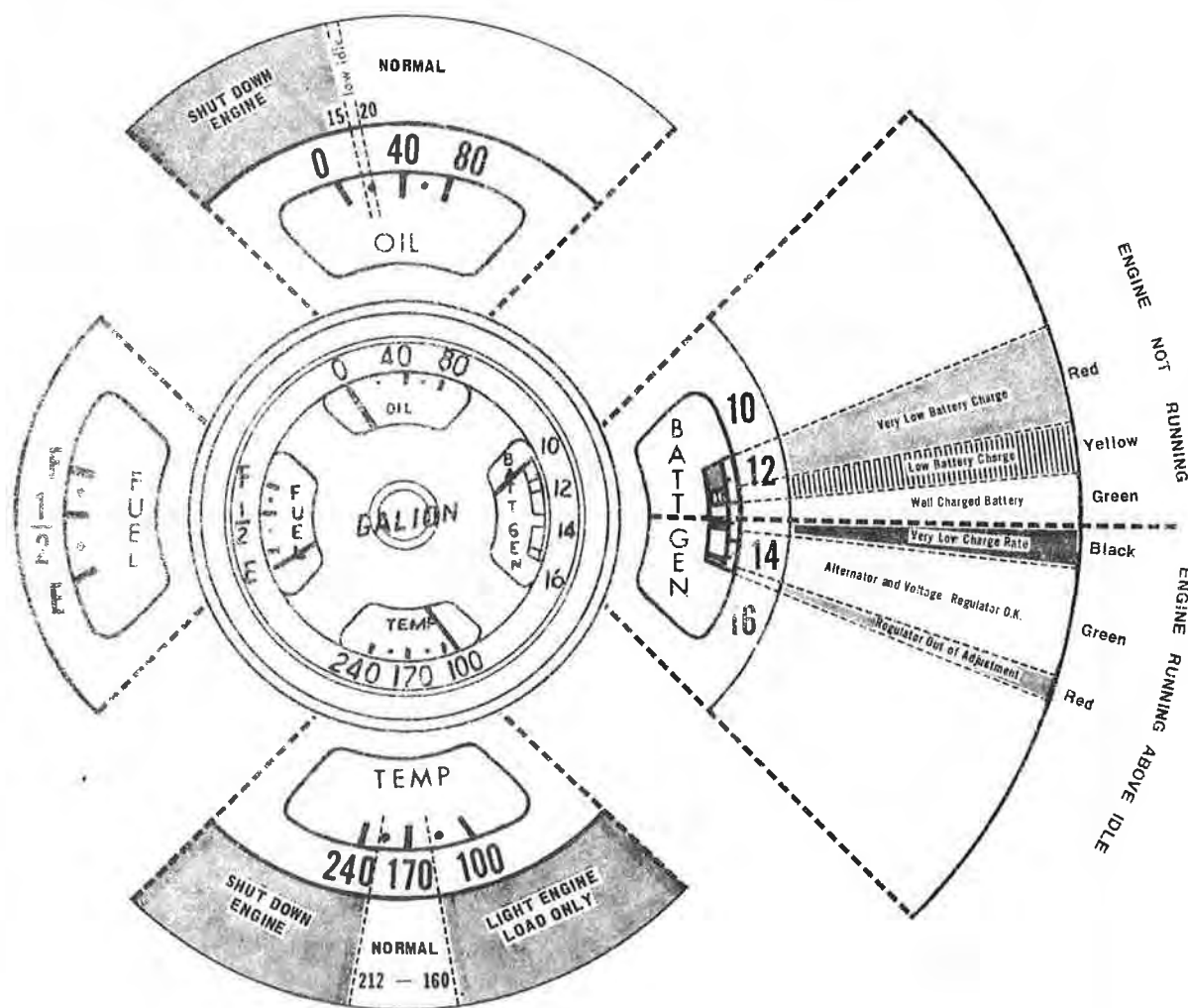
GAUGES

The gauges on the instrument console have been installed to aid in operating the crane at its rated capabilities. By observing them frequently, the operator can obtain an indication of the condition of the engine drive systems. If abnormal conditions are indicated he can make the necessary adjustments or repairs before excessive damage results. Additionally an hourmeter has been installed to aid the operator in caring for and maintaining the crane in accordance with the "Service Schedule" section in this manual.

CLUSTER GAUGE

Shutdown engine immediately if pressure does not reach minimum. Pressure will vary with engine RPM.

Keep fuel tank full when crane is idle to prevent condensation in tank. Use correct fuel as specified.



Allow engine to warm up to operating temperature before operating crane. Shutdown engine if temperature exceeds 212°F. (100°C.).

Figure 8



VOLTMETER

The VOLTMETER indicates the condition of the battery before or after operating the engine. An undercharged battery can be detected immediately, without being caught unprepared with a slow cranking situation. Overcharged batteries can be detected immediately without the need for a period of battery water usage checks. In addition, the voltmeter shows the amount of voltage being produced by the charging circuit.

BEFORE STARTING THE ENGINE -

Turn key switch ON and observe voltmeter. Dial pointer should be in the first GREEN zones (between 12 and 12.9 volts). If pointer indicates a voltage below this zone (less than 12 volts), the battery is undercharged.

A steady reading in the first RED zone (less than 11.2 volts) may indicate a need for a complete inspection of battery and/or charging system.

WHILE WARMED-UP ENGINE IS RUNNING ABOVE IDLE -

Make periodic checks of voltmeter while working the machine. Dial pointer should be in the second GREEN zone (between 13.2 and 15.2 volts).

If pointer indicates a voltage below this zone (less than 13.2 volts), adjustment of voltage regulator may be required. If voltage is less than 12.5 volts (within upper GREEN zone), alternator may be defective.

If pointer indicates a voltage higher than the second GREEN zone, in the bottom RED zone (greater than 15.2 volts), the voltage regulator is out of adjustment. Never allow voltage to exceed 16 volts, as serious damage to the electrical system may result.

AFTER SHUTTING ENGINE DOWN -

Again turn key switch ON and observe voltmeter. Dial pointer should be in the first GREEN zone (between 12 and 12.9 volts). If pointer indicates a voltage above this zone (in excess of 12.9 volts), restart engine and check voltage while engine is running above idle. Such a condition indicates an overcharged battery.

- NOTE:**
1. *It is suggested that only qualified trained personnel attempt to adjust voltage regulator.*
 2. *The voltage regulator is compensated to permit the charging system to produce more voltage during cold weather. Therefore, the voltmeter will show higher readings during cold weather than in warm weather.*
 3. *Depending on ambient temperature, the voltmeter may require 2 to 3 minutes to move to a steady reading after turning the key.*

**CONVERTER TEMPERATURE GAUGE**

Figure 9 illustrates the converter temperature gauge. It indicates the temperature of the hydraulic oil used in the travel drive system before it returns to the cooler sump. This temperature should not exceed 250°F (121°C). Temperature at or even near 250°F (121°C) may indicate a need for service because of improper cooler operation or other system malfunction.

Normal operating ranges for the various transmissions are as follows:

Allison:	180-220°F (82-104°C)
Clark 2420:	180-200°F (82-93°C)
Clark 18000 Series:	180-200°F (82-93°C)

HOURLMETER

Figure 10 illustrates the hourmeter. It records elapsed time of engine operation. This then corresponds to the amount of time that the machine is in operation. Pay particular attention to the amount of hours on machine so maintenance can be performed as described in periodic service section of this manual.

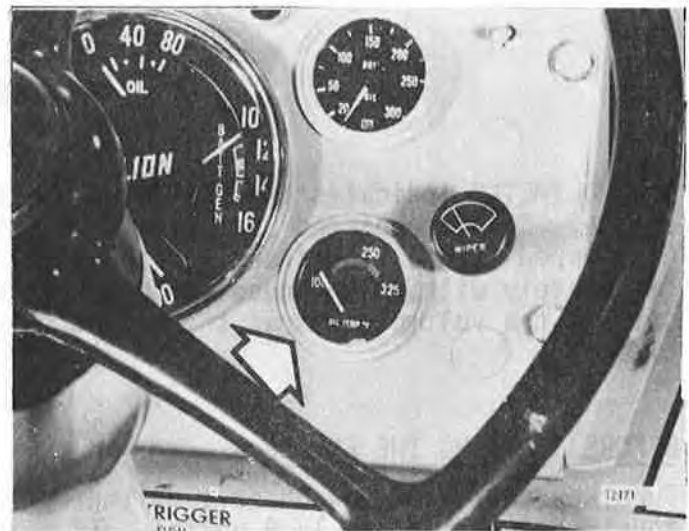


Figure 9



Figure 10

TRANSMISSION PRESSURE GAUGE

Figure 11 illustrates the transmission pressure gauge. It indicates the oil pressure in the charging pump that is used to supply the transmission clutch packs and oil flow through the torque converter.

See "Transmission Checks" section of this manual for further information.

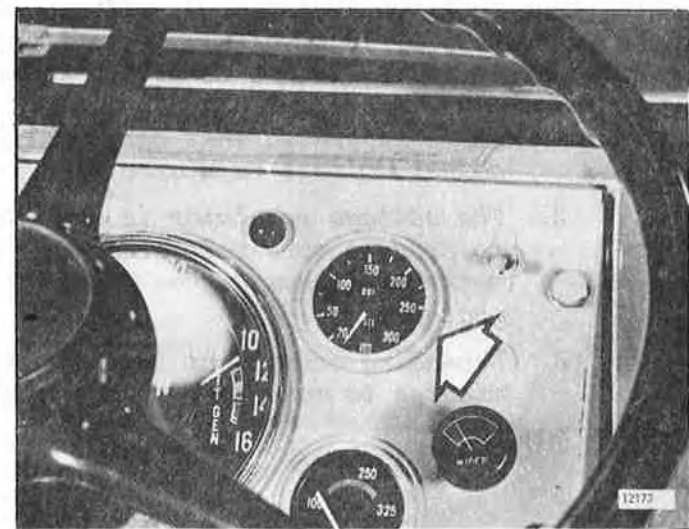


Figure 11



STARTUP PROCEDURE

IH GASOLINE

1. Set parking brake.
2. Move forward/reverse control lever to "NEUTRAL".
3. Depress accelerator pedal about 1/3 of its total travel, or move speed control lever to the rear about 1/3 and twist clockwise to lock.
4. Use choke as needed.
5. Turn ignition key switch clockwise to "START" position to engage cranking motor.



NEVER OPERATE THE CRANKING MOTOR FOR MORE THAN 30 SECONDS AT A TIME. IF THE ENGINE DOES NOT START, ALLOW THE CRANKING MOTOR TO COOL FOR 2 TO 3 MINUTES BEFORE CRANKING AGAIN.

After engine has started, allow engine speed control to remain in its starting position for 5 or 10 minutes; at which time a light load can be applied. After engine reaches normal operating temperatures, a full load may be engaged.

DETROIT DIESEL

1. Set parking brake.
2. Move forward/reverse control lever to "NEUTRAL".
3. Depress accelerator pedal about 1/3 of its total travel, or move speed control lever to the rear about 1/3 and twist clockwise to lock.
4. Push engine shutdown cable all the way in. Make sure emergency shutdown cable has not been activated (See Figure 12). Reset if necessary (See Figure 13).
5. Turn ignition key switch clockwise to "START" position to engage cranking motor.



NEVER OPERATE THE CRANKING MOTOR FOR MORE THAN 30 SECONDS AT A TIME. IF THE ENGINE DOES NOT START, ALLOW THE CRANKING MOTOR TO COOL FOR 2 TO 3 MINUTES BEFORE CRANKING AGAIN.

If the engine fails to start after four attempts, an inspection should be made to determine the cause. Perhaps at the last shutdown operation the emergency cable was pulled. If so, the trap on the intake manifold will have to be reset (See Figure 13).

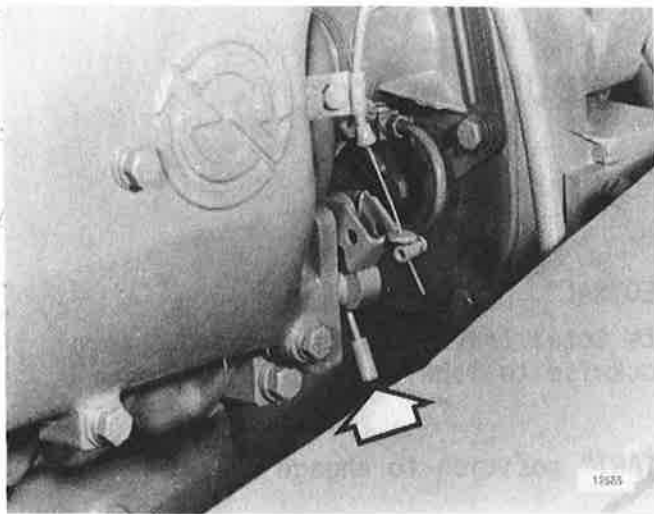


Figure 12
CORRECT SETTING

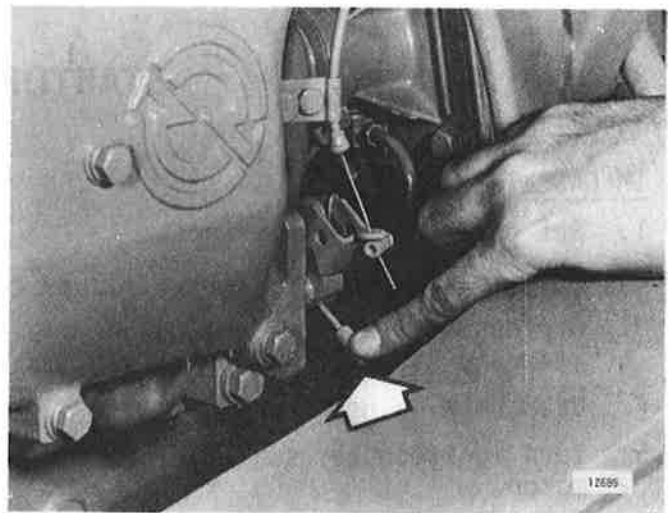


Figure 13
INCORRECT SETTING (RESET)

After engine has started, allow engine speed control to remain in its starting position for 5 to 10 minutes; at which time a light load can be applied. After engine reaches normal operating temperatures, a full load may be engaged.

DEUTZ DIESEL

1. Set parking brake.
2. Move forward/reverse control lever to "NEUTRAL".
3. Depress accelerator pedal about 1/3 of its total travel, or move speed control lever rearward about 1/3 of its total travel and twist clockwise to lock.
4. Turn ignition key switch clockwise to the "START" position.
5. Turn handle on glow plug/starter switch clockwise until engine begins firing.
6. When engine begins to run, release handle and switch will return to neutral.



NEVER OPERATE THE CRANKING MOTOR FOR MORE THAN 10 SECONDS AT A TIME. IF THE ENGINE DOES NOT START, ALLOW THE CRANKING MOTOR TO COOL FOR 2 OR 3 MINUTES BEFORE CRANKING AGAIN.

After engine has started, allow engine speed control to remain in its starting position for 5 to 10 minutes; at which time a light load can be applied. After engine reaches normal operating temperatures, a full load may be engaged.

CONT'D. NEXT PAGE -



SHUTDOWN PROCEDURE

IH GASOLINE

1. Place forward/reverse control lever in "NEUTRAL" and set parking brake.
2. Allow engine to idle for 3 to 5 minutes to avoid heat surge.
3. Turn ignition key switch counterclockwise to the "OFF" position.

DETROIT DIESEL

1. Place forward/reverse control lever in "NEUTRAL" and set parking brake.
2. Allow engine to idle for 3 to 5 minutes to avoid heat surge.
3. Turn ignition key switch counterclockwise to the "OFF" position and pull out engine shutdown cable.
4. After engine has stopped, push cable all the way in.



DO NOT USE EMERGENCY SHUTDOWN CABLE FOR ROUTINE SHUTDOWN. REGULAR USE OF THIS CABLE COULD CAUSE LOSS OF ENGINE PERFORMANCE.

DEUTZ DIESEL

1. Place forward/reverse control lever in "NEUTRAL" and set parking brake.
2. Allow engine to idle 3 to 5 minutes to avoid heat surge.
3. Turn ignition key switch counterclockwise to the "OFF" position.
4. Pull out engine shutdown cable.
5. After engine has stopped push cable all the way in.



APPLICATION

Ratings shown on the CRANE LOAD CHART (mounted on instrument panel cover) are MAXIMUM allowable loads, NOT practical working loads. Ratings (shown on chart) above the heavy line are based on the machine's hydraulic or structural competence and not on the machine's stability.

Operating radius is the horizontal distance from the axis of rotation, before loading, to the vertical hoist line of tackle with load applied.

Weights of hooks, hook block, slings and other load handling devices, except hoist rope, shall be considered a part of the load.

Practical working loads depend on how level machine is, supporting surface, wind and other factors affecting stability. Hazardous surroundings, experience of personnel and proper handling must be taken into account by the operator.

Positioning or operation at radii and boom or jib lengths beyond the maximums and minimums shown (on load chart) is not intended or approved.

The instructions that follow will help you get maximum efficiency from this crane.



NEVER EXCEED LOAD CHART CAPACITIES.

- I. LIFTING CAPACITIES: This crane is rated at a 10' (3.048 m) radius with its maximum payload (see Illustration I, page 20). Increasing the radius decreases the amount of payload. The radius can be changed by raising or lowering the boom or by extending or retracting the telescopic boom section or sections.
 - II. LIFTING UNKNOWN WEIGHT: When loads which are not accurately known are to be lifted, the person responsible for the job shall ascertain that the weight of the load does not exceed the CRANE LOAD RATING CHART at the radius at which it is to be lifted.
- NOTE:** *Always use outriggers for maximum lifting stability.*
- III. LIFTING KNOWN WEIGHT: The load chart is the governing factor when lifting known weights. The load chart is rated with the outriggers all the way down, until the tires clear the ground. It is recommended that you feel your way into any lift as a precaution against tipover. Whenever possible, lift and swing payloads between the outrigger pad area (see Illustration II, page 20). This can be done by positioning the front of the crane as shown in Illustration II. This illustration shows a payload on top of a building being lowered to the ground. Payload is picked up at point (A), swung to the right and lowered to (B).
 - IV. PICK AND CARRY: The Galion Crane has the ability to pick and carry payloads without added labor. There are no manual lockouts on the rear axle. The oscillation is controlled with elastomeric mounts between the main frame and rear axle supports. The crane is elastomeric mounted in two distinct areas: one - the elastomeric rear axle mounts, two - the tires. Rear axle mounts will stretch and compress when hoisting a payload which is a normal operating condition. It is most important to keep the tires at rated maximum pressure. Underinflated tires will cause unnecessary boom movement when hoisting a payload. Longer radius and heavier loads will magnify these conditions. We recommend when traveling with a suspended payload, you evaluate the prevailing conditions and determine the safety precautions required in each individual case. The following factors must be considered before attempting to pick and carry a load.



1. Align the boom with the forward direction of machine travel. Maintain this boom position when turning the machine. Turn only when necessary, at the slowest speed, and at a wide turning radius (see Illustration III).
2. Use the shortest boom length possible.
3. Keep the load as close to the ground as conditions will permit.
4. Provide tag lines to prevent load from pendulating. This can cause a change in radius. A change in radius could exceed the load chart rating or cause a tipover condition.
5. Govern travel speed to suit conditions.
6. Avoid sudden starts and stops.
7. Never travel with outrigger lowered, as they may catch an obstruction.

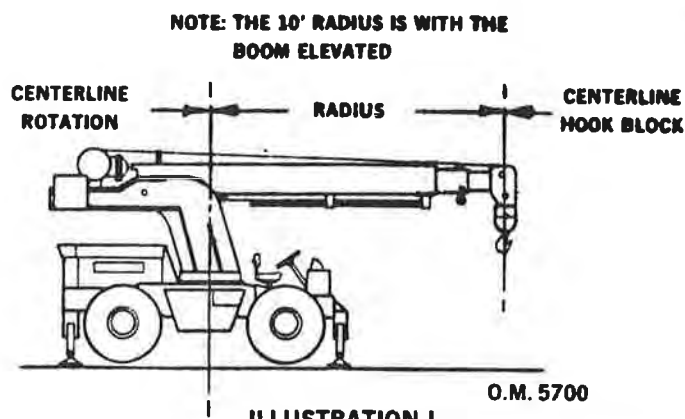


ILLUSTRATION I

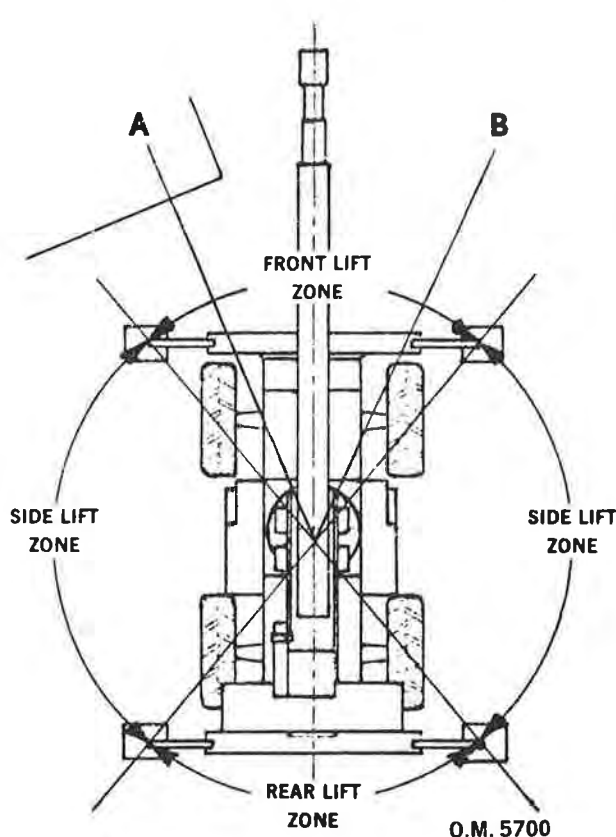


ILLUSTRATION II

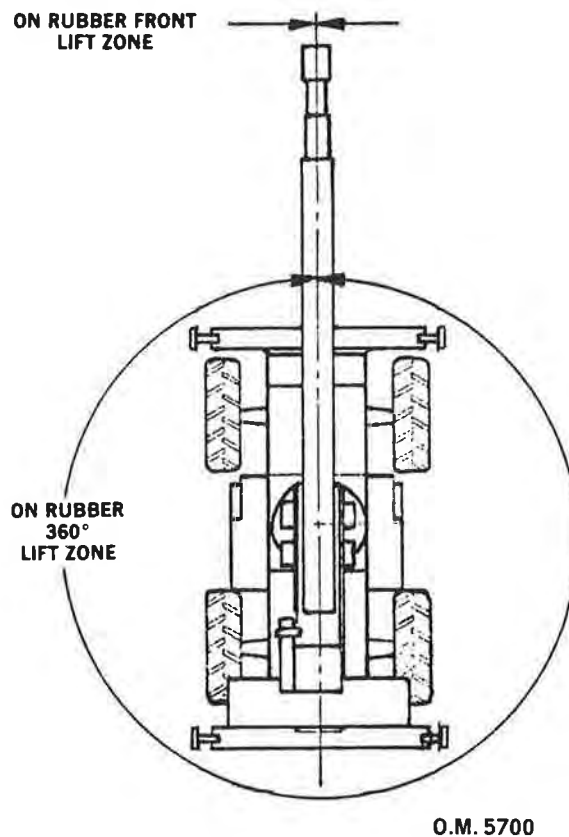


ILLUSTRATION III



LIFTING WITH SLING

PERCENTAGE OF WORKING LOAD -

When hoisting with slings, the line drawings below represent various angles hooked to payload. The percentage represents the amount of full safe working load at various angles. Safe working load will decrease as the angle increases.

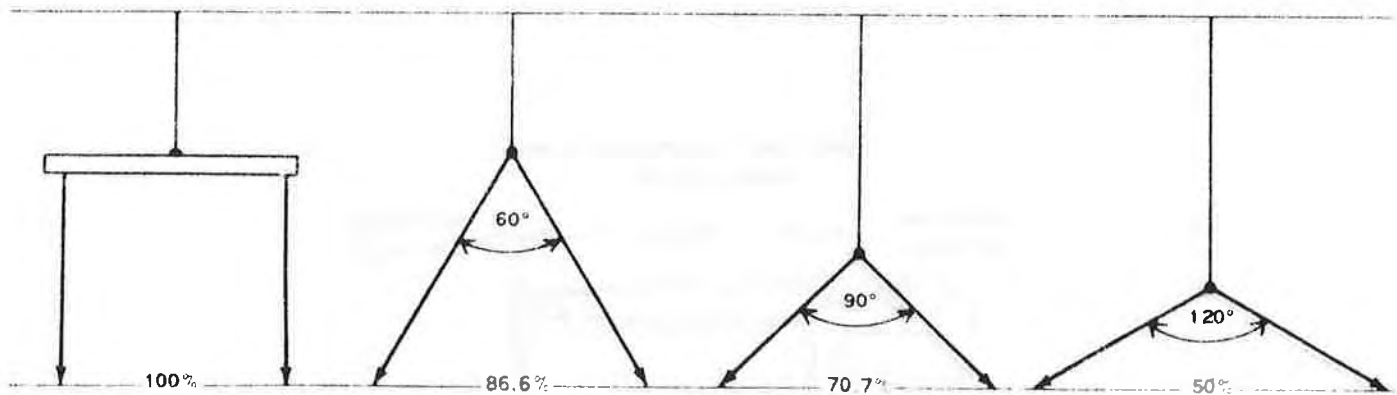


Figure 14



STANDARD HAND SIGNALS

STANDARD HAND SIGNALS FOR CONTROLLING CRANE OPERATIONS

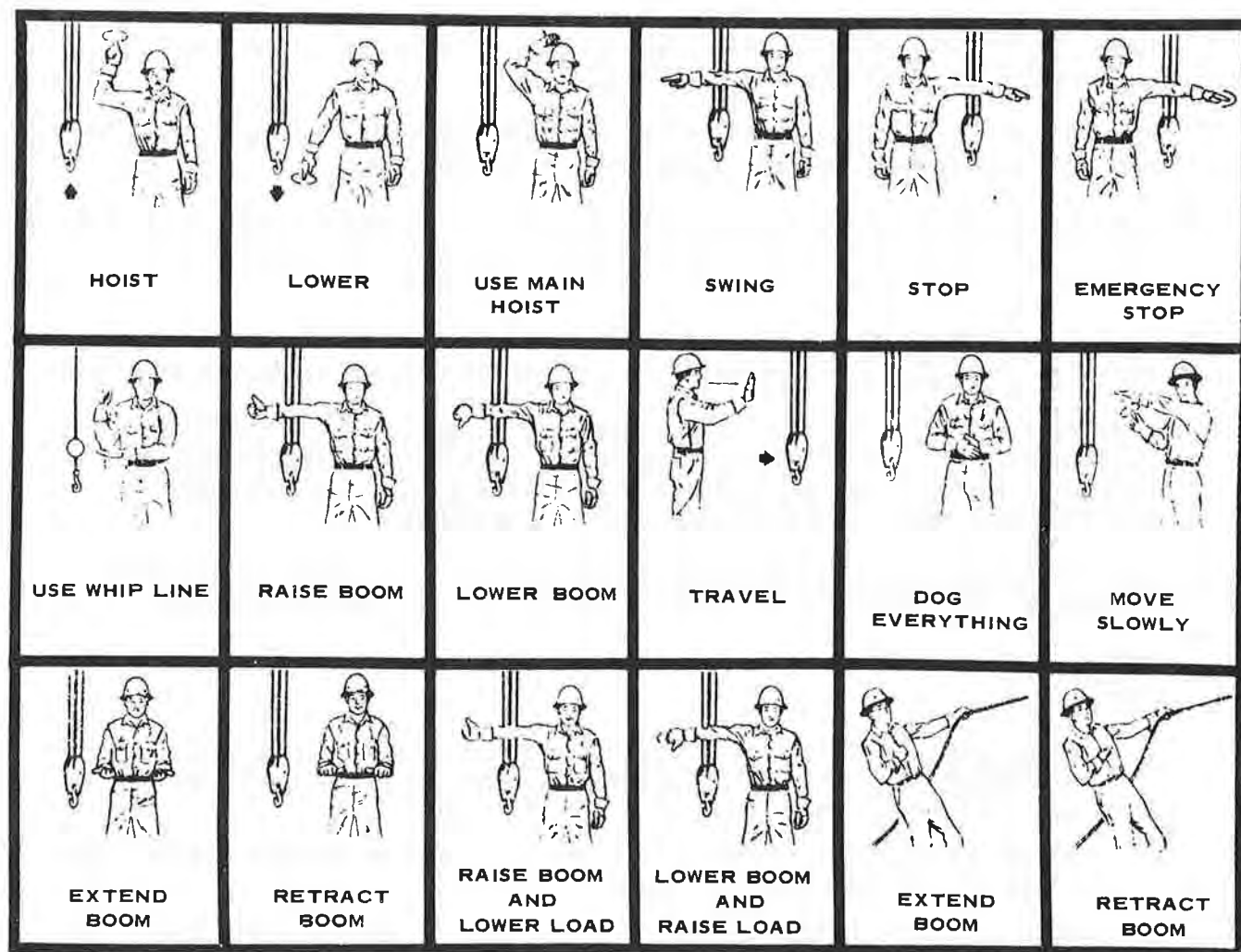


Figure 15



OPERATION UNDER UNUSUAL CONDITIONS

COLD WEATHER PRECAUTIONS

If crane is to be operated in cold weather temperatures, certain precautions must be taken to assure continued normal operation. The following paragraphs detail checks to be made to be certain the crane is capable of operating at these temperatures.

1. Lubricate entire crane according to Periodic Service Table and Chart in this manual or Lubrication Decal on machine.
2. Keep engine in best possible mechanical condition to assure easy starting and good performance during adverse weather conditions.
3. Use engine oil of the proper specifications for the temperatures expected. Refer to the "Lubrication Specifications" section of engine manual for details.
4. Check cooling system for correct antifreeze solution for lowest temperature expected. Carefully inspect cooling system and correct or report any leaks.
5. Keep fuel tank full at all times. Drain condensation from tank before and after operation. To eliminate clogging of fuel filters due to wax crystal formation in the fuel, be sure that the fuel used has a cloud point specification below the lowest expected temperature.
6. Keep batteries fully charged to prevent freezing. If water is added to batteries, run engine at least one hour to mix electrolyte solution.
7. Start engine and allow it to reach normal temperature before applying load.
 - a. If mud and snow collects and freezes on any of the moving parts while crane is idle, apply heat to thaw the frozen material before attempting to operate crane.
 - b. Operate hydraulic units with care until they have reached a temperature to enable them to operate normally.
 - c. Check all crane operations to be sure they are in operating condition.
8. An extra outer air filter element should be kept in the operator's cab to replace element that could become iced and cause restricted air flow to engine.
9. If a cold weather starting aid is to be used, it is recommended that reference be made to Engine Operator's Manual for proper use.
10. At the end of work day, clean off all mud, snow and ice to prevent freezing. Cover crane with tarpaulin if possible. Keep ends of tarpaulin from freezing to ground.



OPERATION IN EXTREME HEAT

Continuous operation of crane in high temperatures may cause the crane to over-heat. Continuously observe engine and transmission temperatures and stop crane for a cooling-off period whenever necessary.

1. Make frequent inspections and servicings of the fan and radiator. Keep coolant level one inch (35.4 mm) from top of radiator. Check grills and radiator fins for accumulation of dust, sand and insects which could block the cooling passages.
 - a. Formation of scale and rust in cooling system occurs more rapidly in extremely high temperatures. Change antifreeze each year to keep corrosion inhibitor at full strength.
 - b. If necessary, flush cooling system periodically to keep passages clean. Avoid use of water with a high alkali content which increases scale and rust formation.
2. Check level of electrolyte daily. Keep electrolyte above plates to prevent damage to batteries. Use a slightly weaker electrolyte solution in hot climates. Dilute 1.280 specific gravity electrolyte as issued to 1.200 to 1.240 specific gravity reading a full charge. Recharge batteries at 1.160 specific gravity. Batteries self-discharge at a higher rate if left standing for long periods at high temperatures. If crane is to stand for several days, remove batteries and store in a cool place.



DO NOT STORE ACID-TYPE STORAGE BATTERIES NEAR STACKS OF TIRES; THE ACID FUMES HAVE A HARMFUL EFFECT ON RUBBER.

3. Service fuel system as directed in the "Preventive Maintenance" section of this manual. Check for water content before filling fuel tank. High temperatures and cooling off cause condensation in storage drums.
4. Lubricate as specified in Periodic Service Chart and Table in this manual or Lubrication Decal on machine.
5. Do not park crane in sun for long periods of time. When practical park crane under cover to protect it from sun, dirt and dust.
 - a. Cover inactive crane with tarpaulin if no suitable shelter is available. Protect engine compartment, transmission and hydraulics from entrance of dust.
 - b. In hot, damp climates, corrosive action will occur on all parts of the crane and will be accelerated during the rainy season. Rust and paint blisters will appear on metal surfaces and fungus growth on other surfaces.
 - c. Protect all unfinished exposed surfaces with a film of preservative lubricating oil. Protect cables and terminals with ignition insulation compound. Apply paint or suitable rust preventative to damaged surfaces to protect from rust and corrosion.



OPERATION IN DUSTY OR SANDY AREAS

Operation of the crane may cause dust in almost any area. Therefore, when operating in predominantly dusty or sandy areas, additional precautions must be taken.

1. Keep cooling system fins and cooling areas clean. Blow out with compressed air, if possible, as often as necessary.



WEAR GOGGLES WHEN USING COMPRESSED AIR.

2. Use care when servicing fuel system to prevent dust and sand from entering the tank.
3. Service the air cleaner at frequent intervals, check air restriction indicator daily and keep dust cup and dust valve clean. Prevent dust and sand from entering engine parts and compartments as much as possible.
4. Lubricate and perform services outlined on current lubrication chart and periodic service section of this manual at much shorter intervals than normal. Clean all lubrication fittings before applying lubricant. Sand mixed with lubricant becomes very abrasive and speeds wear on parts.
5. Protect crane from dust and sand as much as possible. Park crane under cover or protect with tarpaulin to keep dust and sand from damaging unit.

OPERATION IN RAINY OR HUMID CONDITIONS

Operation under rainy conditions is similar to that in "Extreme Heat".

1. Keep all exposed surfaces coated with preservative lubricating oil. Pay particular attention to damaged or unpainted surfaces. Cover all paint cracks and chip marks as soon as possible to prevent corrosive effects.



OPERATION IN SALT WATER AREAS

The corrosive effect of salt water and salt water spray is very extensive. When operating in salt water areas, observe the following precautions:

1. When exposed to salt water, dry crane thoroughly and rinse with fresh water as soon as possible.
2. Keep all exposed surfaces coated with preservative lubricating oil. Pay particular attention to damaged paint surfaces.
3. Keep all painted surfaces in good repair.
4. Lubricate crane as prescribed on lubrication chart on machine or Periodic Service Table and Chart in this manual. Shorten lubricating intervals for parts subject to exposure to salt water.

OPERATION AT HIGH ALTITUDE

Normally, operation of crane at high altitudes will be as outlined in "Cold Weather Precautions".

1. Check engine operating temperature for evidence of overheating. The pressure cap on radiator must make a perfect seal to maintain coolant pressure in the system.



OPERATION OF AUXILIARY/ACCESSORY EQUIPMENT

COLD WEATHER STARTING AID

Illustrated in Figure 16 is an ether starting aid device.

Starting aids should be used at temperatures of or below 32°F. (0°C.).

Instructions below are from the manufacturer on usage of this starting aid.

STARTING PROCEDURE:

1. Pull "QUICK-START" knob and hold for two to three seconds filling valve chamber.
2. Push knob in again allowing two to three seconds to empty valve chamber.
3. After a two second waiting period, engage starter.

PREVENTIVE MAINTENANCE:

Periodically remove cylinder, oil valve and control cable assembly:

1. Use care by wiping dirt from valve inlet when removing cylinder to prevent dirt from entering valve.
2. Check valve gasket for damage and replace if needed.
3. With cylinder removed, actuate system in order to distribute lubricant.

When replacing empty cylinder follow instructions on cylinder.

NOTE: Empty cylinder weight is 17 ounces (481.94 grams), full cylinder weight is 37 ounces (1048.93 grams).

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

Periodically test unit for functioning. Disconnect tube from atomizer and remove atomizer. Reassemble and activate system.

If system is subjected to moisture, spray valve and control cable with a plastic coating.

NOTE: Installation instructions are included with starting aid.

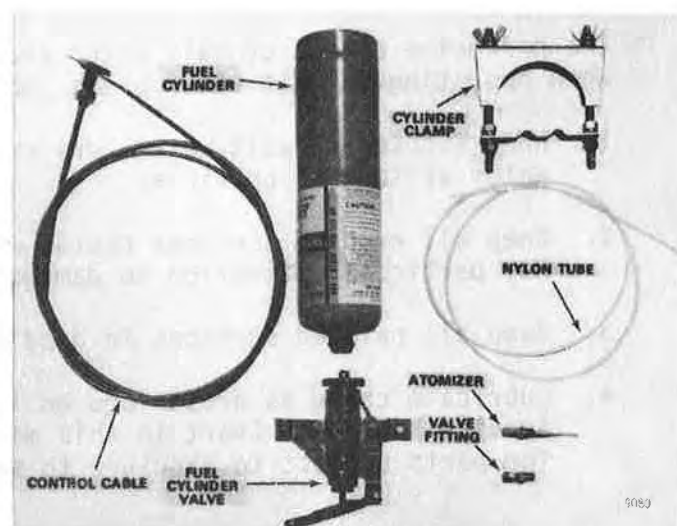


Figure 16



| THREE SECTION POWER BOOM MANUAL EXTENSIONS

The three section power boom has been designed so that an 8', 18' or 20' Manual Boom Extension can be used to provide additional boom length and reach.



EXTREME CARE SHOULD BE TAKEN TO PREVENT BODILY INJURIES WHEN HANDLING AND USING THESE ACCESSORIES. FOLLOW THE LOAD RATINGS AND RECOMMENDATIONS LISTED ON THE "CRANE LOAD RATING CHART" LOCATED ON INSTRUMENT PANEL COVER WHEN USING THESE ACCESSORIES.

The three section power boom head block can be fitted to the 8' and 18' Manual Extensions. The 20' Manual Extension comes with its own head block.

When manual boom extensions are being used the crane should be reeved as follows:

- 8 Ft. (2.44 m) Manual Extension - Three Part Line
- 18 Ft. (5.49 m) Manual Extension - Three Part Line
- 20 Ft. (6.10 m) Manual Extension - Single Part Line

8 FT. (2.44 m) MANUAL EXTENSION

The following is one method of extending and stowing the 8 Ft. (2.44 m) Manual Extension if the crane has been equipped with this accessory.

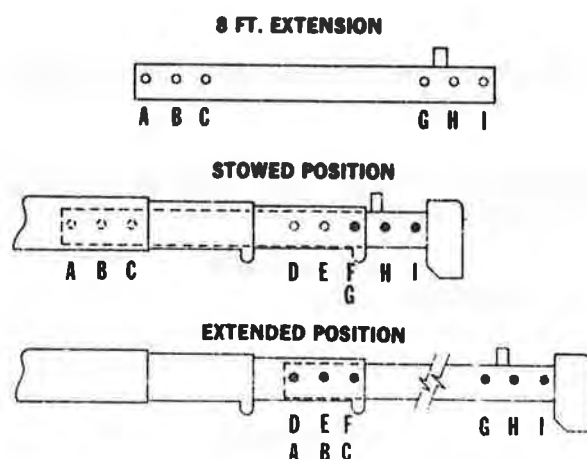


ILLUSTRATION IV

EXTENDING FROM STOWED POSITION -

1. Position crane with head block 10' (3.05 m) from support.
2. Place forward and reverse lever in "NEUTRAL". Set parking brake. Using outriggers, raise all four tires off the ground.



EXTENDING FROM STOWED POSITION - Continued

3. Crowd boom out 10' (3.05 m) and anchor head block to support approximately 12' (3.66 m) above the ground.
4. Remove boom lock pin from holes "F" and "G". See Illustration IV "Stowed Position".
5. Retract boom slowly. Have another person let the operator know when holes "D", "E" and "F" in the first extension align with holes "A", "B" and "C" in manual extension. Install three boom lock pins. See Illustration IV "Extended Position".



DO NOT RETRACT BOOM TO POINT WHERE MANUAL EXTENSION WILL FALL OUT OF BOOM.

6. Install boom lock pin in hole "G" to fully secure head block.
7. Install cotter pins in boom lock pins. Release head block from support.

STOWING FROM EXTENDED POSITION -

1. Remove four boom lock pins from holes "A" thru "F" and "G".
2. Using low line speed control lever, two-block crane and slide manual extension in till hole "G" aligns with hole "F". Install boom lock pin and cotter pins.

18 FT. (5.49 m) MANUAL EXTENSION

The following is one method of extending and stowing the 18 Ft. (5.49 m) Manual Extension if the crane has been equipped with this accessory.

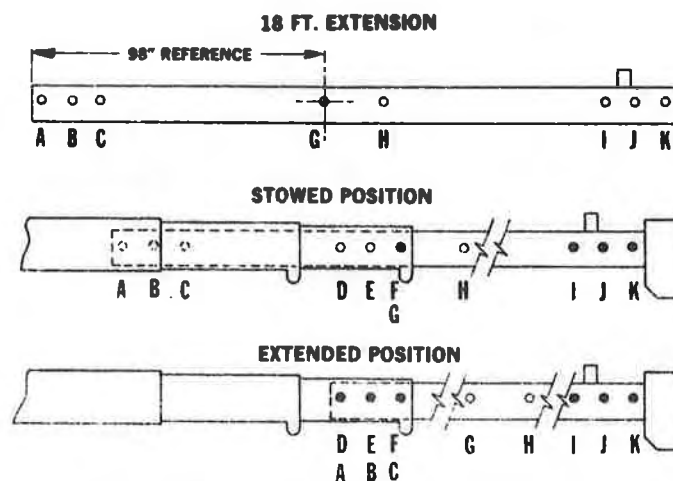


ILLUSTRATION V



EXTENDING FROM STOWED POSITION -

1. Position crane with head block 10' (3.05 m) from support.
2. Place forward and reverse lever in "NEUTRAL". Set parking brake. Using outriggers, raise all four tires off the ground.
3. Crowd boom out 10' (3.05 m) and anchor head block to support approximately 12' (3.66 m) above the ground.
4. Remove boom lock pin from holes "F" and "G". See Illustration V "Stowed Position".
5. Retract boom slowly. Have another person let the operator know when holes "D", "E" and "F" in the first extension align with holes "A", "B" and "C" in manual extension. Install three boom lock pins. See Illustration V "Extended Position".



DO NOT RETRACT BOOM TO POINT WHERE MANUAL EXTENSION WILL FALL OUT OF FIRST EXTENSION.

6. Install cotter pins in boom lock pins. Release head block from support.

STOWING FROM EXTENDED POSITION -

1. Remove three boom lock pins from holes "A" thru "F".
2. Using low line speed control lever, two-block crane and slide manual extension in till hole "G" aligns with hole "F". Install boom lock pin and cotter pins.

20 FT. (6.10 m) MANUAL EXTENSION

The 20 Ft. (6.10 m) Manual Extension is extended and stowed in the same manner as the 18 Ft. (5.49 m) Manual Extension.

The "MAXIMUM" allowable load that can be lifted by this extension is 3000 Lbs. (1 361 kg). Deduct 600 Lbs. (272 kg) plug the weight of any load handling devices to determine the safe working load at any given radius. Refer to "CRANE LOAD RATING CHART" located on instrument panel cover.



JIB AND GANTRY

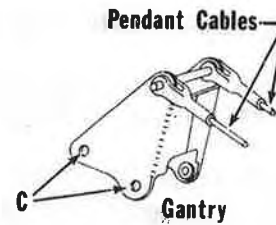
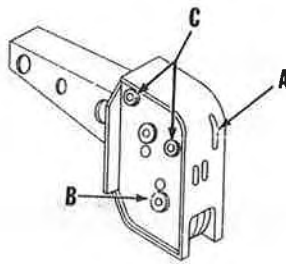


Figure 17

The following procedure applies to the 15 Ft. (4.57 m) jib and gantry.

1. Drop hook block and run single part line through hole "A" in head block.
2. Remove self-locking nut from lower sheave pin "B". Align long sheave pin with short pin and tap through head block, replacing short pin with long pin. Center long pin in head block.
3. Install jib on lower sheave pin and tighten mounting clamps. Install and tighten nut on sheave pin.
4. Set gantry in place and install two pins at "C". Key pins in place.
5. Install each pendant cable clevis over each gantry ear. Pin and key in place.
6. Lift jib to horizontal position and install pendant cables on jib sheave pin. Use adjustment links to angle jib.
 - 0° Jib angle - No adjustment links
 - 15° Jib angle - One pair adjustment links
 - 30° Jib angle - Two pair adjustment links
7. Single part line and weighted hook block must be used with jib. Maximum design load for jib is 4,000 lbs. (1 814 kg).



15 FT. (4.57 m) STOWABLE JIB & GANTRY

Procedure for extension of 15 Ft. (4.57 m) jib:

1. Reeve to single part line and boom over side of crane.
2. Install hinge pins through jib "A".
3. Loop wire rope around cable guides "B".
4. Thread wire rope through jib sheave "C".
5. Fasten wire rope to cable anchor "D".
6. Release pendant cable "E" for stowed position.
7. Winch in (hoist) carefully to release tension on three pins "F". Remove pins.
8. Raise boom and pay out wire rope until jib hangs free (vertical).
9. Remove wire rope from cable anchor "D".
10. Crowd out and lower boom until jib touches ground. Retract so that jib can "unfold" from boom. If required raise opposite side of crane with outriggers to attach pendant cables "G".
11. Reposition crane and attach weighted hook block. To return jib to stowed, reverse procedure.

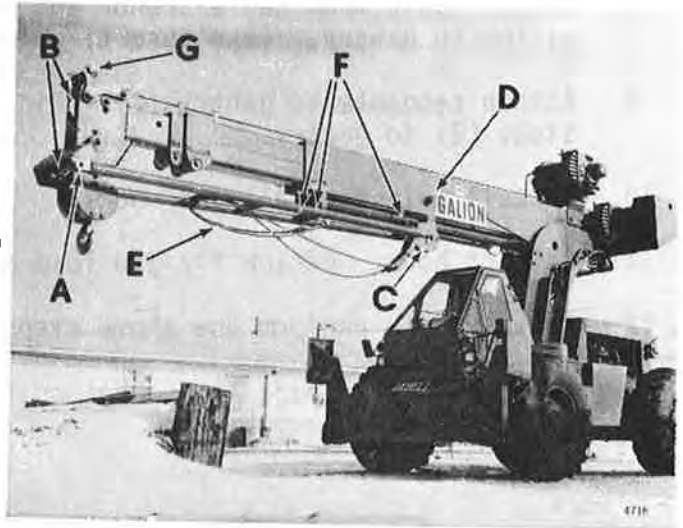


Figure 18

NOTE: Refer to safe load chart located on instrument panel cover for properly jib load capacities.

20FT. (6.10 m) STOWABLE JIB & GANTRY (USED ONLY WITH 4 SECTION POWER BOOM)

Procedure for extension jib:

1. Position boom over side of crane, lower hook block (1) to ground, remove wedge, wire rope and reeve to single part line.
2. Spool wire rope over head block (2) fly jib sheave and attach at cable anchor behind over center check valve (3).
3. Remove hair pins from pendant cable anchors (4) at front mount. Allow pendant cables to hang free.
4. Reposition gantry (5) by removing pins and install into proper hole for working position.
5. Install pins into bifurcated ends of jib (6).

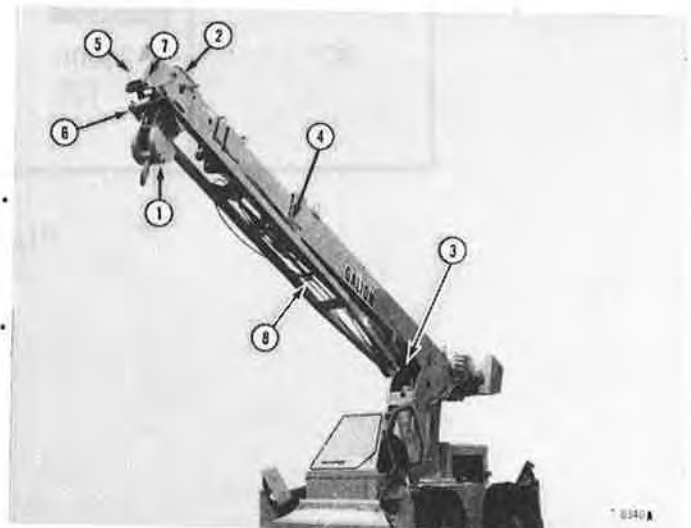


Figure 19



6. Remove jib retainer hair pins boom up 30° and crowd out approximately 6 inches (152.40 mm). This will free the fly jib from its mounts.
7. Winch out line and carefully lower jib so it is hanging perpendicular to ground.
8. Remove cable from cable anchor and reel through underside of jib sheave and attach to gantry. (see insert) Winch in and "lift" jib into position.
9. Attach pendants to gantry (7). Pin in place. Remove wire rope and attach jib stops (8) to gantry.
10. Install weighted ball and hook.
11. Retract boom. Attach fly jib load chart to cowl on instrument panel.
12. To store jib perform the above steps in reverse procedure.

NOTE: Refer to safe load chart on instrument panel cover for proper fly jib load capacities.

20 FT. (6.10 m) JIB CAPACITIES - LOAD IN LBS. (kg.)			
BOOM ANGLE	JIB ANGLE		
	0 DEGREES	15 DEGREES	30 DEGREES
70°	6,000 (2 722)	4,500 (2 041)	3,000 (1 361)
60°	5,300 (2 404)	3,400 (1 542)	2,500 (1 134)
50°	3,900 (1 769)	2,700 (1 225)	2,150 (975)
40°	3,000 (1 361)	2,350 (1 066)	1,850 (839)
30°	2,500 (1 134)	2,000 (907)	1,500 (680)

Figure 20



FIRE EXTINGUISHER

Install, inspect maintain and test in accordance with the standard of the National Fire Protection Association, titled "Portable Fire Extinguishers", NFPA No. 10, suitable for use from minus 40°F to plus 120°F (minus 40°C to plus 49°C).

This extinguisher meets DOT requirements tested to 525 PSI (3.61 MPa).

TO OPERATE:

Hold upright - pull pin - press lever - direct discharge at base of flame with side to side motion.

MAINTENANCE:

Inspect monthly (or at more frequent intervals when circumstances require). Recharge if weight is less than 9 Lbs. 0 Oz. (4.08 kg) or pressure is below operating range. Check that nozzle is unobstructed and seal wire is intact.

NOTE: *After use, recharge immediately.*

RECHARGE:

Invert extinguisher - press lever to release pressure - remove valve - fill with 5 Lbs. (2.27 kg) of general triplex dry chemical - clean valve, valve stem, O-ring, seal and threads. Reassemble valve and screw into cylinder hand tight - remove nozzle and replace with moisture trap - connect to a pressure supply of dry air or nitrogen - press lever and pressurize to 175 PSI (1.21 MPa) - release lever - remove pressure supply - remove moisture trap and replace with nozzle - reinsert lock pin and replace seal wire.

RECORDS:

Record inspection, maintenance and recharge dates on attached tag.



DO NOT RECHARGE WITH ANY MATERIALS EXCEPT THOSE INDICATED IN RECHARGE INSTRUCTIONS.

PRESS LEVER ONLY IN CASE OF FIRE.

PARTIAL DISCHARGE WILL CAUSE PRESSURE LOSS.

DO NOT RECHARGE EXTINGUISHER IF DAMAGED OR CORRODED.

THIS EXTINGUISHER TO BE FITTED WITH A DISCHARGE NOZZLE MARKED CP-196.

WEIGHT:

Minimum full weight 9 Lbs. 0 Oz. (4.08 kg)

Average empty weight 4 Lbs. 3 Oz. (1.90 kg)

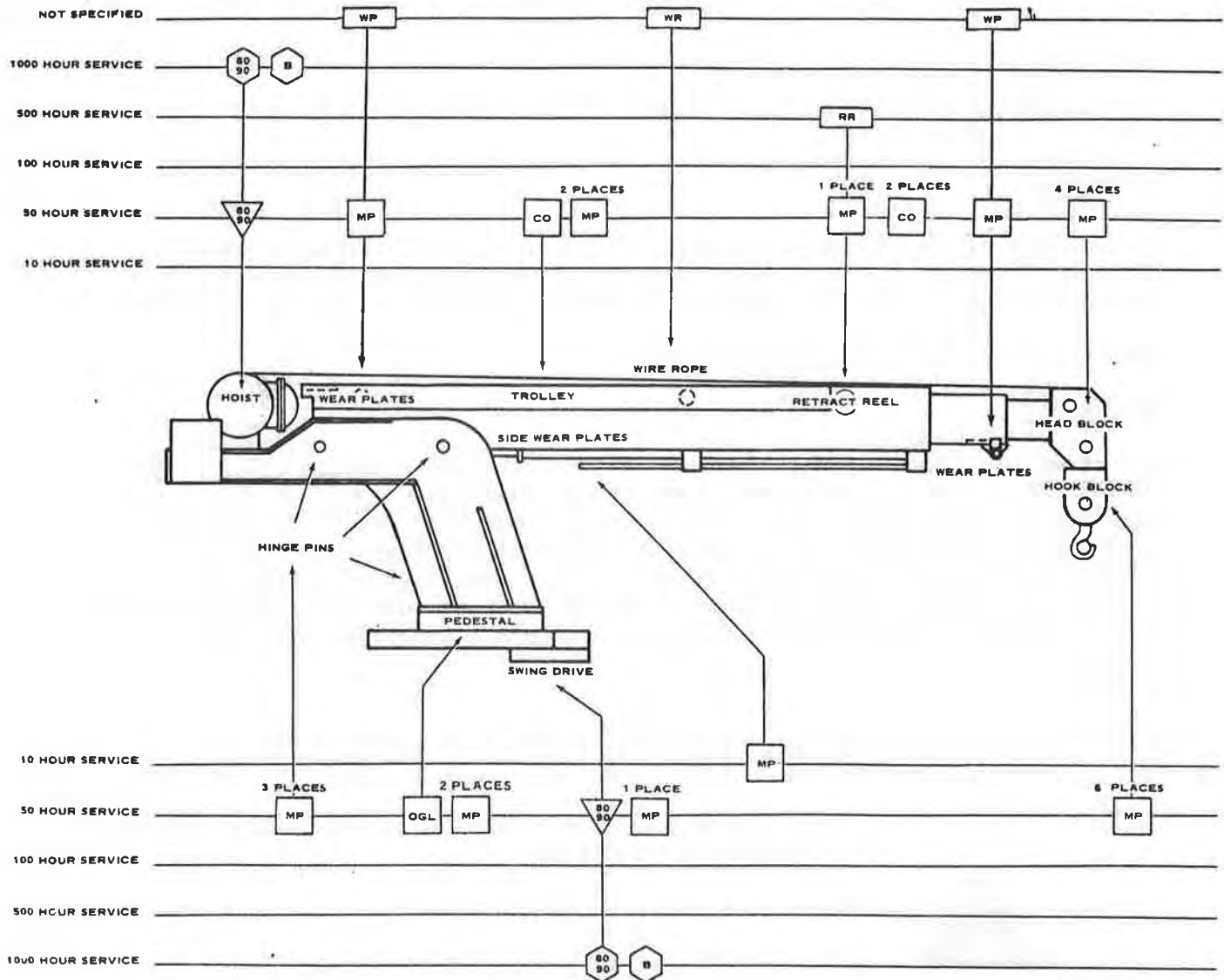
NOTE: *The above recommendations and operational instructions were taken from the label attached to the fire extinguisher. Always refer to the extinguisher instructions for up-to-date instructions.*



MAINTENANCE INSTRUCTIONS

LUBRICATION

PERIODIC SERVICE CHART - BOOM



O.M. 5700

NOTE: See appropriate Lubrication Specifications Shop Manual for the latest specifications and recommendations.

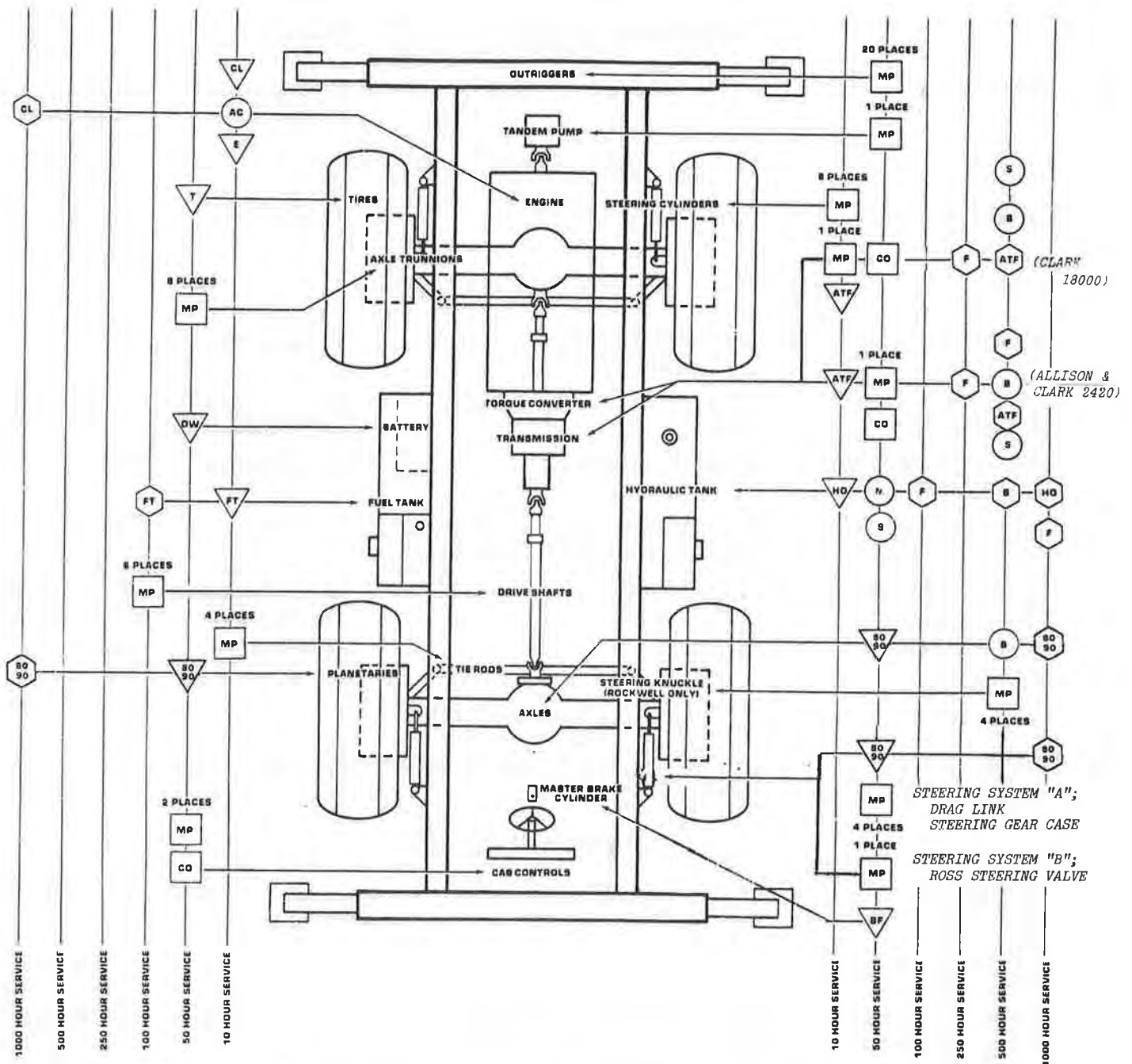
B	BREATHER	MP	MULTI-PURPOSE LITHIUM BASE GREASE	▽	CHECK & MAINTAIN LEVEL
CO	CAN OIL	OGL	OPEN GEAR LUBRICANT	□	LUBRICATE ZERK OR SURFACE
EP 80	EXTREME PRESSURE (SAE 80) MULTI-PURPOSE GEAR LUBRICANT	RR	RETRACT REEL - SEE SECTION THIS MANUAL	⬡	DRAIN & REFILL OR REMOVE & REPLACE
EP 90	EXTREME PRESSURE (SAE 90) MULTI-PURPOSE GEAR LUBRICANT	WP	WEAR PLATES - SEE SECTION THIS MANUAL	○	CLEAN
		WR	WIRE ROPE - SEE SECTION THIS MANUAL	▭	CHECK & ADJUST

O.M. 5700

**PERIODIC SERVICE TABLE - BOOM**

COMPONENTS	SERVICE	APPROXIMATE CAPACITY	TYPE OF LUBRICANT
DAILY/10 HOUR SERVICE			
SIDE WEAR PLATES, LOWER BOOM	CLEAN AND LUBRICATE	AS REQUIRED	MP
WEEKLY/50 HOUR SERVICE			
GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW	AS REQUIRED	MP
LEVEL PLUG, HOIST GEAR CASE	CHECK LEVEL. FILL TO LEVEL PLUG	10 U.S. QUARTS (9 LITERS)	EP 80 OR 90
WEAR PLATES, BOOM EXTENSIONS	CLEAN AND LUBRICATE	AS REQUIRED	MP
GEAR & PINION PEDESTAL DRIVE	AS REQUIRED - ROTATE BOOM 360° DAILY FOR PROPER LUBRICANT DISTRIBUTION		OGL
LEVEL PLUG, SWING DRIVE CASE	CHECK LEVEL. FILL TO LEVEL PLUG	14 U.S. QUARTS (13 LITERS)	EP 80 OR 90
TROLLEY, POWER BOOM	LUBRICATE	AS REQUIRED	CO
500 HOUR SERVICE			
SPRING MOTOR, RETRACT REEL	SEE "RETRACT REEL-SPRING MOTOR" SECTION OF THIS MANUAL FOR SERVICING		
1000 HOUR SERVICE			
DRAIN PLUG, HOIST GEAR CASE	DRAIN AND REFILL TO LEVEL PLUG	10 U.H. QUARTS	EP 80 OR 90
BREATHER, HOIST GEAR CASE	CLEAN		
DRAIN PLUG, SWING DRIVE GEAR CASE	DRAIN AND REFILL TO LEVEL PLUG	14 U.S. QUARTS	EP 80 OR 90
BREATHER, SWING DRIVE GEAR CASE	CLEAN		
NOT SPECIFIED			
WIRE ROPE	AS REQUIRED (SEE "WIRE ROPE" SECTION OF THIS MANUAL FOR SERVICING)		
WEAR PLATES	AS REQUIRED (SEE "WEAR PLATES AND PADS" SECTION OF THIS MANUAL FOR SERVICING)		

PERIODIC SERVICE CHART - CHASSIS



AC	AIR CLEANER - SEE SECTION IN GALION OPERATOR'S MANUAL	DW	DISTILLED WATER	F	FILTER(S)		CHECK • MAINTAIN LEVEL
ATF	AUTOMATIC TRANSMISSION FLUID (ALSO C2 OR DEXRON)	E	ENGINE DIPSTICK - SEE ENGINE MANUAL	FT	FUEL TANK		LUBRICATE ZERK OR SURFACE
B	BREATHER	EP 80	EXTREME PRESSURE (SAE 80) MULTI-PURPOSE GEAR LUBRICANT	HO	HYDRAULIC OIL		DRAIN • REFILL OR REMOVE • REPLACE
BF	BRAKE FLUID	EP 90	EXTREME PRESSURE (SAE 90) MULTI-PURPOSE GEAR LUBRICANT	MP	MULTI-PURPOSE LITHIUM BASE GREASE		CLEAN
CL	COOLANT			M	MAGNET		CHECK • ADJUST
CO	CAN OIL			S	SCREEN		
				T	TIRES		

**PERIODIC SERVICE TABLE - CHASSIS**

COMPONENTS	SERVICE	APPROXIMATE CAPACITY	TYPE OF LUBRICANT
DAILY/10 HOUR SERVICE			
GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW	AS REQUIRED	MP
DIPSTICK, HYDRAULIC TANK	CHECK LEVEL - ALL CYLINDERS RETRACTED, OIL AT OPERATING TEMPERATURE - LEVEL MUST BE BETWEEN MARKS ON DIPSTICK	75 U.S. GALLONS (284 LITERS)	HO OR ATF <u>DO NOT MIX</u>
DIPSTICK, ENGINE	CHECK LEVEL - LEVEL MUST BE BETWEEN MARKS ON DIPSTICK	SEE ENGINE OPERATOR'S MANUAL FOR PROPER CAPACITY AND LUBRICANT	
FILL CAP, ENGINE RADIATOR (COOLING SYSTEM)	CHECK LEVEL AND MAINTAIN	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	COOLANT FOR AMBIENT TEMPERATURE
LEVEL PLUG, TRANSMISSION & TORQUE CONVERTER (CLARK 2420)	USING OUTRIGGERS, RAISE ALL FOUR TIRES OFF THE GROUND. CHECK LEVEL - BETWEEN TWO PLUGS, AT ENGINE IDLE, OPERATING TEMPERATURE AND IN NEUTRAL	9 U.S. GALLONS (34 LITERS)	ATF OR DEXRON
DIPSTICK, TRANSMISSION & TORQUE CONVERTER (CLARK 18000)	CHECK LEVEL - LEVEL MUST BE BETWEEN MARKS ON DIPSTICK, AT ENGINE IDLE, OPERATING TEMPERATURE AND IN NEUTRAL	5 U.S. GALLONS (19 LITERS)	C2 OR DEXRON <u>DO NOT MIX</u>
DIPSTICK, TRANSMISSION & TORQUE CONVERTER (ALLISON)	CHECK LEVEL - LEVEL MUST BE BETWEEN MARKS ON DIPSTICK, AT ENGINE IDLE, OPERATING TEMPERATURE AND IN NEUTRAL	9 TO 10 U.S. GALLONS (34 TO 38 LITERS)	C2 OR DEXRON <u>DO NOT MIX</u>
FILL CAP, FUEL TANK	CHECK LEVEL - FILL AT END OF EACH DAY	46 U.S. GALLONS (174 LITERS)	SEE ENGINE OPERATOR'S MANUAL
AIR CLEANER, ENGINE	CLEAN		

WEEKLY/50 HOUR SERVICE

GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW	AS REQUIRED	MP
LEVEL PLUG, PLANETARY DRIVE (SOMA & CLARK AXLES)	CHECK LEVEL - POSITION WHEELS SO ARROW ON PLANETARY END CAP IS POINTING DOWN	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	EP 80 OR 90
LEVEL PLUG, PLANETARY DRIVE (ROCKWELL AXLE)	CHECK LEVEL - POSITION WHEELS SO ARROW ON PLANETARY IS HORIZONTAL	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	EP 80 OR 90

CONT'D NEXT PAGE -



CONT'D FROM PREVIOUS PAGE

COMPONENTS	SERVICE	APPROXIMATE CAPACITY	TYPE OF LUBRICANT
WEEKLY/50 HOUR SERVICE			
LEVEL PLUGS, AXLES (DIFFERENTIAL)	CHECK LEVEL. FILL TO LEVEL PLUG	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	EP 80 OR 90
SCREEN AND MAGNET ASSEMBLY	REMOVE AND CLEAN THOROUGHLY - REINSTALL		
MASTER CYLINDER, WHEEL BRAKES	CHECK LEVEL AND MAINTAIN	AS REQUIRED	BRAKE FLUID
BATTERY, ELECTRICAL STORAGE	CHECK LEVEL - MAINTAIN LEVEL TO TOP OF RINGS	AS REQUIRED	DISTILLED WATER
LINKAGE, CONTROL LEVER	LUBRICATE	AS REQUIRED	CO
TIRES	CHECK PRESSURE - INFLATE TO PRESSURES SPECIFIED IN "GENERAL SPECIFICATIONS" SECTION OF THIS MANUAL		
CASE, STEERING GEAR	CHECK AND MAINTAIN LEVEL	AS REQUIRED	EP 80 OR 90
TRANSMISSION SHIFT LINKAGE (ALLISON & CLARK 18000)	LUBRICATE	AS REQUIRED	CO

100 HOUR SERVICE

GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW	AS REQUIRED	MP
FILTERS, HYDRAULIC TANK	REPLACE ELEMENT AFTER FIRST 100 HOURS ON NEW MACHINE OR AFTER REBUILD AND EVERY 1000 HOURS THEREAFTER		
DRAIN PLUG, FUEL TANK	REMOVE PLUG AND DRAIN ACCUMULATED WATER AND SEDIMENT		

250 HOUR SERVICE

FILTER, TRANSMISSION & TORQUE CONVERTER (ALLISON & CLARK 2420)	REPLACE ELEMENT AFTER 250 HOURS ON NEW MACHINE OR AFTER REBUILD AND EVERY 500 HOURS THEREAFTER		
FILTER, TRANSMISSION & TORQUE CONVERTER (CLARK 18000)	REPLACE ELEMENT EVERY 250 HOURS, WHEN FLUID IS CHANGED OR AFTER REBUILD		

500 HOUR SERVICE

BREATHER, HYDRAULIC TANK	REMOVE AND REPLACE		
BREATHER, TRANSMISSION & TORQUE CONVERTER	CLEAN		

CONT'D NEXT PAGE -



COMPONENTS	SERVICE	APPROXIMATE CAPACITY	TYPE OF LUBRICANT
500 HOUR SERVICE			
FILTER, TRANSMISSION & TORQUE CONVERTER (<i>ALLISON & CLARK 2420</i>)	REPLACE ELEMENT AFTER 250 HOURS ON NEW MACHINE OR AFTER REBUILD AND EVERY 500 HOURS THEREAFTER		
SCREEN, TRANSMISSION & TORQUE CONVERTER	CLEAN		
DRAIN PLUG, TRANSMISSION & TORQUE CONVERTER (<i>CLARK 2420</i>)	DRAIN - FILL TO LEVEL	9 U.S. GALLONS (34 LITERS)	ATF OR DEXRON <u>DO NOT MIX</u>
DRAIN PLUG, TRANSMISSION & TORQUE CONVERTER (<i>CLARK 18000</i>)	DRAIN - FILL TO LEVEL	5 U.S. GALLONS (19 LITERS)	C2 OR DEXRON <u>DO NOT MIX</u>
DRAIN PLUG, TRANSMISSION & TORQUE CONVERTER (<i>ALLISON</i>)	DRAIN - FILL TO LEVEL	9 TO 10 U.S. GALLONS (34 TO 38 LITERS)	C2 OR DEXRON <u>DO NOT MIX</u>
STEERING KNUCKLE U-JOINT	ROTATE EACH WHEEL CAREFULLY TO ALIGN CARDAN JOINT ZERK THROUGH HOLE IN STEERING KNUCKLE	AS REQUIRED	MP
BREATHER, AXLE	CLEAN		
1000 HOUR SERVICE			
DRAIN PLUGS, PLANETARY DRIVES	DRAIN AND REFILL	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	EP 80 OR 90
DRAIN PLUGS, AXLES (DIFFERENTIAL)	DRAIN AND REFILL	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	EP 80 OR 90
DRAIN PLUGS, STEERING GEAR CASE	DRAIN AND REFILL	1 U.S. QUART (0.95 LITER)	EP 80 OR 90
DRAIN PLUG, HYDRAULIC TANK	DRAIN, CLEAN AND REFILL	75 U.S. GALLONS (284 LITERS) COMPLETE SYSTEM 120 U.S. GALLONS (454 LITERS)	HO OR ATF <u>DO NOT MIX</u>
FILTERS, HYDRAULIC TANK	REPLACE ELEMENT AFTER FIRST 100 HOURS ON NEW MACHINE OR AFTER REBUILD AND EVERY 1000 HOURS THEREAFTER		
DRAIN PLUG, ENGINE RADIATOR	DRAIN, FLUSH AND REFILL	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	COOLANT FOR AMBIENT TEMPERATURE



DAILY/10 HOUR SERVICE

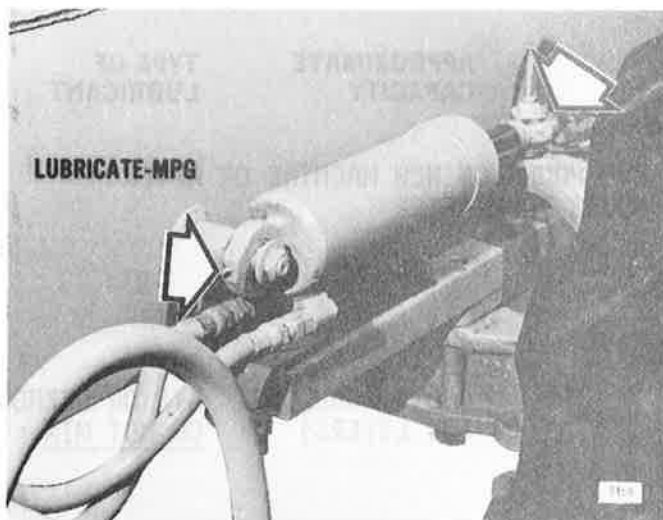


Figure 21
STEERING CYLINDERS - BEARINGS

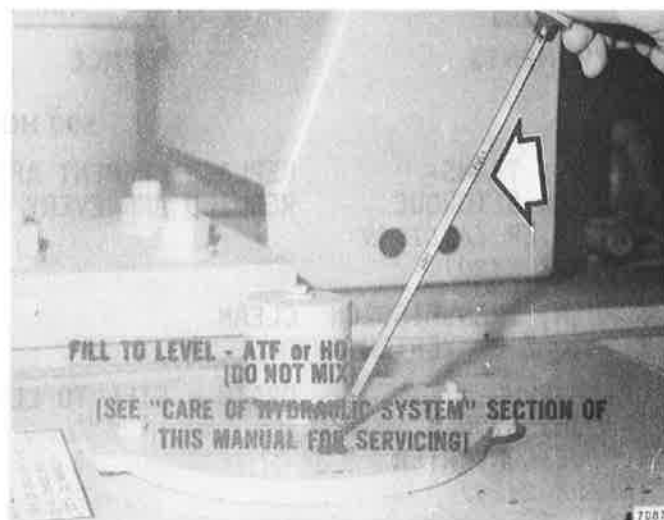


Figure 24
HYDRAULIC TANK DIPSTICK

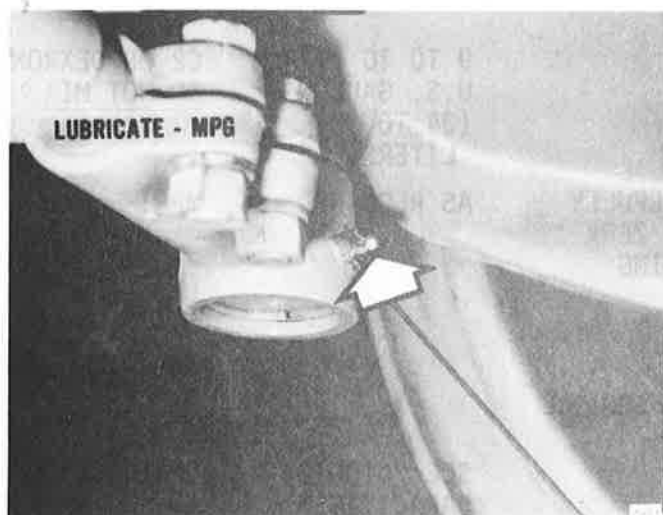


Figure 22
TIE ROD ENDS



Figure 25
DIPSTICK, ENGINE OIL



Figure 23
TRANSMISSION SHIFT LINKAGE
(CLARK 18000)

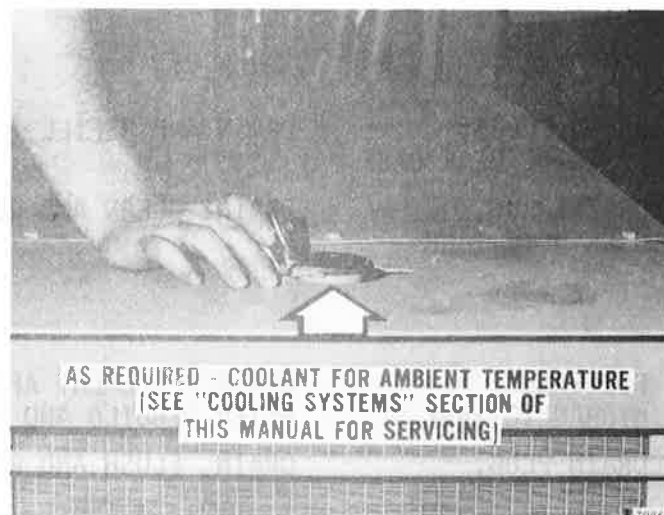


Figure 26
ENGINE RADIATOR FILL CAP



DAILY/10 HOUR SERVICE

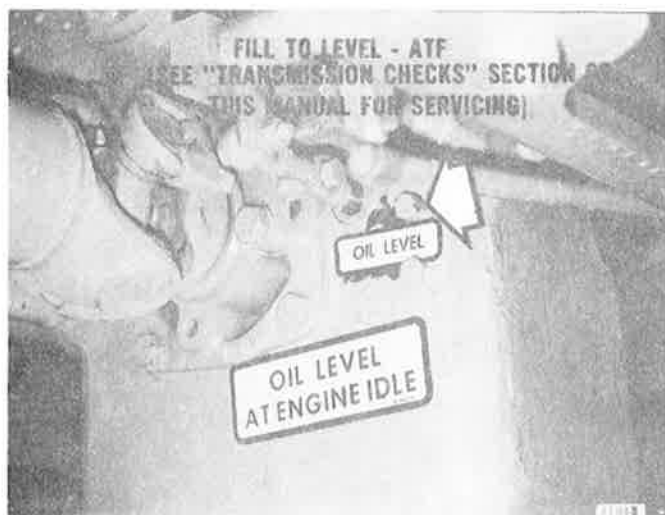


Figure 27
TRANSMISSION & CONVERTER LEVEL
PLUGS (CLARK 2420)



Figure 30
TRANSMISSION & CONVERTER DIPSTICK &
FILL TUBE (ALLISON)

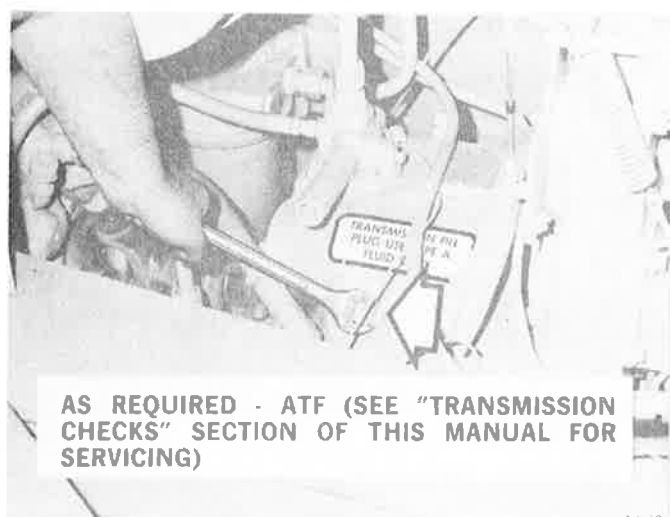


Figure 28
TRANSMISSION & CONVERTER FILL
PLUG (CLARK 2420)

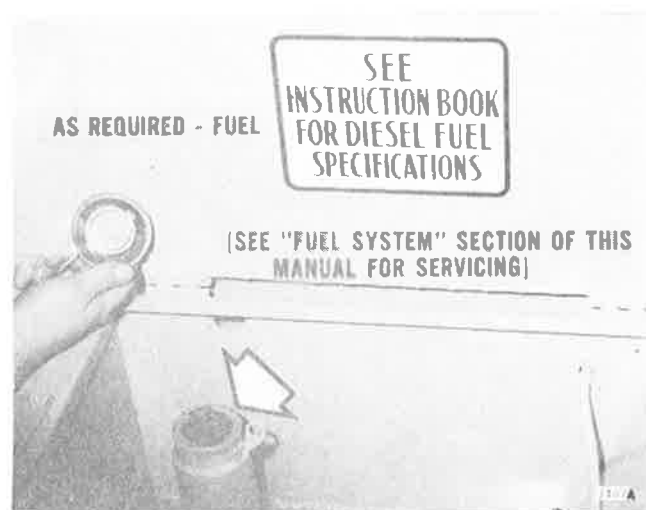


Figure 31
FUEL TANK FILL CAP

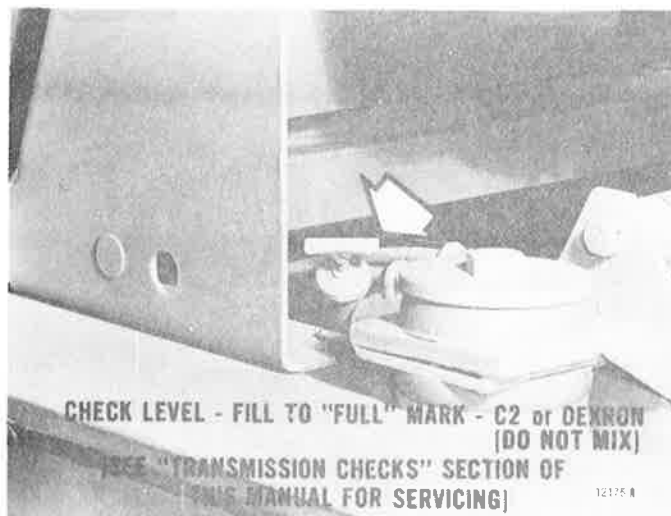


Figure 29
TRANSMISSION & CONVERTER DIPSTICK &
FILL TUBE (CLARK 18000)

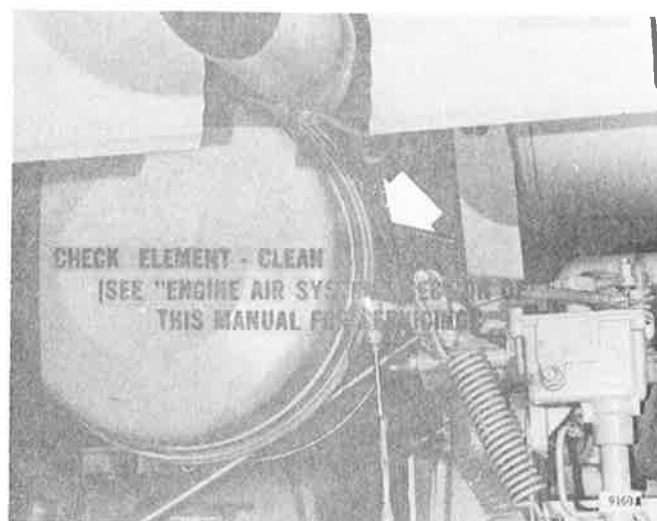


Figure 32
ENGINE AIR CLEANER



DAILY/10 HOUR SERVICE

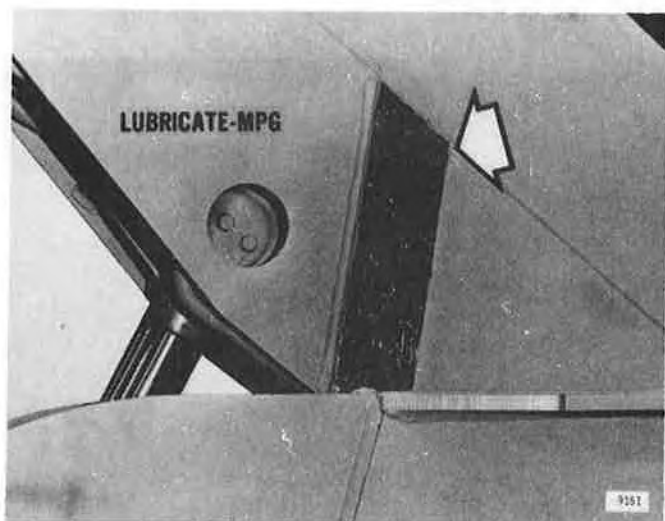


Figure 33
BOOM SIDE WEAR PLATES



WEEKLY/50 HOUR SERVICE



Figure 34
OUTRIGGER CYLINDERS - BASE END

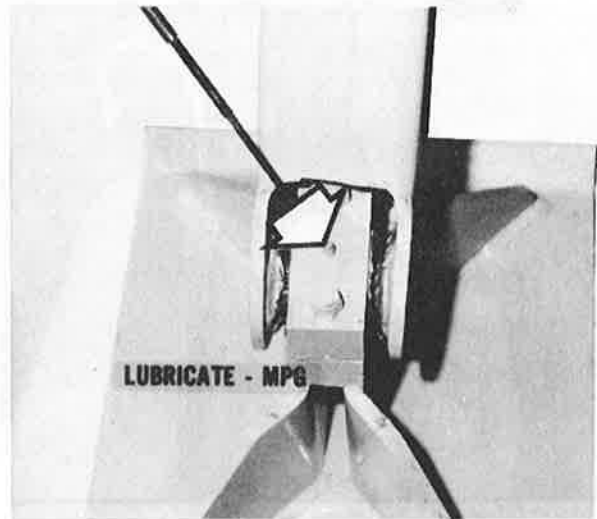


Figure 37
OUTRIGGER PAD PIVOT BEARINGS

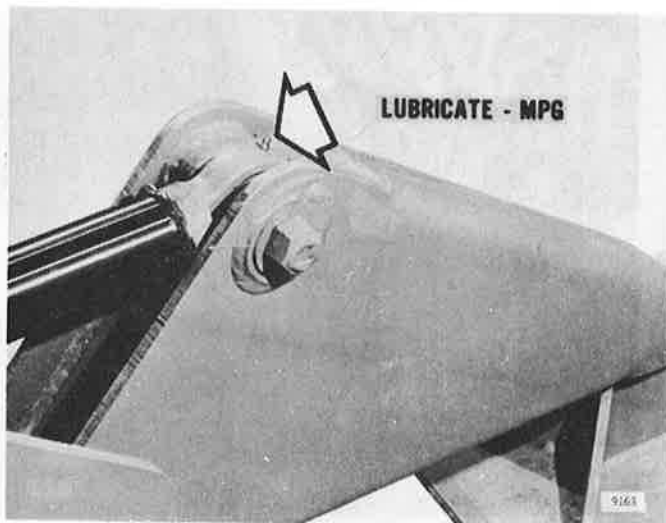


Figure 35
OUTRIGGER CYLINDERS - ROD END

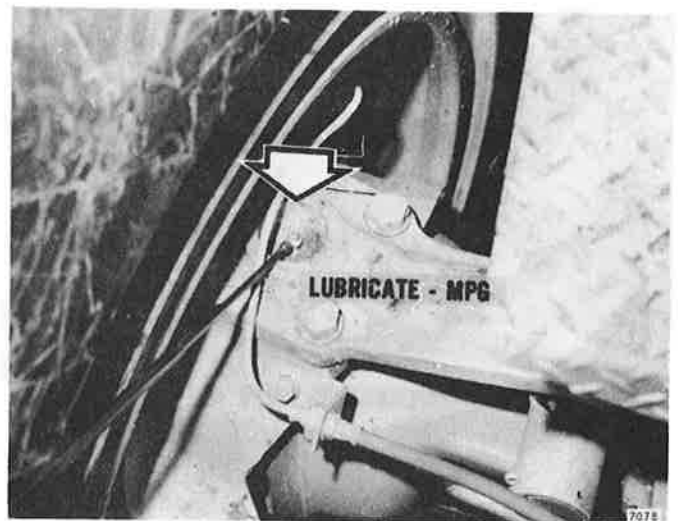


Figure 38
AXLE TRUNNION BEARINGS - UPPER (CLARK)

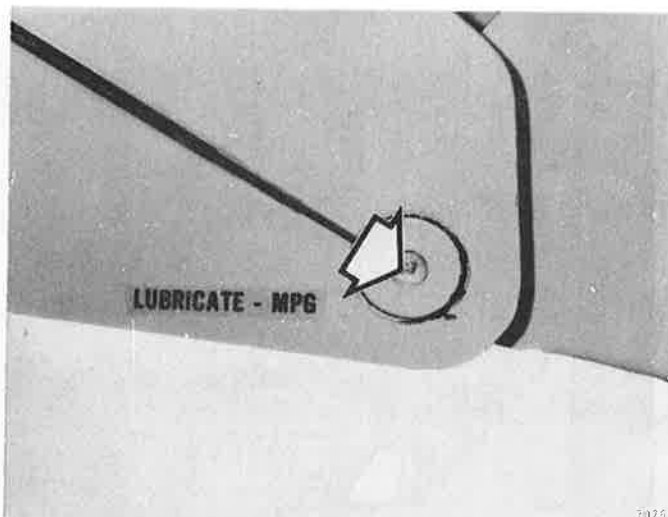


Figure 36
OUTRIGGER PIVOT PINS

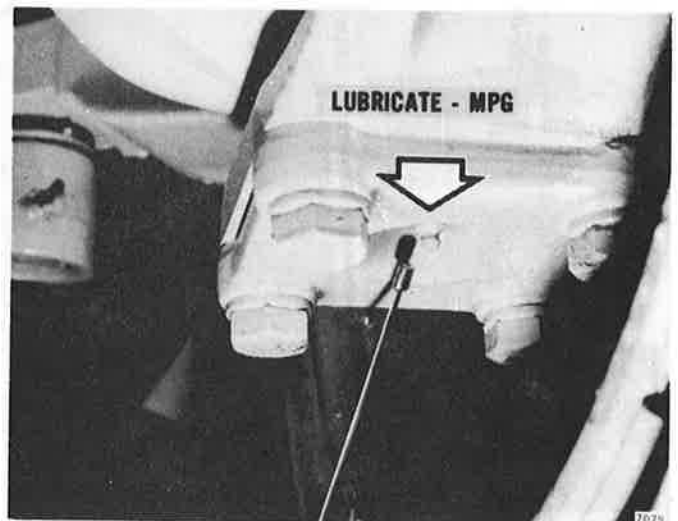


Figure 39
AXLE TRUNNION BEARINGS - LOWER (CLARK)



WEEKLY/50 HOUR SERVICE



Figure 40
AXLE TRUNNION BEARINGS -
UPPER (CLARK DS 13311)

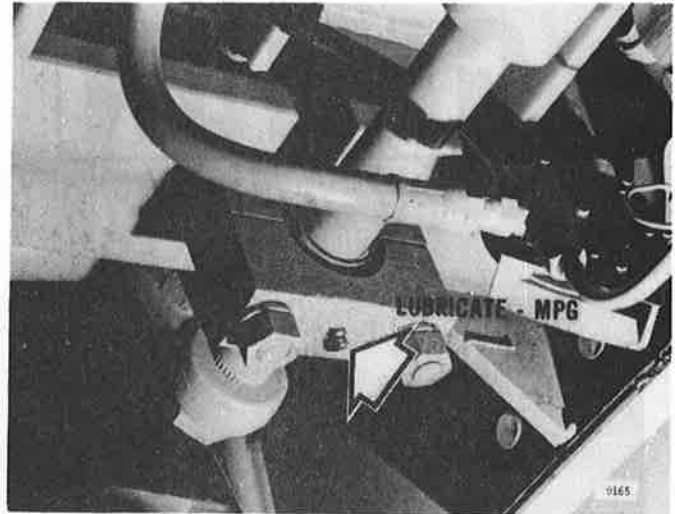


Figure 43
STEERING SHAFT BEARING
(STEERING SYSTEM "A")

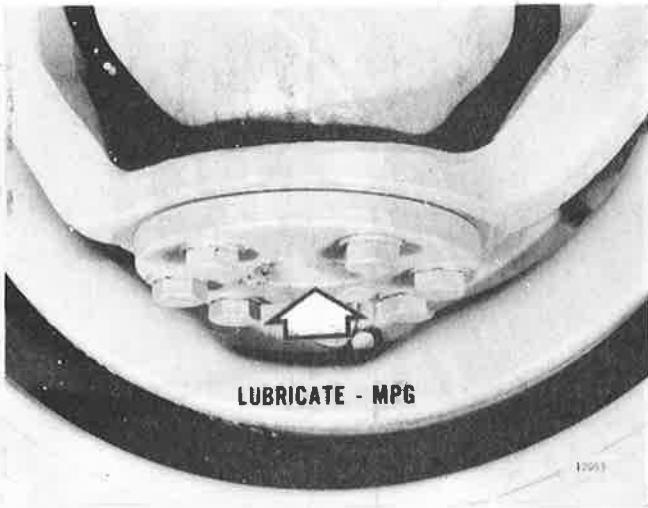


Figure 41
AXLE TRUNNION BEARINGS -
LOWER (CLARK DS 13311)

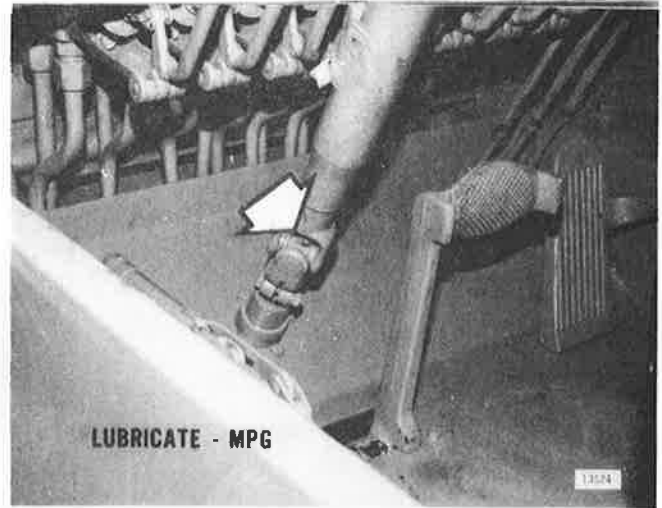


Figure 44
ROSS STEERING VALVE
(STEERING SYSTEM "B")

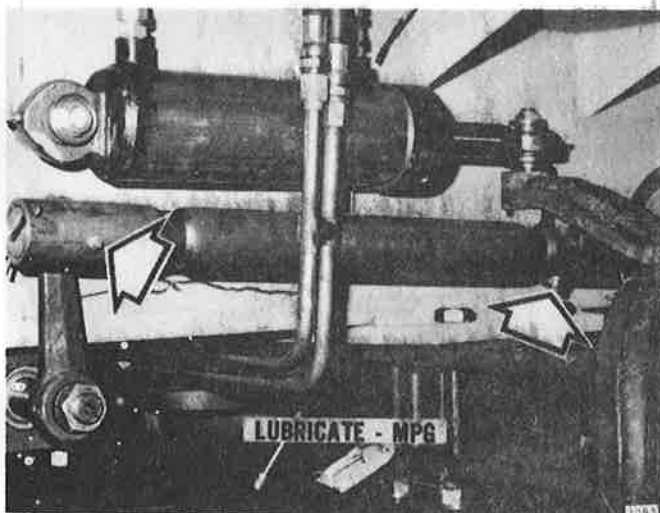


Figure 42
STEERING DRAG LINK
(STEERING SYSTEM "A")

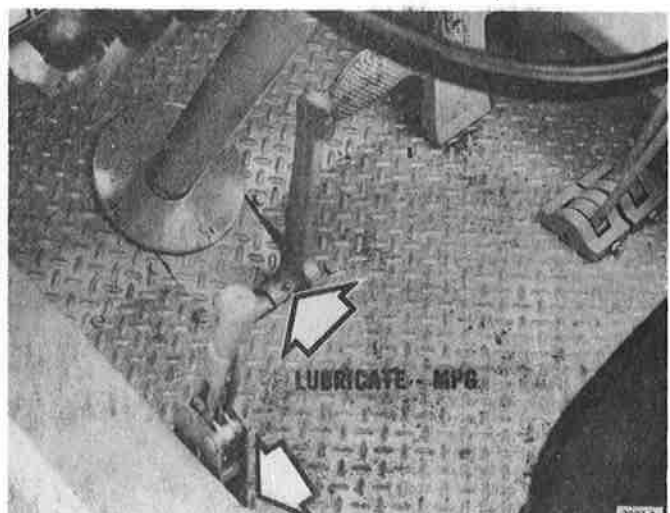


Figure 45
BRAKE PEDAL BEARING &
PARKING BRAKE CABLE



WEEKLY/50 HOUR SERVICE

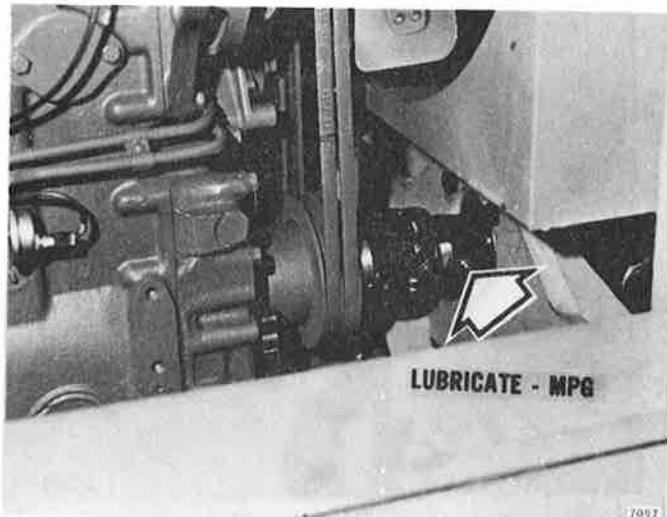


Figure 46
HYDRAULIC PUMP SLIP JOINT

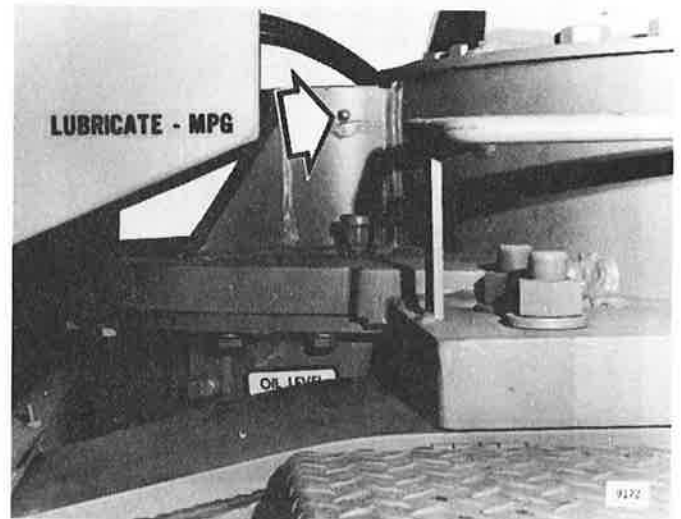


Figure 49
SWING PINION BEARING

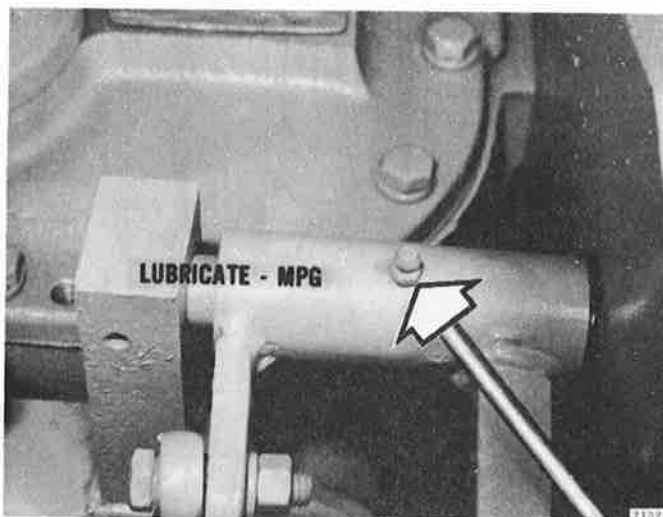


Figure 47
TRANSMISSION SHIFT LINKAGE
(CLARK 2420)

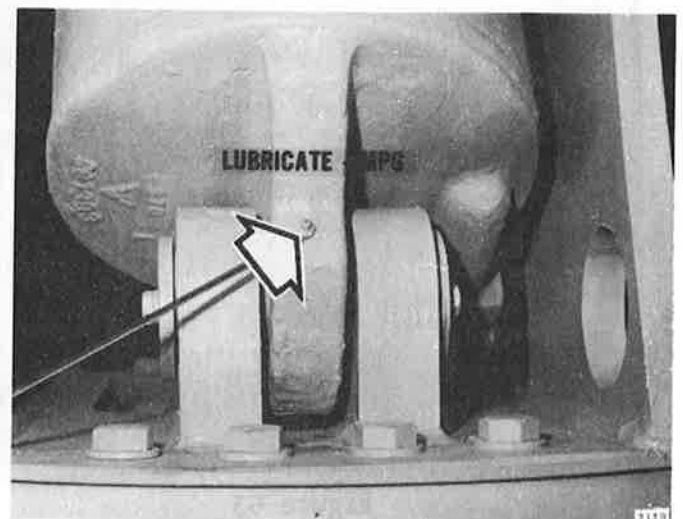


Figure 50
LIFT CYLINDER - BASE END

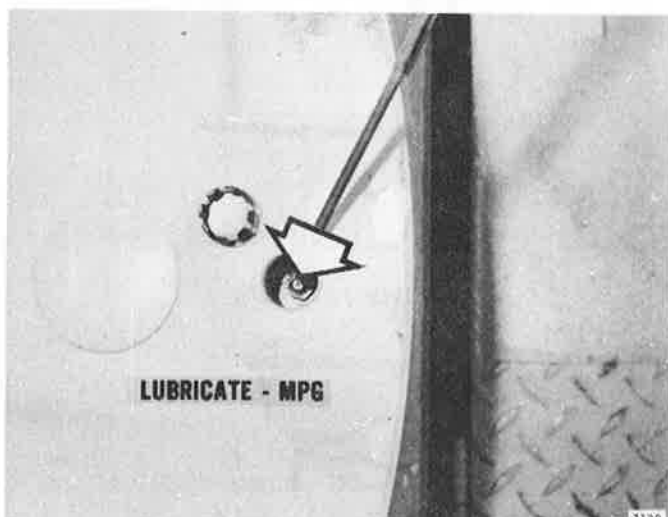


Figure 48
PEDESTAL BEARING



Figure 51
LIFT CYLINDER - ROD END



WEEKLY/50 HOUR SERVICE

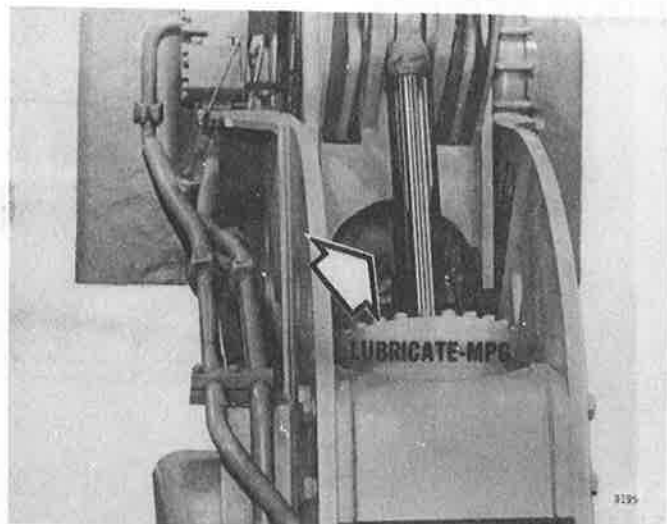


Figure 52
BOOM HINGE PIN



Figure 55
STATIONARY HOOK BLOCK SHEAVES

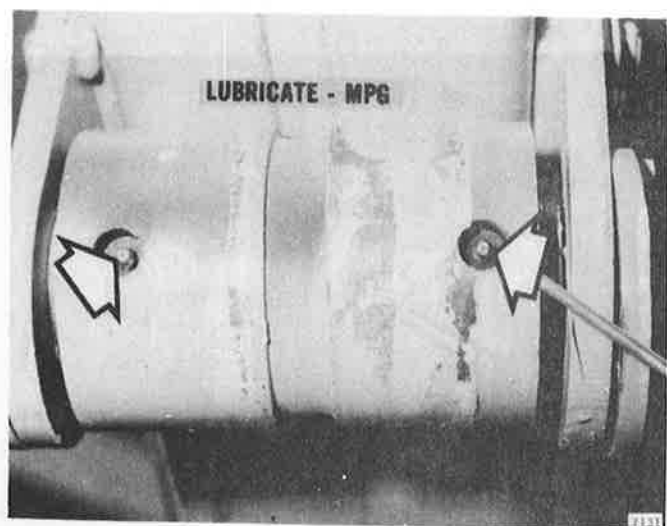


Figure 53
BOOM EXTENSION ROLLERS

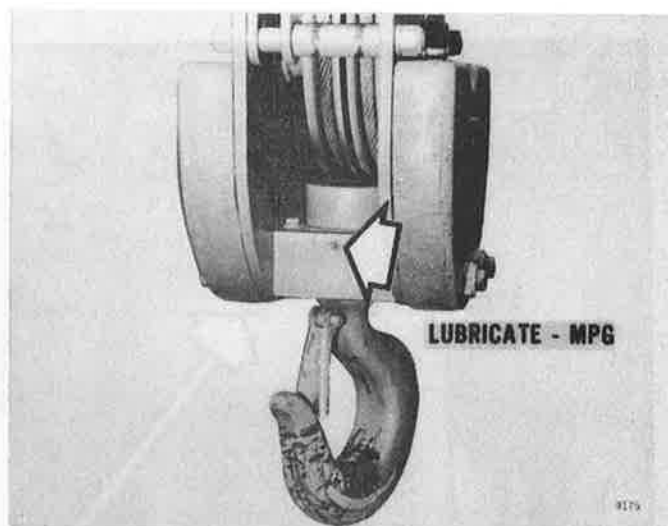


Figure 56
STATIONARY HOOK BLOCK SHEAVES

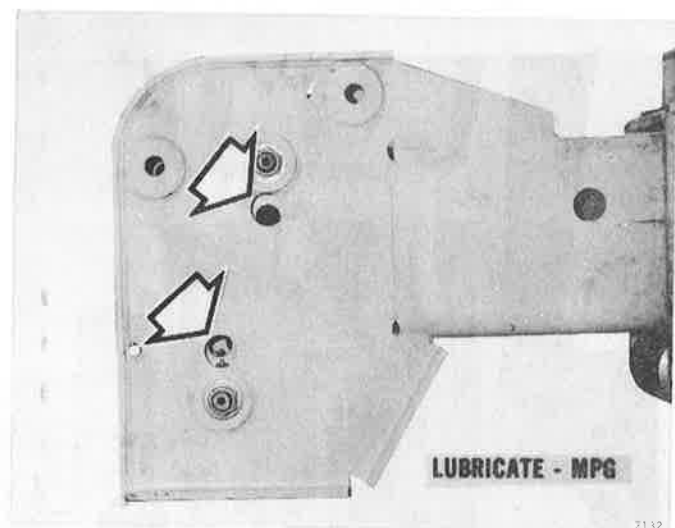


Figure 54
HEAD BLOCK SHEAVES

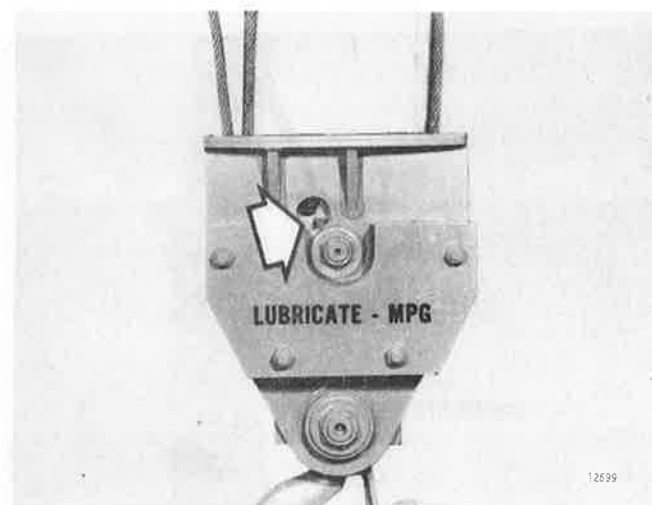


Figure 57
PIVOTING HOOK BLOCK SHEAVES



WEEKLY/50 HOUR SERVICE

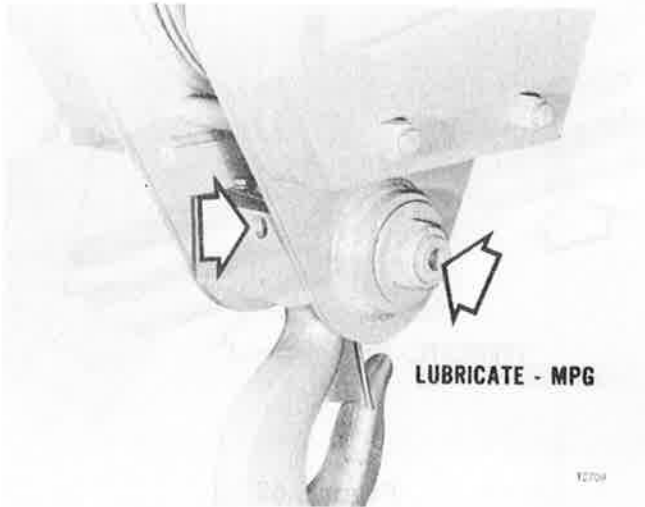


Figure 58
PIVOTING HOOK BLOCK BEARING & PIVOT

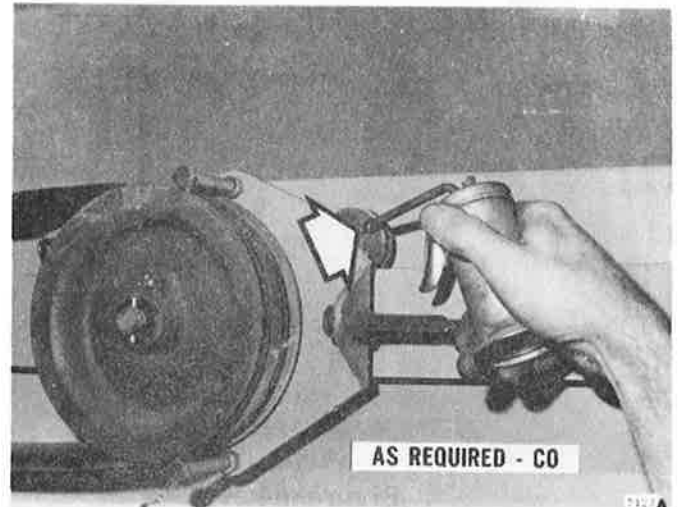


Figure 61
TROLLEY, POWER BOOM



Figure 59
HOSE REEL BEARING, POWER BOOM

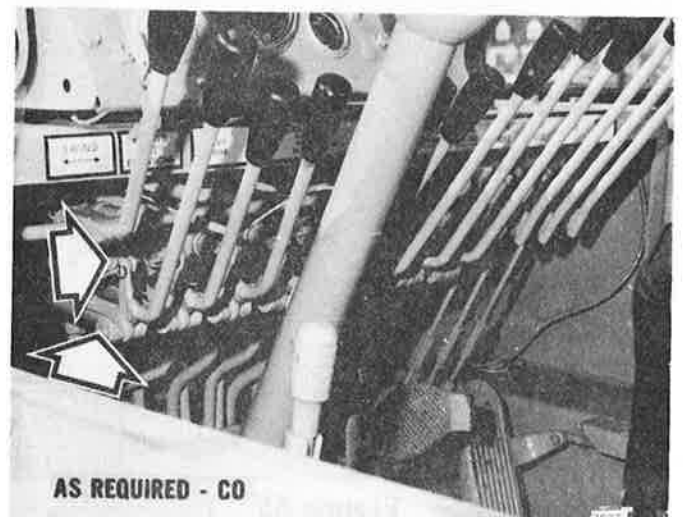


Figure 62
CONTROL LEVER LINKAGE

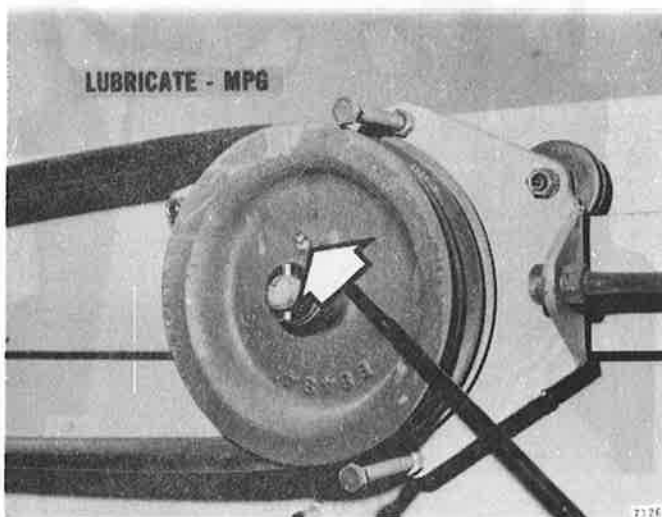


Figure 60
HOSE SHEAVES, POWER BOOM (FRONT & REAR)

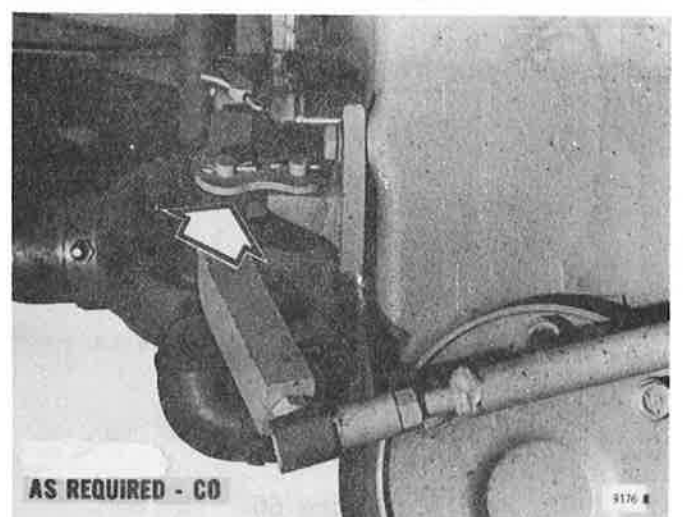


Figure 63
TRANSMISSION SHIFT LINKAGE (ALLISON)



WEEKLY/50 HOUR SERVICE



Figure 64
TRANSMISSION SHIFT LINKAGE
(CLARK 18000)

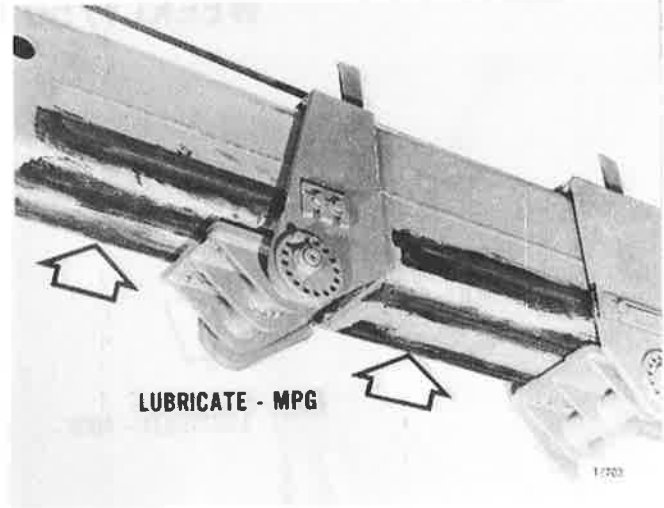


Figure 67
LOWER WEAR PLATES (FRONT)

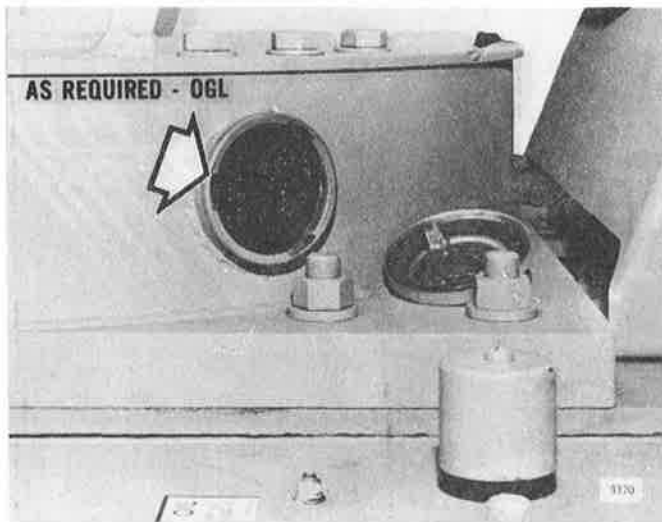


Figure 65
PEDESTAL GEAR & PINION

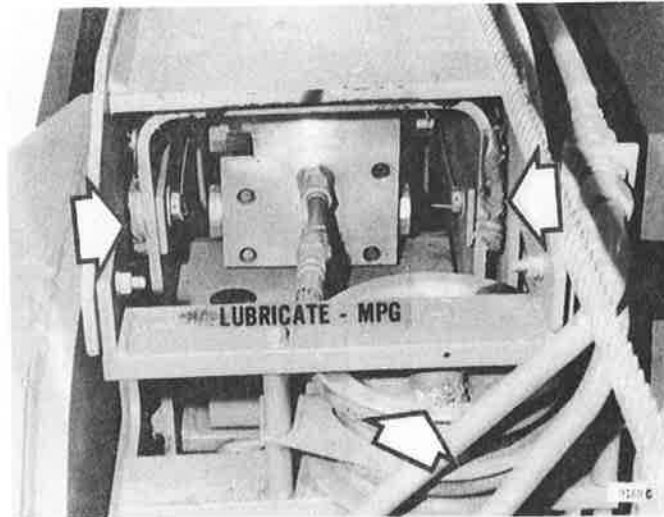


Figure 68
BOOM EXTENSION WEAR PLATES (REAR
& REAR HOSE SHEAVE

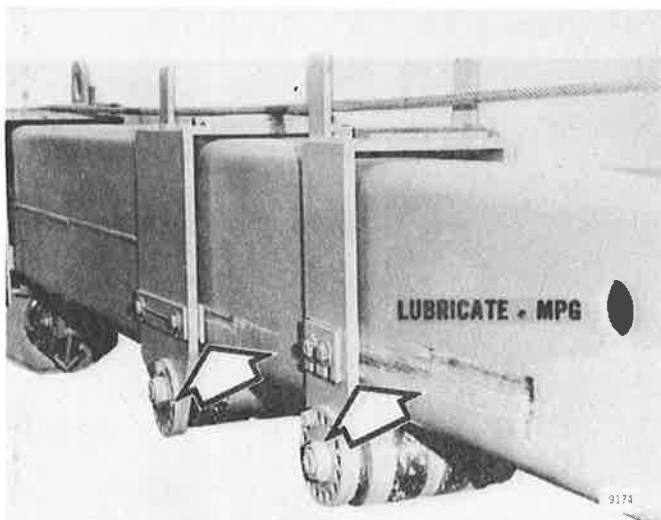


Figure 66
SIDE WEAR PLATES (FRONT)

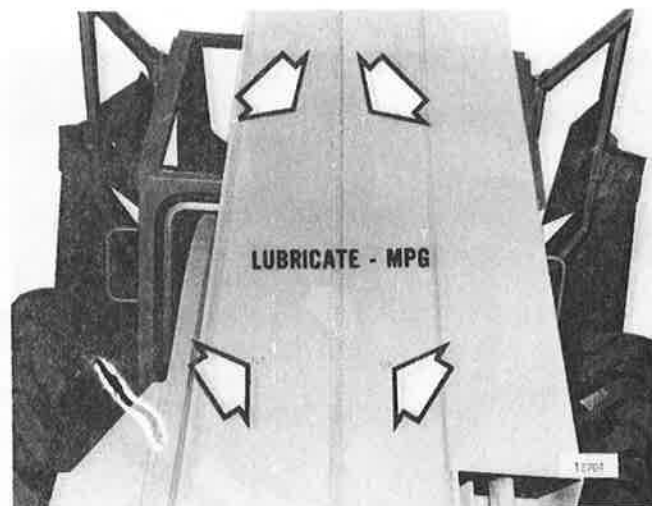


Figure 69
UPPER & LOWER WEAR PLATES (REAR)



WEEKLY/50 HOUR SERVICE

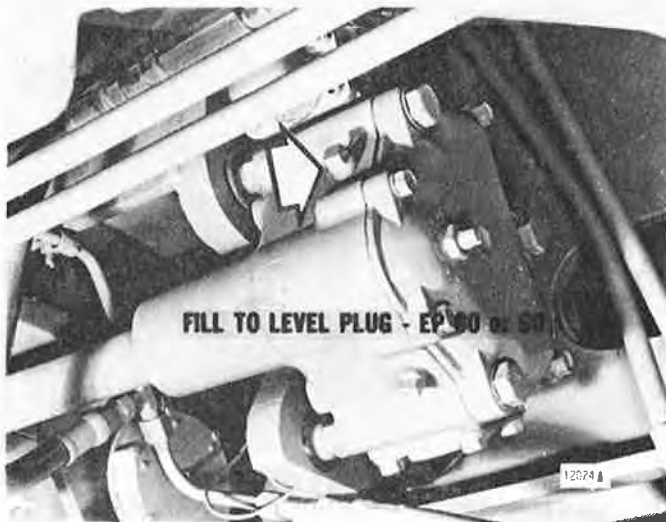


Figure 70
STEERING GEAR CASE
(STEERING SYSTEM "A")



Figure 73
AXLE PLANETARY DRIVE LEVEL PLUG
(CLARK DS-13311)



Figure 71
PLANETARY DRIVE LEVEL PLUG (CLARK)

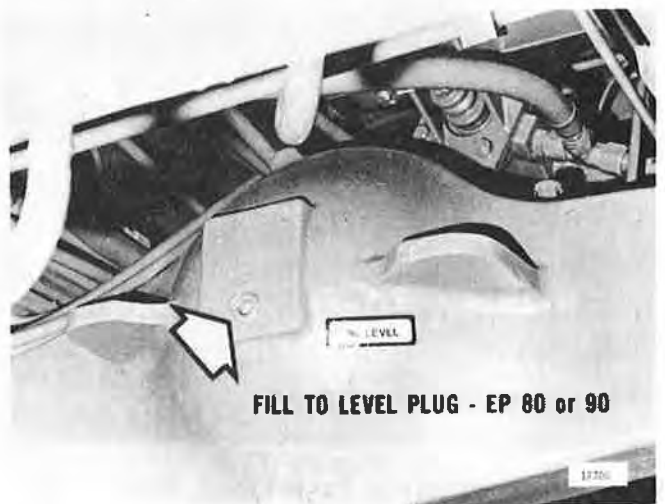


Figure 74
AXLE DIFFERENTIAL LEVEL PLUG
(CLARK DS-13311)



Figure 72
AXLE LEVEL PLUGS (CLARK)



Figure 75
PLANETARY DRIVE LEVEL PLUG (ROCKWELL)



WEEKLY/50 HOUR SERVICE



Figure 76
AXLE LEVEL PLUGS (ROCKWELL)



Figure 79
MASTER BRAKE CYLINDER (CLARK AXLES)

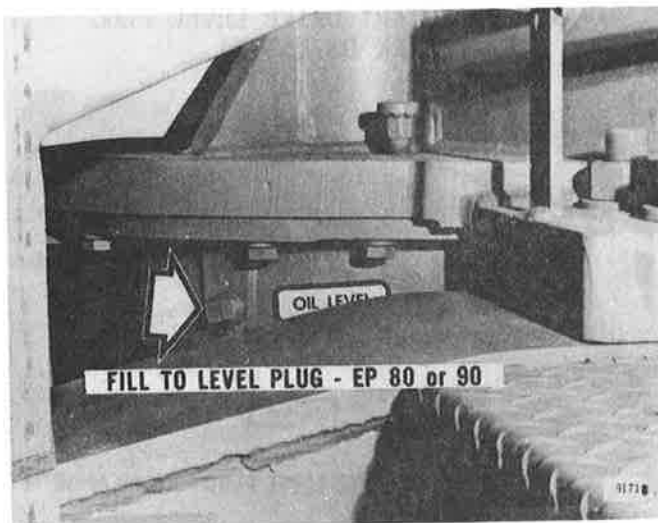


Figure 77
SWING DRIVE CASE LEVEL PLUG

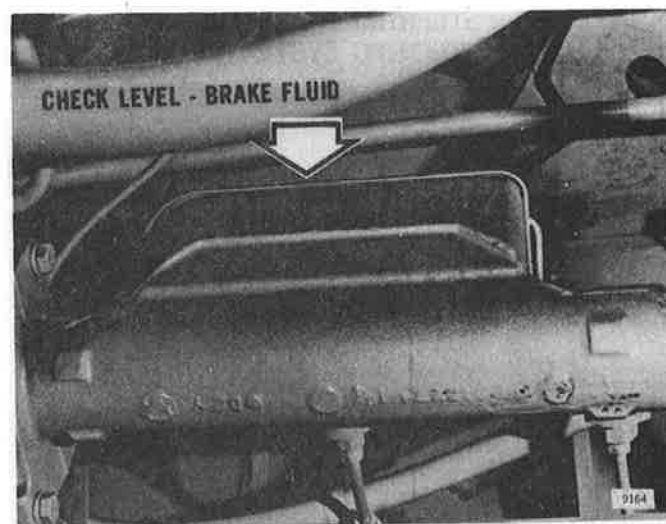


Figure 80
MASTER BRAKE CYLINDER (ROCKWELL AXLES)



Figure 78
HOIST GEAR CASE LEVEL PLUG

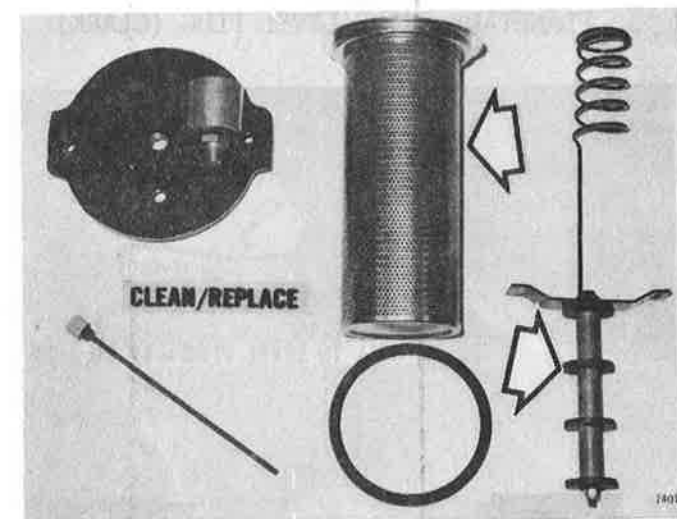


Figure 81
HYDRAULIC TANK SCREEN & MAGNET



WEEKLY/50 HOUR SERVICE



Figure 82
ELECTRICAL STORAGE BATTERY



Figure 83
TIRES



100 HOUR INSPECTION

1. Back-up signal working (if so equipped).
2. All lights working.
3. Parking brake holds unit.
4. Wheel lug nut torque checked per Specific Torque Chart, (See page 80).
5. Check drive belt(s) tension, (See Page 117).



100 HOUR SERVICE

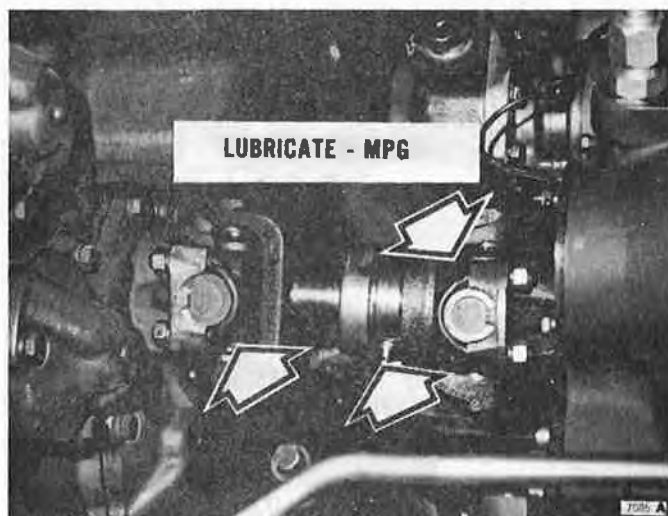


Figure 84

UNIVERSAL JOINTS & SLIP JOINTS (CLARK 2420)



Figure 85

UNIVERSAL JOINTS & SLIP JOINTS

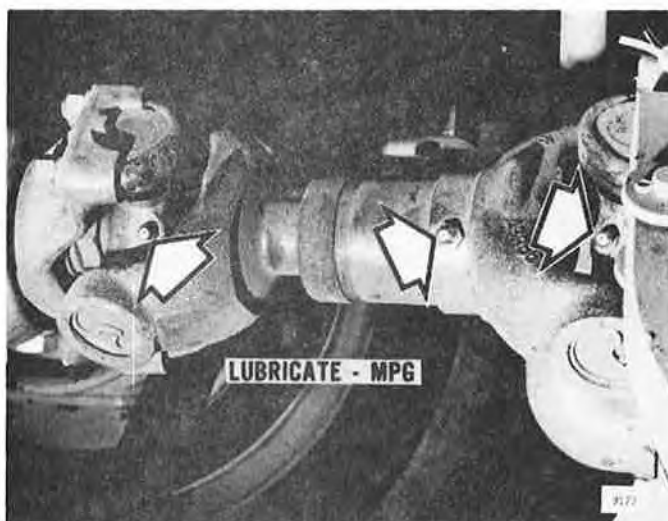


Figure 86

UNIVERSAL JOINTS & SLIP JOINTS

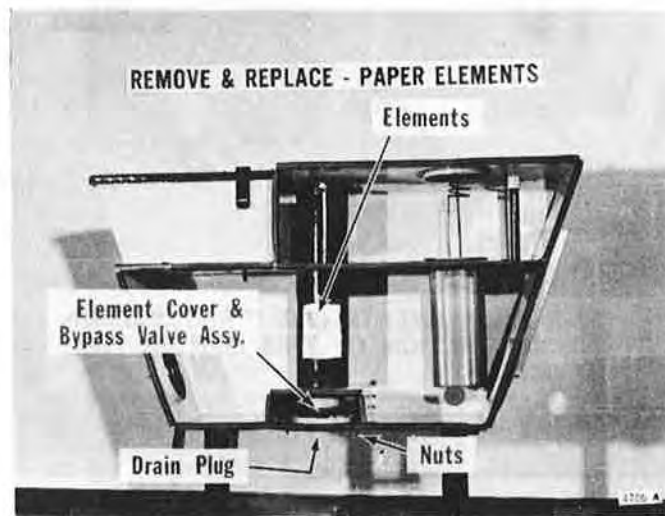


Figure 87

HYDRAULIC TANK FILTERS



Figure 88

FUEL TANK DRAIN PLUG



250 HOUR SERVICE

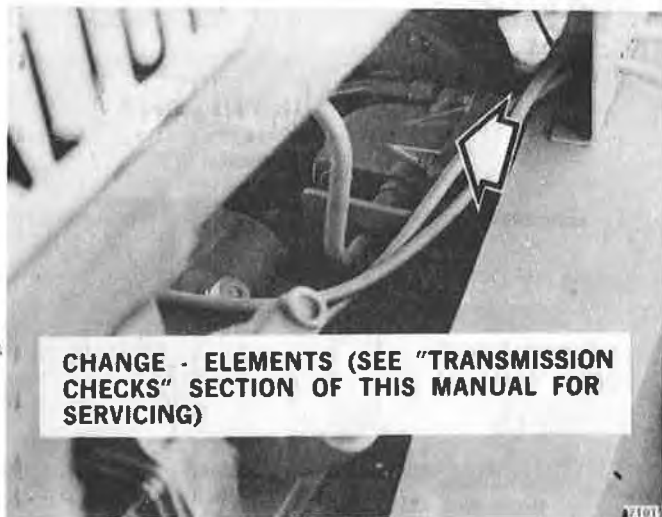


Figure 89
TRANS./CONV. FILTER (CLARK 2420)



Figure 92
TRANS./CONV. FILTER (CLARK 18000)

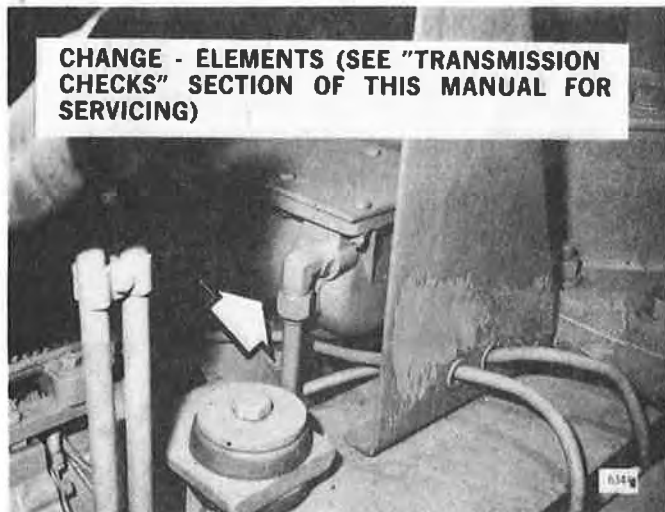


Figure 90
TRANS./CONV. FILTER (ALLISON/DUETZ)

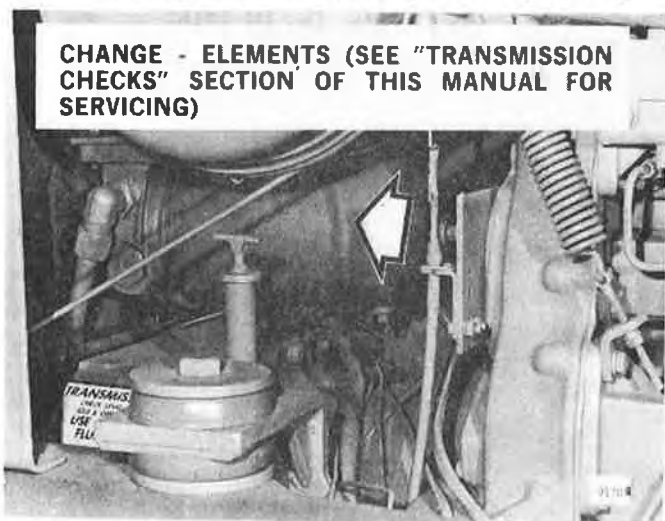


Figure 91
TRANS./CONV. FILTER (ALLISON/D.D.)



500 HOUR INSPECTION

1. Check boom, head block, pedestal, and frame for any stress marks from overloading.
2. Check all bolt and nut torques per Specific Torque Chart (See page 80).
3. Check hook for stress and hook block bearing for end play. Remove cap and observe nut and threads (See page 113).
4. Check boom hinge pin (bolt ends) to see that it is secured in place.
5. Check boom cylinder anchor pin locks to see that they are secured in place.
6. Check outrigger cylinder and arm pivot pins.



500 HOUR SERVICE

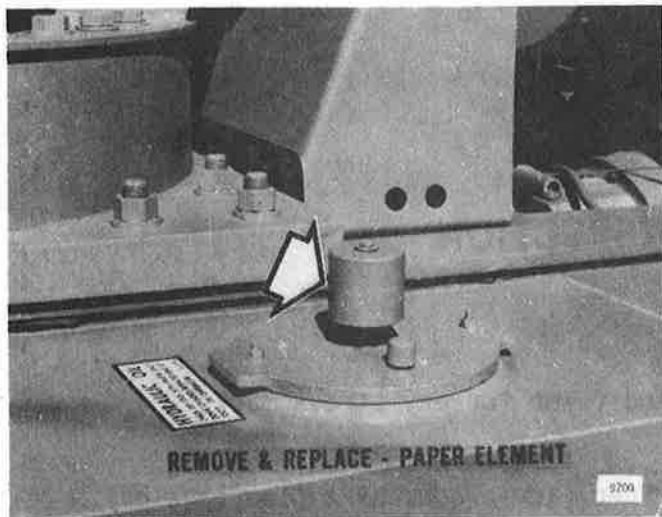


Figure 93
HYDRAULIC TANK BREATHER

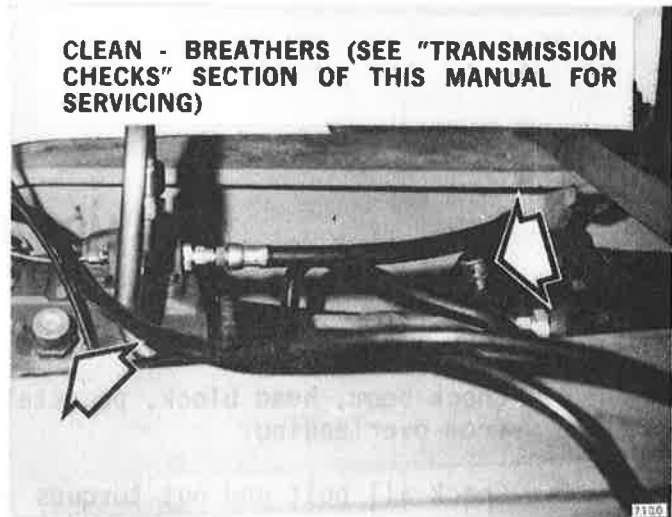


Figure 96
TRANS./CONV. BREATHER (CLARK 2420)

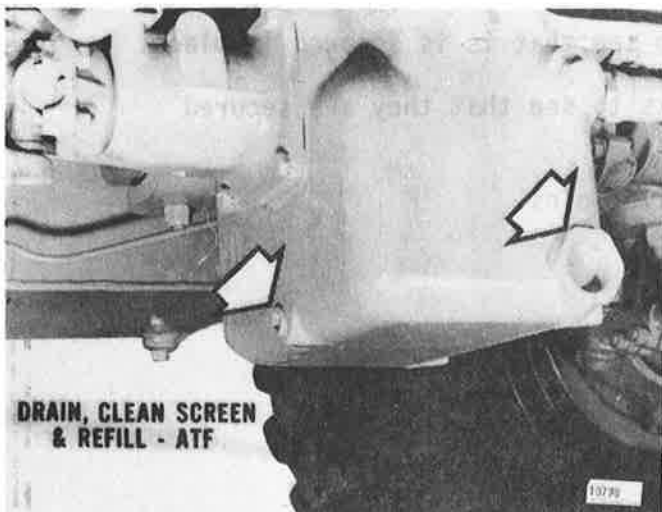


Figure 94
TRANS./CONV. DRAIN PLUG & SCREEN (CLARK 2420)

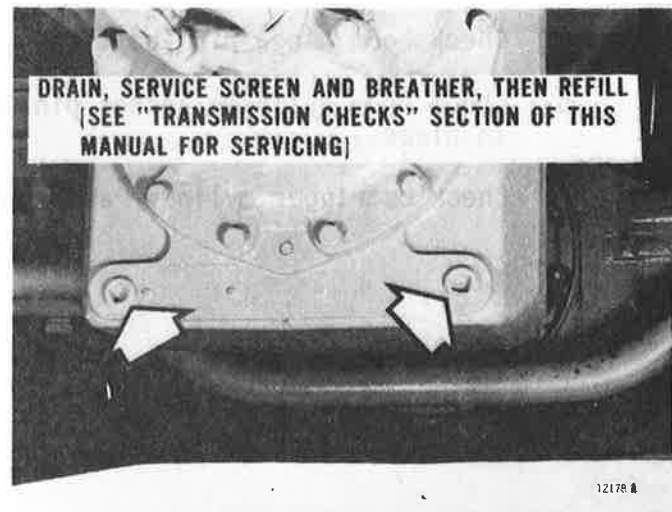


Figure 97
TRANS./CONV. DRAIN PLUGS (CLARK 18000)

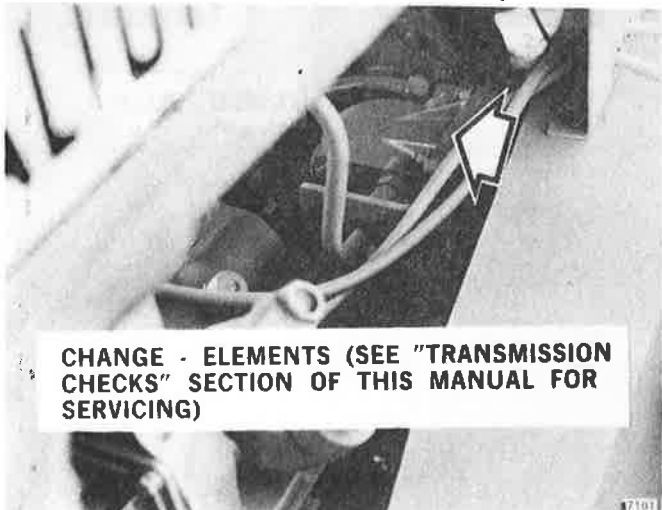


Figure 95
TRANS./CONV. FILTER (CLARK 2420)

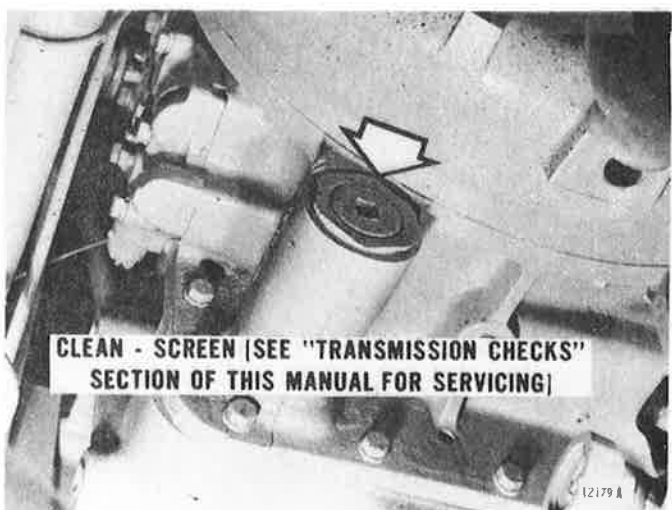


Figure 98
TRANS./CONV. SCREEN (CLARK 18000)



500 HOUR SERVICE

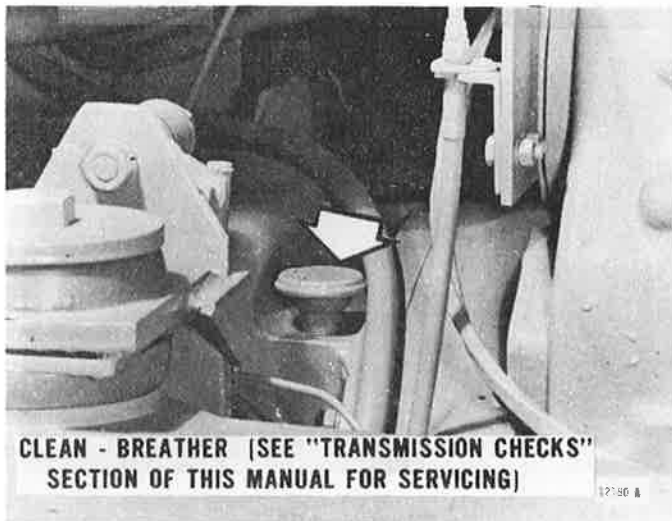


Figure 99
TRANS./CONV. BREATHER (CLARK 18000)

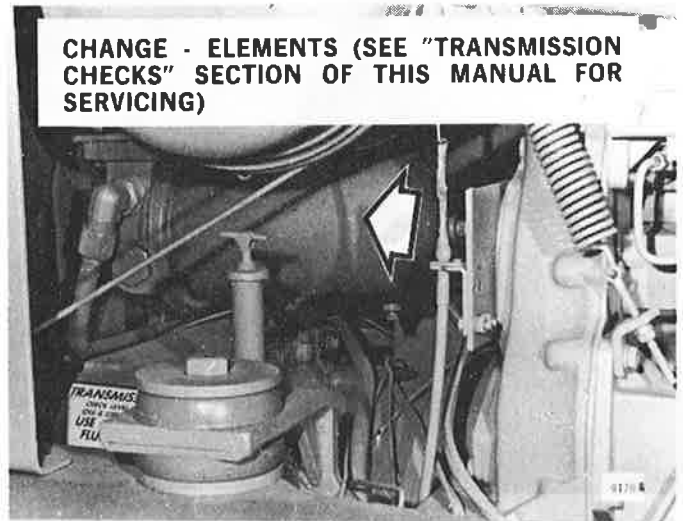


Figure 102
TRANS./CONV. FILTER (ALLISON/D.D.)

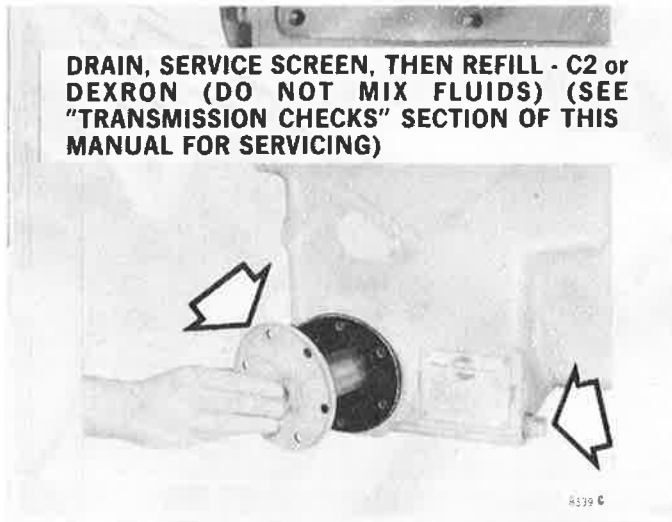


Figure 100
TRANS./CONV. SCREEN & DRAIN PLUG (ALLISON)



Figure 103
TRANS./CONV. BREATHER (ALLISON)

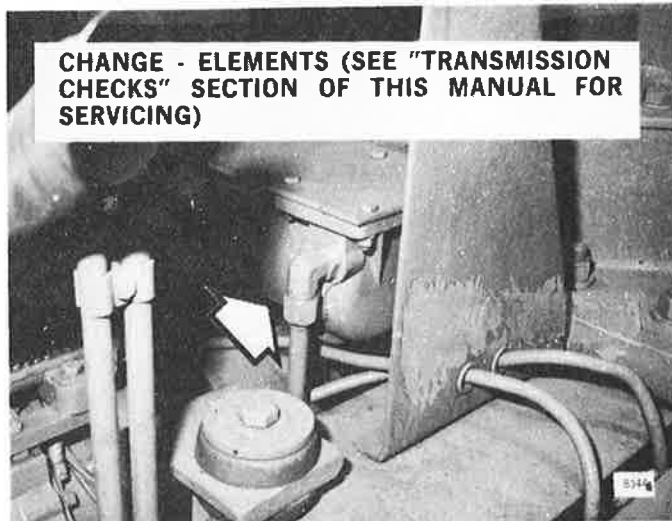


Figure 101
TRANS./CONV. FILTER (ALLISON/DEUTZ)

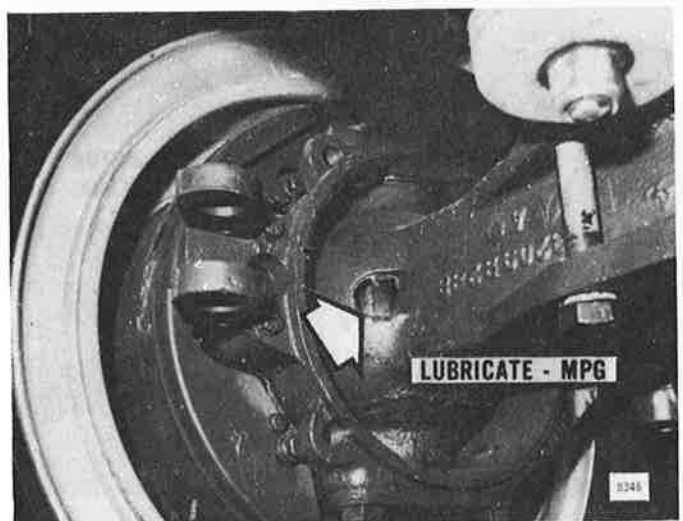


Figure 104
STEERING KNUCKLE U-JOINT (ROCKWELL)



500 HOUR SERVICE

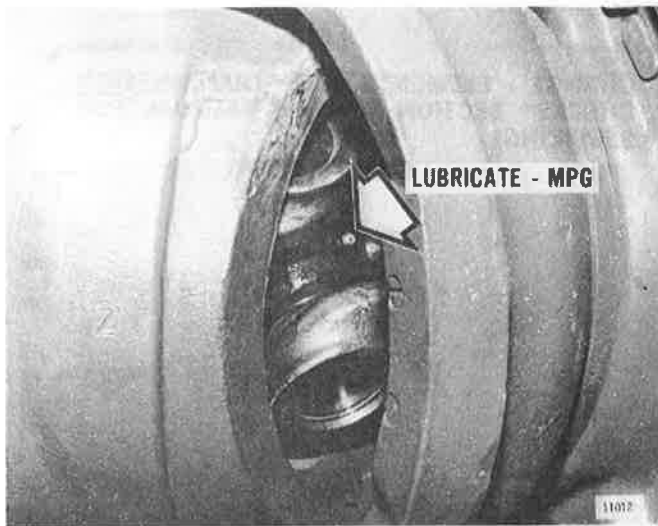


Figure 105
STEERING KNUCKLE U-JOINT (CLARK)

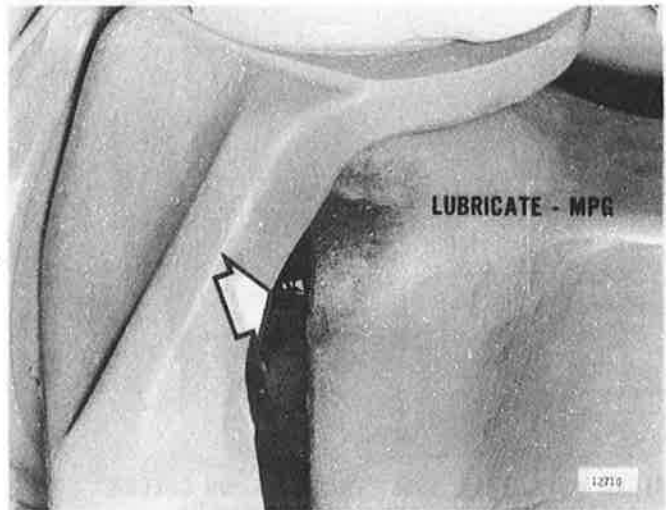


Figure 108
STEERING KNUCKLE U-JOINT
(CLARK DS 13311)



Figure 106
AXLE BREATHER

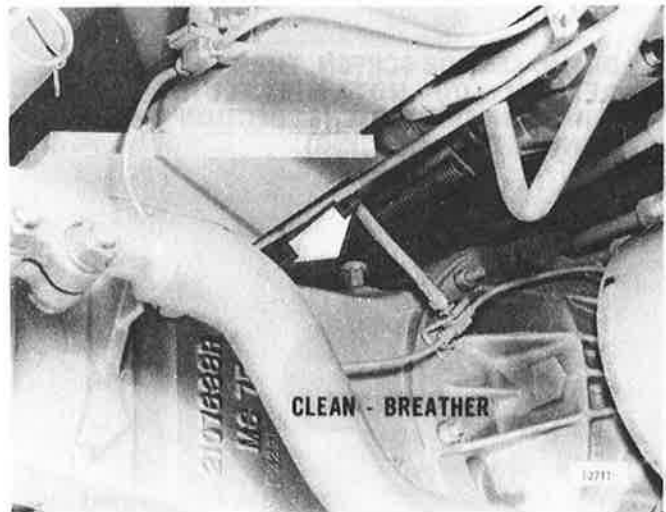


Figure 109
AXLE BREATHER
(CLARK DS 13311)

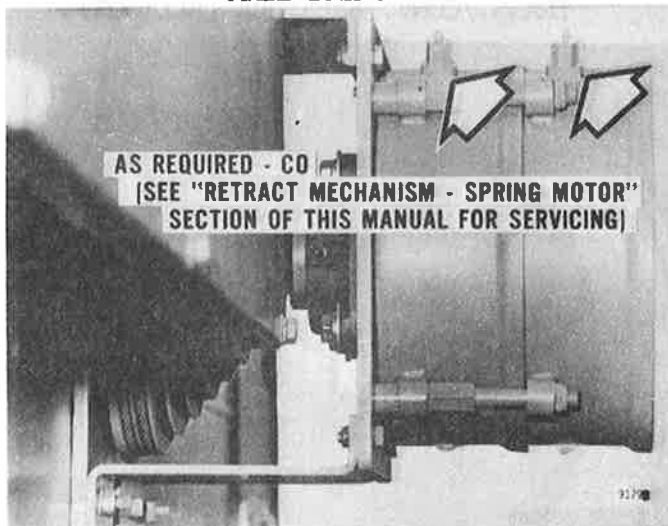


Figure 107
RETRACT REEL SPRING



1000 HOUR SERVICE



Figure 110
PLANETARY DRIVE DRAIN PLUG (CLARK)

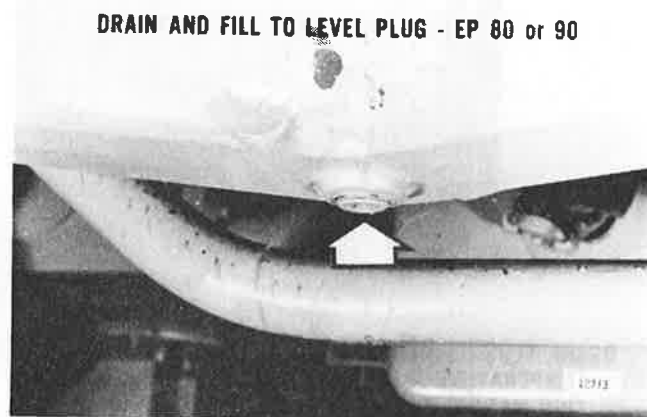


Figure 113
AXLE DRAIN PLUG (CLARK DS-13311)

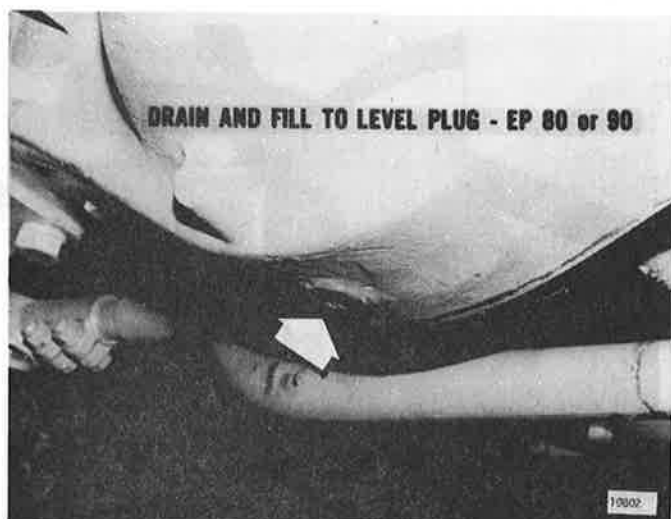


Figure 111
AXLE DRAIN PLUG (CLARK)



Figure 114
PLANETARY DRIVE DRAIN PLUG (ROCKWELL)



Figure 112
PLANETARY DRIVE DRAIN PLUG
(CLARK DS-13311)

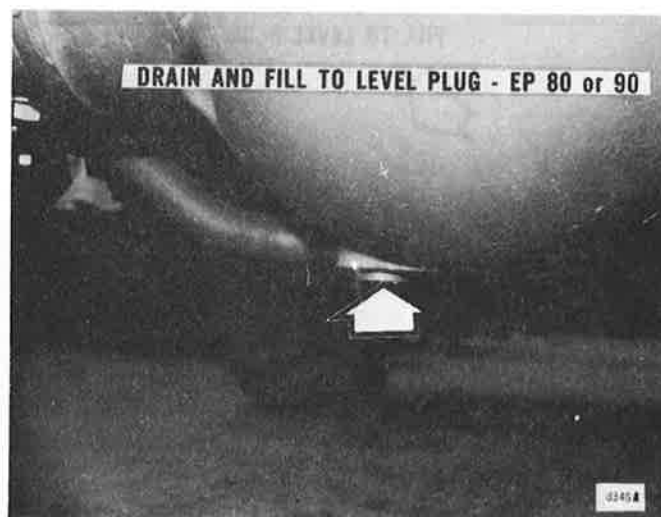


Figure 115
AXLE DRAIN PLUG (ROCKWELL)



1000 HOUR SERVICE

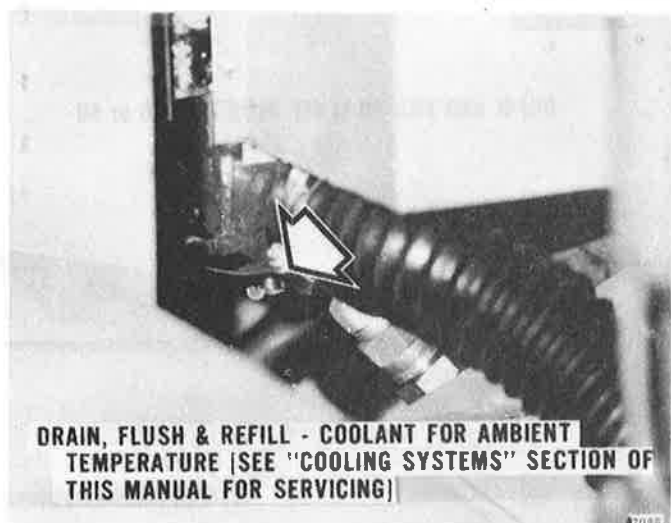


Figure 116
ENGINE RADIATOR DRAIN
(I.H., CUMM. & D.D. ONLY)

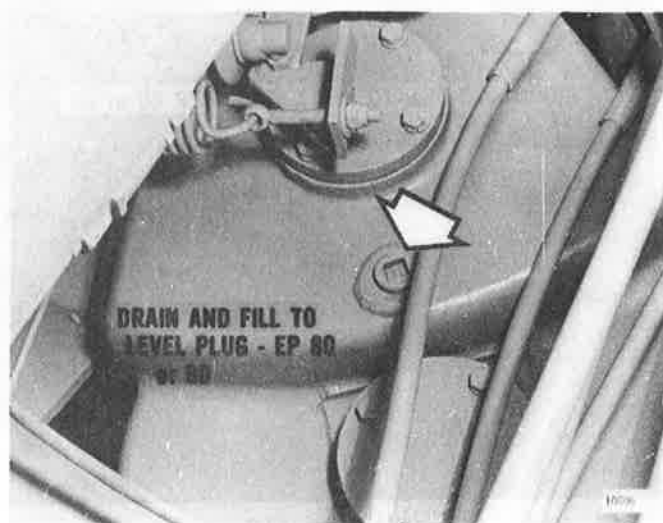


Figure 119
SWING DRIVE DRAIN PLUG

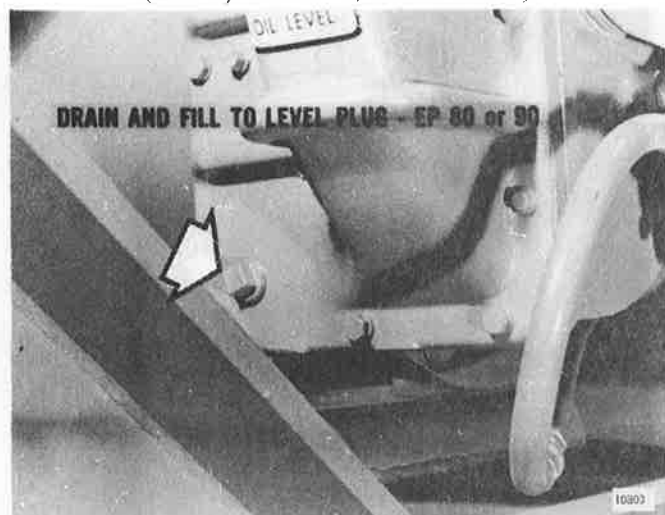


Figure 117
HOIST GEAR CASE DRAIN PLUG

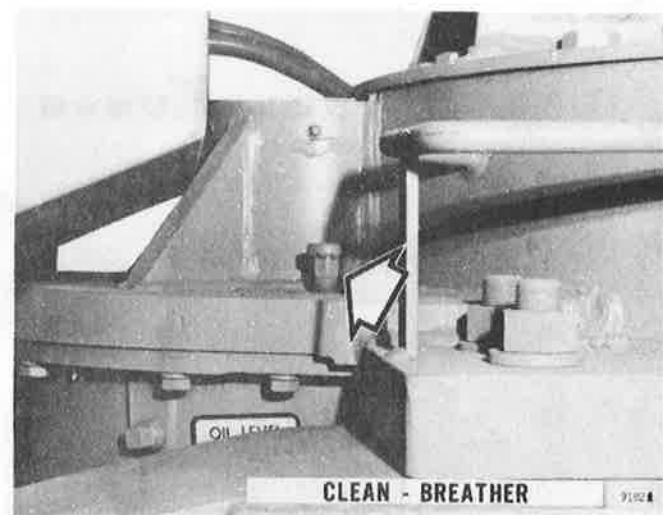


Figure 120
SWING DRIVE BREATHER & FILL PLUG

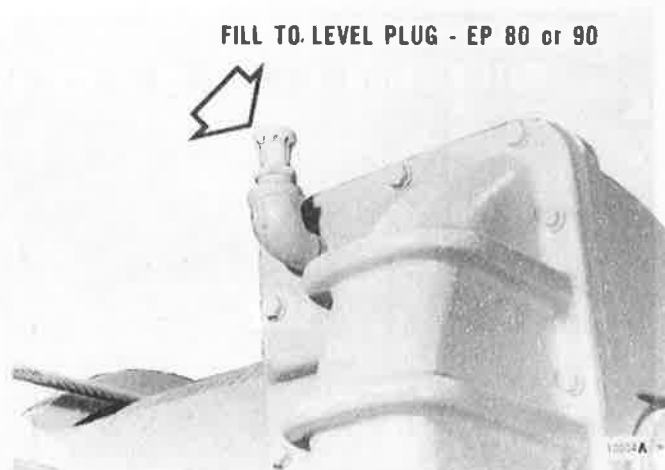


Figure 118
HOIST GEAR CASE BREATHER & FILL PLUG

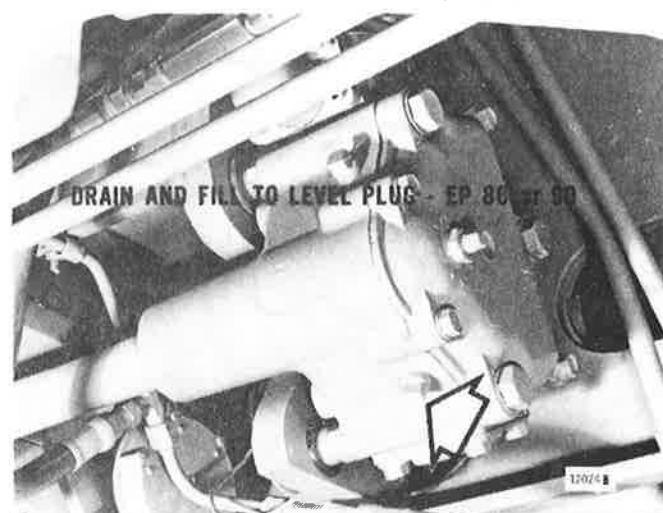


Figure 121
STEERING GEAR CASE DRAIN PLUG
(STEERING SYSTEM "A")



1000 HOUR SERVICE

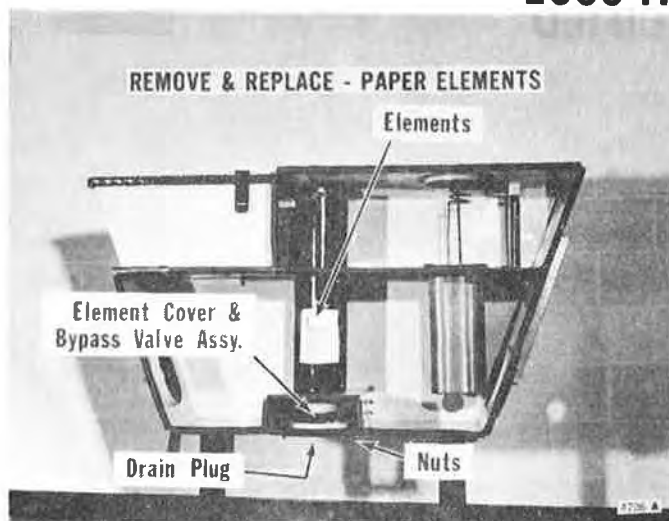


Figure 122
HYD. TANK FILTER



Figure 123
HYD. TANK DRAIN PLUG



NOT SPECIFIED



Figure 124
WIRE ROPE



Figure 125
WEAR PAD SUPPORT(S)



LUBRICATION SPECIFICATIONS

MULTI-PURPOSE LITHIUM BASE GREASE

LUBRICATION CHART CODE: **MP OR MPG**

PROPERTIES:

PENETRATION (D-217)	
UNWORKED -----	275
WORKED 60 STROKES -----	270
WORKED 10,000 STROKES -----	LESS THAN 5% RAISE
DROPPING POINT (D-566) -----	380°F. MIN.
WATER RESISTANCE -----	EXCELLENT
ASTM OXIDATION (D-942) -----	NEGATIVE
TEXTURE -----	BUTTERY & SMOOTH
SOAP BASE -----	LITHIUM
BASE OIL, POUR -----	-10
VISCOSITY AT 210°F. (98°C.) -----	78
VISCOSITY INDEX -----	95
OXIDATION INHIBITED -----	YES
COORDINATING RESEARCH CONCIL TEST	
WHEEL BEARING -----	PASSES
WHEEL BEARING OVERPACKED -----	PASSES

SOURCES:

TEXACO -----	MULTIFAK EP2
SHELL -----	ALVANIA EP-2
MOBIL OIL CORP. -----	MOBIL GREASE 77

BRAKE FLUID

LUBRICATION CHART CODE: **BF**

PROPERTIES:

FLASH POINT	
CLEVELAND OPEN CUP -----	270° (132°C.)
COLOR -----	LIGHT STRAW

TYPE: SAE 70R-3

SUITABLE FOR ALL AMBIENTS TO -60°F.
MILITARY SPEC. VV-H-910 (H58)

SOURCES:

WAGNER-LOCKHEED -----	21B
-----------------------	-----

USES:

TO BE USED IN ALL BRAKE SYSTEMS



EXTREME PRESSURE GEAR OIL SAE 90

LUBRICATION CHART CODE: **EP90 OR 90**

PROPERTIES:

MIL-L-2105C, API-GL-4, API-GL-5 EP	
VISCOSITY SUS @ 210°F. (99°C.)	75-120
VISCOSITY INDEX	90 MIN.
API GRAVITY	24-27
CHANNEL POINT	0°F. MAX. (-18°C.)
FLASH POINT	350°F. MIN. (177°C.)
MOISTURE	0.2% MAX.

SOURCES:

STANDARD OIL	GEAREP 90
TEXACO INC.	TEXACO MULTI-GEAR EP-90
SHELL	SPIRAX HD 85 W-90

EXTREME PRESSURE GEAR OIL SAE 80

LUBRICATION CHART CODE: **EP80 OR 80**

PROPERTIES:

MIL-L-2105C, API-GL-4 EP, API-GL-5 EP	
VISCOSITY SUS @ 210°F. (99°C.)	55-85
VISCOSITY INDEX	100 MIN.
API GRAVITY	25-29
CHANNEL POINT	-30°F. MAX. (-34°C. MAX.)
FLASH POINT	395°F. MIN. (202°C. MIN.)
MOISTURE	0.2% MAX.

SOURCES:

STANDARD OIL	GEAREP 80
TEXACO INC.	TEXACO MULTI-GEAR EP 80
SHELL	SPIRAX HD-80W/90



LUBRICATION CHART CODE: **HO**
TYPE: MIL-L-17672A, GRADE 2110 TL

44	
32	
30.9	D287
7.25	
30.1	D445
5.0	D445
153	D2161
43	D2161
95	D2270
-29(-20)	D97
204(400)	D92
L1.0	D1500
100(212)	D611

INDUSTRON 44
TELLUS 25
SUN PREMIUM HYDRAULIC
OIL 150

LUBRICATION CHART CODE: **C2**
TYPE: C-2 & MIL-L-2104 GRADE 10 ABOVE -10°F.
TYPE: C-2 REPLACE TYPE C-1 & TYPE A OIL

27.9	D287
395(202)	D92
-50(-46)	D97
2000	D2602
200	D2161
47.0	D2161
105	D2270

SUNFLEET C-2
DONAX T-5
C-2 TORQUE FLUID



OPEN GEAR LUBRICANT SPECIAL PURPOSE

LUBRICANT CHART CODE: **OGL OR ML2**

PROPERTIES:

TEST

NLGI GRADE	2	
PENETRATION, WORKED @ 77°F. (25°C.) -----	280	D217
VISCOSITY, MAC MICHAEL AT 70°F. (21°C.) -----	---	SUN M-15
SOAP, TYPE -----	LITHIUM	D128
SOAP, % LITHIUM -----	8.5	D128
DROPPING POINT, °F. (°C.) -----	375 (191)	D2265
PENETRATION, 10,000 STROKES, CHANGE -----	290	D217
BASE OIL DATA		
VISCOSITY, SUS/100°F. (38°C.) -----	790	D2161
VISCOSITY, SUS/210°F. (99°C.) -----	59.2	D2161
FLASH, COC, °F. (°C.) -----	395 (201)	D92
ANILINE POINT, °F. (°C.) -----	166 (74)	D611
GRAVITY, °API -----	19.1	D287
WATER, % -----	NIL	D128
RUST TEST RATING -----	2	D1743
COPPER CORROSION -----	PASS	D1261
OXIDATION STABILITY -----	---	D942
PSI DROP/100 HRS. -----	8.5	
PSI DROP/500 HRS. -----	---	
WATER WASHOUT, % AT 100°F. (38°C.) -----	3.1	D1264
WHEEL BEARING LEAKAGE, gms -----	3	D1263
TIMKEN LB. PASS -----	45	D2509
FOUR-BALL TESTS		
LOAD WEAR INDEX -----	37.6	FED. 6503
WEAR, SCAR, mm -----	.50	D2266
WELD POINT, kg -----	280	FED. 6503
BALL JOINT TEST, mg WEAR -----	18	SUN J-123

SOURCES:

SUN OIL COMPANY -----	PRESTIGE 742 EP
MOBIL OIL CORP. -----	MOBIL GREASE SPECIAL
TEXACO INC. -----	MOLYTEX #2



TABLE A
TRANSMISSION FLUID
 TYPE A, SUFFIX A

LUBRICATION CHART CODE: ATF

PROPERTIES:

TEST

AQ-ATF, TYPE A, SUFFIX A

GRAVITY API	28.2	D287
VISCOSITY, SUS @ 100°F (38°C)	185.0	D445, 2161
VISCOSITY, SUS @ 210°F (99°C)	50.85	D445, 2161
VISCOSITY INDEX	172	D2270
POUR POINT °F (°C)	-45 (-43)	D97
FLASH POINT °F (°C)	375 (191)	D92
COLOR	RED	

DEXRON

PROPERTIES:

GRAVITY API	29.5	D287
VISCOSITY, SUS @ 100°F (38°C)	210	D2161
VISCOSITY, SUS @ 210°F (99°C)	51.2	D2161
VISCOSITY INDEX	148	D2270
POUR POINT °F (°C)	-50 (-45)	D97
FLASH POINT °F (°C)	380 (193)	D92
COLOR	RED	

DEXRON II

LUBRICATION CHART CODE: ATF or D

MEETING ALLISON C-3 QUALIFICATIONS

PROPERTIES:

TEST

GRAVITY API	31.0	D287
VISCOSITY, CENTISTOKES @ 104°F (40°C)	37.0	D445
VISCOSITY, CENTISTOKES @ 212°F (100°C)	7.5	D445
VISCOSITY, SUS @ 100°F (38°C)	190	D2161, D445
VISCOSITY, SUS @ 210°F (99°C)	52.0	D2161, D445
VISCOSITY INDEX	168	D2270
VISCOSITY, CENTIPOSE @ -40°F (-40°C)	40,000	D2983
POUR POINT °F (°C)	-45 (-43)	D97
FLASH POINT °F (°C)	390 (199)	D92
COLOR	RED	

SOURCES:

PENNZOIL PRODUCTS	HYDRAFLO DEXRON II
UNION OIL COMPANY	ATF - DEXRON - II
CASTROL LTD., ASSOCIATE CO. & AGENCIES	CASTROL TQ DEXRON II
ESSO	ESSO AUTO. TRANS. FLUID
CONOCO, INC.	CONOCO DEXRON II
VALVOLINE	VALVOLINE ATF DEXRON II
SHELL INTERNATIONAL	SHELL ATF DEXRON II
VALVOLINE INTERNATIONAL	VALVOLINE ATF DEXRON II
	OR EQUIVALENT



NEW LUBRICANT CHANGE PROCEDURES

When changing to a new specification, the following procedure should be practiced:

It is imperative the new specification lubricants not be mixed with the old specifications in any manner.

1. After the unit has been operated sufficiently to bring the lubricant to normal operating temperature, remove drain plug and completely drain lubricant.
2. After draining, flushing is desirable. Clean and replace drain plug and clean fill plug area. Fill the unit to the correct level with a light flushing oil. Operate the unit for a short period of time (5-10 minutes) under extremely light or no load condition. Drain ALL of the flushing oil from the unit while it is warm. Clean and replace drain plug.
3. To refill, clean the area around the fill plug and fill the unit to the correct level with the new specification lubricant. DO NOT OVER-FILL as an excessive amount will serve no useful purpose.
4. Use same level checks and drain intervals outlined on lubrication chart and in operator's manual for the new lubrications.

NOTE: *If there is any doubt whether the unit has been filled with the old or new lubricant, the unit should be drained and flushed. Mixing of the lubricants could cause damage and cannot be tolerated.*



PREVENTATIVE MAINTENANCE SERVICES

GENERAL TORQUE VALUES

The following General Torques are to be used in all cases where SPECIFIC TORQUES are not given.

NOTE: Torque Values listed throughout this manual are Lubricated (Wet) Threads; values should be increased 1/3 for Non-Lubricated (Dry) Threads.				
Thread Size	Heat treated material Grade 5 & Grade 8			
	Grade 5 (3 radial dashes on bolt or cap screw head)		Grade 8 (6 radial dashes on bolt or cap screw head)	
	Foot Pounds (Ft. Lbs.)	Newton Meters (Nm)	Foot Pounds (Ft. Lbs.)	Newton Meters (Nm)
1/4 - 20	6	8	9	12
1/4 - 28	7	9	11	15
5/16 - 18	13	18	18	24
5/16 - 24	15	20	21	28
3/8 - 16	24	33	34	46
3/8 - 24	27	37	38	52
7/16 - 14	38	52	54	73
7/16 - 20	42	57	60	81
1/2 - 13	58	79	82	111
1/2 - 20	65	88	90	122
9/16 - 12	84	114	120	163
9/16 - 18	93	126	132	179
5/8 - 11	115	156	165	224
5/8 - 18	130	176	185	251
3/4 - 10	205	278	290	393
3/4 - 16	230	312	320	434
7/8 - 9	305	414	455	617
7/8 - 14	335	454	515	698
1 - 8	455	617	695	942
1 - 14	510	691	785	1064
1 1/8 - 7	610	827	990	1342
1 1/8 - 12	685	929	1110	1505
1 1/4 - 7	860	1166	1400	1898
1 1/4 - 12	955	1295	1550	2102
1 3/8 - 6	1130	1532	1830	2481
1 3/8 - 12	1290	1749	2085	2827
1 1/2 - 6	1500	2034	2430	3295
1 1/2 - 12	1690	2291	2730	3701
1 3/4 - 5	2370	3213	3810	5166
2 - 4 1/2	3550	4813	5760	7810

NOTE: If any bolts and nuts are found loose or at values less than what the chart states, it is recommended that the loose bolt and/or nut be replaced with a new one.



SPECIFIC TORQUE VALUES

HOIST MOUNTING BOLTS

150A (3) 3/4" - 16 UNF - 2A X 2-1/4" LG. GR. 5
150FA (3) 3/4" - 10 UNC - 2A X 3-1/4" LG. GR. 5
230 FT. LBS. (WET)
(312 Nm)

COUNTERWEIGHT CAPSCREWS :

150A (4) 1-1/4" - 7 UNC - 2A X 4" LG. GR. 5
150FA (3) 1-1/4" - 7 UNC - 2A X 8-1/2" LG. GR. 5
840 FT. LBS. (WET)
(1139 Nm)

ROTARY JOINT DRIVE CAPSCREWS (2)

ADJUST TO 1/16" (1.58 mm)
CLEARANCE EACH SIDE

BASE PLATE TO FRAME

NUTS (12)
1" - 14 UNS - 2B GR. 8
785 FT. LBS. (WET)
(1064 Nm)

PRIMARY MANIFOLD TO ADAPTOR

BLOCK CAPSCREWS :

SERIAL NO. 07305 - 7531

(2) LARGE HEAD CAPSCREWS

70 FT. LBS. (WET) (95 Nm)

(2) SMALL HEAD CAPSCREWS

61 FT. LBS. (WET) (83 Nm)

SERIAL NO. 07532 & UP

(4) 5/8" - 11 UNC - 3A X 7-3/4" LG. GR. 8

70 FT. LBS. (WET) (95 Nm)

WHEEL LUG NUTS

AMOUNT EACH WHEEL :

CLARK AXLE (10)

3/4" - 16 UNF LUG NUT

ROCKWELL AXLE (12)

3/4" - 16 UNF LUG NUT

230 FT. LBS. (WET)

(312 Nm)

FRONT OUTRIGGER CAPSCREWS (16)

1" - 14 UNS - 2A X 2-1/4" LG. GR. 5

510 FT. LBS. (WET)

(691 Nm)

ROTARY JOINT TO BASE

PLATE CAPSCREWS (4)

1/2" - 13 UNC - 2A X 2" LG. GR. 5

55 FT. LBS. (WET)

(75 Nm)

SUPPORT CAPSCREWS (6)

1" - 8 UNC - 2A X 3" LG. GR. 5

450 - 500 FT. LBS. (WET)

(610 - 678 Nm)

SWING BEARING TO BASE PLATE CAPSCREWS

(19) 7/8" - 14 UNF - 3A X 6-3/4" LG. GR. 8 NOT PAINTED

500 FT. LBS. (WET) (678 Nm)

(5) 7/8" - 14 UNF - 2A X 4-3/4" LG. GR. 8 PAINTED

250 FT. LBS. (WET) (339 Nm)

(REMOVE (2) COVERS ON TOP OF PEDESTAL BASE

TO TORQUE CAPSCREWS AND OBSERVE HEADS OF

BOLTS AS BOOM IS ROTATED 360 DEGREES. THE

(5) PAINTED CAPSCREWS ARE IN FRONT NEXT TO CAB.)

PEDESTAL TO SWING BEARING

CAPSCREWS (20)

7/8" - 14 UNF - 2A X 2-3/4" LG. GR. 8

500 FT. LBS. (WET)

(678 Nm)

FRONT AXLE TO FRAME LOCK

NUTS (4) EACH SIDE

1" - 14 UNS - 3B

510 FT. LBS. (WET)

(691 Nm)

REAR AXLE RUBBER MOUNT TO

FRAME LOCK NUTS (4) EACH SIDE

1" - 14 UNS - 3B

510 FT. LBS. (WET)

(691 Nm)

STEERING SHAFT ARM NUT (1)

1-1/8" - 12 UNF

195 FT. LBS. (WET)

(264 Nm)

REAR AXLE TO REAR AXLE MOUNT

CAPSCREWS (4) EACH SIDE

1" - 14 UNS - 2A X 8-1/2" LG. GR. 5

510 FT. LBS. (WET)

(691 Nm)

OUTRIGGER ON REAR IS
WELDED TO FRAME.

NOTE: If any bolts and nuts are found loose or at values less than what the chart states, it is recommended that the loose bolt and/or nut be replaced with a new one.



ENGINE FUEL SYSTEM

The lower portion of the fuel supply tank acts as a water trap, since the supply line to the fuel pump picks up fuel a short distance above the bottom of the tank. The drain plug can then be used to remove moisture.

To avoid moisture condensation in the fuel tank, fill the tank immediately following the end of each day's operation. Do not allow the tank to stand overnight in an unfilled condition. When filled, the walls of the fuel tank are completely covered with fuel, thereby preventing condensation from forming in the inside of the tank.

Fuel should always be strained or filtered before being put into the supply tank. This will lengthen the life of the engine fuel filter and reduce the chances of dirt getting into the fuel pump and injectors.

Fuel filter elements are designed to trap dirt and sediment that has entered the fuel system. A filter that has been allowed to become dirty and clogged from over-use will be more of a handicap than help to an engine. It will restrict the flow of fuel, thus reducing horsepower output.

Excessive amounts of water in the fuel will cause rusting and corrosion in the injectors as well as to fuel pump shafts, bearings and other parts. In some sections it is difficult to purchase fuel which does not contain some water. Normal condensation, either in the storage tank or in the fuel tank, increases water content. This water, of course, must be filtered out or drained off before it gets into the fuel pump. The life of fuel pump and injectors can be considerably extended if the operator takes the precaution of draining about a cup of fuel from the lowest point in the fuel system before starting the engine each day.

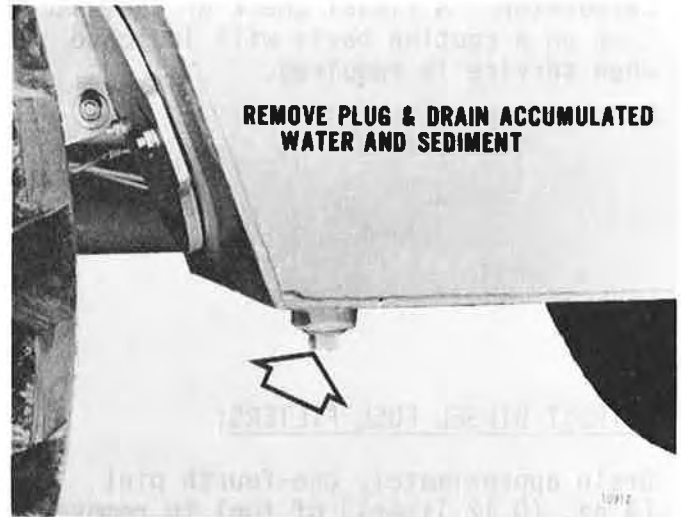


Figure 126



DO NOT SERVICE NEAR OPEN FLAME. NO SMOKING. IT IS RECOMMENDED THAT THE ENGINE BE ALLOWED TO COOL BEFORE SERVICING FUEL SYSTEM. THIS WILL REDUCE THE RISK OF FIRE HAZARD.



IH GASOLINE FUEL FILTER:

Refer to the Engine Operator's Manual for the proper procedure to service the water trap and filter beneath the fuel pump, and the fuel filter element in the carburetor. A visual check of the water trap on a routine basis will indicate when service is required.

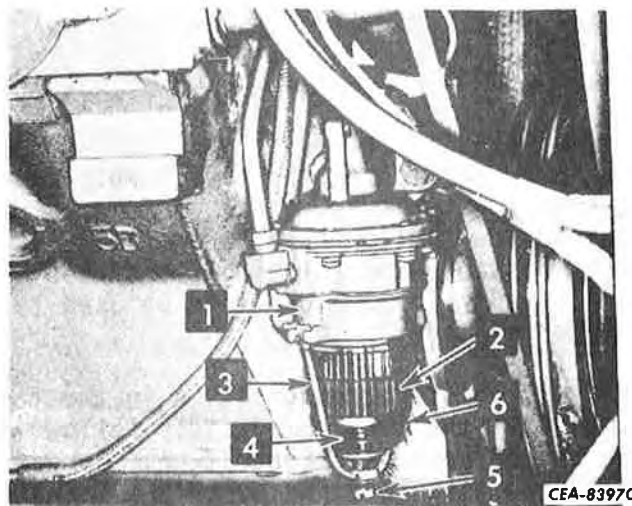


Figure 127
IH GASOLINE FUEL FILTER

DETROIT DIESEL FUEL FILTERS:

Drain approximately one-fourth pint [4 oz. (0.12 liter)] of fuel to remove sediment and water from the strainer and the filter daily by opening the drain cock in the bottom of each shell. Refer to Engine Operator's Manual for element replacement intervals.

NOTE: *On newer Detroit Diesel Engines this style filter element is replaced by a spin-on type filter.*

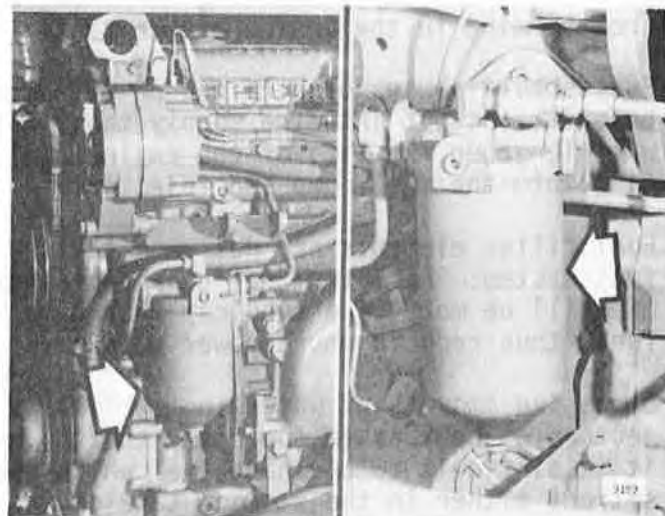


Figure 128
DETROIT DIESEL FUEL FILTERS

DEUTZ DIESEL FUEL FILTER:

Refer to Engine Operator's Manual for proper care and maintenance of fuel filter.



Figure 129
DEUTZ DIESEL FUEL FILTER

**DIESEL FUEL SPECIFICATIONS**

REQUIREMENTS	GRADE 2-D (PREFERRED) +	GRADE 1-D +
Flash Point, (min.)	125°F.(51.6°C.) or legal	100°F.(37.7°C.) or legal
Pour Point, (min.)	10°F.(-12.2°C.) below ambient +	10°F.(-12.2°C.) below ambient +
Cloud Point, (max.)	ambient +	ambient +
Water & Sediment, % by vol., (max.)	0.10	trace
Carbon Residue on 10% Residuum, % (max.)	0.35	0.15
Ash, % by weight, (max.)	0.02	0.01
Distillation Temperature		
90% Point, (min.)	540°F.(282.2°C.)	-
90% Point, (max.)	640°F.(337.7°C.)	550°F.(287.7°C.)
Sulfur, % by weight (max.)	0.5	0.5
Cetane Number, (min.)	40	40
Copper Strop Corrosion, (max.)	No. 3	No. 3
Viscosity, Kinematic @ 100°F.(37.7°C.) centistokes, (min.)	2.0	1.4
Viscosity, Kinematic @ 100°F.(37.7°C.) centistokes, (max.)	4.3	2.5

NOTE: / - Grade 2-D is preferred but 1-D should be used at temperatures below 10°F. (-12.2°C.) or for operations entailing considerable idling.

+ - Ambient refers to lowest temperatures at which engine is to be operated.



ELECTRICAL SYSTEM

The GALION CRANE is equipped with an alternator (a continuous output, diode rectified, a.c. generator) which differs from a d.c. generator. The alternator offers the advantage of being capable of a high charging rate at low engine rpm.

CERTAIN PRECAUTIONS MUST BE OBSERVED WHEN AN ALTERNATOR IS USED.



1. Always make absolutely sure the polarity is correct when installing a new battery. The crane system is a negative (-) ground system. The negative (-) post of the battery must go to ground.
2. Do not short across any of the terminals of the alternator or regulator.
3. Do not attempt to polarize the alternator.
4. Always disconnect the ground strap before replacing any electrical unit in the system.
5. Never operate the alternator on an open circuit. Make sure all leads are connected and tightened securely.
6. Disconnect wiring harness from alternator before using an electric welder anywhere on the crane.
7. Diode installation: connect dark end of diode to wire leading to alternator, light end to wire leading to harness.

All electrical accessories are controlled from the instrument panel.

Keep battery cells to correct level at all times by adding only distilled water when necessary. Maintain storage battery at full charge at all times. A battery that is fully charged has a specific gravity reading of 1.260 to 1.280 at 80°F.(27°C.) when tested with a hydrometer. This reading is affected by temperature, therefore, it is necessary to determine the exact temperature of the electrolyte using a thermometer. Once the temperature of the electrolyte is determined and the specific gravity has been tested, the reading is easily corrected by adding .004 points to the reading for every 10°F.(6°C.) above 80°F.(27°C.) or subtracting .004 points for every 10°F.(6°C.) below 80°F.(27°C.).

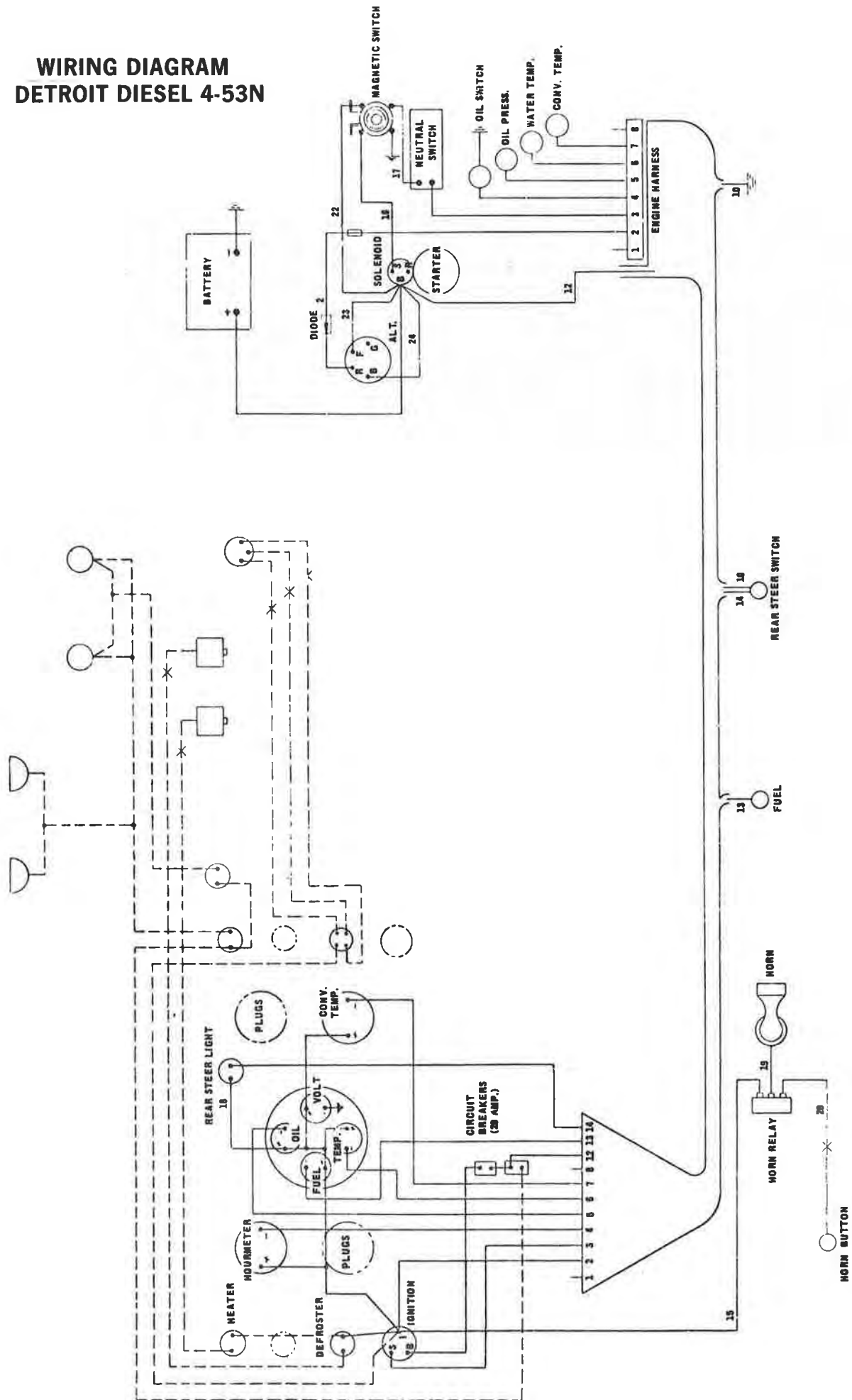
When the ambient air temperature drops to 32°F.(0°C.) and lower, the efficiency of a battery decreases rapidly. At temperatures of -20°F.(-29°C.) or lower, do not try to start the engine unless the battery has been heated. A satisfactory means of heating is to immerse the battery in warm water to within about one inch (25 mm) of the top of the case.



It is especially important to keep the battery at full charge for cold weather operation. Check the specific gravity of the battery electrolyte at frequent intervals, and keep the battery as fully charged as possible. Electrolyte will not freeze if the battery is kept fully charged unless the ambient air temperature reaches -83°F . (-64°C .). Electrolyte will freeze, however, at 0°F . (-18°C .) if the specific gravity is allowed to drop to 1.160. Freezing can occur at even higher temperatures if the specific gravity of the electrolyte is allowed to drop even farther. Remember: FREEZING CAN OCCUR if proper precautions are not taken. Add distilled water to the battery in freezing temperatures only when the engine is to operate for several hours to permit thorough mixing of electrolyte and water. "Topping off" the battery with water without allowing time for mixing can result in the water freezing and, consequently, damage to the battery.

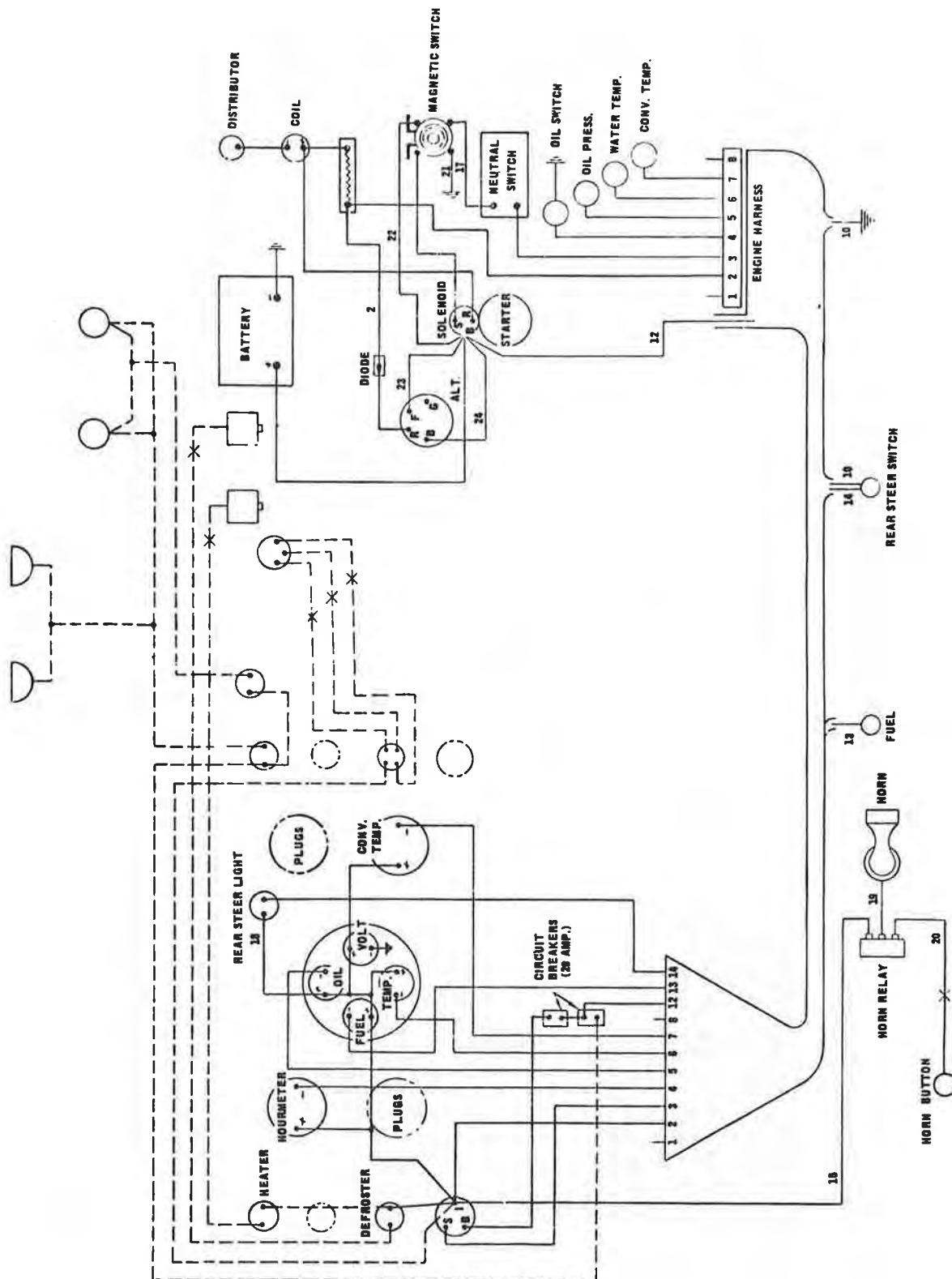


WIRING DIAGRAM DETROIT DIESEL 4-53N



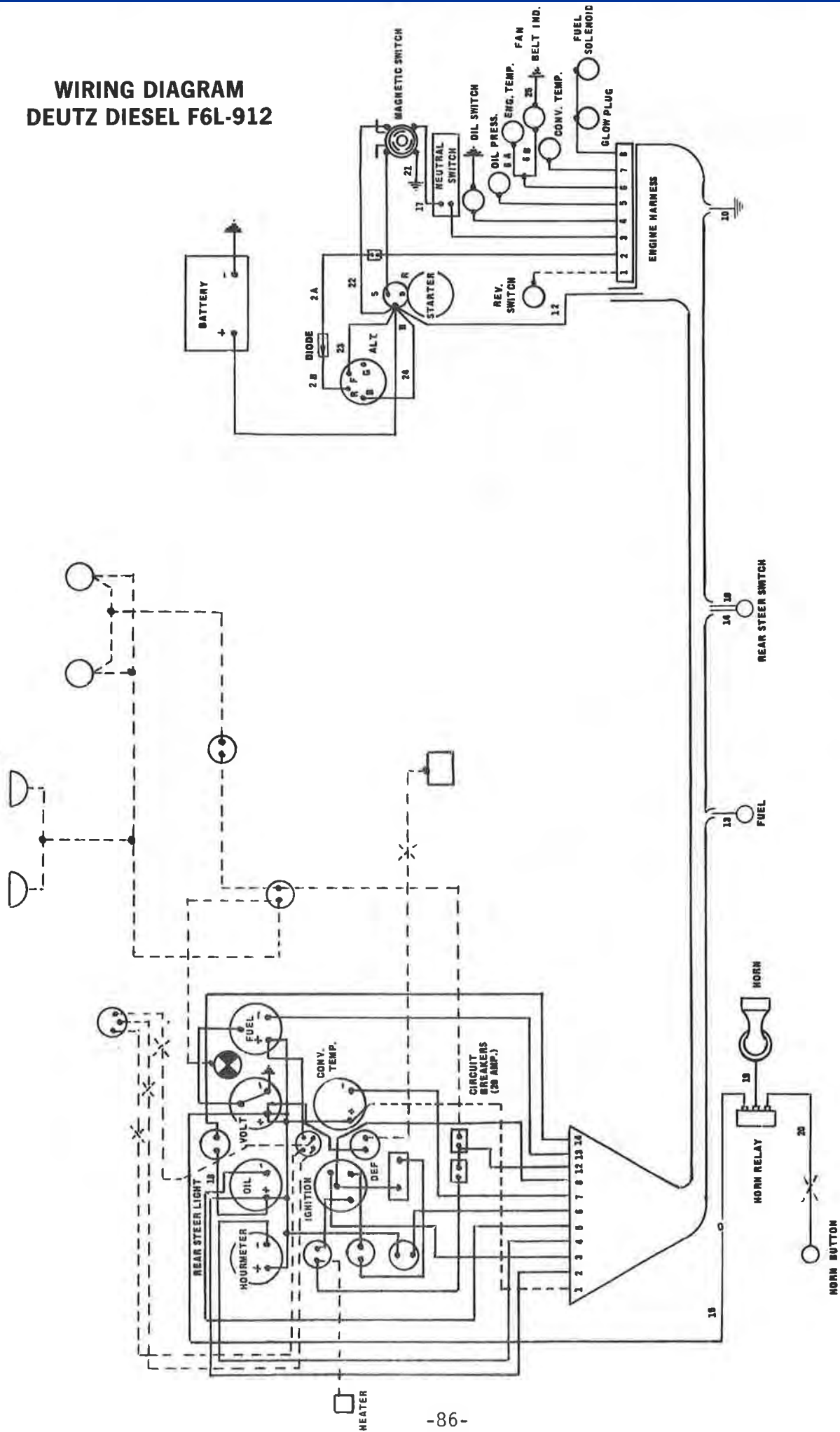


WIRING DIAGRAM IH GASOLINE UV-345





WIRING DIAGRAM DEUTZ DIESEL F6L-912





COOLING SYSTEM

The IH Gasoline, Cummins Diesel and Detroit Diesel engines are liquid cooled. The Deutz Diesel engine is air cooled. Both varieties of engines require their own special services to prevent them from overheating. The following sections outline briefly the services that must be performed to them. Always refer to the Engine Operator's Manual or Handbook for specific information and service intervals.

DEUTZ DIESEL COOLING SYSTEM

Cleaning the cooling fins is essential since accumulation of dust on fins, of cylinders and heads as well as on oil cooler is liable to reduce cooling efficiency substantially.

As to the actual cleaning method, it is advisable to use dry means, e.g. a wire and, if possible, compressed air. Take special care to clean the vertical cylinder head cooling fins.

Carefully clean also the fins of the oil cooler. Start blowing through from the exhaust side.

If diesel fuel or a cold cleansing agent is used for cleaning, it is important, after allowing an adequate soaking-in period, to wash the parts with a powerful water-jet. Following this, the engine should be run until warm so that any water left behind will be evaporated before rust can form.

If a steam-jet is available, this method of cleaning is preferable to any other.



WEAR GOGGLES WHEN USING ANY PRESSURE CLEANING DEVICE.



IH GASOLINE & DETROIT DIESEL COOLING SYSTEMS

Always use clean water in the radiator (rain water or soft water preferred). Water from creeks and stagnant pools usually contains dirt, minerals, and/or organic material that is deposited in the cooling system and impairs cooling efficiency. The cooling system should be cleaned and maintained as per engine manufacturer's instructions which are found in the Engine Operator's Manual or Handbook.

Overheating of engine is often caused by bent or clogged radiator fins. The spaces between the fins can be cleaned by use of air or water under pressure. When straightening bent fins, use care not to injure the tubes or break the bond between the fins and tubes.



DO NOT POUR COLD WATER INTO COOLING SYSTEM WHEN ENGINE IS VERY HOT AND THE WATER LEVEL IS BELOW THE TOP OF THE TUBES IN THE RADIATOR. SUCH ACTION COULD RESULT IN DAMAGE TO CYLINDER HEADS OF THE ENGINE.

The following table indicates percentage of antifreeze to be used for various low ambient temperatures:

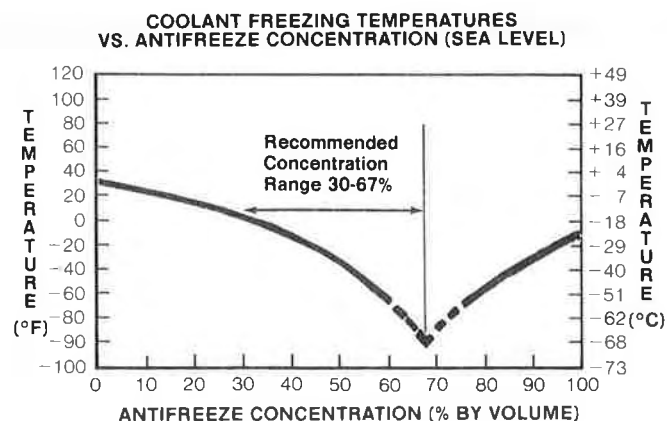


Figure 130



TO DRAIN COOLING SYSTEM:

Drain cooling system immediately after stopping engine, while most of the sediment is in suspension.

1. Shutdown engine.
2. Remove radiator cap.



USING A RAG TO PREVENT BURNS TO HAND, LOOSEN RADIATOR CAP SLOWLY TO ALLOW PRESSURE TO ESCAPE BEFORE REMOVING.

3. Open radiator drain valve.
4. Open engine block drain valves (both sides of engine block).
5. Open oil cooler drain valve (Detroit Diesel only).
6. Allow all coolant to drain before refilling.

TO FILL COOLING SYSTEM:

1. Close all drain valves.
2. Let engine cool before filling the cooling system. Refer to the Engine Operator's Manual for recommended coolant or additives.



DO NOT POUR COOLANT INTO COOLING SYSTEM WHEN ENGINE IS VERY HOT. SUCH ACTION COULD RESULT IN DAMAGE TO THE ENGINE.

3. Fill cooling system to within 1" (25.40 mm) of the radiator cap.
4. Install radiator cap.

NOTE: *If flushing of the cooling system is desired before adding coolant, follow the above filling procedure by first using clean soft water. Operate the engine for 15 minutes to fully circulate water. Repeat draining procedure. Repeat filling procedure using desired coolant.*

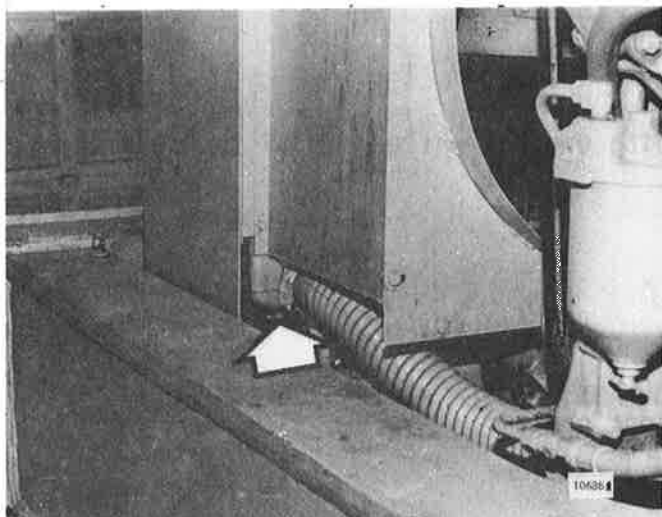


Figure 131
RADIATOR DRAIN VALVE

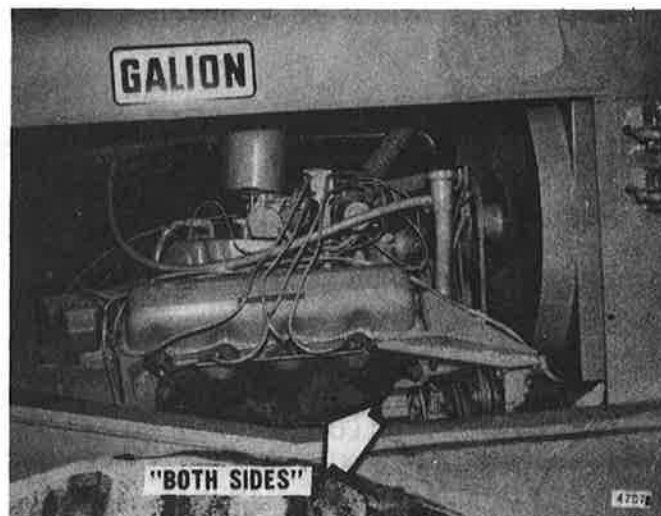


Figure 134
IH GASOLINE DRAIN VALVES

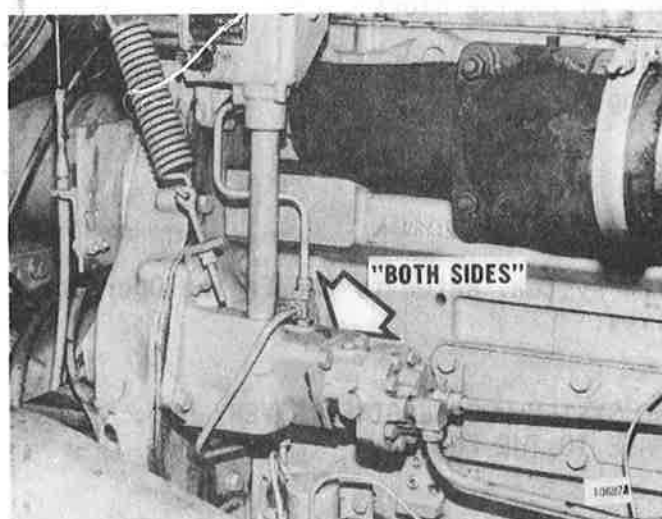


Figure 132
DETROIT DIESEL DRAIN VALVES

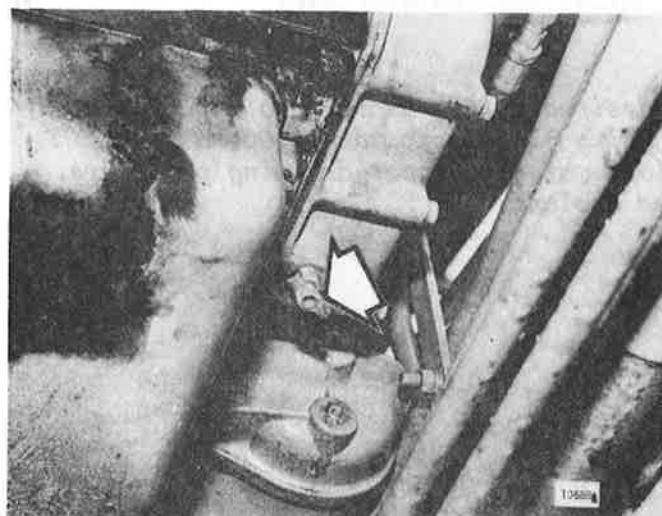


Figure 133
DETROIT DIESEL OIL COOLER DRAIN VALVE



LUBRICATING OIL SYSTEM

The lubricating oil filter(s) keep the circulating oil free from harmful contamination. Refer to appropriate Engine Operator or Service Manual for oil and filter element change intervals and procedure.

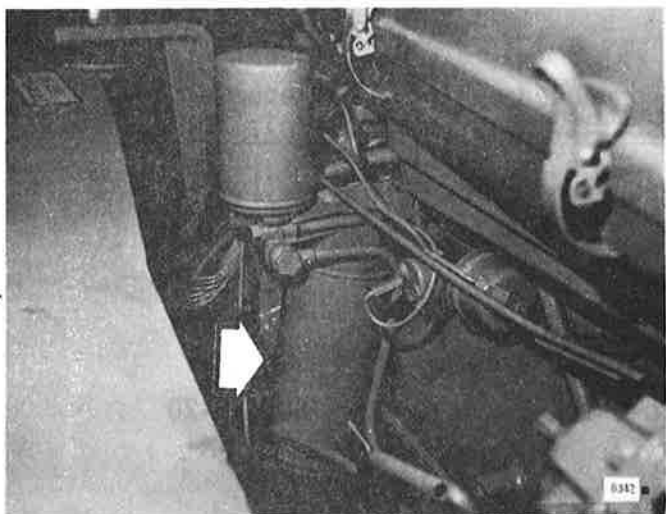


Figure 135
DEUTZ DIESEL

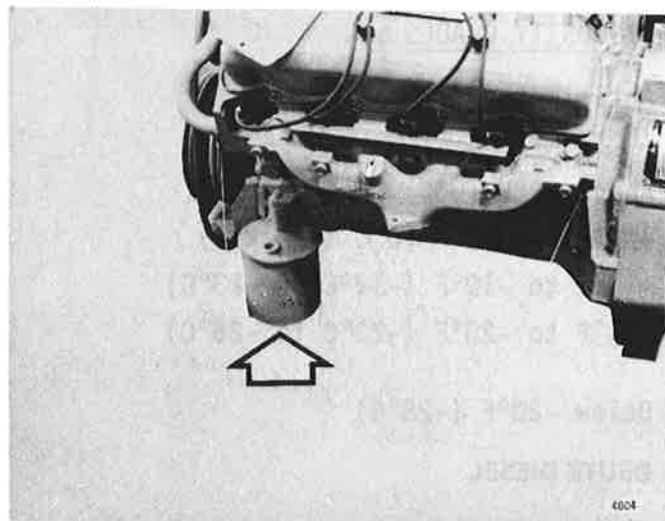


Figure 137
IH GASOLINE

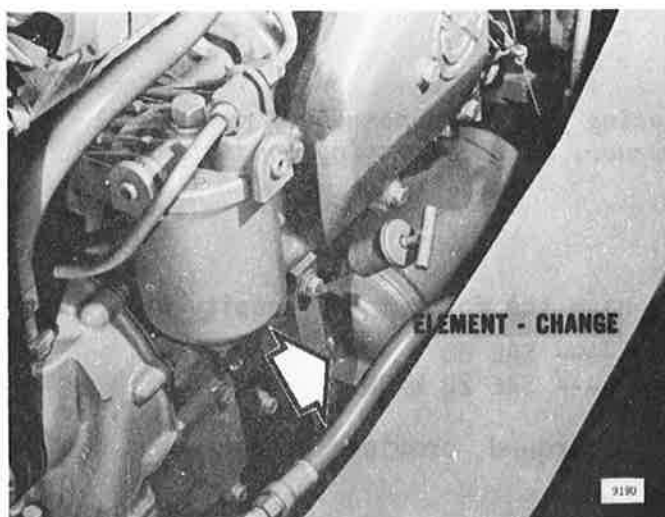


Figure 136
DETROIT DIESEL

NOTE: Check for oil leaks after starting engine.

**LUBRICATING OIL SPECIFICATIONS****IH GASOLINE**APPROVED TYPES

- (1) MIL-L-2104B
- (2) DEF-2101C
- (3) Sup. 1
- (4) Service "MS"
- (5) API Engine Service CC

VISCOSITY GRADES

<u>Anticipated Temperature</u>	<u>Recommended Viscosity</u>	<u>Recommended Multi-Viscosity</u>
Above 32°F (0°C)	Grade 30	
+32°F to +10°F (0°C to -12°C)	Grade 10 SAE 20W	SAE-10W-30
+10°F to -10°F (-12°C to -23°C)	Grade 10	SAE-10W-30
-10°F to -20°F (-23°C to -28°C)	Grade 10 Diluted with 10% Kerosene	
Below -20°F (-28°C)	MIL-L-10295	SAE-5W-20

DEUTZ DIESELAPPROVED TYPES

Normal operating conditions:

MIL-L-2104B Sup. 1
DEF 2101 D

Heavy operating conditions:

MIL-L-2104 B
MIL-L-2104 A Sup. 1

NOTE: *It is also permissible to use oils meeting former Supplement 3 or Supplement 2 requirements, except, however, where operating conditions involve prolonged idling periods.*

VISCOSITY GRADES

To suit ambient temperatures, the oils should have the following viscosity grades:

Above 68°F (+20°C) ----- SAE 30
From 68°F to 14°F (+20°C to -10°C) ----- SAE 20 W/20

It is permissible to use SAE 20 W/20 all the year round, provided temperatures are not extremely high in summer, low in winter.

The viscosity class should be selected according to the temperature prevailing at the time of starting, not the peak temperature of the day.

**DETROIT DIESEL**

Detroit Diesel engines have given optimum performance and experienced the longest service life with the following oil performance levels having the ash and zinc limits shown:

Former Military Identification	API Letter Code Service Classification	SAE Grade
MIL-L-2104B/1964MS*	CC/SC	40 or 30●
Supplement 1 **	CB	40 or 30●

*Military Specification MIL-L-2104B is obsolete and new developed products can no longer be qualified to meet this performance level. However, many lubricants formulated to meet the performance criteria of MIL-L-2104B/1964MS are still being marketed. Detroit Diesel engines have given optimum performance and experienced the longest service life using MIL-L-2104B/1964MS lubricants. The majority of MIL-L-2104B/1964MS lubricants have a sulfated ash content between 0.55 and 0.85 percent by weight.

**Supplement 1 oils have a history of very satisfactory performance in Detroit Diesel engines. Supplement 1 oils have a relatively low ash content. However, the Supplement 1 oil specification is obsolete and new products cannot be qualified to meet this performance level. Some older formulations are still distributed and used by Detroit Diesel engine customers.

●SAE 40 grade oil has performed satisfactorily and is recommended in Detroit Diesel engines. Obviously, the expected ambient temperatures and engine cranking capability must be considered by the engine owner/operator when selecting the proper grade of oil. Only when the ambient temperatures and engine cranking capabilities result in difficult starting should SAE 30 grade oil be used.

ASH LIMIT

The sulfated ash (ASTM D-874) limit of all the lubricants recommended or selected as alternates for use in Detroit Diesel engines shall not exceed 1.000 percent by weight, except lubricants that contain only barium detergent-dispersant salts where 1.500 percent by weight is allowed. Lubricants having a history of excellent performance in Detroit Diesel engines. Lubricants having a sulfated ash content greater than 0.85 percent by weight are prone to produce greater deposit levels in the ring belt and exhaust valve areas of the engine.

ZINC CONTENT

The zinc content, as zinc diorganodithiophosphate, of all the lubricants recommended or selected as alternates for use in Detroit Diesel engines shall be a minimum of 0.07 percent by weight. However, where EMD or RR oils are used in marine service applications, the minimum zinc content is not required.

ALTERNATE LUBRICANT SELECTIONS

Current Military or Industry Accepted Identification	API Letter Code Service Identification	SAE Grade
MIL-L-2104C ***	CD/SC	40 or 30
MIL-L-46152 ***	CC/SE	40 or 30
Universal	Numerous	40 or 30

***Some lube suppliers have superseded the obsolete MIL-L-2104B oils with either MIL-L-2104C, MIL-L-46152 or Universal lubricants. Generally, all of the above oil performance levels contain a higher sulfated ash content than the older MIL-L-2104B/1964MS lubricants. Ring belt and exhaust valve deposits are usually greater when higher ash lubricants are used. Excessive deposit formation in these areas may result in stuck rings and/or guttered valves.

MIL-L-2104C, MIL-L-46152 or Universal lubricants may be used if they meet the sulfated ash and zinc limits shown elsewhere in this specification and sufficient evidence of satisfactory performance in Detroit Diesel engines have been provided to the customer by the oil supplier.

ENGINE CRANKCASE VENTILATION

Ventilation of the crankcase is provided in the IH Gasoline and Detroit Diesel engines to prevent the build-up of harmful vapors and pressure created by the heated lubricating oil.

NOTE: *Refer to the Engine Operator's Manual for the latest service intervals and procedures.*

IH GASOLINE

The IH gasoline engine is provided with a ventilator metering valve which maintains a positive air flow through the crankcase.

Have your IH branch or dealer service this valve at regular intervals of 300 hours or less, depending on operating conditions.

DETROIT DIESEL

Clean the externally mounted crankcase breather assembly every 1,000 hours. This cleaning period may be reduced or lengthened according to severity of service. Clean the internally mounted breather pads at time of engine overhaul, or sooner if excessive crankcase pressure is observed.

Remove the crankcase breather from the engine and wash the steel mesh pad (element) in fuel oil and dry it with compressed air. Reinstall the breather assembly.

Clean the breather cap, mounted on the valve rocker cover, in clean fuel every time the engine oil is changed.



CARE OF HYDRAULIC SYSTEM

The function of the GALION HYDRAULIC CRANE is dependent upon the hydraulic system. The system's life is dependent upon the hydraulic oil and the care given to it.

The hydraulic system has been engineered to function with an oil that is available from most suppliers, and is relatively inexpensive. The Galion Crane is factory filled with what is basically a light turbine oil, non-corrosive and will pour at -30°F (-34°C). It contains rust oxidation inhibitors suitable for a minimum of 1000 hours operation under most conditions. It is available under military specifications and is identified as MIL-L-17672A Grade 2110 TL. Complete specifications and optional use of other oils are listed in the lubrication section of this manual.

Maintain the oil at correct level, keep the tank screen clean and change oil and filter elements at suggested change periods. See Lubrication Chart in this manual for proper procedure.

When additional oil is required, use a clean container. Clean the tank cover and around the tank opening prior to adding oil. Dirt is the worst enemy of a hydraulic system, keep it clean.

REMOVAL:

1. Clean outside of tank in vicinity of cover. Clean cover.
2. Remove nuts and lift cover (1, Figure 138) off.
3. Remove hold down spider (4).
4. With a clean hand, reach into tank and remove screen (5) and gasket (6).
5. Allow oil to drain from screen.

Clean screen by washing in solvent. If possible, blow dry with compressed air from the outside.

Examine screen for petroleum varnish deposits. If present, remove with paint thinner or acetone. If varnish deposits are present, a change of hydraulic oil is indicated. Varnish indicates that the oil has lost its capability to properly protect the hydraulic system.

6. Clean magnets on spider (4).

INSTALLATION:

1. Install gasket (6) on screen (5).
2. Install assembly in tank.
3. Place spider assembly (4) on screen.
4. Install seal (3) in tank cover.
5. Place cover assembly on tank. Spider spring must go on boss in cover.
6. Install the nuts and tighten evenly.

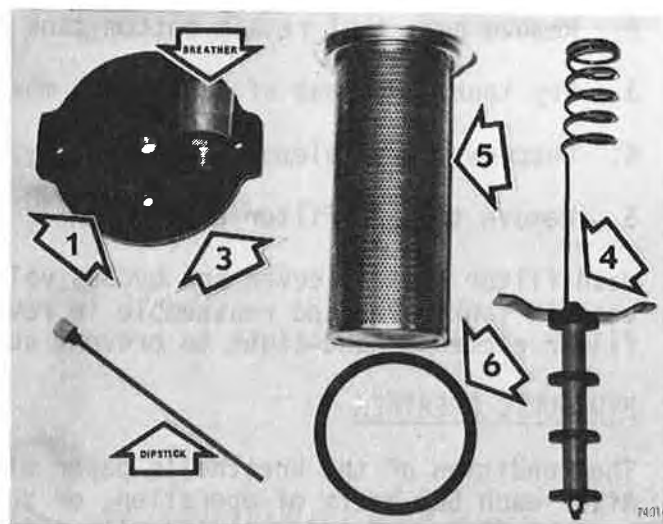


Figure 138



A double element filter is provided in the bottom of the hydraulic tank to filter all oil as it returns to the tank.

The elements must be replaced after first 100 hours, two spare elements are shipped with each crane from factory for this purpose. Change each 1000 hours of operation thereafter. If the hydraulic system is repaired, replace elements after first 100 hours of operation.

TO SERVICE FILTER:

1. Remove drain plug from bottom tank cover. Approx. 5 U.S. Gallons(19 liters) of hydraulic oil will be lost. Discard this oil.
2. Remove nuts that retain bottom tank cover.
3. Pry tank cover out of tank base, moving first one side, then the other.
4. Unscrew filter element cover and bypass valve assembly.
5. Remove two (2) filter elements.

Wash filter element cover and bypass valve assembly in suitable solvent. Replace seal in tank cover and reassemble in reverse order. Tighten filter cover against filter elements hand-tight to prevent crushing elements.

HYDRAULIC BREATHER

The condition of the breather's paper element should be checked every 50 hours. After each 500 hours of operation, or sooner if conditions require, the paper element must be discarded and replaced with a new element.

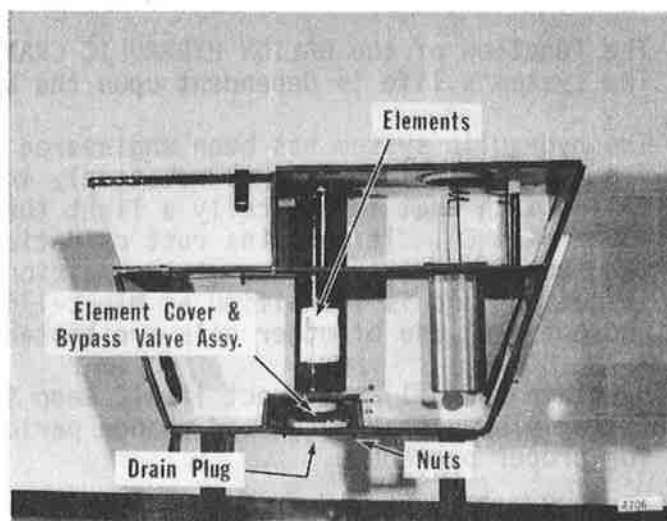


Figure 139



ENGINE AIR SYSTEM

To prevent the entrance of dirt into the engine, it is absolutely essential that periodic inspections be made of air cleaner hose, elbow, and piping connections between the manifold and the air cleaner. Hose connections should be replaced prior to deterioration. To eliminate undue strain on piping and connections, make sure that all components line up properly. See that all joints between the air cleaner and engine manifold are tight. This includes flexible connections and manifold gaskets. Be sure that manifold stud bolts are torqued to required torque readings.

The cleaner is provided with an air intake cap to prevent large particles such as chaff, leaves, etc., from entering the air cleaner. Keep this inlet screen clean. The holes must be kept open and free from paint. Dust, oil, or water may collect on the screen and clog the holes enough to restrict the flow of air to the engine. Restricted air flow will reduce the power delivered by the engine.

The air intake pipe from intake cap to air cleaner should not be allowed to collect dirt on the inside. Clean this pipe when the air cleaner is removed. At the same time, clean inlet tube to the air cleaner.

The Donacclone Cyclopac air cleaner supplied as standard equipment requires daily (10 hour) service -- more often under severe operating conditions.

A tight positive seal must be made between dust cup and cleaner after each servicing.

Leakage at this point will increase dust loading and make it necessary to service filter element more often. It is recommended that several replacement gaskets be kept in stock at all times because of the frequency of dust cup servicing and the possibility of damage to gasket.

Excessive exhaust smoke and/or loss of power may indicate need for filter element service. If equipment is available, measure air restriction of cleaner with a manometer at available restriction taps in the induction system. Service is required when air restriction has increased to maximum allowable limits as established by engine manufacturer. Replace tap plug securely after measuring.



TO SERVICE THE CLEANER & FILTER:

1. Stop engine.
2. Loosen clamp. Remove dust cup.



Figure 140

3. Remove wing nut in cup assembly.
Remove barrier.

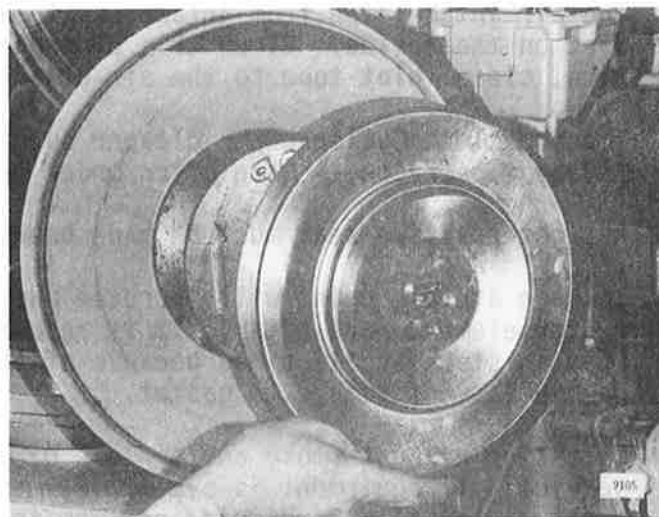


Figure 141

4. Dump dust out of cup. Wipe clean
with dry cloth.

Reassemble dust cup. Make sure cut
away part is inserted around spacer.
Tighten wing nut.

Replace cup gasket if it shows signs
of wear, damage or leaks. Do not use
oil, gasoline or oily waste to clean
components. Arrows on dust cup must
point up when assembled on housing.

NOTE: *The cyclopac air cleaner will
not function correctly if dust
fills cup.*

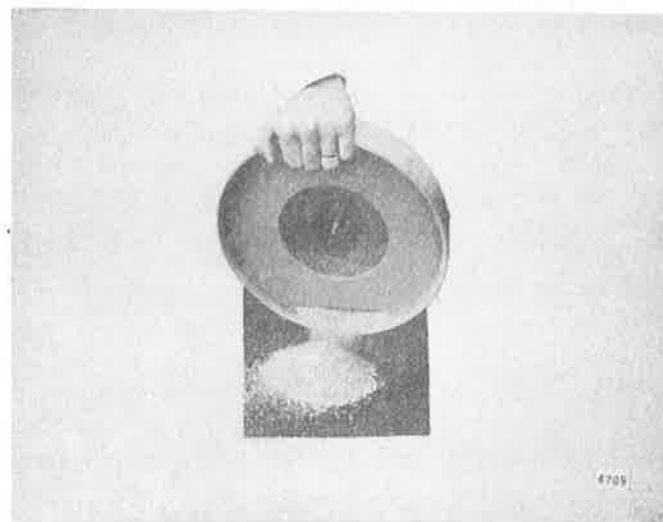


Figure 142



5. Remove filter element by pulling straight out of housing.



Figure 143

6. Clean filter element as outlined after step 7.



Figure 144

7. Wipe dust out of housing. Reassemble in reverse order.

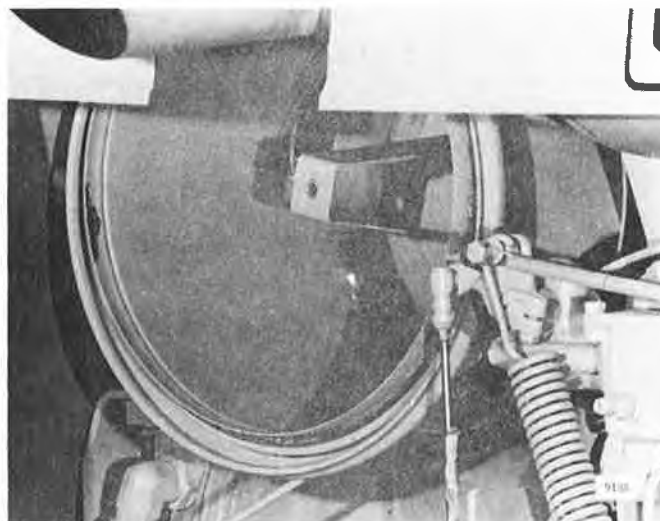


Figure 145



Considerable dust can be dislodged by slapping side or bottom rim of filter element with palm of hand. Do not bang bottom rim of filter element against any hard surface. This may damage rim and effect seal when unit is reassembled. To clean, blow out filter element from the inside if compressed air is available. An even pattern of light through filter element when a light is held inside means filter element is clean. Have spare filter element on hand to minimize downtime.



WEAR GOGGLES WHEN USING COMPRESSED AIR.

In addition to tapping and blowing, it is practical to wash filter element with any good, non-sudsing household detergent. Warm water, 120° - 140°F. (49° - 60°C.), is recommended but not essential. Flush unit with gentle water stream until drain water is clear. Air dry filter element before using (*do not use compressed air*). Inspect for damage or rupture after every cleaning.

For safety's sake, replace your Duralife filter element after 1000 hours of use. While some filter elements may function safely for longer than this, the small savings involved does not justify the risk.

NOTE: *If crane is being used in below freezing weather an extra Duralife filter element should be kept in operator's cab to replace element that could become iced and cause restricted air flow to engine.*



WIRE ROPE

Even though wire rope is one of the most uniform mechanical products made, a certain number of ropes fail prematurely. In most cases these failures are the result of abuse. Some of the more common type of abuse to a wire rope are:



KINKING - which results in localized wear, is generally caused by allowing a loop to form in a slack line and then pulling the loop down to a tight permanent set.

OVERLOADING - which results in complete fracture of the rope or crushing and distortion on the drums and sheaves, is caused by working the rope with a load too near its breaking strength.

IMPROPER SIZING - permits strands in rope to become loose and unbalances a rope, throwing all of the load onto a few strands.

IMPROPER SPOOLING - results in crushed and distorted ropes and comes from careless application and operation of the rope.

WHIPPING a line, which results in many wires broken square off, comes from jerking the line or running it loose.



WIRE ROPE SPECIFICATIONS

Galion Manufacturing Division has carefully selected the 8 x 25 spin resistant construction for the cranes because this type best suits the application. The spin resistant feature is highly desirable in lifting unguided loads such as reeved for single part line. The 8-strand construction is favored over 6-strand construction due to greater flexibility, an extremely important feature that insures proper spooling on the winch drum.

<u>GALION PART NO.</u>	<u>LENGTH</u>	<u>APPLICATION</u>
89346	330' (100.58 m)	3 Section Power Boom
89347	450' (137.16 m)	4 Section Power Boom (optional)
89348	500' (152.40 m)	4 Section Power Boom (optional)

MANUFACTURER'S IDENTIFICATION: 9/16" 8 x 25 Formset, Independent Wire Rope Core, Spin Resistant, Improved Plow Steel.

WIRE ROPE LINE PULL:

Single-Part Rating	6 200 lbs.	(2 812 kg)
Two-Part Rating	12 400 lbs.	(5 625 kg)
Three-Part Rating	18 600 lbs.	(8 346 kg)
Four-Part Rating	24 800 lbs.	(11 249 kg)
Five-Part Rating	31 000 lbs.	(14 061 kg)

Substitutions may be made on the basis of minimum breaking strength at least equal or exceeding those for the 8 x 25 construction, the spin resistant feature, and the flexibility necessary to spool properly on the winch drum.

MAINTENANCE RECOMMENDATIONS:

Due to varying conditions, a definite time interval for inspection and lubrication can not be stated.



SERVICE & INSPECTION OF WIRE ROPE

RESTING HOOK BLOCK

Before performing any of the following services to the wire rope, the hook block is to be rested on the ground. The following procedure will reduce chances of displacing the wire rope when lubricating, changing hook blocks or replacing wire rope.

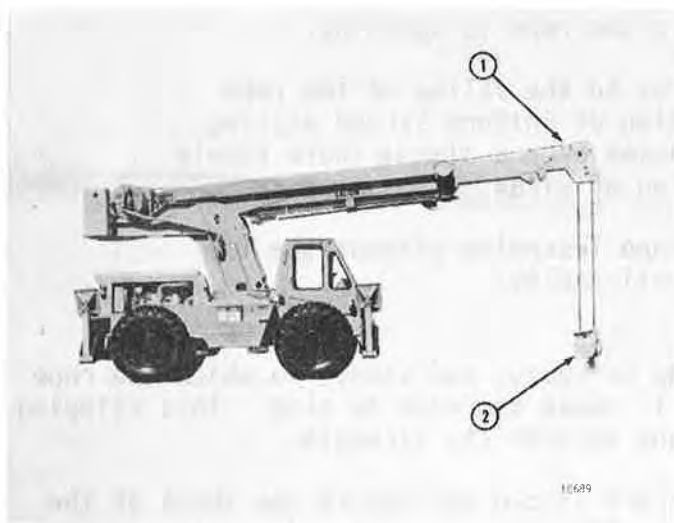


Figure 146

1. Raise boom head block (1) to approximately 3 Ft. (914.40 mm) above a fully depressed position.
2. Using hoist lower hook block (2) until it just touches the ground.

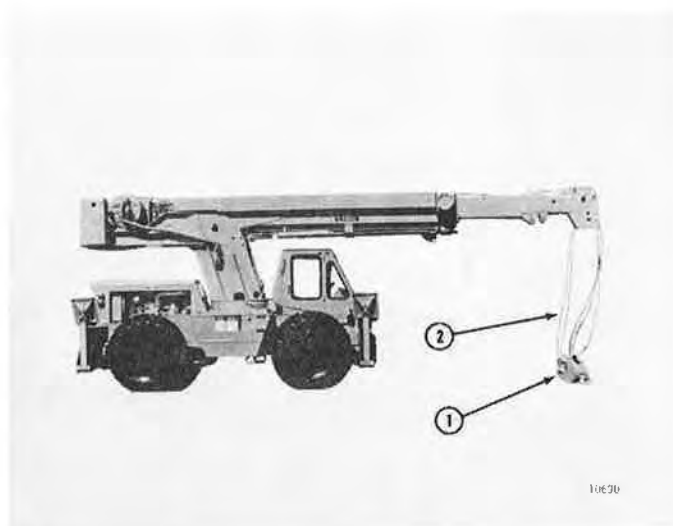


Figure 147

3. Lower boom until hook block (1) is resting on ground and wire rope (2) is slack.



IMPORTANCE OF LUBRICATION

Lubrication is a vital part of the maintenance of the wire rope. Lubricant serves two purposes: it reduces wear and protects the rope.

When wire rope is in use, the wires rub against each other, and outside wires also wear against sheaves and drums. Lubrication reduces wear, both on the inside and on the outside of the rope.

It is comparatively easy to observe that a rope is in need of a lubricant by noting the following characteristics:

1. Creaking noise while the rope is spooling.
2. Breaking of the wires in the valley of the rope without any indication of uniform strand nicking. When a wire rope passes over a sheave there should be smooth interaction of wires.
3. The spring of the rope lessening without the lay being pulled down noticeably.

If a rope is allowed to become dry, corroded or rusty, and sheave in which the rope is running is in a similar condition, it will cause the rope to slip. This slipping over the sheave abrades and cuts the rope and reduces its strength.

When a "rust-bound" rope receives a sudden jerk it can not absorb the shock of the load throughout its length; instead, it is confined to one spot and results in the breaking of one or more strands, and occasionally, the entire rope.



METHODS OF LUBRICATION

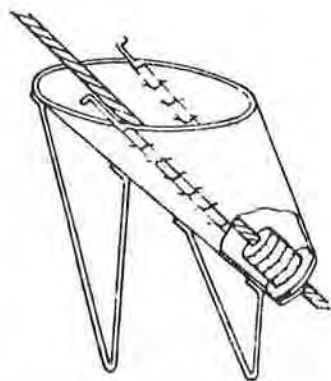


Figure 148



ALWAYS WEAR SUITABLE GLOVES WHEN HANDLING WIRE ROPE.

The pour-on method is effective and adhesive when heated 10 W oil is used.



BE SURE TO HOLD THE WIPING SWAB BEHIND THE SHEAVE. THIS CATCHES ANY EXCESS OIL THAT WOULD BE CARRIED ON ALONG THE ROPE.

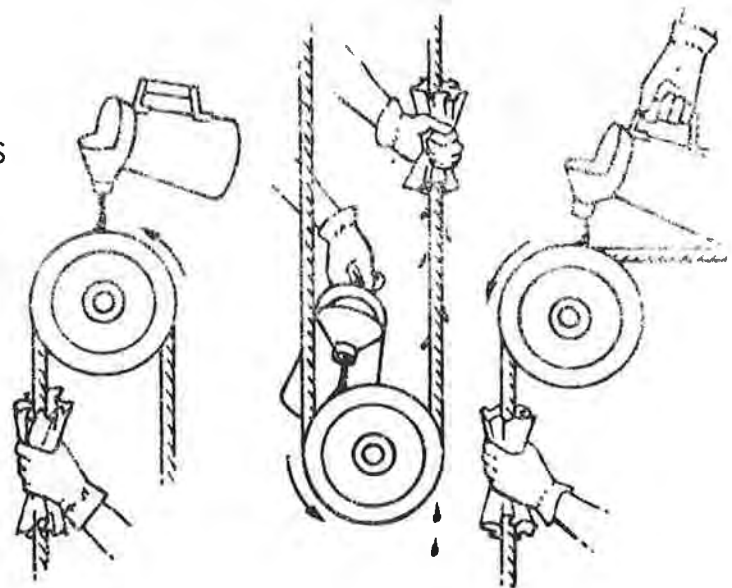
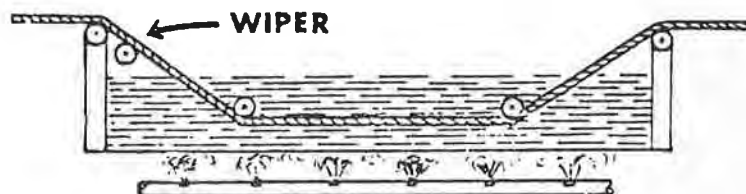


Figure 149



0-3.00

Figure 150

Hot bath method of applying heavier-bodied lubricant at high temperature. Steam heat may be used. Preheated lubrication is always more penetrating. Rope should run through slowly to ensure penetration.

LUBRICATION IN STORAGE

Ropes kept in storage dry out quickly. Lubricate them frequently, or have a sealing compound applied which will retain the lubricant. Before putting into service, carefully inspect rope for condition of lubricant and presence of corrosion.



IDLE ROPES

When ropes that have been in service are kept idle, as in shutdown of operation, they should receive protective care. Condensed moisture, in many instances, settles on the rope causing heaving corrosion and rust. The rope lubricant "weathers" out, particularly if the rope is exposed to outside conditions or kept in a hot or dusty area.

It is advisable to run the rope several times a week even if only with a light load. If the rope must be kept inactively wound on the drum for any length of time, it is wise to smear each layer of rope as it is wound on the drum, with a covering of petrolatum, cupgrease or similar jelly-like protective coating. Otherwise moisture seeps into the rope, often causing dangerous deterioration.

COMPONENT PARTS OF WIRE ROPE

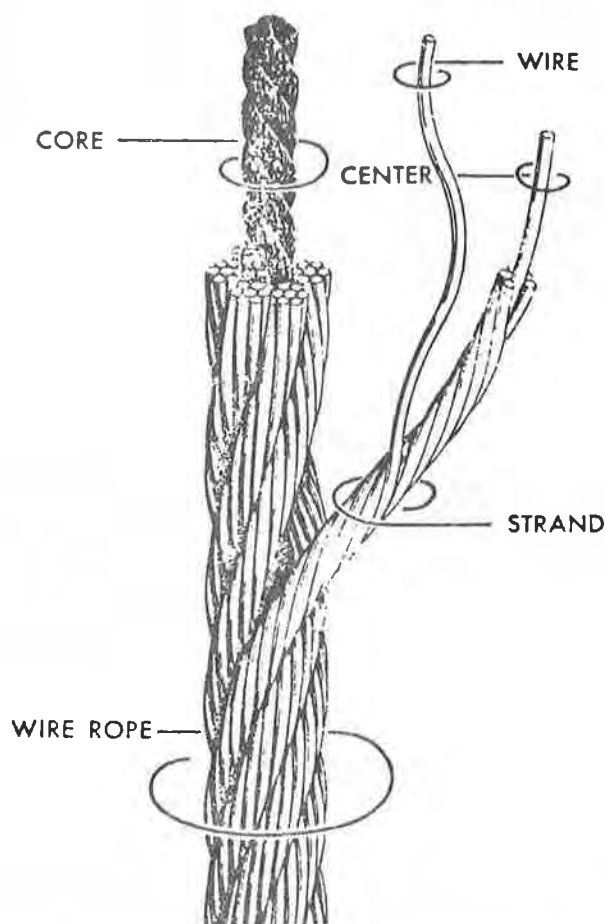


Figure 151



INSPECTION OF WIRE ROPE, SHEAVES & DRUM

WIRE ROPE:

In some operations, the wire rope can be run to complete failure without injuring machinery or endangering life.

Where risk is involved, it is desirable to estimate the remaining strength and service life of a worn rope.

A rope, like a chain, is only as good as its weakest point; that point being the POINT SHOWING THE MOST WEAR. The following information is taken from a National Consensus Standard as referenced by Federal Government Agencies supplied by CIMA.

All wire rope will eventually wear to a point where it is no longer useable. Wire rope shall be taken out of service when any of the following conditions exist:

1. In running ropes, six randomly distributed broken wires in the lay or three broken wires in one strand in one lay.
2. Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure.
3. Evidence of any heat damage from any cause.
4. Reduction from nominal diameter of more than 3/64" (1.19 mm) for a 9/16" (14.28 mm) wire rope.
5. In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.

Certain sections of wire rope often get more wear than others.

Rope on a drum with two or more layers will wear at the point where the rope starts each successive layer, and also at the points where the upper layer crosses the lower.

Wire rope will fatigue each time it passes over a sheave. Rope often fails from vibration fatigue at the point where they are dead-ended.

SHEAVES AND DRUM:

The sheaves and drum should be inspected frequently.

A scored drum and battered lagging will impair rope service.

Broken or scored sheaves will damage the outer wires of the rope. Worn sheave guards may permit a rope to jump the sheaves and cause an expensive, and possibly dangerous accident.

These points are watched carefully by all good operators.



HOOK BLOCK INSPECTION

It is recommended that a Daily/10 Hour Inspection and a 500 Hour and/or Annual Inspection be made of the hook block.

DAILY/10 HOUR SERVICE:

A Daily/10 Hour Inspection can be made by visually and physically examining the hook block as outlined in the following steps:

1. The hook must be able to rotate freely 360° without any binding.

NOTE: *While rotating the hook, push it upwards to see if there is any noticeable end play in the thrust bearing. If there is an abnormal amount of end play, the hook block must be disassembled to make a further inspection of the thrust bearing, in accordance to the appropriate Shop Manual section.*

2. Hook blocks with trunnion mounted hooks must be checked to be sure that the hook can pivot freely. The hook is designed to pivot so that the entire hook block does not react to motions of the load which is being lifted. Also, this design helps prevent load shifting of chains, slings, etc., in the hook which can cause damage to the hook.
3. The sheaves must be able to rotate freely. If they do not rotate properly, the wire rope and sheave will interact together, wearing both of them and also cause load jerking. Raise and lower the hook without any load to observe whether the sheaves are rotating freely. If jerky motion is observed, the hook block must be disassembled to make a further inspection in accordance to the appropriate Shop Manual section.
4. Check the hook for cracks, gouges or other indications of wear. If any of these conditions exist, the hook must be taken out of service and destroyed.
5. Check for hook spreading or twisting. An easy way to determine the satisfactory limit is to check to see if the hook latch does not contact the hook, then if so, the hook must be replaced, as the hook is not satisfactory and is unsafe. Destroy the unsafe hook.

ANNUAL/500 HOUR SERVICE:

It is required that a complete inspection be made of the hook block assembly on a regular schedule, at each 500 hours of operation or annually, whichever comes first.

For this inspection, the hook block assembly must be completely disassembled. Care must be taken to observe the position of side weights in the hook block assembly for reassembly of the side weights in exactly the same position as originally found. Refer to the appropriate Shop Manual section for complete instructions on disassembly and reassembly of the hook block.

Clean all parts in suitable cleaning solvent before the inspection is made. Inspect the hook for twisting or spreading. An easy way to determine the satisfactory limit is that if the latch does not contact the hook, then the hook must be replaced, as the hook is not satisfactory and is unsafe. If the hook is not replaced for twisted or spreading condition, then a magnetic-particle inspection must be performed, including the thread area. If one or more cracks are found, then replacement of the hook is necessary. It is particularly important to inspect the threads on the hook for any wear cracks, pulling or other damage of any kind. If any thread damage is found, then the hook must be replaced.

NOTE: *Always destroy worn and damaged hooks.*

The nut which is used to secure the hook to the hook block assembly is also to be tested and inspected in the same manner as the hook. Besides inspecting for thread damage and cracks, it must also be tested for proper hardness. The following is a list of nuts used on various hook block assemblies with their hardness values. Refer to Parts Book for the nut used on your particular hook block assembly.

<u>PART NUMBER</u>	<u>HARDNESS VALUE</u>
7520	Rockwell C-32
*17046	Rockwell C-24 - 38
102474	Brinell Test 150 - 200
102560	Rockwell C-19 or Brinell Test 223

* **NOTE:** *Used on 150A and 150FA.*



WIRE ROPE REPLACEMENT

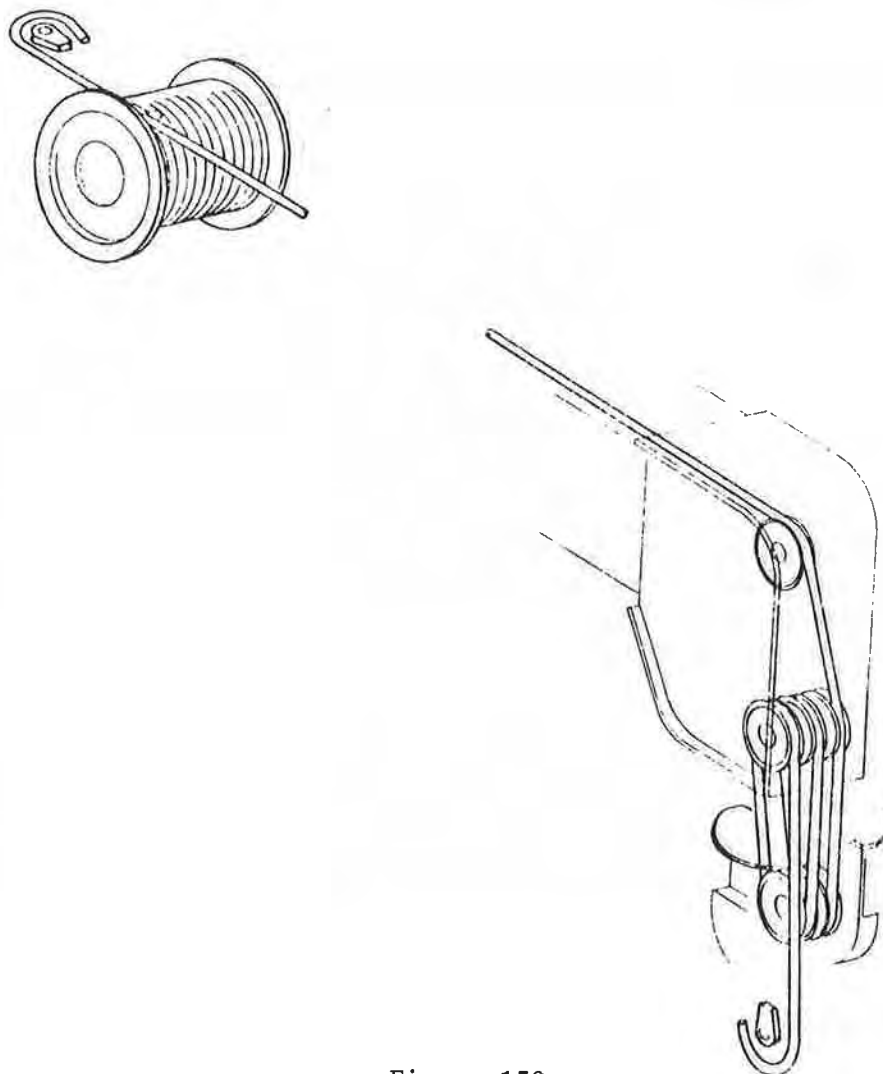


Figure 152

When replacing wire rope extreme care must be taken not to put kinks or unnecessary bends into the rope.

As illustrated, when installing wedges in either drum or socket, the rope must be brought back straight and turned, not twisted, around wedge and inserted into slot.

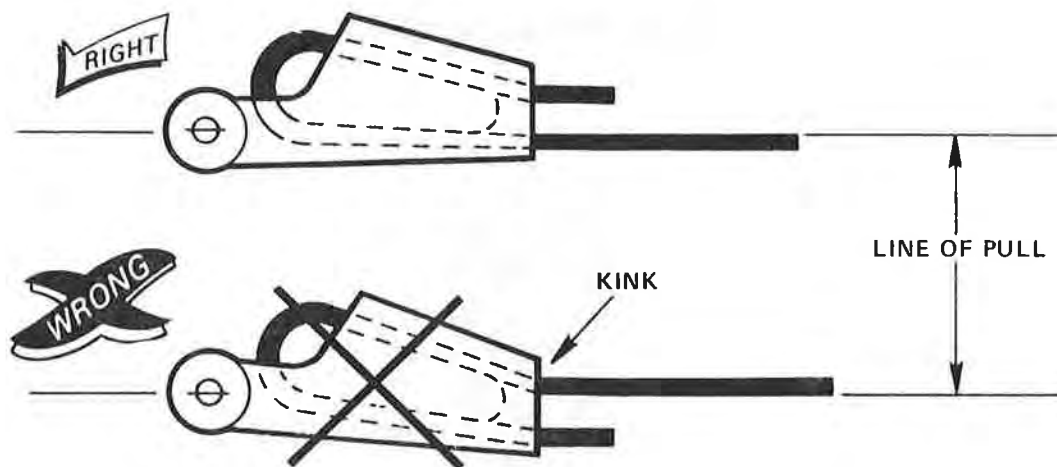


Figure 153

Insert working portion of wire rope into straight side of socket. . If not installed correctly, clamp will bend and weaken wire rope.



ALWAYS WEAR SUITABLE GLOVES WHEN HANDLING WIRE ROPE.

INSTALLATION OF WIRE ROPE

A wire rope can be damaged permanently even before it has gone into operation. Unwinding from a reel the wrong way can put destructive kinks and dog legs in the rope. If the reel can be set on jacks, unwind from the topside of the reel as illustrated. If the wire rope is supplied in coil, uncoil by rolling the coil slowly like a wheel, leaving behind a trail of straight rope. Uncoiling by laying the coil flat and pulling off the top give you hard-to-handle, kinky rope.

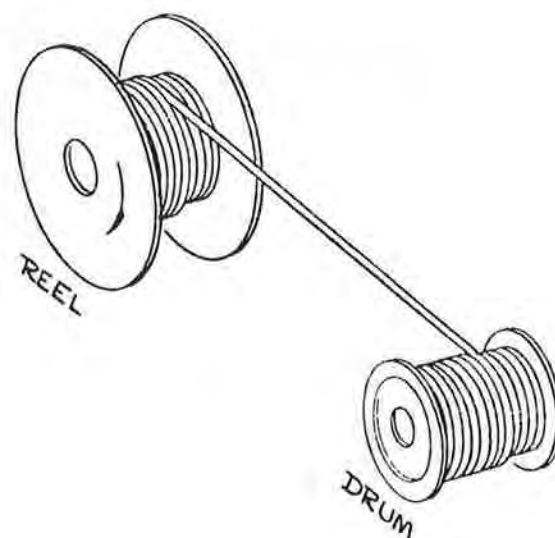


Figure 154



HOOK & HEAD BLOCK REEVING

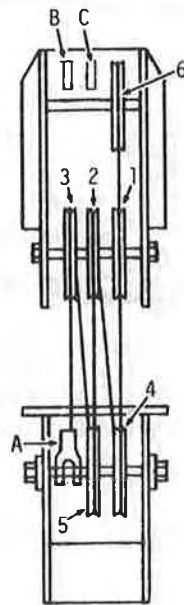


Figure 155

Five part line - as shown above.

Four part line - remove wire rope from wedge socket "A" and install in wedge socket "B".

Three part line - remove rope from wedge socket "A". Remove rope from sheave #3 and sheave #5, then install rope in wedge socket "A".

Two part line - remove rope from wedge socket "A" and from sheave #2, 3, 4, and 5. Thread rope from sheave #1 to sheave #5, and install in wedge socket "C".

Single part line - remove rope from wedge socket "A" and from sheaves #2, 3, 4, and 5. Attach rope to single-line weighted hook block.



BREAKING-IN WIRE ROPE



AFTER NEW WIRE ROPE IS INSTALLED, FIRST OPERATE CRANE WITH A LIGHT LOAD TO LET WIRE ROPE ADJUST ITSELF.

A new rope can be easily damaged by any operating error.

A few trips through the working cycle at slow speeds and light loads will set the strands more firmly in place.

It will also give the operator an opportunity to see that the drums and sheaves are operating properly and are fitted to the new rope.

DRIVE BELT TENSION

New drive belts will stretch after the first few hours of operation. Run the engine for a few minutes to seat the belt, then retension it. Retension drive belt after 1/2 hour and again after 10 hours of operation. Thereafter, check the tension of the drive belt every 100 hours and adjust belt if necessary.

Adjust the belt tension so that a firm push with the thumb, 25 lbs. (11.33 kg) load, at a point midway between two pulleys that are farthest apart will depress the belt 1/2" (12.7 mm). DO NOT OVERTENSION.

Replace badly worn, greasy or cracked belt(s) immediately. These conditions prevent proper belt function. If one belt needs replacing, both are to be replaced if they are a matched set.

Drive belts that squeak do not indicate a worn belt or belt out of adjustment. The belts can be cleaned with brake fluid.



BOOM ROLLER ADJUSTMENT

Adjust rollers (1) against bottom of extension until approx. 1/16" to 1/4" (1.59 to 6.35 mm) clearance exists between top portion of extensions and base section (2).

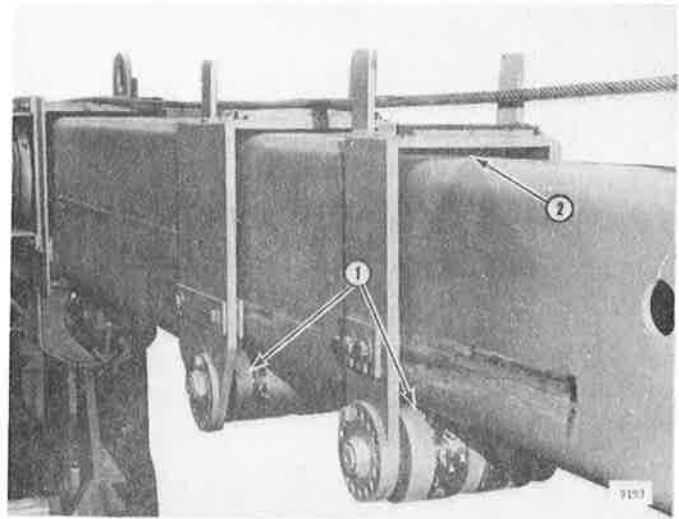


Figure 156

WEAR PAD SUPPORTS

Adjust the wear pad support assemblies (1, Figure 157) against bottom of boom sections until approximately 1/16" to 1/4" (1.59 to 6.35 mm) clearance exists between boom sections at point (2).

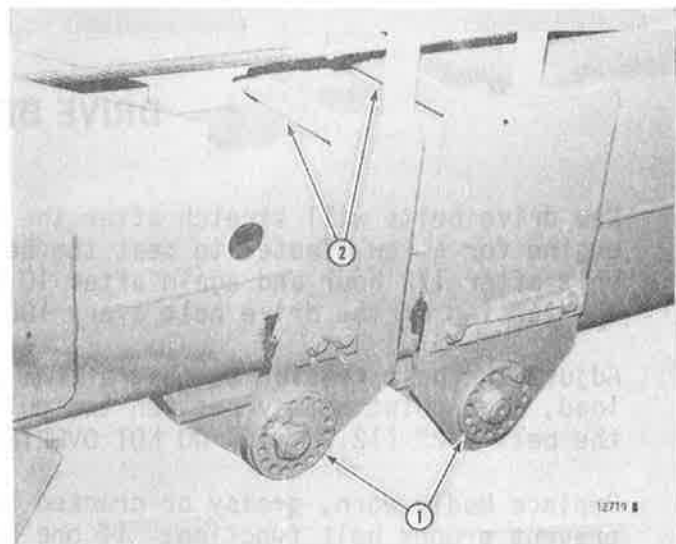


Figure 157



ROTARY DRIVE SCREWS

Periodic inspection of the clearance of these screws is mandatory to keep the rotary joint in time or phase with the rotation of the pedestal.

Check clearance between rotary joint drive capscrews and pedestal. Adjust if necessary to 1/16" (1.59 mm) clearance on either side. Lock with jam nut.

NOTE: *Crane must not be operated with these screws tight against the pedestal.*

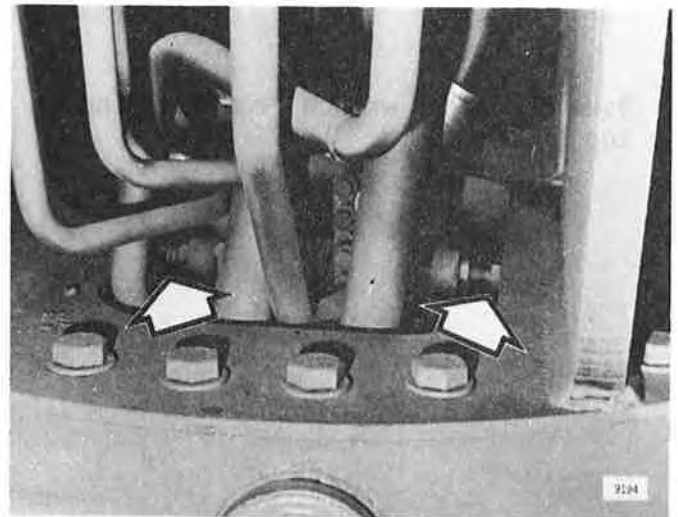


Figure 158



RETRACT REEL - SPRING MOTOR

The proper tension on the boom hoses is vital to hose life. The tension for the hoses is applied by the spring motor assembly. Before properly setting the spring tension on the motor assembly, it is recommended that the spanner wrench, mounted on top of the motor, be modified.

Remove spanner wrench from mounting on top of the motor.

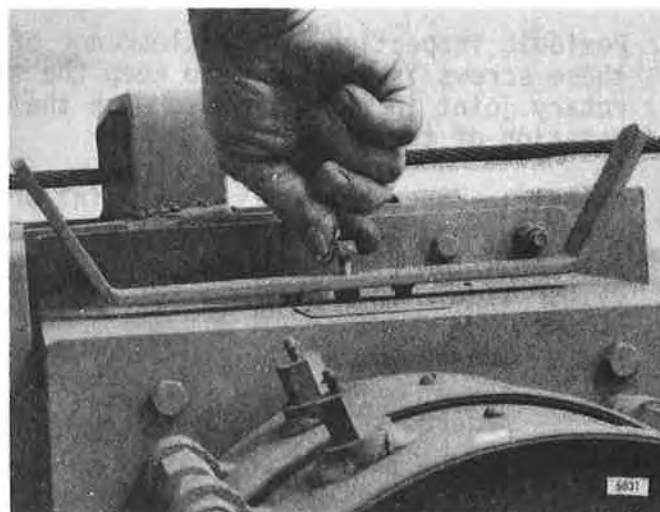


Figure 159

The modification below will aid in tensioning of the springs in the motor.

The formed end of the wrench with the hole, should be bent 1" (25.4 mm) from the straight piece with the studs and it should be parallel with this piece. (See illustration below.)

Weld a piece of bar stock 1" x 1/4" x 24" (25.4 mm x 6.35 mm x 609.6 mm) in length to the spanner wrench as illustrated below.

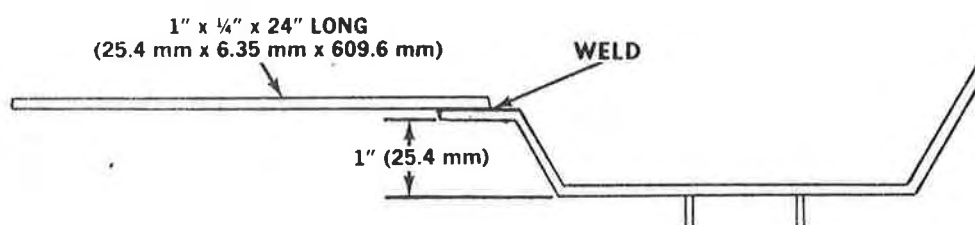


Figure 160

With the boom fully retracted, remove hose guards. Remove the cover plate from the motor spring pack and attach the spanner wrench. Place the wrench studs in the holes provided in the motor shaft. Through the center hole in the wrench, insert and hand tighten a 1/4 - 20 x 1-1/4" or 1-1/2" capscrew. This will prevent the wrench from slipping out of the motor.

NOTE: If there is no hole in the center of the shaft, drill and tap the motor shaft to take a 1/4 - 20 capscrew.

Prior to adjustment of spring motor boom out to maximum extended length. If spring motor is functioning properly spring indicators will fall into case. If spring is broken indicator will remain at top of case and will require replacement.



Install a pair of locking pliers (1) on trolley track approx. six inches (152 mm) behind the hose sheave. This will prevent the hoses from sliding down the trolley when the cable has been disconnected.



USE EXTREME CARE WHEN PUTTING TENSION ON THE SPRINGS. HOLD THE SPANNER WRENCH WITH A FRIM GRIP.

To disconnect the cable, turn the spanner wrench (2) counterclockwise. When there is slack in the cable and while holding the spanner wrench firmly, have another person disconnect the cable from hose sheave.

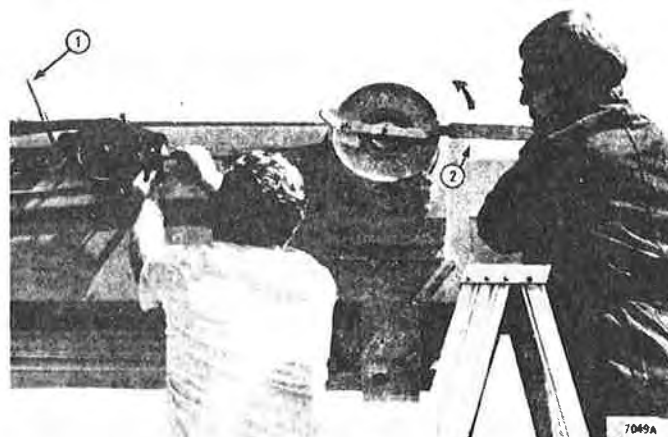


Figure 161

SLOWLY allow the spanner wrench to turn clockwise until there is no tension on the motor springs. While holding the spanner wrench (1), rotate the cable drum clockwise to completely rewind all cable (2) onto drum.



DO NOT LET GO OF THE CABLE. DO NOT LET GO OF THE SPANNER WRENCH UNTIL THERE IS NO TENSION ON THE SPRINGS.

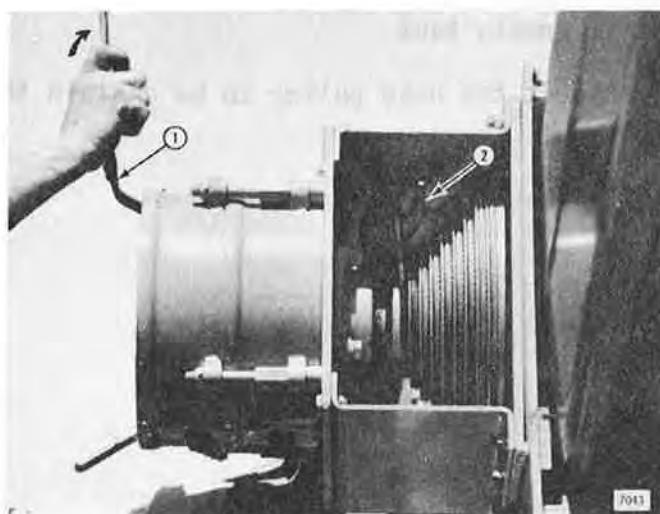


Figure 162



USE EXTREME CARE WHEN PUTTING TENSION ON THE SPRINGS. HOLD THE SPANNER WRENCH WITH A FIRM GRIP.

With the cable fully rewound, begin turning the spanner wrench (1) counterclockwise to slack the cable.



ONE PERSON SHOULD KEEP TENSION ON THE CABLE WHILE ANOTHER TURNS THE SPANNER WRENCH.

Connect the motor cable (2) to the hose sheave making certain that both the jam nuts are fully threaded on the cable end and tightened.

SLOWLY allow spanner wrench to turn clockwise until the slack is taken up in the cable. There should not be any droop in the hoses.

Remove the spanner wrench and mount on top of the motor assembly. Replace the cover plate and remove the locking pliers (3) from the trolley track.

Put all the outriggers to the ground and fully extend the boom over the front of the machine. Retract the boom, check hoses, they should still remain taut.

Install hose guards, inspect the hose pulley to be certain that hoses do not rub along top of hose guard.

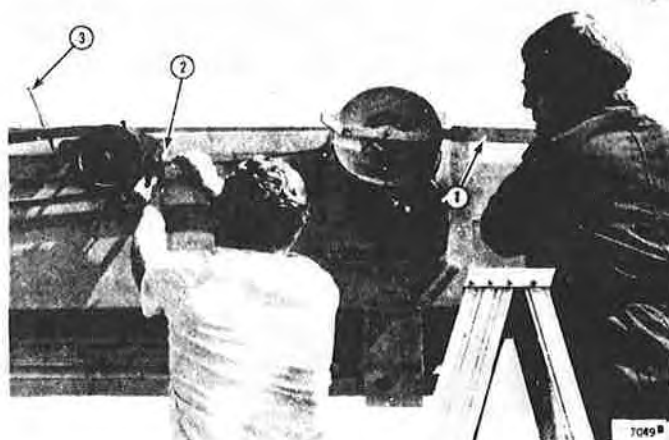


Figure 163



LUBRICATION

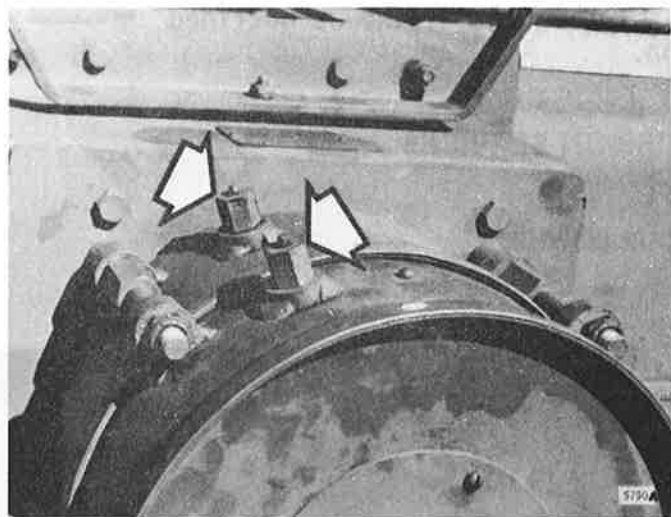


Figure 164

Lower outriggers and fully extend the boom (boom horizontal over front of the crane).

Remove the two spring tension indicators on the housing top.



IF SPRING TENSION INDICATORS ON THE HOUSING TOP DO NOT DROP AFTER EXTENDING BOOM, AN INSPECTION MUST BE MADE OF THE MOTOR. DAMAGE TO HOSES MAY RESULT DUE TO IMPROPER MOTOR FUNCTION.

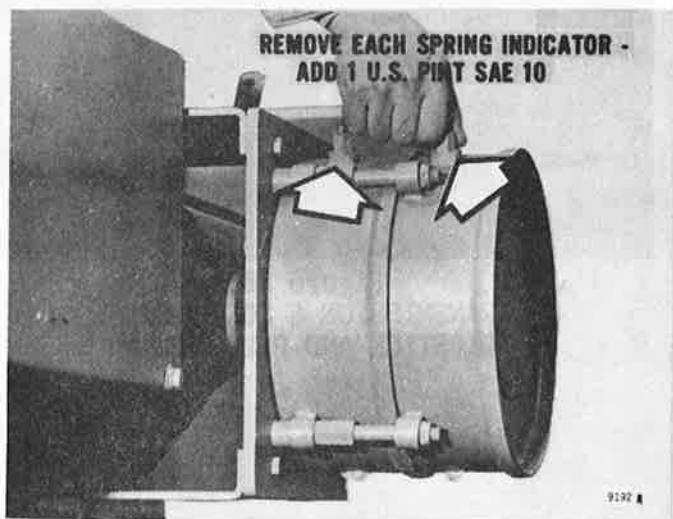


Figure 165

Through the spring tension indicator holes, add approximately 1 U.S. Pint (0.47 liter) SAE 10 oil* to each housing.

Each spring of the spring motor requires approximately one pint of SAE 10 oil* applied every thirty to sixty days.

**When operating in temperatures below -20°F. (-29°C.), use Dexron or Automatic Fluid Type A, Suffix A.*

Cycle boom, retract and extend, to thoroughly cover spring with oil. Excess oil may drain through the housing and cover plate.

NOTE: *This lubrication process must be repeated every thirty to sixty days.*



TRANSMISSION CHECKS

The Galion Crane has evolved through the years to contain various transmissions. Service the transmission in your crane as outlined in the appropriate following section.

ALLISON TRANSMISSION SERVICES

DAILY/10 HOUR SERVICE

TRANSMISSION OIL LEVEL CHECK:

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Oil must be at operating temperature of 180°F - 220°F (82°C - 104°C).
4. With engine running, check oil level. Oil level must be between "LOW" and "FULL" marks on dipstick. If oil must be added, shutdown engine and add oil through dipstick tube.

NOTE: Refer to "Lubrication Specifications" section in this manual for proper oil.

5. After oil has been added, start engine and recheck oil level.

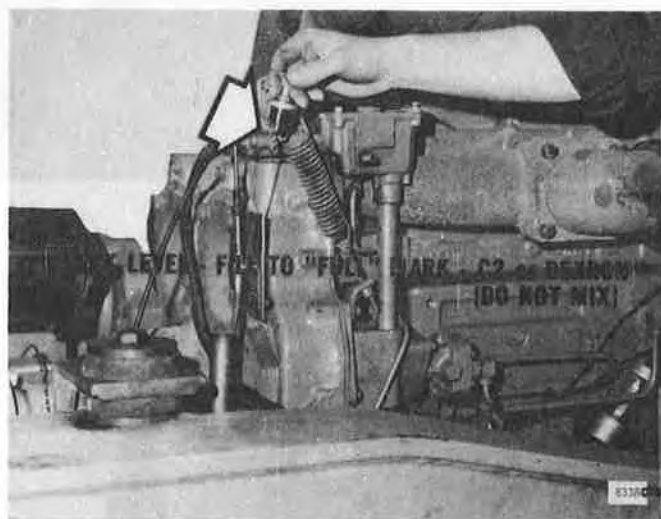


Figure 166
TRANSMISSION & CONVERTER
DIPSTICK AND FILL TUBE



WEEKLY/50 HOUR SERVICE

TRANSMISSION SHIFT LINKAGE:

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Shutdown engine.
4. Clean the shift linkage pivot points and lubricate with CO (can oil). Any 10W oil will work.

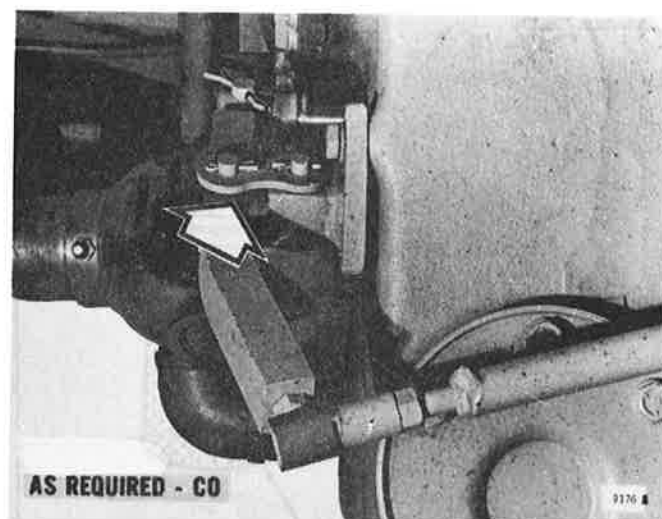


Figure 167
TRANSMISSION SHIFT
LINKAGE

250 HOUR SERVICE

TRANSMISSION AND TORQUE CONVERTER FILTER:

Change filter element after 250 hours on new machine or after rebuild and every 500 hours thereafter.

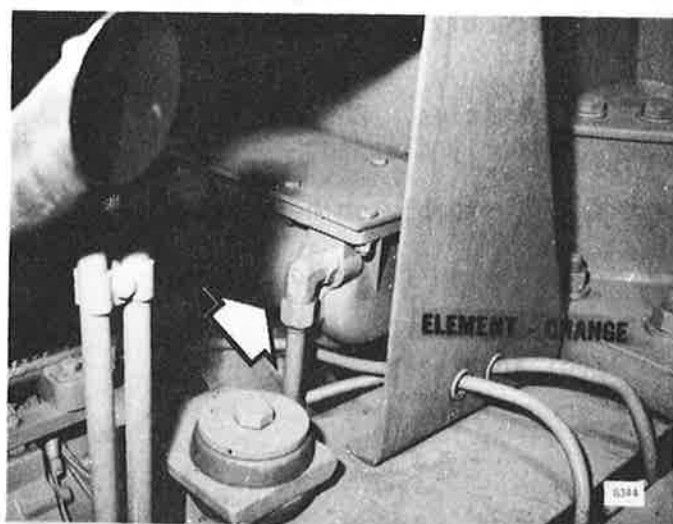


Figure 168
TRANS./CONV. FILTER
(ALLISON WITH DEUTZ ENGINE)

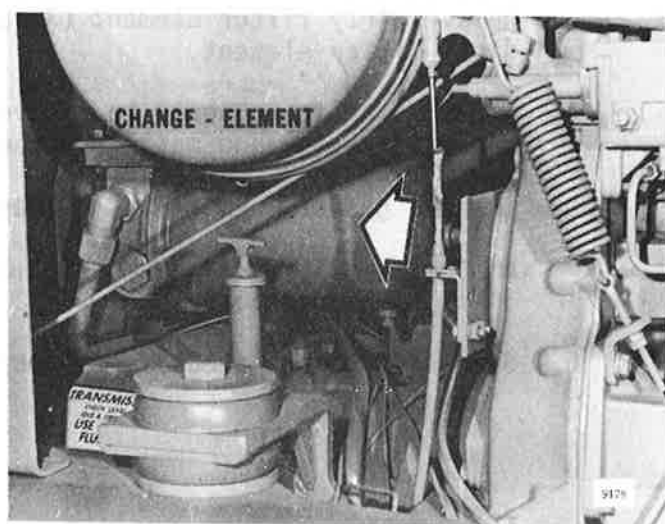


Figure 169
TRANS./CONV. FILTER
(ALLISON WITH D.D. ENGINE)

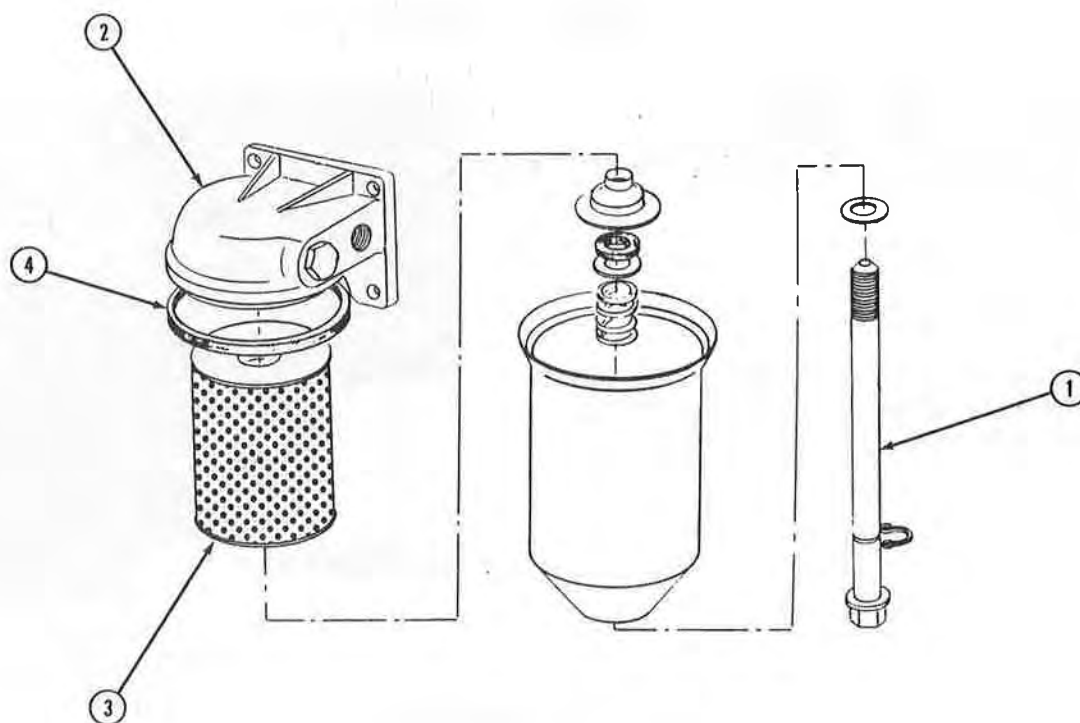


Figure 170

1. Place forward and reverse control lever in "NEUTRAL".
2. Set parking brake and shutdown engine.
3. Unscrew shell retaining bolt (1, Figure 170) from head assembly (2). Remove dirty filter element (3) and shell assembly from head. Discard dirty filter element.
4. Wipe off all components to remove foreign particles. Be sure that seal gasket (4) and mating surfaces are thoroughly cleaned.
5. Install gasket, new filter element and shell assembly on head assembly.

NOTE: *Lightly coat gasket with clean transmission fluid to ensure positive seal.*

6. Start engine and check for proper oil level and leaks.



500 HOUR SERVICE

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Oil must be at operating temperature of 180° - 220°F (82° - 104°C).

NOTE: *This will put sediment into suspension and also allow the oil to drain more freely.*

4. Shutdown engine.
5. Remove drain plug and screen to drain oil. Discard oil.



BE CAREFUL TO PREVENT BURNS TO HANDS, ARMS, ETC., WHEN DRAINING OIL.

NOTE: *Torque converter and transmission hold 9 U.S. Gallons (34 liters) with Detroit Diesel engine or 10 U.S. Gallons (38 liters) with Deutz Diesel engine.*

6. Clean screen using a solvent type cleaner.



CARE SHOULD BE EXERCISED TO AVOID EXPOSURE TO SKIN, FIRE HAZARDS AND INHALATION OF VAPORS WHEN USING SOLVENT TYPE CLEANERS.

7. Reinstall drain plug.
8. Reinstall screen making sure that screen gasket and mating surfaces are thoroughly clean of foreign particles that may cause leaks.
9. Change filter element after 250 hours on new machine or after rebuild and every 500 hours thereafter. Change filter element as outlined under the 250 Hour Service. Then, proceed with the remaining steps.
10. Remove breather from housing and clean using solvent type cleaner.
11. Reinstall breather.
12. Add oil as outlined under Daily/10 Hour Service. Check level. Add oil prior to starting engine.

NOTE: *Torque converter and transmission hold 9 U.S. Gallons (34 liters) with Detroit Diesel engine or 10 U.S. Gallons (38 liters) with Deutz Diesel engine.*

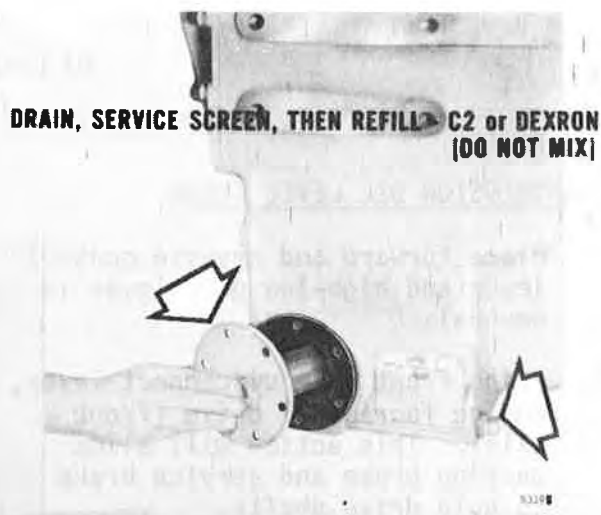


Figure 171
TRANS./CONV. SCREEN &
DRAIN PLUG

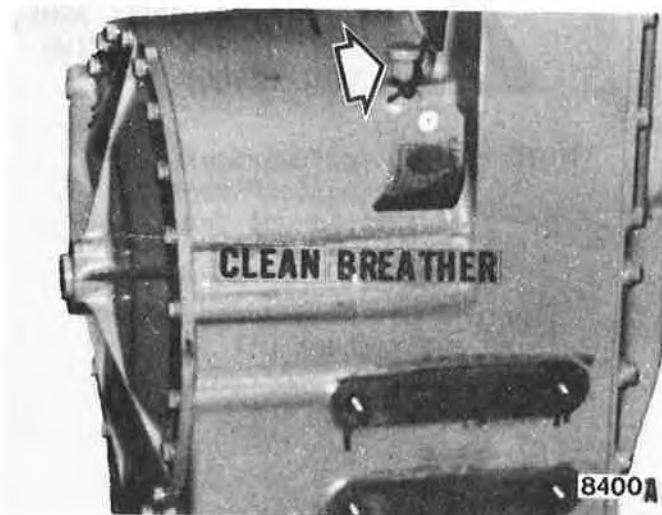


Figure 172
TRANSMISSION AND CONVERTER
BREATHER



CLARK 2420 TRANSMISSION SERVICES

DAILY/10 HOUR SERVICE

TRANSMISSION OIL LEVEL CHECK:

1. Place forward and reverse control lever and high-low gear lever in neutral.
2. Using front axle disconnect lever, engage four wheel drive (front axle). This action will allow parking brake and service brake to hold drive shafts.
3. Set parking brake.
4. With outriggers, raise all four tires off the ground.
5. Oil must be operating temperature of 180° - 200°F (82° - 93°C).
6. Check oil level. Remove top plug. If the transmission is overfilled, allow all the oil to drain out of the top plug. If there is NO oil at the plug, remove the bottom plug. If there is NO oil at the bottom plug, reinstall top and bottom plugs, shutdown engine and add oil through fill plug hole in torque converter housing. Be sure to reinstall fill plug.



BE CAREFUL TO PREVENT BURNS TO HANDS, ARMS, ETC., WHEN CHECKING OIL LEVEL.

NOTE: Refer to "Lubrication Specification" section of this manual for proper oil.

7. After oil has been added, start engine and recheck oil level.



Figure 173
TRANSMISSION AND CONVERTER
LEVEL PLUGS



Figure 174
TRANSMISSION AND CONVERTER
FILL PLUG



WEEKLY/50 HOUR SERVICE

TRANSMISSION SHIFT LINKAGE:

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Shutdown engine.
4. Using grease gun, lubricate zerk.
5. Operate high-low gear lever to ensure proper distribution of lubricant.

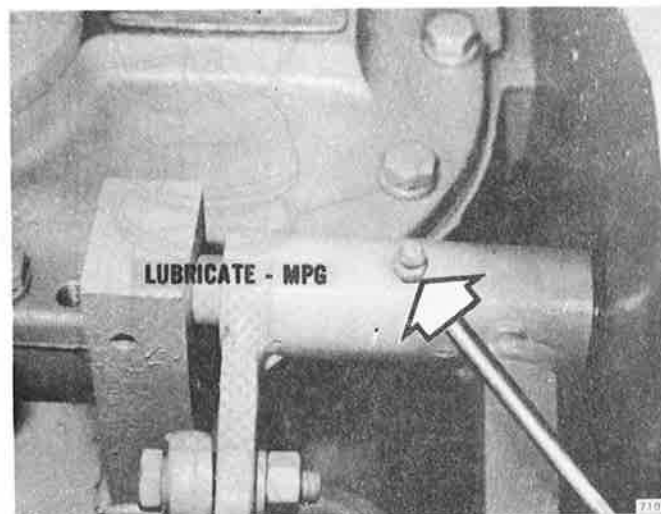


Figure 175
TRANSMISSION SHIFT
LINKAGE

250 HOUR SERVICE

TRANSMISSION & TORQUE CONVERTER FILTER:

Change filter element after 250 hours on new machine or after rebuild and every 500 hours thereafter.

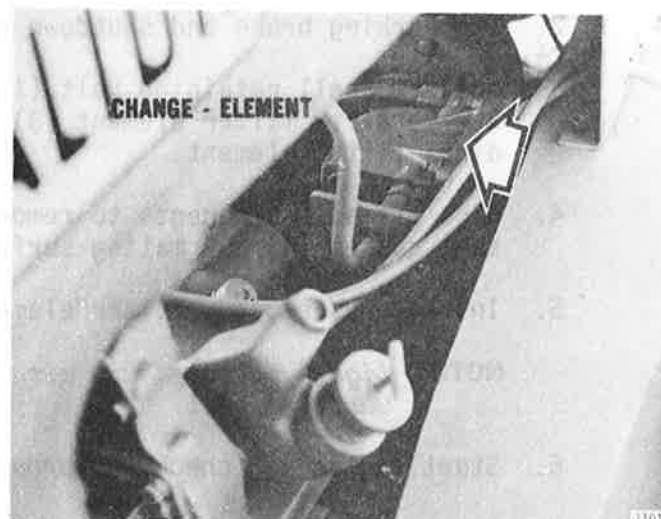


Figure 176
TRANSMISSION AND CONVERTER
FILTER

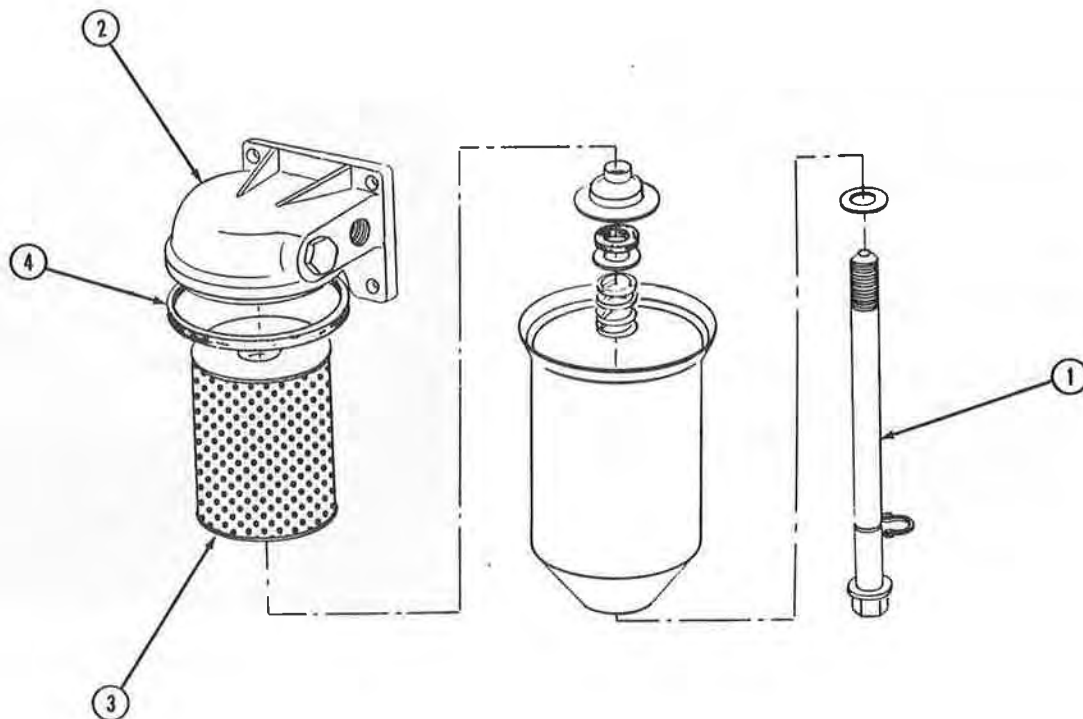


Figure 177

1. Place forward and reverse control lever in "NEUTRAL".
2. Set parking brake and shutdown engine.
3. Unscrew shell retaining bolt (1, Figure 177) from head assembly (2). Remove dirty filter element (3) and shell assembly from head. Discard dirty filter element.
4. Wipe off all components to remove foreign particles. Be sure that seal gasket (4) and mating surfaces are thoroughly cleaned.
5. Install gasket, new filter element and shell assembly on head assembly.

NOTE: *Lightly coat gasket with clean transmission fluid to ensure positive seal.*

6. Start engine and check for proper oil level and leaks.



500 HOUR SERVICE

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Oil must be operating temperature of 180° - 200°F (82° - 93°C).

NOTE: *This will put sediment into suspension and also allow the oil to drain more freely.*

4. Shutdown engine.
5. Remove drain plug and screen to drain oil. Discard oil.



BE CAREFUL TO PREVENT BURNS TO HANDS, ARMS, ETC., WHEN DRAINING OIL.

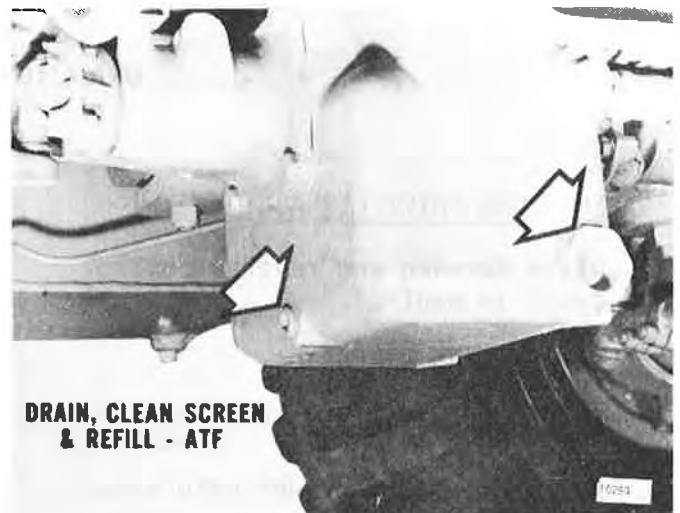


Figure 178
TRANS./CONN. DRAIN PLUG & SCREEN

NOTE: *Torque converter and transmission hold 9 U.S. Gallons (34 liters).*

6. Clean screen using a solvent type cleaner.



CARE SHOULD BE EXERCISED TO AVOID EXPOSURE TO SKIN, FIRE HAZARDS AND INHALATION OF VAPORS WHEN USING SOLVENT TYPE CLEANERS.

7. Reinstall drain plug.
8. Reinstall screen making sure that screen gasket and mating surfaces are thoroughly clean of foreign particles that may cause leaks.
9. Change filter element after 250 hours on new machine or after rebuild and every 500 hours thereafter. Change filter element as outlined under the 250 Hour Service. Then, proceed with the remaining steps.
10. Remove breather from torque converter housing and one from transmission housing. Clean both breathers using solvent type cleaner.
11. Reinstall breathers.
12. Add oil as outlined under Daily/10 Hour Service. Check level. Add oil prior to starting engine.

NOTE: *Torque converter and transmission hold 9 U.S. Gallons (34 liters).*

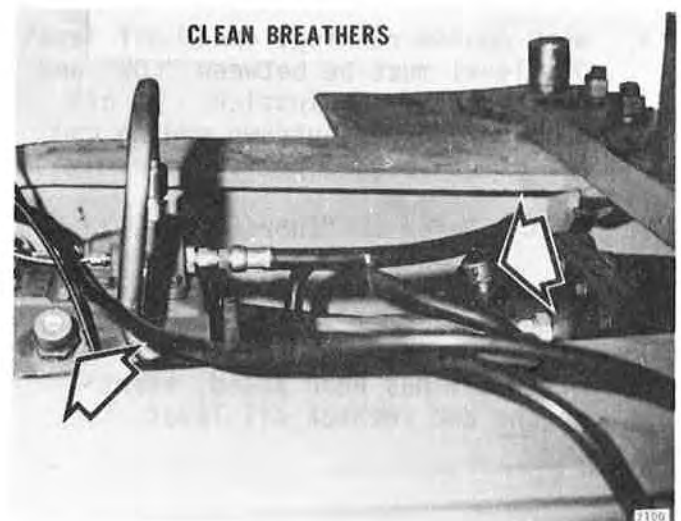


Figure 179
TRANSMISSION AND CONVERTER
BREATHERS



CLARK 18000 SERIES TRANSMISSION SERVICES

DAILY/10 HOUR SERVICE

TRANSMISSION SHIFT LINKAGE:

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Shutdown engine.
4. Using grease gun, lubricate zerk.
5. Operate levers to ensure proper distribution of lubricant.



Figure 180
TRANSMISSION SHIFT LINKAGE

TRANSMISSION OIL LEVEL CHECK:

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Oil must be at operating temperature of 180° - 200°F (82° - 93°C).
4. With engine running, check oil level. Oil level must be between "LOW" and "FULL" marks on dipstick. If oil must be added, shutdown engine and add oil through dipstick tube.

NOTE: Refer to "Lubrication Specifications" section in this manual for proper oil.

5. After oil has been added, start engine and recheck oil level.

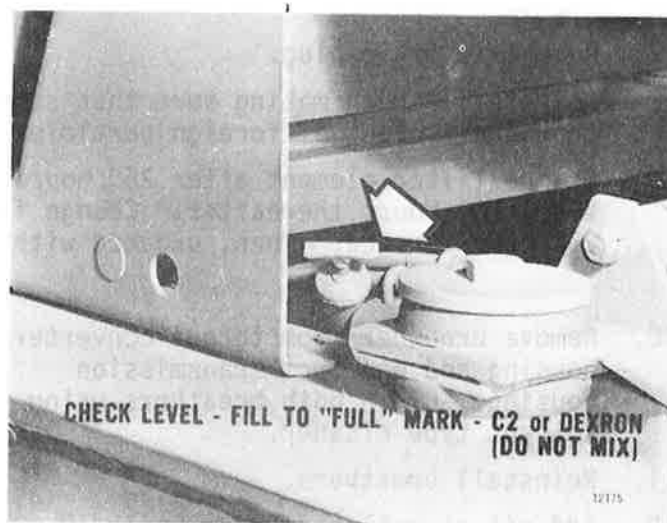


Figure 181
TRANS./CONV. DIPSTICK & FILL TUBE



WEEKLY/50 HOUR SERVICE

TRANSMISSION SHIFT LINKAGE:

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Shutdown engine.
4. Clean the shift linkage pivot points and lubricate with CO (can oil). Any 10W oil will work.

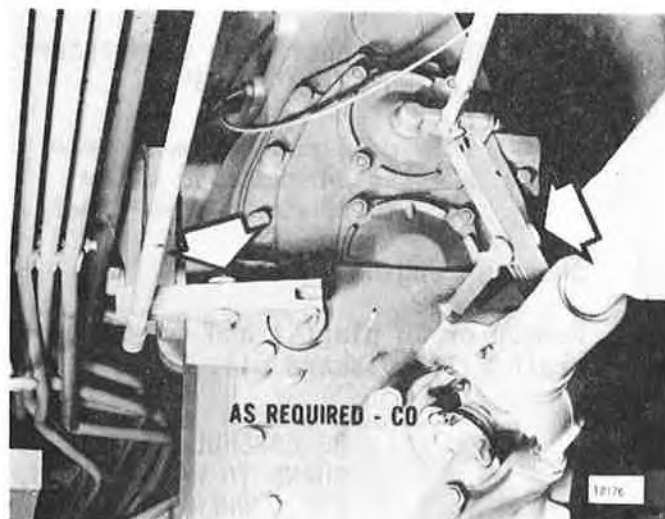


Figure 182
TRANSMISSION SHIFT LINKAGE

250 HOUR SERVICE

TRANSMISSION & TORQUE CONVERTER FILTER:

1. Place forward and reverse control lever in neutral.
2. Set parking brake and shutdown engine.
3. Unscrew filter element from top L.H. side of transmission and discard.
4. Install new element. Lightly coat element seal ring with clean transmission fluid to ensure positive seal. Screw on tightly by hand.
5. Start engine and check for proper oil level and leaks.

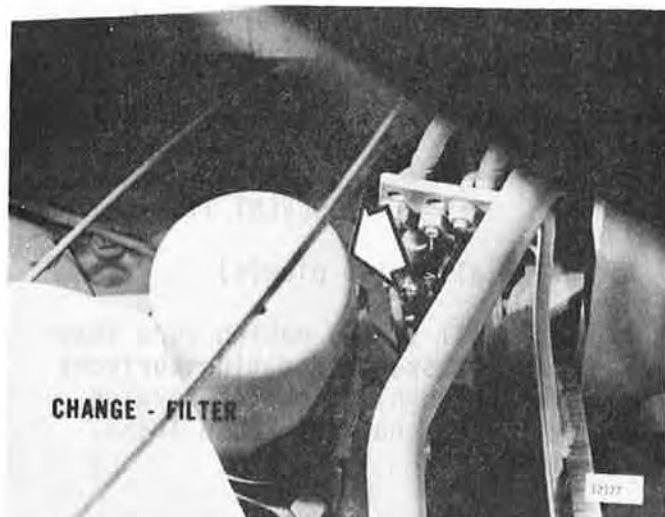


Figure 183
TRANSMISSION & CONVERTER FILTER



500 HOUR SERVICE

1. Place forward and reverse control lever in neutral.
2. Set parking brake.
3. Oil must be at operating temperature of 180° - 200°F (82° - 93°C).

NOTE: *This will put sediment into suspension and also allow the oil to drain more freely.*

4. Shutdown engine.
5. Remove drain plug(s) and screen to drain oil. Discard oil.



BE CAREFUL TO PREVENT BURNS TO HANDS, ARMS, ETC., WHEN DRAINING OIL.

NOTE: *Torque converter and transmission hold 5 U.S. Gallons (19 liters).*

6. Clean screen using a solvent type cleaner.



CARE SHOULD BE EXERCISED TO AVOID EXPOSURE TO SKIN, FIRE HAZARDS AND INHALATION OF VAPORS WHEN USING SOLVENT TYPE CLEANERS.

7. Reinstall drain plug(s).
8. Reinstall screen making sure that screen gasket and mating surfaces are thoroughly clean of foreign particles that may cause leaks.

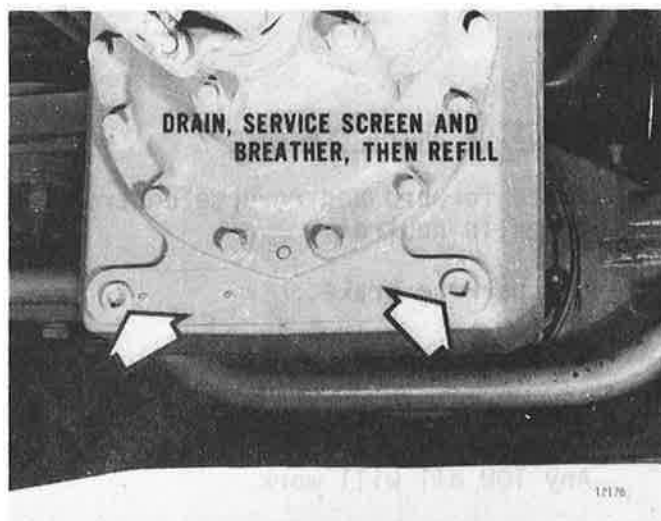


Figure 184
TRANSMISSION & CONVERTER DRAIN PLUGS

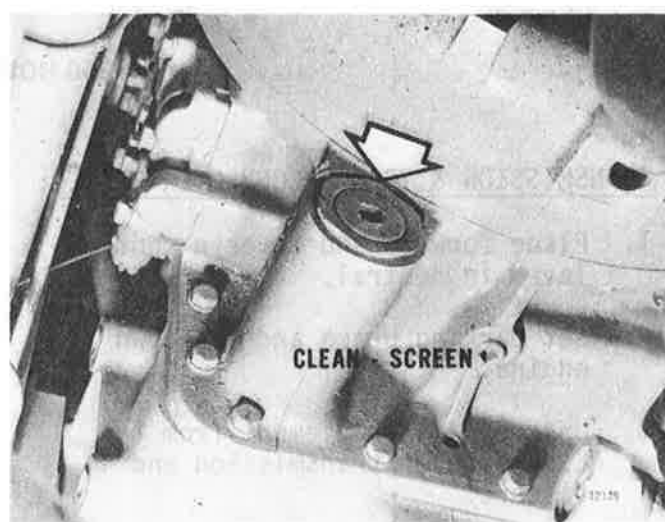


Figure 185
TRANSMISSION & CONVERTER SCREEN



9. Remove breather from housing and clean using solvent type cleaner.
10. Reinstall breather.
11. Add oil as outlined under Daily/10 Hour Service. Check level. Add oil prior to starting engine.

NOTE: Torque converter and transmission hold 5 U.S. Gallons (19 liters).

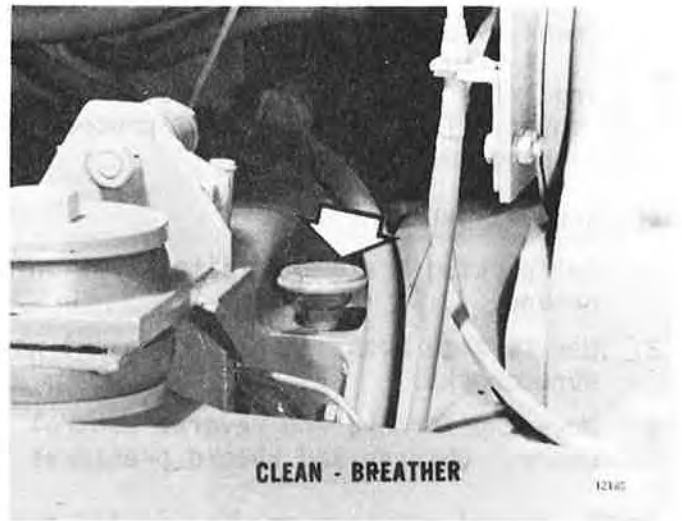
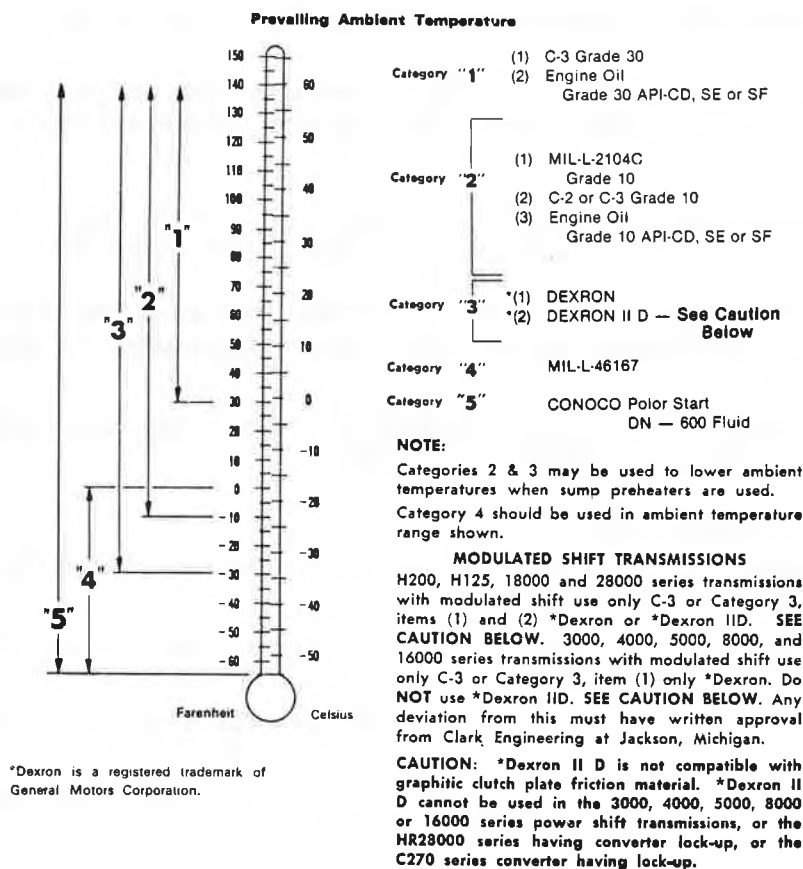


Figure 186
TRANSMISSION & CONVERTER BREATHER

RECOMMENDED LUBRICANTS FOR CLARK POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS



*Dexron is a registered trademark of General Motors Corporation.



CLUTCH PACK PRESSURE CHECKS

The crane is equipped with a converter pressure gauge, located on the instrument panel. A visual check can be made to determine whether a clutch pack is malfunctioning. The needle should remain in approximately the same position after each gear shift. The following test procedures will determine if clutch packs are functioning correctly.

ALLISON TRANSMISSION

1. Set parking brake and raise crane on outriggers until all four tires clear the ground.
2. Use service brake pedal to prevent wheels from turning while performing pressure checks.
3. Move the forward and reverse control lever through first, second and reverse gears. Observe and record pressures in each gear at both low and high idle.

NOTE: *Normal pressure reading is 180 ± 15 PSI (1.24 ± 0.10 MPa) at full throttle. Pressures should not vary between clutch packs by more than 5 PSI (0.03 MPa).*

4. If readings vary more than 5 PSI (0.03 MPa) contact your serviceman or see applicable shop manual for further testing.

CLARK 2420 TRANSMISSION

1. Set parking brake and raise crane up on outriggers until all four tires clear the ground.
2. Use service brake pedal to prevent wheels from turning while performing pressure checks.
3. Place the high-low gear lever in neutral and move the forward and reverse lever from forward to reverse positions. Observe and record pressures in each gear at both low and high idle.

NOTE: *Normal pressure reading is 260 ± 20 PSI (1.79 ± 0.13 MPa). Pressure should not vary between clutch packs by more than 5 PSI (0.03 MPa).*

4. Place the forward and reverse lever in neutral and move the high-low gear lever from low to high positions. Observe and record pressures in each gear at both low and high idle.
5. If readings vary more than 5 PSI (0.03 MPa) contact your serviceman or see applicable shop manual for further testing.

CLARK 18000 SERIES TRANSMISSION

1. Set parking brake and raise crane up on outriggers until all four tires clear the ground.
2. Use service brake pedal to prevent wheels from turning while performing pressure checks.
3. Check all clutch pack combinations at both low and high idle. Observe and record pressure readings.
 - A. Place forward and reverse lever in forward then move gear shift lever through first, second and third then back.

CONT'D. NEXT PAGE -



- B. Place forward and reverse lever in reverse then move gear shift lever through first, second and third then back.

NOTE: Normal pressure reading is 200 ± 20 PSI (1.38 ± 0.13 MPa) at full throttle. Pressures should not vary between clutch packs by more than 5 PSI (0.03 MPa).

4. If readings vary more than 5 PSI (0.03 MPa) contact your serviceman or see applicable shop manual for further testing.

PARKING BRAKE ADJUSTMENT

For the parking brake to be utilized as an emergency brake, it must be adjusted when the following conditions exists:

1. When parking brake is applied and slide "A" has bottomed out on its upward stroke "B".

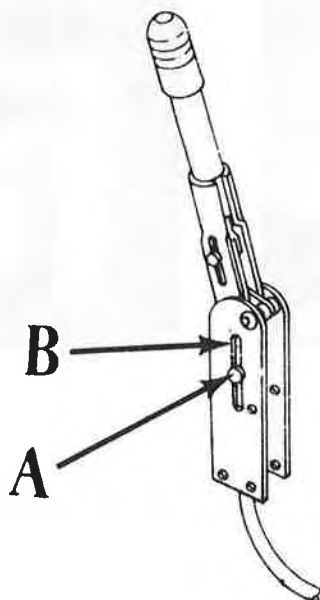


Figure 187

2. When parking brake is applied and there is no contact between the brake drum and the brake shoes.
3. When the parking brake is applied and with engine throttle between 1/3 to 1/2, the machine is placed in forward travel and brake fails to hold machine.

Brake adjustment is accomplished by turning the knob on the brake lever clockwise in the disengaged position with no tension on the cable. This adjustment is good until the slide on the lever bottoms out on its upward stroke and no more adjustment can be made at lever knob. Adjustment can then be made at jam nuts through seat box deck.



REAR STEER INDICATOR

For the convenience of the operator, a red light is installed on the instrument panel to indicate rear wheels not in straight ahead position.

When the red light is on, the wheels are not straight ahead. When steering the rear wheels and the light goes out, the wheels are straight.

A switch is located on the left rear wheel and activates the dash indicator light when wheels are not straight ahead.

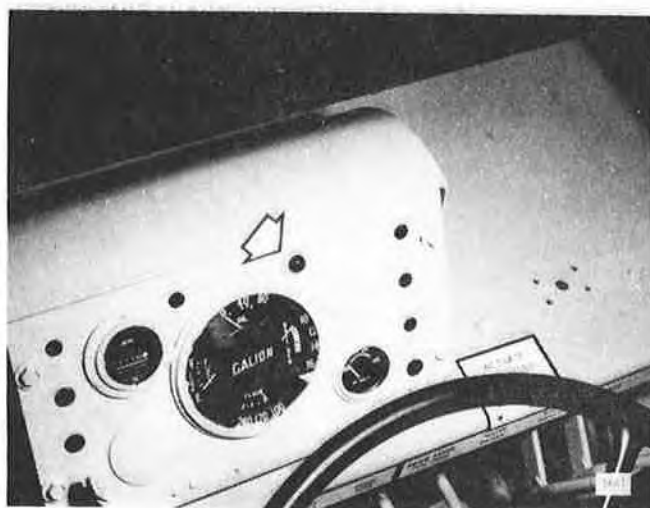


Figure 188
INDICATOR LIGHT

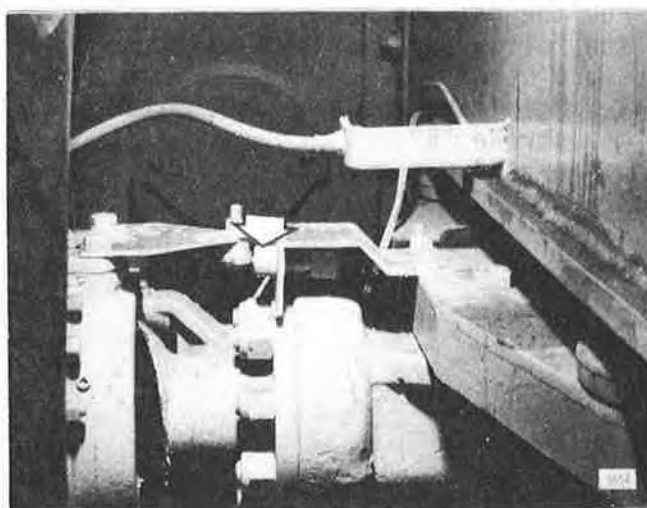


Figure 189
INDICATOR LIGHT



FOOT BRAKE ADJUSTMENT

CLARK FDS-12152 & DS-17220 AXLES

1. Raise crane with outriggers so all four tires are off the ground.
2. Place transmission in neutral. Release parking brake.
3. Remove the two rubber dust covers from the brake shoe backing plate across slots (top and bottom).
4. Using the star wheel adjusting tool, rotate the top and bottom star wheel by engaging the tool into the teeth of the star wheels and moving the tool handle toward the axle. Repeat until the brake linings drag heavily against the drum. Then, back off the star wheel adjuster 5 notches (clicks).

NOTE: *It may be possible to achieve a "no drag" condition on the brake drum by backing off the star wheel less than 5 notches. This can be best be detected if an operator applies the foot pedal and after a notch is taken off the star wheel, the operator applies the brake and no drag exists, another may be taken.*

5. Rotate the wheel and drum. There should not be any "drag" of the lining against the drum.
6. Replace dust covers.

NOTE: *Refer to the appropriate Shop Manual section for complete adjustment procedure.*

CLARK DS-13311 AXLES

1. Remove the two rubber dust covers from the star wheel adjustment access slots (top and bottom) in the brake housing back plate.
2. Using the star wheel adjusting tool, rotate the bottom star wheel by engaging the adjusting tool into the teeth of the star wheel and moving the tool handle toward the axle. Repeat until the brake lining drags heavily against the drum. Then, back off the star wheel adjuster to relieve drag.
3. Rotate the top star wheel by engaging the adjusting tool into the teeth of the star wheel and moving the tool handle toward the axle. Repeat until the brake lining drags heavily against the drum. Then, back off the star wheel adjuster to relieve drag.
4. Firmly depress foot pedal to center shoes, and again rotate star wheels to decrease lining to drum clearance until drag is felt on drum.
5. Relieve drag by backing off star wheels 5 notches (clicks).
6. Rotate the wheel and drum. There should not be any "drag" of the lining against the drum.
7. Replace the two rubber dust covers removed in Step 1.
8. Repeat Steps 1 through 7 for all wheels.



ROCKWELL AXLES

1. Raise crane with outriggers so all four tires are off the ground.
2. Place transmission in neutral. Release parking brake.
3. Remove dust shield from brake drum. Inspect linings for wear and need for a adjustment.
4. With a wrench, rotate roller cam to expand brake shoe linings tight against the drum until wheel drags.
5. Back off cam until "no drag" exists.
6. Tighten anchor pin lock nut leaving .005" (0.13 mm) clearance through the entire arc of brake shoe.

NOTE: *Refer to appropriate Shop Manual section for complete adjustment procedure.*

SOMA AXLES

1. Raise crane with outriggers so all four tires are off the ground.
2. Place transmission in neutral. Release parking brake.
3. Remove two dust cover plugs and inspection plugs from access and inspection holes in dust cover.
4. Using a brake spoon, turn each star wheel until there is 0.010" to 0.020" (0.25 mm to 0.51 mm) clearance between brake shoes and drum.

NOTE: *Insert a feeler gauge through the inspection hole(s) to check clearance. Clearance is to be the same on both sides.*

5. Install two dust cover plugs and two inspection plugs in dust cover.

NOTE: *Refer to appropriate Shop Manual section for complete adjustment procedure.*



HOIST & SWING BRAKE OPERATION



ALL MAJOR REPAIRS SHOULD ONLY BE ATTENDED TO BY EXPERIENCED SERVICE PERSONNEL. SHUTDOWN UNIT WHILE MAKING ADJUSTMENTS AND/OR REPAIRS.

HOIST BRAKE

If the hoist drum brake is operating properly the following should occur during normal operation.

1. When hoisting a load the brake should remain in the applied position. The hoist drum has a one way clutch which allows the hoist to take in line without releasing the brake. The brake cylinder may move slightly due to back pressure in the drain line at times, which will allow the brake drum to rotate some.
2. When lowering a load, hoist brake cylinder should release the brake allowing brake drum to rotate.

If hoist does not function as stated in the preceeding statements and/or the load drifts the following may be possible causes;

1. Spring eyebolt may not be tensioned properly.
2. With hoist control levers in "NEUTRAL" position, the hoist brake push rod is not free to rotate.
3. Push rod may be adjusted too long which will not let the brake be fully applied.
4. Flow regulator, 1 GPM (4 lpm) may be partially or completely plugged.
5. Crowd cylinder overcenter check valve may be stuck open.
6. Brake cylinder may be scored and binding.
7. Brake shoes can be slipping due to being oil spotted or soaked, and should be replaced.
8. Brake shoes may be glazed which can be removed by burnishing.

NOTE: *These items should ONLY be attended to by experienced service personnel using the appropriate shop manual.*

SWING BRAKE

If the swing brake is operating correctly the swing brake cylinder should release when the boom is swung in either direction. When either of the swing control levers are returned to their "NEUTRAL" position the brake should apply. If not the following maybe possible causes;

1. Spring eyebolt may not be tensioned properly.

CONT'D. NEXT PAGE -



2. With swing control levers in "NEUTRAL" position, the swing brake push rod is not free to rotate.
3. Push rod may be adjusted too long which will not let the brake be fully applied.
4. Flow regulator, 1 GPM (4 lpm) may be partially or completely plugged.

SHIPPING

Certain precautions must be observed when the crane is shipped to a new location. The climatic conditions during transit and at destination, method of transportation, and time in transit should determine the precautions to be taken.

If the crane is to be in transit for a long period of time or will not be used immediately upon its arrival, the same precautions should be taken for shipping as outlined for storing. The only exception is that the battery should be disconnected.

The following precautions should suffice if the crane is in transit only a few days.

1. Raise air pressure in tires several pounds above normal operating pressure. This will prevent excessive bouncing during transit.
2. Drain the radiator if not filled with antifreeze.
3. Disconnect the battery.
4. Clean all bright surfaces and coat with heavy grease to prevent rusting.
5. Block wheels. The blocks should be 8" to 12" (203.20 mm to 304.80 mm) high and sawed to fit the tires. Place blocks at least 6" (152.40 mm) high against outside of each tire. Nail all blocks securely.
6. Tie crane down with heavy gauge wire, steel straps, cables, or chains. Tie front and rear end of crane down on both sides.



STORING

The crane should be stored in a dry, protected place when it will not be used for a long period of time. Leaving a unit in an open field or yard exposed to rain and snow will shorten its life.

When taken out of service for an extended period of time, follow these steps:

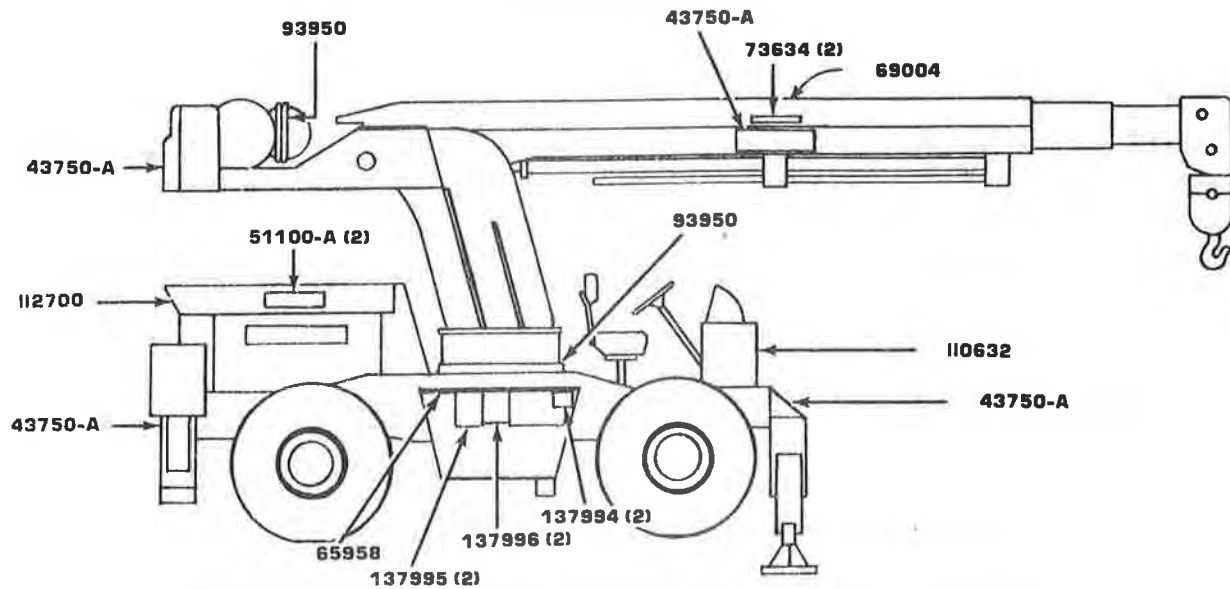
1. Clean all dirt and mud off machine.
2. Paint all bright surfaces with heavy coat of grease.
3. Touch up painted areas where the paint has been scraped.
4. Lubricate entire machine as outlined in lubricating section.
5. Refer to Engine Operator's Manual for engine storage procedure.
6. Raise all wheels clear of ground. Place blocks under front and rear axles so no weight is supported by the tires.
7. Remove battery and store it where it will not be damaged. Charge battery once every four to six weeks so it will not go dead.
8. Remove seat cushions and other perishable items from the machine and store where they will not be damaged.

Adequate precautions must be taken to prevent rust formation in the various cases and storage tanks when machine is stored for a long time. With the exception of the engine crankcase, all other cases and tanks should be filled to maximum capacity with prescribed lubricant or liquid for that particular area. Check Engine Operator's Manual for extended storage.



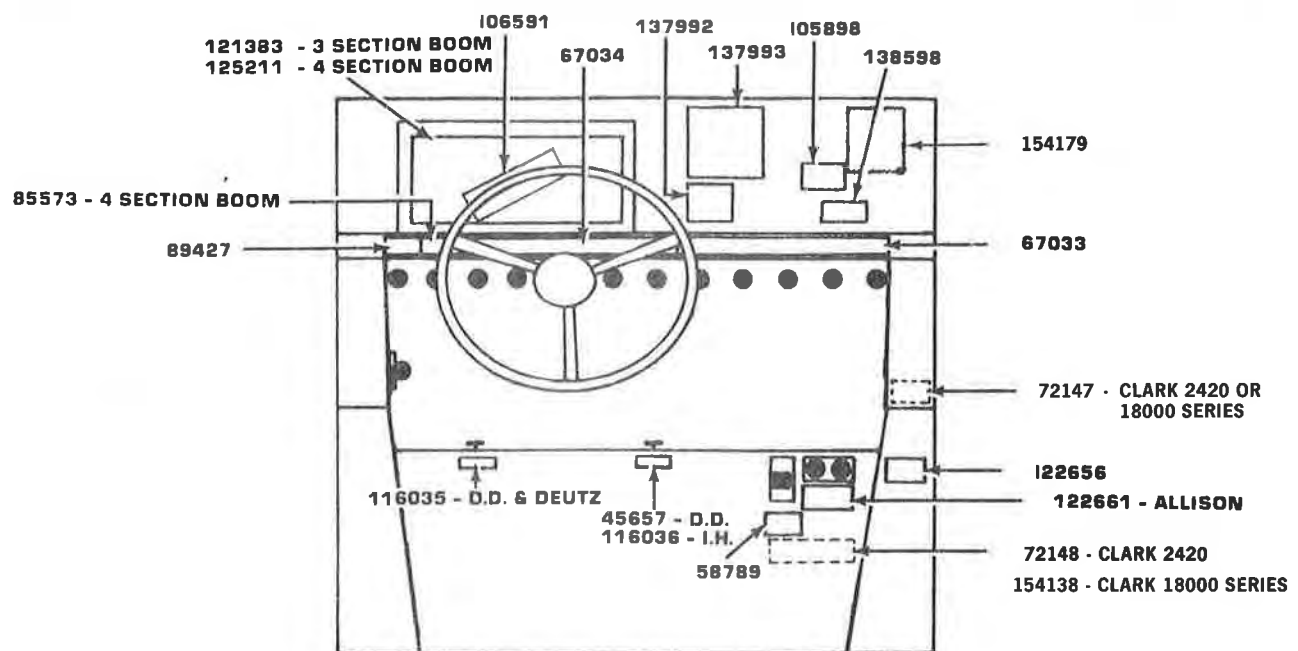
DECALS

DECAL CHART



DECAL NO.	LOCATION	QUANTITY
48807	UNDER FUEL TANK LID	1
59670	CLARK 2420 TRANSMISSION CASE - BOTTOM	1
59671	CLARK 2420 TRANSMISSION CASE - TOP	1
93950	DIFFERENTIAL - FRONT AND REAR BY LEVEL PLUG	2
101281	TOP OF HYDRAULIC OIL TANK	1
122657	ALLISON TRANSMISSION CASE - TOP, OR CLARK 18000 TRANSMISSION - BY DIPSTICK ON FRAME	1
LUBRICATION CHART	UNDER TOOL BOX LID	1

CHASSIS LOCATIONS



CAB LOCATIONS



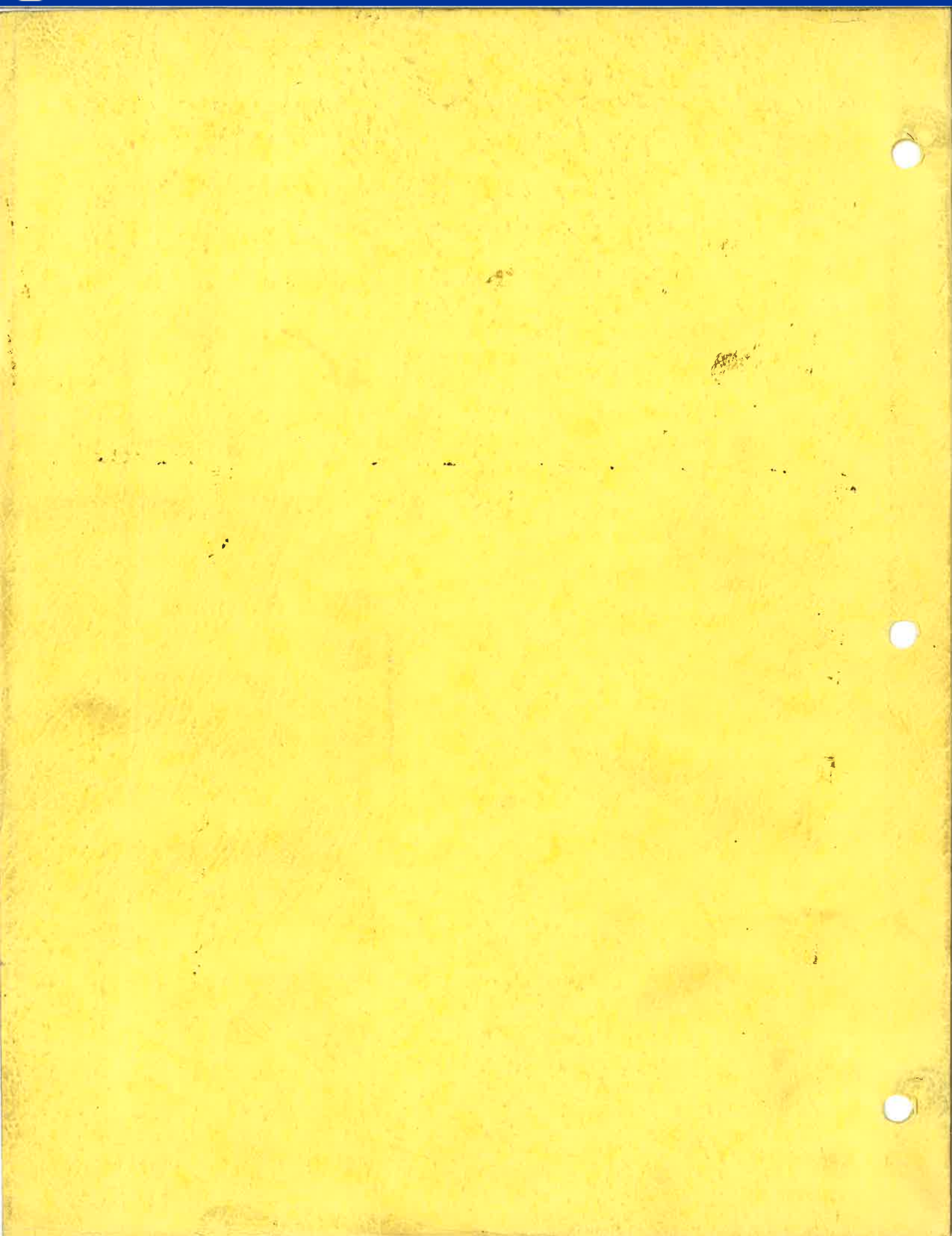
DECAL LIST



IF A SAFETY DECAL IS DEFACED OR BECOMES ILLEGIBLE, IT MUST BE REPLACED. TO HELP THE OPERATOR ACCOMPLISH THIS, A DECAL LOCATION AND IDENTIFICATION CHART IS PRESENTED HERE.

<u>PART NUMBER</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>
43750-A	GALION	4
45657	EMERGENCY SHUTDOWN (<i>DETROIT DIESEL</i>)	1
48807	FUEL SPECIFICATIONS	1
51100-A	GALION	2
58789	CAUTION - STOP BEFORE REVERSING	1
59670	TRANSMISSION OIL LEVEL (<i>CLARK 2420 TRANSMISSION</i>)	1
59671	TRANSMISSION FILL PLUG (<i>CLARK 2420 TRANSMISSION</i>)	1
65958	ALTERNATOR	1
67033	VALVE CONTROL	1
67034	OUTRIGGER CONTROL	1
69004	GALION	1
72147	DRIVE CONTROL (<i>CLARK 2420 & 18000 SERIES TRANSMISSIONS</i>)	1
72148	DRIVE CONTROL (<i>CLARK 2420 TRANSMISSION</i>)	1
73634	SERIES A	2
85573	CROWD - 4 SECTION BOOM	1
89427	SWING	1
93950	OIL LEVEL	4
101281	HYDRAULIC OIL	1
105898	FAST HOIST	1
106591	LOAD CHART CAUTION	1
110632	HAND SIGNAL	1
112700	GALION - MILES AHEAD	1
116035	SHUTDOWN (<i>DETROIT & DEUTZ DIESEL</i>)	1
116036	CHOKE (<i>IH GASOLINE</i>)	1
122656	CAUTION - ROADING	1
122657	TRANSMISSION FILL (<i>ALLISON & CLARK 18000 SERIES TRANSMISSIONS</i>)	1
122661	DRIVE CONTROL (<i>ALLISON TRANSMISSION</i>)	1
SEE PARTS BOOK	SAFE LOAD RATING - 3 SECTION BOOM	1
SEE PARTS BOOK	SAFE LOAD RATING - 4 SECTION BOOM	1
137992	CAUTION - OPERATOR QUALIFICATION	1
137993	DANGER - ELECTRICAL	1
137994	CAUTION - OPERATOR QUALIFICATION	2
137995	DANGER - ELECTRICAL	2
137996	DANGER - ELECTRICAL	2
138598	CAUTION - SAFE OPERATING	1
154138	DRIVE CONTROL (<i>CLARK 18000 SERIES TRANSMISSION</i>)	1
SEE PARTS BOOK	LUBRICATION CHART	1
154179	CAUTION - TWO BLOCKING	1







OPERATING

SECTION 3
Page 5

HYDRAULIC CRANE SYSTEMS

A tandem pump of 30 and 50 Gallons Per Minute (GPM) (114 and 189 liter per minute) (lpm) rated capacity is directly driven at the crankshaft end of the engine.

THIRTY GALLON PUMP

Flow from the 30 GPM (114 lpm) pump is directed to a flow regulator, where 11 GPM (42 lpm) are diverted through the front wheel power booster steering valve. This provides the flow when needed for front wheel steering and power boosted brakes.

After this regulated flow passes through the steering valve it goes to a diverter valve which rejoins the oil separated for front steer with the oil that was bypassed in the regulating valve. This flow now has a volume up to 30 GPM (114 lpm) depending on engine speed.

Flow now goes to the left end of the control (secondary) manifold, and through a series flow valve system becomes available for use by all valves in this manifold.

Outrigger Controls

The outrigger controls will use this flow if the control valves are operated. Since the valves are of the series type; when oil is directed to the outrigger cylinder(s), the oil that is stored on the opposite side of the piston is forced out by piston movement and flows back to the manifold to be used by other controls down stream.

Rear Steering

The next valve in the manifold controls flow to the rear steering cylinders.

Swing

The 30 GPM (114 lpm) flow goes from the rear steering valve to the swing valve. This valve controls the flow of oil to the swing drive motor to rotate the boom and pedestal.

When this valve directs a flow of oil to the swing motor, a small part of the flow goes to the swing brake cylinder. This is a single acting cylinder that releases the brake when oil is supplied during the swing motor operation.

When the swing control valve is returned to neutral, oil drains out of the brake cylinder and a spring applies the brake to the input shaft and prevents rotation of the boom pedestal.

CONT'D NEXT PAGE



OPERATING

Low Line Speed

The 30 GPM (114 lpm) flow is supplied to the hoist motor by the next valve in the manifold. This flow is piped through the rotary joint in the pedestal of the crane.

NOTE: *When hoist is raised the hoist brake is not released. A sprag clutch allows hoist drum to rotate while brake is applied. However when hoist is lowered a small portion of the 30 GPM (114 lpm) is routed through a pilot line to the single acting brake cylinder allowing brake to release. When the lowering operation stops, oil drains out of the brake cylinder and a spring applies the brake to the input shaft and prevents rotation of the hoist drum.*

FIFTY GALLON PUMP

The 50 GPM (189 lpm) flow is routed to the primary manifold located under the boom pedestal. Control of the valves in this manifold is made through aircraft-type cables connecting the control levers with the valves.

Intermediate Line Speed

The first valve in the 50 GPM (189 lpm) system supplies 50 GPM (189 lpm) flow to the hoist motor.

NOTE: *When hoist is raised the hoist brake is not released. A sprag clutch allows hoist drum to rotate while brake is applied. However when hoist is lowered a small portion of the 50 GPM (189 lpm) is routed through a pilot line to the single acting brake cylinder allowing brake to release. When the lowering operation stops, oil drains out of the brake cylinder and a spring applies the brake to the input shaft and prevents rotation of the hoist drum.*

High Line Speed

Operated both the low line speed and intermediate line speed controls together to obtain the high line speed. This will yield a combined flow of up to 80 GPM (303 lpm) to the hoist motor.

NOTE: *When hoist is raised the hoist brake is not released. A sprag clutch allows hoist drum to rotate while brake is applied. However when hoist is lowered a small portion of the 80 GPM (303 lpm) is routed through a pilot line to the single acting brake cylinder allowing brake to release. When the lowering operation stops, oil drains out of the brake cylinder and a spring applies the brake to the input shaft and prevents rotation of the hoist drum.*



OPERATING

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Boom Crowd

The 50 GPM (189 lpm) flow is then supplied to the boom crowd valve. This flow is piped to the crowd cylinder and extends or retracts the boom sliding sections.

NOTE: *When boom is extended a small portion of the 50 GPM (189 lpm) is routed through a pilot line to the single acting brake cylinder allowing brake to release. This actions allows wire rope to be paid out from the hoist drum without damaging components or the rope itself. When the control lever is returned to neutral, oil drains out of the brake cylinder and a spring applies the brake to the input shaft and prevents rotation of the hoist drum.*

Boom Lift

Flow from the last valve in the 50 GPM (189 lpm) manifold is piped to the boom lift cylinder to raise or lower the boom.

NOTE: *When boom is lowered, on fixed counterweight machines, a small portion of the 50 GPM (189 lpm) is routed through a pilot line to the single acting brake cylinder allowing brake to release. This actions allows wire rope to be paid out from the hoist drum without damaging components or the rope itself. When the control lever is returned to neutral, oil drains out of the brake cylinder and a spring applies the brake to the input shaft and prevents rotation of the hoist drum.*



OPERATING

OPERATING CONTROLS - CLARK 18000 SERIES TRANSMISSION

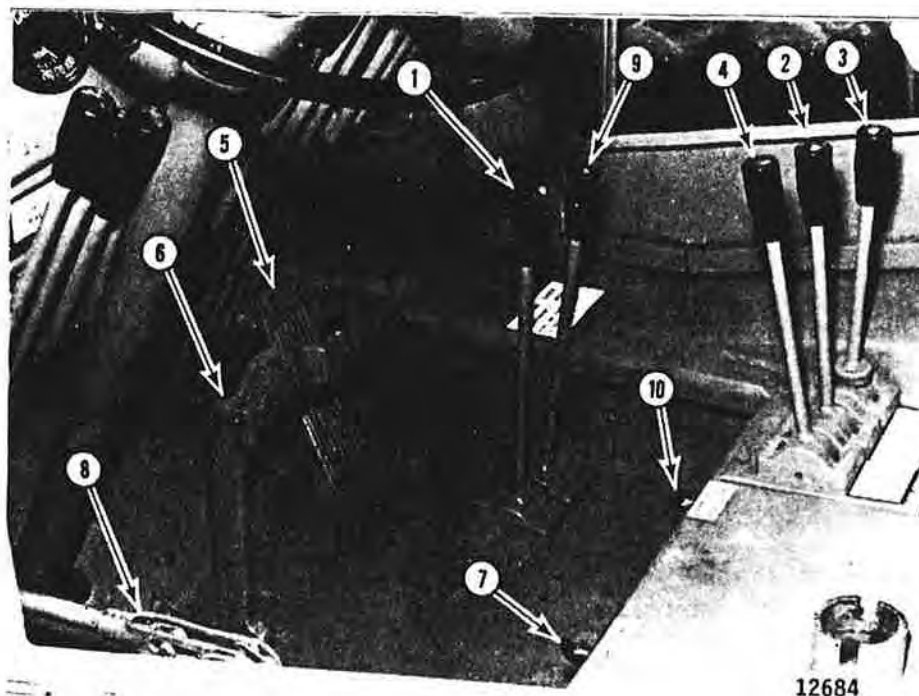


Figure 2

1. FRONT AXLE DISCONNECT LEVER

- a. To engage four wheel drive, stop crane with front and rear wheels directed straight. Position the forward/reverse lever (See Ref. 2) in "NEUTRAL" and apply light hand pressure to the front axle disconnect lever toward the front of the crane. If axle disconnect does not engage, continue to apply hand pressure to the disconnect lever and turn steering wheel to the left and then to the right. When four wheel drive is engaged, the disconnect lever will remain in the forward position.
- b. To disconnect four wheel drive, stop the crane and pull the disconnect lever fully rearward. When four wheel drive is disengaged, the lever will remain in the rearward position.



WARNING! Do not road the crane with the four wheel drive engaged.



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2. FORWARD AND REVERSE CONTROL LEVER

- a. Lever must be in center (NEUTRAL) position to start crane.
- b. When crane is started, engage powershift forward/reverse gear box by moving lever in direction of desired travel.



WARNING! Bring crane to a complete stop before changing direction of travel. Do not shift "DOWN" at high road speed. Shifts may be made "UP" or "DOWN" under load or during travel at lower speeds. Release engine accelerator pedal when shifting "DOWN" at normal travel speeds.

3. ENGINE SPEED CONTROL

- a. Pull rearward to increase speed.
- b. Twist lever clockwise to lock at desired engine speed.



WARNING! Do not lock engine speed control lever when roading. Be sure lock is fully released before roading.

4. POWER GEAR SHIFT LEVER (with CLARK 18000 SERIES TRANSMISSION)

- a. Pull lever all the way back for "FIRST" gear.
- b. Middle position is "SECOND" gear.
- c. Push lever all the way forward for "THIRD" gear.



WARNING! Do not attempt to use high/low range lever (See Ref.9) while crane is moving.

- d. For speed ranges, see "General Specifications" Section 5, in this manual.



WARNING! Downhill grades: When encountering a downhill grade, shift transmission into a lower gear. Downshifting will allow engine to provide additional dynamic braking power. The slope of the grade, load and type of terrain must always be taken into consideration.

5. ENGINE ACCELERATOR

- a. Foot operated. Press toward floor to increase engine speed.

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OPERATING

6. SERVICE BRAKE PEDAL

- a. Foot operated. Press toward floor to activate brake.

7. DIESEL ENGINE SHUTDOWN CABLE (DETROIT DIESEL)

NOTE: *On later model units the shutdown cable is located behind the transmission control levers located to the right of the operator's seat.*

- a. This cable is used for normal shutdown, see "Shutdown Procedure" section in this manual.

8. PARKING BRAKE LEVER

- a. Pull up to apply brake.
- b. Push down (to a horizontal position) to release brake.
- c. Turn knob on top of lever to adjust brake. See "Parking Brake Adjustment" Section 4, of this manual for further information.

9. HIGH/LOW RANGE LEVER

- a. Pull lever rearward to engage "LOW" speed range.
- b. Push lever forward to engage "HIGH" speed range.



WARNING! Bring crane to a complete stop before shifting lever to change speed ranges.

10. EMERGENCY SHUTDOWN CABLE (DETROIT DIESEL)

- a. See "Shutdown Procedure" section in this manual.

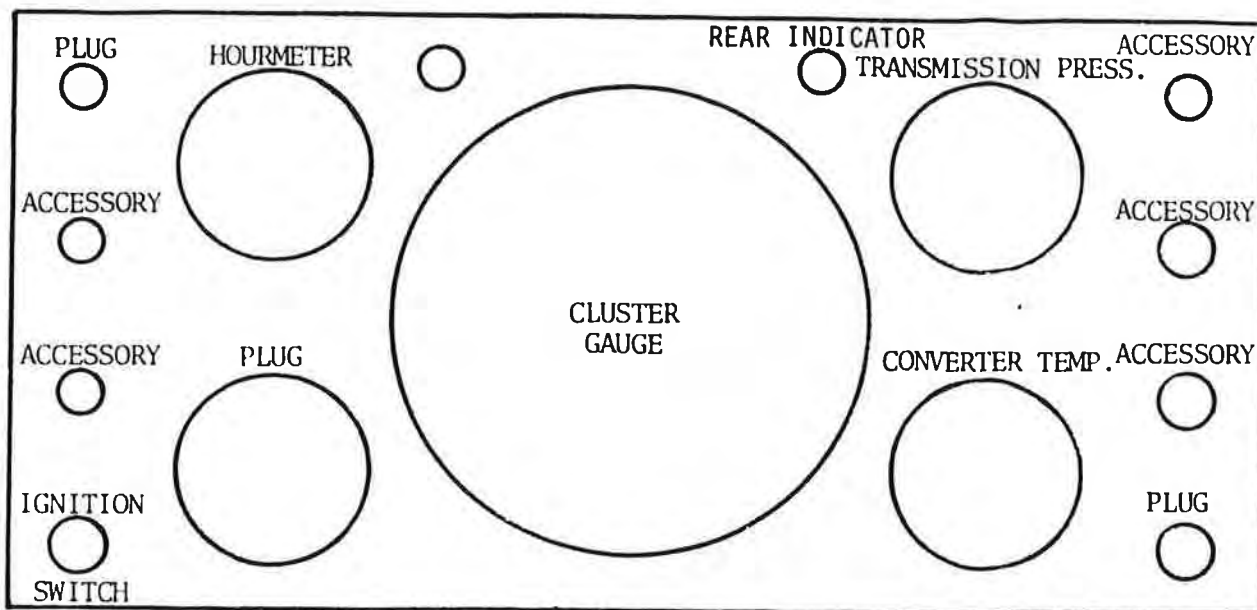
NOTE: *DO NOT use emergency shutdown cable for routine shutdown. Regular use of emergency shutdown cable could damage engine. Use Ref. 7, for routine shutdown of diesel engine.*



OPERATING

INSTRUMENT PANEL

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14278 A

Figure 3
DETROIT DIESEL AND DRESSER ENGINES



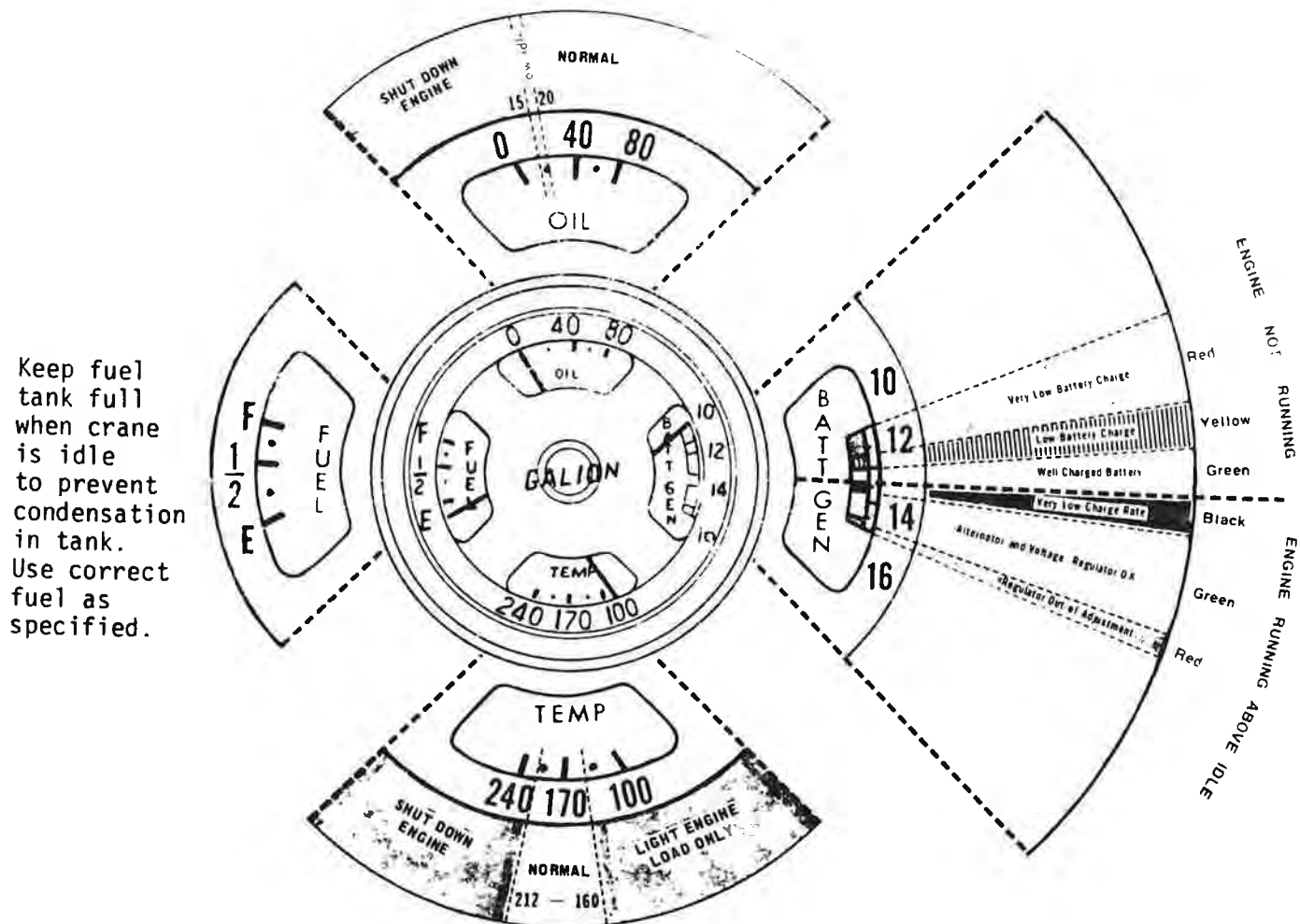
OPERATING

GAUGES

The gauges on the instrument console have been installed to aid in operating the crane at its rated capabilities. By observing them frequently, the operator can obtain an indication of the condition of the engine drive systems. If abnormal conditions are indicated he can make the necessary adjustments or repairs before excessive damage results. Additionally an hour meter has been installed to aid the operator in caring for and maintaining the crane in accordance with the "Periodic Service Charts and Tables" given in this manual.

CLUSTER GAUGE

Shutdown engine immediately if pressure does not reach minimum. Pressure will vary with engine RPM.



Keep fuel tank full when crane is idle to prevent condensation in tank. Use correct fuel as specified.

Allow engine to warm up to operating temperature before operating crane. Shutdown engine if temperature exceeds 212°F. (100°C.).

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Figure 4



OPERATING

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VOLTMETER

The VOLTMETER indicates the condition of the battery before and after operating the engine. An undercharged battery can be detected immediately, without being caught unprepared with a slow cranking situation. Overcharged batteries can be detected immediately without the need for a period of battery water usage checks. In addition, the voltmeter shows the amount of voltage being produced by the charging circuit.

Before Starting Engine

Turn key switch ON and observe voltmeter. Dial pointer should be in the first GREEN zones (between 12 and 12.9 Volts). If pointer indicates a voltage below this zone (less than 12 Volts), the battery is undercharged.

A steady reading in the first RED zone (less than 11.2 Volts) may indicate a need for a complete inspection of battery and/or charging system.

While Warmed-up - Engine Running Above Idle

Make periodic checks of voltmeter while working the machine. Dial pointer should be in the second GREEN zone (between 13.2 and 15.2 Volts).

If pointer indicates a voltage below this zone (less than 13.2 volts), adjustment of voltage regulator may be required. If voltage is less than 12.5 Volts (within upper GREEN zone), alternator may be defective.

If pointer indicates a voltage higher than the second GREEN zone, in the bottom RED zone (greater than 15.2 Volts), the voltage regulator is out of adjustment. Never allow voltage to exceed 16 Volts, as serious damage to the electrical system may result.

After Shutting Down the Engine

Again turn key switch ON and observe voltmeter. Dial pointer should be in the first GREEN zone (between 12 and 12.9 Volts). If pointer indicates a voltage above this zone (in excess of 12.9 Volts), restart engine and check voltage while engine is running above idle. Such a condition indicates an overcharged battery.

NOTE: *It is suggested that only qualified trained personnel attempt to adjust voltage regulator.*

NOTE: *The voltage regulator is compensated to permit the charging system to produce more voltage during cold weather. Therefore, the voltmeter will show higher readings during cold weather than in warm weather.*

NOTE: *Depending on ambient temperature, the voltmeter may require 2 to 3 minutes to move to a steady reading after turning the key on.*



OPERATING

CONVERTER TEMPERATURE GAUGE

Figure 5, illustrates the converter temperature gauge. It indicates the temperature of the transmission fluid used in the travel drive system before it returns to the cooler sump. This temperature should not exceed 250°F (121°C). Temperatures at or even near 250°F (121°C) may indicate a need for service because of improper cooler operation or other system malfunction.

Normal operating ranges for the various transmissions are as follows:

Clark 18000 Series
180 - 200°F (82 - 93°C)

HOURLY METER

Figure 6, illustrates the hour meter. It records elapsed time of engine operation. This then corresponds to the amount of time that the machine is in operation. Pay particular attention to the amount of hours on machine so maintenance can be performed as described in "Periodic Service Charts and Tables" Section 4, of this manual.

TRANSMISSION PRESSURE GAUGE

Figure 7, illustrates the transmission pressure gauge. It indicates the oil pressure in the charging pump that is used to supply the transmission clutch packs and oil flow through the torque converter.

See "Transmission Checks" Section 4, of this manual for further information.

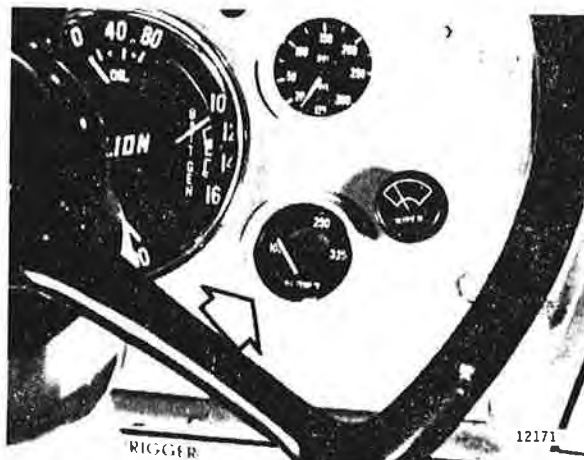


Figure 5



Figure 6



Figure 7



OPERATING

SECTION 3

Page 15

START-UP PROCEDURE

DETROIT DIESEL

1. Set parking brake.
2. Move forward/reverse control lever to "NEUTRAL."
3. Depress accelerator pedal about 1/3 of its total travel, or move speed control lever to the rear about 1/3 and twist clockwise to lock.
4. Push engine shutdown cable all the way in. Make sure emergency shutdown cable has not been activated (See Figure 8). Reset if necessary (See Figure 9).
5. Turn ignition key switch clockwise to "START" position to engage cranking motor.



WARNING! Never operate the cranking motor for more than 30 Seconds at a time. If the engine does not start, allow the cranking motor to cool for 2 to 3 Minutes before cranking again.

If the engine fails to start after four attempts, an inspection should be made to determine the cause. Perhaps at the last shutdown operation the emergency cable was pulled. If so, the trap on the intake manifold must be reset (See Figure 9).

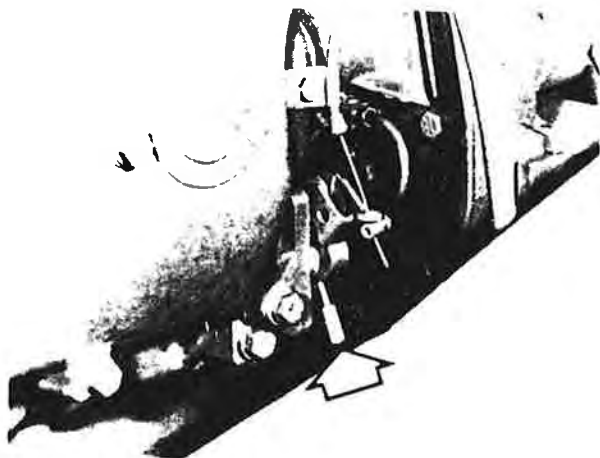


Figure 8
CORRECT SETTING

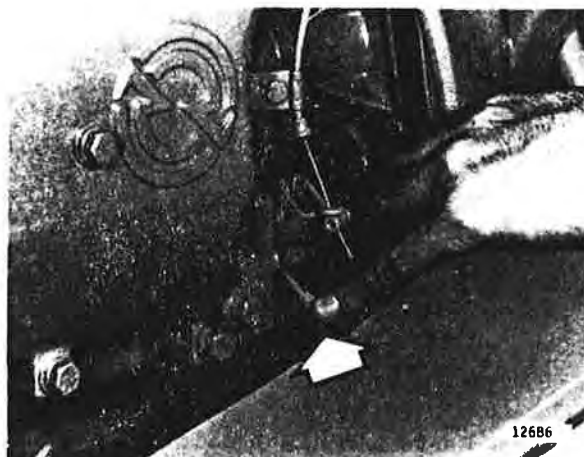


Figure 9
INCORRECT SETTING (RESET)

After engine has started, allow engine speed control to remain in its starting position for 5 or 10 Minutes; at which time a light load can be applied. After engine reaches normal operating temperatures, a full load may be engaged.



OPERATING

DRESSER D359T DIESEL

1. Set parking brake.
2. Move forward/reverse control lever to "NEUTRAL."
3. Depress accelerator pedal about 1/3 of its total travel, or move speed control lever to the rear about 1/3 and twist clockwise to lock.
4. Turn ignition key switch clockwise to "ON" position and depress start button.
5. When engine begins to run, release start button and leave ignition key switch in the "ON" position.



WARNING! Never operate the cranking motor for more than 30 Seconds at a time. If the engine does not start, allow the cranking motor to cool for 2 to 3 Minutes before cranking again.

After engine has started, allow engine speed control to remain in its starting position for 5 or 10 Minutes; at which time a light load can be applied. After engine reaches normal operating temperatures, a full load may be engaged.



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SHUTDOWN PROCEDURE

DETROIT DIESEL

It is important to idle an engine for three to five minutes before shutting down, to allow lubricating oil and coolant to carry heat away from combustion chamber, bearing shafts etc.

1. Place forward/reverse control lever in "NEUTRAL" and set parking brake.
2. Allow engine to idle for 3 to 5 Minutes to avoid heat surge.
3. Turn ignition key switch counterclockwise to the "OFF" position and pull out engine shutdown cable.
4. After engine has stopped, push cable all the way in.



WARNING! Do not use emergency shutdown cable for routine shutdown. Regular use of this cable could cause loss of engine performance.

If engine fails to shutdown using normal shutdown cable, use the emergency shutdown cable. Once the engine has stopped, reset the trap on intake manifold.

Investigate cause of the normal shutdown cable failure.

DRESSER D359T DIESEL

It is important to idle an engine for three to five minutes before shutting down, to allow lubricating oil and coolant to carry heat away from combustion chamber, bearing shafts etc.

1. Place forward/reverse control lever in "NEUTRAL" and set parking brake.
2. Allow engine to idle for 3 to 5 Minutes to avoid heat surge.
3. Turn ignition key switch counterclockwise to the "OFF" position.



SECTION 3

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OPERATING

APPLICATION

Ratings shown on the CRANE LOAD CHART (mounted on instrument panel cover) are MAXIMUM allowable loads, NOT practical working loads. Ratings (shown on chart) above the heavy line are based on the machine's hydraulic or structural competence and not the machine's stability.

Operating radius is the horizontal distance from the axis of rotation, before loading, to the vertical hoist line of tackle with load applied.

Weights of hooks, hook blocks, slings and other load handling devices, except hoist rope, shall be considered a part of the load.

Practical working loads depend on how level machine is, supporting surface, wind and other factors affecting stability. Hazardous surroundings, experience of personnel and proper handling must be taken into account by the operator.

Positioning or operation at radii and boom or jib lengths beyond the maximums and minimums shown (on load chart) is not intended or approved.

The instructions that follow will help you get maximum efficiency from this crane.



WARNING! Never exceed load chart capacities.

- I. **LIFTING CAPACITIES:** This crane is rated at a 10' (3.048 m) radius with its maximum payload (see Illustration I, Page 19). Increasing the radius decreases the amount of payload. The radius can be changed by raising or lowering the boom or by extending or retracting the telescopic boom section or sections.
- II. **LIFTING UNKNOWN WEIGHT:** When loads are not accurately known are to be lifted, the person responsible for the job shall ascertain that the weight of the load does not exceed the CRANE LOAD RATING CHART at the radius at which it is to be lifted.

NOTE: Always use outriggers for maximum lifting stability.
- III. **LIFTING KNOWN WEIGHT:** The load chart is the governing factor when lifting known weights. The load chart is rated with the outriggers all the way down, until the tires clear the ground. It is recommended that you feel your way into any lift as a precaution against tip-over. When ever possible, lift and swing payloads between the front outrigger pad area (see Illustration II, Page 19). This can be done by positioning the front of the crane as shown in Illustration II. This illustration shows a payload on top of a building being lowered to the ground. Payload is picked up at point (A), swung to the right and lowered to (B).
- IV. **PICK AND CARRY:** The DRESSER Crane has the ability to pick and carry payloads without added labor. There are no manual lockouts on the rear axle. The oscillation is controlled with elastomeric mounts between the main frame and rear axle supports. The crane is elastomeric mounted in two distinct areas: one - the elastomeric rear axle mounts, two - the tires. Rear axle mounts will stretch and compress when hoisting a payload which is a normal operating condition. It is most important to keep the tires at rated maximum pressure. Under inflated tires will cause unnecessary boom movement



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when hoisting a payload. Longer radius and heavier loads will magnify these conditions. We recommend when traveling with a suspended payload, you evaluate the prevailing conditions and determine the safety precautions required in each individual case. The following factors must be considered before attempting to pick and carry a load.

1. Align the boom with the forward direction of machine travel. Maintain this boom position when turning the machine. Turn only when necessary, at the slowest speed, and at a wide turning radius (see Illustration III, Page 19).
2. Use the shortest boom length possible.
3. Keep the load as close to the ground as conditions will permit.
4. Provide tag lines to prevent load from pendulating. This can cause a change in radius. A change in radius could exceed the load chart rating or cause a tip-over condition.
5. Govern travel speed to suit conditions.
6. Avoid sudden starts and stops.
7. Never travel with outriggers lowered, as they may catch an obstruction.

NOTE: THE 10' RADIUS IS WITH THE
BOOM ELEVATED

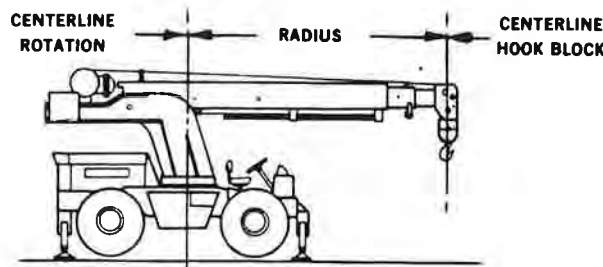


ILLUSTRATION I

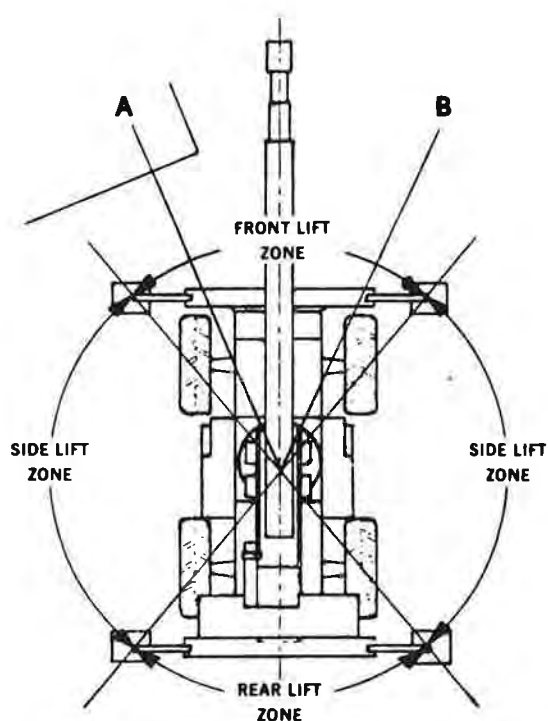


ILLUSTRATION II

ON RUBBER FRONT
LIFT ZONE

ON RUBBER
360°
LIFT ZONE

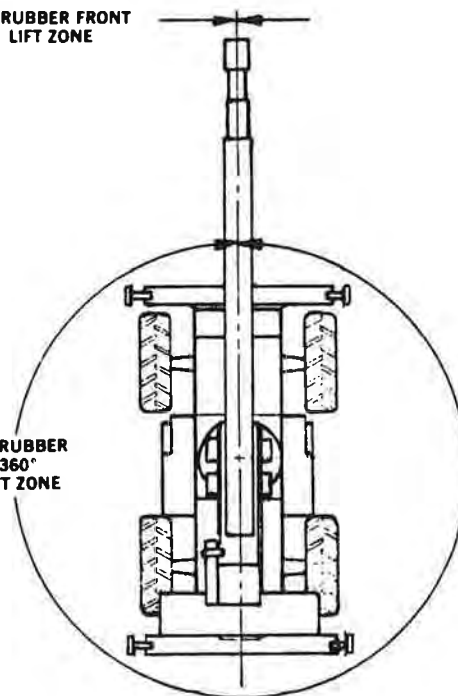


ILLUSTRATION III

14281

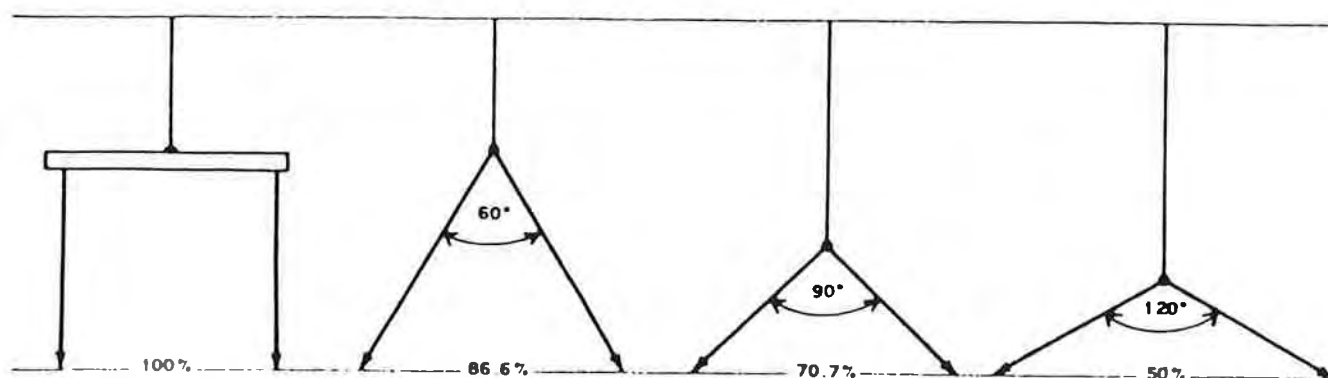


OPERATING

LIFTING WITH SLING

PERCENTAGE OF WORKING LOAD

When hoisting with slings, the line drawing below represents various angles hooked to payload. The percentages represents the amount of full safe working load at various. Safe working load will decrease as the angle increases.



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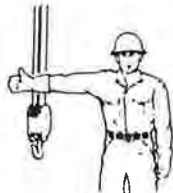
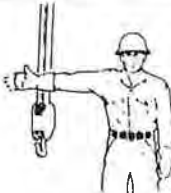
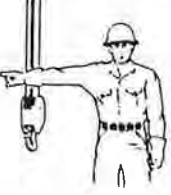
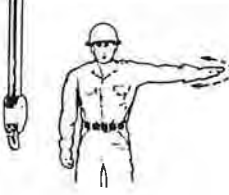
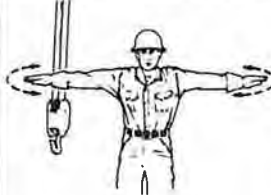
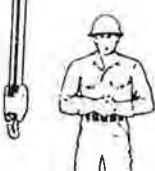
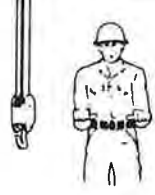
Figure 10



OPERATING

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STANDARD HAND SIGNALS

 HOIST With forearm vertical, forefinger pointing up, move hand in small horizontal circle	 LOWER With arm extended downward, forefinger pointing down, move hand in small horizontal circles	 USE MAIN HOIST Tap fist on head; then use regular signals	 USE WHIP LINE (Auxiliary Hoist) Tap elbow with one hand; then use regular signals
 RAISE BOOM Arm extended, fingers closed, thumb pointing upward	 LOWER BOOM Arm extended, fingers closed, thumb pointing downward	 MOVE SLOWLY Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (Hoist slowly shown as example)	 RAISE THE BOOM AND LOWER THE LOAD With arm extended, thumb pointing up. Flex fingers in and out as long as load movement is desired.
 LOWER THE BOOM AND RAISE THE LOAD With arm extended, thumb pointing down. Flex fingers in and out as long as load movement is desired.	 SWING Arm extended, point with finger in direction of swing of boom	 STOP Arm extended, palm down, move arm back and forth horizontally	 EMERGENCY STOP Both arms extended, palms down, move arms back and forth horizontally
 TRAVEL Arm extended forward, hand open and slightly raised, make a pushing motion in direction of travel	 DOG EVERYTHING Clasp hands in front of body	 TRAVEL (Both Tracks) Use both fists in front of body, making a circular motion, about each other, indicating direction of travel, forward or backward (For land cranes only)	 TRAVEL (One Track) Lock the track on side indicated by raised fist. Travel opposite track in direction indicated by circular motion of either fist, rotated vertically in front of body (For land cranes only)
 EXTEND BOOM (Telescoping Booms) Both fists in front of body with thumbs pointing outward	 RETRACT BOOM (Telescoping Booms) Both fists in front of body with thumbs pointing toward each other	 EXTENDED BOOM (Telescoping Boom) One Hand Signal. One fist in front of chest with thumb tapping chest	 RETRACT BOOM (Telescoping Boom) One Hand Signal. One fist in front of chest, thumb pointing outward and heel of fist tapping chest

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Figure 11



OPERATING

OPERATION UNDER UNUSUAL CONDITIONS

OPERATION IN EXTREME COLD

If Crane must be operated in extreme cold weather temperatures, certain precautions must be taken to assure continued normal operation. The following paragraphs detail checks to be made to be certain the Crane is capable of operating at these temperatures.

1. Check the cooling system for correct antifreeze solution for lowest temperature expected. Carefully inspect cooling system and correct or report any leaks.
2. Keep batteries fully charged to prevent freezing. If water is added to batteries, run engine at least one hour to mix electrolyte solution.
3. Keep engine in best possible mechanical condition to assure easy starting and good performance during adverse weather conditions.
4. Use engine oil of the proper specifications for the temperatures expected. Refer to the "Lubrication Specifications" section of the engine manual for details.
5. Keep fuel tank full at all times. Drain condensation from tank before and after operation. Drain and service fuel filter. To eliminate clogging of fuel filters due to wax crystal formation in the fuel, be sure that the fuel used has a cloud point specification below the lowest expected temperature.
6. Lubricate entire Crane according to "Periodic Service Table and Chart" Section 4, in this manual or lubrication chart on machine.
7. Start engine and allow it to reach normal operating temperature before applying load.
 - a. If mud and ice collects and freezes on any of the moving parts while Crane is idle, apply heat to thaw the frozen material before attempting to operate Crane.
 - b. Operate hydraulic units with care until they have reached a temperature to enable them to operate normally.
 - c. Check all Crane controls and/or functions to be sure they are operating correctly.
8. An extra outer air filter element should be kept in the operator's cab to replace element that could become iced and cause restricted air flow to engine.
9. If cold weather starting aid must be used, it is recommended that reference be made to "Engine Operator's Manual" for proper use.
10. Clean all mud, snow and ice to prevent freezing. Cover Crane with tarpaulin if possible, keep ends of tarpaulin from freezing to ground.



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OPERATION IN EXTREME HEAT

Continuous operation of the Crane in high temperatures may cause the Crane to overheat. Monitor engine and transmission temperatures and stop Crane for a cooling-off period whenever necessary.

1. Make frequent inspections and services of the fan and radiator. Keep coolant level 1.000" (25.4 mm) from the top of the radiator. Check grills and radiator fins for accumulation of dust, sand and insects which could block the cooling passages.
 - a. Formation of scale and rust in cooling system occurs more rapidly in extremely high temperatures. Change antifreeze each year to keep corrosion inhibitor at full strength.
 - b. If necessary, flush cooling system periodically to keep passage clear. Avoid use of water with a high alkali content which increases scale and rust formation.
2. Check level of battery electrolyte daily. Keep electrolyte above plates preventing damage to batteries. Use a slightly weaker electrolyte solution in hot climates. Dilute 1.280 specific gravity electrolyte as issued to 1.200 to 1.240 specific gravity readings at full charge. Recharge batteries whenever they reach a 1.160 specific gravity reading. Batteries self-discharge at a higher rate if left standing for long periods at high temperatures. If Crane is to stand for several days, remove batteries and store in a cool place.



WARNING! Do not store acid-type storage batteries near stacks of tires; the acid fumes have a harmful effect on rubber.

3. Service fuel system as directed in "Maintenance" Section 4, of this manual. Check for water content before filling fuel tank. High temperatures and cooling off cause condensation in storage drums.
4. Lubricate as specified in "Periodic Service Chart and Table" Section 4, in this manual or Lubrication Decal on the machine.
5. Do not park Crane in sun for long periods of time. When practical park Crane under cover to protect it from sun, dirt and dust.
 - a. Cover inactive Crane with tarpaulin if no suitable shelter is available. Protect engine compartment, transmission and hydraulics from entrance of dust.
 - b. In hot, damp, climates corrosive action will occur on all parts of the Crane and will be accelerated during the rainy season. Rust and paint blisters will appear on metal surfaces and fungus growth on other surfaces.
 - c. Protect all unfinished, exposed surfaces with a film of preservative lubricating oil. Protect cables and terminals with ignition insulation compound. Apply paint or suitable rust preventive to damaged surfaces to protect them from rust and corrosion.



OPERATING

OPERATION IN DUSTY OR SANDY AREAS

Operation of the Crane can cause dust in almost any area. However, when in predominantly dusty or sandy areas, additional precautions must be taken.

1. Keep cooling system fins and cooling areas clean. Blow out with compressed air, if possible, as often as necessary.



WARNING! Wear goggles when using compressed air.

2. Use care when servicing fuel system to prevent dust and sand from entering the tank.
3. Service the air cleaner at frequent intervals, check air restriction indicator daily and keep dust cup and dust valve clean. Prevent dust and sand from entering engine parts and compartments as much as possible.
4. Lubricate and perform services outlined on current lubrication chart on machine and "Lubrication Chart and Table" Section 4,. Clean all lubrication fittings before applying lubricant. Sand mixed with lubricant becomes very abrasive and speeds wear on parts.
5. Protect Crane from dust and sand as much as possible. Park Crane under cover or protect with tarpaulin to keep dust and sand from damaging unit.

OPERATION IN RAINY OR HUMID CONDITIONS

Operation under rainy conditions is similar to that as in extreme heat procedures listed previously.

1. Keep all exposed surfaces coated with preservative lubricating oil. Pay particular attention to damaged or unpainted surfaces. Cover all paint cracks and chip marks as soon as possible to prevent corrosive effects.



OPERATING

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OPERATION IN SALT WATER AREAS

The corrosive effect of salt water and salt water spray is very extensive. When operating in salt water areas, observe the following precautions.

1. When exposed to salt water, dry Crane thoroughly and rinse with fresh water as soon as possible.
2. Keep all exposed surfaces coated with preservative lubricating oil. Pay particular attention to damaged paint surfaces.
3. Keep all painted surfaces in good repair.
4. Lubricate Crane as prescribed on lubrication chart on machine or Periodic Service Table and Chart, Section 4, in this manual. Shorten lubricating intervals for parts subject to exposure to salt water, if found to be necessary.

OPERATION AT HIGH ALTITUDES

Normally, operation of Crane at high altitudes will be as outlined in extreme cold. Before operating at high altitudes, engine fuel and air mixture may have to be adjusted according to appropriate engine manual.

1. Check engine operating temperature for evidence of overheating. The pressure cap on radiator must make a perfect seal to maintain coolant pressure in the system.



OPERATING

OPERATION OF AUXILIARY/OPTIONAL ACCESSORIES

COLD WEATHER STARTING AID

ETHER STARTING AID

The accessory illustrated shown here is an ether starting aid device.

Starting aids should be used at temperatures below 32°F (0°C).

Instructions below are from the manufacturer on the usage of this starting aid:

STARTING PROCEDURES

1. Pull out "QUICK-START" knob and hold for two to three seconds filling valve chamber.
2. Push knob in again allowing two to three seconds to empty valve chamber.
3. After waiting period, engage starter.

PREVENTIVE MAINTENANCE

Periodically remove cylinder, oil valve and control cable assembly.

1. Use care by wiping dirt from valve inlet when removing cylinder to prevent dirt from entering valve.
2. Check valve gasket for damage and replace if needed.
3. With cylinder removed, actuate system in order to distribute lubricant.

When replacing empty cylinder, follow instructions on cylinder.

NOTE: Empty cylinder weight is 17 Ounces (0.476 kilograms); full cylinder weight is 37 Ounces (1.036 kilograms).

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

Periodically test unit for functioning. Disconnect tube from atomizer and remove atomizer. Reassemble and activate system.

If system is subjected to moisture, spray valve and control cable with a plastic coating.

NOTE: Installation instructions are included with the starting aid.

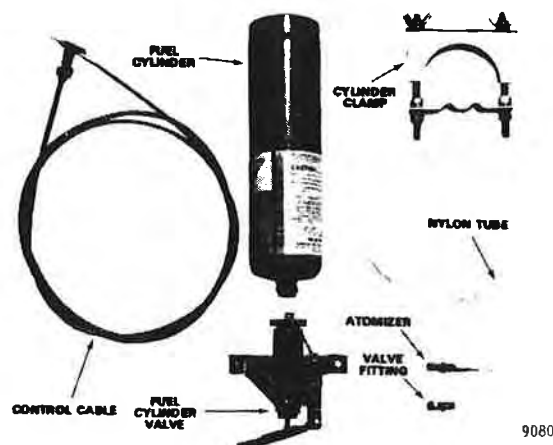


Figure 12
COLD WEATHER STARTING AID



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THREE SECTION POWER BOOM MANUAL EXTENSIONS

The three section power boom has been designed so that an 8', 18' or 20' (2.44 m, 5.49 m or 6.10 m) Manual boom Extension can be used to provide additional boom length and reach.



WARNING! Extreme care should be taken to prevent bodily injuries when handling and using these accessories. Follow the load ratings and recommendations listed on the "Crane Load Rating Chart" located on instrument panel cover when using these accessories.

The three section power boom head block can be fitted to the 8' (2.4 m) and 18' (5.49 m) Manual Extensions. The 20' (6.10 m) Manual Extension comes with its own head block.

When manual boom extensions are being used the crane should be reeved as follows:

- 8 Ft. (2.44 m) Manual Extension - Three Part Line
- 18 Ft. (5.49 m) Manual Extension - Three Part Line
- 20 Ft. (6.10 m) Manual Extension - Single Part Line

8 FT. (2.44 m) MANUAL EXTENSION

The following is one method of extending and stowing the 8 Ft. (2.44 m) Manual Extension if the crane has been equipped with the accessory.

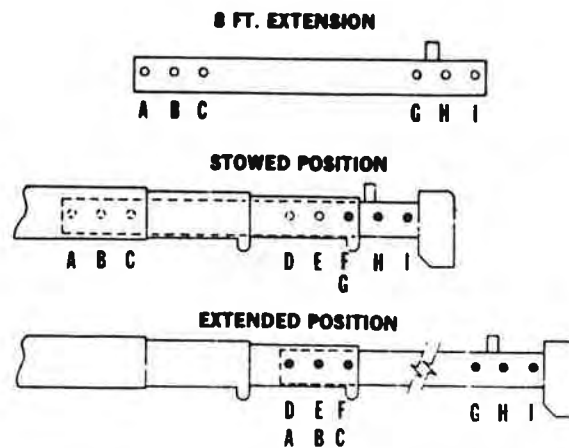


ILLUSTRATION IV

14284

Extending from Stowed Position

1. Position crane with head block 10' (3.05 m) from support.
2. Place forward and reverse lever in "Neutral." Set parking brake. Using outriggers, raise all four tires off the ground.



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3. Crowd boom out 10' (3.05 m) and anchor head block to support approximately 12' (3.66 m) above the ground.
4. Remove boom lock pin from holes "F" and "G." See Illustration IV "Stowed Position."
5. Retract boom slowly. Have another person let the operator know when holes "D", "E" and "F" in the first extension align with holes "A", "B" and "C" in manual extension. Install three boom lock pins. See Illustration IV "Extended Position."



WARNING! Do not retract boom to point where manual extension will fall out of boom.

6. Install boom lock pin in hole "G" to fully secure head block.
7. Install cotter pins in boom lock pins. Release head block from support.

Stowing from Extended Position

1. Remove four boom lock pins from holes "A" thru "F" and "G."
2. Using low line speed control lever, two-block crane and slide manual extensions in till hole "G" align with hole "F." Install boom lock pin and cotter pins.

18 FT. (5.49 m) MANUAL EXTENSION

The following is one method of extending and stowing the 18 Ft. (5.49 m) Manual Extension if the crane has been equipped with this accessory.

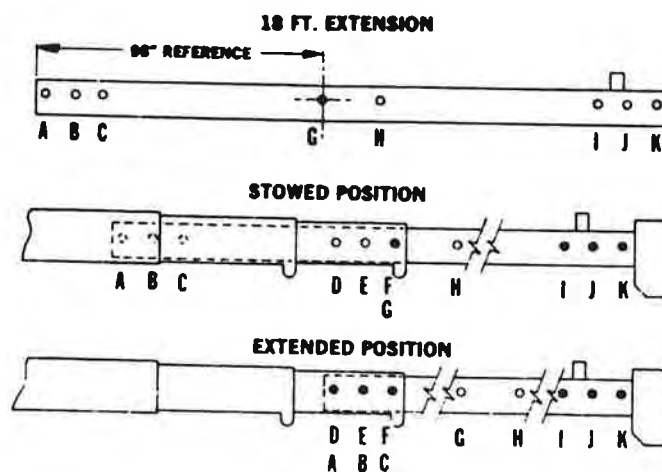


ILLUSTRATION V

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OPERATING

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Extending from Stowed Position

1. Position crane with head block 10' (3.05 m) from support.
2. Place forward and reverse lever in "Neutral." Set parking brake. Using outriggers, raise all four tires off the ground.
3. Crowd boom out 10' (3.05 m) and anchor head block to support approximately 12' (3.66 m) above the ground.
4. Remove boom lock pin from holes "F" and "G." See Illustration V "Stowed Position."
5. Retract boom slowly. Have another person let the operator know when holes "D", "E" and "F" in the first extension align with holes "A", "B" and "C" in manual extension. Install three boom lock pins. See Illustration V "Extended Position."



WARNING! Do not retract boom to point where manual extension will fall out of boom.

6. Install cotter pins in boom lock pins. Release head block from support.

Stowing from Extended Position

1. Remove three boom lock pins from holes "A" thru "F."
2. Using low line speed control lever, two-block crane and slide manual extensions in till hole "G" align with hole "F." Install boom lock pin and cotter pins.

20 FT. (6.10 m) MANUAL EXTENSION

The 20 Ft. (6.10 m) Manual Extension is extended and stowed in the same manner as the 18 Ft. (5.49 m) Manual Extension.

The "MAXIMUM" allowable load that can be lifted by this extension is 3000 Lbs. (1361 kg). Deduct 600 Lbs. (272 kg) plus the weight of any load handling devices to determine the safe working load at any given radius. Refer to "Crane Load Rating Chart" located on instrument panel cover.



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OPERATING

JIB AND GANTRY

The following procedure applies to the 15 Ft. (4.57 m) jib and gantry.

1. Drop hook block and run single part line through hole "A" in head block.
2. Remove self-locking nut from lower sheave pin "B." Align long sheave pin with short pin and tap through head block, replacing short pin with long pin. Center long pin in head block.
3. Install jib on lower sheave pin and tighten mounting clamps. Install and tighten nut on sheave pin.
4. Set gantry in place and install two pins at "C." Key pins in place.
5. Install each pendant cable clevis over each gantry ear. Pin and key in place.
6. Lift jib to horizontal position and install pendant cables on jib sheave pin. Use adjustment links to angle jib.
 - 0 Degree Jib Angle - No adjustment links
 - 15 Degree Jib Angle - One pair adjustment links
 - 30 Degree Jib Angle - Two pair adjustment links
7. Single part line and weighted hook block must be used with jib.

15 FOOT STOWABLE JIB AND GANTRY

Procedure for Extension of 15' Jib

1. Reeve to single part line and swing boom over side of crane.
2. Install hinge pins through jib at point "A."
3. Loop wire rope around cable guides "B."
4. Thread wire rope through jib sheave "C."
5. Fasten wire rope to cable anchor "D."
6. Release pendant cables "E" for stowed position.
7. Winch in (hoist) carefully to release tension on three pins "F." Remove pins.
8. Raise boom and pay out wire rope until jib hangs free (vertical).

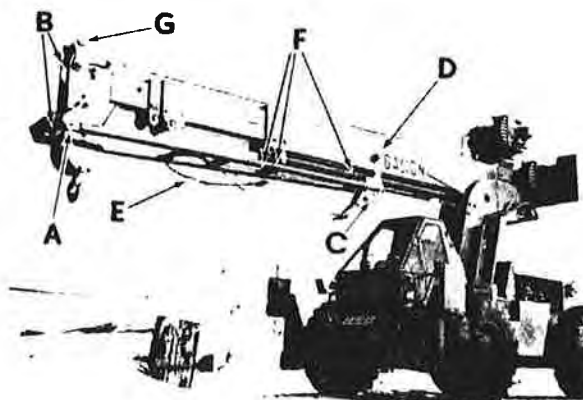


Figure 13

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9. Remove wire rope from cable anchor "D."
10. Crowd out and lower boom until jib touches ground. Retract so that jib can "unfold" from boom. If required raise opposite side of crane with outriggers to attach pendant cables "G."
11. Reposition crane and attach weighted hook block. To return jib to stowed, reverse procedure.

NOTE: Refer to safe load chart located on instrument panel cover for proper fly jib load capacities.

20 FT. (6.10 m) STOWABLE JIB AND GANTRY (USED ONLY WITH 4 SECTION POWER BOOM)

Procedure for Extension of Jib

1. Position boom over side of crane, lower hook block (1, Figure 14) to ground, remove wedge, wire rope and reeve to single part line.
2. Spool wire rope over head block (2, Figure 14) fly jib sheave and attach at cable anchor behind overcenter check valve (3).
3. Remove hair pin from pendant cable anchors (4, Figure 14) at front mount. Allow pendant cable to hang free.
4. Reposition gantry (5, Figure 14) by removing pins and install into proper hole for working position.
5. Install pins into bifurcated ends of jib (6, Figure 14).
6. Remove jib retainer hair pins, boom up 30° and crowd out approximately 6 Inches (152.40 mm). This will free the fly jib from its mounts.
7. Winch out line and carefully lower jib so it is hanging perpendicular ground.
8. Remove cable from cable anchor and reel through underside of jib sheave attach to gantry. (See insert) Winch in and "lift" jib into position.
9. Attach pendants to gantry (7, Figure 14). Pin in place. Remove wire and attach jib stops (8) to gantry.
10. Install weighted ball and hook.
11. Retract boom. Attach fly jib load chart to cowl on instrument panel.

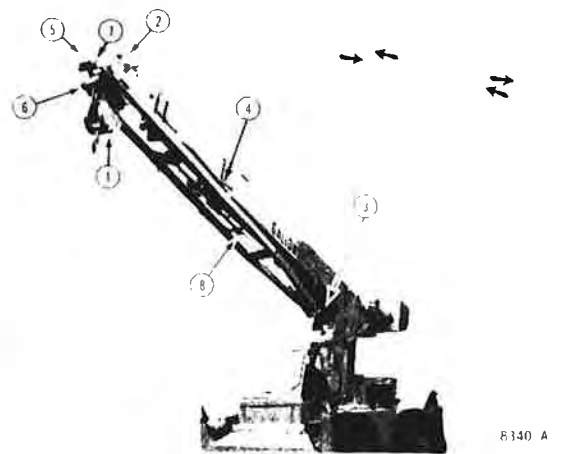


Figure 14



OPERATING

12. To store jib perform the above steps in reverse procedure.

NOTE: Refer to safe load chart on instrument panel cover for proper fly jib load capacities.

20 FT. (6.10 m) JIB CAPACITIES - LOAD IN LBS. (kg)			
BOOM ANGLE	JIB ANGLE		
	0 DEGREES	15 DEGREES	30 DEGREES
70°	6,000 (2700)	4,500 (2041)	3,000 (1361)
60°	5,300 (2404)	3,400 (1542)	2,500 (1134)
50°	3,900 (1769)	2,700 (1225)	2,150 (975)
40°	3,000 (1361)	2,350 (1066)	1,850 (839)
30°	2,500 (1134)	2,000 (907)	1,500 (680)



OPERATING

SECTION 3

Page 33

FIRE EXTINGUISHER

Install, inspect, maintain and test in accordance with the standard of the National Fire Protection Association, titled "Portable Fire Extinguishers," NFPA No. 10, suitable for use from minus 40°F to plus 120°F (minus 40°C to plus 49°C).

This extinguisher meets DOT requirements tested to 525 PSI (3.61 MPa).

TO OPERATE

Hold upright - pull pin - press lever - direct discharge at base of flame with side to side motion.

MAINTENANCE

Inspect monthly (or at more frequent intervals when circumstances require). Recharge if weight is less than 9 Lbs. 0 Oz. (4.08 kg) or pressure is below operating range. Check that nozzle is unobstructed and seal wire is intact.

NOTE: After use recharge immediately.

RECHARGE

Invert extinguisher - press lever to release pressure - remove valve - fill with 5 Lbs. (2.27 kg) of general triplex dry chemical - clean valve, valve stem, O-ring, seals and threads. Reassemble valve and screw into cylinder hand tight - remove nozzle and replace with moisture trap - connect to a pressure supply of dry air or nitrogen - press lever and pressurize to 175 PSI (1.21 MPa) - release lever - remove pressure supply - remove moisture trap and replace with nozzle - reinsert lock pin and replace seal wire.

RECORDS

Record inspection, maintenance and recharge dates on attached tag.



WARNING! Do not recharge with any materials except those indicated in recharge instructions.

WARNING! Press lever only in case of fire.

WARNING! Partial discharge will cause pressure loss.

WARNING! Do not recharge extinguisher if damaged or corroded.

WARNING! This extinguisher to be fitted with a discharge nozzle marked CP-106.

WEIGHT

Minimum full weight: 9 Lbs. 0 Oz. (4.08 kg)

Average empty weight: 4 Lbs. 3 Oz. (1.90 kg)

NOTE: The above recommendations and operational instructions were taken from the label attached to the fire extinguisher. Always refer to the extinguisher instructions for up-to-date instructions.



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MAINTENANCE

SECTION 4

Page 1

LUBRICATION INSTRUCTIONS

Correct lubrication of any machine is of prime importance in prolonging its life. Fuels, oils and greases should be of good quality and kept free of dirt, water and other foreign materials. In the following specifications and Periodic Service Chart, proper lubrication instructions are given. It is of utmost importance that good cleaning operations go along with lubricating procedures.

Care should be taken to have proper Society of Automotive Engineers (SAE) weights of oil on hand for prevailing temperatures. SAE viscosity number system classes oil as to its viscosity of fluidity, however, this has nothing to do with any other characteristics or properties. Higher SAE numbers designate heavier or thicker lubricants. Lower SAE numbers indicate lighter or thinner lubricants. All oil companies have adopted this standard of viscosity.

When draining gear housing cases or engine crankcases, care should be taken to drain when the oil is warm. In following this procedure, you will find that oil is lighter and therefore drains more completely than when it is cold. The best time to drain oils and greases is at day's end. In this way, any dirt in the oil will be drained off while it is still in suspension and before it has had a chance to settle.

When performing service intervals be sure that they are done in multiples of the basic hourly service. That is as illustrated in the following table.

SERVICE INTERVAL	FUTURE SERVICE INTERVALS REQUIRED
DAILY/10 HOUR SERVICE	10, 20, 30, 40, ETC.
50 HOUR SERVICE	50, 100, 150, 200, ETC.
150 HOUR SERVICE	150, 300, 450, 600, ETC.
200 HOUR SERVICE	200, 400, 600, 800, ETC.
250 HOUR SERVICE	250, 500, 750, 1000, ETC.
500 HOUR SERVICE	500, 1000, 1500, 2000, ETC.
600 HOUR SERVICE	600, 1200, 1800, 2400, ETC.
1000 HOUR SERVICE	1000, 2000, 3000, 4000, ETC.
2000 HOUR SERVICE	2000, 4000, 6000, 8000, ETC.

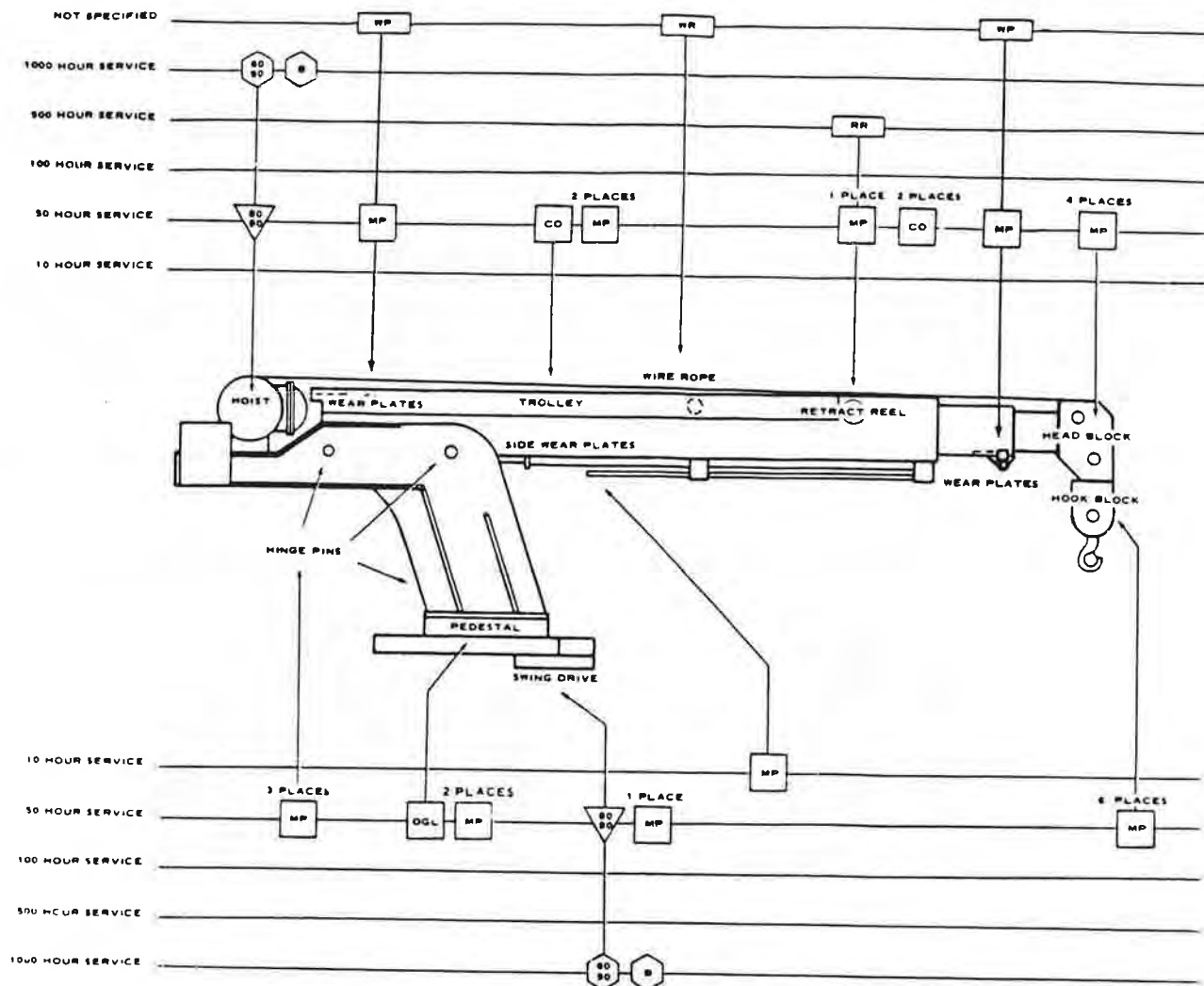


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Page 2

MAINTENANCE

LUBRICATION

PERIODIC SERVICE CHART - BOOM



B BREATHER	MP MULTI-PURPOSE LITHIUM BASE GREASE	▽ CHECK & MAINTAIN LEVEL
CO CAN OIL	OGL OPEN GEAR LUBRICANT	□ LUBRICATE ZERK OR SURFACE
EP 90 EXTREME PRESSURE (SAE 90) MULTI-PURPOSE GEAR LUBRICANT	RR RETRACT REEL SEE SECTION THIS MANUAL	⬡ DRAIN & REFILL OR REMOVE & REPLACE
EP 90 EXTREME PRESSURE (SAE 90) MULTI-PURPOSE GEAR LUBRICANT	WP WEAR PLATES SEE SECTION THIS MANUAL	○ CLEAN
	WR WIRE ROPE SEE SECTION THIS MANUAL	□ CHECK & ADJUST

14286

Figure 1

**MAINTENANCE**SECTION 4
Page 3**PERIODIC SERVICE TABLE - BOOM**

COMPONENT	SERVICE	MEASUREMENT CAPACITY	TYPE OF LUBRICANT
DAILY/10 HOUR SERVICE			
SIDE WEAR PLATES, LOWER BOOM	CLEAN AND LUBRICATE.	AS REQUIRED	MPG
WEEKLY/50 HOUR SERVICE			
GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW.	AS REQUIRED	MPG
LEVEL PLUG, HOIST GEAR CASE	CHECK LEVEL. FILL TO LEVEL PLUG.	10 U.S. QUARTS (9 LITERS)	EP 80 or EP 90
WEAR PLATES, BOOM EXTENSIONS	CLEAN AND LUBRICATE.	AS REQUIRED	MPG
GEAR & PINION PEDESTAL DRIVE	AS REQUIRED - ROTATE BOOM 360° DAILY FOR PROPER LUBRICANT DISTRIBUTION.		OGL
LEVEL PLUG, SWING DRIVE CASE	CHECK LEVEL. FILL TO LEVEL PLUG.	14 U.S. QUARTS (13 LITERS)	EP 80 or EP 90
TROLLEY, POWER BOOM	LUBRICATE.	AS REQUIRED	CO
500 HOUR SERVICE			
SPRING MOTOR, RETRACT REEL	SEE "RETRACT REEL - SPRING MOTOR" SECTION OF THIS MANUAL FOR SERVICING.		
1000 HOUR SERVICE			
DRAIN PLUG, HOIST GEAR CASE	DRAIN AND REFILL TO LEVEL PLUG.	10 U.S. QUARTS (9 LITERS)	EP 80 or EP 90
BREATHER, HOIST GEAR CASE	INSPECT AND CLEAN/REPLACE.		
DRAIN PLUG, SWING DRIVE GEAR CASE	DRAIN AND REFILL TO LEVEL PLUG.	14 U.S. QUARTS (13 LITERS)	EP 80 or EP 90
BREATHER, SWING DRIVE GEAR CASE	INSPECT AND CLEAN/REPLACE.		
NOT SPECIFIED			
WIRE ROPE	AS REQUIRED (SEE "WIRE ROPE" SECTION OF THIS MANUAL FOR SERVICING).		
WEAR PLATES	AS REQUIRED (SEE "BOOM WEAR PAD SUPPORT ADJUSTMENT" SECTION OF THIS MANUAL FOR SERVICING).		

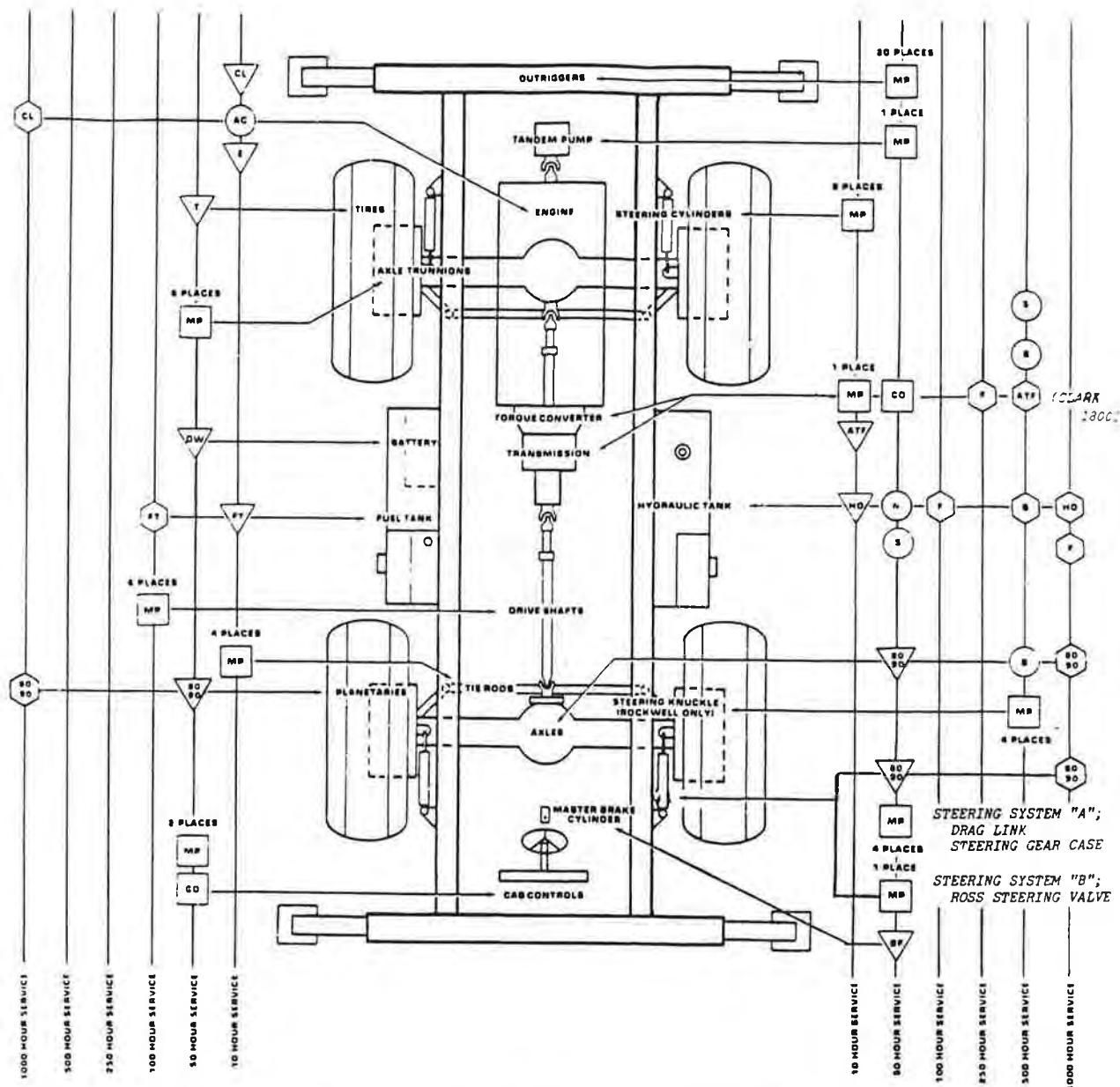


SECTION 4

Page 4

MAINTENANCE

PERIODIC SERVICE CHART - CHASSIS



AC	AIR CLEANER - SEE SECTION IN GALLON OPERATOR'S MANUAL	DW	DISTILLED WATER	F	FILTER(S)	▽	CHECK & MAINTAIN LEVEL
ATF	AUTOMATIC TRANSMISSION FLUID (ALSO C2 OR DEXRON)	E	ENGINE OIL/DIPSTICK - SEE ENGINE MANUAL	FT	FUEL TANK	□	LUBRICATE TIRE OR SURFACE
B	BREATHING	EP 90	EXTREME PRESSURE (SAE 90) MULTI-PURPOSE GEAR LUBRICANT	HO	HYDRAULIC OIL	◇	DRAIN & REFILL OR REMOVE & REPLACE
BF	BRAKE FLUID	EP 100	EXTREME PRESSURE (SAE 100) MULTI-PURPOSE GEAR LUBRICANT	MP	MULTI-PURPOSE LITHIUM BASE GREASE	○	CLEAN
CL	COOLANT			M	MAGNET	□	CHECK & ADJUST
CD	CAN OIL			S	SCREEN		
				T	TIRES		

14328

Figure 2



MAINTENANCE

SECTION 4

Page 5

PERIODIC SERVICE TABLE - CHASSIS

COMPONENT	SERVICE	MEASUREMENT CAPACITY	TYPE OF LUBRICANT
DAILY/10 HOUR SERVICE			
GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW.	AS REQUIRED	MPG
DIPSTICK, HYDRAULIC TANK	CHECK LEVEL - ALL CYLINDERS RETRACTED, OIL AT OPERATING TEMPERATURE - LEVEL MUST BE BETWEEN MARKS ON DIPSTICK.	75 U.S. GALLONS (284 LITERS)	HO or ATF <u>DO NOT MIX</u>
DIPSTICK, ENGINE	CHECK LEVEL - LEVEL MUST BE BETWEEN MARKS ON DIPSTICK.	SEE ENGINE OPERATOR'S MANUAL FOR PROPER CAPACITY AND LUBRICANT.	
FILL CAP, ENGINE RADIATOR (COOLING SYSTEM)	CHECK LEVEL AND MAINTAIN.	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL.	COOLANT FOR AMBIENT TEMPERATURE
DIPSTICK, TRANSMISSION & TORQUE CONVERTER (CLARK 18000)	CHECK LEVEL - LEVEL MUST BE BETWEEN MARKS ON DIPSTICK, AT ENGINE IDLE, OPERATING TEMPERATURE AND IN NEUTRAL.	5 U.S. GALLONS (19 LITERS)	C3 or DEXRON <u>DO NOT MIX</u>
FILL CAP, FUEL TANK	CHECK LEVEL - FILL AT END OF EACH WORK DAY.	46 U.S. GALLONS (174 LITERS)	SEE ENGINE OPERATOR'S MANUAL
AIR CLEANER ENGINE	CLEAN.		
WEEKLY/50 HOUR SERVICE			
GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW.	AS REQUIRED	MPG
LEVEL PLUG, PLANETARY DRIVE (CLARK AXLES)	CHECK LEVEL - POSITION WHEELS SO ARROW ON PLANETARY END CAP IS POINTING DOWN.	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL.	EP 80 or EP 90
LEVEL PLUG, AXLE DIFFERENTIAL	CHECK LEVEL - FILL TO LEVEL PLUG.	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL.	EP 80 or EP 90
SCREEN AND MAGNET ASSEMBLY	REMOVE AND CLEAN THOROUGHLY - REINSTALL (SEE "CARE OF HYDRAULIC SYSTEM" SECTION OF THIS MANUAL FOR SERVICING).		



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MAINTENANCE**WEEKLY/50 HOUR SERVICE (CONT'D)**

MASTER CYLINDER. WHEEL BRAKES	CHECK AND MAINTAIN LEVEL.	AS REQUIRED	BRAKE FLUID
BATTERY, ELECTRI- CAL STORAGE	CHECK LEVEL - MAINTAIN LEVEL TO TOP OF RINGS.	AS REQUIRED	DISTILLED WATER
LINKAGE, CONTROL LEVER	LUBRICATE.	AS REQUIRED	CO
TIRES	CHECK PRESSURE - INFLATE TO PRESSURES SPECIFIED IN "GENERAL SPECIFICATIONS" SECTION OF THIS MANUAL.		
CASE, STEERING GEAR	CHECK AND MAINTAIN LEVEL.	AS REQUIRED	EP 80 or EP 90
TRANSMISSION SHIFT LINKAGE (CLARK 18000 SERIES)	LUBRICATE.	AS REQUIRED	CO

100 HOUR SERVICE

GREASE ZERKS	LUBRICATE FITTINGS - PURGE OLD GREASE WITH NEW.	AS REQUIRED	MPG
FILTERS, HYDRAULIC TANK	REPLACE ELEMENTS AFTER FIRST 100 HOURS ON NEW MACHINE OR AFTER REBUILD AND EVERY 1000 HOURS THEREAFTER. (SEE "CARE OF HYDRAULIC SYSTEM" SECTION OF THIS MANUAL FOR SERVICING.)		
DRAIN PLUG, FUEL TANK	REMOVE PLUG AND DRAIN ACCUMULATED WATER AND SEDIMENT. (SEE "ENGINE FUEL SYSTEM" SECTION OF THIS MANUAL FOR SERVICING.)		

250 HOUR SERVICE

FILTER, TRANS- MISSION & TORQUE CONVERTER (CLARK 18000 SERIES)	REPLACE ELEMENTS EVERY 250 HOURS, WHEN FLUID IS CHANGED OR AFTER REBUILD. (SEE "TRANSMISSION CHECKS" SECTION OF THIS MANUAL FOR SERVICING.)		
---	---	--	--

500 HOUR SERVICE

BREATHER, HYDRAULIC TANK	REMOVE AND REPLACE.		
BREATHER, TRANS- MISSION & TORQUE CONVERTER	INSPECT AND CLEAN/REPLACE.		
TRANSMISSION & TORQUE CONVERTER (CLARK 18000 SERIES)	DRAIN OIL, CLEAN SCREEN AND REFILL TO PROPER LEVEL.	5 U.S. GALLONS (19 LITERS)	C3 or DEXRON <u>DO NOT MIX</u>



MAINTENANCE

SECTION 4
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500 HOUR SERVICE

STEERING KNUCKLE U-JOINT	ROTATE EACH WHEEL CAREFULLY AS REQUIRED TO ALIGN CARDAN JOINT ZERK THROUGH HOLE IN STEERING KNUCKLE.	MPG
BREATHER, AXLE	INSPECT AND CLEAN/REPLACE.	

1000 HOUR SERVICE

DRAIN PLUGS, PLANETARY DRIVES	DRAIN AND REFILL.	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	EP 80 or EP 90
DRAIN PLUGS, AXLE DIFFERENTIAL	DRAIN AND REFILL.	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL	EP 80 or EP 90
DRAIN PLUG, STEERING GEAR CASE	DRAIN AND REFILL.	1 U.S. QUARTS (0.95 LITER)	EP 80 or EP 90
DRAIN PLUG, HYDRAULIC TANK	DRAIN, CLEAN AND REFILL.	75 U.S. GALLONS (284 LITERS) COMPLETE SYSTEM 120 U.S. GALLONS (454 LITERS)	HO or ATF <u>DO NOT MIX</u>
FILTERS, HYDRAULIC TANK	REPLACE ELEMENTS AFTER FIRST 100 HOURS ON NEW MACHINE OR AFTER REBUILD AND EVERY 1000 HOURS THEREAFTER. (SEE "CARE OF HYDRAULIC SYSTEM" SECTION OF THIS MANUAL FOR SERVICING.)		
DRAIN VALVE, ENGINE RADIATOR (COOLING SYSTEM)	DRAIN, FLUSH AND REFILL.	SEE "LIQUID CAPACITIES" SECTION OF THIS MANUAL.	COOLANT FOR AMBIENT TEMPERATURE



MAINTENANCE

DAILY/10 HOUR SERVICE



Figure 3
STEERING CYLINDERS - BEARINGS

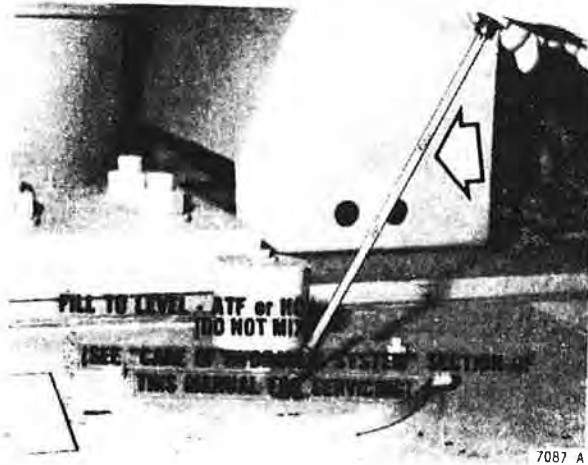


Figure 6
HYDRAULIC TANK DIPSTICK



Figure 4
TIE ROD ENDS



Figure 7
ENGINE OIL DIPSTICK
(DETROIT DIESEL 4-53N)



Figure 5
TRANSMISSION SHIFT LINKAGE
(CLARK 18000 SERIES)



Figure 8
ENGINE OIL DIPSTICK
(DRESSER D359T)



MAINTENANCE

SECTION 4

Page 9

DAILY/10 HOUR SERVICE

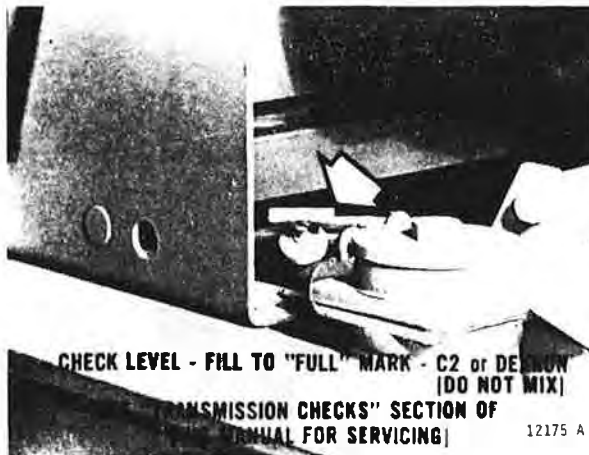


Figure 9
TRANSMISSION & CONVERTER DIPSTICK
& FILL TUBE (CLARK 18000 SERIES)



Figure 12
BOOM SIDE WEAR PLATES



Figure 10
FUEL TANK FILL CAP



Figure 13
ENGINE RADIATOR FILL CAP



Figure 11
ENGINE AIR CLEANER



MAINTENANCE

WEEKLY/50 HOUR SERVICE

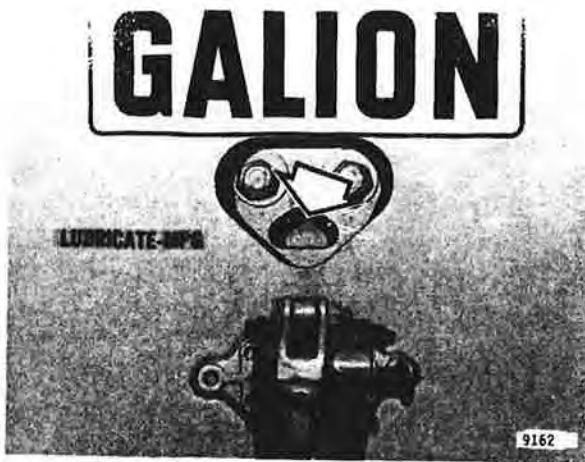


Figure 14
OUTRIGGER CYLINDERS - BASE END



Figure 17
OUTRIGGER PAD PIVOT BEARINGS



Figure 15
OUTRIGGER CYLINDERS - ROD END



Figure 18
AXLE TRUNNION BEARINGS - UPPER
(CLARK DS-17220)

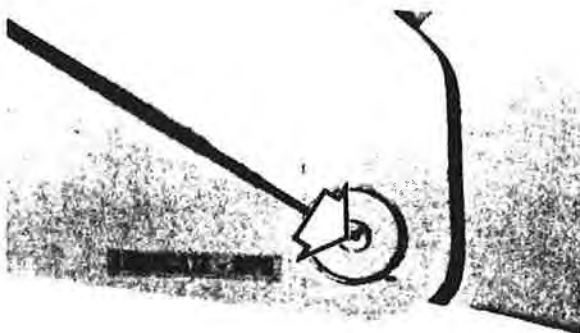


Figure 16
OUTRIGGER PIVOT PINS



Figure 19
AXLE TRUNNION BEARINGS - LOWER
(CLARK DS-17220)



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WEEKLY/50 HOUR SERVICE

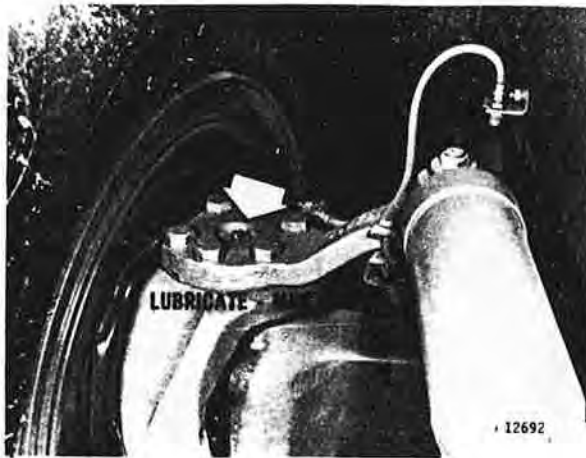


Figure 20
AXLE TRUNNION BEARINGS - UPPER
(CLARK DS-13311)



Figure 21
AXLE TRUNNION BEARINGS - LOWER
(CLARK DS-13311)

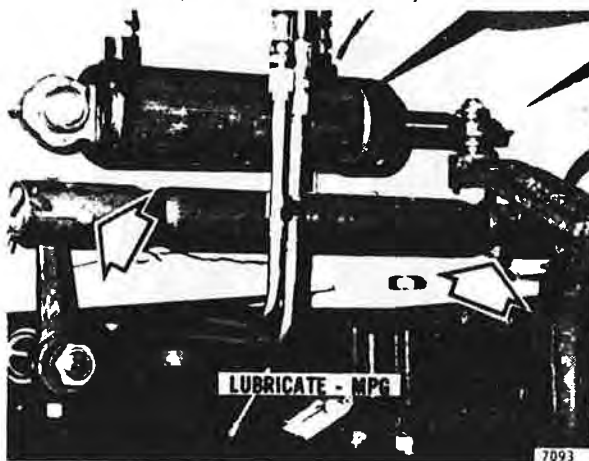


Figure 22
STEERING DRAG LINK
(STEERING SYSTEM "A")

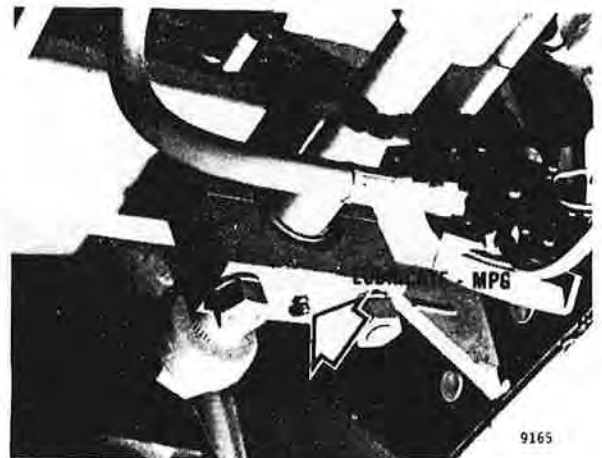


Figure 23
STEERING SHAFT BEARING
(STEERING SYSTEM "A")



Figure 24
ROSS STEERING VALVE
(STEERING SYSTEM "B")

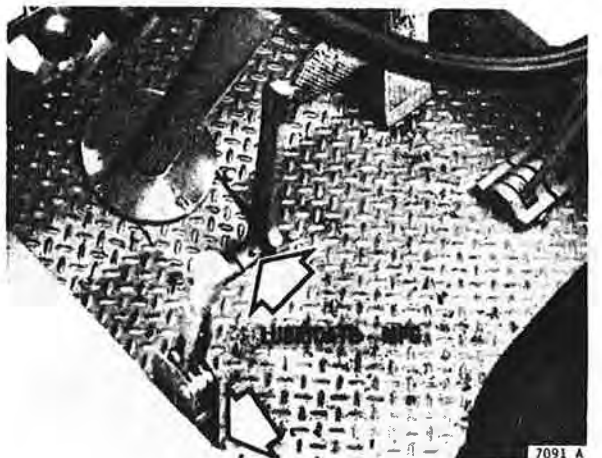


Figure 25
BRAKE PEDAL BEARING &
PARKING BRAKE CABLE



MAINTENANCE

WEEKLY/50 HOUR SERVICE



Figure 26
HYDRAULIC PUMP SLIP JOINT

7097

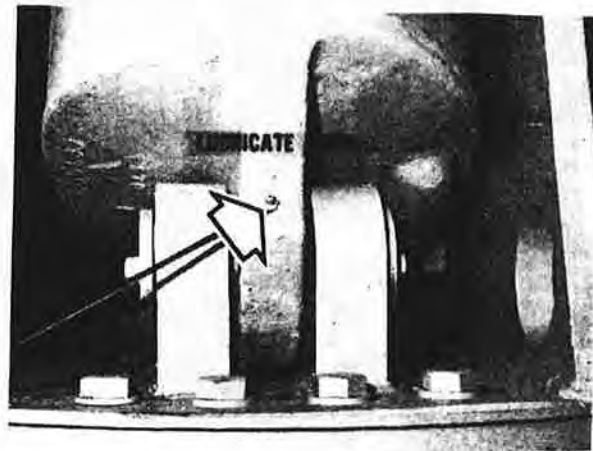


Figure 29
LIFT CYLINDER - BASE END

7118



Figure 27
PEDESTAL BEARING

7120



Figure 30
LIFT CYLINDER - ROD END

9169



Figure 28
SWING PINION BEARING

9172

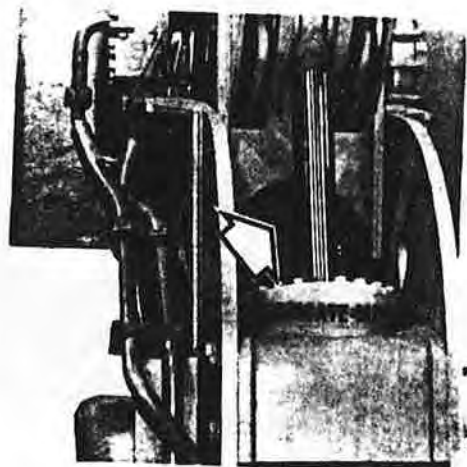


Figure 31
BOOM HINGE PIN

9195



MAINTENANCE

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WEEKLY/50 HOUR SERVICE



Figure 32
BOOM EXTENSION ROLLERS

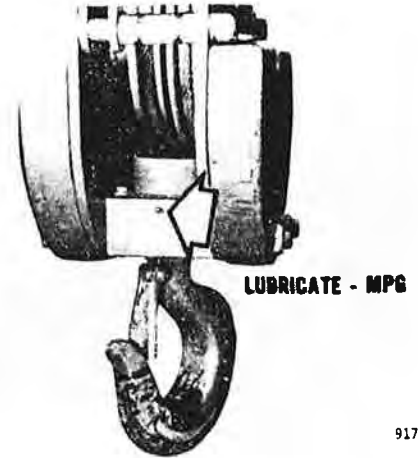


Figure 35
STATIONARY HOOK BLOCK BEARING

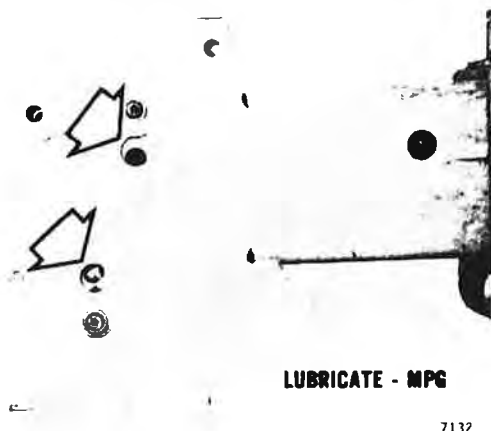


Figure 33
HEAD BLOCK SHEAVES

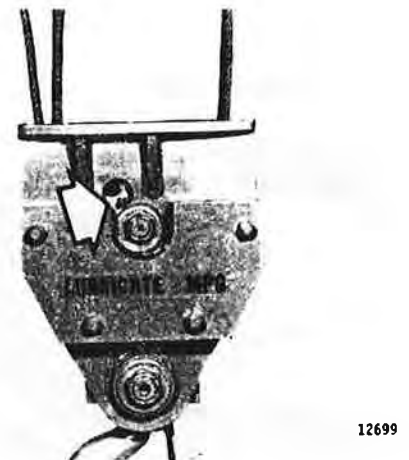


Figure 36
PIVOTING HOOK BLOCK SHEAVES

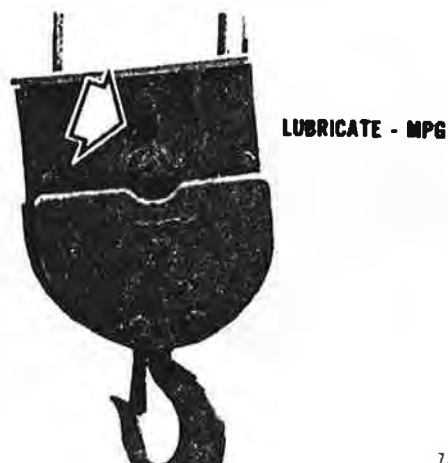


Figure 34
STATIONARY HOOK BLOCK SHEAVES

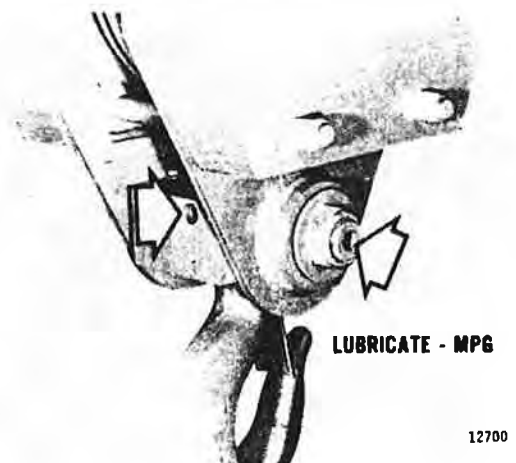


Figure 37
PIVOTING HOOK BLOCK
BEARING & PIVOT



MAINTENANCE

WEEKLY/50 HOUR SERVICE



Figure 38
HOSE REEL BEARING, POWER BOOM



Figure 41
UPPER & LOWER WEAR PLATES
(REAR)

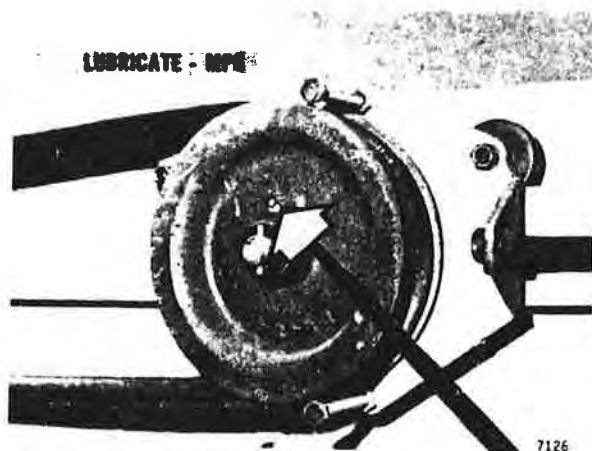


Figure 39
HOSE SHEAVES, POWER BOOM
(FRONT)

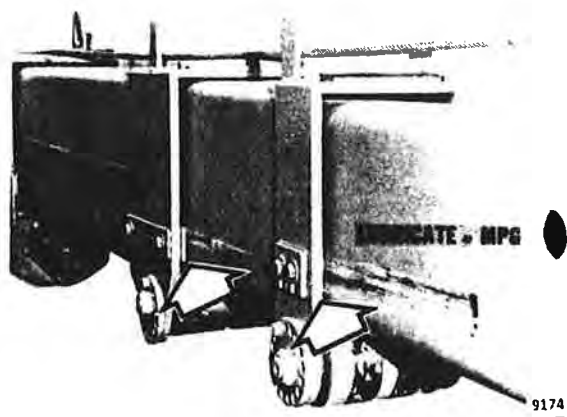


Figure 42
SIDE WEAR PLATES
(FRONT)

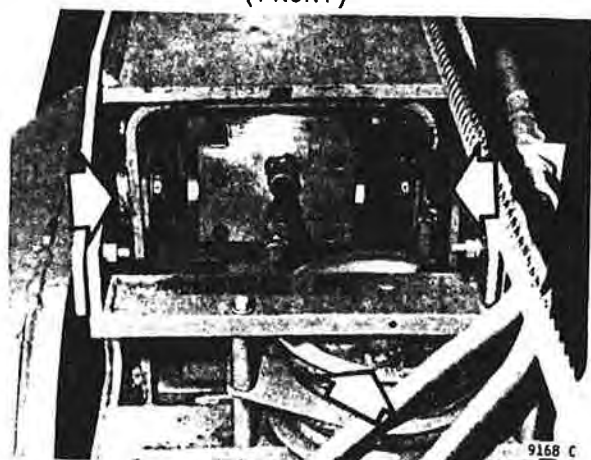


Figure 40
BOOM EXTENSION WEAR PLATES (REAR)
& REAR HOSE SHEAVE

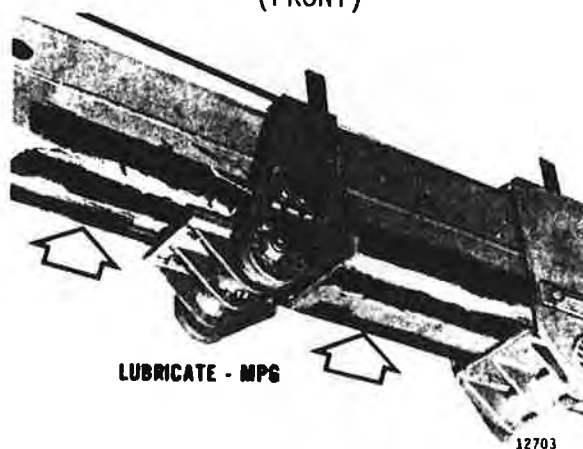


Figure 43
LOWER WEAR PLATES
(FRONT)



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WEEKLY/50 HOUR SERVICE



Figure 44
TROLLEY, POWER BOOM



Figure 47
PEDESTAL GEAR & PINION



Figure 45
CONTROL LEVER LINKAGE



Figure 48
STEERING GEAR CASE
(STEERING SYSTEM "A")

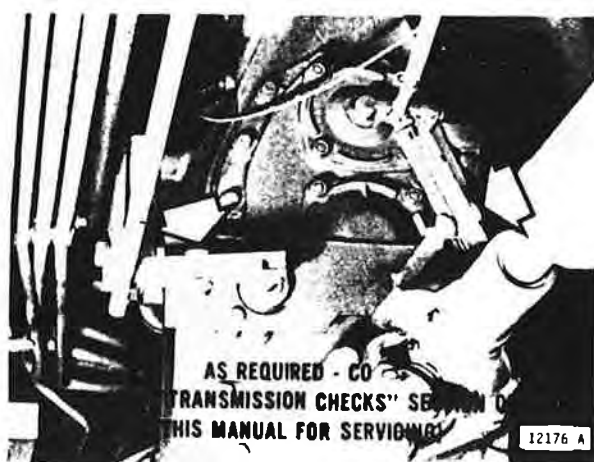


Figure 46
TRANSMISSION SHIFT LINKAGE
(CLARK 18000 SERIES)



Figure 49
AXLE PLANETARY DRIVE LEVEL PLUG
(CLARK DS-17220)



MAINTENANCE

WEEKLY/50 HOUR SERVICE



Figure 50
AXLE DIFFERENTIAL LEVEL PLUG
(CLARK DS-17220)

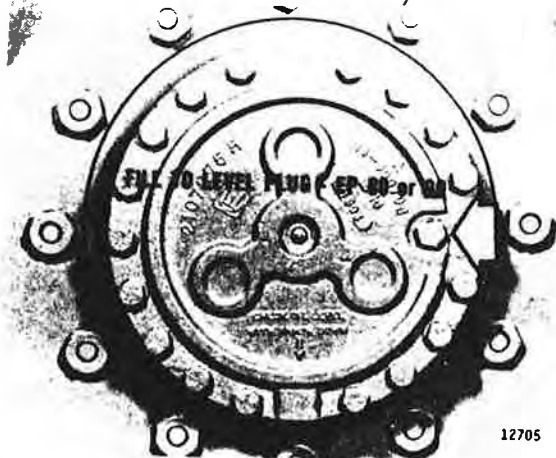


Figure 51
AXLE PLANETARY DRIVE LEVEL PLUG
(CLARK DS-13311)

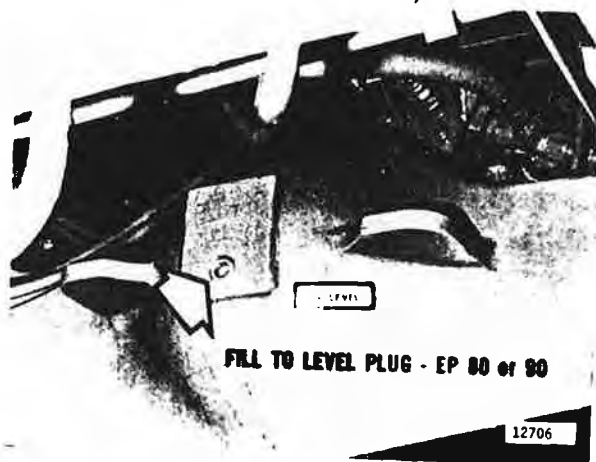


Figure 52
AXLE DIFFERENTIAL LEVEL PLUG
(CLARK DS-13311)

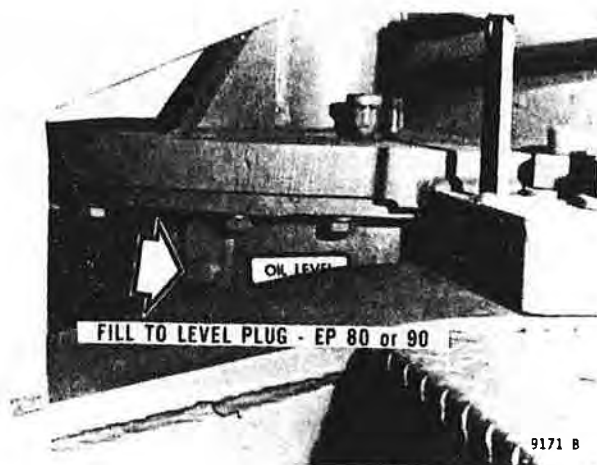


Figure 53
SWING DRIVE GEAR CASE
LEVEL PLUG



Figure 54
HOIST GEAR CASE LEVEL PLUG

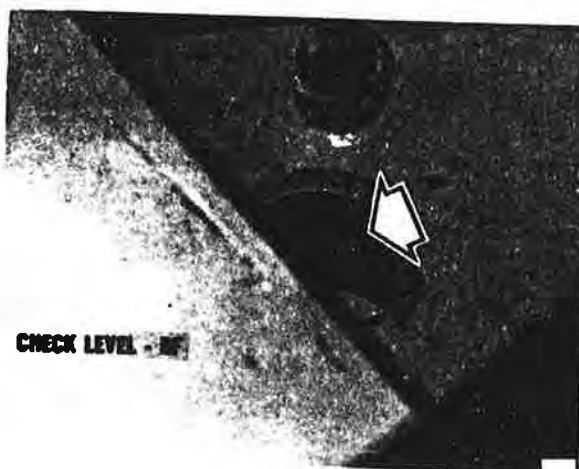


Figure 55
MASTER BRAKE CYLINDER
(CLARK AXLES)



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Page 17

WEEKLY/50 HOUR SERVICE

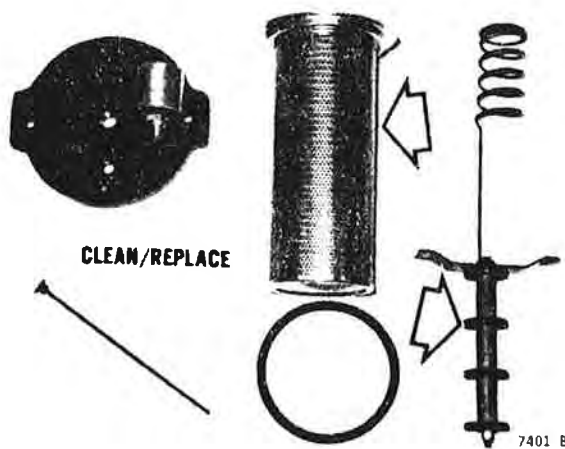


Figure 56
HYDRAULIC TANK SCREEN &
MAGNET



Figure 57
ELECTRICAL STORAGE BATTERY



Figure 58
TIRES



SECTION 4

Page 18

MAINTENANCE

100 HOUR INSPECTION

1. Back-up alarm working (if so equipped).
2. All lights working.
3. Parking brake holds unit.
4. Wheel lug nut torque checked per "Specific Bolt Torques" Section 5, of this manual.
5. Check drive belt tension as outlined in "Drive Belt Tension" section of this manual.

100 HOUR SERVICE

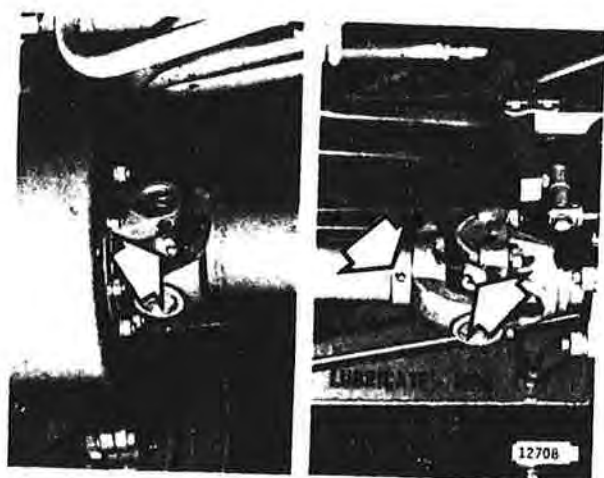


Figure 59
UNIVERSAL JOINTS & SLIP JOINT
(TRANSMISSION TO FRONT AXLE)



Figure 60
UNIVERSAL JOINTS & SLIP JOINT
(TRANSMISSION TO REAR AXLE)

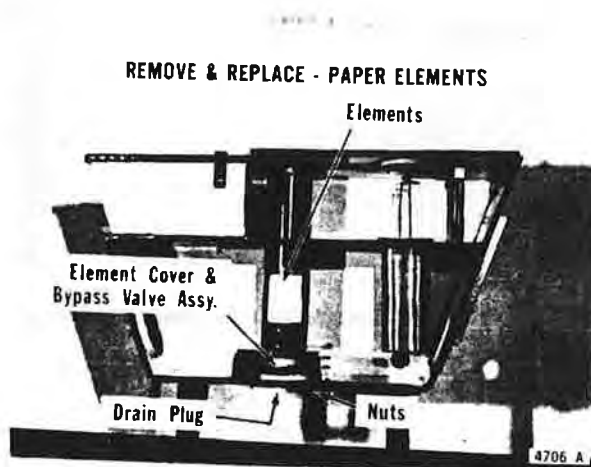


Figure 61
HYDRAULIC TANK FILTERS

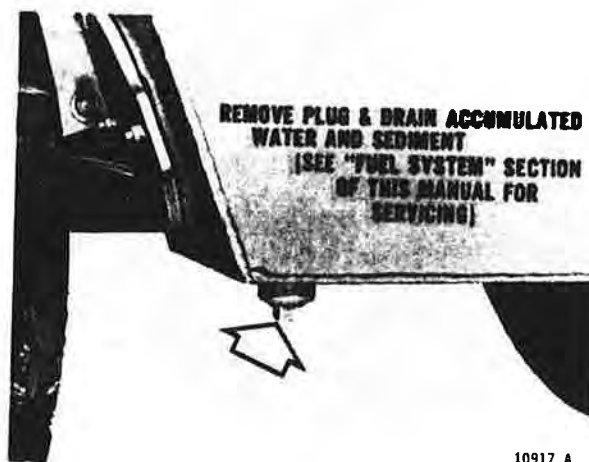


Figure 62
FUEL TANK DRAIN PLUG



MAINTENANCE

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Page 19

250 HOUR SERVICE

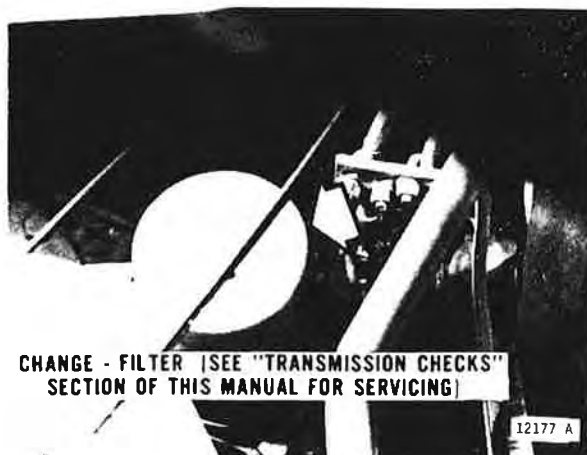


Figure 63
TRANSMISSION & CONVERTER FILTER
(CLARK 18000 SERIES)



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MAINTENANCE

500 HOUR INSPECTION

1. Check boom, head block, pedestal and frame for any stress marks from over-loading.
2. Check all bolts and nut torques per "Specific Bolt Torques" Section 5, of this manual.
3. Check hook for stress and hook bearing for end play. Remove cap screws and observe nut and threads for stress per "Hook Block Inspection" section of this manual.
4. Check boom hinge pin (bolt ends) to see that it is secured in place.
5. Check boom cylinder anchor pin locks to see that they are secured in place.
6. Check outrigger cylinder and arm pivot pins.

500 HOUR SERVICE

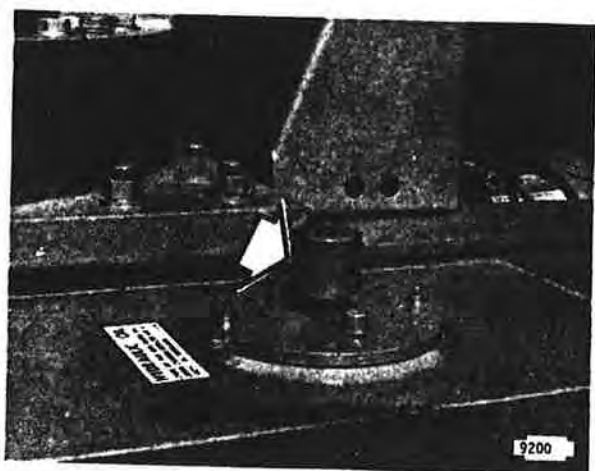


Figure 64
HYDRAULIC TANK BREATHER

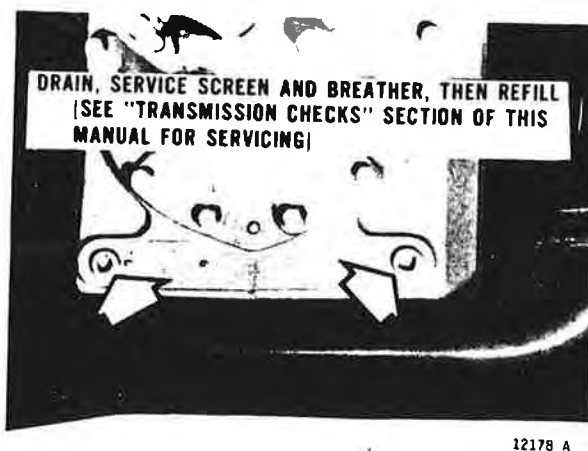


Figure 65
TRANSMISSION & CONVERTER DRAIN
PLUGS (CLARK 18000 SERIES)



MAINTENANCE

SECTION 4
Page 21

500 HOUR SERVICE



Figure 66
TRANSMISSION & CONVERTER SCREEN
(CLARK 18000 SERIES)

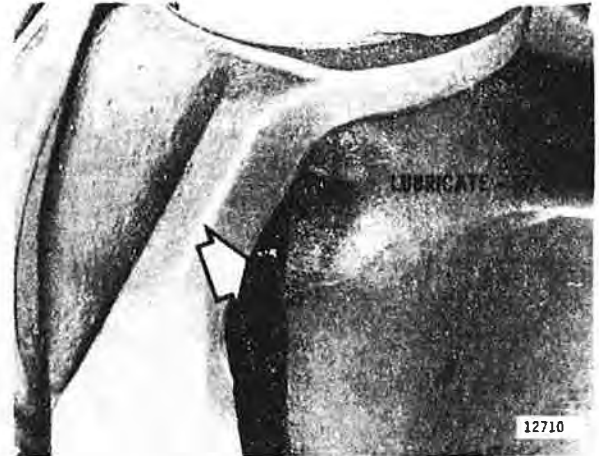


Figure 69
STEERING KNUCKLE U-JOINT
(CLARK DS-13311)



Figure 67
TRANSMISSION & CONVERTER BREATHER
(CLARK 18000 SERIES)

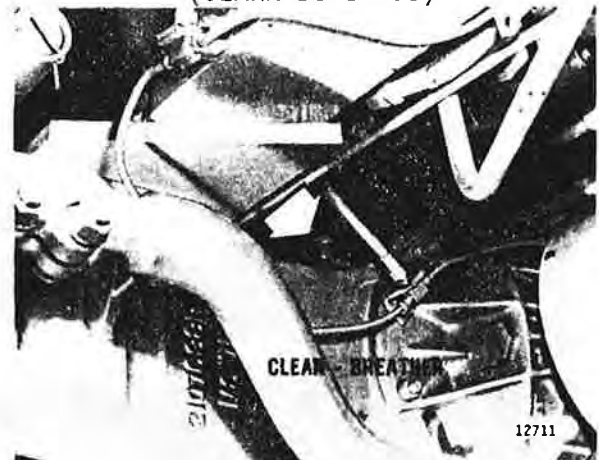


Figure 70
AXLE BREATHER



Figure 68
STEERING KNUCKLE U-JOINT
(CLARK DS-17220)

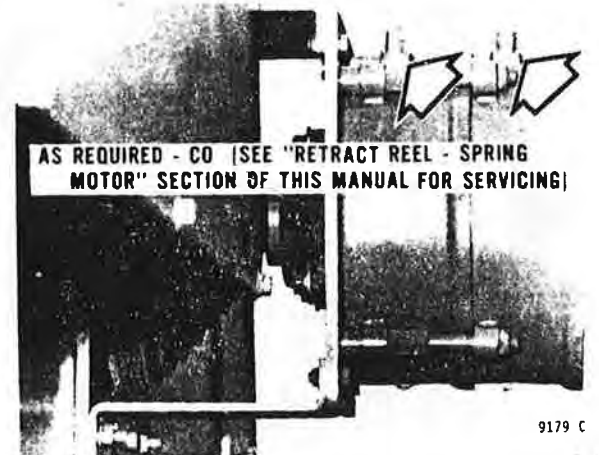


Figure 71
RETRACT REEL - SPRING MOTOR



MAINTENANCE

1000 HOUR SERVICE



Figure 72
PLANETARY DRIVE DRAIN PLUG
(CLARK DS-17220)



Figure 75
AXLE DRAIN PLUG
(CLARK DS-13311)



Figure 73
AXLE DRAIN PLUG
(CLARK DS-17220)

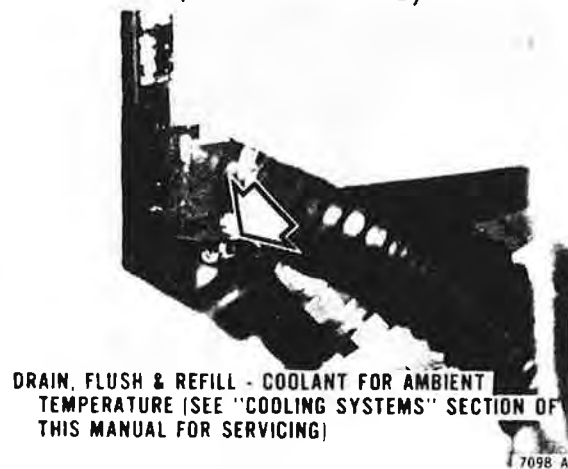


Figure 76
ENGINE RADIATOR DRAIN VALVE
(DETROIT DIESEL AND DRESSER ENGINE)

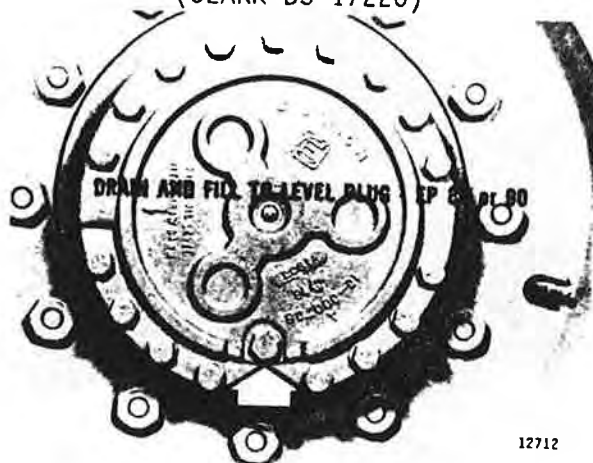


Figure 74
PLANETARY DRIVE DRAIN PLUG
(CLARK DS-13311)



Figure 77
HOIST GEAR CASE DRAIN PLUG



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1000 HOUR SERVICE



Figure 78
HOIST GEAR CASE BREATHER
& FILL PLUG



Figure 81
STEERING GEAR CASE DRAIN PLUG
(STEERING SYSTEM "A")

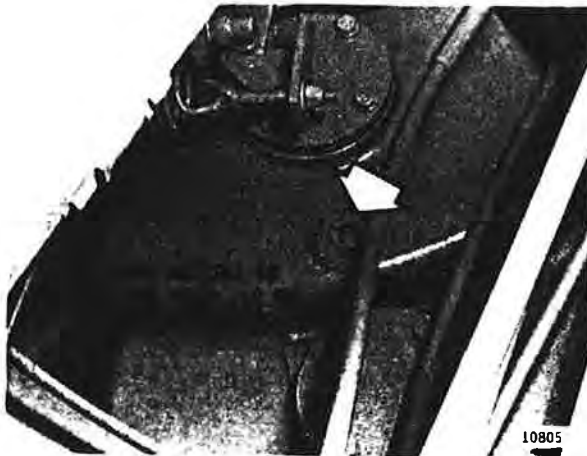


Figure 79
SWING DRIVE GEAR CASE
DRAIN PLUG

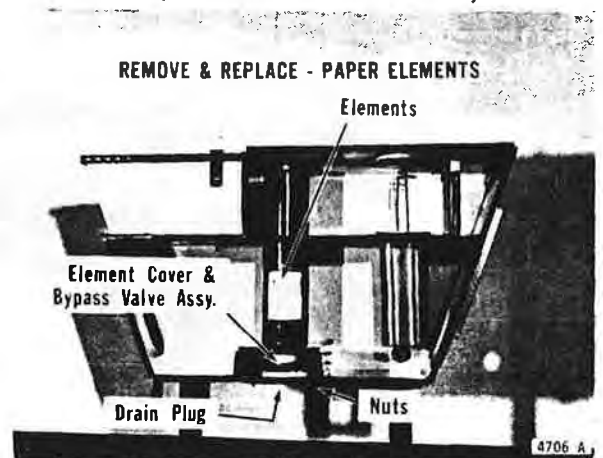


Figure 82
HYDRAULIC TANK FILTERS

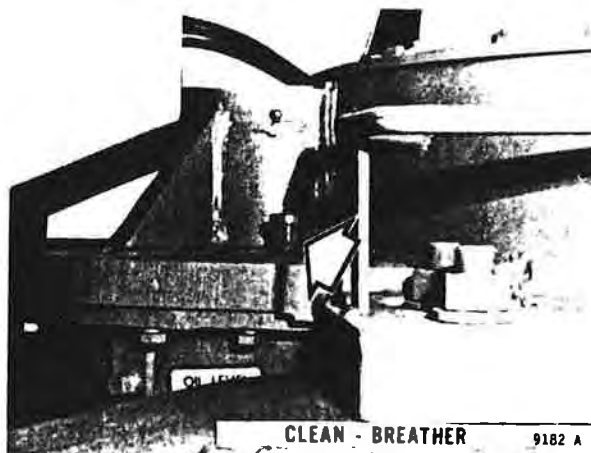


Figure 80
SWING DRIVE GEAR CASE
BREATHER & FILL PLUG



Figure 83
HYDRAULIC TANK DRAIN PLUG



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MAINTENANCE

NOT SPECIFIED

AS REQUIRED

(SEE WIRE ROPE SPECIFICATION AND METHODS OF LUBRICATION
IN THIS MANUAL FOR ADDITIONAL INFORMATION)

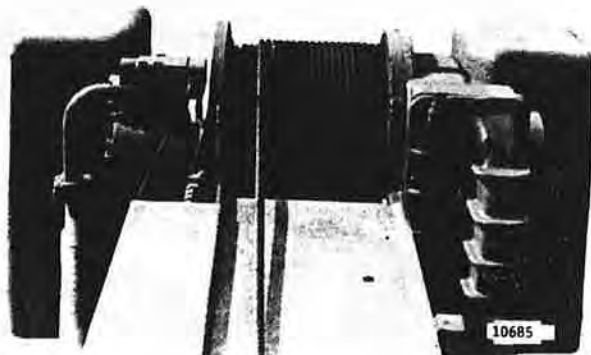


Figure 84
WIRE ROPE



Figure 85
WEAR PAD SUPPORTS



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LUBRICATION SPECIFICATION

EXTREME PRESSURE SAE 80 GEAR OIL

LUBRICATION CHART CODE: 80 OR EP80

MILITARY SPECIFICATION: MIL-L-2105 B, API-GL-4, API-GL-5 EP

TYPICAL PROPERTIES:

GRAVITY, API	25 - 29
FLASH POINT °F (°C)	395 (202) MINIMUM
VISCOSITY, SUS @ 210°F (99°C)	55 - 85
VISCOSITY INDEX	101 MINIMUM
CHANNEL POINT °F (°C)	-30 (-34) MAXIMUM
MOISTURE	0.2% MAXIMUM

SOURCES:

SUN OIL COMPANY	SUNFLEET GL-5 80W-90
MOBIL OIL CORPORATION	MOBILUBE HD 80W-90
TEXACO	TEXACO MULTI-GEAR EP80
STANDARD OIL (OHIO)	GEAREP 80
SHELL	SPIRAX HD 80W-90

EXTREME PRESSURE SAE 90 GEAR OIL

LUBRICATION CHART CODE: 90 OR EP90

MILITARY SPECIFICATION: MIL-L-2105 B, API-GL-4, API-GL-5 EP

TYPICAL PROPERTIES:

GRAVITY, API	24 - 27
FLASH POINT °F (°C)	350 (177) MINIMUM
VISCOSITY, SUS @ 210°F (99°C)	75 - 120
VISCOSITY INDEX	90 MINIMUM
CHANNEL POINT °F (°C)	-0 (-18) MAXIMUM
MOISTURE	0.2% MAXIMUM

SOURCES:

SUN OIL COMPANY	SUNFLEET GL-5 80W-90
MOBIL OIL CORPORATION	MOBILUBE HD 80W-90
TEXACO	TEXACO MULTI-GEAR EP90
STANDARD OIL (OHIO)	GEAREP 90
SHELL	SPIRAX HD 85W-90

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MAINTENANCE

OPEN GEAR LUBRICANT (SPECIAL PURPOSE)

LUBRICATION CHART CODE: OGL OR ML 2

TYPICAL PROPERTIES:

TEST

NLGI GRADE	2	----
PENETRATION, WORKED @ 77°F (25°C)	280	D217
VISCOSITY, MAC MICHAEL @ 70°F (21°C)	---	SUN M-15
SOAP, TYPE	LITHIUM	D128
SOAP, % LITHIUM	8.5	D128
DROPPING POINT °F (°C)	375 (191)	D2265
BASE OIL DATA:		
VISCOSITY, SUS @ 100°F (38°C)	790	D2161
VISCOSITY, SUS @ 210°F (99°C)	59.2	D2161
FLASH, COC, °F (°C)	395 (201)	D97
ANILINE POINT, °F (°C)	166 (74)	D611
GRAVITY, API	19.1	D287
WATER, %	NIL	D1283
RUST TEST RATING	2.0	D1743
COPPER CORROSION	PASS	D1261
OXIDATION STABILITY	---	D942
PSI DROP @ 100 HRS.	8.5	----
PSI DROP @ 500 HRS.	---	----
WATER WASHOUT, % @ 100°F (38°C)	3.1	D1264
WHEEL BEARING LEAKAGE, GMS.	3.0	D1263
TIMKEN LB. PASS	45	D2509
FOUR BALLS TEST:		
LOAD WEAR INDEX	37.6	FED. 6503
WEAR SCAR, MM	50	D2266
WELD POINT, KG	280	FED. 6503
BALL JOINT TEST, MG WEAR	18	SUN J-123

SOURCES:

MOBIL OIL CORPORATION	MOBILGREASE SPECIAL
SUN OIL COMPANY	SUNFLEET HP GREASE
TEXACO	MOLYTEX #2

**MAINTENANCE**SECTION 4
Page 27**HYDRAULIC OIL**

LUBRICATION CHART CODE: H0

TYPICAL PROPERTIES:

TEST

GRADE	44	----
ISO VISCOSITY GRADE	32	----
GRAVITY, API	30.9	D287
POUNDS PER GALLON	7.25	----
VISCOSITY		
KINEMATIC, CENTISTOKES @ 40°C	30.1	D445
CENTISTOKES @ 100°C	5.0	D445
VISCOSITY		
SAYBOLT, SUS @ 100°F	153	D2161
SUS @ 210°F (99°C)	43	D2161
VISCOSITY INDEX, MIN.	95	D2270
POUR POINT, °F (°C)	-29 (-20)	D97
FLASH POINT, °F (°C)	204 (400)	D92
COLOR, ASTM	L1.0	D1500
ANILINE NUMBER, °F (°C)	212 (100)	D611
SEAL GUARD CONDITIONING ADDITIVE	YES	----
AGMA NO.	---	----
ASTM GRADE	150	----
SAE NO. (CRANKCASE OIL)	10W	----
SAE NO. (GEAR LUBRICANT)	---	----

SOURCES:

MOBIL OIL CORPORATION	DTE 13
SHELL	TELLUS 25
STANDARD OIL (OHIO)	INDUSTRON 44
SUN OIL COMPANY	SUN PREMIUM HYDRAULIC OIL 150

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MULTI-PURPOSE LITHIUM BASE GREASE

LUBRICATION CHART CODE: MPG

TYPE: SAE J310

TYPICAL PROPERTIES:

		TEST
PENETRATION		D217
UNWORKED	275	----
WORKED 60 STROKES	270	----
WORKED 10,000	LESS THAN 5%	
	RAISE	----
DROPPING POINT	380°F MINIMUM	
WATER RESISTANCE	EXCELLENT	----
ASTM OXIDATION	NEGATIVE	D942
TEXTURE	BUTTERY &	
	SMOOTH	----
SOAP BASE	LITHIUM	----
BASE OIL, POUR	-10	----
VISCOSITY, SUS @ 210°F (99°C)	78	----
VISCOSITY INDEX	95	----
OXIDATION INHIBITED	YES	----
COORDINATING RESEARCH COUNCIL TEST		
WHEEL BEARING	PASSES	----
WHEEL BEARING OVERPACKED	PASSES	----

SOURCES:

MOBIL OIL CORPORATION	MOBILGREASE 77
SHELL	ALVANIA EP-2
SUN OIL COMPANY	SUNFLEET HP GREASE
TEXACO	MULTIFAK EP 2



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HYDRAULIC BRAKE FLUID

LUBRICATION CHART CODE: BF

TYPE: SAE 7 OR -3

TYPICAL PROPERTIES:

FLASH POINT	
CLEVELAND OPEN CUP	270°F (132°C)
COLOR	LIGHT STRAW

SOURCES:

MOBIL OIL CORPORATION	MOBIL SUPER HEAVY DUTY BRAKE FLUID
WAGNER - LOCKHEED	21 B

USES:

TO BE USED IN ALL BRAKE SYSTEMS

TRANSMISSION FLUID TYPE C-3

LUBRICATION CHART CODE: C3

TYPE: MILITARY SPECIFICATION: MIL-L-10295 TO LATEST SPECIFICATION
MILITARY SPECIFICATION: MIL-L-2104C GRADE 10

TYPICAL PROPERTIES:

		TEST
GRAVITY, API	30.6	D287
VISCOSITY, CENTISTOKES @ 100°F (38°C)	43.21	D445
VISCOSITY, SUS @ 100°F (38°C)	201	D2161
VISCOSITY, CENTISTOKES @ 210°F (99°C)	6.52	D445
VISCOSITY, SUS @ 210°F (99°C)	47.5	D2161
VISCOSITY INDEX	113	D57
POUR POINT, °F (°C)	-20 (-29)	D97
FLASH POINT, °F (°C)	425 (218)	D92
COLOR	6	D1500
ZINC, WT., %	0.11	STM-208
ASH, SULFATED, WT., %	05000.98	D874

SOURCES:

SUN OIL COMPANY	SUNFLEET C2/C3 FLUID
MOBIL OIL CORPORATION	MOBIL DELVAC 1310 OR POWERFLUID C-2/C-3
TEXACO	TORQUE FLUID C-3
CHEVRON OIL COMPANY	CHEVRON DELO 400 MOTOR OIL SAE 10W

**MAINTENANCE****AUTOMATIC TRANSMISSION FLUID****DEXRON II****MEETING ALLISON C-3 SPECIFICATIONS**LUBRICATION CHART CODE: **ATF OR D**

TYPICAL PROPERTIES:

		TEST
GRAVITY, API	31.0	D287
VISCOSITY, CENTISTOKES @ 104°F (40°C)	37.0	D445
VISCOSITY, CENTISTOKES @ 212°F (100°C)	7.5	D445
VISCOSITY, SUS @ 100°F (38°C)	190	D2161, D445
VISCOSITY, SUS @ 210°F (99°C)	52.0	D2161, D445
VISCOSITY INDEX	168	D2270
VISCOSITY, CENTIPOISE @ -40°F (-40°C)	40,000	*
POUR POINT °F (°C)	-45 (-43)	D97
FLASH POINT °F (°C)	390 (199)	D92
COLOR	RED	----

* PROCEDURE IS SAME AS D2983

LISTED BELOW ARE SOME COMPANIES AND THEIR **DEXRON II** PRODUCTS WHICH MEET THE **ALLISON C-3 SPECIFICATIONS**.

CASTROL LIMITED, ASSOCIATE COMPANIES & AGENCIES .	CASTROL TQ DEXRON II
CONOCO, INCORPORATED	CONOCO DEXRON II
PENNZOIL PRODUCTS	HYDRAFLO DEXRON II
SHELL INTERNATIONAL	SHELL ATF DEXRON II
UNION OIL COMPANY	ATF - DEXRON - II
VALVOLINE	VALVOLINE ATF DEXRON II
VALVOLINE INTERNATIONAL	VALVOLINE ATF DEXRON II
	OR EQUIVALENT



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OIL CHANGE RECOMMENDATIONS

It is imperative that the new specification lubricants not be mixed with the old specifications in any manner.

When changing to a new specification, the following procedure should be practiced:

1. After the unit has been operated sufficiently, to bring the lubricant to normal operating temperatures, remove the drain plug and completely drain the lubricant.
2. After draining, flushing is desirable. Clean and replace the drain plug and clean the fill plug area. Fill unit to the correct level with a light flushing oil. Operate the unit for a short period of time (5 to 10 minutes) under extremely light or no load conditions. Drain ALL of the flushing oil from the unit while it is warm. Clean and replace the drain plug.
3. To refill, clean around the fill plug area and fill the unit to the correct level with the new specification lubricant. DO NOT OVERFILL as an excessive amount will serve no useful purpose.
4. Use same level checks and drain intervals as outlined on lubrication chart and/or in Operator's Manual for the new lubricant.

NOTE: *Mixing of the lubricants could cause damage and CANNOT BE TOLERATED. If there is any doubt whether the unit has been filled with the old or new lubricant, the unit should be drained and flushed (as prescribed above).*

A VERY SIMPLE RULE TO FOLLOW, IN THE CASE OF THE HYDRAULIC TANK/HYDRAULIC SYSTEM IS: IF THE OIL IS CLEAR, ADD CLEAR; IF THE OIL IS RED, ADD RED. HO IS CLEAR IN COLOR; Dexron II - Meeting Allison C-3 Specifications IS RED.



MAINTENANCE

FUEL SYSTEM

FUEL TANK

The lower portion of the fuel tank acts as a water trap since the supply line to the fuel pump picks up fuel a short distance above the bottom of the tank. The drain plug can then be used to remove moisture periodically.

To avoid moisture condensation in the fuel tank, fill the tank immediately following the end of each day's operation. Do not allow the tank to stand overnight unfilled. When filled, the walls of the fuel tank are completely covered with fuel, preventing condensation from forming on the inside of the tank.

If an excessive amount of water appears in the fuel consistently, a check of fuel storage facilities and discussion of this problem with the fuel supplier should be effected immediately.

Fuel should always be strained or filtered before being put into the fuel tank. This will lengthen the life of the fuel filter and reduce the chances of dirt getting into the fuel pump and injectors.

Fuel filter elements are designed to trap dirt and sediment that has entered the fuel system. A filter that has been allowed to become dirty and clogged from overuse will be more of a handicap than help to an engine. It will restrict the flow of fuel, thus reducing horsepower output.

Excessive amounts of water in the fuel will cause rusting and corrosion in the injectors as well as to fuel pump shafts, bearings and other parts. In some areas, it is difficult to purchase fuel which does not contain some water. Normal condensation, either in the storage tank or in the fuel tank, increases water content. This water, of course, must be filtered out or drained off before it gets into the fuel pump. The life of fuel pump and injectors can be considerably extended if the operator takes the precaution of draining about a cup of fuel from the lowest point in the fuel system before starting the engine each day.



Figure 86
FUEL TANK DRAIN PLUG



WARNING! Do not service fuel system near open flame. No smoking. It is recommended that the engine be allowed to cool before servicing fuel system. This will reduce the risk of fire hazard.



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FUEL FILTER REPLACEMENT

DETROIT DIESEL FUEL FILTER

Drain approximately one-fourth pint [4 Oz. (0.12 liter)] of fuel to remove sediment and water from the strainer and the filter daily by opening the drain cock in the bottom of each shell. Refer to Engine Operator's Manual for element replacement intervals, proper care and maintenance of fuel filter(s).

NOTE: *On newer Detroit Diesel Engines this style filter element is replaced by a spin-on type filter.*

NOTE: *Check Engine Operator or Service Manual for latest specifications.*

DRESSER DIESEL FUEL FILTERS

Refer to Engine Operator's Manual for element replacement intervals, proper care and maintenance of fuel filter(s).

NOTE: *Check Engine Operator or Service Manual for latest specifications.*

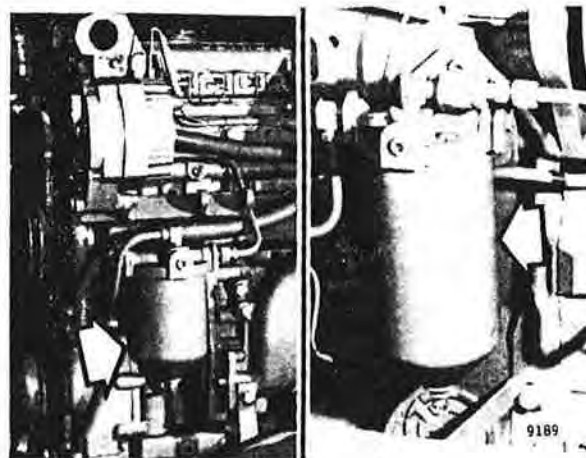


Figure 87
DETROIT DIESEL FUEL FILTERS

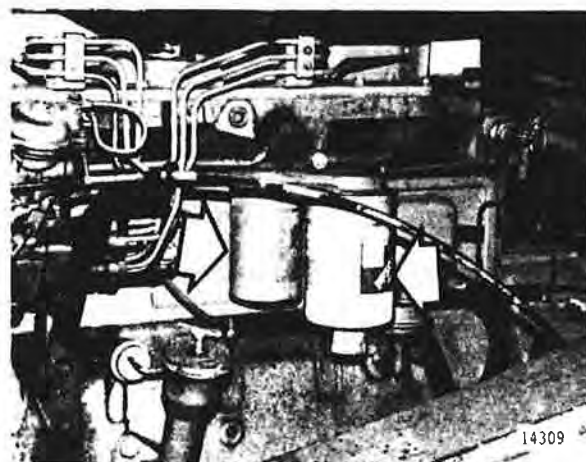


Figure 88
DRESSER DIESEL FUEL FILTERS



MAINTENANCE

DIESEL FUEL SPECIFICATIONS

For most satisfactory engine life in the crane, use only those No. 2-D diesel fuel oils containing 0.5% or less sulfur. Where minimum exhaust smoke is required, long periods of idling or cold weather conditions below 32°F (0°C) are encountered or where altitudes are above 5,000 Ft. (1525 m) the more volatile No. 1-D diesel fuel oils are recommended.

DISTILLATION RANGE, CETANE NUMBER AND SULFUR CONTENT are three of the most important properties in the selection of diesel fuels for optimum combustion and minimum wear. Engine speed, load and ambient temperature influence the selection of the fuels with respect to distillation range and cetane number.

THE SULFUR CONTENT OF THE FUEL MUST BE AS LOW AS POSSIBLE, to avoid excessive deposit formation and premature wear.

ASTM CLASSIFICATION OF DIESEL FUEL OILS

ASTM Designation D 975	No. 1-D	No. 2-D
Flash Point: °F (°C) Min.	100 (38) or Legal	125 (52) or Legal
Carbon Residue: %, Max.	0.15	0.35
Water and Sediment (% by Volume): Max.	Trace	0.10
Ash, % by Weight: Max.	0.01	0.02
Distillation, °F (°C) 90% Pt.: Max. Min.	550 (288) ---	640 (388) 540 (282)
Viscosity @ 100°F (38°C) centistokes: Min. Max.	1.4 2.5	2.0 4.3
Sulfur: % Max.	0.50	0.50
Cetane No.: Max.	40	40

During cold weather engine operation, the "cloud point" (the temperature at which wax crystals begin to form in the fuel oil) should be 10°F (-12°C) below the lowest expected fuel temperature to prevent clogging of the fuel filters by wax crystals.

NOTE: Check Engine Operator or Service Manual for latest specifications.



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ELECTRICAL SYSTEM

The crane is equipped with an alternator (a continuous output, diode rectified, AC generator) which differs from a DC generator. The alternator offers the advantage of being capable of a high charging rate at low engine RPM.



WARNING! Certain precautions must be observed when an alternator is used.

1. Always make absolutely sure the polarity is correct when installing a new battery. The crane system is a **NEGATIVE (-) GROUND** system.
2. Do not short across any of the terminals of the alternator or regulator.
3. Do not attempt to polarize the alternator.
4. Always disconnect the ground cable before replacing any electrical unit in the system.
5. Never operate the alternator on an open circuit. Make sure all leads are connected and tightened securely.
6. Disconnect wiring harness from alternator before using an electric welder anywhere on the crane.
7. Diode installation: connect dark end of diode to wire leading to alternator, light end to wire leading to harness.

NOTE: Use only distilled water and keep battery cells to level by adding when necessary. Maintain storage battery at full charge.

Keep battery cells to correct level at all times by adding only distilled water when necessary. Maintain storage battery at full charge at all times. A battery that is fully charged has a specific gravity reading of 1.260 to 1.280 at 80°F (27°C) when tested with a hydrometer. This reading is affected by temperature, therefore, it is necessary to determine the exact temperature of the electrolyte using a thermometer. Once the temperature of the electrolyte is determined and the specific gravity has been tested, the reading is easily corrected by adding 0.004 points to the reading for every 10°F (6°C) above 80°F (27°C) or subtracting 0.004 points for every 10°F (6°C) below 80°F (27°C).

When the ambient air temperature drops to 32°F (0°C) and lower, the efficiency of a battery decreases rapidly. At a temperature of -20°F (-29°C) or lower, do not try to start the engine unless the battery has been heated. A satisfactory means of heating a battery, is to immersion it in warm water to within about 1.000" (25.4 mm) of the top of the battery case.

CONT'D NEXT PAGE



MAINTENANCE

It is especially important to keep the battery at full charge for cold weather operation. Check the specific gravity of the battery electrolyte at frequent intervals, and keep the battery as fully charged as possible. Electrolyte will not freeze if the battery is kept fully charged unless the ambient air temperature reaches -83°F (-64°C). Electrolyte will freeze, however, at 0°F (-18°C) if the specific gravity is allowed to drop to 1.160. Freezing can occur at even higher temperatures if the specific gravity of the electrolyte is allowed to drop even farther. Remember: FREEZING CAN OCCUR if proper precautions are not taken. Add distilled water to the battery in freezing temperatures only when the engine is to operate for several hours to permit thorough mixing of electrolyte and distilled water. "Topping off" the battery with distilled water without allowing time for mixing can result in it freezing and, consequently, damage to the battery.



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ELECTRICAL WIRING DIAGRAMS

DETROIT DIESEL 4-53N

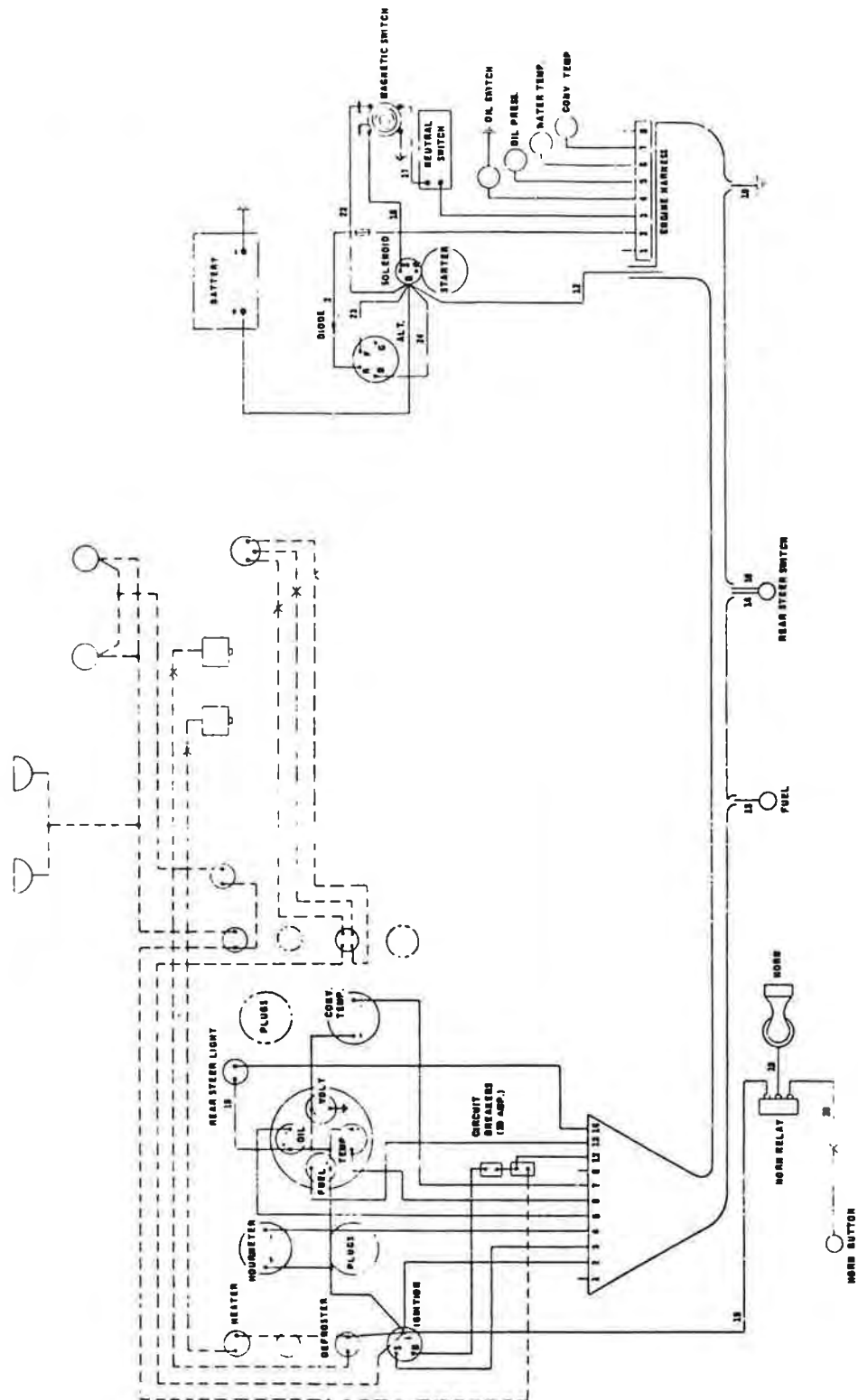


Figure 89

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MAINTENANCE

DRESSER D359T DIESEL ENGINE

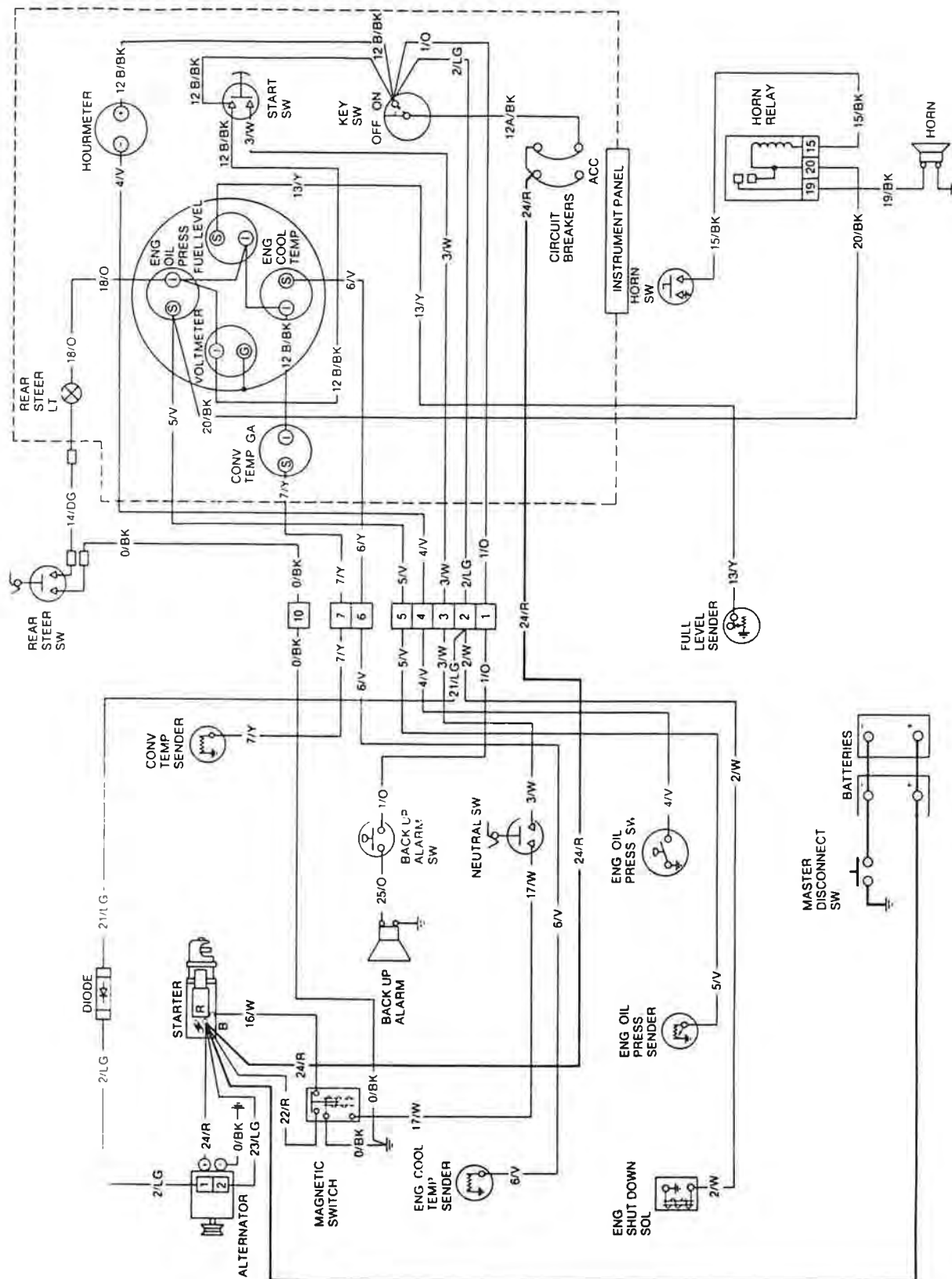


Figure 90

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COOLING SYSTEM

The DRESSER Diesel and Detroit Diesel engines are liquid cooled. The Deutz Diesel engine is air cooled. Both varieties of engines require their own special services to prevent them from overheating. The following sections outline briefly the services that must be performed to them. Always refer to the Engine Operator's Manual or Handbook for specific information and service intervals.

DRESSER DIESEL & DETROIT DIESEL COOLING SYSTEMS

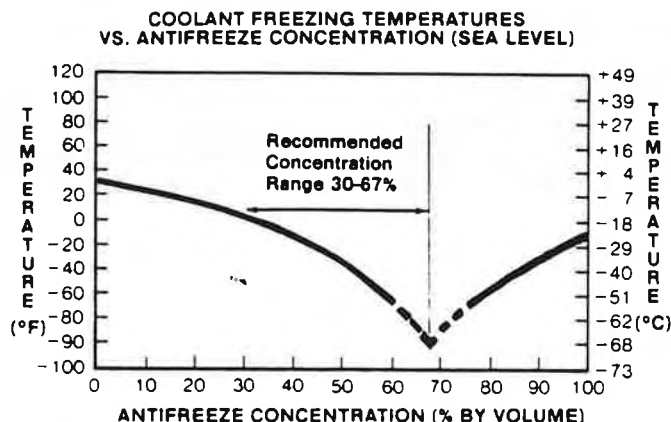
Always use clean water in the radiator (rain water or soft water preferred). Water from creeks and stagnant pools usually contain dirt, minerals and/or organic material that is deposited in the cooling system and impairs cooling efficiency. The cooling system should be cleaned and maintained as per engine manufacturer's instructions which are found in the Engine Operator's Manual or Handbook.

Overheating of engine is often caused by bent or clogged radiator fins. The spaces between the fins can be cleaned by use of air or water under pressure. When straightening bent fins, use care not to injure the tubes or break the bond between the fins and the tubes.



WARNING! Do not pour cold water into radiator when engine is very hot and water level is below the top of the tubes. Such action could result in damage to engine cylinder heads.

The following table indicates percentages of antifreeze to be used for various low ambient temperatures.



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Figure 91
PERCENTAGE OF ANTIFREEZE TABLE

TO DRAIN COOLING SYSTEM

1. Drain the cooling system immediately after stopping the engine while most of the sediment is in suspension.

CONT'D NEXT PAGE



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2. Shutdown engine.
3. Remove radiator cap.



WARNING! Using a rag to prevent burns to hand, loosen radiator cap slowly to allow pressure to escape before removing.

4. Open radiator drain valve to drain radiator.
5. Open engine drain valves to drain engine block. Refer to Engine Operator's Manual or Handbook for locations of engine block drain valves.

TO FILL COOLING SYSTEM

1. Close all drain valves.
2. Let engine fully cool before filling the cooling system with coolant. Refer to the Engine Operator's manual or Handbook for recommended coolant and additives.



WARNING! Do not pour coolant into cooling system when engine is very hot. Such action could result in damage to the engine.

3. Fill cooling system with coolant to within 1" (25.40 mm) of the radiator cap.
4. Install radiator cap.

NOTE: *If flushing of the cooling system is desired before adding coolant, follow the above filling procedure by first using clean soft water. Operate the engine for 15 Minutes to fully circulate water. Repeat draining procedure. Repeat filling procedure using desired coolant.*



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DRAINING COOLING SYSTEM LOCATOR PHOTOS



AS REQUIRED - COOLANT



Figure 92
RADIATOR FILL CAP

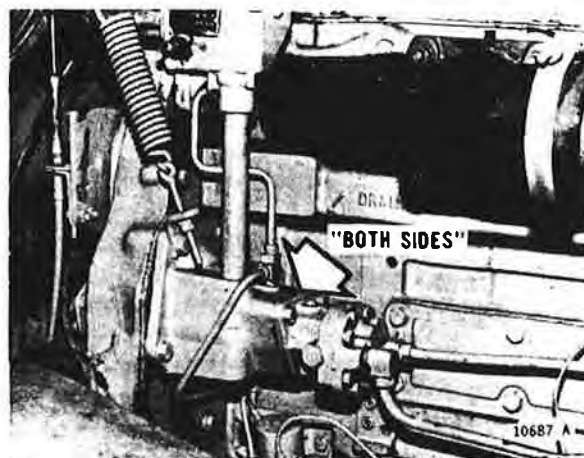


Figure 94
DETROIT DIESEL DRAIN VALVES

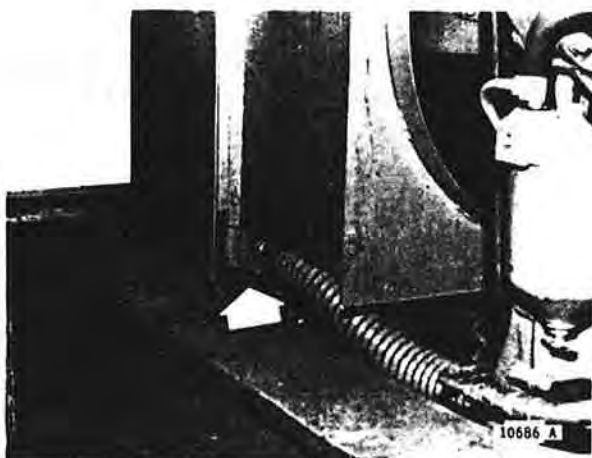


Figure 93
RADIATOR DRAIN VALVE



Figure 95
DETROIT DIESEL OIL COOLER DRAIN VALVE

NOTE: *There are no drain valves on the DRESSER D359T Diesel Engine.*



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TORQUE CONVERTER OIL COOLER

An air to cooler is mounted adjacent to the engine radiator. This "Heat Exchanger" stabilizes the converter/transmission oil temperature.

It should be cleaned externally with compressed air and/or flushed with a water hose every 100 Hours of operation or more frequently when operating where chaff and vegetation could cause stoppage.

Do not allow operating temperature of transmission and converter to exceed 250°F (121°C). Temperatures at or near this values may indicate a need for service because of improper cooler operation or other system malfunction.

Normal operating temperatures are:

Clark 18000 Series Transmission 180° - 200°F (82° - 93°C)



WARNING! Do not stall converter unit in excess of 30 seconds at a time.

WARNING! Converter stall is a condition when clutches are engaged, wheels not turning, with the engine running in full fuel position.



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LUBRICATING OIL SYSTEM

LUBRICATING OIL FILTER

The lubricating oil filter keeps the circulating oil free from harmful contaminants. Engine oil filters must be replaced when engine oil is changed. See current Parts Book/Microfiche for correct oil filter replacement part numbers.

NOTE: *Check for oil leaks after starting engine.*

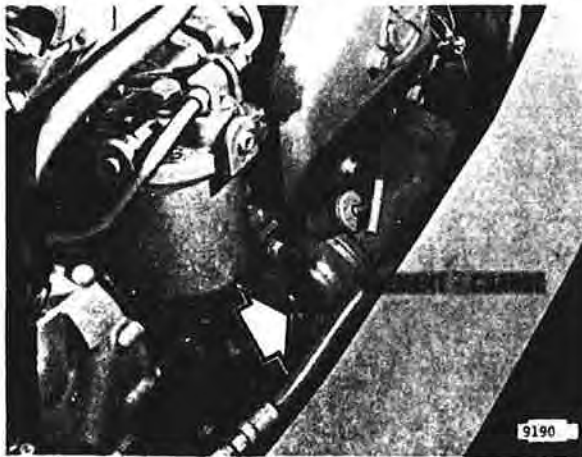


Figure 96
DETROIT DIESEL OIL FILTER

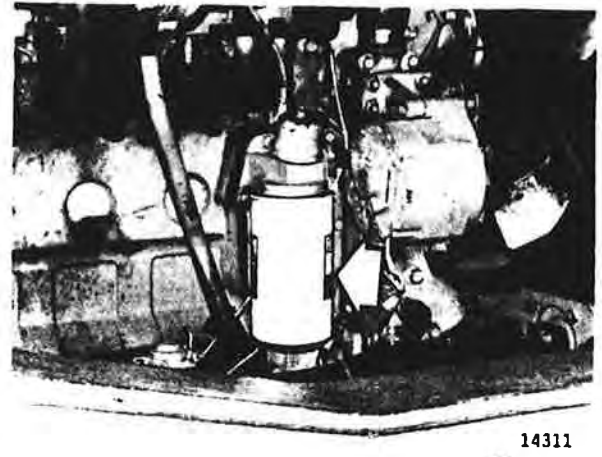


Figure 97
DRESSER DIESEL OIL FILTER



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LUBRICATING OIL SPECIFICATIONS

DRESSER DIESEL ENGINE

Oil Performance Recommendations

CC for use in naturally aspirated engines and in engines that operate in a light duty service including standby and emergency operation (equivalent to MIL-L-2104B).

CC/CD for use in turbocharged engines (equivalent to MIL-L-45199B).

Dual Category oils provide the performance required of each individual category. For example, a CC/CD oil is blended to meet both CC and CD performance levels.

A sulfated ash limit is specified for lubricating oil used in Dresser engines. Past experience has shown that oils with a high ash content may produce deposits on valves that can progress to guttering and valve burning. A maximum sulfated ash content of 1.85 mass % is recommended for all oil used in Dresser engines.

Break-In Oils

Do not use special "break-in" lubricating oils for new or rebuilt engines. Use the lubricating oils specified for normal engine operation.

Oil Viscosity Recommendations

The use of a multi-grade lubricating oil has been found to improve oil consumption control and improve engine cranking in cold temperatures while maintaining lubrication at high operating temperatures. A multi-graded oil is, therefore, recommended with the viscosity grades shown in the following Table. The use of single grade lubricating oil is not recommended except in Arctic conditions.

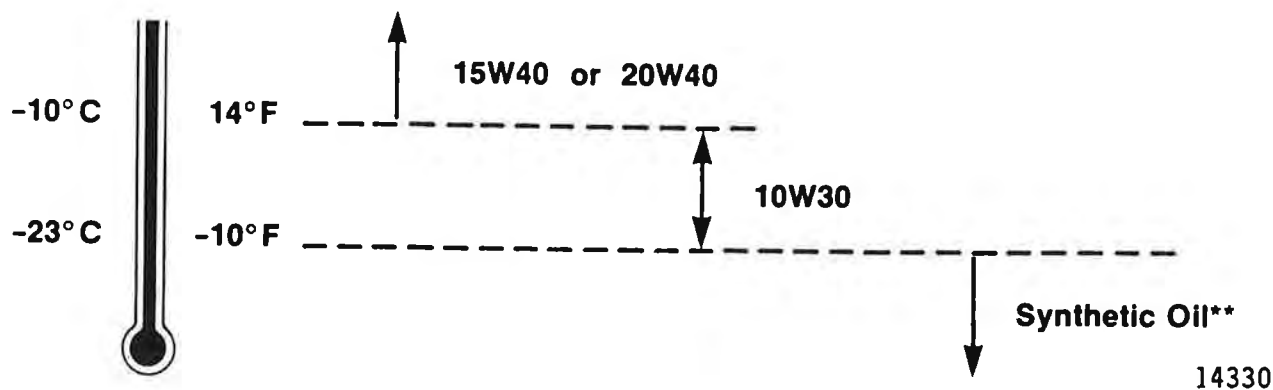


Figure 98

NOTE: * 20W20 is not considered a multi-grade oil.

NOTE: ** The same oil change interval is to be followed for synthetic oil as for petroleum based oil.



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Arctic Operations

Where there is no provision to keep the engine warm when it is operating in ambient temperatures consistently below -10°F (123°C), use a lubricating oil that meets the following requirements.

SAE 5W viscosity grade synthetic oils may be used provided they meet the minimum viscosity at 212°F (100°C).

<u>Parameter (Test Method)</u>	<u>Specification</u>
Performance Quality	API Classification CC/SC API Classification CC/CD
Viscosity	10,000 mPa's Maximum at -31°F (-35°C) 4.1 mm ² /s Minimum at 212°F 100°C
Pour Point (ASTM D-97)	Minimum of 9°F (5°C) Below the Lowest Expected Ambient Temperature
Sulfated ASH Content (ASTM D-874)	Maximum of 1.85% by Weight Maximum

DETROIT DIESEL ENGINE

API Performance Designations, Lube Supplier and Brand Names

Lubricants are blended to meet specific industry accepted tests developed by the American Society for Testing and materials (ASTM). The service for which these products are intended is defined by the American Petroleum Institute (API). The lube supplier markets these products under a specific brand or trade name. The container identification indicates whether the contents meet or exceed specific API letter code designations (example: SF, CD).

Recommendations

Lubricating oils that meet the following performance levels, viscosity grades, sulfated ash limits and zinc requirements are recommended for Detroit Diesel engines. It is also recommended that the oil supplier provide to the user evidence of satisfactory performance of his product in Detroit Diesel engines.

Lube Oil Performance Levels

Lubricants are formulated to meet all the performance criteria defined in either commercial (API) and/or military specifications. The "Lube Oil Performance Levels" table shows the current commercial industry and military oil performance levels. The API letter designations are defined in SAE recommended practice J-183 published in the SAE Handbook.

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**MAINTENANCE**

Specific oil performance level recommendations for Detroit Diesel engines are indicated in the following table.

LUBE OIL PERFORMANCE LEVELS					
API PERFORMANCE DESIGNATION		COMPARABLE MILITARY SPECIFICATION	RECOMMENDED FOR USE IN DDA ENGINES		COMMENTS & CURRENT API OR MILITARY QUALIFICATION STATUS
DIESEL ENGINES	GASOLINE ENGINES		2-CYCLE	4-CYCLE	
CB	--	MIL-L-2104A (Supplement 1)	YES	NO	Obsolete, still limited availability.
CC	--	MIL-L-2104B	YES	NO	Obsolete, still readily available.
CD	--	MIL-L-45199A (Series 3)	YES	NO	Still limited availability.
CC	SE	MIL-L-46152	YES	YES	Obsolete Diesel performance, intended for passenger cars burning gasoline.
CC	SF	NONE	YES	YES	Primarily for passenger cars burning gasoline.
CD	SC	MIL-L-2104C	YES	YES	Current spec. For heavy duty diesel powered military vehicles, acceptable for commercial diesel powered vehicles.
CD	SE		YES	YES	Diesel performance requirements are current. Gasoline fueled passenger cars performance requirements are obsolete.
CD	SF		YES	YES	Meet current diesel & gasoline performance requirements.
--	SF		NO	YES	Service station lubes.



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ENGINE CRANKCASE VENTILATION

Ventilation of the crankcase is provided in the Detroit Diesel engine to prevent the build-up of harmful vapors and pressure created by the heated lubricating oil.

NOTE: *Refer to the Engine Operator's Manual for the latest service intervals and procedures.*

Clean the externally mounted crankcase breather assembly every 1,000 Hours. This cleaning period may be reduced or lengthened according to severity of service. Clean the internally mounted breather pads at time of engine overhaul, or sooner if excessive crankcase pressure is observed.

Remove the crankcase breather from the engine and wash the steel mesh pad (element) in fuel oil and dry it compressed air. Reinstall the breather assembly.



WARNING! Pressure at air nozzle must not exceed 30 PSI (0.207 MPa). Always wear goggles when using compressed air.

Clean the breather cap, mounted on the valve rocker cover, in clean fuel every time the engine oil is changed.



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NOTES



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CARE OF HYDRAULIC SYSTEM

The function of the crane is dependent upon the hydraulic system. The system's life is dependent upon the hydraulic oil and the care given to it.

The hydraulic system has been engineered to function with oil that is available from most suppliers, and is relatively inexpensive. The crane is factory filled with what is basically a light turbine oil, non-corrosive and will pour at -30°F (-34°C). It contains rust oxidation inhibitors suitable for a minimum of 1,000 Hours operation under most conditions. It is available under military specifications and is identified as MIL-L-17672A Grade 2110 TL. Complete specifications and optional use of other oils are listed in the lubrication section of this manual.

Maintain the oil at correct level, keep the tank screen clean and change oil and filter elements at suggested change periods. When additional oil is required, use a clean container. Clean the tank cover and around the tank opening prior to adding oil. Dirt is the worst enemy of a hydraulic system, keep it clean.

DAILY/10 HOUR SERVICE

Check the hydraulic oil level at Daily/10 Hour service intervals. Use the following procedure for checking oil level.

1. Prior to checking the oil level park the crane on a level surface with all outrigger cylinders retracted, boom lowered and fully retracted. This will return the maximum amount of oil from the hydraulic system to tank.
2. The hydraulic oil must be at a minimum operating temperature of 100°F (38°C) prior to shutdown of engine.
3. Shutdown engine and set parking brake.
4. Clean area around dipstick and remove it. Oil must be between marks on dipstick. If oil must be added proceed with remaining steps.
5. Clean outside of tank in vicinity of cover and remove two hex nuts, lock washers and cover from tank. Add oil as required.
6. Reinstall cover and dipstick.



Figure 99
HYDRAULIC OIL TANK DIPSTICK



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WEEKLY/50 HOUR SERVICE

SCREEN AND MAGNET ASSEMBLY

At Weekly/50 Hour Service intervals the screen and magnet assembly must be removed from the hydraulic oil tank and cleaned. Use the following procedure for cleaning the screen and magnet assembly.

Removal

1. Clean outside of tank in vicinity of cover. Clean cover.
2. Remove two hex nuts and lock washers, and lift cover (1, Figure 100) off top of tank.
3. Remove hold down spider (4).
4. With a clean hand, reach into tank and remove screen (5) and gasket (6).
5. Allow oil to drain from screen.

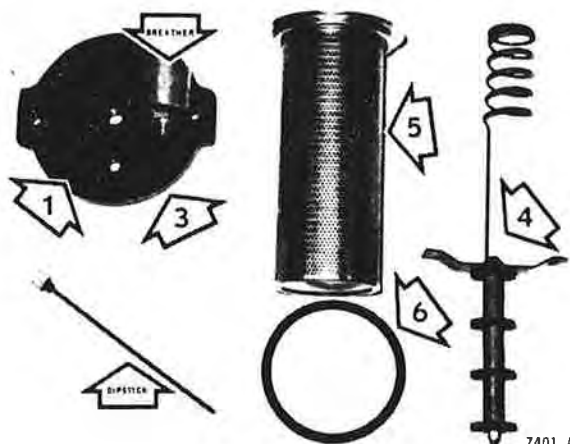


Figure 100

Clean screen by washing in solvent. If possible, blow dry with compressed air from the outside.



WARNING! Pressure at air nozzle must not exceed 30 PSI (0.207 MPa). Always wear goggles when using compressed air.

WARNING! Care should be exercised to avoid inhalation of vapors, exposure to the skin and creating fire hazards when using solvent type cleaners.

Examine screen for petroleum varnish deposits. If present, remove with paint thinner or acetone. If varnish deposits are present a change of hydraulic oil is indicated. Varnish indicates that the oil has lost its capability to properly protect the hydraulic system.

6. Clean magnets on spider (4).

Installation

1. Install gasket (6, Figure 100) on screen (5).
2. Install assembly in tank.
3. Place spider assembly (4) on screen.
4. Install seal (3) in tank cover.

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Page 51

5. Place cover assembly on tank. Spider assembly spring must seat in boss on cover.
6. Install two lock washers and hex nuts to secure cover to tank. Tighten hex nuts evenly.

BREATHER

The condition of the hydraulic oil tank breather element should be checked every Week/50 Hours of operation to ensure that it is not clogged. Replace element if necessary. Refer to 500 Hour Service interval for replacement procedure.

100 HOUR SERVICE

A double element filter is provided in the bottom of the hydraulic tank to filter all oil as it returns to the tank.

The elements must be replaced after 100 Hours. Two spare elements are shipped with each crane from the factory for this purpose. Change each 1,000 Hours of operation thereafter. If the hydraulic system is repaired, replace elements after first 100 Hours of operation.

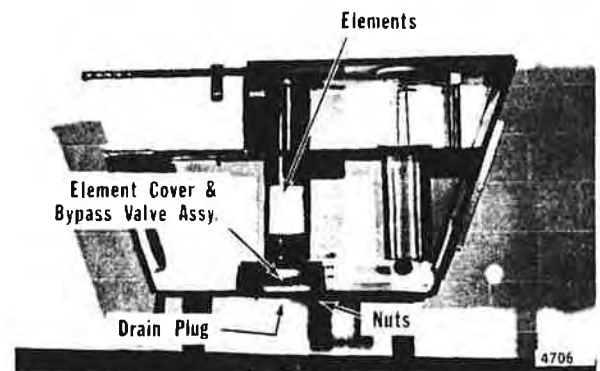


Figure 101

TO SERVICE FILTER

1. Remove drain plug from bottom tank cover. Approximately 5 U.S. Gallons (19 liters) of hydraulic oil will drain from filter compartment. Discard this oil.
2. Remove two hex nuts and lock washers that retain bottom tank cover.
3. Pry tank cover out of tank base, moving first one side, then the other.
4. Unscrew filter element cover and bypass valve assembly.
5. Remove two old filter elements and discard.
6. Wash filter element cover and bypass valve assembly in suitable solvent. Replace seal in tank cover and reassemble in reverse order. Tighten filter cover against new filter elements hand-tight to prevent crushing them.



WARNING! Care should be exercised to avoid inhalation of vapors, exposure to the skin and creating fire hazards when using solvent type cleaners.

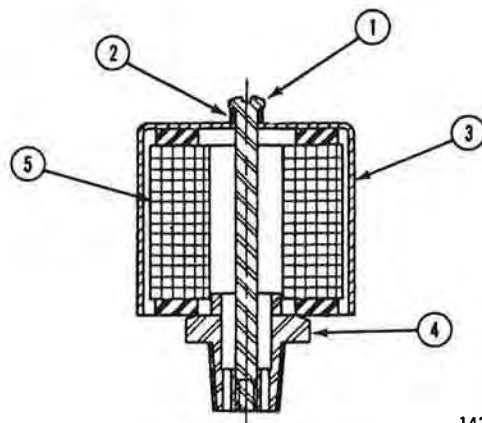
7. Start crane and run for several minutes. Shutdown engine and check hydraulic oil tank level, as outlined in Daily/10 Service interval.

**MAINTENANCE****500 HOUR SERVICE**

The condition of the hydraulic oil tank breather element should be checked every 50 Hours. After each 500 Hours of operation, or sooner if conditions require, the paper element must be discarded and replaced with a new element.

BREATHER ELEMENT SERVICE

1. Remove screw (1, Figure 102), seal (2) and breather can (3) from stem (4).
2. Remove old paper element (5) from stem and discard.
3. Install new paper element on stem. Reinstall breather can, seal and screw.



14291

Figure 102

1000 HOUR SERVICE

At the 1000 Hour Service interval the hydraulic oil tank must be drained, cleaned and filter elements replaced. Use the following procedure to perform this service:

1. Remove the drain plug (Figure 103) from the bottom of the hydraulic tank and discard old oil. The hydraulic oil tank holds approximately 75 U.S. Gallons (284 liters) of oil.
2. Remove old hydraulic filter elements and discard. See 100 Hour Service interval for removal procedure.
3. Remove access covers from each end of the hydraulic oil tank and wipe out inside, using lintless rags.
4. Reinstall drain plug in bottom of tank, and access covers in each end of tank.
5. Install new filter elements.



Figure 103

CONT'D NEXT PAGE



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6. Fill hydraulic oil tank with oil to full mark on dipstick prior to starting engine. Once the tank is filled start engine and allow oil to reach operating temperature of 100°F (38°C). Recheck oil level.

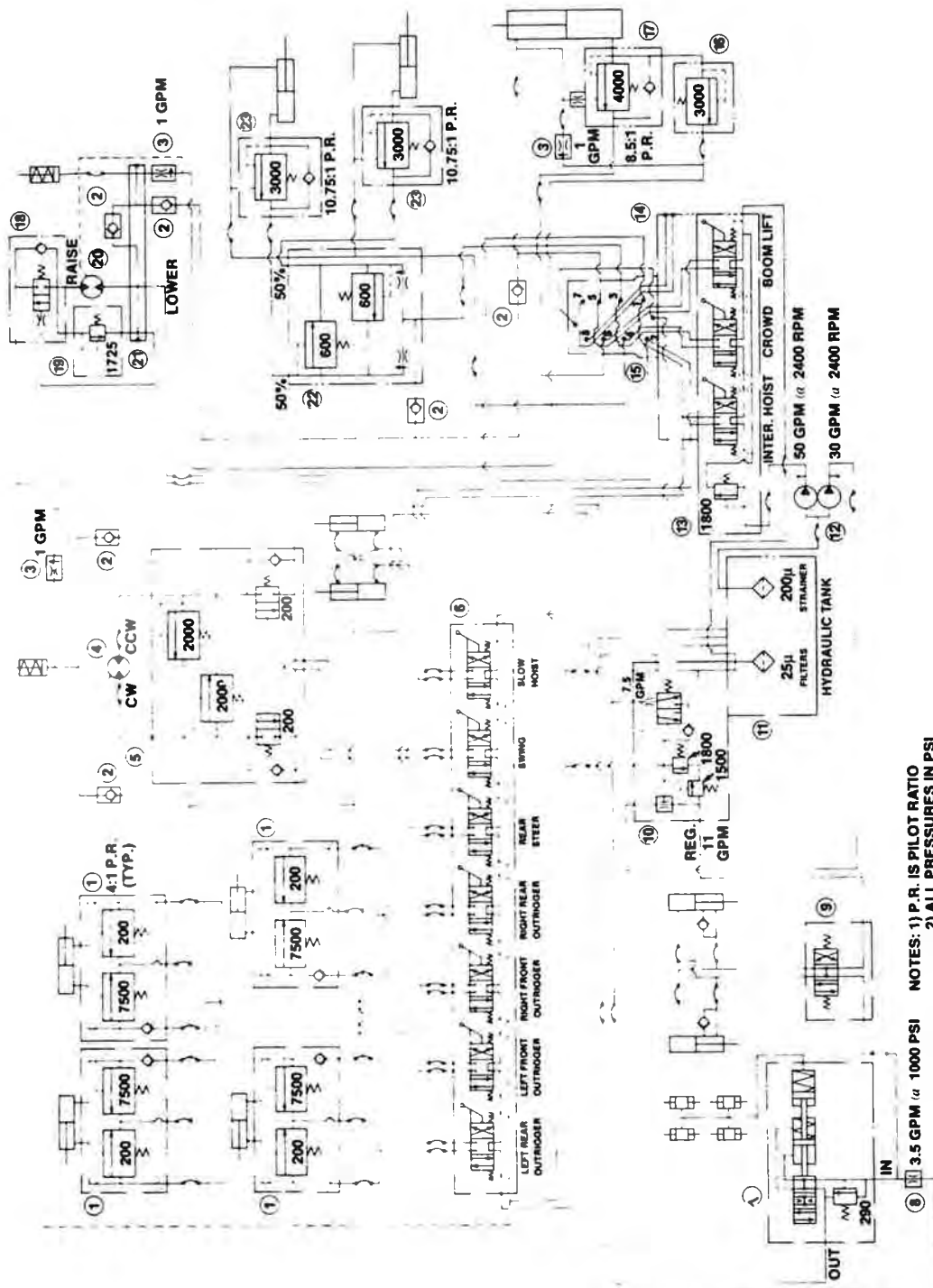
NOTE: *The engine must be started to allow hydraulic filter compartment to fill with oil. This compartment holds approximately 5 U.S. Gallons (19 liters) of oil. This will cause the initial fill of oil to lower.*

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HYDRAULIC SCHEMATICS

150A (3 SECTION FULL POWER BOOM) S/N 08624 THRU 09627



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Figure 104
HYDRAULIC SCHEMATIC K-162762
(SHEET 1 of 2)



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150A (3 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST

CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	89362	COUNTERBALANCE VALVE
6	70450-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	67658	STEERING GEAR
10	92263	FLOW REGULATOR / DIVERTER
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	78067-A	FLOW DIVIDER
23	77333	OVERCENTER VALVE
24	-----	-----
25	-----	-----
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.



MAINTENANCE

150A (3 SECTION FULL POWER BOOM) S/N 09628 & UP

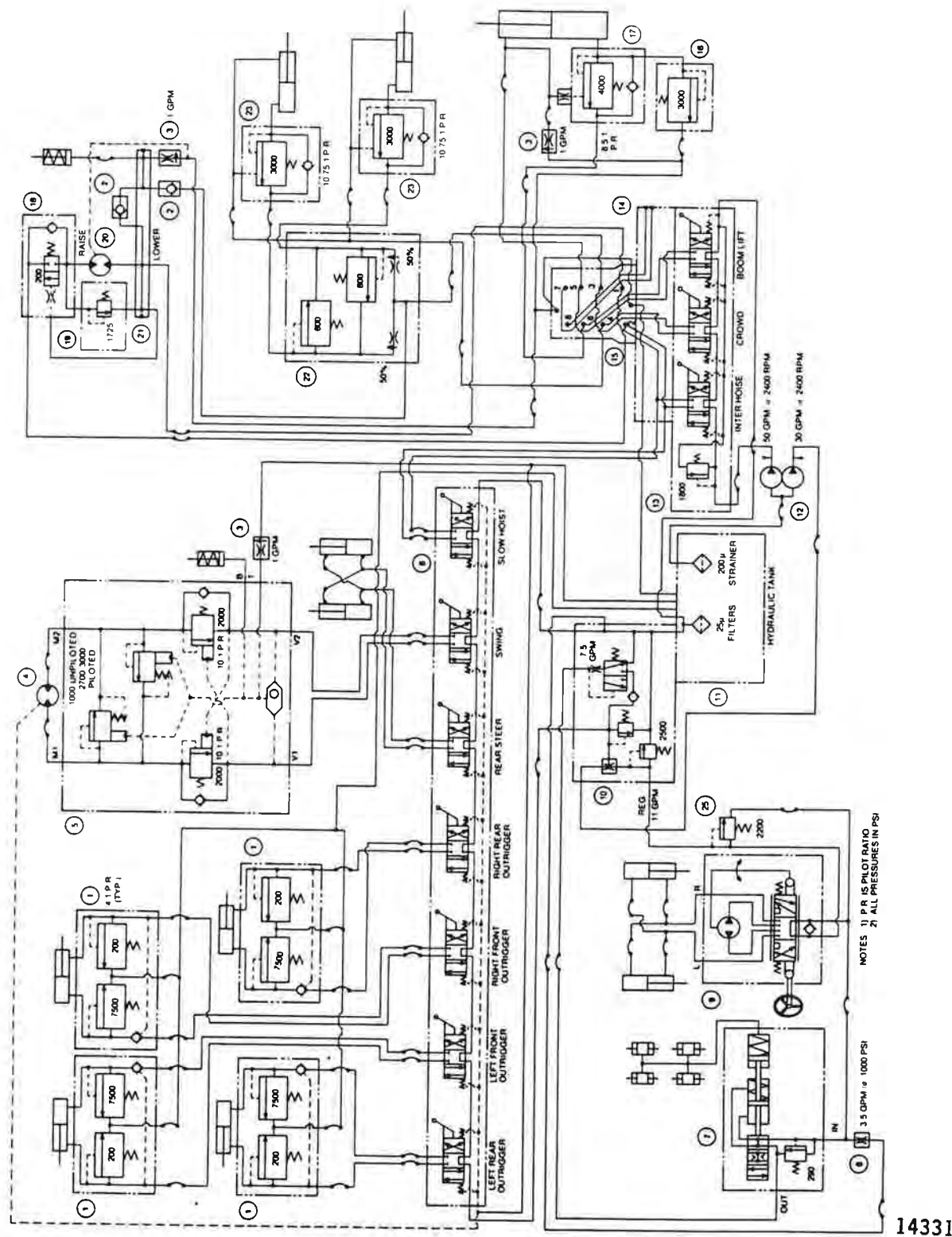


Figure 105
HYDRAULIC SCHEMATIC DEG-9200
(SHEET 1 of 2)

NOTES 1) P.R. IS PILOT RATIO
2) ALL PRESSURES IN PSI

3) 3.5 GPM @ 1000 PSI

**MAINTENANCE**SECTION 4
Page 57**150A (3 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST**

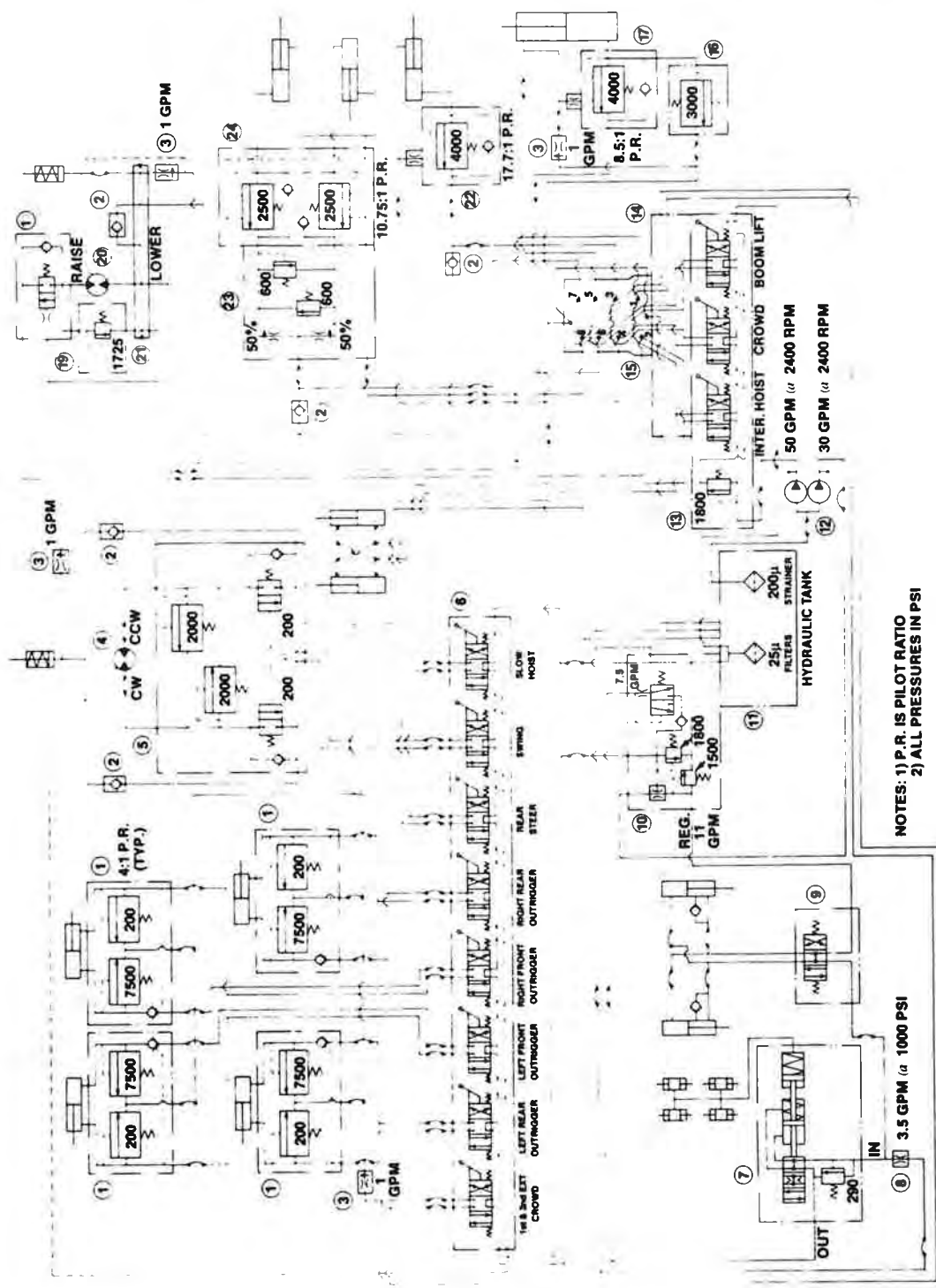
CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	1243 051 H91	SWING CONTROL VALVE
6	70450-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	153116	STEERING VALVE
10	158929	FLOW REGULATOR / DIVERter
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	78067-A	FLOW DIVIDER
23	77333	OVERCENTER VALVE
24	-----	-----
25	158117	RELIEF VALVE
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.

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MAINTENANCE

150A (4 SECTION FULL POWER BOOM) S/N 08624 THRU 09627



NOTES: 1) P.R. IS PILOT RATIO
2) ALL PRESSURES IN PSI

5 GPM (at 1000 PSI)

14313

Figure 106
HYDRAULIC SCHEMATIC K-162762
(SHEET 2 of 2)



MAINTENANCE

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150A (4 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST

CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	89362	COUNTERBALANCE VALVE
6	72161-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	67658	STEERING GEAR
10	92263	FLOW REGULATOR / DIVERTER
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	67838	OVERCENTER VALVE
23	84144	FLOW DIVIDER VALVE
24	84145	OVERCENTER VALVE
25	-----	-----
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.

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MAINTENANCE

150A (4 SECTION FULL POWER BOOM) S/N 09628 & UP

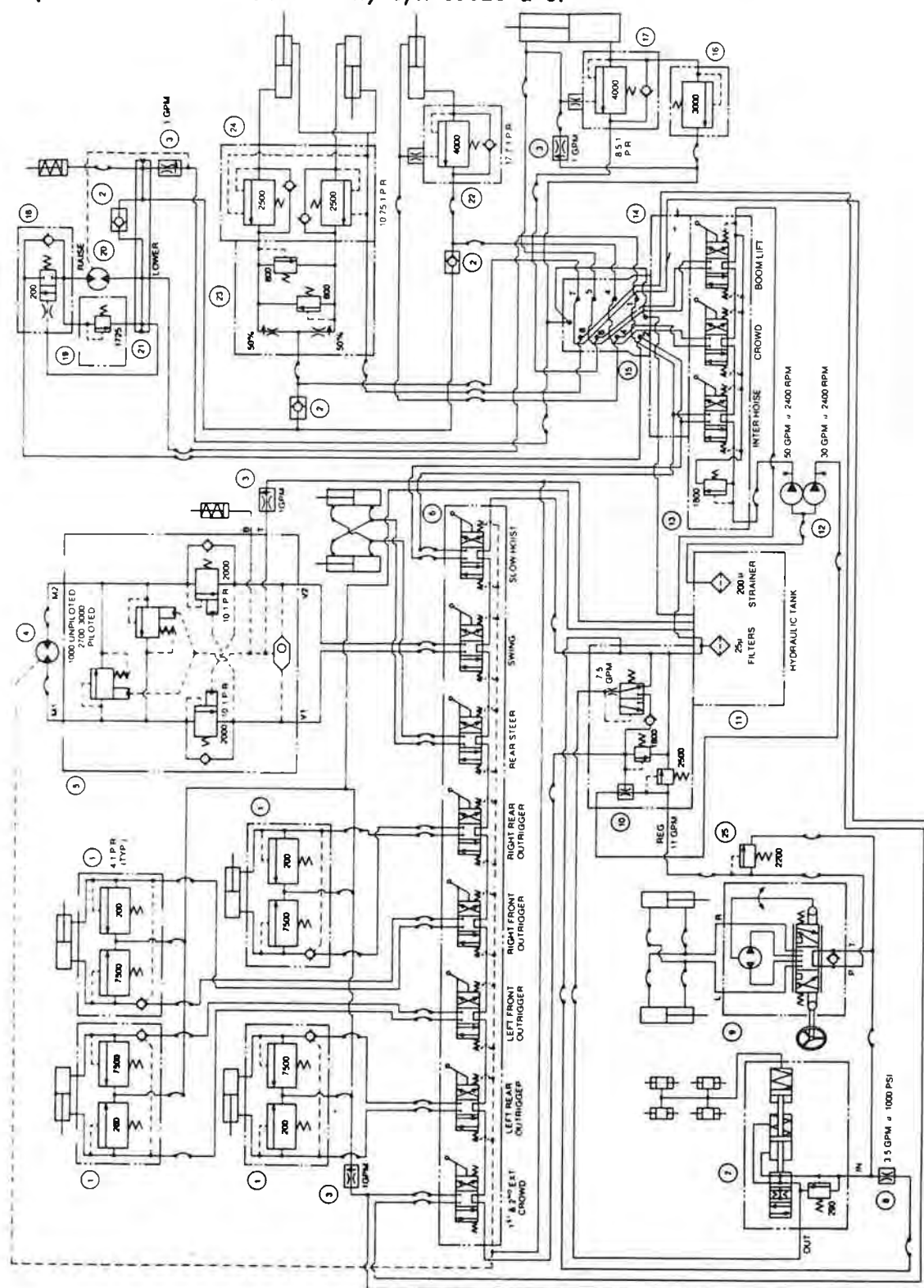


Figure 107
HYDRAULIC SCHEMATIC DEG-9200
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150A (4 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST

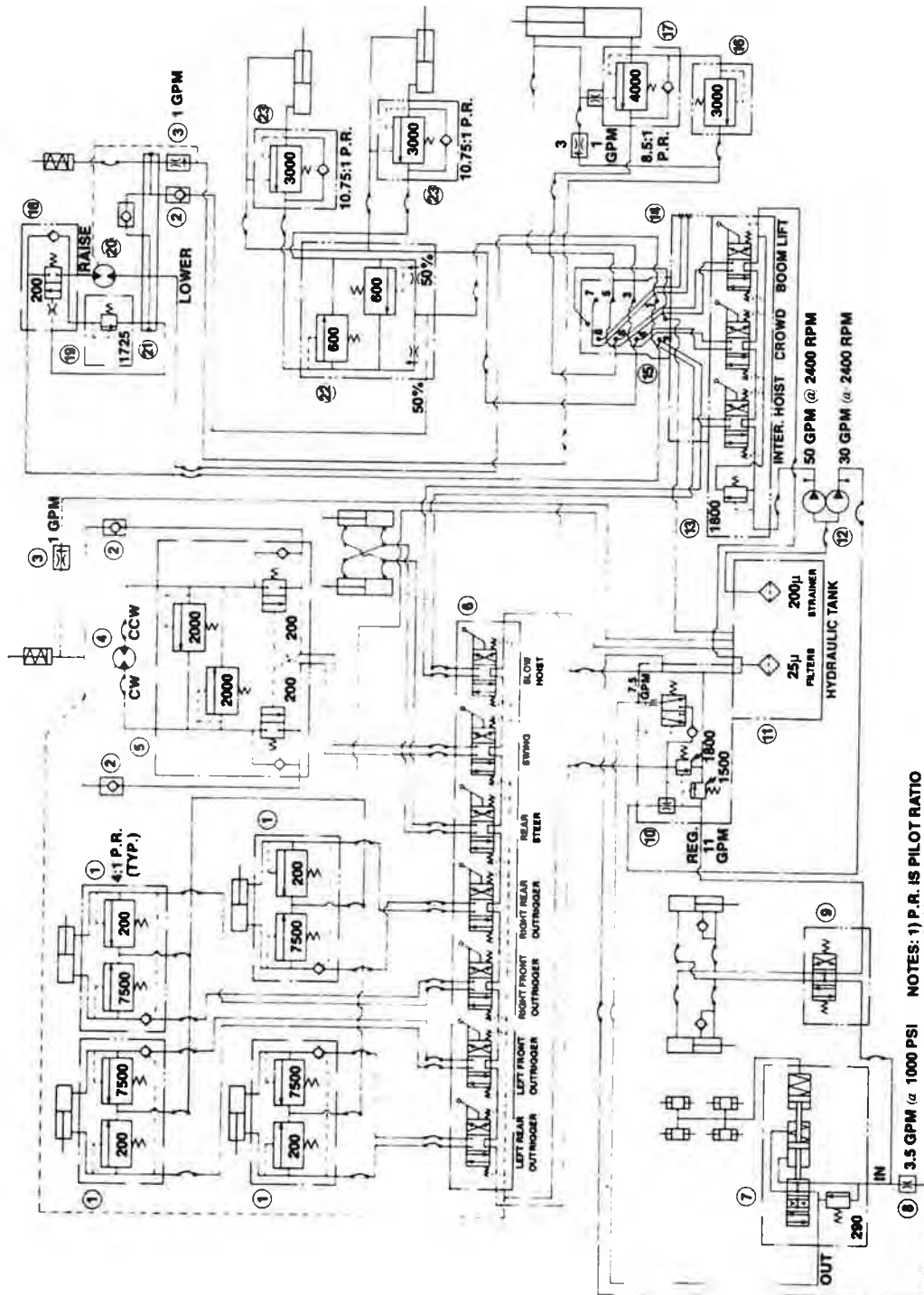
CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	1243 051 H91	SWING CONTROL VALVE
6	72161-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	158116	STEERING VALVE
10	158929	FLOW REGULATOR / DIVERTER
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	67838	OVERCENTER VALVE
23	84144	FLOW DIVIDER VALVE
24	84145	OVERCENTER VALVE
25	158117	RELIEF VALVE
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.



MAINTENANCE

150FA (3 SECTION FULL POWER BOOM) S/N 08624 THRU 09627



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Figure 108
HYDRAULIC SCHEMATIC K-162761
(SHEET 1 of 2)

NOTES: 1) P.R. IS PILOT RATIO
2) ALL PRESSURES IN PSI

**MAINTENANCE**SECTION 4
Page 63**150FA (3 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST**

CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	89362	COUNTERBALANCE VALVE
6	70450-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	67658	STEERING GEAR
10	92263	FLOW REGULATOR / DIVERter
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	78067-A	FLOW DIVIDER
23	77333	OVERCENTER VALVE
24	-----	-----
25	-----	-----
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.

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MAINTENANCE

150FA (3 SECTION FULL POWER BOOM) S/N 09628 & UP

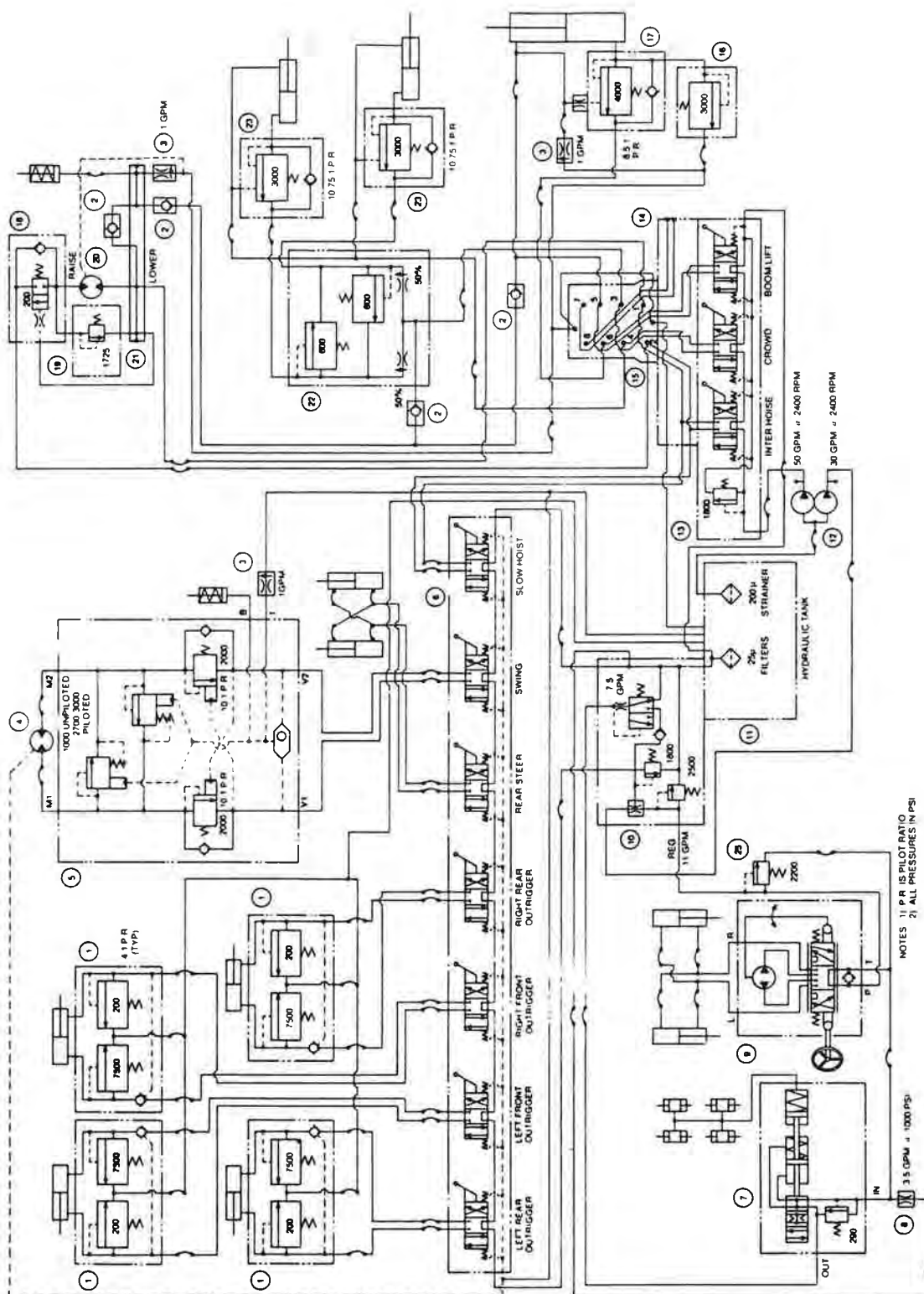


Figure 109
HYDRAULIC SCHEMATIC DEG-9322
(SHEET 1 of 2)

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**MAINTENANCE**SECTION 4
Page 65**150FA (3 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST**

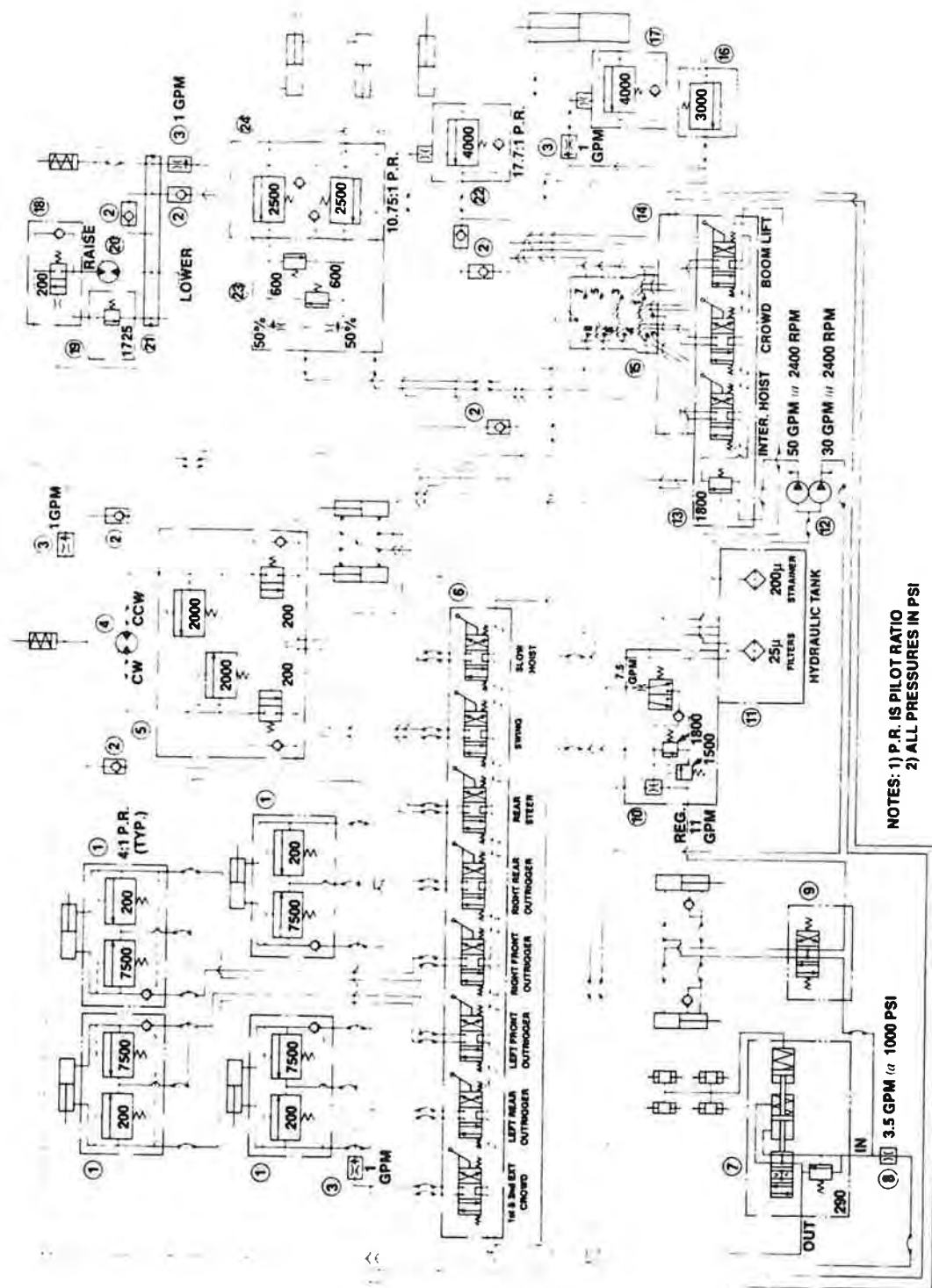
CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	1243 051 H91	SWING CONTROL VALVE
6	70450-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	158116	STEERING VALVE
10	158929	FLOW REGULATOR / DIVERter
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	78067-A	FLOW DIVIDER
23	77333	OVERCENTER VALVE
24	-----	-----
25	158117	RELIEF VALVE
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.



MAINTENANCE

150FA (4 SECTION FULL POWER BOOM) S/N 08624 THRU 09627



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Figure 110
HYDRAULIC SCHEMATIC K-162761
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150FA (4 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST

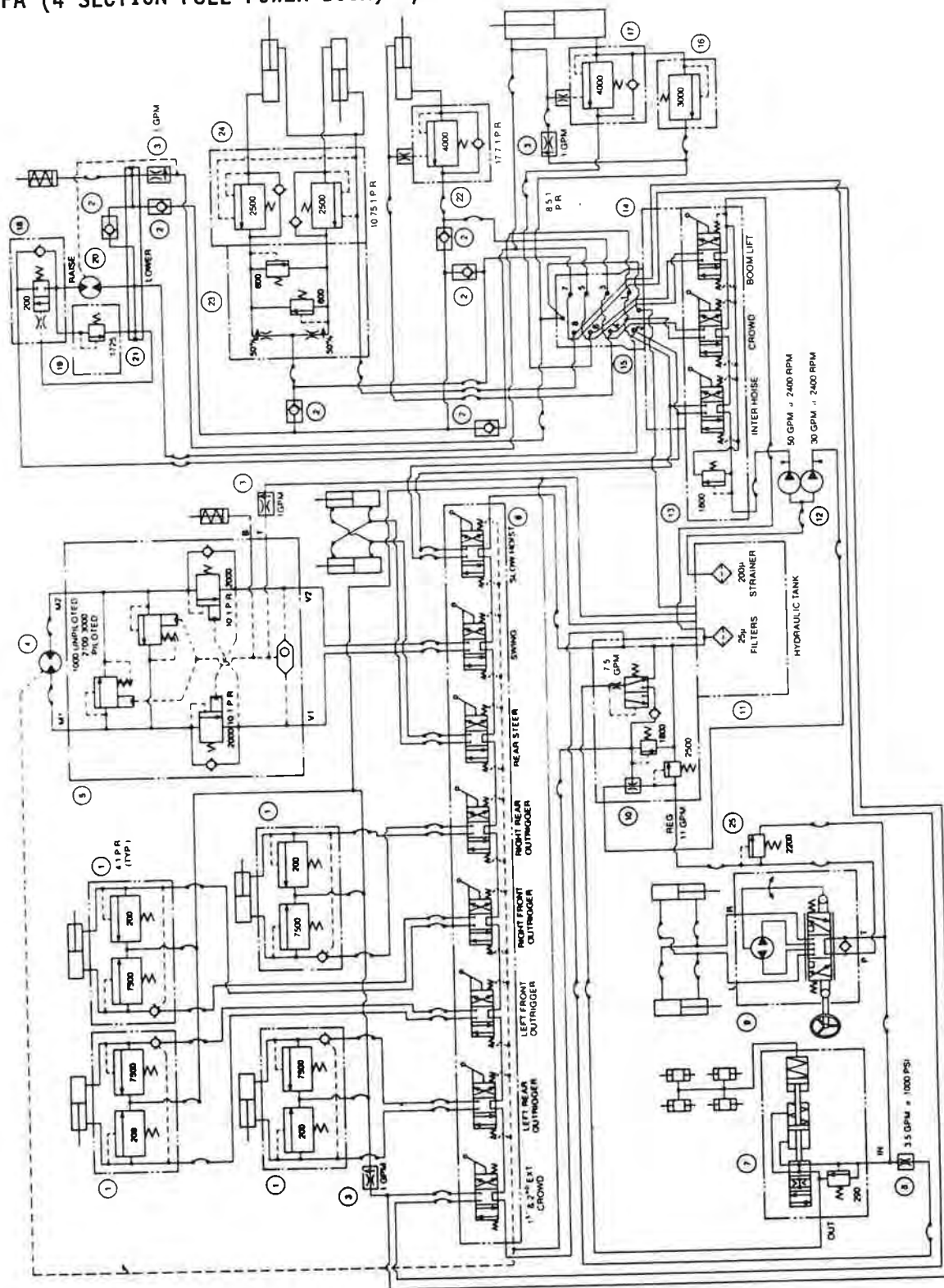
CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	89362	COUNTERBALANCE VALVE
6	72161-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	67658	STEERING GEAR
10	92263	FLOW REGULATOR / DIVERTER
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	67838	OVERCENTER VALVE
23	84144	FLOW DIVIDER VALVE
24	84145	OVERCENTER VALVE
25	-----	-----
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.



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150FA (4 SECTION FULL POWER BOOM) S/N 09628 & UP



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Figure 111
HYDRAULIC SCHEMATIC DEG-9322
(SHEET 2 of 2)

**MAINTENANCE**SECTION 4
Page 69**150FA (4 SECTION FULL POWER BOOM) SCHEMATIC CODE LIST**

CODE NUMBER	PART NUMBER	DESCRIPTION
1	67839	PILOT CHECK H.I.C. VALVE
2	66086	CHECK VALVE
3	66088	FLOW REGULATOR - 1 GPM
4	111408	HYDRAULIC MOTOR SWING
5	1243 051 H91	SWING CONTROL VALVE
6	72161-A	SECONDARY MANIFOLD
7	150758	POWER MASTER CYLINDER
8	118797	REDUCER W/ORIFICE
9	158116	STEERING VALVE
10	158929	FLOW REGULATOR / DIVERTER
11	105709	HYDRAULIC TANK ASSEMBLY
12	72989	HYDRAULIC PUMP
13	124838	PRIMARY MANIFOLD
14	126825	SPACER BLOCK
15	126826	ROTARY JOINT (INCLUDES ITEM 14)
16	137072	RELIEF VALVE - THERMAL
17	160899	OVERCENTER VALVE
18	97431	ANTICAVITATION VALVE
19	70970	RELIEF VALVE
20	108287	HYDRAULIC MOTOR - HOIST
21	73289	JUNCTION BLOCK
22	67838	OVERCENTER VALVE
23	84144	FLOW DIVIDER VALVE
24	84145	OVERCENTER VALVE
25	158117	RELIEF VALVE
26	-----	-----
27	-----	-----
28	-----	-----
29	-----	-----
30	-----	-----
31	-----	-----
32	-----	-----

NOTE: All part numbers are subject to change without notice. Always refer to latest Parts Book or Microfiche for current numbers.



MAINTENANCE

ENGINE AIR SYSTEM

To prevent the entrance of dirt into the engine, it is essential that periodic inspections be made of air cleaner hoses, elbows and piping connections between the manifold and air cleaner. Hose connections should be replaced prior to deterioration. To eliminate undue strain on piping and connections, make sure all components line up properly. See that all joints between the air cleaner and engine manifold are tight; this includes flexible connections and manifold gaskets. Be sure that manifold stud bolts are torqued to required torque values.

The cleaner is provided with an air intake cap screen (located on top of air intake stack) to prevent large particles such as chaff, leaves, etc. from entering the air cleaner. Keep this inlet screen clean. The holes must be kept open and free from paint. Dust, oil, or water may collect on the screen and clog the holes enough to restrict the flow of air to the engine. Restricted air flow will reduce the power delivered by the engine.

The air intake pipe from intake cap to air cleaner should not be allowed to collect dirt on the inside. Clean this pipe when the air cleaner is removed. At the same time, clean inlet tube to the air cleaner.

The Donacclone Cyclopac Air Cleaner supplied as standard equipment requires Daily/10 Hour service; more often under severe operating conditions.

A tight positive seal must be made between dust cup and cleaner after every servicing. Leakage at this point will increase dust loading and make it necessary to service filter elements more often. It is recommended that replacement gaskets be kept in stock at all times because of dust cup servicing and the possibility of damage to gasket.

Excessive exhaust smoke and/or loss of power may indicate need for filter element service. If equipment is available, measure air restrictions of cleaner with a vacuum gauge or water manometer at available restriction taps in the induction system. System is required when air restriction has increased to maximum allowable limits as established by engine manufacturer. replace tap plug securely after measuring.

NOTE: *If unit is being operated in below freezing weather an extra filter element should be kept in operator's cab to replace element that could become iced and cause restricted air flow to engine.*



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SECTION 4

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AIR FILTER ELEMENT SERVICING (SINGLE ELEMENT)

Stop engine.

Loosen clamp (1, Figure 112) and remove dust cup (2) from air cleaner housing (3).

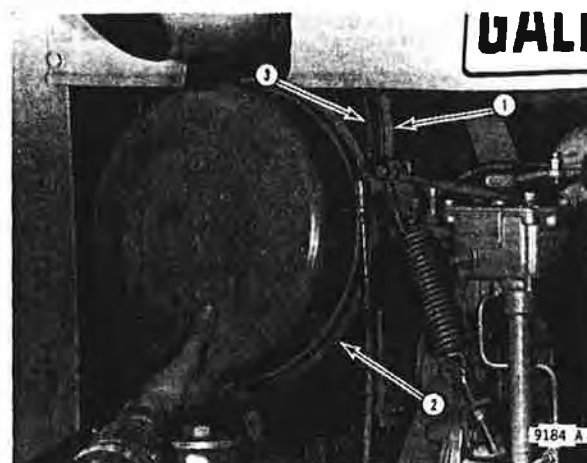


Figure 112

Remove wing nut (1, Figure 113) and baffle (2) from inside dust cup (3).

NOTE: Replace cup gasket (4) if it shows signs of wear, damage or leaks.

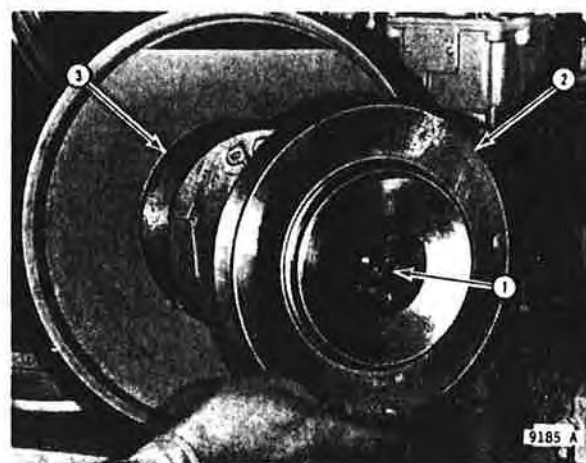


Figure 113

Dump dust out of dust cup (1, Figure 114). Wipe clean with dry cloth.

NOTE: Do not use oil, gasoline or oily waste to clean components.

Reassemble dust cup and baffle. Make sure cut away part of dust cup is inserted around baffle.

NOTE: The air cleaner will not function correctly if dust fills cup.

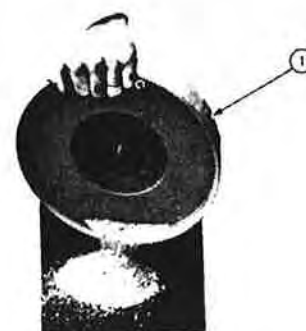


Figure 114



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MAINTENANCE

Remove bolt and gasket (not shown) that secure filter element (1, Figure 115) in air cleaner housing (2).

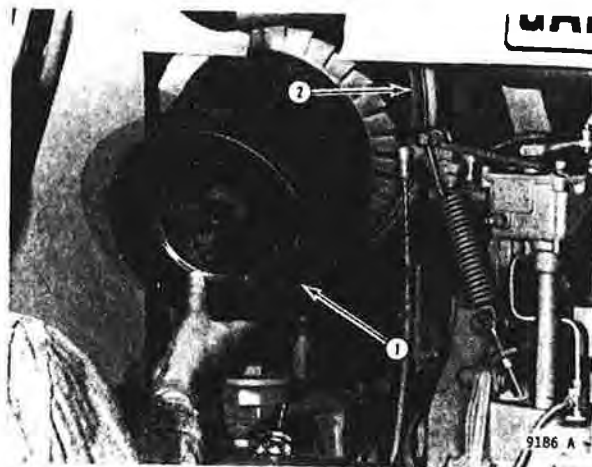


Figure 115

Clean air filter element (1, Figure 116) as outlined in "Air Filter Element Cleaning" section of this manual.

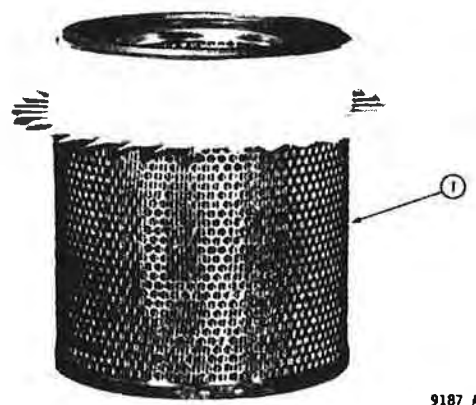


Figure 116

Wipe dust out of housing (1, Figure 117).

NOTE: *Do not use oil, gasoline or oily waste to clean components.*

Reassemble air cleaner in reverse order. Arrows on dust cup must point "UP" when installed on housing.

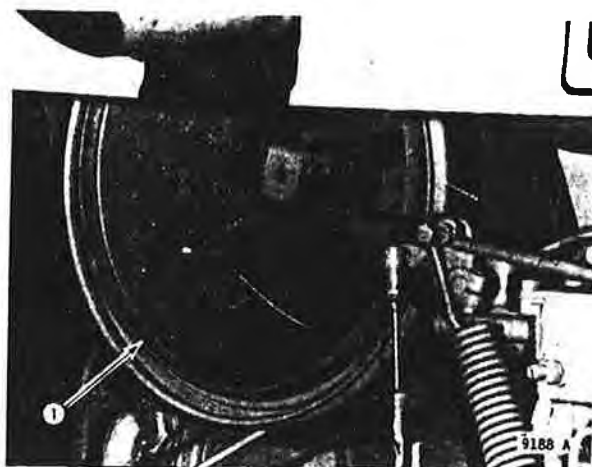


Figure 117



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AIR FILTER ELEMENT CLEANING

Although filter elements are normally considered expendable, proper and careful cleaning can extend their life several times. Maintenance schedules will depend upon the conditions in which the engine operates. Normally the filter element should be replaced after 1000 Hours of operation.

CLEANING WITH COMPRESSED AIR

Direct a jet of clean, dry air from the inside of the filter element perpendicular to the pleats.



WARNING! Pressure at air nozzle must not exceed 30 PSI (0.207 MPa). Always wear goggles when using compressed air.

Move the air jet up and down along pleats, slowly rotating the element, until no more dust is being removed.

CLEANING WITH WATER

Filter element can be cleaned by washing with water and a good non-sudsing detergent. First, direct a jet of clean, dry air from inside of the element. When the loose dust and soot have been removed, the element is ready to be washed. With detergent and water solution at about 100°F (38°C), soak the element in the solution for at least fifteen (15) minutes. Then, agitate the element for about two (2) minutes to loosen the dirt. Rinse the element with clean water until water is clear coming from element. Water hose pressure should not exceed 40 PSI (0.276 MPa). Air dry element thoroughly before using.

INSPECTING THE CLEANED FILTER ELEMENT

After cleaning the filter element, inspect the element for damage. A good method to detect ruptures in the element is to place a light inside the element and look toward the light from the outside. Any hole in the element, even the smallest, will pass dust to the engine and cause unnecessary engine wear.



MAINTENANCE

WIRE ROPE

Even though wire rope is one of the most uniform mechanical products made, a certain number of ropes fail prematurely. In most cases these failures are the result of abuse. Some of the more common types of abuses to wire rope are:



WARNING! KINKING - which results in localized wear, is generally caused by allowing a loop to form in a slack line and then pulling the loop to a tight permanent set.

WARNING! OVERLOADING - which results in complete fracture of the rope or crushing and distortion on the drums and sheaves, is caused by working the rope with a load too near its breaking strength.

WARNING! IMPROPER SIZING - permits strands in rope to become loose and unbalances a rope, throwing all of the load onto a few strands.

WARNING! IMPROPER SPOOLING - results in crushed and distorted ropes and comes from careless application and operation of the rope.

WARNING! WHIPPING A LINE - which results in many wires broken square off, comes from jerking the line or running it loose.



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WIRE ROPE SPECIFICATIONS

DRESSER Construction Equipment Division has carefully selected the 8 x 25 spin resistant construction for the cranes because this type best suits the application. The spin resistant feature is highly desirable in lifting unguided loads such as reeved for single part line. The 8-strand construction is favored over 6-strand construction due to greater flexibility, an extremely important feature that insures proper spooling on the winch drum.

<u>DRESSER PART NUMBER</u>	<u>LENGTH</u>	<u>APPLICATION</u>
89346	330' (100.58 M)	3 SECTION POWER BOOM
89347	450' (137.16 m)	4 SECTION POWER BOOM (STANDARD)
89348	500' (152.40 m)	4 SECTION POWER BOOM (OPTIONAL)

MANUFACTURER'S IDENTIFICATION

9/16" 8 x 25 Form-Set, Independent Wire Rope Core, Spin Resistant, Improved Plow Steel, Breaking Strength - Approximately 12.8 Tons (11.61 Mg)

WIRE ROPE LINE PULL

Single-Part Rating	6,200 Lbs.	(2,812 kg)
Two-Part Rating	12,400 Lbs.	(5,625 kg)
Three-Part Rating	18,600 Lbs.	(8,346 kg)
Four-Part Rating	24,800 Lbs.	(11,249 kg)
Five-Part Rating	31,000 Lbs.	(14,061 kg)

Substitutions may be made on the basis of minimum breaking strength at least equal or exceeding those for the 8 x 25 construction, the spin resistant feature, and the flexibility necessary to spool properly on the hoist drum.

MAINTENANCE RECOMMENDATIONS

Due to varying conditions, a definite time interval for inspection and lubrication can not be stated. See "Service and Inspection of Wire Rope" for further information.



MAINTENANCE

SERVICE AND INSPECTION OF WIRE ROPE

RESTING HOOK BLOCK

Before performing any of the following services to the wire rope, the hook block must be resting on the ground. The following procedure will reduce changes of displacing the wire rope when lubricating, changing hook blocks or replacing wire rope.

1. Raise boom head block (1, Figure 118) to approximately 3' (914.40 mm) above a fully depressed position.
2. Using hoist lower hook block (2) until it just touches the ground.

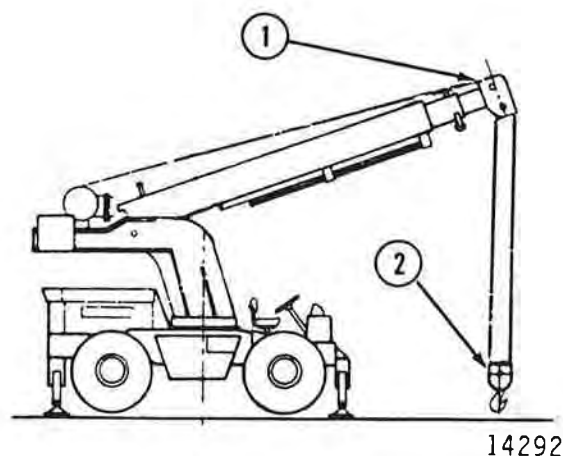


Figure 118

3. Lower boom until hook block (1, Figure 119) is resting on ground and wire rope (2) is slack.

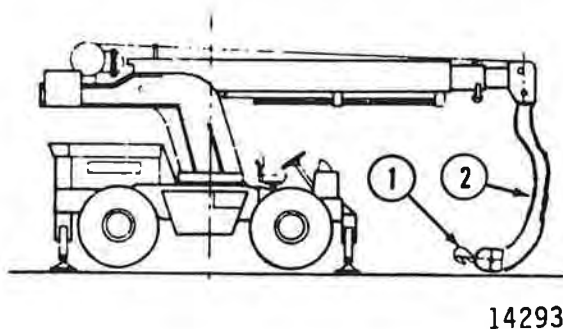


Figure 119

IMPORTANCE OF LUBRICATION

Lubrication is a vital part of the maintenance of the wire rope. Lubricate serves two purposes: it reduces wear and protects the wire rope.

When wire rope is in use, it gradually loses lubricant. The lubricant is squeezed out of a rope as it is worked under load. The internal wires rub against each other, and outside wires also wear against sheaves and drums. Lubrication reduces wear, both on the inside and on the outside of the wire rope.



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It is comparatively easy to observe that a rope is in need of lubrication by noting the following characteristics.

1. Creaking noise while the wire rope is spooling.
2. Breaking of the wires in the valley of the wire rope without any indications of uniform strand nicking. When a wire rope passes over a sheave there should be smooth interaction of wires.
3. The spring of the wire rope lessening without the lay being pulled down noticeably.

If a wire rope is allowed to become dry, corroded or rusty, and the sheave in which the rope is running is in a similar condition, it will cause the rope to slip. This slipping over the sheave abrades and cuts the rope and reduces its strength.

When a "rust-bound" rope receives a sudden jerk it can not absorb the shock of the load throughout its length; instead, it is confined to one spot and results in the breaking of one or more strands, and occasionally, the entire rope.

RECOMMENDED LUBRICANTS FOR WIRE ROPE

A recommended lubricant for wire rope is one that is a volatile solvent. This lubricant should have a consistency that permits cold application by brush, drip method or both. The volatile solvent carries the lubricant into the core of the rope, quickly evaporates, and leaves a film of lubricant as a residue. There are several brands of this type of lubricant on the market. One type is:

<u>BRAND NAME</u>	<u>SUPPLIER</u>
GULF FLUID LUBCOTE #3	GULF

<u>BRAND NAME</u>	<u>SUPPLIER</u>
TEXACO CRATER A	TEXACO
BROOKS KLINGFAST 85	BROOKS OIL CO.
GULF SENECA 39	GULF
WHITMORE'S WIRE ROPE LUBRICANT	WHITMORE MFG. CO.

NOTE: *Crude or used oils and greases should not be used as wire rope lubricants because they contain grit or acid, either of which can have a detrimental effect on wire rope.*



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Generally, a good field lubricant should have these characteristics.

1. Contain no acids or alkalis which will deteriorate wire rope.
2. Good adhesive properties, so it will stay on the rope.
3. Excellent penetrating qualities, so it can easily infiltrate the strands and wires.
4. Good protection against corrosion.
5. Non-solubility under all or most service conditions.
6. Resistance to oxidation, hardening, or crystallization.

METHODS OF LUBRICATION

Prior to lubricating a wire rope it is recommended that it be cleaned to remove accumulations of dirt, grit and other abrasive materials. Use a stiff wire brush and solvent, with compressed air, or steam. Lubricate wire rope immediately after cleaning using any of the following methods.



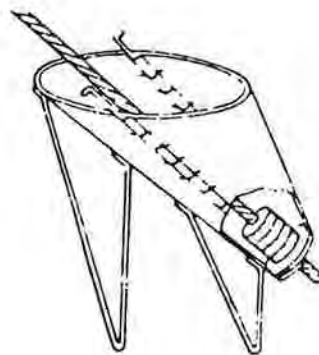
WARNING! Pressure at air nozzle must not exceed 30 PSI (0.207 MPa). Always wear goggles when using compressed air.

WARNING! Care should be exercised to avoid inhalation of vapors, exposure to the skin and creating fire hazards when using solvent type cleaners.

Metal split box for bath treatment has a burlap collar or wiper at outlet end. The sloping interior requires less oil, gives greater contact, better penetration.



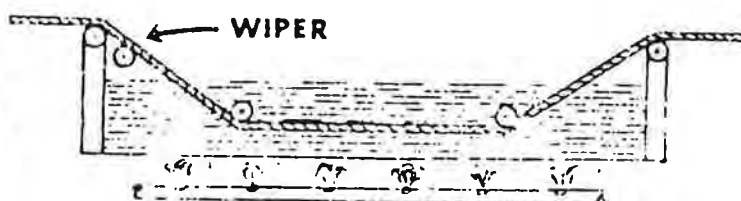
WARNING! Always wear suitable gloves when handling wire rope.



14294

Figure 120

Hot bath method of applying heavier bodied lubricant at high temperatures. Steam heat may be used to heat the lubricant. Preheated lubrication is always more penetrating. Rope should run through slowly to ensure penetration.



14295

Figure 121



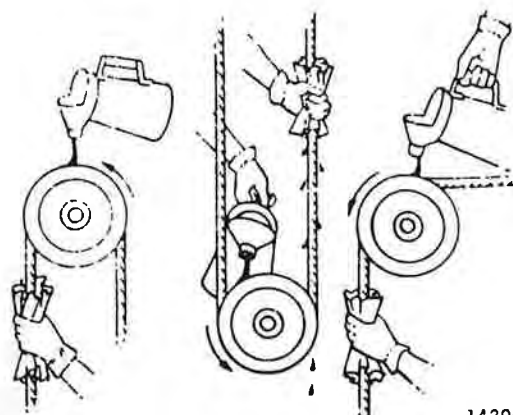
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The pour-on method is effective and adhesive when heated 10W oil is used.



WARNING! Be sure to hold wiping swab **BEHIND** the sheave. This catches any excess oil that would be carried on along the rope.



14296

Figure 122

LUBRICATION IN STORAGE

Ropes kept in storage dry out quickly. Lubricate them frequently, or have a sealing compound applied which will retain the lubricant. Before putting the into service, carefully inspect rope for condition of lubricant and presence of corrosion.

IDLE ROPES

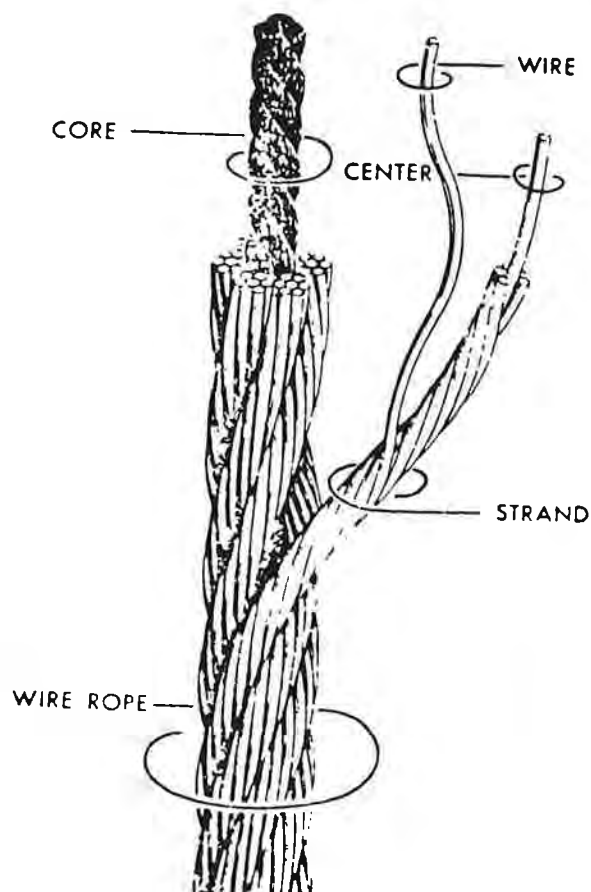
When ropes that have been in service are kept idle, as in shutdown of operation, they should receive protective care. Condensation in many instances, settles on the rope causing heavier corrosion and rust. The rope lubricant "weathers" out, particularly if the rope is exposed to outside conditions or kept in a hot or dusty area.

It is advisable to run the rope several times a week even if only with a light load. If the rope must be kept inactively wound on the drum for any length of time, it is wise to smear each layer of the rope as it is wound on the drum, with a covering of petrolatum, cupgrease or similar jelly-like protective coating. Otherwise moisture seeps into the rope, often causing dangerous deterioration.



MAINTENANCE

COMPONENT PARTS OF WIRE ROPE



14297

Figure 123

INSPECTION OF WIRE ROPE, SHEAVES & DRUM

Wire Rope

In some operations, the wire rope can be run to its complete service life without injuring or endangering life.

Where risk is involved, it is desirable to estimate the remaining strength and service life of a worn rope.

A rope, like a chain, is only as good as its weakest point; that point being the POINT SHOWING THE MOST WEAR. The following information is taken from a National Consensus Standard as referenced by Federal Government Agencies supplied by CIMA (Construction Industry Manufacturers Association).

Wire rope replacement may vary according to Federal, State, or Local Codes and in accordance to the type of rope used. Specific information on the care, inspection, and replacement of wire rope can be obtained from any wire rope manufacturer.



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Some general guidelines for wire rope replacement using steel sheaves are the following.

1. In running rope, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay.
2. One outer wire broken at the point of contact with the core of the rope which has worked its way out of the rope structure and protrudes or loops out from the rope structure. Additional inspection of this section is required.
3. Wear of one-third of the original diameter of outside individual wires.
4. Kinking, crushing, birdcaging, or any other damage resulting in distortion of the rope structure.
5. Evidence of any heat damage from any cause.
6. Reduction from nominal diameter of more than:
 - a. 1/64 In. (0.4 mm) for diameters up to and including 5/16 In. (8.0 mm).
 - b. 1/32 In. (0.8 mm) for diameters 3/8 In. (9.5 mm), to and including 1/2 In. (13.0 mm).
 - c. 3/64 In. (1.2 mm) for diameters 9/16 In. (14.5 mm), to and including 3/4 In. (19.0 mm).
 - d. 1/16 In. (1.6 mm) for diameters 7/8 In. (22.0 mm), to and including 1-1/8 In. (29.0 mm).
 - e. 3/32 In. (2.4 mm) for diameters 1-1/4 In. (32.0 mm), to and including 1-1/2 In. (38.0 mm).
7. In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.
8. When evidence of core failure in rotation resistant ropes is recognized by a lengthening of the lay and a localized reduction in diameter.
9. Inspect sheave grooves for excessive wear.

Certain sections of wire rope often get more wear than others.

Rope on a drum with two or more layers will wear at the point where the rope starts each successive layer, and also at the point where they are dead-ended.



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Sheaves and Drum

The sheaves and drum should be inspected frequently. A scored drum and battered lagging will impair wire rope service. Broken or scored sheaves will damage the outer wires of the rope. Worn sheave guards may permit a rope to jump the sheaves and cause an expensive, and possibly dangerous accident.

These points are watched carefully by all good operator's.

HOOK BLOCK INSPECTION

It is recommended that a Daily/10 Hour Inspection and a 500 Hour and/or Annual Inspection be made of the hook block.

Daily/10 Hour Inspection

A Daily/10 Hour Inspection can be made by visually and physically examining the hook block as outlined in the following steps:

1. The hook must be able to rotate freely 360° without any binding.

NOTE: While rotating the hook, push it upwards to see if there is any noticeable end play in the thrust bearing. If there is an abnormal amount of end play, the hook block must be disassembled to make further inspection of the thrust bearing, in accordance to the appropriate Shop Manual section.

2. Hook blocks with trunnion mounted hooks must be checked to be sure that the hook can pivot freely. The hook is designed to pivot so that the entire hook block does not react to motions of the load which is being lifted. Also this design helps prevent load shifting of chains, slings, etc., in the hook which can cause damage to the hook.
3. The sheave must be able to rotate freely. If they do not rotate properly, the wire rope and sheave will interact together, wearing both of them and also cause load jerking. Raise and lower the hook without any load to observe whether the sheaves are rotating freely. If jerky motion is observed, the hook block must be disassembled to make further inspection in accordance to the appropriate Shop Manual section.
4. Check the hook for cracks, gouges or other indications of wear. If any of these conditions exist, the hook must be taken out of service and destroyed.
5. Check for hook spreading or twisting. An easy way to determine the satisfactory limit is to check to see if the hook latch does not contact the hook, then if so, the hook must be replaced, as the hook is not satisfactory and is unsafe. Destroy the unsafe hook.



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Annual/500 Hour Inspection

It is required that a complete inspection be made of the hook block assembly on a regular schedule, at each 500 Hours of operation or annually, whichever comes first.

For this inspection, the hook block assembly must be completely disassembled. Care must be taken to observe the position of side weights in the hook block assembly for reassembly of the side weights in exactly the same position as originally found. Refer to the appropriate Shop Manual section for complete instructions on disassembly and reassembly of the hook block.

Clean all parts in suitable cleaning solvent before the inspection is made. Inspect the hook for twisting or spreading. An easy way to determine the satisfactory limit is that if the latch does not contact the hook, then the hook must be replaced, as the hook is not satisfactory and is unsafe. If the hook is not replaced for twisted or spreading condition, then a magnetic-particle inspection must be performed, including the tread area. If one or more cracks are found, then replacement of the hook is necessary. It is particularly important to inspect the threads on the hook for any wear, cracks, pulling or other damage of any kind. If any thread damage is found, then the hook must be replaced.

NOTE: *Always destroy worn and damaged hooks.*

The nut which is used to secure the hook to the hook block assembly is also to be tested and inspected in the same manner as the hook. Besides inspecting for thread damage and cracks, it must also be tested for proper hardness. The following is a list of nuts used on various hook block assemblies with their hardness values. Refer to latest Microfiche and/or Parts Manual for the nut used on your particular hook block assembly.

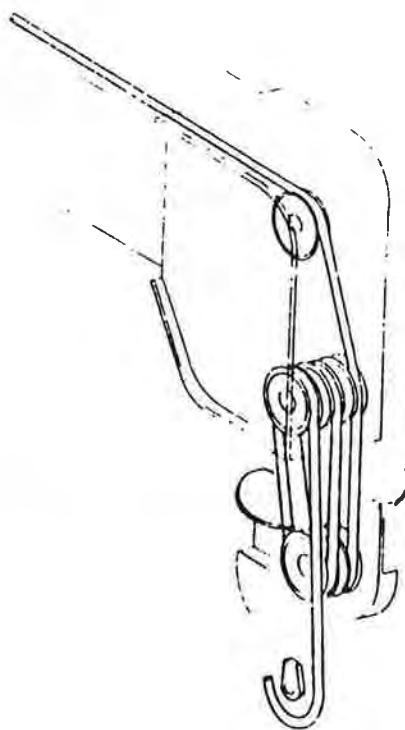
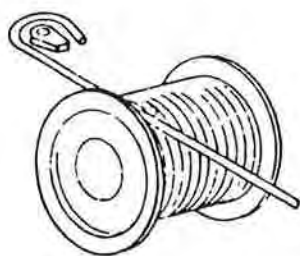
<u>PART NUMBER</u>	<u>HARDNESS VALUE</u>
7520	ROCKWELL C-32
* 17046	ROCKWELL C-24 - C-38
102474	BRINELL TEST 150 - 200
102560	ROCKWELL C-19 or BRINELL TEST 223

* **NOTE:** *Used of 150A and 150FA.*



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WIRE ROPE REPLACEMENT



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Figure 124

When replacing wire rope extreme care must be taken not to put kinks or unnecessary bends into the rope.

As illustrated, when installing wedges in either drum or socket, the rope must be brought back straight and turned, not twisted, around wedge and inserted into slot.



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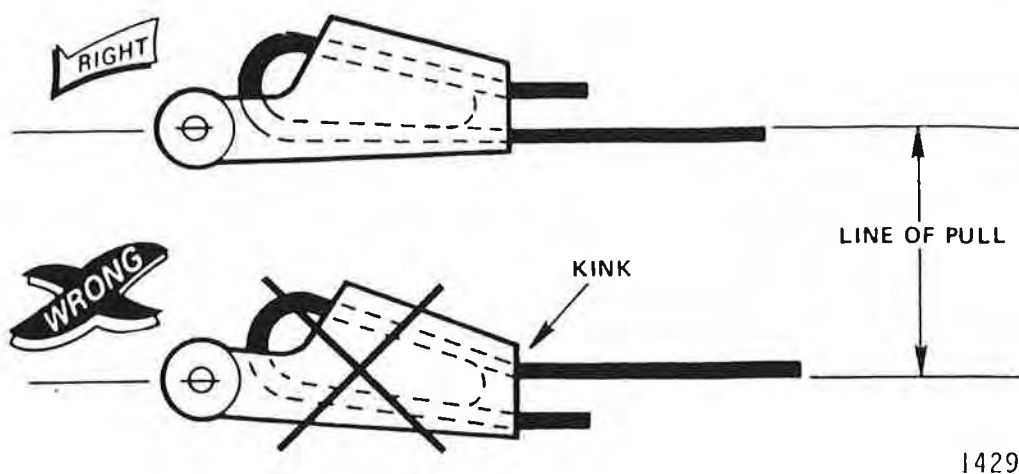


Figure 125

Insert working portion of the wire rope into straight side of socket. If not installed correctly, clamp will bend and weaken wire rope.



WARNING! Always wear suitable gloves when handling wire rope.



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INSTALLATION OF WIRE ROPE

A wire rope can be damaged permanently even before it has gone into operation. Unwinding from a reel the wrong way can put destructive kinks and dog legs in the rope. If the reel can be set on jacks, unwind from the topside of the reel as shown in Figure 128. If the wire rope is supplied in coil, uncoil by rolling the coil slowly like a wheel, leaving behind a trail of straight rope. Uncoiling by laying the coil flat and pulling off the top will give you hard-to-handle, kinky rope.

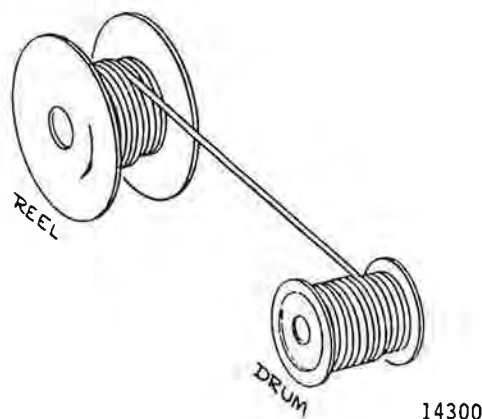


Figure 128

BREAKING IN WIRE ROPE



WARNING! After new wire rope is installed, first operated crane with a light load to let wire rope adjust itself.

A new rope can be easily damaged by any operating error. A few trips through the working cycle at slow speeds and light loads will set the strands more firmly in place.

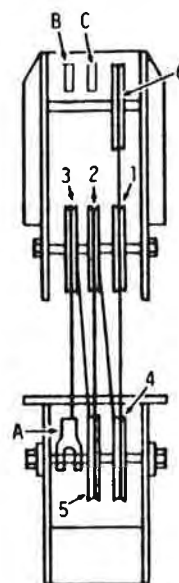
It will also give the operator an opportunity to see that the drums and sheaves are operating properly and are fitted to the new rope.



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HOOK AND HEAD BLOCK REEVING



14301

Figure 129

Figure 129, shows the head and hook block reeving as viewed from the front of the crane. The crane is cable of being reeved from one to five parts of line. Always rest the hook block on the ground prior to reeving.

Five part line - reeve as shown above. The crane is shipped from the factory with this configuration.

Four part line - remove rope from wedge socket "A" and install in wedge socket "B."

Three part line - remove rope from wedge socket "A." Remove rope from sheave #3 and sheave #5, then install rope in wedge socket "A."

Two part line - remove rope from wedge socket "A" and from sheaves #2, 3, 4, and 5. Thread rope from sheave #1 to sheave #5, and install in wedge socket "C."

Single part line - remove rope from wedge socket "A" and from sheaves #2, 3, 4, and 5. Attach rope to a single-line weighted hook block.



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DRIVE BELT TENSION

New drive belts will stretch after the first few hours of operation. Run the engine for a few minutes to seat the belt, then retension it. Retension drive belt after 1/2 hour and again after 10 Hours of operation. Thereafter, check the tension of the drive belt every 100 Hours and adjust belt, if necessary.

Adjust the belt tension so that a firm push with the thumb, 25 Lbs. (11.33 kg) load, at a point midway between two pulleys that are farthest apart will depress the belt from 3/8" to 1/2" (9.53 mm to 12.7 mm). DO NOT OVER TENSION.

Replace badly worn, greasy or cracked belt(s) immediately. These conditions prevent proper belt function. If one belt needs replacing, both must be replaced if they are a matched set.

Drive belts that squeak do not indicate a worn belt or belt out of adjustment. The belts can be cleaned with brake fluid.

NOTE: When adjusting fan belt tension, make sure radiator shroud will not interfere with fan blade.

BOOM ROLLER ADJUSTMENT

Adjust rollers (1, Figure 130) against bottom of extension until approximately 1/16" to 1/4" (1.59 mm to 6.35 mm) clearance exists between top portion of extensions and base section at point (2).

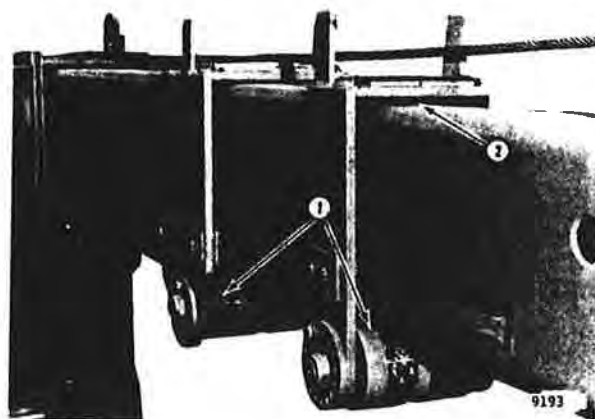


Figure 130



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BOOM WEAR PAD SUPPORT ADJUSTMENT

Adjust the wear pad support assemblies (1, Figure 131) against bottom of boom sections until approximately 1/16" to 1/4" (1.59 mm to 6.35 mm) clearance exists between top portion of extensions and base section at point (2).

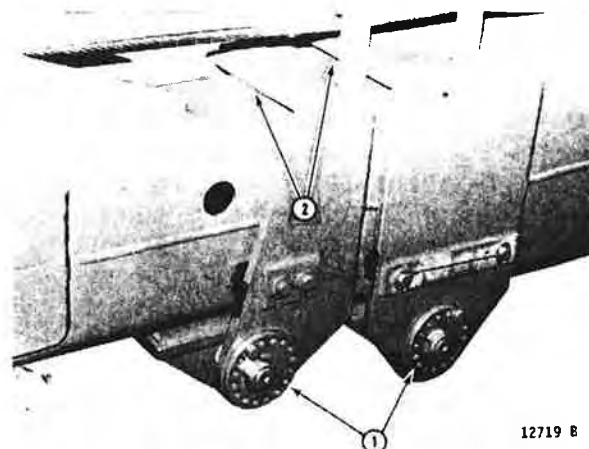


Figure 131

ROTARY JOINT DRIVE SCREWS

Periodic inspection of the clearance of these screws is mandatory to keep the rotary joint in time or phase with the rotation of the pedestal.

Check clearance between rotary joint drive cap screws and pedestal. adjust if necessary to 1/16" (1.59 mm) clearance on either side. Lock with jam nut.

NOTE: *Crane must not be operated with these screws tight against the pedestal.*



Figure 132

**MAINTENANCE****RETRACT REEL - SPRING MOTOR**

The proper tension on the boom hoses is vital to hose life. The tension for the hoses is applied by the spring motor assembly. Before properly setting the spring tension on the motor assembly, it is recommended that the spanner wrench, mounted on top of the motor, be modified.

Remove spanner wrench from mounting on top of the motor.

The modification below will aid in the tensioning of the springs in the motor.

The formed end of the wrench with the hole, should be bent 1" (25.4 mm) from the straight piece with the studs and it should be parallel with this piece. See Figure 134, below.

Weld a piece of bar stock 1" x 1/4" x 24" (25.4 mm x 6.35 mm x 609.6 mm) in length to the spanner wrench as shown in Figure 134.



Figure 133

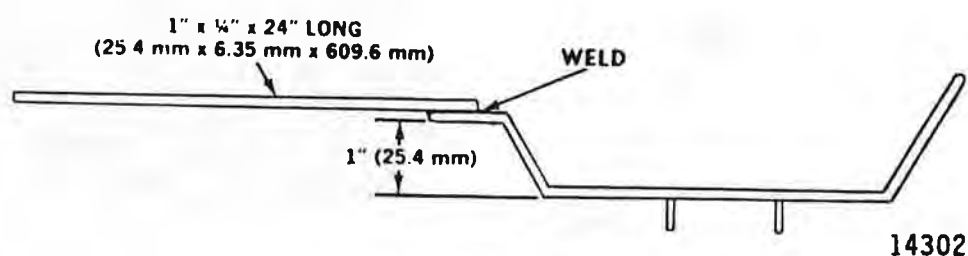


Figure 134

With the boom fully retracted and lowered, remove hose guards. Remove the cover plate from the motor spring pack and attach the spanner wrench. Place the wrench studs in the holes provided in the motor shaft. Through the center hole in the wrench, insert and hand tighten a 1/4" - 20 UNC x 1-1/4" or 1-1/2" cap screw. This will prevent the wrench from slipping out of the motor.

NOTE: *If there is no hole in the center of the shaft, drill and tap the motor shaft to take a 1/4" - 20 UNC cap screw.*

Prior to adjustment of spring motor, put all the outriggers to the ground, boom out to maximum extended length. If spring motor is functioning properly spring indicators will fall into case (see Figure 138). If a spring is broken the indicator will remain at top of case and will require replacement. Retract boom after inspection of indicators is made prior to performing the following adjustments.



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Install a pair of locking pliers (1, Figure 135) on trolley track approximately 6" (152 mm) behind the hose sheave. This will prevent the hoses from sliding down the trolley when the cable has been disconnected.



WARNING! Use extreme care when putting tension on the springs. Hold the spanner wrench with a firm grip.

To disconnect the cable, turn the spanner wrench (2) counterclockwise. When there is slack in the cable and while holding the spanner wrench firmly, have another person disconnect the cable from the hose sheave.

SLOWLY allow the spanner wrench (1, Figure 136) to turn clockwise until there is no tension on the motor springs. While holding the spanner wrench, rotate the cable drum clockwise to completely rewind all cable (2) onto drum.



WARNING! Do not let go of the cable. Do not let go of the spanner wrench until there is no tension on the springs.



Figure 135

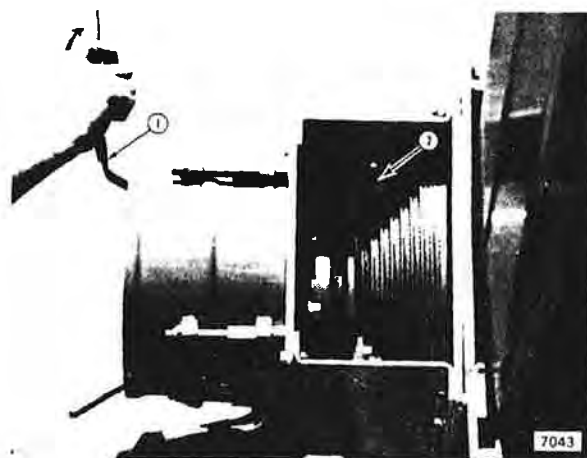


Figure 136



WARNING! Use extreme care when putting tension on the springs. hold the spanner wrench with a firm grip.

With the cable fully rewound, begin turning the spanner wrench (1, Figure 137) counterclockwise to slack the cable.



WARNING! One person should keep tension on the cable while another turns the spanner wrench.

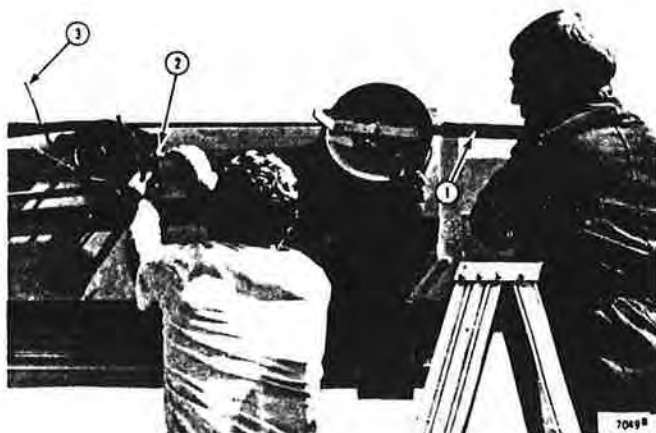


Figure 137

CONT'D NEXT PAGE

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Connect the motor cable (2, Figure 137) to the hose sheave making certain that both the jam nuts are fully threaded on the cable end and tightened.

SLOWLY allow spanner wrench to turn clockwise until the slack is taken up in the cable. there should not be any drop in the hoses.

Remove the spanner wrench and mount on top of the motor assembly. Replace the cover plate and remove the locking pliers (3, Figure 137) from the trolley track.

Put all the outriggers to the ground and fully extend the boom over the front of the machine. Retract the boom, check hoses, they should still remain taut.

Install hose guards, inspect the hose pulley to be certain that hoses do not rub

LUBRICATION OF RETRACT REEL - SPRING MOTOR

Lower outriggers and fully extend the boom (fully horizontal over the front of the crane).

Remove the two spring tension indicators and/or lubrication screws on the housing top.



WARNING! If spring tension indicators on top of housing do not drop after extending boom, an inspection must be made of the motor. Damage to hoses may result due to improper motor function.



Figure 138

Through the spring tension indicator holes, add approximately 1 U.S. Pint (0.47 liter) SAE 10W oil to each housing.

Each spring of the spring motor requires approximately 1 U.S. Pint (0.47 liter) SAE 10W oil applied every thirty to sixty days.

NOTE: When operating in temperatures below -20°F (-29°C), use Dexron or Automatic Transmission Fluid Type A, Suffix A.

Cycle boom, retract and extend, to thoroughly cover spring with oil. Excess oil may drain through the housing and cover plate.

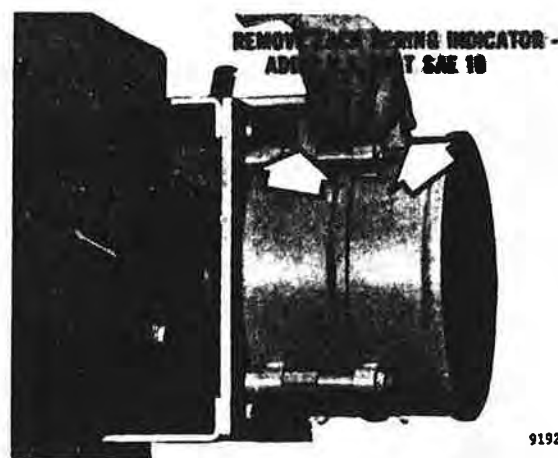


Figure 139

NOTE: This lubrication process must be repeated every thirty to sixty days.



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TRANSMISSIONS CHECKS (CLARK 18000 SERIES TRANSMISSION SERVICES)

DAILY/10 HOUR SERVICE

TRANSMISSION SHIFT LINKAGE

1. Place forward and reverse control lever in "NEUTRAL."
2. Set parking brake.
3. Shutdown engine.
4. Using grease gun, lubricate zerk.
5. Operate levers to ensure proper distribution of lubricant.



Figure 140
TRANSMISSION SHIFT LINKAGE

TRANSMISSION OIL LEVEL CHECK

1. Place forward and reverse control lever in "NEUTRAL."
2. Set parking brake.
3. Oil must be at operating temperature of 180°F - 200°F (82°C - 93°C).
4. With engine running, check oil level. Oil must be between "LOW" and "FULL" marks on dipstick. If oil must be added, shutdown engine and add oil through dipstick tube.
5. After oil has been added, start engine and recheck oil level.

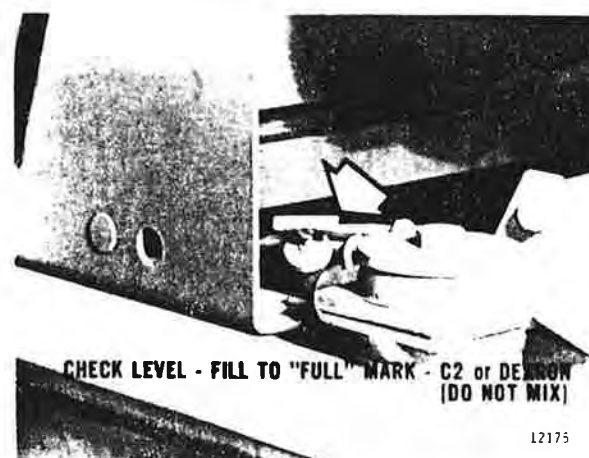


Figure 141
TRANSMISSION AND CONVERTER
DIPSTICK AND FILL TUBE

NOTE: Refer to "Lubrication Specification" section of this manual for proper oil.



MAINTENANCE

WEEKLY/50 HOUR SERVICE

TRANSMISSION SHIFT LINKAGE

1. Place forward and reverse control lever in "NEUTRAL."
2. Set parking brake.
3. Shutdown engine.
4. Clean the shift linkage points and lubricate with CO (can oil). Any 10W oil will work.

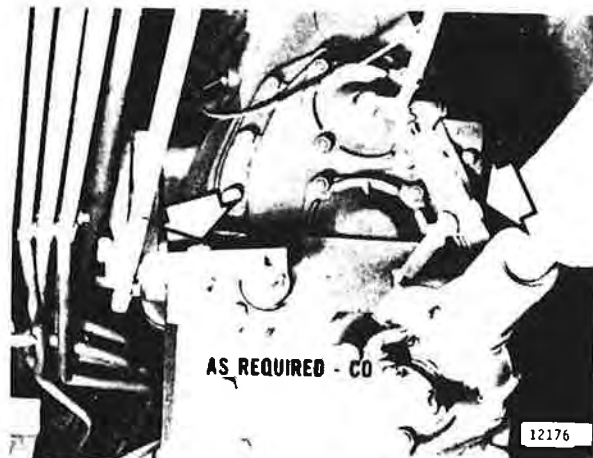


Figure 142
TRANSMISSION SHIFT LINKAGE

250 HOUR SERVICE

TRANSMISSION AND TORQUE CONVERTER FILTER

1. Place forward and reverse control lever in "NEUTRAL."
2. Set parking brake and shutdown engine.
3. Unscrew filter element from top L.H. side of transmission and discard.
4. Install new element. Lightly coat element seal ring with clean transmission fluid to ensure positive seal. Screw on hand tight.
5. Start engine and check for proper oil level and leaks.



Figure 143
TRANSMISSION AND CONVERTER
FILTER



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500 HOUR SERVICE

TRANSMISSION DRAINING AND FILLING

1. Place forward and reverse control lever in "NEUTRAL."
2. Set parking brake.
3. Oil must be at operating temperature of 180° - 200°F (82°-93°C).

NOTE: *This will put sediment into suspension and also allow the oil to drain more freely.*

4. Shutdown engine.
5. Remove drain plug(s) and screen to drain oil. Discard drained oil.



WARNING! Be careful to prevent burns to hands, arms, etc., when draining oil.

NOTE: *Torque converter and transmission hold 5 U.S. Gallons (19 liters).*

6. Clean screen using solvent type cleaner.



WARNING! Care should be exercised to avoid exposure to skin, fire hazards and inhalation of vapors when using solvent type cleaners.

7. Reinstall drain plug(s).
8. Reinstall screen making sure that screen gasket and mating surfaces are thoroughly clean of foreign particles that may cause leaks.

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Figure 144
TRANSMISSION AND CONVERTER
DRAIN PLUGS

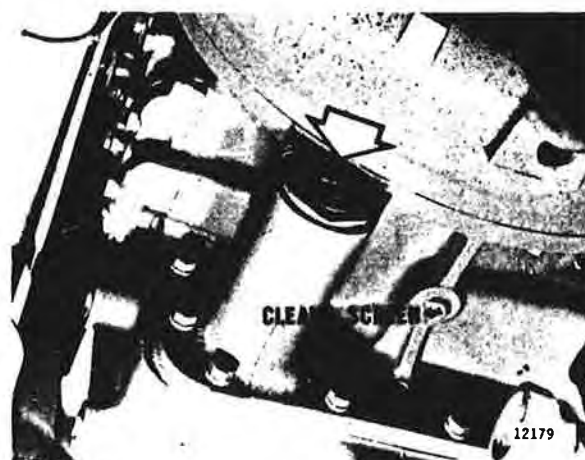


Figure 145
TRANSMISSION AND CONVERTER
SCREEN



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9. Remove breather from housing and clean using solvent type cleaner.
10. Reinstall breather.
11. Add oil as outlined under Daily/10 Hour Service. Check level. Add oil prior to starting engine.

NOTE: *Torque converter and transmission hold 5 U.S. Gallons (19 liters).*



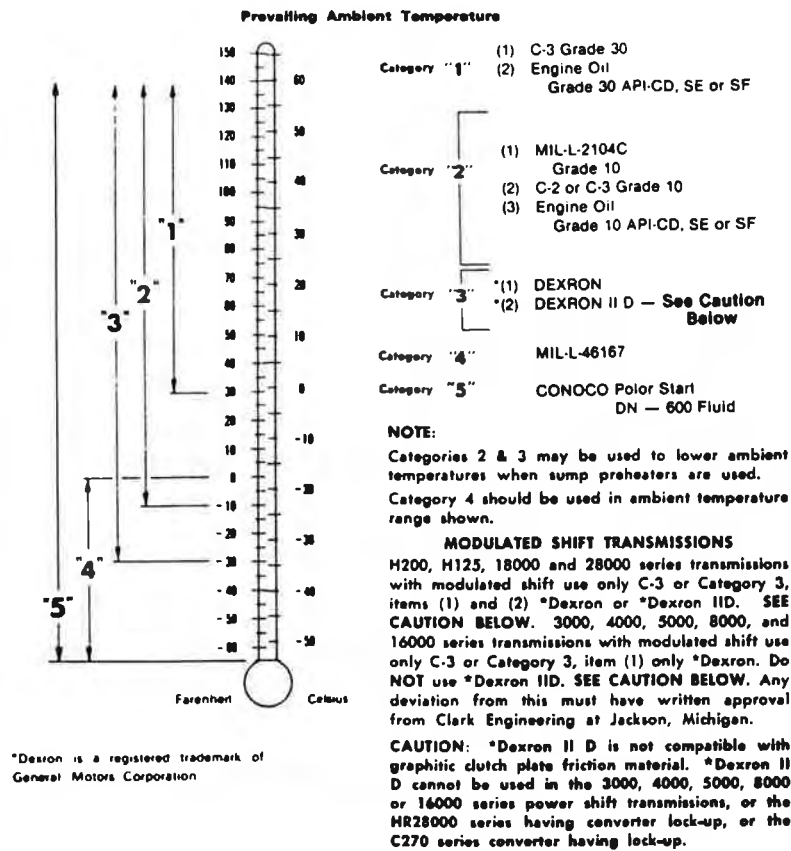
Figure 146
TRANSMISSION AND CONVERTER
BREATHES



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RECOMMENDED LUBRICANTS FOR CLARK POWER SHIFTED TRANSMISSION AND TORQUE CONVERTERS



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Figure 147



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CLUTCH PACK PRESSURE CHECKS

The crane is equipped with a converter pressure gauge, located on the instrument panel. A visual check can be made to determine whether a clutch pack is malfunctioning. The needle should remain in approximately the same position after each gear shift. The following test procedures will determine if clutch packs are functioning properly.

CLARK 18000 SERIES TRANSMISSION

1. Set parking brake and raise crane on outriggers until all four tires clear the ground.
2. Use service brake pedal to prevent wheels from turning while performing pressure checks.
3. Check all clutch pack combinations at both low and high idle. Observe and record pressure readings.
 - A) Place forward and reverse lever in "FORWARD" then move gear shift lever through "FIRST, SECOND and THIRD" then back.
 - B) Place forward and reverse lever in "REVERSE" then move gear shift lever through "FIRST, SECOND and THIRD" then back.

NOTE: *Normal pressure reading is 200 $\pm$ 20 PSI (1.38 $\pm$ 0.13 MPa) at full throttle. Pressures should not vary between clutch packs by more than 5 PSI (0.03 MPa).*

4. If readings vary more than 5 PSI (0.03 MPa) contact your serviceman or see applicable shop manual for further testing.



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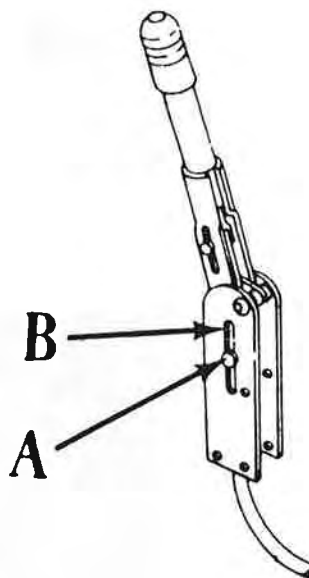
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PARKING BRAKE ADJUSTMENT

For the parking brake to be utilized as an emergency brake, it must be adjusted when the following conditions exist:

1. When parking brake is applied and slide "A" has bottomed out on its upward stroke "B."



14304

Figure 148

2. When parking brake is applied and there is no contact between the brake drum and the brake shoes.
3. When the brake is applied and with engine throttle between $1/3$ to $1/2$, the machine is placed in forward travel and brake fails to hold unit.

Brake adjustment is accomplished by turning the knob on the brake lever clockwise in the disengaged position with no tension on the cable. This adjustment is good until the slide on the lever bottoms out on its upward stroke and no more adjustment can be made at lever knob. Adjustment can then be made at jam nuts through seat box deck.



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REAR STEER INDICATOR

For the convenience of the operator, a red indicator light (Figure 149) is installed on the instrument panel to indicate rear wheels not in straight ahead position.

When red light is "ON," the wheels are not straight ahead. When steering the rear wheels and the light goes "OUT," the wheels are straight.

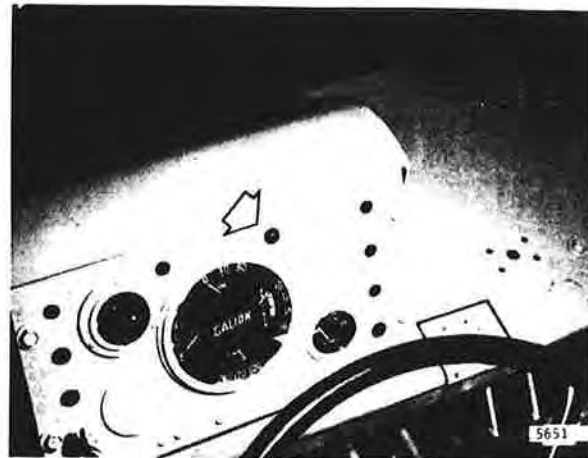


Figure 149
INDICATOR LIGHT

A switch (Figure 150) is located on the left rear wheel and activates the dash indicator light when wheels are not straight ahead.

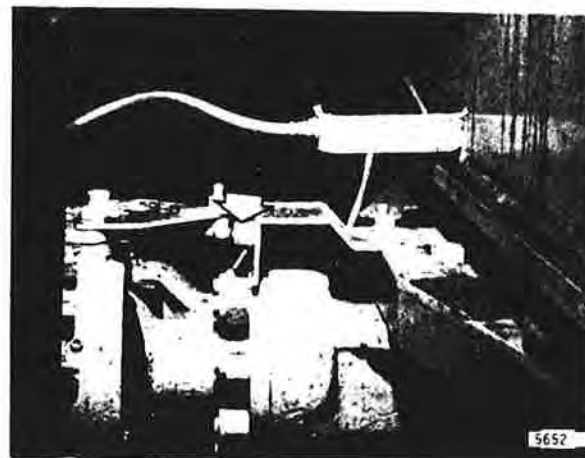


Figure 150
INDICATOR LIGHT SWITCH

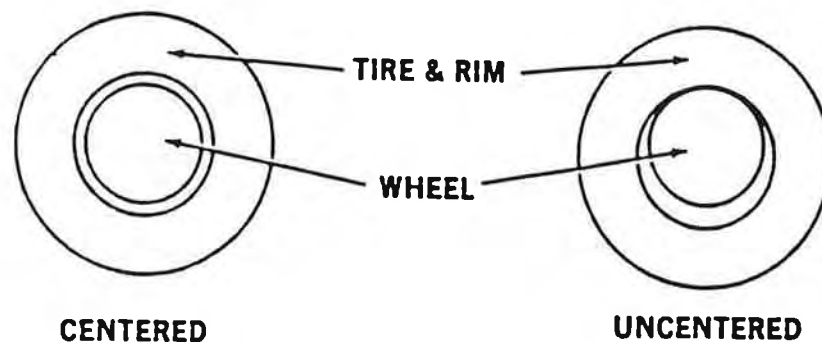


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RIM CENTERING

Excessive bounce when traveling on smooth surfaces may be caused by rims that are not centered to the wheel. Visual inspection of rims will determine if centering of the rims are necessary.



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Figure 151

Whenever tires are changed, the rims should be fastened carefully to make sure that they are properly centered.

TIRE INFLATION

Never inflate a flat tire without inspecting the tire, rim and wheel for damage. Be sure all components are properly assembled. Unmounted tires being inflated or deflated should be placed in a tire safety cage per O.S.H.A. regulations. Inflate tire to 5 PSI (0.034 MPa) and check that all components are properly seated. Never stand directly in front of a tire and rim assembly while inflating. Use a clip-on chuck with a hose long enough to allow the person inflating the tire to stand to the side. Serious injury could result if the tire and mounting were to separate.



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FOOT BRAKE ADJUSTMENT

CLARK DS-17220 & DS-13311 AXLES

1. Raise crane with outriggers so all four tires are off the ground.
2. Place transmission in "NEUTRAL." Release parking brake.
3. Remove the two rubber dust covers from the brake shoe backing plate across slots (top and bottom).
4. Using the star wheel adjusting tool, rotate bottom star wheel by engaging the tool into the teeth of the star wheel and moving the tool handle toward the axle. Repeat until the brake lining drags heavily against the drum. Then, back off the star wheel adjuster 5 notches (clicks) to relieve drag.

NOTE: *It may be possible to achieve a "no drag" condition on the brake drum by backing off the star wheel less than 5 notches (clicks). This can be best detected, if an operator applies the foot pedal, after a notch is taken off.*

5. Using the star wheel adjusting tool, rotate top star wheel by engaging the tool into the teeth of the star wheel and moving the tool handle toward the axle. Repeat until the brake lining drags heavily against the drum. Then, back off the star wheel adjuster 5 notches (clicks) to relieve drag.

NOTE: *It may be possible to achieve a "no drag" condition on the brake drum by backing off the star wheel less than 5 notches (clicks). This can be best detected, if an operator applies the foot pedal, after a notch is taken off.*

6. Firmly depress foot pedal to center shoes, and again rotate star wheels to decrease lining to drum clearance until drag is felt on drum.
5. Relieve drag by backing off star wheels 5 notches (clicks).
6. Rotate the wheel and drum. There should not be any "drag" of the lining against the drum.
7. Replace the two rubber dust covers removed in Step 1.
8. Repeat Steps 1 thru 7, for all wheels.

NOTE: *Refer to appropriate Shop Manual section for complete adjustment procedure.*



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HOIST AND SWING BRAKE OPERATION



WARNING! All major repairs should be attended to by experienced service personnel. Shutdown unit while making adjustments and/or repairs.

HOIST BRAKE

If the hoist drum brake is operating properly the following should occur during normal operation.

1. When hoisting a load the brake should remain in the applied position. the hoist drum has a one way clutch which allows the hoist to take in line without releasing the brake. The brake cylinder may move slightly due to back pressure in the drain line at times, which will allow the brake drum to rotate some.
2. When lowering a load, hoist cylinder should release the brake allowing brake drum to rotate.

If hoist drum does not function as stated in the preceding statements and/or the load drifts, the following may be possible causes;

1. Spring eyebolt may not be tensioned properly.
2. With hoist control levers in "NEUTRAL" position, the hoist brake push rod is not free to rotate.
3. Push rod may be adjusted too long which will not let the brake be fully applied.
4. Flow regulator, 1 GPM (4 lpm) may be partially or completely plugged.
5. Crowd cylinder overcenter check valve may be stuck open.
6. Brake cylinder may be scored and binding.
7. Brake shoes can be slipping due to being oil spotted or soaked, and should be replaced.
8. Brake shoes may be glazed which can be removed by burnishing.

NOTE: These items should ONLY be attended to by experienced service personnel using the appropriate Shop Manual.



MAINTENANCE

SWING BRAKE

If the swing brake is operating correctly the swing brake cylinder should release when the boom is swung in either direction. When either of the swing control levers are returned to their "NEUTRAL" position the brake should apply. If not the following may be possible causes:

1. Spring eyebolt may not be tensioned properly.
2. With swing control levers in "NEUTRAL" position, the swing brake push rod is not free to rotate.
3. Push rod may be adjusted too long which will not let the brake be fully applied.
4. Flow regulator, 1 GPM (4 lpm) may be partially or completely plugged.
5. Brake cylinder may be scored and binding.
6. Brake shoes can be slipping due to being oil spotted or soaked, and should be replaced.
7. Brake shoes may be glazed which can be removed by burnishing.

NOTE: *These items should ONLY be attended to by experienced service personnel using the appropriate Shop Manual.*



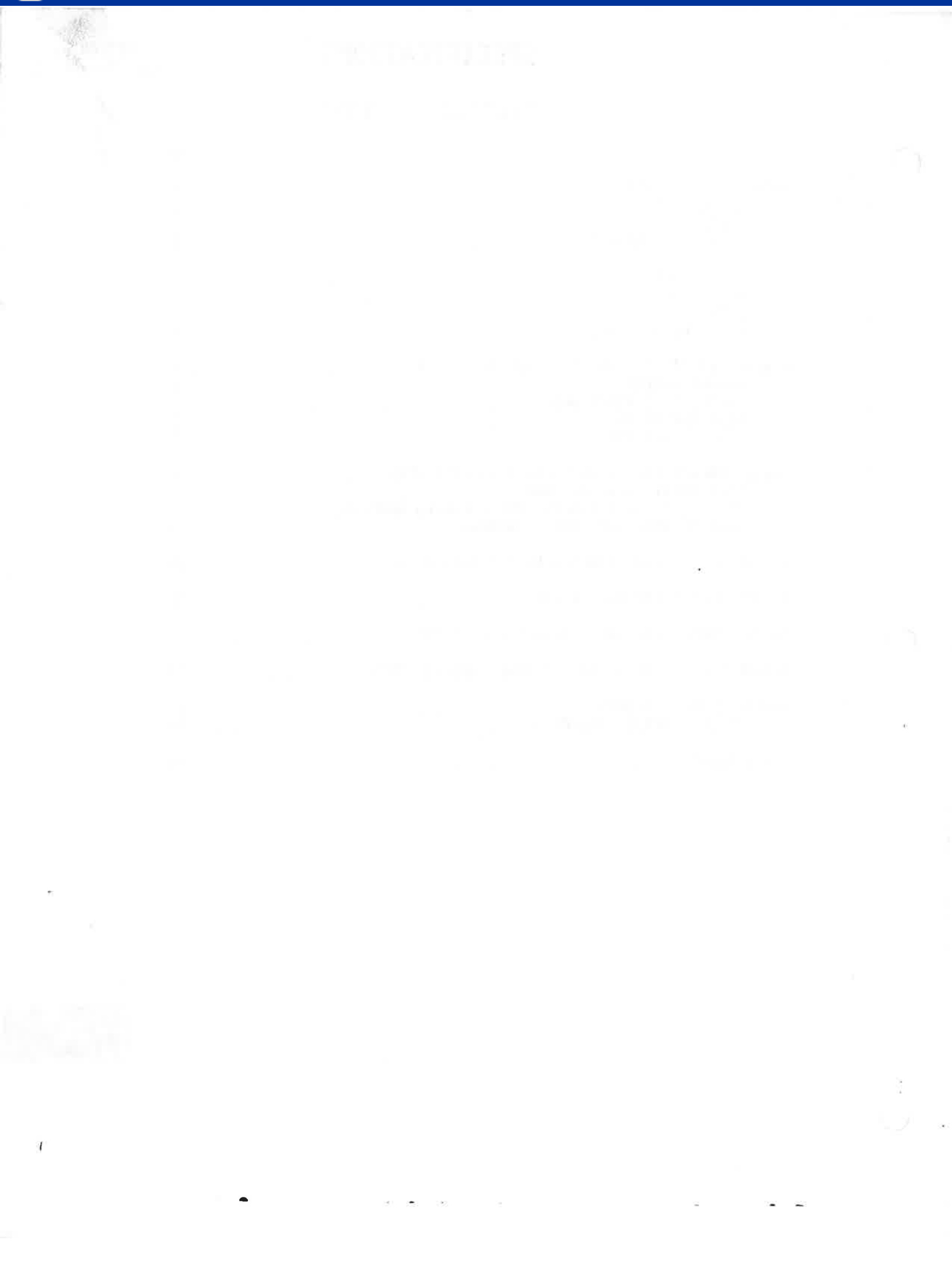
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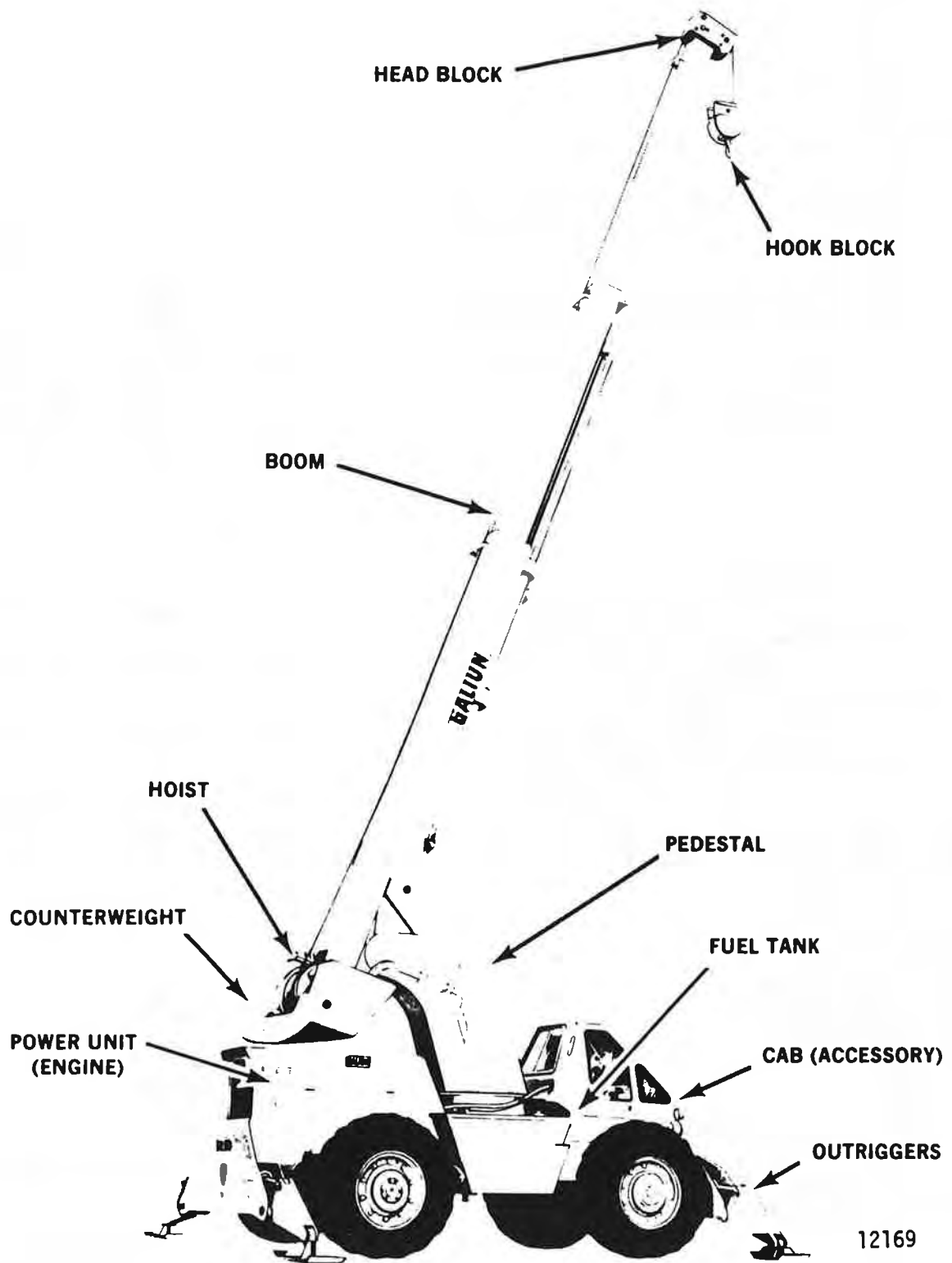


Figure 1

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SPECIFICATIONS**BASIC UNIT**

Weight (Approx.) with 3 Section Power Boom	38,200 LBS.	(17,327 kgs)
Weight on Front Axle	-----	-----
Weight on Rear Axle	-----	-----
Weight (Approx.) with 4 Section Full Power Boom	40,200 LBS.	(18,273 kgs)
Weight on Front Axle	-----	-----
Weight on Rear Axle	-----	-----
Wheelbase	9' - 0.000"	(2.74 m)
Overall Length with 3 Section Power Boom	27' - 2.000"	(8.28 m)
Main Frame	15' - 6.500"	(4.74 m)
Centerline Rotation to Front Outrigger	8' - 0.000"	(2.44 m)
Centerline Rotation to Rear Outrigger	8' - 7.500"	(2.63 m)
Overall Length with 4 Section Full Power Boom	29' - 3.500"	(8.92 m)
Main Frame	15' - 6.500"	(4.74 m)
Centerline Rotation to Front Outrigger	8' - 0.000"	(2.44 m)
Centerline Rotation to Rear Outrigger	8' - 7.500"	(2.63 m)
Overall Height	11' - 5.500"	(3.49 m)
Overall Width with Outrigger Pads Stowed	8' - 0.000"	(2.44 m)
Outrigger Ground Clearance	1' - 3.000"	(381.00 mm)
Axle Ground Clearance	1' - 4.000"	(406.40 mm)
Turning Radius	18' - 1.000"	(5.51 m)

BOOM

Boom Rotation	360°
3 Section Power Boom;	
Minimum Reach (Horizontal) from Centerline of Rotation	17' - 6.000" (5.33 m)
Maximum Reach (Horizontal) from Centerline of Rotation	37' - 6.000" (11.43 m)
4 Section Full Power Boom;	
Minimum Reach (Horizontal) from Centerline of Rotation	20' - 0.000" (6.10 m)
Maximum Reach (Horizontal) from Centerline of Rotation	60' - 0.000" (18.29 m)
Tail Swing	7' - 8.750" (2.36 m)
Height Hook to Ground (Boom Horizontal)	6' - 6.750" (2.00 m)
Maximum Elevation	70°
Standard Rigging	5 Part Line

CRANE PERFORMANCE

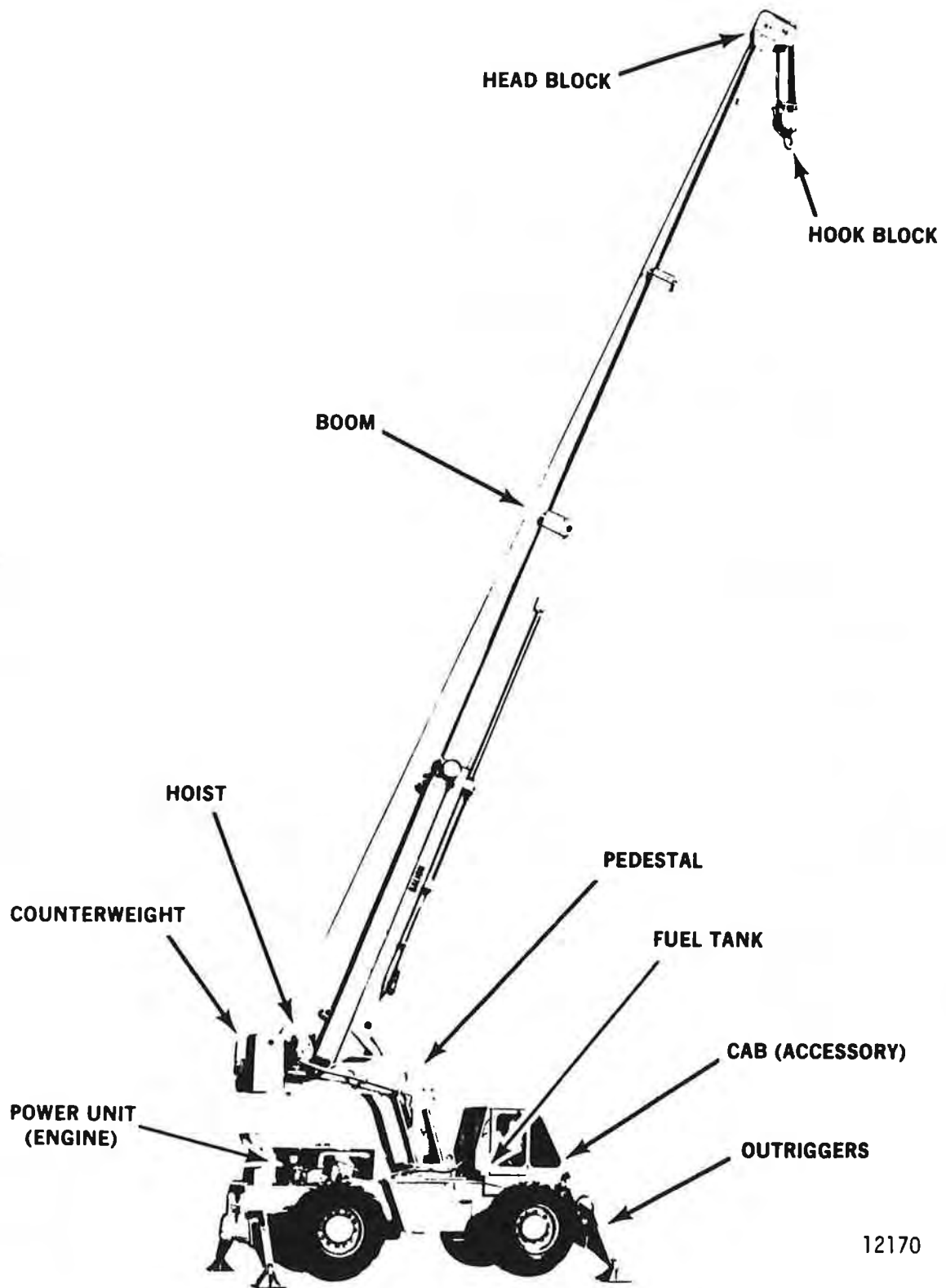
Boom Topping Speed	17.0 Seconds
Boom Lowering Speed	16.0 Seconds
Swing Speed, RPM	4.0
Outrigger Speeds;	
Down	3.5 Seconds
Up	3.0 Seconds
Crowd Speed (Approx.);	
Extending, FPM	50.0 (15.24 m/min.)
Retracting, FPM	60.0 (18.28 m/min.)
Average Line Speed;	
Low, FPM	150.0 (45.72 m/min.)
Intermediate, FPM	250.0 (76.20 m/min.)
High, FPM	400.0 (121.92 m/min.)
Maximum Hook Speed with 5 Part Line, FPM	80.0 (24.38 m/min.)



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150FA SPECIFICATIONS



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Figure 2

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SPECIFICATIONS**BASIC UNIT**

Weight (Approx.) with 3 Section Power Boom	38,200 LBS.	(17,327 kgs)
Weight on Front Axle	-----	-----
Weight on Rear Axle	-----	-----
Weight (Approx.) with 4 Section Full Power Boom	40,200 LBS.	(18,273 kgs)
Weight on Front Axle	-----	-----
Weight on Rear Axle	-----	-----
Wheelbase	9' - 0.000"	(2.74 m)
Overall Length with 3 Section Power Boom	27' - 2.000"	(8.28 m)
Main Frame	15' - 6.500"	(4.74 m)
Centerline Rotation to Front Outrigger	8' - 0.000"	(2.44 m)
Centerline Rotation to Rear Outrigger	8' - 7.500"	(2.63 m)
Overall Length with 4 Section Full Power Boom	29' - 3.500"	(8.92 m)
Main Frame	15' - 6.500"	(4.74 m)
Centerline Rotation to Front Outrigger	8' - 0.000"	(2.44 m)
Centerline Rotation to Rear Outrigger	8' - 7.500"	(2.63 m)
Overall Height	11' - 2.500"	(3.42 m)
Overall Width with Outrigger Pads Stowed	8' - 0.000"	(2.44 m)
Outrigger Ground Clearance	1' - 3.000"	(381.00 mm)
Axle Ground Clearance	1' - 4.000"	(406.40 mm)
Turning Radius	18' - 1.000"	(5.51 m)

BOOM

Boom Rotation	360°
3 Section Power Boom;	
Minimum Reach (Horizontal) from Centerline of Rotation	17' - 6.000" (5.33 m)
Maximum Reach (Horizontal) from Centerline of Rotation	37' - 6.000" (11.43 m)
4 Section Full Power Boom;	
Minimum Reach (Horizontal) from Centerline of Rotation	20' - 0.000" (6.10 m)
Maximum Reach (Horizontal) from Centerline of Rotation	60' - 0.000" (18.29 m)
Tail Swing	8' - 8.000" (2.64 m)
Height Hook to Ground (Boom Horizontal)	6' - 6.750" (2.00 m)
Maximum Elevation	70°
Standard Rigging	5 Part Line

CRANE PERFORMANCE

Boom Topping Speed	17.0 Seconds
Boom Lowering Speed	16.0 Seconds
Swing Speed, RPM	4.0
Outrigger Speeds;	
Down	3.5 Seconds
Up	3.0 Seconds
Crowd Speed (Approx.);	
Extending, FPM	50.0 (15.24 m/min.)
Retracting, FPM	60.0 (18.28 m/min.)
Average Line Speed;	
Low, FPM	150.0 (45.72 m/min.)
Intermediate, FPM	250.0 (76.20 m/min.)
High, FPM	400.0 (121.92 m/min.)
Maximum Hook Speed with 5 Part Line, FPM	80.0 (24.38 m/min.)



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GENERAL SPECIFICATIONS FOR 150A AND 150FA

GROUND SPEEDS

CLARK 18000 SERIES TRANSMISSION (FORWARD & REVERSE)

Low Range;		
First	0.0 - 3.0	0.0 - 4.8
Second	3.0 - 6.5	4.8 - 10.5
Third	6.5 - 14.4	10.5 - 23.2
High Range;		
First	0.0 - 5.9	0.0 - 9.5
Second	5.9 - 12.3	9.5 - 19.8
Third	12.3 - 26.3	19.8 - 42.3

ENGINE SPECIFICATIONS

	DETROIT DIESEL 4-53N	DRESSER D359T
Number of Cylinders	4	6
Bore and Stroke	3.875" x 4.500" (98.43 mm x 114.30 mm)	4.02" x 4.72" (102 mm x 120 mm)
Displacement	212.4 Cu. In. (3481 cc)	359 Cu. In. (5880 cc)
Horsepower (550 FPPS)	127	128
Horsepower (metric)	128.8	129.8
Electrical System	12 Volt 32 AMP Alternator	12 42 AMP Alternator

TIRE INFLATION

14:00 x 24 - 16 Ply	75 - 80 PSI (0.51 - 0.55 MPa)
17:50 x 25 - 14 Ply	50 - 60 PSI (0.34 - 0.41 MPa)
13:00 x 24 - 10 Ply	55 - 70 PSI (0.37 - 0.48 MPa)
15:50 x 25 - 12 Ply	40 - 60 PSI (0.27 - 0.41 MPa)

LIQUID CAPACITIES

	DETROIT DIESEL 4-53N	DRESSER D359T
RADIATOR	18 U.S. QUARTS (17 LITERS)	20 U.S. QUARTS (19 LITERS)
ENGINE CRANKCASE	15 U.S. QUARTS (14 LITERS)	17.3 U.S. QUARTS (16.4 LITERS)
WITH FILTER CHANGE	16 U.S. QUARTS (15 LITERS)	18.3 U.S. QUARTS (16.3 LITERS)

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SPECIFICATIONS

PLANETARIES, AXLES:

CLARK DS-17220

2.5 U.S. QUARTS (PER PLANETARY)
(2.37 LITERS)

CLARK DS-13311

3 U.S. PINTS (PER PLANETARY)
(1.47 LITERS)

DIFFERENTIAL, AXLES:

CLARK DS-17220

9 U.S. QUARTS
(9 LITERS)

CLARK DS-13311

11 U.S. QUARTS
(10 LITERS)

HOIST GEAR CASE

10 U.S. QUARTS
(9 LITERS)

SWING DRIVE CASE

14 U.S. QUARTS
(13 LITERS)

HYDRAULIC BRAKE SYSTEM

1 U.S. PINT
(0.94 LITER)

TORQUE CONVERTER & TRANSMISSION:

CLARK 18000 SERIES

5 U.S. GALLONS
(19 LITERS)

FUEL TANK

46 U.S. GALLONS
(174 LITERS)

HYDRAULIC SYSTEM W/TANK

120 U.S. GALLONS
(454 LITERS)

HYDRAULIC TANK

75 U.S. GALLONS
(284 LITERS)SPRING MOTOR (FOUR SECTION FULL
FULL POWER BOOM)1 U.S. PINT (PER HOUSING)
(0.47 LITER)

STEERING GEAR CASE

1 U.S. QUART
(0.94 LITER)

NOTE: Capacities listed here are drained volumes and do not reflect those which would be needed after the rebuild of a component. These capacities are also subject to change due to manufacturing changes in component cases, engine oil pans, internal construction changes, etc.



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TORQUE VALUES FOR STANDARD ENGLISH FASTENERS

BOLT IDENTIFICATION CHART

TYPE	S.A.E. GRADE	DESCRIPTION	BOLT HEAD MARKING
1	1 or 2	WILL HAVE NO MARKINGS IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	5	WILL HAVE 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	8	WILL HAVE 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

TYPE 1, 5 AND 8 NON-PHOSPHATE COATED HARDWARE

Recommended torque, in foot pounds, for all Standard Application Nuts and Bolts, provided:

- All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)
- Joints are rigid, that is, no gaskets or compressible materials are used.
- When reusing nuts or bolts, use minimum torque values.

NOTE: Multiply the standard torque by:

- 0.65 when finished jam nuts are used.
- 0.70 when Molykote, white lead or similar mixture are used as lubricants.
- 0.75 when cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.
- 0.85 when cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.
- 0.90 when hardened surfaces are used under the nut or bolt head.

When reusing bolts and nuts in service, use minimum torque values.

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SPECIFICATIONS

TYPE 1, 5 AND 8 NON-PHOSPHATE COATED HARDWARE - CONTINUED

The following General Torque Values must be used in all cases where **SPECIFIC TORQUE VALUES** are not given.

NOTE: TORQUE VALUES LISTED THROUGHOUT THIS MANUAL ARE LUBRICATED (WET) THREADS; VALUES SHOULD BE INCREASED 1/3 FOR NON-LUBRICATED (DRY) THREADS.				
THREAD SIZE	HEATED MATERIAL GRADE 5 & GRADE 8			
	GRADE 5 (3 RADIAL DASHES ON HEAD)		GRADE 8 (6 RADIAL DASHES ON HEAD)	
	FOOT POUNDS (FT. LBS.)	NEWTON METER (Nm)	FOOT POUNDS (FT. LBS.)	NEWTON METER (Nm)
1/4" - 20	6	8	9	12
1/4" - 28	7	9	11	15
5/16" - 18	13	18	18	24
5/16" - 24	15	20	21	28
3/8" - 16	24	33	34	46
3/8" - 24	27	37	38	52
7/16" - 14	38	52	54	73
7/16" - 20	42	57	60	81
1/2" - 13	58	79	82	111
1/2" - 20	65	88	90	122
9/16" - 12	84	114	120	163
9/16" - 18	93	126	132	179
5/8" - 11	115	156	165	224
5/8" - 18	130	176	185	251
3/4" - 10	205	278	290	393
3/4" - 16	230	312	320	434
7/8" - 9	305	414	455	617
7/8" - 14	335	454	515	698
1" - 8	455	617	695	942
1" - 14	510	691	785	1064
1 1/8" - 7	610	827	990	1342
1 1/8" - 12	685	929	1110	1505
1 1/4" - 7	860	1166	1400	1898
1 1/4" - 12	955	1295	1550	2102
1 3/8" - 6	1130	1532	1830	2481
1 3/8" - 12	1290	1749	2085	2827
1 1/2" - 6	1500	2034	2430	3295
1 1/2" - 12	1690	2291	2730	3701
1 3/4" - 5	2370	3213	3810	5166
2" - 4 1/2	3550	4813	5760	7810

NOTE: If any bolts and nuts are found loose or at values less than what the chart states, it is recommended that the loose bolt and/or nut be replaced with a new one.



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TYPE 8 PHOSPHATE COATED HARDWARE

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Catalog for the machine involved. **DO NOT SUBSTITUTE.** Original equipment standard hardware is defined as Type 8, coarse thread bolts and nuts and thru hardened flat washers (Rockwell "C" 38-45), all phosphate coated and assembled without supplemental lubrication (as received) condition.

The torques shown below also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.
2. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts).
3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material grade ONLY and are NOT to be used to determine required torque.

NOMINAL THREAD DIAMETER	STANDARD TORQUE $\pm$ 10%	
	Nm	Ft. Lbs.
1/4	10	8
5/16	21	16
3/8	38	28
7/16	60	45
1/2	92	70
9/16	130	100
5/8	180	140
3/4	325	240
7/8	520	390
1	780	580
1-1/8	1110	820
1-1/4	1565	1160
1-3/8	2050	1520
1-1/2	2720	2020
1-3/4	3380	2510
2	5080	3780



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SPECIFICATIONS**TORQUE VALUES FOR STANDARD METRIC FASTENERS**

This chart provides tightening torque for general purpose applications using original equipment standard hardware as listed in the Parts Manual for the machine involved. **DO NOT SUBSTITUTE.** Original equipment standard hardware is defined as coarse thread metric class 10.9 bolts and class 10.0 nuts and thru hardened flat washers (Rockwell "C" 38-45), all phosphate coated and assembled without supplemental lubrication (as received) condition.

The torques shown below also apply to the following:

1. Phosphate coated bolts used in tapped holes in steel or gray iron.
2. Phosphate coated bolts used with phosphate coated prevailing torque nuts (nuts with distorted threads or plastic inserts).
3. Phosphate coated bolts used with copper plated weld nuts.

Markings on bolt heads or nuts indicate material class ONLY and are NOT to be used to determine required torque.

NOMINAL THREAD DIAMETER	STANDARD TORQUE 10%	
MILLIMETER	NEWTON METERS	FOOT POUNDS
6	10	7
7	16	12
8	23	17
10	46	34
12	80	60
14	125	90
16	200	150
18	275	200
20	385	290
22	530	390
24	670	500
27	980	730
30	1330	990
33	1790	1330
36	2325	1730
39	3010	2240



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TORQUE VALUES FOR HOSE CLAMPS

The following chart provides the tightening torques for hose clamps used in all rubber applications (radiator, air cleaner, operating lever boots, hydraulic system, etc.).

CLAMP TYPE & SIZE	TORQUE PLUS OR MINUS 5 In. Lbs. (0.6 Nm)			
	RADIATOR, AIR CLEANER, BOOTS, ETC.		HYDRAULIC SYSTEM	
	Nm	In. Lbs.	Nm	In. lbs.
"T" Bolt (any diameter)	6.2-7.3	55-65	-	-
Worm Drive - 1-3/4 in. Open Diameter & Under	2.2-3.3	20-30	4.5-5.6	40-50
Worm Drive - Over 1-3/4 in. Open Diameter	4.5-5.6	40-50	-	-
Worm Drive - All "Ultra-tite"	10.7-11.8	95-105	4.5-5.6	40-50



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SPECIFICATIONS**TORQUE VALUES FOR SPLIT FLANGE CONNECTIONS**

The following chart provides the tightening torques for split flange connections used in hydraulic systems. Split flanges and fitting shoulders should fit squarely. Install all bolts, finger tight and then torque evenly.

NOTE: *Over torquing bolts will damage the flanges and/or bolts, which may cause leakage.*

FLANGE SIZE (*)	BOLT SIZE	BOLT TORQUE	
		Nm	Ft. Lbs.
1/2	5/16	20-24	15-18
3/4	3/8	30-37	22-27
1	3/8	37-47	27-35
1-1/4	7/16	47-61	35-45
1-1/2	1/2	62-79	46-58
2	1/2	75-88	55-65
2-1/2	1/2	107-123	79-91
3	5/8	187-203	138-150
3-1/2	5/8	159-180	105-115

(*) - Inside diameter of hydraulic tube or hose fitting.



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TORQUE VALUES FOR HYDRAULIC TUBES AND FITTINGS

TUBE NUTS			"O" RING BOSS PLUGS AND SWIVEL NUTS			
FOR 37° FLARED FITTINGS			JIC - 37° SEAT			
SIZE	TUBING O.D.	THREAD SIZE	TORQUE			
			MIN. Ft. Lb.	MAX. Ft. Lb.	MIN. Nm	MAX. Nm
4	1/4	7/16-20	9	12	12	16
5	5/16	1/2-20	12	15	16	20
6	3/8	9/16-18	21	24	29	33
8	1/2	3/4-16	35	40	47	54
10	5/8	7/8-14	53	58	72	79
12	3/4	1-1/16-12	77	82	104	111
14	7/8	1-3/16-12	90	100	122	136
16	1	1-5/16-12	110	120	149	163
20	1-1/4	1-5/8-12	140	150	190	204
24	1-1/2	1-7/8-12	162	175	217	237
32	2	2-1/2-12	225	240	305	325

Above torque figures are recommended for plain, cadmium or zinc plated fittings, dry or wet installations.

Swivel nuts either swaged or brazed.



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SPECIFIC BOLT TORQUES

HOIST MOUNTING BOLTS

150A (3) 3/4" - 16 UNF - 2A x 2-1/4" GR. 5
150FA (3) 3/4" - 10 UNC - 2A x 3-1/4" GR. 5
230 FT. LBS. (WET) (312 Nm)

PEDESTAL TO SWING BEARING CAP SCREWS

(20) 7/8" - 14 UNF - 2A x 2-3/4" GR. 8
500 FT. LBS. (WET) (678 Nm)

SUPPORT CAP SCREWS

(6) 1" - 8 UNC - 2A x 3" GR. 5
450 - 500 FT. LBS. (WET)
(610 - 678 Nm)

COUNTERWEIGHT CAP SCREWS

150A (4) 1-1/4" - 7 UNC - 2A x 4" GR. 5
150FA (3) 1-1/4" - 7 UNC - 2A x 8-1/2" GR. 5
840 FT. LBS. (WET) (1139 Nm)

ROTARY JOINT DRIVE SCREWS (2)

ADJUST TO 1/16" (1.58 mm)
CLEARANCE EACH SIDE

BASE PLATE TO FRAME NUTS

(12) 1" - 14 UNS - 2B GR. 8
785 FT. LBS. (WET) (1064 Nm)

PRIMARY MANIFOLD TO ADAPTOR

BLOCK CAP SCREWS
(4) 5/8" - 11 UNC - 3A x 7-3/4" GR. 8
70 FT. LBS. (WET) (95 Nm)

ROTARY JOINT TO BASE PLATE

CAP SCREWS
(4) 1/2" - 13 UNC - 2A x 2" GR. 5
55 FT. LBS. (WET) (75 Nm)

SWING BEARING TO BASE PLATE

CAP SCREWS
(19) NOT PAINTED
7/8" - 14 UNF - 3A x 6-3/4" GR. 8
500 FT. LBS. (WET) (678 Nm)
(5) PAINTED
7/8" - 14 UNF - 2A x 4-3/4" GR. 8
250 FT. LBS. (WET) (339 Nm)

NOTE: Remove two (2) covers on top of pedestal base to torque cap screws and observe heads of bolts as boom is rotated 360°. The five (5) painted cap screws are in front next to cab.

WHEEL LUG NUTS

CLARK DS-17220 AXLE (10) EACH WHEEL
CLARK DS-13311 AXLE (12) EACH WHEEL
3/4" - 16 UNF LUG NUT

FRONT AXLE TO FRAME LOCK NUTS

(4) EACH SIDE
1" - 14 UNS - 3B
510 FT. LBS. (WET) (691 Nm)

REAR AXLE TO REAR AXLE MOUNT

CAP SCREWS (4) EACH SIDE
1" - 14 UNS - 2A x 8-1/2" GR. 5
510 FT. LBS. (WET) (691 Nm)

FRONT OUTRIGGER CAP SCREWS

(16) 1" - 14 UNS - 2A x 2-1/4" GR. 5
510 FT. LBS. (WET) (691 Nm)

REAR OUTRIGGER
WELDED TO FRAME

STEERING SHAFT ARM NUT

(1) 1-1/8" - 12 UNF
195 FT. LBS. (WET) (264 Nm)

REAR AXLE RUBBER MOUNTS TO

FRAME LOCK NUTS (4) EACH SIDE
1" 14 UNS - 3B
510 FT. LBS. (WET) (691 Nm)

Figure 3

NOTE: If any bolts and nuts are found loose or at values less than what the chart states, it is recommended that the loose bolt and/or nut be replaced with a new one.