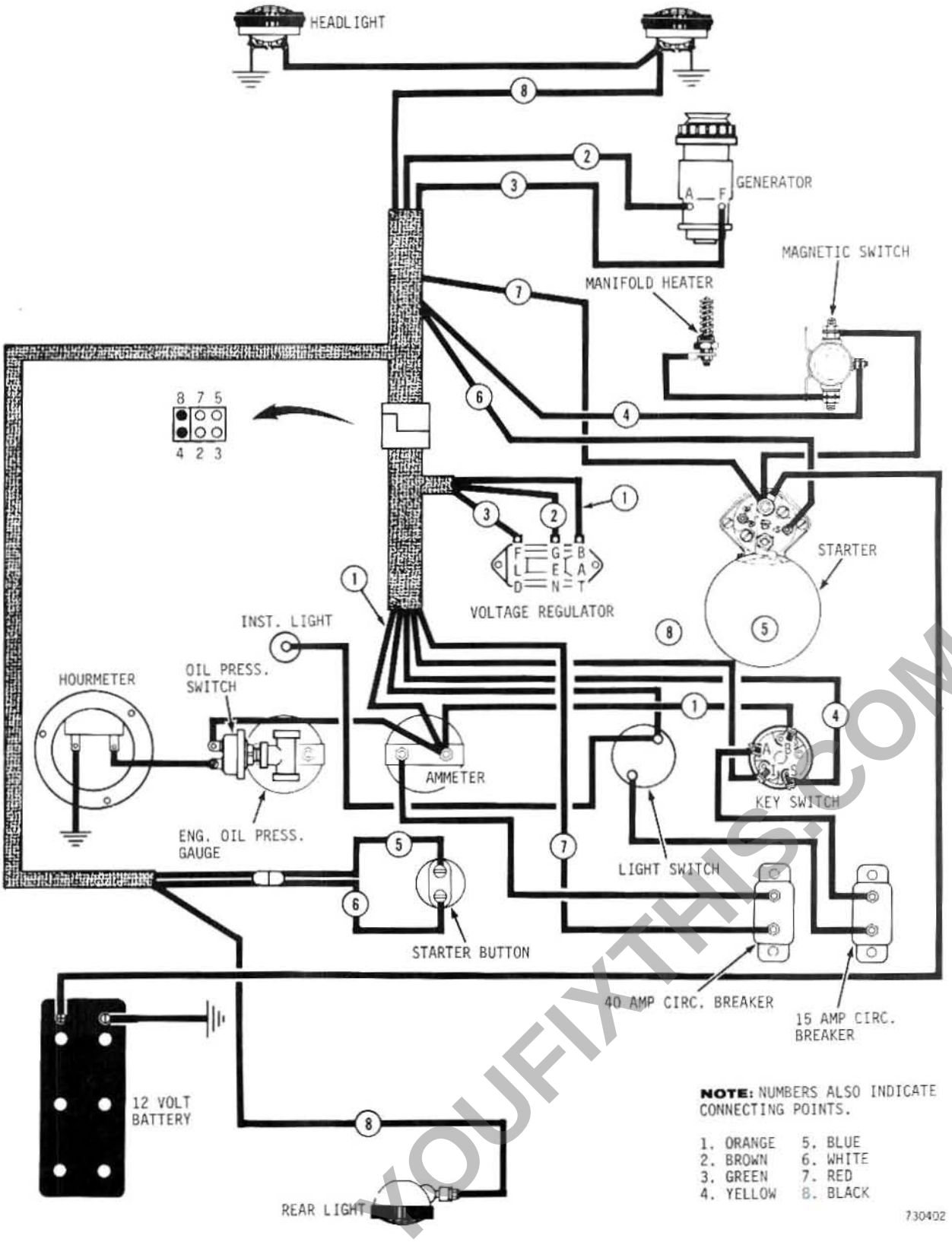


Figure 1 - Diesel Wiring Diagram, S/N 3038436 and After

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HYDRAULIC DIAGRAMS

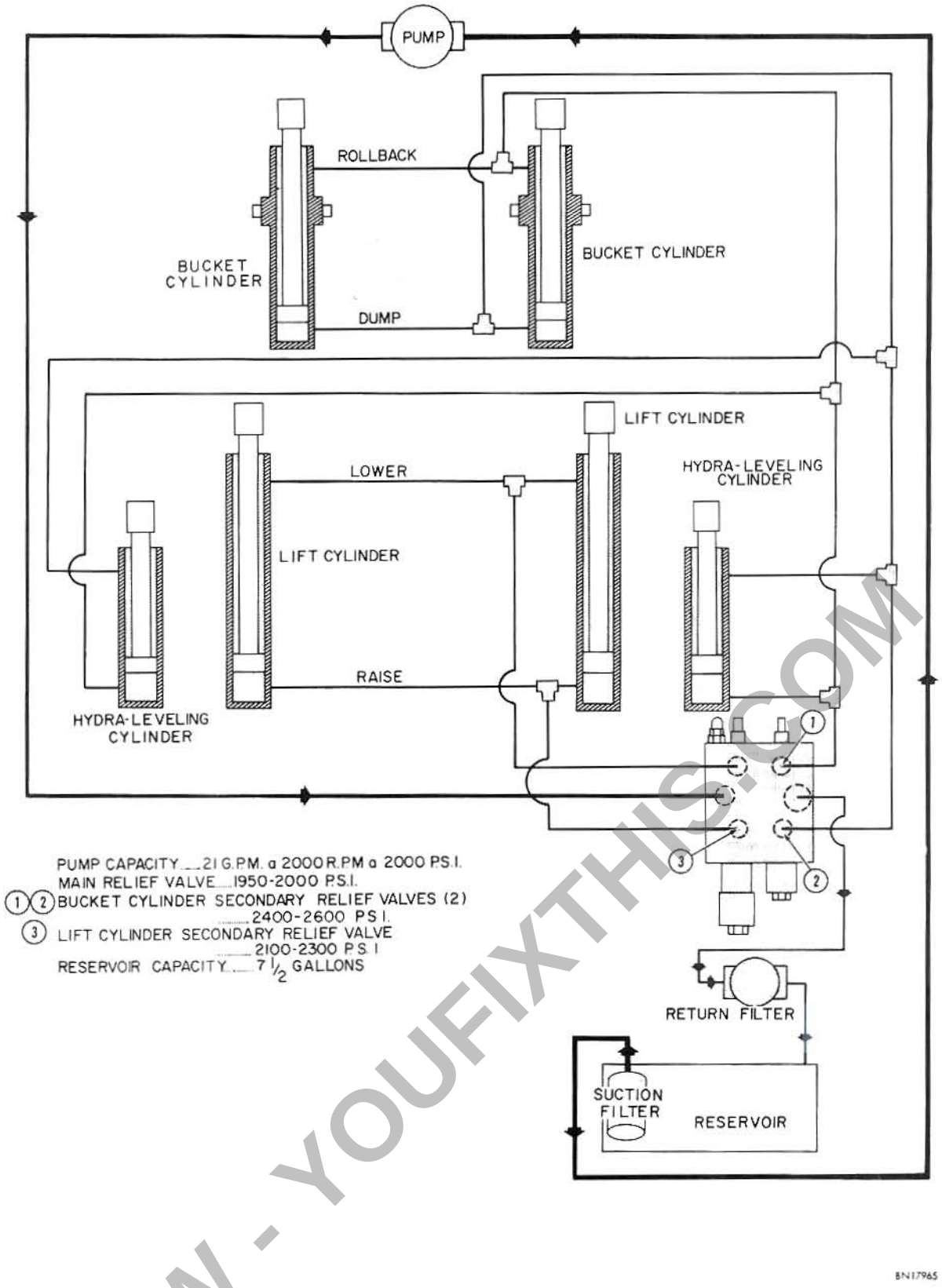


Figure 3 - Loader Hydraulic System, Before S/N 3038436

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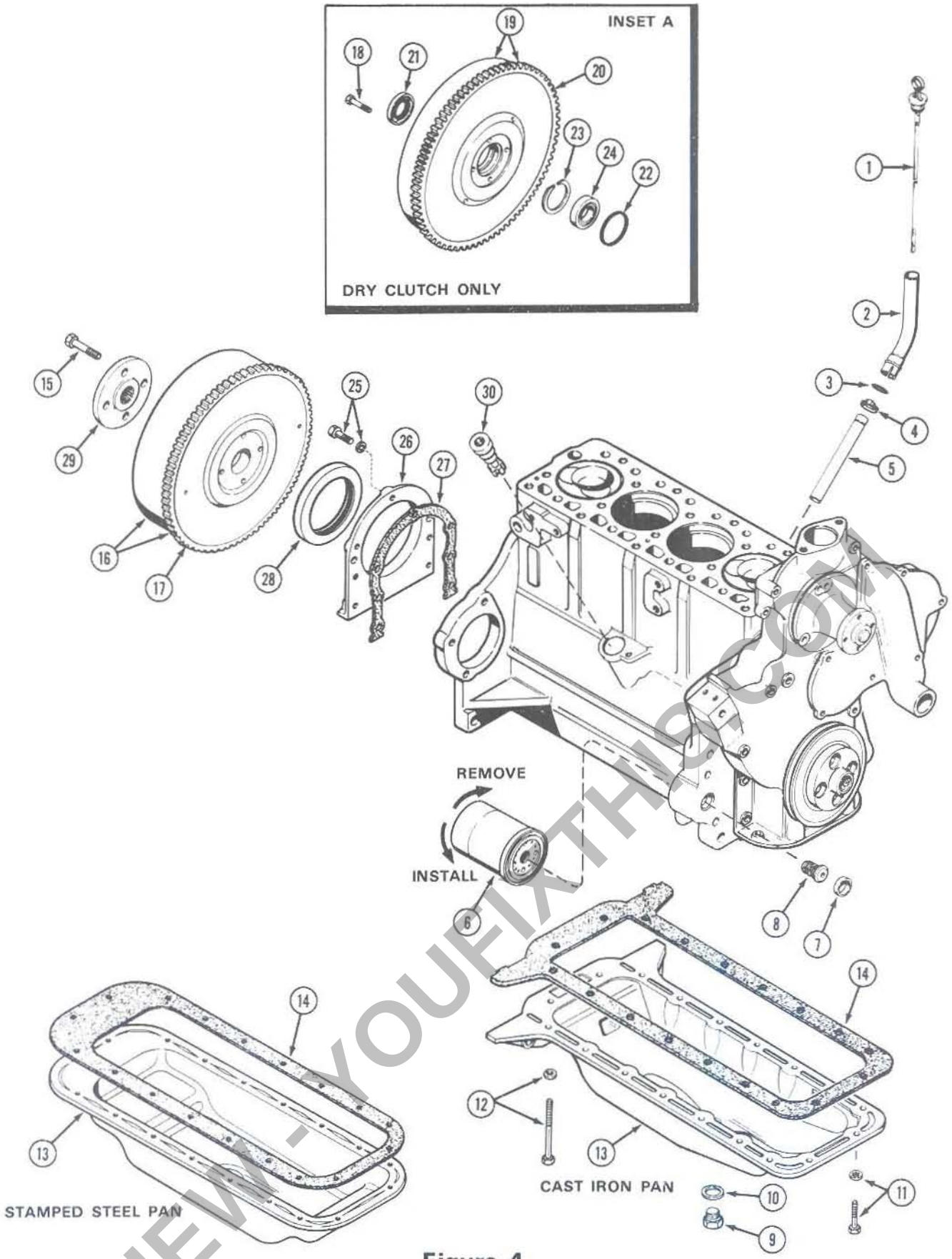


Figure 4

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U.S. AND METRIC TORQUE SPECIFICATIONS

Torque values for all situations unless special torque is specified.

Grade 5 Bolts, Nuts, Studs (Dry)

Thread Size	Torque ft. lbs.	Torque m-kg
1/4" - 20 NC	5-10	0,7-1,4
1/4" - 28 NF	10-15	1,4-2,1
5/16" - 18 NC	15-20	2,1-2,8
5/16" - 24 NF	15-20	2,1-2,8
3/8" - 16 NC	25-35	3,5-4,8
3/8" - 24 NF	30-40	4,1-5,5
7/16" - 14 NC	45-55	6,2-7,6
7/16" - 20 NF	50-60	6,9-8,3
1/2" - 13 NC	65-85	9,0-12,0
1/2" - 20 NF	80-100	11-14
9/16" - 12 NC	100-120	14-17
9/16" - 18 NF	110-130	15-18
5/8" - 11 NC	135-165	19-23
5/8" - 18 NF	160-200	22-28



Thread Size	Torque ft. lbs.	Torque m-kg
3/4" - 10 NC	235-285	32-39
3/4" - 16 NF	270-330	37-46
7/8" - 9 NC	360-440	50-61
7/8" - 14 NF	395-490	55-68
1" - 8 NC	520-640	72-88
1" - 12 NF	575-705	79-97
1-1/8" - 7 NC	720-820	99-113
1-1/8" - 12 NF	790-970	109-134
1-1/4" - 7 NC	1010-1240	139-171
1-1/4" - 12 NF	1115-1365	154-188
1-3/8" - 6 NC	1315-1610	181-222
1-3/8" - 12 NF	1510-1850	208-255
1-1/2" - 6 NC	1745-2135	241-295
1-1/2" - 12 NF	1880-2420	259-334





Grade 8 Bolts, Nuts, Studs (Dry)

Thread Size	Torque ft. lbs.	Torque m-kg
1/4" - 20 NC	10-15	1,4-2,1
1/4" - 28 NF	15-20	2,1-2,8
5/16" - 18 NC	20-30	2,8-4,1
5/16" - 24 NF	25-30	3,5-4,1
3/8" - 16 NC	40-50	5,5-6,9
3/8" - 24 NF	45-55	6,2-7,6
7/16" - 14 NC	60-80	8,3-11,0
7/16" - 20 NF	70-90	9,7-12,0
1/2" - 13 NC	100-120	14-17
1/2" - 20 NF	110-130	15-18
9/16" - 12 NC	135-165	19-23
9/16" - 18 NF	155-190	21-26
5/8" - 11 NC	200-240	28-33
5/8" - 18 NF	215-265	30-37







Thread Size	Torque ft. lbs.	Torque m-kg
3/4" - 10 NC	340-420	47-58
3/4" - 16 NF	380-460	52-63
7/8" - 9 NC	540-660	75-91
7/8" - 14 NF	595-725	82-100
1" - 8 NC	810-990	112-137
1" - 12 NF	900-1100	124-152
1-1/8" - 7 NC	1150-1400	159-193
1-1/8" - 12 NF	1295-1585	179-219
1-1/4" - 7 NC	1640-2000	226-276
1-1/4" - 12 NF	1800-2200	248-304
1-3/8" - 6 NC	2140-2620	295-362
1-3/8" - 12 NF	2450-3000	338-414
1-1/2" - 6 NC	2845-3475	393-480
1-1/2" - 12 NF	3200-3900	442-538

Hydraulic Fittings (Steel)

Dash Size	Tube O.D.	Thread Size	37° Flare Female Swivel Torque ft. lbs.	37° Flare Female Swivel Torque m-kg	Straight Thread O-Ring Torque ft. lbs.	Straight Thread O-Ring Torque m-kg
4	1/4"	7/16" - 20	6-12	0,8-1,7	12-19	1,7-2,6
5	5/16"	1/2" - 20	8-16	1,1-2,2	16-25	2,2-3,5
6	3/8"	9/16" - 18	10-25	1,4-3,5	25-40	3,5-5,5
8	1/2"	3/4" - 16	15-42	2,1-5,8	42-67	5,8-9,2
10	5/8"	7/8" - 14	25-58	3,5-8,0	58-92	8,0-12,7
12	3/4"	1-1/16" - 12	40-80	5,5-11,0	80-128	11-18
14	7/8"	1-3/16" - 12	60-100	8,3-14,0	100-160	14-22
16	1"	1-5/16" - 12	75-117	10-16	117-187	16-26
20	1-1/4"	1-5/8" - 12	125-165	17-23	165-264	23-36
24	1-1/2"	1-7/8" - 12	210-250	29-35	250-400	35-55

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Brakes (Continued)

Disc Spring:

Free Length	1.27″
Wire Diameter	.0857″
No. of Coils	10-1/4
Expand to 1.37″	22-1/2 to 27-1/2 lbs.

Retractor Spring:

Free Length	.66″
Wire Diameter	.060″
No. of Coils	5-3/4
Expand to .74″	9 to 11 lbs.

Power Train

SHUTTLE TRACTORS

Reverse idler gear bushing I.D. (burnished)	.862″ to .863″
Countershaft bearing pre-load	4 to 12 in. lbs. required to rotate shaft.
Differential end play	No end play
Differential gear to countershaft pinion backlash	.005″ to .009″
Axle shaft end play	.0001″ to .001″
Countershaft end play (between 2nd and 3rd speed gear)	.001″ to .006″
Gear shift fork rail interlock plug	O.D. .373″ to .375″ Length .566″ to .574″
Main drive shaft end play	.002″ to .005″
Differential center wheel to side wheel backlash (pinion gear)	.005″ to .015″

Shifter Lever Support Spring:

Free Length	2″
Wire Diameter	.1416″
No. of Coils	Optional
Compress to 1-5/16″	35 to 50 lbs.

Range Detent Spring:

Free Length	Optional
Wire Diameter	.072″
No. of Coils	Optional
Compress to 13/16″	35 to 38 lbs.

Neutral Start Spring:

Free Length	1-9/16″
Wire Diameter	.056″
No. of Coils	11
Compress to 1.250″	19-1/2 lbs.

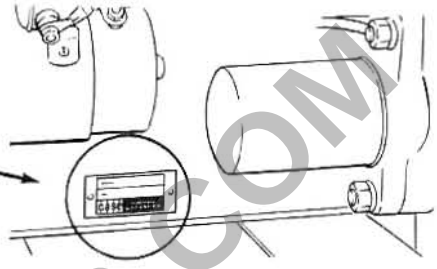
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Section 11

GENERAL ENGINE SPECIFICATIONS

450 CRAWLER

THE MODEL AND ENGINE SERIAL NUMBER IS STAMPED ON A PLATE LOCATED ON THE RIGHT SIDE OF THE ENGINE BELOW THE CRANKING MOTOR.



General — DIESEL ENGINES

Type	Case Open Chamber, 4 Cylinder, 4 Stroke Cycle, Valve-in-Head
Firing Order	1-3-4-2
Bore	3-13/16 Inches
Stroke	4-1/8 Inches
Piston Displacement	188 Cubic Inches
Compression Ratio	17.5 to 1
No Load Governed Speed	2180 RPM
Rated Engine Speed	2000 RPM
Engine Idling Speed	575 to 675 RPM
*Valve Tappet Clearance (Exhaust) and (Intake)	(Hot and Cold) .014 Inch

Hot Settings Are Made After the Engine Has Operated At Thermostat Controlled Temperature For At Least Fifteen Minutes.

Piston and Connecting Rods

Rings per Piston	3
Number of Compression Rings	2
Number of Oil Rings	1
Type Pins	Full Floating Type
Type Bearing	Replaceable Precision, Steel Back, Copper-Lead Alloy Liners

Main Bearings

Number of Bearings	5
Type Bearings	Replaceable Precision Steel Back, Copper-Lead Alloy Liners

Engine Lubricating System

Crankcase Capacity (Without Filter)	5 Quarts
(With Filter Change)	6 Quarts
Oil Pressure	50 to 70 Pounds with Engine Warm and Operating at Rated Engine Speed
Type System	Pressure and Spray Circulation
Oil Pump	Gear Type
Oil Filter	Full Flow Spin on Type

Fuel System

Fuel Injection Pump	Roosa-Master
Pump Timing	8 Degrees Before Top Dead Center
Fuel Injectors (Prior Eng. S/N 2726393)	Pencil Type (Opening Pressure 2800 PSI)
Fuel Injectors (Starting W/Eng. S/N 2726393)	Pencil Type (Opening Pressure 3200 PSI)
Fuel Transfer Pump	Vane Type, Integral Part of Injection Pump
Governor	Variable Speed, Fly-Weight Centrifugal Type, Integral Part of Injection Pump
Fuel Filters (Prior Eng. S/N 2718490)	Replaceable Element Type
Fuel Filters (Starting W/Eng. S/N 2718490)	Full Flow Spin on Type

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FLUIDS AND LUBRICANTS

COMPONENT	CAPACITY		SPECIFICATION
	U.S.	METRIC	
Fuel tank	20 gal.	76 liters	No. 2 diesel fuel Regular grade gasoline Motor method, 85 octane Research method, 93.5 octane
Engine crankcase With filter Without filter	 7 qts. 6 qts.	 7 liters 6 liters	Diesel engine: CD - Commercial class D (DS, Series 3), MIL-L-45199B Above 32° F. (0° C) - SAE 30 10° F to 50° F. (-12.2° C to 10° C) - SAE 20W Below 32° F. (0° C) - SAE 10W Gas engine: SD - Service class D (MS) Above 40° F. (4.4° C) - SAE 30 32° F. to 90° F. (0° C to 32° C) SAE 20W -10° F. to 60° F. (-23° C to 16° C) SAE 10W -10° F. (-23° C) and above - SAE 10W-30 Below 32° F. (0° C) - SAE 5W-20
Brake master cylinder			SAE J1703c brake fluid
Transmission/torque converter	32 qts.	28 liters	Case TCH Fluid Alternate oil: Type A, Suffix A automatic transmission fluid Type C2 transmission and hydraulic fluid (use only in temperatures above 0° (-17° C))
Final drives	6 qts. each	6 liters each	SAE 90 multipurpose gear lubricant API-GL-4, MIL-L-2105
Hydraulic reservoir	7.5 gal.	28 liters	Case TCH Fluid Alternate oil: Engine oil SD or CA (MS or DG) Above 32° F. (0° C) SAE 10W Below 32° F. (0° C) SAE 5W
Grease fittings			Below 32° F. (0° C) Multipurpose or No. 1 lithium-soap base grease Above 32° F. (0 C) Multipurpose or No. 2 lithium-soap base grease
Model 19 winch Winch housing Adapter housing	 6.5 qts. 3 qts.	 6 liters 3 liters	Multipurpose gear lubricant API-GL-4, MIL-L-2105 Above 32° F. (0 C) SAE 90 Below 32° F. (0 C) SAE 75
Model 9 winch	4.5 qts.	4 liters	Same as model 19 winch

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MAINTENANCE CHART

The following chart is based on maximum intervals. If machine is operating in severe conditions, service more often. Refer to page 1050-4 for fluids and lubricants.

INTERVAL	SERVICE	INSTRUCTIONS
Run-in period after first 20 hours	Change engine oil. Change engine oil filter. Check fan belt tension.	 Section 8017
Every 10 hours or daily	Check crankcase oil level. Grease equipment pivot points. Empty dust cup on dry type air cleaner. Service oil cup on oil bath air cleaner. Check coolant level. Check and adjust track tension.	 Section 2051 Section 2051 Section 5010
Every 50 hours	Grease track adjuster guide tubes. Before S/N 3050801. Check fan belt tension. Check battery fluid level. Check transmission fluid level. Check hydraulic oil level. Check winch and adapter housing oil levels.	 Section 8017 Section 8014 Section 6013 Section 4011 Section 9014
Every 120 hours	Change engine oil. Check winch control unit fluid level. Lubricate generator. Check final drive oil levels. Grease throttle linkage. Grease driveshaft. Clean transmission breather.	 Section 9014 Section 8017
Every 240 hours	Replace equipment hydraulic return line filter. Clean equipment hydraulic suction line filter. Replace engine oil filter.	 Section 4011 Section 4011
Every 300 hours	Drain fuel tank water trap. Drain and clean fuel tank sediment bowl. Check brake master cylinder fluid levels. Grease control lever pivot.	 Section 7010
Every 600 hours	Replace fuel filters. Replace transmission pressure line filter. Clean transmission suction line filter.	Section 31 Section 6013 Section 6013

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CYLINDER HEAD AND COMPONENTS

(Refer to Figure 4)

Disassembly

Remove the muffler and hood from vehicle. Disconnect the exhaust system and air cleaner from the manifolds. Loosen the alternator adjusting bolt and remove the fan belt. Remove the water pump and all stud nuts securing water manifold to cylinder head. Steam clean the entire area where service work is to be performed.

1. Drain the cooling system. **CAUTION:** If the engine is hot, do not remove the radiator cap until the coolant has had sufficient time to cool. Loosen the cap to the first stop carefully to relieve any excess pressure before removing it completely. Remove the upper radiator and water pump hoses.
2. Disconnect the high pressure fuel lines from the injectors and the leak-off tubes. Cap them to prevent any foreign particles from entering. Remove the injectors as described in Section 33 of the Service Manual.
3. Remove the breather tube (1).
4. Remove the intake elbow (2) and gasket (3), and discard the gasket.
5. Remove the intake manifold (4) and discard the gaskets (5).
6. Remove the exhaust stack (6) and gasket (7).
7. Remove the exhaust manifold (8) and discard the gaskets (9).
8. Remove the valve cover (10) and cover gasket (11). Discard gasket.
9. Remove the bolts and washers (12), and the rocker arm assembly (13). Remove the push rods (14) and tag them for proper reassembly.
10. Remove the flanged nuts (15). Remove the cylinder head assembly (16), fire rings (17) and head gasket (18). Discard the fire rings and head gasket.
    NOTE: Refer to Inspection and Servicing on Page 6 and 7 prior to assembly.

Assembly

1. Place new cylinder head gasket (18) on the engine block. **NOTE:** Be sure the two dowel rings are installed in their proper location, Inset A.
2. Install the new fire rings (17) with either side up. **NOTE:** The fire rings must be installed dry.
3. Install new gasket (19) between timing cover and cylinder head, coating it with a sealer.
4. Install the cylinder head (16) and flanged nuts (15). Lubricate threads with clean engine oil prior to torquing. Torque the flange nuts to 60 ft. lbs. and then to 90-100 ft. lbs. using the torquing sequence shown in Inset B.
5. Install the water pump and a new gasket, coating the gasket with a sealer. Torque the water pump stud nuts 20-25 ft. lbs. Install the fan belt and adjust.
6. Coat the push rods (14) with clean engine oil and install them in their original location.
7. Install the rocker arm assembly (13). **NOTE:** The rear mounting bolt is drilled for oil passage to the rocker arm shafts. Torque the bolts (12) to 25-30 ft. lbs. Adjust the valve tappet clearance, refer to Page 16.
8. Install the intake (4) and exhaust (8) manifolds using new gaskets (5 & 9). Torque the stud nuts and bolts 25-30 ft. lbs.
9. Install the intake elbow (2) using new gasket (2). Install the exhaust stack (6) using new gasket (7).
10. Reinstall the air cleaner system and exhaust system. Refill the cooling system. Reconnect the high pressure fuel lines to the injectors and the leak-off tubes.
11. Apply clean engine oil to the rocker arm assembly and start the engine. Check that the rocker arms are receiving lubricating oil. Operate the engine for approximately one hour, (under load if possible) to thoroughly warm up the engine seat the head gaskets.
12. Shut the engine off. Back off each cylinder head flanged nut individually 1/4 and retorque to 100 ft. lbs. **NOTE:** DO NOT BACK OFF ALL THE FLANGED NUTS AT THE SAME TIME.
13. Install new valve cover gasket (11) and valve cover (10). Torque the valve cover stud nuts 5-8 ft. lbs. Install breather tube (1).

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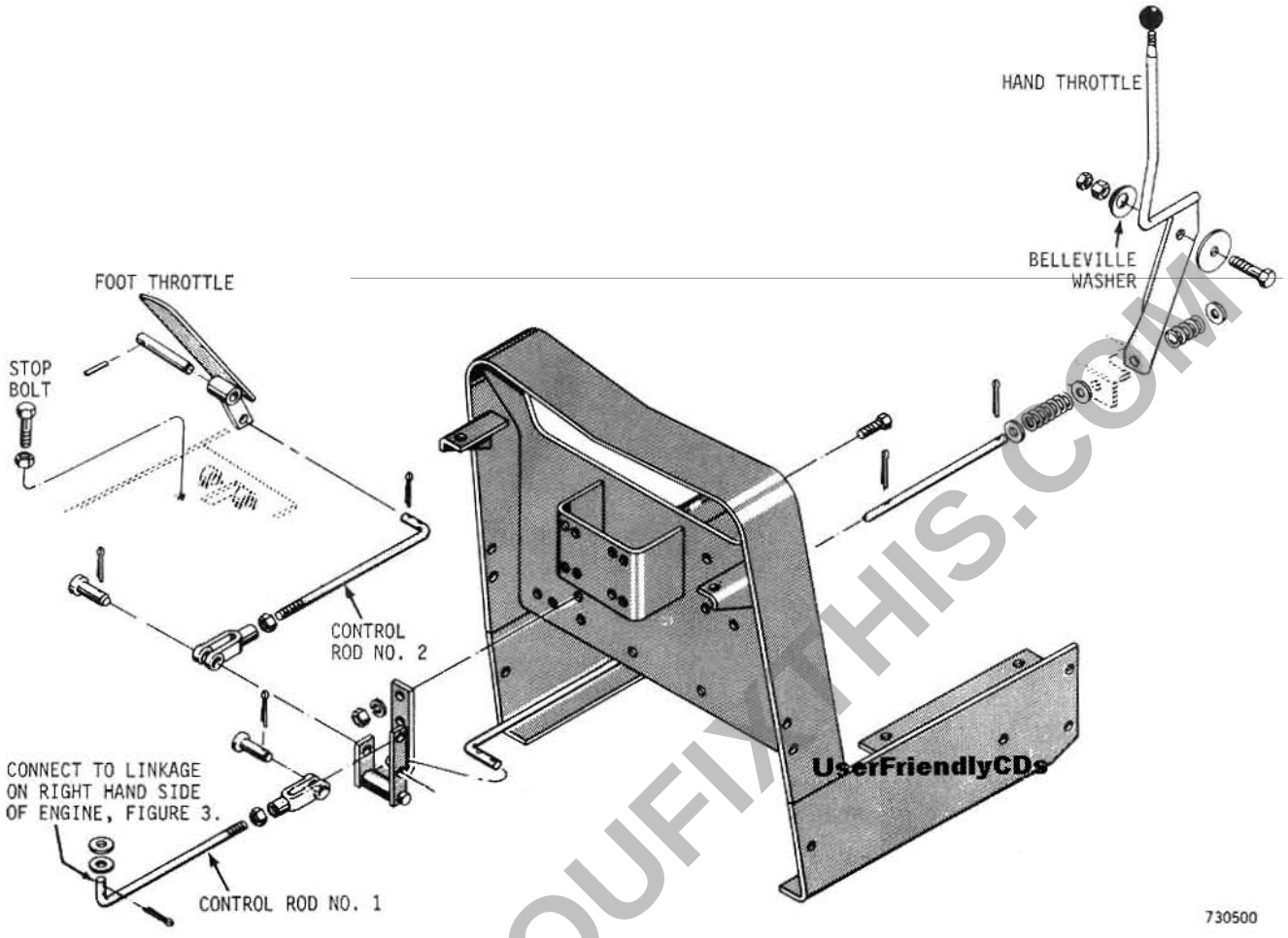
THROTTLE LINKAGE ADJUSTMENTS, GASOLINE ENGINE

Idle Speed Specifications

Low idle.....500 to 550 rpm
High idle.....2150 to 2200 rpm

Foot and Hand Throttle Adjustments

1. Pull the hand throttle back against the stop.
2. Start the engine. Adjust length of control rod no. 1 to attain low idle speed of 500 to 550 rpm.
3. Adjust length of control rod no. 2 until the foot throttle is 66 degrees relative to the floor.
4. Push the hand throttle completely forward to attain high idle.
5. Adjust the foot throttle stop bolt until it touches the underside of the foot throttle.
6. To adjust the hand throttle "feel," loosen the jam nut, then tighten or loosen the nut over the belleville washer until the desired "feel" is attained. Tighten jam nut.



Figure—2

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Section 12

DETAILED SPECIFICATIONS

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SPECIFICATIONS (Cont'd)

	Maximum Limit Including Wear
PISTON RINGS (Continued)	
End gap in 3.812 I.D. sleeve (188D)	.015 to .025
3.375 I.D. sleeve (148G)	.010 to .020
3.500 I.D. sleeve (159G)	.010 to .020
3.812 I.D. sleeve (188G)	.010 to .020
Side clearance (188D)	Not measureable
(188G, 159G, 148G)	.0030 to .0045
No. 2 Compression (188G, 159G, 148G)	Tapered Face
(188D)	Grooved
Width (188G, 159G, 148G)	.0930 to .0935
(188D)	.0925 to .0935
End Gap in 3.812 sleeve (188D)	.015 to .025
3.375 sleeve (148G)	.010 to .020
3.500 sleeve (159G)	.010 to .020
3.812 sleeve (188G)	.010 to .020
No. 2 Compression	
Side clearance (188D)	.0035 to .0055
(188G,159G,148G)	.0020 to .0035
No. 3 Compression (188G,159G,148G)	Tapered Face
Width	.0930 to .0935
End gap in 3.812 sleeve (188G)	.010 to .020
3.375 sleeve (148G)	.010 to .020
3.500 sleeve (159G)	.010 to .020
Side clearance	.0020 to .0035
OIL RINGS	
Width (188D)	.1825 to .1888
(188G,159G,148G)	.2485 to .2490
Side clearance (188D)	.000 to .007
(188G,159G,148G)	.0010 to .0015
End gap in 3.812 I.D. sleeve (188G)	.010 to .018
3.375 I.D. sleeve (148G)	.010 to .018
3.500 I.D. sleeve (159G)	.010 to .018
Rail end gap in 3.812 I.D. sleeve (188D)	.015 to .055

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Section 2050

ENGINE REMOVAL, INSTALLATION AND STALL TESTS

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FUEL LINES

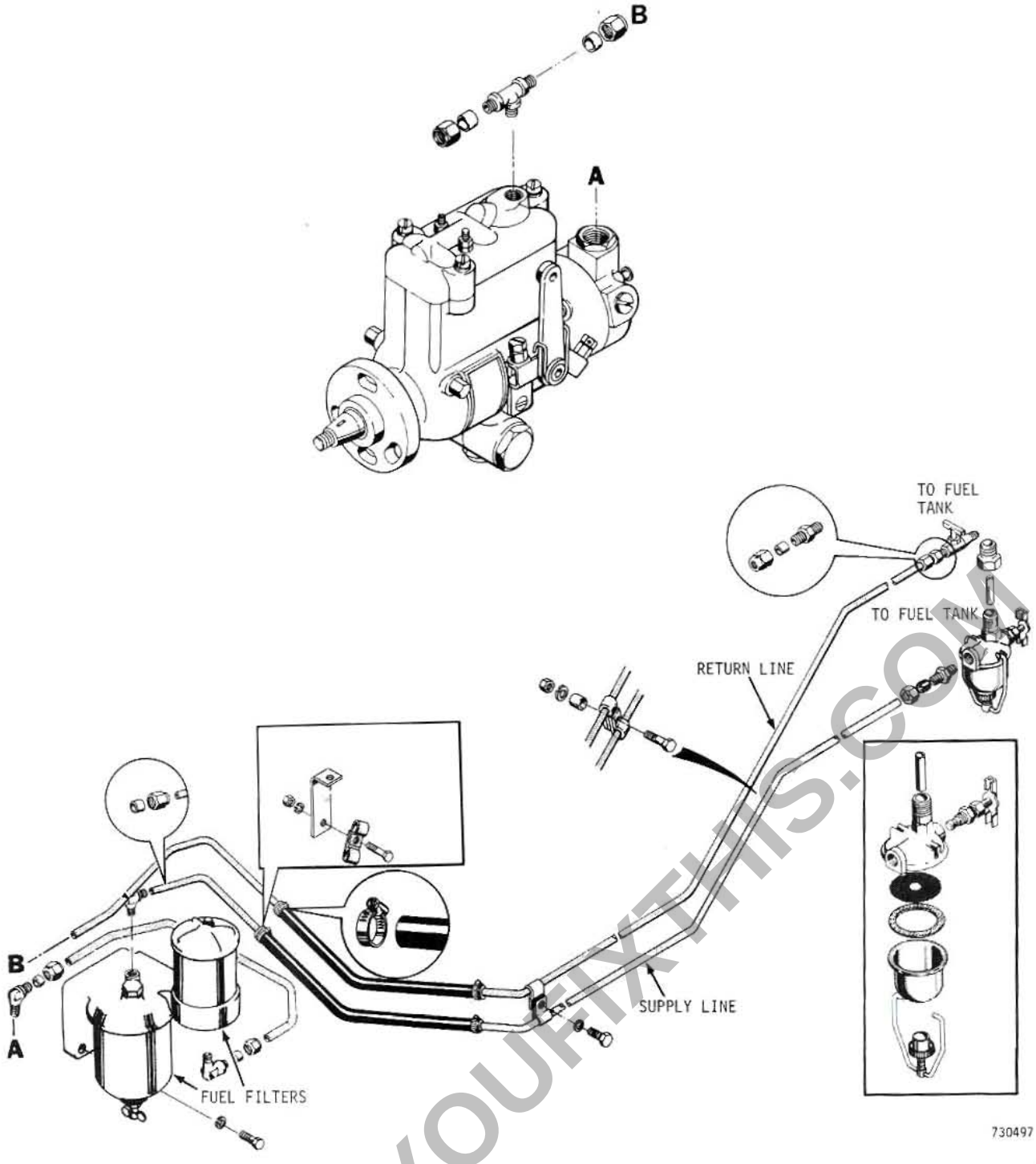


Figure 4 — Fuel Lines and Sediment Bowl, Diesel Engine

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4. Inspect the bushings in both the front and back covers, Figure 11. If the bearing inside diameter is more than .879", both the front and rear covers must be replaced as an assembly with the bushings. Bushings are not supplied separately. Bushings in the front cover are flush with the edge of the cover.

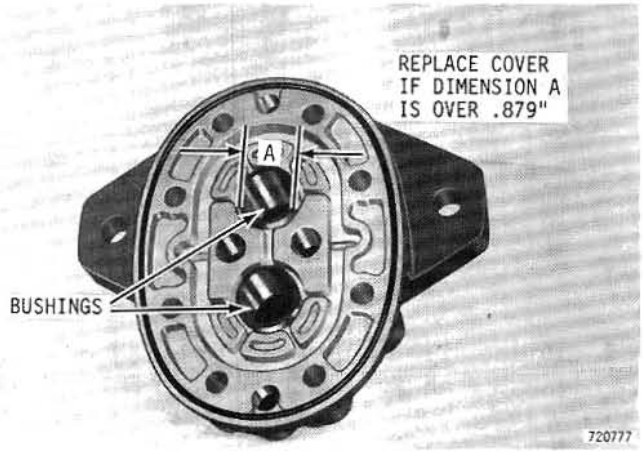


Figure 11 — Checking the Bushings

5. Inspect the gear plate, Figure 12. Check inside of plate for excessive wear or score marks. If inside diameter of gear pocket measures over 2.107", replace.

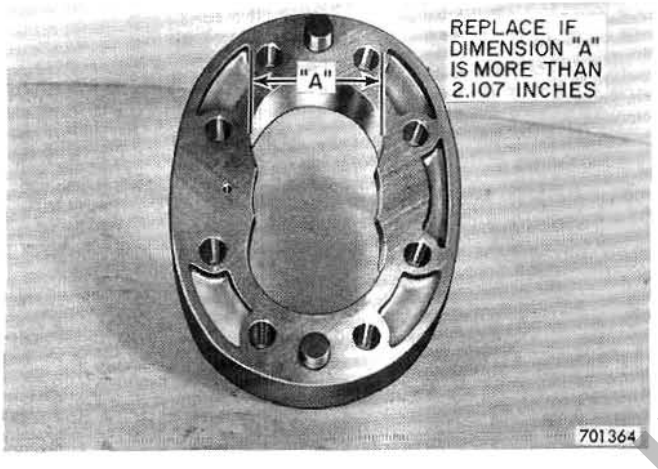


Figure 12 — Checking the Gear Plate

Assembly

A service kit is available for replacing all the pump seals and gaskets. This kit contains a new thrust plate, diaphragm, gaskets, shaft seal, diaphragm seal, and two steel balls and springs. Refer to the Case Parts Catalog.

1. Place a new V-seal on the front cover with the V down. Use a dull instrument and install the seal into the cover. Install new protector gasket on the V-seal. Install new Nylatron gasket. Install O-ring (D41390 Pump).

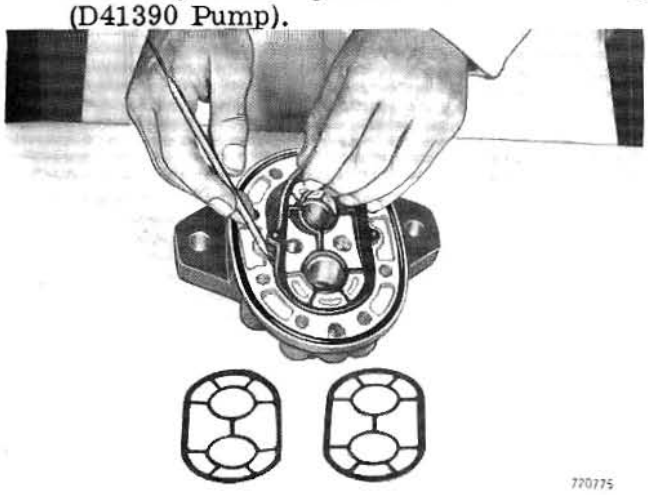


Figure 13 — Installing seals in Front Cover

2. Place the steel balls in the holes in the front cover. Place a spring on top of each ball.



Figure 14 — Front Cover and Diaphragm

3. Install new diaphragm (wear plate) with the bronze side up. It must fit inside of the rim on the V-seal. Make sure coils of the springs are not wedged between diaphragm and front cover. Figure 14.

4. On the rear cover, install the thrust plate (wear plate) with bronze side toward the gears. Side with cutaway must be on the suction side of the pump (side with largest portholes). This plate fits inside the gear plate when gear plate is seated on rear cover. Figure 15.

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General

The optional boom lockout system improves the craning ability or load handling capacity of the backhoe. The system consists of a relief valve and lockout valve placed in the boom circuit, Figure 1 or 2.

When the lockout valve handle is in Lock position, oil can move only in one direction (see arrow, Figure 1 or 2). Thus pressure in the boom circuit caused by the weight of the load pulling down on the boom is not applied against the boom spool or the 2750 psi relief valve in the boom section. Oil is relieved only by the lockout relief valve (which is set higher) permitting a heavier load to be handled. In addition, the boom cannot "settle" due to leakage under pressure past the boom spool (all spools leak slightly due to valve clearances).

NOTE: The boom cannot be lowered hydraulically with the valve in Lock position.

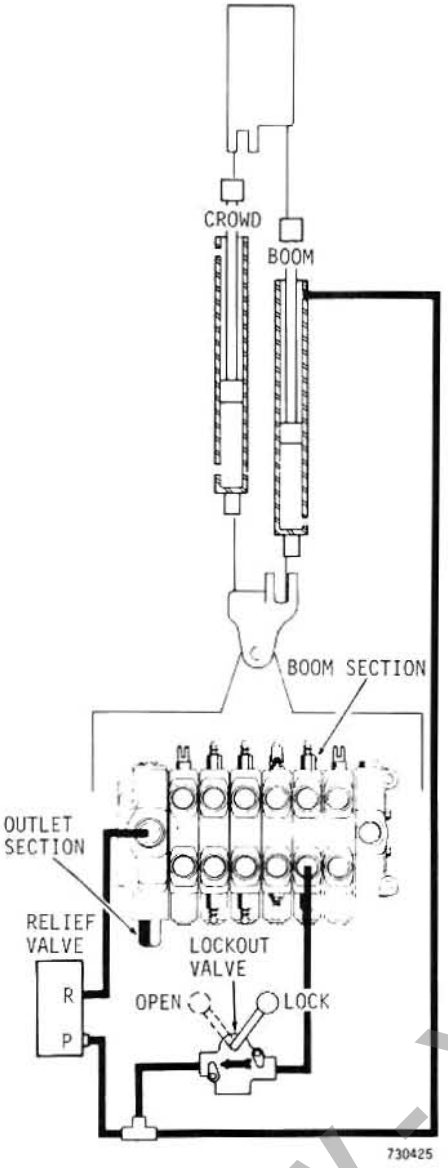


Figure 1 — Hydraulic Diagram of 26 Backhoe

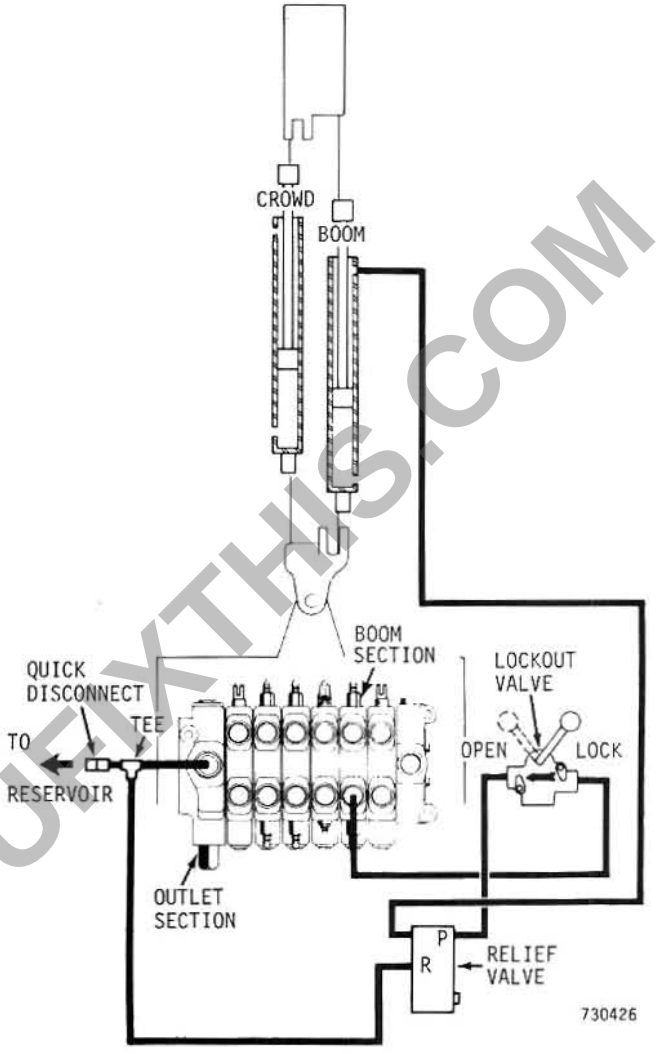


Figure 2 — Hydraulic Diagram of 26C and 33 Backhoes

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SPECIFICATIONS FOR REBUILDING IDLERS AND AND ROLLERS

Idler Wheels

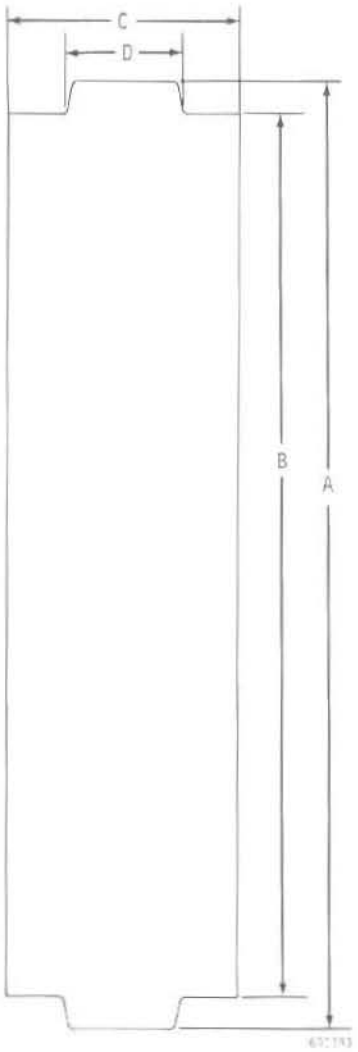


Figure 29

Before Crawler
S/N 3050801

A	21.750"
B	20.250"
C	4.375"
C	2.375"

Crawler S/N 3050801
and After

A	22.375"
B	21.000"
C	5.310"
D	2.690"

Track Rollers

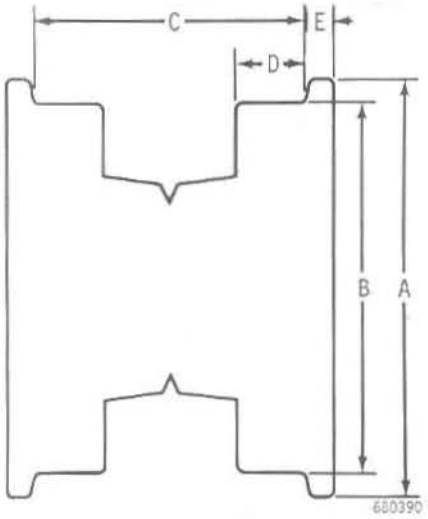


Figure 30

Before Crawler
S/N 3050801

A	7.375"
B	6.062"
C	4.375"
D	1.250"
E	.500"

Crawler S/N
3050801 and After

A	7.400"
B	6.100"
C	5.520"
D	1.350"
E	.560"

Carrier Rollers

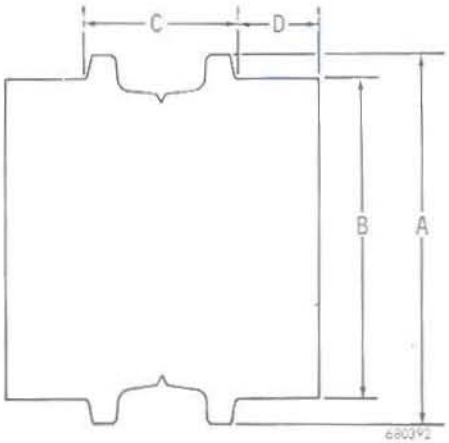


Figure 31

Before Crawler
S/N 3050801

D35352 Roller

A	5.875"
B	5.000"
C	1.875"
D	1.875"

D49923 Roller

A	6.300"
B	5.250"
C	1.875"
D	1.430"

Crawler S/N 3050801
and After

A	6.500"
B	5.630"
C	2.560"
D	1.550"

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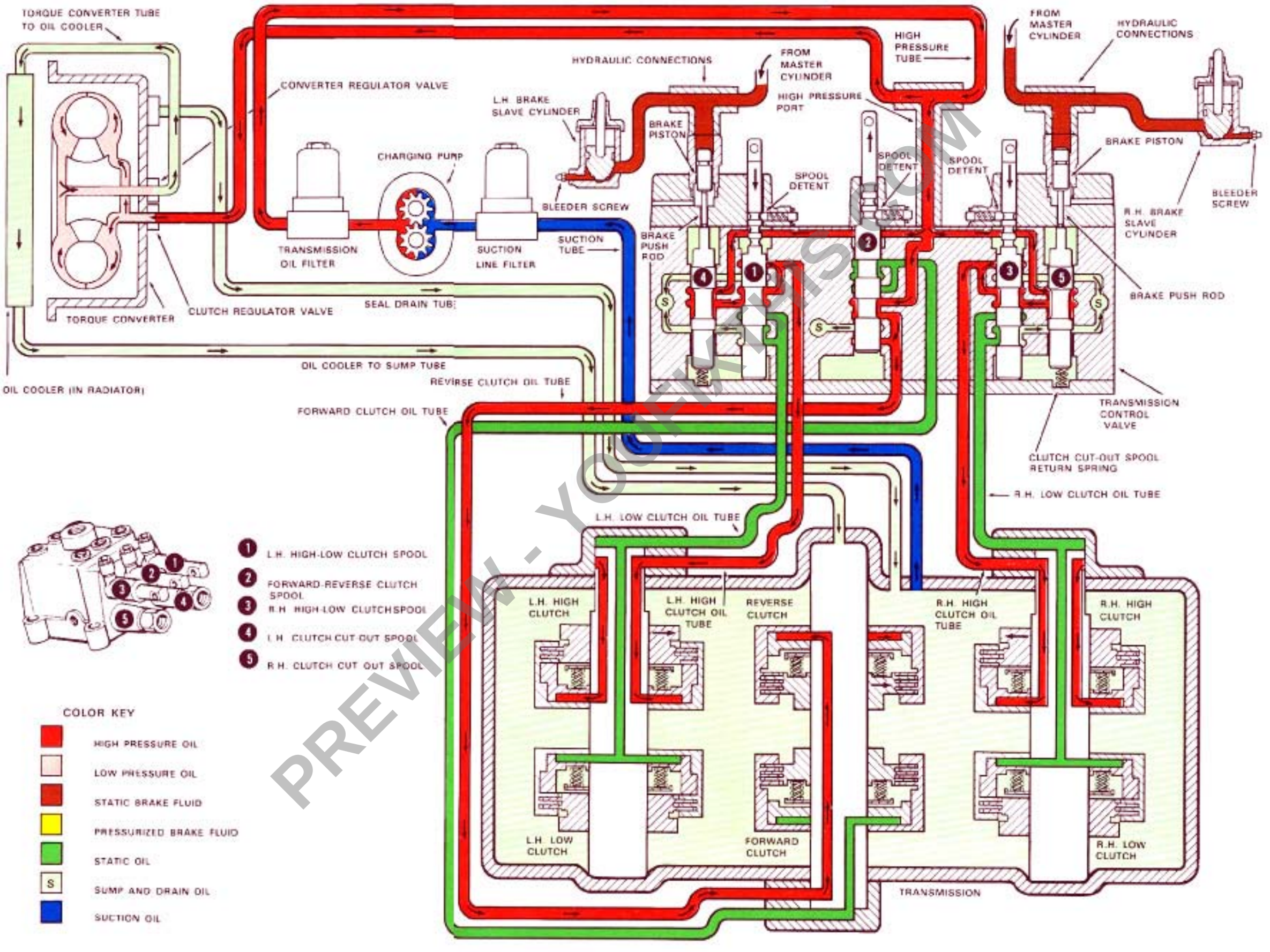


Figure 6

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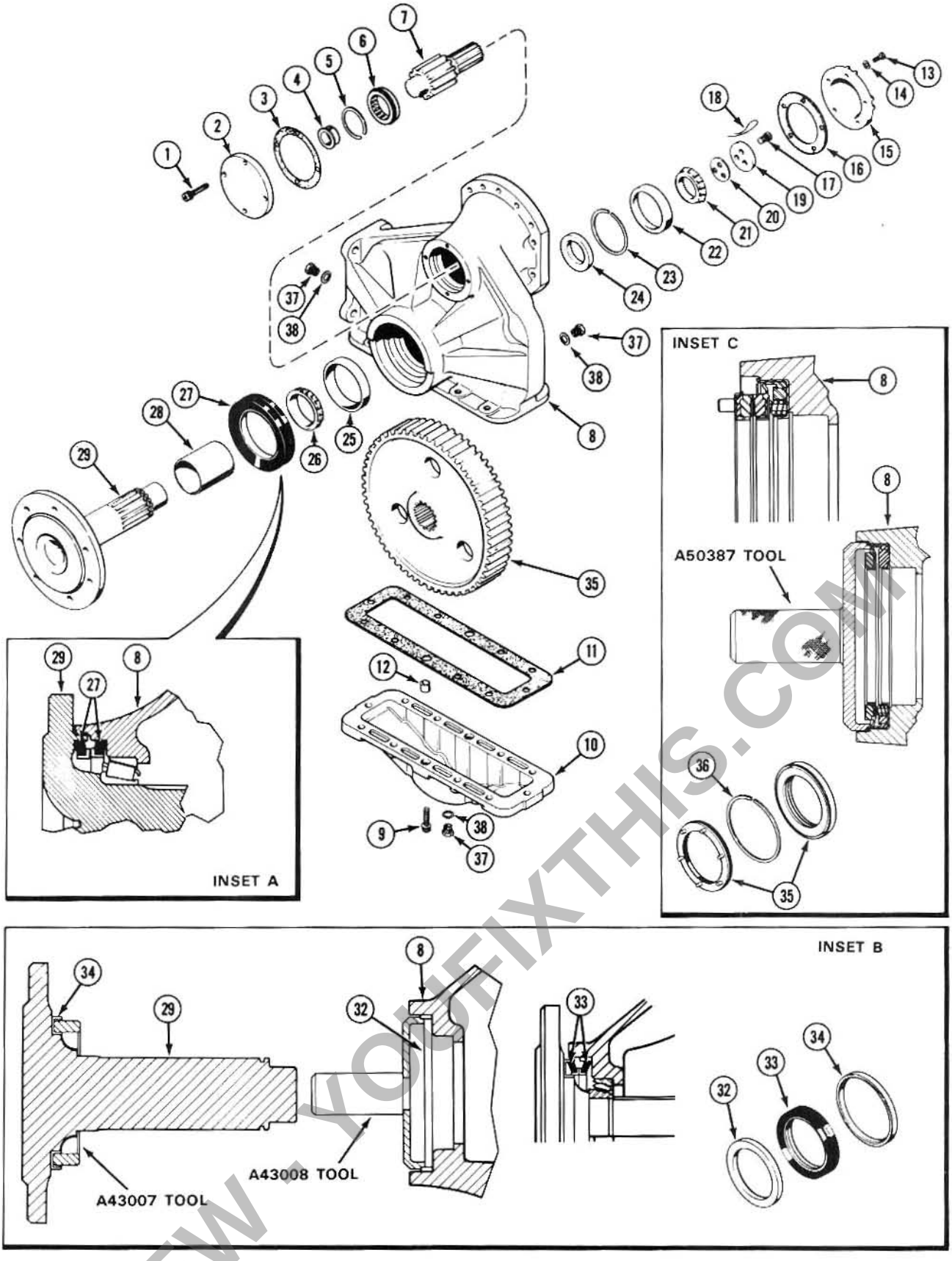


Figure 30

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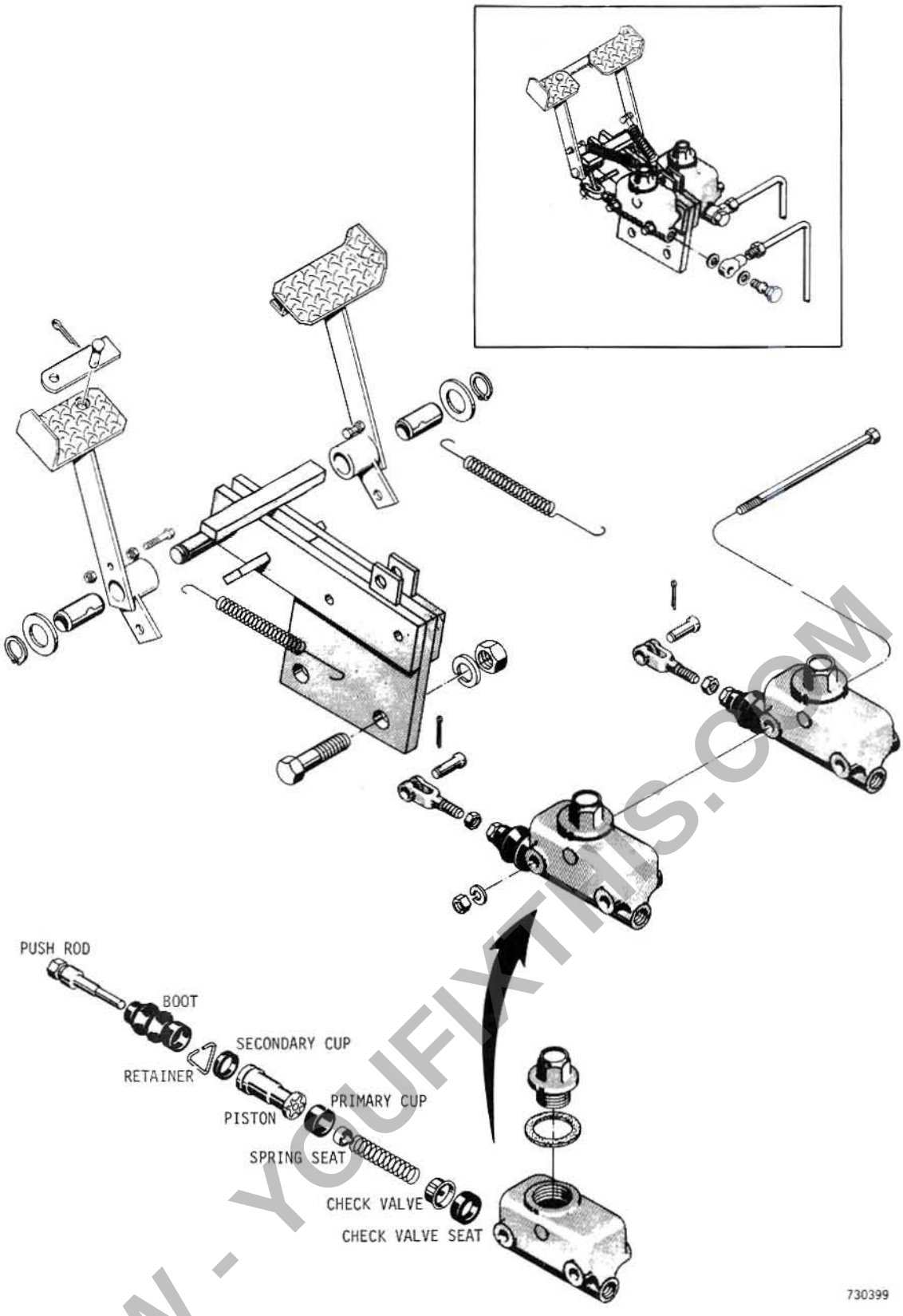


Figure 2 - Master Cylinder Installation (Early Production)

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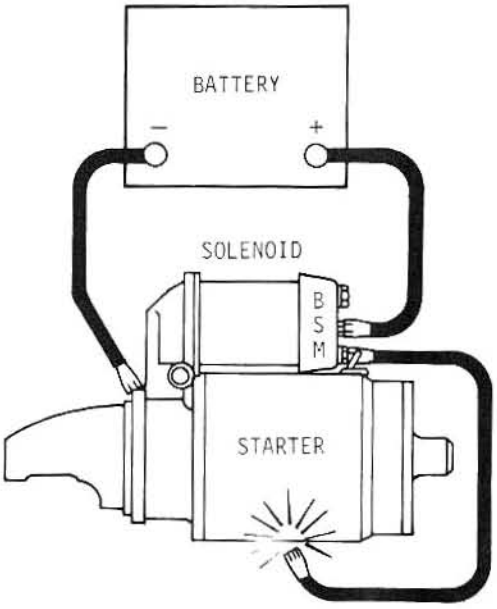


Figure 7 - Circuit for Checking Pinion Clearance

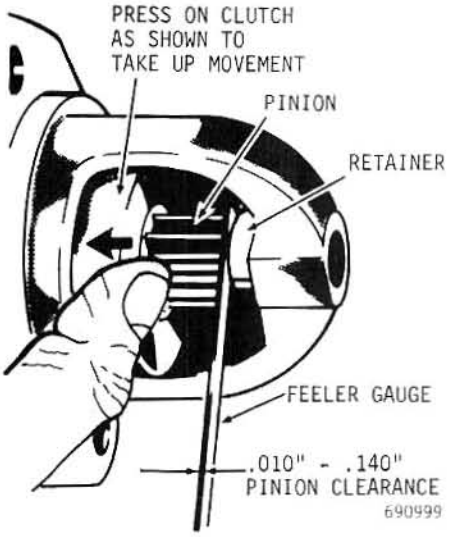


Figure 8 - Measuring and Adjusting Pinion Clearance

4. Push the pinion back towards the commutator end to eliminate slack movement.

5. Measure the distance between pinion and pinion stop, Figure 8.

Pinion Position (Prestolite)

Proper pinion position is 1-23/32" to 1-27/32" with the starter drive at rest. This dimension is measured from the mount-face of the drive housing to the outer edge of the pinion with the starter drive at rest. Check pinion position with the armature pushed against the end plate and again with the armature pushed against the center bearing plate. Adjust the pinion position as required using washers from the thrust washer kit. Refer to Parts Catalog for kit part number.

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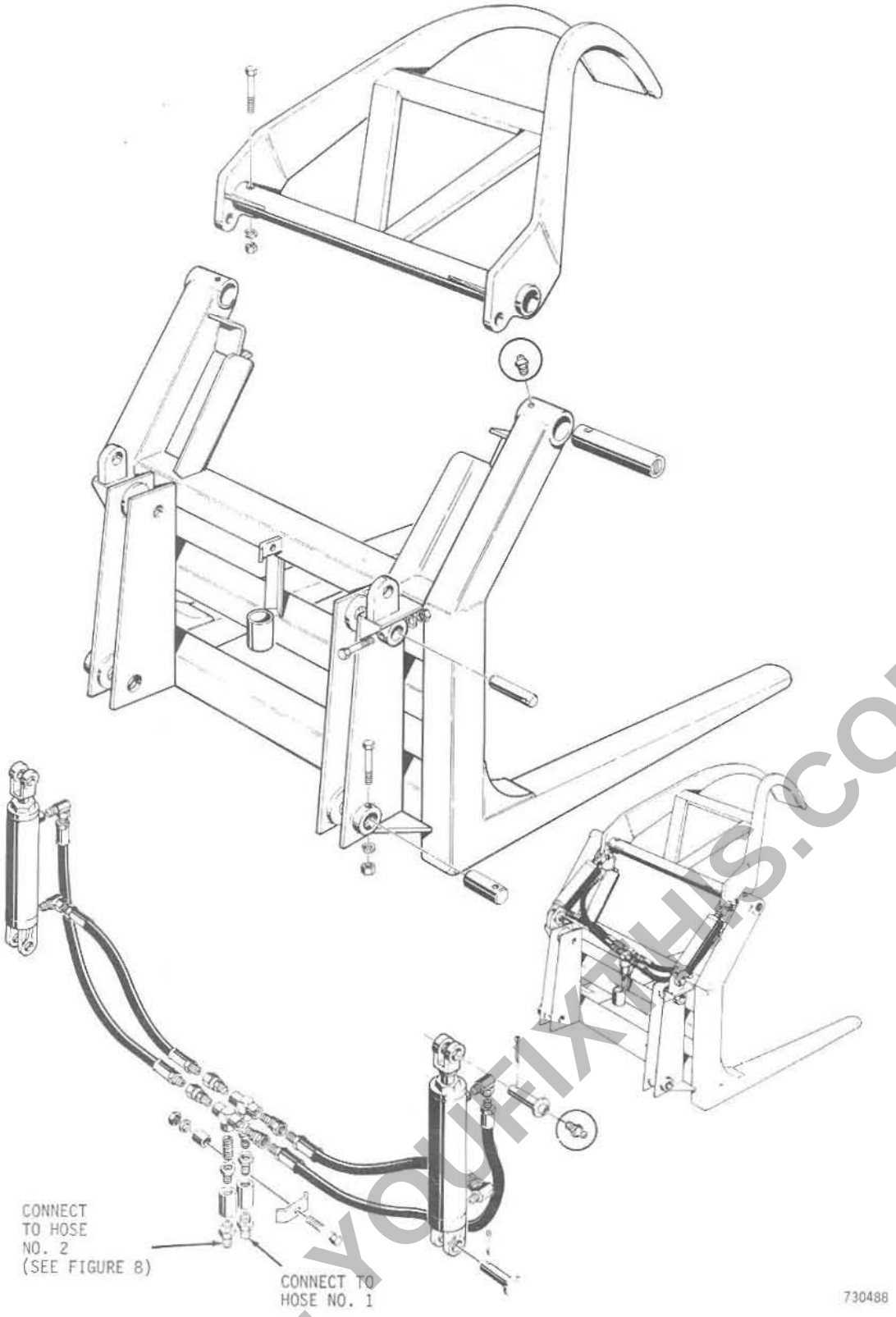


Figure 12 – Logging Fork and Grapple Attachment

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Dipper Installation

1. If the hydraulic lines have been removed from the boom, reinstall them at this time.

2. Raise the boom hydraulically into the position for attaching the dipper.

3. Install the dipper as shown in Figures 5, 6, and 23. A 1/16" to 1/8" gap must be maintained so the dipper may pivot freely without excessive play. Place an equal number of shims on each side. However, if an odd number is required, put the extra shim on the right side. Secure the dipper pivot pin with snap rings.

4. Install the dipper cylinder and its hydraulic lines. Refer to Figures 12 thru 15.

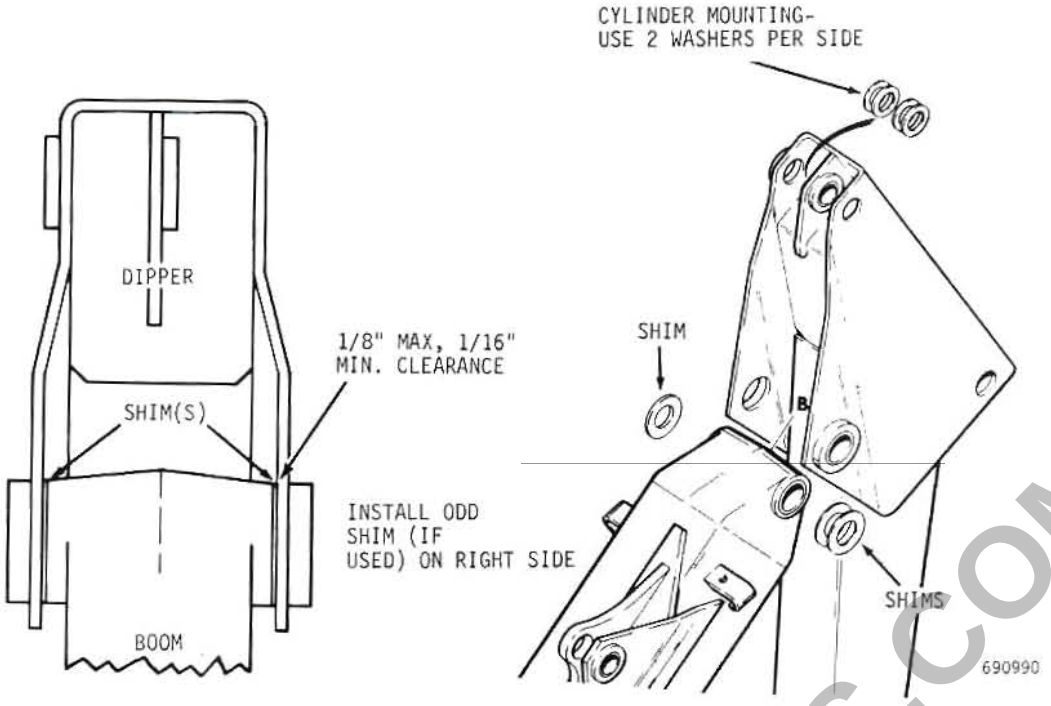


Figure 23 - Installing The Dipper

Bucket Installation

1. If the bucket cylinder was removed, reinstall as shown in Figure 5.

2. Connect the two hydraulic lines to the bucket cylinder.

3. Install the bucket links to the dipper and bucket cylinder, Figures 5, 24, and 25.

4. Position the bucket so that the teeth face the swing tower.

5. Start the engine and position the dipper over the bucket.

6. Install the bucket pivot pin and retain with snap rings. See Figures 24 and 25.

7. Lift the bucket clear of the ground and retract or extend the bucket cylinder until the bucket linkage is in the approximate mounting position.

8. The bucket can be easily connected to the linkage. Rotate the bucket by hand to align the mounting holes. Install the mounting pin and retain with snap rings.

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TROUBLE SHOOTING CHART

TROUBLE	POSSIBLE CAUSE	REMEDY
Clutch Slipping	1. If the winch or master control has recently been installed, there may be air in the clutch line.	1. See Bleeding Brake and Clutch Lines.
	2. If the master control handle continues to move gradually when a constant force is applied to engage the clutch, there may be a leak in the clutch line, clutch cylinder in winch or master control cylinder.	2. Check all fittings for escaping fluid. If no leak is visible, remove the fitting in the end of the master control clutch cylinder and install a 1/8" NPT pipe plug. If the control handle still moves when a constant load is applied, the cup in the master control cylinder is leaking. If the leak is not found by the above tests, remove the clutch cover from the winch and inspect all clutch line connections and the clutch cylinder.
	3. The clutch may require adjustment. If clearance between the clutch drum and the clutch bands has become excessive due to wear the master control handle will have greater than normal travel when moved for clutch engagement.	3. Remove the clutch cover from the winch and adjust the clutch bands.
	4. If the clutch continues to slip after the above points have been checked, the clutch bands may have become glazed.	4. Remove the clutch bands and clean them with rough emery cloth or a coarse file.
	5. The clutch bands may have become soaked by brake fluid.	5. Remove the clutch bands and replace them with new parts.
	6. The clutch may have become hot from excessive slippage under heavy pulls.	6. Allow the winch to cool for 10-15 minutes.
	7. The clutch bands may be worn and require replacement.	7. Remove the clutch bands and replace them with new parts.

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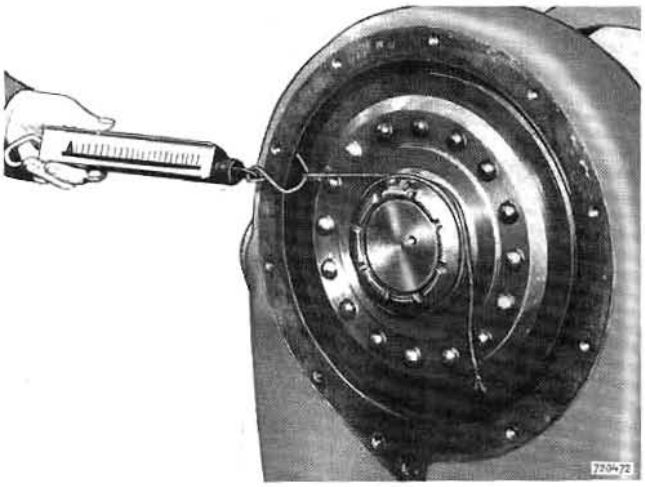


Figure 44 — Checking Preload

BEARING SPACER

1. If the preload is not within specifications, a new bearing spacer of the correct width must be provided.

   a. Remove the inner adjusting nut, inner bearing cone, and bearing spacer.

   b. Grind .040" from the width of the old spacer. Maintain width as uniform as possible all around the spacer. This makes a tool for establishing the width of the new spacer.

2. Reassemble the items removed above with a piece of soft lead gauge wire or Plastigage between the spacer and bearing cone. Tighten the adjusting nut until it takes 11 to 20 inch-pounds to start to rotate the drum shaft.

3. Remove the adjusting nut, bearing cone, spacer tool and wire and measure to total thickness of the tool and compressed gauge wire. This is the width of the spacer required.

   NOTE: Do not attempt to use shims.

4. Order a new spacer from the Case Parts Catalog, specifying the required width (the width is marked on the spacer). To avoid down time, a spacer can be machined from 4-1/4" x 5/16" wall tubing. The width should be within .001" of the width established in step 3.

Ring Gear and Pinion Adjustments

Refer to Figure 45.

If the ring gear and pinion setting is disturbed or if the ring gear and pinion are replaced, the three adjustments to follow must be made. These adjustments require disassembly of the winch to gain access to the inner adjusting nut.

ADJUSTMENT NO. 1 — POSITION THE PINION SHAFT

This adjustment is required only if the ring gear and pinion have been replaced or if the shim pack between the pinion shaft roller bearings has been altered.

1. Establish the total thickness of shims required under the flange of the pinion bearing housing as follows:

   a. When the bevel pinion bearings have been correctly preloaded, measure dimension "Y" as shown in Figure 45. Place the bevel pinion assembly on a smooth surfaced table so that it stands on the end of the pinion and use an inside micrometer to measure dimension "Y".

   b. Dimension "Z" is marked on the end of the pinion shaft and dimension "X" is marked on the back of the winch housing.

   c. Add dimensions "Y" and "Z". Subtract dimension "X" from this total. The result is the thickness of the shim pack required. Thickness of shim pack equals Y+Z-X.

2. Install the pinion assembly with shims as established in step 1. Torque capscrews to 120 foot-pounds.

ADJUSTMENT NO. 2 — BACKLASH

1. Adjust the position of the ring gear by turning the adjusting nuts to provide .010" to .015" backlash at the heel of the ring gear tooth.

   NOTE: The correct backlash is marked on the O.D. of the ring gear.

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