`TM 5-3810-293-14&P-2

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT, AND DEPOT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL MAINTENANCE INSTRUCTIONS)
FOR

CRANE, TRUCK MOUNTED, HYDRAULIC, 25 TON (CCE) HARNISCHFEGER MODEL MT-250, NON-WINTERIZED NSN 3810-00-018-2021 HARNISCHFEGER MODEL MT-250, WINTERIZED NSN 3810-00-018-2007

HEADQUARTERS, DEPARTMENT Of THE ARMY

6 JUNE 1980

This copy is a reprint which includes current pages from Changes 1 through 3.

CHANGE
NO. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C. , *10 October 1986*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL MAINTENANCE INSTRUCTIONS)
FOR
CRANE, TRUCK MOUNTED, HYDRAULIC, 25 TON (CCE)
HARNISCHFEGER MODEL MT-250, NON-WINTERIZED
NSN 3810-00-018-2021
HARNISCHFEGER MODEL MT-250, WINTERIZED
NSN 3810-00-018-2007

TM 5-3810-293-14&P-2, 6 June **1980,** is changed as follows:

1. Part Two-Crane Repair Parts Manual, has been replaced by TM 5-3810-293-20P, ORGANIZATIONAL MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS and TM 5-3810-293-34P, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS.

File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States *Army*
Chief of Staff

Official:

R.L. DILWORTH
Brigadier General. United States Army
The Adjutant General

Distribution:

To be distributed in accordance with DA Form 12-25A-R, Operator, Organizational, Direct Support and Gereral Support Maintenance requirements for Cranes, Truck Mounted, Hydraulic, 25-T, Model MT-250.

Change Number 2

Changes in force C1 and C2

TM 5-3810-293-14&P-2
C2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC 21 December 1984

OPERATORS, ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL MAINTENANCE INSTRUCTIONS)
FOR

CRANE, TRUCK MOUNTED, HYDRAULIC, 25 TON (CCE)
HARNISCHFEGER MODEL MT-250, NON-WINTERIZED
(NSN 3810-00-018-2021)
HARNISCHFEGER MODEL MT-250, WINTERIZED
(NSN 3810-00-018-2007)

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1. Remove old pages and insert new pages as indicated below.

Remove Pages	***Insert Pages***
Table of Contents, Part One	Table of Contents, Part One
None	New Section XI

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CHANGE
NO. 1

TM 5-3810-293-14&P-2
C1

HEADQUARTER
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *7 Oct 83*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL MAINTENANCE INSTRUCTIONS) FOR CRANE, TRUCK MOUNTED, HYDRAULIC, 25 TON (CCE) HARNISCHFEGER MODEL MT-250, NON-WINTERIZED (NSN 381 0-00-018-2021) HARNISCHFEGER MODEL MT-250, WINTERIZED (NSN 3810-00-018-2007)

TM 5-3810-293-14&P-2, 6 June 1980 is changed as follows:
1. Remove old pages and insert new pages as indicated below.
2. New or changed material is indicated by a vertical bar in the margin of the page.
3. Added or revised illustrations are indicated by a vertical bar adjacent to the illustration identification number.

Remove Pages	Insert Pages
i	i
Part two - HOW TO USE THIS BOOK	Part two - HOW TO USE THIS BOOK
Group 3, Page 16.1 Rev 002, Sheet 3 of 4 and Sheet 4 of 4	Group 3, Page 16.1, Rev. 002, Sheet 3 of 4 and Sheet 4 of 4
	Add following sheets after Group 4, Page 20.1, Rev 001, Sheet 1 of 1.
	Editing Section E, Sheets 1 through 5.
	Editing Section F, Sheets 1 through 5
	Group 2, Page 1.2, Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 2, Page 6.2, Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 2, Page 102, Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 2, Page 112. Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 2, Page 13.3, Rev 001 Sheet 1 of 3, Sheet 2 of 3 and Sheet 3 of 3
	Group 2, Page 14.2, Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 2, Page 25.3, Rev 001, Sheets 1 of 2 and Sheet 2 of 2
	Group 2, Page 26.2, Rev 002, Sheet 1 of 2 and Sheet 2 of 2
	Group 2, Page 26.2, Rev 001, Sheet 1 of 2
	Group 2, Page 28.2, Rev 002. Sheet 2 of 2
	Group 3, Page 30.2. Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 3, Page 31.5, Rev 001, Sheet 1 of 11 through 11 of 11
	Group 4, Page 1.2, Rev 001, Sheet 1 of 6 through 8 of 8
	Group 4. Page 2.4, Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 4, Page 5.4. Rev 001, Sheet 01 of 6 through 6 of 6
	Group 4, Page 7.2, Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 4, Page 8.2, Rev 001, Sheet 1 of 2 and Sheet 2 of 2
	Group 4, Page 20.1, Rev 002, Sheet 1 of 1

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JOHN A. WICKHAM, JR.
General, United States Army
chief of staff

official:

ROBERT M. JOYCE
Major General, United States Army
The Adjustment General

Distribution :
To be distributed in accordance with DA Form 12-25B, Operator's, Organizational, Direct Support, General Support and Depot Maintenance Manual for Crane, Truck Mounted, Hydraulic, 25-Ton (CCE) Harnishchfeger Model MT-250.

TECHNICALMANUAL
No. 5-3810-293-14&P-2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *6 June 1980*

**OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT,
GENERAL SUPPORT AND DEPOT MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS INFORMATION AND SUPPLEMENTAL
MAINTENANCE INSTRUCTIONS)
FOR**

CRANE, TRUCK MOUNTED, HYDRAULIC, 25 TON (CCE) HARNISCHFEGER MODEL MT-250, NON-WINTERIZED (NSN 3810-00-018-2021) HARNISCHFEGER MODEL MT-250, WINTERIZED (NSN 3810-00-018-2007)

REPORTING OF ERRORS

You can help improve this publication. If you find any mistakes, or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publication and Blank Forms), or DA Form 2028-2 located in the back of this publication direct to: US Army Tank-Automotive Command, ATTN: DRSTA-MBP, Warren, MI 48090. A reply will be furnished to you.

PART ONE. CRANE SHOP MANUAL
TWO. CRANE REPAIR PARTS MANUAL
THREE. FRONT AXLE, TRANSMISSIONS, AND WINCHES

NOTE: Refer to TM 5-3810-293-14&P-1 for Crane Operator's Manual, Weighload Automatic Safe Load Indicator, Supplemental Maintenance and Repair Parts Instructions.
NOTE: Refer to TM 5-3810-293-14&P-3 for Engine Operator's Manual, Engine Service Manual, and Engine Parts Catalog.

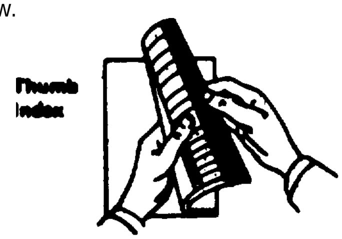
This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

PART ONE
CRANE SHOP MANUAL

TABLE OF CONTENTS

How TO USE THIS SHOP MANUAL

This Shop Manual is divided into the major sections shown above. Each major section can be located using the margin tab marks on the right edge of this paga as shown in the sketch below.



This manual has been planned to allow new information to be added as design changes occur, this eliminating the need for new manuals on the same basic machine model. This will be the only Shop Manual on the Model T-250.

SECTION I
INTRODUCTION

SECTION I
INTRODUCTION

SCOPE

This manual provides maintenence personnel with information and instructions for servicing and repairing this machine. In order to becomes familiar with the various parts of the machine, it is urged that maintenance personnel study the instructions end illustrations in this manual and use it es a reference when performing repair or maintenance operations.

An Operators Manual is provided with each machine for the purpose of providing the essential information regarding day-today maintenance, adjustment, and lubrication of the machine.

NOTE

Sections I, II and Ill of the Operators Manuel have been duplicated as the first three sections of this manual to provide maintenance personnel with the tabulated data, controls and operation, and lubrication information that may be necessary in the per. formance of repair or maintenance operations.

GENERAL INFORMATION

The information, specifications and illustrations in this publication are based on the information in effect at the time this manual was printed. Continuing improvement and advancement of product design may cause changes to your machine which may not be included in this publication. Each publication is reviewed and revised, es required, to update and include these changes in later editions.

When a question arises regarding your machine, or this pub lication, please consult your Harnischfeger representative for the latest available information.

Any part numbers which appear in this manual are for *reference only;* refer to the P&H Replacement Parts Manual when ordering parts.

SAFETY

Proper maintenance of a machine is essential to its safe operation. Catalog 221, Safe Operating Practices, has been prepared es a guide to safe maintenance practices as well as to safe opereting practices. It is *strongly recommended* that all serviceman read and become familiar with Catalog 221 as a pert of service training for this machine.

One copy of Catalog 221 is furnished with each new machine. Additional copies of Catalog 221 are available, in reasonable quantities, at no cost. Submit such requests to the Harnischfeger Technical Publications Department.

SERIAL NUMBER LOCATION

Figure 1-1 illustrates the machine serial number which is located on the lower front side of the operator's cab. Always indicate the machine serial number in all correspondence to properly identify the machine, and to ensure that correct parts are obtained, when ordered.

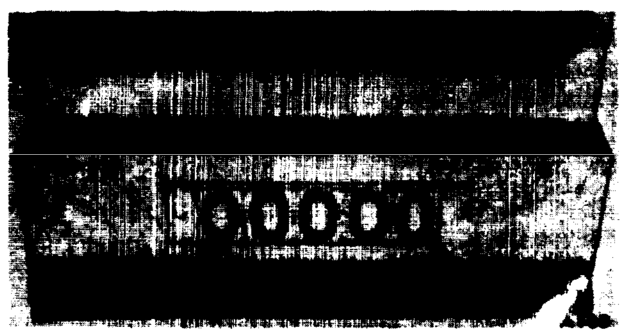


Figure 1-1. Machine Serial Number

WARRANTY

The terms under which this machine is guaranteed are clearly defined under the warranty which accompanies every Harnishfeger product. This warranty, while generous, will be voided if the machine is operated with loads in excess of the rating plate maximums, under unsafe operating conditions, or with accessories or attachments not designed and furnished, or approved by the Harnischfeger Corporation. Modifications made upon the machine which will affect the operation or capacity will void the warranty.

DESCRIPTION

This truck crane is a fully hydraulic machine. All work functions are performed by fluid power. Hydraulic cylinders are used to raise or lower and extend or retract the boom; hydraulic winches raise or lower the load on the main hoist and jib lines; a hydraulic motor swings (rotates) the upper of the machine on the carrier.

The carrier engine serves as the power supply for both the upper and lower. A pump drive, mounted at the front of the engine drives the hydraulic pumps which provide the hydraulic power for the upper. Hydraulic fluid under pressure is delivered through a swivel to the control valves in the upper. When the operator engages the controls in the operator's cab, the control valves direct the fluid to the boom cylinders, swing motor, and winch motors.

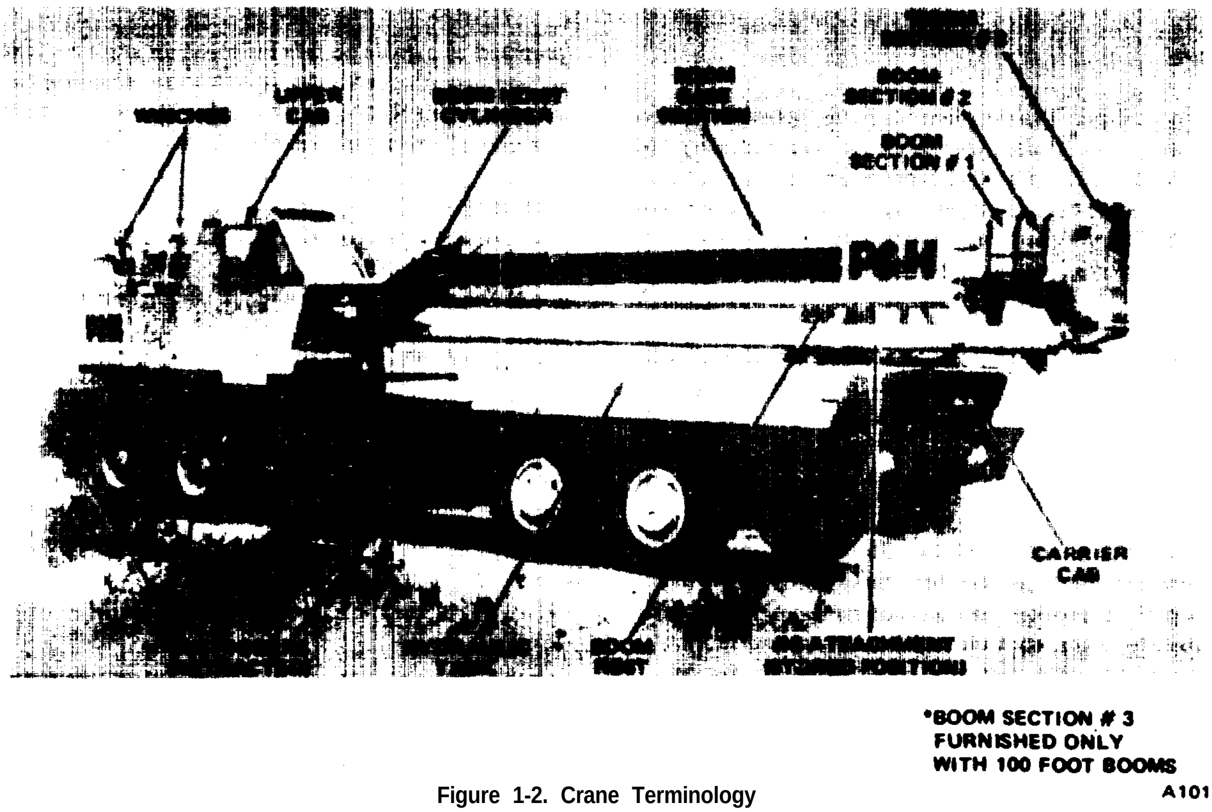


Figure 1-2. Crane Terminology

TABULATED DATA

DIMENSIONS AND TRANSPORTATION DATA

Overall length, with boom in travel position . . . . 38'-1-3/8" (11.62 m)
Overall length, without boom . . . . 33'-1-1/2" (10.10 m)
Overall width . . . . 8'-0"(2.44mm)
Overall height . . . . 9'-10" (3.00 m)
Ground clearance . . . . 0'-10-1/2' (0.27 m)

	80' Boom (24.39 m)	100' Boom (30.46 m)
Gross vehicle weight, with main and auxiliary winches, jib, bottom block, 4500 Ib. (2041 kg) counterweight, and 1/2 tank of fuel	64,400 lbs. (29.211 kg)	65.300 lbs. (29.620 kg)
Weight distribution		
Front axle	26.600 lbs. (12,066 kg)	27,200 lbs. (12,336 kg)
Rear axle	37,800 lbs. (17,146 kg)	38,100 lbs. (17,282 kg)

MAIN WINCH DATA

MODEL: P&H #10-1 P&H PART NO. 923P5-FIG. 1.

Rope Size.:	9/16” Dia. (1.43 cm)	Pressure	3000 P.S.I. (206 BARS)
Drum Dia.:	10-11/16” (27.15 cm)	Flow	55 G.P.M. (206 1/min)
Drum Pitch Dia.:	11-1/4” (28.58cm)	Drum Torque “Up” Low SPD.	65,000 in. Ibs. (749 m-kg)
Drum Width:	14” (35.56 cm)	Drum Torque “Up” High SPD.	29,000 in. Ibs. (334 m-kg)
Flange O.D.:	19” (46.26 cm)	Drum RPM “Up” Low SPD.	46
P.D. to rope dia. ratio:	20:1	Drum RPM “Up” High SPD.	109

	LOW SPEED				HIGH SPEED				
Layer	Rope Pitch Dia.-In. (cm)	Line Pull ‘Up”-Lb. (kg)	Full Load Line SPD. “Up”-FPM (m/min)	No Load Line SPD “Up’ -FPM (m/min)	Line Pull "Up" -Lb. (kg)	Full Load Line SPD. “Up”-FPM (m/min)	No Load Line SPD. “Up”-FPM (m/min)	Drum Capacity Ft./Layer (m/layer)	Accum. Drum Capacity Ft. (m)
1	11-1/4 (28.56)	11,600 15,262)	136 (41.45)	155 (47.24)	5,200 (2.359)	320 197.54)	365 (111.25)	67 (20.42)	67 (20.42)
2	12-3/8 (31.43)	10,500 (4,763)	150 (46.72)	170 (51.62)	4,700 (2,132)	350 (106.68)	400 (121.92)	76 (23.16)	143 (43.59)
3	13-1/2 (34.29)	9,600 (4,354)	163 (49.68)	195 (59.44)	4,300 (1,950)	360 (116.82)	435 (132.59)	83 (25.30)	226 (68.88)
4	14.5/8 (37.15)	8,900 (4.037)	175 (53.34)	200 (60.86)	4,000 (1,814)	415 (126.49)	475 (144.78)	90 (27.43)	316 (96.32)
5	15-3/4 (40.00)	8,300 (3,765)	190 (57.91)	220 (67.06)	3,700 (1.678)	450 (137.18)	515 (156.97)	97 (29.57)	413 (125.88)
6	16.7/8 (42.86)	7,700 (3.493)	200 (60.96)	230 (70.10)	3,400 (1.542)	480 (146.30)	550 (167.64)	104 (31.70)	517 (157.58)

AUXILIARY WINCH DATA

MODEL: P&H #10-1 P&H PART NO. 923P5-FIG. 1.

Rope Size:	9/16” Dir. (1.43 cm)	Pressure	3000 P.S.I. (206 BARS)
Drum Dia.:	10-11/6” (23.16 cm)	Flow	55 G.P.M. (208 1/min)
Drum Pitch Dir.:	11-1/4” (28.56 cm)	Drum Torque “Up” Low SPD.	58,000 in. Ibs. (668 m-kg)
Drum Width :	14” (35.66 cm)	Drum Torque “Up” High SPD.	29,000 in. Ibs. (334 m-kg)
Flange O.D.:	19” (48.26 cm)	Drum RPM “Up” Low SPD.	54.9
P.D. to rope dia. ratio:	20:1	Drum RPM “Up” High SPD.	109

	LOW SPEED				HIGH SPEED				
Lever	Rope Pitch Dia.-In. (cm)	Line Pull ‘Up”-Lb. (kg)	Full Load Line SPD. “Up‘‘-FPM (m/min)	No Load Line SPD. “Up‘‘-FPM (m/min)	Line Pull “Up”-Lb. (kg)	Full Load Line SPD. “Up‘‘-FPM (m/min)	No Load Line SPD. “Up‘‘-FPM (m/min)	Drum Capacity Ft./Layer (m/layer)	Accum. Drum Capacity Ft. (m)
1	11.1/4 (28.56)	10.300 (4.6721	160 (46.77)	180 (54.86)	5,200 (2,359)	320 (97.54)	365 (111.25)	67 (20.42)	67 (20.42)
2	12-3/8 (31.43)	9,400 (4,264)	175 (53.34)	200 (60.960	4,700 (2,132)	350 (106.68)	400 (121.92)	76 (23.16)	143 (43.59)
3	13-112 (34.29)	8.600 (3,901)	190 (67.91)	215 (65.53)	4,300 (1.950)	380 (115.82)	435 (132.59)	83 (25.30)	226 (68.88)
4	14-5/8 (37.15)	7,900 (3,583)	205 (62.48)	235 (71.63)	4,000 (1,814)	416 (126.49)	475 (144.78)	90 (27.43)	316 (96.32)
5	15.3/4 (40.00)	7,300 (3,311)	220 (67.06)	250 (76.20)	3,700 (1,679)	450 (137.16)	515 (166.97)	97 (29.57)	413 (125.88)
6	16.7/8 (42.86)	6,800 (3.084)	240 (73.15)	270 (82.30)	3,400 (1,542)	480 (146.30)	550 (167.64)	104 (31.70)	517 (157.58)

LIQUID CAPACITIES (U.S. UNITS)

Fuel Tank	70 gallons (265 l)
Engine Cooling System:	
Detroit Diesel 6V53N	40 quarts (37.81)
Cummins C190	31-1/2quuts (29.8 l)
Detroit Diesel 6V53N	48 quarts (45.4 l)
Cummins NHF 240	46 quarts (43.5 l)
Engine Lube Oil, including filter(s):	
Detroit Diesel 6V53N	18-1/2 quarts (17.5 l)
Cummins C190	18-1/2- quarts (17.5 l)
Detroit Diesel 6-71	20 quarts (18.9 l)
Cummins NHF 240	22 quarts (20.8 l)
Main Transmission Oil:	
Spicer 6352	1 7 pints (8.0 l)
Fuller 5CW65T	24 pints (11.4 l)
Fuller T905F	22 pints (10.4 l)
Auxiliary Transmission Oil:	
Spicer B031C	13 pints (6.2 l)
Spicer R 8341 E	13 pints (6.2 l)
Fuller 3K65	12 pints (5.7 l)
Rear Axles Rockwell SSHD:	
Front	32 pints (15.1 l)
Rear	28 pints (13.2 l)
Interaxle Differential	2 pints (0.9 l)
Rear Axles Rockwell SRHD:	
Front	37 pints (17.5 l)
Rear	36 pints (17.0 l)
Interaxle Differential	2 pints (9.9 l)
Power Take-Off:	
Dana	6 quarts (5.7 l)
Cotta	3-1/2 quarts (3.3 l)
Hydrlulic Oil Reservoir	200 gallons (757 l)
Winch Planetary Housings (each)	2 quarts (1.9 l)
Swing Reducer Housing	7 quarts (6.6 l)
Stearing Gear	2-1/2 quarts (2.4 l)

LIGHT BULBS

LOCATION	*NUMBER
Headlights Beam	5001
Low Beam	4000
Stop/Tail Lights	1157
Clearance Lights	67
Directional Signal-Front	1157
Rear	1157
Indicator	53
Hazzard Warning Indicator	53
Low Air Pressure Light	53
Upper Ignition Indicator Light	53
Instrument Lights	57
Dome Light	1141
License Plate Light	1157
Identification Lights	67
Outrigger Indicators-Masters Switch	53
Safety Lock	53

*USASI Standard

LOCATION	*NUMBER
Engine Warning Indicator	1893
High Beam Indicator	53
Ignition Indicator	53
Drum Turn Indicators	1893

FILTER ELEMENTS

LOCATION	VENDOR NUMBER
Engine Oil } 6V53N	AC PF-132
Fuel Strainer } 6V53N	AC T-815
Fuel Filter } 6V53N	AC TP816
Air Cleaner	Fur P-32
Hydraulic Oil Filters	Vickers 923070

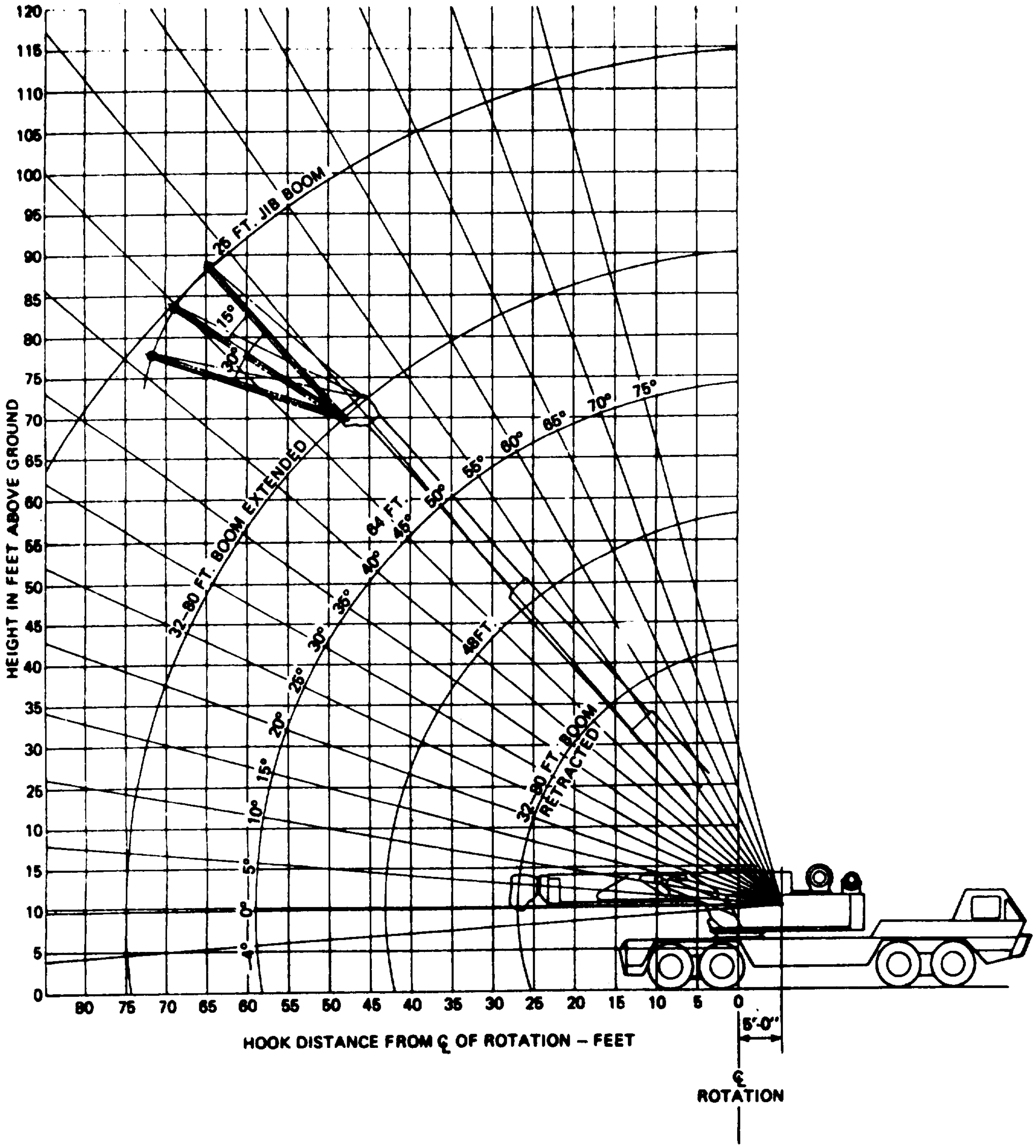


Figure 1-3. Range Diagram - 80' Boom (105x75-A)

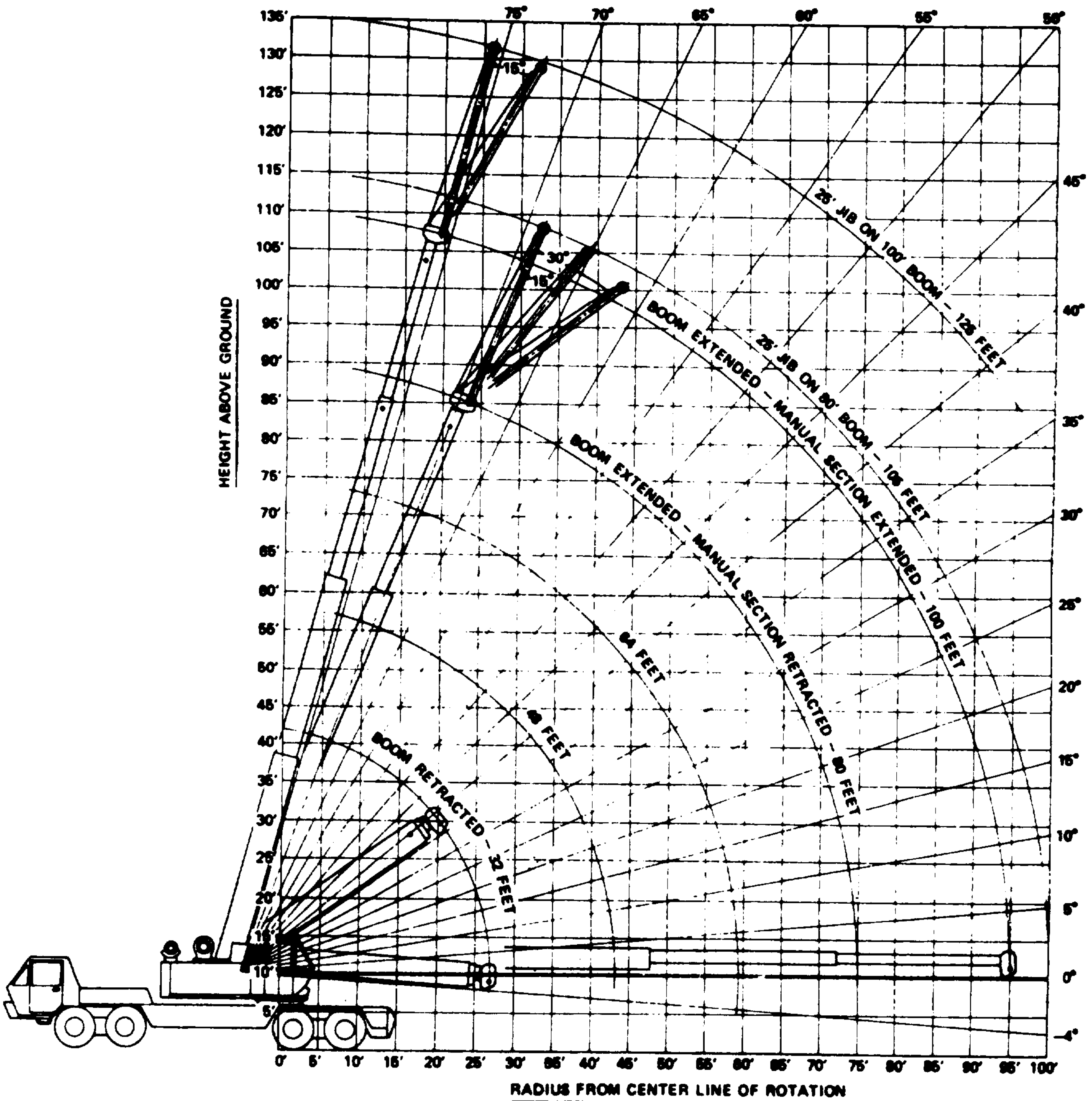
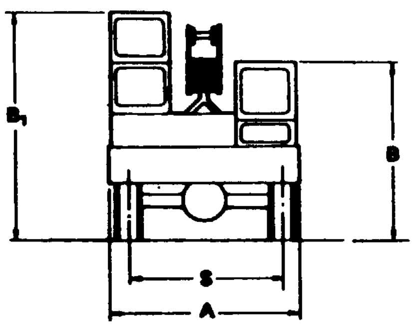
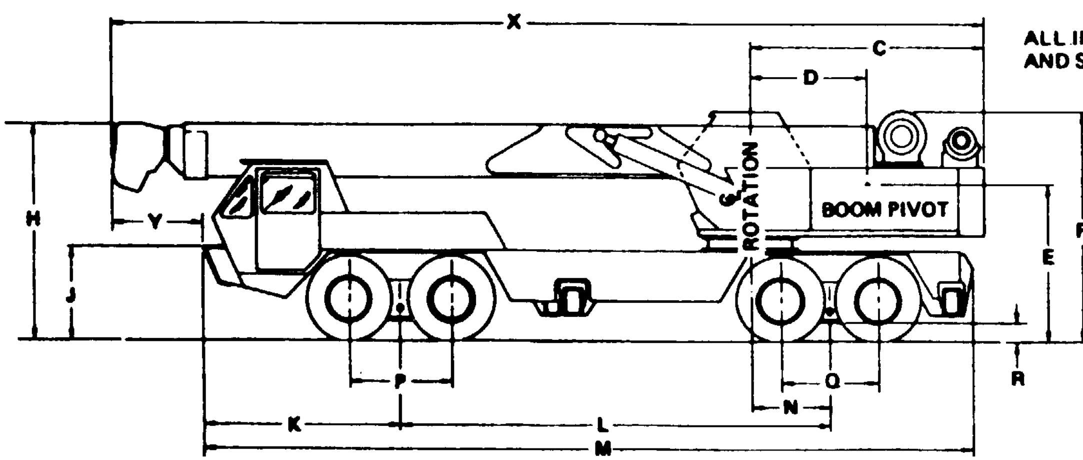


Figure 1-4. Range Diagram - 100' Boom (105J83)



		FEET & INCHES	METERS
A	OVERALL WIDTH (FRONT)	8'-0"	2.44
B	OVERALL HEIGHT (CARRIER CAB)	7'-9-1/4"	2.37
B_1	OVERALL HEIGHT (OPERATORS CAP)	9'-10"	3.00
C	TAIL SWING	10-5-3/8"	3.18
D	CENTERLINE OF ROTATION TO CENTER OF BOOM PIVOT	5'-0"	1.52
E	CENTER OF BOOM PIVOT TO GROUND	6'-9-3/4"	2.06
F	OVERALL HEIGHT (MAIN WINCH)	9'-9"	2.97
H	OVERALL HEIGHT (BOOM HORIZONTAL)	9'-4"	2.84
J	TOP OF BUMPER TO GROUND	3'-10-1/2"	1.18
K	CENTER OF FRONT BOGIE TO FRONT OF CARRIER	8'-2-1/2"	2.50
L	CENTER OF FRONT BOGIE TO CENTER OF REAR BOGIE	18'-8"	5.69
M	OVERALL LENGTH OF CARRIER	33'-1-1/2"	10.10
N	CENTER OF REAR BOGIE TO CENTER OF ROTATION	3'-4"	1.02
P	DISTANCE BETWEEN AXLES (FRONT BOGIE)	4'-1"	1.24
Q	DISTANCE BETWEEN AXLES (REAR BOGIE)	4'-2"	1.27
R	GROUND CLEARANCE (REAR AXLE HSG.)	0'-10-1/2"	.27
S	TRACK (FRONT)	6'-5-3/4"	1.97
T	TRACK (REAR)	5'-11-7/8"	1.82
U	OVERALL WIDTH (REAR)	8'-0"	2.44
V	EFFECTIVE LENGTH OF OUTRIGGERS	16'0"	4.88
W	OVERALL LENGTH OF OUTRIGGERS	17'-5-3/4"	5.33
X	OVERALL LENGTH (BOOM RETRACTED)	38'-1-3/8"	11.62
Y	FRONT OF CARRIER TO END OF BOOM	4'-1-1/2"	1.26
Z(a)	VEHICLE TURNING CIRCLE (NOT SHOWN)	87'-0"	26.52
Z(b)	VEHICLE CLEARANCE CIRCLE (NOT SHOWN)	94'-8"	28.85



NOTE

ALL INFORMATION ON THIS PAGE IS FOR REFERENCE ONLY, AND SUBJECT TO CHANGE WITHOUT NOTICE.

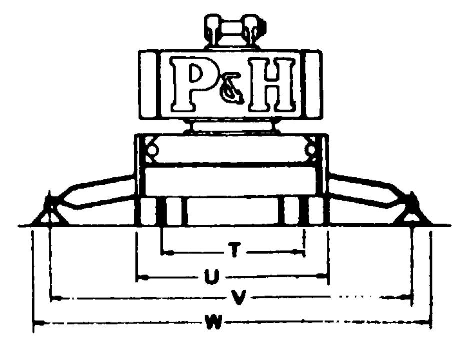


Figure 1-5. Dimensions and Clearance (100J600-C)

SECTION II
CONTROLS AND OPERATION

SECTION II
CONTROLS AND OPERATION

CARRIER CONTROL IDENTIFICATION

The instruments and controls in the cab or the carrier are shown in Figure 2-1. The numbers on this figure correspond to the numbers on the following list, which identifies the controls and describes their function.

Before attempting to operate this machine, the operator should study carefully all of the information in this section and in Catalog 221. The operator should become thoroughly familiar with the location and purpose of each control on the machine.

1. IGNITION INDICATOR. This lamp is illuminated whenever the ignit on switch is in the ON position. If the lamp remains lit after the carrier ignition switch is placed in the OFF position, the upper ignition switch is in the ON position, and must be plead in the OFF position to shut down the ignition system.

2. HIGHBEAM INDICATOR. This lamp, when illuminated, indicates that the high headlight berm are on.

3. VOLTMETER. The voltmeter measures the voltage produced by the alternator end indicates the condition of the battery. Bee Figure 2-2 for an explanation of the voltmeter readings.

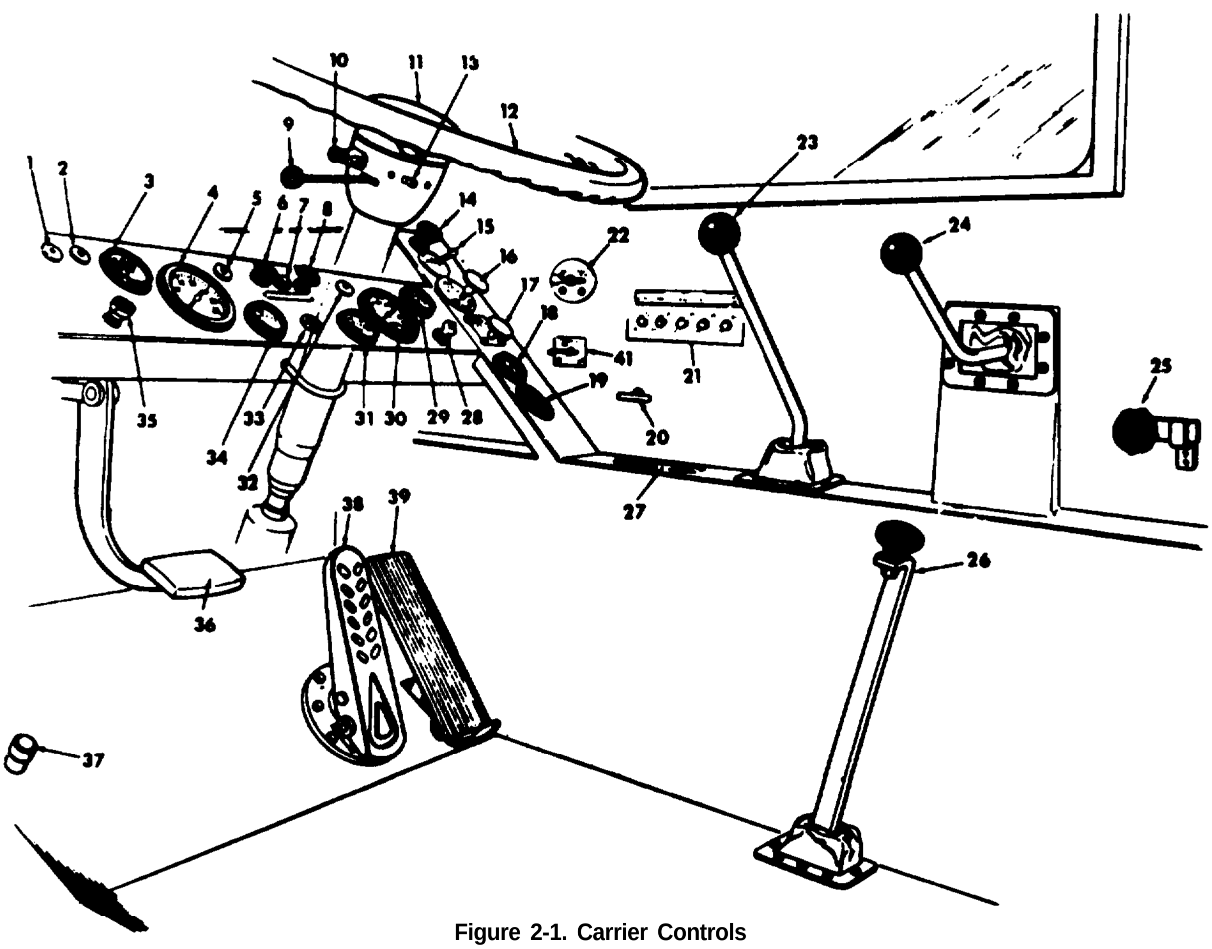


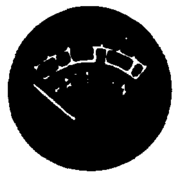
Figure 2-1. Carrier Controls

Engine not running or running at slow idle.

Engine running fast enough to make generator* produce.

1

Dead or disconnected battery. Disconnected or badly connected motor.

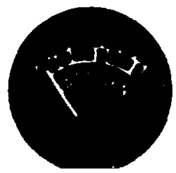


1

Disconnected motor. Engine could not run with dead or disconnected battery unless circuit was completed around battery.

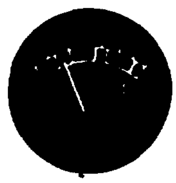
2

Very low battery charge. Engine night not start.



3

Low battery charge. Constant reading in the area would indicate and for check on generator and voltage regulator.



2 3

When motor pointer stays below 13.3 with the engine running fast enough to operate generator, it shows that generator is not operating or voltage regular is out of adjustment, or that currant being drawn from battery by lights, heater fan, or other load, exceeds generator output.

4

Well-charged battery. This indicates a good battery and also that generator and voltage regulator ore operating properly.

5

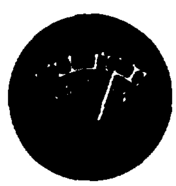
The pointer might remain in this position temporarily when the engine has boon stopped after considerable use, due to a "surface charge' in the battery. To get a correct reading, turn an headlights for a few minutes.

4 5

When engines is started, pointer may stay is this area temporarily but should gradually rise above 13.3 as generator reaches normal output.

6 7

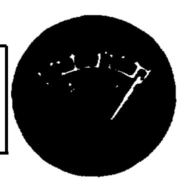
under normal conditions, a 12V battery is fully charged at 12.8V. A slightly higher reading may occur under the conditions outlined in No. 5 but, generally spoking, any reading above 12.8 when the engine is stopped is not o true reading.



6

This is the area in which the pointer should be when generator, voltage regulator and battery an all in good condition and working properly.

*NOTE: The word "generator" refers to both generator and alternator since both requires the sane instrumentation.



7

When the pointer goes above 15.2, the voltage regulator is set too high or is jammed and continued operation of the engine will burn out battery.

Figure 2-2. Voltmeter Operation

4. TACHOMETER-HOURMETER. This gauge indicates the engine speed in revolutions per minute (RPM) end the total number of hours the engine has been run.

5. L.H. DIRECTIONAL SIGNAL INDICATOR

6. HEATER CONTROLS. This switch controls the heater fan. Turn the switch clockwise to energize the heater fan; control the speed of the fan by turning the switch clockwise or counterclockwise as desired.

Figure 2-3 illustrates the heater shutoff valve. Turn the valve clockwise to stop the flow of water through the heater, when heat is not required. Turn the valve counterclockwise when heat is desired.

7. ENGINE STOP BUTTON. Depress this button to stop the engine. *After the engine has stopped,* place the ignition key in the OFF position.

8. DEFOGGER FAN SWITCH. Turn the switch clockwise to energize the defogger fan; control the speed of the fan by turning the switch clockwise or counterclockwise es desired.

9. DIRECTIONAL SIGNAL LEVER. This lever actuates the directional signal lamps at the front end rear of the carrier. Pull the lever toward the operator to actuate the left directional signal; push the lever away from the operator to actuate the right directional signal.

10. HAZARD WARNING INDICATOR. This lamp, when illuminated, indicates that all the directional lights are energized for use as hazard warning lights.

11. HORN BUTTON. Depress this button to sound the carrier horn.

12. STEERING WHEEL.

NOTE

If the machine is equipped with a Power Steering/ Outrigger Selector Valve (item 25). be sure it is pushed in and latched when operating the carrier.

13. HAZARD WARNING LIGHT SWITCH. Push this switch away from the operator to energize all directional lights for use as hazard warning lights.

14. WINDSHIELD WIPER SWITCH. Turn this switch clockwise to energize the windshield wiper; control the speed of the wiper by turning the switch clockwise or counterclockwise as desired.

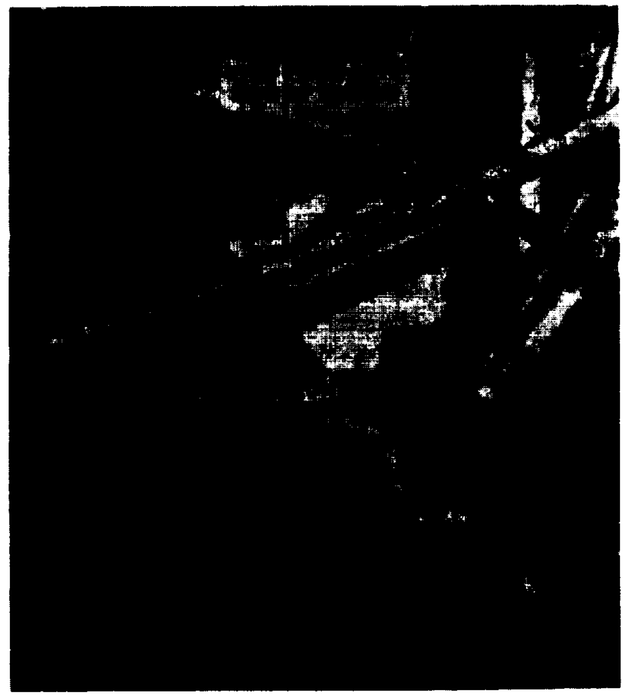


Figure 2-3. Heater Shutoff Valve

15. DIFFERENTIAL LOCKOUT CONTROL. This lever locks and unlocks the interaxle differential. Race the lever in the LOCK position when approaching or anticipating icy or poor tractive conditions. This will provide maximum axle traction. The interaxle differential can be shifted to the locked position at any vehicle speed, *except* if the wheels have already lost traction and are spinning.

CAUTION

Do not wait until you have lost traction and your wheels are spinning to lock the interaxle differential. This could result in damage to the axles.

Place the lever in the UNLOCK position after passing adverse conditions. This permits the interaxle differential to compensate for differences in the tire size and give you maximum speed and performance.

NOTE

Let up on the accelerator to provide an interruption in torque to the drive train when locking or unlocking the interaxle differential.

16. EMERGENCY RELEASE VALVE. The emergency release valve provides a means of transferring the isolated emergency air tank to the Maxibrake control valve (item 17) when pressure in the service tanks is lost.

Push this knob in and pull out the Maxibrake control knob (item 17) if it becomes necessary to use the air in the emergency air tank to release the Maxibrake.

CAUTION

The carrier will have *no* brakae, except the Maxibrakes, *which are controlled by the Maxibrake control valve.* Never move the carrier farther than is absolutely necessary under these conditions, and avoid steep grades. Make certain that this knob is pulled out at all time during normal operation.

17. MAXIBRAKE CONTROL VALVE. Pull this knob out to release the Maxibrakes. Push this knob in to vent air from the Maxibrake chambers and apply the Maxibrakes. This control will return to the applied position automatically if pressure in the air system drops below 28 psi (1.93 BARS).

18. AIR PRESSURE GAUGE. This gauge shows the pressure of the air in the air system of the machine. In normal operation, the pressure reading on this gauge should range between 105 and 120 psi (7.2 - 8.2 BARS).

19. LOW AIR PRESSURE LIGHT. When illuminated, this lamp indicates that the pressure in the air system is below the normal safe operating level. *Do not operate the machine when this light is lit.*

20. EMERGENCY ENGINE SHUTOFF CONTROL. Pull this handle out if the engine continues to run after the Engine Stop button (item 7) is depressad or if an abnormal condition should arise.

NOTE

If the engine is shut down using the Emergency Engine Shutoff Control, the butterfly valve in the intake manifold must be manually reset (see Figure 2-4).

21. CIRCUIT BREAKERS. The function of the circuit breakers is to protect the various electrical circuits of the machine. The circuit which is protected by each circuit breaker is marked on the decal above the circuit brakers.

An electrical overload will cause the circuit breaker button to move outward, indicating that the circuit breaker has tripped. Reset the circuit breaker by depressing the button. If the same circuit breaker should trip shortly after it is reset, check the circuit protected by the circuit breaker for the cause of the overload.

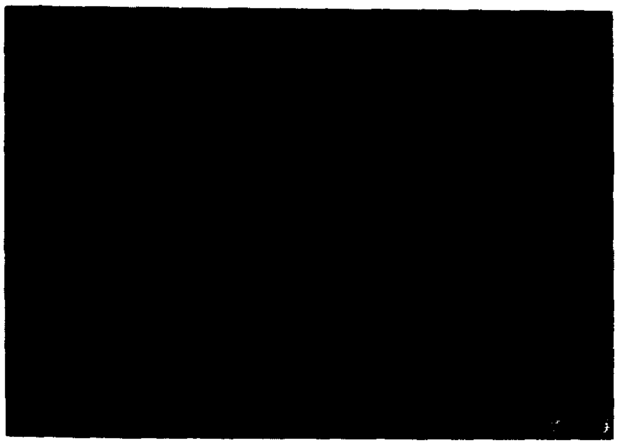


Figure 2-4. Emergency Engine Shutoff

WARNING

***Under no circumstances* should the circuit breakers be prevented from tripping by any means. Overloaded electrical circuits can cause extensive damage to the machine and/or could cause injury to personnel.**

22. THROTTLE SELECTOR VALVE. This valve transfers control of the throttle from the lower to the upper. Place the lever in the LOWER position when driving the carrier. Place the lever in the UPPER position when operating the upper.

23. MAIN TRANSMISSION SHIFT LEVER. This lever is used to select the gears in the main transmission.

24. AUXILIARY TRANSMISSION SHIFT LEVER. This lever is used to select the gears in the auxiliary transmission. The auxiliary transmission should be kept in the *lowest gear range* that will allow the machine to reach the desired maximum speed. Maintaining the auxiliary transmission in a higher than required range could cause gear tooth failure, due to excessive torque from the main transmission.

26. OUTRIGGER/STEERING SELECTOR VALVE. This valve transfers hydraulic fluid from the power steering pump to either the power steering system, or the outrigger system. Push the knob in and engage the latch to direct fluid to the power steering system. Pull the knob out to direct fluid to the outrigger system.

NOTE

The outrigger/steering selector valve is not furnished when the machine is equipped with the optional carrier remote control system. The transfer from outrigger to steering is done automatically when the outrigger master switch is in the OFF position.

26. PUMP DISCONNECT LEVER. Push this lever forward, toward the dash panel, to engage the pump drive. Pull this lever back, toward the rear of the cab, to disengage the pump drive. *The engine must be stopped before engaging or disengaging the pumps.*

27. SHIFT CHART. This chart shows the shifting pattern of the main and auxiliary transmissions.

28. IGNITION SWITCH. Turn this key switch clockwise to the START position to start the engine. Allow the key to return to the ON position as soon as the engine has started.

CAUTION

If the engine does not start within 30 seconds, release the key and allow the starter motor to corm to a stop and rest for two minutes before attempting to start the engine again.

29. ENGINE WATER TEMPERATURE GAUGE. This gauge shows the temperature of the engine coolant. The gauge should read between 160 and 185° F. (71-85° C) during normal operation.

30. SPEEDOMETER-ODOMETER. The speedometer shows carrier speed in miles per hour, while the odometer indicates the total numbers of miles the carrier ha traveled.

31. ENGINE OIL PRESSURE GAUGE. This gauge should read between 40 end 60 psi (2.75 - 4.14 BARS) during normal operation.

32. R.H. DIRECTIONAL SIGNAL INDICATOR

33. ENGINE WARNING LIGHT. This light is furnished when the machine is equipped with the optional engine warning system. This light, when illuminated, indicates that the engine is overhearted or the engine oil pressure is below normal.

34. FUEL GAUGE. This gauge shows the amount of fuel remaining in the fuel tank.

36. LIGHT SWITCH. Pull this switch out halfway, to the detent, to use the tail lights, clearance lights, and dash panel lights. Pull this switch out fully to use the headlights in addition to the other lights. Push this switch in completely to turn off all the lights.

36. CLUTCH PEDAL. Depress this pedal to disengage the engine from the transmission when shifting gears. *Do not use this pedal for a foot rest as this will lead to rapid clutch wear.*

37. HEADLIGHT DIMMER SWITCH The headlight dimmer switch allows the driver to raise or lower the headlight beams. The highbeam indicator (item 2) will be lit when the high kerns are on.

38. BRAKE PEDAL. Depress this pedal to apply the carrier service brakes.

39. ACCELERATOR PEDAL. Depress this pedal to feed more fuel to the engine, thereby increasing carrier speed.

40. SEAT CONTROL (NOT SHOWN). A lever on the left side of the seat locks the seat in position. To adjust the seat, push the lever back toward the rear of the cab and then slide the seat forward or bock as desired. *Be sure the seat is locked in position before driving the carrier.*

41. REMOTE CONTROL AIR VALVE. This valve is only furnished when the machine is equipped with the optional carrier remote controls. Place this lever in the ON position to apply air to the carrier remote control. Place the lever in the OFF position when the carrier remote controls are not king used.

CARRIER OPERATION

GENERAL. The following paragraphs are not intended to describe the method of operating the carrier, but to describe the sequence for starting the engine, releasing the parking brakes, running the carrier, and shutting down the engine.

STARTING THE ENGINE. To start the engine, proceed as follows:

1. Place the main transmission shift lever in the neutral position.

2. Depress the accelerator pedal slightly end turn the ignition key to the START position. As soon as the engine starts, release the key. *Do not hold the starting motor on for more than 30 seconds at one time.* If the engine does not start in this period of time, release the ignition key and wait for two minutes before trying to start the engine again.

NOTE

The use of a cold weather starting rid, furnished as an option, may be required in extremely cold weather.

3. Check all gauges, *immediately after* the engine starts, to be sure the are reading properly. If the readings are improper, stop the engine immediately end determine the cause of the improper gauge reading before continuing operation.

4. Allow the engine to run 800 to 1000 RPM for 4 to 5 minutes or preferably until the water temperature reaches normal operating temperature before operation the mechine.

RUNNING THE CARRIER. To run the carrier. proceed as follows:

1. Engauge the auxiliary transmission in a range suitable for the road conditions. The par range selected should be the *lowest* range that will allow the machine to travel at the desired speed.

2. Depress and hold the clutch pedal. Shift the main transmission into a range suitable for the road conditions.

3. Depress the brake pedal. Then pull the Maxibrake control knob out from the dash panel The curler in now ready to be moved.

STOPPING THE ENGINE. To stop the engine, proceed **as** follows:

1. Place the main transmission lever in the neutral position.

2. Rush the Maxibrake control knob in to apply the puking brakes.

3. If possible, allow the engine to idle for 3 to 5 minutes before shutting down the engine. This will allow the engine to cool down and will prevent overheating due to localized residual heat.

4. Depress the Engine Stop button on the dash panel to stop the engine.

5. *After the engine has stopped,* turn the ignition key to the OFF position.

OUTRIGGER OPERATION

GENERAL. The outriggers on this machine are controlled electrically from each side of the carrier and the upper cab. The control panels on each ride of the ceder control only the outriggers on that side of the carrier, while the control panel in the upper cab controls all four outriggers.

NOTE

Older machines have control panel on each side of the carrier that allow all four outrigger to be operated from one control panel. Even though all four outriggers can be operated from one side of the carrier, as a safety precaution, it is suggested that *only* the outriggers *in view,* while standing by the control panel, be operated.

EXTENDING THE OUTRIGGERS. To extend the outriggers from the carrier control panel, proceed as follows:

1. Pull the Outrigger/Steering Selector Valve knob out to the OUTRIGGER position. This step is not required when the machine is equipped with the oqtional carrier remote control system. The transfer from stowing to outriggers is accomplished automatically when the MASTER switch on the outrigger control panel is placed in the ON position.

NOTE

The power steering system is inoperative when the selector valve is in the OUTRIGGER position.

2. Remove the retainer pin, and move the lock pin to the unlocked position on each outrigger. Install the retainer pin to keep the lock pin in the unlocked position (see Figure 2-6).

CAUTION

Make certain that the swing brake is locked in the applied position with the Swing Brake Lock before extending the outriggers.

3. Place the MASTER switch in the ON position (sac Figure 2-6).

4. Extend the outrigger by placing the desired HORIZONTAL switch in the OUT position. Repeat the procedure for the other outigger

WARNING

Do not set the outriggers near holes, or on rocky, or extremely soft ground. This may cause the machine to tip, resulting in injury to personnel.

5. Lower the outrigger, to raise the machine off the ground, by place the desired VERTICAL switch in the DOWN position. Repeat the procedure for the other outrigger.

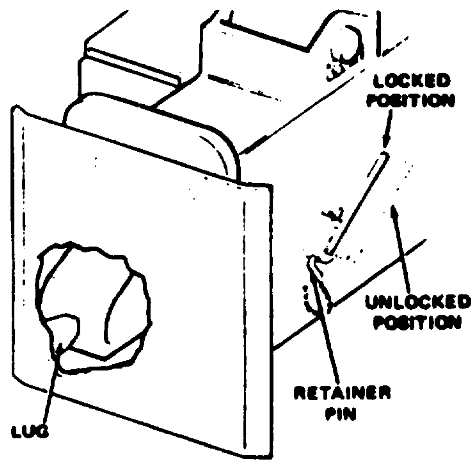


Figure 2-5. Outrigger Locks

6. Repeat Steps 4 and 6 for the outriggers on the opposite side of the carrier. After all four outriggers have been extended and lowered, make the necessary leveling adjustments by raising or lowering each outrigger as required until the machine is level. Checks the level of the machine using the levels on each side of the carrier or in the upper cab.

7. If the machine is equipped with safety locks, engage the safety locks by placing the SAFETY LOCKS switch in the ON position. This step is not required if the machine is not equipped with safety locks.

8. Return the MASTER switch to the OFF position.

NOTE

The operation of the outriggers from the upper cab is identical to the procedure described above, except that all four outriggers controlled from one position in the upper cab.

RETRACTING THE OUTRIGGERS. To retract the outriggers, proceed as follows:

1. Place the MASTER switch in the ON position.

2. Disengage the safety locks, if the machine is so equipped, by placing the SAFETY LOCKS switch in the OFF position.

NOTE

If the weight of the machine is resting on the safety locks it will be necessary to raise the machine slightly, by placing the required VERTICAL switch in the DOWN position, to disengage the safaty locks.

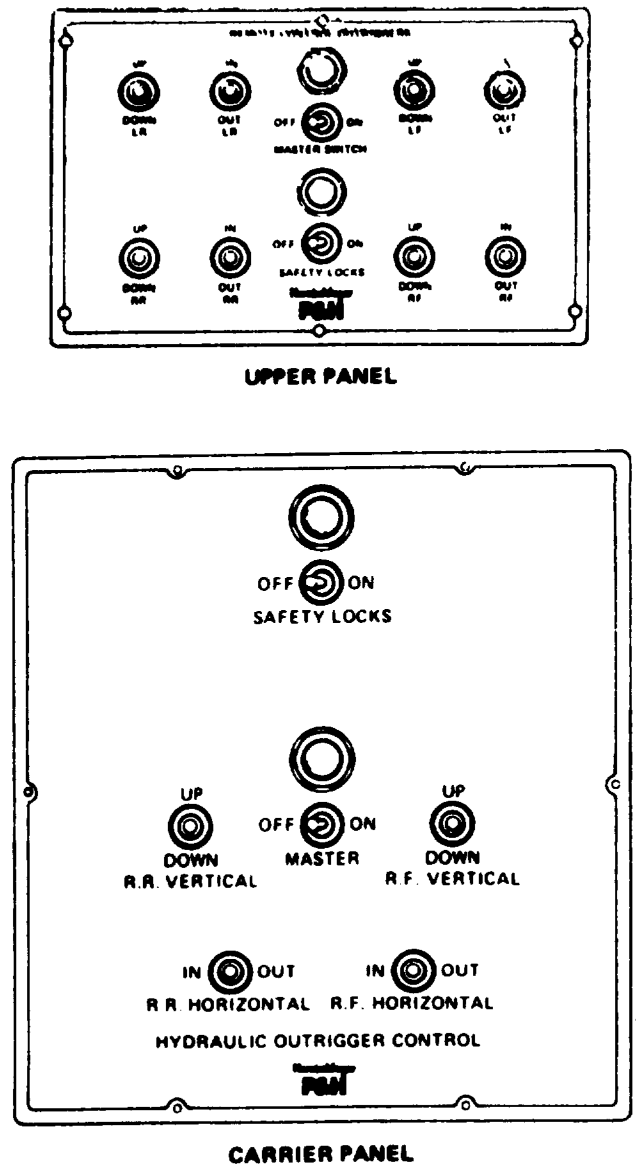


Figure 2-6. Outrigger Control Panels

3. Raise the outrigger by placing the desired VERTICAL switch in the UP position. Repeat the procedure for the other three outrigger *before* they are retracted.

4. Retract each outriggar by placing the appropriate HORIZONTAL switch in the IN position. Be sure the lug on each outrigger float engages the outrigger bum (see Figure 2-5).

5. Remove the retainer pin, and move the lock pin to the locked position. Install the retainer pin to maintain the lock pin in the locked position.

6. Place the MASTER switch in the OFF position.

7. Push the Outrigger/Steering Selector Valve in end engege the latch to divert hydraulic fluid to the steering system. This step is not required on machines equipped with the optional carrier remote control system. The transfer from outrigger to steering is accomplished automatically when the MASTER switch is placed in the OFF position.

UPPER CONTROL IDENTIFICATION

The instruments and controls in the upper cab are shown in Figure 2-7. The numbers on this illustration correspond to the numbers in the following list, which identifies the controls and describes their function.

CAUTION

Holding a control lever in either engaged position after a cylinder has reached its maximum stroke in the corresponding direction will force hydraulic fluid through the relief valve at maximum speed and pressure, and will cause overheating of the hydraulic fluid.

1. SIGNAL HORN BUTTON. Depress the button on the top of the swing lever to sound the upper signal horn.

2. SWING LEVER. Push this lever forward to swing the upper to the left (toward the boom). Pull this lever beck to swing the upper to the right.

3. BOOM TELESCOPE LEVERS. Two levers are used to extend and retract the boom sections. Each lever controls one telescoping section of the boom, end each is identified below:

Lever A controls boom section No. 2.

Lever B controls boom section No. 1.

Push both levers forward to extend all the telescoping sections of the boom. Pull both levers back to retract all the telescoping sections of the boom.

CAUTION

Extend all boom sections equally. If all the sections are not extended equally, operate the control Ievers individually as required to equalize the boom sections.

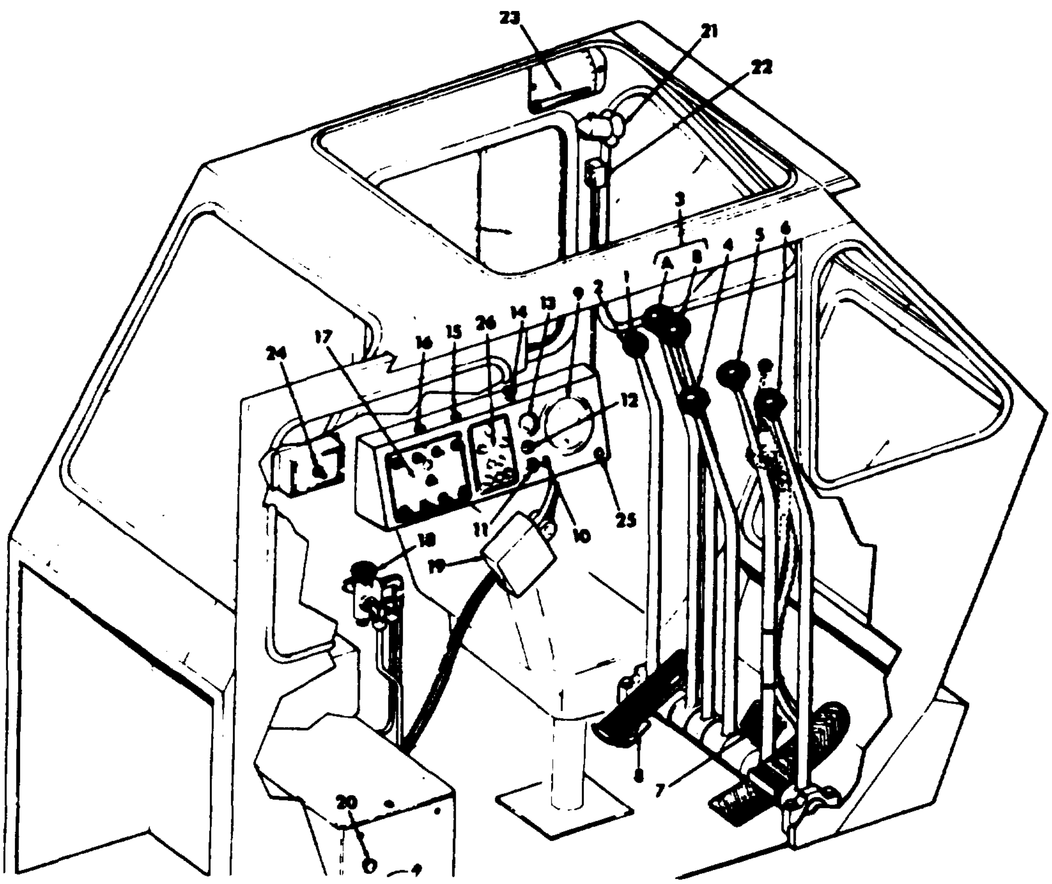


Figure 2-7. Upper Controls

4. AUXILIARY WINCH LEVER. This lever controls the operation of the optional auxiliary winch. When the machine is equipped with a P&H winch, this lever is also used to operate the free-fall feature of the winch. *A// P&H winches have free-fall capability.*

Not all Gearmatic which have free-fall capability. Gear matic winches which have the free-fell feature will always be quipped with a separate free-all lever attached to the winch lever.

WARNING

Be sure you know whether or not you have a free-fall winch, the make of winch (P&H or Gearmatic), and that you fully understand the operation of the free-fall feature, which is described below, before lifting or lowering a load.

The auxiliary winch lever will function as follows when the machine is equipped with a P&H winch.

CAUTION

Maintain ample tension on the winch line when lowering light loads to prevent the cable on the winch drum from loosening. If the layers of cable are loose, damage to the cable can occur, resulting in possible damage to the machine or injury to personnel.

Pull beck on the winch lever to lift a load with the auxiliary winch. Push the lever forward, part way, to power down the load (see Figure 2-8). Push the lever forward, to the extreme foward position, to free-fall the load.

WARNING

Maximum recommended load to be lowered using free-fall must not exceed 50% of the rating plate or hoist reerving chart. Caution must be exercised when using free-fill. Always allows the winch lever to return to the power down position slowly to avoid shock loading of the winch and winch line.

The auxiliary winch lever will function as follows when the machine is equipped with a Gearmatic winch (see Figure 28).

Pull the fever back to lift a bad with the auxiliary winch. Push the lever forward to power down J load on the auxiliary winch (see Figure 2-8).

WARNING

The Gearmatic winch free-fell feature allows a load to be free-fall lowered *whenever the free-fall lever is speeded,* regardless of winch lever position. In other words, it is possible to free-fall J load when the winch lever is in the raise, neutral, or lower positions, just by squeezing the free-fell lever.

Squeeze the free-fall lever toward the winch lever to free-fall lower a load. Release the squeeze lever *slow/y* to return the winch to normal operation. This squeeze lever is only furnished when the Gearmatic winch has a free-fall feature.

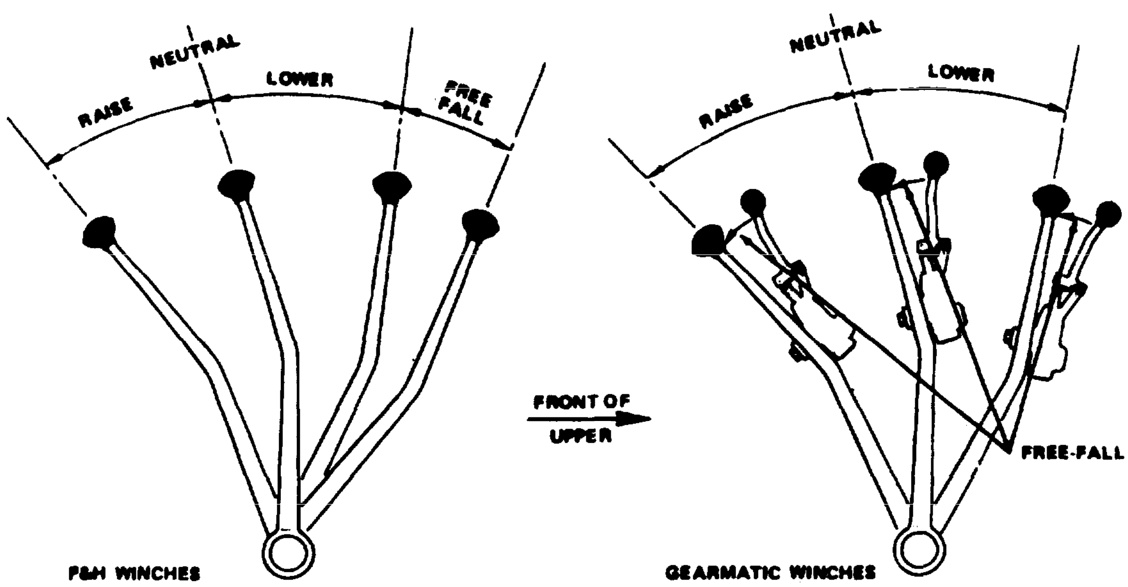


Figure 2-8. Winch Lever Positions

5. MAIN WINCH LEVER. This lever controls the operation of the main winch. The operation of the main winch is identical to that Of the auxiliary winch.

6. BOOM HOIST LEVER AND PEDAL. Push this lover (or padal) forward to lower the boom. Pull this lever (or pedal) to raise the boom.

7. SWING BRAKE PEDAL. Depress this pedal to apply the swing brake. Allow the pedal to return to the free position to release the swing brake.

NOTE

This brake is to be used primarily as a holding brake. Movement of the upper should be slowed by plugging the swing lever before the swing brake pedal is depressed:

8. ACCELERATOR. Depress this pedal to increase engine speed. Let up on the padal to decrease engine speed. Engine speed will return to low idle speed when no pressure is applied to this pedal, unless the engine idle speed has been preset to a higher speed by means of the Hand Throttle.

NOTE

The Throttle Selector Valve in the carrier cab must be in the UPPER position to allow the accelerator to control the engine.

9. GAUGE GROUP. The gauge group contains the following:

A. Engine Oil Pressure Gauge. This gauge should read between 40 and 60 psi (2.75 - 4.14 BARS) during normal operation.

CAUTION

Be sure that engine oil pressure reaches the normal operating range within 15 seconds after starting the engine. If it does not, stop the engine and correct the cause of the pressure failure before restarting the engine.

B. Fuel Gauge. This gauge shows the amount of fuel remaining in the fuel tank.

C. Engine Water Temperature Gauge. This gauge shows the temperature of the engine coolant. The gauge should read between 160 and 185° F. (71 - 85° C) during normal operation.

D. Voltmeter. The voltmeter measures the voltage produced by the alternator and indicates the condition of the battery. See Figure 2-2 for an explanation of the voltmeter readings.

10. IGNITION INDICATOR. This lamp is illuminated whenever the ignition switch is In the ON position. If the lamp remains lit after the upper ignition switch is placed in the OFF position, the carrier ignition switch is still in the ON position, and must be placed in the OFF position to shut down the ignition system.

11. ENGINE STOP BUTTON. Depress this button to shut down the engine. *After the engine has stopped,* place the ignition switch in the OFF position.

12. IGNITION KEY. The ignition key has three positions. Starting from the vertical position they are, OFF, ON, and START.

13. TEMPERATURE GAUGE. This gauge measures hydraulic oil temperature. The oil should be warmed to 70° F. (21° C) before operating the machine, and should not be allowed to exceed 200° F. (93°C) during operation.

14. WINDSHIELD WIPER SWITCH. Turn this switch clockwise, to the detent, to operate the upper windshield wiper at slow speed. Turn the switch past the detent to operate the wiper at high speed.

15. MAIN WINCH SPEED SELECTOR SWITCH. Place this switch in the HI position to operate the main winch at high speed. Place the switch in the LO position to operate the winch at low speed.

CAUTION

The winch is only capable of producing approximately 50% of the maximum line pull when the Speed Selector Switch is in the HI position. Be sure the switch is in the appropriate position for the load being lifted.

16. AUXILIARY WINCH SPEED SELECTOR SWITCH. This switch controls the speed of the auxiliary winch. Its operation is identical to that of the main winch speed selector switch.

17. OUTRIGGER CONTROL SWITCHES. These switches control the operation of the outrigger. The operation of the outriggers, from the upper cab, is identical to the operation from the carrier, except that all outriggers can be controlled from the upper cab. Refer to the topic Outriggers Operation for instructions on extending or retracting the outriggers.

18. SWING BRAKE LOCK. Depress this button to lock the swing swing in the applied position. Lift this button to unlock the swing brake.

NOTE

This control operates independently of the swing brake pedal, and will override the swing brake pedal.

19. HAND THROTTLE. Use this lever to set the engine high idle speed, as required for the machine application. For maximum efficiency and safety of operation, the high idle speed must be set high enough, by means of this control, to handle the typical load. The Accelerator should be used for momentary increases in engines speed.

20. HEATER CONTROL. This control regulates the heater temperature and heater fan speed. Turn the knob clockwise to start the heater fan. Fan speed is controlled by turning the knob clockwise or counterclockwise until the desired fan speed is obtained. Heater temperature is increased by pulling the knob outward and is decrease by pushing the knob inward.

21. DEFOGGER FAN. The defogger fan is controlled by the switch on the fan housing. Place the switch in the canter position to operate the fan at low speed. Place the switch in the extreme right position to operation the fan at high speed.

22. WINCH TURN INDICATORS. These lights indicates the rate at which the winch drums are turning. The upper light indicate, main winch rotation, while the lower light indicates auxiliary winch rotation.

The lights will flicker whenever the winch drums are turning. The light will flicker at different rater depending upon how fast the winch drum is turning.

NOTE

The lights will have slight glow when the winches are not turning, and will increase in intensity when the winches are turning. This sight glow provides a mans of checking the lamps in the turn indications. The lamps should be replaced if it does not glow, as it is burned out.

23. BOOM ANGLE INDICATOR. This gauge indicates the number of degrees the boom is raised above the horizontal.

24. FLOODLIGHT SWITCH. This switch, or switches, turn the optional floodlights on and off.

26. ENGINE WARNING LIGHT. This lights, when illuminated, indicates that the engine is overheated or the engine oil pressure is below normal.

26. CARRIER REMOTE CONTROLS. Then switches are used to operate the carrier from the upper cab. Refer to the topic Remote Control Carrier Operation.

CRANE OPERATION

GENERAL. The following operating suggestions are offered as a reminder rather than as an attempt to instruct, since the Harnischfeger Corporation is well aware of the fact that a machine of this size is not entrusted to anyone exact a fully qualified operator.

1. Always consult the rating plate in the upper cab for the maximum load which may be lifted with the various cornbinations of boom lenght, boom and, and other variable function which may be involved with lifting the load.

2. Always perform all operations with the engine running at governed speed. Machine performance and safety of machine operation require that the engine be run at governed speed.

3. When the load is being swung, it should be kept as near the machine and as close to the ground as possible.

4. Always pay out cable from the main and/or auxiliary winch when is being extended or when the boom is being lowered to prevent to "two blocking the hook block.

5. Always set the outriggers before operating the machine.

STARTING THE ENGINE. To start the engine from the upper cab, proceed as follows:

1. Perform the following functions before leaving the carrier cab:

A. shift the main transmission to natural.

B. Place the Throttle Selector Valve in the UPPER position.

C. Engage pump drive.

D. Apply the Maxibrakes by pushing the Maxibrake button in.

2. Turn the upper ignition Key clockwise, past the detent, to to start the engine. Do *not* hold the starter on for more than 30 seconds at one time. If the engine does not start in this period of time, release the ignition key, and wait two minutes before attempting to start the engine again.

3. Chuck all gauges, *immediately after the engines starts,* to be sure they are reading properly. If the readings are improper, stop the engine *immediately* and determine the cause of the improper gauge reading before continuing operation.

4. Allow the engine to run at 800 to 1000 rpm for 4 to 6 minutes or preferably until the water temperature reaches normal operating temperature before working the machine.

CRANE OPERATING CYCLE. The crane operating cycle consists of six steps: setting the boom angle (boom hoist operation), setting the boom length (boom telescope operation), lifting the load (hoisting operation), swinging the load, spotting the load, and lowering the load (See Figures 2-9 and 2-10).

CAUTION

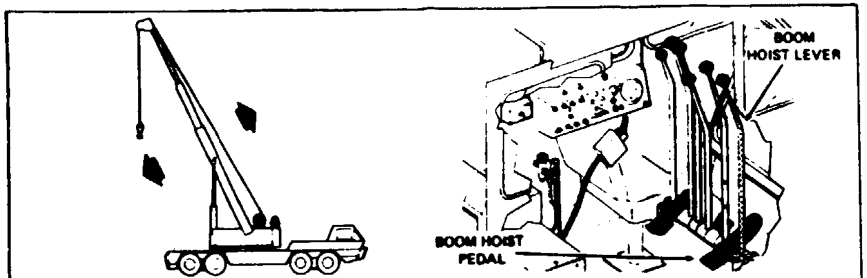
Figure 2-9 illustrates the operation of the machine when it is equipped with P&H winches, while Figure 2-10 illustrates the operation of machines equipped with Gearmatic winches. *The operation these machines is different.* Therefore, be sure you understand the operation of your machine *before* you begin to operate it. The operation of both types of winches is described in the topic Upper Control Identification.

STOPPING THE ENGINE. To stop the engine, proceed as follows:

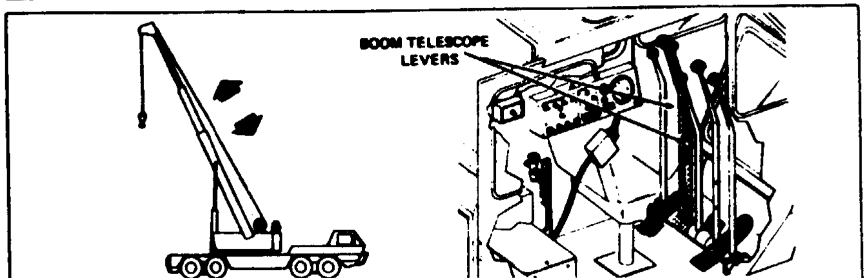
1. Make certain that all controls are in the neutral position, and the swing brake is locked in the applied position. Lower the boom onto the boom rest or to a horizontal position.

2. If possible, allow the engine to run at half speed or less for several minutes before stopping the engine. This will allow the engine to cool down.

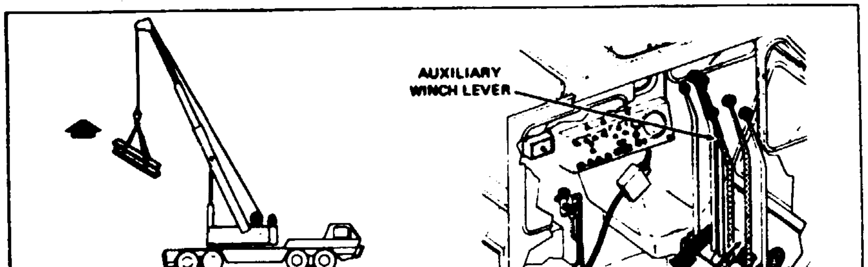
3. Depress the Engine Stop Button to stop the engine. *After the engine has stopped, place the ignition key in the* OFF position.



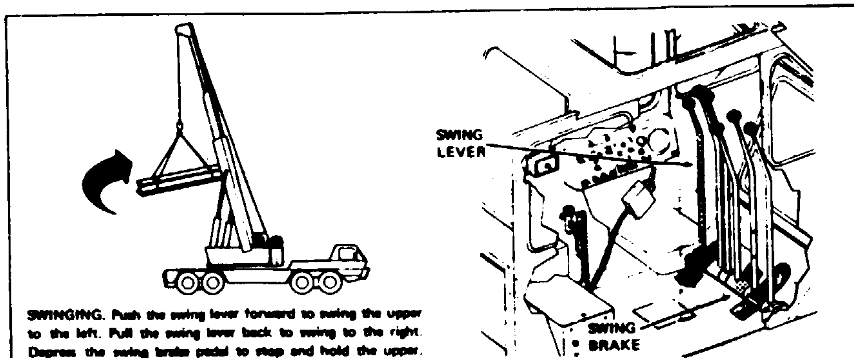
SETTING BOOM ANGLE. Position the boom at the proper angle for the load and working conditions. Refer to the rating plate for proper angle. Pull the boom hoist lever (or pedal) back to raise the boom. Push the boom hoist lever (or pedal) forward to lower the boom. Be sure to pay out line from the main and/or auxiliary winch, as required, to prevent the hook block(s) from coming in contact with the boom point.



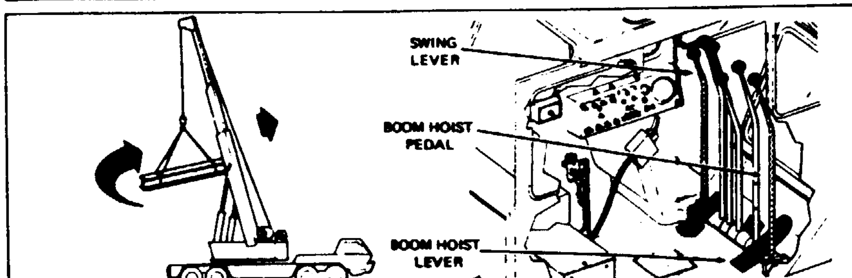
SETTING BOOM LENGTH. Push the boom telescope levers forward to extend the boom sections. Pull the boom telescope levers back to retract the boom sections. Be sure the boom sections are extended equally, and do not extend the boom further than required to perform the operation. Be sure to pay out line from the main and/or auxiliary winch, as required, to prevent the hook block(s) from coming in contact with the boom point.



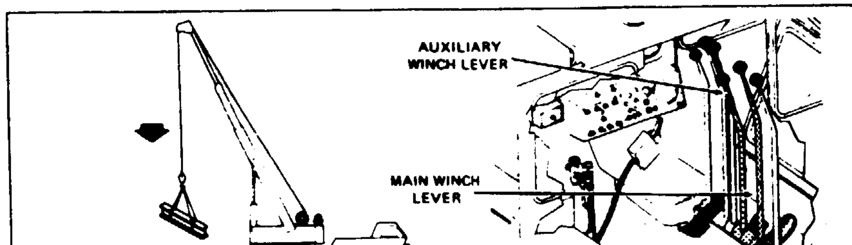
LIFTING THE LOAD (HOISTING). Push the main (or auxiliary) winch lever forward to lower the hook block. Attach the load to the hook block, then pull the main (or auxiliary) winch lever back to raise the load.



SWINGING. Push the swing lever forward to swing the upper to the left. Pull the swing lever back to swing to the right. Depress the swing brake pedal to stop and hold the upper.



SPOTTING THE LOAD. Spotting the load requires accurate control of the boom hoist and swing movements. It takes practice to locate the load at the exact spot without hunting or overshooting. Raise or lower the boom with the boom hoist lever as necessary to accurately locate the load. Never extend the boom out so far that rated load is exceeded. See the rating plate.



LOWERING THE LOAD. The load can be lowered by two methods. Push the main (or auxiliary) winch lever forward, part way, to power down the load. Light loads can be free-falled by pushing the lever to the extreme forward position.

CAUTION

Return the control lever to the power lowering position slowly to avoid shock loading the winch and winch line.

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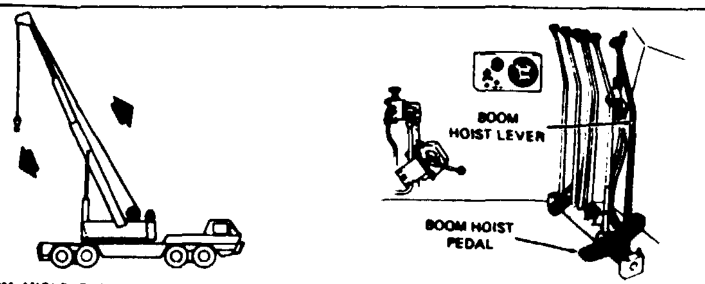
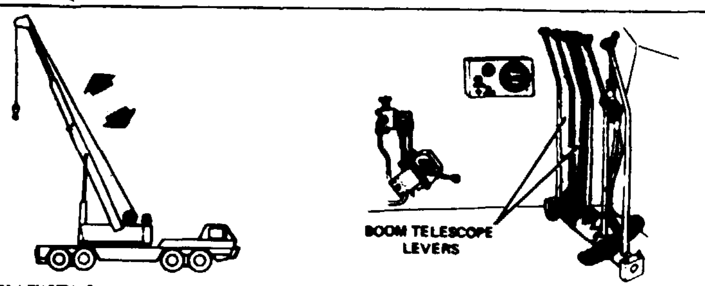
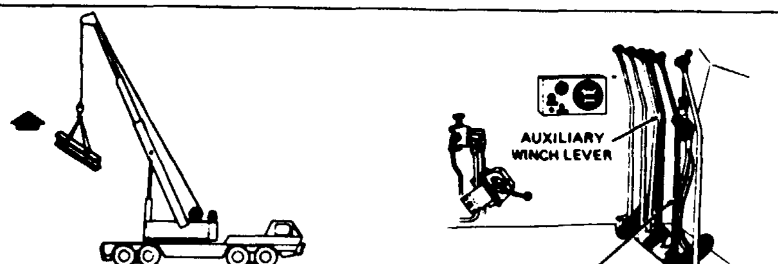
Figure 2-9. Crane Operating Cycle - P&H Winch



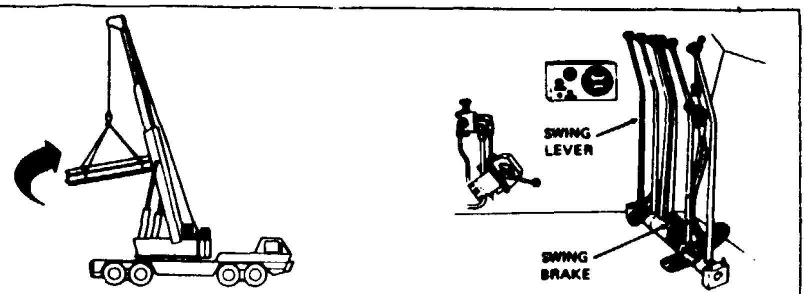
SETTING BOOM ANGLE. Position the boom at the proper angle for the load and working conditions. Refer to the rating plate for proper angle. Pull the boom hoist lever (or pedal) back to raise the boom. Push the boom hoist lever (or pedal) forward to lower the boom. Be sure to pay out line from the main and/or auxiliary winch, as required, to prevent the hook block(s) from coming in contact with the boom point.



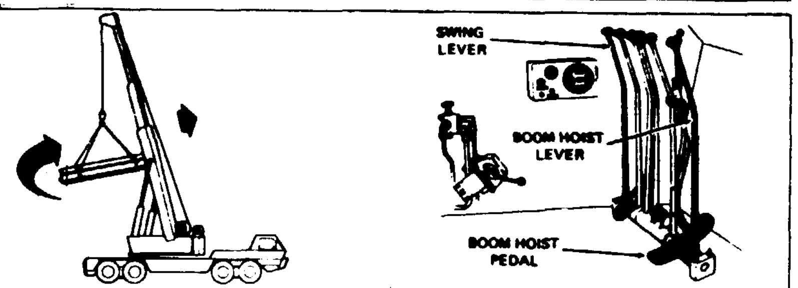
SETTING BOOM LENGTH. Push the boom telescope levers forward to extend the boom sections. Pull the boom telescope levers back to retract the boom sections. Be sure the boom sections are extended equally, and do not extend the boom further than required to perform the operation. Be sure to pay out line from the main and/or auxiliary winch, as required, to prevent the hook block(s) from coming in contact with the boom point.



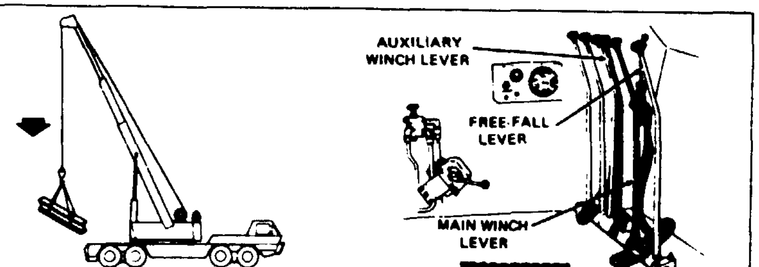
LIFTING THE LOAD (HOISTING). Push the main (or auxiliary) winch lever forward to lower the hook block. Attach the load to the hook block, then pull the main (or auxiliary) winch lever back to raise the load.



SWINGING. Push the swing lever forward to swing the upper to the left. Pull the swing lever back to swing to the right. Depress the swing brake pedal to stop and hold the upper.



SPOTTING THE LOAD. Spotting the load requires accurate control of the boom hoist and swing movements. It takes practice to locate the load at the exact spot without hunting or overshooting. Raise or lower the boom with the boom hoist lever as necessary to accurately locate the load. Never extend the boom out so far that rated load is exceeded. See the rating plate.



LOWERING THE LOAD. The load can be lowered by two methods. Push the main (or auxiliary) winch lever forward to power down the load. Light loads can be free-falled by slowly squeezing the free-fall lever toward the main winch lever.

CAUTION

Release the free-fall control lever slowly to avoid shock loading of the main winch and main winch line.

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Figure 2-10. Crane Operating Cycle - Gearmatic Winch

CARRIER REMOTE CONTROLS

GENERAL

The purpose of the carrier remote controls is to provide a means of moving the carrier, without having to leave the upper cab.

CONTROL IDENTIFICATION

The controls provided on the carrier remote control panel are shown in Figure 2-11. The function of the controls are as follows:

1. LOW AIR PRESSURE LIGHT. This lamp, when illuminated, indicates that the air pressure is *below* the pressure required to operate the carrier by remote control. *Do not operate the carrier by remote control when the this lamp is illuminated.*

2. L.H. STEER. Depress and hold this button to turn the front wheels to the left. The number of degrees that the wheels are turned with the length of time the button is held depressed. Release the button to stop turning the wheels.

3. R.H. STEER. This button operates in the same manner as the L.H. Steer button, except the this button causes the wheels to turn to the right.

4. CLUTCH. This button controls the operation of the clutch. Depress and hold this button to disengage the clutch. Release the button to engage the clutch.

5. BRAKE. This toggle switch controls the operation of the carrier *service* brakes. Place the switch handle in the up position to apply the brakes. Place the switch handle in the down position to release the brakes.

6. FORWARD. This button, when used in con/unction with the Clutch button, shifts the main transmission into first gear.

7. NEUTRAL. This button, when used in conjunction with the Clutch button, shifts the main transmission into neutral.

8. REVERSE. This button, when used in conjunction with the Clutch button, shifts thr main transmission into reverse.

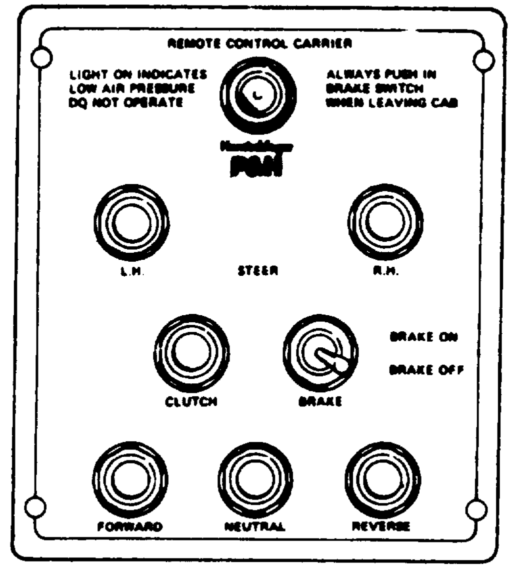


Figure 2-11. Carrier Remote Control Panel

OPERATION

To operate the carrier by remote control, proceed as follows:

CAUTION

The following instructions describe the step necessary to transfer control of the carrier from the carrier cab to the upper cab. These instruction must followed carefully to ensure safe, proper transfer of carrier control.

1. Perform the following functions before leaving the carrier cab:

A. Shift the main transmission to neutral.

B. Shift the auxiliary transmission to low gear.

C. Place the Remote Control Air Valve in the ON position.

D. RH, the Throttle Selector Valve in the UPPER position.

2. Go to the upper cab and place the ignition switch in the ON position. Then place the Brake switch in the BRAKE ON position.

WARNING

Be sure the Low Air Pressure Light, on the carrier dash panel, is not lit before releasing the Maxibrakes. If the light is lit. it is possibls that the carrier could move because the air pressure is *not* sufficient to apply the service brakes via the remote control systom.

3. Return to the carrier cab and release the Maxibrakes by pulling out the Maxibrake button.

4. The carrier can now be operated from the upper by remote control as follows:

A. Start the engine by turning the Ignition key to the START position.

B. Raise the outriggers to the stored position, if they are extended, as described in the topic Outrigger Operation. Be sure the MASTER switch on the outrigger control panel is *returned* to the OFF position.

C. Depress the Clutch and either the Forward or Reverse buttons on the carrier remote control panel to engage either the first or reverse gear of the main transmission.

D. Release the Forward or Reverse button, while maintaining the Clutch button in the depressed position.

E. Place the Brake switch in the BRAKE OFF position.

F. Release the Clutch button to engage the clutch.

G. Control the speed of the carrier with the Accelerator, and steer the machined in the desired direction by depressing the Steer Left or Steer Right buttons as required.

H. Stop the carrier by *first* depressing the Clutch button, and then place the Brake switch in the BRAKE ON position. Maintain the Clutch button in the depressed position while the carrier is stopped, or shift the transmission to neutral by depressing the Neutral button. The Clutch button can be released when the transmission Is in the neutral.

5. To transfer control of the carrier back to the carrier cab, perform the following steps:

A. Shift the main transmission to neutral by depressing the Clutch and Nuetral buttons.

B. Place the Brake switch in the BRAKE ON position.

C. Go to the carrier cab and apply the Maxibrake by pushing the Maxibrake button in.

D. Return to the upper cab and place the Brake switch in the BRAKE OFF position. Place the Ignition key in the OFF position if the machine is to be completete ly shut down.

E. Place the Remote Control Air Valve in the carrier cab in the OFF position. Place the Throttle Selector Valve in the LOWER position. The operation of the carrier is now controlled from the carrier cab.

HAND SIGNALS

It is frequently necessary during crane operation for the operation to depend on a signalman for instruction. When moving the machine into a position when there is very limited clearance, or when handing loads that are out of sight of the operator, the use of a signalman is essential. The hand signal illustrated in Figure 2-12 (are those generally accepted throughout the industry. Both the operator and the signalman should be thoroughly familiar with the standard hand signals illustrated to ensure cooperation and tramwork.

OPERATION UNDER UNUSUAL CONDITIONS

GENERAL. Unusual conditions refer to environment; specifically, extreme cold, extreme heat, dusty or sandy conditions, areas with high humidity or salt air, and high altitudes. Separate paragraphs are devoted to each of these conditions.

OPERATION IN EXTREME COLD. Operation in extreme cold present special problems to the increased brittle. ness of metallic and rubber parts, the danger of freezing and the increased difficulty of keeping parts lubricated adequately.

WARNING

Personnel should use care to keep from spilling fuel, coolmnt, or other liquids upon themselves. Exposed parts of the body should not come into contact with metal during cold weather, as serious and painful Injury may rerult.

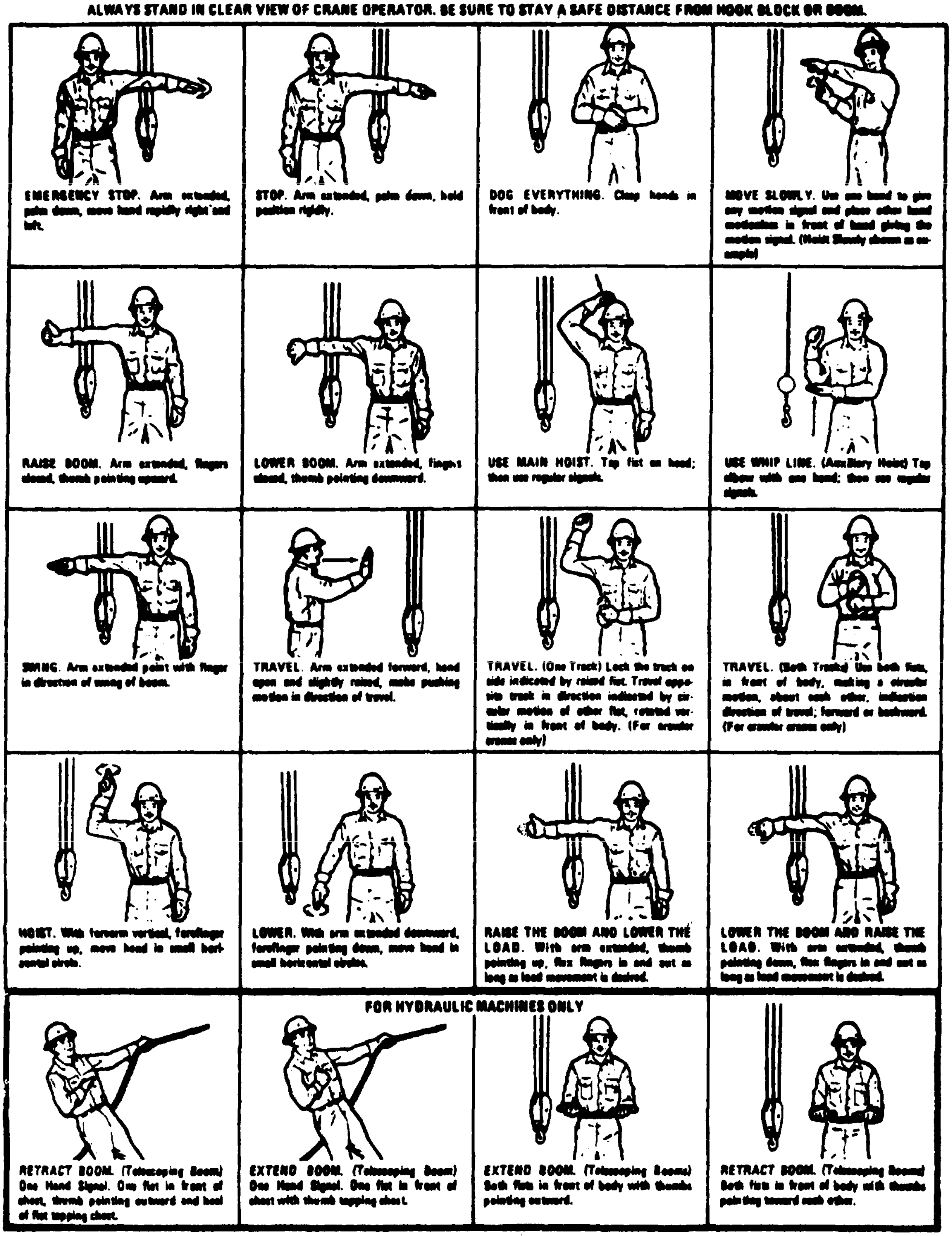


Figure 2-12. Hand Signal for Crane Operation

1. Refer to Section III, Lubrication. for lubricant recommendations for cold weather operation. Change the lubricult if necessary.

2. Drain and flush the cooling system, to insure proper circulation of coolant throughout the radiator core. Clean the radiator cooling fins, particularly the air passages through the core.

Check the condition of the radiator hoses, clamps, thermostat and radiator core.

When assured that the cooling system is clean, and in good condition. refill the system with an ethylen/glycol and water solution of the proper strength for the anticipated low temperatures.

NOTE

A high quality corrosion inhibitor can be added to the cooling system, if desired. Do not, however, use a Chromate base inhibitor with on an ehylene/glycol anti-freeze. That combination can produce Chromium Hydroxide, commonly known as "green slime."

3. Keep the battery fully charged at all times. The electrolyte in a discharged battery will freeze at a higher temperature than that in a fully charged battery.

NOTE

If it is necessary to add water to the battery, do so only immediately before or during operation, or with an external charger connected to the battery. Charging the battery, by any means, mixes the water and electrolyte and thereby prevents the water from freezing.

Keep the battery terminal connections clean and free from snow or ice which could short circuit the terminals. Clean the cable connectors and battery posts thoroughly, using a soda and water solution to remove corrosion.

in extremely cold weather, it is advisable to remove the battery and store it in a heated area if the machine is to be idle overnight or for any extended period.

4. Keep the fuel tank as full es possible et all times to minimize condensation. If water is detected in the fuel supply, drain the tank and refill it with dean fuel.

5. Engage the pump drive and jog the starter for about one minute to move hydraulic oil through the pumps, thereby insuring proper lubrication of pump components. Then start the engine in accordance the engine manufacturen recommendations for cold weather staring and run it at approximately 1200 RPM until the engine has warned up.

NOTE

Cover part of the radiator, to aid warmup and to maintain engine running temperature. During warmup only, the entire radiator may be covered.

6. After the hydraulic oil has warmed to a minimum of 70° F. (21°C). slowly and gradually actuate each cylinder a number of times, in turn, without allowing the cylinders to travel to the end of their stroke. Then slowly swing the upper end operate the winches in both directions. The oil in the lines end other components of these systems will the be warmed.

CAUTION

Cold fluid makes relief valves sluggish in operation. It can add 500 to 1000 psi (34.5 - 68.9 BARS) to the maximum pressure setting of the relief valves. Therefore, extreme care must be used when actuating a cold system to prevent a hose or tube from rupturing, or causing other damage.

7. Before shutting down the machine, raise the outriggers to the stored position, and drive the machine onto wooden planks or mats to prevent the machine from being frozen to the ground.

OPERATION IN EXTREME HEAT. Operation in extreme heat present special problems due to the difficulty in keeping the engine and hydraulic oil from overheating.

1. Refer to Section Ill, Lubrication, for lubricant recommendations for hot weather operation. Change the lubriant if necessary.

2. Make certain that the engine crankcase oil is at the prop er level. An inadequate supply of crankcase will prevent proper dissipation of heat from the engine.

3. Drain and flush the cooling system, to insure proper circulation of coolant throughout the radiator core. Clean the radiator cooling fins, particularly the air passenger through the core, of insects, leaves, dirt, and other foreign material that will restrict air flow.

4. Inspect the cooling system for leeks. Replace worm or damaged hoses. Tighten the hose clamps.

5. Keep the water pump fen belt adjusted properly.

6. If the engines becomes overheated from Iack of coolant, let the engines run at a fast idle and add coolant slowly.

7. If the engine overheats after refilling the cooling system, shut down the engine and allow it to cool. Drain the cooling system by opening the drain cocks on the radiator end the engine block, and flush out the system. Refill the cooling system with clean water; *do not use salt or mineral water solutions in the cooling systems.*

8. Keep as much air as possible circulating around the battery. Check the electrolyte level frequently; add distilled water as necessary to keep the electrolyte level 3/8 inch (9.2 mm) above the plates.

9. Keep the air intake and exhaust openings clear. Keep the engine dean, and allow air to circulate freely around the engine.

10. Avoid racing the engine; and avoid operation at full throttle when part throttle will handle the load.

11. Avoid lugging the engine; keep the engine speed high enough to maintain fan speed.

12. Avoid idling the engine unnecessarily; shut the engine down during a lull in the operation.

OPERATION IN DUSTY AND SANDY AREAS. Operation in dusty or sandy areas present special problems due to the abrasive action of dust which shortens the life of parts Make every effort to keep dust and sand out of the moving parts of the crane machinery and engine.

1. All lubricants and lubricating equipment must be kept clean. Service breathers and air clearner frequently to remove accumulated sand ad dust. Lubricate more frequently to keep a supply of clean lubricant in the moving parts. Clean all lubrication fittings thoroughly before ettaching the grease gun.

2. Keep the fuel tank filler cap tight to prevent sand or dust from entering the fuel tank. Service fuel filters frequently to keep them free from sand and dust.

3. Keep the hydraulic oil reservoir filler up tight to prevent sand and dust from entering the hydraulic system. Service the hydraulic oil filter frequently to keep the systern free from sand and dust.

4. Use wood blocking or mats under the outrigger jackfloats when operating in sand. See that the carrier does not shift during operation.

OPERATION IN HUMIDITY OR SALT WATER AREAS. Moisture and salt will cause deterioration of paint, cables, wiring, end all exposed metallic parts. Keep parts dry and well lubricated in high humidity or salt water conditions.

1. Completely remove rust end corrosion at the first appearance on my part of the truck crane. Wash off salt water and dry all parts thoroughly; paint the exposed surfaces immediately. Place a film of lubricant or grease on all polished or machined metal surfaces and other surfaces which cannot be painted.

2. Keep parts lubricated thoroughly to repel water from polished metal surfaces and to prevent the entry of water into bearings. Keep lifting cables lubricated.

OPERATION AT HIGH ALTITUDES. Operation at high altitudes present special problems due to lower atmospheric pressure and wide temperature ranges. At altitudes above 5000 feet (1524 m) it may be necessary to change the engine fuel injectors. Make certain that the air cleaner is clean and free from obstructions. Check the engine frequently for overheating.

INSTALLING ROPE ON DRUMS

The manner in which a new or replacement wire rope is installed on the winch drum will, to a large measure, determine the service life of that rope. Improperly wound ropes will cause undue crushing of the rope, doglegs, kinks, excessive abrasion and cutting of the individual wires. Bad spooling also causes uneven application of force and motion. This results in fast fatiguing of the rope from the hook block to the drum.

The following five precautionary steps should be taken, particularly with a replacement wire rope, before starting the actual installation of the rope.

1. A check should be made of the drum to determine the condition, size and shape of the drum grooves.

2. Drum flanges should be checked to determine the extent, if any, of undercutting at the base of the flange.

3. Dirt, grit, or any other type of debris should be cleaned off the drum.

4. Bearings should be checked.

5. Cracks or breaks in the drum should be reported.

Whenever any of these conditions are observed, the winch should be removed from service and properly cleaned, repaired or replaced. This recommendation is made not only to improved or maintain good rope life, but to eliminate a potential hazzard.

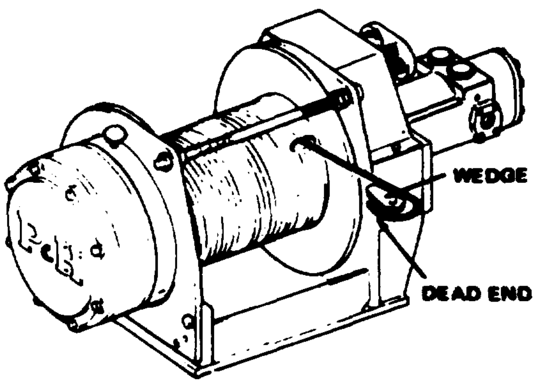


Figure 2-13. Securing Rope to Drum

After establishing the satisfactory condition of the win& drum mount the reel of wire rope on suitable jacks at the front of the boom. Pass the end of the rope over the idler sheave at the boom point and attach the rope to the winch drum as shown in Figure 2-13.

NOTE

A tension should be induce into the rope by providing some means of braking the shipping reel while installing the rope on the winch drum. A tight winding is imperative.

Slowly wind the rope onto the winch drum by moving the winch lever to the raise position. A lead or brass hammer may be useful in tapping the rope over is it is being would on the drum. *Do not use a steel hammer or pinch bar. These can readily cause damage to the rope.*

REEVING

Rowing diagrams for the main hoist line are shown in Figure 2-14. The number of parts of lint (from one to seven) used in reeving the twin hoist line will depend on the load to be lifted. Refer to the rating chart in the upper cab to determine reeving requirements for various loads. Hoisting and lowering speeds decreases as the number of parts of line

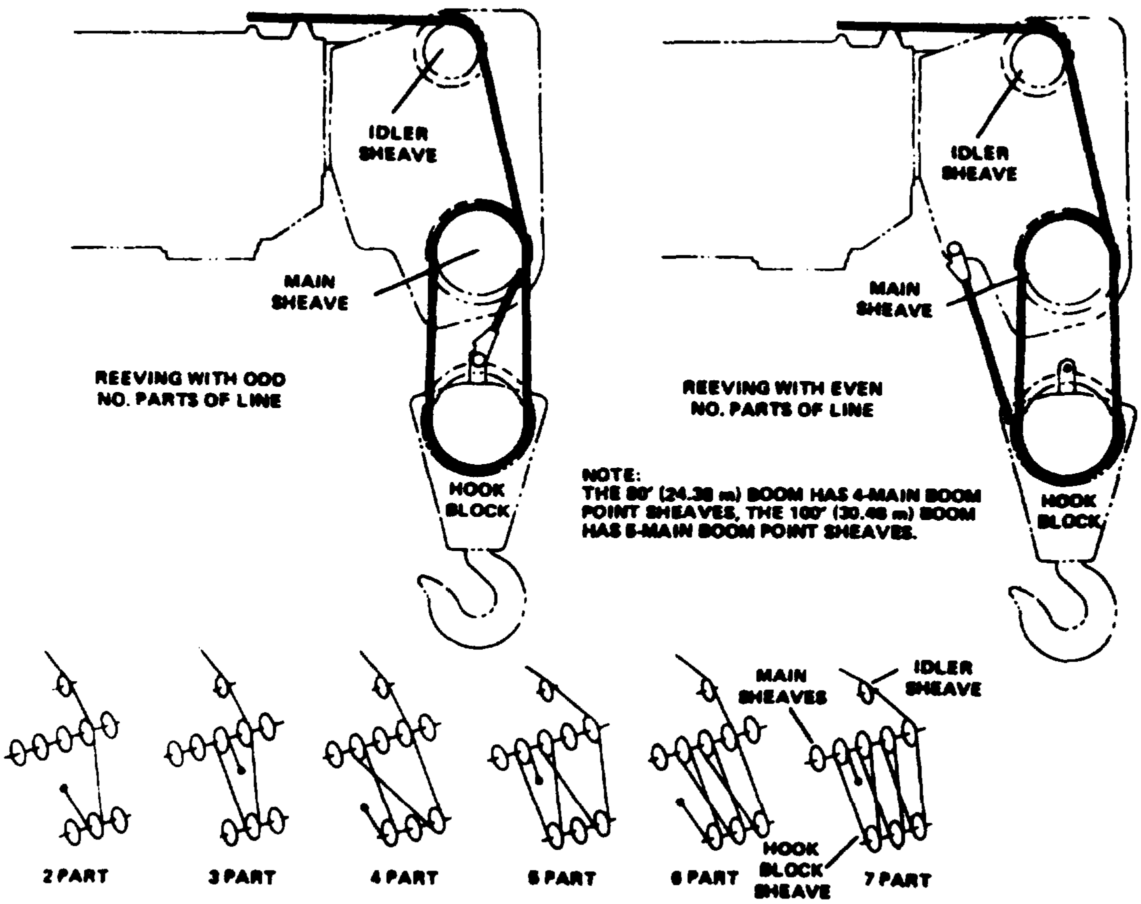


Figure 2-14. Reeving Diagram (105N416)

increases. When practical, use the minimum number of parts required for the loads to be lifted.

NOTE

Jib reeving is limited to a single part of line. The main or auxiliary winch line can be used to reeve the jib. The auxiliary winch line cannot, however, be used for reeving the main hoist line.

The dead end of rope is attached to the hook block (or boom point) with a wedge type rope socket. The rope socket should be installed on the rope as follows (see Figure 2-15):

1. Place the socket in an upright position as shown in View A. and bring the rope around in a large, easy to handle loop.

2. The dead end of the rope should extended from the socket for a distance of at least one rope lay, permitting the strands to adjust around the wedge and to keep the rope in balance. Insert the wedge as shown in View B.

3. Secure the ears of the socket to a sturdy support and carefully take a strain on the live side of, the rope. Pull the wedge and rope loop into position tight enough to hold the wedge in place during handling. Final wedge positioning takes place under full operating loads.

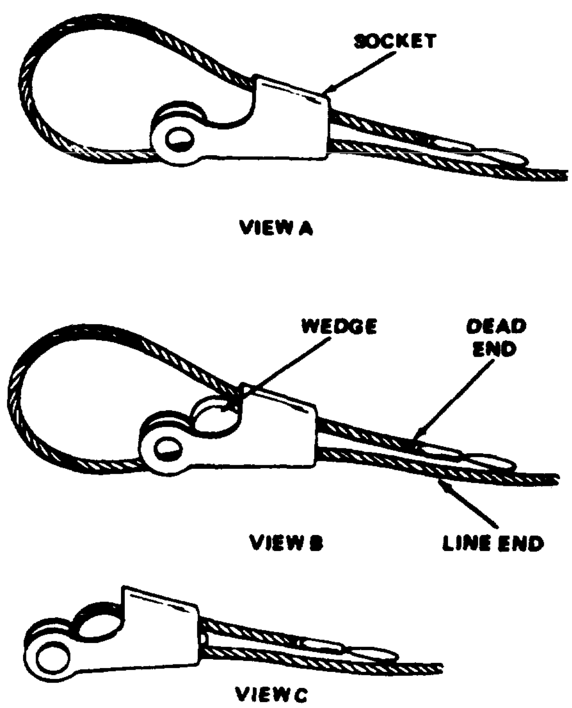


Figure 2.16. Installing a Rope Socket

4. After the socket is pinned to the hook block (or boom point), apply gradually increasing loads until the wedge is seated. Avoid applying any sudden shock loads before the wedge is in its final position. View C shows the general operating appearance of the rope socket with the wedge pulled into the socket and the end of the wedge showing.

JIB ATTACHMENT

The optional jib attachment is mounted on the boom point when it is in the operating position, and is stored under the boom when not used.

NOTE

Consult the rating plate in the operator's cab for lifting capacities when operating with the jib attachment.

To place the jib into the operating position from the storage position, proceed as follows (see Figure 2-16):

1. Rotate the upper so that the boom is over either side or the rear of the carrier. *Do not attempt to unfold the jib with the boom over the front of the carrier.*

2. Install T-pins (1), spacers (2), and cotter pins (3) to attach the jib to the boom point. Install the T-pin upward from the bottom to that the cotter pin will be on the bottom side of the jib when it is erected.

3. Remove the hook block from the main or auxiliary winch line, ad attach the line to becket (4) with a rope socket. Take up the slack in the line with the winch so that the jib point is supported by the line.

4. Removes capscrews (5), lockwashers (6), retainers (7) and spacers (8). Remove cotter pin (9) and pin (10).

5. Elevate the boom to an angle of approximately 45 degrees, and extend the boom while paying out on the winch line until the jib is suspended vertically, from the boom point.

6. Disconnect the winch line from becket (4) and attach it to backet (11). Take up slack in the winch line to raise the jib to the operating position.

7. Attach the jib suspension cable as shown in Figure 2-17 to fix the jib at the required operating angle. The angle at which the jib operates can be varied by increasing or decreaing the length of the suspension cable by means of cable links. The cable links are installed between the main

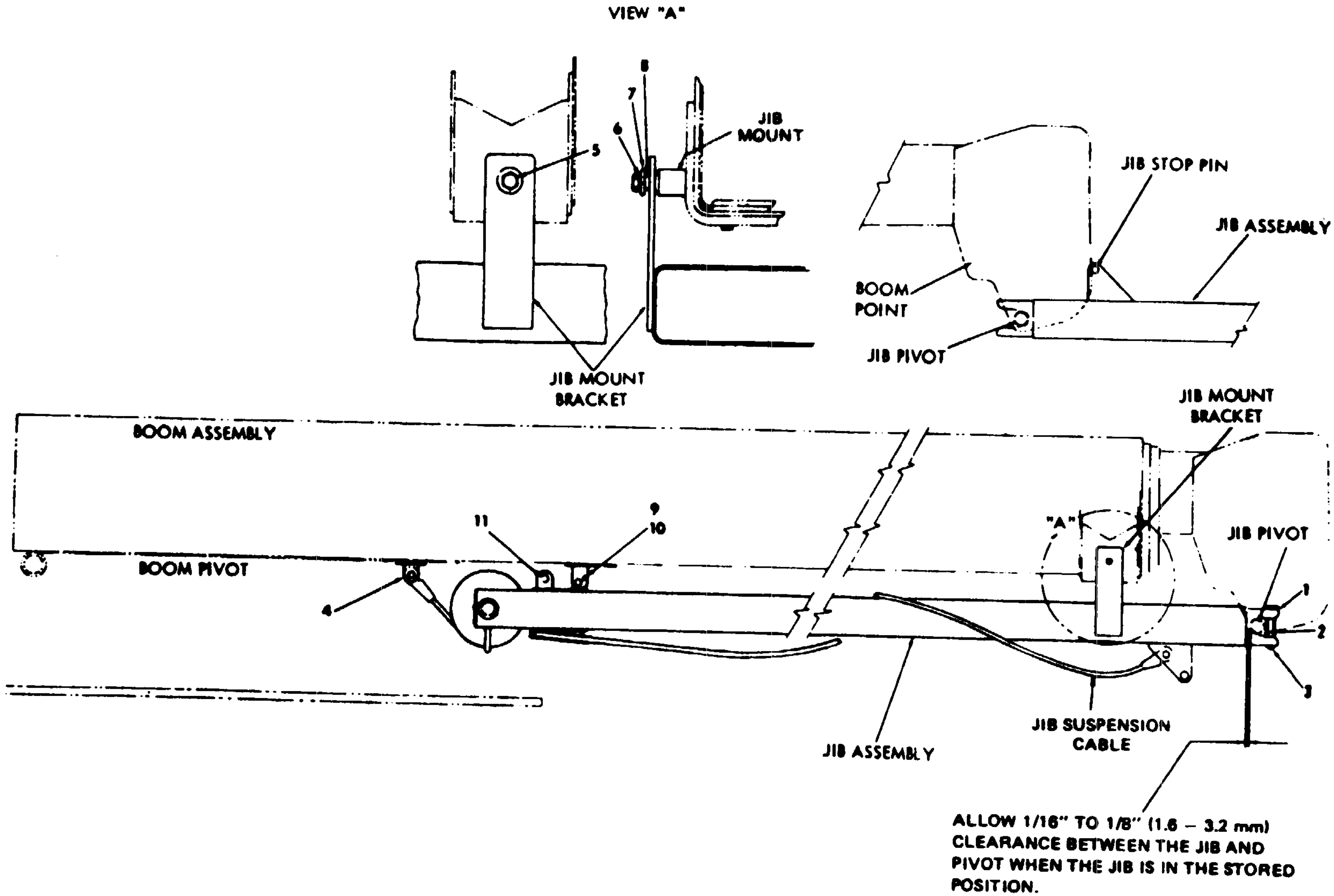


Figure 2-16. Jib Storage (911J90-E)

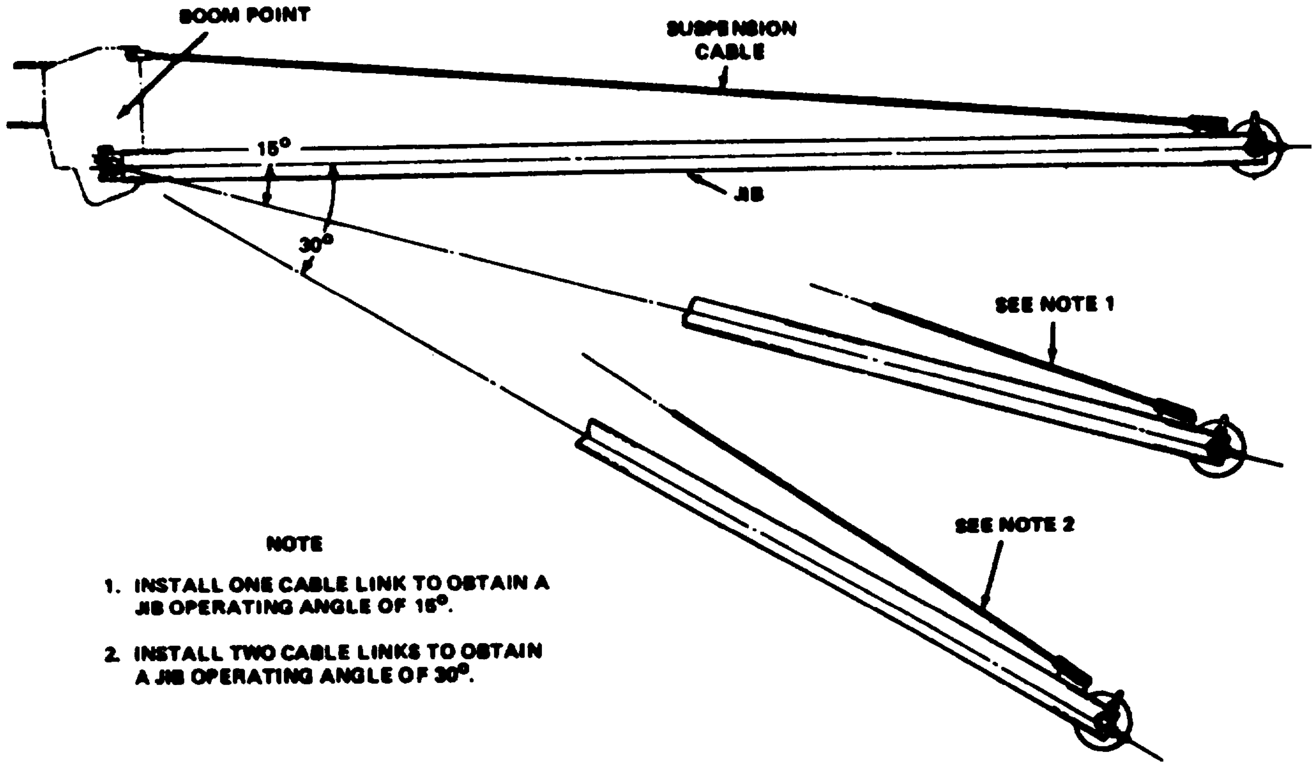


Figure 2-17. Jib Suspension (911591)

suspension cable and the boom point. Figure 2-17 illustrates the positions at which the jib can operate, and the number of cable links required to obtain the operating angles shown.

8. Remove the winch line from becket (11) and attach the hook block to the line.

To place the jib into the storage position from the operating position, proceed as follows (see Figure 2-16):

1. Rotate the upper so that the boom is over either side or the rear of the carrier, *Do not attempt to fold the jib with the boom over the front of the carrier.*

2. Remove the hook block from the main or auxiliary winch line, and attach the line to backet (11). Take up on the winch line to relieve the tension on the jib suspension cable.

3. Remove the suspension cable from the boom point and attach it to the bracket at the base of the jib n shown in Figure 2-16. Elevate the boom to an angle of approximately 45 degrees, and pay out line from the winch slowly, until the jib is suspended vertically from the boom point.

4. Telescope the boom back, leaving, approximately one foot of boom extended.

5. Remove the winch line from backet (11) and attach it to backet (4). Slowly lower the boom and take up slack in the line with the winch to fold the jib under the boom.

6. Telescope the boom back fully, and take up slack with the winch until the jib mount bracket is aligned with the jib mounts. Install spacers (8), retainers (7), lockwashers (6), and capcrews (6,.

7. Install pin (10) and lock it in place with cotter pin (9).

8. Unhook the winch line from becket (4) and attach the line to the hook block.

MANUAL FLY SECTION

This machine can be equipped with an optional manually opened fly section which will increase the maximum boom length to 100 feet (30.48 m).

The manual fly section is stored within the telescoping booms, and is extended by means of boom section 2 telescoping cylinder, as described below. To extend the manual fly section, proceed es follows (see Figure 2-18):

CAUTION

The crane boom must be in a horizontal position while the manual fly section is being extended or retracted. If this is not observad, it is possible that the fly section could move when the cylinder pin is removed, and cause damage to other puts of the boom.

1. Extend the boom sections until boom section 2 is out approximately 48 inches (121.9 cm) and the cylinder pin is visible, as shown in View A.

2. Install the boom stop as show in View B.

3. Remove cylinder pin end caps.

4. Center the cylinder pin in the manual fly section. Extend the boom until the second hole the manual fly section is aligned with the hole in boom section 2.

5. Remove the cylinder pin. Retract the telescope cylinder until the cylinder rod eye is aligned with the hole in boom section 2.

6. Install the cylinder pin so that it press through boom section 2, the second hole in the manual fly section, and cylinder rod eye. Install the cylinder pin I no caps.

7. Remove the boom stop. The boom can now be operated as it would normally he operated.

WARNING

The machine must not he operated with the telescope cylinder pinned only to the manual fly section. The telescope cylinder must he retracted end pinned to boom section 2 es shown in Section A-A.

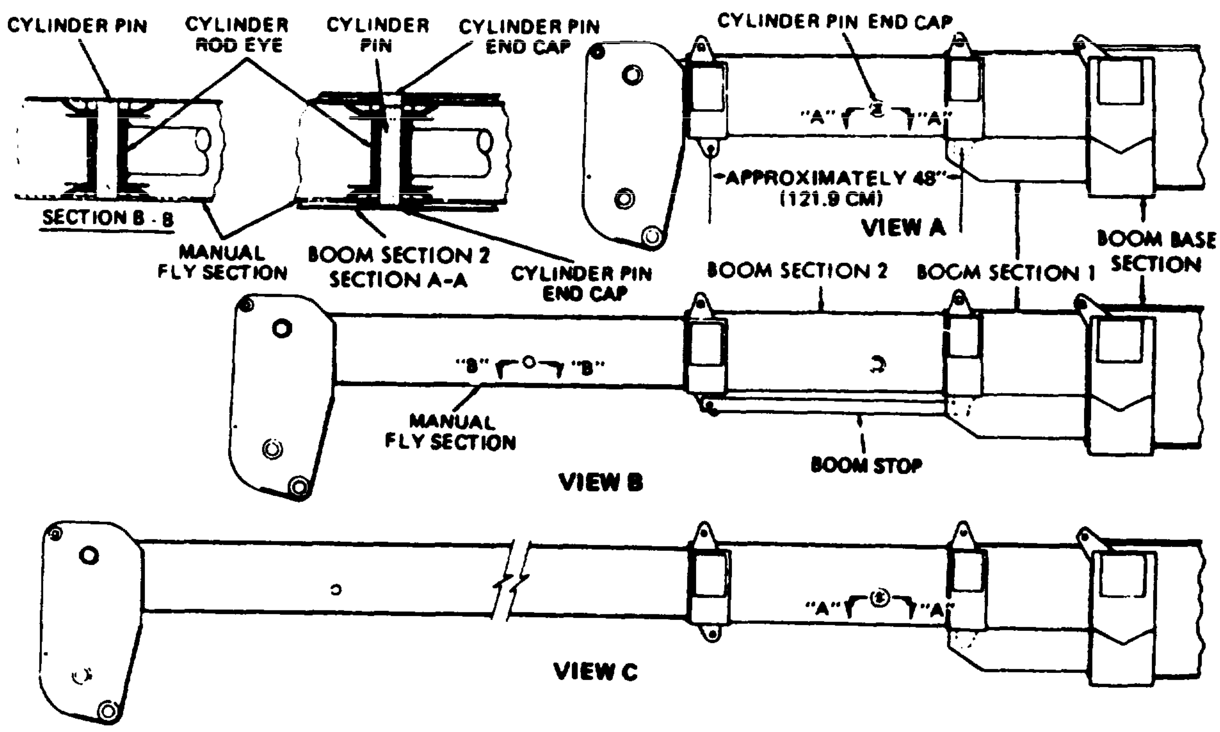


Figure 2-18. Manual Fly Section (105J681)

To retract the manual fly section back to the storage position, proceed as follows:

1. Install the boom stop as shown in View B.

2. Remove the cylinder pin end caps and cylinder pin. Extend the telescope cylinder until the cylinder rod eye is aligned with the hole nearest the tip of the manual fly section.

3. Install the cylinder pin in the cylinder rod eye u shown in Section B-B. Retract the telescope cylinder until the cylinder pin is aligned with the hole in boom section 2.

4. Rush the cylinder pin toward the left side of the machine so that it engages boom section 2. Then install the cylinder pin end caps (see Section A-A).

5. Remove the boom stop.

COUNTERWEIGHT

The counterweight on this machine is attached to the rear of the revolving frame, and can be removed, when necessary, as described below:

1. Rotate the upper so that the boom is over either side of the carrier.

2. Reeve the auxiliary winch line as shown in Figure 2-19 and dead end the cable by means of the cable socket to the bottom of the winch platform.

3. Loosen the counterweight hold down screws.

4. Take up on the auxiliary winch line slightly to relieve the weight on the counterweight pins. Remove the cotter pins in the counterweight pins, and remove the countermight pins.

5. Pay out the auxiliary winch line to lower the counterweight to the ground.

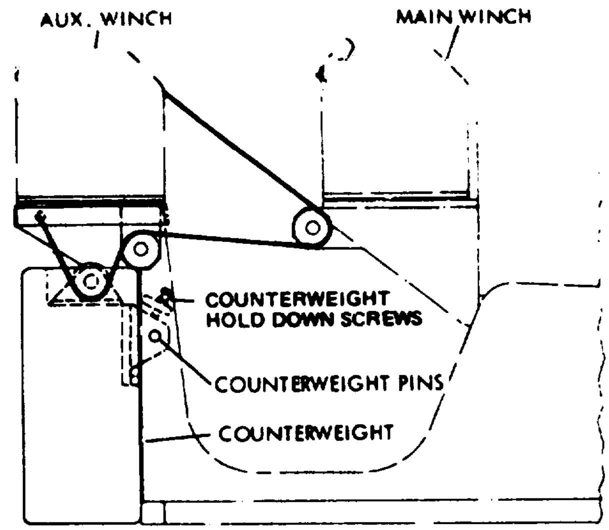


Figure 2-19. Counterweight Removal (1002382)

6. The counterweight can now be lifted onto a truck using the main winch line.

CAUTION

Be sure that the boom sections are retracted fully before lifting the counterweight.

TOWING

Should it become necessary to tow this machine to a repair facility, the propeller shaft between the auxiliary transmission and the front rear axle *must be disconnected.* If the propeller shaft is not removed, the transmission could be damaged due to inadequate lubrication of the internal gear train while the machine is being towed.

Towing cables or chains, of adequate length, should be attached to the two towing eyes located behind the front bumper.

SECTION III
LUBRICATION

GENERAL

To insure proper operation of this machine, all points requiring lubrication must serviced with the correct lubricant, at the proper time interval. All normal wear points which require lubrication are shown in the lubrication charts at the rear of this section, with the possible exception of that lubrication information concerning purchased components. For information concerning the lubrication of purchased major components not manufactured by Harnischfeger Corporation, see the manufacturer's manual. Note that the original manufacturer's recommendations take precedence over lubrication recommendations contained in this manual if any conflict exists.

Points not considered to be normal wear points (levers, linkages, pins, and so forth) should be lubricated with an oil can once a week. Use a few drops of engine oil on each exposed pin or lever not equipped with grease fittings to prevent rust and to provide the limited lubrication required.

NOTE

The lubrication recommended in this manual is based on operation of the machine for a period not to exceed eight hours per day, five days per week. If a machine is operated in excess of the above time per day or week, lubrication schedules must be adjusted accordingly.

All attachment fittings, whether illustrated on the lubrication chart or not, must be lubricated with multipurpose grease every 8 hours.

CAUTION

Initial factory fill of MPG is of the soap base 12-Hydroxy Lithium Stearate type. Other soap base greases are not always compatible with initial fill lubricant, and Barium base grease is definitely not compatible. Various other soap base greases may be used if experience by the purchaser has shown these greases to be acceptable for the application. The grease systems must be thoroughly purged and the affected parts removed and cleaned before switching from a grease having one type of base to a grease having a different soap base.

LUBRICANT SPECIFICATIONS

The following list will identify suitable lubricants for points shown in the lubrication charts by three methods. They am:

1. BY P&H SPECIFICATION NUMBER. This lubricant specification identifies the initial fill lubricant as classified by internal Harnischfeger Corporation Standards.

2. BY MILITARY SPECIFICATION NUMBER. If the lubricant classified by P&H Specification Number has a known military specification equivalent number, this equivalent number is also listed in the individual lubricant description.

NOTE

The absence of an entry in the Military Specification Column in a lubricant description does not mean that the lubricant recommended does not meet *my* equivalent military specification. It may mean, for instance, that the lubricant has not bean tested and qualified by the military because it is relatively new. For that reason, it is not certified es meeting the standards of a particular military specification, even though it may be perfectly capable of so doing.

3. BY EQUIVALENT LUBRICANT. Equivalent lubricants Presently confirmed as meeting the requirements of the P&H specification are listed by trade names. The absence of a lubricant from this list does not mean that it is unsuitable. It means only that, as of the date of this writing, the lubricant has not been tested by P&H. The order in which the lubricants appear on any list is of no significance. No superiority of any brand listed should be read into the order of appearance on a list. The listing is purely random and all products on the list are equally acceptable.

MULTIPURPOSE GREASE

SYMBOL	P&H SPEC. NO.	AMBIENT RANGE	MILITARY SPEC. NO.	EQUIVALENT LUBRICANTS	MANUFACTURERS
MPG	472A (NLGI #0 EP)	*Below -10° F. (-12°C)	MIL-L-7646 MIL-G-10924 MIL-G-23827 MIL-G-2349 MIL-G-81827	Litholine Industrial 0 EP "Sinclair"	Atlantic Richfield Oil Co.
				Conolith EP #0	Continental Oil Company
				Rolubricant 0	Humble Oil and Refining Company
				Mobilux EP #0	Mobil Oil Corporation
				Alvania EPRO	Shell Oil Company
				Prestige EP #0	Sun Oil Co. - DX Division
				Multifak EP #0	Texaco, Incorporated
MPG	4728 (NLGI #1 EP)	*-20 to +40° F . (-29 to 4° C)	MIL-L-7645 MIL-G-10924 MIL-G-23827 MIL-G-2349 MIL-G-81827	Amolith No. 1 EP	American Oil Company
				Litholine Industrial 1 EP "Sinclair"	Atlantic Richfield Company
				Conolith EP #1	Continental Oil Company
				Rolubricant 1	Humble Oil and Refining Company
				Mobilux EP #1	Mobil Oil Corporation
				Alvania EP #1	Shell Oil Company
				Prestige EP #1	Sun Oil Co. - DX Division
				Multifak EP #1	Texaco, Incorporated
MPG	472C (NLGI #2 EP)	*+20 to 125°F. (-6 to 52° C)	MIL-L-7645 MIL-G-10924 MIL-G-23827 MIL-G-2349 MIL-G-81827	Amolith No. 2 E P	American Oil Company
				Litholine EP Moly "Sinclair"	Atlantic Richfield Company
				Conolith EP #2	Continental Oil Company
				Rolubricant 2	Humble Oil and Refining Company
				Mobilux EP #2	Mobil Oil Corporation
				Alvania EP #2	Shell Oil Company
				All Purpose EP #2	Sun Oil Company
				Multifak EP #2	Texaco, Incorporated

*Pumpability tests also required when used in centralized lubrication systems. Consult manufacturer of system.

PETROLEUM GEAR OIL

SYMBOL	P&H SPEC. NO.	AMBIENT RANGE	MILITARY SPEC. NO.	EQUIVALENT LUBRICANTS	SAE GRADE	MANUFACTURER
GO	497A	Varies, depending on use. See the Lubrication Chart	MIL-L-2105B	Multipurpose Gear Lube	80	American Oil Company
			MIL-L-2109	Ultragear Oil and Extra Duty Gear Lube "Sinclair"	80	Atlantic Ritchfield Company
			MIL-L-10295			
			MIL-L-45199	Conoco Universal Gear Lubricant	80	Continental Oil Company
				Enco Gear Oils GX	80	Humble Oil & Refining Company
				Mobilube HD	80	Mobil Oil Corporation
				Spirax Heavy Duty	80	Shell Oil Company
				DX Geartran HD	80	Sun Oil Company-DX Division
				Multigear Lubricant	80	Texaco, Incorporated
GO	497B	Varies, depending on use. See the Lubrication Chart	See above.	**NOTE: Equivalent lubricants and manufacturers are the same as for P&H Spec 497A Petroleum Gear Oil as described above. The only difference, insofar as this description is concerned, is that P&H Specification 497B is an SAE 90 grade lubricant.**		
GO	497C	Varies, depending on use. See the Lubrication Chart	See above.	**NOTE: Equivalent lubricants and manufacturers are the same as for P&H Spec 497A Petroleum Gear Oil as described above. The only difference, insofar as this description is concerned is that P&H Specification 497C is an SAE 140 grade lubricant.**		

HYDRAULIC BRAKE FLUID

SYMBOL	P&H SPEC. NO.	AMBIENT RANGE	MILITARY SPEC. NO.	EQUIVALENT FLUIDS	MANUFACTURER
HBF	492	Not applicable	VV-B-680 (latest issue)	21B Brake Fluid Formula H-68	Wagner Electric Corporation
				UCON Brake Fluid 4823	Union Carbide Corporation

POWER TRANSMISSION FLUID AND GEAR OIL

SYMBOL	P&H SPEC. NO.	MILITARY SPEC. NO.	EQUIVALENT LUBRICANTS	MANUFACTURER
ATF	494	None Assigned	Dexron®	Continental Oil Company
			Enco ATF	Humble Oil and Refining
			Mobil ATF 220	Mobil Oil Corporation
			Shell Donax T-6	Shell Oil Company
			DX ATF Dexron®	Sun Oil Company - DX Division
			Texamatic Fluid 6673	Texaco, Incorporated
			ATF-Dexron®	Sinclair Refining Company
			American Dexron® ATF	American Oil Company

NOTE : This specification covers a petroleum power transmission fluid and lubricating oil properly described as Dexron® fluid.

OPEN GEAR AND WIRE ROPE LUBRICANT

SYMBOL	P&H SPEC. NO.	AMBIENT RANGE (or application)	MILITARY SPEC. NO.	EQUIVALENT LUBRICANTS	SAE GRADE	MANUFACTURER
GL	464	Open gears and racks under varying weather conditions. Peripheral speeds not to exceed 1200 feet (3,837 m) per minute.	VV-L-751C,	Amovis Lubricant and Amoco Open Gear Comp'd.	•	American Oil Company
			VV-L-751C, Type 1, Regular	Richcote Lubricant, Jet Lubricants "Sinclair", and Atlantic Lubricants 36 thru 40	•	Atlantic Richfield Company
			Grade 1 Light			
			Grade 2- Medium	Coglube	•	Continental Oil Company
			Grade 3- Heavy	Surett	•	Humble Oil & Refining Company
			MIL-L-43914,	Mobitac	•	Mobil Oil Corporation
			Grade 1	Cardium EP Com'ds & Fluid,	•	Shell Oil Company
				DX Coating Compounds	•	Sun Oil Co. DX Division
				Crater X	•	Texaco, Inc.
				Open Gear, Dipper Stick, and Cam Lube	•	Whitmore Mfg. co.

*Consult lubricant manufacturer for proper viscosity grade, which will depend on application and climate.

HEAVY DUTY MOTOR OIL

SYMBOL	P&H SPEC. NO.	AMBIENT RANGE	MILITARY SPEC. NO.	EQUIVALENT LUBRICANTS	SAE GRADE	MANUFACTURER
MO	451A	See Lubrication Chart	MIL-L-2104B (or latest issue) in effect)	Conoco Tracon	SAE 10W	Continental Oil Company
				Enconolube	"	Humble Oil & Refining Co.
				Delvac 1200 Series	"	Mobil Oil Corporation
				Rotella T Oils	"	Shell Oil Company
				TBD Mil B Motor Oil	"	Sun Oil Co. - DX Division
				Ursa Oils-Extra Duty	"	Texaco, Inc.
				Super Tenol	"	Sinclair Refining Company
				Amoco 200 Motor Oils	"	Amman Oil Company
MO	451B	See Lubrication Chart	MIL-L-2104B (or latest issue in effect)	NOTE: Equivalent lubricants and manufacturers are the same as for P&H Spec. 451A Motor Oil as described above. The only difference, insofar as this description is concerned, is that P&H Specification 451B is an SAE 20-20W grade oil.		
MO	451C	See Lubrication Chart	MIL-L-2104B (or latest issue in effect)	**NOTE: Equivalent lubricants and manufacturers are the same as for P&H Spec. 451A Motor Oil as deacribed above. The only difference, insofar as this description is concerned, is that P&H Specification 451C is an SAE 30 grade oil.**		
MO	451D	See Lubrication Chart	MIL-L-2104B (or latest issue in Hut)	**NOTE: Equivalent lubricants and manufacturers are the same as for P&H Spec. 451A Motor Oil as described above. The only difference, insofar as this description is concerned, is the that P&H Specification 451D is an SAE 40 grade oil.**		
MO	451E	See Lubrication Chart	MI L-L-2104B (or latest issue in effect)	**NOTE: Equivalent lubricants and manufacturers are the same as for P&H Spec. 451A Motor Oil as de-**scribed above. The only difference, insofar as this description is concerned, is that P&H **Specification 451E is an SAE 50 grade oil.**		

HYDRAULIC OIL

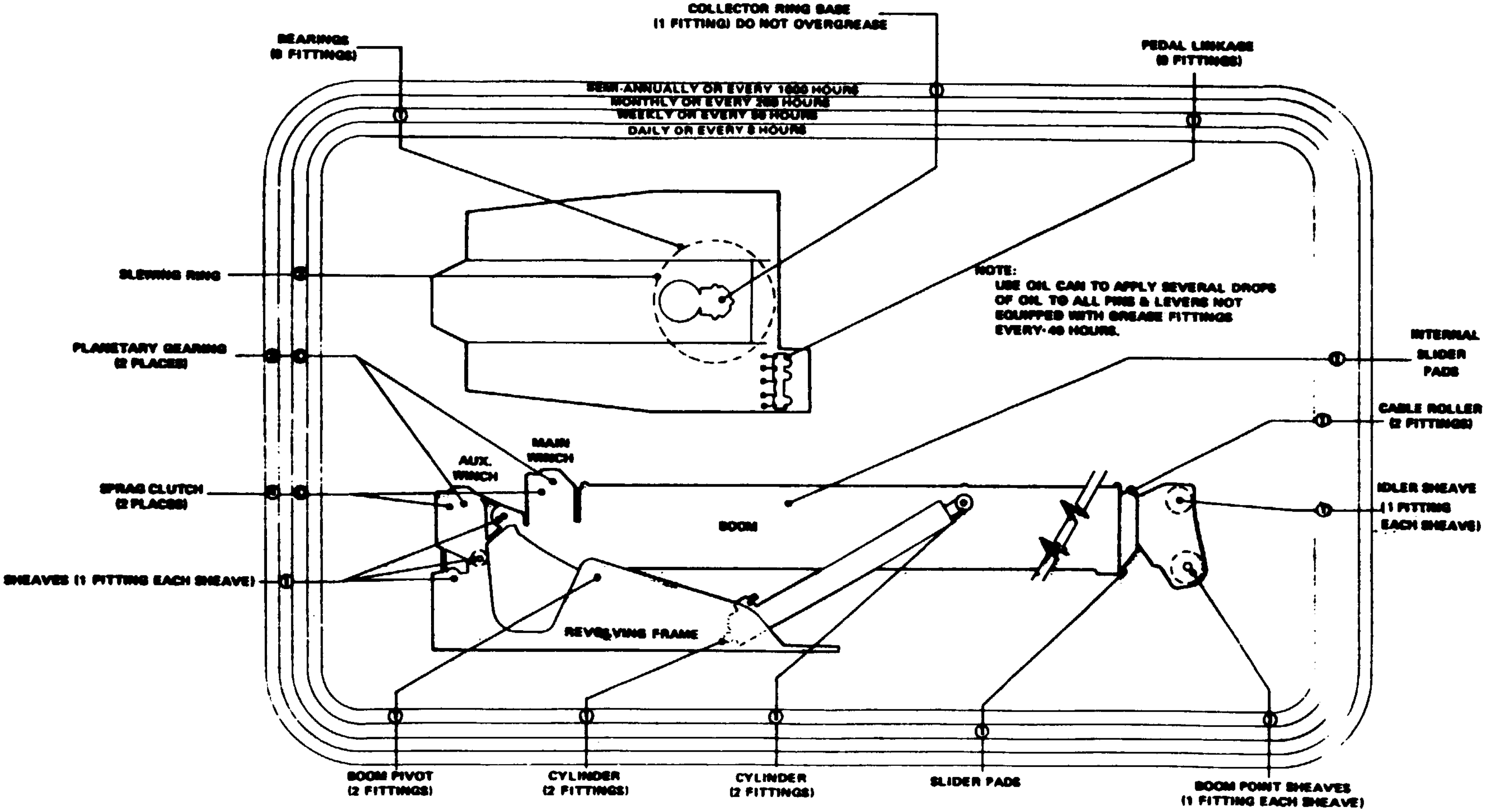
SYMBOL	P&H SPEC. NO.	AMBIENT RANGE	MILITARY SPEC. NO.	EQUIVALENT LUBRICANTS	SAE GRADE	MANUFACTURER
HO	**484S**	-10° to +65° F (-23 to 18°C)	Not Available	Alubco Hydraulic Oil - Medium	SAE 10	The American Lubricants Company
				Amoco AW 15	"	American Oil Company
				B.P. Energo SHF 60	"	B.P. North America Inc. (International)
				Citco Extra Duty Circulating Oil #42	"	Cities Service Oil Company
				Conoco Super Hydraulic Oil #15	"	Continental Oil Company
				Gulf Harmony 43 AW	"	Gulf Oil Company
				Nuto H 44	"	Humble Oil Company (Exxon) and Imperial Esso of Canada
				Molub-Alloy Hydraulic Oil #771	"	Imperial Oil and Grease Company
				DTE #24 Hydraulic Oil	"	Mobil Oil Company
				Lo Hydraul #27	"	Shell Oil Company
				Chevron EP Hydraulic Oil #9	"	Standard Oil of California
				Industron #44	"	Standard Oil of Ohio (S. Ohio)
				Rando Oil HD-A	"	Texaco
				Union Unax AW # 150	"	Union Oil Company of California (Union 76)
HO	484T	Above +65° F (Above 18° C)	Not Available	Alubco Moly Hydraulic Oil - Medium	SAE 20	The American Lubricants Company
				Amoco AW 21	"	American Oil Company
				Citco Extra-Duty Circulating Oil #48	"	Cities Service Oil Company
				Super Hydraulic ##21	"	Continental Oil Company
				Harmony 48 AW	"	Gulf Oil Company
				Nuto H 48	"	Humble Oil Company (Exxon) and Imperial Oil Company (Esso)
				Molub-Alloy Hydraulic Oil #772	"	Imperial Oil and Grease Company
				DTE 25	"	Mobil Oil Company
				Hydraulic #29	"	Shell Oil Company
				Chevron EP Hydraulic Oil #11	"	Standard Oil Company of California (Chevron)
				Industron 48	"	Standard of Company of Ohio (Sohio)
				Sunvis 821 WR	"	Sun Oil Company
				Rando Oil HD-B	"	Texaco
				Union Unax AW 215	"	Union Oil Company of California (Union 76)

HIGH TEMPERATURE GREASE

SYMBOL	P&H SPEC. NO.	AMBIENT RANGE	MILITARY SPEC. NO.	EQUIVALENT LUBRICANTS	MANUFACTURERS
HTG	476	(working tom-perature range) 0° to 450°F (-21 to 232°C)	Not available	Shell Darina No. 2 E.P.	Shell Oil Company

Note: The above lubricant is the only one currently approved as meeting P&H Specification No. 476. It is Shell Oil Code Number 71522. This is a special grease which shows high thermal stability and resistance to shock loading and adverse chemical environmental conditions. It is used as a replacement for P&H 472 MPG when reversing service, long life, or high temperature operation demands this premium lubricant.

UPPER LUBRICATION CHART



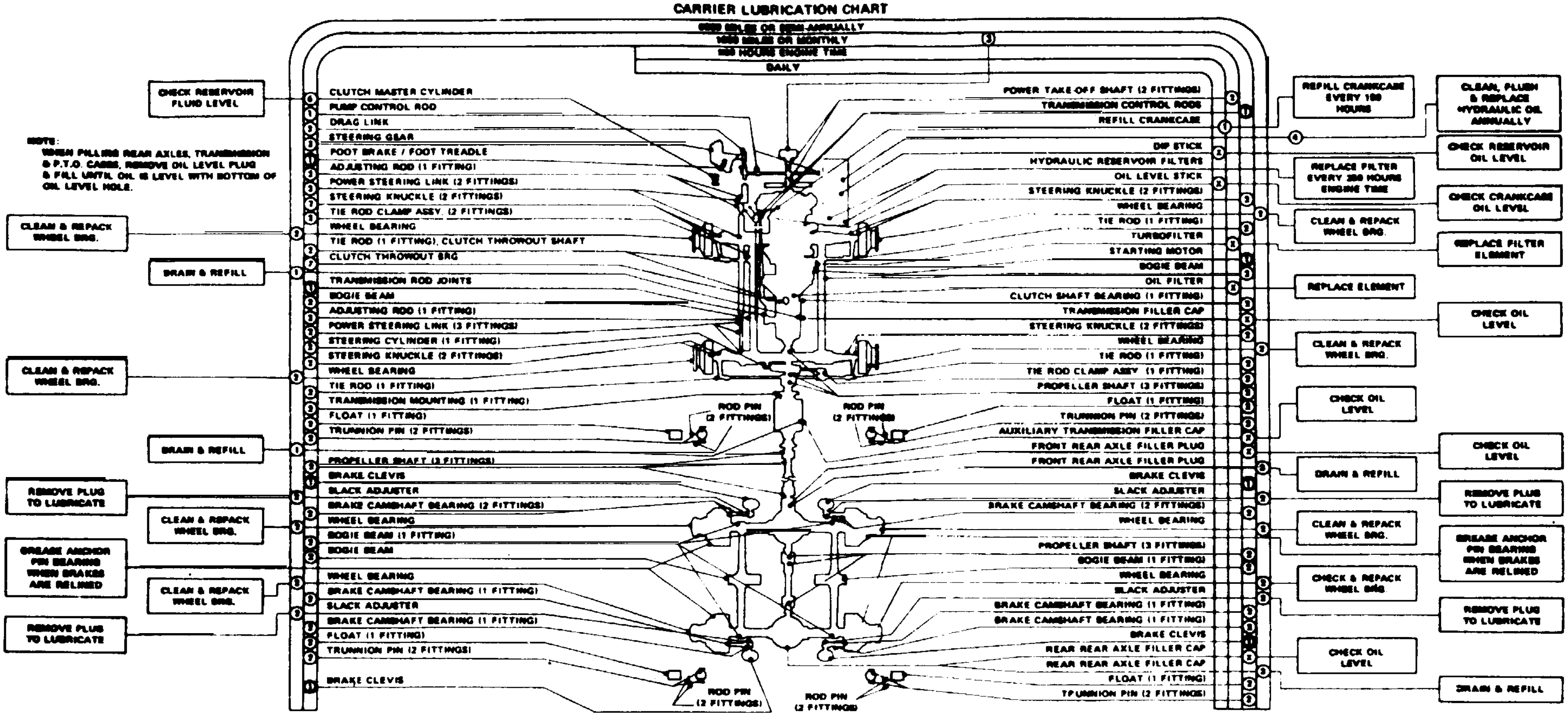
LUBRICATION RECOMMENDATIONS					
NO.	LUBRICANT	SYMBOL	P&H NO.	ABOVE 40° F (4° C)	BELOW 40° F (4° C)
1	MULTIPURPOSE GREASE	MPG		472 C	472 B
2	OPEN GEAR LUBRICANT	GL	484	ALL SEASONS	
3	GEAR OIL	GO		487 C	487 B
4	POWER TRANSMISSION & GEAR OIL	ATF	484	ALL SEASONS	

LEGEND

- ◐ – CHECK FREQUENCY
- ○ – SERVICE FREQUENCY

Figure 3-1. Upper Lubrication Chart (105J827)

CARRIER LUBRICATION CHART



G.M. 6V-53N 32.5 QTS. (30.76 l) (TOTAL COOLING SYSTEM)		
ENGINE OIL		
YEAR	S.A.E. NO.	P&H NO.
AROUND	30	451C

GENERAL LUBRICATION						
REF. NO.	LUBRICANT	SYMBOL	ABOVE –40° F (4° C)		BELOW +40° F (4° C)	
			P&H NO.	DESIGN	P&H NO.	DESIGN
1	MOTOR OIL (SEE MFGS. REF. FOR ENGINES)	MO	ABOVE +30° (1° C) 451E	SAE 50	BELOW +30° (1° C) 451C	SAE 30
2	MULTI-PURPOSE GREASE	MPG		N.L.G.I. #2 ALL SEASONS		
3	GEAR OIL EXTREME PRESSURE	EP	497C	SAE 140	497B	SAE 90
4	HYDRAULIC OIL	HO	4646	#10		
5	HEAVY DUTY OIL		461	AGMA-4	486	AGMA-4
O	USE OIL CAN	MO		CRANKCASE OIL		
6	BRAKE FLUID	HBF	492	ALL SEASONS		
7	HIGH TEMP. GREASE	HTG	476	–	476	–

OIL CAPACITY	U.S. QTS.	OIL CAPACITY	U.S. QTS.
TRANSMISSION-SPICER 6352	8.5 (8.0 l)	INTER-AXLE DIFFERENTIAL	1 (0.9 l)
AUX. TRANS.-SPICER R8341E	6.5 (6.2 l)	POWER TAKE OFF – COTTA	3.5 (3.3 l)
REAR AXLES S.S. H.D.		STEERING GEAR	2.5 (2.4 l)
FRONT	16 (15.1 l)	POWER STEERING	SEE RESERVOIR
REAR	14 (13.2 l)	HYDRAULIC RESERVOIR	200 (757 l)

A107

Figure 3-2. Carrier Lubrication Chart (105J828-A)

SECTION IV
HYDRAULIC SYSTEM AND COMPONENTS

SUB-SECTION 4A
HYDRAULIC SYSTEM

SCOPE

The hydraulic system, as defined for this manual, includes all the hydraulic components which are common to the various sub-systems of the machine. The components included in this system are the pumps, rotary joint assembly, control valves, return line filters, and reservoir.

Hydraulic schematics of complete hydraulic systems, along with a description of each system's operation, are at the rear of this section.

Later in the manual, the components of each independent hydraulic circuit within the complete system is discussed separately. These systems include the outrigger, the boom hoist and extension, the hoist, end the swing systems.

PRINCIPLES OF HYDRAULICS

There are two factors that govern the operation of any hydraulic system; namely, volume end pressure.

VOLUME is the amount of oil that a pump will push through the system in a given amount of time at a predetermined pump speed. It is usually expressed in gallons per minute (GPM). *Volume determines the speed of operation.* The greater the volume, the faster a cylinder will fill with hydraulic oil and the fester its rod will move.

PRESSURE is the amount of force or work *capability* exerted by the hydraulic oil on all parts of the system opening directly to the pump when the pump is delivering oil. The amount of pressure that a pump produces has no relationship to the speed et which an actuator operates. Pressure is expressed in pounds per square inch (PSI).

When the pump is merely circulating oil through a system which has no restrictions or is not under load, pressure is negligible. But when a restriction or load is introduced, pressure builds up almost immediately. The pressure will continue to increase until the restriction or load is overcome, the pump reaches the limit of its capacity, or some portion of the system ruptures end relieves the pressure.

Relief valves are provided to limit the pressure in the system to safe operating levels.

FLUSHING THE HYDRAULIC SYSTEM

If any evidence of hydraulic system contamination, such es dirt, sludge, and/or metallic particles are discovered. flush end clean the system as follows. If the cause of the contamination is due to a faulty component, the component must be repaired or replaced before the hydraulic system is flushed.

NOTE

> The hydraulic oil should be warmed to normal operating temperature before the reservoir is drained.

1. Remove the drain plug end drain the oil into a suitable container. Allow sufficient time for all the oil to drain from the walls of the reservoir.

2. Install the drain plug. Fill the reservoir with a 50-50 mixture of kerosene and clean hydraulic oil.

3. Cycle the machine through all crane functions, and operate the carrier steering and outrigger systems several times to circulate the flushing oil throughout the hydraulic system. Then return the machine to the travel position.

4. Remove the drain plug and drain the flushing oil from the reservoir. Remove the cover from the top of the reservoir, and clean the inside of the reservoir manually. Replace the reservoir cover and refill the reservoir with clean hydraulic oil.

5. Disconnect the hoses attached to the retract side of the boom hoist cylinders, and raise the boom to its maximum elevation slowly: This will force the flushing oil from the cylinders.

6. Reconnect the hoses to the boom hoist cylinders, and lower the boom to the horizontal. Add clean oil to the reservoir as required to maintain the proper oil level.

7. Disconnect the hoses attached to the retract side of the telescope cylinders at the hose reel or at the base of the boom. Extend the boom to force the flushing oil from the telescope cylinders.

8. Reconnect the telescope cylinder hoses and retract the boom. Add clean oil to the reservoir as required to maintain the proper oil level.

9. Disconnect the hoses attached to the retract side of the outrigger extension cylinders, and then extend the outriggers fully. This will force the flushing oil from the cylinders.

10. Reconnect the hoses to the outrigger extension cylinders, and retract the outriggers. Add oil to the reservoir as required to maintain the proper oil level.

11. Disconnect the hoses attached to the retract side of the outrigger lift cylinders, and then lift the machine off the ground. This will force the flushing oil out of the cylinders.

12. Reconnect the hoses and lower the machine to the ground. Add oil to the reservoir as required to maintain the proper oil level.

13. Operate the steering wheel left and right several times to force the flushing oil in the steering system back to the reservoir.

14. Swing the upper of the machine in both directions, and operate the winches in both directions several times to force the flushing oil in these motors back to the reservoir.

15. Replace the return line filters. Cycle the machine through all crane functions and operate the steering and outrigger systems several times to filter out any remaining contamination.

16. Another method of cleaning the hydraulic system is to use a self-contained batch filter unit, such as the Schroeder Brothers Filter Buggy, to filter the oil in the reservoir.

It is necessary with this method to cycle all the machine's functions periodically to circulate unfiltered oil from the actuators back to the reservoir for filtering.

NOTE

It is recommended that the hydraulic oil be filtered periodically using a self-contained batch filtering unit. if it is available, to keep the contamination level to a minimum.

GENERAL MAINTENANCE

The following points should be kept in mind when working on the hydraulic system or any hydraulic component:

1. Any structure has limits of strength and durability. To prevent the failure of structural parts of hydraulic components, relief valves which limit pressure to safe operating values are included in the hydraulic circuits. *The settings of these relief valves must never be changed,* except as described under the topic Relief Valve Adjustment.

2. Tolerances of working parts in the hydraulic system are very close. Even small amounts of dirt or foreign material in the system can cause wear or damage to components, as well as generally faulty operation of the system. *Every precaution must be taken to assure absolute cleanliness of the hydraulic oil.*

3. Samples of hydraulic oil should be drawn from the reservoir every six months. These samples should be about two quarts, and should be taken while the oil is warmed through normal operation. If possible, the sample should be analyzed by a qualified lubrication specialist to determine whether it is suitable for further use. The interval between oil changes, depend on operating conditions, and on the care used in keeping the oil clean.

4. Whenever there is a hydraulic component failure which gives reason to believe that than are metal particles or other foreign materials in the system, drain and flush the entire system, and replace the filter cartridges. A complete change of hydraulic oil must be made under these circumstances.

5. Whenever the hydraulic system is drained, check the magnetics at the bottom of the reservoir for metal particles. If metal particles are present, flush the system and add a new charge of oil. The presence of metal particles also may indicate the possibility of imminent component failure.

6. Do not use synthetic or fire resistant oils in this machine. The packings in this system are designed for a good grade mineral oil.

7. All containers and funnels used in handling hydraulic oil must be absolutely clean. Use a funnel with a 200 mesh screen for filling the hydraulic oil reservoir, and fill the reservoir only through the filler opening. The use of cloth to strain the oil should be avoided to prevent lint from getting into the system.

8. When removing any hydraulic component, be sure to cap and tag all hydraulic lines involved. Also plug the ports of the removed components.

9. All hydraulic components must be disassembled and assembled in spotlessly clean surroundings. During disassembly, pay particular attention to the identification of parts to assure proper reassembly. Clean all metal parts in a clean mineral oil solvent. Be sure to thoroughly clean all internal passages. After the parts have been dried thoroughly, lay them on a clean, lint-free surface for inspection.

10. Replace all O-rings, back-up rings, and seals when overhauling any component. Lubricate all parts with clean hydraulic oil before reassembly. Use small amounts of petroleum jelly to hold O-rings in place during reassembly.

11. Be sure to replace any lost hydraulic oil when completing the installation of the repaired component, and bleed any air from the system when required.

12. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the oil to leek out or air to be drawn into the system. Air in the system can cause damage to the components and noisy or erratic system operation.

TROUBLESHOOTING GUIDE

GENERAL. The troubleshooting charts and maintenance hints that follow are of a general nature, but should provide an intuitive feeling for a specific system.

KNOWING THE SYSTEM. Probably the greatest aid to troubleshooting is knowing the system. Every component has a purpose in the system. The construction and operating characteristics of each one should be understood. Some additional practices which will increase your ability to troubleshoot the system, and also the useful life of the system are listed below:

1. Know the capabilities of the system. Each component in the system has a maximum rated speed, torque, or pressure. Loading the system beyond the specifications simply increases the possibility of failure.

2. Know the correct operating pressures. Always set and check pressures with a gauge that is known to be accurate. How else can you know if the operating pressure is above the maximum rating of the components? The question may arise as to what the correct operating pressure is. If it is not specified, the following rule should be applied:

The correct operating pressure is the lowest pressure which will allow adequate performance of the system function and still remain below the maximum rating of the corn ponents.

Once the correct pressures have been determined, note them for future reference.

DEVELOPING SYSTEMATIC PROCEDURES. Analyze the system and develop a logical sequence for setting relief valves and mechanical stops. Develop a cause and effect troubleshooting guide similar to the charts shown. The initial time spent on such a project could save hours of downtime.

RECOGNIZING TROUBLE INDICATIONS. The ability to recognize trouble indications in a specific system is usually acquired with experience. However, a few general trouble indications can be discussed.

1. Excessive heat means trouble. A misaligned pump or motor places an excessive load on bearings and cm be readily identified by the heat generated. A warmer than normal return line indicates that the system is operating at relief valve setting. Hydraulic oils which have a low viscosity will increase the internal Ieakage of components resulting in a heat rise. Cavitation and slippage in a pump will also generate heat.

2. Excessive noise means wear, misalignment, cavitation or air in the oil. Contaminated oil can cause a relief valve to stick and chatter. These noises may be the result of dirty filters, or fluid, high fluid viscosity, excessive drive speed, low reservoir level, or loose intake lines.

MAINTENANCE. Three simple maintenance procedures have the greatest effect on hydraulic system performance, efficiency, and life. Yet, the very simplicity of them may be the reasons they are so often overlooked. What are they? Simply these:

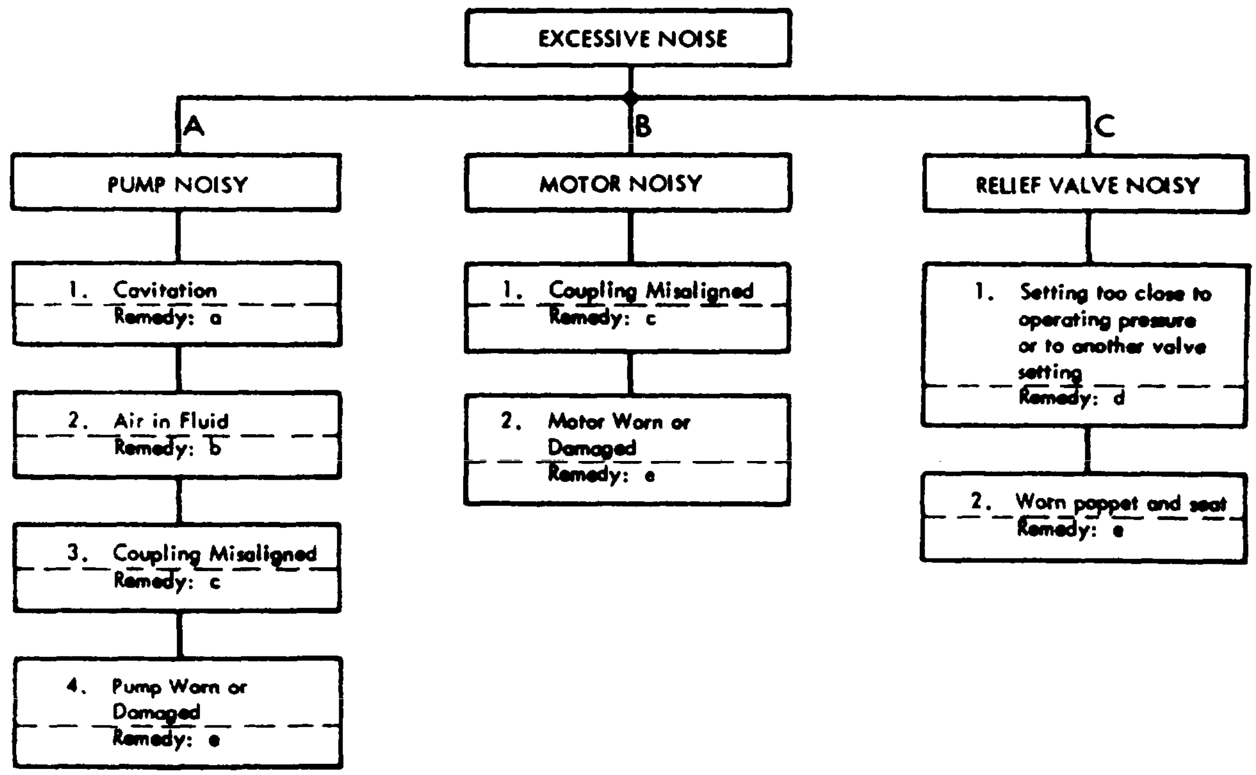
1. Change filters.

2. Maintaining a sufficient quantity of clean hydraulic fluid of the proper type and viscosity in the reservoir.

3. Keeping all connections tight, but not to the point of distortion, so that air is excluded from the system.

TROUBLESHOOTING CHARTS. The following charts are arranged in five main catogories. The headings of each is an effect which Indicates a malfunction in the system. For example; if a pump is exceptionally noisy, refer to Chart I titled EXCESSIVE NOISE. The noisy pump appears in Column A under the main heading. In Column A there are four probable causes for a noisy pump. The causes are listed according to the likelihood of occurrence or the ease of checking it. The first cause is cavitation and the remedy is "a". If the first cause does not exist, check for cause number 2, etc.

Chart 1. Excessive Noise



REMEDIES:

a. Any or all of the following: Replace dirty filters - Clean clogged inlet line - Clean reservoir breather vent - Change system fluid - Change to proper pump drive motor speed

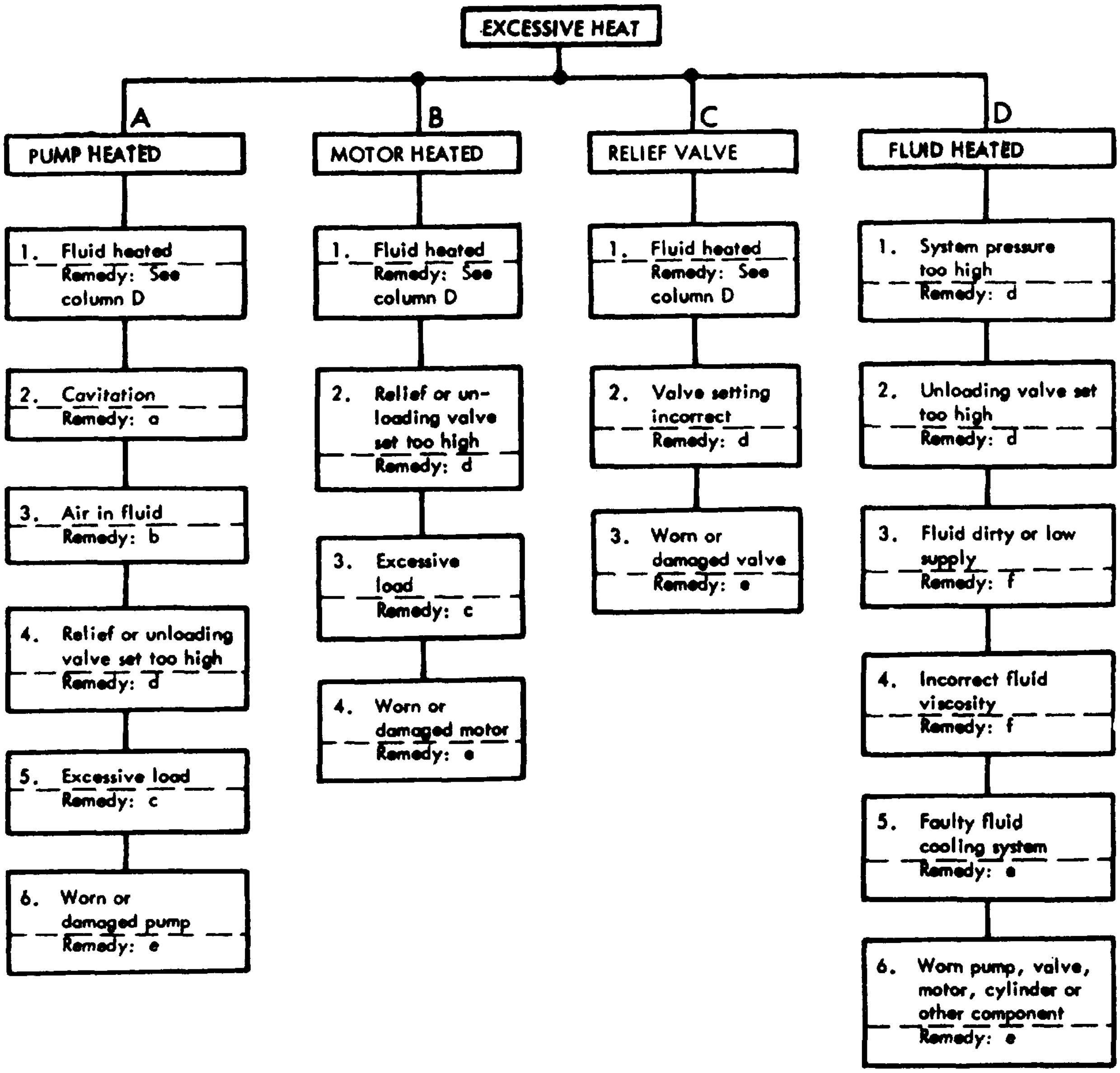
b. Any or all of the following: Tighten leaky inlet connections - Fill reservoir to proper level - Replace pump shaft seal

c. Align unit and check condition of seals and bearings

d. Install pressure gauge and adjust to correct pressure

e. Overhaul or replace

Chart 2. Excessive Heat



REMEDIES:

a. Any or all of the following: Replace dirty filters - Clean clogged inlet line - Clean reservoir breather vent - Change system fluid - Change to proper pump drive motor speed

b. Any or all of the following: Tighten leaky inlet connections - Fill reservoir to proper level - Replace pump shaft seal

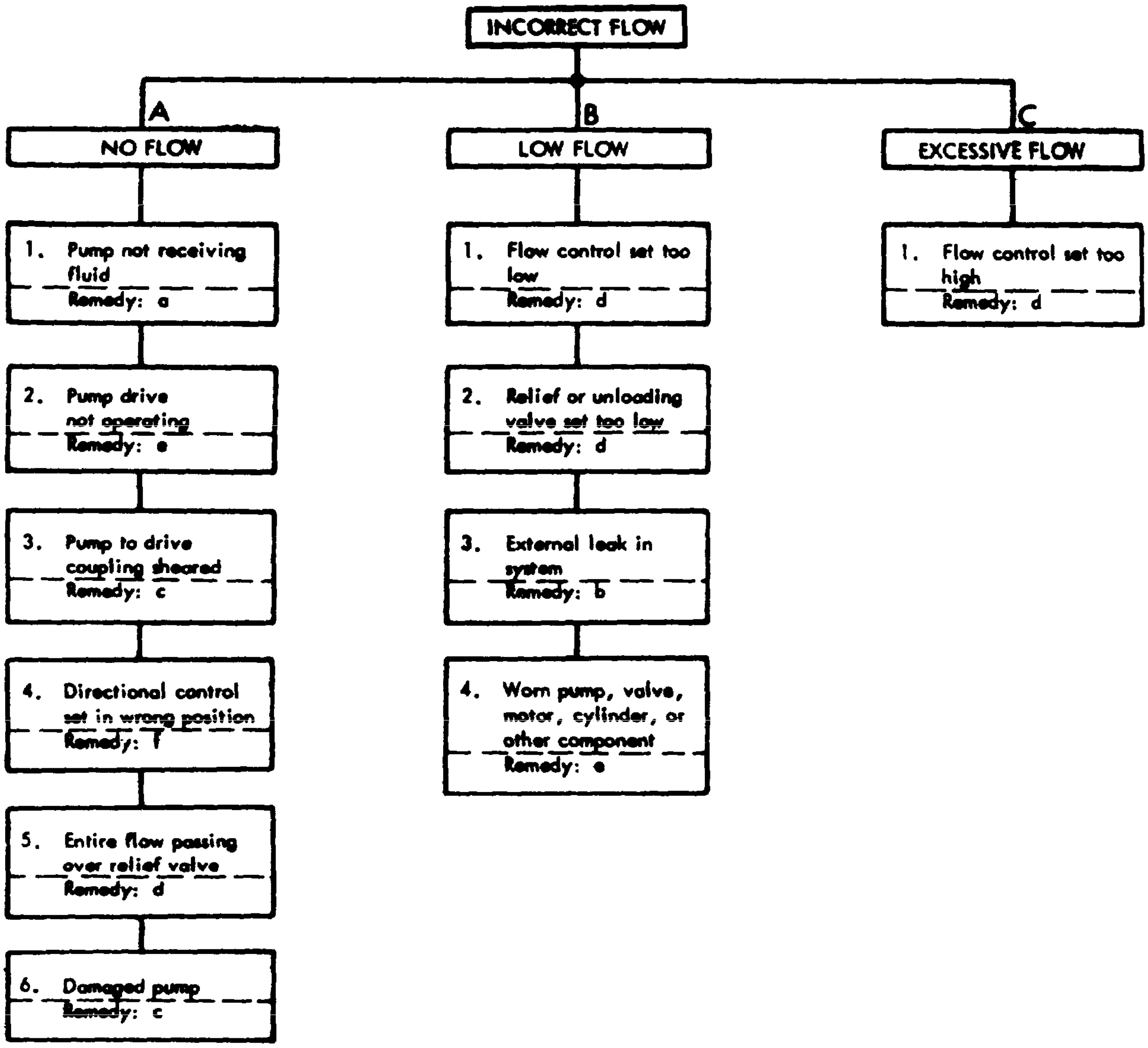
c. Align unit and check condition of seals and bearings - Locate and correct mechanical binding - Check for work load in excess of circuit design

d. Install pressure gauge and adjust to correct pressure

e. Overhaul or replace

f. Change filters and also system fluid if of improper viscosity - Fill reservoir to proper level

Chart 3. Incorrect Flow



REMEDIES:

a. Any or all of the following: Replace dirty filters - Clean clogged inlet line - Clean reservoir breather vent - Fill reservoir to proper level

b. Tighten leaky connections

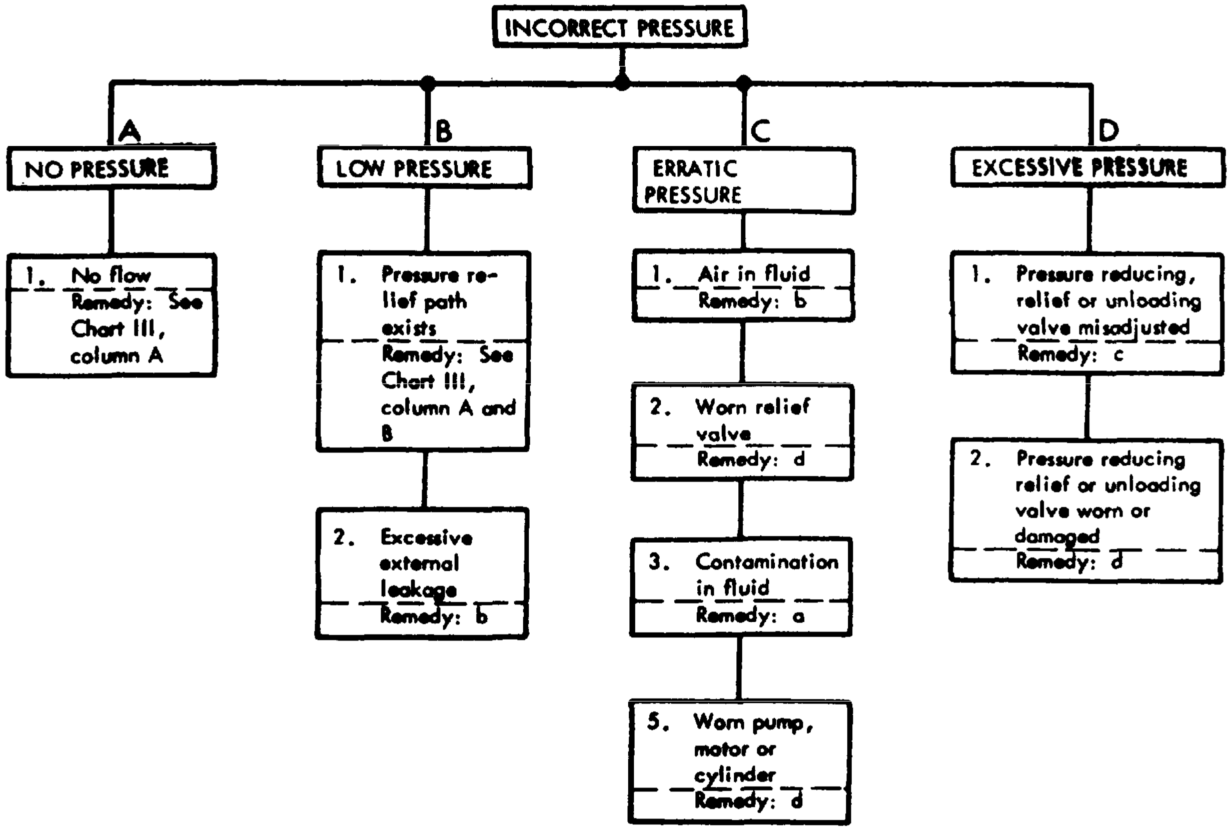
c. Check for damaged pump or pump drive - Replace and align coupling

d. Adjust

e. Overhaul or replace

f. Check position of manually operated controls

Chart 4. Incorrect Pressure



REMEDIES:

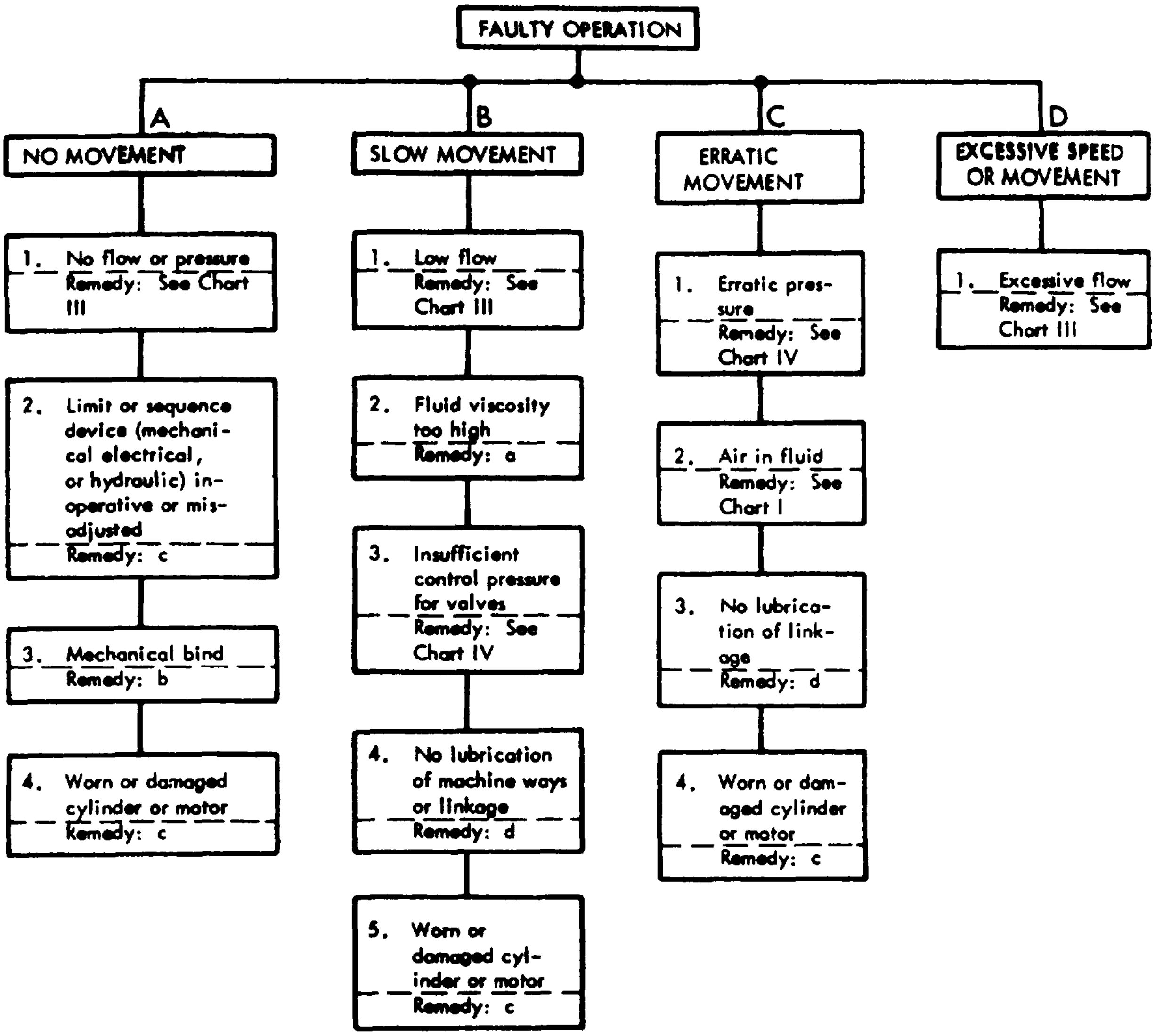
a. Replace dirty filters and system fluid

b. Tighten leaky connections, Fill reservoir to proper level

c. Adjust

d. Overhaul or replace

Chart 5. Faulty Operation



REMEDIES:

a. Fluid may be too cold or should be changed to clean fluid of correct viscosity

b. Locate bind and repair

c. Overhaul or replace

d. Lubricate

SYSTEM DESCRIPTIONS

BASIC MACHINE WITH GEARMATIC MAIN WINCH (100J3556)

PUMPING CIRCUIT The pumping circuit consists of the reservoir, pumps, swivel, return line filters and oil cooler.

The hydraulic pumps are driven by the carrier engine through a pump drive, which allows the pumps to be disconnected from the engine when the machine is being roaded. When the pumps are driven, oil is drawn from the reservoir through the suction manifold and is forced out into the system. The oil leaving the pumps flows through the rotary joint, through the open center control valves, and then back to the reservoir through either the return line filters or oil cooler.

The oil will continue to circulate through the system, as long as all the control valves are in the neutral position. Under these conditions, very little pressure will be developed, since there is practically no resistance to oil flow.

Oil flowing through the oil cooler comes from the return side of the swing control valve. Oil returning from the remaining control valves flows through the return line filters. This arrangement ensures that all the return oil is either cooled or filtered before returning to tank.

BOOM HOIST CIRCUIT. To raise the boom, the operator pulls the control lever back. In this position, hydraulic oil passes from the pump, through the control valve and the check valve in the counterbalance valve, to the boom hoist cylinders. Since the oil flowing to the cylinders is blocked by the velocity fuse on each cylinder, no cylinder movement will occur until the pressure in the circuit is sufficient to shift the velocity fuse spool to the open position. When this occurs, the oil from the control valve will flow past the velocity fuse spool and check valve to the blind end of the cylinder, causing the cylinder to extend and lift the boom.

NOTE

> Once the velocity fuses are shifted to the open position, the spool will remain in the open position es long as pressure is trapped in the circuit. If pressure is lost, the spool will shift to the closed position and the boom will lower slowly as the oil in the cylinders is vented to atmosphere through the orifices in the valve.

To lower the boom, the operator pushes the control lever forward. In this position, hydraulic oil is fed directly to the rod end of the cylinder. The oil at the blind end of the cylinder, however, is prevented from returning to the reservoir by the counterbalance valve until sufficient pressure from the rod end of the cylinder, supplied through a pilot line, is applied to the counterbalance valve. When enough pressure is developed in the pilot circuit, the counterbalance valve will shift to the open position, allowing the oil at the blind end of the cylinder to return to tank.

BOOM TELESCOPE CIRCUIT. To extend the boom at low speed, the operator pushes the control lever forward, to the detent. In this position, hydraulic oil passes from the pump, through the control valve and the check valve in the counterbalance valve, to the telescope cylinders. Oil from the blind end of the telescope cylinders flows through a 50-50 flow divider and a priority flow control valve, and then returns to tank through the control valve. These flow control valves are used to synchronize the extension of the boom sections by metering the flow of oil out of the cylinders. Crossover relief valves are provided in the flow divider to divert the oil that the flow divider is not capable of handling back to tank via an alternate flow path.

To extend the boom at high speed, the operator pushes the control lever pest the detent. In this position, hydraulic oil enters and leaves the cylinders as described above. Instead of returning to tank, however, the oil passes through the control valve end returns to the blind end of the cylinders. In this way, a relatively small amount of oil, represented by the difference between the volume of the blind and rod ends of the cylinder, is all that is required to extend the cylinder rod. This reduces the force applied to the boom sections by the cylinders, but increases the speed of operation.

To retract the boom, the operator pulls the control lever back. In this position, hydraulic oil is fed directly to the rod end of the cylinder through the priority flow control valve and 50-50 flow divider, The priority flow control valve meters the oil to the circuit, which is then divided into two equal flows by the 50-50 flow divider. Oil flowing to the rod end of the cylinder also applies pressure to the counterbalance valve, opening the valve to allow the oil to return to tank through the control valve.

SWING CIRCUIT. When the operator moves the swing lever to either the forward or backward position, hydraulic oil is directed through the control valve to the swing motor.

This causes the swing pinion, which is mated to the slewing ring gear, to rotate and turn the upper in relationship to the lower.

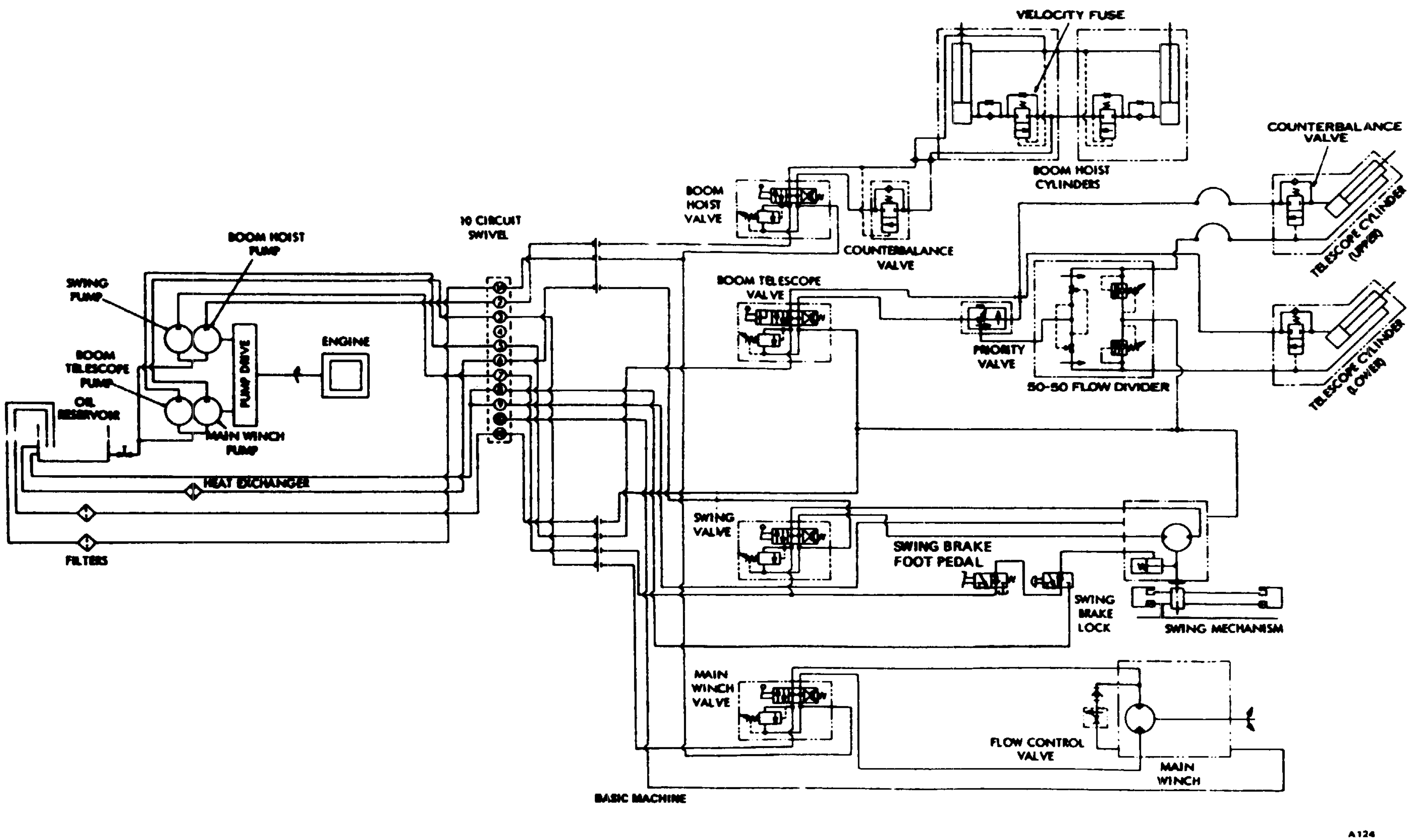


Figure 4A-1. Hydraulic System Schematic (100J3556-G)

The swing brake is used to lock the swing reducer so that the swing motor cannot turn, thus preventing the revolving upper portion of the machine from turning.

NOTE

The upper of the machine will swing freely if the swing brake is not applied.

The swing brake pedal is shown in the released position. In this position, oil is allowed to enter the brake chamber and release the brake. When the operator depresses the swing brake pedal, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

The swing brake lock is shown in its normal operating position. When the machine is not working or is shut down, the swing brake lock should be placed in the locked position. In this position, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

MAIN WINCH CIRCUIT. The main winch control valve directs hydraulic oil from the pump to the winch motor. The direction in which the valve spool is shifted will determine whether the winch will lift or lower a load. The speed of winch operation is determined by the amount of oil metered through the control valve to the winch motor.

BASIC MACHINE WITH GEARMATIC MAIN AND AUXILIARY WINCHES (100J3556)

PUMPING CIRCUIT. The pumping circuit consists of the reservoir, pumps, swivel, return line filters and oil cooler.

The hydraulic pumps are driven by the carrier engine through a pump drive, which allows the pumps to be disconnected from the engine when the machine is being roaded. When the pumps are driven, oil is drawn from the reservoir through the suction manifold and IS forced out into the system. The oil leaving the pumps flows through the rotary joint, through the open center control valves, and then back to the reservoir through either the return line filters or oil cooler.

The oil will continue to circulate through the system, as long as all the control valves are in the neutral position. Under these conditions, very little pressure wiII be developed, since there is practically no resistance to oil flow.

Oil flowing through the oil cooler comes from the return side of the swing control valve. Oil returning from the remaining control valves flows through the return line filters. This arrangement ensures that all the return oil is either cooled or filtered before returning to tank.

BOOM HOIST CIRCUIT. To raise the boom, the operator pulls the control lever back. In this position, hydraulic oil parses from the pump, through the control valve and the check valve in the counterbalance valve, to the boom hoist cylinders. Since the oil flowing to the cylinders is blocked by the velocity fuse on each cylinder, no cylinder movement will occur until the pressure in the circuit is sufficient to shift the velocity fuse spool to the open position. When this occurs. the oil from the control valve will flow past the velocity fuse spoof and check valve to the blind end of the cylinder, causing the cylinder to extend and lift the boom.

NOTE

> Once the velocity fuses are shifted to the open position, the spool will remain in the open position as long as pressure is trapped in the circuit. If pressure is lost, the spool will shift to the closed position and the boom will lower slowly as the oil in the cylinders is vented to atmosphere through the orifices in the valve.

To lower the boom, the operator pushes the control lever forward. In this position, hydraulic oil is fed directly to the rod end of the cylinder. The oil at the blind end of the cylinder, however, is prevented from returning to the reservoir by the counterbalance valve until sufficient pressure from the rod end of the cylinder, supplied through a pilot line, is applied to the counterbalance valve. When enough pressure is developed in the pilot circuit, the counter. balance valve will shift to the open position, allowing the oil at the blind end of the cylinder to return to tank.

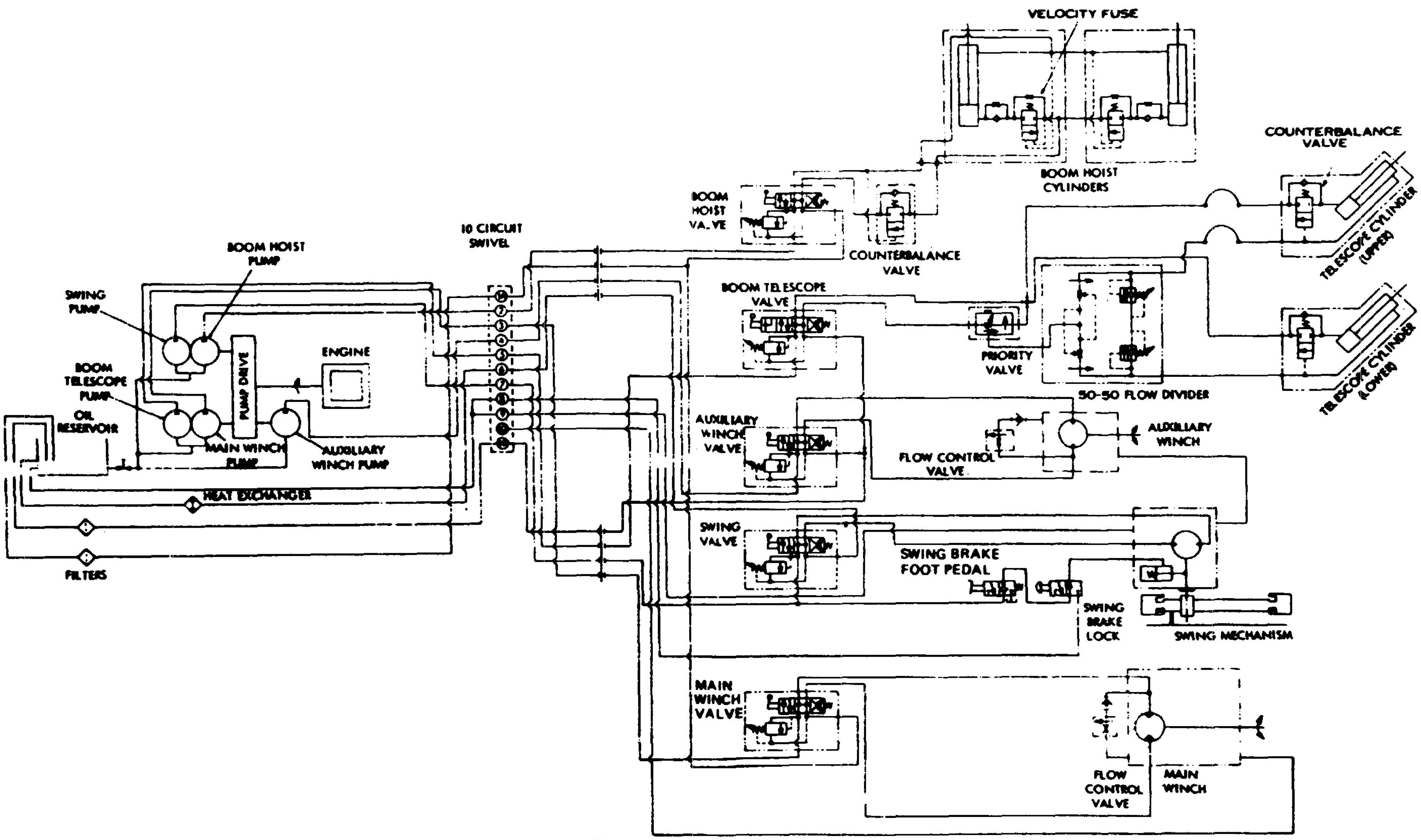
BOOM TELESCOPE CIRCUIT. To extend the boom at low speed, the operator pushes the control lever forward, to the detent. In this position, hydraulic oil passes from the pump, through the control valve and the check valve in the counterbalance valve, to the telescope cylinders. Oil from the blind end of the telescope cylinders flows through a 50-50 flow divider and a priority flow control valve, and then returns to tank through the control valve. These flow control valves are used to synchronize the extension of the boom sections by metering the flow of oil out of the cylinders. Crossover relief valves are provided in the flow divider to divert the oil that the flow divider is not capable of handling back to tank via an alternate flow path.

To extend the boom at high speed, the operator pushes the control lever past the detent. In this position, hydraulic oil enters and leaves the cylinders as described above. Instead of returning to tank, however, the oil passes through the control valve and returns to the blind end of the cylinders. In this way, a relatively small amount of oil, represented by the difference between the volume of the blind and rod ends of the cylinder, is all that is required to extend the cylinder rod. This reduces the force applied to the boom sections by the cylinders, but increases the speed of operation.

To retract the boom, the operator pulls the control lever back. In this position, hydraulic oil is fed directly to the rod end of the cylinder through the priority flow control valve and 50-50 flow divider. The priority flow control valve meters the oil to the circuit, which is then divided into two equal flows by the 50-50 flow divider. Oil flowing to the rod end of the cylinder also applies pressure to the counterbalance valve, opening the valve to allow the oil to return to tank through the control valve.

SWING CIRCUIT. When the operator moves the swing lever to either the forward or backward position, hydraulic oil is directed through the control valve to the swing motor.

This causes the swing pinion, which is mated to the slewing ring gear, to rotate and turn the upper in relationship to the lower.



BASIC MACHINE WITH AUXILIARY WINCH.

A129

Figure 4A-2. Hydraulic System Schematic (100J3858-G)

The swing brake is used to lock the swing reducer so that the swing motor cannot turn, thus preventing the revolving upper portion of the machine from turning.

NOTE

The upper of the machine will swing freely if the swing brake is not applied.

The swing brake pedal is shown in the released position. In this position, oil is allowed to enter the brake chamber and release the brake. When the operator depresses the swing brake pedal, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

The swing brake lock is shown in its normal operating position. When the machine is not working or is shut down, the swing brake lock should be placed in the locked position. In this position, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

MAIN WINCH CIRCUIT. The main winch control valve directs hydraulic oil from the pump to the winch motor. The direction in which the valve spool is shifted will determine whether the winch will lift or lower a load. The speed of winch operation is determined by the amount of oil metered through the control valve to the winch motor.

AUXILIARY WINCH CIRCUIT. The auxiliary winch control valve directs hydraulic oil from the pump to the winch motor. The direction in which the valve spool is shifted will determine whether the winch will lift or lower a load. The speed of winch operation is determined by the amount of oil metered through the control valve to the winch motor.

BASIC MACHINE WITH GEARMATIC FREE-FALL MAIN AND NON FREE-FALL AUXILIARY WINCHES (100J3556)

PUMPING CIRCUIT. The pumping circuit consists of the reservoir, pumps, swivel, return line filters and oil cooler,

The hydraulic pumps are driven by the carrier engine through a pump drive, which allows the pumps to be disconnected from the engine when the machine is being roaded. When the pumps are driven, oil is drawn from the reservoir through the suction manifold and is forced out into the system. The oil leaving the pumps flows through the rotary joint, through the open center control valves, and then back to the reservoir through either the return line filters or oil cooler.

The oil will continue to circulate through the system, as long as all the control valves are in the neutral position. Under these conditions, very little pressure will be developed, since there is practically no resistance to oil flow.

Oil flowing through the oil cooler comes from the return side of the swing control valve. Oil returning from the remaining control valves flows through the return line filters. This arrangement ensures that all the return oil is either cooled or filtered before returning to tank.

BOOM HOIST CIRCUIT. To raise the boom, the operator pulls the control lever back. In this position, hydraulic oil passes from the pump, through the control valve and the check valve in the counterbalance valve, to the boom hoist cylinders. Since the oil flowing to the cylinders is blocked by the velocity fuse on each cylinder, no cylinder movement will occur until the pressure in the circuit is sufficient to shift the velocity fuse spool to the open position. When this occurs, the oil from the control valve will flow past the velocity fuse spool and check valve to the blind end of the cylinder, causing the cylinder to extend and lift the boom.

NOTE

Once the velocity fuses are shifted to the open position, the spool will remain in the open position as long as pressure is trapped in the circuit. If pressure is lost, the spool will shift to the closed position and the boom will lower slowly as the oil in the cylinders is vented to atmosphere through the orifices in the valve.

To lower the boom, the operator pushes the control lever forward. In this position, hydraulic oil is fed directly to the rod end of the cylinder. The oil at the blind end of the cylinder, however, is prevented from returning to the reservoir by the counterbalance valve until sufficient pressure from the rod end of the cylinder, supplied through a pilot line, is applied to the counterbalance valve. When enough pressure is developed in the pilot circuit, the counterbalance vulva will shift to the open position, allowing the oil at the blind end of the cylinder to return to tank.

BOOM TELESCOPE CIRCUIT. To extend the boom at low speed, the operator pushes the control lever forward, to the detent. In this position, hydraulic oil passes from the pump, through the control valve and the check valve in the counterbalance valve, to the telescope cylinders. Oil from the blind end of the telescope cylinders flows through a 50-50 flow divider and a priority flow control valve, and then returns to tank through the control valve. These flow control valves are used to synchronize the extension of the boom sections by metering the flow of oil out of the cylinders. Crossover relief valves are provided in the flow divider to divert the oil that the flow divider is not capable of handling back to tank via an alternate flow path,

To extend the boom at high speed, the operator pushes the control lever past the detent. In this position, hydraulic oil enters and leaves the cylinders as described above. Instead of returning to tank, however, the oil passes through the control valve and returns to the blind end of the cylinders. In this way, a relatively small amount of oil, represented by the difference between the volume of the blind and rod ends of the cylinder, is all that is required to extend the cylinder rod. This reduces the force applied to the boom sections by the cylinders, but increases the speed of operation.

To retract the boom, the operator pulls the control lever back. In this position, hydraulic oil is fed directly to the rod end of the cylinder through the priority flow control valve and 50-50 flow divider. The priority flow control valve meters the oil to the circuit, which is then divided into two equal flows by the 50-50 flow divider. Oil flowing to the rod end of the cylinder also applies pressure to the counterbalance valve, opening the valve to allow the oil to return to tank through the control valve.

SWING CIRCUIT. When the operator moves the swing lever to either the forward or backward position, hydraulic oil is directed through the control valve to the swing motor.

This causes the swing pinion, which is mated to the slewing ring gear, to rotate and turn the upper in relationship to the lower.

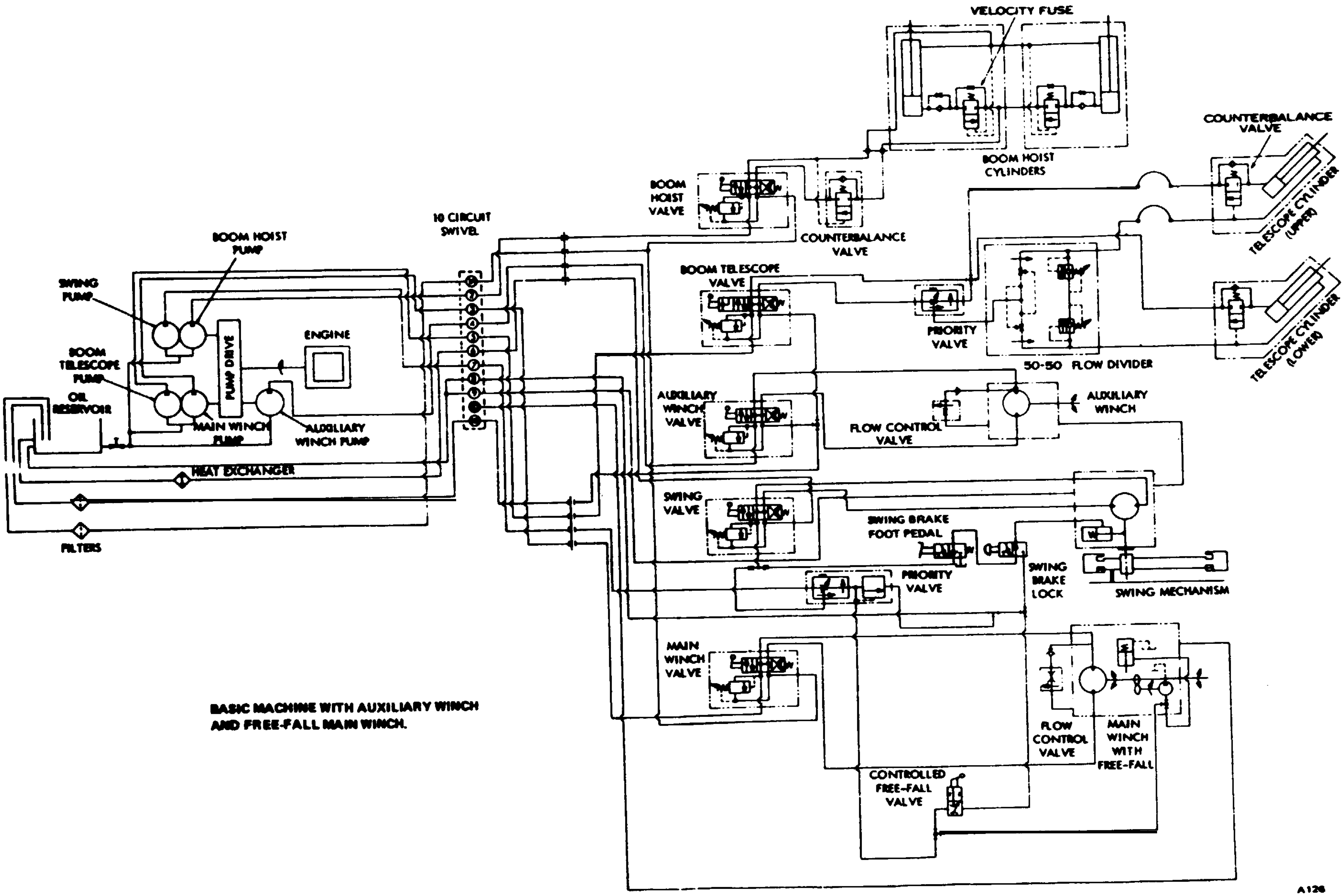


Figure 4A-3. Hydraulic System Schematic (100J3556-G)

The swing brake is used to lock the swing reducer so that the swing motor cannot turn, thus preventing the revolving upper portion of the machine from turning.

NOTE

The upper of the machine will swing freely if the swing brake is not applied.

The swing brake pedal is shown in the released position. In this position, oil is allowed to enter the brake chamber and release the brake. When the operator depresses the swing brake pedal, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

The swing brake lock is shown in its normal operating position. When the machine is not working or is shut down, the swing brake lock should be placed in the locked position. In this position, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

MAIN WINCH CIRCUIT. The main winch control valve directs hydraulic oil from the pump to the winch motor. The direction in which the valve spool is shifted will determine whether the winch will lift or lower a load. The speed of winch operation is determined by the amount of oil metered through the control valve to the winch.

An optional free-fall feature is incorporated into the main winch, and operates as follows:

A metered flow of hydraulic oil from the swing pump is directed to the free-fall circuit by the priority valve. When the free-fall control valve is in the released position, this fluid passes through the valve and returns to the reservoir. Under this condition, the free-fall feature is inoperative and the main winch operates as a non free-fall winch.

When the free-fall control lever is moved toward the operator, the metered oil flow is restricted, creating pressure at the free-fall brake release port. As soon as the brake is released sufficiently to allow the internal gear to rotate, the metering pump is driven by the internal gear and meters part of the oil supply out of the circuit. This decreases the pressure in the free-fall brake circuit, which tends to apply the brake; thereby regulating winch drum speed.

The speed at which the load is lowered is proportional to the amount of control lever travel. As the travel of the control lever is increased, the flow of oil through the control valve is restricted to a greater extent; an increase in pressure releases the brake further, causing an increase in speed. When the control valve lever is moved to its full extent, all the oil is required to pass through the metering pump and maximum uniform speed is obtained.

CAUTION

When a load is being lowered with the free-fall brake, the control valve lever must be moved gradually. Sudden movement of the control lever will create a pressure surge and cause the load to lower at an uneven speed. The control valve lever must also be moved slowly to stop the load smoothly.

AUXILIARY WINCH CIRCUIT. The auxiliary winch control valve directs hydraulic oil from the pump to the winch motor. The direction in which the valve spool is shifted will determine whether the winch will lift or lower a load. The speed of winch operation is determined by the amount of oil metered through the control valve to the winch motor.

BASIC MACHINE WITH FREE-FALL MAIN AND AUXILIARY WINCHES (100J3556)

PUMPING CIRCUIT. The pumping circuit consists of the reservoir, pumps, swivel, return line filters and oil cooler.

The hydraulic pumps are driven by the carrier engine through a pump drive, which allows the pumps to be disconnected from the engine when the machine is being roaded. When the pumps are driven, oil is drawn from the reservoir through the suction manifold and is forced out into the system. The oil leaving the pumps flows through the rotary joint, through the open center control valves, and then back to the reservoir through either the return line filters or oil cooler.

The oil will continue to circulate through the system, as long as all the control valves are in the neutral position. Under these conditions, very little pressure will be developed, since there is practically no resistance to oil flow.

Oil flowing through the oil cooler comes from the return side of the swing control valve. Oil returning from the remaining control valves flows through the return line filters. This arrangement ensures that all the return oil is either cooled or filtered before returning to tank.

BOOM HOIST CIRCUIT. To raise the boom, the operator pulls the control lever back. In this position, hydraulic oil passes from the pump, through the control valve and the check valve in the counterbalance valve, to the boom hoist cylinders. Since the oil flowing to the cylinders is blocked by the velocity fun on each cylinder, no cylinder movement will occur until the pressure in the circuit is sufficient to shift the velocity fuse spool to the open position. When this occurs, the oil from the control valve will flow past the velocity fuse spool and check valve to the blind end of the cylinder, causing the cylinder to extend and lift the boom.

NOTE

> Once the velocity fuses are shifted to the open position, the spool will remain in the open position as long as pressure is trapped in the circuit. If pressure is lost, the spool will shift to the closed position and the boom will lower slowly as the oil in the cylinders is vented to atmosphere through the orifices in the valve.

To lower the boom, the operator pushes the control lever forward. In this position, hydraulic oil is fed directly to the rod end of the cylinder. The oil at the blind end of the cylinder, however, is prevented from returning to the reservoir by the counterbalance valve until sufficient pressure from the rod end of the cylinder, supplied through a pilot line, is applied to the counterbalance valve. When enough pressure is developed in the pilot circuit, the counter. balance valve will shift to the open position, allowing the oil at the blind end of the cylinder to return to tank.

BOOM TELESCOPE CIRCUIT. To extend the boom at low speed, the operator pushes the control lever forward, to the detent. In this position, hydraulic oil passer from the pump, through the control valve and the check valve in the counterbalance valve, to the telescope cylinders. Oil from the blind end of the telescope cylinders flows through a 50-50 flow divider and a priority flow control valve, and then returns to tank through the control valve. These flow control valves are used to synchronize the extension of the boom sections by metering the flow of oil out of the cylinders. Crossover relief valves are provided in the flow divider to divert the oil that the flow divider is not capable of handling back to tank via an alternate flow path.

To extend the boom at high speed, the operator pushes the control lever past the detent. In this position, hydraulic oil enters and leaves the cylinders as described above. Instead of returning to tank, however, the oil passes through the control valve and returns to the blind end of the cylinders. In this way, a relatively small amount of oil, represented by the difference between the volume of the blind and rod ends of the cylinder, is all that is required to extend the cylinder rod. This reduces the force applied to the boom sections by the cylinders, but increases the speed of operation.

To retract the boom, the operator pulls the control lever back. In this position, hydraulic oil is fed directly to the rod end of the cylinder through the priority flow control valve and 50-50 flow divider. The priority flow control valve meters the oil to the circuit, which is then divided into two equal flows by the 50-50 flow divider. Oil flowing to the rod and of the cylinder also applies pressure to the counterbalance valve, opening the valve to allow the oil to return to tank through the control valve.

SWING CIRCUIT. When the operator moves the swing lever to either the forward or backward position, hydraulic oil is directed through the control valve to the swing motor.

This causes the swing pinion, which is meted to the slewing ring gear, to rotate and turn the upper in relationship to the lower.

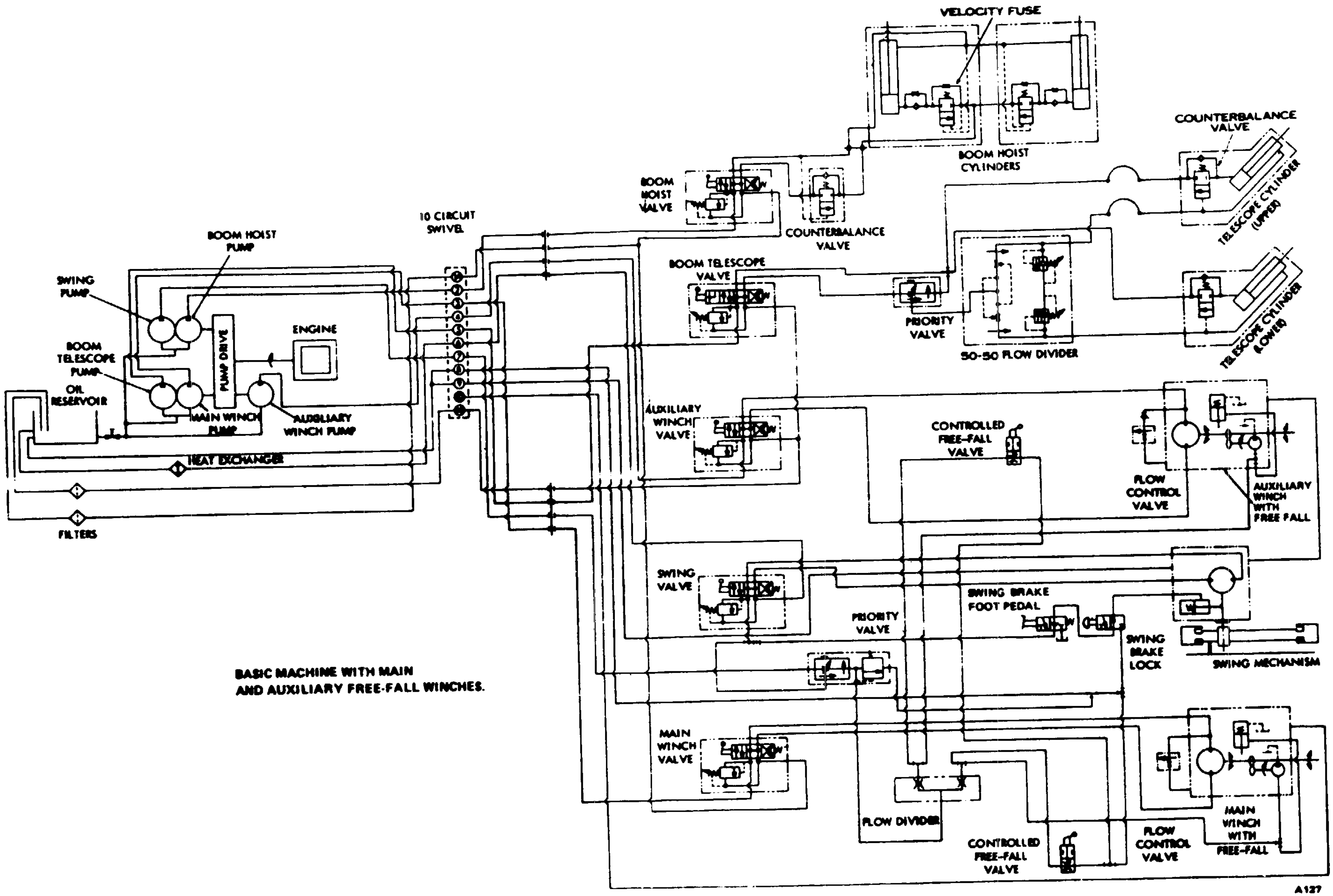


Figure 4A-4. Hydraulic System Schematic (100J3666-G)

The swing brake is used to lock the swing reducer so that the swing motor cannot turn, thus preventing the revolving upper portion of the machine from turning.

NOTE

> The upper of the machine will swing freely if the swing brake is not applied.

The swing brake pedal is shown in the released position. In this position, oil is allowed to enter the brake chamber and release the brake. When the operator depresses the swing brake pedal, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

The swing brake lock is shown in its normal operating position. When the machine is not working or is shut down, the swing brake lock should be placed in the locked position. In this position, the oil in the brake chamber is allowed to return to tank and the brake springs set the brake.

MAIN WINCH CIRCUIT. The main winch control valve directs hydraulic oil from the pump to the winch motor. The direction in which the valve spool is shifted will determine whether the winch will lift or lower a load. The speed of winch operation is determined by the amount of oil metered through the control valve to the winch motor.

An optional free-fall feature is incorporated into the main winch, and operates as follows:

A metered flow of hydraulic oil from the swing pump is directed to the free-fall circuit by the priority valve. When the free-fall control valve is in the released position, this fluid passes through the valve end returns to the reservoir.

Under this condition, the free-fall feature is inoperative end the main winch operates as a non free-fall winch.

When the free-fell control lever is moved toward the operator, the metered oil flow is restricted, creating pressure at the free-fell brake release port. As soon as the brake is released sufficiently to allow the internal gear to rotate, the metering pump is driven by the internal gear and meters pert of the oil supply out of the circuit. This decreases the pressure in the free-fall brake circuit, which tends to apply the brake; thereby quieting winch drum speed.

The speed at which the load is lowered is proportional to the amount of control lever travel. As the travel of the control lever is increased, the flow of oil through the control valve is restricted to a greater extent; and an increase in pressure releases the brake further, causing an increase in speed. When the control valve lever is moved to its full extent, ail the oil is required to pass through the metering pump and maximum uniform speed is obtained.

CAUTION

> When a load is being lowered with the free-fail brake, the control valve lever must be moved gradually. Sudden movement of the control lever will create a pressure surge end cause the load to lower at an uneven speed. The control valve lever must also be moved slowly to stop the load smoothly.

AUXILIARY WINCH CIRCUIT. The operation of the auxlliary winch circuit is identical to the operation of the main winch circuit, except that the metered flow of oil from the swing pump is divided equally between the main end auxillary winch circuits after the oil leaves the priority valve.

BASIC MACHINE WITH P&H MAIN AND AUXILIARY WINCHES (100X133)

PUMPING CIRCUIT. The pumping circuit consists of the reservoir, pumps, swivel, return line filters and oil cooler.

The hydraulic pumps are driven by the carrier engine through a pump drive, which allows the pumps to be disconnected from the engine when the machine is being roaded. When the pumps are driven, oil is drown from the reservoir through the suction manifold and is forced out into the system. The oil leaving the pumps flows through the rotary joint, through the open center control valve, and then back to the reservoir either through the return line filters or oil cooler.

The oil will continue to circulate through the system, as long as all the control valves are in the neutral position. Under these conditions, very little pressure will be developed, since there is practically no resistance to oil flow.

Oil flowing through the oil cooler comes from the return side of the swing control valve. Oil returning from the remaining control valves flows through the return line filters. This arrangement ensures that all the return oil is either cooled or filtered before returning to tank.

BOOM HOIST CIRCUIT. To raise the boom, the operator pulls the control lever back. In this position, hydraulic oil passes from the pump, through the control valve and the check valve in the counterbalance valve on the boom hoist cylinder, to the blind end of the cylinder. Fluid from the rod end of the cylinders returns to the reservoir through the control valve.

To lower the boom, the operator pushes the control lever forward. in this position, hydraulic oil is fed directly into the rod end of the cylinders. At the same time, pilot pressure from the line is applied to the counterbalance valve, opening the valve and allowing the oil at the blind end of the cylinder to return to tank through this valve and the control valve.

BOOM TELESCOPE CIRCUIT. To extend the boom, the operator pushes the control levers forward. In this position, hydraulic oil passes from the pump, through a one to one flow divider to the control valve. From the control valves, the oil passes through the check valve in the counterbalance into the blind end of the cylinders.

To retract the boom, the operator pulls the control levers back. In this position, hydraulic oil is fed directly into the rod end of the cylinders. At the same time, pilot pressure from the line is applied to the counterbalance valve, opening the valve and allowing the oil to return from the blind end of the cylinder, through this valve and the control valve to tank.

SWING CIRCUIT. Hydraulic oil, under pressure, is delivered by the swing pump to the swing control valve through the priority flow control valves. The hydraulic oil will continue to circulate and no motion will occur until the operator moves the swing lever to either the forward or backward positions.

When the operator moves the swing lever to either the forward or backward position, hydraulic oil is directed through the control valve to the swing motor. This causes the swing pinion, which is mated with the slewing ring gear, to rotate, thereby turning the upper in relation to the lower.

The swing brake is used to lock the swing reducer so that the swing motor cannot turn, thus preventing the upper from turning.

NOTE

The upper of the machine will swing freely if the swing brake is not applied.

The swing brake is shown in the released position. When the operator depresses the swing brake pedal, the hydraulic oil in the brake chamber is returned to tank, and the brake springs set the brake. Releasing the brake pedal, allows hydraulic oil to enter the brake chamber, thereby releasing the brake.

The swing brake lock is shown in its normal operating position. When the machine is not working or is shut down, the swing brake lock should be pieced in the locked position. in this position, the oil in the brake chamber is returned to tank and the brake is applied.

MAIN WINCH CIRCUIT. The main winch control valve directs hydraulic oil from the pump to one winch motor port or the other. This will cause the winch to turn in a direction which will lift or lower the load, depending upon which side of the motor the hydraulic pressure is applied.

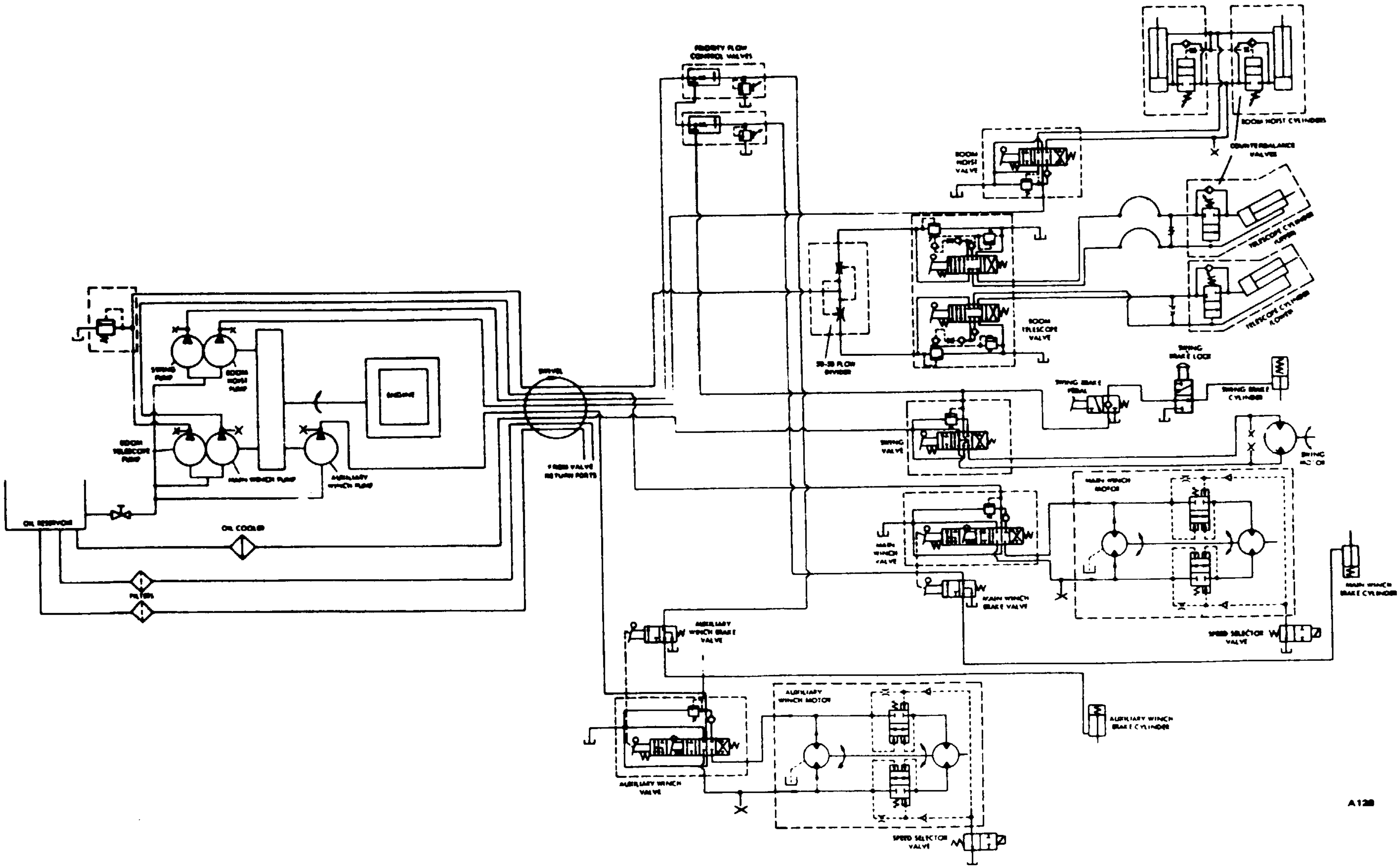


Figure 4A-5. Hydraulic Systems Schematic (100X133-B).

When the winch control lever is moved to the lower position, the winch brake valve spool is shifted, blocking the tank port while allowing the oil to flow from the swing pump to the winch brake cylinder. Pressure developed in the cylinder will then release the winch brake.

NOTE

> The winch brake is not released when the winch is operated in the raising direction. A Sprag clutch allows the motor to drive the winch drum through the brake disc.

A two speed, gear type motor is used to drive the winch. When the winch speed selector switch in the cab is in the low speed position, the winch speed selector valve is de-energized, allowing the valving within the motor to shift to the open position. This allows the oil supplied to the motor by the control valve to flow through both motor sections, producing high torque at low speed.

When the selector switch is in the high speed position, the winch speed selector valve is energized, causing the valving within the motor to shift to the closed position. This prevents oil from flowing through both sections of the motor. Since all the oil flow from the control valve must now pass through one section of the motor, the motor will develop low torque at a high speed.

When the winch control lever is pushed fully forward, the oil in the circuit will recirculate from the motor, through the control valve and back to the inlet of the motor. This will cause the load to lower under controlled free-fall conditions.

AUXILIARY WINCH CIRCUIT. The operation of the auxiliary winch circuit is the same as the operation of the main winch circuit. Refer to the above description.

SUB-SECTION 4B
PUMPS

DUAL PUMPS (41Z55 & 41Z56)

GENERAL

Dual hydraulic pump 41Z55 is used to develop fluid flow for the operation of the main winch and boom telescope circuits, while dual pump 41Z56 provides flow for the operation of the swing and boom hoist circuits.

The pump illustrated in Figure 4B-1 is representative of the dual pumps. The pump consists principally of an outlet body, inlet housing, outlet cover, driveshaft and two pumping cartridges. The principal components of each cartridge are an elliptical cam ring, a slotted rotor splined to the driveshaft, a pressure plate, wear plate, and ten vanes fitted to the rotor slots.

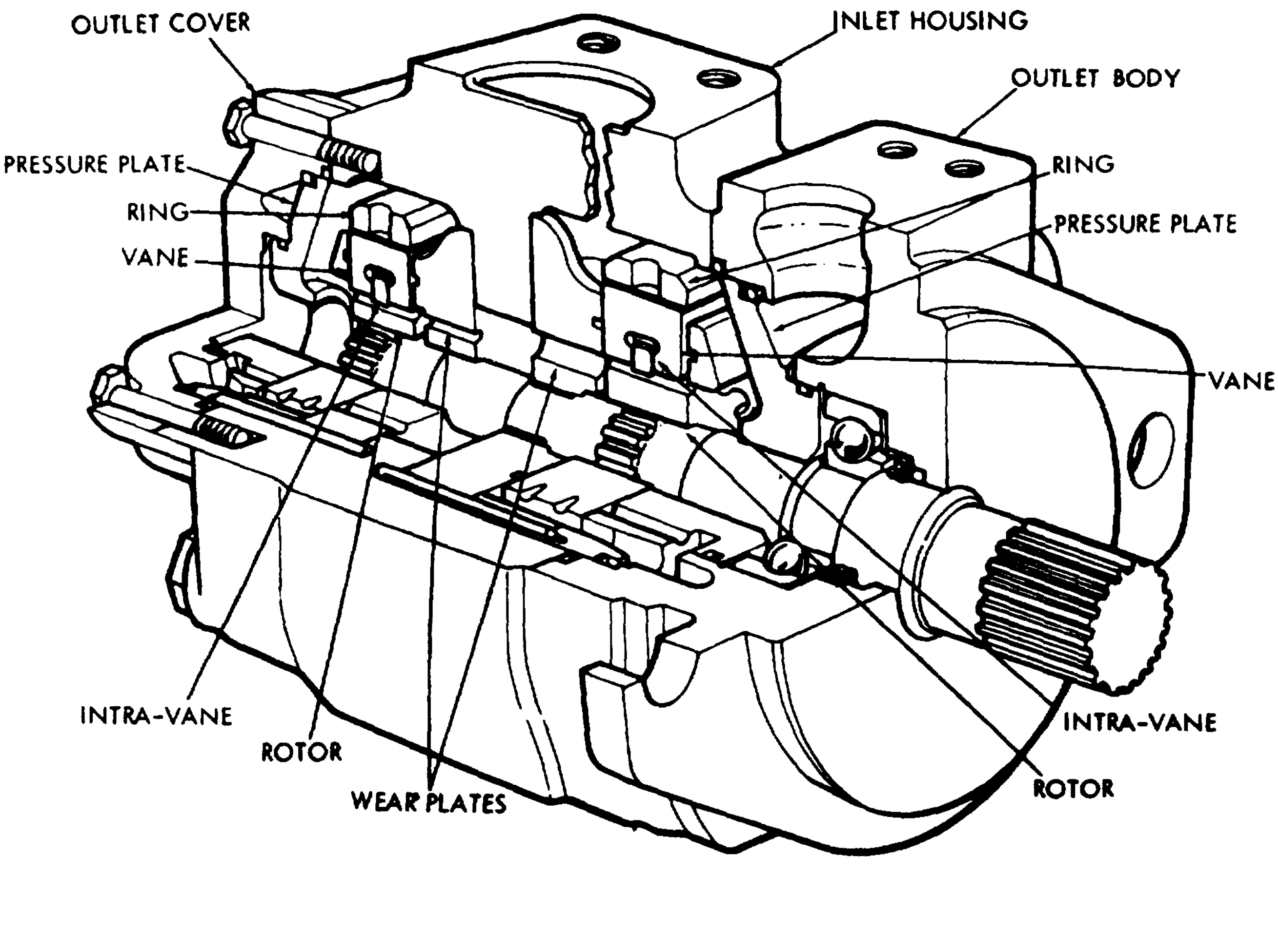


Figure 4B-1. Dual Pumps (41Z55 and 41Z56)

PRINCIPLES OF OPERATION

Fluid enters the pumping cartridge through the inlet port and is discharged through the pressure plates to the outlet ports. The action of the pumping cartridge is illustrated in Figure 4B-2.

The rotor is driven within the cam ring by the driveshaft, which is coupled to the pump drive. As the rotor turns, centrifugal force on the vanes, aided by under-vane pressure fed from the outlet port, causes them to follow the elliptical inner surface of the cam ring.

Radial movement of the vanes and turning of the rotor cause the chamber volume between the vanes to increase as the vanes pass the inlet section of the cam ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers.

This fluid is trapped between the vanes and carried past a sealing land to the outlet section of the cam ring. As the outlet section is approached, the chamber volume decreases and the fluid is forced out onto the system.

The intra-vane design provides a means of controlling the outward thrust of the vane against the cam ring to maintain the tip loads within reasonable limits. In the intra-vane cartridge, full system pressure is continuously applied for outward vane thrust only over the area between the vane and insert. This area is small and thrust is correspondingly light. During vane travel through pressure areas, full system pressure is also applied against the bottom of the vane. The valving of pressure to and from the bottom area of the vane is through holes drilled in the rotor, as shown in Figure 4B-3. This selective application of pressure maintains the vane in constant radial hydraulic balance in all positions.

The cam ring is shaped so that the two pumping chambers are formed 180 degrees apart (see Figure 4B-2). Thus, opposing hydraulic forces which would impose side loads on the driveshaft cancel each other out.

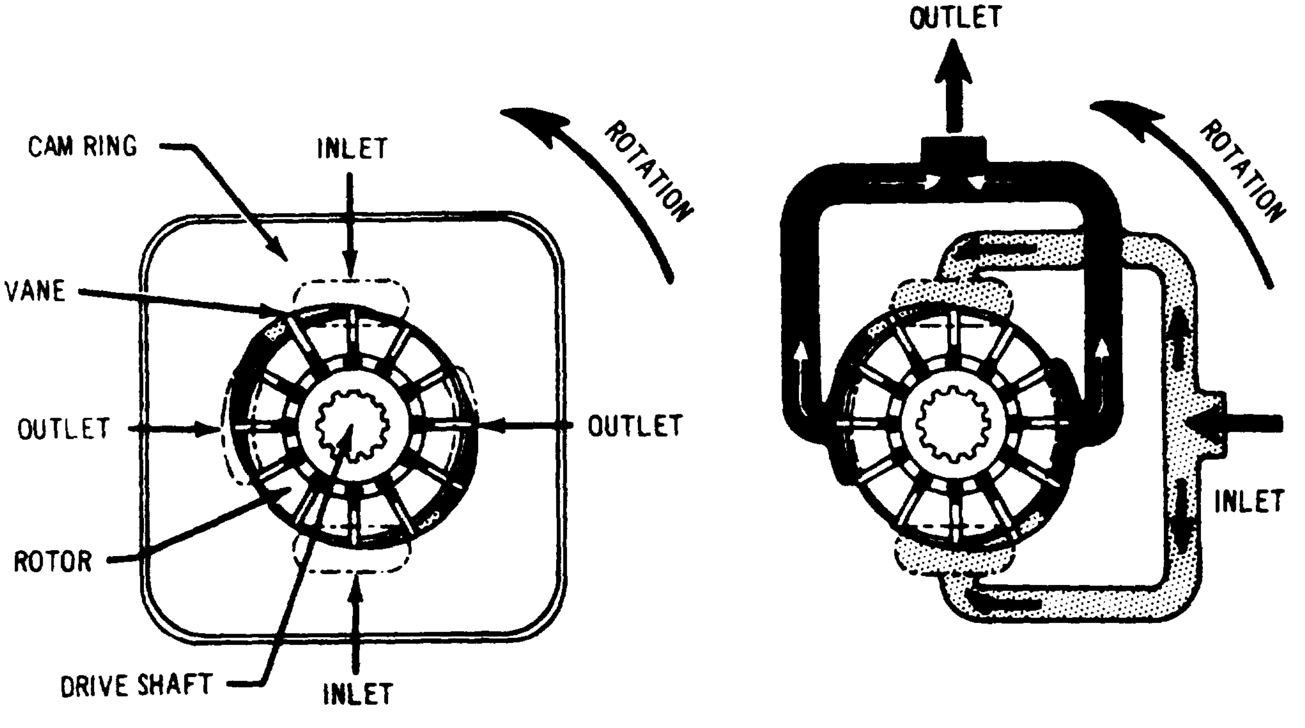


Figure 4B-2. Pump Cartridge Operation

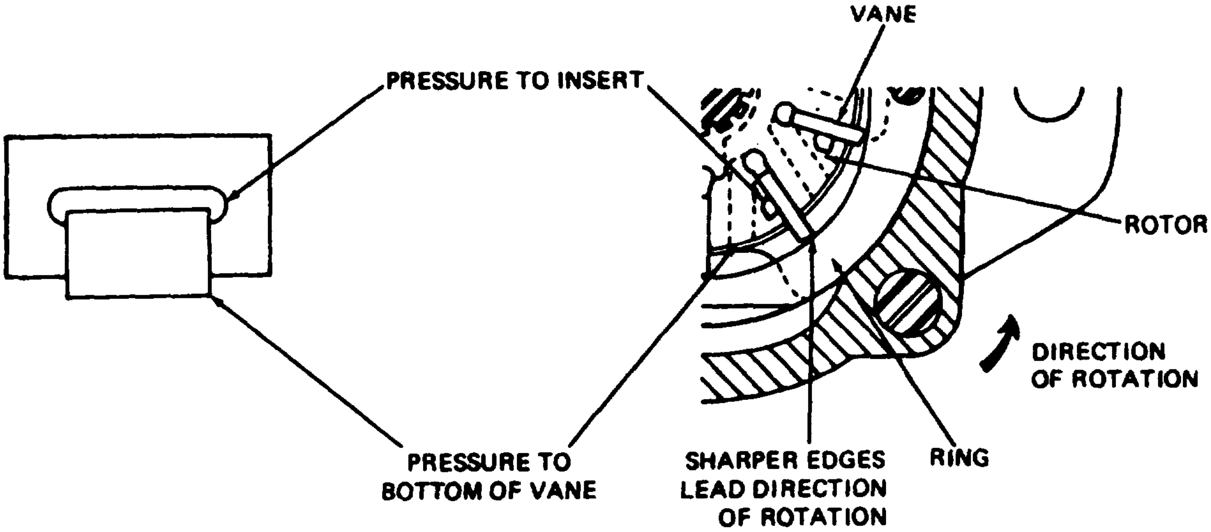


Figure 4B-3. Pressure Feed to Vanes

The pressure plate seals the pump chamber as shown in Figure 4B-4. System pressure is effective against the area at the back of the plate, which is larger than the area exposed to the pumping cartridge. Thus, an unbalanced force holds the plate against the cartridge, sealing the cartridge and providing the proper running clearance for the rotor and vanes. The pressure plate also contains passages for feeding pressure to the space between the vanes and inserts.

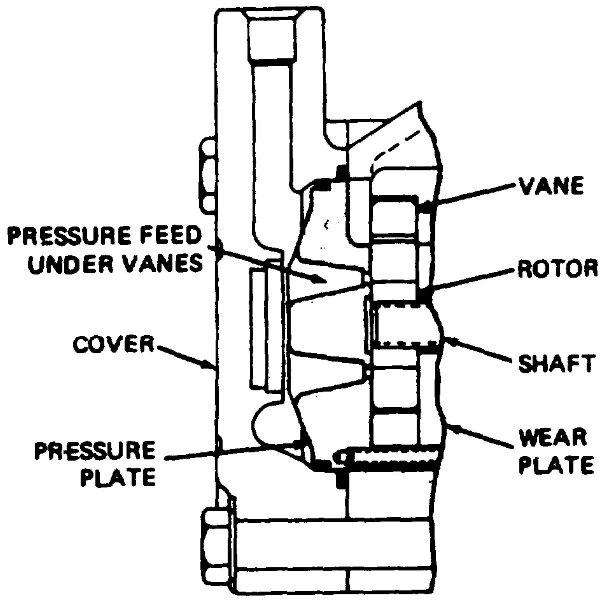
REMOVAL

To remove a pump from the pump drive, proceed as follows:

1. Turn the suction line valve to the closed position.

2. Disconnect the suction and outlet lines from the pump. Cap the lines and plug the pump ports to prevent the entry of foreign material into the pump or hydraulic system.

3. Block the pump in position against the pump drive so that it will not drop when the capscrews are removed. Remove the two capscrews securing the pump to the pump drive. Slide the pump back from the pump drive until the driveshaft is clear of the pump drive, and remove the pump to a suitable repair area.



COVER END STRAIGHT VANE PUMPING CARTRIDGE SHOWN

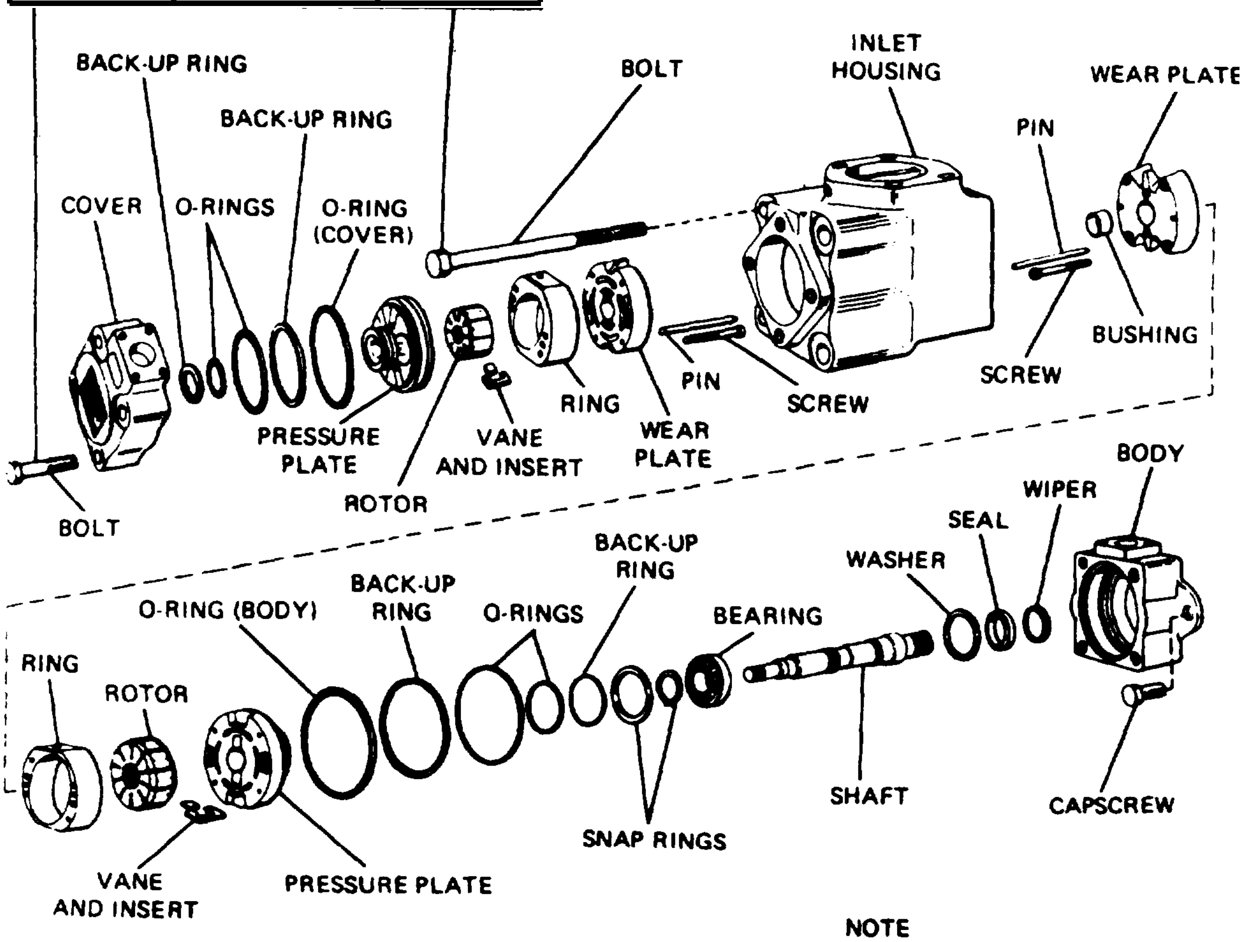
Figure 4B-4 Pressure Plate Functions

CARTRIDGE REPLACEMENT

GENERAL. Preassembled replacement cartridges are available for rapid field overhaul of these pumps. If a replacement cartridge is being used, proceed as described below for disassembly and reassembly.

Figure 4B-5 shows the proper relationship of the parts for disassembly and reassembly. During disassembly, pay particular attention to identification of the parts for correct reassembly.

TORQUE SPECIFICATIONS		
FT. LBS. (m-kg)	PUMP	FT. LBS. (m-kg)
70 ± 5 (9.68 ± 0.7)	MAIN WINCH AND BOOM TELESCOPE	265 ± 10 (36.6 ± 1.4)
70 ± 5 (9.68 ± 0.7)	BOOM HOIST AND SWING	90 ± 5 (12.4 ± 0.7)



NOTE

A CARTRIDGE KIT CONSISTS OF A PRESSURE PLATE, ROTOR, VANE KIT AND INSERTS, RING WEAR PLATE, TW0 PINS, AND TWO SCREWS.

Figure 4B-5. Exploded View of Dual Pump

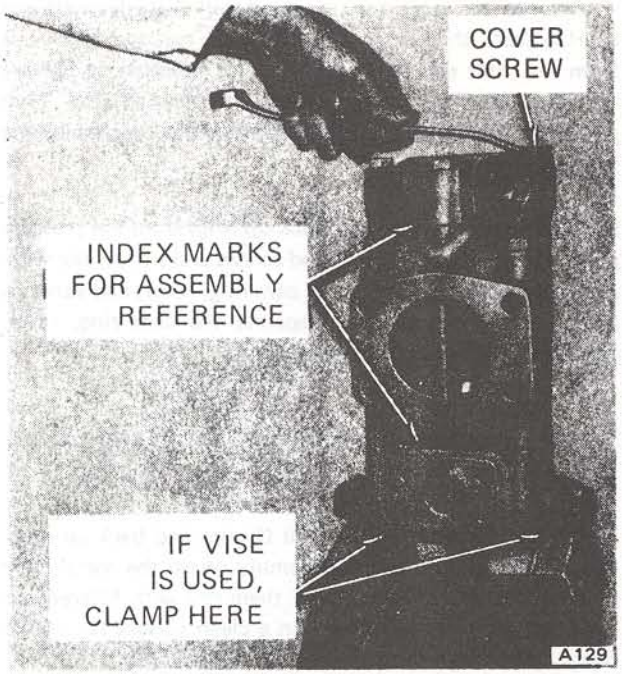


Figure 4B-6. Beginning Disassembly

DISASSEMBLY. Disassemble the pump, to replace the pumping cartridge, as follows:

1. Support the pump on blocks or clamp the body in a vise as shown in Figure 4B-6. If a vise is used, use *protective jaws* to avoid damage to the body and its machined surfaces.

Figure 4B-7. Removing Pump Cover

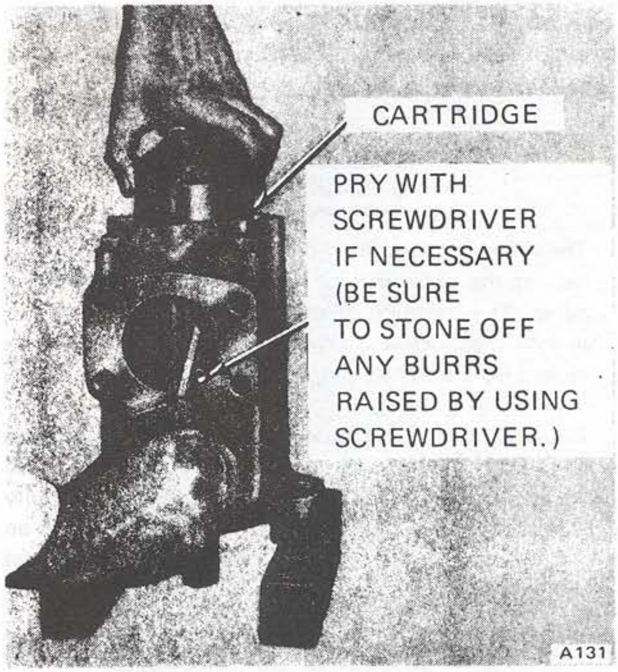


Figure 4B-8. Removing Cover End Cartridge

2. Mark the body, inlet housing and cover for correct re-assembly. Remove the four cover screws and lift the cover off the pump. Remove the cover O-ring (see Figure 4B-7). Pull and/or pry out the cover end cartridge as shown in Figure 4B-8.

3. Next, remove the four screws attaching the inlet housing to the body. Lift off the inlet housing (see Figure 4B-9) and remove the body O-ring. Turn the drive shaft to free the cartridge and pull the cartridge from the body.

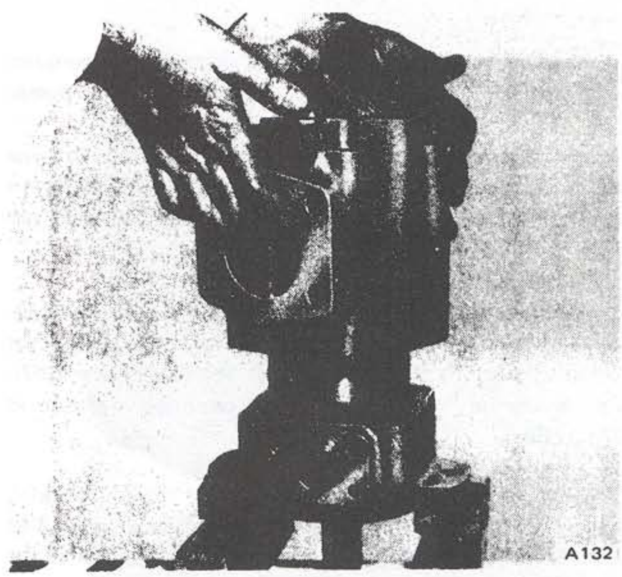


Figure 4B-9. Removing Inlet Housing

REASSEMBLY. Reassemble the pump, with a presassembled pumping cartridge, as follows:

1. Clamp the body in a vise or place it on blocks as at disassembly.

CAUTION

> These are *left* hand rotation pumps. Check the rotation of the new cartridge before installing it in the pump, The direction of rotation arrow should point in a counterclockwise direction when the cartridge is viewed from the shaft end.

2. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the inlet housing is installed.

3. Place the inlet housing over the cartridge so the locating pins are properly engaged, and the inlet is in the correct position with respect to the body outlet. Install the four screws and torque them to the values shown in Figure 4B-5.

4. Install the cover end cartridge, being certain the pins engage the inlet housing. Place the large back-up ring and O-ring on the pressure plate.

5. Install the small O-ring and back-up ring on the pressure plate hub. Install the cover O-ring in its groove. Install the cover and screws. Tighten the screws to the torque values shown in Figure 4B-5.

OVERHAUL

DISASSEMBLY. Use the following procedure in conjunction with Figure 4B-5 to completely disassemble the pump:

1. Support the pump on blocks clamp the body in a vise as shown in Figure 4B-6. If a vise is used, use *protective* jaws to avoid damage to the body and its machined surfaces.

2. Mark the body, inlet housing, and cover for correct reassembly. Remove the four cover screws and lift the cover off me pump. Remove the cover O-ring (see Figure 4B-7). Pull and/or pry out the cover end cartridge as shown in Figure 4B-8.

3. Next, remove the four screws attaching the inlet housing to the body. Lift off the inlet housing (see Figure 4B-9) and remove the body O-ring. Turn the driveshaft to free the cartridge and pull the cartridge from the body.

4. Remove the large snap ring and pull the driveshaft and bearing from the body. Drive the shaft seal and wiper out from the shaft of the body. If it necessary to remove the shaft bearing, first remove the small snap ring. Then press the shaft out of the bearing, while supporting the bearing inner race.

5. Remove the O-ring, and backup rings from the pressure plate. Remove the fillister head screws and lift off the wear plate. Note the position of the am ring, rotor, and vanes to assure correct reassembly. Separate the cam ring, rotor, vanes, locating pins, and pressure plate.

INSPECTION AND REPAIR. Inspect and repair the following items:

1. Discard the shaft seal and all O-rings and back-up rings. Use new gasket kit for reassembly. Wash the metal parts in clean mineral solvent, blow them dry with filtered, dehydrated air, and place them on a clean surface for inspection.

2. Check the wearing surfaces of the cartridge parts for scoring and excessive wear. Remove light score marks by lapping. Lubriting, Moly-Koteing or equivalent is desirable after lapping to prevent seizure during start-up. Replace any heavily scored or badly worn parts.

3. Inspect the vanes and inserts for burrs, wear, and excessive play in the rotor slots. Replace the rotor if the slots are worn.

4. Rotate the bearing while applying pressure to check for wear, looseness and pitted or cracked races.

5. Inspect the seal and bushing mating surfaces on the shaft for scoring or wear. Replace the shaft if marks cannot be removed by light polishing.

REASSEMBLY. Use the following procedure to reassemble the pump:

NOTE

> Coat all parts except seals and back-up rings with clean hydraulic fluid to facilitate reassembly, and to provide initial lubrication. Use small amounts of petroleum jelly to hold the O-rings in place during reassembly.

1. Place the pressure plate on blocks as shown in Figure 4B-10. Place the rotor on the pressure plate with the arrow

pointed in the correct direction for *left* hand rotation. Install the locating pins.

NOTE

The direction of rotation is as viewed from the shaft end. *Left hand rotation is counterclockwise.*

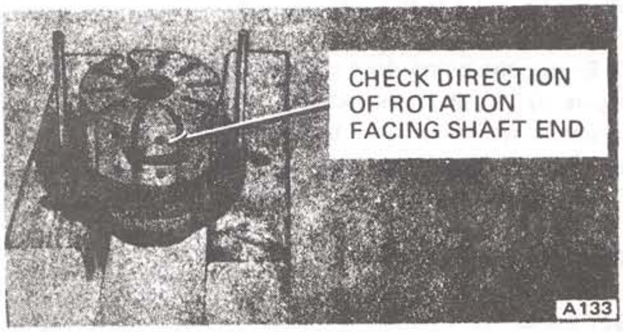


Figure 4B-10. Installing Rotor

2. Position the cam ring over the pins and rotor, again observing the rotation arrow (see Figure 4B-11). Place the inserts in the vanes and install both in the rotor slots. Be sure the sharp edges are toward the direction of rotation, and that both vanes and inserts move freely in the slots (see Figure 4B-12). Install the wear plate and screws.

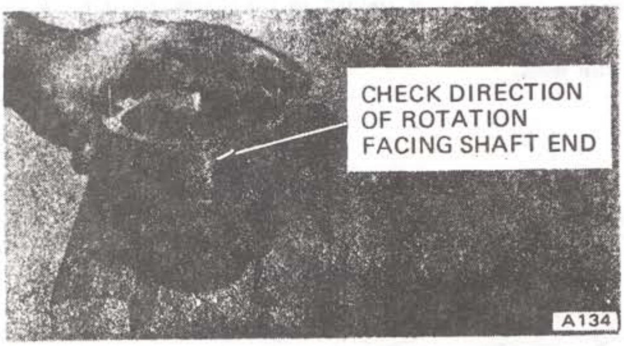


Figure 4B-11. Installing Ring

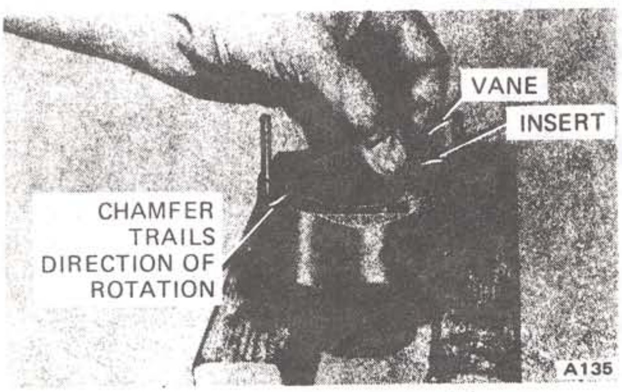
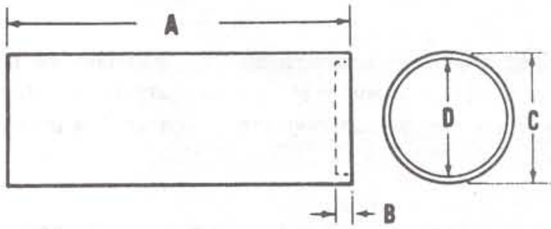


Figure 4B-12. Installing Vanes and Inserts

3. Soak a new shaft wiper in hydraulic fluid and install the wiper and seal in the body. Use the seal installation tool shown in Figure 4B-13 to prevent damaging the seal. Be sure the seal O.D. is below the chamfer in the body.



PUMP	LENGTH A INCHES (mm)	UNDERCUT B INCHES (mm)	O.D. C INCHES (mm)	I.D. D INCHES (mm)
Main winch and boom telescope	3-3/4 (9.52)	7/16 (1.11)	2-7/32 (5.63)	1-29/32 (4.84)
Boom hoist and swing	3-1/4 (8.25)	1/4 (0.63)	1-25/32 (4.52)	1-11/16 (4.29)

The driver can be made from tubular stock machined to the above dimensions.

Figure 4B-13. Shaft Seal Driver

4. Clamp the body in a vise or place it on blocks as at disassembly. Install the washer against the seal.

5. Press the shaft into the bearing in an arbor press, while supporting the inner race of the bearing. Install the small snap ring. Tape the shaft splines and cover the tape with grease or petroleum jelly to protect the seal when the shaft is installed. Tap the shaft and bearing gently into the body and install the large snap ring.

CAUTION

These are *left* hand rotation pumps. Check the rotation of the cartridge before installing it in the pump. The direction of rotation arrow should point in a *counterclockwise* direction when the cartridge is viewed from the shaft end.

6. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the inlet housing is installed.

7. Place the inlet housing over the cartridge so the locating pins are properly engaged, and the inlet housing is in the correct position with respect to the body outlet. Install the four screws end torque them to the values shown in Figure 4B-5.

8. Install the cover end cartridge, being certain the pins engage the housing and that cartridge rotation is correct. Place the large back-up ring and O-ring on the pressure plate.

9. Install the small O-ring and back-up ring on the pressure plate hub. Install the cover O-ring in its groove. Install the cover and screws, and tighten the screws to the torque values shown in Figure 4B-5.

INSTALLATION

Care must be exercised when installing a new or overhauled pump on the pump drive to prevent misaligment, which can lead to premature pump failure. Install a new or overhauled pump on the pump drive as follows:

1. Check the mounting flange on the pump drive, the pilot diameter on the pump, the splined coupling, and the splined driveshaft for burrs or imperfections that would prevent the pump from seating properly on the pump drive. Carefully remove any imperfections by lapping.

2. Apply a light coating of grease to the pilot diameter end driveshaft splines. Position the gasket on the pump.

3. Carefully install the pump on the pump drive, and install the mounting screws. Care should be exercised in tightening the mounting screws to prevent misalignment.

4. Reconnect the suction and outlet lines. Then turn the suction line valve to the open position.

5. Engage the pump drive and start the engine. Allow the engine to run at idle speed, with no load applied to the hydraulic system to prime the pump. Then run the engine at moderate speed and load for a short period of time. Check the reservoir oil level and add oil if required.

SINGLE PUMP (41Z57)

GENERAL

Single hydraulic pump 41Z57 is used to develop fluid flow for the operation of the auxiliary winch.

The pump illustrated in Figure 4B-14 is representative of the single pump. The pump consists principally of an inlet cover, outlet body, driveshaft and pumping cartridge. The principal components of the cartridge are an elliptical cam ring, a slotted rotor splined to the driveshaft, a pressure plate, wear plate, and ten vanes and inserts fitted to the rotor slots.

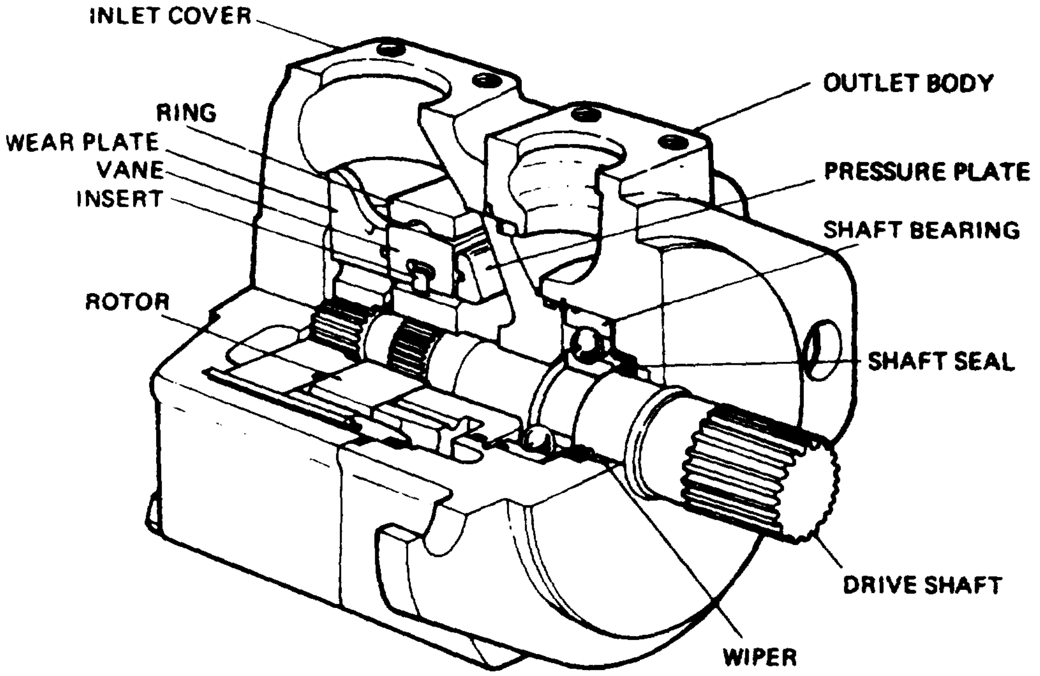


Figure 4B-14. Single Pump (41Z57)

PRINCIPLES OF OPERATION

Fluid enters the pumping cartridge through the inlet port and is discharged through the pressure plate to the outlet port. The action of the pump cartridge is illustrated in Figure 4B-15.

The rotor is driven within the cam ring by the driveshaft, which is coupled to the pump drive. As the rotor turns, centrifugal force on the vanes, aided by under-vane pressure fed from the outlet port, causes them to follow the elliptical inner surface of the cam ring.

Radial movement of the vanes and turning of the rotor cause the chamber volume between the vanes to increase as the vanes pass the inlet section of the cam ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers.

This fluid is trapped between the vanes and carried past a sealing land to the outlet section of the cam ring. As the outlet section is approached, the chamber volume decreases and the fluid is forced out into the system.

The intra-vane design provides a means of controlling the outward thrust of the vane against the cam ring to maintain the tip loads within reasonable limits. In the intra-vane cartridge, full system pressure is continuously applied for outward vane thrust only over the area between the vane and insert. This area is small and thrust is correspondingly light. During vane travel through pressure areas, full system pressure is also applied against the bottom of the vane. The valving of pressure to and from the bottom area of the vane is through holes drilled in the rotor, as shown in Figure 4B-16. This selective application of pressure maintains the vane in constant radial hydraulic balance in all positions.

The cam ring is shaped so that the two pumping chambers are formed 180 degrees apart (see Figure 4B-15). Thus, opposing hydraulic forces which would impose side loads on the driveshaft cancel each other out.

The pressure plate seals the pump chamber as shown in Figure 4B-17. System pressure is effective against the area at the back of the plate, which is larger than the area exposed to the pumping cartridge. Thus, an unbalanced force holds the plate against the cartridge, sealing the cartridge and providing the proper running clearance for the rotor and vanes. The pressure plate also contains passages for feeding pressure to the space between the vanes and inserts.

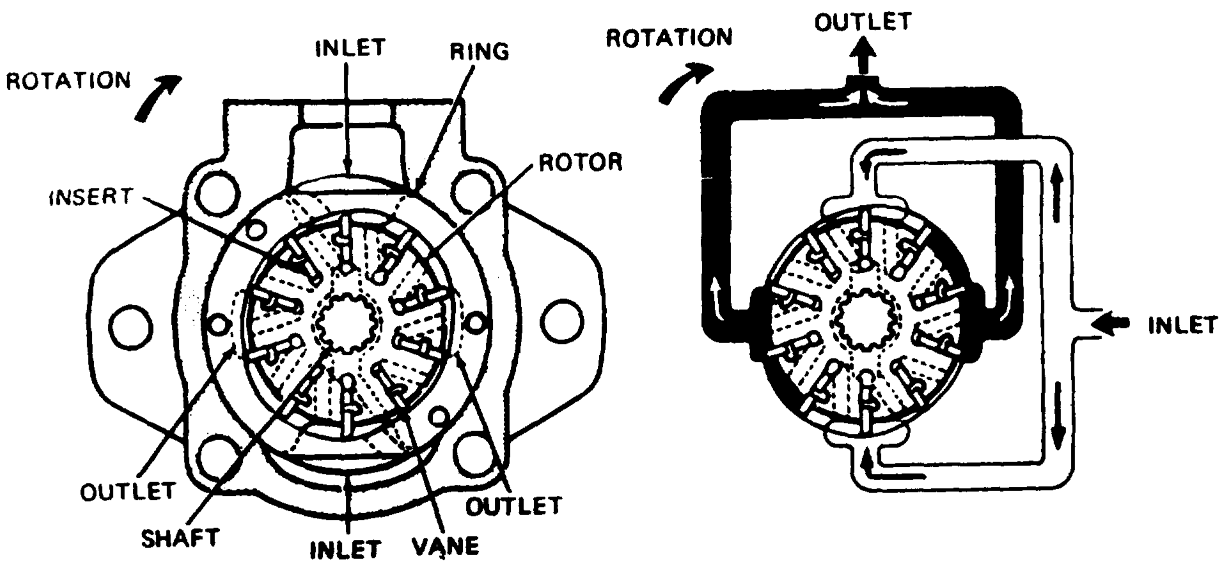


Figure 4B-15. Pump Cartridge Operation

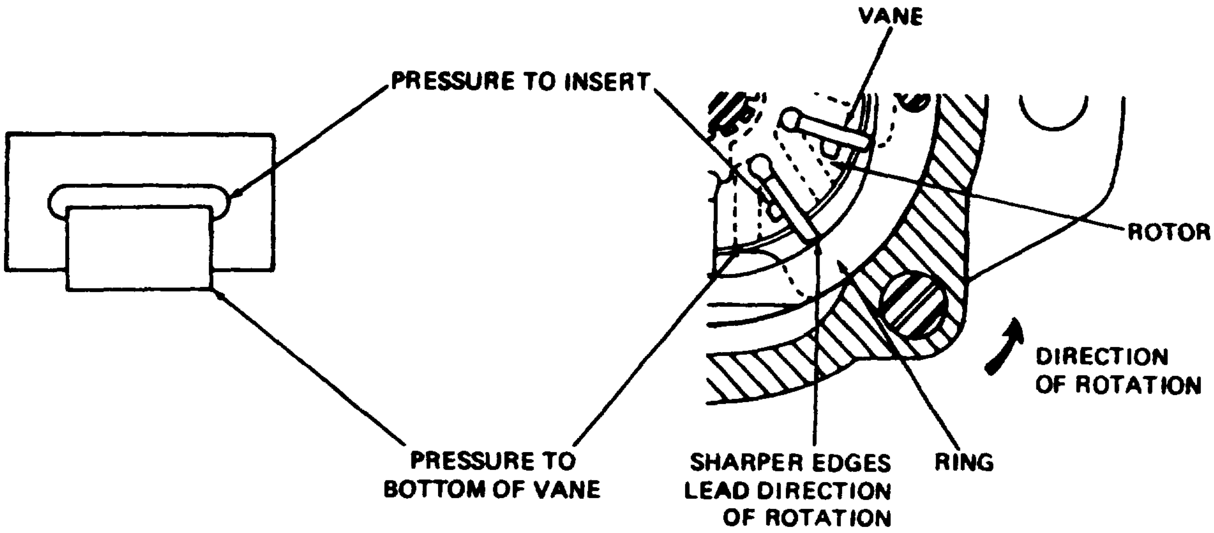


Figure 4B-16. Pressure Feed to Vanes

REMOVAL

To remove a pump from the pump drive, proceed as follows:

1. Turn the suction line valve to the dosed position.

2. Disconnect the suction and outlet lines from the pump. Cap the lines and plug the pump ports to prevent the entry of foreign material into the pump or hydraulic system.

3. Block the pump in position against the pump drive so that it will not drop when the capscrews are removed. Remove the two capscrews securing the pump to the pump drive. Slide the pump back from the pump drive until the driveshaft is clear of the pump drive, and remove the pump to a suitable repair area.

CARTRIDGE REPLACEMENT

GENERAL. Preassembled replacement cartridges are available for rapid field overhaul of these pumps. If a replacement cartridge is being used, proceed as described below for disassembly and reassembly.

Figure 4B-18 shows the proper relationship of the parts for disassembly and reassembly. During disassembly, pay particular attention to identification of the parts for correct reassembly.

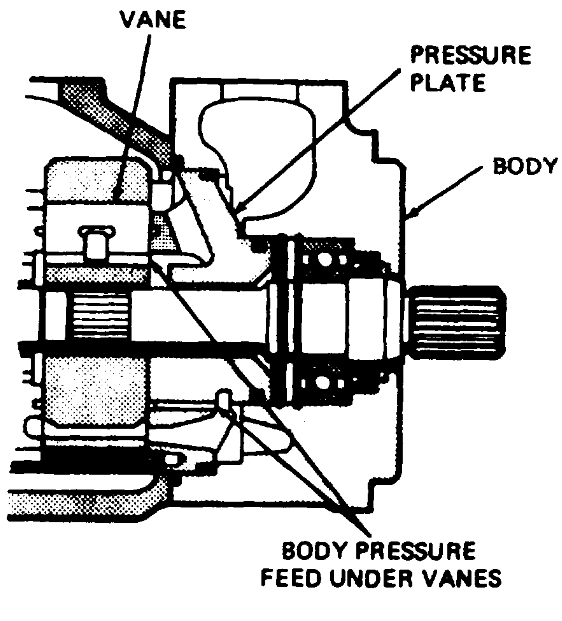


Figure 4B-17. Pressure Plate Operation

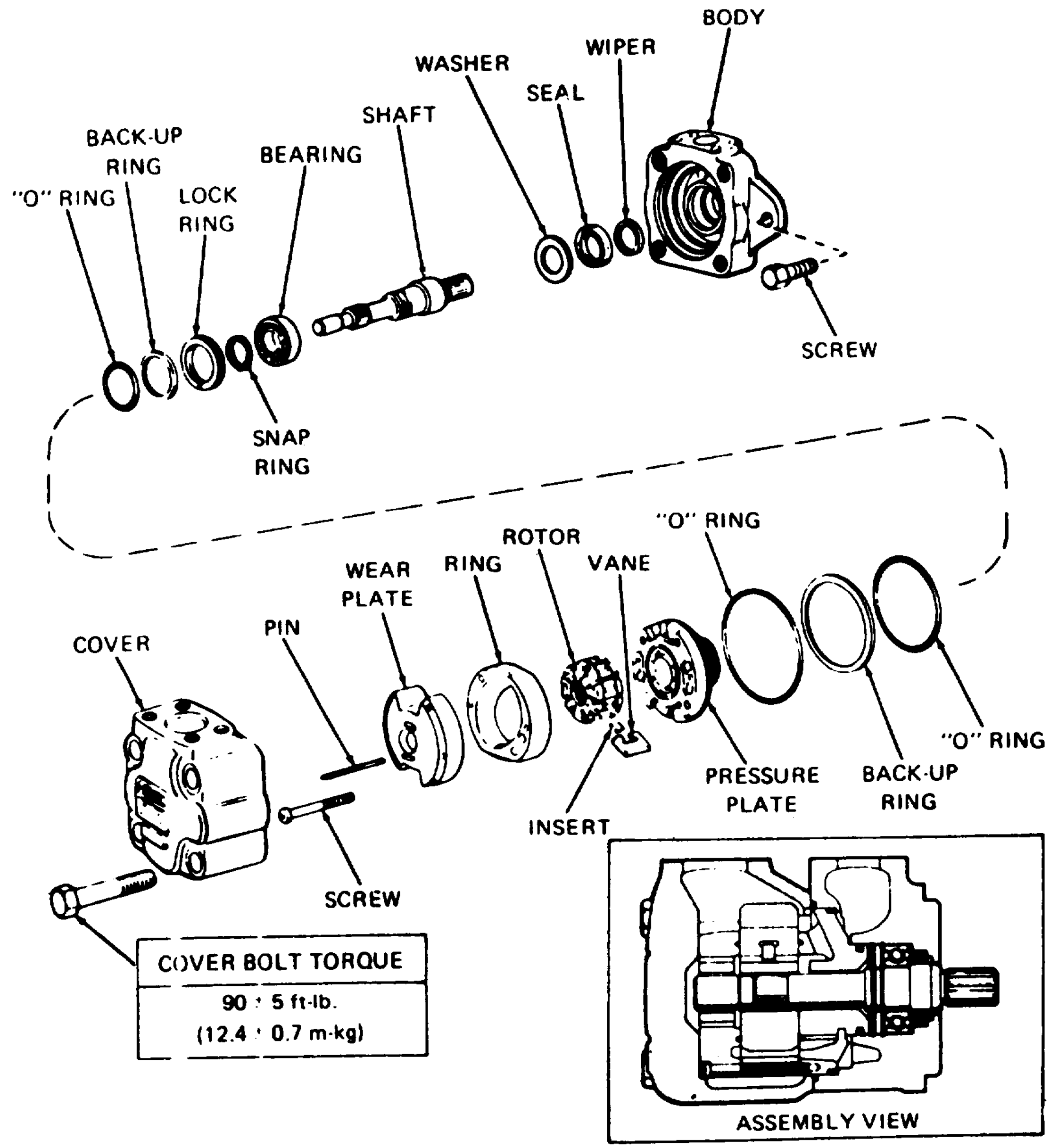


Figure 4B-18. Exploded View of Single Pump

DISASSEMBLY. Disassemble the pump, to replace the pumping cartridge, as follows:

1. Support the pump on blocks or clamp the body in a vise. If a vise is used, use protective jaws to avoid damage to the body and its machined surfaces.

2. Mark the body and cover for correct reassembly. Remove the four cover screws and lift the cover oft the pump. Remove the cover O-ring Pull and/or pry out the cartridge.

REASSEMBLY. Reassemble the pump, with a preassembled pumping cartridge, as follows:

1. Clamp the body in a vise or place it on blocks as at disassembly.

CAUTION

This is a right hand rotation pump. Check the rotation of the new cartridge before installing it in the pump. The direction of rotation arrow should point in a clockwise direction when the cartridge is viewed from the shaft end.

2. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the cover is installed.

3. Install the cover and screws. Tighten the screws to 90 ± 5 foot-pounds (12.4 ± 0.7 m-kg).

OVERHAUL

DISASSEMBLY. Use the following procedure in conjunction with Figure 4B-18 to completely disassemble the pump:

1. Support the pump on blocks or clamp the body in a vise. If a vise is used, use *protective jaws* to avoid damage to the body and its machined surfaces.

2. Mark the body and cover for correct reassembly. Remove the four cover screws and lift the cover off the pump. Remove the cover O-ring. Pull and/or pry out the cartridge.

3. Remove the large snap ring and pull the driveshaft and bearing from the body. Drive the shaft seal and wiper out from the shaft end of the body. If it is necessary to remove the shaft bearing, first remove the small snap ring. Then press the shaft out of the bearing, while supporting the bearing inner race.

4. Remove the O-rings and back-up rings from the pressure plate. Remove the fillister head screws and lift off the wear plate. Note the position of the cam ring, rotor, and vanes to assure correct reassembly. Separate the cam ring, rotor, vanes, locating pins, and pressure plate.

INSPECTION AND REPAIR. Inspect and repair the following items:

1. Discard the shaft seal and all O-rings and back-up rings. Use a new gasket kit for reassembly. Wash the metal parts in clean mineral solvent, blow them dry with filtered, dehydrated air, and place them on a clean surface for inspection.

2. Check the wearing surfaces of the cartridge parts for scoring and excessive wear. Remove light score marks by lapping. Lubriting, Moly-Koteing or equivalent is desirable after lapping to prevent seizure during start-up. Replace any heavily scored or badly worn parts.

3. Inspect the vanes and inserts for burrs, wear, and excessive play in the rotor slots. Replace the rotor if the slots are worn.

4. Rotate the bearing while applying pressure to check for wear, looseness and pitted or cracked races.

5. Inspect the seal and bushing mating surfaces on the shaft for scoring or wear. Replace the shaft if marks cannot be removed by light polishing.

REASSEMBLY. Use the following procedure to reassemble the pump:

NOTE

Coat all parts except seals and back-up rings with clean hydraulic fluid to facilitate reassembly, and to provide initial lubrication. Use small amounts of petroleum jelly to hold the O-rings in place during reassembly.

1. Place the pressure plate on blocks as shown in Figure 4B-19. Place the rotor on the pressure plate with the arrow pointed in the correct direction for right hand rotation. Install the locating pins.

NOTE

The direction of rotation is as viewed from the shaft end. *Right hand rotation is clockwise.*

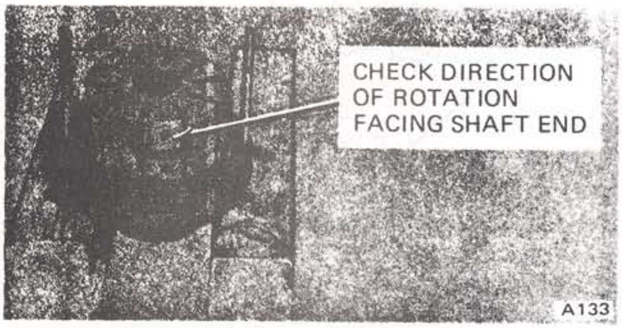


Figure 4B-19. Installing Rotor

2. Position the cam ring over the pins and rotor, again observing the rotation arrow (see Figure 4B-20). Place the inserts in the vanes and install both in the rotor slots. Be sure the sharp edges are toward the direction of rotation, and that both vanes and inserts move freely in the slots (see Figure 4B-21). Install the wear plate and screws.

3. Soak a new shaft wiper in hydraulic fluid and install the wiper and seal in the body. Use the seal installation tool shown in Figure 4B-22 to prevent damaging the seal. Be sure the seal O.D. is below the chamfer in the body.

4. Clamp the body in a vise or place it on blocks as at disassembly. Install the washer against the seal.

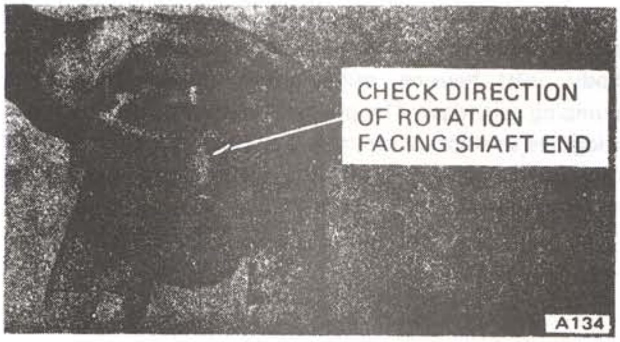


Figure 4B-20. Installing Ring

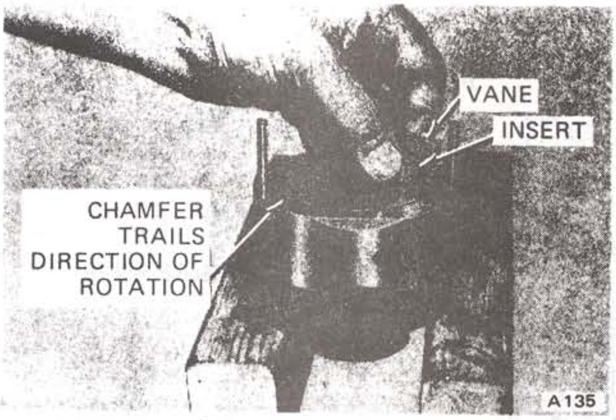


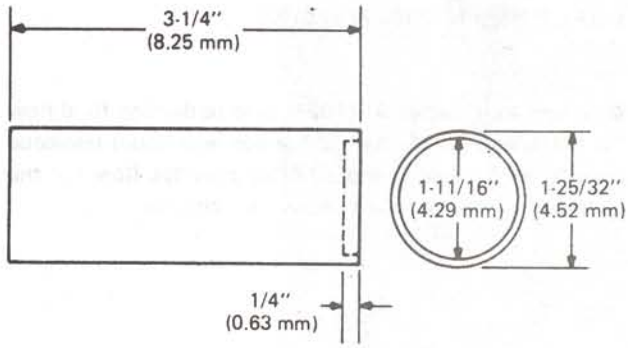
Figure 4B-21. Install Vanes and Inserts

5. Press the shaft into the bearing in an arbor press, while supporting the inner race of the bearing. Install the small snap ring. Tape the shaft splines and cover the tape with grease or petroleum jelly to protect the seal when the shaft is installed. Tap the shaft and bearing gently into the body and install the large snap ring.

CAUTION

This is a *right* hand rotation pump. Check the rotation of the cartridge before installing it in the pump. The direction of rotation arrow should point in a *clockwise* direction when the cartridge is viewed from the shaft end.

6. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the cover is installed.



The driver can be made from tubular stock machined to the above dimensions.

Figure 4B-22. Shaft Seal Driver

7. Install the cover and screws. Tighten the screws to 90 ± 5 foot-pounds (12.4 ± 0.7 m-kg).

INSTALLATION

Care must be exercised when installing a new or overhauled pump on the pump drive to prevent misalignment, which can lead to premature pump failure. Install a new or overhauled pump on the pump drive as follows:

1. Check the mounting flange on the pump drive, the pilot diameter on the pump, the splined coupling, and the splined driveshaft for burrs or imperfections that would prevent the pump from seating properly on the pump drive. Carefully remove any imperfections by lapping.

2. Apply a light coating of grease to the pilot diameter and driveshaft splines. Position the gasket on the pump.

3. Carefully install the pump on the pump drive, and install the mounting screws. Care should be exercised in tightening the mounting screws to prevent misalignment.

4. Reconnect the suction and outlet lines. Then turn the suction line valve to the open position.

5. Engage the pump drive and start the engine. Allow the engine to run at idle speed, with no load applied to the hydraulic system, to prime the pump. Then run the engine at moderate speed and load for a short period of time. Check the reservoir oil level and add oil if required.

DUAL PUMPS (41Z102 & 41Z103)

GENERAL

Dual hydraulic pumps 41Z102 is used to develop fluid flow for the operation of the main winch and boom telescope circuits, while dual pump 41Z103 provides flow for the operation of the swing and boom hoist circuits.

The pump illustration in figure 4B 23 is representative of the dual pumps. The pump consists principally of an outlet body, inlet housing, outlet cover, driveshaft and two pumping cartridges. The principal components of each cartridge are an elliptical cam ring, a slotted rotor splined to the driveshaft, a pressure plate, wear plate, and ten vanes fitted to the rotor dots.

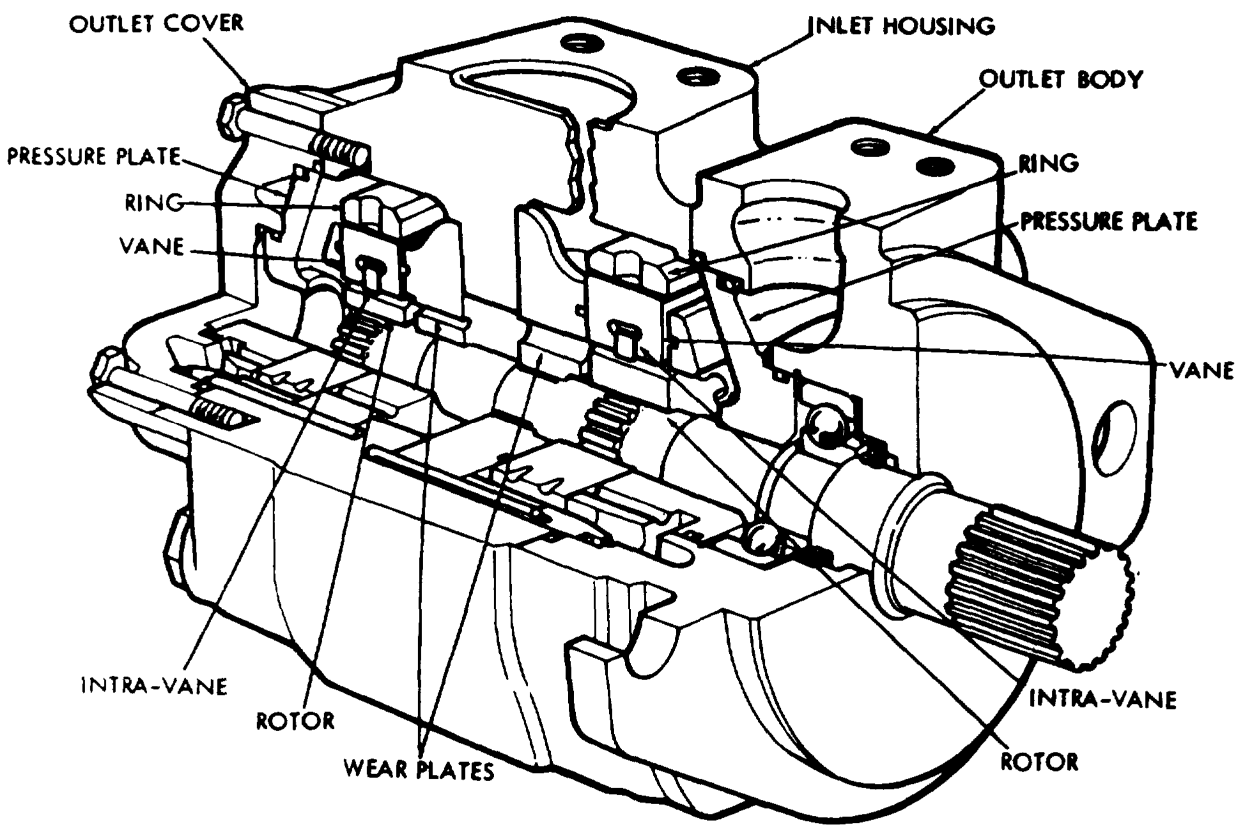


Figure 4B-23. Dual Pumps (41Z102 and 41Z103)

PRINCIPLES OF OPERATION

Fluid enters the pumping cartridge through the inlet port and is discharged through the pressure plates to the outlet ports. The action of the pumping cartridge is illustrated in Figure 4B-24.

The rotor is driven within the cam ring by the driveshaft, which is coupled to the pump drive. As the rotor turns, centrifugal force on the vanes, aided by under-vane pressure fed from the outlet port, causes them to follow the elliptical inner surface of the cam ring.

Radial movement of the vanes and turning of the rotor cause the chamber volume between the vanes to increase as the vanes pass the inlet section of the cam ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers.

This fluid is trapped between the vanes and carried past a sealing land to the outlet section of the cam ring. As the outlet section is approached, the chamber volume decreases and the fluid is forced out into the system.

The intra-vane design provides a means of controlling the outward thrust of the vane against the cam ring to maintain the tip loads within reasonable limits. In the intra-vane, cartridge, full system pressure is continuously applied for outward, vane thrust only over the area between the vane and insert. This area is small and thrust is correspondingly light. During vane travel through pressure areas, full system pressure is also applied against the bottom of the vane. The valving of pressure to and from the bottom area of the vane is through holes drilled in the rotor, as shown in Figure 4B-25. This selective application of pressure maintains the vane in constant radial hydraulic balance in all positions.

The cam ring is shaped so that the two pumping chambers are formed 180 degrees apart (see Figure 4B-24). Thus, opposing hydraulic forces which would impose side loads on the driveshaft cancel each other out.

The pressure plate seals the pump chamber as shown in Figure 4B-26. System pressure is effective against the area at the back of the plate, which is larger than the area exposed to the pumping cartridge. Thus, an unbalanced force holds the plate against the cartridge, sealing the cartridge and providing the proper running clearance for the rotor and vanes. The pressure plate also contains passages for feeding pressure to the space between the vanes and inserts.

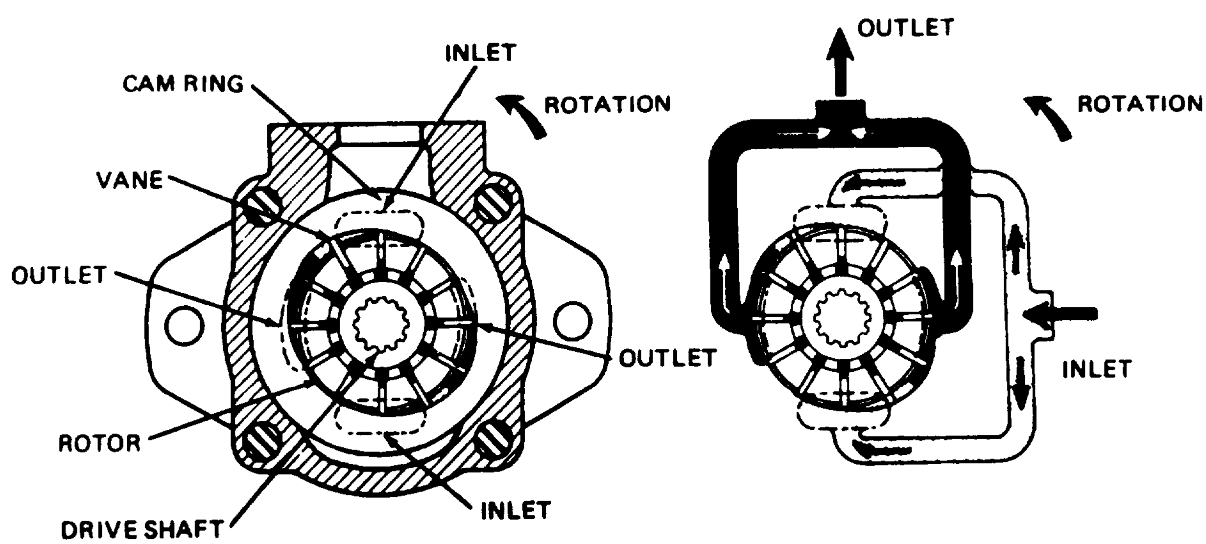


Figure 4B-24. Pump Cartridge Operation

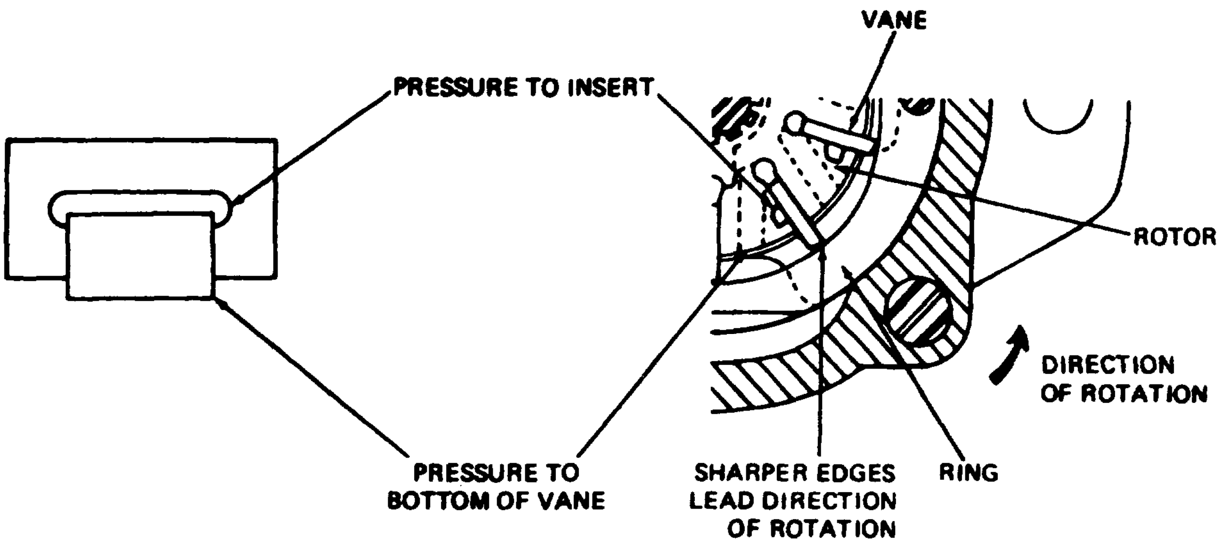


Figure 4B-25. Pressure Feed to Vanes

REMOVAL

To remove a pump from the pump drive, proceed as follows:

1. Turn the suction line valve to the closed position.

2. Disconnect the suction and outlet lines from the pump. Cap the lines and plug the pump ports to prevent the entry of foreign material into the pump or hydraulic system.

3. Block the pump in position against the pump drive so that it will not drop when the capscrews are removed. Remove the two capscrews securing the pump to the pump drive. Slide the pump back from the pump drive until the driveshaft is clear of the pump drive and remove the pump to a suitable repair area.

CARTRIDGE REPLACEMENT

GENERAL. Preassembled replacement cartridges are available for rapid field overhaul of these pumps. if a replacement cartridge, is being used, proceed as described below for disassembly and reassembly.

Figure 4B-27 shows the proper relationship of the parts for disassembly and reassembly. During disassembly, pay particular attention to identification of the parts for correct reassembly.

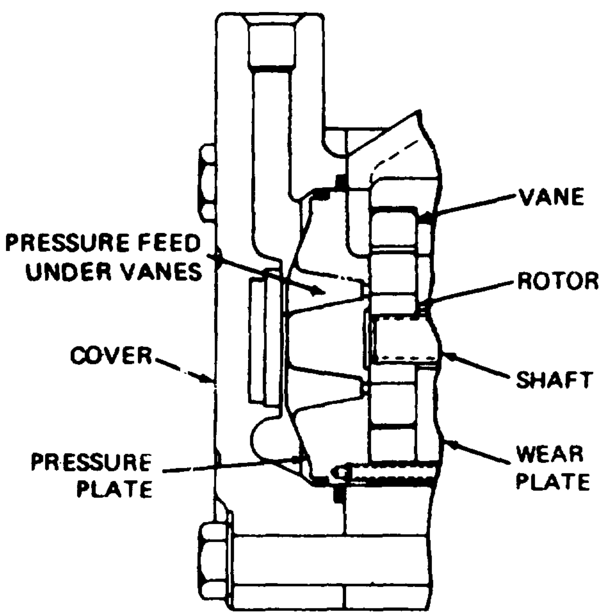
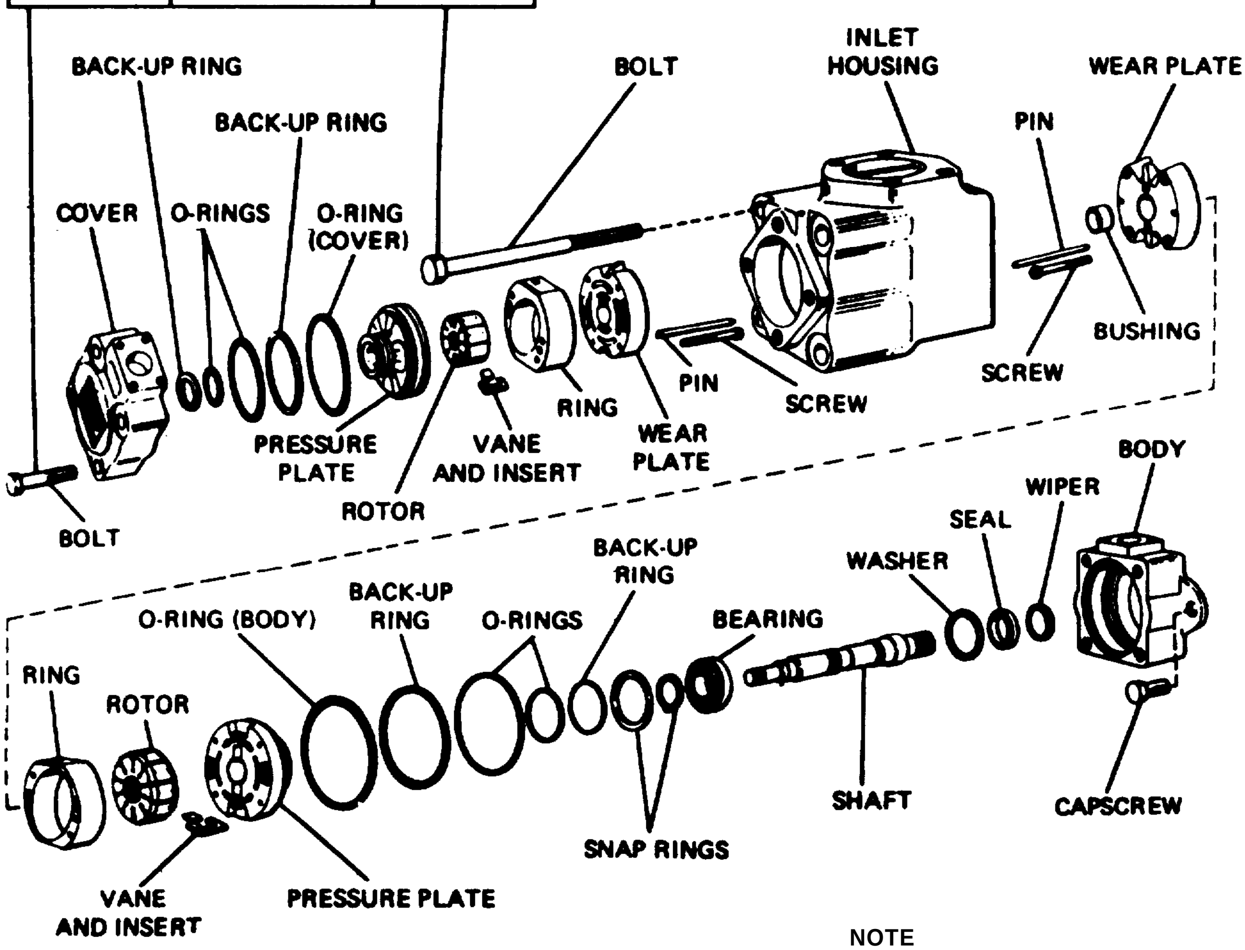


Figure 4B-26. Pressure Plate Operation

TORQUE SPECIFICATIONS		
FT. LBS. (m-kg)	PUMP	FT. LBS. (m-kg)
70 ± 5 (9.68 ± 0.7)	MAIN WINCH AND BOOM TELESCOPE	265 ± 10 (36.6 ± 1.4)
70 ± 5 (9.68 ± 0.7)	BOOM HOIST AND SWING	90 ± 5 (12.4 ± 0.7)



NOTE

A CARTRIDGE KIT CONSISTS OF A PRESSURE PLATE, ROTOR, VANE KIT AND INSERTS, RING WEAR PLATE, TWO PINS, AND TWO SCREWS.

Figure 4B-27. Exploded View of Dual Pump

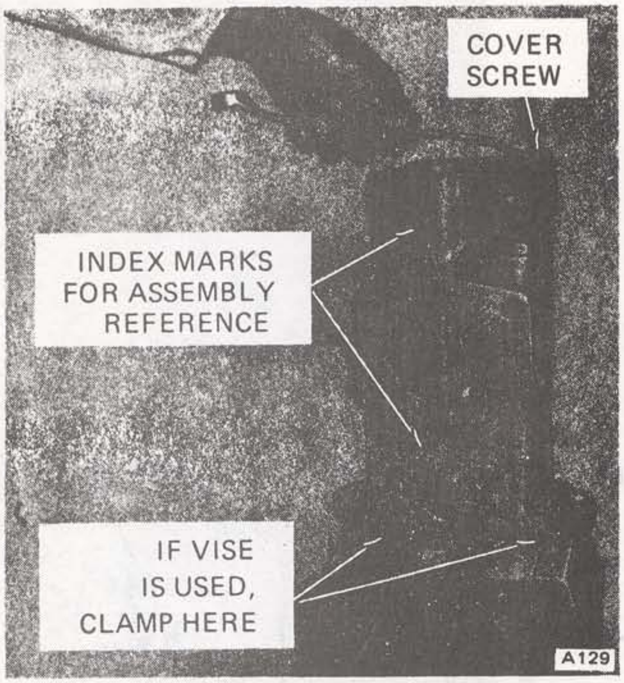


Figure 4B-28. Beginning Disassembly

DISASSEMBLY. Disassemble the pump, to replace the pumping cartridge, as follows:

1. Support the pump on blocks or clamp the body in a vise as shown in Figure 4B-28. If a vise is used, use *protective jaws* to avoid damage to the body and its machined surfaces.

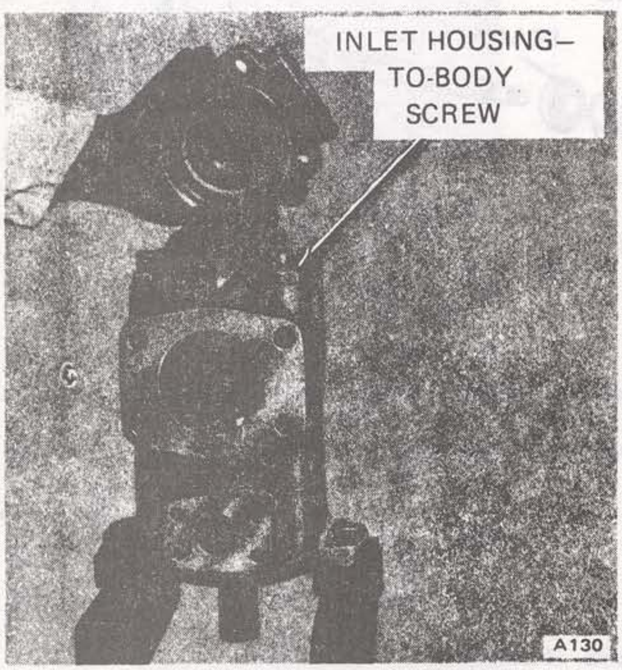


Figure 4B-29. Removing Pump Cover

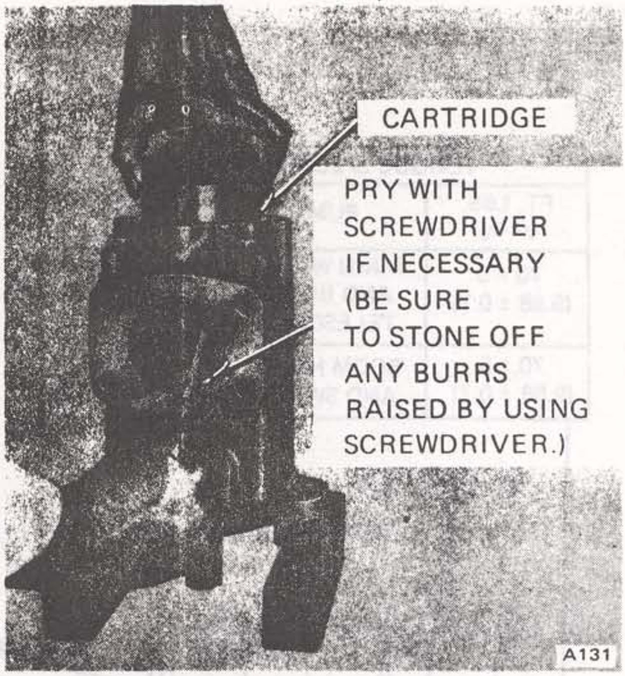


Figure 4B-30. Removing Cover End Cartridge

2. Mark the body, inlet housing and cover for correct reassembly. Remove the four cover screws and lift the cover off the pump. Remove the cover O-ring (see Figure 4B-29). Pull and/or pry out the cover end cartridge as shown in Figure 4B-30.

3. Next, remove the four screws attaching the inlet housing to the body. Lift off the inlet housing (see Figure 4B-31) and remove the body O-ring. Turn the drive shaft to free the cartridge and pull the cartridge from the body.

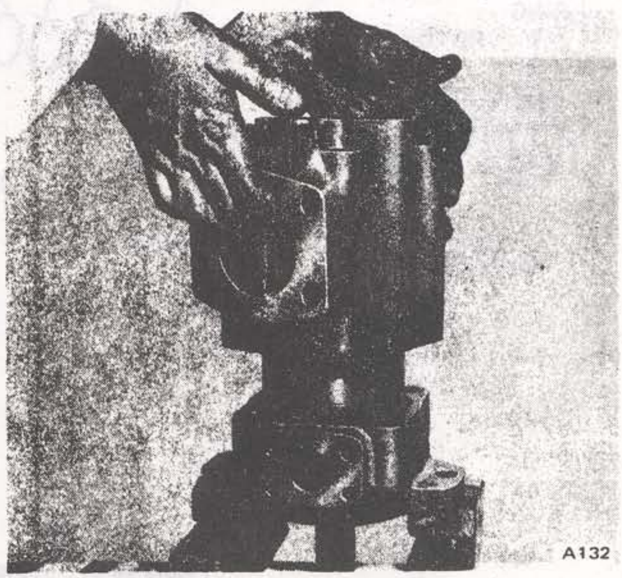


Figure 4B-31. Removing Inlet Housing

REASSEMBLY. Reassemble the pump, with a preassembled pumping cartridge, as follows:

1. Clamp the body in a vise or place it on blocks as at disassembly.

CAUTION

These are right hand rotation pumps. Check the rotation of the new cartridge before installing it in the pump. The direction of rotation arrow should point in a clockwise direction when the cartridge is viewed from the shaft end.

2. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the inlet housing is installed.

3. Place the inlet housing over the cartridge so the locating pins are properly engaged and the inlet is in the correct position with respect to the body outlet. Install the four screws and torque them to the values shown in Figure 4B-27.

4. Install the cover end cartridge, being certain the pins engage the inlet housing. Place the large back-up ring and O-ring on the pressure plate.

5. Install the small O-ring and back-up ring on the pressure plate hub. Install the cover O-ring in its groove. Install the cover and screws. Tighten the screws to the torque values shown in Figure 4B-27.

OVERHAUL

DISASSEMBLY. Use the following procedure in conjunction with Figure 4B-27 to completely disassemble the pump:

1. Support the pump on blocks or clamp the body. in a vise as shown in Figure 4B-28. If a vise is used, use protective jaws to avoid damage to the body and its machined surfaces.

2. Mark the body, inlet housing, and cover for correct reassembly. Remove the four cover screws and lift the cover off the pump. Remove the cover O-ring (see Figure 4B-29). Pull and/or pry out the cover end cartridge as shown in Figure 4B-30.

3. Next, remove the four screws attaching the inlet housing to the body. Lift off the inlet housing (see Figure 4B-31) and remove the body O-ring. Turn the driveshaft to free the cartridge and pull the cartridge from the body.

4. Remove the large snap ring and pull the driveshaft and bearing from the body. Drive the shaft seal and wiper out from the shaft end of the body. If it is necessary to remove the shaft bearing, first remove the small snap ring. Then press the shaft out of the bearing, while supporting the bearing inner race.

5. Remove the O-rings and back-up rings from the pressure plate. Remove the fillister head screws and lift off the wear plate. Note the position of the cam ring, rotor, and vanes to assure correct reassembly. Separate the cam ring, rotor, vanes, locating pins, and pressure plate.

INSPECTION AND REPAIR. Inspect and repair the following items :

1. Discard the shaft seal and all O-rings and back-up rings. Use a new gasket kit for reassembly. Wash the metal parts in clean mineral solvent, blow them dry with filtered, dehydrated air, and place them on a clean surface for inspection.

2. Check the wearing surfaces of the cartridge parts for scoring and excessive wear. Remove light score marks by lapping. Lubriting, Moly-Koteing or equivalent is desirable after lapping to prevent seizure during start-up. Replace any heavily scored or badly worn parts.

3. Inspect the vanes and inserts for burrs, wear, and excessive play in the rotor slots. Replace the rotor if the slots are worn.

4. Rotate the bearing while applying pressure to check for wear, looseness and pitted or cracked races.

5. Inspect the seal and bushing mating surfaces on the shaft for scoring or wear. Replace the shaft if marks cannot be removed by light polishing.

REASSEMBLY. Use the following procedure to reassemble the pump:

NOTE

Coat all parts except seals and back-up rings with clean hydraulic fluid to facilitate reassembly, and to provide initial lubrication. Use small amounts of petroleum jelly to hold the O-rings in place during reassembly.

1. Place the pressure plate on blocks as shown in Figure 4B-32. Place the rotor on the pressure plate with the arrow pointed in the correct direction for *right* hand rotation. Install the locating pins.

NOTE

The direction of rotation is as viewed from the shaft end. *Right hand rotation is clockwise.*

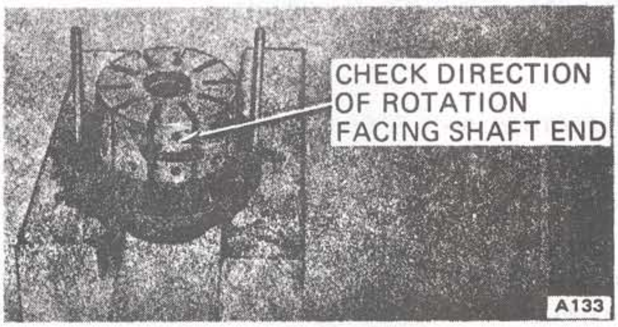


Figure 4B-32. Installing Rotor

2. Position the cam ring over the pins and rotor, again observing the rotation arrow (see Figure 4B-33). Place the inserts in the vanes and install both in the rotor slots. Be sure the sharp edges are toward the direction of rotation, and that both vanes and inserts move freely in the slots (see Figure 4B-34). Install the wear plate and screws.

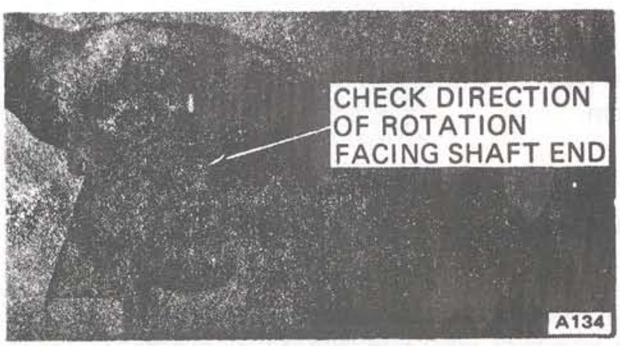


Figure 4B-33. Installing Ring

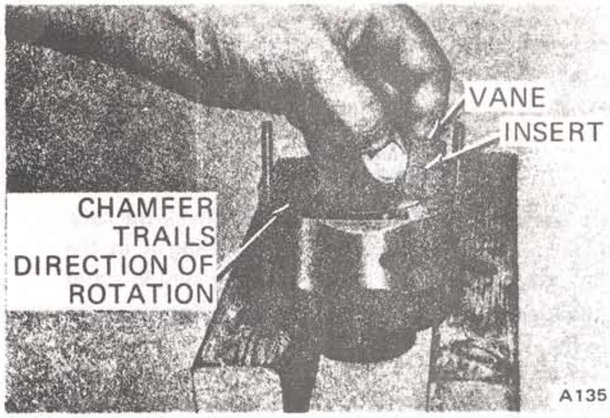
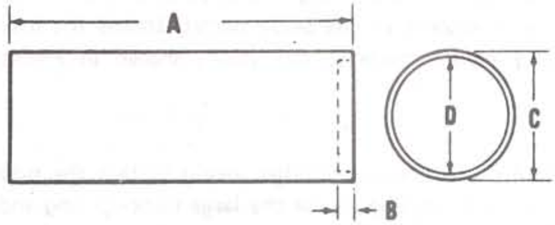


Figure 4B-34. Installing Vanes and Inserts

3. Soak a new shaft wiper in hydraulic fluid and install the wiper and seal in the body. Use the seal installation tool shown in Figure 4B-35 to prevent damaging the seal. Be sure the seal O.D. is below the chamfer in the body.



PUMP	LENGTH A INCHES (mm)	UNDERCUT B INCHES (mm)	O.D. C INCHES (mm)	I.D. D INCHES (mm)
Main winch and boom telescope	3-3/4 (9.52)	7/16 (1.11)	2-7/32 (5.63)	1-29/32 (4.84)
Boom hoist and swing	3-1/4 (8.25)	1/4 (0.63)	1-25/32 (4.52)	1-11/16 (4.29)
The driver can be made from tubular stock machined to the above dimensions.				

Figure 4B-35. Shaft Seal Driver

4. Clamp the body in a vise or place it on blocks as at disassembly. Install the washer against the seal.

5. Press the shaft into the bearing in an arbor press, while supporting the inner race of the bearing. Install the small snap ring. Tape the shaft splines and cover the tape with grease or petroleum jelly to protect the seal when the shaft

is installed. Tap the shaft and bearing gently into the body and install the large snap ring.

CAUTION

These are right hand rotation pumps. Check the rotation of the cartridge before installing it in the pump. The direction of rotation arrow should point in a clockwise direction when the cartridge is viewed from the shaft end.

6. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the inlet housing is installed.

7. Place the inlet housing over the cartridge so the locating pins are properly engaged and the inlet housing is in the correct position with respect to the body outlet. Install the four screws and torque them to the values shown in Figure 4B-27.

8. Install the cover end cartridge, being certain the pins engage the housing and that cartridge rotation is correct. Place the large back-up ring and O-ring on the pressure plate.

9. Install the small O-ring and back-up ring on the pressure plate hub. Install the cover O-ring in its groove. Install the cover and screws, and tighten the screws to the torque values shown in Figure 4B-27.

INSTALLATION

Care must be exercised when installing a new or overhauled pump on the pump drive to prevent misalignment, which can lead to premature pump failure. Install a new or overhauled pump on the pump drive as follows:

1. Check the mounting flange on the pump drive, the pilot diameter on the pump, the splined coupling, and the splined driveshaft for burrs or imperfections that would Prevent the pump from seating properly on the pump drive. Carefully remove any imperfections by lapping.

2. Apply a light coating of grease to the pilot diameter and drivesheft splines. Position the gasket on the pump.

3. Carefully install the pump on the pump drive, and install the mounting screws. Care should be exercised in tightening the mounting screws to prevent misalignment.

4. Reconnect the suction and outlet lines. Then turn the suction line valve to the open position.

5. Engage the pump drive and start the engine. Allow the engine to run at idle speed, with no load applied to the hydraulic system to prime the pump. Then run the engine at moderate speed and load for a short period of time. Check the reservoir oil level and add oil if required.

SINGLE PUMP (41Z104)

GENERAL

Single hydraulic pump 41Z104 is used to develop fluid flow for the operation of the auxiliary winch.

The pump illustrated in Figure 4B-36 is representative of the single pump. The pump consists principally of an inlet cover, outlet body, driveshaft and pumping cartridge. The principal components of the cartridge are en elliptical cam ring, a slotted rotor splined to the driveshaft, a pressure plate, wear plate, and ten vanes and inserts fitted to the rotor slots.

PRINCIPLES OF OPERATION

Fluid enters the pumping cartridge through the inlet port end is discharged through the pressure plate to the outlet port. The action of the pump cartridge is illustrated in Figure 4B-37.

The rotor is driven within the cam ring by the driveshaft, which is coupled to the pump drive. As the rotor turns, centrifugal force on the vanes, aided by under-vane pressure fed from the outlet port, causes them to follow the elliptical inner surface of the cam ring.

Radial movement of the vanes and turning of the rotor cause the chamber volume between the vanes to increase as the vanes pass the inlet section of the cam ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers.

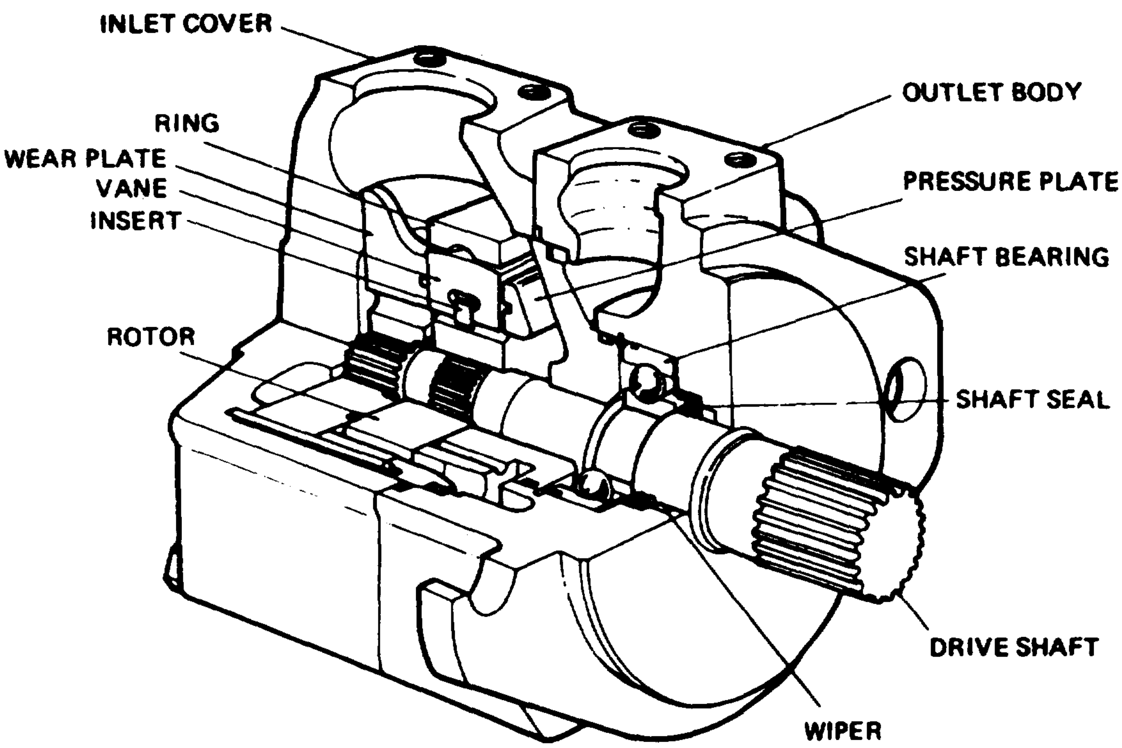


Figure 4B-36. Single Pump (41Z57)

This fluid is trapped between the vanes and carried pest a sealing land to the outlet section of the cam ring. As the outlet section is approached, the chamber volume decreases and the fluid is forced out into the system.

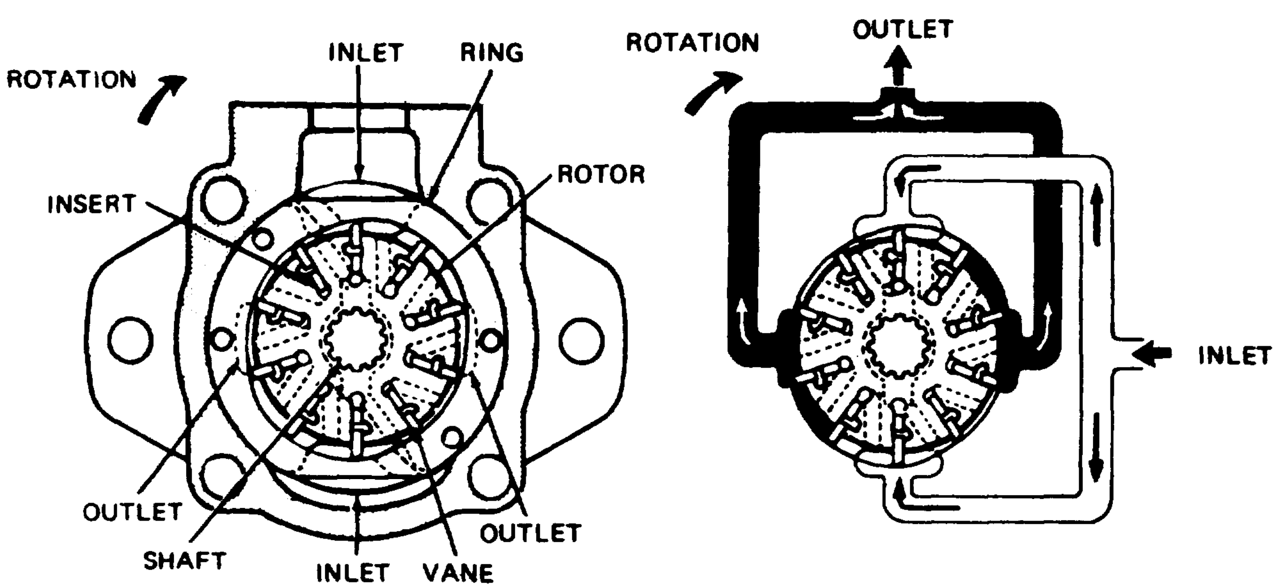


Figure 4B-37. Pump Cartridge Operation

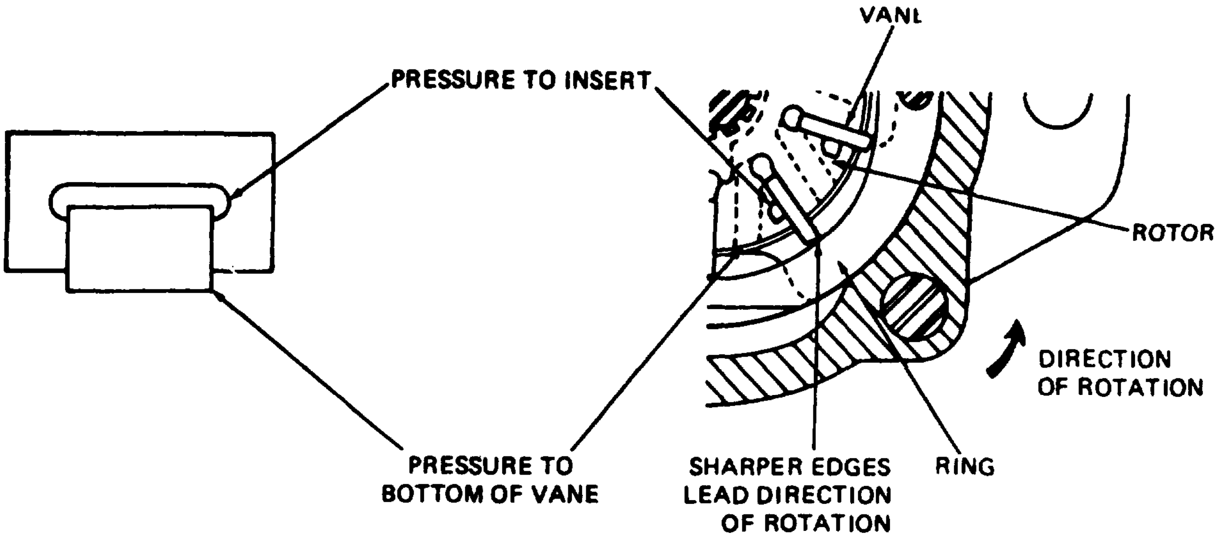


Figure 4B-38. Pressure Feed to Vanes

The intra-vane design provides a means of controlling the outward thrust of the vane against the cam ring to maintain the tip loads within reasonable limits. In the intra-vane cartridge, full system pressure is continuously applied for outward vane thrust only over the area between the vane and insert. This area is smell and thrust is correspondingly light. During vane travel through pressure areas, full system pressure is also applied against the bottom of the vane. The valving of pressure to and from the bottom area of the vane is through holes drilled in the rotor, as shown in Figure 4B-38. This selective application of pressure maintains the vane in constant radial hydraulic balance in all positions.

The cam ring is shaped so that the two pumping chambers are formed 180 degrees apart (see Figure 4B-27). Thus, opposing hydraulic forces which would impose side loads on the driveshaft cancel each other out.

The pressure plate seals the pump chamber as shown in Figure 4B-39. System pressure is effective against the area at the back of the plate, which is larger then the area exposed to the pumping cartridge. Thus, an unbalanced force holds the plate against the cartridge, sealing the cartridge and providing the proper running clearance for the rotor and vanes. The pressure plate also contains passages for feeding pressure to the space between the vanes and inserts.

REMOVAL

To remove a pump from the pump drive, proceed as follows:

1. Turn the suction line valve to the closed position.

2. Disconnect the suction and outlet lines from the pump. Cap the lines and plug the pump ports to prevent the entry of foreign material into the pump or hydraulic system.

3. Block the pump in position against the pump drive so that it will not drop when the capscrews are removed. Remove the two capscrews securing the pump to the pump drive. Slide the pump beck from the pump drive until the driveshaft is clear of the pump drive, and remove the pump to a suitable repair area.

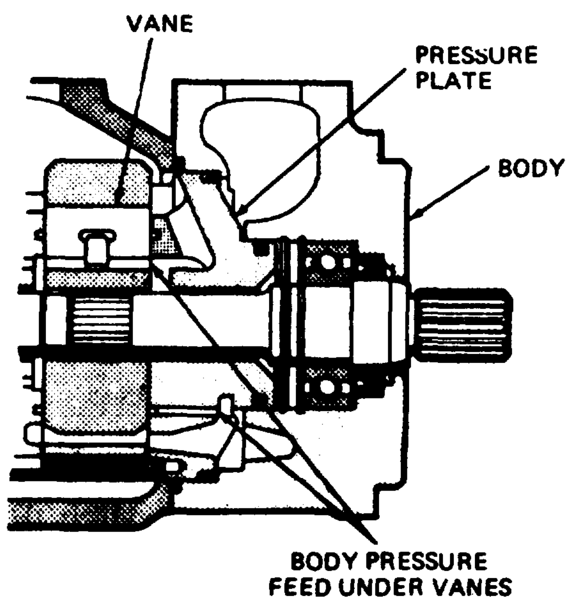


Figure 4B-39. Pressure Plate Operation

CARTRIDGE REPLACEMENT

GENERAL. Preassembled replacement cartridges are available for rapid field overhaul of these pumps. If a replacement cartridge is being used, proceed as described below for disassembly and reassembly.

Figure 4B-40 shows the proper relationship of the parts for disassembly and reassembly. During disassembly, pay particular attention to identification of the parts for correct reassembly.

DISASSEMBLY. Disassemble the pump to replace the pumping cartridge, as follows:

1. Support the pump on blocks or clamp the body in a vise If a vise is used, use protective to avoid damage to the body and its machined surfaces.

2. Mark the body and cover for correct reassembly. Remove the four cover screws and lift the cover off the pump. Remove the cover O-ring. Pull and/or pry out the cartridge.

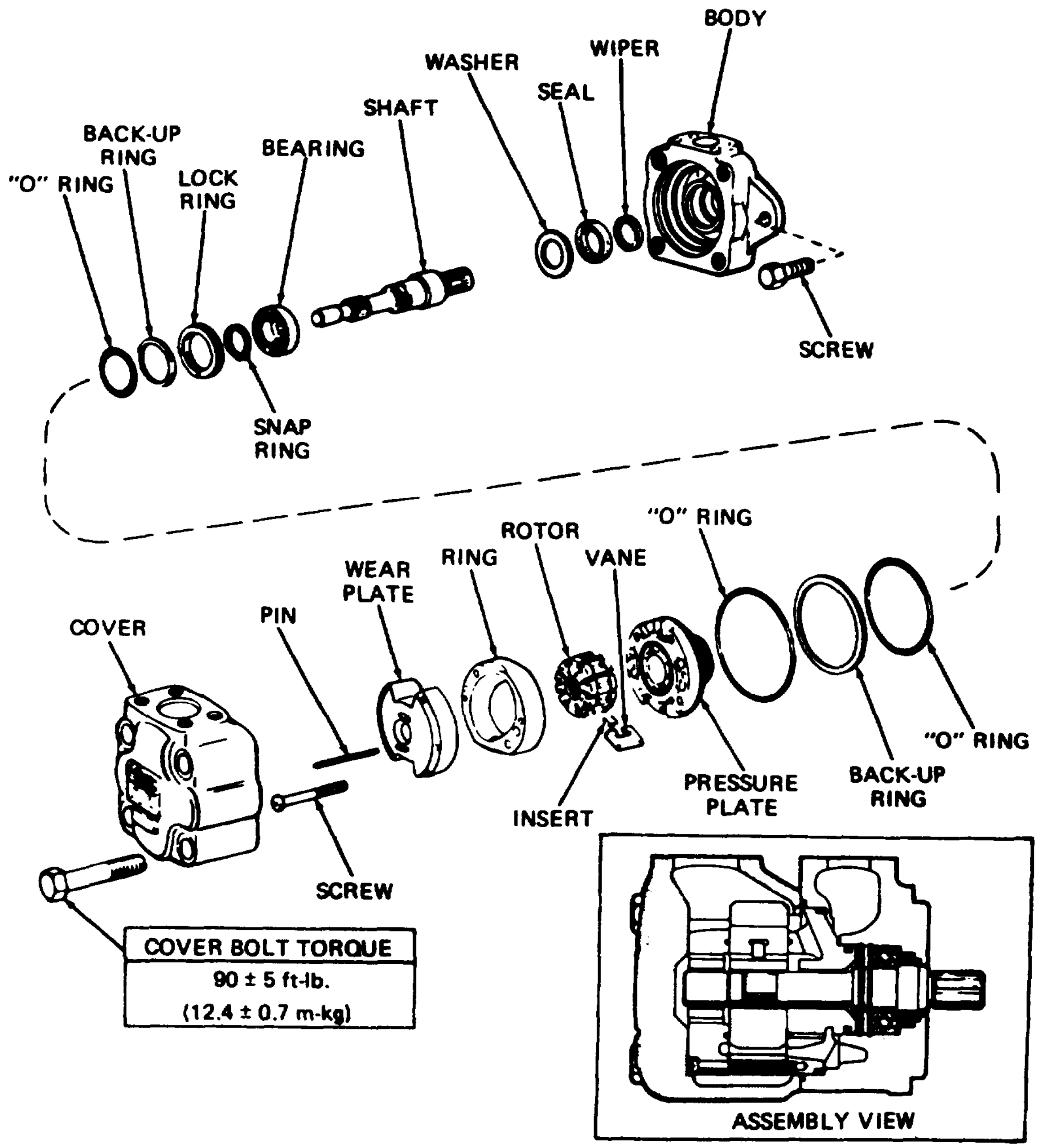


Figure 4B-40. Exploded View of Single Pump

REASSEMBLY. Reassemble the pump, with a pre-assembled pumping cartridge, as follows:

1. Clamp the body in a vise or place it on blocks as at disassembly.

CAUTION

This is a *left* hand rotation pump. Check the rotation of the new cartridge before installing it in the pump. The direction of rotation arrow should point in a *counterclockwise* direction when the cartridge is viewed from the shaft end.

2. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the cover is installed.

3. Install the cover and screws. Tighten the screws to 90 ± 5 foot-pounds (17.4 ± 0.7 m-kg).

OVERHAUL

DISASSEMBLY. Use the following procedure in conjunction with Figure 4B-40 to completely disassemble the pump:

1. Support the pump on blocks or clamp the body in a vise. If a vise is used, use *protective jaws* to avoid damage to the body and its machined surfaces.

2. Mark the body and cover for correct reassembly. Remove the four cover screws and lift the cover off the pump. Remove the cover O-ring. Pull and/or pry out the cartridge.

3. Remove the large snap ring and pull the driveshaft and bearing from the body. Drive the shaft seal and wiper out from the shaft end of the body. If it is necessary to remove the shaft bearing, first remove the small snap ring. Then press the shaft out of the bearing, while supporting the bearing inner race.

4. Remove the O-rings and back-up rings from the pressure plate. Remove the fillister head screws and lift off the wear plate. Note the position of the cam ring, rotor, and vanes to assure correct reassembly. Separate the cam ring, rotor, vanes, locating pins, and pressure plate.

INSPECTION AND REPAIR. Inspect and repair the following items:

1. Discard the shaft seal and all O-rings and back-up rings. Use a new gasket kit for reassembly. Wash the metal parts in clean mineral solvent, blow them dry with filtered, dehydrated air, and place them on a clean surface for inspection.

2. Check the wearing surfaces of the cartridge parts for scoring and excessive wear. Remove light score marks by lapping. Lubriting, Moly-Koteing or equivalent is desirable after lapping to prevent seizure during start-up. Replace any heavily scored or badly worn parts.

3. Inspect the vanes and inserts for burrs, wear, and excessive play in the rotor slots. Replace the rotor if the slots are worn.

4. Rotate the bearing while applying pressure to check for wear, looseness and pitted or cracked races.

5. Inspect the seal and bushing mating surfaces on the shaft for scoring or wear. Replace the shaft if marks cannot be removed by light polishing.

REASSEMBLY. Use the following procedure to reassemble the pump:

NOTE

Coat all parts except seals and back-up rings with clean hydraulic fluid to facilitate reassembly, and to provide initial lubrication. Use small amounts of petroleum jelly to hold the O-rings in place during reassembly.

1. Place the pressure plate on blocks as shown in Figure 4B-41. Place the rotor on the pressure plate with the arrow pointed in the correct direction for right hand rotation. Install the locating pins.

NOTE

The direction of rotation is as viewed from the shaft end. *Left hand rotation is counterclockwise.*

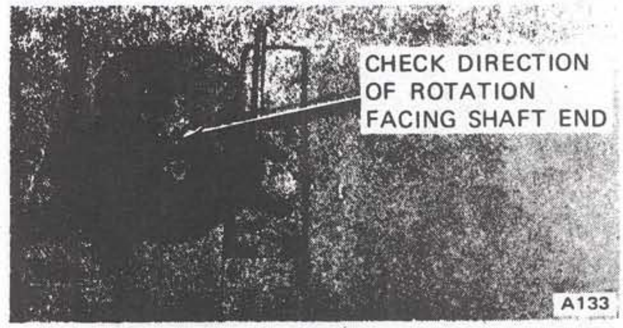


Figure 4B-41. Installing Rotor

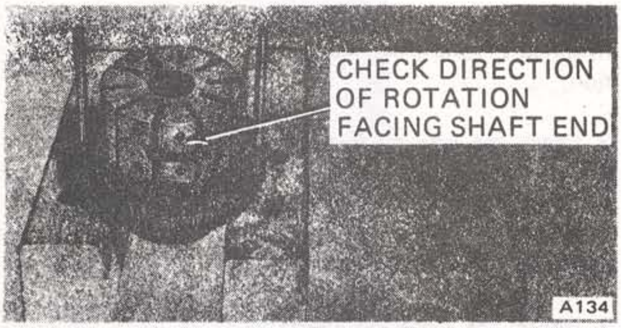


Figure 4B-42. Installing Ring

2. Position the cam ring over the pins and rotor, again observing the rotation arrow (see Figure 4B-42). Place the inserts in the vanes and install both in the rotor slots. Be sure the sharp edges are toward the direction of rotation, and that both vanes and inserts move freely in the slots (see Figure 4B-43). Install the wear plate and screws.

3. Soak a new shaft wiper in hydraulic fluid and install the wiper and seal in the body. Use the seal installation tool shown in Figure 4B-44 to prevent damaging the seal. Be sure the seal O.D. is below the chamfer in the body.

4. Clamp the body in a vise or place it on blocks as at disassembly. Install the washer against the seal.

5. Press the shaft into the bearing in an arbor press, while supporting the inner race of the bearing. Install the small snap ring. Tape the shaft splines and cover the tape with grease or petroleum jelly to protect the seal when the shaft is installed. Tap the shaft and bearing gently into the body and install the large snap ring.

CAUTION

This is a *left* hand rotation pump. Check the rotation of the cartridge before installing it in the pump. The direction of rotation arrow should point in a *counter-clockwise* direction when the cartridge is viewed from the shaft end.

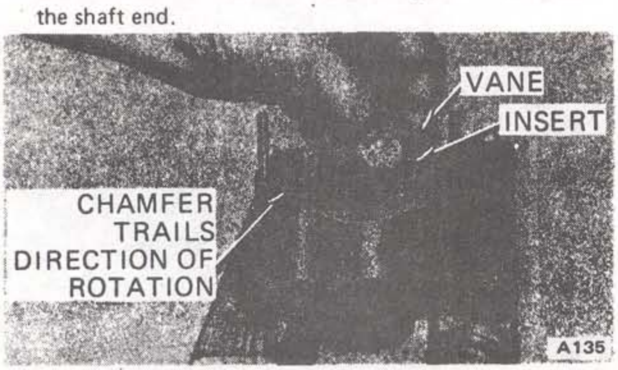
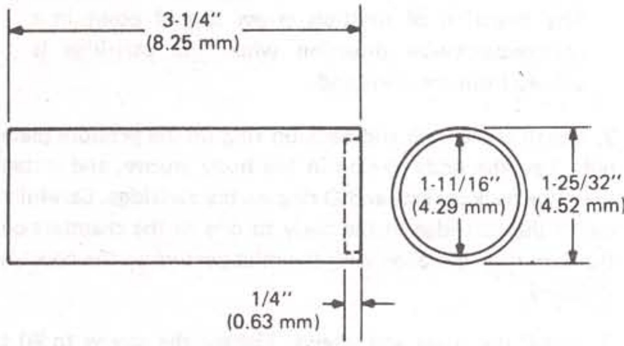


Figure 4B-43. Install Vanes and Inserts

6. Install the O-ring and back-up ring on the pressure plate hub. Lay the body O-ring in the body groove, and install the large back-up ring and O-ring on the cartridge. Carefully install the cartridge in the body so one of the chamfers on the cam ring will align with the inlet port when the cover is installed.

7. Install the cover and screws. Tighten the screws to 90 ± 5 foot-pounds (12.4 ± 0.7 m-kg).



The driver can be made from tubular stock machined to the above dimensions.

Figure 4B-44. Shaft Seal Driver

INSTALLATION

Care must be exercised when installing a new or overhauled pump on the pump drive to prevent misalignment, which can lead to premature pump failure. Install a new or overhauled pump on the pump drive as follows:

1. Check the mounting flange on the pump drive, the pilot diameter on the pump, the splined coupling, and the splined driveshaft for burrs or imperfections that would prevent the pump from seating properly on the pump drive. Carefully remove any imperfections by lapping.

2. Apply a light coating of grease to the pilot diameter and driveshaft splines. Position the gasket on the pump.

3. Carefully install the pump on the pump drive, and install the mounting screws. Care should be exercised in tightening the mounting screws to prevent misalignment.

4. Reconnect the suction and outlet lines. Then turn the suction line valve to the open position.

5. Engage the pump drive and start the engine. Allow the engine to run at idle speed, with no load applied to the hydraulic system, to prime the pump. Then run the engine at moderate speed and load for a short period of time. Check the reservoir oil level and add oil if required.

SUB-SECTION 4C
ROTARY JOINTS

ROTARY JOINT (979J24)

GENERAL. The rotary joint is mounted on the center of the upper, and is the means by which the hydraulic and electrical circuits in the upper are connected to their respective circuits in the carrier.

The hydraulic swivel consists of an outerbody fixed to the deck of the revolving frame and an inner stem fixed to the carrier deck. This arrangement allows the upper to rotate on the carrier without breaking a hydraulic connection.

The electrical swivel consists of a set of fixed circular conductors and a set of collectors that make contact with the conductors. The conductors are connected to the inner stem of the hydraulic swivel so that the conductors will rotate with the hydraulic swivel whenever the upper is rotated. This maintains a continuous electrical connection between the upper and carrier, regardless of the position of the upper.

REMOVAL. The rotary joint must be removed to perform any repairs. Remove the rotary joint as follows (see Figure 4C-1):

1. Disconnect the wound cable from the battery.

2. Tag and disconnect the electrical wires in the junction box at the top of the hydraulic swivel.

3. Disconnect and remove the throttle cable. Loosen the setscrews in the collar at the bottom of the junction box, and remove the junction box.

4. Tag and remove the hydraulic lines attached to the outer body of the swivel.

5. Tag and remove the hoses attached to the O-ring elbow fittings in the lower portion of the inner stem.

6. Working either up from below the carrier or down through the opening in the revolving frame, remove the O-ring elbow fittings from the lower portion of the inner stem.

7. Remove the two capscrews which connect the collector assembly to the bottom of the hydraulic swivel.

8. Remove the capscrews and lockwashers securing the hydraulic swivel to the revolving frame deck. Then carefully

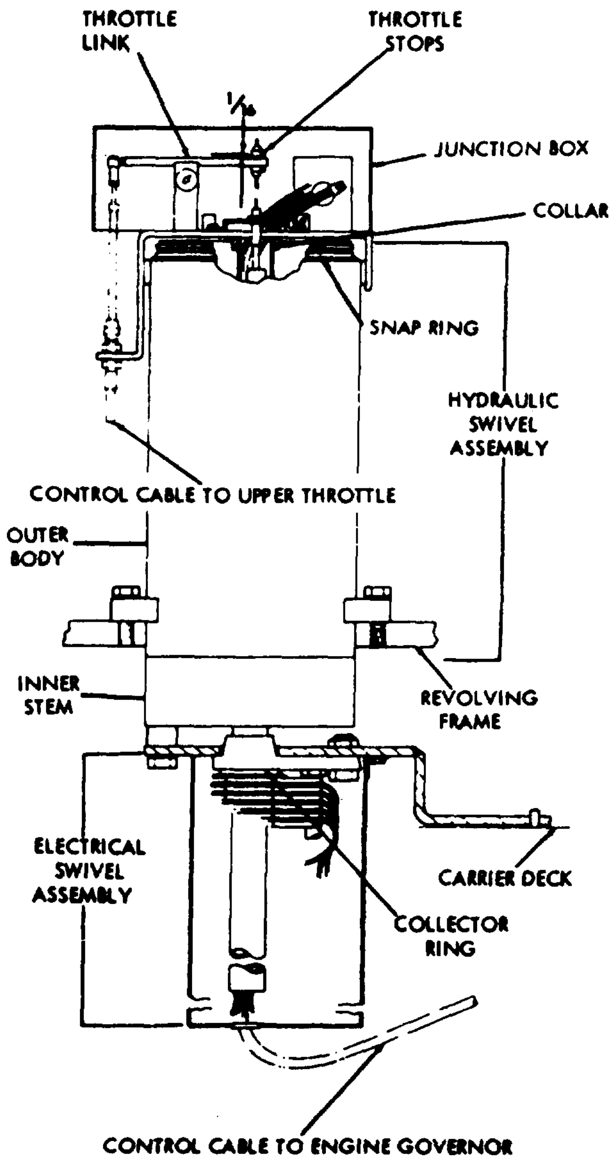


Figure 4C-1. Rotary Joint (979J24)

lift the hydraulic swivel straight up until it clears the stem of the collector, and remove the hydraulic swivel to a suitable repair area.

OVERHAUL. Overhaul of the rotary joint consists only of seal replacement. To replace the rotary joint seals, proceed as follows (see Figure 4C-1):

1. Remove the snap ring at the top of the hydraulic rotary joint.

2. Carefully remove the outer body from the inner stem.

3. The outer body bore should be thoroughly washed with a suitable cleaning solvent or diesel fuel, and inspected for signs of scoring or deep scratches. If excessive scoring or deep scratches are found, the entire rotary joint should be replaced.

NOTE

Excessive scoring or deep scratches are usually caused by foreign material in the hydraulic system. If these defects are found, the hydraulic system should be checked for foreign material.

4. The inner stem should be thorougly washed with a suitable solvent or diesel fuel. The teflon seals should then be inspected for deep scratches or severe damage.

NOTE

The teflon seals and the loading O-rings under the seals should not be removed unless the seals show signs of deep scratches or severe damage, since removal of these seals will damage them beyond use.

In the event a seal must be replaced, use the following procedure:

A. Generously lubricate the spool with clean hydraulic oil.

B. Carefully install a new loading O-ring in the seal groove.

C. Walk a new seal into place in the same manner the bead of a tire is walked onto a wheel rim.

D. Knead the seal by hand to squeeze it into the seal groove.

5. Generously lubricate the outer body bore and inner stem with clean hydraulic oil.

6. Place the outer body in a vertical position with the bottom of the body up. Insert the top of the inner stem into the body bore, and while the stem is being lowered into the body compress the teflon seals by hand as they enter the bore.

7. Turn the assembly over, and install the retaining snap ring.

INSTALLATION. To install a rotary joint that has been removed from the machine, proceed as follows:

1. Carefully install the hydraulic swivel over the collector stem. Position the swivel so that port #4 on the Inner stem is facing toward the front of the carrier. Then install the capscrews which connect the collector assembly to the bottom of the swivel.

2. Turn the outer body as required to position the swivel with the ports facing the rear of the revolving frame. Install the capscrews and lockwashers which secure the swivel to the revolving frame deck.

3. Install the O-ring elbow fittings on the lower portion of the inner stem.

4. Attach the hoses to the O-ring fittings on the lower portion of the inner stem.

5. Reconnect the hydraulic lines to the outer body of the swivel.

6. Install the junction box on the top of the swivel, and tighten the setscrews in the collar at the bottom of the junction box.

7. Reconnect the throttle cable and electrical wires.

9. Reconnect the ground cable to the battery. Then start the engine and check for leakage while opearating all machine functions.

ROTARY JOINT (979J30)

GENERAL. The rotary joint is mounted on the center of the upper, and is the means by which the hydraulic and electrical circuits in the upper are connected to their respective circuit in the carrier.

The hydraulic swivel consists of an outer body fixed to the deck of the revolving frame and an inner stem fixed to the carrier deck. This arrangement allows the upper to rotate on the carrier without breaking a hydraulic connection.

The electrical swivel consists of a set of fixed circular conductors and a set of collectors that make contact with the conductors. The conductors are connected to the inner stem of the hydraulic swivel so that the conductors will rotate with the hydraulic swivel whenever the upper is rotated. This maintains a continuous electrical connection between the upper and carrier, regardless of the position of the upper.

REMOVAL. The rotary joint must be removed to perform any repairs. Remove the rotary joint as follows (see Figure 4C-2):

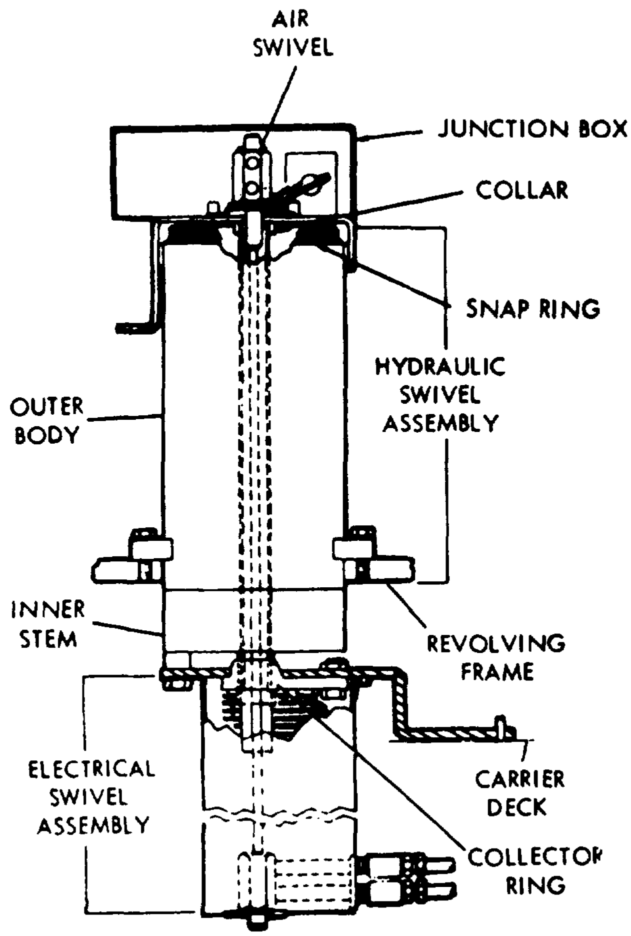


Figure 4C-2. Rotary Joint (979J30)

1. Disconnect the ground cable from the battery.

2. Tag and disconnect the electrical wires in the junction box at the top of the hydraulic swivel.

3. Remove the upper snap ring on the air swivel, and remove the outer body of the swivel. Remove the lower snap ring and thrust washer.

4. Loosen the setscrews in the collar at the bottom of the junction box, and remove the junction box.

5. Tag and remove the hydraulic lines attached to the outer body of the swivel.

6. Tag and remove the hoses attached to the O-ring elbow fittings in the lower portion of the inner stem.

7. Working either up from below the carrier or down through the opening in the revolving frame, remove the O-ring elbow fitting, from the lower portion of the inner stem.

8. Remove the two capscrews which connect the collector assembly to the bottom of the hydraulic swivel.

9. Remove the capscrews and lockwashers securing the hydraulic swivel to the revolving frame deck. Then carefully lift the hydraulic swivel straight up until it clears the stem of the collector, and remove the hydraulic swivel to a suitable repair area.

OVERHAUL. Overhaul of the rotary joint consists only of seal replacement. To replace the rotary joint seals, proceed as follows (see Figure 4C-2):

1. Remove the snap ring at the top of the hydraulic rotary joint.

2. Carefully remove the outer body from the inner stem.

3. The outer body bore should be thoroughly washed with a suitable cleaning solvent or diesel fuel, and inspected for signs of scoring or deep scratches. If excessive scoring or deep scratches are found, the entire rotary joint should be replaced.

NOTE

Excessive scoring or deep scratches are usually caused by foreign material in the hydraulic system. If these defects are found the hydraulic system should be checked for foreign material.

4. The inner stem should be thoroughly washed with a suitable solvent or diesel fuel. The teflon seals should then be inspected for deep scratches or severe damage.

NOTE

The teflon seals and the loading O-rings under the seals should not be removed unless the seals show signs of deep scratches or severe damage, since removel of these seals will damage them beyond use.

In the event a seal must be replaced, use the following procedure:

A. Generously lubricate the spool with clean hydraulic oil.

B. Carefully install a new loading O-ring in the seal groove.

C. Walk a new seal into place in the same manner the bead of a tire is walked onto a wheel rim.

D. Knead the seal by hand to squeeze it into the seal groove.

5. Generously lubricate the outer body bore and inner stem with clean hydraulic oil.

6. Place the outer body in a vertical position with the bottom of the body up. Insert the top of the inner stem into the body bore, and while the stem is being lowered into the body compress the teflon seals by hand as they enter the bore.

7. Turn the assembly over, and install the retaining snap ring.

INSTALLATION. To install a rotary joint that has been removed from the machine, proceed as follows:

1. Carefully install the hydraulic swivel over the collector stem. Position the swivel so that port #4 on the inner stem is facing toward the front of the carrier. Then install the capscrews which connect the collector assembly to the bottom of the swivel.

2. Turn the outer body as required to position the swivel with the ports facing the rear of the revolving frame. Install the capscrews and lockwashers which secure the swivel to the revolving frame deck.

3. Install the O-ring elbow fitting, on the lower portion of the inner stem.

4. Attach the hoses to the O-ring fittings on the lower portion of the inner stem.

5. Reconnect the hydraulic lines to the outer body of the swivel.

6. Install the junction box on the top of the swivel, and tighten the setscrews in the collar at the bottom of the junction box.

7. Install the thrust washer and lower snap ring on the air swivel stem. Lubricate the swivel bore, and carefully install it on the stem. Be sure the ‘X” ring seals do not extrude or twist when the outer body of the swivel is installed. Install the upper snap ring.

8. Reconnect the electrical wires in the junction box.

9. Reconnect the ground cable to the battery. Then start the engine and check for leakage while operating all machine functions.

SUB-SECTION 4D
CONTROL VALVES

CONTROL VALVE (36Z724)

DESCRIPTION

Control valve 36Z724 is used to control the operation of the swing and auxiliary winch motors. This is a four-way, spring centered directional control valve. The valve is a balanced sliding spool type with open-center circuitry, which allows free flow from inlet to outlet when the spool is in the neutral position. The operation of the valve is illustrated in Figure 4D-1.

A main relief valve is provided to limit circuit pressure to a preset maximum. When the circuit is operating at less than the relief valve setting, there is no flow over the by-pass orifice of the relief valve, so full circuit pressure is sensed at the spring end of the valve, as well as the opposite end. The valve is thus hydraulically balanced end the large spring holds it closed.

Maximum circuit pressure is determined by the small spring inside the relief valve assembly. When circuit pressure is high enough to overcome this small spring, the poppet inside the assembly is forced off its seat. Fluid immediately flows past the poppet to the tank passage. This flow creates a pressure drop across the sensing orifice and the relief valve is no longer hydraulically balanced. When this pressure differential is great enough to overcome the large spring, the valve shifts, permitting flow to the tank passage.

RELIEF VALVE ADJUSTMENT

The setting of the main relief valve is determined by a spring installed in the relief valve at the factory, and no provisions have been made to adjust this relief valve.

TROUBLESHOOTING

Table 4D-1 lists the difficulties which may be experienced

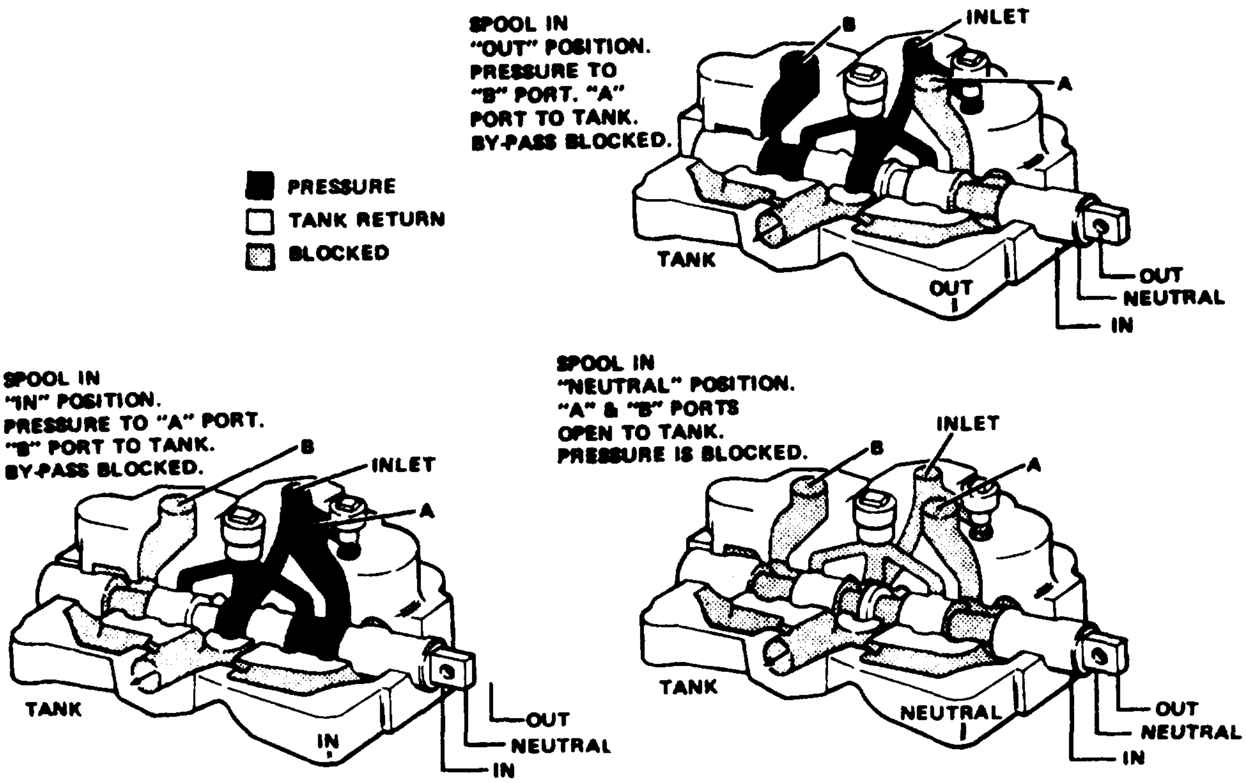


Figure 4D-1. Control Valve Operation (36Z724)

TABLE 4D-1
TROUBLE, CAUSE AND REMEDY CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks at either end of spool.	Defective O-rings in valve body.	Replace O-rings.
Spring-centered spools do not return to neutral.	Broken springs.	Replace springs.
	Foreign particles.	Clean system and valve.
	Misalignment of operating linkage.	Check linkage for binding condition.
No motion, slow or jerky action of hydraulic system.	Relief valve not properly set, or stuck in base and/or worn.	Repair, clean and readjust.
	Dirt or foreign particles lodged between relief valve control poppet and seat.	Disassemble, clean and reassemble.
	Spool not moved to full stroke.	Check travel.
No relief valve action (High Pressure).	Small particle of dirt plugging orifice in relief valve subassembly.	Remove relief valve and check hole. If blocked, clear hole.
Load will not hold.	Oil by-passing between spool and body.	Replace valve.
	Oil by-passing piston in cylinder.	Repair or replace cylinder.
	Spool not centered.	Refer to above spool remedies,

with the valve and hydraulic system. It indicates the cause and remedy for each of the troubles listed. It should always be remembered that pressure and delivery are factors which are usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnosing improper valve operation.

OVERHAUL

GENERAL. Overhaul of this valve is limited to the replacement of the relief valve assembly and seals. Replace the complete valve when the required overhaul is beyond these limitations.

During disassembly, particular attentions should be given to identification and orientation of parts for reassembly. The spool is selectively fitted to the valve body and must be returned to the same body from which it was removed.

Figure 4D-2 is an exploded view of the valve showing the proper relationship of the parts for reassembly. Refer to this figure while disassembling and reassembling the valve.

DISASSEMBLY. Disassemble the valve as follows:

1. Be sure the valve is not subjected to pressure. Disconnect and cap all lines, and disconnect the linkage from the spool. Remove the valve from the machine.

2. Remove the screws which secure the end cap, and remove the end cap.

3. Slide the spool out of its bore from the end up, and remove the O-rings from the spool bore.

4. Screw out the plug which retains the relief valve and remove the O-ring from the plug. Remove the spring and relief valve.

CLEANING, INSPECTION AND REPAIR. After the valve has been disassembled, perform the following:

1. Discard all old O-rings. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

2. Carefully remove burrs by light stoning or lapping. Be certain that there is no paint on the mating surfaces of the valve body. Check all parts for wear. Replace if necessary.

3. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive the valve body and spool must be re-

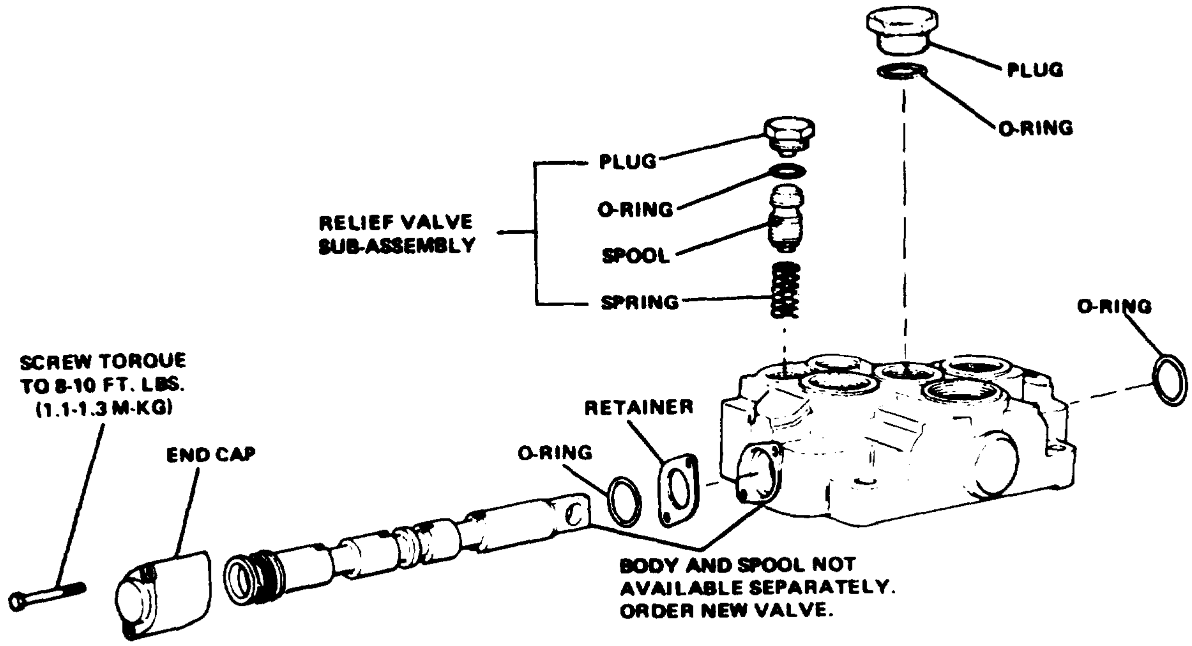


Figure 4D-2. Control Valve (36Z724)

placed. Check the valve spool for freedom of movement in the bore.

4. Check the relief valve for smooth movement in its bore. The valve should mow by its own weight.

ASSEMBLY. To assemble the valve, proceed as follows:

NOTE

Coat all parts with clean hydraulic oil to facilitate reassembly and provide initial lubrication. Petroleum jelly can be used to hold O-rings in place during reassembly.

1. Install the O-ring on the relief valve plug. Install the spring in the relief valve bore, then install the relief valve on the spring. Install and tighten the relief valve plug. Do not over-tighten the plug.

2. Install new O-rings at each end of the spool bore.

3. Install the flat retainer on the spool, if it was removed.

4. Install the spool in the bore from the end cap end.

5. Align the flat retainer by shifting the spool. Spool bind is an indication of flat retainer misalignment. Install the end cap and attaching screws. Tighten the screws to 8 to 10 foot-pounds (1.1 - 1.3 m-kg).

CONTROL VALVE (36Z725)

DESCRIPTION

Control valve 36Z725 is used to control the operation of the boom telescope cylinders. This is a four-way, spring centered directional control valve. The valve is a balanced sliding spool type with open-center circuitry, which allows free flow from inlet to outlet when the spool is in the neutral position. The operation of the valve is illustrated in Figure 4D-3.

A main relief valve is provided to limit circuit pressure to a preset maximum. When the circuit is operating at less than the relief valve setting, there is no flow over the by-pass orifice of the relief valve, so full circuit pressure is sensed at the spring end of the valve, as well as the opposite end. The valve is thus hydraulically balanced end the large spring holds it closed.

Maximum circuit pressure is determined by the small spring inside the relief valve assembly. When circuit Pressure is high enough to overcome this small spring. the poppet inside the assembly is forced off its seat. Fluid immediately flows past the poppet to the tank passage. This flow creates a pressure drop across the sensing orifice and the relief valve is no longer hydraulically balanced. When this pressure differential is great enough to overcome the large spring, the valve shifts, permitting flow to the tank passage.

RELIEF VALVE ADJUSTMENT

The setting of the main relief valve is determined by a spring installed in the relief valve at the factory, and no provisions have been made to adjust this relief valve.

TROUBLESHOOTING

Table 4D-2 lists the difficulties which may be experienced with the valve and hydraulic system. It indicates the cause and remedy for each of the troubles listed. It should always be remembered that pressure and delivery are factors which

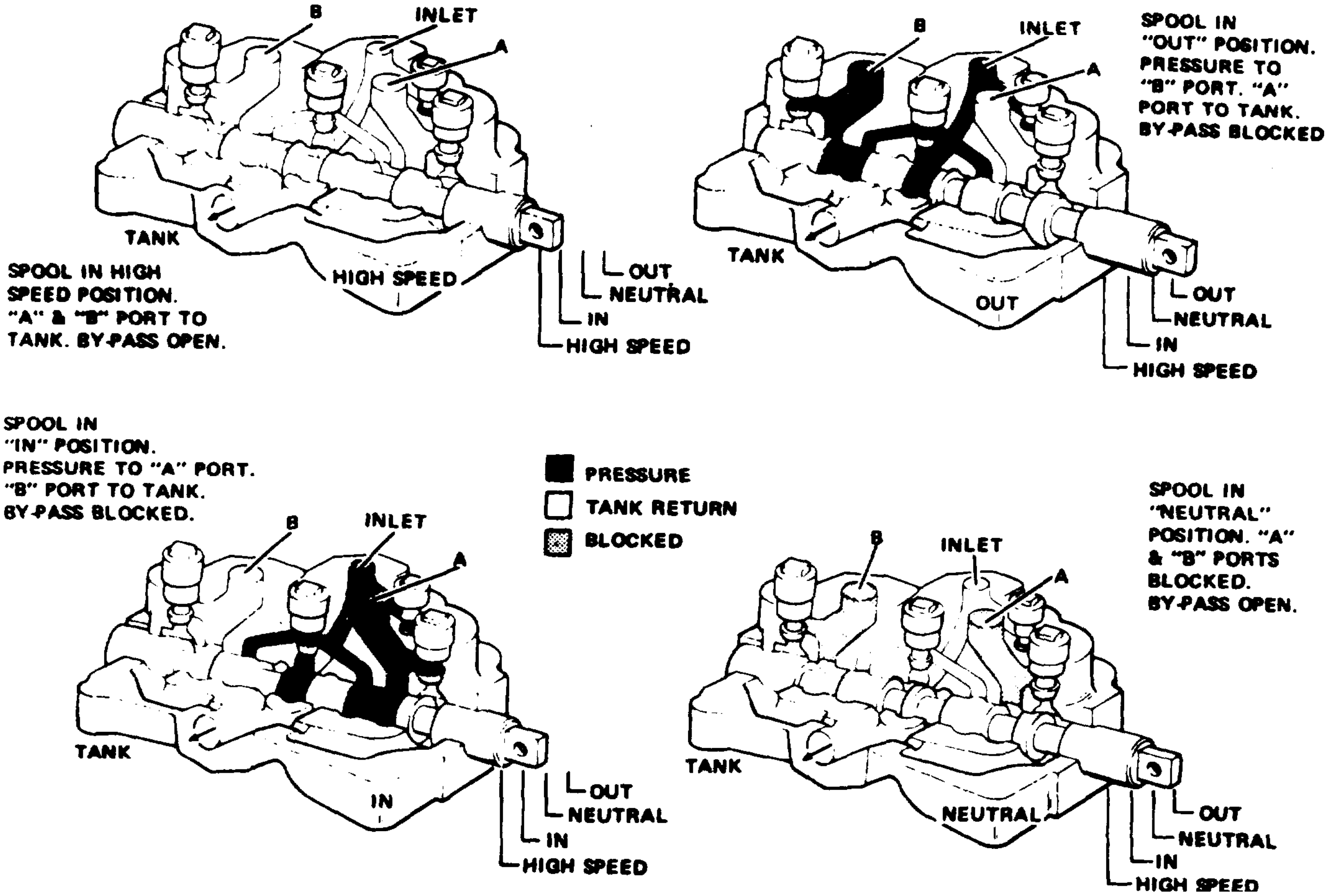


Figure 4D-3. Control Valve Operation (36Z725)

TABLE 4D-2
TROUBLE, CAUSE AND REMEDY CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks at either end of spool.	Defective O-rings in valve body.	Replace O-rings.
Spring-centered spools do not return to neutral.	Broken springs.	Replace springs.
	Foreign particles.	Clean system and valve.
	Misalignment of operating linkage.	Check linkage for binding condition.
No motion, slow or jerky action of hydraulic system.	Relief valve not properly set, or stuck in base and/or worn.	Repair, clean and readjust.
	Dirt or foreign particles lodged between relief valve control pop pet and seat.	Disassemble, clean and reassemble.
	Spool not moved to full stroke.	Check travel.
No relief valve action (High Pressure).	Small particle of dirt plugging orifice in relief valve sub-assembly.	Remove relief valve and check hole. If blocked, deer hole.

TABLE 4D-2
TROUBLE, CAUSE AND REMEDY CHART (CONTINUED)

TROUBLE	PROBABLE CAUSE	REMEDY
Load will not hold.	Oil by-passing between spool and body.	Replace valve.
	Oil by-passing piston in cylinder.	Repair or replace cylinder.
	Spool not centered.	Refer to above spool remedies.
Load drops when spool is moved from neutral to a power position.	Dirt or foreign particles lodged between check valve poppet and seat.	Disassemble, clean and reassemble.
	Scored or sticking check valve poppet.	Replace poppet.

are usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnosing improper valve operation.

OVERHAUL

GENERAL. Overhaul of this valve is limited to the replacement of the relief valve assembly and seals. Replace the complete valve when the required overhaul is beyond these limitations.

During disassembly, particular attention should be given to identification and orientation of parts for reassembly. The spool is selectively fitted to the valve body and must be returned to the same body from which it was removed.

Figure 4D-4 is an exploded view of the valve showing the proper relationship of the parts for reassembly. Refer to this figure while disassembling and reassembling the valve.

DISASSEMBLY. Disassemble the valve as follows:

1. Be sure the valve is not subjected to pressure. Disconnect and cap all lines, and disconnect the linkage from the spool. Remove the valve from the machine.

2. Remove the screws which the the end up, ad remove the end cap.

3. Slide out of its bore from the end cap end, and remove the O-ring from the spool bore.

4. Screw out the plug which retains the relief valve and remove the O-ring from the plug. Remove the spring and relief valve.

CLEANING, INSPECTION AND REPAIR. After the valve has been disassembled, Perform the following:

1. Discard all the O-rings. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

2. Carefully remove burrs by light stoning or lapping. Be certain that there is no paint on the mating surfaces of the valve body. Check all parts for wear. Replace if necessary.

3. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive the valve body and spool must be replaced. Check the valve spool for freedom of movement in the bore.

4. Check the relief valve for smooth movement in its bore. The valve should mow by its own weight.

ASSEMBLY. To assemble the valve, proceed as follows:

NOTE

Coat all parts with clean hydraulic oil to facilitate reassembly and provide initial lubrication. Petroleum jelly can be used to hold O-rings in place during reassembly.

1. Install the O-ring on the relief vavle plug. Install the spring in the relief valve bore, then install the relief valve on the spring. Install and tighten the relief valve plug. Do not over-tighten the plug.

2. Install new O-rings at each end of the spool bore.

3. Install the flat retainer on the spool, if it was removed.

4. Install the spool in the bore from the end cap end.

5. Align the flat retainer by shifting the spool. Spool bind is an indication of flat retainer misalignment. Install the end cap and attaching screws. Tighten the screws to 8 to 10 foot-pounds (1.1 - 1.3 m-kg).

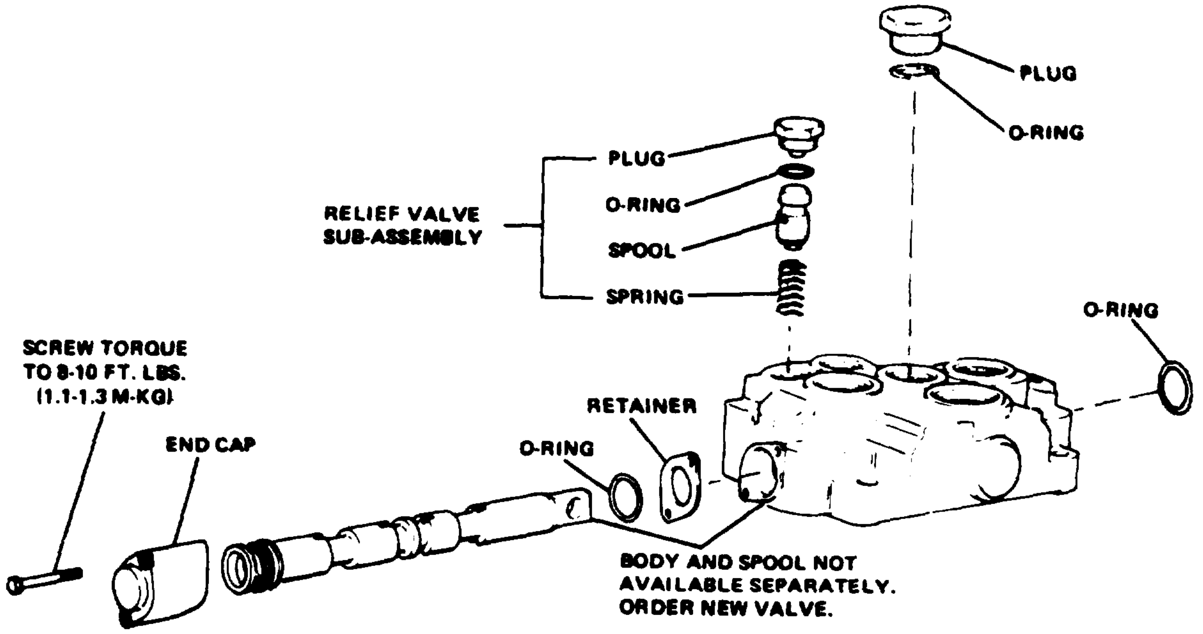


Figure 4D-4. Control Valve (36Z725)

CONTROL VALVE (36Z726)

DESCRIPTION

Control valve 36Z726 is used to control the operation of the boom hoist cylinders. This is a four-way, spring centered directional control valve. The valve is a balanced sliding spool type with open-centered circuitry, which allows free flow from inlet to outlet when the spool is in the neutral position. The operation of the valve is illustratad in Figure 4D-5.

A main relief valve is provided to limit circuit pressure to a preset maximum. When the circuit is operating at less than the relief valve setting, there is no flow over the by-pass orifice of the relief valve, so full circuit pressure is sensed at the spring end of the valve, as well as the opposite end. The valve is thus hydraulically balanced and the large spring holds it closed.

Maximum circuit pressure is determined by the small spring inside the relief valve assembly. When circuit pressure is high enough to overcome this small spring, the poppet inside the assembly is forced off its seat. Fluid immediately flows past the poppet to the tank passage. This flow creates a pressure drop across the sensing orifice and the relief valve is no longer hydraulically balanced. When this pressure differential is great enough to overcome the large spring, the valve shifts, permitting flow to the tank passage.

RELIEF VALVE ADJUSTMENT

The setting of the main relief valve is determined by a spring installed in the relief valve at the factory, and no provisions have been made to adjust this relief valve.

TROUBLESHOOTING

Table 4D-3 lists the difficulties which may be experienced with the valve and hydraulic system. It indicates the cause and remedy for each of the troubles listed. It should always be remembered that pressure and delivery are factors which am usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnosing improper valve operation.

OVERHAUL

GENERAL. Overhaul of this valve is limited to the replacement of the relief valve assembly and seals. Replace, the complete valve when the required overhaul is beyond these limitations.

During disassembly, particular attention should be given to identification and orientation of parts for reassembly. The spool is selectively fitted to the valve body and must be returned to the same body from which it was removed.

Figure 4D-6 is an exploded view of the valve showing the proper relationship of the parts for reassembly. Refer to this figure while disassembling and reassembling the valve.

DISASSEMBLY. Disassemble the valve as follows:

1. Be sure the valve is not subjected to pressure. Disconnect and cap all lines, and disconnect the linkage from the spool. Remove the valve from the machine.

2. Remove the screws which secure the end cap, and remove the end cap.

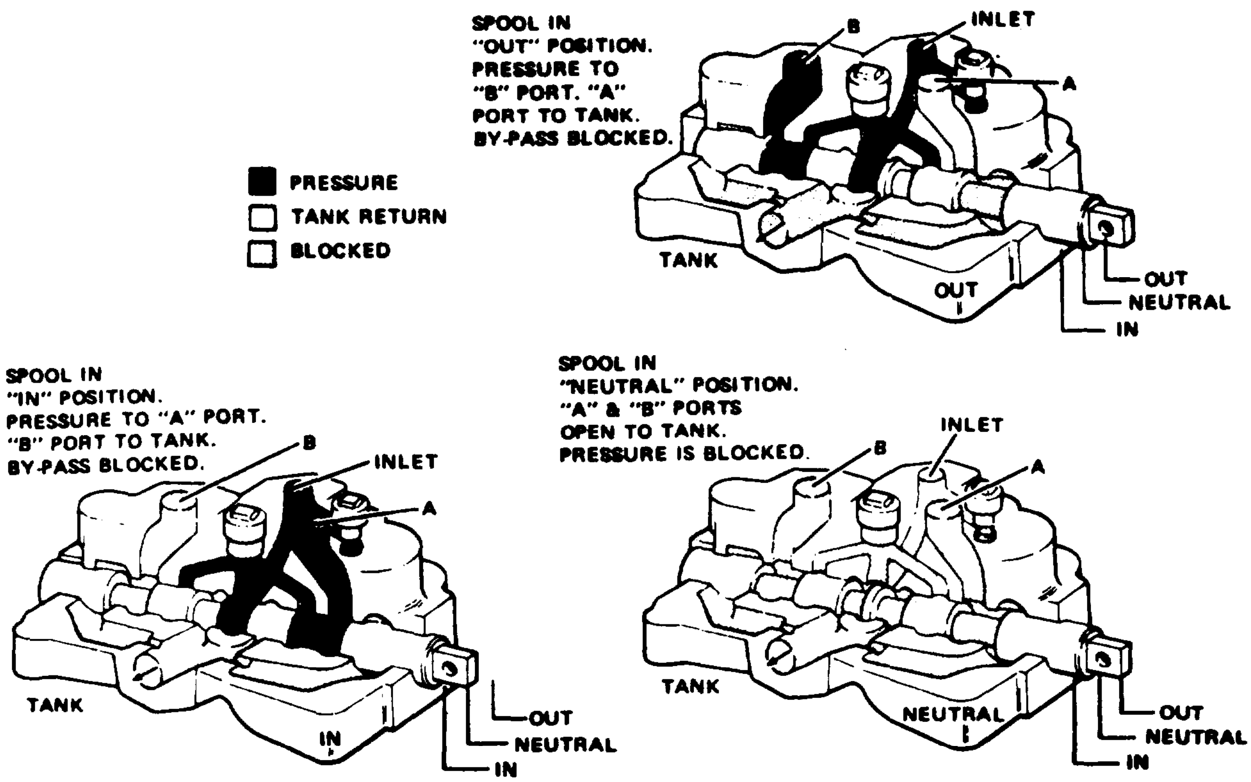


Figure 4D-5. Control Valve Operation (36Z726)

TABLE 4D-3
TROUBLE, CAUSE AND REMEDY CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks at either end of spool.	Defective O-rings in valve body.	Replace O-rings.
Spring-centered spools do not return to neutral.	Broken springs.	Replace springs.
	Foreign particles.	Clean system and valve.
	Misalignment of operating linkage.	Check linkage for binding condition.
No motion, slow or jerky action of hydraulic system.	Relief valve not properly set, or stuck in base and/or worn.	Repair, clean and readjust.
	Dirt or foreign particles lodged between relief valve control poppet and seat.	Disassemble, clean and reassemble.
	Spool not moved to full stroke.	Check travel.

TABLE 4D-3
TROUBLE, CAUSE AND REMEDY CHART (CONTINUED)

TROUBLE	PROBABLE CAUSE	REMEDY
No relief valve action (High Pressure).	Small particle of dirt plugging orifice in relief valve sub-assembly.	Remove relief valve and check hole. If blocked, clear hole.
Load will not hold.	Oil by-passing between spool and body.	Replace valve.
	Oil by-passing piston in cylinder.	Repair or replace cylinder.
	Spool not centered.	Refer to above spool remedies.

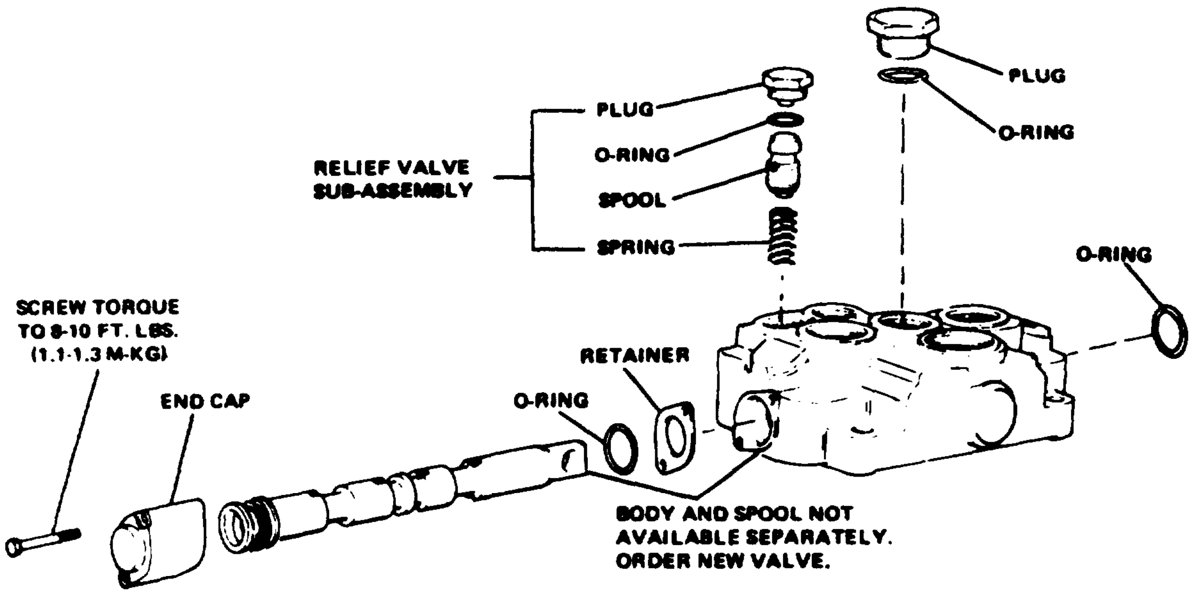


Figure 4D-6. Control Valve (36Z726)

3. Slide the spool out of its bore from the end cap end, and remove the O-rings from the spool bore.

4. Screw out the plug which retains the relief valve and remove the O-ring from the plug. Remove the spring and relief valve.

CLEANING, INSPECTION AND REPAIR. After the valve has been disassembled, perform the following:

1. Discard all old O-rings. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

2. Carefully remove burrs by light stoning or lapping. Be certain that there is no paint on the mating surfaces of the valve body. Check all parts for wear. Replace if necessary.

3. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive the valve body and spool must be replaced. Check the valve spool for freedom of movement in the bore.

4. Chock the relief valve for smooth movement in its bore. The valve should move by its own weight.

ASSEMBLY. To assemble the valve, proceed as follows:

NOTE

Coat all parts with clean hydraulic oil to facilitate reassembly and provide initial lubrication. Petroleum jelly can be used to hold O-rings in place during reassembly.

1. Install the O-ring on the relief valve plug. Install the spring in the relief valve bore, then install the relief valve on the spring. Install and tiqhten the relief valve plug. Do not over-tighten the plug.

2. Install new O-rings at each end of the spool bore.

3. Install the flat retainer on the spool, if it was removed.

4. Install the spool in the bore from the end cap end.

5. Align the flat retainer by shifting the spool. Spool bind is an indication of flat retainer misalignment. Install the end cap and attaching screws. Tighten the screws to 8 to 10 foot-pounds (1.1 - 13 m-kg).

CONTROL VALVE (36Z727)

DESCRIPTION

Control valve 36Z727 is used to control the operation of the main winch motor. This is a four-way, spring centered directional control valve. The valve is a balanced sliding spool type with open-center circuitry, which allows free flow from inlet to outlet when the spool is in the neutral position. The operation of the valve is illustrated in Figure 4D-7.

A main relief valve is provided to limit circuit pressure to a preset maximum. When the circuit is operating at less than the relief valve setting, there is no flow over the by-pass orifice of the relief valve, so full circuit pressure is sensed at the spring end of the valve, as well as the opposite end. The valve is thus hydraulically balanced and the large spring holds it closed.

Maximum circuit pressure is determined by the small spring inside the relief valve assembly. When circuit pressure is high enough to overcome this small spring, the poppet inside the assembly is forced off its seat. Fluid immediately flows past the poppet to the tank passage. This flow creates a pressure drop across the sensing orifice and the relief valve is no longer hydraulically balanced. When this pressure differential is great enough to overcome the large spring, the valve shifts, permitting flow to the tank passage.

Anti-cavitation check valves are installed next to the work ports to eliminate cavitation created in the system, and operates as follows: When the circuit pressure is less than tank pressure, a vacuum is created. The anti-cavitation check valve equalizes the unbalanced pressure condition by metering fluid from the tank passage back to the pressure port.

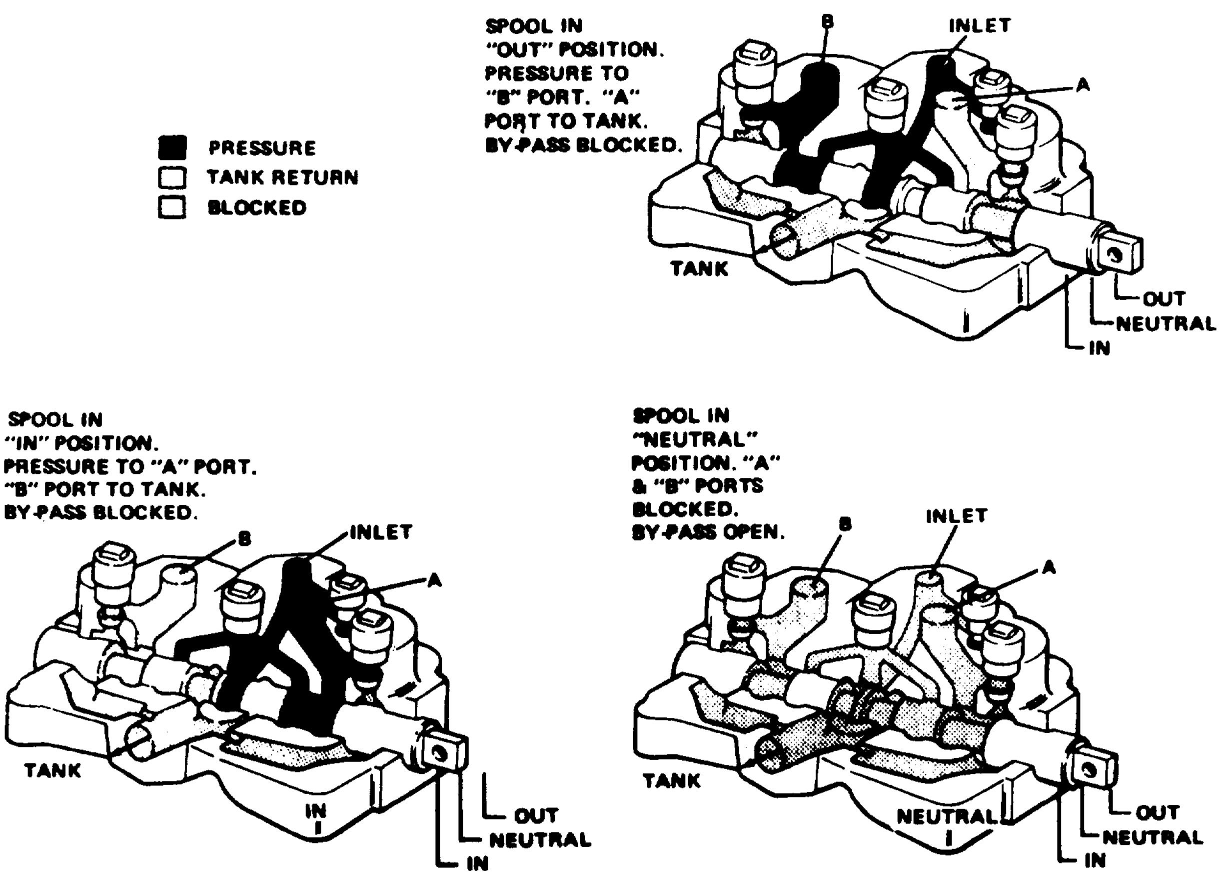


Figure 4D-7. Control Valve Operation (36Z727)

RELIEF VALVE ADJUSTMENT

The setting of the main relief valve is determined by a spring installed in the relief valve at the factory, and no provisions have been made to adjust this relief valve.

TROUBLESHOOTING

Table 4D-4 lists the difficulties which may be experienced with the valve and hydraulic system. It indicates the cause and remedy for each of the troubles listed. It should always be remembered that pressure and delivery are factors which are usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnosing improper valve operation.

OVERHAUL

GENERAL. Overhaul of this valve is limited to the replacement of the relief valve assembly and seals. Replace the complete valve when the required overhaul is beyond these limitations.

During disassembly, particular attentions should be given to identification and orientation of parts for reassembly. The spool is selectively fitted to the valve body and must be returned to the same body from which it was removed.

Figure 4D-8 is an exploded view of the valve showing the proper relationship of the parts for reassembly. Refer to this figure while disassembling and reassembling the valve.

DISASSEMBLY. Disassemble the valve as follows:

1. Be sure the valve is not subjected to pressure. Disconnect and cap all lines, and disconnect the linkage from the spool. Remove the valve from the machine.

2. Remove the screws which secure the wiper retainer, and remove the wiper retainer, wiper, retainer plate, and O-ring from the valve body.

3. Remove the screws which secure the end cap, and remove the end cap.

4. Slide the spool out of its bore from the end cap end, and remove the O-ring from the spool bore.

TABLE 4D-4
TROUBLE, CAUSE AND REMEDY CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks at either end of spool.	Defective O-rings in valve body.	Replace O-rings.
Spring-centered spools do not return to neutral.	Broken springs.	Replace springs.
	Foreign particles.	Clean system and valve.
	Misalignment of operating linkage.	Check linkage for binding condition.
No motion, slow or jerky action of hydraulic system.	Relief valve not properly set, or stuck in base and/or worn.	Repair, clean and readjust.
	Dirt or foreign particles lodged between relief valve control pop pet and seat.	Disassemble, clean and reassemble.
	Spool not moved to full stroke.	Check travel.
No relief valve action (High Pressure).	Small particle of dirt plugging orifice in relief valve sub-assembly.	Remove relief valve and check hole. If blocked, clear hole.
Load will not hold.	Oil by-passing between spool and body.	Replace valve.
	Oil by-passing piston in cylinder.	Repair or replace cylinder.
	Spool not centered.	Refer to above spool remedies.

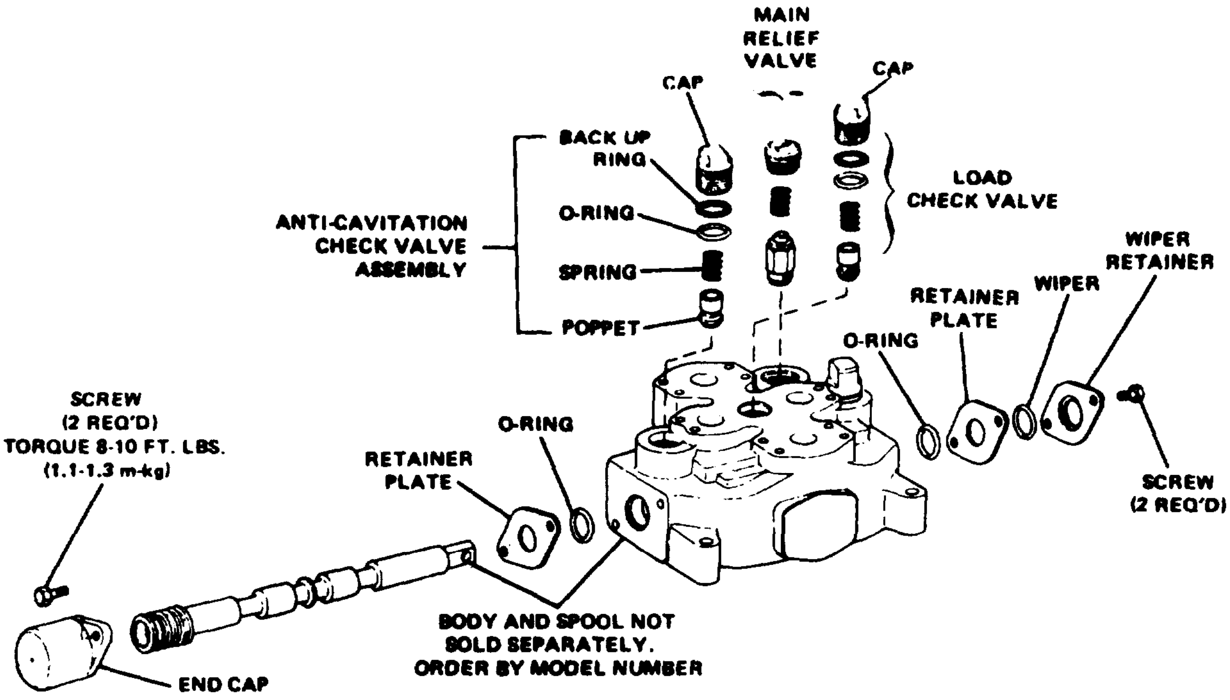


Figure 4D-8. Control Valve (36Z727)

5. Screw out the plug which retains the relief valve, and remove the O-ring and back up ring from the plug. Remove the spring and poppet. Do not lose the pin in the relief valve.

CLEANING, INSPECTION AND REPAIR. After the valve has bean disassembled, perform the following:

1. Discard all old O-rings and back up rings. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

2. Carefully remove burrs by light stoning of lapping. Be certain that there is no paint on mating surfaces of valve body. Check all parts for wear. Replace if necessary.

3. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive the valve body and spool must be replaced. Check the valve spool for freedom of movement in the bore.

4. Check the relief valve for smooth movement in its bore. This should move by its own weight.

ASSEMBLY. To assemble the valve proceed as follows:

NOTE

Coat all parts with clean hydraulic oil to facilitate reassembly and provide initial lubrication. Petroleum jelly can be used to hold the O-rings in place during reassembly.

1. Install the O-ring and beck up ring on the. relief valve plug, with the O-ring nearest the relief valve. Install the relief valve in its bore, then install the spring on the relief valve. Install and tighten the relief valve plug. Do not over-tighten the plug.

2. Install new O-ring in each end of the spool bore.

3. Install the spool in the bore from the end cap end.

4. Install the end up end attaching screws. Tighten the screws to 8 to 10 foot-pounds (1.1 - 1.3 m-kg).

5. Install the retainer plate, wiper, and wiper retainer over the spool, and secure with screws.

CONTROL VALVE (36Z986)

DESCRIPTION

Control valve 36Z986 is used to control the operation of the boom hoist cylinders. This is a four-way, spring centered directional control valve. The valve is a balanced sliding spool type with open-center circuitry, which allows free flow from inlet to outlet when, the spool is in the neutral position. The operation of the valve is illustrated in Figure 4D-9.

A main relief valve is provided to limit circuit pressure to a preset maximum. When the circuit is operating at less then the relief valve setting, there is no flow over the by-pass orifice of the relief valve, so full circuit pressure is sensed at the spring end of the valve, as well as the opposite end. The valve is thus hydraulically balanced and the large spring holds it closed.

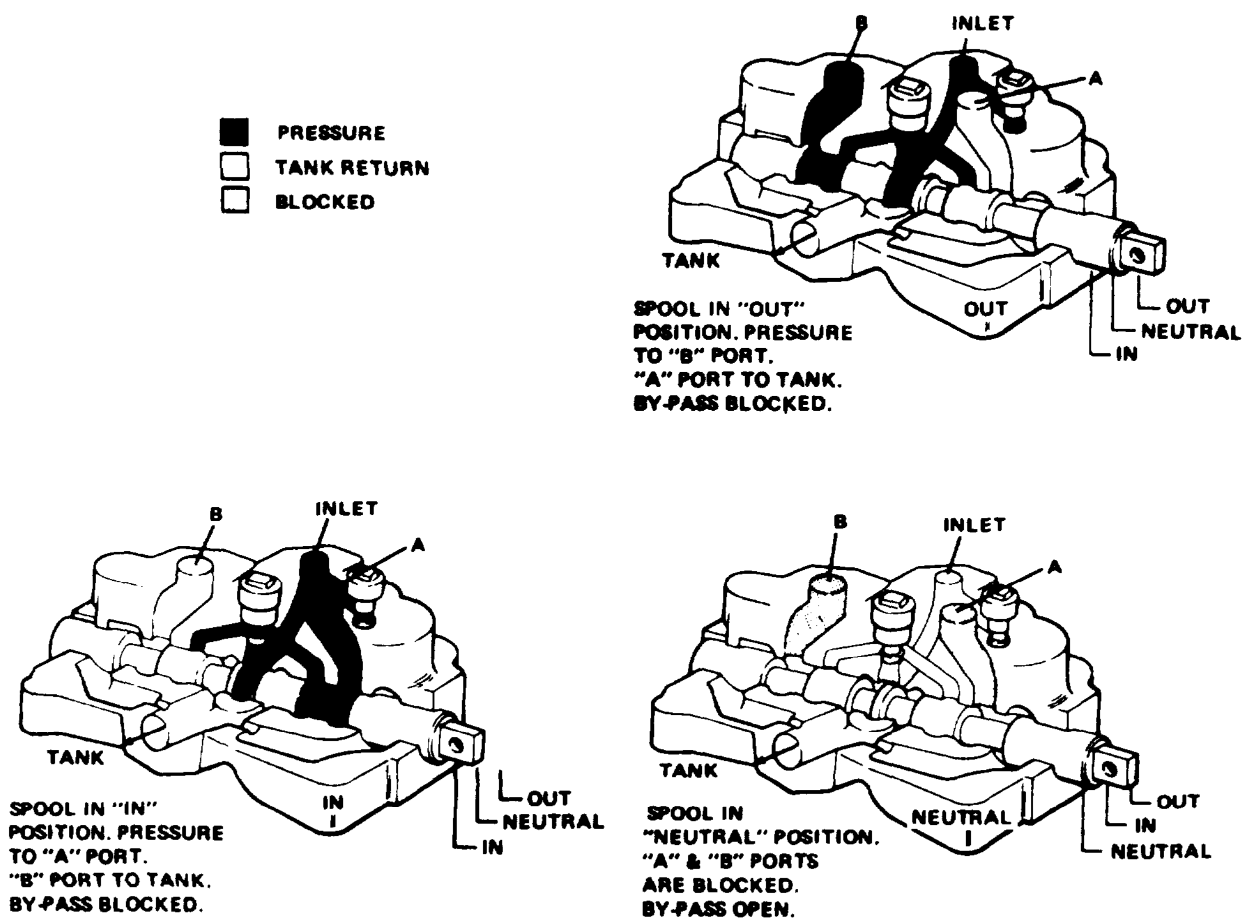


Figure 4D-9. Control Valve Operation (36Z986)

Maximum circuit pressure is determined by the small spring inside the relief valve assembly. When circuit pressure is high enough to overcome this small spring, the poppet inside the assembly is forced off its seat. Fluid immediately flaws past the poppet to the tank passage. This flow creates a pressure drop across the sensing orifice end the relief valve is no longer hydraulically balanced. When this pressure differential is great enough to overcome the large spring, the valve shifts, permitting flow to the tank passage.

RELIEF VALVE ADJUSTMENT

The setting of the main relief valve is determined by a spring installed in the relief valve at the factory, and no provisions have been made to adjust this relief valve.

TROUBLESHOOTING

Table 4D-5 lists the difficulties which may be experienced with the valve and hydraulic system. It indicates the cause and remedy for each of the troubles listed. It should always be remembered that pressure and delivery are factors which are usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnosing improper valve operation.

OVERHAUL

GENERAL. Overhaul of this valve is limited to the replacement of the relief valve assembly and seals. Replace the complete valve when the required overhaul is beyond these limitations.

During disassembly, particular attention should be given to identification and orientation of parts for reassembly. The spool is selectively fitted to the valve body and must be returned to the same body from which it was removed.

Figure 4D-10 is en exploded view of the valve showing the proper relationship of the parts for reassembly. Refer to this figure while disassembling and reassembling the valve.

DISASSEMBLY. Disassemble the valve as follows:

1. Be sure the valve is not subjected to pressure. Disconnect and cap all lines, and diconnect the linkage from the spool. Remove the valve from the machine.

TABLE 4D-5
TROUBLE, CAUSE AND REMEDY CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Oil leaks at either end of spool.	Defective O-rings in valve body.	Replace O-rings.
Spring-centered spools do not return to neutral.	Broken springs.	Replace springs.
	Foreign particles.	Clean system and valve.
	Misalignment of operating linkage.	Check linkage for binding condition.
No motion, slow or jerky action of hydraulic system.	Relief valve not properly set, or stuck in base and/or worn.	Repair, clean and readjust.
	Dirt or foreign particles lodged between relief valve control pop pet and seat.	Disassemble, clean and reassemble.
	Spool not moved to full stroke.	Check travel.
No relief valve action (High Pressure).	Smell particle of dirt plugging orifice in relief valve sub-assembly.	Remove relief valve and check hole. If blocked, clear hole.
Load will not hold.	Oil by-passing between spool and body.	Replace valve.
	Oil by-passing piston in cylinder.	Repair or replace cylinder.
	Spool not centered.	Refer to above spool remedies.
Load drops when spool is moved from neutral to a power position.	Dirt or foreign particles lodged between check valve poppet and seat.	Disassemble, clean and reassemble.
	Scored or sticking check valve poppet.	Replace poppet.

2. Remove the screws which secure the end cap, and remove the end cap.

3. Slide the spool out of its bore from the end cap end, and remove the O-ring from the spool bore.

4. Screw out the plug which retains the relief valve and remove the O-ring from the plug. Remove the spring and relief valve.

5. Remove the check valve plug, and remove the O-ring from the plug, Remove the spring and poppet from the valve body.

CLEANING, INSPECTION AND REPAIR. After the valve has been disassembled, perform the following:

1. Discard all oil O-rings. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

2. Carefully remove burrs by light stoning or lapping. Be certain that there is no paint on mating surfaces of valve body. Check all parts for wear. Replace if necessary.

3. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive the valve body and spool must be replaced. Check the valve spool for freedom of movement in the bore.

4. Check the relief valve for smooth movement in its bore. The valve should move by its own weight.

ASSEMBLY. To assemble the valve, proceed as follows:

NOTE

Coat all parts with clean hydraulic oil to facilitate reassembly and provide initial lubrication. Petroleum jelly can be used to hold O-rings in place during reassembly.

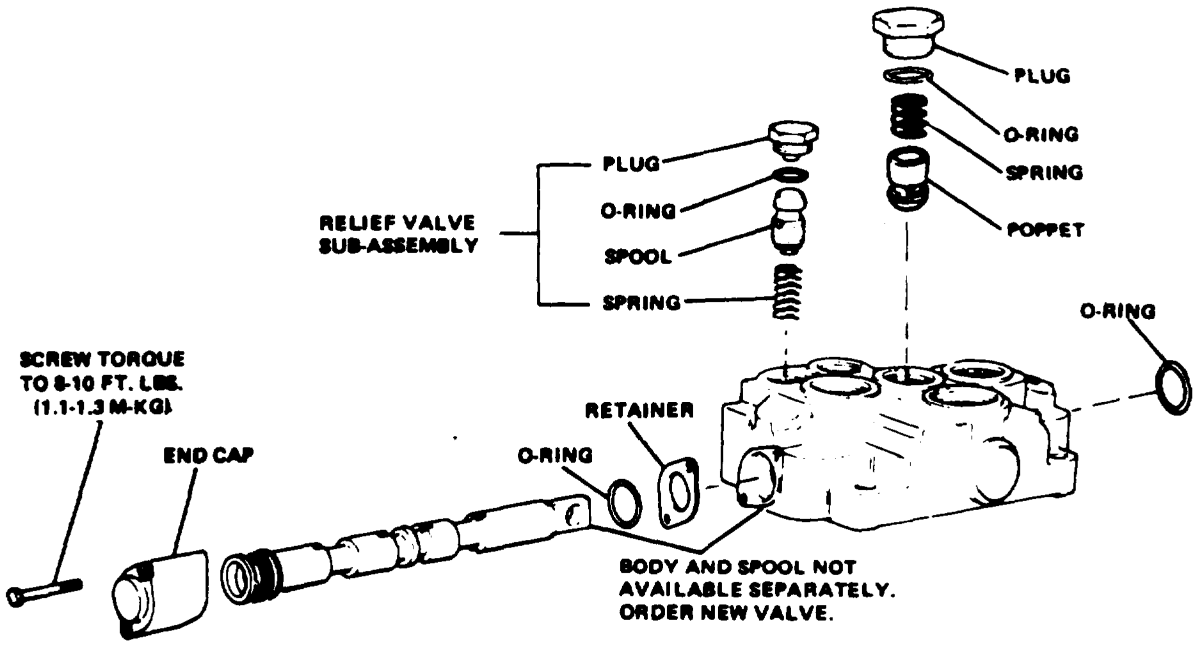


Figure 4D-10. Control Valve (36Z986)

1. Install the O-ring on the relief valve plug. Install the spring in the relief valve bore, then install the relief valve on the spring. Install and tighten the relief valve plug. Do not over-tighten the plug.

2. Install new O-rings at each end of the spool bore.

3. Install the flat retainer on the spool, if it was removed.

4. Install the spool in the bore from the end cap end.

5. Align the flat retainer by shifting the spool. Spool bind IS an indication of flat retainer misalignment. Install the end cap and attaching screws. Tighten the screws to 8 to 10 foot-pounds (1.1 - 1.3 m-kg).

6. Install a new O-ring on the check valve plug. Place the poppet and spring in the valve body and install the plug.

CONTROL VALVE (36Q70)

DESCRIPTION

Control valve 36Q70 is used to control the operation of the main winch motor. This is a four-way, spring centered directional control valve. The valve is a balanced sliding spool type with open-center circuitry, which allows free flow from inlet to outlet when the spool is in the neutral position. The operation of the valve is illustrated in Figure 4D-11.

A main relief valve is provided to limit circuit pressure to a preset maximum. When the circuit is operating at less than the relief valve setting, there is no flow over the by-pass orifice of the relief valve, so full circuit pressure is sensed at the spring end of the valve, as welt as the opposite end. The valve is thus hydraulically balanced and the large spring holds it closed.

Maximum circuit pressure is determined by the small spring inside the relief valve assembly. When circuit pressure is high enough to overcome this small spring, the poppet inside the assembly is forced off its seat. Fluid immediately flows past the poppet to the tank passage. This flow creates a pressure drop across the sensing orifice and the relief valve is no longer hydraulically balanced. When this pressure differential is great enough to overcome the large spring, the valve shifts, permitting flow to the tank passage.

Anti-cavitation check valves are installed next to the work ports to eliminate cavitation created in the system, and operates as follows: When the circuit pressure is less than tank pressure, a vacuum is created. The anti-cavitation check valve equalizes the unbalanced pressure condition by metering fluid from the tank passage back to the pressure port.

RELIEF VALVE ADJUSTMENT

The setting of the main relief valve is determined by a spring installed in the relief valve at the factory, and no provisions have been made to adjust this relief valve.

TROUBLESHOOTING

Table 4D-6 lists the difficulties which may be experienced with the valve and hydraulic system. It indicates the cause

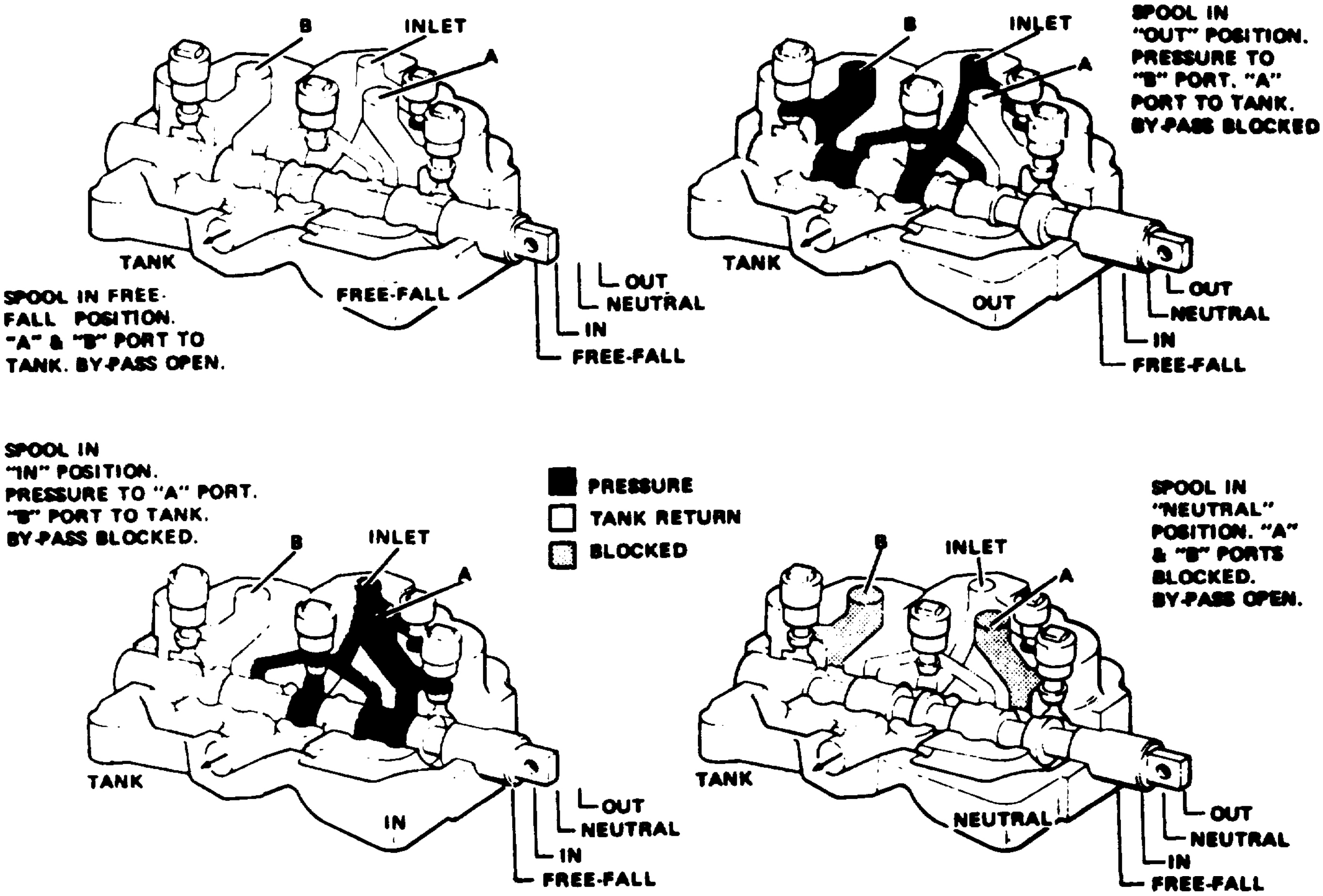


Figure 4D-11. Control Valve Operation (36Q70)

and remedy for each of the troubles listed. It should always be remembered that pressure and delivery are factors which are usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnosing improper valve operation.

OVERHAUL

GENERAL. Overhaul of this valve is limited to the replacement of the relief valve assembly and seals. Replace the complete valve when the required overhaul is beyond these limitations.

During disassembly, particular attention should be given to identification and orientation of parts for reassembly. The spool is selectively fitted to the valve body and must be returned to the same body from which it was removed.

Figure 4D-12 is an exploded view of the valve showing the proper relationship of the parts for reassembly. Refer to this figure while disassembling and reassembling the valve.

DISASSEMBLY. Disassemble the valve as follows:

1. Be sure the valve is not subjected to pressure. Disconnect and cap all lines, and disconnect the linkage from the spool. Remove the valve from the machine.

2. Remove the screws which secure the wiper retainer, and remove the wiper retainer, wiper, retainer plate, and O-ring from the valve body.

3. Remove the screws which secure the end cap, and remove the end cap.

4. Slide the spool out of its bore from the end cap end, and remove the O-ring from the spool bore.

5. Screw out the plug which retains the relief valve, and remove the O-ring and back up ring from the plug. Remove the spring and poppet. Do not lose the pin in the relief valve.

6. Remove the check valve plug, and remove the O-ring and back up ring from the plug. Remove the spring and poppet from the valve.

CLEANING, INSPECTION AND REPAIR. After the valve has been disassembled, perform the following:

TABLE 4D-6
TROUBLE, CAUSE AND REMEDY CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Oil teaks at either end of spool.	Defective O-rings in valve body.	Replace O-rings.
Spring-centered spools do not return to neutral.	Broken springs.	Replace springs.
	Foreign particle.	Clean system and valve.
	Misalignment of operating linkage.	Check linkage for binding condition.
No motion, slow or jerky action of hydraulic system.	Relief valve not properly set, or stuck in base and/or worn.	Repair, clean and readjust.
	Dirt or foreign particles lodged between relief valve control pop-pet and seat.	Disassemble, clean and reassemble.
	Spool not moved to full stroke.	Check travel.
No relief valve action (High Pressure).	Small particle of dirt plugging orifice in relief valve sub-assembly.	Remove relief valve and check hole. If blocked, clear hole.
Load will not hold.	Oil by-passing between spool and body.	Replace valve.
	Oil by-passing piston in cylinder.	Repair or replace cylinder.
	Spool not centered.	Refer to above spool remedies.
Load drops when spool is moved from neutral to a power position.	Dirt or foreign particles lodged between check valve poppet and sort.	Disassemble, clean and reassemble.
	Scored or sticking check valve poppet.	Replace poppet.

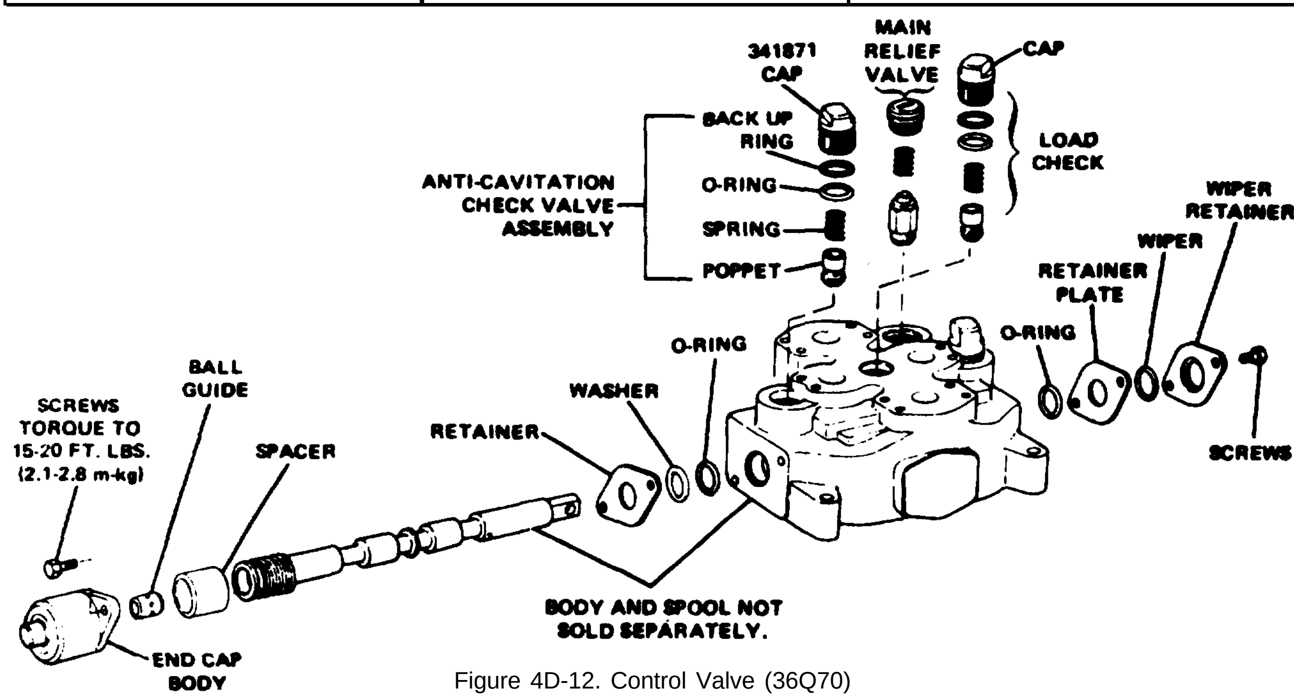


Figure 4D-12. Control Valve (36Q70)

1. Discard all old O-rings and back up rings. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

2. Carefully remove burrs by light stoning or lapping. Be certain that there is no paint on mating surfaces of valve body. Check all parts for woof. Replace if necessary.

3. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive the valve body and spool must be replaced. Check the valve spool for freedom of movement in the bore.

4. Check the relief valve for smooth operation in its bore. The valve should move by its own weight.

ASSEMBLY. To assemble the valve, proceed as follows:

NOTE

Coat all parts with clean hydraulic oil to facilitate reassembly and provide initial lubrication. Petroleum jolly can be used to hold O-rings in place during reassembly.

1. Install the O-ring and back up ring on the relief valve plug, with O-ring nearest the relief valve. Install the relief valve in its bore, then install the spring on the relief valve. Install and tighten the relief valve plug. Do not over-tighten plug.

2. Install new O-rings in each end of the spool bore.

3. Install the spool in the bore from the end cap end.

4. Install the end cap and attaching screws. Tighten the screws to 15 to 20 foot-pounds (2.1 - 2.8 m-kg).

5. Install the retainer plate, wiper, and wiper retainer over the spool, and secure with screws.

CONTROL VALVE (36Z840)

DESCRIPTION

Control valve 36Z840 is actually two individual pressures compensated, directional control valves which are joined together to form a single assembly. Each valve does, however, function independently to control only one of the two telescope cylinders in the boom (see Figure 4D-13).

NOTE

The following description applies to one section of the valve only. The operation of the other valve section is identical to the one described.

When the telescope lever is in the neutral, centered. position, the oil delivered to the valve by the telescope pump is prevented from entering the telescope circuit by the control and compensator spools. Since the oil is prevented from passing through the valve, pressure will build up in the inlet and spool sections. This pressure is then fed through the orifice in the compensator spool to the right end of the spool. When the pressure the right end of the spool exceeds the force imposed on the spool by the compensator spring, the spool will shift to the left. When the spool is shifted to the left, the inlet port is connected to the tank port, and the pump delivery is diverted to tank at a very low pressure.

When the control spool is shifted, pump flow is metered across an orifice formed by the hole in the spool and the body of the valve and into a passage within the spool. The oil flowing into the spool will first lift the appropriate load check, and then flow onto the circuit through the work port. The oil returning from the circuit will flow into the other work port, lifting the load check at the opposite end of the spool, which opens a passage to the tank port.

The pressure in the circuit, imposed by the load, is fed through a pilot pressure passage, which contains two check balls and an orifice, to the left end of the compensator spool. The pressure at the left end of the spool adds to the force applied to the spool by the compensator spring and tends to shift the spool to the right. Pump pressure, on the other hand, is fed through the orifice in the center land of the compensator spool to the right end of the spool.

As load changes occur, a corresponding pressure change will be felt in the left end of the compensator spool, while changes in pump pressure will be felt on the right end of the spool. These pressures, and the force applied by the compensator spring, will interact with each other to shift the compensator spool either right or left. Increases in load pressure or decreases in pump pressure will cause the spool to shift to the right. This tends to block the opening between the inlet and tank passage, forcing a greater volume of oil to pass through the valve. Decreases in load pressure or increases in pump pressure will cause the opposite to occur. Thus, a constant flow of oil is, delivered by the valve, regardless of changes in either load or pump pressure.

The pressure acting on the left end of the compensator spool also acts against the lower end of the main relief poppet. When the load pressure exceeds the setting of the poppet, the poppets unseats, venting the pressure on the left end of the compensator spool. When this occurs, the compensator spool will immediately shift to the left, opening the inlet port to the tank port. This will divert the main flow of oil back to tank, reducing the pressure in the circuit. The relief poppet reseats when the pressure in the circuit drops below the setting of the relief poppet, and normal compensator operation resumes.

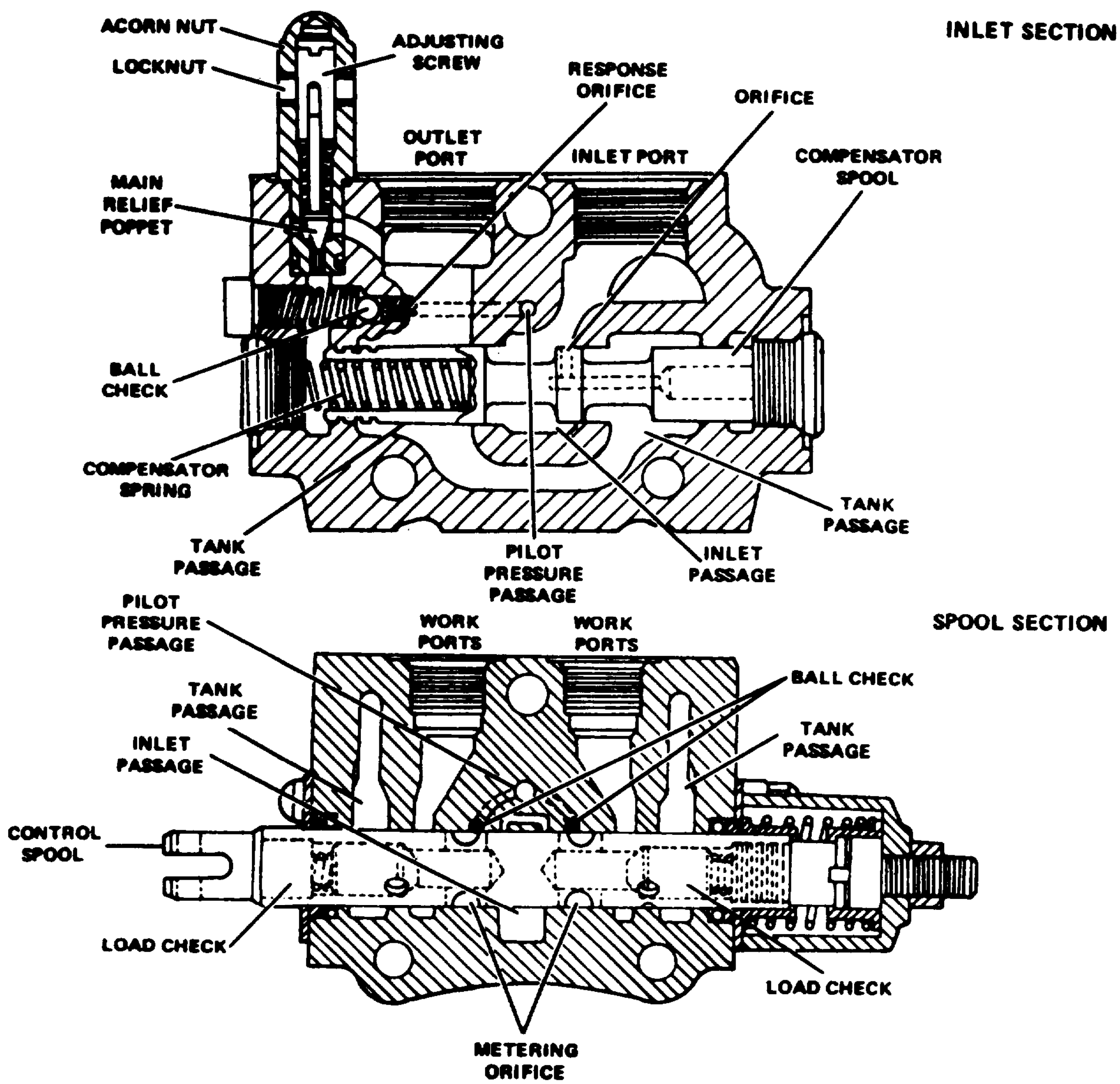


Figure 4D-13. Control Valve (36Z840)

RELIEF VALVE ADJUSTMENT

GENERAL. Each inlet section of this valve contains its awn relief valve to limit maximum circuit pressure. Refer to the pressure deal mounted on the control valve access door behind the operators cab for the exact relief valve settings.

The relief valves have been adjusted at the factory end should retain their setting over extended periods of time under normal conditions. The valve springs will eventually weaken with machine use, however, so periodic checking of the valve settings is recommended.

If a relief valve is removed for cleaning, inspection, of other reason, readjustment will be required following installation.

The following adjustment procedures are intended to be performed by qualified service personnel who posses a thorough working knowledge of the hydraulic system.

CAUTION

The pressure settings listed on the pressure decal must be strictly adhered to. Any attempt to change the settings without specific written approval of the Regional Service Manager will void any and all warranties, expressed or implied.

ADJUSTMENT. Adjust each relief valve as follows:

1. Before adjusting the relief valve settings, it is recom-

mended that the engine high speed and low idle speed be checked and adjusted if necessary. A check of engine speed should show a high speed of approximately 2750 RPM at no load and a low idle speed of approximately 600 RPM at no load.

2. Operate the machine until the hydraulic oil temperature is a minimum of 70°F (21°C). Check the control valve spools to be sure they travel a full stroke in each direction.

3. Shut down the engine and install an accurate 0 to 3000 psi (0 to 206.0 bars) pressure gauge in the gauge tee at the base of the boom (see Figure 4D-14).

NOTE

It may be helpful to swing the winch base downward before installing the pressure gauge. This can be done by supporting the winch and removing the upper winch base bolts. Then allow the winch to swing down and hang from the lower mounting bolts.

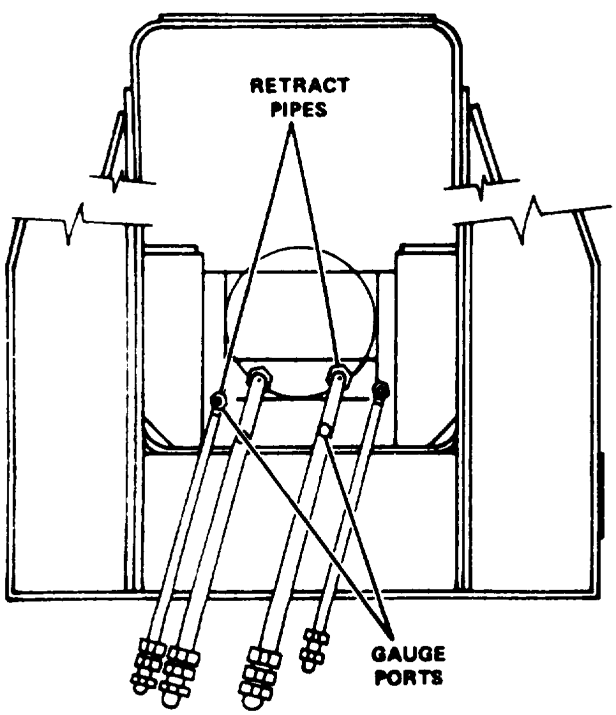


Figure 4D-14. Gauge Ports

4. Start the engine and set the speed at approximately 1480 RPM.

5. Operate the control valve, which controls the cylinder with the test gauge installed in it, to retract the cylinder and hold the lever in the retract position briefly when the cylinder reaches the end of its stroke. The relief valve will by-pass, as indicated by a pressure drop, after reaching a peak. The peak pressure represents the relief valve setting and must correspond with the pressure listed on the pressure decal.

6. If the relief valve setting is incorrect, remove the acorn nut from the adjusting screw(see Figure 4D-13), loosen the locknut and set the pressure by turning the adjusting screw in or out.

NOTE

Initially. back the adjusting screw out a few turns, allowing the valve poppet and seat to be flushed thoroughly. Then turn the adjusting screw in to obtain the specified pressure setting.

7. Repeat the above procedure for the relief valve in the other valve section.

8. When the settings are correct, shut down the engine and disconnect the test gauge. Clean and install the test tee cap. Then swing the winch up and install the upper winch base bolts.

TROUBLESHOOTING

Table 4D-7 lists the difficulties which may be experienced with the valve and hydraulic system. It indicates the cause and remedy for arch of the troubles listed. It should always be remembered that pressure and delivery ore factors which are usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the operation of the complete hydraulic system are essential to diagnosing improper valve operation.

REMOVAL

Remove the valve assembly from the machine as follows:

1. Shut off the engine and tag the ignition switch in the upper and carrier to warn against starting the engine until the valve is reinstalled.

2. Clean the valve and fittings on it, with a suitable solvent. Then wipe or blow away the solvent.

3. Disconnect the hydraulic lines at the valve and position the lines to avoid interference as the valve is removed. Cap the lines and plug the valve port to prevent the entry of contaminants.

4. Disconnect the control linkage at the spools.

5. Remove the bolts attaching the valve to the deck plate.

6. The valve can now be removed. Note the presence of any shims under one corner of the valve. The purpose of such shims is explained at installation of the valve.

OVERHAUL

GENERAL. All parts of the valve are serviceable, except for the control and compensator spools, and the valve bodies. If either a valve body or spool is damaged, the complete valve section must be replaced.

Control valve repairs, however, should be limited to the steps listed in the REMEDY column of the troubleshooting chart.

During disassembly, particular attention should be given to identification and orientation of parts for reassembly. The spools are selectively fitted to the valve body and must be returned to the same body from which it was removed.

TABLE 4D-7
TROUBLE, CAUSE AND REMEDY CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Entire valve inoperative.	Compensating spool stuck open.	Remove compensating spool - examine for contamination, clean and replace.
	Pilot relief poppet stuck open.	Remove pilot poppet - examine for contaminents, clean and replace.
High pressure thru neutral (When valve plungers are centered)	Compensating spool stuck.	Remove spool, clean and flush inlet section.
	Compensating spool orifice partially plugged.	Clean orifice.
One valve section does not operate.	Contamination under relief valve.	Remove relief, clean, install and reset pressure.
Valve response slow.	Spool sticking.	Remove spool and clean, flush bore.
	Pilot poppet held open due to contamination.	Remove poppet and clean, flush housing.
	Response orifice partially plugged.	Remove and clean.
Sticking plungers.	Excessively high oil temperature.	Eliminate causes such as restrictions in lines and filter.
	Dirt in oil.	Change oil, clean system.
	Valve warped from mounting.	Loosen mounting bolts & check.
	Excessively high pressure.	Chock pressure with gauge on inlet and cylinder ports.
	Handle or linkage binding.	Free up linkage.
	Plunger bent or damaged.	Replace entire section.
	Return spring damaged.	Replace faulty parts.
	Spring or detent cap binding.	Loosen cap, recenter & retighten.
	Valve temperature not equal.	Let system warm up.
Leaking seals.	Paint or dirt on or under seal.	Remove and clean.
	Excessive back pressure.	Check back pressure at tank port.
	Scored plunger.	Replace valve section.

TABLE 4D-7
TROUBLE, CAUSE AND REMEDY CHART (CONTINUED)

TROUBLE	PROBABLE CAUSE	REMEDY
	Loose seal plates.	Clean and tighten.
	Cut or scored seal.	Replace seals.
Unable to move plunger in or out.	Dirt in valve.	Clean and flush out valve.
	Plunger cap full of oil.	Replace seals.
	Binding linkage.	Free up linkage.
Load will not hold.	Port relief valve not holding.	Remove, clean install & reset.
	Contamination holding load holding check open.	Remove, clean and re-install.
	Oil by-passing valve plunger.	Replace valve section.
	Spool not centered.	Check linkage.
Load drops when plunger is moved from neutral.	Dirt in load holding check.	Remove and clean.
	Scored check valve, poppet or seat.	Replace poppet or plunger as necessary.
Valve leaks between sections.	Valve not torqued to properly.	Torque to proper valve.
	O-ring damaged.	Disassemble valve and replace necessary O-rings.
	Contamination between sections.	Clean valve section surfaces.

Figure 4D-15 is an exploded view of the valve showing the proper relationship of the parts for reassembly. Refer to this figure while disassembling and reassembling the valve, unless otherwise specified.

DISASSEMBLY. The following disassembly procedure assumes that the complete valve will be disassembled. The following instructions have been arranged to provide the best method of completely disassembling and reassembling the telescope control valve. The instructions for disassembling and reassembling a subassembly, such as the inlet section, are given in the lettered stops following the removal of the subassembly. In the event that it is not necessary to overhaul a subassembly, proceed to the next numbered step.

To disassemble the telescope control valve, proceed as follows:

NOTE

Disassembly should only be attempted on a bench in as clean an area as possible. The workbench, the mechanic's hands and tools must be clean, and the disassembled valve must be protected from airborne dust. Contaminants introduced directly into the control valve, or any other components of the hydraulic system, have the greatest potential for causing damage. This is because such contaminants are carried under high pressure to the working portion of the system before being removed from the oil by the return line filter.

1. Loosen nuts (1) on the ends of the through-bolts, in small increments, initially. Then remove all attaching nuts.

2. When the nuts are removed from all through-bolts, carefully slide the inlet section off the through-bolts. Note the number and location of the O-rings on the inlet section. If the inlet section of the valve must be disassembled, proceed as follows:

A. Remove plugs (5), and carefully push the compensator spool out of inlet body (3).

B. Remove plug (13), spring (11) and ball (10) from inlet body (3). Orifice (9) should not be removed unless it is plugged. If the orifice is plugged, it can be removed using a suitable Allen wrench.

C. Remove relief valve assembly (6) from inlet body (3). The relief valve assembly should not be disassembled unless it requires cleaning, in which case the puts can be unscrewed to separate them.

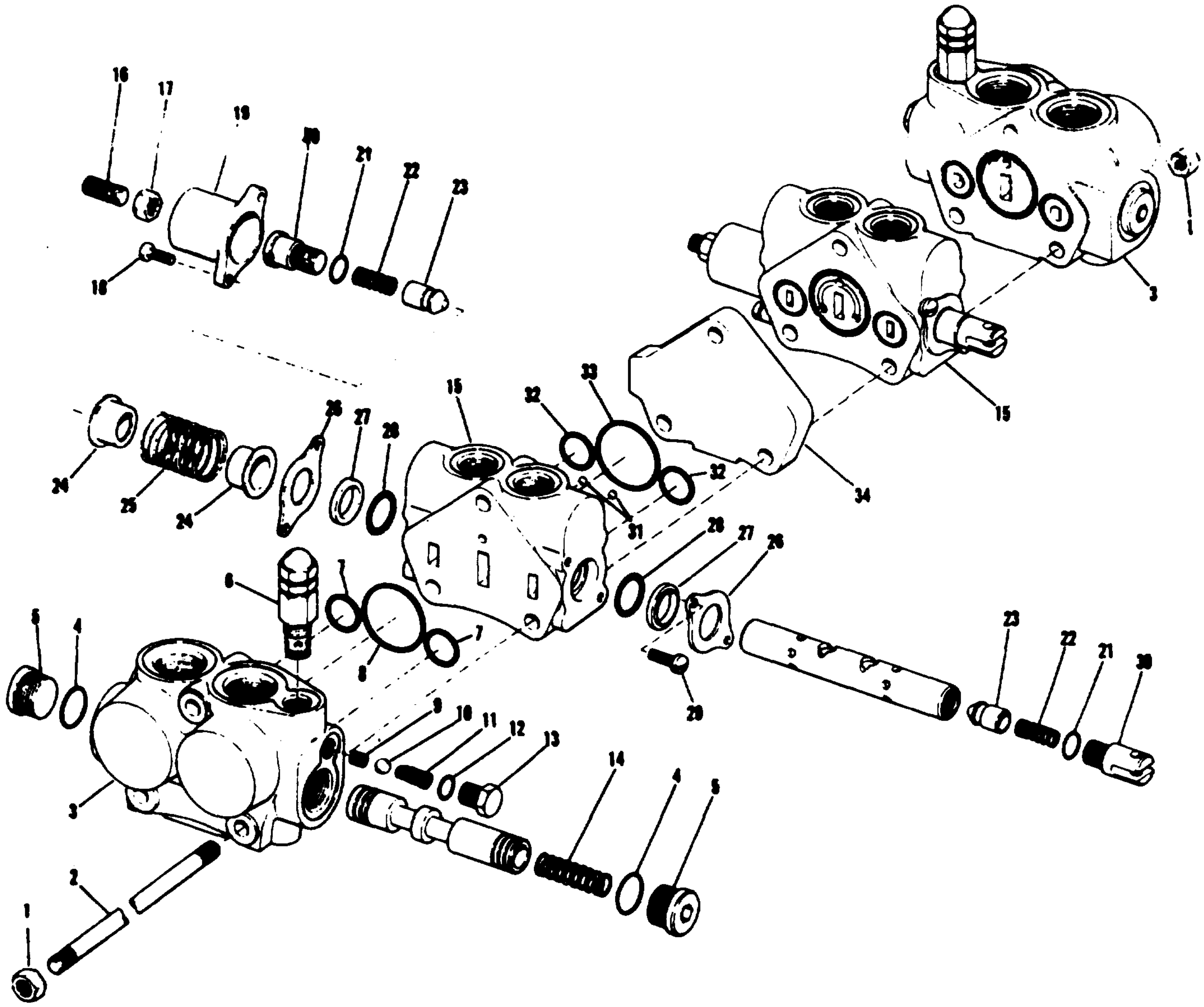


Figure 4D-15. Control Valve (36Z840)

3. Slide the spool section off the through-bolts. Be sure check balls (31) are not lost when the spool section is slid off the through-bolts. Note the number and location of the O-rings on the spool section. If the spool section must be disassembled, proceed as follows:

A. Remove screws (29) and seal retainer (26).

B. Remove screws (18) and cap (19). Note that a suitable twelve point socket wrench must be used to remove the screws.

C. Carefully push the spool out of valve body (15).

D. Remove O-ring (28) and wipers (27) from the valve body counterbores.

E. Insert a suitable drift pin through one of the holes in the spool as shown in Figure 4D-16. Use a screwdriver between the clevis ears to unscrew plug (30). Plug (20) can be removed using a suitable screwdriver. Springs (22) and poppets (23) can now be removed from the spool.

4. Slide spacer (34) off the through-bolts. The other spool and inlet section can now be removed and disassembled as described above.

INSPECTION AND REPAIR. After the valve has been disassembled, wash the parts with cleaning solvent, and dry the parts with clean compressed air. Be sure to blow out the orifices and internal passages of the valve. After the parts are cleaned, inspect and repair the following:

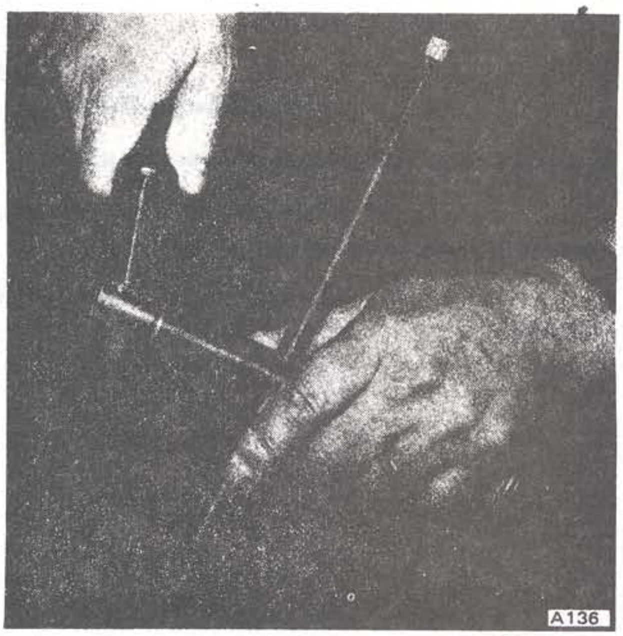


Figure 4D-16. Control Spool Disassembly

1. It is recommended that all O-rings be discarded and replaced with new O-rings.

2. Closely inspect the mating surfaces of each section for nicks, burrs, scratches and other minor defects. Slight imperfections can be corrected using a fine polishing stone or file, or a high grade crocus cloth. Do *not* use a power grinder, sandpaper or emery paper.

3. If a mating surface is badly damaged, that section should be replaced with a complete new section.

4. Minor repairs, such as cleaning and polishing, can be made to the control and compensator spools. Replacement spools are not available. A complete new valve body and spool must be installed if the spool is damaged beyond repair.

5. Inspect the load check and relief valve poppets and seats for burrs, nicks, scratches, or the presence of foreign matter. Any of these conditions can cause the valves to leak. Small imperfections are best removed by lapping the poppet to its seat.

6. Defective spool centering springs can be replaced.

7. Prior to installing a spool, lubricate it with clean hydraulic oil.

REASSEMBLY. The following reassembly procedure assumes that the valve has been completely disassembled. To reassemble the valve, proceed as follows:

1. Install one inlet section on the through-bolts. If the inlet section has been disassembled, reassemble it as follows:

A. Install relief valve assembly (6) in inlet body (3).

B. Install orifice (9) in the inlet body using a suitable Allen wrench, if the orifice was removed. Then install ball (10), spring (11), O-ring (12) and plug (13).

C. Install one plug (5) with an O-ring (4), in the opening nearest the inlet port. Then install the compensator spool in inlet body (3), with the spring cavity nearest the outlet port. Install spring (14) in the compensator spool and secure the spool with another plug (5) and O-ring (4).

2. Install one spool section on the through-bolts. If the spool section has been disassembled, reassemble it as follows:

A. Install poppets (23) and springs (22) in the spool. Then install plugs (20 and 30) in the ends of the spool with O-rings (21). Insert a suitable drift pin through one of the holes in the spool as shown in Figure 4D-16. Tighten the plugs with a screwdriver.

B. Carefully install the control spool in valve body (15). Note that valve bodies (15) and the control spools are identical. The spools must be installed so that the spool clevises extend in the same direction when the valve is assembled.

C. Install an O-ring (28) and wiper (27) in each end of the spool bore. The lip of the wiper must point outward from the valve body.

D. Install seal retainer (26) and cap (19). Secure the cap with screws (18). Tighten the screws using a suitable *twelve* point socket wrench.

E. Install seal retainer (26), and secure it with screws (29).

3. Install spacer (34) on the through-bolts. The remaining spool and inlet sections can be reassembled as described above and installed on the through-bolts.

4. Install nuts (1) on the end of the through-bolts, and tighten the nuts finger tight.

5. Lay the assembly down, on its mounting feet, on a flat surface and align the sections as perfectly as possible, using a rawhide mallet or other suitable means.

6. When the sections are perfectly aligned, tighten the nuts on the through-bolts to 32 ft-lbs (4.43 m-kg). Note that this torque value is obtained with lubricated threads.

INSTALLATION

Install the valve assembly on the machine as follows:

1. Note the corner of the valve under which shims had been installed.

2. Install and fully tighten the attaching bolts in the other three corners.

3. Insert shims under the forth corner to fill any gap between this mounting foot and the deck plate. Then install and tighten that mounting bolt.

NOTE

Installation must be accomplishad as described above. If all four mounting bolts are installad and tightened at the same time, any unevenness in the deck may cause the valve assembly to warp when drawn down by the mounting bolts. Leakage, binding of the spools and other conditions may then occur, resulting in improper operation of the valve.

4. One by one, remove the protective cap and plug and connect the hydraulic lines to their respective ports.

5. Connect the operating linkage to the control spools.

6. Start the engine and operate each of the control spools, observing for leaks, binding of other defects.

7. Check each of the relief valve settings and readjust as necessary.

SUB-SECTION 4E
RETURN LINE FILTERS

RETURN LINE FILTER (46Z180)

DESCRIPTION

Two full flow filters, located at the right rear corner of the engine compartment, are used to filter the oil in the hydraulic system before it is returned to tank.

The filters are designed to provide full flow filtration of all the oil returning to the hydraulic tank. A poppet type by-pass valve is provided in the filter head, which permits part or all of the oil to by-pass the filter element when it becomes clogged, or when the viscosity of the oil is too high, due to cold weather. (See Figure 4E-1.)

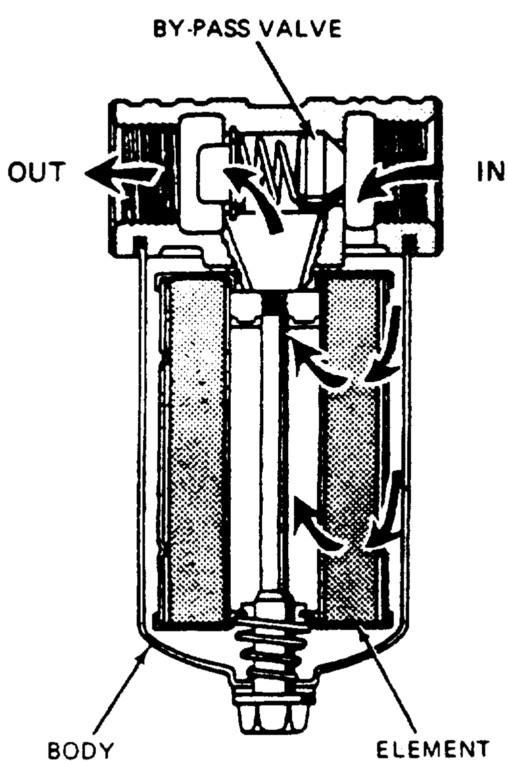


Figure 4E-1. Filter Operation

REPLACEMENT

Repair of the return line filters is limited to replacement of the complete filter. In the event, that it is necessary to replace the return line filters, proceed as follows (see Figure 4E-1):

1. Lift the rear end of the machine using the rear outriggers. This will ensure that the oil level in the hydraulic tank is below the level of the return manifold.

2. Support the return line filter to be removed, and remove the four socket head capscrews on each side of the filter. Remove the filter from the machine.

3. Remove the O-rings from the adapter flanges, and inspect them for damage or brittleness. If either of these conditions exist, replace the O-rings.

4. Coat the O-rings with a small amount of grease, and install them on the adapter flanges.

5. Position the new filter between the adapter flanges and install the socket head capscrews.

6. Operate the hydraulic system for several minutes and check the filter for leakage.

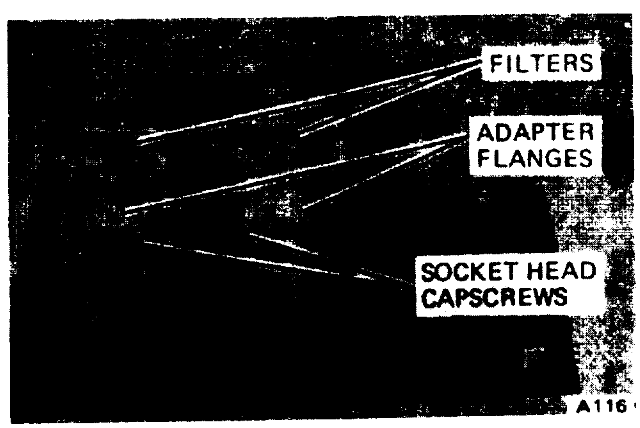


Figure 4E-2. Filter Replacement.

SECTION V
BOOM AND WINCH SYSTEMS AND COMPONENTS

SUB-SECTION PAGE

SUB-SECTION 5A
BOOM AND WINCH SYSTEMS

GENERAL

This section covers the components used in the boom hoist, boom telescope, and winch systems, with the exception of the pumps and control valves.

This sub-section describes the method of removing the boom hoist and boom telescope cylinders from the mechine. Repair of the cylinders is covered in the next two sub-sections.

Repair of the other components of the boom and winch systems are covered in the remaining subsections.

REMOVAL-BOOM HOIST CYLINDERS

To remove the boom hoist cylinders, proceed as follows (see Figure 5A-1):

1. Lower the boom onto the boom cradle at the front of the carrier.

2. Remove the hydraulic lines attached to the cylinder to be removed. Cap the line securely and plug the cylinder ports.

3. Remove the retainers at the top and bottom of the cylinder which is being removed. Press the pin out of the bottom of the cylinder rod eye.

4. Attach a suitable lifting device to the cylinder that is being removed to prevent it from swinging away from the revolving frame as the boom is lifted.

5. Slowly lift the boom by placing the boom hoist lever in the raise position. Lift the boom high enough to allow the cylinder to be swung away from the revolving frame.

6. When the cylinder is in a vertical position, slide it outward from the boom, and remove it to a suitable repair area.

WARNING

Lower the boom back onto the boom cradle after the cylinder has been removed. Install warning tags on the machine to warn against operating the machine while the cylinder is removed.

REMOVAL - BOOM TELESCOPE CYLINDERS

To remove the boom telescope cylinders, the boom itself must first be disassembled. To disassemble the boom, proceed as follows (see Figure 5A-2):

1. Rotate the upper so that the boom assembly is over the front of the carrier, and lower the boom onto the boom cradle.

2. Support the main winch and winch mount. and remove the attaching hardware. Lower the winch and winch mount onto the deck of the machine.

NOTE

The winch and winch mount can be left suspended from the boom by removing only the top attaching hardware, and allowing the mount to swing down. Be sure that the winch mount is supported before removing any attaching hardware.

3. Disconnect the hydraulic lines attached to the cylinders. Cap the lines and plug the inlet ports of the cylinders.

CAUTION

Block the end of the lower telescope cylinder so that it will not drop when the pin is driven out of the cylinder and.

4. Loosen the set screw in the locking collar on each side of the lower cylinder pin. Drive the pin out of the lower cylinder eye using a suitable drift pin.

5. Slide boom sections 1 and 2 forward until they can be removed with a crane, and placed on suitable cribbing.

6. Loosen the set screw in the locking collar on each side of the upper cylinder pin. Drive the pin out of the upper cylinder eye using a suitable drift pin.

7. Slide boom section 2 forward until it can be removed with a crane, and placed on suitable cribbing.

8. Remove the screws and retainers attached to the front

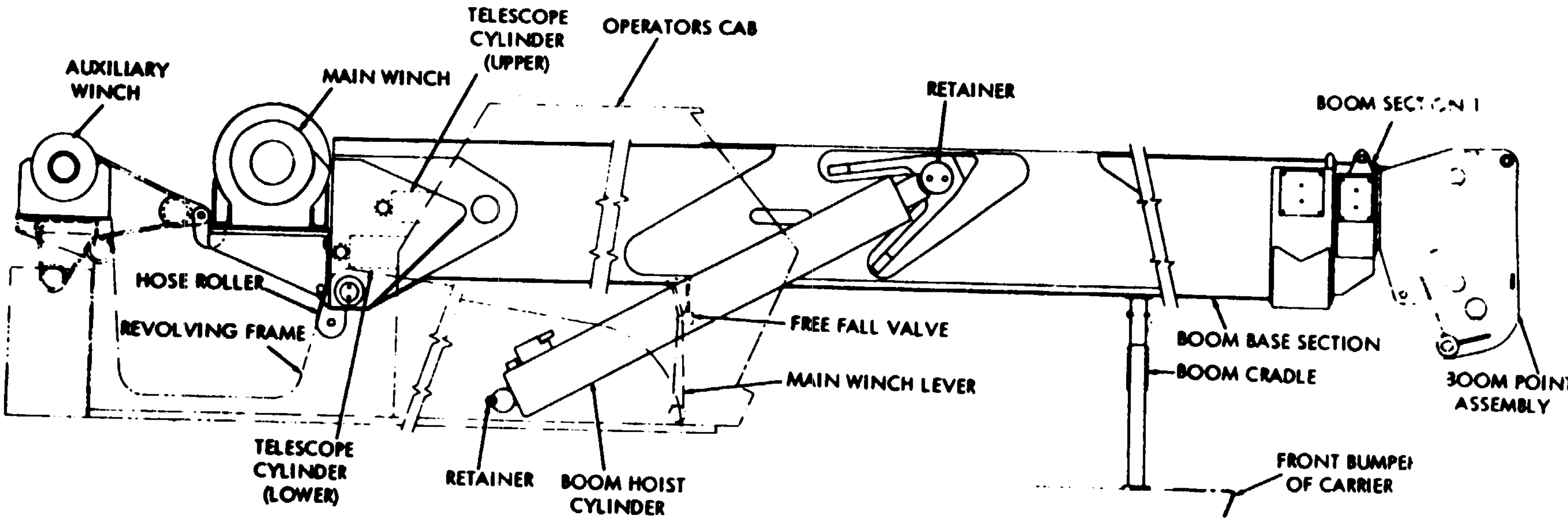


Figure 5A-1. Boom Installation (100J3482

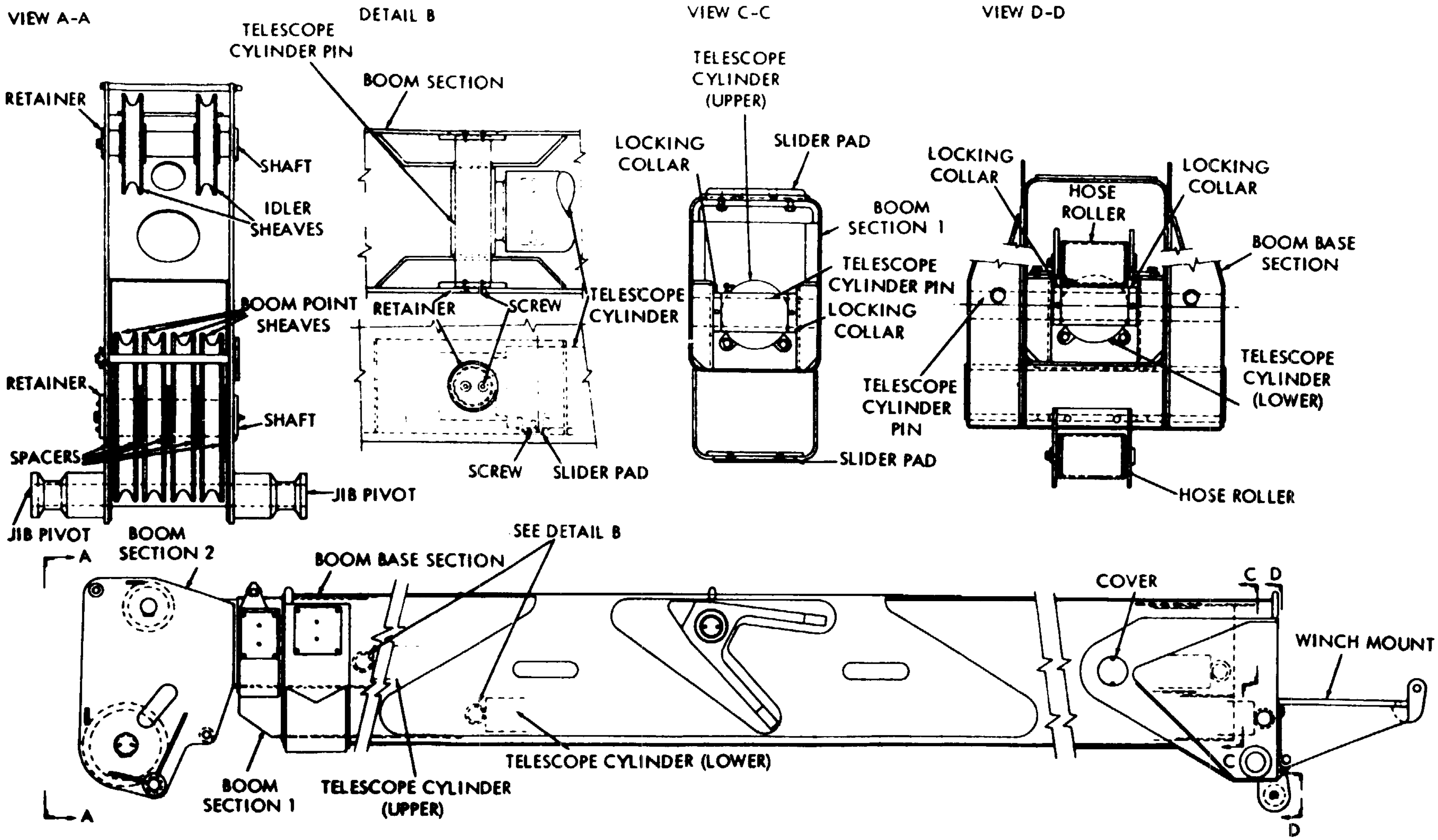


Figure 5A-2. Boom Assembly (100J4198-1)

cylinder pins, and drive the pins out using a suitable drift pin. Support the cylinders and slide them out the rear of the boom sections.

BOOM ALIGNMENT

GENERAL. The alignment of the boom sections on this machine is controlled by means of slider pads at each end of each boom section. Two adjustments are required to place the boom sections in proper alignment. They are: (1) side adjustment, and (2) vertical adjustment. Each adjustment is described below (see Figure 5A-3):

SIDE ADJUSTMENT. To determine the need for side adjustment, extend the boom to its maximum length and raise it to its maximum elevation. Sit along the centerline of the boom, with a transit if possible, to determine the amount of side deflection, If the amount of deflection exceeds 4 inches to either side of center, when no load is applied to the boom, it must be adjusted as follows:

Add shims at positions 5, 6, 7 end 8 to obtain a maximum of 1/32" (0.744 mm) clearance in the area of closest fit between the boom sections.

NOTE

The slider pads must be replaced when they hew worn to the point of exposing the heads of the bolts used to hold the slider pads in place.

VERTICAL ADJUSTMENT. Vertical alignment is controlled by slider pad thickness. When the thickness of slider pad (1) her worn to 7/8" (22.2 mm). shims totaling 3/16" (4.762 mm) should be installed between the slide pad carrier and the bottom plate of the boom base section. When the slider pad has worn on additional 1/8" (3.175 mm), install shims equaling 1/8" (3.175 mm) to compensate for the additional wear.

When the thickness of slider pad (2) has worn to 5/8" (15.8 mm), shims totaling 3/16" (4.762 mm) should be instolled between the slide pad carrier and the bottom plate of boom section 1. When the slider pad has worn an additional 1/8" (3.175 mm), install shims equaling 1/8" (3.175 mm) to compensate for the additional wear.

When it becomes necessary to reshim slider pad (2), the second time, rear slider pad (3) should be checked. If slide pad (3) has worn to a thickness of 7/8" (22.2 mm), shims totaling 3/16" (4.762 mm) should be installed between the slider pad carrier end the top plate of boom section 1. The rear slide pad should be reshimmed as required to maintain the 7/8" (22.2 mm) height of the slider pad.

Rear slider pads (4) generally do not require adjustment, but should be checked whenever slide pad (3) is adjusted. Adjust slider pads (4) in the same manner slide pad (3) is adjusted.

NOTE

The slider pads should be replaced when they are 1/2" (12.7 mm) thick.

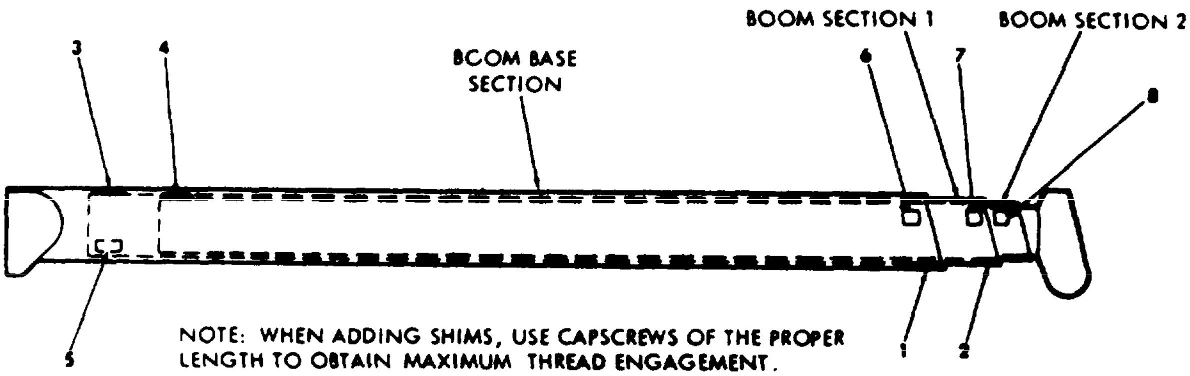


Figure 5A-3. Boom Alignment (1100P154)

SUB-SECTION 5B
BOOM HOIST CYLINDERS

BOOM HOIST CYLINDER (38Z231)

DISASSEMBLY. To disassemble the boom hoist cylinders, proceed as follows (see Figure 5B-1):

1. Remove lock screw (1) and washer to unlock the thread ring. Remove two screws (2). Insert a spanner wrench into the screw holes in the thread ring, and unscrew the thread ring.

2. Pull the rod, thread ring, head gland, and piston out of the cylinder.

NOTE

It may be necessary to bump the piston against the head assembly repeatly to force the head gland out of the cylinder bore.

3. Remove the cotter pin at the piston end of the rod and remove the piston nut. The piston, head gland, and thread ring can now be removed.

INSPECTION AND REPAIR. After the cylinder has been disassembled, clean all the cylinder components in a suitable commercial cleaning solvent, and then lay the parts on a clean workbench for inspection. Particular attention should be paid to the following items when inspecting the cylinder components:

1. Carefully inspect all seals and components for damage or excessive wear, and replace as required. The grey iron piston rings tend to wear or “break-in” to the mating cylinder bore surface. These piston rings should not be replaced unless they have been seriously damaged.

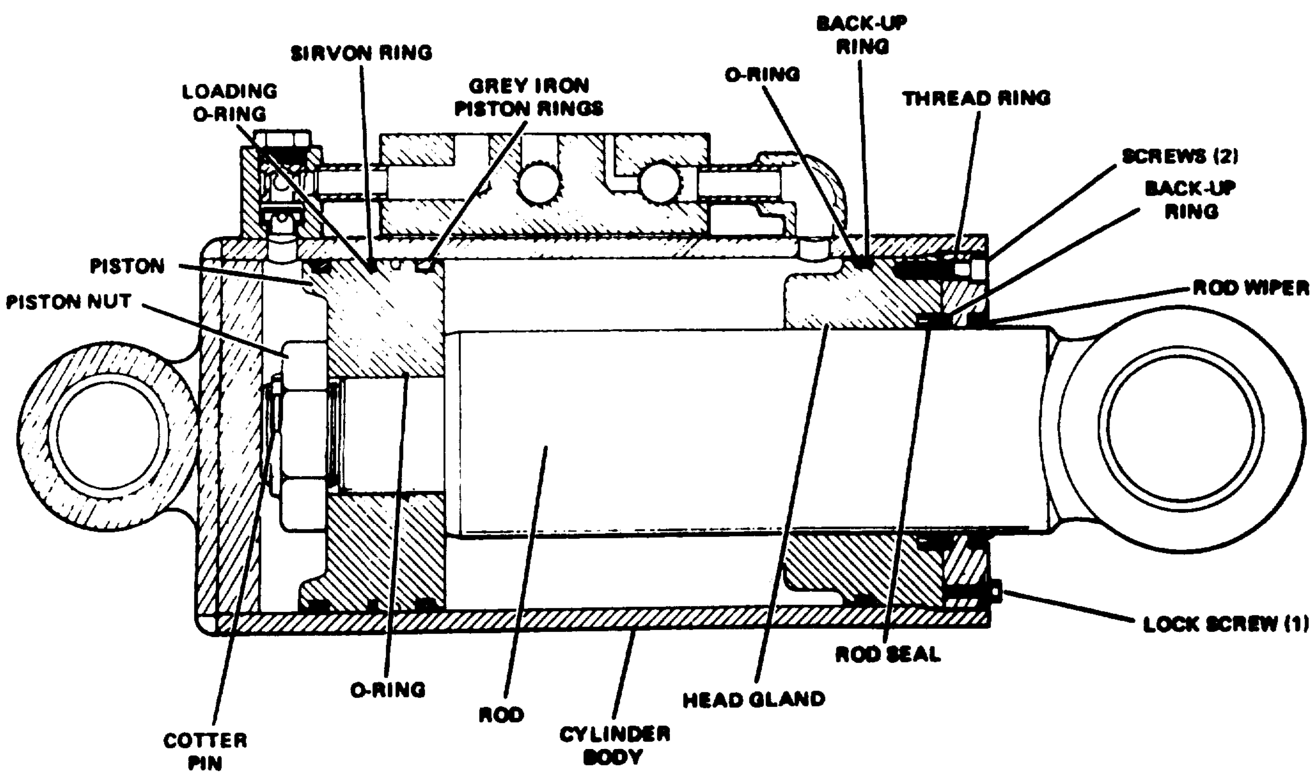


Figure 5B-1. Boom Hoist Cylinder (38Z231)

2. The sirvon piston ring seal should not be removed from the piston unless a new ring must be installed, since removing the seal will permanently damage it. To replace the sirvon piston seal, proceed as follows:

A. Remove the grey iron piston ring closest to the sirvon piston seal groove.

B. Warm the sirvon piston seal in either hot water or oil. Install one side of the seal in its groove and carefully walk the other side into the groove.

CAUTION

When installing the sirvon piston seal, do not allow it to become twisted in the piston groove.

REASSEMBLY. To reassemble the cylinder, proceed as follows:

1. Install the thread ring, head gland, piston, and piston nut on the rod. Be certain that the cotter pin is installed properly in the end of the rod.

2. Oil or grease the inside of the cylinder bore and piston thoroughly. Then carefully position the piston in the mouth of the cylinder, end rock the rod slightly to compress the piston rings es they enter the cylinder bore. Slide the head gland into the cylinder bore.

NOTE

If the head gland has difficulty sliding into the cylinder bore, a pair of bar clamps should be used to apply a steady pressure to the herd gland. which will cause the seals to compress and enter the bore.

3. Note the location of the two tapped holes in the head gland and mark these locations on the outside of the cylinder. Screw the thread ring into the cylinder bore until it is flush with the end of the cylinder.

Then turn the thread ring until the two countersunk holes are aligned with the holes in the head gland. Install the two countersunk head screws, and tighten both screws evenly until both screws are tight.

4. Install screw (1) with a washer and tighten it snugly to lock the thread ring.

5. After the cylinder is reinstalled on the machine, cycle the cylinder slowly a full stroke in both directions repeatly to purge the trapped air from the cylinder.

NOTE

When air is present in the cylinders, jerky and/or irratic operation of the cylinders can be expected.

BOOM HOIST CYLINDER (38U92)

DISASSEMBLY. To disassemble the boom hoist cylinders, proceed as follows (see Figure 5B-2):

1. Remove screw (1) and washer to unlock the thread ring. Remove two screws (2). Insert a spanner wrench into the screw holes in the thread ring, and unscrew the thread ring.

2. Pull the rod, thread ring, head gland, and piston out of the cylinder.

NOTE

It may be necessary to bump the piston against the head assembly repeatly to force the head gland out of the cylinder bore.

3. Remove the cotter pin at the piston end of the rod and remove the piston nut. The piston, head gland, and thread ring can now be removed.

INSPECTION AND REPAIR. After the cylinder has been disassembled, clean all the cylinder components in a suitable commercial cleaning solvent, and then lay the parts on a clean workbench for inspection. Particular attention should be paid to the following items when inspecting the cylinder components:

1. Carefully inspect all seals and components for damage or excessive wear. and replace as required. The grey iron piston rings tend to wear or “break-in” to the mating cylinder bore surface. These piston rings should not be replaced unless they have been seriously damaged.

2. The sirvon piston ring seal should not be removed from the piston unless a new ring must be installed, since removing the seal will permanently damage it. To replace the sirvon piston seal, proceed as follows:

A. Remove the gray iron piston ring closest to the sirvon piston seal groove.

B. Warm the sirvon piston seal in either hot water or oil. Install one side of the seal in its qroove and carefully walk the other side into the goove.

CAUTION

When installing the sirvon piston seal, do not allow it to become twisted in the piston groove.

REASSEMBLY. To reassemble the cylinder, proceed as follows:

1. Install the thread ring, head gland, piston, and piston nut on the rod. Be certain that the cotter pin is installed properly in the end of the rod.

2. Oil or grease the inside of the cylinder bore and piston thoroughly. Then carefully position the piston in the mouth of the cylinder, and rock the rod slightly to compress the piston ring, as they enter the cylinder bore. Slide the head gland into the cylinder bore.

NOTE

If the head gland has difficulty sliding into the cylinder bore, a pair of bar clamps should be used to apply a steady pressure to the head gland, which will cause the seals to compress and enter the bore.

3. Note the location of the two tapped holes in the head gland and mark these locations on the outside of the cylinder. Screw the thread ring into the cylinder bore until it is flush with the end of the cylinder. Then turn the thread ring until the two countersunk holes are aligned with the holes in the head gland. Install the two countersunk head screws. and tighten both screws evenly until both screws are tight.

4. Install screw (1) with a washer and tighten it snugly to lock the thread ring.

5. After the cylinder is reinstalled on the machine, cycle the cylinder slowly a full stroke in both directions repeatly to purge the trapped air from the cylinder.

NOTE

When air is present in the cylinders, jerky and/or irratic operation of the cylinders can be expected.

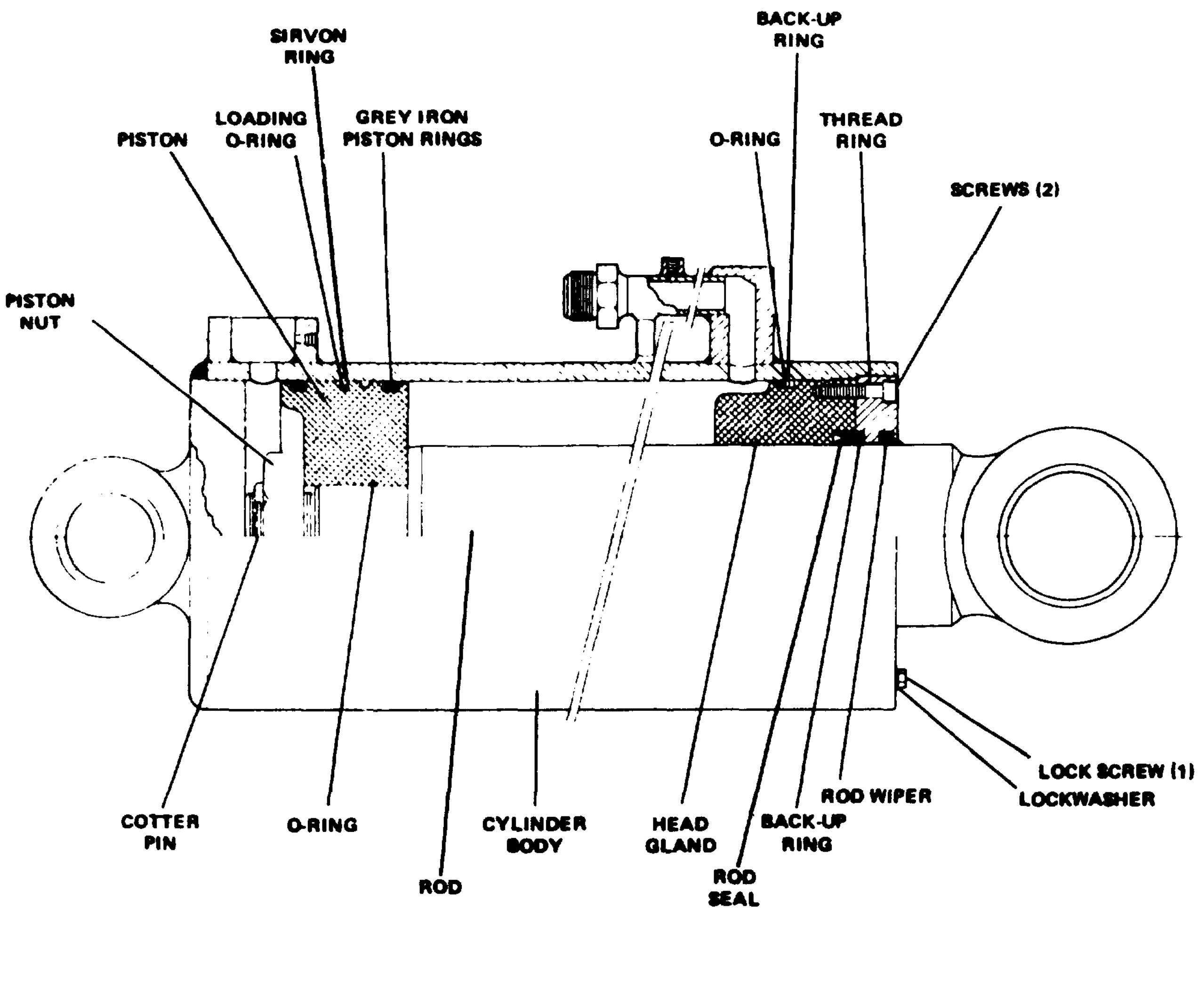


Figure 5B-2 Boom Hoist Cylinder (38U92)

SUB-SECTION 5C
BOOM TELESCOPE CYLINDERS

BOOM TELESCOPE CYLINDER (38Z230)

DISASSEMBLY. To disassemble the boom telescope cylinder. proceed as follows (see Figure 5C-1):

1. Remove the counterbalance valve cartridge at the base of the cylinder only if repairs are required.

2. Remove the two locking set screws at the extreme outer end of the rod. Unscrew the rod eye from the tubular rod by placing a pin or bar through the rod eye, and if necessary, prevent the rod from rotating by placing a spanner wrench in the holes provided in the end of the rod.

3. Remove the locking sat screw from the face of the head gland nut, and unscrew the nut. The rod seals can be removed by either pulling the rod out of the cylinder a few inches, or by prying the seals out of the pocket with a sharp instrument.

4. Pull the rod out of the cylinder approximately two feet and support the rod to remove the weight of the rod from the head gland. Unscrew the head gland and slide it off the rod.

CAUTION

The rod must be supportad at all times to prevent damage to the piston and/or cylinder bore. Do not allow the rod to cantilever from the cylinder.

5. Remove the rod and piston by pulling the rod straight out of the cylinder. Use extreme caution to ensure that the rod surface does not become scratched, nicked, or otherwise damaged during or after its removal from the cylinder.

5. Loosen the two locking set screws in the piston nut, and remove the piston nut using a spanner wrench. Remove the piston by tapping the front end of the spacer sleeve with a wooden block.

INSPECTION AND REPAIR. After the cylinder has been disassembled, clean all the cylinder components in a suit-

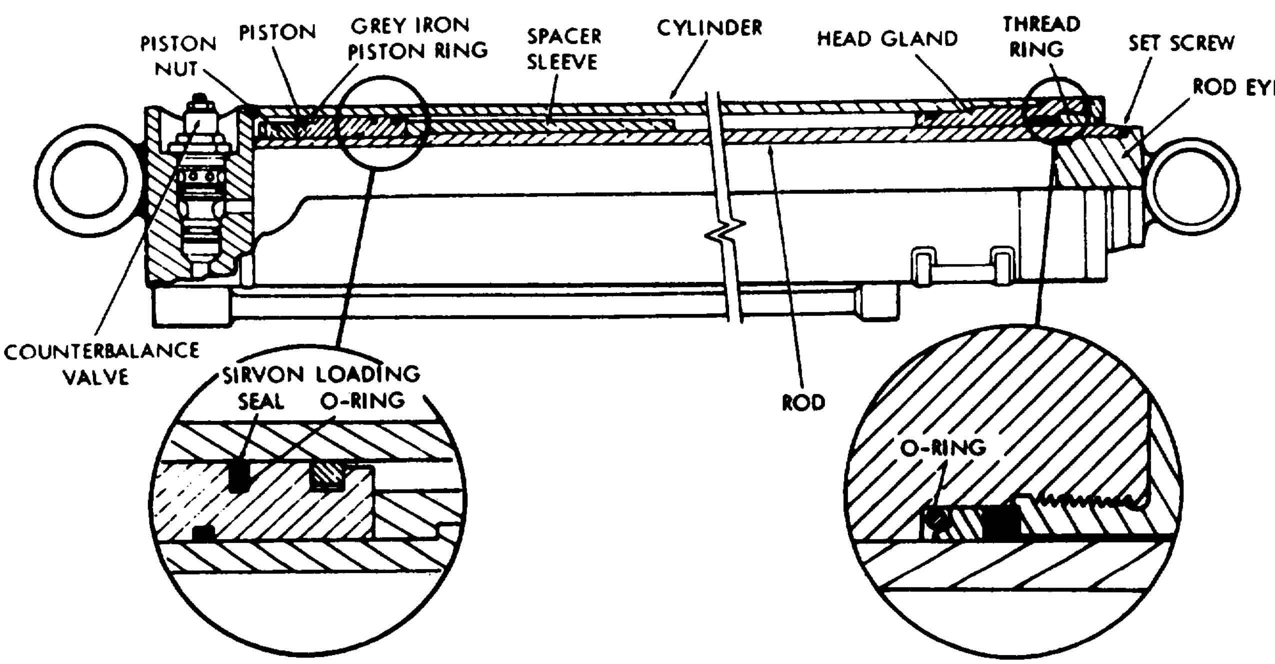


Figure 5C-1. Boom Telescope Cylinder

able commercial cleaning solvent. and then lay the parts on a clean workbench for Inspection. Particular attention should be paid to the following items when inspecting the cylinder components:

1. Carefully inspect all seals and components for damage or excessive wear, and replace as required. The grey iron piston rings tend to wear or "break-in" to the mating cylinder bore surface. These piston rings should not be replaced unless they have been seriously damaged.

2. The sirvon piston ring seal should not be removed from the piston unless a new ring must be installed, since removing the seal will permanently damage it. To replace the sirvon piston seal, proceed as follows:

A. Remove the grey iron piston ring closest to the sirvon piston seal groove.

B. Warm the new sirvon piston seal in either hot water or oil. Install one side of the seal in its groove and carefully walk the other side into the groove.

CAUTION

When installing the sirvon piston seal, do not allow it to become twisted in the piston groove.

REASSEMBLY To reassemble the boom extension cylinder. proceed as follows:

1. Install the spacer sleeve on the rod-, and then install the piston. Install the piston nut and tighten it until it is snug. Install the piston nut locking set screws and torque them down tight to prevent the piston from loosening.

2. Oil or grease the mouth of the cylinder and the piston thoroughly. Position the rod and piston assembly in the mouth of the cylinder, and slowly rock the outer end of the rod to compress the piston rings as they enter the cylinder.

CAUTION

Be sure to support the rod at all times to prevent damage to the piston and/or cylinder bore.

3. Oil or grease the outside of the head gland and then screw it into the cylinder bore. Install the rod eye on the rod and tighten the locking set screws in the outer end of the rod.

4. After the cylinder is reinstalled on the machine. cycle the cylinder slowly a full stroke in both directions repeatly to purge the trapped air from the cylinder.

NOTE

When air is present in the cylinder, jerky and/or irratic operation of the cylinder can be expected.

BOOM TELESCOPE CYLINDER (38R32)

DISASSEMBLY. TO disassemble the boom telescope cylinder, proceed as follows:

NOTE

The telescope cylinders used to extend and retract the boom sections are Identical internally. The basic difference between these cylinders is that the lower telescope cylinder has the hose loop assembly attached to it. If the upper telescope cylinder is to be disassembled, begin with Step 2 below. If the lower telescope cylinder is to be disassembled, begin with Step 1.

1. Remove the cable clamps which secure the rope to the anchor bracket welded to the rod end of the cylinder (see Figure 5C-2).

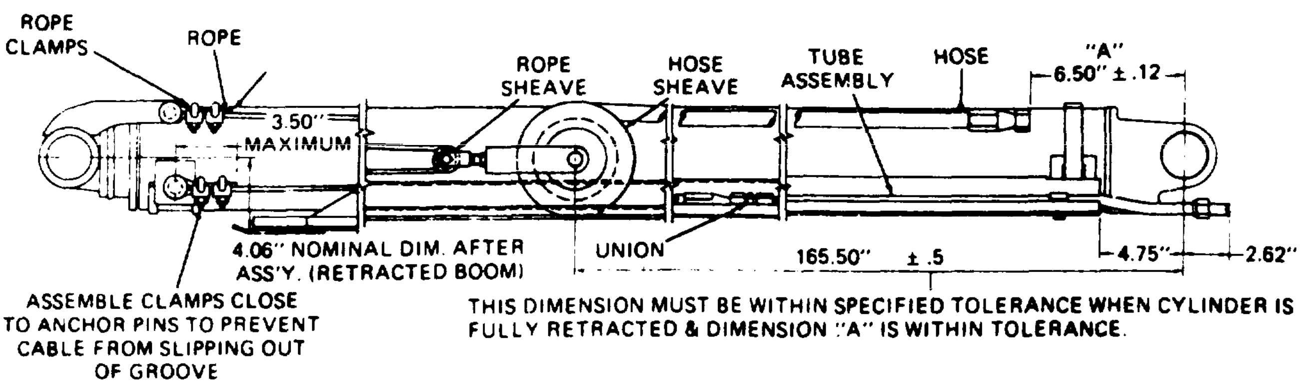


Figure 5C-2. Hose Loop Assembly (100J3870)

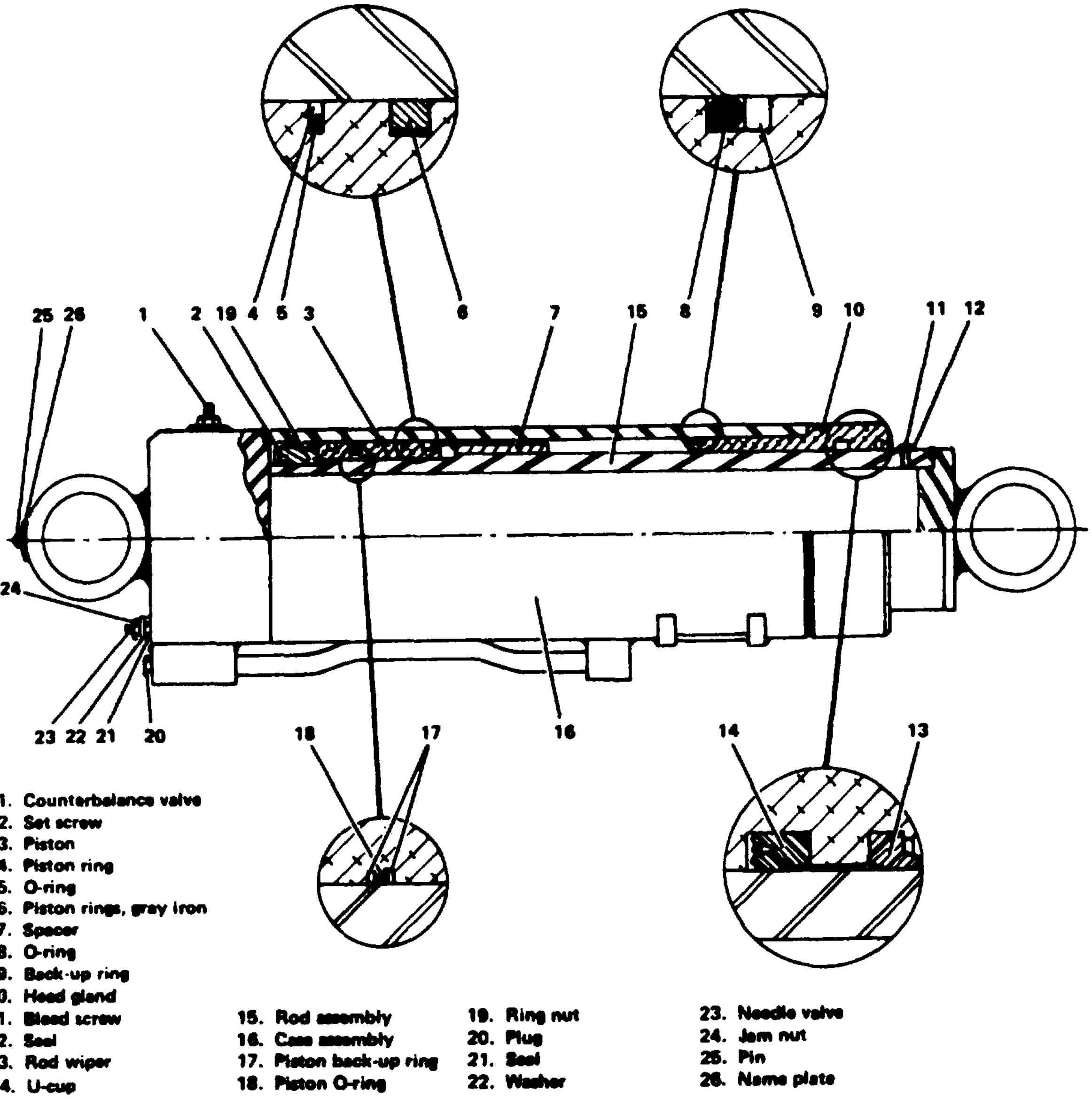


Figure 5C-3. Boom Telescope Cylinder (38R32)

2. Remove the counterbalance valve cartridge at the base of the cylinder only if repairs are required (see Figure 5C-3).

3. Use a suitable spanner wrench to remove head gland (10).

4. Slide rod assembly (15) from cylinder case (16).

CAUTION

The rod must be supported at all times to prevent damage to the piston and/or cylinder bore. Do not allow the rod to cantilever from the cylinder.

5. Loosen setscrew (2). Then remove ring nut (19).

6. Remove piston (3), spacer (7), and head gland (10). The remaining parts can now be removed as required.

INSPECTION AND REPAIR. After the cylinder has boon disassembled, clean all the cylinder components in a suitable commercial cleaning solvent, and then lay the parts on a clean workbench for inspection. Particular attention should be paid to the following items when inspecting the cylinder components:

1. Carefully inspect all seals and components for damage or excessive wear, and replace as required. The grey iron piston rings, tend to wear or “break-in” to the mating cylinder bore surface. These piston rings should not be replaced unless they have been seriously damaged.

2. The sirvon piston ring seal should not be removed from the piston unless a new ring must he installed, since removing the seal will permanently damage it. To replace the sirvon piston reel, proceed as follows:

A. Remove the grey iron piston ring closest to the sirvon piston seal groove.

B. Warm the new sirvon piston seal in either hot water or oil. Install one side of the seal in its groove and carefully walk the other side into the groove.

CAUTION

When installing the sirvon piston seal, do not allow it to become twisted in the piston groove.

REASSEMBLY. To reassemble the boom telescope cylinder, proceed as follows (see Figure 5C-3):

1. lnstall all the seals, Furnished in the the repair kit, as shown in Figure 5C-3.

2. Slide head gland (10), spacer (7), and piston (3) onto rod assembly (15).

3. Install ring nut (19) and tighten setscrew (2).

4. Slide the rod assembly into the cylinder case and tighten head cland (10).

5. Attach the cable to the cable anchor bracket, and secure it with two cable clamps. This step is not necessary when reassembling the upper telescope cylinder. Check all the dimensions shown on Figure 5C-2 before installing the cylinder in the boom.

SUB-SECTION 5D
FLOW DIVIDERS

FLOW DIVIDER (36Z680)

DESCRIPTION

Flow divider 36Z680 is a combination flow divider-cross over relief valve. The flow divider portion of the valve is a pressure compensated fixed flow valve which divides the input flow proportionally into two output flows.

As flow enters the inlet port it is divided into two flows, each of which passes through a calibrated orifice in one of the two pistons and out through their respective outlet ports (see Figure 5D-1). If flow tends to become greater at one of the outlet ports, the resulting pressure drop across that piston will force the linked pistons to shift in that direction, restricting flow through that outlet port. Any other changes in inlet or outlet pressure will cause the pistons to shift similarly to restrict or allow flow through the valve, thus providing a constant flow to each outlet port.

The cross-over relief valve portion of the valve allows excess pressure, caused by a greater volume of oil returning to tank through the flow divider than it is capable of handling, to return to tank through an alternate path.

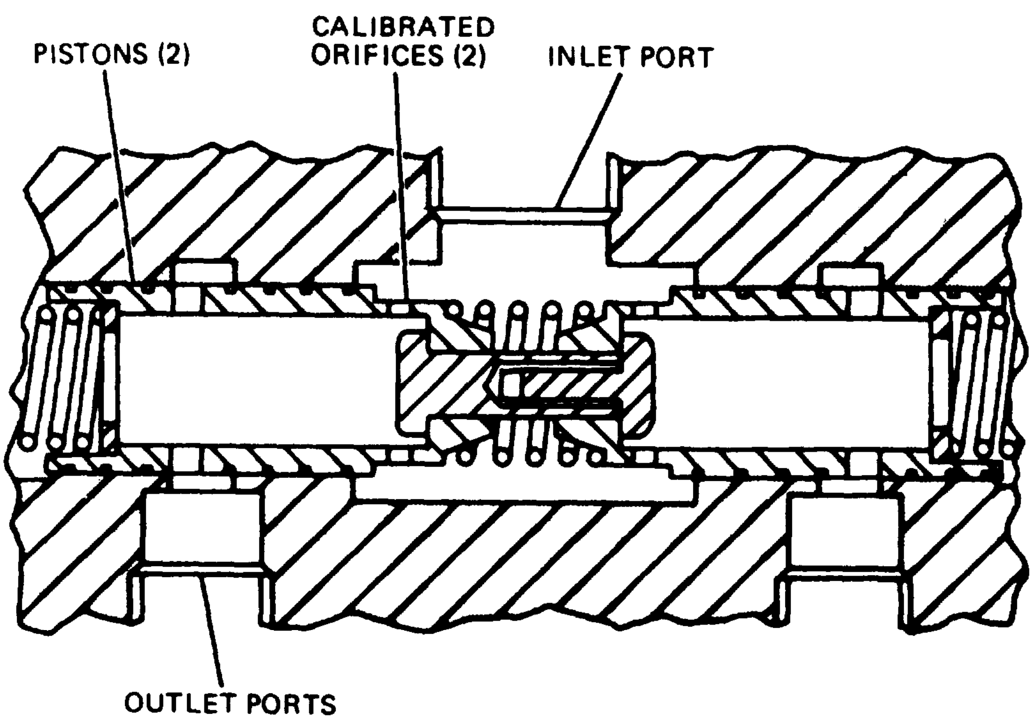


Figure 5D-1. Flow Divider Operation

TROUBLESHOOTING

A malfunctioning flow divider will cause one boom section to extend or retract faster than the other. Improper boom sequencing can, however, be caused by a mechanical problem within the boom itself.

Since Improper boom sequencing can be caused by a faulty flow divider or mechanical problems within the boom, it is recommended that the boom be thoroughly inspected before the flow divider is removed.

If no mechanical problems exist within the boom, the problem is probably caused by contamination or excessive leakage within the flow divider. In this case, the piston subassembly within the flow divider should be removed, cleaned and Inspected.

REPAIR

GENERAL. Repair of this valve should be limited to the replacement of seals, the piston sub-assembly and relief valve sub-assemblies, or the complete flow divider.

REMOVAL. To remove the flow divider, proceed as follows:

1. Loosen the fittings at the inlet and outlet ports, but do not disconnect the fittings. Tap the fittings gently to break the oil tight connection. This will allow any pressure which might be trapped in the circuit to escape.

2. Disconnect the fittings attached to the inlet and outlet ports.

3. Remove the mounting capscrews and lockwashers which secure the flow divider to the machine, and remove the flow divider.

DISASSEMBLY. To disassemble the flow divider, proceed as follows (see Figure 5D-2):

1. Remove the plugs at each end of the flow divider.

2. Carefully push the piston sub-assembly out one end of the body. Do not disassemble the piston subassembly. If the pistons are worn or damaged, the entire sub-assembly should be replaced.

3. Remove the plugs at each end of the cross-over relief valve. Remove the relief valve sub-assemblies and inspect the poppet and seat for damage, and replace the part if wear or damage is evident.

4. Wash all parts in a clean mineral oil solvent.

REASSEMBLY. Reassemble the flow divider in the reverse order of disassembly. Be sure to lubricate the piston and relief valve sub-assemblies with clean hydraulic oil before they are installed in the valve body.

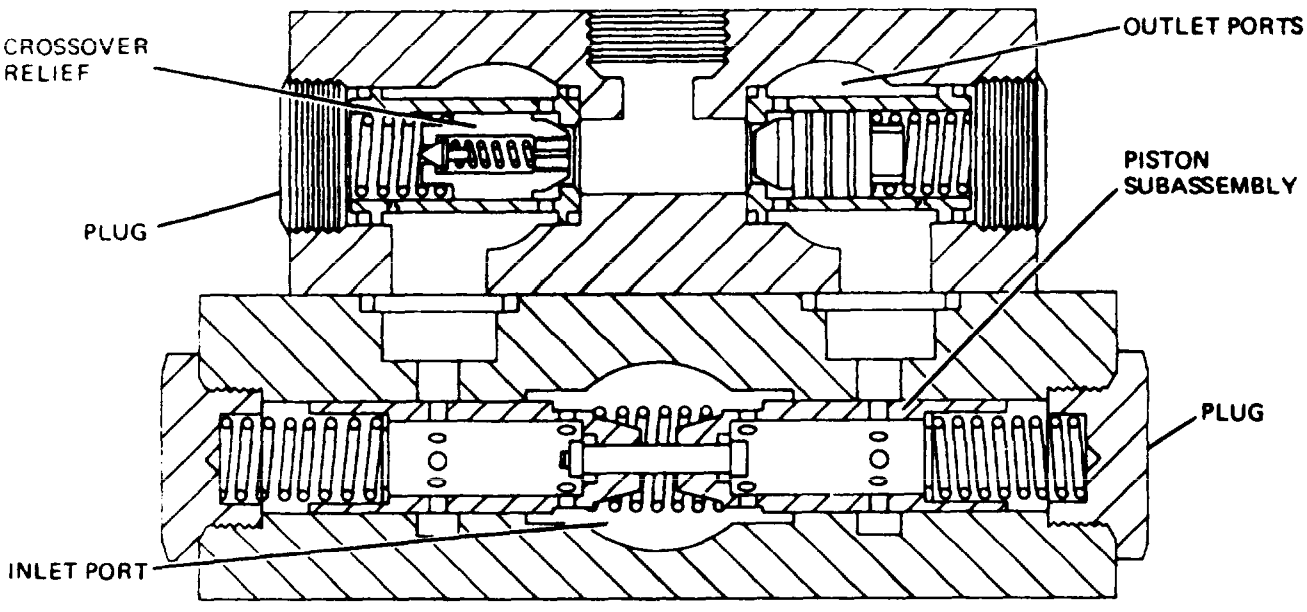


Figure 5D-2. Flow Divider (36Z680)

FLOW DIVIDER (36Q46)

DESCRIPTION

Flow divider 36Q46 is a pressure compensated fixed flow valve which divides one input flow proportionally into two output flows.

As flow enters the inlet port it is divided into two flows, each of which passes through a calibrated orifice in one of the two pistons and out through their respective outlet ports (see Figure 5D-3). If flows tends to become greater at one of the outlet ports, the resulting pressure drop across that piston will force the linked pistons to shift in that direction, restricting flow through that outlet port. Any other changes in inlet or outlet pressure will cause the pistons to shift similarly to restrict or allow flow through the valve, thus providing a constant flow to each outlet port.

TROUBLESHOOTING

A malfunctioning flow divider will cause one boom section to extend or retract faster than the other. Improper boom sequencing can, however be caused by a mechanical problem within the boom itself or by a fault in the boom telescope control valve.

Since improper boom sequencing can be caused by a faulty flow divider, a mechanical problem within the boom, or a faulty control valve, it is recommended that the boom and control valve be thoroughly inspected before the flow divider is removed.

If no mechanical problems exist with the boom and the control, valve is functioning properly, the problem is prob. ably caused by contamination or excessive leakage within the flow divider. In this case, the piston sub-assembly with. in the flow divider should be removed, cleaned and inspected.

REPAIR

GENERAL. Repair of this valve should be limited to the replacement of seals and piston sub-assembly, or the complete flow divider.

REMOVAL. To remove the flow divider, proceed as follows:

NOTE

It is not necessary to remove the flow divider from the machine to remove the piston sub-assembly. Be sure the flow divider is not subjected to pressure as described in Step 1 before removing the piston sub-assembly.

1. Loosen the fittings at the inlet and outlet ports, but do not disconnect the fittings. Tap the fittings gently to break the oil tight connection. This will allow my pressure which might be trapped in the circuit to escape.

2. Disconnect the fittings attached to the inlet and outlet ports, and remove the flow divider.

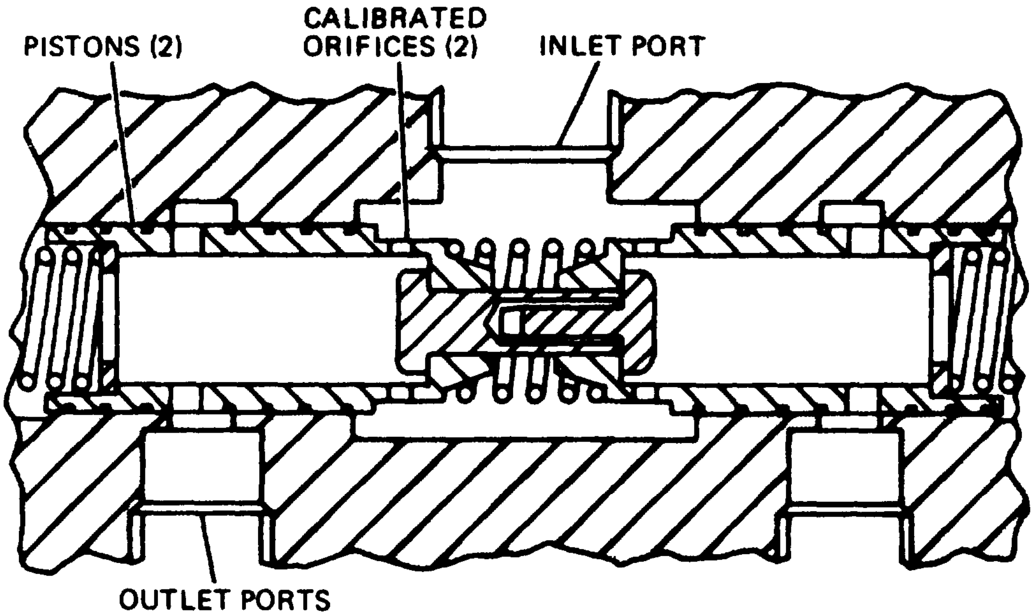


Figure 5D-3. Flow Divider Operation

DISASSEMBLY. To disassemble the flow divider, proceed as follows (see Figure 5D-4):

1. Remove the plugs at each end of the flow divider.

2. Carefully push the piston sub-assembly out on. end of the body. Do not disassemble the piston sub-assembly. If the pistons are worn or damaged, the entire sub-assembly should be replaced.

3. Wash all parts in a clean mineral oil solvent.

REASSEMBLY. Reassemble the flow divider in the reverse order of disassembly. Be sure to lubricate the piston sub-assembly with clean hydraulic oil before it is installed in the valve body.

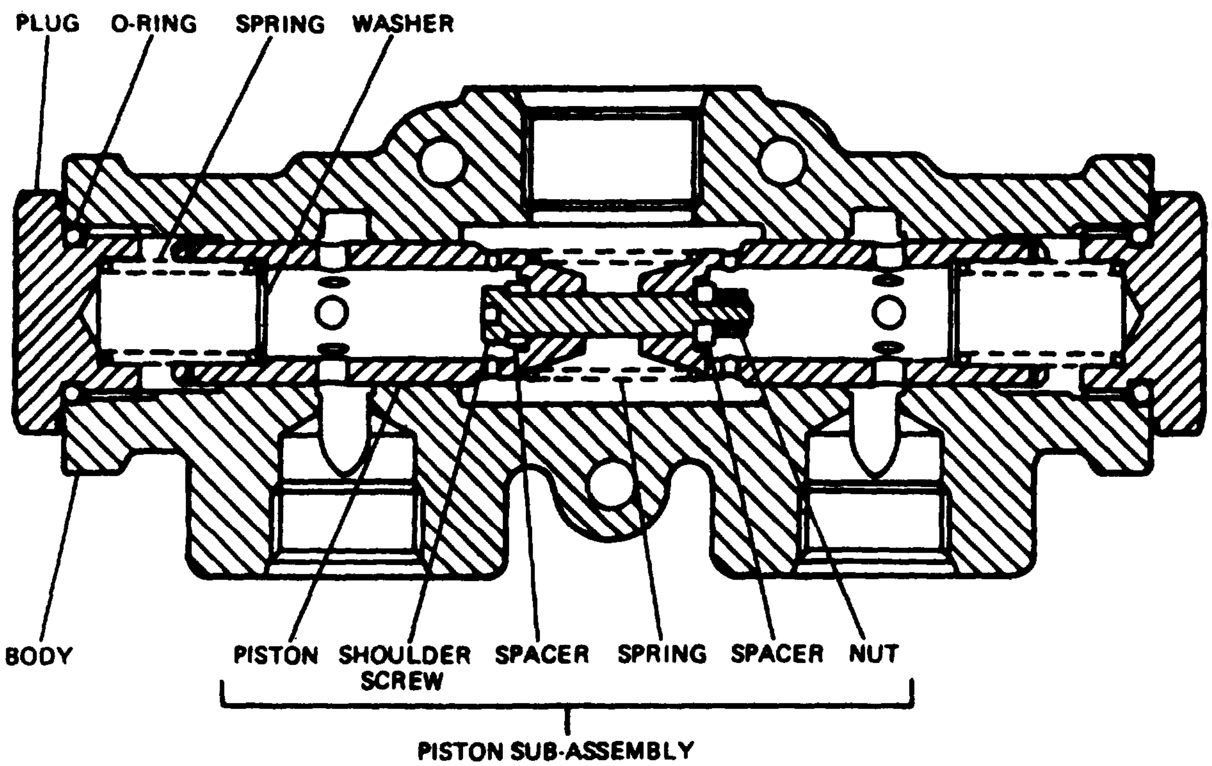


Figure 5D-4. Flow Divider (36Q46)

SUB-SECTION 5E
HOSE REELS

HOSE REEL (36Z691)

GENERAL

The hose reel is mounted on the revolving frame and provides an extendable hydraulic connection between the revolving frame and the telescoping sections of the boom. In other words, the hose reel pays out hose when the boom is extended and takes up hose when the boom is retracted.

The hose reel consists basically of three parts; a spring motor, a swivel, and a reel. Oil from the control valve is fed to the swivel which maintains a flow path to the hoses regardless of the position of the hose reel. The spring motor maintains the hoses at a predetermined tension so that the hoses will retract when the boom is retracted, while still allowing enough freedom for the hoses to extend when the boom is extended.

REPAIR

GENERAL. Repair of the hose reel should be limited lo the replacement of the spring motor, springs in the motor, swivel seals, and hoses, or the complete unit. The procedure for replacing each of these items is described below:

WARNING

Before attempting any repairs on the hose reel, remove all hydraulic pressure by operating the telescope lever(s) with the engine stopped, and relieve spring motor tension by disconnecting the hoses and unwinding the spring motor. Be sure to prevent the hose reel from turning while the hoses are being disconnected.

SPRING MOTOR REPLACEMENT. To replace the spring motor, proceed as follows (see Figure 5E-1):

1. Remove four screws (3) and washers (4).

2. Full motor (1) away from mounting plate (2) until the reel shaft drive pin is disengaged from the motor shaft.

3. Position the new motor on the mounting plate, making sure the reel shaft drive pin engages the motor shaft. When the new motor is properly positioned, install screws (3) and washers (4).

4. Pretension the how reel by turning the reel clockwise, as viewed from the how side, three turns. Cast off one wrap of hose from the real, without removing any pretension, and attach the hoses to the upper telescope cylinder.

MOTOR SPRING REPLACEMENT. To replace the spring in the spring motor, proceed as follows:

1. Remove four screws (3, Figure 5E-1) and washers (4). Pull motor'(l) away from mounting plate (2) until the reel shaft drive pin is disengaged from the motor shaft.

2. Place the motor on end, back plate (1, Figure 5E-2) down. Remove six tie bolts (2) and nuts (3). Lift off front cover (4) and outside motor band (5).

3. Pull driveshaft (6), with fixed hubs (7), up and out, while holding the center of exposed spring (8) in position. Do nor allow the center of the spring to be pulled out.

4. Springs (8) and cup assemblies (9 and 10) may now be removed and separated as required.

5. Install a new spring in cup assemblies (9 or 10). Position the spring in the cup assembly so that-the hook on the outer edge of the spring engages the hook on the inner surface of the cup assembly.

6. lnstall cup assembly (9), with spring (8) installed, on drive ring (11). Be sure the square cutout in cup assembly (9) engages the fine on drive ring (11).

7. Install cup assembly (10) on assembly (9).

8. Install driveshaft (6), with fixed hubs (7), down through the center of the springs. Be sure thee hook on the fixed hub engages the hook on the spring.

9. Install outside motor band (5) and front cover (4). Install tie bolts (2) through front and back covers. Apply a small amount of Loctite Grade E sealant to the lie bolt threads, and then install nuts (3).

10. Position the motor on mounting plate (2, Figure 5E-1), making sure the reel shaft drive pin engages the motor shaft. When the motor is properly positioned, install screws (3) with washers (4).

11. Pretension the hose reel by turning the reel clockwise, as viewed from the hose side, three turns. Cast off one wrap of hose from the reel. without removing any pretension, and attach the hoses to the upper telescope cylinder.

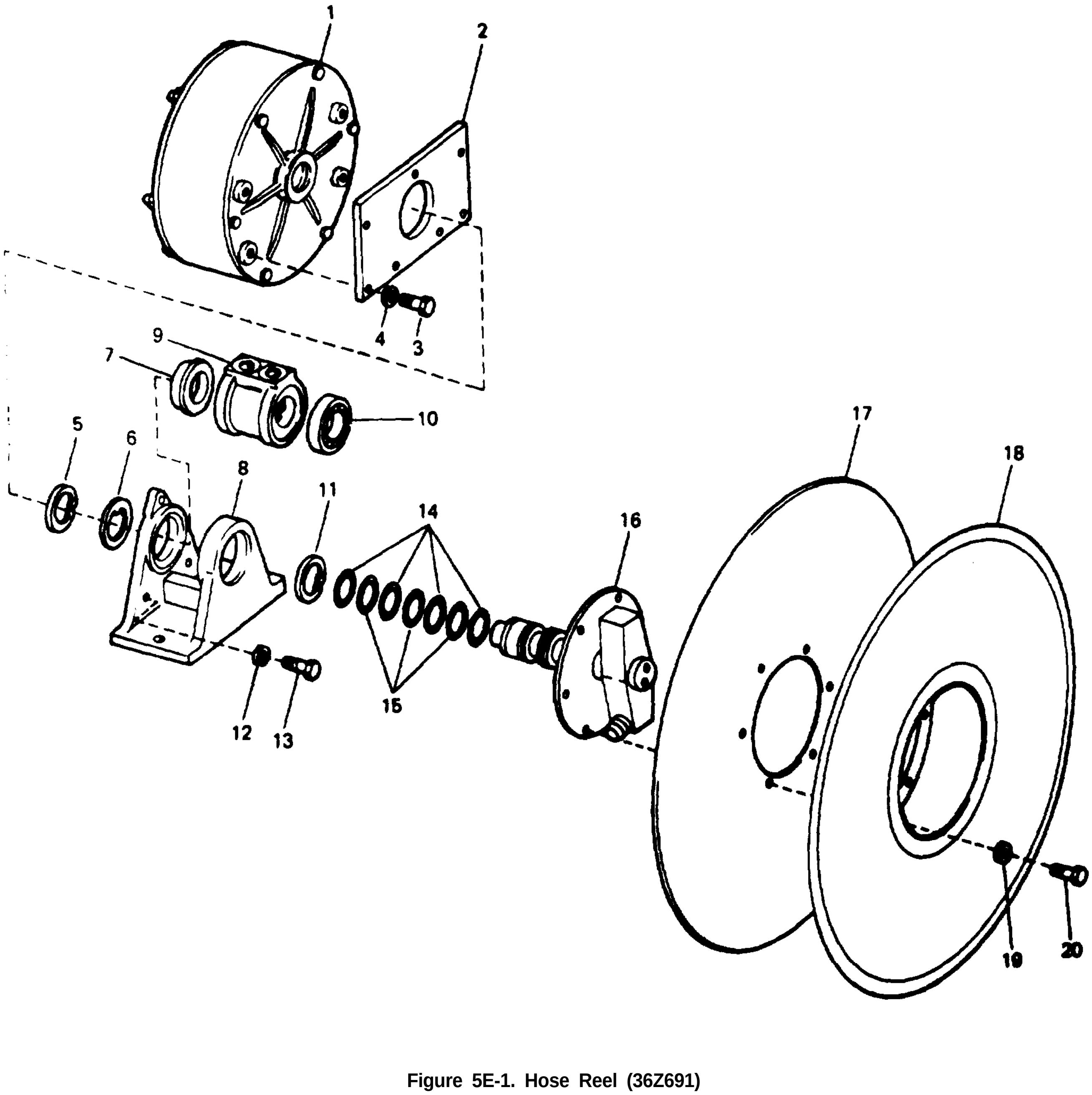


Figure 5E-1. Hose Reel (36Z691)

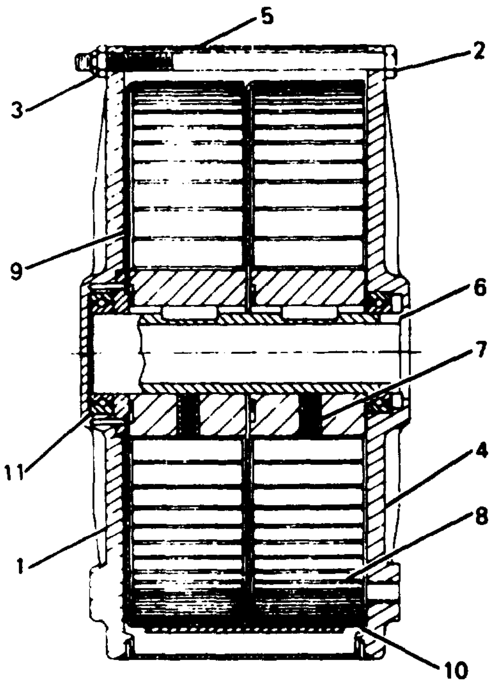


Figure 5E-2. Hose Reel Spring Motor

SWIVEL SEAL REPLACEMENT. To replace the swivel seals, proceed as follows:

NOTE

Two different seal arrangements have been applied lo the swivel of this hose reel by its manufacturer. Earlier hose reels have a seal arrangement which consists of 3 Glyd rings and 3 O-rings, while later units have 3 O-rings and 4 back-up rings. These seals are not interchangeable. In order lo expedite shipment of the proper seals, the Harnischfeger Parts Department mutt know the two letter date code stamped on the hose reel nameplate (see Figure 5E-3). Some hose reels do not have a date code. If this is the case, the parts department should be informed that no date code is shown.

1. Remove tour screws (3, Figure 5E-1) and washers (4). Pull motor (1) away from mounting plate (2) until the reel shaft drive pin is disengaged from the motor shaft.

2. Remove the hose from the reel. Remove screws (20) end washers (19), and remove the inner and outer flanges (17 end 18).

3. Remove retaining ring (5), keyed washer (6), and retaining ring (11). Pull mainshaft (16). by the reel and, out of swivel (9). Remove old seals (14 and 15) from mainshaft (16).

4. Install new seals in the seal grooves. If the swivel was equipped with 3 Glyd rings and 3 O-rings, proceed as described in Step A. If 3 O-rings end 4 back-up rings were used, proceed as described in Step B. Be sure the new seal arrangement is identical to the seal arrangement that was removed.

   A. Lubricate the O-rings end Glyd rings in clean hydraulic oil. Install one O-ring in each seal groove. Then install one Glyd ring over each O-ring (see Figure 5E-4, Early Arrangement). Kneed the Glyd ring into the seal grooves.

   B. Lubricate the O-rings and back-up rings in clean hydraulic oil. Install one O-ring end two back-up rings in the center seal groove. Install one O-ring in each outboard seal groove. Install a back-up ring next to each outboard O-ring so that the back-up ring is on the outboard side of the O-ring (see Figure 5E-4, Later Arrangement).

5. Lubricate main shaft (16, Figure 5E-1) with clean hydraulic oil, Insert the main shaft through frame (8) and into swivel (9), being careful not to damage the seals.

6. Install retaining ring (5), keyed washer (6), and retaining ring (11).

7. Install inner and outer flanges (17 and 18) and secure the flanges with screws (20) and washers (19). Install the hose on the reel.

8. Position motor (1) on mounting plate (2), making sure the reel shaft drive pin engages the motor shaft. When the motor is properly positioned, install screws (3) end washers (4).

9. Pretension the hose reel by turning the reel clockwire, as viewed from the hose side, three turns. Cast off one wrap of hose from the reel, without removing my pretension, and attach the hose to the upper telescope cylinder.

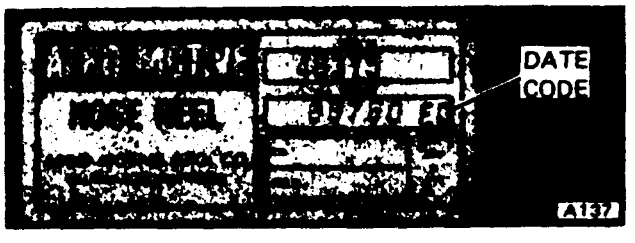


Figure 5E-3. How Reel Nameplate

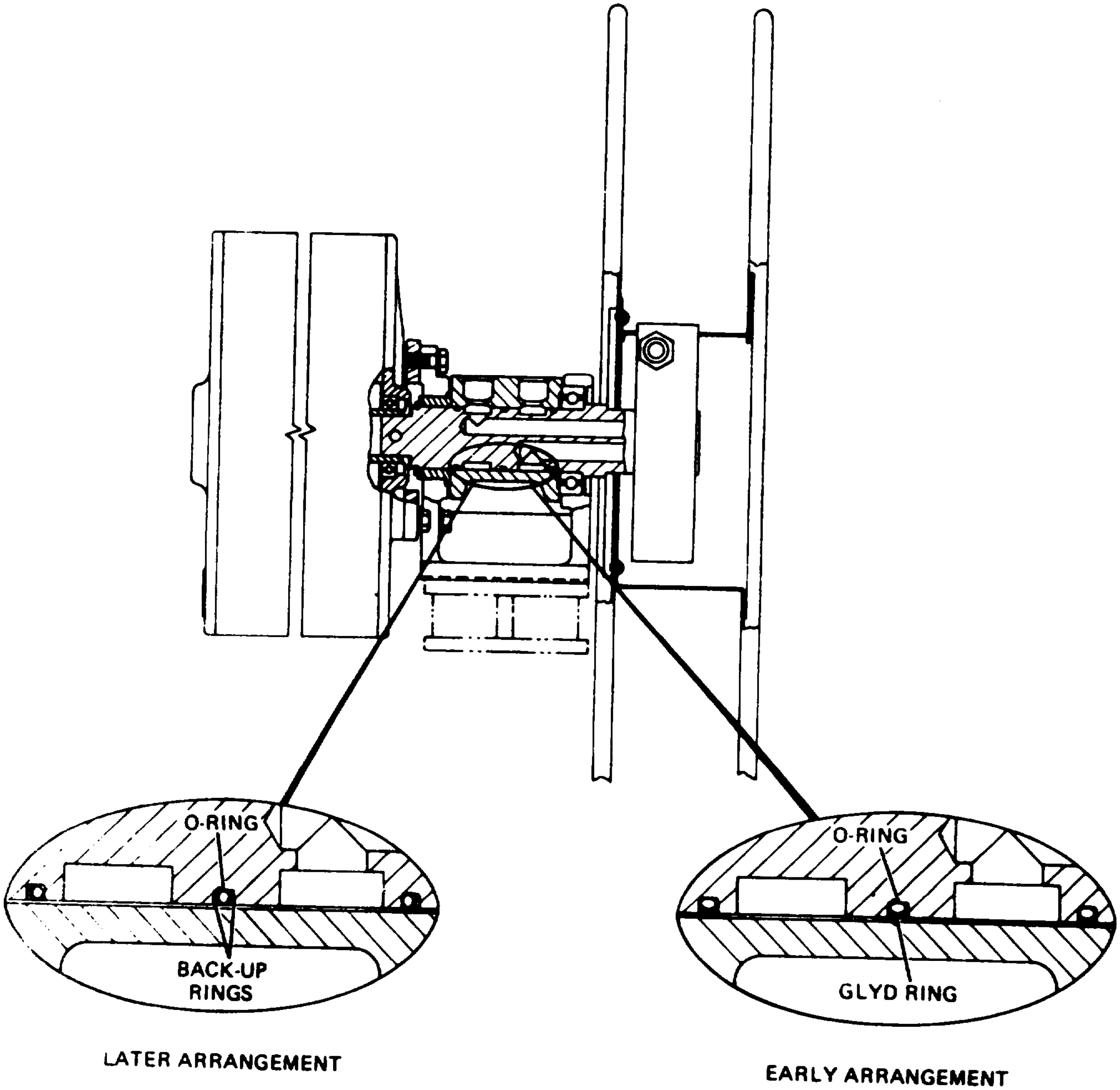


Figure 5E-4. Seat Arrangement

HOSE REPLACEMENT. To replace the how on the reel, proceed as follows (see Figure 5E-5):

1. Note and mark which swivel port the short end of the how is attached to. Remove the old how from the reel.

2. Wrap the fitting on the new short how with rubber, and secure the rubber shield in place with plastic tape.

3. Attach the short how to the swivel port marked in Step 1. Then attach the long how to the other swivel port. Carefully wrap the remainder of the how onto the reel.

4. Pretension the how reel by turning the reel clockwise, as viewed from the how side, three turns. Cost off one wrap of how from the reel, without removing my pretension, and attach the how to the upper telescope cylinder.

5. Check the operation of the telescope circuit. If both boom sections do not extend when the telescope lover is pushed forward, the hoses am cross-connected et the swivel ports, and must be changed before the machine is returned to service.

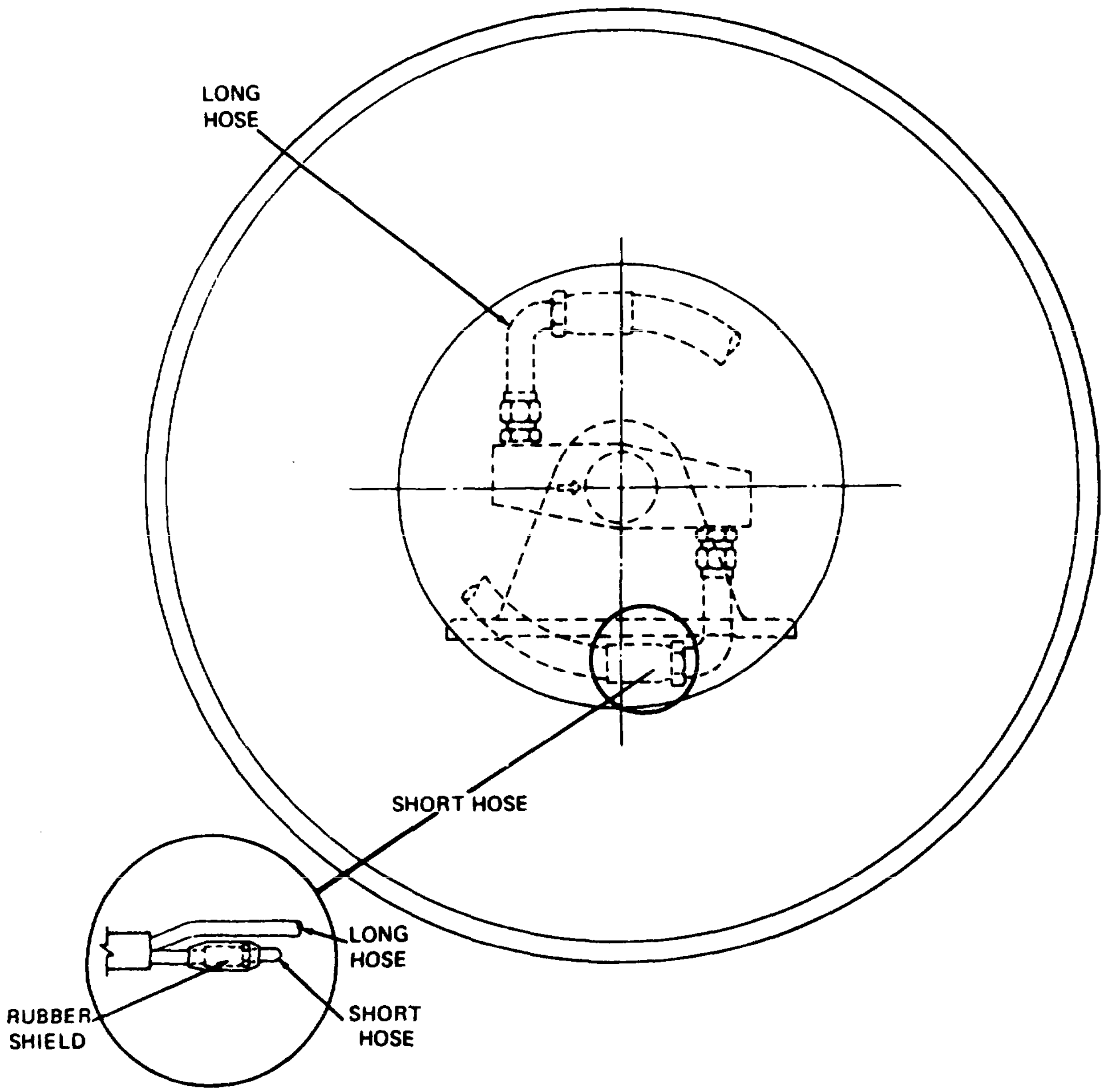


Figure 5E-5. Hose Replacement

SUBSECTION 5F
COUNTERBALANCE VALVES

COUNTERBALANCE VALVE (36Z683)

DESCRIPTION. The counterbalance valve is installed between the boom hoist control valve and the velocity fuses on the boom hoist cylinders. The valve is mounted on the inner side of the right hand sidestand. just below and forward of the boom pivot point (see Figure 5F-2).

The purpose of this valve is to prevent cylinder movement until pressure has been developed in the boom hoist circuit. The valve operates as follows (see Figure 5F-1):

When the boom hoist lever is in the raise position, oil from the control valve is supplied to the counterbalance valve, and the pressure in the valve will increase until it is sufficient to unseat the check valve, allowing the oil to flow through the value to the blind end of the cylinders.

When the control lever is in the neutral position, oil pressure an the top of the check valve is insufficient to hold the check valve open. The check valve will then be seated by the spring inside it, blocking the flow of oil from the blind end of the cylinders.

When the control lever is in the lower position, oil flows to the rod end of the cylinders, while the oil from the blind end of the cylinders is prevented from returning to tank by the piston. This causes circuit pressure to increase. A tube connecting the rod end of the cylinders to the pilot port of the counterbalance valve allows this circuit pressure to be sensed by the valve. Pressure at the pilot port will cause oil to flow through a fixed orifice, which determines the opening rate of the piston, until sufficient pressure is applied to the end of the piston to unseat it. When the piston is unseated, oil in the blind end of the cylinders is allowed to return to tank. When the control lever is returned to the neutral position, the pressure in the rod end of the cylinders and at the pilot port drops below the pressure required to hold the piston open, thereby allowing the springs above the piston to seat it. As the piston closes, the oil at the end of the piston is returned to the pilot port via the small check valve in the cap end of the valve. The small check valve by-passes the fixed orifice, allowing rapid seating of the piston.

TROUBLESHOOTING. The problems that can be experienced with this valve fall mainly into two areas; namely, the valve will not hold the boom in a raised position or the boom will not lower. To determine the cause of valve malfunction, proceed as follows:

1. The inability of the valve to hold the boom in a raised position could be caused by contamination or a worn piston and/or seat. Proceed as follows to determine the cause:

   A. Raise and lower the boom severaltimes to flush any contamination from the valve which could prevent the piston and/or check valve from wating properly.

   B. Elevate the boom to approximately 45 degrees and return the control lever to the neutral position.

   C. Allow the boom to remain in this position for several minutes and note whether or not the boom lowers.

   D. If the boom lowers, clean the entire charge of hydraulic oil thoroughly, using a filter buggy, and replace the return line filters. After the oil has been cleaned, repeat Steps A through C. If the boom still lowers, the problem is most likely a worn piston or check valve, and the valve should be repaired.

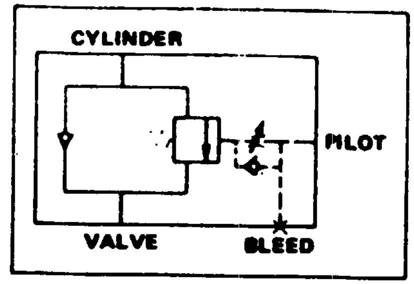
2. If the boom cannot be lowered, the problem is due to the piston not shifting. This can be caused by blockage in the pilot line or orifice, or excessive leakage past the piston O-ring. Proceed as follows to determine the cause:

   A. Elevate the boom to approximately 45 degrees, and return the control valve to neutral.

   B. Remove the tube connected to the pilot port of the valve.

   C. If the piston O-ring is worn, seepage will be observed at the pilot port. If no seepage is observed, remove the valve and pilot tube, and check for blockage.

REMOVAL. To remove the counterbalance valve, proceed as follows (see Figure 5F-2):



USASI SYMBOL

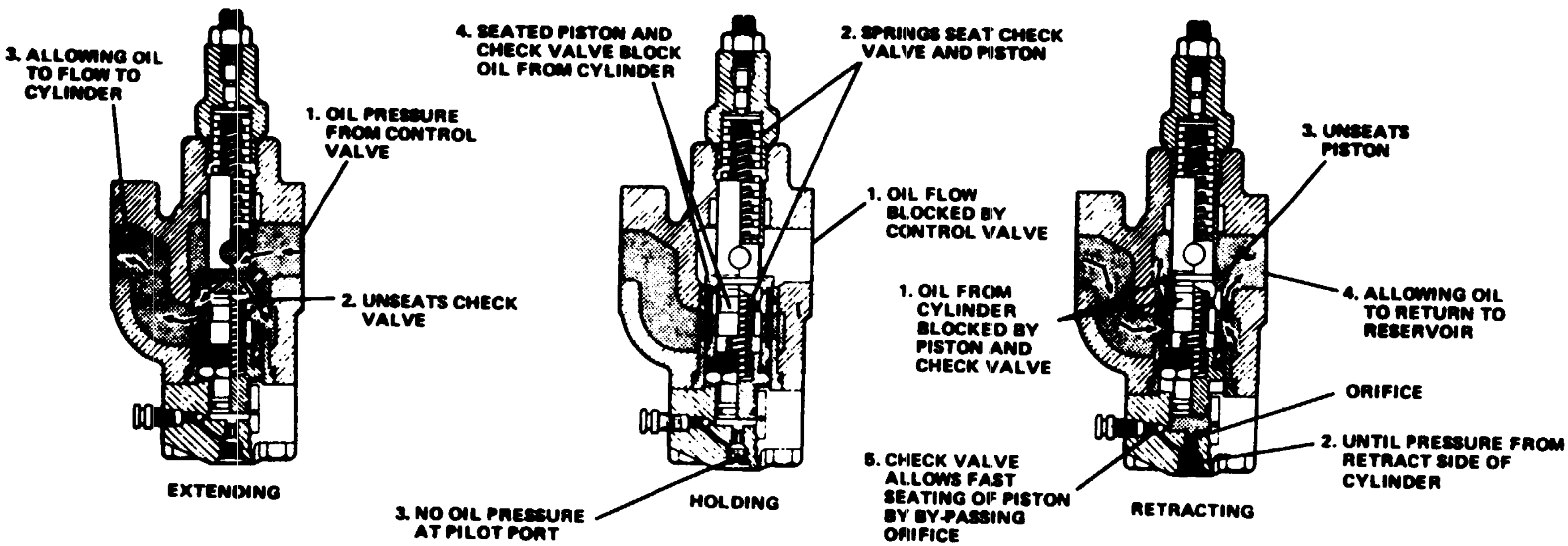


Figure 5F-1. Counterbalance Valve Operation (36Z683)

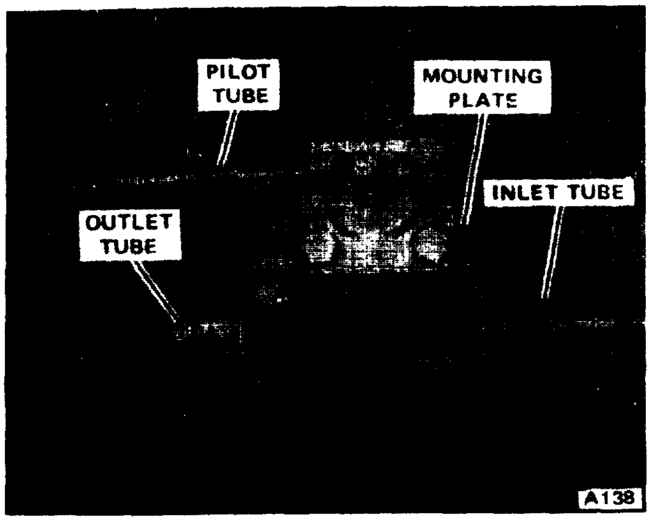


Figure 5F-2. Counterbalance Valve Removal

WARNING

Extreme caution must be exercised when removing the counterbalance valve from the machine. as this valve is the only hydraulic means of preventing the boom from lowering once the boom has been elevated. The following procedure describes a method of removing the valve with the boom in the boom rest, which is the preferred method. However, if circumstances do not allow removal of the counterbalance valve with the boom in the boom rest, a positive, mechanical means must be used to prevent boom movement while repairing the counterbalance valve.

1. Lower the boom onto the boom rest, and secure it to the boom rest with the retaining pin.

NOTE

The counterbalance valve can be removed by reaching down between the boom and right hand sidestand from the shroud behind the operators cab.

2. Disconnect the pilot tube from the valve. Loosen the capscrews which secure the inlet and outlet tube to the valve. Tap the tubes gently to break the oil tight connection. This will allow any trapped pressure to escape. Then remove the capscrews and disconnect the inlet and outlet tubes.

3. Remove the capscrews securing the counterbalance valve mounting plate to the sidestand, and remove the valve.

4. Remove the mounting plate from the valve using a suitable Allen wrench.

REPAIR. Repair of this valve should be limited to the replacement of O-ring seals and the parts in the poppet subassembly. To replace these parts, proceed as follows:

1. Place the valve in a vise with the cap end of the valve up. Be sure the vise is equipped with protective jaws.

2. Remove the four capscrews which secure the cap to the valve body, and remove the cap (we Figure 5F-3).

3. Remove the poppet subassembly from the valve body.

4. Wash all the removed parts using a suitable cleaning solvent.

5. Inspect all the O-rings and wets on the poppet subassembly, and replace any worn or damaged parts. The poppet subassembly can be disassembled, by removing the plug at the pilot end of the poppet subassembly.

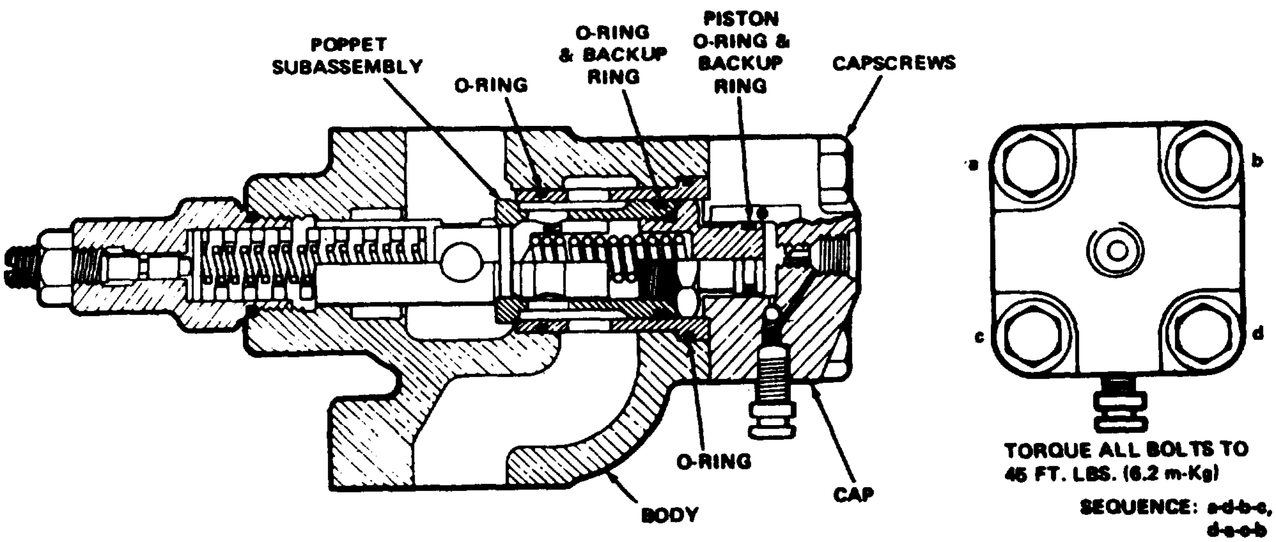


Figure 5F-3. Counterbalance Valve (36Z683)

6. Lubricate the valve body bore with clean hydraulic oil, and install the poppet subassembly. Install the cap and the four capscrews which secure the cap to the valve body.

7. Tighten the capscrews to 45 ft-lbs (6.2 m-kg) in the sequence shown in Figure 5F-3.

COUNTERBALANCE VALVE (36Z838)

DESCRIPTION The counterbalance valve is installed between the boom hoist control valve and the velocity fuses on the boom hoist cylinders. The valve is mounted on the inner side of the right hand sidestand, just below and forward of the boom pivot point (see Figure 5F-5).

The purpose of this valve is to prevent cylinder movement until pressure has been developed in the boom hoist circuit. The valve operates as follows (see Figure 5F-4):

When the boom hoist lever is in the raise position, oil from the control valve is supplied to the counterbalance valve, and the pressure in the valve will increase until it is sufficient to unseat the check valve, allowing the oil to flow through the valve to the blind end of the cylinders.

When the control lever is in the neutral position, oil pressure on the top of the check valve is insufficient to hold the check valve open. The check valve will then be seated by the spring inside it, blocking the flow of oil from the blind end of the cylinders.

When the control lever is in the lower position, oil flows to the rod end of the cylinders, while the oil from the Mind end of the cylinders is prevented from returning to tank by the piston, causing the pressure in the circuit to increase. A tuba connecting the rod end of the cylinders to the pilot port of the counterbalance valve allows this pressure to be sensed by the valve. Pressure at the pilot port will cause oil to flow through an adjustable orifice, which determines the opening rate of the piston, until sufficient pressure is applied to the end of the piston to unseat it. When the piston is unseated, oil in the blind end of the cylinders is allowed to return to tank.

When the control lever is returned to the neutral position, the pressure in the rod and of the cylinder and at the pilot port drops below the pressure required to hold the piston open, thereby allowing the springs above the piston to seat it. As the piston closes, the oil at the end of the piston is returned to the pilot port via the small check valve in the cap end of the valve. The mall check valve by-passes the adjustable orifice, allowing rapid seating of the piston.

TROUBLESHOOTING. The problems that can be experienced with this valve fall mainly into two areas; namely, the valve will not hold the boom in a raisad position or the boom will not lower. To determine the cause of valve malfunction, proceed as follows:

1. The inability of the valve to hold the boom in a raisad position could be caused by contamination or a worn piston and/or seat. Proceed as follows to determine the cause:

A. Raise and lower the boom several times to flush any contamination from the valve which could prevent the piston and/or check valve from seating properly.

B. Elevate the boom to approximataly 45 degrees and return the control lever to the neutral position.

C. Allow the boom to remain in this position for several minutes and note whether or not the boom lowers.

D. If the boom lowers, clean the entire charge of hydraulic oil thoroughly using a filter buggy, and replace the return line filters. After the oil has been cleaned, repeat Steps A through C. If the boom still lowers, the problem is most likely a worn piston or check valve, and the valve should be repaired.

2. If the boom cannot be lowered, the problem is due to the piston not shifting. This can be caused by blockage in the pilot line or orifice, or excessive leakage past the piston O-ring. Proceed as follows to determine the cause:

A. Elevate the boom to approximately 45 degrees, and return the control valve to neutral.

B. Remove the tube connected to the pilot port of the valve.

C. If the piston O-ring is worn, seepage will be observed at the pilot port. If no seepage is observed, remove the valve and pilot tube, and check for blockage.

REMOVAL. To remove the counterbalance valve, proceed as follows (see Figure 5F-5):

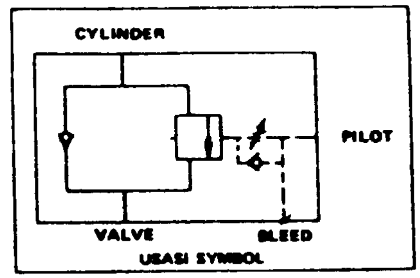
WARNING

Extreme caution must be exercised when removing the counterbalance valve from the machine, as this valve is the only hydraulic means of preventing the boom from lowering once the boom has been elevated. The following procedure describes a method of removing the valve with the boom in the boom rest, which is the preferred method. However, if circumstances do not allow removal of the counterbalance valve with the boom in the boom rest, a positive, mechanical means must be used to prevent boom movement while repairing the counterbalance valve.

1. Lower the boom onto the boom rest, and secure it to the boom rest with the retaining pin.

NOTE

The counterbalance valve can be removed by reaching down between the boom and right hand sidestand from the shroud behind the operators cab.



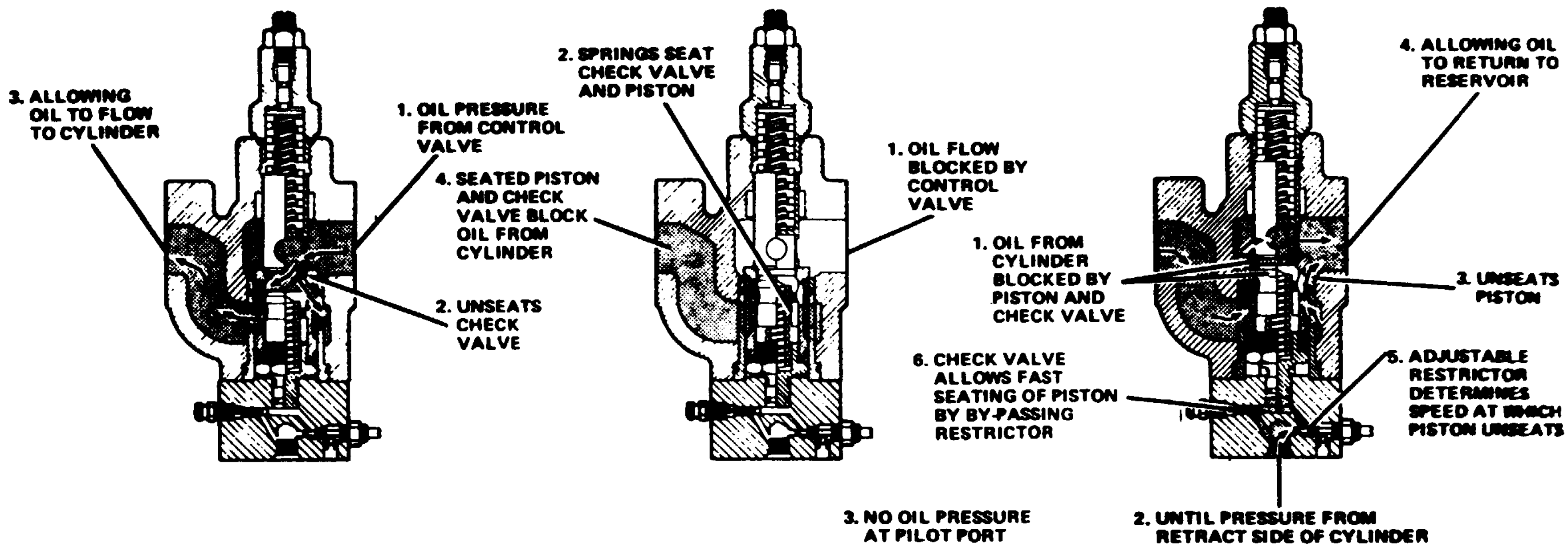


Figure 5F-4. Counterbalance Valve Operation (36Z838)

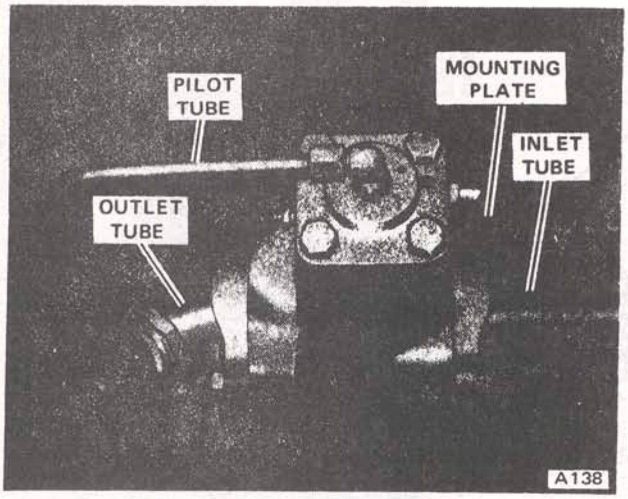


Figure 5F-5. Counterbalance Valve Removal

2. Disconnect the pilot tube from the valve. Loosen the capscrews which secure the inlet and outlet tube to the valve. Tap the tubes gently to break the oil tight connection. This will allow any trapped pressure to escape. Then remove the capscrews and disconnect the inlet and outlet tubes.

3. Remove the capscrews securing the counterbalance valve mounting plate to the sidestand, and remove the valve.

4. Remove the mounting plate from the valve using a suitable Allen wrench.

REPAIR. Repair of this valve should be limited to the replacement of O-ring seals and the parts in the poppet subassembly. To replace these parts, proceed as follows:

1. Place the valve in a vise with the cap end of the valve up. Be sure the vise is equipped with protective jaws.

2. Remove the four capscrews which secure the cap to the valve body, and remove the cap (see Figure 5F-6).

3. Remove the poppet subassembly from the valve body.

4. Wash all the removed parts using a suitable cleaning solvent.

5. Inspect all the O-rings and seats on the poppet subassembly, and replace any worn or damaged parts. The poppet subassembly can be disassembled by removing the plug at the pilot end of the poppet subassembly.

6. Lubricate the valve body bore with clean hydraulic oil, and install the poppet subassembly. Install the cap and the four capscrews which secure the cap to the valve body.

7. Tighten the capscrews to 45 ft-lbs (6.2 m-kg) in the sequence shown in Figure 5F-6.

COUNTERBALANCE VALVE (36Z931)

DESCRIPTION. One counterbalance valve is installed on the blind end of each boom hoist cylinder. The purpose of these valves is to prevent cylinder movement until pressure has been developed in the boom hoist circuit to raise or lower the boom.

A typical 36Z931 counterbalance valve is shown in Figure 5F-7, and its operation is described in the following paragraphs:

When the boom hoist control lever is in the raise position, oil from the control valve is supplied to the inlet port of the

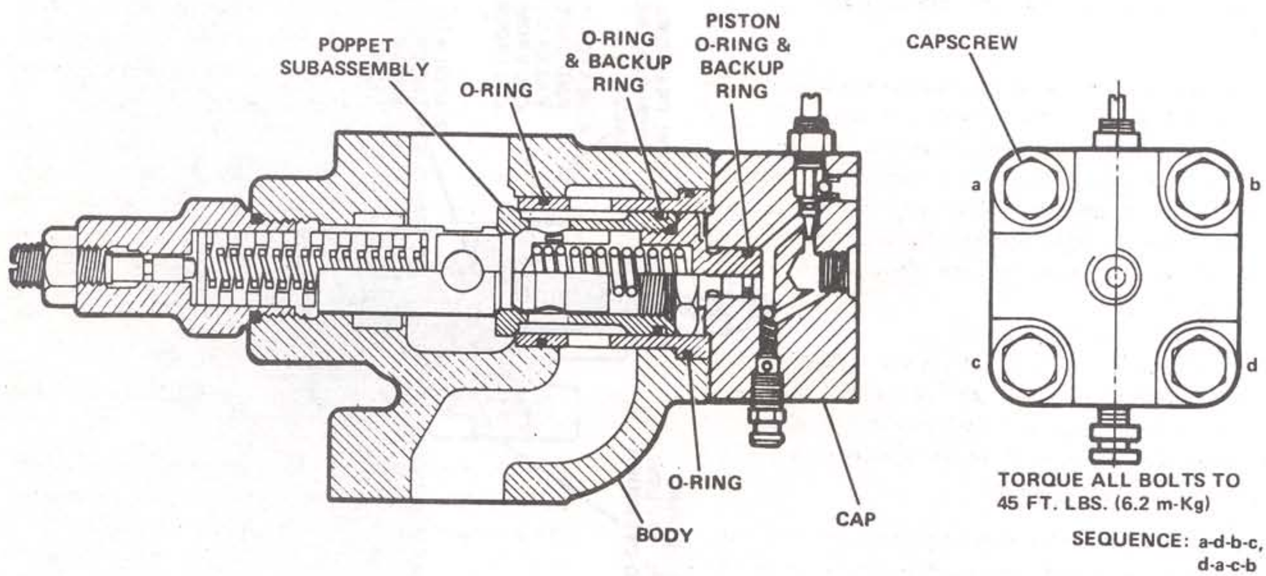


Figure 5F-6. Counterbalance Valve (36Z838)

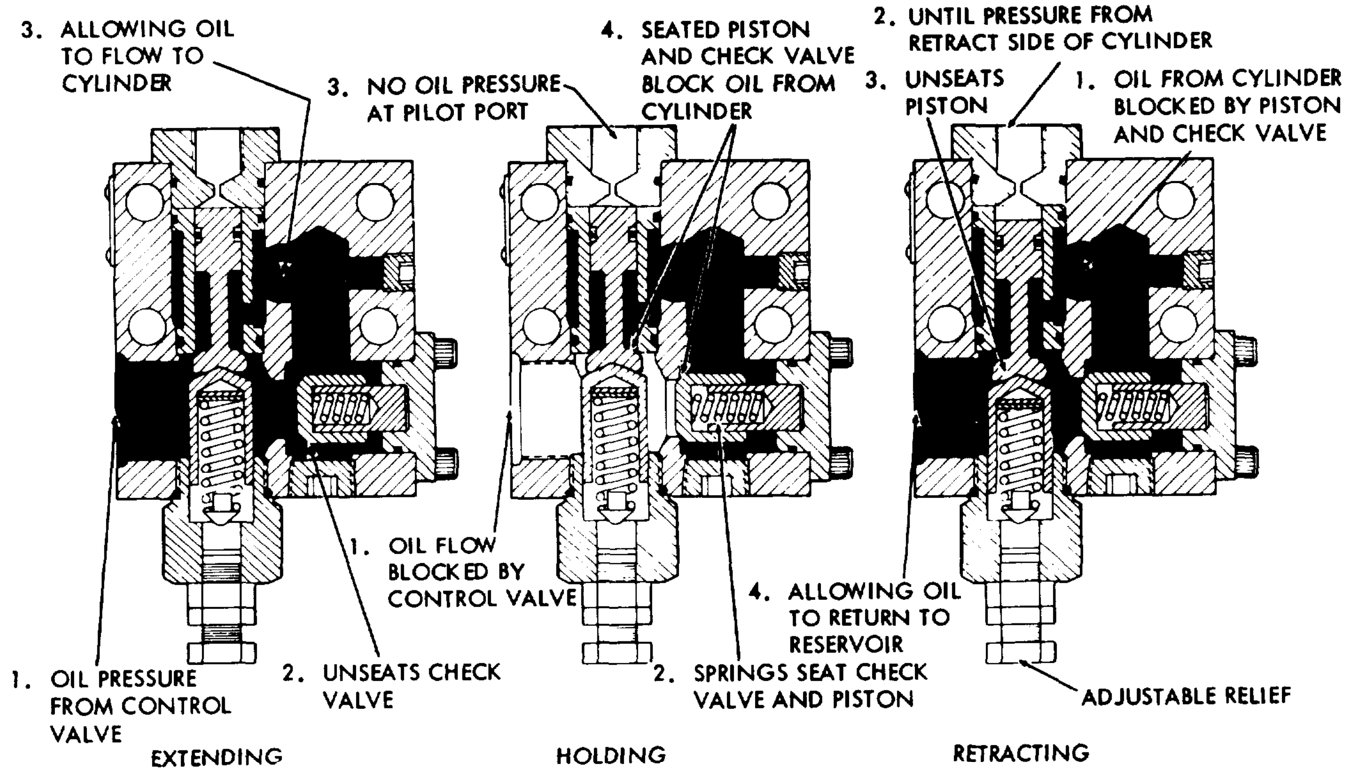


Figure 5F-7. Counterbalance Valve Operation

counterbalance valve. The oil entering the valve is prevented from going to the blind end of the cylinder by the check valve until sufficient pressure is developed to unseat the check valve. Unseating the check valve allows the oil to flow through the valve to the blind end of the cylinder.

When the control lever is in the neutral position, oil flow is blocked by the control valve, and circuit pressure decreases, allowing the check valve to seat. With the check valve seated, the oil in the blind end of the cylinder is prevented from returning to tank by the seated check valve and piston.

When the control lever is in the lower position, oil is supplied to the rod end of the cylinder and the pilot port of the counterbalance valve. Pressure at the rod end of the cylinder and the pilot port of the counterbalance valve will increase until it reaches the setting of the valve, at which point the piston will shift, allowing the oil at the blind end of the cylinder to return to tank through the counterbalance valve.

TROUBLESHOOTING. The problems that can be experienced with this valve fall mainly into two areas; namely, the valve will not hold the boom in a raised position or the boom will not lower. To determine the cause of valve malfunction, proceed as follows:

1. The inability of the valve to hold the boom in a raised position could be caused by contamination or a worn piston and/or seat. Proceed as follows to determine the cause:

A. Raise and lower the boom several times to flush any contamination from the valve which could prevent the piston and/or check valve from seating properly.

B. Elevate the boom to approximately 45 degrees and return the control lever to the neutral position.

C. Allow the boom to remain in this position for several minutes and note whether or not the boom lowers.

D. If the boom lowers, clean the entire charge of hydraulic oil thoroughly, using a filter buggy, and replace the return line filters. After the oil has been cleaned, repeat Steps A through C. If the boom still lowers, the problem is most likely a worn piston or check valve, and the valve should be repaired.

2. If the boom cannot be lowered, the problem is due to the piston not shifting. This can be caused by blockage in the pilot line or orifice, or excessive leakage past the piston O-ring. Proceed as follows to determine the cause:

A. Elevate the boom to approximately 45 degrees, and return the control valve to neutral.

B. Remove the tube connected to the pilot port of the valve.

C. If the piston O-ring is worn, seepage will be observed at the pilot port. If no seepage is observed, remove the valve and pilot tube, and check for blockage.

REMOVAL. To remove the counterbalance valve, proceed as follows:

WARNING

Extreme caution must be exercised when removing the counterbalance valve from the machine, as thou valves are the only hydraulic means of preventing the boom from lowering once the boom has been elevated. The following procedure describes a method of removing the valves with the boom in the boom rest, which is the prefered method. However, if circumstances do not allow removal of the counterbalance valves with the boom in the boom rest, a positive, mechanical means must be used to prevent boom movement while repairing the counterbalance valves.

1. Lower the boom onto the boom rest, end secure it to the boom rest with the retaining pin.

2. Remove the pilot tube and inlet tube attached to the valve.

3. Remove the socket heed capscrews which secure the valve to the cylinder using a suitable Allen wrench, end remove the valve.

REPAIR. These vales are considered non-repairable items. If the valve is faulty, the complete valve assembly should be replaced with a new valve.

SUB-SECTION 5G
VELOCITY FUSES

VELOCITY FUSE (1036Z403)

DESCRIPTION

One velocity fuse is mounted at the blind end of each boom hoist cylinder. The purpose of these valves is to prevent rapid lowering of the boom should a hydraulic line between the counterbalance valve and the boom hoist cylinders break.

WARNING

These valves will not hold the boom in a raised position. Therefore, the boom must be prevented from lowering by some mechanical means before any hydraulic line between the counterbalance valve and velocity fuses is removed.

The operation of a velocity fuse is illustrated in Figure 5G-1, and is described in the following paragraphs:

Oil supplied to the extend port of the boom hoist cylinders is blocked by the velocity fuse spool. Since the oil can not enter the blind end of the cylinder, it is forced through the passage in the spool to the blind end of the spool. Oil pressure at the blind end of the spool will increase until it is sufficient to shift the spool to the open position, allowing oil to flow to the blind end of the cylinder through a check valve.

Blocking the supply of oil to the extend port stops the motion of the cylinders. The valve spool, however, is maintained in the open position by the oil pressure, caused by the weight of the boom on the cylinder, trapped in the cylinder. This pressure is transmitted through the passage in the spool to the blind end of the spool to maintain it in the open position. The trapped pressure will also shift the check valve to the seated position.

NOTE

The valve spool will not shift to the blocked position when the supply of oil is blocked, unless a leakage path, such as a faulty counterbalance valve, exists.

Oil supplied to the retract port of the cylinder is directed to the rod end of the cylinder and to the spool piston chamber. The oil in the spool piston chamber will maintain the spool in the open position when the pressure at the blind end of the spool is dropped to a minimal level, by opening the extend port to tank. Retracting the cylinder causes all the oil at the blind end of the cylinder to first flow through the orifice in the check valve, and then through the velocity fuse to tank.

Should the hydraulic line connected to the extend port of the boom hoist cylinders break while the boom is being raised, or when the machine is shut down, the oil pressure at the extend port would immediately drop to zero. This would allow the pressure at the blind end of the valve spool to also drop to zero, allowing the spring to shift the valve spool to the blocked position. With the spool in the blocked position, all the oil at the blind end of the cylinders must then pass through the orifice in the check valve. then through the orifice in the spool to the passage in the spool, and finally to atmosphere. This will cause the boom to lower slowly.

MAINTENANCE

At least once a year, these valves should be disassembled and cleaned as follows to ensure free movement of the spool and to prevent rusting due to condensation (see Figure 5G-2):

1. Lower the boom onto the boom rest to prevent boom movement while servicing the velocity fuses.

2. Remove the jam nuts and weather cap from the spool stem.

3. Carefully loosen the spring stop, and remove the spool from the valve body.

4. Clean the spool and spring cavity with a clean mineral solvent, Then inspect the valve for wear and replace any worn parts.

5. Pack the spring with lightweight rustproofing grease, and lubricate the spool with clean hydraulic oil. Then install the spool in the valve body and tighten the spring stop securely.

6. Check the operation of the valve by first prying the spool stem out with a screwdriver under the jam nut, and then releasing it. The spool should snap into the valve body when it is released. If the spool does not snap into the valve body when it is released, binding exists, and the cause of the binding must be aliminated before the machine is returned to service.

7. When the valve is functioning properly, replace the weather cap and jam nuts.

TROUBLESHOOTING

The problem usually attributed to these valves is erratic downward drifting of the boom when it is resting in an elevated position. This problem can be caused by two conditions; namely, by-passing of oil within the valve or bypassing of oil within the cylinders. To determine which of the two causes is responsible for the problem, proceed as follows:

1. Raise the boom several inches off the boom rest, and extend the boom several feet to apply a load to the boom hoist cylinders.

2. Attach a suitable lifting device to the boom point to limit the amount of boom movement while performing the test.

3. Remove the tube connected to the upper (extend) valve manifold ports. Oil flowing from one port or the other indicates that either the velocity fuse or cylinder is bypassing oil. To determine which of the components is bypassing oil, proceed with the remainder of this procedure.

No oil flowing from the manifold ports indicate that the problem is not caused by the velocity fuses or boom hoist cylinders.

4. Reconnect the tuba, and lower the boom onto the boom rest. Mark the valve which had oil flowing through it.

5. Loosen the capscrews which secure the velocity fuses to the boom hoist cylinders. Tap the valve to break the oil tight seal to allow any trapped pressure to escape. Then remove each valve and reinstall it on the opposite cylinder

6. Repeat Steps 1 through 3. If oil now flows from the opposite cylinder, the valve is faulty and must be replaced Or repaired. However, if oil flows from the same cylinder, the cylinder is bypassing oil and must be replaced or repaired.

OVERHAUL

GENERAL. Repair of this valve should be limited to the replacement of seals or replacement of the complete valve. The spool and valve body are selectively fitted and must not be interchanged with other valves or replaced separately.

REMOVAL. To remove the valve from the boom hoist cylinder, proceed as follows:

1. Lower the boom onto the boom rest to prevent boom movement while repairing the valve.

2. Loosen the capscrews which secure the valve to the cylinder. Tap the valve to break the oil tight seal. This will allow any trapped pressure to escape. Then remove the valve from the cylinder.

DISASSEMBLY. To disassemble the valve, proceed as follows (see Figure 5G-2):

1. Remove the jam nuts and weather cap from the spool stem.

2. Carefully loosen the spring stop, and remove the spool from the valve body.

3. The remaining parts on the spool may now be removed.

CLEANING. INSPECTION AND REPAIR. After the valve has been disassembled, perform the following:

1. Discard all O-rings and beck-up rings. Wash all parts in a clean mineral oil solvent and places them on a clean surface for inspection.

2. Inspect the mating surfaces of the valve body and valve manifold for paint, burrs or other damage. Be sure these surfaces are flat. If they are not, remove slight imperfections by stoning the surface lightly.

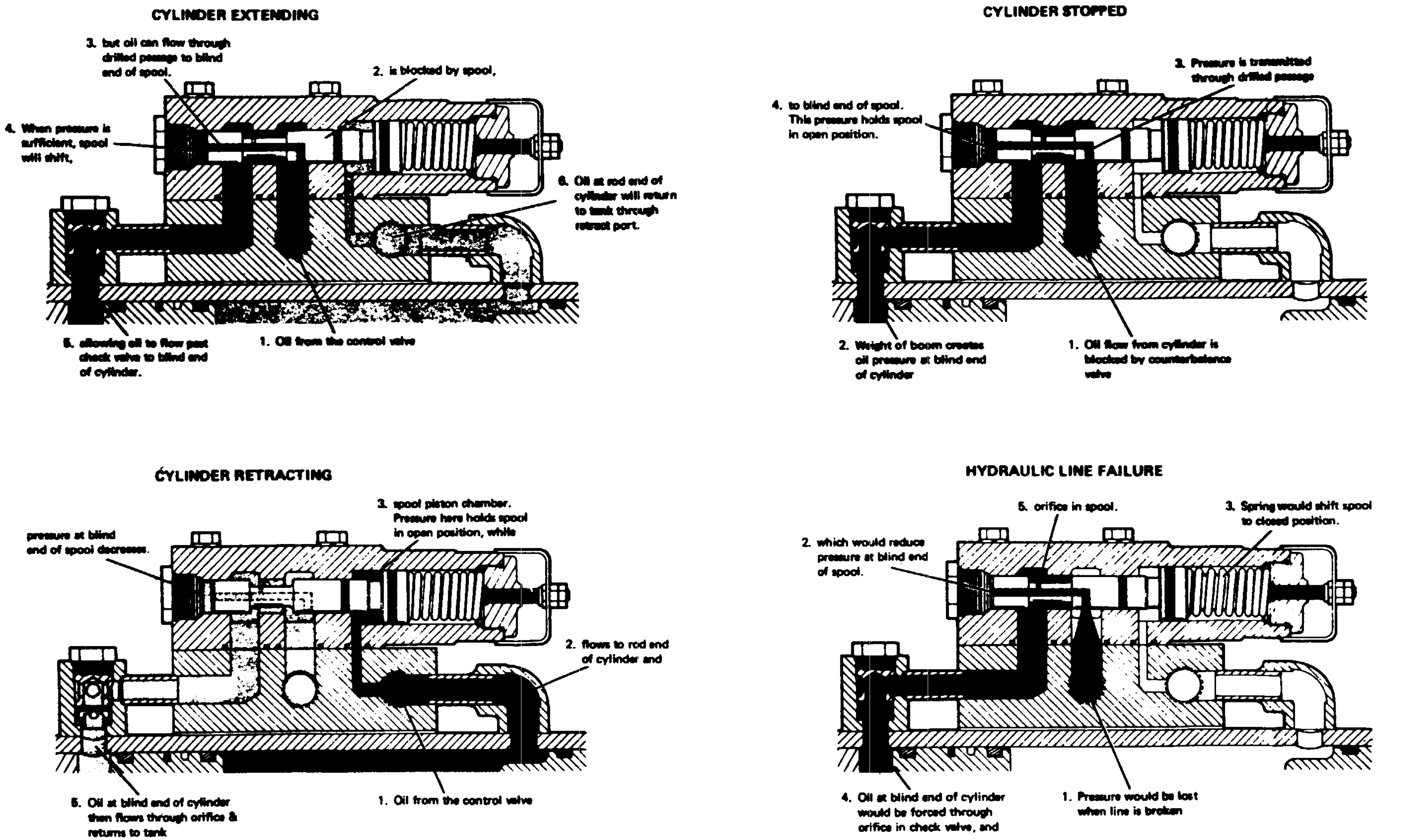


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Figure 5G-1. Velocity Fuse Operation

3. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive the valve body and spool must be replaced. Check the spool for freedom of movement in the bore.

REASSEMBLY. To reassemble the valve, proceed as follows:

NOTE

Coat all parts with clean hydraulic oil to facilitate reassembly and provide initial lubrication. Petroleum jelly can be used to hold the O-rings in place during reassembly.

1. Install the O-rings and back-up rings on the spool as shown in Figure 5G-2.

2. Install the spring and spring stop on the valve spool stem. Pack the spring with light weight rust proofing grease and lubricate the spool with clean hydraulic oil. Then install the spool in the valve body and tighten the spring stop securely.

3. Check the operation of the valve by first prying the spool stem out with a screwdriver under a jam nut, and then releasing it, The spool should snap into the valve body when it is released. If the spool does not snap into the valve body when it is released, binding exists, and the cause of the binding must be eliminated before the valve is reinstalled on the cylinder.

4. When the valve is functioning properly, replace the weather cap and remaining jam nuts.

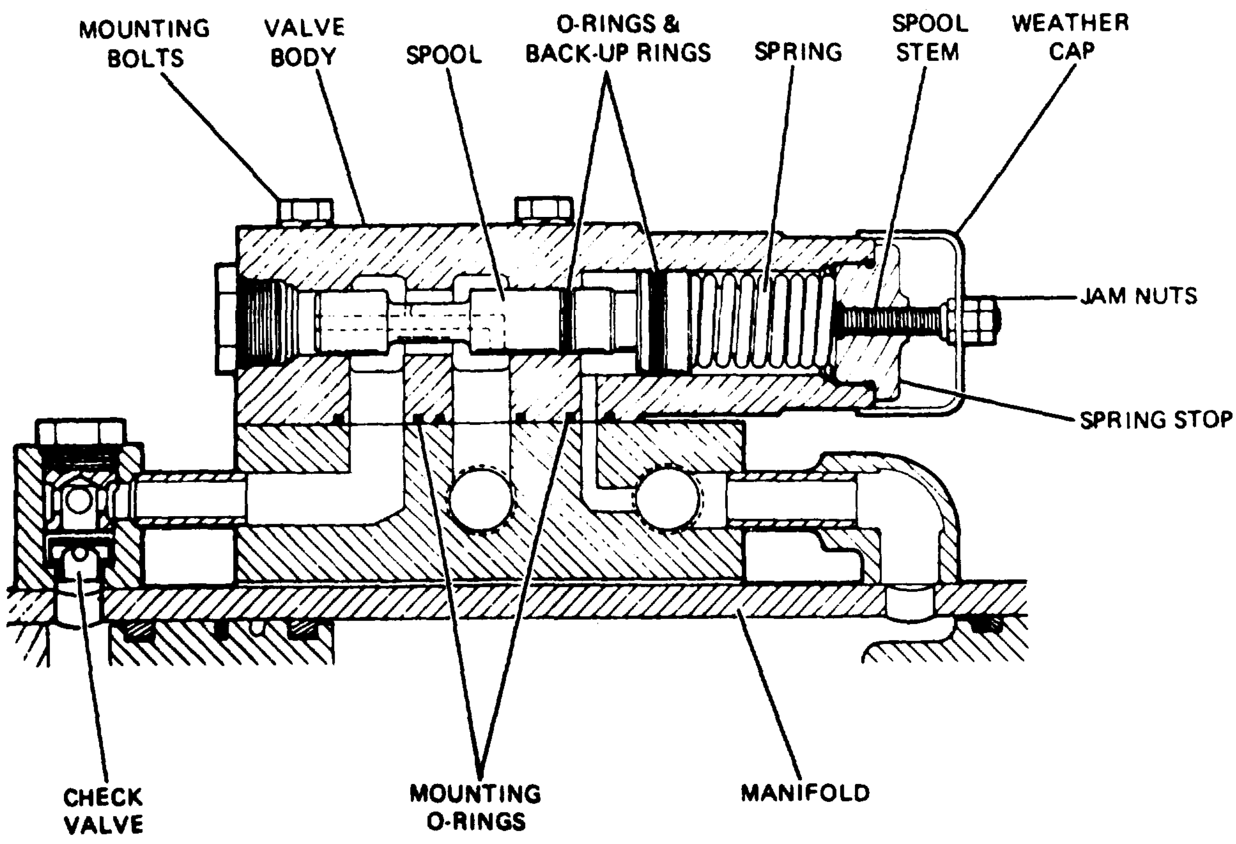


Figure 5G-2. Velocity Fuse (1036Z403)

INSTALLATION. Use the following procedure to install a new or overhauled velocity fun on the boom hoist cylinder.

1. Install the O-rings in the O-ring groove of the valve body. Then install the valve on the cylinder end secure it with four capscrews.

2. Swing the boom over the side of the carrier.

3. Test the operation of the valve es described in the following paragraphs. If the valve does not function as described in each step, it should be removed end inspected for binding or replaced.

NOTE

An assistant is required for the remaining step of this procedure. The assistant should position himself so that he can observe the left hand valve during the test. The right hand valve can be observed by the operator from the cab.

A. Pull beck on the boom hoist lever end observe that both valve spools pop up.

B. Lower the boom slowly until the boom hoist cylinders bottom at the end of their stroke. Than return the lever to the neutral position and observe the valve spool. The valve spool should snap into the valve body when the lever is returned to neutral.

C. Push the boom hoist lever forward slightly again and observe the valve spool. The valve spool should pop out. Then return the lever to the neutral position. The valve spool should snap into the valve body.

D. If the valve functions es just described, the valve is functioning properly, and the machine can be returned to service.

SUB-SECTION 5H
WINCH BRAKE VALVES

WINCH BRAKE VALVE (36Q76)

DESCRIPTION. A 36Q76 winch brake valve is shown in Figure 5H-1. This valve is operated by the same linkage that actuates the winch control valve, and is used to release the winch brake used on the P&H winch. The operation of the winch brake valve is as follows:

When the winch control lever is in the neutral position, hydraulic fluid from the swing pump is allowed to flow to the winch brake and tank simultaneously. Since the flow is allowed to return to tank, no pressure will buildup in the brake chamber, and the brake will remain set.

The control lever linkage allows the winch lever to be moved to the raise position without moving the winch brake valve spool. Since the valve spool does not move, hydraulic fluid will continue to flow to the brake chamber and tank, and the brake will remain set.

When the winch control lever is moved to the lower position, the winch brake valve spool is pushed inward into the valve body. Inward movement of the spool will block the tank passage, causing all the oil to flow to the brake chamber. Pressure in the brake chamber will then release the brake.

REMOVAL. To remove the winch brake valve, proceed as follows:

1. Clean the valve and surrounding area with a suitable solvent.

2. Disconnect the three hydraulic lines. Cap the lines and plug the valve ports as each line is disconnected.

3. Remove the three attaching screws and slide the valve beck to disengage it from the linkage.

DISASSEMBLY. Disassemble the winch brake valve as follows (see Figure 5H-1):

1. Remove the two screws from the spool cap and spacer. The spool cap, spacer and spring are now free, and should be removed.

2. Remove the snap ring and washer from the spool.

3. Slide the spool out of the valve body.

4. Remove the two O-rings from the valve body.

REPAIR. All components of the winch brake valve are serviceable, except for the valve body and spool. If either a

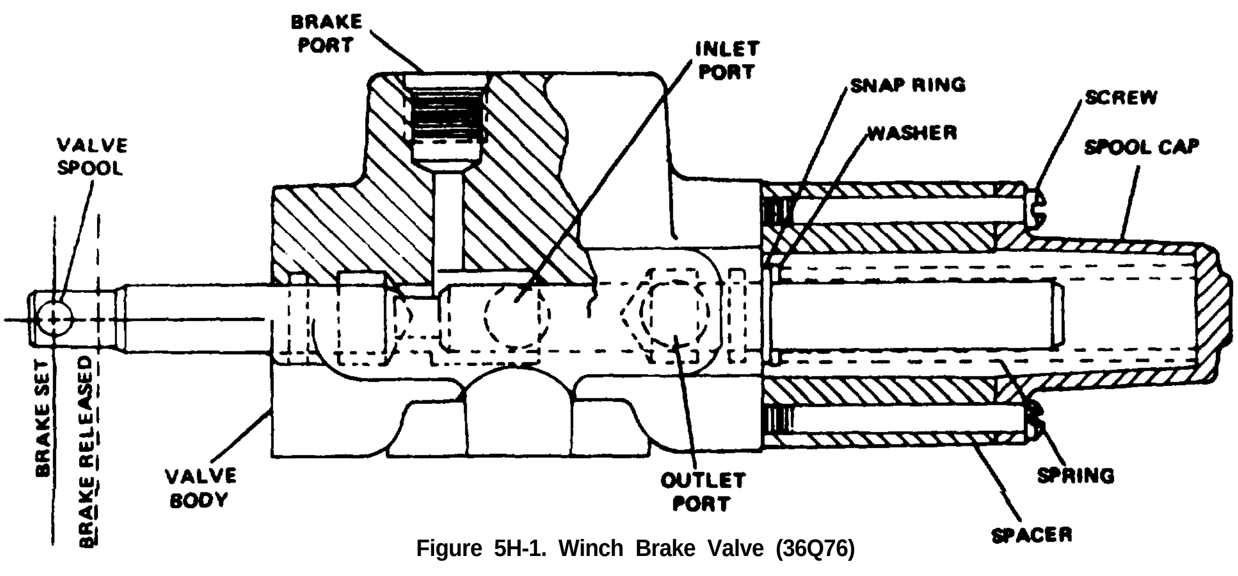


Figure 5H-1. Winch Brake Valve (36Q76)

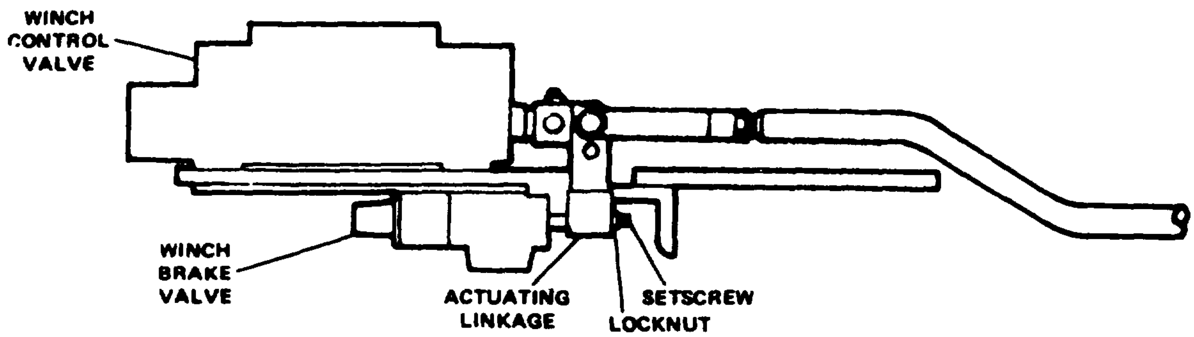


Figure 5H-2. Linkage Adjustment

valve body or spool is damaged, the complete valve must be replaced. Make a visual inspection of all parts and replace parts as required.

REASSEMBLY. Reassemble the valve as follows. Use extreme care in keeping all parts clean prior to and during assembly.

1. Coat the spool bore and O-rings liberally with clean hydraulic oil. Then install the O-ring in the valve body.

2. Install the snap ring and washer on the spool.

3. Coat the spool with clean hydraulic oil. Then install the spool in the valve body with a slight turning motion.

4. Install the spring, spacer, and spool cap on the end of the valve body, and secure the parts with the two screws.

INSTALLATION. Install the valve in the reverse order of removal. Then adjust the actuating linkage as follows (see Figure 5H-2):

1. Loosen the locknut and back out the setscrew.

2. Then turn the setscrew in until it just touches the end of the spool.

3. Lock the setscrew by tightening the locknut.

WINCH BRAKE VALVE (36Z1028)

DESCRIPTION. A 36Z1028 winch brake valve is shown in Figure 5H-3. This valve is operated by the same linkage that actuates the winch control valve, and is used to release the winch brake used on the P&H winch. The operation of the winch brake valve is as follows:

When the winch control lever is in the neutral position, hydraulic fluid from the swing pump is allowed to flow to the winch brake and tank simultaneously. Since the flow is allowed to return to tank, no pressure will buildup in the brake chamber, and the brake will remain sot.

The control lever linkage allows the winch lever to be moved to the raise position without moving the winch brake valve spool. Since the valve spool does not move, hydraulic fluid will continue to flow to the brake chamber and tank, and the brake will remain set.

When the winch control lever is moved to the lower position, the winch brake valve spool is pushed inward into the valve body. Inward movement of the spool will block the tank passage, causing all the oil to flow to the brake

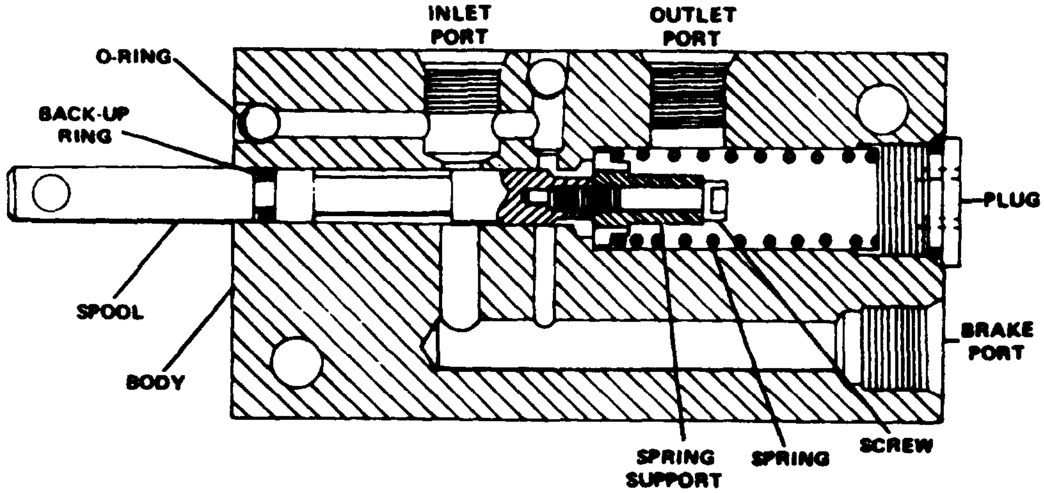


Figure 5H-3. Winch Brake Valve (36Z1028) chamber. Pressure in the brake chamber will then release the brake.

REMOVAL. To remove the winch brake valve, proceed as follows:

1. Clean the valve and surrounding area with a suitable solvent.

2. Disconnect the three hydraulic lines. Cap the lines and plug the valve ports as each line is disconnected.

3. Remove the two attaching screws and slide the valve back to disengage it from the linkage.

REPAIR. Repair of this valve is limited to the replacement of the O-ring and back up ring on the spool. To replace these parts, proceed as follows (see Figure 5H-3):

1. Remove the plug and spring from the end of the valve.

2. Push the spool out the plug end of the body. Remove, and discard the O-ring and back up ring.

3. Insert a suitable drift pin in the hole at the end of the spool to prevent the spool from turn while removing the screw from the opposite end of the spool. Remove the screw and spring support.

4. Wash all parts thoroughly with a suitable solvent.

Inspect the body and spool for damage. If either part is damaged, the complete valve should be replaced.

5. Install a new back up ring and O-ring in the spool qroove. The back up ring should be nearest the hole in the end of the spool.

6. Lubricate the spool and bore with clean hydraulic oil. Then carefully install the spool with a slight turning motion. Push the spool into the body until 1/2" (12.7 mm) of spool is protruding from the body.

7. Install the spring support and secure it with the screw. Hold the spool with a suitable drift pin and tighten the screw.

8. Pull the spool out until the spring support seats against the body. Then install the spring and plug.

INSTALLATION. Install the valve in the reverse order of removal. Then adjust the actuating linkage as follows (see Figure 5H-4):

1. Loosen the locknut and back out the setscrew in the actuating linkage.

2. Then turn the setscrew in until it just touches the end of the spool.

3. Lock the setscrew by tightening the locknut.

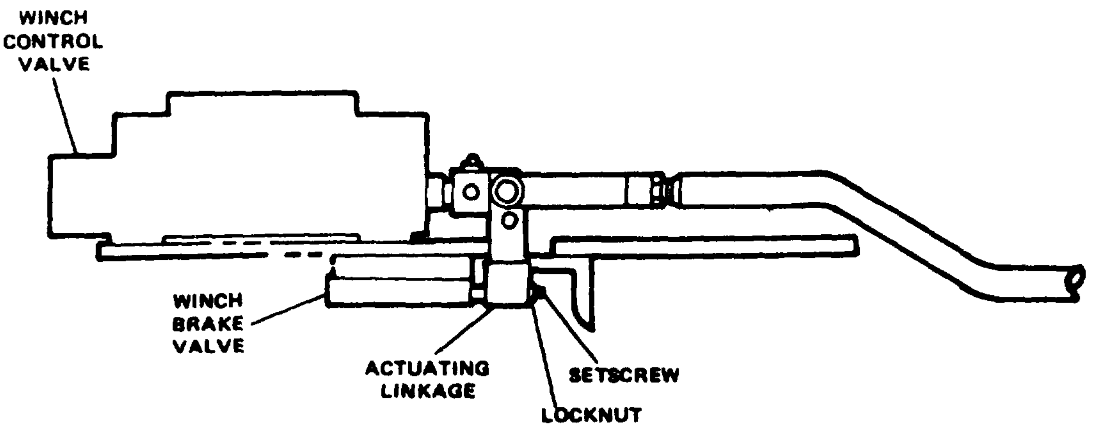


Figure 5H-4. Linkage Adjustment

SUBSECTION 5J
WINCHES

GEARMATIC WINCHES

GENERAL. Various models of free-fall and non free-fall Gearmatic winches have been used on this machine. Instructions for removing and installing the winches are provided later in this topic.

Repair of these winches is covered in Instruction Manuals prepared by Gearmatic. These manuals can be obtained by contacting the nearest Gearmatic Dealer, or by contacting Gearmatic at the following address:

Gearmatic Company, Ltd.
7400 132nd Street
North Surrey, B.C., Canada

To assist the user of this manual, the various Gearmatic winches have been tabulated and cross referenced from P&H Part Number to Gearmatic Model Number below.

P&H PART NUMBER	GEARMATIC MODEL NUMBER
23Q1	11 S-G-E-C-R
23Q2	11 S-G-C-R
23Q5	22 MG-EC
23Q6	22 M-EC
23Q9	23 MC-EC
23Q10	23 M-EC
23Z60	11 S-E-C
23Z61	11 S-C-R
23Z66	22 H-E-C-R
23Z67	22 HG-EC
23Z80	22 SG-EC

REMOVAL. It is recommended that the winch be removed from the machine when repairs are required. To remove the winch, proceed as follows:

1. Unreeve the bottom block, end either remove the wire rope or wind the rope onto the winch end secure it.

2. Disconnect the winch drum turn indicator, if quipped.

3. Disconnect the hydraulic lines attached to the winch motor ports. If the winch being removed is a free-fall type winch, disconnect the drain line attached to the free-fail metering pump.

4. Attach a suitable lifting device to the winch to support it while the mounting capscrews are removed.

5. Remove the mounting capscrews and the hardened flat washers. Lift the winch from the machine using the lifting device, and remove it to a suitable repair area.

INSTALLATION. Use the following procedure to install a new or overhauled winch:

1. Position the winch on the winch mounting Install the mounting capscrews with a hardened washer on each capscrew finger tight.

2. Measure clearance (Y) with feeler gauges et points (A and B) as indicated in Figure 5J-1. Also measure clearance (Z) at points (A end B).

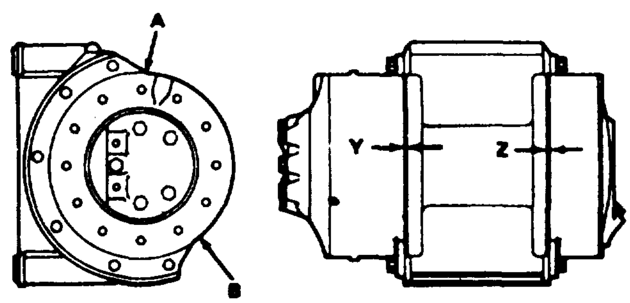


Figure 5J-1. Winch Clearances

For good alignment, clearance (Y) should be equal when measured at points (A end B) within 0.005 inch (0.127 mm). Clearance (Z) should also be equal when measured at (A and B) within 0.005 inch (0.127 mm). Clearance (Y) does not however have to be equal to clearance (Z).

3. If the clearances measured at points (A end B) are not within 0.005 inch (.127 mm), install shims under one corner of the winch base until clearance et points (A end B) is within 0.005 inch (0.127 mm) when the winch is bolted to its mounting.

4. After the winch has been properly aligned, tighten the mounting capscrews to 300 foot-pounds (41.5 m-kg).

5. Reconnect the hydraulic lines to the motor ports. Reconnect the drain line to the metering pump if the winch is a free-fall type.

6. Reconnect the winch drum turn indicator, if quipped.

7. Install the winch line on the winch, and reeve the bottom block to complete the installation of the winch.

P&H WINCHES (923P4, 923P5 end 923P6)

GENERAL. This section describes the disassembly, field repair, and reassembly of the Models 10 and 16 P&H Winches, which are identified by the above pert numbers.

NOTE

Earlier models of the P&H winch were identified by the following part numbers: 923X1, 923X2 and 923X7. These winches are identical to the 923P4, 923P5 and 923P7 winches, with the exception of the motors.

The Models 10 and 16 winches are nearly identical in physical appearance except for size. The major difference is that the Model 10 uses only one caliper brake assembly, while the Model 16 uses two.

The procedures in this section are deliberately limited to those which we believe should be attempted in the field, using commonly available tools and average facilities. Repairs beyond the scope of this section should not be attempted.

I: should be noted that the most probable cause of trouble IS the hydraulic motor, which can be removed end replaced without disturbing any other portion of the winch. The second most probable cause for service, would be the replacement of the brake pads. This can also be done without disassembly or removal of any other pert of the winch.

REMOVAL. It is recommended that the winch be removed from the machine if the required repairs are beyond the replacement of the motor or brake pads. To remove the winch, proceed as follows:

1. Unreeve the bottom block, and either remove the wire rope or wind the rope onto the winch drum and secure it.

2. Disconnect the winch drum turn indicator, if quipped.

3 Disconnect the hydraulic lines attached to the win& motor ports, motor drain port, and brake assembly. If the winch is quipped with a two speed motor, disconnect the hydraulic line and electrical wires attached to the solenoid valve.

4. Attach a suitable lifting device to the winch to support it while the mounting capscrews are removed.

5. Remove the mounting capscrews and the hardened flat washers. Lift the winch from the machine using the lifting device, and. remove it to a suitable repair area.

DISASSEMBLY OF PRIMARY DRIVE. Disassemble the primary drive of the winch as follows:

1. Refer to Figure 5J.2 and remove the cover shown.

2. Remove the three brake assembly mounting bolts (see Figure 5J.3).

3. Back off the brake adjusting nuts until the brake assembly is loose on the brake disc and remove the brake assembly as shown in Figure 5J-4. Note that some winches are provided with shims behind the brake assembly. If used, be sure to install them at the original points during assembly.

4. If the brake assembly is to be disassembled, refer to the topic winch brake at the rear of this section and disassemble and reassemble as described.

NOTE

The springs used in this brake assembly are color coded. Always observe the locations of the springs and replace them in their original positions.

5. Using a punch, stake the motor and the plate shown in Figure 5J-5 so as to prevent reinstallation of the motor at an incorrect position. Then remove the motor es shown, bearing in mind that it is not necessary to remove the brake assembly if only the motor is to be replaced. It may be necessary to use a pry bar to loosen the motor. Have a suitable pan ready to catch the hydraulic oil which will drain as the motor is removed. Always replace the motor O-ring and all other O-rings and seals disturbed during disassembly.

6. Match mark the plate and its corresponding surface on the winch sidestand. Then, remove the plate shown in Figure 5J-5. This plate is doweled on each end and it may be necessary to use a pry bar to loosen the plate. A seal is located on the rear side of this plate and will come off in the bore in the plate.

7. Remove the lower caliper brake assembly in the same manner described for the upper brake assembly if your winch is a Model 16. The Model 10 winch her only one brake assembly. Refer to Figures 5J-3 end 5J-4.

8. Refer to Figure 5J-6 end remove the brake disc, shaft, and bearing as shown. It may be necessery to use a pry bar to free the assembly. Note that the Sprag clutch (a one-way clutch) is contained in the hub behind the bearing.

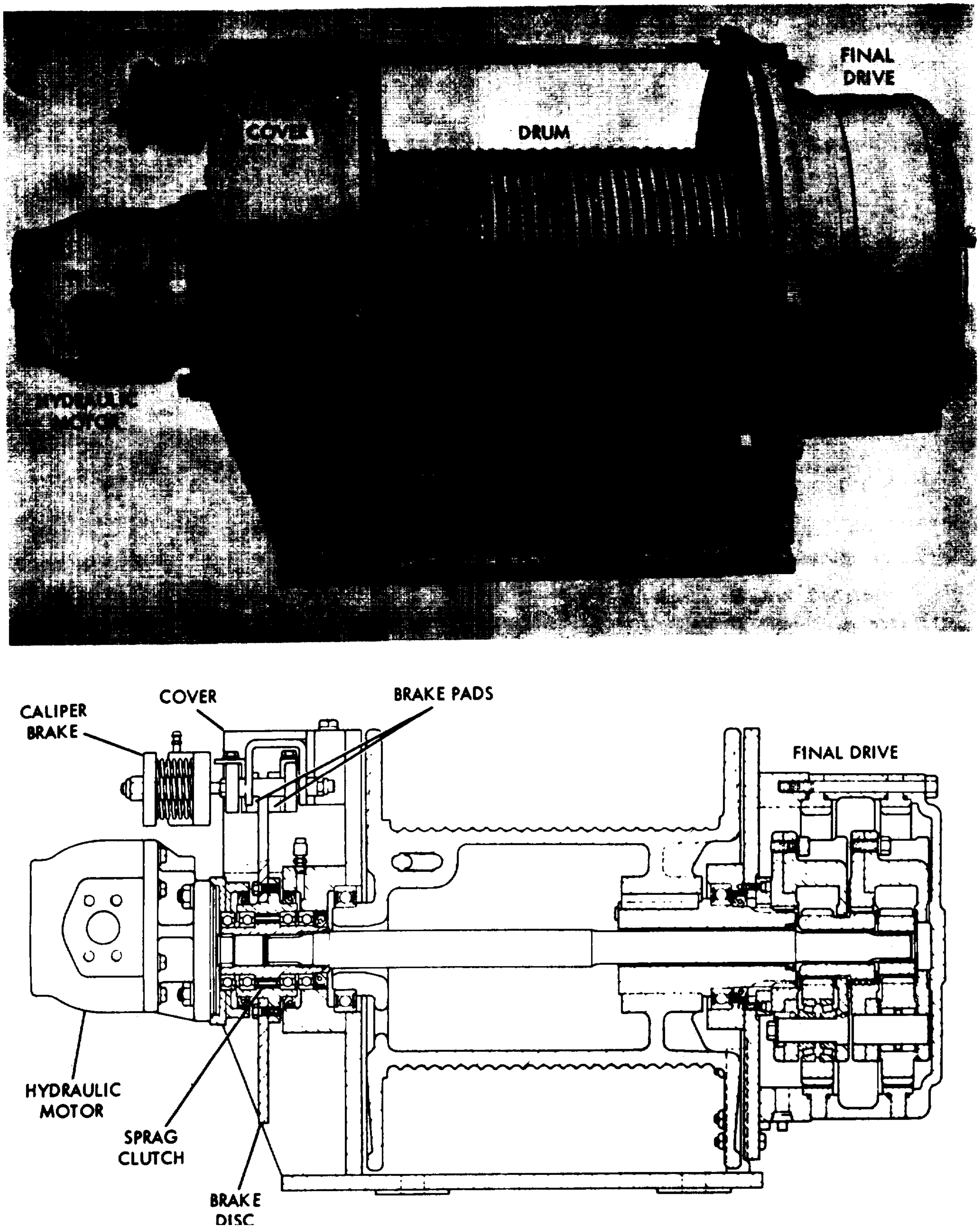


Figure 5J-2. The P&H Winch

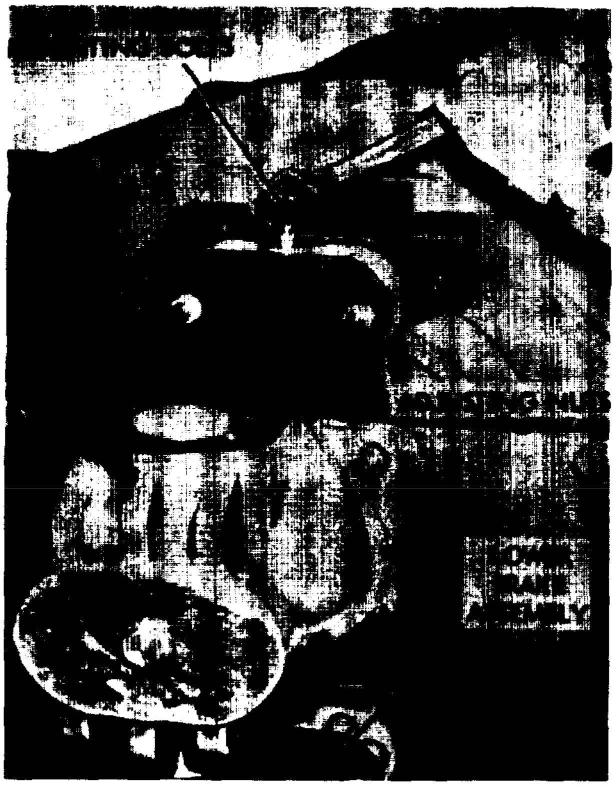


Figure 5J-3. Brake Mounting Bolts

Figure 5J-4. Removing Brake Assembly

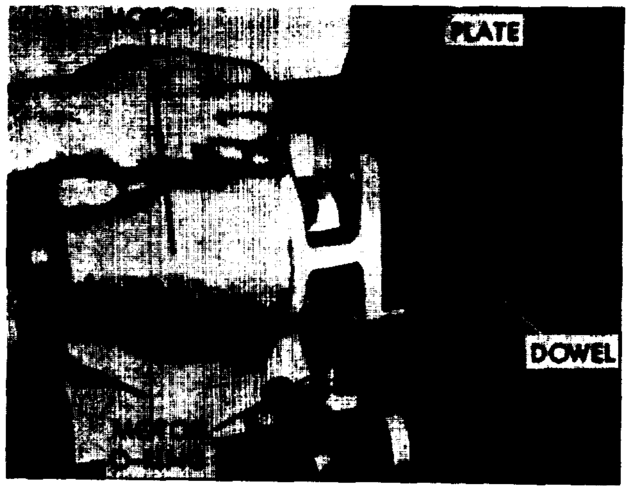


Figure 5J-5. Removing Hydraulic Motor

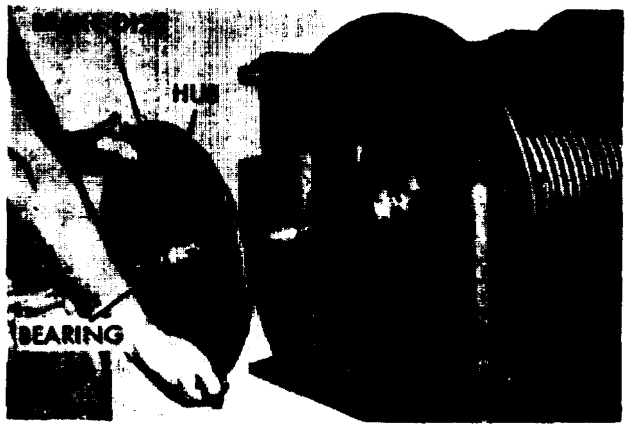


Figure 5J-6. Removing Brake Disc and Shaft Assembly

9. Before removing the bearing shown in Figure 5J-6, spin it by hand to check for any signs of roughness or failure.

10. Refer to Figure 5J-7 and pull the outer of the two bearings mounted on the sleeve, using a suitable puller as shown.

NOTE

A spacer is located behind the bearing shown in Figure 5J-7. See Figure 5J-19.

11. Slide the assembly consisting of the brake disc and hub shown in Figure 5J-8 off the shaft and remove the shaft from the winch drum. Then, using a rubber mallet, tap the sleeve end Sprag clutch out of the hub in the direction shown in Figure 5J-8. In other words, tap on the left end of the sleeve.

12. Inspect the sleeve surfaces to which the arrows point end the hub surface which contacts the outer diameter of the clutch. The sleeve and hub surfaces must be extremely smooth. The original finish was 16 rms. An oil seal rides on the and of the sleeve. Any scratches or scoring on these

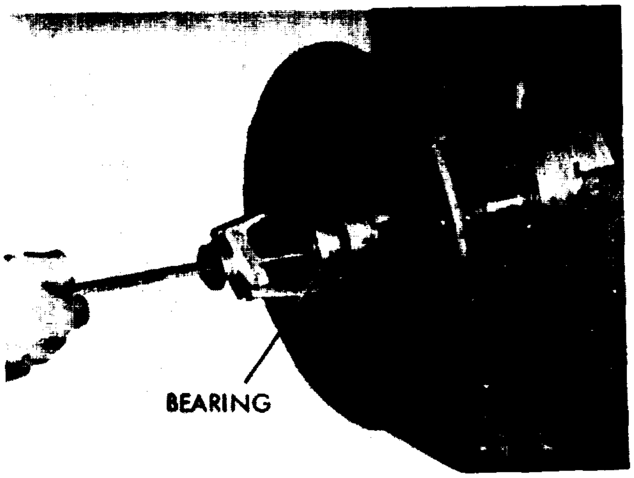


Figure 5J-7. Removing Sleeve Bearing

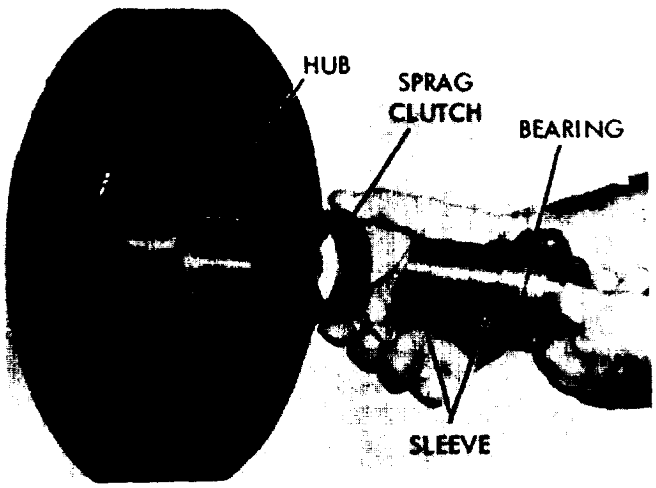


Figure 5J-8. Removing Sleeve and Sprag Clutch

highly finished surfaces is cause for replacement of the part. Any visible signs of wear, scoring, or damage is cause to replace the clutch assembly, which should be replaced as a unit, consisting of the hub, the sleeve, or the Sprag clutch.

13. The O-ring shown in Figure 5J-9 should be checked. This sleeve O-ring is one probable cause if hydraulic oil is found in the winch drum, Always replace this O-ring if the winch is disassembled enough to permit replacement.

NOTE

Figure 5J-9 is viewed from the winch drum side of the brake disc, and shows the sleeve before it was tapped out of the hub as shown in Figure 5J-8.

14. At this time, the motor and of the winch will appear as shown in Figure 5J-10. The two seals and bearing shown can be removed and replaced. Note that the large outer seal lip points toward the winch drum, while the small seal lip points outward, away from the drum.

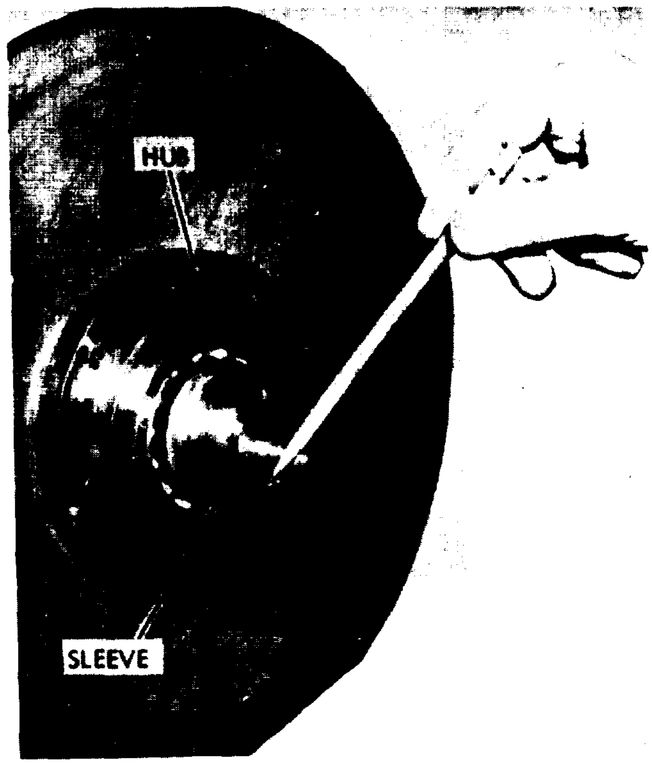


Figure 5J-9. Sleeve O-Ring Location

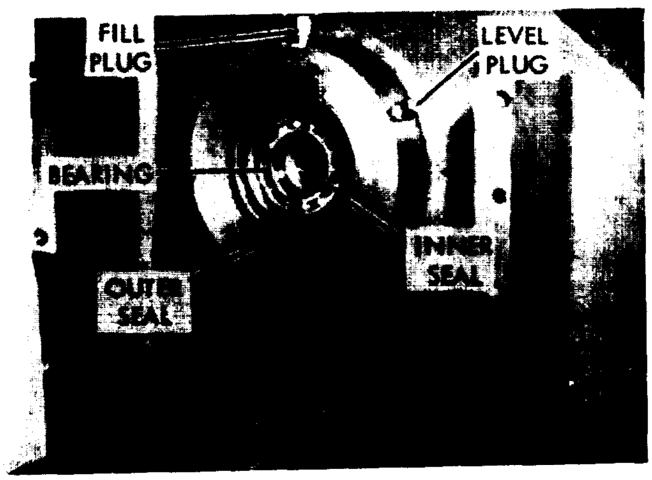


Figure 5J-10. Motor End Drum Bearing and Seals

DISASSEMBLY OF FINAL DRIVE. Disassemble the final drive as follows:

1. Refer to Figure 5J-11. Drain approximately 1/2 gallon (1.9 l) of SAE 90 transmission oil from the drain plug.

NOTE

Disassembly of the final drive unit is only necessary when some internal failure is believed to have occured.

2. Remove the cover mounting capscrews and install three

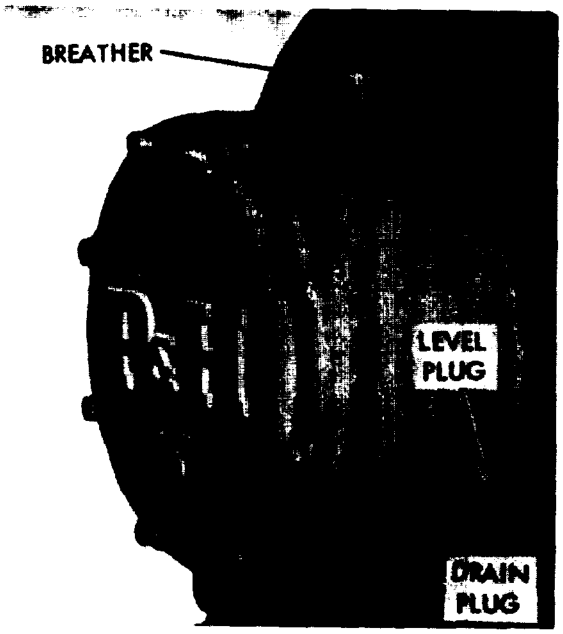


Figure 5J-11. Location of Breather, Level, and Drain Plugs

Figure 5J-12. Guide Studs for Final Drive

1/2-13x11 UNC bolts with heads cut off or three 1/2-13x11 UNC studs at the points indicated in Figure 5J-12. These studs will serve as guides in the removal and installation of the parts comprising the final drive

3. Carefully separate the end cover end remove it from the assembly as shown in Figure 5J-13. Inspect the wear plate shown for discernible wear patterns. The wear plates between the inner and outer planetary stages and the cover can stand about 1/32" (0.79 mm) wear before the retaining

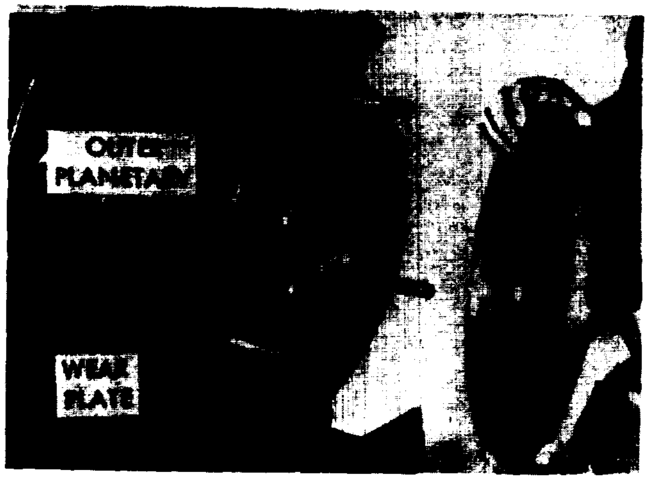


Figure 5J-13. Removing End Cover

Figure 5J-14. Removing Outer Planetary Assembly

screws will begin to cut into the mating surfaces. Initial thickness was 1/8 inch (3.17 mm). The internal wear plates (Inside the planetary stages) can stand about 3/64 inch (2.38 mm) wear before the gear teeth will start to cut into the wear plates. The wear plate in Figure 5J-16 can stand about 1/8 inch (3.17 mm) wear. Note that wear on the interstage surfaces should be even across the entire surfaces, and should show up as a concentric circle within the I.D. of the wear plate.

4. Remove the outer planetary assembly as shown in Figure 5J-14. Inspect the wear plate shown in Figure 5J-14 and replace this wear plate if required. Note that disassembly of either of the two planetary assemblies shown in Figure 5J-14 is not recommended. However, it is recommended to spin the gears and see that they turn freely and smoothly. If they do not spin freely, check to see if the pins turn when the gears turn. The pins should not turn. If one does, it is probable that one of the roll pins which holds each pin in place has sheared. As a general rule, if one of the bearings on which the planetary gears is mounted in

Figure 5J-15. Removing Outer Ring Gear

Figure 6J-16. Removing Inner Planetary Assembly

bad or if a roll pin has sheared, the damage will be so extensive that it is advisable to order a complete replacement assembly.

5. Loosen and remove the outer ring par as shown in Figure 5J-15. Inspect the gear teeth for excessive wear. Original backlash was 0.004 to 0.008 inch (0.10-0.20 mm) per gear sat. Note that the proper criterion for replacement is basically "does it work?". Replace only if absolutely necessary.

6. Remove the inner planetary as shown in Figure 5J-16. Inspect this planetary assembly in the same manner described for the outer assembly. Inspect the wear plates shown in Figure 5J.16 and replace if wear patterns are evident.

7. This should normally complete the disassembly of the secondary drive. However, if complete disassembly is required including the drum bearings and seals, refer to Figure 5J-15 and remove the housing spacer and inner ring gear. Then, block the winch drum so that it cannot drop, remove the mounting plate (Figure 5J-16) capscrews and lockwashers, and remove the mounting plate. The drum can now be removed from its base for replacement of bearings and seals as required. Note that the drum sleeve is pressed into the drum and cannot be removed until the mounting plate is removed.

REASSEMBLY OF FINAL DRIVE. In general, reassembly is the reverse of disassembly. Only where an adjustment or a procedure is not the exact reverse of disassembly will additional detail be given in the following reassembly procedure. Reassemble from the final drive end as follows:

NOTE

When the drum has been installed in the side stand, production tolerances will allow 0.018 to 0.069 inch (0.46-1.75 mm) drum end play.

1 Refer to Figure 5J-16, reinstall the mounting plate and secure with mounting plate capscrews. If they have been removed, reinstall the three guide studs and install the inner ring gear and housing ring (Figure 5J-15) on the studs. Press the ring gear and housing ring firmly against the mounting plate.

2. Install the inner planetary assembly (Figure 5J-16).

3. Install the outer ring gear in the position shown in Figure 5J-15.

4. Install the outer planetary in the position shown in Figure 5J-13.

5. Place the end cover on the guide studs as shown in Figure 5J-12 and install two end cover capscrews 180 degrees apart. Remove the three guide studs and install the rest of the eight end cover capscrews. Then tighten the end plate capscrews to 55 foot pounds (7.6 m-kg) lubricated or 75 foot pounds (10.4 m-kg) dry torque, being sure to tighten in the approved cross bolting sequence. That is, tighten two capscrews 180 degrees apart, then two more at right angles to the first pair, and so on.

6. Refer to Figure 5J-11, remove the breather cap, and fill with 1/2 gallon (1.9 l) of SAE 90 transmission oil to the level of the level plug.

7. Refer to Figure 5J-17 and install the drum shaft as shown. Note that the shaft has a smaller outer diameter for about four inches (10.2 cm) on the end being inserted. This end of the shaft must be installed as shown. It will be necessary to align the shaft splines with the outer planetary sun gear by feel. Be sure the shaft is fully entered into the outer planetary.

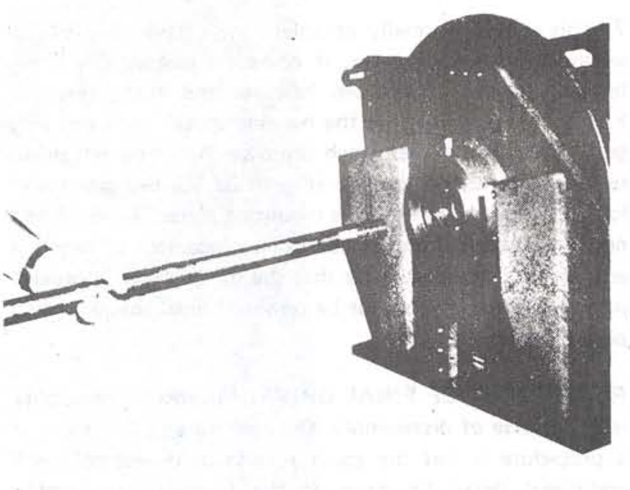


Figure 5J-17. Installing Drum Shaft

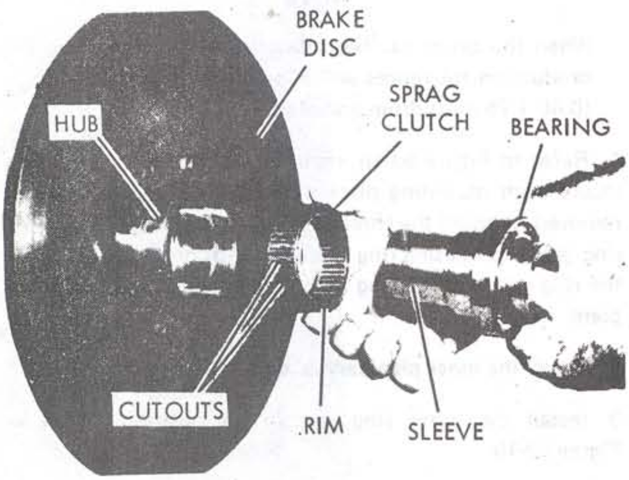


Figure 5J-18. Installing Sprag Clutch

NOTE

Seals and bearings shown in Figure 5J-10 must be installed before the shaft is reinstalled. Be careful to avoid damaging the inner seal shown in Figure 5J-10 when installing the shaft.

REASSEMBLY OF PRIMARY DRIVE. Reassemble the primary drive as follows:

1. Assemble the Sprag clutch and bearings in the hub as follows:

CAUTION

If the Sprag clutch is installed opposite to the position in which it is shown in Figure 5J-18, it will lock up in the wrong direction.

A. Install one bearing on the sleeve as shown in Figure 5J-18, if it was removed.

B. Hold the Sprag clutch as shown in Figure 5J-18. Observe that the cutouts are *above* their individual sprag. Also, see that the rim on the end of the clutch faces the sleeve, as shown. These two checkpoints show the relationship of the Sprag clutch to the sleeve and the hub.

C. Make sure a bearing has been installed in the bore on the opposite side of the hub. Then slip the Sprag clutch over the end of the sleeve, against the bearing.

D. Install the Sprag clutch and sleeve-bearing assembly in the hub.

NOTE

No force is required to install the Sprag clutch in the hub. However, it may be necessary to go around the circumference of the clutch with a screwdriver, turning the individual Sprags in the same direction. When all are turned the same way, the entire assembly will slide easily into the bore of the hub.

E. Place the other spacer (identical to the one shown in Figure 5J-19) on the sleeve at the opposite end of the hub. Reference to Figure 5J-2 will show that there are four ball bearings on the sleeve. It is most important that one of these spacers be installed between the two bearings on one side of the brake disc and the other between the two bearings on the opposite side of the brake disc.

2. With the Sprag clutch installed in the brake disc hub, install the brake disc on the end of the drum shaft in the general manner shown in Figure 5J-6. Figure 5J-6 shows the

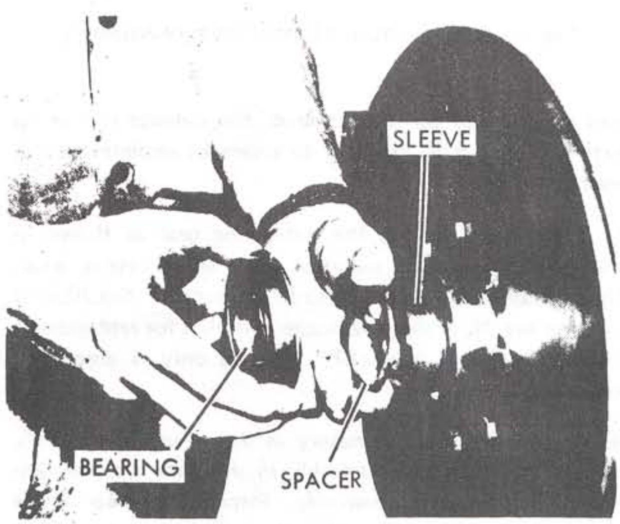


Figure 5J-19. Bearing and Spacer Location shaft extended out of the winch drum, which would not be the case as the disc/hub assembly is being installed.

NOTE

Production tolerances will allow 0.010 to 0.041 inch (0.25-1.04 mm) end play in the Sprag hub, clutch, and sleeve assembly.

3. Using a rubber mallet, alternately tap the sleeve and the hub firmly into place on the shaft. Be sure that the spacer on the inner side of the sleeve remains in place while moving the assembly onto the shaft.

NOTE

If the Sprag clutch is installed correctly, turning the brake disc counterclockwise will cause the winch drum to turn counterclockwise. Turning the brake disc clockwise will have no effect upon the drum. Be sure this is the case before continuing with assembly. If the reverse is true, the Sprag clutch has been installed backward and must be removed and assembled correctly.

4. Refer to Figure 5J-19 and install the spacer and bearing in the positions shown. Be sure to apply force only to the inner race of the bearing, using a piece of pipe or other suitable device to prevent force from being applied to the outer race.

NOTE

Inspect the brake disc to be sure no grooving is apparent. If wear patterns can be seen, it is probable that the brake pads need to be replaced, or they should be machined smooth, using adequate disc brake servicing equipment.

5. Install the plate shown in Figure 5J-5. Be sure to drive the two dowels shown (one on each side) flush with the plate. If the winch is a Model 16 (which has two brake assemblies) it will be necessary to remount the lower brake assembly as shown in Figure 5J-5 before installing the plate.

6. Install the hydraulic motor as shown in Figure 5J-5. One man should hold the motor while another turns the drum so as to line up the motor shaft splines with the mating splines in the sleeve. Be sure that the match marks on the motor housing and the plate are lined up.

7. Refer to Figure 5J-20 and remove the oil level plug and relief valve. Pour oil, of the type specified in Section III for the Sprag clutch, into the relief valve opening until the oil just runs out of the oil level opening. Replace the oil level plug and relief valve.

8. Refer to Figure 5J-21 and install the brake assembly as shown. Note that shims are sometimes used at the point

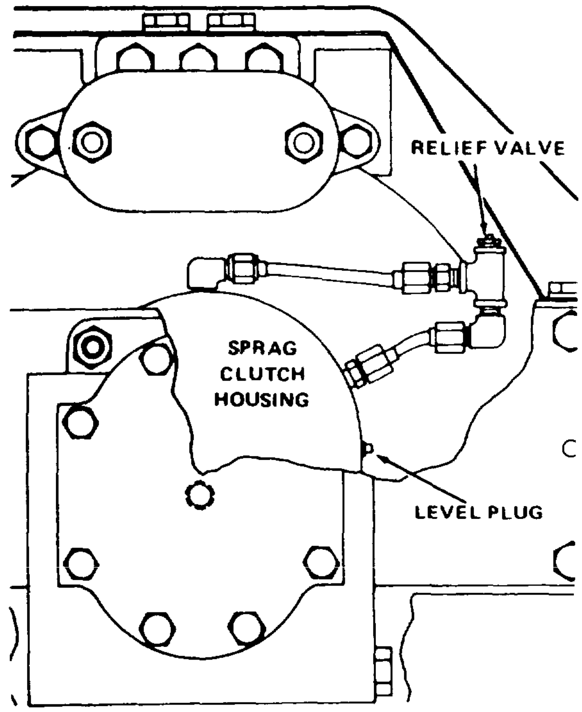


Figure 5J-20. Sprag Clutch Oil Level

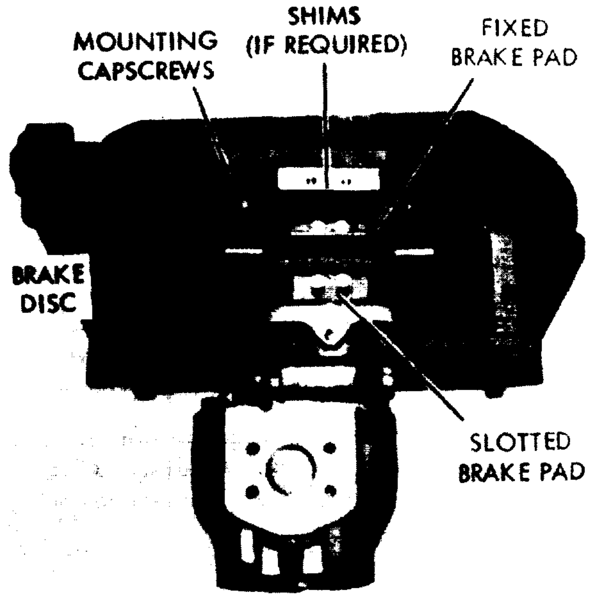


Figure 5J-21. Winch Brake Assembly

shown. However, no shims should be used unless the winch was originally provided with them, in which case the same shims must be reused. The slotted brake pad is adjustable to place the pads firmly against the brake disc. However, this adjustment should not be touched after it has once been made. Any further adjustment of the winch brake should be made as described below.

9. After completing assembly of the winch, check and

adjust each brake assembly as described under the topic Winch Brake.

INSTALLATION. Use the following procedure to install a new of overhauled winch:

1. Position the winch on the winch mounting. Install three of the four mounting screws with a hardened washer on each screw. Tighten the screws to 300 ft-lbs (41.5 m-kg) lubricated.

2. Measure the clearance between the winch base and winch mounting at the remaining mounting hole. Install shim stock as required to fill any gap that may exist.

3. Install the remaining screw with a hardened washer and tighten the screw to 300 ft-lbs (41.5 m-kg) lubricated.

WINCH BRAKE (15U26)

DESCRIPTION. The winch brake used on the P&H winch is a spring set, hydraulically released disc type brake. When pressure is applied to the brake cylinder, as it is when the winch lever is in the lower position, the brake springs are compressed. This relieves the pressure on the friction pads, and allows the brake disc to turn freely.

When the pressure is vented from the brake cylinder, the brake springs force the friction pads into contact with the brake disc. This applies braking torque to the winch drum through the Sprag clutch, driveshaft and planetary reduction.

ADJUSTMENT. Maximum recommended brake torque is obtained by tightening the two large nuts (1, Figure 5J-22). compressing the springs evenly. until the dimension measured from the inside surface of spring retainer plate (2) to the machined back surface of casting (3) is exactly 1/8 inch (3.17 mm). Never over-compress the springs; always maintain the 1/8 inch (3.17 mm) check dimension.

To ensure even spring pressure and reliable operation of the hydraulic release mechanism, check that dimension “A”, as measured at the end of the spring retainer plate and casting, is the same on both sides. Failure to maintain even spring pressures may cause the hydraulic piston to jam or malfunction.

FRICTION PAD REPLACEMENT. The friction pads of the winch brake should be replaced when they have worn to a thickness of 1/8 inch (3.17 mm). To replace the friction pads, proceed as follows (see Figure 5J-23):

1. Remove the screws, lockwashers, washers, and bushings securing the friction pads to the piston side carriers.

2. Withdraw the friction pad assemblies, noting that the assembly with the slotted holes is nearest the piston housing.

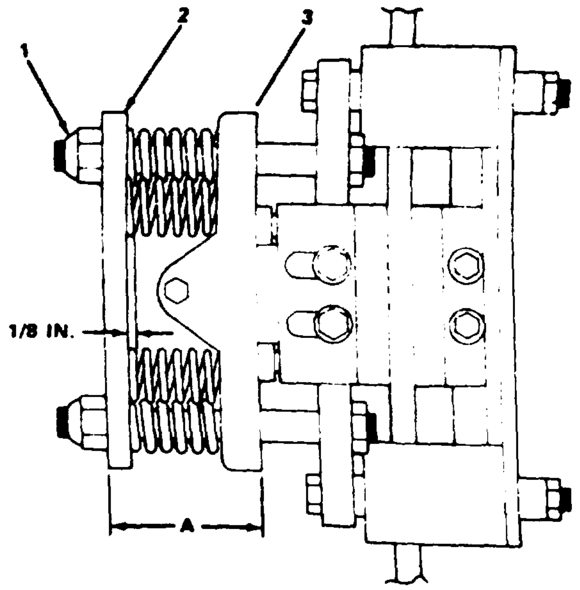


Figure 5J-22. Dimensions for Spring Setting

NOTE

It may be necessary to reduce the spring pressure by backing off nuts (1) to obtain the clearance required to remove and replace the friction pads.

3. Install the new pad assemblies on the piston side carriers, and secure them with the screws, lockwashers, washers, and bushings. Check that the pad assembly nearest the piston housing slides freely on the bushings.

4. Adjust the brake as described under the topic Adjustment.

SEAL REPLACEMENT. The piston which releases the brake has an D-ring seal and a back-up ring which must be replaced if leakage around the piston Is excessive. To replace the O-ring seal, proceed as follows (see Figure 5J-23):

1. Carefully loosen nuts (1) to relieve spring pressure. Then remove the nuts, retainer plate, and color coded springs. Be sum to note the location of the springs before removing them.

2 Disconnect the hydraulic pressure line connected to the piston housing if the brake has not been removed from the winch.

3. Slide the piston housing off the studs. Open the bleeder screw to allow air to enter the piston housing bore while the piston is removed. Then remove the piston from the piston housing, and remove the O-ring and backup ring from the piston.

4. Examine all components for damage. Replace any defective parts, especially weak springs. All springs should exhibit the same free length.

Replace the O-ring seal and back-up rings, and examine the piston for evidence of scoring.

Evidence of severe scoring in the piston housing bore will mean replacing the piston housing assembly, since it would be impossible to effect a proper seal.

5. Dip the piston assembly, O-ring seal and backup ring in clean hydraulic fluid, Assemble the O-ring and back-up ring on the piston so that the back-up ring is on the low pressure side of the seal groove. Press the piston into the piston bore, keeping it square to avoid scoring the bore. Push it firmly all the way into the bore.

6. Install the piston housing on the studs. Then install the springs in the proper location, and secure the springs with the retainer plate and nuts (1).

7. Adjust the brake as described under the topic Adjustment.

8. Connect the hydraulic pressure line to the piston housing.

9. Attach a flexible bleeder tube to the bleeder fitting. Submerge the other end of the tube In a container partially filled with hydraulic fluid.

10. Start the engine and engage the pump drive. Place the winch lever in the lower position to supply fluid to the winch motor and winch brake. Hold the lever in the lower position until a solid stream of fluid escapes from the tube. Then tighten the bleeder fitting and return the lever to the centered position. Do the same for the other brake assembly if the winch is equipped with two brakes.

CAUTION

Do not pour any of the purged fluid back into the reservoir, since it is aerated and the air trapped within it will again enter the system.

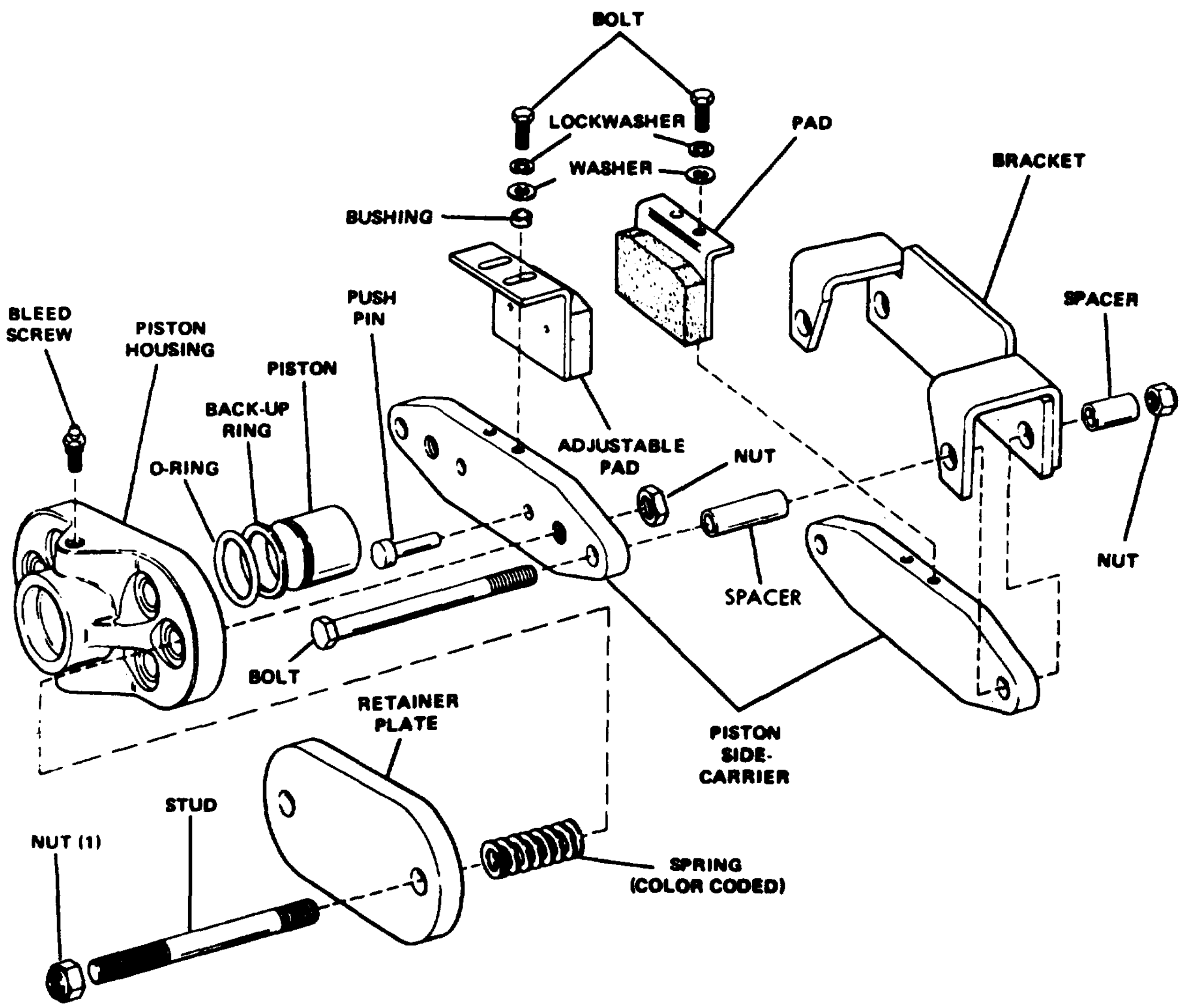


Figure 5J-23. Brake Assembly

SUB-SECTION 5K
WINCH MOTORS

MOTOR (41Q6)

DESCRIPTION

This hydraulic motor is a fixed displacement, single speed gear type motor. The construction of the winch motor is shown in Figure 5K-1.

Port connections are located in the motor body. The direction of oil flow through these ports determines the direction of shaft rotation.

Oil entering one of the ports subjects two gear teeth on the inlet side of the motor to high pressure which tends to rotate the gears as shown in Figure 5K-2.

As the gears rotate around the motor housing, they carry the oil that enters the inlet side of the motor to the outlet side of the motor, where the oil is returned to tank.

DETERMINING MOTOR EFFICIENCY

The rate of tail drain leakage, from a stalled motor, is a measure of the motor's volumetric efficiency. A new motor, having maximum practical volumetric efficiency, will have a tail drain leakage rate of approximately 4 GPM (15.14 l/min). A drain rate of 9 GPM (33.9 l/min) represents a volumetric efficiency of approximately 80 percent. This is the point at which consideration should be given to replacing or repairing the motor. The final decision on

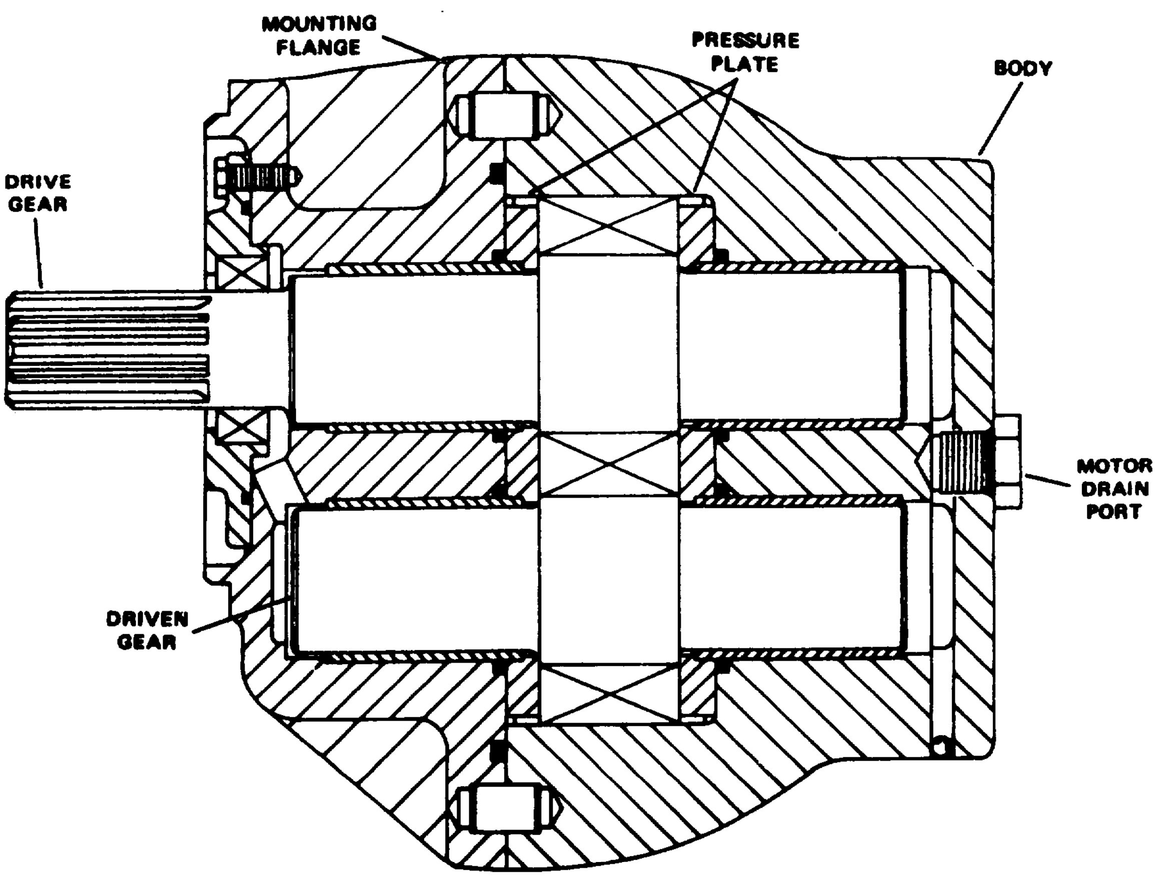


Figure 5K-1. Winch Motor (41Q6)

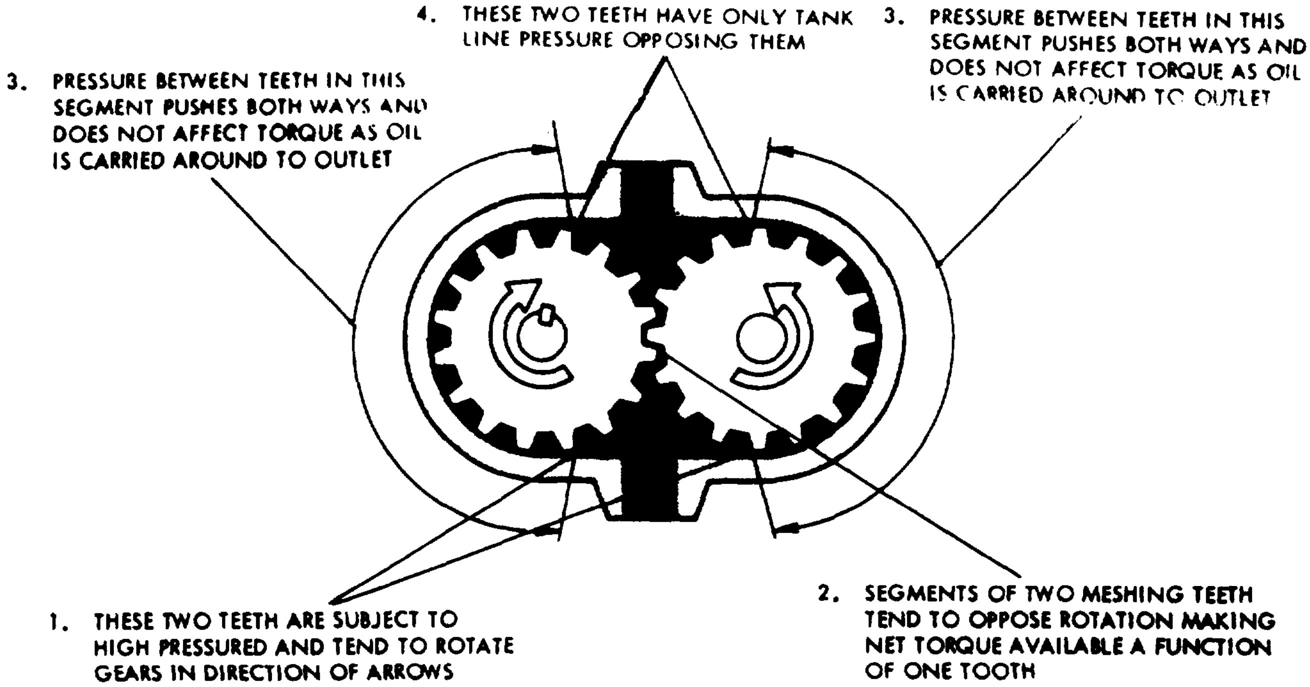


Figure 5K-2. Motor Operation

whether or not to replace the motor, however, must be based on what torque and speed you consider to be satisfactory.

To measure the motor tail drain leakage, proceed as follows:

1. Disconnect the motor drain hose attached to the end of the motor.

2. Install a short piece of hose to the motor drain fitting, and insert the opposite end of the hose in a suitable container having a capacity of approximately 5 gallons (18 l).

3. Unreeve the hook block, if necessary, to reduce the receiving to a single part of line. Attach the winch line to a choker chain attached to the towing hooks under the front bumper. Take up the slack to stall the winch motor.

4. Start the engine and run it at high idle.

5. Pull the winch lever back fully, and hold it for 20 seconds.

NOTE

The motor must remain stalled for the full 20 seconds.

6. Measure the amount of oil that drained into the conminer in that 20 second period. Three gallons drained in a 20 second period represents an 80 percent efficiency level; more than 3 gallons represents a lower efficiency level; and less than 3 gallons represents a higher efficiency.

7. Reconnect the drain line upon completion of the test.

REMOVAL

To remove the motor, proceed as follows:

1. Disconnect all the hydraulic lines attached to the motor, and cap the ends of the hydraulic lines to prevent the entry of dirt into the hydraulic system. Plug the motor ports to prevent the entry of dirt into the motor.

2. Remove the capscrews which secure the motor to the winch. Pull the motor straight out until the motor shaft is clear of the winch. Remove the motor to a suitable work area.

NOTE

It is recommended that the motor be replaced with a new motor, since the time required to replace the motor is less than that required to overhaul it. It should also be noted that the volumetric efficiency of an overhauled motor will always be lower than that of a new motor.

OVERHAUL

GENERAL. It is suggested that before any work is done on this unit, all the steps for disassembly and reassembly be read carefully and understood.

Expendable parts such as oil seals, back-up rings, O-rings, sealing strips, and separators should never be re-used even though inspection may show these items as being serviceable for future use. The cost of these items is negligible compared to the costs involved in replacing such items if they do not function properly.

All replacement parts should be given your final inspection to ensure that no damage has resulted after the final factory inspection was made.

Cleanliness is of prime importance when any part of this unit is disassembled or reassembled. Before starting disassembly, be sure that a clean work area with a dust and grit free workbench is available.

DISASSEMBLY. To disassemble the motor, proceed as follows (see Figure 5K-3):

1. Clean the outside of the motor with a suitable solvent. Matchmark the sections of the motor to assure correct reassembly.

2. Clamp the motor, output shaft up, across the motor ports in a vise having protective jaws.

3. Remove capscrews (13) and lockwashers (14). Coat the end of the output shaft with clean grease. Lift mounting flange (5) straight up until it clears the end of the output shaft, and then remove the mounting flange.

NOTE

It may be necessary to tap the mounting flange with a wooden mallet or plastic hammer to loosen it.

4. Remove capscrews (1). Lift seal retainer (2) off of mounting flange (5). Remove O-ring (3), and carefully press seal (4) from seal retainer (2).

5. Remove O-ring (6) from the mounting flange.

6. Remove O-rings (8) and back-up rings (9).

7. Marks the side of body (16) newest gear (12). Grasp the gear, and lift it slightly with a quick, upward motion to dislodge pressure plate (10). Remove the pressure plate. Remove sealing strips (7) from pressure plate (10).

8. Remove gear (12) and gear (11).

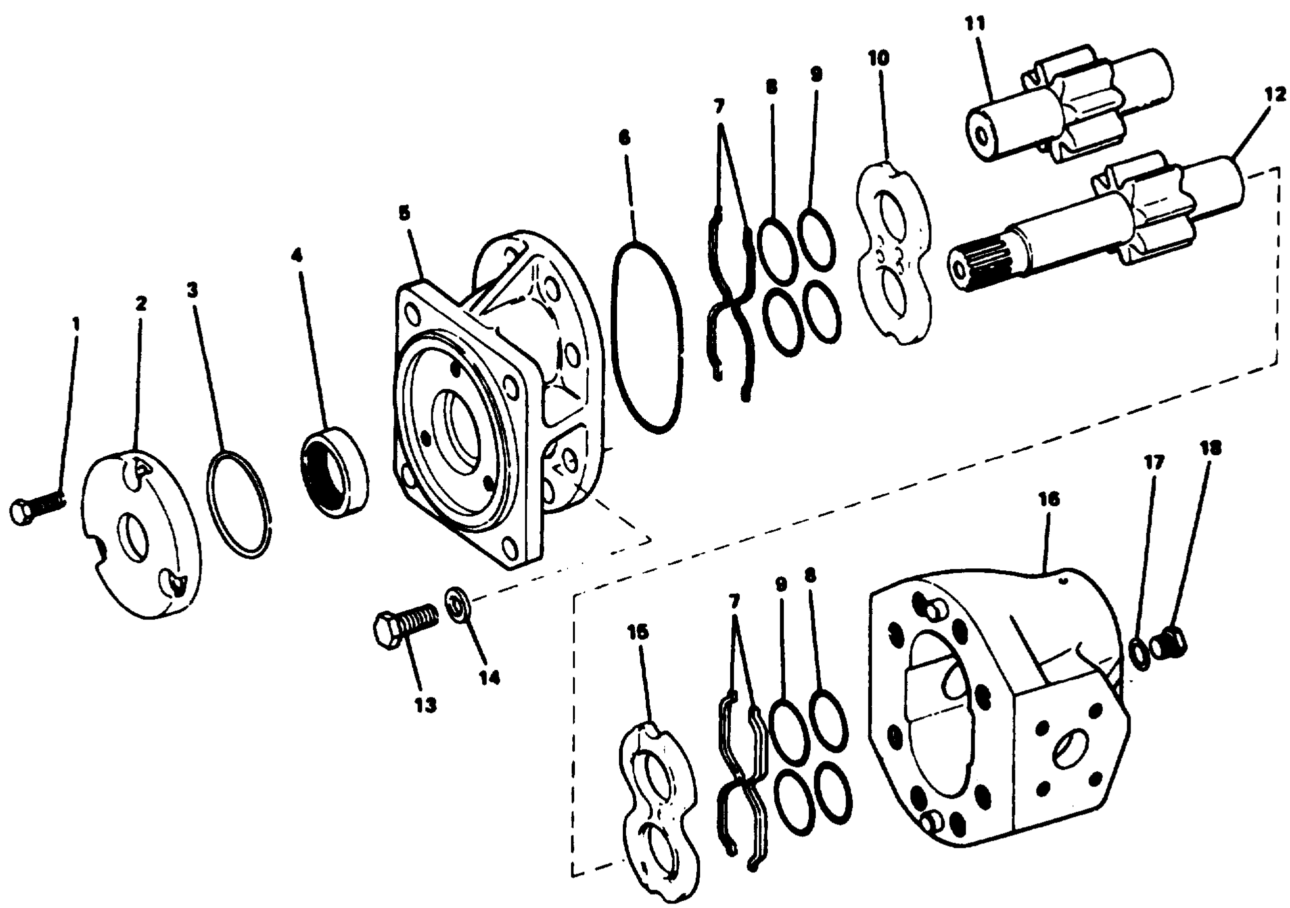


Figure 5K-3. Motor (41Q6)

9. Place the fingers of each hand in the gear bores of pressure plate (15). and carefully lift the pressure plate straight out of body (16). Do nor force or pry the pressure plate when removing it. Remove sealing strips (7) from pressure plate (15).

10. Remove back-up rings (9) and O-rings (8).

INSPECTION. After the motor has been disassembled, wash all parts in a suitable solvent and dry with compressed air. All parts should be visually inspected for excessive wear, cracks, or any other damage which would make them unfit for further service, with particular attention to the following:

1. The gears will wear a groove in the sides of the body (item 16). The depth of this groove should be measured. If the depth of the groove is more than 0.005 inch (0.127 mm), the motor must be replaced.

2. Inspect the pressure plates for excessive wear. If deep curved wear marks are visible, the pressure plates should be replaced.

3. Measure the gear journals at a point next to the face of the gear, and at a point 1/2 inch (12.7 mm) or more from the gear face. Compare the two measurements. If the difference in the measurements is more than 0.001 inch (0.025 mm), the motor must be replaced. Using the same procedure, measure the journal on the other side of the gear.

REASSEMBLY. To reassemble a motor which has been completely disassembled, proceed as follows (see Figure 5K-3):

1. Place body (16) on a clean workbench with the large opening up and the mark made in step 7 of disassembly facing you.

2. Lubricate the inside of body (16) with clean hydraulic oil. Install O-rings (8) and back-up rings (9) on the bearings at the bottom of the body.

NOTE

Two different types of pressure plates are used in this motor. Close examination of the plates will show that four small areas of pressure (15) have rounded edges (see Figure 5K-4). The same areas of pressure plate (10) are not rounded.

3. Install sealing strips (7) in the seal grooves in pressure plate (15).

4. Lubricate pressure plate (15) with clean hydraulic oil and place the pressure plate, bronze side up, in the opening of the body as level as possible. Carefully slide the pressure plate to the bottom of the body. Do not force the plate into position.

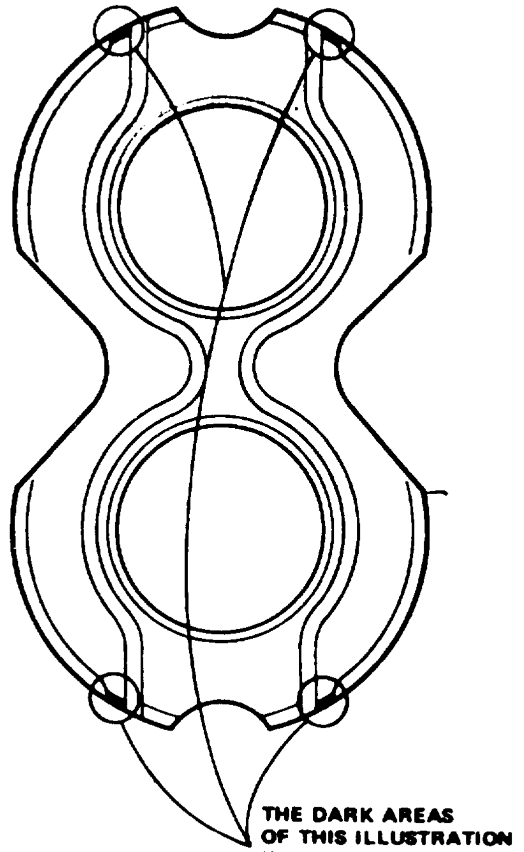


Figure 5K-4. Pressure Plate

5. Install gear (12) in the bore nearest you. Do not drop the gear into place, as this will damage the bronze on the pressure date. Install gear (11), with the long journal up, in the opposite bore.

6. Lubricate pressure plate (10) with clean hydraulic oil and place it, bronze side down, over the protruding end of the gears and into the opening. Carefully slide the pressure plate into the body.

7. Install sealing strips (7) in the seal grooves in pressure plate (10).

8. Coat O-ring (6) with a small amount of clean grease and install the O-ring in its groove in mounting flange (5). Install the mounting flange on body (16).

9. Install a capscrew (13) and lockwasher (14) in two holes which are 180 degrees apart. Tighten the nuts to 175 foot-pounds (24.2 m-kg).

10. Attach a torque wrench to the output shaft and rotate the shaft. The shaft will be tight, but should turn with a maximum of 5 to 10 foot-pounds (0.69-1.38 m-kg) of torque. If the shaft will not turn with 5 to 10 foot-pounds (0.69-1.38 m-kg) of torque, the motor should be disas-

sembled, inspected, and the problem corrected before installing the remaining nuts and lockwashers.

11. If the shaft turns properly, install the remaining cap screws (13) and lockwashers (14). lighten the capscrews to 175 foot-pounds (24.2 m-kg).

12. Install seal (4) in retainer (2) so that the metal race of the seal enters the retainer first. Press the seal into the retainer using a suitable driver which bears against the metal part of the seal.

13. Coat O-ring (3) with a small amount of clean grease, and install the O-ring in its groove in retainer (2). Coat the lip of the seal with clean grease.

14. Carefully install retainer (2) over the end of the output shaft. Install capscrews (1).

MOTOR (41Q7)

DESCRIPTION

This hydraulic motor is a fixed displacement, single speed gear type motor. The construction of the winch motor is shown in Figure 5K-5.

Port connections are located in the motor body. The direction of oil flow through these ports determines the direction of shaft rotation.

Oil entering one of the ports subjects two gear teeth on the inlet side of the motor to high pressure which tends to rotate the gears as shown in Figure 5K-6.

As the gears rotate around the motor housing, they carry the oil that enters the inlet side of the motor to the outlet side of the motor, where the oil is returned to tank.

DETERMINING MOTOR EFFICIENCY

The rate of tail drain leakage, from a stalled motor, is a measure of the motor's volumetric efficiency. A new motor, having maximum practical volumetric efficiency, will have a tail drain leakage rate of approximately 3 GPM (11.36 l/min). A drain rate of 8 GPM (30.2 l/min) represents a volumetric efficiency of approximately 80 percent. This is the point at which consideration should be given to replacing or repairing the motor. The final decision on whether or not to replace the motor, however, must be based on what torque and speed you consider to be satisfactory.

To measure the motor tail drain leakage, proceed as follows:

1. Disconnect the motor drain hose attached to the end of the motor.

2. Install a short piece of hose to the motor drain fitting, and insert the opposite end of the hose in a suitable container having a capacity of approximately 5 gallons (18 l).

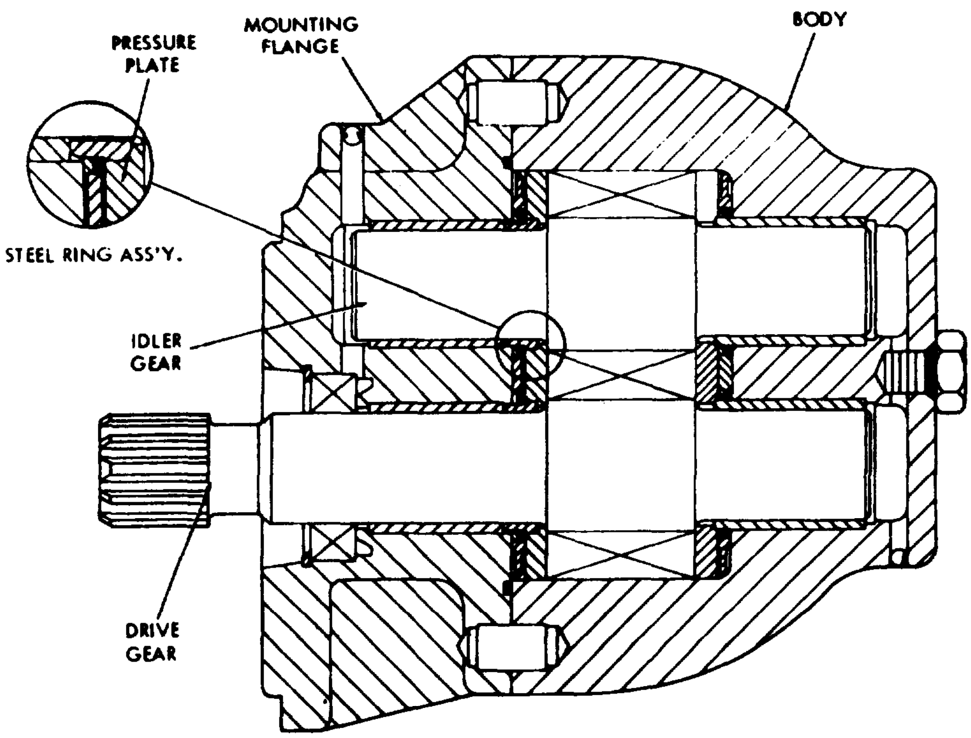


Figure 5K-5. Motor (41Q7)

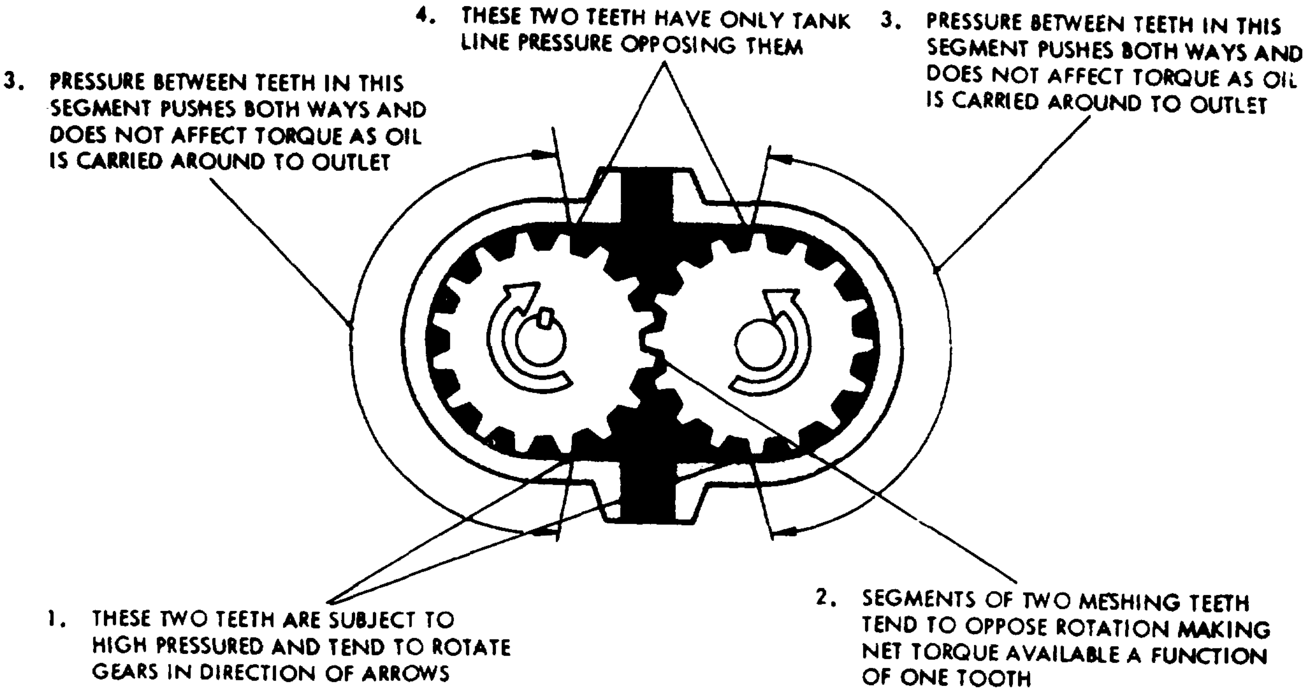


Figure 5K-6. Motor Operation

3. Unreeve the hook block, if necessary, to reduce the reeving to a single part of line. Attach the winch line to a choker chain attached to the towing hooks under the front bumper. Take up the slack to stall the motor.

4. Start the engine and run it at high idle.

5. Pull the winch lever back fully and hold it for 15 seconds.

NOTE

The motor must remain stalled for the full 15 seconds.

6. Measure the amount of oil that drained into the container in that 15 second period. Two gallons drained in a 15 second period represents an 80 percent efficiency level; more than 2 gallons represents a lower efficiency level; and less than 2 gallons represents a higher efficiency level.

7. Reconnect the drain line upon completion of the test.

REMOVAL

To remove the motor, proceed a follows:

1. Disconnect all the hydraulic lines attached to the motor, and cap the ends of the hydraulic lines to prevent the entry of dirt into the hydraulic system. Plug the motor ports to prevent the entry of dirt into the motor.

2. Remove the capscrews which secure the motor to the winch. Pull the motor straight out until the motor shaft is clear of the winch. Remove the motor to a suitable work area.

NOTE

It is recommended that the motor be replaced with a new motor, since the time required to replace the motor is less than that required to overhaul it. It should also be noted that the volumetric efficiency of an overhauled motor will always be lower than that of a new motor.

OVERHAUL

GENERAL. It is suggested that before any work is done on this unit, all the steps for disassembly and reassembly be read carefully and understood.

Expendable parts such as oil seals, back-up rings, O-rings, sealing strips, and separators should never be re-used even though inspection may show them items as being serviceable for future use. The coat of these items is negligible compared to the costs involved in replacing such items if they do not function properly.

All replacement parts should be given your final inspection to ensure that no damage has resulted after the final factory inspection was made.

Cleanliness is of prime importance when any part of this unit is disassembled or reassembled. Before starting disassembly, be sure that a clean work area with a dust and grit free workbench is available.

DISASSEMBLY. To disassemble the motor proceed as follows (see Figure 5K-7):

1. Clean the outside of the motor with a suitable solvent. Matchmark the sections of the motor to assure correct reassembly.

2. Clamp the motor, output shaft up, across the motor ports in a vise having protective jaws.

3. Remove capscrews (3) and lockwashers (4). Coat the end of the output shaft with clean grease. Lift mounting flange (5) straight up until it clears the end of the output shaft, and then remove the mounting flange.

NOTE

It may be necessary to tap the mounting flange with a wooden mallet or plastic hammer to loosen it.

4. Remove snap ring (1). Place the mounting flange on wooden blocks with seal (2) facing down. Using a suitable pin punch and hammer, tap around the edge of the seal until it can be removed.

5. Remove O-ring (6) from the mounting flange.

6. Remove back-up rings (9) and O-rings (10) from steel rings (13). Remove isolation plates (7), sealing strips (8), end separators (11), and center separator (12).

7. Mark the side of body (24) nearest gear (16). Grasp the gear, and lift it slightly with a quick, upward motion to dislodge pressure plate (14). Remove the pressure plate.

8. Remove gear (16) and gear (15) from body (24).

9. Place the thumb of each hand in the gear bores of pressure plate (17), and carefully lift the pressure plate straight out of body (24). Do not force or pry the pressure plate when removing it.

10. Remove isolation plates (18). sealing strips (19), back-up rings (20), O-rings (21), end separators (22), and center separator (23) from body (24).

INSPECTION. After the motor has been disassembled, wash all parts in a suitable solvent and dry with compressed air. All parts should be visually inspected for excessive wear, cracks, or any other damage which would make them unfit for further service, with particular attention to the following:

1. The gears will wear a groove in the sides of the body section (item 24) of the motor. The depth of this groove should be measured. If the depth of the groove is more then 0.005 inch (0.127 mm), the motor must be raplaced.

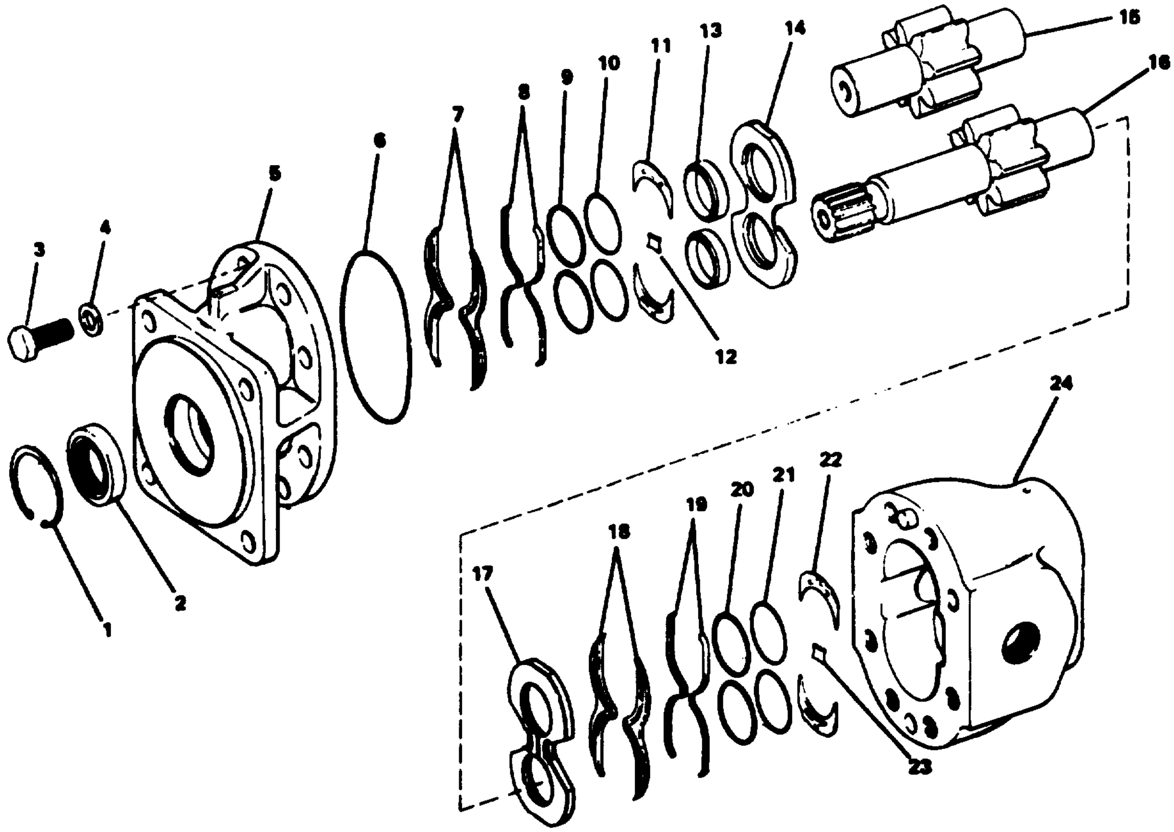


Figure 5K-7. Motor (41Q7)

2. Inspect the pressure plates for excessive wear. If deep curved wear marks are visible, the pressure plates should be replaced.

3. Measure the gear journals at a point next to the face of the gear, and at a point 1/2 inch (12.7 mm) or more from the gear face. Compare the two measurements. If the difference in the measurements is more than 0.001 inch (0.025 mm), the motor must be replaced. Using the same procedure, measure the journal on the other side of the gear.

REASSEMBLY. To reassemble a motor which has been completely disassembled, including the bearings, proceed as follows (see Figure 5K-7):

1. Place body (24) on a clean workbench with the large opening up and the mark made in step 7 of disassembly facing you.

2. Lubricate the inside of body (24) with clean hydraulic oil. Install O-rings (21) and back-up rings (20) on the bearings at the bottom of the body.

NOTE

Two different types of isolation plates are used in this motor. Close examination of the plates will show that two plates (item 7) have square edges and two plates (item 18) have rounded edges.

3. Install isolation plates (18) so that rounded edge enters the body first.

4. Install center separator (23), end separators (22), and sealing strips (19) in the bottom of the body.

5. Lubricate pressure plate (17) with clean hydraulic oil and place the pressure plate, bronze side up, in the opening of the body as level as possible. Carefully slide the pressure plate to the bottom of the body. Do not force the plate into position.

6. Install gear (16) in the bore nearest you. Do not drop the gear into place, as this will damage the bronze on the pressure plate. Install gear (15) with the long journal up in the opposite bore.

7. Lubricate pressure plate (14) with clean hydraulic oil and place it, bronze side down, over the protruding end of the gears and into the opening. Carefully slide the pressure plate into the body.

8. Install steel rings (13) so that the large diameter end enters the pressure plate first. Install O-rings (10) on the steel rings. Be sure the O-rings are seated against the pressure plate, and then install back-up rings (9).

9. Install isolation plates (7), center separator (12), end separators (11), and sealing strips (8).

10. Install seal (2) in the bore of mounting flange (5). Press the seal into position using a suitable driver and press, Install snap ring (1).

11. Coat O-ring (6) with a small amount of clean grease and install the O-ring in its groove in mounting flange (5). Install the mounting flange on body (24).

12. Install a capscrew (3) and lockwasher (4) in two holes which are 180 degrees apart. Tighten the nuts to 125 foot-pounds (17.3 m-kg).

13. Attach a torque wrench to the drive shaft and rotate the shaft. The shaft will be tight, but should turn with a maximum of 5 to 10 foot-pounds of torque (0.69-1.38 m-kg). If the shaft will not turn with 5 to 10 foot-pounds (0.69-1.38 m-kg) of torque, the motor should be disassembled, inspected, and the problem corrected before installing the remaining nuts and lockwashers.

14. If the shaft turns properly, install the remaining cap screws (3) and lockwashers (4). Tighten the capscrews to 125 foot-pounds (17.3 m-kg).

MOTOR (41U13)

DESCRIPTION

This hydraulic motor is a two-speed, fixed displacement, gear type motor, which consists of two independent motors connected by internal valving that directs the flow of oil to only the rear section of the motor or to both sections of the motor. The operation of the motor is as follows:

When the motor is operated in the high speed mode, the pilot port is blocked by the energized solenoid valve. The shifter pistons in the motor remain in the block position because, with no oil flow out the pilot port, the pressure at each end of the shifter pistons is equal. The spring force then shifts the pistons to the blocked position. All flow to the motor is therefore directed through the rear motor section only, resulting in high RPM and lower torque.

Shifting the motor to lower range, by de-energizing the solenoid valve, connects the pilot port to tank. A portion of the flow going to the motor then passes through the restrictor and the check valve, and then through the speed control valve to tank. Because of the oil flow, a pressure drop occurs across the restrictor. The pressure applied to the piston at the end containing the spring will now be less than the pressure applied to the opposite end of the piston. The piston will then shift toward the spring end, opening a passage for flow to the front motor section. The shifter piston connected in the discharge port of the front motor section is initially blocked when the other piston shifts to the open position. Pressure builds up quickly in the discharge port of the front motor section, however, and this pressure is applied to the piston end connected in that port. The piston shifts when the applied pressure is sufficient to overcome the spring force at the opposite end of the piston, opening a passsage for oil to flow out of the front motor section to tank. Thus, the total flow *divides* between the motor sections, and the rotational speed decreases. Full system pressure, however, is dropped across both sections, resulting in increased torque.

DETERMINING MOTOR EFFICIENCY

The rate of tail drain leakage, from a stalled motor, is a measure of volumetric efficiency. In a new motor, having a maximum practical volumetric efficiency, the tail drain leakage with both sections engaged (low speed range) will be approximately 6 GPM (22.7 l/min). An increase in tail drain leakage to 16 GPM (60.56 l/min) represents a decrease in volumetric efficiency to approximately 80 percent. This is the point at which replacement of the motor should be considered. However, replacement is not mandatory at this point; a motor operating at 80 percent efficiency may be perfectly adequate, depending on the operating conditions.

To measure the motor tail drain leakage, proceed as follows:

1. Disconnect the motor drain line attached to the end of the motor (see Figure 5K-8).

2. Connect a suitable hose to the tail drain port and insert the end of the hose in a container of approximately five gallon (18 l) capacity.

3. Unreeve the hook block, if necessary, to reduce the reeving to a single part of line. Attach the winch line to a choker chain attached to the towing hooks under the front bumper. Take up the slack to stall the motor.

4. Start the engine and run it at full throttle.

5. Shift the motor to the low range by placing the Winch Speed Selector Switch in the LO position.

6. Pull the winch lever back fully and hold it for 15 seconds.

NOTE

The motor must remain stalled for the full 15 seconds.

7. Measure the amount of oil that was drained into the container during the 15 second running time. Four gallons (15.1 l) drained in 15 seconds represents an 80 percent efficiency level; more than four (15.1 l) gallons represents a lower efficiency level, and less than four (15.1 l) gallons represents a higher efficiency.

8. Reconnect the drain line upon completion of the test.

REMOVAL

To remove the motor, proceed as follows (see Figure 5K-8):

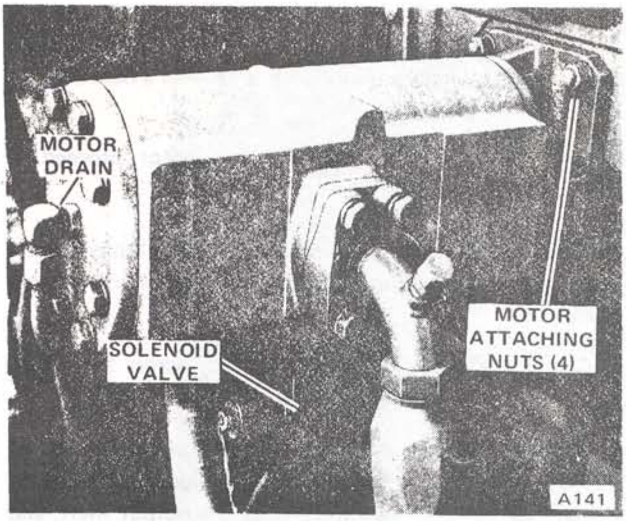


Figure 5K-8. Motor Removal

1. Clean the hydraulic line fittings and the areas around the ports using a solvent and blow dry.

2. Disconnect the four hydraulic lines from the motor. Cap each line as it is disconnected and plug the ports. Disconnect the solenoid valve wiring.

3. Block the motor securely or attach a suitable hoist to the motor housing.

4. Remove the four nuts attaching the motor to the winch.

5. Carefully pull the motor away from the winch.

NOTE

It is recommended that the motor be replaced with a new motor, since the time required to replace the motor is less than that required to overhaul it. It should also be noted that the volumetric efficiency of an overhauled motor will always be lower than that of a new motor.

OVERHAUL

GENERAL. This motor should be replaced as a complete unit or repaired to the limits allowed by the three Service Kits for this motor. The three kits for this motor are: shaft seal, front motor section and rear motor section.

The following overhaul instructions describe the procedure for installing each of the above kits.

SHAFT SEAL REPLACEMENT. To replace the shaft seal, proceed as follows (see Figure 5K-9):

1. Stand the motor on end, with the output shaft up, and remove the nuts securing the flange to the motor body.

Cleanliness is of prime importance when any part of this unit is disassembled or reassembled. Before starting disassembly, be sure that a clean work area with a dust and grit free workbench is available.

DISASSEMBLY. To disassemble the motor proceed as follows (see Figure 5K-9):

1. Clean the outside of the motor with a suitable solvent. Matchmark the sections of the motor to assure correct reassembly.

2. Clamp the motor, output shaft up, across the motor ports in a vise having protective jaws.

3. Remove nuts (3) and lockwashers (4). Coat the end of the output shaft with clean grease. Lift mounting flange (5) straight up until it clears the end of the output shaft, and then remove the mounting flange.

NOTE

It may be necessary to tap the mounting flange with a wooden mallet or plastic hammer to loosen it.

4. Remove snap ring (1). Place the mounting flange on wooden blocks with seal (2) facing down. Using a suitable pin punch and hammer, tap around the edge of the seal until it can be removed.

5. Remove O-ring (6) from the mounting flange.

6. Remove back-up rings (9) and O-rings (10) from steel rings (13). Remove isolation plates (7), sealing strips (8), end separators (11), and center separator (12).

7. Marks the side of body (24) nearest gear (16). Grasp gear, and lift it slightly with a quick, upward motion to dislodge pressure plate (14). Remove the pressure plate.

8. Remove gears (15 and 16).

9. Lift body (24) over studs (25) and remove it. Remove O-ring (26).

10. Place the thumb of each hand in the par bores of pressure plate (17). and carefully lift the pressure plate straight out of body (24). Do not force of pry the pressure plate when removing it.

11. Remove isolation plates (18), sealing strips (19), back-up rings (20), O-rings (21), end separators (22), and center separator (23) from body (24).

12. Remove coupling (28). Snap rings (27) will be removed with the coupling.

13. Reclamp the motor across valve housing (29), with the tail drain port up in the vise.

14. Remove nuts (57) and lockwashers (56). Lift end cover (56) from the motor and remove O-ring (54). Then lift the entire rear section of the motor from valve housing (20). Place the rear section of the motor on a suitable protective surface with the splined end of gear (44) up.

15. Remove O-rings (37) and back-up rings (38) from steel rings (41) which are still in valve housing (29). Remove isolation plates (35), sealing strips (36), and separators (39) and center separator (40), if these items did not drop out when the rear section of the motor was removed.

16. Mark the side of body (53) nearest gear (44). Grasp the gear, and lift it slightly with a quick, upward motion to dislodge pressure plate (45). Remove the pressure plate.

17. Remove gears (43 and 44).

18. Place the thumb of each hand in the gear bores of pressure plate (45), and carefully lift the pressure plate straight out of body (53). Do not force or pry the pressure plate when removing it.

19. Remove isolation plates (47), sealing strips (48), end separators (52), and center separator (51). Then remove O-rings (50) and back-up rings (49).

20. Remove plugs (30) to gain access to O-rings (31), springs (32) and poppets (33).

INSPECTION. After the motor has been disassembled, wash all parts in a suitable solvent and dry with compressed air. All parts should be visually inspected for excessive wear, cracks, or any other damage which would make them unfit for further service, with particular attention to the following:

1. The gears will wear a groove in the sides of the body section (item 24) of the motor. The depth of this groove should be measured. If the depth of the groove is more than 0.005 inch (0.127 mm), the motor must be replaced.

2. Inspect the pressure plates for excessive wear. If deep curved wear marks are visible, the pressure plates should be replaced.

3. Measure the gear journals at a point next to the face of the gear, and at a point 1/2-inch (12.7 mm) or more from the gear face. Compare the two measurements. If the difference in the measurements is more than 0.001 inch (0.025 mm), the motor must be replaced. Using the same procedure, measure the journal on the other side of the gear.

REASSEMBLY. To reassemble a motor which has been completely disassembled, including the bearings, proceed as follows (see Figure 5K-9):

1. Place body (53) on a clean workbench with the large opening up and the mark made in step 16 of disassembly facing you.

2. Lubricate the inside of body (53) with clean hydraulic oil. Install O-rings (50) and back-up rings (49) on the

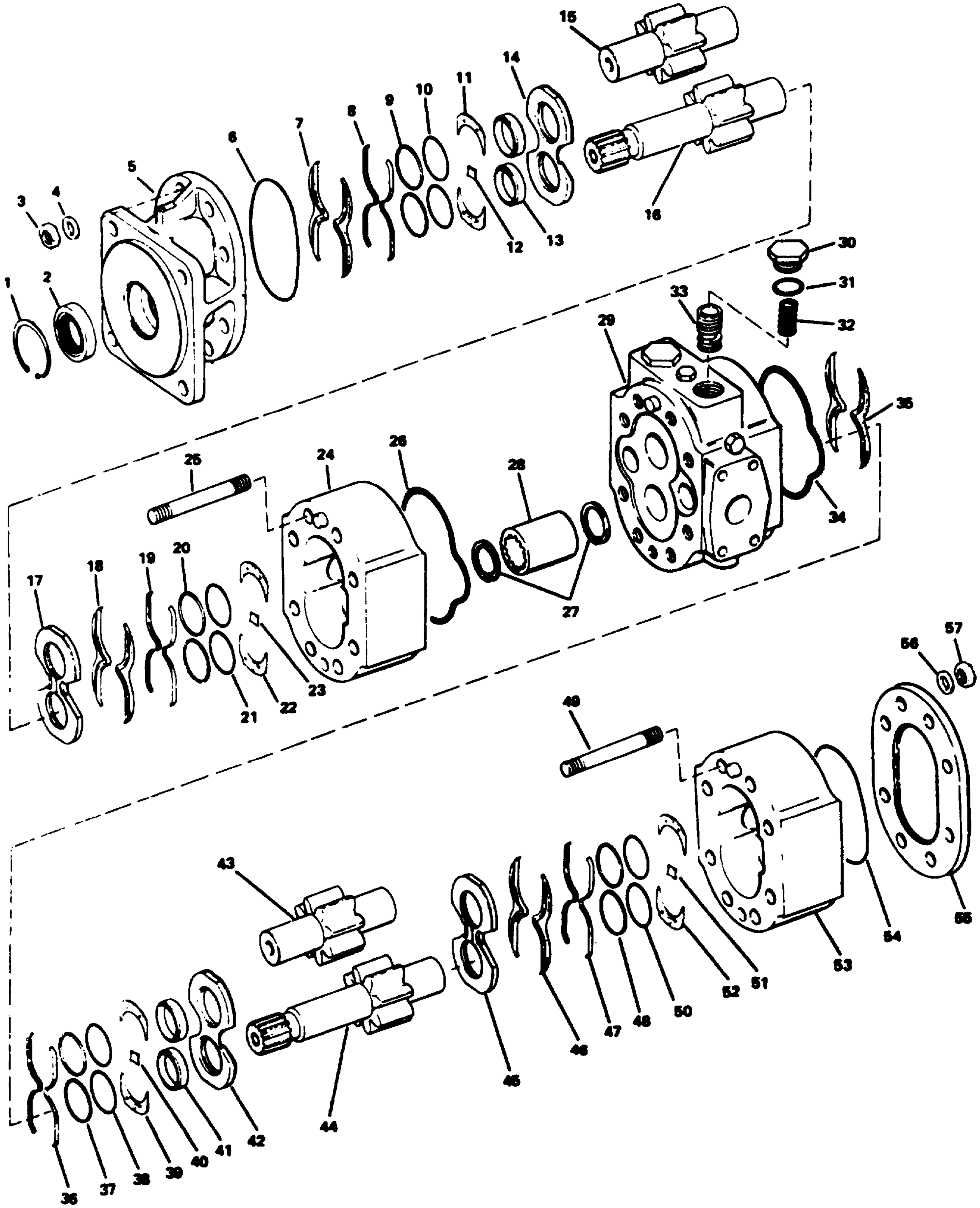


Figure 5K-9. Motor (41U13)

bearings at the bottom of the body.

NOTE

Two different types of isolation plates are used in this motor. Close examination of the plates will show that two plates (item 47) have rounded edges and the other plates (item 42) have square edges.

3. Install isolation plates (47) so that the rounded edge enters the body first.

4. Install center separator (51), end separators (52) and sealing strips (48) in the bottom of the body.

5. Lubricate pressure plate (45) with clean hydraulic oil and place the pressure plate. bronze side up, in the opening of the body as level as possible. Carefully slide the pressure plate to the bottom of the body. Do not force the plate into position.

6. Install gear (44) in the bore nearest you. Do not drop the gear into place, as this will damage the bronze on the pressure plate. Position the gear so that a tooth lines up with the locating dowel nearest you. Install gear (43) with the long journal up in the opposite bore.

7. Lubricate pressure plate (42) with clean hydraulic oil and place it, bronze side down, over the protruding end of the gears and into the opening. Carefully slide the pressure plate into the body.

8. Install isolation plates (35), center separator (40), end separators (39) and sealing strips (36).

9. Install O-ring (37) and back-up rings (39) on steel rings (41). Hold the rings in place with a small amount of clean grease.

10. Coat O-ring (34) with a small amount of clean grease and install the O-ring in its groove in the valve housing (29). Carefully install valve housing (29) on the rear section of the motor.

11. Coat O-ring (54) with a small amount of clean grease and install the O-ring in its groove in end cover (55). Carefully lift the rear motor section and valve housing, and install end cover (55). Install two nuts (57) and lockwasher (56) on studs which are 180 degrees apart. Tighten the nuts to 175 ft-lbs (24.2 m-kg).

12. Install snap rings (27) in coupling (28) if they were removed Install the coupling on the end of gear (44).

13. Coat O-ring (26) with clean grease, and install the O-ring in its groove in body (24). Install body (24) on valve housing (29), with the mark made in step 7 of disassembly facing you.

14. Lubricate the inside of body (24) with clean hydraulic oil. Install the O-rings (21) and back-up rings (20) on the bearings at the bottom of the body.

NOTE

Two different types of isolation plates are used in this motor. Close examination of the plates will show that two plates (item 7) have square edges and two plates (item 18) have rounded edges.

15. Install isolation plates (18) so that rounded edge enters the body first.

16. Install center separator (23), end separators (22), and sealing strips (19) in the bottom of the body.

17. Lubricate pressure plate (17) with clean hydraulic oil and place the pressure plate, bronze side up, in the opening of the body as level es possible. Carefully slide the pressure plate to the bottom of the body. Do not force the plate into position.

18. Install gear (16) in the bore nearest you. Do not drop the gear into place, as this will damage the bronze on the pressure plate. Position the gear so that a valley between two gear teeth line up with the locating dowel nearest you. Install gear (15) with the long journal up in the opposite bore.

19. Lubricate pressure plate (14) with clean hydraulic oil and place it, bronze side down, over the protruding end of the gears and into the opening. Carefully slide the pressure plate into the body.

20. Install isolation plates (7). center separator (12), end separators (11), and sealing strip (8).

21. Install seal (2) in the bore of mounting flange (5). Press the seal into position using a suitable driver and press. Install snap ring (1).

22. Install O-rings (10) and back-up rings (9) on steel ring (13), which are in mounting flange (5).

23. Coat O-ring (6) with a small amount of clean grease and install the O-ring in its groove on mounting flange (5). Install the mounting flange on body (24).

24. Install a nut (3) and lockwasher (4) on two studs which are 180 degrees apart. Tighten the nuts to 175 ft-lbs (24.2 m-kg).

25. Attach a torque wrench to the drive shaft and rotate the shaft. The shaft will be tight, but should turn with a maximum of 5 to 10 foot-pounds of torque (0.69-1.38 m-kg). If the shaft will not turn with 5 to 10 foot-pounds (0.69-1.38 m-kg) of torque, the motor should be disassembled, inspected, and the problem corrected before installing the remaining nuts and lockwashers.

26. If the shaft turns properly, install the remaining nuts (3 and 57) and lackwashers (4 and 56). Tighten the nuts to 175 foot-pounds (24.2 m-kg).

SECTION VI
SWING SYSTEM AND COMPONENTS

SUB-SECTION 6A
SWING SYSTEM

GENERAL

The swing system consists of a swing reducer, or a hydraulic motor and swing transmission, a stewing ring, and a disc type brake. The swing brake control valves are also included in this system.

GEAR TRAIN

The swing transmission provided two gear reductions between the hydraulic motor and the swing shaft. The swing shaft pinion to slewing ring ratio provides a third reduction.

The hydraulic motor drives the sun gear of the primary planetary reduction. The output of this reduction is transmitted to the sun gear of the final planetary reduction. The output of the final planetary reduction is transmitted directly to the swing pinion.

The disc brake is connected to the sun gear of the primary planetary reduction, and is a spring applied - hydraulically released brake. The brake is in the released position during normal crane operations, and is applied when the brake pedal is depressed, or when the brake lock is in the applied position.

TROUBLESHOOTING

Table 6A-1 contains a list of possible troubles, along with probable causes and remedies for each. It is recommended that you study the schematics in Section 4A prior to troubleshooting the swing circuit.

TABLE 6A-1.
SWING CIRCUIT TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
1. Swing completely inoperative.	A. Swing lock in applied position.	A. Lift swing brake lock knob.
	B. Swing brake not releasing due to excessive internal leakage.	B. Disassemble and reseal swing brake.
	C. Swing brake pedal stuck in released position.	C. Check swing brake valve spool for binding.
	D. Main relief valve stuck in open position.	D. Remove & clean main relief valve.
	E. Swing motor leaks excessively internally.	E. Replace or re-seal the motor.
	F. Mechanical fault in swing reducer or slewing ring.	F. Repair swing reducer or replace slewing ring.
	G. Faulty swing pump.	G. Repair or replace swing pump.

TABLE 6A-1 (CONTINUED)

TROUBLE	PROBABLE CAUSE	REMEDY
2. Swing motion sluggish.	A. Faulty swing pump.	A. Repair or replace swing pump.
	B. Swing motor leaks excessively internally.	B. Replace or re-seal the motor.
	C. Main relief valve stuck in open position.	C. Remove & clean main relief valve.
	D. Excessive leakage around control valve spool.	D. Replace complete control valve.
3. Swing motion erratic.	A. Low hydraulic oil level.	A. Add oil as required.
	B. Brake not releasing completely.	B. Check operation of swing brake.
	C. Sewing ring not lubricated properly.	C. Lubricate slewing ring.
	D. Main relief malfunctioning.	D. Check main relief valve.

SUB-SECTION 6B
SWING REDUCERS

SWING REDUCER (53Z373)

DESCRIPTION

Swing reducer 53Z373 is an integral swing drive which contains a double pianetary gear reduction, driven by a gear type hydraulic motor, and a disc brake (see Figure 6B-1). 6B-1).

The hydraulic motor drives the sun gear of the primary planetary reduction. The output of the primary reduction is transmitted to the sun gear of the final planetary reduction. The output of the final reduction is transmitted directly to the swing pinion, which is mated to the ring gear of the slewing ring. Therefore, the upper will swing whenever hydraulic oil is supplied to the hydraulic motor.

The disc brake is connected directly to the sun gear of the primary planetary reduction and is a spring applied-hydraulically released brake. The brake is released when pressure is applied to the brake port. This pressure causes

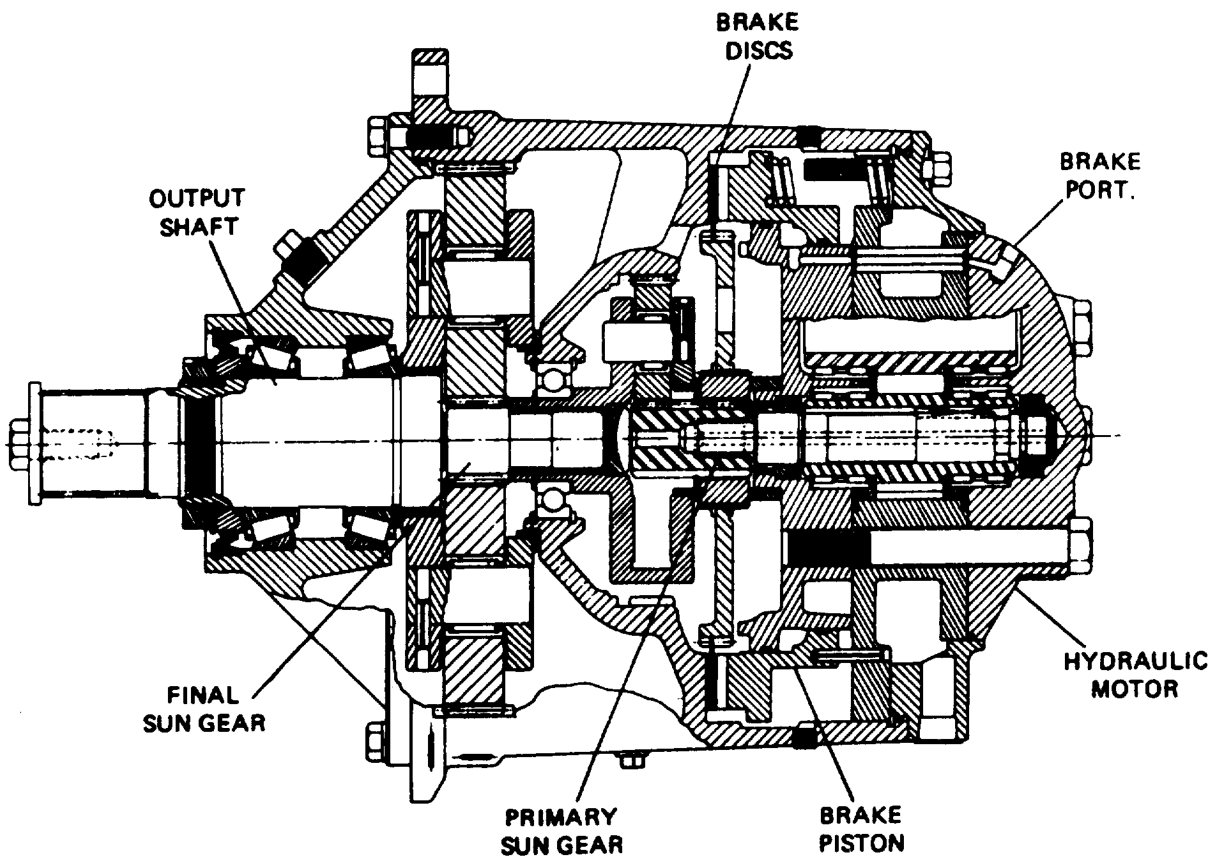


Figure 6B-1. Swing Reducer (53Z373)

the brake piston to move away from the brake discs, allowing the discs to turn freely. When the pressure is vented from the brake chamber, the brake springs move the brake piston into contact with the brake discs. This clamps the friction discs between the housing and brake piston, thereby preventing the planetary reductions from turning.

REMOVAL

To remove the swing reducer from the machine, procced as follows (see Figure 6B-2):

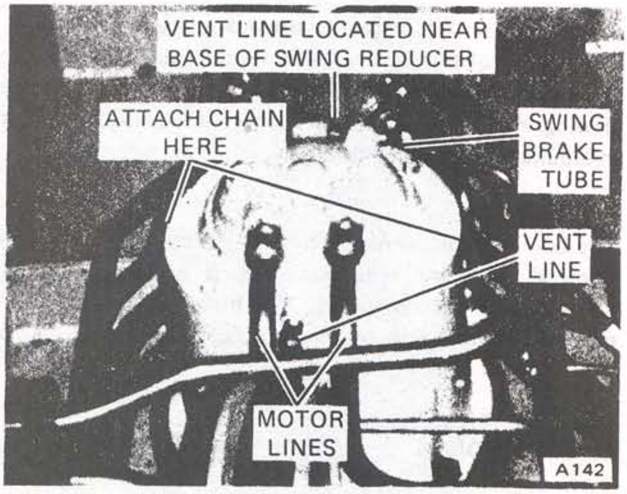


Figure 6B-2. Swing Reducer Removal

WARNING

The upper of the machine will be able to swing freely when the swing reducer is removed. Therefore, the serviceman must take the precautions as instructed in Step 2 below to prevent the upper from swinging while the swing reducer is removed from the machine.

1. Elevate the boom to provide the room necessary to remove the swing reducer.

2. Carefully *level* the machine using the outriggers, and secure the upper to the truck frame, *by some mechanical means,* to prevent the upper from turning when the swing reducer is removed from the machine.

3. Clean the entire area around the swing reducer to remove any dirt or grit which could enter the hydraulic system when the hydraulic fittings are disconnected.

4. Depress the swing brake lock to vent the pressure in the swing brake circuit. Loosen the tube nut which attaches the swing brake tube to the swing reducer, but *do not* disconnect the nut. Tape the tube gently to break the oil tight connection. This will allow any pressure which may still be trapped in the swing brake circuit to escape.

5. Tag and remove the five hydraulic lines attached to the swing reducer. Cap or plug the end of each line to prevent the entry of dirt.

6. Remove the four capscrews and washers which secure the swing reducer to the revolving frame.

7. Remove a capscrew from each side of the spring cover and attach a short chain to the swing reducer with the capscrews. Attach a suitable lifting device to the chain, and lift the swing reducer from the machine.

TROUBLESHOOTING

Table 6B-1 lists some of the difficulties which may be experienced with the swing reducer. It indicates the cause and remedy for each of the troubles listed. It should be remembered that pressure and flow rate are factors which are usually dependent upon each other. Adequate pressure gauge equipment and a thorough understanding of the complete hydraulic system are essential to diagnosing improper swing reducer operation.

OVERHAUL

GENERAL. The following overhaul instructions have been arranged to provide the best method of complete disassembling and reassembling the swing reducer. The instructions for disassembling and reassembling a subassembly, such as the hydraulic motor, are given in the lettered steps following the removal of the subassembly. In the event that it is not necessary to overhaul a subassembly, proceed with the next numbered step.

It is suggested that before any work is done on this unit, all the steps for disassembly and reassembly be read carefully and understood.

Expendable parts such as oil seals, back-up washers, O-rings and pocket seals should never be re-used even though inspection may show these items as being serviceable for future use. The cost of these items is negligible compared to the cost of replacing such items if they do not function properly.

All replacement parts should be given your final inspection to ensure that no damage has resulted after the final factory inspection was made.

Table 6B-1 Swing Reducer Troubleshooting

TROUBLE	PROBABLE CAUSE	REMEDY
A. Swing reducer will not deliver maximum torque.	1. If this trouble occurs suddenly after working at maximum load, a particle of dirt may be lodged under the relief valve, holding it partially open. If this is the cause, a considerable loss in speed may be noticed as the load is increased.	Remove the relief valve, disassemble and clean parts thoroughly in a suitable solvent. Reassemble and install the relief valve.
	2. The oil level in the reservoir may be too low. The suction line may be restricted or have an air leak, causing cavitation at the pump inlet. This will cause the pump to make a whining sound.	Check the oil level in the reservoir. Check the suction line for damage, externally and internally. Replace the suction line if necessary.
	3. After all the causes listed above have been investigated and it is found that the swing reducer will stall at maximum pressure without developing the maximum load on the output shaft, the trouble may be in the swing reducer.	Install a pressure gage in the gage port that is pressurized for clockwise rotation, and apply a load to the swing reducer. If the pressure is up to maximum and the output torque is less than that required to rotate the upper at full speed, the trouble will be in the swing reducer. Disassemble the swing reducer according to the disassembly instructions and inspect. Check that all gears turn freely for forward rotation. If the gears are found to be satisfactory, inspect the hydraulic motor.
B. Considerable reduction in speed.	1. Same as Cause 1 of Trouble A.	Same as Cause 1 of Trouble A.
	2. Same as Cause 2 of Trouble A.	Same as Cause 2 of Trouble A.
	3. If this trouble has increased gradually, the pump or swing reducer motor may be worn.	Remove and inspect the pump. If it is satisfactory, remove and inspect the swing reducer motor according to the instructions for the motor.
C. Swing speed in one direction is slower than the other direction.	1. Control valve may be restricted in it's travel.	Check the travel of the control valve spool. The spool travel should be the same in both directions.
	2. Oil may be escaping past a damaged O-ring in the brake cylinder.	Check the flow of oil from the vent line while the swing reducer is run at full speed for 2 or 3 minutes with the vent port plugged. If the flow continues, remove the motor. Disassemble and inspect the O-rings in the brake cylinder.

Cleanliness is of prime importance when any part of this unit is disassembled or reassembled. Before starting disassembly, be sure that a clean work area with a dust and grit free workbench is available.

DISASSEMBLY. To disassemble the swing reducer, proceed as follows (see Figure 6B-3):

1. Remove capscrew (46) and wahser (47). Then remove the swing pinion from output shaft (50). Position the swing reducer on suitable wooden blocks, with the output shaft down, for disassembly. Remove all dirt from the unit with a suitable cleaning solvent before proceeding with the following instructions.

2. Remove pipe plug (35) from end cover (40), and drain the oil from the unit. Remove one capscrew (75) from spring cover (77) to allow air to enter housing (72).

3. Mark the location of spring cover (77) with respect to housing (72), and the location of the motor assembly with respect to spring cover (77). This will ensure that the motor ports and vent port are located correctly when reassembling the unit.

4. Loosen each capscrew (75) one-half turn at a time, until the pressure of brake spring, (73) on the spring cover has been released, and remove the cover.

CAUTION

Care must be used to ensure that the spring cover screws are removed evenly, as the cover carries the full load of the brake springs.

5. Mark the location of each brake spring prior to removing the springs. Remove and discard O-rings (58) and (78).

6. Remove snap ring (74). Lift the motor assembly and brake piston out of the reducer housing. If it is necessary to disassemble the motor assembly, proceed as follows:

NOTE

It is recommended, if the motor assembly is found to be faulty, that it be returned to the factory for a new or reconditioned unit. Be sure to have on hand new O-rings, backup washers, and pocket seals before starting to disassemble the unit. It is important to install new O-rings and pocket seals once the old parts, have been disturbed, to prevent leakage.

A. Remove five capscrews (13) from port end cover (19). Lift off the port end cover. Items (1), (2), (3), (9), (10), (11), (12), (15), and (17) will be removed with the port end cover.

B. Remove snap ring (4) and sleeve (5) from motor shaft (7). Remove capscrews (14) and O-ring (18). Discard the O-ring.

C. Remove gears (20), and keep them together as they are a matched set. Note which end of the gears were next to the port end cover.

D. Remove key (6) from the motor shaft, and remove gear housing (21). Remove the second O-ring (18) from the other side of the gear housing and discard it.

E. Remove brake tube (79) from the gear housing and discard O-rings (80). Remove the motor shaft and O-ring (8). Discard the O-ring.

F. Remove brake piston (27) from shaft end cover (24). Remove end discard O-rings (25) and (28), and backup washers (26) and (29). Remove brake pins (23) only if replacement is required because of damage or wear.

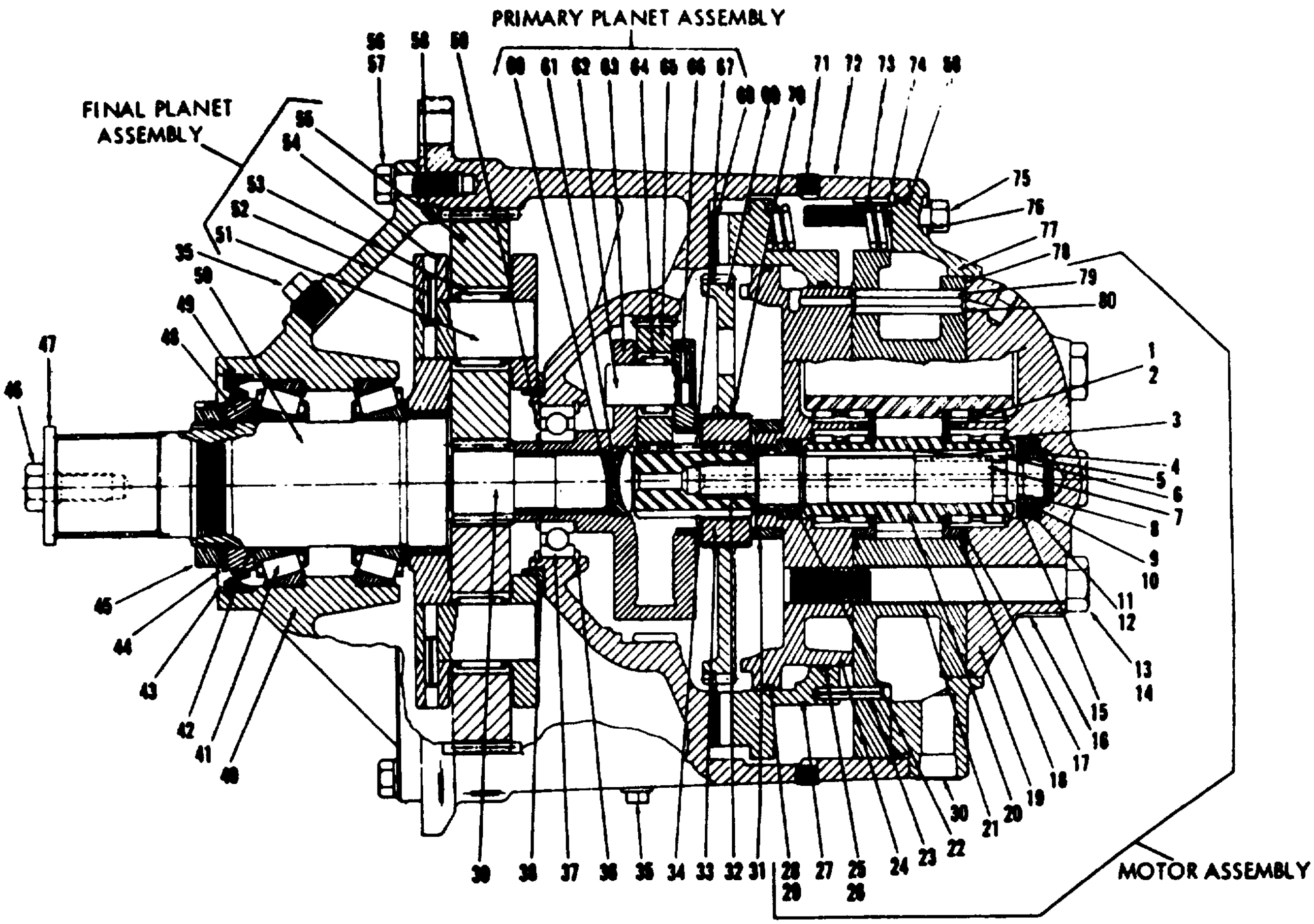
G. Turn port end cover (19) and shaft end cover (24) over to that thrust plates (17) are up. Pry off the thrust plates with a knife blade or thin screwdriver, taking care not to mark the face next to the end covers. Remove and discard pocket seals (1) and (2).

H. Pull bearings (3) with a bearing puller from the end covers, only if they are to be replaced. Remove and discard O-rings (9) and backup washers (10) from bushings (15) and (22).

NOTE

If bearings (3) have been removed, remove bushings (15) and (22). Then remove and discard O-rings (11) and backup washers (12). If bearings (3) are not being replaced, it is unlikely that bushings (15) and (22) will require replacement.

7. Brake hub assembly (33) may have been removed with the motor assembly in Step 6. If not, remove the brake hub assembly from the bore of the primary planet hub. Remove snap rings (70) and brake ring (69) from brake hub assembly (33). Remove brake plate (68).



1. Pocket seal
2. Pocket seal
3. Needle bearing
4. Snap ring
5. Sleeve
6. Key
7. Motor shaft
8. O-ring
9. O-ring
10. Backup washer
11. O-ring
12. Backup washer
13. Capscrew
14. Capscrew
15. Short bushing
16. Port plug
17. Thrust plate
18. O-ring
19. Port end cover
20. Matched gear set
21. Gear housing
22. Long bushing
23. Pin
24. Shaft end cover
25. O-ring
26. Backup washer
27. Brake piston
28. O-ring
29. Backup washer
30. Port plug
31. Thrust spacer
32. Primary sun gear
33. Brake hub
34. Snap ring
35. Pipe plug
36. Snap ring
37. Bell bearing
38. Spacer ring
39. Final sun gear
40. End cover
41. Roller bearing
42. O-ring
43. Snap ring
44. Lockwasher
45. Locknut
46. Capscrew
47. Washer
48. Seal ring
49. Oil seal
50. Output shaft
51. Final planet pin
52. Pin
53. Needle bearing
54. Final planet hub
55. Final planet gear
56. Capscrew
57. Washer
58. O-ring
59. Snap ring
60. O-ring
61. Thrust pad
62. Primary planet pin
63. Primary planet hub
64. Needle bearing
65. Primary planet gear
66. Pin
67. Bushing
68. Brake plate
69. Brake ring
70. Snap ring
71. Pipe plug
72. Housing
73. Brake springs
74. Snap ring
75. Capscrew
76. Seal washer
77. Spring cover
78. O-ring
79. Brake tube
80. O-ring

Figure 6B-3. Swing Reducer (53Z373)

8. Mark end cover (40) with respect to housing (72) so that it can be installed in the same location when reassembling the unit. Remove capscrews (56) and lockwashers (57).

9. Install two capscrews (56) in the tapped holes provided in end cover (40), and jack the end cover from housing (72). Remove and discard a second O-ring (58).

10. Sun gear (39) may have been removed with the final planet assembly and end cover in Step 9. If not, remove it from the bore of the primary planet hub.

11. Place two pinch bars under the rim of the final planet assembly and against the end cover, and pry the final planet assembly from output shaft (50). If it is necessary to disassemble the final planet assembly, proceed as follows (see Figure (6B-4).

A. Drive pin (52) into final planet pin (51) with a 1/4 inch (6.35 mm) pin punch.

B. Remove the final planet pin from the splined bore side of the planet hub. Remove pin (52) from the planet pin.

C. Press needle bearings (53) out of planet gears (55) using a sleeve that is 1-23/32 inches (43.6 mm) in diameter to bear against the outer race of the bearing.

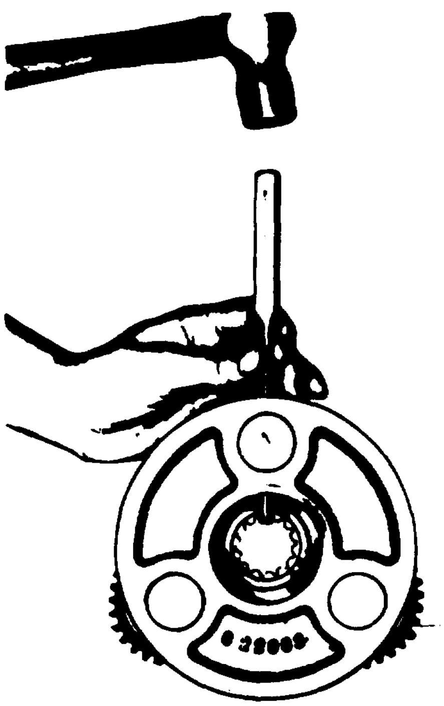


Figure 6B-4. Removing Planet Pins

12. Straighten the tabs on lockwashers (44), and unscrew locknut (45). It may be necessary to install capscrew (46) in the output shaft so that the shaft can be held in a stationary position while the locknut is being removed. Remove lockwasher (44) and snap ring (43).

13. Support the underside of end cover (40) with a sleeve. and press output shaft (50) out of the end cover by bearing against the splined end of the output shaft.

14. Remove seal ring (48), O-ring (42), and one bearing (41) from end cover (40). Press the second bearing (41) off the output shaft. Remove and discard oil seal (49).

15. Remove snap ring (59), and slide the primary planet assembly out of housing (72) from the motor end of the unit. If it is necessary to disassemble the primary planet assembly, proceed as follows (see Figure 8-3):

A. Remove bushing (67). Drive pin (66) into planet pin (62) using a 3/16 inch (4.76 mm) diameter pin punch.

B. Remove the planet pin from planet hub (63) by tapping on the end of the pin opposite pin (66).

C. After the planet gears have been removed, thrust pad (61) can be removed from the planet hub. Remove and discard O-ring (60).

16. Remove snap rings (36) and bearing (37).

INSPECTION AND REPAIR. After the swing reducer or any subassembly of the swing reducer has been disassembled, inspect and repair the components as described below:

1. Wash all parts in a suitable cleaning solvent, and dry thoroughly with compressed air or clean cloths.

CAUTION

Do not dry any complete subassemblies with compressed air, as this may drive particles of dirt into the bearings of the subassembly.

2. Discard all O-rings and oil seals that were removed during disassembly.

3. Check that all snap rings form a true circle, and check all lockwashers for flatness. If these items are bent or damaged, or if the tabs on lockwasher (44) are broken off, replace the damaged items.

4. Check that the planet gears run freely in the final and primary planet assemblies if these assemblies have not been disassembled. If these assemblies have been disassembled, check the following:

A. Inspect the planet pin bores in planet hubs (64) and (63) for scores or bruises which may have been caused during the removal of the planet pins. Remove the high spots of any scores or bruises sufficiently to allow a planet pin to be pressed into each bore by hand.

B. Inspect the planet pins for excessive wear at the bearing area. If the wear exceeds 0.001 inch (0.025 mm) on the diameter, the pins should be replaced.

C. Check planet gears (55) and (65) for excessive wear and damage to the gear teeth. If the wear is excessive or item (72) is replaced because of gear tooth wear, replace the planet gear.

D. Inspect needle bearings (53) and (64) for freeness of rollers. Check for pitting, broken rollers, or excessive wear, and replace the bearings if any of these conditions exist.

5. Inspect the gear teeth in housing (72). If the wear is greater than 0.015 inch (0.38 mm) when compared to the unworn part of the teeth, replace the housing.

NOTE

If housing (72) is replaced, replace planet gears (55) and (65).

6. Inspect the large pilot bore at the end of the housing used to carry end cover (40). Remove all roughness and scores using fine emery cloth. so that O-ring (58) will seat properly in the bore.

7. Inspect sun gears (39) and (32) for excessive wear by comparing the tooth thickness at the worn area of the teeth with the tooth thickness at the unworn area. If the wear is greater than 0.012 inch (0.3 mm), replace the sun gear.

8. Inspect seal ring (48). If the outside diameter or the O-ring groove have any roughness or scratches, remove them carefully with extra fine emery cloth.

9. Inspect the area of output shaft (50) where the O-rings seat. If any scratches, roughness, or rust exist, remove it with extra fine emery cloth. Check the threads for damage, and replace the shaft if the threads are damaged. Check the bearing diameters for scores and wear, and replace the shaft if any wear is apparent.

10. Inspect the bore in spring cover (77) for scores or bruises. Smooth out the scores or bruises with extra fine emery cloth.

REASSEMBLY. To reassemble the swing reducer, proceed as follows (see Figure 6B-3):

1. Press one bearing cone (41) onto output shaft (50) so that the large radius of the bearing cone is seated next to the gear end of the output shaft.

2. Press bearing cups (41) into the bores provided in end cover (40). Slide the output shaft through the bearing cups from the inside of the end cover until the bearing cone is seated against the inner bearing cup. Support the gear end of the output shaft, and press the remaining bearing cone (41) onto the output shaft until it mates with the outer bearing cup.

NOTE

Make sure that both bearing cones mate with both bearing cups.

3. Coat O-ring (42) with grease and install it on the output shaft. Be careful not to damage the O-ring on the threads of the output shaft.

4. Coat the lip of oil seal (49) with grease and install it in the bore provided in the end cover. Install seal ring (48) on the output shaft with the O-ring groove toward bearing (41). Install snap ring (43).

5. Install lockwasher (44) on the output shaft so that the tab on the inside diameter of the lockwasher mates with the slot in the output shaft.

6. Place the end cover in a vise with protective jaws so that the output shaft is free to turn. Wrap a piece of string about 18 inches (45.7 cm) long with a spring scale attached around the splines of the output shaft. Adjust locknut (45) while pulling on the scale until 16-26 pounds (6.6 - 11.8 kg) of pull is required for continuous rotation of the output shaft. Bend the tab on lockwasher (44) into one of the four slots in the locknut.

7. If the final planet hub assembly was not disassembled, install it on the output shaft, and tap the assembly onto the output shaft until it contacts bearing (41). If the final planet hub assembly has been disassembled, assemble it as described below, and then install it as just described.

A. Press needle bearing (53) into planet gear (55) so that the end of the bearing is flush, or slightly below the side of the gear at each end.

B. Place the planet gear in final planet hub (54) so that the bore of the bearing lines up with the planet pin hole.

C. Install a planet pin (51) in the planet hub so that it passes through the needle bearing, and the drilled hole in the planet pin lines up the hole in the rim of the plant hub.

D. Install pin (52) in the rim of the planet hub, and drive it into planet pin (51) with a 1/4 inch (6.35 mm) diameter pin punch until pin (52) is 7/16 inch (11.1 mm) below the rim of the planet hub.

E. Repeat the above steps for the remaining two planet gears, and check that all the gears turn freely in the planet hub.

8. Turn housing (72) to a horizontal position. Install one snap ring (36) in the snap ring groove nearest the primary planet assembly. Install bearing (37) in the bearing bore, and install the second snap ring (36).

9. Install the primary planet assembly in the bore of bearing (37), and install snap ring (59) on the primary planet hub. Be sure that bushings (61) and (67) are in place. When the primary planet assembly is in place, rotate it by hand to be sure that it is free to turn.

If the primary planet assembly has been disassembled, assemble it as described below, and then install it as just described.

A. Install O-ring (60) in the groove in thrust pad (61). Then install the thrust pad in the recessed bore of the primary planet hub so that the slotted face of the thrust pad is facing the planet gears.

B. Install bushing (67) in the primary planet hub opposite thrust pad (61), and check that the thrust pad is still in place.

C. Press needle bearing (64) into planet gear (65) so that the ends of the bearing are flush, or slightly below the side of the gear at each end.

D. Place the planet gear in planet hub (63) so that the bore of the bearing lines up with the planet pin hole. Install a planet pin (62) in the planet hub so that it passes through the needle bearing, and the drilled hole in the planet pin lines up with the hole in the rim of the planet hub.

E. Install pin (66) in the rim of the planet hub, and drive it into planet pin (62) with a 3/16 inch (4.76 mm) diameter pin punch until pin (66) is 3/16 inch (4.76 mm) below the rim of the planet hub.

F. Repeat the above steps for the remaining two planet gears, and check that ail the gears turn freely in the planet hub.

10. Turn the housing back on end so that the final drive end of the housing is facing up. Install sun gear (39) in the splined bore of the primary planet assembly.

11. Install O-ring (58) in the groove provided on end cover (40). Position the final drive assembly in front of housing (72), and slide the assembly onto sun gear (39). It my be necessary to rotate the output shaft slightly to engage the planet gears with the sun gear and internal ring gear in the housing. When the end cover mates with the housing, rotate the end cover until it is in its original position, as identified by the marks placed on the housing and end cover prior to disassembly. Install capscrews (56) with washers (57), and torque the capscrews to 60 foot-pounds (8.3 m-kg).

12. Turn the housing over so that the primary drive end is facing up. Assemble brake ring (69) and snap rings (70) on brake hub (33). Install the brake assembly on sun gear (32). Then install the brake assembly and sun gear on the primary planet assembly.

13. Install brake plate (68) so that it engages the teeth of the brake ring, and is against the brake face in the housing.

14. Place the motor assembly on a workbench with the motor shaft end up. Be sure that the clearance between brake piston (27) and gear housing (21) is 9/32 inch (7.14 mm). If necessary, tap the brake piston down with a soft hammer, or pry it up with two heel bars until the 9/32 inch (7.14 mm) gap is obtained (see Figure 6B-5).

CAUTION

Do not use force to install the motor assembly. If there is interference, remove the motor assembly and investigate.

If the motor assembly has been disassembled, assemble it as described below, and then install it as just described.

A. Install two backup washers (10) in the inside groove of short bushing (15) and one backup washer (12) in

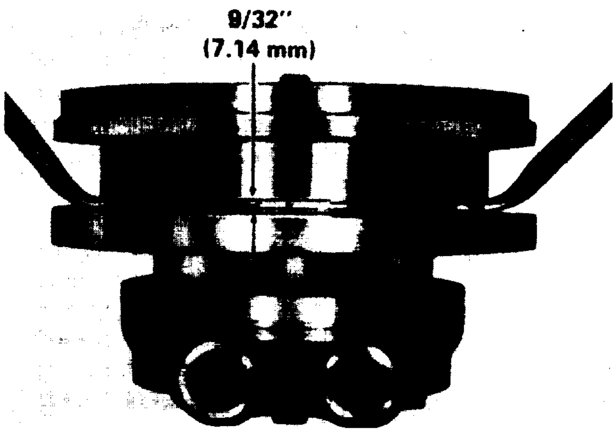


Figure 6B-5. Adjusting Brake Piston Clearance

the outside groove of the bushing. Lubricate O-rings (9) and (11) with grease and install one O-ring (9) in the inside groove of the short bushing so that both backup washers are together at the thick wall side of the groove. Install O-ring (11) in the outside groove of the short bushing so that it is at the same end of the bushing as O-ring (9).

Install one backup washer (12) and two backup washers (10) on long bushing (22). Lubricate O-rings (9) and (11) and install them on the long bushing so that the backup washers are together and both O-rings are toward the large end of the bushing. Give all O-rings an additional coat of grease.

B. Place port end cover (19) and shaft end cover (24) on a workbench with the bearing bores facing up. Install the short bushing in the center bore of port end cover (19) so that the backup washers enter before the O-rings.

Install the long bushing in the center bore of shaft end cover (24) so that the small diameter end of the bushing enters first.

Press each bushing in until it seats on the bottom of its bore. Be sure that all O-rings are installed toward the gear side of the end covers.

C. Check that the bearing bores in the end covers are clean, and install needle bearings (3) in the bearing bores. Press the bearings into the bores until the bearings are seated at the bottom of the bores.

D. Place a small amount of heavy grease in the center slot of each thrust plate (17), and insert a small pocket seal (1) in the center slot.

E. Place each thrust plate over needle bearings (3) so that the pocket seal is toward end cover (19) or (24) Tap the thrust plate into position with a soft hammer until approximately 1/32 inch (0.8 mm) clearance is left between the thrust plate and end cover. Check pocket seal (1) to be sure that it is still in place in the center slot.

F. Insert a large pocket seal (2) into each of the four slots in the thrust plates. Be sure to push the seals all the way into the slots so that the hidden end is in contact with the needle bearing races. Then tap the thrust plates into position against the end covers. Trim the exposed ends of the pocket seals with a razor blade.

NOTE

Be sure to trim the exposed ends of the pocket seals square and flush with the thrust plate.

G. Install backup washer (29) in the outside groove of shaft end cover (24). Lubricate O-ring (28) with, grease and install it next to the backup washer so that it is in the groove nearest gear housing (21). Give the O-ring and backup washer an additional coat of grease.

H. Install backup washer (26) in the inside groove in brake piston (27). Lubricate O-ring (25), and install it next to the backup washer so that it is on the side of the backup washer nearest the large bore of the brake piston. Give the O-ring and backup washer an additional coat of grease.

I. Install pins (23) in brake piston (27). Assemble the brake piston to the shaft end cover, taking care that backup washers (26) and (29) do not extrude and get pinched between the mating surfaces of the brake piston and shaft end cover.

J. Install motor shaft (7) in the shaft end cover so that the splined end of the shaft passes through the long bushing first. Place the assembly on parallel bars so that it does not rest on the motor shaft.

K. Lubricate O-rings (18) and install one in the grooves on each side of gear housing (21). Give the O-rings an additional coat of grease.

L. Place the gear housing over the thrust plate on shaft end cover (24) so that the housing and shaft end cover are concentric, and pins (23) enter the holes in the housing. Tap the gear housing into place with a soft hammer. Be careful not to pinch the O-rings while assembling these components.

M. Install key (6) in the motor shaft. Install gear (20) with the keyed bore on the motor shaft. Install the other gear (20) in the bearing in the shaft end cover.

N. Lubricate O-ring (8) and install it in the groove at the end of the motor shaft. Install sleeve (5) on the motor shaft so that it covers O-ring (8) and contacts the shoulder at the end of the motor shaft.

O. Install snap ring (4) on the end of the motor shaft. Make sure that it is seated properly in the snap ring groove.

P. Install two capscrews (14) and torque them to 250 foot-pounds (34.5 m-kg). Install the port end cover previously assembled, on gear housing (21) so that the hubs of gears (20) enter needle bearings (3). and the thrust plate on the port end cover enters the gear housing. Tap the port end cover with a soft hammer until its seated against the gear housing. Be sure O-ring (18) does not get pinched during assembly. Install five capscrews (13) and tighten each capscrew evenly in stages to a torque of 250 foot-pounds (34.5 m-kg).

NOTE

After tightening capscrews (13) to their specified torque, be sure that the motor shaft can be rotated by hand.

15. Once the motor assembly is in place, install snap ring (74) and make sure that it is seated properly in the snap ring groove. Lubricate O-ring (78) with grease and install it in the groove on the motor assembly. Give the O-ring an additional coat of grease.

16. Rotate the motor assembly by hand to the position it was at prior to disassembly. Install brake springs (73) in the same symmetrical pattern as they were prior to disassembly. Lubricate O-ring (58) with grease and install it in the groove in spring cover (77). Give the O-ring an additional coat of grease.

17. Install spring cover (77) over the motor assembly so that the vent port is located where it was prior to disassembly. Install capscrews (75) with washers (76). Tighten all the capscrews finger tight, and than tighten them one-half turn at a time, progressively around the rim of the spring cover. Torque the capscrews to 35 foot-pounds (4.8 m-kg).

INSTALLATION

To install a new or overhauled swing reducer, proceed as follows:

1. Place the swing reducer on the revolving frame. Rotate the unit, as required, to position the brake and motor ports properly, and to align the mounting holes.

2. Install the capscrews and washers that were originally used to secure the swing reducer to the revolving frame. Do not use substitutes, as these are high strength capscrews and hardened washers.

3. Tighten each capscrew to 400 foot-pounds (55.3 m-kg) (dry), using a cross bolt tightening sequence.

4. Install the five tubes that ware removed to allow removal of the swing reducer.

5. Remove all the materials used to prevent the upper from swinging while the swing reducer was removed from the machine.

6. Swing the upper slowly in both directions and apply the swing brake several times to purge any air from the swing and swing brake circuits. Also, check the operation of the swing reducer while the upper is being swung.

SUB-SECTION 6C
SWING MOTORS

SWING MOTOR (41Z110)

DESCRIPTION

Swing motor 41Z110 is a fixed displacement, gear type hydraulic motor. Port connections are located in the motor body, and the direction of oil flow through these ports determines the direction of motor shaft rotation.

Oil entering one of the ports subjects two gear teeth on the inlet side of the motor to high pressure which tends to rotate the gears as shown in Figure 6C-1. As the gears rotate around the motor housing, they carry the oil that enters the inlet side of the motor to the outlet side of the motor, where the oil is returned to tank.

TESTING

The rate of oil flow from the tail drain, of a stalled motor, is a measure of the motor's volumetric efficiency. In a new motor, having maximum practical volumetric efficiency, the tail drain rate will be approximately 3 GPM (11.3 l/min). As the motor wears, as it will through normal usage, this drain rate will increase and the volumetric efficiency will decrease, which will affect the overall performance of the motor.

A drain rate of 8 GPM (30.2 l/min) represents a volumetric efficiency of approximately 80 percent. This is the point a which consideration should be given to replacing the motor The find decision on whether or not to replace the motor

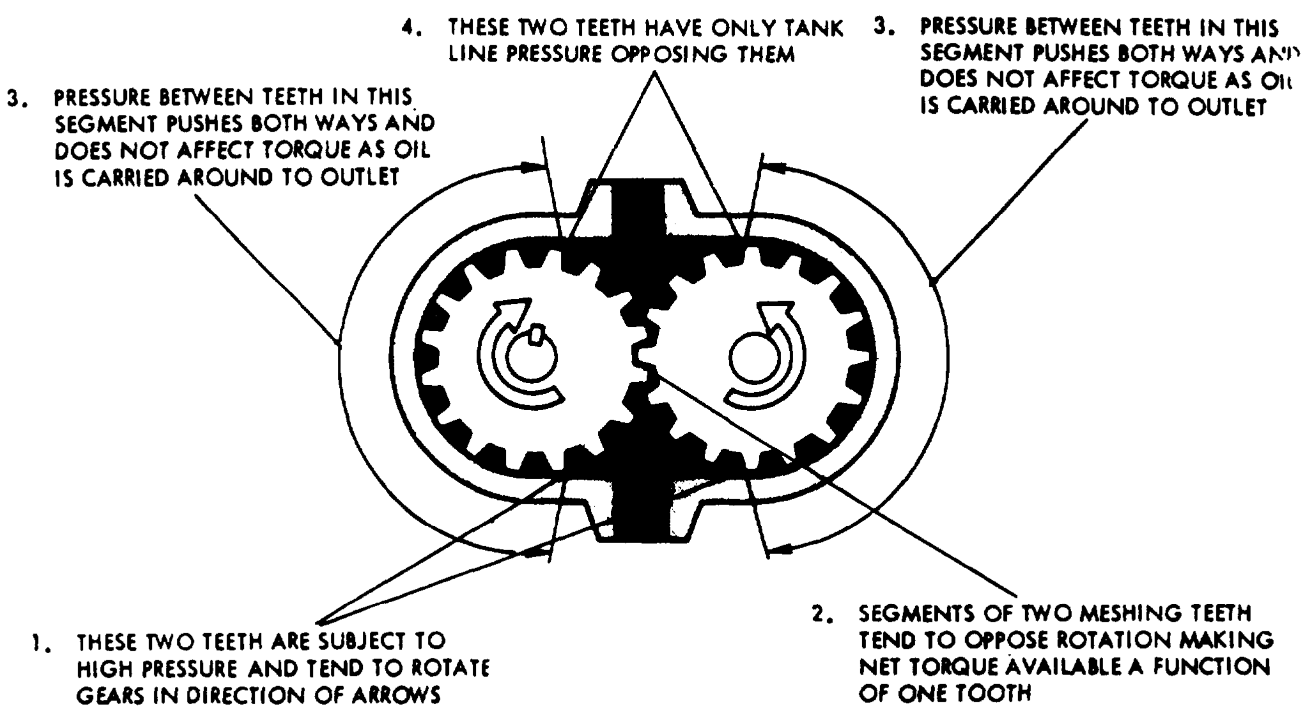


Figure 6C-1. Swing Motor Operation

however, must be based on what motor torque and speed are considered satisfactory for your application.

To measure the motor tail drain rate, proceed as follows (see Figure 6C-2):

1. Disconnect the swing motor tail drain line. Attach a short piece of tubing or hose to the drain line fitting.

2. Insert the opposite end of the tubing or hose in a container capable of holding several gallons of oil.

3. Depress the swing brake lock button to apply a stall load to the motor, and set the engine speed at high idle.

4. Then place the swing lever in either the fully forward or backward position and *hold* it in that position for 20 seconds. Measure this time interval with a watch to ensure accuracy of the test.

5. Measure the amount of oil in the container. If the amount of oil is less than 2-2/3 gallons (10 l), the volumetric efficiency of the motor is greater than 80 percent and the motor is considered to be suitable for continued service. If 2-2/3 gallons (10 l) or more is obtained, the volumetric efficiency is below 80 percent and consideration should be given to replacing the motor.

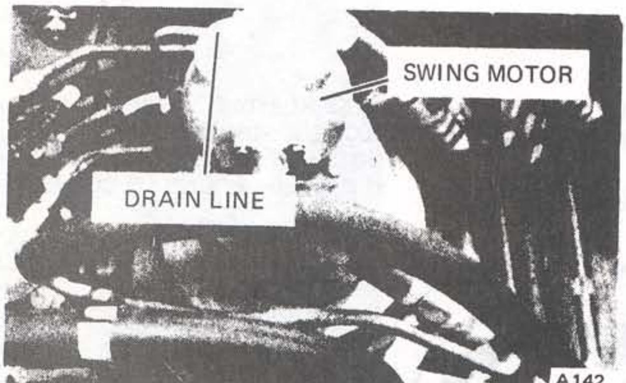


Figure 6C-2. Swing Motor Tail Drain

REMOVAL

To remove the swing motor, proceed as follows:

1. Depress the swing brake lock button, in the upper cab, to prevent the upper from turning while the swing motor is being removed.

2. Elevate the boom to gain access to the swing motor.

3. Disconnect all the hydraulic lines from the swing motor and cap the end of the lines to prevent the entry of dirt into the hydraulic system. Plug the motor ports to prevent the entry of dirt into the motor.

4. Remove the capscrews, which secure the motor to the reducer. Lift the motor *straight up* until the motor shaft is clear of the reducer, and remove the motor.

OVERHAUL

GENERAL. Repair of this motor is limited to the replacement of the shaft seal, or by replacing the complete motor.

If a new motor is to be installed, install it as described under the topic Installation.

SHAFT SEAL REPLACEMENT. To replace the shaft seal, proceed as follows (see Figure 6C-3):

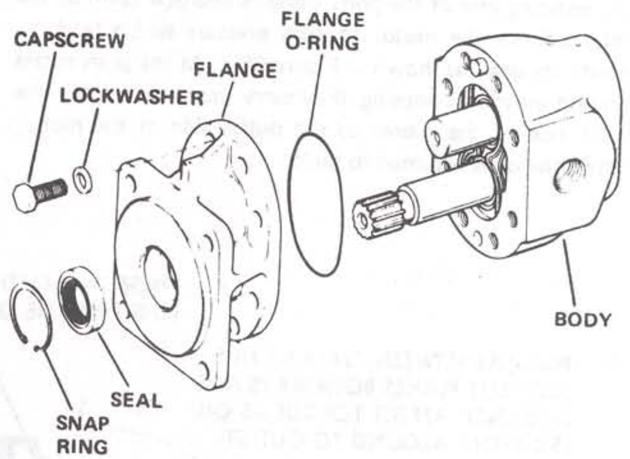


Figure 6C-3. Swing Motor (41Z110)

1. Stand the motor on end, with the output shaft up, and remove the capscrews securing the flange to the motor body.

2. Lift the flange straight up to remove it from the motor. Lay the flange on a smooth, clean surface, and remove and discard the snap ring.

3. Turn the flange over and place it on suitable wooden blocks so that the seal can be driven out of the flange. Be sure the blocks do not interfere with the removal of the seal.

4. Drive the seal out of the flange with a brass drift pin and hammer. The drift pin should be moved around the perimeter of the seal as it is driven out, so that the seal is not cocked in its bore.

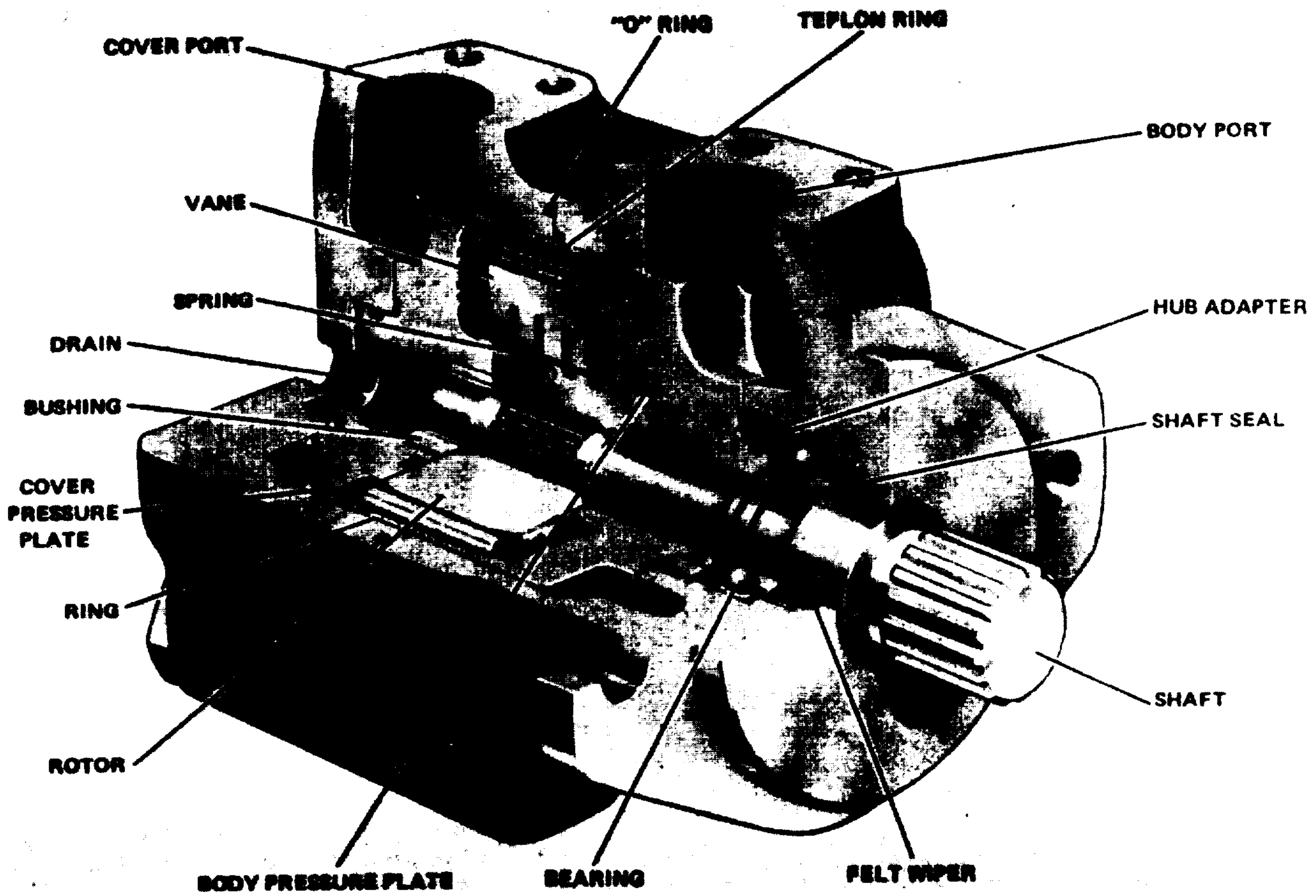


Figure 6C-4. Swing Motor (41Z125)

5. Position the new seal on the flange so that the rubber lip of the seal is facing the motor side of the flange.

6. Place the flange and seal in a vise which has a wooden block on the rear jaw. Place a suitable driver between the front jaw of the vise and seal.

7. Press the seal into the flange by tightening the vise. Stop pressing the seal when the seal reaches the shoulder on the inside of the bore. Install a new snap ring to secure the seal.

8. Coat the new flange O-ring with a light coating of clean grease, and install the O-ring in the flange O-ring groove.

9. Carefully install the flange over the input shaft and onto the motor. Do not turn the mounting flange while it is being installed as this could damp the seal.

10. Install the capscrews and lockwashers used to secure the flange to the motor. Tighten the capscrews to 125 ft-lbs (17.3 m-kg).

INSTALLATION

To install a new or repaired motor, proceed as follows:

1. Coat the shaft splines and pilot diameter with a small amount of grease. Carefully position the motor on the reducer, making sure that the splines engage the sun gear properly, and the pilot diameter seats in the reducer bore squarely.

2. Rotate the motor as required to position it in the same position it was before removal. Secure the motor to the reducer with four capscrews and lockwashers.

3. Attach the hydraulic lines to the appropriate ports of the motor. Engage the pump drive, start the engine, and release the swing brake by lifting the swing brake lock button. Then swing the upper slowly in both directions several times to purge any air from the swing circuit. Check all connections for leaks.

SWING MOTOR (41Z125)

GENERAL. Swing motor (41Z125) is used to convert hydraulic power from the swing hydraulic circuit into rotary mechanical power to the swing transmission. The swing speed is dependent on the amount of oil delivered to the ports of the swing motor. The direction of rotation of the

SUB-SECTION 6D
SWING TRANSMISSION

SWING TRANSMISSION (53R3)

DESCRIPTION

Swing transmission 53R3 contains a double planetary gear reduction, driven by a separate motor, and an integral spring set-hydraulically released brake (see Figure 6D-1).

The hydraulic motor drives the sun gear of the primary planetary reduction. The output of the primary reduction is transmitted to the sun gear of the final planetary reduction. The output of the final planetary reduction is transmitted directly to the swing pinion, which is mated to the ring gear of the slewing ring, Therefore, the upper will swing when hydraulic oil is supplied to the swing motor.

The disc brake is connected directly to the input shaft, which includes the primary sun gear, and is a spring set-hydraulically released brake. The brake is released when pressure is applied to the brake port. This pressure causes the brake piston to move away from the brake discs, allowing the discs to turn freely. When the pressure is vented from the brake chamber, the brake springs move the brake piston into contact with the brake discs. This clamps the brake discs between the housing and brake piston, thereby preventing the planetary reductions from turning.

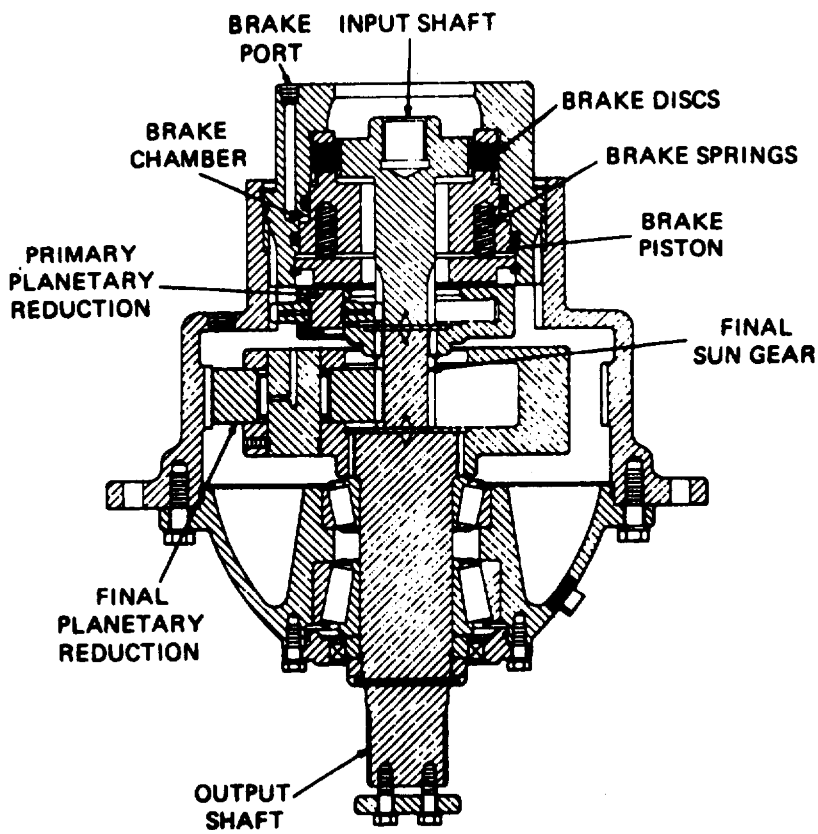


Figure 6D-1. Swing Transmission (53R3)

MAINTENANCE

The gearing in the swing transmission operates in an oil bath. Check the level of the oil each week by removing the filler plug (see Figure 6D-2). The oil should be just up to the bottom of the filler opening. If the oil is not at the proper level, add oil of the type specified on the lubrication charts.

REMOVAL

To remove the swing transmission from the machine, proceed as follows:

WARNING

The upper of the machine will be able to swing freely when the swing transmission is removed. Therefore, the serviceman must take precautions as instructed in Step 2 below to prevent the upper from swinging while the swing transmission is removed from the machine.

1. Elevate the boom to provide the room necessary to remove the swing transmission.

2. Carefully *level* the machine using the outriggers, and secure the upper to the truck frame, *by some mechanical means,* to prevent the upper from turning when the swing transmission is removed from the machine.

3. Clean the entire area around the swing transmission to remove any dirt or grit which could enter the hydraulic system when the hydraulic fittings are disconnected.

4. Disconnect and cap the hoses attached to the motor. Remove the motor drain line. Cap or plug each port to prevent the entry of dirt into the hydraulic system.

5. Depress the swing brake lock to vent the pressure in the swing brake circuit. Loosen the tube nut which attaches the swing brake tube to the swing transmission, but *do not* disconnect the nut. Tap the tube gently to break the oil tight connection. This will allow any pressure which may still remain in the swing brake circuit to escape.

6. Remove the swing brake tube. Cap or plug each port to prevent the entry of dirt.

7. Tag and remove the tubes on the operators cab side of the swing transmission. Cap or plug each port to prevent the entry of dirt.

8. Remove the capscrews and washers which secure the swing transmission to the revolving frame. Attach a suitable lifting device to the assembly, and lift it from the machine.

9. Remove the swing motor from the swing transmission as described in the section covering the swing motor.

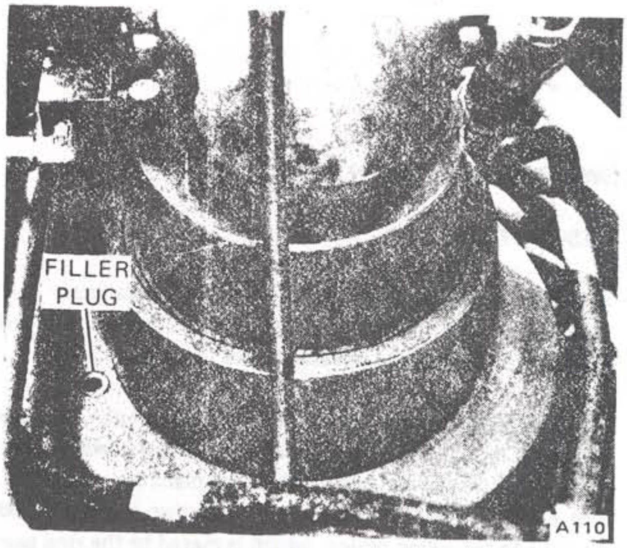


Figure 6D-2. Swing Transmission Filler Plug

OVERHAUL

GENERAL. The following overhaul instructions have been arranged to provide the best method of completely disassembling and reassembling the swing transmission. The instructions for disassembling and reassembling a subassembly, such as a planetary reduction, are given in the lettered steps following the removal of the subassembly. In the event that it is not necessary to overhaul a subassembly, proceed to the next numbered step.

It is suggested that before any work is done on this unit, that all steps for disassembly and reassembly be read and understood.

Expendable parts such as oil seals and O-rings should never be re-used even though inspection may show these items as being serviceable for future use. The cost of these items is negligible compared to the costs involved in replacing them if they do not function properly.

All replacement parts should be given your final inspection to ensure that no damage has resulted after the final factory inspection was made.

Cleanliness is of prime importance when any part of this unit is disassembled or reassembled. Before starting disassembly, be sure that a clean work area with a dust and grit free workbench is available.

DISASSEMBLY. To disassemble the swing transmission, proceed as follows (see Figure 6D-3):

1. Remove drain plug (27) and drain the oil into a suitable container. Remove capscrews (39), lockwashers (38), and washer (37) to remove the swing pinion.

2. Remove input gear (12). Remove snap ring (6), and then remove brake assembly (17). If it is necessary to disassemble the brake assembly, proceed as follows:

A. Place the brake assembly in a press with the motor flange down. Apply pressure to spring plate (10). and remove snap ring (7). Then slowly release the pressure on the spring plate until compression is removed from brake springs (18).

B. Remove spring plate (10), brake springs (18), piston (23), friction discs (15), brake discs (14) and back-up plate (16).

C. Remove and discard O-rings (19 and 21) and back-up rings (20 and 22).

3. Remove primary planetary assembly (9) by lifting it straight out of housing (53). If it is necessary to disassemble the primary planetary assembly, proceed as follows:

A. Drive roll pins (2) out with a suitable pin punch.

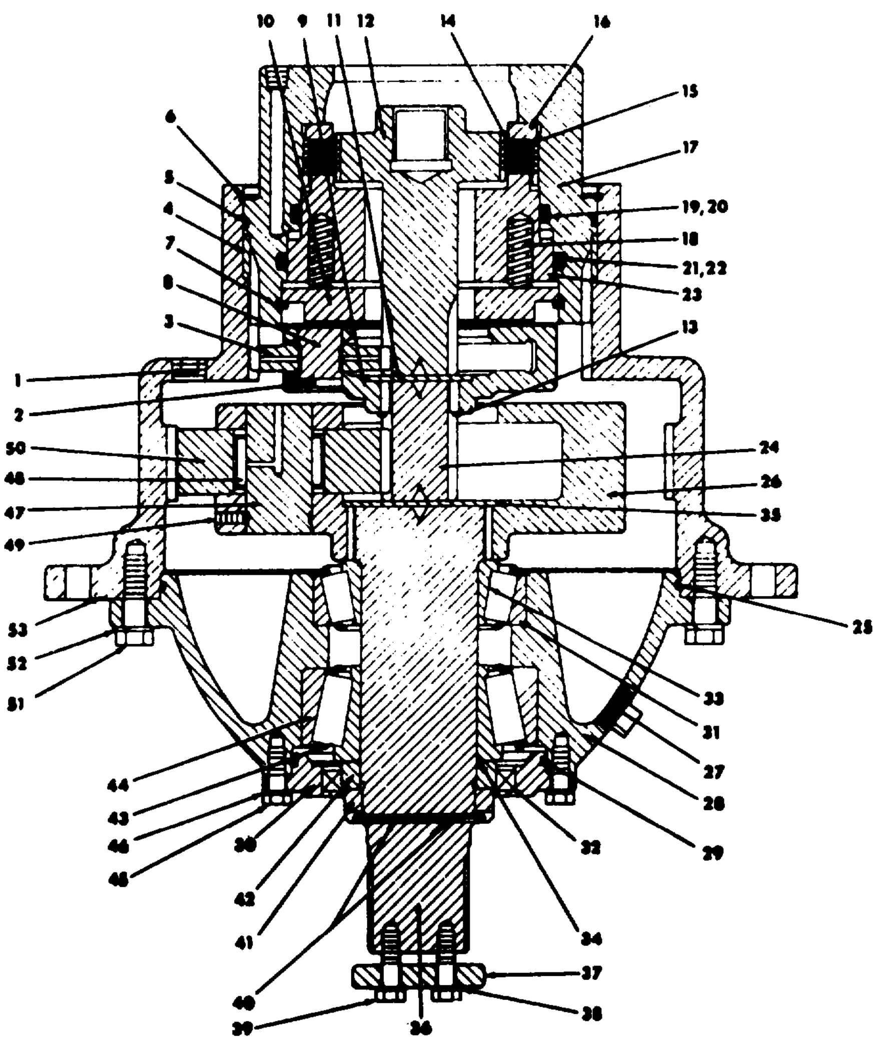


Figure 6D-3. Swing Transmission (53R3)

B. Remove shafts (8) and planet gears (3). Remove bronze washer (11) from primary planetary carrier (9).

4. Invert the assembly and remove capscrews (51) and lockwashers (52). Remove bearing carrier (28) from housing (53). Remove and discard O-ring (25).

5. Remove capscrews (45) and lockwashers (46). Then remove seal carrier (30). Remove and discard oil seal (32) and O-ring (29). If it is necessary to disassemble the bearing carrier, proceed as follows:

A. Drive roll pins (40) out with a suitable pin punch.

B. Remove locknut (41), seal journal (42), and large bearing cone (43).

C. Remove output shaft (36). Remove small bearing cone (33) from the output shaft only if replacement is required.

D. Remove bearing cups (31 and 44) from bearing carrier only if they are to be replaced.

6. Lift final planetary assembly (26) from housing (53). If it is necessary to disassemble the final planetary assembly, proceed as follows:

A. Remove setscrews (49), and press shaft (47) out to remove planet gears (50). Press bearing (48) out only if they require replacement.

B. Remove bronze spacer (35).

INSPECTION. After the swing reducer or my subassembly of the swing reducer has been disassembled, inspect the components as described below:

1. Wash all parts in a suitable cleaning solvent, and dry thoroughly with compressed air or clean cloths.

CAUTION

Do not dry any complete subassemblies with compressed air, as this may drive particles of dirt into the subassembly.

2. Discard all O-rings and oil seals that were removed during disassembly.

3. Check that all snap rings form a true circle, and check all lockwashers for flatness. If these items are bent or damaged, replace the damaged items.

4. Check that the planet gears run freely in the primary end final planet assemblies if these assemblies have not been disassembled. If these assemblies have been disassembled, check the following:

A. Inspect the planet pin bores in planet carriers (9 and 27) for scores or bruises which may have been caused during the removal of the planet pins. Remove the high spots of any scores or bruises sufficiently to allow a planet pin to be pressed into each bore by hand.

B. Inspect the planet pins for excessive wear at the bearing area.

C. Check planet gears (3 and 50) for excessive wear and damage to the gear teeth. If wear is excessive or teeth are damaged, replace the planet gear.

5. Inspect the ring gears in housing (53) for excessive wear or damage to the teeth. If wear is excessive or teeth are damaged, replace housing (53).

REASSEMBLY. To reassemble the swing reducer, proceed as follows (see Figure 6D-3):

1. Place housing (53) on a workbench with the brake end down. Install final planetary assembly (26), with bronze washer (35) up, in housing (53).

If the final planetary assembly has been disassembled, assemble it as described below, and then install it as just described.

A. Press one roller bearing (48) into each planet gear (50).

B. Place bronze washer (35) in the center of planet carrier (26).

C. Install planet gears (50) in planet carrier (26). Insert shafts (47) through the planet carrier and gears so that the groove in the end of the shaft will be aligned with the setscrew holes.

D. Install setscrews (49).

2. Lubricate O-ring (25) with a small amount of clean grease.

3. Place bearing carrier assembly (28) over housing (53), and rotate output shaft (36) until the output shaft splines engage the internal splines of planet carrier (26). Install capscrews (51) and lockwashers (52).

If the bearing carrier assembly has been disassembled, assemble it as described below, and then install it as just described.

A. Install bearing cups (31 and 44) in bearing carrier (28).

B. Press small bearing cone (33) on output shaft (36). Be sure the bearing cone is seated tightly against the shoulder on the output shaft.

C. Insert output shaft (36) into bearing carrier (28) from the inside of the bearing carrier.

D. Press large bearing cone (43) onto output shaft (36).

E. Install seal journal (42) and locknut (41) on output shaft (36). lighten the locknut to 15 inch-pounds (0.17 m-kg), and then install roll pins (40) to secure locknut (41) in place.

F. Install oil seal (32) in the bore of seal carrier (30). Install O-ring (29) in the groove of the seal carrier. Lubricate the oil seal and O-ring with a small amount of clean grease, and install the seal carrier on bearing carrier (28). Install capscrews (45) and lockwashers (46).

G. Install O-ring (25) in the pilot portion of bearing carrier (28). Lubricate the O-ring with a small amount of clean grease.

4. Invert the assembly and check the final planetary reduc tion for freedom of movement by turning the output shaft. If the final planetary reduction does not turn freely, correct the problem before continuing with the assembly procedure.

5. Install snap ring (13) on sun gear (24). and then install the sun gear in final planet assembly (26).

6. Place primary planet assembly (9) in housing (53). Rotate the planet assembly until planet gears (3) mesh with the ring gear in the housing, and planet carrier (9) meshes with sun gear (24).

Check the assembly for freedom of movement by turning the output shaft. If the assembly does not turn freely, correct the problem before continuing the assembly procedure.

If the primary planet assembly has been disassembled, assemble it as described below, and then install it as just described.

A. Place bronze washer (11) in the center of panel carrier (9).

B. Install planet gears (3) in planet carrier (9). Insert bronze shafts (8) through the planet carrier and planet gears so that the hole in the shaft will be aligned with the hole in the planet carrier.

C. Install roll pins (2).

7. Install brake assembly (17) in the top of housing (53). Be sure to position the brake assembly in the same position it was before it was removed. Secure the brake assembly with snap ring (6).

If the brake assembly has been disassembled, assemble it as described below, and then install it as just described.

A. Install back-up plate (16) in brake cylinder (17).

B. Alternately install a brake disc (14) and then a friction disc (15) in brake cylinder (17).

NOTE

Place input shaft (12) in the center of brake cylinder (17) to align the brake discs.

C. Install O-rings (19 and 21) and back-up rings (20 and 22) in the proper groove in brake cylinder (17). Lubricate the O-rings with clean hydraulic oil.

D. Lubricate piston (23) with clean hydraulic oil, and install it in brake cylinder (17).

NOTE

It may be necessary to tap the piston lightly with a plastic hammer to seat the piston in the brake cylinder.

E. Install sixteen brake springs (18) in piston (23).

F. Install spring plate (10) over brake springs (18). Place the assembly in a press and apply pressure to spring plate (10) until snap ring (7) can be installed.

G. Lubricate O-ring (5) with a small amount of clean grease, and install it in the groove on the outer diameter of brake cylinder (17). Install spacer ring (4) over the external splines of brake cylinder (17).

8. Install the swing pinion on the output shaft, and secure

the pinion in place with washer (37), lockwashers (38) and capscrews (39).

9. Replace drain plug (27) and remove filler plug (1). Add oil of the type specified on the lubrication charts until the oil level is just below the filler plug opening.

INSTALLATION

To install a new or overhauled swing transmission, proceed as follows:

1. Place the swing transmission on the revolving frame. Rotate the transmission, as required, to position the brake port properly and to align the mounting holes.

2. Install the capscrews and washers that were originally used to secure the transmission to the revolving frame. Do not use substitutes, as these are high strength capscrews and hardened washers.

3. Tighten each capscrew to 400 foot-pounds (55.32 m-kg) (dry), using a cross bolt tightening sequence.

4. Install the swing motor on the transmission. Be sure the motor is properly positioned.

5. Install the tubes that were removed to allow removal of the swing transmission. Connect the hoses to the motor ports.

6. Remove all the materials used to prevent the upper from swinging while the swing transmission was removed from the machine.

7. Swing the upper slowly in both directions and apply the swing brake several times to purge any air from the swing and swing brake circuits. Also, check the operation of the swing transmission while the upper is being swung.

SUB-SECTION 6E
SLEWING RINGS

GENERAL

The slewing ring is basically a large bearing upon which the upper is mounted. The outer race of the slewing ring is bolted to the upper, and the inner race is bolted to the deck of the carrier. An internal ring gear machined into the inner face mates with the swing pinion which projects downward from the swing reducer mounted on the revolving frame. This arrangement allows the upper to rotate in a full circle, when the upper is driven by the swing reducer.

REPAIR

A slewing ring is not a repairable item. If the slewing ring is no longer serviceable, it must be replaced with a new unit.

Any attempts to disassemble or repair the slewing ring will void any warranty, expressed or implied.

REMOVAL

To remove the slewing ring, proceed as follows (see Figure 6E-1):

WARNING

Extreme caution must be exercised when replacing the slewing ring, as it is necessary to remove the upper from the carrier to replace the slewing ring. Every precaution must be taken to prevent the upper from falling or shifting while lifting the upper and when the upper is off the carrier.

1. Block the carrier so that it will not move while the upper is being removed. Position the upper in the position it will have to be to remove it.

2. Disconnect the hydraulic hoses attached to the rotary joint, at the point where the hoses are connected to the hydraulic tubes on the carrier. Note the routing of each hose before removing it. Cap each hose and tube as the hose is removed to prevent dirt from entering the system.

3. Disconnect the electrical wires attached to the collector assembly. The wiring of earlier machines is connected permanently to the collector and must be disconnected at the terminal board on the cab firewall and the fuel gauge sending unit.

The wiring of later machines is equipped with plugs near the bottom of the collector assembly. Disconnect these plugs.

4. Block or support the upper using a suitable lifting device. Be sure the upper is blocked or supported adequately, because the next step of these instructions remove the bolts which secure the upper to the slewing ring.

5. Loosen all the bolts which secure the upper to the slewing ring, and allow them to drop to the carrier deck. The bolts which are secured with a nut should be removed.

6. Lift or jack the upper until the bottom of the collector assembly is above the top of the slewing ring. Then place the upper on suitable blocking away from the carrier, or drive the carrier out from below the upper. If the carrier is driven out from below the upper, the upper should be placed on suitable blocking while the slewing ring is being removed from the carrier.

7. Remove all the bolts and hardened washers which are used to secure the slewing ring to the carrier deck.

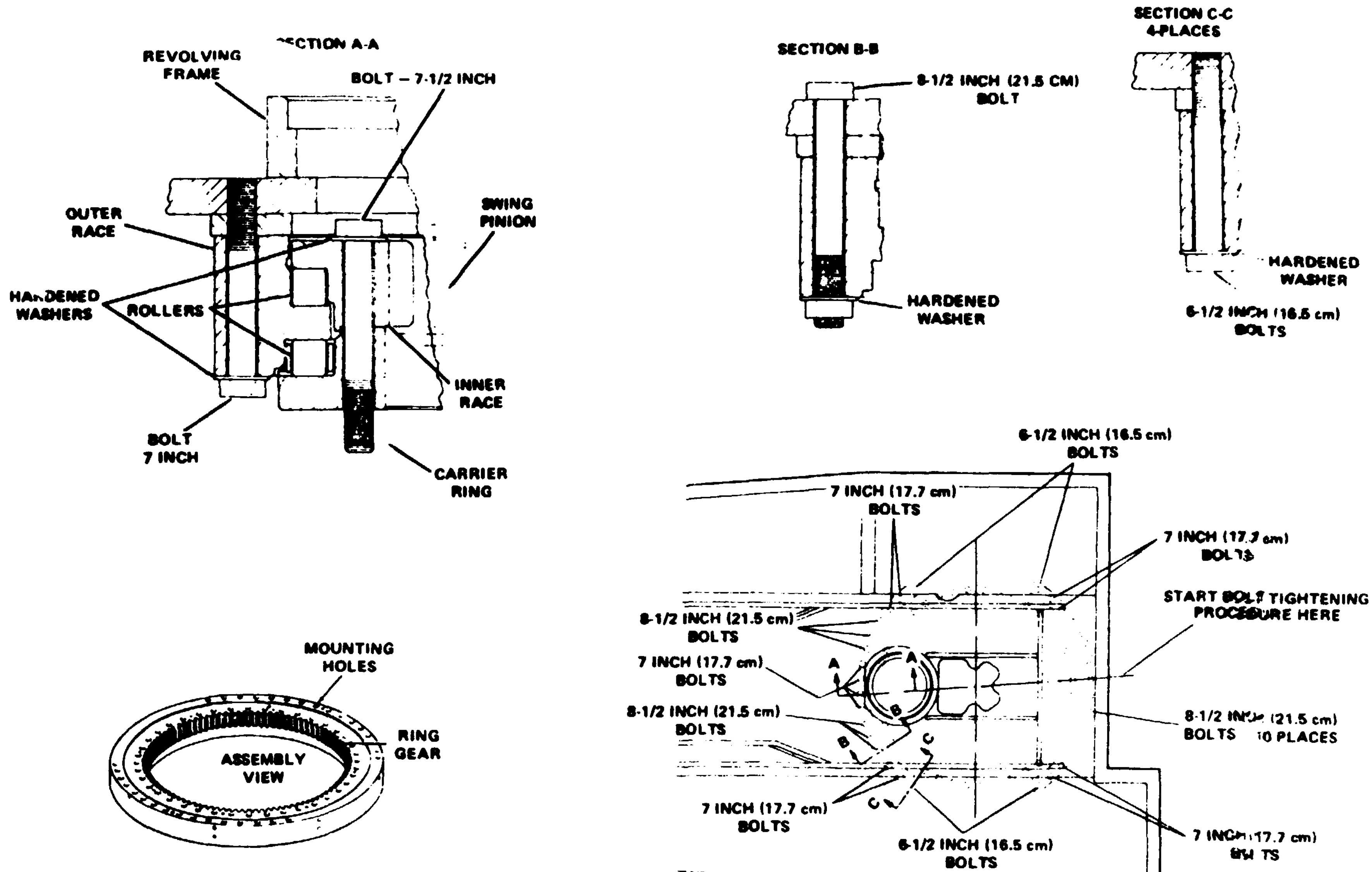
8. Install a suitable eyebolt in two holes which are 180 degrees apart. Attach a suitable lifting sling to these eye bolts and lift the slewing ring from the carrier.

INSTALLATION

To install a new slewing ring, proceed as follows:

1. Clean the carrier ring and the tapped holes in the ring with a suitable cleaning solvent, and blow the surface and holes dry with compressed air.

2. Install the eyebolts in the new slewing ring in the same manner as they were installed in the old slewing ring for removal, and lift the new slewing ring onto the carrier. Position the slewing ring so that the word FRONT stamped on the inner race will be facing the rear of the carrier when it is bolted to the carrier deck.



NOTE

The slewing ring must be installed so that the word FRONT stamped on the inner race faces the rear of the carrier. The word FRONT on the outer race must face the front of the upper.

Figure 6E-1. Slewing Ring Installation (100J3517)

3. Lift the slewing ring until the bottom of the slewing ring is approximately 7 inches (17.8 cm) above the carrier deck. Then install the 7 inch (17.8 cm) bolts in the outer race of the slowing ring at the points shown on Figure 6E-1. The bolts must be installed up from below the slewing ring.

4. Lower the slewing ring onto the carrier ring, making sure the slewing ring is properly positioned. Lubricate the 7-1/2 inch (19 cm) bolts with a light oil and install them in the holes in the inner race of the slewing ring.

5. Check the area between the bottom of the slewing ring and the top of the carrier ring with a 0.005 inch (0.127 mm) feeler gauge, If a gap, greater than 0.005 inch (0.127 mm), exists, it should be filled with shims.

6. Tighten two bolts, which are 180 degrees apart from each other, to 150 ft-lbs (20.74 m-kg). Then tighten two other bolts, which are 180 degrees apart and 90 degrees from the first two bolts, to 150 ft-lbs (20.74 m-kg). Continue this cross-bolting procedure until all the bolts have been torqued to 150 ft-lbs (20.74 m-kg).

7. Increase the bolt torque to 500 ft-lbs (69.15 m-kg) using the cross-bolting procedure described above.

8. Install six 8-1/2 inch (21.6 cm) bolts in the holes on each side of the swing reducer as shown on Figure 6E-1.

9. Position the outer race of the slewing ring so that the word FRONT stamped on the outer race will face toward the front of the upper, when the upper is installed on the slewing ring.

10. Carefully lower the upper onto the slewing ring. Be sure that port #4 on the inner stem of the hydraulic swivel will be facing toward the front of the carrier when the upper is installed on the slowing ring, and that the brackets on the swivel engage the ears on the carrier deck. Also, be sure the hydraulic hoses and electrical wires are routed to their original positions.

11. Install the remaining bolts, hardened washers and nuts in the holes as shown in Figure 6E-1.

12. Starting at the point indicated in Figure 6E-1, tighten two bolts which are 160 degrees apart from each other, to 220 ft-lbs (27.6 m-kg). Then tighten two other bolts, which are 180 degrees apart from each other and 90 degrees from the first two bolts, to 220 ft-lbs (27.6 m-kg). Continue this cross-bolting procedure until all the bolts have been tightened to 220 ft-lbs (27.6 m-kg).

13. Increase the bolt torque to 440 ft-lbs (60.8 m-kg) using the cross-bolting procedure described above.

14. Reconnect all the hydraulic hoses and electrical wires that were disconnected during this procedure.

SUBSECTION 6F
SWING BRAKE VALVES

SWING BRAKE VALVE (36Q45)

DESCRIPTION

Swing brake valve 36Q45 is operated by the swing brake pedal in the upper cab, and is used to control the operation of the swing brake. The operation of the valve is as follows (see Figure 6F-1):

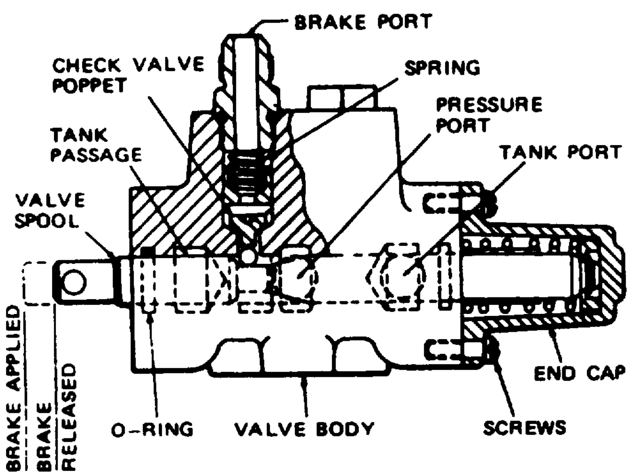


Figure 6F-1. Swing Brake Valve (36Q45)

When the brake pedal is in the released position, hydraulic pressure in the swing brake circuit is prevented from returning to tank by the check valve in the valve body. This trapped pressure will maintain the swing brake in the released position until the swing brake pedal is depressed.

When the brake pedal is depressed, the valve spool is pulled outward from the valve body. The outward movement of the valve spool will first block the pressure port, and then lift the check valve off its seat and open the tank port. Lifting the check valve off its seat, allows the oil in the brake circuit to return to tank, thereby allowing the brake springs to apply the swing brake.

When the brake pedal is returned to the released position. the valve spool moves into the valve body. Inward movement of the valve spool blocks the tank port first, and then allows the check valve to seat and opens the pressure port to the brake circuit. Since the oil in the brake circuit was vented to tank when the brake pedal was depressed, a pressure differential exists on each side of the check valve. This pressure differential allows the oil at the pressure port to lift the check valve from its seat, and flow into the brake circuit. When the pressure in the brake circuit equals the pressure at the pressure port, the check valve spring will seat the check valve and the brake will be maintained in the released position until the brake pedal is again depressed.

REMOVAL

To remove the swing brake valve, proceed as follows:

1. Depress and hold the brake pedal for several seconds to vent trapped pressure from the brake circuit.

2. Loosen the brake port connections, but do not remove the fitting nut completely. Tap the tube gently to ensure that the oil tight connection is broken. This will allow any pressure which might still be trapped in the brake circuit escape.

3. Disconnect the pressure, tank and brake port tubes from the valve. Cap the tubes to prevent the entry of dirt into the system.

4. Disconnect the brake pedal linkage from the valve spool. Remove the capscrews and washers which secure the valve to the cab floor, and remove the valve.

OVERHAUL

GENERAL. All parts in this valve are replaceable separately, with the exception of the valve body and spool which must be replaced as a unit. It is recommended, however, that the complete valve assembly be replaced when the spool or body are no longer serviceable.

DISASSEMBLY. If the valve is to be overhauled, use the following procedure:

1. Clamp the valve in a vise with the brake port up. Use

protective jaws on the vise to prevent damage to the valve body.

2. Remove the fitting from the brake port, and remove the spring and check valve poppet from the valve body. Discard the fitting O-ring.

3. Remove the screws which secure the end cap to the valve body. Each screw should be loosened a turn at a time until the spring force is relieved. Remove the end cap, and slide the spool out of the valve body.

4. Remove the O-rings at each end of the spool bore.

INSPECTION. After the valve is disassembled, perform the following inspection:

1. Wash all parts in a clean mineral oil solvent and place them on a clean surface for inspection.

2. Inspect the valve spool and bore for burrs and scoring. If scoring is not deep enough to cause objectionable leakage, the surfaces can be stoned or polished with crocus cloth. If scoring is excessive, the valve body and spool must be replaced.

3. Inspect the check valve poppet and seat for damage that would prevent the check valve from sealing properly.

REASSEMBLY. Reassemble the valve as follows:

1. Install new O-rings in the O-ring grooves at each end of the spool bore.

2. Lubricate the spool bore and spool with clean hydraulic oil. Carefully insert the valve spool in the valve body from the end cap end. Position the end cap over the end of the spool and install the end cap screws.

3. Place the check valve poppet in the valve body as shown in Figure 6F-1, and then install the spring.

4. Install a new O-ring on the brake port fitting and install the fitting on the brake port of the valve body.

BRAKE PEDAL STOP ADJUSTMENT

A stop screw is provided to prevent overtravel of the brake valve spool. This stop screw should be checked periodically to be sure it is tight and has not moved. If there is reason to believe that the adjustment has been disturbed, or if repairs have been made on the swing brake valve, readjust the stop screw as follows (see Figure 6F-2):

1. Loosen the locknut and back the stop screw out.

2. Depress the brake pedal fully, by hand, to pull the valve spool out to the end of its stroke, and hdd it.

3. Turn the stop screw in until it contacts the brake pedal. Then release the brake pedal and turn the stop screw an additional 1-1/2 turns and tighten the locknut.

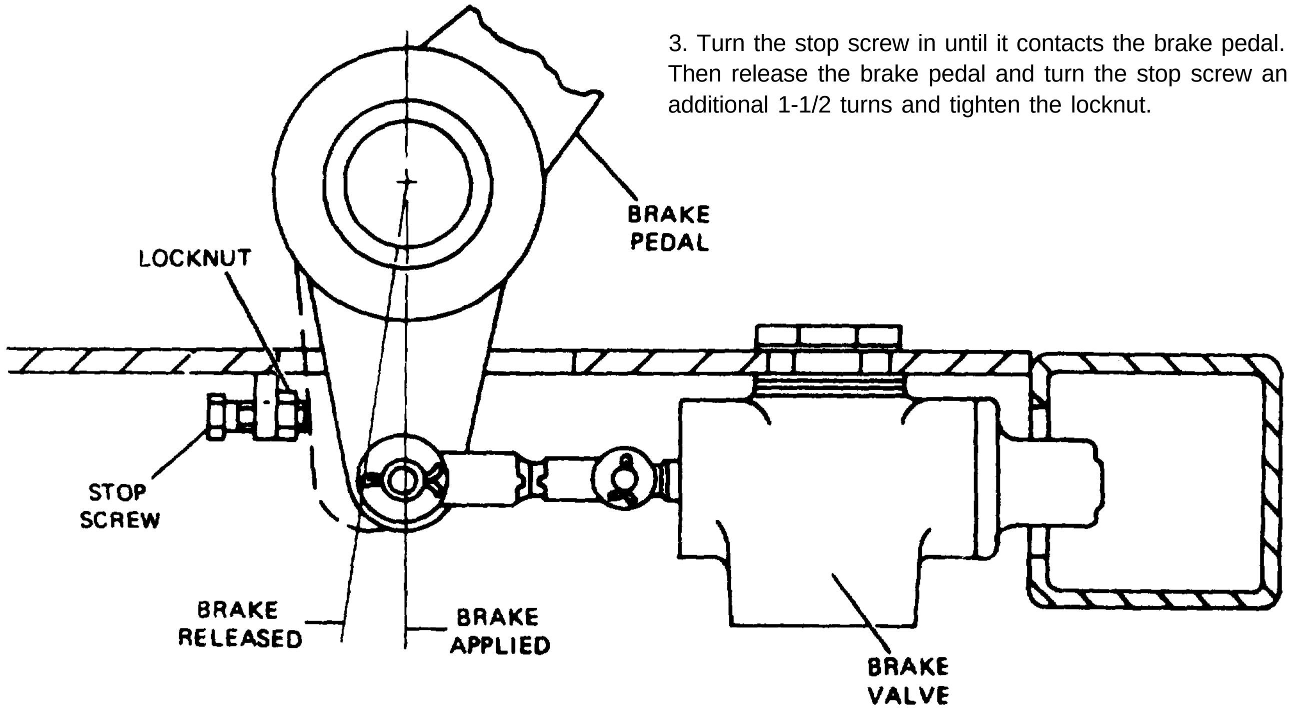


Figure 6F-2. Brake Pedal Stop Adjustment (100J4194-1-A)

SUB-SECTION 6G
SWING BRAKE LOCK VALVES

SWING BRAKE LOCK VALVE (36Z361)

DESCRIPTION

The swing brake lock valve is located just below and to the rear of the instrument panel in the upper cab, and is used to maintain the swing brake in the applied position when operated. This valve is a three way, two position, spool type valve which operates in the swing brake circuit as follows:

NOTE

> The swing brake lock valve is installed between the swing brake valve and the swing brake. It operates independently of the swing brake valve, and will override the swing brake valve, when operated.

When the control knob is pulled up, the spool is positioned so that the swing brake valve is connected to the swing brake. This allows the swing brake to be applied and released by the swing brake pedal.

When the control knob is depressed, the spool is positioned so that the swing brake valve is disconnected from the swing brake, and the swing brake is connected to tank. This allows the pressure in the swing brake circuit to vent to tank, thereby allowing the brake springs to apply the swing brake. The swing brake will remain in the applied position until the control knob of this valve is pulled up.

REMOVAL

To remove the swing lock valve, proceed es follows:

1. Depress the control knob to vent any pressure which may exist in the swing brake circuit. If the knob cannot be depressed, proceed as follows, otherwise proceed to Step 2.

   A. Loosen all the tube nuts on the tubes attached to the valve, but do not disconnect the nuts from the fittings.

   B. Tap each tube gently to break the oil tight connection. This will allow any pressure trapped in the brake circuit to escape.

2. Disconnect the tubes attached to the valve.

3. Remove the capscrews, lockwashers, and nuts which secure the valve to the cab wall, and remove the valve. Be sure to hold the nuts, as they are not welded to the cab wall.

REPAIR

Repair of this valve is limited to the replacement of ring seals. To replace the ring seal, proceed as follows (see Figure 6G-1):

1. Remove the snap rings at each end of the valve spool.

2. Push the control knob in until the rear ring seal is exposed. Remove the rear ring seal.

3. The valve spool may now be removed from the valve body. Remove the front ring seal.

4. To prevent cutting the front ring seal on sharp edges, wrap the spool with 3 or 4 layers of glossy paper, leaving only the front seal groove exposed. Slids the front ring seal on from the rear of the spool over the paper and into the front seal groove.

5. Apply clean grease to the new seal. Remove the paper and insert the spool in the valve body, and with a rotating

action on the knob, push the spool in until the front ring seal disappears and the rear seal groove is exposed.

6. Install the rear ring seal.

7. Apply clean grease to the rear ring seal.

8. Now install the rear snap ring, and with a firm, rotating action pull the spool up against the snap ring.

9. Install the front snap ring.

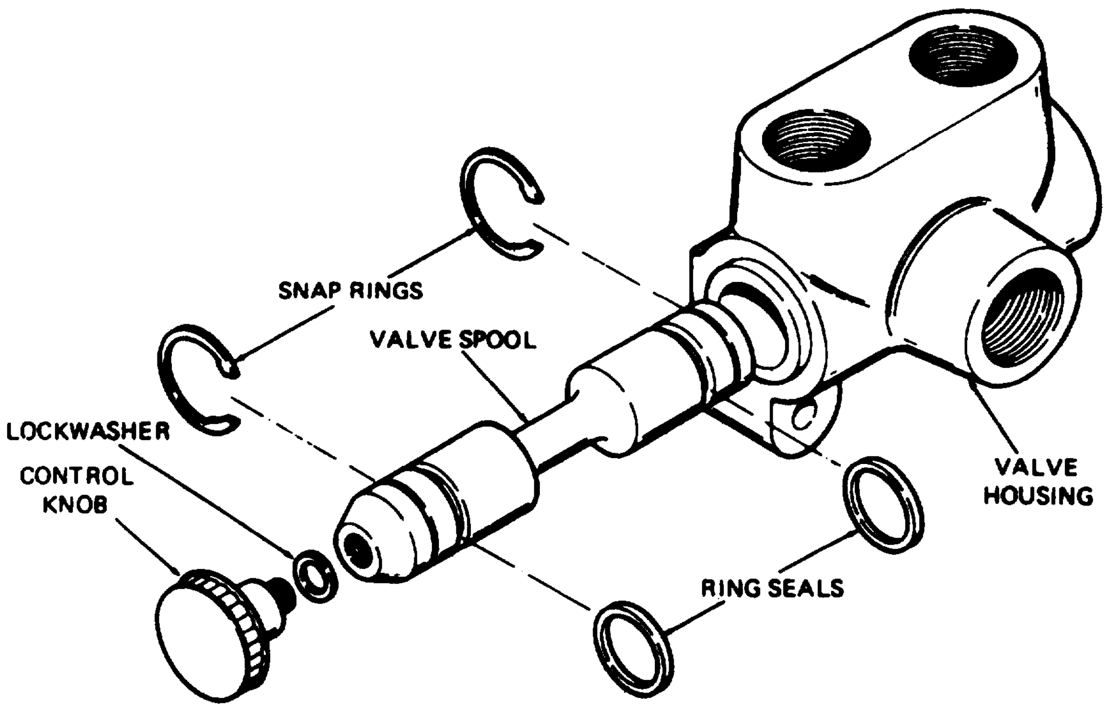


Figure 6G-1. Swing Brake Lock Valve (36Z361)

SECTION VII
OUTRIGGER SYSTEM

TOPIC **PAGE**

SECTION VII
OUTRIGGER SYSTEM

DESCRIPTION

The outriggers used on this machine are hydraulically operated (see Figure 7-1). The outriggers are designed so that they may be controlled from either side of the carrier, by means of electric control boxes. In addition, the control system can be extended to include a third control box in the upper of the machine. All control boxes are wired in parallel.

Figures 7-2 and 7-3 are diagrams of the outrigger hydraulic and electrical control systems. Examination of the hydraulic schematic, Figure 7-3, will show that the same hydraulic pump is used to supply both the carrier power steering system and the outrigger system. The pump takes supply from the hydraulic reservoir and discharges through a filter to the steering/outrigger selector valve, located at the right rear of the carrier cab. With the selector valve in the outrigger position, pressurized hydraulic fluid will now pass through the supply line to both the front and rear solenoid valve banks, and back to the hydraulic reservoir. No work will be done until one or more of the solenoid valves is actuated from one of the control boxes.

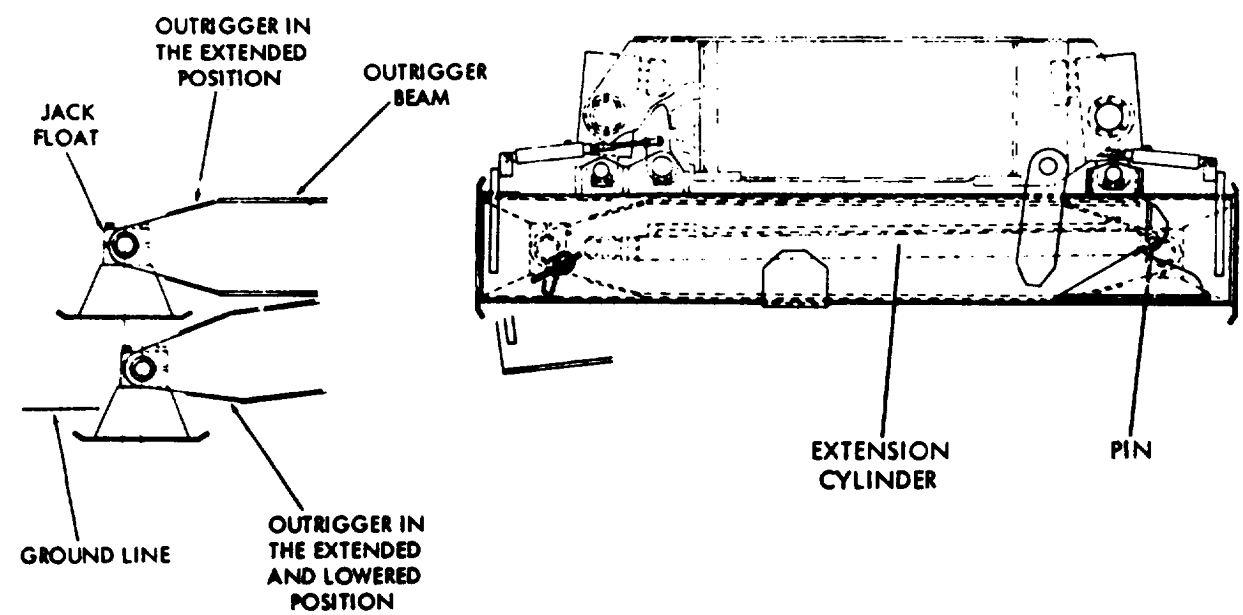


Figure 7-1. Hydraulic Outrigger Assembly

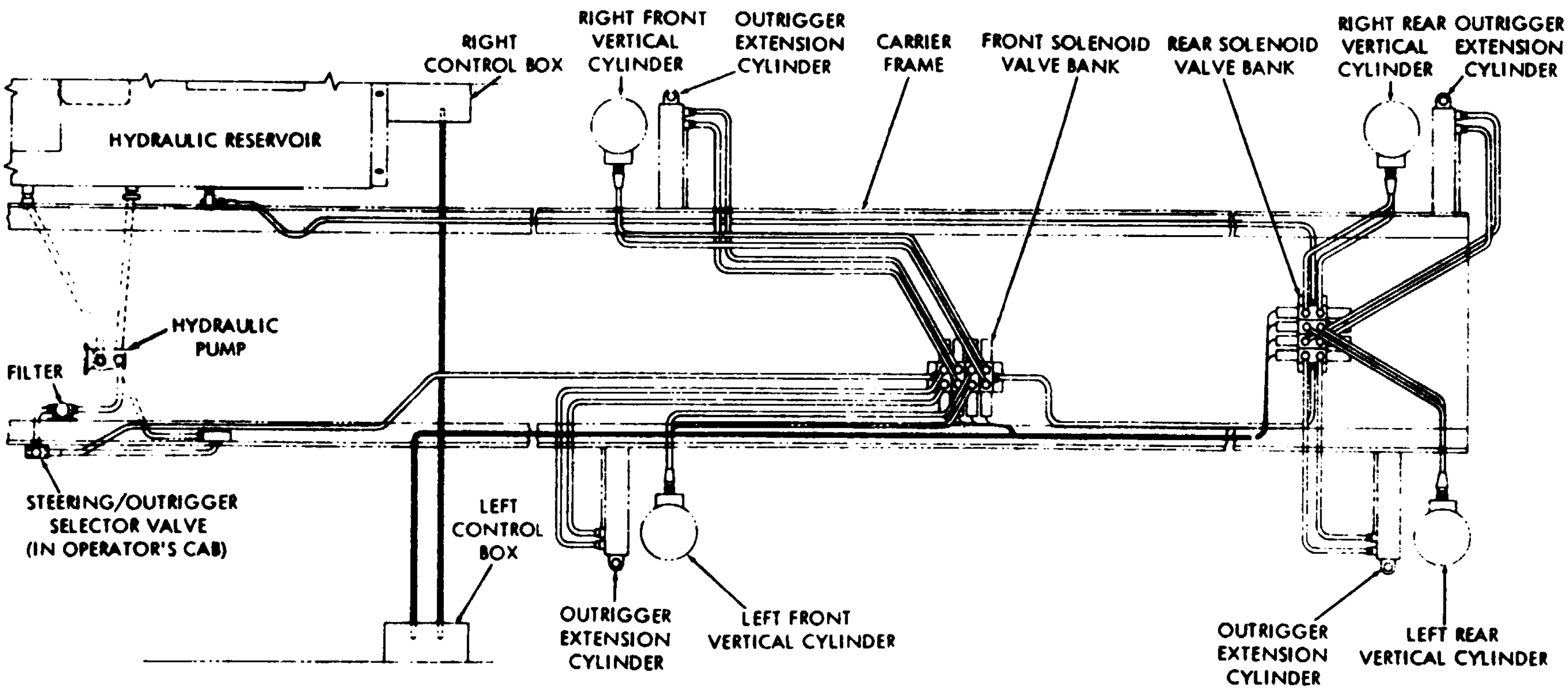


Figure 7-2. Hydraulic Outrigger Control System (8100J3980)

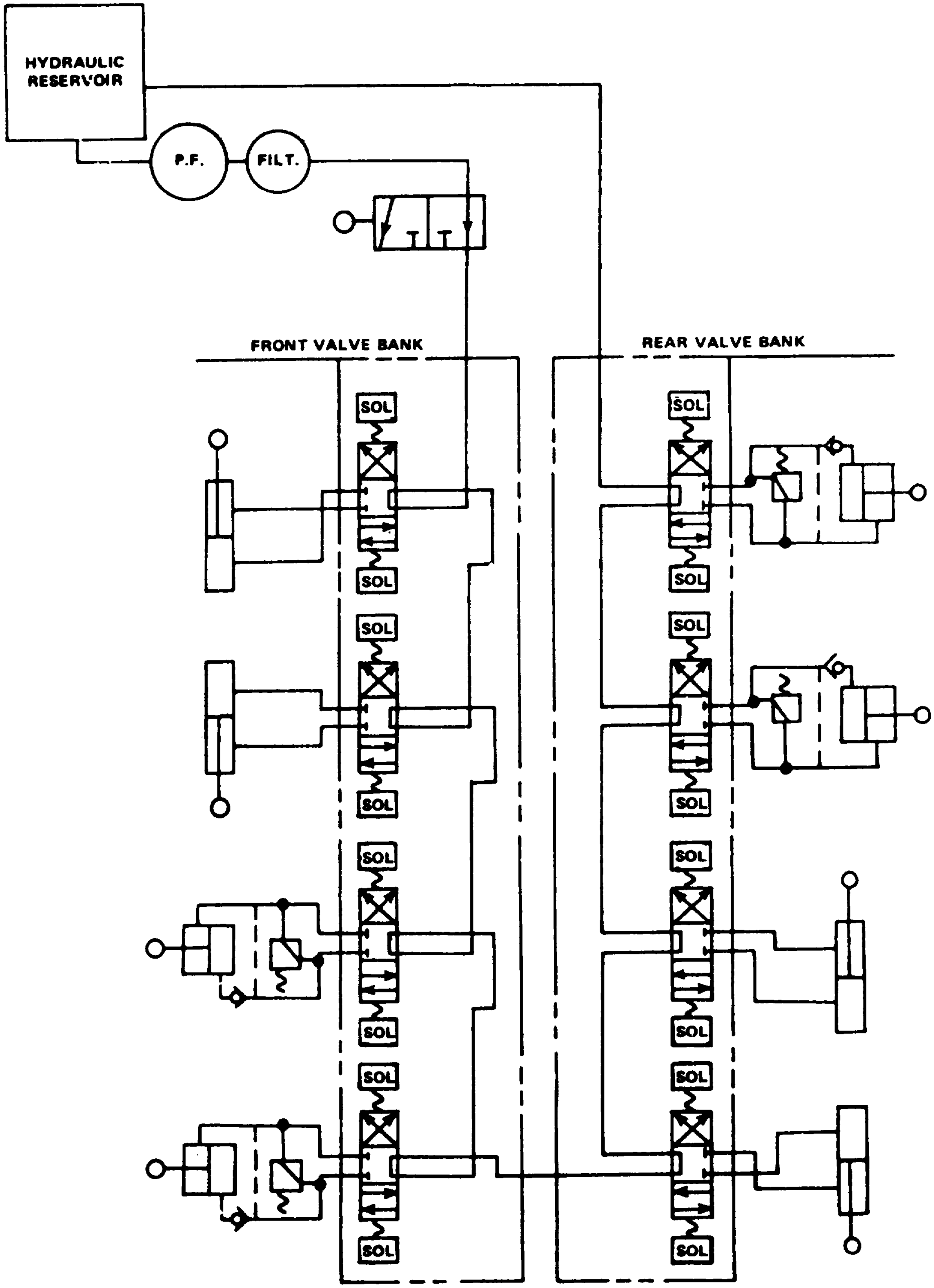


Figure 7-3. Outrigger Hydraulic Schematic (8100J3980)

SOLENOID VALVES (36Z341)

GENERAL. (Sec Figure 7-4.) The solenoid operated hydraulic outrigger control valves are located in two banks of four valves each beneath the rear deck covers of the carrier.

These valves are four-way valves of the sliding spool type. In either shifted position, the pressure port is connectad to one cylinder port, while the opposite cylinder port is open to tank. When the spool is in the neutral position, the oil passes through the remaining valve in the bank and then back to tank.

Each valve consists primarily of a body, a sliding spool, and solenoids which are used to position the spool. The spool is precision fitted into the bore in the valve body. The lands of the spool divide this bore into a series of separate chambers. Ports in the valve body lead into these chambers so that the position of the spool determines which of the ports are open to each other and which am sealed off. Ports which are sealed off from each other in one position may be interconnected in another position.

The spool is spring loaded at each end. The springs return the spool to the center position when both solenoids are de-energized The valve can be operated manually by depressing the small pushbuttons in each end of the valve.

If one of the solenoid operated valves should fail to function properly, the solenoids may be tested by removing the suspected valve from the valve body for bench testing.

The solenoids are energized by a two wire, 12 volt DC system.

REMOVAL. To remove the solenoid valves, proceed as follows:

NOTE

It is not necessary to remove the solenoid valves to replace a defactive solenoid. If only a solenoid is to be replaced. proceed as described in step 2 of disassembly.

1. Mark all electrical wiring and hydraulic hose connections before they are removed.

2. Disconnect all electric wiring from the solenoids.

3. Disconnect the hydraulic hoses and cap each hose so dirt will not enter the system.

4. Unbolt the assembly from the carrier frame and remove the entire solenoid valve assembly.

DISASSEMBLY. Disassemble the solenoid valves as follows (see Figure 74):

1. Remove the nuts from the four studs which hold the valve assembly together.

NOTE

Each valve is separated by a seal plate which serves the purpose of retaining the connecting port O-rings. When removeing valves, note their position in the bank, since they must be reassembled in the same position.

2. Remove the solenoids by removing the four holding screws, and pull the solenoid from the valve body.

3. The centering springs and spring seats may now be

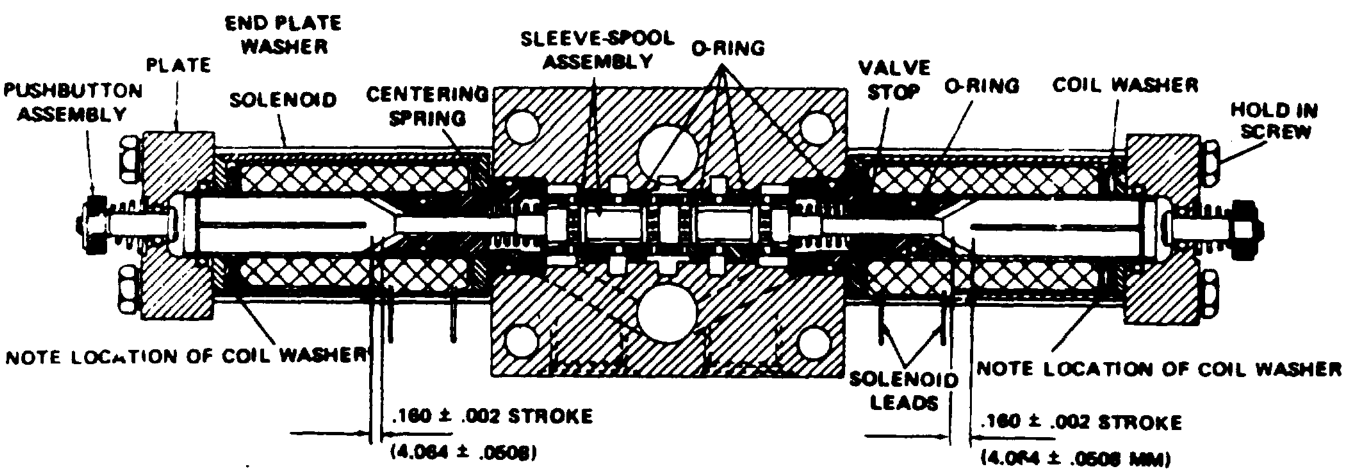


Figure 7-4. Solenoid Operated Valve (36Z341)

removed. The spool may now be pushed from either end of the valve body.

NOTE

Do not remove the body sleeve unless replacement is necessary. The sleeve-spool assembly is a matched set and must be replaced as a unit in the event of wear or damage to one Of these parts.

INSPECTION. Inspect the disassembled solenoid valve and perform the following maintenance as require:

1. Thoroughly clean the spool and body in kerosene or clean diesel fuel and examine the parts for scoring.

2. Inspect the centering springs for proper Iength. If one spring is noticeably longer than the other spring, It should be replaced.

3. Discard all O-rings.

4. Check all solenoids for continuity, using an ohmmeter. The solenoid resistance should be approximately 3.6 ohms.

ASSEMBLY. To assemble each solenoid valve, proceed as follows (see Figure 7-4):

1. Be sure all pans we clean and free from dust and dirt. The sleeve, spool and O-rings should be coated with hydraulic oil before assembly.

NOTE

The sleeve-spool assembly is J matched set and must be replaced as a unit in the event of wear or damage to one of these parts.

2. Install the O-rings on the sleeve.

3. Using a soft driving tool, push the sleeve into place in the valve body.

4. Insert the spool into the sleeve.

5. Insert a large brass washer in each side of the valve body.

6. Install the two. small washers, being sure they seat inside each of the large washer.

7. Insert the O-ring in place on the valve body.

8. Place the large metal end plate washer over the tube. Slide it to the end plate. lnstall the coil washer on the end plate. note the location of the coil washer.

9. Install the plunger in the solenoid coil tube with the pointed end facing away from the pushbutton assembly.

10. Insert the O-ring on the end washer and push the end washer into the end plate tuba.

11. Insert the rod assembly and centering spring.

12. Install the completed coil assembly on the solenoid valve body and fasten with the four bolts.

13. When assembling the valve sections together be sure to replace the O-ring on the connecting ports.

14. Torque the nuts that hold the valve sections together to 25 foot-pounds (3.4575 m-kg).

TESTING. When the valves have been reassembled, test for proper operation by applying 12 volts DC to each of the solenoids in turn. This should cause the valve to “click” into the energized position. The click should be clearly audible if the solenoid and valve are in good condition. Solenoids are replaceable.

Test the manual operation of the valves by depressing the pushbuttons on each end of each valve until they bottom. No tendency to stick should be apparent. The total stroke of each pushbutton should be approximately 0.160 inch (4.064 mm), plus or minus 0.002 inch (.0508 mm), all measurements being taken from the point where the pushbutton first contacts the valve stop.

INSTALLATION. Install the valve bank on the truck frame and make all electrical and hydraulic connections. Be extremely careful to prevent the entrance of foreign material into the hydraulic lines and valves.

OUTRIGGER EXTENSION CYLINDERS

CYLINDER (100J3305)

GENERAL. The function of the outrigger extension cylinders is to extend and retract the outrigger beams (see Figure 7-2). The cylinders are of the double acting type.

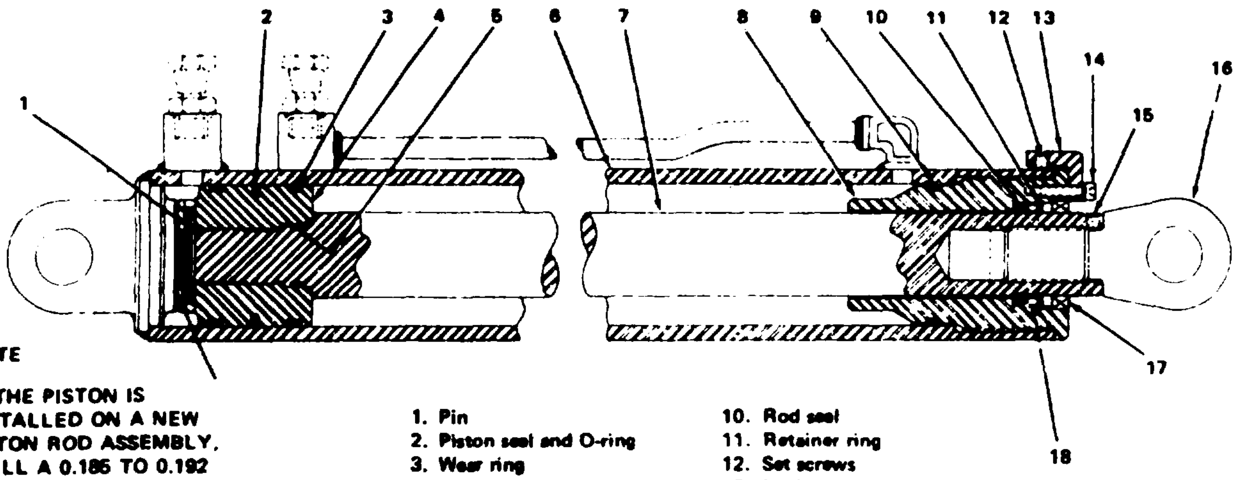
REMOVAL. To remove the extension cy!inders, proceed as follows (see Figure 7-1):

1. Remove the hydraulic lines from the cylinder to be removed. Install duct plugs and caps to prevent the entry of dirt into the system.

2. Remove the pin from the mar of the cylinder and re move the outrigger beam from the outrigger box. Remove the pin that connects the cylinder to the outrigger beam to remove the cylinder completely.

DISASSEMBLY. To disassemble the outrigger extension cylinders, proceed es follows (see Figure 7-5):

1. Loosen setscrews (12) and remove screw (14) and locking bracket (13). Unscrew rod bearing end (8) front cylinder body (6) and remove piston rod assembly (7) from cylinder body (6).



NOTE

IF THE PISTON IS INSTALLED ON A NEW PISTON ROD ASSEMBLY, DRILL A 0.185 TO 0.192 INCH (4.699-4.876 MM) DIAMETER HOLE THROUGH THE PISTON ROD ASSEMBLY, AND INSTALL A NEW ROLL PIN.

1. Pin
2. Piston seal and O-ring
3. Wear ring
4. Piston
5. O-ring
6. Cylinder body
7. Piston rod
8. Rod bearing end
9. Backup ring
10. Rod seal
11. Retainer ring
12. Set screws
13. Locking bracket
14. Screw
15. Setscrew
16. Rod end
17. Rod scraper
18. Spacer

Figure 7-5. Outrigger Extension Cylinder (10053305)

2. Drive out pin (1) with a suitable punch. Unscrew piston (4) from piston rod assembly (7).

3. Slide rod bearing end (8) from piston rod assembly (7).

4. Remove rod scraper (17). retainer ring (11). spacer (18). and rod seal (10).

INSPECTION. Inspect the disassembled extension cylinder and perform the following maintenance as required:

1. Examine wear rings (3). piston (4). and piston rod assembly (7) for evidence of excessive wear or scoring. Replace if necessary.

2. Inspect all other parts for wear, cracks, or distortion. Replace all parts which are questionable.

NOTE

A repair kit is available. See the Replacement Part Manual.

REASSEMBLY. To reassemble the cylinder, proceed as follows:

1. Install rod seal (10), spacer (18), retainer ring (11). and rod scraper (17) in rod bearing end (8).

2. Lubricate the internal diameter of rod bearing end (8). Carefully work the rod bearing end onto piston rod assembly (7).

3. Screw piston (4) on piston rod assembly (7). If a new piston rod assembly is installed, drill a 0.185 to 0.192 inch (4.699-4.876 mm) diameter hole through piston (4) and piston rod assembly (7). and install a new roll pin (1). If the old piston rod assembly is used, align the hole in the piston with the hole in the piston rod assembly, and install a new roll pin (1).

4. Slide the piston rod assembly into cylinder body (6). and screw rod bearing end (8) into the cylinder body.

5. Install locking bracket (13) on the rod bearing end with screw (14). Install setscrew (12).

CYLINDER (38U89 & 38U91)

DISASSEMBLY. To disassemble the extension cylinder, proceed as follows:

1. Remove setscrew (17. Figure 7-6) from cartridge nut (5).

2. Remove cartridge nut (5). by turning it counter-clockwise.

3. Remove fitting (16) to permit the removal of the rod assembly.

4. Using a suitable lifting device, slide the rod and piston assembly from the cylinder body.

5. Remove elastic stop nut (15) from the rod end, by turning it counterclockwise.

6. Slide piston assemblies (6) and (3) from the rod.

7. Slide stuffing box (4) from the rod.

8. Remove wiper ring (8) from the stuffing box.

9. Remove O-ring (12) and back-up ring (13) from the stuffing box.

INSPECTION. Inspect rod and cylinder bore for excessive wear, nicks or scratches. If either of these pans are demaged, the entire cylinder must be replaced.

ASSEMBLY. To assemble the extension cylinder, proceed as follows:

1. Press wiper rings (7) and (8) on the stuffing box.

2. Install back-up ring (13) and O-ring (12) in the groove on the outside diameter of the stuffing box. Place the back-up ring on the side away from the pressure.

3. Lubricate inside diameter of pecking end wiper ring (8) with clean hydraulic oil.

4. Slide cartridge nut (5) onto the rod.

5. Install the stuffing box on rod assembly (8). Push in the rod eye.

6. Install wiper ring (8) and seal (7) onto the rod.

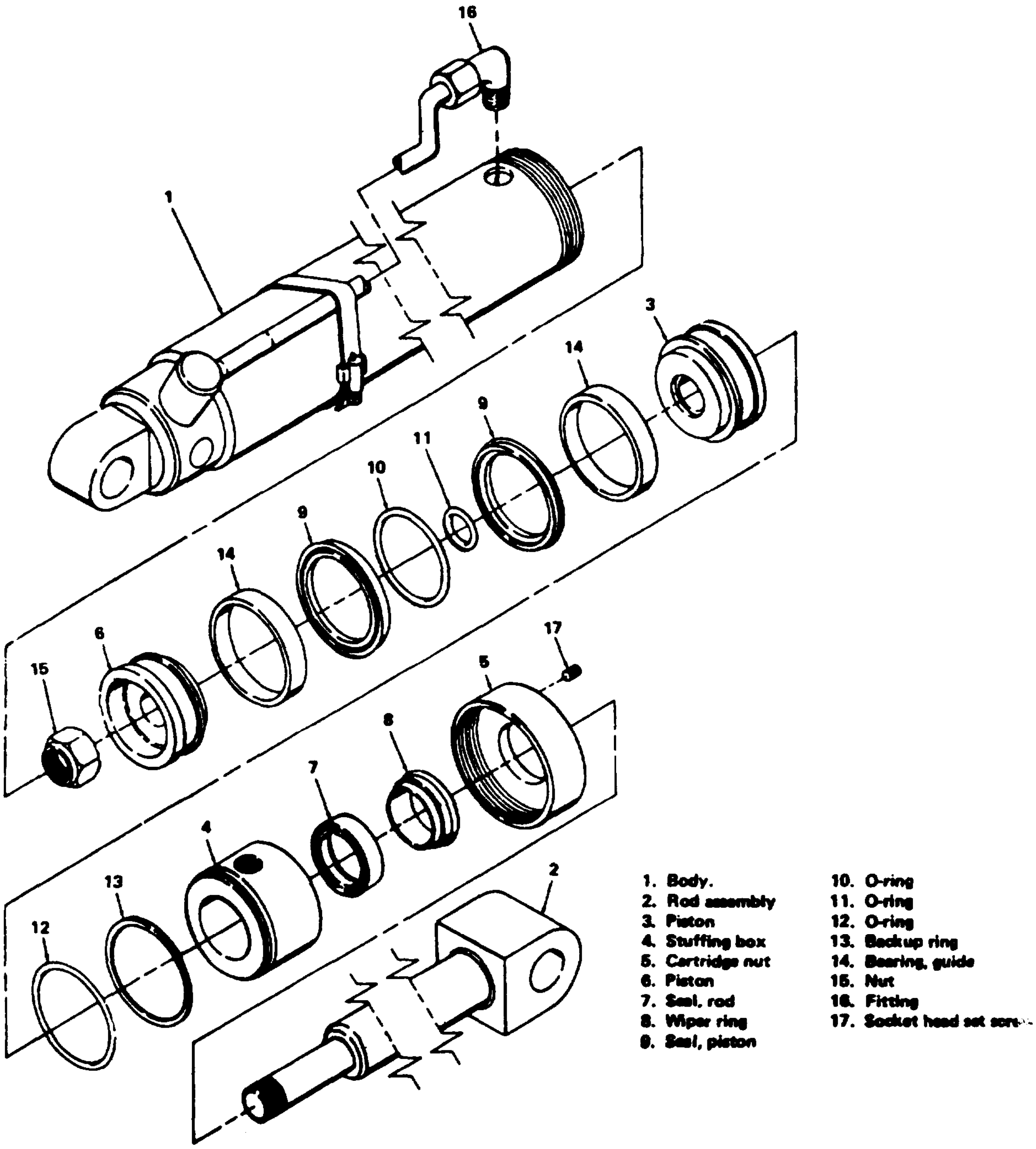


Figure 7-6. Outrigger Extension Cylinder (38489 & 38491)

7. Install packing (14) on metal pistons (6) and (3) and lubricate the pistons with clean hydraulic oil.

NOTE

Vee's of the packing must point away from the direction of pressure to induce flaring.

8. Install O-ring (11) in the counterbore of the piston.

9. Place O-ring (10) between the pistons.

10. Slide the assembled pistons onto the rod assembly.

11. Install elastic stop nut (151 and tighten securely.

12. Using a suitable lifting device, insert the rod assembly into cylinder (5).

NOTE

Be sure hole in stuffing box (4) lines up with the hole in body (1).

13. Install fitting (16).

14. Coat threads of the cartridge nut with lubricant. Screw cartridge nut (5) to the cylinder, and tighten it securely against the stuffing box.

15. Replace setscrew (17) and tighten securely.

INSTALLATION. To install the extension cylinders, proceed as follows:

1 Slide the cylinder into the outrigger beam, and insert the pin that connects the cylinder to the outrigger.

2. Using a suitable lifting device, slide the outrigger beam into the outrigger box. Insert the pin, which connects the cylinder to the outrigger box.

3. Connect the hydraulic lines to the cylinder.

VERTICAL LIFT CYLINDER (100J4298)

REMOVAL. To remove the vertical lift cylinder, proceed as follows (see Figure 7-8):

1. Disconnect the two adapter unions at the lock valve. Cap a plug the coupling ends to avoid excess hydraulic fluid loss and entry of dirt.

2. Install a suitable eyebolt in the top of the cylinder to suspend the cylinder from a suitable lifting device, Remove capscrews (12) which hold trunnion pin (11) in place. Remove cylinder trunnion pin (11) by installing a 5/8-inch bolt of suitable length in the tapped hole in the center of the trunnion pin. Tightening the bolt will jack the trunnion pin from the cylinder.

3. Block the outrigger box so it will not drop when cylinder-to-box pin (14) IS removed. Remove the keeper plate from the cylinder-to-box pin.

4. Tap out cylinder-to-box pin (14) and remove the vertical lift cylinder.

DISASSEMBLY. To disassemble the vertical lift cylinder proceed as follows (see Figure 7-7):

NOTE

The lock valve on the cylinder is not a serviceable item. If the valve does not function properly, it must be replaced with a new lock valve.

1. Remove capscrews (14) and lockwashers (15).

2. slide retainer (13) and piston rod assembly (5) from the cylinder bore.

3. Remove capscrew (7) and socket head capscrews (4) from piston head (6).

4. Slide piston head (6) off piston rod assembly (5).

5. Remove retainer (13) from piston rod (5).

6. Remove snap ring (19), washer (18) and U-cup packing with filler ring (17).

7. Remove wiper seal (16) and O-ring (12).

INSPECTION. Inspect the disassembled cylinder for evidence of excessive wear or scoring.

Inspect all parts for cracks or distortions. Replace parts which are questionable and renew all seals. If the cylinder rod or body is damaged, the entire cylinder should be replaced.

ASSEMBLY. To assemble the verticle lift cylinder, proceed as follows (see Figure 7-7):

1. Coat the new O-rings with dean oil to ease assembly.

2. Install O-ring (12) in its groove, on retainer (13). Install wipe ring (16).

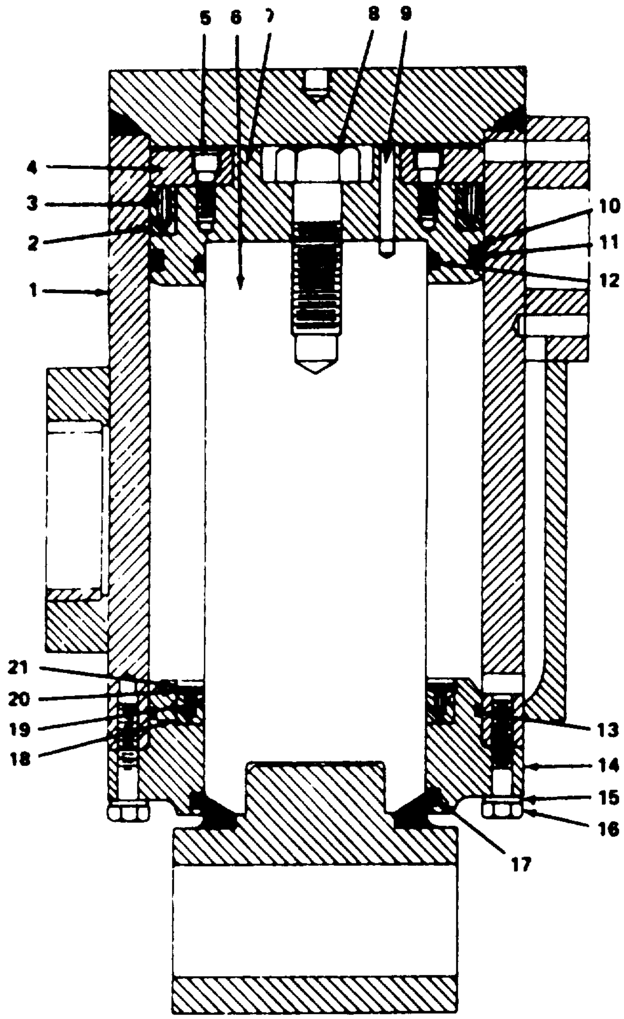
3. Install U-cup packing with filler ring (17). washer (18). and snap ring (19). as shown in Figure 7-7.

4. Slide this retainer assembly onto piston rod (5).

5. Install O-ring (11) in its O-ring groove.

6. Install back-up ring (10) and O-ring (9). The O-ring should be closest to the chamfered edge.

7. Insert the U-cup pecking with filler ring (2) on the piston heed. Install retainer (3) and fasten it with socket head capscrews (4).



1. Cylinder
2. U-cup packing
3. Retainer
4. Socket head capscrew
5. Piston rod assembly
6. Piston rod assembly
7. Capscrew
8. Roll pin
9. O-ring
10. Backup ring
11. O-ring
12. O-ring
13. Retainer
14. Lockwasher
15. Capscrew
16. Wiper seal
17. U-cup packing with filler ring
18. Washer
19. Snap ring

Figure 7-7. Vertical List Cylinder (100J4208)

8. Position piston rod head assembly (6) on the end of piston rod (5). Be sure roll pin (8) engages the hole in the end of the piston rod. Insert capscrew (7) and tighten securely.

9. Using a suitable lifting device, lower piston rod assembly (5) into the cylinder body (1). Fasten retainer (13) with lockwashers (15) and capscrews (14).

INSTALLATION. To install the vertical lift cylinder, proceed as follows (see Figure 7-8):

1. Use a suitable lifting device attached to the eyebolt in the top of the cylinder to lift the cylinder assembly in place.

2. Insert trunnion pins (11) on both sides of the cylinder and fasten them to the frame with trunnion pin bolts (12).

3. Insert cylinder-to-box pin (14) through the ears on the outrigger box and rod eye.

4. Install keeper plate (13).

5. Connect the hydraulic lines.

SAFETY LOCKS

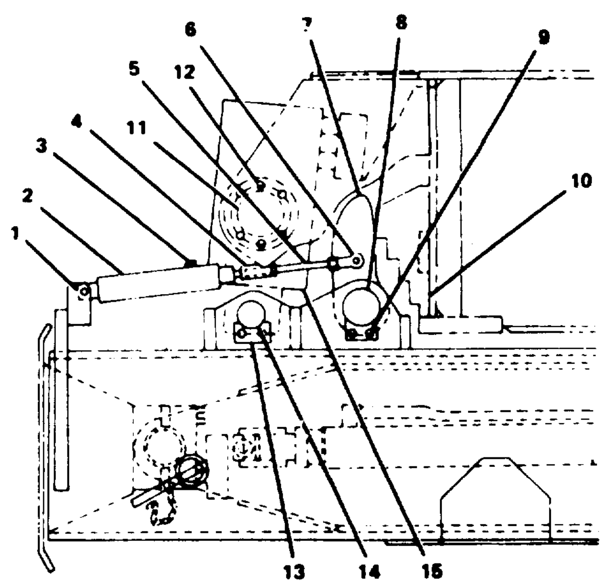
OPERATION. The optional safety locks are actuated by the SAFETY LOCK switch located on the outrigger control panel.

After the carrier has been set on the outriggers, the safety lock switch is placed in the ON position. This allows air to enter the safety lock air cylinder, moving the ratchet pin against the stepped cam.

When the switch is returned to the OFF position the air within the cylinder is vented. Spring force inside the air cylinder then pulls the ratchet pin away from the stepped cam.

These safety locks provide a mechanical lock for the outriggers in the down position.

REMOVAL. To remove the safety lock air cylinder and ratchet pin proceed as follows (see Figure 7-8):



1. Pin and cotter pin
2. Air cylinder
3. Vent
4. Rod coupling
5. Extension rod
6. Rod end, washer, cotter pin
7. Ratchet pin
8. Pin
9. Keeper plate
10. Step cam

Figure 7-8. Outrigger Disassembly

1. Remove the air hose from the air cylinder.

2. Remove the cotter pin and pin (1).

3. Remove the cotter pin and pin from rod end (6). The air cylinder can now be removed.

4. Remove ratchet pin keeper plate (9).

5. Remove pin (8). It may be necessary to drive the pin out with a brass bumping bar. Ratchet pin (7) can now be removed.

INSTALLATION. To install the safety lock, proceed as follows:

1. Place ratchet pin (7) in place and install pin (8).

2. Install the keeper plate (9) to lock the pin.

3. Place the air cylinder in position and insert mounting pin (1) through the outrigger bracket and mounting on the cylinder. Fasten pin with a cotter pin.

4. Position rod end (6) on the ratchet pin and fasten it with the washer, pin and cotter pin.

5. Connect the air hose.

SECTION VIII
POWER TRAIN

SECTION VIII
POWER TRAIN

GENERAL

This section covers the complete power train, Figure 8-1. This includes the engine, clutch, main transmission. auxiliary transmission, propeller shafts, rear axle assemblies and the pump drive.

NOTE

The procedure described here is for a G.M. 6V53N engine installation. If another make or model is used there will be minor variations to this procedure.

CARRIER ENGINE

REMOVAL. To remove the carrier engine, clutch and main transmission, proceed as follows:

1. Remove the sheet metal over the engine end main transmission, as required.

2. Drain the engine cooling system and crankcase.

3. Remove the air cleaner and its mounting bracket.

4. Remove the fuel filters end mounting bracket from the upper left rear of the engine.

5. Disconnect the shift rod on the left side of the engine.

6. Remove the exhaust pipe between engine and muffler.

7. Disconnect the linkage attached to the clutch lever at the front left of main transmission.

8. Mark all electric wiring connections, including those wires connected to the air solenoid valves on machines equipped with carrier remote controls (see Figure 8-2). Mark all hydraulic, air, and water connections.

9. Disconnect all electric wiring, hydraulic, and air hose connections, Remove the upper and lower radiator hoses.

10. Remove the pump drive propeller shaft et the front of the engine.

11. Disconnect the propeller shaft from the rear of the main transmission.

12. Remove the radiator, being careful not to lose the insulators on the mounting frame.

13. Make a thorough visual inspection of the engine to insure that all necessary wiring and hoses have been disconnected.

14. Attach a suitable lifting device to the lifting eyes on top of the engine to support it while removing the mounting bolts.

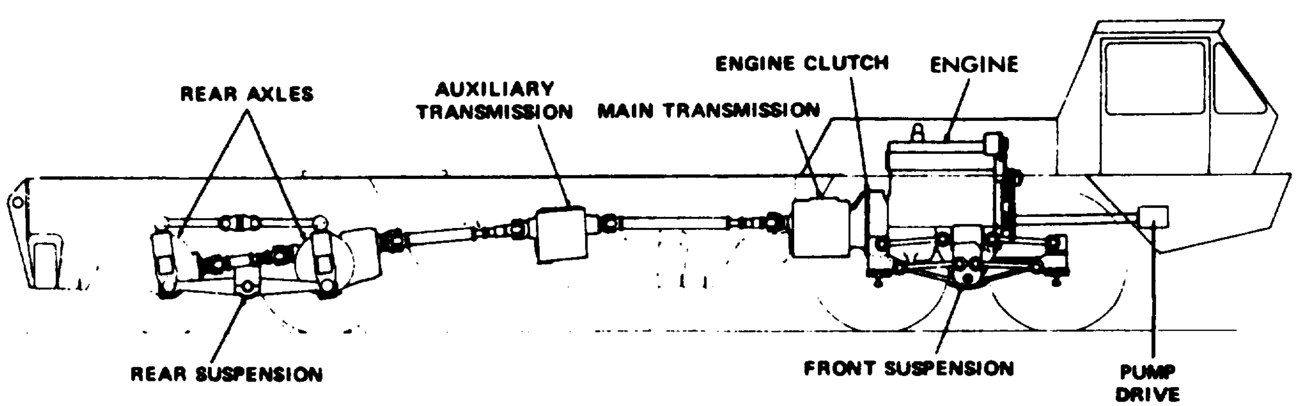


Figure 8-1. Drive Train

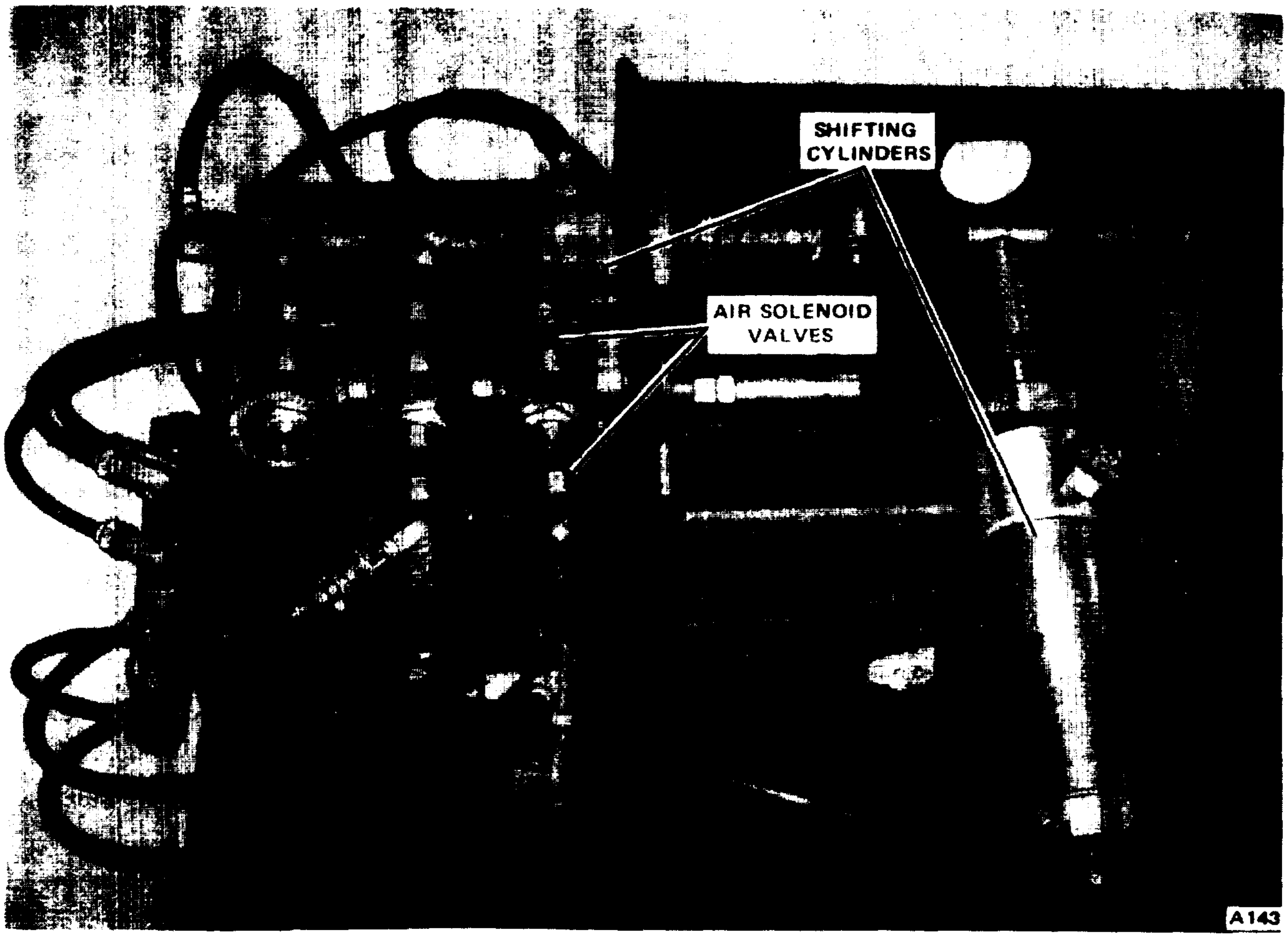


Figure 8-2. Remote Control Assembly

15. Remove the two front mounting bolts and the four rear mounting bolts. which hold the engine to the carrier frame. Also, remove the bolt supporting the main transmission.

16. Remove the engine from the carrier. Do not lose the mounting insulators on the frame.

REPAIRS AND ADJUSTMENTS. Engine repairs and adjustments are covered by a Service Manual prepared by the engine manufacturer. These service manuals can be obtained by contacting the nearest engine dealer or from the manufacturers at the following addresses:

Detroit Diesel Engine Division
General Motors Corporation
13400 W. Outer Drive
Detroit. Michigan 48228

Cummins Engine Co., Inc.
1000 Fifth Street
Columbus, Indiana 47201

INSTALLATION. To install the engine. clutch and main transmission in the carrier, proceed as follows:

1. Make a check to see that all wiring, hoses and connections are clear of the mountings and frame.

2. With suitable lifting device, lower engine and main transmission into the carrier.

3. Place the mounting insulators, two at the front of the engine and two on each side at rear of the engine. Place insulators between carrier frame and engine mountings.

4. Install the engine mounting bolts and tighten.

5. Place the radiator insulators on the frame. Install radiator and fasten to the frame.

6. Install the exhaust pipe.

7. Connect all the electrical wiring that was disconnected to remove the engine.

8. Connect all the hydraulic and air hoses that were disconnected to remove the engine.

9. Replace the upper and lower radiator hoses.

10. Connect the clutch linkage and shift rod.

11. Connect propeller shaft to main transmission.

12. Install pump drive propeller shaft.

13. Install air cleaner bracket, air cleaner and hose.

14. Install fuel filter bracket and fuel filters on the engine.

15. Connect the fuel lines to the filters.

16. Fill the engine with oil and water. Check transmission oil level, and add oil as needed.

17. Replace the sheet metal.

18. Run engine and check for oil, water, and air leaks.

ENGINE CLUTCH (1524451

REMOVAL. To remove clutch from engine, the main transmission must first be removed, as described under the topic Main Transmission. After the main transmission has been removed proceed as follows:

1. Loosen the clutch ring mounting screws diagonally opposite each other a little at a time to relieve the spring force on the clutch ring rim (see Figure 8-3).

2. Matchmark the engine flywheel, clutch ring, and pressure plate so that they can be reassembled in their original position. This is important since they are balanced as an assembly. Matchmark the driven discs on engine flywheel side to prevent installing them in the reversed position.

DISASSEMBLY. To disassemble the engine clutch, proceed as follows:

1. Place the clutch assembly, with the ring upward on the bed of an arbor press. Place a steel bar across the top of the clutch ring, and press down to relieve spring pressure on the clutch ring. Remove the locknuts.

WARNING

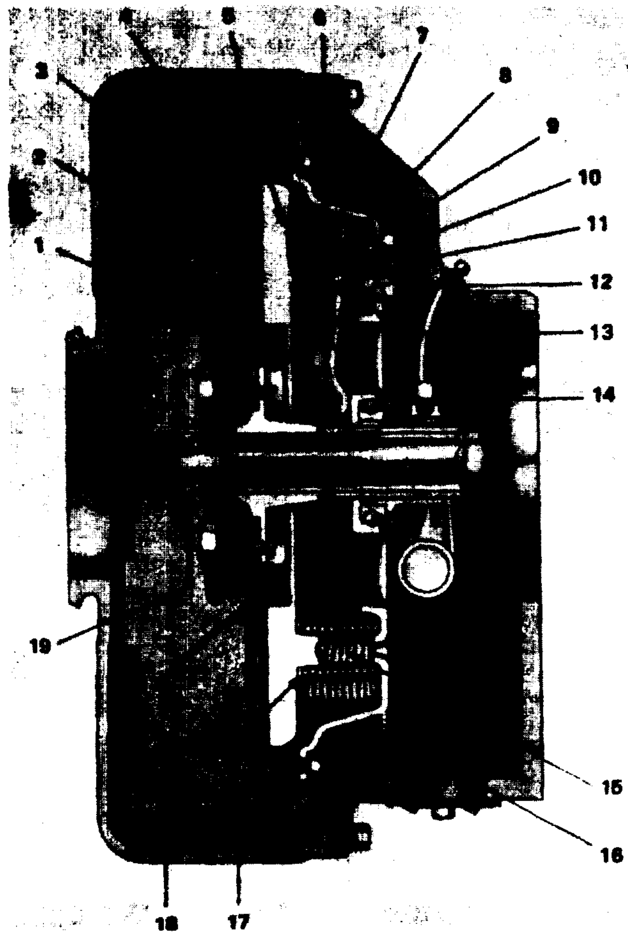
Use extreme caution when releasing the clutch assembly since the pressure springs are compressed when the clutch is assembled.

2. Release the pressure on the clutch ring. Remove the clutch ring, pressure springs, and insulating washers.

3. Remove the retaining rings and pressure plate pins. Remove the release lever assemblies, eyebolt assemblies, and adjusting nuts.

REPAIR AND INSPECTION. After the clutch has been disassembled, clean all parts thoroughly end inspect the parts for wear. Check the following items:

1. Replace the driven disc assemblies if any of the following conditions exist:



1. Release lever
2. Engine flywheel
3. Facing
4. Facing rivet
5. Pressure plate
6. Pressure plate pin
7. Needle bearing (pressure plate pin)
8. Eyebolt pin
9. Needle bearing (eyebolt)
10. Adjusting nut
11. Eyebolt assembly
12. Locknut
13. Retractor spring
14. Release bearing
15. Pressure spring
16. Clutch ring
17. Insulating washer
18. Driven disc
19. Pilot bearing

Figure 8-3. Engine Clutch Assembly

A. The hub splines are worn.
B. The disc is distorted.
C. The disc is cracked or broken.

2. If the driven disc friction material is worn excessively, replace the material. Refer to the Replacement Parts Manual. Use a star set anvil when riveting fabric facings, a roll set when riveting metallic facings.

3. Replace the pressure plate if any of the following conditions are present:

A. The friction surface of the pressure plate is severely heat checked.

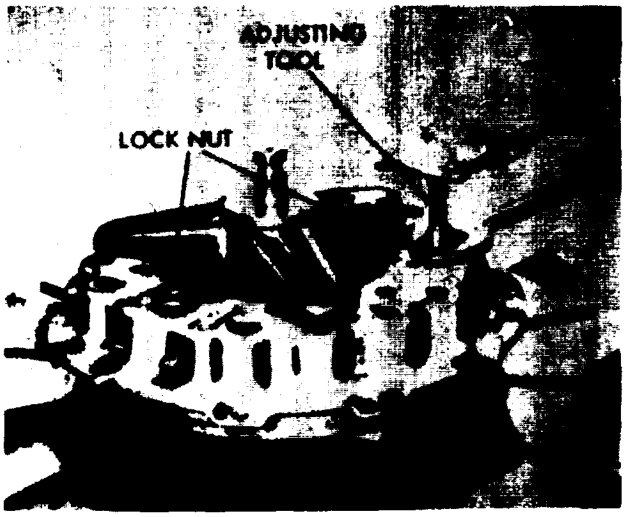


Figure 8-4. Clutch Disassembly

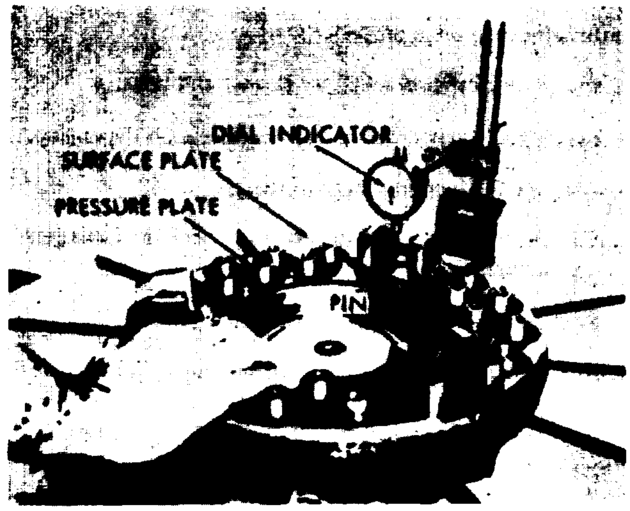


Figure 8-5. Checking Pressure Plate Thickness

B. The pressure plate is warped in excess of 0.015 inch (.381 mm).

C. The driving lugs are worn excessively.

D. The eyebolt pin holes are elongated.

CAUTION

Using a scored, warped, or heat checked pressure plate will cause the facings to disintegrate rapidly, and will seriously affect clutch life

4. It is not recommended that more 1/32 inch (.795 mm) be removed from the friction face of the pressure plate by regrinding. The original thickness of the pressure plate is 1.531 inches (38.887 mm). Measure the pressure plate thickness as shown in Figure 8-5.

5. Do not reuse the intermediate plate if there is more than 0.012 inch (.254 mm) clearance between the driving lugs and the mating slots in the flywheel. It is recommended that grinding of the intermediate plate be kept to a minimum, with not more than 0.015 inch (.381 mm) king removed from either side. The original thickness of the intermediate plate is 0.676 inch (17.17 mm).

6. inspect the clutch ring for distortion or cracks. The bolting flange must be flat to within 0.015 inch (.381 mm) when checked on a surface plate.

7. Inspect the slots in the clutch ring which engage the driving lugs of the pressure plate. If these driving surfaces are worn to the extent that, with a new pressure plate installed, a clearance in excess of 0.012 inch (.254 mm) is present, replace the clutch ring. Also, there should be not less than 0.004 inch (.1016 mm) nor more than 0.014 inch (.355 mm) movement possible between the pressure plate and clutch ring, using a new pressure plate. A tight fit may hamper smooth engagement and release, while excessive clearance may cause noise or allow the pressure plate to shift off center. creating an unbalanced condition.

8. Check the pressure springs for proper compression weight. The proper compression weight is 150 pounds (66.04 kg) at 1-27/32 inches (36.116 mm).

NOTE

Underweight springs will reduce clutch capacity and may cause clutch slippage To insure the best clutch performance, install new pressure springs.

9. Replace the needle bearings in each eyebolt assembly. When installing new needle bearings, use a suitable tool and press on the end of the bearing having numbers stamped on it.

10. Replace the release levers if the hole for the eyebolt or pressure plate pins are worn, or if the levers are worn severely by the release bearing.

ASSEMBLY. To assemble the engine clutch, proceed as follows:

1. Place the pressure plate on an arbor press with the friction face down. Install the adjusting nuts on the eyebolts, and assemble the eyebolts to the release levers, using new pins. See Figure 8-6.

2. Install the release levers. pressure plate pins, and retaining rings on the pressure plate. Place insulating washers over the spring bosses on the pressure plate, and set the springs in place.

3. Place the clutch ring over the pressure springs, making certain that each spring is positioned properly in the ring. If the original pressure plate and clutch ring are being used,

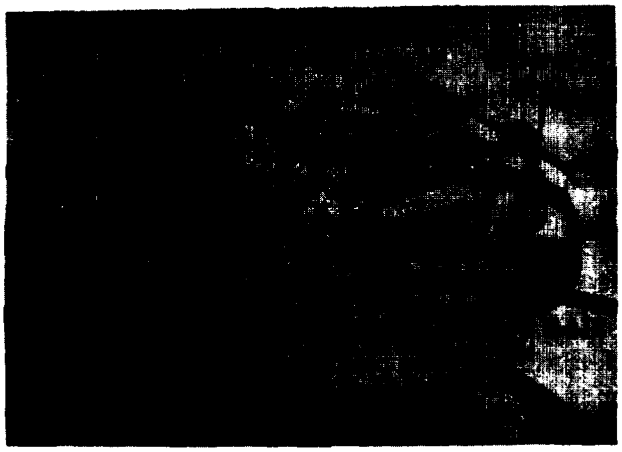


Figure 8-6. Clutch Assembly

line up the matchmarks on the clutch ring and pressure plate.

4. Carefully press the clutch ring into position over the pressure plate. Make certain that the driving lugs engage the slots in the clutch ring, and do not distort the ring.

5. Pull the adjusting nuts up through the holes in the clutch ring, and install the locknuts.

6. Install three 3/8" - 16 x 2-1/4" capscrews through the clutch ring into the tapped holes in the pressure plate to hold it under compression while reassembling the clutch to the engine flywheel. Remove the clutch assembly from the arbor press.

INSTALLATION. To install the clutch assembly on the engine flywheel. proceed as follows:

1. Check the depth of the recess in the engine flywheel. The depth of the recess must be within 0.005 inch (.127 mm) of 1.062 inches (26.974 mm).

2. The friction face of the flywheel must be free from heat cracks, score marks, or taper. The presence of any of these conditions will adversely affect clutch life.

3. Install the release bearing and carrier, and the pilot bearing. The pilot bearing should be a hand press fit in the flywheel recess and on the transmission input shaft. The release yoke should contact the release bearing carrier evenly to prevent a bind on the front bearing cap extension.

4. Place the intermediate plate in the driving slots of the engine flywheel to check the clearance between the lugs on the plate and the slots. A minimum of 0.006 inch (0.15 mm) clearance is recommended for free movement of the intermediate plate. Remove the intermediate plate.

5. Install the driven discs on the engine flywheel, with the intermediate plate between the two driven discs. The two driven discs must be positioned with the side marked either flywheel side or pressure plate side facing the respective part. Do not allow the hubs to be within less than 5/32 inch (3.967 mm) of the pilot bearing, or each other.

6. Bolt the clutch assembly to the engine flywheel. Tighten each capscrew gradually until the ring is drawn up tight. Make certain that the clutch ring is seated properly on the flywheel pilot rim.

NOTE

If the release levers are not in plane, it is possible that the ring is not seated properly on the flywheel.

7. Remove the three capscrews that were installed through the clutch ring, into the pressure plate.

8. Check the heights of the release levers, as measured from the clutch ring to the ends of the release levers (see Figure 8-7). This dimension must be 1-1/16 inch (26.987 mm). If necessary, adjust the release levers by turning each adjusting nut and locknut as a unit until each lever is at the proper height, and then hold the adjusting nut and tighten the locknut.

Figure 8-7. Checking Release Lever Height

ADJUSTMENT. The amount of clutch pedal free travel should be checked to determine the need for clutch adjustment. Free travel is the distance the pedal can be depressed before resistance is felt. and is best checked, by hand. The proper amount of clutch pedal free travel is 3/4 to 1 inch (19.05-25.4 mm).

A gradual reduction in the amount of free travel is a normal condition caused by wearing of the clutch friction material. If free travel is less than 3/4 inch (19.05 mm), adjust the clutch as follows (see Figure B-B):

1. Loosen the jam nut. Back the adjusting screw out until the clearance between the release lever is approximately 1/16 inch (1.587 mm).

2. Check clutch pedal free travel. If the free travel is within 3/4 to 1 inch (19.05-25.4 mm), hold the adjusting screw and tighten the jam nut.

3. If the free travel is not within 3/4 to 1 inch (19.05-25.4 mm), increase or decrease the clearance between the release levers until proper free travel is obtained. Then hold the adjusting screw and tighten the jam nut.

MAIN TRANSMISSION

REMOVAL. If the main transmission is to be removed at the time the engine is removed, refer to topic Carrier Engine Removal. The main transmission can be removed from the carrier without removing the engine by following this procedure:

1. Remove the sheet metal over the main transmission, as necessary.

2. Disconnect the shift rod on the left side of engine at the universal joint.

3. Disconnect the clutch linkage.

4. Disconnect the propeller shaft, at the rear of the transmission.

5. support the main transmission from the bottom. Remove the hanger bar bolt on the top rear of the transmission (see Figure 8-9).

6. Remove the bolts that hold the transmission to the engine.

7. Slide the transmission away from the engine to disengage the transmission shaft from the engine flywheel.

8. Lower the transmission from the carrier.

REPAIR. Repair instructions are provided in the transmission manufactureres service manual. Service manuals can be obtained from the nearest dealer or directly from the manufacturer at the following address:

Eaton Yale and Towne, Inc.
Fuller Transmission Division
Kalamazoo, Michigan 49001

INSTALLATION. To install the main transmission proceed as follows:

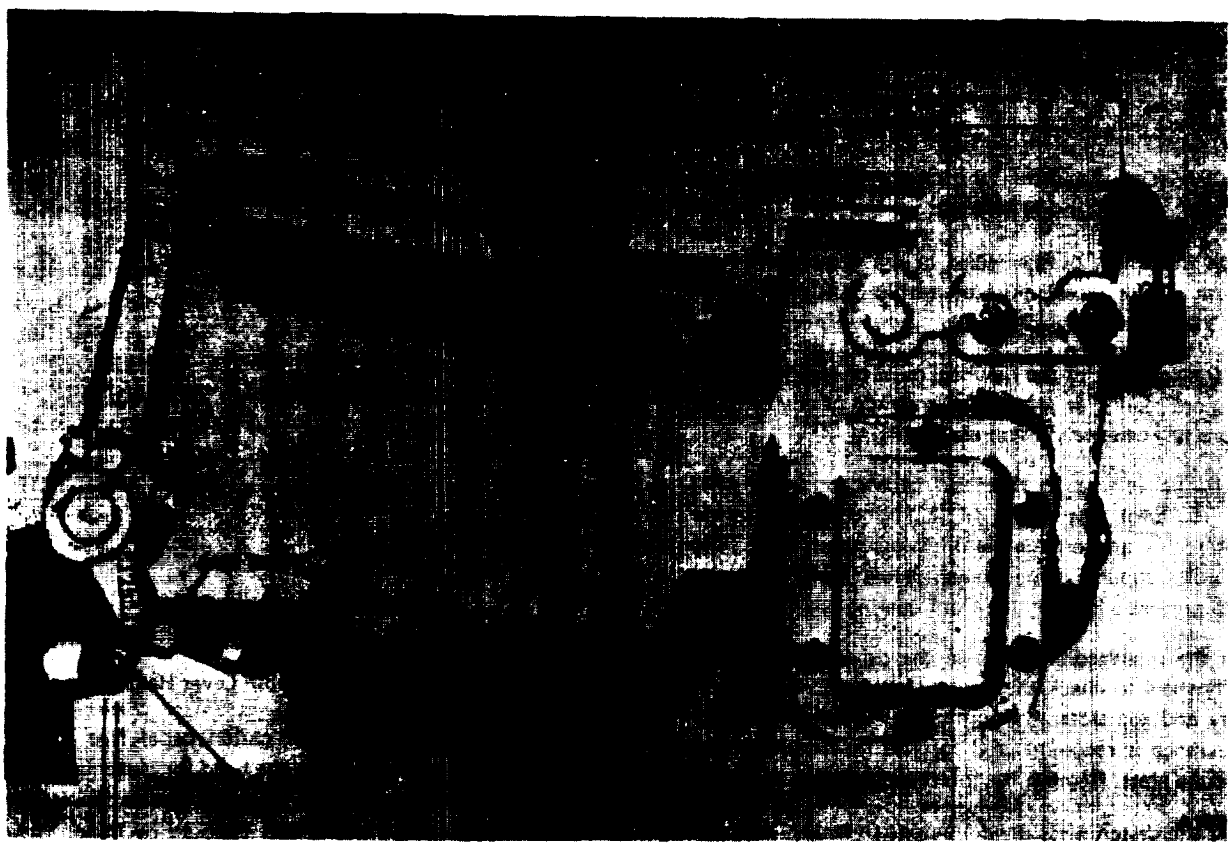


Figure 8-8. Clutch Adjustment

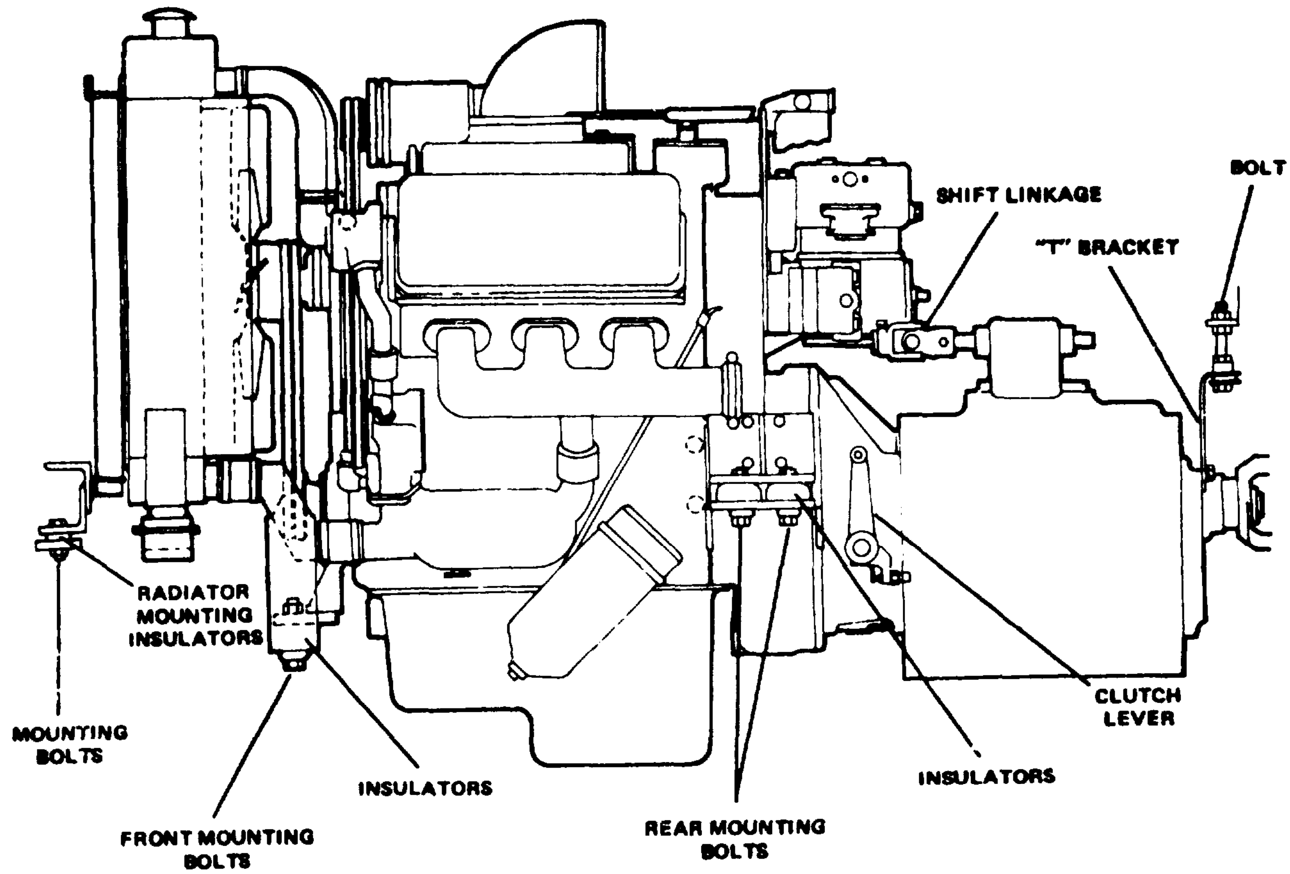


Figure 8-9. Engine and Transmission Mounting

1. Using a suitable lifting device, raise the main transmission into carrier from below.

2. Align shaft of transmission with engine flywheel. Slide transmission forward to engine.

3. Install the bolts that hold transmission to engine.

4. Attach the rear of the main transmission to the hanger bar. Tighten the nut so there is a slight tension on the hangar bar.

5. Connect the propeller shaft.

6. Connect the clutch linkage.

7. Connect the shift rod.

8. Replace sheet metal over main transmission housing.

AUXILIARY TRANSMISSION

REMOVAL. To remove the auxiliary transmission, proceed as follows:

1. Disconnect front and rear propeller shaft from auxiliary transmission.

2. Disconnect the auxiliary transmission shifting linkage and speedometer cable.

3. Support the auxiliary transmission from below the carrier.

4. Remove mounting bolts and lower auxiliary transmission from carrier.

REPAIR. Repairs and internal adjustments to the auxiliary transmission are covered in the service manuals prepared by the transmission manufacturer. These service manuals can be obtained from the nearest dealer or by contacting the manufacturer at the following address:

Dana Corporation
Spicer Transmission
P.O. Box 986
Toledo, Ohio 43696

INSTALLATION. To install the auxiliary transmission, proceed as follows.

1. Raise auxiliary transmission into position under carrier.

2. Install the spacers and mounting bolts which secure the transmission to carrier.

3. Connect the speedometer cable and shift linkage.

4. Connect front and rear propeller shafts to auxiliary transmission.

ADJUSTMENT. The auxiliary transmission has no external adjustments. If necessary the control cable clevis can be adjusted by turning the clevises to line up with the shift Ievers of the auxiliary transmission.

PROPELLER SHAFTS

PROPELLER SHAFT (810N37 & 10U49)

GENERAL. These propeller shafts are used to connect the main transmission, auxiliary transmission and rear axles togather.

The slip joint end of the propeller shaft must always be installed nearest the power source. The slip joint allows for variations in the length of the propeller shaft caused by movement of the connected units.

REMOVAL. To remove a propeller shaft, proceed aS follows (see Figure 8-10):

1. Remove capscrews (1), lock straps (2) and barring assemblies (3) from the yoke at each end of the propeller shaft.

2. Remove the propeller shaft with the journal cross and bearing assemblies.

REPAIR. Repair of the propeller shafts is limited to replacing the journal cross, bearings. and lock straps contained in the repair kit. To replace the bearing assemblies. proceed as follows:

1. Remove capscrews (1), lock straps (2). and bearing assemblies (3).

2. Tilt journal cross (5) to one side and remove it from the yoke.

NOTE

If slip joint (6) is removed from shaft (7), they must be reassembled in the same position. The matchmarking arrows on the shaft and sleeve must be visible before disassembly. If the arrow marks are not visible, mark both members before disassembling them.

ASSEMBLY. To assemble the bearing assemblies, proceed as follows:

1. Tilt journal cross (5) and insert it in the yoke,

2. Lubricate one set of bearings with multipurpose grease.

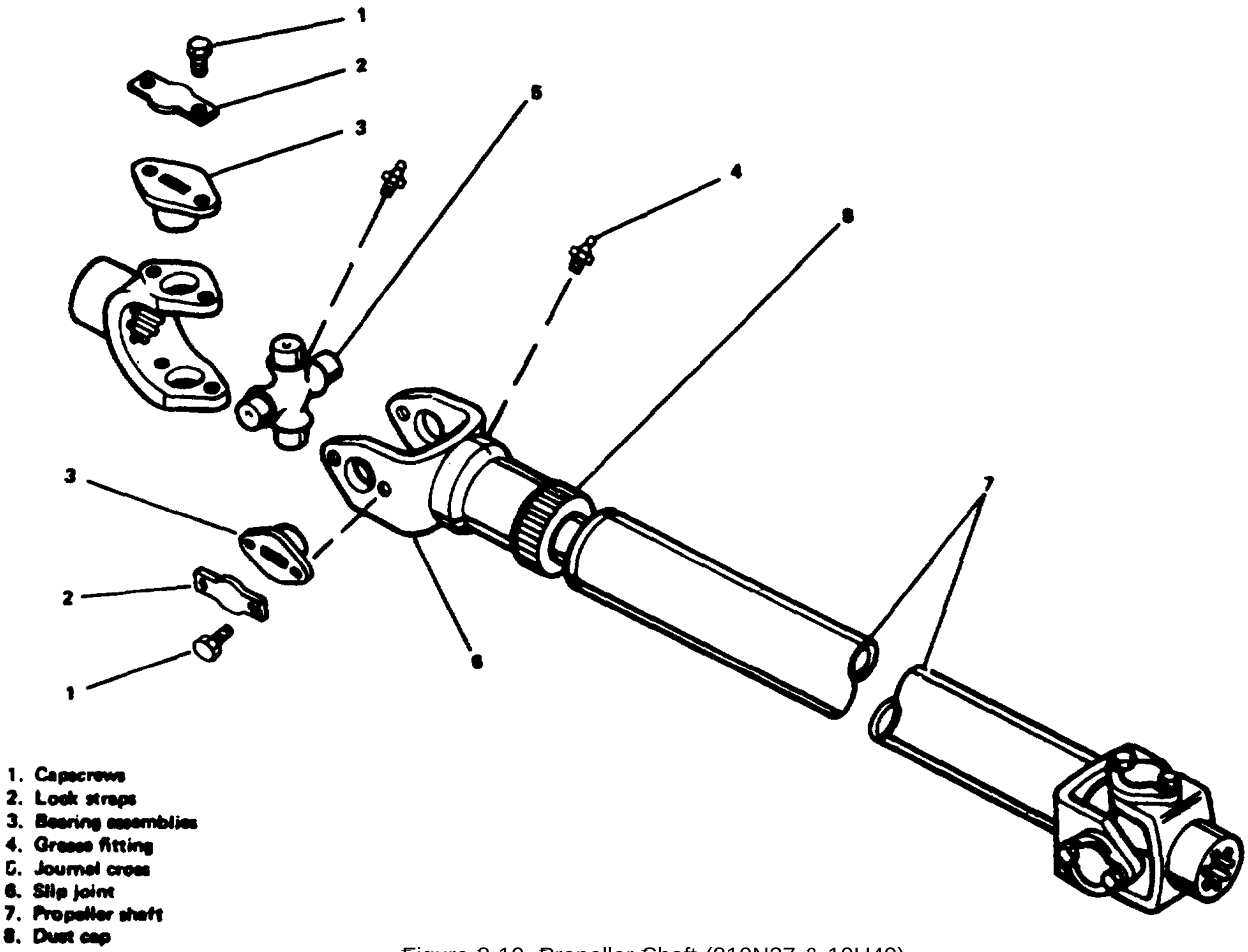


Figure 8-10. Propeller Shaft (810N37 & 10U49)

Insert the bearings from the outside of the yoke. Press or tap the bearing into place with a soft drift punch.

3. Install lock straps (2) and capscrews (1).

INSTALLATION. To install the propeller shaft, proceed as follows:

1. Lubricate the other set of bearings with multipurpose grease. Insert the bearing from the outside of the yoke. Press or tap the bearings into place with a soft drift punch.

2. Install lock strap (2) and capscrews (1).

PROPELLER SHAFT (20Q17)

GENERAL. This propeller shaft is used to connect the pump drive to the front of the engine.

The slip joint end of the propeller shaft must always be installed nearest the power source, The slip joint allows for variations in the length of the propeller shaft caused by movement of the connected units.

REMOVAL. To remove the propeller shaft, proceed as follows (see Figure 8-11):

1. Remove the bolts securing the companion flange, to the flange yoke at each end of the shaft.

2. Lower the propeller shaft from the carrier as a complete unit.

REPAIR. Repair of the propeller shaft is limited to replace ing the journal cross, bearings, and snap rings. To replace the bearing assemblied, proceed es follows:

1. Remove snap rings (2) and bearings (3).

2. Tilt journal cross (4) to one side and remove it from the yoke.

NOTE

If slip joint (6) is removed from shaft (7), they must be reassembled in the same position. The met&-marking arrows on the shaft and sleeve must be visible before disassembly. If the arrow marks are not visible, mark both members before disassembling thorn.

ASSEMBLY. To assemble the bearing assemblies, proceed as follows:

1. Tilt journal cross (4) and insert it in the yoke.

2. Lubricate one set of bearings with multipurpose grease. Insert the bearing from the outside of the yoke. Press or tap the bearing into place with a soft drift punch.

3. Install snap rings (2).

INSTALLATION. To install the propeller shaft, proceed as follows:

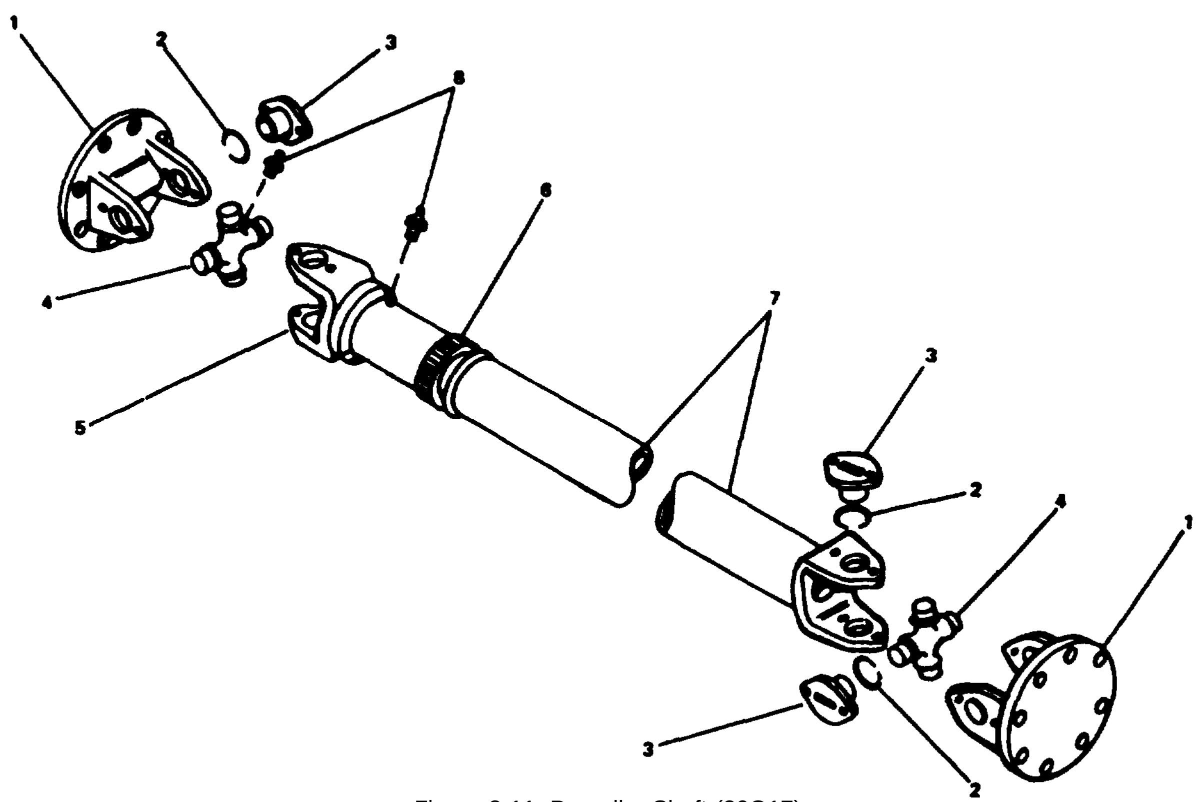


Figure 8-11. Propeller Shaft (20Q17)

1. Place the propeller shaft between the connected units, and install the capscrews end nuts which secure the shaft flanges to the companion flanges.

2. After all the capscrews and nut hew been installed, tighten each securely.

REAR AXLES

The rear axle suspensions are shown in Figure 8-12.

Repairs to the rear axles are covered by the service manuals prepared by the axle manufacturer. These service manuals can be obtained from the nearest dealer or by contacting the manufacturer at the following address:

Rockwell-Standard
Automotive Division
North American Rockwell Corp.
Detroit, Michigan 48232

PUMP DRIVES

PUMP DRIVE (53U13)

GENERAL. The hydraulic pump drive mechanism consists of three basic assemblies, the central gear box assembly and two power take off units, one on each side of the center gear box (see Figure 8-13).

The pumps are mounted on the power takeoff units. The two power take off units are quipped with shifter shafts, which are actuated by levers on a cross shaft. The shifter shafts disengage and engage the pumps and pump drives.

CAUTION

The pumps should always be disengaged when the machine is driven on the highway.

REMOVAL. To remove the pump drive assembly, proceed as follows:

1. Remove necassary sheet metal to gain access to the pump drive assembly.

2. If equipped with a Cummins engine, proceed as follows to remove power steering pump. If not proceed with step 3.

A. Loosen the two hex nuts (1. Figure 8-14) on the right and left side of the power steering pump.

B. Remove drive belts from the pump sheave.

C. Remove two mounting bolts (2) and shims. Swing the power steering pump to the side.

3. Disconnect the propeller shaft from the pump drive assembly by removing the bolts from the drive flange. Disconnect shifter shaft by removing cotter pin end pin. Disconnect pumps.

4. Using a suitable lifting device remove pump drive assembly from the carrier.

REPAIR. Repairs to the pump drive assembly should be limited to the replacement of worn or broken parts.

The pump drive assembly can be disassembled into three basic sections, the center gear box and two power take-offs,

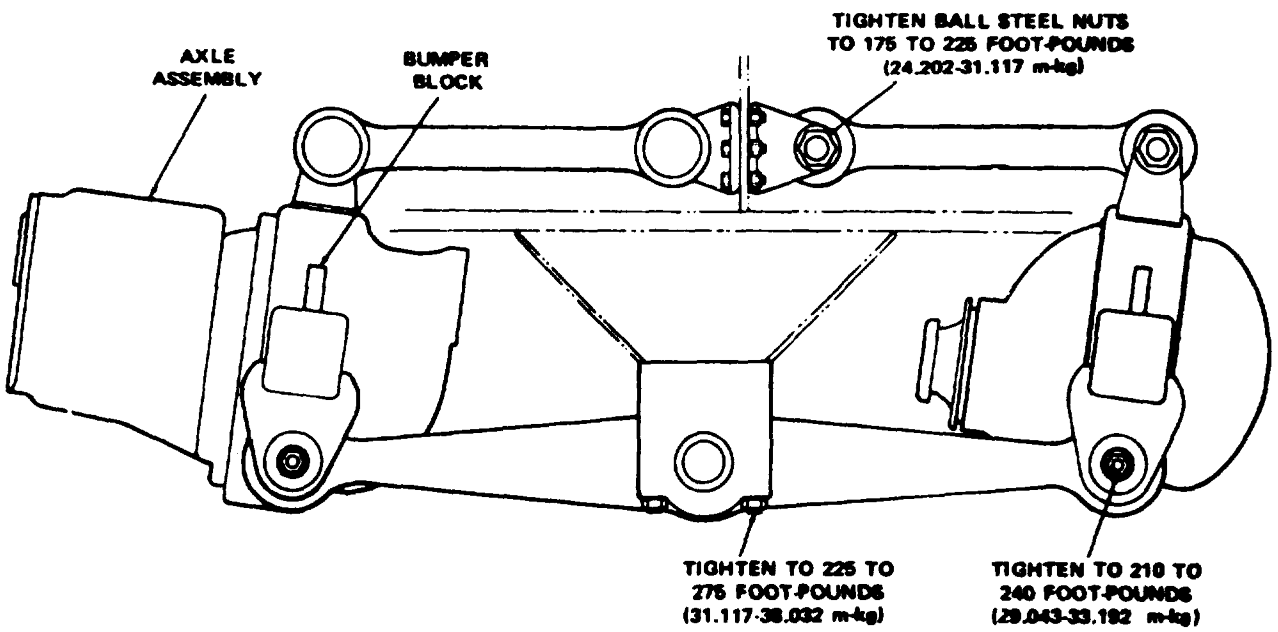


Figure 8-12. Rear Suspension

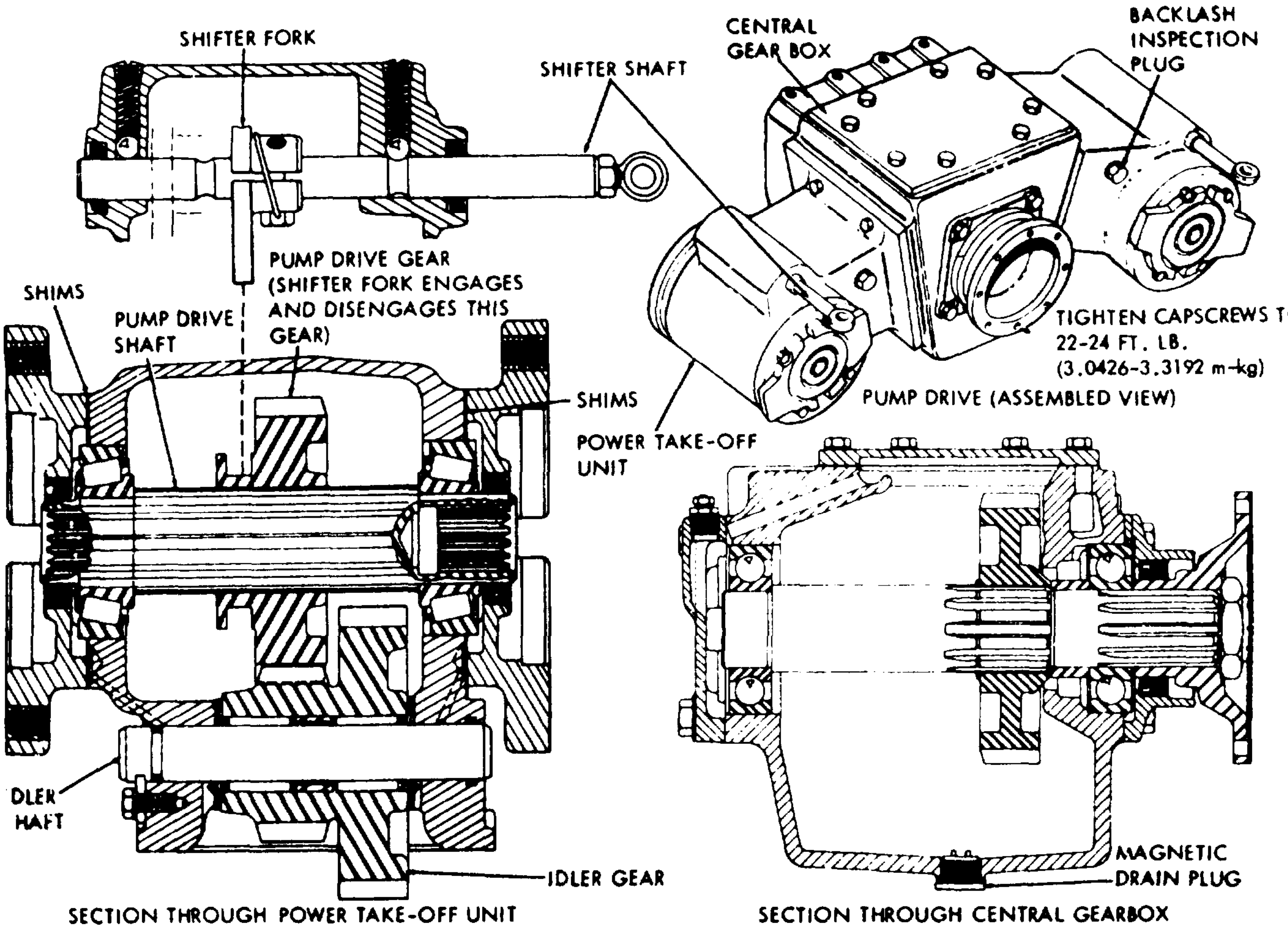


Figure 8-13. Hydraulic Pump Drive Assembly (53U13)

The following points should be kept in mind upon reassembly.

1. Permatex or equal, should be used on all capscrews.

2. All oil seal lips should point in the right direction.

3. The needle bearings for the idle shaft are not enclosed in a race. Be careful not to lose these needle bearings when disassembling the unit. Use heavy grease to hold them in place during reassembly. Two sets of 21 needle bearings are required.

4. End play on the power take-off pump drive shaft should be as near zero as possible without pm-loading the bearings. End play can be adjusted by means of steel shims located between the housing and the end cover.

5. Backlash inspection plug is built into each power take-off unit, just inboard of the shifter shafts. Ocassionally backlash between the power takeoff unit idler gear and the pump shaft drive gear should be checked through this opening. Backlash should be between 0.006 and 0.012 inch (.1524-.3048 mm). If backlash does not fall within these limits, consideration should be given to replacing the gears.

6. Capscrews which secure the pump drive shaft flange to the drive input flange should be torqued to 22-24 foot pounds (3.0426-3.3192 m-kg).

INSTALLATION. To install the pump drive assembly, proceed as follows:

1. Using a suitable lifting device, lower pump drive assem My in place and bolt it to carrier frame.

NOTE

If this installation includes the power steering pump, place the drive belts over the pully of the hydraulic pump drive assembly et this point.

2. Connect propeller shaft to the drive flange and torque bolts to 22-24 foot-pounds (3.0426-3.3192 m-kg).

3. Connect shifter shaft with a pin and cotter pin.

4. If equipped with a Cummins engine, proceed es follows to install the power steering pump.

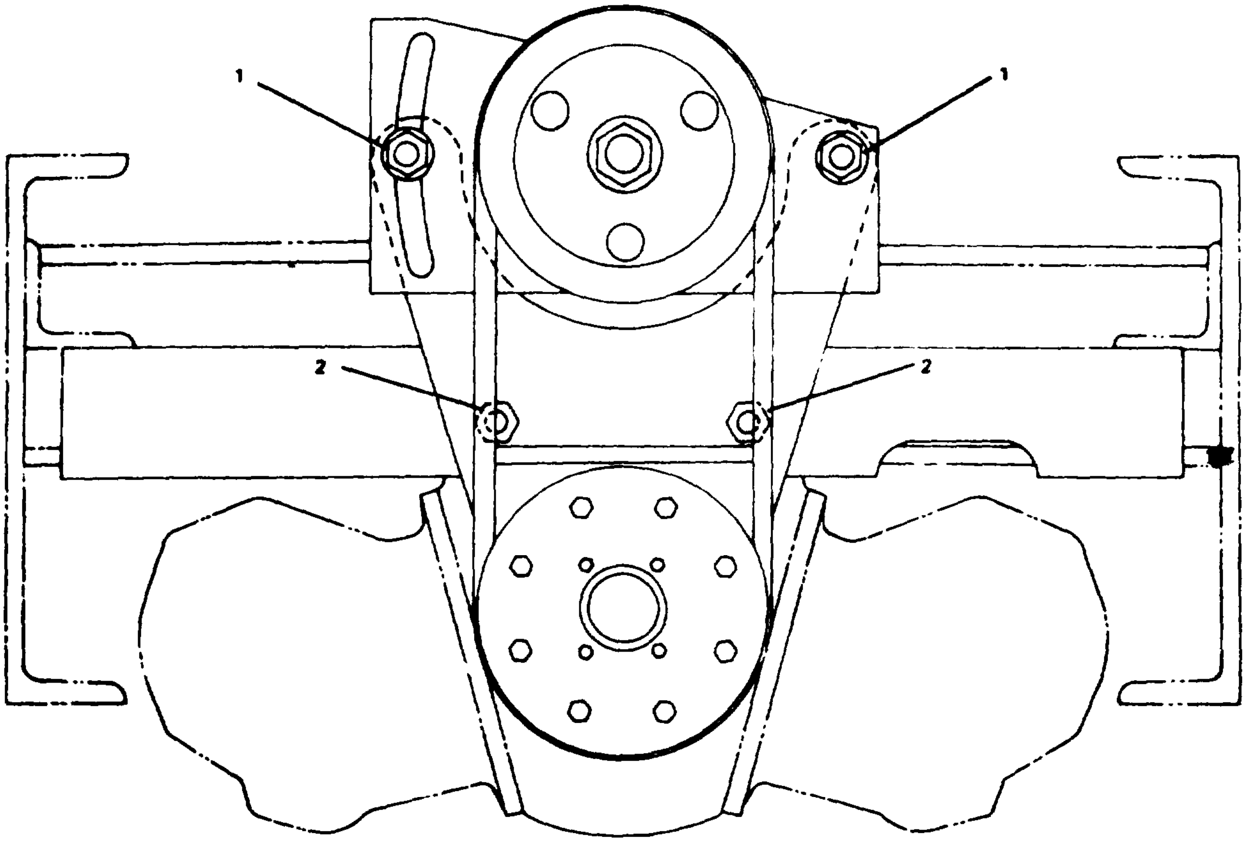


Figure 8-14. Power Steering Pump Installation

A. Place shims between the power steering pump bracket end the hydraulic pump drive assembly to assure proper alignment of drive belt. Check this alignment with a straight edge.

B. Install mounting bolts (2, Figure 8-14) end tighten.

C. Place the drive belt over the pump pulley.

D. Raise the power steering pump to adjust drive belt tension. Tighten hex nut (1).

PUMP DRIVE (53U37)

GENERAL. The hydraulic pump drive mechanism consists of the housing, gears, and power take-offs.

The pumps are mounted on the power takeoff unit. The power take-off unit is equipped with a shifter shaft, which engage the pumps.

CAUTION

The pumps should always be disengaged when the machine is driven on the highway.

REMOVAL. To remove the pump drive assembly, proceed as follows:

1. Remove necessary sheet metal to gain access to the pump drive assembly.

2. If equipped with a Cummins engine, proceed as follows to remove power steering pump. If not proceed with step 3.

   A. Loosen two hex nuts (1, Figure 8-15) on the right end left side of the power steering pump.

   B. Loosen locknut (2) and tension bolt (3). Remove the drive belts.

   C. Remove two mounting bolts (4) end shims. Swing the power steering pump unit to the side.

3. Disconnect the propeller shaft from the pump drive assembly by removing the bolts from the drive flag. Disconnect the linkage attached to the shifter shaft by removing the cotter pin and pin.

4. Disconnect pomps. Remove mounting bolts on right and left side of the pump drive assembly. Using a suitable lifting device, remove the pump drive assembly from carrier.

REPAIR. Repairs to the pump drive assembly are limited to the replacement of worn or broken parts.

To gain access to the power take-offs and gears remove the end cover of the pump drive assembly (see Figure 8-16). The following points should be kept in mind upon assembling the pump drive.

1. Assemble both pump drive gears (12) with longer shoulder to the end cover side.

2. All oil seal lips should be pointing in the right direction.

3 Always replace the end cover gasket with a new one whenever the and cover has been removed.

4. The capscrews which secure the pump propel shaft flange to the drive input flange should be torqued to 22-24 foot-pounds (3.0426-3.3192 m-kg).

INSTALLATION. To install the pump drive assembly, proceed as follows:

1. Using a suitable lifting device lower pump drive assembly in place and bolt it to carrier frame.

NOTE

If this installation includes the power steering pump, place the drive belts over the pulley of the pump drive assembly at this point.

2. Connect the propeller shaft to the drive shaft flange and torque bolts to 22-24 foot-pounds (3.0426-3.3192 m-kg).

3. Connect the shifter shaft linkage with pin end cotter pin.

4. If equipped with a Cummins engine, proceed es follows to install the power steering pump.

A. Place shims between power steering pump and pump drive assembly to assure proper alignment of the drive belts. Check this alignment with a straight edge.

B. Install mounting bolts (4, Figure 8-15) and tighten.

C. Place drive belts over the pulley of power steering pump.

D. To adjust drive belt tension, turn tension bolt (3) clockwise until proper tension is obtained. When proper belt tension is acquired tighten nut (2).

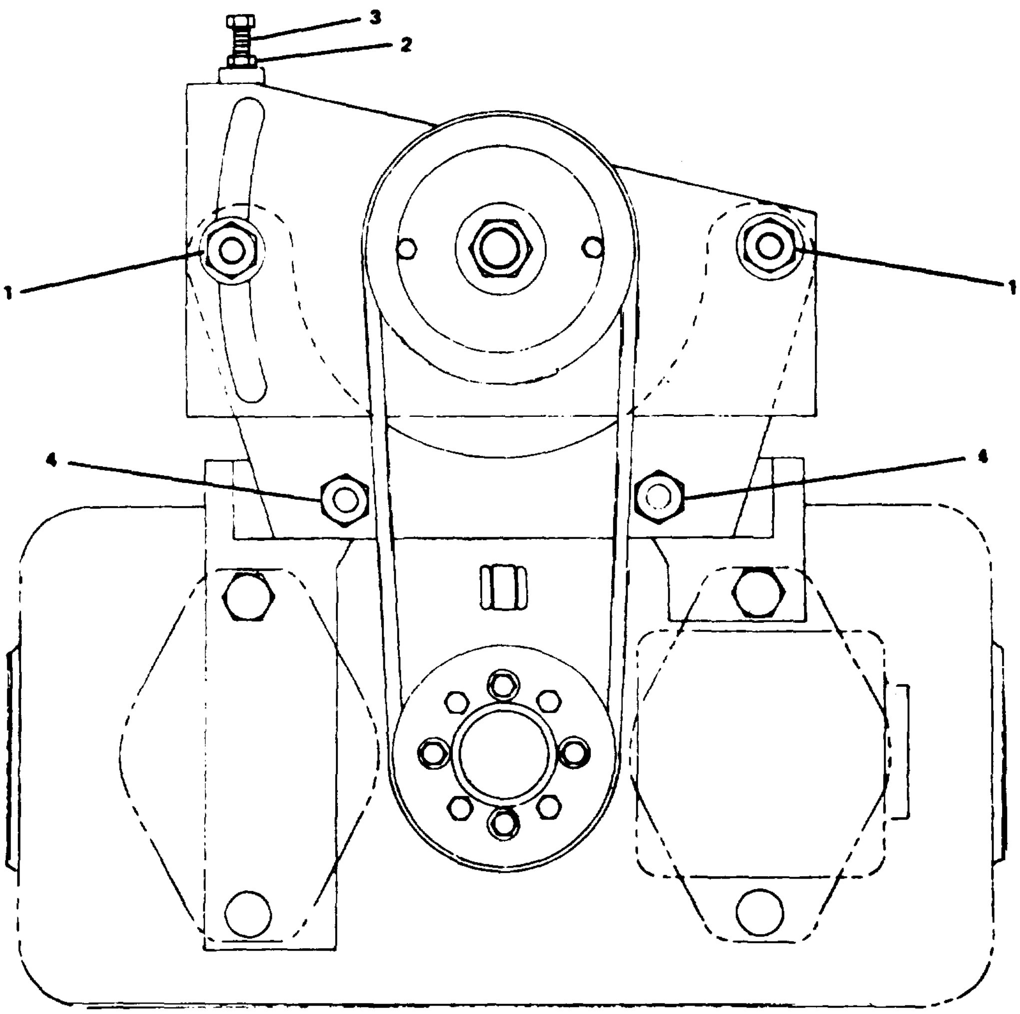
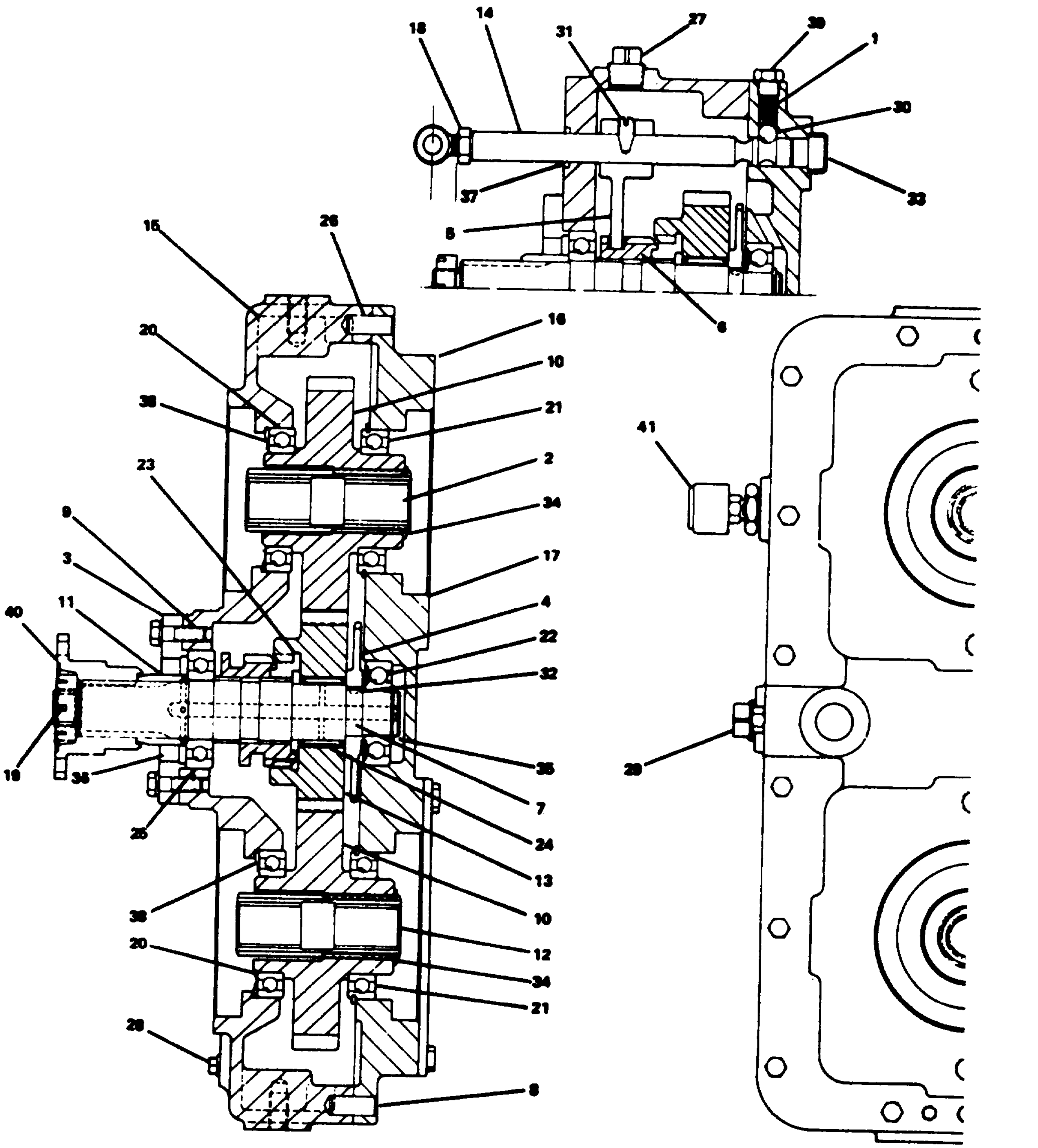


Figure 8-15. Power Steering Pump Installation



1. Spring, shifting
2. Adapter, pump spline
3. Housing, oil seal
4. Gear, oil splash
5. Fork, shift
6. Clutch, sliding
7. Shaft, input
8. Gasket, case
9. Shim pack, input hsg.
10. Gear, pump drive 38T
11. Spacer, input oil seal
12. Adapter, pump spline
13. Gear, input 30T
14. Rod, shift
15. Case, trans
16. Cover, case
17. Gasket, pump pad cover
18. Nut, ½-20, shift rod
19. Pin, cotter 1/8 x 1-1/2
20. Bearing, pump shaft rear
21. Bearing, pump shaft frong
22. Bearing, input
23. Race, thrust
24. Bearing, input gear
25. Bearing, input gear
26. Pin, dowel
27. Plug, pipe, 3/4 in.
28. Plug, pipe, 3/8 in.
29. Plug, pipe, 3/4 in.
30. Ball, 1/2 in.
31. Screw, set 7/16-20
22. Key, No. 213 Woodruff
33. Plug, cupped
34. Snap ring, spline adapter
35. Snap ring, input
36. Oil seal
37. Oil seal
38. Wavy washer
39. Boss plug
40. Companion flange
41. Breather

Figure 8-16. Hydraulic Pump Drive Assembly (53U37)

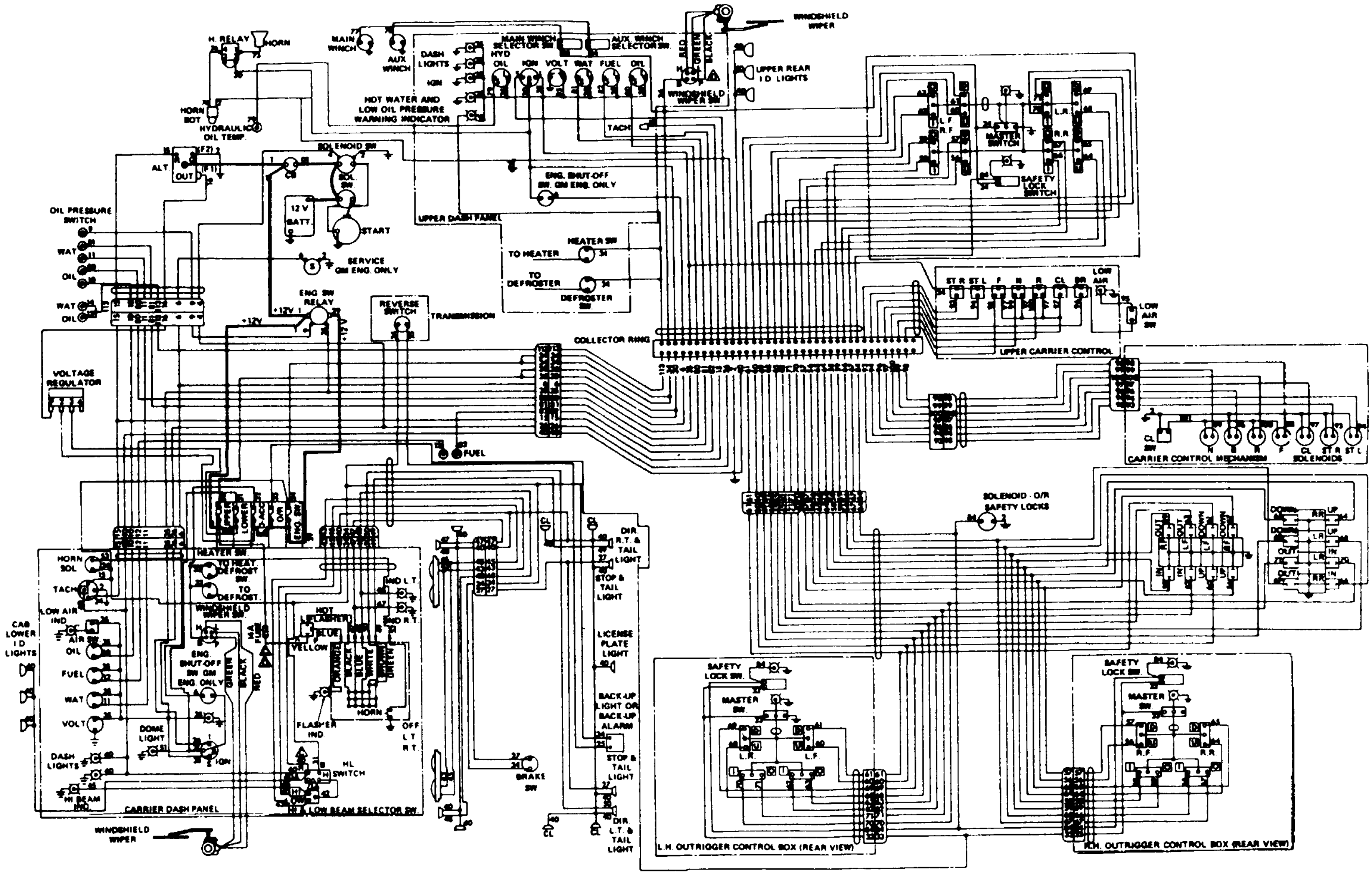


Figure 8-17. Carrier Electrical Schematic (100X139)

SECTION IX
AIR SYSTEM AND COMPONENTS

SUB-SECTION 9A
AIR SYSTEM

SCOPE

The air system of this machine consists of the devices used to control and actuate the carrier brakes, carrier remote controls when furnished, and the air operated throttle used on later machines.

BRAKE SYSTEM DESCRIPTION

GENERAL. This machine is equipped with an air brake system which serves three separate functions. These functions are service brakes, perking brakes and emergency brakes. The operation of each of these sub-systems is described below (see Figures 9A-1 and QA-2).

Compressed air for the operation of the brake system is supplied by an engine driven air compressor, and is stored in a number of tanks on the machine. A governor, mounted on the air compressor, senses the pressure of the air in the tanks, and controls the compressor output. Compression starts when the pressure drops to approximately 105 psi (7.24 BARS) and is stopped by the governor when it reaches approximately 120 psi (8.27 BARS).

SERVICE BRAKES. Supply air from the tanks is available at the brake treadle valve at all times. When the operator depresses the brake treadle, air from the dry tank passes through the treadle valve to the relay end quick release valves, which admits air from the tank to the front and rear service brake chambers. Air pressure in the brake chambers force the brake shoes apart, placing them in contact with the brake drums, and braking force is applied to the wharfs. Inasmuch as the air pressure deliverad to the brake chambars is controlled by the treadle valve, the driver, by operating the treadle valve end controlling the air pressure dalivered to the brake chambers, also controls the braking force being developed.

The relay valve is provided to speed up the application and release of the rear brakes. The valve operates as a remote controlled brake valve, delivering air to the rear service brake chambers which is at the same pressure as the air which is delivered to the relay valve by the treadle, valve.

The relay valve vents air pressure from the rear service brake chambers locally, making it unnecessary for the air to travel back through the line to the treadle valve.

PARKING BRAKES. By depressing the Maxibrake control knob, on the carrier dashboard, the operator can use the Maxibrakes as parking brakes. Depressing the Maxibrake control knob cuts off pressure at the inlet of the exhaust and pressure retaining valve, exhausting air from the spring chambers of the Maxibrakes. Venting the spring chambers allow the power springs to expand and apply the rear wheel brakes.

The brake will remain set until air pressure is reapplied to the spring chambers, compressing the power springs and releasing the brakes.

Pulling out the Maxibrake control knob applies air pressure to the inlet of the exhaust and pressure retaining valve, closing off the exhaust port of the valve. Air pressure then passes through the movable seat of the valve, and into the spring chamber. This compresses the power springs, releasing the brakes.

EMERGENCY BRAKES. The basic Purpose of the Maxibrakes is to provide a means of stopping the vehicle in the event that air pressure is lost or drops below a safe level when the vehicle is in motior..

The Maxibrake control valve functions autometically as well as manually. In the event that air pressure drops to 28 psi (1.93 BARS) or lees, pressure at the inlet port of the control valve will be overcome by the force applied to the valve shuttle by the spring, and the spring will shift the shuttle to the applied Position. This will vent air Pressure from the inlet of the exhaust and pressure retaining valve, thus venting air pressure from the spring chambers. The rear brakes will then be applied by the force created by the power springs.

Air pressure to compress the power springs is normally supplied by the dry tank, through the Maxibrake control valve, to the spring chambers. This arrangement would not provide a means of moving the vehicle from the point at which it was stopped by the Maxibrakes, if the loss of air pressure is due to a failure in an air line or the compressor. Therefore, an emergency air tank, which is isolated from the service air system by a check valve, is provided.

Since the emergency air tank is isolated from the service air system, air pressure will be available in the emergency tank to release the Maxibrakes. To release the Maxibrakes, after an air system failure. the operator would depress the emergency release valve knob and pull out the Maxibrake control knob. This applies air pressure from the emergency tank to the spring chambers. through the Maxibrake control valve and the exhaust and pressure retaining valve. This compresses the power springs. releasing the brakes.

CARRIER REMOTE CONTROL DESCRIPTION

The carrier remote controls operate the carrier steering system, clutch and transmission, and the service brakes by means of air valves and cylinders.

Depressing a pushbutton on the carrier remote control panel, completes an electrical circuit which energizes a solenoid operated air valve. When on air valve is operated, it will allow air to pass through it to an air cylinder which will operate the desired actuator. When the air valve is deenergized. by releasing the pushbutton, air pressure will be blocked, and the air in the cylinder will be vented to atmosphere.

AIR THROTTLE DESCRIPTION

Later machines are equipped with an air operated throttle in both the upper and carrier. Air from the air compressor IS supplied to the selector valve in the carrier cab which directs the air to either the carrier air tank or the upper air tank,

When the throttle pedal in either the carrier or upper cab is depressed, air pressure from the appropriate tank is supplied to the slave cylinder on the engine through the shuttle valve. Air pressure at the slave cylinder moves the engine throttle in the appropriate direction to increase engine speed.

Allowing the throttle pedal to return to the released position will vent air pressure from the slave cylinder, which moves the engine throttle in the appropriate direction to decrease engine speed.

TESTING FOR SERVICEABILITY

To ensure that the brake system is functioning properly, and to aid in scheduling brake system service, a systematic method of checking the serviceability of the system must be employed to be sure that all parts of the system are inspected. The procedure outlined below is one such method.

WARNING

Do not use the brake system to hold the machine while performing the following test. Hold the machine by blocking the wheels with wheel chocks.

1. Drain Air Tanks. Charge the air brake system. Open the drain cocks on each air tank. Close the drain cocks after all devices have been completely drained of all air pressure and condensation.

2. Check Stop Light Switch. With no air pressure in the system, start the engine, depress the brake pedal, and observe the dash gauge pressure when the stop lights light up. Stop lights should normally light when the dash gauge registers approximately 5 pounds (0.34 BARS). Release the brake pedal and the stop light should go out.

3. Check Brake Chamber Push Rod Travel. Apply the brakes and check the push rod travel of each rear brake. Adjust if the stroke is excessive.

4. Check Low Air Pressure Light. Run engine, continuing pressure build-up Low pressure light must remain lit until dash gauge pressure reaches approximately 60 pounds (4.13 BARS), at which point the light should go out.

5. Pressure Build-Up Test. Run engine at fast idle. Time required to raise the air pressure from 50 to 90 pounds (3.44 - 6.20 BARS) will vary, but should not exceed 5 minutes.

6. Governor Setting Test. Run engine. Governor should cut out, stopping further compression, at approximately 120 pounds (8.27 BARS). Reduce air pressure by making a series of brake applications. The governor should cut in, resuming compression, at approximately 105 pounds (7.24 BARS).

7. Leakage Test. Run the engine until the governor cuts out. Stop the engine. Wait until the air pressure stabilizes. With the brakes released, dash gauge pressure drop should not exceed 2 pounds per minute (0.13 BAR/min). Make a full brake application and hold it. Allow the pressure to stabilize. Pressure drop should not exceed 3 pounds par minute (0.20 BAR/min). Check system connections and applicable devices if leakage in either test is excessive.

8. Operating Tests. Connect an accurate test gauge to the brake valve delivery line. Fully charge the air brake system.

Depress the brake pedal fully. Test gauge pressure should approximately equal dash gauge pressure. Hold the pedal in several different positions; delivery should vary rapidly in accordance with changes in pedal position. Check for quick application and release of all brakes.

With the engine stopped, reduce air pressure to approximately 30 pounds (2.06 BARS) by making a series of brake applications. The Maxibrake control knob should move inward to the applied position automatically when the pressure drops below 30 pounds (2.06 BARS). Check the rear brakes to be sure they are in the applied position when the Maxibrake control valve is in the applied position.

Push in the Emergency Release Valve knob and pull out the Maxibrake control valve knob. Pressure from the emergency air tank should be transferred to the Maxibrake control valve and the Maxibrakes should release.

TROUBLESHOOTING

1. INSUFFICIENT BRAKES

Brakes need adjusting, lubricating or relining
Low air pressure in the brake system (below 80 pounds)
Brake valve delivery pressure below normal

2. BRAKES APPLY TOO SLOWLY

Brakes need adjusting or lubricating
Low air pressure in the brake system (below 80 pounds)
Brake valve delivery pressure below normal
Excessive leakage with brakes applied
Restricted tubing or hose line

3. BRAKES RELEASE TOO SLOWLY

Brakes need adjusting or lubricating
Brake valve not returning to fully released position
Restricted tubing or hose line
Exhaust port of brake valve or quick release valve restricted or plugged
Defective brake valve or quick release valve

4. BRAKES DO NOT APPLY

No air pressure in brake system
Restricted or broken tubing or hose line
Defective brake valve

5. BRAKES DO NOT RELEASE

Brake rigging binding
Brake valve not in fully released position
Defective brake valve
Restriction in tubing or hose line

6. BRAKES GRAB

Grease on brake lining - reline brakes
Brake drum out of round
Defective brake valve
Brake rigging binding

7. UNEVEN BRAKES

Brakes need adjusting. lubricating or relining
Grease on brake lining - reline brakes
Brake shoe release spring or brake chamber release spring broken
Brake drum out of round
Brake chamber diaphragm leaking

8. AIR PRESSURE WILL NOT RISE TO NORMAL

Defective air gauge (registering incorrectly)
Excessive leakage.
Reservoir drain cock open
Cut-out cock improperly left open
Governor out of adjustment
No clearance at compressor unloading valves
Slipping compressor drive belt
Defective compressor

9. AIR PRESSURE RISES TO NORMAL TOO SLOWLY

Excessive leakage
Clogged compressor air strainer
No clearance at compressor unloading valves
Engine speed too slow
Compressor discharge valves leaking
Compressor drive belt slipping
Worn compressor
Excessive carbon in compressor cylinder head or discharge line

10. AIR PRESSURE RISES ABOVE NORMAL

Defective air gauge (registering incorrectly)
Compressor governor out of adjustment
Defective compressor governor
Restriction in line between governor and compressor unloading mechanism
Too much clearance at compressor unloader valves
Unloading valve cavities or unloading passage in compressor cylinder head blocked with carbon
Compressor unloading valves stuck closed

TOUBLESHOOTING (Cont'd)

11. AIR PRESSURE DROPS QUICKLY WITH ENGINE STOPPED AND BRAKES RELEASED

Leaking brake valve
Leaking tubing or hose line
Compressor discharge valve leaking
Compressor governor leaking
Excessive leakage elsewhere in the Air Brake System

12. AIR PRESSURE DROPS QUICKLY WITH ENGINE STOPPED AND BRAKES FULLY APPLIED

Leaking brake chamber,
Cutout cock improperly left open
Leaking brake valve
Leaking tubing or hose line

13. COMPRESSOR KNOCKS CONTINUOUSLY OR INTERMITTENTLY

Loose drive pulley
Back lash in drive gears or drive coupling
Worn or burnt out bearings
Excessive carbon deposits in compressor cylinder heed

14. SAFETY VALVE "BLOWS OFF"

Safety valve out of adjustment
Air pressure in the Air Brake System above normal

15. EXCESSIVE OIL OR WATER IN THE BRAKE SYSTEM

Reservoirs not being drained often enough
Compressor passing excessive oil
Compressor air strainer dirty

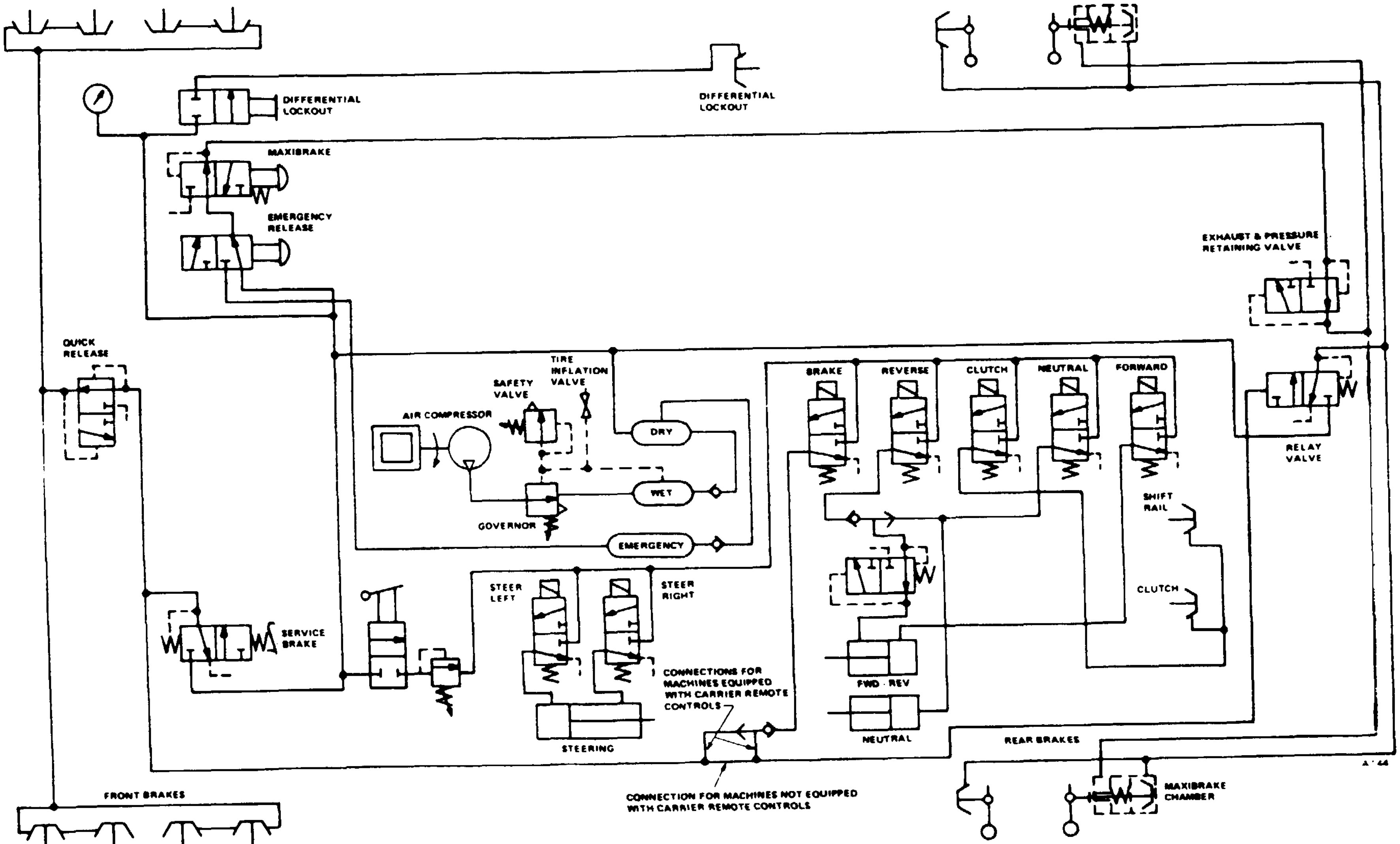


Figure 9A-1. Air System Schematic

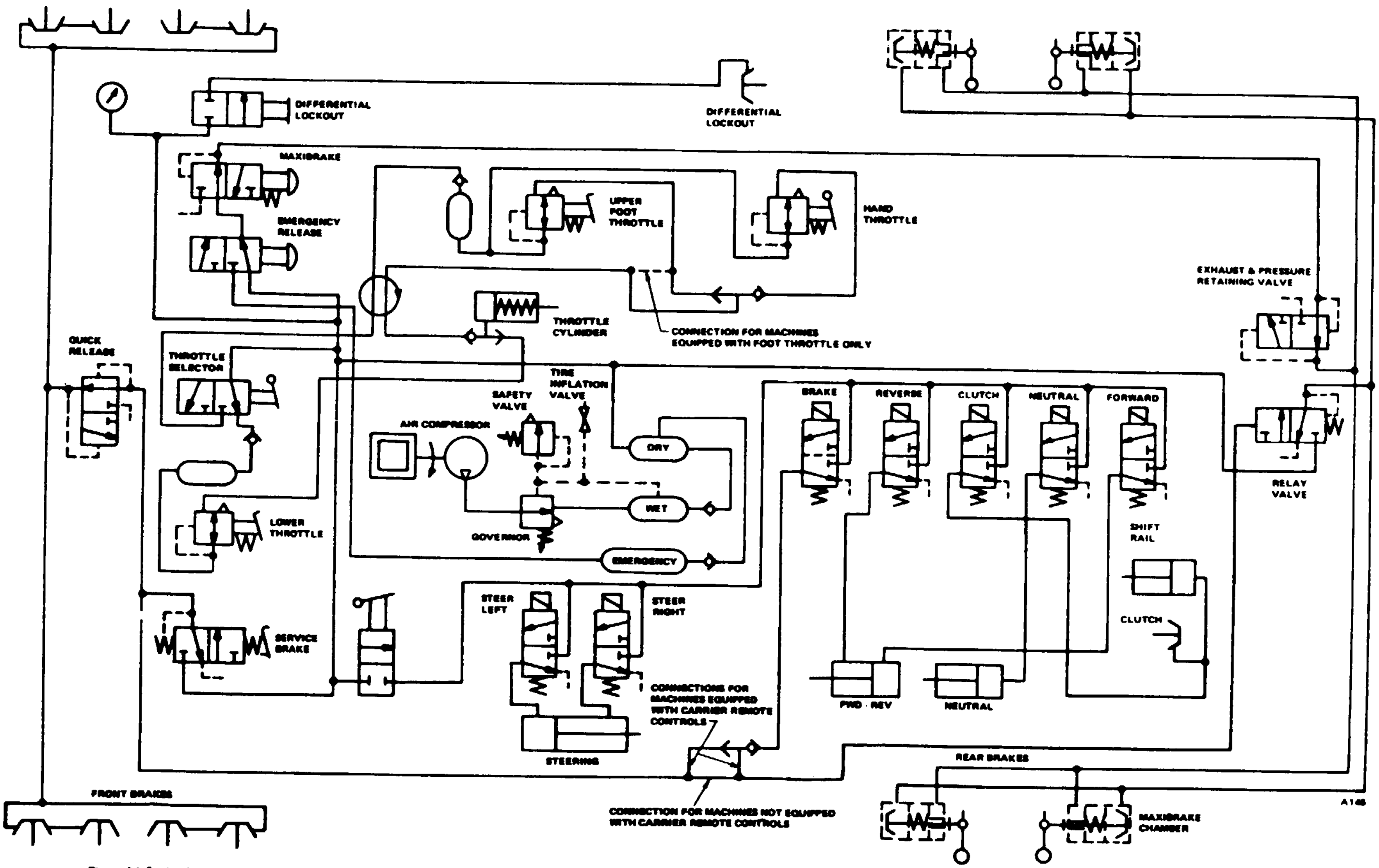


Figure 9A-2. Air System Schematic

SUB-SECTION 9B
AIR COMPRESSORS

GENERAL

The function of the air compressor is to build-up and maintain the air pressure required to operate air powered devices in the air brake, carrier remote controls, and throttle systerns.

OPERATION

The compressor runs continuously while the engine is running, but actual compression of air is controlled by the governor which stops or starts the compression of air by loading or unloading the compressor in conjunction with its unloading mechanism. This is done when the air pressure in the system reaches the desired maximum or minimum pressuns.

During the down stroke of the piston, a slight vacuum created above the piston causes the inlet valve to move off its seat. Atmospheric air is drawn in through the compressor intake, by the open inlet valve, and onto the top of the piston. As the piston starts its upward stroke, the air that was drawn in on the down stroke is being compressed. Now, air pressure on the inlet valve plus the force of its spring, returns the inlet valve to its seat. The piston continues the upward stroke and compresses the air sufficiently to overcome the discharge valve spring and unseats the discharge valve. The compressed air then flows by the open discharge valve, into the discharge line and on to the air tanks.

As the piston reaches the top of its stroke and starts down, the discharge valve spring returns the discharge valve to its seat. This prevents the compressed air in the discharge line from returning to the cylinder bore as the intake and compression cycle is repeated.

When the pressure in the air tanks reach the high pressure setting of the governor, the governor opens, allowing air to pass from the air tank through the governor and into the cavity beneath the unloader pistons. This lifts the unloader pistons and plungers. The plungers move up and hold the inlet valves off their seats.

With the inlet valves held off their seats by the unloader pistons and plungers, air is merely pumped back and forth between the two cylinders. When air is used from the air tank and the pressure drops to the low pressure setting of the governor, the governor closes and in doing so exhausts the air from beneath the unloader pistons. The unloader spring forces the pistons and plungers down and the inlet valves return to their seats. Compression is then resumed.

SERVICE CHECKS

INSPECTION. The following service checks should be performed periodically to ensure proper operation of the air compressor:

WARNING

Do not use the brake system to hold the machine while testing or working on the air system. Hold the machine by blocking the wheels with wheel chocks.

1. It is of utmost importance that the compressor is taking in clean air. Be sure the compressor intake is air tight and that the connections are tight.

2. Check compressor mounting to be sure it is secure.

3. Inspect the oil supply and return lines. Be sure the compressor is getting the proper supply of oil, and just as important, that the oil is returning to the engine properly.

4. Check the water lines to and from the compressor.

AIR LEAKAGE TEST. Leakage past the discharge valves can be detected by removing the discharge line, applying shop air back through the discharge port, and listening for escaping air. Also the discharge valves and unloader pistons can be checked for leakage by building up the air pressure until the governor cuts out, then stop the engine. With the engine stopped, carefully listen for escaping air at the in. take. To pinpoint leakage, if noted, squirt soapy water around the unloader pistons. If there is no noticeable leakage at the unloader pistons, the discharge valves may be leaking.

If the compressor does not function as described above, or leakage is excessive, it is recommended that the nearest Bendix-Westinghouse distributor be contacted for repair information, or that the compressor be returned for a factory rebuilt unit under the repair exchange plan.

NOTE

Air compressors furnished on Cummins engines are serviced by authorized Cummins distributors.

REMOVAL

These instructions are general and would apply to compressors on both GM and Cummins engines, with the major difference being the location of the compressors. To remove the compressor, proceed as follows:

1. Drain the air from the system by opening the drain cocks on each air tank.

2. Drain the engine cooling system, and compressor cylinder head and block.

3. Disconnect all air, water and oil lines to and from the compressor.

4. Remove the compressor mounting bolts. Then remove the compressor from the engine.

INSTALLATION

Installation of the air compressor is basically the reverse of removal. However, to ensure proper performance of the compressor, the following should be inspected before actually installing the compressor:

1. Clean oil supply line. Before connecting this line to the compressor, run the engine briefly to be sure oil is flowing freely through the supply line.

2. Clean the oil return line; this line must be unrestricted so oil can return to the engine.

3. Always use a new mounting gasket. Be sure the gasket is properly aligned on the compressor.

SUB-SECTION 9C
AIR SYSTEM COMPONENTS

SCOPE

This sub-section covers all the valves and devices in the air system, with the exception of the air compressor and the brake chambers.

GOVERNOR (36Z290)

DESCRIPTION. Reservoir air pressure enters the governor at the reservoir port and acts on the area of the piston and on the inlet and exhaust valve (see Figure 9C-1). As the air ressure builds up, the piston moves against the resistance of the pressure-setting spring. When the reservoir air pressure reaches the cut out setting of the governor, the piston and inlet and exhaust valve move up. The exhaust stem seats on the inlet and exhaust valve, shifting the valve to the open position. Reservoir air pressure then flows through a drilled passage in the piston and out the unloader port to the compressor unloading mechanism. The air, besides flowing to the compressor unloading mechanism, also flows around the piston and acts on the additional area of the piston. This additional force, which results from the larger area on the piston, assures a positive action and fully opens the inlet and exhaust valve.

As the system reservoir air pressure drops to the cut in setting of the governor, the force exerted by the air pressure on the piston will be reduced so that the pressure-setting spring will move the piston down. The inlet valve will close and the exhaust will open. With the exhaust open, the air at the compressor unloading mechanism will escape back through the piston, on through the exhaust stem and out the exhaust port.

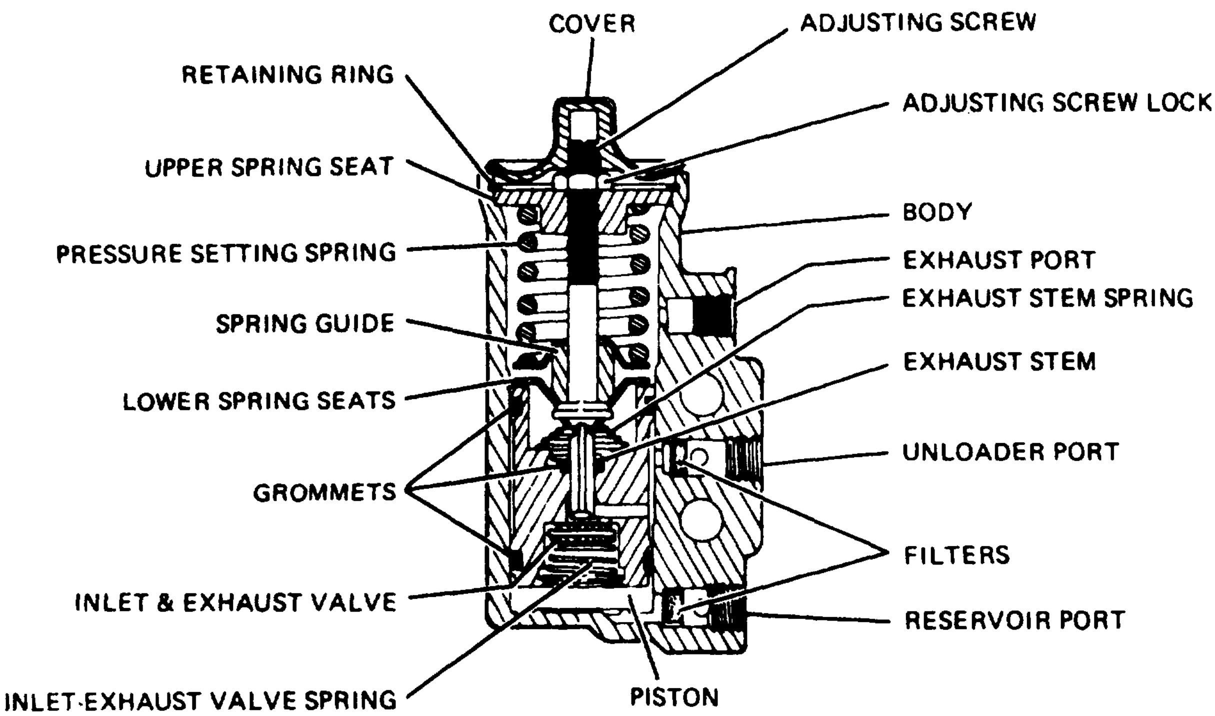


Figure 9C-1. Governor (36Z290)

OPERATING TEST. The operating test is one of the two tests which should be performed to check the operation of the governor when it is suspected that the governor is the cause of en air system malfunction. To perform the operating test, proceed as follows:

Start the engine and build-up air pressure in the air system and check the pressure registered by the dash gauge at the time the governor cuts out and stops the compression of air by the compressor. The cut out pressure should be 120 pounds (8.27 BARS).

With the engine still running, make a series of brake applications to reduce the air pressure end observe at what pressure the governor cuts in the compressor. The cut in pressure should be 100 pounds (6.89 BARS).

NOTE

Never condemn or adjust the governor pressure setting unless they are checked with an accurate test gauge or a dash gauge that is known to be registering accurately.

If the pressure settings are incorrect, adjust the governor Cut out and cut in pressure settings as described under the topic, Adjustment.

LEAKAGE TEST. The leakage test will determine whether the air system malfunction is caused by a worn governor. Perform the leakage test as follows:

With the governor at the cut in pressure, check for leakage at the inlet valve by applying soap suds at the exhaust port.

With the governor at the cut out pressure, check the exhaust valve by applying soap suds to the exhaust port.

If the governor does not function as described, or leakage is excessive, it is recommended that the complete governor be replaced. It is possible, however, to overhaul the governor. If this is the case, contact the nearest Bendix-Westinghouse distributor for the necessary overhaul information and parts.

ADJUSTMENT. To adjust the pressure setting of the governor, first, unscrew the cover et the top of the governor. Next, loosen the adjusting screw locknut. With a screwdriver, turn the adjusting screw counterclockwise to raise the pressure setting or clockwise to lower the pressure setting After the adjustment is completed, tighten the adjusting screw locknut to lock this adjustment.

REMOVAL. To remove the governor, proceed as follow

1. Block and hold the carrier by a means other than the carrier brakes.

2. Open the drain cocks at the bottom of each air reserve to drain the air pressure from the system.

3. Remove the reservoir air Iine. Then remove the governor mounting bolts and governor.

INSTALLATION. To Install a new or rebuilt governor, proceed as follows:

1. Clean the mounting pad on both the compressor and governor block. Also be sure the connecting line and the compressor unloading port are clean and clear.

2. Position a new mounting gasket on the compressor, and install the governor.

3. Connect the air lines to the governor.

4. Test the governor as outlined under the topics, Operating Test and Leakage Test.

AIR RESERVOIR (27Z5 and 26Z558)

DESCRIPTION. A reservoir is a storage tank. The function of a reservoir is to provide a place to store compressed air so there will always be an ample supply available for immediate use in air system operation. It also provides storage for sufficient compressed air to permit several brake appli. cations even after the engine has stopped.

A reservoir has no moving parts and could hardly be said to operate. Nevertheless, things do happen inside the reservoir which are not always understood. All compressors must pass a certain amount of oil in order to lubricate the cylinder wells and piston rings; otherwise, rapid wear or even seizing will result. Also, depending on the humidity, the atmosphere entering the compressor contains a certain amount of water. This oil and water normally passes into the reservoir in the form of vapor because of the heat generated during compression. After they reach the reservoir, the vapors cool and condense in the form of an oil and water emulsion and are drained off before entering the air system proper.

This drainage is often referred to as oil but in most cases analysis will show it to be practically all water. An easy method Of checking the amount of Oil and water in the drainage is to put it in a clear glass sealed container and set the container aside for several days. At the end of this eriod, the oil and water will separate and a visual inspection wilt show the percentage of oil and water in the mixture. The next time you drain the reservoir remember that in all probability only a small percentage of the drainage is oil.

ROUTINE INSPECTION. There is probably no other device in the air system requiring simpler maintenance and yet more important maintenance than the reservoirs.

Many an efficient reservoir arrangement has been defeated in its normal function through haphazard maintenance. Any collector of unwanted oil and water condensation will fail in its function if it is not properly and regularly drained. The simple routine of draining all the reservoir daily will pay dividends far beyond what is generally recognized.

Also when we say drained, we do not mean to open the drain cock and let the air out. Satisfactory draining is only accomplished by leaving the drain cock open after the air has escaped and until all drainage stops.

MINOR REPAIRS. Minor repairs to a reservoir consist of examining the reservoir mounting and the inspection of the outside for corrosion or damage. The outside should be kept painted because based on actual experience the possibility of corrosion causing a failure except from the outside is very remote.

MAJOR REPAIRS. Except in unusual cases, major repairs on reservoirs are not economical or practical. If a reservoir has been damaged so as to be unfit for use, it is most economical to replace it with a new one.

In exceptional cases where the inside of the reservoir has become excessively coated with sludge which cannot be drained off, it is sometimes advisable to remove it and clean it out with steam and hot water.

SAFETY VALVE (3626)

DESCRIPTION. The safety valve protects the air system against excessive air pressure above 150 pounds (10.34 BARS). Should the reservoir pressure below the ball valve rise to a point above the setting of the safety valve, the force developed will overcome the force of the regulating spring holding the ball on its seat, and the ball will lift (see Figure 9C-2). This permits air to pass up into the spring cage and exhaust to atmosphere through the exhaust port. As soon as this exhaust process reduces the pressure to the setting of the safety valve, the regulating spring forces the ball back on its seat, stopping the exhaust.

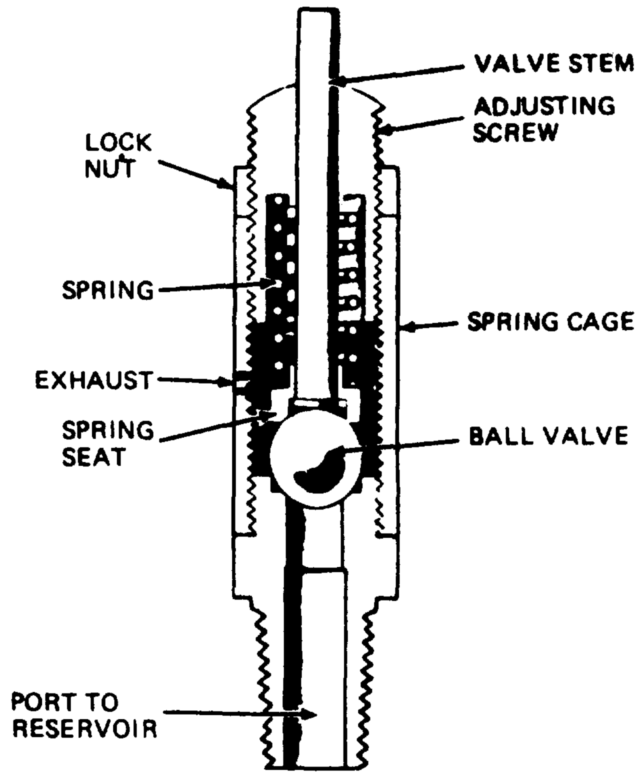


Figure 9C-2. Safety Valve (36Z6)

OPERATING TEST. The safety valve may be tested to be sure it is operative by pulling the exposed end of the valve stem. This removes the spring load from the ball and permits the valve to exhaust. If the safety valve does not “blow off” when this is done, the ball must be stuck on its seat. The valve should be removed and disassembled for cleaning.

LEAKAGE TEST. Leakage at the exhaust port should not exceed a three-inch soap bubble in three seconds.

PREVENTIVE MAINTENANCE. Every year or after every 50,000 miles (60,467 km) of operation, the safety valve should be removed and cleaned as follows (see Figure 9C-3) :2.

1. Unscrew the spring cage from the body of the safety valve. Lift the bell valve from the body and remove the spring, spring seat and release pin from the spring cage.

2. Clean all parts in cleaning solvent. Inspect the parts for excessive wear, cracks or damage. If wear or damage is excessive, the complete safety valve should be replaced.

3. Place the ball valve in the body of the safety valve. Place the spring release pin and spring seat in the spring cage with the adjusting screw assembly. Position the spring seat over the ball valve and screw the spring cage to the body.

TEST OF REBUILT SAFETY VALVES. Both the opera. ting and Ieakage test must be made after repairing the safety valve and the valve must meet the following specifications:

1. Leakage at the exhaust port should not exceed a three-inch soap bubble in three seconds.

2. The safety valve should be set to “blow off” at approxi. mately 150 pounds (10.34 BARS). The pressure setting may be adjusted by loosening the locknut and turning the adjusting screw. Turning the adjusting screw clockwise, raises the pressure setting. Turning the adjusting screw counterclockwise. lowers the pressure setting. The setting of the adjusting screw should be locked by tightening the adjusting screw locknut after each adjustment. An accurate test gauge should be used when adjusting pressure setting of the safety valve.

TREADLE VALVE (36Z225)

DESCRIPTION. The treadle valve is the control unit of the air brake system. It provides the driver with an easily operated and graduated means of applying or releasing the vehicle brakes.

When the treadle IS pressed down by the driver’s foot, force IS exerted on the plunger, rubber graduating spring and to the piston (see Figure 9C-3). The piston moves down and its stem which is the exhaust seat closes the exhaust. As the exhaust closes. the inlet valve moves off its seat. Air pressure from the reservoir then flows in by the inlet valve and out the delivery port to the brake actuators.

When the air pressure in the cavity beneath the piston and the air pressure being delivered to the brake actuators equals the mechanical force on the top of the piston, the piston lifts and the inlet valve closes, cutting off any further flow of air from the supply line through the valve. The exhaust remains closed, preventing any escape of air through the exhaust port.

When applications in the above average pressure range are made, the valve reaches a balanced position as the air pressure beneath the piston equals the effort exerted by the driver’s foot on the treadle. When the piston is pressed down all the way, the inlet valve remains open and reservoir pressure is delivered to the actuators.

If the treadle application is released and mechanical force is removed from the top of the piston, the air pressure beneath the piston is then greater end the piston lifts, opening the exhaust in the valve. The air below the piston and in the delivery lines is then exhausted through the exhaust port.

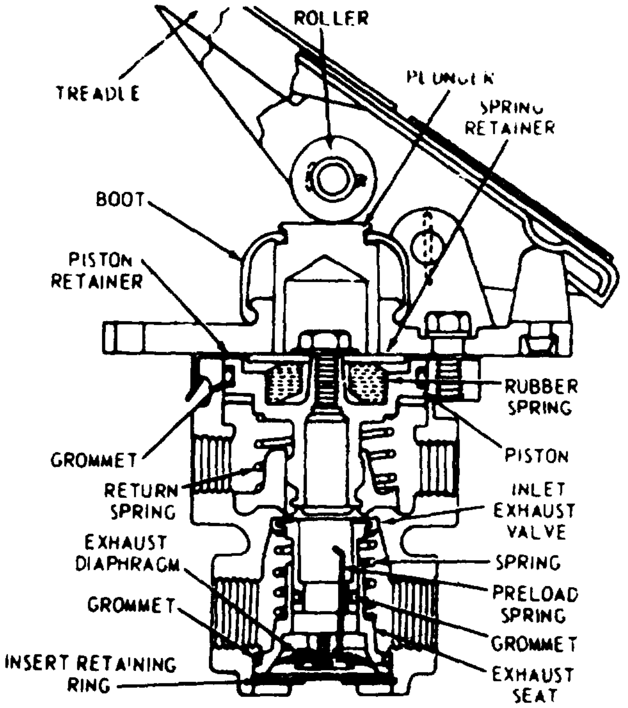


Figure 9C-3. Treadle Valve (38Z225)

OPERATING TEST. Check the delivery pressure of the treadle valve using a test gauge known to be accurate. Depress the treadle to several positions between the fully released and fully applied positions and check the delivered pressure to see that it varies proportionately with the move. ment of the treadle. When the treadle is fully applied the reading on the test gauge should be approximately that of full reservoir pressure. The reading on the test gauge should fell off to zero when the treadle is released.

LEAKAGE TEST. With the valve fully released, check the exhaust port for leakage. No leakage is permissible. Make and hold a high pressure application. Coat the exhaust port and the top of the valve with soap suds. No leakage is permissible.

If the treadle valve does not function as described above, or leakage is excessive, it is recommended that the complete valve be replaced. If it is desired to rebuild the treadle valve, contact the nearest Bendix-Westinghouse distributor for overhaul information and parts.

NOTE

The inlet end exhaust valve assembly, generally referred to as the E-2 insert. can be removed end replaced without disturbing the valve mounting or its connections. Contact a Bendix-Westinghouse distributor for further information on the insert. *Before removing the insert, it is important that the air system be drained.*

REMOVAL. To remove the treadle valve, proceed as follows:

1. Block and hold the vehicle by some means other than the carrier brakes.

2. Open the drain cock on each reservoir to exhaust air pressure from the air system.

3. Disconnect the air lines attached to the treadle valve. Remove the mounting bolts. Then remove the treadle valve.

INSTALLATION. To install a new or rebuilt treadle valve, proceed as follows:

1. Clean the air line to the treadle.

2. Mount the treadle valve on the cab floor and install the mounting bolts.

3. Connect the air line to the valve and plug any unused ports.

4. Test the valve for serviceability by performing the Operating and Leakage Tests.

QUICK RELEASE VALVE (38Z254)

DESCRIPTION. The quick release valve speeds up the release of air pressure from the brake chambers. The operation of the quick release valve is as follows (see figure 9C-4):

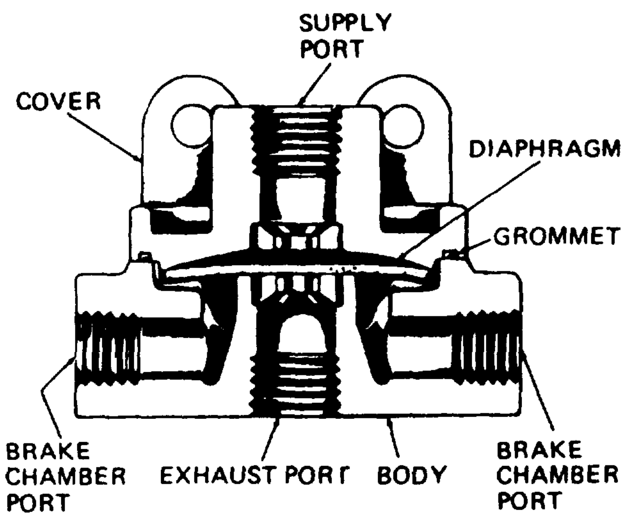


Figure 9C-4. Quick Release Valve (36Z254)

When a treadle valve application is made, air pressure enters the top (supply) port of the quick release valve, Air pressure at this port moves the diaphragm down and closes the exhaust port. At the same time, this air pressure forces the edges of the diaphragm down, and air flows by the diaphragm to the brake chambers.

As soon as the brake chamber pressure beneath the diaphragm equals the air pressure being delivered to the valve, the outer edge of the diaphragm will seal against the cover seat. The exhaust port remains sealed by the center portion of the diaphragm. When the treadle valve is released, air pressure above the diaphragm is exhausted, allowing the diaphragm to raise, opening the exhaust port and allowing brake chamber pressure to exhaust through the quick release valve.

OPERATING TEST. Make a treadle valve application and note that the brake chambers served by the quick release valve apply the brakes. Release the application and observe that the air pressure is quickly exhausted through the exhaust port of the quick release valve.

LEAKAGE TEST. Make and hold a treadle valve application, and then check the exhaust port of the quick release valve for leakage. If the valve does not function as just described, or leaks excessively, it is recommended that the valve be replaced. If overhaul information is required, contact the nearest Bendix-Westinghouse distributor.

REMOVAL. To remove the quick release valve, proceed as follows:

1. Block or hold the vehicle in position with wheel chocks.

2. Open the drain cocks on each reservoir to drain the air pressure from the air system.

3. Disconnect the air lines connected to the quick release valve.

4. Remove the mounting bolts, and then the valve.

INSTALLATION. Install a new or rebuilt quick release valve as follows:

1. Mount the quick release valve with mounting bolts and lockwashers with the valve's exhaust port pointing down.

2. Connect the treadle valve line to the top port and the brake chamber lines to the side ports of the valve.

3. Be sure the exhaust port of the valve is not restricted.

4. Test the valve for serviceability by performing the Operating and Leakage Tests.

RELAY VALVE (36Z291)

DESCRIPTION. The relay valve serves to speed up the application and release of the rear wheel brakes. The valve operates as a remote controlled brake valve, delivering air pressure directly from the reservoir to the brake chambers, at a rate proportional to the pressure delivered to the front brake chambers by the treadle valve.

The relay valve (see Figure 9C-5) operates very rapidly because of the small volume of air required to fill the space between the cover and diaphragm. When the treadle valve is depressed, air pressure is delivered to the relay valve and enters the relatively small cavity above the diaphragm. The pressure developed in the cavity depresses the diaphragm and seals it against the exhaust seat. At the same time, it moves the diaphragm guide down and opens the inlet valve, permitting air to flow from the dry tank through the relay valve, and to the brake chambers.

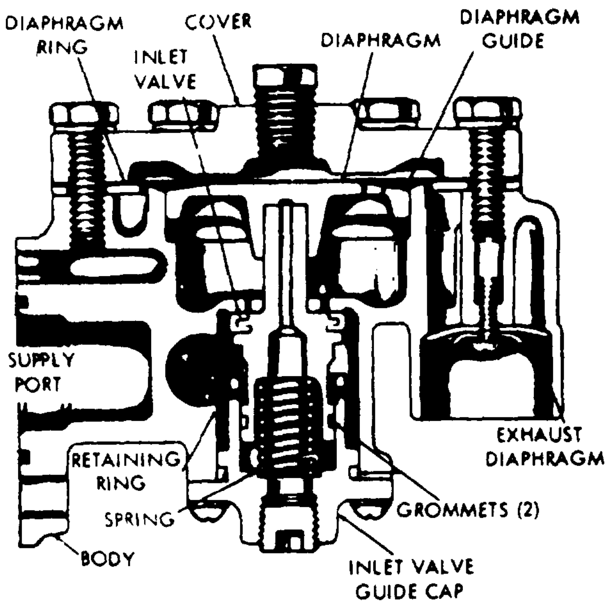


Figure 9C.5. Relay Valve (36Z291)

As the air pressure below the diaphragm equals that above the diaphragm, the inlet valve returns to its seat (balanced condition) and the brake application is held at whatever pressure the operator desires. A relief slot in the bottom of the diaphragm guide permits air pressure to enter the cavity below the inlet valve piston through the drilled hole in the valve stem, thus assuring a positive balance of air pressure above and below the diaphragm.

When the treadle valve is released, the air pressure in the cavity above the diaphragm and the connecting line is exhausted through the exhaust port of the treadle valve. When this occurs, the air pressure below the diaphragm moves the diaphragm and diaphragm guide up, opening the exhaust passage in the relay valve. exhausting air pressure from the brake chambers through the relay valve exhaust port.

OPERATING AND LEAKAGE TEST. To determine the serviceability of the relay valve, perform the following test:

1. Fully charge the air system.

2. Make several brake applications and check for prompt application and release of all rear wheel brakes.

3. With the treadle valve in the fully released position, coat the exhaust port of the relay valve with soap suds. A maximum leakage of a one inch soap bubble in not less than three seconds is permissible.

4. Make and hold a brake application. Coat the exhaust port of the relay valve with soap suds. A maximum leakage of a one inch soap bubble in not less than two seconds is permissible.

5. If the relay valve does not function as just described, or leaks excessively, it is recommended that the valve be replaced. If overhaul of the valve is desired, contact the nearest Bendix-Westinghouse distributor for overhaul information and parts.

NOTE

The valve assembly, generally referred to as the R-5 insert, can be removed and replaced without removing or disconnecting the lines attached to the valve. Contact the nearest Bendix-Westinghouse dis. tributor for information on the insert.

REMOVAL. To remove the relay valve, proceed as follows:

1. Block or hold the vehicle with wheel chocks.

2. Open the drain cock on each reservoir to drain the air pressure from the system.

3. Disconnect the air lines attached to the relay valve.

4. Remove the mounting bolts, and then remove the valve.

INSTALLATION. To install a new or rebuilt relay valve, proceed as follows:

1. Clean or replace the air lines connected to the relay valve. Replace any damaged air lines.

2. Mount the relay valve and secure it in place with the mounting bolts,

3. Test the valve for serviceability as outlined in Oparating and Leakage Test.

RELAY VALVE (36Z650)

DESCRIPTION. The relay valve serves to speed up the ap plication ma release of the rear wheel brakes. The valve operates as a remote controllad brake valve, delivering air pressure directly from the reservoir to the brake chambers, at a rata proportional to the pressure delivered to the front brake chambers by the treadle valve.

The relay valve acts very rapidly because of the small volume of air required between the cover and relay piston (see Figure 9C-6). When the treadle valve is applied, air pressure enters this small cavity above the piston through the service port and forces the piston down. The exhaust valve seat moves down with the piston and seats on the inner or exhaust port of the inlet and exhaust valve, sealing off the exhaust passage. At the same time, the outer or inlet part of the inlet and exhaust valve moves off its seat, permitting air from the dry tank past the open inlet valve to the brake chambers.

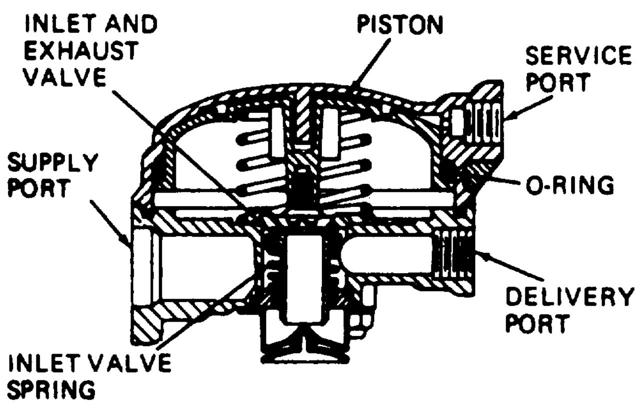


Figure 9C-6. Relay Valve (36Z650)

me air pressure being delivered by the open inlet valve is also impressed on the bottom area of the relay piston. When this pressure beneath the piston approaches that king delivered above, the piston spring lifts the piston slightly and the inlet valve spring returns the inlet valve to its seat. The exhaust remains closed as the service line pressure balances the delivery pressure,

When the deliverad pressure is raised, lowered or completely exhaustad, the valve reacts instantly to these changes. If the treadle valve is released, the air above the piston is exhausted. The air beneath the piston will then lift the piston and the exhaust valve, exposing the exhaust passage to atmosphere. With the exhaust passage open, the air pressure in the brake chamber is vented through the relay valve, ad the brakes release.

OPERATING AND LEAKAGE. TEST To determine the serviceability of the relay valve, perform the following test:

1. Fully charge the air system and adjust the brakes.

2. Make several brake applications and check for prompt application and release of all rear wheel brakes.

3. With the treadle valve in the released position, check the exhaust port of the relay valve for inlet valve and valve guide O-ring leakage. This can be done by applying soap suds to the exhaust valve,

4. Make and hold a treadle valve, and check the exhaust port for leakage. If excessive leakage is detected, the insert or exhaust valve only should be replaced. If leakage still occurs at the exhaust port, the leakage could be at the relay piston O-ring or possibly at the exhaust valve seat. Continue to hold the brake application and check between the cover and body for cover O-ring leakage.

5. If the valve does not function as described in the above test, or if leakage is excessive, it is recommendad that the valve be replaced. If the valve is to be overhauled, contact the nearest Bendix-Westinghouse distributor for overhaul information and the necessary parts.

NOTE

The inlet and exhaust valve assembly, generally referred to as the R-6 insert, can be removed and replaced without disturbing the valve mounting or connecting lines. Contact Bendix-Westinghouse for information concerning the insert.

REMOVAL. To remove the relay valve, proceed as follows:

1. Block and hold the vehicle with wheel chocks.

2. Open the drain cock on each reservoir to drain the pressure from the air system.

3. Disconnect the air lines attached to the relay valve.

4. Remove the valve mounting bolts and remove the valve.

INSTALLATION. To install a new or rebuilt relay valve, proceed as follows:

1. Clean and inspect the air lines which connect to the relay valve. Replace any air lines which are damaged.

2. Mount the relay valve securely with the mounting bolts.

3. Connect the air lines to the valve.

4. Test the valve for serviceability as outlined under the topic Operating and Leakage Test. Also, check the air line connections for leakage.

EXHAUST & PRESSURE RETAINING VALVE (36Z221)

DESCRIPTION. The exhaust and pressure retaining valve performs two important functions. One is to keep the Maxi-brakes from easing to the applied position due to low air pressure. The other function is to provide a quick local release of air pressure from the Maxibrake chambers when the Maxibrake control valve is manually or automatically operated.

When air pressure from the Maxibrake control valve is sup plied to the inlet port of the valve, the moveable seat is shifted away from the inlet port, closing off the exhaust port of the valve (see Figure 9C-7). The air pressure must then pass through the drilled passage in the movable seat, pass the check valve, and then out to the Maxibrakes. When the pressure at the Maxibrakes equals the pressure at the inlet port, the check valve will seat. This will prevent the air pressure at the Maxbrakes from exhausting through the inlet or exhaust port of the valve.

When the air pressure is vented from the inlet port of the valve, through the Maxibrake control valve, the pressure holding the movable seat against the exhaust port seal is removed. This allows the pressure in the Maxibrakes, acting on the bottom of the movable seat, to lift the seat. This opens the exhaust port, allowing the pressure in the Maxi-brakes to exhaust through the exhaust port.

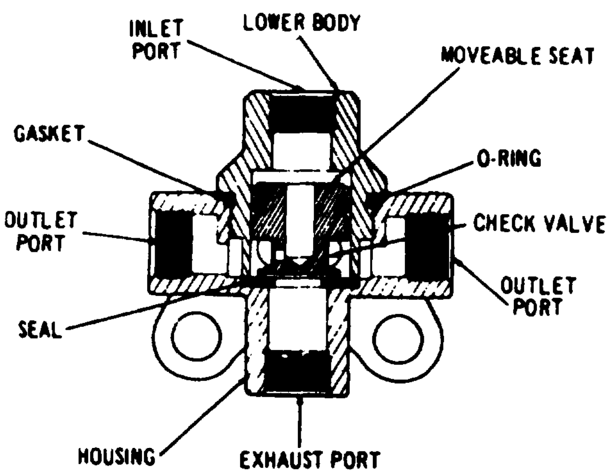


Figure 9C-7. Exhaust & Pressure Retaining Valve (36Z221)

OPERATING AND LEAKAGE TEST. To determine the serviceability of the exhaust and pressure retaining valve, perform the following test:

1. Block the vehicle in position with wheel chocks.

2. Fully charge the air system.

3. Pull the Maxibrake control knob outward from the dash panel. The Maxibrakes should release the rear wheel brakes.

4. Apply a soap solution to the exhaust port of the valve to detect any leakage. Replace the valve if leakage is excessive.

5. Push the Maxibrake control knob in and note whether or not the Maxibrakes set quickly.

6. If the valve does not function as just described, or leaks excessively, it should be replaced or overhauled.

REMOVAL. To remove the exhaust and pressure retaining valve, proceed as follows:

1. Block the vehicle in position with wheel chocks.

2. Open the drain cock on each reservoir to drain the air system, and depress the Maxibrake control knob to vent any pressure which may be in the Maxibrakes.

3. Disconnect the lines attached to the valve, Then remove the valve from the machine.

OVERHAUL. Overhaul of this valve is limited to the re-placement of the seal, O-ring, gasket, and check valve. To replace these items, proceed as follows (see Figure 9C-7):

1. Using a suitable wrench, unscrew the lower body from the housing.

2. Remove the O-ring, seal, gasket, and check valve.

3. Wash all the remaining parts in cleaning solvent.

4. Reassemble the new O-ring, seal, gasket, and check valve as shown in Figure 9C-7.

INSTALLATION. To install a new or overhauled exhaust and pressure retaining valve, proceed as follows:

1. Mount the valve on the machine and secure it with mounting bolts.

2. Conned the air lines to the valve.

3. Test the operation of the valve by performing the Operating and Leakage Test.

MAXIBRAKE CONTROL VALVE (39Z222)

DESCRIPTION. The Maxibrake control valve provides manual driver control as well as automatic application of the Maxibrake safety chambers.

The Maxibrakes are released when the sir system is fully merged and the Maxibrake Control Knob is pulled out. Under these conditions, air pressure enters the valve at the inlet, port and flows through the drilled passage in the shuttle to the outlet port (see Figure 9C-8). The air flowing to the outlet also applies pressure to the bottom of the shuttle, compressing the spring et the top of the shuttle. This holds the valve in the open position as long aS the service air pressure is sufficient to hold the spring in the compressed position.

If the service air pressure should drop to approximately 28 psi (1.93 BARS), the pressure at the bottom of the shuttle would be insufficient to hold the valve in the open position. When this occurs, the spring at the top of the shuttle will shift the shuttle to the closed position. This will block the inlet port and connect the outlet port to the exhaust port, allowing air pressure in the Maxibrake safety chambers to exhaust.

NOTE

The same sequence of events occurs when the shuttle is shifted to the closed position manually by the operator. This allows the operator to use the Maxibrakes as parking brakes.

OPERATING AND LEAKAGE TEST. To determine the serviceability of the Maxibrake control valve, perform the following test:

1. Block the wheels with wheel chocks to prevent movement of the machine while performing this test,

2. Fully charge the air system.

3. Pull the Maxibrake control knob outward from the dash panel, and check the rear wheel brakes. The brakes should release when air is applied to the Maxibrake safety chambers.

4. Coat the exhaust port of the Maxibrake control valve with soap suds to determine if leakage exists.

5. Make a series of brake applications and observe the Maxibrake control knob. The knob should automatically move inward, toward the dash panel, when the service air pressure drops to approximately 28 psi (1.93 BARS). This pressure can be checked with the air gauge on the dash panel.

6. If the valve does not function as described above, or excessive leakage is present, it is recommended that the valve be replaced or overhauled.

REMOVAL. To remove the Maxibrake control valve, proceed as follows:

1. Open the drain cock on each reservoir to drain the air pressure from the system. Check the Maxibrake control knob to be sure that it is pushed in fully. This will vent any air pressure which may be in the Maxibrake safety chambers.

2. Loosen the locknut and remove the knob. After the knob has been removed, remove the locknut.

3. Disconnect the two air lines attached to the valve.

4. Remove the mounting bolts and nameplate, and then remove the valve.

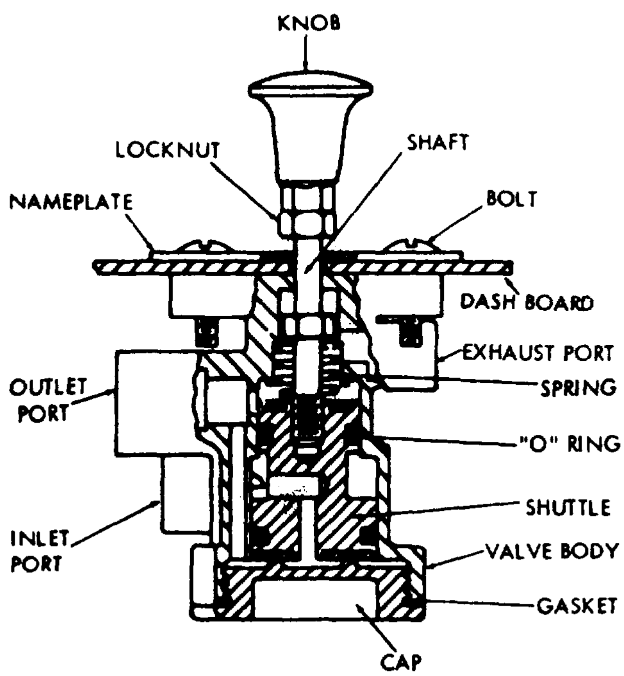


Figure 9C-8. Maxibrake Control Valve (36Z222)

OVERHAUL. Overhaul of this valve is limited to the replacement of two O-rings and a gasket. To replace these parts, proceed as follows (see Figure 9C-8):

1. Using a suitable wrench, unscrew the cap from the bottom of the valve body.

2. Carefully remove the shuttle by pushing it out the bottom of the valve body with the shaft.

3. Remove the gasket from the cap and the two O-rings from the shuttle.

4. Wash all remaining parts in cleaning solvent.

5. Install the two O-rings in their respective grooves.

6. Carefully install the shuttle in the valve body. Be sure the O-rings do not extrude as the shuttle is installed. Install the gasket on the cap, and install the cap in the bottom of the valve body.

INSTALLATION. To install a new or overhauled valve, proceed as follows :

NOTE

If a new valve is being installed, the knob and locknut must be removed from the shaft.

1. Position the valve on the underside of the dash panel. Then install the nameplate on the topside of the dash panel, and secure the valve with the mounting bolts,

2. Install the locknut and knob on the end of the shaft. Secure the knob by tightening the locknut.

3. Connect the two air lines to the inlet and outlet ports of the vaive.

4. Test the operation of the newly installed valve by performing the Operating and Leakage Test.

EMERGENCY RELEASE VALVE (36Z362)

DESCRIPTION. The emergency release valve provides a means of transferring protected air from the emergency air tank to the Maxibrake control valve when service air pressure is lost.

When the knob is pulled out, the emergency air inlet is blocked, and the service air inlet is connected to the Maxibrake control valve outlet. In this can, the air at the service air inlet flows through the drilled passages in the plunger to the outlet port (see Figure 9C-9).

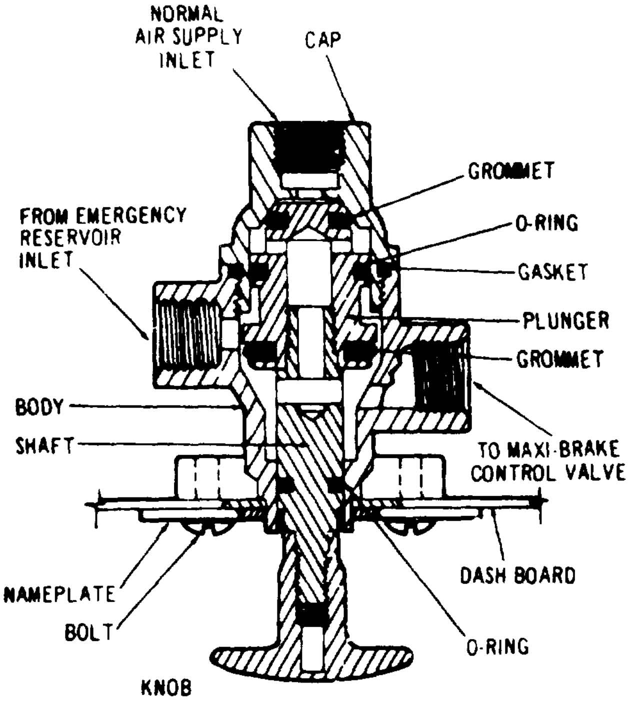


Figure 9C-9. Emergency Release Valve (362362)

When the knob is depressed, the service air inlet is blocked end the emergency air inlet is connected to the Maxibrake control value outlet. Air from the emergency air tank can then flow around the plunger to the outlet port.

LEAKAGE TEST. The only factor that could affect the operation of the emergency release valve would be internal leakage between the service end emergency air inlets. If this leakage is excessive, the air pressure in the emergency air tank could be lost, which would prevent releasing the Maxi-brakes. To check for internal leakage, proceed as follows:

1. Depress the emergency release valve knob.

2. Open the drain cock on the wet and dry air tanks to drain the air pressure from the service air system. Do not drain the emergency air tank.

3. Loosen the service air connection at the valve. Coat the connection with a soap solution to determine if any leakage from the emergency air inlet to the service air inlet exists. If leakage is excessive, the valve should be replaced or over. hauled.

REMOVAL. To remove the emergency release valve, proceed es follows:

1. Remove the knob from the end of the shaft. If the knob is equipped with a locknut, it will be necessary to loosen

1. Be locknut before the knob can be removed. Then remove the locknut.

2. Disconnect the air lines connected to the valve.

3. Remove the mounting bolts end nameplate. Then remove the valve.

OVERHAUL. Overhaul of this valve is limited to the replacement of two grommets, two O-rings end a gasket. To replace these parts, proceed as follows (see Figure 9C-9):

1. Using a suitable wrench, unscrew the cap from the body. Remove the gasket from the cap.

2. Carefully push the plunger out the bottom of the body, by pushing on the knob end of the shaft. Remove the two grommets and the two O-rings on the plunger.

3. Wash all the remaining parts in cleaning solvent.

4. Install the grommets end O-rings on the plunger as shown in Figure 9C-9.

5. Carefully install the plunger in the body. Be sure the grommets end O-rings do not extrude when the plunger is installed in the body.

6. Install the gasket on the cap. Then install the cap on the bottom of the body.

INSTALLATION. To install a new or overhauled valve. proceed es follows:

NOTE

If a new valve is being installed, it will be necessary to remove the knob and locknut.

1. Position the valve on the underside of the dash panel. Then install the nameplate and secure the valve to the dash panel with the mounting bolts.

2. Install the locknut and knob. Then connect the air lines to the valve.

3. Check the operation of the valve by performing the Leakage Test.

DIFFERENTIAL LOCKOUT VALVE (36Z289)

DESCRIPTION. Differential lockout valve 36Z289 is a palm operated, spring returned, two way air control valve (see Figure 9C-10). The valve is used to control the operation of the interaxle differential.

When the palm button of the valve is in the depressed position, the valve is on, Its inlet valve is off its seat and the exhaust is closed. In this position, air has free passage through the valve to the interaxle differential lockout cylinder.

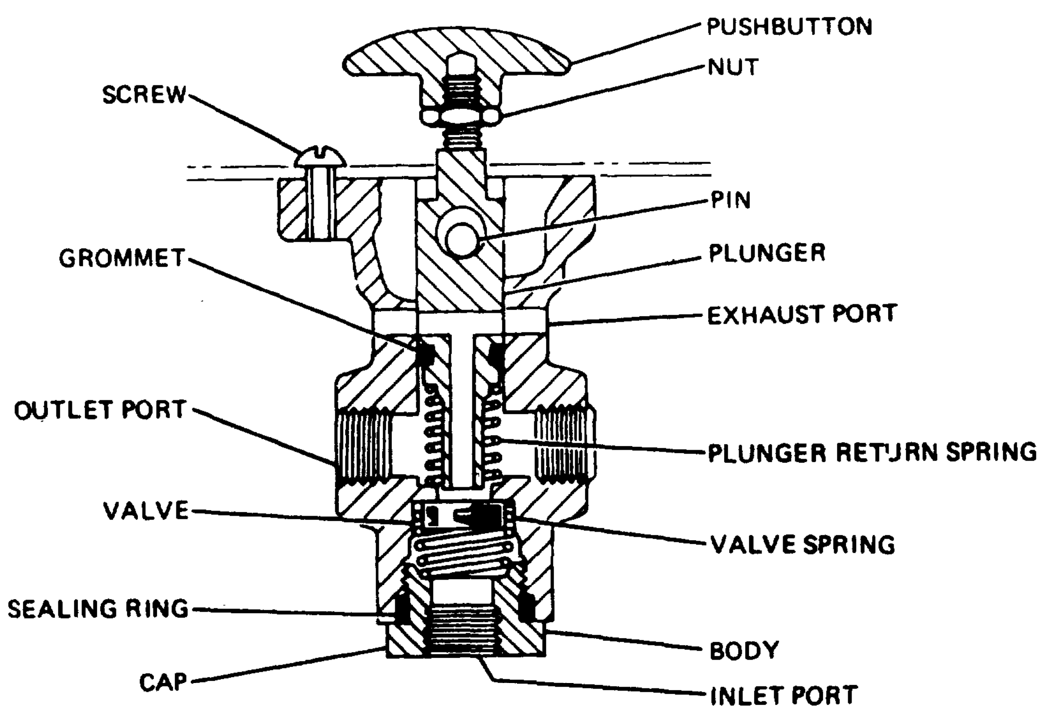


Figure 9C-10. Differential Lockout Valve (36Z289)

When the palm button is in the released position, the return spring shifts the valve off. The inlet valve is now seated end the exhaust is open. Air is now prevented from passing through the valve. while the air in the interaxle differential lockout cylinder is allowed to exhaust through the exhaust port of the valve.

LEAKAGE TEST. To determine if the valve is leaking internally, perform the following test:

1. Fully charge the air system.

2. Coat the exhaust port of the valve with a soap solution to check for Ieakage.

3. Depress end hold the palm button of the valve. Then coat the exhaust port of the valve with a soap solution to check for Ieakage.

4. If the valve doer not function es described, or leeks excessively, it is recommended that the valve be replaced.

REMOVAL. To remove the differential lockout valve, proceed as follows:

1. Drain the air system by opening the drain cock on each reservoir.

2. Disconnect the air lines et the valve.

3. Loosen the locknut and remove the palm button. Then remove the locknut.

4. Remove the two screws on the valve dial, and remove the valve dial. The valve can now be removed from the dash panel.

INSTALLATION. To install a new differential lockout valve, proceed as follows:

1. Place the valve on the underside of the dash panel with the screw holes properly aligned with the holes in the dash panel.

2. Place the valve dial on the topside of the dash panel, over the valve. Then install the screws to secure the valve end dial to the dash panel.

3. Reconnect the air lines to the valve. Install the lock nut end palm button on the end of the plunger.

4. Check the operation of the valve by performing the Leakage Test.

DIFFERENTIAL LOCKOUT VALVE (36Z1025)

DESCRIPTION. Differential lock valve 36Z1025 is a lever-operated, two way air control valve (see Figure 9C-11). The valve is used to control the operation of the interaxle differential.

When the handle of the valve is in the LOCK position, the valve is on. Its inlet valve is off its seat end the exhaust is closed. In this position. air has free passage through the valve to the interaxle differential lockout cylinder.

When the handle of the valve is in the UNLOCK position, the valve is off. The inlet valve is now stated and the exhaust is open. Air is now prevented from passing through the valve, while the air in the interaxle differential lockout cylinder is allowed to exhaust through the exhaust port of the valve.

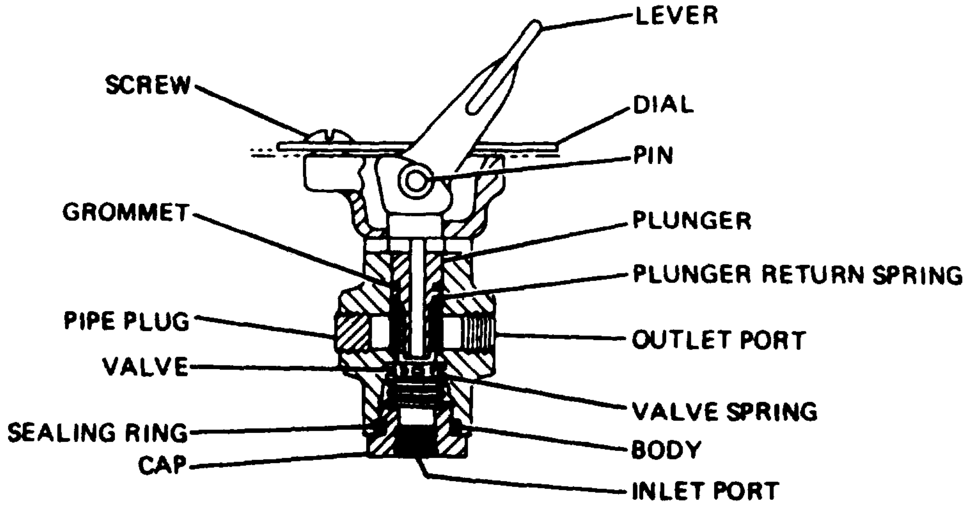


Figure 9C-11. Differential Lookout Valve (36Z1025)

LEAKAGE TEST. To determine if the valve is leaking inter. nally, perform the following test:

1. Fully charge the air system.

2. Place the control lever in the LOCK position. Coat the exhaust port of the valve with a soap solution to check for leakage.

3. Place the control lever in the UNLOCK position. Then coat the exhaust port with a soap solution to check for leakage.

4. If the valve does not function as described, or leaks excessively, it is recommended that the valve be replaced.

REMOVAL. To remove the differential lockout valve, proceed as follows:

1. Drain the air system by opening the drain cock on each reservoir.

2. Disconnect the air lines at the valve.

3. Remove the two screws on the valve dial, and remove the valve dial. The valve can now be removed from the dash panel.

INSTALLATION. To install a new differential lockout valve, proceed as follows:

1. Place the valve on the underside of the dash panel with the screw holes properly aligned with the holes in the dash panel.

2. Place the valve dial on the topside of the dash panel, over the valve. Then install the screws to secure the valve and dial to the dash panel.

3. Reconnect the air lines to the valve.

4. Check the operation of the valve by performing the Leakage Test.

THROTTLE SELECTOR VALVE (36Z971)

DESCRIPTION. Throttle selector valve 36Z971 is a lever operated, three way air control valve (see Figure 9C-12). The valve is used to direct air from the air system to either the upper or lower throttle reservoir.

When the handle of the valve is in the UPPER position, the upper delivery port is on and the lower delivery port is off. In this position, the upper delivery port inlet valve is off its seat and the exhaust is closed. Air pressure then has free passage through the valve to the upper throttle reservoir.

The inlet valve of the lower delivery port is seated when the handle is in the UPPER position. This prevents air from passing through the valve and allows any air pressure which is trapped in the air line to the lower throttle reservoir to escape through the valve.

The selector valve operates in exactly the same manner when the handle is in the LOWER position, except that the air is directed to the lower throttle reservoir.

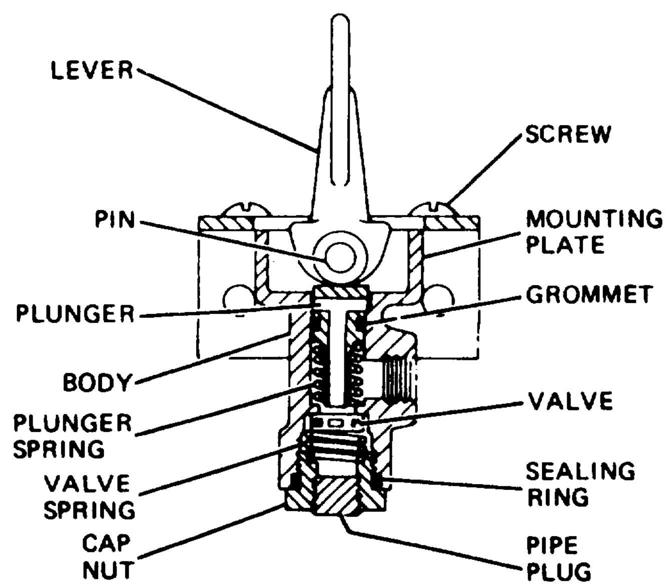
LEAKAGE TEST. To determine if the valve is leaking internally, perform the following test:

1. Fully charge the air system.

2. Place the handle in the UPPER position. Then coat the area around the handle with a soap solution to check for leakage.

3. Place the handle in the LOWER position. Again, coat the area around the handle with a soap solution to check for leakage.

4. If leakage is excessive, it is recommended that the valve be replaced.



NOTE: HALF OF VALVE SHOWN. OTHER HALF IDENTICAL TO HALF SHOWN.

Figure 9C-12. Throttle Selector Valve (36Z971)

REMOVAL. To remove the throttle selector valve, proceed as follows:

1. Drain the air system by opening the drain cocks on each reservoir.

2. Disconnect the air lines at the valve.

3. Remove the two screws on the valve dial, and remove the valve dial. The valve can now be removed from the cab wall.

INSTALLATION. To install a new throttle selector valve, proceed as follows:

1. Place the valve on the engine side of the cab wall with the screw holes properly aligned with the holes in the cab wall.

2. Place the valve dial over the valve. Then install the screws to secure the valve to the cab wall.

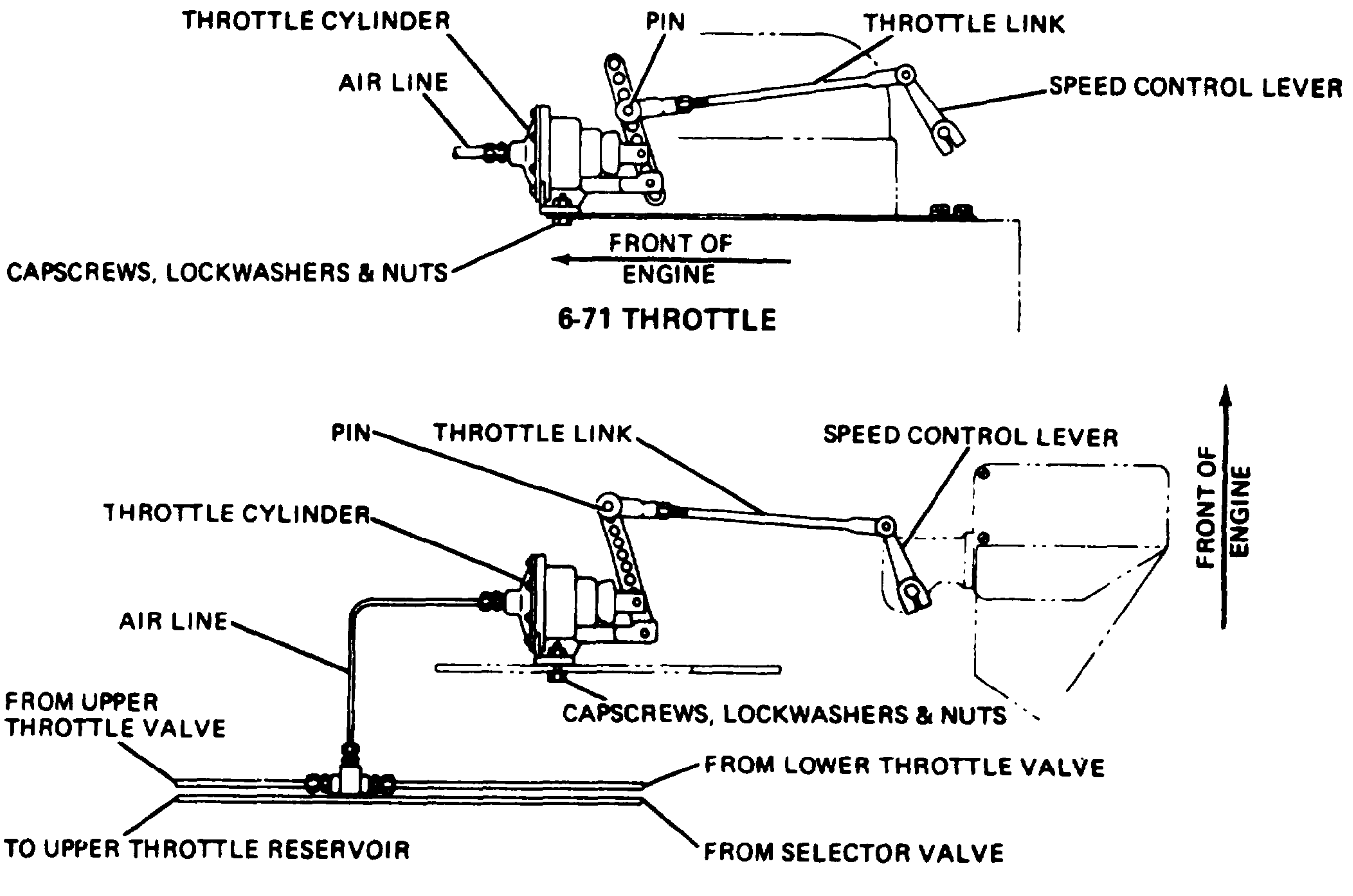
3. Reconnect the air lines to the valve.

4. Check the operation of the valve by performing the Leakage Test.

THROTTLE CYLINDER (36U30)

DESCRIPTION. The throttle cylinder is a single acting, spring returned, air cylinder. This air cylinder is connected to the engine speed control lever, and is used to control the speed of the engine (see Figure 9C-13).

When air is applied to the control port of the cylinder, the piston is forced outward against the return spring (see Figure 9C-14). The amount of piston travel is proportional to the amount of air delivered to the cylinder by the throttle valve. Therefore, the piston will move further outward when more air is applied to the cylinder and will be moved inward, by the return spring, when the applied air pressure is reduced.



6V53 THROTTLE

Figure 9C-13. Throttle Arrangements

LEAKAGE TEST. Perform the following leakage test to determine if the throttle cylinder is suitable for continued service.

1. Fully charge the air system.

2. Fold back the dust boot on the air cylinder. Then coat the area around the piston rod with a soap solution.

3. Have an assistant depress and hold the throttle pedal in either the upper or lower cab. Determine whether .or not leakage exists at the cylinder piston rod. No leakage is permissible.

4. If leakage is present, it is recommended that the cylinder be replaced or overhauled.

REMOVAL. To remove the throttle cylinder, proceed as follows (see Figure 9C-13):

1. Drain the air system bv opening the drain cock on each reservoir. Depress and release the throttle pedal in the up per and lower cab several times to vent any air pressure which may be trapped in the throttle system.

2. Disconnect the throttle link at the cylinder by removing the pin which connects the throttle link to the cylinder lever.

3. Disconnect the air line at the cylinder. Remove the mounting capscrews, lockwashers, and nuts, and remove the cylinder.

OVERHAUL. Overhaul of this cylinder should be limited to the replacement of the parts furnished in the repair kit for the cylinder. To overhaul the cylinder, proceed as follows (see Figure 9C-14):

NOTE

It is possible to overhaul the cylinder while it is on the machine. However, removing the cylinder would simplify the procedure.

1. Remove the machine screws that secure the cover to the body, and remove the cover.

2. Remove the old diaphragm.

3. Remove and discard the two clevis pins and cotter pins securing the cylinder lever.

4. Remove and discard the dust boot. Push the piston into the body, and loosen the jam nut. Remove and discard the clevis, and then remove the jam nut.

5. Slide the piston assembly out of the body. Remove the thrust ring from the piston.

6. Install a new thrust ring on the piston, with the lip of the thrust ring facing the diaphragm end of the piston.

7. Coat the body bore with light grease. Then install the return spring and piston assembly in the body. Push the piston into the bodv until the piston rod extends from the body, and then install the jam nut on the piston rod.

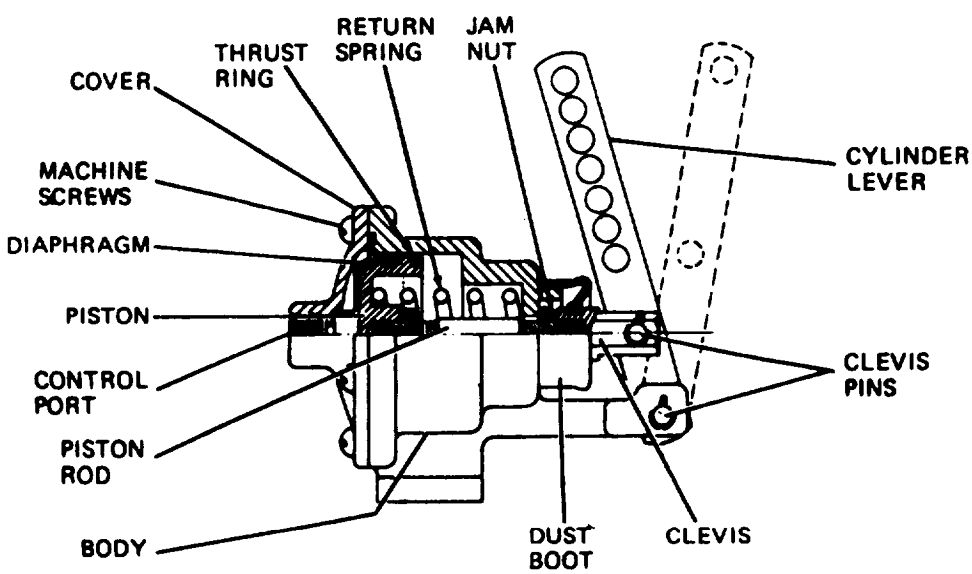


Figure 9C-14. Throttle Cylinder (36U30)

8. Install the new clevis on the end of the piston rod. Screw the clevis on the piston rod as far as it will go. Install the dust boot over the clevis.

9. Position the cylinder lever on the cylinder and connect it with new clevis pins and cotter pins. After the cylinder lever is installed on the cylinder, tighten the jam nut to lock the clevis in position.

10. Install a new diaphragm over the piston as shown in Figure 9C-14. Be sure the lip on the diaphragm is properly seated in the body groove.

11. Install the cover over the diaphragm, and secure the cover with new machine screws.

INSTALLATION. To install a new or overhauled throttle cylinder, proceed as follows (sea Figure 9C-13):

1. Position the cylinder on the mounting plate, and install the mounting capscrews, lockwashers, and nuts.

2. Connect the throttle link to the cylinder lever, and pin the throttle link in place on the cylinder lever.

3. Connect the air line to the cylinder.

4. Check the operation of the cylinder by performing the Leakage Test.

THROTTLE VALVE (36U29)

DESCRIPTION. The air throttle valve is the control unit of the air throttle system. It provides the driver with an easily operated and graduated means of increasing or decreasing the engine speed.

When the valve pedal is in the released position, the piston is held up against the push rod by the air pressure acting on the underside of the piston. The piston also lifts the cage, which opens the exhaust seat and closes the inlet seat of the valve. This allows any air pressure in the throttle cylinder to be vented to atmosphere through the valve, and blocks the flow of air from the supply tank through the valve to the throttle cylinder (see Figure 9C-15).

When the operator depresses the pedal, the cage is moved downward, seating the exhaust seat. Once the exhaust seat is seated. further downward movement will unseat the inlet valve, allowing air to flow through the valve to the throttle cylinder. Air flowing to the throttle cylinder also acts on the top of the balance piston. When the air pressure acting on the top of the balance piston exceeds the force applied to the bottom of the balance piston by the spring, the balance piston moves downward, allowing the cage to also move downward. Downward movement of the cage will block the flow of air through the valve, and the valve is in a balanced condition.

If the pressure at the throttle cylinder should decrease, the spring at the bottom of the balance piston will push the balance piston and cage upward, opening a passage which will allow air to flow to the throttle cylinder. The balance piston will continue to move up and down, allowing and blocking the flow of air through the valve, as the pressure within the system varies or the operator changes the position of the pedal.

When the operator releases the pedal, the piston moves up ward, seating the inlet seat. Once the inlet seat is seated, the air pressure acting on the underside of the seat will cause the cage to move upward, unseating the exhaust seat. This will allow the air pressure in the throttle cylinder to escape to atmosphere through the valve.

OPERATING AND LEAKAGE TEST. Perform the following tests periodically to determine the serviceability of the throttle valve.

1. Coat the exhaust port of the throttle valve with a soap solution to determine if the valve is leaking when the air system is fully charged and the throttle pedal is in the released position. No leakage is permissible at this point. If the valve leaks at the exhaust port, the valve cartridge is faulty, and a new valve cartridge should be installed or the complete valve should be replaced.

2. Have an assistant depress and release the throttle pedal several times and observe the operation of the slave cylinder. The slave cylinder should respond smoothly to changes in throttle pedal position. If the throttle cylinder does not respond smoothly, the compensating spring in the throttle valve is broken, and the complete valve should be replaced.

OVERHAUL. Overhaul of this valve should be limited to the replacement of the parts furnished in the repair kit for this valve. To overhaul the valve, proceed as follows (see Figure 9C-16) :

1. Disconnect the air lines attached to the outlet body of the valve. Remove the six body screws and remove the outlet body. Remove the barrier plate assembly and lift out the balance piston. The barrier plate assembly may be discarded, as a new assembled replacement is included in the repair kit.

2. Remove the balance spring and wear shim from the outlet body. Wash the parts in cleaning solvent. Then inspect the outlet body for excessive wear in the area where the piston contacts the body bore.

3. Remove the balance piston U-cup and thrust ring. These items an be easily replaced without disturbing the seal retainer, as the nylon thrust ring is split and the U-cup will stretch the small amount necessary for removal and installation. Install a new thrust ring and U-cup on the balance piston. Be sure the sealing surface of the U-cup is pointing toward the retainer.

4. Install the wear shim and balance spring in the outlet body cavity.

6. Wipe a coating of light grease on the body bore and on the face and small diameter of the assembled balance piston. Install the balance piston in the outlet body, then place the new barrier plate assembly in position on the outlet body. Make sure the plate is set into the mating counterbore of the body, and the small diameter of the balance piston engages the bore in the bottom of the outlet body.

8. Install the O-ring in the inlet body counterbore. Install the outlet body on the inlet body with a slight turning motion to seat the O-ring. Install six new body screws.

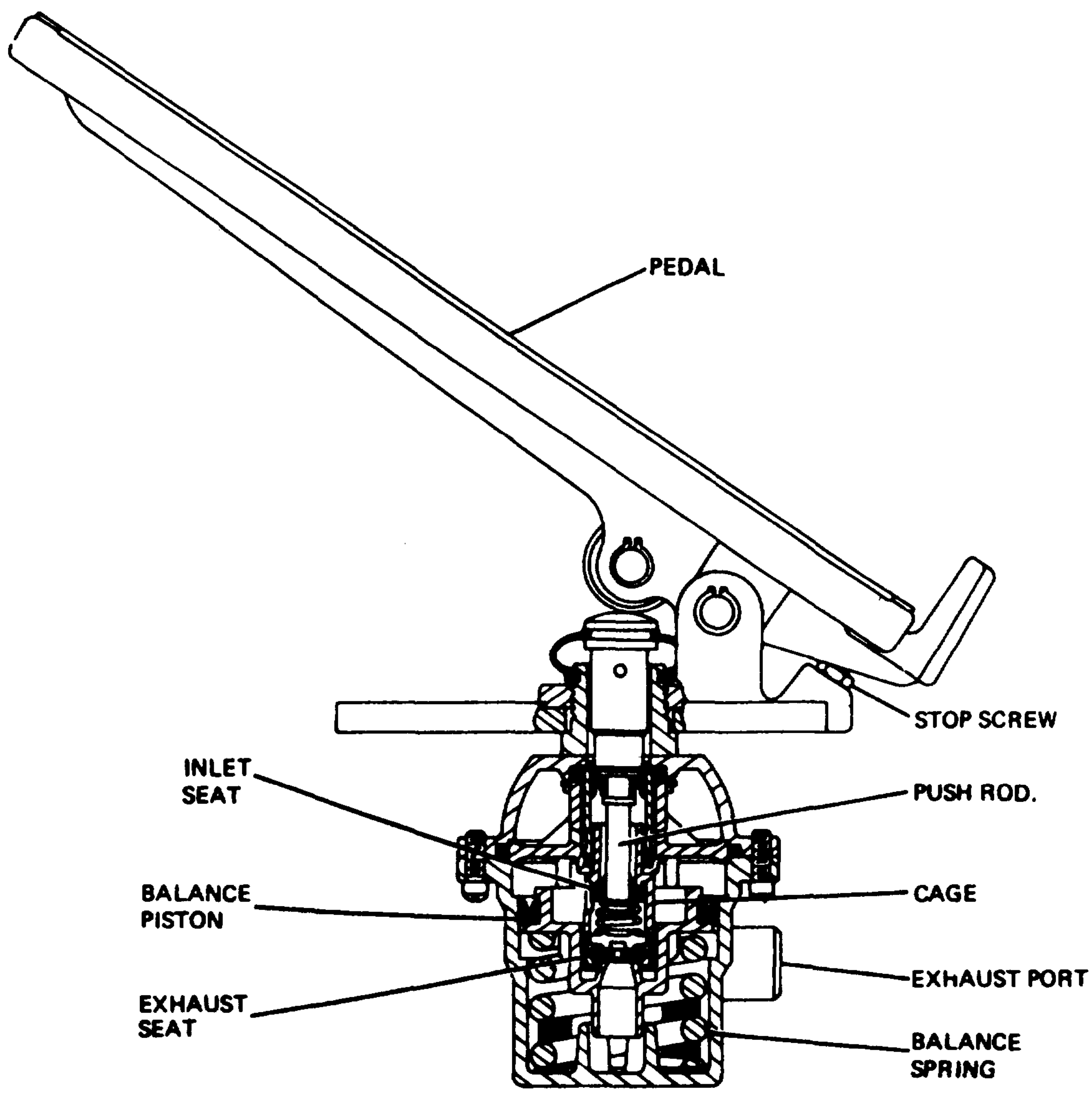


Figure 9C-15. Throttle Valve (36U29)

7. Reconnect the air lines to the outlet body.

8. Test the operation of the overhauled throttle valve by performing the Operating and Leakage Test.

ADJUSTMENT. The following adjustments should be made after the value has been overhauled or replaced.

NOTE

Disconnect the throttle linkage at the throttle cylinder, and use the throttle cylinder to determine when the throttle valve is delivering air in the first adjustment. Reconnect the linkage before performing the second adjustment.

1. Adjust the stop screw under the heel of the pedal so that the valve will deliver pressure as soon as the pedal is depressed. Run the screw up until pressure just begins to be delivered to the throttle cylinder. Then turn it back until pressure just shuts off. Tighten the locknut.

2. The upper throttle valve has an additional adjustment that is not required on the carrier throttle valve; namely, a high speed limit adjustment. This adjustment is accomplished by depressing the throttle pedal until the engine speed is increased to 2600 rpm, with no load applied to the engine. Loosen the locknut and turn the adjusting screw under the toe of the pedal until it limits maximum engine speed to 2600 rpm. lighten the locknut.

HAND THROTTLE VALVE (36U54)

DESCRIPTION. The hand throttle valve is an optional control unit of the air throttle system. It provides the operator with a means of setting and maintaining a desired engine speed.

When the hand lever is in the off position, the piston is held up against the push rod by the air pressure acting on the underside of the piston. The piston also lifts the cage, which opens the exhaust seat and closes the inlet seat of the valve. This allows any air pressure in the throttle cylinder to be vented to atmosphere through the valve, and blocks the flow of air from the supply tank through the valve to the throttle cylinder (see Figure 9C-16).

When the operator moves the hand lever to the on position. the cage is moved downward, seating the exhaust seat. Once the exhaust seat is seated, further downward movement will unseat the Inlet valve. allowing air to flow through the valve to the throttle cylinder. Air flowing to the throttle cylinder also acts on the top of the balance piston. When the air pressure acting on the top of the balance piston exceeds the force applied to the bottom of the balance piston by the spring, the balance piston moves downward, allowing the cage to also move downward. Downward movement of the cage will block the flow of air through the valve, and the valve is in a balanced condition.

If the pressure at the throttle cylinder should decrease, the spring at the bottom of the balance piston will push the balance piston and cage upward, opening a passage which will allow air to flow to the throttle cylinder. The balance piston will continue to move up and down, allowing and blocking the flow of air through the valve, as the pressure within the system varies or the operator changes the position of the hand lever.

When the operator returns the hand lever to the off position, the piston moves upward, seating the inlet seat. Once the inlet seat is seated, the air pressure acting on the underside of the seat will cause the cage to move upward, unseating the exhaust seat. This will allow the air pressure in the throttle cylinder to escape to atmosphere through the valve.

OPERATING AND LEAKAGE TEST. Perform the following tests periodically to determine the serviceability of the hand throttle valve.

1. Coat the exhaust port of the hand throttle valve with a soap solution to determine If the valve is leaking when the air system is fully charged and the hand lever is in the off position, No *leakage is permissible at this point.* If the valve leaks at the exhaust port, the valve cartridge is faulty. and a new valve cartridge should be installed or the complete valve should be replaced.

2. Have an assistant move the hand lever from the full on to full off positions several times and observe the operation of the throttle cylinder. The throttle cylinder should respond smoothly to changes in hand lever position. If the throttle cylinder does not respond smoothly. the compensating spring in the valve is broken, and the complete valve should be replaced.

1. Push Rod
2. Dust Boot
3. Nut
4. Rod Guide
5. Inlet Body
6. Seal Washers
7. Screen
8. Screws
9. O-ring
10. O-ring
11. Barrier Plate Assembly
12. U-cup
13. Thrust Ring
14. Balance Piston
15. Booster Spring
16. Balance Spring
17. Wear Shim
18. Plug
19. Outlet Body
20. Air Filter
21. Body Screws

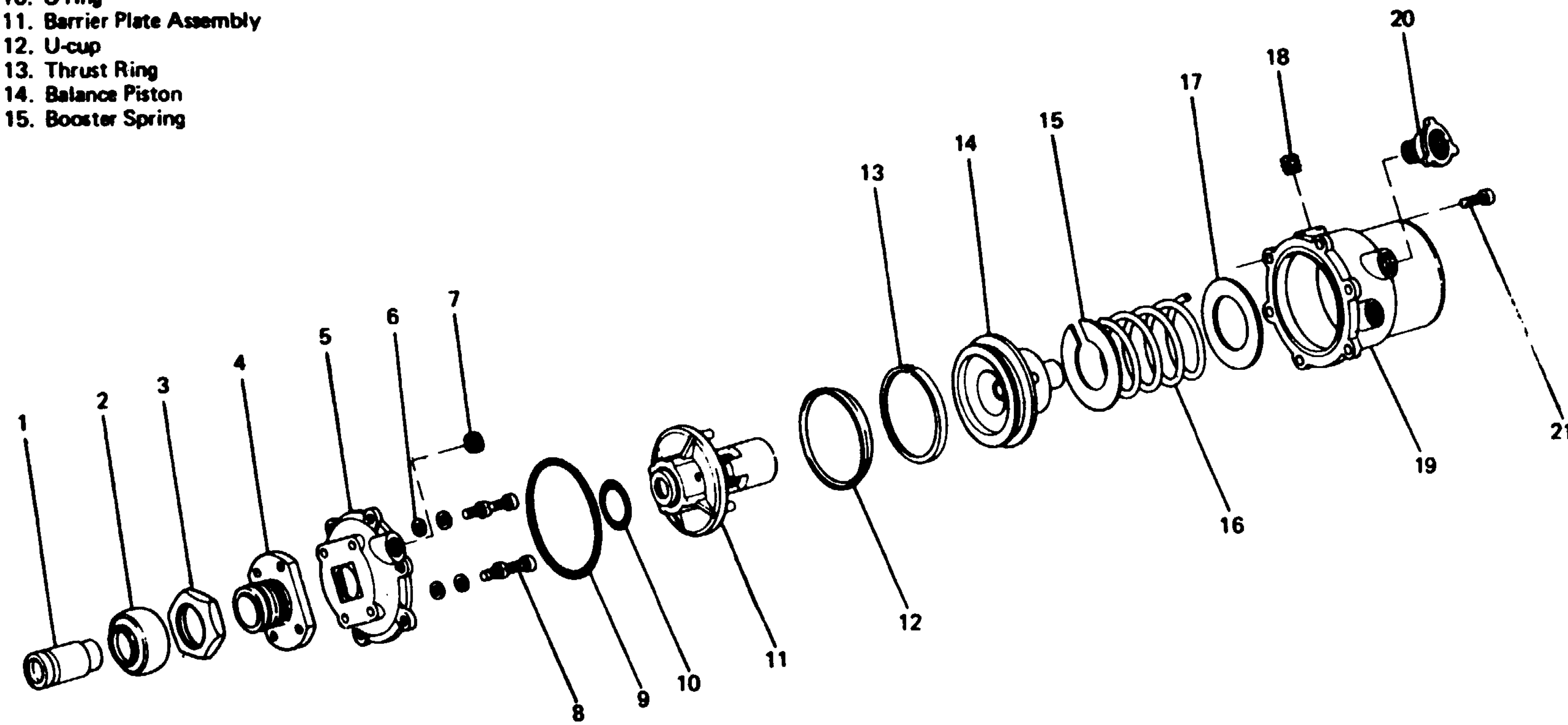


Figure 9C-16. Throttle Valve (36U29)

OVERHAUL. Overhaul of this valve should be limited to the replacement of the parts furnished in the repair kit for this valve. To overhaul the valve, proceed as follows (see Figure 9C-17).

1. Disconnect the air lines attached to the outlet body of the valve. Remove the capscrews. lockwashers, and nuts securing the va!ve to the mounting bracket. and remove the valve.

2. Remove the six body screws and remove the outlet body. Remove the barrier plate assembly and lift out the balance piston. The barrier plate assembly may be discarded, as a new assembled replacement is included in the repair kit.

3. Remove the balance spring and wear shim from the outlet body. Wash the parts in cleaning solvent. Then inspect the outlet body for excessive wear in the area where the piston contacts the body bore.

4. Remove the balance piston U-cup and thrust ring. These items can be easily replaced without disturbing the seal retainer. as the nylon thrust ring is split and the U-cup will stretch the small amount necessary for removal and installation. Install a new thrust ring and U-cup on the balance piston. Be sure the sealing surface of the U-cup is pointing toward the retainer.

5. Install the wear shim and balance piston in the outlet body cavity.

6. Wipe a coating of light grease on the body bore and on the face and small diameter of the assembled balance piston. Install the balance piston in the outlet body; then place the new barrier plate assembly in position on the outlet body. Make sure the plate is set into the mating counterbore of the body, and the small diameter of the balance piston engages the bore in the bottom of the outlet body.

7. Remove the handle screw, and remove the handle by pulling it outward. Determine at this point whether or not the friction plates are excessively worn. If the plates do not require replacement, proceed to the next step. If the friction plates require replacement, proceed as follows:

   A. Remove the four assembly screws. Separate the handle mechanism from the mounting plate and inlet body.

   B. Remove the special screw, and remove the friction plates from the handle shaft.

   C. Remove the snap ring securing the closure plate

   D. Disassemble and wipe all parts free of grease and dirt. Coat the cam follower with a film of light grease, then install the closure plate and secure the plate with a new snap ring.

   E. Install new friction plates and secure the plates with the special screw.

   F. Assemble the handle mechanism on the mounting plate and inlet body, and secure the assembly with the four assembly screws.

   G. Adjust the three Allen head set screws until the desired amount of handle drag is obtained.

8. Install the handle and secure it with the handle screw.

9. Install the O-ring in the inlet body counterbore. Install the outlet body on the inlet body with a slight turning motion to seat the O-ring. Install six new body screws.

10. Install the valve on the mounting bracket with the four capscrews. lockwashers, and nuts. Reconnect the air lines to the outlet body.

11. Test the operation of the overhauled hand throttle valve by performing the Operating and Leakage Test.

ADJUSTMENT. An adjustment is provided to vary the amount of handle drag. Some operators prefer a heavy drag, while others like a lighter drag. Adjust the handle drag as follows:

1. Remove the handle screw, and remove the handle by pulling it outward.

2. Turn the three Allen head set screws clockwise to increase the drag. Turn the *screws* counterclockwise to decrease the drag. Be sure each screw is turned an equal amount to ensure uniform drag.

NOTE

If the adjustment screws do not produce the desired handle drag, introduce several drops of heavy oil down the handle screw bore. Take care not to over lubricate or spill lubricant on the friction plates.

3. Install the handle and secure it with the handle screw.

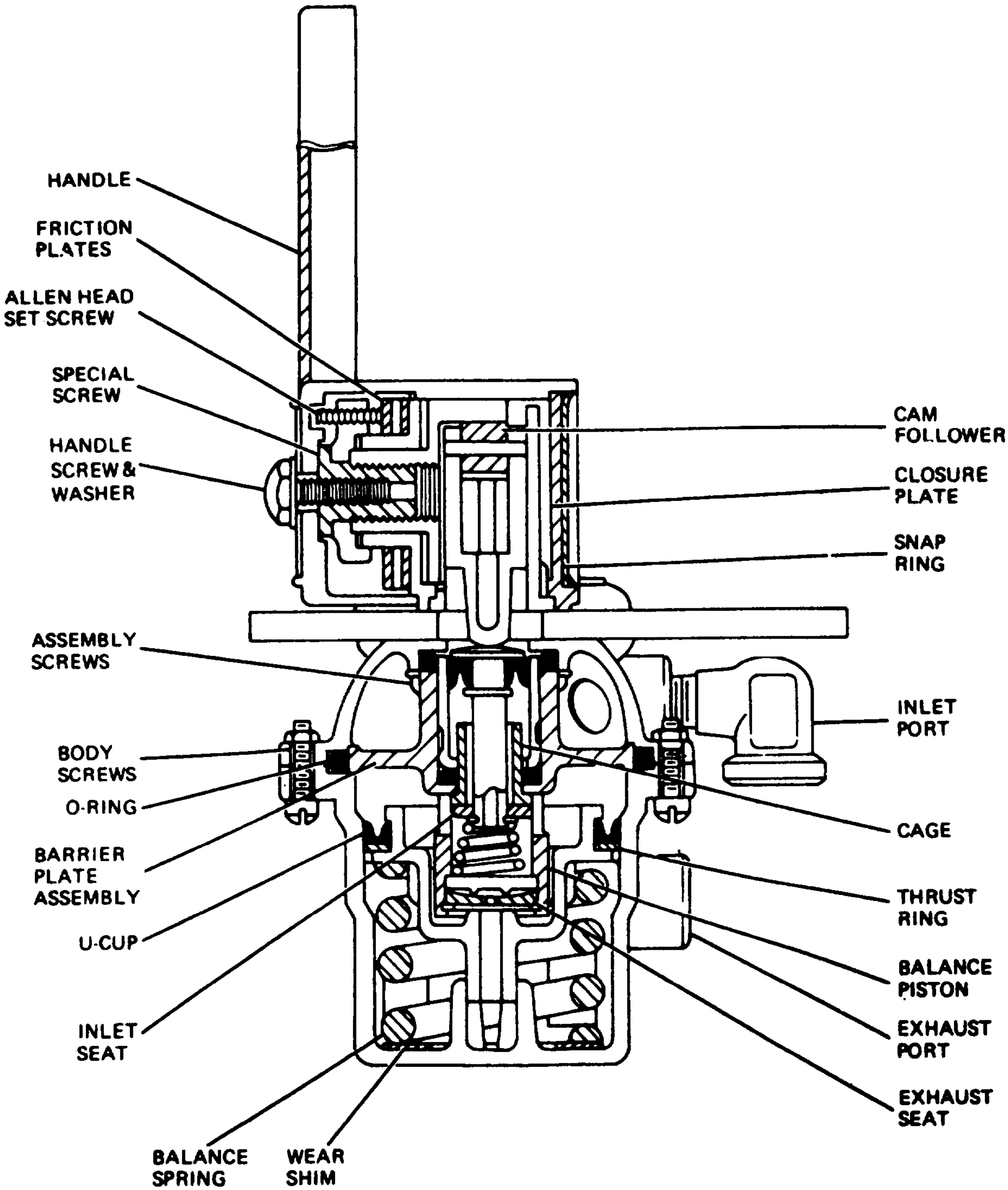


Figure 9C-17. Hand Throttle Valve (36U54)

SUB-SECTION 9D

BRAKE CHAMBERS

BRAKE CHAMBER (1038Z170)

DESCRIPTION. Two of these brake chambers are used at each front wheel. The purpose of brake chambers in an air brake system is to convert compressed air energy into mechanical force and movement, which applies the vehicle brakes.

Air pressure enters the pressure side of the brake chamber and forces against the diaphragm, which in turn moves the push rod forward (see Figure 90-1). The push rod is connected to a wedge assembly which forces two plungers apart when the wedge is forced between the plungers by the push rod. This spreads the plungers apart, pushing the brake shoes outward to apply the brakes.

When air pressure is vented from the brake chamber, the wedge spring returns the wedge and diaphragm to their released position, releasing the brakes.

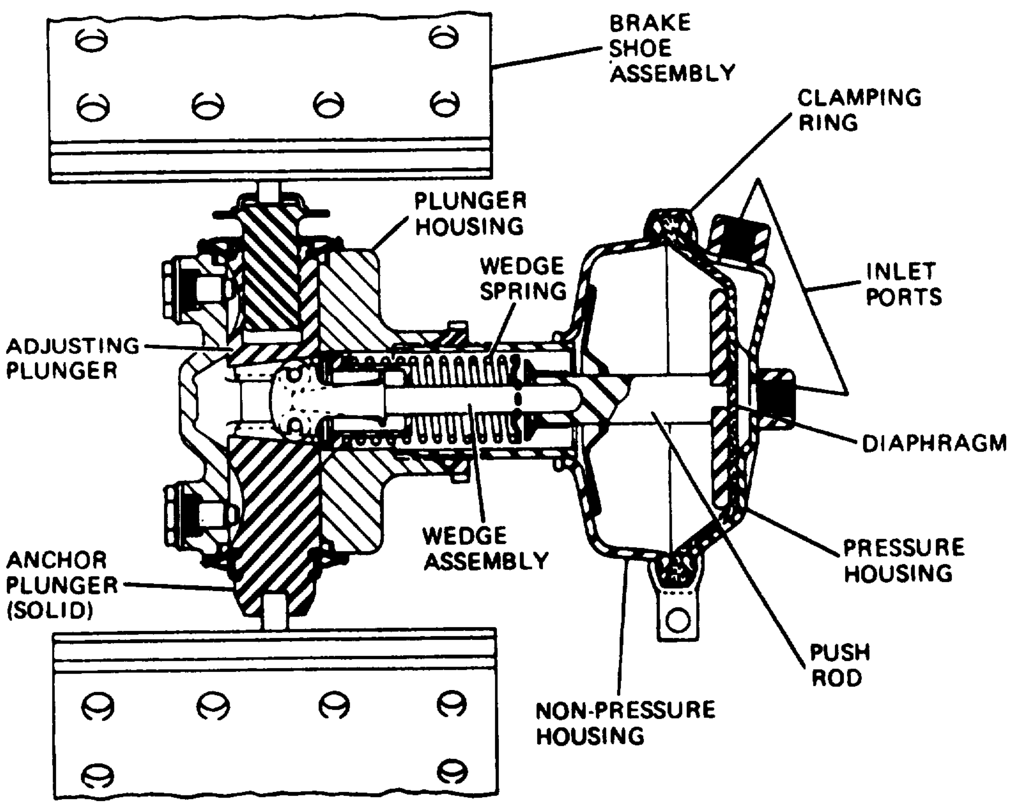


Figure 90-1. Front Brake Mechanism

LEAKAGE TEST. Perform the following test periodically to determine whether or not the brake chambers is suitable for continued service:

1. Have an assistant make and hold a full brake application.

2. Coat the non-pressure housing, clamping ring, and inlet ports and fittings with a soap solution. No leakage is permissible at these points.

3. If leakage is detected around the Clamping ring, the clamp bolt should be tightened, but only enough to stop the leakage. Excessive tightening could distort the diaphragm sealing flange.

4. If leakage occurs at the non-pressure housing or leakage cannot be stopped by tightening the clamp bolt, the brake chamber should be disassembled as follows:

DISASSEMBLY. The following procedure describes the method of removing the diaphragm and boot, which are the items which would cause leakage, when the brake chamber is on the machine (see Figure 9D-2):

1. Disconnect the air line or lines at the brake chamber.

2. Remove the clamp ring nut and bolt. Spread the clamp ring and remove it, while holding the pressure housing in place.

3. Hold the diaphragm against the non-pressure housing and remove the pressure housing.

4. Carefully remove the diaphragm while holding the diaphragm plate against the wedge rod. This will prevent the wedge assembly from coming out of engagement with the plungers.

NOTE

If the wedge assembly backs out of the plungers at anytime during the procedure, it will be necessary to remove the brake shoes to replace the wedge assembly .

5. Continue to hold the diaphragm plate and inspect the boot. If the boot is torn or not attached to the non-pressure housing, strip the old boot from the housing.

6. Carefully extract the diaphragm plate from the wedge assembly. The boot and wedge guide will remain on the diaphragm plate push rod.

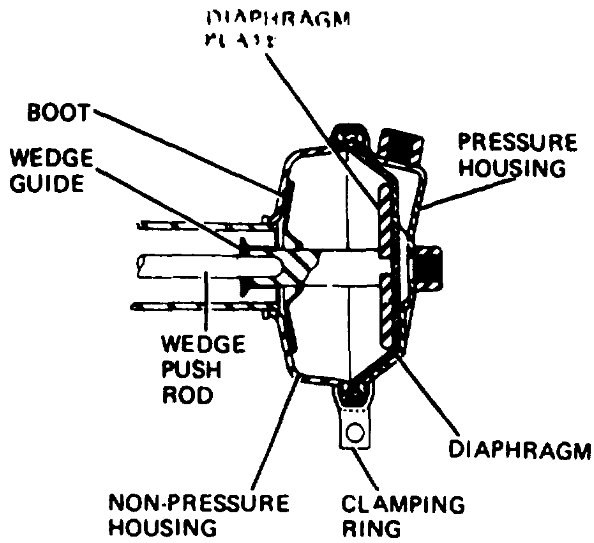


Figure 9D-2. Brake Chamber (1038Z170)

REASSEMBLY. Install a new diaphragm and boot as follows:

1. Install a new boot on the diaphragm plate push rod and press the wedge guide all the way to the end of the push rod.

2. Clean the non-pressure housing with cement thinner or similar solvent in the area where the boot is to be cemented.

3. Apply cement to the non-pressure housing around the tube end. Position the diaphragm plate push rod in the tube. Carefully engage the wedge rod so as not to pull it out of the plungers.

4. While holding the diaphragm against the wedge assembly, press the boot into portion for cementing.

5. Install a new diaphragm Over the diaphragm plate and onto the non-pressure housing, while pushing the diaphragm plate against the wedge assembly.

6. Install the pressure housing over the diaphragm. Install the clamp ring over the non-pressure and pressure housing flanges, and secure the clamp ring with the clamp ring bolt and nut.

7. Reconnect the air line or lines to the brake chamber. Have an assistant make and hold a full brake application, and check, the brake chamber for leakage. Then road test the machine and check brake performance.

MAXIBRAKE CHAMBER 38Q18)

DESCRIPTION. A Maxibrake chamber is a combination *service brake* chamber and spring brake, which provides two methods of applying the carrier brakes (see Figure 9D-3).

NOTE

Earlier models of this machine- are equipped with Maxibrake chambers on the rear axle only. Current models have Maxibrake chambers on all rear wheels.

Service air pressure is supplied to the spring chamber air inlet by the Maxibrake control valve. Air pressure at this inlet will compress the power spring, allowing the chamber to function as a basic service brake chamber.

Air pressure entering the service brake air inlet will force the diaphragm against the push rod assembly, extending the push rod from the chamber. Since the push rod is connected to a slack adjuster, outward movement of the push rod will rotate the brake cam and apply the brakes, Venting air pressure from the chamber will retract the push rod, which in turn rotates the brake cam in the opposite direction, releasing the brakes.

If the air pressure is vented from the spring chamber, by shifting the Maxibrake control valve to the vented position, either automatically or manually, the power spring will expand, forcing the piston outward. Outward movement of the piston, places the neck of the piston against a flange nut on the end of the push rod. This pushes the push rod outward, rotating the brake cam to apply the brakes.

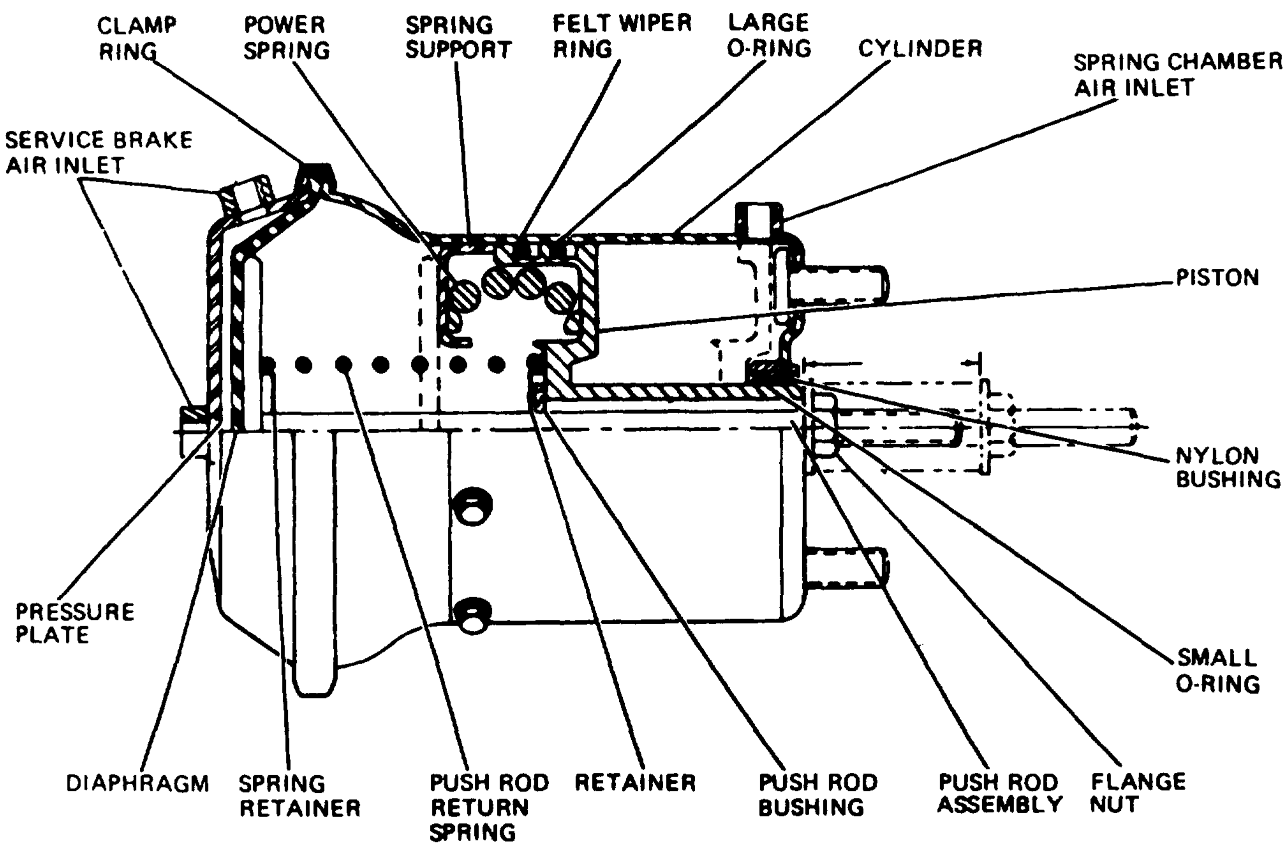


Figure 9D-3. Maxibrake Chamber 38Q18)

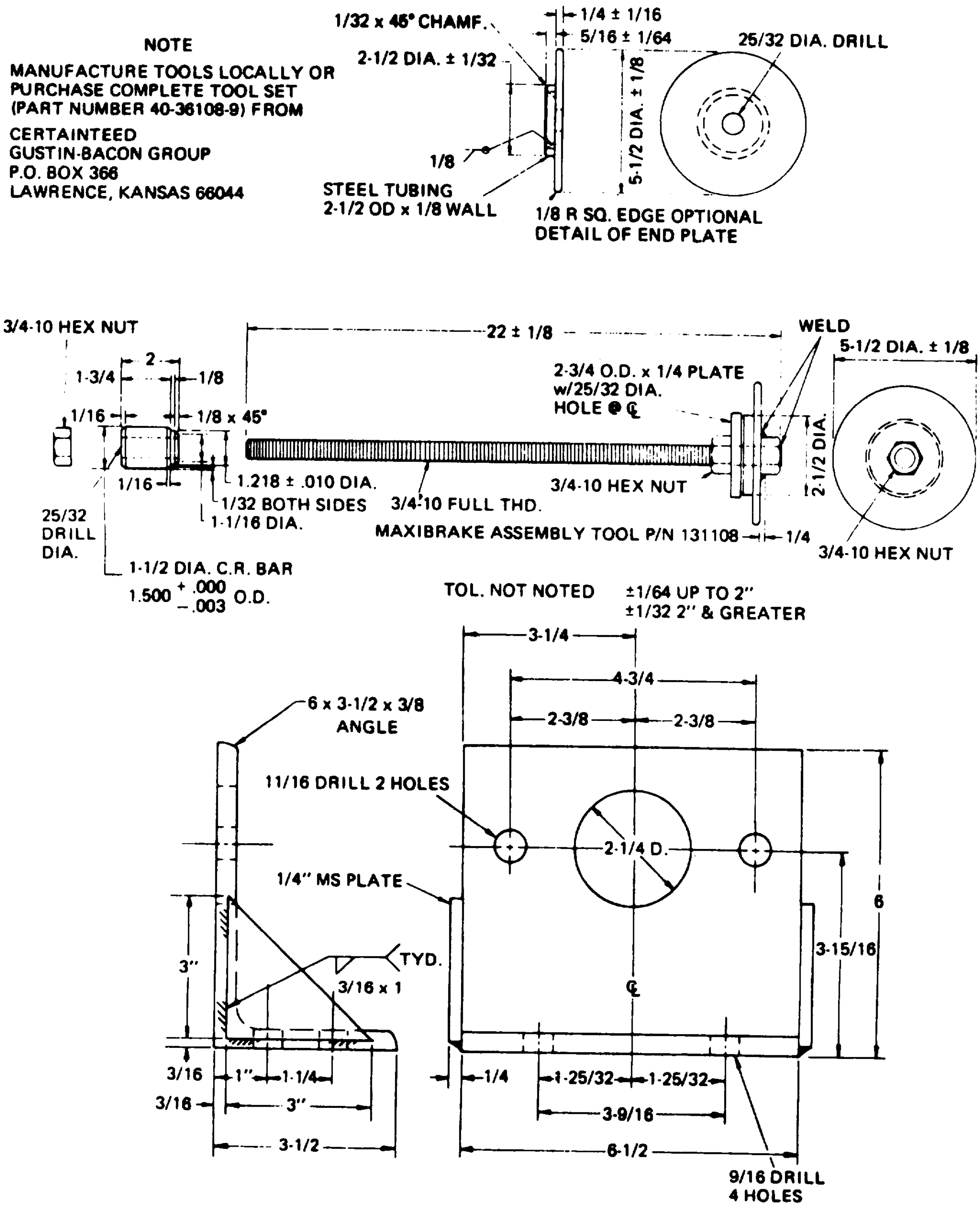


Figure 9D-4. Maxibrake Tools

LEAKAGE TEST. The Maxibrake system should be checked periodically to determine that the brakes are suitable for continued service or to determine whether a problem is caused by a faulty Maxibrake chamber. Test the system as follows:

1. Start the engine and build-up maximum air pressure. Stop the engine and depress the Maxibrake control valve knob. Then check the air gauge for a drop in pressure. A drop in pressure indicates that a leek exists in the air supply system.

2. Pull the Maxibrake control valve knob outward from the dash panel, and check the air gauge for a drop in pressure after the Maxibrakes are released. A drop in pressure indicates that a leak exists *beyond* the control valve.

Coat the pressure plate, clamp ring, and push rod of the Maxibrake chamber with a soap solution to determine if the leakage is within the chamber itself. Maximum permissible leakage *at* these points is 1 Ib./min. with a total volume of 200 cu. in/100 psi (3.227 m3/6.89 BARS) test pressure.

3. Make a full service brake application by depressing and holding the treadle valve. Check the air gauge for a drop in pressure. An air pressure drop of over 3 pounds per minute indicates that excessive leakage beyond the treadle valve exists.

4. If leaks occur at the points indicated above, they should be repaired before the machine is returned to service.

DISASSEMBLY. To disassemble a Maxibrake chamber, proceed as follows. Refer to Figure 9D-5, unless otherwise directed.

NOTE

> To ensure that the Maxibrake chamber is serviced quickly and safely, it is recommended that the caging tool and servicing bracket shown in Figure 9D-4 be used. These tools can be manufactured locally or purchased from the chamber manufacturer at the address shown on Figure 9D-4.

1. Mount the Maxibrake chamber on the servicing bracket and secure it with the stud nuts (see Figure 9D-6).

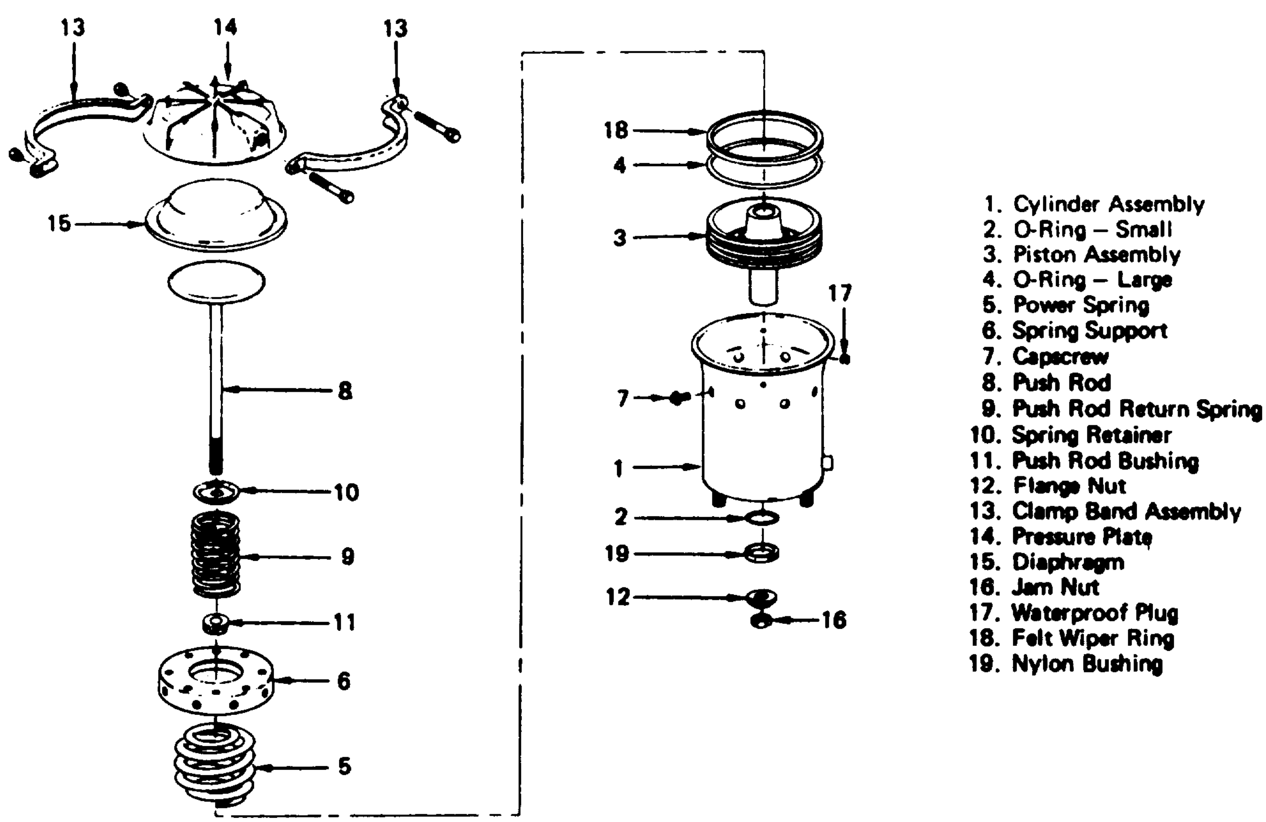


Figure 9D-5. Exploded View - Maxibrake Chamber

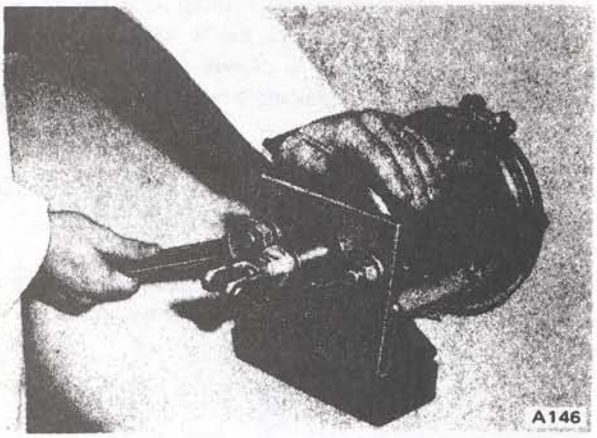


Figure 9D-6. Service Bracket

2. Note the location of the pressure plate inlet port with respect to the cylinder. Loosen the clamp band nuts and bolts, and remove the clamp band halves.

3. Remove the pressure plate and diaphragm.

4. Press down on the push rod face plate to remove the jam nut and flange nut securing the push rod (see Figure 9D-7).

5. Remove the push rod assembly from the cylinder. The push rod, spring retainer, and push rod return spring will be removed with the assembly.

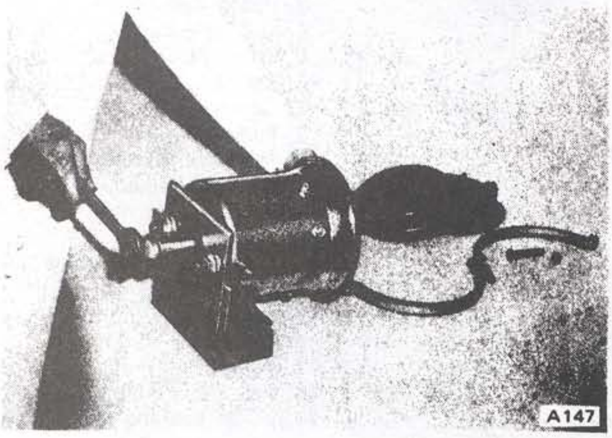


Figure 9D-7. Removing Flange Nut

6. Free the push rod bushing from the piston boss by inserting the caging tool shaft through the piston tube and tapping the tool lightly (see Figure 9D-8). Remove the push rod bushing.

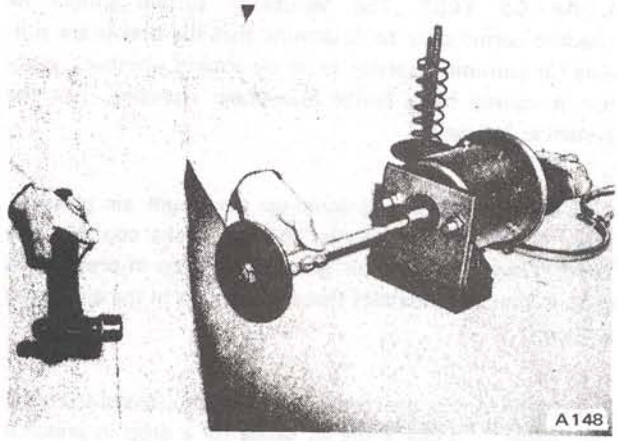


Figure 9D-8. Removing Push Rod Bushing

7. Insert the caging tool, from the back of the chamber, through the piston tube. Install the machined end of the caging tool bushing into the neck of the piston. Install the nut on the caging tool and tighten the nut down until the caging tool is centered and resting firmly against the spring support (see Figure 9D-9).

8. Remove the eight capscrews holding the spring support to the cylinder.

9. Gradually back off the nut on the caging tool until all spring pressure is removed. Remove the caging tool, power spring and spring support.

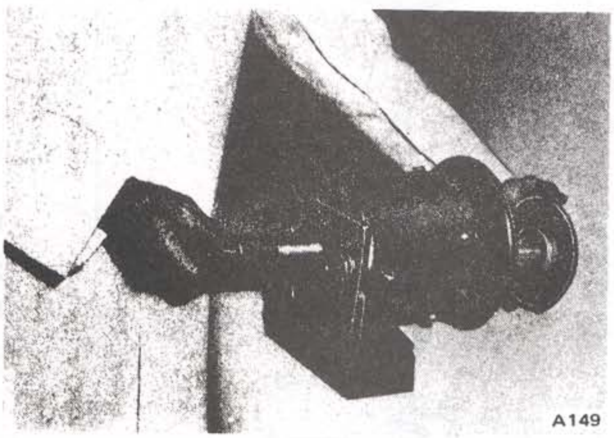


Figure 9D-9. Caging Power Spring

10. Using the caging tool bushing on the piston neck, drive the piston assembly from the cylinder. Remove the piston assembly from the cylinder (see Figure 9D-10).

11. Remove the felt wiper ring and O-ring from the piston.

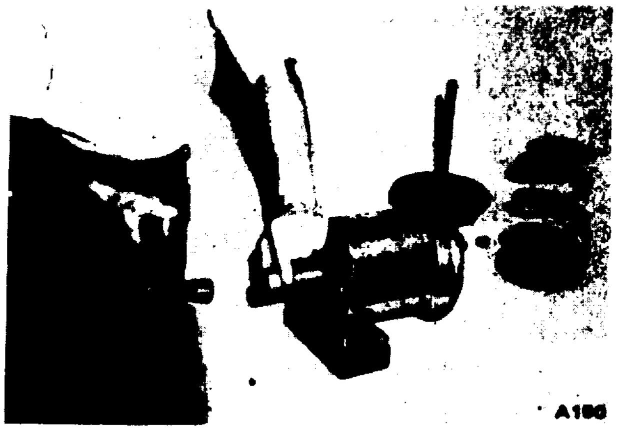


Figure 9D-10. Removing Piston Assembly

12. Remove the O-ring and nylon bushing from the cylinder center boss. Use a sharp pointed instrument to remove the bushing; work clockwise from the cut to pry the bushing out of the groove (see Figure 9D-11).

Figure 9D-11. Removing Nylon Bushing

INSPECTION AND REPAIR. After the Maxibrake chamber has been disassembled, wash all the metal parts in cleaning solvent and inspect and repair the following:

1. Check the bore diameter of the cylinder for rust, scoring, or dents. Sandblasting of the cylinder removes the plating and is not recommended. Inspect a cylinder with a suitable bore finish for other defects, such as damaged or worn studs and push rod bushing wear.

2. Remove all nicks and scratches from the piston skirt. The piston. neck is chrome plated, and only pistons with necks in good condition should be reused. If the piston neck is corroded, scored, or notched, corrective action should be taken to prevent a reoccurance. Painting the outside diameter of the piston neck must be avoided.

3. The power spring should be wire brushed and immediately coated with-a rust inhibiting compound, It is important that all rust on the inside diameter of the spring be removed.

4. The spring support should be wire brushed and coated with rust inhibiting compound.

5. Inspect the push rod for a loose pressure plate and rod wear. If rust is present, wire brush and coat with rust inhibiting compound.

6. If the push rod return spring is rusty, it should be wire brushed and coated with a rust inhibiting compound.

7. The remaining parts should be inspected in accordance with standard brake service and shop practices.

REASSEMBLY. Reassemble the Maxibrake chamber as follows:

1. Fill the inside center boss groove, and lightly coat the cylinder bore, with grease. Install the small O-ring in the inner center boss groove. Then install the nylon bushing in the outer center boss groove with the beveled edge of the bushing toward the inside of the cylinder (see Figure 9D-12).

2. Install the large O-ring in the piston groove nearest the neck. Install the saturated felt wiper ring in the remaining groove.

Figure 9D-12., Installing Nylon Bushing

3. Insert the piston assembly all the way into the cylinder, holding the felt wiper ring in place as the piston is inserted (see Figure 9D-13).

Figure 9D-13. Installing Piston Assembly

4. Assemble the spring support and power spring onto the caging tool, and insert the tool through the piston assembly. Install the caging tool bushing and nut on the end of the tool. Tighten the nut slightly and center the power spring over the piston hub and spring support.

5. Tighten the caging tool nut until the holes in the spring support are aligned with the holes in the cylinder. Install the eight capscrews used to secure the spring support to the cylinder. Alternately tighten each capscrew.

6. Remove the caging tool. Then install the push rod bushing in the piston (see Figure 9D-14). Tap the bushing lightly to be sure it is seated properly.

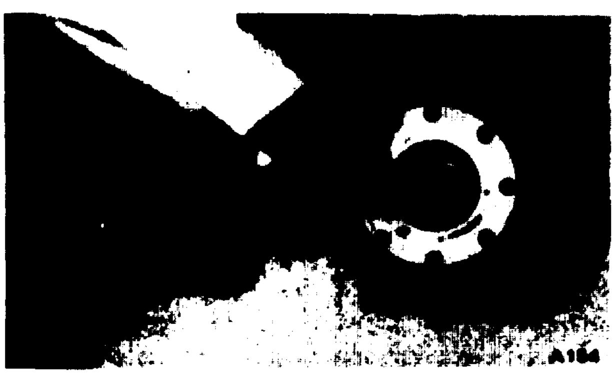


Figure 9D-14. Installing Push Rod Bushing

7. Assemble the spring retainer and push rod return spring on the push rod, and install the assembly through the push rod bushing and piston tube. Install the flange nut on the end of the push rod (see Figure 9D-15).

8. Install the diaphragm with the crown surface in the pressure plate, and center the assembly over the cylinder. Apply pressure to the top of the pressure plate to squeeze the diaphragm in place. Install the clamp band on the pressure plate and cylinder. Be sure the service air inlet is in the position it was before the unit was disassembled. Tighten the clamp band bolts to 100 to 150 in./lb. (1.15 - 1.73 m-kg).

Figure 9D-15. Installing Push Rod

9. Connect a shop air supply to the spring chamber air inlet and compress the power spring. Adjust the flange nut to provide a 1/16 to 1/8 inch (1.6 . 3.2 mm) gap at the piston neck. Secure the flange nut with the jam nut (see Figure 9D-16).

10. Test the chamber for air leaks by applying air pressure to both inlets. Maximum permissible leakage is 1 Ib./min. with a total volume of 200 cu. in./100 psi (3.278 cm3/6.89 BARS) test pressure.

Figure 9D-16. Adjusting Flange Nut

INSTALLATION. Install a new or reconditioned Maxibrake chamber as follows:

1. Position the chamber on the mounting bracket and run on the stud nuts. Torque the nuts to 110 to 150 ft./lb. (15.2-20.7 m-kg).

2. Connect a shop air supply to the spring chamber air inlet and compress the power spring. Adjust the slack adjuster so it is perpendicular to the push rod when the push rod is at 50% of its stroke. Connect the push rod yoke to the slack adjuster. Remove the air supply.

3. Connect all service air lines to the chamber, and compress the power spring. Check the clearance between the flange nut and piston neck. The gap should be 1/16 to 1/8 inch (1.6 - 3.2 mm). Adjust the gap if necessary and tighten the jam nut.

4. Adjust the service brakes so that push rod travel is as short as possible with no brake shoe drag.

SECTION X
POWER STEERING SYSTEM

SECTION X

POWER STEERING SYSTEM

DESCRIPTION

The steering system on this carrier is of the power assist type, wherein steering effort is normally exerted by the hydraulic steering cylinders. See Figure 10-1. Operation of the system is as follows:

1. With the carrier engine running, the engine driven hydraulic pump discharges fluid through the filter and selector valve to the drag link valve, and back to the reservoir. The fluid will continue to circulate until the operator exerts force on the drag link valve by turning the steering wheel.

NOTE

> The selector valve must be in the STEERING position before the steering system is operational. In the OUTRIGGER position, only the outrigger system is operational.

2. When the operator turns the steering wheel, mechanical motion is transmitted from the steering gear, through the drag link, to the drag link valve. This motion moves a valve spool in the drag link valve, directing hydraulic fluid to opposite ends of the two steering cylinders. One cylinder piston extends and the other retracts; since the two cylinders are mounted in opposite directions, all of the front wheels turn in the same direction.

3. The drag link valve centers itself and shuts off the flow of hydraulic fluid to the cylinders as soon as the operator stops turning the wheel and the front wheels reach the position corresponding to the steering wheel position,

4. Road shock forces on the wheels tend to mow the drag link valve, but this action also mows the control valve spool in relation to the drag link valve body, which is held by the drag link. This movement of the drag link valve body relative to the internal valve spool directs fluid to the cylinder to compensate for road shock loads, and to maintain vehicle directional control at the steering wheel.

5. Note that force applied to the drag link may also be transmitted through the drag link valve directly to the steering arm on the front axle. Therefore, loss of hydraulic fluid pressure will not prevent the operator from steering the vehicle, although additional effort will then be required.

HIGH PRESSURE FILTER (46Z133)

The outrigger/power steering system high pressure filter (see Figure 10-2) is located in the pump discharge line, forward of the front solenoid valve bank. This filter should be inspected at regular intervals. When cleaning the filter, inspect the material trapped in the filter for metallic particles. Any accumulation of metallic particles may be an indication that trouble is developing within the pump. If metallic particles are found, check the filter again within a few days; if metallic particles are found again, remove the pump for inspection and repair.

STEERING/OUTRIGGER SELECTOR VALVE (36Z706)

DESCRIPTION

The selector valve is provided to enable the operator to divert the hydraulic pump output to either the outrigger system, or to the power steering system. The valve is mounted at the right rear of the carrier cab.

REMOVAL

To remove the selector valve, proceed as follows:

1. Mark the hydraulic lines attached to the valve.

2. Disconnect the hydraulic lines and cap to prevent the entry of dirt.

3. Unbolt and remove the valve from the carrier wall.

REPAIR

Repair of this valve is limited to the replacement of ring seals. To replace the ring seal, proceed as follows (see Figure 10-3):

1. Remove the snap rings at each end of the valve spool.

2. Push the control knob in until the rear ring seal is exposed. Remove the rear ring seal.

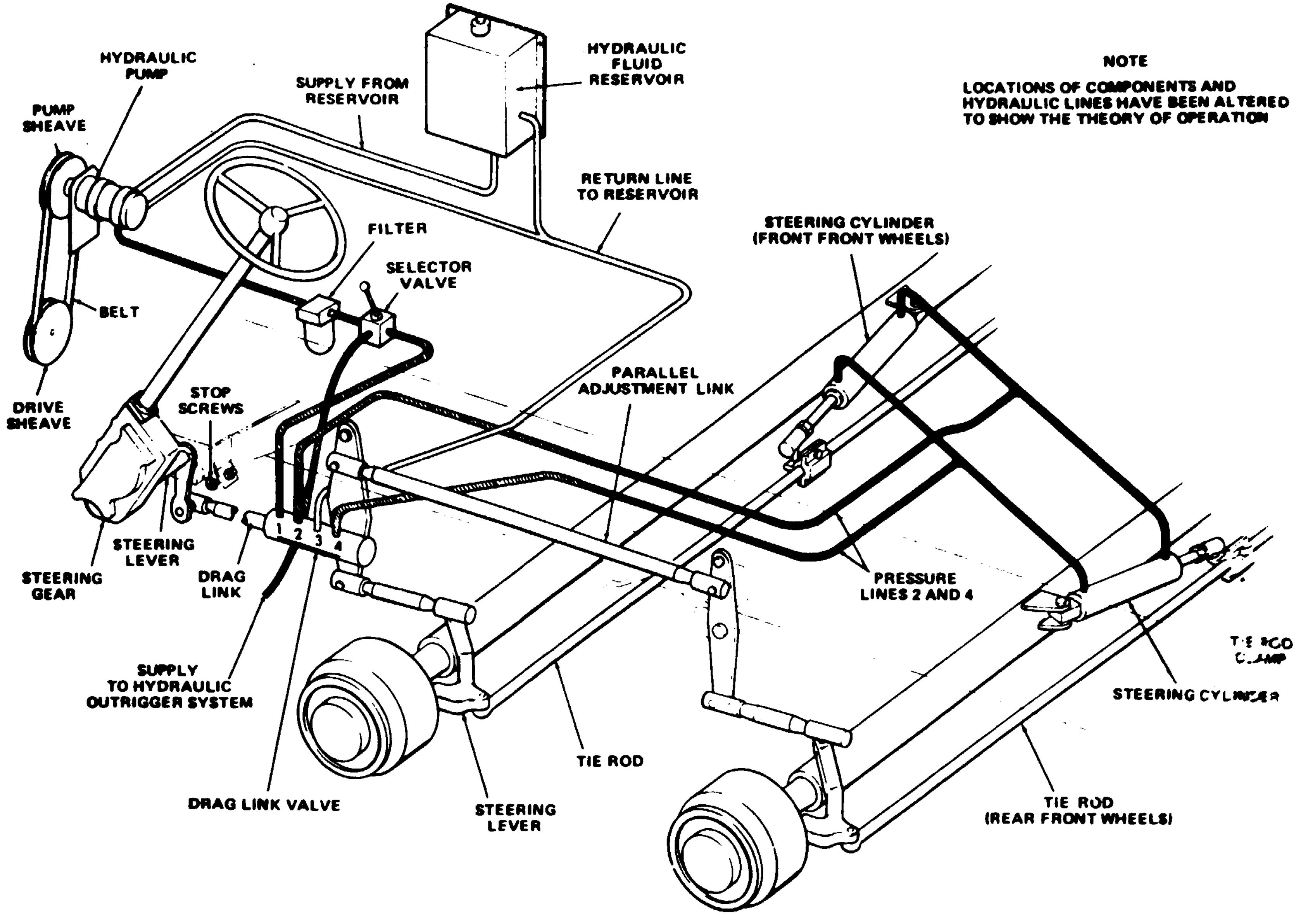


Figure 10-1. Steering System Schematic

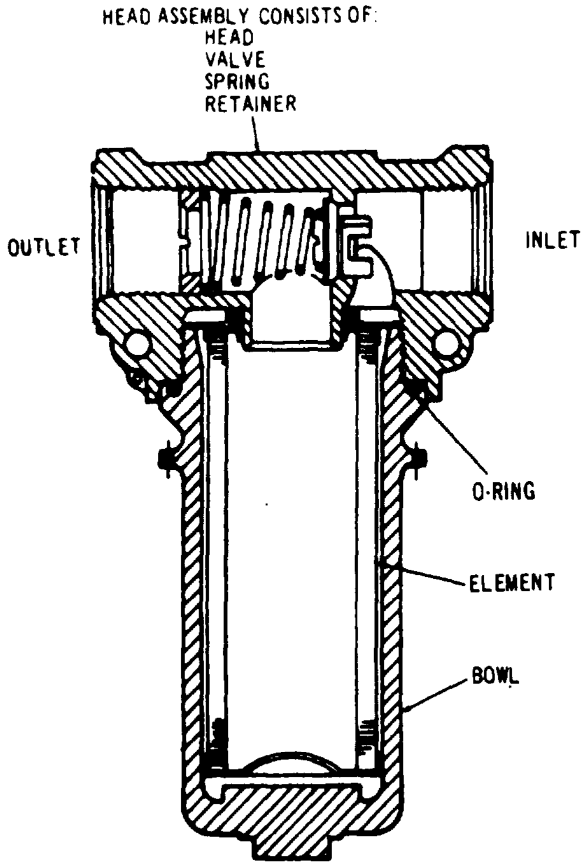


Figure 10-2. High Pressure Filter (46Z133)

3. The valve spool may now be removed from the valve body. Remove the front ring seal.

'4. To prevent cutting the front ring seal on sharp edges, wrap the spool with 3 or 4 layers of glossy paper, leaving only the front seal groove exposed. Slide the front ring seal on from the rear of the spool over the paper and Into the front seal groove.

5. Apply clean grease to the new seal. Remove the paper and insert the spool in the valve body, and with a rotating action on the knob, push the spool in until the front ring seal disappears and the rear seal groove is exposed,

6. Install the rear ring seal.

7. Apply clean grease to the rear ring seal.

8. Now install the rear snap ring, and with a firm, rotating action pull the spool up against the snap ring.

9. Install the front snap ring.

STEERING COLUMN (20Z1144)

DISASSEMBLY. To disassemble the steering column, proceed as follows:

1. Disconnect the horn, indicator light and turn signal cables.

2. Remove the entire steering column as follows:

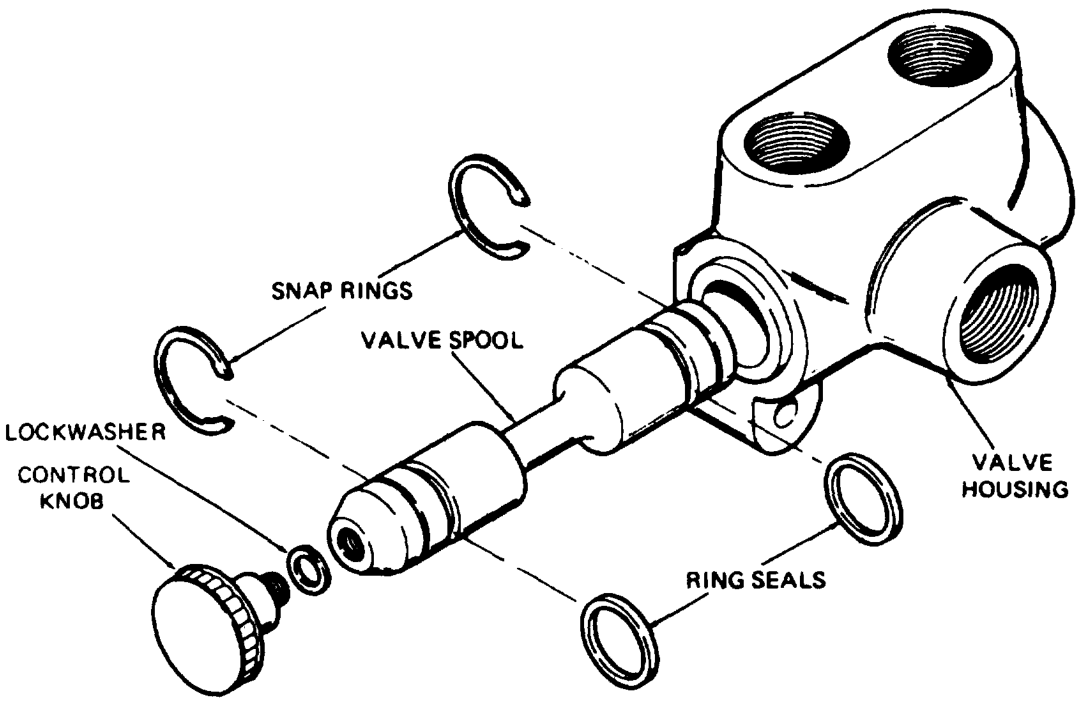


Figure 10-3. Steering/Outrigger, Selector Valve (36Z706)

A. Loosen the damp that secures steering wheel tube (14, Figure 10-4) to the steering gear.

B. Remove the U-bolt which supports the steering column In the cab.

c. Remove the steering column.

3. Remove the horn button (2, Figure 10-5) by twisting it counter clock wise.

4. Remove horn contact cup (3) and spring (4).

5. Remove wheel nut (7). Then remove wheel (8) with a wheel puller or by m-installing wheel nut (7) about 4 turns. Grasp the wheel with with hands at the spokes and pull up steadily as the wheel is rocked back and forth slightly.

6. Remove bearing spring (11) and spring seat (12).

7. Remove turn signal control lever (18) by unscrewing it from the turn signal switch plate pivot post.

8. To disconnect the turn signal switch plate from the switch assembly proceed as follows. The switch and switch plate are joined by means of a sliding pin In the switch assembly extending through the switch plate just inside the detent point. The pin is held in position by a small spring loaded "C" washer.

A. Compress the spring and slide the "C" washer off the pin. Then remove the spring.

B. Remove the turn signal switch plate by lifting it straight up out of switch housing (16).

NOTE

Carefully note the way the wiring is laid in the housing. Incorrect routing of the wiring at reassembly may cause binding of the switch plate or shorting of the circuit.

9. Carefully pull the disconnected cable assemblies out of the wire trough in jacket tube (23) and out of switch housing (16).

10. Remove J-bolts (15).

NOTE

By removing turn signal housing (16), the spring (11). spring seat (12), and jacket tuba bearing (13) will also be removed.

11. Remove signal housing (16).

REASSEMBLY. To reassemble the steering column proceed as follows:

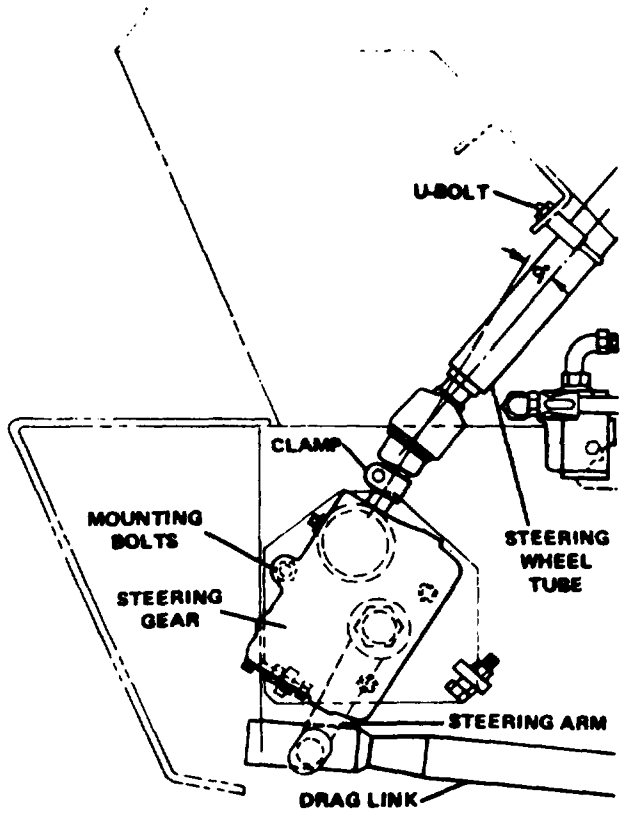


Figure 10-4. Steering Gear and Column Mounting

1. Lubricate upper bearing (13) lightly with lubri-plate.

2. Reassemble horn cable and contact assembly (21) in the new switch plate. (Be certain roller contact is on the same side of the switch plate as the cancelling cams and springs.)

3. Gather horn cable (21). indicator light cable (24) and turn signal cables with terminals slightly staggered to prevent bunching.

4. Wrap the terminal ends lightly with tape and insert them into the opening in turn signal housing (16), and feed them through jacket tuba (23). until they start out the opening in the lower portion of the jacket tube.

5. Slip the plastic protector tube over the cable assembly and carefully pull the cable assembly on down while properly locating the cables in the base of switch housing (16).

6. Insert the turn signal switch plate pivot pin in the pivot hole of the housing after lubricating it lightly with lubri-plate or a similar lubricant.

7. Reassemble switch plate on switch pin and install the spring and "c" washer on the switch pin.

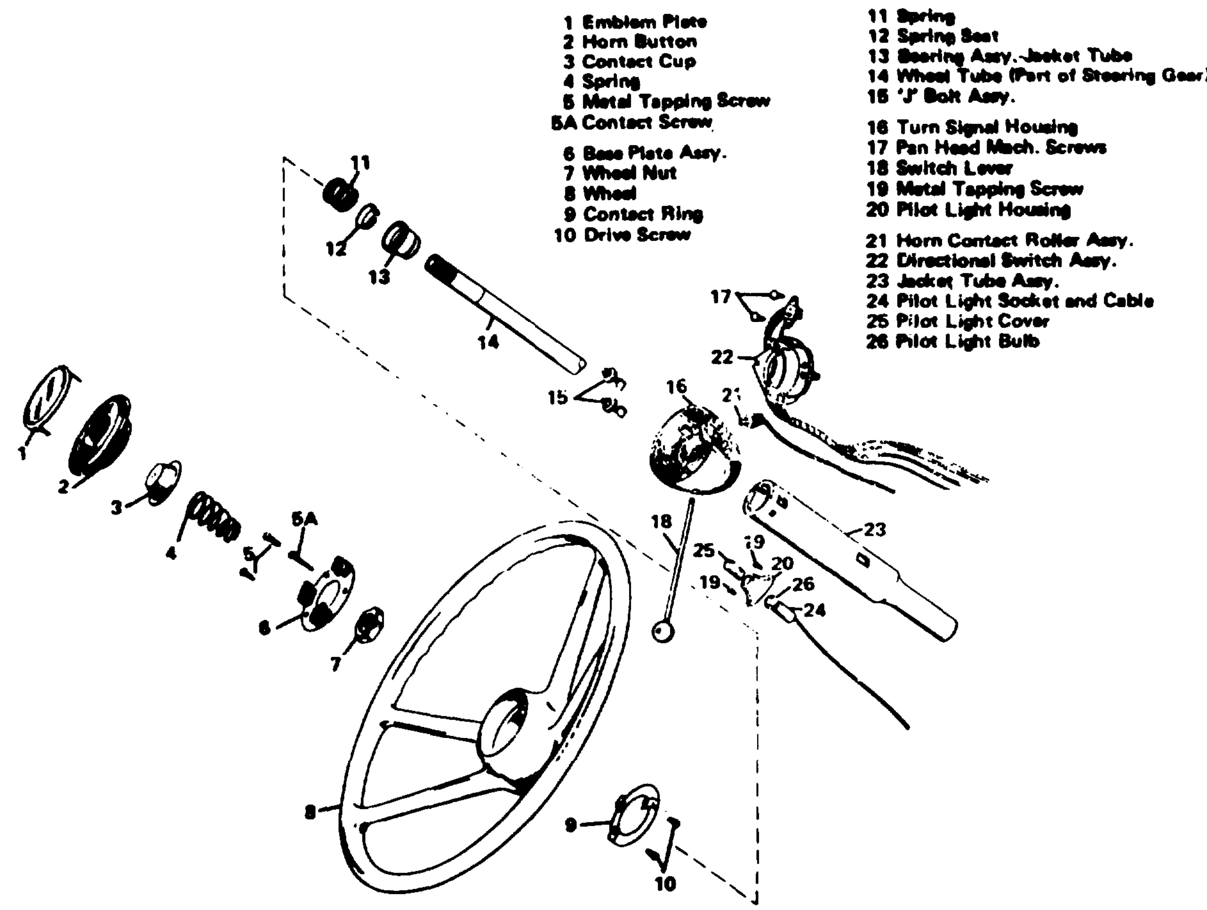


Figure 10-5. Steering Column (20Z1144)

8. Install control lever (18) and actuate switch in both directions several times to be certain there is no binding. If there is friction or binding, recheck the position on the wiring in the switch housing and reposition if necessary.

9. Install bearing seat (12) and spring (11) on wheel tube (14).

10. Place turn signal switch in off or neutral position.

11. Install steering wheel (8).

12. Install wheel nut (7) and torque it to 55-65 foot-pounds (7.6065-8.9895 m/kg).

13. Install horn contact spring (4) and contact cup (3) and replace horn button (1) and emblem assembly (2) by pressing button down hard and turning it dockwise.

14. Remove the tape from the cable terminals and reconnect the wires. Check the horn, emergency flasher switch and turn signal switch to be sure they are functioning properly.

15. Check gap between upper face of turn signal switch housing (16) and lower edge of the steering wheel skirt. This gap must be a minimum of 3/32 inch (2.382 mm). If adjustment is necessary loosen the jacket tube clamp at the steering gear upper cover and mow the jacket tube up or down to obtain the necessary clearance. Tighten the jacket tube clamp bolt to 30-35 foot-pounds torque (4.149-4.8405 m/kg).

16. Install the completed steering column in the carrier as follows:

A. Place the steering column in place, sliding the U joint end of the steering column over the splind shaft of the steering gear.

B. Fasten the clamp which holds wheel tube (14) to the steering gear.

C. Install the supporting U bolt, for the steering column.

STEERING GEAR (53Z341)

REMOVAL. To remove the steering gear from the carrier, proceed as follows (see Figure 10-4):

1. Loosen the damp that secures the steering column to the steering gear.

2. Disconnect the drag link from the steering arm of the steering gear.

3. Remove the steering gear mounting bolts and remove the steering gear.

DISASSEMBLY. To disassemble the steering gear proceed as follows:

1. Remove lever shaft nut (1, Figure 10-6). lockwasher (2). and steering arm (3) from the housing.

NOTE

The housing is filled with grease and will run out when the side cover is removed.

2. Remove side cover (12).

3. Remove lever shaft (10) end bearing assembly (9) by pushing on the end of the nutput shaft.

4. Remove end cover (6).

6. Remove end cover shims (19).

6. Pull cam assembly (18) out of the housing.

7. Ball bearing (17), retainer assembly (15), and bell cups (16) can now be removed from the worm shaft.

8. Using a soft bar the diameter of the bushing, drive bushings (5) and seal (4) out of the housing.

ASSEMBLY. To assemble the steering gear, proceed es follows:

1. Install bearings (17), ball cups (16), end retainers (15) on cam shaft (18).

2. Insert the bushings in the housing. Use a soft bar the

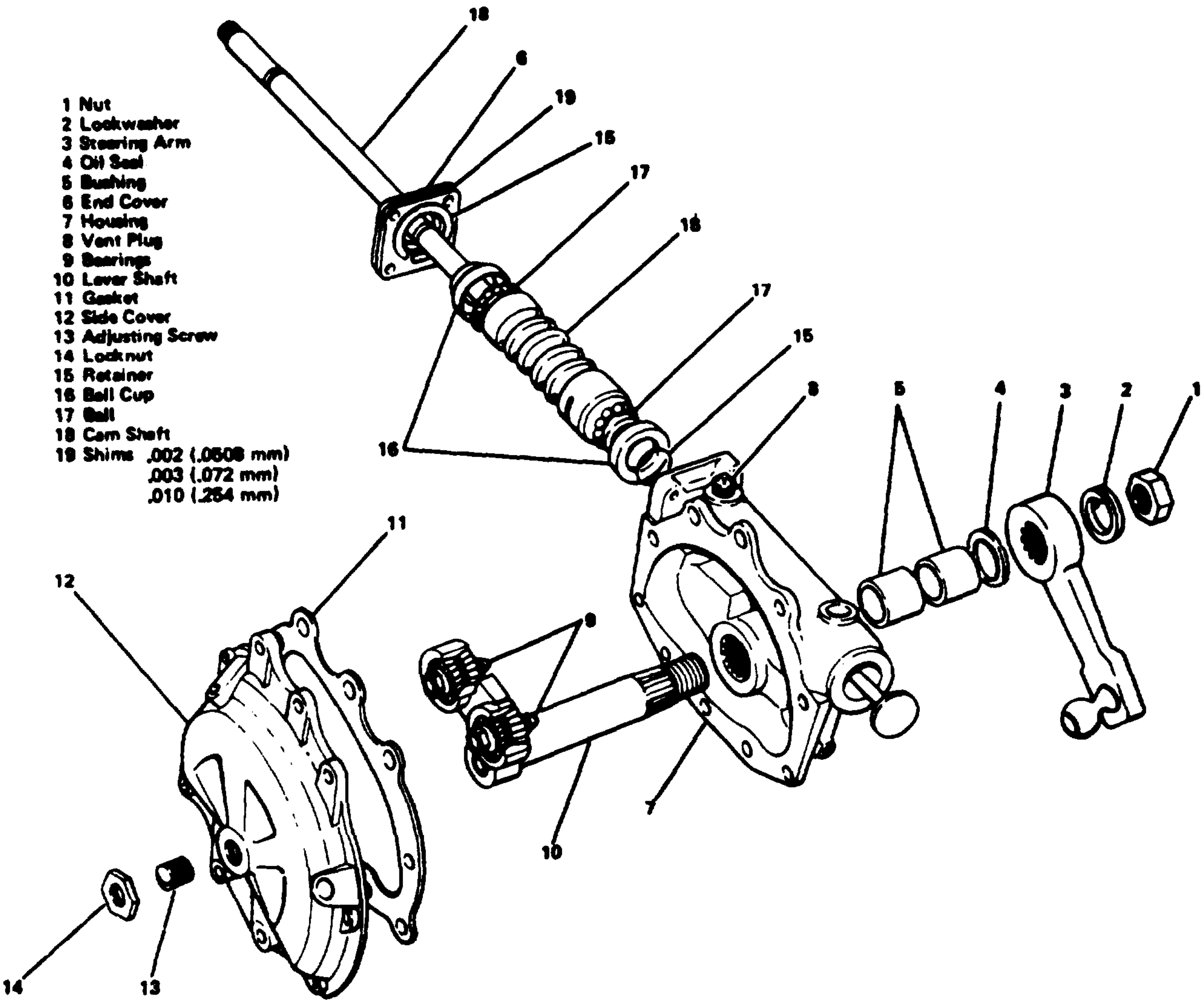


Figure 10-6. Steering Gear (53Z341)

diameter of the bushings to drive the bushings into place.

3. Replace oil seal (4).

4. Insert cam shaft assembly (18) into housing (7). Install three shims over the protruding end of camshaft (18). Fastening the end cover with capscrews.

6. Install bearings (9), in lever shaft (10).

6. Insert the lever shaft into the housing so the hearing studs are between the teeth of the cam Gear.

7. Replace gasket (11) and side cover (12).

8. Install steering arm (3), lockwasher (2). and nut (1).

9. Fill the housing with the recommended lubricant.

INSTALLATION. To install the steering gear to the carrier, proceed as follows:

1. Slide the steering gear shaft end into the steering column U-joint.

2. Install the steering Gear mounting bolt and tighten securely.

3. Tighten steering column damp.

4. Connect the drag link to the steering gear arm.

THRUST BEARING ADJUSTMENT. To adjust the thrust bearings on the cam, proceed as follows:

NOTE

The steering wheel should turn freely with the thumb and forefinger lightly Gripping the rim when the bearings are properly adjusted.

1. Loosen the side adjusting screw to free the studs in the cam groove (see Figure 10-7).

2. Remove the capscrews which hold the upper cover to the steering gear and slide it up the steering shaft to permit removal of the shims.

3. Clip and remove a thin shim.

4. Install the cover screws and tighten.

6. Test adjustment and if necessary repeat steps 2,3 and 4.

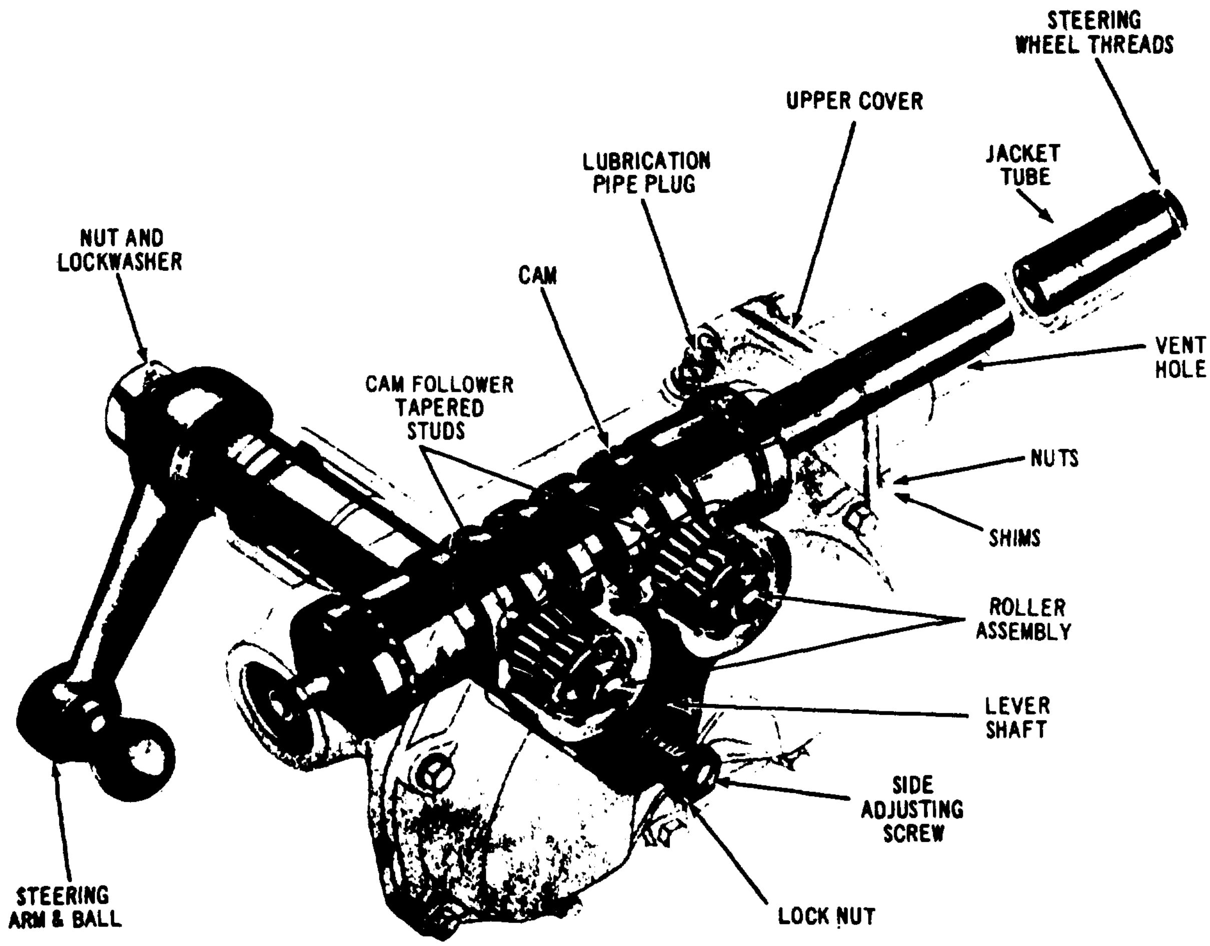


Figure 10-7. Steering Gear (53Z341)

MINIMUM HACKLASH ADJUSTMENT. Adjust the back lash so that a very slight drag is felt through the mid-position high spot while turning the steering wheel slowly from one extreme position to the other.

Backlash of the studs in the the groove up as backlash at the steering wheel and at the ball on the steering arm. The groove is purposely cut shallower, and narrower, in the mid-position range of travel of each stud to provide close adjustment where usually the straight-ahead-driving action takes place. It also makes this close adjustment possible after normal wear occurs without causing a bind elsewhere.

Adjust through the mid-position. Do not adjust in positions off mid-position as backlash at these points is normal and not objectionable. To adjust proceed as follows:

1. Tighten the side cover adjusting screw until the adjustment is correct.

2. Tighten the locknut.

3. Give the gear a final test.

HYDRAULIC PUMPS

HYDRAULIC PUMP (37Z135,37Z182,37Z196)

GENERAL. The hydraulic pump supplies fluid to the power steering and outrigger systems. The pump is mounted on the upper rear of a G.M. engine and on top of the hydraulic pump drive assembly when Cummins engines are used.

A cutaway view of a hydraulic pump is shown in Figure 10-7. The major components of the pump are a ported body and cover. a driveshaft, a pumping cartridge, and a pressure plate. The components of the pumping cartridge are an elliptical ring, a slotted rotor which is splined to the driveshaft, and twelve vanes fitted into the rotor slots.

The differences between these power steering pumps is the GPM rating and the direction of rotation.

OPERATION. Fluid enters the pumping cartridge through the inlet port in the body and is discharged through the pressure plate to the outlet port in the cover. The action of a pumping cartridge is shown in Figure 10-8.

As the rotor turns, centrifugal force on the vanes causes them to follow the elliptical inner surface of the ring. Radial movement of the vanes and turning of the motor causes the chamber between the vanes to increase as the vanes pass the inlet sections of the ring. This results in a low pressure condition which allows atmospheric pressure to force fluid into the chambers. This fluid is trapped between the vanes and carried past the large diameter or dwell section of the ring. As the outlet section is approached, the ring diameter decreases and the fluid is forced out into the system. System pressure is fed under the vanes, assuring their sealing contact against the ring during normal operation.

Maximum pump delivery and maximum system pressure are determined by the integral flow control and relief valve in the outlet cover. The flow control and relief valve is shown schematically in Figure 10-9.

An orifice in the cover limits maximum flow. A pilot-operated type relief valve shifts to divert excess fluid delivery to tank, thus limiting the system pressure to a prescribed maximum.

Figure 10-9, Part A, shows the condition of the valve components when the total pump delivery can pass through the orifice. This condition usually occurs only at low drive speeds. The large spring chamber is connected to the pressure port through an orifice. Pressure in this chamber equalizes pressure at the other end of the relief valve spool and the light spring holds the spool dosed. Pump delivery is blocked from the tank port by the spool land.

When pump delivery is more than the flow rate determined by the orifice plug, a pressure build-up forces the spool open against the light spring. Excess fluid is throttled past the spool to the tank port as shown in Part 8.

If the pressure in the system builds up to the relief setting (Part C), the pilot poppet is forced of! its seat. Fluid in the large spring chamber flows through the spool and out to tank. This flow causes a pressure differential on the spool, shifting it against the light spring. All pump delivery is thus permitted to flow to tank.

REMOVAL-ENGINE MOUNTED. To remove an engine mounted power steering pump, proceed as follows:

1. Remove all dirt from the pump and connections with a suitable cleaning solvent.

2. Mark the hose connections to assure proper connection upon reassembly.

3. Remove the hydraulic hoses from the pump.

4. Plug the ports of the pump and cap-all lines to prevent the entry of dirt into the system.

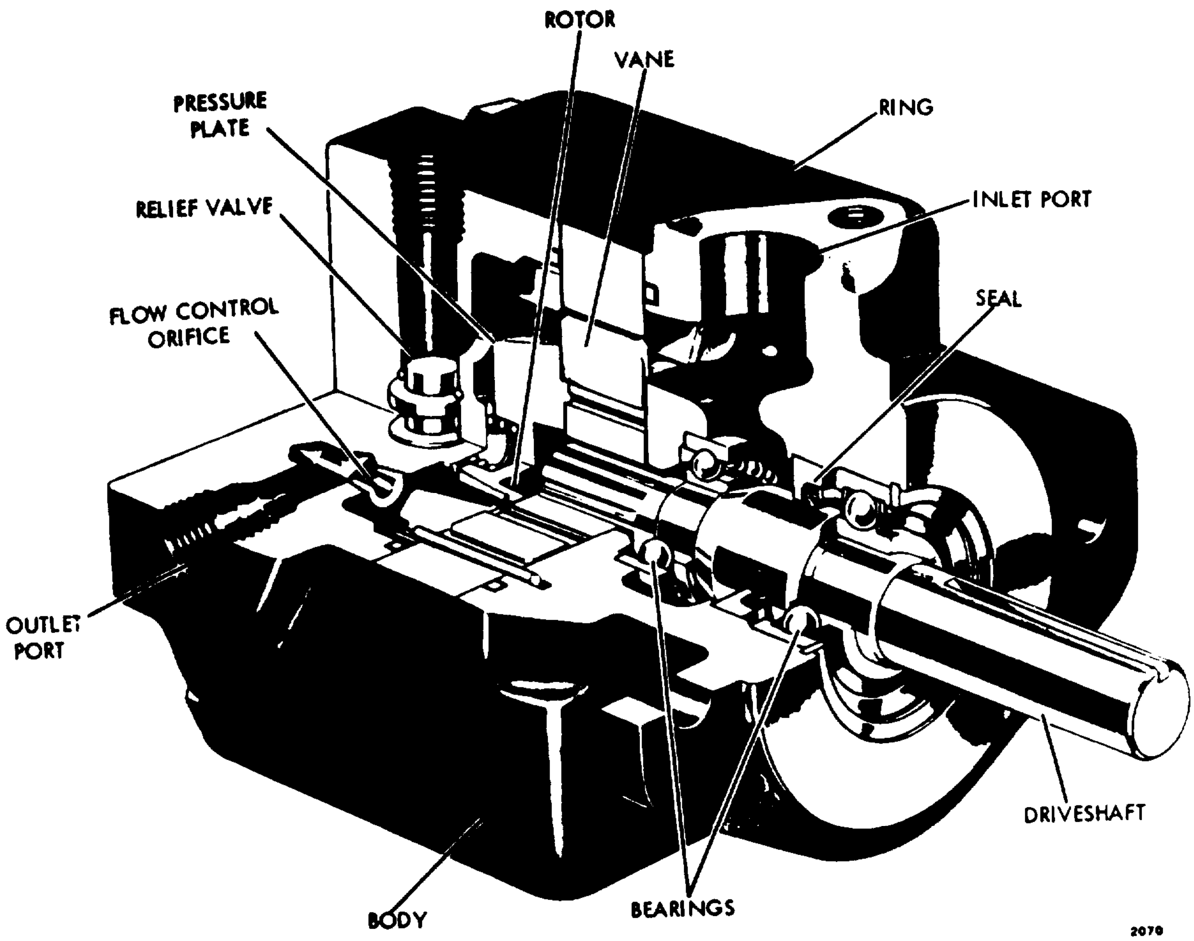
5. Remove the mounting bolts and pull the pump away from the engine.

REMOVAL - PUMP DRIVE MOUNTED. To remove a power steering pump mounted on the pump drive, proceed as follows:

1. Remove all dirt from the pump and connections with a suitable cleaning solvent.

2. Mark the hose connections to assure proper connection upon reassembly.

3. Remove the hydraulic hoses from the pump.



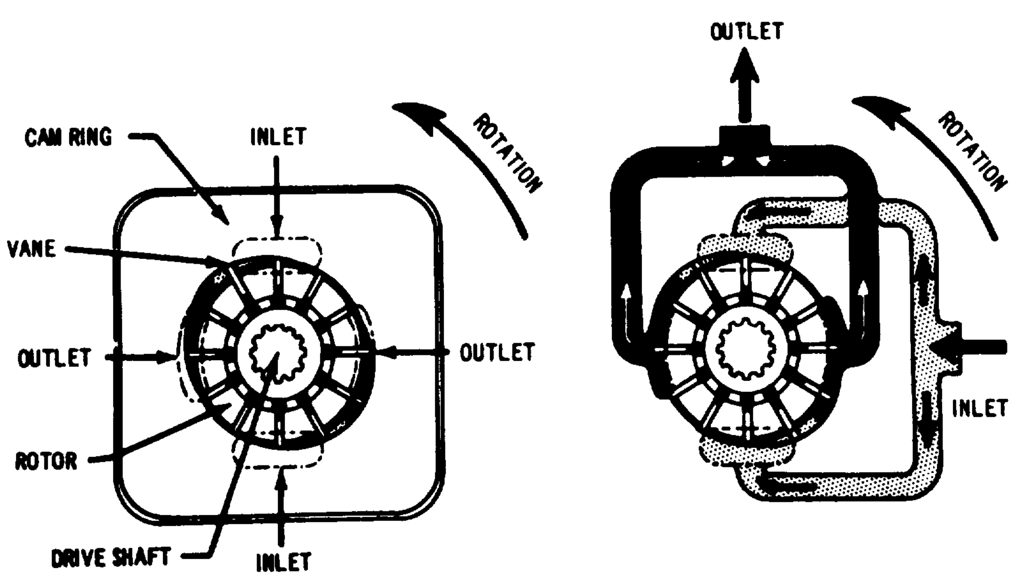


Figure 10-8. Hydraulic Pump and Pump Cartridge Operation

TABLE 10-1 TROUBLESHOOTING CHART

TROUBLE	PROBABLE CAUSE	REMEDY
Pump not delivering fluid.	Coupling or shaft shaft or disengaged.	Disassemble the pump and check the shaft and cartridge for damage. Replace the necessary parts.
	Fluid intake pipe in reservoir restricted.	Check all strainers and filters for dirt and sludge. Clean if necessary
	Fluid viscosity too heavy to pick up prime.	Completely dram the system. Add new filtered fluid of the proper viscosity.
	Air leaks at the intake. Pump not priming.	Check the inlet connections to determine where air is being drawn in. lighten any loose connections. See that the fluid in the servoir is above the intake pipe opening. Check the minimum drive speed which may be too slow to prime the pump
	Relief valve stuck open.	Disassemble the pump and wash the valve in clean solvent. Return the valve to its bore and check for any stickness. A gritty feeling on the valve periphery cm be polished with crocus cloth. Do not remove excess material, round off the edges of the lands or attempt to polish the bore. Wash all parts and reassemble the pump.
	Vane(s) stuck in the rotor slot(s).	Disassemble the pump. Check for dirt or metal chips. Clean the parts thoroughly and replace any damaged pieces. If necessary flush the system and refill it with clean fluid.
Insufficient pressure build-up.	System relief valve set too low.	Use a pressure gauge to correctly adjust the relief valve.
	Worn parts causing internal leakage of pump delivery.	Replace pump cartridge.
Pump making noise.	Pump intake partially blocked.	Service the intake strainers. Check the - fluid condition and, if necessary, dram and flush the system. Refill with clean fluid.
	Air leaks at the intake or shaft seal. (Oil in reservoir would probably be foamy.)	Check the inlet connections and seal to determine where air is being drawn in. Tighten any loose connectcons and replace the seal if necessary. See that the fluid in the resevoir is above the intake pipe opening.
	Pump drive speed too slow or too fast.	Operate the pump at the recommended speed.
	Coupling misalignment.	Check if the shaft seal bearing or other parts have been damaged. Replace any damaged parts. Realign the coupled shafts.

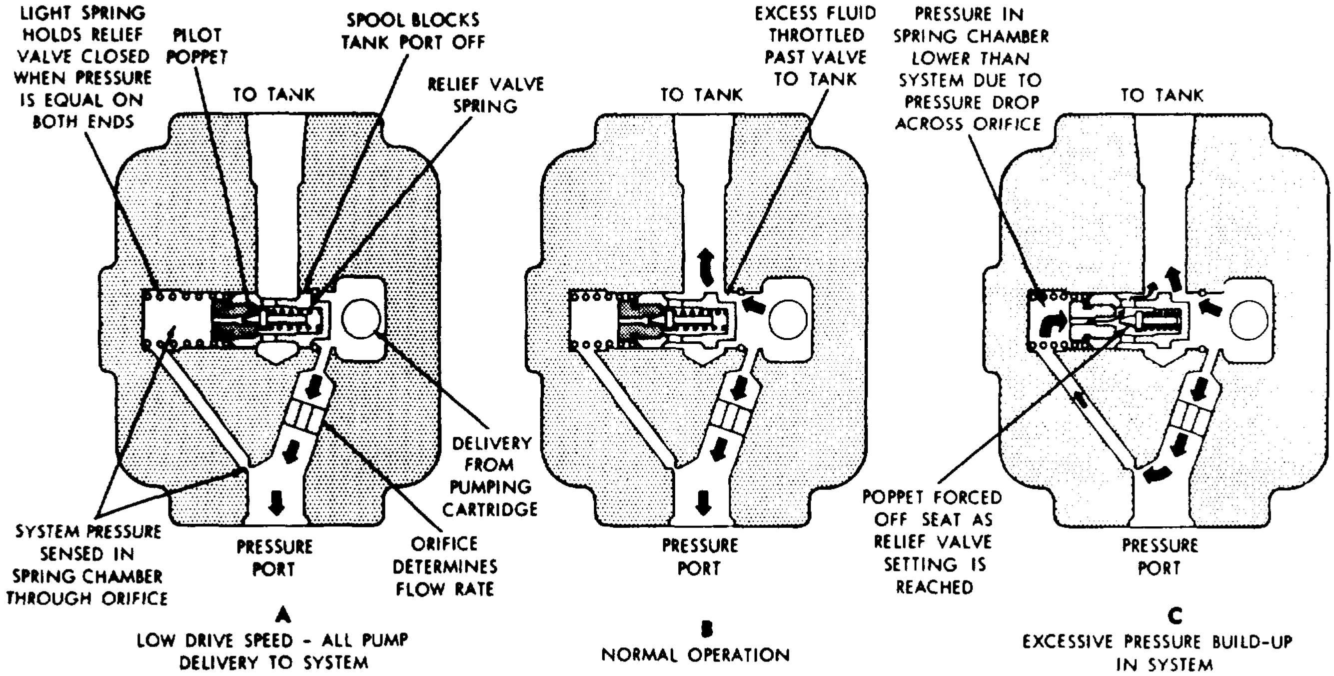


Figure 10B-2. Relief Valve Operation

4. Plug the ports of the pump and cap all lines to prevent the entry of dirt into the system.

5. Remove the drive belts.

6. Remove the nut on the pump shaft and remove the pulley with a suitable puller.

7. Remove the pump mounting bolts, and remove the pump.

CARTRIDGE REPLACEMENT

GENERAL. It is recommended that rebuild of this pump be limited to the replacement of the pumping cartridge and/or seals, each of which is available in the form of a service kit.

Both kits contain the O-rings used to seal the sections of the pump. Therefore, if both of these kits are installed at the same time, one set of O-rings is not required.

DISASSEMBLY. To install the service kits, disassemble the pump as follows (see Figure 10B-3):

1 **Scribe** matchmarks on the cover, ring and body to ensure that the pump is reassembled with the inlet and discharge ports in the proper locations.

2. Clamp the pump body in a vise (not too tight), cover end up, and remove the four cover screws. Lift off the cover and O-ring.

3. Remove the pressure plate and spring, and note the position of the cam ring for correct reassembly. Lift off the cam ring and remove the locating pins. Separate the vanes from the rotor, and remove the rotor from the drive shaft.

4. The following steps should be performed on/y if the seal kit is to be installed. If the seal kit is not being installed, proceed to step 5.

A. Turn the pump body over and remove the shaft key, and the snap ring.

B. Tap with a soft hammer on the splined end of the driveshaft to force the shaft out of the body.

C. Pull the shaft seal out of the body with a suitable hooked tool.

5. Remove the plugs on each side of the cover, and remove the spring and relief valve sub-assembly. Do not remove the snap ring unless it is damaged.

INSPECTION AND REPAIR. Inspect and repair the following items:

1. Discard all O-rings and the shaft seal, if the shaft seal has been removed. Wash the metal parts in mineral oil solvent, blow them dry with filtered compressed air and place them on a clean surface for inspection.

2. Check the wearing surfaces of the inlet body and pressure plates for scoring and excessive wear. Remove light score marks by lapping. Replace any heavily scored or badly worn parts.

3. Check the bearings for wear and looseness. Rotate the bearings while applying pressure to check for pitted or cracked races.

in the cover bore. Remove burrs from the valve by polishing, but do not round off the corners of the lends. Do not attempt to rework the valve bore. If the bore is damaged, replace the cover.

REASSEMBLY. To reassemble the pump, proceed es follows (see Figure 10-10):

1. Coat all parts with hydraulic fluid to facilitate assembly and provide intial lubrication. Use smell amounts of petroleum jelly to hold O-ring in place during assembly.

NOTE

During handling end shipping of the precision mechined cartridge parts, it is possible to raise burrs on the sharp edges. All sharp edges on the parts of a new cartridge kit should be stoned prior to installation.

2. Install the valve in the cover bore, smell lend first. Then install the spring end pipe plug.

3. Press the shaft into the front bearing while supporting the bearing inner race. Next, press the inner bearing into the body, using a driver which contacts the outer race only. Be certain both bearings are firmly seated.

NOTE

Before assembling the shaft seal, determine the correct position of the sealing lip (see Figure 10-11). Double lip seals em assembled with the spring toward the pumping cartridge. Single lip seals have two pressure holes, which are assembled toward the shaft end of the pump.

4. Press the shaft seal firmly in place end lubricate the lip with petroleum jelly or other grease compatible with the system fluid. Slide the driveshaft into the body until the bearing is seated. Tap lightly on the end of the shaft if necessary . Install the snap ring.

6. Install new O-ring in the body end cover. Insert the ring locating pins in the body end assemble the ring so that the arrow on the perimeter points in the proper direction of rotation. Check the assembly against Figure 10-11. Install the rotor on the shaft end insert the vanes in the rotor slots. Be certain the radius edges of the vanes are toward the cam ring.

NOTE

The O-ring, ring, rotor, or vanes should not be renewed separately. Renew these parts es a cartridge kit.

6. Place the pressure plate on the locating pins end flat against the ring. Use a smell amount of petroleum jelly or grease to stick the spring in the recess in the pressure plate. Carefully install the cover with the outlet port in the correct position. Tighten the cover screws to 76-85 foot-pounds (10.3725-11.7555 m/kg) of torque. Turn the shaft by hand to insure that there is no internal binding.

INSTALLATION - ENGINE MOUNTED. To install the pump on the carrier engine. proceed es follows:

1. Place a new gasket on the mounting flange of the pump.

2. Fasten pump to the engine with the mounting bolts.

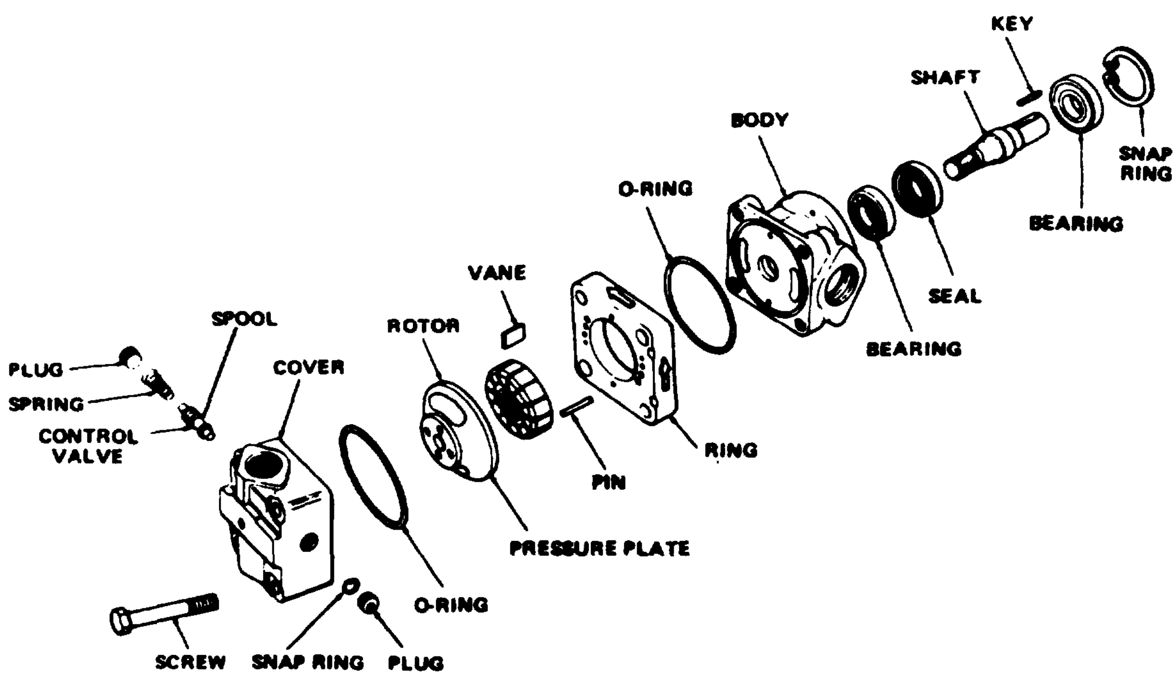


Figure 10-10. Hydraulic Pump

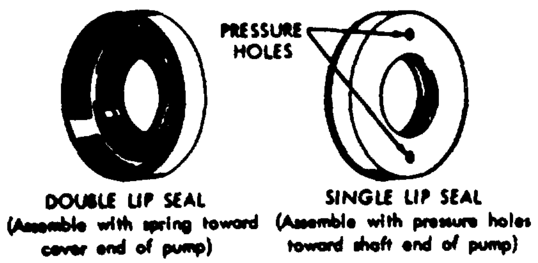


Figure 10-11. Drive Shaft Seals

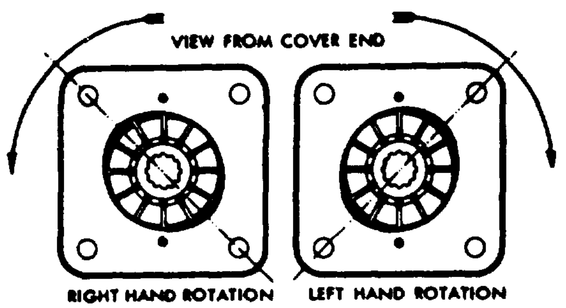


Figure 10-12. Ring Positions

3. Connect the hydraulic hoses to the proper ports of the pump.

4. Run engine end check for leeks.

INSTALLATION - PUMP DRIVE MOUNTED. To install the pump on the pump drive, proceed es fdlows:

1. Fasten pump to pump bracket end tighten the mounting bolts.

2. Install pulley on the pump shaft. lnstall the nut end tighten it.

3. Replace the drive belts end adjust drive belt tension.

4. Connect the hydraulic hoses to the proper ports of the pump.

5. Run Engine end check for leeks.

BREAK-IN. On start up apply the load intermittently for a few seconds et a time, for approximately ten minutes running time to break in the new parts.

HYDRAULIC PUMP (41U16)

GENERAL. This is a gear type, fixed displacement pump which contains an integral flow control end relief valve. These valves act to limit the amount of oil delivered by the pump, end the maximum system pressure.

REMOVAL - ENGINE MOUNTED. To remove power steering pump mounted on the engine, proceed as follows:

1. Remove all dirt from the pump end connections with a droning solvent.

2. Tag the hose connections to assure proper connection upon reassembly.

3. Remove the hydraulic hoses from the pump.

4. Plug the ports of the pump and cap all lines to Prevent the entry of dirt into the system.

6. Remove mounting bolts end pull pump away from the engine.

REMOVAL - PUMP DRIVE MOUNTED. To remove a power steering pump mounted on the pump drive, proceed es follows:

1. Remove all dirt from the pump end connections with a cleaning solvent.

2. Mark the hose connections to assure proper connection upon reassembly.

3. Remove the hydraulic hoses from the pump.

4. Plug the ports of the pump end cap all lines to prevent the entry of dirt into the system.

6. Remove the drive belts.

6. Remove the nut on the pump shaft. Use a suitable puller to remove the pulley from the shaft.

7. Remove the pump mounting bolts, and remove the pump.

REPAIR. Repair of this pump is limited the replacement of the complete pump.

INSTALLATION ENGINE MOUNTED. To install the pump on the carrier engine, proceed es follows:

1. Place a new gasket on the mounting flange of the pump.

2. Fasten pump to the engine with the mounting bolts.

3. Connect the hydraulic hoses to the proper ports of the pump.

4. Run engine end check for leeks.

INSTALLATION - PUMP DRIVE MOUNTED. To install the pump on the pump drive, proceed es follows:

1. Fasten Pump to pump bracket and tighten the mounting bolts.

2. lnstall pulley on the pump shaft. Install the nut end tighten it.

3. Replace the drive belts end adjust drive belt tension.

4. Connect the hydraulic hoses to the proper ports of the pump.

5. **Run engine and check for leaks.**

BREAK-IN. On start up apply the load intermittently for a few seconds et a time, for approximately ten minutes running time to break in the new parts.

DRAG LINK VALVE (6Z197)

DESCRIPTION. The drag link valve is actuated when turning effort is applied to the steering wheel of the vehicle. The drag link valve directs hydraulic fluid from the pump directly to the steering cylinders located in the steering linkage.

The valve piston is normally centered by the hydraulic pressure against the reaction ring (see Figure 10-13). When the operator's effort et the steering wheel exceeds the hydraulic force at the reaction ring, the control valve is actuated end hydraulic power is provided for power steering.

When the valve piston is in the center (neutral) position, the pressure et the cylinder ports of the valve is low. Under this condition them is no circulation of fluid to the steering cylinders. The fluid is circulating however, from the pump, through the valve end to the reservoir.

When the effort in turning the steering wheel of the vehicle overcomes the centering effect of the force against the reaction rings, the valve piston moves axially to restrict the flow of fluid to one of the cylinder ports. At the same instant, the passage in the second cylinder port opens, thus causing en immediate increase in pressure in one of the ports et the power steering cylinders.

While the fluid under pressure enters one end of the cylinder, fluid from the discharge end of the cylinder returns through the valve return port to the reservoir.

Full hydraulic pressure is obtained in the steering cylinders with a valve piston travel of about 0.035 inch. However, the slightest movement of the piston causes a pressure differential et the valve cylinder ports. When the effort et the steering wheel is released, the valve piston returns to center (neutral) position.

Whenever the steered wheels are subjected to shock loads, the movement of the steering linkage tends to actuate the valve in the dreg link momentarily. This action mows the valve piston axially in the appropriate direction. Thereby diverting the hydraulic fluid to the proper side of the steering cylinder piston, end thus resisting the force of the shock. This blocking action prevents "kickbacks" et the steering wheel end stabilizes the steering.

Very little is required to keep the power steering dreg link valve operating properly. The internal parts are hardened end ground to a precise finish, end therefore wear of the working parts will be negligible under clean operating conditions. However, foreign matter in the hydraulic system may score the polished surfaces of the piston and body end cut the seals. This will eventually result in Ieakage end reduced power output for steering.

DISASSEMBLY. To remove the dreg link proceed es follows:

1. Disconnect and UP the hvdraulic lines from the valve. Note the position in which each line is connected to the valve so each can be reassembled in the original position.

2. Remove cotter pin (1, Figure 10-13) and end plug (2).

3. Remove win lock (3) end socket plug (4). Washer (5). spring (6), ball seat (7), and bell arm (8) may now be removed. The valve can now be removed from the steering arm of the vehicle. Disconnect the other end of the dreg link from the steering arm.

4. Hold the valve in a vise for disassembly. CIamp only in the center section of housing (9), since this is the heaviest section.

5. Lock ring (10) her been crimped into a notch in the dreg link adapter (11). Straighten the ring and remove the adapter with a pipe wrench.

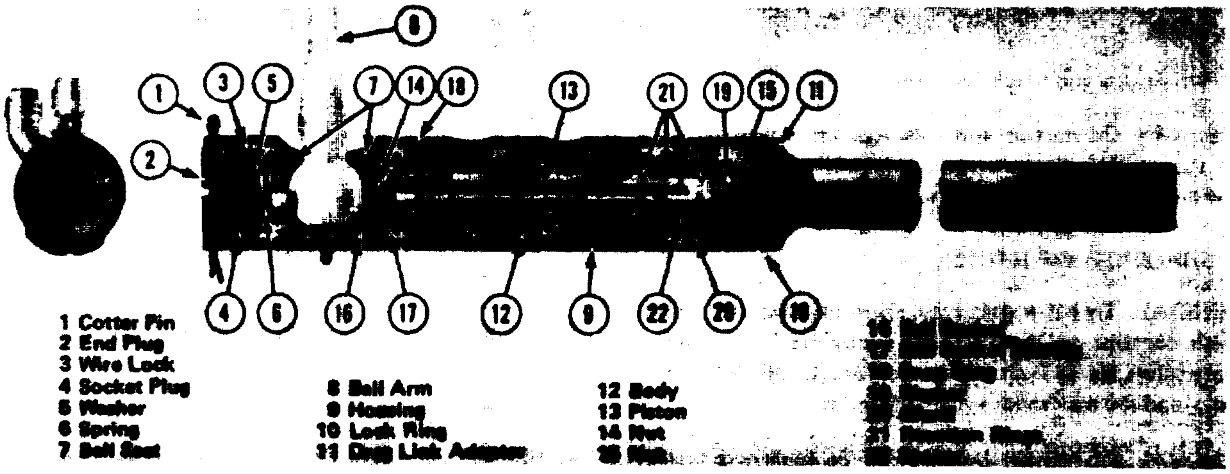


Figure 10-13. Drag Link Valve (6Z197)

TABLE 10-2. DRAG LINK VALVE TROUBLESHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Hard steering.	1. Insufficient pump pressure. 2. Pump drive belt slipping. 3. Low oil level. 4. Sticky relief valve. 5. Piston in steering valve sticking. 6. Valve piston not traveling full stroke. 7. Reaction ring area too high. 8. Excessive leakage in power cylinder. 9. Steering gear not adjusted properly. 10. Improper front end alignment.	I. Check pump with pressure gauge. 2. Tighten belt. 3. Refill reservoir and system. 4. Repair or replace relief valve. 5. Overhaul valve a outlined in service instructlons. 6. Adjust position of end plug per instructions. 7. Select ring with smaller area. 8. Check cylinder for broken piston or rings. Check condition of cylinder wall. Replace if necessary. 9. Adjust in accordance with manufacturers specifications. 10. Align in accordance with manufacturers specifications.
No recovery from turn to straight ahead.	1. Low pump output 2. Piston in steering valve sticking, (prevents centering). 3. Ball stud adjustment too tight. 4. Steering linkage too tight. 5. Insufficient wheel caster. 6. Steering gear too tight (out of adjustment).	1. Check pump output and replace if necessary. 2. Disassemble valve and inspect for sticking. 3. Adjust for proper clearance. 4. Readjust. 5. Readjust per manufacturers specifications. 6. Readjust per manufacturers specifications.
Excessive lost motion at steering wheel.	1. Loose ball socket connections or other linkage connections. 2. Excessive back-lash in steering gear. 3. End plug on steering valve not properly positioned.	1. Tighten and readjust. 2. Readjust per manufacturers specifications. 3. Make adjustment as outlined in service instructions.
Noise.	1. Pump drive belt out of adjustment. 2. Low oil level. 3. Air in system. 4. Worn pump. 5. Hydraulic hose lines in direct contact with vehicle frame or sheet metal.	1. Adjust. 2 Refill system. 3. Bleed system by loosening fitting on power cylinder to let air escape. Check all fitting connections for tightness. 4. Repair or replace. 5. Insulate lines from frame contact with rubber grommets.
Steering shimmy or chatter.	1. Loose ball socket connections or other linkage connections. 2. Wheels out of balance. 3 Excessive caster. 4. Excessive back-lash in steering gear 5. Loose pump belt. 6. Area of valve reaction rings too low.	1. Tighten and readjust. 2. Balance. 3. Correct and have alignment of front end checked. 4. Readjust gear. 5. Adjust belt tension. 6. Select rings with greater area.

6. Disassemble the the socket before attempting to remove body (12) from housing (9). To do so, place a punch into an oil passage in piston (13) to prevent the piston from turning. Remove nut (14) from the ball socket and the 4 inch extension. Remove ball socket (16) and ball socket bearing (17).

7.The valve body assembly can now be removed from housing (9). The housing contains the snap ring (18). It is not necessary to remove this snap ring.

8. To disassemble valve body (12) from piston (13), hold the assembly in a vise, clamping on the body. Place a punch in the oil passage hole in the piston to keep it from turning in the body and remove nut (15) from the gland end of the piston with a 3/4 inch box socket.

9. Remove washer (19). Hold the piston in the body and remove gland (20), reaction rings (21), and spacer (22). Do not attempt to remove the gland and piston together, as the O-ring seals on the piston will be damaged. When removing the piston, first move it toward the gland end of the body just far enough to permit removing the O-ring. Then move the piston in the opposite direction just far enough to remove the O-ring from the other end. Finally, slide the piston out from the gland end of the body.

REPAIR AND INSPECTION. Clean and wash all parts thoroughly in solvent or kerosene. Handle the part, separat-ely and carefully to avoid damaging the finished surfaces. Wear of parts such as piston, reaction rings and valve body is negligible as these parts operate in circulating oil. It is impractical for a field service shop to attempt to measure MU. Therefore a careful visual inspection of all parts is most important.

Examine the surface of the piston and the bore of the body for scoring damage that may have been cause by foreign matter in the fluid. Parts that are badly scored and scratched should be replaced. Light scratches can be removed by polishing with fine crocus cloth. Do not “round-off” or chamfer the port edges of the piston or body. These edges should remain sharp to insure proper sealing. If they are broken the result would be excessive leakage and reduced hydraulic power.

REASSEMBLY. To reassemble the drag link valve, proceed as follows:

1. Hold the valve body in a vise end install the valve piston. Insert the piston into the gland end of the body for easy assembly. Install an O-ring on the piston opposite the gland end first and mow the piston into the body just enough to permit installation of the O-ring on the gland end of the piston. Center the piston on the body so that the shoulder on the gland end of the piston is flush with the bottom of the counterbore in the body.

CAUTION

When installing the O-ring seals on the piston do not mow the piston in the body my farther the, is required to assemble the seal. If the seal on the gland end of the piston drops into the cavity in the body, it is likely to be cut or damaged. Apply light lubricating oil to the piston and seals when assembling.

2. Install the two O-ring seals on the gland end of the piston.

3. Install the O-ring seals on the two reaction rings. Install one ring on the piston, then install the gland in the body and the second reaction ring on the end of the piston.

4. Install the spacer in the gland between the two reaction rings **and** assemble In the body.

6. Install the washer and nut and tighten the nut to 20-25 foot-pounds torque (2.766-3.4575 m/kg). To hold the piston stem from turning while tightening the nut, place a punch in the oil passage hole in the piston.

6. Place the body assembly in the housing and assemble the drag link adapter with the lock ring and tighten enough to hold the body in position. Be sure that the interior of the housing is clean and that no obstructions prevent the body assembly from bearing against the stop ring in the housing. This an be observed through the opening in the housing.

7. Place the assembly in a vise with the bell stud opening in the housing facing upward.

CAUTION

Clamp only in the canter of the valve, as this is the heaviest section.

8. Place the ball socket bearing in the ball socket. The counterbored side should face toward the socket opening,

9. Assemble the socket in the housing and secure with a nut. Tighten the nut to 20-25 foot-pounds torque (2.7660-3.4575 m/kg).

10. Tighten the dreg link adapter to 70-75 foot-pounds torque (9.681-10.3725 m/kg). Bend the edge of the lock ring into a slot in the rim of the adapter.

INSTALLATION. To install the valve, proceed a follows:

1. Plea the ball seat in the ball socket and assemble the valve over the ball stud on the vehicle steering arm. Assemble the ball seat, spring, and ball socket end plug. Tighten the end plug until it bottoms, then back it off until the nearest set of holes in the socket lines up with the slot in the end plug to permit installing the plug lock.

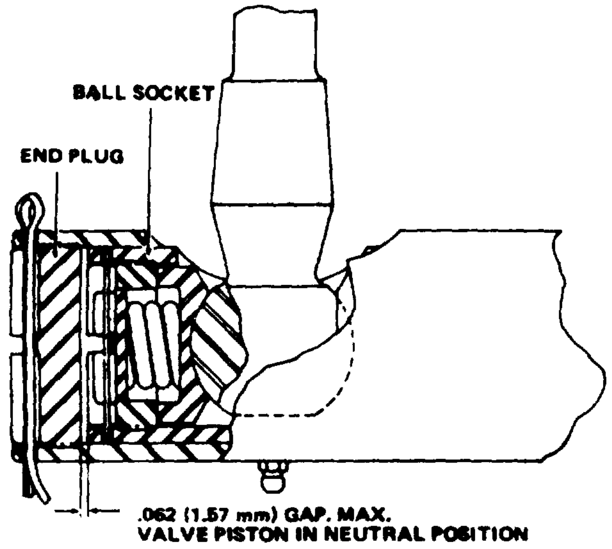


Figure 10-14. Adjusting End Plug Gap

2. Attach the hydraulic lines to the valve ports. Lines must be attached to the same ports from which they were originally removed.

3. When installing the valve housing end plug, particular attention should be given to positioning it properly. The plug provides a stop which limits the outward stroke of the valve piston. There should be a 1/l6 inch (.062) (1.5875 mm) maximum gap between the end of the ball socket and the force of the end plug when the valve piston is in a contend (neutral) position (see Figure 10-15).

ADJUSTMENT. It is important that the end plug adjustment be made properly to assure that it provides for a stop when the ball socket mows outward. This eliminates the possibility of placing tension on the valve piston when the valve is actuated during steering operation.

To obtain the proper end plug position, proceed as follows:

1. After the power steering system installation is complete, fill the reservoir to the specified level with the type of fluid recommended. Start the engine to allow the hydraulic fluid to circulate through the system. Have the front axle jacked up so that the wheels are deer. Turn the wheels to full right and full left a few times to allow the steering cylinders and lines to fill. Check the fluid level in the reservoir and replenish if necessary.

2. Increase the engine speed to about 750 or 800 rpm. Hydraulic system pressure will center the valve piston in the neutral position.

3. Turn the housing end plug inward until there is a 1/16 inch (1.587 mm) gap between the two end plugs. This dimension can be measured by inserting a feeler gauge shim (.062 width) (1.574 mm) between the plug, through the inspection hole in the valve housing. Remove the gauge and continue turning the end plug inward until the nearest set of holes in the housing line up with the riot in the and plug, and install the cotter pin.

If the valve is to be lnstalled when it is not possible to operate the engine for hydraulic power as descrlbed in the proceeding paragraphs, use the following procedure to make the end plug adjustment.

1. Assemble the valve on the steering arm ball stud and assemble the ball socket end plug as described in the first paragraph of the installation instructions.

2. Move the valve so that the valve piston and ball socket travel inward. Hold the valve against the stop and turn the housing end plug inward until there is 1/8 (.125) (3.175 mm) gap between it and the ball socket end plug. Insert a gauge (.125) (3.175 mm) between the plugs through the inspection hole in the housing to check the measurement. Remove the gauge and continue turning the end plug inward until the nearest set of holes in the housing lines up with the slot in the end plug, and install the end cotter pin.

3. Always provide a dust shield to cover the ball socket opening. A lubrication fitting is provided for the valve ball socket and stud.

4. Before pIacing the vehicle into operation, recheck all line fittings on the valve, and hydraulic pump. Be sure the end plug is adjusted properly.

POWER STEERING CYLINDER 14Z286)

DISASSEMBLY. To service the cylinder, Proceed as follows:

1. Remove the steering cylinder from the carrier.

2. Remove the snap ring from the heed (see Figure 10-15).

3. Push the head into the cylinder about 1/2 inch (12.7 mm), or far enough to permit remove of the snap ring from the body.

4. Remove the head piston, and rod assembly as a unit by pulling the rod outward. Remove the head from the rod.

5. Remove the rod seal and washer from the head by taking out the retaining ring.

REPAIR AND INSPECTION. When the cylinder is disassembled, inspect and repair as follows:

1. Examine the piston and piston rings for damage, replace these parts if they are worn or badly scored.

2. If the piston is removed from the rod, replace the copper washer.

3. Inspect the inner wall of the cylinder body for scoring. Light scratches on the well can be removed by buffing with crocus cloth.

4. Examine the O-ring seaI for cuts and abrasions on the

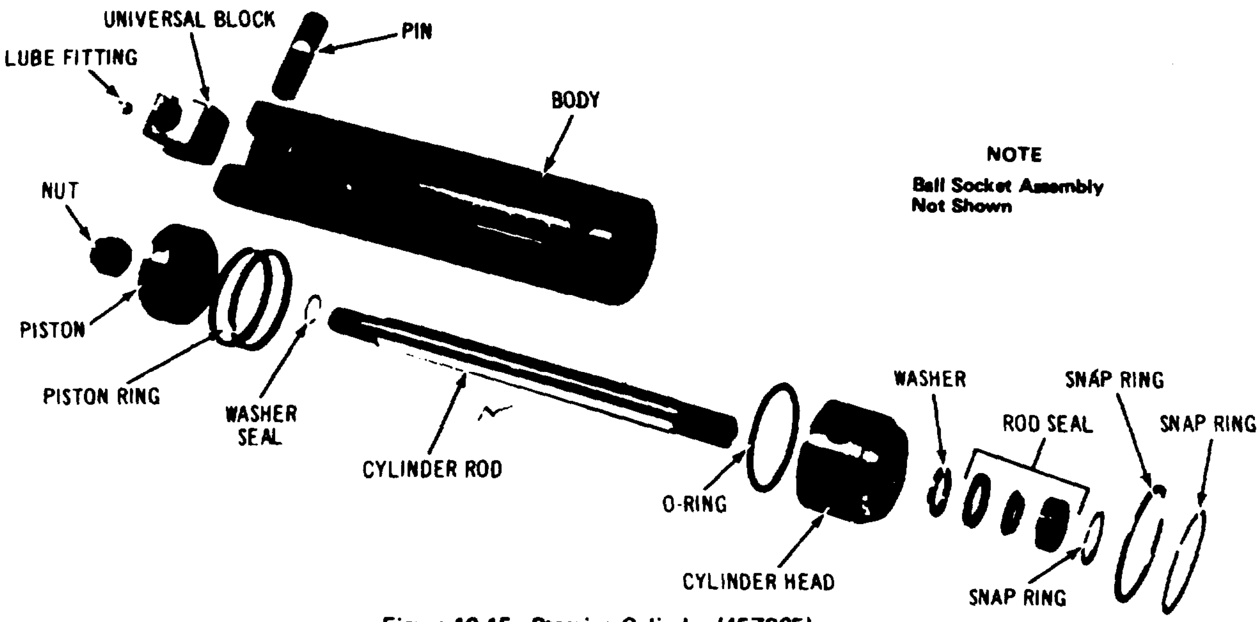


Figure 10-15. Steering Cylinder (45Z265)

outer surface that Would cause leakage. Examine the rod seal assembly for damage.

5. If the sealing edge of the neoprene ring are cut or worn, leakage will occur. The nylon wedge ring and gland act as a rod scraper; if the edges are broken or "notched" foreign matter will enter the seal cavity.

6. Wash and dean all parts thoroughly in solvent or kerosene before reassembly.

7. Check the mar pin and universal block for wear. The pin should fit snugly when assembled in the cylinder base end universal block.

REASSEMBLY. To reassemble the cylinder, proceed as follows:

1. Lubricate all seals and parts with light oil before assembly.

2. Install the rings on the piston with the joints positioned on opposite sides of the piston. Assemble the piston and rod assembly in the body, using a standard ring compressor.

3. Install the washer and rod seal assembly in the head and secure it with the snap ring.

4. Install the O-ring seal on the head. Assemble the head into the body, moving it slowly so that the O-ring will not be damaged as it passes the port hole in the body.

5. Install the snap ring in the body. Pull the rod outward to force the heed against the snap ring.

6. Install the spiral lock ring on the head.

7. Install the complete steering cylinder on the axle.

WHEEL ALIGNMENT

GENERAL. To obtain the best tire wear life and proper steering of the carrier, two types of alignment must be checked and maintained for the front front and rear front wheels. The wheels on each axle must be adjusted so that they "toe in". This prevents the vehicle from tending to Wander when steering in a straight fine, by allowing the forces applied to the tires during travel to act to keep the wheels set to steer straight.

In addition, the parallel wheel alignment must be set so the Wheels on both axles are as nearly parallel to each other, relative to the centerline of the carrier, as possible. This adjustment is necessary to assure that all wheels will steer in the same direction.

If the tires begin to show signs of excessive or uneven war, and they have been maintained at the proper inflation pressure, check the alignment of the wheels as described below.

NOTE

Toe-in must be adjusted properly before adjusting parallel alignment. All tires must be inflated properly, and matched in outer diameter, for the following adjustments to be fully effective. The adjustments must be made with the wheels set to steer in a straight line, since the front front wheels and the rear front wheels turn on slightly different arcs.

TOE-IN ADJUSTMENT. The recommended toe-in for this carrier is 1/8 inch (3.175 mm) maximum, O-inch minimum. To check and adjust the amount of toe-in, proceed as follows (see Figure 10-16):

1. Place the carrier on a flat and level concrete surface, and

jack up the front of the carrier.

2. Whiten the center of the tread areas of all four tires, around the circumference, with chalk. Scribe a straight line around the circumference of each tire, by positioning a scribe or other pointed instrument against the whitened area of the tire, and rotating the tire. Be sure to hold the scribe firmly in place.

3. Lower the carrier to the ground, and move the carrier backward and then forward approximately 6 feet (1.8288 m). This will cause the tires and steering linkage to assume their normal driving positions.

NOTE

Do not measure toe-in with the front axles jacked up. Toe-in must be measured with the weight of the carrier on the axles, so that the tires are in their normal driving positions.

4. Measure the distance between the scribed lines at the rear of the tires on the front front axle at the height of the hubs, using a trammel bar or other suitable measuring device. Measure the distance between the same lines at the front of the tires. Subtract the front measurement from the rear measurement to obtain the amount of toe-in.

5. If adjustment is necessary, loosen the tie rod clamps and disconnect the parallel adjusting link between the axles. Rotate the tie rod until the required toe-in is obtained, 7 Tighten the tie rod clamps.

6. Repeat steps (4) and (5) to check and adjust the toe-in of the rear front axle.

7. Reconnect the parallel adjusting link. Move the carrier backward and then forward approximately 6 feet. Recheck the toe-in as described above, and readjust if necessary.

PARALLEL WHEEL ALIGNMENT. Parallel wheel alignment is adjusted by means of the adjusting link shown in figure 10-16. To adjust the parallel alignment, proceed as follows:

1. Check the alignment of the wheels on one axle, relative to the wheels on the other axle using a long straight edge. The wheels should be as nearly parallel to each other as possible.

2. If necessary, adjust length in small increments. After each adjustment, run the carrier backward and then forward at least one full tire revolution, so that the wheels assume their normal driving positions.

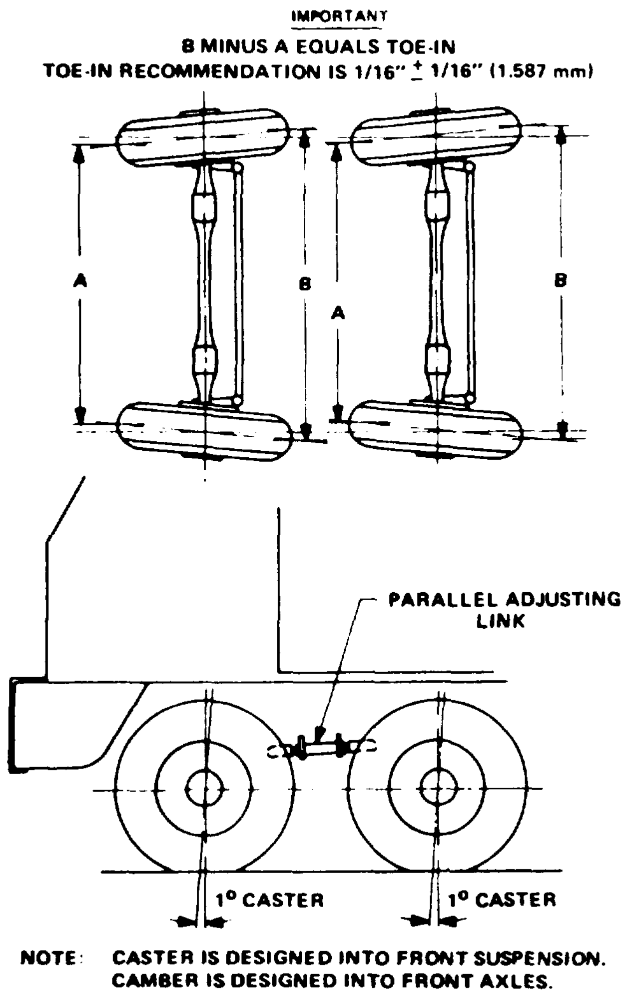


Figure 10-16. Toe-In Adjustment

PART TWO

CRANE REPAIR PARTS MANUAL

HOW TO USE THIS BOOK

GENERAL

This parts book provides a cross-reference between the parts list and an illustration of the part. in that respect, it is not very different from many other parts books. However, it is unusual in some ways, since it contains much additional information not normally included in parts books. Some features of this book are pointed out below.

INDIVIDUAL EDITING

This book is edited to match it to a specific machine. The serial number of the machine appears on the EDITING PAGE immediately following.

Editing is only necessary when the machine model offers an EITHER/OR option, such as a GM or Cummins engine. In such a case, a check mark will appear in the box adjacent to the option selected. Applicable subassemblies will be listed below on the basic option.

If you wish, you can remove those pages of the book which do not apply to your machine. The remainder of the pages will then constitute a fully edited manual, except that items (such as boom inserts) which were not necessarily sold with this machine will be listed in the manual, since it is quite conceivable that the user may wish to buy such an item at a later date.

THE LISTING OF A PART IN THIS MANUAL DOES NOT IMPLY THAT IS WAS FURNISHED WITH YOUR MACHINE. IT IS SIMPLY AVAILABLE FOR PURCHASE, IF YOU SO DESIRE.

DEALER STOCK PARTS

Items marked with an "X" in the "stock" column are recommended for inclusion in dealer's stock. The recommended stock quantity is indicated in the adjacent "QTY" column. The quantity shown is based on one machine in heavy duty service, and should be correspondingly increased if more than one machine of this type is in your area.

COMMON HARDWARE

Common hardware is described by standard methods. For instance, a capscrew may be described as a 1/2-3UNC x 1-1/2 in. It will not be listed by pert number, because it is not economically sound to sell small quantities of common hardware. We recommend that you purchase such items locally, However, if you choose to order such items from Harnischfeger, you will be sold the minimum order quantity of the part. See the topic MINIMUM ORDER QUANTITIES below.

MINIMUM ORDER QUANTITIES

For items such as common hardware, the minimum order quantity is 50. For instance, any item identified in the parts list by description only is automatically a common hardware item. The lack of a specific part number indicates that any commercial grade of hardware is acceptable for use at that point on the machine. Such common hardware items will be sold in quantities of 50 or in multiples of 50 only.

However, if a part number is assigned to a hardware item in this book, this will usually indicate that severe service conditions require the use of the item listed.

KITS

Certain items (primarily pumps, cylinders, valves, etc.) should normally be completely repacked when they are disassembled. In these cases, we are listing gasket and seal kits rather then individual O-rings or seals. Experience has convinced us that this is the least expensive method from the viewpoint of both the dealer and the customer. It will prevent down time caused by inadvertant damage to seals or gaskets during reassembly. For these reasons, some items formerly listed separately are available in kit form only.

INDENTION

The indention of a part in the "Description" column indicates the relationship of that part to the assembly of which it is a pert. For instance, the shaft assembly listed above can be purchased in two ways - as a assembly, or the key alone. You can tell this at a glance, since parts indented beneath an assembly are a part of that assembly, and will be received automatically ii the assembly Is ordered.

EXAMPLE NO. 1

-	10N000F1	SHAFT ASSY	2
1	20HOOOO	. KEY	1

EXAMPLE NO. 2

-	10N000F1	SHAFT ASSY	2
1	20H0000	. KEY	1
2		. BOLT, Hex hd 1/2-13UNC x 1 in.	4
3	16T0000	PLATE	1

NOTE

Parts pages are intended for use in ordering parts. and therefore do not always depict the correct way to assemble components.

Note that in the second example, a bolt is shown as being a part of the shaft assembly. You will get this bolt automatically when you order the assembly. However, the Iack of a pert number identifies the bolt as being common hardware, which we recommend you purchase locally.

Also, a plate (item 3) has been added to the list. Since this plate is not indented beneath the shaft assembly, you will not receive the plate unless it is ordered as a separate item.

QUANTITIES

Note that example 2 lists two shaft assemblies, but only one key. Quantities in this manual are shown as follows:

1. For assemblies, the quantity is the number of assemblies per machine.

2. For piece parts, the quantity is the number of parts par assembly.

GLASS

Standard flat glass items are not considered to be replacement parts, due to the extreme difficulty involved in shipping such parts without breakage. For that reason, all flat glass which can be obtained locally is illustrated, with full dimensions, in this manual. This material should be obtained locally. Only curved or special glass items will be listed in this manual as repair parts.

GROUPS

The machine is broken down into basic groups. For instance, on a hydraulic truck crane, Group 1 will always be the attachment. Group 2 the upper works, Group 3 the lower and Group 4 the power plant. To find any part, determine which group it is a part of, turn to the group, and find the page on which the part is listed.

NOTE

The following Editing Section A, B, C & D (21 pages), section E (5 pages), section F (5 pages) each cover a different group of serial numbers. Before ordering parts, refer to the upper left hand corner of each index to determine which one is applicable for your machine. Changes which occur within a block of serial numbers are also specified in the upper left hand corner. After you have determined which index is applicable, check to see if your machine is affected by the interim changes. If it is, use the assembly which is specified in the index as a change.

EDITING SECTION A

GROUP ONE
ATTACHMENT

GROUP Two
BASIC UPPER

GROUP THREE
CARRIER

GROUP FOUR
POWER PLANT

Model No. MT250
Serial No. 36107 to 36118
Change # 1 36119 to 36139
Change # 2 36140 to 36154

Change # 1 effective with this unit and future Change # 2 effective with this unit and future.

EDITING SECTION 8

GROUP ONE ATTACHMENT

GROUP TWO
BASIC UPPER

Serial No. 36107 to 36118
36119 to 36139
36140 to 36154

Model No. MT250
Serial No. 36107 to 36118
36119 to 36139
36140 to 36154

GROUP THREE
CARRIER

GROUP FOUR
POWER PLANT

Model No. MT250
Serial No. 36155 to 36199
37223 to 37247
37591 to 37642
Change = 3 37643 to 37670
38155
41402 to 41407
41745
Change = 3 effective with this unit and future

EDITING SECTION C

GROUP ONE
ATTACHMENT

Model No. MT250

Seriel No. 36155 to 36199
37223 to 37247
37591 to 37642
37643 to 37670
38155
41402 to 41407
41745

GROUP TWO
BASIC UPPER

Model No. MT250
Serial No. 36155 to 36199
37223 to 37247
37591 to 37642
37643 to 37670
38155
41402 to 41407
41745

GROUP THREE
CARRIER

Model No. MT250

Serial No. 36155 to 36199
37223 to 37247
37591 to 37642
37643 to 37670
38155
41402 to 41407
41745

GROUP FOUR
POWER PLANT

EDITING SECTION D

GROUP ONE
ATTACHMENT

Serial No. 41746 to 41775
41777 to 41804
41812
42043 to 42096

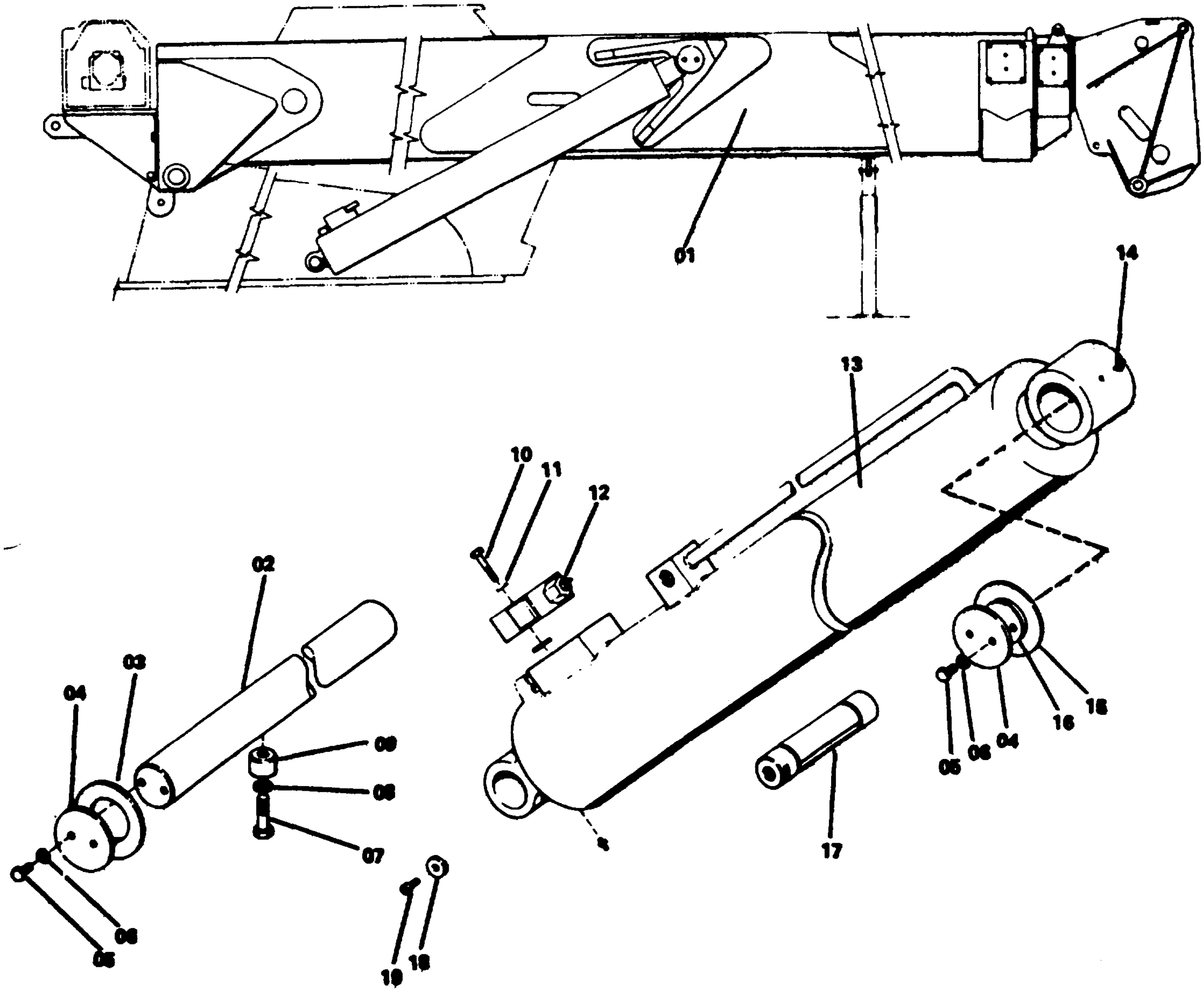
GROUP TWO
BASIC UPPER

Model No. MT250
Serial No. 41746 to 41775
41777 to 41804
41812
42043 to 42096

GROUP THREE
CARRIER

GROUP FOUR
POWER PLANT

BOOM INSTALLATION - 80 FOOT

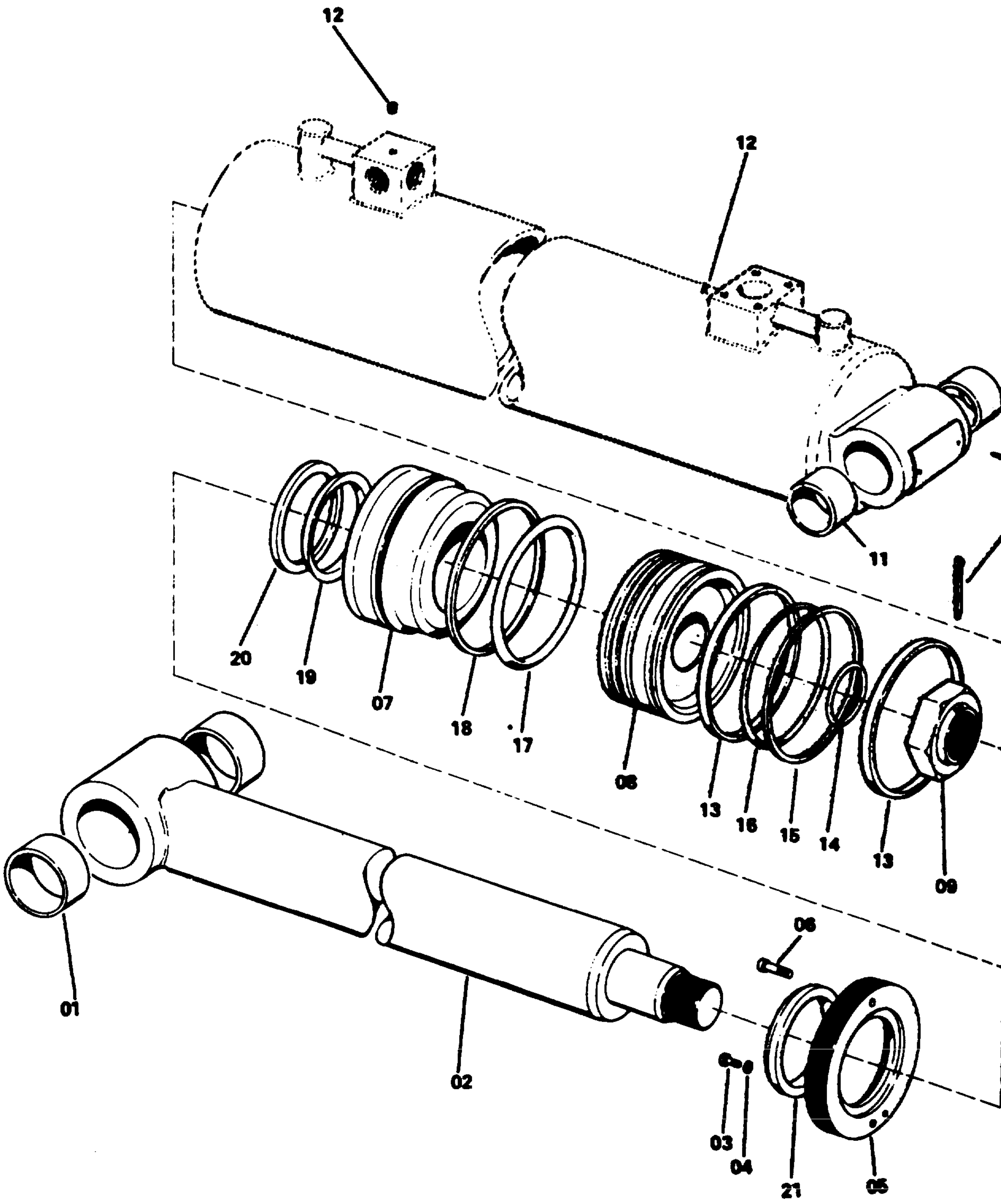


BOOM INSTALLATION - 80 FOOT (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 10	11	14	
		–	100J3748-10	BOOM INSTALLATION - 80 FT.	↓			
		–	100J3748-11	BOOM INSTALLATION - 80 FT.		↓		
		–	100J3748-14	BOOM INSTALLATION - 80 FT.			↓	
		01	100J4198-1	. BOOM ASSEMBLY (Page 3.1)	1	–	–	
		01	100J4198-2	. BOOM ASSEMBLY (Page 3.1)	–	1	1	
		02	10T1360	. SHAFT, Boom pivot	1	1	1	
		03	18T11060	. RETAINER	1	1	1	
		04	18T9801	. RETAINER	3	3	3	
		05		. SCREW, Hex hd. 1/2-13UNC x 1 in	8	8	8	
		06		. WASHER, Lock 1/2 in	8	8	8	
		07	20Z133502	. SCREW, Self-locking hex hd. 5/8-11UNC x 2-1/2 in.	1	1	1	
		08		. WASHER, Flat 5/8 in.	1	1	1	
		09	18T10582	. WASHER, Shear	1	1	1	
		10		. SCREW, Socket hd. 1/2-13UNC x 2-1/4 in	8	8	8	
		11		. WASHER, Lock 1/2 in	8	8	8	
		12	36Z931	. VALVE. Holding	2	–	–	
		–	45Z91D71	. . O-RING	1	–	–	
		12	36Z1116	. VALVE, Holding	–	2	2	
		–	45Z91D71	. . O-RING	–	1	1	
		13	38U92	. CYLINDER, Boom hoist (Page 2.1)	2	2	2	
		14		. FITTING, Lube.	4	4	4	
		15	18T9829	. SPACER	2	2	2	
		16	20T8570	. SHIM	2	2	2	
		17	19N20	. PIN, Hoist cylinder	2	2	2	
		18	18T10386	. RETAINER	2	2	2	
		19		. SCREW, Socker hd. 3/8-16UNC x 1 in	2	2	2	

Ref. Dwg. 100J3748-A
100J3748-11
100J3748-10
100J3748-14

BOOM HOIST CYLINDER

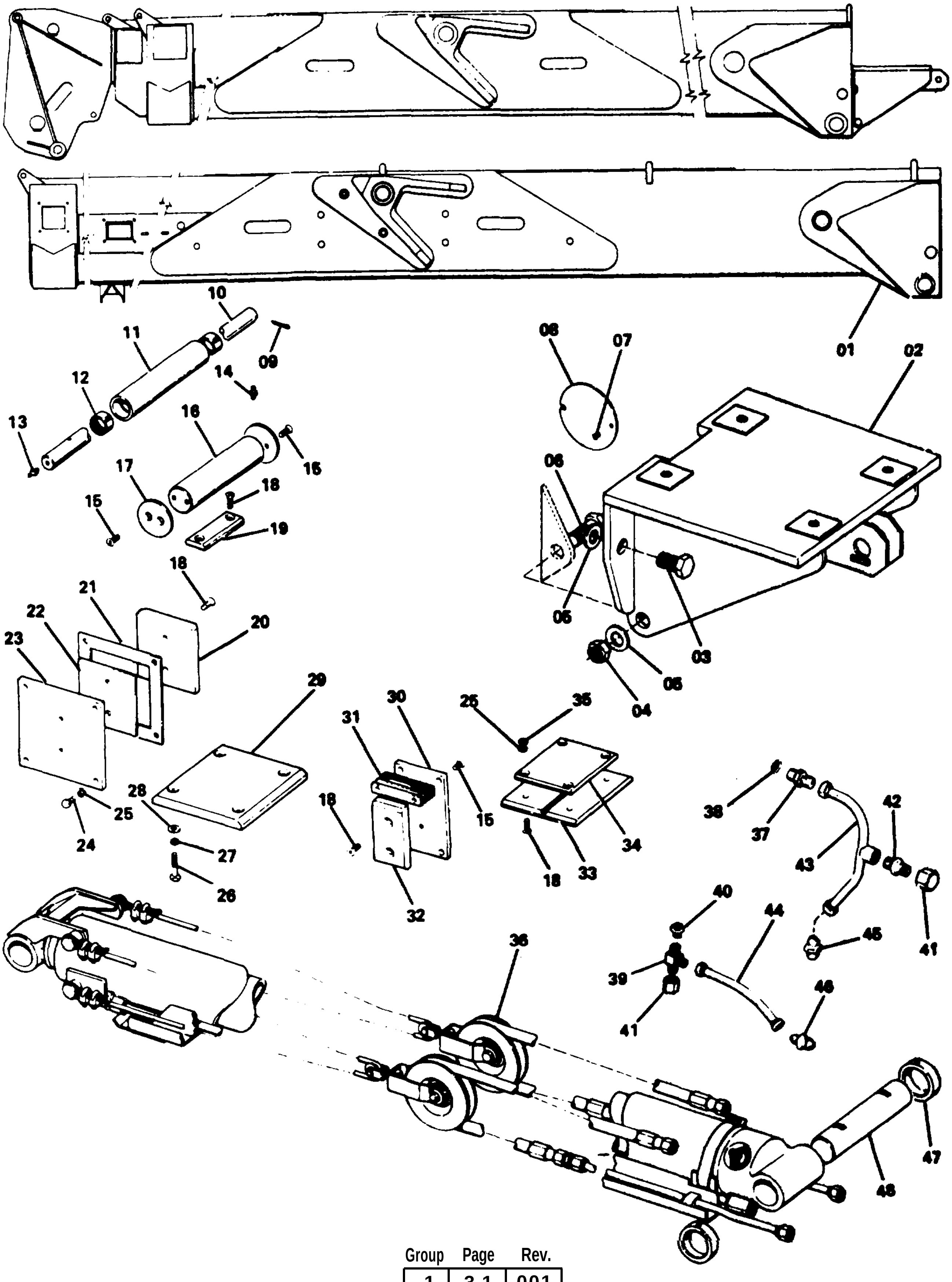


BOOM HOIST CYLINDER (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–	38U92	CYLINDER, BOOM HOIST				
		01	1005Z454	. BUSHING, Rod end	2			
		02	1039Z288	. ROD ASSY	1			
		03		. SCREW, Hex hd. 1/4-28UNF x 3/4 in.	1			
		04		. WASHER, Spring lock 1/4 in.	1			
		05	1018Z2471	. RING, Thread	1			
		06		. SCREW, Socket hd. 3/8-16UNC x 1-1/2 in.	2			
		07	1018Z2467	. GLAND, Had	1			
		08	1039Z286	. PISTON	1			
		09	1020Z2682	. NUT, Slotted hex buttress	1			
		10		. PIN, Cotter 5/32 x 3-1/2 in.	1			
		11	1005Z453	. BUSHING, Body end	2			
		12		. PLUG, Allen hd. pipe 1/8 N.P.T.	2			
		–	1045Z982	. KIT, Seal	1			
		13		.. RING, Piston	2			
		–	1045Z1114	.. KIT, Soft seal	1			
		14		... O-RING, Static piston	1			
		15		... RING, Sirvon seal	1			
		16		... O-RING, Sirvon loading	1			
		17		... O-RING, Static head	1			
		18		... RING, Back-up	1			
		19		... U-CUP, Rod	1			
		20		... RING, Back-up	1			
		21		... WIPER, Rod	1			

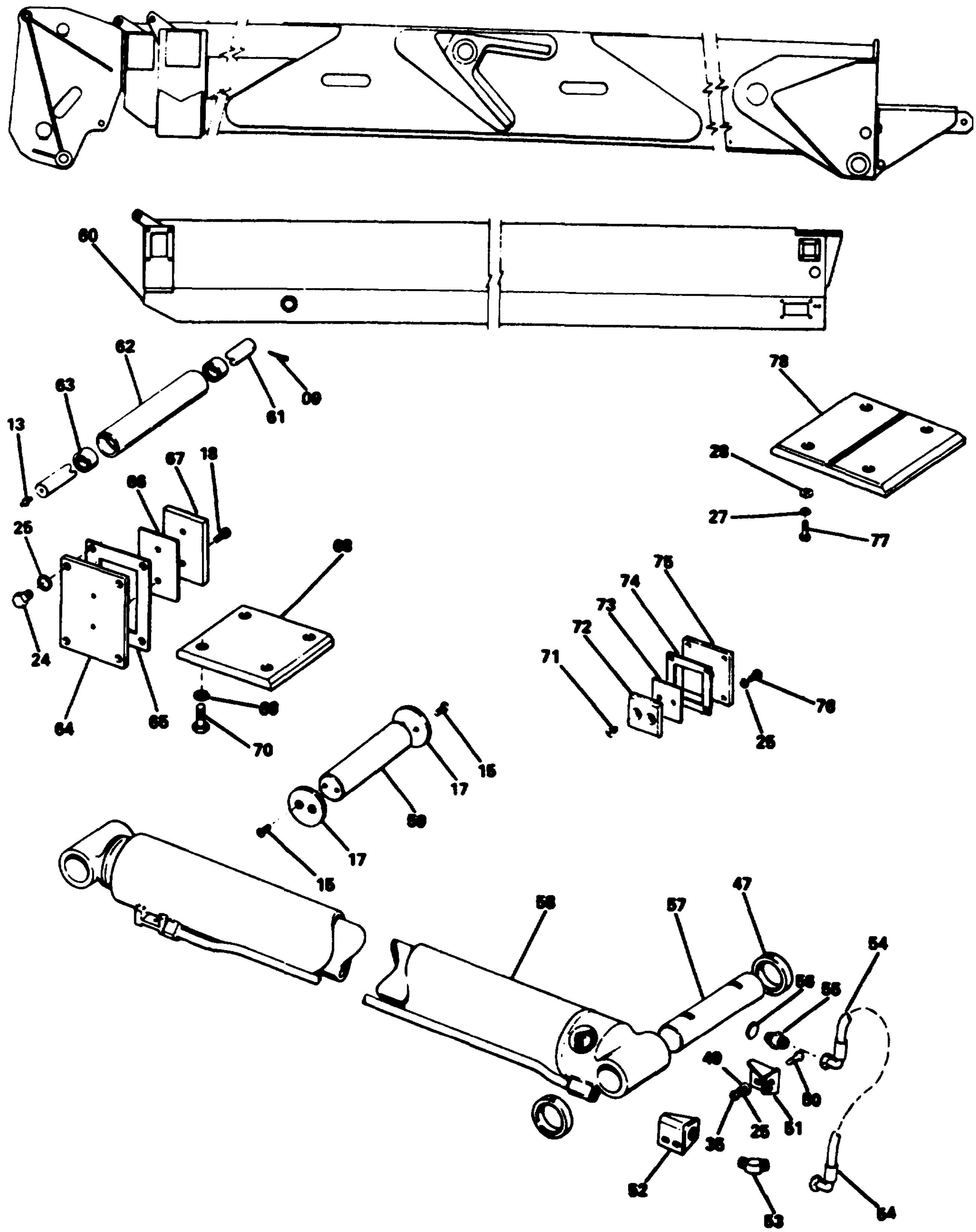
Ref. Dwg. 38U92

(BASE SECTION)

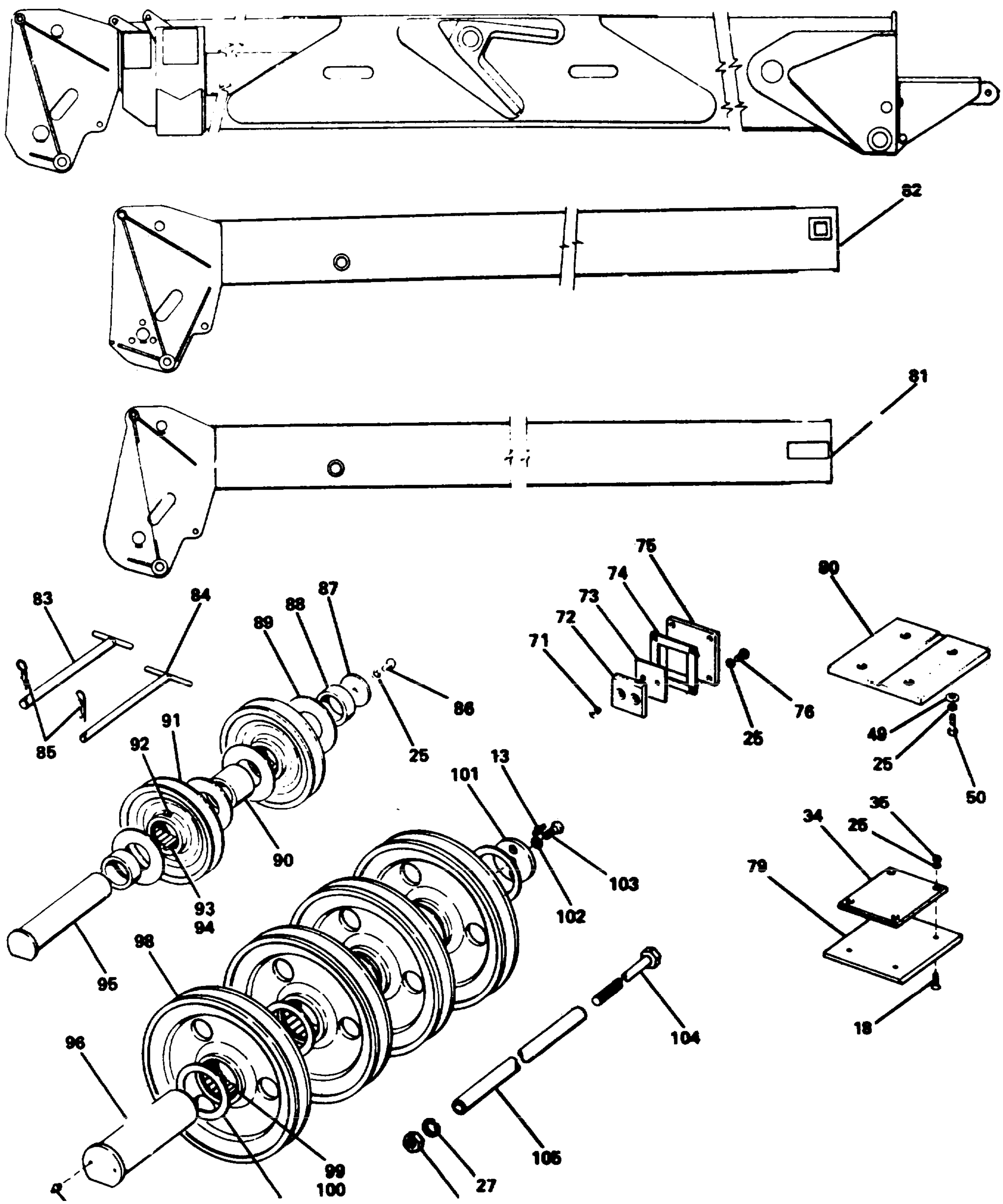


Group	Page	Rev.
1	3.1	001

80 FOOT BOOM ASSEMBLY
(MIDSECTION)



80 FOOT BOOM ASSEMBLY
(FLY SECTION)



80 FOOT BOOM ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	2	3	
		–	100J4198-1	BOOM ASSEMBLY, 80 FOOT	↓			
		–	100J4198-2	BOOM ASSEMBLY, 80 FOOT		↓		
		–	100J4198-3	BOOM ASSEMBLY, 80 FOOT			↓	
		01	11IJ2175D4	. SECTION, Boom base	1	–	–	
		01	11J2578D1	. SECTION. Boom base	–	1	1	
		02	11N2060	. BRACKET, Winch mount	1	1	1	
		03	20T8306	. SCREW, Hex hd. 1-1/4-7UNC x 2 in	2	2	2	
		04	20Z739D12	. NUT, Hex 1-1/4-7UNC	2	2	2	
		05	18Z694D12	. WASHER, Hardened 1-1/4 in.	4	4	4	
		06	20Z1036D12	. SCREW, Hex hd. 1-1/4-7UNC x 3 in	2	2	2	
		07		. SCREW, Rd. hd. mach #10-24UNC x 1/2in.	4	4	4	
		08	14T1419	. COVER	2	2	2	
		09		. PIN,Cotter 1/8 x 1-3/4 in.	2	2	2	
		10	10T1358D3	. SHAFT, Cable roller.	1	1	1	
		11	13T375-3	. ROLLER, Cable	1	1	1	
		12	25Z489D31	. . BEARING, Roller	2	2	2	
		13	44Z1D10	. FITTING, Lube.	6	6	6	
		14	44Z1D92	. FITTING, Lube	2	2	2	
		15		. SCREW, Hex sock, fl. hd. 3/8-16UNC x 3/4 in	16	16	16	
		16	19T5223	. PIN, Lower telescope cylinder	1	1	1	
		17	18T9837	. RETAINER	4	4	4	
		18		. SCREW, Fl. sock hd. 3/8-16UNC x 1 in.	28	28	18	
		19	16T4608	. PAD, Slider	2	2	2	
		20	16T4607	. PAD, Slider	2	2	2	
		21	20T8302	. SHIM..	4	4	4	
		22	20T8301	. SHIM..	6	6	6	
		23	16T3676	. PLATE, Mounting.	2	2	2	
		24		. SCREW, Hex hd. 3/8-16UNC x 1 in	24	14	24	
		25		. WASHER, Lock 3/8 in	63	63	63	
		26		. SCREW, Hex hd. 3/4-10UNC x 2 in	4	4	4	
		27		. WASHER, Lock 3/4 in	8	9	a	
		28		. WASHER, Plain 3/4 in	8	8	9	
		29	16T4609	. PAD, Slider	1	1	1	
		30	16T4502	. CARRIER, Slider pad.	2	2	2	
		31	20T8556D1	. SHIM, 1/4 in.	2	2	2	
		31	20T8556D2	. SHIM, 3/16 in.	2	2	2	
		31	20T8558D3	. SHIM, 1/8 in.	2	2	2	
		31	20TB556D4	. SHIM, 16 Ga	2	2	1	
		31	20TB556D5	. SHIM, 20 Ga	2	2	2	
		32	16T4604	. PAO, Slider	2	2	2	
		33	16T4601	. PAD, Slider	1	1	1	
		34	16T4605	. PAD, Slider	2	2	2	
		35		. NUT, Hex jam 3/8-16UNC	12	12	2	
		36	100J3870-2	. CYLINDER ASSY, Lower telescope (Page 5.1)	1	1	1	
		37	44Z485D22	. CONNECTOR, O-ring.	2	2	2	
		38	45Z91D165	. O-RING	1	1	I	
		39	44Z491D7	. TEE, Union	2	2	2	
		40	44Z492D4	. REDUCER 5/8 x 3/8	2	2	2	
		41	44Z511D3	. CAP	4	4	4	
		42	44Z590D7	. CONNECTOR, Male.	2	2	2	

80 FOOT BOOM ASSEMBLY (Continued)

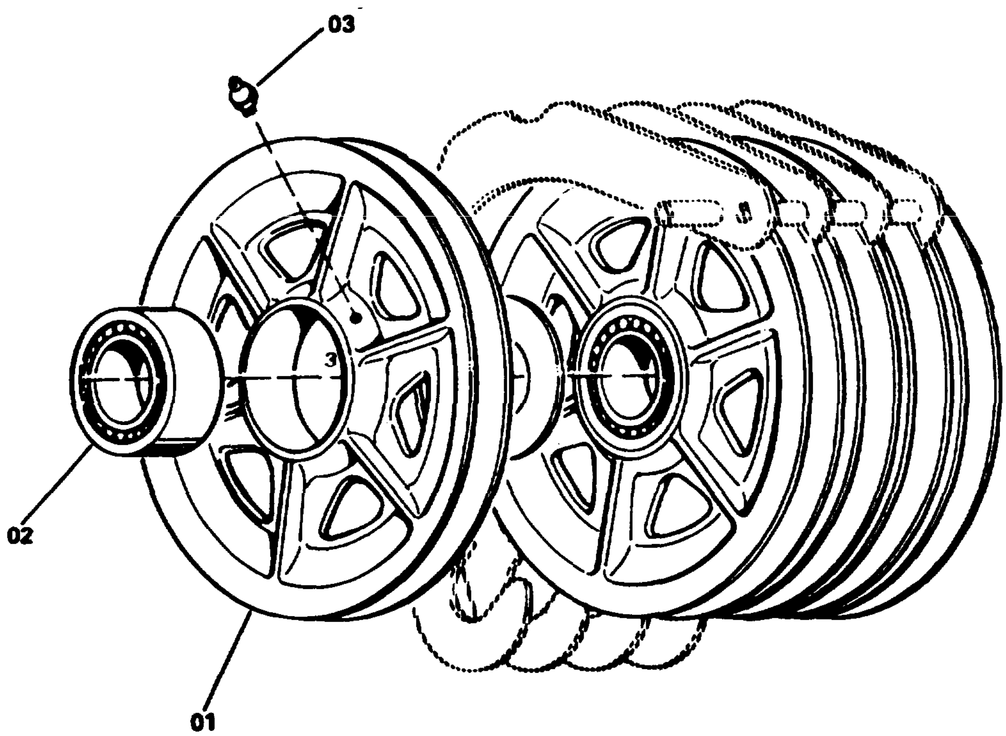
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	2	3	
		43	44P1267	TUBE	2	2	2	
		44	44P1268	.TUBE	2	2	2	
		45	44Q44D23	.UNION	2	2	2	
		46	44Q44D19	.UNION	2	2	2	
		47	18T9789	. COLLAR, Telescope pin set	4	4	4	
		48	19T4193	. PIN, Lower telescope cylinder	1	1	1	
		49		.WASHER, Plain 3/8 in	8	8	8	
		50		. SCREW, Hex hd. 3/8-16UNC x 1-1/4 in	8	8	8	
		51	16P3442D1	. BRACKET, R.H	1	1	1	
		52	16P3442D2	. BRACKET, L.H.	1	1	1	
		53	44Z869D7	. UNION, 45° bulkhead	2	2	2	
		54	44P854D1	.HOSE ASSY	2	2	2	
		55	44Z485D23	. CONNECTOR, O-ring.	2	2	2	
		56	45Z91D58	..O-RING	1	1	1	
		57	19T5194	. PIN, Upper telescope cylinder	1	1	1	
		58	38R32	. CYLINDER, Upper telescope (Page 7.1)	1	1	1	
		59	19T5224	PIN, Upper telescope cylinder	1	1	1	
		60	11J2443D1	. SECTION, Boom mid.	1	–	–	
		60	11J2443D2	. SECTION, Boom mid.	-	1	1	
		61	10T1339	. SHAFT, Roller	1	1	1	
		62	13T369-1	. ROLLER, Cable	1	1	1	
		63	25Z489D31	.. BEARING, Roller	2	2	2	
		64	16T3675	. PLATE, Mounting.	4	4	4	
		65	20T8300	.SHIM	4	4	4	
		66	20T8299	.SHIM	12	12	12	
		67	16T4606	.PAD, Slider	4	4	4	
		68	16T4611	.PAD, Slider	1	1	1	
		69		. WASHER, Lock 5/8 in	4	4	4	
		70		. SCREW, Hex hd. 5/8-11UNC x 1-314 in	4	4	4	
		71		. SCREW, Fl. sock. hd. 3/8-16UNC x 1/2 in	8	8	8	
		72	16T4615	.PAD, Slider	4	4	4	
		73	20T8780	.SHIM	4	4	4	
		74	20T8781	.SHIM	4	4	4	
		75	16T4616	.SUPPORT, Pad	4	4	4	
		76		.SCREW, Hex hd. 3/8-16UNC x 7/8in	16	16	16	
		77		. SCREW, Hex hd. 3/4-10UNC x 1-114 in	4	4	4	
		78	16T4613	.PAD, Slider	1	4	1	
		79	16T4614	.PAD, Slider	1	1	1	
		80	16T4612	. PAD, Slider	1	1	1	
		81	11J2177D3	. SECTION, Boom fly	1	–	–	
		82	11J2579D2	. SECTION, Boom fly	–	1	–	
		82	11J2579D1	. SECTION, Boom fly	–	–	1	
		83	19T5205	.PIN	1	1	1	
		84	19T5198	.PIN	1	–	–	
		85	20Z939D4	. PIN, Hair cotter.	2	1	1	
		86		.SCREW, Hex hd. 3/8-16UNC x 3/4 in	7	7	7	
		87	14T1421	.RETAINER	1	1	1	
		88	18T10955D1	.SPACER	2	2	2	
		89	18Z2066	SPACER	4	4	4	
		90	18T10955D2	.SPACER	1	1	1	

80 FOOT BOOM ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	2	3	
		91	7N186D3-1	. SHEAVE ASSY, Idler	2	2	2	
		92	44Z1D28	.. FITTING, Lube	1	1	1	
		93	25Z489D28	.. BEARING, Roller	1	1	1	
		94	18Z2D191	.. RING, Snap	2	2	2	
		95	10T1338	. SHAFT, Idler sheave	1	1	1	
		96	10P1607	.SHAFT, Main sheave	1	1	1	
		97	18Z1746	.SPACER	5	5	5	
		98	7P873-3	. SHEAVE ASSY, Main	4	4	4	
		99	25Z489D5	.. BEARING, Roller	1	1	1	
		100	18T9663	.. RING, REtaining	2	2	2	
		101	18T9660	.RETAINER	1	1	1	
		102		. WASHER, Lock 1/2 in	1	1	1	
		103		. SCREW, Hex hd. 1/2-13UNC x 1-1/4 in	1	1	1	
		104	20Z547D549	.SCREW, Hex hd. 3/4-18UNF x 12 in	–	1	1	
		105	18P933D320	.SPACER	–	1	1	
		106		. NUT, Hex 3/4-18UNF	–	1	1	

Ref. Dwg. 100J4198 A
100J4198-1
100J4198-2
100J4198-3

EXPORT SHEAVE MODIFICATION



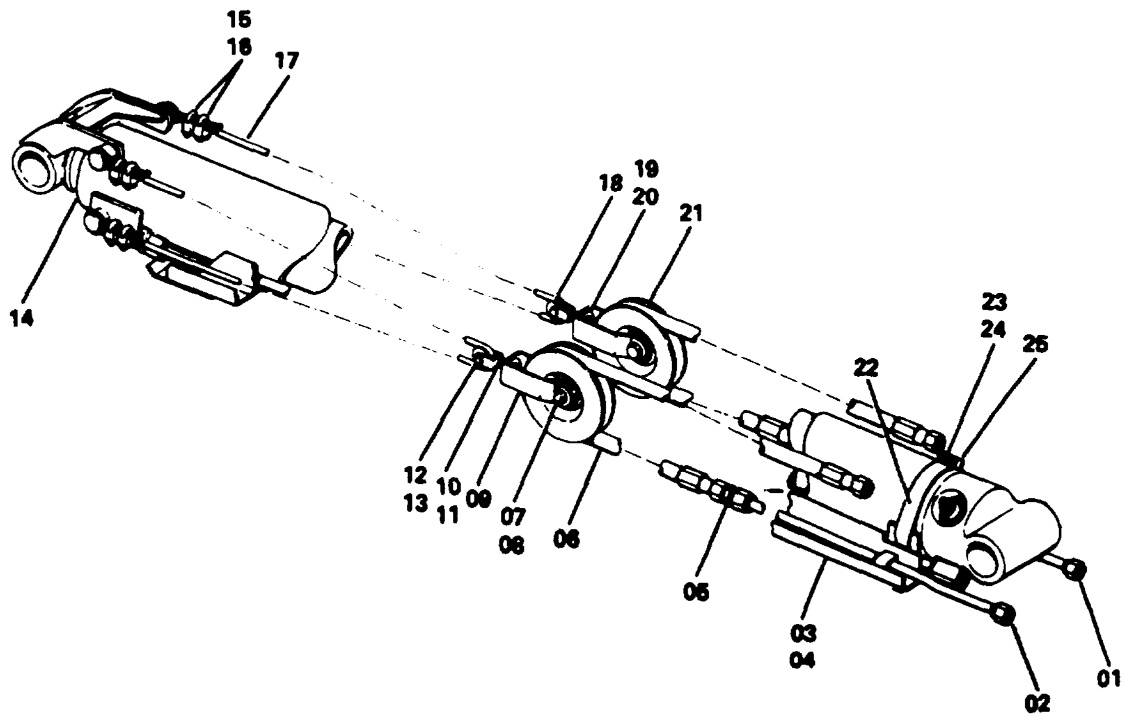
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		SHEAVE MODIFICATION - EXPORT				
		01	7N215-1	. SHEAVE, 15 in.	5			
		02	25Z372D61	. . BEARING, Roller	1			
		03	44Z1D10	. . FITTING, Lube	1			

Ref. Dwg. 7N215 Λ 7N215-1
100P838 J 100P838-4
100P910 A 100P910-1

Group	Page	Rev.
1	4.1	001

Sheet 1 of 1

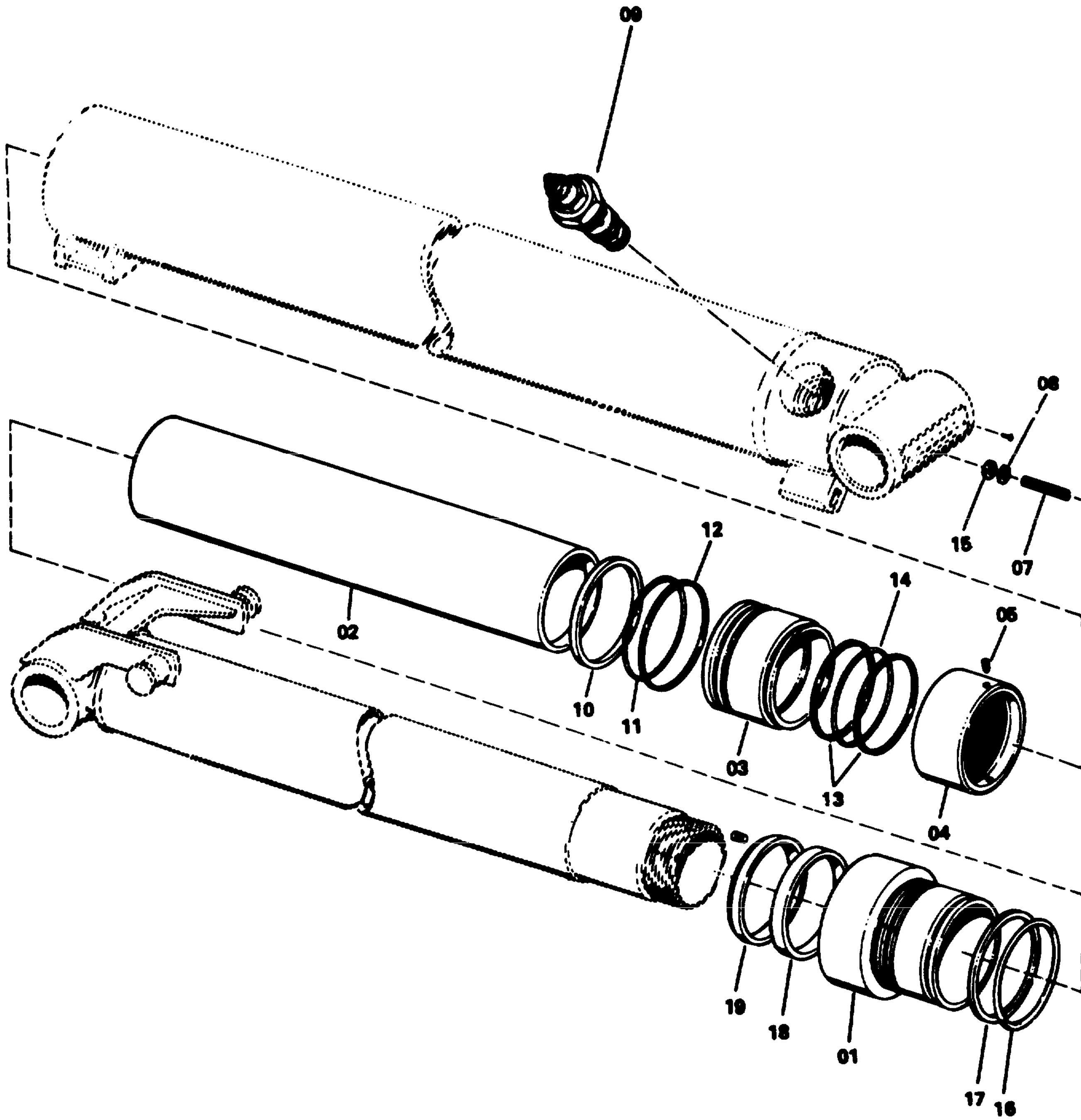
LOWER TELESCOPE CYLINDER ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figures Number 2			
		–	100J3870-2	CYLINDER ASSY., LOWER TELESCOPE				
		01	44P1275D2	. TUBE ASSY., R.H.	1			
		02	44P1275D1	.TUBE ASSY., L.H.	1			
		03	11N2055	. CHANNEL, How	1			
		04		.SCREW, Hex hd. 5/16-18UNC x 1/2in.	4			
		05	44Q44D19	. UNION, Tube to hose	2			
		06	44PQ49D1	. HOSE ASSEMBLY	2			
		07	19T5391	. PIN, Drilled	2			
		08		. PIN, Cotter 7/16 x 3-1/2 in. lg.	4			
		09	16P3441	. BRACKET, Sheave	2			
		10		. NUT, Hex jam 1/2-20UNF	2			
		11	6Z153D12	. YOKE END	2			
		12	919T117-6	. PIN, Clevis	2			
		13		. . PIN, Cotter 1/8 x 7/8 in. lg.	1			
		14	938N15-1	.CYLINDER, Lower telescope (Page 6.1)	1			
		15	30Z1D19	. CLAMP, Cable	8			
		16	2OH1614D3	. NUT, Lock	16			
		17	3OZ180	. CABLE, Nylon coated 28 ft. for right left sheave	1			
		18	7Z356	. SHEAVE, Cable	2			
		19		. WASHER, Flat 1/2 in	2			
		20	20Z586D5	. NUT, Lock	2			
		21	7P927	. SHEAVE, Hose	2			
		22	32T688D2	. CLAMP, Channel to cylinder L.H	1			
		23	20Z846D9	. SCREW, Hex hd. 1/4-20UNC x 1-3/4 in. Gr. 5	1			
		24	2OH1617D2	. NUT, Lock 1/4-20UNC	1			
		25	32T686D1	. CLAMP, Channel to cylinder R.H.				

Ref. Dwg. 100J3870 /H\
100J3870-2

TELESCOPE CYLINDER ASSEMBLY

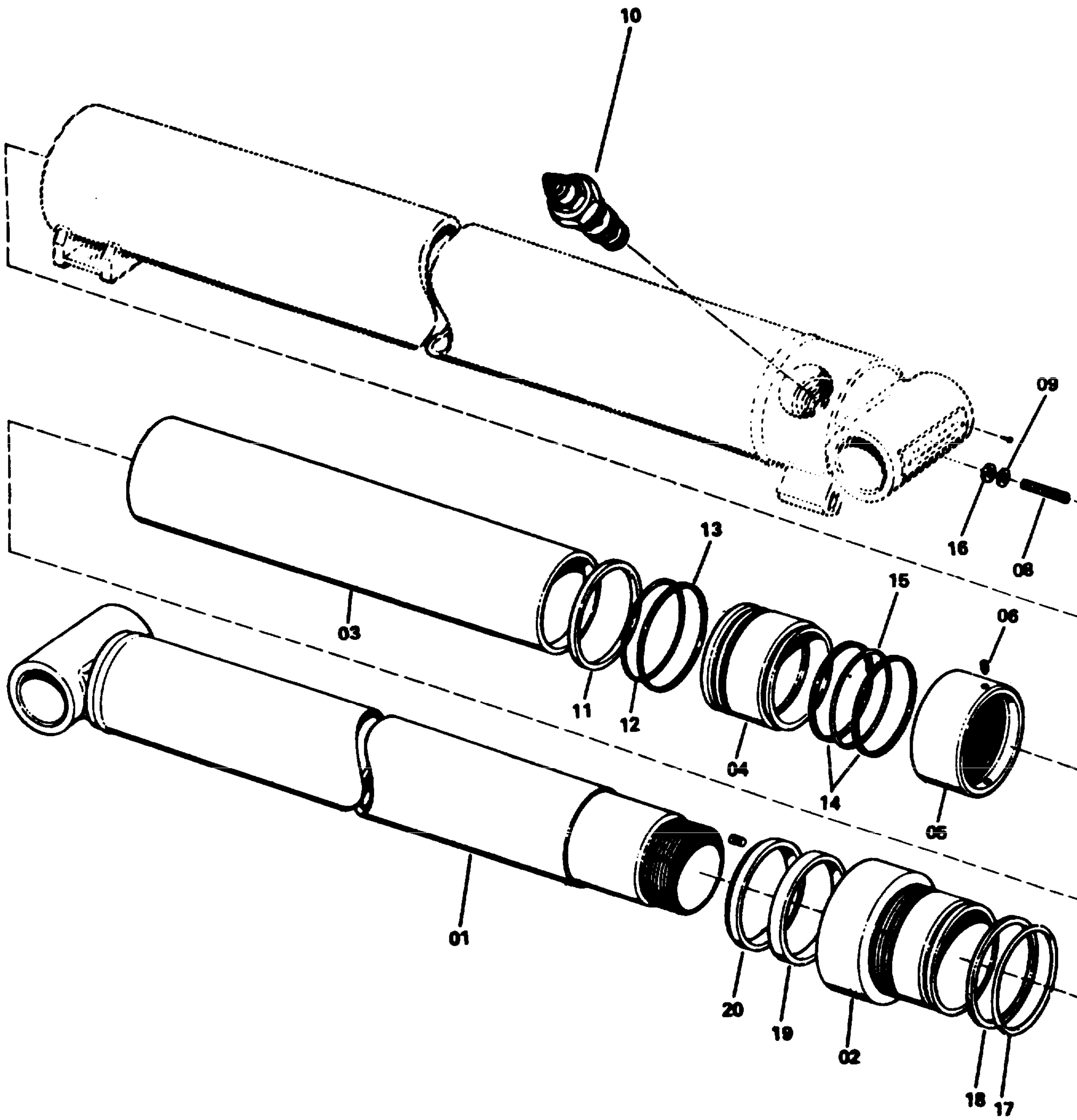


TELESCOPE CYLINDER ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		–	938N15-1	CYLINDER ASSY., LOWER TELESCOPE				
		01	1018Z4204	.GLAND, Head	1			
		02	1018Z2470	.SPACER	1			
		03	1039Z287	.PISTON	1			
		04		NUT, Ring type buttress	1			
		05		. SCREW, Sock. hd. cup pt. set 1/4-20UNC x 3/8 in.	2			
		06		.NUT, Hex jam 3/8-16UNC	1			
		07	1036Z649	.VALVE, Needle	1			
		08	1018Z4239	.WASHER, Special flat 3/8 in	1			
		09	1036Z447	.VALVE, Holding	1			
		–	1045Z1262	..KIT, Valve seal	1			
		–	1045Z1134	.KIT, Cylinder seal	1			
		10		..RING, Piston	2			
		–	1045Z1135	..KIT, Soft seal	1			
		11		...O-RING, Sirvon loading	1			
		12		...RING, Sirvon seal	1			
		13		...RING, Piston leather back-up	2			
		14		...O-RING, Static piston	1			
		15	1045Z1396	...SEAL, Thread	1			
		16		....O-RING, Static head	1			
		17		...RING, Back-up	1			
		18		...U-CUP	1			
		19		...WIPER, Rod	1			

Ref. Dwg. 938N15
938N15-1

BOOM TELESCOPE CYLINDER

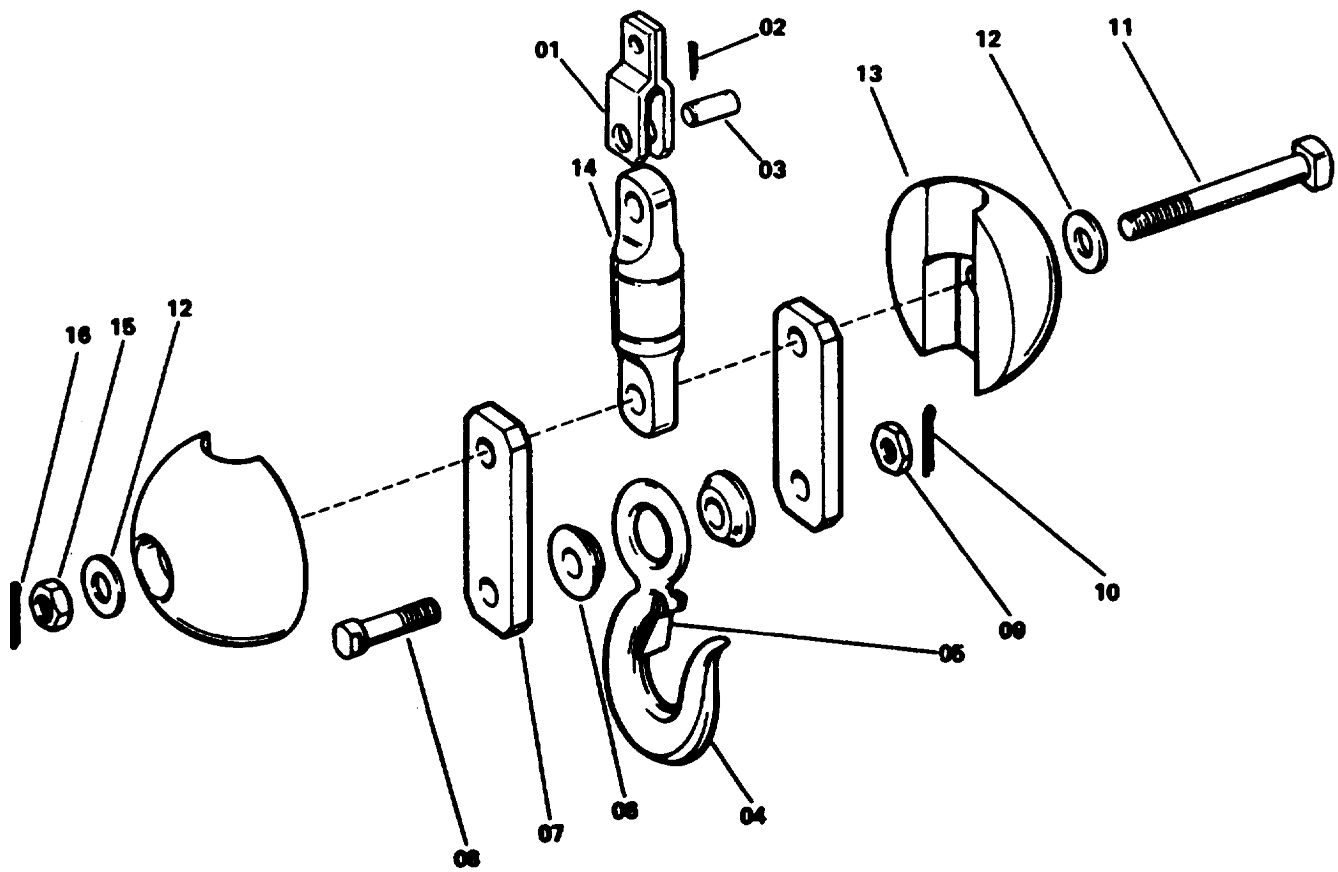


BOOM TELESCOPE CYLINDER (Continwd)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
			38R32	CYLINDER, BOOM TELESCOPE				
		01	1039Z379	.ROD ASSY	1			
		02	1018Z4240	.GLAND, Head	1			
		03	1018Z2470	.SPACER	1			
		04	1039Z287	.PISTON	1			
		05	1020Z2445	.NUT, Ring type buttress	1			
		06		.SCREW, Sock, hd. cup pt. set 1/4-20UNC x 3/8	2			
		07		.NUT, Hex jam 3/8-16UNC	1			
		08	1036Z649	.VALVE, Needle	1			
		09	1018Z4239	WASHER, Special flat 3/8 in	1			
		10	1036Z447	.VALVE, Holding	1			
			1045Z1262	..KIT, Valve seal	1			
			1045Z1134	.KIT, Cylinder seal	1			
		11		RING, Piston	2			
			1045Z1135	..KIT, Soft seal	1			
		12		...O-RING, Sirvon loading	1			
		13		...RING, Sirvon seal	1			
		14		...RING, Piston leather back-up	2			
		15		...O-RING, Static piston	1			
		16	1045Z1396	...SEAL, Thread	1			
		17		...O-RING, Static head	1			
		18		...RING, Back-up	1			
		19		...U-CUP	1			
		20		...WIPER, Rod	1			

Ref. Dwg. 38R32

HOOK BLOCK ASSEMBLY

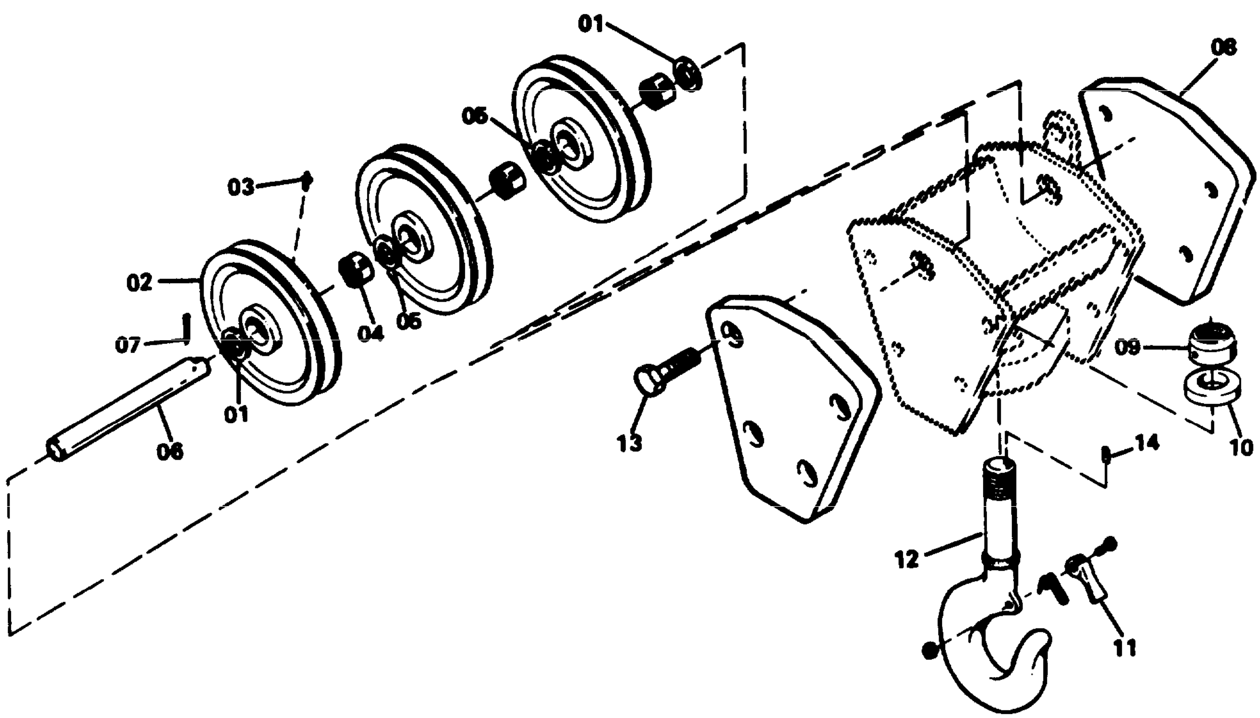


HOOK BLOCK ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		–	100T256-1	HOOK BLOCK & LINK ASSEMBLY				
		–	8U7D511	HOOK BLOCK ASSEMBLY				
		01	6P2337	. LINK, 1/2 or 5/8 in. socket	1	–		
		02		. PIN, Cotter 5/16 x 2-1/4 in. lg.	2	–		
		03	19F61D9	.PIN, Drilled	1	–		
		–	8U7D516	. HOOK BLOCK ASSEMBLY	1	–		
		04	1008Z41	.. HOOK	1	–		
		05	1045Z1360	.. KIT, Hook safety latch	1	–		
		06	18Z854D8	.. WASHER, Hook	2	–		
		07	8Z203D1	.. STRAP	2	–		
		08	19Z171D20	.. PIN, Hook	1	–		
		09		... NUT, Hook pin	1	–		
		10	1019Z932	.. PIN, Cotter	1	–		
		11	19Z171D25	.. PIN, Ball	1	–		
		12	1018Z4773	.. WASHER, Ball pin	1	–		
		13	22Z3D1	.. BALL, Split	2	–		
		14	1025Z1693	.. SWIVEL, Ball bearing	1	–		
		15	1020Z4891	.. NUT, Ball pin	1	–		
		16	1019Z931	.. PIN, Ball pin Cotter	1	–		
		04	1008Z40	..HOOK	–	1		
		05	1045Z1303	. KIT, Hook safety latch	–	1		
		06	18Z854D62	. WASHER, Hook	–	2		
		07	8Z203D3	.STRAP	–	2		
		08	19Z171D14	.PIN, Hook	–	1		
		09	1020Z4715	. NUT, Hook pin	–	1		
		10	1019Z917	. PIN, Cotter	–	1		
		11	19Z171D112	. PIN, Ball	–	1		
		12	1018Z4662	. WASHER, Ball pin	–	2		
		13	1008Z39	. BALL, Split.	–	2		
		14	1025Z1673	. SWIVEL, Ball bearing	–	1		
		15	1020Z4716	. NUT, Ball pin	–	1		
		16	1019Z915	. PIN, Ball pin cotter	–	1		

Ref. Dwg. 100T256
100T256-1
8U7D511
8U7D516

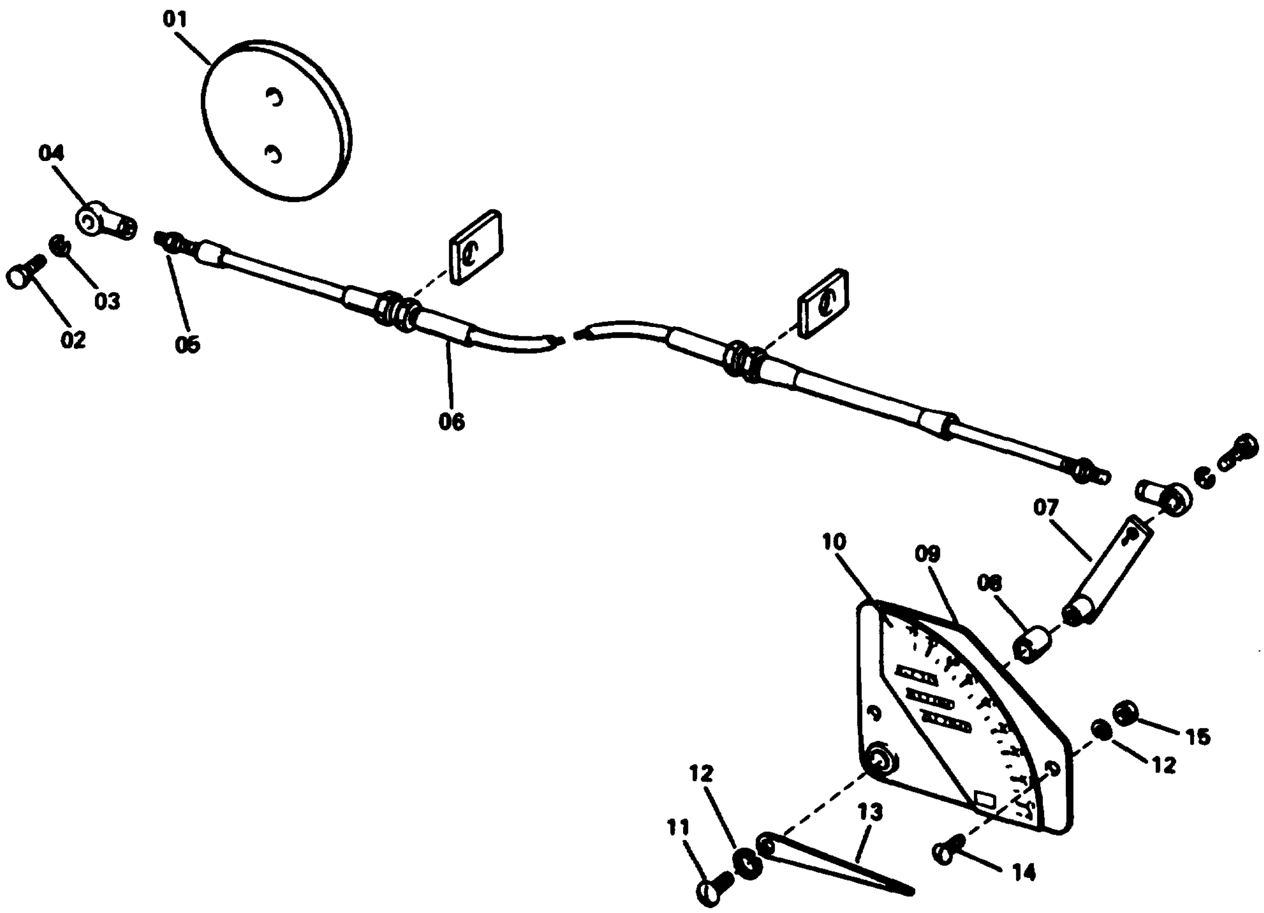
HOOK BLOCK



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number D3	D77	D8	
		–	8U7D3	HOOK BLOCK - TWO SHEAVE	↓			
		–	8U7D77	HOOK BLOCK - TWO SHEAVE		↓		
		–	8U7D8	HOOK BLOCK - THREE SHEAVE			↓	
		01	18Z771D3	.SPACER, Bronze	2	2	2	
		02	7Z279D18	.SHEAVE	2	–	2	
		02	1007Z127	.SHEAVE	–	2	–	
		03		.FITTING, Grease 1/4-28UNF	3	3	4	
		04	25Z489D3	.BUSHING, Roller	2	2	3	
		05	18Z771D1	.SPACER, Bronze	1	1	2	
		06	19Z169D1	.PIN, Sheave	1	1	–	
		06	19Z169D10	.PIN, Sheave	–	–	1	
		07		.PIN, Cotter 3/8 x 3 in	1	–	1	
		07		.PIN, Cotter 3/8 x 4 in	–	1	–	
		08	22Z1D2	.PLATE, Check	2	–	2	
		08	22Z1D1	.PLATE, Check	–	2	–	
		09	20Z781D3	.NUT, Hook	1	1	–	
		09	20Z781D5	.NUT, Hook	–	–	1	
		10	25Z579D29	.BEARING, Thrust	1	1	–	
		10	25Z579D39	.BEARING, Thrust	–	–	1	
		11	8Z64D18	.KIT, Safety latch	1	1	–	
		11	8Z64D20	.KIT, Safety latch	–	–	1	
		12	8Z68D3	.HOOK	1		–	
		12	1006Z46	.HOOK	–	1	–	
		12	8Z68D22	.HOOK	–	–	1	
		13			8	–	8	
		13			–	8	–	
		14			–	2	–	

Ref. Dwg. 8U7D0 K
8U7D3
8U7D77
8U7D8

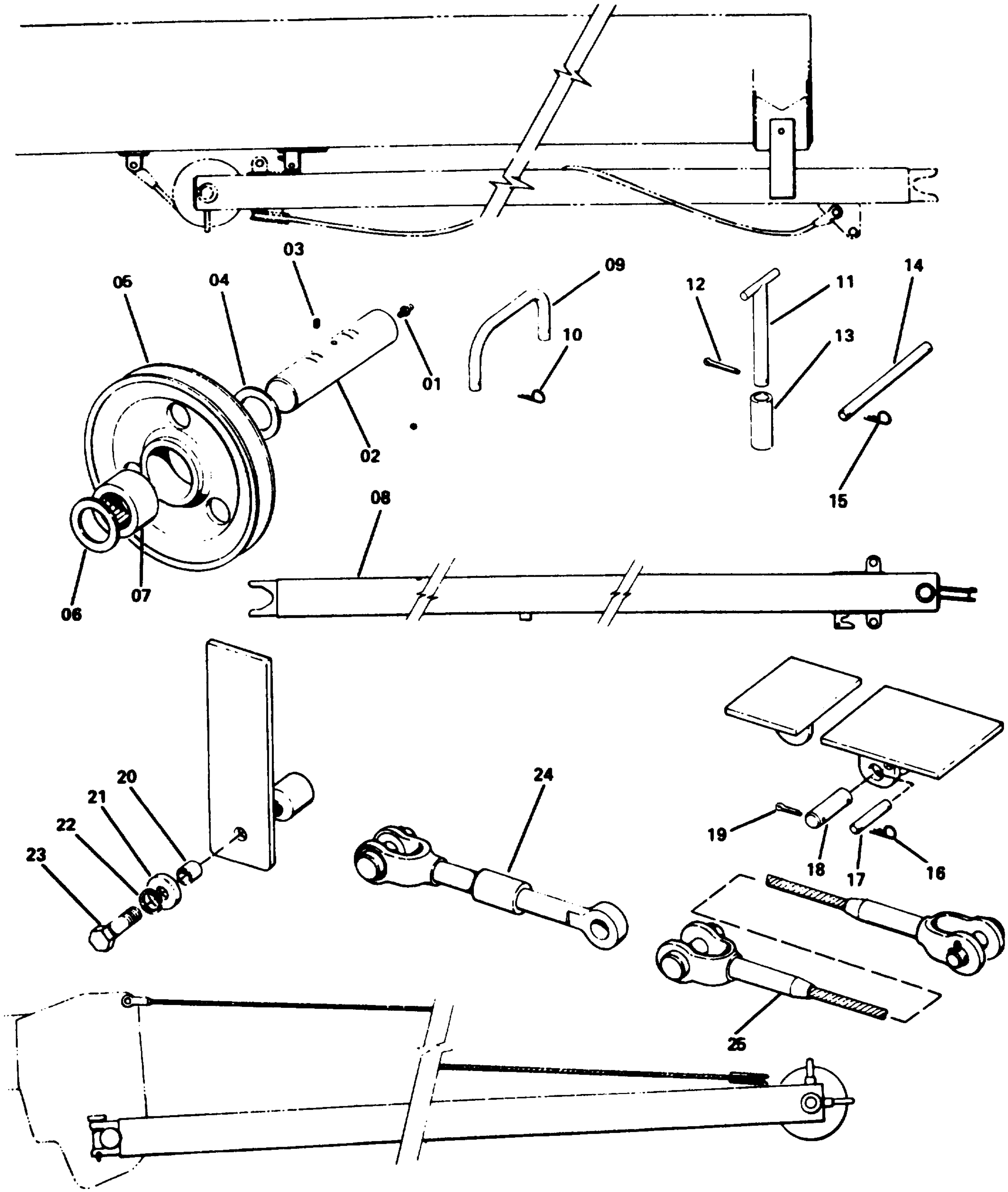
BOOM ANGLE INDICATOR



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 3	5		
			50J2-3	BOOM ANGLE INDICATOR	↓			
			50J2-5	BOOM ANGLE INDICATOR		↓		
		01	18T11059	.RETAINER	1	1		
		02		. SCREW, Hex head 1/4-20UNF x 3/4 in.	2	2		
		03		. WASHER, Lock 1/4 in.	2	2		
		04	25Z822D2	. ROD END, Spherical	2	2		
		05		. NUT, Jam 1/4-28UNF	2	2		
		06	6Q11D8	. CABLE, Flexible	1	1		
		07	6T2312	.LEVER	1	1		
		08	5Z284D17	. BUSHING	1	1		
		09	32T624	.HOLDER	1	1		
		10	32P340	. DECAL, Angle	1	1		
		11		.SCREW, Pan hd. mach. 1/4-28 UNF x 5/8 in.	1	1		
		12		. WASHER, Lock 1/4 in.	3	3		
		13	20T8554	. POINTER	1	1		
		14		. SCREW, Rd. hd. mach. 1/4-28 UNF x 5/8 in.	2	2		
		15		. NUT. Hex 1/4-28 UNF	2	2		

Ref. Dwg. 50J2 A
50J2-3
50J2-5

JIB ASSEMBLY STORAGE. MOUNTING & SUSPENSION



JIB ASSEMBLY STORAGE, MOUNTING & SUSPENSION (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 4	1	1	2
		-	911J84-4	JIB ASSEMBLY				
		-	911J90-1	JIB STORAGE & MOUNTING ASSEMBLY				
		-	911J116-1	JIB SUSPENSION				
		-	911J116-2	JIB SUSPENSION				
		01		FITTING, Lube	1	-	-	-
		02	10T1400	.SHAFT	1	-	-	-
		03		. SCREW, Headless slotted set cup pt. 3/8-16UNC x 1/2 in.	2	-	-	-
		04	18T9679	. SPACER	2	-	-	-
		05	7P873-4	. SHEAVE ASSEMBLY	1	-	-	-
		06	18T9728	.. RING. Retaining	2	-	-	-
		07	25Z372D4	.. BEARING, Roller	1	-	-	-
		08	11J2285	.JIB	1	-	-	-
		09	14T1432	. GUARD, Cable	1	-	-	-
		10	20Z939D8	.PIN, Hair cotter	2	-	-	-
		11	19T5166	.T-PIN	2	-	-	-
		12	18T9678	.SPACER	2	-	-	-
		13		PIN, Cotter 1/4 x 2-1/2 in.	2	-	-	-
		14	19F63D63	.PIN	-	1	-	-
		15	20Z939D6	. PIN, Hair cotter	-	2	-	-
		16	20Z939D4	. PIN, Hair cotter.	-	1	-	-
		17	19T5164	.PIN	-	1	-	-
		18	19F59D12	.PIN, Drilled	-	1	-	-
		19		PIN, Cotter 1/4 x 1-3/4 in.	-	2	-	-
		20	18T9680	: SPACER	-	2	-	-
		21	18T9677	.RETAINER, Jib	-	2	-	-
		22		. WASHER, Lock 1 in.	-	2	-	-
		23		.SCREW, Hex hd. 1-8UNC x 4 in.	-	2	-	-
		24	29P1300	.LINK, Cable	-	-	2	1
		25	30U9409	. ROPE ASSEMBLY, 3/4 in. dia.	-	-	1	1

Ref. Dwg. 911J84 911J84-4
911J90 911J90-1
911J116 911J116-1
911J116-2

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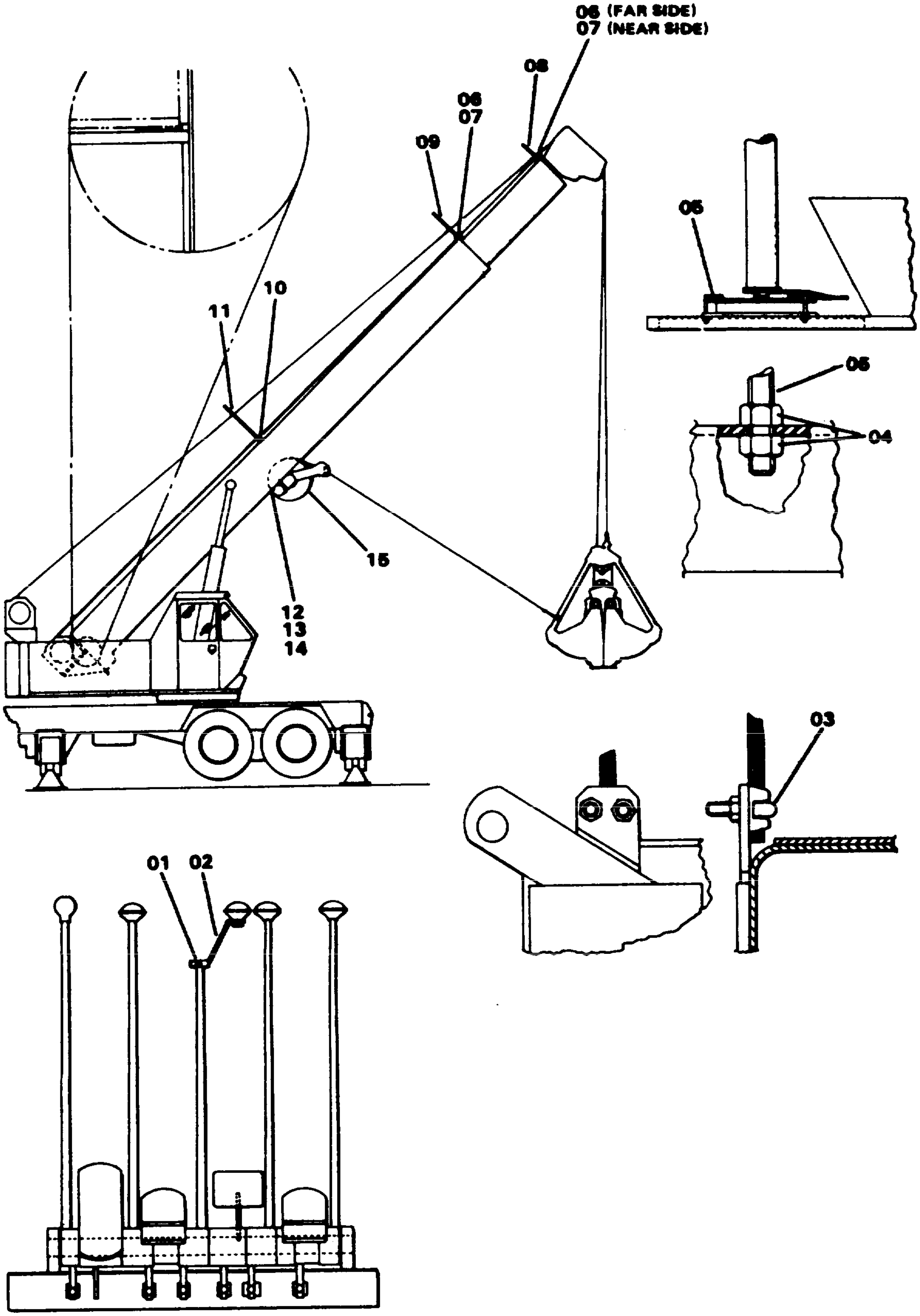
TAGLINE INSTALLATION

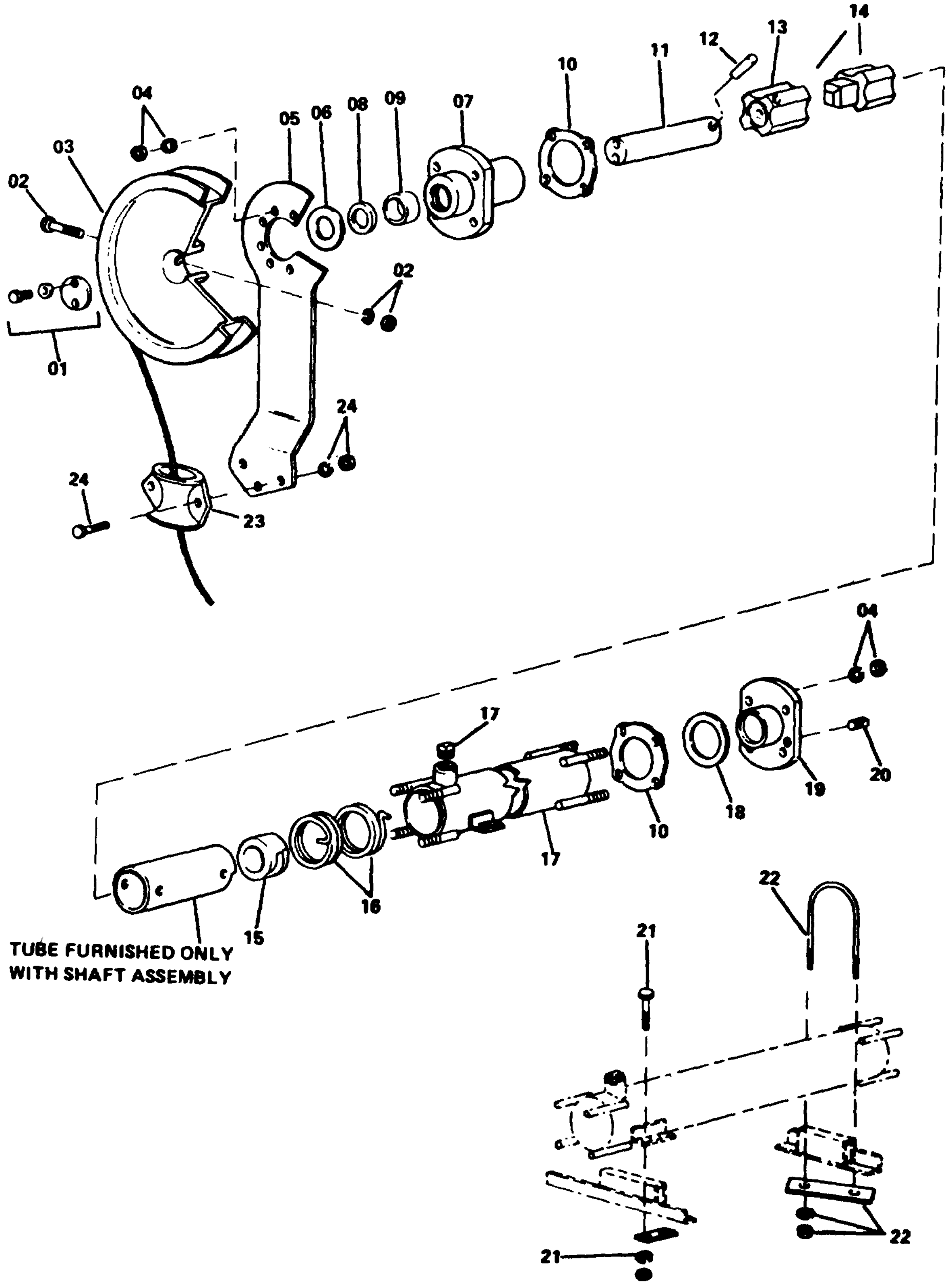


TAGLINE INSTALLATION (Continued)

Ref.	Part Number	Description	Quantity Figure Number 2					
–	100J4147-2	TAGLINE INSTALLATION						
01		SCREW, Hex hd. cap 1/4-20UNC x 1 in.	7					
02	6P2402	EXTENSION, Control lever.	1					
03	30Z1D17	.CLAMP, U-bolt	6					
04		. NUT, Hex 1/2-13UNC	4					
05	20T8909	. BOLT, Hook.	2					
06	16T4987D1	BRACKET, Wire rope.	2					
07	16T498JD2	. BRACKET, Wire rope.	2					
08	30T20D1	. ROPE, Retaining.	1					
09	30T20D2	ROPE, Retaining.	1					
10	16T4988	BRACKET, Wire rope.	2					
11	30T20D3	. ROPE, Retaining.	1					
12		.SCREW, Hex hd. cap 5/8-11UNC x 2 in	4					
13		. WASHER, Lock 5/8 in	4					
14		. NUT, Hex 5/8-11UNC	4					
15	30Z179	WINDER ASSEMBLY, Tagline (Page 13.1)	1					

Ref. Dwg. 100J4147 /J\
100J4147-2

TAGLINE WINDER ASSEMBLY

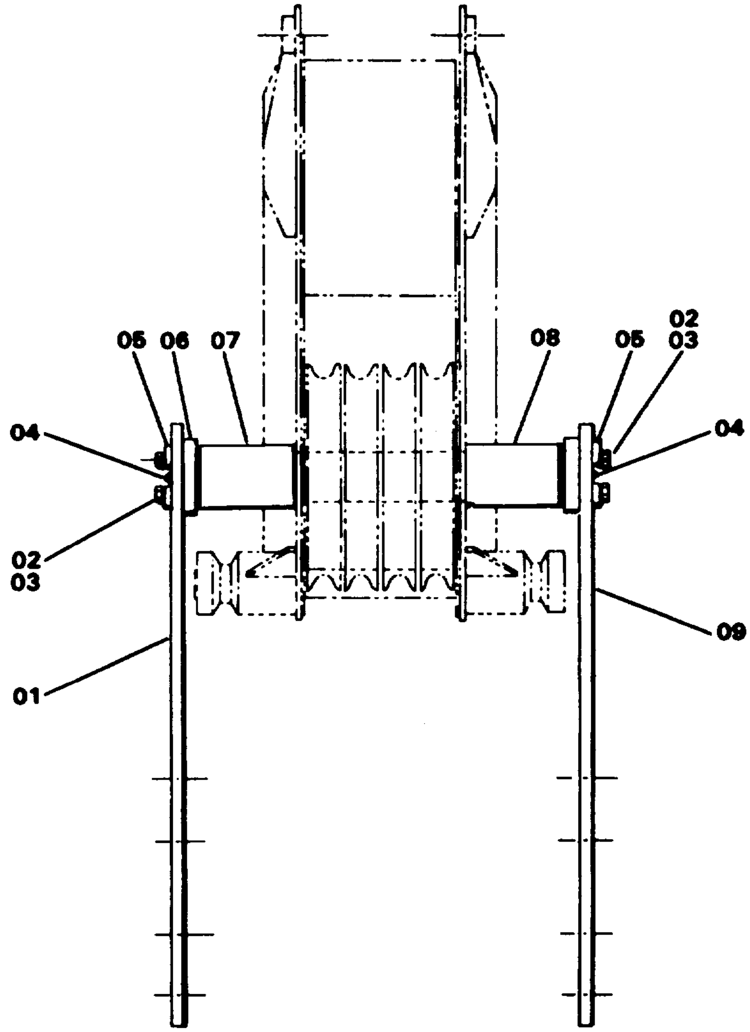


TAGLINE WINDER ASSEMBLY (Continued)

Ref.	Part Number	Description	Quantity Figure Number					
–	30Z179	.TAGLINE WINDER						
01	18Z8	.. PLATE, Keeper w/capscrew and lockwasher.	1					
02	1020Z4229	.. BOLT, w/Nut and lock washer 5/8 x 4 in	1					
03	13Z1	.. REEL, Cable	1					
04	2OZ26	.. NUT, w/Lockwasher 5/8 in	8					
05	1008Z33	.. ARM, Fairlead.	1					
06	1018Z1295	.. WASHER, Thrust.	1					
07	25Z8	.. BEARING ASSEMBLY.	1					
08	1018Z1422	... SEAL, Oil.	1					
09	1005Z399	.... BUSHING, Oil.	1					
10	20Z25	... GASKET..	2					
	1010Z827	.. SHAFT ASSEMBLY.	1					
11	10Z84	...SHAFT	1					
12	1019Z844	... PIN, Shaft.	1					
13	1018Z4222	... COUPLING, Female core.	1					
14	1018Z4221	... COUPLING, Male core	1					
15	18Z10	... PROPELLER, L.H	1					
16	1017Z62	.. SPRING, L.H	1					
17	1314Z189	.. HOUSING, w/Nut, lockwasher and oil plug.	1					
18	1018Z4224	.. WASHER, Thrust.	1					
19	1018Z4223	..PLATE, End	1					
20		... PLUG, Pipe 1/2 in	1					
21	18Z11	.. PLATE, Clamping w/bolt, nut and lockwasher	2					
22	20Z28	.. U-BOLT, w/Plate, nut and lockwasher	1					
23	1008Z32	.. GUIDE, Bell cable	1					
24	1020Z4230	... BOLT, w/Nut and lockwasher	2					

Ref. Dwg. 30Z179

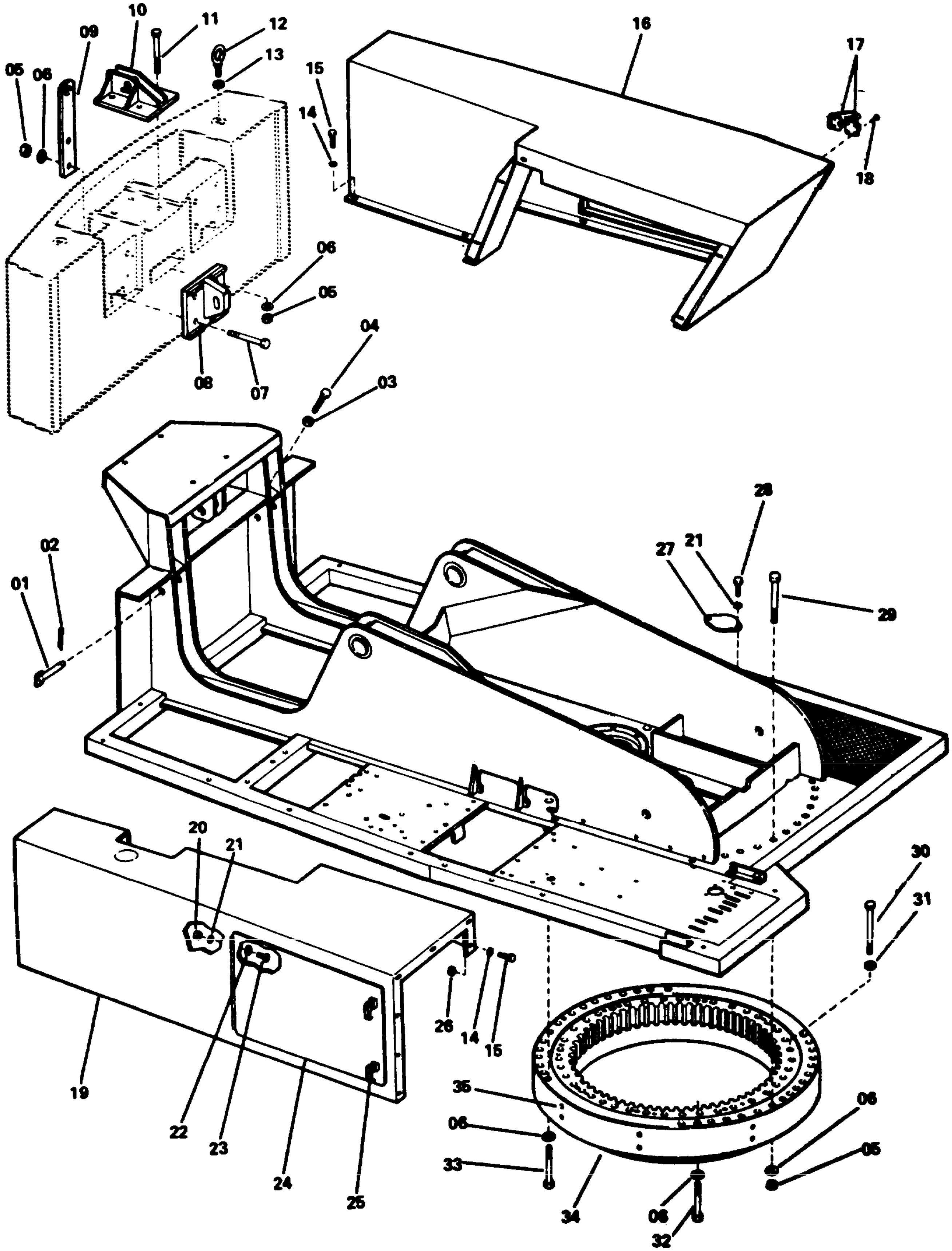
PILE DRIVER INSTALLATION



Ref.	Part Number	Description	Quantity Figure Number 1					
–	100J4200-1	PILE DRIVER INSTALLATION						
01	18P4132D1	. PLATE, R.H. Adapter	1					
02		.SCREW, Hex hd. up 1/2-13UNC x 1-1/4 in	4					
03		.WASHER, Lock 1/2 in	4					
04	44Z1D10	. FITTING, Lube	2					
05	18T11049	.PLATE, Keeper	2					
06	18P4138	.SPACER, Adapter	1					
07	18P4137	.SPACER, Pin	1					
08	10P1671	. SHAFT, Driver adapter.	1					
09	18P4132D2	. PLATE, L.H. Adapter.	1					

Ref. Dwg. 100J4200
100J4200-1

REVOLVING FRAME GROUP



REVOLVING FRAME GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number				
							5	1	6
				COUNTERWEIGHT HARDWARE WITH LIFTING BRACKETS	↓				
		–		COUNTERWEIGHT HARDWARE W/O LIFTING BRACKETS		↓			
		–	927J67-5	GUARDS AND COVERS			↓		
		–	100J3517-1	REVOLVING FRAME INSTALLATION				↓	
		–	1OON2079-6	SLEWING RIM INSTALLATION					↓
		01	19P468D2	. PIN, Counterweight	2	2	-	-	
		02		.PIN, Cotter 5/16 x 2-1/2 in. lg	2	2	-	-	-
		03		. NUT, Plated hex 1-8UNC	2	2	-	-	-
		04	20H3169D265	. BOLT. Hex hd. tab 1-8UNC x 4 in. lg	2	2	-	-	-
		05	20Z739D10	.NUT, Hex 1-8UNC	12	12	-	16	-
		06	18Z694D10	.WASHER, Hardened 1 in.	12	12	-	32	-
		07	20Z719D69	. BOLT, Hex hd. 1-8UNC x 9 in. lg.	8	8	-	-	-
		07	20Z719D64	. BOLT, Hex hd. 1-8UNC x 6-1/2in. lg	-	8	-	-	-
		08	16P3053	. LUG, Mounting	2	2	-	-	-
		09	16P32OO	. BRACKET, Counterweight lifting	2	-	-	-	-
		10	16P3054	. BRACKET	1	1	-	-	-
		10	16P3214	. BRACKET	-	1	-	-	-
		11	20Z719D130	. BOLT, Hex hd. 1-8UNC x 11 in. lg	4	4	-	-	-
		11	20Z646D283	. BOLT, Hex hd. 1-8UNC x 12 in. lg	-	4	-	-	-
		12	20Z1226D1	. BOLT, Eye	-	2	-	-	-
		13		. WASHER, Flat 1 in.	-	4	-	-	-
				NOTE To determine which ref. 07, 10 and 11 are replacement puts for your machine, if it is not equipped with ref. 09 counterweight lifting brackets, inspect the counterweight. If it is outfitted for lifting brackets, replacement parts am the same as those used with lifting brackets.					
		14		. WASHER, Lock 3/8 in.	-	-	46	-	-
		15		. SCREW, Hex hd. 3/8-16UNC x 1 in.	-	-	46	-	-
		16	27J1182	. COVER, L.H	-	-	1	-	-
		17	20Z805	HASP, Hinged safety	-	-	1	-	-
		18	20Z709D1	: SCREW, Self tapping #10	-	-	7	-	-
		19	27J1176	.COVER, R.H	-	-	1	-	-
		20		. NUT, 1/4-20UNC	-	-	8	-	-
		21		. WASHER, Lock 1/4 in.	-	-	10	-	-
		22		.WASHER, Flat 1/4 in.	-	-	8	-	-
		23		.SCREW, Truss hd. 1/4-20UNC x 5/8 in. lg	-	-	8	-	-
		24	27N2368	.DOOR	-	-	2	-	-
		25	32Z1132	. FASTENER, Adjustable pawl	-	-	4	-	-
		26		. NUT, Hex 3/8-16UNC	-	-	7	-	-
		27	14T1B31	. COVER	-	-	1	-	-
		28		.SCREW, Rd. hd. mach. 1/4-20UNC x 5/8 in. lg	-	-	2	-	-
		29	20Z646D275	. BOLT, Hex hd. 1-8UNC x 8-1/2 in. lg.	-	-	-	16	-
		30	20Z719D66	BOLT, High strength	-	-	-	-	40
		31	18Z694D10	: WASHER	-	-	-	-	40
		32	20Z648D272	. BOLT, Hex hd. 1-8UNC x 7 in. lg.	-	-	-	12	-
		33	20Z646D271	. BOLT, Hex hd. 1-8UNC x 6-1/2 in. lg.	-	-	-	4	-
		34	901J3-6	. SLEWING, Rim assy	-	-	-	-	1
		35	44Z1D10	..FITTING, Lube	-	-	-	-	8

Ref. Dwg. 100N2382 & 100N2382-1
927J67 & 100N2382-2
100J3517 & 927J67-5
100N2079 & 100J3517-1
100N2079-6

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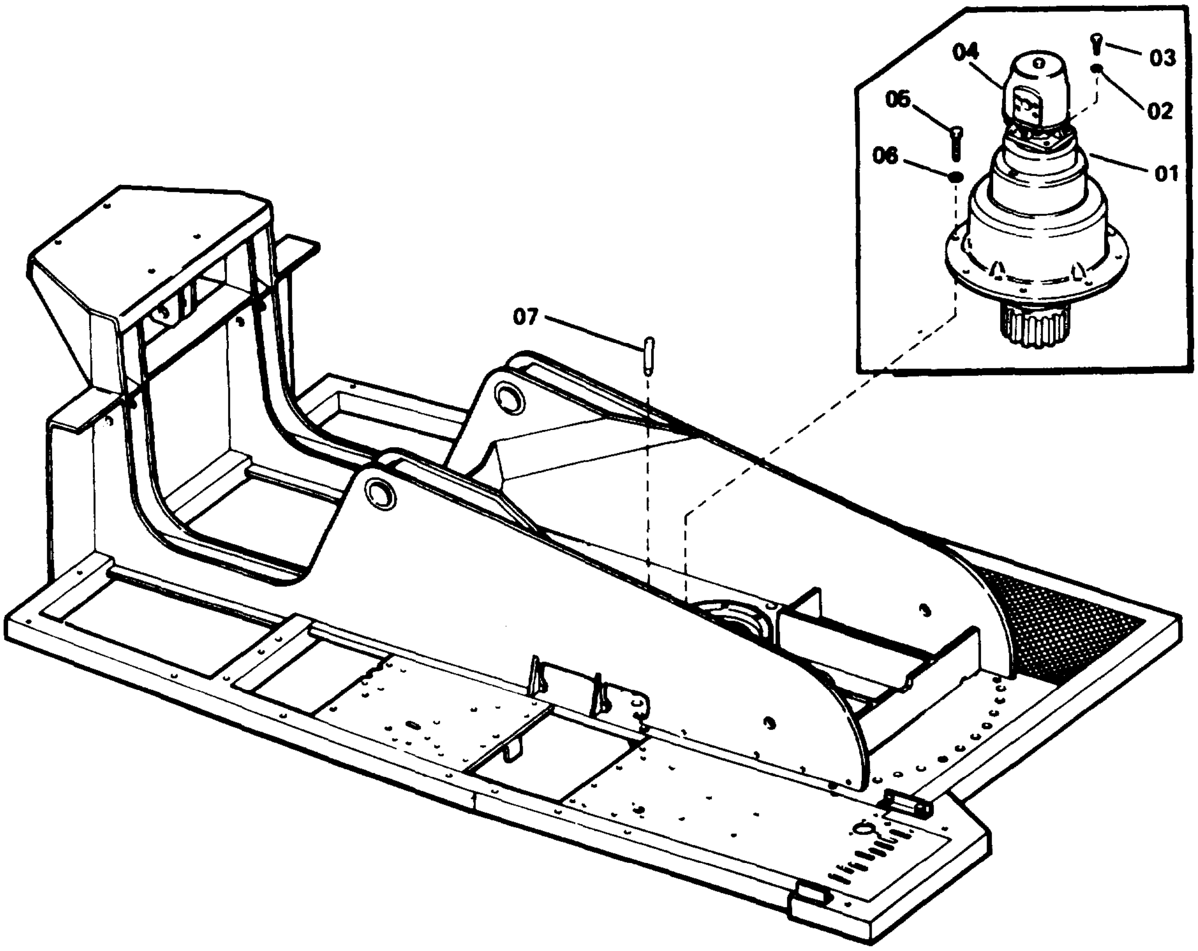
SWING TRANSMISSION INSTALLATION



QTY	STOCK	Ref.	Part Number	Desription	Quantity Figure Number 2	4	6	7
		–	100J4062-2	SWING TRANSMISSION INSTALL	↓			
		–	100J4062-4	SWING TRANSMISSION INSTALL		↓		
		–	100J4062-6	SWING TRANSMISSION INSTALL			↓	
			100J4062-7	SWING TRANSMISSION INSTALL				↓
		01	100T300-1	SWING TRANSMISSION ASSY. (Page 3.1)	1	–	1	–
		01	100T300-2	SWING TRANSMISSION ASSY. (Page 32)	–	1	–	1
		02		.WASHER, Lock 1/2 in	4	2	4	4
		03		.SCREW, Hex hd. 1/2-20UNF x 1 in lg.	4	2	4	4
		04	41Z110	MOTOR, Hydraulic swing (Page 4.1)	1	–	1	–
		04	41Z125	. MOTOR, Hydraulic swing (Page 42)	–	1	–	1
		05		. SCREW, Hex hd. 3/4-10UNC x 2 in. lg	8	8	8	8
		06	18Z694D8	.WASHER 3/4 in	8	8	8	8
		07	19T5233	. PIN, Dowel	1	1	1	1

Ref. Dwg. **100J4062** **10054062-7**
100J4062-2
100J4062-4
100J4062-6

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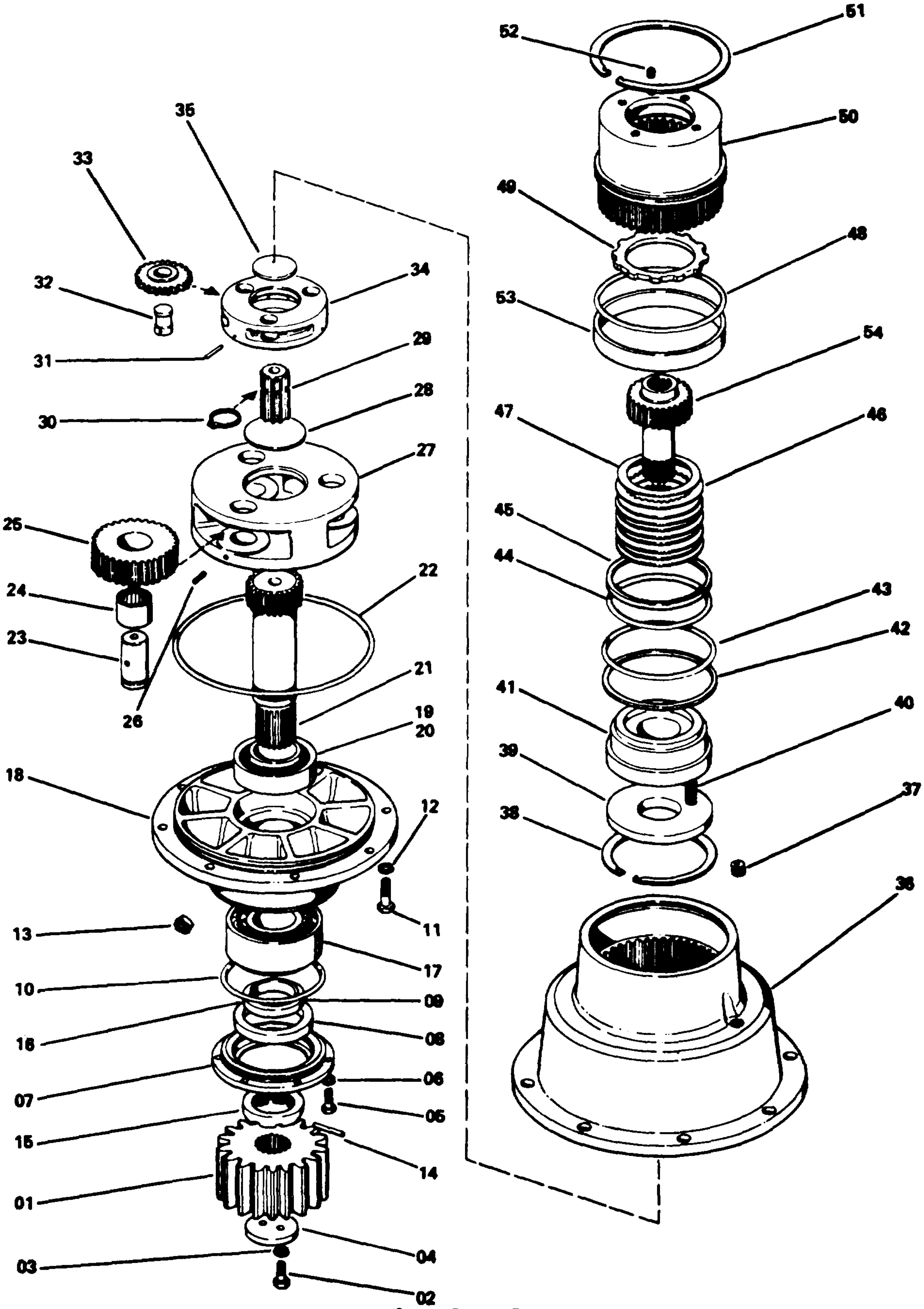
Sheet 1 of 1

SWING TRANSMISSION ASSEMBLY



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SWING TRANSMISSION ASSEMBLY (Continued)

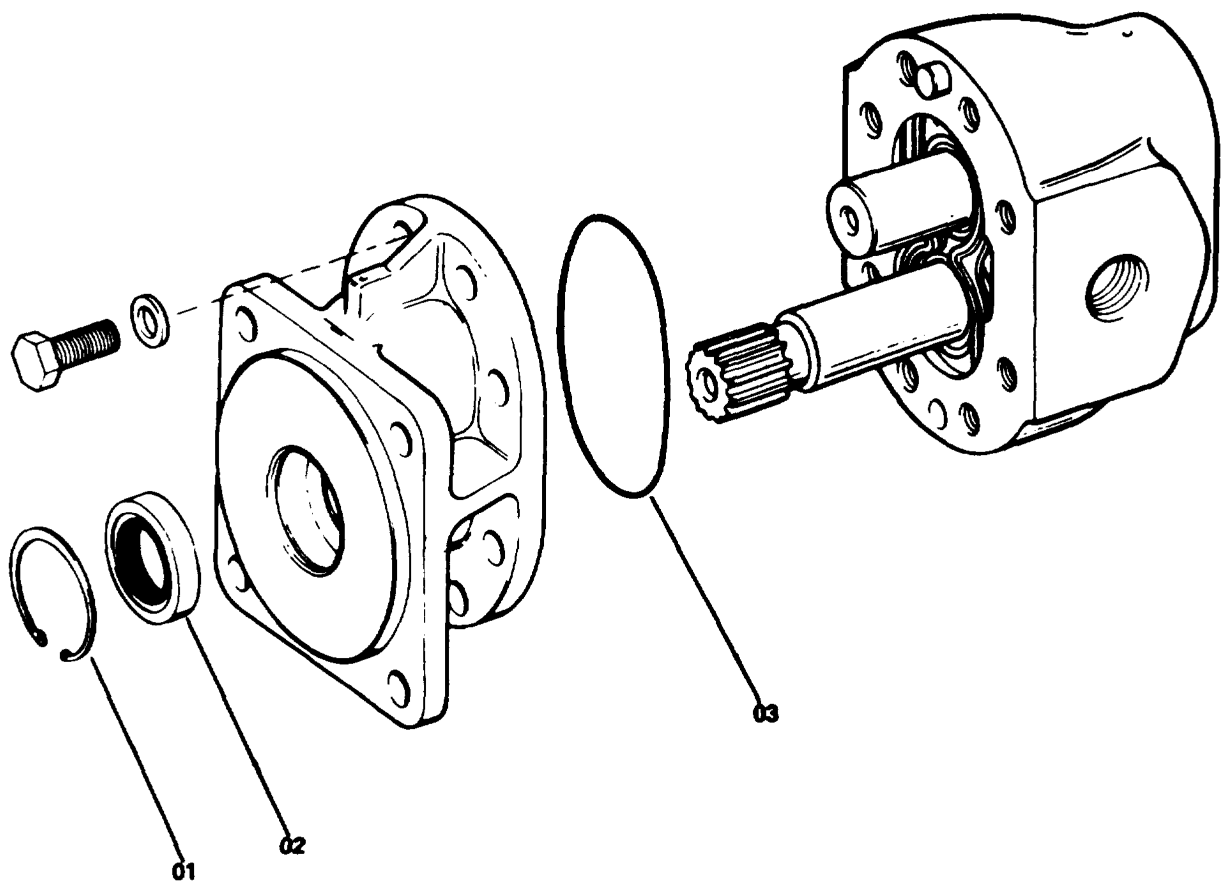
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
			100T300-1	SWING TRANSMISSION ASSEMBLY				
		01	1P1451	.GEAR, Swing pinion	1			
			53R3	. TRANSMISSION, Swing	1			
		02		.. SCREW, Hex hd. 1/2-13UNC x 1 in.	2			
		03		.. WASHER, Lock 1/2 in.	2			
		04	1018Z3949	.. RETAINER, Swing pinion	1			
		05	20Z646D47	.. SCREW, Hex hd. 3/8-16UNC x 1 in. Gr. 5	8			
		06		.. WASHER, Lock 3/8in.	8			
		07	1018Z3953	..CARRIER, Seal	1			
		08	18F682D350	..SEAL,Oil	1			
		09	1045Z1036	..O-RING	1			
		10	1045Z1037	..O-RING	1			
		11	20Z646D76	.. SCREW, Hex hd. 1/2-13UNC x 1-1/2 in. Gr. 5	8			
		12		.. WASHER, Lock 1/2 in.	8			
		13	1020Z3837	.. PLUG, Pipe	1			
		–	1025Z1499	.. CARRIER ASSEMBLY, Bearing	1			
		14	1019Z826	...PIN, Roll	2			
		15	1020Z3840	...NUT, Lock	1			
		16	1018Z3948	... JOURNAL, Seal	1			
		17	25Z259D18	...BEARING, Shaft	1			
		18	1025Z1502	... CARRIER, Bearing	1			
		19	1025Z1500	... CONE, Bearing	1			
		20	1025Z1501	... CUP, Bearing	1			
		21	1010Z778	... SHAFT, Output	1			
		22	1045Z1039	...O-RING	1			
		–	1053Z132	.. CARRIER ASSEMBLY. Secondary planet	1			
		23	1010Z777	... SHAFT, Secondary carrier	3			
		24	25Z489D26	... BEARING, Roller	3			
		25	1001Z881	... GEAR, Secondary planet	3			
		26	1020Z3839	...SCREW, Set	3			
		27	1063Z134	... CARRIER, Secondary planet	1			
		28	1018Z3947	.. SPACER	1			
		29	1001Z882	.. GEAR, Output sun	1			
		30	18Z2D216	.. RING, Snap	1			
		–	1053Z131	.. CARRIER ASSEMBLY, Primary planet	1			
		31	1019Z825	...PIN, Roll	3			
		32	1010Z776	... SHAFT, Primary planet gear	3			
		33	1001Z880	... GEAR, Primary planet	3			
		34	1053Z133	... CARRIER, Primary planet	1			
		35	1018Z3946	.. SPACER, Bronze	1			
		36	1014Z931	.. HOUSING, Swing reducer	1			
		37	1020Z3838	.. PLUG, Filler	1			
		–	1038Z189	.. CYLINDER ASSEMBLY, Swing brake	1			
		38	18Z2D72	... RING, Snap	1			
		39	1018Z3950	... PLATE, Brake spring.	1			
		40	1017Z857	... SPRING, Brake	16			
		41	1039Z358	... PISTON, Brake	1			
		42	1018Z3945	... RING, Back-up	1			
		43	1045Z1041	..O-RING	1			
		44	1045Z1040	..O-RING	1			

SWING TRANSMISSION ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		45	1018Z3944	. . . RING, Back-up	1			
		46	1015Z929	. . . DISC, Friction	5			
		47	1015Z928	. . . DISC, Brake	5			
		48	1045Z1038	. . . O-RING	1			
		49	1018Z3951	. . . PLATE, Back-up	1			
		50	1038Z190	. . . CYLINDER, Brake	1			
		51	1018Z3943	. . RING, Snap	1			
		52	1020Z3836	. . PLUG, Brake cylinder vent	1			
		53	1018Z3952	. . SPACER	1			
		54	1010Z883	. . GEAR, Input	1			
		–	1045Z1382	. . BOOT, Housing water repellent (Not Shown)	1			
		–	1032Z230	. . CLAMP, Housing boot (Not Shown)	1			

Ref. Dwg. 100T300
100T300-1

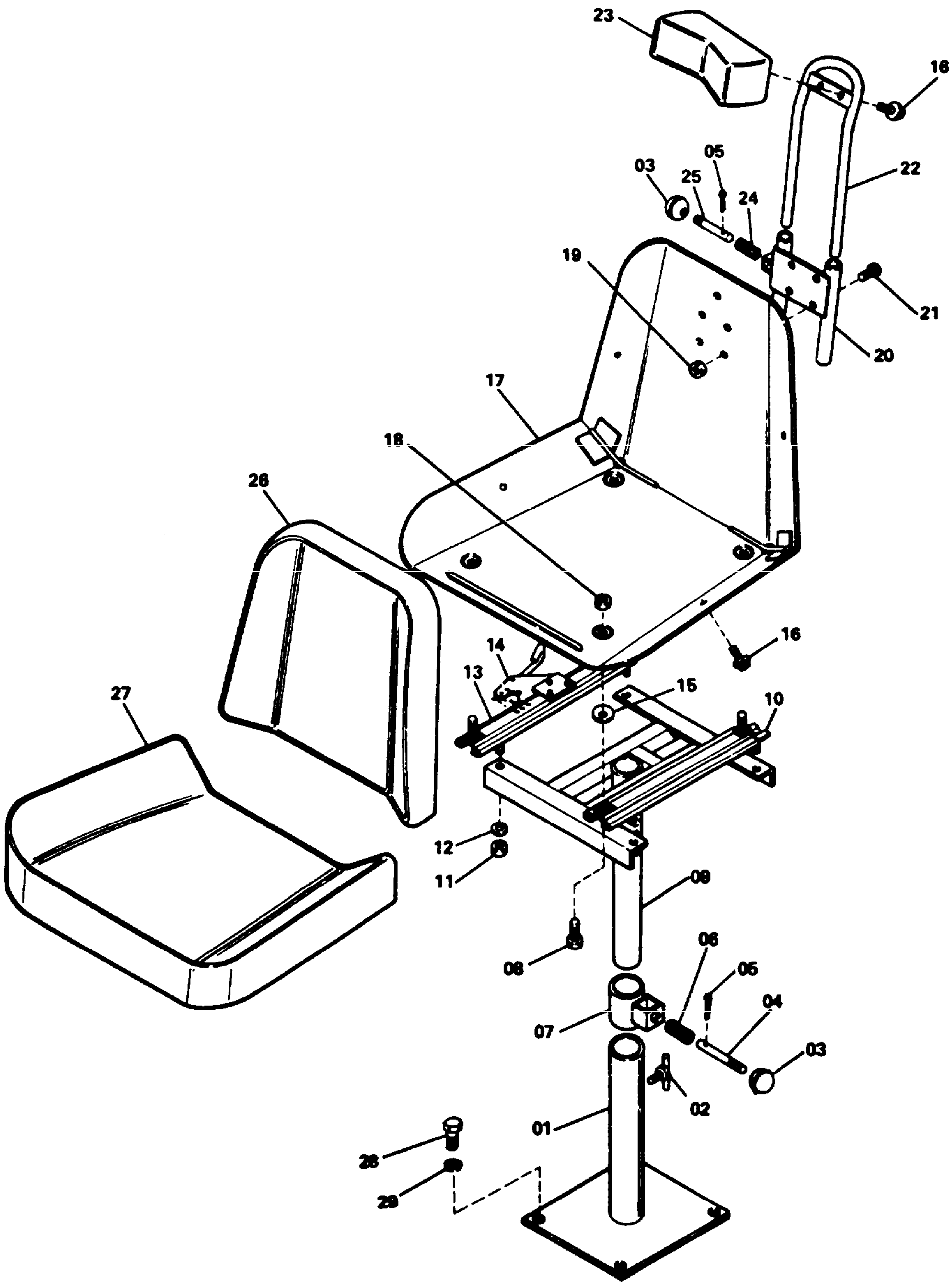
MOTOR, SWING



QTY	STOCK	Ret.	Part Number	Description	Quantity Figure Number			
		–	41Z110	MOTOR, SWING				
		–	1046Z1015	KIT, Shaft seal	1			
		01		. . RING, Snap	1			
		02		. . SEAL, Shaft	1			
		03		. . O-RING, Flange	1			

Ref. Dwg. 41Z110

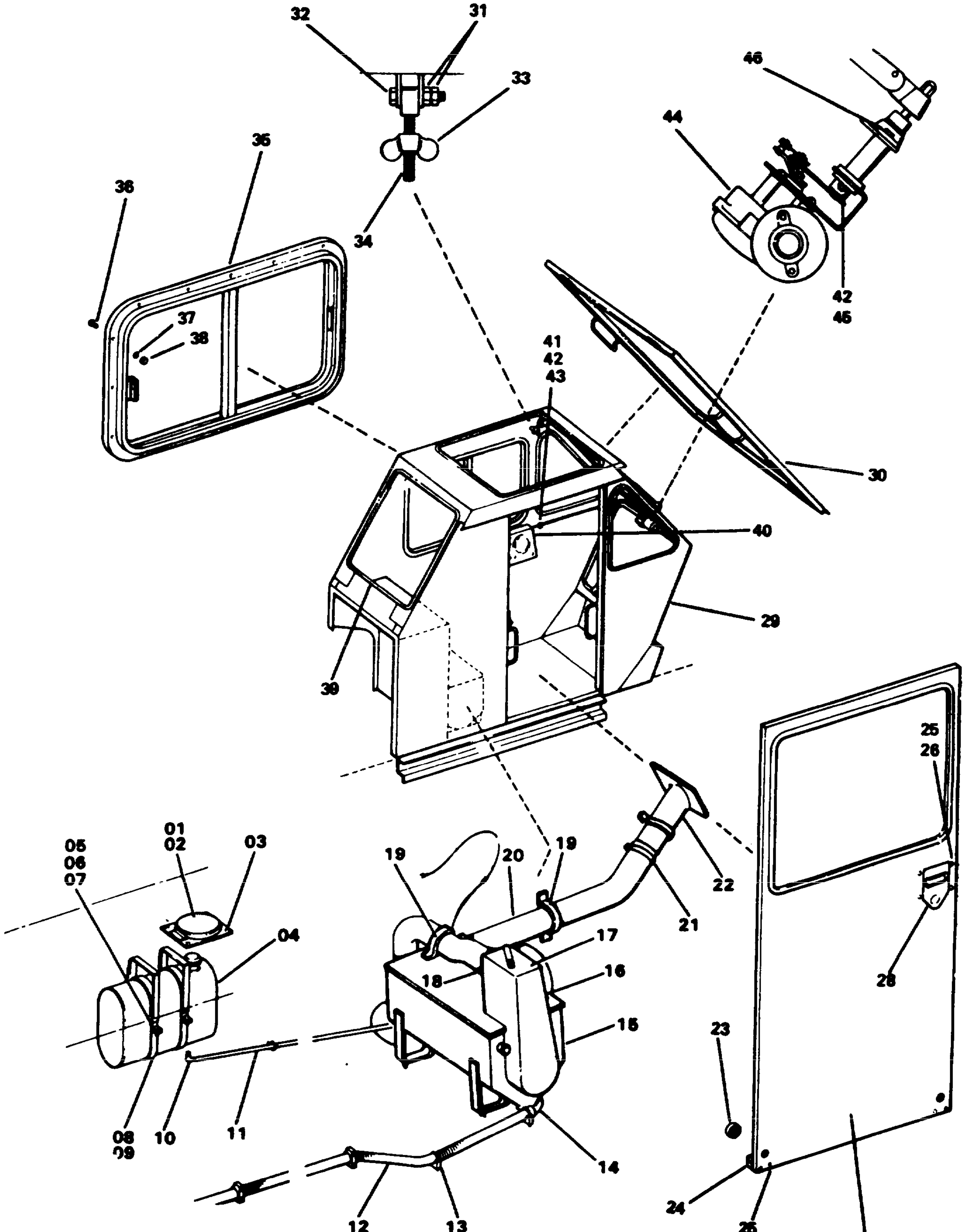
OPERATORS SEAT ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-	48Z51	SEAT ASSEMBLY, OPERATOR	1			
		01	1048242	• PEDESTAL, Lower	1			
		02	1020Z2680	• SCREW, Locking	1			
		03	1048Z33	• BALL, Adjustment pin	2			
		04	1019Z655	• PIN, Lower adjustment	1			
		05		•PIN,Cotter	2			
		06	1017Z699	• SPRING	1			
		07	1018Z2734	• COLLAR, Height adjustment	1			
		08		• BOLT, Carriage 5/16-18UNC x 1 in.	4			
		09	1048Z43	• PEDESTAL, Upper	1			
		10	1048Z45	•SLIDE	1			
		11		• NUT, Hex 5/16-24UNF	4			
		12		• WASHER, Lock 5/16 in.	4			
		13	1048Z44	• SLIDE, Adjustment	1			
		14	1017Z700	• SPRING	1			
		15	1018Z4774	• SPACER	4			
		16		• SCREW, hex hd. rnach. 1/4-20UNC x 3/4	7			
		17	1048Z41	• SHELL, Metal	1			
		18		• NUT, Lock 5/16-1BBUNC	4			
		19		• NUT, Lock 1/4-20UNC	4			
		20	1016Z280	• BRACKET, Head rest adjustment	1			
		21		• SCREW, Rd. hd. 1/4-2OUNC x 1/2 in.	4			
		22	1016Z281	• BRACKET, Head rest	1			
		23	1048Z46	•PAD,Head rest	1			
		24	1017Z698	• SPRING	1			
		25	1019Z656	• PIN, Head rest adjustment	1			
		26	1048Z39	• CUSHION, Back rest	1			
		27	1048Z40	• CUSHION, Seat	1			
		28		• SCREW, Hex hd. 1/2-13UNC x 1-1/4 in	4			
		29		• WASHER, Lock 1/2 in..	4			

Ref. Dwg. 48Z51

UPPER CAB GROUP



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Sheet 1 of 2

UPPER CAB GROUP (Continued)

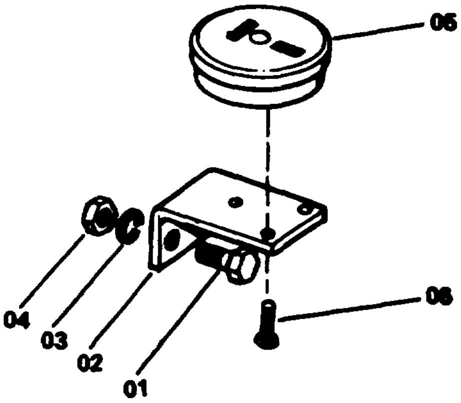
Ref.	Part Number	Description	Quantity Figure Number 1	2	3			
–	100J4202-1	HEATER AND DEFROSTER ASSEMBLY						
–	927J61-2	OPERATORS CAB ASSEMBLY						
–	100J3850-3	WINDSHIELD WIPER ASSEMBLY						
01	14Z221	• CAP, Gas tank access	1	–	–			
02	32Z1076	• DECAL, Heater gas tank.	1	–	–			
03	20Z1282D3	• SCREW, Self-tapping 1/4-20UNC.	11	–	–			
04	27Z448	• TANK, 2-3/4 gal. fuel.	1	–	–			
05		• SCREW, Rd. hd. mach. #5-40UNC x 1/2in	4	–	–			
06		• WASHER, Lock #5	4	–	–			
07		• NUT, Hex #5-40UNC.	4	–	–			
08		• BELT, 1 in. wide x 17 in. lg.	2	–	–			
09	816T1098	• BRACKET, Fuel tank support.	2	–	–			
10	44Z934D1	• ELBOW, 90° Male	1	–	–			
11		• LINE, Fuel 3/16in. ID x 10 ft.	1	–	–			
12	44Z1410D1	• TUBE, Flexible steel	1	–	–			
13	32Z171D3	• CLAMP, Muffler	4	–	–			
14	27Z595D1	• ELBOW, Exhaust.	1	–	–			
15	80Z894	• HEATER (Page 9.1).	1	–	–			
16	27J1286F1	• BOX, Heat & defrost control	1	–	–			
17	32Z1404	• DECAL, Heat and defrost.	1	–	–			
18	44Z12D9	• CLAMP,Hose	1	–	–			
19	32Z890D9	• CLAMP, Hose	2	–	–			
20	20Z1569	• HOSE, Defroster.	1	–	–			
21	44Z12D9	• CLAMP,Hose	1	–	–			
22	27N2567	• DEFROSTER	1	–	–			
23	27T1569	• ROLLER, Door.	–	2	–			
24	27T1570	• KEEPER, Door	–	2	–			
25		• SCREW, Hex hd. cap 1/4-20UNC x 1/2in..	–	8	–			
26		• WASHER, Lock 1/4in	–	8	–			
27	27J965	• DOOR ASSEMBLY.	–	1	–			
28	27P2310	• LOCK ASSEMBLY	–	1	–			
29	27J967	•CAB,Operaton	–	1	–			
30	27J966	• FRAME, Removable front window.	–	1	–			
31		• NUT, Hex 1/4-20UNC	–	8	–			
32		• SCREW, Hex hd. cap 1/4-20UNC x 1-1/4 in	–	4	–			
33	20H1686D2	•NUT,Wing	–	4	–			
34	27T1576	•SCREW, Window	–	4	–			
35	1014Z1279	• FRAME, L.H. sliding window	–	1	–			
38		•SCREW, Rd. hd. mach. #10-24UNC x 1/2in	–	16	–			
37		•WASHER, Lock #10.	–	18	–			
38		• NUT, Hex #10-24UNC.	–	18	–			
39	27Z385	• CHANNEL, Window	–	AR	–			
40	20F57D48	• GROMMET	–	–	1			
41	32Z423D16	• HANGER, Cable.	–	–	4			
42		• SCREW, Hex hd. cap 1/4-28UNF x 1/2in..	–	–	4			
43		• NUT, Hex 1/4-28UNF	–	–	6			
44	49T3	• WIPER ASSEMBLY.	–	–	1			
45		• WASHER, Lock 1/4in	–	–	2			
46		• SCREW, Hex hd. cap 1/4-28UNF x 2-3/4 in	–	–	2			

NOTE

All individual wires, leads and jumpers should be fabricated locally.

Ref. Dwg. 100J4202 C 100J4202-1
927J61 E 927J61-2
100J3850 B 100J3850-3

UPPER OUTRIGGER LEVEL ASSEMBLY



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number 1			
		–	100P851-1	**LEVEL ASSEMBLY. UPPER OUTRIGGER**				
		01		• SCREW, Hex hd. 3/8-16UNC x 1 in.	2			
		02	16P3688	• BRACKET, Level mounting	1			
		03		• WASHER, Lock 3/8in	2			
		04		• NUT, Hex 3/8-16UNC	2			
		05	89Z421	• LEVEL, Two-my	1			
		06		•• SCREW, Fl. hd. mach. #6-32UNC x 5/8 in..	3			

Ref. Dwg. 100P861 A
100P851-1

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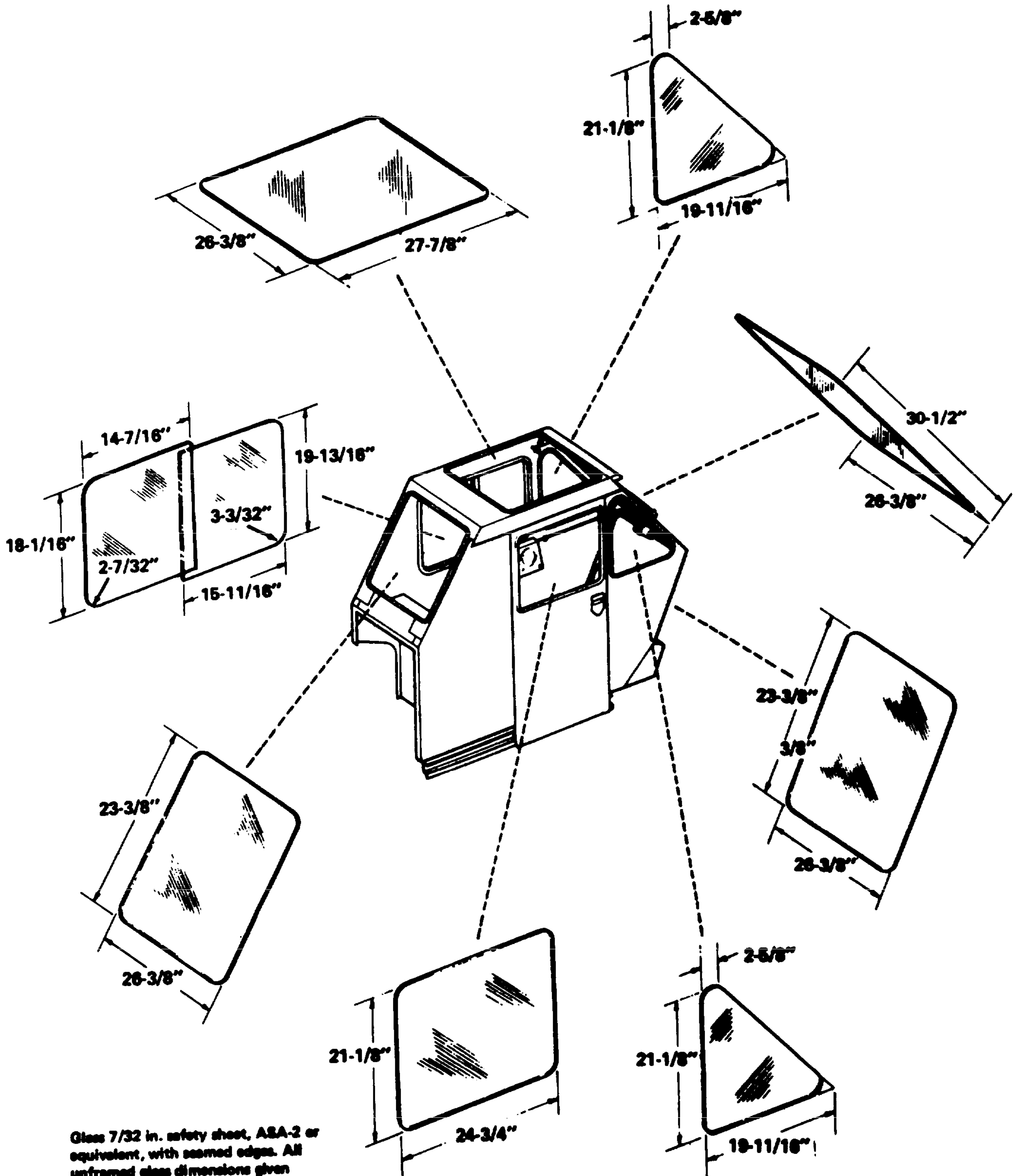
UPPER CAB GLASS



Glass 7/32 in. safety sheet, ASA-2 or equivalent, with seamed edges. All unframed glass dimensions given with a ± 1/16" tolerance. Framed glass dimensions given with a ± 1/32" tolerance. All radii are 1-11/16 except where noted. Framed glass is available from Young Windows, Inc., 900 Brook Rd., Conshohocken, Pennsylvania 19428. Unframed glass is available from L.O.F. Co., 811 Madison Ave., Toledo, Ohio 43624.

HIGH MORTALITY HEATER PARTS

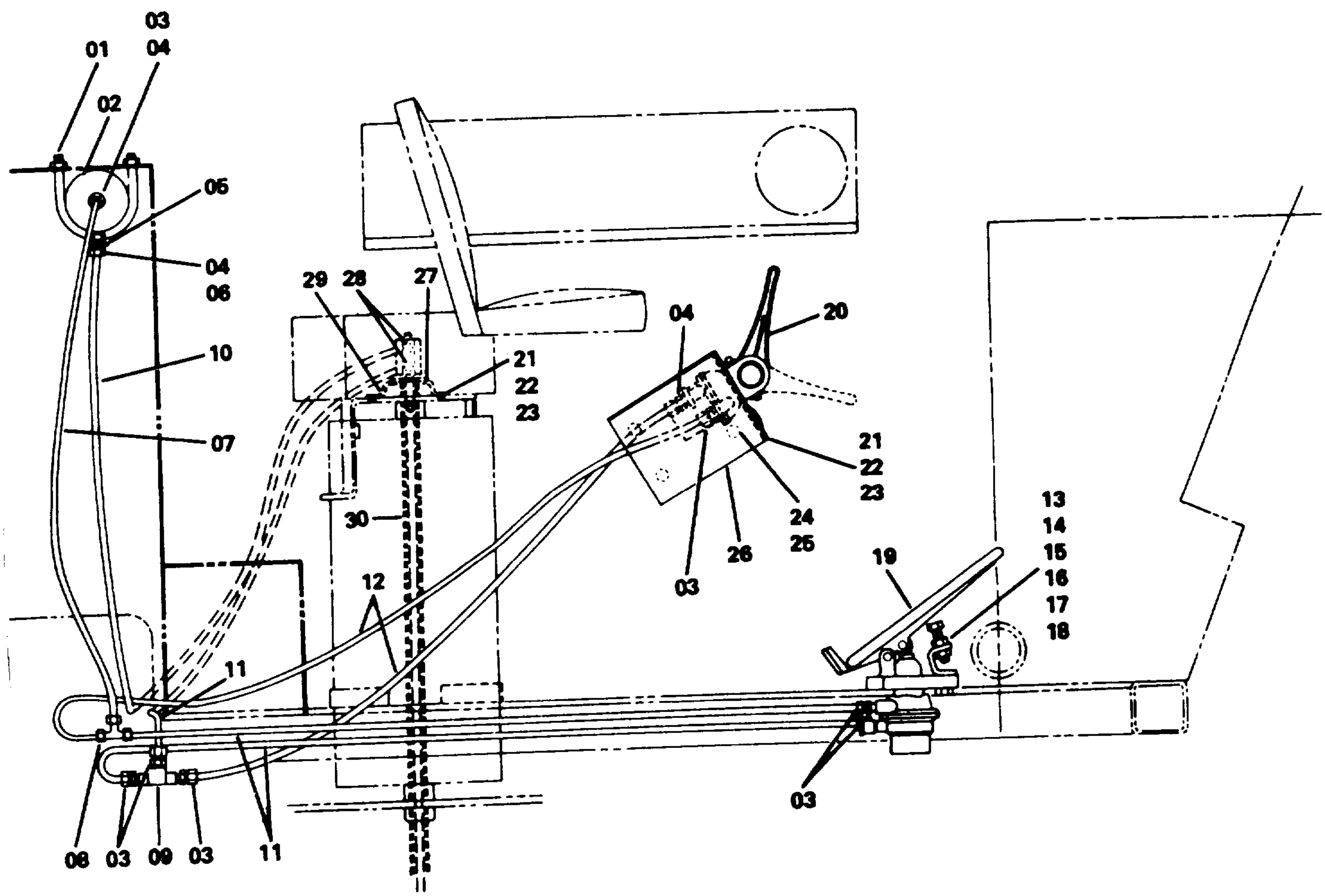
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		HIGH MORTALITY HEATER PARTS				
		–	1044Z507	• KIT, Pump coupling	1			
		–	1018Z4674	• CAM, Fuel pump	2			
		–	1036Z683	• KIT, Fuel pumprepair	1			
		–	1075Z704	• COIL, Ignition	1			
		–	1089Z92	• THERMOSTAT.	1			
		–	1044Z508	• LINE,Fuel	1			
		–	1079Z1480	• POINTS, Breaker.	1			
		–	1079Z1481	•KIT,Spark plug	1			
		–	1060Z355	• KIT, Burner repair	1			
		–	1034Z13	•NOZZLE	1			
		–	1080Z356	• MIXER	1			
		–	1079Z1505	• WITCH ASSEMBLY	1			
		–	1014Z1256	• MOTOR, Ventilation	1			
		–	1027Z128	• EXTENSION, Exhaust	1			
		–	1037Z229	• PUMP, Fuel	1			
		–	1088Z71	• MOTOR, Air combustion	1			
		–	1079Z1506	• SWITCH, Overheat				

NOTE

Additional parts information is available from manufactures address, listed below.

Stewart Warner Corporation
south wind Division
1514 Drover Street
Indianapolis, Indiana 46221
317/632-8411

UPPER AIR THROTTLE ASSEMBLY



UPPER AIR THROTTLE ASSEMBLY (Continued)

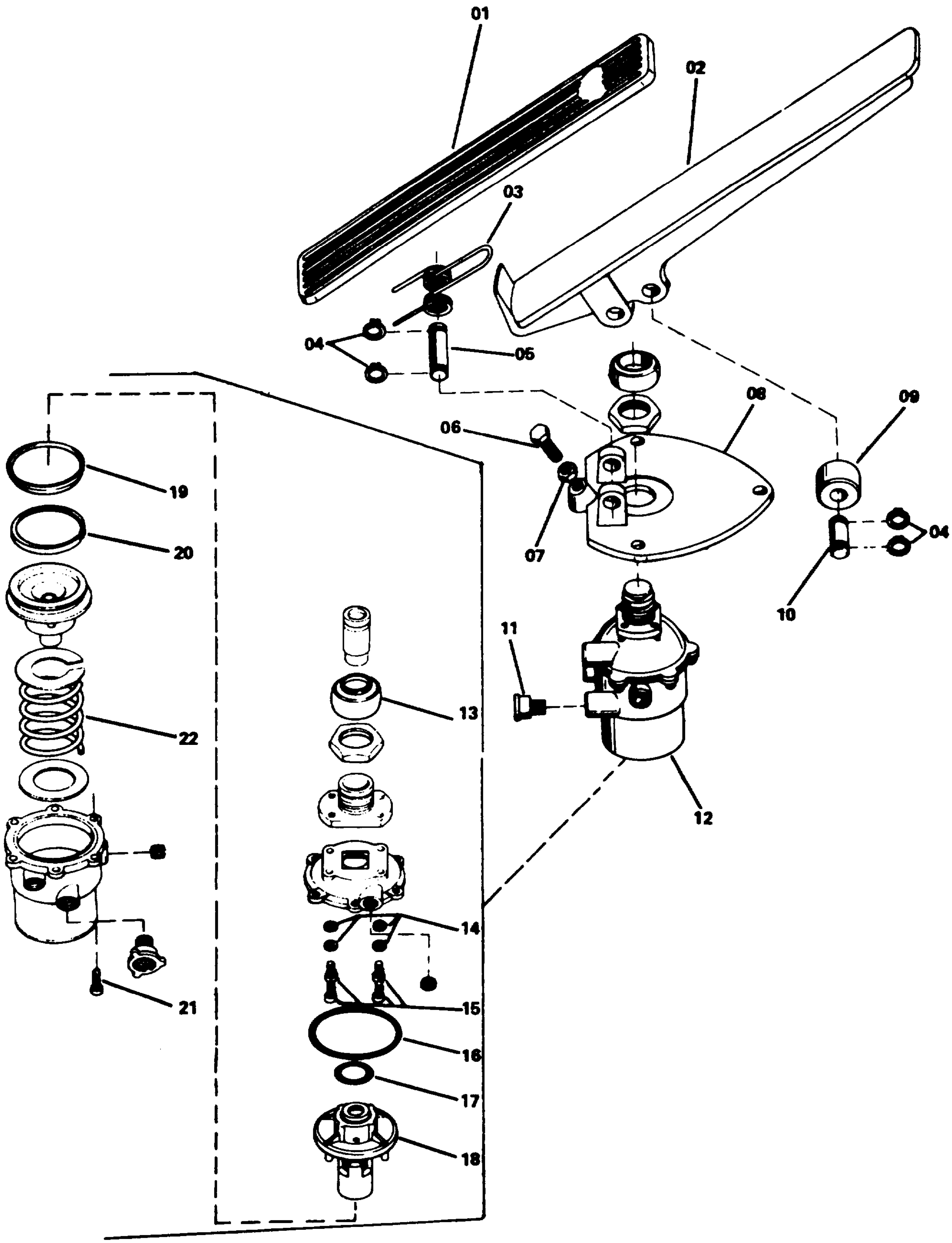
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 2	7		
		–	190X131-2	AIR THROTTLE ASSY .,FOOT CONTROL				
		–	19DX131-7	AIR THROTTLE ASSY., HAND CONTROL				
		01	32Z171D11	• CLAMP, Air tank mounting	1	–		
		02	27Z558	• TANK, Air	1	-		
		03	44Z1322D1	• FITTING, Straight	6	4		
		04	44Z1320D1	•ELBOW.99°	3	-		
		05	36Z39	• COCK, Tank drain	1	-		
		06	36Z872	• VALVE, Single check	1	-		
		07		• TUBE, Nylon 3ft. lg.	1	-		
		08	44Z142201	• TEE, Fitting	-	1		
		09	36Z763	• VALVE, Shuttle	-	1		
		09	44Z1466D2	• UNION, Tube	2	-		
		10		• TUBE, Nylon 8ft	1	-		
		11		• TUBE, Nylon 5ft	3	-		
		12		• TUBE, Nylon 4ft	-	2		
		13	16T4971	• BRACKET, Foot throttle stop	1	-		
		14		• SCREW, Hex hd. 5/16-18UNC x 1 in.	3	-		
		15		• WASHER, Lock 5/16 in.	3	-		
		16		• NUT, Hex 5/16-18UNC	3	-		
		17		• NUT, Hex jam 3/8-16UNC	1	3		
		18		• SCREW, Hex hd. 3/8-16UNC x 1 in.	1	-		
		19	36U29D2	• VALVE, Air throttle (Page 11.1).	1	-		
		20	36U54D1	• VALVE, Hand throttle (Page 12.1).	-	1		
		21		• SCREW, Hex hd. 1/4-20UNC x 3/4 in.	6	4		
		22		• WASHER, Lock 1/4 in.	6	4		
		23		• NUT, Hex 1/4-20UNC	6	4		
		24		• SCREW, Hex hd. 3/8-16UNC x 3/4 in.	-	3		
		25		• WASHER, Lock 3/8 in.	-	3		
		26	16N1830	• BRACKET, Hand throttle valve	-	1		
		27	18Z2288	• WASHER, Thrust	1	-		
		28	44Z1322D3	• FITTING, Straight	2	-		
		29	16P3666	• BRACKET, Air swivel	1	-		
		30	45Q9D2	• SWIVEL ASSY.,Air	1	-		
		–	1045Z1357	•• KIT, Seal	1	-		

NOTE

The nylon tubing called for on this assembly is part number 20Z1411D2. When ordering nylon tubing you MUST specify, in feet, the length required.

Ref. Dwg. 100X131-A
100X131-2
100X131-7

AIR THROTTLE PEDAL AND VALVE ASSEMBLY

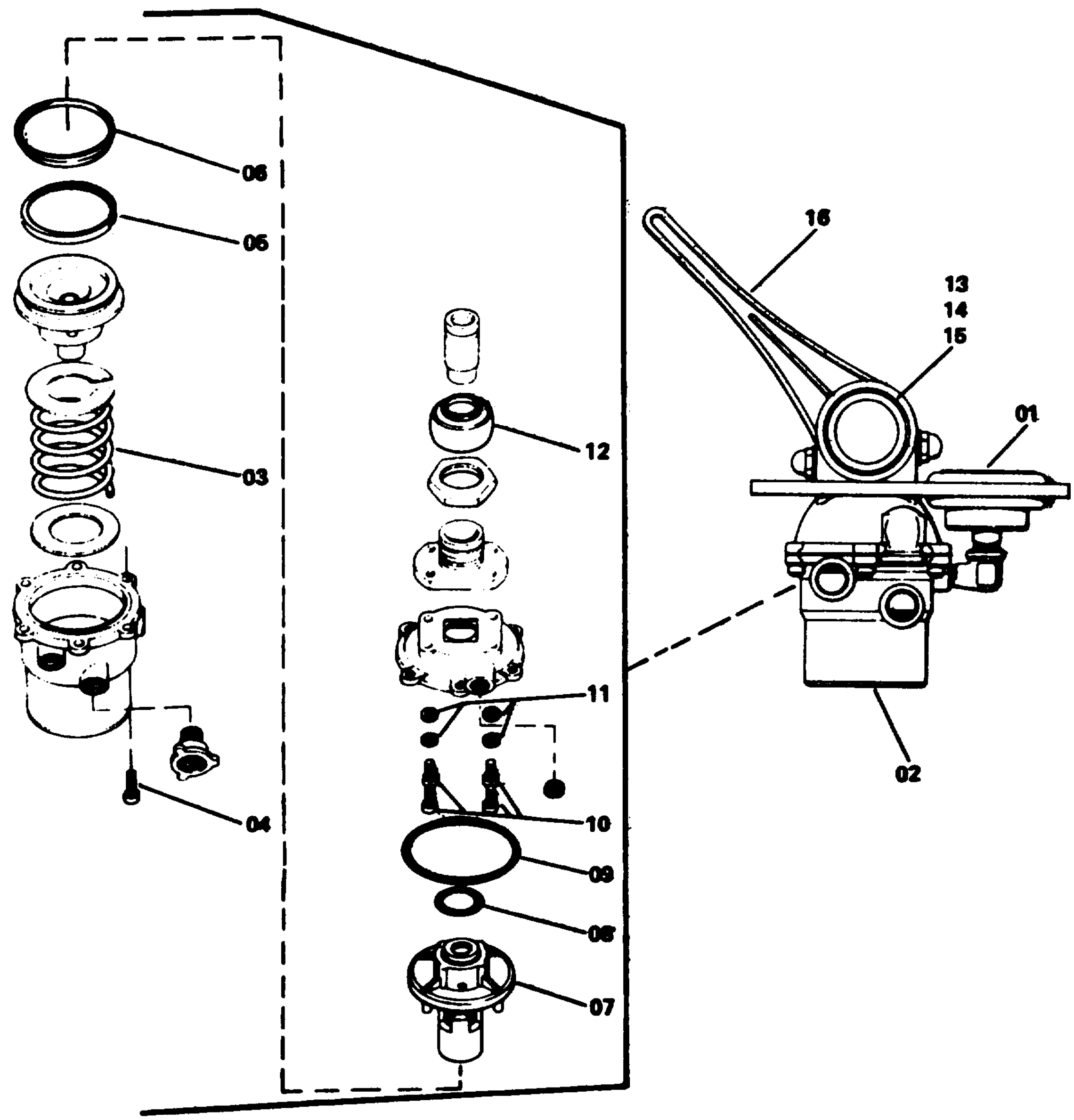


AIR THROTTLE PEDAL AND VALVE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number D2			
			36U29D2	AIR THROTTLE PEDAL AND VALVE ASSY.				
		01	1014Z955	• COVER, Treadle	1			
		02	1006Z509	• TREADLE	1			
		03	1017Z873	• SPRING	1			
		04	1018Z4078	• RING, Retaining	4			
		05	1019Z838	• PIN, Treadle	1			
		06	1020Z4073	• SCREW, Cap	1			
		07	1020Z4068	• NUT, Jam	1			
		08	1016Z336	• PLATE, Treadle mounting	1			
		09	1013Z221	• ROLLER	1			
		10	1019Z837	• PIN, Push rod	1			
		11	1046Z203	• BREATHER	1			
		12	1036Z606	• VALVE ASSEMBLY	1			
		--	1036Z607	•• KIT, Valve repair	1			
		13		••• BOOT, Dust	1			
		14			4			
		15		••• SCREW, Machine	4			
		16		••• O-RING	1			
		17		••• D-RING	1			
		18		••• PLATE ASSEMBLY, Barrier	1			
		19		••• U-CUP	1			
		20		••• RING, Thrust	1			
		21		••• SCREW, Machine	6			
		22	1017Z869	••SPRING, Balance	1			

Ref. Dwg. 36U29D2

HAND THROTTLE CONTROL VALVE

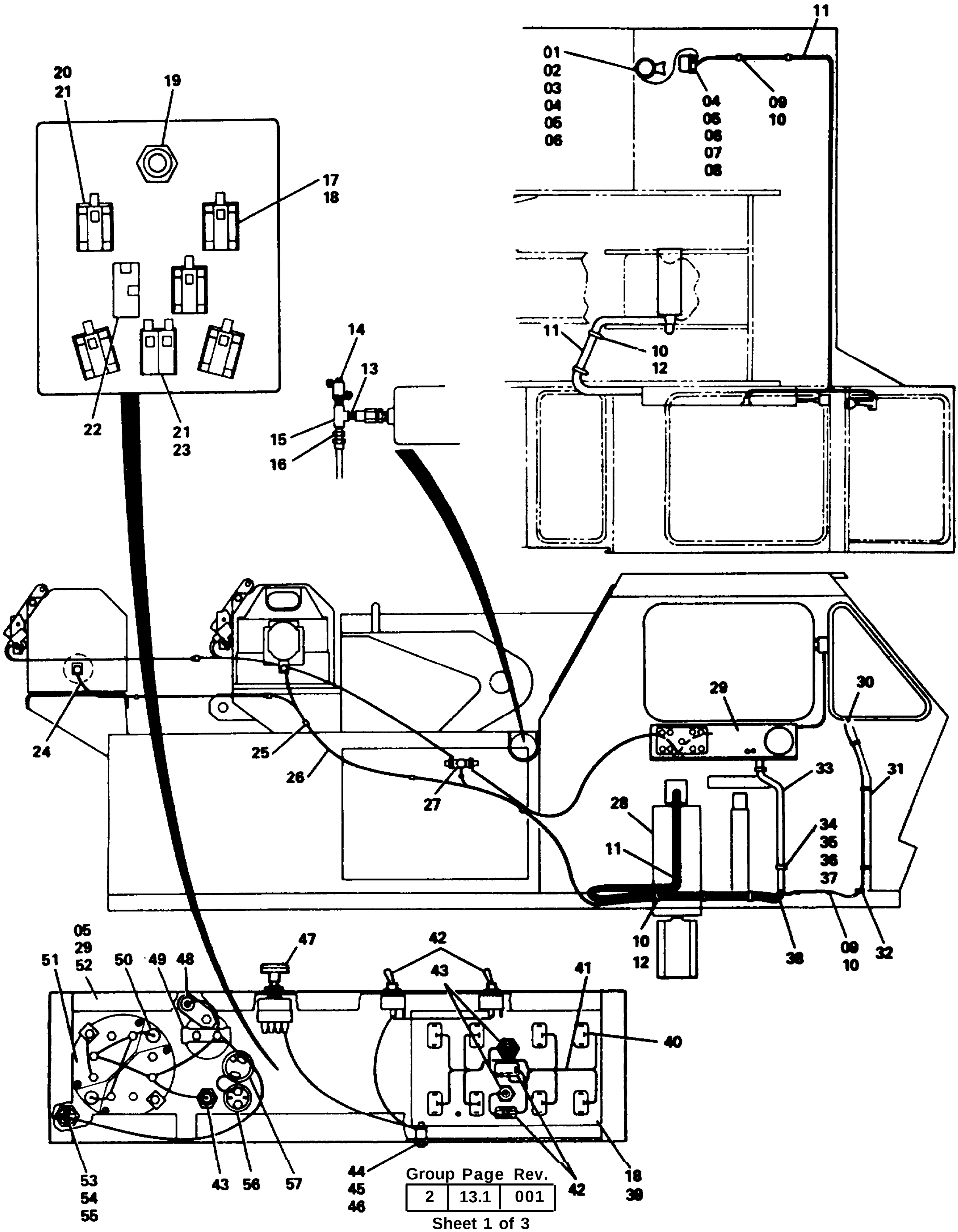


HAND THROTTLE CONTROL VALVE (Continual)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–	36U54D1	VALVE, HAND THROTTLE CONTROL				
		01	1089Z103	• GAUGE, Air pressure				
		02	1036Z729	• VALVE	1			
		03	1017Z872	•• SPRING, Balancing	1			
		–	1045Z1371	•• KIT, Valve rebuilding	1			
		04		•• SCREW, Machine	6			
		05		•• RING,Thrust	1			
		06		•• U-CUP	1			
		07		•• PLATE ASSY., Barrier	1			
		08		•• O-RING	1			
		09		•• O-RING	1			
		10		•• SCREW, Machine	1			
		11		•• WASHER, Seal	4			
		12		•• RING, Retaining	4			
		13		•• DISC, Handle	1			
		14		•• DISC, Inner friction	1			
		15		•• DISC, Outer friction	1			
		16	1006Z653	• HANDLE, Control	1			

Ref. Dwg. 36U54D0
36U54D1

UPPER ELECTRICAL ASSEMBLY



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UPPER ELECTRICAL ASSEMBLY (Continued)

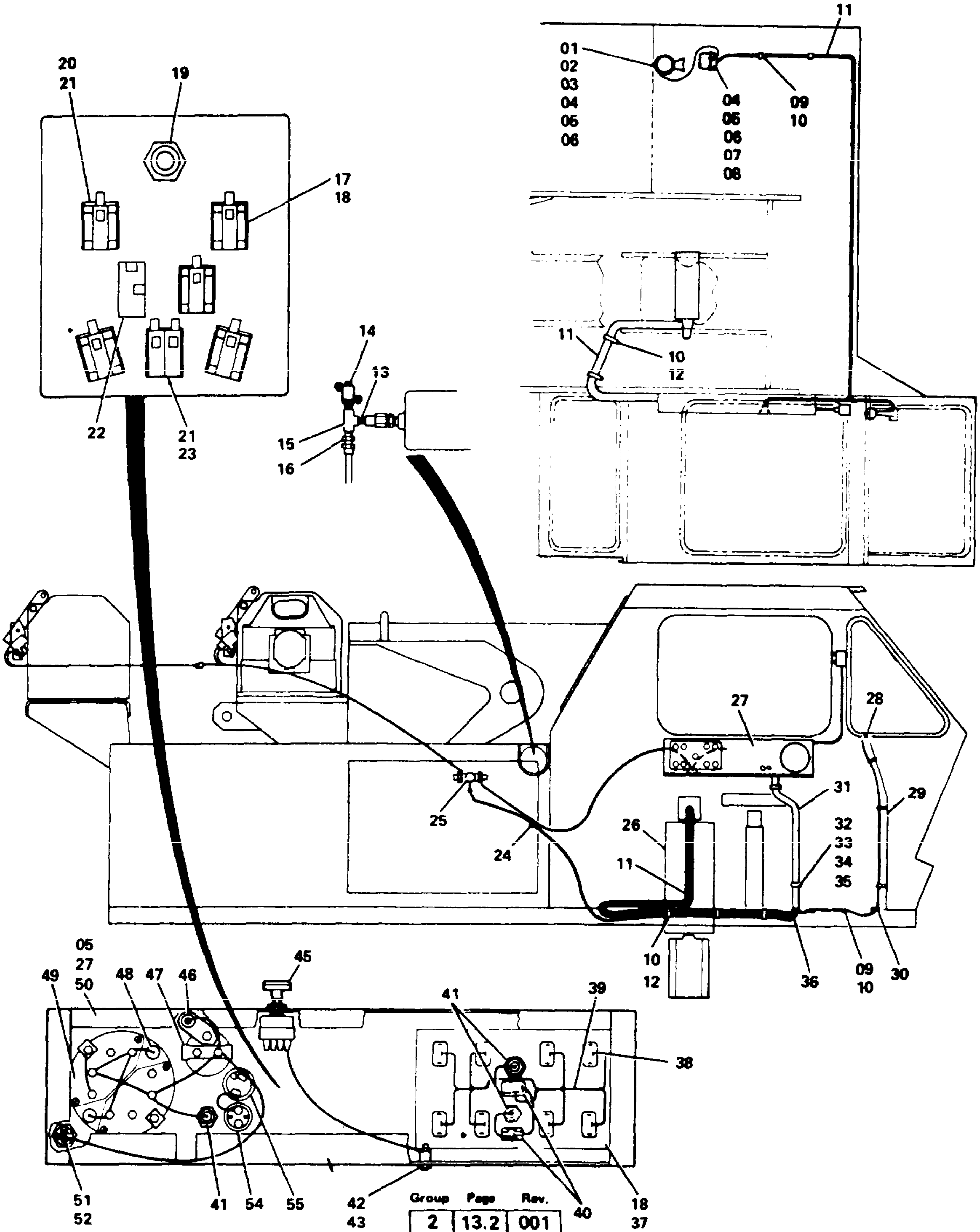
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 8	10	14	15	38
			100X139-8						
			100X139-10	ELECTRICAL ASSY., BASIC UPPER					
			100X139-14	ELECTRICAL ASSY., REMOTE CONTROL CARRIER					
		–	100X139-15	ELECTRICAL ASSY., REMOTE CONTROL CARRIER					
		–	100X139-38	ELECTRICAL ASSY., ENGINE WARNING					
		01	47Z23D5	• HORN, Signal	1	1			
		02	16Z165D2	• BRACKET. Horn mounting	1	1	–	–	–
		03	20Z1040D1	• NUT, Horn mounting	1	1	–	–	–
		04		• SCREW, Hex hd. 1/4-20UNC x 3/4 in.	3	3	–	–	–
		05		• WASHER, Lock 1/4in.	14	14	–	–	–
		06		• NUT, Hex 1/4-20UNC	5	5	–	–	–
		07		• SCREW, Rd. hd. mach. 1/4-20UNC x 1 in.	2	2	–	–	–
		08	79Z2368	•RELAY	1	1	–	–	–
		09	32Z423D14	• HANGER, Cable	8	8	–	–	–
		10	20Z1282D1	• FASTENER, Self drilling	11	11	–	–	–
		11	79R2	• HARNESS. Upper main	1	1	–	–	–
		11	79Q293	• HARNESS, Upper main remote control	–	–	1	1	–
		12	32Z423D12	• HANGER, Cable	5	5	–	–	–
		13		• NIPPLE, Close 1/4 x 7/8 in. l g.	–	–	1	1	–
		14	79Z51D1	• SWITCH, Low air pressure	–	–	1	1	–
		15		• TEE, Pipe 1/4in	–	–	1	1	–
		16	442132201	• FITTING, Str. 1/4 tube x 1/4 N T.	–	–	1	1	–
		17	32U671D3	• PANEL, Carrier remote control	–	–	1	1	–
		18	20Z40D13	• SCREW, Self tapping	6	6	4	4	–
		19	56Z160	• LIGHT. Indicator	–	–	1	1	–
		20	79Z2419D1	• BLOCK, Contact	–	–	5	5	–
		21	79Z2418D2	• MODULE, Operator	–	–	6	6	–
		22	79Z2406D1	• SWITCH, Toggle	–	–	1	1	–
		23	79Z2419D2	• BLOCK, Contact	–	–	1	1	–
		24	79Q292	• HARNESS, Auxiliary winch control	1	1	–	–	–
		25	32Z890D3	• CLAMP, Tie wrap	10	10	–	–	–
		26	79Q285	• HARNESS. Main winch control	1	1	–	–	–
		27	89Z154	• SENDING UNIT, Hydraulic oil temp.	1	1	–	–	–
		28	979J30-1	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).	1	-	–	–	–
		28	979J30-3	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).		1	–	–	–
		28	979J30-2	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).	-	–	1	–	–
		28	979J30-4	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).		–	–	1	–
		29	16N1657D3	• PANEL, Upper instrument	1	1	–	–	–
		29	16N1657D4	• PANEL, Upper instrument	–	–	1	1	–
		30	79Z1586	• SWITCH, Push button signal horn	1	1	–	–	–
		31	32Z890D4	• CLAMP, Tie wrap	3	3	–	–	–
		32	20F179D7	• GROMMET	1	1	–	–	–
		33	87T15	• CONDUIT	1	1	–	–	–
		34		• CLAMP, Conduit	2	2	–	–	–
		35		• SCREW, Hex hd. 3/8-16UNC x 1/2 in.	2	2	–	–	–
		36		• WASHER, Lock 3/8 in.	2	2	–	–	–
		37		• NUT, Hex 3/8-16UNC	2	2	–	–	–
		38	87Z221D1	• BUSHING, Snap in	2	2	–	–	–
		39	32U672D1	• PANEL, Outrigger control	1	1	–	–	–
		40	79Z2400D5	• SWITCH, Outrigger control toggle	B	8	–	–	–

UPPER ELECTRICAL ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 8	10	14	15	38
		41	79Z2412	• HARNESS, Upper outrigger poHsr					
		42	79Z2400D1	• SWITCH, Winch speed, outrigger on-off & lock	4	4	–	–	–
		43	56Z63	• LIGHT, Outrigger and iqnition indicator	3	3	–	–	–
		44	16Z408	• INSULATOR	1	1	–	–	–
		45		• WASHER, Lock #10	2	2	–	–	–
		46		• NUT, Hex #10-32UNF	2	2	–	–	–
		47	1079Z1510	• SWITCH, Windshield wipe control	1	1	–	–	–
		48	56Z240D1	• LIGHT, Oil temp. gauge	1	1	–	–	–
		49	88Z238	• GAUGE, Oil temp.	1	1	–	–	–
		50	56Z142	• LIGHT, Gauge cluster	2	2	–	–	–
		51	89Z296	• CLUSTER, Gauge	1	1	–	–	–
			1089Z100	•• GAUGE, Oil and volt	1	1	–	–	–
			1089Z101	•• GAUGE, Fuel and water temp.	1	1	–	–	–
		52		• SCREW, Truss hd. 1/4-20UNC x 5/8 in.	6	6	–	–	–
		53		• PLUG, Button	1	1	–	–	–
		54	56Z298D1	• LIGHT, Engine warning indicator	–	–	–	–	1
		55	32Z1428	• DECAL, Engine warning	–	–	–	–	1
		56	79Z1297	• SWITCH, Engine kill push button	1	1	–	–	–
		57	79Z2337	• SWITCH, Upper ignition	1	1	–	–	–

Ref. Dwg. 100X139/H 100X139-38
100X139-8 100X138-38
100X139-10
100X139-14
100x139-16

UPPER ELECTRICAL ASSEMBLY



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UPPER ELECTRICAL ASSEMBLY (Continued)

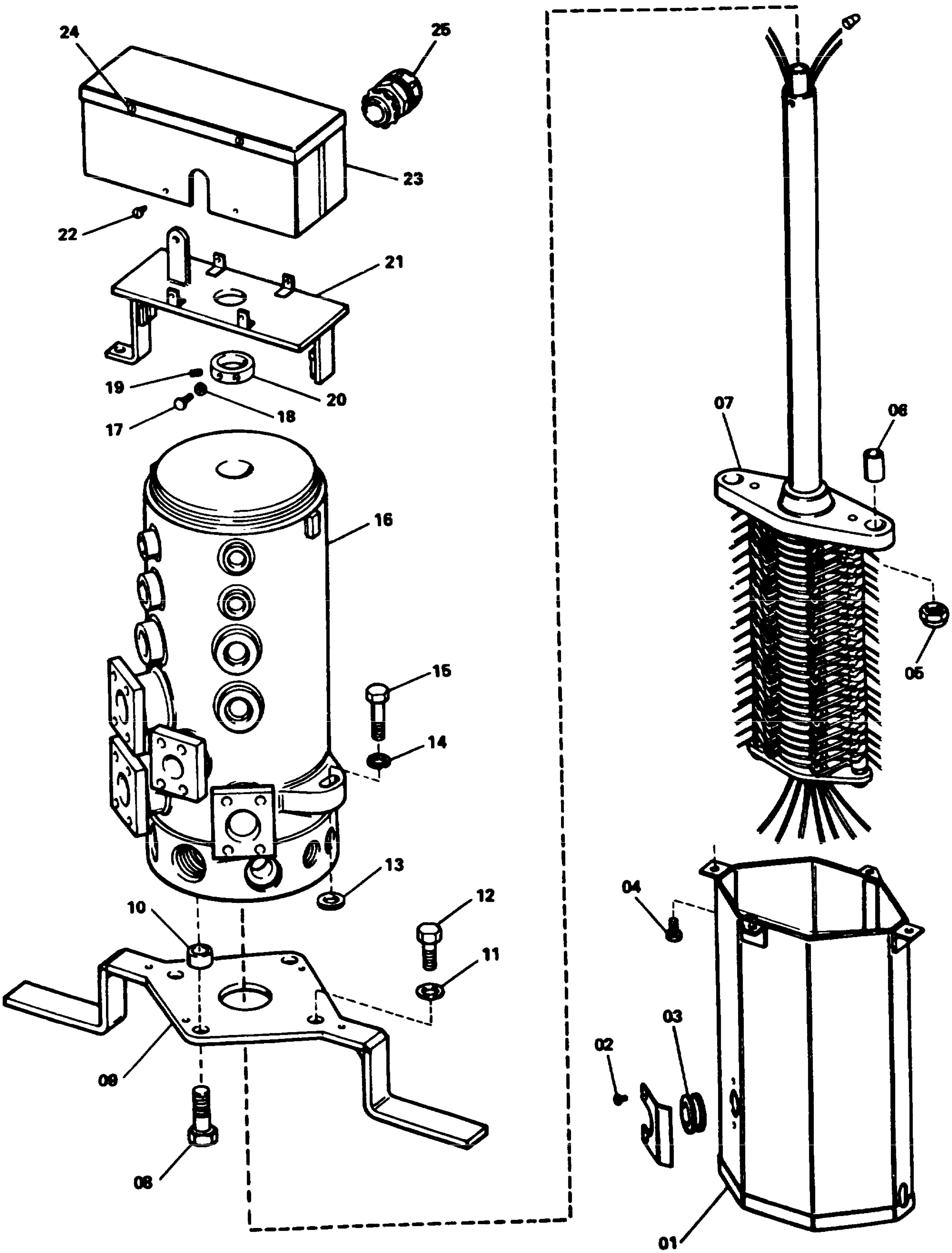
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 8	10	14	15	38
		–	100X139-8	ELECTRICAL ASSY., BASIC UPPER					
		–	100X139-10	ELECTRICAL ASSY., BASIC UPPER					
		–	100X139-14	ELECTRICAL ASSY., REMOTE CONTROL CARRIER					
		–	100X139-15	ELECTRICAL ASSY., REMOTE CONTROL CARRIER					
		–	100X139-38	ELECTRICAL ASSY., ENGINE WARNING					
		01	47Z23D5	• HORN, Signal	1	1	–	–	–
		02	16Z165D2	• BRACKET, Horn mounting	1	1	–	–	–
		03	20Z1040D1	• NUT, Horn mounting	1	1	–	–	–
		04		• SCREW, Hex hd. 1/4-20UNC x 3/4 in.	3	3	–	–	–
		05		WASHER, Lock 1/4 in.	14	14	–	–	–
		06		• NUT, Hex 1/4-20UNC	5	5	–	–	–
		07		• SCREW, Rd. hd. mach. 1/4-20UNC x 1 in.	2	2	–	–	–
		08	79Z2368	• RELAY	1	1	–	–	–
		09	32Z423D14	• HANGER, Cable	8	8	–	–	–
		10	20Z1282D1	• FASTENER, Self drilling	11	11	–	–	–
		11	79R2	• HARNESS, Upper main	1	1	–	–	–
		11	79Q293	• HARNESS, Upper main remote control	–	–	1	1	–
		12	32Z423D12	• HANGER, Cable	5	5	–	–	–
		13		• NIPPLE, Close 1/4 x 7/8 in. lg.	–	–	1	1	–
		14	79Z51D1	• SWITCH, Low air pressure	–	–	1	1	–
		15		• TEE, Pipe 1/4in..	–	–	1	1	–
		16	44Z1322D1	• FITTING, Str. 1/4 tube x 1/4 N.P.T.	–	–	1	1	–
		17	32U671D3	• PANEL, Carrier remote control	–	–	1	1	–
		18	20Z40D13	• SCREW, Self tapping.	6	6	4	4	–
		19	56Z160	• LIGHT, Indicator	–	–	1	1	–
		20	79Z2419D1	• BLOCK, Contact	–	–	5	5	–
		21	79Z2418D2	• MODULE, Operator	–	–	6	6	–
		22	79Z2400D1	• SWITCH, Toggle	–	–	1	1	–
		23	79Z2419D2	• BLOCK, Contact	–	–	1	1	–
		24	79Q292	• HARNESS, Auxiliary winch control	1	1	–	–	–
		25	32Z890D3	• CLAMP, Tie wrap	10	10	–	–	–
		26	79Q285	• HARNESS, Main winch control	1	1	–	–	–
		27	89Z154	• SENDING UNIT, Hydraulic oil temp.	1	1	–	–	–
		28	979J30-1	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).	1	–	–	–	–
		28	979J30-3	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).	–	1	–	–	–
		28	979J3B2	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).	–	–	1	–	–
		28	979J30-4	• SWIVEL & COLLECTOR RING ASSY. (Page 14.1).	–	–	–	1	–
		29	16N1657D3	• PANEL, Upper instrument	1	1	–	–	–
		29	16N1657D4	• PANEL, Upper instrument	–	–	1	1	–
		30	79Z1586	• SWITCH, Push button signal horn	1	1	–	–	–
		31	32Z890D4	• CLAMP, Tie wrap	3	3	–	–	–
		32	20F179D7	• GROMMET	1	1	–	–	–
		33	87T15	• CONDUIT	1	1	–	–	–
		34		• CLAMP, Conduit.	2	2	–	–	–
		35		• SCREW, Hex hd. 3/8-16UNC x 1/2 in.	2	2	–	–	–
		36		• WASHER, Lock 3/8in.	2	2	–	–	–
		37		• NUT, Hex 3/8-16UNC	2	2	–	–	–
		38	87Z221D1	• BUSHING, Snap in	2	2	–	–	–
		39	32U672D1	• PANEL, Outrigger control	1	1	–	–	–
		40	79Z2400D5	• SWITCH, Outrigger control t-e	8	8	–	–	–

UPPER ELECTRICAL ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity – Figure Number 11	12	14	15	38
		40	79Z2400D1	SWITCH. Winch speed, outrigger on-off & lock	2	1		-	-
		41	56Z63	• LIGHT. Outrigger and ignition indicator	3	2	-	-	-
		42	16Z406	• INSULATOR	1	1	-	-	-
		43		• WASHER, Lock #10	2	2	-	-	-
		44		• NUT, Hex #10-32UNF	2	2	-	-	-
		45	1079Z1510	• SWITCH, Windshield wipe control	1	1	-	-	-
		46	56Z240D1	• LIGHT, Oil temp. gauge	1	1	-	-	-
		47	89Z236	• GAUGE, Oil temp	1	1	-	-	-
		48	56Z142	• LIGHT, Gauge cluster	2	2	-	-	-
		49	89Z296	• CLUSTER, Gauge	1	1	-	-	-
			1089Z100	• GAUGE, Oil and volt	1	1	-	-	-
			1089Z101	•• GAUGE, Fuel and water temp	1	1	-	-	-
		50		• SCREW, Truss hd. 1/4-20UNC x 5/8in	6	6	-	-	-
		51		• PLUG, Button	1	1	-	-	-
		52	56Z298D1	• LIGHT, Engine warning indicator	-	-	-	-	1
		53	32Z1426	• DECAL. Engine warning	-	-	-	-	1
		54	79Z1297	• SWITCH, Engine kill push button	1	1	-	-	-
		55	79Z2337	• SWITCH, Upper ignition	1	1	-	-	-

Ref. Dwg. 100X139A
100X139-11
100X139-12
100X139-14
100X139-15
100X139-38
100X139-38

COLLECTOR RING & SWIVEL ASSEMBLY



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2	14.1	001

COLLECTOR RING & SWIVEL ASSEMBLY (Continued)

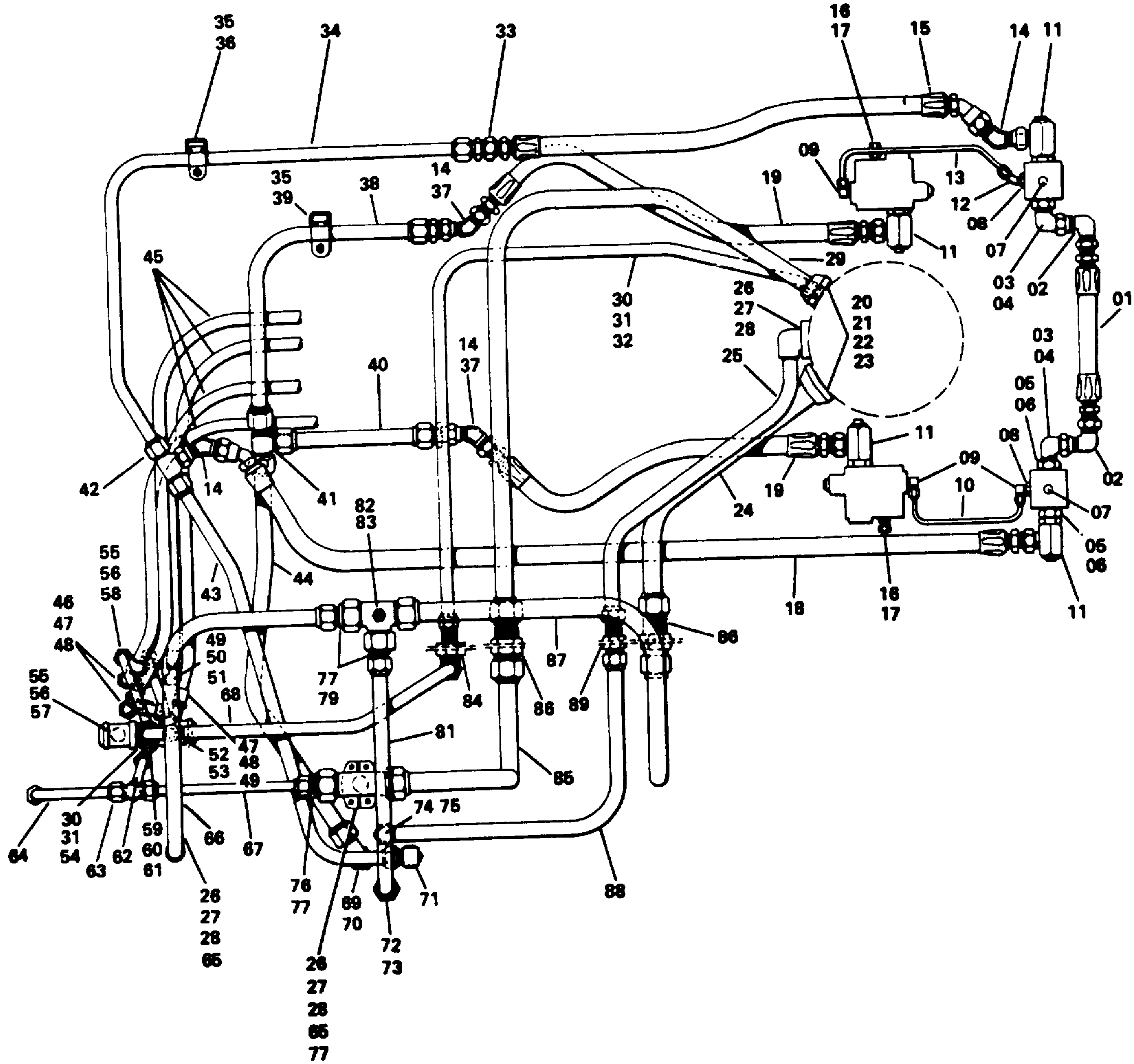
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	2	3	4
		–	979J30-1	COLLECTOR RING & SWIVEL ASSEMBLY	↓			
		–	979J30-2	COLLECTOR RING & SWIVEL ASSEMBLY		↓		
		–	979J30-3	COLLECTOR RING & SWIVEL ASSEMBLY			↓	
		–	979J30-4	COLLECTOR RING & SWIVEL ASSEMBLY				↓
		01	87J11-1	• COVER, Lower	1	1	1	1
		02		•• SCREW, Thread forming #8 x 1/4 in.	4	4	4	4
		03	20F57D35	• GROMMET	1	1	1	1
		04		• SCREW, Hex hd. 1/4-20UNC x 1/2 in	4	4	4	4
		05	20Z586D5	• NUT, Hex lock 1/2-20UNF	2	2	2	2
		06	18T10592D4	SPACER	2	2	2	2
		07	77U7D1	• COLLECTOR RING	1	-	1	-
			1073Z130	•• BRUSH ARM ASSY ., for 10 and 12 GA. wire	AR	-	AR	-
			1073Z131	•• BRUSH ARM ASSY., for 14 and 16 GA. win	AR	-	AR	-
		07	77U7D2	• COLLECTOR RING, Remote control carrier	-	1	-	1
			1073Z130	•• BRUSH ARM ASSY ., for 10 and 12 GA. wire	-	AR	-	AR
			1073Z131	•• BRUSH ARM ASSY ., for 14 and 16 GA. wire	-	AR	-	AR
		08		• SCREW, Hex hd. 3/4-10UNC x 2-1/4 in	2	2	2	2
		09	16N1639	BRACKET, Swivel mounting	1	1	1	1
		10	18T11055	• SPACER, Swivel mounting	2	2	2	2
		11		• WASHER, Flat 1/2 in	2	2	2	2
		12		• SCREW, Hex hd. 1/2-20UNF x 1-3/4 in	2	2	2	2
		13		• WASHER. Flat 5/8 in.	9	9	9	9
		14		• WASHER, Lock 5/8 in.	3	3	3	3
		15		• SCREW, Hex hd. 5/8-11 UNC x 2-1/4 in.	3	3	3	3
		16	45Z430	• SWIVEL, Hydraulic	1	1	-	-
			1045Z1096	•• KIT, Swivel reseal	1	1	-	-
		16	45R4	• SWIVEL, Hydraulic	-	-	1	1
			1045Z1322	•• KIT, Swivel reseal	-	-	1	1
		17		• SCREW, Hex sock. hd. 1/4-20UNC x 1/2 in.	1	1	1	1
		18		• NUT. Hex 1/4-20UNC.	1	1	1	1
		19		• SCREW, Allen hd. sat 1/4-20UNC x 3/8 in	2	2	2	2
		20	18T10224	• COLLAR	1	1	1	1
		21	16N1560	• BRACKET, Upper	1	1	1	1
		22		• SCREW, Rd. hd. slot #10-32UNF x 3/8 in	4	4	4	4
		23	87N33-1	• COVER, Upper	1	1	1	1
		24		•• SCREW, Thread forming #10 x 3/8 in	4	4	4	4
		25	79Z1885D2	• CONNECTOR, Strain relief.	1	1	1	1

NOTE

All individual wires, leads and jumpers should be fabricated locally.

Ref. Dwg. 979J30 H
979J30-1
979J30-2
979J30-3
979J30-4

UPPER HYDRAULIC ASSEMBLY
(BOOM HOIST AND TELESCOPE CIRCUITS
MAIN AND AUXILIARY WINCH VALVE RETURN)



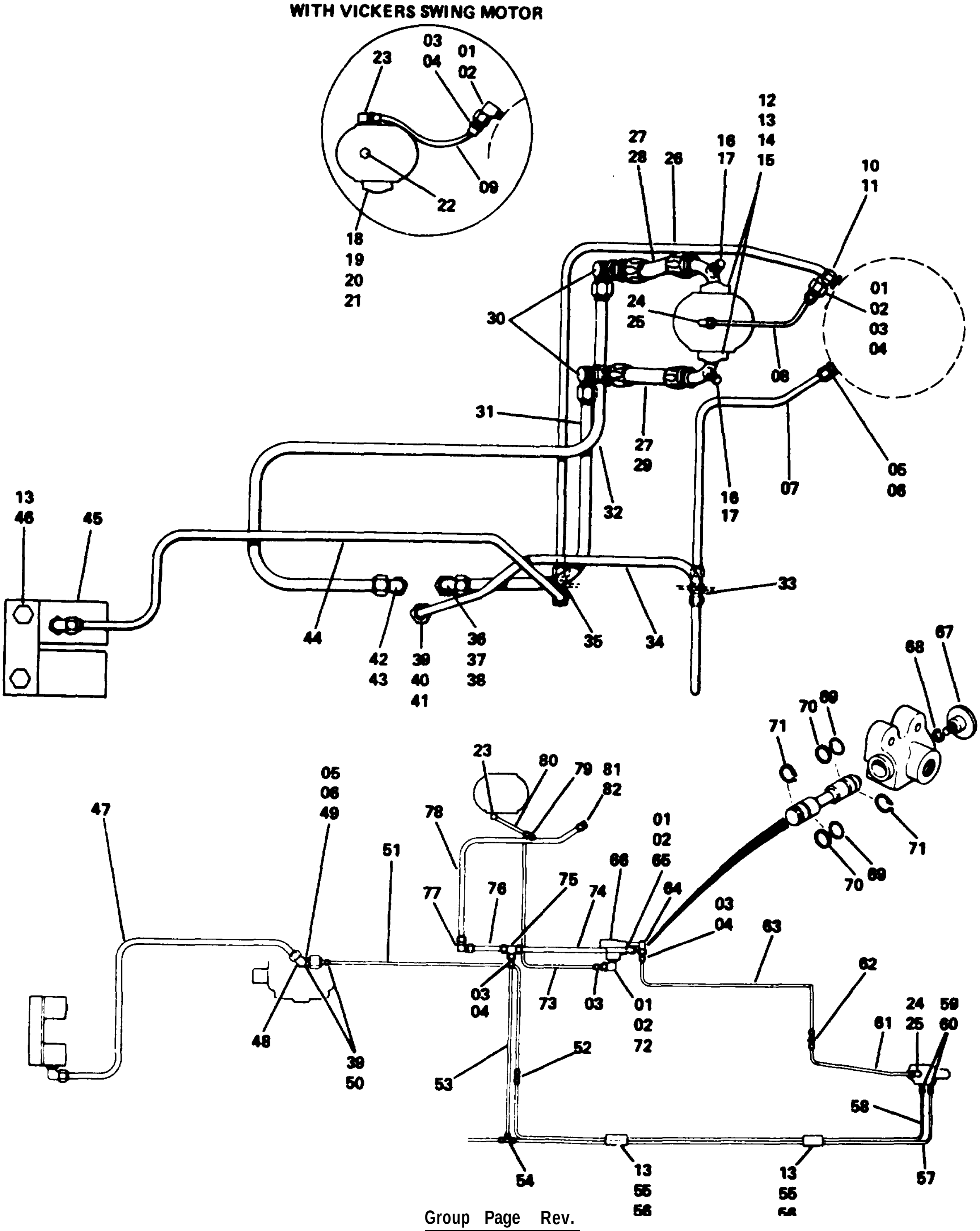
UPPER HYDRAULIC ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	3	4	
		--	100X133-1	HYD. ASSY. - BOOM CIRCUITS. WINCH VALVES TO SWIVEL	↓			
		–	100X133-3	HYD. ASSY. - BOOM CIRCUITS, WINCH VALVES TO SWIVEL		↓		
		–	100X133-4	HYD. ASSY. - BOOM CIRCUITS, WINCH VALVES TO SWIVEL			↓	
		01	44P102D45	• HOSE ASSY, Cylinder crossover	1	-	-	
		02	44Z473D10	• ELBOW, 90° Swivel	3	3	3	
		03	44Z421D10	• ELBOW, 90° O-ring	3	1	1	
		04	45Z91D172	•• O-RING	1	1	1	
		05	44Z536D8	• PLUG, Hex. hd. o-ring	1	2	2	
		06	45Z91D172	•• O-RING	1	1	1	
		07	44Z1010D1	• PLUG, Hex hd.	2	2	2	
		08	44T338	• PLUG, Special o-ring	2	2	2	
		09	44Z591D7	• ELB0W, 90°	5	6	6	
		10	44P1239	• TUBE ASSY, Holding valve pilot	1	1	1	
		11	44Z1435D5	• JOINT, Swivel	3	4	4	
		12	44Z898D8	• ELBOW, 45°	1	1	1	
		13	44P1240	• TUBE ASSY, Holding valve pilot	1	1	1	
		14	44Z472D10	• ELBOW, 45° Swivel	4	4	4	
		15	44P294D12	• HOSE ASSY, Hoist cylinder retract	1	1	1	
		16	44Z599D7	• CONNECTOR, Straight	5	5	5	
		17	44Z511D3	• NUT, Cap	4	4	4	
		18	44P204D3	• HOSE ASSY, Hoist cylinder retract	-	1	1	
		19	44P102D26	• HOSE ASSY, Hoist cylinder extend	2	2	2	
		20	45Z91D79	• O-RING	4	4	4	
		21	44Q26D5	• FLANGE, Split half	8	8	8	
		22		• WASHER, Lock 1/2 in.	12	12	12	
		23	20Z646D76	• SCREW, Hex hd. 1/2-13UNC x 1-1/2 in. GR,5	8	8	8	
		24	44N31	• TUBE ASSY, Hoist and main winch return	1	1	1	
		25	44N33	• TUBE ASSY, Hoist pressure	1	1	1	
		26	20Z646D62	• SCREW, Hex hd. 7/16-14UNC x 1-1/4 in. GR.5	12	20	20	
		27		• WASHER, Lock 7/16in.	12	20	20	
		28	45Z91D59	• O-RING	8	5	5	
		29	44N34	• TUBE ASSY, telescope and aux. winch return	1	1	1	
		30	44Z465D17	• CONNECTOR, Straight o-ring	3	3	3	
		31	45Z91D172	•• O-RING	1	1	1	
		32	44N203	• TUBE ASSY, Telescope pressure	1	1	1	
		33	44Q44D22	• UNION	1	1	1	
		34	44P1265	• TUBE ASSY, Hoist cylinder retract	1	1	1	
		35	16Z339D8	• BRACKET, Tube clamp	6	6	6	
		36	16Z336D5	• CLAMP ASSY, Tube	2	2	2	
		37	44Q44D31	• UNION, Reducer	2	2	2	
		38	44P1264	• TUBE ASSY, Boom hoist extend crossover	1	1	1	
		39	16Z338D6	• CLAMP ASSY. Tube	4	4	4	
		40	44P1266D1	• TUBE ASSY, Hoist cylinder extend	1	1	1	
		41	44Z491D11	• TEE, Union	1	1	1	
		42	44Q44D28	• UNION	1	-	-	
		42	44Z491D10	• TEE, Union	-	1	1	
		43	44P1065	• TUBE ASSY, Boom lower.	1	-	-	
		43	44P1538	• TUBE ASSY, Boom tower	-	1	1	
		44	44N166	• TUBE ASSY. Boom raise	1	1	1	

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	3	4	
		45	44P92D2	• HOSE ASSY, Teles. valve to lower teles. cyl.	4	4	4	
		46	44Z472D7	• ELBOW, 45° Swivel	2	2	2	
		47	44Z485D23	• CONNECTOR, O-ring	3	3	3	
		48	45Z91D58	••O-RING	1	1	1	
		49	44Z473D7	• ELBOW, 90° swivel	3	3	3	
		50	44Z421D20	• ELBOW, 90° O-ring	1	1	1	
		51	45Z91D47	•• O-RING	1	1	1	
		52	44Z429D6	• ELBOW, 45°.	2	2	2	
		53	44P1058D2	• TUBE ASSY, Flow divider to teles. valve	1	1	1	
		54	36Q46	• VALVE, Flow divider (Page 19.1)	1	1	1	
		55	44Z485D14	• CONNECTOR, Straight o-ring.	4	4	4	
		56	45Z91D165	•• O-RING	1	1	1	
		57	44P1058D1	• TUBE ASSY, Flow divider to teles. valve	1	1	1	
		58	44P802	• TUBE ASSY, Telescope inter-connection	1	1	1	
		59	44Z488D8	• TEE, Run	1	1	1	
		60	45Z91D165	•• O-RING	1	1	1	
		61	44Z473D8	• ELBOW, 90°	2	2	2	
		62	44P1077	• TUBE ASSY, Telescope return	1	1	1	
		63	44Z491D8	• TEE, Union	1	1	1	
		64	44P1063	• TUBE ASSY, Priority valves to tales. return	1	1	1	
		65	44Q26D4	• FLANGE, Split half	4	8	8	
		66	44N27	• TUBE ASSY, Main winch return	1	1	1	
		67	44P1058D3	• TUBE ASSY, Priority and teles. return	1	1	1	
		68	44P1057	• TUBE ASSY, Flow divider pressure	1	1	1	
		69	44Z421D16	• ELBOW, 90° O-ring	1	1	1	
		70	45Z91D172	•• O-RING	1	1	1	
		71	44Z1399D6	• ELBOW, 90° Long	1	1	1	
		72	44Z485D19	• CONNECTOR, Straight o-ring	1	1	1	
		73	45Z91D173	•• O-RING	1	1	1	
		74	44Z485D20	• CONNECTOR, Straight o-ring	1	1	1	
		75	45Z91D173	•• O-RING	1	1	1	
		76	44Z492D15	• REDUCER, Tube	1	1	1	
		77	20Z649D12	• NUT, Tube	5	5	5	
		78	44P1076	• TUBE ASSY, Aux. winch return to tales. return	1	1	1	
		79	44Z492D19	• REDUCER, Tuba	3	3	3	
		80	44Z491D12	• TEE, Union	1	1	1	
		81	44P627	• TUBE ASSY, Hoist return	1	1	1	
		82	44P3	• TEE, Sending unit	1	1	1	
		83	89Z154	• SENDING UNIT, Hydraulic oil temp.	1	1	1	
		84	44Z489D9	• UNION, 90° Bulkhead	1	1	1	
		85	44P1100	• TUBE ASSY, Teles. and aux. winch return	1	1	1	
		86	44Z490D12	• UNION, Bulkhead	2	2	2	
		87	44N78	• TUBE ASSY, Hoist and main winch return	1	1	1	
		88	44N40	• TUBE ASSY, Hoist pressure	1	1	1	
		89	44Z490D11	• UNION, Bulkhead	1	1	1	

Ref. Dwg. 100X133
100X133-1
100X133-3
100X133-4

UPPER HYDRAULIC ASSEMBLY
(SWING AND SWING BRAKE CONTROL CIRCUIT)



UPPER HYDRAULIC ASSEMBLY (Continued)
(SWING AND SWING BRAKE CONTROL CIRCUIT)

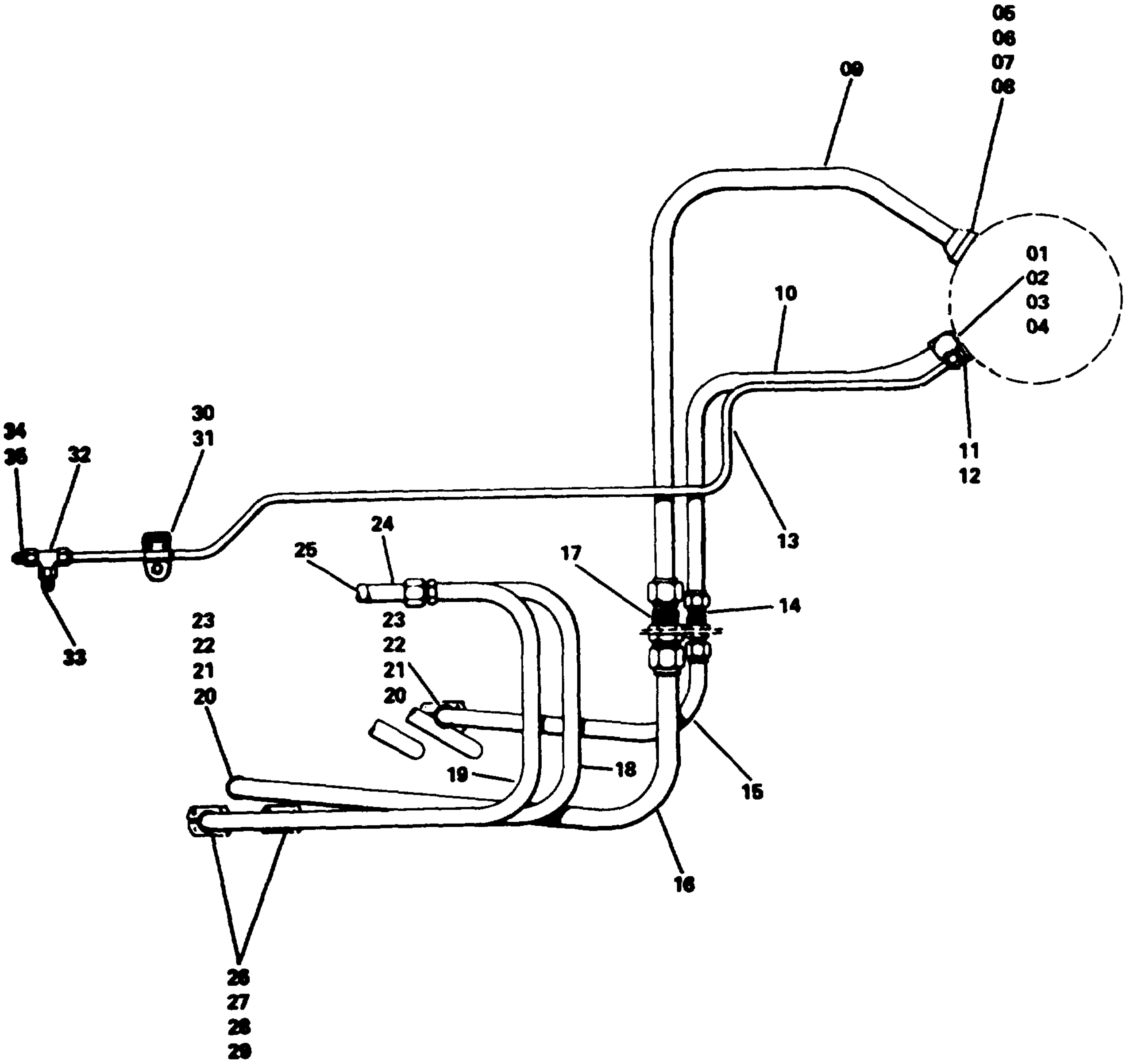
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number		
		-	100X133-1	HYDRAULIC, ASSY., SWING& SWING BRAKE CIRCUIT			
		-	100X133-3	HYDRAULIC, ASSY., SWING& SWING BRAKE CIRCUIT			
		-	100X133-4	HYDRAULIC, ASSY., SWING& SWING BRAKE CIRCUIT			
		01	44Z421D7	.ELBOW, 90° O-ring	2	2	2
		02	45Z91D58	. . O-ring	1	1	1
		03	44Z492D4	. REDUCER,Tube	3	3	3
		04	20Z649D8	. NUT,Tube	3	3	3
		05	44Z485D15	. CONNECTOR,Straight O-ring	2	2	2
		06	45Z91D165	. . O-RING	1	1	1
		07	44N202	. TUBE ASSY, Swing return	1	1	1
		08	44P1072	. TUBE ASSY, Swing motor drain	1	-	-
		09	44P1542	. TUBE ASSY, Swing motor drain	-	1	1
		10	44Z485D14	. CONNECTOR, Straight O-ring	1	1	1
		11	45Z91D165	. . O- RING	1	1	1
		12	20Z646D48	. SCREW, Hex, hd 3/8-16UNC x 1-1/4 in. Gr. 5	8	8	8
		13		. WASHER, Lock 3/8 in	12	12	12
		14	45Z91D150	. O-RING	2	2	2
		15	44Q26D3	. FLANGE,Split, half	4	4	4
		16	44Z590D7	. PLUG, Pipe	2	2	2
		17	44Z511D3	. ELBOW, 90°	2	2	2
		18	20Z646D62	. ELBOW, 90° O-ring	-	8	8
		19		. . O-RING	-	8	8
		20	45Z91D59	. FLANGE,Split half	-	2	2
		21	44Q26D4	. PLUG, Pipe	-	4	4
		22	2422V002	. ELBOW, 90°	-	1	1
		23	44Z5914D7	. ELBOW, 90° O-ring	1	1	1
		24	44Z421D3	. . O-RING	1	-	-
		25	45Z91D52	. TUBE ASSY., Swing pressure	1	-	-
		26	44N206	. HOSE ASSY., Swing right and left	1	1	1
		27	44P1079D1	. HOSE ASSY., Swing right	2	-	-
		28	44P1079D3	. HOSE ASSY ., Swing left	-	1	1
		29	44P1079D2	. ELBOW, Union	-	1	1
		30	44Q47D22	. TUBE ASSY., Swing left	2	2	2
		31	44N163	. TUBE ASSY., Swing right	1	1	1
		32	44N162	. UNION, Bulkhead	1	1	1
		33	44Z490D8	. TUBE ASSY., Swing return	1	1	1
		34	44N26	. UNION, 90° bulkhead	1	1	1
		35	44Z4489D8	. ELBOW, 90°swivel	1	1	1
		36	44Z473D10	. CONNECTOR, Straight O-ring	1	1	1
		37	44Z485D17	. . O-RING	1	1	1
		38	45Z91D172	. REDUCER, Tube	1	1	1
		39	44Z492D8	. CONNECTOR Straight O-ring	2	2	2
		40	44Z485D18	. . O-RING	1	1	1
		41	45Z91D172	. REDUCER, Tube	1	1	1
		42	44Z421D10	. CONNECTOR, Straight O-ring	1	1	1
		43	45Z91D172	. O-RING	1	1	1
		44	44P1049	. TUBE ASSY., Swing pressure –priority valve	1	1	1
		45	936N6-1	VALVE ASSY., Priority (Page 20.1)	1	1	1
		46		. SCREW, Hex hd.3/8-16UNC x ½ in.	2	2	2
		47	44N261	TUBE ASSY., Priority valve to swing valve	1	1	1

UPPER HYDRAULIC ASSEMBLY (Continued)
(SWING AND SWING BRAKE CONTROL CIRCUIT)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	3	4
		48	44Z473D8	.ELBOW 90°	1	1	1
		49	44Z473D8	.TEE, Run	1	1	1
		50	20Z649D10	.NUT, Tube	2	2	2
		51	44P1068	.TUBE ASSY, Swing brake	1	1	1
		52	44Q44D11	.UNION	1	1	1
		53	44P1069	.TUBE ASSY, Swing brake drain	1	1	1
		54	44Z491D5	.TEE, Union	1	1	1
		55	32Z423D19	.CLAMP, Tube	2	2	2
		56		.NUT, Hex 3/8-16UNC	2	2	2
		57	44P1051D4	. TUBE ASSY, Swing brake drain	1	1	1
		58	18P3737	. TUBE ASSY, Swing brake	1	1	1
		59	44Z4874D7	. CONNECTOR Straight O-ring	2	2	2
		60	45Z91D52	. O-ring	1	1	1
		61	18P3738	. TUBE ASSY Swing brake	1	1	1
		62	44Z490D5	. UNION bulkhead	1	1	1
		63	44P1513	. TUBE ASSY, Swing brake	1	1	-
		63	44Z958D7	. TUBE ASSY, Swing brake	-	-	1
		64	44Z1390D4	. ELBOW , 90° extra long	1	1	-
		64	44Z591D15	. ELBOW , 90° extra long	-	-	1
		65	36Q155D1	. ELBOW , 90°	1	1	-
		66		. VALVE, Swing brake control	-	-	1
		67		..KNOB, Control	-	-	1
		68		.. WASHER, Lock	-	-	1
		-	1045Z1358	.. KIT , Seal	-	-	1
		69		… O-ring	-	-	2
		70		…RING, Back-up	-	-	2
		71		…RING ,Snap	-	-	2
		66	36Q154D1	. VALVE,Swing brake control	1	1	-
		67		.. KNOB Control	1	1	-
		-	1145Z3	.. KIT, Seal	1	1	-
		68		… RING,Retaining	2	2	-
		69		…O-RING	2	2	-
		70		… RING,Back-up	2	2	-
		72	44Z591D10	. ELBOW, 90°	1	1	-
		73	44N22	. TUBE ASSY, Swing brake	1	1	-
		73	44N260	. TUBE ASSY, Swing brake	-	-	1
		74	44P342	. TUBE ASSY, Swing brake	1	1	-
		74	44P1511	. TUBE ASSY, Swing brake	-	-	1
		75	44Z491D7	. TEE, Union	2	2	2
		76	44P1159D1	. TUBE ASSY, Swing brake	1	1	1
		77	44Q447D15	. ELBOW,90° union	1	1	1
		78	44P1160	. TUBE ASSY, Swing brake	1	1	1
		79	44Q47D11	. ELBOW, 90° union	2	2	2
		80	44P1067	. TUBE ASSY, Swing brake	1	1	1
		81	44Z485D12	. CONNECTOR,Straight O-ring	2	2	2
		82	45Z91D58	.. O-ring	1	1	1

Ref,Dwg 100X133 Λ
100X133-1
100X133-3
100X133-4

UPPER HYDRAULIC ASSEMBLY
(MAIN AND AUXILIARY WINCH-SWIVEL TO VALVE CIRCUIT)

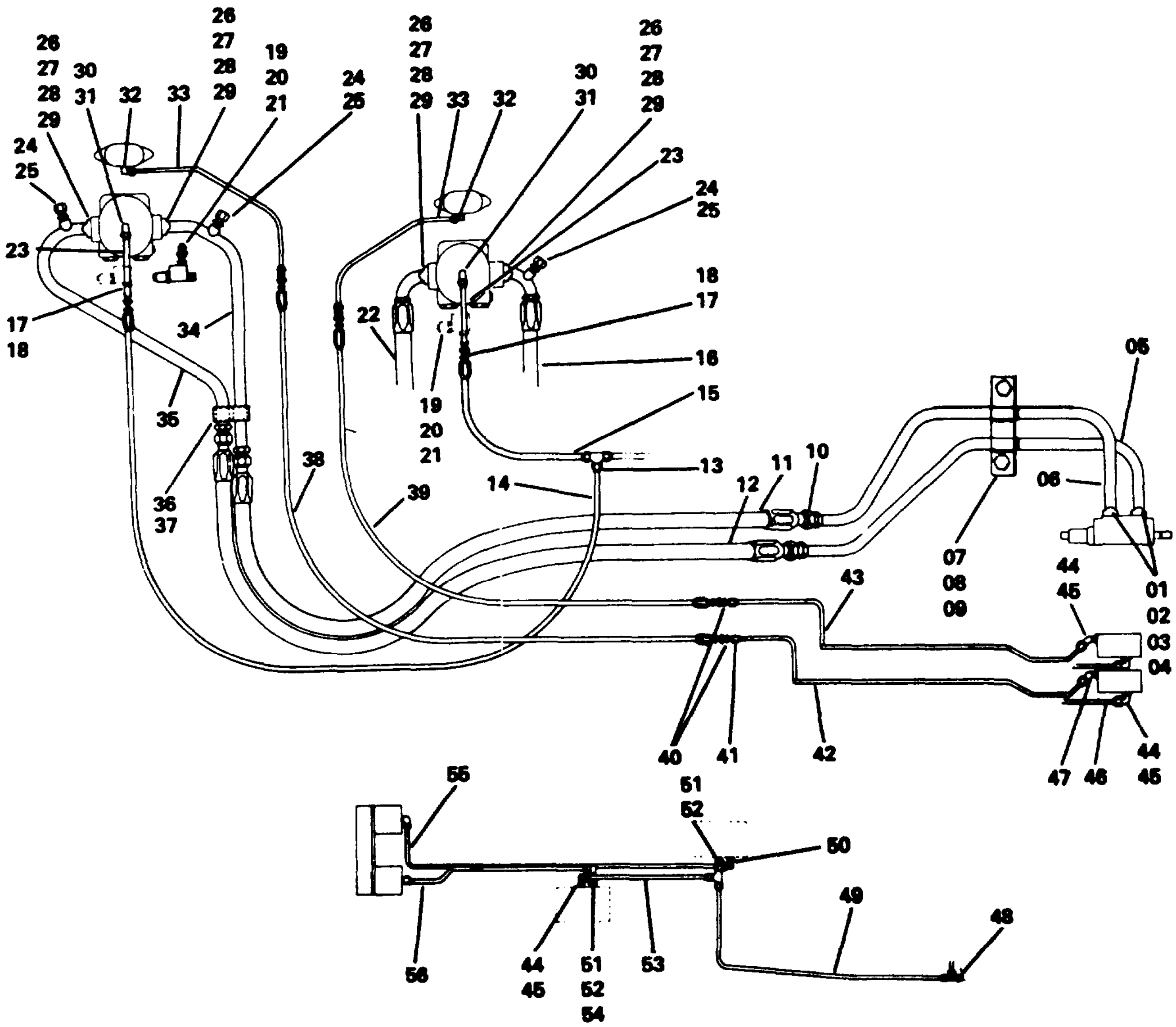


UPPER HYDRAULIC ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	3	4
		-	100X133-1	HYDRAUILIC ASSY . WINCH VALVE SUPPLY CIRCUIT			
		-	100X133-3	HYDRAUILIC ASSY . WINCH VALVE SUPPLY CIRCUIT			
		-	100X133-4	HYDRAUILIC ASSY . WINCH VALVE SUPPLY CIRCUIT			
		01	44Z536D8	. PLUG, Hex,hd, O-ring.			
		02	45Z91D172	. . O-ring	-	1	1
		03	44Z485D20	. CONNECTOR, Straight O-ring	-	1	1
		04	45Z91D173	. . O-ring	1	1	1
		05	45Z91D79	. O-ring	1	1	1
		06	44Q26D5	. FLANGE, Split, half	1	1	1
		07		. WASHER,Lock ½ in.	2	2	2
		08	20Z646D76	. SCREW, Hex,hd. ½-13UNC x 1 ½ in. Gr. 5	4	4	4
		09	44N36	. TUBE ASSY ., Main winch pressure	4	4	4
		10	44N164	. TUBE ASSY., Auxiliary winch pressure	1	1	1
		11	44Z485D12	. CONNECTOR,Straight O-ring.	1	1	1
		12	45Z91D58	. . O-ring	1	1	1
		13	44P1074	. TUBE ASSY ., Winch motor drain	1	1	1
		14	44Z490D11	. UNION, Bilkhead	1	1	1
		15	44P1075	. TUBE ASSY Auxiliary winch pressure	1	1	1
		16	44N28	. TUBE ASSY ., Main winch pressure	1	1	1
		17	44Z490D12	. UNION, Bulkhead	1	1	1
		18	44N161D1	. TUBE ASSY., Main winch raise	1	1	1
		19	44N161D2	. TUBE ASSY ., Main winch lower	1	1	1
		20	44Q26D4	. FLANGE, Split half	4	4	4
		21	45Z91D59	O-RING	2	2	2
		22		. WASHER,Lock 7/16 in.	8	8	8
		23	20Z646D48	. SCREW, Hex hd. 7/16-14UNC x 1-1/4 in. Gr.5	8	8	8
		24	44P1050D1	. HOSE ASSY.,Main winch raise	1	1	1
		25	44P1054D1	. HOSE ASSY.,Main winch raise	1	1	1
		26	20Z646D48	. SCREW,Hex hd. 3/8-16UNC x 1-1/4 in. Gr.5	8	8	8
		27		. WASHER.Lock 3/8 in.	8	8	8
		28	45Z91D150	. O-ring	2	2	2
		29	44Q26D3	. FLANGE, Split half	4	4	4
		30	16Z339D8	. BRACKET, Tube clamp	1	1	1
		31	16Z338D3	. CLAMP, Tube	1	1	1
		32	44Z491D7	. TEE, Union	1	1	1
		33	44Z1170D1	. REDUCER,One piece	2	2	2
		34	44Z511D5	. NUT, Cap	1	1	1

Ref. Dwg. 100X133 Λ
100X133-1
100X133-3
100X133-4

UPPER HYDRAULIC ASSEMBLY
(MAIN AND AUXILIARY WINCH VALVE AND WINCH BRAKE CIRCUIT)



Group	Page	Rev.
2	15.1	001

UPPER HYDRAULIC ASSEMBLY (Continued)

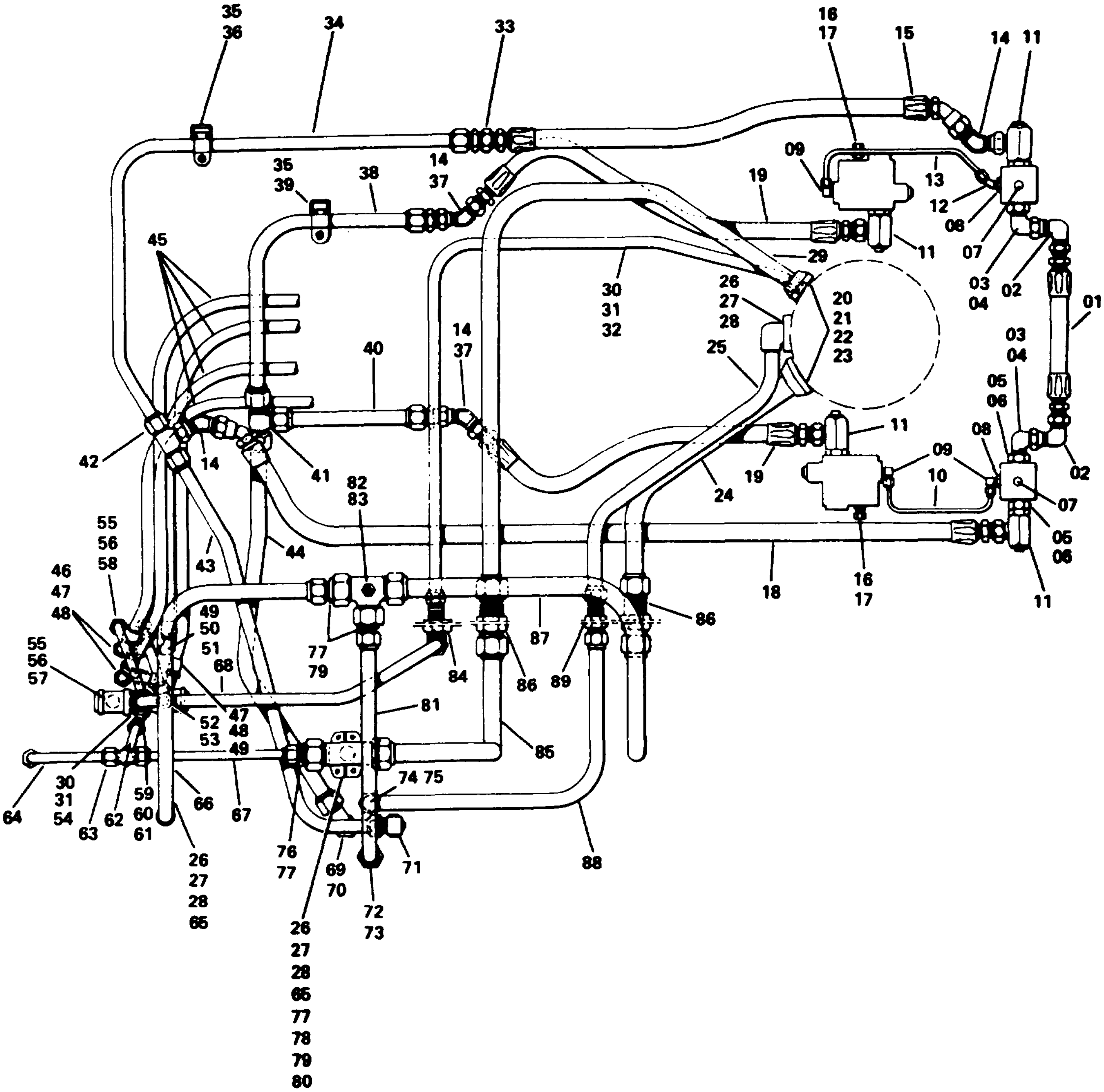
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Numbe 1	3	4	1
		-	100X133-1	HYDRAULIC ASSY, MAIN WINCH CIRCUIT				
		-	100X133-3	HYDRAULIC ASSY, MAIN WINCH CIRCUIT				
		-	100X133-4	HYDRAULIC ASSY, MAIN WINCH CIRCUIT				
		-	100J4441-1	HYDRAULIC ASSY, AUXILIARY WINCH CIRCUIT				
		01	20Z646D48	. SCREW, Hex hd. 3/8-16UNC x 1-1/4 in. Gr. 5	8	8	8	-
		02		. WASHER, Lock 3/8 in	8	8	8	-
		03	45Z91D150	. O-RING	2	2	2	-
		04	44Q26D3	. FLANGE,Split half	4	4	4	-
		05	44P1042	. TUBE ASSY., Auxiliary winch	1	1	1	-
		06	44P1044	. TUBE ASSY ., Auxiliary winch	1	1	1	-
		07	16N1510-1	. BRACKET ,Tube support	2	2	2	-
		08		. . SCREW, Hex hd.3/8-16 UNC x 1- ½ in	2	2	2	-
		09		. . WASHER,Lock3/8 in	2	2	2	-
		10	44Z511D9	. NUT, Cap	-	2	2	-
		11	44P1055D2	. HOSE ASSY., Auxiilary winch	1	-	-	1
		12	44P1055D1	. HOSE ASSY ., Auxiliary winch	1	-	-	1
		13	44Z511D4	. NUT, Cap	-	1	1	-
		14	44P243D33	. HOSE ASSY., Auxiliary winch motor drain	1	-	-	1
		15	44P243D6	. HOSE ASSY., Auxiliary winch motor drain	1	1	1	-
		16	44P1054D1	. HOSE ASSY., Main winch raise	1	1	1	-
		17	44Z487D6	. TEE , Swivel run	2	1	1	1
		18	44Z591D12	. ELBOW, 90°	2	1	1	1
		19	36Z967D1	. VALVE, Anti-shift solenoid	2	1	1	1
		20	44Z1181D3	. ADAPTER, Straight swivel	2	1	1	1
		21	44Z590D12	. CONNECTOR, Straight	2	1	1	1
		22	44P1050D1	. HOSE ASSY ., Main winch lower	1	1	1	-
		23	44P1168	. TUBE ASSY ., Motor drain	2	1	1	2
		24	44Z590D7	. CONNECTOR, Straight	1	1	1	2
		25	44Z511D3	. NUT, Cap	1	1	1	2
		26	45Z91D79	. O-RING	4	2	2	2
		27	44Q26D5	. FLANGE,Split half	8	4	4	4
		28		. WASHER, Lock ½ in	16	8	8	8
		29	20Z646D76	. SCREW, Hex hd. ½-13UNC x 1-1/2 in. Gr.5	16	8	8	8
		30	44Z421D19	. ELBOW, 90° O-ring	2	1	1	1
		31	45Z91D52	. O-RING	1	1	1	1
		32	44Z591D8	. ELBOW, 90°	2	1	1	1
		33	18P3829D19	. TUBE ASSY., Winch brake	2	1	1	1
		34	44P1045	. TUBE ASSY., Auxiliary winch	1	-	-	1
		35	44P1043	. TUBE ASSY ., Auxiliary winch	1	-	-	1
		36	16Z339D1	. BRACKET, Tube clamp	-	-	-	1
		37	16Z338D6	. CLAMP ASSY., Tube	-	-	-	1
		38	44P165D22	. HOSE ASSY ., Brake release valve	1	-	-	1
		39	44P165D23	. HOSE ASSY ., Brake release valve	1	1	1	-
		40	44Q44D11	. UNION Connector	3	2	2	1
		41	44Z1326D5	. PLUG, Tube	-	1	1	-
		42	44P1286	TUBE ASSY, Auxiliary winch brake	1	1	1	-
		43	44P1285	. TUBE ASSY ., Main winch brake	1	1	1	-
		44	44Z421D3	. ELBOW, 90° O-ring	4	4	4	-
		45	45Z9D52	. . O-RING	1	1	1	-
		46	44P1296	. TUBE ASSY.., Auxiliary winch brake	1	1	1	-

UPPER HYDRAULIC ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		47	44Z429D3	•ELBOW,45°	2	2	2	-
		48	44Z491D5	• TEE, Union	1	1	1	-
		49	44P1284	• TUBE ASSY :, Winch brake drains	1	1	1	-
		50	44Z487D5	• TEE, Swivel run	1	1	1	-
		51	44Z485D7	• CONNECTOR, Straight O-ring	2	2	2	-
		52	45Z91D52	•• O-RING	1	1	1	-
		53	44P1283	• TUBE ASSY., Main winch brake	1	1	1	-
		54	44Z473D5	• ELBOW, 90° swivel	1	1	1	-
		55	44P1296	• TUBE ASSY., Auxiliary winch brake	1	1	1	-
		56	44P1296	• TUBE ASSY., Main winch brake	1	1	1	-

Ref. Dwg. 100X133 H
100J4441
100X133-1
100J4441-1

UPPER HYDRAULIC ASSEMBLY
(BOOM HOIST AND TELESCOPE CIRCUITS
MAIN AND AUXILIARY WINCH VALVE RETURN)



UPPER HYDRAULIC ASSEMBLY (Continued)

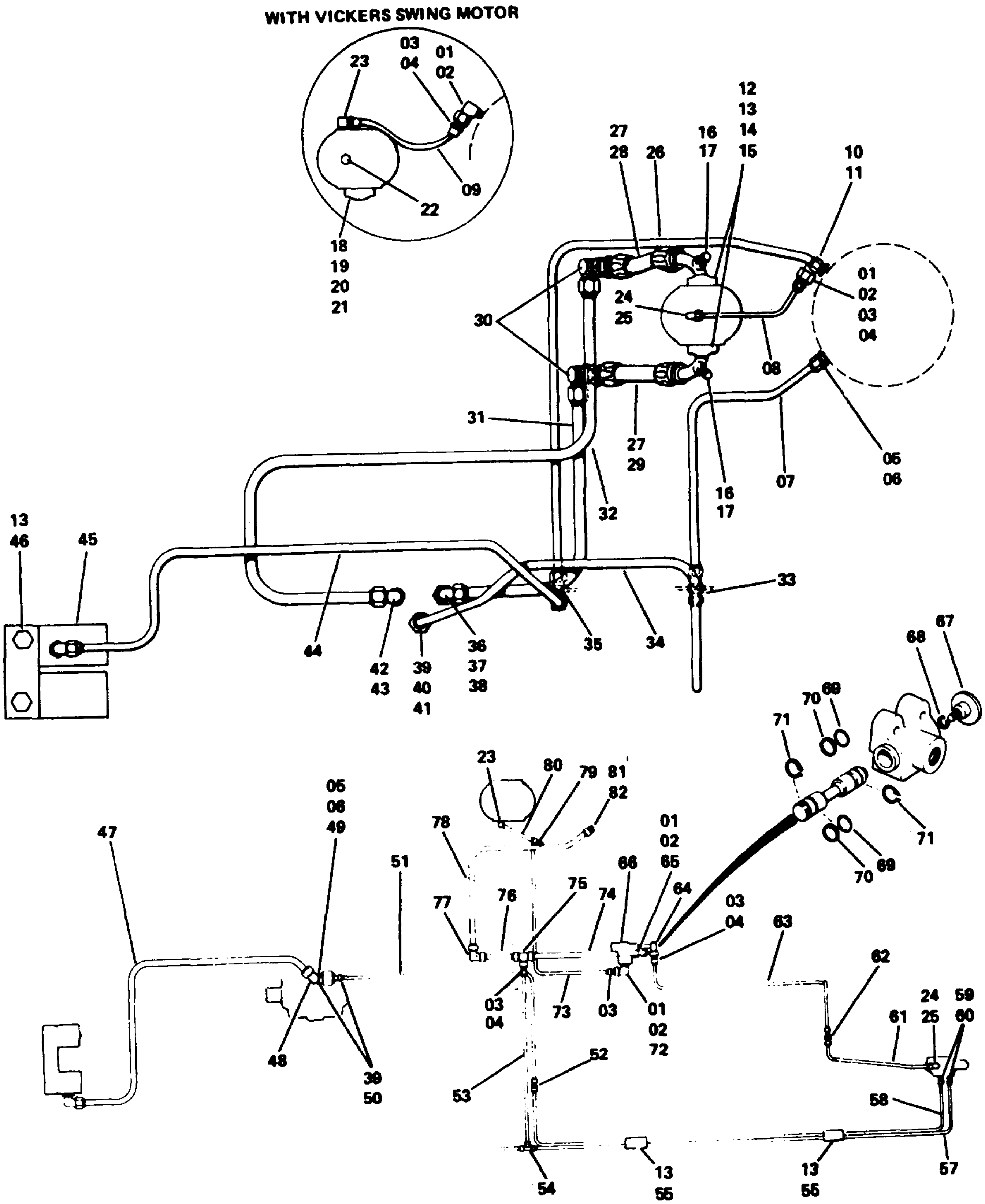
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 5	6		
		-	100X133-5	HYD. ASSY. - BOOM CIRCUITS, WINCH VALVES TO SWIVEL				
		-	100X133-6	HYD. ASSY. - BOOM CIRCUITS, WINCH VALVES TO SWIVEL				
		01	44P102D45	• HOSE ASSY, Cylinder crossover	1	–		
		02	44Z473D10	• ELBOW, 90° Swivel	3	3		
		03	44Z421D10	• ELB0W, 90° O-ring	3	1		
		04	45Z91D172	•• O-RING	1	1		
		05	44Z536D8	• PLUG, Hex. hd. o-ring..	1	2		
		06	45Z91D172	•• O-RING	1	1		
		07	44Z1010D1	• PLUG, Hex hd.	2	2		
		08	44T338	• PLUG, Special o-ring	2	2		
		09	44Z591D7	• ELBOW, 90°	5	6		
		10	44P1233	• TUBE ASSY, Holding valve pilot	1	1		
		11	44Z1435D5	• JOINT, Swivel	3	4		
		12	44Z898D8	• ELBOW, 45°	1	1		
		13	44P1240	• TUBE ASSY. Holding valve pilot	1	1		
		14	44Z472D10	• ELBOW, 45° Swivel	4	4		
		15	44P204D12	• HOSE ASSY, Hoist cylinder retract	1	1		
		16	44Z590D7	• CONNECTOR, Straight	5	5		
		17	44Z511D3	• NUT, Cap	4	4		
		18	44P204D3	• HOSE ASSY, Hoist cylinder retract	–	1		
		19	44P102D26	• HOSE ASSY, Hoist cylinder extend	2	2		
		20	45Z91D79	• O-RING	4	4		
		21	44Q26D5	• FLANGE, Split half	8	8		
		22		• WASHER, Lock 1/2 in.	12	12		
		23	20Z646D76	• SCREW, Hex hd. 1/2-13UNC x 1-1/2 in. GR.5	8	8		
		24	44N31	• TUBE ASSY, Hoist and main winch return	1	1		
		25	44N33	• TUBE ASSY, Hoist pressure	1	1		
		26	20Z646D62	• SCREW, Hex hd. 7/16-14UNC x 1.1/4 in. GR.5	12	20		
		27		• WASHER, Lock 7/16 in.	12	20		
		28	45Z91D59	• O-RING	8	5		
		29	44N34	• TUBE ASSY, telescope and aux. winch return	1	1		
		30	44Z485D17	• CONNECTOR, Straight o-ring	3	3		
		31	45Z91D172	•• O-RING	1	1		
		32	44N203	• TUBE ASSY, Telescope pressure	1	1		
		33	44Q44D22	• UNION	1	1		
		34	44P1265D1	• TUBE ASSY, Hoist cylinder retract	1	1		
		35	16Z339D10	• BRACKET, lube clamp	6	6		
		36	16Z338D5	• CLAMP ASSY, Tube	2	2		
		37	44Q44D31	• UNION, Reducer	2	2		
		38	44P1264	• TUBE ASSY, Boom hoist extend crossover	1	1		
		39	16Z338D6	• CLAMP ASSY,Tube	4	4		
		40	44P1266D1	• TUBE ASSY, Hoist cylinder extend	1	1		
		41	44Z491D11	• TEE, Union	1	1		
		42	44Q44D28	• UNION	1			
		42	44Z491D10	• TEE, Union	-	1		
		43	44P1065	• TUBE ASSY, Boom lower	1	-		
		43	44P1538	• TUBE ASSY, Boom lower.	-	1		
		44	44N166	• TUBE ASSY, Boom raise	1	1		

UPPER HYDRAULIC ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 5	6		
		45	44P92D2	• HOSE ASSY, Teles. valve to lower teles. cyl.	4	4		
		46	44Z472D7	• ELBOW, 45° Swivel	2	2		
		47	44Z485D23	• CONNECTOR, O-ring	3	3		
		48	45Z91D58	••O-RING	1	1		
		49	44Z473D7	• ELBOW, 90° swivel	3	3		
		50	44Z421D20	•ELBOW,90°0-ring..	1	1		
		51	45Z91D47	••O-RING	1	1		
		52	44Z429D6	• ELBOW, 45°	2	2		
		53	44P1058D2	• TUBE ASSY, Flow divider to teles. valve	1	1		
		54	36Q46	• VALVE, Flow divider (Page 19.1).	1	1		
		55	44Z485D14	• CONNECTOR, Straight o-ring.	4	4		
		56	45Z91D165	•• O-RING	1	1		
		57	44P1058D1	• TUBE ASSY, Flow divider to teles. valve	1	1		
		58	44P802	• TUBE ASSY, Telescope inter-connection	1	1		
		59	44Z488D8	• TEE, Run	1	1		
		60	45Z91D165	•• O-RING	1	1		
		61	44Z473D8	• ELBOW, 90°	2	2		
		62	44P1077	• TUBE ASSY, Telescope return	1	1		
		63	44Z491D8	• TEE, Union	1	1		
		64	44P1063	• TUBE ASSY, Priority valves to teles. return				
		65	44Q26D4	• FLANGE, Split half	4	8		
		66	44N27	• TUBE ASSY, Main winch return	1	1		
		67	44P1058D3	• TUBE ASSY, Priority and teles. return	1	1		
		68	44P1057	• TUBE ASSY, Flow divider pressure	1	1		
		69	44Z421D16	• ELB0W,90° O-ring	1	1		
		70	45Z91D172	•• O-RING	1	1		
		71	44Z1390D6	• ELBOW, 90° Long	1	1		
		72	44Z485D19	• CONNECTOR, Straight o-ring.,	1	1		
		73	45Z91D173	•• O-RING	1	1		
		74	44Z485D20	• CONNECTOR, Straight o-ring	1	1		
		75	45Z91D173	•• O-RING	1	1		
		76	44Z492D15	• REDUCER, Tube	1	1		
		77	20Z649D12	• NUT, Tube	5	5		
		78	44P1076	• TUBE ASSY, AUK. winch return to teles. return	1	1		
		79	44Z492D19	• REDUCER, Tube	3	3		
		80	44Z491D12	•TEE, Union	1	1		
		81	44P627	• TUBE ASSY, Hoist return	1	1		
		82	44P371	• TEE, Sending unit	1	1		
		83	89Z154	• SENDING UNIT, Hydraulicoil temp.	1	1		
		84	44Z489D9	• UNION, 90° Bulkhead	1	1		
		85	44P1100	• TUBE ASSY, Teles. and aux. winch return	1	1		
		86	44Z490D12	• UNION, Bulkhead	2	2		
		87	44N78	• TUBE ASSY, Hoist and main winch return	1	1		
		88	44N40	• TUBE ASSY, Hoist pressure	1	1		
		89	44Z490D11	• UNION, Bulkhead	1	1		

Ref. Dwg. 100X13[illegible]
100X133-5
100X133-6

UPPER HYDRAULIC ASSEMBLY
(SWING AND SWING BRAKE CONTROL CIRCUIT)



UPPER HYDRAULIC ASSEMBLY (Continued)
(SWING AND SWING BRAKE CONTROL CIRCUIT)

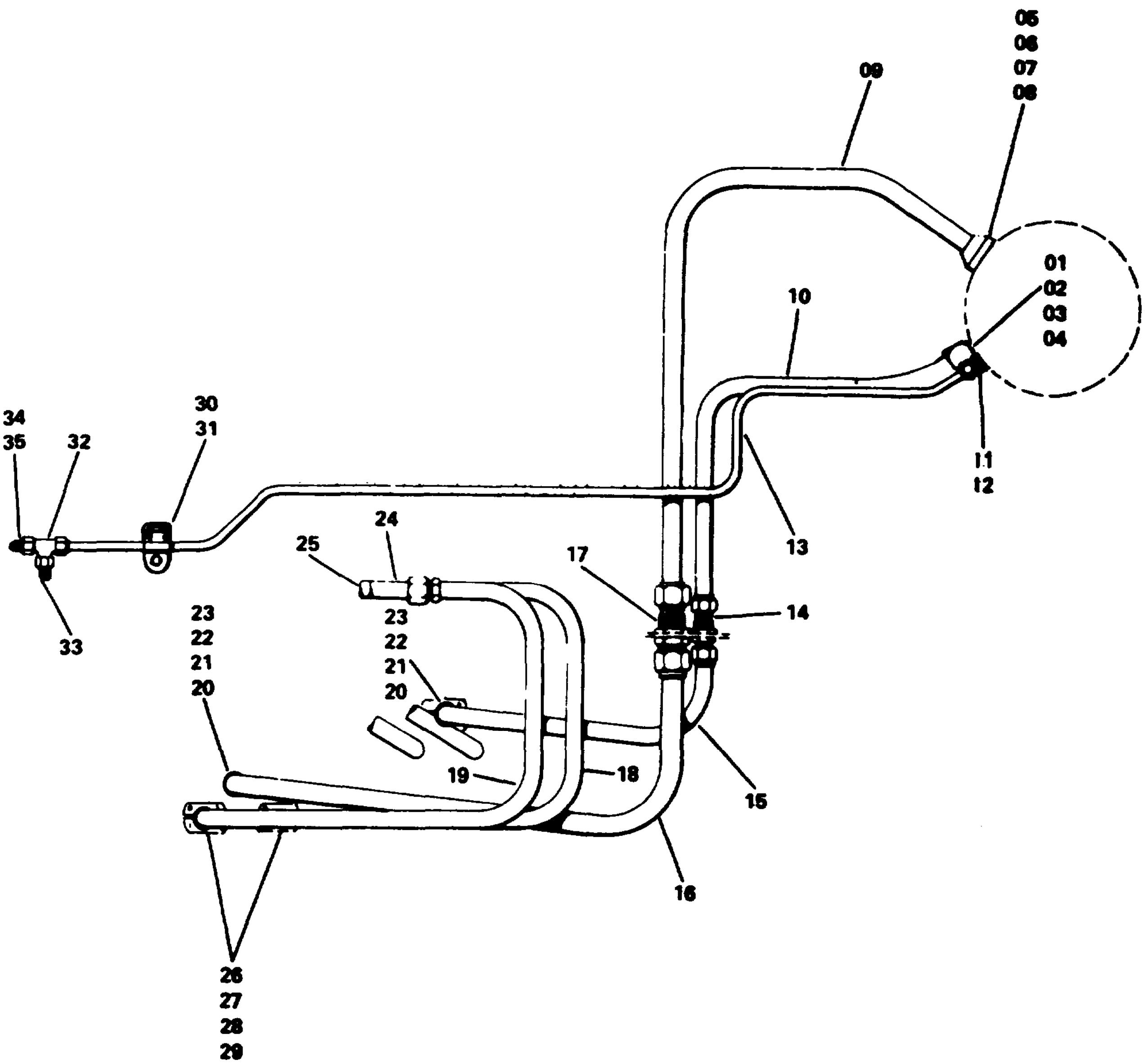
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
			100X133-5	HYDRAULIC ASSY., SWING & SWING BRAKE CIRCUIT	↓			
			100X133-6	HYDRAULIC ASSY ., SWING & SWING BRAKE CIRCUIT		↓		
		01	44Z421D7	• ELBOW. 90° O-ring	2	2		
		02	45Z91D58	•• O-RING	1	1		
		03	44Z492D4	• REDUCER, Tube	3	3		
		04	20Z649D8	• NUT, Tube	3	3		
		05	44Z485D15	• CONNECTOR, Straight O-ring	2	2		
		06	45Z91D165	• • O-RING	1	1		
		07	44N202	• TUBE ASSY., Swing return	1	1		
		08	44P1072	• TUBE ASSY., Swing motor drain	1	-		
		09	44P1542	• TUBE ASSY ., wing motor drain	-	1		
		10	44Z485D14	• CONNECTOR, Straight O-ring	1	1		
		11	45Z91D165	•• O-RING	1	1		
		12	20Z646D48	• SCREW. Hex hd. 3/8-16UNC x 1-1/4 in. Gr. 5	8	8		
		13		• WASHER. Lock 3/8 in.	12	12		
		14	45Z91D150	• R I N G	2	2		
		15	44Q26D3	• FLANGE, Split half	4	4		
		16	44Z590D7	• CONNECTOR, Straight	2	2		
		17	44Z511D3	• NUT,Cap	2	2		
		18	20Z646D62	• SCREW, Hex hd: 7/16-14UNC x 1-1/4 in. Gr. 5	-	8		
		19		• WASHER , Lock 7/16 in	-	8		
		20	45Z91D59	• O-RING	-	2		
		21	44Q26D4	• FLANGE, Split half	-	4		
		22	2422V002		-	1		
		23	44Z591D7	• ELBOW. 90°	1	1		
		24	44Z421D3	• ELBOW, 90° O-ring	1	-		
		25	45Z91D52	• O-RING	1	-		
		26	44N206	• TUBE ASSY., Swing pressure	1	1		
		27	44P1079D1	• HOSE ASSY., Swing right and left	2	-		
		28	44P1079D3	• HOSE ASSY., Swing right	-	1		
		29	44P1079D2	• HOSE ASSY., Swing left	-	1		
		30	44Q7D22	• ELBOW, Union	2	2		
		31	44N163	• TUBE ASSY., Swing left	1	1		
		32	44N162	• TUBE ASSY., Swing right	1	1		
		33	44Z490D8	• UNION, Bulkhead	1	1		
		34	44N26	• TUBE ASSY., Swing return	1	1		
		35	44Z489D8	• UNION, 90° bulkhead	1	1		
		36	44Z473D10	• ELBOW, 90° swivel	1	1		
		37	44Z485D17	• CONNECTOR. Straight O-ring	1	1		
		38	45Z91D172	• O-RING	1	1		
		39	44Z492D8	• REDUCER, Tube	2	2		
		40	44Z485D18	• CONNECTOR, Straight O-ring	1	1		
		41	45Z91D172	• O-RING	1	1		
		42	44Z421D10	• ELBOW, 99° O-ring	1	1		
		43	45Z91D172	• O-RING	1	1		
		44	44P1049	• TUBE ASSY., Swing pressure - priority valve	1	1		
		45	936N6-1	• VALVE ASSY., Priority (Page 20.1)	1	1		
		46		• SCREW, Hex hd. 3/8-16UNC x 1/2 in.	2	2		
		47	44N261	• TUBE ASSY ., Priority valve to swing valve	1	1		

UPPER HYDRAULIC ASSEMBLY (Continued)
(SWING AND SWING BRAKE CONTROL CIRCUIT)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 5	6	
		48	44Z473D8	. ELBOW, 90°	1	1	
		49	44Z487D8	. TEE,Run	1	1	
		50	20Z649D10	. NUT,Tube	2	2	
		51	44P1068	. TUBE, ASSY.,Swing brake	1	1	
		52	44Q44D11	. UNION	1	1	
		53	44P1069	. TUBE ASSY., Swing brake drain	1	1	
		54	44Z491D5	. TEE, Union	1	1	
		55	32Z423D19	. CLAMP, Tube	2	2	
		56		. NUT, Hex. 3/8-16UNC	2	2	
		57	44P1051D4	. TUBE ASSY., Swing brake drain	1	1	
		58	18P3737	. TUBE ASSY ., Swing brake	1	1	
		59	44Z485D7	. CONNECTOR, Straight O-ring	2	2	
		60	45Z91D52	. . O-RING	1	1	
		61	18P3738	. TUBE ASSY.,Swing brake	1	1	
		62	44Z490D5	. UNION, Bulkhead	1	1	
		63	20P1545	. TUBE ASSY,Swing brake	1	-	
		63	44P1513	. TUBE ASSY.,Swing brake	-	1	
		64	44Z958D7	. ELBOW, 90° extra long	1	-	
		64	44Z1390D4	. ELBOW, 90° extra long	-	1	
		65	44Z591D15	. ELBOW, 90°	1	-	
		66	36Q155D1	. VALVE, Swing brake control	-	1	
		67		. . KNOB,Control	-	1	
		68		. . WASHER, Lock	-	1	
		-	1045Z1358	. . KIT, Seal	-	1	
		69		. . . O-RING	-	2	
		70		. . . RING,Back-up	-	2	
		71		. . . RING,Snap	-	2	
		66	36Q154D1	. VALVE, Swing brake control	1	-	
		67		. . KNOB, Control	1	-	
		-	1145Z3	. . KIT,Seal	1	-	
		68		. . .RING, Retaining	2	-	
		69		. . .O-RING	2	-	
		70		. . . RING, Back-up	2	-	
		72	44Z591D10	. ELBOW, 90°	1	-	
		73	44N22	. TUBE ASSY,Swing brake	1	-	
		73	44N260	. TUBE ASSY,Swing brake	-	1	
		74	44P342	. TUBE ASSY,Swing brake	1	-	
		74	44P1511	. TUBE ASSY,Swing brake	-	1	
		75	44Z491D7	. TEE, Union	2	2	
		76	44P1159D1	. TUBE ASSY,Swing brake	1	1	
		77	44Q47D15	. ELBOW, 90°union	1	1	
		78	44P1160	. TUBE ASSY,Swing brake	1	1	
		79	44Q47D11	. ELBOW, 90° union	2	2	
		80	44P1067	. TUBE ASSY,Swing brake	1	1	
		81	44Z485D12	. CONNECTOR, Straight O-ring	2	2	
		82	45Z91D58	. . O-RING	1	1	

Ref. Dwg 100X133 ^
100X133-5
100X133-6

UPPER HYDRAULIC ASSEMBLY
(MAIN AND AUXILIARY WINCH-SWIVEL TO VALVE CIRCUIT)



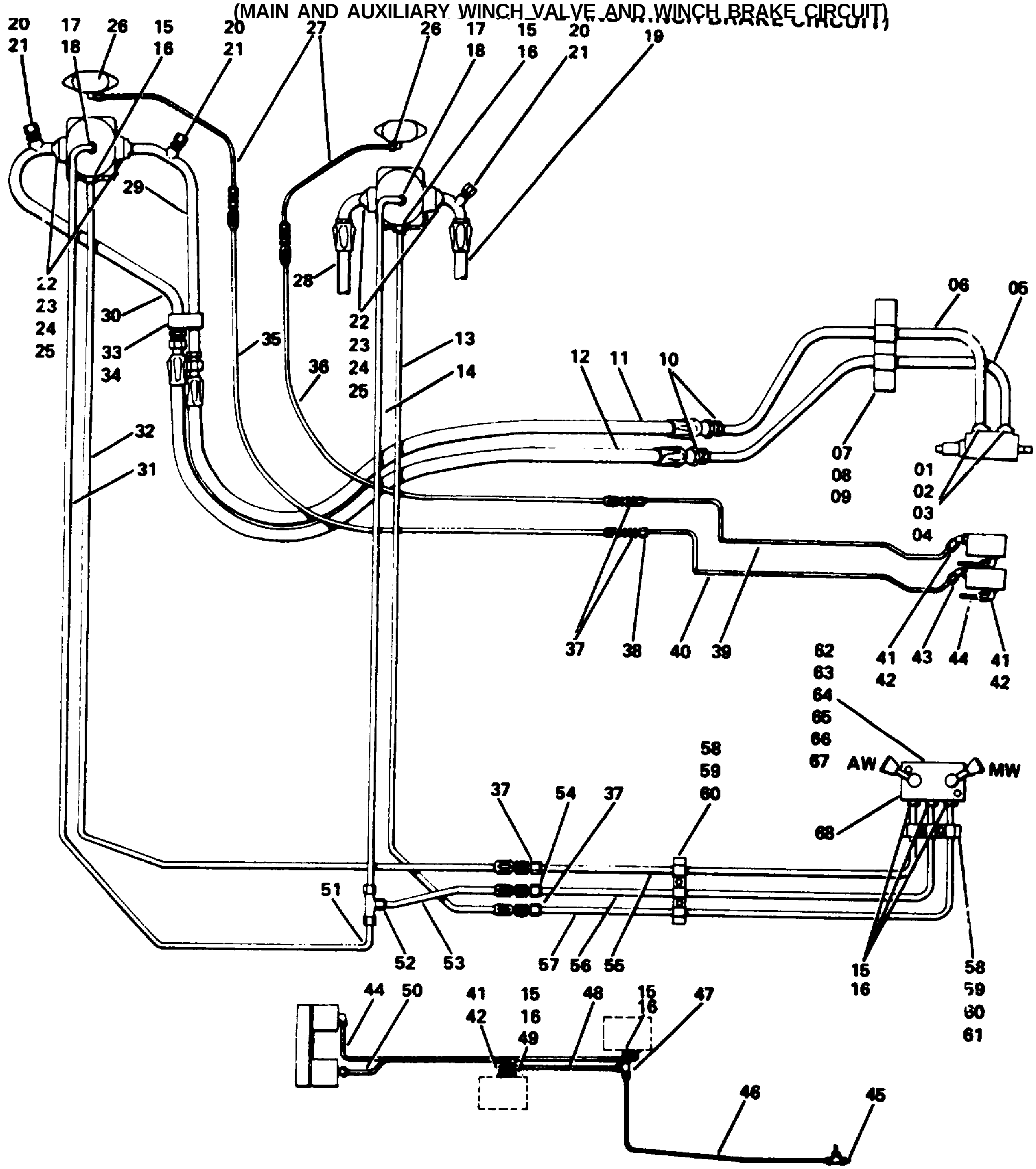
UPPER HYDRAULIC ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 5	6	
		-	100X133-5	HYDRAULIC ASSY, WINCH VALVE SUPPLY CIRCUIT	-	1	
		-	100X133-6	HYDRAULIC ASSY, WINCH VALVE SUPPLY CIRCUIT	-	1	
		01	44Z536D8	. PLUG,Hex hd. O-ring	1	1	
		02	45Z91D172	. . O-RING	1	1	
		03	44Z485D20	. CONNECTOR,Straight O-ring	1	1	
		04	45Z91D173	. . O-RING	2	2	
		05	45Z91D79*	. O-RING	4	4	
		06	44Q26D5	. FLANGE,Split half	4	4	
		07		. WASHER, Lock ½ in	1	1	
		08	20Z646D76	. SCREW, Hex hd. ½-13UNC x 1/1/2 in. Gr.5	1	1	
		09	44N36	. TUBE ASSY ., Main winch pressure	1	1	
		10	44N164	. TUBE ASSY ., Auxiliary winch pressure	1	1	
		11	44Z485D12	. CONNECTOR, Straight O-ring	1	1	
		12	44P1D58	. O-RING	1	1	
		13	44P1074	. TUBE ASSY., Winch motor drain	1	1	
		14	44Z490D11	. UNION, Bulkhead	1	1	
		15	44P1075	. TUBE ASSY., Auxiliary winch pressure	1	1	
		16	44N28	. TUBE ASSY., Main winch pressure	1	1	
		17	44Z490D12	. UNION, Bulkhead	1	1	
		18	44N161D1	. TUBE ASSY., Main winch raise\	1	1	
		19	44N161D2	. TUBE ASSY.,Main winch lower	1	1	
		20	44Q26D4	. FLANGE, Split half	4	4	
		21	45Z91D59	. O-RING	2	2	
		22		. WASHER, Lock 7/16 in	8	8	
		23	20Z646D62	. SCREW, Hex hd 7/16UNC x 1-1/4in. Gr.5	8	8	
		24	44P1050D1	. HOSE ASSY., Main winch raise	1	1	
		25	44P1054D1	. HOSE ASSY., Main winch raise	1	1	
		26	20Z646D48	. SCREW,Hex hd 3/8-16UNC x 1-1/4 in. Gr.5	8	8	
		27		. WASHER, Lock 3/8 in.	8	8	
		28	45Z91D150	. O-RING	2	2	
		29	44Q26D3	. FLANGE,Split half	4	4	
		30	16Z339D8	. BRACKET, Tube clamp	1	1	
		31	16Z338D3	. CLAMP, Tube	1	1	
		32	44Z491D7	. TEE, Union	1	1	
		33	44Z1170D1	, REDUCER, One piece	2	2	
		34	44Z511D5	. NUT, Cap	1	1	
			.	.			

Ref Dwg. 100X133 ^
100X133-5
100X133-6

UPPER HYDRAULIC ASSEMBLY

(MAIN AND AUXILIARY WINCH VALVE AND WINCH BRAKE CIRCUIT)



UPPER HYDRAULIC ASSEMBLY(continued)

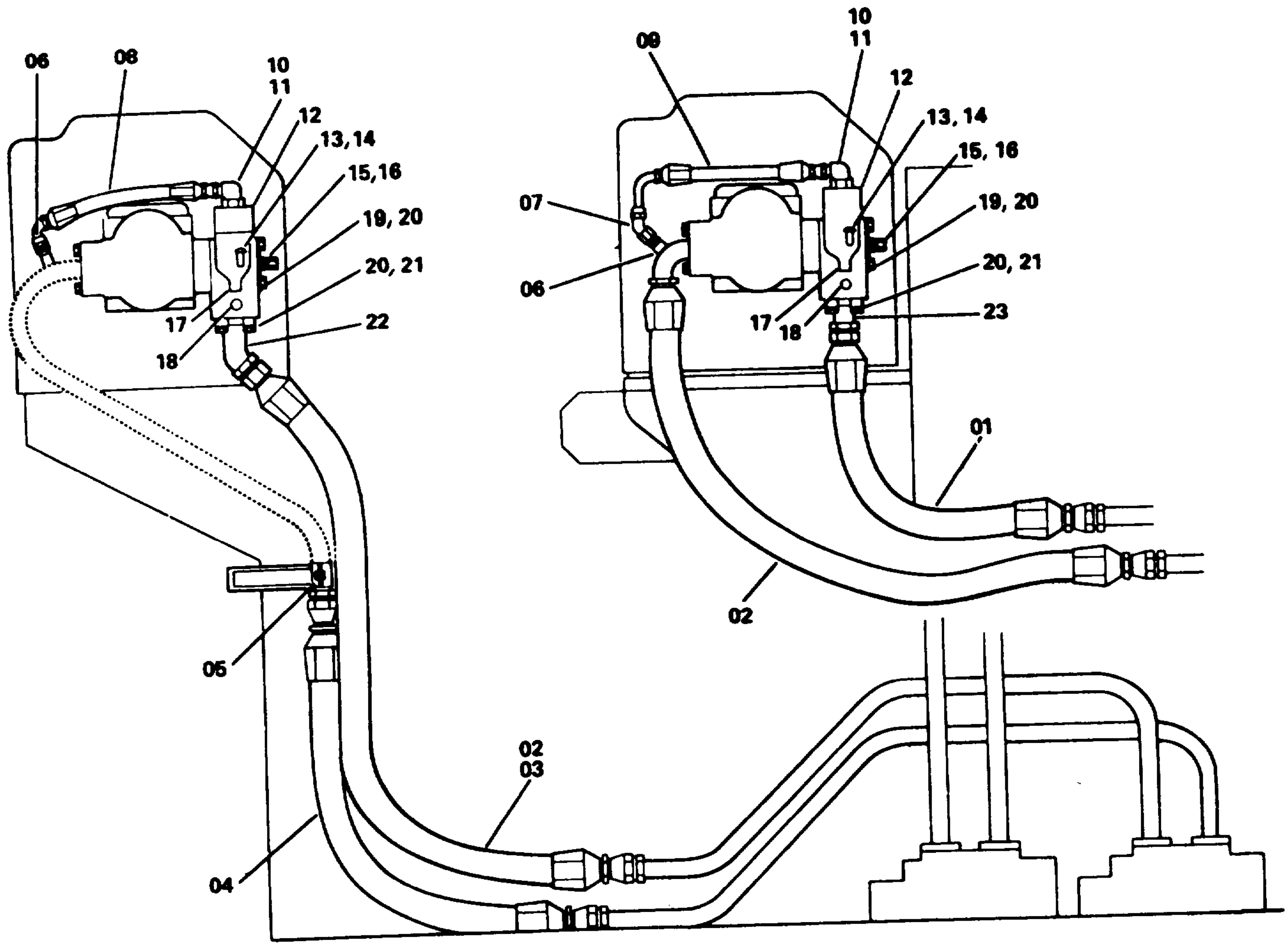
QTY	STOCK	REF.	Part Number	Description	Quantity – Figure Number 5	6	1
		-	100X133-5	HYDRAULIC ASSY., Main and auxiliary winch control			
		-	100X133-6	HYDRAULIC ASSY .,Main winch curcuir			
		-	100J4723-1	HYDRAULIC ASSY ., Auxiliary winch circuit			
		01	45Z91D150	.O-RING,Split flange			-
		02	44Q26D3	. FLANGE.Split half	2	2	-
		03		. WASHER, Lock3/8 in	4	4	-
		04	20Z646D48	. SCREW, Hex hd. 3/8-16UNC x 1-1/4 in. gr. 5	8	8	-
		05	44P1042	. TUBE ASSY., Auxiliary winch valve to motor	8	8	-
		06	44P1044	. TUBE ASSY., Auxiliary winch valve to motor	1	1	-
		07	16N1510-1	. BRACKET, Tube support	1	1	-
		08		. . SCREW, Hex hd 3/8-16UNC x 1-1/2 in	1	1	-
		09		. . WASHER, Lock 3/8 in	2	2	-
		10	44Z511D9	. CAP,Nut	2	2	-
		11	44P1055D2	. HOSE ASSY .,Auxiliary winch valve to motor	-	2	-
		12	44P1055D1	. HOSE ASSY .,Auxiliary winch valve to motor	1	-	1
		13	44P165D6	. HOSE ASSY .,Main winch two speed	1	-	2
		14	44P243D6	. HOSE ASSY .,Main winch motor drain	1	1	-
		15	44Z485D7	. CONNECTOR,Str. o-ring	1	1	-
		16	45Z91D52	. . O-RING	7	6	2
		17	44Z421D19	. ELBOW, 90° o-ring	1	1	1
		18	45Z91D52	. O-RING	2	1	1
		19	44P1054D1	. HOSE ASSY .,Main winch valve to motor	1	1	-
		20	44Z590D7	. CONNECTOR . Straight	1	1	-
		21	44Z511D3	. CAP,Nut	3	1	2
		22	20Z646D76	. SCREW, Hex hd ½-13UNC x 1-1/2 in gr.5	3	1	2
		23		. WASHER,Lock ½ in	16	8	8
		24	44Q26D5	. FLANGE, Split half	16	8	8
		25	45Z91D76	. O-RING	8	4	4
		25	45Z91D79	. O-RING	4	2	-
		26	44Z591D8	. ELBOW 90°	-	-	2
		27	18P3829D19	. TUBE ASSY., Winch brake	2	1	1
		28	44P1050D1	. HOSE ASSY .,Main winch valve to motor	2	1	1
		29	44P1045	. TUBE ASSY ., Auxiliary winch valve to motor	1	1	-
		30	44P1043	. TUBE ASSY ., Auxiliary winch valve to motor	1	-	1
		31	44P243D33	. HOSE ASSY .,Auxiliary winch motor drain	1	-	1
		32	44P165D16	. HOSE ASSY .,Auxiliary winch two speed	1	-	1
		33	16Z339D5	. BRACKET,Tube clamp	1	-	-
		33	16Z339D1	. BRACKET, Tube clamp	-	-	1
		34	16Z338D6	. CLAMP ASSY., Tube	1	-	1
		35	44P165D22	. HOSE ASSY .,Auxiliary winch brake	1	-	1
		36	44Q165D23	. HOSE ASSY .,Main winch brake	1	1	-
		37	44Q44D11	. UNION, Hose	4	3	1
		38	44Z1326D5	. PLUG, Tube	-	1	-
		39	44P1285	. TUBE ASSY., Main winch brake	1	1	-
		40	44P1286	. TUBE ASSY., Auxiliary winch brake	1	1	-
		41	44Z421D3	. ELBOW, 90° o-ring	4	4	-
		42	45Z91D52	. . O-RING	4	4	-
		43	44Z429D3	. ELBOW, 45°	1	1	-
		44	44P1296	. TUBE ASSY., Aux winch brake valve to priority	1	1	-
		45	44Z491D5	. TEE, Union	1	1	-

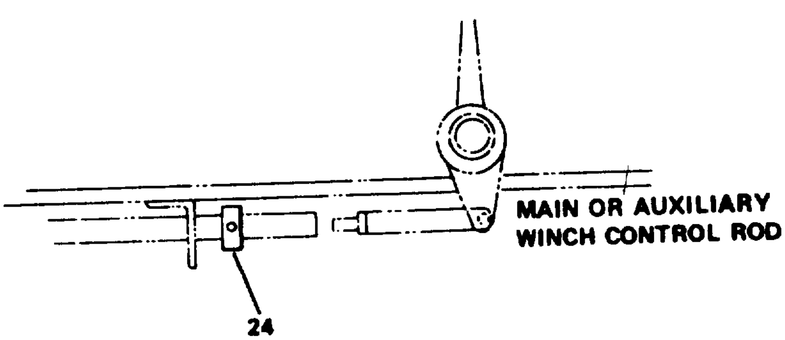
UPPER HYDRAULIC ASSEMBLY (continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 5	6	1	
		46	44P1284	• TUBE ASSY., Winch brake valve drain.	1	1	-.	
		47	44Z487D5	• TEE Swivel run	1	1	-.	
		48	44P1283	• TUBE ASSY., Aux. winch brake valve to drain	1	1	–	
		49	44Z473D5	• ELB0W, 90° swivel	1	1	--	
		50	44P1295	• TUBE ASSY., Main winch brake valve to priority	1	1	–	
		51	44Z511D4	• CAP, Nut.	-	1	–	
		52	44Z487D6	• TEE, Swivel run	1	1	–	
		53	44P243D39	• HOSE ASSY., Motor drains to speed select.	1	1	–	
		54	44Q44D14	• UNION, Hose.	1	1	–	
		55	2OP1548	• TUBE ASSY., Auxiliary winch speed.	1	-	1	
		56	2OP1546	• TUBE ASSY., Winch speed selector.	1	1	–	
		57	2OP1547	• TUBE ASSY ., Main winch speed.	1	1	-	
		58	32Z423D19	• CLAMP, Insulated.	6	4	2	
		59		• WASHER, Lock 5/16 in	4	3	1	
		60		• NUT, Hex 5/16-18UNC	4	3	1	
		61		• SCREW, Hex hd. 5/16-18UNC x 5/8 in	2	1	1	
		62		• SCREW, Sock. hd. 1/4-20UNC x 3-1/2 in.	2	2	–	
		63		• WASHER, Lock 1/4 in	2	2	–	
		64		• WASHER, Flat 1/4in	2	2	–	
		65	36Q187	• VALVE, Winch speed selector	1	1	–	
		66	18T11898	• SPACER, Valve mounting.	1	1	–	
		67		• NUT, Hex 1/4.20UNC	2	2	–	
		68	44Z599D5	• PLUG, Tube	-	1	–	

Ref. Dwg. 100X133 N 100J47223-1
100J4723 A
100X133-5
100X133-6

WINCH HOLDING VALVE ASSEMBLY



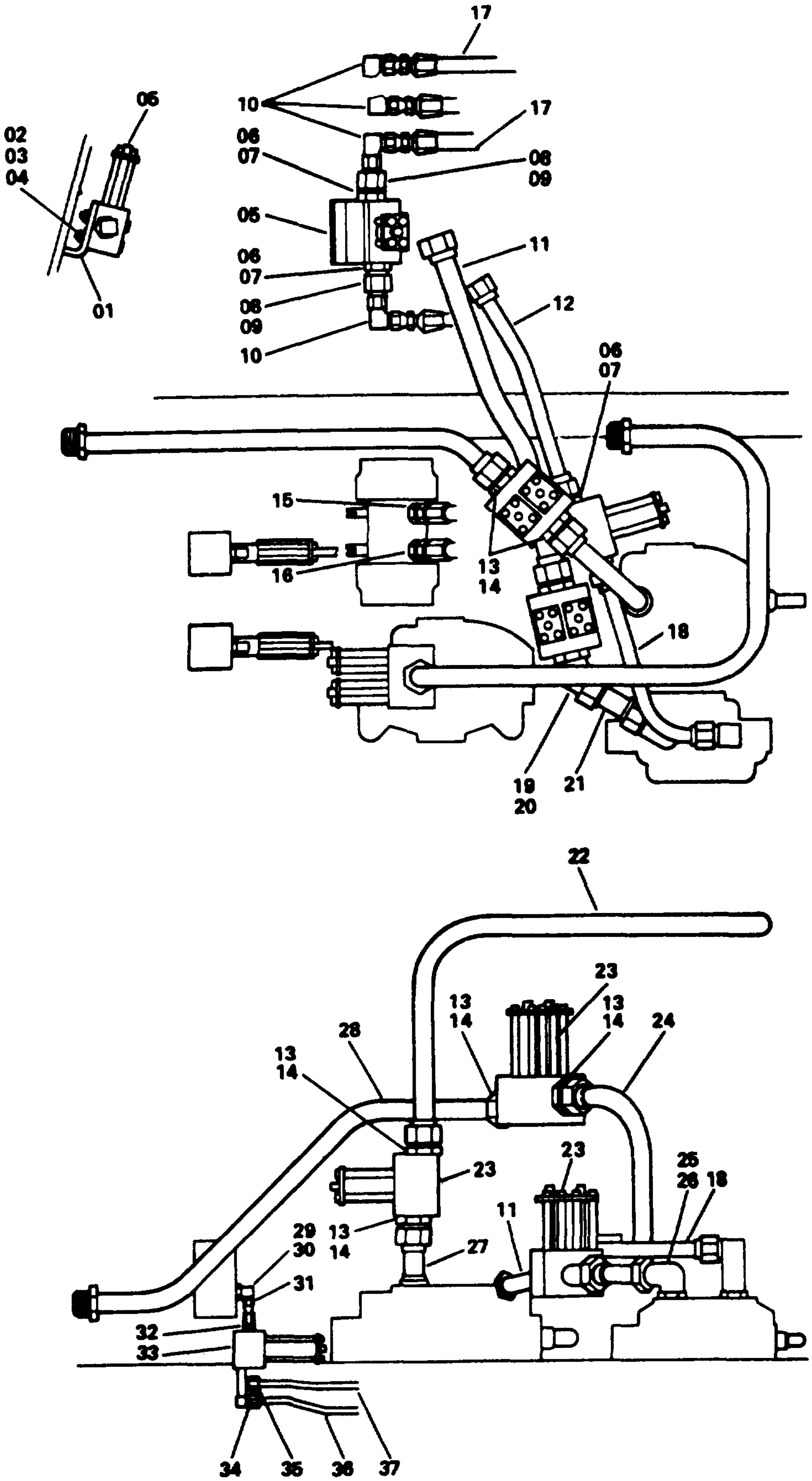


WINCH HOLDING VALVE INSTALLATION (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	1	2
		-	100J4530-1	VALVE INSTALLATION, WINCH HOLDING			
		-	1100J246-1	VALVE INSTALLATION, MAIN WINCH HOLDING			
		-	1100J246-2	VALVE INSTALLATION, AUX, WINCH HOLDING			
		01	44P1055D2	. HOSE ASSEMBLY	-	1	-
		02	44P1055D6	. HOSE ASSEMBLY	1	1	-
		03	44P1055D3	. HOSE ASSEMBLY	-	-	1
		04	44P1055D2	. HOSE ASSEMBLY	1	-	-
		05	16Z338D6	. CLAMP ASSEMBLY,Tube	1	-	-
		06	44Z590D12	. CONNECTOR,Straight	1	1	1
		07	44Z472D6	. ELBOW, 45° O-ring	-	1	-
		08	44P1078D26	. HOSE ASSEMBLY	-	-	1
		09	44P1078D4	. HOSE ASSEMBLY	1	1	-
		10	44Z421D26	. ELBOW, 90° O-ring	1	1	1
		11	45Z91D165	. . O-RING	1	1	1
		12	36Q161	. VALVE, Winch holding	1	1	1
		13	44Z206D1	. ELBOW, 90°	1	1	1
		14	44Z1D67	. BREATHER, Valve	1	1	1
		15	44Z590D12	. CONNECTOR, Straight	1	1	1
		16	44Z511D3	. CAP, 3/8 in. J.I.C	1	1	1
		17	2422V001	. PLUG, Countersunk pipe 1/8-27UNC	2	1	1
		18	2422V003	. PLUG, Countersunk pipe 3/8-16UNC	1	1	1
		19	20Z646D86	. SCREW, Hex hd. 1/2-13UNC x 4 in Gr. 5	4	4	4
		20		. WASHER, Lock 1/2 in	8	4	4
		21	45Z91D79	. O-RING, Adapter	1	1	1
		22	44Q144D3	. ADAPTER, 45° stem	1	-	1
		23	44Z1176D7	. ADAPTER, Straight	-	1	-
		-	100P854-1	. FREE FALL LOCKOUT	1	1	1
		24	18Z1188D15	.. COLLAR, Set	1	1	1

Ref Dwg. 100J453^ 1100J246-1
100J246^ 1100J246-2
100P854^ 100P854-1
100J4530-1

SOLENOID VALVE INSTALLATION



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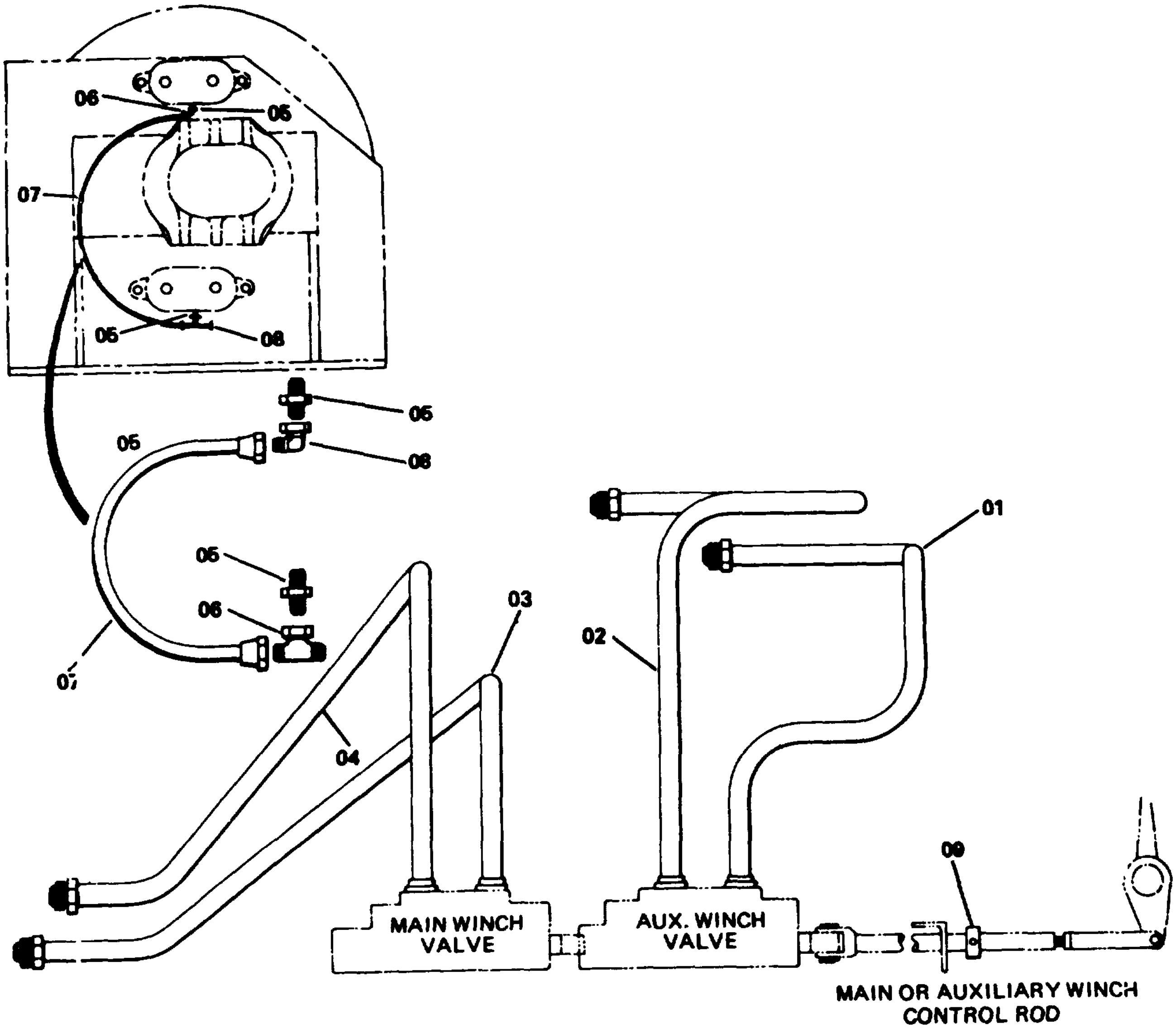
Sheet 1 of 2

SOLENOID VALVE INSTALLATION (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	5	6	
		–	100J4534-1	VALVE INST. BOOM FUNCTIONS & MAIN WINCH EXPORT	↓			
		–	100J4029-5	VALVE INST. BOOM FUNCTIONS & MAIN WINCH SOLE.		↓		
		–	100J4029-6	VALVE INST. BOOM FUNCTIONS. AUX. & MAIN WINCH SOLE			↓	
		01	16T4498	• BRACK ET, Solenoid mounting	2	2	2	
		02	20Z646D55	• SCREW, Hex hd. 3/8-16UNC x 3 in. Gr. 5	4	4	4	
		03		• WASHER, Lock 3/8 in..	4	4	4	
		04		• NUT, Hex 3/8-16UNC	4	4	4	
		05	36Z746	• VALVE, Solenoid	3	3	3	
		06	44Z485D17	• CONNECTOR, O-ring	6	6	6	
		07	45Z91D172	•• O-ring	1	1	1	
		08	44Z492D11	• REDUCER, Tube	4	4	4	
		09	20Z649D10	• NUT, Tube	4	4	4	
		10	44Z473D7	• ELBOW, 90° swivel	4	4	4	
		11	44P1172	• TUBE ASSY., Boom hoist.	1	1	1	
		12	44P1175	• TUBE ASSY., Boomhoist..	1	1	1	
		13	44Z485D19	• CONNECTOR, O-ring	3	3	5	
		14	45Z91D173	•• O-RING	1	1	1	
		15	44P92D1	• HOSE ASSY., Telescope	1	1	1	
		16	44P92D4	• HOSE ASSY., Telescope	1	1	1	
		17	44P92D10	• HOSE ASSY., Telescope	2	2	2	
		18	44P1174	• TUBE ASSY ., Boom hoist..	1	1	1	
		19	44Z429D8	• ELBOW, 45° O-ring	1	1	1	
		20	45Z91D173	•• O-RING	1	1	1	
		21	44T90	• TUBE, 1-1/4 in	1	1	1	
		22	44N258	• TUBE ASSY., Main winch	1	-	–	
		22	44N214	• TUBE ASSY., Main winch.	–	1	1	
		23	36Z745	• VALVE, Dual solenoid	2	2	3	
		24	44P1173	• TUBE ASSY., Auxiliary winch	–	–	1	
		25	44Z421D16	• ELBOW, 90° O-ring	1	1	1	
		26	45Z91D172	•• O-RING	1	1	1	
		27	44P961D2	• TUBE ASSY., Main winch	1	1	1	
		28	44N215	• TUBE ASSY., Auxiliary winch	–	–	1	
		29	44Z421D3	• ELBOW, 90° 0-ring	1	1	2	
		30	45Z91D52	•• O-RING	1	1	1	
		31	44Z1376D1	• ADAPTER, Straight	1	1	2	
		32	44Z558D3	• NIPPLE, 3/8 in. pipe	1	1	2	
		33	36Z219	• VALVE, Solenoid	1	1	2	
		34	44Z958D13	• ELB0W, 90° long	–	–	1	
		35	44Z591D9	• ELB0W, 90°	1	1	1	
		36	44P1380	• TUBE ASSY., Auxiliary winch	–	–	1	
		37	44P1176	• TUBE ASSY., Main winch..	1	1	1	

Ref. Dwg. 100J4534 Λ 100J4029-5
100J4029 G 100J4029-6
100J4534-1

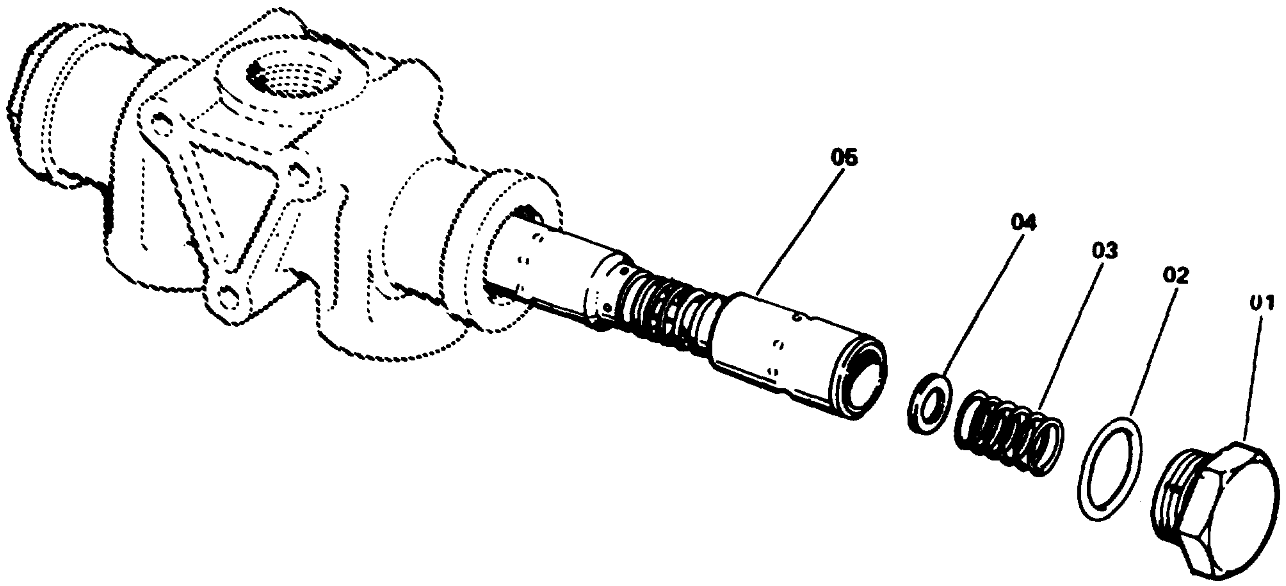
EXPORT MODIFICATION - WINCH TUBE CONVERSION



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	2	3	
		–	100N2497-1	TUBE CONVERSION - FRENCH MAIN WINCH				
		–	100N2497-2	TUBE CONVERSION - FRENCH AUX. WINCH				
		–	100N2497-3	TUBE CONVERSION - ITALIAN MAIN WINCH				
		01	44N232	• TUBE ASSY ., Aux. winch	–	1		
		02	44P1245	• TUBE ASSY., Aux. winch	–	1	–	
		03	44N230	• TUBE ASSY ., Main winch	1	–	1	
		04	44N231	• TUBE ASSY., Main winch	1	–	–	
		05	44Z590D8	• CONNECTOR, Male	2	–	2	
		06	44Z612D5	• TEE, Swivel nut	1	–	1	
		07	18P3829D7	• TUBE, Dual winch brake	1	–	1	
		08	44Z473D5	• ELBOW, 90° swivel nut	1	–	1	
			100P854-1	• FREE FALL LOCKOUT ASSY.	1	1	1	
		09	18Z1188D15	•• COLLAR, Set	1	1	1	

Ref. Dwg. 100N2497 D 100N2497-3
100N2497-1 100P854-1
100N2497-2

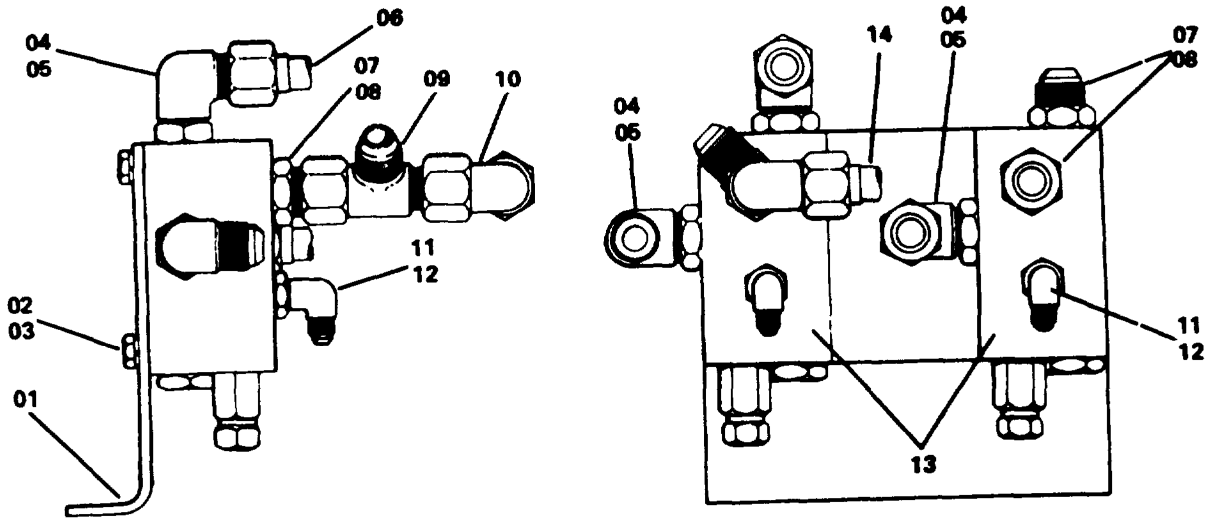
FLOW DIVIDER VALVE ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
			36Q46	VALVE ASSY., FLOW DIVIDER				
		01	1020Z2377	• PLUG, End cover				
		02	1018Z2366	• O-RING, End plug	2			
		03	1017Z600	• SPRING, Centering	2			
		04	1018Z2364	• WASHER, Spring retainer	2			
		05	1039Z327	• PISTON SUB-ASSY	1			

Ref, Dwg. 36Q46

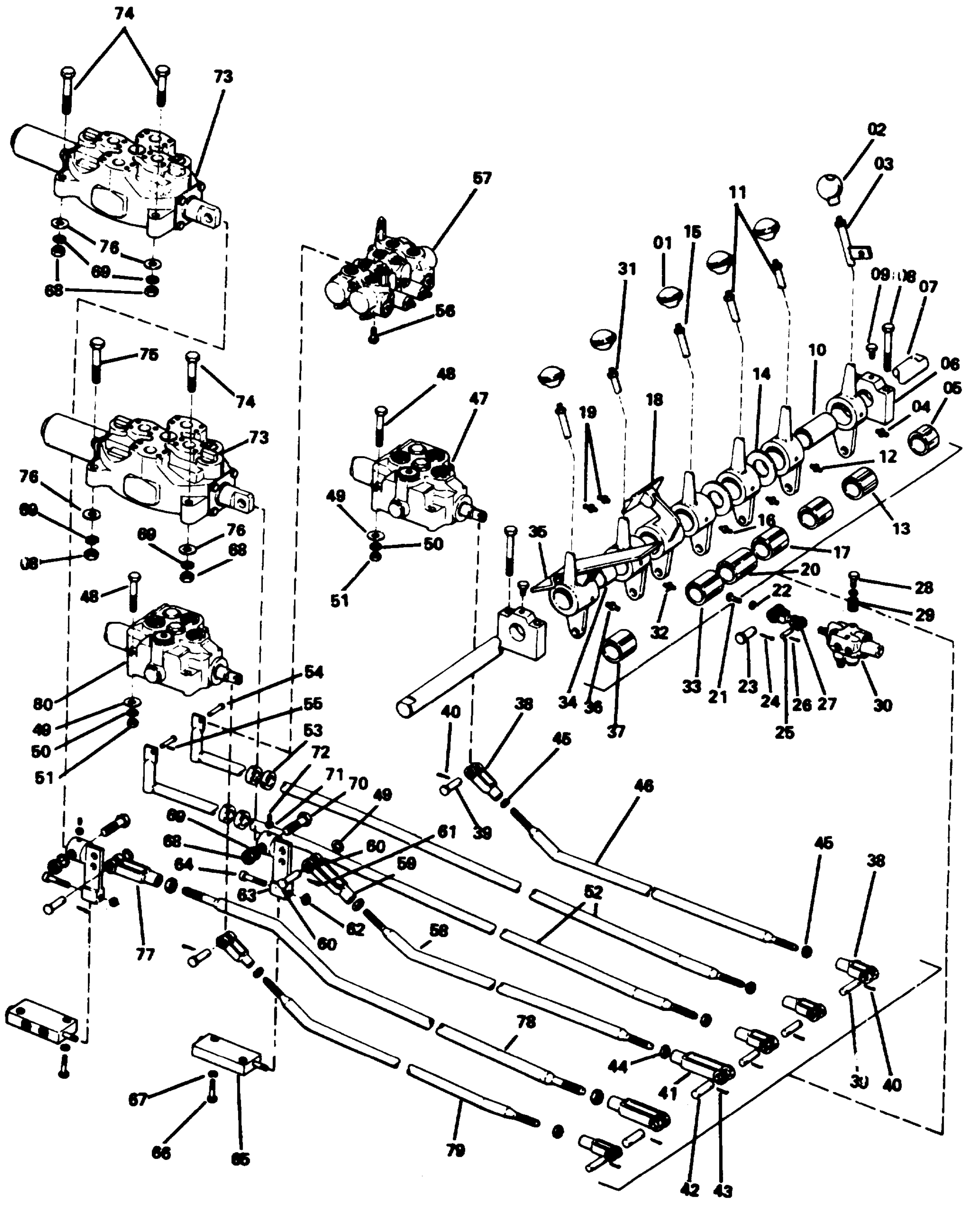
PRIORITY VALVE SUB ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		–	936N6-1	PRIORITY VALVE SUB-ASSY				
		01	16P3728	• BRACKET, Mounting	1			
		02		• SCREW, Hex hd. 3/8-16UNC x 3/4 in.	4			
		03		• WASHER, Lock 3/8 in.	4			
		04	44Z421D8	•ELBOW,90°o-ring	3			
		05	45Z91D185	•• O-RING	1			
		06	44P1023	•TUBE ASSY	1			
		07	44Z485D14	• CONNECTOR, Str. o-ring	3			
		08	45Z91D165	•• O-RING	1			
		09	44Z487D8	• TEE, Swivel run	1			
		10	44Z473D8	• ELBOW, Swivel nut	1			
		11	44Z421D3	• ELB0W, 90° o-ring	2			
		12	45Z91D52	•• O-RING	1			
		13	35Q55D5	• VALVE, Main and auxiliary priority	2			
			1036Z475	•• KIT, Cartridge relief	1			
		14	44P1024	• TUBE ASSY	1			

Ref. Dwg. 936N6^
936N6-1

UPPER CONTROL ASSEMBLY

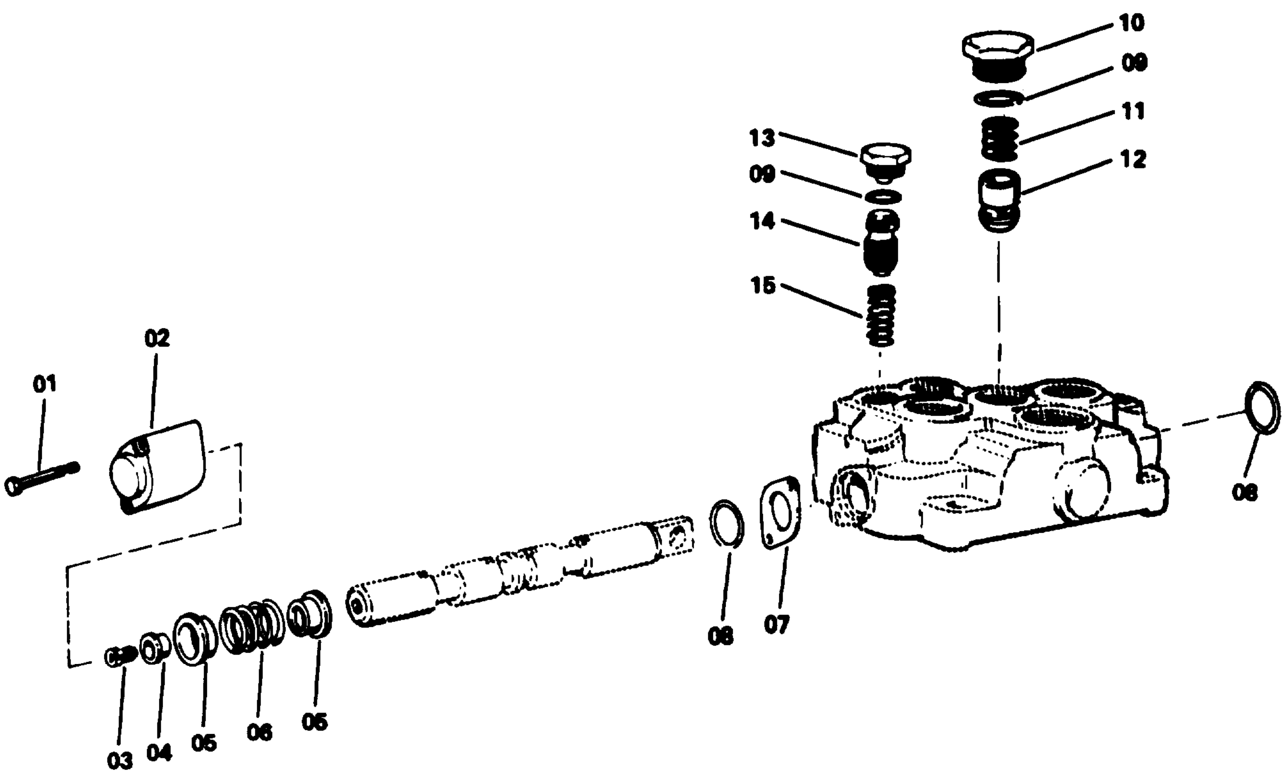


QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 2			
		-	100J4194-2	UPPER CONTROL ASSY				
		01	6Z1	. BALL, Control lever	5			
		02	6T2183	. BALL, Swing control lever	1			
		03	6N377-1	. LEVER, Swing control	1			
		04		.. FITTING, Lube	1			
		05	5Z285D13	.. BUSHING, Bronze	1			
		06	18T9465	. BRACKET, Lever shaft	2			
		07	10T1341C2	. SHAFT, Lever	1			
		08		. SCREW, Hex hd. 1/2-13UNC x 4 in. lg.	4			
		09		. SCREW, Cup pt. sock. hd. set 3/8-16UNC x 3/4 in.	2			
		10	18T9729D6	. SPACER	1			
		11	6N422-1	. LEVER, Telescope controls	2			
		12		. . FITTING, Lube	1			
		13	5Z285D16	. . BUSHING, Bronze	1			
		14	18H3892D378	. WASHER, Flat	2			
		15	6N457-1	. LEVER, Aux. winch control	1			
		16		. . FITTING. Lube	1			
		17	5Z285D17	. . BUSHING, Bronze	1			
		18	6N378-1	. PEDAL, Swing brake control	1			
		19		. . FITTING, Lube	2			
		20	5Z285D15	. . BUSHING, Bronze	1			
		21		. SCREW, Hex hd. 5/16-18UNC x 1 in.	1			
		22		. NUT, Hex jam 5/16-18UNC	1			
		23	919T117-11	. PIN, Clevis	1			
		24		. . PIN, Cotter 5/32 x 1-1/4 in.	1			
		25	19F46D2	. PIN, Drilled	1			
		26		. PIN, Cotter 1/16 x 1/2 in.	2			
		27	6T2325	. LINK	1			
		28		. SCREW, Hex hd. 3/8-16UNC x 1 in.	7			
		29		. WASHER, Heavy flat 3/8 in.	9			
		30	36Q45	. VALVE, Swing brake	1			
		-	1045Z1356	. . KIT, Valve seal	1			
		31	6N375-1	. LEVER, Main winch control	1			
		32		. . FITTING, Lube	1			
		33	5Z285D17	. . BUSHING, Bronze	1			
		34	18T9729D3	. SPACER	1			
		35	6N379-1	. LEVER & PEDAL, Boom hoist control	1			
		36		. . FITTING, Lube	1			
		37	5Z285D13	. . BUSHING, Bronze	1			
		38	6Z131D6	. YOKE	6			
		39	919T117-6	. PIN, Clevis	7			
		40		. . PIN, Cotter 1/8 x 7/8 in.	7			
		41	6Z131D8	. YOKE	2			
		42	919T117-9	. PIN, Clevis	2			
		43		. . PIN, Cotter 1/8 x 1 in.	2			
		44		. NUT, Hex jam 5/8-18UNF	4			
		45		. NUT, Hex jam 1/2-20UNF	6			
		46	6Z414	. ROD, Swing control	1			
		47	36Z724	. VALVE, Swing (Page 22.1).	1			
		48		. SCREW, Hex hd. 1/2-13UNC x 3 in.	6			

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 2			
		49		. WASHER, Flat 1/2 in.	8			
		50		. WASHER, Lock 1/2 in.	6			
		51		. NUT, Hex 1/2-13UNC	6			
		52	6T2348	. ROD, Telescope control	2			
		53	18Z1188D12	. COLLAR, Set	4			
		54	919T117-2	. PIN, Clevis	2			
		55		. . PIN, Cotter 1/16 x 7/16 in.	1			
		56		. SCREW, Hex hd. 3/8-16UNC x 1 in.	7			
		57	36Z840	. VALVE, Telescope (Page 23.1).	1			
		58	6Z487	. ROD, Aux. winch control	1			
		59	6Z131D9	. YOKE	1			
		60	919T117-7	. PIN, Clevis	2			
		61		. . PIN. Cotter 1/8 x 7/8 in	1			
		62		. NUT, Hex jam 3/8-16UNC	2			
		63	6P2409	. LINK, Aux. winch control	1			
		64		. SCREW, Sock, hd. cap 3/8-16UNC x 2 in.	2			
		65	36Z1028	. VALVE, Winch brake	2			
		-	1145Z2	. . KIT, Valve seal	1			
		66		. SCREW, Hex hd. 5/16-18UNC x 1-1/2 in.	6			
		67		. WASHER, Lock 5/16 in.	6			
		68		. NUT, Hex 5/8-11UNC	8			
		69		. WASHER, Lock 5/8 in.	8			
		70		. SCREW, Hex hd. 5/8-11UNC x 2-1/4 in.	2			
		71		. NUT, Hex jam 1/4 -20UNC	2			
		72		. SCREW, Slot hd. set 1/4-2OUNC x 1/2 in.	2			
		73	36Q70	. VALVE, Main and aux. winch (Page 24.1)	2			
		74		. SCREW. Hex hd. 5/8-11UNC x 3 in.	5			
		75		. SCREW, Hex hd. 5/8-11UNC x 3-1/2 in.	1			
		76		. WASHER, Flat 5/8 in.	6			
		77	6T2554	. CLEVIS	1			
		78	6Q20	. ROD, Main winch control	1			
		79	8Z415	. ROD, Hoist control	1			
		80	36Z986	. VALVE. Hoist (Page 22.1)	1			

Ref Dwg. 100J4194 A
100J4194-2

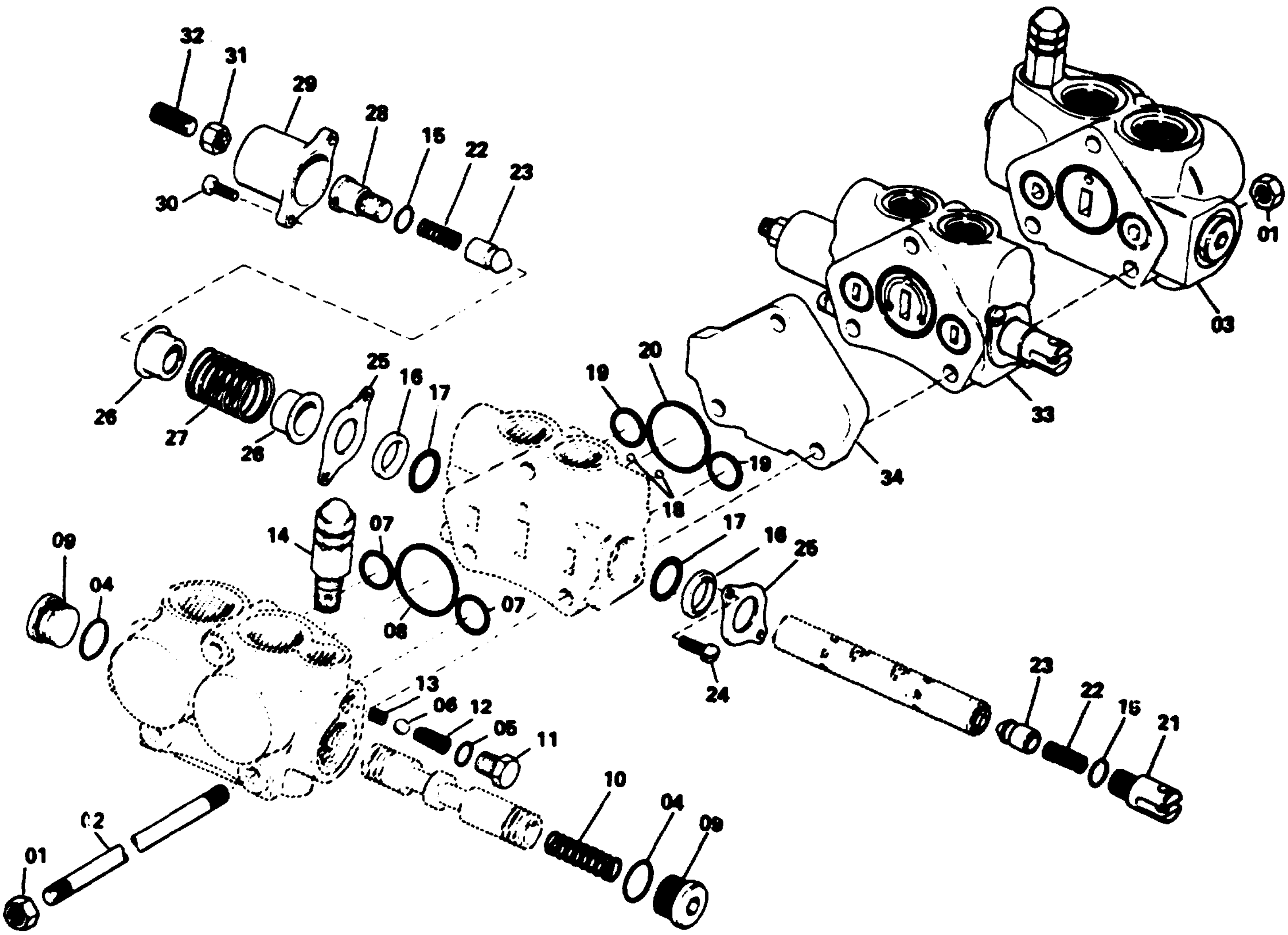
SWING & HOIST CONTROL VALVES



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-	36Z724	VALVE ASSY., SWING CONTROL				
		-	36Z986	VALVE ASSY., HOIST CONTROL				
		01	1020Z4884	. SCREW, End cap	2	2		
		02	1014Z1309	. CAP, End	1	1		
		03	1020Z4883	. SCREW, Spring retainer	1	1		
		04	1017Z958	. GUIDE, Spring	1	1		
		05	1018Z4769	. RETAINER, Spring	2	2		
		06	1017Z962	. SPRING	1	1		
		07	1018Z4768	. RETAINER	1	1		
		-	1045Z644	. KIT, Seal	1	1		
		08		. . O-RING, Spool	2	2		
		09		. . O-RING, Rug	2	2		
		10	1020Z4889	. PLUG	1	1		
		11	1017Z620	. SPRING, Poppet	1	-		
		12	1036Z725	. POPPET	1	-		
		13	1020Z4887	. PLUG	1	1		
		14	36Z783	. VALVE SUB-ASSEMBLY, Relief	1	-		
		14	1036Z396	. VALVE SUB-ASSEMBLY, Relief	—	1		
		15	1017Z617	. SPRING, Relief valve	1	1		

Ref. Dwg. 362724
362986

TELESCOPE CONTROL VALVE



TELESCOPE CONTROL VALVE (Continued))

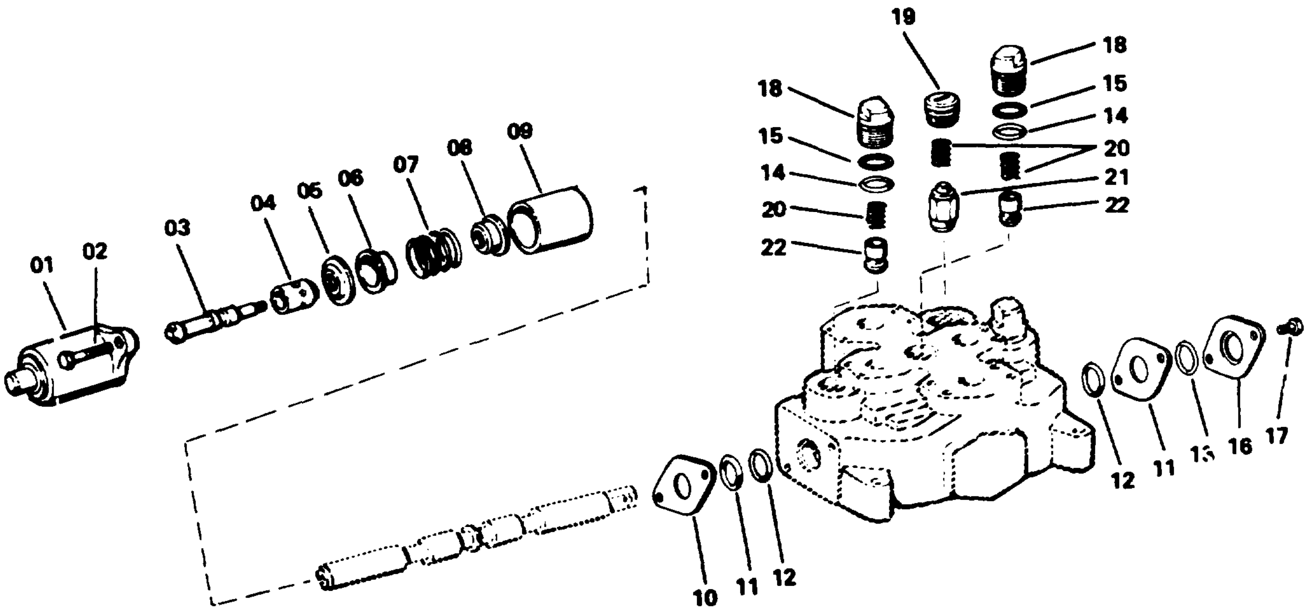
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number				
		-	36Z840	VALVE TELESCOPE CONTROL	▼				
		01	1020Z3037	.NUT	6				
		02	1020Z3041	.BOLT, Rod	3				
		03	1036Z473	.SECTION, Valve inlet	2				
		-	1045Z1355	…KIT, Seal	1				
		04		…O-RING	2				
		05		…O-RING	1				
		06		…BALL	1				
		07		…O-RING	2				
		08		…O-RING	1				
		09	1020Z3036	..PLUG, Compensator spool	2				
		10	1017Z756	..SPRING, Compensator spool	1				
		11	1020Z2960	..PLUG	1				
		12	1017Z754	..SPRING	1				
		13	1020Z3042	..SCREW	1				
		14	1036Z472	..VALVE, Main relief	1				
		-	1045Z1354	…KIT, Relief seal	1				
		-	1036Z474	.SECTION, Telescope	1				
		-	1045Z1354	..KIT, Section seal	2				
		15		…O-RING	2				
		16		…WIPER, Spool	2				
		17		…O-RING	2				
		18		…BALL	2				
		19		…O-RING	1				
		20		…O-RING	1				
		21	1006Z375	..CLEVIS	2				
		22	1017Z753	..SPRING, Spool	2				
		23	1018Z3158	..POPPET	2				
		24	1020Z3038	..SCREW, Retainer	2				
		25	1018Z3157	..PLATE, Retainer	2				
		26	1018Z3159	..SEAT, Spring	1				
		27	1017Z755	..SPRING, Spool	1				
		28	1020Z3043	..SCREW, Adjusting	1				
		29	1014Z685	..CAP	1				
		30	1020Z3039	..SCREW, Cap	2				
		31	1020Z3037	..NUT, Adjusting screw	1				
		32	1020Z3040	….SCREW, Adjusting	1				
		33	1036Z640	.SECTION, Telescope	1				
		-	1045Z1353	..KIT, Section seal	1				
		15		…O-RING	2				
		16		…WIPER, Spool	2				
		17		…O-RING	2				
		18		…BALL	2				
		19		…O-RING	2				
		20		…O-RING	1				
		21	1006Z375	..CLEVIS	1				
		22	1017Z753	..SPRING, Poppet	2				
		23	1018Z3158	..POPPET	2				
		24	1020Z3038	..SCREW, Retainer	2				
		25	1018Z3157	..PLATE, Retainer	2				

TELESCOPE CONTROL VALVE (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		26	1018Z3159	..SEAT, Spring	2			
		27	1017Z755	..SPRING, Spool	1			
		28	1020Z3043	..SCREW, Adjusting	1			
		29	1014Z685	..CAP	1			
		30	1020Z3039	..SCREW, Cap	2			
		31	1020Z3037	..NUT, Adjusting screw	1			
		32	1020Z3040	..SCREW, Adjusting	1			
		33	1036Z640	.SECTION, Telescope	1			
		34	1018Z3156	.PLATE, Spacer	1			

Ref. Dwg. 36Z840 A
36Z840

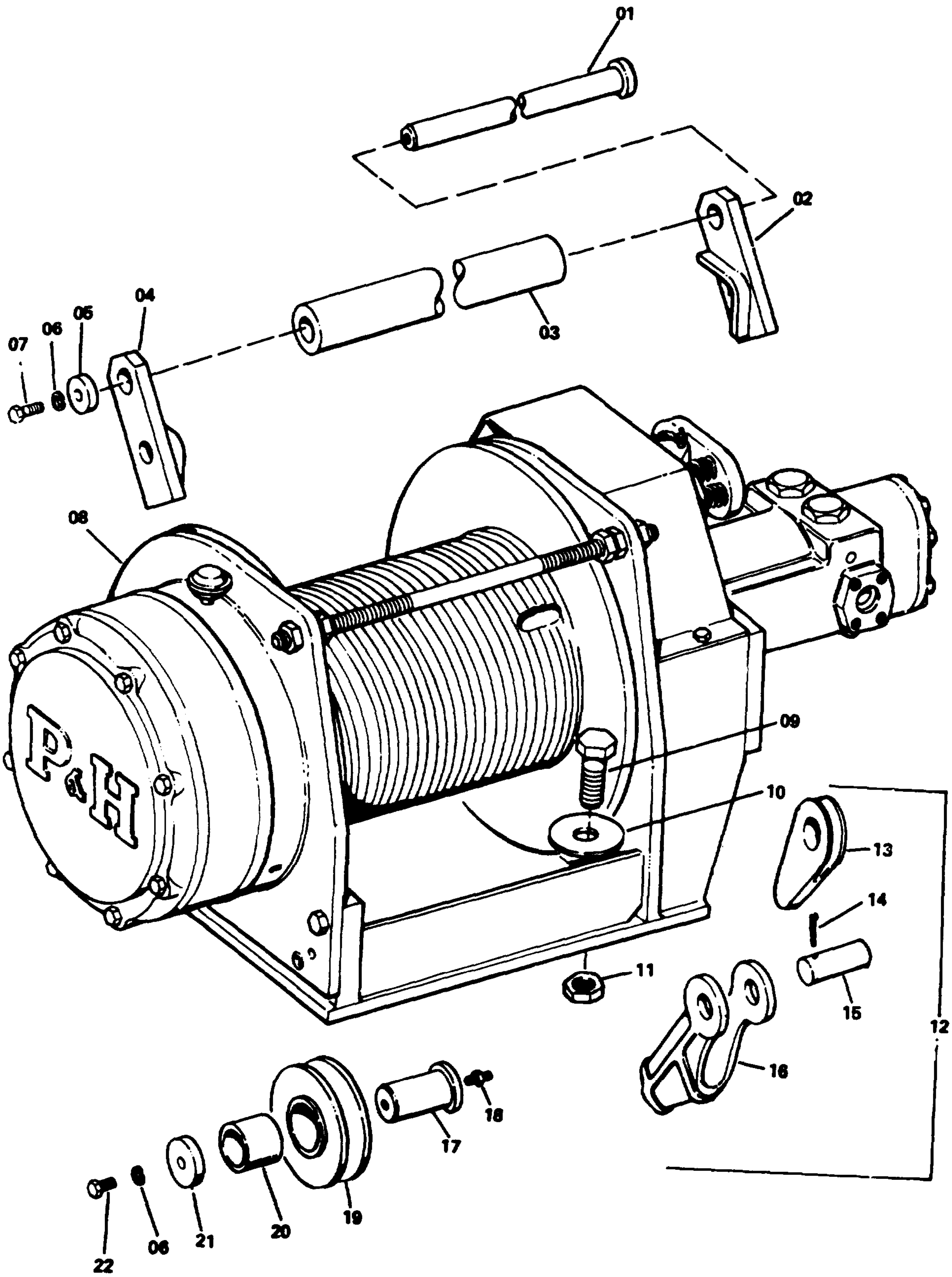
MAIN & AUXILIARY WINCH CONTROL VALVE



QTY	STOCK		Part Number	Description	Quantity Figure Number			
		-	36Q70	VALVE, MAIN & AUXILIARY WINCH CONTROL				
		01	1014Z1310	. CAP, End	1			
		02	1020Z4886	. SCREW, End cap..	2			
		03	1036Z727	. EXTENSION, Spool	1			
		04	1017Z961	. GUIDE	1			
		05	1018Z4765	. WASHER	1			
		06	1018Z4766	RETAINER. Outer spring	1			
		07	1017Z960	. SPRING	1			
		08	1018Z4770	. RETAINER, Inner spring	1			
		09	1018Z4767	. SPACER	1			
		10	1018Z4771	. PLATE, Retainer.	2			
		11	1018Z4764	RETAINER, O-ring	1			
		-	1045Z709		1			
		12		..O-RING	2			
		13		. . WIPER, Spool	1			
		14		. . O-RING	2			
		15		. . RING, Beck-up	2			
		16	1018Z4763	. RETAINER, Wiper	1			
		17	1020Z4885	. SCREW, Wiper retainer	2			
		18	1020Z4890	. CAP	2			
		19	1020Z4888	. CAP, Slotted	1			
		20	1017Z959	. SPRING	3			
		21	1036Z645	. VALVE SUB-ASSEMBLY, Relief	1			
		22	1036Z726	. POPPET	2			

Ref. Dwg. 36Q70

MAIN AND AUXILIARY WINCH INSTALLATIONS

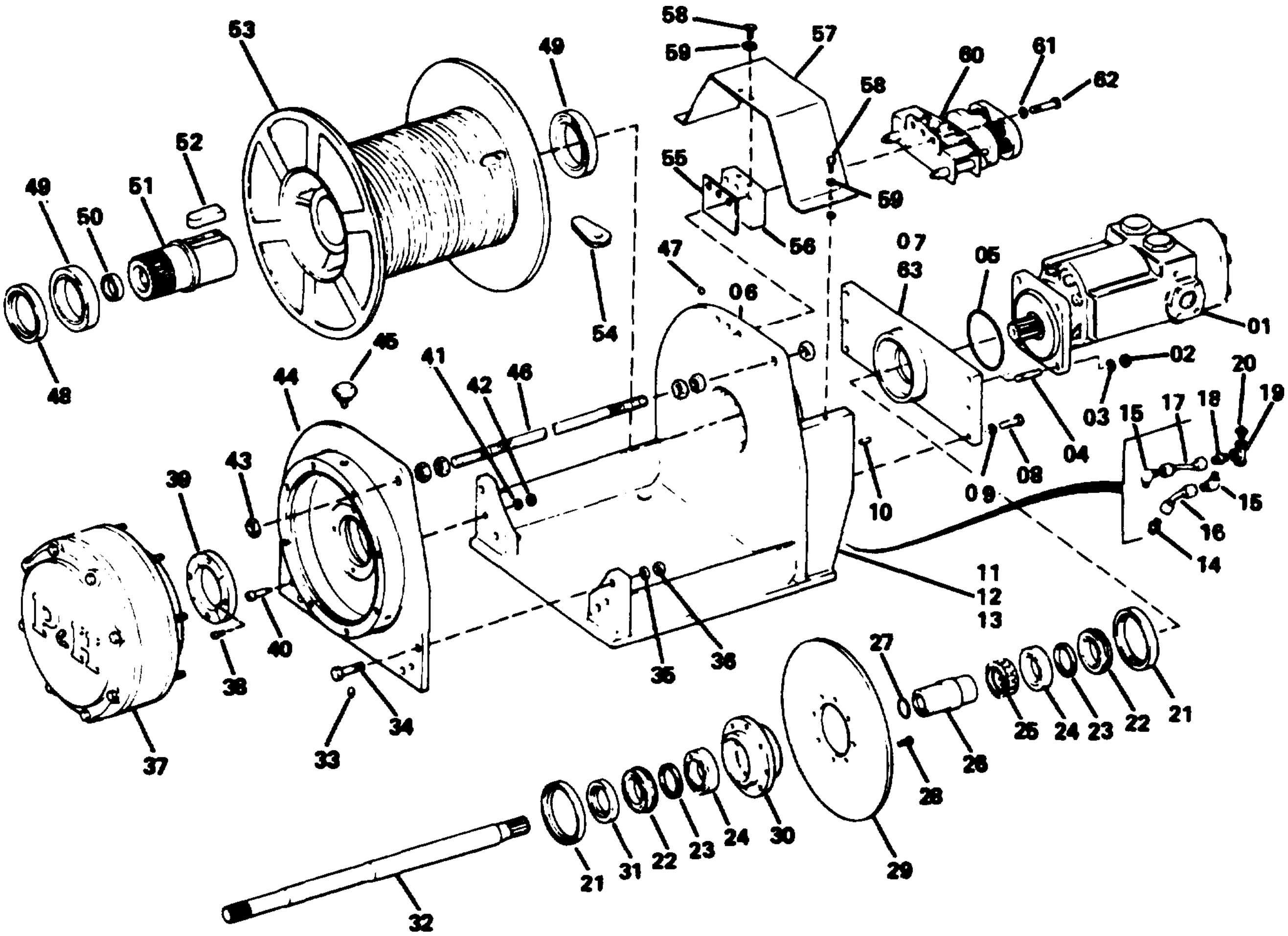


MAIN AND AUXILIARY WINCH INSTALLATIONS (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	2	3	4
		-	100N2383-1	MAIN WINCH INSTALLATION	▼			
		-	100N2496-2	AUX. WINCH INSTALLATION NO DRUM IND. ON MAIN		▼		
		-	100N2496-4	AUX. WINCH INSTALLATION DRUM IND. ON MAIN			▼	
		01	10T1382	.SHAFT, Roller	-	1	1	
		02	16P3450D3	.BRACKET, Roller	-	1	1	
		03	13T384	.ROLLER	-	1	1	
		04	16P3450D2	.BRACKET, Roller	-	1	1	
		05	14T1433	.CAP, Roller end	-	1	1	
		06		.WASHER, Lock 3/8in.	-	4	4	
		07		.SCREW, Hex hd 3/8-16UNC x 1in	-	1	1	
		08	923P5-1	.WINCH, P&H #10 (Page 26.1)	1	1	1	
		09		.SCREW, Hex hd. 7/8-9UNC x 2-1/4in.	4	4	4	
		10	18Z694D9	.WASHER, Hardened 7/8in.	4	4	4	
		11		.NUT, Hex 7/8-9UNC	-	4	4	
		12	908P39-44	.SOCKET, 1/8in. rope	-	1	1	
		13	8T259C1	..WEDGE, 1/2in	-	1	1	
		14		..PIN, Cotter ¼ x 1-1/2in.	-	2	2	
		15	19F57D10	..PIN, Drilled 1 x 3in.	-	1	1	
		16	8P168	..SOCKET, 1/2in.	-	1	1	
		12	908P39-	.SOCKET, 5/8in.rope	1	1	1	
		13	8P877-1	..WEDGE, 5/8in.	1	1	1	
		14	8T97C3	..PIN, Cotter ¼ x 2in.	2	2	2	
		15	19F59D10	..PIN, Drilled 1-1/4 x 3-1/2in.	1	1	1	
		16	8P240	..SOCKET, 5/8in.	1	1	1	
		17	10T345-1	.SHAFT	-	3	3	
		18		..FITTING, Lube	-	1	1	
		19	7P877-1	.SHEAVE ASSY	-	3	-	
		20	5Z285D13	..BEARING	-	1	1	
		21	14T1421	.CAP, End	-	3	3	
		22		.SCREW, Hex hd. 3/8-16UNC x 3/4in.	-	3	3	

Ref. Dwg. 100N2383 D
100N2496…..F
100N2383-1
100N2496-2
100N2496-4

WINCH ASSEMBLY



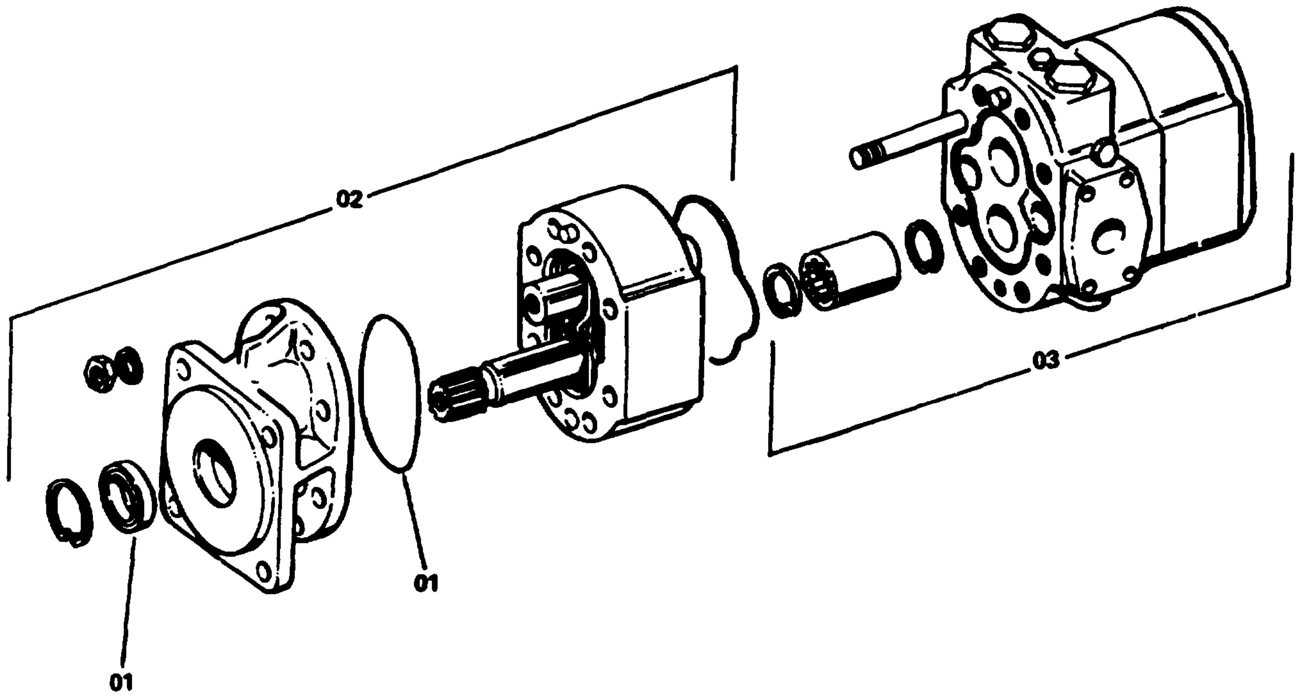
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	923P5-1	WINCH end MOTOR ASSEMBLY				
		01	41U13D9	. MOTOR, Hydraulic (Page 27.1).	1			
		02		. NUT, Hex 1/2-13UNC	4			
		03		WASHER, Lock 1/2 in	4			
		-	923X7-3	: WINCH ASSEMBLY, Model #10	1			
		04	20T5485D2	.. STUD	4			
1	X	05	46Z91D144	.. O-RING	1			
		06	16J851-1	.. BASE, Winch	1			
		07	716N4	... SUPPORT, Motor	1			
		08		... SCREW, Hex heed 1/2-13UNC x 1-1/2 in. lg.	4			
		09		... WASHER, Lock 1/2 in.	4			
		10	18Z138D37	... PIN, Dowel	2			
		11	14P2414	.. COVER	1			
		12		.. SCREW, Hex heed 3/8-16UNC x 1 in. lg.	2			
		13		.. WASHER, Lock 3/8 in	2			
		14	44Z590D4	.. CONNECTOR, Male	1			

WINCH ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1			
		15	44Z591D3	..ELBOW, 90°	2			
		16	44T358	..TUBE	1			
		17	44T359	..TUBE	1			
		18	44Z590D3	..CONNECTOR, Male	1			
		19	44Z342D1	..TEE, Pipe	1			
		20	44ZD37	..FITTING, Relief	1			
1	X	21	18F68D323	..SEAL	2			
2	X	22	25Z868D11	..BEARING, Ball	2			
		23	18Z2036D1	..WASHER, Support	2			
		24	25Z377D12	..BEARING, Ball	2			
		25	15Z400D2	..SPRAGE, Clutch assembly	1			
		26	18N980	..SLEEVE, Motor shaft	1			
1	X	27	45Z91D206	..O-RING	1			
		28	20Z994D8	..SCREW, Self locking cap	8			
		29	18Z2040	..DISC, Brake	1			
		30	18N979	..HUB, Brake	1			
1	X	31	18F682D75	..SEAL	1			
		32	10P1634	..SHAFT	1			
		33		..PLUG, 3/8in. pipe	1			
		34		..SCREW, Hex head 5/8-16UNC x 2-1/4in. lg.	4			
		35		..WASHER, Lock 5/8in.	4			
		36		..NUT, Hex 5/8-16UNC	4			
		37	53U28	..PLANETARY DRIVE (Page 29.1)	1			
		38		..SCREW, Socket head 1/4-20UNC x 3/4in. lg	4			
		39	18P3776	..WASHER, Trust	1			
		40	20Q1D38	..BOLT, Hex socket shoulder	2			
		41		..WASHER, Lock 3/8in.	2			
		42		..NUT, Hex jam 3/8-16UNC	2			
		43		..NUT, Hex jam ¾-10UNC	6			
		44	16N1714	..PLATE, Planetary drive mounting	1			
		45	46Z4	..BREATHER	1			
		46	20T8599	..BOLT, Rod	1			
		47		..PLUG, 1/4in. pipe	1			
1	X	48	18F682D307	..SEAL	1			
2	X	49	25Z874D17	..BEARING, Ball	2			
1	X	50	18F682D378	..SEAL	1			
		51	18N985	..SLEEVE, Drum	1			
		52	20H1449D1	..KEY	1			
		53	23J489	..DRUM, Winch 9/16in. wire rope	1			
		54	8T95C3	..WEDGE, Cable	1			
		55	18T10531D1	..SHIM	1			
		55	18T10531D2	..SHIM	1			
		56	18T10403	..SPACER	1			
		57	14N1967	..COVER	1			
		58		..SCREW, Hex head 3/8-16UNC x 1	4			
		59		..WASHER, Lock 3/8in	4			
		60	15U26	..CALIPER BRAKE ASSEMBLY (Page 28.1)	1			
		61		..WASHER, Lock 1/2in	3			
		62		..SCREW, Hex head ½-13UNC x 2-1/4in. lg	3			
		63	32Z837	..PLATE, Name	1			

Ref. Dwg. 923P5
923X7 D
923P5-1
923X7-3

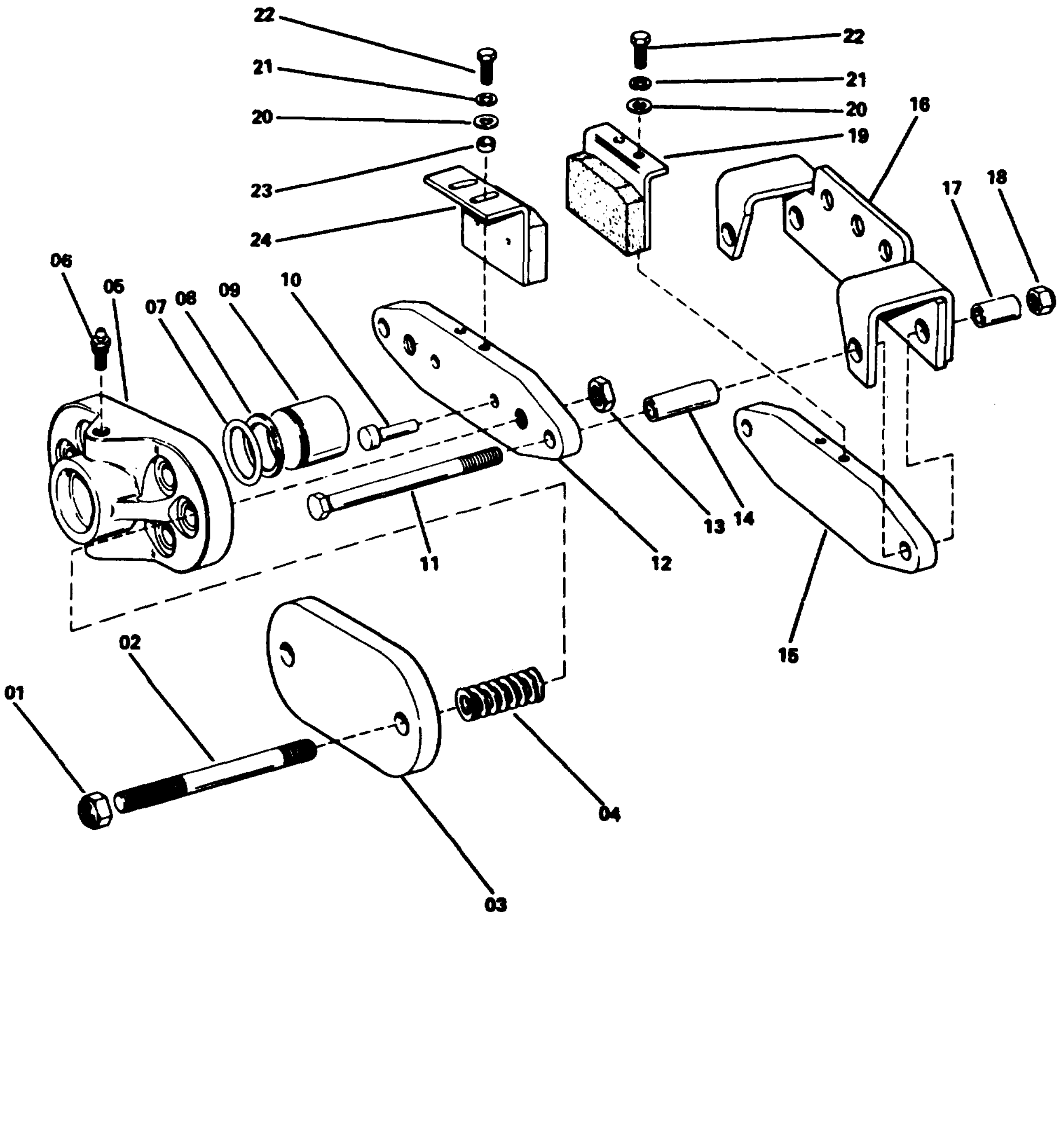
WINCH MOTOR ASSEMBLY



QTY	STOCK	Ref..	Put Number	Description	Quantity Figure Number D6	D9		
			41U13D8	WINCH MOTOR ASSY. - EXPORT	▼			
			41U13D9	WINCH MOTOR ASSY. - STANDARD		▼		
		01	1046Z1122	. KIT, Shaft seal	1	1		
		02	1045Z1158	. KIT, Front section	1	-		
		02	1045Z1156	. KIT, Front section	-	1		
		03	1045Z1159	. KIT. Rear section with valve	1	-		
		03	1045Z1157	. KIT, Rear section with valve	-	1		

Ref. Dwg. 41U13D0
41U13D8
41U13D9

WINCH BRAKE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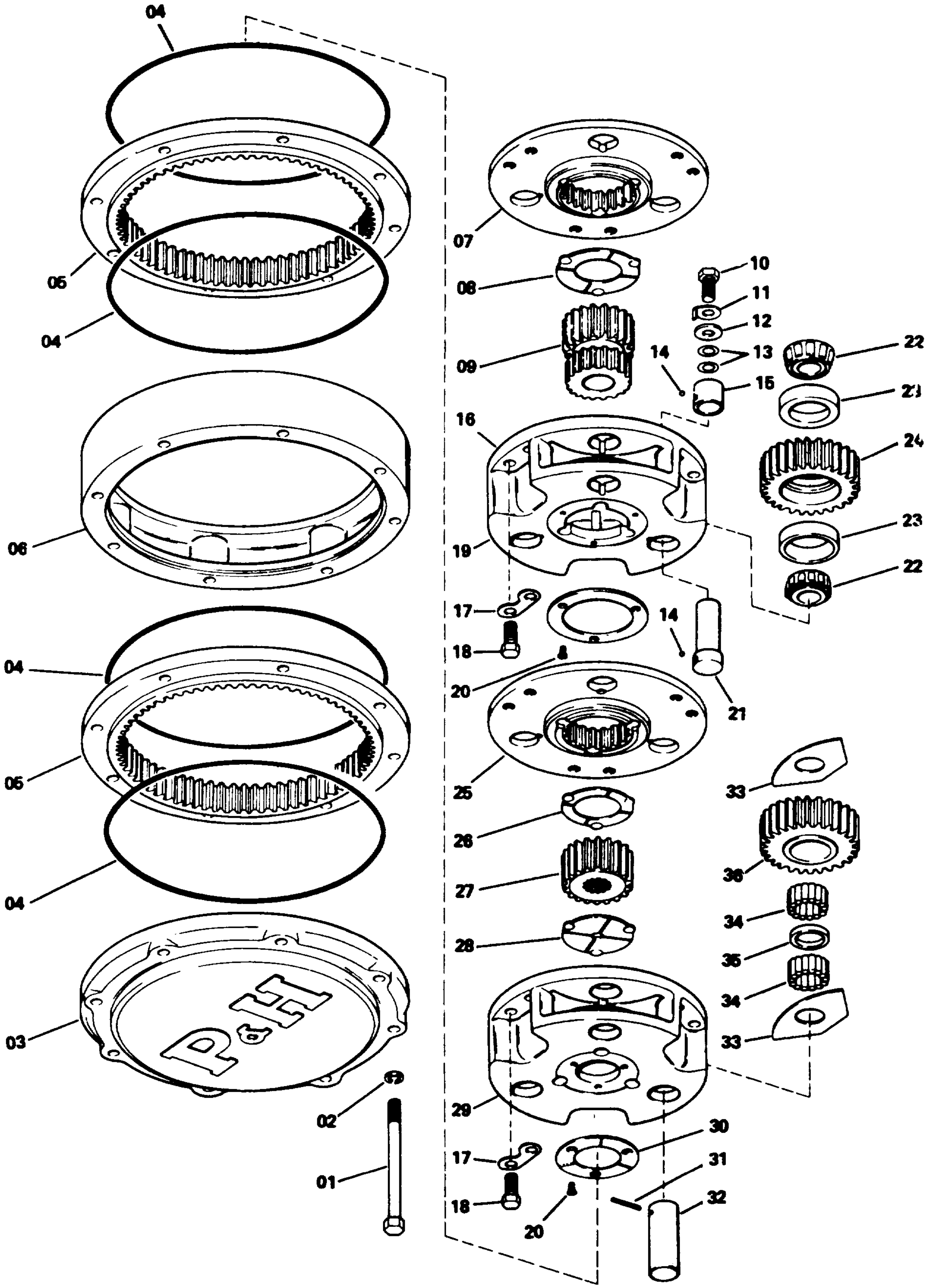
WINCH BRAKE ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-	15U26	BRAKE – STANDARD WINCH				
		-	15U27	BRAKE – UPPER EXPORT WINCH				
		-	15U29	BRAKE – LOWER EXPORT WINCH				
		01		.NUT, Hex ½-13UNC	2	2	2	
		02		.STUD, ½-13UNC x 5in.	2	2	2	
		03	1018Z2884	.PLATE, Spring Keeper	1	1	1	
		04	1017Z718	.SPRING	4	-	-	
		04	1017Z751	.SPRING, Green	-	2	2	
		04	1017Z719	.SPRING, Gold	2	4	4	
		05	1014Z599	.HOUSING	1	-	-	
		05	1014Z678	.HOUSING	-	1	1	
		06	1044Z356	.BLEEDER, Housing	1	1	1	
		07	1045Z782	.O-RING	1	1	1	
		08	1045Z1222	.RING, Back-up	1	-	-	
		09	1038Z160	.PISTON	1	1	1	
		10	1019Z677	.PIN	2	2	2	
		11		.SCREW, Hex hd 3/8-24UNF x 4-1/2in.	2	2	2	
		12	1015Z803	.CARRIER, Piston side	1	1	1	
		13		.NUT, Hex ½-13UNC	2	2	2	
		14	1005Z387	.BUSHING	2	2	2	
		15	1015Z804	.CARRIER, Bracket side	1	1	1	
		16	1016Z285	.BRACKET	1	1	1	
		17	1005Z388	.BUSHING	1	1	1	
		18		.NUT, Hex 3/8-24UNF	2	2	2	
		19	1015Z806	.PAD, Bracket side	1	1	1	
		20		.WASHER, Flat 1/4in.	4	4	4	
		21		.WASHER, Lock 1/4in.	4	4	4	
		22		.SCREW, Hex hd. ¼-20UNC x 3/4in.	4	4	4	
		23	1005Z389	.BUSHING	2	2	2	
		24	1015Z805	.PAD, Piston side	1	1	1	

Ref. Dwg. 15U26
15U27
15U29

PLANETARY DRIVE ASSEMBLY

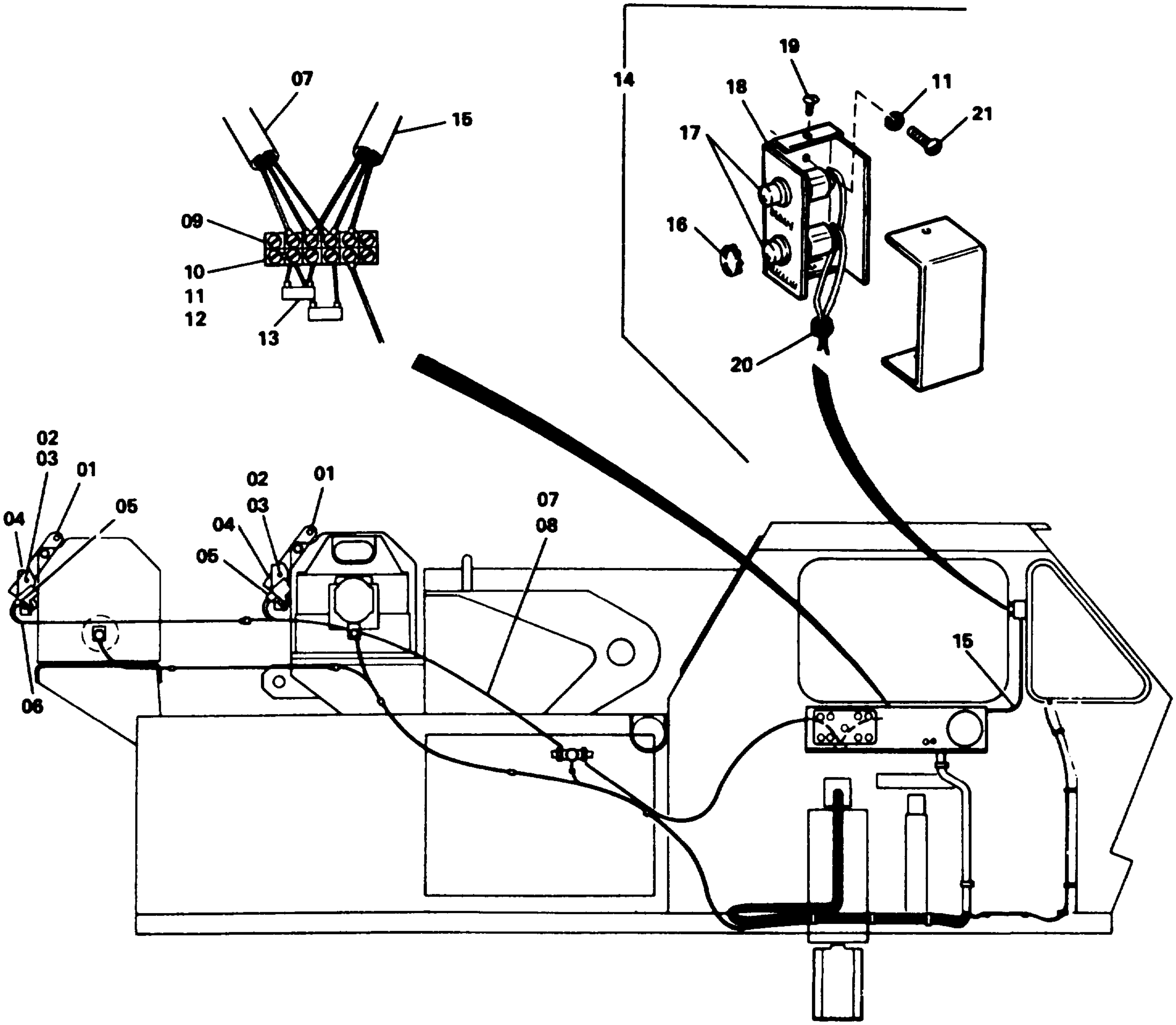


PLANETARY DRIVE ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	2	3	4
		-	53U28	PLANETARY DRIVE ASSEMBLY	▼			
		01		.SCREW, Hex head ½-13UNC x 6in.	8			
		02		.WASHER, Lock 1/2in.	8			
		03	1014Z598	.COVER	1			
		04	1018Z2902	.SEAL	4			
		05	1018Z2888	.GEAR, Ring	2			
		06	1014Z597	.HOUSING, Center section	1			
		07	1018Z2897	.PLATE, 2nd Stage back-up	1			
		08	1018Z2895	.WASHER, Thrust	1			
		09	1001Z688	.GEAR, Sun	1			
		10		.SCREW, Hex head 7/16-20UNF x 1in.	3			
		11	1018Z2900	.PLATE, Lock	3			
		12		.WASHER, Flat 7/16in.	3			
		13	1020Z2832	.SHIM, 0.002in. use	AR			
		13	1020Z2833	.SHIM, 0.003in. as	AR			
		13	1020Z2834	.SHIM, 0.005in. required	AR			
		13	1020Z835	.SHIM, 0.010in.	AR			
		14	25Z439D2	.BALL 1/4in. Dia.	6			
		15	1018Z2898	.SLEEVE, Planetary shaft	3			
		16	1018Z2893	.CAGE, 2nd Stage planetary	1			
		17	1018Z2892	.PLATE, Lock	6			
		18		.SCREW, Hex head 7-16-14UNC x 1in.	12			
		19	1018Z2894	.WASHER, Thrust	1			
		20	1020Z2836	.SCREW, Under cut countersunk head machine	6			
		21	1010Z583	.SHAFT, Planetary gear	3			
		22	1018Z2901	.CONE, Bearing	6			
		23	1025Z1231	.CUP, Bearing	6			
		24	1001Z160	.GEAR, 2nd Stage planetary	3			
		25	1018Z2886	.PLATE, 1st Stage back-up	1			
		26	1018Z2890	.RING, Thrust	1			
		27	1001Z689	.GEAR, 1st Stage sun	1			
		28	1018Z2896	.WASHER, Thrust	1			
		29	1018Z2885	.CAGE, 1st Stage planetary	1			
		30	1018Z2891	.WASHER, Thrust	1			
		31	19Z8D90	.PIN, Roll	3			
		32	1010Z582	.SHAFT, planetary	3			
		33	1018Z2887	.WASHER, Thrust	6			
		34	1025Z1230	.ROLLER	126			
		35	1018Z2889	.SPACER	3			
		36	1001Z687	.GEAR, 1st Stage planetary	3			

Ref. Dwg. 53U28

DRUM TURN INDICATOR GROUP

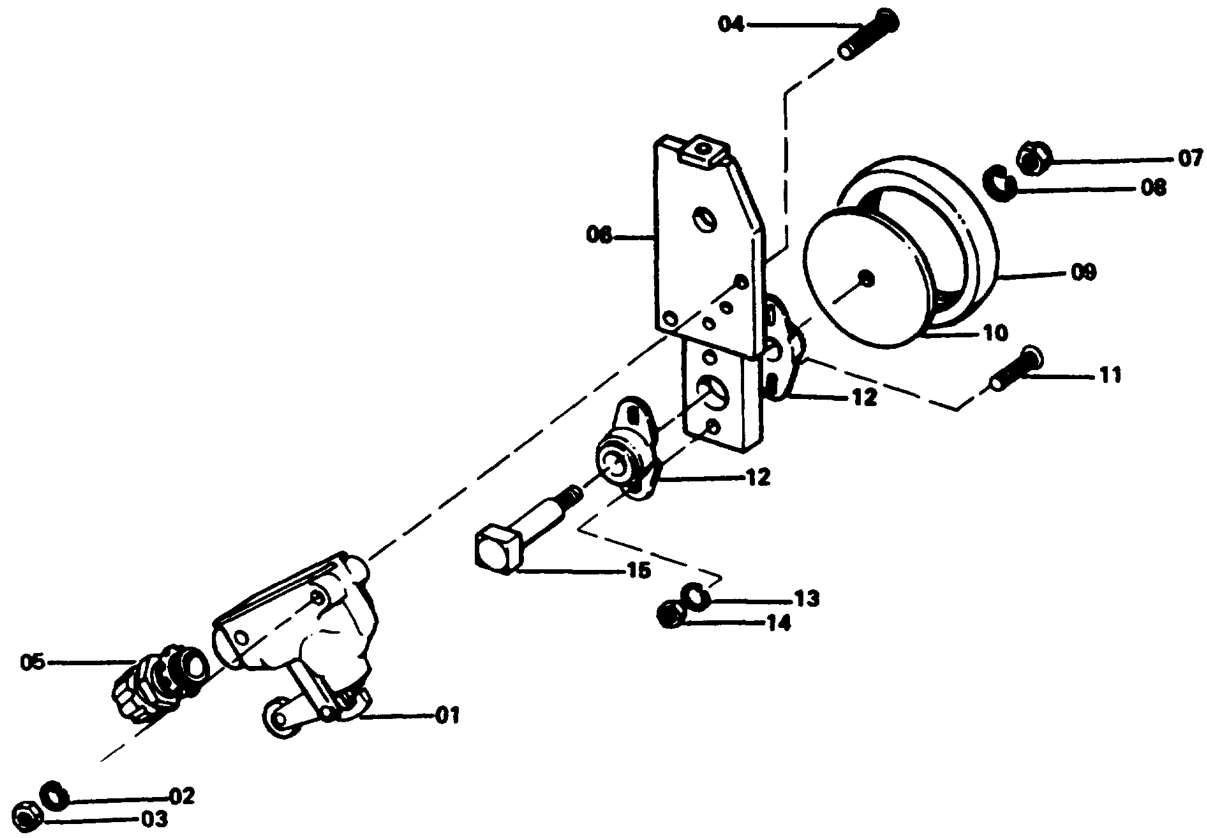


DRUM TURN INDICATOR GROUP (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-		INDICATOR, MAIN WINCH ROTATION	▼			
		-		INDICATOR, AUXILIARY WINCH ROTATION		▼		
		01	16P3450D1	.BRACKET, Rotation sending unit mounting	1	1		
		02		.SCREW, Hex hd. ½-13UNC x 1-3/4in.	1	1		
		03		.NUT, Hex ½-13UNC	2	2		
		04	17T297	.SPRING	1	1		
		05	950N3-3	.SENDING UNIT, Winch indicator (Page 31.1)	1	1		
		06	79Q302	.HARNDESS, Auxiliary which indicator	-	1		
		07	79Q301	.HARDNESS, Main which indicator	1	-		
		08	32Z890D2	.CLAMP, Wire tie	8	-		
		09	79Z1890D	.STRIP, Terminal	1	-		
		10		.SCREW, rd. hd. Mach. #8-32UNC x 1/2in.	4	-		
		11		.WASHER, Lock #8	6	-		
		12		.NUT, Hex #8-32UNCE	4	-		
		13	80Z882D1	.RESISTER	2	-		
		14	100P856-1	.INDICATOR BOX ASSEMBLY	1	-		
		14	100P856-2	.INDICATOR BOX ASSEMBLY	-	1		
		15	79Z2303D7	..HARNESS, indicator box power	1	-		
		16	32Z964D17	..PLUG, Button	1	-		
		17	56Z298D1	..LIGHT, Drum rotation indicator	1	1		
		18	32Z1430	..DECAL, Drum rotation indicator	1	-		
		19	87P50	..BOX, Indicator	1	-		
		20	79Z2423D5	..BUSHING, Strain relief	1	-		
		21		.SCREW, rd hd. Mach. #8-32unch x	2	-		

Ref. Dwg. 100X139 H
100N205 A
100X139-19
100X139-25
100N2505-1

WINCH INDICATOR BRACKET ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Number 3			
		-	950N3-3	BRACKET ASSY., Winch Indicator				
		01	79Z2453	. SWITCH	1			
		02		. . WASHER, Lock #6	2			
		03		. . NUT, Hex #6-32UNC	2			
		04		. . SCREW, Hex hd. cap #6-32UNC x 1-1/2 in..	2			
		05	79Z1886D5	. CONNECTOR, Stain relief	1			
		06	16P344OD3	. BRACKET, Drum indicator	1			
		07		. NUT, 5/16-18UNC	1			
		08		. WASHER, Lock 5/16 in..	1			
		09	20Z1381	. GROMMET	1			
		10	13Z153	. WHEEL	1			
		11		. SCREW, Round hd. mach. #10-24UNC x 1-1/8 in.	2			
		12	25Z897	. BEARING	2			
		13		. WASHER, Lock #10	2			
		14		. NUT, #10-24UNC	2			
		15	10T1381	. SHAFT, Drum indicator	1			

Ref. Dwg. 950N3 &
960N3-3

TRADEMARKS AND NAMEPLATES (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3	4		
			100J4142-3	TRADEMARKS, NAMEPLATES AND DECALS		▼		
			100J4142-2	TRADEMARKS, NAMEPLATES AND DECALS	▼			
			32R43	.DECAL, Upper lubrication	1	1		
			932T4-2	.PLATE, Serial number mounting	1	1		
			32Q339	.LABEL, Upper control	1	1		
			32Q426	.DECAL, Warranty	1	1		
			32Z180	.LABEL, Upper inspection	1	1		
			32P250	.LABEL, Recorded standards	1	1		
			32R44	.DECAL, Carrier lubrication	1	1		
			32Q341	.DECAL, Relief pressure	1	1		
			32U321	.NAMEPLATE, Boom rest	1	1		
			32Z1162	.DECAL, Upper door service plate	1	1		
			See note	.PLATE, Range	1	1		
			See note	.PLATE, Rating	1	1		
			32Q307	.DECAL, Free fall	1	1		
			32U846	.DECAL, Upper crane signals	1	1		
			32Z1260	.DECAL, Hydraulic oil	1	1		
			32Q243	.DECAL, Carrier emblem	1	1		
			32Q289	.DECAL, Upper caution	1	1		
			32Q416	.PLATE, Noise level warning	1	1		
			32Z1201	.DECAL, Diesel fuel caution	1	1		
			32Z1294	.DECAL, Upper hydraulic oil temp	1	1		
			32Z1319	.LABEL, Hydraulic oil level caution	1	1		
			32Z1320	.DECAL, Boom length 40	2	2		
			32Z1321	.DECAL, Boom length 48	2	2		
			32Z1322	.DECAL, Boom length 56	2	2		
			32Z1323	.DECAL, Boom length 64	2	2		
			32Z1324	.DECAL, Boom length 72	2	2		
			32R1	.DECAL, Boom length 80	2	2		
			20Z254D1	.DECAL, Standard crane signal door	1	1		
				.SCREW, Serial number plate mounting ¼in.self-top	4	4		
				.SCREW, Rd. hd. #10-32UNC x 1/4in. range and rating mount	4	4		
			32U950	.NUT, Hex #10-32UNC range and rating mounting	4	4		
			32Z1360	.DECAL, Lifting and tie down	1	1		
			32Q409	.PLATE, O.S.H.A. certification	1	1		
			32Z1572	.DECAL, Upper operation	1	1		
			32Z1417	.DECAL, Upper load caution	1	1		
			32Z1413	.DECAL, Main transmission control	1	1		
			32Z1414	.DECAL, Auxiliary transmission control	1	1		
			32Z1411	.DECAL, Hydraulic selector valve	1	1		
			32Q413	.DECAL, Circuit breakers	1	1		
			32Q398	.DECAL, Transmission shift chart	1	1		
			32Z975	.NAMEPLATE, Safety brake release	1	1		
			32Z1030	.NAMEPLATE, Safety brake	1	1		
			32Z1412	.DECAL, Four way flasher	1	1		
			32Z1415	.DECAL, Upper hydraulic oil	1	1		
			32Z1409	.DECAL, Ignition and engine stop	1	1		
			32Z1401	.DECAL, Machine area warning	1	1		
			32Z1418	.DECAL, Windshield wipers	1	1		
			32R60	.DECAL, Dash panel	1	1		

TRADEMARKS AND NAMEPLATES (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3	4		
			32Z1363	.DECAL, Pump control engage-disengage	1	1		
			32Z1381	.DECAL, Upper-lower air accelerator select	1	1		
			32Z1404	.DECAL, heater-defroster	1	1		
			32Z1372	.DECAL, Floodlight	1	1		
			32Z1393	.DECAL, Engine lube fitting	1	1		
			32Z324	.DECAL, Low air pressure	1	1		
			32Z1356	.DECAL, Emergency engine stop	1	1		
			32Z1422	.DECAL, Upper caution	1	1		
			32Z1407	.DECAL, Upper door warning	1	1		
			32Z1400	.DECAL, Boom warning	12	12		
			32Z1439	.DECAL, Swing brake	1	1		
			32Q501	.LABEL, Outrigger caution	3	3		
			32Z1585	.DECAL, Speed chart	1	1		
			32Z1605	.DECAL, Winch hi speed label	-	2		
			32Z1606	.DECAL, Main winch label	-	1		
			32Z1607	.DECAL, Auxiliary winch low speed label	-	1		
			32Z1608	.DECAL, Winch low speed label	-	2		
				NOTE				
				All orders involving rating plates and range diagrams MUST include both the Serial Numbers and Model Number of the machine it is to be used on.				

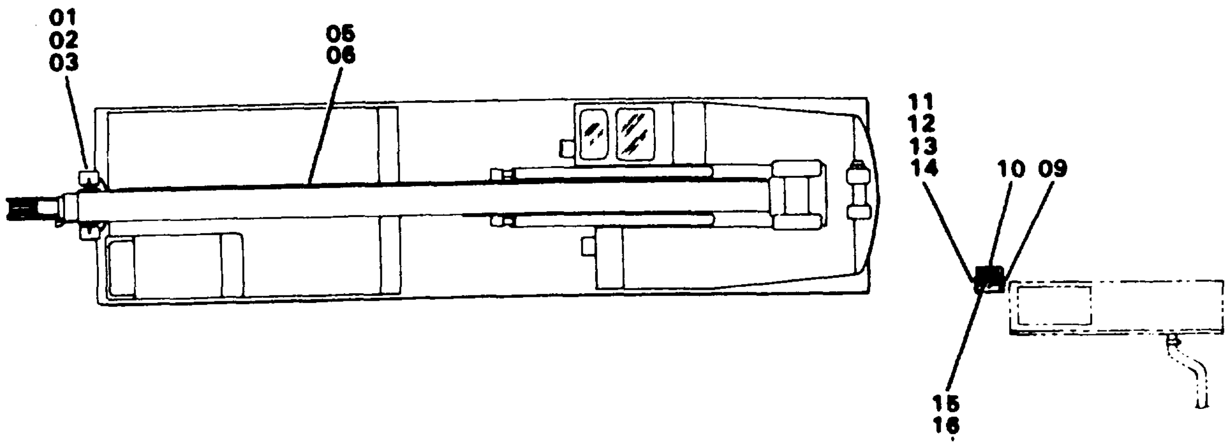
Ref. Dwg. 100J4142 H
100J4142-4
100J4142-3

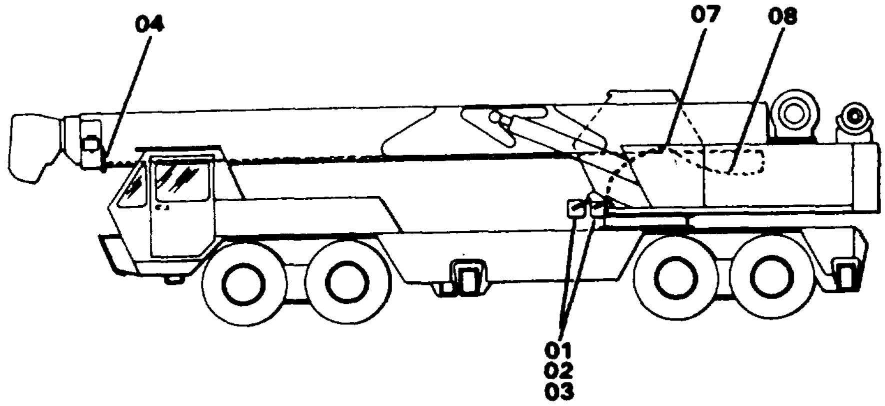
TOOLS

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1			
		-	100T234-1	TOOLS				
			21Z2	.GUN, Grease	1			
			44Z111	.HOSE ASSENBLY, Grease gun	1			
			44Z1D26	.WRENCH, Wheel nut	1			
				.HANDLE, Wheel nut wrench	1			
				.ADAPTER, Grease extension	1			

Ref. Dwg. 100T234 B
100T234-1

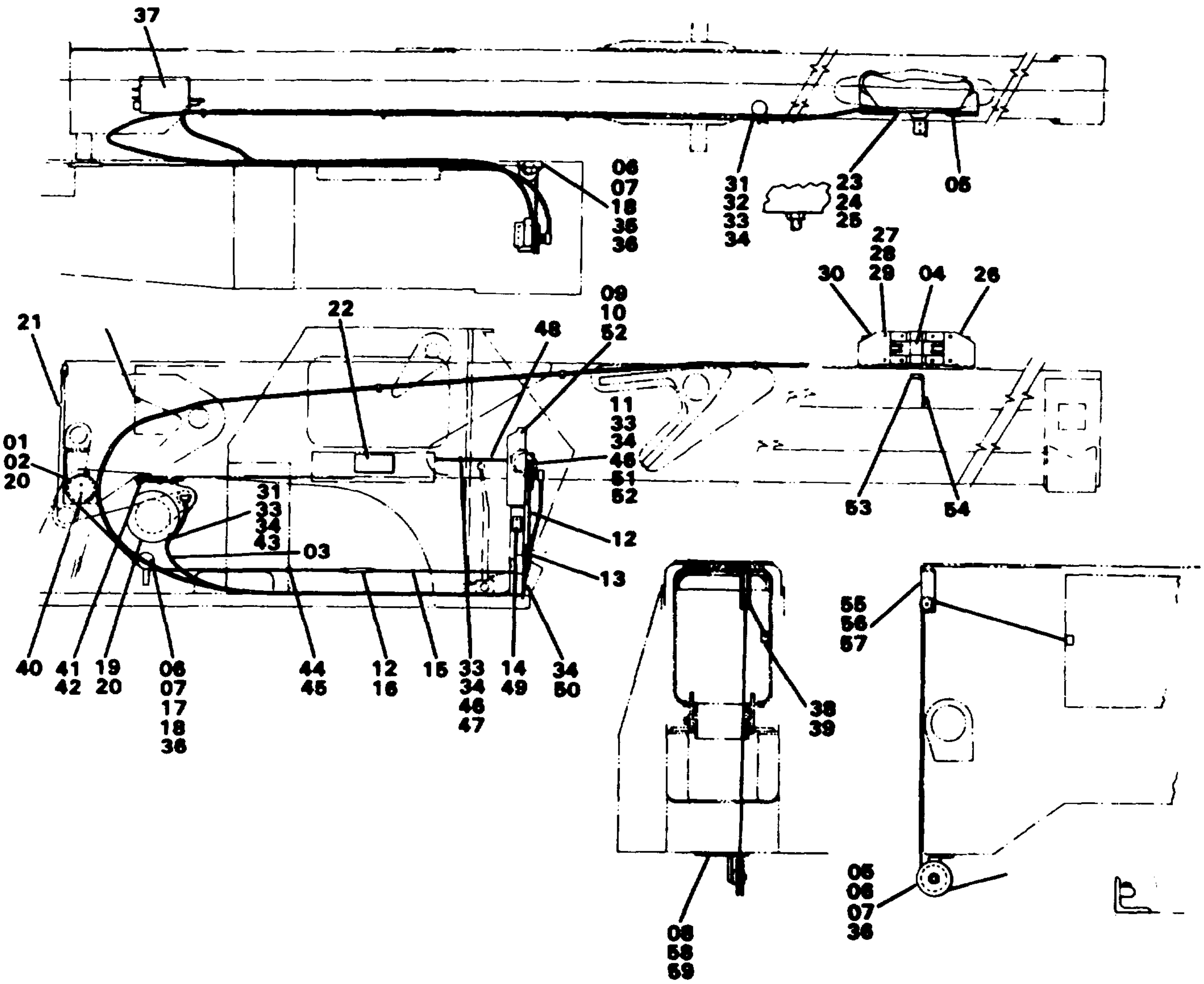
FLOODLIGHT INSTALLATION





Rd.	Part Number	Description	Quantity Figure Number 5
	100J3659-5	FLOODLIGHT INSTALLATION	
01	56Z30	. FLOODLIGHT.	4
02		. WASHER, Lock 3/8 in	16
03		SCREW, Hex hd. cap 3/8-16UNC x 1-1/2 in	16
04	820T530	: TUBE, Floodlight cable	1
05		. TUBE, Steel 5/8 x 0.049 wall x 40 ft..	1
06	32Z114D20	. CLAMP, Tube.	4
07	20F57D8	. GROMMET	1
08		. LOOM, Wire 1/4 in. ID x 10 ft.	1
09	20F57D25	. GROMMET	1
10	32Z1159	. DECAL, Caution.	2
11	79T237	. BOX, Switch.	1
12		. NUT, Hex 1/4-20UNC	4
13		. WASHER, Lock 1/4 in	4
14		. SCREW, Hex hd. cap 1/4-20UNC x 1/2 in	4
15	32Z1257	. DECAL, Light.	1
16	79Z1	. SWITCH, Utility	2
		NOTE All individual wires, leads and jumpers should be fabricated locally.	

Ref. Dwg. 100J3659G
100J3659-5



Ref.	Part Number	Description	Quantity					
			Figure Number					
			1					
	100X134-1	SAFELOAD INDICATOR ASSEMBLY						
	79Q268	. WEIGHLOAD ASSEMBLY	1					
01	7T362	. . SHEAVE AND LEVER ASSEMBLY, Boom foot	1					
02	7Z376	. . . SHEAVE, boom foot	1					
03	10Z438	. . . CABLE, 13ft. 6in. flexible drive	1					
04	19T5282	. . . PIN, Dynamometer	1					
05	18Z2360	. . . WASHER, Bevel 5/8 in	4					
06	7Z375	. . SHEAVE,Cable	2					
07	18Z2334	. . WASHER, Thrust	4					
08	18P3740	. . BRACKET, Sheave	1					
09	80Z912	. . CONTROL ASSEMBLY, W/capillary	1					
10		. . SCREW, Sock. hd. cap 5/16-18UNC x 7/8 in	4					

SAFELOAD INDICATOR ASSEMBLY (Continued))

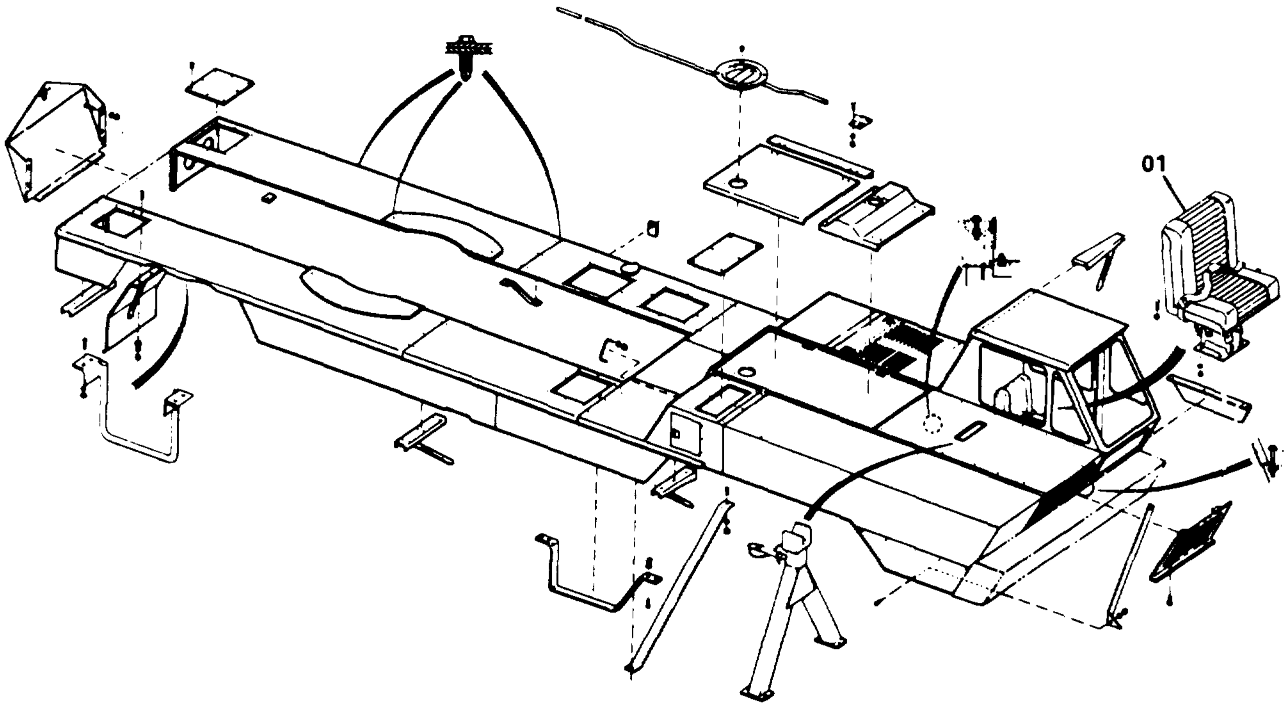
REF.	Part Number	Description	Quantity / Figure Number 1					
11	47Z78	..ALARM	1					
12	30Z189	..TERMINAL, Wire rope	3					
13	17Z569	..SPRING	1					
14	18Z2382	..CAM, 32ft. boom-7 part line-outriggers	1					
14	18Z2383	..CAM, 48ft. boom-6 part line-outriggers	1					
14	18Z2384	..CAM, 64ft. boom-4 part line-outriggers	1					
14	18Z2385	..CAM, 80ft. boom-3 part line-outriggers	1					
14	18Z2386	..CAM, 80ft. boom-2 part line-outriggers	1					
14	18Z2387	..CAM, 80ft. boom-1 part line-outriggers	1					
14	18Z2357	..CAM, 25ft. jib	1					
14	18Z2389	..CAM, 3 part line-over rear tires	1					
14	18Z2390	..CAM, 2 part line-over side tires	1					
15	30Z188	..CABLE, 27ft. boom angle	1					
16	6Z509	..TURNBUCKLE	2					
17	16Z403	..BRACKET, Sheave	1					
18		..WASHER, Flat 5/8in.	1					
19	86Z83	..REEL, Cable	0					
20	30Z190	..TERMINAL, Brass cable	1					
21	30Z187	..CABLE, 100ft. boom length	4					
22	32Z1395	..PLATE, Instruction	1					
23	80Z913	..DYNAMOMETER	1					
24		..SCREW, Sock. hd. Cap 5/16-22UNF x 1in.	1					
25		..PIN, Cotter 1/8 x 1-3/4 in. lg.	2					
26	16P3745D1	.BRACKET, Dynamometer	2					
27		.SCREW, Hex. hd. Cap 5/8-11UNC x 2in.	1					
28		.NUT, Hex 5/8-11UNC	4					
29		.WASHER, Lock 5/8in.	4					
30	16P3745D2	.BACKET, Dynamometer	4					
31	32Z423D10	.HANGER, Cable	1					
32		.SCREW, Hex. hd. Cap ¼-20UNC x 3/4in.	6					
33		.WASHER, Lock ¼ in.	5					
34		.NUT, Hex. ¼-20UNC	9					
35	16T4906	.BRACKET, Sheave	1					
36		.PIN, Cotter 1/8 x 1-1/4in. lg.	1					
37	16T3835	.BRACKET, Cable reel	1					
38	18T9905	.RETAINER	2					
39	16Z106	.STOP, Throttle	1					
40		.SCREW, Button sock. hd. ½-13UNC x 1-1/2in.	1					
41		.SCREW, Hex. hd. Cap ½-13UNC x 1-1/4in.	1					
42		.WASHER, Lock 1/2in.	3					
43		.SCREW, Hex. hd. Cap ¼-20UNC x 1-1/4in.	3					
44	20Z1509D1	.NIPPLE, Bushed conduit	3					
45	20Z1512D1	.NUT, Lock ½-13UNC	2					
46		.SCREW, Rd. hd. Mach. ¼-20UNC x 1/2in	1					
47	32Z423D13	.CABLE, Hanger	1					
48	79P358	.HARNESS, Wiring	2					
49		.NUT, Wing 3/8-16UNC	1					
50	20Z1251D24	.BOLT, Eye ¼ X 4 X 9/16in	1					
51	79Z1885D5	.CONNECTOR, Strain relief	1					
52	79Z703D16	.CONNECTOR, Butt	1					
			1					
			2					

SAFELOAD INDICATOR ASSEMBLY (Continued))

REF.	Part Number	Description	Quantity Figure Number 1				
53	16T4972	.BRACKET, Dynamometer	1				
54	16T4997	.BRACKET, Deflector	1				
55	20Q1D36	.BOLT, Shoulder	1				
56	7Z356	.SHEAVE	1				
57	16T4919	.HANGER	1				
58		.WASHER, Lock 3/8in.	2				
59		.SCREW, Hex. hd. Cap 3/8-16UNC x 1-1/4in.	2				

Ref. Dwg. 100X134 G
100X134-1

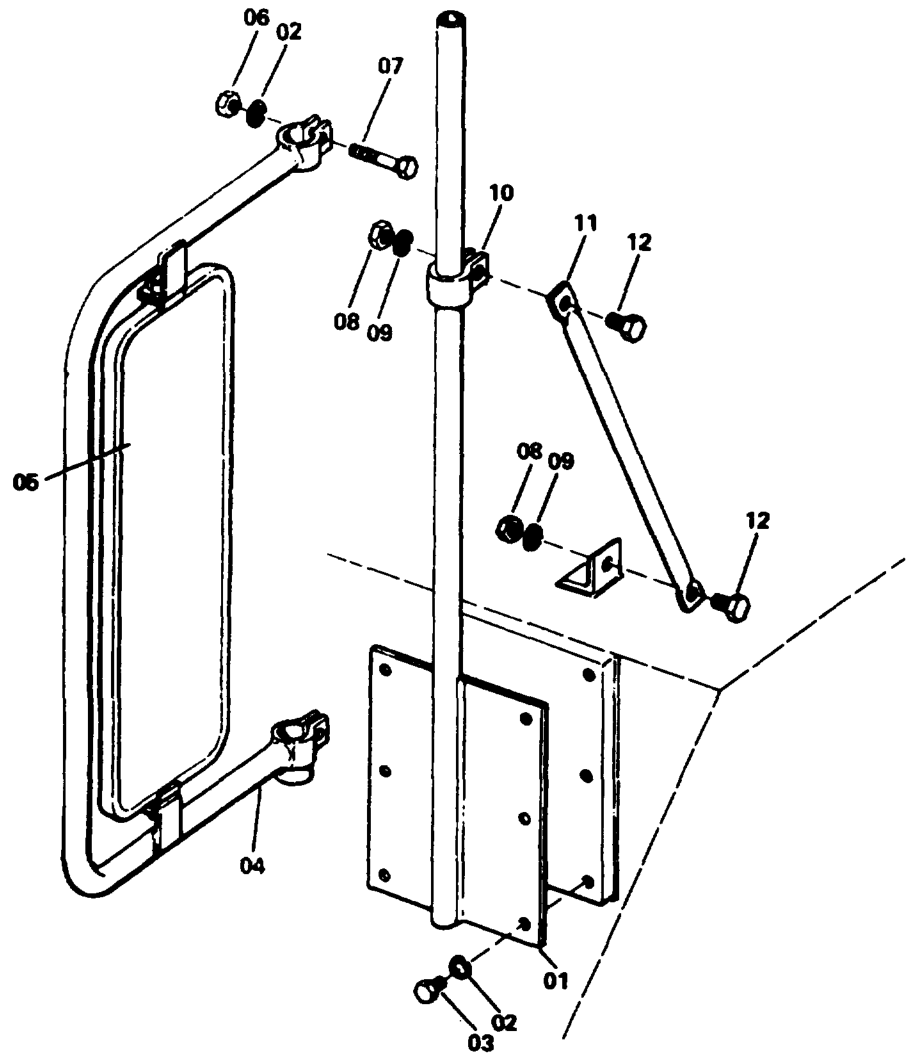
CAB AND BODY ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 6	7	8	9
		-	8100J1834-6	CAB AND BODY ASSEMBLY	▼			
		-	8100J1834-7	CAB AND BODY ASSEMBLY		▼		
		-	8100J1834-8	CAB AND BODY ASSEMBLY			▼	
		-	8100J1834-9	CAB AND BODY ASSEMBLY				▼
		01	48U22	.SEAT, Operators (**Page 5.1**)	1	1	-	-
		01	8100N175-1	.SEAT AND BELT ASSY (**Page 5.**2)	-	-	1	1

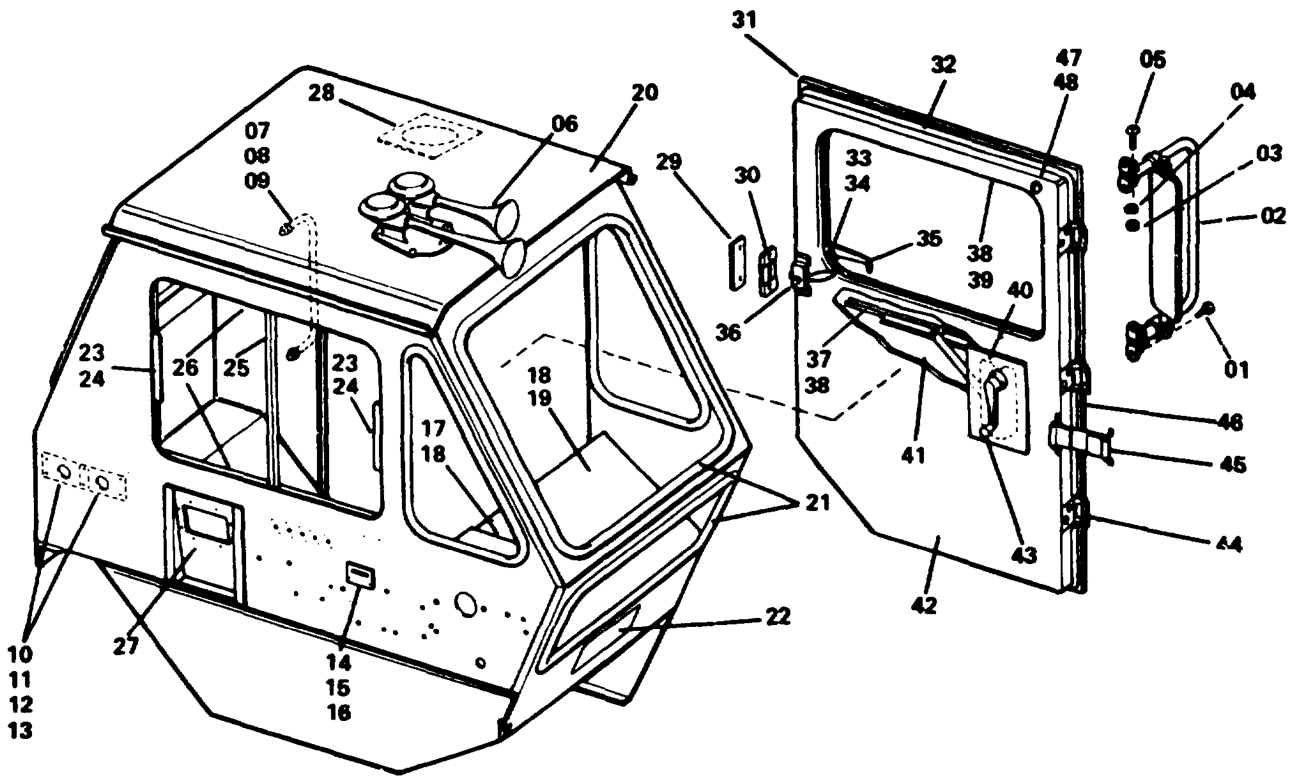
Ref. Dwg. 8100J1834 AE
8100J1834-6
8100J1834-7
8100J1834-8
8100J1834-9

SAFELOAD INDICATOR ASSEMBLY



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity / Figure Number			
		-	100X134-1	SAFELOAD INDICATOR ASSEMBLY				
		-	79Q268	.WEIGHLOAD ASSEMBLY	1			
		01	7T362	..SHEAVE AND LEVER ASSEMBLY, Boom foot	1			
		02	7Z376	…SHEAVE, boom foot	1			
		03	10Z438	…CABLE, 13ft. 6in. flexible drive	1			
		04	19T5282	…PIN, Dynamometer	1			
		05	18Z2360	…WASHER, Bevel 5/8in.	4			
		06	7Z375	…SHEAVE, Cable	2			
		07	18Z2334	..WASHER, Thrust	4			
		08	16P3740	..BRACKET, Sheave	1			
		09	80Z912	..CONTROL ASSEMBLY, W/capillary	1			
		10		..screw, Sock. Hd. Cap 5/16 – 18UNC x 7/8in.	4			

CARRIER CAB ASSEMBLY



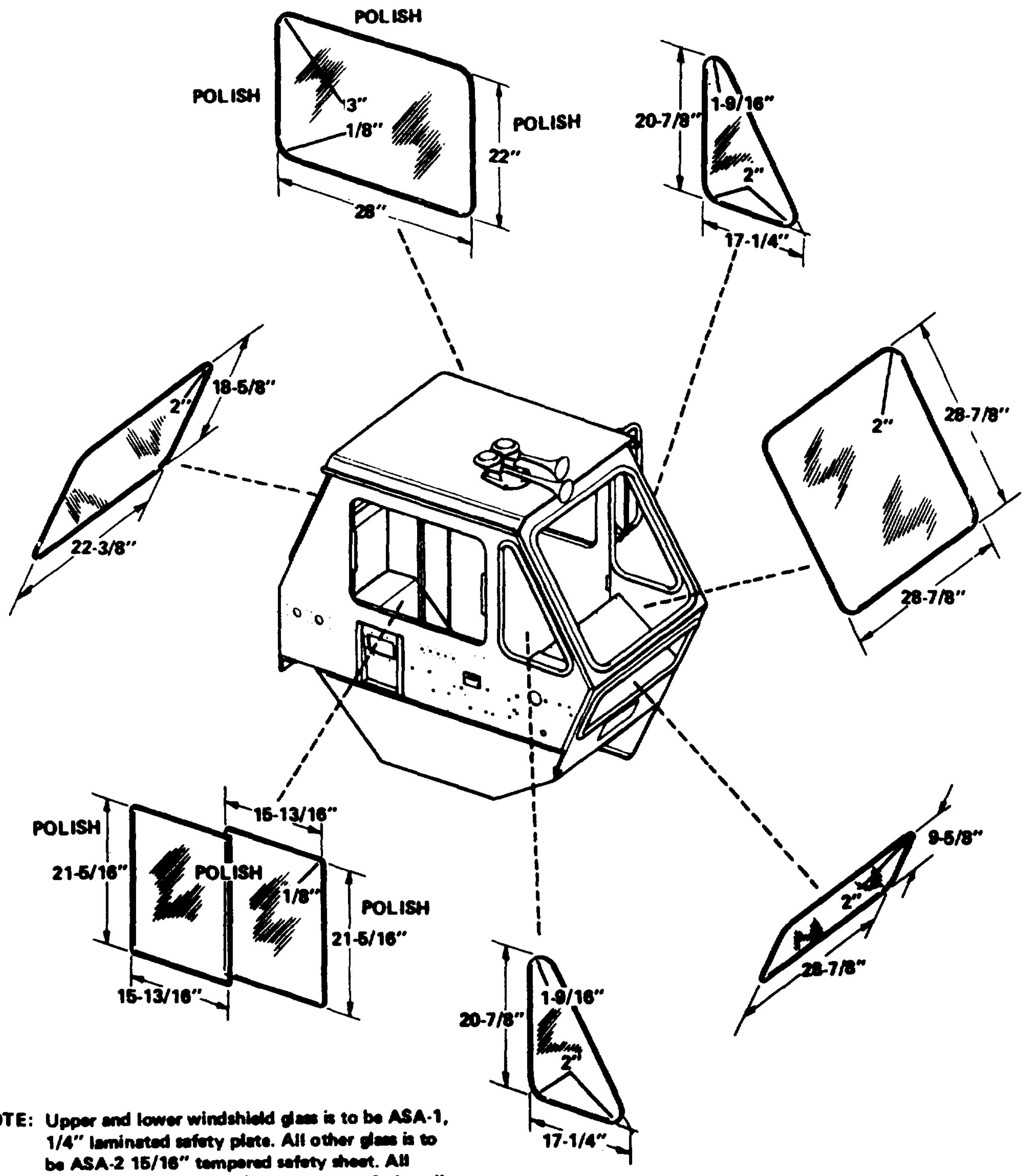
Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number 1	2		
		-	100J4268-1	CAB ASSEMBLY - CARRIER				
		-	100J4268-2	CAB ASSEMBLY-CARRIER				
		-	8100P563-2	. MIRROR ASSEMBLY	1	1		
		01		. . SCREW, Self-tapping 1/420UNC	4	4		
		02	56Z145	. . MIRROR ASSEMBLY	1	1		
		03		. NUT, Hex 4/4-20UNC	2	2		
		04		. WASHER, Lock 1/4 in	2	2		

CARRIER CAB ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	2		
		05		.SCREW, Rd. hd. Mach. ¼-20UNC x 3/4in.	2	2		
		-	100P824-2	.AIR HORN INSTALLATION	1	1		
		-	47Z55	..AIR HORN ASSEMBLY	1	1		
		06	1047Z10	…HORN, AIR	1	1		
		-	1045Z1336	…KIT, Solenoid horn button wiring and tubing	1	1		
		-	1036Z724	…VALVE, Air horn solenoid	1	1		
		07	832T32	.HANDLE, Cab	1	1		
		08		.WASHER, Lock 1/2IN.	4	4		
		09		.NUT, Hex ½-13UNC	4	4		
		10	14T1520	.PLATE, Selector valve cab cover	1	1		
		11		.SCREW, Rd. hd. Mach. 5-16-18UNC x 1/2in.	2	2		
		12		.WASHER, Lock 5/16in.	2	2		
		13		.NUT, Hex 5/16-18UNC	2	2		
		14	814T27	.COVER, Remote control	1	1		
		15		.SCREW, slotted rd. hd. mach. #8-32UNC x 1/2in.	2	2		
		16		.NUT, Hex 8-32UNC	2	2		
		17	827P532D1	.PLATE, R.H. side dash cover	1	-		
		17	827P532D2	.PLATE, R.H. side dash cover	-	1		
		18	20Z40D13	.SCREW, Self-tapping #10	8	8		
		19	827T361D2	.PLATE, Center dash cover	1	-		
		19	827T361D1	.PLATE, Center dash cover	-	1		
		20	837J135D2	.CAB	1	1		
		21	27Z385	..CHANNEL, Glass mounting rubber	AR	AR		
		22	1027Z69	..DOOR, Vent	1	1		
		23	27Z519	..HANDLE, Window lift	2	2		
		24	27Z649	..STRIP, Glass setting rubber	AR	AR		
		25	27Z520	..STRIP, R.H. center rubber weather	1	1		
		26	27Z521	..CHANNEL, Double glass	1	1		
		27	814P12D2	..COVER, shaft lever	1	1		
		28	816T997	..PLATE, Dome light mounting	1	1		
		29	1027Z124	..STRIP, Tapping	1	1		
		30	1018Z4252	..PLATE, Lock striker	1	1		
		31	1027Z125	..DOOR ASSRMBLY	1	1		
		32	1027Z132	…SEALER, Door	1	1		
		33	1027Z11	…SHEILD, adjustment	1	1		
		34	1020Z35	…SCREW, Regulator	1	1		
		35	1006Z8	…HANDLER, Outer door locking	1	1		
		36	1006Z542	…LOCK, Inner door	1	1		
		37	1027Z118	…CHANNEL, Regulator bottom	1	1		
		38	1027Z131	…STRIP, Window weather	2	2		
		39	1027Z16	…CHANNEL, Top window glass	1	1		
		40	1027Z8	…REGULATOR, Window	1	1		
		41	1027Z133	…PANEL, Outer door	1	1		
		42	1027Z122	…PANEL, Inner door	1	1		
		43	1006Z7	…HANDLE, Window regulator	1	1		
		44	1027Z19	…HINGE, Door	3	3		
		45	1027Z18	…STRAP, Door check	1	1		
		46	1027Z117	…SEAL, Hinge rubber	2	2		
		47	1020Z4271	…SCREW, Phillips rd. hd.	1	1		
		48	1020Z4270	…NUT, Tinnerman	1	1		

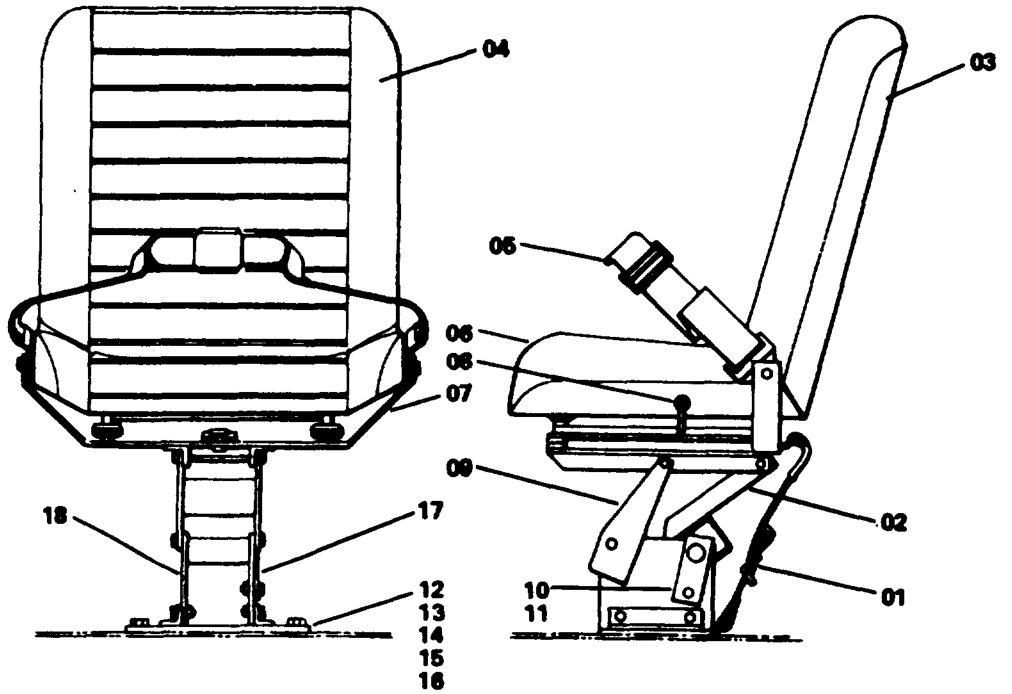
Ref. Dwg. 100J4268 F
100J4268-1
100J4268-2

CARRIER CAB GLASS



NOTE: Upper and lower windshield glass is to be ASA-1, 1/4" laminated safety plate. All other glass is to be ASA-2 15/16" tempered safety sheet. All dimensions given are ±1/16" tolerance. Swipe all edges except where noted. All glass is available from CHICAGO MANUFACTURING CO. 1855 South 54th Avenue, Chicago, Illinois 60650.

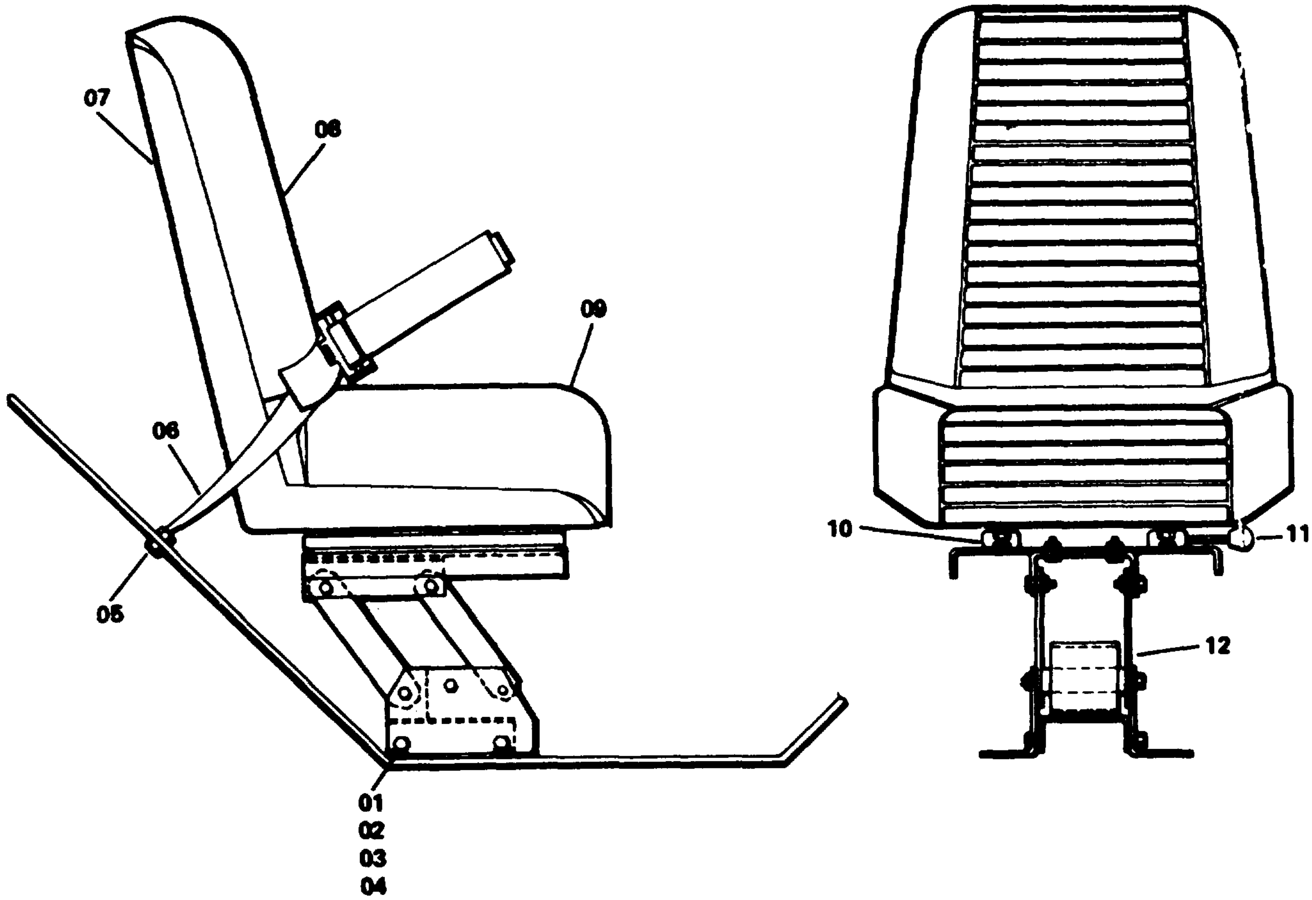
CARRIER SEAT AND SAFETY BELT ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity / Figure Number			
		-	48U22	SEAT & SAFETY BELT ASSY. – CARRIER	▼			
		01	1048Z38	.BELT, Anchor	1			
		02	1048Z37	.LINKANGE, Seat housing	1			
		03	1048Z36	.SHELL	1			
		04	1048Z28	.CUSHION, Back	1			
		05	1048Z35	.BELT, Safety	1			
		06	1048Z34	..CUSHION, Seat	1			
		07	1048Z29	.BRACKET, Seat mounting	1			
		08	1048Z33	.BALL, Control level	1			
		09	1048Z32	.BRACKET, Housing linkage	1			
		10	1010Z532	.SHAFT, Linkage	1			
		11	1020Z2523	.KEY, Linkage shaft	1			
		12	1048Z31	.PLATE, Base	1			
		13	20Z646D48	.SCREW, Hex hd. 3/8-16UNC x 1-1/4 in. Gr.5	4			
		14		.WASHER, Flat 3/8 in.	4			
		15		.WASHER, Lock 3/8 in.	4			
		16		.NUT, Hex 3/8-16UNC	4			
		17	1048Z30	.PLATE, L.H. side mounting	1			
		18	1048Z27	.PLATE, R.H. side mounting	1			

Ref. Dwg. 48U22
48U22

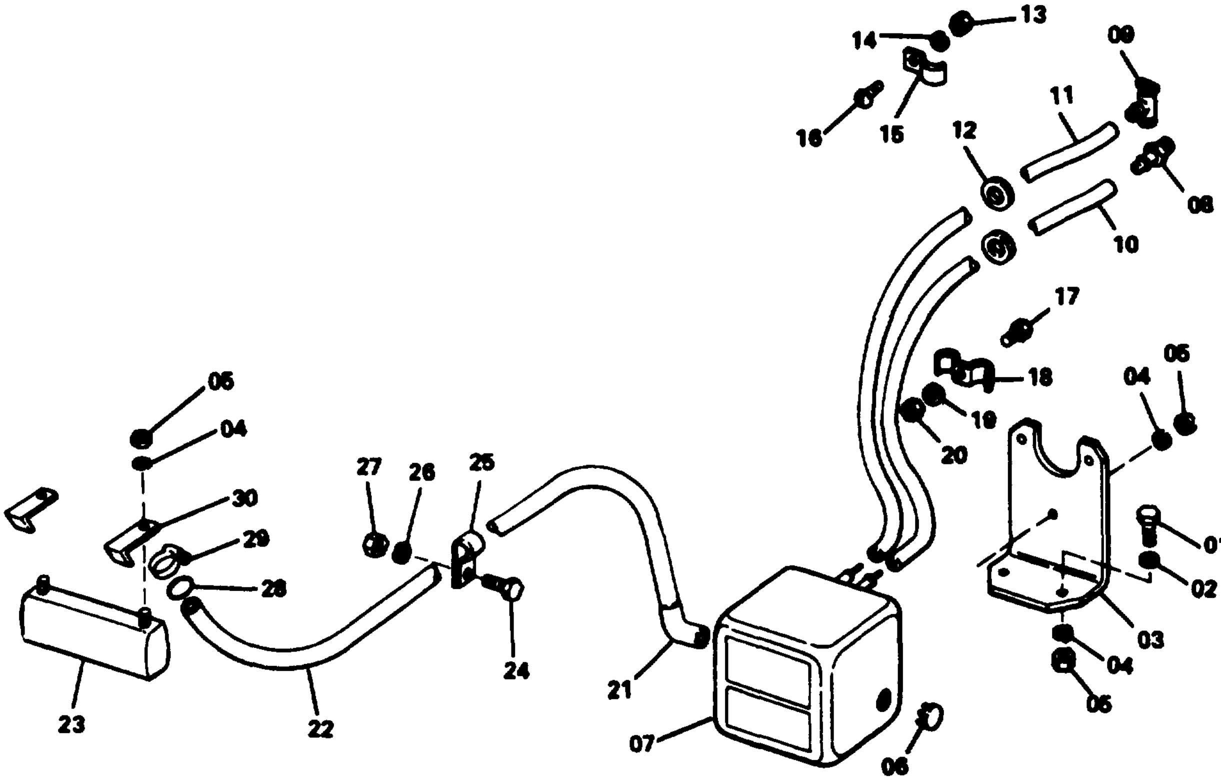
CARRIER SEAT AND SAFETY BELT ASSEMBLY



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity			
					Figure Number			
					1			
		-	8100N175-1	SEAT & BELT ASSY. – CARRIER				
		01		.NUT, Hex 3/8-16UNC	4			
		02		.WASHER, Lock 3/8in.	4			
		03		.WASHER, Flat 3/8in	4			
		04	20Z646D48	.SCREW, Hex HD. 3/8-16UNC x 1-1/4in. Gr.5	4			
		05	7Z371D1	.BELT, SAFETY	1			
		06	48U31	.SEAT, Carrier	1			
		07	1048Z99	…SHELL	1			
		08	1048Z94	..CUSHION, Back	1			
		09	1048Z95	..CUSHION, Seat	1			
		10	1048Z101	..TRACK, Free sliding	1			
		11	1048Z100	..TRACK, Control sliding	1			
		12	1048Z98	..BASE, Shock	1			

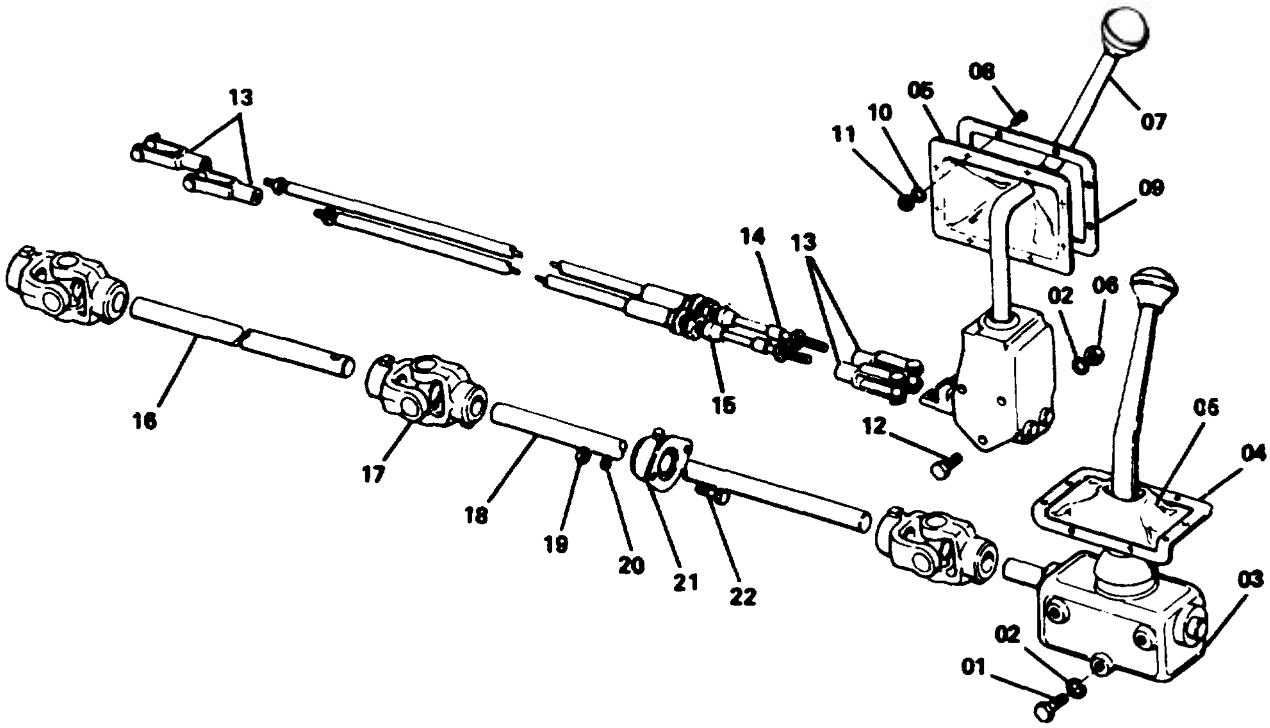
Ref. Dwg. 8100n175
8100N175-1

HEADER and DEFROSTER INSTALLATION



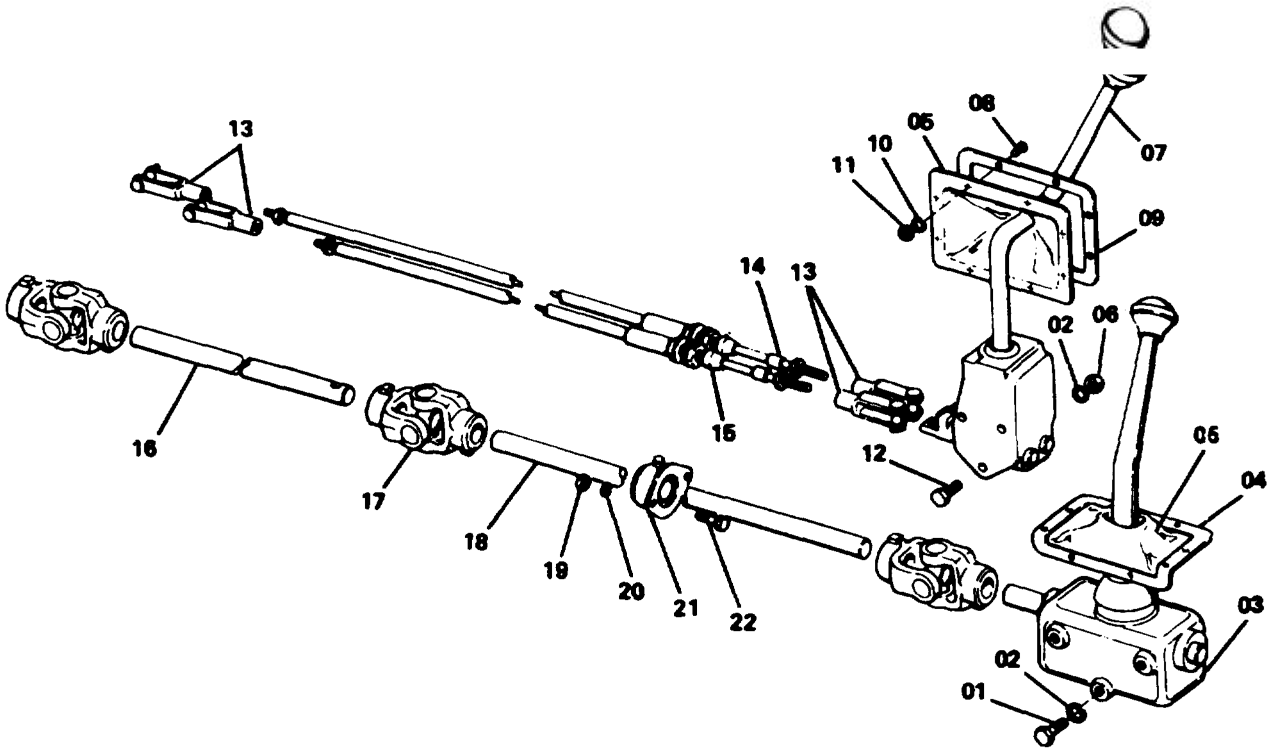
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	8100N4014-1	HEATER and DEFROSTER INSTALLATION	▼			
		01		.SCREW Hex, hd.5-16-16UNC x 1-3/4in.	2			
		02		.WASHER, F:at 5-16in.	2			
		03	816P614	.BRACKET, Heater mounting	1			
		04		.WASHER. Lock 5-16in.	5			
		05		NUT, Hex 5-16-16UNC	5			
		06	44Z139D15	.PLUG, Heater	1			
		07	80Z921	.HEATER	1			
		08		..FITTING, Return line	1			
		09		.VALVE, Heater shut-off	1			
		10	820T409D8	.HOSE, Heater return to engine	1			
		11	820T4094D4	.HOSE, Heater suction	1			
		12	20F57D37	.GROMMET, Heater hose	2			
		13		.NUT, Hex #10-32UNC	2			
		14		.WASHER, Lock #10	2			
		15	32Z33D2	.CLAMP, Heater wire	2			
		16		.SCREW, Rd. hd. #10-32UNCE x ¼ in,	2			
		17		.SCREW, Hex hd. ¼-20UNC x 3/4in.	1			
		18	32Z423D2	.CLAMP, Double hose	2			
		19		.WASHER, Lock ¼ in.	2			
		20		.NUT, Hex ¼-20UNC	2			
		-	80Z922	.DEFROSTER	1			

TRANSMISSION CONTROL ASSEMBLY



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity / Figure Number			
		-	8100J0764-1	TRANSMISSION CONTROL ASSY				
		-	80100J0764-2	TRANSMISSION CONTROL ASSY				
		01		.SCREW, Hex hd. 3/8-16UNC x 1-1/4in.				
		02		.WASHER, Lock 3/8IN.				
		03	6Z524	.LEVEL, Main transmission shift (Page 8.1)				
		04	45U7	.BOOT, Transmission level				
		05	827P559	.PLATE, Main boot				
		06		.NUT, Hex, 3/8-16UNC				
		07	6Z523	.LEVEL, Aux. Transmission shift (Page 9.1)				
		07	SEE NOTE	.LEVEL, Aux. Transmission shift (Page 9.1)				
		08		.SCREW, Rd. hd. Mach. #10-24UNC x 1/2in.				
		09	827P49	.PLATE, Aux. Boot				
		10		.WASHER, Lock #10				
		11		.NUT, Hex hd. 3/8-16UNC x 1in.				
		12		.SCREW, Hex hd. 3/8-16UNC x 1in.				
		13	6Z284D13	.CLEVIS ASSY				
		14	6011D64	.CABLE, Control				
		15	6Q11D55	.CABLE, Control				
		16	SEE NOTE	.ROD, Main transmission control				
		17	18Z2211	.JOINT, Universal				
		18	820T514D1	.ROD, Main transmission control				
		18	SEE NOTE	.ROD, Main transmission control				
		19		.NUT, Hex ¼-20UNC				
		20		.WASHER, Lock 1/4in.				
		21	6Z353D10	.BEARING				
		22		.SCREW, Hex hd. ¼-20UNC x 1in.				
				NOTE				
				References 07, 16 and 18 vary by the power which is used. For these part numbers consult your power plant assembly.				

Ref. Dwg. 8100J0764 C
8100J0764-1
8100J0764-2



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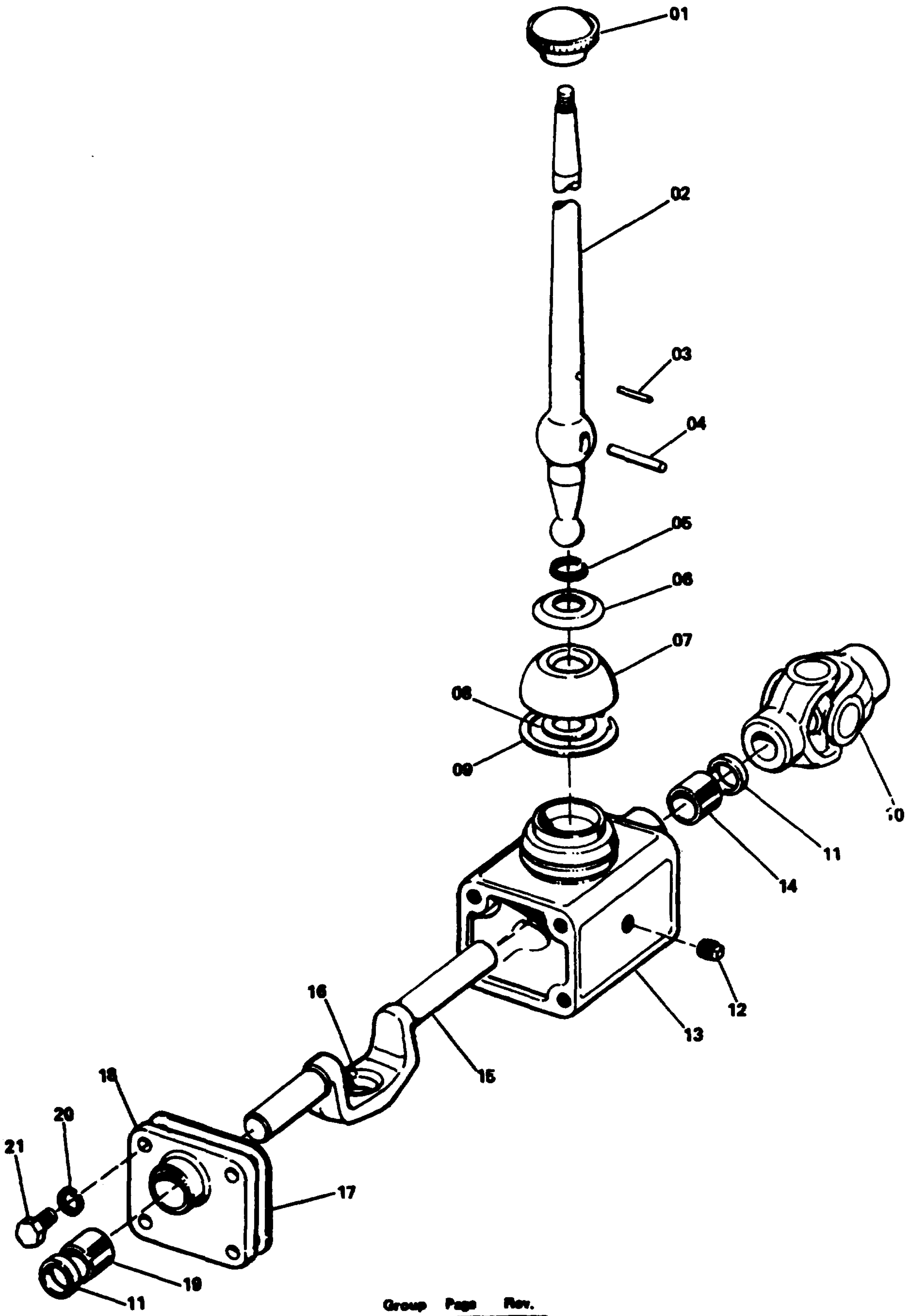
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	2		
		-	8100J0764-1	TRANSMISSION CONTROL ASSY				
		-	8100J0764-2	TRANSMISSION CONTROL ASSY				
		01		.SCREW, Hex hd. 3/8-16UNC x 1-1/4 in.	3	3		
		02		.WASHER, Lock 3/8 in.	6	6		
		03	6Z524	.LEVER, Main transmission shift (Page 8.1)	1	1		
		04	45U7	.BOOT, Transmission lever	2	2		
		05	827P559	.PLATE, Main boot	1	1		
		06		.NUT, Hex, 3/8-16UNC	3	3		
		07	6Z523	.LEVER, Aux. Transmission shift (Page 9.1)	1	-		
		07	SEE NOTE	.LEVER, Aux. Transmission shift (Page 9.1)	-	1		
		08		. SCREW, Rd. hd. Mach #10-24UNC x 1/2in.	8	8		
		09	827P49	.PLATE, Aux boot	1	1		
		10		.WASHER, Lock #10	8	8		
		11		.NUT, Hex 10-24UNC	8	8		
		12		.SCREW, Hex hd. 3/8-16UNC x 1 in.	3	3		
		13	6Z284D13	.CLEVIS ASSY	4	4		
		14	6011D64	.CABLE, Control	1	1		
		15	6Q11D55	.CABLE, Control	1	1		
		16	SEE NOTE	.ROD, Main transmission control	1	1		
		17	18Z2211	.JOINT, Universal	1	1		
		18	820T514D1	.ROD, Main transmission control	1	-		
		18	SEE NOTE	.ROD, Main transmission control	-	1		
		19		.NUT, Hex ¼-20UNC	2	2		
		20		.WASHER, Lock ¼ in.	2	2		
		21	6Z353D10	.BEARING	1	1		
		22		.SCREW, Hex hd. ¼-20UNC x 1 in.	2	2		
				NOTE				
				References 07, 16 and 18 vary by the power plant which used. For these part numbers consult your power plant assembly.				

Ref. Dwg. 8100J0764 C
8100J0764-1
8100J0764-2

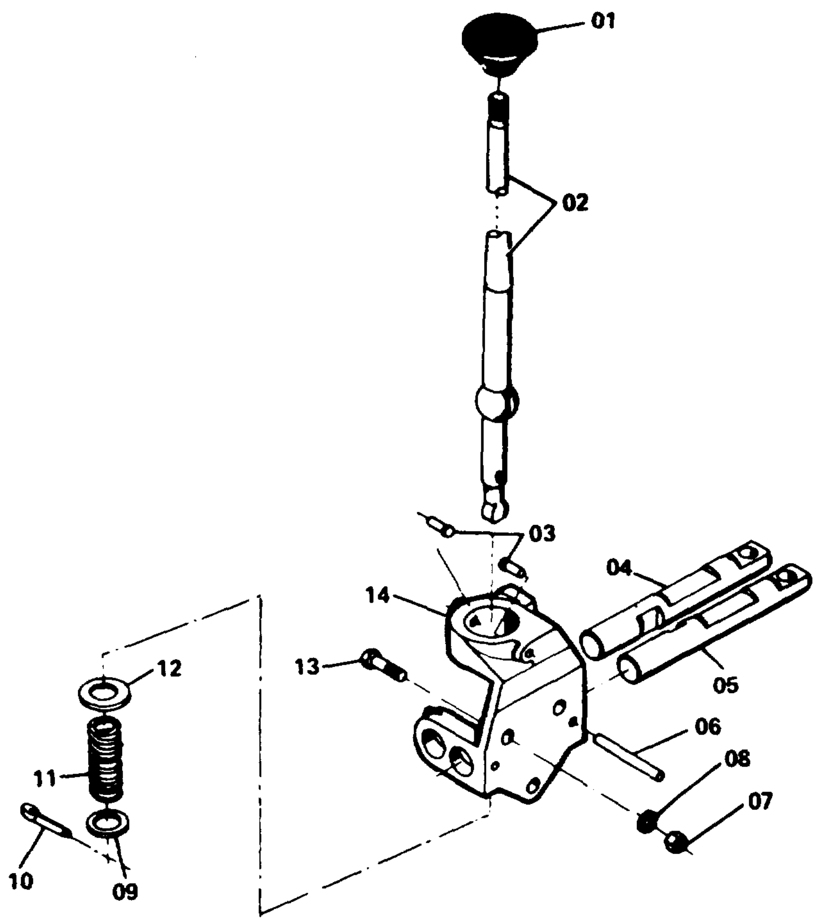
MAIN TRANSMISSION SHIFT LEVER ASSEMBLY



MAIN TRANSMISSION SHIFT LEVEL ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number				
		-	6Z524	LEVER ASSY., MAIN TRANSMISSION SHIFT					
		01	1006Z395	.BALL, Shift lever	1				
		02	1006Z648	.LEVER, Shift	1				
		03	1019Z237	.PIN, Collar	1				
		04	1010Z194	.SHAFT, Shift lever lock	1				
		05	1017Z227	.SPRING, Compression	1				
		06	1018Z740	.collar, Compression	1				
		07	1025Z423	.CUP, Compression	1				
		08	1018Z741	.WASHER, Compression	1				
		09	1018Z739	.RING, Lock shaft snap	1				
		10	18Z2211	.JOINT, Universal	1				
		11	1018Z3445	.SEAL, Oil	2				
		12	1020Z3824	.PLUG, Housing oil	1				
		13	1014Z926	..HOUSING, Shift control	1				
		14	1005Z413	..BUSHING, Housing	1				
		15	1020Z3822	.ROD, Control	1				
		16	1005Z500	..BUSHING, Control rod	1				
		17	1020Z3823	.GASKET, Housing end cover	1				
		18	1014Z923	.COVER, Housing end	1				
		19	1005Z413	..BUSHING, Housing end cover	1				
		20	1018Z3868	.WASHER, Lock	4				
		21	1020Z3825	. SCREW, Cover mounting	4				

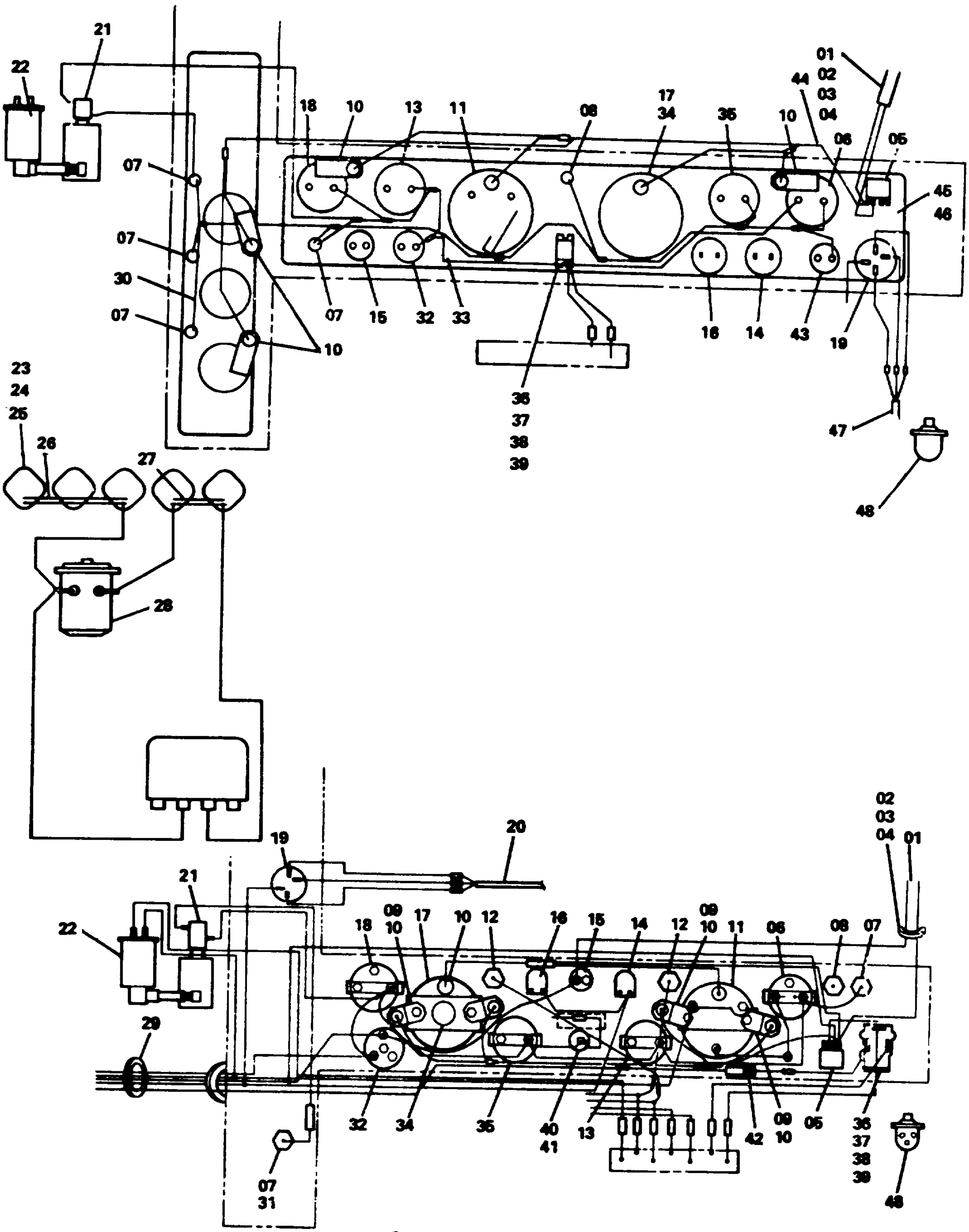
Ref. Dwg. 6Z524



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity			
					Figure Number			
		-	6Z523	LEVER ASSY., AUX. TRANS. CONTROL	▼			
		-	6Z526	LEVER ASSY., AUX. TRANS. CONTROL		▼		
		01	1006Z477	.KNOB, Control level	1	-		
		01	1006Z395	.KNOB, Control level	-	1		
		02	6Z550	.LEVEL, Aux. Transmission control	1	-		
		02	1006Z573	.LEVEL, Aux. Transmission control	-	1		
		03	1019Z739	.PIN, Shift level pivot	2	2		
		04	1006Z396	.SLIDE, Right shift	1	1		
		05	1006Z397	.SLIDE, Left shift	1	1		
		06	1019Z741	.PIN, Shift slide stop	1	1		
		07		.NUT, Hex 3/8-16UNC	3	-		
		08		.WASHER, Lock 3/8in.	3	-		
		09	1018Z3453	.WASHER, Lower spring	1	1		
		10	1019Z803	.PIN, Shifter lever cotter	1	-		
		10	1019Z740	.PIN, Shift lever cotter	-	1		
		11	1017Z794	.SPRING, Shift level	1	1		
		12	1018Z3444	.WASHER, Upper spring	1	1		
		13		.SCREW, Hex hd. Cap 3/8-16UNC x 1in.	3	-		
		14	1016Z313	.BRACKET, Shift lever	1	1		

Ref. Dwg. 6Z523
6Z526

CARRIER CAB DASH PANEL GROUP



CARRIER CAB DASH GROUP (Continued))

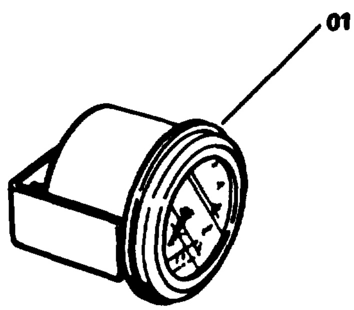
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 2	3			
		-	100X139-2	ELECTRICAL ASSY., CARRIER DASH PANEL					
		-	100X139-3	ELECTRICAL ASSY., CARRIER DASH PANEL					
		01	79Q294	.HARNESS, Dome and ID light	1	-			
		01	79Q379	.HARNESS, Dome and ID light	-	1			
		02		.SCREW, Rd. Hd. Mach. ¼-20UNC x 1/2in.	3	3			
		03		.NUT, Hex ¼-20UNC	12	12			
		04	32Z423D17	.CLAMP, Loom	3	3			
		05	79Z39	.SWITCH, headlight	1	-			
		05	79Z2653	.SWITCH, headlight	-	1			
		06	89Z322	.GAUGE, Voltmeter	1	1			
		07	56Z63	.LIGHT, Low air press. And ignition indicator	2	-			
		07	56Z331D1	.LIGHT, Low air press. And ignition indicator	-	4			
		08	56Z143	.LIGHT, High beam indicator	1	-			
		08	56Z331D1	.LIGHT, High beam indicator	-	1			
		09	16T4830	.BRACKET, Dash light mounting	4	-			
		10	56Z142	.LIGHT, Dash	5	-			
		10	56Z240D1	.LIGHT & SOCKET ASSY., Dash	-	4			
		11	89Z276D5	.GAUGE, Tachometer	1	1			
		12	56Z113	.LIGHT, Turn indicator	2	-			
		13	89Z318	.GAUGE, Fuel	1	1			
		14	79Z2655	.SWITCH, Heater	1	1			
		15	79Z1297	.BUTTON, Engine stop	1	-			
		15	79Z2633D1	.BUTTON, Engine stop	-	1			
		16	79Z2654	.SWITCH, Defroster	1	1			
		17	89Z320	.GUAGE, Speedometer	1	1			
		18	89Z316	.GUAGE, Water, temp	1	1			
		19	1079Z1510	.SWITCH, Windshield wiper	1	1			
		20	79Q284D1	.HARNESS, Wiper, extension	1	-			
		21	79Z51D1	.SWITCH, Low air pressure	1	3			
		22	1036Z724	.SOLENOID, Air horn	1	1			
		23		.SCREW, Rd. hd. Mach. #8-32UNC x 3/4in.	10	10			
		24		.SCREW, Rd. hd. Mach. #8-32UNC x 3/8in.	5	5			
		25	79Z1508D2	.BREAKER, Circuit	5	5			
		26	79T353D1	.BAR, Bus	1	1			
		27	79T353D2	.BAR, Bus	1	1			
		28	79Z1745D1	.SWITCH, Magnetic	1	1			
		29	79Q290	.HARNESS, Dash to circuit breakers	1	-			
		29	79Q307	.HARNESS, Dash to circuit breakers	-	1			
		30	79Z2651	.HARNESS, Ground	-	1			
		31	32Z324	.PLATE, Low air	1	-			
		32	79Z2337	.SWITCH, Ignition	1	-			
		32	79Z1690	.SWITCH, Ignition	-	1			
		33	790Q378	.HARNESS, Engine start	-	1			
		34	89Z294	.ADAPTER, 90° gear	1	1			
		35	89Z315	.GUAGE, Oil pressure	1	1			
		36		.SCREW, Rd. hd. Mach. #8-32UNC x 5/16in.	2	2			
		37		.NUT, Hex #8-32UNC	2	2			
		38	79Z2370D1	.SOCKET, Flasher	1	-			
		38	79Z2370D3	.SOCKET, Flasher	-	1			
		39	56Z262D1	.FLASHER	1	1			

CARRIER CAB DASH PANEL GROUP (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 2	3		
		40	56Z298D1	.LIGHT, Engine warning	1	1		
		41	32Z1428	.DECAL, Engine overheat and low oil pressure	1	1		
		42	79Z1271D2	.CONNECTOR, Fused line 14 amp. Fuse	1	-		
		43	79Z2633D2	.BUTTON, Engine start	-	1		
		44	79Z2650	.HARNESS, Gauge lights	-	1		
		45	32R138	.PANEL, Center instrument	-	1		
		46		.SCREW, Slot. Rd. hd. #10-24UNC x 3/8in.	-	14		
		47	79Q284D4	.HARNESS, Windshield wiper	-	1		
		48	79Z31	.SWITCH, Headlight dim	1	1		

Ref. Dwg. 100X139 H
100X139-2
100X139-3

METRIC SPEEDOMETER INSTALLATION



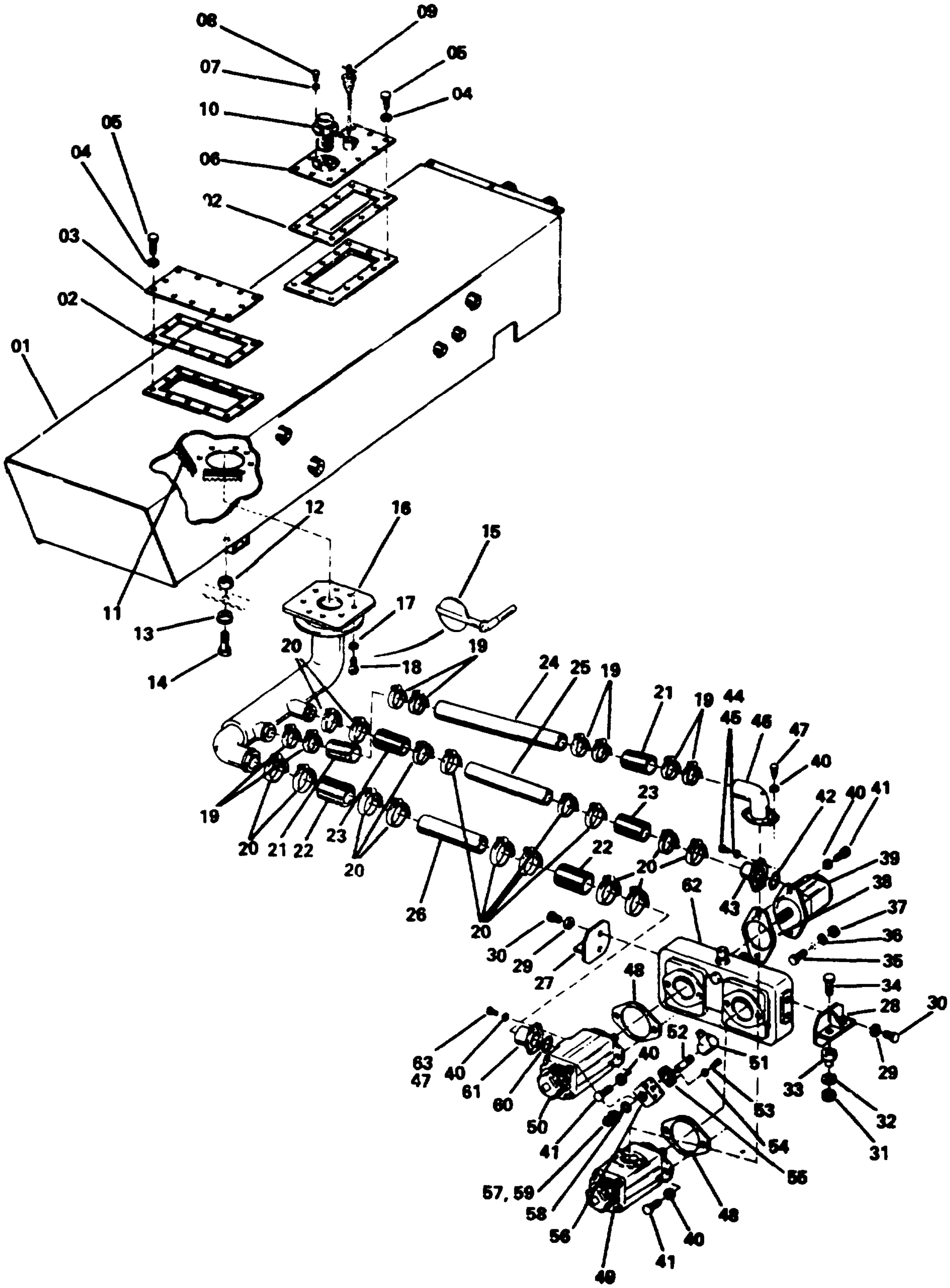
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	100T313-1	SPEEDOMETER INSTALLATION, METRIC	▼			
		01	89Z454	.SPEEDOMETER, Metric	1			

Ref Dwg. 100T313
100T313-1

GROUP	PAGE	REV.
3	11.1	001

Sheet 1 of 1

TANK - SUCTION MANIFOLD AND LINES ASSEMBLY



TANK-SUCTION MANIFOLD AND LINES ASSEMBLY (Continued))

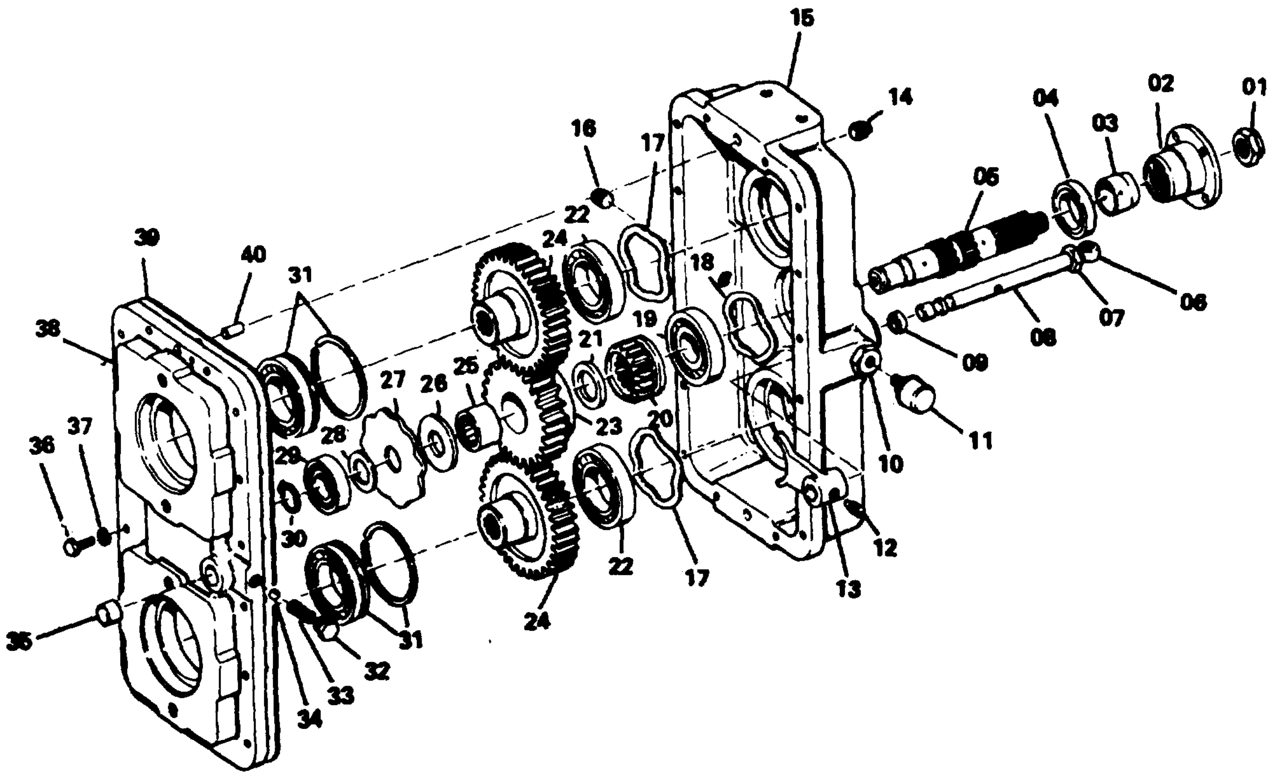
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 2	3	4	
		-	100J4192-2	SUCTION MANIFOLD and LINES ASSY.	▼			
		-	100J4192-3	SUCTION MANIFOLD and LINES ASSY.		▼		
		-	100J4192-4	SUCTION MANIFOLD and LINES ASSY.			▼	
		01	27J1157-2	.RESERVIOR, Hydraulic oil.	1	-	-	
		02	20T8420C1	..GASKET, Cover	2	-	-	
		03	14P2234	..COVER	1	-	-	
		04		..WASHER, Lock 3/8in.	24	-	-	
		05		..SCREW, Hex hd. 3/8-16UNC x 3/4in.	24	-	-	
		06	14P2480	..COVER	1	-	-	
		07		..WASHER, Lock #10	6	-	-	
		08		..SCREW, Rd. hd. Mach. #10-24UNC x 1/2in	6	-	-	
		01	27J1300-1	.RESERVOIR, Hydraulic oil.	-	1	-	
		02	20T8420C1	..GASKET, Cover	-	2	-	
		03	14P2234	..COVER	-	1	-	
		04		..WASHER, Lock 3/8in	-	24	-	
		05		..SCREW, Hex hd. 3/8-16UNC x 3/4in	-	24	-	
		06	14P2265	..COVER	-	1	-	
		07		..WASHER, Lock #10	-	6	-	
		08		..SCREW, Rd. hd. Mach. #10-24UNC x 1/2in.	-	6	-	
		01	27J1300-2	.RESERVOIR, Hydraulic oil	-	-	1	
		02	20T8420C1	..GASKET, Cover	-	-	2	
		03	14P2234	..COVER	-	-	1	
		04		..WASHER, lock 3/8in.	-	-	24	
		05		..SCREW, Hex hd. 3/8-16UNC x 3/4in.	-	-	24	
		06	14P2480	..COVER	-	-	1	
		07		..WASHER, Lock #10	-	-	6	
		08		..SCREW, Rd. hd. Mach. #10-24UNC x 1/2in.	-	-	6	
		09	20Z1484	.DIPSTICK	1	1	1	
		10	14Z242	.CAP, Breather and filter	1	1	1	
		11	75Z573	.MAGNET	2	2	2	
		12	79Z29D1	.SUPPORT, Tank	3	3	3	
		13	79Z30	.SUPPORT, Tank	3	3	3	
		14	820T36	.BOLT, Tank support	3	3	3	
		15	36Z634D5	.VALVE, Butterfly	1	1	1	
		16	44N197	.MANIFOLD, Suction	1	1	1	
		17		.WASHER, Lock 3/4in.	8	8	8	
		18		.SCREW, Hex hd. ¾-10UNC x 3-1/2in.	18	18	18	
		19	44Z12D13	.CLAMP, Hose	8	8	8	
		20	44Z12D12	.CLAMP, Hose	16	16	16	
		21	44Z1002D47	.HOSE	2	2	2	
		22	44Z1002D49	.HOSE	2	2	2	
		23	44Z1002D43	.HOSE	2	2	2	
		24	818T459	.TUBE, Swing and hoist suction	1	1	1	
		25	818T460D1	.TUBE, Aux. Winch suction	1	1	1	
		26	818T458	.TUBE, Main winch and telescope suction	1	1	1	
		27	816P600D1	.BRACKET, Pump drive mounting	1	1	1	
		28	816P600P2	.BRACKET, Pump drive mounting	1	1	1	
		29	18Z694D6	.WASHER, Hardened 1/2in.	4	4	4	
		30	20Z646D74	.SCREW, Hex hd. ½-13UNC x 1 in. Gr.5	4	4	4	
		31	20Z1208D5	.NUT, Lock	4	4	4	

TANK-SUCTION AND LINES ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 2	3	4	
		32		.WASHER, Wide flat 1/2in,	4	4	4	
		33	16Z209D3	..MOUNTING, Center bonded	4	4	4	
		34	20Z646D79	.SCREW, Hex hd. ½-13UNC x 2-1/4in.Gr. 5	4	4	4	
		35	20Z80D5	.BOLT, Companion flange 3/8-24UNF x 1-1/4in..	4	4	4	
		36		..WASHER, Lock 3/8in.	4	4	4	
		37		..NUT, Hex 3/8-24UNF	4	4	4	
		38	20Z1032	.GASKET, Aux. Winch pump	1	1	1	
		39	41Z104	.PUMP, Aux.winch (Page 15.1)	1	1	1	
		40		.WASHER, Lock 5/8in.	14	14	14	
		41		.SCREW, Hex hd. 5/8-11UNC x 1-1/2in.	6	6	6	
		42	45Z91D84	.O-RING	1	1	1	
		43	18U41	.FLANGE, Aux. Winch suction	1	1	1	
		44		.WASHER, Lock 1/2in.	4	4	4	
		45		.SCREW, Hex hd. ½-13UNC x 1-1/2 in.	4	4	4	
		46	18Q61	.FLANGE, Hoist and swing suction	1	1	1	
		47		.SCREW, Hex hd. 5/8-11UNC x 2in.	4	8	4	
		48	20Z1032	.GASKET	2	2	2	
		49	41Z103	.PUMP, Hoist and swing (Page 14.1)	1	1	1	
		50	41Z102	.PUMP, Main winch and telescope (Page 14.1)	1	1	1	
		51	36Z431	.VALVE, Relief	1	1	1	
		52	44Z558D6	.NIPPLE, Pipe 1in.	1	1	1	
		53		.SCREW, Alan hd. Cap, 3/8-16UNC x 2-1/2in.	4	4	4	
		54		.WASHER, Lock 3/8in.	4	4	4	
		55	44Q28D3	.ADAPTER, 4 Bolt flange	1	1	1	
		56	36P12	.BLOCK, Valve pressure setting	1	1	1	
		57	44Z485D7	.CONNECTOR, O-RING	1	1	1	
		58	45Z91D52	..O-RING	1	1	1	
		59	44Z511D3	.CAP	1	1	1	
		60	45Z91D150	.O-RING	2	2	2	
		61	18P4404	.FLANGE, Suction line	-	1	-	
		62	18P3886	.FLANGE, Suction line	1	-	1	
		63	53U37	.PUMP DRIVE ASSY. (Page13.1)	1	1	1	
				.SCREW, Hex hd. 5/8-11UNC x 3-1/4in.	4	-	4	

Ref. Dwg. 100J4192 C
100J4192-2
100J4192-3
100J4192-4

PUMP DRIVE ASSEMBLY

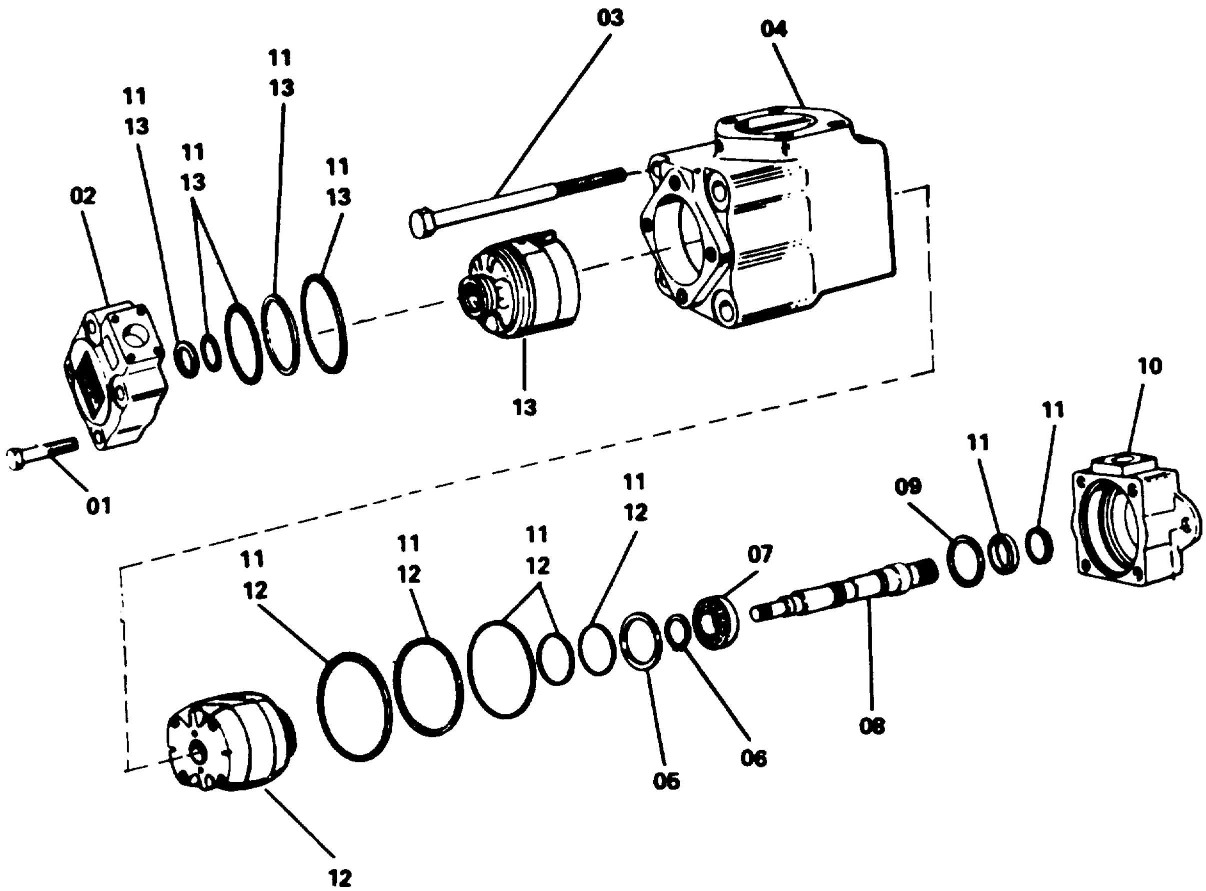


PUMP DRIVE ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-	53U37	PUMP DRIVE ASSY	▼			
		01	1020Z4254	.NUT, Shaft end	1			
		02	1018Z3857	.FLANGE, Companion	1			
		03	1018Z385110	.Spacer, Input oil seal	1			
		04	18Z3855	.SEAL, Input shaft	1			
		05	1010Z829	.SHAFT, Input	1			
		06	1020Z3750	.BOLT, Shift rod eye	1			
		07		.NUT, Hex ½-20UNF	1			
		08	1006Z456	.ROD, Shift	1			
		09	1018Z3856	.SEAL, Shift rod	1			
		10	1044Z467	.REDUCER, Breather 3/8 x 3/4in.	1			
		11	1046Z198	.BREATHER	1			
		12	1020Z3716	.SCREW, Shift fork set	1			
		13	1006Z455	.FORK, Shifting	1			
		14	1044Z468	.PLUG, Pipe-oil level	1			
		15	1014Z1030	.CASE, Gear	1			
		16	1044Z282	.PLUG, Pipe-oil drain	1			
		17	1018Z1909	.WASHER, Wavy	2			
		18	1018Z4235	.WASHER, Wavy	1			
		19	1025Z1446	.Bearing, Input	1			
		20	1015Z921	.CLUTCH, Sliding	1			
		21	1015Z1447	.RACE, Thrust	1			
		22	1025Z1577	.BEARING, Rear pump shaft	2			
		23	1001Z838	.GEAR, 30T Input	1			
		24	1001Z946	.GEAR, 38T Pump drive	2			
		25	1005Z1448	.BEARING, Input gear	1			
		26	1018Z4236	.WASHER, Thrust	1			
		27	1018Z4233	.DISC., Oil splash	1			
		28	1018Z4234	.RING, Spacer	1			
		29	1025Z1449	.BEARING, Input	1			
		30	1018Z3854	.RING, Snap-input shaft	1			
		31	1025Z903	.BEARING, Front pump shaft	2			
		32	1020Z3719	.PLUG	1			
		33	1017Z904	.SPRING, Detent	1			
		34	1025Z709	.BALL, Detent 1/2in.	1			
		35	1020Z4252	.PLUG, Cupped	1			
		36		.SCREW, Hex hd.3/8-16UNC x 1-1/4in.	16			
		37		.WASHER, Lock 3/8in.	16			
		38	1014Z886	.COVER, Gear case	1			
		39	1020Z3712	.GASKET, Gear case cover	1			
		40	1019Z796	.PIN, Dowel	2			

Ref. Dwg. 53U37

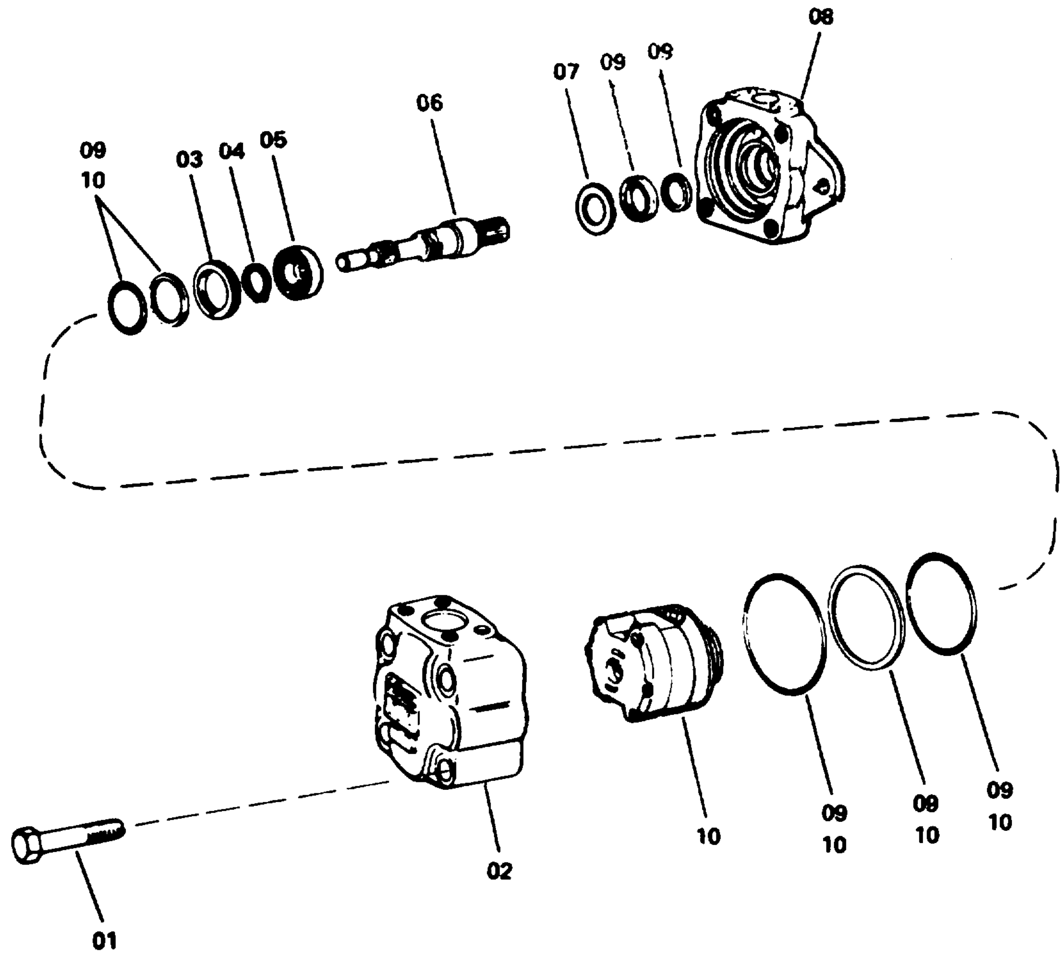
HYDRAULIC PUMP ASSEMBLIES



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity / Figure Number			
		-	41Z102	PUMP TELESCOPE and MAIN WINCH	▼			
		-	14Z103	PUP, BOOM HOIST and SWING		▼		
		01	1020Z2015	.BOLT, Cover to housing	4	4		
		02	1014Z352	.COVER	1	1		
		03	1020Z2018	.BOLT, Housing to body	4	4		
		04	1016Z232	.HOUSING, Inlet	1	1		
		05	1018Z1918	.RING, Lock	1	1		
		06	1018Z1919	.RING, Snap	1	1		
		07	41025Z910	.BEARING, Shaft	1	1		
		08	1010Z418	.SHAFT	1	1		
		09	1018Z1917	..WASHER	1	1		
		10	1045Z412	.BODY	1	1		
		11	1020Z2051	.KIT, Complete pump seal	1	1		
		12	1045Z1017	.KIT, Main winch and hoist cartridge	1	1		
		13	1045Z655	.KIT, Telescope cartridge	1	-		
		13	1045Z570	.KIT, Swing cartridge	-	1		

Ref. Dwg. 41Z102
41Z103

AUILIARY WINCH PUMP



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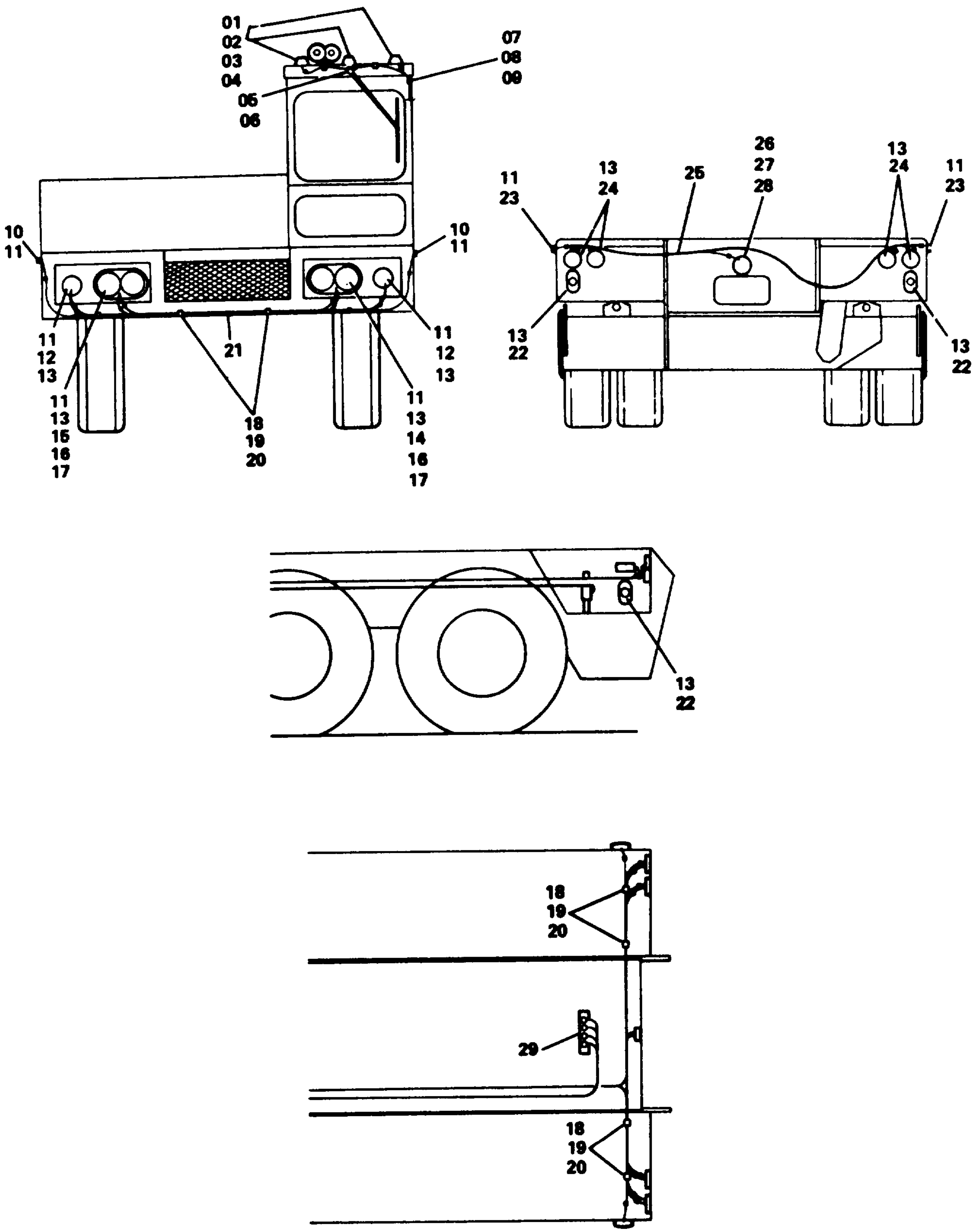
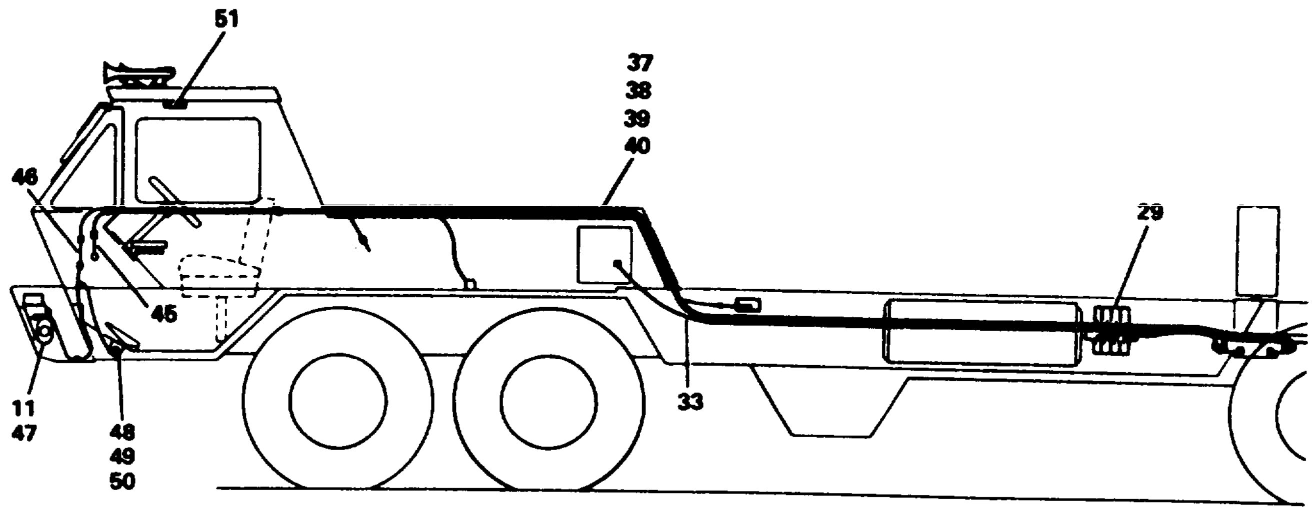
Q T Y	S T O C K	Ref.	Part Number	Description	Quantity / Figure Number			
		-	41Z104	PUMP AUXILIARY WINCH	▼			
		01	1020Z2016	.SCREW, Cover to body	4			
		02	1014Z355	.COVER	1			
		03	018Z1918	.RING, Lock	1			
		04	1018Z1919	.RING, Snap	1			
		05	1025Z910	.BEARING, Shaft	1			
		06	1010Z420	.SHAFT	1			
		07	1018Z1917	.WASHER	1			
		08	1045Z412	.BODY	1			
		09	1020Z2026	.KIT, Complete seal	1			
		10	1045Z616	.KIT, Cartridge	1			

Ref. Dwg. 41Z104

CARRIER WIRING HARNESS GROUP

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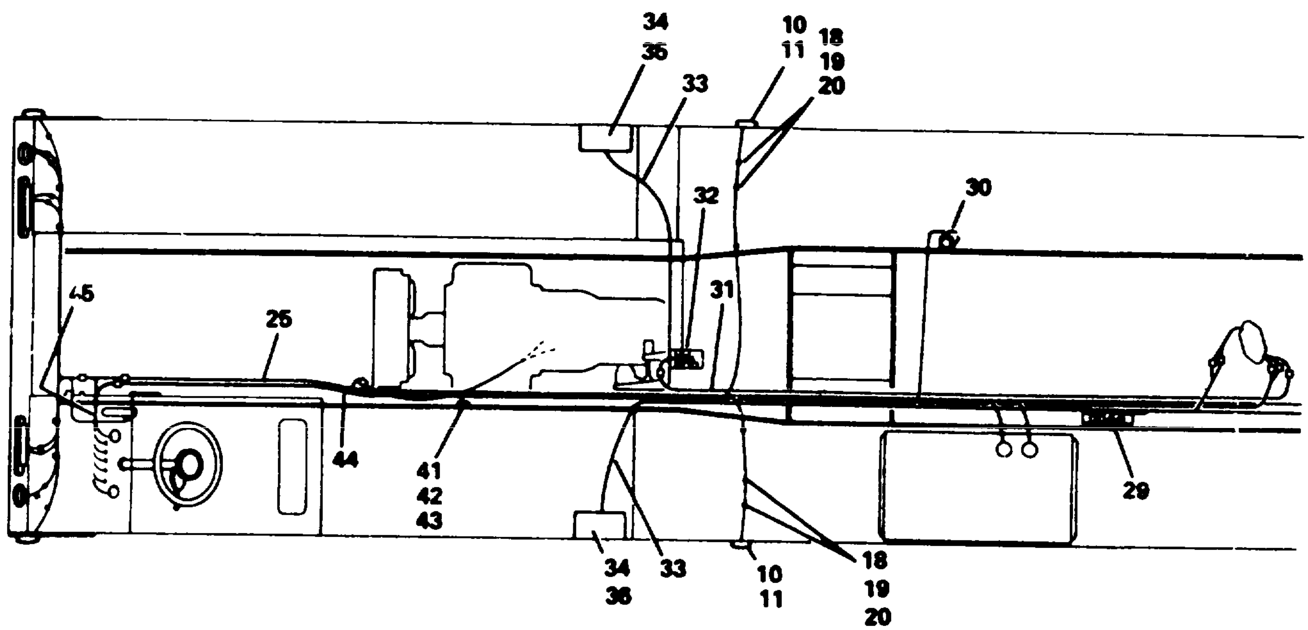
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CARRIER WIRING HARNESS GROUP (Continued)

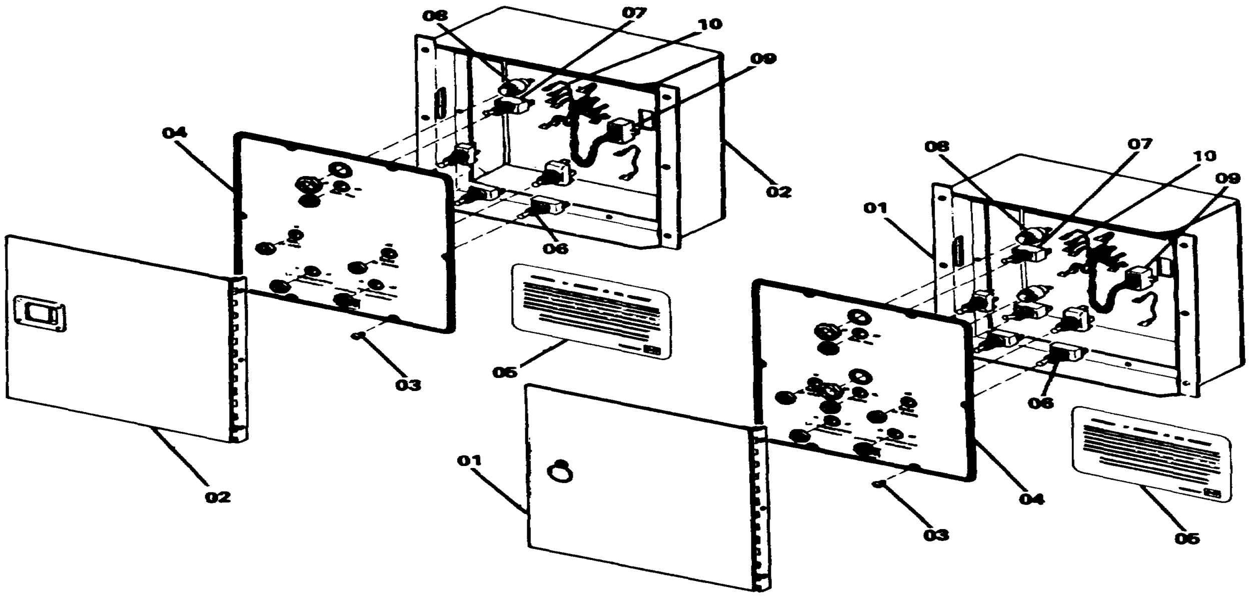
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
					2	3	13	
		-	100X139-2	ELECTRICAL ASSY., BASIC CARRIER				
		-	100X139-3	ELECTRICAL ASSY., BASIC CARRIER				
		-	100X139-13	ELECTRICAL ASSY., REMOTE CONTROL CARRIER				
		01	56Z202D1	.LIGHT, ID	3	3	-	
		02		.SCREW, Rd. hd. mach. #10-32UNF x 1/2 in.	8	8	-	
		03		.WASHER, Lock #10	8	8	-	
		04		.NUT, Hex #10-32UNF	8	8	-	
		05	49Z195D3	.WIPER ASSEMBLY	1	1	-	
		06		.SCREW, Slot. rd. hd. 1/4 -28UNF x 3/4 in.	2	2	-	
		07		.SCREW, Rd. hd. mach. 1/2-20UNC x 1/2 in.	3	3	-	
		08		.NUT, Hex 1/4-20UNC	12	12	-	
		09	32Z423D17	.CLAMP, Loom	3	-	-	
		10	56Z234D1	.LIGHT, Amber clearance	4	4	-	
		11	20Z1449D15	.RIVET, Pop 3/16 in. dia.	12	12	-	
		12	56Z55D4	.LIGHT, Amber park and directional	2	2	-	
		13	20Z1449D14	.RIVET, Pop 3/16 in. dia.	46	46	-	
		14	56Z117D2	.LIGHT, L.H. head	1	1	-	
		15	56Z117D1	.LIGHT, R.H. head	1	1	-	
		16	56Z118	.DOOR, Headlight	2	2	-	
		17	20Z709D1	.SCREW, Phillips hd. =10-16 x 1/2 in.	8	8	-	
		18	32Z1083D10	.CLAMP, Loom	12	12	-	
		19		.SCREW, Rd. hd. mach. 3/8-16UNC x 1/2 in.	12	12	-	
		20		.NUT, Hex 3/8-16UNC	12	12	-	
		21	79Q286	.HARNESS, Front lighting	1	-	-	
		21	79Q352	.HARNESS, Front lighting	-	1	-	
		22	56Z20	.REFLECTOR, Red	4	4	-	
		23	56Z234D2	.LIGHT, Red clearance	4	4	-	
		24	56Z55D2	.LIGHT, Red directional and stop	4	4	-	
		25	79U463	.HARNESS, Rear lighting	1	-	-	
		25	79U1011	.HARNESS, Rear lighting	-	1	-	
		26	56Z16	.LIGHT, Licsense plate and tail	1	1	-	
		27		.SCREW, Rd. hd. mach. 1/4-20UNC x 3/4 in.	2	2	-	
		28		.WASHER, Lock 1/4 in	2	2	-	
		29	79Q281	.HARNESS, Outrigger solenoid valve ground	4	4	-	
		30	36Z871	.VALVE, Solenoid	1	1	-	
		31	79Q287	.HARNESS, Remote control carrier distribution	-	-	1	
		32	79Q289	.HARNESS, Remote control carrier	-	-	1	
		33	79U459	.HARNESS, Outrigger main	1	1	-	
		34	20Z1449D23	.RIVOT, Pip 1/4 in. dia.	12	12	-	
		35	8100N06191-3	.BOX, R.H. outrigger control (Page 17.1)	1	-	-	
		36	8100N06191-4	.BOX, L.H. outrigger control (Page 17.1)	1	-	-	
		37	32Z423D2	.CLAMP, Loom	7	7	-	
		38		.SCREW, Rd. hd. mach. 1/4-20UNC x 3/4 in.	9	9	-	
		39		.WASHER, Lock 1/4 in	9	9	-	
		40		.NUT, Hex 1/4-20UNC	9	9	-	
		41	79Z2453	.SWITCH, Neutral	1	1	-	
		42	18T11053	.COLLAR, Shift rod	1	1	-	
		43		.SCREW, Set #10-32UNF x 5/8 in.	2	2	-	
		44	79U460	.HARNESS, Main distribution	1	-	-	
		44	79U811	.HARNESS, Main distribution	-	1	-	

CARRIER WIRING HARNESS GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity			
					Figure Number			
					2	3	13	
		45	79U461	.HARNESS, Instrumental panel	1	-	-	
		45	79U815	.HARNESS, Instrumental panel	-	1	-	
		46	79U462	.HARNESS, Dash lights	1	-	-	
		47	56Z19	.REFLECTOR, Amber	2	2	-	
		48	79Z640	.SWITCH, Stop light	1	-	-	
		48	79Z2550	.SWITCH, Stop light	-	1	-	
		49	44Z210D5	.BUSHING, Reducing	1	-	-	
		50	79Z51D1	.SWITCH, Low air pressure	-	2	-	
		51	56Z209	.LIGHT, Dome	1	1	-	
		52	MS35001-5	BATTERY, 12 v, 200 amp, NSN 6140-00-191-8485 (96906) (not illustrated)				

Ref Dwg. 100X139 H
100X139-2
100X139-3
100X139-13

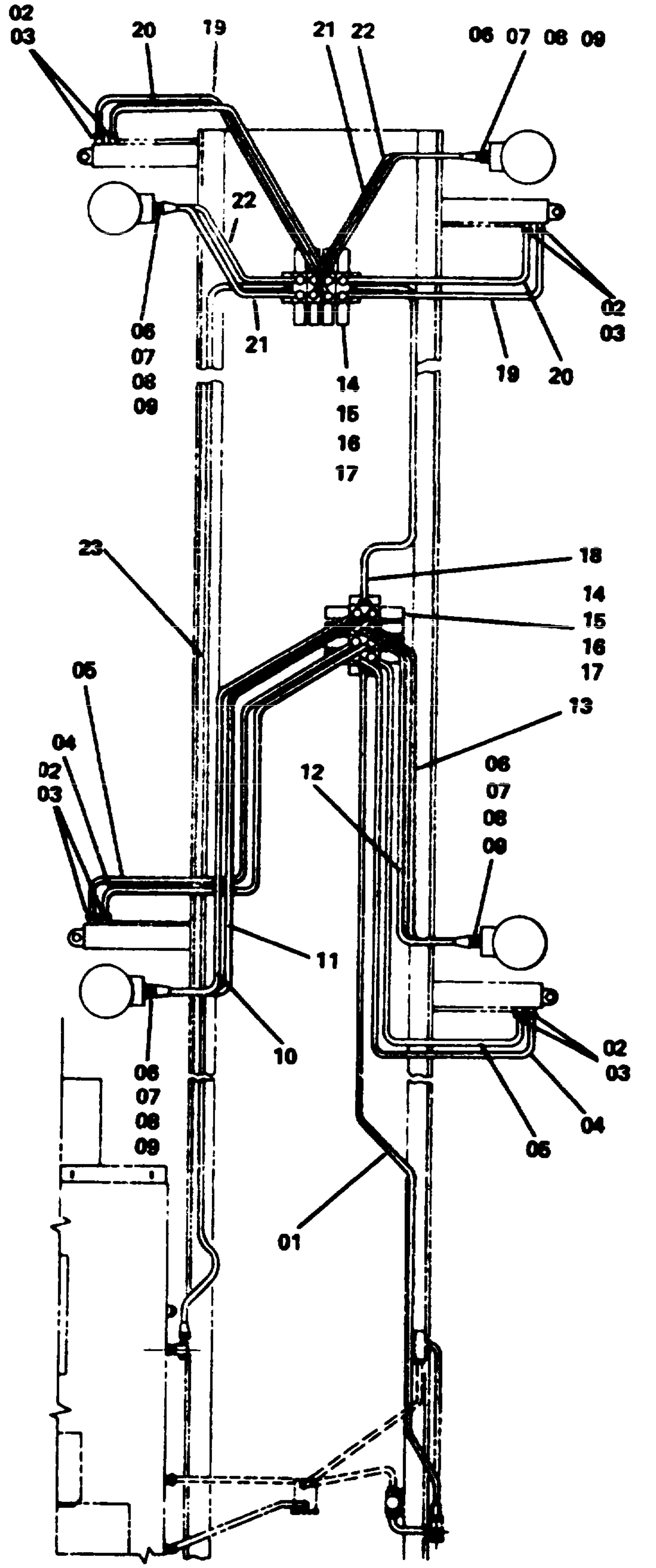
OUTRIGGER CONTROL BOX ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	2	3	4
		-	8100N06191-1	OUTRIGGER CONTROL BOX ASSY. – R.H.				
		-	8100N06191-2	OUTRIGGER CONTROL BOX ASSY. – L.H.				
		-	8100N06191-3	OUTRIGGER CONTROL BOX ASSY. – R.H.				
		-	8100N06191-4	OUTRIGGER CONTROL BOX ASSY. – L.H.				
		01	832N43	.BOX, Control	1	1	-	-
		02	832N42	.BOX, Control	-	-	1	1
		03		.SCREW, Self tapping #8 x 3/8 in.	6	6	6	6
		04	32U958	.PANEL, R.H. control	1	-	-	-
		04	32U959	.PANEL, L.H. control	-	1	-	-
		04	32U955	.PANEL, R.H. control	-	-	1	-
		04	32U956	.PANEL, L.H. control	-	-	-	1
		05	32Q498	.LABEL, Instruction	1	1	-	-
		05	32Q323	.LABEL, Instruction	-	-	1	1
		06	79Z2400D5	.SWTCH, Toggle	4	4	4	4
		07	79Z2400D1	.SWTCH, Toggle	2	2	1	1
		08	56Z143	.LIGHT, Indicator	2	2	1	1
		09	79Q282	.HARNESS, WIRING – R.H. control box	1	-	1	-
		09	79Q283	.HARNESS, WIRING – L.H. control box	-	1	-	1
		10	79Q279	.HARNESS, WIRING –outrigger control power	1	1	1	1

Ref. Dwg. 8100N06191 E 8100N06191-2
8100N06191-1 8100N06191-3
8100N06191-4

HYDRAULIC ASSEMBLY - OUTRIGGERS

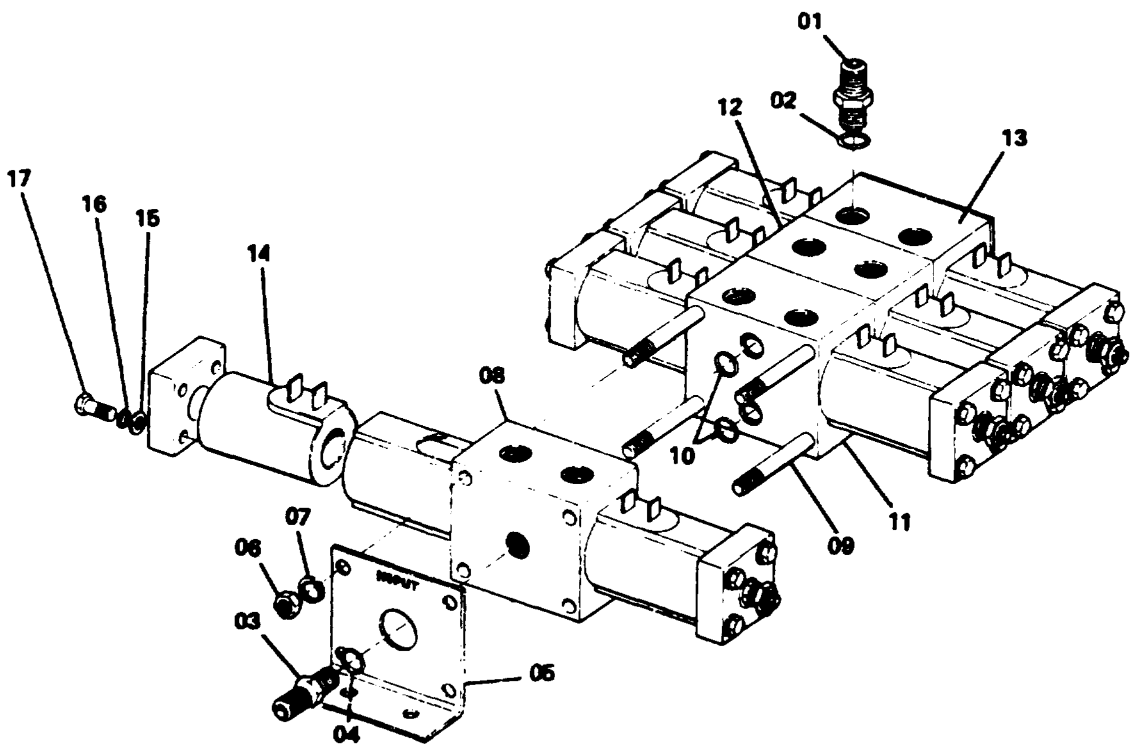


HYDRAULIC ASSEMBLY - OUTRIGGERS (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	8100J3980-1	HYDRAULIC ASSEMBLY – OUTRIGGERS				
		01	44P260D26	.HOSE ASSY., selector valve to valve bank	1			
		02	44Z421D19	.ELBOW, 90° O-ring	8			
		03	45Z91D52	..O-RING	1			
		04	44P246D2	.HOSE ASSEMBLY	2			
		05	44P245D2	.HOSE ASSEMBLY	2			
		06	44Z536D4	.PLUG	4			
		07	45Z91D52	..O-RING	1			
		08	44Z485D9	.CONNECTOR, Straight thread	8			
		09	45Z91D47	..O-RING	1			
		10	44P240D5	.HOSE ASSEMBLY	1			
		11	44P241D4	.HOSE ASSEMBLY	1			
		12	44P241D11	.HOSE ASSEMBLY	1			
		13	44P240D25	.HOSE ASSEMBLY	1			
		14	8100T364-1	.SOLENOID VALVE BANK ASSY. (Page 19.1)	2			
		15		.SCREW, Hex hd. 5/16-18UNC x 1 in.	8			
		16		.WASHER, Lock 5/16 in.	8			
		17		.NUT, Hex 5/16-18UNC	8			
		18	44P260D6	.HOSE ASSEMBLY	1			
		19	44P246D5	.HOSE ASSEMBLY	2			
		20	44P245D6	.HOSE ASSEMBLY	2			
		21	44P241D7	.HOSE ASSEMBLY	2			
		22	44P240D10	.HOSE ASSEMBLY	2			
		23	44P260D31	.HOSE ASSEMBLY	1			

Ref. Dwg. 8100J3980 B
8100J3980-1

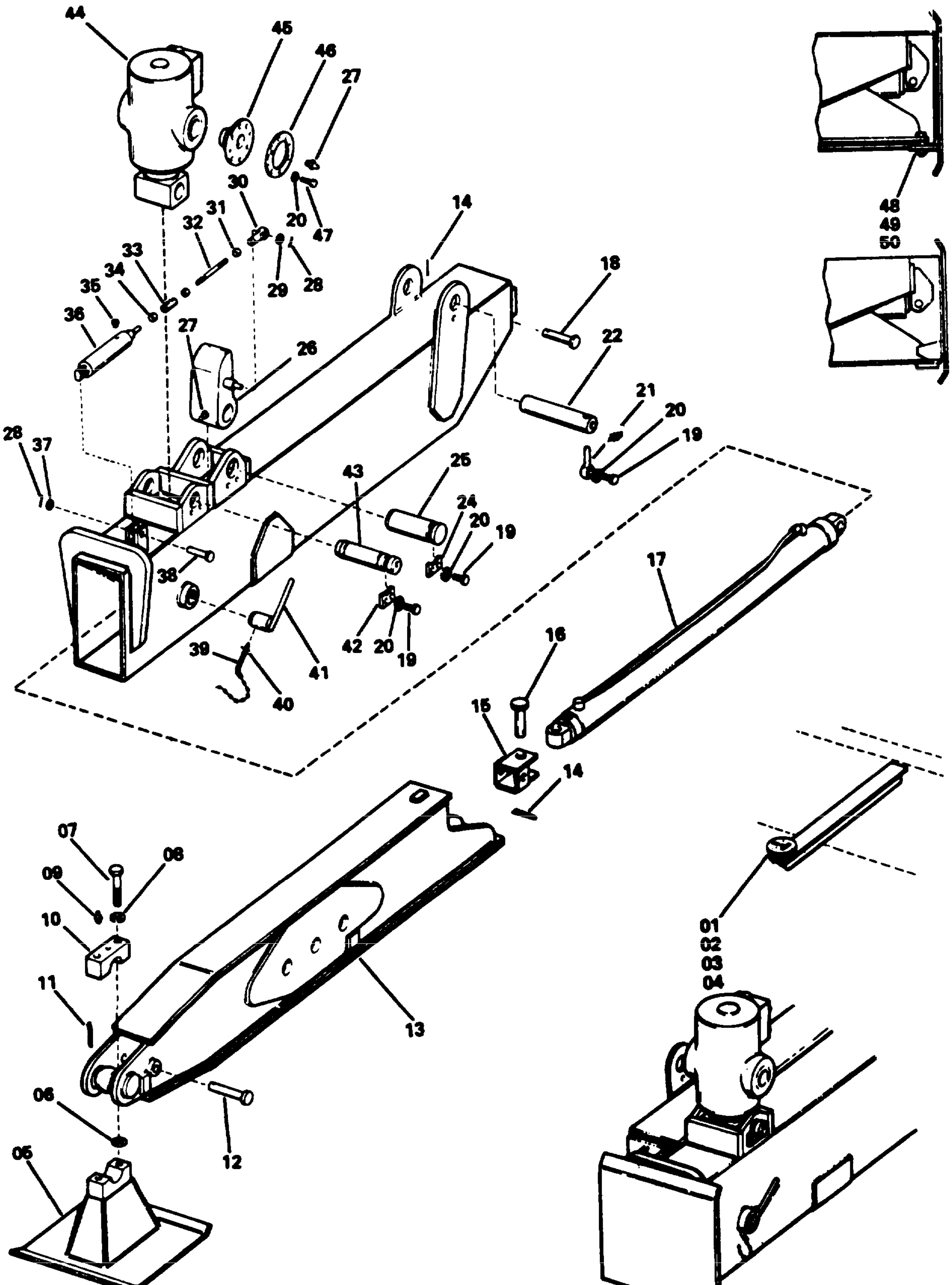
OUTRIGGER SOLENOID VALVE BANK ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	8100T364-1	VALVE ASSY., OUTRIGGER SOLENOID				
		01	44Z485D9	.CONNECTOR, O-ring	8			
		02	45Z91D47	..O-RING	1			
		03	44Z485D23	.CONNECTOR, O-ring	2			
		04	45Z91D58	..O-RING	1			
		-	36Z341	.VALVE, Outrigger solenoid	1			
		05	1036Z436	..BRACKET, Valve mounting	2			
		06		..NUT, Hex 5/16-24UNF	8			
		07		..WASHER, Lock 5/16 in.	8			
		08	1036Z222	..VALVE ASSY., Right front and rear - in and out	1			
		09	1020Z2693	..BOLT, Rod	4			
		10	1018Z1817	..SEAL, Teflon ring	6			
		11	1036Z223	..VALVE ASSY., Left front and rear - in and out	1			
		12	1036Z224	..VALVE ASSY., Left front and rear - up and down	1			
		13	1036Z225	..VALVE ASSY., Left front and rear - up and down	1			
		14	1075Z479	..COIL	8			
		15	1045Z426	..SEAL O-ring	32			
		16		..WASHER, Lock 1/4 in.	32			
		17		..SCREW, Hex hd. 1/4-20UNC x 4 in.	32			

Ref. Dwg. 8100T364 ^
8100T364-1

OUTRIGGER ASSEMBLY



OUTRIGGER ASSEMBLY (Continued)

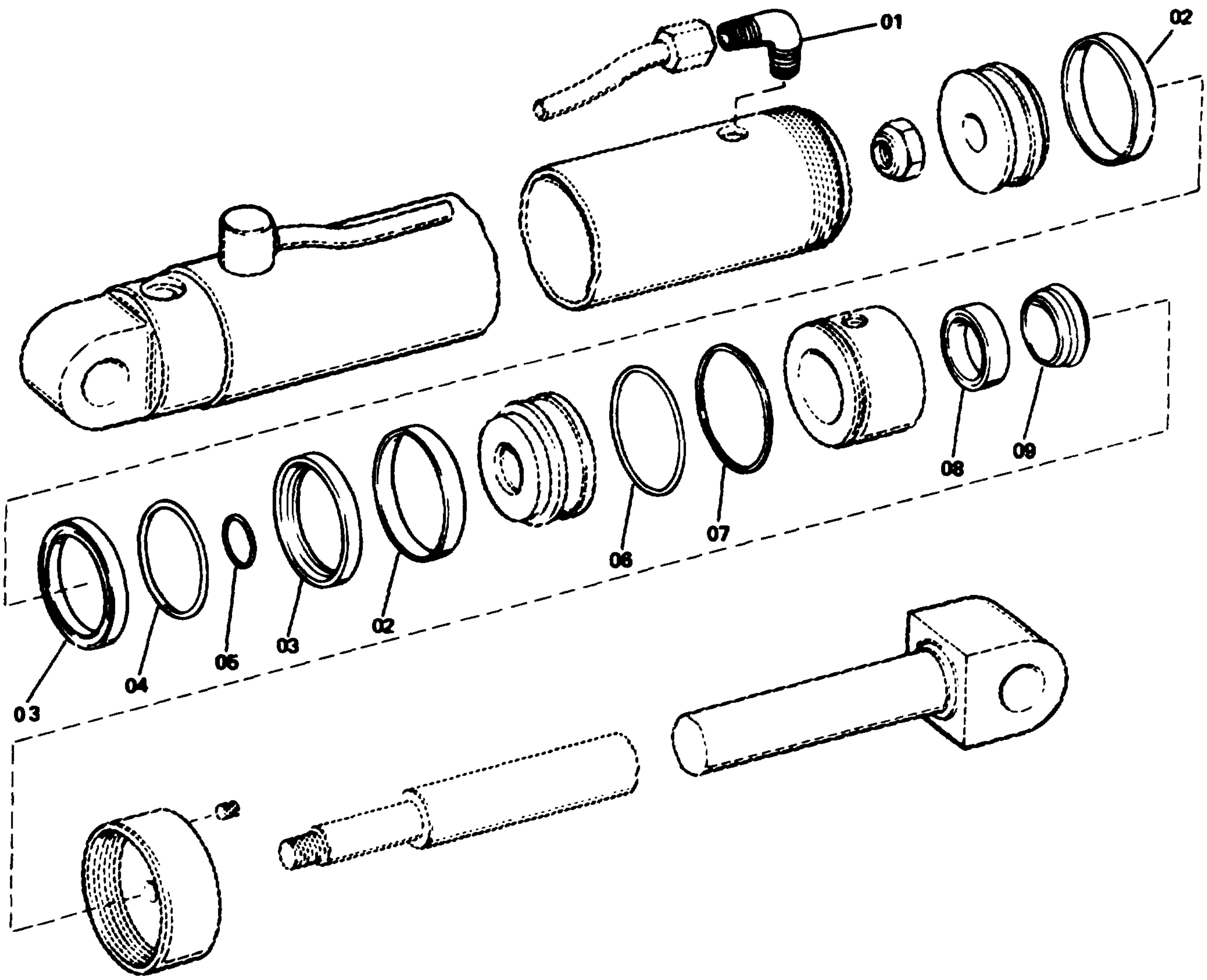
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 6	7	9	
		-	8100J3953-6	OUTRIGGER ASSY - W/SAFETY LOCKS				
		-	8100J3953-7	OUTRIGGER ASSY - W/O SAFETY LOCKS				
		-	8100J3953-9	OUTRIGGER ASSY - W/12 METER TURNING RADIUS				
		-	8100P896-1	.LEVEL INSTALLATION	1	1	1	
		01	89Z421	..LEVEL, Two way	2	2	2	
		02		..SCREW, Fl. hd. mach. #6-32UNC x 5/8 in.	6	6	6	
		03		..WASHER, Lock #6	6	6	6	
		04		..NUT, Hex #6-32UNC	6	6	6	
		05	829N229-1	.FLOAT, Forward and rear outrigger	4	4	4	
		06		..WASHER, Narrow rim 3/4 in. I.D. x 1/1/4 in. O.D.	4	4	4	
		07		..SCREW, Hex hd. Cap 3/4-10UNC x 4 in	2	2	2	
		08		..WASHER, Lock 3/4 in.	2	2	2	
		09		..FITTING, Lube	1	1	1	
		10	18T10446	..RETAINER, Upper	1	1	1	
		05	829N263-1	.FLOAT, Forward outrigger	-	2	-	
		06		..WASHER, Narrow rim 3/4 in. I.D. x 1-1/4 in. O.D.	-	4	-	
		07		..SCREW, Hex hd. cap 3/4-10UNC x 4 in.	-	2	-	
		08		..WASHER, Lock 3/4 in.	-	2	-	
		09		..FITTING, Lube	-	1	-	
		10	18T10446	..RETAINER, Upper	-	1	-	
		11		.PIN, Cotter 3/16 in. x 2-1/2 in. lg.	8	8	8	
		12	19F57D12	.PIN, Drilled 3/4 in. x 5-1/2 in. lg	4	4	4	
		13	829N17	.BEAM, Outrigger	4	4	4	
		14		.Pin, Cotter 1/4 in. x 1-1/2 in. lg.	16	16	16	
		15	806T160	.YOKE, Cylinder	4	4	4	
		16	19F57D13	.PIN, Drilled 1 in. x 3-3/4 in. lg.	4	4	4	
		17	38U91D2	.CYLINDER, Horozontal (Page 21.1)	4	4	4	
		18	19F57D12	.PIN, Drilled 1 in. x 3-1/2 in. lg.	4	4	4	
		19		.SCREW, Hex hd. 1/2-13UNC x 1 in.	20	12	12	
		20		.WASHER, Lock 1/2 in.	68	60	60	
		21	220T19	.ROD, End	4	4	4	
		22	819T88	.PIN, Outrigger box to frame	4	4	4	
		23	829J89D2	.BOX, Outrigger w/safety lock bracket	4	-	-	
		23	829J89D1	.BOX, Outrigger w/o safety lock bracket	-	4	4	
		24	818T462	.PLATE, Keeper	4	-	-	
		25	819T150	.PIN, Outrigger safety lock	4	-	-	
		26	815P58	.RATCHET AND PIN, safety lock	4	-	-	
		27		.FITTING, Lube	20	16	16	
		28		.PIN, Cotter 3/32 in. x 1/2 in. lg.	4	-	-	
		29		.WASHER, Flat 3/8 in.	4	-	-	
		30	25Z822D4	.ROD END, Spherical bearing	4	-	-	
		31		.NUT, Hex jam 3/8-16UNC	8	-	-	
		32	820T512D1	.ROD, Air cylinder extension	4	-	-	
		33	818T463	.COUPLING, Rod	4	-	-	
		34		.NUT, Hex jam 12-13UNC	4	-	-	
		35	46Z286D2	.VENT, Breather	4	-	-	
		36	38Z285	.CYLINDER, Safety lock air	4	-	-	
		37		.WASHER, Flat 5/16 in.	4	-	-	
		38	19T3650D16	.PIN, Yoke	4	-	-	
		39	819T81-1	.PIN, Beam retaining	4	4	4	

OUTRIGGER ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 6	7	9	
		-		..PIN, Cotter 3/16 in. x 1 in. lg.	1	1	1	
		-		..CHAIN, Tenso wire 12 in. lg.	1	1	1	
		40		.PIN, Cotter 3/16 in. x 1-1/2 in. lg.	4	4	4	
		41	820T517	.PIN, Retainer	4	4	4	
		42	818T276	.PLATE, Keeper	4	4	4	
		43	819T149	PIN, Vertical cylinder to box	4	4	4	
		44	100T282-1	.CYLINDER, Vertical (Page 22.1)	4	4	4	
		45	819T154	.PIN, Trunnion	8	8	8	
		46	820T356	.SHIM, Cylinder	16	16	16	
		47		.SCREW, Hex hd. 1/2-20UNC x 1-1/4 in.	20	12	12	
		48		.SCREW, Hex hd. 5/8-11UNC x 2-3/4 in.	4	-	4	
		49		.WASHER, Lock 5/8 in.	4	-	4	
		50		.NUT, Hex 5/8-11UNC	4	-	4	

Ref. Dwg. 8100J3953 O
8100J3953-6
8100J3953-7
8100J3953-9

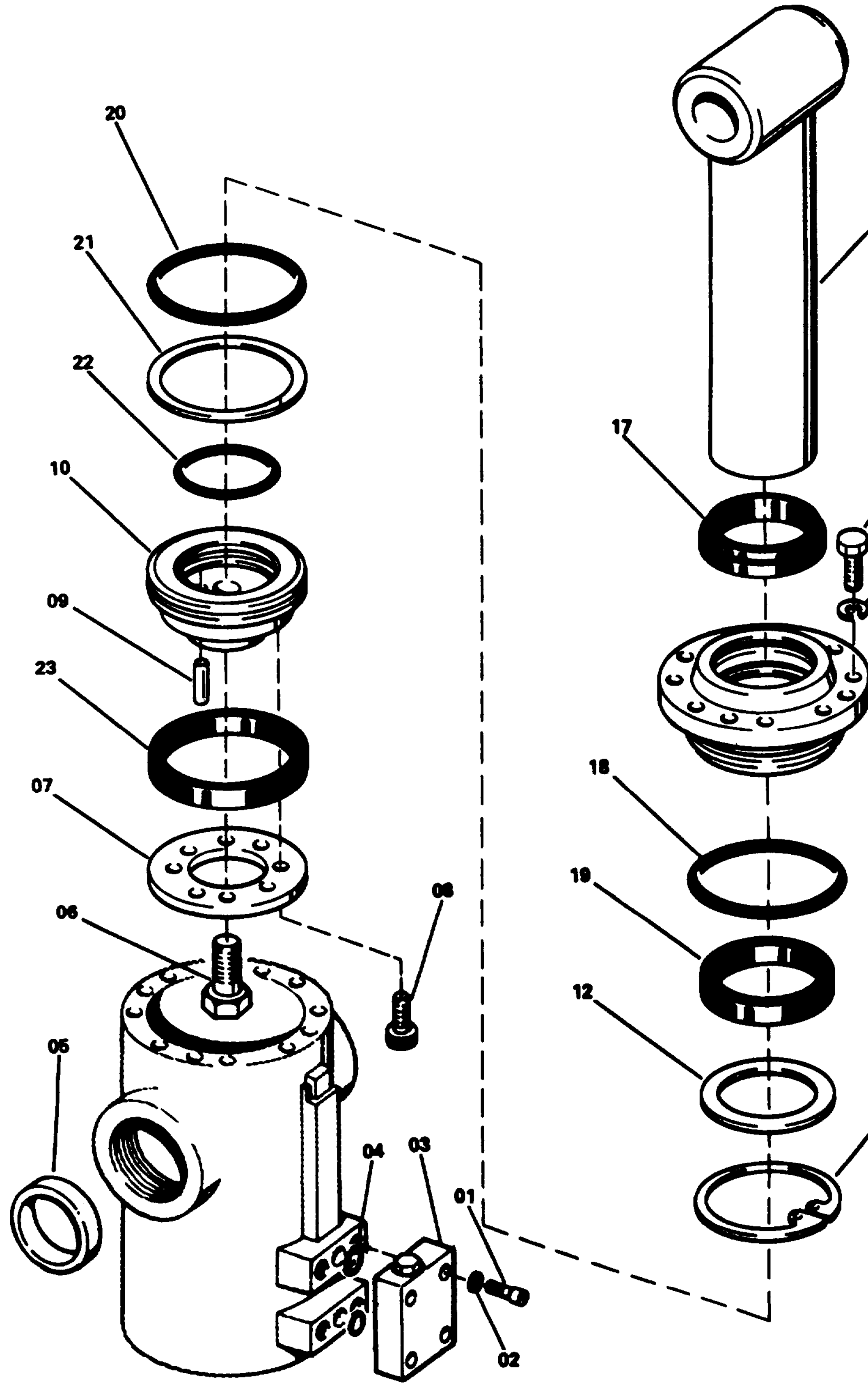
HOROZONTAL OUTRIGGER CYLINDER



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity / Figure Number			
		-	38U91D2	CYLINDER , HOROZONTAL OUTRIGGER	▼			
		01	1044Z491	.ELBOW	1			
4	X	-	1045Z1128	.KIT, Packing	1			
		02		..GUIDE, Bearing	2			
		03		..SEAL, Piston	2			
		04		..O-RING	1			
		05		..O-RING	1			
		06		..O-RING	1			
		07		..RING,Back-up	1			
		08		..SEAL- Rod	1			
		09		..SEAL- Rod	1			

Ref. Dwg. 38U91D0
38U91D2

VERTICAL CYLINDER ASSEMBLY

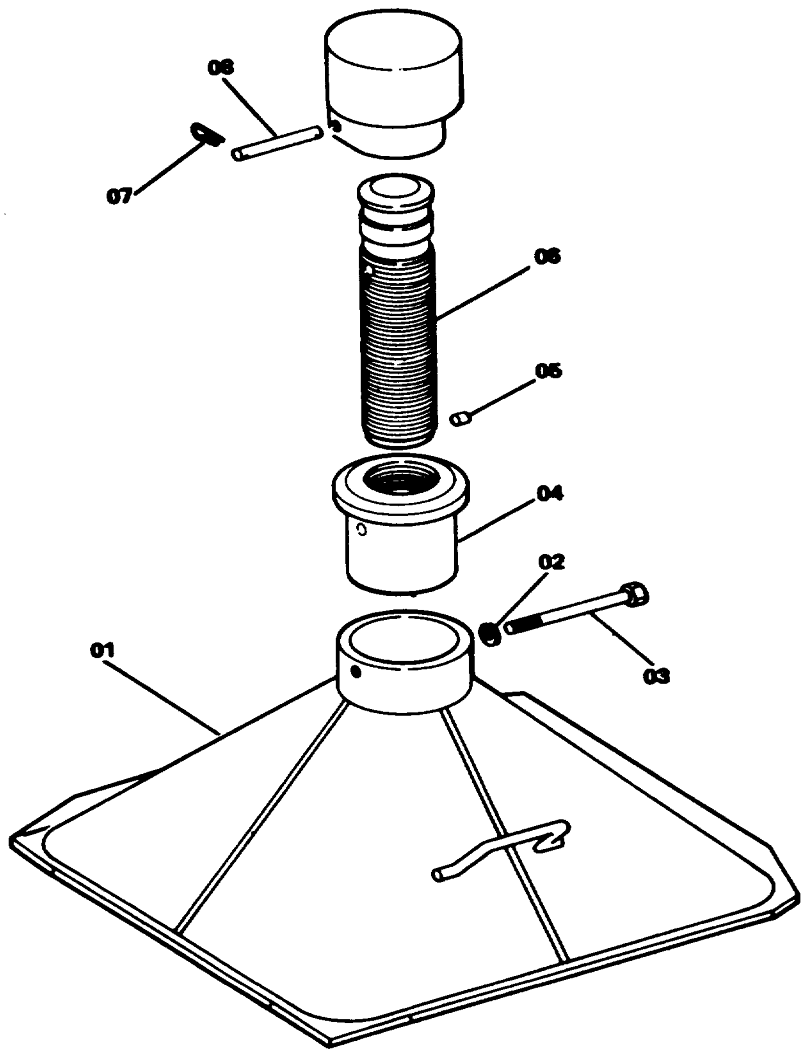


VERTICAL CYLINDER ASSEMBMLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	100T282-1	CYLINDER ASSY., VERTICLE OUTRIGGER	▼			
		01		.SCREW, Hex hd. 3/8-24UNF x 2/1/4 in.	4			
		02		.WASHER, Lock 3/8 in.	4			
		03	36Z1024	.VALVE, Lock	1			
		04	45Z91D133	.O-RING	2			
		-	100J4208-1	.CYLINDER, Verticle	1			
		05	25Z86D3	..RACE, Outer	2			
		06	20Z547D147	..SCREW, Hex hd. 7/8-14UNF x 2-1/2 in. Gr. 5	1			
		07	818P68	..RETAINER	1			
		08		..SCREW, Sock. hd. cap 5/16-24UNF x 3/4 in.	8			
		09	19Z8D118	..PIN, Roll 1/4 x 1-7/8 in. lg	1			
		10	818P70	..HEAD, Piston	1			
		11	18Z2D102	..RING, Snap	1			
		12	18H3892D284	..WASHER	1			
		13	818P69	..RETAINER	1			
		14		..WASHER, Lock 3/8 in.	12			
		15	20Z547D43	..SCREW, Hex hd. 3/8-24UNF x 1-3/4 in. Gr. 5	12			
		16	820P336	..ROD ASSY., Piston	1			
		-	110J215-14	..KIT, Seal	1			
		17		...SEAL, Rod wiper	1			
		18		…O-RING	1			
		19		…U-CUP, w/Filler ring	1			
		20		…O-RING	1			
		21		…RING, Back-up	1			
		22		…O-RING	1			
		23		…U-CUP, w/Filler ring	1			

Ref. Dwg. 100T282 /\
100T282-1

FRONT 5TH FLOAT ASSEMBLY

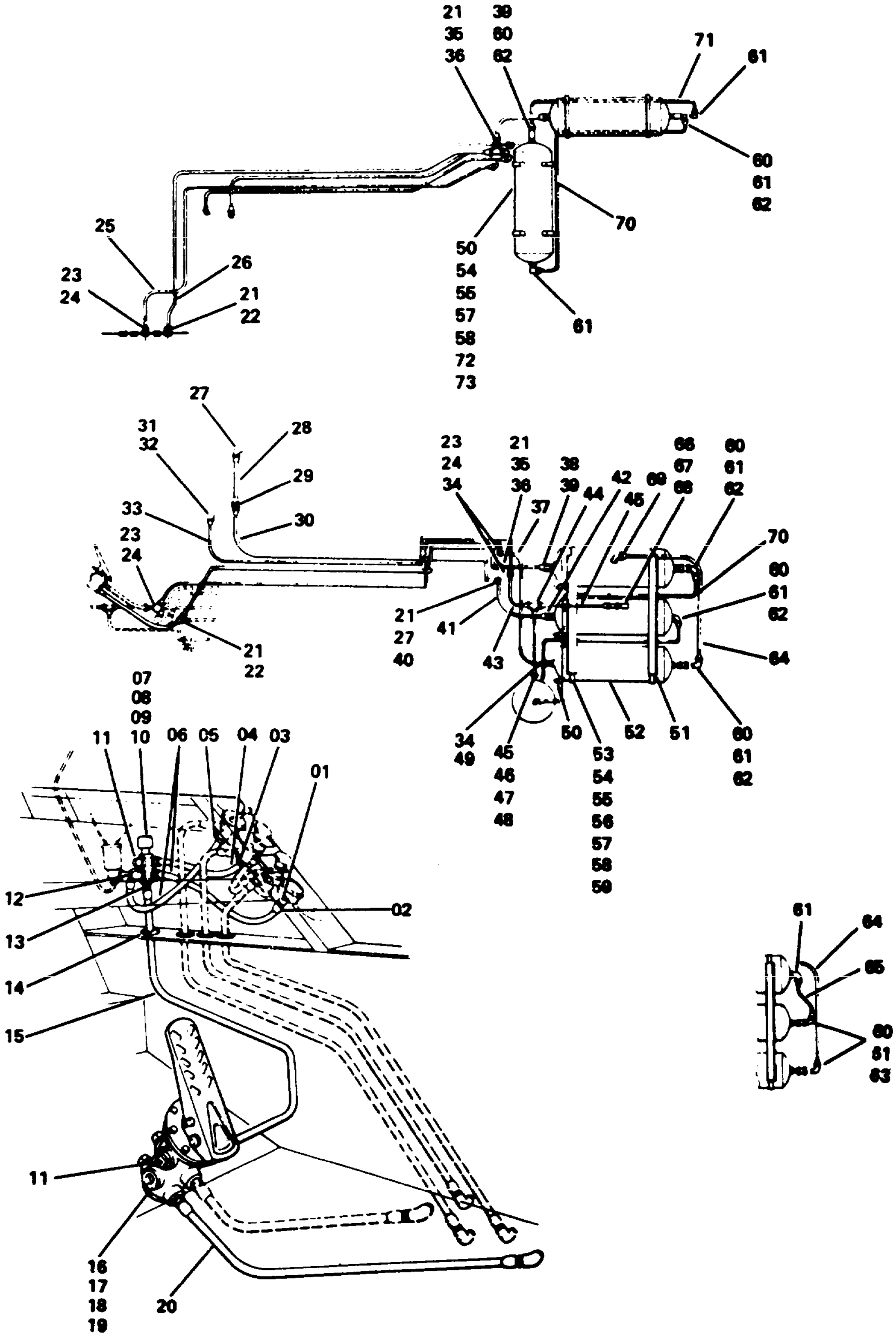


QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	100N2493-1	FRONT 5TH FLOAT ASSY.	▼			
		01	829P153F2	.FLOAT OUTRIGGER	1			
		02		..WASHER, Lock1/2 in.	1			
		03		..SCREW, Hex hd. Cap 1/2-13UNC x 1 in.	1			
		04	820T274	..NUT, Jack Screw	1			
		05	19F79D111	..PIN	1			
		06	820T146C1	..SCREW, Jack	1			
		07	20Z939D4	.PIN, Hair cotter	2			
		08	819T58	.PIN, Flaot lock	1			
		-	32Q368	.DECAL, Operation	2			
		-	32Z1037	.PLATE, Instruction	2			

Ref. Dwg. 100N2493

100n2493-1

CARRIER AIR BRAKE ASSEMBLY
(SUPPLY CIRCUITS)



Group	Page	Rev.
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Sheet 1 of 6

CARRIER AIR BRAKE ASSEMBLY (Continued)

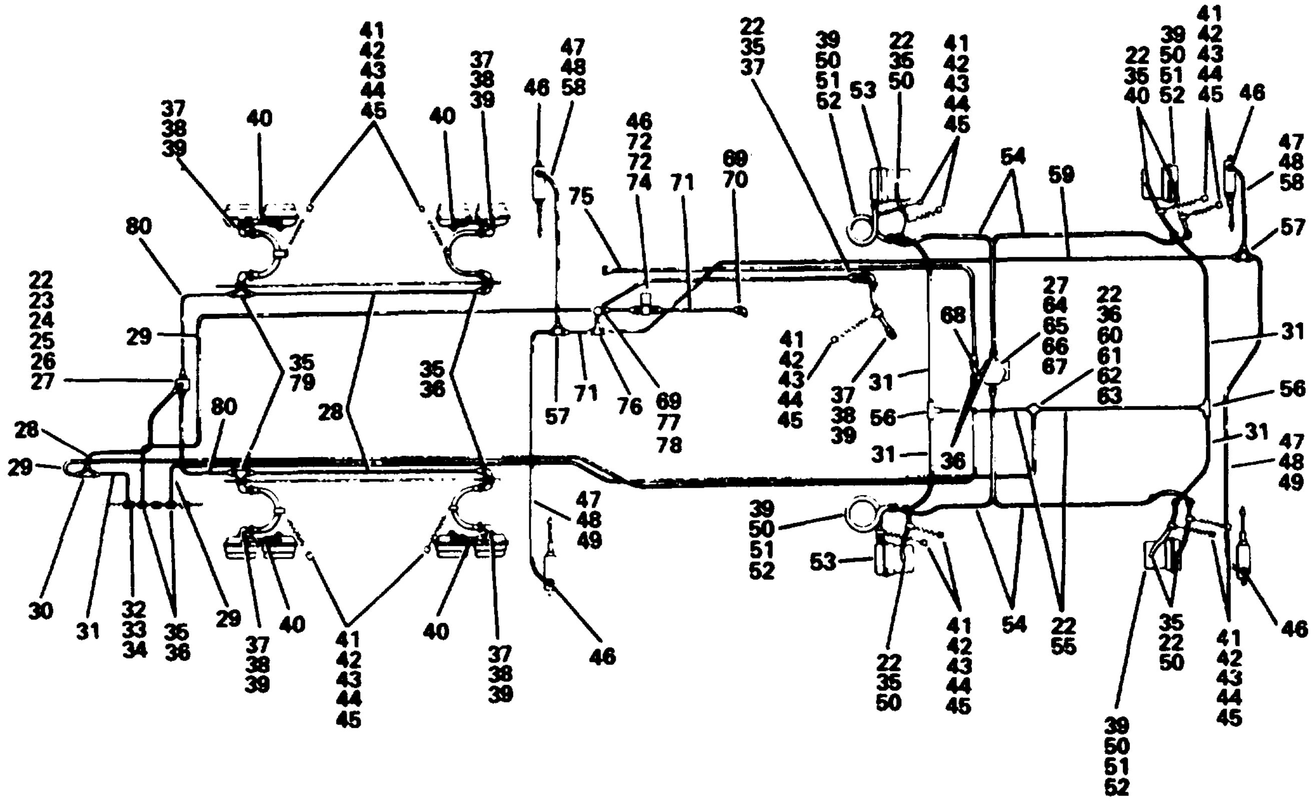
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	3	4	
		-	8100J1260-1	CARRIER AIR BRAKE ASSEMBLY-SUPPLY CIRCUIT	▼			
		-	8100J1260-3	CARRIER AIR BRAKE ASSEMBLY-SUPPLY CIRCUIT		▼		
		-	8100J1260-4	CARRIER AIR BRAKE ASSEMBLY-SUPPLY CIRCUIT			▼	
		01	44Z214D2	.CONNECTOR, Female	1	1	1	
		02	44Q3D1	.FITTING, Female swivel	1	1	1	
		03	44Q14D2	.FITTING	7	7	7	
		04		.HOSE, 1/4 in. ID x 1/2 in. OD x 7 in.	1	1	1	
		05	44Q14D1	.FITTING	1	1	1	
		06		.HOSE, 1/4 in. ID x 1/2 in. OD x 11 in.	3	3	3	
		07	44Z112	.MANIFOLD	1	1	1	
		08		.SCREW, Rd. hd. mach. 1/4-20UNC x 3/4 in	6	6	6	
		09		.WASHER, Lock 1/4 in.	6	6	6	
		10		.NUT, Hex 1/4-20UNC	6	6	6	
		11	44Z226D2	.PLUG, Pipe 1/4 in.	3	3	3	
		12	44Z206D3	.ELBOW, 90° street	5	5	5	
		13	44Z210D3	.BUSHING, Reducer 3/8 x 1/4 in.	1	1	1	
		14	20F57D29	.GROMMET	4	4	4	
		15	820P267D3	.HOSE ASSY., Treads valve to manifold	1	1	1	
		16	36Z225	.VALVE, Brake treadle	1	1	1	
		17		.SCREW, Hex hd. 5/16-18UNC x 1 in.	3	3	3	
		18		.WASHER, Lock 5/16 in.	5	5	5	
		19		.NUT, Hex 5/16-18UNC	5	5	5	
		20	820P292D2	.HOSE ASSY., Treads service and supply	2	2	2	
		21	14Z9D5	.FITTING, Through frame	4	4	4	
		22	44Z259D17	.ELBOW, 90°	1	1	1	
		23	14Z9D3	.FITTING, Through frame	18	18	18	
		24	44Z259D10	.ELBOW, 90°	11	11	11	
		25		.TUBE, 3/8 in. OD x 0.032 wall x 21 ft. 6 in.	1	1	1	
		26		.TUBE, 1/2 in. OD x 0.049 wall x 21 ft. 6 in.	1	1	1	
		27	44Z259D20	.ELBOW, 90°	2	2	2	
		28	44Z758D16	.HOSE, Compressor discharge	1	1	1	
		29	44Z371D6	UNION, Tube	1	1	1	
		30		.TUBE, 5/8 in. OD x 0.049 wall x 16 ft.	1	1	1	
		31	44Z206D1	.ELBOW, 90° street	1	1	1	
		32	44Z773D7	.CONNECTOR, Male	1	1	1	
		33		.TUBE, 3/8 in. OD x 0.032 wall x 15 ft.	1	1	1	
		34	44Z187D8	.CONNECTOR	18	18	18	
		35	44Z187D14	.CONNECTOR	1	1	1	
		36	44Z124D9	.TEE, Male	1	1	1	
		37		.TUBE, 3/8 in. OD x 0.032 wall x 3 ft. 6 in.	1	1	1	
		38		.TUBE, 1/2 in. OD x 0.049 wall x 1 ft. 6 in.	1	1	1	
		39	44Z187D15	.CONNECTOR	1	2	2	
		40	44Z187D18	.CONNECTOR	1	1	1	
		41		.TUBE, 5/8 in. OD x 0.049 wall x 1 ft. 6 in.	1	1	1	
		42	44Z187D19	.CONNECTOR	1	1	1	
		43		.TUBE, 3/8 in. OD x 0.032 wall x 2 ft	1	1	1	
		44	44Z42D3	.TEE, Unoin	1	1	1	
		45		.TUBE, 3/8 in. OD x 0.032 wall x 1 ft. 3 in.	2	2	2	
		46	816T23	.BRACKET, Supply valve	1	1	1	
		47	36Z7	.VALVE, Air supply	1	1	1	

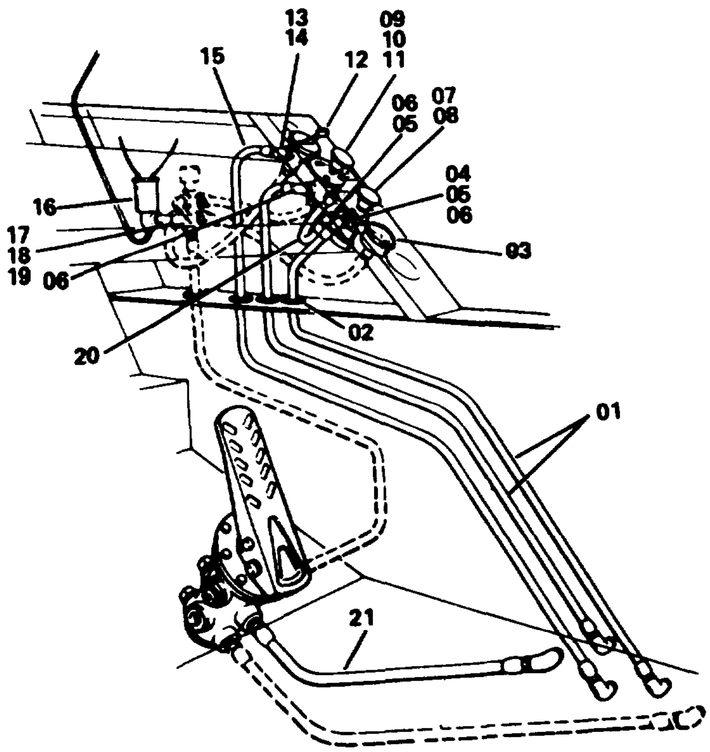
CARRIER AIR BRAKE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	3	4	
		48	44Z226D2	.PLUG, Pipe	1	1	1	
		49	44Z210D7	.BUSHING, Reducing 3/4 x 1/4 in.	1	1	1	
		50	36Z8	.COCK, Drain	3	4	4	
		51	816T949	.BRACKET, Air reservoir mounting	2	2	2	
		52	27Z5	.RESERVOIR, Air	3	3	3	
		53	16Z34	.BRACKET, Reservoir	6	6	6	
		54	44Z226D3	.PLUG, Pipe	4	6	6	
		55		.SCREW, Hex hd. 3/8-16UNC x 1 in.	2	6	6	
		56		.SCREW, Hex hd. 3/8-16UNC x 1-1/4 in.	14	14	14	
		57		.WASHER, Lock 3/8 in.	16	20	20	
		58		.NUT, Hex 3/8-16UNC	16	20	20	
		59		.WASHER, Plain 3/8 in.	12	12	12	
		60	44Z816	.VALVE, Check	2	3	3	
		61	44Z259D18	.ELBOW, 90°	3	4	4	
		62	44Z694D7	.NIPPLE, Hex pipe	-	3	3	
		63		.NIPPLE, 3/4 in. close galvanized pipe	2	-	-	
		64		.TUBE, 1/2 in. OD x 0.049 wall x 3 ft. 6 in.	1	1	1	
		65		.TUBE, 1/2 in. OD x 0.049 wall x 1 ft. 2 in.	1	-	-	
		66	36Z6	.VALVE, Safety	1	1	1	
		67	44Z210D3	.BUSHING, Reducer 3/8 x 1/4 in.	2	2	2	
		68	44Z41D1	.TEE, Adapter	1	1	1	
		69	44Z259D16	.ELBOW, 90°	2	2	2	
		70		.TUBE, 1/2 in. OD x 0.049 wall x 10 ft. 10 in.	-	1	1	
		71		.TUBE, 1/2 in. OD x 0.049 wall x 9 ft. 1 in.	-	1	1	
		72	27Z709	.RESERVOIR, Air	-	1	1	
		73	16Z180	.BRACKET, Reservoir	-	2	2	

Ref. Dwg. 8100J1260 G 100J4268-1
100J4268 F 100J4268-2
8100J1260-1
8100J1260-4

CARRIER AIR ASSEMBLY (Continued)
(FUNCTION CIRCUITS)





CARRIER AIR BRAKE ASSEMBLY (Continued)

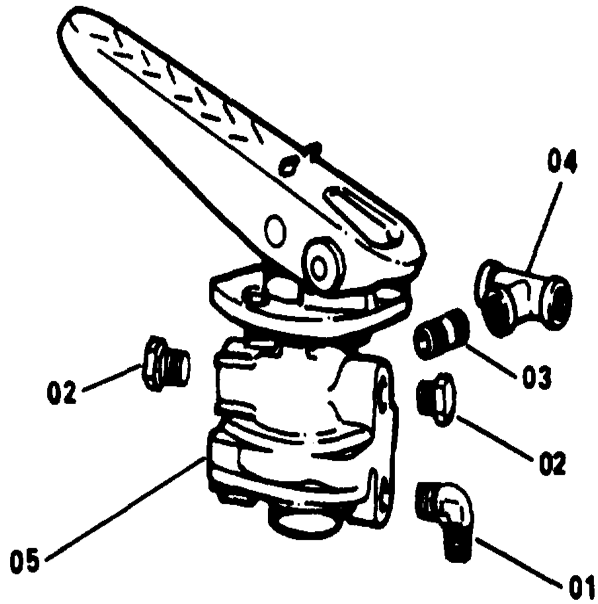
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	3	4
		-	8100J1260-1	AIR BRAKE ASSY - FUNCTION CIRCUIT			
		-	8100J1260-3	AIR BRAKE ASSY - FUNCTION CIRCUIT			
		-	8100J1260-4	AIR BRAKE ASSY - FUNCTION CIRCUIT			
		01	820P267D11	.HOSE ASSEMBLY	2	2	2
		02	20F57D29	.GROMMET	3	3	3
		03	89Z323	.GAUGE, Air	1	1	1
		04	20T5582D6	.COUPLING, Half pipe	1	1	1
		05	44Z425D2	.NIPPLE, Brass	1	1	1
		06	44Z206D3	.ELBOW, 90° street	3	3	3
		07	36Z222	.VALVE, Brake control	1	1	1
		08	32Z1030	.PLATE, Safety brake	1	1	1
		09	36Z362	.VALVE, Emergency release	1	1	1
		10	32Z975	.PLATE, Safety brake release	1	1	1
		11	32Z1399	.LABEL, Caution	1	1	1
		12	36Z1025	.VALVE, Inter axle differential lockout	1	1	1
		13	44Z226D1	.PLUG, Pipe	1	1	1
		14	44Z206D4	.ELBOW, 90° street	1	1	1
		15	820P267D4	.HOSE ASSY	1	1	1
		16	1036Z724	.VALVE, Air born solenoid	1	1	1
		17	44Z206D3	.ELBOW, 90°	1	1	1
		18	44Z210D1	.BUSHING, Reducing 1/4 x 1/8 in.	1	1	1
		19	44Z425D1	.NIPPLE, 1/8 x 1-1/2 in. lg.	1	1	1
		20		.HOSE, 1/4 in. ID x 1/2 in. OD x 11 in.	1	1	1
		21	820P292D2	.HOSE ASSY., Treadle service and supply	1	1	1
		22	44Z187D8	.CONNECTOR	7	7	7
		23	36Z254	.VALVE, Quick release	1	1	1
		24		.SCREW, Hex hd. 5/16-18UNC x 1 in.	2	2	2
		25		.WASHER, Lock 5/16 in.	2	2	2
		26		.NUT, Hex 5/16-18UNC	2	2	2
		27	44Z259D12	.ELBOW, 90°	4	4	4
		28		.TUBE, 3/8 in. OD x 0.032 wall x 4 ft. 8 in.	3	3	3
		29		.TUBE, 3/8 in. OD x 0.032 wall x 28 ft. 10 in.	3	3	3
		30	44Z42D3	.TEE, Union	1	1	1
		31		.TUBE, 3/8 in. OD x 0.032 wall x 1 ft. 8 in.	4	4	4
		32	14Z9D5	.FITTING, Through frame	1	1	1
		33	44Z259D14	.ELBOW, 90°	1	1	1
		34	2417V019	.ELBOW, 90° galvanized street	1	1	1
		35	14Z9D3	.FITTING, Through frame	6	6	6
		36	44Z259D10	.ELBOW, 90°	1	1	1
		37	2417V017	.ELBOW, 90° galvanized street	9	9	9
		38	44Z759D34	.HOSE ASSY	5	5	5
		39	44Z694D2	.NIPPLE, Hex pipe	9	9	9
		40	44Z759D20	.HOSE ASSY	4	4	4
		41	32Z1083D12	.CLAMP	11	11	11
		42	17Z8	.SPRING, Hose	13	13	13
		43		.SCREW, Rd. hd. Mach. 1/4-20UNC x 1/2 in.	11	11	11
		44		.WASHER, Lock 1/4 in.	11	11	11
		45		.NUT, Hex 1/4-20UNC	11	11	11
		46	44Z187D4	.CONNECTOR	-	-	6
		47	32Z372D5	.CLAMP, Insert	8	8	12

CARRIER AIR BRAKE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1	3	4	
		48	44Z1360D4	.INSERT,1/4 in. OD	-	-	8	
		49		.TUBE, Nylon 1/4 in. OD x 8 ft. 6 in.	-	-	2	
		50	44Z759D25	.HOSE ASSY	8	8	8	
		51	44Z206D3	.ELBOW, 45° street	4	4	4	
		52	38Q18D2	.CHAMBER, Rear axle air brake (Page 32.1)	4	4	4	
		53	6Q10D3	.YOKE ASSY	4	4	4	
		54		.TUBE, 3/8 in. OD x 0.032 wall x 6 ft. 6 in.	4	4	4	
		55		.TUBE, 3/8 in. OD x 0.032 wall x 3 ft	2	2	2	
		56	44Z42D3	.TEE, Tube	2	2	2	
		57	44Z42D7	.TEE, Union	-	-	2	
		58		.TUBE, Nylon 1/4 in. OD x 4 ft. 6 in.	-	-	2	
		59		.TUBE, 1/4 in. OD x 0.032 wall x 14 ft. 3-1/2 in.	-	-	1	
		60	36Z221	.VALVE, Exhaust and pressure retaining	1	1	1	
		61		.SCREW, Hex hd. 1/4-20UNC x 3/4 in.	2	2	2	
		62		.WASHER, Lock 1/4 in.	2	2	2	
		63		.NUT, Hex 1/4-20UNC	2	2	2	
		64		.SCREW, Hex hd. 3/8-16UNC x 1-1/4 in.	4	4	4	
		65		.WASHER, Lock 3/8 in.	4	4	4	
		66	36Z650	.VALVE, Relay	1	1	1	
		67		.NUT, Hex 3/8-16UNC	4	4	4	
		68	44Z259D16	.ELBOW, 90°	1	1	1	
		69		.TUBE, 1/4 in. OD x 0.032 wall x 4 in.	-	-	1	
		70	44Z210D2	.BUSHING, Pipe reducer	-	-	1	
		71		.TUBE, 1/4 in. OD x 0.032 wall x 2 ft.	-	-	2	
		72	36Z871	.VALVE, Solenoid	-	-	1	
		73		.SCREW, Rd. hd. mach. =10.24UNC x 5/16 in.	-	-	2	
		74	18H4146D7	.WASHER, Internal lock =10	-	-	2	
		75		.TUBE, 1/2 in. OD x 0.049 wall x 11 ft.	1	1	1	
		76	44Z124D8	.TEE, Male	-	-	1	
		77	14Z9D1	.FITTING, Through frame	-	-	1	
		78	44Z259D4	.ELBOW, 90°	-	2	2	
		79	44Z124D2	.TEE, Male	3	3	3	
		80		.TUBE, 3/8 in. OD x 0.032 wall x 6 ft.	2	2	2	

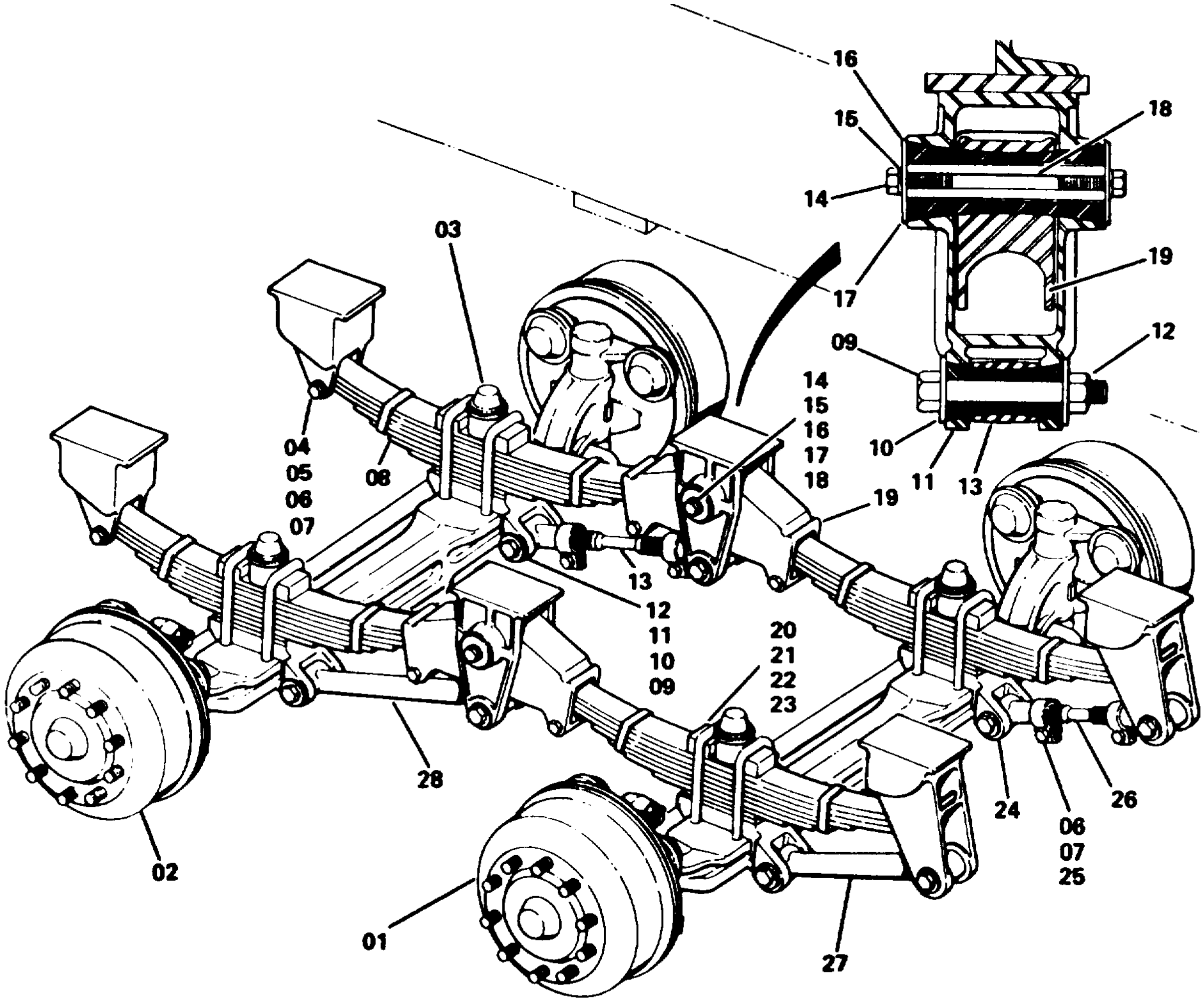
Ref. Dwg. 8100J1260 G 8100J1260-4
100J4268 F 100J4268-1
8100J1260-1 100J4268-2

DUAL BRAKE VALVE INSTALLATION



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	100T266-1	DUAL BRAKE VALVE INSTALLATION	▼			
		01	2417V019	.ELBOW, 90°	1			
		02	44Z226D4	.PLUG, Pipe 1/2 in.	2			
		03	2420V102	.NIPPLE,Galvanized pipe	2			
		04	2426V004	.TEE, Galvanized pipe	2			
		05	36Z933	.VALVE, Dual brake pedal	1			

FRONT SUSPENSION ASSEMBLY



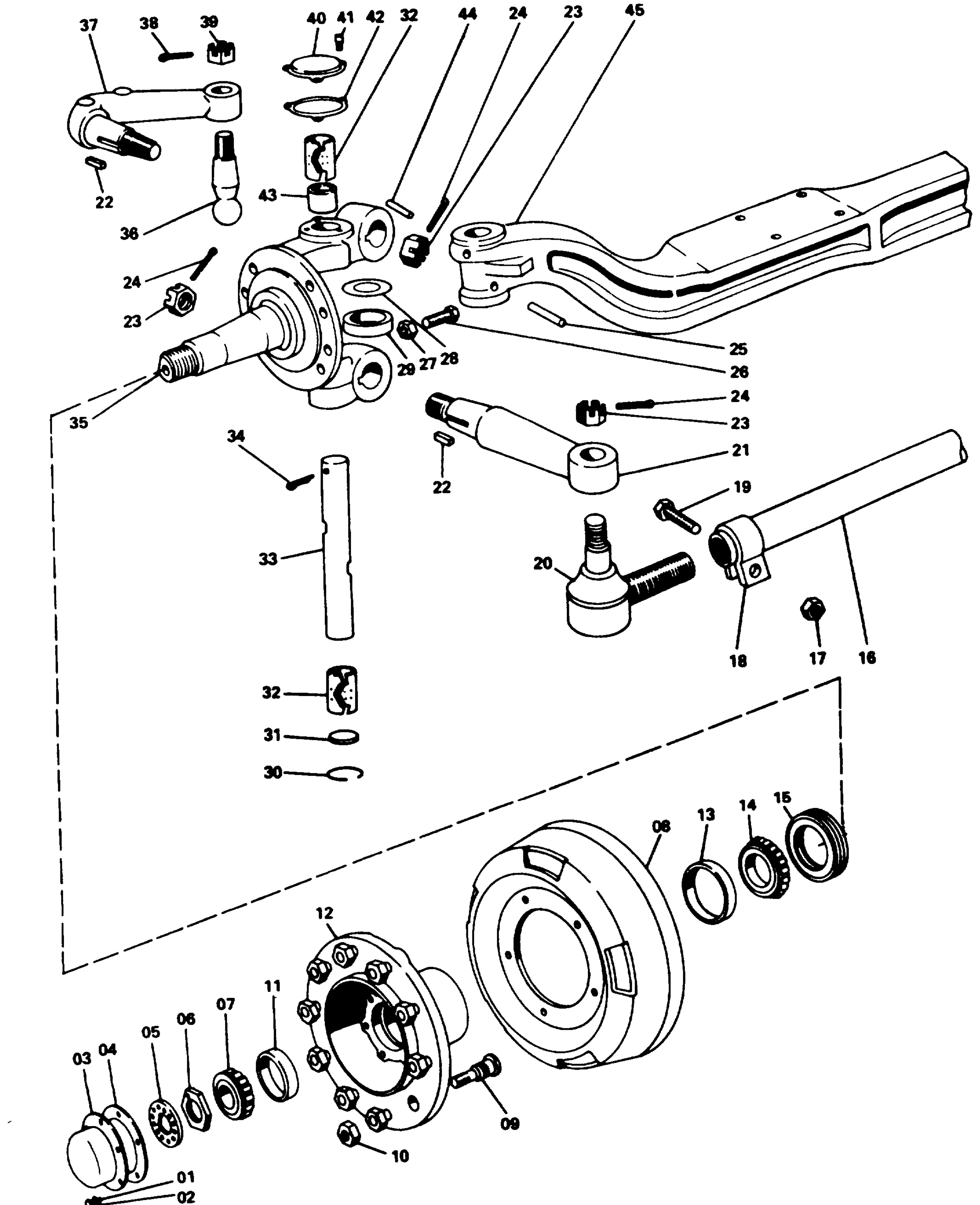
Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number 4	5		
		-	8100J1027-4	FRONT SUSPENSION ASSY				
		-	8100J1027-5	FRONT SUSPENSION ASSY				
		01	810P28D7	.AXLE, Forward front (Page 27.1)	1	-		
		01	810P30D1	.AXLE, Forward front (Page 27.2)	-	1		
		02	810P28D8	.AXLE, Rear front (Page 27.1)	1	-		
		02	810P30D2	.AXLE, Rear front (Page 27.2)	-	1		
		03	810N36D1	.BLOCK, Spring bumper	4	4		
		-	10U68D1	.KIT, Front axle suspension	1	1		
		04	1020Z22718	..SCREW, Cap 1/2 x 4-3/4 in.	6	6		
		05	1013Z166	..ROLLER, Spring	6	6		
		06		..WASHER, Lock 1/2 in.	10	10		
		07	1020Z2714	..NUT, Hex 1/2 in.	10	10		
		08	1017Z925	..SPRING	4	4		
		09	1020Z2715	..BOLT, Torque arm	8	8		
		10	1018Z2777	..WASHER, Compression	16	16		
		11	1005Z374	..BUSHING, Torque arm	16	16		
		12	1020Z2716	..NUT, Lock 1 in.	8	8		

FRONT SUSPENSION ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 4	5		
		13	1006Z329	..TORQUE ARM, Adjustable rear	1	1		
		14	1020Z2719	..BOLT, Equalizer	4	4		
		15		..WASHER, Lock 3/4 in.	4	4		
		16	1018Z2778	..WASHER, Equalizer compression	4	4		
		17	1025Z1209	..BEARING, Equalizer	4	4		
		18	1010Z555	..SHAFT, Equalizer	2	2		
		19	1024Z18	..EQUALIZER	2	2		
		20	1020Z2720	..U-BOLT, 3/4 x 11-1/2 in. lg.	8	8		
		21	1014Z506	..PLATE, U-bolt top	4	4		
		22		..WASHER, Lock 3/4 in.	16	16		
		23	1020Z2717	..NUT, High 3/4 in.	16	16		
		24	1010Z864	..SEAT, Axle	4	4		
		25	1020Z4861	..SCREW, Cap 1/2 x 1-3/4 in. lg.	4	4		
		26	1006Z328	..TORQUE ARM, Adjustable front	1	1		
		27	1006Z330	..TORQUE ARM, Rigid front	1	1		
		28	1006Z327	..TORQUE ARM, Rigid rear	1	1		

Ref. Dwg. 8100J1027 8
8100J1027-4
8100J1027-5

FRONT AXLE ASSEMBLY



Group	Page	Rev.
3	27.1	001

Sheet 1 of 5

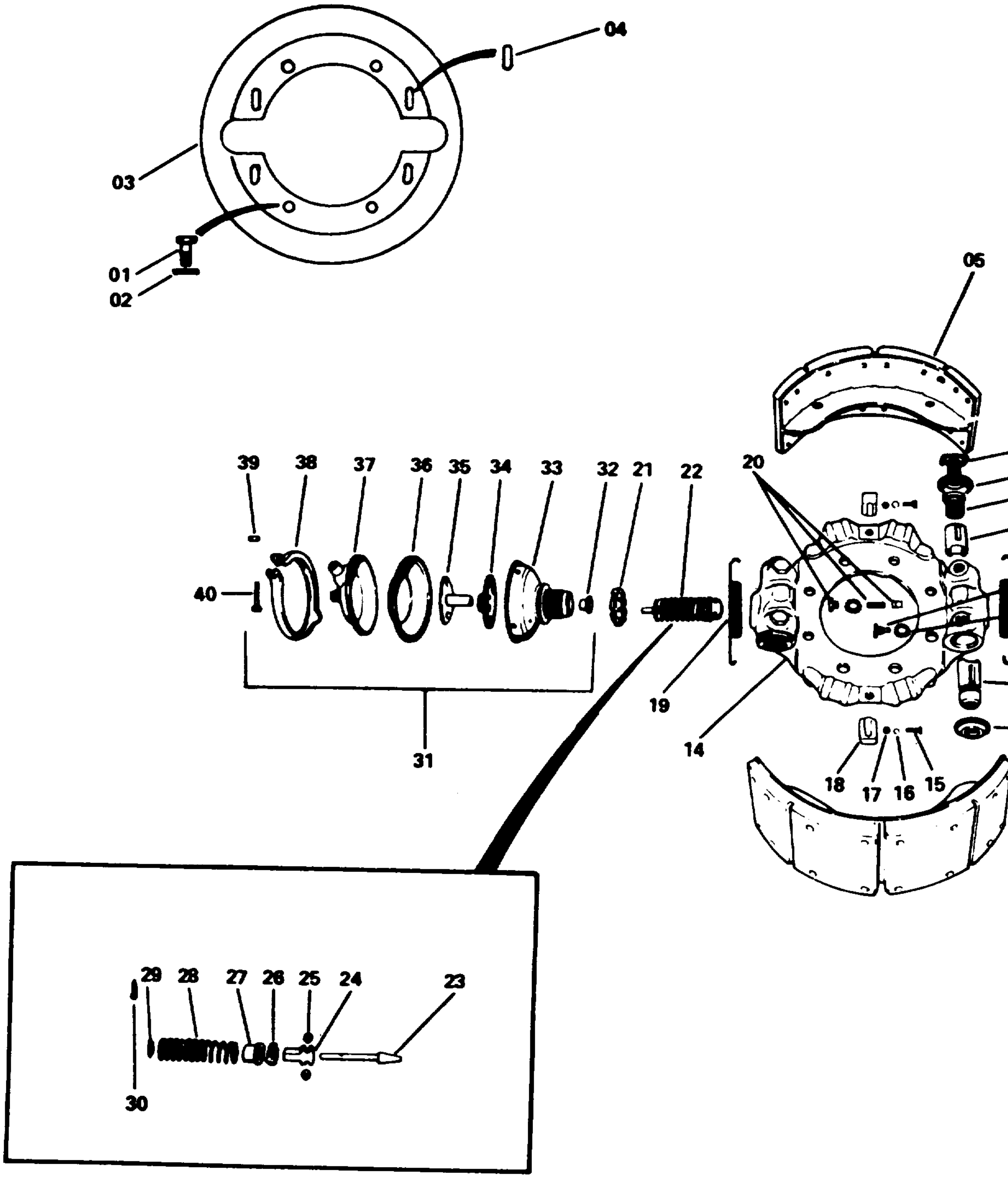
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number D7	D8		
		-	810P28D7	AXLE ASSEMBLY, FORWARD FRONT				
		-	810P28D8	AXLE ASSEMBLY, REAR FRONT				
		01	1020Z3411	.SCREW, Bearing cover cap	12	12		
		02	1018Z2821	.WASHER, Bearing cover screw	12	12		
		03	1014Z798	.COVER, Bearing cap	2	2		
		04	1020Z2455	.GASKET, Bearing cap	2	2		
		05	1018Z3547	.WASHER, Outer bearing	2	2		
		06	1020Z3394	.NUT, Bearing adjusting	2	2		
		07	1025Z1101	.CONE, Outer bearing	2	2		
		-	1013Z306	.HUB & DRUM ASSY., L.H.	1	1		
		08	1015Z894	..DRUM, Brake	1	1		
		09	1020Z3391	..STUD, L.H.wheel mouiting	10	10		
		10	20Z962D3	..NUT, L.H. wheel stud	10	10		
		-	1018Z3628	..HUB & CUP ASSY., L.H.	1	1		
		11	1025Z181	…CUP, Outer bearing	1	1		
		12	N.S.S.	…HUB	1	1		
		13	1025Z1360	…CUP, Inner bearing	1	1		
		-	1013Z305	.HUB & DRUM ASSY., R.H.	1	1		
		08	1015Z894	..DRUM, Brake	1	1		
		09	1020Z3392	..STUD, R.H. wheel mounting	10	10		
		10	1020Z2746	..NUT, R.H. wheel stud	10	10		
		-	1018Z3628	..HUB & CUP ASSY., R.H.	1	1		
		11	1025Z181	…CUP, Outer bearing	1	1		
		12	N.S.S.	…HUB	1	1		
		13	1025Z1360	…CUP, Inner bearing	1	1		
		14	1025Z1100	.CONE, Inner bearing	2	2		
		15	1018Z4339	.SEAL, Wheel bearing oil	2	2		
		16	1018Z3559	.TUBE, Tie rod	1	1		
		-	1032Z167	.CLAMP ASSY., Tie rod end	2	2		
		17	1020Z3407	..NUT, Tie rod clamp	2	2		
		18	1032Z116	..CLAMP, Tie rod end	2	2		
		19	1020Z3412	..BOLT, Tie rod clamp	2	2		
		20	1075Z673	.END ASSY., L.H.	1	1		
		20	1075Z672	.END ASSY., R.H.	1	1		
		21	1018Z3558	.ARM, Tie rod L.H.	1	1		
		21	1018Z3557	.ARM, Tie rod R.H.	1	1		
		22	1020Z2740	.KEY, Tie rod arm	4	4		
		23	1020Z3390	.NUT, Tie rod end	5	5		
		24	1019Z761	.PIN, Tie rod end cotter	5	5		
		25	1020Z3384	.KEY, Lower draw	2	2		
		25	1020Z3385	.KEY, Lower draw	2	2		
		25	1020Z3386	.KEY, Lower draw	2	2		
		26	1020Z3393	.SCREW, Center stop	2	2		
		27	1020Z2771	.NUT, Stop screw lock	2	2		
		28	1020Z3400	.SHIM, 0.005	AR	AR		
		28	1020Z3399	.SHIM, 0.010	AR	AR		
		28	1020Z3398	.SHIM, 0.015	AR	AR		
		28	1020Z3397	.SHIM, 0.030	AR	AR		
		29	1025Z1362	.BEARING, Thrust	2	2		
		30	1018Z3549	.RING, Pin lock	2	2		

FRONT AXLE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity			
					Figure Number			
					D7	D8		
		31	1020Z3395	.PLUG, Steering knuckle	2	2		
		32	1005Z415	.BUSHING, Steering knuckle	4	4		
		33	1019Z759	.PIN, Steering knuckle	2	2		
		34	1020Z949	.PIN, Steering knuckle pin cotter	2	2		
		35	1006Z437	.KNUCKLE, L.H. steering	1	1		
		35	1006Z436	.KNUCKLE, R.H. steering	1	1		
		36	1020Z1213	.BALL, Steering arm	1	1		
		37	1006Z438	.ARM, Steering	1	1		
		38	1020Z949	.PIN, Steering arm cotter	1	1		
		39	10Z391	.NUT, Steering arm	1	1		
		40	1014Z796	.CAP, Steering knuckle bushing	2	2		
		41	1020Z3458	.SCREW, Bushing cap	6	6		
		42	1020Z3401	.GASKET, Bushing cap	2	2		
		43	1018Z3550	.SPACER	A	A		
		44	1020Z3387	.KEY, Upper draw	R	R		
		44	1020Z3388	.KEY, Upper draw	2	2		
		44	1020Z3389	.KEY, Upper draw	2	2		
		45	1010Z705	.AXLE CENTER	2	2		
					1	1		

Ref. Dwg. 810P28D0 G
810P28D7
810P28D8

BRAKE GROUP - FRONT AXLE

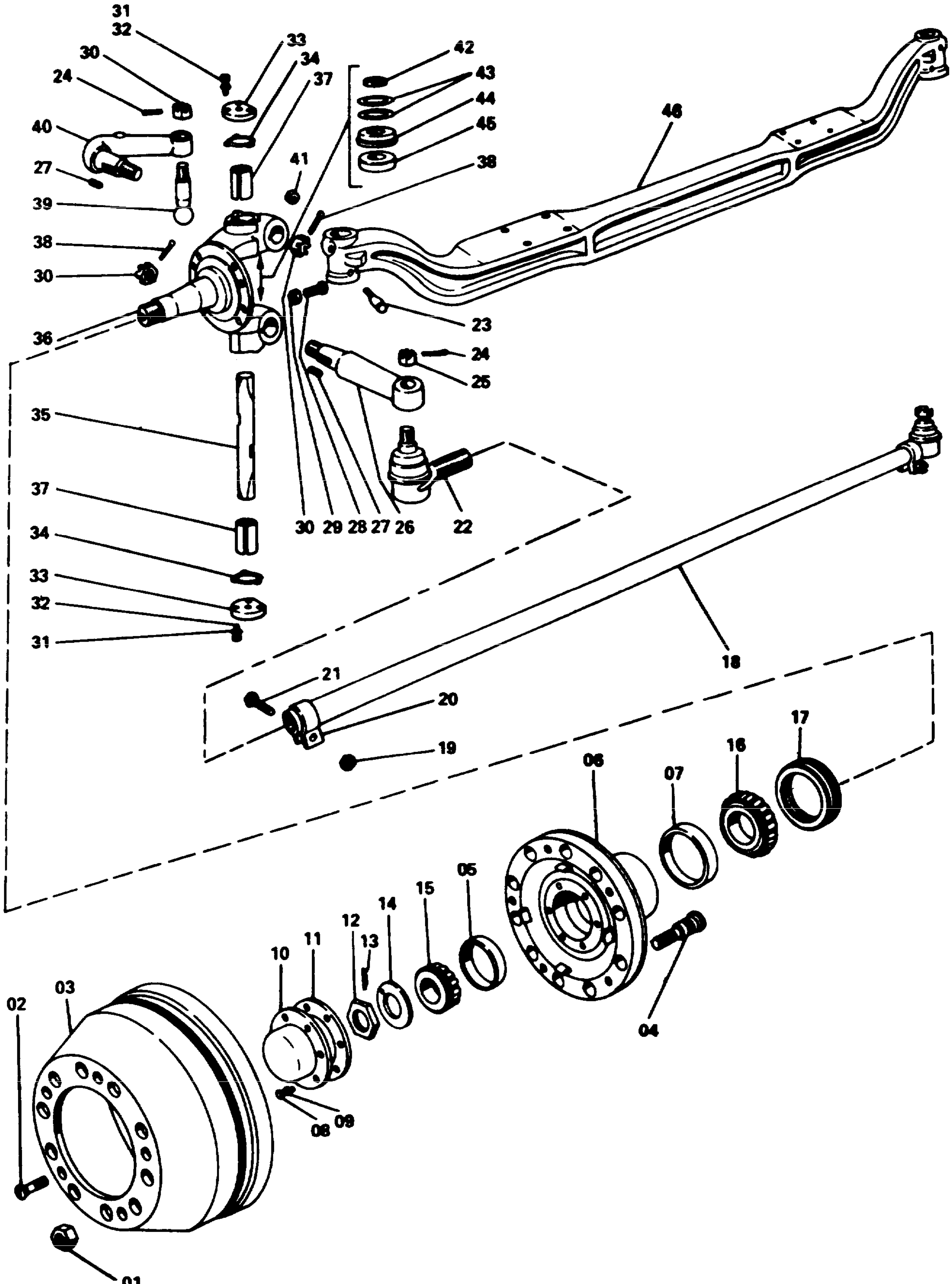


BRAKE GROUP - FRONT AXLE (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-		BRAKE GROUP, R.H. FRONT AXLE				
		-		BRAKE GROUP, L.H. FRONT AXLE				
		01	1020Z2773	.SCREW, Dust shield mounting	4	4		
		02	1018Z3548	.WASHER, Lock	4	4		
		03	1014Z799	.SHIELD, Dust	1	1		
		04	1014Z797	.PLUG, Dust shield	4	4		
		05	1015Z967	.SHOE & LINING ASSY	2	2		
		06	1038Z249	.BOLT ASSY., Adjusting	2	2		
		07	1018Z4340	.SEAL, Adjusting bolt	2	2		
		08	1020Z4387	.ACTUATOR, Adjusting	2	2		
		09	75Z797D1	.PLUNGER, Adjusting	2	2		
		10	1020Z3396	.GUIDE, Plunger	2	2		
		11	1020Z2754	.GASKET, Plunger guide	2	2		
		12	1075Z669	.ANCHOR, R.H. plunger	2	-		
		12	1075Z670	.ANCHOR, L.H. plunger	-	2		
		13	1018Z3560	.SEAL, Plunger anchor	2	2		
		14	1013Z231	.SPIDER ASSY	1	1		
		15	1020Z3410	..SCREW, Hold down clip	2	2		
		16	1018Z1544	..WASHER, Lock	2	2		
		17	1020Z3406	..NUT, Hold down clip	2	2		
		18	1018Z3552	..CLIP, Spider hold down	2	2		
		19	1017Z633	.SPRING, Shoe return	2	2		
		20	1006Z535	.GUIDE ASSY., Adjusting pawl	2	2		
		21	1020Z2752	.NUT, Collet	2	2		
		22	1020Z3404	.WEDGE ASSY	2	2		
		23	1020Z3402	..WEDGE	1	1		
		24	1018Z3553	..RETAINER, Wedge roller	1	1		
		25	1013Z200	..ROLLER, Wedge	2	2		
		26	1018Z3555	..WSHER, Wedge seal	1	1		
		27	1018Z3551	..SEAL, Wedge	1	1		
		28	1017Z805	..SPRING, Wedge	1	1		
		29	1018Z3554	..WASHER, Wedge spring	1	1		
		30	1019Z760	..PIN, Cotter	1	1		
		31	1038Z250	.BRAKE CHAMBER, Front axle	2	2		
		32	1018Z3556	..GUIDE, Wedge	1	1		
		33	1014Z800	..HOUSING, Non-pressure	1	1		
		34	1045Z766	..BOOT, Diaphragm plate	1	1		
		35	1050Z114	..PLATE ASSY., Diaphragm	1	1		
		36	1050Z107	..DIAPHRAGM	1	1		
		37	1014Z556	..HOUSING, Pressure	1	1		
		38	1032Z109	..CLAMP, Housing	1	1		
		39	1020Z4893	..NUT, Housing clamp	1	1		
		40	1020Z2734	..BOLT, Housing clamp	1	1		

Ref. Dwg. 810P28D0 G
810P28D7
810P28D8

FRONT AXLE ASSEMBLY



FRONT AXLE ASSEMBLY (Continued)

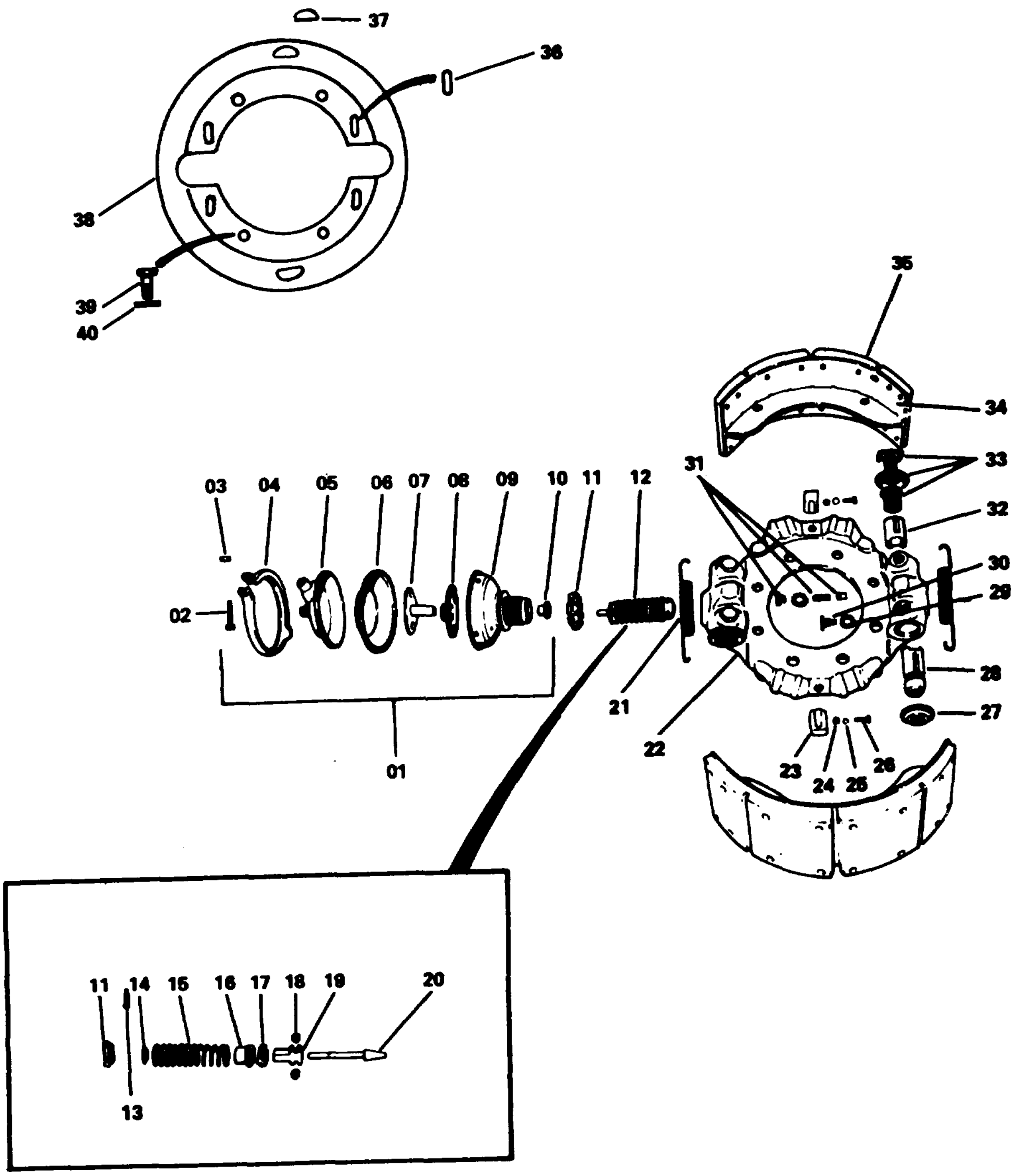
QTY	STOCK	Ref.	Part Number	Description	Quantity D1	Quantity D2		
		-	810P30D1	AXLE ASSEMBLY - FORWARD FRONT	▼			
		-	810P30D2	AXLE ASSEMBLY - FORWARD FRONT		▼		
		-	1013Z301	.HUB & DRUM ASSY., L.H.	1	1		
		01	1020Z291	..NUT, L.H. wheel stud	10	10		
		02	1020Z2777	..SCREW, Hub to drum mounting	5	5		
		03	1015Z1082	..DRUM, Brake	1	1		
		-	1013Z299	..HUB & STUD ASSY., L.H.	1	1		
		04	1020Z4852	…STUD, L.H. wheel	10	10		
		-	1013Z303	…HUB & BEARING CUP ASSY	1	1		
		05	1025Z744	….CUP, Outer bearing	1	1		
		06	N.S.S.	….HUB	1	1		
		07	1025Z1360	….CUP, Inner bearing	1	1		
		-	1013Z302	.HUB & DRUM ASSY., R.H.	1	1		
		01	1020Z2746	..NUT, R.H. wheel stud	10	10		
		02	1020Z2777	..SCREW, Hub to drum mounting	5	5		
		03	1015Z1082	..DRUM, Brake	1	1		
		-	1013Z300	..HUB & STUD ASSY., R.H.	1	1		
		04	1020Z4851	…STUD, R.H. wheel	10	10		
		-	1013Z303	…HUB & BEARING CUP ASSY	1	1		
		05	1025Z744	….CUP, Outer bearing	1	1		
		06	N.S.S.	….HUB	1	1		
		07	1025Z1360	….CUP, Inner bearing	1	1		
		08	1020Z4873	.SCREW, Bearing cap	12	12		
		09	1018Z4708	.WASHER, Bearing cap lock	12	12		
		10	1014Z798	.CAP, Hub bearing	2	2		
		11	1020Z4872	.GASKET, Hub bearing cap	2	2		
		12	1020Z3394	.NUT, Wheel bearing	2	2		
		13	1019Z767	.PIN, Cotter	2	2		
		14	1018Z3547	.WASHER, Wheel bearing	2	2		
		15	1025Z1374	.CONE, Outer wheel bearing	2	2		
		16	1025Z1100	.CONE, Inner wheel bearing	2	2		
		17	1018Z4756	.SEAL, Wheel bearing oil	2	2		
		18	1018Z4753	.TIE ROD ASSY	1	1		
		19	N.S.S.	..NUT, Tie rod end clamp	2	2		
		20	N.S.S.	..CLAMP, Tie rod end	2	2		
		21	N.S.S.	..SCREW, Tie rod end clamp	2	2		
		22	N.S.S.	..END ASSY	2	2		
		23	1020Z4876	.KEY, Lower steering knuckles draw	2	2		
		23	1020Z4875	.KEY, Upper steering knuckles draw	2	2		
		24	1020Z949	.PIN, Cross tube arm cotter	2	2		
		25	1020Z3390	.NUT, Tie rod end	2	2		
		26	1018Z3558	.ARM, L.H. cross tube	1	1		
		26	1018Z3557	.ARM, R.H. cross tube	1	1		
		27	1020Z2740	.KEY, Steering arm	2	2		
		28	1020Z4833	.SCREW, Axle center stop	2	2		
		29	1020Z4166	.NUT, Axle center stop screw	2	2		
		30	20Z391	.NUT, Steering arm bell	4	4		
		31	1020Z4871	.SCREW, Dust cover cap	12	12		
		32	1018Z2821	.WASHER, Dust cover screw lock	12	12		
		33	1020Z4877	.COVER, Dust cap	4	4		

FRONT AXLE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number D1	D2		
		34	1020Z4870	.GASKET, Dust cap	4	4		
		35	1019Z930	.PIN, Steering knuckle	2	2		
		36	1010Z975	.STEERING KNUCKLE & BUSHING ASSY., L.H.	1	1		
		37	1005Z497	..BUSHING, Bronze	2	2		
		36	1010Z974	.STEERING KNUCKLE & BUSHING ASSY., R.H.	1	1		
		37	1005Z497	..BUSHING, Bronze	2	2		
		38	1019Z761	.PIN, Tie rod cotter	4	4		
		39	1006Z641	.BALL, 1-3/4 in. steering	1	1		
		40	1006Z642	.ARM, Steering	1	1		
		41	1020Z4854	.NUT, Draw key	4	4		
		42	1018Z4755	.SEAL, Upper steering knuckle oil	2	2		
		43	1020Z3400	.SHIM, Steering knuckle 0.005	A	A		
		43	1020Z339	.SHIM, Steering knuckle 0.010	R	R		
		43	1020Z3398	.SHIM, Steering knuckle 0.015	A	A		
		43	1020Z3397	.SHIM, Steering knuckle 0.030	R	R		
		44	1018Z4754	.SEAL, Lower steering knuckle oil	A	A		
		45	1025Z1362	.BEARING, Thrust	R	R		
		46	1010Z977	.AXLE CENTER	A	A		
					R	R		
					2	2		
					2	2		
					1	1		

Ref. Dwg. 810P30D0 C
810P30D1
810P30D2

BRAKE ASSEMBLY - FRONT AXLE

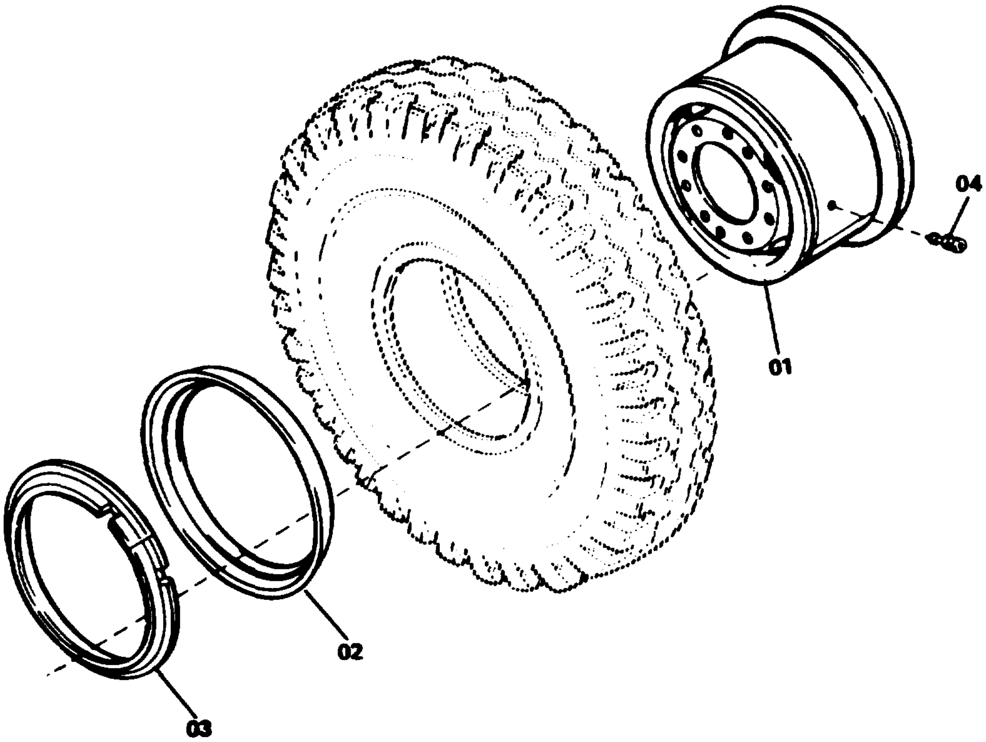


BRAKE ASSEMBLY - FRONT AXLE (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-	1015Z1079	BRAKE ASSY.-L.H. FORWARD & REAR FRONT AXLE				
		-	1015Z1078	BRAKE ASSY.-R.H. FORWARD & REAR FRONT AXLE				
		01	1038Z246	.CHAMBER, Front axle brake	4	4		
		02	1020Z2734	..BOLT, Clamp	1	1		
		03	1020Z4390	..NUT, Clamp bolt	1	1		
		04	1018Z4165	..RING, Clamp	1	1		
		05	1014Z1288	..HOUSING, Pressure	1	1		
		-	1020Z4874	…PLUG	1	1		
		06	1050Z125	..DIAPHRAGM	1	1		
		07	1050Z134	..PLATE ASSY., Diaphragm	1	1		
		08	1045Z1341	..PROTECTOR, Non-pressure housing	1	1		
		09	1014Z1305	..HOUSING ASSY., Non-pressure	1	1		
		10	1018Z3556	..GUIDE, Wedge return	1	1		
		11	1020Z2752	.NUT, Collet	4	4		
		12	1020Z4164	.WEDGE ASSY	4	4		
		13	1019Z760	..PIN, Wedge cotter	1	1		
		14	1018Z3554	..WASHER, Wedge	1	1		
		15	1017Z805	..SPRING, Wedge	1	1		
		16	1018Z3551	..SEAL, Wedge	1	1		
		17	1018Z3555	..WASHER, Wedge	1	1		
		18	1013Z200	..ROLLER, Wedge	2	2		
		19	1018Z3553	..CAGE, Wedge roller	1	1		
		20	1020Z4156	..WEDGE	1	1		
		21	1017Z955	.SPRING, Shoe return	4	4		
		22	1013Z298	.SPIDER ASSY., Brake mounting	2	2		
		23	1018Z3552	..CLIP, Spider hold down	2	2		
		24	1020Z3406	..NUT, Hold down clip	2	2		
		25	1018Z1544	..WASHER, Hold down clip lock	2	2		
		26	1020Z3410	..SCREW, Hold down clip mounting	2	2		
		27	1018Z3560	.RETAINER ASSY., Plunger anchor	4	4		
		28	1075Z697	.ANCHOR, L.H. plunger	2			
		28	1075Z696	.ANCHOR, R.H. plunger		2		
		29	1018Z3548	.WASHER, Guide lock	4	4		
		30	1020Z3396	.GUIDE, Plunger	4	4		
		31	1006Z535	.GUIDE ASSY., Adjusting pawl	4	4		
		32	1075Z690	.PLUNGER, Adjusting	4	4		
		33	1020Z4388	.ACTUATOR ASSY	4	4		
		34	1015Z1077	.SHOE & LINING ASSY	4	4		
		35	1015Z1081	..KIT, Brake lining	1	1		
		-		…LINING, Brake	1	1		
		-		…RIVET, Brake mounting	1	1		
		36	1014Z797	.PLUG, Dust shield	8	8		
		37	1014Z1280	.PLUG, Dust shield	4	4		
		38	1014Z1306	.PLATE, Dust shield	2	2		
		39	1020Z2754	.WASHER, Dust shield screw	8	8		
		40	1020Z2773	.SCREW, Dust shield mounting	4	4		

Ref. Dwg. 810P30D0 C
810P30D1
810P30D2

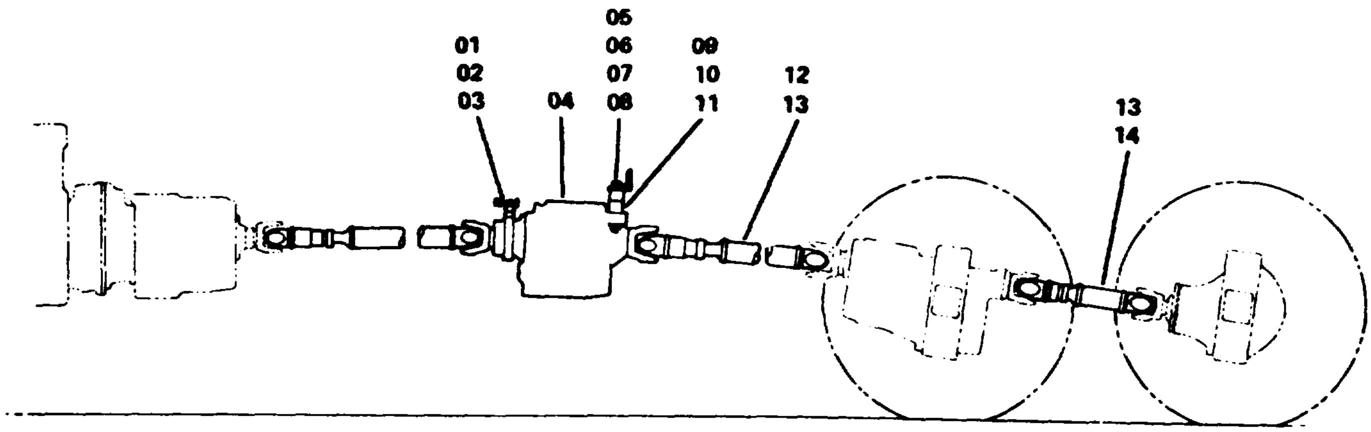
WHEEL AND RIM ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 1			
		-	913T13-1	WHEEL & RIM ASSEMBLY	▼			
		-	13Z99	.RIM ASSEMBLY	12			
		01	13Z205	..BASE, Rim	1			
		02	13Z204	..FLANGE	1			
		03	13Z206	..RING, Lock	1			
		04	36Z93	.KIT, Valve extension	8			

Ref. Dwg. 913T13 A
913T13-1

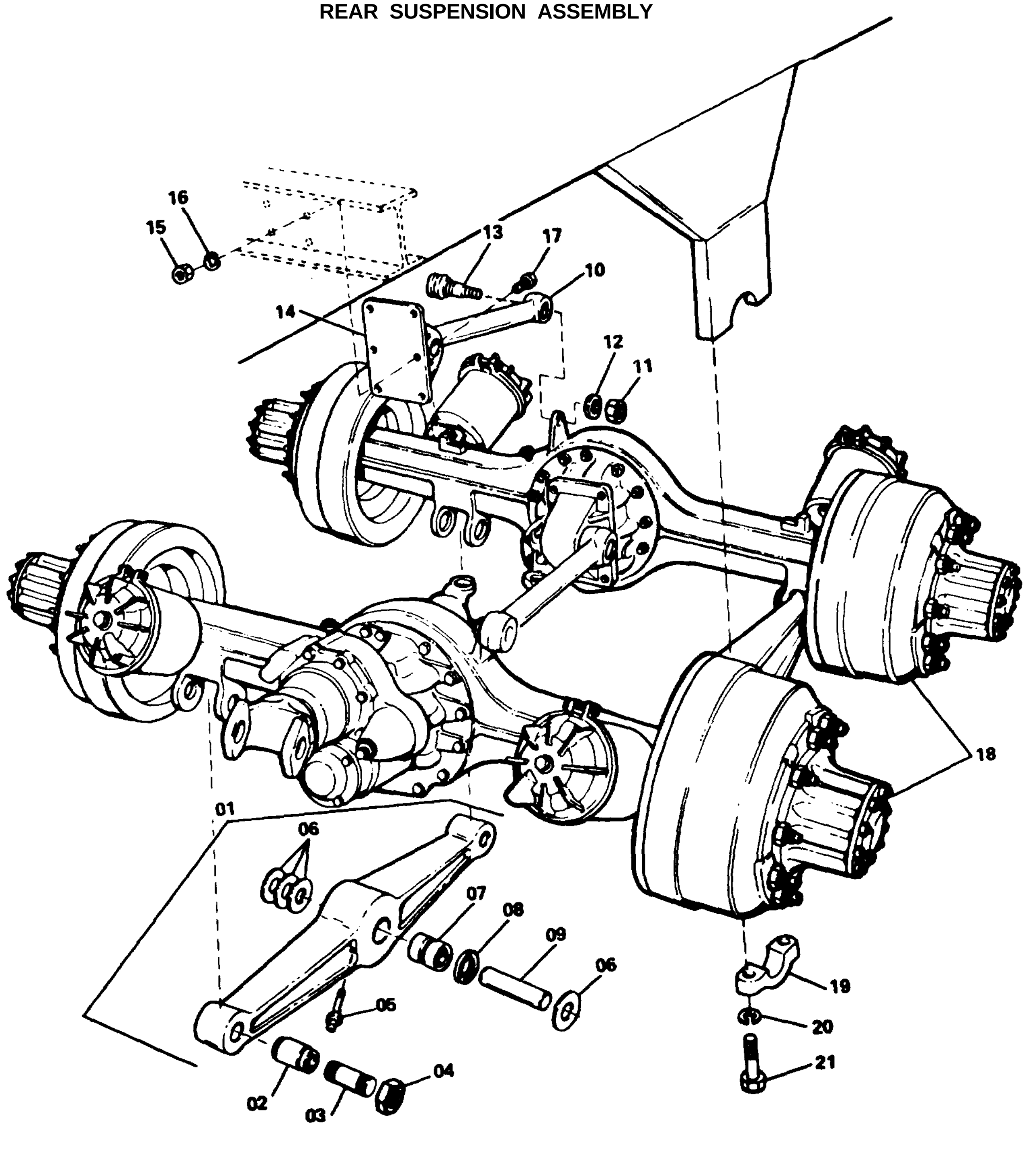
PROPELLER SHAFTS AND AUXILIARY TRANSMISSION ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 7	8		
		-	8100J1145-7	PROPELLER SHAFTS & AUXILLIARY TRANS.	▼			
		-	8100J1145-8	PROPELLER SHAFTS & AUXILLIARY TRANS.		▼		
		-	SEE NOTE	.SHAFT, Front propeller	1	1		
		01		.WASHER, Lock 5/8 in.	2	2		
		02		.NUT, Hex 5/8-18UNF	2	2		
		03	20Z547D119	.SCREW, Hex hd. 5/8-18UNF x 3 in. GR 5	2	2		
		04	53Z455	.TRANSMISSION, Auxiliary (Page 4-6.1,4-6.2)	1	-		
		05	20Z547D156	.SCREW, Hex hd. 7/8-18UNF x 5-1/2 in. GR 5	2	2		
		06		.WASHER, Lock 7/8 in.	2	2		
		07		.WASHER, Plain 7/8 in.	2	2		
		08		.NUT, Hex 7/8-14UNF	2	2		
		09	818T442	.BLOCK, Spacer	2	2		
		10	45Z335D2	.ADAPTER, Speedometer gear	1	1		
		11	6Z212D10	.CABLE, Speedometer	1	1		
		12	810N37D14	.SHAFT, Immediate propeller	1	1		
		-	1025Z1558	..KIT, Journal cross and bearing	2	2		
		13		.FITTING, Lube	9	9		
		14	10U49D4	.SHAFT, Inter-axle propeller	1	1		
		-	1025Z1560	..KIT, Journal cross and bearing	2	2		
				NOTE				
				Front propeller shaft and auxiliary transmission, Ref. 04, Figure 8, vary according to the power plant used on your machine. For these part numbers consult your power plant industry.				

Ref. Dwg. 8100J1145 E
8100J1145-7
8100J1145-8

REAR SUSPENSION ASSEMBLY



REAR SUSPENSION ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 6	7	8	9
		-	8100J2019-6	REAR SUSPENSION ASSEMBLY				
		-	8100J2019-7	REAR SUSPENSION ASSEMBLY				
		-	8100J2019-8	REAR SUSPENSION ASSEMBLY				
		-	8100J2019-9	REAR SUSPENSION ASSEMBLY				
		-	20Z1564	.SUSPENSION, Rear	1	1	1	1
		01	1016Z387	..BEAM ASSEMBLY, Enqualizer	2	2	2	2
		02	1005Z386	…BUSHING, Beam end	2	2	2	2
		-	1020Z4892	…TUBE & NUT, Beam end	1	1	1	1
		03		….TUBE, Beam end	4	4	4	4
		04		….NUT, Beam end tube	8	8	8	8
		05	1044Z532	…FITTING, Lube	1	1	1	1
		-	1045Z1352	…KIT, Center bushing	1	1	1	1
		06		….WASHER, Thrust	4	4	4	4
		07		….BUSHING, Beam center	1	1	1	1
		08		….SEAL	2	2	2	2
		09	1018Z2881	…SLEEVE, Center beam	1	1	1	1
		10	1006Z358	..ROD ASSEMBLY, Torque	2	2	2	2
		-	1045Z1351	…KIT, Torque rod end	1	1	1	1
		11		….NUT, Lock	1	1	1	1
		12		….SPACER	1	1	1	1
		13		….STUD & RUBBER ASSEMBLY	1	1	1	1
		14	1016Z386	..BRACKET, Torque rod frame	2	2	2	2
		15		.NUT, Hex 1/2-13UNC	12	12	12	12
		16		.WASHER, Lock 1/2 in.	12	12	12	12
		17	20Z646D78	.SCREW, Hex hd. 1/2-13UNC x 2 in. Gr.5	12	12	12	12
		18	10Z464	.AXLE, Rear (Page 31.1)	1	1	-	-
		18	10Z463	.AXLE, Rear (Page 31.2)	-	-	1	1
		19	1014Z1312	.CAP, Lower	2	2	2	2
		20		.WASHER, Lock 3/4 in.	4	4	4	4
		21		.SCREW, Hex hd. 3/4-16UNF x 4 in.	4	4	4	4

Ref. Dwg. ~~8100J2019-E~~
8100J2019-6
8100J2019-7
8100J2019-8
8100J2019-9

REAR SUSPENSION ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 6	7	8	9
		-	8100J2019-6	REAR SUSPENSION ASSEMBLY	▼			
		-	8100J2019-7	REAR SUSPENSION ASSEMBLY		▼		
		-	8100J2019-8	REAR SUSPENSION ASSEMBLY			▼	
		-	8100J2019-9	REAR SUSPENSION ASSEMBLY				▼
		-	20Z1564	SUSPENSION, Rear	1	1	1	1
		01	1016Z387	..BEAM ASSEMBLY, Enqualizer	2	2	2	2
		02	1005Z386	…BUSHING, Beam end	2	2	2	2
		-	1020Z4892	…TUBE & NUT, Beam end	1	1	1	1
		03		….TUBE, Beam end	4	4	4	4
		04		….NUT, Beam end tube	8	8	8	8
		05	1044Z532	…FITTING, Lube	1	1	1	1
		-	1045Z1352	…KIT, Center bushing	1	1	1	1
		06		….WASHER, Thrust	4	4	4	4
		07		….BUSHING, Beam center	1	1	1	1
		08		….SEAL	2	2	2	2
		09	1018Z2881	…SLEEVE, Center beam	1	1	1	1
		10	1006Z358	..ROD ASSEMBLY, Torque	2	2	2	2
		-	1045Z1351	…KIT, Torque rod end	1	1	1	1
		11		….NUT, Lock	1	1	1	1
		12		….SPACER	1	1	1	1
		13		….STUD & RUBBER ASSEMBLY	1	1	1	1
		14	1016Z386	..BRACKET, Torque rod frame	2	2	2	2
		15		.NUT, Hex 1/2-13UNC	12	12	12	12
		16		.WASHER, Lock 1/2 in.	12	12	12	12
		17	20Z646D78	.SCREW, Hex hd. 1/2-13UNC x 2 in. Gr.5	12	12	12	12
		18	10Z464	.AXLE, Rear (Page 31.1)	1	1	-	-
		18	10Z463	.AXLE, Rear (Page 31.2)	-	-	1	1
		19	1014Z1312	.CAP, Lower	2	2	2	2
		20		.WASHER, Lock 3/4 in.	4	4	4	4
		21		.SCREW, Hex hd. 3/4-16UNF x 4 in.	4	4	4	4

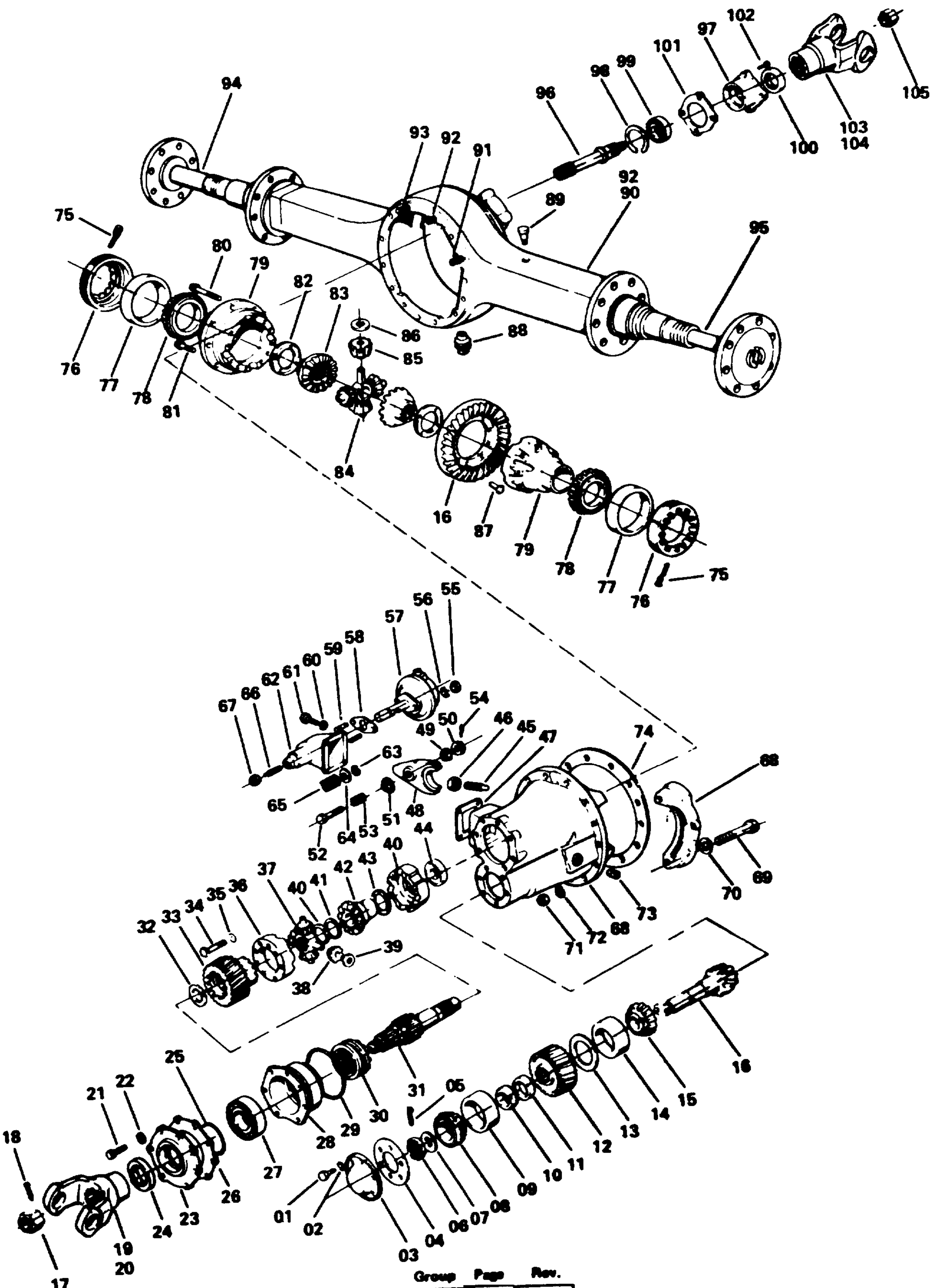
Ref. Dwg. 8100J2019-F
8100J2019-6
8100J2019-7
8100J2019-8
8100J2019-9

REAR SUSPENSION ASSEMBLY (Continued)

Ref.	Part Number	Description	Quantity					
			Figure Number					
			5					
-	8100J2019-5	REAR SUSPENSION ASSEMBLY						
-	20Z1564	.SUSPENSION, Rear	1					
01	1016Z387	..BEAM ASSEMBLY, Equalizer	2					
02	1005Z386	…BUSHING, Beam end	2					
-	1020Z4892	…TUBE AND NUT, Beam end	1					
03		….TUBE, Beam end	4					
04		….NUT, Beam end tube	8					
05	1044Z532	…FITTING, Lube	1					
-	1045Z1352	…KIT, Center bushing	1					
06		….WASHER, Thrust	4					
07		….BUSHING, Beam center	1					
08		….SEAL	2					
09	1018Z2881	…SLEEVE, Center beam	1					
10	1006Z358	..ROD ASSEMBLY, Torque	2					
-	1045Z1351	…KIT, Torque rod end	1					
11		….NUT, Lock	1					
12		….SPACER	1					
13		….STUD AND RUBBER ASSEMBLY	1					
14	1016Z386	..BRACKET, Torque rod frame	2					
15		.NUT, Hex 1/2-13UNC	1					
16		.WASHER, Lock 1/2 in.	2					
17	20Z646D78	.SCREW, Hex hd. 1/2-13UNC x 2 in. GR. 5	1					
18	10Z423	.AXLE, Rear (Page 31.4)	2					
19	1014Z1312	.CAP, Lower	1					
20		.WASHER, Lock 3/4 in.	2					
21		.SCREW, Hex hd. 3/4-16UNF x 4 in.	1					
			2					
			4					
			4					

Ref. Dwg. 8100J2015 G
8100J2015-5

FORWARD REAR AXLE GROUP



FORWARD REAR AXLE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-		AXLE GROUP, FORWARD REAR				
		-	1053Z117	.DIFFERENTIAL ASSY., Forward rear	1			
		1	1020Z2744	..BOLT, Lower cover	6			
		2	1018Z2786	..WASHER, Lower cover bolt	6			
		3	1014Z545	..COVER, Drive gear	1			
		4	1020Z2763	..GASKET, Drive gear cover	1			
		5	1020Z2768	..PIN, Cotter	1			
		6	1020Z4286	..NUT, Drive gear	1			
		7	1018Z2796	..WASHER, Drive gear nut	1			
		8	1025Z1129	..CONE, Outer drive gear bearing	1			
		9	1025Z1130	..CUP, Outer drive gear bearing	1			
		10	1018Z3771	..SPACER, Drive gear bearing .248	AR			
		10	1018Z3772	..SPACER, Drive gear bearing .249	AR			
		10	1018Z3773	..SPACER, Drive gear bearing .250	AR			
		10	1018Z3774	..SPACER, Drive gear bearing .251	AR			
		10	1018Z3775	..SPACER, Drive gear bearing .252	AR			
		10	1018Z3776	..SPACER, Drive gear bearing .253	AR			
		10	1018Z3777	..SPACER, Drive gear bearing .259	AR			
		10	1018Z3778	..SPACER, Drive gear bearing .265	AR			
		10	1018Z3779	..SPACER, Drive gear bearing .271	AR			
		10	1018Z3780	..SPACER, Drive gear bearing .277	AR			
		10	1018Z3781	..SPACER, Drive gear bearing .283	AR			
		11	1018Z2801	..SPACER, Drive gear	1			
		12	1001Z648	..GEAR, Drop box driven	1			
		13	1020Z2758	..SHIM, 0.003	AR			
		13	1020Z2759	..SHIM, 0.005	AR			
		13	1020Z2760	..SHIM, 0.010	AR			
		14	1025Z441	..CUP, Inner drive gear bearing	1			
		15	1025Z1135	..CONE, Inner drive gear bearing	1			
		16	1001Z832	..DRIVE & RING GEAR 7.40 to 1	1			
		17	1020Z4286	..NUT, Input yoke	1			
		18	1020Z2768	..PIN, Cotter	1			
		19	1018Z3010	..YOKE, Input	1			
		20	1018Z2998	…SLINGER, Oil	1			
		21	1020Z4285	..BOLT, Bearing cage cover	7			
		22	1018Z1649	..WASHER, Bolt	7			
		23	1014Z867	..COVER, Bearing cage	1			
		24	1018Z511	…SEAL, Oil	1			
		25	1045Z985	..O-RING, Cover	1			
		26	1020Z3639	..SHIM, 0.003	3			
		26	1020Z3640	..SHIM, 0.005	4			
		27	1025Z1411	..BEARING, Input shaft	1			
		28	1025Z1414	..CAGE, Input bearing	1			
		29	1045Z1155	..O-RING, Bearing cage	1			
		30	1015Z790	..COLLAR, Input shaft	1			
		-	1010Z836	..SHAFT ASSY., Inter-axle differential	1			
		31	1010Z744	…SHAFT, Input	1			
		32	1018Z2790	…WASHER, Thrust	1			
		33	1001Z649	..GEAR, Inter drive	1			
		34	1020Z3645	…BOLT, Case assembly	8			

FORWARD REAR AXLE GROUP (Continued)

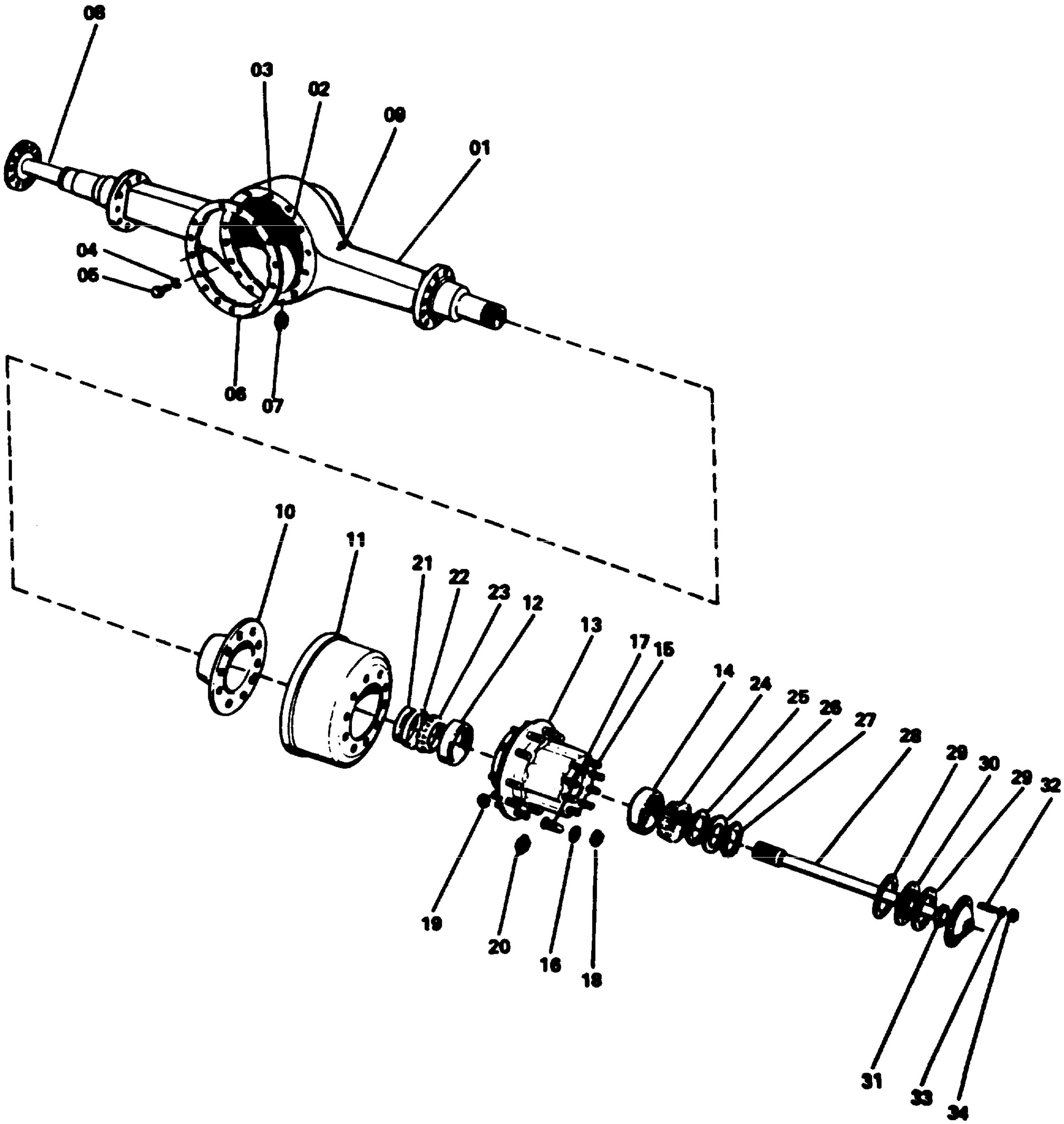
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		35	1018Z649	…WASHER, Case bolt	8			
		36	1014Z554	…CASE ASSEMBLY, Differential	1			
		37	1013Z169	...SPIDER, Inter axle differential	1			
		38	1010Z557	…GEAR, pinion	4			
		39	1018Z2798	…WASHER, Pinion gear thrust	4			
		40	1018Z2784	…RETAINER, Differential	1			
		41	1018Z2795	…RING, Snap	1			
		42	1001Z646	…GEAR, Inter differential side	1			
		43	1018Z2794	…WASHER, Side gear thrust	1			
		44	1025Z1415	…BEARING, Inter axle differential	1			
		45	1020Z2739	..SCREW, Thrust	1			
		46	1020Z2733	..NUT, Thrust screw	1			
		-	1014Z863	..SHIFT ASSY., Inter axle differential	1			
		47	1020Z2463	…GASKET, Housing	1			
		48	1015Z792	…FORK & HOKE ASSEMBLY	1			
		49	1025Z435	….BALL, Yoke	1			
		50	1020Z3962	….NUT, Yoke ball	1			
		51	1020Z876	….WASHER, Seat	1			
		51	1018Z169	….WASHER, Flat	1			
		52	1020Z3960	….BOLT, Yoke spring	1			
		53	1017Z708	….SPRING, Shift yoke	1			
		54	1019Z444	…PIN, Cotter	1			
		55	1020Z2993	…NUT, Air chamber stud	2			
		56	1018Z2961	…WASHER, Air chamber stud	2			
		57	1010Z564	…CHAMBER, Air shift	1			
		58	1020Z127	…GASKET, Air chamber	1			
		59	1020Z2997	…STUD, Air chamber mounting	2			
		60	1018Z2786	…WASHER, Lock	4			
		61	1020Z2776	…BOLT, Shift housing mounting	4			
		62	1014Z1006	…HOUSING, Air shift	1			
		63	1018Z2787	…RING, Snap	1			
		64	1018Z2010	…RETAINER, Spring	1			
		65	1017Z707	…SPRING, Shift	1			
		66	1020Z2738	…BOLT, Adjusting	1			
		67	1020Z2732	…NUT, Adjusting bolt	1			
		68	1014Z865	..CARRIER & CAP ASSEMBLY	1			
		69	1020Z2731	…Bolt, Bearing cap	4			
		70	1018Z2797	…WASHER, Flat	4			
		71	20Z189	..NUT, Carrier to housing	14			
		72	1018Z2799	..WASHER, Lock	14			
		73	1044Z120	..PLUG, Housing filler	1			
		74	1020Z2181	..GASKET, Carrier to housing	1			
		75	1019Z788	..PIN, Cotter	2			
		76	1018Z3782	..RING, Bearing adjusting	2			
		77	1025Z1413	..CUP, Bearing	2			
		78	1025Z1414	..CONE, Bearing	2			
		-	1053Z114	..CASE & NEST ASSEMBLY	1			
		79	1014Z866	…CASE ASSY., Differential	1			
		80	1020Z3647	….BOLT, Long	8			
		81	1020Z3646	…BOLT, Short	4			

FORWARD REAR AXLE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		82	1018Z1238	…WASHER, Side gear thrust	2			
		83	1001Z830	…GEAR, Differential side	2			
		84	1013Z208	…SPIDER, Differential	1			
		85	1001Z232	…GEAR, Differential pinion	4			
		86	1018Z1239	…WASHER, Pinion gear thrust	4			
		87	1020Z3643	..RIVET, Differential ring gear	12			
		88	1020Z2980	.PLUG, Magnetic drain	1			
		89	1046Z170	.BREATHER, Axle housing	1			
		90	1014Z1072	.HOUSING, Forward rear axle	1			
		91	1020Z3634	..STUD, Long carrier mounting	4			
		92	1020Z2781	..STUD, Medium carrier mounting	9			
		93	1020Z4037	..STUD, Short carrier mounting	1			
		94	1010Z524	.SHAFT, L.H. forward rear axle	1			
		95	1010Z523	.SHAFT, R.H. forward rear axle	1			
		96	1010Z560	.SHAFT, Thru	1			
		97	1025Z1215	.CAGE, Thru shaft bearing	1			
		98	1018Z2791	..RING, Snap	1			
		99	1025Z1125	..BEARING, Thru shaft	1			
		100	18Z952D2	..SEAL, Oil	1			
		101	1020Z128	..GASKET, Thru shaft cage	1			
		102	1020Z2775	.SCREW, Cage mounting	4			
		103	1018Z2815	.YOKE, Thru shaft	1			
		104	1018Z2997	..SLINGER, Thru shaft yoke	1			
		105	20Z848	.NUT, Output yoke	1			

Ref. Dwg. 10Z464

FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP

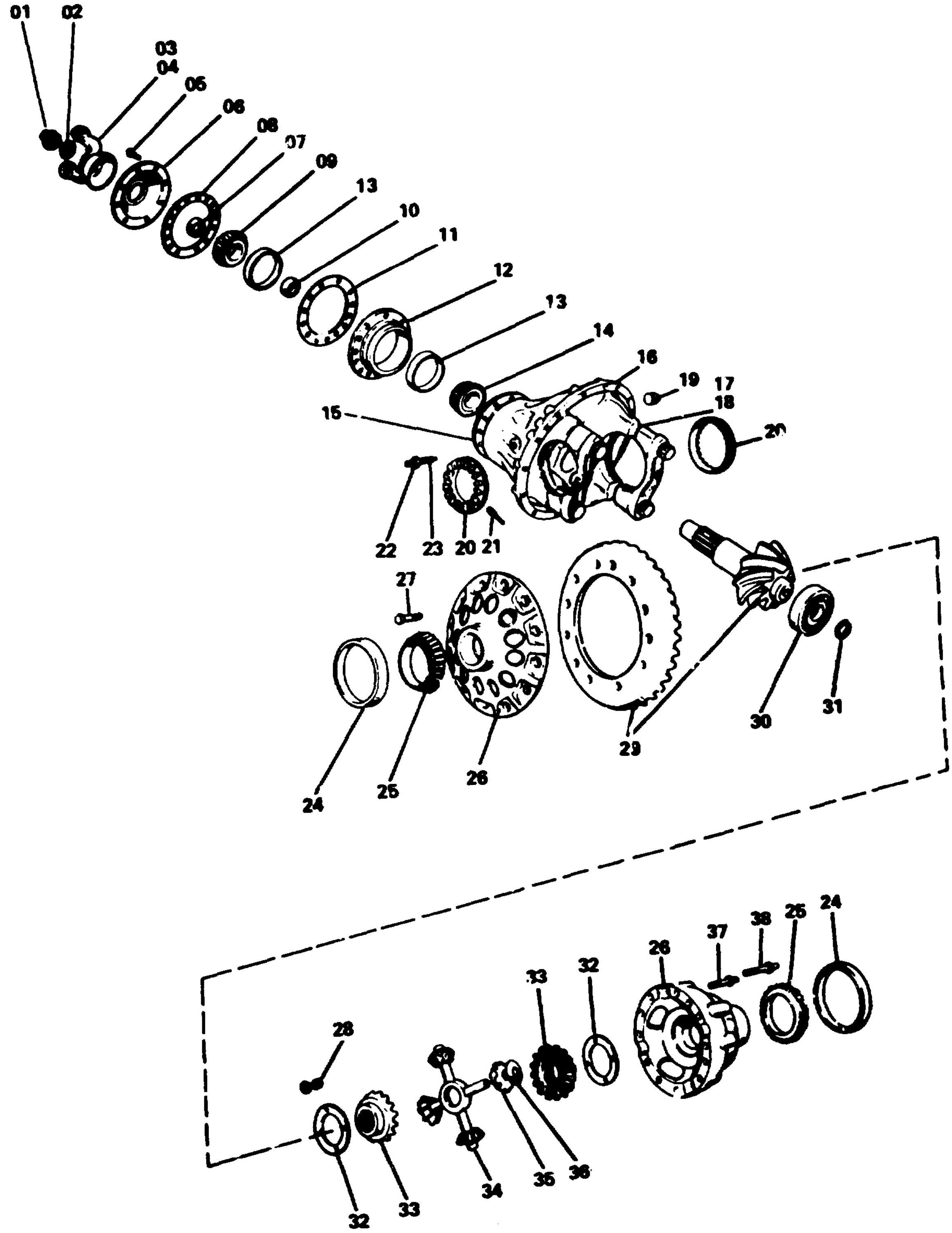


FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-		HUB & DRUM GP, FORWARD & REAR REAR AXLE	▼			
		01	1014Z1071	.HOUSING, Rear axle	1			
		02	1020Z2781	..STUD, Short	10			
		03	1020Z2723	..STUD, Long	4			
		04	1018Z2709	..WASHER, Lock	14			
		05	20Z189	..NUT, Carrier to housing	14			
		06	1020Z2181	.GASKET, Housing to carrier	1			
		07	1020Z2980	.PLUG, Magnetic drain	1			
		08	1010Z523	.SHAFT, L.H. rear axle	1			
		09	46Z286D1	.BREATHER, Housing	1			
		-	1013Z263	.HUB & DRUM ASSEMBLY, R.H.	2			
		10	1018Z4641	..SLINGER, Oil	1			
		11	1015Z1033	..DRUM, Brake	1			
		-	1013Z260	.HUB & CUP ASSEMBLY, R.H.	1			
		12	1025Z1660	…CUP, Inner bearing	1			
		13	1013Z259	…HUB	1			
		14	25Z265D102	…CUP, Outer bearing	1			
		15	102Z4673	..STUD, Axle shaft	8			
		16	1018Z4640	..RETAINER, Stud	10			
		17	1020Z4675	..STUD, R.H. wheel	10			
		-	1013Z262	.HUB & DRUM ASSY., L.H.	2			
		10	1018Z4641	..SLINGER, Oil	1			
		11	1015Z1033	..DRUM, Brake	1			
		-	1013Z261	.HUB & CUP ASSEMBLY, L.H.	1			
		12	1025Z1660	…CUP, Inner bearing	1			
		13	1013Z259	…HUB	1			
		14	25Z265D102	…CUP, Outer bearing	1			
		15	1020Z4673	..STUD, Axle shaft	8			
		16	1018Z4640	..RETAINER, Stud	10			
		17	1020Z4674	..STUD, L.H. wheel	10			
		18	20Z962D4	.NUT, R.H. outer	10			
		18	20Z962D3	.NUT, L.H. outer	10			
		19	1020Z2745	.NUT, R.H. inner	10			
		19	1020Z1093	.NUT, L.H. inner	10			
		20	1044Z527	.PLUG, Hub	2			
		21	1018Z155	.SEAL,Oil	2			
		22	1049Z44	.WIPER, Inner	2			
		23	1025Z547	.CONE, Inner bearing	2			
		24	1025Z357	.CONE, Outer bearing	2			
		25	1020Z2896	.NUT, Wheel bearing	2			
		26	1018Z2963	.WASHER, Wheel bearing lock	2			
		27	1020Z2895	.NUT, Outer wheel bearing	2			
		28	1010Z524	.SHAFT, R.H. rear axle	1			
		-	1018Z651	.KIT, Axle shaft oil seal	4			
		29	1020Z4287	..GASKET, Axle shaft	2			
		30	N.S.S.	.SEAL,Oil	1			
		31	N.S.S.	..WIPER, Axle shaft	1			
		32	1025Z746	.DOWEL, Axle shaft	16			
		33	18Z953D6	.WASHER, Lock	16			
		34	20Z189	.NUT, Axle shaft	16			

Ref. Dwg. 10Z464

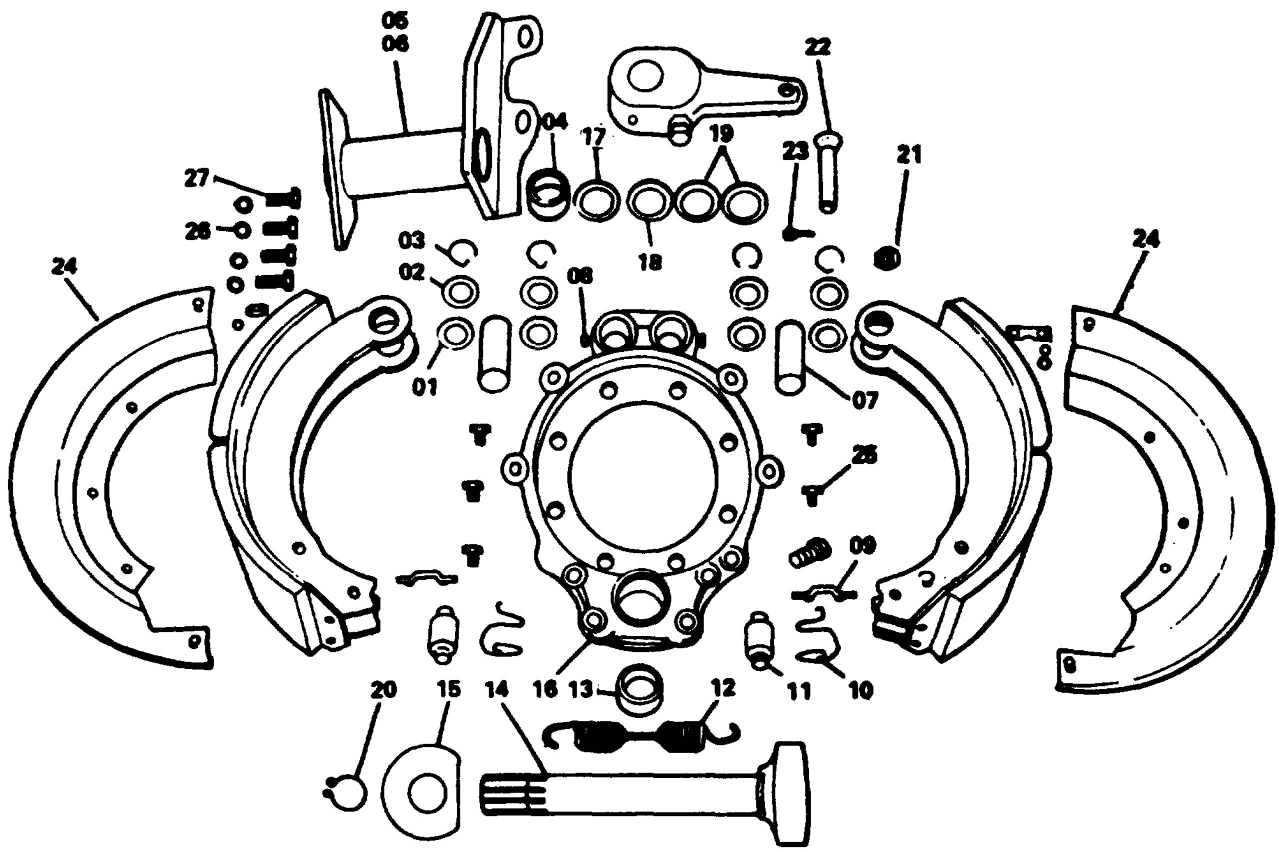
REAR REAR AXLE DIFFERENTIAL CARRIER ASSEMBLY



REAR REAR AXILE DIFFERENTIAL CARRIER ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-	1053Z116	DIFFERENTIAL ASSY., REAR REAR AXLE	▼			
		01	20Z848	.NUT, Yoke	1			
		02	1018Z3768	.WASHER, Yoke	1			
		03	1018Z3016	.YOKE, Companion	1			
		04	1018Z2999	..SLINGER, Deflector	1			
		05	1020Z1664	.SCREW, Bearing cap	8			
		06	1018Z3014	.COVER & SEAL ASSEMBLY	1			
		07	18Z965D1	..SEAL, Oil	1			
		08	1020Z3642	.GASKET, Bearing cage cap	1			
		09	1025Z1417	.CONE, Outer bearing	1			
		10	1018Z3771	.SPACER, 0.248 in. thick	AR			
		10	1018Z3772	.SPACER, 0.249 in. thick	AR			
		10	1018Z3773	.SPACER, 0.250 in. thick	AR			
		10	1018Z3774	.SPACER, 0.251 in. thick	AR			
		10	1018Z3775	.SPACER, 0.252 in. thick	AR			
		10	1018Z3776	.SPACER, 0.253 in. thick	AR			
		10	1018Z3777	.SPACER, 0.259 in. thick	AR			
		10	1018Z3778	.SPACER, 0.265 in. thick	AR			
		10	1018Z3779	.SPACER, 0.271 in. thick	AR			
		10	1018Z3780	.SPACER, 0.277 in. thick	AR			
		10	1018Z3781	.SPACER, 0.283 in. thick	AR			
		11	1020Z3641	.SHIM, 0.003 in. thick	AR			
		11	1020Z3637	.SHIM, 0.005 in. thick	AR			
		11	1020Z3638	.SHIM, 0.010 in. thick	AR			
		12	1025Z1416	.CAGE ASSY., Pinion bearing	1			
		13	1025Z441	..CUP, Inner and outer bearing	2			
		14	1025Z1135	.CONE, Inner bearing	1			
		15	1018Z2797	.SPACER, Shim	1			
		16	1018Z2801	.CASE & CAP ASSEMBLY	1			
		17	1014Z864	..SCREW, Cap - differential bearing cap	4			
		18	1020Z3731	..WASHER, Flat - differential bearing cap	4			
		19	1018Z2797	.PLUG, Filler and inspection	1			
		20	1044Z120	.RING, Adjusting - differential bearing	2			
		21	1018Z3782	.PIN, Cotter	2			
		22	1019Z788	.NUT, Lock	1			
		23	1020Z2733	.SCREW, Bevel gear thrust	1			
		24	1020Z2739	.CUP, Differential bearing	2			
		25	1025Z1413	.CONE, Differential bearing	2			
		26	1025Z1414	.CASE ASSEMBLY, Differential	1			
		27	1014Z866	..BOLT, Differential case	12			
		28	1020Z3958	..NUT, Differential case	12			
		29	1020Z3964	.GEAR & PINION ASSY., 7.40 to 1	1			
		30	1001Z831	.BEARING, Drive pinion	1			
		31	1025Z1412	.RING, lock - pinion	1			
		32	1018Z3769	.WASHER, Thrust - differential side gear	2			
		33	1018Z1238	.GEAR, Differential side	2			
		34	1001Z830	.SPIDER, Differential	1			
		35	1013Z208	.PINION, Differential	4			
		36	1001Z232	.WASHER, Pinion thrust	4			
		37	1018Z1239	.BOLT, Short - differential case	4			
		38	1020Z3646	.BOLT, Long - differential case	8			
			1020Z3641					

Ref. Dwg. 10Z464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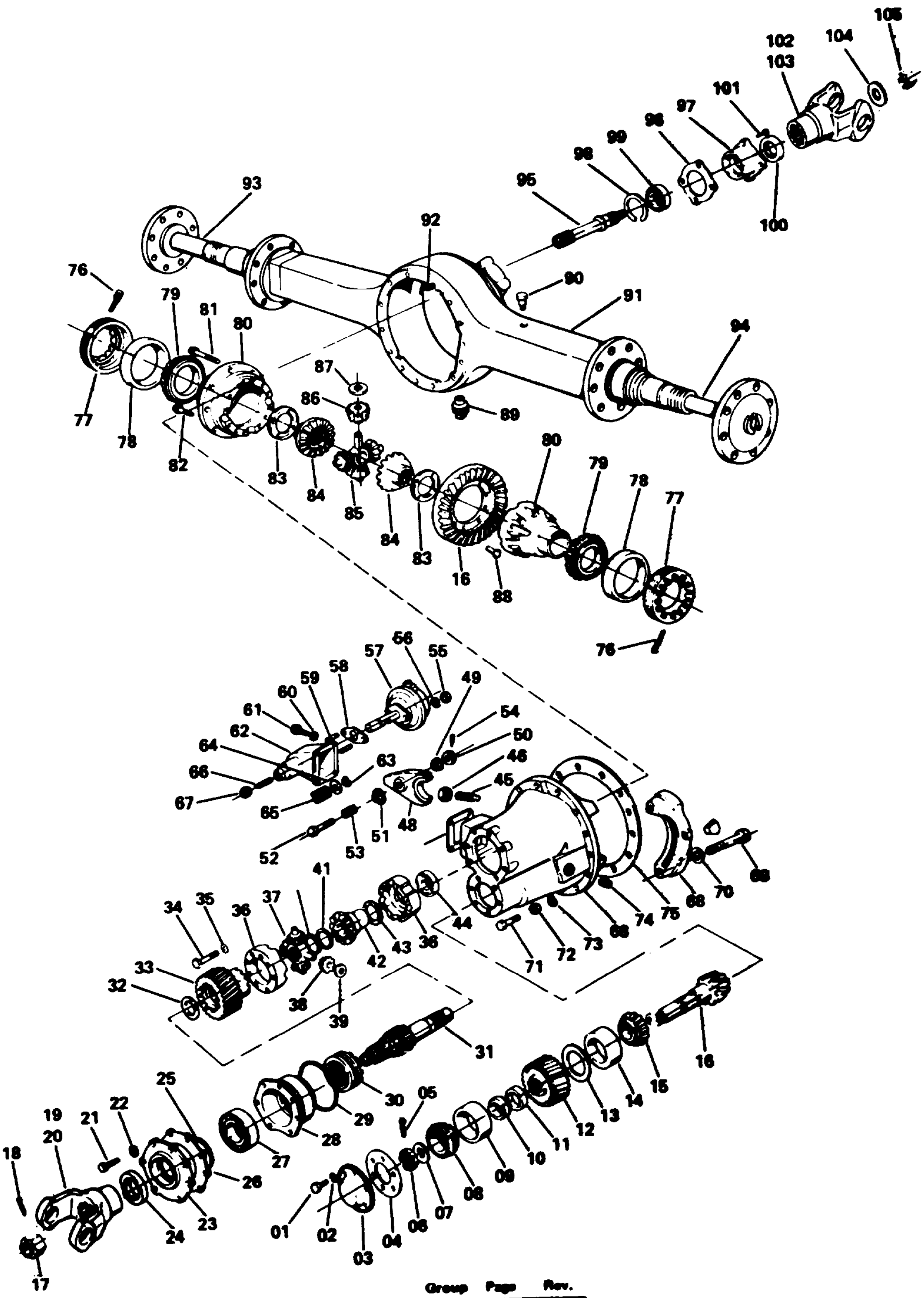
FORWARD AND REAR REAR AXLE BRAKE GROUP (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-		BRAKE GROUP, FORWARD & REAR REAR AXLE				
		-	1015Z148	.SHOE & LINING ASSY., Primary	1			
		01	18Z125	..RETAINER, Anchor pin felt	4			
		02	1018Z672	..FELT, Anchor pin	4			
		03	17Z46	..SPRING, Anchor pin retainer	4			
		04	25Z79	…BUSHING, Anchor pin	1			
		05	1016Z354	..BRACKET, R.H. rear or L.H. forward	1			
		05	1016Z355	..BRACKET, R.H. forward or L.H. rear	1			
		06	1020Z2169	..GASKET, Brake spider and cam	1			
		07	1019Z70	..PIN, Anchor	2			
		08	20Z406	..SCREW, Anchor pin lock	2			
		09	1019Z236	..PIN, Spring return	2			
		10	1013Z7	..RETAINER, Roller	2			
		11	1013Z14	..ROLLER	2			
		12	1017Z66	..SPRING, Return	1			
		-	1015Z147	.SHOE & LINING ASSY., Secondary	1			
		01	18Z125	..RETAINER, Anchor pin felt	4			
		02	1018Z672	..FELT, Anchor pin	4			
		03	17Z46	..SPRING, Anchor pin retainer	4			
		04	25Z79	…BUSHING, Anchor pin	1			
		05	1016Z354	..BRACKET, R.H. rear or L.H. forward	1			
		05	1016Z355	..BRACKET, R.H. forward or L.H. rear	1			
		06	1020Z2169	..GASKET, Brake spider and cam	1			
		07	1019Z70	..PIN, Anchor	2			
		08	20Z406	..SCREW, Anchor pin lock	2			
		09	1019Z236	..PIN, Spring return	2			
		10	1013Z7	..RETAINER, Roller	2			
		11	1013Z14	..ROLLER	2			
		12	1017Z66	..SPRING, Return	1			
		13	25Z79	.BUSHING	1			
		14	1043Z9	.CAMSHAFT, R.H. rear or L.H. forward	1			
		14	1043Z35	.CAMSHAFT, R.H. forward or L.H. rear	1			
		15	1018Z1730	.WASHER, Brake camshaft	1			
		16	1015Z573	.SPIDER, Brake mounting	1			
		17	18Z952D9	..SEAL, Oil	1			
		18	18Z952D11	..RETAINER, Oil Seal	1			
		19	18Z124	..WASHER	1			
		-	1006Z546	.ADJUSTER, Brake slack	1			
		-	1018Z812	..WASHER, Spacer	AR			
		-	1018Z814	..WASHER	AR			
		19	18Z124	..WASHER	1			
		20	1018Z1786	..RING, Slack adjuster lock	1			
		21	18Z148	.NUT, Chamber stud	2			
		22	1019Z662	.PIN, Clevis	1			
		23	1019Z665	.PIN, Cotter	1			
		24	1014Z547	.SHIELD ASSEMBLY, Dust	2			
		25	20Z397	..SCREW, Dust shield mounting	6			
		26	18Z147	.WASHER, Lock	4			
		27	1020Z2779	.BOLT, Spider and cam bracket mounting	4			
		-	1015Z914	.KIT, Brake shoe lining	2			
		-	1020Z889	..RIVET	AR			

Ref. Dwg. 10Z464

FORWARD REAR AXLE GROUP



FORWARD REAR AXLE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description				
		–		AXLE GROUP, FORWARD REAR				
		–	10532187	. DIFFERENTIAL ASSY., Forward rear	1			
		01	1020Z2744	.. BOLT, Lower cover	6			
		02	1018Z2786	.. WASHER, Lower cover bolt flat	6			
		03	1014Z545	.. COVER, Lower bearing	1			
		04	1020Z2763	.. GASKET, Lower bearing cover	1			
		05	1020Z2768	.. PIN.Cotter	1			
		06	1020Z4286	.. NUT, Drive gear	1			
		07	1018Z2796	.. WASHER, Drive gear nut	1			
		08	1025Z1129	.. CONE, Outer bearing	1			
		09	1025Z1130	.. CUP, Outer bearing	1			
		10	1018Z3771	.. SPACER, Drive gear bearing 0.248 in.	AR			
		10	1018Z3772	.. SPACER, Drive gear bearing 0.249 in.	AR			
		10	1018Z3773	.. SPACER, Drive gear bearing 0.256 in.	AR			
		10	1018Z3774	.. SPACER, Drive gear bearing 6.251 in.	AR			
		10	1018Z3775	.. SPACER, Drive gear bearing 0.252 in	AR			
		10	1018Z3776	.. SPACER, Drive gear bearing 0.253 in.	AR			
		10	1018Z3777	.. SPACER, Drive gear bearing 0.259 in.	AR			
		10	1018Z3778	.. SPACER, Drive gear bearing 0.265 in.	AR			
		10	1018Z3779	.. SPACER, Drive gear bearing 0.271 in.	AR			
		10	1018Z3780	.. SPACER, Drive gear bearing 0.277 in.	AR			
		10	1018Z3781	.. SPACER, Drive gear bearing 0.283 in.	AR			
		11	1018Z2801	.. SPACER, Drive gear	1			
		12	1001Z648	.. GEAR, Drop box driven	1			
		13	1020Z2758	.. SHIM,0.003 in	AR			
		13	1020Z2759	.. SHIM,0.005 in	AR			
		13	1020Z2760	.. SHIM,0.010 in	AR			
		14	1025Z441	.. CUP, Inner bearing	1			
		15	1025Z1135	.. CONE, Inner bearing	1			
		16	1001Z832	.. DRIVE & RING GEAR - 7.46 to 1	1			
		17	1020Z4286	.. NUT,Yoke	1			
		18	1020Z2768	.. PIN,Cotter	1			
		19	1018Z3010	.. YOKE,Input	1			
		20	1018Z2998	... SLINGER, Oil	1			
		21	1020Z4285	.. BOLT, Bearing cage cover	7			
		22	1018Z1649	.. WASHER, Bearing cover bolt	7			
		23	1014Z867	.. COVER & SEAL ASSEMBLY	1			
		24	1018Z511	... SEAL,Oil	1			
		25	1045Z985	.. O-RING	1			
		26	1020Z3639	.. SHIM,0.003	3			
		26	1020Z3640	.. SHIM,0.005	4			
		27	10251411	.. BEARING, Input shaft	1			
		28	1025Z1214	.. CAGE, Input bearing	1			
		29	1045Z1155	.. O-RING,Beeringcage	1			
		30	1015Z790	.. COLLAR, Input shaft	1			
		–	1010Z836	.. SHAFT ASSY., Inter differential	1			
		31	1010Z744	... SHAFT, Input	1			
		32	1018Z2790	... WASHER, Thrust	1			
		33	1001Z649	... GEAR, Inter drive	1			
		34	1020Z3645	... BOLT, Inter axle differential case	8			

FORWARD REAR AXLE GROUP (Continued)

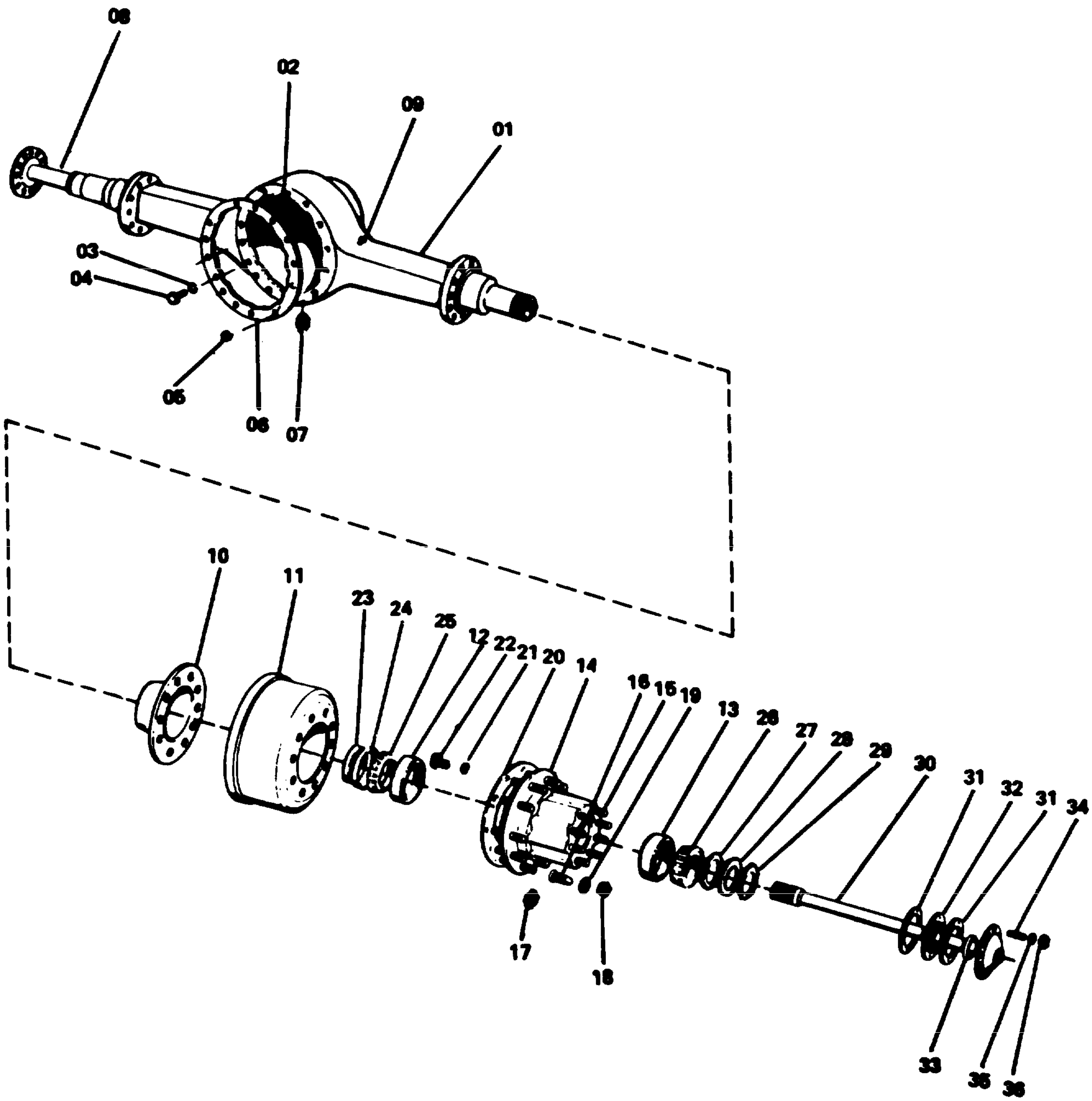
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		35	1018Z1649	. .. WASHER,Case bolt	8			
		36	1014Z554	. . . CASE ASSY., Inter axle differential	1			
		37	1013Z169	. . . SPIDER, Inter axle differential	1			
		38	1010Z557	. . . GEAR, Pinion	4			
		39	1018Z2798	. . . WASHER, Pinion gear thrust	4			
		40	1018Z1784	. . . RETAINER, Snap ring	1			
		41	1018Z2795	. . . RING, Snap	1			
		42	1001Z646	. . . GEAR, Side	1			
		43	1018Z2794	. . . WASHER, Side gear thrust	1			
		44	1025Z1415	. . . BEARING, Inter axle differential	1			
		45	1020Z2739	. . SCREW, Thrust	1			
		46	1020Z2733	. . NUT, Thrust screw	1			
		–	1014Z863	. . SHIFT ASSY., Inter axle differential	1			
		47	1020Z2463	. . . GASKET, Shift housing	1			
		48	1015Z792	. . . FORK & YOKE ASSEMBLY	1			
		49	1025Z435	. . . . BALL,Yoke	1			
		50	1020Z3962	. . . . NUT, Yoke ball	1			
		51	1020Z876	. . . . WASHER, Seat	1			
		51	1018Z1649	. . . . WASHER, Flat	AR			
		52	1020Z3960	. . . . BOLT, Spring retaining	1			
		53	1017Z708	. . . . SPRING, Yoke	1			
		54	1019Z444	. . . PIN,Cotter	1			
		55	1020Z2993	. . . NUT, Air chamber stud	2			
		56	1018Z2961	. . . WASHER.Air charmber stud nut	2			
		57	1010Z561	. . . CHAMBER, Air shift	1			
		58	1020Z127	. . . GASKET, Air chamber	1			
		59	1020Z2997	. . . STUD, Air chamber mounting.	2			
		60	1018Z22786	. . . WASHER, Lock	4			
		61	1020Z2776	. . . BOLT, Shift housing mounting	4			
		62	1014Z1006	. . . HOUSING, Air shift	1			
		63	1018Z2787	. . . RING,Snap	1			
		64	1018Z2010	. . . RETAINER, Spring	1			
		65	1017Z707	. . . SPRING,Shift	1			
		66	1020Z2738	. . .B0LT,Adjusting	1			
		67	1020Z2732	. . . NUT, Adjusting bolt	1			
		68	1014Z865	. . CARRIER & CAP ASSEMBLY	1			
		69	1020Z2731	. . BOLT, Bearing cap	4			
		70	1018Z2797	. . WASHER, Bearing cap bolt	4			
		71	1020Z3646	... SCREW, Long differential housing	4			
		71	1020Z4867	. . SCREW, Short differential mounting	9			
		72	1020Z4166	. . NUT, Carrier to housing	1			
		73	1018Z3596	. . WASHER, Carrier to housing	14			
		74	1044Z120	. . PLUG, Filler	1			
		75	1020Z2181	. . GASKET, Coarrier to housing	1			
		76	1019Z788	. . PIN,Cotter	2			
		77	1018Z3782	. . RING, Bearing adjustment	2			
		78	1025Z1413	. . CUP, Differential baring	2			
		79	1025Z1414	. . CONE, Differential bearing	2			
		–	1053Z188	. . CASE & NEST ASSEMBLY	1			
		80	1014Z866	. . . CASE ASSEMBLY, Differantial	1			

FORWARD REAR AXLE GROUP (Cotinued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		81	1020Z4888	.... BOLT, Long differential case	8			
		82	1020Z4410	.... BOLT, Short differential case	4			
		83	1018Z1238	... WASHER, Side gear thrust	2			
		84	1001Z231	... GEAR, Differential side	2			
		85	1013Z208	... SPIDER, Differential	1			
		85	1001Z232	... PINION, Differential	4			
		87	1018Z1239	... WASHER, Pinion thrust	4			
		88	1020Z3643	..RIVET, ring gear	12			
		89	1020Z4834	.PLUG, magnetic drain	1			
		90	1046Z170	.BREATHER, housing	1			
		91	1014Z1299	.HOUSING, Forward rear axle	1			
		92	1020Z4037	..STUD, Differential mounting	1			
		93	1010Z971	.SHAFT, L.H. forward axle	1			
		94	1010Z972	.SHAFT, R.H. forward axle	1			
		95	1010Z560	.SHAFT, Thru	1			
		96	1020Z128	.GASKET, Cage assembly	1			
		97	10Z1215	.CAGE ASSEMBLY, Thru shaft	1			
		98	1018Z2791	..RING, Snap	1			
		99	1025Z1125	..BEARING, Thru shaft	1			
		100	18Z952D2	..SEAL,Oil	1			
		101	1020Z2775	.SCREW, Cage mounting	4			
		102	1018Z2815	.YOKE, Output	1			
		103	1018Z2997	..Slinger,Oil	1			
		104	1018Z4361	.WASHER, Flat				
		105	20Z848	.Nut,Yoke				

Ref. Dwg. 10Z463

FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP



FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

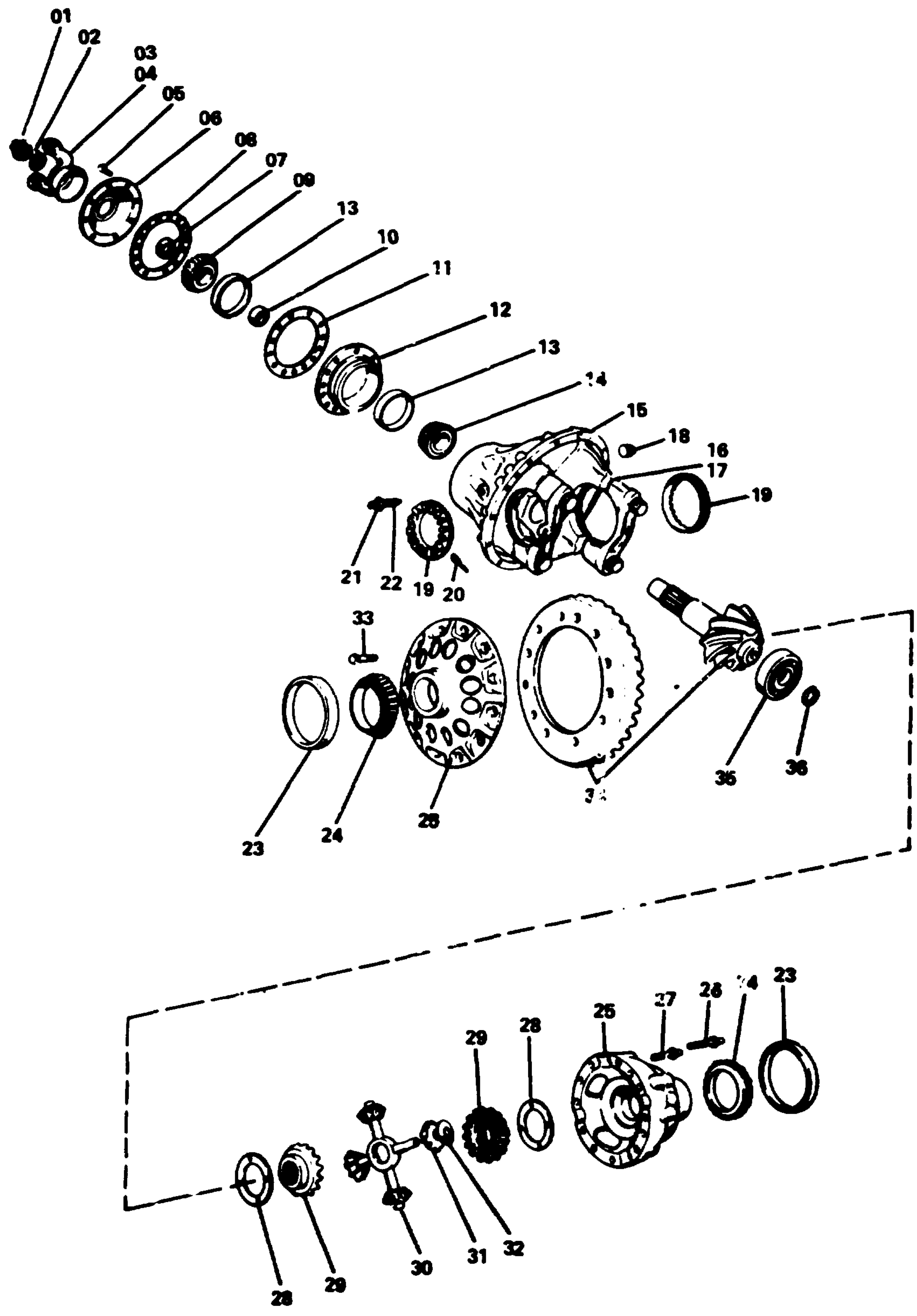
Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number			
		–		HUB & DRUM GP., FORWARD & REAR REAR				
		01	1014Z1300	. HOUSING, Rear rear axle	1			
		02	1020Z4037	.STUD,Locating	1			
		03	1018Z3596	.WASHER,Lock	14			
		04	1020Z3646	.SCREW,Long cap	4			
		04	1020Z4867	.SCREW,Short cap	9			
		05	1020Z4166	. NUT, Differential stud	1			
		06	1020Z2181	. GASKET, Carrier to housing	1			
		07	1020Z4834	. PLUG, Magnetic drain	1			
		O8	1010Z972	. SHAFT, L.H. rear axle	1			
		09	1046Z170	. BREATHER, Axle housing	1			
		–	1013Z295	. HUB & DRUM ASSEMBLY, L.H.	1			
		10	1018Z4706	.. SLINGER, Oil	1			
		11	1015Z1033	.. DRUM, Brake	1			
		–	1013Z277	.. HUB & STUD ASSEMBLY, L.H.	1			
		–	1013Z276	... HUB &CUP ASSEMBLY, L.H.	1			
		12	1018Z2783	.... CUP, inner bearing	1			
		13	1018Z2782	.... CUP, Outer bearing	1			
		14	1013Z274	.... HUB	1			
		15	1020Z4673	... STUD, Axle shaft mounting	8			
		16	1020Z4831	... STUD.L.H.wheel	10			
		17	1079Z1508	... PLUG, Hub filler	1			
		18	1020Z1093	.. NUT,InnerL.H.wheel stud	10			
		18	1020Z921	.. NUT, Outer L.H.wheel stud	10			
		19	1018Z4640	.. RETAINER, Drum to hub	5			
		20	1018Z4641	.. ROTOR, Slinger	1			
		21	1018Z4708	.. WASHER,Flat	5			
		22	1020Z4832	.. SCREW, Cap - rotor mounting	5			
		–	1013Z296	. HUB & DRUM ASSEMBLY, R.H.	1			
		10	1018Z4706	.. SLINGER, Oil	1			
		11	1015Z1033	.. DRUM, Brake	1			
		–	1013Z293	.. HUB & STUD ASSEMBLY, R.H.	1			
		–	1013Z276	... HUB & CUP ASSEMBLY, R.H.	1			
		12	1018Z2783	.... CUP, Inner bearing	1			
		13	1018Z1782	.... CUP, Outer bearing	1			
		14	1013Z274	.... HUB	1			
		15	1020Z4673	... STUD, Axle shaft mounting	8			
		16	1020Z4830	... STUD,R.H.wheel	10			
		17	1079Z1508	...PLUG, Hub filler	1			
		18	1020Z2745	.. NUT, Inner R.H. wheel stud	10			
		18	1020Z2746	.. NUT, Outer R.H. wheel stud	10			
		19	1018Z4640	.. RETAINER, Drum to hub	6			
		20	1018Z4641	.. ROTOR,Slinger	1			
		21	1018Z4708	.. WASHER,Flat	5			
		22	1020Z4832	.. SCREW, Cap - rotor mounting	5			
		23	1018Z155	. SEAL ASSY., Inner hub oil	1			
		24	1049Z44	.WIPER,Inner axle shaft	1			
		26	1025Z1248	. CONE, Innner bearing	1			
		26	1025Z1211	. CONE, Outer bearing	1			
		27	1020Z2896	. NUT, Wheel bearing inner	1			

FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		28	1018Z2963	. WASHER, Lock - wheel bearing nut	1			
		29	1020Z895	.NUT,Wheel bearing outer	1			
		30	1010Z971	. SHAFT, R.H. rear axle	1			
		31	1020Z4287	. GASKET, Axle shaft	2			
		32	1018Z1126	. SEAL, Outer oil	1			
		33	1018Z1126	. WIPER, Axle shaft outer	1			
		34	1025Z746	.DOWEL,Tapered	8			
		35	18Z853D6	. WASHER, Lock	8			
		36	1020Z4166	. NUT, Axle shaft mounting	8			

Ref. Dwg. 10Z463

REAR REAR AXLE DIFFERENTIAL ASSEMBLY



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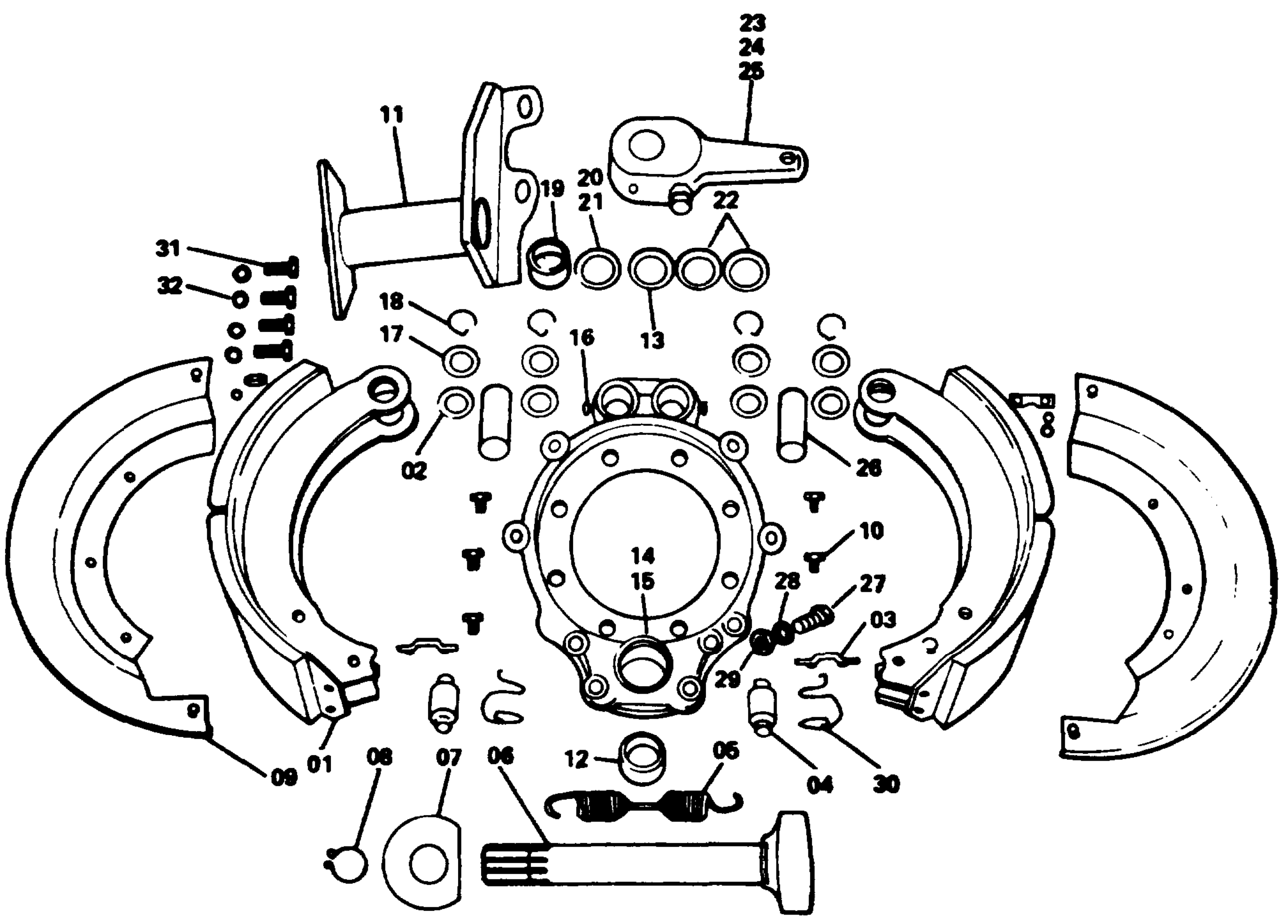
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-	1053Z189	DIFFERENTIAL ASSY., REAR REAR AXLE	1			
		01	20Z848	.NUT,Yoke	1			
		02	1018Z3768	. WASHER, Yoke	1			
		03	1018Z3016	. YOKE, Input	1			
		04	1018Z2999	.. SLINGER, Oil	1			
		05	1020Z1664	. SCREW,Bearing cap	8			
		06	1018Z3014	. COVER & SEAL ASSEMBLY	1			
		07	18Z965D1	.. SEAL, Bearing Cover	1			
		08	1020Z3642	. GASKET, Bearing cage cover	1			
		09	1025Z1417	. CONE, Outer bearing	1			
		10	1018Z3771	. SPACER, 0.248 in. thick	AR			
		10	1018Z3772	.SPACER, 0.249 in. thick	AR			
		10	1018Z3773	. SPACER, 0.250 in. thick	AR			
		10	1018Z3774	. SPACER, 0.251 in. thick	AR			
		10	1018Z3775	. SPACER, 0.252 in. thick	AR			
		10	1018Z3776	. SPACER, 0.253 in. thick	AR			
		10	1018Z3777	. SPACER, 0.259 in. thick	AR			
		10	1018Z3778	. SPACER, 0.266 in.thick	AR			
		10	1018Z3779	. SPACER, 0.271 in. thick	AR			
		10	1018Z3780	.SPACER,0.277 in. thick	AR			
		10	1018Z3781	. SPACER, 0.283 in. thick	AR			
		10	1020Z3641	. SHIM, 0.003 in	AR			
		11	1020Z3637	. SHIM, 0.005 in	AR			
		11	1020Z3638	. SHIM, 0.010 in	AR			
		12	1025Z1416	. CAGE ASSY,. Pinion bearing	1			
		13	1025Z441	.. CUP, Inner and outer bearing	2			
		14	1025Z1135	. CONE, Inner bearing	1			
		15	1014Z864	. CASE & CAP ASSEMBLY	1			
		16	1020Z3781	.. SCREW, Bearing cap	4			
		17	1018Z2797	.. WASHER, Bearing cap	4			
		18	1041Z120	. PLUG, Filler and inspection	1			
		19	1018Z23782	. RING, Bearing adjustment	2			
		20	1019Z788	. PIN, Cotter	2			
		21	1020Z0733	. NUT, bearing adjustment	1			
		22	1020Z0739	. SCREW, Bearing adjustment thrust	1			
		23	102521410	. CUP, Differential tiring	2			
		24	1025Z1414	. CONE, Differential bearing	2			
		-	1053Z168	. CASE & NEST ASSEMBLY	1			
		25	1014Z866	.. CASE ASSEMBLY, Differential	1			
		26	1020Z4868	... BOLT, Long differential	8			
		27	1020Z4410	... BOLT, Short differential	4			
		28	1018Z1238	.. WASHER, Side gear thrust	2			
		29	10012231	.. GEAR, Side	2			
		30	1013Z208	.. SPIDER, Differential	1			
		31	10012232	.. PINION, Differential	4			
		32	1018Z1239	.. WASHER, Pinion thrust	4			
		33	1020Z003643	. RIVET, Ring gear	12			
		34	1001Z831	. DRIVE & RING GEAR, 7.40 to 1				
		35	1025Z1412	. BEARING, Drive gear	1			
		36	1018Z3769	. RING, Lock	1			

Ref. Dwg. 10Z463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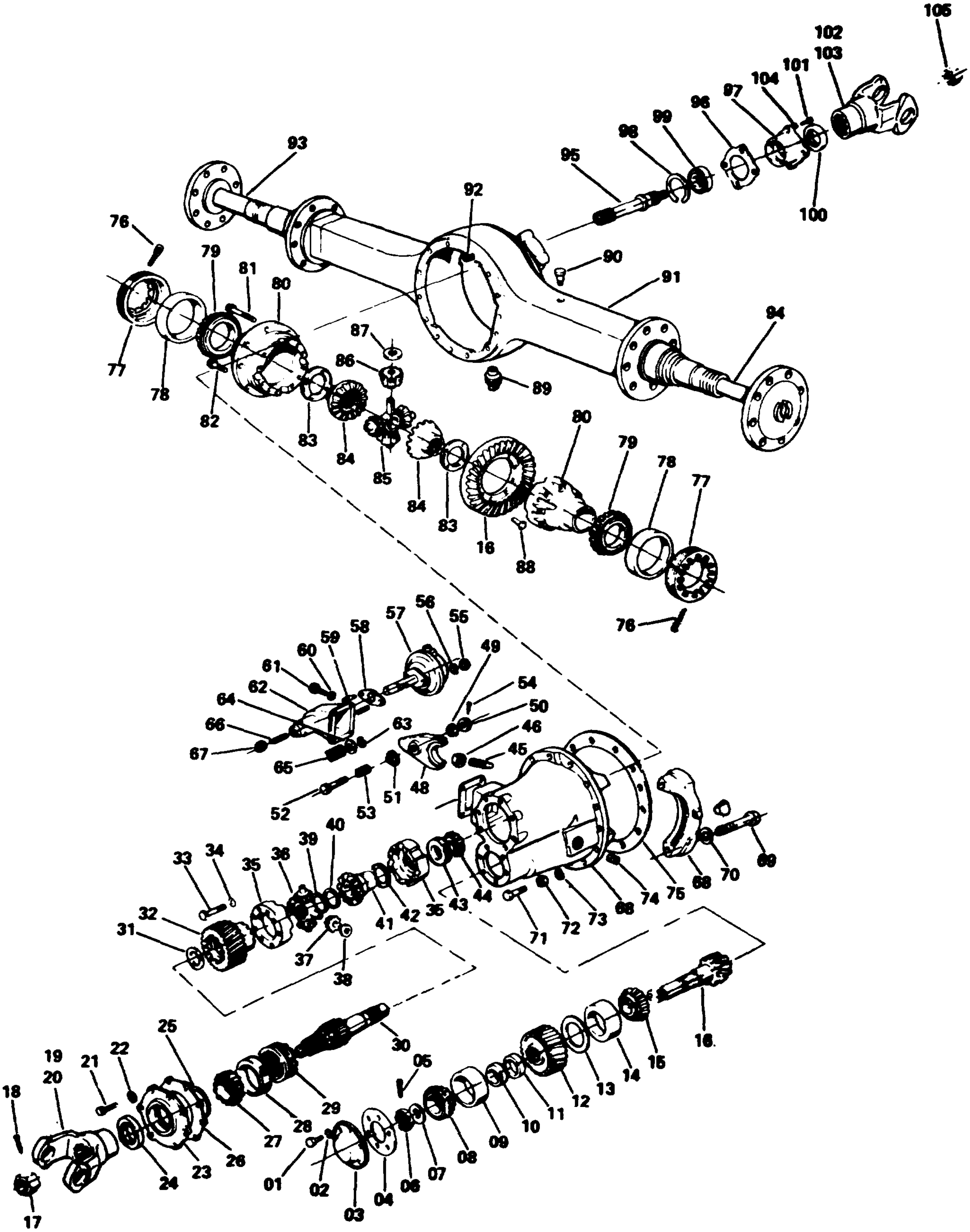
FORWARD AND REAR REAR AXLE BRAKE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		BRAKE GP., FORWARD & REAR REAR AXLE	1			
		01	1015Z1076	. SHOE & LINING ASSEMBLY, Brake	2			
		02	18Z125	.. RETAINER, Anchor pin felt	4			
		03	1019Z236	.. PIN, Return spring	2			
		04	1013Z14	.. ROLLER, Brake shoe	2			
		05	1017Z66	. SPRING, Shoe return	1			
		06	1043Z9	. CAMSHAFT, L.H. forward, R.H. rear	1			
		06	1043Z35	.CAMSHAFT, R.H.forward, L.H. rear	1			
		07	1018Z1730	. WASHER, Camshaft	1			
		08	1018Z1786	.RING,Camshaft lock	1			
		09	1014Z547	.SHIELD,Dust	2			
		10	20Z397	.. SCREW, Dust shield mounting	6			
		11	1016Z282	. BRACKET, R.H. rear, L.H. forward	1			
		–	1020Z2169	.. GASKET, Brake spider and cam	1			
		12	25Z79	.. BUSHING,Camshaft bracket	1			
		13	1045Z1348	.. O-RING, Camshaft bracket	2			
		14	1018Z4746	.. SEAL, Brake spider	1			
		11	1016Z283	. BRACKET, L.H. rear, R.H.forward	1			
		–	1020Z2169	.. GASKET, Brake spider and cam	1			
		12	25Z79	.. BUSHING, Camshaft bracket	1			
		13	1045Z1348	.. D-RING, Camshaft bracket	2			
		14	1018Z4746	.. SEAL, Brake spider	1			
		–	1015Z1075	.SPIDER,Brake	1			
		12	25Z79	.. BUSHING, Camshaft bracket	1			
		13	1045Z1348	.. O-RING, Camshaft bracket	2			
		15	1018Z4746	.. SEAL, Brake spider	1			
		15	1018Z4747	.. RETAINER, Brake spider	1			
		16	1020Z2916	. SCREW, Anchor pin lock	2			
		17	1018Z672	. FELT, Anchor pin	4			
		18	18Z125	. SPRING, Anchor pin felt retainer	4			
		19	1005Z496	. BUSHING, Brake cam	2			
		20	18Z952D9	.SEAL,Felt	1			
		21	18Z952011	. RETAINER, Felt seal	1			
		22	18Z124	. WASHER, Retainer	2			
		23	1006Z546	. ADJUSTER, Brake slack	1			
		24	1018Z812	. WASHER, Spacer	AR			
		25	1018Z814	.WASHER	AR			
		26	1019Z929	. PIN, Brake anchor	2			
		27	1020Z4833	. BOLT, Spider to housing	8			
		28	1018Z3596	. WASHER, Spider mounting bolt	16			
		29	1020Z4447	. NUT, Brake spider mounting	8			
		30	1018Z4748	. RETAINER, Brake roller	4			
		31	1020Z2779	. SCREW, Brake spider and cam. bracket	4			
		32	18Z147	. WASHER, Bracket mounting lock	4			

Ref. Dwg. 10Z463

FORWARD REAR AXLE GROUP



FORWARD REAR AXLE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		AXLE GROUP, FORWARD REAR				
		–	1053Z196	.DIFFERENTIAL ASSY., Forward rear	1			
		01	1020Z2774	.. BOLT, Lower cover	6			
		02	1018Z2786	.. WASHER, Lower cover bolt flat	6			
		03	1014Z545	.. COVER, Lower bearing	1			
		04	1020Z2763	.. GASKET, Lower bearing cover	1			
		05	1020Z2768	. . PIN, Cotter	1			
		06	1020Z4286	.. NUT, Drive gear	1			
		07	1018Z2796	.. WASHER, Drive gear nut	1			
		08	1025Z1129	.. CONE, Outer bearing	1			
		09	1025Z1130	.. CUP, Outer bearing	1			
		10	101Z23771	.. SPACER, Drive gear bearing 0.248 in.	AR			
		10	1018Z3772	.. SPACER, Drive gear bearing 0.249 in.	AR			
		10	1018Z3773	.. SPACER, Drive gear bearing 0.250 in.	AR			
		10	1018Z3774	.. SPACER, Drive gear bearing 0.251 in.	AR			
		10	101Z23775	.. SPACER, Drive gear bearing 0.252 in.	AR			
		10	1018Z3776	.. SPACER, Drive gear bearing 0.253 in.	AR			
		10	1018Z3777	.. SPACER, Drive gear bearing 0.259 in.	AR			
		10	1018Z3776	.. SPACER, Drive gear bearing 0.265 in.	R			
		10	1018Z3779	.. SPACER, Drivegear bearing 0.271 in.	AR			
		10	1018Z3780	. . SPACER, Drive gear bearing 0.277 in.	AR			
		10	1018Z3781	. . SPACER, Drive gear bearing 0.283 in.	AR			
		11	1018Z2B01	. . SPACER. Drive gear	1			
		12	1001lZ648	.. GEAR, Drop box driven	1			
		13	1020Z2758	.. SHIM. 0.003 in	AR			
		13	1020Z2759	.. SHIM. 0.005 in	AR			
		13	1020Z2760	.. SHIM. 0.010 in	AR			
		14	1025Z1219	.. CUP, Inner bearing	1			
		15	1025Z1135	.. CONE, Inner bearing	1			
		16	1001Z832	.. DRIVE & RING GEAR -7.40 to 1	1			
		17	1020Z4286	. NUT,Yoke	1			
		18	1020Z2768	.. PIN, Cotter	1			
		19	1018Z4833	.. YOKE, Input	1			
		20	1018Z4B808	.. SLINGER, Oil	1			
		21	1020Z4285	.. BOLT, Bearing cage cover	7			
		22	1018Z1649	.. WASHER, Bearing cover bolt	7			
		23	1025Z1717	.. COVER &SEAL ASSEMBLY	1			
		24	1018Z511	... SEAL, Oil	1			
		25	1045Z1155	.. O-RING, Bearing cage	1			
		26	1020Z4928	.. SHIM,0.003	3			
		26	1020Z4936	.. SHIM,0.006	4			
		26	1020Z4940	.. SHIM,0.010	1			
		27	1025Z1719	.. CUP, Outer input shaft bearing	1			
		28	1025Z1720	.. CONE, Outer input shaft bearing	1			
		29	1015Z799	.. COLLAR, Input shaft	1			
		-	1010Z1000	.. SHAFT ASSY., Inter differential	1			
		30	1010Z1010	... SHAFT, Input	1			
		31	1018Z2790	... WASHER, Thrust	1			
		32	1001Z649	... GEAR, Inter drive	1			
		33	1020Z3645	... BOLT, Inter axle differential case	8			

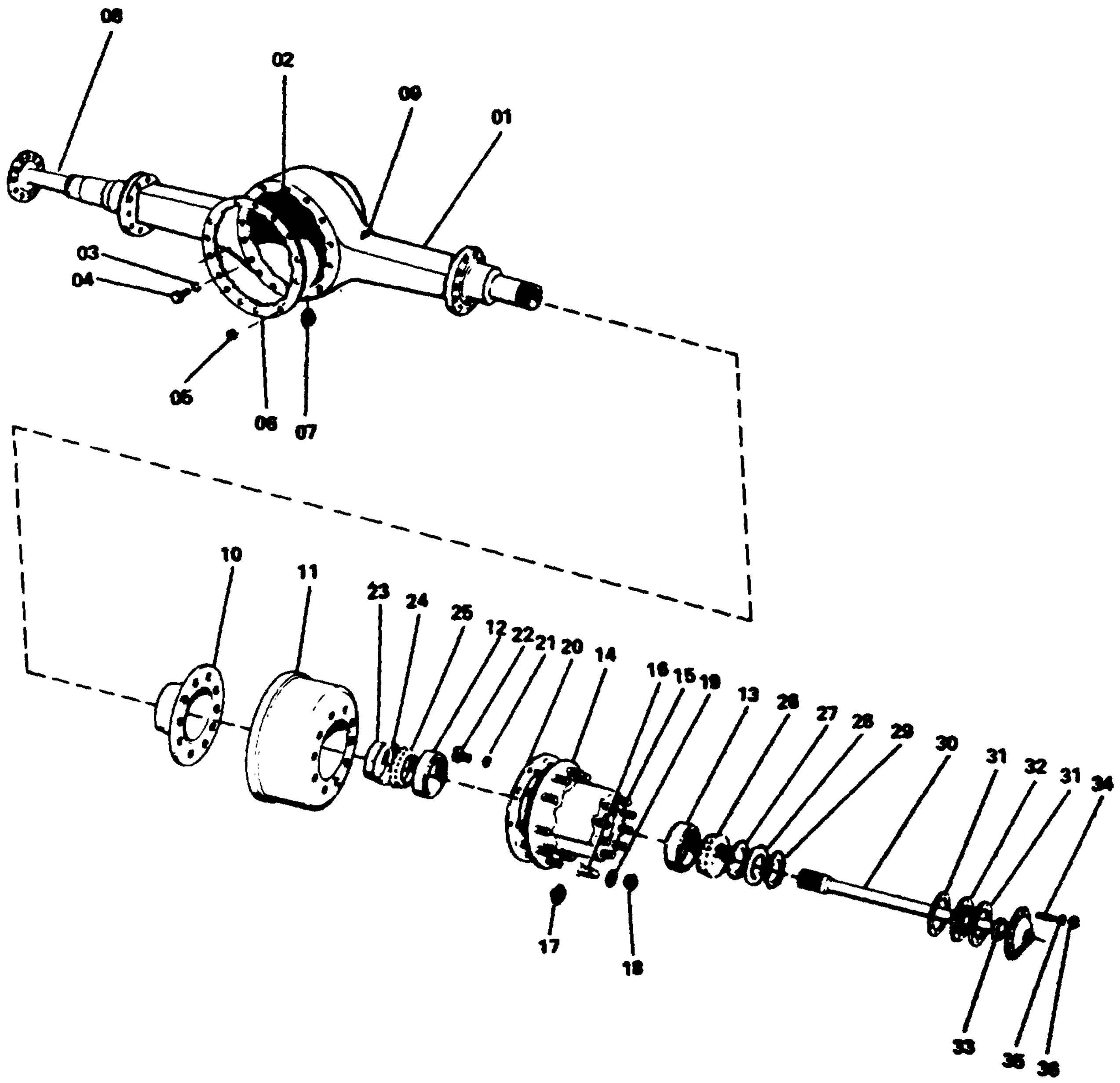
FORWARD REAR AXLE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		34	1018Z1649	...WASHER, Case bolt	8			
		35	1014Z554	...CASE ASSY , Inter axle differential	1			
		36	1013Z311	...SPIDER, Inter axle differential	1			
		37	1010Z557	...GEAR, Pinion	4			
		38	1018Z2798	...WASHER, Pinion gear thrust	4			
		39	1018Z4834	...RETAINER, Snap ring	1			
		40	1018Z2795	...RING, Snap	1			
		41	1001Z1075	...GEAR,Side	1			
		42	10182274	...WASHER, Side gear thrust	1			
		43	1025Z1718	...CONE, Inter axle differential bearing	1			
		44	1025Z1721	...CUP, Inter axle differential bearing	1			
		45	1020Z2739	..SCREW, Thrust	1			
		46	1020Z2733	..NUT, Thrust screw	1			
		–	1014Z1330	... SHIFT ASSY, Inter axle differential	1			
		47	1020Z2463	...GASKET, Shift housing	1			
		48	1015Z792	...FORK & YOKE ASSEMBLY	1			
		49	10252435	....BALL, Yoke	1			
		50	1020Z3962	....NUT, Yoke ball	1			
		51	1020Z876	....WASHER, Seat	1			
		51	1018Z1649	....WASHER, Flat	AR			
		52	1020Z3960	....BOLT, Spring retaining	1			
		53	1017Z708	....SPRING, Yoke	1			
		54	1019Z444	...PIN, Cotter	1			
		55	1020Z2993	...NUT, Air chamber stud	2			
		56	1018Z2961	...WASHER, Air chamber stud nut	2			
		57	15Z342D1	...CHAMBER, Air shift	1			
		58	1020Z127	...GASKET, Air chamber	1			
		59	1020Z2997	...STUD, Air chamber mounting	2			
		60	10182Z2786	... WASHER, Lock	4			
		61	1020Z2776	...BOLT, Shift housing mounting	4			
		62	1014Z1006	...HOUSING. Air shift	1			
		63	1018Z2787	...RING, Snap	1			
		64	101Z22010	...RETAINER, Spring	1			
		65	1017Z707	...SPRING, Shift	1			
		66	1020Z2738	...BOLT, Adjusting	1			
		67	102022732	...NUT, Adjusting bolt	1			
		68	1014Z1329	..CARRIER & CAP ASSEMBLY	1			
		69	1020Z2731	...BOLT, Bearing cap	4			
		70	1018Z2797	..WASHER, Bearing cap bolt	4			
		71	1020Z3646	..SCREW, Long differential housing	4			
		71	1020Z4867	..SCREW, Short differential mounting	9			
		72	1020Z4166	..NUT, Carrier to housing	1			
		73	1018Z3596	..WASHER, Carrier to housing	14			
		74	1044Z120	..PLUG, Fuller	1			
		75	1020Z2181	..GASKET, Carrier to housing	1			
		76	1019Z788	.. PIN,Cotter	2			
		77	1018Z3782	..RING, Bearing adjustment	2			
		78	1025Z1413	..CUP, Differential bearing	2			
		79	1025Z1414	..CONE, Differential bearing	2			
		–	1053Z188	..CASE & NEST ASSEMBLY	1			

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		80	1014Z866	CASE ASSEMBLY, Differential	1			
		81	1020Z4868	BOLT, Long differential case	8			
		82	1020Z4410	BOLT, Short differential case	4			
		83	1018Z1238	WASHER, Side gear thrust	2			
		84	1001Z1076	GEAR, Differential side	2			
		85	1013Z208	SPIDER, Differential	1			
		86	1001Z232	PINION, Differential	4			
		87	1018Z1239	WASHER, Pinion thrust	4			
		88	1020Z3643	RIVET. Ring gear	12			
		89	1020Z4834	PLUG, Magnetic drain	1			
		90	1046Z170	BREATHER, Housing	1			
		91	1014Z1299	HOUSING, Forward rear axle	1			
		92	1020Z4037	STUD, Differential mounting	1			
		93	1010Z971	SHAFT. L.H. forward axle	1			
		94	1010Z972	SHAFT, R.H. forward axle	1			
		95	1010Z560	SHAFT, Thru	1			
		96	1020Z128	GASKET, Cage assembly	1			
		97	1025Z1215	CAGE ASSEMBLY, Thru shaft	1			
		98	1018Z2791	RING,Snap	1			
		99	1025Z1135	BEARING, Thru shaft	1			
		100	18Z95202	SEAL, Oil	1			
		101	1020Z2775	SCREW, Cage mounting	4			
		102	1018Z2815	YOKE, Output	1			
		103	1018Z2997	SLINGER, Oil	1			
		104	1018Z4361	WASHER, Flat	1			
		105	20Z848	NUT, Yoke	1			

Ref Dwg. 10Z497

FORWARD AND REAR REAR AXLE HUB AND DRUM GRDUP



FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

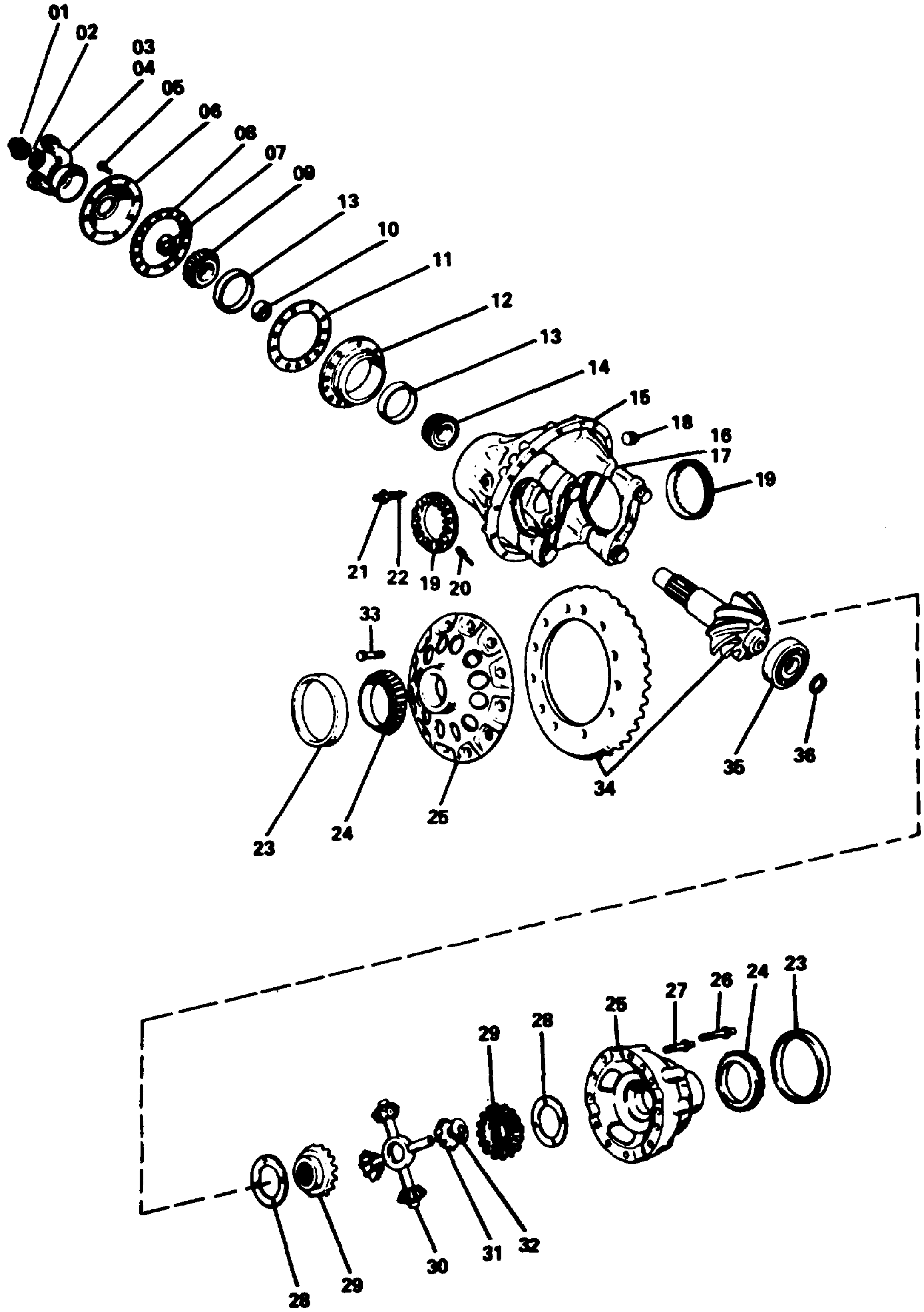
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		HUB & DRUM GP., FORWARD & REAR REAR				
		01	1014Z1300	. HOUSING, Rear rear axle	8			
		02	1020Z4037	.STUD,Locating	1			
		03	1018Z3596	.WASHER,Lock	14			
		04	1020Z3BI6	. SCREW, Long cap	4			
		04	1020Z4867	. SCREW, Short cap	9			
		05	102OZ4166	. NUT, Differential stud	1			
		06	1020Z2181	. GASKET, Carrier to housing	1			
		07	1020Z4834	. PLUG, Magnetic drain	1			
		08	1010Z972	. SHAFT, L.H. rear axle	1			
		09	1046Z170	. BREATHER, Axle housing	1			
		10	1013Z295	. HUB & DRUM ASSEMBLY, L.H.	1			
		10	1018Z4706	.. SLINGER,Oil	1			
		11	1015Z1033	.. DRUM,Brake	1			
		–	1013Z277	.. HUB & STUD ASSEMBLY, L.H.	1			
		–	1013Z276	... HU8 & CUP ASSEMBLY, L.H.	1			
		12	1018Z2783	.... CUP, Inner bearing	1			
		13	1018Z2782	.... CUP, Outer bearing	1			
		14	1013Z274	.... HUB	1			
		15	1020Z4673	... STUD, Axle shaft mounting	8			
		16	1020Z4831	... STUD, L.H. wheel	10			
		17	1079Z1508	... PLUG, Hub filler	1			
		18	102OZ1O93	.. NUT, Inner L.H. wheel stud	10			
		18	1020Z921	.. NUT, Outer L.H. wheel stud	10			
		19	1018Z640	.. RETAINER, Drum to hub	5			
		20	1018Z4641	.. ROTOR, Slinger	1			
		21	1018Z4708	..WASHER,Flat	5			
		22	1020Z4832	.. SCREW, Cap - rotor mounting	5			
		–	1013Z296	. HUB & DRUM ASSEMBLY, R.H.	1			
		10	1018Z4706	.. SLINGER, Oil	1			
		11	1015Z1033	..DRUM.Brake	1			
		–	1013Z293	.. HUB & STUD ASSEMBLY, R.H.	1			
		–	1013Z276	...HUB & CUP ASSEMBLY,R.H.	1			
		12	1018Z2783	.... CUP, Inner bearing	1			
		13	1018Z2762	.... CUP, Outer bearing	1			
		14	1013Z274	.... HUB	1			
		15	1020Z4673	... STUD, Axle shaft mounting	8			
		16	1020Z4830	... STUD,R.H.wheel	10			
		17	1079Z1508	... PLUG, Hub filler	1			
		18	1020Z2745	.. NUT, Inner R.H. wheel stud	10			
		18	1020Z2746	.. NUT, Outer R.H. wheel stud	10			
		19	1018Z4646	.. RETAINER, Drum to hub	5			
		20	1018Z4641	.. ROTOR, Slinger	1			
		21	1018Z4708	..WASHER,Flat	5			
		22	1020Z4632	.. SCREW, Cap - rotor mounting	5			
		23	1018Z155	.SEALASSY., Inner hub oil	1			
		24	1049Z44	.WIPER, Inner axle shaft	1			
		25	1025Z1248	. CONE, Inner bearing	1			
		26	1025Z1211	. CONE, Outer bearing	1			
		27	1020Z2896	. NUT, Wheel bearing inner	1			

FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		28	1018Z2963	.WASHER, Lock - wheel bearing nut	1			
		29	1020Z2895	.NUT, Wheel bearing outer	1			
		30	1010Z971	.SHAFT, R.H. rear axle	1			
		31	1020Z4287	.GASKET, Axle shaft	2			
		32	1018Z1125	.SEAL, Outer oil	1			
		33	1018Z1126	.WIPER, Axle shaft outer	1			
		34	1025Z746	.DOWEL, Tapered	8			
		35	18Z853D6	.WASHER, Lock	8			
		36	1020Z4166	.NUT, Axle shaft mounting	8			

Ref. Dwg 10Z497

REAR REAR AXLE DIFFERENTIAL ASSEMBLY



REAR REAR AXLE DIFFERENTIAL ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–	1053Z189	DIFFERENTIAL ASSY REAR REAR AXLE				
		01	20Z848	.NUT,Yoke	1			
		02	1018Z3768	.WASHER,Yoke	1			
		03	1018Z3016	.YOKE,Input	1			
		04	1018Z2999	.. SLINGER,OIL	1			
		05	1020Z1664	. SCREW, Bearing cage cap	8			
		06	1018Z3014	. COVER & SEAL ASSEMBLY	1			
		07	18Z96501	.. SEAL, Bearing cover	1			
		08	1020Z3642	. GASKET, Bearing cage cover	1			
		09	1025Z1417	. CONE, Outer bearing	1			
		10	1018Z3771	. SPACER,0.248 in. thick	AR			
		10	10183772	. SPACER, 0.249 in. thick	AR			
		10	1018Z3773	. SPACER.0.250 in. thick	AR			
		10	1018Z3774	. SPACER, 0.251 in. thick	AR			
		10	1018Z3775	. SPACER , 0.252 in. thick	AR			
		10	10183776	. SPACER, 0.253 in. thick	AR			
		10	10183777	. SPACER, 0.259 in. thick	AR			
		10	1018Z3778	. SPACER, 0.265 in thick	AR			
		10	10183779	. SPACER, 0.271 in. thick	AR			
		10	10183780	. SPACER, 0.277 in. thick	AR			
		10	10183781	. SPACER, 0.283 in. thick	AR			
		11	1020Z3641	.SHIM.0.003 in	AR			
		11	1020Z3637	.SHIM.0.005 in	AR			
		11	1020Z3638	SHIM.0.010 in	AR			
		12	1025Z1416	. CAGE ASSY., Pinon bearing	1			
		13	1025Z441	.. CUP, Inner and outer bearing	2			
		14	1025Z1135	. CONE, Inner bearing	1			
		15	1014864	. CASE & CAP ASSEMBLY	1			
		16	1020Z3731	.. SCREW, Bearing cap	4			
		17	1018Z2797	.. WASHER, Bearing cap	4			
		18	1044120	. PLUG, File, and inspection	1			
		19	10183782	. RING, Bearing adjustment	2			
		20	1019788	.PIN,Cotter	2			
		21	10202733	NUT, Bearing adjustment	1			
		22	10202739	SCREW. Bearing adjustment thrust	1			
		23	10251413	CUP, Differential bearing	2			
		24	10251414	CONE, Differential bearing	2			
		-	1053188	CASE & NEST ASSEMBLY	1			
		25	1014866	.. CASE ASSEMBLY, Differential	1			
		26	1020Z4868	... BOLT, Long differential	8			
		27	1020Z4410	... BOLT, Short differential	4			
		28	1018Z1238	.. WASHER. Side gear thrust	2			
		29	1001Z231	.. GEAR, Side	2			
		30	1013Z208	.. SPIDER, Differential	1			
		31	1001Z232	. PINION, Differential	4			
		32	1018Z1239	.. WASHER, Pinion thrust	4			
		33	1020Z3643	. RIVET, Ring gear	12			
		34	1001Z831	. DRIVE & RING GEAR, 7.4C to 1	1			
		35	1025Z1412	. BEARING, Drive gear	1			
		36	1018Z3788	. RING, ock	1			

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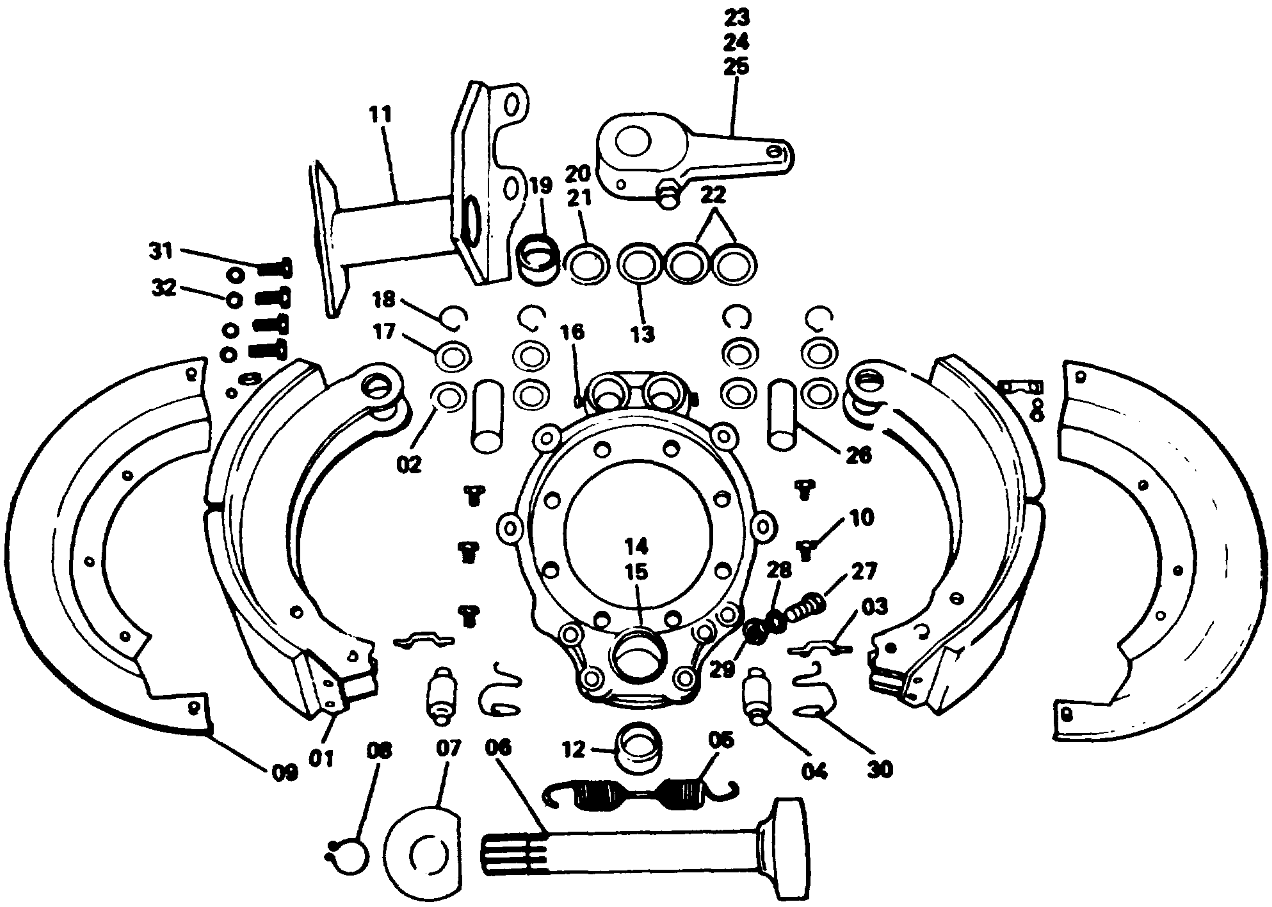
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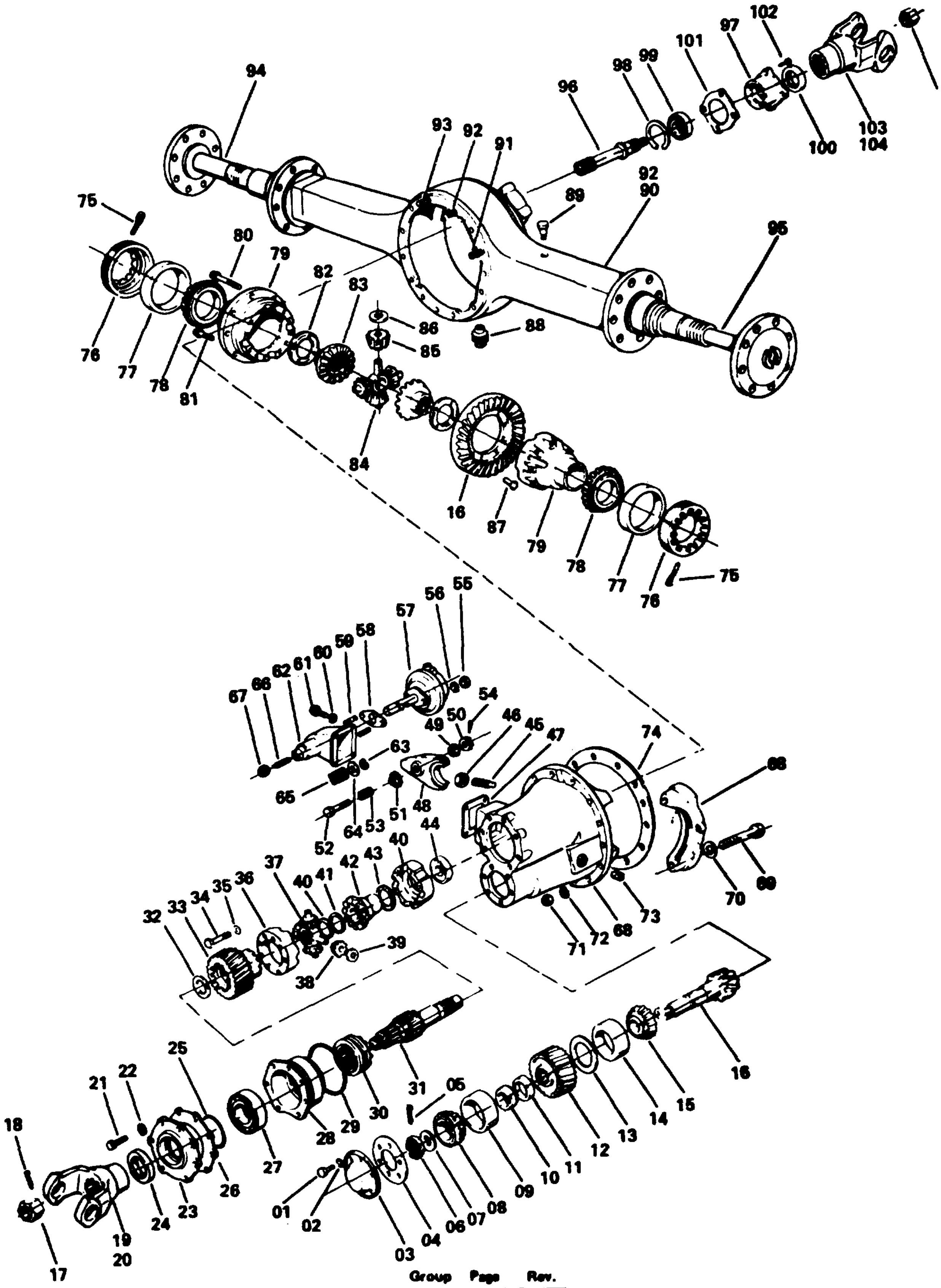
FORWARD AND REAR REAR AXLE BRAKE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		BRAKE GP., FORWARD & REAR REAR AXLE	1			
		01	1015Z1076	. SHOE & LINING ASSEMBLY, Brake	2			
		02	18Z125	.. RETAINER, Anchor pin felt	4			
		03	1019Z236	.. PIN, Return spring	2			
		04	1013Z14	.. ROLLER, Brakeshoe	2			
		05	1017Z66	. SPRING, Shoe return	1			
		06	1043Z9	. CAMSHAFT, L.H. forward, R.H. rear	1			
		06	1043Z35	. CAMSHAFT, R.H. forward, L.H. rear	1			
		07	1018Z1730	. WASHER, Camshaft	1			
		08	1018Z1786	. RING, Camshaft lock	1			
		09	1014Z547	. SHIELD, Dust	2			
		10	20Z397	. . SCREW, Dust shield mountmg	6			
		11	1016Z282	. BRACKET, R.H. rear, L.H. forward	1			
		–	1020Z2169	. . GASKET. 8rake spider and cam	1			
		12	25Z79	. .BUSHING, Camshaft bracket	1			
		13	1045Z1348	. . O RING, Camshaft bracket	2			
		14	1018Z4746	. . SEAL, Brake spider	1			
		11	1016Z283	. BRACKET, L.H. rear, R.H. forward	1			
		–	1020Z2169	. . GASKET, Brake spider and cam	1			
		12	25Z79	. . BUSHING, Camshaft bracket	1			
		13	1045Z1348	. . O-RING, Camshaft bracket	2			
		14	1018Z4746	. . SEAL, Brake spider	1			
		–	1015Z1075	. . SPIDER, Brake	1			
		12	25Z79	. . BUSHING, Camshaft bracket	1			
		13	1045Z1348	. . O-RING, Camshaft bracket	2			
		14	101824746	. . SEAL, Brake spider	1			
		15	1018Z4747	. . RETAINER, Brake spider	1			
		16	1020Z2916	. . SCREW, Anchor pm lock	2			
		17	1018Z672	. FELT, Anchor pin	4			
		18	18Z125	. SPRING, Anchor pin felt retainer	4			
		19	1005Z496	. BUSHING, Brake cam	2			
		20	18Z952D9	. SEAL, Felt	1			
		21	18Z952D11	. RETAINER, Felt seal	1			
		22	18Z124	. WASHER, Retainer	2			
		23	1006Z546	. ADJUSTER, Brake slack	1			
		24	1018Z812	. WASHER, Spacer	AR			
		25	1018Z814	.WASHER	AR			
		26	1019Z929	. PIN, Brake anchor	2			
		27	1020Z4833	. BOLT, Spider to housing	8			
		28	1018Z3596	. WASHER, Sprder mounting bolt	16			
		29	1020Z4447	. NUT, Brake spider mounting	8			
		30	1018Z4748	. RETAINER, Brake roller	4			
		31	1020Z2779	. SCREW, Brake spider and cam. bracket	4			
		32	18Z147	. WASHER, Bracket mounting lock	4			

Ref. Dwg. 10Z497

FORWARD REAR AXLE GROUP



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FORWARD REAR AXLE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		—		AXLE GROUP, FORWARD REAR				
		—	1063Z117	. DIFFERENTIAL ASSY., forward rear	1			
		01	1020Z2744	.. BOLT, Lower cover	6			
		02	1018Z2786	.. WASHER, Lower cover bolt	6			
		03	1014Z545	.. COVER, Drive gear	1			
		04	1020Z2763	.. GASKET, Drive gear cover	1			
		05	1020Z2768	.. PIN, Cotter	1			
		06	1020Z4286	.. NUT, Drive gear	1			
		07	1018Z2796	.. WASHER, Drive gear nut	1			
		08	1025Z1129	.. CONE, Outer drive gear bearing	1			
		09	1025Z1130	.. CUP, Outer drive gear bearing	1			
		10	1018Z3771	.. SPACER, Drive gear bearing .248	AF			
		10	1018Z3772	.. SPACER, Drive gear bearing .249	AF			
		10	1018Z3773	.. SPACER, Drive gear bearing .250	Af			
		10	1018Z3774	.. SPACER, Drive gear bearing 251	AF			
		10	1018Z3775	.. SPACER, Drive gear bearing .252	AF			
		10	1018Z3776	.. SPACER, Drive par bearing .253	AF			
		10	101823777	.. SPACER, Drive gear bearing .259	AF			
		10	1018Z3778	.. SPACER, Drive gear bearing .265	AF			
		10	1018Z3779	.. SPACER, Drive gear bearing .271	AF			
		10	1018Z3780	.. SPACER, Drive gear bearing .277	AF			
		10	1018Z3781	.. SPACER, Drive gear bearing .283	AF			
		11	1018Z2801	.. SPACER. Drive gear	1			
		12	1001Z648	.. GEAR, Drop box driven	1			
		13	1020Z2758	.. SHIM.0.003	AR			
		13	1020Z2759	.. SHIM,0.005	AR			
		13	1020Z2760	.. SHIM,0.010	AR			
		14	1025Z441	.. CUP, Inner drive gear bearing	1			
		15	10251135	.. CONE, Inner drive gear bearing	1			
		16	1001Z832	.. DRIVE & RING GEAR 7.40 to 1	1			
		17	1020Z4286	.. NUT, Input yoke	1			
		18	1020Z2766	.. PIN, Cotter	1			
		19	1018Z3010	.. YOKE, Input	1			
		20	1018Z998	... SLINGER, Oil	1			
		21	1020Z4285	.. BOLT, Bearing cage cover	7			
		22	1018Z1649	.. WASHER, Bolt	7			
		23	1014Z867	.. COVER, Bearing cage	1			
		24	1018Z511	... SEAL, Oil	1			
		25	1045Z985	.. O-RING, Cover	1			
		26	1020Z3639	.. SHIM, 0.003	3			
		26	1020Z3640	.. SHIM, 0.005	4			
		27	1025Z1411	.. BEARING, Inprt shaft	1			
		28	1025Z1414	.. CAGE, Input bearing	1			
		29	1045Z1155	.. O-RING, Bearing cage	1			
		30	1015Z790	.. COLLAR, Input shaft	1			
		—	1010Z836	.. SHAFT ASSY., Inter-axle differential	1			
		31	1010Z744	... SHAFT, Input	1			
		32	1018Z2790	... WASHER, Thrust	1			
		33	1001Z649	.. GEAR, Inter drive	1			
		34	1020Z3645	... BOLT, Case assembly	8			

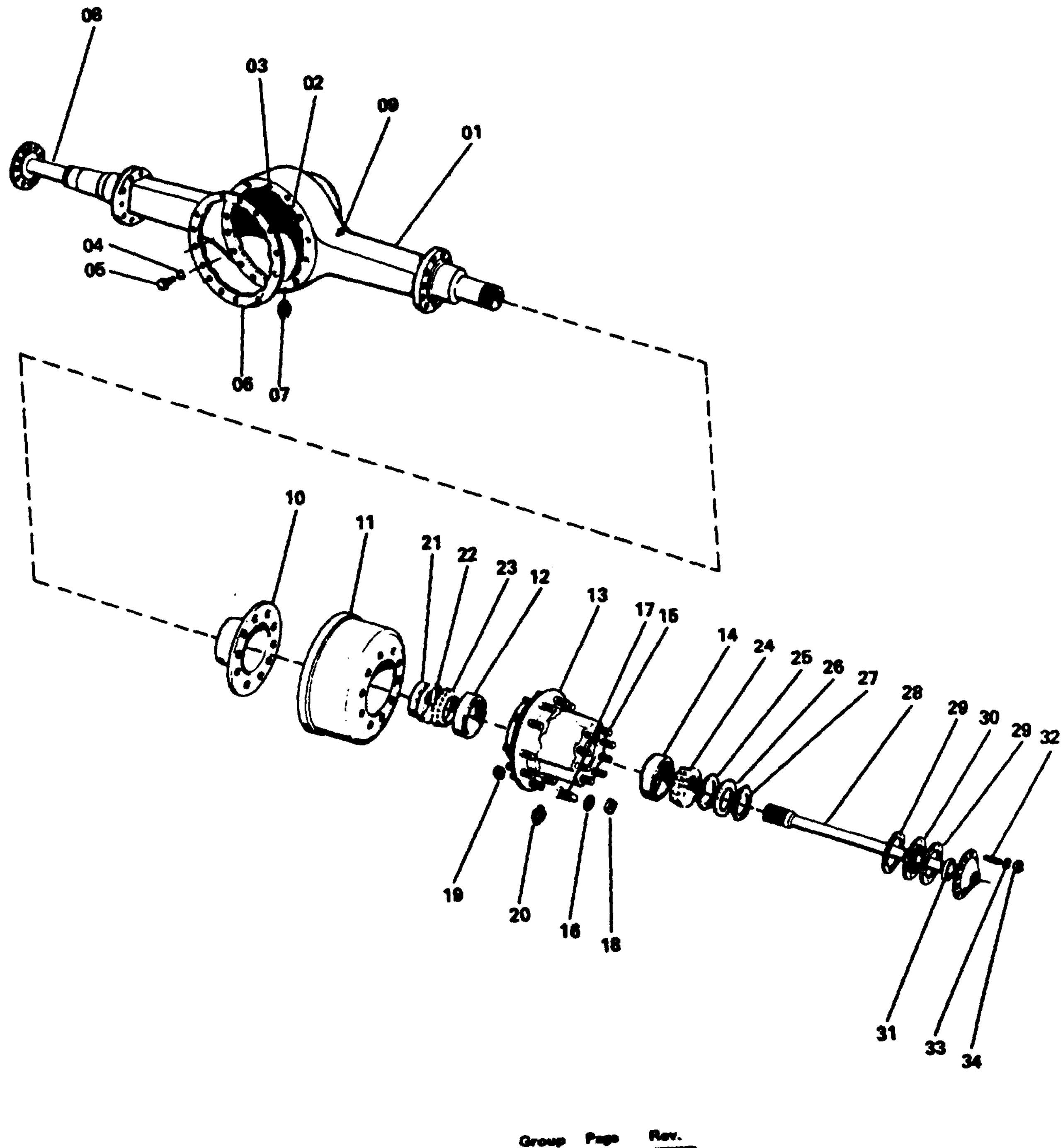
QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		35	1018Z1649	. . . WASHER, Case bolt	8			
		36	1014Z554	. . . CASE ASSEMBLY, Differential	1			
		37	1013Z169	. . . SPIDER, Inter axle differential	1			
		38	1010Z557	. . . GEAR, Pinion	4			
		39	1018Z2798	. . . WASHER, Pinion gear thrust	4			
		40	1018Z2784	. . . RETAINER, Differential	1			
		41	1018Z2795	. . . RING,Snap	1			
		42	1061Z646	. . . GEAR, Inter differential side	1			
		43	1018Z2794	. . . WASHER, Side gear thrust	1			
		44	1025Z1415	. . . BEARING, Inter axle differential	1			
		45	1020Z2739	. . SCREW, Thrust	1			
		46	1020Z2733	.. NUT, Thrust screw	1			
		–	1014Z863	. . SHIFT ASSY., Inter axle differential	1			
		47	1020Z2463	. . . GASKET, Housing	1			
		48	1015Z792	. . . FORK & HOKE ASSEMBLY	1			
		49	1025Z435	. . . . BALL, Yoke	1			
		50	1020Z3962	. . . .NUT,Yokeball	1			
		51	1020Z876	. . . .WASHER,Seat	1			
		51	1018Z1649	. . . . WASHER, Flat	1			
		52	1020Z3960	. . . . BOLT,Yoke spring	1			
		53	1017Z708	. . . . SPRING, Shift yoke	1			
		54	1019Z444	. . . PIN,Cotter	1			
		55	1020Z2993	. . . NUT, Air chamber stud	2			
		56	1018Z2961	... WASHER, Air chamber stud	2			
		57	1010Z561	. . . CHAMBER, Air shift	1			
		58	1020Z127	. . . GASKET, Air chamber	1			
		59	1020Z2997	. . . STUD, Air chamber mounting	2			
		60	1018Z2786	... WASHER,Lock	4			
		61	1020Z2776	. . . BOLT, Shift housing mounting	4			
		62	1014Z1006	. . . HOUSING, Air shift	1			
		63	1018Z2787	. . . RING,Snap	1			
		64	1018Z2010	. . . RETAINER, Spring	1			
		65	1017Z707	...SPRING,Shift	1			
		66	102OZ2738	. . . BOLT, Adjusting	1			
		67	1020Z2732	. . . NUT, Adjusting bolt	1			
		68	1014Z865	. . CARRIER &CAP ASSEMBLY	1			
		69	1020Z2731	. . . BOLT,Bearing cap	4			
		70	1018Z2797	. . . . WASHER, Flat	4			
		71	20Z189	. . NUT, Carrier to housing	4			
		72	1018Z2799	. . WASHER, Lock	4			
		73	1044Z120	. . PLUG, Housing filler	1			
		74	1020Z2181	. . GASKET, Carrier to housing	1			
		75	1019Z788	..PIN,Cotter	2			
		76	1018Z3782	. . RING, Bearing adjusting	2			
		77	1625Z1413	. . CUP, Bearing	2			
		78	1025Z1414	..CONE,Bearing	2			
		–	1653Z114	. . CASE & NEST ASSEMBLY	1			
		79	1014ZB66	. . . CASE ASSY., Differential	1			
		80	1020Z3647	. . . . BOLT,Long	8			
		81	1020Z3646	. . . BOLT, Short	4			

FORWARD REAR AXLE (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		82	1018Z1238	…WASHER, Side gear thrust	2			
		83	1001Z830	…GEAR, Differential side	2			
		84	1013Z208	…SPIDER, Differential	1			
		85	1001Z232	…GEAR, Differential pinion	4			
		86	1018Z1239	…WASHER, Pinion gear thrust	4			
		87	1020Z3643	..RIVET, Differential ring gear	12			
		88	1020Z2980	..PLUG, Magnetic drain	1			
		89	1046Z170	.BREATHER, Axle housing	1			
		90	1014Z1072	.HOUSING, Forward rear axle	1			
		91	1020Z3634	..STUD, Long carrier mounting	4			
		92	1020Z2781	..STUD, Medium carrier mounting	9			
		93	1020Z4037	..STUD, Short carrier mounting	1			
		94	1010Z524	.SHAFT, L.H. forward rear axle	1			
		95	1010Z523	.SHAFT, R.H. forward rear axle	1			
		96	1010Z560	.SHAFT, Thru	1			
		97	1025Z1215	.CAGE, Thru shaft bearing	1			
		98	1018Z2791	..RING, Snap	1			
		99	1025Z1125	..BEARING, thru shaft	1			
		100	18Z952D2	..SEAL, Oil	1			
		101	1020Z128	..GASKET, Thru shaft cage	1			
		102	1020Z2775	.SCREW, Cage mounting	4			
		103	1018Z2815	.YOKE, Thru shaft yoke	1			
		104	1018Z2997	..SLINGER, Thru shaft yoke	1			
		105	20Z848	.NUT, Output yoke	1			

Ref. Dwg 10Z423

FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP

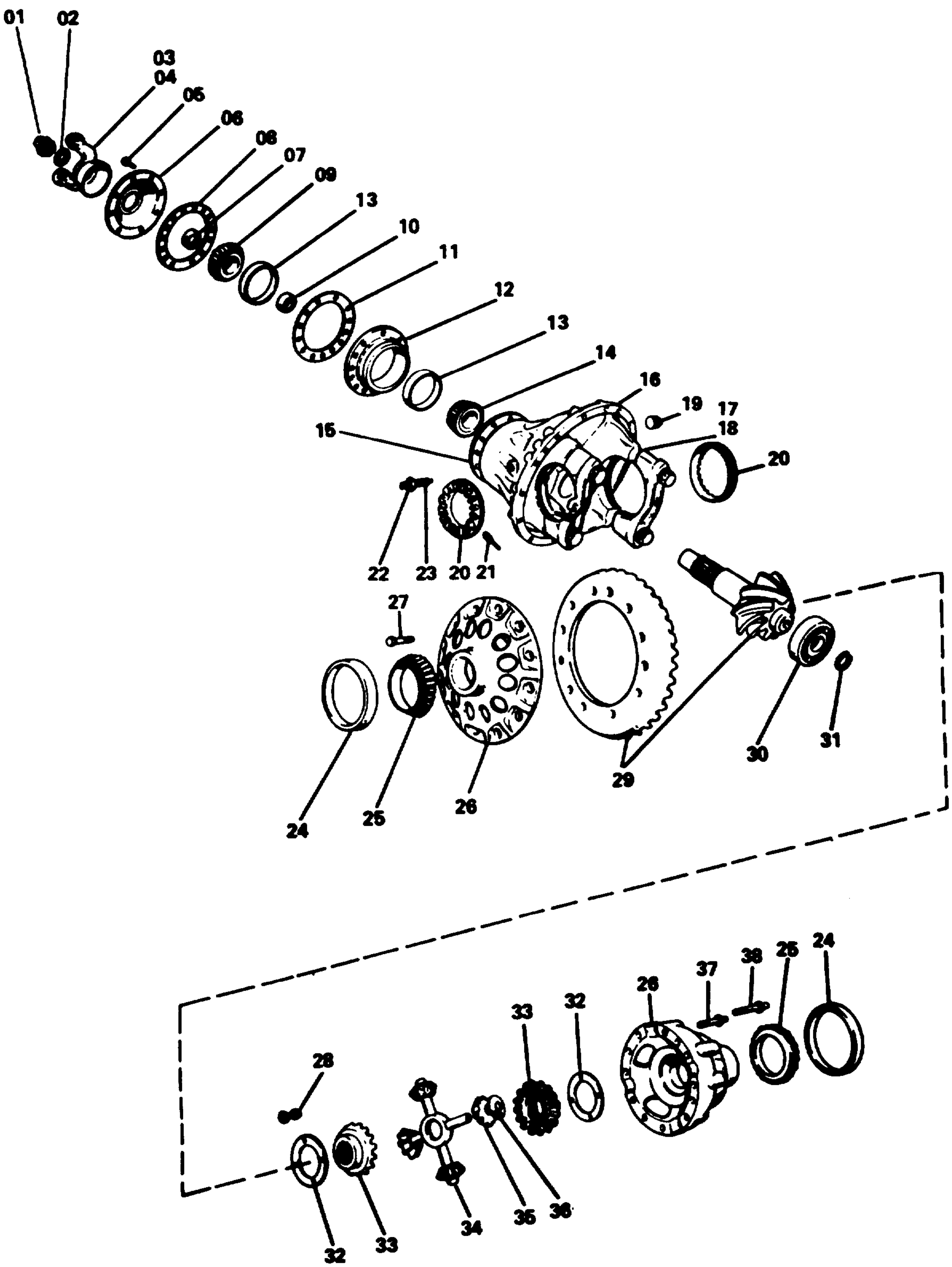


FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		—		HUB & DRUM GP, FORWARD & REAR REAR AXLE	▼			
		01	1014Z1071	. HOUSING, Rear rear axle	1			
		02	1020Z2781	.. STUD, Short	10			
		03	1020Z2723	.. STUD,Long	4			
		04	1018Z2799	.. WASHER,Lock	14			
		05	2OZ189	.. NUT, Carrier to housing	14			
		06	1020Z2181	. GASKET, Housing to carrier	1			
		07	1020Z2980	. PLUG, Magnetic drain	1			
		08	1010Z523	.SHAFT, L.H. rear axle	1			
		09	1046Z170	. BREATHER, Housing	1			
		—	1013Z212	. HUB & DRUM ASSEMBLY, R.H.	2			
		10	1018Z3003	.. SLINGER, Oil	1			
		11	1015Z520	.. DRUM, Brake	1			
		—	1013Z91	.. HUB & CUP ASSEMBLY, R.H.	1			
		12	1025Z334	... CUP, Inner bearing	1			
		13	N.S.S.	... HUB	1			
		14	25Z265D102	... CUP, Outer bearing	1			
		15	1010Z563	.. STUD, Axle shaft	8			
		16	1018Z4640	.. RETAINER, Stud	10			
		17	20Z96007	.. STUD, R.H. wheel	10			
		—	1013Z211	.HUB & DRUM ASSY., L.H.	2			
		10	1018Z3003	.. SLINGER,Oil	1			
		11	1015Z520	.. DRUM,Brake	1			
		—	1013Z91	.. HUB & CUP ASSEMBLY, L.H.	1			
		12	1025Z334	... CUP, Inner bearing	1			
		13	N.S.S.	... HUB	1			
		14	25Z265D102	... CUP, Outer bearing	1			
		15	1010Z563	.. STUD, Axle shaft	8			
		16	1018Z4640	.. RETAINER,Stud	10			
		17	20Z960D8	.. STUD, L.H. wheel	10			
		18	20Z962D4	.NUT, R.H. outer	10			
		18	20Z962D3	.NUT,L.H.outer	10			
		19	1020Z2746	. NUT, R.H. inner	10			
		19	102OZ1093	. NUT, L.H. inner	10			
		20	1044Z527	.PLUG,Hub	2			
		21	1018Z155	. SEAL, Oil	2			
		22	1049Z44	.WIPER,Inner	2			
		23	1025Z547	. CONE, Inner bearing	2			
		24	1025Z357	. CONE, Outer bearing	2			
		25	1020Z2696	. NUT, Wheel bearing	2			
		26	1018Z2963	.WASHER,Wheel bearing lock	2			
		27	1020Z2895	NUT, Outer wheel bearing	2			
		28	1010Z524	. SHAFT, R.H. rear axle	1			
		—	1018Z651	. KIT, Axle shaft oil seal	4			
		29	1020Z4287	.. GASKET, Axle shaft	2			
		30	N.S.S.	.. SEAL, Oil	1			
		31	N.S.S.	.. WIPER, Axle shaft	1			
		32	1025Z746	. DOWEL, Axle shaft	16			
		33	18Z95306	. WASHER, Lock	16			
		34	20Z189	. NUT, Axle shaft	16			

Ref. Dwg. 10Z423

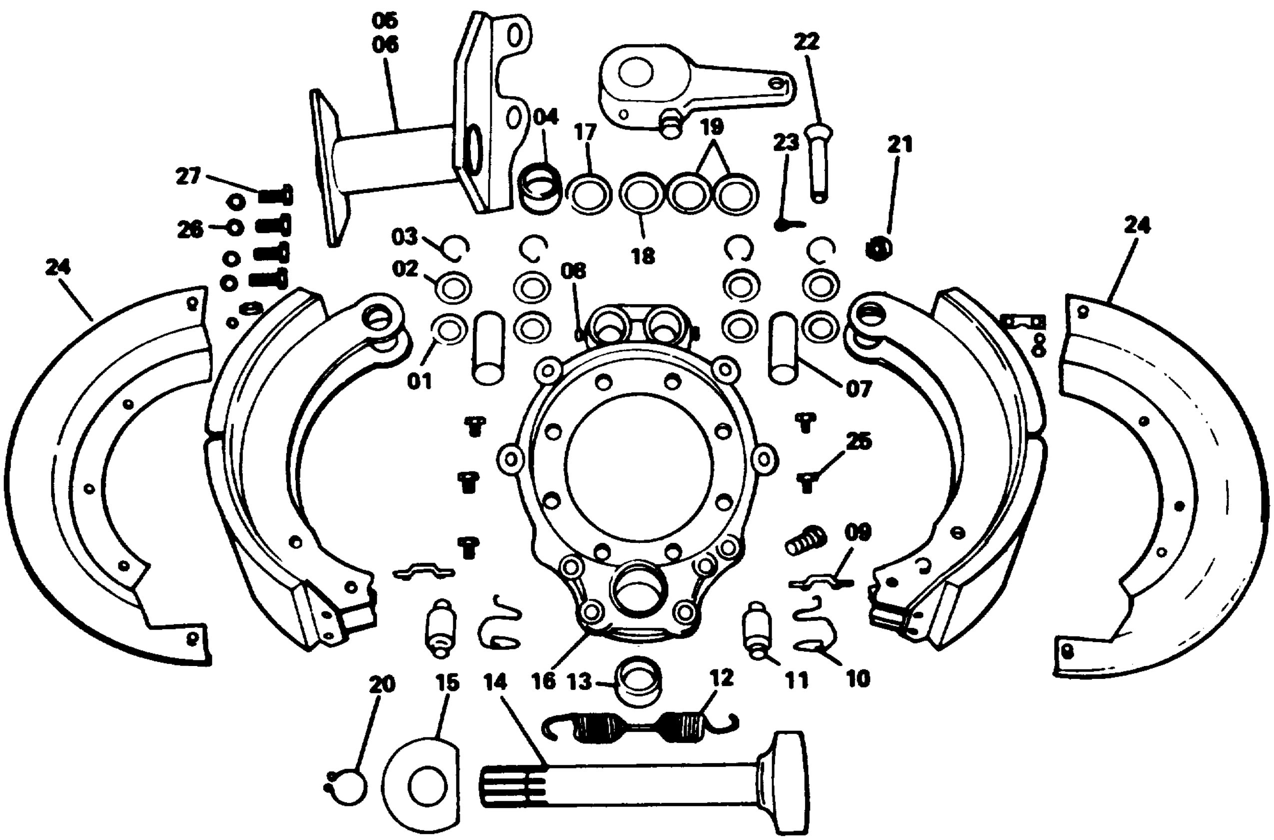
REAR REAR AXLE DIFFERENTIAL CARRIER ASSEMBLY



REAR REAR AXLE DIFFERENTIAL CARRIER ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		—	1053Z116	DIFFERENTIAL ASSY ., REAR REAR AXLE				
		01	20Z848	.NUT,Yoke	1			
		02	1018Z3768	.WASHER,Yoke	1			
		03	1018Z3016	. YOKE, Companion	1			
		04	1018Z2999	..SLINGER,Deflector	1			
		05	1020Z1664	. SCREW, Bearing cap	8			
		06	1018Z3014	. COVER & SEAL ASSEMBLY	1			
		07	18Z965D1	.. SEAL,Oil	1			
		08	1020Z3642	. GASKET, Bearing cage cap	1			
		09	1025Z1417	. CONE, Outer bearing	1			
		10	1018Z3771	.SPACER,0.248in.thick	AR			
		10	1018Z3772	. SPACER, 0.249 in thick	AR			
		10	1018Z3773	. SPACER, 0.250 in. thick	AR			
		10	1018Z3774	. SPACER, 0.251 in. thick	AR			
		10	1018Z3775	. SPACER, 0.252 in. thick	AR			
		10	1018Z3776	. SPACER, 0.253 in. thick	AR			
		10	1018Z3777	.SPACER, 0.259 in. thick	AR			
		10	1018Z3778	.SPACER, 0.266 in. thick	AR			
		10	1018Z3779	. SPACER,0.271 in. thick	AR			
		10	1018Z3780	.SPACER,0.277in.thick	AR			
		10	1018Z3781	. SPACER, 0.283 in. thick	AR			
		11	1020Z3341	.SHIM,0.003in.thick	AR			
		11	1020Z3637	.SHIM,0.005in.thick	AR			
		11	1020Z3838	. SHIM, 0.010 in. thick	AR			
		12	1025Z1416	. CAGE ASSY., Pinion bearing	1			
		13	1025Z441	.. CUP, Inner and outer bearing	2			
		14	1025Z1135	. CONE, Inner bearing	1			
		15	1018Z2801	.SPACER,Shim	1			
		16	1014Z864	. CASE & CAP ASSEMBLY	1			
		17	1020Z3731	.. SCREW, Cap - differential bearing up.	4			
		18	1018Z2797	.. WASHER, Flat - differential bearing cap	4			
		19	1044Z120	. PLUG, Filler and inspection	1			
		20	1018Z3782	. RING, Adjusting - differential bearing	2			
		21	1019Z788	.PIN,Cotter	2			
		22	1020Z2733	.NUT,Lock	1			
		23	1020Z2738	. SCREW, Bevel gear thrust	1			
		24	1025Z1413	. CUP, Differential bearing	2			
		25	1025Z1414	. CONE, Differential bearing	2			
		26	1014Z866	. CASE ASSEMBLY. Differential	1			
		27	1020Z3958	.. BOLT, Differential case	12			
		28	1020Z3964	.. NUT, Differential case	12			
		29	1001Z831	. GEAR & PINION ASSY., 7.40 to 1	1			
		30	1025Z1412	. BEARING, Drive pinion	1			
		31	1018Z3769	. RING, Lock- pinion bearing	1			
		32	1018Z1238	. WASHER, Thrust - differential side gear	2			
		33	1001Z830	. GEAR, Differential side	2			
		34	10132208	. SPIDER, Differential	1			
		35	1001Z232	. PINION, Differential	4			
		36	1018Z1239	. WASHER, Pinion thrust	4			
		37	1020Z3646	. B0LT, Short - differential case	4			
		38	1020Z3641	. BOLT, Long - differential case	8			

Ref. Dwg. 10Z423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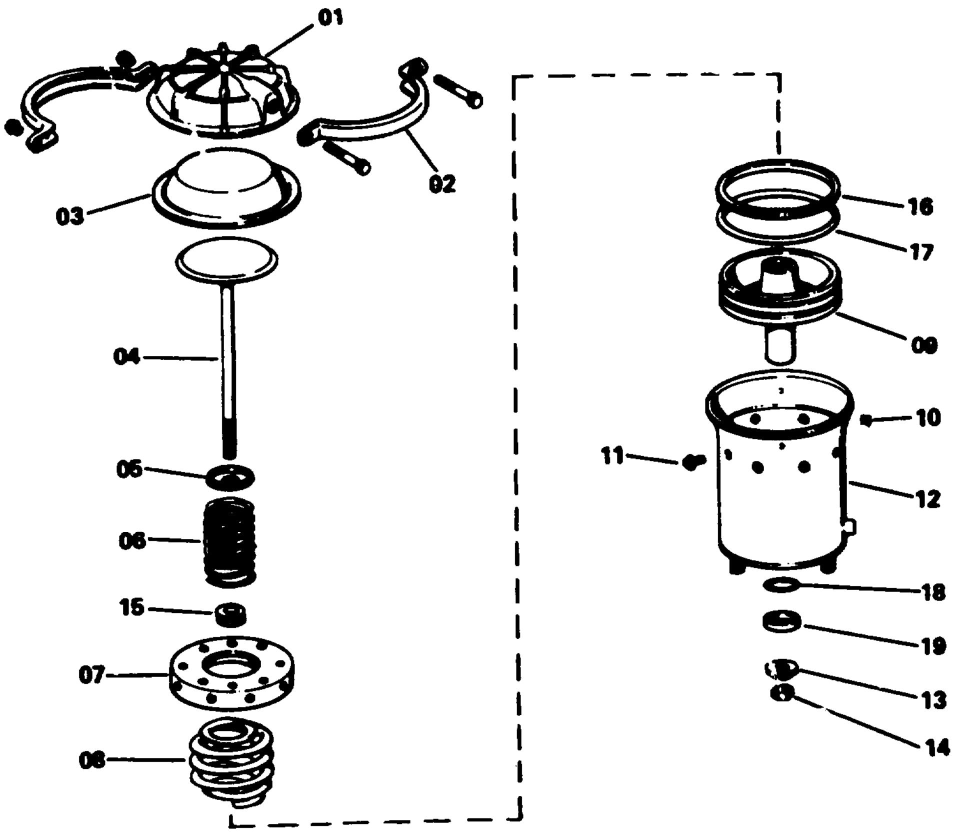
FORWARD AND REAR REAR AXLE BRAKE GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		BRAKE GROUP, FORWARD & REAR REAR AXLE				
		–	1015Z14B	. SHOE & LINING ASSY., Primary	1			
		01	18Z125	.. RETAINER, Anchor pin felt	4			
		02	1018Z672	.. FELT, Anchor pin	4			
		03	17Z46	.. SPRING, Anchor pin retainer	4			
		04	25Z79	... BUSHING, Anchor pin	1			
		05	1016Z354	.. BRACKET, R.H. rear or L.H. forward	1			
		05	1016Z355	.. BRACKET, R.H. forward or L.H. rear	1			
		66	1020Z2169	.. GASKET, Brake spider and cam	1			
		37	1019Z70	.. PIN,Anchor	2			
		08	20Z406	.. SCREW, Anchor pin lock	2			
		09	1019Z236	.. PIN, Spring return	2			
		10	1013Z7	.. RETAINER. Roller	2			
		11	1013Z14	.. ROLLER	2			
		12	1017Z66	.. SPRING,Return	1			
		-	1015Z147	. SHOE & LINING ASSY,. Secondary	1			
		01	18Z125	.. RETAINER, Anchor pin felt	4			
		02	1018Z672	.. FELT, Anchor pin	4			
		03	17Z46	.. SPRING, Anchor pin retainer	4			
		04	25Z79	... BUSHING, Anchor pin	1			
		05	1016Z354	.. BRACKET, R.H. rear or L.H. forward	1			
		05	1016Z355	.. BRACKET, R.H. forward or L.H. rear	1			
		06	1020Z2169	.. GASKET, Brake spider and cam	1			
		07	1019Z70	.. PIN,Anchor	2			
		08	20Z406	.. SCREW, Anchor pin lock	2			
		09	1019Z236	.. PIN, Spring return	2			
		10	1013Z7	.. RETAINER, Roller	2			
		11	1013Z14	.. ROLLER	2			
		12	1017Z66	.. SPRING,Return	1			
		13	25Z79	.BUSHING	1			
		14	1043Z9	. CAMSHAFT, R.H. rear or L.H. forward	1			
		14	1043Z36	. CAMSHAFT, R.H. forward or L.H. rear	1			
		15	1018Z1730	. WASHER, Brake camshaft	1			
		16	1015Z573	. SPIDFR, Brake mounting	1			
		17	18Z9952D9	.. SEAL,Oil	1			
		18	18Z952D11	.. RETAINER, Oil seal	1			
		19	18Z124	.. WASHER	1			
		--	1006Z546	. ADJUSTER, Brake slack	1			
		–	1018Z812	.. WASHER, Spacer	AR			
		–	1018Z814	.. WASHER	AR			
		19	18Z124	.. WASHER	1			
		20	1018Z1786	.. RING, Slack adjuster lock	1			
		21	18Z148	.NUT,Chamber stud	2			
		22	1019Z662	.PIN,Clevis	1			
		23	1019Z665	.PIN,Cotter	1			
		24	1014Z547	. SHIELD ASSEMBLY, Dust	2			
		25	20Z397	.. SCREW, Dust shield mounting	6			
		26	18Z147	.WASHER,Lock	4			
		27	1020Z2779	. BOLT, Spider and cam bracket mounting	4			
		–	1015Z914	.KIT, Brake shoe lining	2			
		–	1020Z889	.. RIVET	AR			

Ref. Dwg. 10Z423

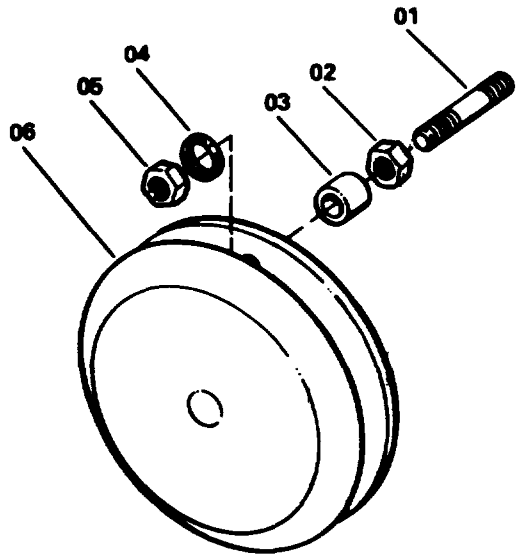
REAR AXLE MAXIBRAKE CHAMBER



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–	38Q18D2	AIR CHAMBER-REAR AXLES				
		01	1014Z520	. PLATE, Pressure	1			
		02	1032Z125	.CLAMP ASSY Band	1			
		03	1050Z106	.DIAPHRAM	1			
		04	1006Z322	. ROD, Push	1			
		05	1018Z2754	. RETAINER, Spring	1			
		06	1017Z703	.SPRING,Push rod return	1			
		07	1018Z2753	. SUPPORT, Spring	1			
		08	1017Z702	.SPRING,Power	1			
		09	1038Z14B	. PISTON ASSY	1			
		10	1020Z26B5	. PLUG, Waterproof	2			
		11	1010Z2694	. SCREW, cap	8			
		12	1038Z148	.CYLINDER	1			
		13	1020Z2697	.NUT,Flange	1			
		14	1020Z2696	.NUT,Jam	1			
		–	1045Z893	.KIT,Repair				
		15		.. BUSHING, Push rod	1			
		16		..WIPER,Felt	1			
		17		..O-RING,Large	1			
		18		..O-RING,Small	1			
		19		.. BUSHING, Nylon	1			
		20		.. LUBE, 8 oz. tube	1			

Ref. Dwg. 3BQ18D2

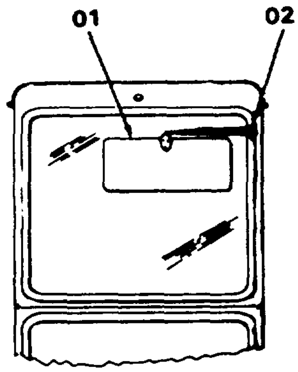
BACK-UP WARNING DEVICE ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 3	4		
		-	8100T475-3	BACK-UP WARNING ASSEMBLY, R.H.				
		-	8100T475-4	BACK-UP WARNING ASSEMBLY, L.H.				
		01	820T308	.STUD, Warning device mounting	2	2		
		02		.NUT, Hex 5/8-18UNF	2	2		
		03	18P933D28	.SPACER, Pipe	2	2		
		04		.WASHER, Flat 5/8 in	2	2		
		05		.NUT, Hex jam 5/8-18UNF	2	2		
		06	47Z58D1	.WARNING DEVICE, R.H. back-up	1	-		
		06	47Z58D2	.WARNING DEVICE, L.H. back-up	-	1		

Ref. Dwg. **8100T475** **A**
8100T475-3
8100T475-4

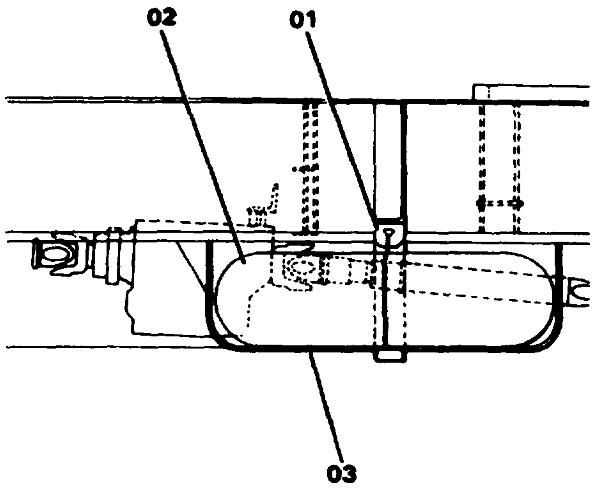
SUN VISOR INSTALLATION



Ref.	Part Number	Description	Quantity / Figure Number					
–	8100N172-1	SUN VISOR INSTALLATION						
01	272647	. VISOR,Sun	1					
02	20Z254D6	. SCREW, Self-tapping 1/4-20UNC x 1/2 in	2					

Ref. Dwg. 8100N172
8100N172-1

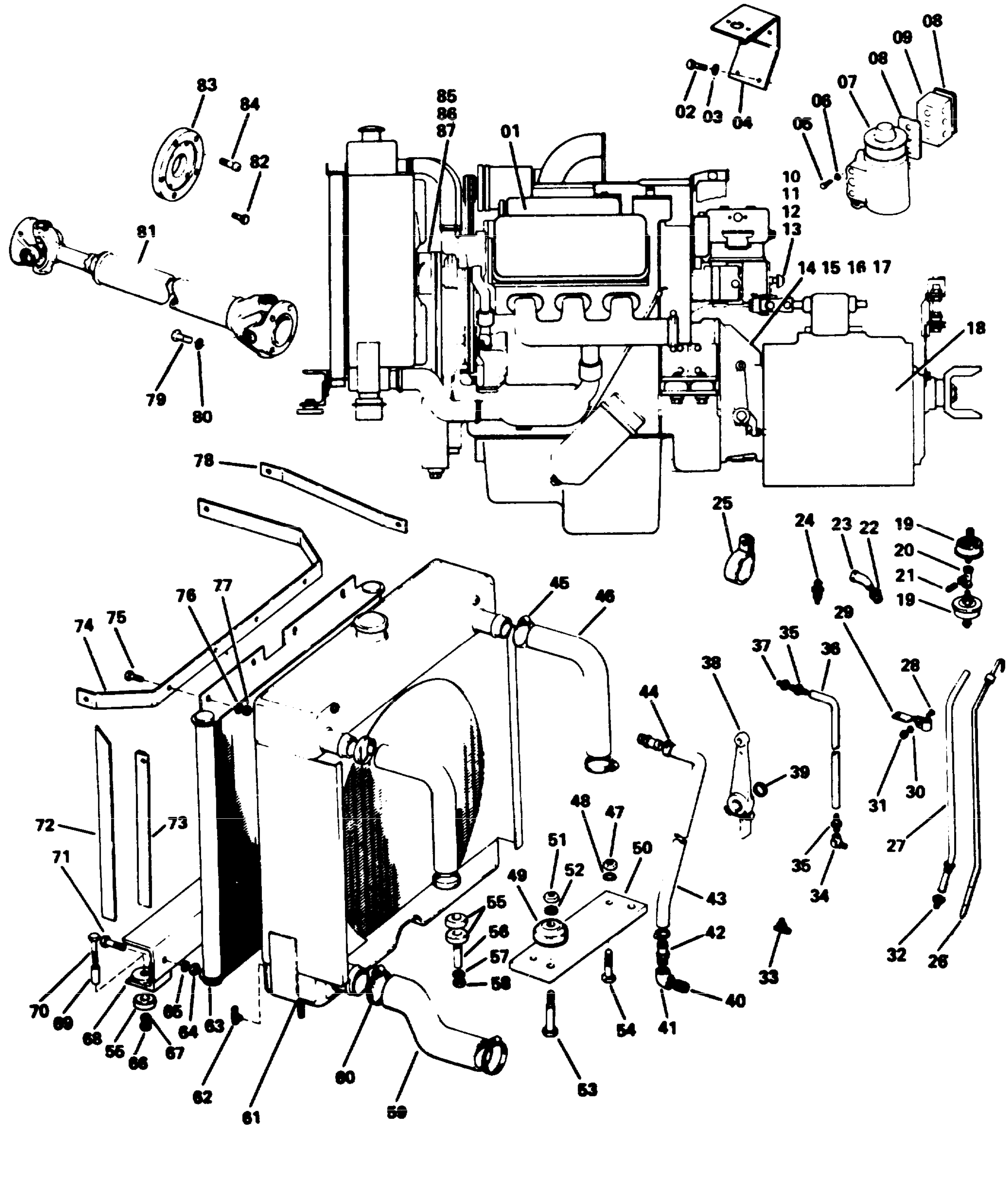
SPARE TIRE AND RACK ASSEMBLY

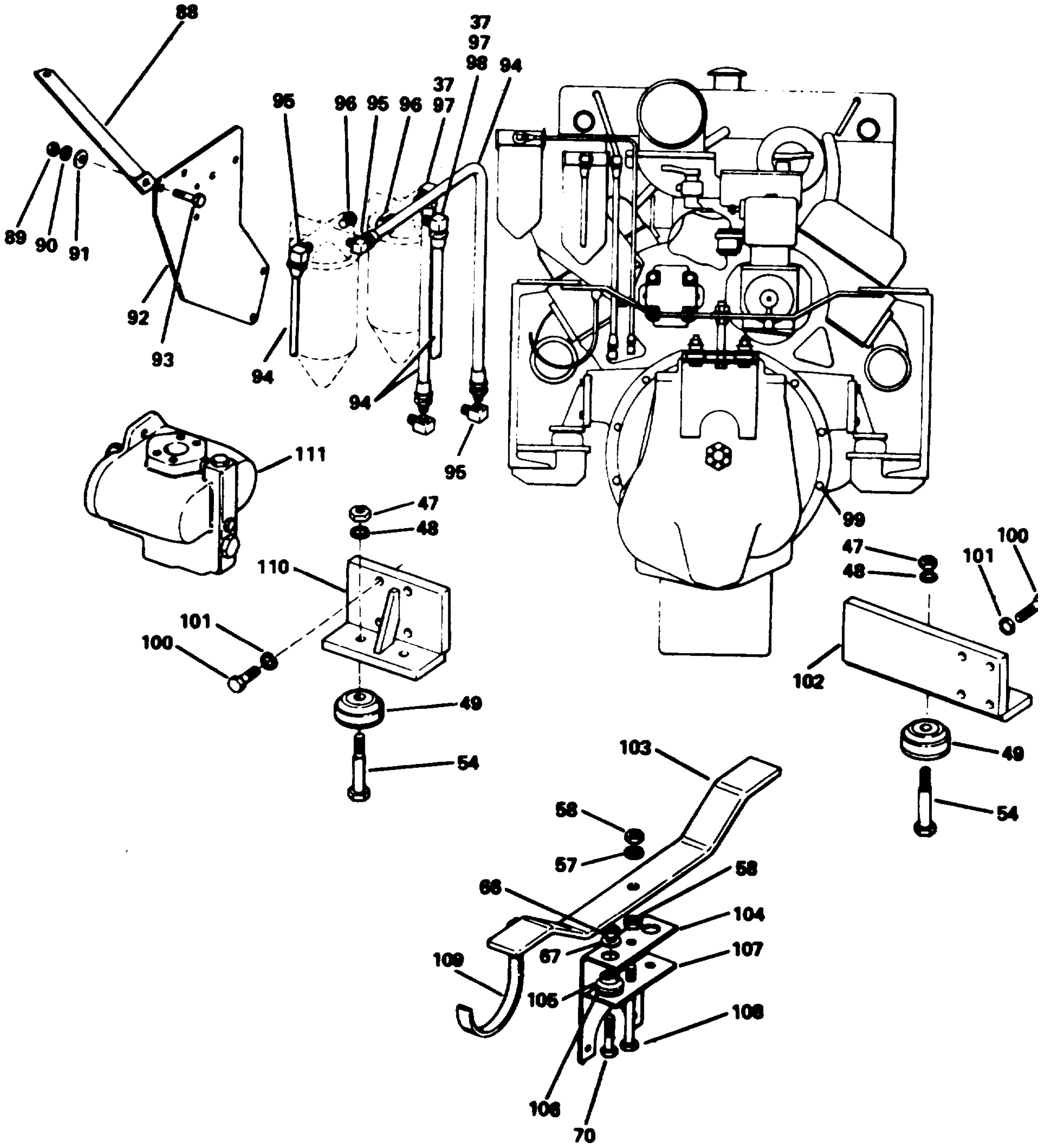


Ref.	Part Number	Description	Quantity Figure Number 1					
–	8100J06132-1	SPARE TIRE AND RACK ASSEMBLY						
01	816T1241	. BRACKET, Chain	1					
02	913T9-1	. WHEEL AND TIRE, Spare	1					
03	816N202	. RACK, Spare tire	1					

Ref. Dwg. 8100J0613 A
8100J06132-1

POWER PLANT ASSEMBLY

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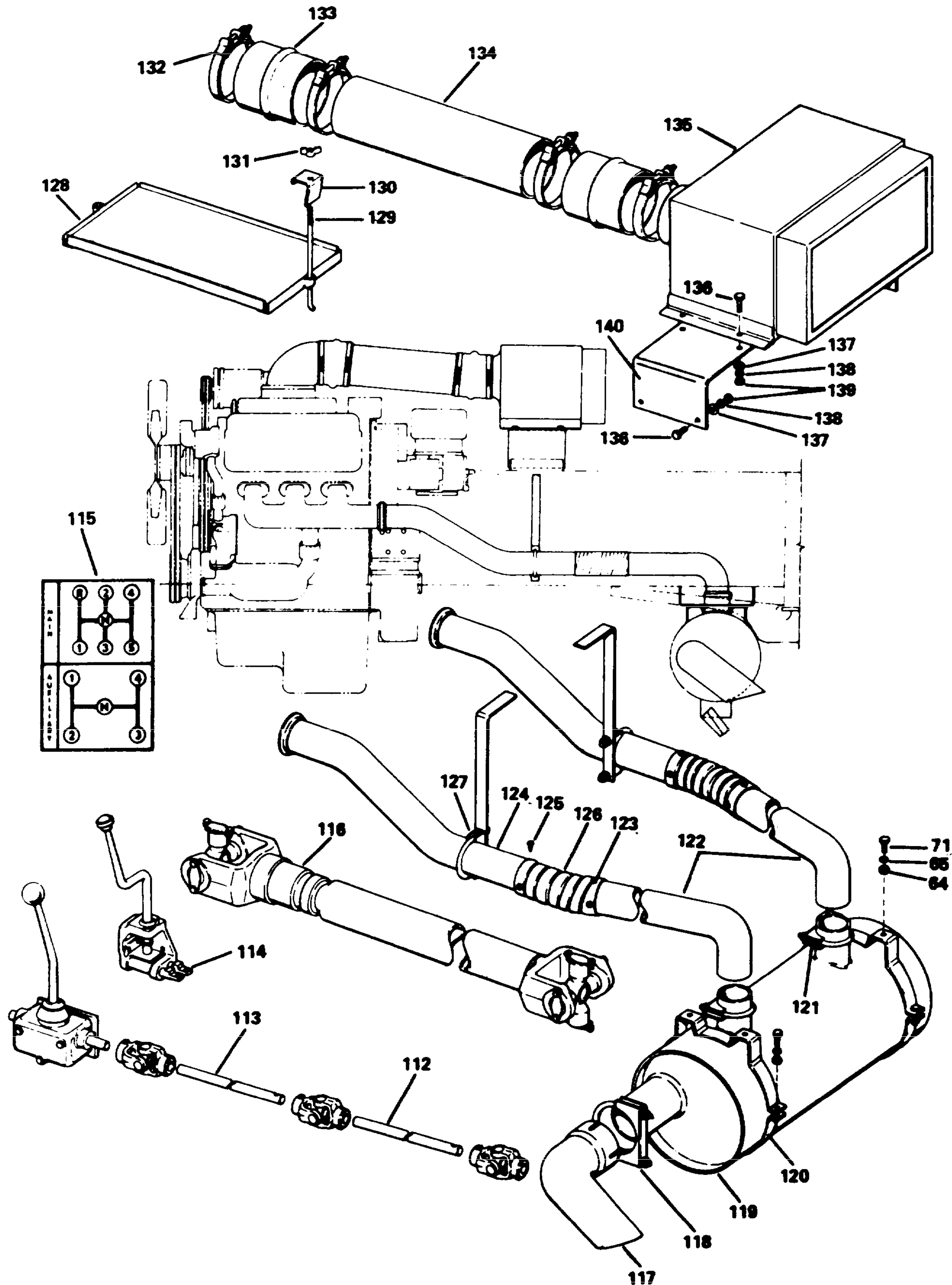
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AUXILIARY
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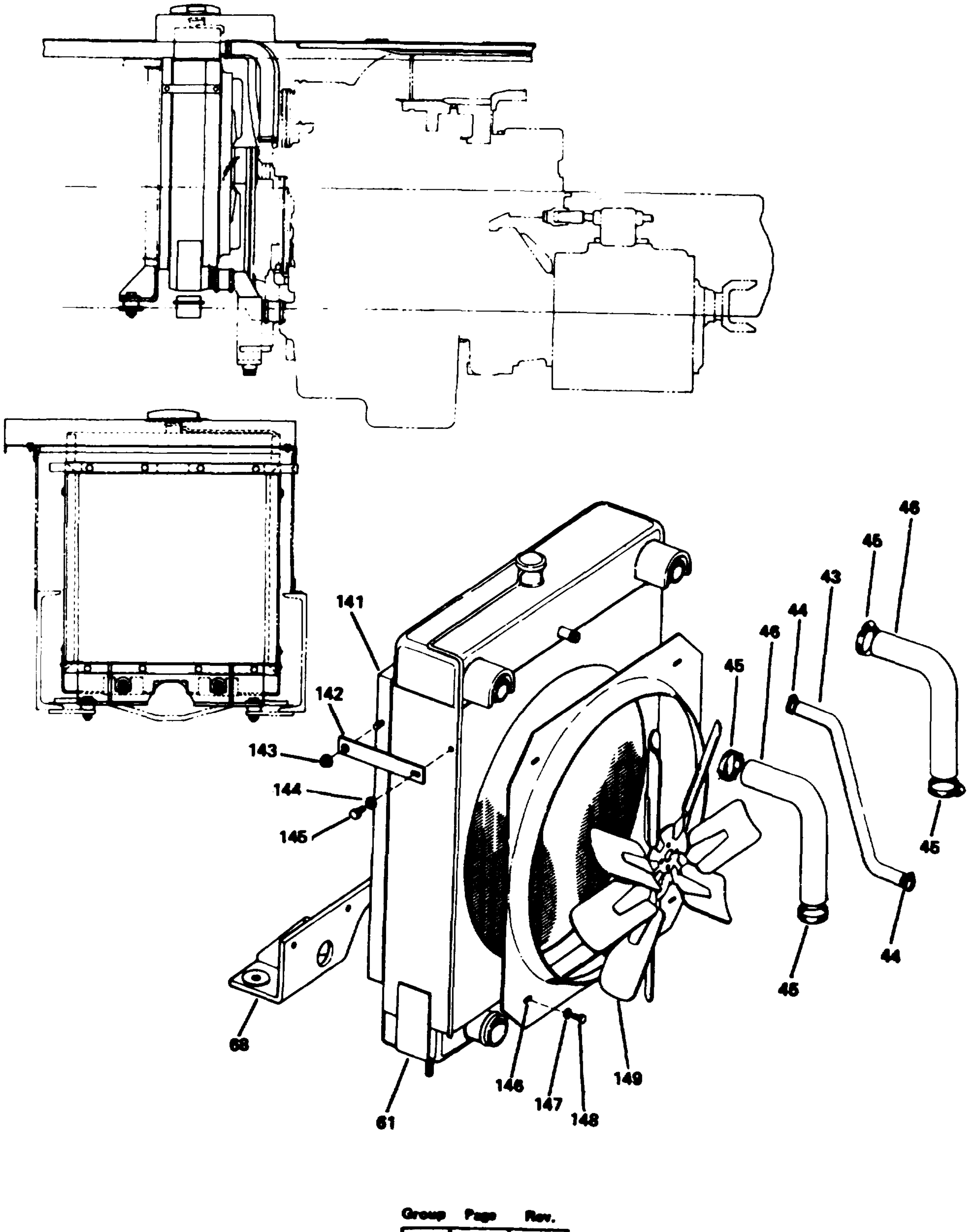
POWER PLANT ASSEMBLY (Continued)



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 9	10	11	13
		–	8100J0579-9	POWER PLANT ASSY. - ENGINE GROUP				
		–	8100J0579-10	POWER PT. ASSY. - RADIATOR, AIR CLEANER & MUF. GP.				
		–	81OOJO579-11	POWER PT. ASSY. - RADIATOR, AIR CLEANER & MUF. GP.				
		–	8100J9579-13	POWER PLANT ASSY. - ENGINE GROUP				
		01	51Q299	. ENGINE GM 6V53N	–			
		01	51Q282	. ENGINE GM 6V53N	1	–	–	
		02		. SCREW, Hex hd. 3/8-16UNC x 1-1/4 in	2	–	–	2
		03		. WASHER, Lock 3/8in	2	–	–	2
		04	816P553	. BRACKET, Magnetic switch mounting	1	–	–	1
		05		. SCREW, Hex hd. 5/16-18UNC x 2-3/4 in	1	–	–	1
		06		. WASHER, Lock 5/16 in	1	–	–	1
		07	36Z290	. GOVERNOR, Compressor	1	–	–	1
		08	20Z1321	. GASKET, Governor	2	–	–	2
		09	818T339	. BRACKET, Governor	1	–	–	1
		10	89Z138	. SWITCH, Pressure	1	–	–	1
		11	44Z208D3	. CONNECTOR, Male	1	–	–	1
		12	44Z342D1	.TEE, 1/8in. pipe	1	–	–	1
		13	44Z558D1	.NIPPLE,Pipe	1	–	–	1
		14	25T817D4	. BEARING, Main shaft pilot	1	–	–	1
		15	18Z2150	. BEARING, Clutch release	1	–	–	1
		16	15Z445	. CLUTCH **(Page 4.1)**	1	–	–	1
		17	20Z646D8	. SCREW, Hex hd. 3/8-16UNC x 1-1/4 in. Gr. 5	8	–	–	8
		18	53Z441	. TRANSMISSION, Main **(Page 5.1)**	1	–	–	1
		19	89Z153	. SENDING UNIT, Oil pressure	2	–	–	2
		20		. TEE, 1/8x 1-1/2 in. lg. extra strong pipe	1	–	–	1
		21		. NIPPLE, 1/8in.pipe	1	–	–	1
		22		.BUSHING, 3/8x1/2in. N.P.T. heater return	1	–	–	1
		23		. ELBOW, 90^{o} street - 3/8 in. N.P.T. heater return	1	–	–	1
		24	89Z154	. SENDING UNIT, Water temp	1	–	–	1
		25	32Z1083D26	.CLAMP,2in.dia	–	2	2	–
		26	89Z382	.DIPSTICK	1	–	–	1
		27	B27N474	.TUBE,Diprtick	1	–	–	1
		28		. SCREW, Rd. hd. math. 1/4-20UNC x 1/2 in	1	–	–	1
		29	816T1111	. SUPPORT, Dipstick tube	1	–	–	1
		30		. WASHER, Lock 1/4 in	1	–	–	1
		31		. NUT, Hex 1/4-2OUNC	1	–	–	1
		32	44Z198D12	. FITTING, Tub adapter	1	–	–	1
		33	44Z250D3	. COCK, Engine drain	1	–	–	1
		34		.ELBOW, 90^{o}street -3/8in. N.P.T.	2	–	–	2
		35	44Q14D1	. FiTTING, Hose	–	4	4	–
		36		. HOSE, 1/4in. ID x 18in. lg	–	2	2	–
		37	44Z210D3	. BUSHING, 3/8in. x 1/4in	6	–	–	6
		38	806T245	. LEVER, Clutch	1	–	–	1
		39	1BP935D40	. SPACER, Clutch lever	1	–	–	1
		40		.NIPPLE,3/Bin.N.P.T.close	1	–	–	1
		41		. ELBOW, 90^{o} street 3/4 in. N.P.T.	1	–	–	1
		42	44Z911D1	. FITTING, Beaded insert	2	–	–	2
		43		. HOSE.3/4in. ID x 43in. lg. heater	–	1	–	–
		43		. HOSE, 3/4 in. ID x 40 in. Ig. heater	–	–	1	–
		44	44Z12D7	. CLAMP, Heater hose	–	2	2	–

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 9	10	11	13
		45	44Z12D8	.CLAMP, Radiator hose	2	2	2	2
		46	44Z867D8	.HOSE, Upper radiator	-	2	-	-
		46	44Z867D6	.HOSE, Upper radiator	-	-	2	-
		47		.NUT, Hex ½-20UNF	-	6	6	-
		48		.WASHER, Lock ½ in	-	6	6	-
		49	79Z29D1	.INSULATOR, Engine	-	6	6	-
		50	816T1100	.BAR, Engine mounting	1	-	-	1
		51		.NUT, Hex 5/8-18UNF	2	-	-	2
		52		.WASHER, Lock 5/8 in	2	-	-	2
		53		.SCREW, Hex 5/8-18UNF x 2-1/4 in	2	-	-	2
		54	820T36	.BOLT, Motor support	-	6	6	-
		55	79Z30	.INSULATOR, Radiator	-	10	10	-
		56	820T142	.SPACER, Radiator stud	-	2	2	-
		57		.WASHER, Lock 1/2 in	-	2	2	-
		58		.NUT, Hex 1/2-13UNC	-	2	2	-
		59	44Z1493	.HOSE, Lower radiator	-	1	1	-
		60	44Z12D13	.CLAMP, Lower radiator	-	2	2	-
		61	52U91D1	.RADIATOR	-	1	-	-
		61	52U79D1	.RADIATOR	-	-	1	-
		62	44Z463D4	.COCK, Radiator drain	-	2	2	-
		63	52U58	.COOLER, Hydraulic oil	-	1	1	-
		64		.NUT, Hex 3/8-16UNC	-	8	8	-
		65		.WASHER, Lock 3/8 in	-	8	8	-
		66		.NUT, Hex 1/2-13UNC	-	4	4	-
		67		.WASHER, Lock 1/2 in	-	4	4	-
		68	816P609	.MOUNT, Oil cooler	-	1	-	-
		68	816T1056	.MOUNT, Oil cooler	-	-	1	-
		69	820T492D2	.SPACER, Oil cooler mount	-	2	2	-
		70		.SCREW, Hex hd. 1/2-13UNC x 2	-	4	4	-
		71		.SCREW, Hex hd. 3/8-16UNC x 1 in	-	8	8	-
		72	829T233	.SUPPORT, Oil cooler side	-	1	1	-
		73	816T904	.SUPPORT, Oil cooler side	-	1	1	-
		74	816T544D1	.SUPPORT, Oil cooler top	-	1	1	-
		75		.SCREW, Hex hd. 5/16-18UNC x 1 in	-	6	6	-
		76		.WASHER, Lock 5/16 in	-	6	6	-
		77		.NUT, Hex 5/16-18UNC	-	6	6	-
		78	829T232	.SUPPORT, Radiator side	-	1	1	-
		79		.SCREW, Hex hd. 3/8-24UNF x 1-1/4 in	-	4	4	-
		80		.WASHER, Lock 3/8 in	-	4	4	-
		81	20Q17D3	.SHAFT, Pump drive	-	1	1	-
		-	1025Z1546	..KIT, Journal cross and bearing	-	2	2	-
		82	20Z80D12	.SCREW, Hex hd. 3/8-24UNF x 1 in. Gr. 8	-	4	4	-
		83	18P4233	.ADAPTER, Pump drive shaft	-	1	1	-
		84		.SCREW, Socket hd. 3/8-16UNC x 1-1/4 in	-	6	6	-
		85	20Z646D25	.SCREW, Hex hd. 5/16-18UNC x 1-1/2 in. Gr. 5	6	-	-	-
		86		.WASHER, Lock 5/16 in	6	-	-	-
		87	18Z2461	.SPACER, Fan	1	-	-	-
		88	816T1109	.BRACKET, Fuel filter support	1	-	2	1
		89		.NUT, Hex 3/8-16UNC	4	-	-	4
		90		.WASHER, Lock 3/8 in	4	-	-	4

POWER PLANT ASSEMBLY (Continued)

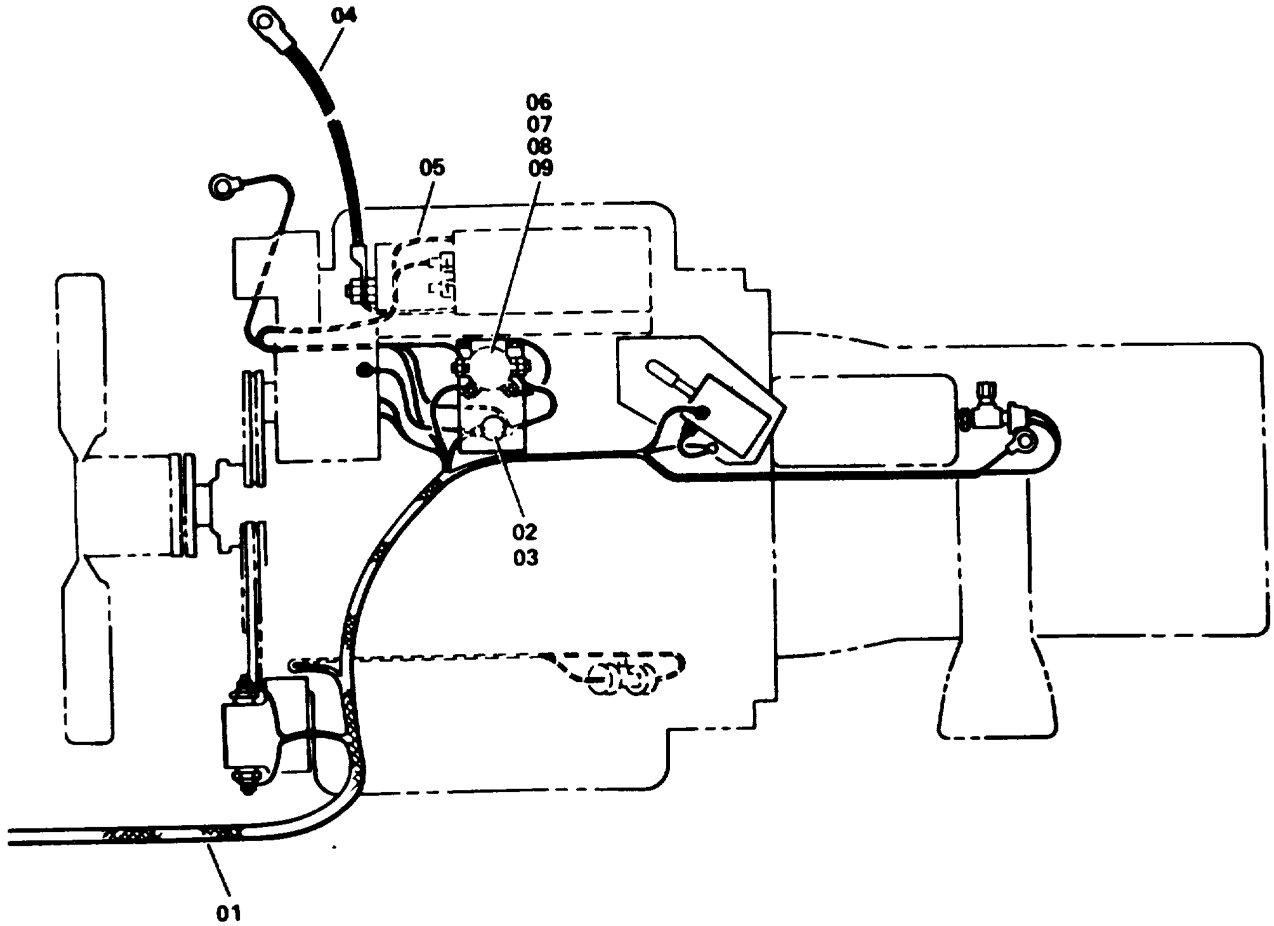
QTY	STOCK	REF.	Part Number	Description	Quantity / Figure Number			
					9	10	11	13
		91		.WASHER, Flat 3/8 in	4	-	-	4
		92	816P552	.BRACKET, Fuel filter	1	-	-	1
		93		.SCREW, Hex hd/ 3/8-10UNC x 1-1/2 in	4	-	-	4
		94	44Z473D24	.HOSE, Flexible fuel line	4	-	-	4
		95	44Z206D3	.ELBOW, 90°	3	-	-	3
		96	44Z226D1	.PLUG, Fuel filter	2	-	-	2
		97	44Z206D5	.ELBOW, 90°	3	-	-	3
		98	44Z368D8	.CONNECTOR, Compression	1	-	-	1
		99	20Z646D49	.SCREW, Hex, hd. 3/8-16UNC x 1-1/2 in. Gr. 5	12	-	-	12
		100		.SCREW, Hex, hd. 1/2-13UNC x 1-3/4 in	8	-	-	8
		101		.WASHER, Lock 1/2 in	8	-	-	8
		102	816P521	.SUPPORT, R.H. rear engine	1	-	-	1
		103	829P292	.BAR, Rear transmission support	-	1	1	-
		104		.BRACKET, Hanger	-	1	1	-
		105	16Z209D3	.INSULATOR, Transmission mount	-	2	2	-
		106	18H3892D15	.WASHER	-	2	2	-
		107	829T316	.BAR, Transmission hanger	-	1	1	-
		108		.BOLT, 1/2-13unc x 5 in	-	1	1	-
		109	829T337	.HANGER, Harness and hose	-	1	1	-
		110	816P522	.BRACKET, L.H. rear engine	1	-	-	1
		111	41U16	.PUMP, Power steer, and outrigger (Page 11.1)	1	-	-	1
		112	820T513D1	..ROD, Main transmission rear shift	-	1	1	-
		113	820T514D1	.ROD, Main transmission forward shift	-	-	1	-
		114	6Z523	.LEVER ASSY., Auxiliary shift (Page 3-9.1)	-	-	1	-
		115	32Q398	.CHART, Transmission shift	-	1	1	-
		116	10U49D7	.SHAFT, Main to auxiliary drive	-	1	1	-
		-	1025Z1560	..KIT, Journal cross and bearings	-	2	2	-
		117	827T450	.PIPE, Exhaust tail	-	1	1	-
		118	32Z171D12	.CLAMP, Tail pipe	-	1	1	-
		119	27Z646	.MUFFLER	-	1	1	-
		120	16Z264D6	.BAND, Muffler mounting	-	2	2	-
		121	32Z171D10	.CLAMP, Muffler	-	2	2	-
		122	827T376	.TUBE, Exhaust	-	2	2	-
		123		.SCREW, Sheet metal 1/4-20-UNC x 1/2 in	-	8	8	-
		124	827T380-1	.TUBE, Exhaust	-	2	2	-
		125		..SCREW, Sheet metal 1/4 –20UNC x 1/2 in	-	4	4	-
		126	44Z1308D4	..HOSE, Flexible exhaust	-	1	1	-
		127	32Z171D11	.CLAMP, Exhaust	-	2	2	-
		128	227P123-1	.CARRIER, Battery	-	1	1	-
		129	220T126	.STUD, Battery carrier	-	2	2	-
		130	16T1497	.CLAMP, Battery hold down	-	2	2	-
		131	20H1686D3	.BELLOWS, Air intake	-	2	2	-
		132	44Z978D3	.FILTER, Air	-	4	4	-
		133	44Z808D2	..ELEMENT	-	2	2	-
		134	827T431	.SCREW, Hex hd. 3/8-16UNC x 1-1/4 in	-	1	1	-
		135	46Q12D1	.WASHER, Flat 3/8 in	-	1	1	-
		-	1045Z639	.WASHER, Lock 3/8 in	-	1	1	-
		136			-	8	8	-
		137			-	8	8	-
		138			-	8	8	-

POWER PLANT ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 9	10	11	13
		139		.NUT, Hex 3/8-16UNC	-	8	8	-
		140	816P524	.BRACKET, Air cleaner mounting	-	1	1	-
		141	814P13	.SHROUD, Oil cooler	-	1	-	-
		142	829T350	.BRACE, Oil cooler shroud	-	2	-	-
		143	20Z1112D3	.NUT, Hex lock 3/8-16UNC	-	4	-	-
		144		.WASHER, Lock 3/8 in	-	4	-	-
		145		.SCREW, Hex hd. 3/8-UNC x 5/5 in	-	10	-	-
		146	814N11	.SHROUD, Fan	-	1	-	-
		147		.WASHER, Lock 5/16 in	-	4	-	-
		148		.SCREW, Hex hd. 5/16-18UNC x 5/8 in	-	4	-	-
		149	49Z220	.FAN, 22 inch suction	1	-	-	-
		-		.CLUTCH GROUP, Hydraulic (Page 3.1)	1	-	-	1
		-	53Z455	.TRANSMISSION, Auxiliary (page 6.1, 6.2)	-	-	1	-
		-	100X139-43	.ELECTRICAL ASSY., GM6V53N (Page 2.1)	-	1	1	-

Ref. Dwg. 8100J0579 G
8100J0579-9
8100J0579-10
8100J0579-11
8100J0579-13

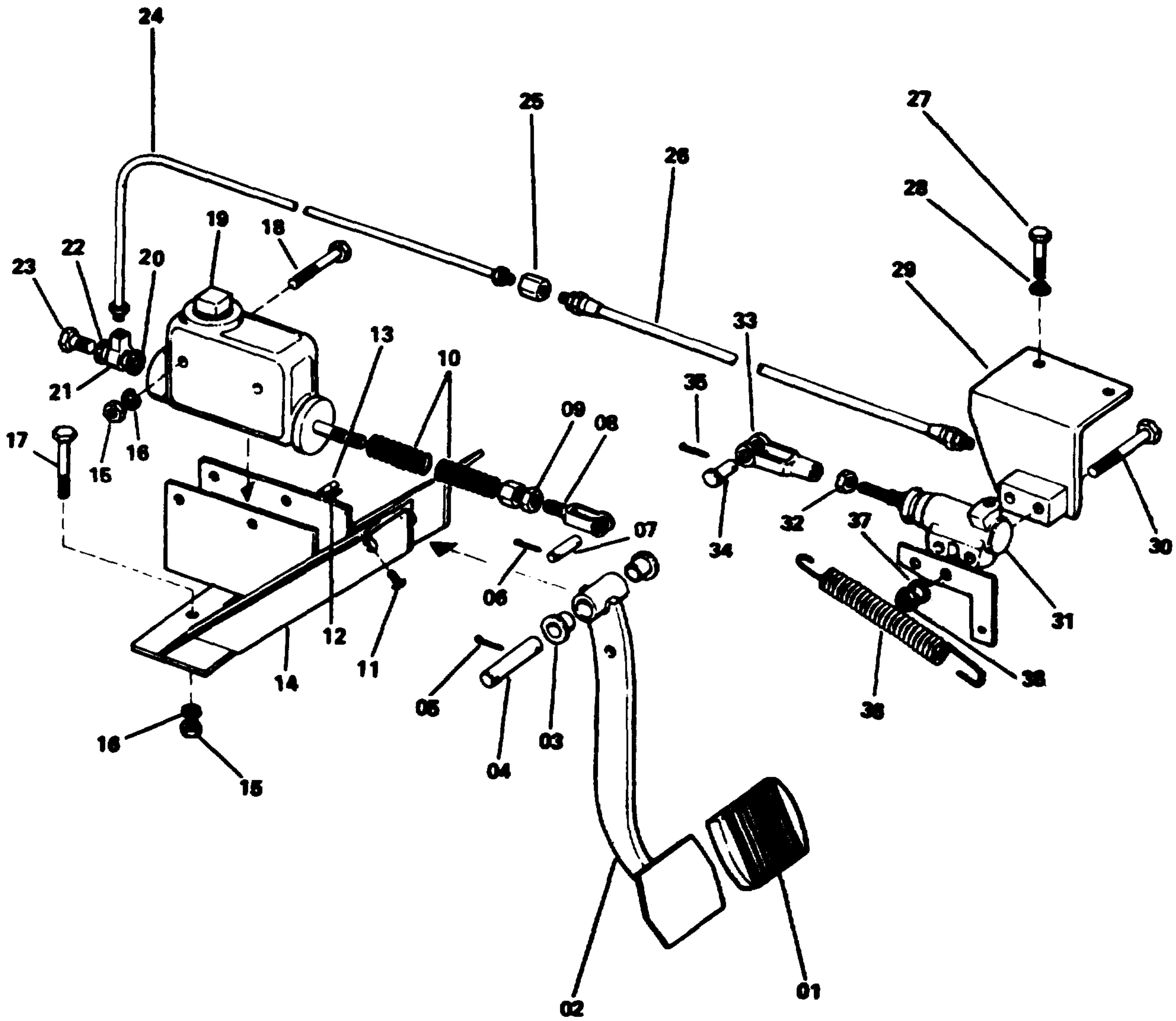
ENGINE WIRING HARNESS ASSEMBLY



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number 43	44		
		-	100X139-43	WIRING HARNESS ASSY., GM6V-53N ENGINE	▼			
		-	100X139-44	WIRING HARNESS ASSY., GM6V-53N ENGINE		▼		
		01	79Q280	.HARNESS, GM6V-53N engine wiring	1	1		
		02	79Z1508D1	.BREAKER, Circuit	1	1		
		03		.SCREW, Rd. hd. mach. #10-32UNF x 1 in	2	2		
		04	86Z7	.CABLE, Starter ground	1	1		
		05	79P194	.HARNESS, Starter solenoid wiring	1	1		
		06	79Z990	.SWITCH, Magnetic	1	1		
		07		.SCREW, Hex hd. 1/4-20UNC x 1/2 in	2	2		
		08		.WASHER, Lock 1/4 in	2	2		
		09		.NUT, Hex 1/4-20UNC	2	2		
		-	879T16D5	.CABLE, Positive battery	1	1		
		-	879T16D3	.CABLE, Negative battery	1	1		
				NOTE				
				All individual wires, leads and jumpers should be fabricated locally.				

Ref. Dwg. 100x139 H
100x139-43
100x139-44

CLUTCH GROUP - HYDRAULIC

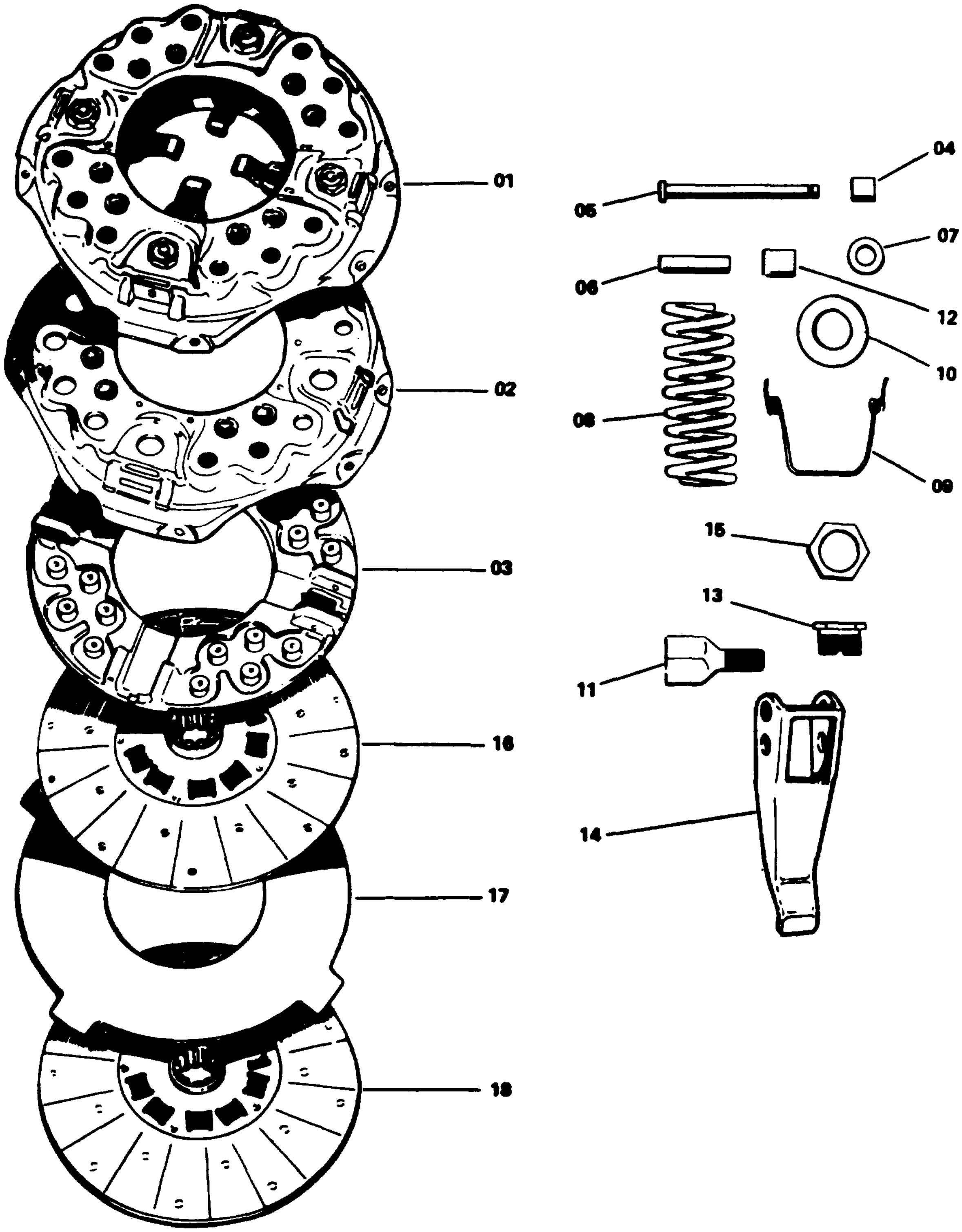


CLUTCH GROUP - HVDRAULIC (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		–		CLUTCH GROUP - GM. ENGINE	▼			
		–		CLUTCH GROUP - CUMMINS ENGINE		▼		
		01	182154	. PAD, Clutch pedal				
		02	808P198-1	.PEDAL,Clutch	1	1		
		03	5Z130D1	..BUSHING	2	2		
		04	19F52D15	. PIN, Drilled	1	1		
		05		. PIN, Cotter 5/32 x 1 in.	2	2		
		06		. PIN, Cotter 1/8 x 1 in.	2	2		
		07	19F49D2	. PIN, Drilled	1	1		
		08	906T288	.YOKE	1	1		
		09		. NUT, Hex 7/16-20UNF	1	1		
		10	172535	. SPRING	2	2		
		11		. SCREW, Rd. hd. mach. 5/16-18UNC x 1 in.	2	2		
		12		. WASHER, Lock 5/16 in	2	2		
		13		. NUT, Hex 5/16-18UNC	2	2		
		14	816P605	. BRACKET, Clutch pedal	1	1		
		15		. NUT, Hex 3/8-2OUNF	3	3		
		16		. WASHER, Lock 3/8 in	3	3		
		17		.SCREW.Hex.hd.3/8-20UNFx2-1/2in	1	1		
		18		. SCREW, Hex hd. 3/8-20UNF x 3 in	2	2		
		19	838T1	. CYLINDER, Clutch	1	1		
		–	1045Z672	.. KIT, Cylinder rebuild	1	1		
		20	20Z61	WASHER, Copper	1	1		
		21	44Z84	. ADAPTER	1	1		
		22	20Z62	. WASHER, Copper	1	1		
		23	20Z63	. BOLT, Adapter	1	1		
		24	820T447D2	. TUBE, Clutch	1	1		
		25	44Z255D3	. UNION	1	1		
		28	44Z660	. HOSE ASSY, Clutch	1	1		
		27		. SCREW, Hex hd. 3/8-16UNC x 1-3/4 in	2	–		
		27		. SCREW, Hex hd. 3/&16UNC x 1-1/4 in	–	2		
		28		. WASHER, Lock 3/8 in	2	2		
		29	816P664	. BRACKET, Slave cylinder mounting	1	–		
		29	8160P560	.BRACKET, Slave cylinder mounting	–	1		
		30		. SCREW, Hex hd. 7/1614UNC x 3-3/4 in	2	–		
		30		. SCREW, Hex hd. 7/1614UNC x 2-3/4 in	–	2		
		31	38P40	. CYLINDER, Clutch slave	1	–		
		–	1038Z138	.. KIT, Cylinder repair	1	–		
		31	36Z225	. CYLINDER, Clutch slave	–	1		
		–	1038Z138	.. KIT, Cylinder repair	–	1		
		32		. NUT, Hex 3/8-24UNF	1	1		
		33	8Z131D11	. YOKE, End	1	1		
		34	919T117-6	. PIN ASSY, Yoke	1	1		
		35		..PIN,Cotter 1/8 x 7/8 in	1	1		
		36	17T238	. SPRING, Return	1	1		
		37		. WASHER, Lock 7/16 in.	2	2		
		38		. NUT, Hex 7/16-14UNC	2	2		

Ref.Dwg. 8100N0215 D 81OONO215-2
81OONO219 A 81OONO219-1
8100N0222 A 8100N0222-1

CLUTCH ASSEMBLY

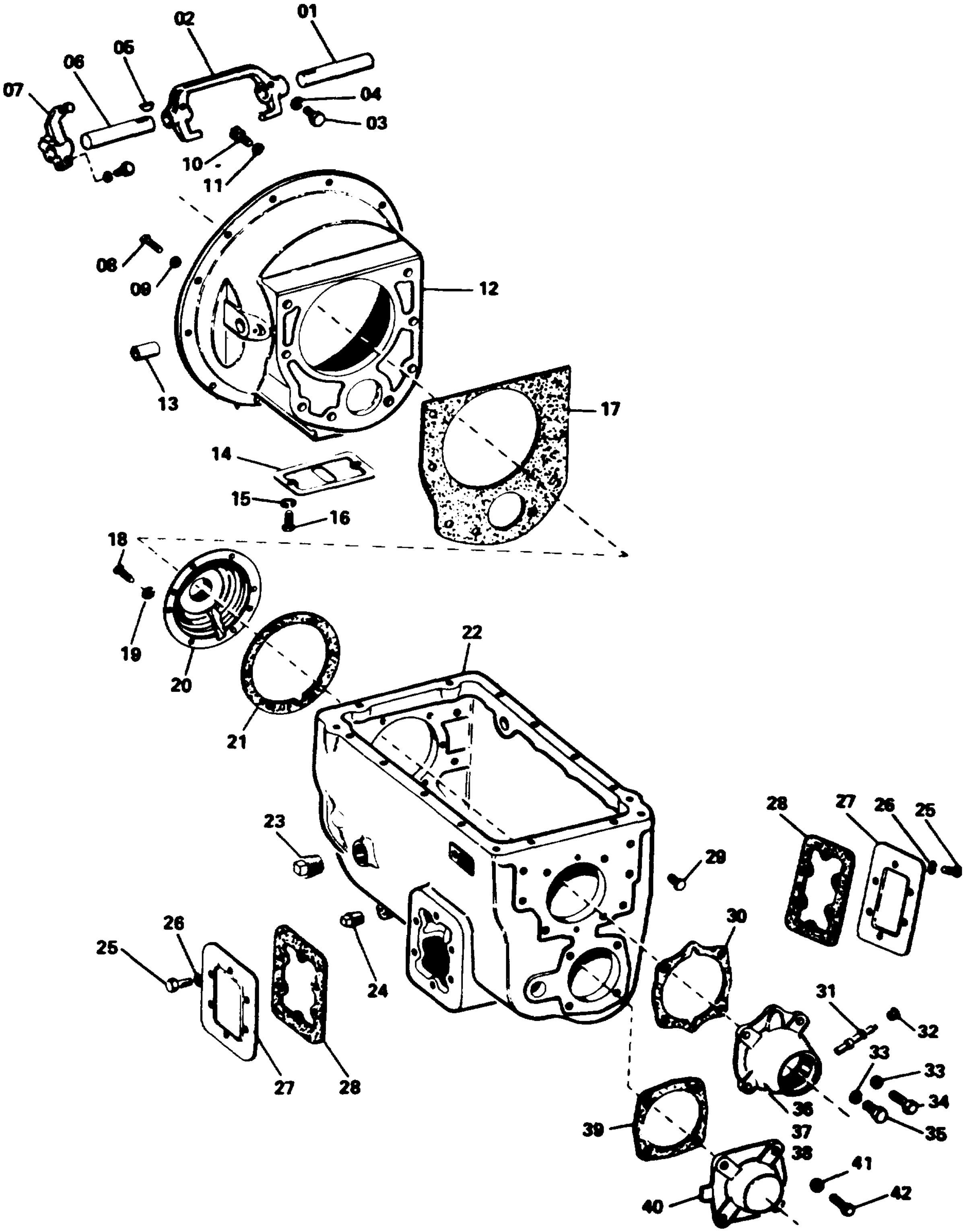


CLUTCH ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity / Figure Number			
		-	15Z445	CLUTCH ASSEMBLY	▼			
		01	1014Z903	.COVER PLATE ASSEMBLY	1			
		02	1018Z4028	..RING, Flywheel cover	1			
		03	1015Z786	..PLATE, Pressure	1			
		04	1025Z1533	…BEARING, Needle	8			
		05	1019Z660	..PIN, Pressure plate	4			
		06	1019Z659	..PIN, Eye bolt	4			
		07	1018Z2780	..WASHER	8			
		08	1017Z830	..SPRING, Pressure	16			
		09	1017Z861	..SPRING, Retractor	4			
		10	1018Z2436	..WASHER, Insulating	16			
		11	1020Z2703	..EYE BOLT	4			
		12	1025Z1267	…BEARING, Needle	1			
		13	102Z2705	..NUT, Adjusting	4			
		14	1006Z324	..LEVER, Release	4			
		15	1020Z2704	.NUT, Lock	4			
		16	1015Z682	.DISC ASSY., Pressure plate side	1			
		17	1015Z930	.PLATE, Intermediate	1			
		18	1015Z683	.DISC ASSY., Flywheel side	1			
		19	1015Z684	.FACING KIT, Disc	AR			

Ref. Dwg. 15Z445

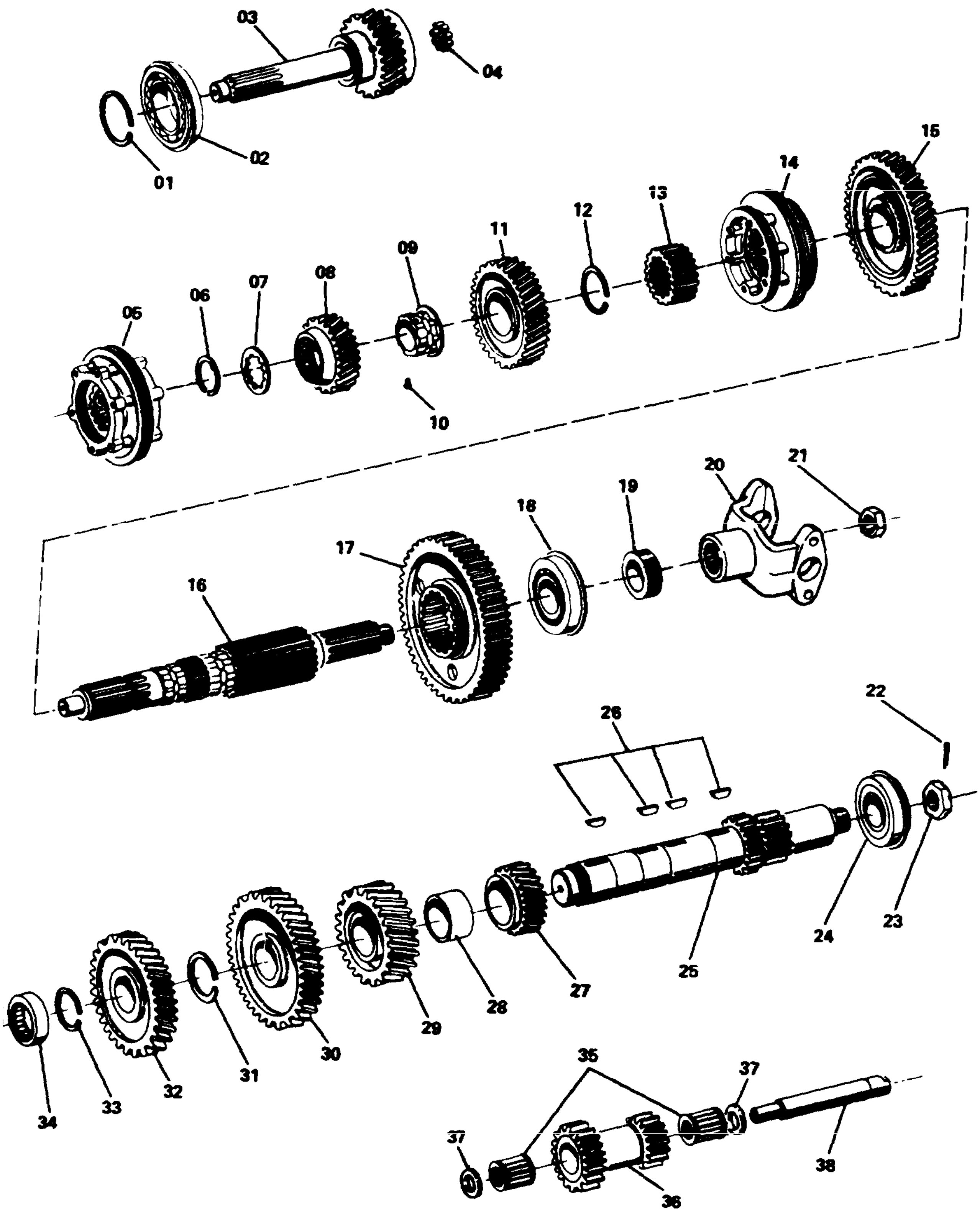
MAIN TRANSMISSION CASE AND CLUTCH HOUSING GROUP



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-		CASE & CLUTCH HOUSING GP. MAIN TRANS.				
		01	1010Z698	. SHAFT, Short clutch release	1			
		02	1006Z428	. YOKE, Clutch release	1			
		03	1020Z2261	. SCREW, Clutch release yoke	1			
		04	1018Z2139	. WASHER, Clutch release screw	1			
		05	1020Z841	. KEY, Clutch release shaft	1			
		06	1010Z697	. SHAFT, Long clutch release	1			
		07	1006Z429	. LEVER, Clutch release	7			
		08		.SCREW, Hex hd. 5/8-11UNC x 1-3/8in	7			
		09		. WASHER, Lock 5/8in.	1			
		10		.SCREW, Hex hd. 7/16-14UNC x 1-3/8in	1			
		11		. WASHER, Lock 7/16 in	1			
		12	1014Z778	. HOUSING, Clutch	2			
		13	1005Z133	. BUSHING, Clutch shaft	1			
		14	1014Z744	.COVER	2			
		15		. WASHER, Lock 5/16 in.	2			
		16		. SCREW, Hex hd. 5/16-18UNC x 1 in	1			
		17	1020Z3351	. GASKET, Clutch housing to case	6			
		18		. SCREW, hex hd. 3/8-16UNC x 1-1/4 in	6			
		19		. WASHER, Lock 3/8 in.	1			
		20	1025Z1349	. CAP, Main shaft front bearing	1			
		21	1020Z3345	. GASKET, Front bearing cap	1			
		22	1014Z775	. CASE, Main transmission	1			
		23	1020Z1957	.PLUG	1			
		24	1020Z3341	. PLUG, Magnetic drain	12			
		25		. SCREW, Hex hd. 3/8-16UNC x 1 in	12			
		26		. WASHER, Lock 3/8 in	2			
		27	1014Z153	. COVER, Aperature	2			
		28	1020Z3241	. GASKET, Aperature cover	5			
		29	1020Z3350	.PLUG, Rear case	1			
		30	1020Z3344	. GASKET, Rear bearing cap	1			
		31	1920Z3340	. PLUG	1			
		32	1005Z412	.BUSHING	4			
		33		. WASHER, Lock 1/2 in	3			
		34		. SCREW, Hex hd. 1/2-13UNC x 1-1/2in	1			
		35		. SCREW, Hex hd. 1/2-13UNC x 2-3/8 in	1			
		36	1025Z1354	. CAP ASSY., Rear bearing	1			
		37	1005Z412	. . BUSHING, Speedometer	1			
		38	1018Z3515	..SEAL, Oil	1			
		39	1020Z3339	. GASKET, Countershaft bearing cap	1			
		40	1025Z1350	. CAP, Countershaft rear bearing	4			
		41		. WASHER, Lock 1/2in	4			
		42		.SCREW, Hex hd. 1/2-13UNC x 1-1/2in				

Ref. Dwg. 53Z441

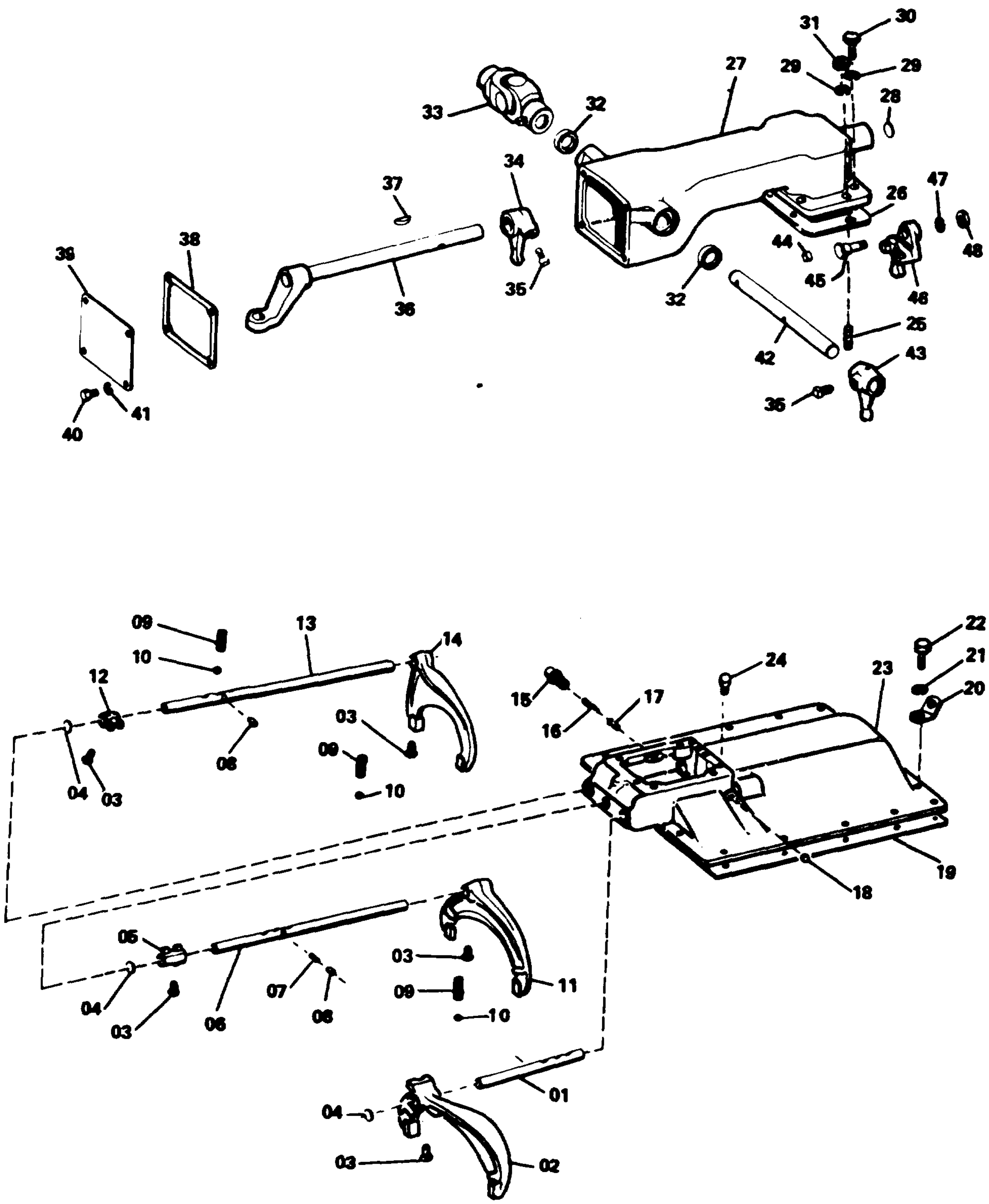
MAIN TRANSMISSION GEAR AND SHAFT GROUP



MAIN TRANSMISSION GEAR AND SHAFT GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-		GEAR & SHAFT GP. MAIN TRANS.	1			
		01	1018Z3520	.RING, Snap	1			
		02	1025Z1355	. BEARING, Drive gear	1			
		03	1001Z769	.GEAR, Drive	1			
		04	1025Z1353	. BEARING, Drive gear roller	1			
		05	1053Z95	.SYNCHRONIZER, 4th and 5th	1			
		06	1018Z3519	.RING, Snap	1			
		07	1018Z3524	. WASHER, Thrust	1			
		08	1001Z768	. GEAR, Main shaft 4th and 5th overdrive	1			
		09	1018Z3517	. SLEEVE, 4th	1			
		10	1019Z756	.PIN, 4th gear sleeve	1			
		11	1001Z767	.GEAR, Main shaft 3rd	1			
		12	1018Z3522	.RING, Snap	1			
		13	1001Z772	.GEAR, Main shaft 2nd and 3rd clutch	1			
		14	1053Z94	. SYNCHRONIZER, 2nd and 3rd	1			
		15	1001Z766	. GEAR, Main shaft 2nd	1			
		16	1010Z696	. SHAFT, Main	1			
		17	1001Z765	. GEAR, Main shaft 1st and reverse sliding	1			
		18	1025Z1357	. BEARING, Main shaft rear	1			
		19	1018Z3516	SPACER, Speedometer	1			
		20	1006Z416	.YOKE, Output	1			
		21	1020Z3262	. NUT, Yoke retaining	1			
		22	1019Z757	. PIN, Countershaft nut cotter.	1			
		23	1020Z3352	. NUT, Countershaft	1			
		24	1025Z1356	. BEARING, Countershaft rear	1			
		25	1010Z694	. SHAFT, Counter	1			
		26	1020Z3362	. KEY, Countershaft	4			
		27	1001Z771	. GEAR, Countershaft 2nd	1			
		28	1018Z3518	. SPACER. Countershaft 2nd and 3rd	1			
		29	1001Z762	. GEAR, Countershaft 3rd	1			
		30	1001Z770	. GEAR, Countershaft 4th or 5th overdrive	1			
		31	1018Z3521	.RING, Snap	1			
		32	1001Z763	. GEAR, Countershaft drive	1			
		33	1018Z3523	.RING, Snap	1			
		34	1025Z1359	. BEARING, Countershaft front	1			
		35	1025Z1358	. BEARING, Reverse idler gear	2			
		36	1001Z764	.GEAR, Reverse idler	1			
		37	1018Z3525	. WASHER, Reverse idler gear thrust	2			
		38	1010Z695	. SHAFT, Reverse idler gear	1			

Ref. Dwg. 53Z441



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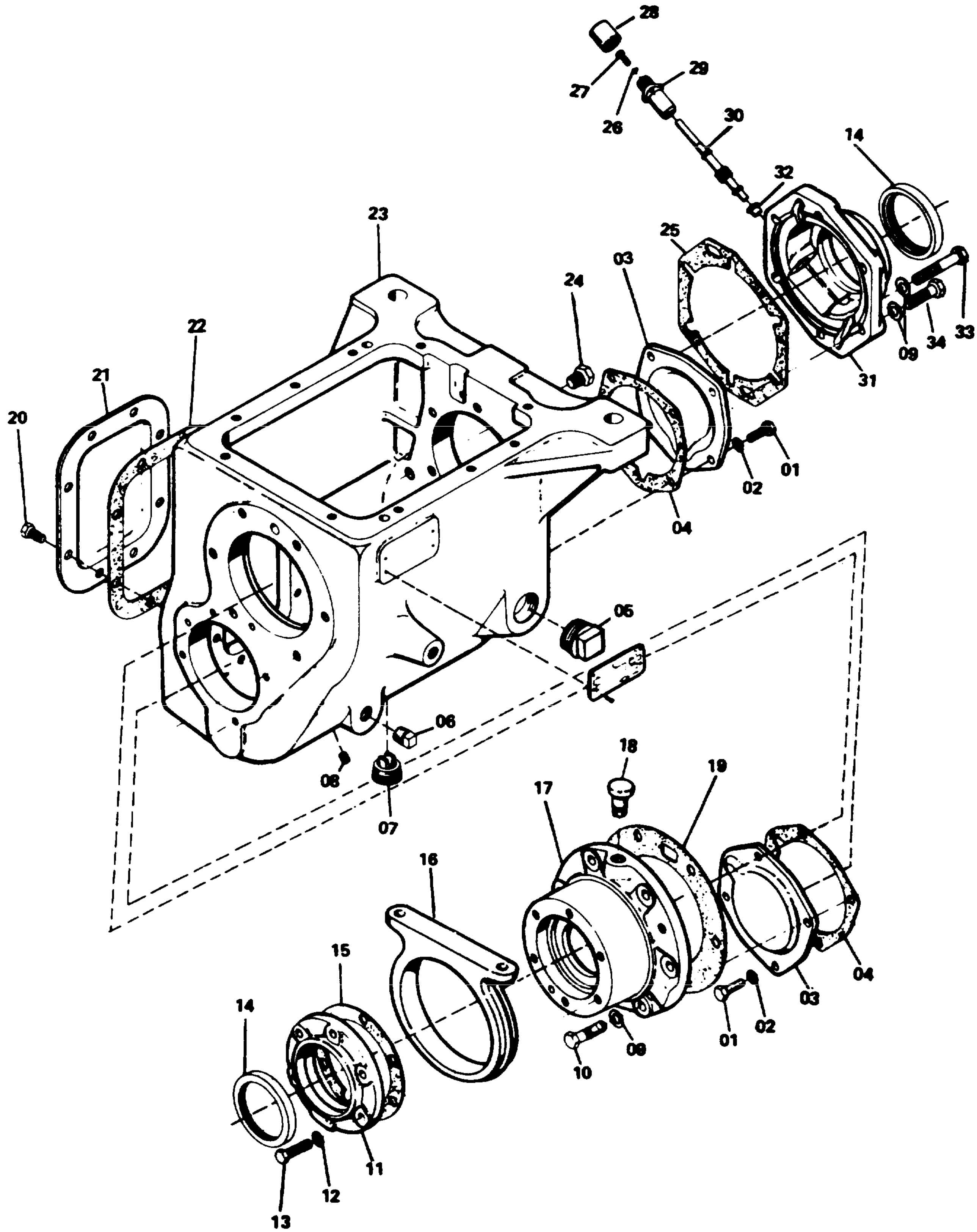
MAIN TRANSMISSION YOKES, BAR AND REMOTE CONTROL GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-		YOKES, BARS & REMOTE CONTROL GP. MAIN TRANS.-				
		01	1906Z424	. ROD, 4th and 5th shift	1			
		02	1006Z422	. FORK, 4th and 5th shift	1			
		03	1020Z3353	.SCREW, Set	5			
		04	1020Z3358	.PLUG	3			
		05	1020Z3346	. BRACKET. 2nd and 3rd	1			
		06	1006Z423	.ROD, 2nd and 3rd shift	1			
		07	1019Z755	. PIN, Interlock	1			
		08	1025Z1346	. PIN, Interlock	2			
		09	1017Z801	. SPRING, Shift rod poppet	3			
		10	1025Z1347	. BALL, Shift rod poppet	3			
		11	1006Z421	. FORK, 2nd and 3rd shift	1			
		12	1020Z3347	. BRACKET, 1st and reverse shift	1			
		13	1006Z425	. ROD, 1st and reverse shift	1			
		14	1006Z418	. FORK, 1st and reverse shift	1			
		15	1018Z3514	. RETAINER, Plunger	1			
		16	1017Z802	.SPRING, Plunger	1			
		17	1019Z754	. PIN, Plunger	1			
		18	1020Z3357	. PLUG, Interlock	1			
		19	1020Z3343	. GASKET, Housing to case	1			
		20		. HOOK, Lift	2			
		21		. WASHER, Lock 3/8 in,	14			
		22		. SCREW, Hex hd. 3/8-16UNC x 1-1/4 in	14			
		23	1014Z777	.HOUSING, Shift	1			
		24	1046Z185	. BREATHER	1			
		25	1020Z3349	. STUD, Remote tower mounting	2			
		26	1020Z3342	. GASKET, Tower to housing	1			
		27	1014Z783	. TOWER, Remote control	1			
		-	1005Z413	..BUSHING	4			
		28	1020Z3359	. PLUG, Expansion	1			
		29		. WASHER, Lock 7/16 in.	6			
		30		. SCREW, hex hd. 7/16-14UNC x 1-1/4 in.	4			
		31		. NUT, Hex 7/16-14UNC	2			
		32	1018Z3445	. SEAL, Shift rod	2			
		33		. U-JOINT	1			
		34	1006Z419	. FINGER, Inner shift	1			
		35	1020Z3248	.SCREW, Set	2			
		36	1006Z430	. ROD & BRACKET, Shift finger	1			
		37	1920Z3249	.. KEY, Shift rod	1			
		38	1020Z804	. GASKET, Tower cover	1			
		39	1014Z780	. COVER, Tower	1			
		40		.SCREW, Hex hd. 5/16-18UNC x 3/4 in	4			
		41		. WASHER, Lock 5/16 in.	4			
		42	1006Z427	. ROD, Remote control shift	1			
		43	1006Z426	. FINGER, Outer shift	1			
		44	1020Z843	. PLUG, 1st and reverse finger hole	1			
		45	1020Z3354	. STUD, 1st and reverse shift finger	1			
		46	1006Z417	. FINGER. 1st and reverse shift	1			
		47		. WASHER, Lock 1/2 in.	1			
		48	1020Z3361	. NUT, Shift finger stud	1			

Ref. Dwg. 53Z441

AUXILIARY TRANSMISSION CASE, GASKET & COVER GROUP

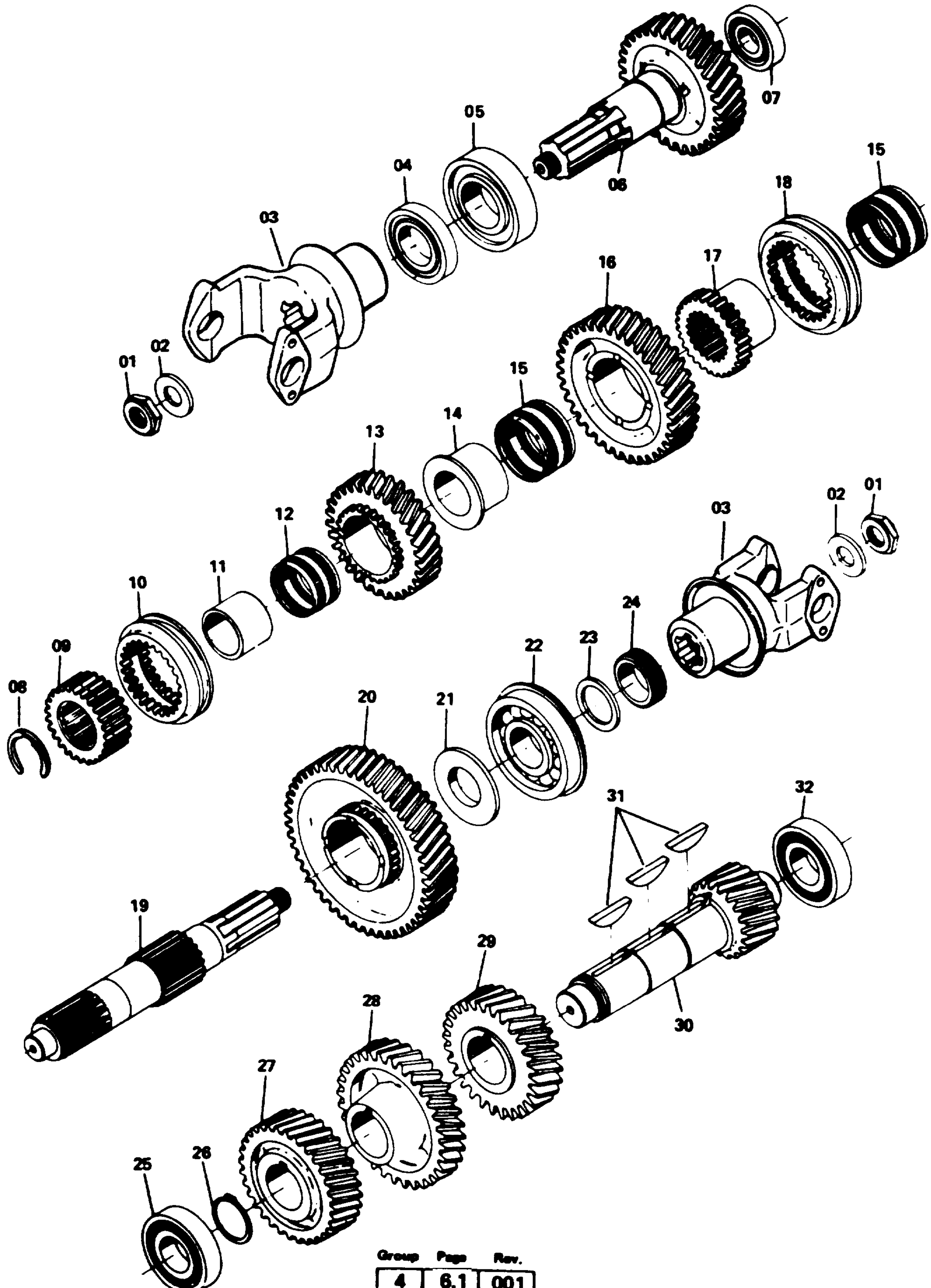


AUXILIARY TRANSMISSION – GEAR AND SHAFT (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity / Figure Number			
		-		CASE, GSKT. & COVER GR. – AUX. TRANS. W/SIDE CNTL.				
		-		CASE, GSKT. & CVR GR. – AUX. TRANS. W/FRONT CNTL.				
		01	1020Z3258	.SCREW, Cover mounting	8	-		
		01	1020Z3369	.SCREW, Cover mounting	-	8		
		02	1018Z3866	.WASHER	8	-		
		03	1014Z472	.CAP, Countershaft bearing	2	2		
		04	1020Z2491	.GASKET, Countershaft bearing cover	2	2		
		05	1020Z3975	.PLUG, Oil filler	1	1		
		06	1020Z3265	.PLUG, Temp. indicator	1	1		
		07	1020Z3242	.PLUG, Magnetic oil drain	1	1		
		08	1020Z3252	.PLUG, Oil pump oil hole	1	1		
		09	1018Z4359	.WASHER, Lock	12	-		
		10	1020Z3261	.SCREW, Front bearing cap	6	-		
		10	1020Z4418	.SCREW, Front bearing cap	-	6		
		11	1014Z742	.COVER, Front bearing cap	1	1		
		12	1018Z3867	.WASHER, Front bearing cover lock	6	-		
		13	1020Z3260	.SCREW, Front bearing cover	6	-		
		13	1020Z4422	.SCREW, Front bearing cover	-	6		
		14	1020Z3244	.SEAL, Bearing cover oil	2	2		
		15	1020Z825	.GASKET, Front bearing cover	1	1		
		16	1018Z3450	.TRUNNION	1	1		
		17	1014Z898	.CAP, Front bearing	1	-		
		17	1014Z1120	.CAP, Front bearing	-	1		
		18	1044Z440	.BREATHER, Front cap	1	-		
		19	1020Z3728	.GASKET, Front cap	1	1		
		20	1020Z4006	.SCREW, Self locking	8	8		
		21	1014Z899	.COVER, Aperture	1	1		
		22	1020Z3727	.GASKET, Aperture cover	1	1		
		23	1014Z897	.CASE	1	1		
		24	1020Z3729	.SCREW, Rear case	2	2		
		25	1020Z808	.GASKET, Rear cap	1	1		
		26	1018Z3868	.WASHER, Lock screw	2	2		
		27	1020Z3733	.SCREW, Speedometer sleeve	2	2		
		28	1014Z896	.CAP, Sleeve dust	1	1		
		29	1018Z3451	.SLEEVE, Speedometer	1	1		
		30	1001Z851	.GEAR, Speedometer driven	1	1		
		31	1014Z746	.CAP ASSY., Rear bearing	1	1		
		32	1005Z408	..BUSHING, Speedometer	1	1		
		33	1020Z3735	.SCREW, Rear cap	2	-		
		33	1020Z4419	.SCREW, Rear cap	-	2		
		34	1020Z3734	.SCREW, Rear cap	4	-		
		34	1020Z4417	.SCREW, Rear cap	-	4		

Ref. Dwg. 53Z455
53Z502

AUXILIARY TRANSMISSION GEAR & SHAFT GROUP

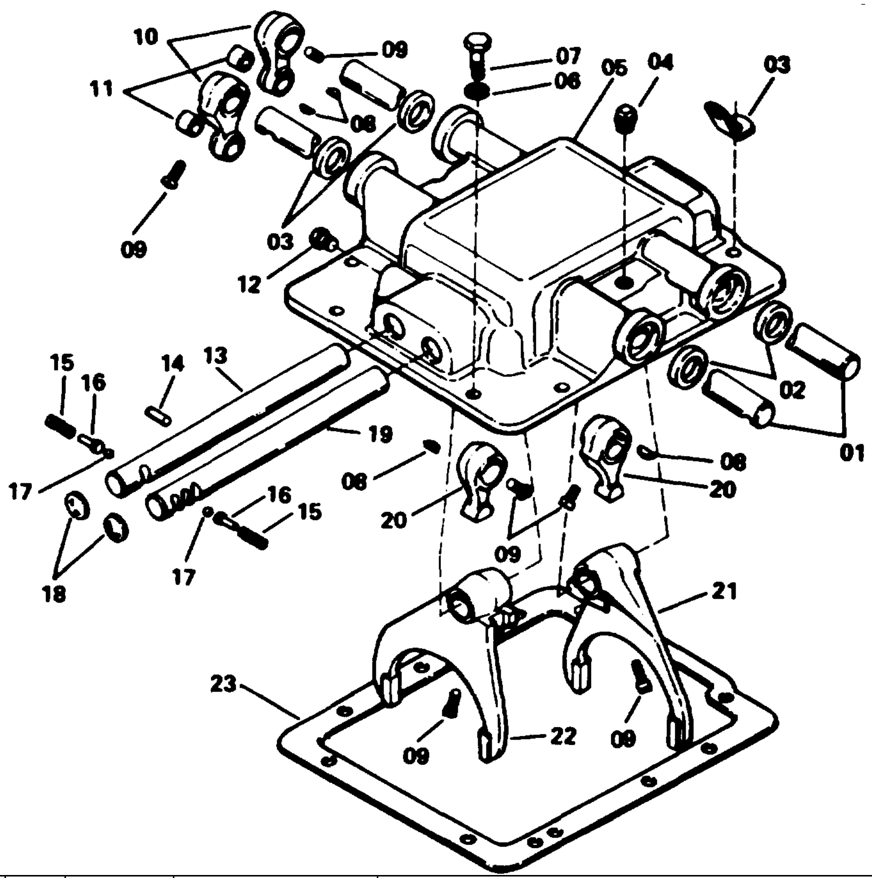


AUXILIARY TRANSMISSION – GEAR AND SHAFT (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-		GEAR & SHAFT GR. – AUX. TRANS. W/SIDE CONTROLS	▼			
		-		GEAR & SHAFT GR. – AUX. TRANS. W/FRONT CONTROLS		▼		
		01	1020Z3262	.NUT, Drive gear	2	2		
		02	1018Z3452	.WASHER Drive gear nut	2	2		
		03	1018Z3863	.YOKE, Front and rear	1	2		
		03	1018Z3862	.YOKE, Front	1	-		
		04	1025Z1455	.BEARING, Drive gear front	1	1		
		05	1025Z1456	.BEARING, Drive gear rear	1	1		
		06	1001Z848	.GEAR, Main drive	1	1		
		07	1025Z1454	.BEARING, Drive gear pocket	1	1		
		08	1018Z3472	.RING, Clutch gear retaining	1	1		
		09	1001Z215	.GEAR, 3rd and 4th clutch	1	1		
		10	1001Z747	.COLLAR, 3rd and4th clutch gear	1	1		
		11	1018Z3467	.SLEEVE, 3rd and 4th gear	1	1		
		12	1025Z1458	.BEARING, 3rd and 4th gear roller	1	1		
		13	1001Z847	.GEAR, Main shaft 4th speed overdrive	1	1		
		14	1018Z4238	.SLEEVE, 2nd gear	1	1		
		15	1025Z1457	.BEARING, 1st and 2nd gear roller	2	2		
		16	1001Z947	.GEAR, Main shaft 2nd speed overdrive	1	1		
		17	1001Z219	.GEAR, 1st and 2nd clutch	1	1		
		18	1001Z750	.COLLAR, 1st and 2nd clutch gear	1	1		
		19	1010Z191	.SHAFT, Main	1	1		
		20	1001Z218	.GEAR, 1st speed overdrive	1	1		
		21	1018Z3475	.WASHER, 1st speed thrust	1	1		
		22	1025Z755	.BEARING, Main shaft rear	1	1		
		23	1018Z3455	.WASHER, Rear bearing	1	1		
		24	1001Z850	.GEAR, Speedometer drive	1	1		
		25	1025Z1459	.BEARING, Countershaft drive	1	1		
		26	1018Z3864	.RING, Gear retaining	1	1		
		27	1001Z846	.GEAR, Countershaft drive	1	1		
		28	1001Z849	.GEAR, Countershaft 4th speed overdrive	1	1		
		29	1001Z591	.GEAR, Countershaft 2nd speed overdrive	1	1		
		30	1010Z834	.SHAFT, 1st speed counter	1	1		
		31	1020Z3251	.KEY, 2nd, 4th and drive countershaft drive	3	3		

Ref. Dwg. 53Z455
53Z502

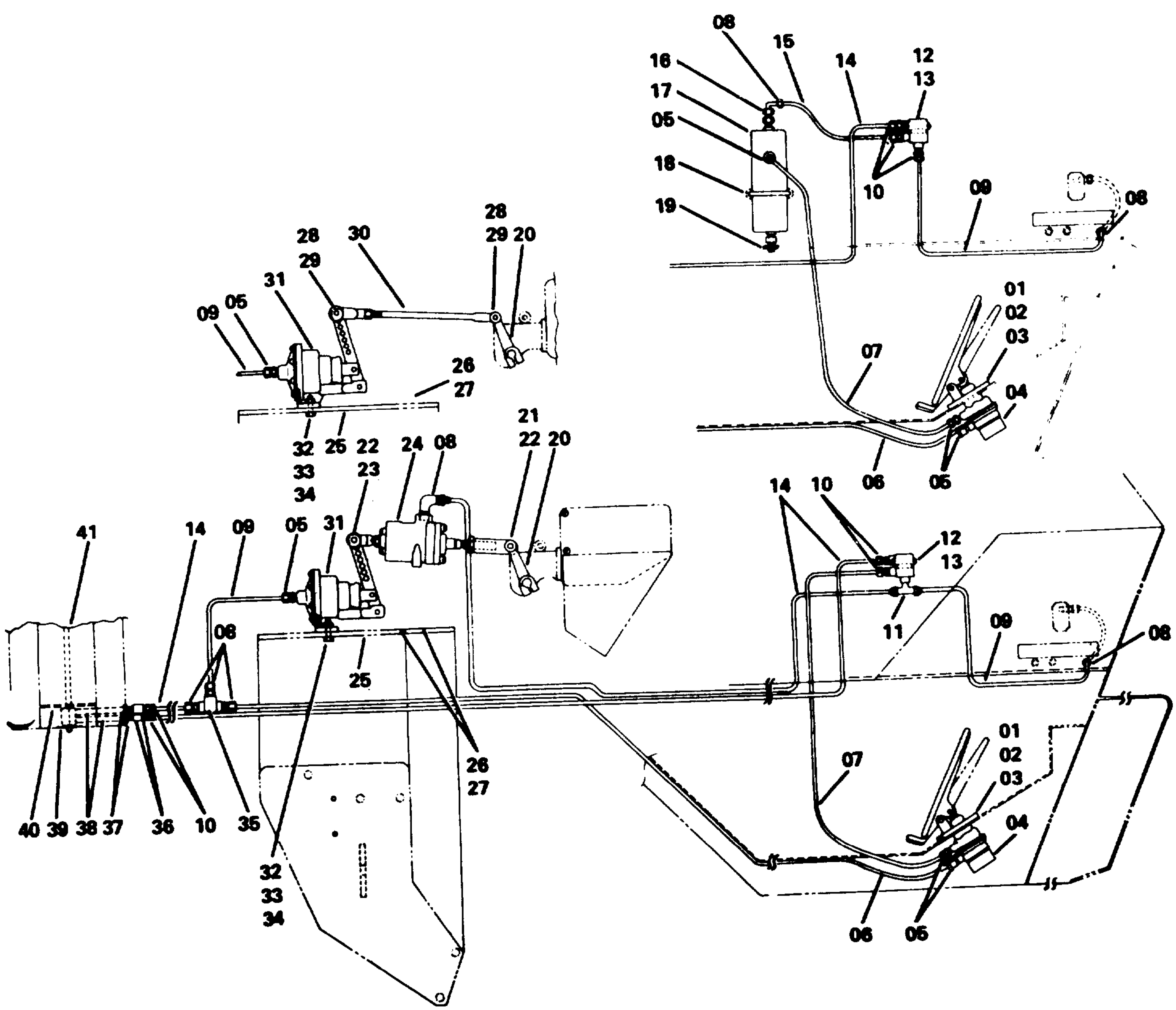
AUXILIARY TRANSMISSION SIDE SHIFT HOUSING GROUP



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number			
		-		SIDE SHIFT HOUSING GP. AUX. TRANS.	▼			
		01	1006Z399	.ROD, Cross shift	2			
		02	1018Z3445	.SEAL, Cross shift rod oil	4			
		03	1006Z406	.HOOK, Transmission lift	2			
		04	1020Z3732	.PLUG, Vent	1			
		05	1014Z748	.HOUSING, Shift	1			
		06	1018Z3867	.WASHER, Housing screw lock	10			
		07	1020Z3363	.SCREW, Housing	10			
		08	1020Z3249	.KEY, Cross shaft lever	4			
		09	1020Z3736	.SCREW, Set	4			
		10	1006Z404	.LEVER ASSEMBLY, Cross shift	2			
		11	1005Z407	..BUSHING, Cross shift lever	1			
		12	1020Z3245	.PLUG, Poppet hole	1			
		13	1006Z459	.ROD, 1st and 2nd shift	1			
		14	1025Z1452	.LOCK, Inter shift rod	1			
		15	1017Z795	.SPRING, Shift rod ball	2			
		16	1053Z84	.PLUNGER, Shift rod poppet	2			
		17	1025Z424	.BALL, Shift rod plunger	2			
		18	1020Z3253	.PLUG, Shift rod hole	2			
		19	1006Z401	.ROD, 3rd and 4th shift	1			
		20	1006Z398	.FINGER, Cross shift rod inner	2			
		21	1006Z400	.FORK, 3rd and 4th shift	1			
		22	1006Z458	.FORK, 1st and 2nd shift	1			
		23	1020Z1678	.GASKET, Shift housing to case	1			

Ref. Dwg. 53Z455

CARRIER AIR THROTTLE ASSEMBLY



CARRIER AIR THROTTLE ASSEMBLY (Continued))

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	2	3	4	5
		-	100X131-1	AIR THROTTLE ASSY., CARRIER	▼				
		-	100X131-2	AIR THROTTLE ASSY., UPPER MATERIAL		▼			
		-	100X131-3	AIR THROTTLE ASSY., CARRIER			▼		
		-	100X131-4	AIR THROTTLE ASSY., CARRIER				▼	
		-	100X131-5	AIR THROTTLE ASSY., CARRIER					▼
		01		.SCREW, Hex hd. 5/16—18UNC x 1 in.	3	-	3	3	3
		02		.WASHER, Lock 5/16 in.	3	-	3	3	3
		03		.NUT, Hex 5/16-18UNC	3	-	3	3	3
		04	36U29D2	.VALVE, Air throttle (Page 8.1)	1	-	1	1	1
		05		.FITTING, Straight	9	-	9	8	8
		06		.TUBE, Nylon 24 in.	1	-	1	1	1
		07		.TUBE, Nylon 3 ft	1	-	1	1	1
		08	44Z1320D1	.ELBOW, 90°	5	-	5	4	4
		09		.TUBE, Nylon 2 ft	2	-	2	2	2
		10	44Z1322D3	.FITTING, Straight	3	2	3	2	2
		11	44Z1321D4	.TEE	-	-	-	1	1
		12	36Z971	.VALVE, Air selector	1	-	1	1	1
		13	32Z1381	.DECAL, Selector	1	-	1	1	1
		14		.TUBE, Nylon 14 ft	2	-	2	2	2
		15		.TUBE, Nylon 4 ft	1	-	1	1	1
		16	36Z872	.VALVE, Single check	1	-	1	-	-
		17	27Z558	TANK, Air	1	-	1	-	-
		18	32Z171D11	.BRACKET, Air tank drain	1	-	1	-	-
		19	36Z39	.COCK, Air tank drain	1	-	1	-	-
		20	6T2458	.ARM, Governor control	1	-	-	1	-
		21	19F47D2	.PIN, Drilled	-	-	-	1	1
		22		.PIN, Cotter 3/32 x 1/2 in.	-	-	-	4	4
		23	19F47D3	.PIN, Drilled	-	-	-	1	1
		24	938P14-1	.CYLINDER ASSY., Air	-	-	-	1	1
		-	38Q40	..CYLINDER, Air	-	-	-	1	1
		-	806T321	…YOKE, Governor rod end	-	-	-	1	1
		-		…NUT, Jam 7/16-20UNF	-	-	-	1	1
		-	806T326	..YOKE, Slave cylinder rod end	-	-	-	1	1
		25	816T1326	.BRACKET, Slave cylinder	-	-	-	-	1
		25	816T1267	.BRACKET, Slave cylinder	-	-	1	-	-
		26		.SCREW, Hex hd. 3/8-16UNC x 1 in	-	-	2	-	2
		27		.WASHER, Lock 3/8 in	-	-	2	-	2
		28	919T117-3	.PIN ASSY., Yoke	2	-	2	-	-
		29		..PIN, Cotter 3/32 x 1/2 in	1	-	1	-	-
		30	6T2435	.LINK, Throttle	1	-	-	-	-
		30	6T2476D1	.LINK, Throttle	-	-	1	-	-
		31	36U30D1	.CYLINDER, Throttle slave	1	-	1	1	1
		-	1045Z1310	..KIT, Cylinder repair	1	-	1	1	1
		32		.SCREW, Hex hd, 1/4-20UNC x 3/4 in	2	-	2	2	2
		33		.WASHER, Lock 1/4 in	2	-	2	2	2
		34		.NUT, Hex 1/4-20UNC	2	-	2	2	2
		35	36Z736	.VALVE, Shuttle	1	-	1	1	1
		36	2408V002	.COUPLING	-	2	-	-	-
		37	20F57D1	.GROMMET	-	2	-	-	-
		38	2419V022	.NIPPLE, 1/8 in. NPT x 6 in. lg	-	2	-	-	-

CARRIER AIR THROTTLE ASSEMBLY (Continued))

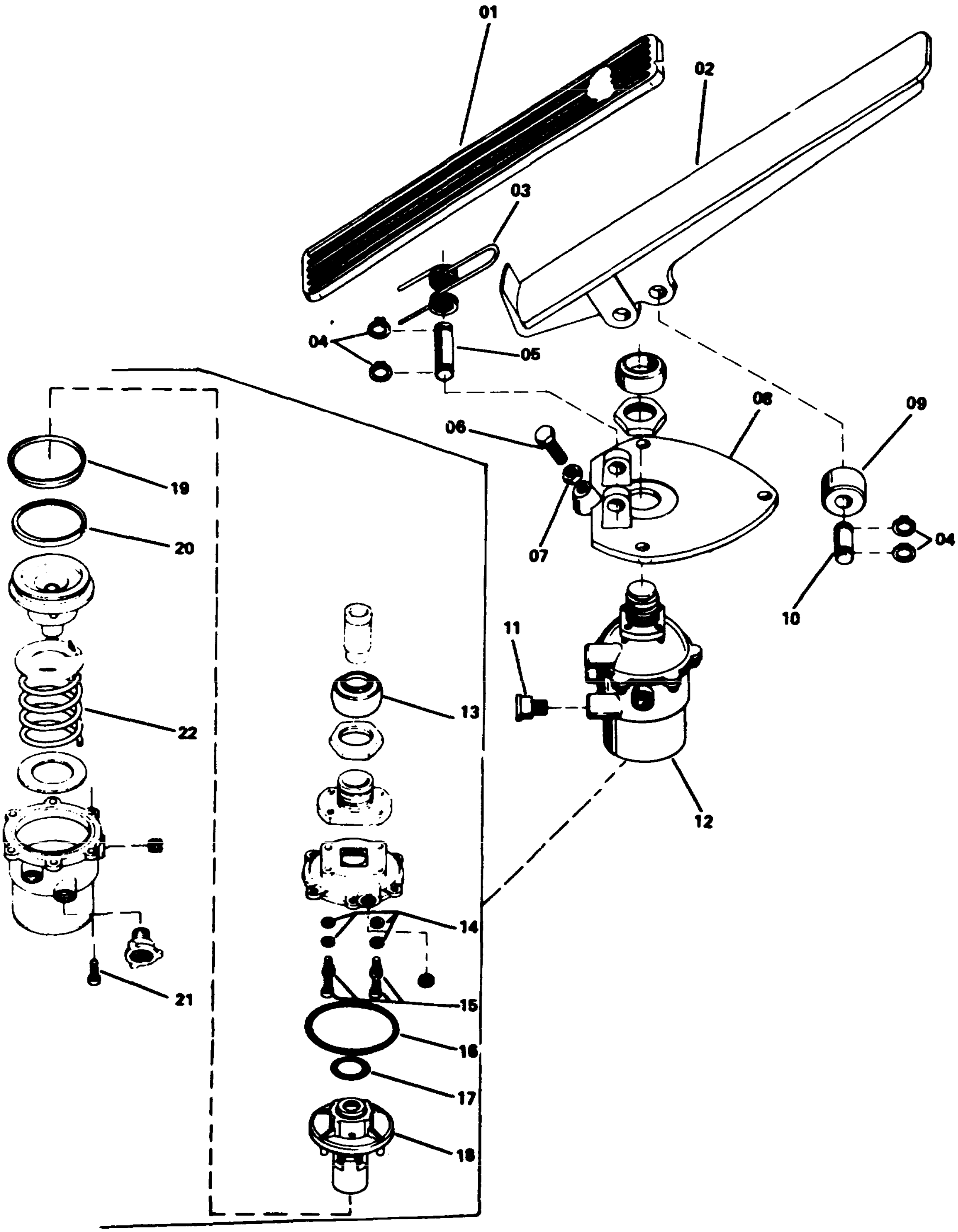
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	2	3	4	5
		39	18Z2288	.WASHER, Thrust	-	1	-	-	-
		40	18T11052	.WASHER	-	1	-	-	-
		41	45Q9D2	.SWIVEL ASSY., Air	-	1	-	-	-
		-	1045Z1357	..KIT, Seal	-	1	-	-	-

NOTE

The nylon tubing called for on this assembly is part number 20Z1411D2. When ordering nylon tubing you MUST specify, in feet, the length required.

Ref. Dwg. 100X131 H
100X131-1
100X131-2
100X131-3
100X131-4
100X131-5

AIR THROTTLE PEDAL AND VALVE ASSEMBLY

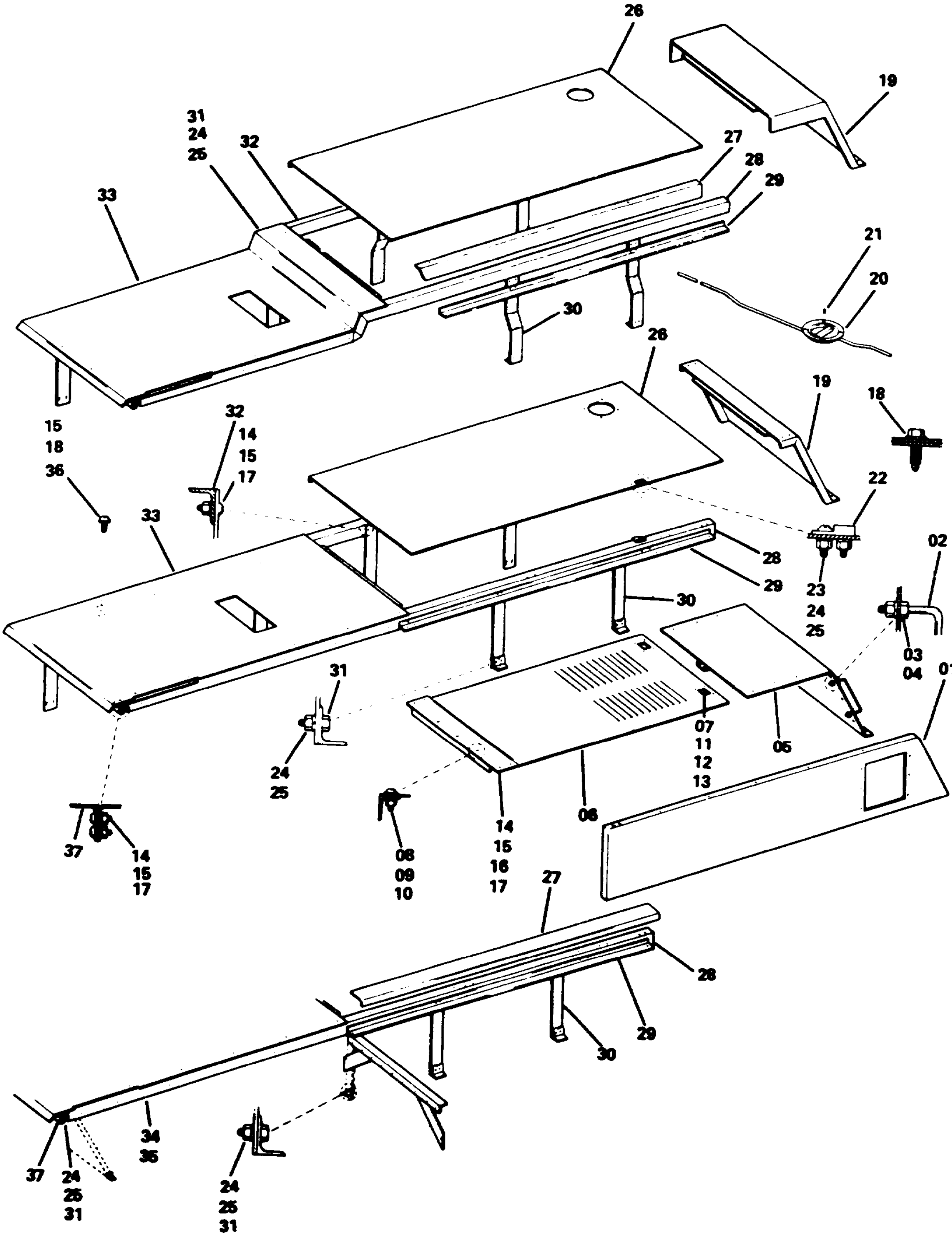


AIR THROTTLE PEDAL AND VALVE ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number D2			
		-	36U29D2	AIR THROTTLE PEDAL AND VALVE ASSY.	▼			
		01	1014Z955	.COVER, Treadle	1			
		02	1006Z509	.TREADLE	1			
		03	1017Z873	.SPRING	1			
		04	1018Z4078	.RING, Retaining	4			
		05	1019Z838	.PIN, Treadle	1			
		06	1020Z4073	.SCREW, Cap	1			
		07	1020Z4068	.NUT, Jam	1			
		08	1016Z336	.PLATE, Treadle mounting	1			
		09	1013Z221	.ROLLER	1			
		10	1019Z837	.PIN, Push rod	1			
		11	1046Z203	.BREATHER	1			
		12	1036Z606	.VALVE ASSEMBLY	1			
		-	1036Z607	..KIT, Valve repair	1			
		13		…BOOT, Dust	1			
		14		…WASHER, Seal	4			
		15		…SCREW, Machine	4			
		16		…O-RING	1			
		17		…O-RING	1			
		18		…PLATE ASSEMBLY, Barrier	1			
		19		…U-CUP	1			
		20		…RING, Thrust	1			
		21		…SCREW, Machine	6			
		22	1017Z869	..SPRING, Balance	1			

Ref. Dwg. 36U29D2

ENGINE COVERING SHEET METAL ASSEMBLY



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Sheet 1 of 3

ENGINE COVERING SHEET METAL ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number				
					1	2	3	4	5
		-	8100N186-1	ENGINE COVERING SHEET METAL ASSY					
		-	8100N186-2	ENGINE COVERING SHEET METAL ASSY					
		-	8100N186-3	ENGINE COVERING SHEET METAL ASSY					
		-	8100N186-4	ENGINE COVERING SHEET METAL ASSY					
		-	8100N186-5	ENGINE COVERING SHEET METAL ASSY					
		01	827P642	.HOOD, L.H. side	1	-	-	1	-
		01	827N535	.HOOD, L.H. side	-	1	-	-	1
		01	827P743	.HOOD, L.H. side	-	-	1	-	-
		02	832T32	.HANDLE	2	2	2	2	2
		03		.NUT, hex 1/2-13UNC	8	8	8	8	8
		04		.WASHER, Lock 1/2 in.	8	8	8	8	8
		05	827N435D2	.HOOD, L.H. rear	1	-	-	-	-
		05	827N536D1	.HOOD, L.H. rear	-	1	-	-	-
		05	827N435D4	.HOOD, L.H. rear	-	-	1	1	-
		05	827N536D2	.HOOD, L.H. rear	-	-	-	-	1
		06	827N654-1	.HOOD, L.H. louvered	-	-	1	-	-
		07	6Z432	..LOCK, Door	-	-	1	-	-
		06	827N616-1	.HOOD, L.H. louvered	-	-	-	1	1
		07	6Z432	..LOCK, Door	-	-	-	1	1
		08		..SCREW, Rd. hd. mach. 5/16-18UNC x 1/2 in.	-	-	-	3	3
		09		..WASHER, Lock 5/16 in.	-	-	-	3	3
		10		..NUT, Hex 5/16-18UNC	-	-	-	3	3
		06	827N410-1	.HOOD, L.H. louvered	1	1	-	-	-
		07	6Q15	..LOCK, Paddle type	2	2	-	-	-
		08		..SCREW, Rd, hd, mach. 5/16-24INF x 1/2 in.	3	3	-	-	-
		09		..WASHER, Lock 5/16 in	3	3	-	-	-
		10		..NUT, Hex 5/16-24UNF	3	3	-	-	-
		11		..SCREW, Rd. hd. mach. #8-32UNC x 1/2 in	8	8	-	-	-
		12		..WASHER, Lock #8	8	8	-	-	-
		13		..NUT, Hex #8-32UNC	8	8	-	-	-
		14		.SCREW, Rd. hd. mach. 5/16-18UNC x 3/4 in	19	19	19	19	19
		15		.WASHER, Lock 5/16 in	31	31	19	31	31
		16		.WASHER, Flat 5/16 in	7	7	7	7	7
		17		.NUT, Hex 5/16-18UNC	19	19	19	19	19
		18	20Z1282D3	.FASTENER, Self-drilling	38	43	36	38	43
		19	827P561D2	.HOOD, Center cover	1	-	1	1	-
		19	827N533	.HOOD, Center cover	-	1	-	-	1
		20	806P191	.LATCH ASSY	1	1	1	1	1
		21		.SCREW, Rd. hd. mach. #10-24UNC x 1/2 in	4	4	4	4	4
		22	32Z908D2	.HINGE ASSY	2	2	2	2	2
		23		.SCREW, Rd. hd. mach. 3/8-16UNC x 1 in	8	8	8	8	8
		24		.WASHER, Lock 3/8 in	16	14	41	16	14
		25		.NUT, Hex 3/8-16UNC	16	14	41	16	14
		26	827P534	.HOOD, Top rear center	1	-	1	1	-
		26	827P645	. HOOD, Top rear center	-	1	-	-	1
		27	827T362	.HOOD, Top	1	-	-	1	-
		27	827T452	.HOOD, Top	-	1	-	-	1
		27	27T1832	.HOOD, Top	-	-	1	-	-
		28	829P275D2	.SUPPORT, L.H.	1	-	-	1	-
		28	829P318	.SUPPORT, L.H.	-	1	-	-	1

ENGINE COVERING SHEET METAL ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	2	3	4	5
		28	829P352D1	.SUPPORT, L.H.	-	-	1	-	-
		29	829P273D2	.SUPPORT	1	-	-	1	-
		29	829P319	.SUPPORT	-	1	-	-	1
		29	829P351	.SUPPORT	-	-	1	-	-
		30	829T250	.SUPPORT, L.H. mounting	2	-	2	2	-
		30	829T343	.SUPPORT, L.H. mounting	-	2	-	-	2
		31		.SCREW, Hex hd. cap 3/8-16UNC x 1 in	8	14	39	8	14
		32	829P274D2	.SUPPORT, R.H.	1	-	1	1	-
		32	829P317	.SUPPORT, R.H.	-	1	-	-	1
		33	827P533	.HOOD, Top front center	1	-	-	1	-
		33	827P646	.HOOD, Top front center	-	1	-	-	1
		33	27P2758	.HOOD, Top front center	-	-	1	-	-
		34	16Z468	.CUSHION, 10 ft. rubber	-	-	1	-	-
		35	20Z1449D6	.RIVET, Pop	-	-	28	-	-
		36		.SCREW, Rd. hd. mach 5/16-24UNF x 5/8 in	12	12	12	12	12
		37	829T249	.SUPPORT, Front	1	1	1	1	1

Ref. Dwg. 8100N186 C 8100N186-3
8100N186-1 8100N186-4
8100N186-2 8100N186-5

FUEL SYSTEM ASSEMBLY

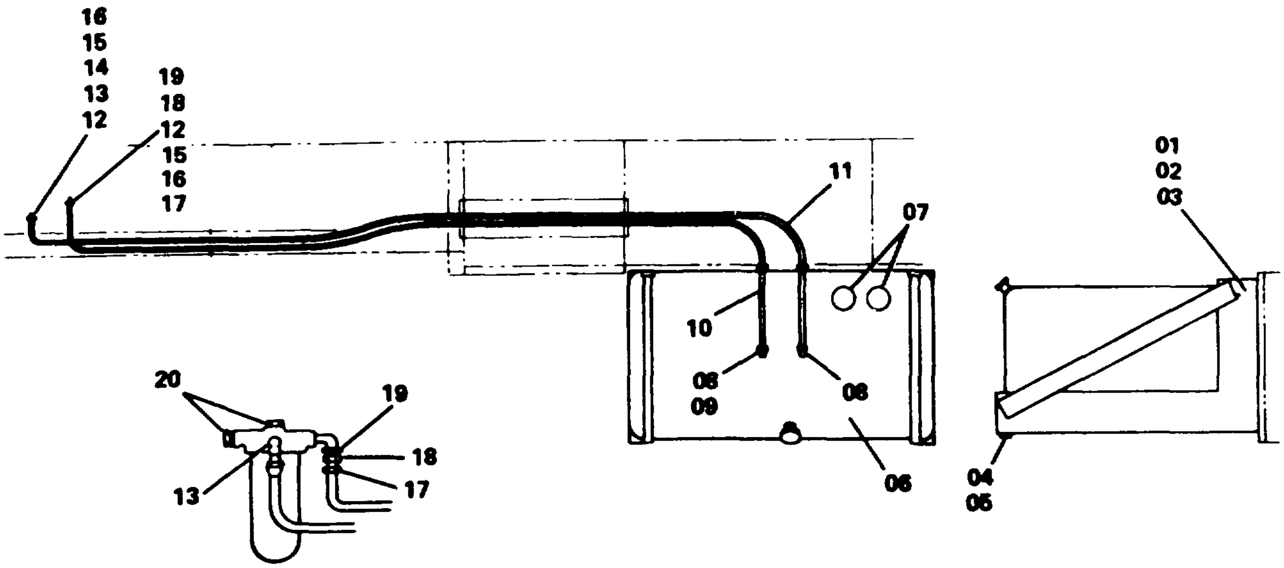
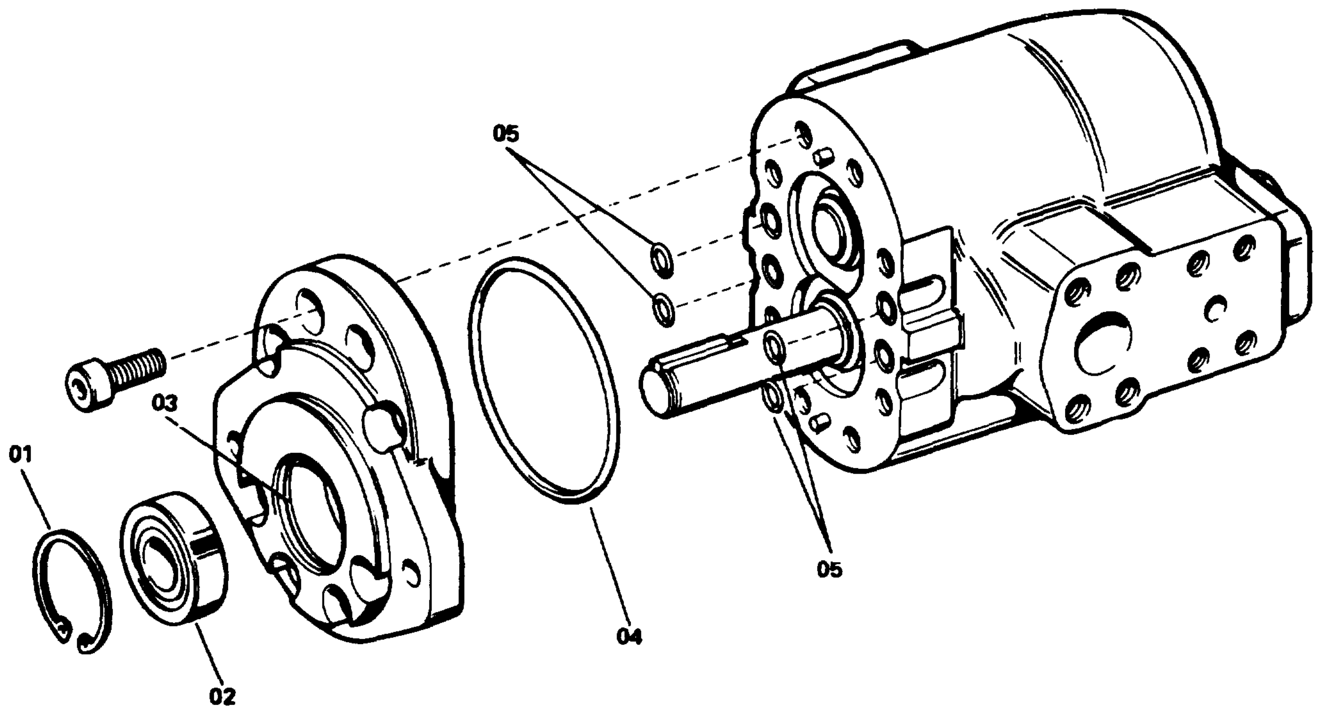


FIGURE 3

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 2	 3	 4	
		-	8100N1939-2	FUEL SYSTEM ASSY., GM6V53N ENGINE				
		-	8100N1939-2	FUEL SYSTEM ASSY., GM6V71N ENGINE				
		-	8100N1939-4	FUEL SYSTEM ASSY., CUMMINS NHF 240				
		01		.SCREW, Rd. hd. mach #8-36UNF x 3/4 in	1	1	1	
		02		.WASHER, Lock #8	1	1	1	
		03		.NUT, Hex #8-36UNF	1	1	1	
		04		.WASHER, Lock 3/8 in	2	2	2	
		05		.NUT, Hex 3/8-24UNF	2	2	2	
		06	27Z482D1	.TANK, Fuel	1	1	1	
		07	89Z391D2	.SENDING UNIT, Fuel level	2	2	2	
		08	44Z220D16	.ELBOW, 90° male	1	1	2	
		09	2416V019	.ELBOW, 90° male	1	1	-	
		10		.TUBE, 3/8 in. OD x 10 ft. lg	1	1	-	
		11		.TUBE, 1/2 in. OD x 0.058 wall x 10 ft. lg	1	1	2	
		12	44Z590D7	.CONNECTOR, Male	2	-	-	
		13	44Z259D16	.ELBOW, 90° male	-	1	-	
		13	44Z702D8	.ADAPTER, 90° union	-	-	1	
		14	44Z208D13	.CONNECTOR, Male	-	-	1	
		15		.HOSE, 13/32 in. ID x 40 in. lg	-	-	2	
		16	44Z368D8	.CONNECTOR, Tube	-	-	2	
		17	44Z368D7	.CONNECTOR, Compression	1	-	-	
		17	44Z187D10	.CONNECTOR, Long nut	-	1	-	
		18	44Z590D8	.CONNECTOR, Male	1	-	-	
		18	44Z214D14	.CONNECTOR, Female	-	1	-	
		19	11Z215D15	.ELBOW, 90° male	-	1	-	
		20	44Z226D3	.PLUG, 3/8 in. pipe	-	2	-	

Ref. Dwg. 8100N1939 G
8100N1939-2
8100N1939-3
8100N1939-4

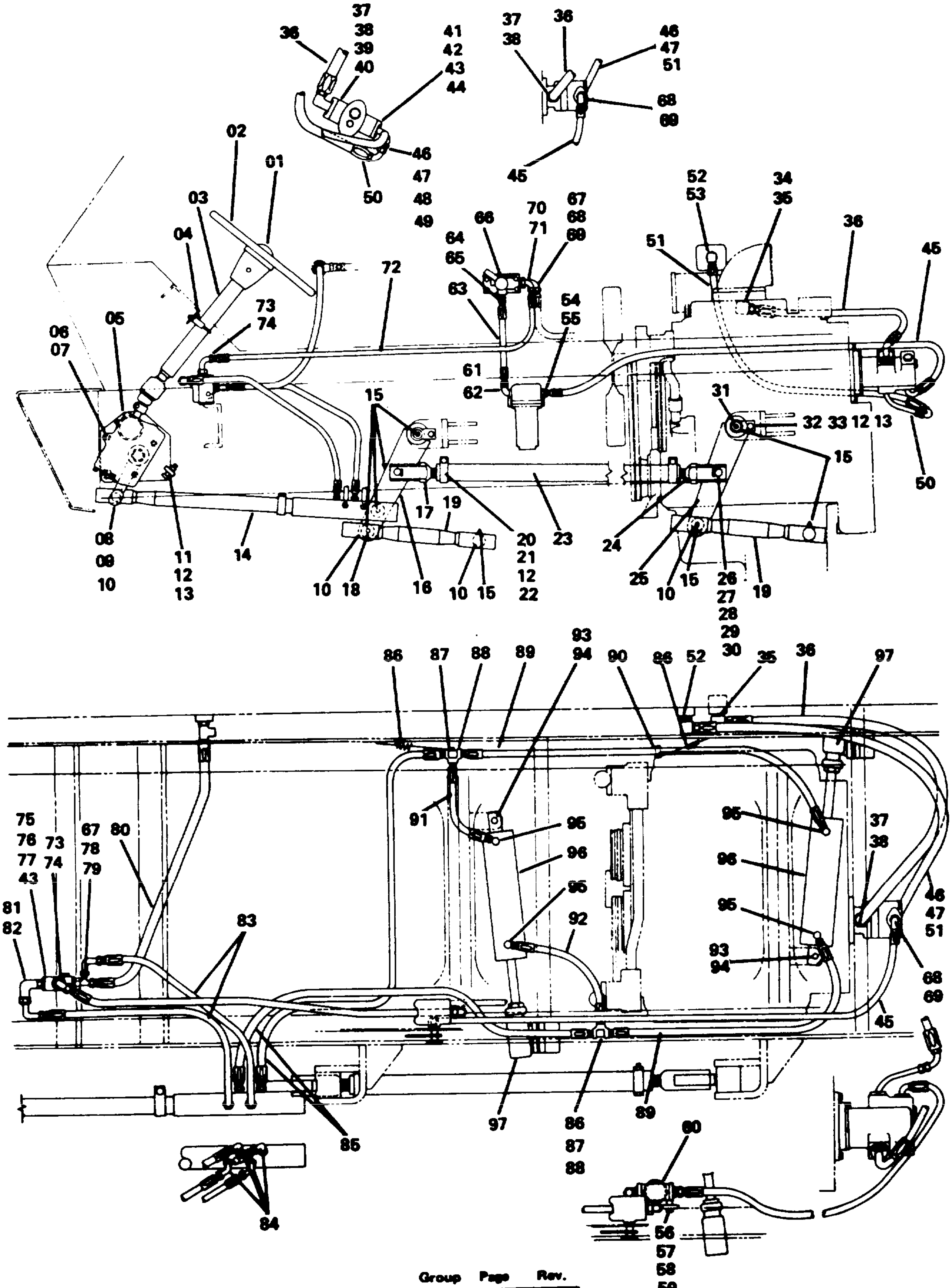
POWER STEERING AND OUTRIGGER PUMP



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		-	41U16	PUMP, POWER STEERING & OUTRIGGERS				
		-	41U22	PUMP, POWER STEERING & OUTRIGGERS				
		-	41U33	PUMP, POWER STEERING & OUTRIGGERS				
		-	41U34	PUMP, POWER STEERING & OUTRIGGERS				
		-	1045Z929	.KIT, Shaft seal	1	1	1	1
		01		..RING, Snap	1	1	1	1
		02		..SEAL, Shaft	1	1	1	1
		03		..RING, Back-up	1	1	1	1
		04		..O-RING, Flange	1	1	1	1
		05		..O-RING, Flange	4	4	4	4

Ref. Dwg. 41U16
41U22
41U33
41U34

POWER STEERING ASSEMBLY



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QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3			
		-	8100J1442-3	POWER STEERING ASSY., W/TYRONE PUMP	▼			
		01	49Z165	.KIT, Horn button	1			
		02	13Z155	.WHEEL, Steering	1			
		03	20Z144D2	.COLUMN, Steering (Page 14.1)	1			
		04	32Z171D6	.CLAMP, Steering column	1			
		05	53Z341	.GEAR, Steering (Page 15.1)	1			
		06		.WASHER, Lock 5/8 in	3			
		07		.NUT, Hex 5/8-11UNC	3			
		08	6Z435	.ARM, Steering	1			
		09	44Z1D12	.FITTING, Lube	1			
		10	14Z126D3	.COVER, Dust	5			
		11		.SCREW, Hex hd. 1/2-13UNC x 2 in	2			
		12		.WASHER, Lock 1/2 in	6			
		13		.NUT, Hex 1/2-13UNC	4			
		14	6Z197D10	.DRAG LINK and VALVE ASSY. (Page 16.1)	1			
		15	44Z1D10	.FITTING, Lube	9			
		16	806P190-1	.LEVER, Front steering	1			
		-	25Z520D4	..BUSHING	1			
		-	818T209	..RACE, Outer	2			
		-	806T121D1	..SPACER	1			
		17		.CLEVIS, Forward	1			
		18	6Z167D4	..PIN, Cotter 1/4 x 2-3/4 in	4			
		19	832T63	.LINK, Steering	2			
		20		.CLAMP, Adjusting rod	2			
		21		.SCREW, Hex hd. 1/2-20UNF x 3-1/4 in	2			
		22		.NUT, Hex 1/2-20UNF	2			
		23	820P337	.ROD, Adjusting	1			
		24	806T121D2	.CLEVIS, Rear	1			
		25	806P176-1	.LEVER, Rear steering	1			
		-	25Z520D4	..BUSHING	1			
		-	25Z489D24	..RACE, outer	2			
		-	818T209	..SPACER	1			
		26	810T56	.PIN, Adjusting rod	2			
		27	818T156	.SPACER	4			
		28		.NUT, Hex jam 7/8-9UNC	2			
		29		.WASHER, Lock 7/8 in	2			
		30	18H4144D17	.WASHER, Shake proof 7/8 in	2			
		31	810T69	.PIN, Steering lever	2			
		32	818T183	..PLATE, Keeper	2			
		33		.SCREW, Hex hd. 1/2-13UNC x 1 in.	2			
		34	44Z590D28	.CONNECTOR, str	1			
		35	2416V022	.ELBOW, 90° male	1			
		36	44P80D6	.HOSE ASSY., Pump pressure	1			
		37	44Q26D4	.FLANGE, Split	2			
		38	45Z91D59	.O-RING	1			
		39		.WASHER, Lock 7/16 in	4			
		40		.SCREW, Hex hd. 7/16-14UNC x 1-1/4 in	4			
		41	44Q26D1	.FLANGE, Split	2			
		42	45Z91D2	.O-RING	1			
		43		.WASHER, Lock 5/16 in	6			

POWER STEERING ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3			
		44		.SCREW, Hex hd. 5/16-18UNC x 1-1/4 in	4			
		45	44P1301D2	.HOSE ASSY., Filter pressure	1			
		46	44Q26D2	.FLANGE, Split	2			
		47	45Z91D73	.O-RING	1			
		48		.WASHER, Lock 3/8 in	4			
		49		.SCREW, Hex hd. 3/8-16UNC x 1-1/4 in	4			
		50	44P1359	.TUBE ASSY., Pump return	1			
		51	44P502D5	.HOSE ASSY., Pump return	1			
		52	44Z591D18	.ELBOW, 90° male	1			
		53	44Z826D11	.REDUCER, 1 in to 1/2 in	1			
		54	44Z485D13	.CONNECTOR, O-ring	1			
		55	45Z91D58	…O-RING	1			
		56	18P926D28	.SPACER	2			
		57		.SCREW, Hex hd. 1/4-20UNC x 3-1/2 in	2			
		58		.WASHER, Lock 1/4 in	2			
		59		.NUT, Hex 1/4-20UNC	2			
		60	46Z133	.FILTER, Power steering	1			
		-	1046Z146	..ELEMENT, Filter	1			
		61	44Z421D22	ELBOW, 90° O-ring	1			
		62	45Z91D165	.O-RING	1			
		63	44P260D1	.HOSE ASSY., Filter to selector valve	1			
		64	44Z485D12	.CONNECTOR, O-ring	1			
		65	45Z91D58	..O-RING	1			
		66	8100P92-1	.VALVE ASSY., Outrigger or steer select (Page 13.1)	1			
		67	44Z787D8	.REDUCER, Expander	2			
		68	44Z421D20	.ELBOW, 90° O-ring	2			
		69	45Z91D47	…O-RING	1			
		70	44Z421D7	.ELBOW, 90° O-ring	1			
		71	45Z91D58	..O-RING	1			
		72	44P260D26	.HOSE ASSY., Select valve to flow control	1			
		73	44Z485D10	.CONNECTOR, O-ring	1			
		74	45Z91D47	…O-RING	1			
		75	36Z293D15	.VALVE, Flow control and relief	1			
		76		.SCREW, Hex hd. 5/16-18UNC	2			
		77		.NUT, Hex hd. 5/16-18UNC x 2-1/2 in	2			
		78	44Z488D6	.TEE, O-ring	1			
		79	45Z91D47	..O-RING	1			
		80	44P243D3	.HOSE ASSY., Flow control return	1			
		81	44Z421D5	.ELBOW, 90° O-ring	1			
		82	45Z91D47	..O-RING	1			
		83	44P242D1	.HOSE ASSY., Flow control to drag link valve	1			
		84	44Z590D11	.ELBOW, 90° male	4			
		85	44P240D12	…HOSE ASSY., Drag link valve to tee	2			
		86	17Z8	.SPRING, Hose tension	3			
		87	32Z1083D26	.CLAMP, 2 in	2			
		88	44Z491D6	.TEE, Union	2			
		89	44P240D6	.HOSE ASSY., Tee to rear steering cylinder	2			
		90	32Z423D2	.CLAMP, 1 in	2			
		91	44P240D9	.HOSE ASSY., Tee to forward steering cylinder	1			
		92	44P240D8	.HOSE ASSY., Tee to forward steering cylinder	1			

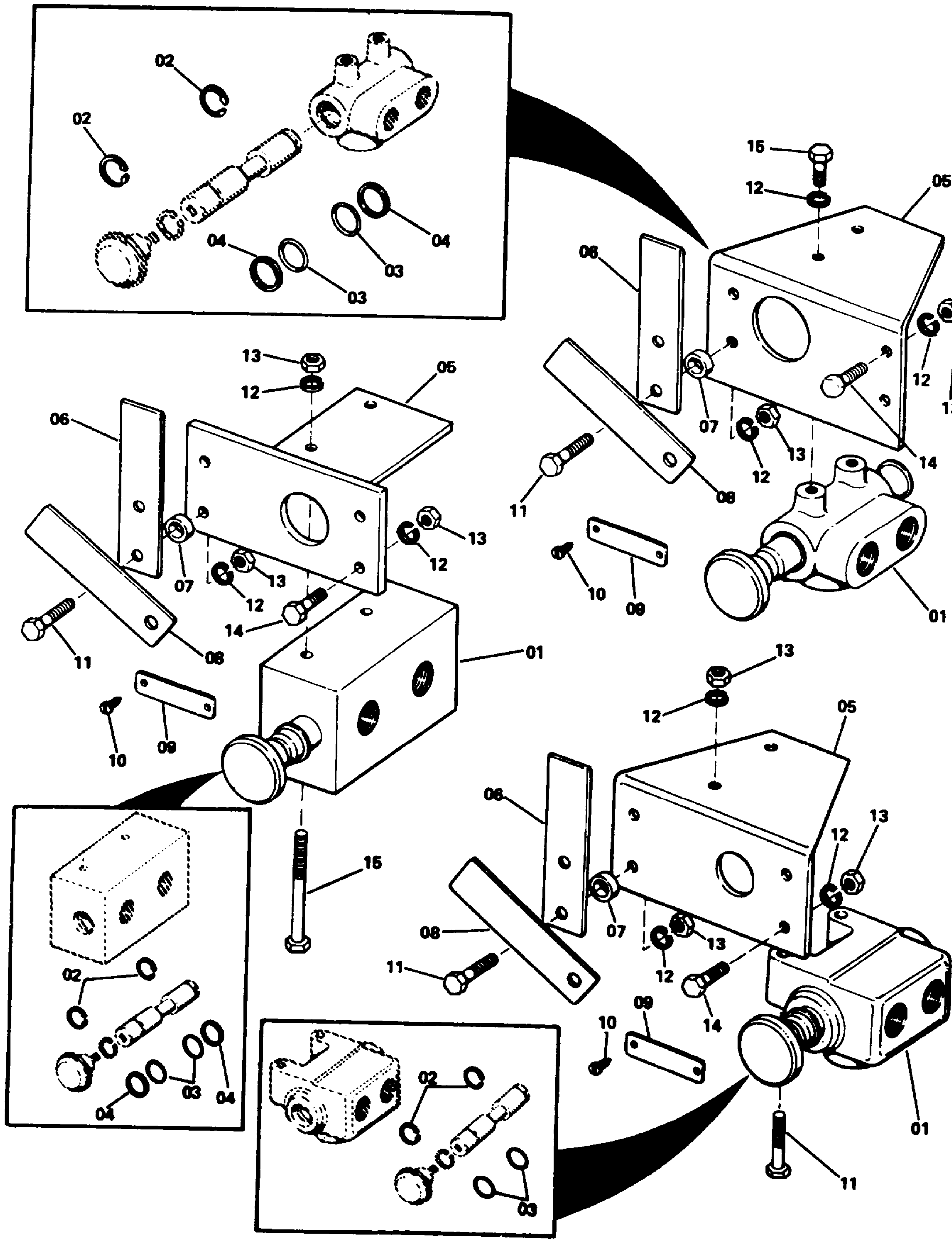
QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3			
		93	819T65	.PIN, Cylinder anchor	2			
		94		.PIN, Cotter 1/4 x 1-1/2 in	2			
		95	44Z591D11	.ELBOW, 90° male	4			
		96	45Z265	.CYLINDER, Steering (Page 17.1)	2			
		97	32Z213D4	.CLAMP ASSY., Cylinder to tie rod	2			
				NOTE				
				The following parts, when added to those listed in Figure 3, become power steering assembly 8100J1442-5.				
		-	8100J1442-5	POWER STEERING ASSY., W/TYRONE PUMP	▼			
		98	14Z303D2	.GUARD, Hose 36 in	1			
		99	32Z890D4	.TIES, Hose	10			
				NOTE				
				8100J1442-6 includes all parts in Figures 3 and 5, except 50, 63, 72, 86, 87, 90. The following parts are added to replace parts deleted from Figure 3.				
		-	8100J1442-6	POWER STEERING ASSY., W/TYRONE PUMP	▼			
		50	44P1453	.TUBE ASSY., Pump return	1			
		63	44P260D3	.HOSE ASSY., Filter to selector valve	1			
		72	44P260D35	.HOSE ASSY., Select valve to flow control	1			
				NOTE				
				8100J1442-8 includes all parts in Figure 3, except 34, 35, 36, 45, 56, 57, 60, 63. The following parts are added to replace parts deleted from Figure 3.				
		-	8100J1442-8	POWER STEERING ASSY., W/TYRONE PUMP	▼			
		35	44Z591D22	.ELBOW, 90°	1			
		36	44P80D8	.HOSE ASSY., Pump pressure	1			
		45	44P1301D4	.HOSE ASSY., Filter pressure	1			
		56	816T1328	.PAD, Power steering filter mounting	1			
		57	820T1328	.U-BOLT, Power steering filter mounting	1			
		60	46Q28D1	.FILTER, Power steering	1			
		-	1046Z242	..ELEMENT, Filter	1			
		-	1018Z4710	..WASHER, Leather back-up	1			
		-	1045Z1335	..O-RING, Element	1			
		63	44P164D30	.HOSE ASSY., Filter to selector valve	1			
				NOTE				
				8100J1442-9 includes all parts in Figures 3 and 5, except 34, 35, 36, 45, 56, 57, 60, 63. The following parts are added to replaced parts deleted from Figure 3.				
		-	8100J1442-9	POWER STEERING ASSY., W/TYRONE PUMP	▼			
		35	44Z591D22	.ELBOW, 90°	1			
		36	44P80D8	.HOSE ASSY., Pump pressure	1			
		45	44P1301D4	.HOSE ASSY., Filter pressure	1			
		56	816T1328	.PAD, Power steering filter mounting	1			

POWER STEERING ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity			
					Figure Number			
					3			
		57	820T533	.U-BOLT, Power steering filter mounting	1			
		60	46Q28D1	.FILTER, Power steering	1			
		-	1046Z242	..ELEMENT, Filter	1			
		-	1018Z4710	..WASHER, Leather back-up	1			
		-	1045Z1335	..O-RING, Element	1			
		63	44P16D30	.HOSE ASSY., Filter to Selector Valve	1			
				NOTE				
				8100J1442-10 includes all parts in Figure 3, 5 and 9, except 50, 63, 72, 86, 87, 90. The following parts are added to replace parts deleted from Figures 3 and 9.				
		-	8100J1442-10	POWER STEERING ASSY., W/TYRONE PUMP	▼			
		50	44P1453	.TUBE ASSY., Pump return	1			
		63	44P164D9	.HOSE ASSY., Filter to selector valve	1			
		72	44P260D35	.HOSE ASSY., Select valve to flow control	1			
				NOTE				
				8100J1442-13 includes all parts in Figures 3, 5 and 6, except 34-53. The following parts are added to replace those deleted from Figures 3 and 6.				
		-	8100J1442-13	POWER STEERING ASSY., W/VICKERS PUMP	▼			
		35	44Z591D20	.ELBOW, 90° male	1			
		36	44P159D8	.HOSE ASSY., Pump pressure	1			
		37	44Z421D11	.ELBOW, 90°O-ring	1			
		38	45Z91D173	..O-RING	1			
		45	44P260D4	.HOSE ASSY., Filter pressure	1			
		46	44Z421D22	.ELBOW, 90° O-ring	1			
		47	45Z91D165	..O-RING	1			
		51	44P260D33	.HOSE ASY., Pump return	1			
		52	44Z591D15	.ELBOW, 90° male	1			
				NOTE				
				8100J1442-14 includes all parts in Figures 3, 5 and 13, except 35-38, 45, 56, 57, 60, 63. The following parts are added to replace those deleted from Figures 3 and 13.				
		-	8100J1442-14	POWER STEERING ASSY., W/VICKERS PUMP	▼			
		35	44Z591D22	.ELBOW 90° male	1			
		36	44P1545D1	.HOSE ASSY., Pump pressure	1			
		37	44Z591D33	.ELBOW, 90° male	1			
		45	44P164D29	.HOSE ASSY., Filter pressure	1			
		56	816T1328	.PAD, Power steering filter mounting	1			
		57	820T533	.U-BOLT, Filter mounting	1			
		60	46Q28D1	.FILTER, Power steering	1			
		-	1046Z242	..ELEMENT, Filter	1			
		-	1018Z4710	..WASHER, Leather back-up	1			
		-	145Z1335	..O-RING, Element	1			
		63	44P164D9	.HOSE ASSY., Filter to select valve	1			
					1			

Ref. Dwg. 8100J1442
8100J1442-3-14

POWER STEERING AND OUTRIGGER SELECTOR VALVE ASSEMBLY



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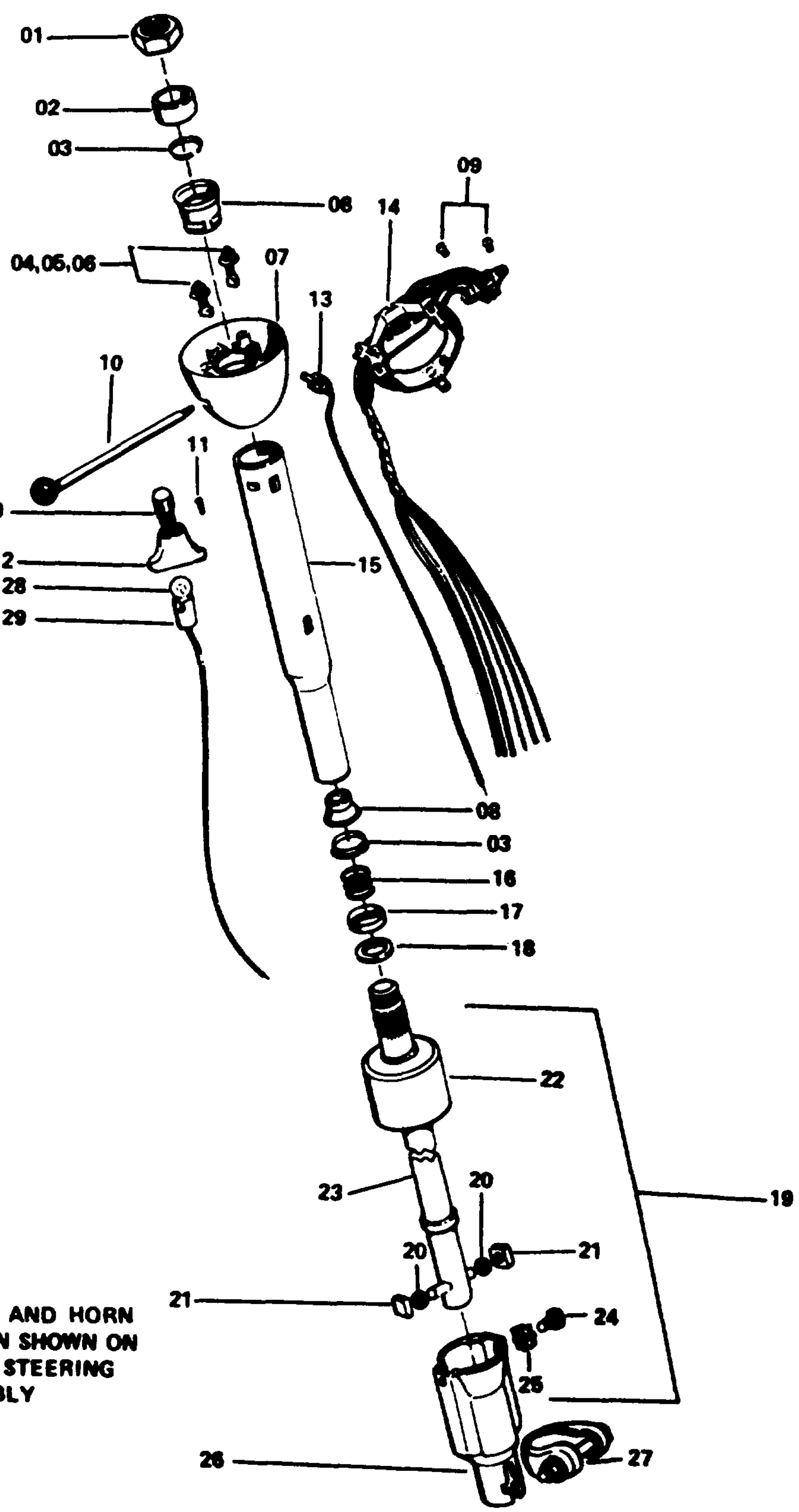
Sheet 1 of 2

POWER STEERING AND OUTRIGGER SELECTOR VALVE ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1	2	3
		-	8100P92-1	VALVE ASSY., POWER STEER & OUTRIGGER SELECT			
		-	8100P92-2	VALVE ASSY., POWER STEER & OUTRIGGER SELECT			
		-	8100P92-3	VALVE ASSY., POWER STEER & OUTRIGGER SELECT			
		01	36Z706	.VALVE, Selector	1	-	-
		-	1045Z915	..KIT, Seal	1	-	-
		02		…RING, Snap	2	-	-
		03		…O-RING, Seal	2	-	-
		01	36Q155	.VALVE, Selector	-	1	-
		-	1045Z1358	..KIT, Seal	-	1	-
		02		…RING, Snap	-	2	-
		03		…O-RING, Seal	-	2	-
		04		…RING, Back-up	-	2	-
		01	36Q154D1	.VALVE, Selector	-	-	1
		-	1145Z3	..KIT, Seal	-	-	1
		02		…RING, Spool retaining	-	-	2
		03		…O-RING, Seal	-	-	2
		04		…RING, Back-up	-	-	2
		05	816T558	.BRACKET, Valve mounting	1	-	-
		05	816T711	.BRACKET, Valve mounting	-	1	-
		05	816P714	.BRACKET, Valve mounting	-	-	1
		06	832T184	.PLATE, Retaining	1	1	1
		07	18P927D8	.SPACER, Retaining plate	2	2	2
		08	832T193	.PLATE, Valve control	1	1	-
		08	832T203	.PLATE, Valve control	-	-	1
		09	32Z112D12	.PLATE, Name	1	1	1
		10	20Z40D6	.SCREW, Self-tapping #6 x 1/4 in	2	2	2
		11		.SCREW, Hex hd. 5/16-18UNC x 1-1/4 in	4	2	2
		12		.WASHER, Lock 5/16 in	6	6	6
		13		.NUT, Hex 5/16-18UNC	6	4	4
		14		.SCREW, Hex hd. 5/16-18UNC x 1 in	2	2	-
		14		.SCREW, Hex hd. 5/16-18UNC x 7/8 in	-	-	2
		15		.SCREW, Hex hd. 5/16-18UNC x 5/8 in	-	2	-
		15		.SCREW, Hex hd. 5/16-18UNC x 2-1/2 in	-	-	2

Ref. Dwg. **8100P92** B
8100P92-1
8100P92-2
8100P92-3

STEERING COLUMN



NOTE: WHEEL AND HORN BUTTON SHOWN ON POWER STEERING ASSEMBLY

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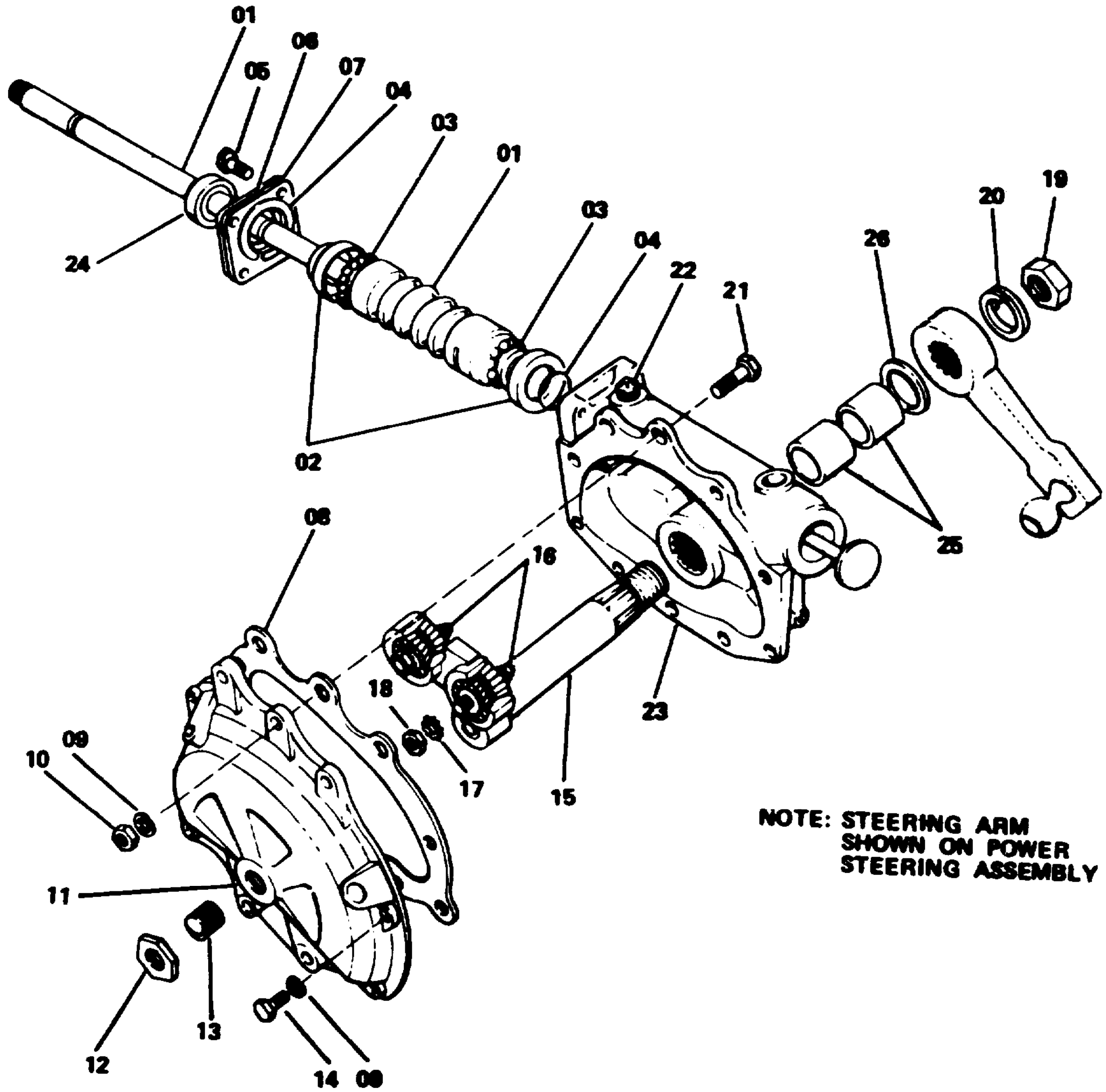
STEERING COLUMN (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-	20Z1144D2	COLUMN, STEERING				
		01	20Z420	.NUT, Wheel	1			
		02	1018Z2763	.SPACER	1			
		03	17Z83	.SEAT, Spring	2			
		04	1032Z122	.CLAMP, J-Bolt	2			
		05		.WASHER, 5/16 in	2			
		06		.NUT, Hex 1/4-28UNF	2			
		07	1014Z523	.HOUSING ASEMBLY, Turn signal	12			
		08	1025Z563	..BEARING ASSEMBLY	2			
		09		.SCREW, Pan hd. #10-16 x 5/16 in	1			
		10	1006Z323	.LEVER, Directional switch	2			
		11		.SCREW, Pan hd. slot, tapping #4-24 x 3/8	1			
		12	1014Z521	.HOUSING, Pilot light	1			
		13	1038Z147	.ROLLER, Horn contact	1			
		14	1079Z1376	.SWITCH ASSY., Directional signal	1			
		15	1044Z417	.TUBE ASSY., Jacket	1			
		16	1017Z758	.SPRING	1			
		17	1014Z512	.CAP, Dust	1			
		18	1018Z2742	.WASHER	1			
		19	1018Z3213	.COUPLING ASSY., Flexible	2			
		20	1018Z2743	..WASHER, 9/64 x 3/8	2			
		21	1079Z1374	..BUTTON	1			
		22	1018Z4619	..SEAL	1			
		23	1044Z416	..TUBE ASSEMBLY, Wheel	2			
		24	1020Z2706	..SCREW, 1/4-28UNF x 3/8 in	2			
		25	1018Z2744	..WASHER, Tongued	1			
		26	1014Z522	.SHELL ASSEMBLY	1			
		27	1032Z126	.CLAMP ASSEMBLY	1			
		28	1052Z28	.BULB, Light (I.C.P No. 53)	1			
		29	1056Z27	.SOCKET & CABLE	1			
		30	1014Z519	.COVER				

Ref. Dwg. 20Z1144D0 G
20Z1144D2

STEERING GEAR

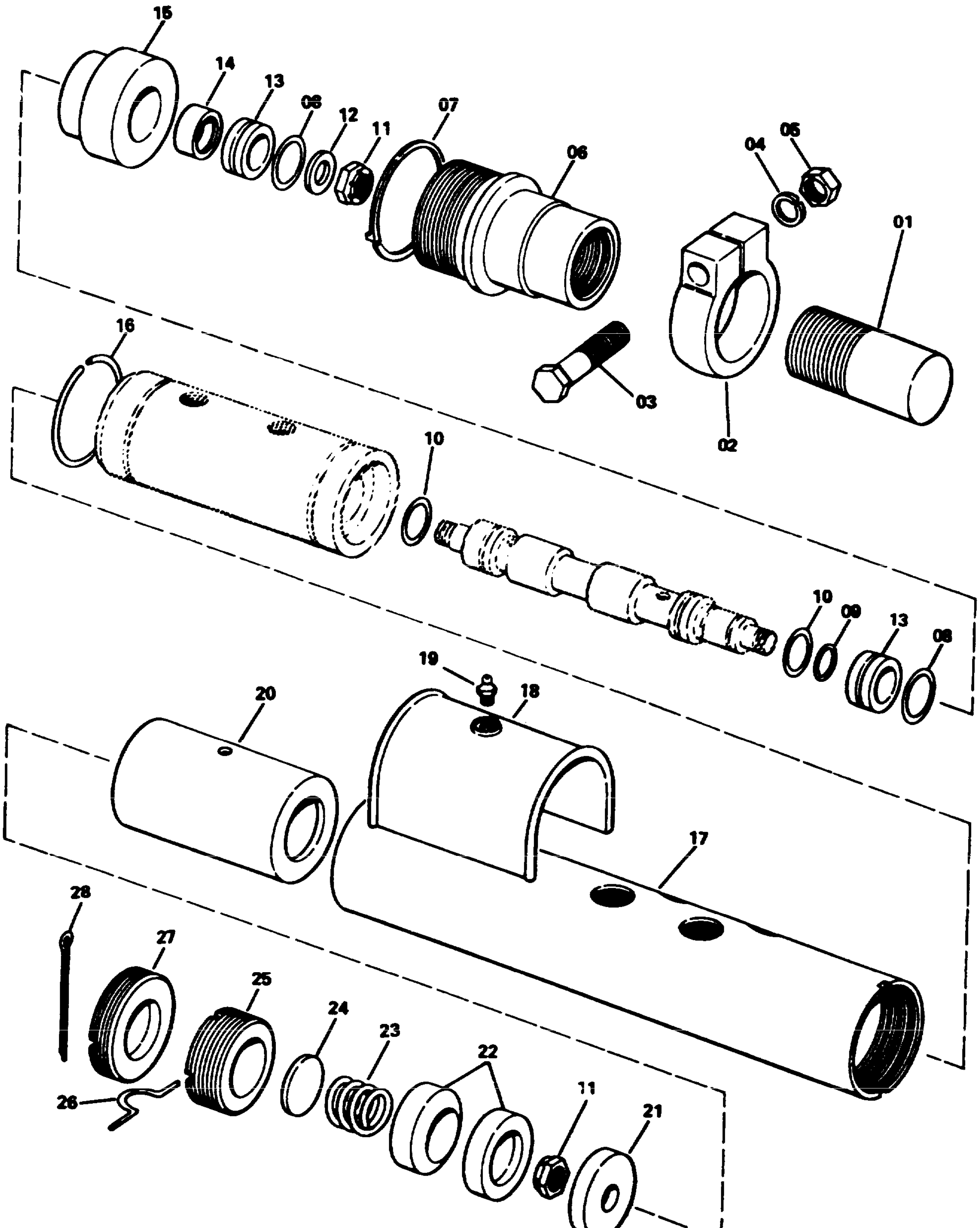


STEERING GEAR (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-	53Z341	GEAR, STEERING	▼			
		01	1018Z2779	.CAM ASSEMBLY	1			
		02	1018Z4443	..KIT, Ball cup	1			
		03		…BEARING, Ball	2			
		04	1018Z2758	…RETAINER	2			
		05		.SCREW, Hex hd. 3/8-16UNC x 1-1/8 in	4			
		06	1014Z557	.COVER, Upper	1			
		07	1020Z2688	.SHIM, 0.002	3			
		07	1020Z2689	.SHIM, 0.003	3			
		07	1020Z2690	.SHIM, 0.010	3			
		08	1020Z2721	.GASKET, Side cover	1			
		09		.WASHER, 41/64 x 1-1/8 in	6			
		10		.NUT, Hex 5/8-18UNF	3			
		11	1014Z541	.COVER ASSEMBLY, Side	1			
		12	20Z422	..NUT, hex 1/2-20UNG	1			
		13	20Z423	..SCREW, Adjusting	1			
		14		.SCREW, Hex hd. 3/8-16UNC x 1-1/2 in	2			
		15	1010Z556	.LEVER SHAFT ASSEMBLY	1			
		16	1025Z1544	..BEARING ASSEMBLY, Material	1			
		17		…WASHER, Star 1/2 in	2			
		18		…NUT, Hex 1/2-20UNC	2			
		19		..NUT, Hex 1-14UNF	1			
		20		..WASHER, Lock 1 in	1			
		21		.SCREW, Hex hd. 5/8-18UNF x 4-7/8 in	3			
		22	1020Z2691	.PLUG, Vent	1			
		23	1014Z540	.HOUSING ASSEMBLY	1			
		24	1018Z4772	..SEAL, Cam shaft	1			
		25	5Z72	..BUSHING, Housing	2			
		26	18Z341	..SEAL, Outer housing	1			

Ref. Dwg. 53Z341

POWER STEERING VALVE ASSEMBLY

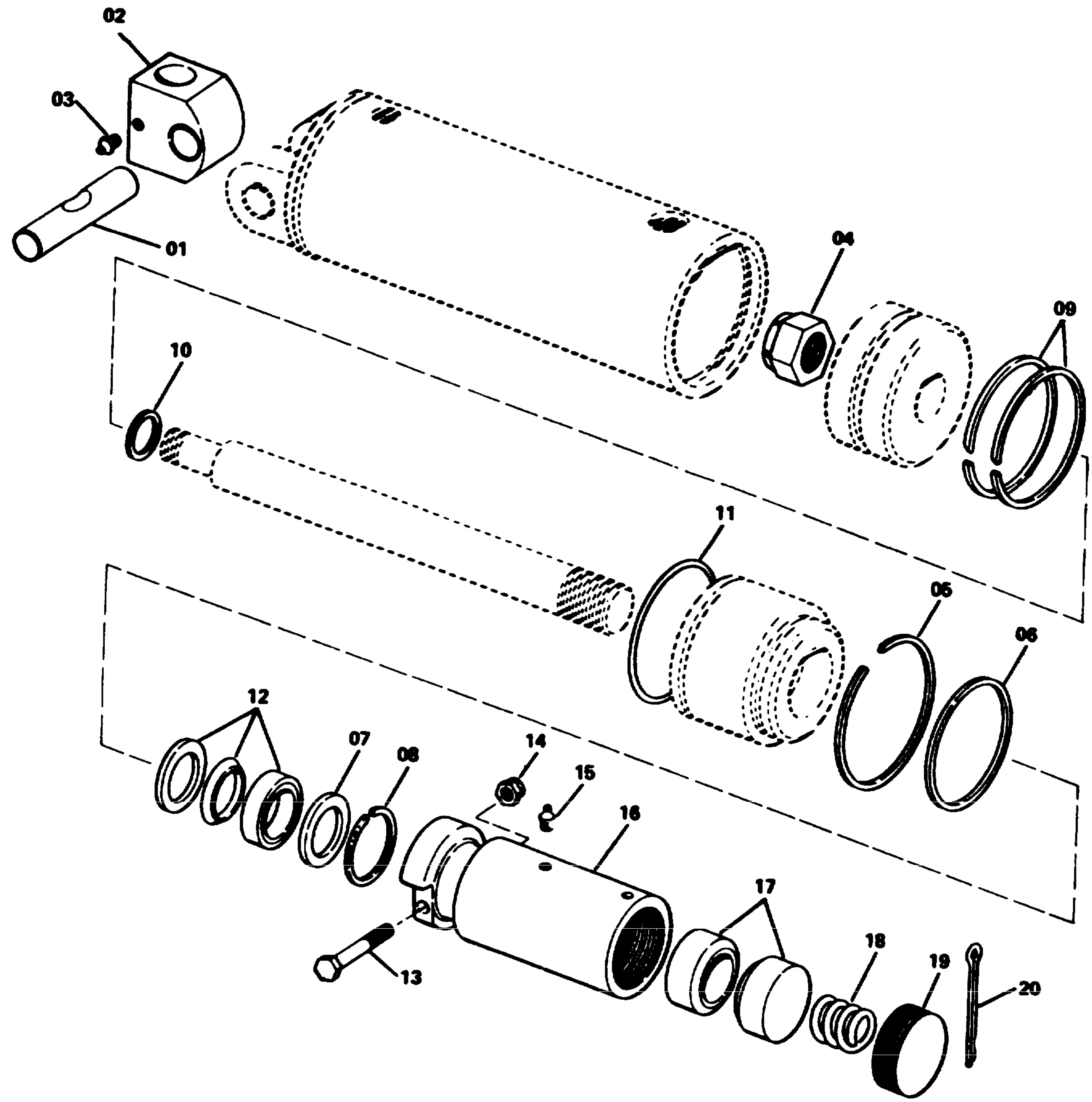


POWER STEERING VALVE ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number			
		-	6Z197D10	POWER STEERING VALVE ASSY	▼			
		01	1006Z643	.LINK, Steering	1			
		02	1032Z109	.CLAMP, Adapter	1			
		03		.SCREW, Hex hd. 1/2-20UNF x 2-3/4 in	1			
		04		.WASHER, Lock 1/2 in	1			
		05		.NUT, Hex 1/2-20UNF	1			
		06	1020Z2632	.ADAPTER	1			
		-	1045Z302	.KIT, Valve seal	1			
		07		..RING, Lock	1			
		08		..O-RING	2			
		09		..O-RING	2			
		10		..O-RING	2			
		11	1020Z2452	.NUT	2			
		12	1018Z2481	.WASHER, Flat	1			
		13	1018Z2483	.RING	2			
		14	1018Z2691	.SPACER	1			
		15	1018Z1842	.GLAND	1			
		16	1018Z1448	.RING, Retaining	1			
		17	1014Z482	.HOUSING, Valve	1			
		18	1014Z452	.SHIELD, Dust	1			
		19	1044Z322	.FITTING, Lube	1			
		20	1011Z309	.SOCKET, Ball	1			
		21	1025Z434	.BEARING	1			
		22	1036Z140	.SEAT, Ball	2			
		23	1017Z134	.SPRING	1			
		24	1018Z2480	.WASHER, Plug	1			
		25	1020Z2450	.PLUG	1			
		26	1021Z61	.PIN, Lock	1			
		27	1020Z2451	.PLUG, End	1			
		28		.PIN, Cotter 1/8 x 3 in	1			

Ref. Dwg. 6Z197D10

POWER STEERING CYLINDER

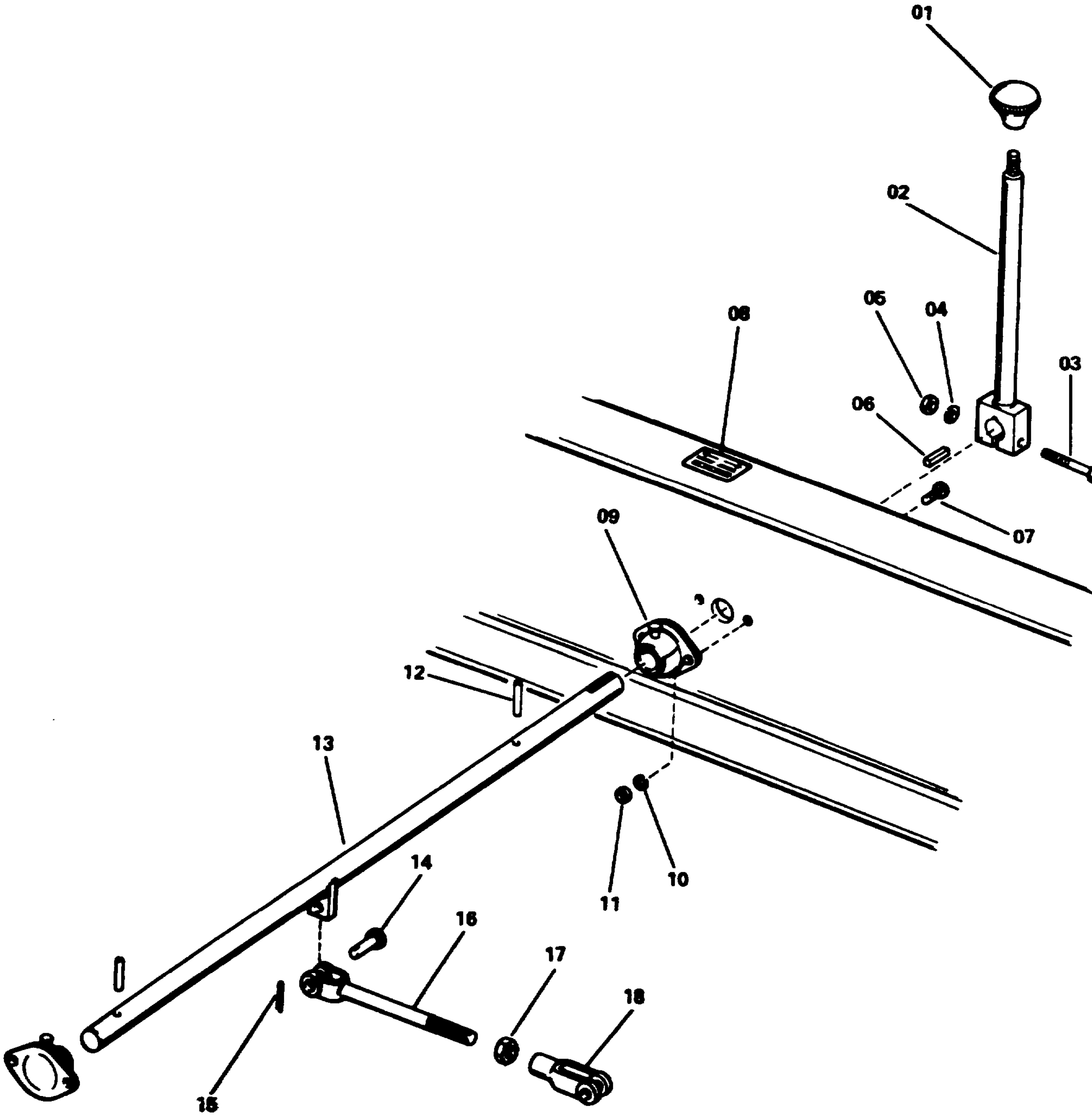


POWER STEERING CYLINDER (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 1			
		-	45Z265	CYLINDER ASSY, POWER STEERING	▼			
		01	1019Z181	.PIN	1			
		02	1018Z555	.BLOCK ASSY, Universal	1			
		03	1044Z242	.FITTING, Lube	1			
		-	45Z357D1	.CYLINDER, Steering	1			
		04	1020Z1113	..NUT	1			
		05	1018Z654	..RING, Snap	1			
		06	1018Z1844	..RING, Retaining	1			
		07	1018Z2287	..WASHER	2			
		08	1018Z2144	..RING, Snap	1			
		-	1045Z1029	..KIT, Seal	1			
		09		…RING, Piston	2			
		10		...SEAL, Cooper washer	1			
		11		…SEAL, O-ring	1			
		12		…SEAL ASSY, Rod	1			
		-	1010Z124	..BALL SOCKET ASSY, 1-3/4 in	1			
		13		…SCREW, Hex hd. cap 3/8-24UNF x 2 in. GR.8	1			
		14	1020Z4403	…NUT, Lock 3/8-24UNF	1			
		15	1044242	…FITTING, Lube	1			
		16	1010Z440	…BODY, Ball socket	1			
		17	1036Z92	…SEAT, Ball	2			
		18	1017Z265	…SPRING	1			
		19	1020Z2114	…PLUG	1			
		20		…PIN, Cotter 3/16 x 2-1/2 in	1			

Ref. Dwg. 45Z265

PUMP CONTROL ASSEMBLY

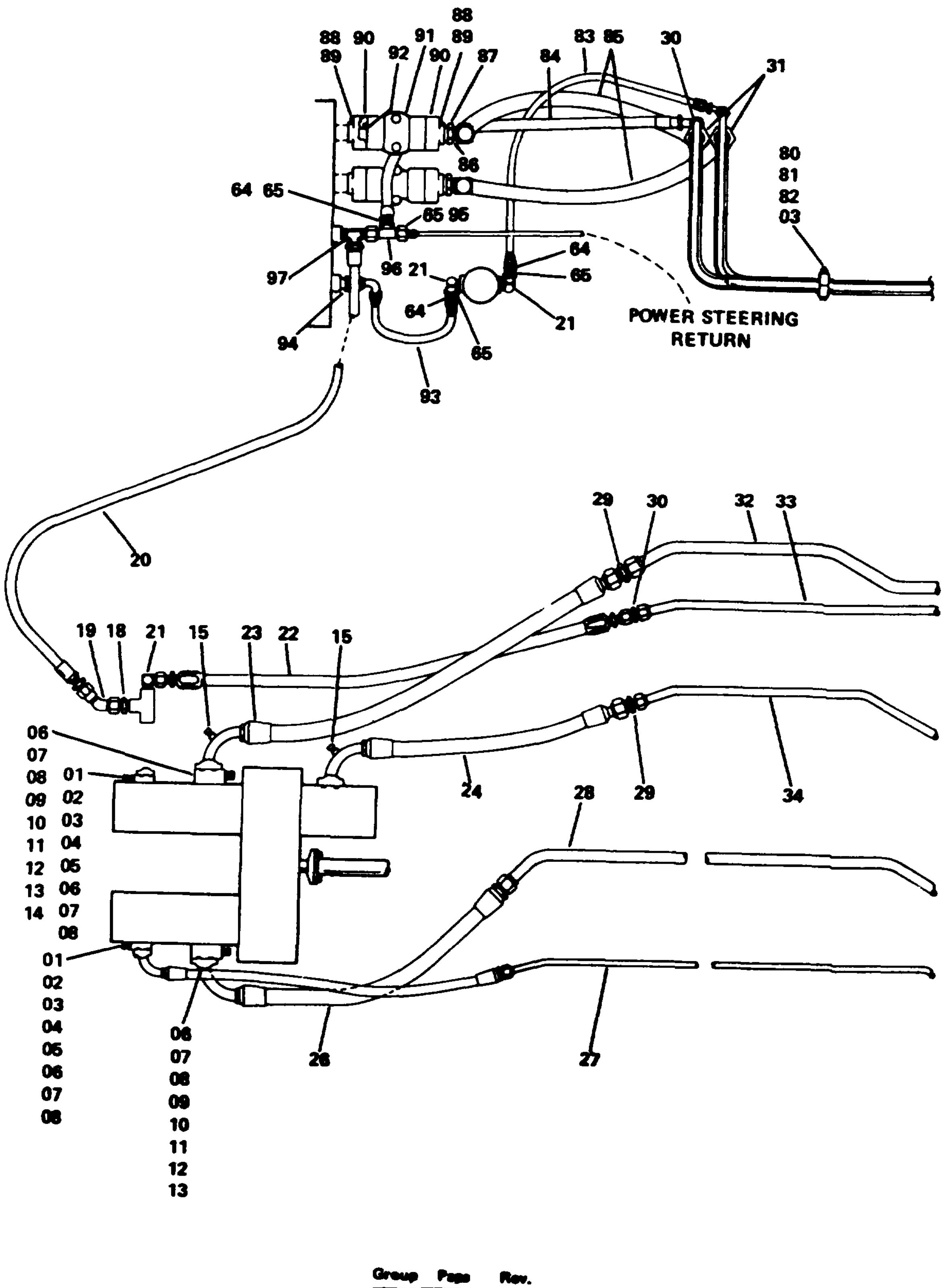


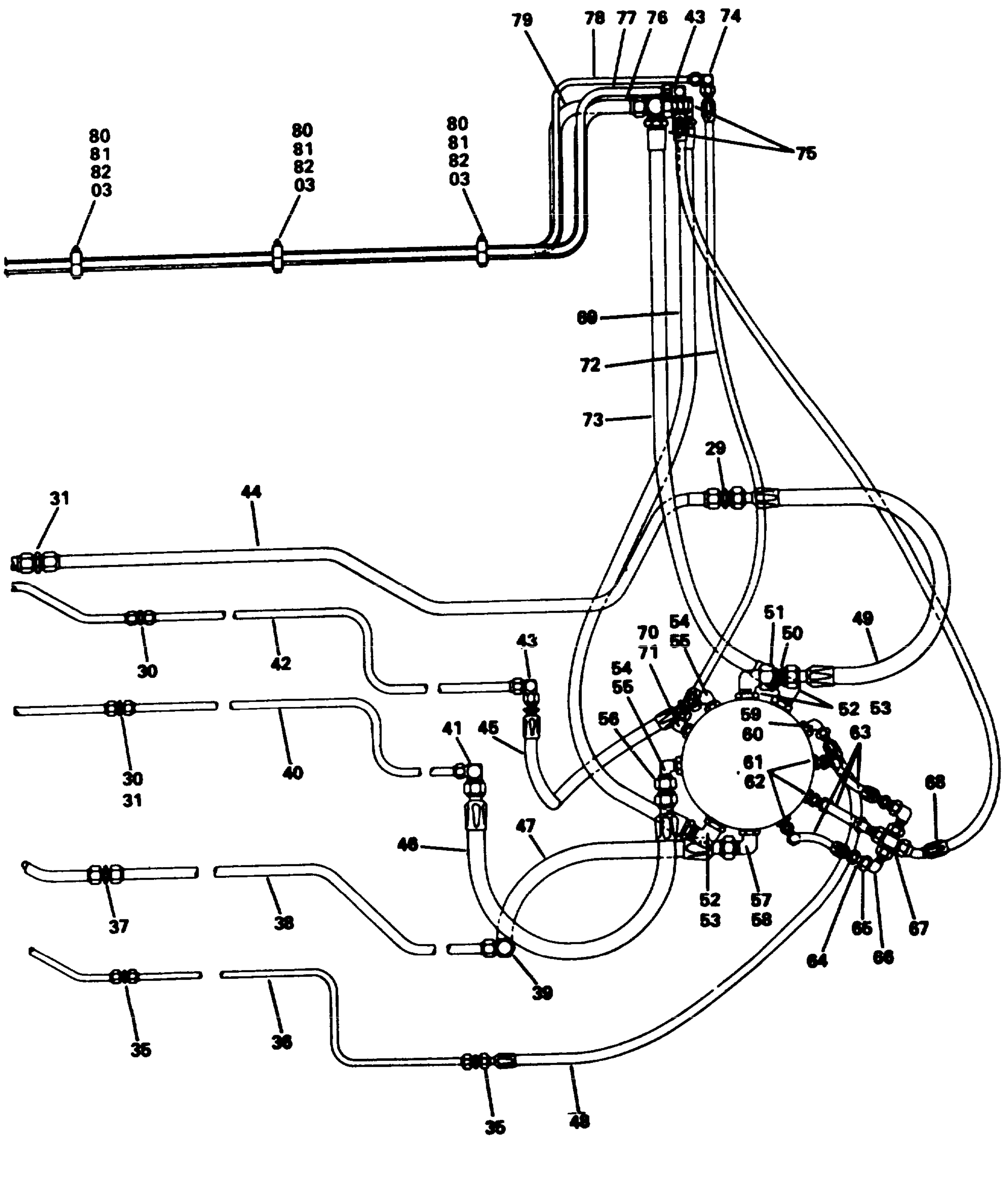
PUMP CONTROL ASSEMBLY (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 4			
		-	8100J0336-4	PUMP CONTROL ASSEMBLY	▼			
		01	6Z1	.BALL, Control lever	1			
		02	806T319	.LEVER, Pump engage - disengage	1			
		03		.SCREW, Hex hd. 5/16-18UNC x 1-1/2 in	1			
		04		.WASHER, Lock 5/16 in	1			
		05		.NUT, Hex 5/16-18UNC	1			
		06	20H1385D1	.KEY, 5/16 x 5/16 x 1 in. lg	1			
		07		.SCREW, Hex hd. 1/4-20UNC x 1-1/4 in	4			
		08	32Z1363	.DECAL, Engage - disengage	1			
		09	6Z353D4	.BEARING	2			
		10		.WASHER, Lock 1/4 in	4			
		11		.NUT, Hex 1/4-20UNC	4			
		12	19Z8D102	.PIN, Roll	2			
		13	806T318	.SHAFT, Pump lever	1			
		14	919T117-6	.PIN ASSEMBLY, Yoke	2			
		15		…PIN, Cotter 1/8 x 7/8 in	1			
		16	6Z502D1	.ROD, Control	1			
		17		.NUT, Hex jam 1/2-20UNF-2B	1			
		18	6Z131D6	.YOKE END, Female	1			

Ref. Dwg. 8100J0336 E
8100J0336-4

HYDRAULIC ASSEMBLY - FROM PUMPS TO SWIVEL AND RETURN

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QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3	4	5	6
		-	100J4193-3	HYDRAULIC ASSEMBLY - LOWER				
		-	100J4193-4	HYDRAULIC ASSEMBLY - LOWER				
		-	100J4193-5	HYDRAULIC ASSEMBLY - LOWER				
		-	100J4193-6	HYDRAULIC ASSEMBLY - LOWER				
		01	45Z91D150	.O-RING	1	1	1	1
		02	44Q26D3	.FLANGE, Split half	2	2	2	2
		03		.WASHER, Lock 3/8 in	12	12	12	12
		04	20Z646D52	.SCREW, Hex hd. 3/8-16UNC x 2-1/4 in Gr. 5	4	4	4	1
		05	36P12	.BLOCK, Valve 1 in	1	1	1	3
		06	44Z485D7	.CONNECTOR, O-ring	3	3	3	1
		07	45Z91D52	..O-RING	1	1		3
		08	44Z511D3	.CAP, 3/8 in	3	3	3	3
		09	45Z91D59	.O-RING	4	3	4	6
		10	44Q26D4	.FLANGE, Split half	6	6	6	12
		11		.WASHER, Lock 7/16 in	12	12	12	4
		12	20Z646D66	.SCREW, Hex hd. 7/16-14UNC x 2-1/4 in. Gr. 5	8	4	8	1
		13	36P45	.BLOCK, Valve	2	1	2	8
		14	20Z646D62	.SCREW, Hex hd. 7/16-14UNC x 1-1/4 in. Gr. 5	4	8	4	-
		15	44Z1010D2	.PLUG, Pipe 1/4 in	1	-	1	1
		16	44Z536D4	.PLUG, O-ring	1	1	1	1
		17	45Z91D52	..O-RING	1	1	1	1
		18	44Z590D20	.CONNECTOR, Male	1	1	1	1
		19	44Z472D10	.ELBOW, 45° swivel	1	1	1	1
		20	44P47D14	.HOSE ASSY., Telescope relief	1	1	1	1
		21	44Z591D14	.ELBOW, 90°	3	3	3	3
		22	44P102D4	.HOSE ASSY., Telescope	1	1	1	1
		23	44P1054D10	.HOSE ASSY., Main winch	1	-	1	-
		23	44P1054D9	.HOSE ASSY., Main winch	-	1	-	1
		24	44P1054D8	.HOSE ASSY., Auxiliary winch	1	1	1	1
		25	44P391D1	.HOSE ASSY., Swing	1	1	1	1
		26	44P388D4	.HOSE ASSY., Hoist	1	-	1	-
		26	44P388D1	.HOSE ASSY., Hoist	-	1	-	1
		27	18P4211	.HOSE ASSY., Swing	1	-	1	-
		27	18P3853	.HOSE ASSY., Swing	-	1	-	1
		28	18P4211	.HOSE ASSY., Hoist	1	-	1	-
		28	18P3852	.HOSE ASSY., Hoist	-	1	-	1
		29	44Q44D31	.UNION, Tube	1	1	-	-
		29	44Q44D34	.UNION, Tube	2	2	3	3
		30	44Q44D28	.UNION, Tube	3	3	2	2
		31	44Q44D35	.UNION, Tube	3	3	4	4
		32	18P4205	.TUBE ASSY., Main winch	1	-	1	-
		32	18P3856	.TUBE ASSY., Main winch	-	1	-	1
		33	18P4204	.TUBE ASSY., Telescope	1	-	1	-
		33	18P3855	.TUBE ASSY., Telescope	-	1	-	1
		34	18P4210	.TUBE ASSY., Auxiliary winch	1	-	-	-
		34	18P3854	.TUBE ASSY., Auxiliary winch	-	1	-	-
		34	18P4369	.TUBE ASSY., Auxiliary winch	-	-	1	-
		34	18P4368	.TUBE ASSY., Auxiliary winch	-	-	-	1
		35	44Q44D24	.UNION, Tube	2	2	2	2
		36	44P375	.TUBE ASSY., Swing	1	1	1	1

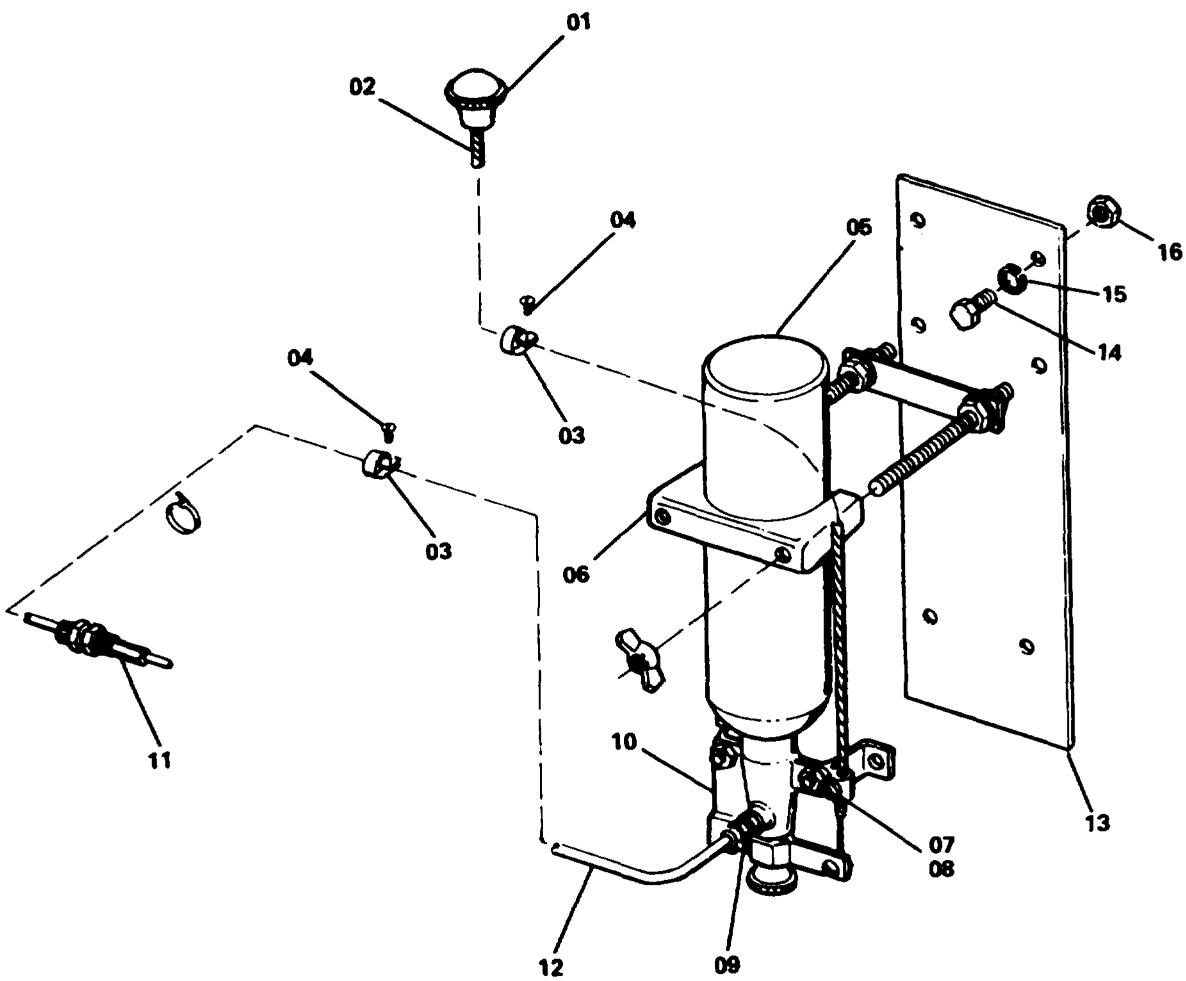
HYDRAULIC ASSEMBLY - FROM PUMPS TO SWIVEL AND RETURN (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3	4	5	6
		37	44Q44D32	.UNION, Tube	1	1	1	1
		38	44P372	.TUBE ASSY., Hoist	1	1	1	1
		39	44Q47D26	.ELBOW, 90° union	1	1	1	1
		40	44P1352	.TUBE ASSY., Auxiliary winch	1	1	-	-
		40	44P1518	.TUBE ASSY., Auxiliary winch	-	-	1	1
		41	44Q47D25	.ELBOW, 90° union	1	1	-	-
		41	44Q47D27	.ELBOW, 90° union	-	-	1	1
		42	44P806	.TUBE ASSY., Telescope	1	1	1	1
		43	44Q47D22	.ELBOW, 90° union	2	2	2	2
		44	44P1353	.TUBE ASSY., Main winch	1	1	1	1
		45	44P102D1	.HOSE ASSY., Telescope	1	1	1	1
		46	44P1055D13	.HOSE ASSY., Auxiliary winch	1	1	1	1
		47	44P395D1	.HOSE ASSY., Hoist	1	1	1	1
		48	44P400D1	.HOSE ASSY, Swing	1	1	1	1
		49	44P1055D3	.HOSE ASSY, Main winch	1	1	1	1
		50	44Z492D19	.REDUCER, Tube 1-1/2 x 1-1/4 in. JIC	1	1	1	1
		51	20Z649D12	.NUT, Tube 1-1/2 in. JIC	1	1	1	1
		52	44Z421D12	.ELBOW 90° O-ring	3	3	3	3
		53	45Z91D174	..O-RING	1	1	1	1
		54	44Z421D10	.ELBOW, 90 O-ring	2	2	2	2
		55	45Z91D172	..O-RING	1	1	1	1
		56	44Z1417D7	.EXPANDER, Tube	1	1	1	1
		57	44Z421D11	.ELBOW 90° O-ring	1	1	1	1
		58	45Z91D173	..O-RING	1	1	1	1
		59	44Z421D8	.ELBOW 90° O-ring	1	1	1	1
		60	45Z91D165	..O-RING	1	1	1	1
		61	44Z485D16	.CONNECTOR, O-ring	3	3	3	3
		62	45Z91D165	..O-RING	1	1	1	1
		63	44P502D3	.HOSE ASSY., Winch, swing brake and motor drain	3	3	3	3
		64	44Z492D8	.REDUCER, Tube	6	6	6	6
		65	20Z649D10	.NUT, Tube	7	7	7	7
		66	44Z473D10	.ELBOW, Swivel	3	3	3	3
		67	44Z589D9	.CROSS, Union	1	1	1	1
		68	44P265D5	.HOSE ASSY., Drain line	1	1	1	1
		69	44P60D9	.HOSE ASSY., Hoist and main winch return	1	1	1	1
		70	44Z421D14	.ELBOW 90° O-ring	1	1	1	1
		71	45Z91D172	..O-RING	1	1	1	1
		72	44P252D16	.HOSE ASSY., Swing return	1	1	1	1
		73	44P60D12	.HOSE ASSY., Auxiliary winch and telescope return	1	1	1	1
		74	44Q47D17	.ELBOW, 90° union	1	1	1	1
		75	44Q47D28	.ELBOW, 90° union	2	2	2	2
		76	44P382D1	.TUBE ASSY., Auxiliary winch and telescope return	1	1	1	1
		77	44P384	.TUBE ASSY., Drain line	1	1	1	1
		78	44P383	.TUBE ASSY., Swing return	1	1	1	1
		79	44P382D2	.TUBE ASSY., Hoist and main winch return	1	1	1	1
		80	16Z254	.SUPPORT, Tube	4	4	4	4
		81		.SCREW, Hex hd. 3/8-16UNC x 3-3/4 in	8	8	8	8
		82			8	8	8	8
		83	44P392D1	.HOSE ASSY., Swing return	1	1	1	1
		84	44P48D4	.HOSE ASSY., Drain line	1	1	1	1

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 3	4	5	6
		85	44P60D8	.HOSE ASSY., Hoist, telescope, main and aux. return	2	2	2	2
		86	44Z591D22	.ELBOW, 90°	2	2	2	2
		87	44Z826D20	.REDUCER, Pipe	2	2	2	2
		88		.SCREW, Socket hd. 1/2-13UNC x 2 in	16	16	16	16
		89		.WASHER, Lock 1/2 in	16	16	16	16
		90	44Q28D6	.FLANGE, Adapter	4	4	4	4
		91	46Z80D1	.FILTER, Hydraulic oil	2	2	2	2
		-	1045Z324	..ELEMENT	1	1	1	1
		92	45Z91D84	.O-RING	4	4	4	4
		93	44P502D6	.HOSE ASSY., Oil cooler to tank	1	-	1	-
		93	44P502D4	.HOSE ASSY., Oil cooler to tank	-	1	-	1
		94	44Z590D22	.CONNECTOR, Male	1	1	1	1
		95	44Z492D9	.REDUCER, Tube 1 in. x 1/2 in	1	1	1	1
		96	44Z487D10	.TEE, Swivel run	1	1	1	1
		97	44Z650D10	.TEE, Pipe run	1	1	1	1

Ref. Dwg. 100J4193 L
100J4193-3-6

ETHER STARTING AID ASSEMBLY



Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number 2			
		-	8100N0528-2	EITHER STARTING AID ASSEMBLY	▼			
		01	6U12D4	.KNOB, Control cable	1			
		02	6Z424D96	.CABLE, Control	1			
		03	32Z332D1	.CLAMP, Cable	4			
		04	20Z40D13	.SCREW, Self tapping #10 x 3/8 in	4			
		-	35Z19	.KIT, Starting aid	1			
		05		..CYLINDER	1			
		06		..CLAMP ASSEMBLY	1			
		07		..STOP, Cable	1			
		08		..SCREW, Cable stop	1			
		09		..FITTING, Straight	1			
		10		..VALVE, Measured shot	1			
		11		..ATOMIZER	1			
		12		..TUBE, Nylon 48 in. lg	1			
		13	816T1193	.PLATE, Cylinder mounting	1			
		14		.SCREW, hex hd. 1/4-20UNC x 1 in	2			
		15		.WASHER, Lock 1/4 in	2			
		16		.NUT, Hex 1/4-20UNC	2			

Ref. Dwg. 8100N0528
8100N0528-2

EDITING SECTION E

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ATTACHMENT

GROUP TWO
BASIC UPPER

GROUP THREE
CARRIER

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GROUP FOUR
POWER PLANT

EDITING SECTION F

GROUP ONE
ATTACHMENT

GROUP TWO
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GROUP THREE
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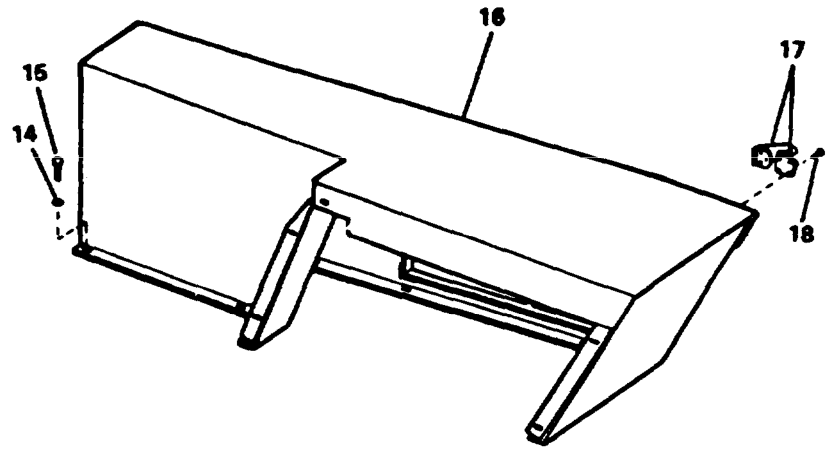
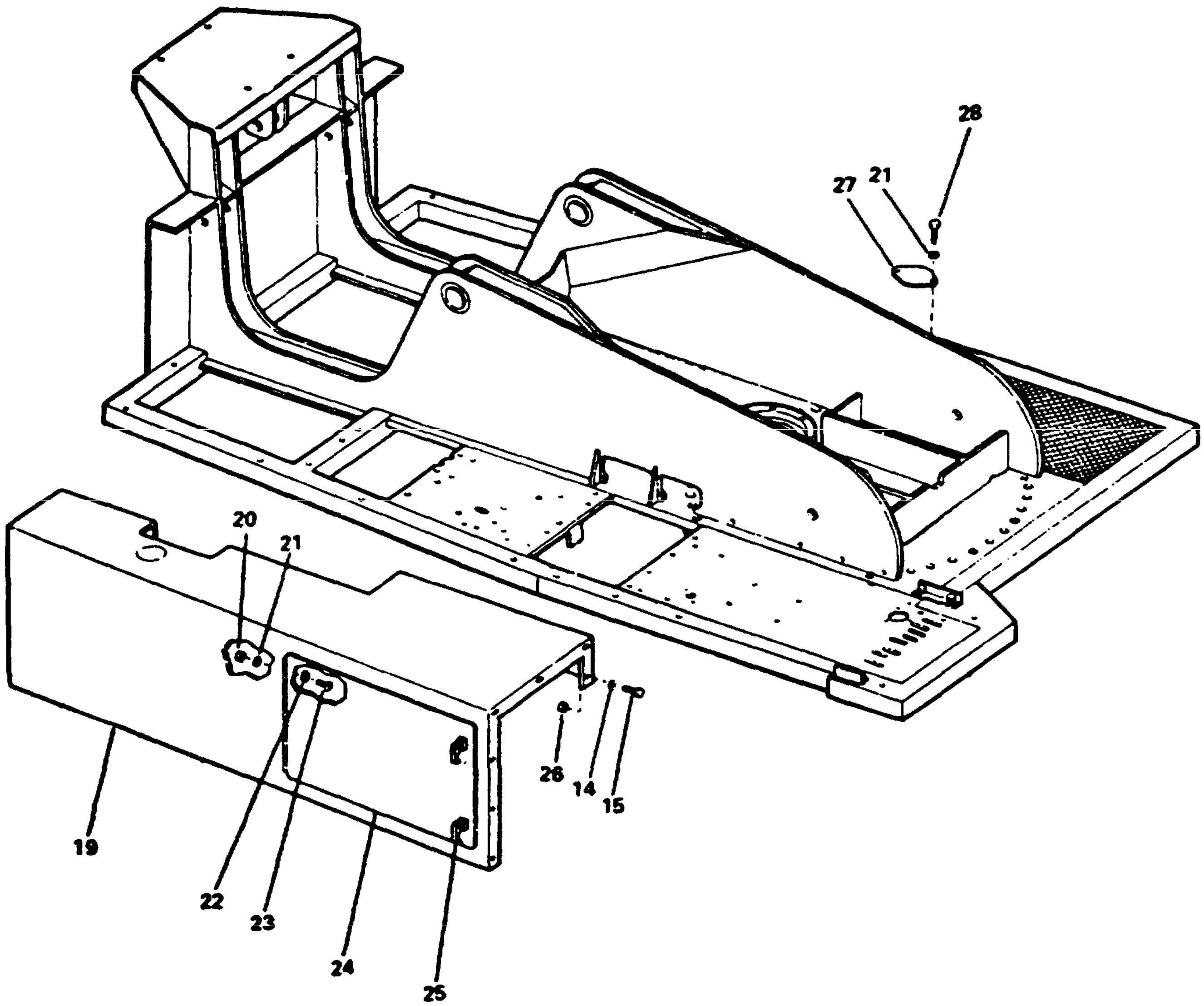
POWER PLANT

GUARDS AND COVERS





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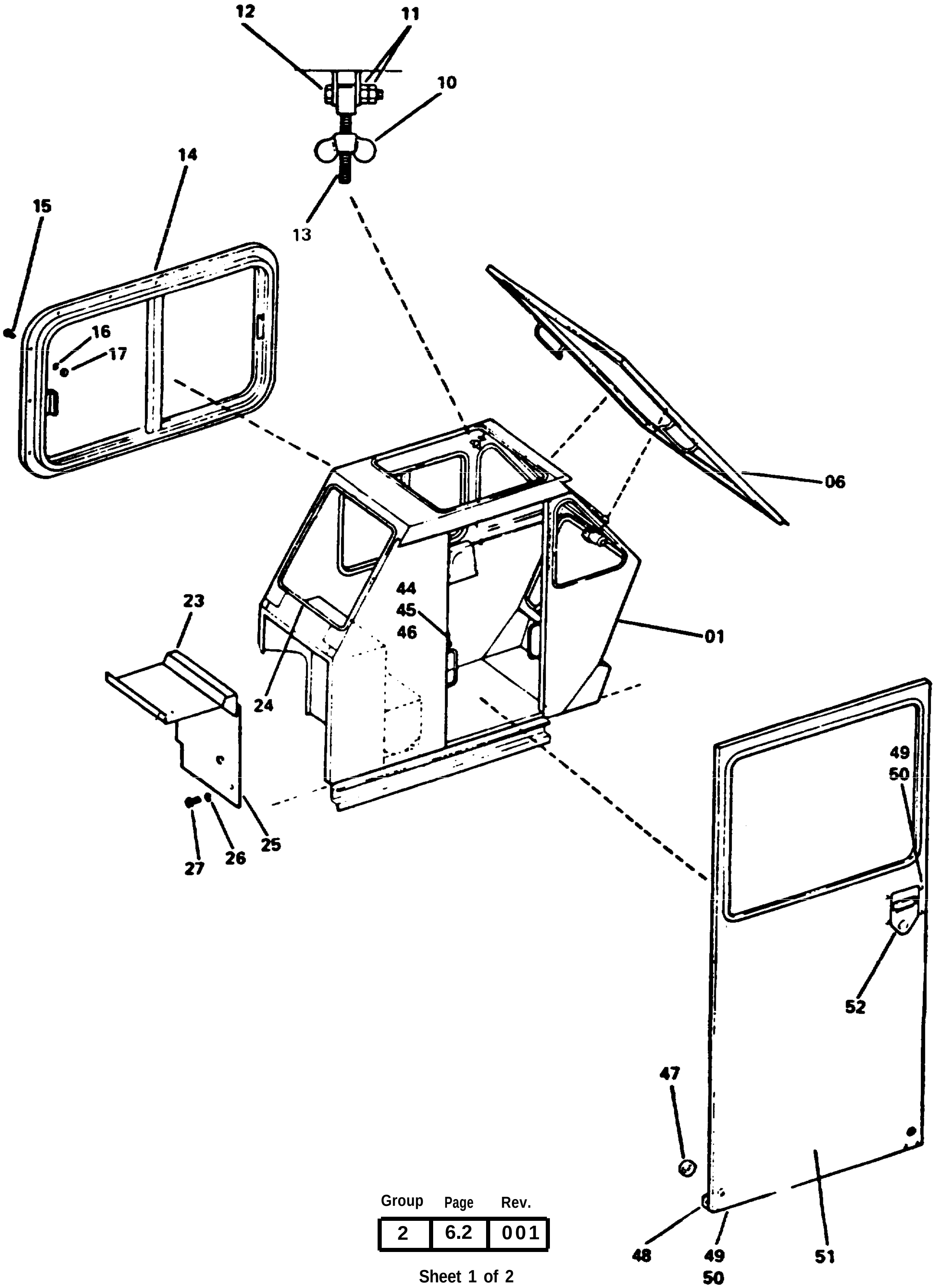
GUARDS AND COVERS

REF	PART NUMBER	DESCRIPTION	QUANTITY FIGURE NUMBER		
			1		
--	927J184-1	GUARDS AND COVERS			
--		.Items 01 thru 13 NOT USED	--		
14		.WASHER, Lock 3/8 in.	46		
15		.SCREW, Hex hd cap 3/8-16unc X1 in.	46		
16	27J1182	.COVER, L. H.	1		
17	20Z805	.HASP, Hinged safety	1		
18	20Z709D1	.SCREW, Self-tapping #10	7		
19	27J1554	.COVER, R. H.	1		
20		.NUT, Hex 1/4-20UNC	11		
21		.WASHER, Lock 1/4 in.	10		
22		.WASHER, Flat 1/4 in.	8		
23		.SCREW, Truss hd 1/4-20UNC X 5/8 in.	11		
24	27N2368	.DOOR	2		
25	32Z1132	FASTENER, Adjustable pawl	4		
26		.NUT, Hex 3/8-16UNC	7		
27	14T1531	.COVER	1		
28		.SCREW, Rd hd mach 1/4-20unc X 5/8 in.	2		



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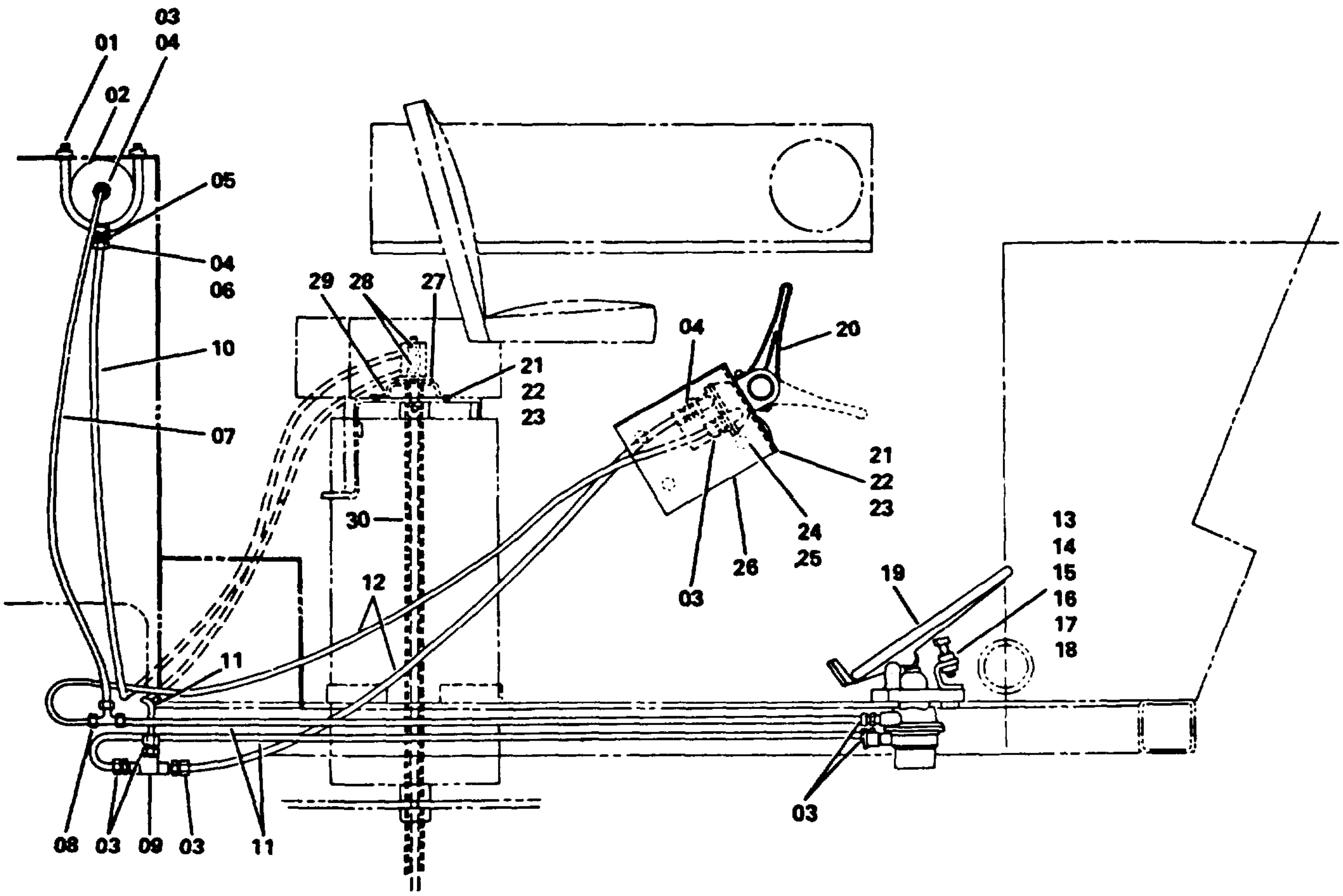
CAB, OPERATOR'S

REF	PART NUMBER	DESCRIPTION	QUANTITY FIGURE NUMBER 1		
--	927J61-3	CAB, OPERATOR	▼		
01	27J967D2	.CAB, Operator's	1		
--		.Items 02 thru 05 NOT USED	--		
06	27J966	.FRAME, Removable front window	1		
--		.Items 07 thru 09 NOT USED	--		
10	20H1686D2	.NUT, Wing	4		
11		.NUT, Hex 1/4-20UNC X 1 1/4 in.	8		
12		.SCREW, Hex hd cap 1/4-20unc X 1 1/4 in.	4		
13	27T1576	.SCREW, Window	4		
14	1014Z1279	.FRAME, L. H. Sliding window	1		
15		.SCREW, Rd. hd mach #10-24UNC X 1/2 in.	16		
16		.WASHER, Lock #10	16		
17		.NUT, Hex #10-24UNC	16		
--		.Items 18 thru 22 NOT USED	--		
23	27P2371	.COVER, Removable top	1		
24	27Z385	.CHANNEL, Window	AR		
25	27P2883D2	.COVER, Rear compartment	1		
26		.WASHER, Heavy duty slat 3/8 in.	6		
27		.SCREW, Hex hd cap 3/8-16UNC X 3/4 in.	6		
--		.Items 28 thru 43 NOT USED	--		
44		.SCREW, Hex hd cap 5/16-18UNC X 11 in.	4		
45		.WASHER, Lock 5/16 in.	4		
46		.NUT, HEX 5/16-18UNC	4		
47	27T1569	.ROLLER, Door	2		
48	27T1570	.KEEPER, Door	2		
49		.SCREW, Hex hd cap 1/4-20UNC X 1/2 in.	8		
50		.WASHER, Lock 1/4 in.	8		
51	27J965	.DOOR ASSEMBLY	1		
52	27P2310	.LOCK ASSY., Door	1		

UPPER AIR THROTTLE ASSEMBLY



UPPER AIR THROTTLE ASSEMBLY (Continued)

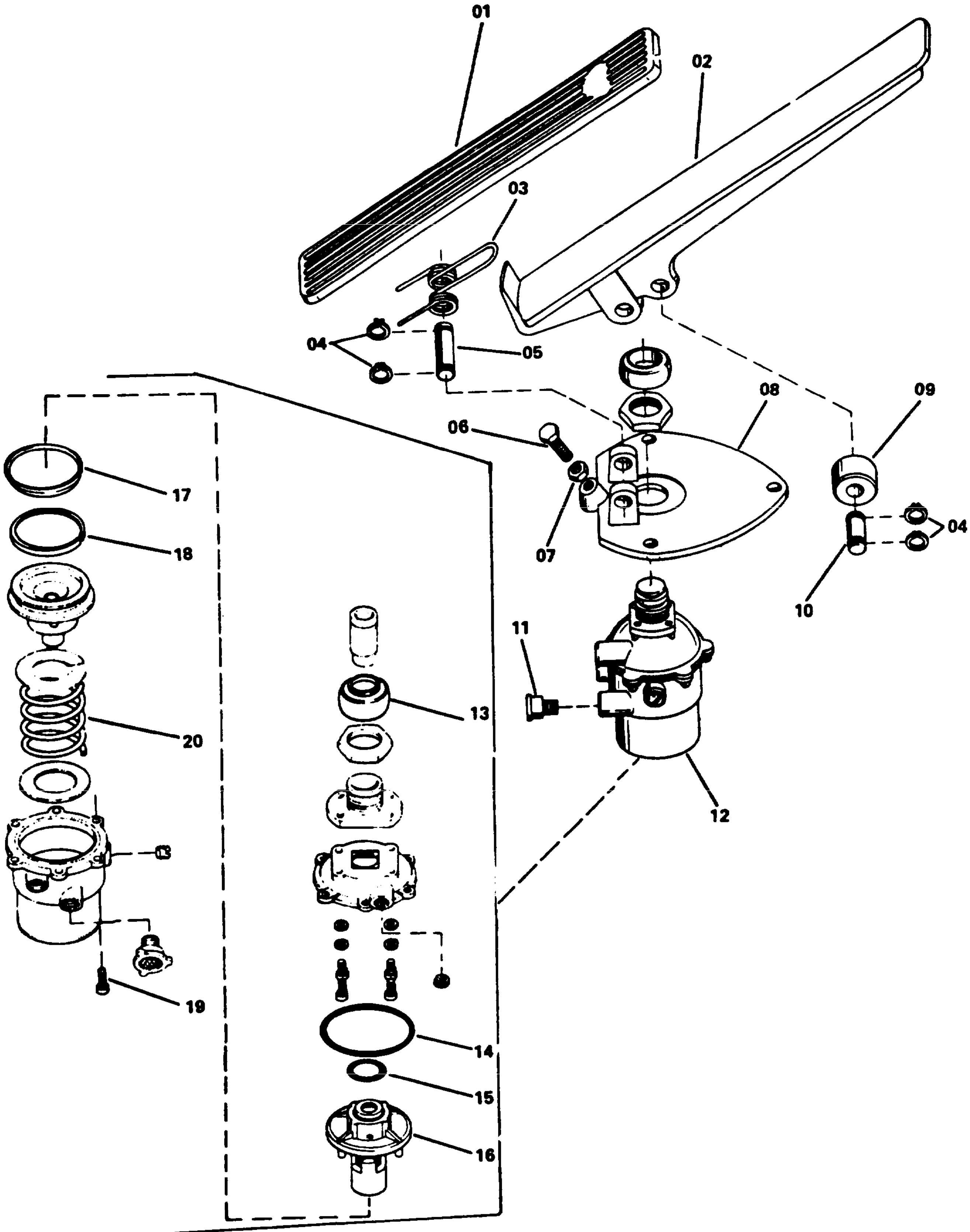
QTY	STOCK	REF	PART NUMBER	DESCRIPTION	QUANTITY FIGURE NUMBER 10	7	
		--	100X131-10	AIR THROTTLE ASSY., FOOT CONTROL	▼		
		--	100X131-7	AIR THROTTLE ASSY., HAND CONTROL		▼	
		01	32Z171D11	.CLAMP, Air tank mounting	1	--	
		02	27Z558	.TANK. Air	1	--	
		03	44Z1322D1	.FITTING, Straight	6	4	
		04	44Z1320D1	.ELBOW, 90°	3	--	
		05	36Z39	.COCK, Tank drain	1	--	
		06	36Z872	.VALVE, Single check	1	--	
		07		.TUBEM Nylon 3 ft. lg.	1	--	
		08	44Z1422D1	.TEE, Fitting	--	1	
		09	36Z763	.VALVE, Shuttle	--	1	
		09	44Z1466D2	.UNION, Tube	2	--	
		10		.TUBE, Nylon 8 ft.	1	--	
		11		.TUBE, Nylon 5 ft.	3	--	
		12		.TUBE, Nylon 4 ft.	--	2	
		13	16T4971	.BRACKET, Foot throttle stop	1	--	
		14		.SCREW, Hex hd. 5/16-18UNC X 1 in.	3	--	
		15		.WASHER, Lock 5/16 in.	3	--	
		16		.NUT, Hex 5/16-18UNC	3	--	
		17		.NUT,Hex jam 3/18-16UNC	1	3	
		18		.SCREW, Hex hd. 3/8-16UNC X 1 in.	1	--	
		19	36U29D4	.VALVE, Air throttle (Page 11.2)	1	--	
		20	36U54D1	.VALVE, Hand throttle (Page 12.1)	--	1	
		21		.SCREW, Hex hd. 1/4-20UNC X 3/4 in.	6	4	
		22		.WASHER, Lock 1/4 in.	6	4	
		23		.NUT, Hex 1/4-20UNC	6	4	
		24		.SCREW, Hex hd. 3/8-16UNC X 3/4 in.	--	3	
		25		.WASHER, Lock 3/8 in.	--	3	
		26	16N1830	.BRACKET, Hand throttle valve	--	1	
		27	18Z2288	.WASHER, Thrust	1	--	
		28	44Z1322D3	.FITTING, Straight	2	--	
		29	16P3666	.BRACKET, Air swivel	1	--	
		30	45Q9D2	.SWIVEL ASSY., Air	1	--	
		--	1045Z1357	..KIT, Seal	1	--	

NOTE

The nylon tubing called for on this assembly is part number 20Z1411D2. When ordering nylon tubing you MUST specify, in feet, the length required.

Ref. Dwg. 100X131 AH
100X131-10
100X131-7

AIR THROTTLE PEDAL AND VALVE ASSEMBLY

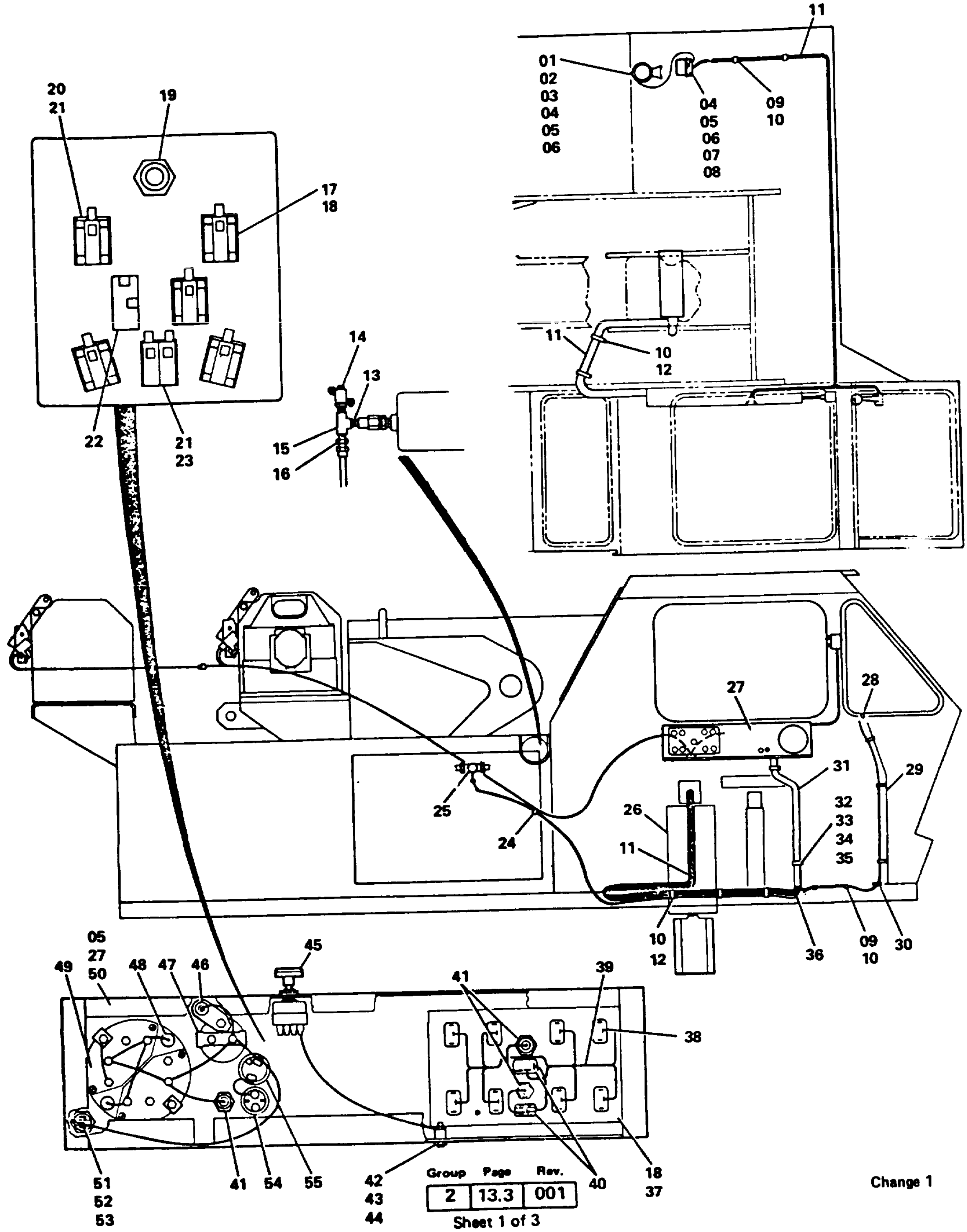


AIR THROTTLE PEDAL AND VALVE ASSEMBLY (Continued)

QTY	STOCK	REF	PART NUMBER	DESCRIPTION	QUANTITY FIGURE NUMBER D4		
		--	36U29D4	AIR THROTTLE PEDAL AND VALVE ASSY.	▼		
		01	1014Z1372	.COVER, Treadle	1		
		02	1006Z509	.TREADLE	1		
		03	1017Z873	.SPRING	1		
		04	1018Z4078	.RING, Retaining	1		
		05	1019Z838	.PIN, Treadle	4		
		06	1020Z5009	.SCREW, Cap	1		
		07	1020Z4068	.NUT, Jam	1		
		08	1016Z395	.PLATE, Treadle mounting	1		
		09	1013Z221	.ROLLER	1		
		10	1019Z837	.PIN, Push rod	1		
		11	1046Z252	.BREATHER	1		
		12	1036Z735	.VALVE ASSEMBLY	1		
		--	1045Z1402	..KIT,Valve repair	1		
		13		…BOOT, Dust	1		
		14		…O-RING	1		
		15		…O-RING	1		
		16		…PLATE ASSEMBLY, Barrier	1		
		17		…U-CUP	1		
		18		…RING, Thrust	1		
		19		…SCREW, Machine	6		
		20	1017Z869	..SPRING, Balance	1		

Ref. Dwg. 36U29D4

UPPER ELECTRICAL ASSEMBLY



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Change 1

AIR THROTTLE PEDAL AND VALVE ASSEMBLY (Continued)

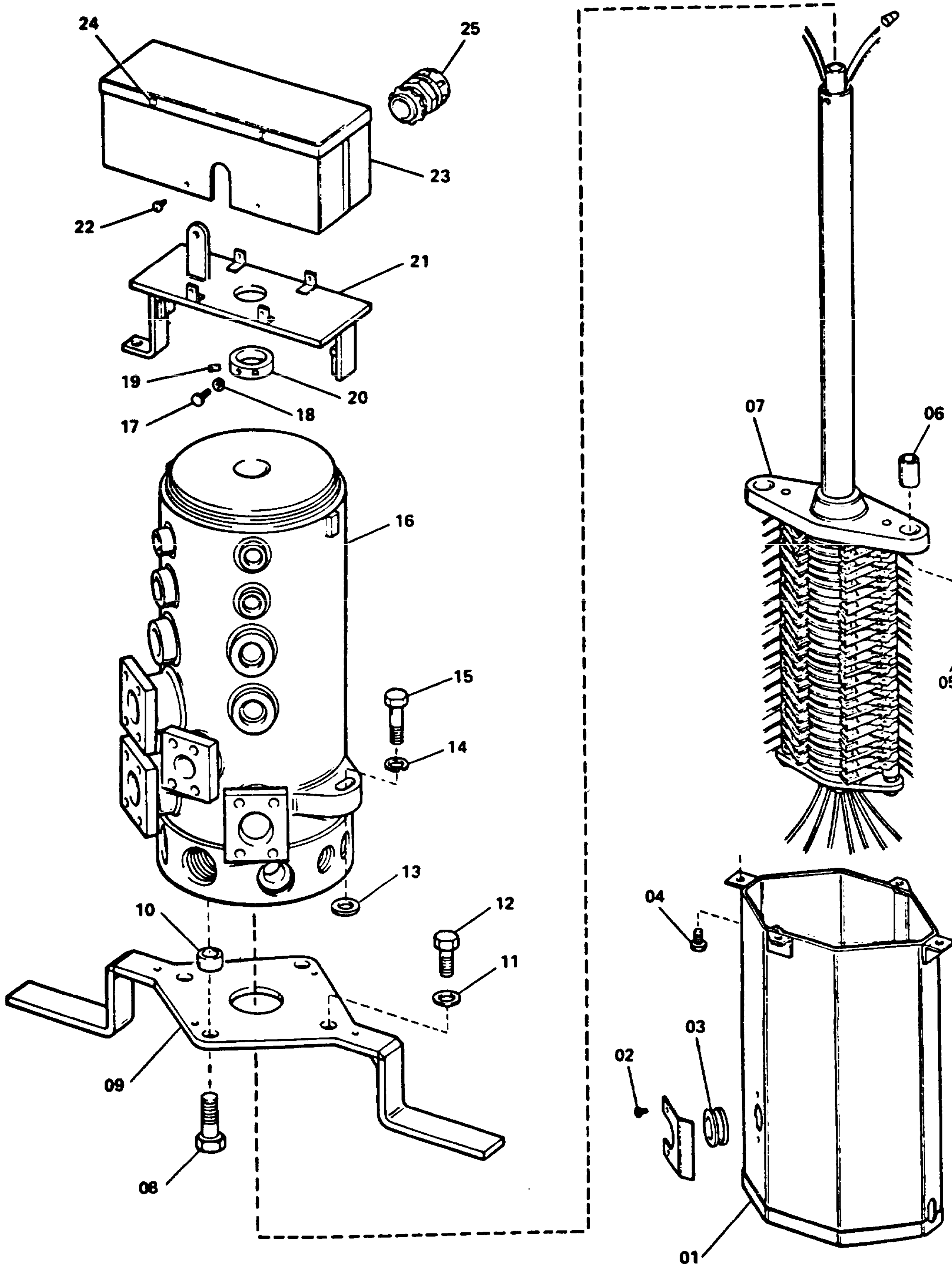
QTY	STOCK	REF	PART NUMBER	DESCRIPTION	QUANTITY FIGURE NUMBER				
					71	72	14	15	38
		--	100X139-71	ELECTRICAL ASSY., BASIC UPPER					
		--	100X139-72	ELECTRICAL ASSY., BASIC UPPER					
		--	100X139-14	ELECTRICAL ASSY., REMOTE CONTROL CARRIER					
		--	100X139-15	ELECTRICAL ASSY., REMOTE CONTROL CARRIER					
		--	100X139-38	ELECTRICAL ASSY., ENGINE WARNING					
		01	47Z23D5	.HORN,Signal	1	1	--	--	--
		02	16Z165D2	.BRACKET, Horn mounting	1	1	--	--	--
		03	20Z1040D1	.NUT, Horn mounting	1	1	--	--	--
		04		.SCREW, Hex hd. 1/4-20UNC X 3/4 in.	3	3	--	--	--
		05		.WASHER, Lock 1/4 in.	14	14	--	--	--
		06		.NUT, Hex 1/4-20UNC	5	5	--	--	--
		07		.SCREW, Rd, hd. mach. 1/4-20UNC X 1 in.	2	2	--	--	--
		08	79Z2368	.RELAY	1	1	--	--	--
		09	32Z423D14	.HANGER, Cable	8	8	--	--	--
		10	20Z1282D1	.FASTENER, Self drilling	11	11	--	--	--
		11	79R2	.HARNESS, Upper main	1	1	--	--	--
		11	79Q293	.HARNESS, Upper main remote control	--	--	1	1	--
		12	32Z423D12	.HANGER, Cable	5	5	--	--	--
		13		.NIPPLE, Close 1/4 X 7/8 in. lg.	--	--	1	1	--
		14	79Z51D1	.SWITCH, Low air pressure	--	--	1	1	--
		15		.TEE, Pipe 1/4 in.	--	--	1	1	--
		16	44Z1322D1	.FITTING, Str. 1/4 tube X 1/4 N.P.T.	--	--	1	1	--
		17	32U671D3	.PANEL, Carrier remote control	--	--	1	1	--
		18	20Z40D13	.SCREW, Self tapping	6	6	4	4	--
		19	56Z160	.LIGHT, Indicator	--	--	1	1	--
		20	79Z2419D1	.BLOCK, Contact	--	--	5	5	--
		21	79Z2418D2	.MODULE, Operator	--	--	6	6	--
		22	79Z2400D1	.SWITCH, Toggle	--	--	1	1	--
		23	79Z2419D2	.BLOCK, Contact	--	--	1	1	--
		24	32Z890D3	.CLAMP, Tie wrap	5	5	--	--	--
		25	89Z154	.SENDING UNIT, Hydraulic oil temp	1	1	--	--	--
		26	979J49-2	.SWIVEL & COLLECTOR RING ASSY. (Page 15.1)	1	--	--	--	--
		26	979J49-1	.SWIVEL & COLLECTOR RING ASSY. (Page 14.2)	--	1	--	--	--
		26	979J30-2	.SWIVEL & COLLECTOR RING ASSY. (Page 14.1)	--	--	1	--	--
		26	979J30-4	.SWIVEL & COLLECTOR RING ASSY. (Page 14.1)	--	--	--	1	--
		27	16N1657D3	.PANEL, Upper instrument	1	1	1	--	--
		27	16N1657D4	.PANEL, Upper instrument	--	--	--	1	--
		28	79Z1586	.SWITCH, Push button signal horn	1	1	--	--	--
		29	32Z890D4	.CLAMP, Tie wrap	3	3	1	1	--
		30	20F179D7	.GROMMET	1	1	--	--	--
		31	87T15	.CONDUIT	1	1	--	--	--
		32		.CLAMP, Conduit	2	2	--	--	--
		33		.SCREW, Hex hd. 3/8-16UNC X 1/2 in.	2	2	--	--	--
		34		.WASHER, Lock 3/8 in.	2	2	--	--	--
		35		.NUT, Hex 3/8-16UNC	2	2	--	--	--
		36	87Z221D1	.BUSHING, Snap in.	2	2	--	--	--
		37	32U896	.PANEL, Outrigger control	1	--	--	--	--
		37	32U672D1	.PANEL, Outrigger control		1	--	--	--
		38	79Z2400D5	.SWITCH, Outrigger control toggle	8	8	--	--	--
		39	79Z2412	.HARNESS, Upper outrigger power	1	1	--	--	--

AIR THROTTLE PEDAL AND VALVE ASSEMBLY (Continued)

QTY	STOCK	REF	PART NUMBER	DESCRIPTION	QUANTITY FIGURE NUMBER 71	72	14	15	38
		40	79Z2400D1	.SWITCH, Winch speed, outrigger on-off & lock	2	1	--	--	--
		41	56Z63	.LIGHT, Outrigger and ignition indicator	3	2	--	--	--
		42	16Z408	.INSULATOR	1	1	--	--	--
		43		.WASHER, Lock #10	2	2	--	--	--
		44		.NUT, Hex #10-32UNF	2	2	--	--	--
		45	1079Z1510	.SWITCH, Windshield wipe control	1	1	--	--	--
		46	56Z240D1	.LIGHT, Oil temp, gauge	1	1	--	--	--
		47	89Z238	.GUAGE, Oil temp	1	1	--	--	--
		48	56Z142	.LIGHT, Gauge cluster	2	2	--	--	--
		49	89Z296	.CLUSTER, Guage	1	1	--	--	--
		--	1089Z100	..GAUGE, Oil and volt	1	1	--	--	--
		--	1089Z101	..GAUGE, Fuel and water temp	1	1	--	--	--
		50		.SCREW, Truss hd. 1/4-20UNC X 5/8 in.	6	6	--	--	--
		51		.PLUG, Button	1	1	--	--	--
		52	56Z298D1	.LIGHT, Engine warning indicator	--	--	--	--	1
		53	32Z1428	.DECAL, Engine warning	--	--	--	--	1
		54	79Z1297	.SWITCH, Engine kill push button	1	1	--	--	--
		55	79Z2337	.SWITCH, Upper ignition	1	1	--	--	--

Ref. Dwg. 100X139 /K\ 100X139-71 100X139-72 100X139-14 100X139-15 100X139-38 100X138-38

COLLECTOR RING & SWIVEL ASSEMBLY

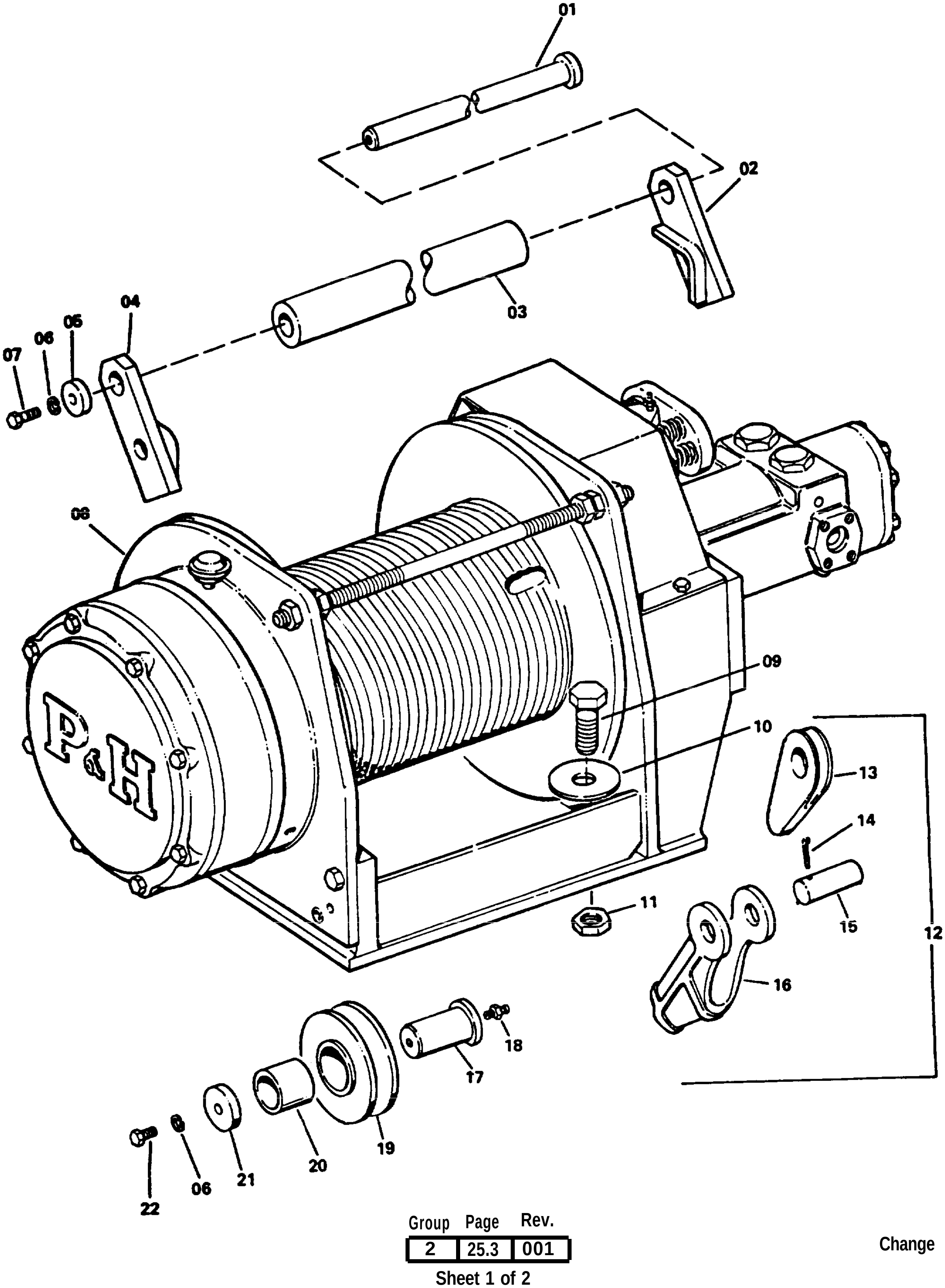


COLLECTRO RING AND SWIVEL ASSEMBLY (Continued)

REF	PART NUMBER	DESCRIPTION	QUANTITY FIGURE NUMBER 1	2			
--	979J49-1	COLLECTOR RING AND SWIVEL ASSEMBLY					
--	979J49-2	COLLECTOR RING AND SWIVEL ASSEMBLY					
01	87J11-1	.COVER, Lower	1	1			
02		..SCREW, Thread forming #8 X 1/4 in.	4	4			
03	20F57D60	.GROMMET, 1 in.	2	2			
04		.SCREW, Hex. hd. cap 1/4-20UNC X 1/2 in.	4	4			
05	20Z586D5	.NUT, Hex. lock 1/4 –20UNC	2	2			
06	18T10592D4	.SPACER	2	2			
07	77U7D1	.COLLECTOR RING	1	--			
--	1073Z130	..BRUSH ARM ASSEMBLY, For 10 and 12 ga. wire	AR	--			
--	1073Z131	..BRUSH ARM ASSEMBLY, For 14 and 16 ga. wire	AR	--			
--	1017Z975	..SPRING, Brush arm	AR	--			
07	77U7D2	.COLLECTOR RING	--	1			
--	1073Z130	..BRUSH ARM ASSEMBLY, For 10 and 12 ga. wire	--	AR			
--	1073Z131	..BRUSH ARM ASSEMBLY, For 14 and 16 ga. wire	--	AR			
--	1017Z975	..SPRING, Brush arm	--	AR			
08		.SCREW, Hex. hd. cap 3/4-10UNC X 2-1/4 in.	2	2			
09	16N1839	.BRACKET, Swivel mounting	1	1			
10	18T11055	.SPACER	2	2			
11		.WASHER, Flat 1/2 in.	2	2			
12		.SCREW, Hex. hd. cap 1/2-20UNF X 1-3/4 in.	2	2			
13		.WASHER, Flat 5/8 in.	9	9			
14		.WASHER, Lock 5/8 in.	3	3			
15		.SCREW, Hex. hd. cap 5/8-11UNC X 2-1/4 in.	3	3			
16	945J38-1	.SWIVEL, Hydraulic	1	1			
--	1045T16-1	..KIT, Swivel reseal	1	1			
17		.SCREW, Allen hd. set 1/4-20UNF X 3/8 in.	2	2			
18		.NUT, Hex. 1/4-20UNF	2	2			
19		.SCREW, Hex. sock. hd. cap 1/4-20UNF X 1/2 in.	1	1			
20	18T10224	.COLLAR	1	1			
21	16N1560	.BRACKET, Upper	1	1			
22		.SCREW, Slot. rd. hd. mach. #10-32UNC X 3/8 in.	4	4			
23	87N33-1	.COVER, Upper	1	1			
24		..SCREW, Thread forming #10 X 3/8 in.	4	4			
25	79Z1885D2	.CONNECTOR, Strain relief	1	1			

Ref. Dwg. 979J49 A
979J49-1
979J49-2

MAIN AND AUXILIARY WINCH INSTALLATIONS



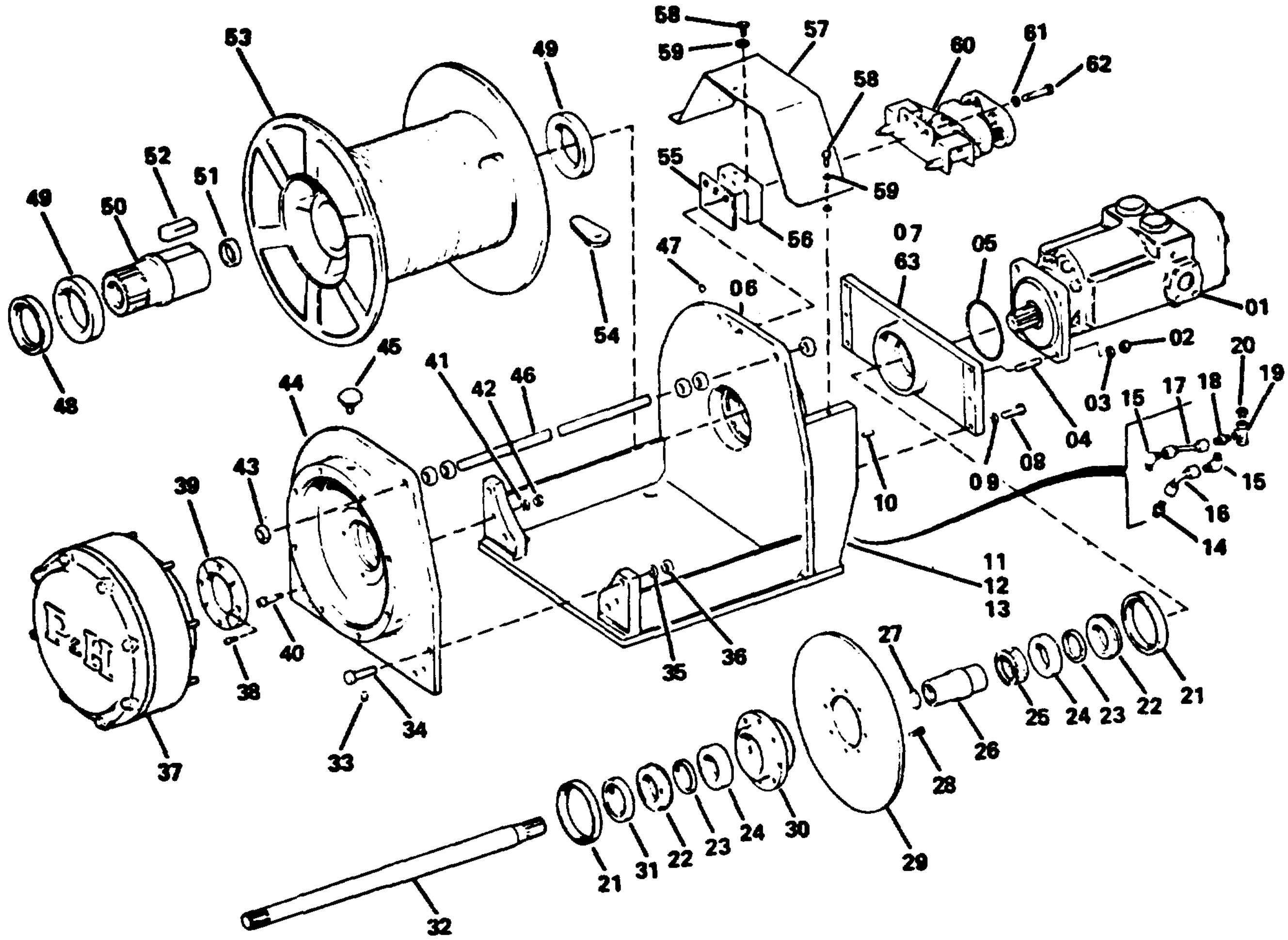
MAIN AND AUXILIARY WINCH INSTALLATION (Continued)

QTY	STOCK	REF.	Part Number	Description	Quantity Figure Number 2	7	8		
		--	100N2383-2	MAIN WINCH INSTALLATION	▼				
		--	100N2496-7	AUX. WINCH INSTALLATION – DRUM IND. ON MAIN		▼			
		--	100N2496-8	AUX. WINCH INSTALLATION – NO DRUM IND. ON MAIN			▼		
		01	10T1382	.SHAFT, Roller	--	1	1		
		02	16P3450D3	.BRACKET, Roller	--	--	1		
		03	13T384	.ROLLER	--	1	1		
		04	16P3450D2	.BRACKET, Roller	--	1	1		
		05	14T1433	.CAP, Roller end	--	1	1		
		06		.WASHER, Lock 3/8 in.	--	4	4		
		07		.SCREW, Hex hd. 3/8-16UNC X 1 in.	--	1	1		
		08	923P5-3	.WINCH, P&H #10 (Page 26.2)	1	1	1		
		09		.SCREW, Hex hd. 7/8-9UNC X 2-1/4 in.	4	4	4		
		10	18Z694D9	.WASHER, Hardened 7/8 in.	4	4	4		
		11		.NUT, Hex 7/8-9UNC	--	4	4		
		12	908P39-44	.SOCKET, 1/2 in. rope	--	1	1		
		13	8T259C1	..WEDGE, 1/2 in.	--	1	1		
		14		..PIN, Cotter 1/4 X 1-1/2 in.	--	2	2		
		15	19F57D10	..PIN, Drilled 1 X 3 in.	--	1	1		
		16	8P168	..SOCKET, 1/2 in.	--	1	1		
		12	908P39-8	.SOCKET, 5/8 in. rope	1	1	1		
		13	8T97C3	..WEDGE, 5/8 in.	1	1	1		
		14		..PIN, Cotter 1/4 X 2 in.	2	2	2		
		15	19F59D10	..PIN, Drilled 1-1/4 X 3-1/2 in.	1	1	1		
		16	8P240	..SOCKET, 5/8 in.	1	1	1		
		17	10T345-1	.SHAFT	--	3	3		
		18		..FITTING, Lube	--	1	1		
		19	7P877-1	.SHEAVE ASSY	--	3	--		
		20	5Z285D13	..BEARING	--	1	1		
		21	14T1421	.CAP, End	--	3	3		
		22		.SCREW, Hex hd. 3/8-16UNC X 3/4 in.	--	3	3		
		--	100J4723-1	.HYDRAULIC ASSY., Aux. Winch (Page 15.2)	--	1	1		

Ref. Dwg. 100N2383 D
100N2496 F
100N2383-2
1002N2496-7
1002N2496-8

Change 1

WINCH ASSEMBLY



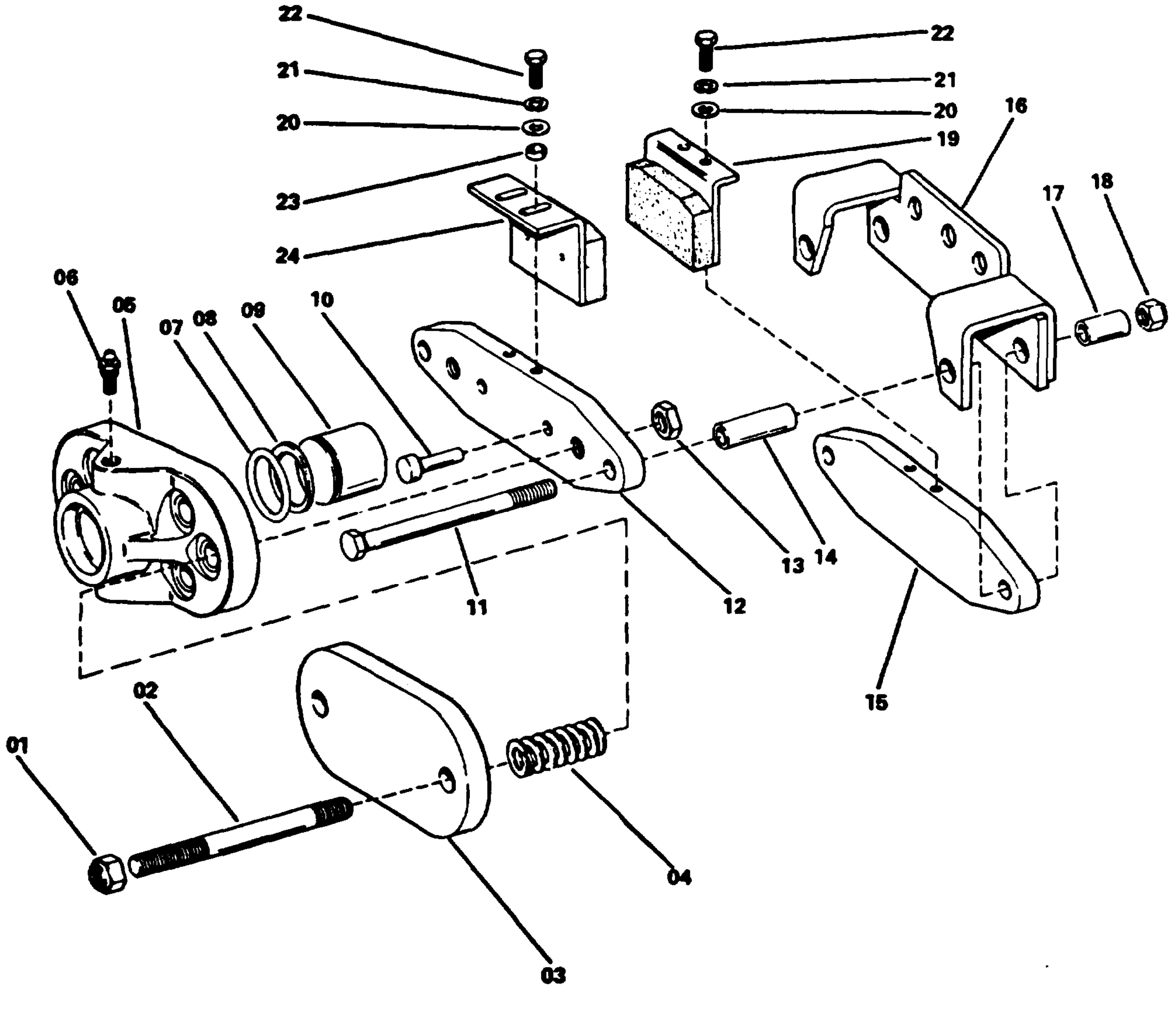
Q T Y	S T O C K	Ref.	Part Number	Description	Quantity Figure Number 3			
		--	923P5-3	WINCH AND MOTOR ASSEMBLY	▼			
		01	41U13D9	.MOTOR, Hydraulic (Page 27)	1			
		02		.NUT, Hex 1/2-13UNC	4			
		03		.WASHER, Lock 1/2 in.	4			
		--	923X13-1	.WINCH ASSEMBLY, Model #10	1			
		04	20T9032D2	..STUD	4			
		05	45Z91D144	..O-RING	1			
		06	16J851-1	..BASE, Winch	1			
		07	716N4	…SUPPORT, Motor	1			
		08		…SCREW, Hex head 1/2-13UNC X 1-1/2 in. lg.	4			
		09		…WASHER, Lock 1/2 in.	4			
		10	19Z138D37	…PIN, Dowel	2			
		11	14P2414	..COVER	1			
		12		..SCREW, Hex head 3/8-16UNC X 1 in. lg.	2			
		13		..WASHER, Lock 3/8 in.	2			
		14	44Z590D4	..CONNECTOR, Male	1			
		15	44Z591D3	..ELBOW, 90°	2			

WINCH ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 3			
		16	44T358	..TUBE	1			
		17	44T359	..TUBE	1			
		18	44Z590D3	..CONNECTOR, Male	1			
		19	44Z342D1	..TEE, Pipe	1			
		20	44Z1D37	..FITTING, Relief	1			
		21	18F682D323	..SEAL	2			
		22	25Z868D11	..BEARING, Ball	2			
		23	18Z2036D1	..WASHER, Support	2			
		24	25Z377D12	..BEARING, Ball	2			
		25	15Z400D2	..SPRAG, Clutch assembly	1			
		26	18N980	..SLEEVE, Motor shaft	1			
		27	45Z91D206	..O-RING	1			
		28	20Z994D8	..SCREW, Self locking cap	8			
		29	18Z2040	..DISC, Brake	1			
		30	18N979	..HUB, Brake	1			
		31	18F682D75	..SEAL	1			
		32	10P1704	..SHAFT	1			
		33		..PLUG, 3/8 in. pipe	1			
		34		..SCREW, Hex head 5/8-16UNC X 2-1/4 in. lg.	4			
		35		..WASHER, Lock 5/8 in.	4			
		36		.NUT, Hex 5/8-16UNC	4			
		37	53U28	..PLANETARY DRIVE (Page 29.1)	1			
		38		..SCREW, Socket head ¼-20unc X ¾ in. lg	4			
		39	18P3776	..WASHER, Thrust	1			
		40	20Q1D38	..BOLT, Hex socket shoulder	2			
		41		..WASHER, Lock 3/8 in.	2			
		42		..NUT, Hex jam 3/8-16UNC	2			
		43		..NUT, Hex jam 3/4-10UNC	6			
		44	16N1714	..PLATE, Planetary drive mounting	1			
		45	46Z4	..BREATHER	1			
		46	20T8599	..BOLT, Rod	1			
		47		..PLUG, 1/4 in. pipe	1			
		48	18F682D307	..SEAL	1			
		49	25Z874D17	..BEARING, Ball	2			
		50	18N1235-1	..SLEEVE, Drum	1			
		--	5Z361D1	…BUSHING, Drum sleeve	1			
		51	18Z2607	..SEAL, Drum sleeve	1			
		52	20H1449D1	..KEY	1			
		53	23J489	..DRUM, Winch 9/16 in. wire rope	1			
		54	8T95C3	..WEDGE, Cable	1			
		55	18T10531D1	..SHIM	1			
		55	18T10531D2	..SHIM	1			
		56	18T10403	..SPACER	1			
		57	14N1967	..COVER	1			
		58		..SCREW, Hex head 3/8-16UNC X 1	4			
		59		..WASHER, Lock 3/8 in.	4			
		60	15U45	..CALIPER BRAKE ASSEMBLY (Page 28.2)	1			
		61		..WASHER, Lock 1/2 in.	3			
		62		..SCREW, Hex head 1/2-13UNC X 2-1/4 in. lg	3			
		63	32Z837	..PLATE, Name	1			

Ref. Dwg. 923P5
923X13
923P5-3
923X13-1

WINCH BRAKE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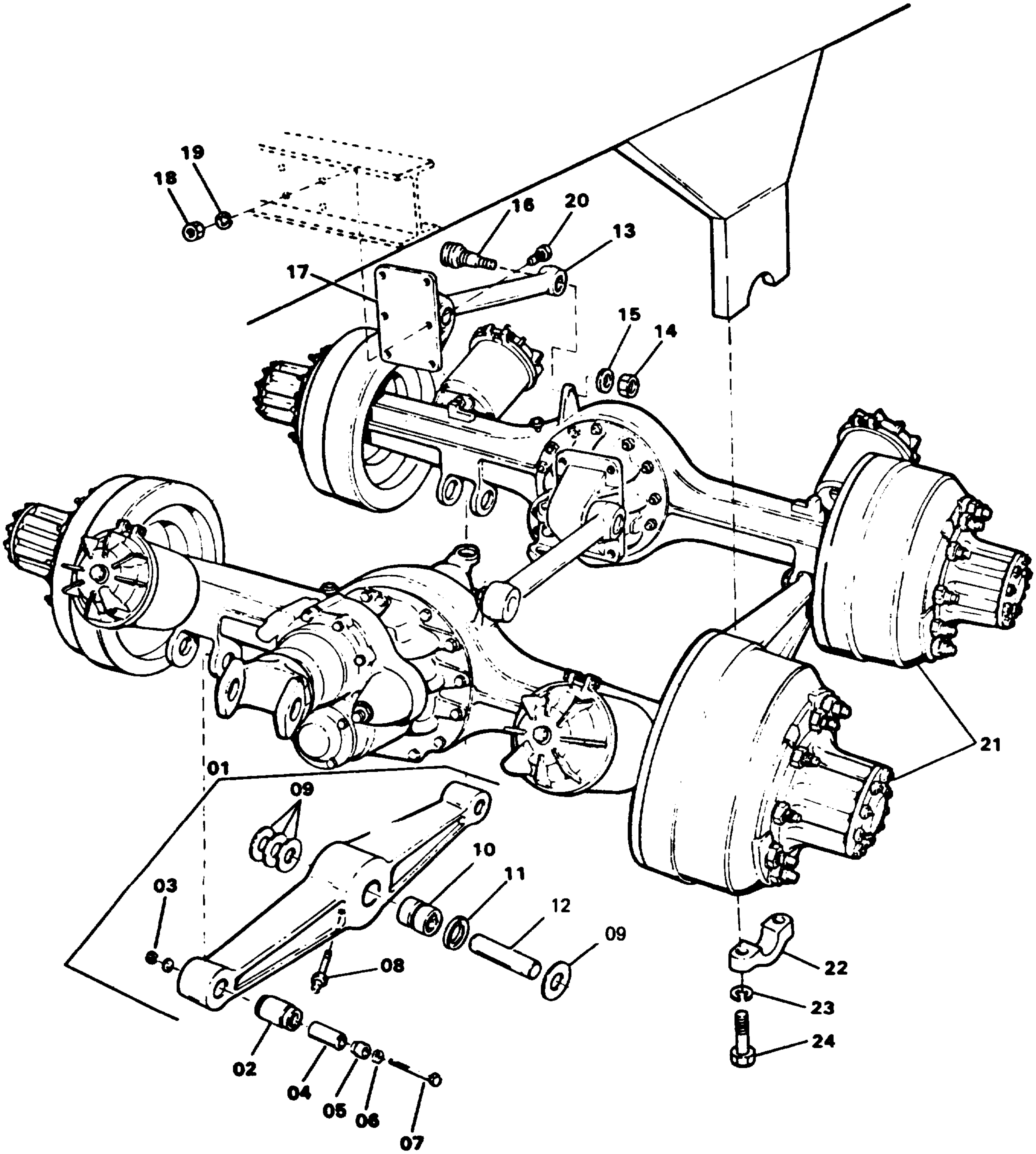
WINCH BRAKE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity / Figure Number			
		--	15U45	BRAKE – STANDARD WINCH	↓			
		--	15U46	BRAKE – UPPER EXPORT WINCH		↓		
		--	15U47	BRAKE – LOWER EXPORT WINCH			↓	
		01		.NUT, Hex 1/2-13UNC	2	2	2	
		02		.STUD,1/2-13UNC X 5 in.	2	2	2	
		03	1018Z2884	.PLATE, Spring keeper	1	1	1	
		04	1017Z879	.SPRING	4	--	--	
		04	1017Z976	.SPRING, Green	--	2	2	
		04	1017Z880	.SPRING, Gold	2	4	4	
		05	1014Z678	.HOUSING	1	1	1	
		06	1044Z356	.BLEEDER, Housing	1	1	1	
		07	1045Z1342	.O-RING	1	1	1	
		08	1045Z1222	.RING, Back-up	1	--	--	
		09	1038Z245	.PISTON	1	1	1	
		10	1019Z950	.PIN	2	2	2	
		11		.SCREW, Hex hd. 3/8-24UNF X 4-1/2 in.	2	2	2	
		12	1015Z1106	.CARRIER, Piston side	1	1	1	
		13		.NUT, Hex 1/2-13UNC	2	2	2	
		14	1005Z493	.BUSHING	2	2	2	
		15	1015Z804	.CARRIER, Bracket side	1	1	1	
		16	1016Z383	.BRACKET	1	1	1	
		17	1005Z494	.BUSHING	1	1	1	
		18		.NUT, Hex 3/8-24UNF	2	2	2	
		19	15Z478	.PAD, Bracket side	1	1	1	
		20		.WASHER, Flat 1/4 in.	4	4	4	
		21		.WASHER, Lock 1/4 in.	4	4	4	
		22		.SCREW, Hex hd. 1/4-20UNC X 3/4 in.	4	4	4	
		23	1005Z495	.BUSHING	2	2	2	
		24	15Z477	.PAD, Piston side	1	1	1	

Ref. Dwg. 15U45
15U46
15U47

REAR SUSPENSION ASSEMBLY

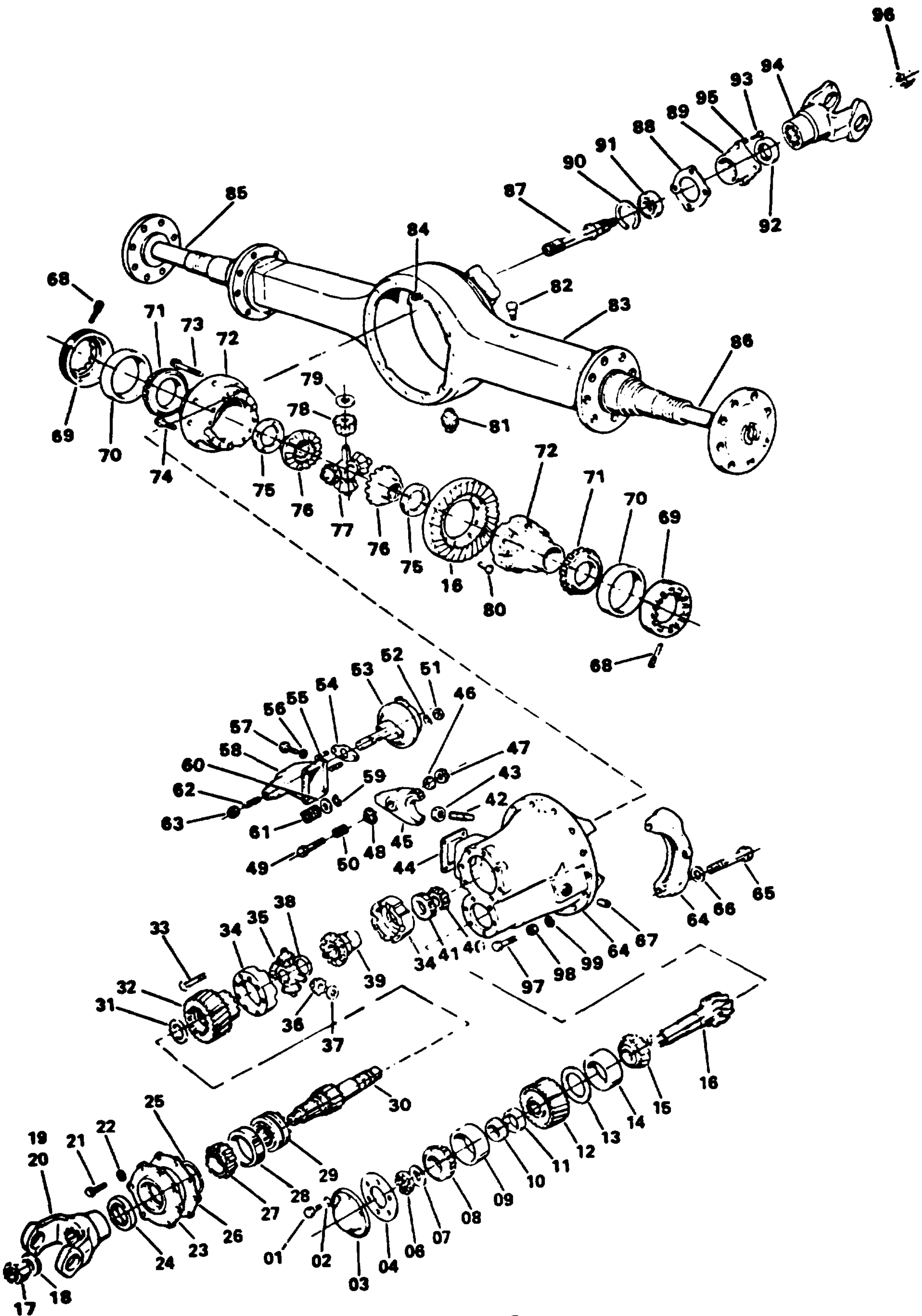


REAR SUSPENSION ASSEMBLY (Continued)

Ref.	Part Number	Description	Quantity Figure Number 1			
--	910J452-1	REAR SUSPENSION ASSEMBLY	▼			
--	20Z1803	.SUSPENSION, Rear	1			
01	1016Z387	..BEAM ASSY., Equalizer	2			
02	1005Z386	…BUSHING, Beam end	2			
--	1018Z2880	…ADAPTER ASSY, Beam end	4			
03		….NUT, Lock	1			
04		….TUBE, Intermediate	1			
05		….ADAPTER, Beam end	2			
06		….WASHER, Hardened	2			
07		….BOLT, Adapter	1			
08	1044Z532	…FITTING, Lube	1			
--	1045Z1352	…KIT, Center bushing	1			
09		….WASHER, Thrust	4			
10		….BUSHING, Beam center	1			
11		….SEAL, Lube	2			
12	1018Z2881	…SEAL, Beam center	1			
13	1006Z358	..ROD, ASSY., Torque	2			
--	1045Z1351	…KIT, Torque rod end	1			
14		….NUT, Lock	1			
15		….SPACER	1			
16		….STUD AND RUBBER ASSY	1			
17	1016Z284	..BRACKET, Torque rod frame	2			
18		.NUT, Hex 1/2-13UNC	12			
19		.WASHER, Lock 1/2 in.	12			
20	20Z646D78	.SCREW, Hex hd. Cap 1/2-13UNC X 2 in. Gr. 5	12			
21	10Z508	.AXLE, Rear (Page 31.5)	1			
22	1014Z1312	.CAP, Lower	2			
23		.WASHER, Lock 3/4 in.	4			
24		.SCREW, Hex hd. Cap 3/4-16UNF X 4 in.	4			

Ref. Dwg. 910J452 ^
910J452-1

FORWARD REAR AXLE GROUP



FORWARD REAR AXLE GROUP (Continued)

Ref.	Part Number	Description	Quantity / Figure Number			
--		AXLE GROUP, FORWARD REAR	▼			
--	1053Z229	.DIFFERENTIAL ASSY., Forward rear	1			
01	1020Z2774	..BOLT, Lower cover	6			
02	1018Z2786	..WASHER, Lower cover bolt flat	6			
03	1014Z545	..COVER, Lower bearing	1			
04	1020Z2763	..GASKET, Lower bearing cover	1			
06	20Z389	..NUT, Drive gear	1			
07	1018Z2796	..WASHER, Drive gear nut	1			
08	1025Z1129	..CONE, Outer bearing	1			
09	1025Z1130	..CUP, Outer bearing	1			
10	1018Z3771	..SPACER, Drive gear bearing 0.248 in.	AR			
10	1018Z3772	..SPACER, Drive gear bearing 0.249 in.	AR			
10	1018Z3773	..SPACER, Drive gear bearing 0.250 in.	AR			
10	1018Z3774	..SPACER, Drive gear bearing 0.251 in.	AR			
10	1018Z3775	..SPACER, Drive gear bearing 0.252 in.	AR			
10	1018Z3776	..SPACER, Drive gear bearing 0.253 in.	AR			
10	1018Z3777	..SPACER, Drive gear bearing 0.259 in.	AR			
10	1018Z3778	..SPACER, Drive gear bearing 0.265 in.	AR			
10	1018Z3779	..SPACER, Drive gear bearing 0.271 in.	AR			
10	1018Z3780	..SPACER, Drive gear bearing 0.277 in.	AR			
10	1018Z3781	..SPACER, Drive gear bearing 0.283 in.	AR			
11	1018Z2801	..SPACER, Drive gear	1			
12	1001Z648	..GEAR, Drop box driven	1			
13	1020Z2758	..SHIM, 0.003 in.	AR			
13	1020Z2759	..SHIM, 0.005 in.	AR			
13	1020Z2760	..SHIM, 0.010 in.	AR			
14	1025Z441	..CUP, Inner bearing	1			
15	1025Z1135	..CONE, Inner bearing	1			
16	1001Z1236	..DRIVE & RING GEAR – 7.40 to 1	1			
17	20Z389	..NUT, Yoke	1			
18	1018Z4014	..WASHER, Flat	1			
19	1018Z4833	..YOKE, Input	1			
20	1018Z4808	…SLINGER, Oil	1			
21	1020Z4285	..BOLT, Bearing cage cover	7			
22	1018Z1649	..WASHER, Bearing cover bolt	7			
23	1025Z1717	..COVER & SEAL ASSEMBLY	1			
24	1045Z1379	…SEAL, Oil	1			
25	1045Z1155	..O-RING, Bearing cage	1			
26	1020Z4928	..SHIM, 0.003	3			
26	1020Z4936	..SHIM, 0.005	4			
26	1020Z4940	..SHIM, 0.010	1			
27	1025Z1719	..CUP, Outer input shaft bearing	1			
28	1025Z1720	..CONE, Outer input shaft bearing	1			
29	1015790	..COLLAR, Input shaft	1			
--	1010Z1160	..SHAFT ASSY., Inter differential	1			
30	1010Z1010	…SHAFT, Input	1			
31	1018Z2790	…WASHER, Thrust	1			
32	1001Z649	…GEAR, Inter drive	1			
--	1014Z1599	…CASE ASSY., Inter axle	1			
33		….RIVET, Inter axle differential case	8			

FORWARD REAR AXLE GROUP (Continued)

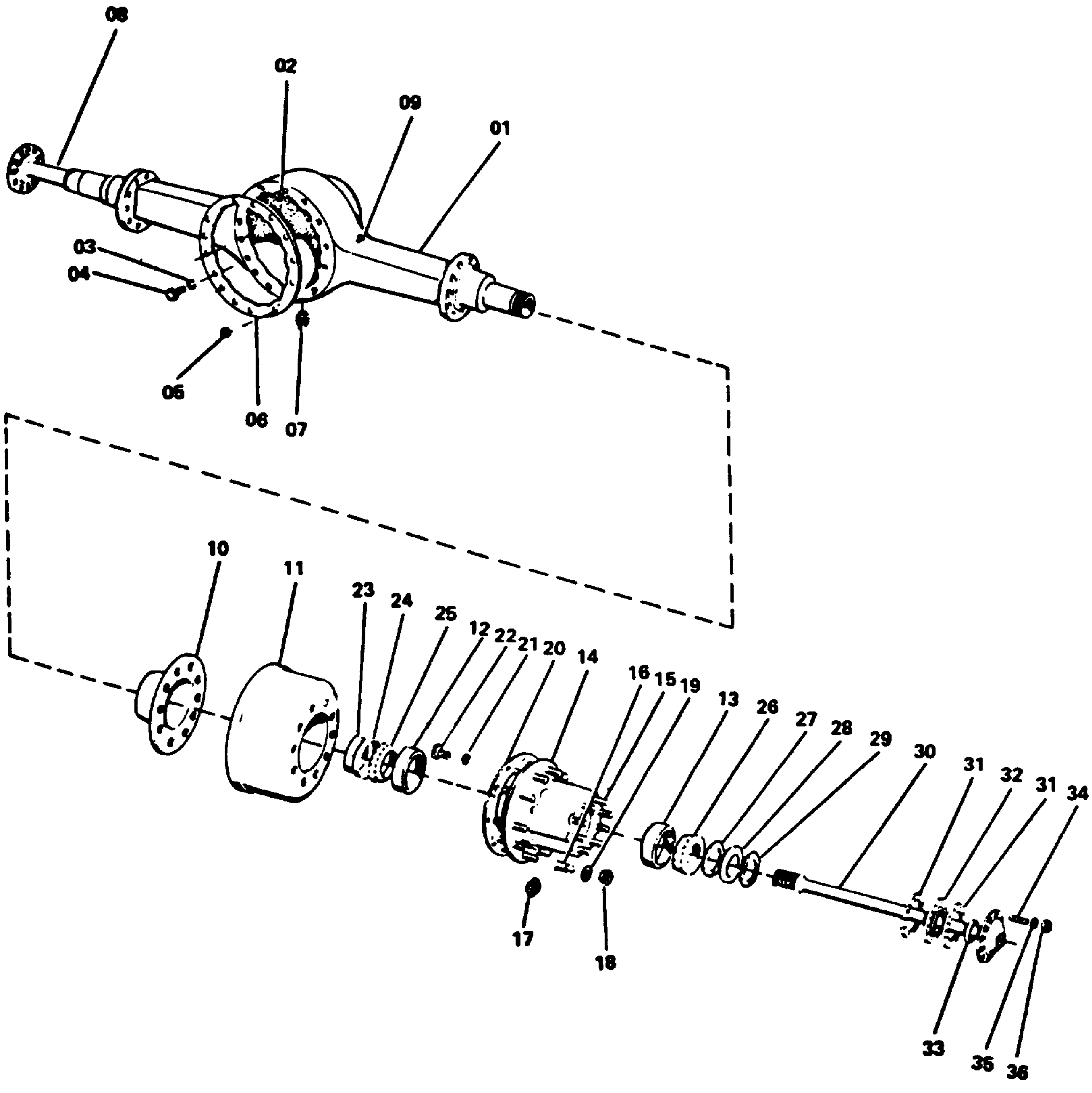
Ref.	Part Number	Description	Quantity Figure Number			
34		….CASE ASSY., Inter axle differential	1			
35		….SPIDER, Inter axle differential	1			
36		….GEAR, Pinion	4			
37		….WASHER, Pinion gear thrust	4			
38		….RETAINER, Snap ring	1			
39		….GEAR, Side	1			
40	1025Z1718	…CONE, Inter axle differential bearing	1			
41	1025Z1721	…CUP, Inter axle differential bearing	1			
42	1020Z2739	..SCREW, Thrust	1			
43	1020Z2733	..NUT, Thrust screw	1			
--	1014Z1330	..SHIFT ASSY., Inter axle differential	1			
44	1020Z2463	…GASKET, Shift housing	1			
45	1015Z792	…FORK & YOKE ASSEMBLY	1			
46	1025Z435	….BALL, Yoke	1			
47	1020Z3962	….NUT, Yoke ball	1			
48	1020Z876	….WASHER, Seat	1			
49	1020Z3960	….BOLT, Spring retaining	1			
50	1017Z708	….SPRING, Yoke	1			
51	1020Z4031	…NUT, Air chamber stud	2			
52	1018Z2961	…WASHER, Air chamber stud nut	2			
53	1010Z1001	…CHAMBER, Air shift	1			
54	1020Z127	…GASKET, Air chamber	1			
55	1020Z4653	… STUD, Air chamber mounting	2			
56	1018Z2786	…WASHER, Lock	4			
57	1020Z584	…BOLT, Shift housing mounting	4			
58	1014Z1006	…HOUSING, Air shift	1			
59	1018Z793	…WASHER, Special	1			
60	1018Z2010	…RETAINER, Spring	1			
61	1017Z707	…SPRING, Shift	1			
62	1020Z5558	…BOLT, Adjusting	1			
63	1020Z3325	…NUT, Adjusting bolt	1			
64	1014Z1329	..CARRIER & CAP ASSEMBLY	1			
65	1020Z2731	..BOLT, Bearing cap	4			
66	1018Z2797	..WASHER, Bearing cap bolt	4			
67	1044Z120	..PLUG, Filler	1			
68	1019Z788	..PIN, Cotter	2			
69	1018Z3782	..RING, Bearing adjustment	2			
70	1025Z1413	..CUP, Differential bearing	2			
71	1025Z1414	..CONE, Differential bearing	2			
--	1053Z188	..CASE & NEST ASSEMBLY	1			
72	1014Z866	…CASE ASSEMBLY, Differential	1			
73	1020Z4868	….BOLT, Long differential case	8			
74	1020Z4410	….BOLT, Short differential case	4			
75	1018Z1238	…WASHER, Side gear thrust	2			
76	1001Z1076	…GEAR, Differential side	2			
77	1013Z208	…SPIDER, Differential	1			
78	1001Z232	…PINION, Differential	4			
79	1018Z1239	…WASHER, Pinion thrust	4			
80	1020Z3643	..RIVET, Ring gear	12			
81	1020Z5529	.PLUG, Magnetic drain	1			

FORWARD REAR AXLE GROUP (Continued)

Ref.	Part Number	Description	Quantity / Figure Number			
82	1046Z170	.BREATHER, Housing	1			
83	1014Z1299	.HOUSING, Forward rear axle	1			
84	1020Z2723	..STUD, Differential mounting	2			
84	1020Z5560	..STUD, Differential mounting	3			
85	101Z971	.SHAFT, L. H. forward axle	1			
86	1010Z972	.SHAFT, R. H. forward axle	1			
87	1010Z560	.SHAFT, Thru	1			
88	1020Z128	.GASKET, Cage assembly	1			
89	1025Z1215	.CAGE ASSEMBLY, Thru shaft	1			
90	1018Z2791	..RING, Snap	1			
91	1025Z1135	..BEARING, Thru shaft	1			
92	18Z952D2	..SEAL, Oil	1			
93	1020Z584	.SCREW, Cage mounting	4			
94	1018Z5528	.YOKE, Output	1			
95	1018Z4361	.WASHER, Flat	4			
96	1020Z848	.NUT, Yoke	1			
97	1020Z3646	..SCREW, Long differential housing	2			
97	1020Z4867	..SCREW, Short differential mounting	7			
98	1020Z4166	..NUT, Carrier to housing	4			
98	1020Z4168	.NUT, Carrier to housing	1			
99	1018Z2799	..WASHER, Carrier to housing	14			

Ref. Dwg. 10Z508

FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP



FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

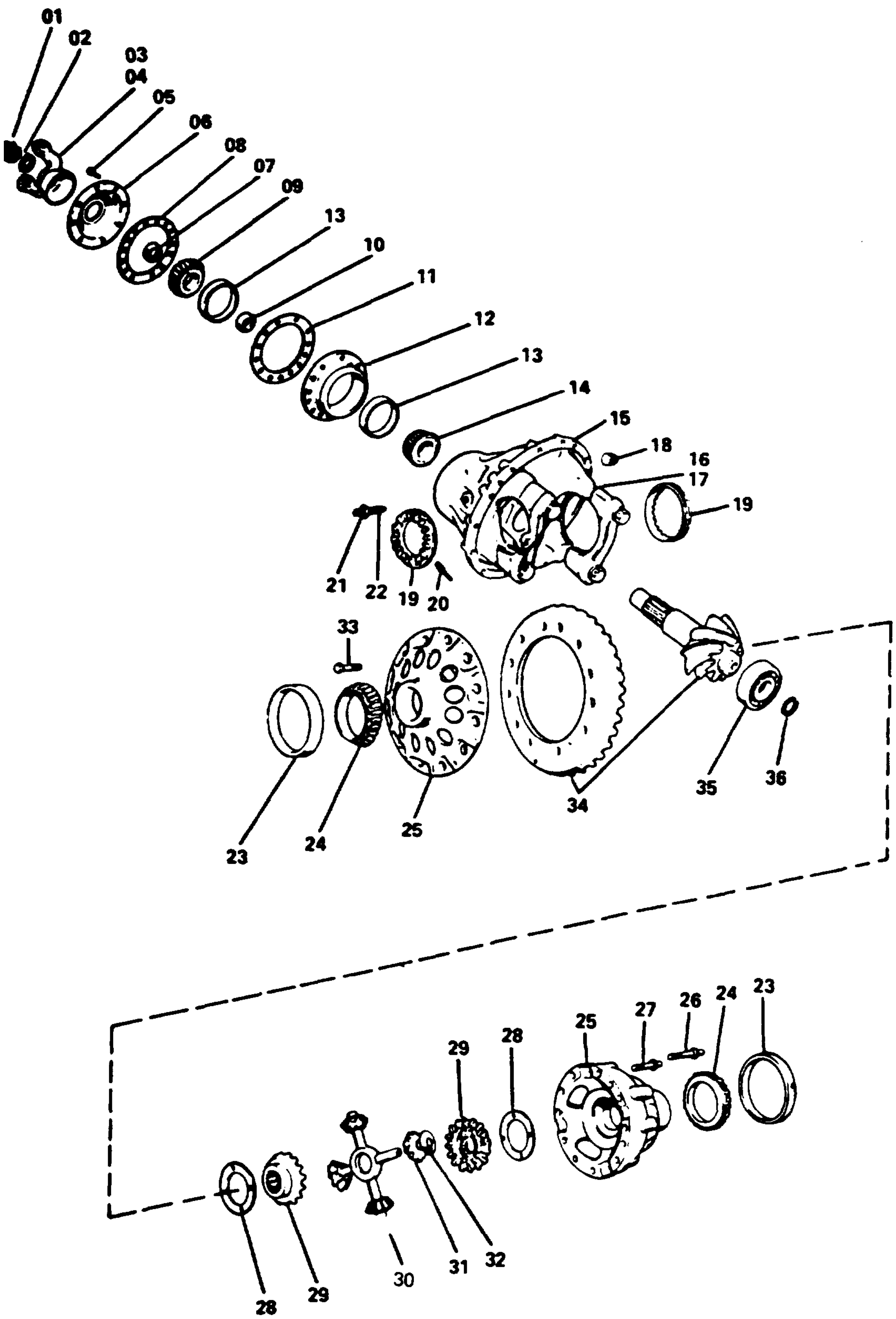
QTY	STOCK	Ref.	Part Number	Description	Quantity / Figure Number			
		--		HUB & DRUM GP., FORWARD & REAR REAR	▼			
		01	1014Z1300	.HOUSING, Rear rear axle	1			
		02	1020Z4037	.STUD, Locating	1			
		03	1018Z3596	.WASHER, Lock	14			
		04	1020Z3646	.SCREW, Long cap	4			
		04	1020Z4867	.SCREW, Short cap	9			
		05	1020Z4166	.NUT, Differential stud	1			
		06	1020Z2181	.GASKET, Carrier to housing	1			
		07	1020Z4834	.PLUG, Magnetic drain	1			
		08	1010Z972	.SHAFT, L.H. rear axle	1			
		09	1046Z170	.BREATHER, Axle housing	1			
		--	1013Z295	.HUB & DRUM ASSEMBLY, L. H.	1			
		10	1018Z4706	..SLINGER, Oil	1			
		11	1015Z1033	..DRUM, Brake	1			
		--	1013Z277	..HUB & STUD ASSEMBLY, L. H.	1			
		--	1013Z276	…HUB & CUP ASSEMBLY, L. .H.	1			
		12	1018Z2783	….CUP, Inner bearing	1			
		13	1018Z2782	….CUP, Outer bearing	1			
		14	1013Z274	….HUB	1			
		15	1020Z4673	…STUD, Axle shaft mounting	8			
		16	1020Z4831	…STUD, L. H. wheel	10			
		17	1079Z1508	…PLUG, Hub filler	1			
		18	1020Z1093	..NUT, Inner L. H. wheel stud	10			
		18	1020Z921	..NUT, OUTER L. H. wheel stud	10			
		19	1018Z4640	..RETAINER, Drum to hub	5			
		20	1018Z4641	..ROTOR, Slinger	1			
		21	1018Z4708	..WASHER, Flat	5			
		22	1020Z4832	..SCREW,Cap – rotor mounting	5			
		--	1013Z296	.HUB & DRUM ASSEMBLY, R. H.	1			
		10	1018Z4706	..SLINGER, Oil	1			
		11	1015Z1033	..DRUM, Brake	1			
		--	1013Z293	..HUB & STUD ASSEMBLY, R. H.	1			
		--	1013Z276	…HUB & CUP ASSEMBLY, R. H.	1			
		12	1018Z2783	….CUP, Inner bearing	1			
		13	1018Z2782	….CUP, Outer bearing	1			
		14	1013Z274	….HUB	1			
		15	1020Z4673	…STUD, Axle shaft mounting	8			
		16	1020Z4830	…STUD, R. H. wheel	10			
		17	1079Z1508	…PLUG, Hub filler	1			
		18	1020Z2745	..NUT, Inner R. H. wheel stud	10			
		18	1020Z2746	..NUT, Outer R. H. wheel stud	10			
		19	1018Z4640	..RETAINER, Drum to hub	5			
		20	1018Z4641	..ROTOR, Slinger	1			
		21	1018Z4708	..WASHER, Flat	5			
		22	1020Z4832	..SCREW, Cap – rotor mounting	5			
		23	1018Z155	.SEAL ASSY., Inner hub oil	1			
		24	1049Z44	.WIPER, Inner axle shaft	1			
		25	1025Z1248	.CONE, Inner bearing	1			
		26	1025Z1211	.CONE, Outer bearing	1			
		27	1020Z2896	.NUT, Wheel bearing inner	1			

FORWARD AND REAR REAR AXLE HUB AND DRUM GROUP (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		28	1018Z2963	.WASHER, Lock – wheel bearing unit	1			
		29	1020Z2895	.NUT, Wheel bearing outer	1			
		30	1020Z971	.SHAFT, R. H. rear axle	1			
		31	1020Z4287	.GASKET, Axle shaft	2			
		32	1018Z1125	.SEAL, Outer oil	1			
		33	1018Z1126	.WIPER, Axle shaft outer	1			
		34	1025Z746	.DOWEL, Tapered	8			
		35	18Z853D6	.WASHER, Lock	8			
		36	1020Z4166	.NUT, Axle shaft mounting	8			

Ref. Dwg 10Z508

REAR REAR AXLE DIFFERENTIAL ASSEMBLY

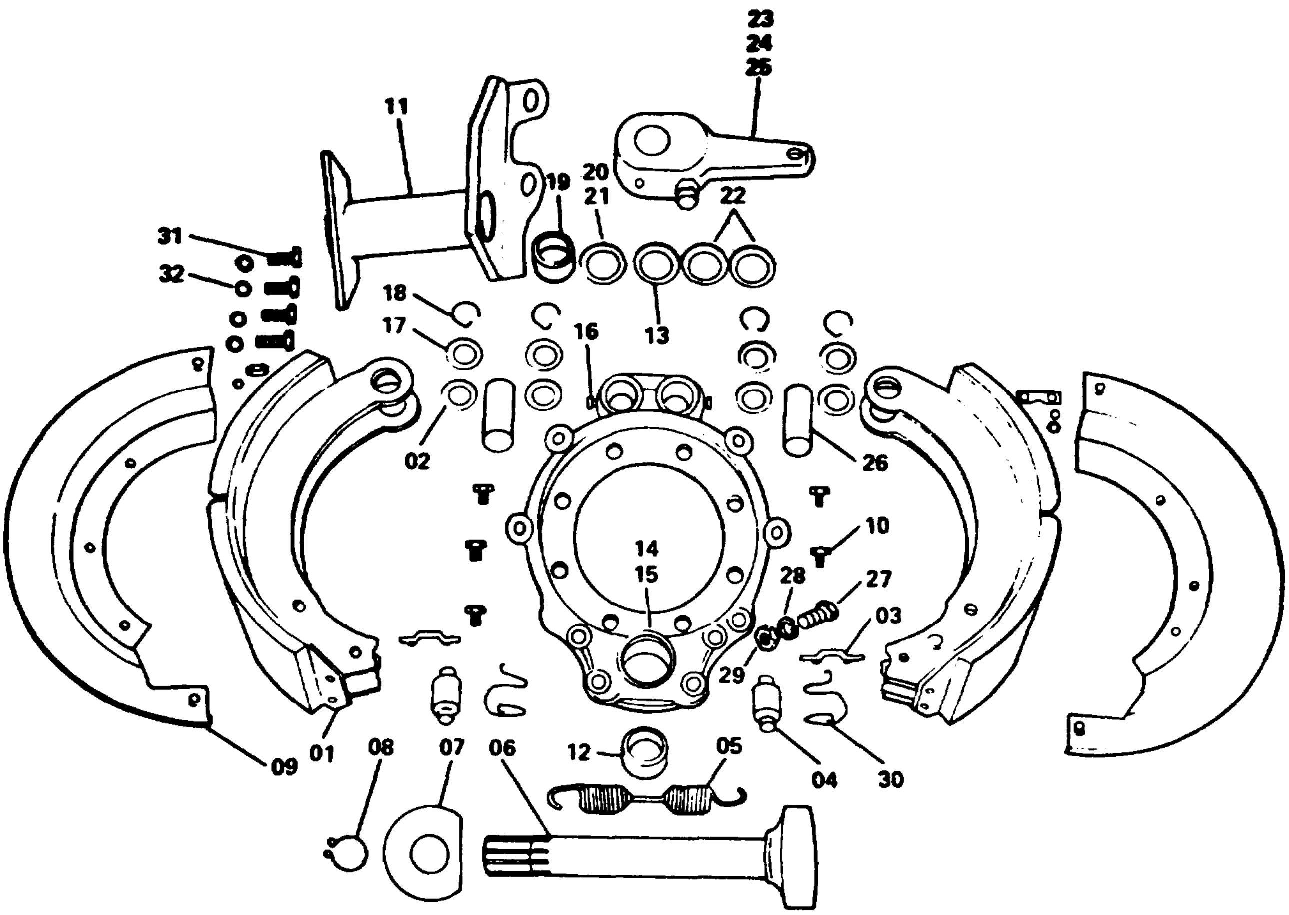


REAR REAR AXLE DIFFERENTIAL ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		--	1053Z189	DIFFERENTIAL ASSY., REAR REAR AXLE	▼			
		01	20Z848	.NUT, Yoke	1			
		02	1018Z3768	.WASHER, Yoke	1			
		03	1018Z3016	.YOKE, Input	1			
		04	1018Z2999	..SLINGER, Oil	1			
		05	1020Z1664	.SCREW, BEARING cage cap	8			
		06	1018Z3014	.COVER & SEAL ASSEMBLY	1			
		07	18Z965D1	..SEAL, Bearing cover	1			
		08	1020Z3642	.GASKET, Bearing cage cover	1			
		09	1025Z1417	.CONE, Outer bearing	1			
		10	1018Z3771	.SPACER, 0.248 in. thick	AR			
		10	1018Z3772	.SPACER, 0.249 in. thick	AR			
		10	1018Z3773	.SPACER, 0.250 in. thick	AR			
		10	1018Z3774	.SPACER, 0.251 in. thick	AR			
		10	1018Z3775	.SPACER, 0.252 in. thick	AR			
		10	1018Z3776	.SPACER, 0.253 in. thick	AR			
		10	1018Z3777	.SPACER, 0.259 in. thick	AR			
		10	1018Z3778	.SPACER, 0.265 in. thick	AR			
		10	1018Z3779	.SPACER, 0.271 in. thick	AR			
		10	1018Z3780	.SPACER, 0.277 in. thick	AR			
		10	1018Z3781	.SPACER, 0.283 in. thick	AR			
		11	1020Z3641	.SHIM, 0.003 in.	AR			
		11	1020Z3637	.SHIM, 0.005 in.	AR			
		11	1020Z3638	.SHIM. 0.010 in.	AR			
		12	1025Z1416	.CAGE, ASSY., Pinion bearing	1			
		13	1025Z441	..CUP, Inner and outer bearing	2			
		14	1025Z1135	.CONE, Inner bearing	1			
		15	1014Z864	.CASE & CAP ASSEMBLY	1			
		16	1020Z3731	..SCREW, Bearing cap	4			
		17	1018Z2797	..WASHER, Bearing cap	4			
		18	1044Z120	.PLUG, Filler and inspection	1			
		19	1018Z3782	.RING, Bearing adustment	2			
		20	1019Z788	.PIN, Cotter	2			
		21	1020Z2733	.NUT, Bearing adjustment	1			
		22	1020Z2739	.SCREW, Bearing adjustment thrust	1			
		23	1025Z1413	.CUP, Differential bearing	2			
		24	1025Z1414	.CONE, Differential bearing	2			
		--	1053Z188	.CASE & NEST ASSEMBLY	1			
		25	1014Z866	..CASE ASSEMBLY, Differential	1			
		26	1020Z4868	…BOLT, Long differential	8			
		27	1020Z4410	…BOLT, Short differential	4			
		28	1018Z1238	..WASHER, Side gear thrust	2			
		29	10012231	..GEAR, Side	2			
		30	1013Z208	..SPIDER, Differential	1			
		31	10012232	..PINION, Differential	4			
		32	1018Z1239	..WASHER, Pinion thrust	4			
		33	1020Z3643	.RIVET, Ring gear	12			
		34	1001Z831	.DRIVE & RING GEAR, 7.40 to 1	1			
		35	1025Z1412	.BEARING, Drive gear	1			
		36	1018Z3769	.RING, Lock	1			

Ref. Dwg 10Z508

FORWARD AND REAR REAR AXLE BRAKE GROUP

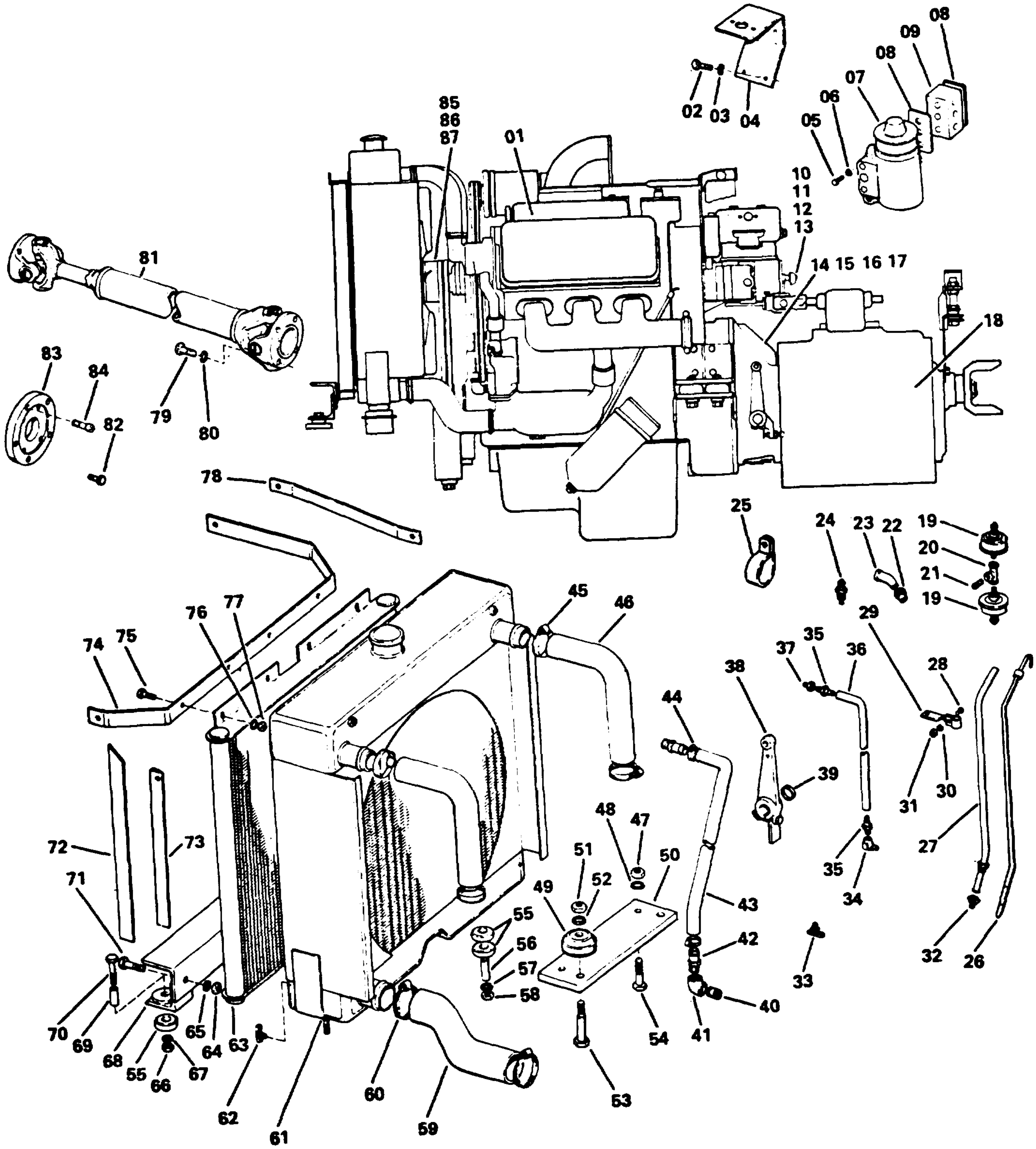


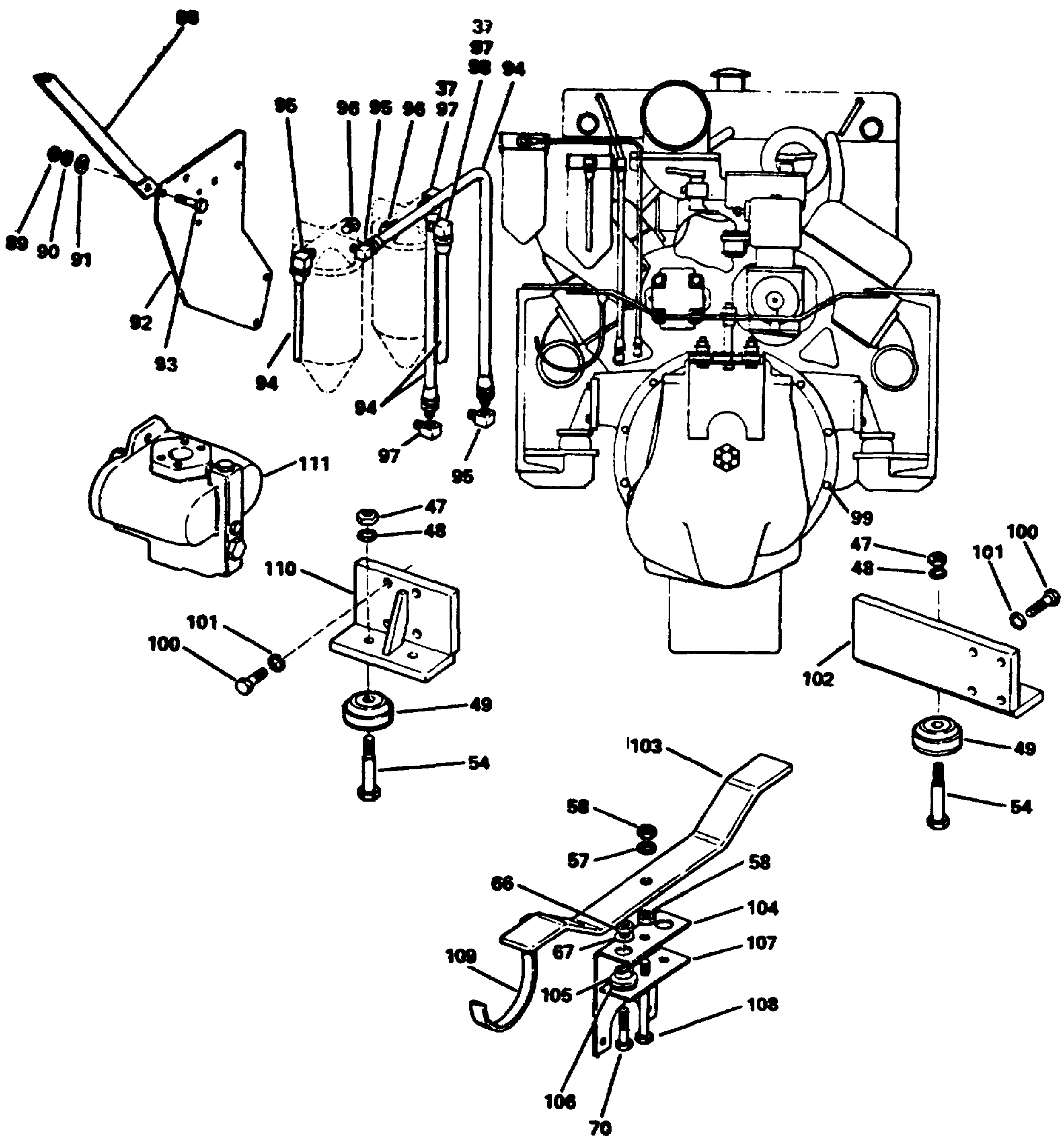
REAR REAR AXLE DIFFERENTIAL ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
		--						
		01	1015Z1076	BRAKE GP., FORWARD & REAR REAR AXLE				
		02	18Z125	.SHOE, & LINING ASSEMBLY, Brake	2			
		03	1019Z236	..RETAINER, Anchor pin felt	4			
		04	1013Z14	..PIN, Return spring	2			
		05	1017Z66	..ROLLER, Brake shoe	2			
		06	1043Z9	.SPRING, Shoe return	1			
		06	1043Z35	.CAMSHAFT, L. H. forward, R. H. rear	1			
		07	1018Z1730	.CAMSHAFT, R. H. forward, L. H. rear	1			
		08	1018Z1786	.WASHER, Camshaft	1			
		09	1014Z547	.RING, Camshaft lock	1			
		10	20Z397	.SHIELD, Dust	2			
		11	1016Z282	..SCREW, Dust shield mounting	6			
		--	1020Z2169	.BRACKET, R. H. rear, L. H. forward	1			
		12	25Z79	..GASKET, Brake spider and cam	1			
		13	1045Z1348	..BUSHING, Camshaft bracket	1			
		14	1018Z4746	..O-RING, Camshaft bracket	2			
		11	1016Z283	..SEAL, Brake spider	1			
		--	1020Z2169	.BRACKET, L.H. rear, R. H. forward	1			
		12	25Z79	..GASKET, Brake spider and cam	1			
		13	1045Z1348	..BUSHING, Camshaft bracket	1			
		14	1018Z4746	..O-RING, Camshaft bracket	2			
		--	1015Z1075	..SEAL, Brake spider	1			
		12	25Z79	.SPIDER, Brake	1			
		13	1045Z1348	..BUSHING, Camshaft bracket	1			
		14	1018Z4746	..O-RING, Camshaft bracket	2			
		15	1018Z4747	..SEAL, Brake spider	1			
		16	1020Z2916	..RETAINER, Brake spider	1			
		17	1018Z672	.SCREW, Anchor pin lock	2			
		18	18Z125	.FELT, Anchor pin	4			
		19	1005Z496	.SPRING, Anchor pin felt retainer	4			
		20	18Z952D9	.BUSHING, Brake cam	2			
		21	18Z952D11	.SEAL, Felt	1			
		22	18Z124	.RETAINER, Felt seal	1			
		23	1006Z546	.WASHER, Retainer	2			
		24	1018Z812	.ADJUSTER, Brake slack	1			
		25	1018Z814	.WASHER, Spacer	AR			
		26	1019Z929	.WASHER	AR			
		27	1020Z4833	.PIN, Brake anchor	2			
		28	1018Z3596	.BOLT, Spider to housing	8			
		29	1020Z4447	.WASHER, Spider mounting bolt	16			
		30	1018Z4748	.NUT, Brake spider mounting	8			
		31	1020Z2779	.RETAINER, Brake roller	4			
		32	18Z147	.SCREW, Brake spider and cam bracket	4			
				.WASHER, Bracket mounting lock	4			

Ref. Dwg 10Z508

POWER PLANT ASSEMBLY

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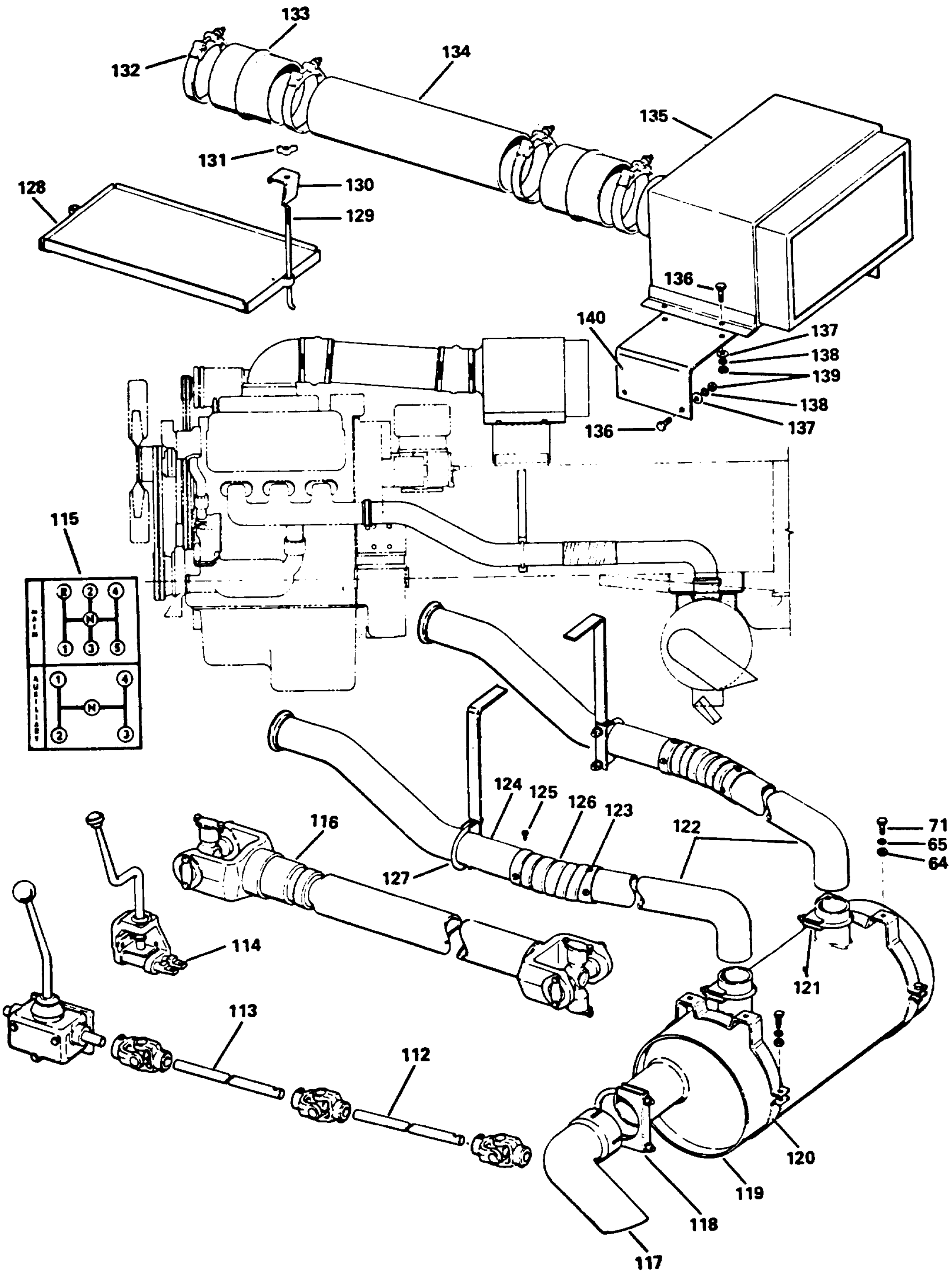
POWER PLANT ASSEMBLY (Continued)



Group	Page	Rev.
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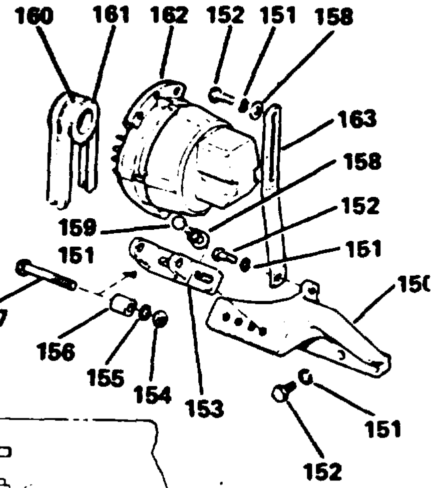
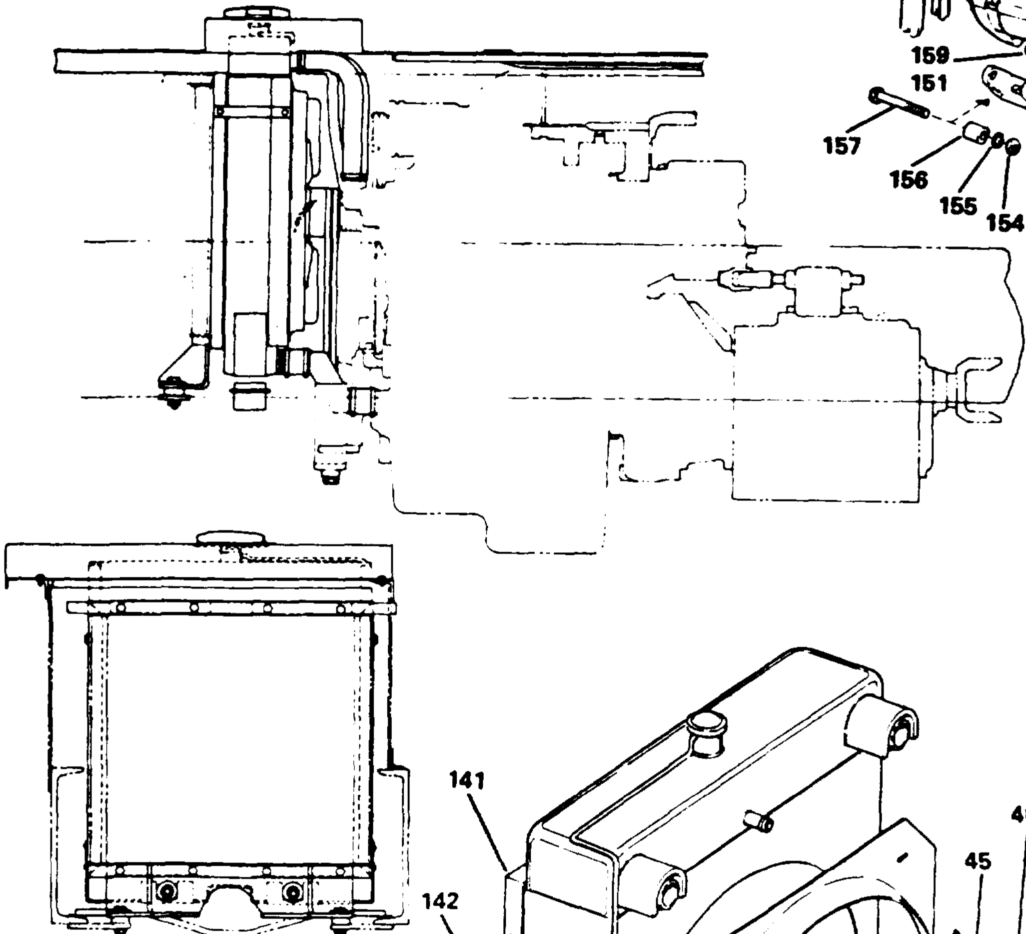
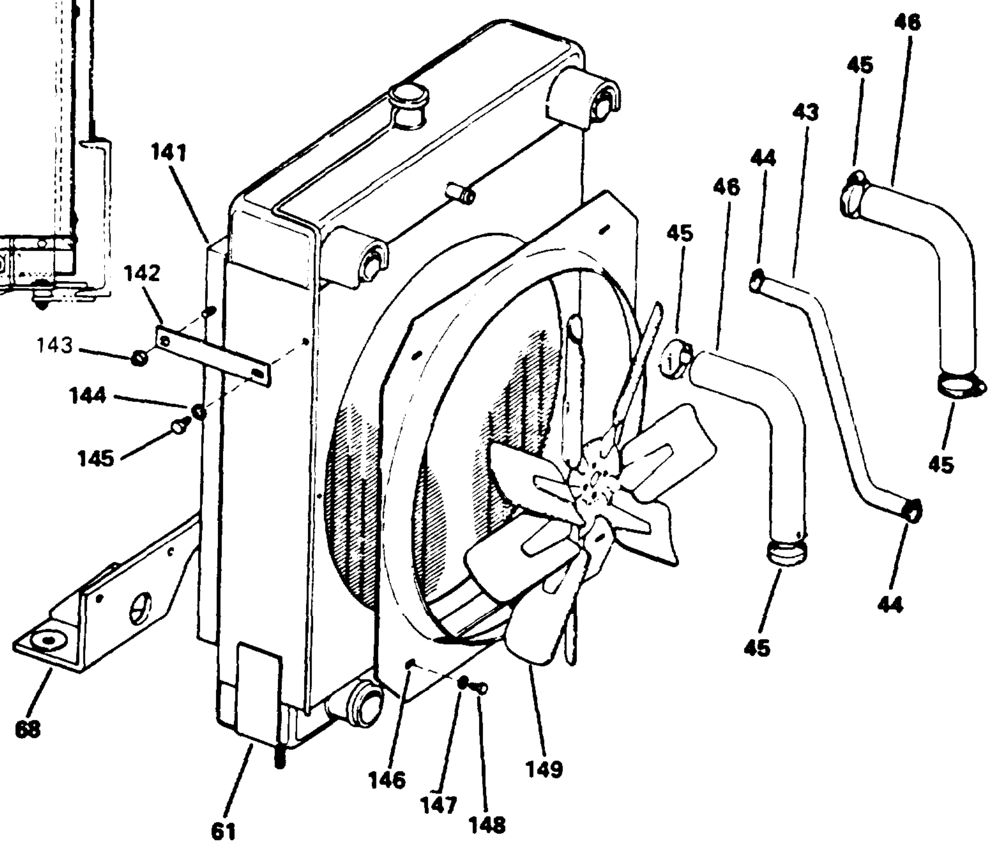
Sheet 3 of 8

POWER PLANT ASSEMBLY (Continued)







POWER PLANT ASSEMBLY (Continued)

Engine Assy 51Q282 (27315) 2815-00-315-9718

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 14	15	11	13
		--	8100J0579-14	POWER PLANT ASSY. – ENGINE GROUP				
		--	8100J0579-15	POWER PT. ASSY. – RADIATOR, AIR CLEANER & MFU. GP.				
		--	8100J0579-11	POWER PT. ASSY. – RADIATOR, AIR CLEANER & MUF. GP.				
		--	8100J0579-13	POWER PLANT ASSY. – ENGINE GROUP				
		01	51Q299	.ENGINE, GM 6V53N	--	--	--	1
		01	51Q366	.ENGINE, GM 6V53N	1	--	--	--
		02		.SCREW, Hex hd. 3/8-16UNC X 1-1/4 in.	2	--	--	2
		03		.WASHER, Lock 3/8 in.	2	--	--	2
		04	816P553	.BRACKET, Magnetic switch mounting	1	--	--	1
		05		.SCREW, Hex hd. 5/16-18UNC X 2-3/4 in.	1	--	--	1
		06		.WASHER, Lock 5/16 in.	1	--	--	1
		07	36Z290	.GOVERNOR, Compressor	1	--	--	1
		08	20Z1321	.GASKET, Governor	2	--	--	2
		09	818T339	.BRACKET, Governor	1	--	--	1
		10	89Z138	.SWITCH, Pressure	1	--	--	1
		11	44Z208D3	.CONNECTOR, Male	1	--	--	1
		12	44Z342D1	.TEE, 1/8 in. pipe	1	--	--	1
		13	44Z558D1	.NIPPLE, Pipe	1	--	--	1
		14	25T817D4	.BEARING, Main shaft pilot	1	--	--	1
		15	18Z2150	.BEARING, Clutch release	1	--	--	1
		16	15Z445	.CLUTCH (Page 4.1)	1	--	--	1
		17	20Z646D8	.SCREW, Hex hd. 3/8-16unc X 1-1/4 in. Gr. 5	8	--	--	8
		18	53Z550	.TRANSMISSION, Main (Page 5.4)	1	--	--	1
		19	89Z153	.SENDING UNIT, Oil pressure	2	--	--	2
		20		.TEE, 1/8 X 1-1/2 in. lg. extra strong pipe	1	--	--	1
		21		.NIPPLE, 1/8 in. pipe	1	--	--	1
		22		.BUSHING, 3/8 X 1/2 in. N.P.T. heater return	1	--	--	1
		23		.ELBOW, 90º street – 3/8 in. N.P.T. heater return	1	--	--	1
		24	89Z154	.SENDING UNIT, Water temp	1	--	--	1
		25	32Z1083D26	.CLAMP, 2 in. dia.	--	2	2	--
		26	89Z382	.DIPSTICK	1	--	--	1
		27	827N474	.TUBE, Dipstick	1	--	--	1
		28		.SCREW, Rd. hd. Mach. 1/4-20UNC X 1/2 in.	1	--	--	1
		29	816T1111	.SUPPORT, Dipstick tube	1	--	--	1
		30		.WASHER, Lock 1/4 in.	1	--	--	1
		31		.NUT, Hex 1/4 –20UNC	1	--	--	1
		32	44Z198D12	.FITTING, Tube adapter	1	--	--	1
		33	44Z250D3	.COCK, Engine drain	1	--	--	1
		34		.ELBOW, 90º street – 3/8 in. N.P.T.	2	--	--	2
		35	44Q14D1	.FITTING, Hose	--	4	4	--
		36		.HOSE, 1/4 in. ID X 18 in. lg.	--	2	2	--
		37	44Z210D3	.BUSHING, 3/8 in. X 1/4 in.	6	--	--	6
		38	806T245	.LEVER, Clutch	1	--	--	1
		39	18P935D40	.SPACER, Clutch lever	1	--	--	1
		40		.NIPPLE, 3/8 in. N.P.T. close	1	--	--	1
		41		.ELBOW, 90º street 3/4 in. N.P.T.	1	--	--	1
		42	44Z911D1	.FITTING, Beaded insert	2	--	--	2
		43		.HOSE, 3/4 in. ID X 43 in. lg. heater	--	1	--	--
		43		.HOSE, 3/4 in. ID X 40 in. lg. heater	--	--	1	--
		44	44Z12D7	.CLAMP, Heater hose	--	2	2	--

POWER PLANT ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 14	15	11	13
		45	44Z12D8	.CLAMP, Radiator hose	2	2	2	2
		46	44Z867D8	.HOSE, Upper radiator	--	2	--	--
		46	44Z867D6	.HOSE, Upper radiator	--	--	2	--
		47		.NUT, Hex 1/2-20UNF	--	6	6	--
		48		.WASHER, Lock 1/2 in.	--	6	6	--
		49	79Z29D1	.INSULATOR, Engine	--	6	6	--
		50	816T1100	.BAR, Engine mounting	1	--	--	1
		51		.NUT, Hex 5/8-18UNF	2	--	--	2
		52		.WASHER, Lock 5/8 in.	2	--	--	2
		53		.SCREW, Hex 5/8-18UNF X 2-1/4 in.	2	--	--	2
		54	820T36	.BOLT, Motor support	--	6	6	--
		55	79Z30	.INSULATOR, Radiator	--	10	10	--
		56	820T142	.SPACER, Radiator stud	--	2	2	--
		57		.WASHER, Lock 1/2 in.	--	2	2	--
		58		.NUT, Hex 1/2-13UNC	--	2	2	--
		59	44Z1493	.HOSE, Lower radiator	--	1	1	--
		60	44Z12D13	.CLAMP, Lower radiator	--	2	2	--
		61	52U91D1	.RADIATOR	--	1	--	--
		61	52U79D1	.RADIATOR	--	--	1	--
		62	44Z463D4	.COCK, Radiator drain	--	2	2	--
		63	52U58	.COOLER, Hydraulic oil	--	1	1	--
		64		.NUT, Hex 3/8-16UNC	--	8	8	--
		65		.WASHER, Lock 3/ 8 in.	--	8	8	--
		66		..NUT, Hex 1/2-13UNC	--	4	4	--
		67		.WASHER, Lock 1/2 in.	--	4	4	--
		68	816P609	.MOUNT, Oil cooler	--	1	--	--
		68	816T1056	.MOUNT, Oil cooler	--	--	1	--
		69	820T492D2	.SPACER, Oil cooler mount	--	2	2	--
		70		.SCREW, Hex hd. 1/2-13UNC X 2	--	4	4	--
		71		.SCREW, Hex hd. 3/8-16UNC X 1 in.	--	8	8	--
		72	829T233	.SUPPORT, Oil cooler side	--	1	1	--
		73	816T904	.SUPPORT, Oil cooler side	--	1	1	--
		74	816T544D1	.SUPPORT, Oil cooler top	--	1	1	--
		75		.SCREW, Hex hd. 5/16-18UNC X 1 in.	--	6	6	--
		76		.WASHER, Lock 5/16 in.	--	6	6	--
		77		.NUT, Hex 5/16-18UNC	--	6	6	--
		78	829T232	.SUPPORT, Radiator side	--	1	1	--
		79		.SCREW, Hex hd. 3/8-24UNF X 1-1/4 in.	--	4	4	--
		80		.WASHER, Lock 3/8 in.	--	4	4	--
		81	20Q17D3	.SHAFT, Pump drive	--	1	1	--
		--	1025Z1546	..KIT, Journal cross and bearing	--	2	2	--
		82	20Z80D12	.SCREW, Hex hd. 3/8-24UNF X 1 in. Gr. 8	--	4	4	--
		83	18P4233	.ADAPTER, Pump drive shaft	--	1	1	--
		84		.SCREW, Socket hd. 3/8-16UNC X 1-1/4 in.	--	6	6	--
		85	20Z646D25	.SCREW, Hex hd. 5/16-18UNC X 1-1/2 in. Gr. 5	6	--	--	--
		86		.WASHER, Lock 5/16 in.	6	--	--	--
		87	18Z2461	.SPACER, Fan	1	--	--	--
		88	816T1109	.BRACKET, Fuel filter support	1	--	2	1
		89		.NUT, Hex 3/8-16UNC	4	--	--	4
		90		.WASHER, Lock 3/8 in.	4	--	--	4

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 14	15	11	13
		91		.WASHER, Flat 3/8 in.	4	--	--	4
		92	816P552	.BRACKET, Fuel filter	1	--	--	1
		93		.SCREW, Hex hd. 3/8-10UNC X 1-1/2 in.	4	--	--	4
		94	44Z473D24	.HOSE, Flexible fuel line	4	--	--	4
		95	44Z206D3	.ELBOW, 90º	3	--	--	3
		96	44Z226D1	.PLUG, Fuel filter	2	--	--	2
		97	44Z206D5	.ELBOW, 90º	3	--	--	3
		98	44Z368D8	.CONNECTOR, Compression	1	--	--	1
		99	20Z646D49	.SCREW, Hex hd. 3/8-16UNC X 1-1/2 in. Gr. 5	12	--	--	12
		100		.SCREW, Hex hd. 1/2-13UNC X 1-3/4 in.	8	--	--	8
		101		.WASHER, Lock 1/2 in.	8	--	--	8
		102	816P521	.SUPPORT, R.H. rear engine	1	--	--	1
		103	829P292	.BAR, Rear transmission support	--	1	1	--
		104		.BRACKET, Hanger	--	1	1	--
		105	16Z209D3	.INSULATOR, Transmission mount	--	2	2	--
		106	18H3892D15	.WASHER	--	2	2	--
		107	829T316	.BAR, Transmission hanger	--	1	1	--
		108		.BOLT, 1/2-13UNC X 5 in.	--	1	1	--
		109	829T337	.HANGER, Harness and hose	--	1	1	--
		110	816P522	.BRACKET, L.H. rear engine	1	--	--	1
		111	41U16	.PUMP, Power steer and outrigger (Page 11.1)	1	--	--	1
		112	820T513D1	.ROD, Main transmission rear shift	--	1	1	--
		113	820T514D1	.ROD, Main transmission forward shift	--	--	1	--
		114	6Z523	.LEVER ASSY., Auxiliary shift (Page 3-9.1)	--	--	1	--
		115	32Q398	.CHART, Transmission shift	--	1	1	--
		116	10U49D7	.SHAFT, Main to auxiliary drive	--	1	1	--
		--	1025Z1560	.KIT, Journal cross and bearings	--	2	2	--
		117	827T450	.PIPE, Exhaust tail	--	1	1	--
		118	32Z171D12	.CLAMP, Tail pipe	--	1	1	--
		119	27Z646	.MUFFLER	--	1	1	--
		120	16Z264D6	.BAND, Muffler mounting	--	2	2	--
		121	32Z171D10	.CLAMP, Muffler	--	2	2	--
		122	827T376	.TUBE, Exhaust	--	2	2	--
		123		.SCREW, Sheet metal 1/4-20UNC X 1/2 in.	--	8	8	--
		124	827T380-1	.TUBE, Exhaust	--	2	2	--
		125		.SCREW, Sheet metal 1/4-20UNC X 1/2 in.	--	4	4	--
		126	44Z1308D4	.HOSE, Flexible exhaust	--	1	1	--
		127	32Z171D11	.CLAMP, Exhaust	--	2	2	--
		128	227P123-1	.CARRIER, Battery	--	1	1	--
			MS35001-5	.BATTERY, 12V, 200 amp, NSN 6140-00-191-8485 (96906)				
		129	220T126	.STUD, Battery carrier	--	2	2	--
		130	16T1497	.CLAMP, Battery hold down	--	2	2	--
		131	20H1686D3	.NUT, Wing	--	2	2	--
		132	44Z978D3	.CLAMP, T-Bolt	--	4	4	--
		133	44Z808D2	.BELLOWS, Air intake	--	2	2	--
		134	827T431	.TUBE, Air intake	--	1	1	--
		135	46Q12D1	.FILTER, Air	--	1	1	--
		--	1045Z639	.ELEMENT	--	1	1	--
		136		.SCREW, Hex hd. 3/8-16UNC X 1-1/4 in.	--	8	8	--
		137		.WASHER, Flat 3/8 in.	--	8	8	--
		138		.WASHER, Lock 3/8 in.	--	8	8	--

POWER PLANT ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 14	15	11	13
		139		.NUT, Hex 3/8-16UNC	--	8	8	--
		140	816P524	.BRACKET, Air cleaner mounting	--	1	1	--
		141	814P13	.SHROUD, Oil cooler	--	1	--	--
		142	829T350	.BRACE, Oil cooler shroud	--	2	--	--
		143	20Z1112D3	.NUT, Hex lock 3/8-16UNC	--	4	--	--
		144		.WASHER, Lock 3/8 in.	--	4	--	--
		145		.SCREW, Hex hd. 3/8-16UNC X 5/8 in.	--	10	--	--
		146	814N11	.SHROUD, Fan	--	1	--	--
		147	49Z220	.WASHER, Lock 5/16 in.	--	4	--	--
		148	16U18	.SCREW, Hex hd. 5/16-18UNC X 5/8 in.	--	4	--	--
		149	20Z646D47	.FAN, 22 inch suction	1	--	--	--
		150	16Q50	.BRACKET, Alternator mounting	1	--	--	--
		151		.WASHER, Lock 3/8 in.	3	--	--	--
		152		.SCREW, Hex hd. 3/8-16UNC X 1 in. Gr. 5	5	--	--	--
		153		.BRACKET, Alternator	1	--	--	--
		154		..NUT, Hex 1/2-20UNF	1	--	--	--
		155		..WASHER, Lock 1/2 in.	1	--	--	--
		156		..SPACER, Pipe 15/16 in. lg.	1	--	--	--
		157		..SCREW, Hex hd. 1/2-20UNF X 3-1/2 in.	1	--	--	--
		158		.WASHER, Flat 3/8 in.	2	--	--	--
		159	20Z646D48	.SCREW, Hex hd. 3/8-16UNC X 1-1/4 in. Gr. 5	2	--	--	--
		160	7Z395D2	.BELT, Alternator	1	--	--	--
		161	7Q21D1	.PULLEY, Alternator	1	--	--	--
		162	88U11D1	.ALTERNATOR, (Page 2.4)	1	--	--	--
		163	6P2540	.ARM, Alternator adjusting	1	--	--	--
		--		.CLUTCH, GROUP,Hydraulic (Page 3.1)	1	--	--	--
		--	53Z455	.TRANSMISSION, Auxiliary (Page 6.1, 6.2)	1	--	--	1
		--	100X139-43	.ELECTRICAL ASSY., GM6V53N (Page 2.1)	--	--	1	--
		--	100X139-44	.ELECTRICAL ASSY., GM6V53N (Page 2.1)	--	--	1	--
					1	--	--	--

Ref. Dwg. 8100J0579 2 8100J0579-11
8100J0579-14 8100J0579-13
8100J0579-15

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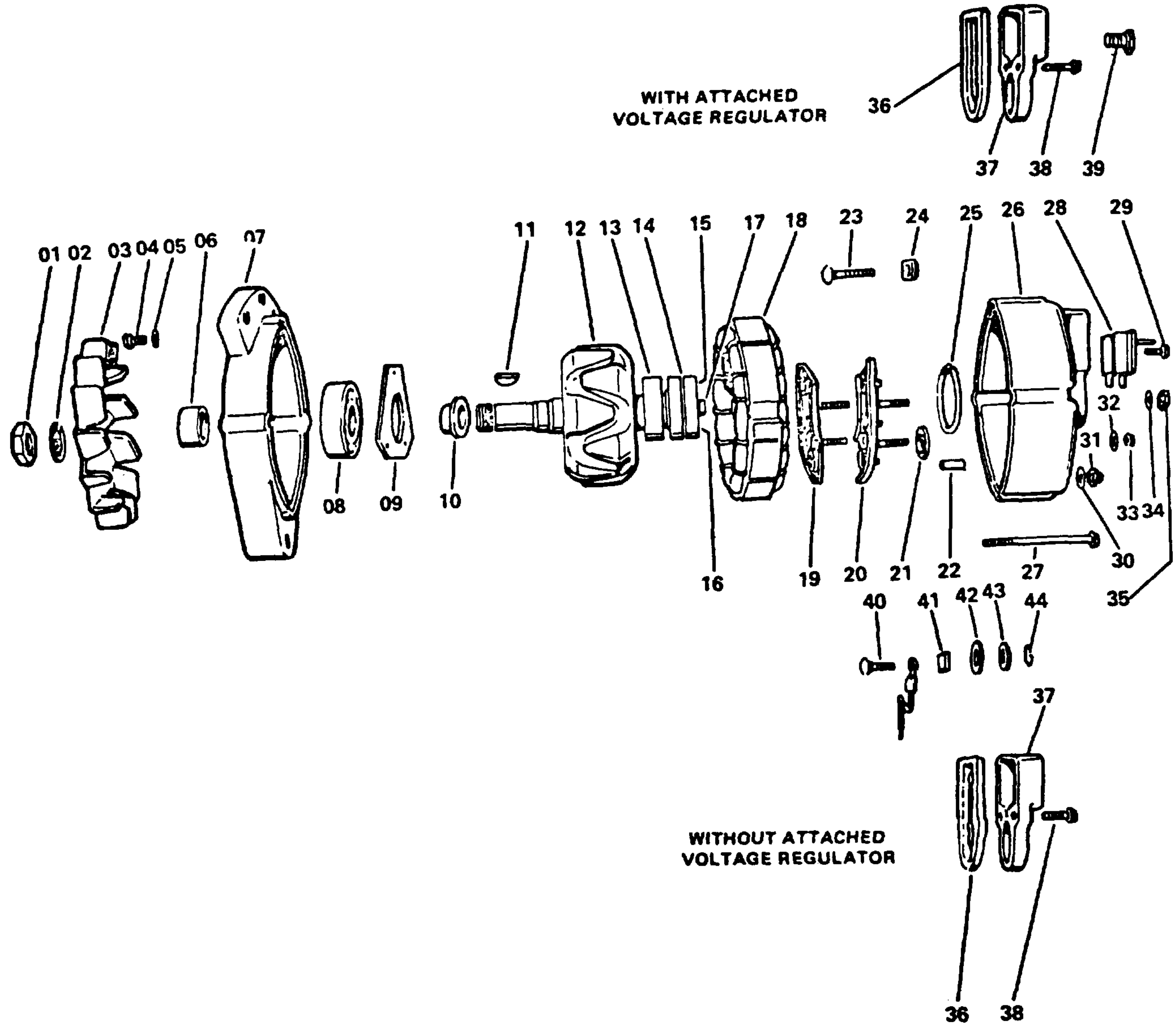
Group	Page	Rev.
4	1.2	002

ALTERNATOR

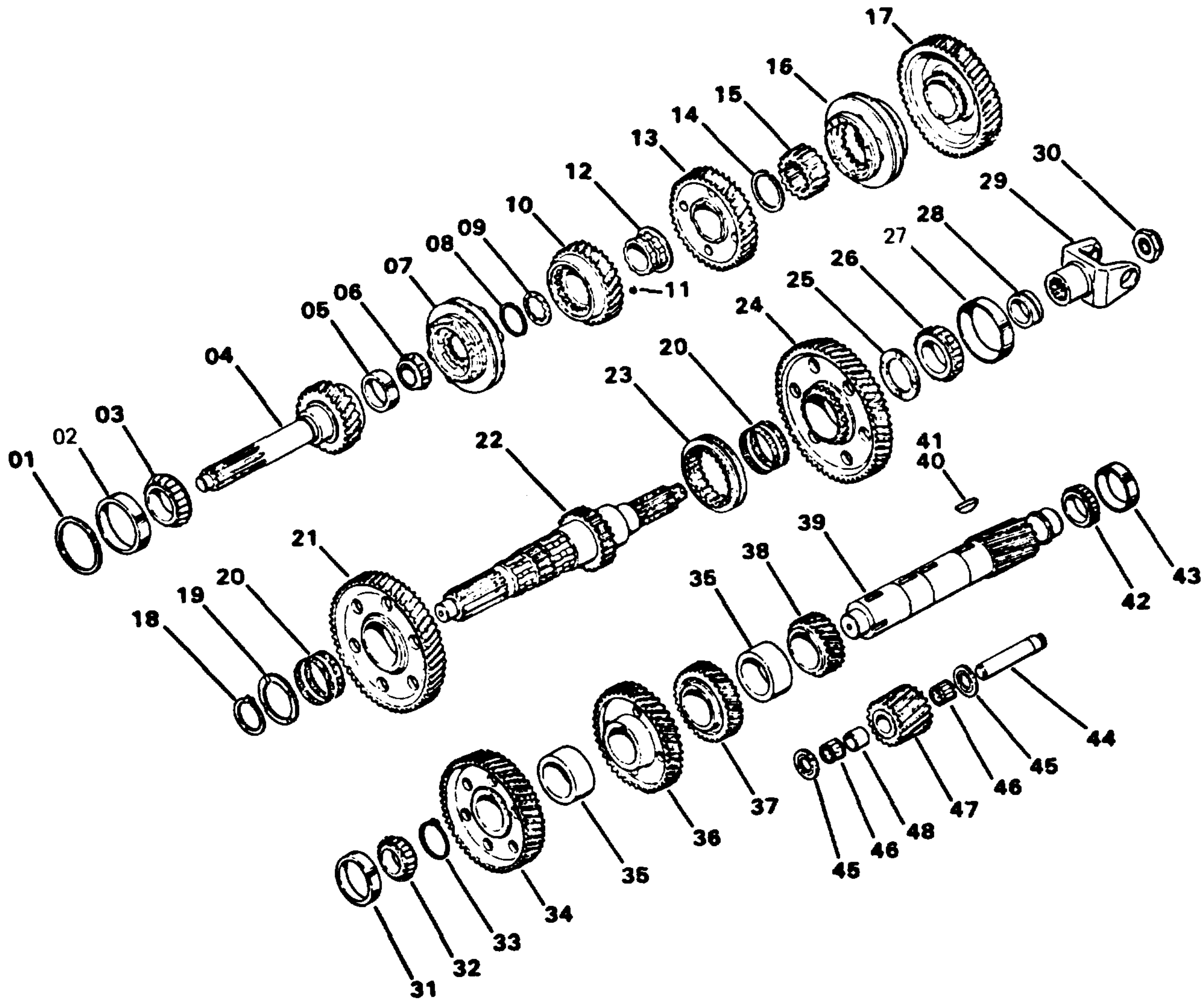


QTY	STOCK	Ref.	Part Number	Description	Quantity / Figure Number D1	D2		
		--	88U11D1	ALTERNATOR, WITH ATTACHED VOLTAGE REGULATOR				
		--	88U11D2	ALTERNATOR, W/O ATTACHED VOLTAGE REGULATOR				
		01	1020Z5012	.NUT, Fan and pulley retaining	1	1		
		02	1018Z4894	.WASHER, Lock	1	1		
		03	49Z268	.BLADE, Bi-directional fan	1	1		
		04	1020Z5018	.SCREW, Iridite plated machine #8-32 X 5/8 in.	1	1		
		05	1018Z4897	.WASHER, Cadium plated lock #8	1	1		
		06	1074Z100	.SPACER, Fan	1	1		
		07	1014Z1378	.HOUSING, Front	1	--		
		07	1014Z1376	.HOUSING, Front	--	1		
		08	1025Z1282	.BEARING, Front	1	1		

ALTERNATOR (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number D1	D2		
		09	1020Z1737	.RETAINER, Front bearing	1	1		
		10	1018Z3295	.SLEEVE, Front bearing to shaft	1	1		
		11	1020Z3139	.KEY, #5 Woodruff	1	1		
		12	1074Z11	.ROTOR ASSY	1	1		
		13	1025Z1280	.BEARING, Rear	1	1		
		14	1018Z3290	.RING, ASSY., Slip	1	1		
		15	1018Z3294	.WASHER, Cadium plated #10	1	1		
		16	1018Z4898	.WASHER, Cadium plated #10	1	1		
		17		.SCREW, Socket hd. #10-32 X 5/8 in.	1	1		
		18	1071Z79	.STATOR ASSY	1	1		
		19	1075Z716	.DIODE, Negative	1	--		
		19	1075Z713	.DIODE, Negative	--	1		
		20	1075Z715	.DIODE, Positive	1	--		
		20	1075Z714	.DIODE, Positive	--	1		
		21	1018Z3291	.INSULATOR, Diode	--	4		
		22	1018Z4874	.SLEEVE, Diode	4	--		
		22	1018Z4893	.SLEEVE, Diode	--	4		
		23	1020Z5020	.BOLT, Cadium plated carriage #10-24 X 1-1/2 in.	4	4		
		24	1079Z1392	.INSULATOR, Molded	4	4		
		25	1025Z1736	.RETAINER, Rear bearing	1	1		
		26	1014Z1377	.HOUSING, Rear	1	1		
		27	1020Z5019	.BOLT, Cadium plated through #10-32 X 3-5/16 in.	4	--		
		27	1020Z5011	.BOLT, Cadium plated through #10-32 X 3-1/8 in.	--	4		
		28	73Z35	.BRUSH ASSY	1	1		
		29		.SCREW, Self tapping #8-32 X 3/4 in.	2	--		
		29	1020Z5013	.SCREW, Cadium plated tapping #8 X 1/2 in.	--	2		
		30		.WASHER, Flat 1/4 in.	2	1		
		31	1020Z5015	.NUT, Cadium plated #10-24UNC	2	1		
		32	1018Z4875	.INSULATOR	--	1		
		33	1020Z5014	.NUT, Cadium plated lock #10-24UNC	--	1		
		34	1018Z4896	.WASHER, Cadium plated lock 1/4 in.	2	2		
		35		.NUT, Hex 1/4-20UNC	2	--		
		35	1020Z5021	.NUT, Cadium plated hex 1/4-20UNC	--	2		
		36	1020Z3138	.GASKET, Felt	1	1		
		37	79Z2762	.REGULATOR, Voltage	1	--		
		37	87Z306	.COVER, Rear housing	--	1		
		38	1020Z5016	.SCREW, Cadium plated tapping #8 X 3/4 in.	--	2		
		38	1020Z5017	.SCREW, Self tapping #8-32 X 3/4 in.	1	--		
		39	1079Z1392	.SCREW, Self tapping #8-32 X 1/2 in.	1	--		
		40		.BOLT, Cadium plated carriage #10-24UNC X 3/4 in.	--	1		
		41		.INSULATOR, Molded	--	1		
		42		.WASHER, Flat 1/4 in.	--	1		
		43	1018Z4895	.WASHER,Cadium plated flat #10	--	1		
		44		.WASHER,Cadium plated lock #10	--	1		
		--	1079Z1512	.REGULATOR, Voltage (NOT SHOWN)	--	1		
				NOTE				
				All individual wires, leads, and jumpers should be fabricated locally.				

MAIN TRANSMISSION GEAR AND SHAFT GROUP



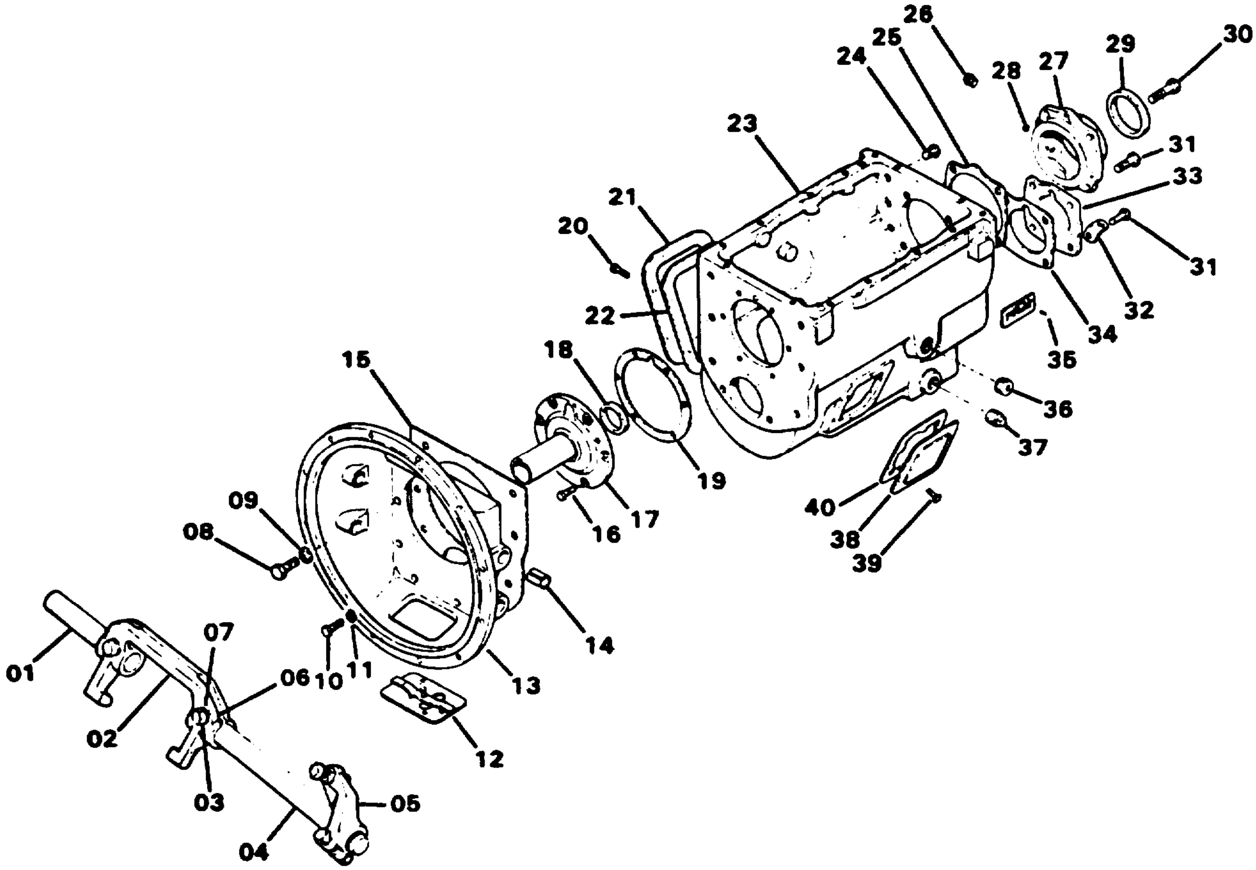
Ref.	Part Number	Description	Quantity Figure Number					
--		.GEAR & SHAFT GROUP – MAIN TRANS.	▼					
01	1018Z5269	.SPACER, main shaft front bearing	AR					
02	1025Z1854	.CUP, Bearing	1					
03	1025Z1855	.CONE, Bearing	1					
04	1001Z1164	.GEAR, Drive	1					
05	1025Z1852	.CUP, Bearing	1					
06	1025Z1851	.CONE, Bearing	1					
07	1053Z95	.SYNCHRONIZER ASSY., 4th and 5th gear	1					
08	1018Z3519	.RING, Snap	1					
09	1018Z3524	,WASHER, Thrust	1					
10	1001Z768	.GEAR, Main shaft 4th	1					
11	1019Z756	.PIN, Gear sleeve	1					
12	1018Z3517	.SLEEVE, Main shaft 4th gear	1					
13	1001Z767	.GEAR, Main shaft 3rd	1					

MAIN TRANSMISSION GEAR AND SHAFT GROUP (Continued)

Ref.	Part Number	Description	Quantity Figure Number					
14	1018Z3522	.RING, Snap	1					
15	1001Z772	.GEAR, 2nd and 3rd speed clutch	1					
16	1053Z94	.SYNCHRONIZER ASSY., 2nd and 3rd gear	1					
17	1001Z1163	.GEAR, Main shaft 2nd speed	1					
18	1018Z5266	.RING, Snap	1					
19	1018Z5271	.WASHER, Thrust	1					
20	1025Z1861	.BEARING, Double row	2					
21	1001Z1161	.GEAR, Mainshaft 1st	1					
22	1010Z1105	.SHAFT, Main	1					
23	1018Z5267	.COLLAR, 1st and reverse clutch	1					
24	1001Z1162	.GEAR, Mainshaft reverse	1					
25	1018Z5270	.WASHER, Thrust	1					
26	1025Z1853	.CONE, Bearing	1					
27	1025Z1854	.CUP, Bearing	1					
28	1018Z3516	.SPACER, Speedometer	1					
29	1006Z416	.YOKE, U-joint	1					
30	1020Z3262	.NUT, Yoke	1					
31	1025Z1856	.CUP, Bearing	1					
32	1025Z1857	.CONE, Bearing	1					
33	1018Z3864	.RING, Snap	1					
34	1001Z1159	.GEAR, Countershaft drive	1					
35	1020Z5325	.SPACER, 2nd and 3rd gear	2					
36	1001Z770	.GEAR, Countershaft 4th speed overdrive	1					
37	1001Z762	.GEAR, Countershaft 3rd speed	1					
38	1001Z1165	.GEAR, Countershaft 2nd speed	1					
39	1010Z1103	.COUNTERSHAFT	1					
40	1020Z5326	.KEY, Countershaft 2nd speed gear	1					
41	1020Z5331	.KEY, Countershaft drive, 3rd and 4th gear	3					
42	1025Z1859	.CONE, Bearing	1					
43	1025Z1858	.CUP, Bearing	1					
44	1010Z1104	.SHAFT, Reverse idler	1					
45	1018Z4008	.WASHER, Thrust	2					
46	1025Z1860	.BEARING, Reverse idler gear	2					
47	1001Z1160	.GEAR, Reverse idler	1					
48	1018Z5268	.SPACER, Reverse idler shaft	1					

Ref. Dwg. 53Z550

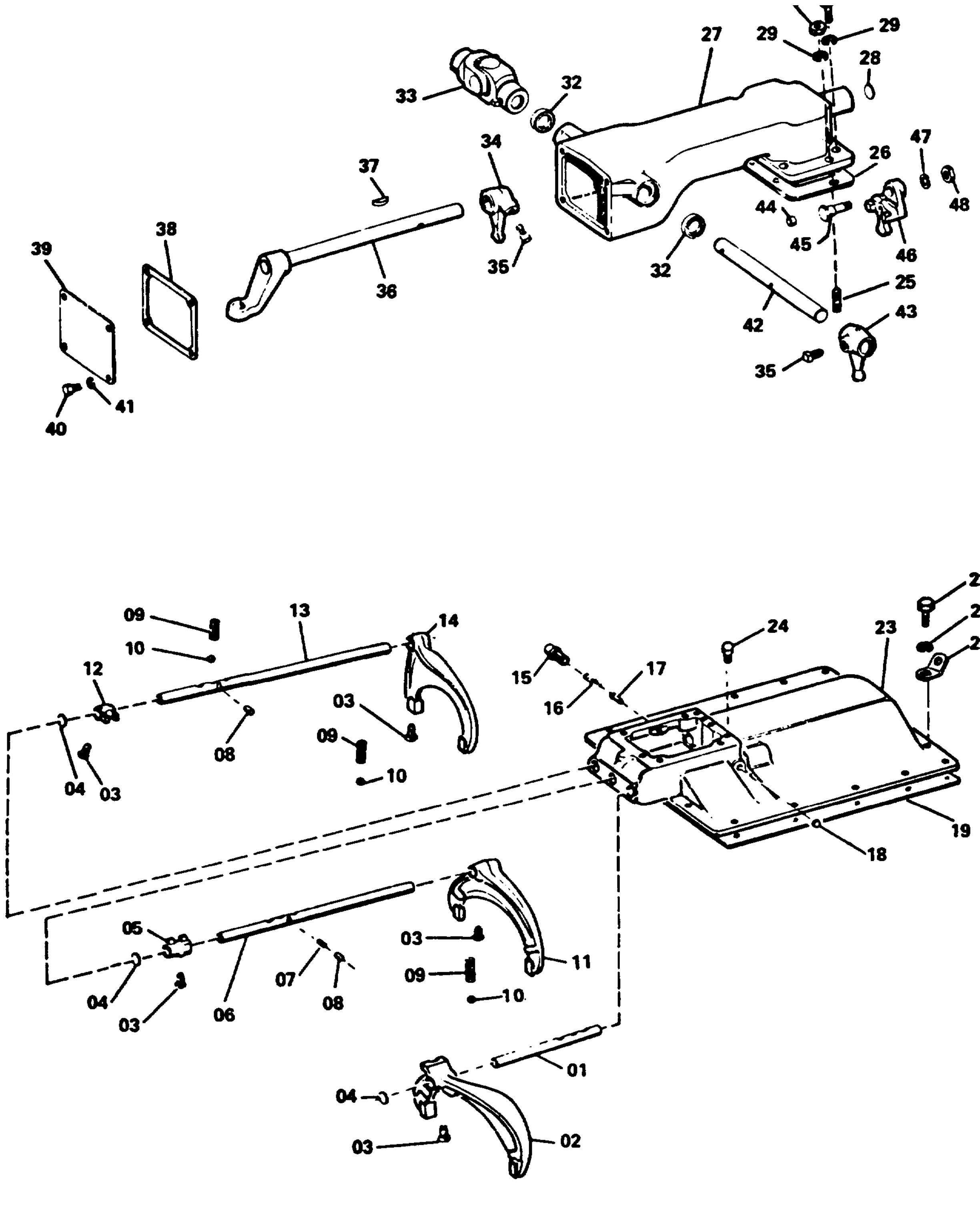
MAIN TRANSMISSION CASE AND CLUTCH HOUSING GROUP



Ref.	Part Number	Description	Quantity Figure Number					
		CASE &CLUTCH HOUSING GROUP - MAIN TRANS.						
01	1010Z698	. SHAFT, Short.	1					
02	1006Z428	. YOKE..	1					
03		. SCREW, Hex. hd. 7/16-14UNC x 3/16 in.	2					
04	1010Z697	. SHAFT, Long.	1					
05	1006Z429	. ARM, Pedal adjusting.	1					
06	1020Z841	.KEY.	1					
07		. WASHER, Lock 7/16 in..	2					
08	1020Z3355	. SCREW, Nylon patch.	7					
09		. WASHER, External tooth lock *5/8* in..	7					
10		. SCREW, Hex. hd. cap 7/16-14UNC x 1-3/8 in.	1					
11		. WASHER, External tooth lock 7/16 in.	1					
12	1014Z1482	. COVER, Inspection.	1					
13	1014Z779	. HOUSING ASSY., Clutch.	1					

Ref.	Part Number	Description	Quantity Figure Number					
14	1005Z133	.. BUSHING, Clutch release shaft.	2					
15	1020Z5330	. GASKET. Clutch housing	1					
16	1020Z3369	. SCREW, Nylon patch.	6					
17	1025Z1850	. CAP, Front bearing	1					
18	1018Z5261	.. SEAL,Oil.	1					
19	1020Z5328	GASKET, Front bearing cap	1					
20	1020Z4006	SCREW,Nylon patch	8					
21	1014Z899	. COVER, Aperature	1					
22	1020Z3727	.GASKET,Cover	1					
23	1014Z1483	CASE, Transmission.	1					
24	1020Z3350	. PLUG, Rear case	5					
25	1020Z5329	. GASKET, Rear bearing cap.	1					
26	1020Z3340	. PLUG, Speedometer hole	1					
27	1025Z1849	CAP, Mainshaft rear bearing.	1					
28	1005Z412	.. BUSHING, Speedometer.	1					
29	1018Z3515	.. SEAL,Oil.	1					
30	1020Z4418	. SCREW, Nylon patch.	1					
31	1020Z3367	. SCREW, Nylon patch.	3					
32	1020Z5333	. HOOK, Lifting	1					
33	1025Z1847	. CAP, Countershaft rear bearing	1					
34	1020Z5327	. GASKET, Countershaft bearing cap	1					
35	1019Z745	. PIN, Nameplate.	4					
36	1020Z5332	. PLUG, Level.	1					
37	1020Z3341	. PLUG, Magnetic drain	1					
36	1014Z153	. COVER, Aperature	1					
39	1020Z3356	. SCREW, Nylon patch.	6					
40	1020Z3241	.GASKET,Cover	1					

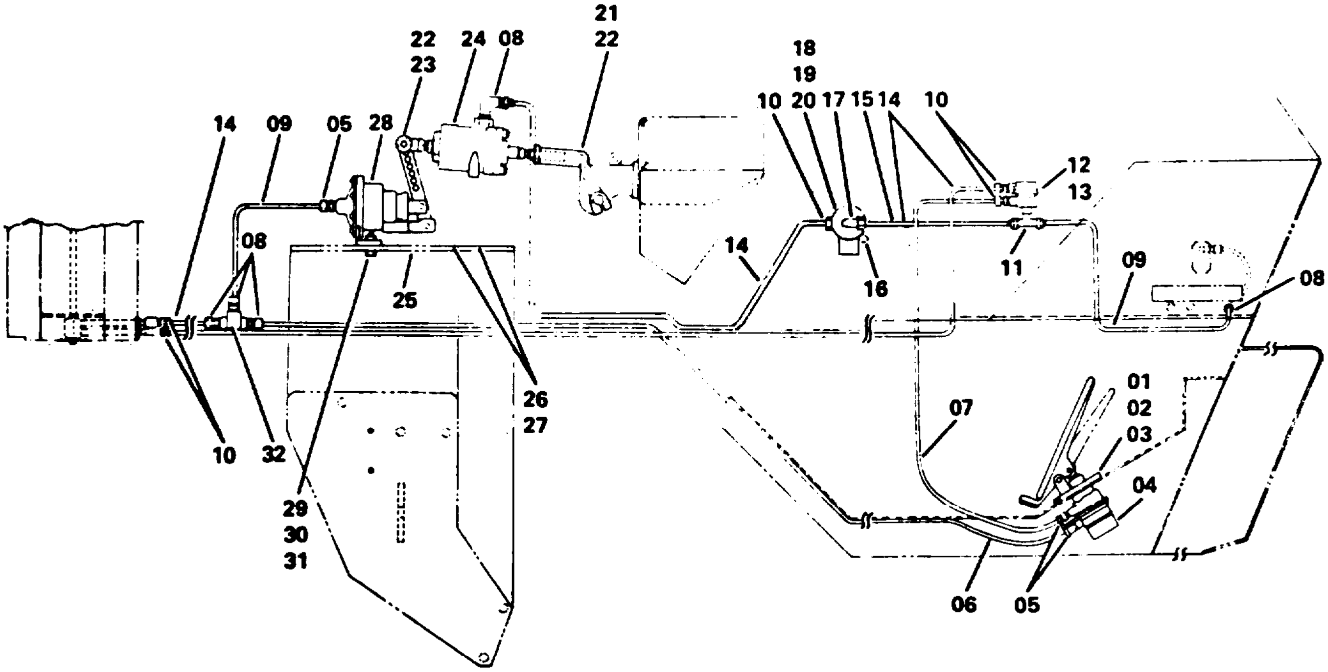
MAIN TRANSMISSION YOKES, BAR AND REMOTE CONTROL GROUP



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number			
				YOKES, BARS & REMOTE CONTROL GP. MAIN TRANS				
		01	1006Z424	. ROD, 4th and 5th Shift	1			
		02	1006Z422	.FORK, 4th and 5th shift	1			
		03	1020Z3353	.SCREW, Set	5			
		04	1020Z3358	.PLUG	3			
		05	1020Z3346	.BRACKET, 2nd and 3rd	1			
		06	1006Z423	.ROD, 2nd and 3rd shift	1			
		07	1019Z755	.PIN, Interlock	1			
		08	1025Z1346	. PIN, Interlock	2			
		09	1017Z801	.SPRING, SHIFT ROD POPPET	3			
		10	1025Z1347	. Ball, SHIFT ROD POPPET	3			
		11	1006Z421	. Fork, 2ND AND 3RD SHIFT	1			
		12	1020Z3347	. Bracket, 1ST AND REVERSE SHIFT	1			
		13	1006Z425	. ROD, 1st and reverse shift	1			
		14	1006Z418	. FORK, 1st and reverse shift	1			
		15	1018Z3514	. RETAINER, PLUNGER	1			
		16	1017Z802	. SPRING, Plunger	1			
		17	1019Z754	. PIN, PLUNGER	1			
		18	1020Z3357	. Plug, INTERLOCK	1			
		19	1020Z3343	. Gasket, Housing to case	1			
		20		. HOOK, LiFT	2			
		21		. Washer, Lock 3/8 in.	14			
		22		. Screw, Hex hd. 3/8-16 UNC x 1-1/4 in.	14			
		23	1014Z777	. HOUSING, Shift	1			
		24	1046Z185	. BREATHER	1			
		25	1020Z3349	. STUD, Remote tower mounting	2			
		26	1020Z3342	. GASKET, Tower to housing	1			
		27	1014Z783	. TOWER, Remote control	1			
			1005Z413	..BUSHING	4			
		28	1020Z3359	. PLUG, Expansion	1			
		29		. WASHER, Lock 7/16 in	6			
		30		. SCREW, hex hd. 7/16-14 UNC x 1-1/4 in	4			
		31		.NUT, Hex 7/16-14 UNC	2			
		32	1018Z3445	. SEAL, Shift rod	2			
		33		. U-JOINT	1			
		34	1006Z419	. FINGER, Inner shift	1			
		35	1020Z3248	. SCREW, Set	2			
		36	1006Z430	. ROD & BRACKET, Shift finger	1			
		37	1020Z3249	.. KEY, Shift rod	1			
		38	1020Z804	. GASKET, Tower cover	1			
		39	1014Z780	.COVER, Tower	1			
		40		.SCREW, hex hd. 5/16-18UNC x 3/4 in.	4			
		41		.WASHER, Lock 5/16 in.	4			
		42	1006Z427	.ROD, Remote control shift	1			
		43	1006Z426	.FINGER, Outer SHIFT	1			
		44	1020Z843	.PLUG,1st and reverse finger hole	1			
		45	1020Z3354	STUD, 1st and reverse shift finger	1			
		46	1006Z417	.FINGER, 1ST AND REVERSE SHIFT	1			
		47		.WASHER, Lock 1/2 in	1			
		48	1020Z3361	NUT, Shift finger stud	1			

Ref. Dwg. 53Z550

CARRIER AIR THROTTLE ASSEMBLY



QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 6			
			100X131-6	AIR THROTTLE ASSY., CARRIER				
		01		.SCREW,Hex hd.5/16-18UNCx 1 in..	3			
		02		. WASHER, Lock 5/16 in	3			
		03		. NUT, Hex 5/16-18UNC	3			
		04	36U29D4	. VALVE, Air throttle (Page 8.2)	1			
		05	44Z1322D1	. FITTING, Straight.	8			
		06		.TUBE,Nylon24ft..	1			
		07		.TUBE,Nylon3ft..	1			
		08	44Z1320D1	. ELBOW, 90°.	4			
		09		.TUBE, Nylon 2ft..	2			
		10	44Z1322D3	. FITTING. Straight	3			
		11	44Z1321SD4	. T E E..	1			
		12	36Z971	. VALVE, Air selector	1			
		13	32Z1381	. DECAL, Selector.	1			
		14		.TUBE,Nylon 14ft	2			
		15		.TUBE, Nylon 1ft..	1			
		16	46Z330D1	. BREATHER, Solenoid valve	1			
		17	44Z1320D3	. ELB0W, 90°.	1			
		18	36Z2888D1	. VALVE, Solenoid	1			
		19		.SCREW.Rd.hd.#8-32UNC x 5/16in..	2			
		20		.WASHER,Lock #8	2			
		21	19F47D2	. PIN, Drilled	1			
		22		.PIN,Cotter3/32x1/2in..	4			
		23	19F47D3	. PIN, Drilled	1			
		24	938P14.1	. CYLINDER ASSY Air	1			
			38Q40	. .CYLINDER, Air	1			
			806T321	. . YOKE, Governor rod end	1			

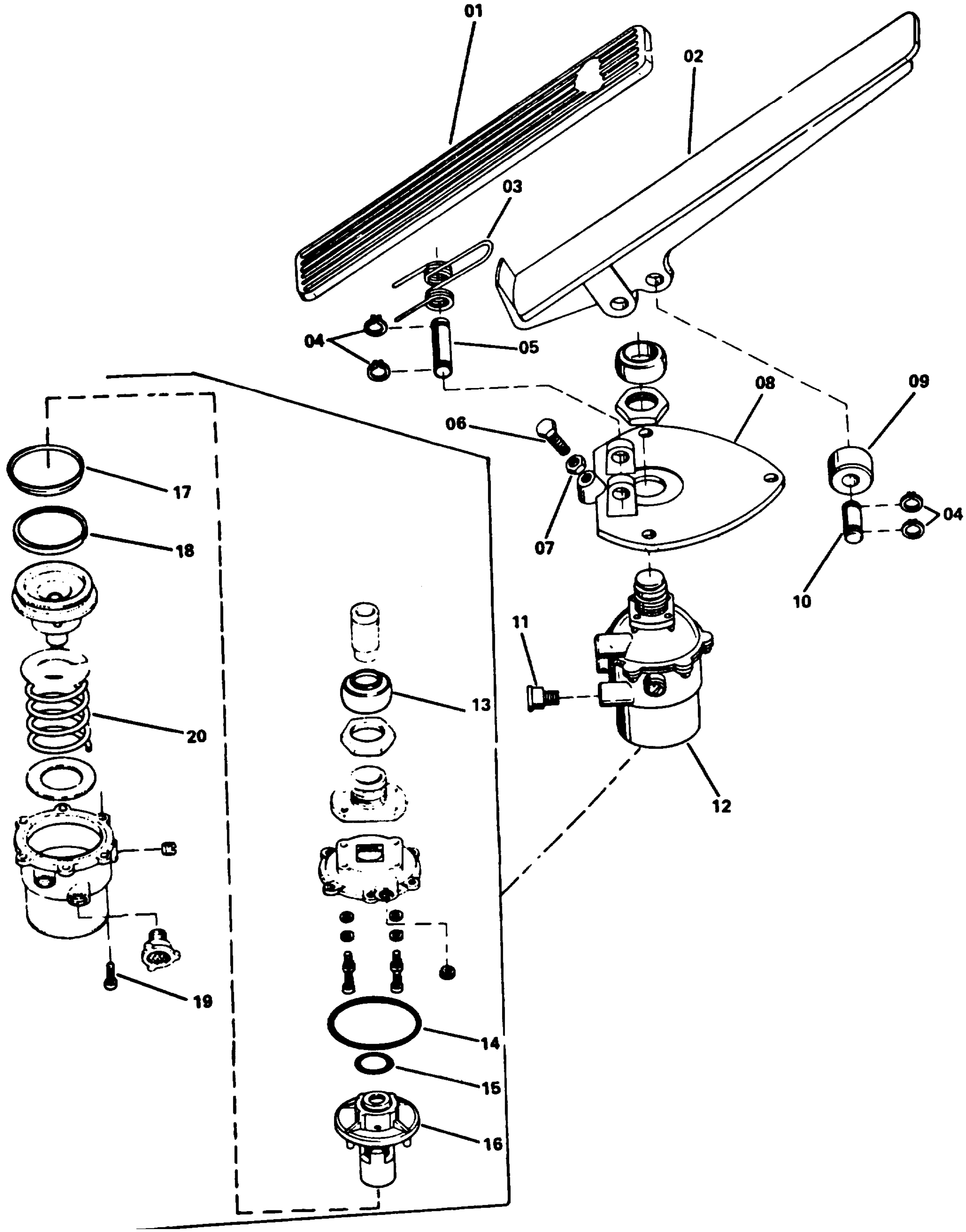
CARRIER AIR THROTTLE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number 6			
				.. NUT, Hex jam 7/16-20UNF.	1			
			806T326	.. YOKE, Slave cylinder rod end	1			
		25	816T1326	. BRACKET, Cylinder mounting	1			
		26		.SCREW,Hex hd.3/8-16UNCxlin..	2			
		27		.WASHER, Lock 3/8in	2			
		28	36U30D3	. CYLINDER, Throttle slave	1			
		29		. SCREW, Hex hd. 1/4-2OUNC x 3/4 in	2			
		30		.WASHER,Lock 1/4in	2			
		31		. NUT, Hex 1/4-20UNC	2			
		32	36Z763	. VALVE, Shuttle	1			

NOTE

The nylon tubing called for on this assembly is part number 20Z1411D2. When ordering nylon tubing you MUST specify, in feet, the length required.

AIR THROTTLE PEDAL AND VALVE ASSEMBLY

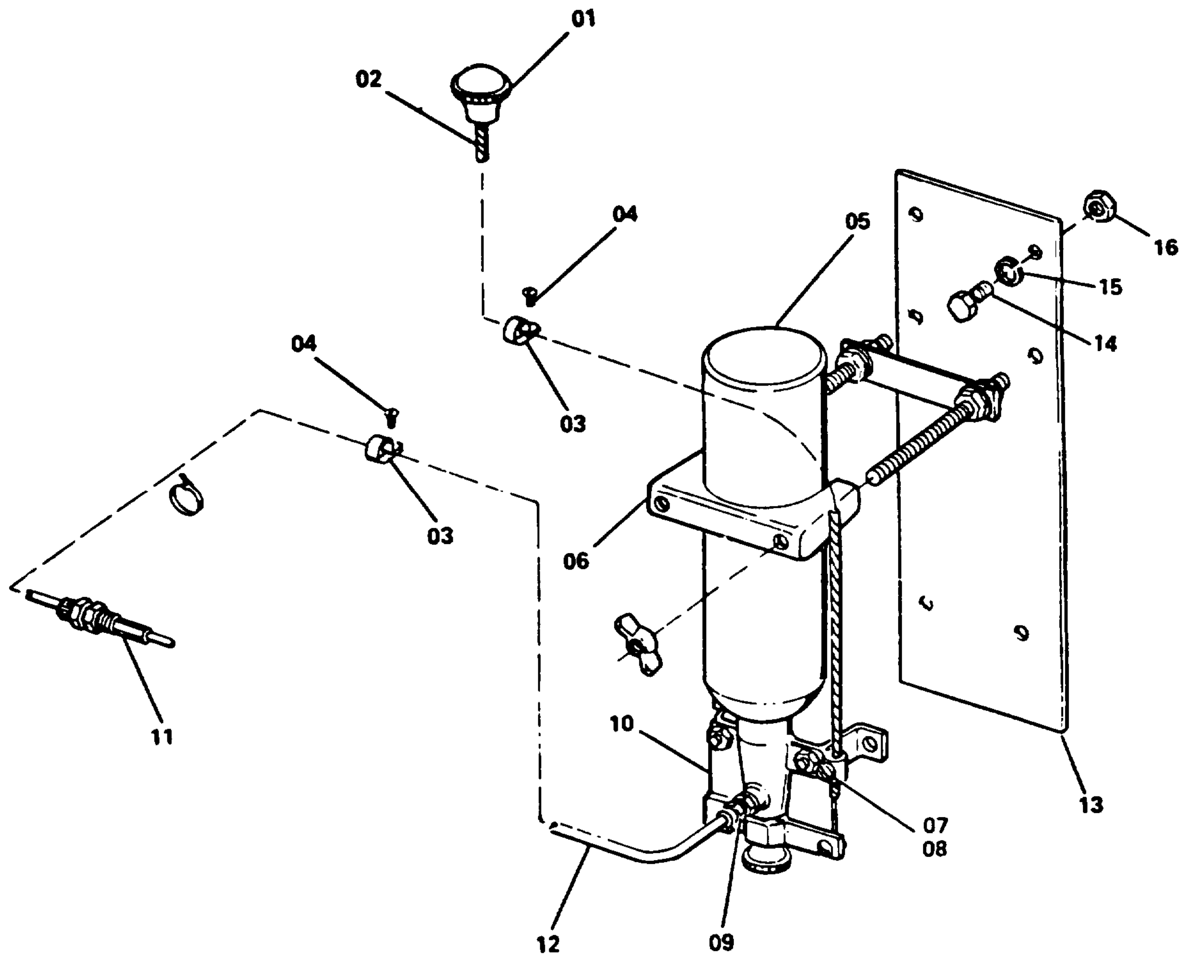


AIR THROTTLE PEDAL AND VALVE ASSEMBLY (Continued)

QTY	STOCK	Ref.	Part Number	Description	Quantity Figure Number D4			
			36U29D4	AIR THROTTLE PEDAL AND VALVE ASSY.				
		01	1014Z1372	. COVER, Treadle.	1			
		02	1006Z509	TREADLE	1			
		03	1017Z873	. SPRING.	1			
		04	1018Z4078	. RING, Retaining	4			
		05	1019Z838	.PIN,Treadle	1			
		06	1020Z5009	. SCREW, Cap.	1			
		07	1020Z4068	.NUT,Jam	1			
		08	1016Z395	. PLATE, Treadle mounting.	1			
		09	1013Z221	. ROLLER	1			
		10	1019Z837	.PIN, Push rod..	1			
		11	1046Z252	. BREATHER	1			
		12	1036Z735	. VALVE ASSEMBLY	1			
			1045Z1402	.. KIT, Valve repair.	1			
		13		... BOOT, Dust	1			
		14		... O-RING. .	1			
		15		...O-RING	1			
		16		... PLATE ASSEMBLY, Barrier	1			
		17		...U-CUP	1			
		18		... RING, Thrust	1			
		19		... SCREW, Machine.	6			
		20	1017Z869	.. SPRING, Balance	1			

Ref. Dwg. 36U29D4

ETHER STARTING AID ASSEMBLY



Ref.	Part Number	Description	Quantity Figure Number 2	3				
	8100N0528-2	ETHER STARTING AID ASSEMBLY	↓					
	8100N0528-3	ETHER STARTING AID ASSEMBLY		↓				
01	6U12D4	. KNOB, Control cable.	1	1				
02	6Z424D96	. CABLE, Control	1	1				
03	32Z332D1	. CLAMP, Cable	4	4				
04	20Z40D13	. SCREW. Self tapping #10 x 3/8 in	4	4				
	35Z19	. KIT, Starting aid	1	-				
	35R2D1	. KIT, Starting aid	-	1				
05		.. CYLINDER	1	1				
06		.. CLAMP ASSEMBLY	1	1				
07		.. STOP, Cable	1	1				
08		.. SCREW, Cable stop	1	1				
09		.. FITTING, Straight.	1	1				
10		.. VALVE, Measured shot.	1	1				
11		.. ATOMIZER	1	1				
12		.. TUBE, Nylon 48 in. lg.	1	1				
13	816T1193	. PLATE, Cylinder mounting	1	1				
14		.SCREW, Hex hd. 1/4-20UNCx 1 in	2	2				
16		.WASHER, Lock 1/4 in..	2	2				
16		. NUT, Hex 1/4-20UNC.	2	2				

Ref. Dwg. **8100N0528**
8100N0528-2
8100N058-3

PART THREE

FRONT AXLE, TRANSMISSION AND WINCHES

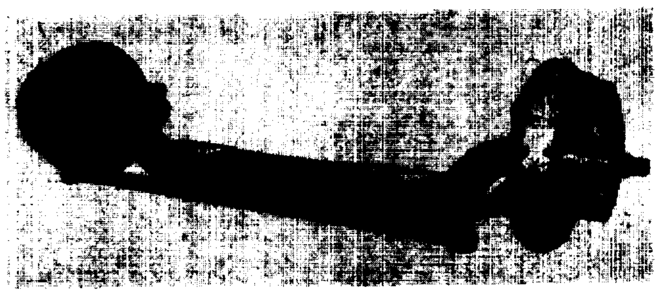
NOTE

Field Maintenance Manual No. 5B for Rockwell International Single-Reduction Hypoid-Drive Unit, Two-Gear Transfer Train is not included in this manual. Obtain from DCSC or Rockwell International, 2445 West Maple Road, Troy, MI 48084.

Field Maintenance Manual No. 2

Front Axles

Non-Driving

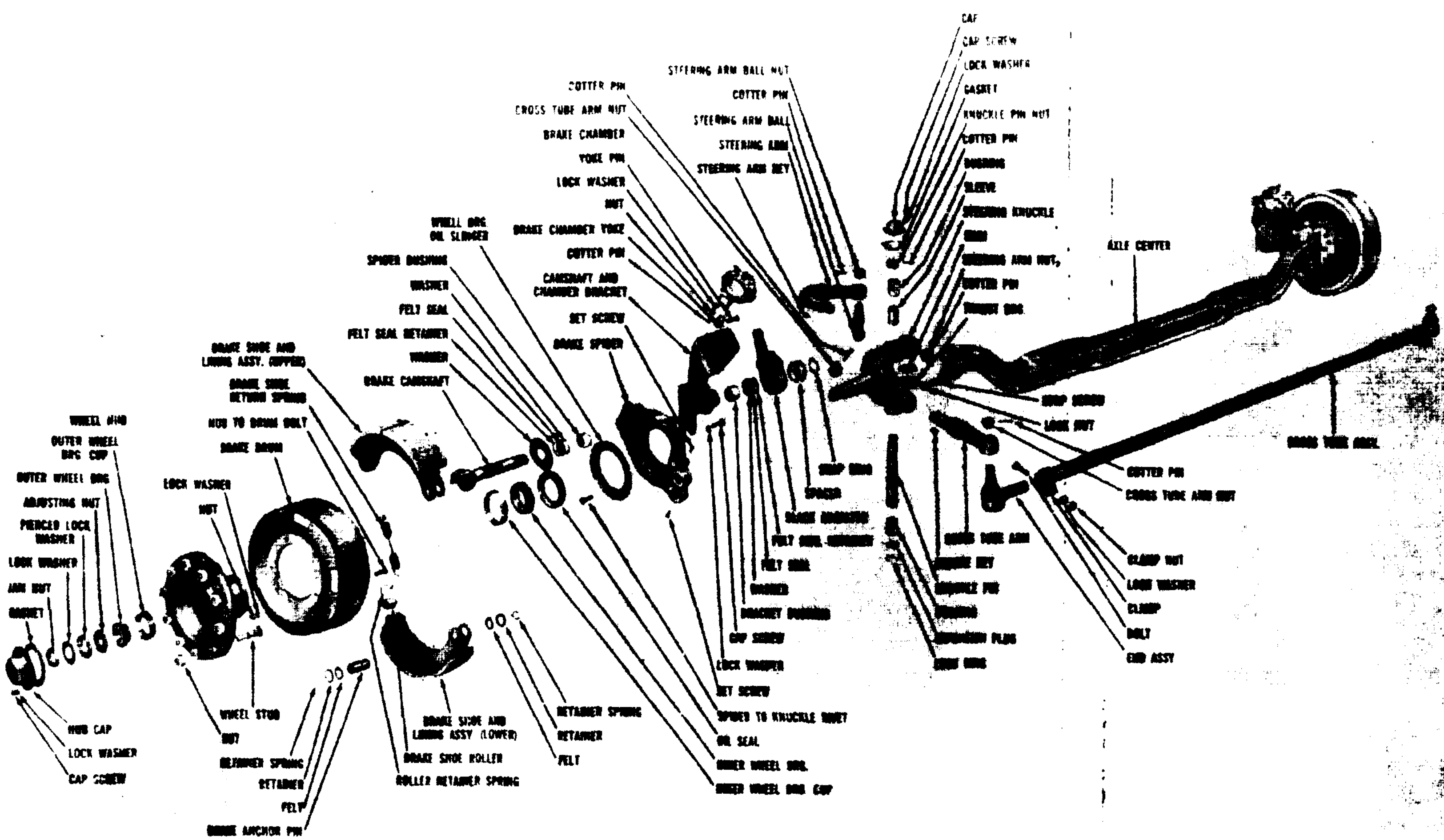


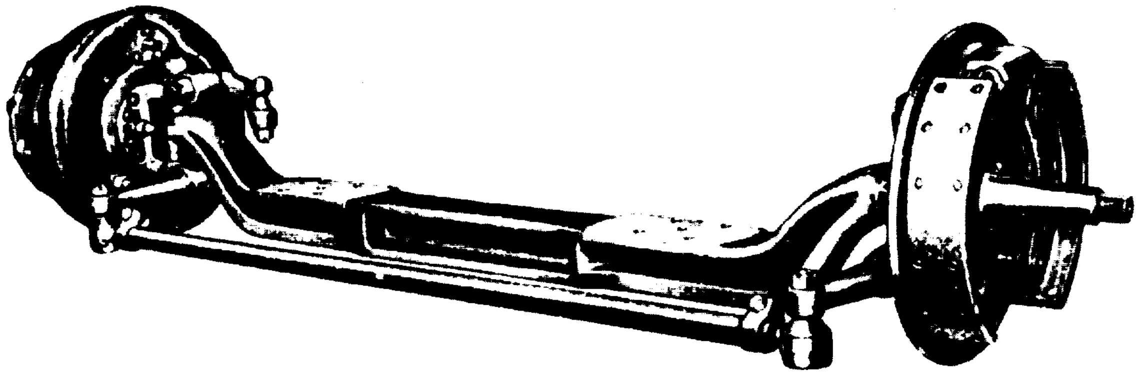
Use Only Genuine Rockwell-Standard Parts

Rockwell International

2445 West Maple Road, Troy, Michigan 48084

FRONT AXLE EXPLODED VIEW (TAPERED KNUCKLE PIN DESIGN)





NON-DRIVING FRONT AXLES

Component Description

AXLE CENTERS

All "I-beam" type non-driving front axle centers, though varying in size, are machined from heat-treated steel forgings with "I-beam" section and spring pads integral.

All tubular type non-driving front axle centers are built of tempered seamless steel tube center sections with heat-treated steel forged knuckle pin ends. The knuckle pin ends and spring pads are electrically welded in position on the tube and become integral parts of the axle center.

Both the "I-beam" and the tubular type are of the "Reversed Elliot" design.

STEERING KNUCKLE PINS

Rockwell-Standard non-driving front axles may be equipped with tapered knuckle pins or straight knuckle pins, depending on model. Tapered knuckle pins are drawn into the axle center by tightening the nut at the upper end of pin, while the straight pins may employ one or two flats and are held in the axle center by means of tapered dowel keys. Both the tapered pins and the straight pins effectively become an integral or rigid part of the axle center.

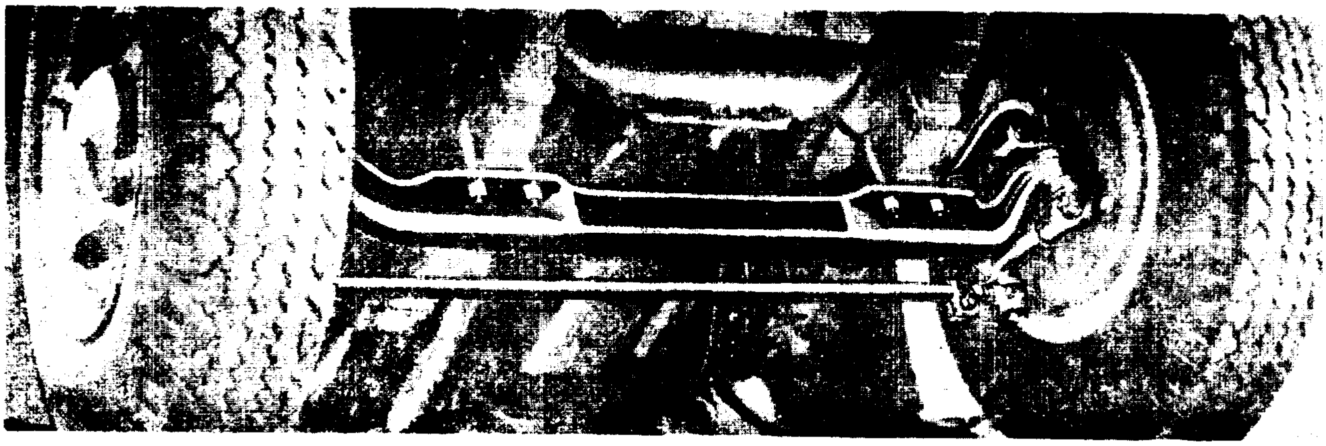
STEERING KNUCKLE AND BUSHING ASSEMBLY

Steering knuckles are bushed in the upper and lower pin bosses so that they may turn freely about the pins. Bushings, depending on model, may be bronze, steel backed bronze, or plastic material, all of which contain grooves to allow grease to flow uniformly to the high-pressure areas. Grease fittings are installed in both upper and lower knuckle pin bosses.

TIE ROD

The two steering knuckle assemblies are connected to each other by a tie rod. The tie rod is threaded at each end and held securely in position by clamp bolts. Right and left band or "differential" threads are provided on the tie rod to facilitate toe-in adjustment.

FRONT AXLE ALIGNMENT

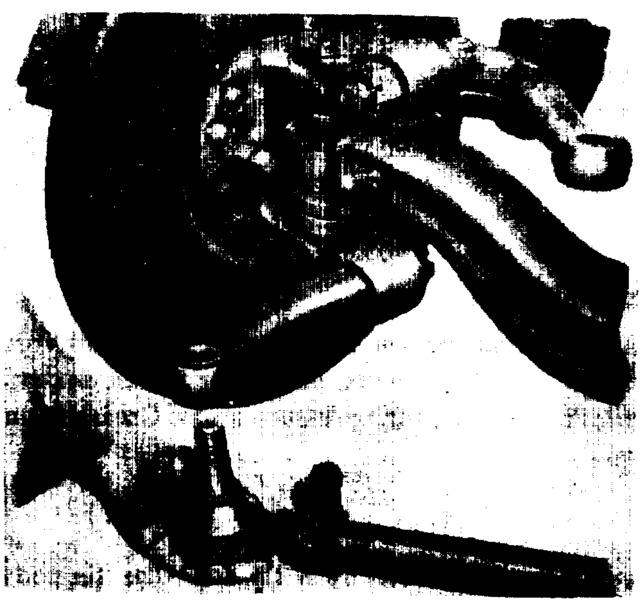


Front wheels must be properly aligned to assure efficient steering and optimum tire life. Recommendations for proper alignment of front axles, as furnished by the various vehicle manufacturers, should be carefully followed.

DISASSEMBLE FRONT AXLE

REMOVE THE STEERING KNUCKLE

A. Jack up the front end of vehicle so that tires clear floor. Block up securely at this position and remove jacks. (Do not attempt to disassemble or perform knuckle repair with vehicle supported by jacks only.)



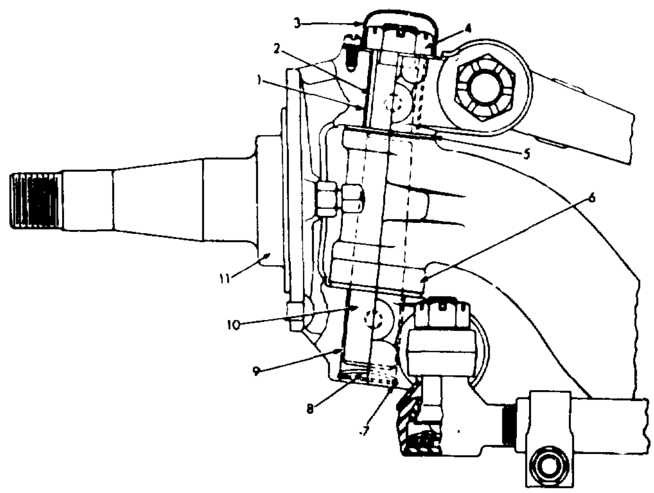
B. Remove the hub cap plate, wheel bearing adjusting nut, lock, lock dowel ring and doweled nut assembly.

C. Remove the outer wheel bearing cone.

D. Remove the wheel and hub assembly.

E. Disconnect the tie-rod from the steering arm.

TAPERED KNUCKLE PIN UNITS

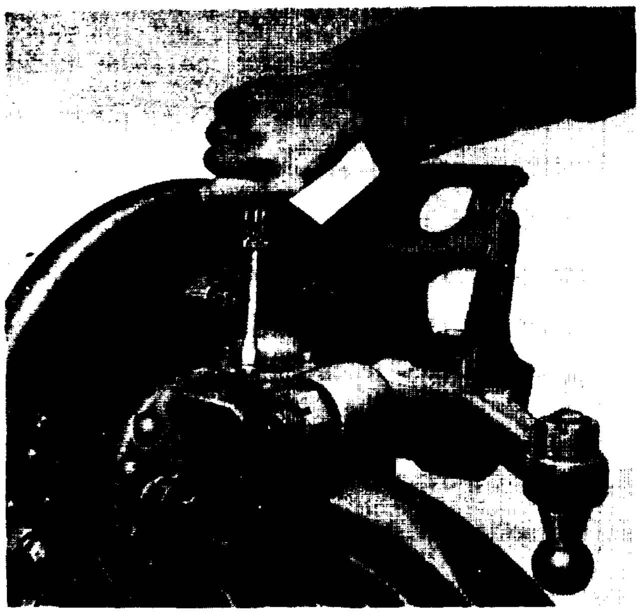


1. Knuckle Upper Bushing
2. Knuckle Pin Sleeve
3. Upper Dust Cap
4. Knuckle Pin Nut
5. Spacing Washer and Shim
6. Thrust Bearing
7. Expansion Plug Lock Ring
8. Expansion Plug
9. Knuckle Lower Bushing
10. Tapered Knuckle Pin
11. Knuckle Wheel Spindle

A. Tapered knuckle pins must be removed *from* the bottom side of the knuckle.

1. Disconnect push rod and remove brake chamber on units equipped with air brakes where clearance is needed for knuckle pin removal.

2. Remove cylinder brake fluid adapter fitting on units equipped with hydraulic brakes where clearance is needed for knuckle pin removal.



3. On some models it will be necessary to remove the brake shoe assembly and backing

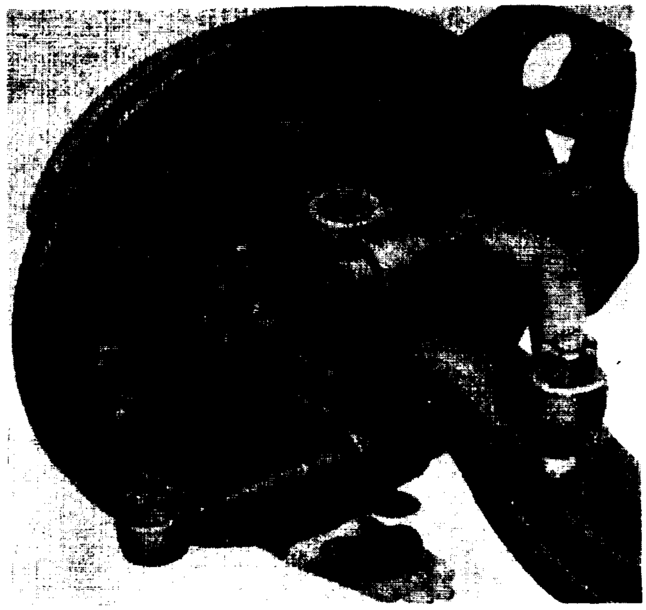


plate to provide clearance for knuckle pin removal.

B. Remove the knuckle pin cover cap screws, cover and cover gasket.

C. Knuckles employing expansion plugs and lock rings :

1. Remove the lock ring with a pair of snap ring pliers.
2. Dislodge and remove expansion plug with a small drift.

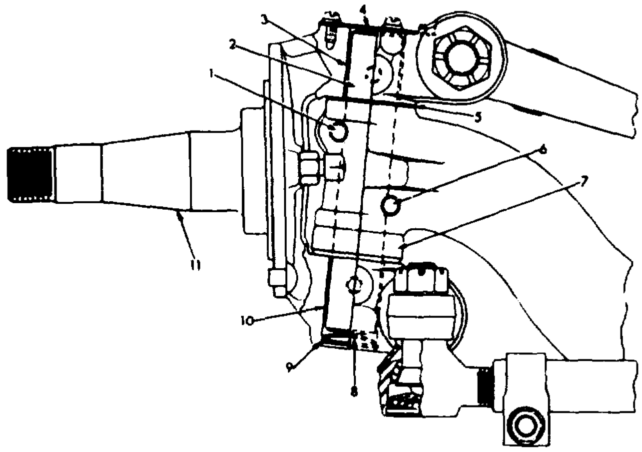
D. Remove knuckle pin cotter key and nut.

E. Drive knuckle pin out by use of drift on upper end. Bronze drift should be used to avoid any damage to threads.

CAUTION: Do not strike these hardened steel pieces directly with a steel hammer.

F. Remove the knuckle pin sleeve and lift off steering knuckle, thrust bearing and spacing washers.

STRAIGHT KNUCKLE PINS

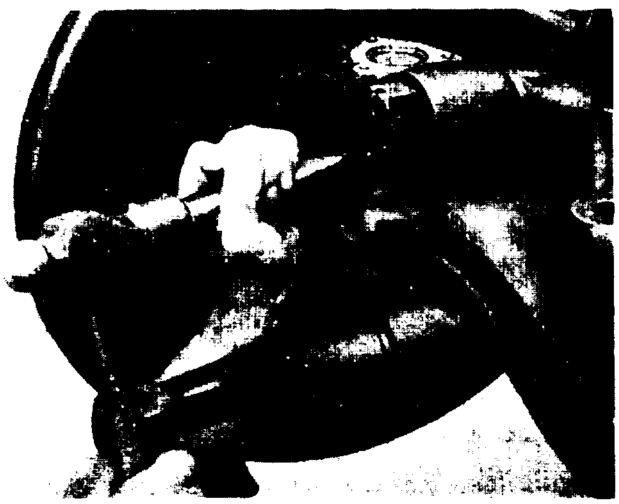


1. Draw Key-Upper
2. Knuckle Pin
3. Knuckle Bushing-Upper
4. Dust Cover
5. Spacing Washer and Shim
6. Draw Key-Lower
7. Thrust Bearing
8. Expansion Plug
9. Expansion Plug Lock Ring
10. Knuckle Bushing-Lower
11. Knuckle Wheel Spindle

A. Straight knuckle pins may be removed from the bottom of the knuckle where adequate clearance is provided; however, on some models such as those with riveted backing plates, less work is involved by tapping the knuckle pin out the top of knuckle. In either case the adjacent parts, such as air chambers, hydraulic lines or fittings, etc., that might cause an obstruction to the knuckle pin, must be removed first.

B. Remove the snap rings and expansion plug from the bottom of the knuckle where employed. If plug employs no snap ring and is expanded and staked, remove plug by use of a cape chisel and discard.

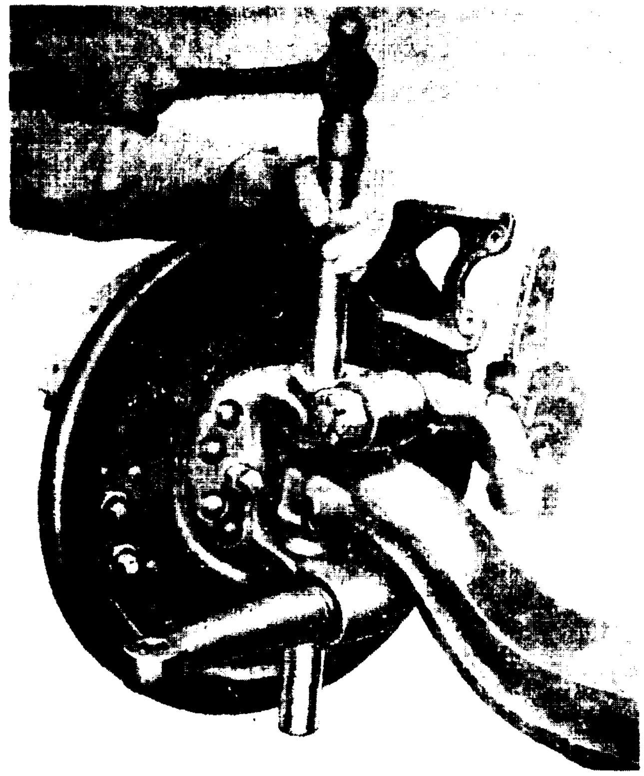
C. Remove the cap screws, cover plate and gasket from top of knuckle or remove lock ring retainer and seal, depending on model.



D. Tap out the knuckle pin draw key (or keys) from the small end using a suitable small slender drift.

CAUTION: .Do not strike these hardened steel pieces directly with a steel hammer.

(Older models may employ tapered draw key that is threaded on small end and drawn into place by a nut. On these models, remove the nut and lock washer. Drive the draw key out by use of brass hammer on threaded end.)



E. Tap out the knuckle pin by use of a bronze drift.

CAUTION: Do not strike these hardened steel pieces directly with a steel hammer.

F. Lift off the knuckle assembly, thrust bearing and spacing washers.

PREPARE FOR REASSEMBLY

Parts having ground and polished surfaces such as knuckle pins, knuckle pin sleeves, bearings and spindles, should be cleaned in a suitable solvent such as kerosene or diesel fuel oil.

GASOLINE SHOULD BE AVOIDED.

Do *NOT clean* these ports in a *hot* solution *tank* or *with water and* alkaline *solutions such* as sodium hydroxide, orthosilicates or phosphates.

DRYING

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless, absorbent paper towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

CORROSION PREVENTION

Parts that have been cleaned, dried, inspected and are to be immediately reassembled should be coated with light oil to prevent corrosion. Spindles, knuckle pins or sleeves that are to be stored for any length of time should-be treated with a good rust preventative and wrapped in oiled paper and boxed to keep dry and clean.

INSPECT

It is impossible to overstress the importance of careful and thorough inspection of steering knuckle components prior to reassembly. Thorough visual inspection for indications of wear or stress, and the replacement of such parts as are necessary will eliminate costly and avoidable front end difficulties.

A. Inspect the steering knuckle thrust bearing, wheel bearing cones and cups. Replace if rollers or cups are worn, pitted or damaged in any way. If wheel bearing cups are to be replaced, remove from hubs with a suitable puller. Avoid the use of drift and hammers as they may easily mutilate cup bores.

B. Inspect the steering knuckles and replace if indications of weakness or excessive wear is found.

C. Check wear of the knuckle pins and bushings. compare with correct specification.

D. Check the tightness of the steering connections such as tie-rod arms, steering arm, etc.

REPAIRS

REPAIR OF FORGED PARTS BENT IN SERVICE

A. In deciding whether to repair or scrap a damaged part, always keep in mind that we, as manufacturers, never hesitate to scrap any part which is in any way doubtful.

B. Straightening of bent parts should be done cold. Various components are heat-treated and hot straightening would destroy some of the heat treatment.

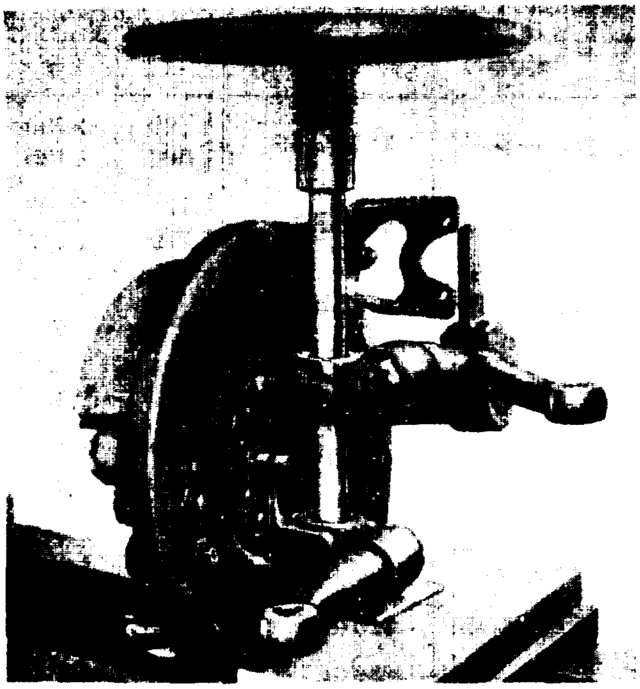
Axle centers (that are bent no more than ½") may be straightened cold; if bent more than ½" they should be replaced.

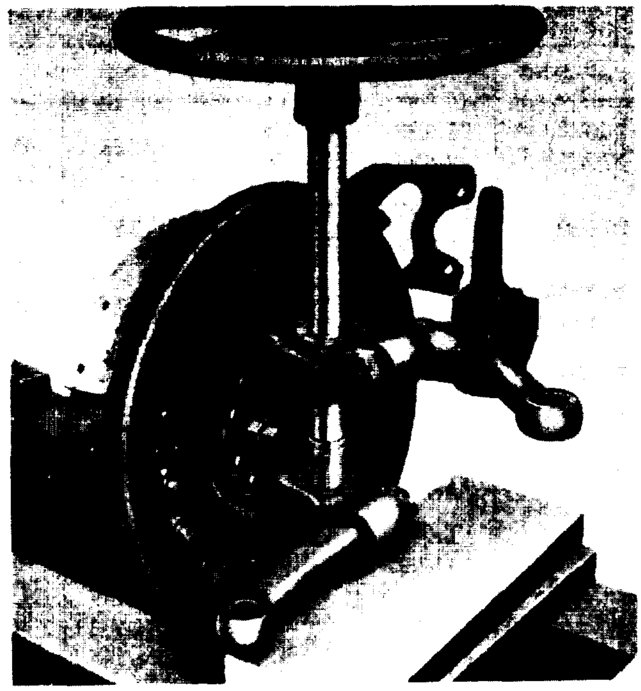
Bent steering arms or knuckles should be replaced rather than straightened.

REPLACEMENT OF BRONZE OR STEEL BACKED BRONZE STEERING KNUCKLE BUSHINGS

When it is desirable to service the steering knuckle bushings the following procedure is recommended and the tools shown in the sketches will facilitate this operation.

The tool utilized for removal of old and installation of new steering knuckle bushings is shown on the following page. The tool can be made from a piece of round bar stock which is ground with a step to serve as a pilot.





A. The worn bushings are pressed out of the knuckle, employing tool shown below.

B. The new bushings should be installed with the same tool. The pilot of this tool prevents collapse or distortion of bushing during installation. The bushing should be pressed into the knuckle in three or more steps to allow it to align itself with the bore. Oil hole in bushing must line up with oil hole in knuckle.

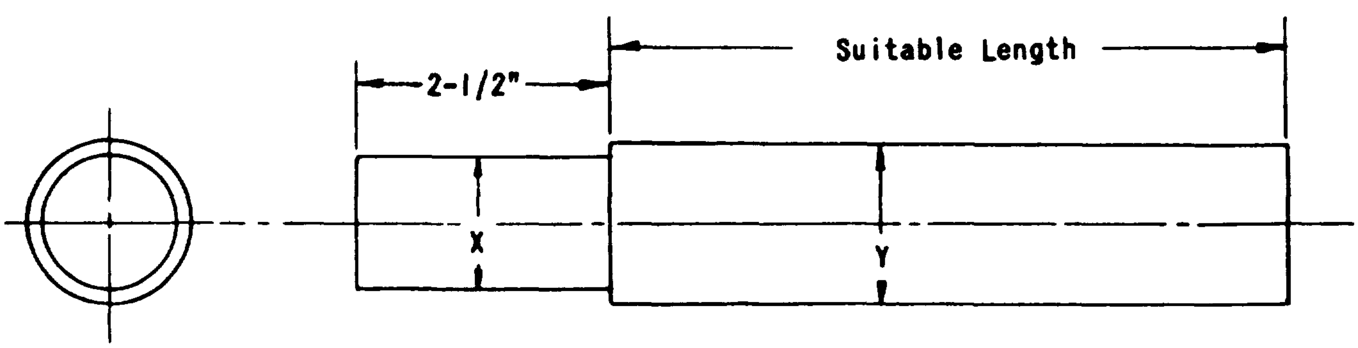
First press bushing into knuckle approximately 1/8" and relieve press pressure, press bushing in another 1/2" and relieve press pressure. The bushing can now be pressed in until it is flush with the inner machined surface of the knuckle.

This applies to both upper and lower bushings.

C. To finish a bushing, either a burnishing bar or reamer must be employed. The dimensional limits of these tools at finishing surfaces should correspond to those listed in columns "B" and "C" for the desired axle. (See table, page 10.)

Utilization of burnishing ball for this operation must be avoided, as it does not insure a true alignment between the two bushings.

BUSHING REMOVAL AND INSTALLATION TOOL



Dimension "X" is 0.010" less than the bushing bore.
Dimension "Y" is 0.010" less than the steerling knuckle bore.

See table on following page

TABLE OF REAMER DIMENSIONS

AXLE NO.	A	B AND C	D	E	BUSHING	KNUCKLE PIN	X	Y
26660 27000	1.600 1.602	1.6095 1.6105	7.8125	6.9375	1225-R-278	3101-G-59	1.590 1.592	1.723 1.725
27460	1.787 1.789	1.7965 1.7975	8.125	7.250	1225-G-345	3101-F-84	1.777 1.779	1.909 1.911
30000 31000	1.100 1.102	1.1095 1.1105	5.750	4.875	1225-N-248	3101-B-54	1.090 1.092	1.223 1.225
32000 33000	1.225 1.227	1.2345 1.2355	6.375	5.500	1225-Z-234	3101-H-60	1.215 1.217	1.348 1.350
35000	1.349 1.351	1.3595 1.3605	6.6875	5.8125	1225-R-252	3191-C-55	1.339 1.341	1.473 1.475
36000	1.474 1.478	1.4845 1.4855	7.8125	6.9375	1225-Z-260	3101-F-58	1.464 1.466	1.598 1.600
FC-900	1.225 1.227	1.2345 1.2355	6.500	5.750	1225-B-366	3101-L-90	1.215 1.217.	1.348 1.350
FD-900	1.427 1.429	1.4365 1.4375	8.000	7.125	1225-J-348	3101-G-85	1.417 1.419	1.550 1.552
FE-900	1.600 1.602	1.6095 1.6105	8.500	7.625	1225-Y-337	3101-B-80.	1.590 1.592	1.723 1.725
FG-900	1.787 1.789	1.7965 1.7975	8.875	8.000	1225-A-417	3101-Q-95	1.777 1.779	1.909 1.911
FU-900	2.054 2.056	2.0635 2.0645	12.375	11.490	1225-F-318	3101-Y-77	2.044 2.046	2.177 1.179
2661 2770	1.710 1.712	1.717 1.718	8.500	7.625	1225-A-157	3101-Q-43	1.700 1.702	2.083 2.085

Two sets of reamers, shown on next page, are designed to permit line reaming **of** the bushings without removing the dust shields. Reamers "Nos. 1 and 1A" comprise one set while the second set, "No. 2," consists of a reamer and pilot.

When using the "Nos. 1 and 1A" reamer set to ream the bushings, use reamer "No. 1" first to ream the upper bushing, then "No. 1A" to ream the lower bushing.

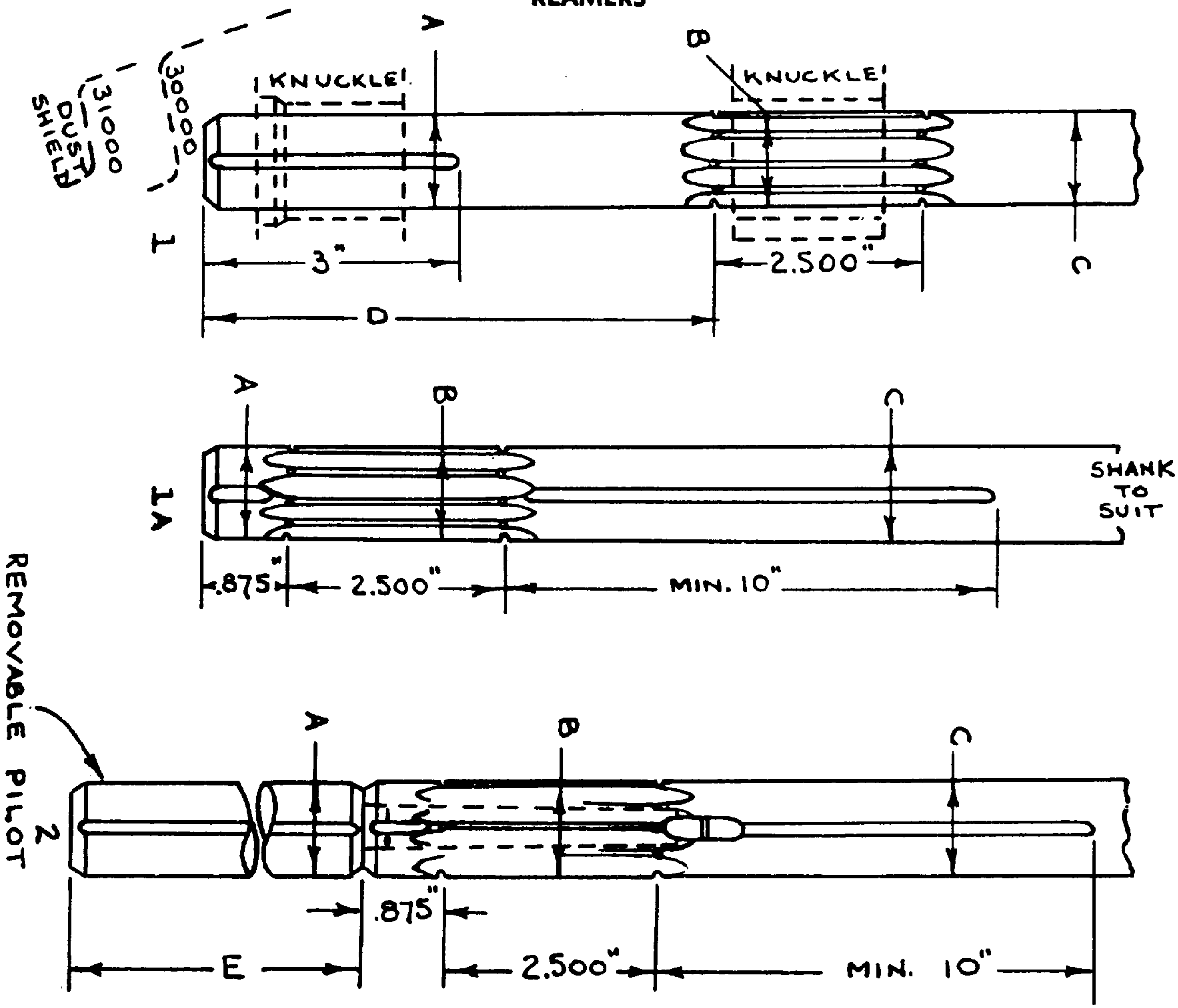
To use reamer "No. 2," first insert the pilot into the reamer to ream upper bushing, then remove the pilot to ream the lower bushing. Length of "D" dimension is dependent on model.

Avoid the possibility of tapering or enlarging the upper bushing while inserting the tool to ream the lower bushing. To do this, the reamer should be turned slightly, in the non-cutting direction. Do not turn it in excess **of** 90 degrees as this may damage the cutting edges of the reamer.

Both the "Nos. 1 and 1A" reamer set and the "No. 2" reamer and pilot can be made **by a** reliable tool **source** from the specifications on page 11.

Reamers "Nos. 1 and 1A," which make a set, may be purchased from Red Arrow Tool Company, 26531 King Road, Romulus, Michigan, or from L. O. Beard Company, Lancaster, Pennsylvania.

REAMERS



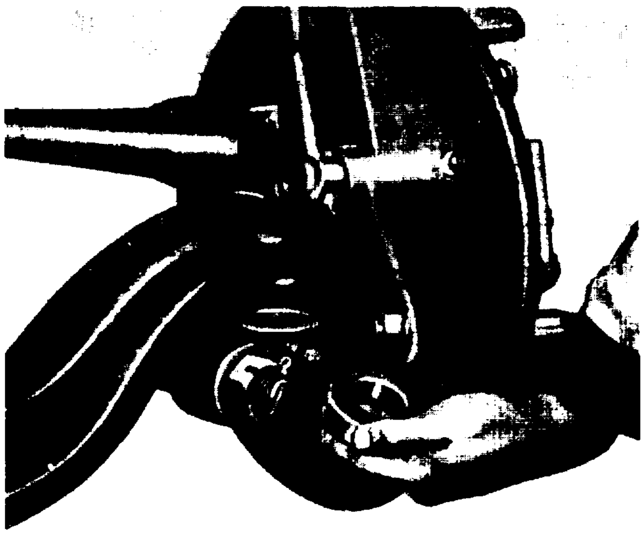
USING "NO. 1" REAMER FIRST TO REAM UPPER BUSHING

USING "NO. 2" REAMER TO REAM LOWER BUSHING

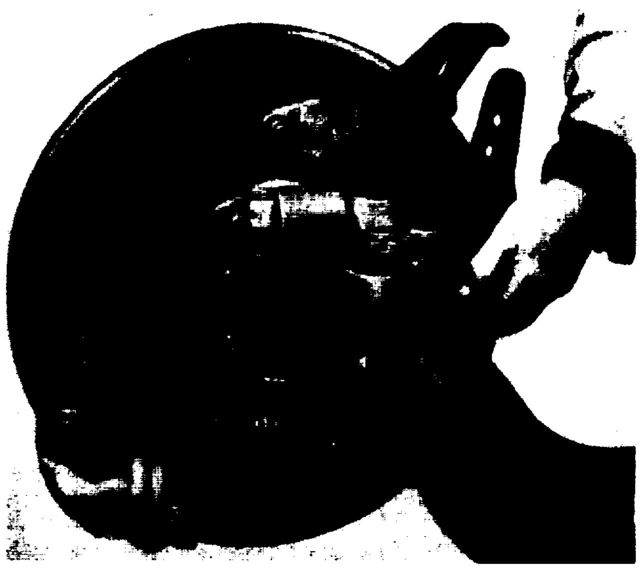
KNUCKLE PIN INSTALLATION

A. Make certain that knuckle pin hole in axle center is clean and dry.

B. Position and support the steering knuckle assembly on the axle center.



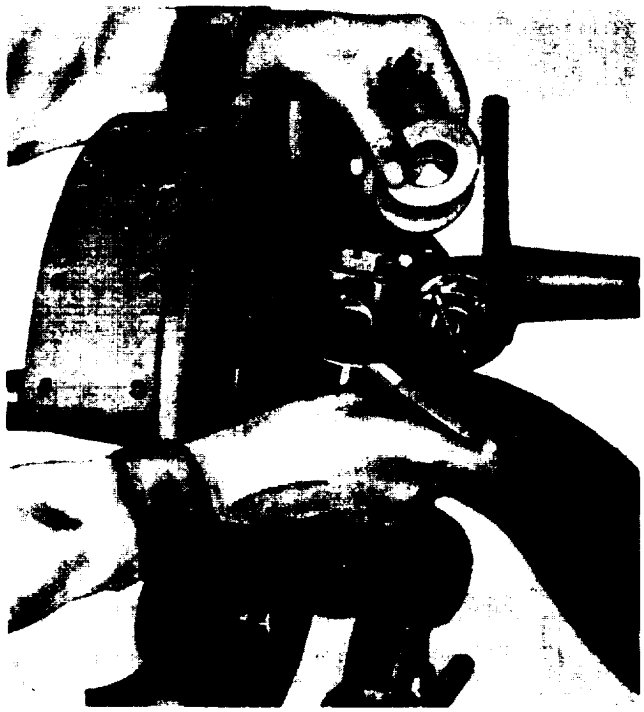
C. Slide the thrust bearing between the lower face of axle center and lower steering knuckle yoke. Thrust bearings that are not marked "top" to



indicate proper installation position must be positioned with retainer lip down.

D. Align the steering knuckle yoke holes with axle center and thrust bearing holes.

E. Place a jack under the lower side of steering knuckle yoke and raise knuckle so that all clearance is taken up between lower yoke, thrust bearing and lower face of axle center end.



F. Check the clearance between the top face of upper axle center end and lower face of upper knuckle pin boss. The clearance must not exceed .015". Washers and shims are available in various thicknesses to take up this clearance and hold it within the desired .015" tolerance.

G. TAPERED PIN UNITS

1. Make sure the knuckle pin nut turns freely on the knuckle pin threads. Insert the knuckle pin from the bottom yoke of knuckle and tap pm into seat of axle center end by use of a bronze drift.
2. Place the steel knuckle pin sleeve over the pin and tap into place. Install nut and tighten to specified torque. If necessary, align cotter pin hole by advancing nut to nearest castellation and install cotter pin.

H. **STRAIGHT PIN UNITS**

1. On straight knuckle pins align flat (or flats) to mate with draw key hole (or holes). Tap knuckle pin through knuckle yoke, axle center and thrust bearing from top or bottom side.

CAUTION: Do not strike these hardened* steel *pieces directly with a steel hammer.

2. Install the draw key so that the flat on the key mates with the corresponding flat on the knuckle pin.

   Where two (2) draw keys are used, install one key from each side of the axle center. DO NOT INSTALL BOTH KEYS FROM THE SAME SIDE. Secure each key in the axle center by prick punching edge of hole.

I. **EXPANSION PLUGS**

1. On axles that have grooved holes, install lock rings.

2. On axles not grooved for lock rings, install grease retainer plate and secure in place by staking in four equally spaced places.

3. On units employing grooved knuckle pins that protrude below the knuckle lower yoke, install lock ring in groove.

J. The upper ends of steering knuckle are pro. tected with covers, caps, or retainers and *felts.*

1. Install the cover or cap and gasket with cap screws where used.

2. Install the felt, retainer and lock ring on protruding straight pins that are not provided with covers or caps.

COMPLETE ASSEMBLY AS FOLLOWS:

Reinstall the tie-rod tapered ends into the steering arms and install nuts. Tighten the nuts to correct torque and install cotter pin.

Connect brake chambers, push rods or any other parts that were removed. (If brakes require service, refer to Field Maintenance Manual No. 4.)

WHEEL BEARINGS

INSPECTION

Wheel bearings should be very closely inspected at the time *of* knuckle inspection or when knuckle repair is being made.

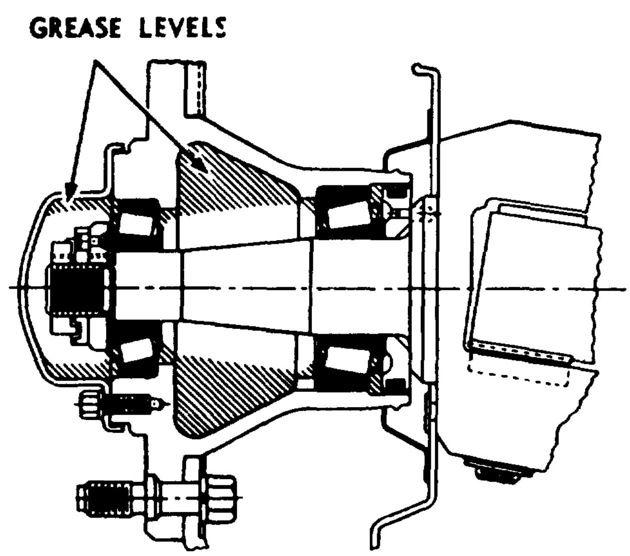
Remove all the old grease from the wheel bearings, spindle, hub cavity and hub cap. (The old grease may contain moisture which would lead to an early bearing failure if not removed.) Use kerosene or diesel fuel oil and a stiff brush. Gasoline and heated solvents which are commonly used should be avoided.

Allow the cleaned parts to dry, or dry them with a clean absorbent cloth or paper. Clean and dry the hands and all tools used in the service operation. Grease will not adhere to a surface which is wet with solvent, and solvent may dilute the lubricant.

Replace any *worn* or damaged parts.

LUBRICANT

Pack the bearings with a pressure packer if possible. Use Rockwell-Standard Specified Lubricant 0-610. If a packer is not available, pack the



THE SHADING IN EACH INDICATES THE RECOMMENDATION FOR THE CORRECT AMOUNT OF GREASE.

bearings by hand, forcing the grease into the cavities between the rollers and cage from the large end of the cone. Pack the hub between the two bearing cups with grease to the level of the cups' smallest diameter.

Assemble the hub and bearings on the spindle, being careful sot to damage the oil seals or bearings.

WHEEL BEARING ADJUSTMENT

1. Assemble bearings and hub on the axle spindle.
2. Install thrust washer if used.
3. Install the wheel bearing adjusting nut. Screw the nut against the bearing or thrust washer as the wheel is revolved. Be sure there is sufficient clearance between the brake shoe and drum so brake shoe drag will not interfere with the bearing adjustment.

   NOTE: It is recommended that a torque wrench be employed for assembly of the adjusting nut and jam nut.

1. Tighten the adjusting nut to 50 lb. ft. torque while rotating wheel in both directions.

5A. For axles that have single nut construction, back off adjusting nut 1/6 to 1/4r turn. Cotter pin (or lock) nut in place.

5B. For axles that have double nut and lock construction, back off adjusting nut 1/4 to 1/3 turn. Assemble wheel bearing nut lockwasher and jam nut.

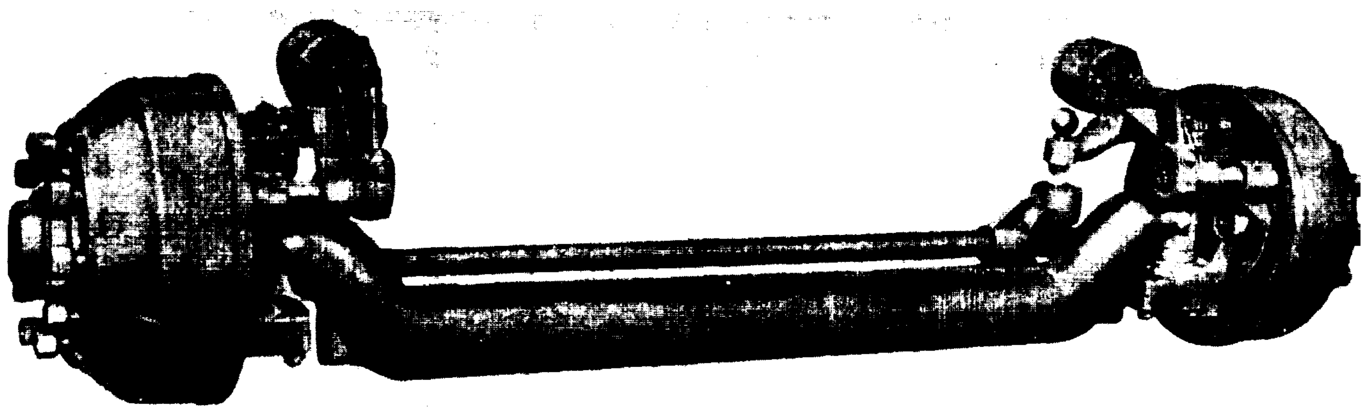
a. For assemblies using a bending type lockwasher, torque jam nut as follows:

NUT SIZE	LBS. FT. TORQUE	
	Min.	Ma.
11/8" to 2%"	100	150
2 5/8" and over	100	200

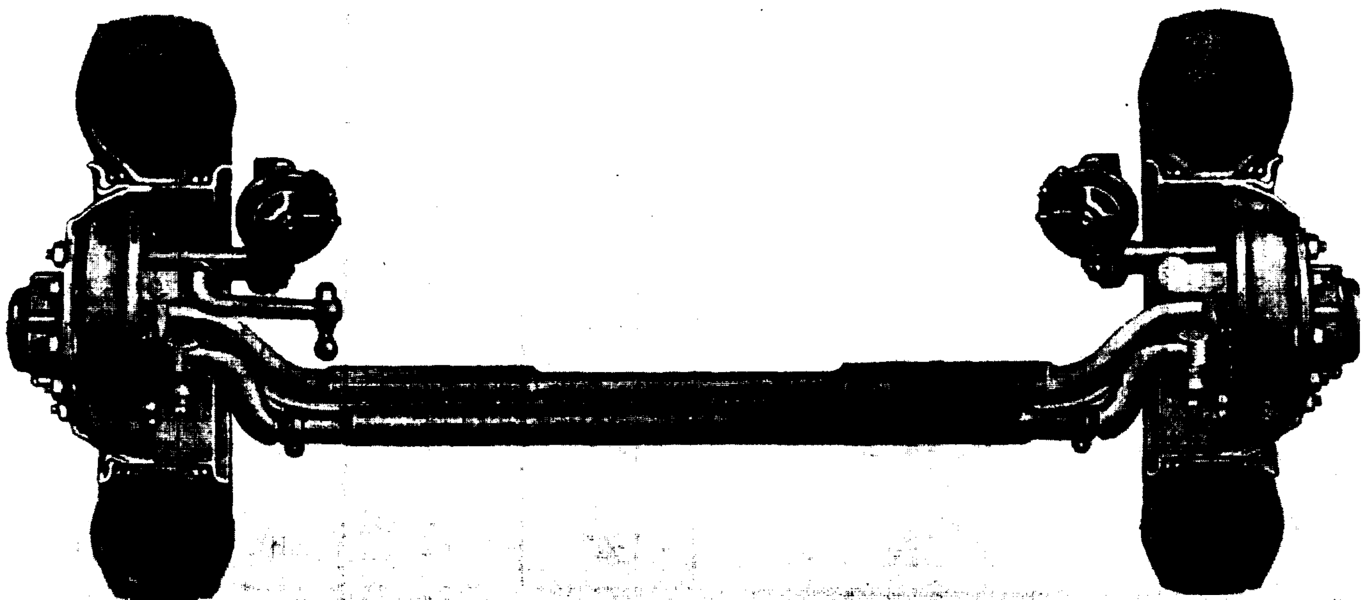
Bend lockwasher over both the adjusting and jam nuts to complete the assembly.

b. For assemblies using a dowelled adjusting nut and pierced nut lock, torque jam nut as follows:

NUT SIZE	LBS. FT. TORQUE	
	Min.	Max.
1 1/8" to 2 5/8"	200	300
2 5/8 and over	250	400



Tubular Axle

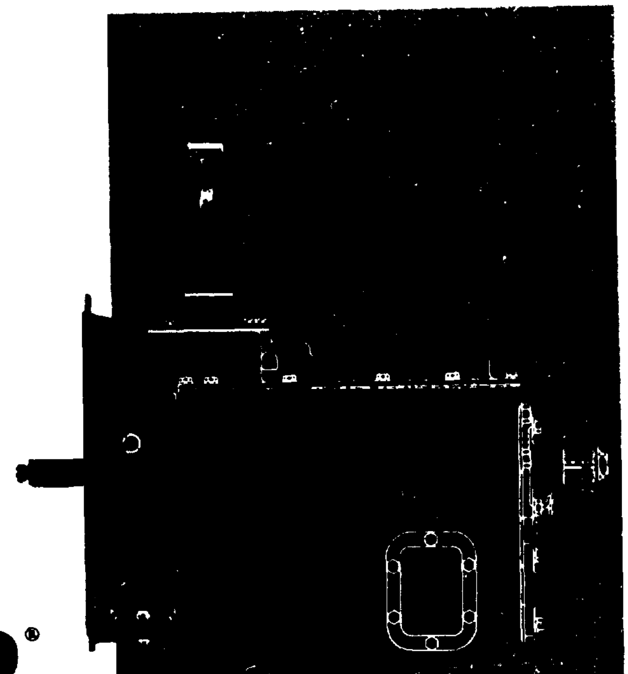


Center Point Steering Axle

TABULATION OF TORQUE LIMITS

LOCATION	DIAMETER	NO. THREADS	TORQUE-LB. FT. Min.	TORQUE-LB. FT. Max.
*Tie rod end nut torque	9/16"	18	42	47
	5/8"	16	60	80
	5/8"	18	60	80
	3/4"	16	90	115
	7/8"	14	165	180
	1"	14	250	275
	1 1/8"	12	350	390
Tie rod clamp bolt	7/16,"	20	25	30
	1/2"	20	40	50
	5/8"	18	60	80
*Steering arm ball nut	5/8"	16	60	80
	5/8"	18	60	80
	3/4"	16	90	115
	7/8"	14	165	180
* Steering arm nut	7/8"	14	260	290
	1 "	14	390	430
	1 1/8"	12	560	620
	1 1/4"	12	770	850
*Tapered king pin nut	7/8"	14	165	180
	1"	12	250	275
	1 1/8"	12	350	390
	1 1/4"	12	400	450

*Assemble nut in accordance with chart shown. Use wrench torque given and as much more as necessary to line up next cotter pin hole. Do not back off.



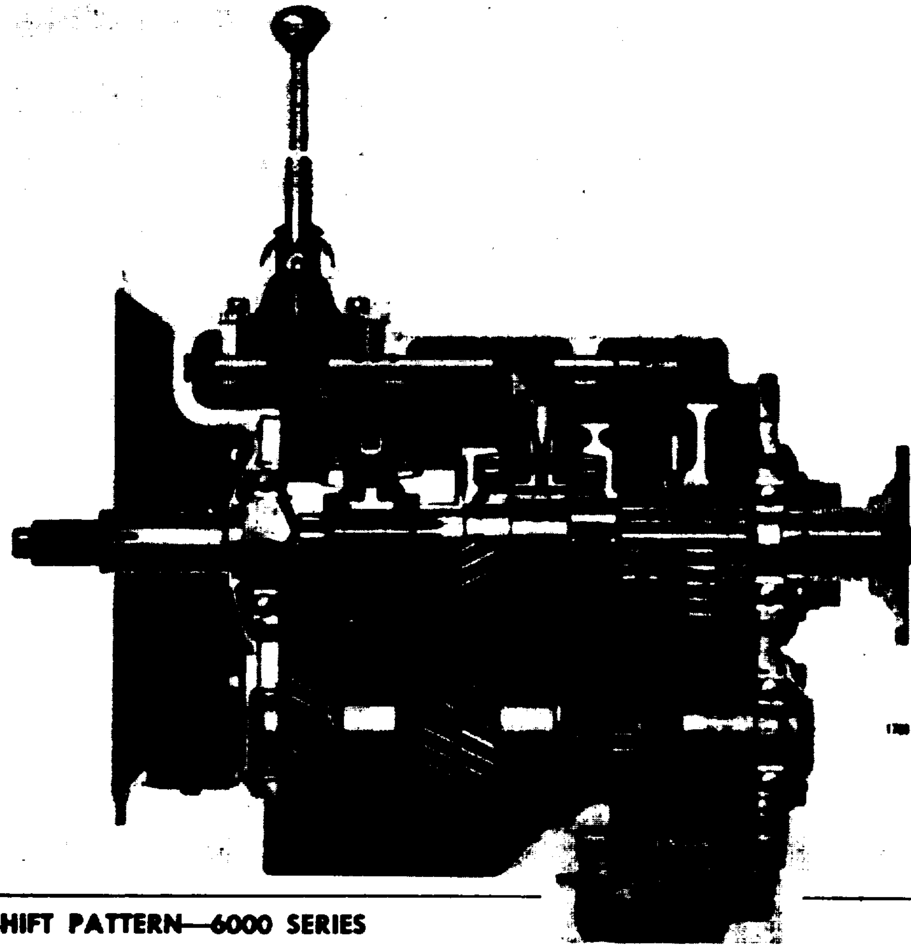
SPICER®

6000 SERIES

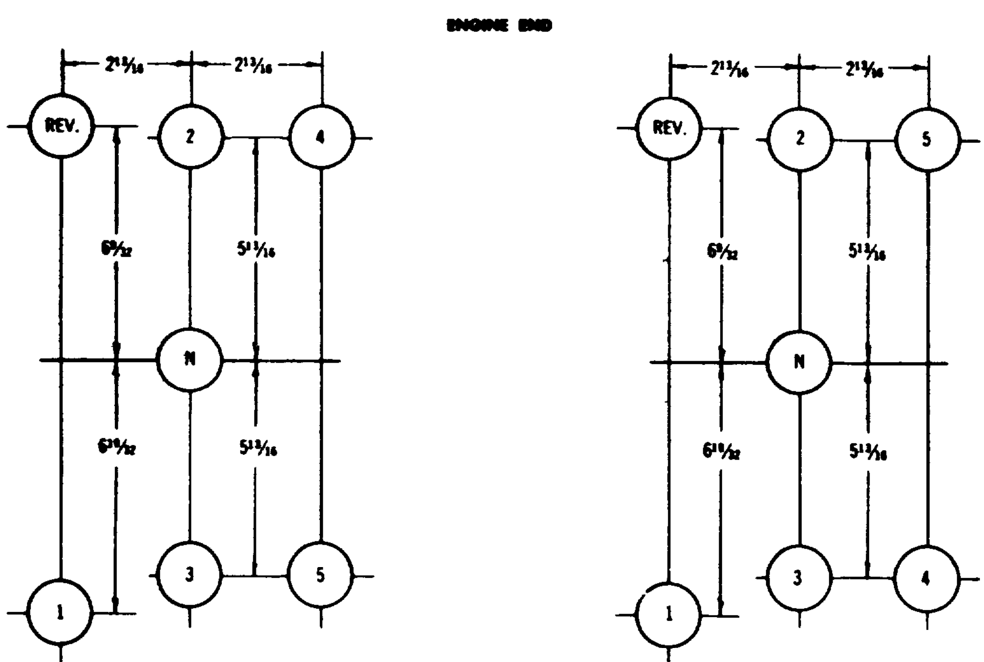
5-SPEED TRANSMISSION

SERVICE MANUAL

DANA CORPORATION
SPICER TRANSMISSION DIVISION



SHIFT PATTERN—6000 SERIES



DIRECT ON 5TH — GEAR SHIFT POSITIONS FOR 33⅝" LEVER — OVERDRIVE ON 5TH

GENERAL INFORMATION

The 6000 Series five-speed synchronized transmissions are designed to utilize splash lubrication for all internal bearings, bushings, shafts and gears.

To insure proper lubrication and operating temperatures in these units it is most important that the proper lubricants be used and that correct oil levels be maintained.

RECOMMENDED LUBRICANTS

TEMPERATURE	GRADE	TYPE
ABOVE 0°F BELOW 0°F	SAE 30, 40, or 50 SAE 30	HEAVY DUTY ENGINE OIL MEETING SPEC MIL-L-2104B OR MIL-L-45199 SERIES 3
ABOVE 0°F BELOW 0°F	SAE 90 SAE 80	STRAIGHT MINERAL GEAR OIL

Do NOT USE EXTREME PRESSURE ADDITIVES, such as found in multi-purpose or rear axle type lubricants. These additives are not required in Spicer transmissions, and may, in some cases, create transmission problems. Multi-purpose oils, as a group, have relatively poor oxidation stability, a high rate of sludge formation and a greater tendency to react on, or corrode, the steel and bronze parts.

Capacity: 17 pints at 0° installation - capacity will vary with, and is dependent on, angle of installation.

OIL CHANGES

We recommend an initial oil change and flush after the transmission is placed in actual service. This change should be made any time following 1000 miles, but never to exceed 4000 miles, of over-the-road service. In off-highway use, the change should be made after 24 and before 100 hours of service have elapsed. There are many factors that influence the following oil change periods and we have not specified a definite mileage interval.

In general, it is suggested that a drain and flush period be scheduled every 20,000 miles for normal over-the-highway operations. Off-the-highway usually requires oil change every .30 days. The oil level in the transmission should be checked every 2,000 miles on-highway, or every 24 hours in off-highway operation. The correct. oil level in all Spicer transmissions is established by the filler plug opening.

REFILL - First, remove all dirt around the filler plug. Then refill with new oil of a grade recommended for the existing season and prevailing service. Fill to the bottom of the level testing plug positioned on the side of the transmission.

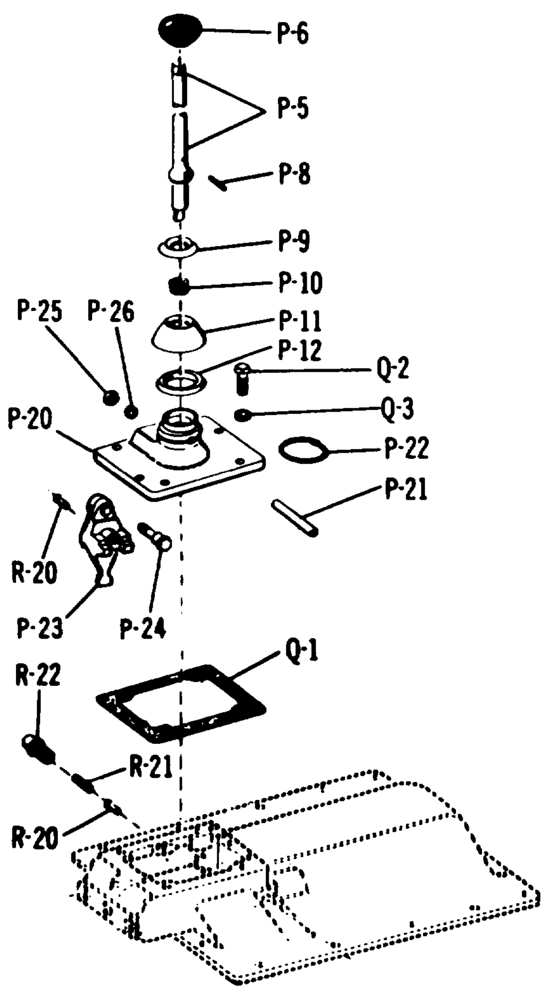
OVERFILLING

Do not overfill the transmission. Overfilling usually results in oil breakdown due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil will result in heavy varnish and sludge deposits that plug up oil ports and build up on splines and bearings. Overflow of oil usually escapes onto parking brakes or clutches, causing additional trouble.

CAUTION

Do not tow vehicles equipped with Spicer transmissions at high speeds or for long distances without first pulling the axles or disconnecting the drive shaft. Lubrication of the internal gear train is inadequate when the vehicle is towed.

DISASSEMBLY:



REMOVAL:

1. Remove the 1st and reverse lockout plunger retainer (R-22), spring (R-21) and plunger (R-20) from shifter housing before removing the dome assembly.

2. Remove retaining cap screws (Q-2) and lock washers (Q-3). Separate dome from shifter housing and gasket and lift straight up.

> **CAUTION**
> ***Do not lose second lockout plunger (R-20) also used in cross hole of 1st and reverse shift finger (P-23).***

3. Position dome (P-20) on edge in vise.

4. Depress collar (P-9) against spring (P-10) and remove lock pin (P-8).

5. Slide compression cup (P-11) up the shaft and remove rock shaft snap ring (P-22).

6. Tap rock shaft (P-21) free of dome and remove shift lever (P-5). Remove seal (P-12).

7. Remove shift handle or ball (P-6) and slide collar (P-9), spring (P-10) and cup (P-11) off lever.

8. Hold 1st and reverse shift finger stud (P-24) and remove lock nut (P-25) and washer (P-26).

9. Remove stud and finger from dome.

INSPECTION :

Wash all parts thoroughly and inspect for excessive wear at cross hole in lever and rock shaft (P-21).

Inspect finger end of shift lever and shift finger for excessive wear. (See Figure on next page for original contour.)

Check spring tension by comparing to new part.

Replace seal.

REASSEMBLY:

1. Position dome (P-20) on edge in vise.

2. Grease lightly and assemble 1st and reverse shift finger (P-23) to dome with stud (P-24). Secure with washer (P-26) and nut (P-25). Check operation, as finger must rotate freely.

3. Position shift lever (P-5) in dome so that dot in lever aligns with the rock shaft cross holes.

REASSEMBLY (Contd):

4. Align slot and start rock shaft (P-21) through hole in dome and slot of shift lever.

5. Assemble rock shaft snap ring (P-22) to groove of dome and lock rock shaft in place.

6. Grease lightly and assemble new seal (P-12) to dome. Grease inner wall of cup (P-11) and slide down over lever into position on dome.,

7. Assemble spring (P-9) to lever. Depress collar and assemble lock pin (P-8) through hole in shift lever.

8. Assemble shift handle (P-6) to end of lever.

ASSEMBLY OF OVERHEAD CONTROL TO SHIFTER HOUSING:

1. Place transmission in neutral so that dots Of forks and brackets align.

2. Dome assembly serves as cover plate for shift rod poppet balls and springs. Check to determine that balls (R-7) and springs (R-8) are in place.

3. Use light coat of cement to locate and assemble new gasket (Q-1) to shifter housing opening.

4. Use heavy grease to hold and assemble 1st and reverse lock out plunger (R-20) to shift finger (P-23).

NOTE

Button end of plunger assembles into counterbore of shift finger cross hole.

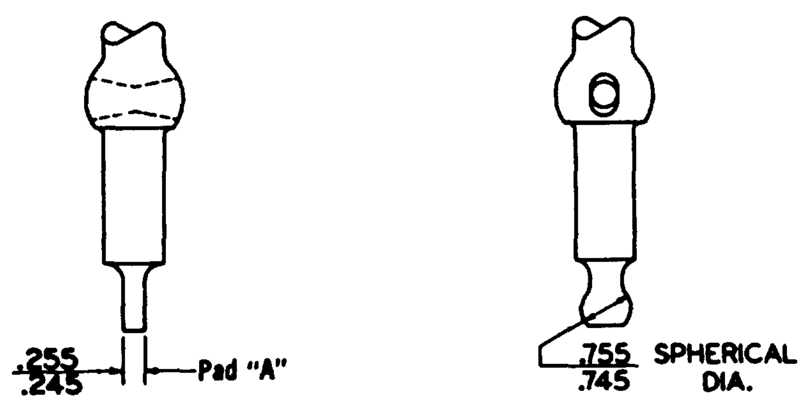
6. Assemble shift lever and dome assembly to shifter housing, noting that let and reverse shift finger and shift lever itself are positioned in the neutral notches.

6. Secure with 6 cap screws (Q-2) and 6 lock washers (Q-3).

7. Assemble lockout plunger (R-20) to shifter housing (R-2). Secure and preload with spring (R-21) in retainer (R-22).

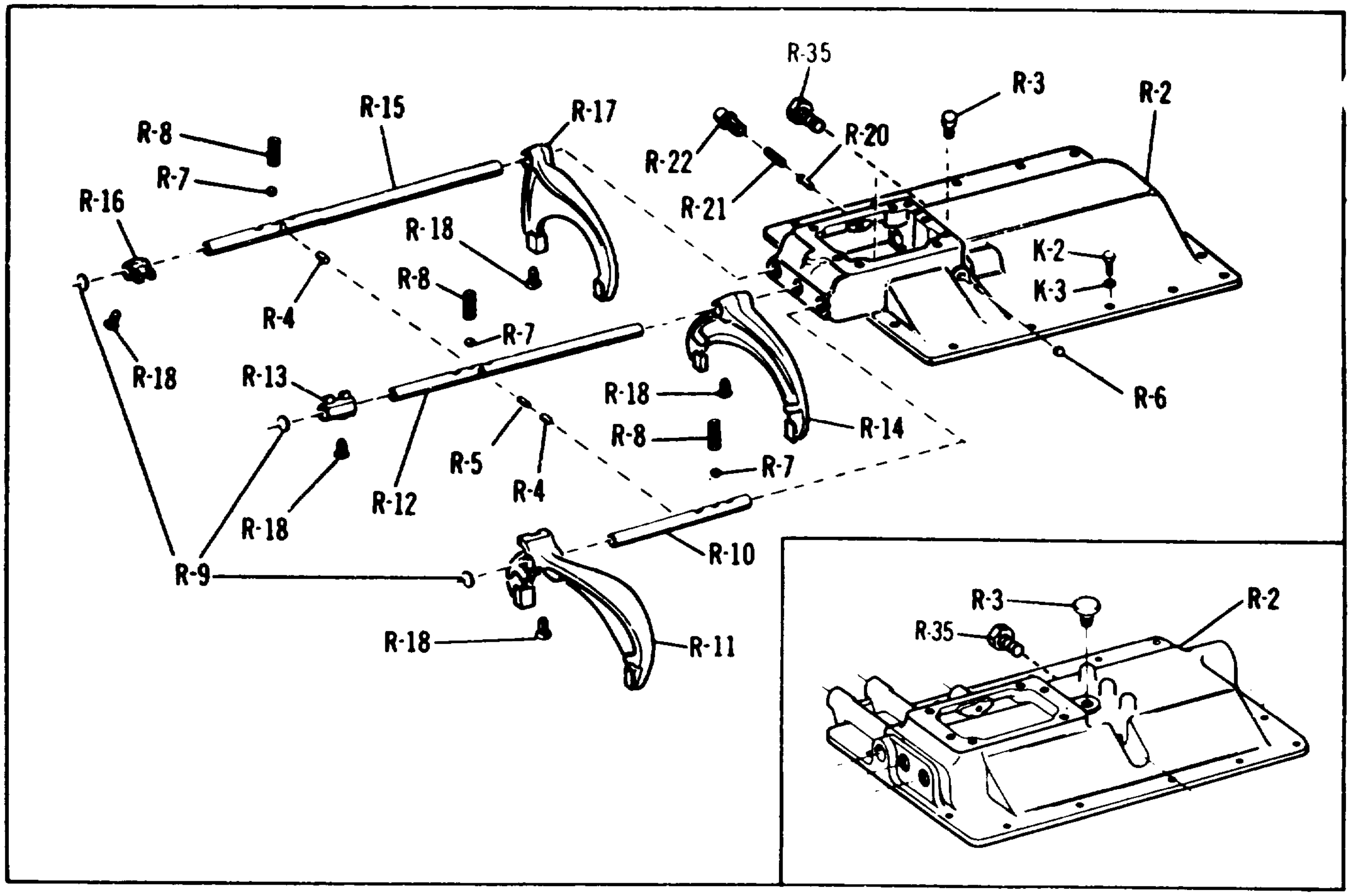
8. Check shifting of transmission into all gear positions to verify workmanship.

Check wear on pad "A" to dimension shown. Replace rock shaft (P-21) if worn excessively. Replace seal (P-12) see figure on opposite page.



SHIFTER HOUSING

DISASSEMBLY:



> **NOTE**
> If overhead or remote control is intact on shifter housing, remote per instructions on page 4.

1. Depending on the shifter housing, shift rod poppet springs and balls are removed two different ways.

(a) If shift lever opening extends over clutch housing, the three sets of poppet springs (R-8) and balls (R-7) can be removed out the top of the housing with a magnet, as the shift lever dome is removed. See main illustration.

(b) If the shift lever opening is not extended, the poppet springs and balls are contained under the three domes back of the opening. These parts are preloaded and caution must be used in removing them from inside the housing as the respective shift rod clears the center boss. See inset.

2. Remove the retaining cap screws (K-2) and lock washers (K-3). Separate shifter housing (R-2) from main case and gasket by lifting straight up.

3. Place shifter housing in vise with forks facing out and welch plugs (R-9) or front of housing facing to the left.

4. Tap 4th - 5th shift fork (R-11) forward to move shift rod (R-10) against welch plug (R-9). Drive plug free of case and tap fork forward until stopped by housing boss. Cut lockwire and remove set screw (R-18) fork (R-11). Use soft rod to tap shift rod free of fork and out of housing,

5. Tap 2nd - 3rd shift fork (R-14) forward to move shift rod (R-12) against welch plug (R-9). Drive lug free of case and tap fork forward until stopped by housing boss. Cut lockwire and remove set screw (R-18) from fork (R-14) and bracket (R-13). Use soft rod to tap shift rod free of fork and bracket and out of housing Note: Use caution as rods are removed from housing to prevent loss of cross interlock (R-4) and pin (R-5).

6. Tap 1st - reverse shift fork (R-17) forward to move shift rod (R-15) against welch plug (R-9). Drive lug free of case and tap fork forward until stopped by housing boss. Cut lockwire and remove set screw (R-18) from reverse fork (R-17) and bracket (R-16). Use soft rod to tap shift rod free of fork and bracket and out of housing.

7. Remove old gaskets or sealing materials from machined surfaces and clean shifter housing.

8. Wash all shifter housing parts. Examine all parts before reassembly.

REASSEMBLY:

1. Place shifter housing in vise with inside of housing facing out and welch plug (R-9) openings to the left.

2. Check all three shift rods (R-10, 12, 15) in their proper position to make sure they slide freely. Remove rods and apply a light coat of grease to all bores in the housing and to the rods as they are assembled to the housing.

> **IMPORTANT**
>
> As noted in Step 1 (b) of disassembly, if shift lever opening does not overhang, poppet springs and balls must be inserted as shift rods are assembled. As each successive rod is assembled, insert poppet spring (R-8) and position poppet ball (R-7) in detent bore of center boss. Preload spring and ball with poppet tool. As each shift rod passes through center boss, tap rod sharply to remove tool.

3. Select the longest rod (1st and reverse shift rod R-15) and enter longest end from poppet detents into bottom welch plug opening at left of housing.

4. Assemble shift rod bracket (R-16) to rod (notch offset up). Pass rod through center and rear bosses and assemble 1st and rev. shift fork (R-17) to rod (long hub to the left).

5. Locate shift bracket and fork in their proper position on rod. Secure shift bracket (R-16) and shift fork (R-17) to rod (R-15) with set screws (R-18). Torque set screws to 40-50 lbs. ft. and secure with lockwire.

6. Position 1st and rev. rod in neutral position and assemble interlock (R-4) to cross hole of center boss. Seat interlock in notch of rod.

7. Select the next longest shift rod (2nd and 3rd shift rod R-12) and enter longest end from poppet detent into center opening at left of housing.

8. Assemble shift rod bracket (R-13) to rod (notch offset facing top of housing). Note: Use heavy grease to hold and assemble interlock pin (R-5) to cross hole of shift rod detent before poppet notches enter center boss. Pass rod through center boss and assemble 2nd and 3rd shift fork (R-14) to rod (long hub to the left).

9. Locate shift bracket and fork in their proper position on rod. Secure shift bracket (R-13) and shift fork (R-14) to rod (R-12) with set screws (R-18). Torque set screws to 40-50 lbs. ft. and secure with lockwire.

10. Position 2nd - 3rd rod in neutral position and assemble short interlock (R-4) to cross hole of center boss. Seat interlock in notch of rod.

11. Start the shortest or 4th - 5th shift rod (R-10) in upper hole of shifter housing (poppet notch end first). Position 4th - 5th shift fork (R-11) on rod (web to left and shift finger notch down). Tap shift rod into proper position and secure fork (R-11) to rod (R-10) with set screw (R-18). Torque to 40-50 lbs. ft. and secure with lockwire.

12. Shift bottom rod into 1st or reverse speed and then try to shift upper rod. This rod should be locked out.

13. Return reverse rod to neutral position and check movement of each shift rod to make sure it moves readily and completely into each gear position.

14. Use light coat of cement and assemble the three welch plugs (R-9) to openings at front of shifter housing. If welch plug (R-6) and breather (R-3) were removed, replace at this time. Also, remove back-up switch (R-35) if so equipped.

INSTALLATION OF SHIFTER HOUSING ASSEMBLY TO TRANSMISSION:

1. Use light coat of cement and assemble shift cover gasket (K-1) to transmission case.

2. Check and place shifter forks and transmission clutch collars in neutral position.

3. Set shifter housing into position on case and make sure all three shift forks are in their proper place in corresponding shift collar.

4. Secure shifter housing to main case with cap screws (K-2) and lock washers (K-3).

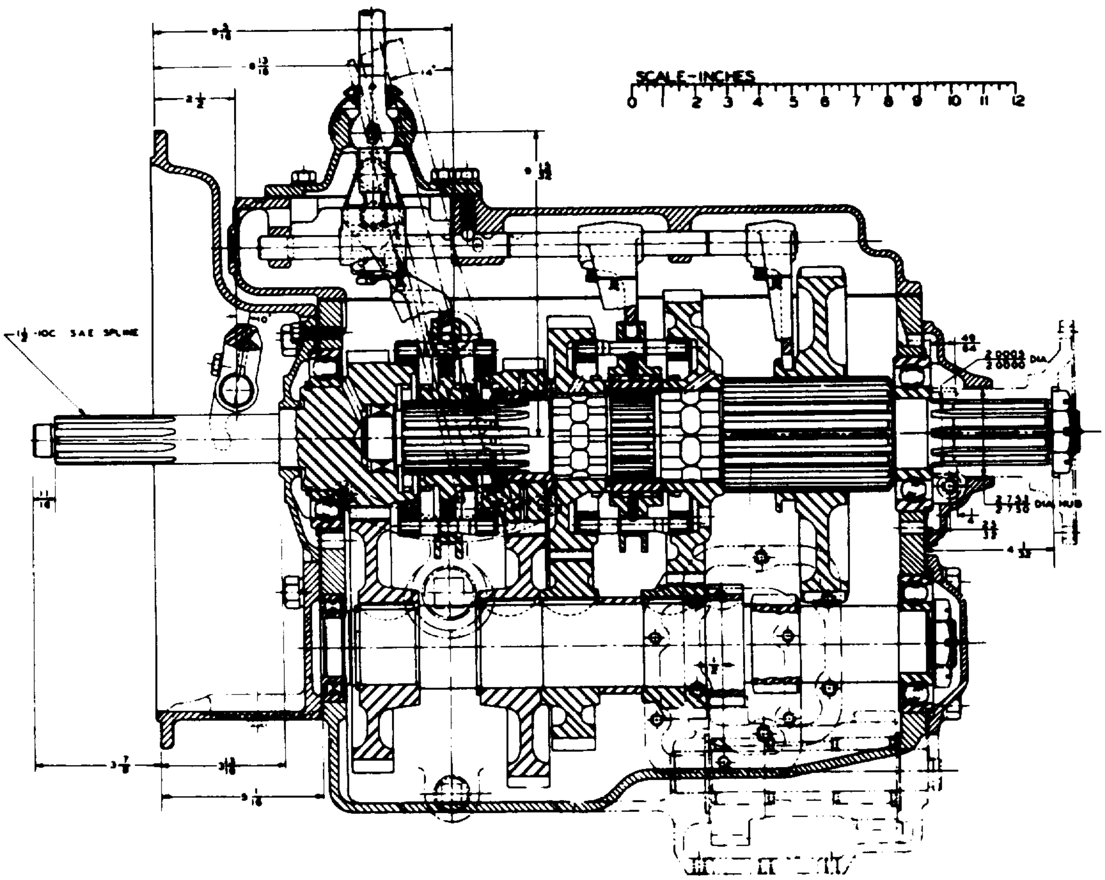
5. Use large screw driver or small pry bar and check movement of each shift rod to make sure transmission will shift readily and completely into each gear position.

6. Place three poppet balls (R-7) in proper locations in top of shifter housing over shift rods.

7. Place three poppet springs (R-8) on poppet balls.

8. Assemble remote or overhead control to shifter housing (see page 5).

DISASSEMBLY:



MAINSHAFT REMOVAL:

1. Engage 2nd - 3rd synchronizer (B-11) with 2nd speed gear (B-12) and 4th - 5th synchronizer (B-2) with 4th or 5th speed gear (B-3) to lock transmission in two gears.

2. Pull cotter pin (B-19) and use 2 1/8" socket to remove output yoke or flange nut (B-18). Later model transmissions may use a self-locking type nut.

3. Use puller to remove end yoke or flange (B-17).

4. Use 3/4" socket to remove cap screws (H-5) and lock washers (H-7) from mainshaft rear bearing cap (H-1). Separate bearing cap from case and gasket (H-4). Remove speedometer drive gear or spacer (B-15) from rear of mainshaft.

> **NOTE**
> If countershaft (C-1 through C-16) is not to be removed, proceed to step #7.

5. Use 3/4" socket to remove cap (J-3) and lock washers (J-5) from countershaft rear bearing cap (J-1). Separate cap from case and gasket (J-2).

6. Pull cotter in (C-16) and use 2 1/8" socket to remove countershaft rear bearing lock nut (C-15).

> **NOTE**
> The procedure of disassembly for this series transmission varies with gear ratios provided.
> If the drive gear (A-1) is smaller than the case bearing bore, remove drive gear and bearing sub-assembly A-1 through A-4 at this time. (See Step #7.) If the drive gear is larger than case bearing bore, it is necessary to remove the mainshaft assembly before drive gear (A-1) can be removed from case. (Proceed to Step #10.)

7. Remove cap screw (CR-8), washer (CR-10) and key (CR-9) from clutch release yoke (CR-7)

MAINSHAFT REMOVAL (Contd):

Pull long shaft (CR-2) and release lever out of bushing. Slide yoke and short shaft (CR-1) toward inside of housing to clear bushing.

8. Remove capscrews (F-4), lock washers (F-6) from drive gear bearing cap. Remove bearing cap (F-1).

9. Use soft hammer, or soft drift if necessary, to tap drive gear (A-1) and bearing (A-2) through front bearing bore of case.

> **NOTE**
> Fourteen (14) loose rollers (A-4) am used for the pocket bearing between drive gear (A-1) and mainshaft (B-1). Remove rollers from drive gear pocket or from bottom of case if they fell out when drive gear was removed.

10. Use two pry bars to elide main&aft and gear assembly (B-1 through B-14) toward rear of case as far as possible and remove mainshaft rear bearing (B-14). See Note below.

> **NOTE**
> Internal gearing used with some ratios limits the rearward travel of mainshaft to a approximately 1/2 inch. Since this will not free the M/S rear bearing (B-14) from case bore, it is necessary to use a puller that clamps on the snap ring or in the snap ring groove to pull bearing free of case bore and off of mainshaft. However, internal gearing of other ratios will permit complete removal of rear bearing (B-14) from case bore and easier puller and red applications.

11. Remove mainshaft and gear assembly (B-1 through B-13) by lifting front of mainshaft up and sliding it forward out of rear bearing bore. The 1st and reverse sliding gear (B-13) may be removed with the mainshaft or left in the case.

12. Remove the 4th - 5th synchronizer (B-2) and lay aside.

13. Remove 4th speed (or overdrive) gear retaining snap ring (B-7) and thrust washer (B-6).

14. Slide 4th speed (or overdrive) gear (B-3) from end of mainshaft (B-1).

15. Remove M/S 3rd speed gear (B-8), sleeve (B-4) from shaft. If necessary sleeve, shift synchronizer into 2nd gear and support under 3rd speed gear (B-8).

16. Slide 2nd - 3rd speed synchronizer (B-11) from shaft.

17. Remove mainshaft 2nd - 3rd speed clutch gear snap ring (B-10).

18. Support 2nd speed gear (B-12) under arbor press mainshaft out of 2nd- 3rd speed clutch gear (B-9) and gear (B-12).

REMOVAL OF DRIVE GEAR:

If transmission drive gear (A-1) is larger than case bearing bore and could not be removed as mentioned in Note and Step #7, remove as follows:

1. Remove cap screws (F-4), lock washer (F-6) and pull front bearing cap (F-1).

2. Remove large snap ring from outer-race of drive gear bearing (A-2).

3. Use soft hammer to tap bearing and gear sub-assembly toward inside of case and out of bearing bore.

4. Remove small snap ring (A-3) from drive gear and press bearing (A-2) free of drive gear.

REMOVAL OF REVERSE IDLER AND COUNTERSHAFT:

1. Remove reverse idler gear shaft (D-1) with impact tool.

2. Lift idler gear (D-3) with roller bearings (D-2) up and out of case. Remove thrust washers at ends of idler gear if provided.

3. Use pry bars behind countershaft drive gear (C-3) and slide countershaft toward rear of case until rear bearing (C-14) is free of case bore. Use bearing puller to remove rear bearing (C-14) from countershaft (C-1).

4. Lift up front end of countershaft and remove shaft and gear assembly (C-1 through C-13) from case.

5. Remove outer race and roller assembly of countershaft front roller bearing (C-2) from case bore.

DISASSEMBLY COUNTERSHAFT:

1. Remove inner race of bearing (C-2) from front of countershaft.

2. Remove countershaft drive gear snap ring (C-4). Support drive gear (C-3) with parallel bars under and as close to hub as possible and press countershaft (C-1) free of gear.

3. Remove key (C-5) and snap ring (C-6). Support 4th (or overdrive) gear (C-7) and press countershaft he of gear.

4. Remove key (C-8). Support 3rd speed gear (C-9) and press out countershaft.

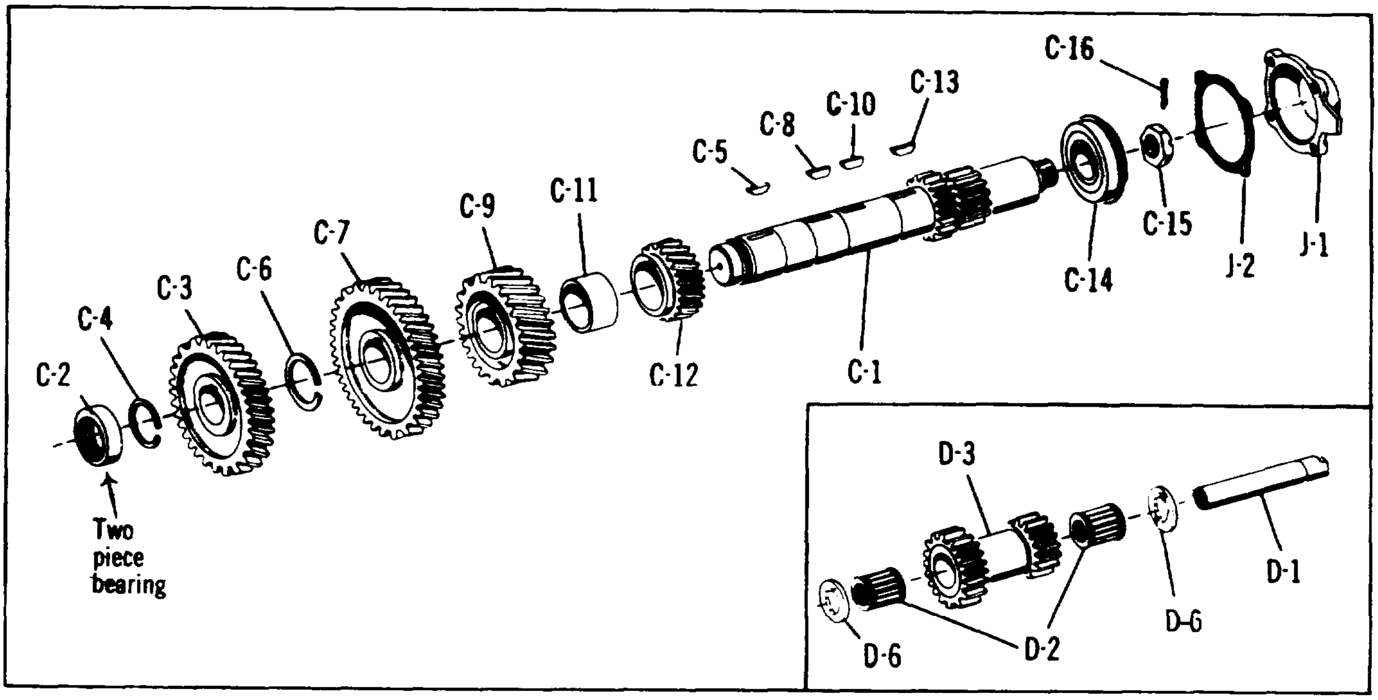
5. Remove key (C-10) and spacer (C-11). Support 2nd speed gear (C-12) and press out countershaft.

6. Remove key (C-13).

CLUTCH HOUSING AND P.T.O. APERTURE COVERS:

1. It is not necessary to remove clutch housing or P.T.O. covers from case unless they are damaged, gaskets leak, etc.

ASSEMBLY:



PRESSING GEARS ON COUNTERSHAFT:

> **NOTE**
> It is advisable to coat the bores of all gears with white lead when pressing the gears on the countershaft.
> If Woodruff keys are mutilated or burred over after assembly to countershaft, use mill file to align sides, remove burrs, etc. This prevents chips and slivers from peeling off and lodging between gear thrust faces.
> When in doubt about which way gear assembles to shaft, look for chamfered end of bore. Most gear bores are only chamfered on the end that enters shaft first.

1. Assemble Woodruff key (C-13) to countershaft (C-1). Seat key securely and dress up with file, if necessary.

2. Support on hub of 2nd speed gear (C-12). With long hub down and chamfer up, set countershaft (C-1) into position under arbor. Align key with keyway and press shaft to gear.

3. Slide 2nd - 3rd gear spacer (C-11) on countershaft and then assemble rest of keys (C-5, C-8 and C-10). Seat the keys securely and dress up with a file if assembly.

4. Support on hub of 3rd speed gear (C-9). With long hub down and chamfer up, set countershaft into gear under arbor. Align key with keyway and press countershaft to gear. Seat gear (C-9) firmly against spacer (C-11).

5. Support on hub of 4th (or overdrive) gear (C-7). With long hub down press countershaft to gear.

6. Assemble snap ring (C-6)' to lock gears (C-7, C-9 and C-12) to shaft.

> **NOTE**
> Use caution when assembling snap ring to shaft to prevent extending or distorting snap ring. AU snap rings must seat firmly in grooves to give secure lock.

7. Support on hub of drive gear (C-3). With long hub and chamfer up, start counter&aft and gears into hub. Align key with keyway and press shaft into gear.

8. Assemble snap ring (C-4) to lock drive gear in place. Observe 'Note", Step #6.

9. Assemble inner race of (C-2) to shaft (C-1).

INSTALLATION OF COUNTERSHAFT IN CASE:

1. Lower rear of countershaft and gear assembly (C-1 through C-13), into case and out rear countershaft bearing bore. Align front of shaft and slide front roller bearing (C-2) (18 Roller Type) completely into front case bearing bore.

2. Position countershaft rear bearing (C-14) on shaft with bearing shield toward inside of case and snap ring toward rear. Align bearing with shaft and case bore and tap lightly to start bearing in place.

> **CAUTION**
> To prevent damage to countershaft front roller bearing (C-2), position two strips of flat steel stock, approximately 3/8" thick, between countershaft drive gear (C-3) and wall of case. Since rear beanbag (C-14) should fit tight on shaft, use tubing to drive against inner race. Seat bearing on shaft, then remove steel strips and tap bearing into bore seating snap ring against case.

3. Start and run lock nut (C-15) against bearing, by band.

INSTALLATION OF REVERSE IDLER GEAR:

1. Hand-pack roller bearings (D-2) with light grease and assemble to bores at either end of reverse idler gear (D-3).

2. Position idler gear assembly with thrust washers, if provided in unit, at each gear face in case with large gear toward front of transmission. Mesh with countershaft and align bore of bearings with hole in case.

3. Assemble reverse idler shaft (D-1) through rear case bore, noting that "flat" on shaft is squared toward countershaft for proper lock by countershaft bearing cap (J-1).

4. Set countershaft rear bearing cap in place to check lock of reverse idler shaft. Secure with two finger-tight cap screws (J-3) to keep countershaft in place during assembly of mainshaft.

INSTALLATION OF DRIVE GEAR:

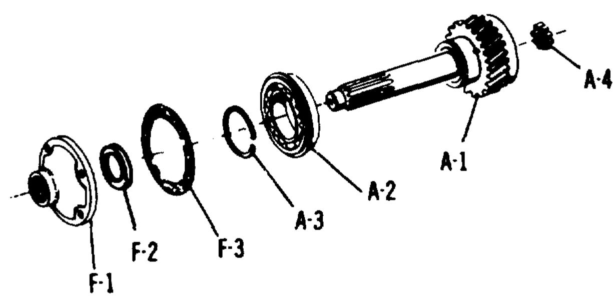
> **NOTE**
> If transmission drive gear (A-1) is larger than case bearing bore, drive gear must be assembled to case before installation of mainshaft.
> If drive gear (A-1) will pass through case bearing bore, drive gear and bearing cap may be installed after mainshaft.

1. Position drive gear bearing (A-2) on arbor so that shield is up and snap ring is down. Support inner race of bearing and press drive gear (A-1) through bearing.

2. Lock bearing (A-2) to drive gear (A-1) with snap ring (A-3). Make sure snap ring is seated in groove.

3. If drive gear must be installed from inside cafe, remove large snap ring from outer race of drive gear bearing (A-2). Install drive gear and bearing from inside the case, tapping bearing through case bore.

4. Assemble snap ring to bearing and tap bearing back so snap ring is flush with case.

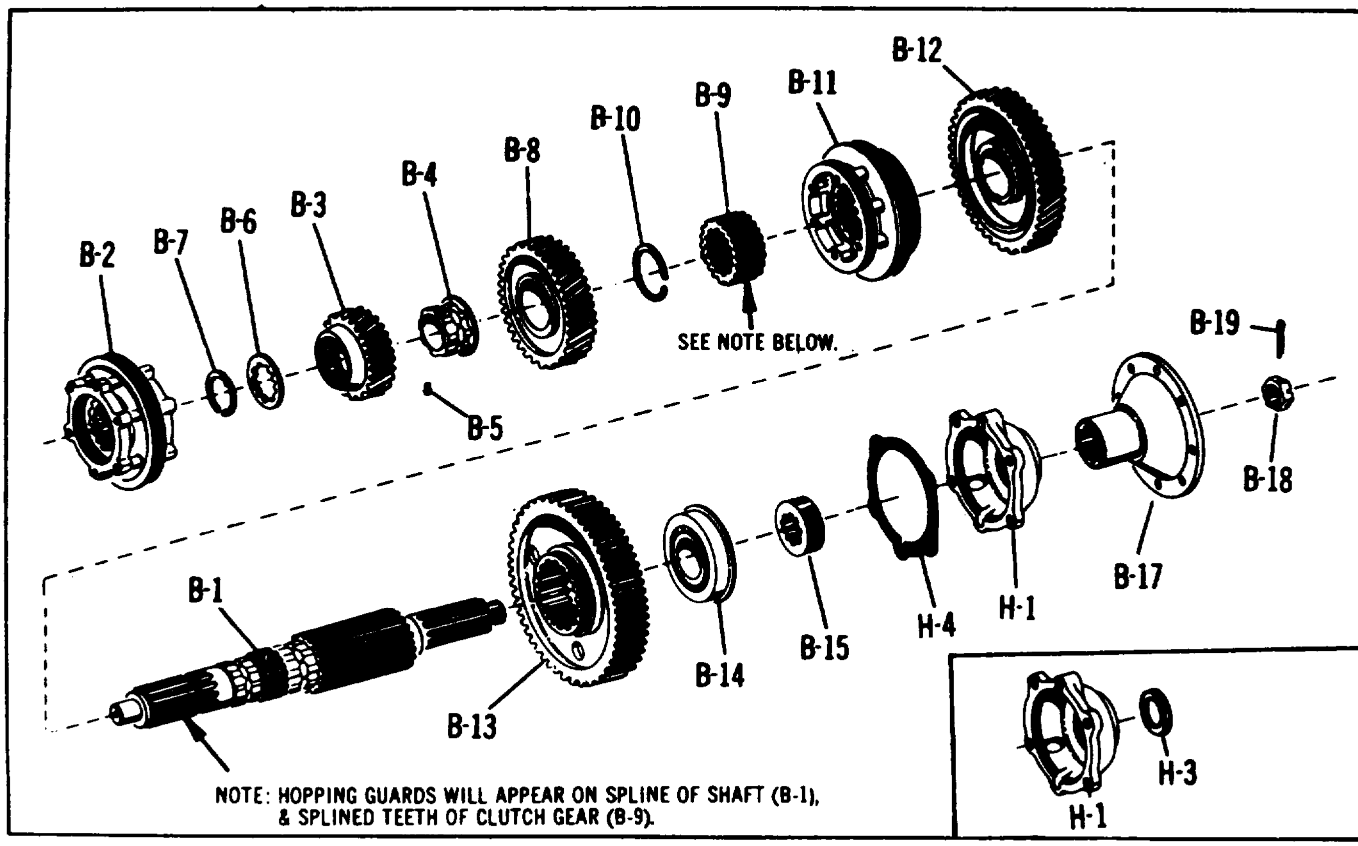


5. Assemble bearing cap seal (F-2) into bearing cap, if required.

6. Position new gasket (F-3) on drive ear bearing cap (F-1) an of locate with cap screw (F-4). Slide cap and gasket into position over drive gear stem. Do not damage oil seal. Secure with cap screws (F-4) and lock washers (F-6). Torque cap screws 60 - 80 lbs. ft. Note: Make sure the oil drainback hole in gasket and cover is at the 7 o'clock position.

7. To assemble the 14 rollers (A-4) to pocket of drive gear (A-1), coat bore of pocket with grease and set rollers in place. The last roller must be slid into position endways due to the "keystone" effect.

REASSEMBLY:



REASSEMBLY OF MAINSHAFT:

> **NOTE**
> Lubricate free-running gear bearing bores with light grease as gears am assembled to shaft. CAUTION: Do not plug oil holes with grease.

1. Position mainshaft vertically in vise with output end of shaft resting on bed and soft jaws clamping on long splined area. NOTE: Fit of new parts may require the use of an arbor press. If so, set up vertically and follow same procedure.

2. Assemble 2nd speed gear (B-12) to shaft. Clutch gear teeth and synchronizer cone up.

3. Slide 2nd - 3rd clutch gear (B-9) down on shaft. Use 2½" I.D. tubing approximately 8" long to press gear against shoulder of shaft.

4. Install 2nd - 3rd clutch gear snap ring (B-10); make sure it is seated in groove of mainshaft. Note: Use caution when assembling snap ring to shaft to prevent extending or distorting snap ring.

5. Check end clearance between gear (B-9) and 2nd speed gear (B-12). (Minimum end clearance .004).

6. Assemble 2nd - 3rd synchronizer (B-11) to clutch gear (B-9). This synchronizer (B-11) can be, and often is, assembled backward on the mainshaft. Make sure that long hub on synchronizer clutch gear is assembled facing second speed gear (B-12). Notice the word front, stamped on the short hub side of collar face.

7. Place 3rd speed gear (B-8) on mainshaft with clutch teeth and synchronizer cone down.

8. Assemble sleeve pin (B-5) to fluted sleeve (B-4) with head of pin inside sleeve.

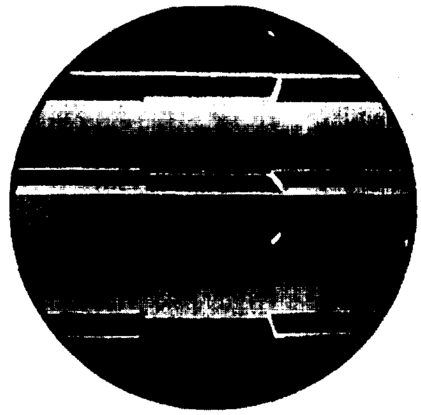
9. With flanged end toward the rear or 3rd speed gear (B-8), align pin (B-5), with spline and press on mainshaft.

10. Assemble 4th speed (or overdrive) gear (B-3) on mainshaft with long hub up. Secure in place with thrust washer (B-6) and snap ring (B-7). See NOTE Step #4.

11. Remove assembly from vise.

CAUTION

The spline of many Spicer clutching gears, main shafts, etc., are equipped with a machined relief called a "hopping guard". With the clutch gear in the engaged position, the mating gear is free to slip into this notch, preventing the two gears from "walking out of gear" under load. (See enlarged view.) This is not a worn or chipped gear! Do not grind it down or discard the gear.



INSTALLATION OF MAINSHAFT IN CASE:

NOTE

Check drive gear pocket (A-1) to verify that all 14 rollers (A-4) are in their proper position.

1. Place let and reverse sliding gear (B-13) on an angle in rear of case with shift fork collar toward front of case.

2. Assemble 4th - 5th synchronizer (B-2) on mainshaft. Shift synchronizer clutch collar into mesh with 4th (or overdrive) gear (B-3) to help lock synchronizer in place during installation in case.

3. Lower rear of mainshaft into case through 1st and reverse sliding gear (B-13) and out mainshaft rear bearing bore.

4. Lower front of mainshaft into approximate position and mesh all gears. Raise rear of mainshaft and elide forward into pocket bearing. If drive gear is not in place, install at this time.

5. Slide rear bearing (B-14) into position on mainshaft. Snap ring on bearing toward rear.

6. Align bearing with rear case bore and press bearing on shaft. A piece of 2" I.D. tubing approximately 2¾" long used with rear lock nut (B-18) and washers ma es a suitable pusher for rear bearing installations.

CAUTION

Do not drive rear bearing on M/S into case bore unless gear (B-12) is blocked against front of case with 2x4 or similar tool.

7. Assemble speedometer drive or spacer (B-15) to the mainshaft and seat against bearing.

8. Position and locate gasket (H-4) on rear bearing cap (H-1). Assemble cap and gaskets to case and tighten cap screws (H-5) 60-80 lbs ft. for 1/2" -13 thread and 90-115 lbs. fts. for 5/8"-11 thread.

NOTE

Some bearing caps have oil seals (H-3) in the I.D. If this was removed, replace at this time.

9. If necessary, reengage 4th - 5th synchronizer (B-2) with 4th speed (or overdrive) gear (B-3) and 1st and reverse sliding gear with countershaft or reverse idler (D-3).

10. Assemble companion flange or end yoke (B-17) to mainshaft.

11. Use 2 1/8" socket to tighten rear mainshaft lock nut (B-18) to 500-550 lbs. ft. torque. Secure with cotter pin (B-19).

12. Remove cap screws and countershaft rear bearing cap (J-1). Use 2 1/8" socket and tighten countershaft rear lock nut (C-15) to 500-550 lbs. ft. torque. Secure with cotter pin (C-16).

13. Assemble cap (J-1) with gasket (J-2) to rear of case, noting that projection on cap locks reverse idler shaft (D-1). Torque cap screws (J-3) to 60-80

14. Shift transmission into neutral and rotate drive gear to check for free rotation of all gears

15. Use pressure type oil can to force oil through holes and end slots of all mainshaft gears to flush out grease and open oil passageways.

INSTALLATION OF CLUTCH HOUSING AND MISCELLANEOUS:

1. Apply light coat of gasket cement to front of case an set gasket (E-7) in place. Apply light coat of cement to face of gasket.

2. Set clutch housing in place using drive gear bearing cap as centering gauge. Line up cap screws and secure to case with screws (E-8) and washers (E-10). Tighten cap screws to 120-150 lbs. ft.

CAUTION

Cap screw in aluminum case should only be tightened to 70-75 lbs. ft.

REASSEMBLE

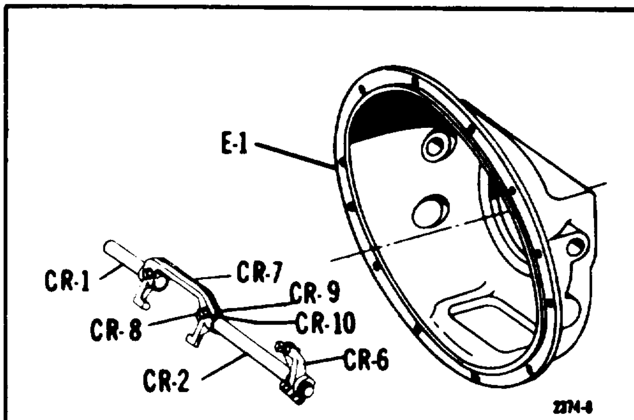
3. Secure release yoke (CR-7) to short shaft (CR-1) with cap screw (CR-8) and washer (CR-10).

4. Install clutch release yoke (CR-7) and short shaft (CR-1) to clutch housing. Assemble long shaft (CR-2) to yoke (CR-7). Align keyway with slots in yoke and assemble key (CR-9), washer (CR-10) and cap screw 10-15 lb. ft.

5. Replace P.T.O. aperture covers (G-13) using new gaskets (G-14) and gasket cement. Torque cap screws 10 - 15 lb. ft.

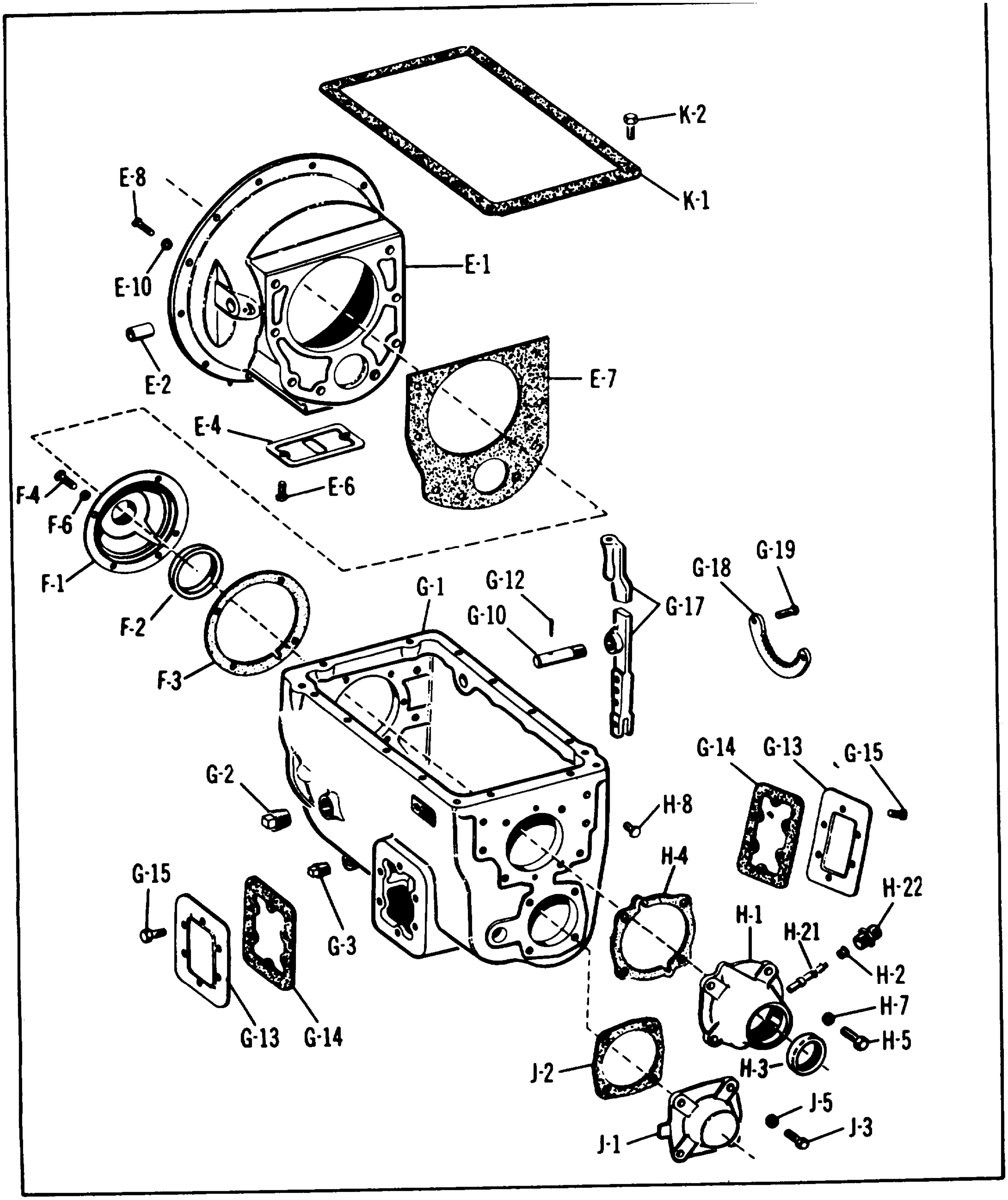
6. Install drain plug (G-3) or temperature-sending unit if used. In&all oil level plug (G-2).

7. Plug openings in rear face of transmission if an emergency brake or rear support does not utilize these holes. For installation of shifter housing see page 7.



CLUTCH HOUSING AND RELEASE PARTS

REASSEMBLY:


K-2
K-1
E-8
E-10
E-1
E-2
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E-4
E-6
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F-2
F-3
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G-13
G-14
J-2
H-3
J-5
J-3
J-1

IMPORTANT PROCEDURE

When locating and correcting unit power or auxiliary transmission troubles, a systematic procedure should be followed.

Road test whenever possible. Mechanics usually net second or third hand reports of trouble experienced with the unit and these reports do not always accurately describe the actual conditions. Sometimes symptoms seem to indicate trouble in the transmission; while, actually the trouble may be caused by the axle, propeller shaft. universal joint, engine or clutch. This is especially true of complaints on noise. Therefore, before removing transmission or related components to locate trouble, always road test to check possibility that trouble may exist in other closely associated units. If the mechanic can drive, road testing will be more effective; however, just riding with the driver can be very informative.

Check Functioning Prior to Disassembly:

If remote controls are used, a careful check of the remote and connecting linkage to transmission and auxiliary must be made. The remote units and linkage must be in good working order if the tranamission and auxiliary are expected to shift satisfactorily.

Many times the answer to the trouble is apparent when the unit is inspected prior to disassembly, but this evidence is often lost when the parts are equated. If possible, check the unit prior to disassembly. Bear in mind that a careful inspection of the unit should be made as each disassembly step is performed.

Inspect Thoroughly During Disassembly:

It is poor practice to disassemble a unit or complete transmission as quickly as possible without bothering to examine the parts as they come down. It happens many times that a mechanic has completely disassembled a unit and failed to find the cause of the trouble because he did not bother to examine the parts as they came apart. After the transmission is disassembled, check the lubricant for foreign particles which often reveal sources of trouble that are overlooked during the disassembly.

Repair or Replace Defective Parts:

Many times the or critical adjustments that have caused the trouble are not replaced or corrected because the mechanic will only inspect and replace parts that have failed completely. All pieces should be accurately examined because the broken parts are often just the result and not the cause of the trouble. All parts that are broken or worn and no longer meet specifications should be replaced. On large unite, like a tranamission, it is suggested that a mechanic replace parts that are worn to the extent that they do not have a long service life remaining. This avoids another teardown on the unit in the near future. It is also good practice, at this time, to make the changes or modifications recommended to bring the transmission up to date and increase the service life of the unit.

Noisy Operation:

Noise is usually very elusive and generally not the fault of the transmission; therefore, mechanics should road test to determine if the driver's complaint of noise is actually in the transmission.

In numerous instances, drivers have insisted that the noise was in the transmission, however, investigations revealed the noise to be caused by one of the following conditions:

(a) Fan out of balance or blades were bent.
(b) Defective vibration dampers.
(c) Crankshafts out of balance.
(d) Flywheels out of balance.
(e) Flywheels mounting bolts loose.
(f) Engine rough at Idle producing rattle in gear train.
(g) Clutch assembly out of balance.
(h) Engine mounts loose or broken.
(i) Power-take-off engaged.
(j) Universal joints worn out.
(k) Propeller shafts out of balance.
(l) Universal joint angles out of plane or at excessive angle.
(m) Center bearings in drive line dry, not mounted properly, etc.
(n) Feels out of balance.
(0) Tire treads humming or vibrating at certain speeds.
(p) Air leaks on auction side of induction system - - especially with turbo-chargers.

Mechanics should try to locate and eliminate noise by means other than transmission removal, or overhaul. However, if the noise appears to be in the transmission try to break it down into the following classifications. If possible, determine what position the gear shift lever is in when the noise occurs. If the noise is evident in only one gear position, the cause of the noise is generally traceable to the gears in operation.

(a) Growl and humming or, more serious, a grinding noise. These noises are caused by worn, chipped, rough or cracked gears. As gears continue to wear, the grinding noise will be noticeable, particularly in the gear position that throws the greatest load on the worn gear.

(b) Hissing or, more serious, a thumping or bumping-type noise. Hissing noises can be caused by bad bearings. As bearings wear and retainers start to break up, etc., the noise could change to a thumping or bumping.

(c) Metallic ratttles within the transmission usually result from a variety of conditions. Engine torsional vibrations are transmitted to the transmission through the clutch. In heavy duty equipment, clutch discs with vibration dampers are not used, so a rattle, particularly in neutral, is common with diesel equipment. In general, engine speeds should be 600 RPM or above to eliminate objectionable rattles and vibration during the idle. A da fective or faulty injector would cause a rough or lower idle speed and a rattle in the transmission. Rattle could also be caused by excessive backlash in P.T.O. unit mounting.

(d) Improper lubricants or lack of lubricant can produce noises. Transmissions with low oil levels sometimes run hotter than normal, as there is insufficient lubricant to cool and cover the gears.

(e) Squealing, particularly when the transmission is operating at higher speeds, could be caused by one of the free running gears seizing on the thrust face or fluted diameter temporarily and then letting go. In general, a mild seizure will clear itself up and the transmission will continue to operate very satisfactorily without this defect being known. See (g) below:

(f) Gear seizure at high speed, usually accompanied with loud squealing noise. This type of seizure is readily apparent to the driver since the truck will suddenly slow down as if the brakes were being applied. If the truck continues to move ahead, even though the gear shift lever is placed in neutral, it would indicate the floating gear on the mainshaft had seized. Depressing the clutch should interrupt the driving-torque. The seized gear could be checked quite readily by depressrng the clutch and checking the action with the gear shift lever progressively in all shift positions. If releasing the clutch tends to kill the engine, then this gear position has not seized. In other words, the transmission would be in two gears at the same time. By a process of elimination, the ear at fault can be readily identified. See (g) below:

(g) Vibration: Gear seizures on thrust faces or fluted diameters are usually caused by vibrations in the power train--this could be engine, propeller shafts, joint angle, rear axle, differentials, etc.

Improved highways permit sustained high speeds. The fact that engines and entire trains can now cruise at a higher R.P.M. can introduce vibration frequencies, that were not critical in the past. At slower speeds these items would get by or only pass -through critical periods while accelerating or decelerating through the gears.

In the past, drive line vibrations such as bent tubes, joints out of phase or alignment, bad angles due to short couples, clutches out of balance, gears and shaft in transmission out of balance, were fairly obvious. These. items will become more critlcal in vehicles running at sustained high speeds.

Critical vibrationa associated with higher speeds are not the old thumping or bumping type but are high frequency vibrations which sting or tingle the soles of your feet, tickle the end of your fingers, etc. This type of vibration will cause gear seizures, broken synchronizer pins, bearing failure due to retainer rivet failures, promote brinelling, fretting corrosion, etc.

(h) Gear whine is usually caused by lack of backlash between mating ears - improper shimming of P.T.O. units is the big offender here.

Noise In Neutral:

Possible Causes:

(a) Misalignment of transmission.
(b) Worn flywheel pilot bearing.
(c) Worn, or scored countershaft bearings.
(d) Worn. or rough reverse idler gear.
(e) Sprung, or worn countershaft.
(f) Excessive backlash in gears.
(g) Worn mainshaft pilot bearing.
(h) Scuffed gear tooth contact surface.
(i) Insufficient lubrication.
(j) Use of incorrect grade of lubricant.

Noise In Gear:

Possible Causes:

(a) Worn, or rough mainshaft rear bearing.
(b) Rough, chipped, or tapered sliding gear teeth.
(c) Noisy speedometer gears.
(d) Excessive end play of mainshaft gears.
(e) Refer to conditions listed under Noise in Neutral.

Oil Leaks:

Possible Causes:

(a) Oil level too high.
(b) Wrong lubricant in unit.
(c) Non-shielded bearing used at front or rear bearing cap. (Where applicable.)
(d) Seals (if used) defective or omitted from bearing cap, wrong type seal used, etc.
(e) Transmission breather omitted, plugged internally, etc.
(f) Capecrews loose, omitted or missing from remote control, shifter housing, bearing caps, P.T.O. or covers, etc.
(g) Welch "seal" plugs loose or missing entirely from machine openings in case.
(h) Oil drain-back openings in bearing caps or case plugged with varnish, dirt, covered with gasket material, etc.
(i) Broken gaskets, gaskets shifted or squeezed out of position, pieces still under hearing cape, clutch housing, P.T.O. and covers, etc.
(j) Cracks or boles in castings.
(k) Drain plug loose.
(l) Also possibility that oil leakage could be from engine.

Walking or Jumping Out of Gear:

Dana/Spicer transmissions and auxiliaries are provided with "hopping guards" for most gear positions. Therefore, if the units are walking out of gear it could be caused by:

(a) Interference or resistance in the shift mechanism preventing full engagement of the sliding clutch gear or -

(b) If the gear has been shift&l completely into position some other malfunction which could move the gear or the shaft itself out of its proper location.

If remote controls are used, the mechanic must satisfy himself that the remote units are satisfactory and that transmission is actually at fault. One other point that should be noted is whether the unit walks out of gear under drive (while pulling a load) or on a coast load. Also, does the gear hop occur on smooth or only on rough roads. A number of items that would prevent full engagement of gears are:

(a) Improperly positioned forward remote control which limits full travel forward and backward from the remote neutral position.

(b) Improper length shift rods or linkage that limits travel of forward remote from neutral position.

(c) Loose bell cranks, sloppy ball and socket joints.

(d) Shift rods, cables, etc., too spongy, flexible, or not secured properly at both ends.

(e) Worn or loose engine mounts if forward unit is mounted to frame.

(f) Forward remote mount too flimsy, loose on frame, etc.

(g) Set screws loose at remote control joints or on shift forks inside remote or even inside transmission unit.

(h) Shift fork pads or groove in sliding gear or collar worn excessively.

(i) Worn taper on gear clutch teeth.

(j) Transmission and engine out of alignment either vertically or horizontally.

A few items which could move the gear or shaft out of proper position, particularly on rough roads are:

(a) Use of heavy shift lever extensions.

(b) Shift rod poppet springs broken.

(c) Shift rod poppet notches worn.

(d) Shift rod bent or sprung out of line.

(e) Shift fork pads not square with shift rod bore.

(f) Excessive end-play in drive gear, mainshaft or countershaft, caused by worn bearings, retainers, etc.

(g) Thrust washers or faces worn excessively, missing, etc.

Hard Shifting (Unsynchronized Units):

An improperly operating clutch will interfere with the proper shifting of gears in any transmission. It is important that the hydraulic, air or similar release mechanism (if used), also be in proper working order. If the mechanic is sure that a full and complete clutch release is being made, the following could he a few of the possible cause for hard shifting complainta:

(a) No lubricant in remote control unite. Forward remote is isolated and is often overlooked. However, many remote controls used on transmissions and auxiliaries require separate lubrication.

(b) No lubricant in (or grease fittings on) U-joints or swivels of, remote controls.

(c) Lack of lubricant or wrong lubricant used. causing buildup of sticky varnish and sludge deposits on splines of shaft and gears.

(d) Badly worn or bent shift rode.

(e) Improper adjustment of shifter linkage.

(f) Sliding clutch gears tight on splines of shaft.

(g) Clutch teeth burr& over, chipped or badly mutilated due to improper shifting.

(h) Binding or interference of shift lever with other objects or rode inside the cab or near the remote control island.

(i) Driver not familiar with proper shifting procedure for this transmission. Also includes proper shifting if used with 2-speed axle, auxiliary, etc.

(j) Clutch or drive gear pilot bearing seized, rough, or dragging.

(k) Clutch brake engaging too soon when clutch pedal is depressed.

Hard Shifting (Synchronized Units):

(a) Loose or flimsy remote controls, spongy or flexible rods and/or cables, preventing full application of force to hold and synchronize gears.

(b) Improper design of remote controls. If shift lever linkage and mechanical advantage inside the remote control units is not co&, manual shifting will be hard. Further, driver may not be able to feel the synchronizer action which usually results in a map-type shift.

(c) Improper adjustment of shift linkage.

(d) Synchronizer bronze worn, or steel chips imbedded in bronze prevent proper synchronization.

(e) Damaged synchronizer such as broken poppet springs, poppets jammed, loose or broken blocker pins.

(f) Wrong lubricant especially if E.P. type lubricants are added.

(g) Free running gears, seized or galled on either the thrust face or diameters.

Sticking in Gear:

(a) Clutch not releasing - also check remote units such as hydraulic or air assist, etc. Note: On some units employing a full air control for clutch release, air pressure of approximately 60 lbs. or more must be secured before clutch can be released. Do not leave these vehicles parked in gear.

(b) Sliding clutch gears tight on splines.

(c) Chips wedged between or under splines of shaft and gear.

(d) Improper adjustment, excessive wear or lost motion in shifter linkage.

(e) Clutch brake set too high on clutch pedal - locking gears behind hopping guard.

Crash Shifting or Raking of Gears (Synchronized Units):

Cause: Raking of gears during the manual shift in usually caused by a defective synchronizer or improper shifting technique for synchronized transmission.

When the shift lever moves directly into the manual shift position without resistance, the raking of teeth will be audible and felt through the gear shift lever. This condition does not always mean the synchronizer in worn out. The following may cause this condition:

(a) Quite often, small chips may lodge in the bronze cone temporarily, which prevents proper synchronization and causes raking shifts. Continued operation of the transmission may either imbed the chip below the surface of the bronze or reject it and the synchronizer will return to normal functioning.

(b) Use of improper oils often causes raking of synchronizer. Heavy oil prevents the synchronizer cone from breaking through the oil film and doing the job properly. The above condition usually occurs with cold, heavy oil, but the synchronizer begins to work properly when the transmission oil reaches normal operating temperature. Use recommended lube.

Crash Shifting or Raking of Gears (Synchronized Units) (contd):

(c) The use of E.P. or extreme pressure additives is not required and certainly not desirable in any Dana/Spicer unit power or auxiliary type transmission. Glazing of synchronizer bronze cone due to breakdown of oil is especially common with E.P. additives found in multi-purpose or rear axle type lubricanta.

(d) Broken synchronizer poppet springs sometimes jam under the poppet preventing proper movement of the synchronizer cone, resulting in crash shifts.

(e) Synchronizer bronze worn smooth with loss of clutching action. This is usually caused by poor driver technique, or failure to control engine speed drop-off during upshift, or failure to bring engine speed nearly up to governor speed when down-shifting. causes overwork of synchronizer and failure to shift. Also. drivers who try to shift without using the clutch will bum or wear out manual synchronizers at relatively low mileage.

(f) Blocker pin detents of the synchronizer worn excessively. resulting in loss of blocker action and crash shifting.

(g) Blocker pins loose, broken, or turned over.

Bearing Failures:

The service life of most transmissions either main or auxiliaries is governed by the life of the bearings. Majority of bearing failures can be attributed to vibration and dirt. Some of the more prominent reasons for unit removal with hearing failures are:

(a) Worn out due to dirt
(b) Fatigue of raceways or balls
(c) Wrong type or grade of lubricant
(d) Lack of lubricant
(e) Vibrations -breakup of retainer & brinnelling of races -fretting corrosion.
(f) Bearings tied-up due to chips in bearing
(g) Bearings set-up too tight or too loose
(h) Improper assembly brinnelling bearing.
(j) Improper fit of shafts or bore
(k) Acid etch of hearings due to water in lube
(I) Overloading of vehicle. Overload from engine or engine too large for transmissions used

Dirt:

More than 90% of all ball bearing failures are caused by dirt which is always abrasive.

Dirt may enter the bearings during assemblv of the units or be carried into the bearing by the lubricant while in service. Dirt may enter through seals, breather or even dirty containers used for addition or change of lubricant.

Softer material such as dirt, dust, etc., usually forms abrasive paste or lapping compounds within the bearings themselves since the unit pressure between the balls and raceways makes a perfect pulverizer. The rolling motion tends to entrap and hold the abrasives. As the balls and raceways wear, the bearings become noisy. The lapping action tends to increase rapidly as the fine steel from the balls and rollway adds to the lapping material.

Hard coarse material such as chips, etc., may enter the bearings during assembly from hammers, drifts, power chisels, etc., or be manufactured within the unit during service from raking teeth, etc. These chips produce small indentation in balls and races. Jamming of these hard particles between balls and races may cause the inner race to turn on shaft, or the outer race to turn in the housing.

Fatigue:

All bearings are subject to fatigue and must be replaced eventually. Your own operating experience will dictate mileage replacement of bearings showing only normal wear.

Corrosion:

Water, acid and corrosive materiala formed by deterioration of lubricant, will produce reddish-brown coating and small etched holes over outer and exposed surfaces of race. Corrosive oxides also act as lapping agent.

Brinelling caused by improper assembly or removal - usually hammering with off-center lows. Use drivers, preferably under an arbor, or pullers.

Shaft Fits:

Excessive looseness under load is very objectionable because it produces a creeping or slipping of the inner ring on the rotating shaft. This causes the surface metal of shafts to scrub or wear off.

Bearing fits on rotating shafts are usually specified as tight. W en play or looseness, even .001". exists between the bearing and shaft. there is a very powerful force tending to rotate the inner race on the shaft; this force is caused by the looseness or lost motion between the parts and disappears when no looseness exists.

Removal of Bearings:

It is far more difficult to remove bearings from a shaft than to put them on. In most cases it is necessary to remove the bearing by pulling on the outer-race which can damage the balls or races. Since such damage is seldom visible. it does not become known until after complete reassembly. It is good P.M. to replace most ball bearings during the overhaul period. If a bearing is not going to be replaced, avoid removal during low mileage rebuild.

Interchangeability:

All ball bearings (whether manufactured here or abroad) are interchangeable in repaid to-- standardized dimensions. tolerances and fits. However, for a given shaft size there are standard bearings for light, medium, and heavy-duty service.

Numbers and symbols stamped on inner and outer races of bearings designate size and type.

Numbering systems of different bearing manufacturers, however, have not been standardized. Consult interchangeable tables and use proper bearings for replacement parts.

For further information write to: Spicer Transmission Division
Dana Corporation
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Toledo, Ohio 43696

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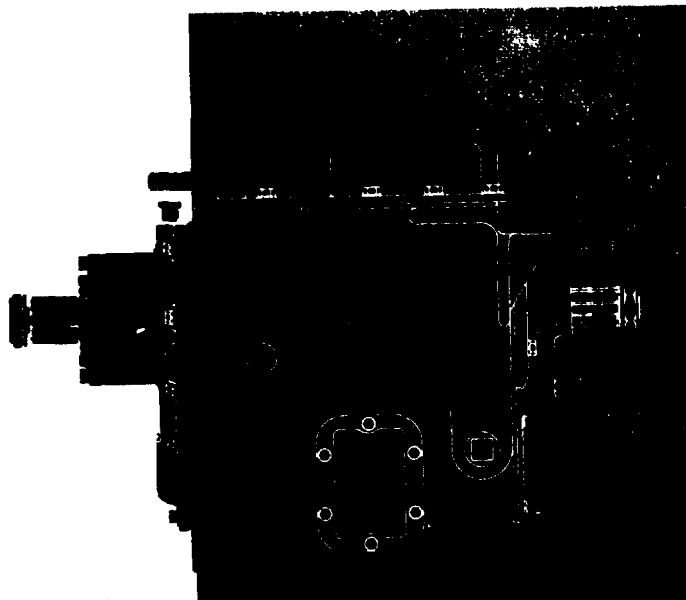

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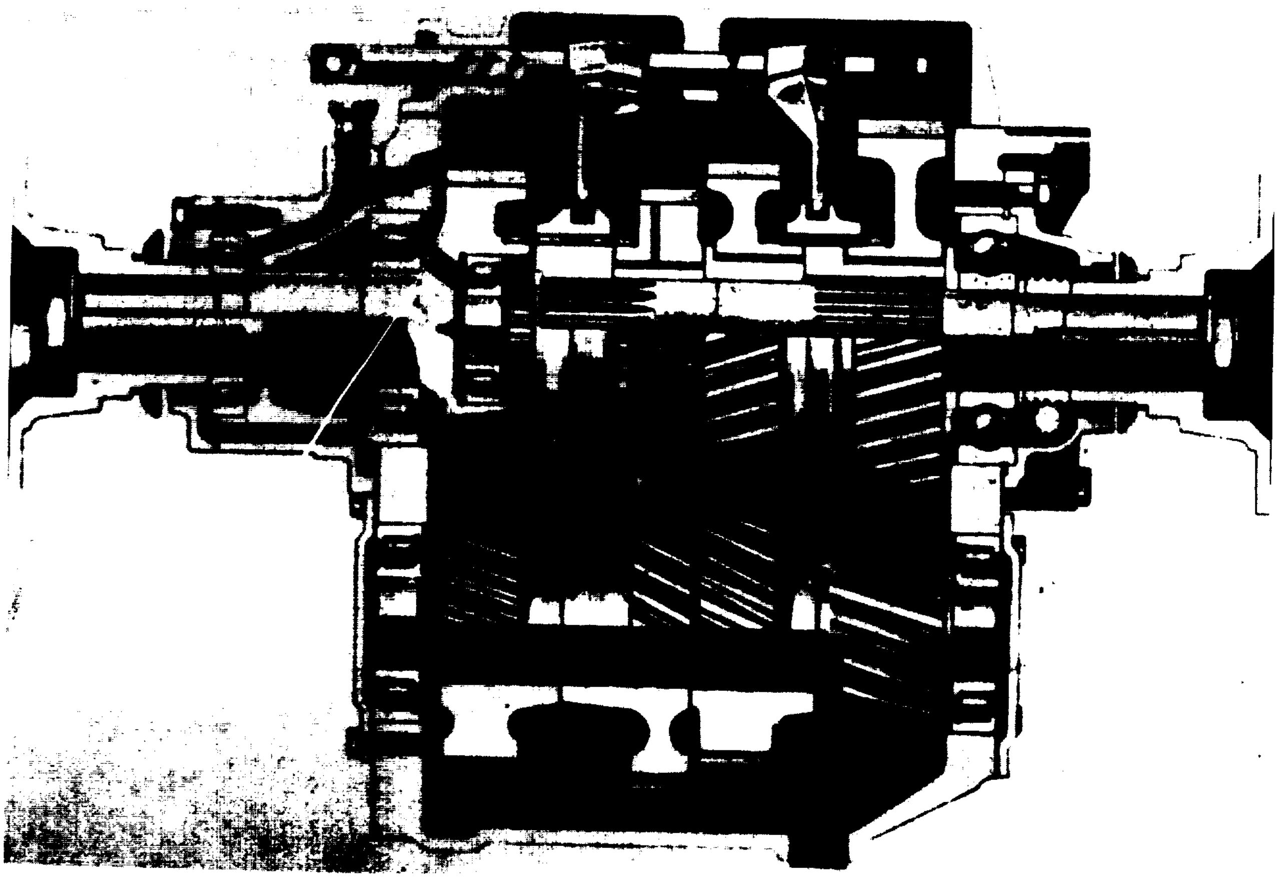
SERVICE MANUAL

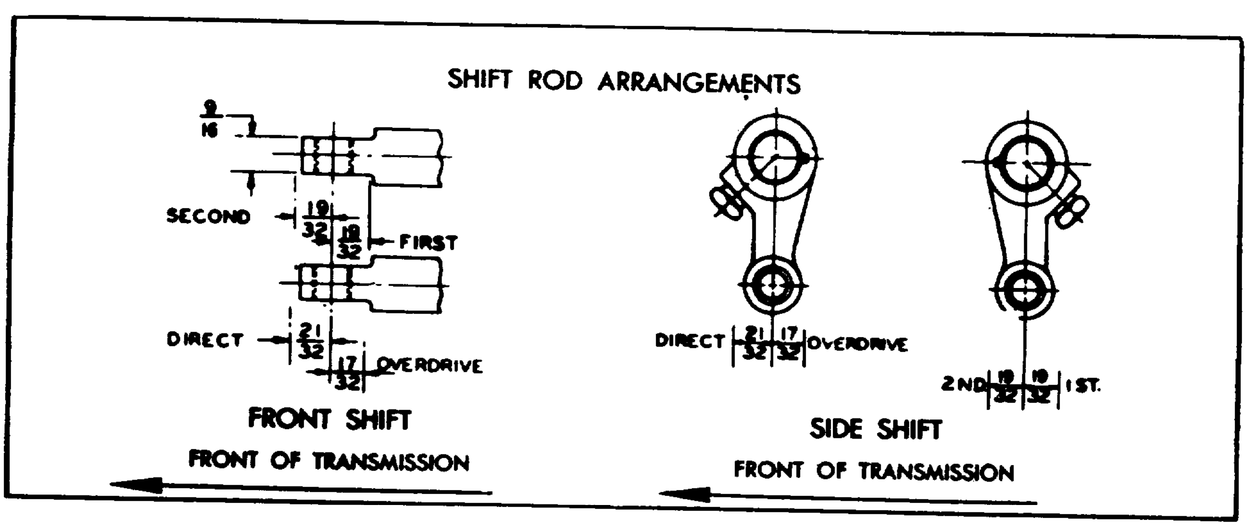
DANA CORPORATION
SPICER TRANSMISSION DIVISION

INTRODUCTION

This maintenance manual covers details of the SPICER R8000 Series 4-Speed Auxiliary Transmissions.

The information is written for the professional service man and therefore excludes much elementary information. Application of this information should result in longer service life with less downtime and reduced maintenance cost.





SPICER TRANSMISSION LUBRICATION

GENERAL INFORMATION

The R8341 auxiliary transmission is designed to utilize splash lubrication for all internal bearings, bushings, shafts and gears.

To insure proper lubrication and operating temperatures in these units it is most important that the proper lubricants be used and that correct oil levels be maintained.

RECOMMENDED LUBRICANTS

TEMPERATURE	S.A.E. SPECIFICATION	TYPE
ABOVE 0° F	S.A.E. 50, 40, 30	HEAVY DUTY ENGINE OIL. API SERVICE CLASSIFICATION MS, DG, DM or DS
BELOW 0° F	S.A.E. 30	HEAVY DUTY ENGINE OIL. API SERVICE CLASSIFICATION MS, DG, DM or DS

Do NOT USE EXTREME PRESSURE ADDITIVES, such as found in multi-purpose or rear axle type lubricants. These additives are not required in Spicer transmissions, and may, in some cases, create transmission problems. Multi-purpose oils, as a group, have relatively poor oxidation stability, a high rate of sludge formation and a greater tendency to react on, or corrode, the steel and bronze parts.

Capacity: 12 pints at 0° installation - capacity will vary with, and is dependent on, angle of installation.

OIL CHANGES

We recommend an initial oil change and flush after the transmission is placed in *actual* service. This change should be made any time following 1000 miles, but never to exceed 4000 *miles,* of over-the-road service. In off-highway use, the change should be made after 24 and before 100 hours of service have elapsed. There are many factors that influence the following oil change periods and we have not specified a definite mileage interval.

In general, it is suggested that a drain and flush period be scheduled every 20,000 miles for normal over-the-highway operations. Off-the-highway usually requires oil change every 30 days: The oil level in the transmission should be checked every 2,000 miles on-highway, or every 24 hours, in off-highway operation. The correct oil level in *all* Spicer transmissions is established by the filler plug opening.

REFILL - First, remove all dirt around the filler plug. Then refill with new oil of a grade recommended for the existing season and prevailing service. Fill to the bottom of the level testing plug positioned on the side of the transmission.

OVERFILLING

Do not overfill the transmission . Overfilling usually results in oil breakdown due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil will result in heavy varnish and sludge deposits that plug up oil ports and build up on splines and bearings. Overfiow of oil usually escapes onto parking brakes, causing additional trouble.

SHIFTER HOUSING-FRONT CONTROL

FRONT AND SIDE CONTROLS

Two shifter housings are used with the R8341/ R8345 auxiliary transmissions. Accordinly, the maintenance instructions have been divided into the front control as illustrated on Page 5 and the side control as illustrated on Page 7.

DISASSEMBLY:

FRONT CONTROL

1. Shift auxiliary into neutral. Remove retaining cap screws (K-2) and lock washers (K-5). Separate cover (R-2) from case (G-1) and gasket (K-1) and lift straight up.

2. Remove plug (R-7) from poppet ball hole and tip shifter housing to remove poppet spring (R-6), poppet plunger (R-5) and poppet ball (R-4) from housing

3. Place shifter housing in a vise so that shift fork are facing out and en of shift rode (R-11 and R-8) are pointing to the right.

4. Remove screw (R-14) from shift fork (R-12) and use brass drill to tap shift rod free of lo-lo and underdrive shift fork (R-12) and out of housing.

5. Remove screw (R-14) from direct and overdrive shift fork (R-9). Use brass drift to tap shift rod forward and free of fork. Use *caution* as shift rod is pulled free of front boss to prevent loss of interlock (R-10) and poppet ball (R-4). Use magnet or tip shifter housing over to remove poppet plunger (R-5) and spring (R-6) from cross bore in front boss of shifter housing.

6. If shift rod oil seals (R-3) are to be replaced then remove from housing at this time. Remove old gaskets from sealing surface and clean housing for inspection prior to reassembly.

7. Clean and inspect all shifter housing parts for wear or damage before reassembly.

ASSEMBLY

FRONT CONTROL:

1. To reassemble shifter housing it may be placed on edge in a vise with inside of housing facing out and shift rod seal openings to the right. Or, if desired, housing may be placed upside down on a bench.

2. Check fit of shift rods (R-8 and R-11) in shift forks (R-9 and R-12) as well as in their proper position in housing to make sure the parts assemble properly and slide freely. Remove shift rods and apply a light coat of grease to all bores in housing and to the rods as they are assembled in the housing.

3. If shift rod oil seals (R-3) were removed, use a light coat of cement on O.D. of seals and use 1½" tubing or proper tools to press seals into housing.

4. Assemble shift rod poppet spring (R-6), poppet plunger (R-5) and poppet ball (R -4) into lower end of interlock and poppet cross hole in front boss of shifter housing. Use poppet assembly tool to preload poppet, ball and spring during assembly of shift rod.

5. Select the shortest shift rod (direct and overdrive speed shift rod R-8) and enter it through the lower seal (R-3) and into bore of housing. Position shift rod so that three poppet notches are down and will align with poppet ball.

6. Tap shift rod (R-8) through first boss to dislodge poppet assembly tool. Slide shift rod through bore and with long hub of shift fork to the left (or toward the rear) assemble direct and overdrive shift fork (R-9) to rod.

7. Locate shift fork (R-9) in its proper position and secure to shift rod with clamp screws (R-14). Torque screw to 40 - 50 lbs. ft.

8. Locate direct and overdrive shift rod in its neutral position and drop interlock (R-10) into interlock and poppet cross hole of front boss. Make sure interlock seats in neutral notch of shift rod (R-8).

9. Select longest shift rod (lo-lo and underdrive rod R-11) and enter through upper seal (R-3) and through front boss of shifter housing. Position shift rod so that three poppet notches are up.

10. Slide shift rod into housing. With long hub of shift fork to the left, assemble lo-lo and underdrive shift fork (R-12) to rod.

11. Pass shift rod through rear boss and locate shift fork in its proper position on rod. Secure fork rod with screw (R-14) torqued to 40 - 50 lbs. ft.

12. Assemble poppet ball (R-4), pop t plunger (R-5) and poppet spring (R-6) through threaded hole on to outside of shifter housing. Secure with poppet hole plug (R-7).

13. Use large screwdriver and move lo-lo and underdrive shift fork out of neutral position. If interlocks are in place and operative then direct and overdrive shift fork (R-9) will be locked in the neutral position.

14. Return lo-lo and underdrive rod to neutral. Check shifting of both rods in and out of neutral to make sure they travel freely and completely into all shift positions. Shift rod back into neutral position.

SHIFTER HOUSING - FRONT CONTROL

NOTE

Poppet spring (R-6) used in this control is not the same as spring (R-66) used in side control.

Spring (R-6) is Spicer Part 71-72-1 Spec's. 38#. Plus or Minus 2 lbs. at 1.00 inch—free length 1-7/32".

Spring (R-66) is Spicer Part 82-72-2 Spec's. 38# Plus or Minus 2 lbs. at 1-13/64 inch—free length 1-31/64".

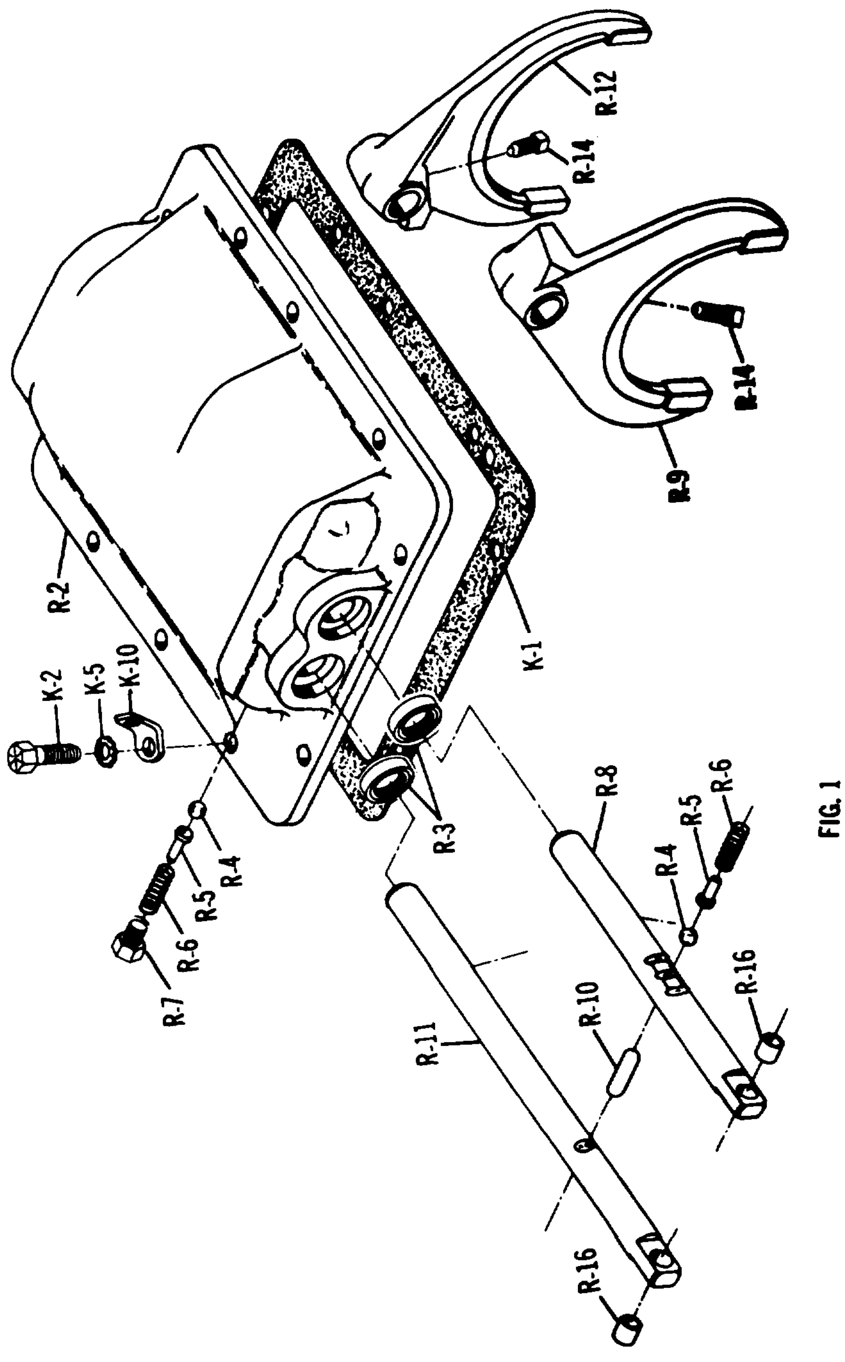


FIG. 1

CAUTION

Do not tow vehicles equipped with Spicer transmissions at high speeds or for long distances without first pulling the axles or disconnecting the drive shaft. Lubrication of the internal gear train is inadequate when the vehicle is towed.

SHIFTER HOUSING-SIDE CONTROL

DISASSEMBLY

SIDE CONTROL:

1. Remove the eight retaining cap screws (K-2) and lock washers (K-5). Separate the shifter housing (R-52) from the case and gasket (K-1) and lift assembly straight up.

2. Remove poppet ball hole plug (R-67) and tip shifter housing to remove poppet spring (R-66) poppet plunger (R-66) and poppet ball (R-64) from right side.

3. Place shifter housing in a vise so that shift forks are facing out and the welch plugs (R-68) or front of housing is to the left.

Important: In disassembly of this housing, be sure to note the positioning of the parts as they are removed. Due to their similarity, rods, forks and shift fingers can be easily switched with a counterpart and the unit will not install on the case.

4. Cut and remove the lock wire from the set screws (R-61) in shift forks (R-70 and R-73), cross shift rod inner fingers (R-67) and outer shift levers (R-9)

5. Use brass drift to drive lower shift rod (R-72) forward to dislodge welch plug (R-68). Remove set screws (R-61) from fork (R-73) and remove lo-lo and underdrive shift rod (R-72) from fork and shifter housing. CAUTION: Interlock (R-71) will drop out as shift rod pulls free of front boss.

6. In a similar manner, remove direct and overdrive shift rod (R-69) from shift fork (R-70). Use CAUTION as rod pulls free of front boss to prevent loss of poppet ball (R-64) plunger (R-65) and spring (R-66).

7. Remove set screws (R-61) from *outer* shift levers (R-59) and remove levers from cross shift rod (R-56 and R-58). Remove Woodruff keys (R-60) from shift rods.

8. Remove set screws (R-61) from *inner* shift fingers (R-57). Support under inner shift rod fingers (R-67) and tap end of cross shift rods (R-56 and R-58) until Woodruff keys (R-60) are clear of finger bores.

9. Remove Woodruff keys (R-60) from cross shift rods (R-56 and R-58).

Important: Remove all nicks and burrs from Woodruff keyways before attempting to remove cross shift rods (R-56 and R-58) through bearing bores and seals (R-55) of shifter housing.

10. Remove inner shift fingers (R-57) as cross shift rods pull free.

11. If oil seals (R-55) are to be replaced, remove at this time.

12. Clean and inspect all parts for wear or damage before reassembly.

ASSEMBLY

SIDE CONTROL:

1. If cross shift rod oil seals (R-55) were removed, use proper tool to press seals into shifter housing (R-52) prior to reassembly.

2. Check fit of shift forks (R-70 and R-73) to shift rods (R-69 and R-72) and fit of inner shift fingers (R-57) and outer shift levers (R-59) to cross shift rods (R-56 and R-58) to make sure they assemble freely.

3. To reassemble shifter housing (R-52) it may be placed on edge in vine with inside of housing facing out and welch plug opening to the *right.* Or, housing may be placed upside on bench,

4. Install all shift rode (R-56, 58, 69 and 72) in their correct positions and check to make sure they assemble properly and slide freely. Remove rode and apply a light coat of grease to all shift rod bores in the housing and to the rods as they are assembled in the following steps:

NOTE

Cross shift rods (R-56 and R-58) are identical but not symmetrical. Be sure to insert them in opposite end direction, so the middle Woodruff keyways and set screw counterpoint will be on the right and left of center to secure the inner shift fingers (R-57) on the respective sides of the shifter housing. (See Fig. 2.)

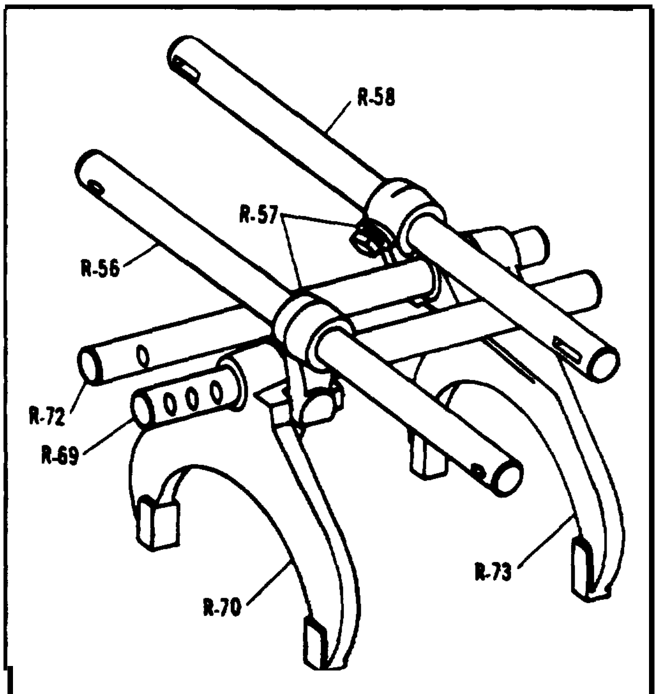
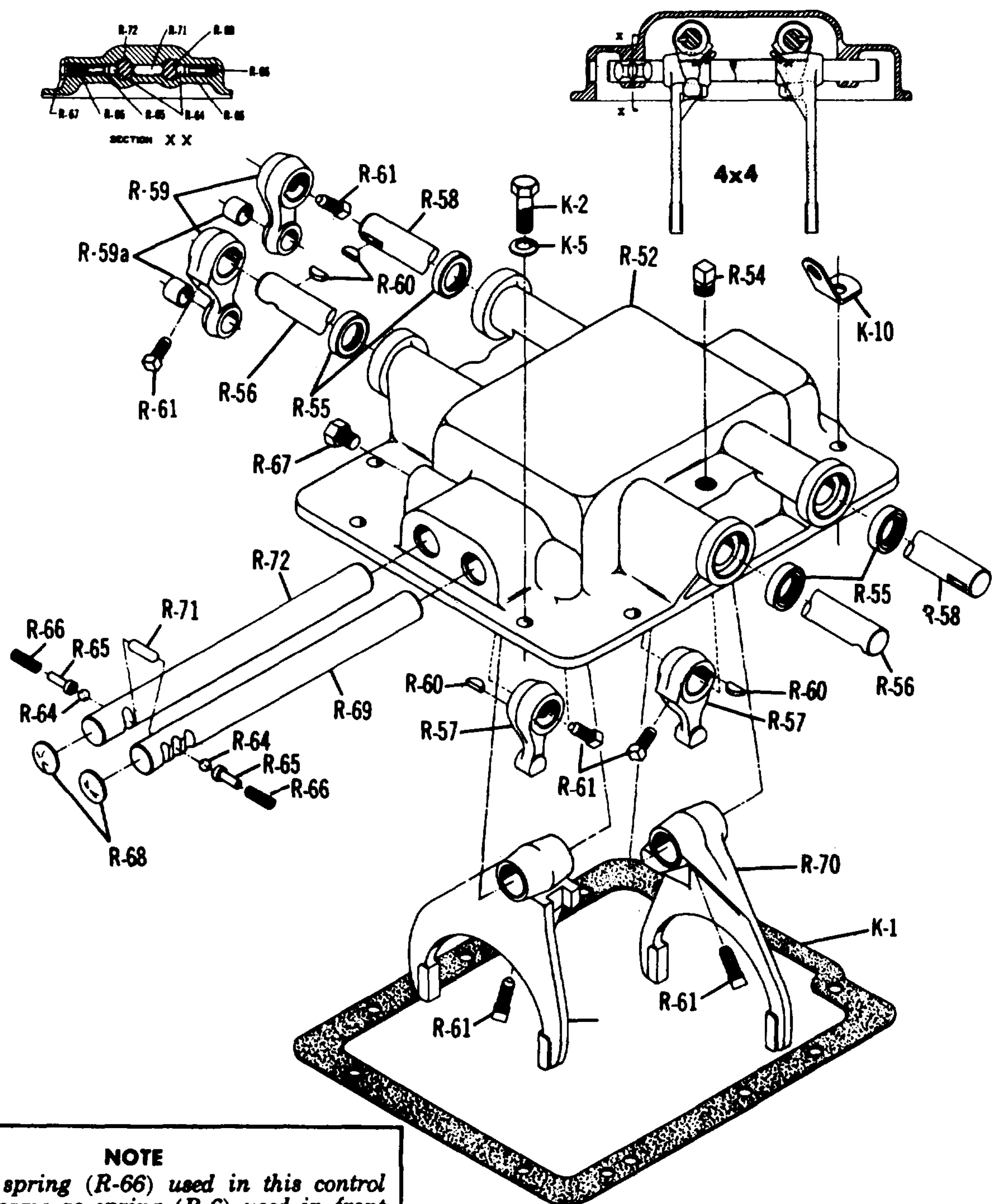


FIG. 2

SHIFTER HOUSING - SIDE CONTROL



NOTE

Poppet spring (R-66) used in this control is not the same as spring (R-6) used in front control.

Spring (R-66) is Spicer Part 82-72-2 Spec's. 38#. Plus or Minus 2 lbs. at 1-13/64 inch—free length 1-31/64".

Spring (R-6) is Spicer Part 71-72-1 Spec's. 38#. Plus or Minus 2 lbs. at 1.00 inch—free length 1-7/32".

FIG. 3

SHIFTER HOUSING - SIDE CONTROL

5. If housing is held in vise, enter the lo-lo and underdrive cross shift rod (R-58) through seal (R-55) and boss at the upper left of shifter housing. Assemble inner shift finger (R-57) to shift rod (R-58) so that set screw hole is toward the center of shifter housing. Pass cross shift rod through finger and out lower boss and seal of shifter housing.

6. Assemble Woodruff key (R-60) to cross shift rod and tap inner shift finger (R-57) over key (R-60). Locate finger in its proper position on rod and secure with set screw (R-61). Torque to 40 - 50 lbs. ft.

7. Enter the direct and overdrive cross shift rod (R-56) through seal (R-55) and boss at the upper right of shifter housing. Assemble inner shift finger (R-57) to shift rod (R-56) so that set screw hole is toward the center of shifter housing. Pass cross shift rod through finger and out lower boss and seal of shifter housing.

8. Assemble Woodruff key (R-60) to cross shift rod and tap inner shift finger (R-57) over key (R-60). Locate finger in its proper position on rod and secure with set screw (R-61). Torque to 40 - 50 lbs. ft.

9. Assemble shift rod poppet spring (R-66), plunger (R-65) and ball (R-64) through interlock crosshole opening to lower pocket of shifter housing. Preload poppet ball and spring.

10. Select the direct and overdrive shift rod (R-69) and enter the long smooth end into bottom welch plug opening at right of shifter housing. Tap shift rod through front boss to dislodge pet tool and assemble direct and overdrive shift or fork (R-70) to rod with shift notch down and engaging inner shift finger (R-57).

NOTE

When assembling shift forks, (R-70) has the thickest pads. Accidental interchange of these forks will not allow the assembled shifter housing to remount on the case as the shift collar for the other fork (R-73) is too narrow for the thick pads.

11. Pass shift rod (R-69) through fork and into rear boss of shifter housing. Locate shift fork (R-70) in its proper position on shift rod and secure with set screw (R-61). Torque to 40 - 50 lbs. ft., then lockwire.

12. Position direct and overdrive shift rod in neutral. Apply a light coat of grease to shift rod interlock (R-71) and drop into interlock crosshole. Make sure interlock seats in neutral (or center) notch of shift rod (R-69).

13. Select the lo-lo and underdrive shift rod (R-72) and enter long smooth end into upper welch plug opening at right of shifter housing. Pass shift rod through front boss and assemble shift fork (R-73) to rod near rear bore of housing. Long hub of fork assembles toward front of housing (or to the right) with the shift notch up and engages inner shift finger (R-57).

14. Locate shift fork (R-73) in its proper position on shift rod and secure with set screw (R-61). Torque to 40 - 50 lbs. ft.

15. Position lo-lo and underdrive shift rod in neutral and assemble shift rod poppet ball (R-64), plunger (R-65) and spring (R-66) to poppet and interlock crosshole. Compress spring with poppet ball hole plug (R-67).

16. Use large screwdriver to move either shift rod out of the neutral position. If interlock is functioning, other rod will be locked in neutral.

17. Return shift rod to neutral and check movement of shift rods to make sure they move easily and completely into each gear position.

18. Use light coat of cement and assemble the two welch plugs (R-68) to openings at front of shifter housing. Expand plugs to lock in place.

19. Assemble Woodruff keys (R-60) to proper end of both cross shift rods (R-56 and R-58) and assemble outer shift rod levers (R-59) over keys.

20. Secure levers with set screws (R-61). Torque to 40 - 50 lbs. ft.. then lockwire.

INSTALLATION Of SHIFTER HOUSING ON CASE:

1. Use light coat of cement and assemble shift cover gasket (K-1) to auxiliary case.

2. Place both clutch gear collars in neutral position.

3. Check to determine that shifter housing is in neutral and set shift housing assembly down into position on case. Make sure both shift forks are in their proper place on corresponding shift collars.

4. Secure shifter housing to main case with cap screws (K-2), lock washers (K-5).

5. Use large screwdriver or small pry bar and check movement of each shift rod to make sure auxiliary will shift readily and completely into each gear position.

GEARS AND CASE

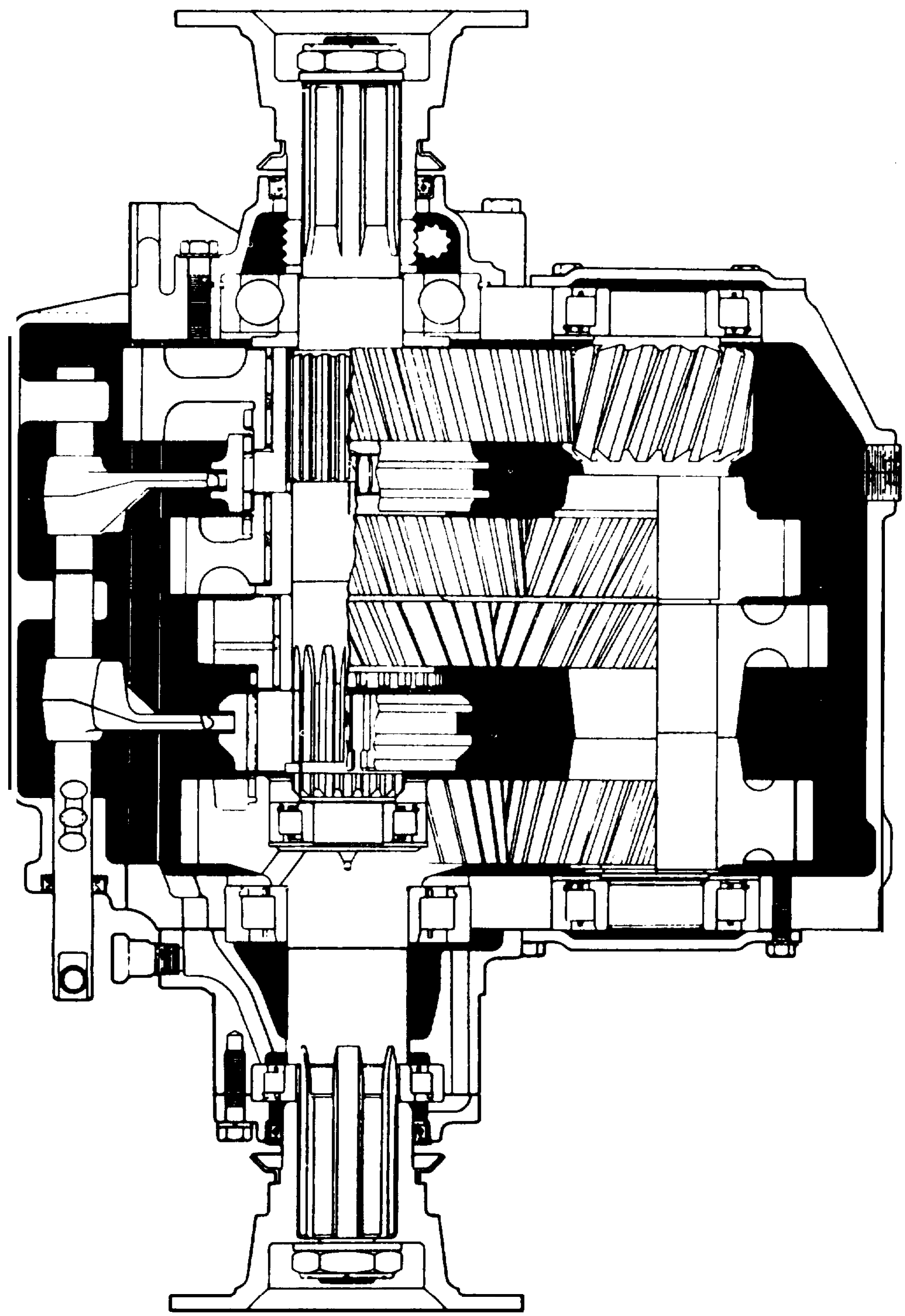


FIG. 4

GEARS AND CASE

GENERAL INFORMATION:

The R8000 series four-speed auxiliary is available with a number of different ratios which are identified by letters following the model number, i.e., R8341-C, D, E, F, G.

Assembly and disassembly procedure for models using a deep lo-lo of 2.40 to 1 and those for models using the "splitter type" lo-lo of 1.60 to 1 are different.

Accordingly, the countershaft procedures have been divided into two sections, one designated 2.40 RATIO, the other 1.60 RATIO.

Removal and installation of the mainshaft will be the same for all models and is covered in one section only.

MAINSHAFT REMOVAL & DISASSEMBLY:

1. Lock auxiliary transmission in two gears by engaging lo-lo and underdrive clutch collar (B-16) with lo-lo mainshaft gear (B-18) and direct and overdrive clutch collar (B-6) with overdrive gear (B-7).

2. Pull cotter pins (if used) and use 2 1/8 " socket to remove drive gear and mainshaft companion flange or end yoke nuts (A-5 and B-28) and flat washers (A-4 and B-27).

3. Use puller or equivalent and remove main drive gear and mainshaft rear companion flanges or end yokes (A-2 and B-25).

4. Remove front transmission hanger (if used) from drive gear bearing cap.

5. Remove cap screws (F-4), lock washers (F-6) and separate front bearing cap (F-1) from main drive gear bearing cap (F-7). Remove bearing cap gasket (F-3). Remove front bearing cap oil seal (F-2).

6. Remove cap screws (F-9), lock washer (F-10) from drive gear bearing cap (F-7). Use puller screws on drive gear bearing cap until cap is separated from case and bearing (A-7) is off shaft.

7. After drive gear bearing cap (F-7) has been removed, tap cylindrical roller bearing (A-7) free of bearing cap by tapping on outer race of bearing from inside of bearing cap. Note the inner race flange is positioned toward outside.

8. Remove retaining cap screws (H-5 and J-3) with washers (H-7 and J-4) from mainshaft and countershaft rear bearing caps (H-1 and J-1). Separate bearing caps from gasket and case. Check and remove speedometer bushing (H-2) if it is to he replaced in cap (H-l).

9. Remove speedometer drive gear (or spacer if used) (B-24) and bearing thrust washer (B-23) from rear of mainshaft.

10. Place a ½" thick, soft block (aluminum or brass) between main drive gear (A-1) and mainshaft direct and overdrive clutch gear (B-5).

11. Tap mainshaft forward to start rear bearing off mainshaft and expose retaining lock ring (B-2) by using tubular driver against splined at shoulder at rear of shaft.

CAUTION

Do not drive against threaded section at end of shaft.

12. Remove ½" blocks from clutch gear (B-5) and main drive gear (A-1) and remove retaining lock ring (B-2) if tight in groove of mainshaft. Continue to tap shaft forward until mainshaft clutch gear (B-5) bottoms against drive gear (A-1).

13. Use two pry bars to elide mainshaft and gear assembly (B-1 through B-22) toward rear of case as far as possible. This should slide mainshaft rear bearing (B-22) out of case far enough to use a puller that clamps on the snap ring of the bearing. Remove rear bearing (B-22).

14. Remove mainshaft low-speed gear thrust washer (B-21).

CAUTION

Early production units of these models of auxiliary transmissions were produced with the old style loose needle bearings in bores of gears. If unit is so equipped, some of the needle roller bearings used with the various gears may fail out as the mainshaft moves rearward. Use care to prevent the loss of these needles if they are to be used again. In later units intergal caged needle bearings were used in the gear bores. This type bearing will usually stay in the gear bore when the mainshaft is moved rearward.

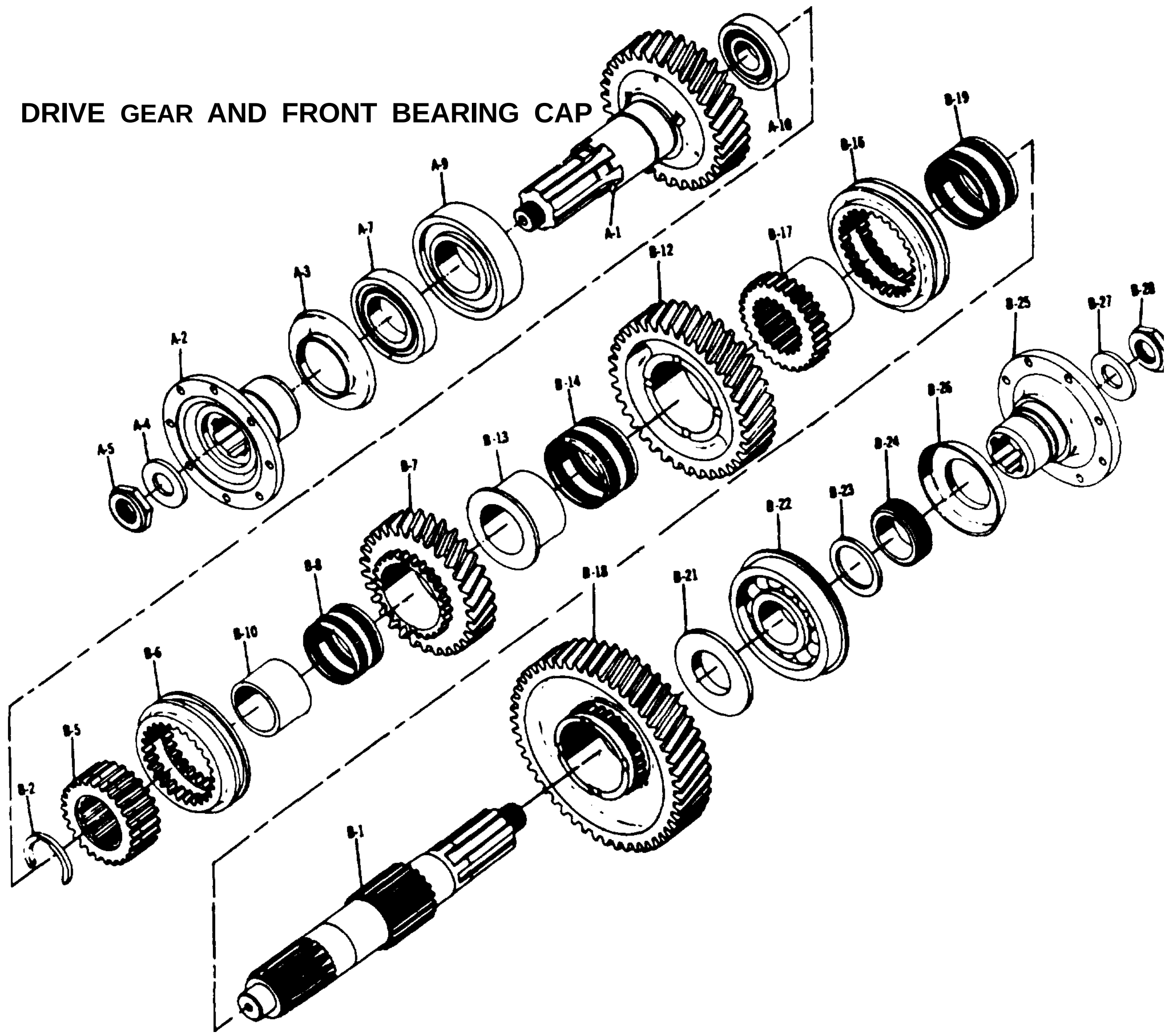
15. Pull mainshaft out through rear bearing bore lifting the following parts from the shaft and out the top opening of case as the shaft pulls free.

(a) Direct and overdrive clutch gear (B-5) and collar (B-6).

(b) Overdrive gear (B-7) with sleeve (B-10), needle hearings (B-8) and bearing spacer (B-9) if used.

(c) Underdrive gear (B-12), with sleeve (B-13), needle bearings (B-14) and bearing spacer (B-15) if used.

(d) Lo-lo and underdrive clutch collar (B-16).



MAINSHAFT AND REAR BEARING CAP

FIG. 5

(e) Lo-lo gear (B-18) with clutch gear (B-17) needle bearings (B-19) and bearing spacer (B-20) if used.

16. Slide drive gear (A-1) and inner race of drive gear roller bearing (A-9) rearward and lift out through top opening of case. Remove inner race of bearing (A-9).

NOTE

Drive gear roller bearing (A-9) is made of two pieces The inner race will stay on drive gear (A-1) and the outer race and roller assembly will remain in case bore.

17. Use soft hammer and tap outer race-of drive gear roller bearing (A-9) out of front bearing bore of case.

18. Remove pocket bearing (A-10) from drive gear (A-1).

19. Clean and inspect all parts for wear or damage before reassembly.

GEARS AND CASE

COUNTERSHAFT REMOVAL & DISASSEMBLY

2.40 RATIOS ONLY:

1. With pry bar on front face of gear (C-6), drive countershaft assembly rearward out of front bearing (C-2) which the outer race will remain in of case bore. Rear bearing (C-14) will be pushed out of case.

2. Remove outer race of rear bearing (C-14).

3. Lift countershaft assembly out of case.

4. Remove front bearing outer race (C-2) by tapping out with soft hammer from inside case.

> **NOTE**
>
> *Press countershaft out of gears (one at a time) by supporting each gear with parallel bars as close to hub as possible.*

5. Remove snap ring (C-3) at face of gear (C-6).

6. In succession, press off countershaft drive gear (C-6), 4th speed (overdrive) gear (C-8) and 2nd speed (underdrive) gear (C-12). Inner race of bearing (C-2) will come off the shaft as gear (C-6) is pressed off shaft.

7. Woodruff keys (C-7, 9 and 11) need not be removed unless worn or loose.

> **NOTE**
>
> *Lo-lo gear is intergral with shaft (C-1) and cannot be separated.*

REASSEMBLY COUNTERSHAFT:

All countershaft gears should fit tight on the countershaft. As a shrink (or interference) fit of .0015" to .003" is built into new parts, it presents a field assembly problem.

If heat is used to expand gear bores, boiling water, hot oil or steam are usually satisfactory. DO NOT EXCEED 250° F. Do *not* use hot plates, acetylene torches or other methods that will turn the steel blue or straw color and damage the heat-treated gears.

If heat is not used, it is advisable to coat the gear bores heavily with white lead to prevent galling or seizing of parts.

When in doubt about which end of the gear hub to assemble on the shaft first look for the chamfered end in the bore. This end assemble first.

If Woodruff keys or keyways are mutilated or burred during disassembly, dress up with file before reassembling to prevent metal chips from getting between gear hub faces.

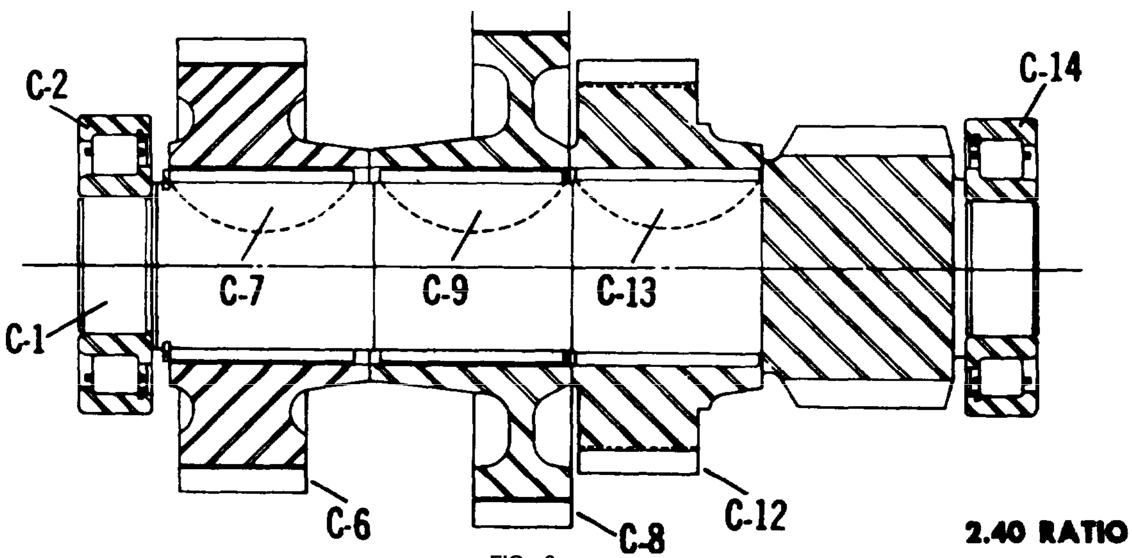


FIG. 6

IMPORTANT CHANGE

Page 13-NOTE: The instructions in the note on Page 13 to provide .020 clearance outside of the case bore for bearings is **correct.** Instructions under installation of the countershaft which instruct you to tap the bearing **flush** to the case bore are **incorrect.** Disregard the instructions in steps 2 and 5 in the second column.

This correction also applies to the installation instructions on Page 15 in steps 1 and 7 in the second column.

GEARS AND CASE

1. Assemble Woodruff keys (C-7, 9 and 11) to countershaft (C-1). Seat securely and dress with file if necessary.

2. In a suitable arbor press, support hub of 2nd speed (underdrive) gear (C-12) with long hub and chamfer up. Place countershaft (C-1) into position, align key with keyway and press into gear until shoulder on shaft seats firmly against gear.

3. Again, in arbor press, support hub of 4th speed (overdrive) gear (C-8) with long hub down and chamfer up. Place countershaft into position, align key with keyway and press shaft into gear (C-8) until seated firmly against gear (C-12).

4. In a similar manner, support hub of countershaft drive gear (C-6) with long hub and chamfer Press countershaft into gear (C-6) until seated firmly against gear (C-8). Assemble snap ring (C-3) on shaft groove.

NOTE

To facilitate installation and removal of countershaft sub-assemblies, a two-piece (or separable) roller bearings (C-2) (C-14) are now being used at the front and rear of all production auxiliary transmissions. It is recommended that this two-piece bearings be used as a replacement part regardless of original equipment. Do not use old type bearing 550806 on front of counter-shaft in this unit. To prevent auxiliary counter-shaft bearing preload at assembly, front and rear bearing outer rings must protrude .020 outside of case bore before bearing caps **are** *assembled and secured.*

5. Press inner race of bearings (C-2) (C-14) on front and rear of countershaft with lip or flange seated firmly against shoulder of 1st speed (lo-lo) gear, also shaft front face.

INSTALLATION COUNTERSHAFT

2.40 RATIOS ONLY:

1. Lower rear end of countershaft sub-assembly into case with end of shaft and lo-lo gear through rear bearing bore. Lower front of countershaft into its approximate position and maintain alignment with a cable support or by blocking up drive gear (C-6).

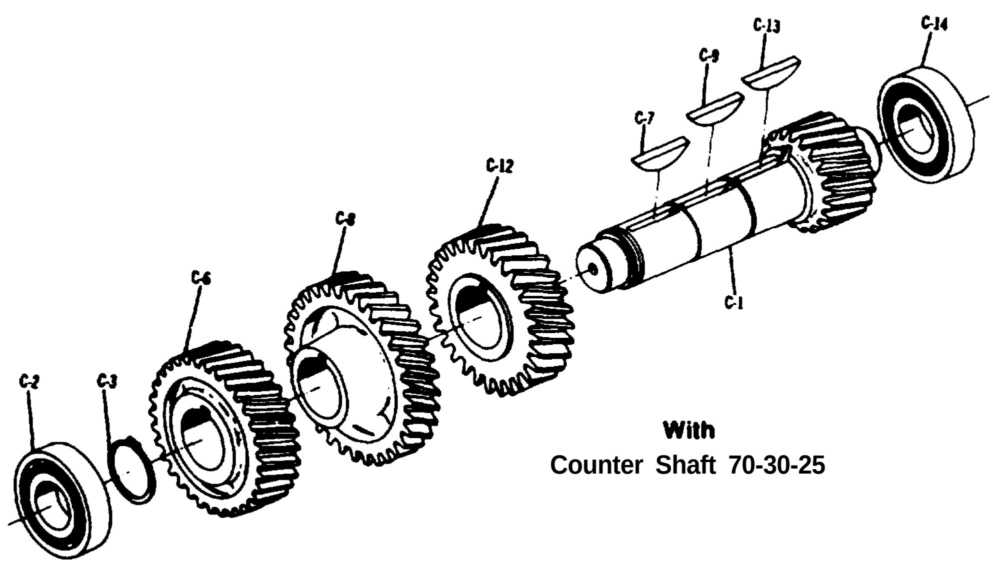
2. Align outer race assembly of rear bearing (C-14) with inner race and rear bore and tap flush with case.

3. Use light coat of gasket cement and assemble countershaft rear bearing cap gasket (J-2) to bearing cap (J-l). Apply cement to other side of gasket and assemble cap and gasket to case.

4. Dip retaining cap screws (J-3) in cement and assemble to case with lock washers (J-4). Torque to 25 - 32 lbs. ft.

5. Position front bearing outer race (C-2) on countershaft inner race. Tap outer race into position.

6. Apply gasket cement to gasket (F-21) assemble cap and gasket to case, assemble cap screws (F-22) with lockwashers (F-23). Torque to 25 - 32 lbs. ft.



With
Counter Shaft 70-30-25

FIG. 7

GEARS AND CASE

COUNTERSHAFT REMOVAL & DISASSEMBLY

1.60 RATIOS ONLY:

> **NOTE**
>
> *To facilitate installation and removal of countershaft sub-assemblies a two-piece (or separable) roller bearings (C-2) (C-14) are now being used at the front and rear of all production transmissions. It is recommended that two-piece bearings be used as a replacement part regardless of original equipment. Do not use old type bearing 550806 on front end of countershaft in this unit.*

1. Remove rear snap ring (C-3) from face of gear (C-6) and out of shaft groove. Slide snap ring rearward on shaft. Force gear (C-6) rearward. Force counter&aft forward to remove outer race of bearing (C-2).

2. With rear of counter&aft free of bearing outer race, lift rear end first and remove remaining assembly out top of case.

3. Remove forward snap ring (C-3) from shaft groove. Slide drive gear (C-6) forward off countershaft splines. After removing inner race of bearing (C-2) from shaft.

> **NOTE**
>
> *Press countershaft out of gears (one at a time) by supporting each gear with parallel bars as close to hub as possible.*

4. Remove snap ring (C-3) on face of gear (C-3). In succession, press off countershaft 4th speed (overdrive) gear (C-8) and 2nd speed (underdrive) gear (C-12).

> **NOTE**
>
> *Woodruff keys (C-9 and C-13) need not be removed unless worn or loose. 1st speed gear is integral with shaft (C-l) and cannot be separated.*

5. Use suitable puller to remove remainder of rear bearing (C-14) inner race from shaft.

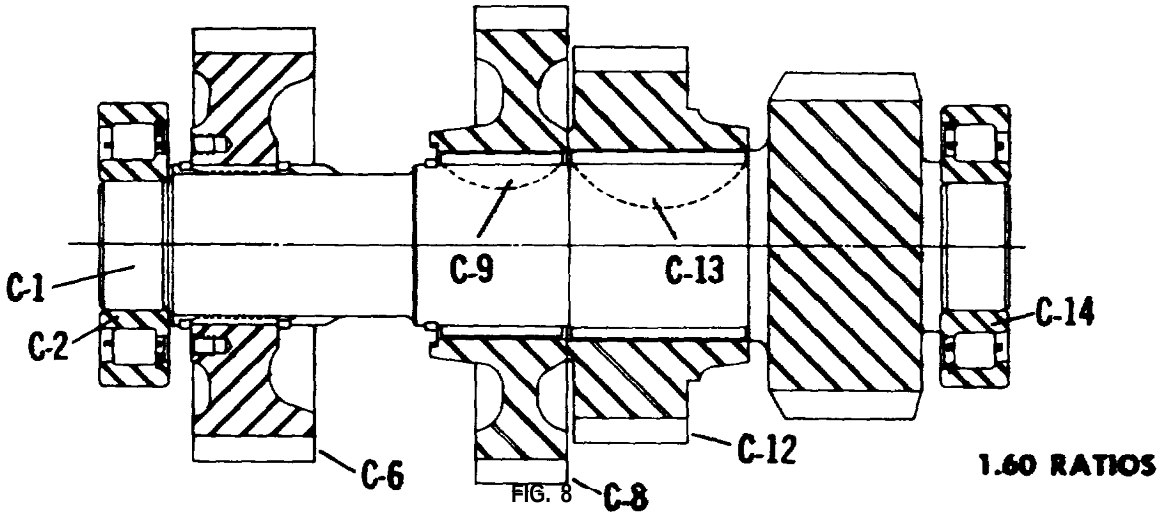


FIG. 8

GEARS AND CASE

ASSEMBLY COUNTERSHAFT

1.60 RATIOS ONLY:

1. Assemble Woodruff keys (C-9 and C-13) to countershaft (C-1). Seat key securely and dress with file if necessary.

2. Using a suitable arbor press, support hub of 2nd speed (underdrive) gear (C-12) with long hub and chamfer up, place counter-shaft (C-1) into position, align key with keyway and press shaft into gear, until shoulder on countershaft seats firmly against gear.

3. Again, in arbor press, support hub of 4th speed (overdrive) gear (C-8), with long hub down and chamfer up, place countershaft into position, align key with keyway and press shaft into gear (C-8) until seated firmly against gear (C-12). Install snap ring (C-3) in shaft groove securely.

4. Press inner race of rear bearing (C-14) on rear of countershaft with lip or flange seated firmly against shoulder of 1st speed (lo-lo) gear.

5. Assemble rear snap ring (C-3) on shaft. Assemble splined drive gear (C-6) to front of countershaft and gear sub-assembly with the flush hub of drive gear toward the front of countershaft. Slide gear to the rear until it butts against rear snap ring (C-3). Force gear and snap ring close as possible to 4th speed gear (C-8). Assemble front snap ring (C-3) in shaft groove. Assemble inner race of hearing (C-2) on-shaft.

INSTALLATION COUNTERSHAFT

1.60 RATIOS ONLY:

1. Assemble outer race, rollers and cage of rear bearing (C-14) to rear bearing bore of case. Tap outer race in flush with face of case.

2. Use light coat of gasket cement and assemble countershaft rear bearing cap gasket (J-2) to bearing cap (J-l). Apply gasket cement to other side of gasket and assemble cap and gasket to case.

3. Dip cap screws (J-3) in sealer and assemble to case with lock washers (J-4). Torque to 25 - 32 lbs. ft.

4. Lower front of counter-shaft assembly into case with front end through front case bore. Lower rear of countershaft into its approximate position and move toward rear until inner race on shaft is inserted in rollers of rear bearing.

5. Use a cable and chain hoist to support countershaft in its correct position. Block countershaft from moving while tapping drive gear (C-6) forward on splines until stopped by front snap ring (C-3).

6. Assemble rear snap ring (C-3) in groove securely.

7. Position front bearing outer race (C-2) on countershaft and tap into position. Use light coat of gasket cement and assemble front bearing cap and gasket.

8. Dip cap screws (F-22) in sealer and assemble in case with lockwashers (F-23). Torque 25-32 lbs. ft.

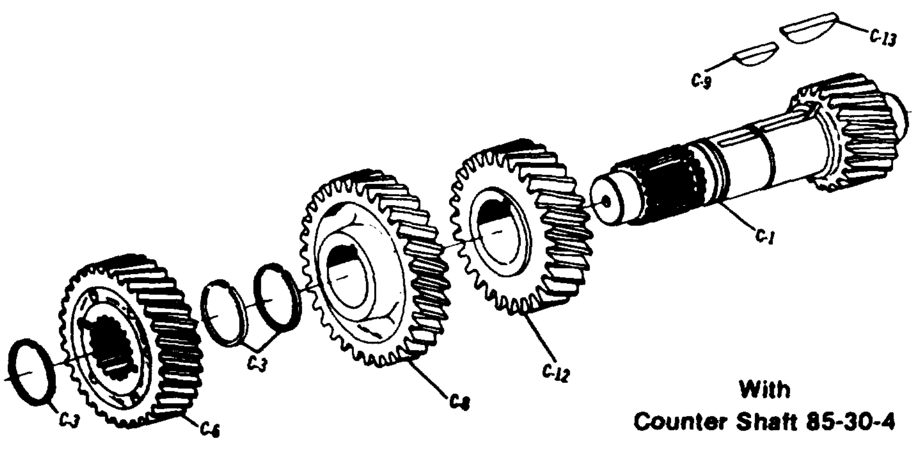


FIG. 9

GEARS AND CASE

> **CAUTION**
>
> *Early production units of these models of auxiliary transmissions were produced with the old style loose needle bearings in bores of gears. If unit is so equipped, some of the needle roller bearings used with the various gears may fall out as the mainshaft moves rearward. Use care to prevent the loss of these needles if they are to be used again. In later units, integral caged needle bearings were used in the gear bores. This type bearing will usually stay in the gear bore when the mainshaft is moved rearward.*

A. Needle roller hearings are used to carry the overdrive, underdrive and lo-lo ears (B-7, B-12 & B-18) on the mainshaft of the R8000 Series auxiliaries.

B. The individual gears, with sleeve and needle roller bearing sub-assemblies must be positioned in the case and the mainshaft assembled through the rear bearing retainer bore.

C. Due to variations in tolerances and to provide better bearing lubrication, Dana engineers recommend that needle bearings should not completely encircle the shaft. Space for approximately one needle should be left unfilled on all Dana/Spicer needle bearing applications. This will aid in preventing seizures by allowing easier oil entry and free movement of the needle bearings.

D. To reassemble needle roller bearings (B-8 and B-19) the following steps are suggested. However, if it is more convenient to assemble needle bearings to inside of gears, rather than outside of sleeves, the method is applicable.

If new parts are being installed, always check the following to insure free and easy assembly and installation of mainshaft:

a. Spline fit of lo-lo and underdrive clutch gear (B-17).

b. Spline fit of direct and overdrive clutch gear (B-5).

c. Underdrive gear sleeve (B-13).

d. Overdrive gear sleeve (B-10).

Spline and sleeve must be a free fit with mainshaft.

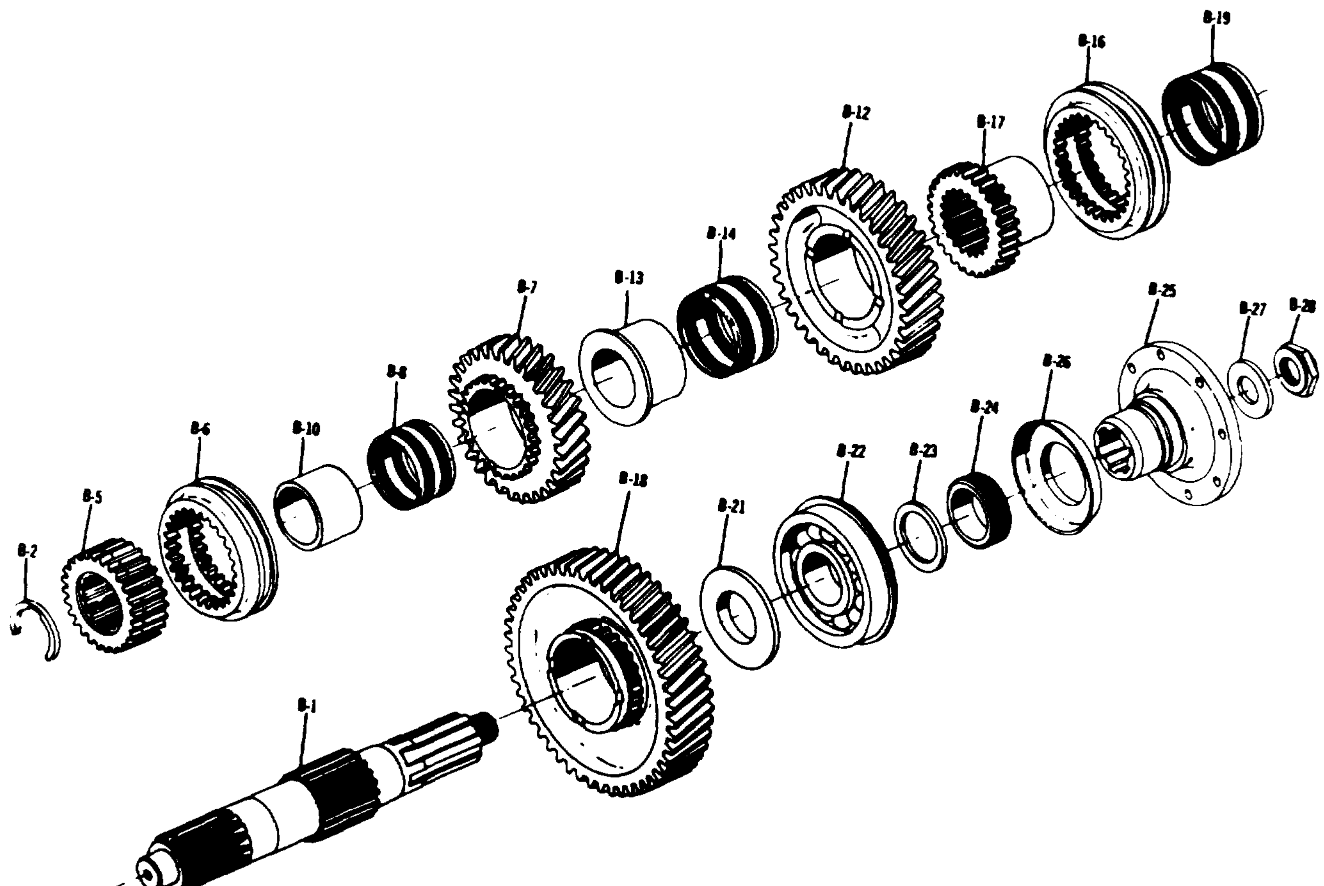


FIG.10

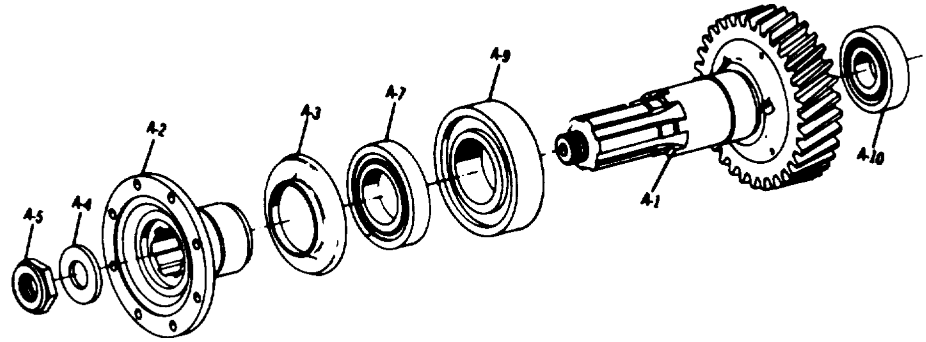


FIG.11

1. Place lo-lo and underdrive clutch gear (B-17) on bench with flange down. Apply a light coat of grease, approximately 1" wide, to the ground area above the flange. Assemble one row of 72 needle roller bearings, (B-19) to clutch gear. Assemble spacer (B-20). Apply light coat of grease and assemble the second row of 72 needle roller bearings or caged needle bearing.

CAUTION

Do not plug oil holes in gears with grease.

2. Assemble lo-lo ear (B-18) to clutch gear (B-17) by placing (B-18) clutch teeth toward flanged end of (B-17). Slide over needles and spacer. Place gear and sleeve assembly aside.

3. In a similar manner, coat underdrive gear sleeve (B-13) on thrust face and ground surface with grease and apply two rows of 72 needle bearings (B-14) with spacer (B-15) between or caged needle bearing.

4. Assemble underdrive gear (B-12) to sleeve and bearings with clutch teeth of gear away from flanged end. Place gear and sleeve assembly aside.

5. Place overdrive gear sleeve (B-10) on flat plate and coat lower 1" with light grease. Assemble one row of 62 needle roller bearings (B-8) to sleeve, add spacer (B-9) and in a like manner, assemble the second row of 62 needle roller bearings or caged needle bearing.

6. Assemble overdrive gear (B-7) to sleeve and bearings with clutch teeth of gear up. Place assembly aside.

INSTALLATION OF MAINSHAFT:

The diameter of the main drive gears used in the R8000 Series auxiliaries are larger than the main drive gear bearing bore in the case. This necessitates assembly of the drive gear in the case prior to installation of the mainshaft.

Assemble auxiliary drive gear bearing (A-9) with outer race snap ring toward gear teeth to prevent bearing from operating with thrust load against snap ring.

1. Position inner race of drive gear roller bearing (A-9) under arbor press with flanged end of inner race up. Set drive gear (A-1) in lace and press into position. Be sure flanged end of inner race bottoms against front face of drive gear.

2. Position drive gear pocket bearing (A-10) in drive gear (A-l) and press into place.

NOTE

Drive gear pocket bearing (A-10) is made in two pieces. Be sure pocket bearing is assembled with flanged end of inner race up or toward mainshaft.

3. Use soft hammer and tap outer race of drive gear roller bearing (A-9) into front bearing bore of case. Seat bearing tight against counterbore of case.

4. Lower front end of drive gear (A-l) through top opening of case and slide it forward into outer race of drive gear roller bearing (A-9).

5. Position lo-lo ear and sleeve assembly (B-17 thru B-20) in rear of case with clutch teeth toward front of case. Mesh with countershaft ear (C-1). Assemble lo-lo and underdrive clutch collar (B-16) to lo-lo gear with extended hub toward gear (B-18).

GEARS AND CASE

6. Place underdrive gear and sleeve assembly (B-12 thru B-15) in case with clutching teeth of gear toward lo-lo gear (B-18) and mesh with countershaft gear (C-12). Move clutch collar (B-16) into engagement with underdrive gear (B-12) to hold alignment.

7. Coat thrust faces and splines of main shaft with light grease. Enter pilot bearing end of main shaft through rear bearing bore until main shaft has paised through underdrive gear sleeve (B-13) approximately 1".

8. Place overdrive gear and sleeve assembly (B-7 thru B-10) in case with clutch teeth forward or away from underdrive gear (B-12). Slide main shaft forward through bore of sleeve (B-10).

NOTE

Check to make sure inner race of drive gear pocket bearing (A-10) is in place in drive gear counterbore.

9. Assemble direct and overdrive clutch collar (B-6) to clutch gear (B-5). Extended hub of clutch collar assembles toward front as does lock ring counter-bore in end of clutch gear (B-5). Position gear and collar in case and assemble to main shaft spline.

10. Place a ½ " thick soft block (aluminum or brass) between main drive gear (A-1) and direct and overdrive clutch gear (B-5). Tap mainshaft forward until the lock ring groove in splines at front of mainshaft extend beyond face of clutch gear (B-5).

11. Assemble lo-lo gear thrust washer (B-21) on rear of mainshaft with flat surface of washer toward lo-lo gear (B-18).

12. Position mainshaft rear bearing (B-22) onto mainshaft with external snap ring away from case. Use pinch bar to lift mainshaft into position to align outer race of hearing with rear case bore. Tap rear bearing onto mainshaft and into rear case bore. If bearing taps into position easily, then seat snap ring of bearing against case and proceed to step 15.

13. If mainshaft rear bearing (B-22) does not tap into position readily then remove ½" block between drive gear (A-1) and clutch gear (B-5). Assemble gear lock ring (B-2) to groove in mainshaft.

14. Use short length of 2½" I.D. tubing with flange washer and nut (B-27 and B-28) to pull mainshaft back into its proper position and against rear mainshaft bearing. Make sure split ring is centered and seated inside of clutch gear (B-5) counterbore during mainshaft positioning.

15. Remove puller tool or tubing from rear of mainshaft and assemble rear bearing washer (B-23) and speedometer gear or spacer washer (B-24) to mainshaft and seat against rear hearing (B-22).

16. If mainshaft rear bearing cap oil seal (H-3) was removed, then replace. Use gasket cement on O.D. of seal and use seal installation tool to press into lace. If required, assemble new speedometer gear bushing (H-2) in cap. Lubricate with engine oil and assemble speedometer driven gear (H-21) and sleeve (H-22) to cap. Check speedometer driven gear to make sure it rotates freely and has .005-.008 end play.

17. Apply gasket cement to mainshaft rear bearing cap gasket (H-4) and install on rear bearing cap. Align the oil passage ports.

18. Apply gasket cement to other side of gasket and assemble bearing cap and gasket to rear of case. Dip cap screws (H-5) in gasket cement and assemble to case with washers (H-7). Torque cap screws 60 - 80 lbs. ft. Assemble dirt flinger on hub of yoke or flange if removed.

19. Assemble end yoke or flange (B-25) to mainshaft with pusher tool. Do not drive yoke or flange onto shaft without provisions to block mainshaft overdrive gear (B-7) against front of case with hardwood block. Be sure lock ring (B-2) is in proper location.

CAUTION

If necessary to drive flanges or end yokes onto mainshaft spline, take care not to damage flange pilot surfaces or bearing diameters in yokes. Use tubing and drive on hubs only.

20. Assemble flat washer (B-27) and nut (B-28) to mainshaft. Lock unit in two gears and torque to 500 - 550 lbs. ft.

21. Shift clutch collars back into neutral and make sure all shafts turn free.

22. Apply gasket cement to drive gear bearing cap gasket (F-8) and install on drive gear bearing cap (F-7). Align the oil passage ports.

23. Apply gasket cement to other side of gasket and assemble drive gear bearing cap to front of case. Make sure bearing cap is piloted on drive gear roller bearing (A-9).

24. Dip cap screws (F-9) in gasket cement and assemble to case with lock washers (F-10). Torque cap screws 60 - 80 lbs. ft.

25. Position outer race roller bearing (A-7) on shaft of main drive gear (A-1). Use tubing and drive on inner race of bearing with inner race flange positioned toward splines. Also, outer race snap ring toward splines.

26. If used, assemble new lip seal (F-2) to front bearing cap (F-1). Apply gasket cement to front bearing cap cover gasket (F-3) and install on bearing cap cover (F-1). Line up oil drain hole.

27. Apply gasket cement to other side of gasket and assemble bearing cap cover to front of drive gear bearing cap (F-7).

28. Locate and secure front bearing cap cover (F-1) to drive gear bearing cap (F-7) with cap screws (F-4) and lock washers (F-6). Torque cap screws to 40 - 50 lbs. ft.

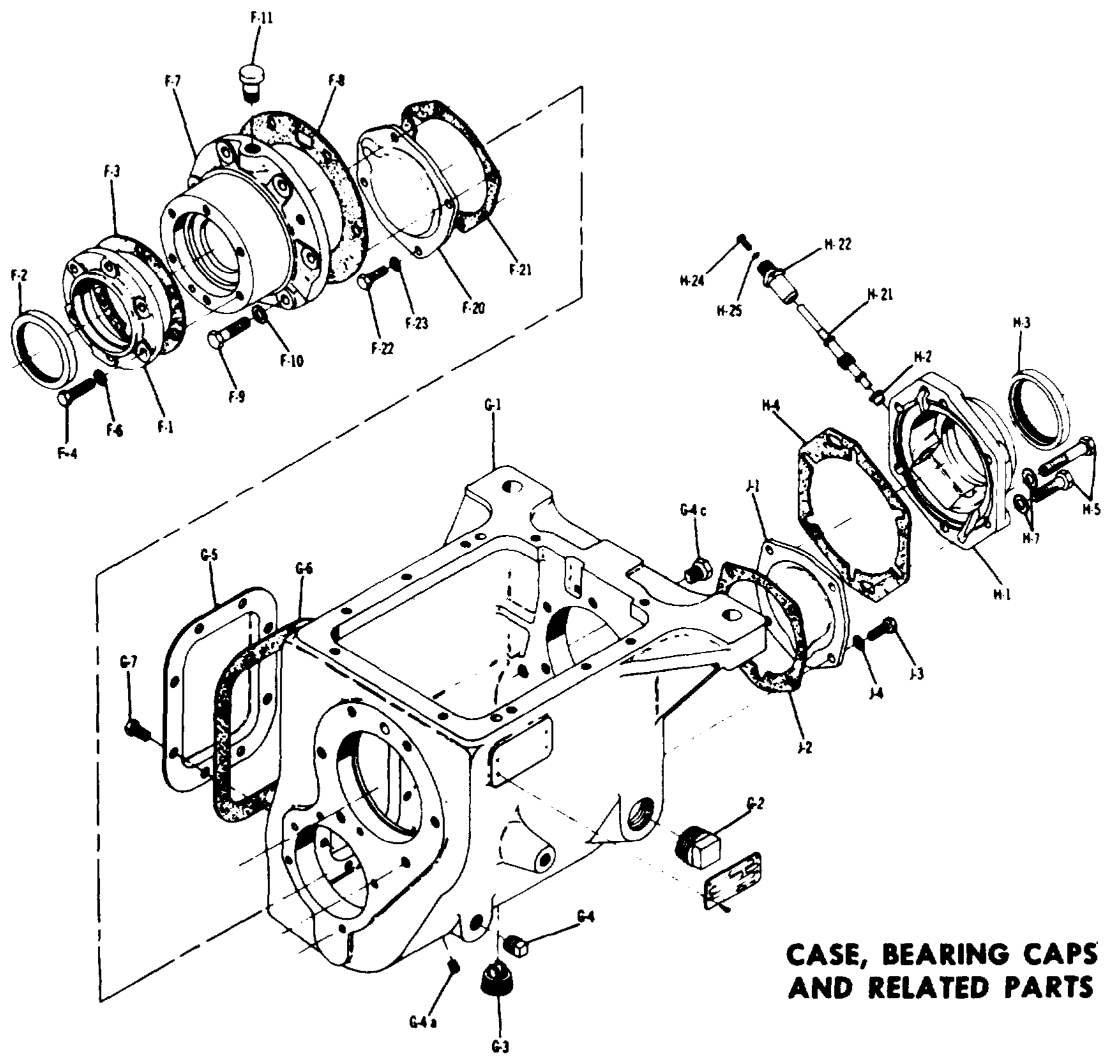
29. Place front transmission hanger over front bearing cap and assemble end yoke or flange with dirt flinger on hub of yoke or flange (A-2). Observe the same caution and procedure used in step 19.

30. Assemble flat washer (A-4) and nut (A-5) to end of main drive gear. Lock auxiliary in two gears and torque drive gear nut to 500 - 550 lbs. ft.

31. Shift clutch collars (B-6 and B-16) back into neutral and rotate drive gear to make sure all shafts turn free.

32. Use pressure type oil can to force lubricant down the oil holes and end slots of all floating gears on the mainshaft to flush out the grease and insure initial lubrication of over-running gears and bearings. Use regular auxiliary lubricant as recommended on Page 3.

For installation of shifter housing on case, see Page 8.



CASE, BEARING CAPS AND RELATED PARTS

FIG. 12

TROUBLE SHOOTING

CAUTION

The splines of many Spicer clutching main shafts, etc., are equipped with a machined relief called a "hopping guard". With the clutch gear in the engaged position, the mating gear ***is*** *free to slip into this notch, preventing the two gears from "walking out of gear" under load. (See enlarged view.) This is not a worn or chipped gear! Do not grind it down or discard the gear.*

IMPORTANT PROCEDURE

When locating and correcting unit power or auxiliary transmission troubles, a systematic procedure should be followed.

Road test whenever possible. Mechanics usually get second or third hand reports of trouble experienced with the unit and these reports do not always accurately describe the actual conditions. Sometimes symptoms seem to indicate trouble in the auxiliary; while, actually the trouble may be caused by the axle, propeller shaft, universal joints, engine or clutch. This is especially true of complaints on noise. Therefore, before removing transmission or related components to locate trouble, always road test to check possibility that trouble may exist in other closely associated units. If the mechanic can drive, road testing will be more effective; however, just riding with the driver can be very informative.

Check Functioning Prior to Disassembly:

If remote controls are used, a careful check of the remote and connecting linkage to auxiliary must be made. The remote units and linkage must be in good working order if the auxiliary is expected to shift satisfactorily.

Many times the answer to the trouble is apparent when the unit is inspected prior to disassembly, but this evidence is often lost when the parts are separated. If possible, check the unit prior to disassembly. Bear in mind that a careful inspection of the unit should be made as each disassembly step is performed.

Inspect Thoroughly During Disassembly:

It is poor practice to diassemble a unit as quickly as possible without bothering to examine the parts as they come down. It happens many times that a mechanic has completely disassembled a unit and failed to find the cause of the trouble because he did not bother to examine the parts as they came apart, After the auxiliary is disassembled, check the lubricant for breakdown and foreign particles which often reveal sources of trouble that are overlooked during the disassembly.

Repair or Replace Defective Parts:

Many times the parts or critical adjustments that have caused the trouble are not replaced or corrected because the mechanic will only inspect and replace parts that have failed completely. All pieces should be accurately examined because the broken are often often the result and not the cause of the trouble. All parts that are broken or worn and no longer meet specifications should be replaced. On large units, like an auxiliary, it is suggested that a mechanic replace that are worn to the extent that do not have a long service life remaining. This avoids another teardown on the unit in the near future. It is also good practice to make the change or modifications recommended to bring the auxiliary up to date and increase the service life of the unit.

TROUBLE SHOOTING

Driver Training:

One of the major causes of bearing and gear failures in the auxiliary unit is poor driving habits. Driver should be taught to always use the lo speed or reductions available in the auxiliary unit and keep the front box in the higher ratios not vice versa.

Worn and pitted gears, as well as worn and pitted bearings are usually caused by excessive use of the auxiliary overdrive gears with the mainbox in lower gear ratios.

Broken teeth in the auxiliary unit are usually caused by drivers trying to start their vehicles with the auxiliary unit in the high ratio while the big reduction is made in the front box. Frogging or quick release of clutch gives a jump start also noted for breaking teeth.

Noisy Operation:

Noise is usually very elusive and generally not the fault of the auxiliary; therefore, mechanics should road test to determine if the driver's complaint of noise is actually in the auxiliary. Remember that auxiliary units act as sounding boxes and in numerous instances, drivers have insisted that the noise was in the auxiliary; however, investigations revealed the noise to be caused by one of the following conditions:

(a) Fan out of balance or blades were bent.
(b) Defective vibration dampers.
(c) Crankshafts out of balance.
(d) Flywheels out of balance.
(e) Flywheels mounting bolts loose.
(f) Engine rough at idle producing rattle in gear train.
(g) Clutch assembly out of balance.
(h) Engine mounts loose or broken.
(i) P.T.O. gear not fully engaged or housing not properly shimmed.
(j) Universal joints worn out.
(k) Propeller shafts out of balance.
(l) Universal joint angles out of plane or at excessive angle.
(m) Center bearings in drive line dry, not mounted properly, etc.
(n) Wheels out of balance.
(o) Tire treads humming or vibrating at certain speeds.
(p) Air leaks on suction side of induction system---especially with turbo-chargers.

Mechanics should try to locate and eliminate noise by means other da n auxiliary removal, or overhaul. However, if the noise appears to be in the auxiliary try to break it down into the following. classifications. If possible, determine what position the gear shift lever is in when the noise. If the noise is evident in only one gear position, the cause of the noise is generally traceable to the gears in operation.

(a) Growl and humming or, more serious, a grinding noise. These noises are caused by worn, chipped, rough or cracked gears. As gears continue to wear, the grinding noise will be noticeable, particularly in the gear position that throws the greatest load on the worn gear.

(b) Hissing or, more serious, a thumping or bumping-type noise. Hissing noises can be caused by bad bearings. As bearings wear and retainers start to break up, etc., the noise could change to a thumping or-bumping.

(c) Metallic rattles within the auxiliary usually result from a variety of conditions. Engine torsional vibrations are transmitted to the transmission through the clutch, which may be amplified and transmitted to the auxiliary through the connecting propeller shaft. In heavy duty equipment, clutch discs with vibration dampers are not used, so a rattle, particularly in neutral, is common with diesel equipment. In general, engine speeds should be 600 RPM or above to eliminate objectionable rattles and vibration during the idle. *Always leave the main box in neutral and the auxiliary unit in* gear *when idling.* A defective or faulty injector would cause a rough or lower idle speed and a rattle in the auxiliary. Rattle could also be caused by excessive backlash in P.T.O. unit mounting.

(d) Improper lubricants or lack of lubricant can produce noises. Auxiliaries with low oil levels sometimes run hotter than normal, as there is insufficient lubricant to cool and cover the gears.

(e) Squealing, particularly when the auxiliary is operating at higher speeds, could be caused by one of the free running gears seizing on the thrust face or fluted diameter temporarily and then letting go. In general, a mild seizure will clear itself up and the auxiliary will continue to operate very satisfactorily without this defect

(f) Gear seizure at high speed, usually accompanied with loud squealing noise. This type of seizure is readily apparent to the driver, since the truck will suddenly slow down as if the brakes were being applied. If the truck continues to move ahead, even though the gear shift lever is placed in neutral, it would indicate the floating gear on the mainshaft had seized. Depressing the clutch should interrupt the driving torque. The seized gear could be checked quite readily by depressing the clutch and checking the action with the gear shift lever progressively in all shift positions. If releasing the clutch tends to kill the engine, then this gear position has not seized. In other words, the auxiliary would be in two gears at the same time. By a process of elimination, the gear at fault can be readily identified. See (g) below:

(g) Vibration: Gear seizures on thrust faces or fluted diameters are usually caused by vibrations in, the power train-this could be engine, proper shafts, joint angles rear axle, differentials, etc.

TROUBLE SHOOTING

Improved highways permit sustained high speeds. The fact that engines and entire power trains can now cruise at higher R.P.M. can introduce vibration frequencies, that were not critical in the past. At slower speeds these items would get by or only pass through critical periods while accelerating or decelerating through the gears.

In the past, drive line vibrations such as bent tubes, joints out of phase or alignment, bad angles due to short couples, clutches out of balance, gears and shafts in auxiliaries out of balance, were fairly obvious. These items will become more critical in vehicles running at sustained high speeds.

Critical vibrations associated with higher speeds are not the old thumping or bumping type, but are high frequency vibrations which sting or tingle the soles of your feet, tickle the end of your fingers, etc. This type of vibration will cause gear seizures bearing failure due to retainer rivet failures, promote brinelling, fretting, corrosion, etc.

(h) Gear whine is usually caused by lack of backlash between mating gears-improper shimmmg of P.T.O. units is the big offender here.

Noise in Neutral

Possible Causes:

(a) Misalignment.
(b) Worn, or scored countershaft bearings.
(c) Worn drive gear bearings.
(d) Sprung, or worn counter&aft.
(e) Excessive backlash in gears.
(f) Worn mainshaft pocket bearing.
(g) Scuffed gear tooth contact surface.
(h) Insufficient lubrication.
(i) Use of incorrect grade of lubricant.

Noise in Gear

Possible Causes:

(a) Worn, or rough mainshaft rear being.
(b) Rough, chipped, or tapered sliding gear teeth.
(c) Noisy speedometer gears.
(d) Excessive end play of mainshaft gears.
(e) Refer to conditions listed under Noise in Neutral.

Oil Leaks

Possible Causes:

(a) Oil level too high.
(b) Wrong lubricant in unit.
(c) Non-shielded bearing used at front or rear bearing cap. (Where applicable.)
(d) Seals (if used) defective or omitted from bearing cap, wrong type seal used, etc.
(f) Transmission breather omitted, plugged interally, etc.
(g) Capscrews loose, omitted or missing from remote control, shifter housing, bearing caps, P.T.O. or covers, etc.
(h) Welch "seal" plugs loose or missing entirely from machined openings in shifter housing or case.
(i) Oil drain-back openings in bearing cape or case plugged with varnish, dirt, covered with gasket material, etc.
(j) Broken gaskets, gaskets shifted or squeezed out of position, pieces still under bearing cape, clutch housing, P.T.O. and covers, etc.
(k) Cracks or holes in castings.
(l) Drain plug loose.
(m) Also possibility that oil leakage could be from engine.

Walking or Jumping Out of Gear:

For clarification we would like to separate walking out of gear and jumping out of gear into two distinct groups.

Walking out of gear is usually associated with power application or coasting on long smooth grades, i.e., when power is applied the shift lever moves into the neutral position. Occasionally it may be impossible to hold the shift lever in gear by hand.

Sometimes this condition may also be noted when coasting down a long relatively smooth grade or power is being applied on the coast side of the gear.

Dana/Spicer transmissions and auxiliaries are provided with "hopping guards" for most gear positions. Therefore, if the units are walking out of gear it could be caused by:

(a) Interference or resistance in the shift mechanism preventing full engagement of the sliding clutch gear or -

(b) If the gear has been shifted completely into position some other malfunction which could move the gear or the shaft itself out of its proper location.

(c) On new or rebuilt units the wrong parts or old defective parts may have been used; thereby rendering the hopping-guard feature useless. High mileage units may start walking out of gear due to the general deterioration or rounding of clutch teeth due to numerous slip-outs or partial engagements due to conditions listed below.

(d) Walkout on coast side could be caused by lack of hopping guard feature for this particular gear position.

If remote controls are used, the mechanic must satisfy himself that the remote units are satisfactory and that auxiliary is actually at fault. A number of items that would prevent full engagement of gears are:

TROUBLE SHOOTING

(a) Improperly positioned forward remote con--1 which limits full travel forward and backward from the remote neutral position.

(b) Improper length shift rods or linkage that limits travel of forward remote from neutral position.

(c) Loose ball cranks, sloppy ball and socket joints.

(d) Shift rods, cables, etc., too spongy flexible, or not secured properly at both ends.

(e) Worn or loose auxiliary mounts if remote unit is mounted to frame.

(f) Forward remote mount too flimsy, loose on frame, etc.

(g) Set screws loose at remote control joints or on shift forks inside remote or even inside auxiliary unit.

(h) Shift fork pads or groove in sliding gear or collar worn excessively.

(i) Worn taper on gear clutch teeth.

(j) Auxiliary out of alignment either vertically or horizontally.

Jumping Out of Gear:

Jumping out of gear is usually associated with slip-out reports experienced when crossing railroad tracks-traveling rough roads, etc.

A few items which could move the gear or shaft out of proper position, particularly on rough roads are:

(a) Use of long and heavy shift lever extensions.

(b) Shift rod poppet springs broken.

(c) Shift rod poppet notches worn.

(d) Shift rod bent or sprung out of line.

(e) Shift fork pads not square with shift rod bore.

(f) Excessive end-play in drive gear, mainshaft or countershaft caused by worn bearings, retainers, etc.

(g) Thrust washers or faces worn excessively, missing, etc.

Hard Shifting:

An improperly operating clutch will interfere with the proper shifting of gears in any auxiliary. It is important that the hydraulic air or similar release mechanism (if used), also be in proper working order. if the mechanic is sure that a full and complete clutch release is being made, the following could be a few of the possible causes for hard shifting complaints.

(a) No lubricant in remote control units. Forward remote is isolated and is often overlooked. However, many remote controls used on transmissions and auxiliaries require separate lubrication.

(b) No lubricant in (or grease fittings on) U-joints or swivels of remote controls.

(c) Lack of lubricant or wrong lubricant used, causing buildup of sticky varnish and sludge deposits on splines of shaft and gears.

(d) Badly worn or bent shift rode.

(e) Improper adjustment of shifter linkage.

(f) Sliding clutch gears tight on splines of shaft.

(g) Clutch teeth burred over, chipped or badly mutilated due to improper shifting.

(h) Binding or interference of shift lever with other objects or rods inside the cab or near the remote control island.

(i) Driver not familiar with proper shifting procedure for this transmission. Also includes proper shifting as used with 2-speed axle, auxiliary, etc.

(j) Drive gear pocket bearing seized, rough, or dragging.

(k) Gear seizure on thrust face or hearing diameter.

Sticking In Gear:

(a) Clutch not releasing-also check remote unite such as hydraulic or air assist, etc. Note: On some units employing a full air control for clutch release, air pressure of approximately 60 lbs. or more must be secured before clutch can be released. *Do not leave these vehicles parked in gear.*

(b) Sliding clutch gears tight on splines.

(c) Chips wedged between or under splines of shaft and gear.

(d) Improper adjustment, excessive wear or lost motion in shifter linkage.

Bearing Failures:

The service life of most transmissions either main or auxiliaries governed by the life of the bearings. Majority of bearing failures can be attributed to vibration and dirt. Some of the more prominent reasons for unit removal with bearing failures are:

(a) Worn out due to dirt

(b) Fatigue of raceways or balls.

(c) Wrong type or grade of lubricant.

(d) Lack of lubricant.

(e) Vibrationa-breakup of retainer and brinnelling of races-fretting corrosion.

(f) Bearing tied-up due to chips in bearings.

(g) Bearings set-up too tight or too loose.

(h) Improper assembly-brinnelling hearing.

(j) Improper fit of shafts or bore.

(k) Acid etch of bearings due to water in lube.

(l) Overloading of vehicle. Overload from engine or engine too large for transmissions used

Dirt:

More than 90% of all ball bearing failures are caused by dirt which is always abrasive.

Dirt may enter the bearings during assembly of

TROUBLE SHOOTING

the units or be carried into the hearing by the lubricant while in service. Dirt may enter through seals, breather or even dirty containers used for addition or change of lubricant.

Softer material such as dirt, dust, etc., usually forms abrasive paste or lapping compounds within the bearings themselves since the, unit pressure between the balls and raceways makes a perfect pulverizer. The rolling motion tends to entrap and hold the abrasives. As the balls and raceways wear, the bearings become noisy. The lapping action tends to increase rapidly as the fine steel from the balls and rollway adds to the lapping material.

Hard, coarse material such as chips, etc., may enter the bearings during assembly from hammers, drifts, power chisels, etc., or be manufactured within the unit during service from raking teeth, etc. These chips produce small indentation in balls and races. Jamming of these hard particles between balls and races may cause the inner race to turn on shaft, or the outer race to turn in the housing.

Fatigue:

All bearings are subject to fatigue and must be replaced eventually. Your own operating experience will dictate mileage replacement of bearings showing only normal wear.

Corrosion:

Water, acid and corrosive materials formed by deterioration of lubricant, will produce reddish-brown coating and small etched holes over outer and exposed surfaces of race. Corrosive oxides also act as lapping agent.

Brinelling caused by improper assembly or removal - usually hammering with off-center blows. Use drivers, preferably under an arbor, or pullers.

Shaft Fits:

Excessive looseness under load is very objectionable because it produces a creeping or slipping of the inner ring on the rotating shaft. This causes the surface metal of shafts to scrub or wear off.

Bearing fits on rotating shafts are usually specified as tight. When play or looseness, even .001", exists between the bearing and shaft, there is a very powerful force tending to rotate the inner race on the shaft; this force is caused by the looseness or lost motion between the parts and disappears when no looseness exists.

Removal of Bearings:

It is far more difficult to remove bearings from a shaft than to put them on. In most cases it is necessary to remove the bearing by pulling on the outer-race which can damage the balls or races. Since such damage is seldom visible, it does not become known until after complete reassembly. It is good P.M. to replace most ball bearings during the overhaul period. If a bearing is not going to be replaced, avoid removal during low mileage rebuild.

Interchangeability:

All ball bearings (whether manufactured here or abroad) are interchangeable in regard to–standardized dimensions, tolerances and fits. However, for a given shaft size there are standard bearings for light, medium, and heavy-duty service.

Numbers and symbols stamped on inner and outer races of bearings designate size and type.

Numbering systems of different bearing manufacturers, however, have not been standardized. Consult interchangeable tables and use proper bearings for replacement parts.

For further information write to:

Spicer Transmission Division
Dana Corporation
P.O. Box 986
Toledo, Ohio 43696

Section I

Volume III

HYDRAULIC SHOP MANUAL

WINCHES

P&H

HARNISCHFEGER

WINCH DATA

	MODEL 10	MODEL 16
Pressure	2400 psi	2800 psi
Volume.	74 gpm	97 gpm
Drumtorque.	50,000 in. lb.	120,000 in. lb.
Drum speed up - full load	76.5 rpm	51 rpm
Cable size.	1/2 inch	3/4 inch
P.D. to cable diameter ratio	20:1	20:1

MODEL 10 TABULATED DATA

LAYER	LINE PULL (POUNDS)	LINE SPEED (FPM)	DRUM CAPACITY IN FT./ LAYER	DRUM CAPACITY IN FT./ TOTAL
1	10,000	200	66.5	66.5
2	9,100	220	76	142.5
3	8,330	240	83	225.5
4	7,700	260	90	315.5
5	7,150	280	96.5	412
6	6,660	300	103.5	515.5
7	6,250	320	110.5	626
8	5,900	340	117	743

MODEL 16 TABULATED DATA

LAYER	LINE PULL (POUNDS)	LINE SPEED (FPM)	DRUM CAPACITY IN FT./ LAYER	DRUM CAPACITY IN FT./ TOTAL
1	16,000	200	96.5	96.5
2	14,550	220	110.5	207
3	13,300	240	120.5	327.5
4	12,300	260	130.5	458
5	11,400	280	140.5	598.5
6	10,650	300	150.5	749

NOTE

This data is based upon maximum hydraulic input pressure and flow. It is general in nature, is subject to change without notice, and may vary from crane model to model. Consult the Harnischfeger Engineering Department for information in the event the above approximate information is critical in respect to complete accuracy.

VOLUME III

PURPOSE

The purpose of this publication is to give the highlights of disassembly, field repair, and reassembly of the Models 10 and 16 P&H Winches. These winches are nearly identical in physical appearance except for size. The major difference is that the Model 10 uses only one caliper brake assembly, where the Model 16 uses two.

The procedures in this manual are deliberately limited to those which we believe should be attempted in the field, using commonly available tools and average facilities. Repairs beyond the scope of this publication should be done by the manufacturer.

TIME AND TOOLS

The disassembly, inspection, and reassembly procedures described in the remainder of this publication should not normally exceed eight hours. Tools required include a torque wrench of at least 100 foot pounds capacity, as well as a normal complement of mechanics tools. Three 1/2-13 x 11 inch unc studs (or bolts with heads cut off) will also be required.

GENERAL INFORMATION

It should be noted that the most probable cause of trouble is the hydraulic motor, which can be removed and replaced without disturbing any other part. The second most probable cause for disassembly is replacement of the brake pads. This can also be done without disassembly or removal of any other major part.

Disassembly of these winches can be done from either end. No hoist or lifting device is required after the hoist has been removed from the crane and taken to the disassembly area. Of course, this area must be very clean.

DISASSEMBLY OF PRIMARY DRIVE

Disassemble the primary drive as follows:

NOTE

The procedure for disassembling the primary drive will depend on the reason for disassembly. If the motor is to be replaced, there is no reason to remove the brake assembly. If the brake pads are to be replaced, they can be removed without removing the motor. The procedure given below is for removal of the top brake assembly first, then the motor. This is a purely arbitrary choice. Note that it is not necessary to remove brake assemblies to replace brake pads.

1. Refer to Figure 1 and remove the cover shown.

2. Remove the three brake assembly mounting bolts (Figure 2).

3. Back off the brake adjusting nuts (Figure 2) until the brake assembly is loose on the brake disc and remove the brake assembly as shown in Figure 3. Note that some winches are provided with shims behind the brake assembly.

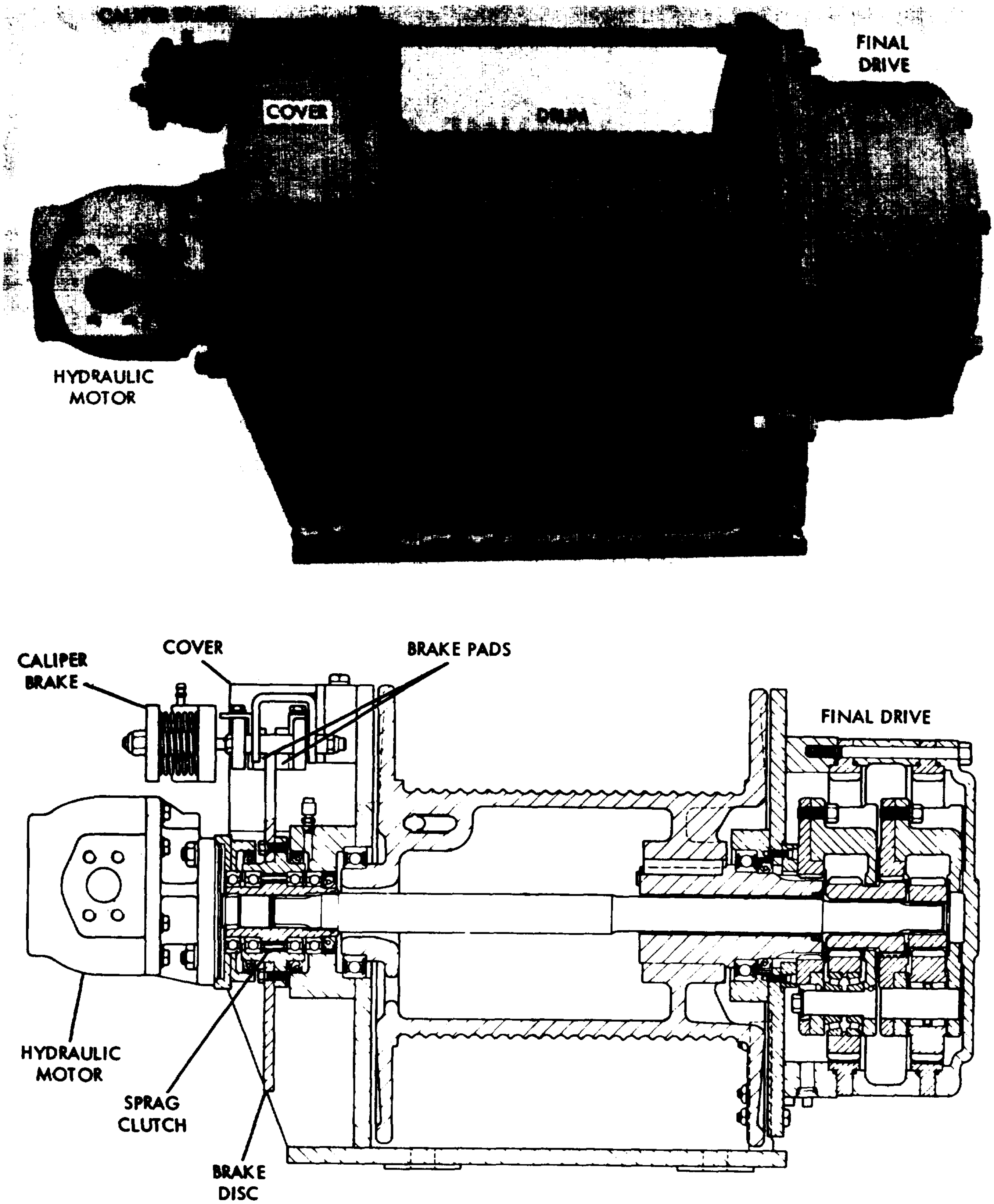


Figure 1. The P&H Winch

Figure 2. Brake Mounting Bolts

Figure 3. Removing Brake Assembly

If used, be sure to reinstall them at the original points during assembly.

4. If the brake assembly is to be disassembled, refer to the topic BRAKE DISASSEMBLY at the rear of this manual and disassemble and reassemble as described.

NOTE

The springs used in this brake assembly are color coded. Always observe the locations of the springs and replace them in their original positions.

5. Using a punch, stake the motor and the plate shown in Figure 4 so as to prevent reinstallation of the motor at an incorrect position. Then remove the motor as shown, bearing in mind that it is not necessary to remove the brake assembly if only the motor is to be replaced. If the winch has lost normal power, the motor is the logical part to suspect. Note that motor repairs are not recommended. The motor should be replaced as an assembly if it does not operate properly. It may be necessary to use a pry bar to loosen the motor. Have a suitable pan ready to catch the hydraulic oil which will drain as the motor is removed. Always replace the motor O-ring and all other O-rings and seals disturbed during disassembly.

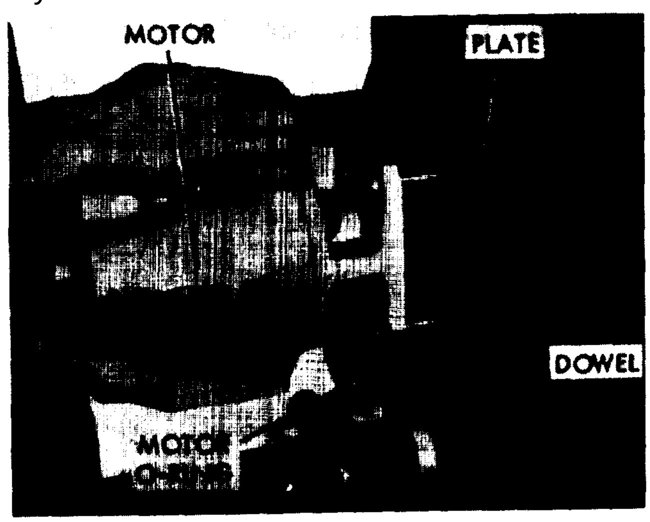


Figure 4. Removing Hydraulic Motor

6. Match mark the plate and its correspon-ding surface on the winch sidestand. Then, remove the plate shown in Figure 4. This plate is doweled on each end and it may be necessary to use a pry bar to loosen the plate. A seal is located on the rear side of this plate and will come off in the bore in the plate.

7. Remove the lower caliper brake assembly in the same manner described for the upper brake assembly if your winch is a Model 16. The Model 10 winch has only one brake assembly. Refer to Figures 2 and 3.

8. Refer to Figure 5 and remove the brake disc, shaft, and bearing as shown. It may be necessary to use a pry bar to free the assembly. Note that the Sprag clutch (a one-way clutch) is contained in the hub behind the bearing.

9. Before removing the bearing shown in Figure 5, spin it by hand to check for any signs of roughness or failure.

10. Refer to Figure 6 and pull the outer of the two bearings mounted on the sleeve, using a suitable puller as shown.

NOTE

A spacer is located behind the bearing shown in Figure 6. See Figure 18.

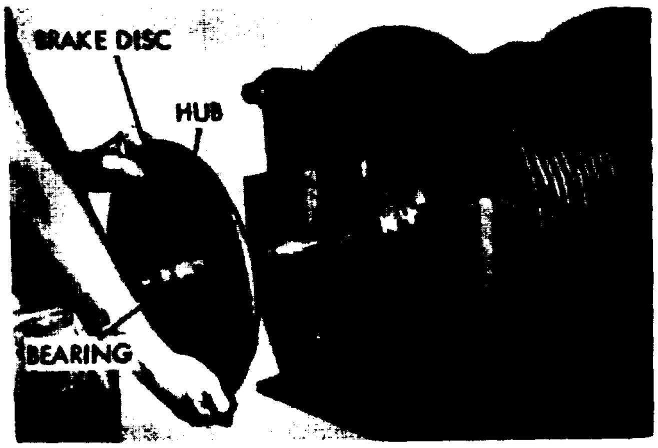


Figure 5. Removing Brake Disc and Shaft Assembly

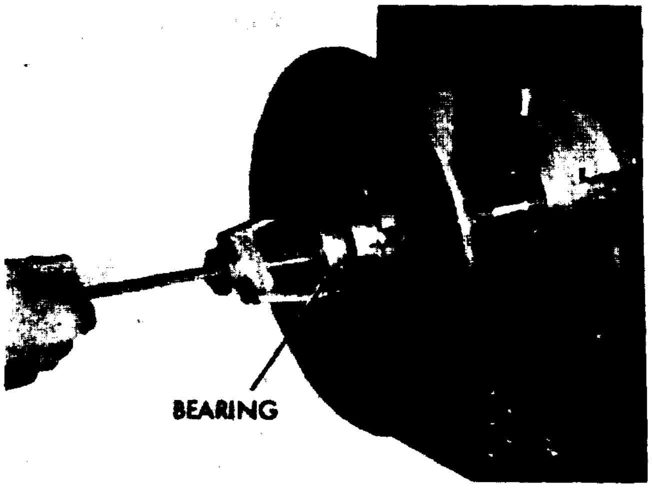


Figure 6. Removing Sleeve Bearing

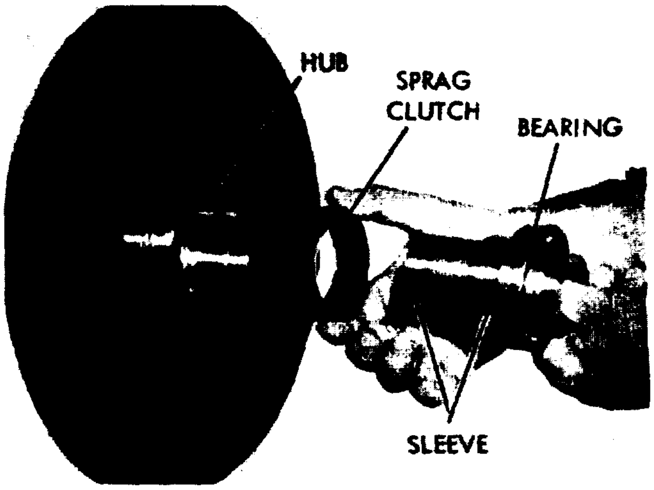


Figure 7. Removing Sleeve and Sprag Clutch

11. Slide the assembly consisting of the brake disc and hub shown in Figure 7 off the shaft and remove the shaft from the winch drum. Then, using a rubber mallet, tap the sleeve and Sprag clutch out of the hub in the direction shown in Figure 7. In other words, tap on the left end of the sleeve.

12. Inspect the sleeve surfaces to which the arrows point and the hub surface which contacts the outer diameter of the clutch. The sleeve and hub surfaces must be extremely smooth. The original finish was 16 rms. An oil seal rides on the end of the sleeve. Any

scratches or scoring on these highly finished surfaces is cause for replacement of the part. Any visible signs of wear, scoring, or damage is cause to replace the clutch assembly, which should be replaced as a unit, consisting of the hub, the sleeve, or the Sprag clutch.

13. The O-ring shown in Figure 8 should be checked. This sleeve O-ring is one probable cause if hydraulic. oil is found in the winch drum. Always replace this O-ring if the winch is disassembled enough to permit replacement.

NOTE

Figure 8 is viewed from the winch drum side of the brake disc, and shows the sleeve before it was tapped out of the hub as shown in Figure 7.

14. At this time, the motor end of the winch will appear as shown in Figure 9. The two seals and bearing shown can be removed and replaced. Note that the large outer seal lip points toward the winch drum, while the small seal lip points outward, away from the drum.

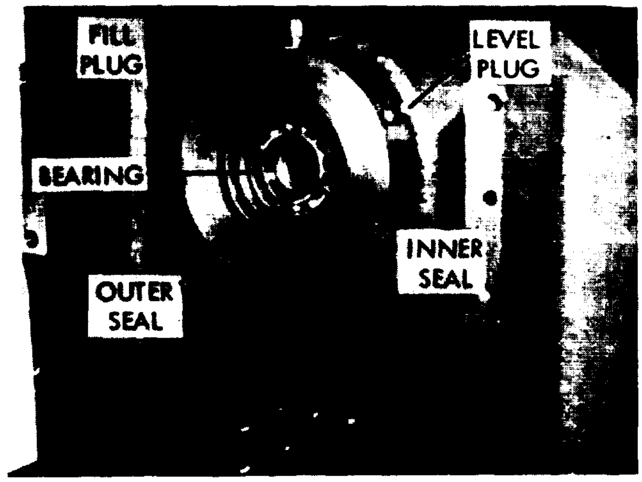


Figure 9. Motor End Drum Bearing and Seals

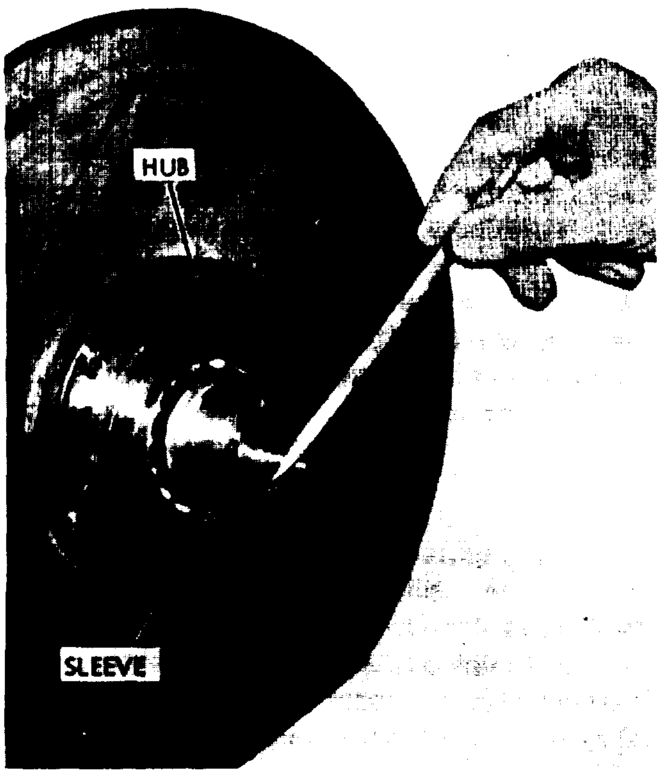


Figure 8. Sleeve O-Ring Location

DISASSEMBLY OF FINAL DRIVE

Disassemble the final drive as follows:

1. Refer to Figure 10. Drain approximately 1/2 gallon of SAE 90 transmission oil from the drain plug.

NOTE

Disassembly of the final drive unit is only necessary when some Internal failure is believed to have occurred.

2. Remove the cover mounting capscrews and install three 1/2-13x11 UNC bolts with heads out off or three 1/2-13x11 UNC studs at the points indicated in Figure 11. These studs will serve as guides in the removal and installation of the parts comprising the final drive.

NOTE

Disassembly of the planetary drive as illustrated in Figures 12, 13, and 14 is not necessary if bearings or seals in the side stand are the reason for disassembly. In that event, remove the inner and outer planetaries as a unit.

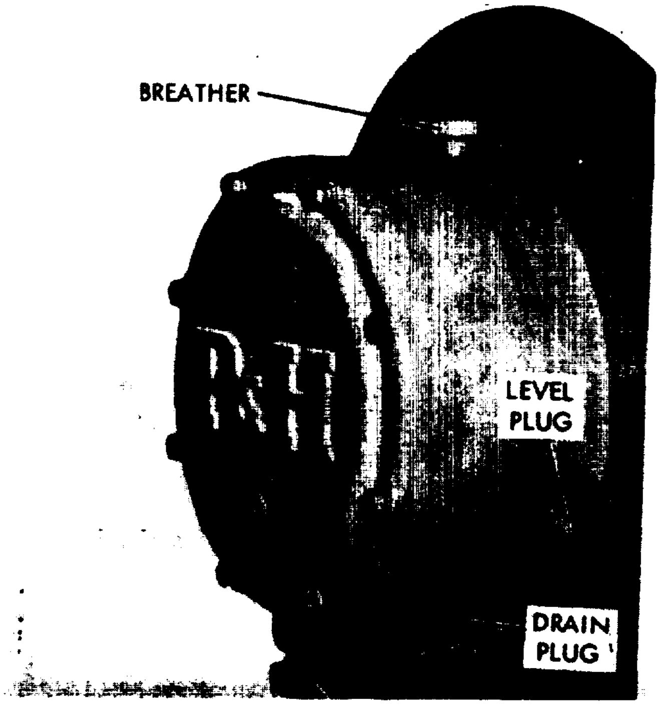


Figure 10. Location of Breather, Level, and Drain Plugs

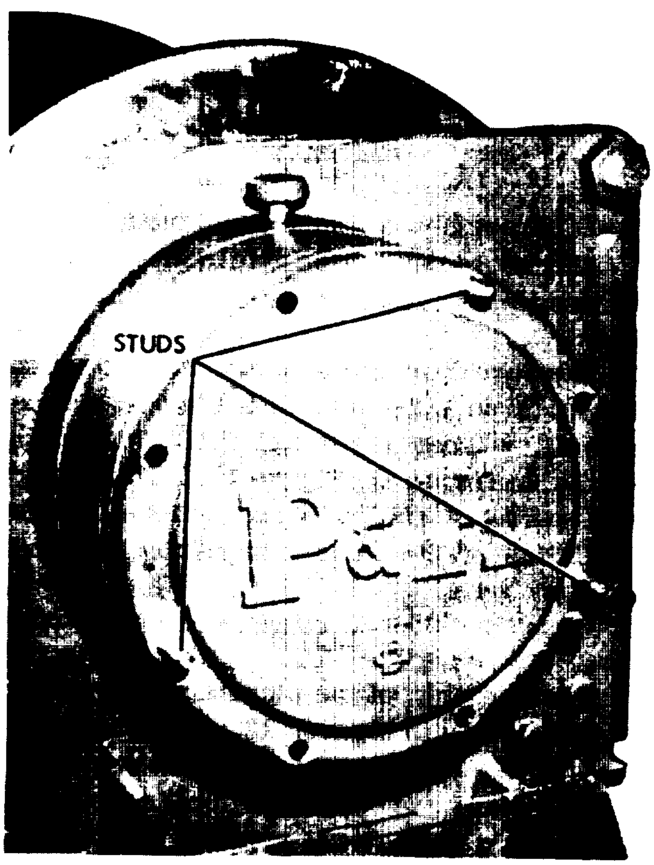


Figure 11. Guide Studs for Final Drive

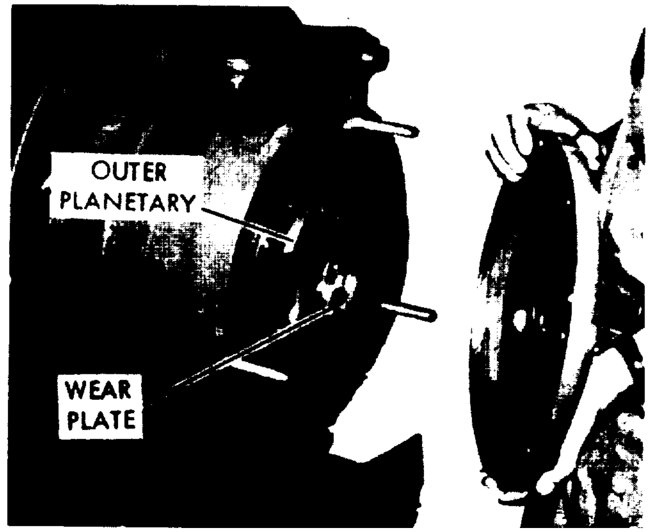


Figure 12. Removing End Cover

3. Carefully separate the end cover and remove it from the assembly as shown in Figure 12. Inspect the wear plate shown for discernible wear patterns. The wear plates between the inner and outer planetary stages and the cover can stand about 1/32" wear before the retaining screws will begin to cut into the mating surfaces. Initial thickness was 1/8 inch. The internal wear plates (inside the planetary stages) can stand about 3/64 inch wear before the gear teeth will start to cut Into the wear plates. The wear plate in Figure 15 can stand about 1/8 inch wear. Note that wear on the interstage surfaces should be even across the entire surfaces, and should show up as a concentric circle within the I. D. of the wear plate.

4. Remove the outer planetary assembly as shown in Figure 13. Inspect the wear plate shown in Figure 13 and replace this wear plate if required. Note that disassembly of either of the two planetary assemblies shown in Figure 13 is not recommended. However, it is recommended to spin the gears and see that they turn freely and smoothly. If they do not spin freely, check to see if the pins turn when the gears turn. The pins should not turn. If one does, it probable that one of the roll

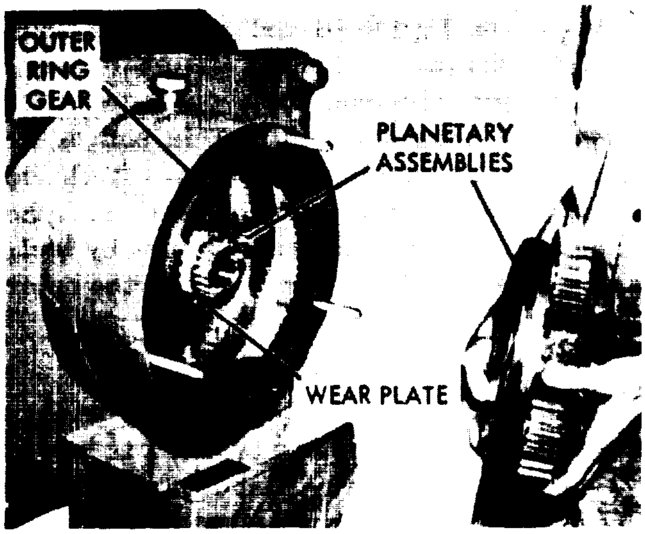


Figure 13. Removing Outer Planetary Assembly

pins which holds each pin in place has sheared. As a general rule, if one of the bearings on which the planetary gears is mounted is bad or if a roll pin has sheared, the damage will be so extensive that it is advisable to order a complete replacement assembly.

5. Loosen and remove the outer ring gear as shown in Figure 14. Inspect the gear teeth for excessive wear. Original backlash was 0.004 to 0.008 inch per gear set. Note that the proper criterion for replacement is basically "does it work?". Replace only if absolutely necessary.

6. Remove the inner planetary as shown in Figure 15. Inspect this planetary assembly in the same manner described for the outer assembly. Inspect the wear plates shown in Figure 15 and replace if wear patterns are evident.

7. This should normally complete the disassembly of the secondary drive. However, if complete disassembly is required including the drum bearings and seals, refer to Figure 14 and remove the housing spacer and inner ring gear. Then, block the winch drum so that it cannot drop, remove the mounting plate (Figure 15) capscrews and lo&washers, and remove the mounting plate. The drum can now be removed from its base for replacement of bearings and seals as required. Note that the drum sleeve is pressed into the drum and cannot be removeduntil the mounting plate is removed.

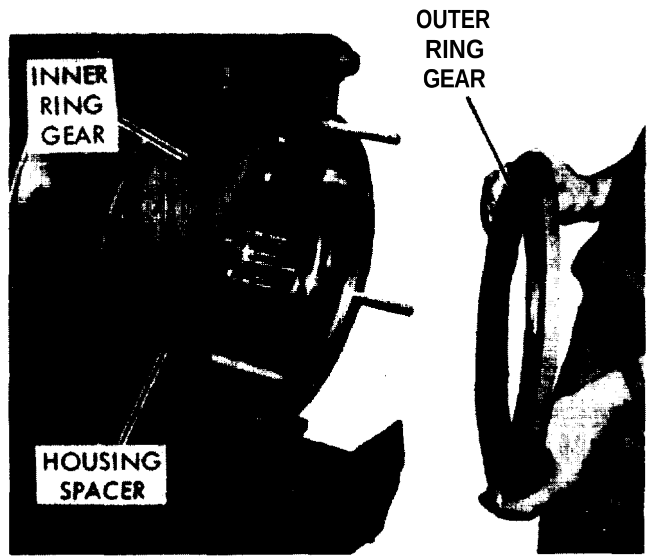


Figure 14. Removing Outer Ring Gear

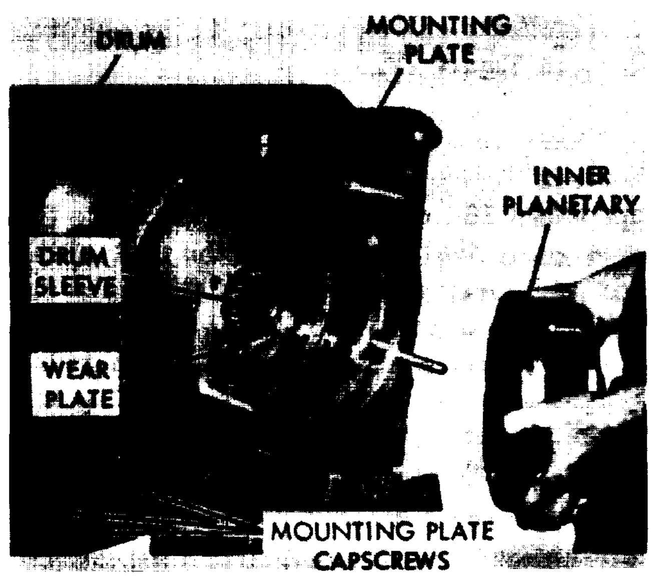


Figure 15. Removing Inner Planetary Assembly

REASSEMBLY OF FINAL DRIVE

In general, reassembly is the reverse of die-assembly. Only where an adjustment or a procedure is not the exact reverse of dis-assembly will additional detail be given in the following reassembly procedure. Reassemble from the final drive end as follows:

NOTE

when the drum has been installed in the side stand, production tolerance will allow 0.018 to 0.069 inch drum end play.

1. Refer to Figure 15, reinstall the mounting plate and secure with mounting plate cap-screws. If they have been removed, reinstall the three guide studs and install the inner ring gear and housing ring (Figure 14) on the studs. Press the ring gear and housing ring firmly against the mounting plate.

2. Install the inner planetary assembly (Figure 15).

3. Install the outer ring gear in the position shown in Figure 14.

4. Install the outer planetary in the position shown in Figure 12.

5. Place the end cover on the guide studs as shown in Figure 11 and install two end cover capscrews 180 degrees apart. Remove the three guide studs and install the rest of the eight end cover capscrews. Then tighten the end plate capscrews to 55 foot pounds lubricated or 75 foot pounder dry torque, being sure to tighten in the approved cross bolting sequence. That is, tighten two capscrews 180 degrees apart, then two more at right angles to the first pair, and so on.

6. Refer to Figure 10, remove the breather cap, and fill with 1/2 gallon of SAE 90 transmission oil to the level of the level plug.

7. Refer to Figure 16 and install the drum shaft as shown. Note that the shaft has a smaller outer diameter for about four inches on the end being inserted. This end of the shaft must be installed as shown. It will be necessary to align the shaft splines with the outer planetary internal gear splines by feel. Be sure the shaft is fully entered into the outer planetary.

NOTE

Seals and bearings shown in Figure 9 must be installed before the shaft is re-installed. Be careful to avoid damaging the inner seal shown Figure 9 when installing the shaft.

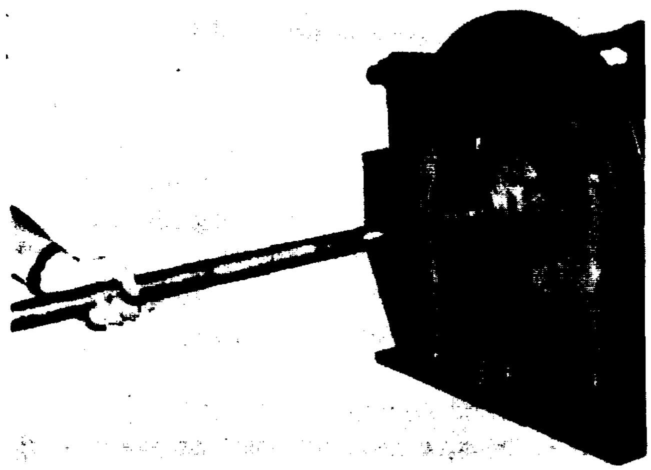


Figure 16. Installing Drum Shaft

REASSEMBLY OF PRIMARY DRIVE

Reassemble the primary drive as follows:

1. Assemble the Sprag clutch and bearings in the hub as follows:

CAUTION

If the Sprag clutch is installed opposite to the position in which it is shown in Figure 17, it will lock up in the wrong direction.

A. Install one bearing on the sleeve as shown in Figure 17, if it was removed.

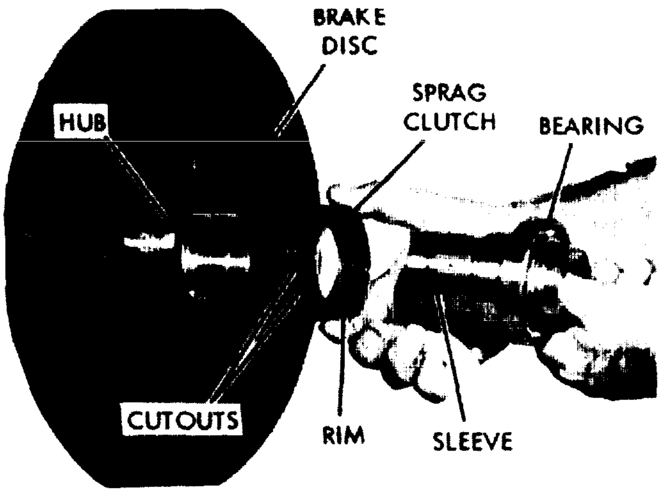


Figure 17. Installing Sprag Clutch

B. Hold the Sprag clutch as shown in Figure 17. Observe that the cutouts are above their individual sprag. Also, see that the rim on the end of the clutch faces the sleeve, as shown These two checkpoints show the relationship of the Sprag clutch to the sleeve and the hub.

C. Make sure a bearing has been installed in the bore on the opposite side of the hub. Then slip the Sprag clutchover the end of the sleeve, against the bearing.

D. Install the Sprag clutch and sleeve-bearing assembly in the hub.

NOTE

No force is required to install the Sprag clutch in the hub. However, it may be necessary to go around the circumference of the clutch with a screwdriver, turning the individual Sprags in the same direction. When all are turned the same way, the entire assembly will slide easily into the bore of the hub.

E. Place the other spacer (identical to the one shown in Figure 18) on the sleeve at the opposite end of the hub. Reference to Figure 1 will show that there are four ball bearings on the sleeve. It is most important that one of these a Pacers be installed between the two bearings on one side of the brake disc and the other between the two bearings on the opposite side of the brake disc.

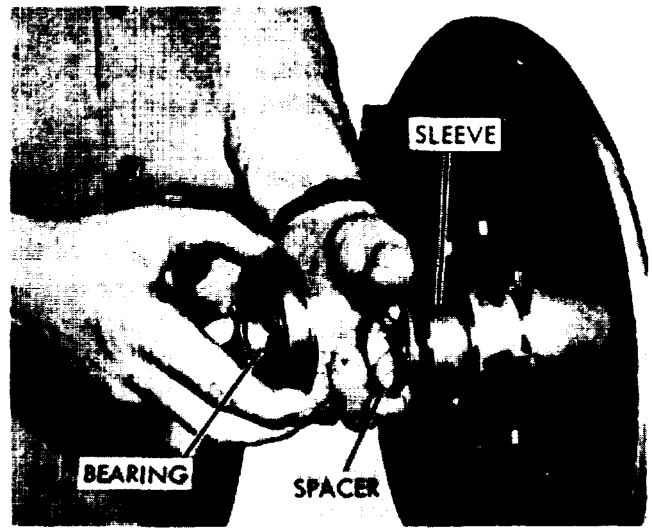


Figure 18. Bearing and Spacer Location

2. With the Sprag clutch installed in the brake disc hub, install the brake disc on the end of the drum shaft in the general -manner shown in Figure 5. Figure 5 shows the shaft extended out of the winch drum, which would NOT be the case as the disc/hub assembly is being installed.

NOTE

Production tolerances will allow 0.010 to 0.041 inch end play in the Sprag hub, clutch, and sleeve assembly.

3. Using a rubber mallet, alternately tap the sleeve and the hub firmly into place on the shaft. Be sure that the spacer on the inner side of the sleeve remains in place while moving the assembly onto the shaft.

NOTE

If the Sprag clutch is installed correctly , turning the brake disc counterclockwise will cause the winch drum to turn counterclockwise. Turning the brake disc clockwise will have no effect upon the drum. Be sure this is the case before continuing with assembly. If the reverse is true, the Sprag clutch has beeninstalled backward and must be removed and assembled correctly.

4. Refer to Figure 18 and install the spacer and bearing in the position shown. Be sure to apply force only to the inner race of the bearing, using a piece of pipe or other suitable device to prevent force from being applied to the outer race.

NOTE

Inspect the brake disc to be sure no grooving is apparent. If wear patterns can be seen, it is probable that the brake pads need to be replaced, or they should be machined smooth, using adequate disc brake servicing equipment.

6. Install the plate shown in Figure 4. Be sure to drive the two dowels shown (one on each side) flush with the plate. If the winch is a Model 16 (which has two brake assemblies) it will be necessary to remount the lower brake assembly as shown in Figure 4 before installing the plate.

6. Install the hydraulic motor as shown in Figure 4. One man should hold the motor while another turns the drum so as to line up the motor shaft splines with the mating splines in the sleeve. Be sure that the match marks on the motor housing and the plate are lined up.

7. When the motor is installed and the mounting nuts and lockwashers are tight, add approximately six ounces of the hydraulic oil used in the system at the filler plug shown in Figure 19. Add oil until it reaches the level plug shown. If this is not done before the upper brake assembly is installed, it will be very difficult to obtain access to the filler plug.

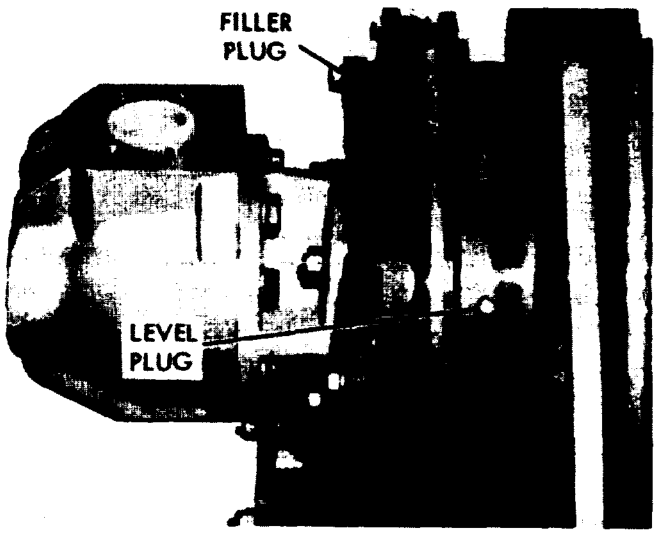


Figure 19. Primary Drive Filler and Level Plugs

8. Refer to Figure 20 and install the brake assembly as shown. Note that shims are sometimes used at the point shown. However, no shims should be used unless the winch was originally provided with them, in which case the sameshims must be reused. The slotted brake pad is adjustable to place the pads firmly against the brake disc. However, this adjustment should not be touched after it has once been made. Any further adjustment of the winch brake should be made as described below.

9. After completing assembly of the winch, check and adjust each brake assembly as follows: See Figure 21.

A. Insert a 1/8 inch spacer or feeler gage at the point shown.

B. Using an open end or boxwrench, tighten the adjusting nuts on each side evenly until the gap at the point illustrated is 1/8 inch.

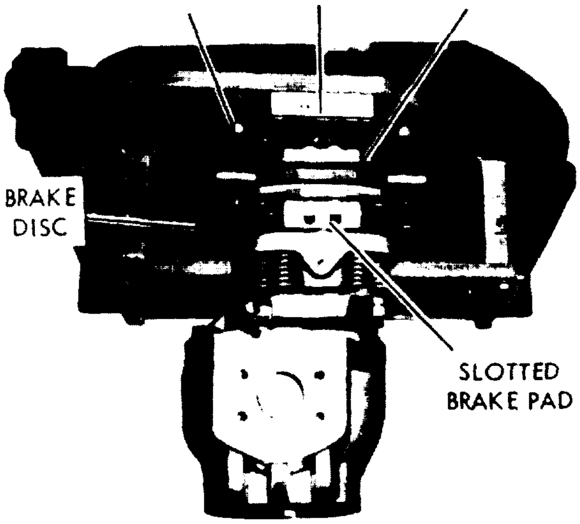


Figure 20. Winch Brake Assembly

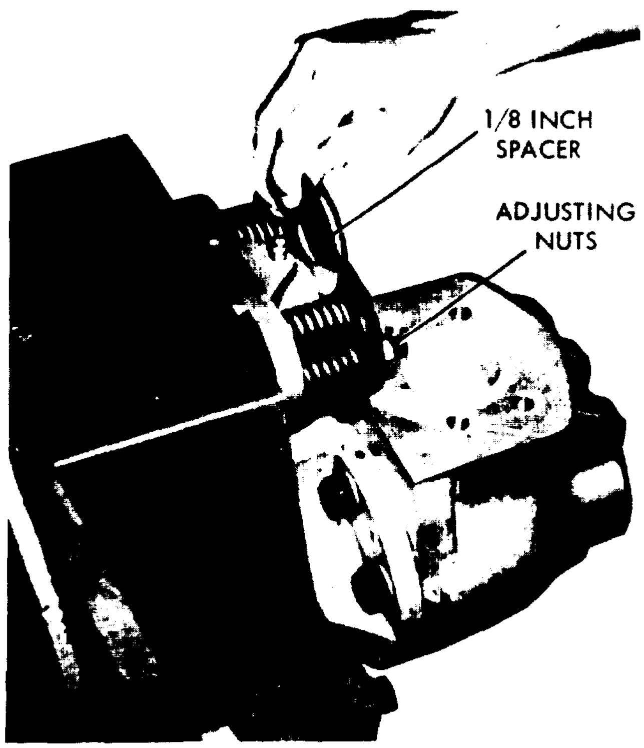


Figure 21. Adjusting Brake Gap

BRAKE DISASSEMBLY AND REPAIR

GENERAL

It is possible to remove and replace both brake pads (Figure 20) by loosening the adjusting nuts to relieve spring tension and removing the two pad mounting capscrews. It is not usually necessary to remove the entire brake assembly. However, if it is decided to completely disassemble the brake for any reason, it will break down into the components shown in Figure 22.

Reassembly is basically the reverse of 'disassembly. Be sure that all components are clean and serviceable before reassembly. Observe the following points:

1. Dip the piston and the O-ring (Figure 22) in the fluid used in the system and assemble the O-ring on the piston. Press the piston into the piston housing bore, keeping it square to avoid scoring the bore. Push it all the way in.

2. After reassembly and installation, be sure to adjust spring pressure and to bleed the system as described below.

BLEEDING THE BRAKE

If the brake is completely disassembled, it will be necessary to bleed the brake actuating cylinder when it is reassembled. To do so, attach a clear flexible bleeder tube to the bleed fitting shown in Figure 21. Place the other end of the tube in a jar containing a small amount of the same fluid used in the system. The end of the tube must be below the surface of the fluid to prevent air from entering. Loosen the bleeder valve one turn.

Then, using the winch lever, release brake spring tension (the brake is hydraulically released-spring applied) and observe that all air bubbles escape until only solid fluid comes out of the bleeder screw. Tighten the bleeder screw while fluid continues to escape to prevent air from entering the system. Do the same for the other brake assembly if your winch has two.

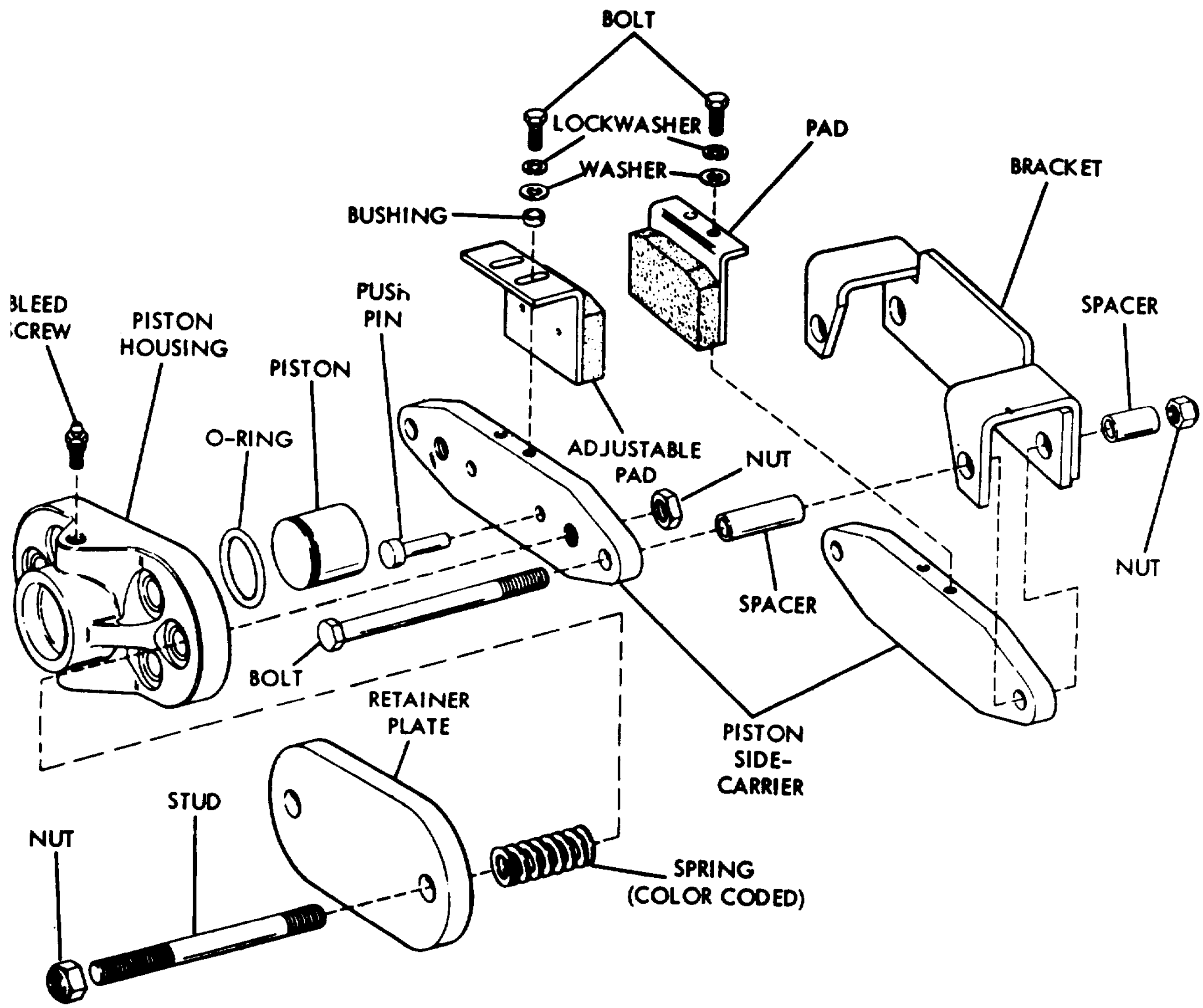


Figure 22. Brake Assembly

SECTION XI

POWER TRAIN DRIVE UNIT COMPONENTS

SUBSECTION **PAGE**

11B. SINGLE-REDUCTION HYPOID DRIVE UNIT

SUB-SECTION 11A

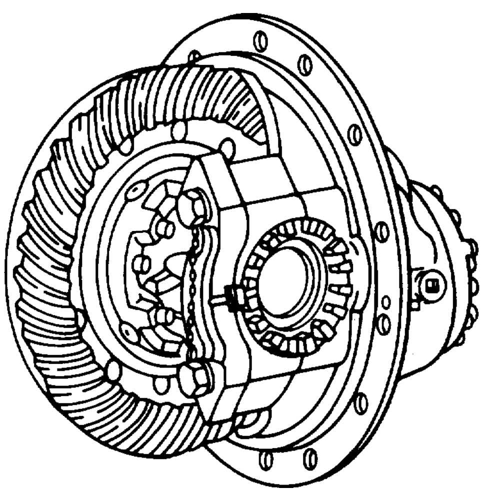
SINGLE-REDUCTION DRIVE UNIT

ROCKWELL-STANDARD SINGLE-REDUCTION DRIVE UNITS (Figure 11-3).

CARE AND MAINTENANCE

The Rockwell-Standard Single Reduction Final Drive employs a heavy duty spiral bevel or hypoid pinion and gear. The differential and gear assembly is mounted on tapered roller bearings. The straddle mounted pinion has two tapered roller bearings in front of the pinion teeth which take the forward and reverse thrust and a third bearing behind the pinion teeth to carry the radial load.

Single-Reduction Final Drives are available in a wide range of gear ratios and sizes to cover most operating conditions. (Figure 11-1).



TA222168

Figure 11-1. Single-Reduction Final Drive

REMOVE DIFFERENTIAL CARRIER FROM HOUSING (Figure 11-2)

A. Remove plug from bottom of axle housing and drain lubricant.

B. Remove the axle shaft stud nuts, lock washers and tapered dowels.

WARNING

Do not hit the circular driving lugs on the shaft head - this may cause the lugs to shatter and splinter. Wear protective safety glasses. Do not use chisels or wedges to loosen the shaft or dowels - this will damage the hub, shaft and oil seal.

CAUTION

Axleshaft weighs 80 Ibs. Get help if necessary for removal.

C. Remove the axle shaft from the drive unit and housing.

D. Disconnect universal at pinion shaft.

E. Remove carrier to housing stud nuts and washers. Loosen two top nuts and leave on studs to prevent carrier from falling.

F. Break carrier loose from axle housing with rawhide mallet.

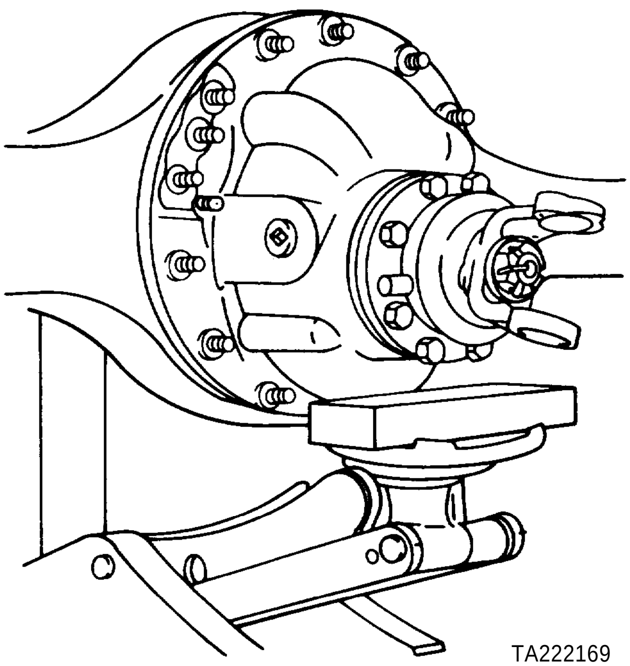


Figure 11-2. Carrier Removal

CAUTION

Carrier weighs 400 Ibs. Carrier will not sit flat on roller jack without a cradle.

G. Remove top nuts and washers and work carrier free. A small pinch bar may be used to straighten the carrier in the housing bore. However, the end must be rounded to prevent indenting the carrier flange. A roller jack may be used to facilitate removal of carrier.

DISASSEMBLE CARRIER

Place carrier in suitable holding fixture as illustrated. Prints of carrier repair stand are available upon request.

NOTE

If the initial inspection indicates that the drive gear is not going to be replaced, we suggest the established backlash be measured and noted for reference and used at reassembly.

REMOVE DIFFERENTIAL AND GEAR ASSEMBLY (Figure 11-4)

A. Loosen jamnut and back off thrust block adjusting screw (Figure 11-5).

B. Center punch one differential carrier leg and bearing cap to identify for properly reassembling (Figure 11-6).

C. Cut lockwire, if used. Remove capscrew and adjusting nut locks.

D. Remove bearing cap stud nuts or capscrews, bearing caps and adjusting nuts.

E. Lift out differential and gear assembly (Figure 11-7).

F. Remove thrust block, if used, from inside of carrier housing.

DISASSEMBLE DIFFERENTIAL CASE AND GEAR ASSEMBLY (Figure 11-8)

A. If original identification marks are not clear, mark differential case halves with a punch or chisel for correct alignment on reassembling.

B. Cut lockwire, if used, remove bolts and separate case halves.

C. Remove spider, pinions, side gears and thrust washers.

D. If necessary, remove rivets and separate gear and case.

REMOVE GEAR RIVETS (Figure 11-9)

1. Carefully center punch rivets in center of head.

2. Use drill 1/32” smaller than body of rivet to drill through head.

3. Press out rivets.

SHOWING HOW HOLES IN FLANGE WERE ELONGATED WHEN RIVETS WERE CHISELED OUT (FIGURE 11-9)

E. If necessary to replace differential bearings, remove with a suitable puller (Figure 11-10).

REMOVE PINION AND CAGE ASSEMBLY

A. Hold flange or yoke with suitable tool and remove pinion shaft nut and washer (Figure 11-11).

B. Remove flange or yoke with a suitable puller. *Driving tie flange off will cause runout* (Figure 11-12).

C. Remove pinion cage stud nuts or capscrews.

D. Remove bearing cover and oil seal assembly.

E. Remove bearing cage. Original may have puller holes (Figure 11-13).

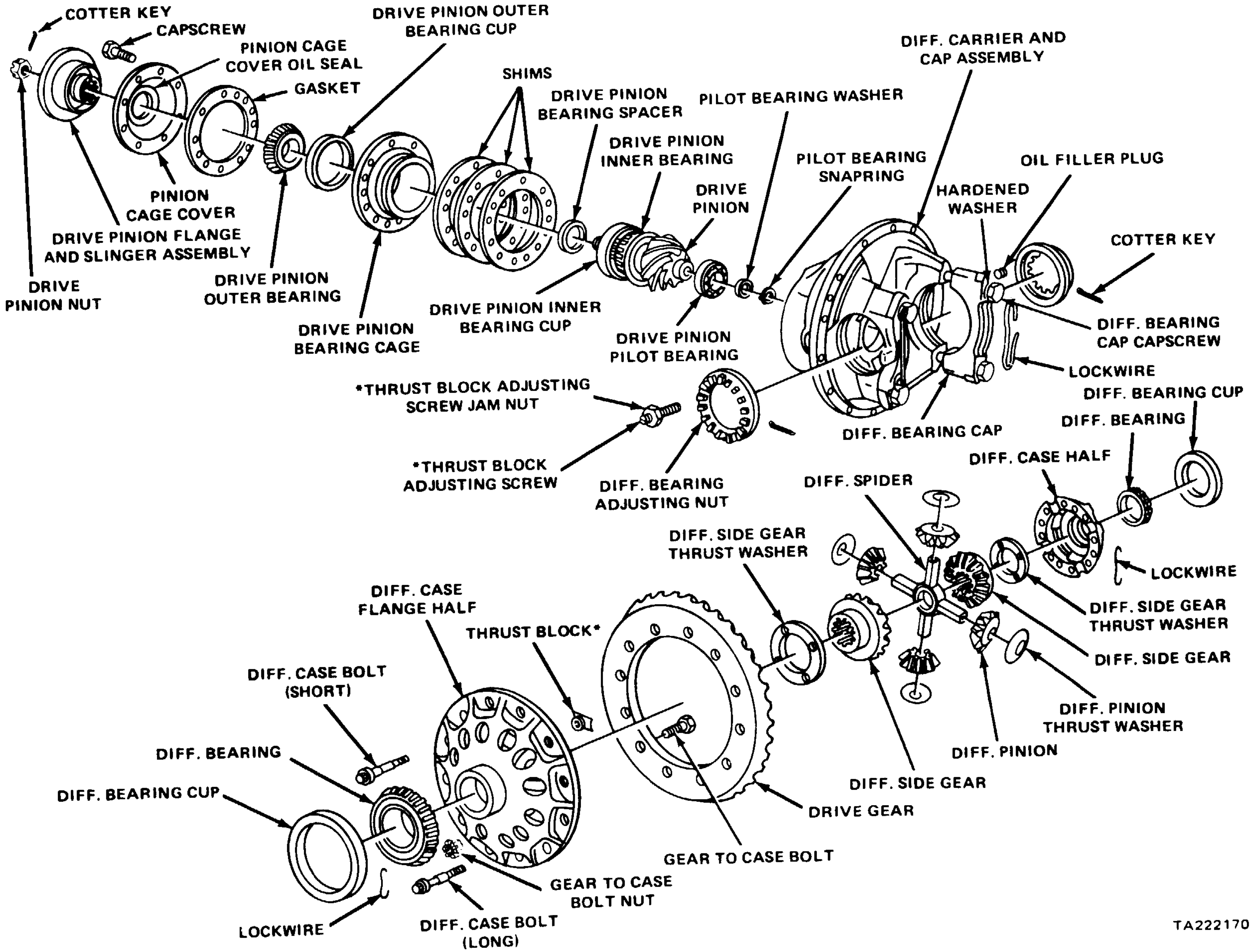


Figure 11-3. Parts Identification and Nomenclature

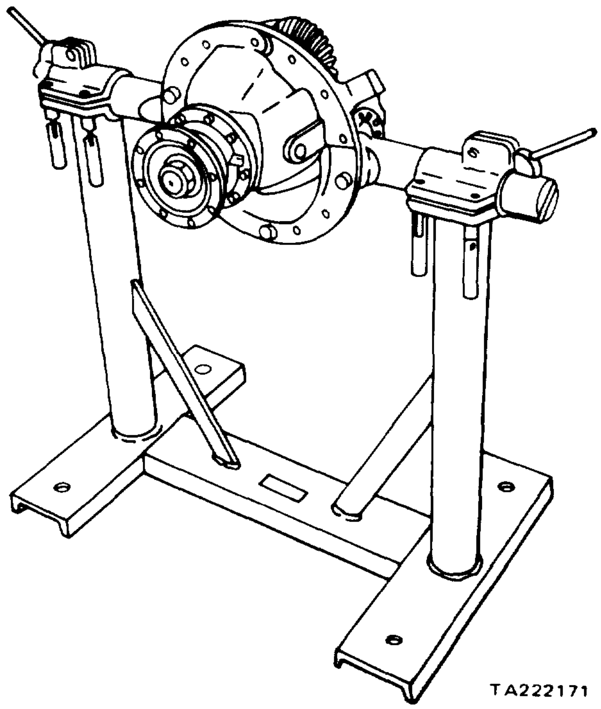


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Figure 11-4. Carrier Repair Stand

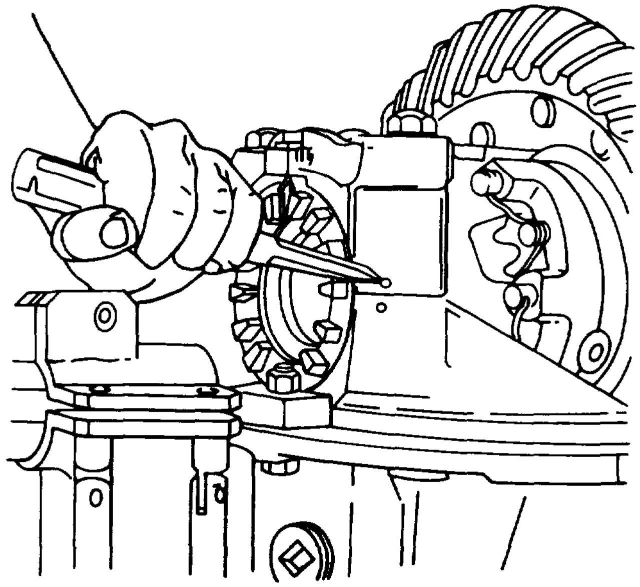

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Figure 11-6. Center Punch Carrier Legend Bearing Cap

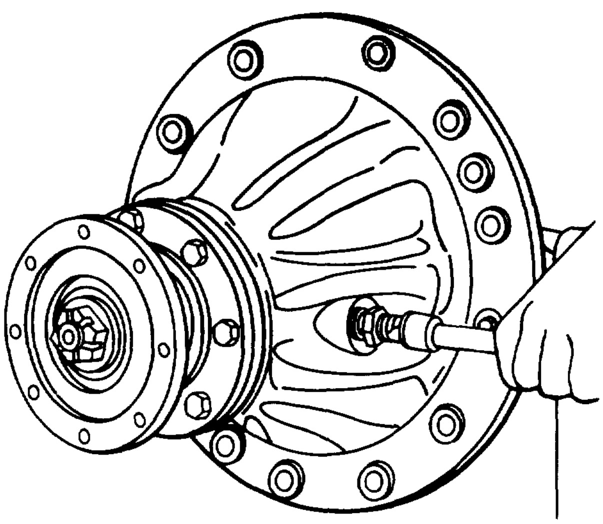

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Figure 11-5. Thrust Block Jamnut

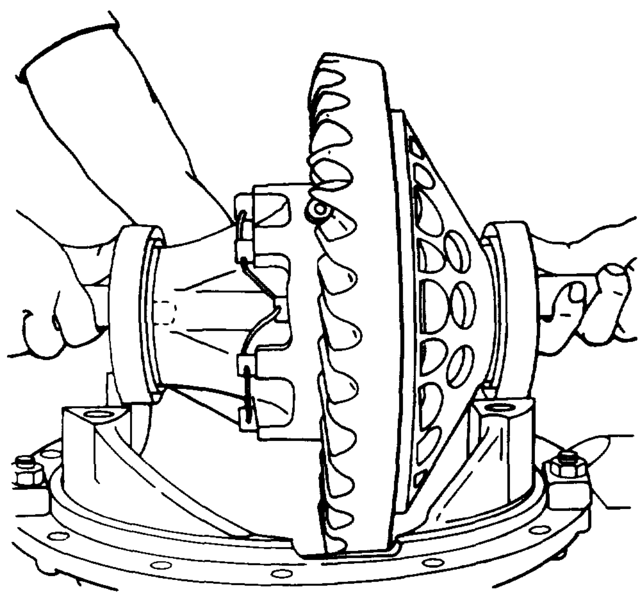

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Figure 11-7. Removing Differential and Gear Assembly

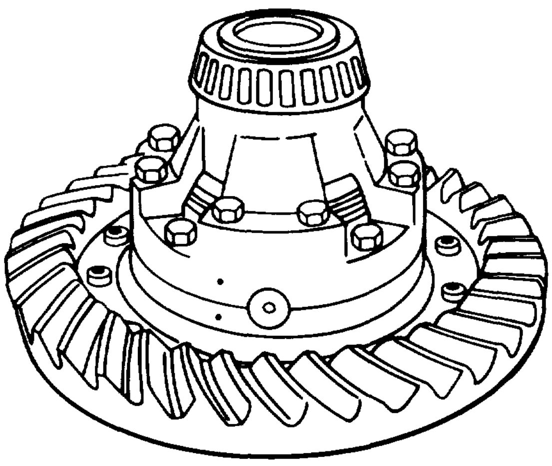

Figure 11-8. Differential Case and Gear Assembly

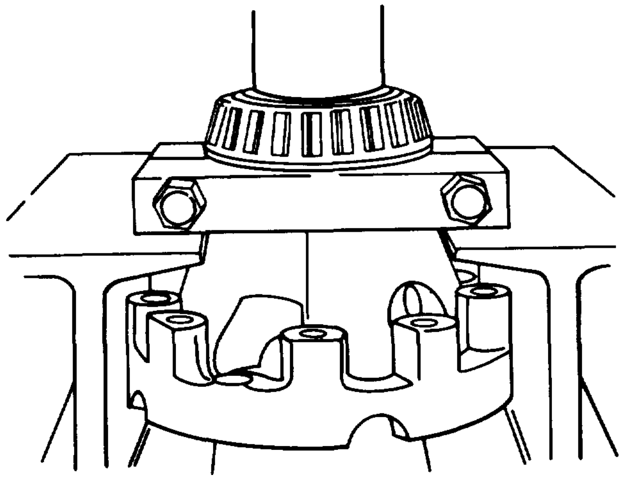

Figure 11-10. Removing Differential Bearings

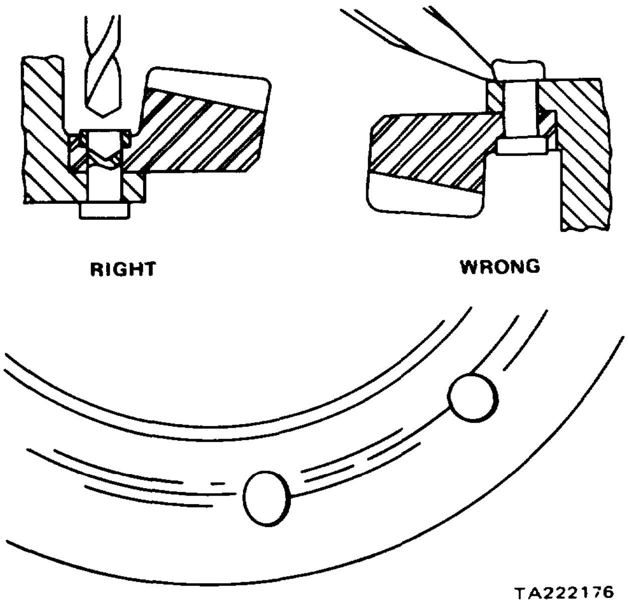

Figure 11-9. Removing Gear Rivets

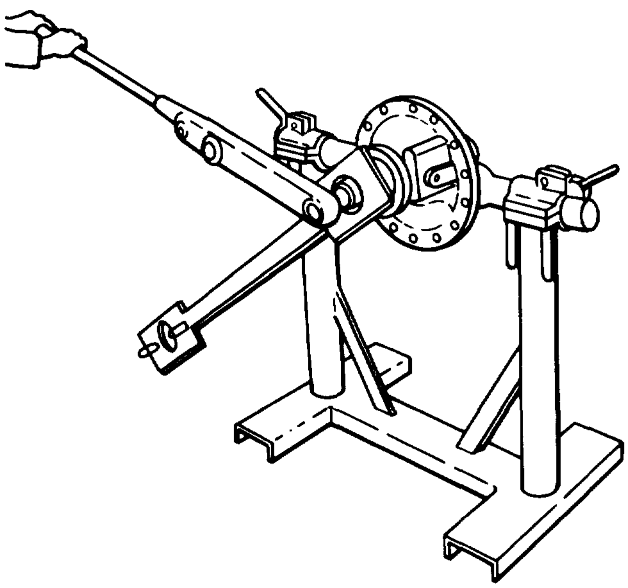

Figure 11-11. Removing Shaft Nut and Washer

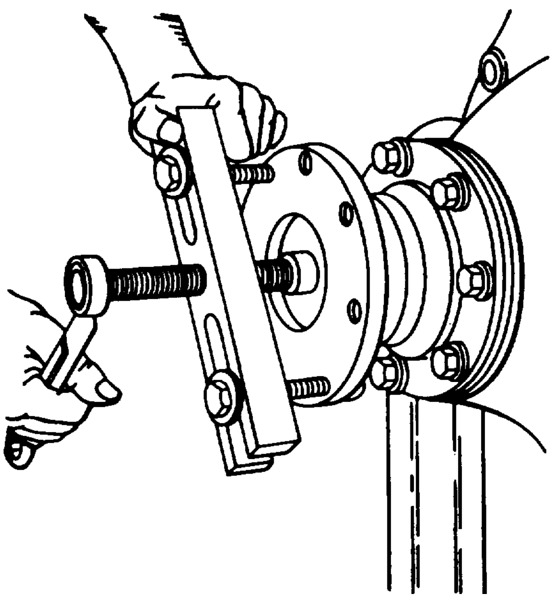

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Figure 11-12. Carrier Flange Removal

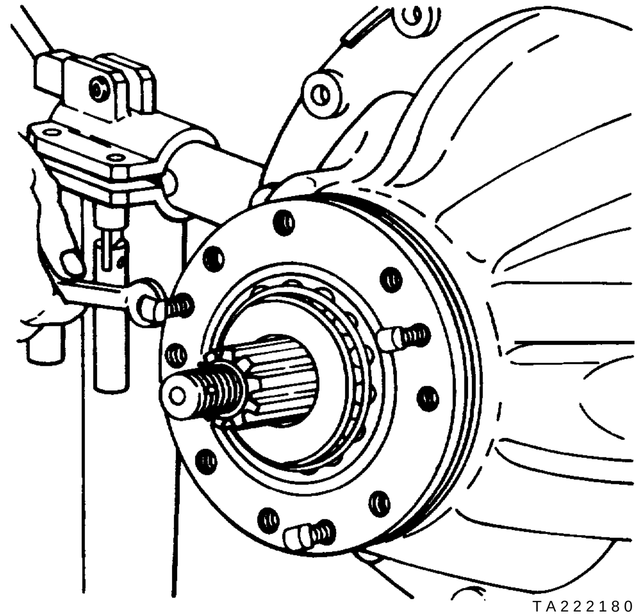

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Figure 11-13. Bearing Cage Removal

CAUTION

The use of a pinch bar will damage the shims. Driving pinion from inner end with a drift will damage the bearing lockring groove.

F. Wire shim pack together to facilitate adjustment on reassembling.

DISASSEMBLE PINION AND CAGE ASSEMBLY

Both splined and tapered pinion shafts are used in single reduction carriers. Where the tapered shaft is used, the thrust bearings are adjusted by means of adjusting screws and locknuts or thrust screws. On the splined shaft this adjustment is secured with a selective spacer or spacer combination.

A. Tap shaft out of cage with soft mallet or press shaft from cage.

B. Remove outer bearing from cage.

C. Remove spacer or spacer combination from pinion shaft.

D. If necessary to replace rear thrust bearing or radial bearing, remove with suitable puller.

E. Remove oil seal assembly from bearing cover.

Splined Shaft (Figure 11-14)

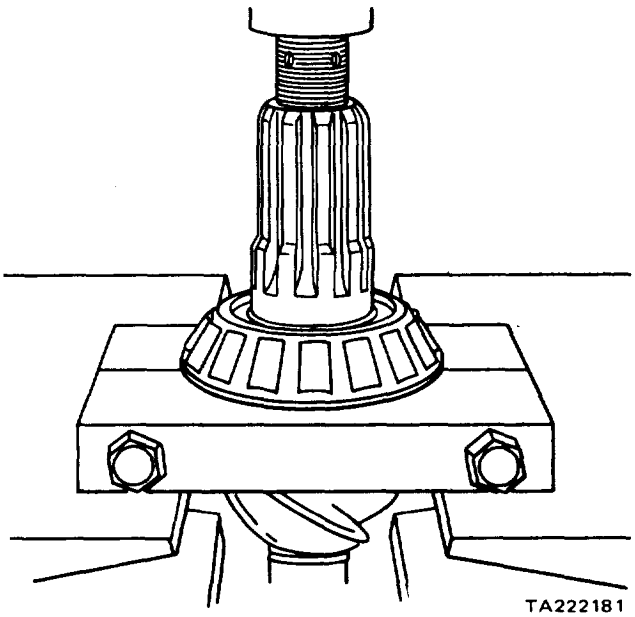

Figure 11-14. Pinion Shaft Bearing Removal

Tapered Shaft

A. Straighten lock washer and remove locknut, washer, adjusting nut and thrust washer.

B. Tap pinion out of cage with soft mallet or press shaft from cage.

C. Remove bearing from cage.

D. Remove bearings from shaft with suitable puller if necessary.

E. Remove oil seal assembly from bearing cover.

PREPARE FOR REASSEMBLY CLEAN, INSPECT AND REPAIR

Parts having ground and polished surfaces such as gears, bearings, shafts and collars should be cleaned in solvent P-D-680(SD-II).

GASOLINE SHOULD BE AVOIDED.

CAUTION

Do NOT clean these parts in a hot solution tank or with water and alkaline solutions such as sodium hydroxide, orthosilicates or phosphates.

We do NOT recommend steam cleaning assembled drive units after they have been removed from the housing. When this method of cleaning is used, water is trapped in the cored passages of the castings and in the close clearances between parts as well as on the parts. This can lead to corrosion or rust of critical parts of the assembly and the possibility of circulating particles in the lubricant. Premature failure of bearings, gears and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

WARNING

Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

ROUGH PARTS

Rough parts such as differential carrier casting, cast brackets and some brake parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali.

COMPLETE ASSEMBLIES

Completely assembled axles, torque dividers and transfer cases may be steam cleaned on the outside only, to facilitate initial removal and disassembly, providing all openings are closed. Breathers, vented shift units, and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

DRYING

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

CORROSION PREVENTION

Parts that have been cleaned, dried, inspected and are to be immediately reassembled should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good RUST PREVENTIVE and wrapped in special paper or other material designed to prevent corrosion or rust.

INSPECT

It is impossible to overstress the importance of careful and thorough inspection of drive unit parts prior to reassembly. Thorough visual inspection for indications of wear or stress, and the replacement of such parts as are necessary will eliminate costly and avoidable drive unit failure.

A. Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves. Avoid the use of drifts and hammers. They may easily mutilate or distort component parts.

B. Inspect hypoid gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. When necessary to replace either the pinion or gear of hypoid set, the entire gear set should be replaced.

C. Inspect the differential assembly for the following:

1. Pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions and differential gears. Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.

2. Wear or damage to the differential pinion and side gear teeth. Always replace differential pinions and side gears in sets.

D. Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

REPAIR

A. In the interest of safety and preserving the service life of drive axle assemblies, Rockwell-Standard recommends that drive axle assemblies not be repair welded. Repair welding can detract from the structural integrity of a component, particularly as to heat treated parts where the benefit of heat treatment may be nullified by the welding.

Since it can be extremely hazardous to repair weld corn- ponents of any kind, repair welding can be approved only where stringent controls are imposed and equipment, customarily located only at manufacturing facilities, is employed, so as to minimize the potentially detrimental effects of repair welding.

In deciding whether to repair or scrap any damaged part, always keep in mind that we, as manufacturers. never hesitate to scrap any part which is in any way doubtful.

B. Hex nuts with rounded corners, all lock washers, oil seals and gaskets should be replaced at the time of overhaul.

Use only genuine Rockwell-Standard replacement parts for satisfactory service. For example, using gaskets of foreign, material generally leads to mechanical trouble due to variations in thickness and the inability of certain materials to withstand compression, oil, etc.

C. Remove nicks, mars, and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. A fine mill file of India stone is suitable for this purpose. Studs must be tight prior to reassembling the parts.

D. All Rockwell-Standard bronze bushed differential pinions should be ball burnished after bushing installation. Install the bushing with a small stepped drift. The small O.D. should be .010” smaller than the bushing burnished I.D. and 1-½ times bushing length. Always install bushings so end is even with the I.D. chamfer or about 1/16” below the spherical surface.

E. When assembling component parts use a press where possible.

F. lighten all the nuts to the specified torque. (See torque limits following service instructions.) Where a lockwire is employed, use soft iron locking wire to prevent possibility of wire breakage.

G. The burrs, caused by lock washers, at the spot face of stud holes of cages and covers should be removed to assure easy reassembly of these parts.

REASSEMBLE CARRIER

REASSEMBLE PINION AND CAGE ASSEMBLY (Figure 11-15).

Splined Shaft

A. If new cups are to be installed, press firmly against pinion bearing cage shoulders.

B. Lubricate bearings and cups with light machine oil.

C. Press rear thrust and radial bearings firmly against the pinion shoulders with a suitable sleeve that will bear only on bearing inner race.

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Figure 11-15. Pinion Shaft Bearing Installation

D. Install radial bearing lockring and squeeze ring into pinion shaft groove with pliers.

E. Insert pinion and bearing assembly in pinion cage and position spacer or spacer combination over pinion shaft.

F. Press front bearing firmly against spacer.

G. Rotate cage several revolutions to assure normal bearing contact.

H. While in press under pressure, check bearing preload torque. Wrap soft wire around cage and pull on horizontal line with pound scale. If a press is not available, the pinion nut may be tightened to the correct torque and preload checked (Figure 11-16).

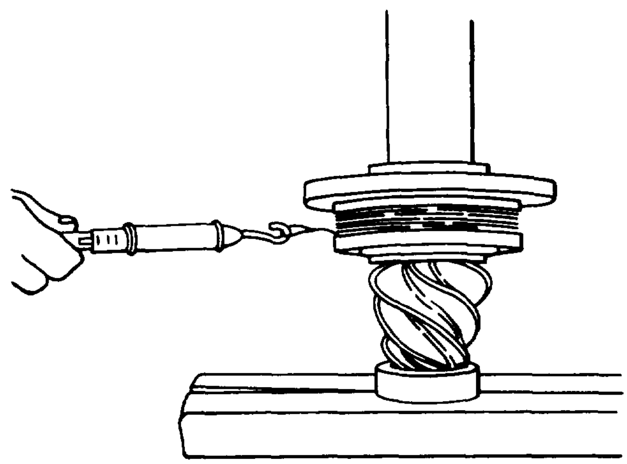

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Figure 11-16. Preload Torque Check

The correct pressures and torque for checking pinion bearing preload are as follows:

PINION SHAFT THREAD SIZE	PRESSURE REQUIRED TO OBTAIN CORRECT PRE-LOAD	NUT TORQUE REQUIRED (FOR FASTENERS USING LOCKWIRE OR COTTER PINS) TO OBTAIN CORRECT PRE-LOAD	NUT TORQUE REQUIRED (FOR FASTENERS NOT USING LOCK-WIRE OR COTTER PINS) TO OBTAIN CORRECT PRE-LOAD
7/8" x 20	6 tons	175-200 lb. ft.	200-275 lb. ft.
7/8" x 20	6 tons*	200-275 lb. ft.	
1" x 20	6 tons	300-400 lb. ft.	300-400 lb. ft.
1-1/4" x 18	11 tons	700-900 lb. ft.	700-900 lb. ft.
1-1/2" x 12	14 tons	800-1100 lb. ft.	
1-1/2" x 18	14 tons	800-1100 lb. ft.	800-1100 lb. ft.
1-3/4" x 12	14 tons	800-1100 lb. ft.	900-1200 lb. ft.
2"x 12	14 tons		1000-1300 lb. ft.

*Elastic Stopnut

Use rotating torque, not starting torque.

If rotating torque is not within 5 to 15 pound inches, use thinner spacer to increase or thicker spacer to decrease preload.

Example: Assuming pinion cage diameter to be 6 inches, the radius would be 3 inches and with 5 pounds pull would equal 15 pound inches preload torque.

I. Press flange or yoke against forward bearing and install washer pinion shaft nut.

J. Place pinion and cage assembly over carrier studs, hold flange and tighten pinion shaft nut to the correct torque. The flange must be held with a suitable tool or fixture to tighten nut (Figure 11-17).

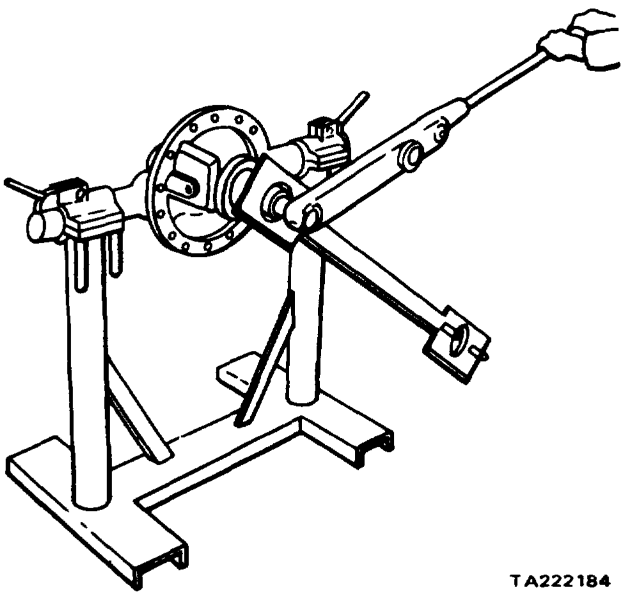

Figure 11-17. Torquing Pinion Shaft Nut

K. Recheck pinion bearing preload torque. If rotating torque is not within 5 to 15 pound inches, repeat the foregoing procedure.

L. Hold flange and remove pinion shaft nut and flange.

M. Lubricate pinion shaft oil seal and cover outer edge of seal body with a non-hardening sealing compound. Press seal against cover shoulder with seal driver (Figure 11-18).

N. Install new gasket and bearing cover.

O. Press flange against forward bearing and install washer and pinion shaft nut.

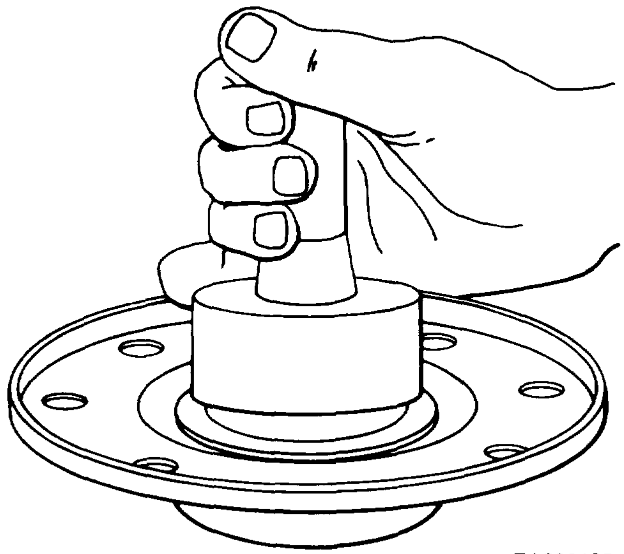

Figure 11-18. Installing Pinion Shaft Seal

P. Tighten to the correct torque. If a drilled or castellated fastener is employed install a cotter key.

NOTE

Do not back off nut to align cotter key holes.

Tapered Shaft (Figure 11-19)

A. Press rear thrust and radial bearings firmly against the pinion shaft shoulder.

B. Install radial bearing lockring and squeeze ring into pinion shaft groove with pliers.

C. If new cups are to be installed, press firmly against pinion cage shoulders.

D. Lubricate bearings and cups with light machine oil.

E. Install forward bearing, thrust washer and adjusting nut.

F. Install new lock washer and the locknut.

G. Adjust pinion bearing preload to 5 to 15 pound inches with locknut tightened securely against washer.

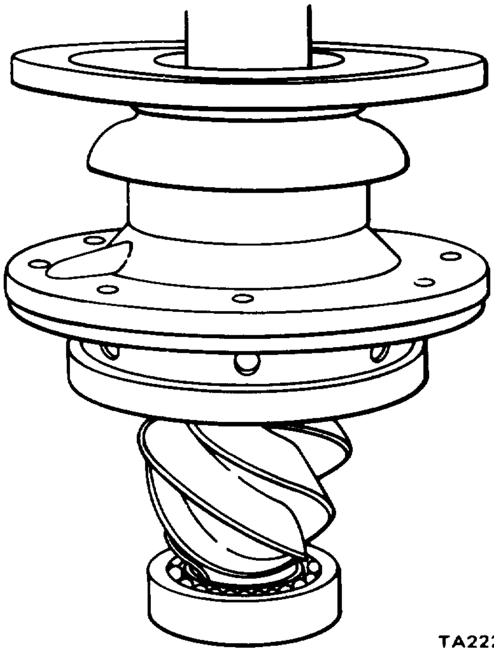

Figure 11-19. Installing Tapered Shaft Rear Bearing

NOTE

The locknut must be tight to secure the correct preload.

H. Bend lock washer when correct adjustment has been secured.

I. Lubricate pinion shaft oil seal and cover outer edge of seal body with a non-hardening sealing compound. Press seal against cover shoulder with seal driver.

J. Install new gasket and bearing cover. Cover should be carefully installed to prevent cutting seal on keyway.

K. Install key, press flange on taper and install washer and pinion shaft nut.

L. Tighten to the correct torque. If a drilled or castellated fastener is employed install a cotter key.

Do not back off nut to align cotter key holes

INSTALL PINION AND CAGE ASSEMBLY

A. Install correct shim pack. Locate thin shims on both sides for maximum sealing ability.

B. Position pinion and cage assembly over studs and tap into position with soft mallet.

C. Install lock washers and stud nuts or capscrews. Tighten to the correct torque.

ASSEMBLE DIFFERENTIAL AND GEAR

A. Rivet the hypoid gear to the case half with new Rockwell-Standard rivets. Rivets should not be heated, but always upset cold. When the correct rivet is used, the head being formed will be at least l/B" larger in diameter than the rivet hole. The head will then be approximately the same height as the preformed head. Excessive pressure will cause distortion of the case holes and result in gear eccentricity.

Tonnage required for squeezing cold rivets. These pressures are approximate for annealed steel rivets and pressure can be adjusted to suit individual working conditions.

DIAMETER OF RIVET	TONNAGE REQUIRED
7/16"	22
1/2"	30
9/16"	36
5/8"	45

Final pressure should be held for approximately one minute to make sure the rivet has filled the hole.

Differential case and gear bolts are available for service replacement of rivets. The use of bolts greatly facilitates servicing these units in the field and eliminates the need for special equipment necessary to correctly cold upset rivets. Consult chart for service bolt instruction shown with the torque chart on last page of manual.

DIFFERENTIAL PINION AND SIDE (Figure 11-20)

B. Lubricate differential case inner walls and all component parts with axle lubricant.

C. Position thrust washer and side gear in bevel gear and case half assembly.

D. Place spider with pinions and thrust washers in position.

E. Install component side gear and thrust washer.

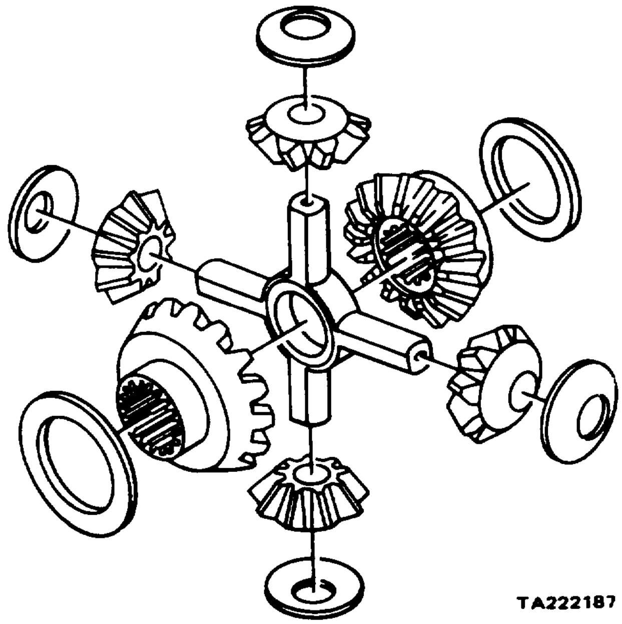

Figure 11-20. Differential Gears and Washers

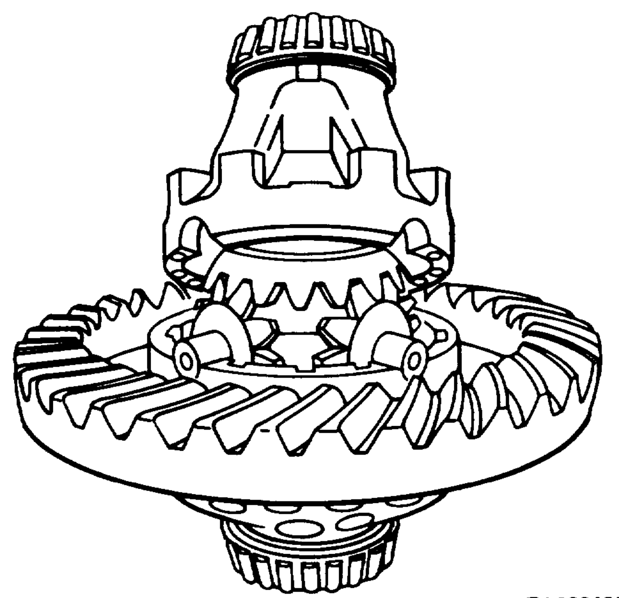

Figure 11-21. Differential Case Assembly

F. Align mating marks, position component case half and draw assembly together with four bolts or capscrews equally spaced.

G. Check assembly for free rotation of differential gears and correct if necessary.

H. Install remaining bolts and capscrews, tighten to the correct torque. If a drilled or castellated fastener is employed, install a lockwire.

I. If bearings are to be replaced, press squarely and firmly on differential case halves (Figure 11-21).

INSTALL BEARING CUPS IN CARRIER LEG BORES (Figure 11-22)

A. Temporarily install the bearing cups, threaded adjusting rings where employed and bearing caps. Tighten the capscrews to the proper torque.

B. The bearing cups must be of a hand push fit in the bores, otherwise the bores must be reworked with a scraper or some emery cloth until a hand push fit is obtained. Use a blued bearing cup as a gauge and check the fits as work progresses. Once the cups fit properly, remove the bearing caps.

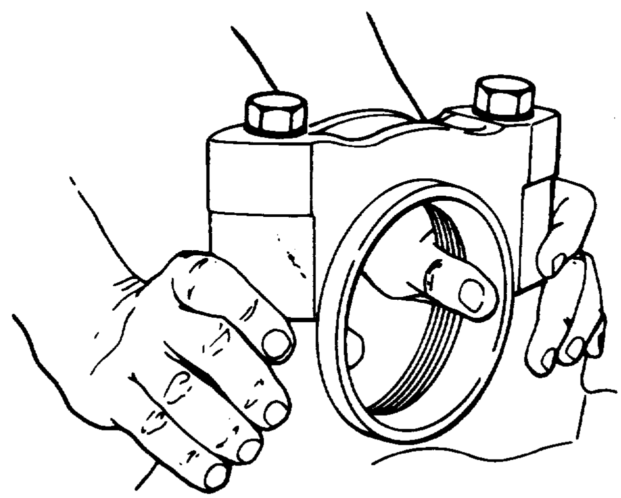

Figure 11-22. Bearing Cup Installation

INSTALL DIFFERENTIAL AND GEAR ASSEMBLY (Figure 11-23)

A. After checking related parts, coat the differential bearing cones and cups with specified rear axle lubricant.

B. Place the bearing cups over the assembled differential bearing cones, then position the differential assembly in the carrier.

C. Insert bearing adjusting nuts and turn handtight against bearing cups.

D, Install bearing caps in the correct location as marked and tap lightly into position.

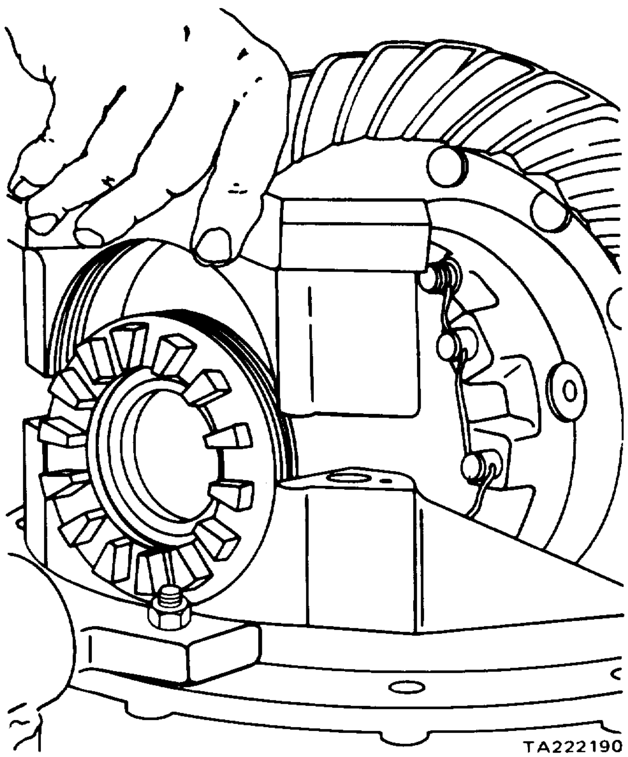

Figure 11-23. Installing Differential Assembly

NOTE

If bearing caps do not position properly, adjusting nuts may be cross threaded. Remove caps and reposition the adjusting nuts forcing caps into position will result in irreparable damage to the carrier housing or bearing caps.

E. Install flat washers where used and stud nuts or cap screws. Tighten stud nuts or capscrews to correct torque. If carrier leg fasteners are drilled or castellated, lockwire after final adjustments are made.

ADJUST DIFFERENTIAL BEARING PRELOAD (Figure 11-24)

A. Using dial indicator at backface of gear, loosen the bearing adjusting nut on tie side opposite gear only sufficient to notice end play on the indicator.

B. Tighten the same adjusting nut only sufficient to obtain .000 end play.

C. Check gear for runout. If runout exceeds .008", remove differential and check for cause.

D. Tighten adjusting nuts one notch each from .000 end play to preload differential bearings.

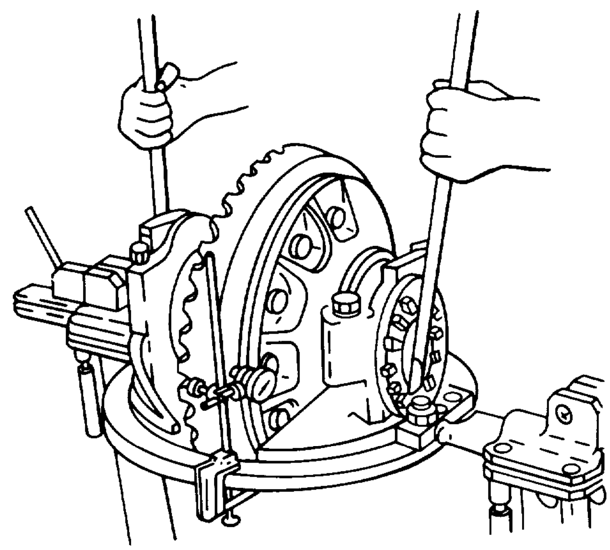

Figure 11-24. Adjusting Differential Bearing Preload

CHECK HYPOID GEAR BACKLASH (Figure 11-25)

If the drive gear is not going to be replaced, we suggest the established backlash recorded before disassembly be used. For new gears the new backlash should be initially set at .010". Adjust backlash by moving the gear only. This is done by backing off one adjusting ring and advancing the opposite ring the same amount.

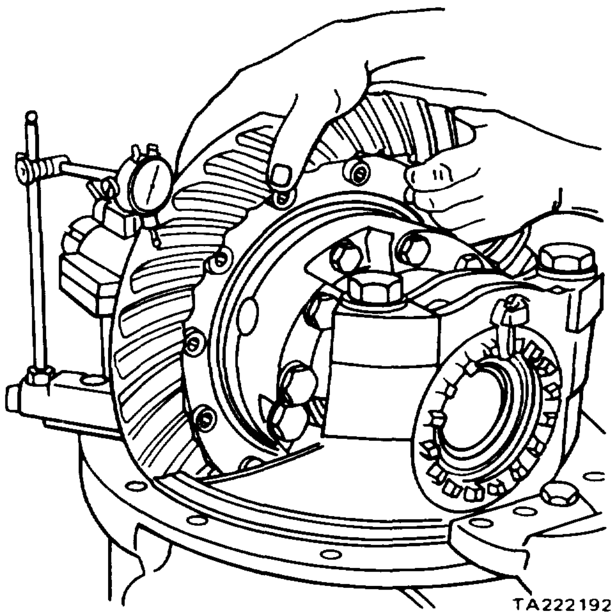

Figure 11-25. Checking Gear Backlash

CHECK TOOTH CONTACT (Figure 11-26)

Apply oiled red lead lightly to the hypoid gear teeth. When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts.

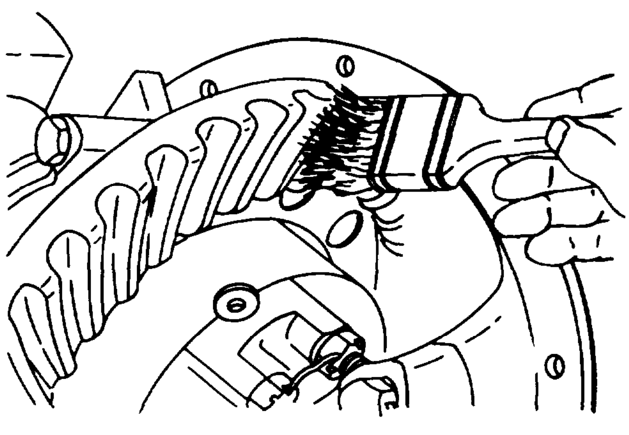

Figure 11-26. Checking Tooth Contacts

Sharper impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion, When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when drive side is correct. As a rule, coating about twelve teeth is sufficient for checking purposes.

After obtaining a satisfactory tooth contact, especially in relation to the top and bottom of the tooth, the back-lash can be altered within the limits of .005" - .015" to obtain a better contact position relative to the length of the tooth.

A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

After correct tooth contact has been established, install adjusting nut locks and capscrews. Tighten capscrews and lockwire to bearing cap capscrews.

CORRECT TOOTH CONTACT ASSURES LONGER GEAR LIFE

SATISFACTORY TOOTH CONTACT (Figure 11-27) (GEARS UNLOADED)

With adjustments properly made (pinion at correct depth and backlash set at .010") the above contacts will be procured. The area of contact favors the toe and is centered between the top and bottom of the tooth.

The hand rolled pattern shown at left (gears unloaded), will result in a pattern centered in the length of the tooth when the gears are under load shown at right. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear tooth.

SATISFACTORY TOOTH CONTACT (Figure 11-28) (GEARS LOADED)

The pattern on the coast side of teeth will appear the same width as the drive side shown above; however, the over-all length will be centered between the toe and heel of gear tooth.

Set used hypoid gear to have the tooth contacts to match wear patterns. Hand rolled patterns of used gears will be smaller in area and should be at the toe end of wear patterns.

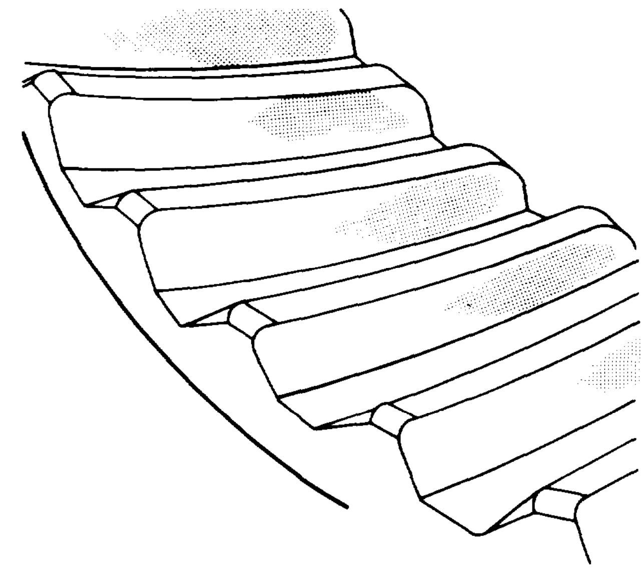

Figure 11-27. Satisfactory Tooth Contact
(Gears Unloaded)

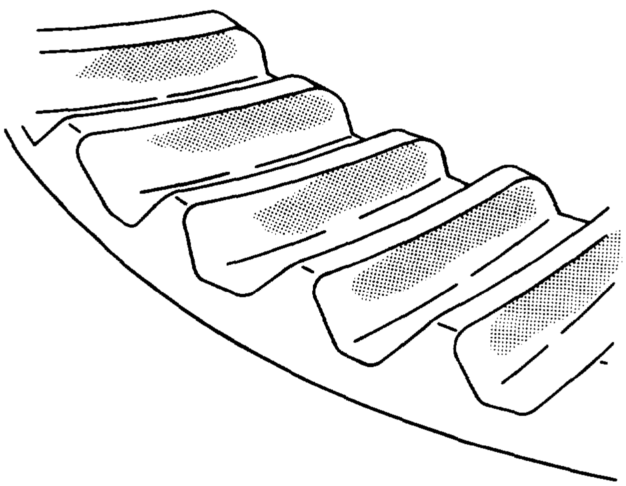

Figure 11-28. Satisfactory Tooth Contact
(Gears Loaded)

INCORRECT TOOTH CONTACT (Figure 11-29)

A high contact indicates pinion is too far out. Set the pinion to the correct depth by removing shims under the pinion cage. Slight outward movement of hypoid gear may be necessary to maintain correct backlash.

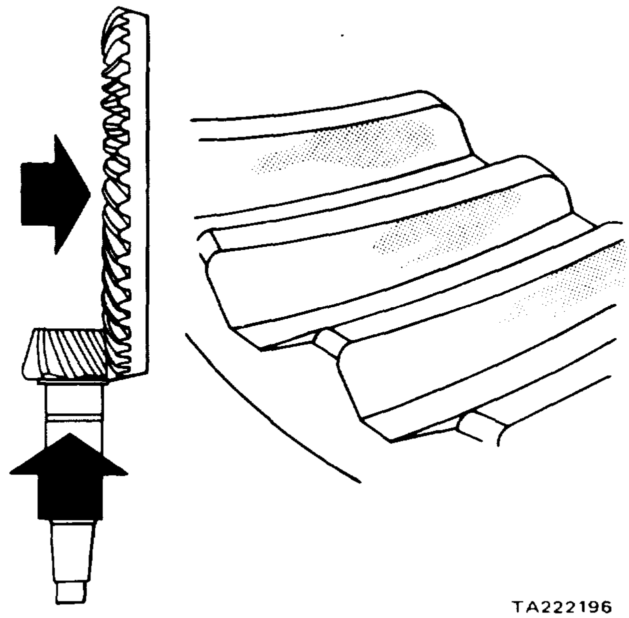

Figure 11-29. Incorrect Tooth Contact

A low contact (Figure 11-30) indicates pinion is too deep. Set the pinion to the correct depth by adding shims under the pinion cage. Slight inward movement of the hypoid gear may be necessary to maintain correct backlash.

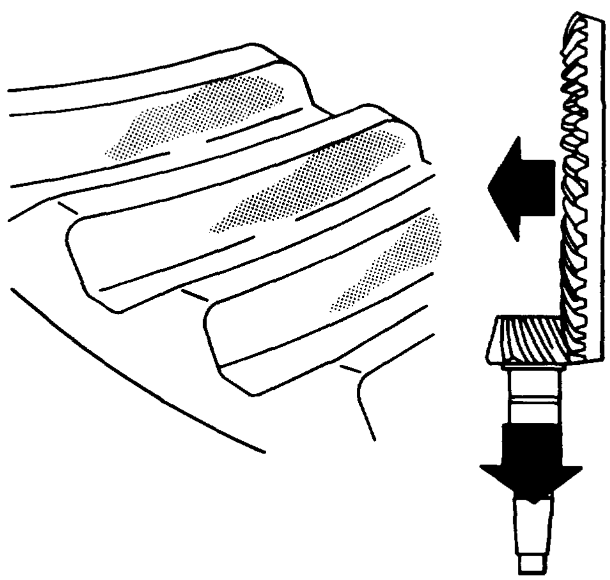

Figure 11-30. Correcting Pinion Depth

INSTALL THRUST SCREW OR BLOCK

A. Remove carrier from stand and position with backface of hypoid or spiral bevel gear upward.

NOTE

Current carrier designs employ only the thrust screw, which may replace the thrust screw and block assembly.

B. Remove adjusting screw and locknut (Figure 11-31).

C. If a thrust block is employed, place thrust block on rear face of hypoid gear and rotate gear until the hole in the thrust block is aligned with the adjusting screw hole.

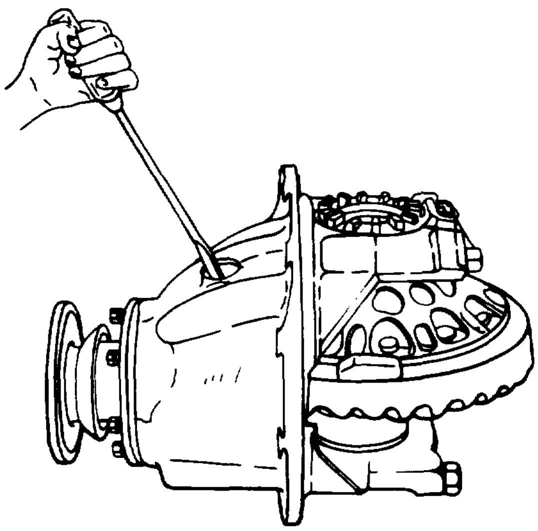

Figure 11-31. Adjusting Screw Removal

D. install thrust screw and locknut and tighten thrust screw sufficient to locate thrust block firmly against back face of hypoid gear (Figure 11-32).

E. To secure the correct adjustment of .010" - .015" clearance, loosen adjusting screw (or thrust screw) 1/4 turn and lock securely with nut.

F. Recheck to assure minimum clearance of .010" during full rotation of bevel gear.

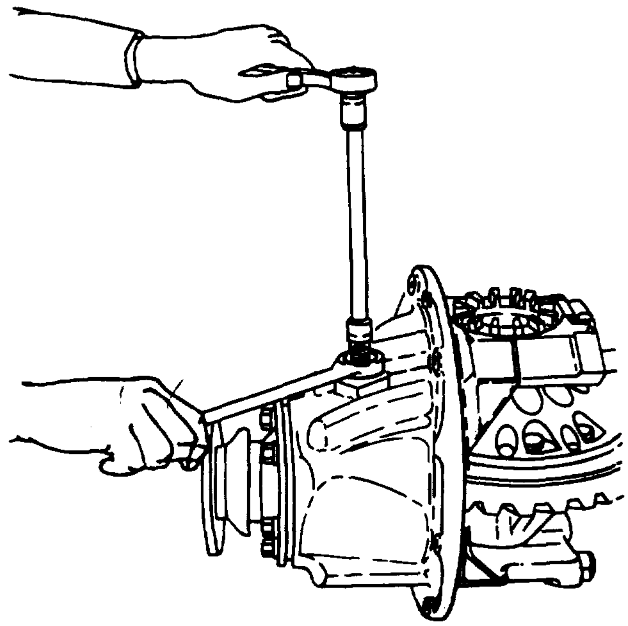

Figure 11-32. Adjusting Screw Installation

CLEAN AND INSPECT HOUSING, ASSEMBLE DRIVE UNIT

A. Remove any accumulation of dirt, grit or gum from housing bowl and sleeves. Clean housing thoroughly with solvent and blow dry with compressed air.

B. Inspect housing for cracks, loose studs, nicks, and burrs at machined surfaces. Remove nicks and burrs with stone or file. Make all necessary repairs or parts replacement before installing drive unit in housing.

C. Install new drive unit to housing gasket over housing studs.

Roll carrier into position on roller jack. Start carrier into housing with four flat washers and nuts equally spaced.

CAUTION

Do not drive carrier into housing with a hammer at the carrier stud flange. The flange may easily be distorted and cause severe oil leakage.

Install lock washers and stud nuts on any studs under carrier housing offsets. It is impossible to start these nuts after carrier is drawn into housing.

D. Tighten the four nuts over flat washers alternately to draw carrier squarely into axle housing.

E. If necessary, remove nuts and flat washers and install taper dowels, lock washers and stud nuts. Tighten to the correct torque.

F. Connect universal at pinion shaft.

G. Install axle shafts.

PREPARATION FOR STORAGE

In the event the carrier is a spare and may not be immediately installed, all gears and bearings should be thoroughly oiled and the carrier placed in a dustproof container.

LUBRICATION

Proper lubrication of the drive units is extremely important. Our "Standard" recommended lubricant is GO SAE 140 viscosity, multipurpose gear lubricant. Unusual operating conditions such as extremes in climatic temperatures may require lubricants of "Optional" viscosities. However, experience has shown that the use of an SAE 140 viscosity grade lubricant will result in longer gear life. Refer to Section III, page 3-3 of this TM for detailed information.

A. Fill axle housing to the correct level with specified lubricant.

B. Lubricate universal joint.

C. Jack up both rear wheels and operate vehicle in high transmission gear at approximately 25 to 30 miles per hour for five minutes to assure satisfactory lubrication of all parts of the carrier assembly.

CAUTION

Do not operate with one wheel jacked up. Operation in this manner will result in overheating the differential spider with resultant galling or shearing of the spider pins.

Both wheel brakes should be free to allow both wheels to rotate at approximately the same speed.

NEW AND RECONDITIONED AXLE SERVICE

The original rear axle lubricant should be drained at the end of the drive-away or before the maximum of 3,000 miles prior to placing the vehicle in regular service. Drain the lubricant initially used in the assembly following reconditioning at the same interval. Completely drain the lubricant while the unit is warm.

Fill axle housings to bottom of level hole with specified lubricant with the vehicle level.

REGULAR AXLE SERVICE

Refer to Section III page 3-10 of this TM for recommended service interval.

Completely drain the lubricant while the unit is warm.

Some newer model axles have a smaller tapped and plugged hole located near and below the housing lubricant level hole. This smaller hole has been provided for the use of a lubricant temperature indicator only and should not be used as a fill or level hole.

MAGNETIC DRAIN PLUGS

Magnetic drain plugs perform the vital function of trapping small metallic particles that circulate in the lubricant, through the gears and bearings, causing rapid wear and premature failure. The magnet must be strong enough to firmly hold the particles under service conditions. We recommend plugs with elements having a minimum pick-up capacity of 2 pounds of low carbon steel in plate or flat bar form.

Spare clean plugs should be kept on hand for replacement at regular intervals. The change schedule can easily be established by periodic plug examination.

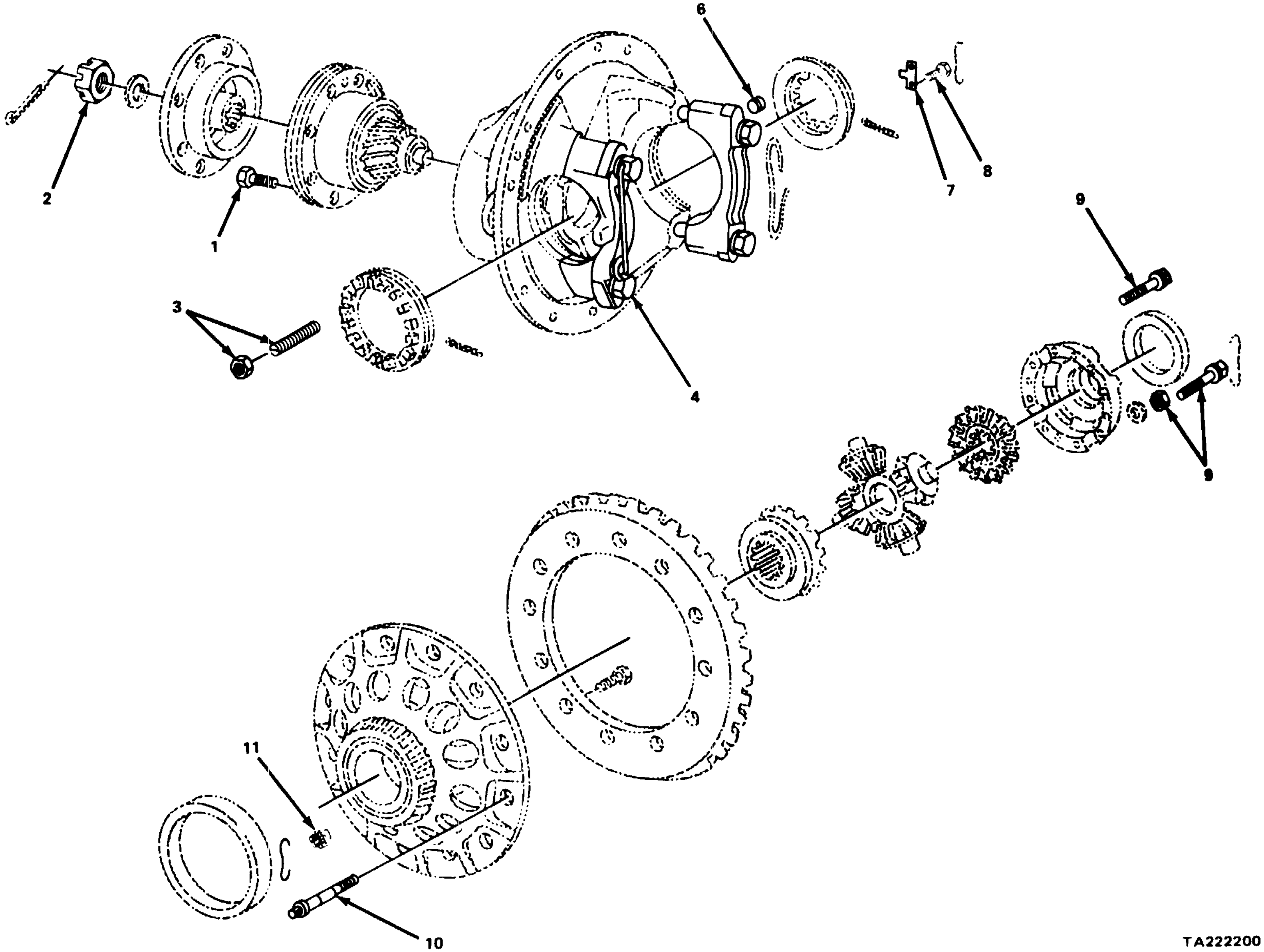

Figure 11-33. Torque Limits

1. PINION BEARING CAGE TO CARRIER CAPSCREWS.

	3/8" - 16	30 - 40 LB. FT. (4.2 - 5.5 mkg.)
	7/16" - 14	50 - 65 LB. FT. (6.9 - 9.0 mkg.)
	1/2" - 13	80 - 105 LB. FT. (11.0 - 14.5 mkg.)
	5/8" - 11	130 - 170 LB. FT. (18.0 - 23.5 mkg.)

2. PINION SHAFT (INPUT) NUTS.

	7/8" - 20	175 - 250 LB. FT. (23.5 - 34.5 mkg.)
	7/8" - 20	ELASTIC STOP NUT
		200 - 275 LB. FT. (27.5 - 38.0 mkg.)
*	1" - 20	300-400 LB. FT. (41.5-55.0 mkg.)
	1-1/4" - 18	700 - 900 LB. FT. (96.6 - 124.0 mkg.)
	1-1/2" - 18	800 - 1100 LB. FT. (110.0 - 152.0 mkg.)
	1-3/4" - 12	800 - 1100 LB. FT. (110.0 - 152.0 mkg.)
	7/18" - 20	200 - 275 LB. FT. (27.5 - 38.0 mkg.)
	1" - 20	300 - 400 LB. FT. (41.5 - 55.0 mkg.)
	1-1/4" - 18	700 - 900 LB. FT. (96.6 - 124.0 mkg.)
	1-1/2" - 18	800 - 1100 LB. FT. (110.0 - 152.0 mkg.)
	1-3/4" - 12	900 - 1200 LB. FT. (124.0 - 165.0 mkg.)
	2" - 12	1000 - 1300 LB. FT. (150.0 - 180.0 mkg.)

3. THRUST SCREW JAMNUT.

3/4" - 16	145 - 190 LB. FT. (20 - 26 mkg.)
7/8" - 14	145 - 190 LB. FT. (20 - 26 mkg.)

4. DIFFERENTIAL BEARING CAP TO CARRIER CAPSCREWS.

	9/16" - 12	116 - 129 LB. FT. (16.0 - 17.8 mkg.)
	5/8" - 11	160 - 180 LB. FT. (22.0 - 25.0 mkg.)
*	3/4" - 10	290-320 LB. FT. (40.0 - 44.0 mkg.)
	7/8" - 14	375 - 415 LB. FT. (52.0 - 57.0 mkg.)
	7/8" - 9	470 - 520 LB. FT. (65.0 - 72.0 mkg.)
	9/16" - 12	115 - 140 LB. FT. (16.0 - 19.0 mkg.)
	5/8" - 11	160 - 190 LB. FT. (22.0 - 26.0 mkg.)
	3/4" - 10	290 - 350 LB. FT. (40.0 - 48.0 mkg.)
	7/8" - 14	375 - 435 LB. FT. (52.0 - 60.0 mkg.)
	7/8" - 9	470 - 550 LB. FT. (65.0 - 76.0 mkg.)

5. FOR ALL FASTENERS.

ALL TORQUES GIVEN APPLY TO PARTS COATED WITH MACHINE OIL.

*FOR DRY PARTS - INCREASE TORQUES 10% FOR PARTS COATED WITH MULTI-PURPOSE GEAR OIL - DECREASE TORQUES 10%. NUTS ON STUDS TO USE THE SAME TORQUE AS FOR DRIVING THE STUD.

6. OIL FILLER PLUG THREAD INTO CARRIER HOUSING TO ALLOW ONE THREAD STAND OUT.

7. ADJUSTING RING LOCK (SOME MODELS ONLY).

8. ADJUSTING RING LOCK TO DIFFERENTIAL BEARING CAP CAPSCREWS.

*	5/16" - 18	15 - 20 LB. FT. (2.0 - 2.75 mkg.)
	5/16" - 18	22 - 28 LB. FT. (3.0 - 3.85 mkg.)

9. DIFFERENTIAL CASE CAPSCREWS OR BOLTS AND NUTS (LONG & SHORT).

	3/8" - 16	35 - 50 LB. FT. (4.8 - 6.9 mkg.)
	7/16" - 14	60 - 75 LB. FT. (8.2 - 10.3 mkg.)
*	1/2" - 13	90 - 120 LB. FT. (12.4 - 16.5 mkg.)
	1/2" - 20	105 - 135 LB. FT. (14.5 - 18.5 mkg.)
	5/8" - 11	185 - 235 LB. FT. (25.5 - 32.5 mkg.)
	5/8" - 18	210 - 270 LB. FT. (29.0 - 37.0 mkg.)
	3/8" - 16	35 - 50 LB. FT. (4.8 - 6.9 mkg.)
	7/16" - 14	60 - 75 LB. FT. (8.2 - 10.3 mkg.)
	1/2" - 13	90 - 120 LB. FT. (12.4 - 16.5 mkg.)
	1/2" - 20	105 - 135 LB. FT. (14.5 - 18.5 mkg.)
	5/8" - 11	185 - 235 LB. FT. (25.5 - 32.5 mkg.)
	5/8" - 18	210 - 270 LB. FT. (29.0 - 32.0 mkg.)

10. DIFFERENTIAL CASE BOLT WITH NUT "THRU BOLT" TYPE (SOME MODELS ONLY).

11. GEAR TO DIFFERENTIAL CASE BOLT NUTS.

*	5/8" - 18	210 - 270 LB. FT. (29.0 - 37.0 mkg.)
	1/2" - 20	105 - 135 LB. FT. (14.5 - 18.5 mkg.)
	5/8" - 11	150 - 190 LB. FT. (20.7 - 26.2 mkg.)
	1/2" - 13	90 - 120 LB. FT. (12.4 - 16.5 mkg.)

* 12. OUTLINE INDICATES - TORQUE VALUES FOR FASTENERS USING LOCKWIRE OR COTTER PINS.

ALL OTHER TORQUE VALUES ARE FOR FASTENERS NOT USING LOCKWIRE OR COTTER PINS.

13. FOR FURTHER INFORMATION REFER TO FIELD MAINTENANCE MANUAL NO. 5 AND WALL CHART TP 5MC.

SUB-SECTION 11B

SINGLE-REDUCTION HYPOID DRIVE UNIT FRONT=MOUNTED THROUGH DRIVE SINGLE-REDUCTION DRIVE UNITS WITH INTER-AXLE DIFFERENTIAL AND TWO GEAR TRANSFER TRAIN (SHD, THD AND UHD MODEL TYPES)

The Rockwell International SHD, THD AND UHD type drive units (Figure 11-34) are of the front mounted, single reduction, through drive design. These drive units incorporate a helical spur two gear transfer train, hypoid reduction gears and bevel gears in the inter-axle and main differential assemblies. These units differ from other Rockwell International front mounted through drive units by the omission of an idler gear and shaft within the transfer gear train. Correct rotation of the hypoid reduction gears is accomplished by cutting both the drive (ring) gear and drive pinion with the opposite (R.H.) spiral angle and mounting the gear on the opposite (R.H.) side of the pinion.

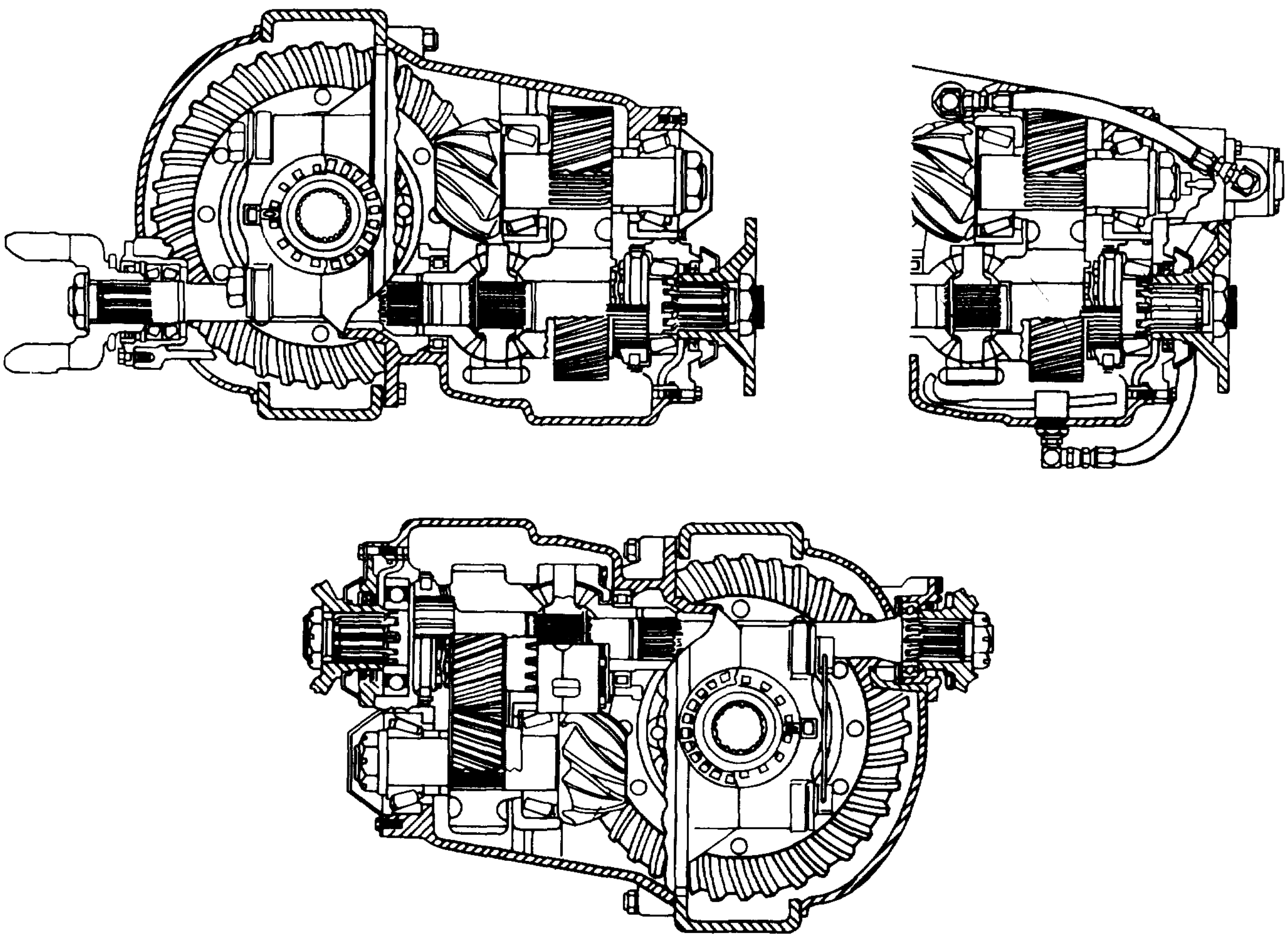

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Figure 11-34. Front Mounted Single-Reduction Drive Units

Further, this type of drive unit employs a single piece carrier/gear case which houses all the component parts. The inter-axle differential is located behind the upper helical gear on the input shaft. The forward side gear of the inter-axle differential is machined integrally on the rear hub portion of the helical gear. The output or through shaft is splined to the rear side gear of the inter-axle differential for a through drive power flow to the rear/rear axle drive unit.

INTER-AXLE DIFFERENTIAL (Figure 11-35)

The inter-axle differential may be either locked (disengaged) or unlocked (engaged) by a power actuated shift unit, which moves a sliding clutch collar on the input shaft splines.

The shift unit is controlled by a selector switch or lever within the cab of the vehicle and may be unlocked or locked under any normal operating conditions. The inter-axle differential when unlocked (engaged) divides the engine torque between the forward/rear and rear/rear axles, when locked (disengaged) converts the two axles to a through drive type tandem.

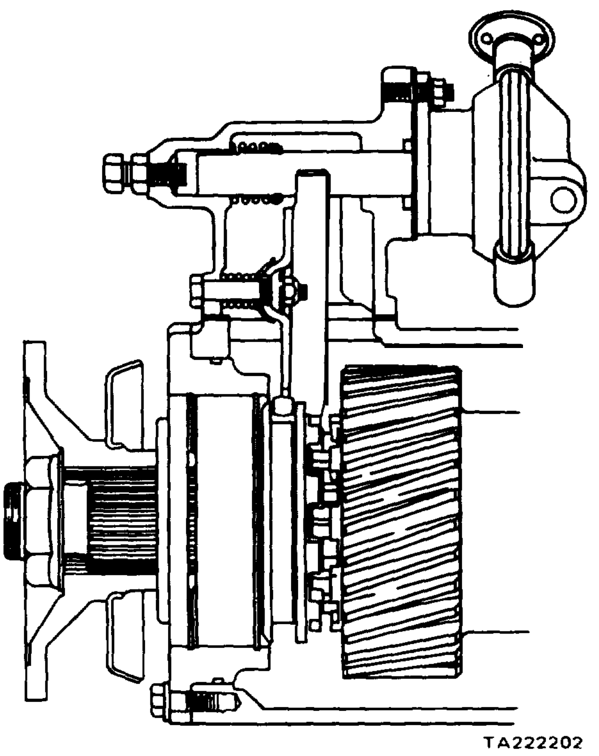


Figure 11-35. Inter-Axle Differential

CURRENT DESIGN (AS OF FEBRUARY, 1978) (Figure 11-36)

Current models incorporate the same basic design as the original models, however, the current design employs an input shaft, inter-axle differential assembly and through shaft supported completely by tapered roller bearings. Further, an optional, externally mounted oil pump can be fitted to current models if desired. The pump is driven by the hypoid pinion shaft and circulates lubricant to the forward and rear input bearings and to the inter-axle differential assembly.

ORIGINAL DESIGN (Figure 11-37)

The input shaft of original design drive unit is mounted on a single ball bearing at the forward end. The rearward end of the input shaft is splined through the inter-axle differential spider (cross) and seats in the inner bore of the side gear. The rear side gear, in turn, is supported by one straight roller bearing. The output or through shaft is supported by a single ball bearing at the axle housing bowl. The drive pinion is the overhung type, being supported at the shaft by two tapered roller bearings.

REMOVE AND DISASSEMBLE DRIVE UNIT

REMOVE DRIVE UNIT FROM HOUSING (Figures 11-38 and 11-39)

A. Remove plug from bottom of axle housing and drain lubricant.

B. Remove the axle shaft stud nuts, lock washers and tapered dowels at the wheel end.

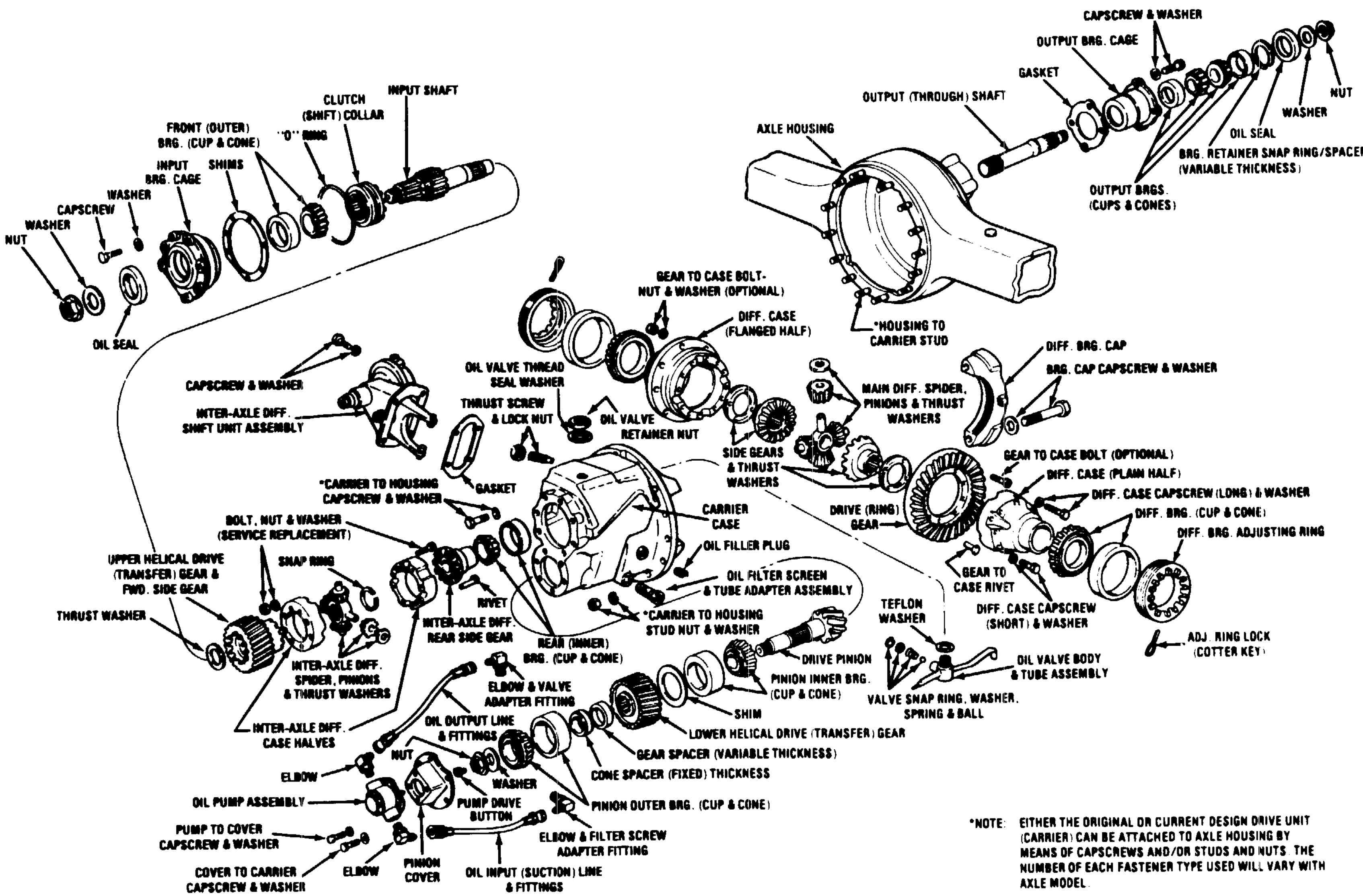
NOTE

To loosen the dowels, hold a 1½ inch diameter brass drift against the center of the axle shaft head, INSIDE THE CIRCULAR DRIVING LUGS. Strike the drift a sharp blow with a 5 to 6 pound hammer or sledge. A 1½ inch diameter brass hammer is an excellent and safe drift.

WARNING

Do not hit the circular driving lugs on the shaft head - this may cause the lugs to shatter and splinter. Wear protective safety glasses. Do not use chisels or wedges to loosen the shaft or dowels - this will damage the hub, shaft and oil seal.

C. Pull the axle shaft from the drive unit and axle housing.



*NOTE: EITHER THE ORIGINAL OR CURRENT DESIGN DRIVE UNIT (CARRIER) CAN BE ATTACHED TO AXLE HOUSING BY MEANS OF CAPSCREWS AND/OR STUDS AND NUTS. THE NUMBER OF EACH FASTENER TYPE USED WILL VARY WITH AXLE MODEL.

Figure 11-36. Current Design with Externally Mounted Oil Pump

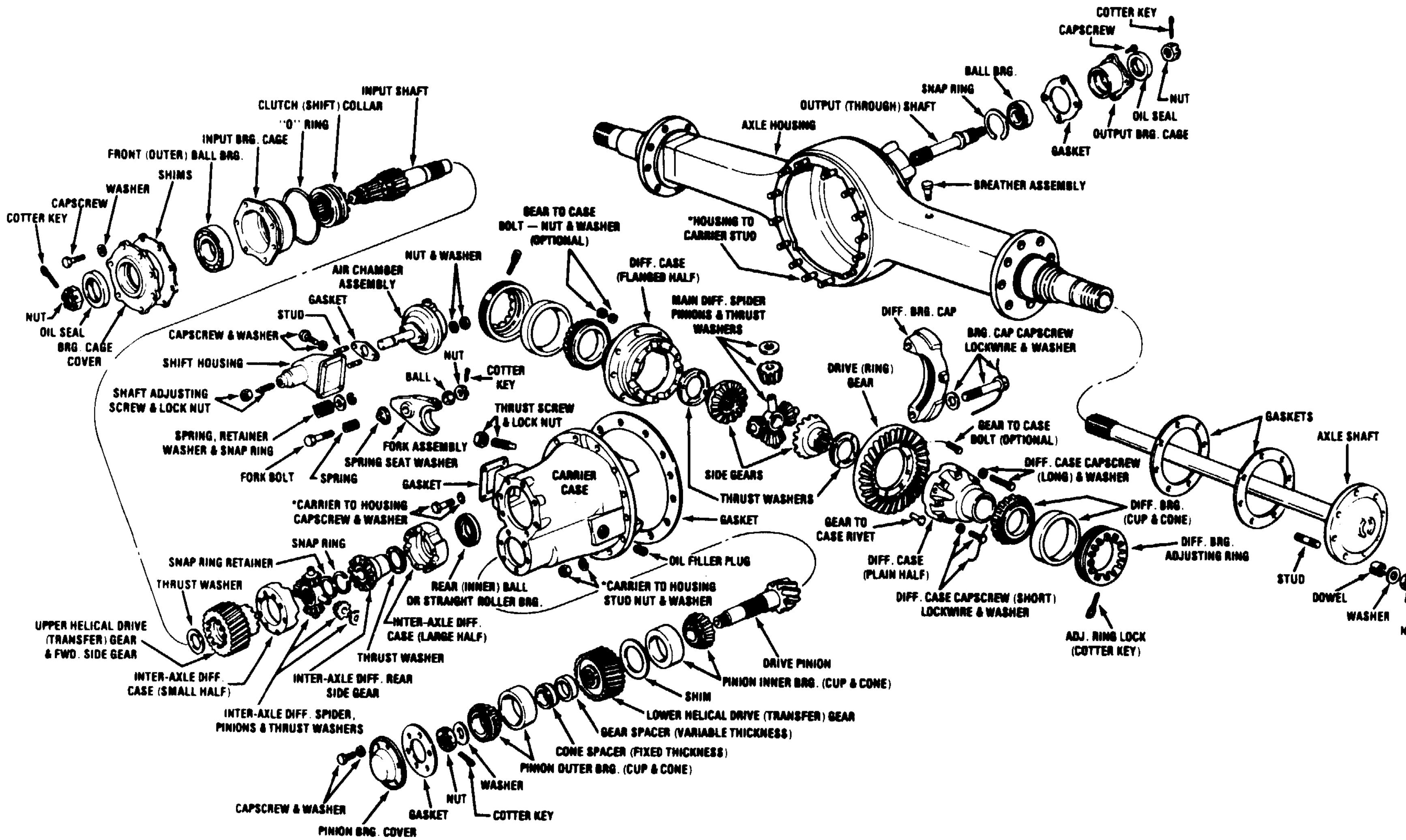


Figure 11-37. Typical Original Drive Unit

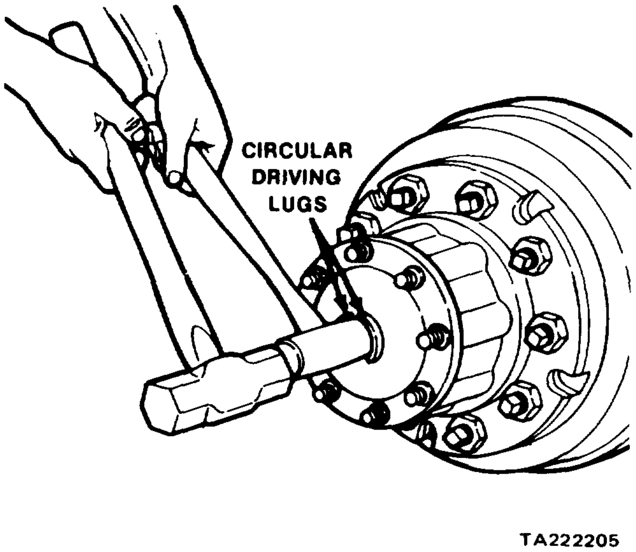


Figure 11-38. Removing Axle

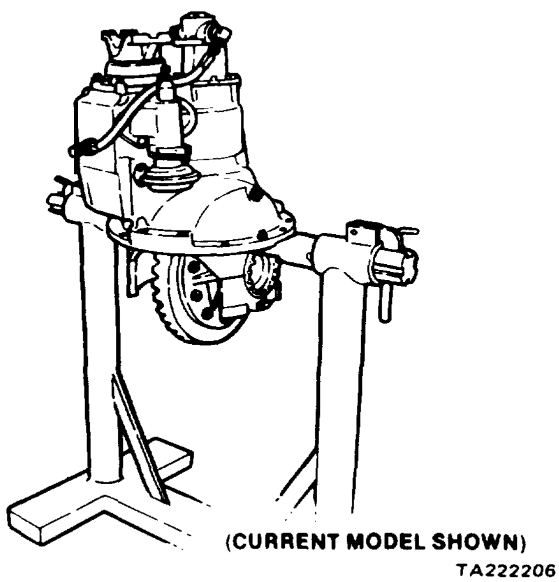


Figure 11-39. Carrier Mounted in Holding Fixture

D. Disconnect the forward and rear propeller (drive) shafts from the input and output flanges or yokes of the drive unit.

E. Disconnect the air line from the inter-axle differential shift unit located at front side of carrier housing.

F. Remove the output or through shaft cotter (if used), nut and yoke or flange. Current models do not employ a cotter key, further, with current models also remove the yoke to bearing washer.

CAUTION

Do not drive yoke or flange from shaft using a hammer or mallet. Damage to splines will result. Use a suitable puller if required.

G. Remove the output (through) shaft bearing cage to axle housing capscrews and washers. Pull the gasket, cage, shaft and bearing assembly from the housing. It may be necessary to tap the shaft and cage with a rawhide mallet.

H. To remove carrier from housing, first loosen the two top stud nuts and leave attached to the housing. This will prevent the carrier from falling. Remove all other capscrews or stud nuts and washers.

I. Break the carrier loose from the axle housing with a rawhide mallet.

J. Remove the carrier from axle housing by placing a roller jack under the carrier. Remove the top two stud nuts and washers and carefully work carrier free. A small pinch bar may be used to straighten the carrier in housing bore as removal takes place. However, the end of the bar must be rounded to prevent indenting and damaging the carrier and housing flanges.

K. Place carrier in suitable holding fixture as illustrated. Prints of carrier repair stand are available upon request. Refer to address on back of manual (Figure 11-39).

L. Loosen the thrust block adjusting screw jamnut, located at side of carrier and back off thrust screw. Roll the main differential and gear slightly to allow the thrust block, if used, to drop out from carrier. Current models employ a thrust screw and jamnut only (Figure 11-40).

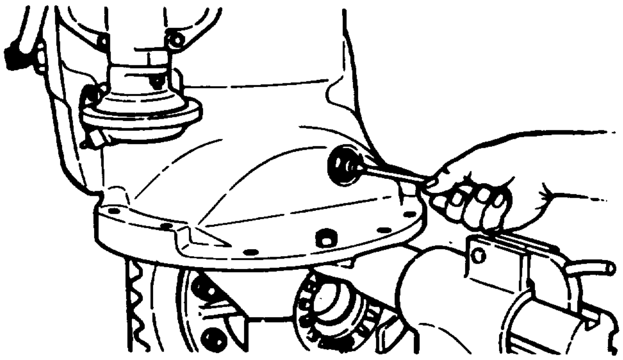


Figure 11-40. Thrust Block Jamnut

A. Remove the oil seal from bearing cage using a suitable pointed tool to pry out seal. Be careful not to damage the I.D. of cage. Discard the oil seal (Figure 11-41).

B. Remove the bearing retaining snapring/spacer from groove in the cage inside diameter. Use snapring pliers (Figure 11-42).

C. Position the output shaft and cage assembly in a press, threaded end of shaft and cage facing down. Press out shaft from cage (Figure 11-43).

NOTE

The inner and outer cones will remain on the shaft while the inner cup remains in the cage. The outer cup will be loose.

D. Inspect both inner and outer bearings (cups and cones) and if required, remove as follows: (Refer to page 11B-22 for bearing inspection.)

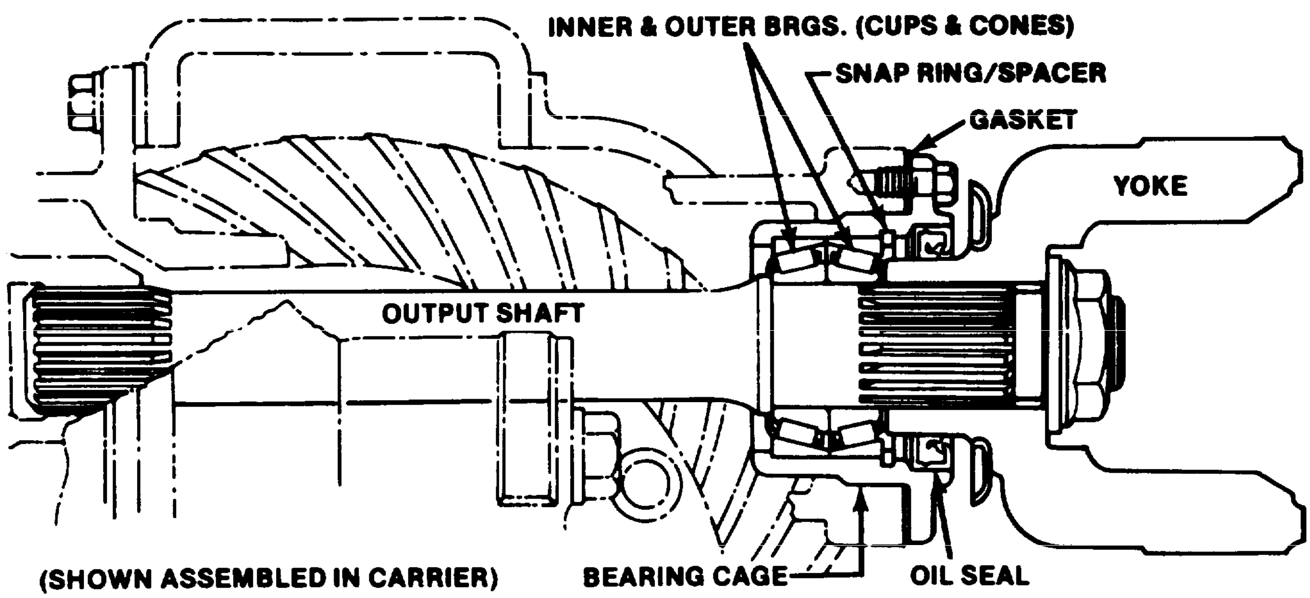


Figure 11-41. Tapered Bearings and Cage Assembly

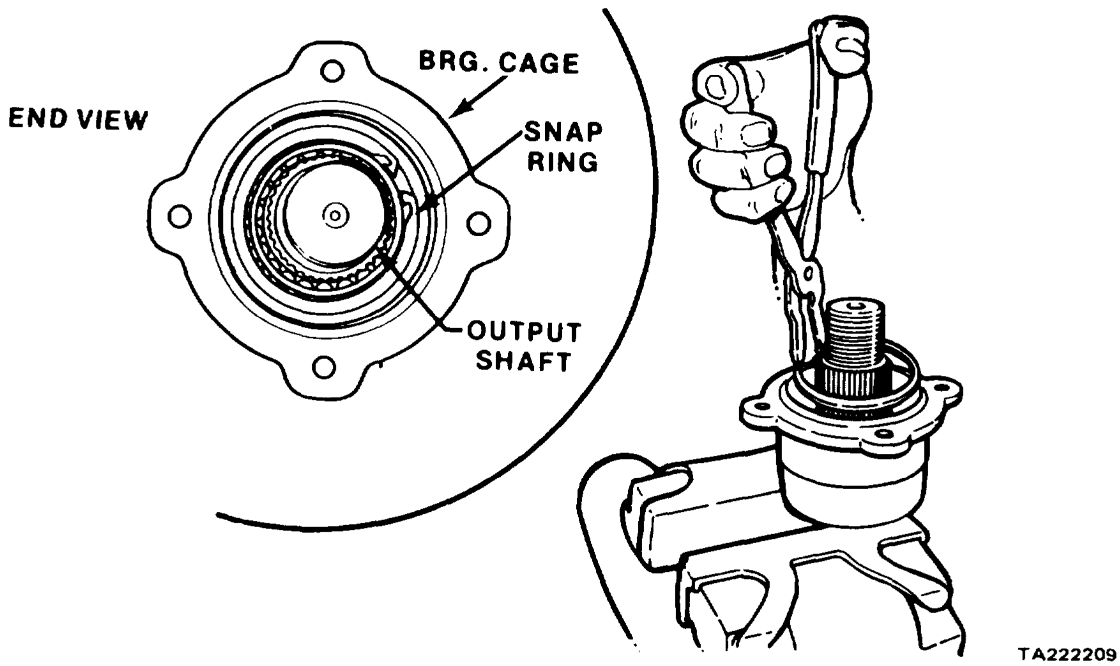


Figure 11-42. Removing Snapring

E. To remove the inner bearing cup from cage, use a drift and hammer and tap out cup (Figure 11-44).

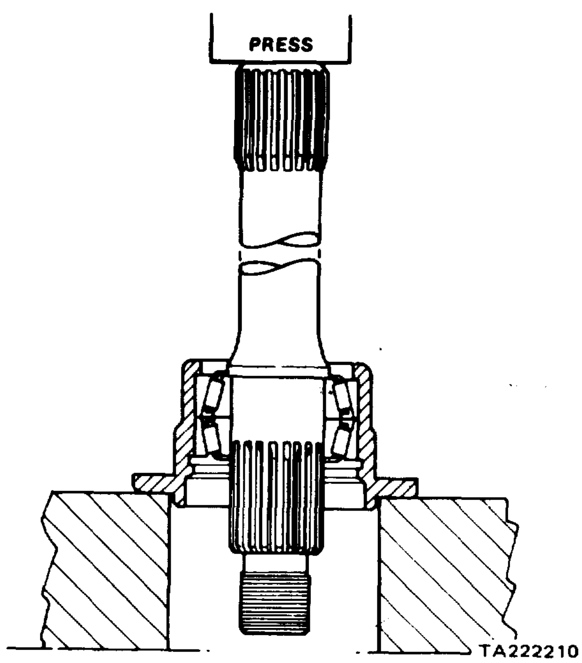


Figure 11-43. Installing Cage on Output Shaft

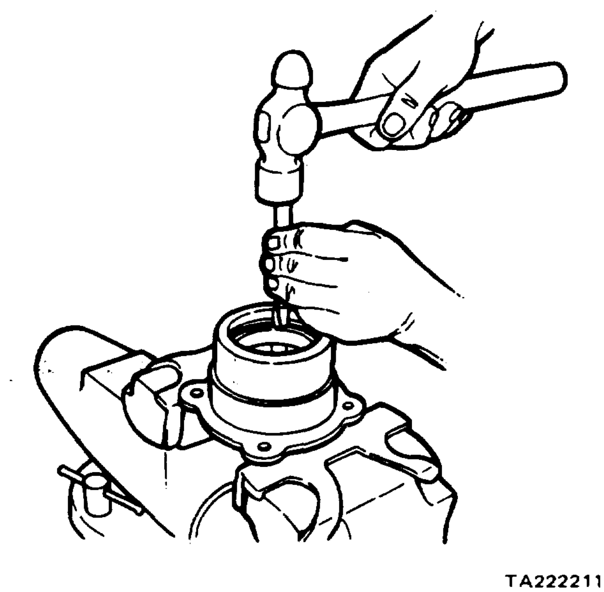


Figure 11-44. Inner Bearing Cup Removal

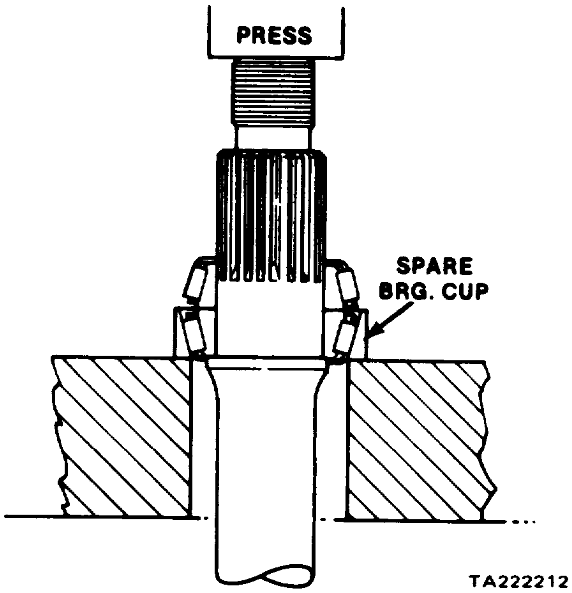


Figure 11-45. Press Method to Remove Bearing

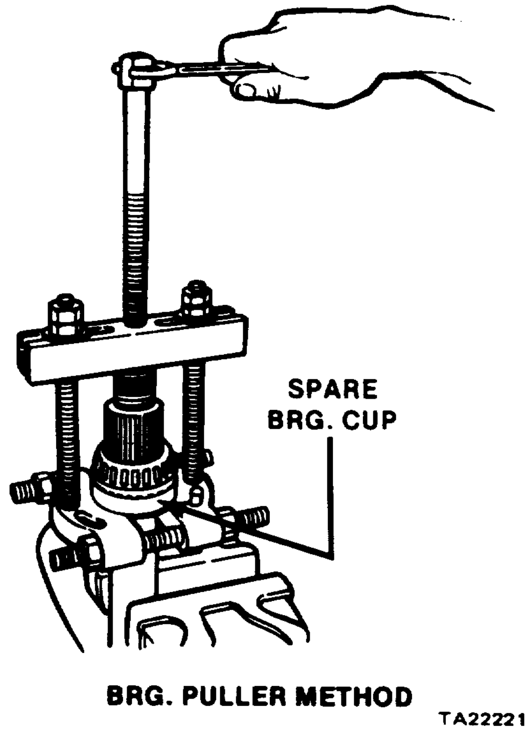


Figure 11-46. Puller Method to Remove Bearing

F. To remove the bearing cones from shaft, position a spare bearing cup of the correct size over the inner cone. Using a press or bearing puller against the cup, remove cones as shown above (Figures 11-45 and 11-46).

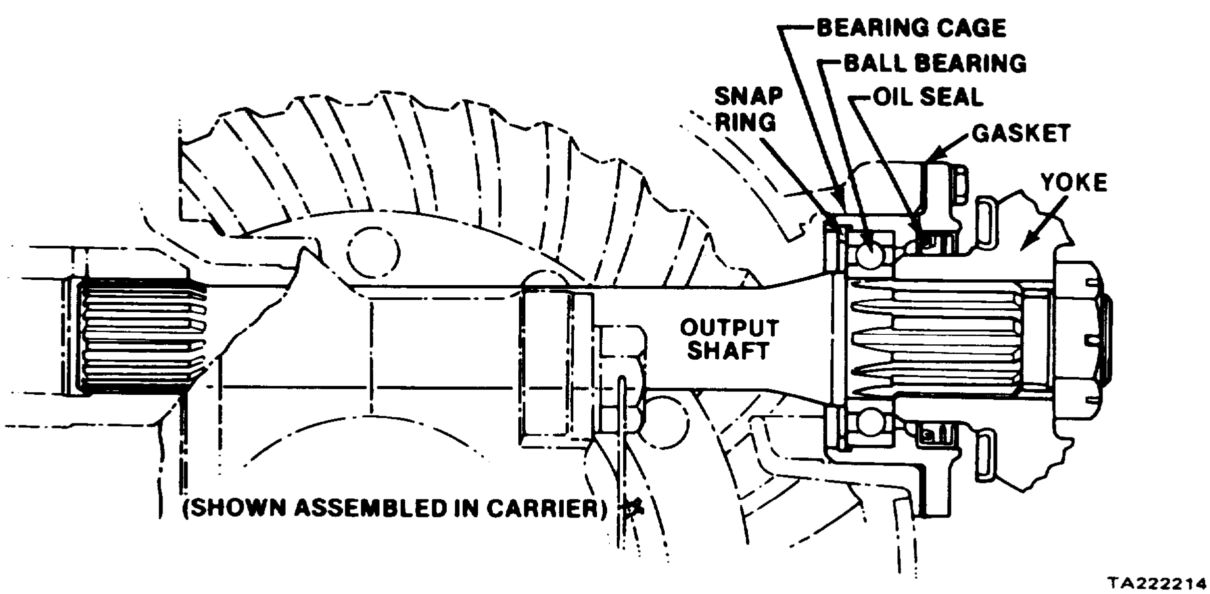


Figure 11-47. Original Model - Ball Bearing Assembly

ORIGINAL MODEL-BALL BEARING

A. Remove the oil seal from the cage using a suitable pointed tool to pry out. Be careful not to damage the cage I.D. Discard the seal (Figure 11-47).

B. Remove the bearing retainer snap ring from groove in cage I.D. (Figure 11-47).

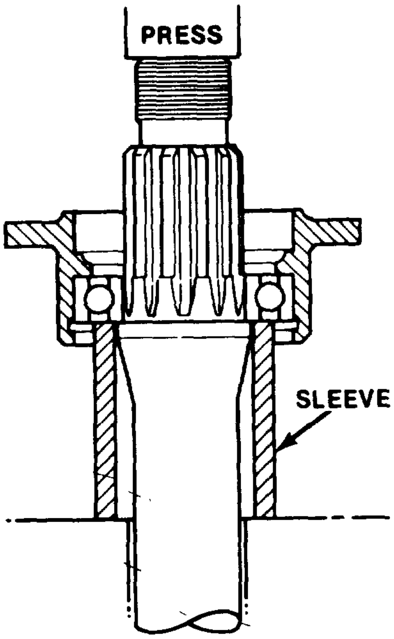


Figure 11-48. Shaft and Bearing Removal

C. Position the output shaft and cage assembly in a press, threaded end of shaft pointing up. From underside of cage, position a sleeve against the bearing inner race to support the assembly (Figure 11-48).

D. Press out the shaft from bearing and cage.

E. Place the cage and bearing assembly in a vise with soft metal jaw covers. Tap the bearing out from cage using a small brass drift and hammer being careful not to damage the cage I.D.

CAUTION

Do not strike the bearing directly with a steel hammer. Damage to bearing will result. Use a brass hammer.

REMOVE AND DISASSEMBLE INTER-AXLE DIFFERENTIAL SHIFT UNIT

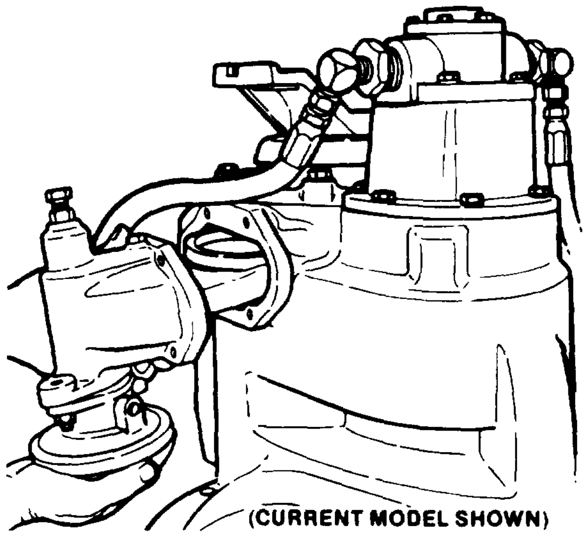


Figure 11-49. Differential Shift Unit Removal

A. Remove the shift housing to carrier capscrews and washers and pull the shift unit assembly and gasket from the carrier (Figure 11-49).

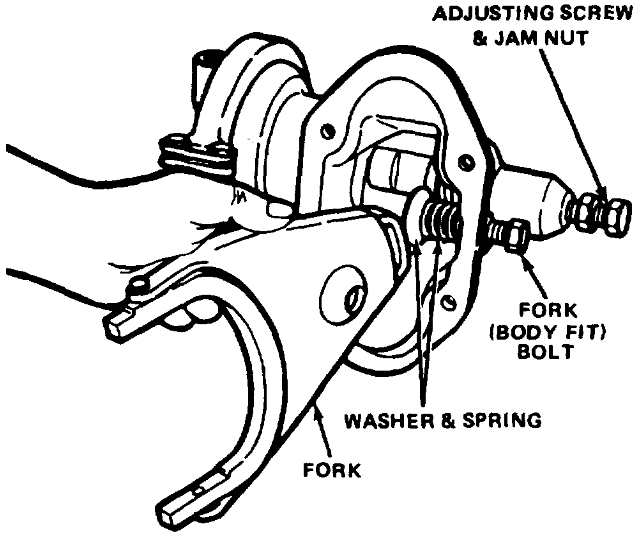


Figure 11-50. Shift Fork Removal

B. To disassemble the shift unit components from housing, first remove the shift fork attaching nut cotter key, if used, and nut. Current models employ locknut only. Tap the body fit bolt back far enough to remove fork ball and fork from shaft slot. Also remove the spring seat washer and spring from body fit bolt (Figure 11-50).

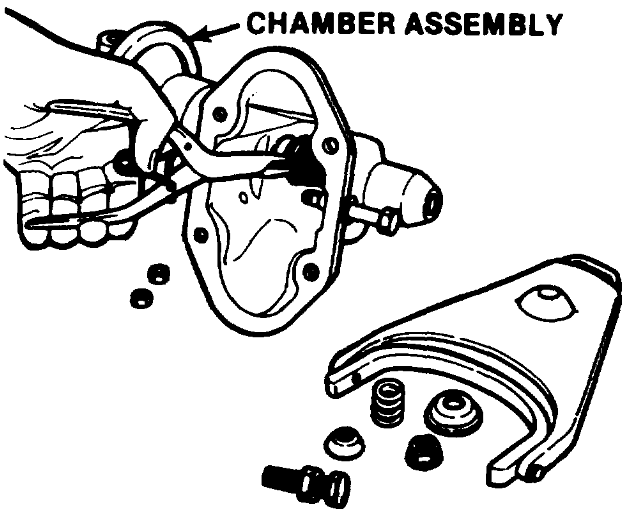


Figure 11-51. Shift Chamber Disassembly

C. Remove the shift shaft adjusting screw and jam nut and the shift chamber to housing nuts and washers. Using snap ring pliers, expand snap ring to clear shaft groove and slide out the shaft and chamber assembly from housing. As the chamber is being removed, the snap ring, spring retainer washer and spring will drop from shaft (Figure 11-51).

REMOVE INTER-AXLE DIFFERENTIAL AND CAGE ASSEMBLY

NOTE

Before disassembly is started, measure and record gear backlash between the drive pinion and ring gear (Figure 11-52).

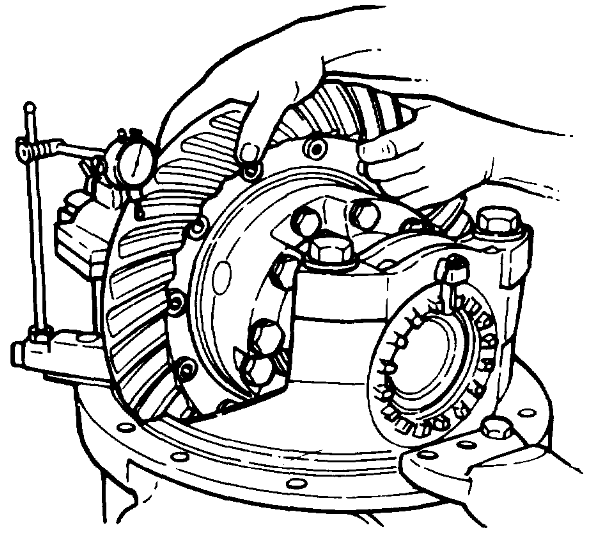


Figure 11-52. Measuring Gear Backlash

Refer to page 11B-45 for procedures, use steps A & B. This information will be needed at reassembly - gears must be reset to this figure unless a new gear set is used.

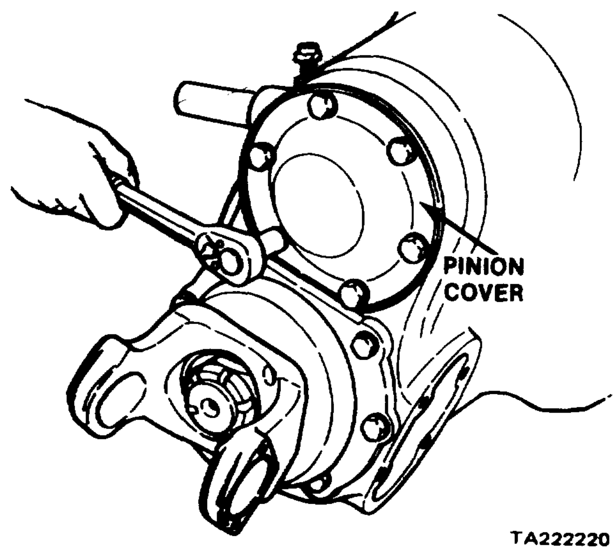


Figure 11-53. Pinion Cover Removal, Original Model

A. Turn the drive unit to a horizontal position in the carrier stand. With original models and current models without the oil pump, remove the pinion bearing cover to carrier capscrews, washers, cover and gasket. Discard the gasket (Figure 11-53).

With current models that employ the optional oil pump, first make sure the suction (input) port of pump is marked for identification at reassembly. The original marking is a stamped "S" at the port boss. Remark if required (Figure 11-54).

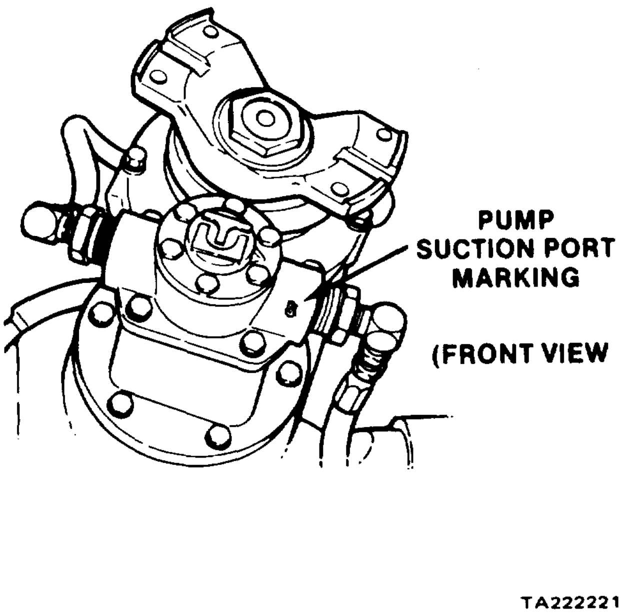


Figure 11-54. Pump Suction Port Marking

NOTE

(As a reference, when looking at front of carrier, with input shaft at top, the suction port is located at the lower right of pump.)

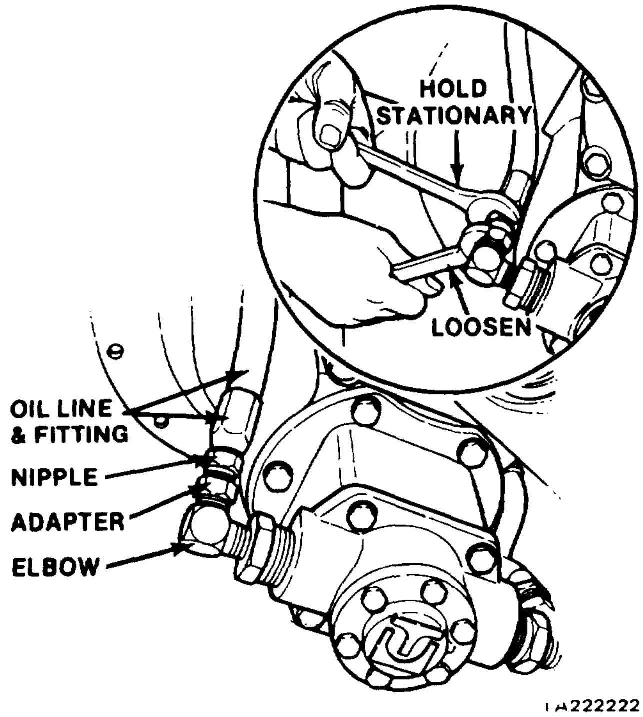


Figure 11-55. Disconnecting Oil Lines

Disconnect both oil lines from elbow fittings in the pump, as follows; Hold the nipple (middle hex of fitting) stationary and loosen the fitting adapter from elbow (Figure 11-55).

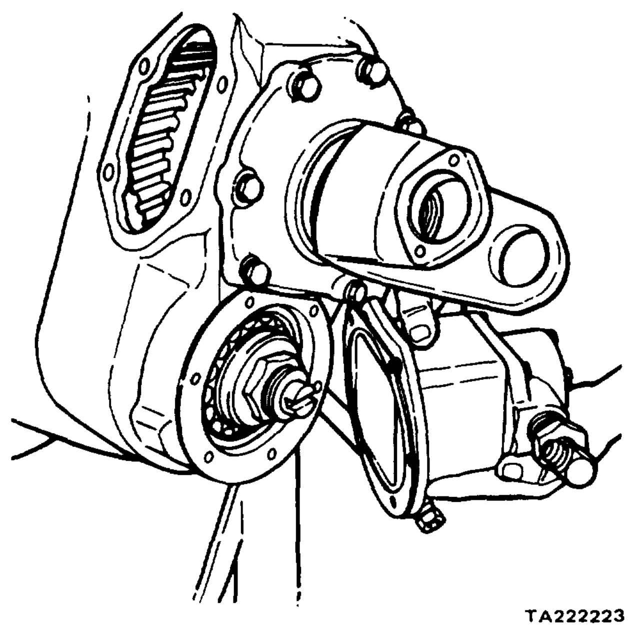


Figure 11-56. Carrier Pinion Cover Removal
Current Model

Next, remove the pinion cover (Figure 11-56) to carrier capscrews, washers, pump/cover assembly and gasket from carrier. For service information on the pump, refer to pages 11B-20 and 11B-21.

CAUTION

There may be oil trapped in the pump and lines. Be careful when disconnecting and removing component parts. Use a suitable container to catch any oil spillage.

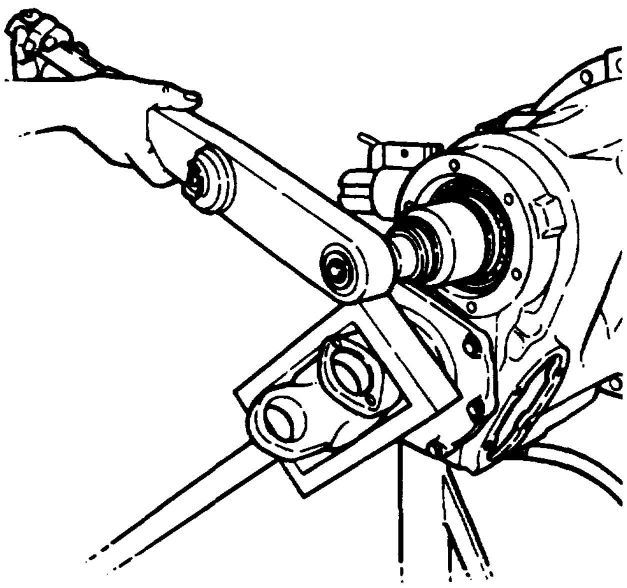


Figure 11-57. Pinion Nut Removal

B. Remove the pinion nut cotter key, if used. Current models do not employ a cotter key. Attach a suitable holding fixture to the input yoke or flange and loosen the pinion nut. Do not remove nut at this time (Figure 11-57).

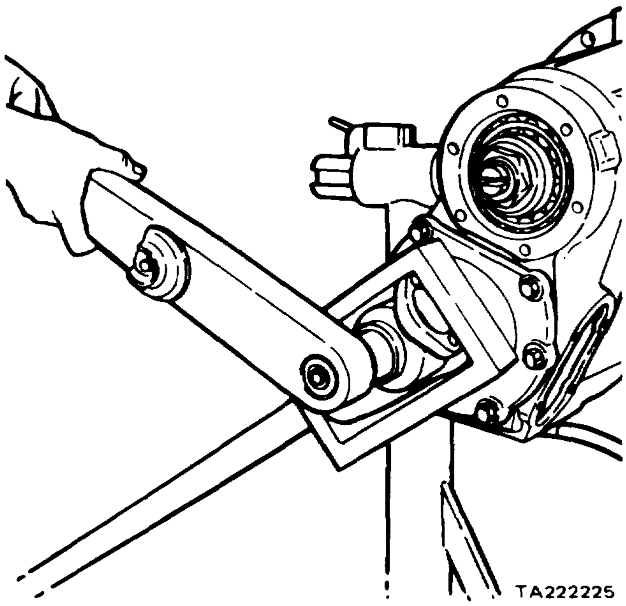


Figure 11-58. Input Shaft Flange Nut Removal

C. Remove the input shaft cotter key, if used. Current models do not employ a cotter key. Loosen the yoke or flange nut. Do not remove nut, yoke or flange at this time. The yoke or flange will aid lifting the inter-axle differential from carrier (Figure 11-58).

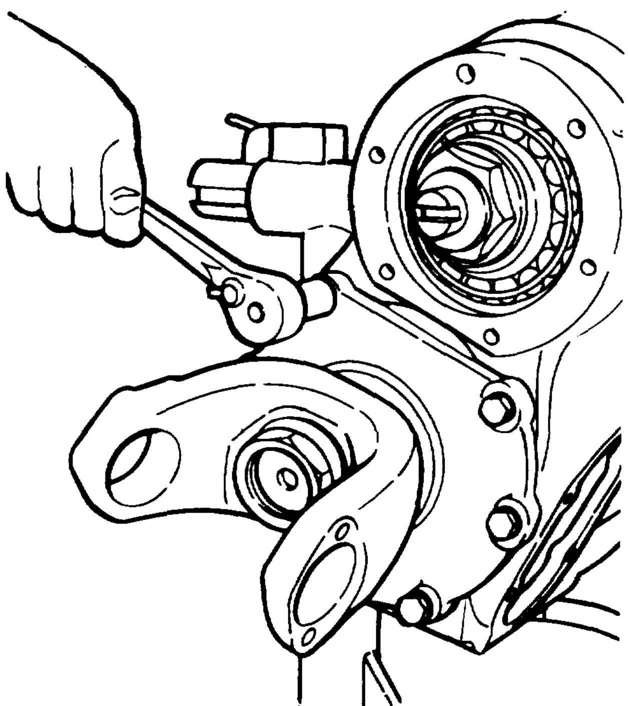


Figure 11-59. Input Shaft Bearing Cage Removal

D. Remove the input shaft bearing cage to carrier Capscrews and washers (Figure 11-59).

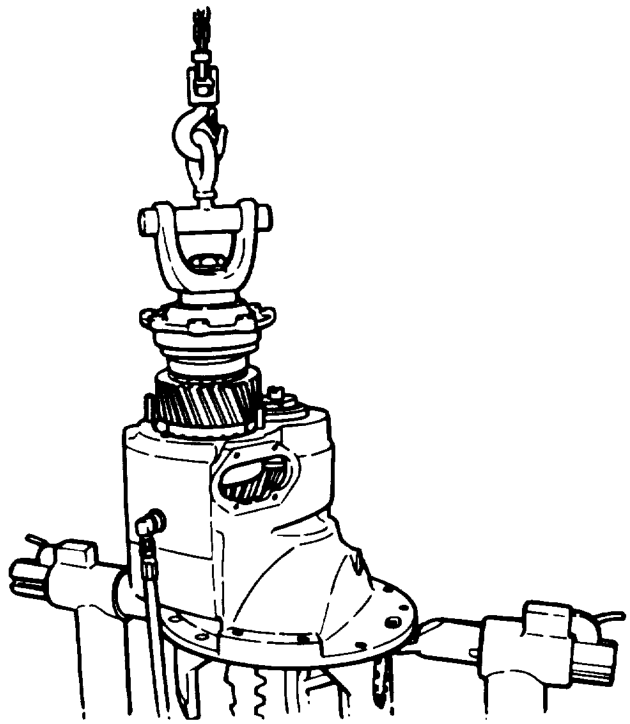


Figure 11-60. Inter-Axle Differential Removal

E. Turn the drive unit assembly to a vertical position in the carrier stand. Attach a lifting fixture and/or a chain fall to the input yoke (as shown above) or flange and carefully lift the inter-axle differential assembly from carrier (Figure 11-60).

As lifting begins, lightly tap carrier housing and bearing cage with a rawhide mallet to free the assembly. It may be necessary to rotate the input shaft to align flat of inter-axle differential case with the lower, drive, transfer gear.

F. After the input shaft and inter-axle differential assembly is lifted from the carrier, remove the bearing cage to carrier gasket or shims, depending on how current the model is. Discard gasket. However if shims are removed, wire them together and retain for reassembly.

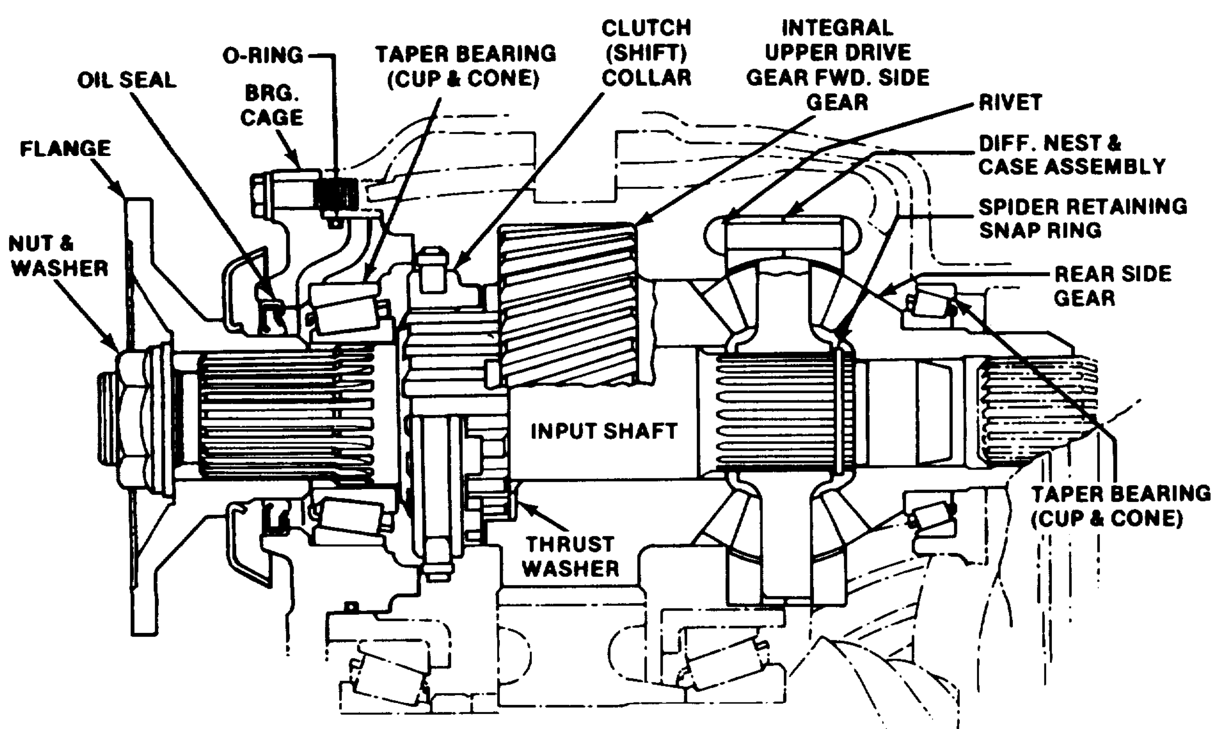


Figure 11-61. Inter-Axle Differential Assembly

NOTE

With original models, the rear input or inter-axle differential ball bearing will be removed along with the assembly. On original models that employ a straight roller bearing, the inner race will remain on the assembly (rear inter-axle differential side gear), while the outer race and rollers will remain seated in the carrier housing. With current models, the tapered roller bearing (cup and cone) and rear inter-axle differential side gear will remain in the carrier housing (Figure 11-61).

A. Remove rear inter-axle differential side gear and bearing cone from carrier housing. The bearing cup will remain seated in carrier (Figure 11-62).

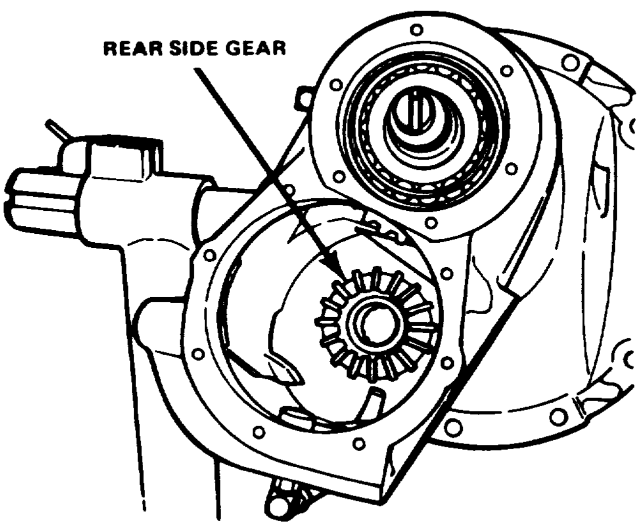


Figure 11-62. Bearing, Cup and Cone

B. Inspect the bearing, cup and cone, for excessive wear or damage. Refer to "Inspect Tapered Roller Bearings" section on page 11B-22.

If bearing required replacement, remove rear side gear bearing cup from carrier, after main differential is removed. Tap out cup from differential side of carrier using brass drift and hammer. Remove the bearing cone from rear side gear using a press and bearing puller as shown (Figure 11-63).

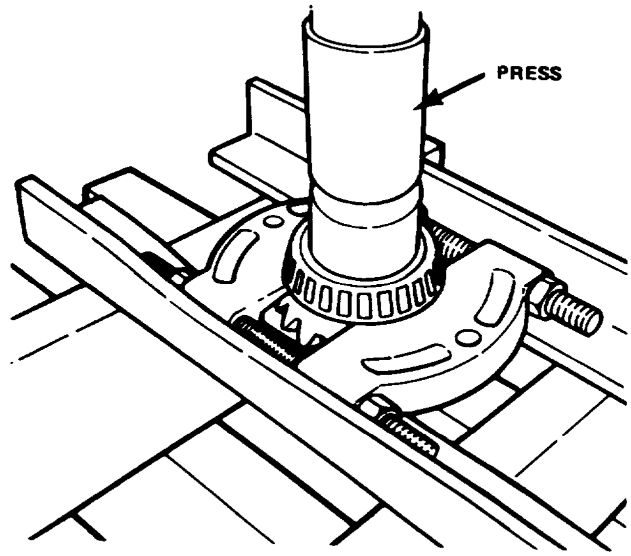


Figure 11-63. Bearing Cup and Cone Removal

C. Remove the spider retaining snapring from input shaft and slide inter-axle differential nest and case assembly from shaft (Figure 11-64).

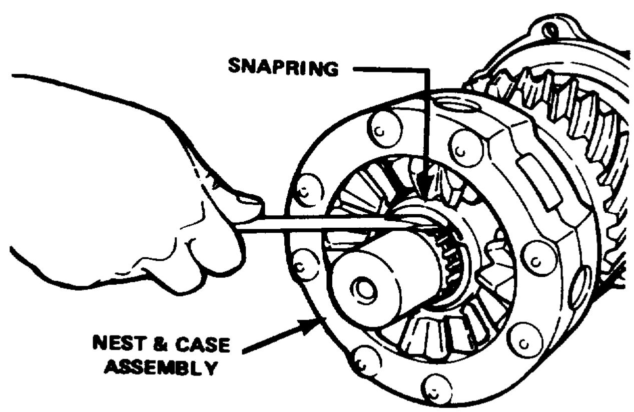


Figure 11-64. Nest and Case Assembly Removal

CAUTION

Before continuing with disassembly, inspect the inter-axle differential nest and case assembly for wear or damage and disassemble only if required. If wear or damage is excessive, replace the nest and case as a complete assembly. To disassemble continue with item "D".

D. If original identification (match) marks on case halves are not clear, remark both parts using a punch or chisel and hammer (Figure 11-65).

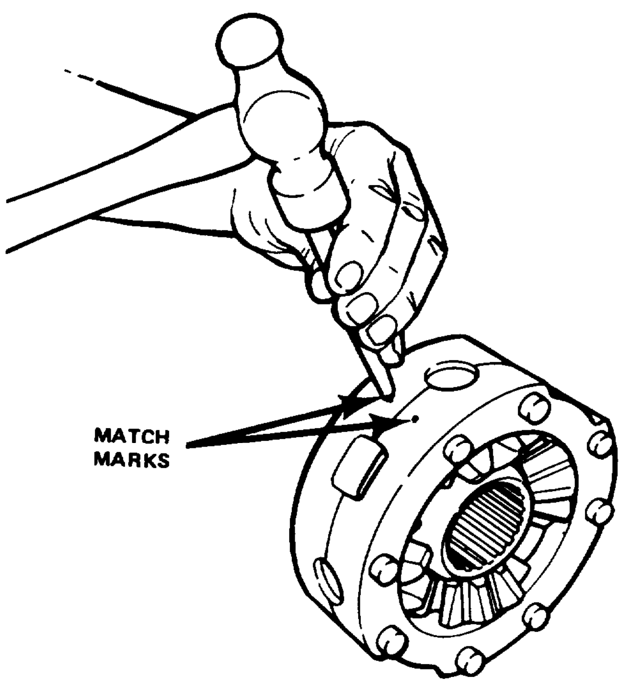


Figure 11-65. Match Marks

E. Disassemble inter-axle case halves by removing capscrews and washers or rivets. This will free the spider, 4 pinions and thrust washers. The latest models employ rivets instead of capscrews to hold case halves together. If rivet removal is required, use the following procedures:

1. Carefully center punch rivets in center of head.

2. Use a drill that is 1/32" smaller in diameter than body of rivet to drill through head.

3. Press out rivets.

CAUTION

Do not chisel or pry rivet heads off, damage to case will result.

F. Slide off helical drive gear, thrust washer and clutch collar from input shaft (Figure 11-66).

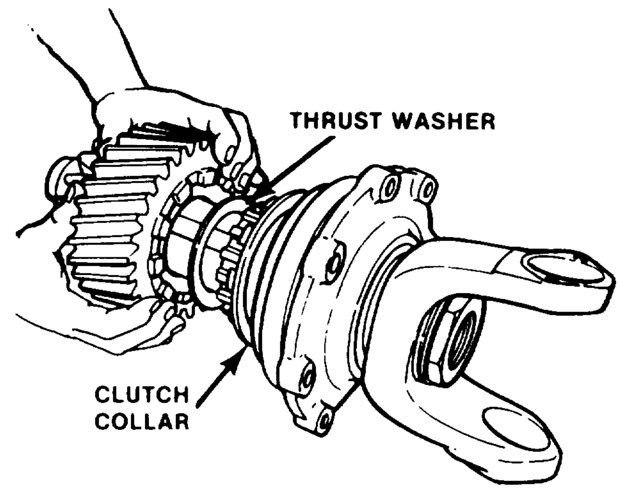


Figure 11-66. Removing Helical Drive Gear

G. Remove the yoke or flange nut and washer (if applicable) from input shaft. Using a suitable puller, remove the yoke or flange from shaft (Figure 11-67).

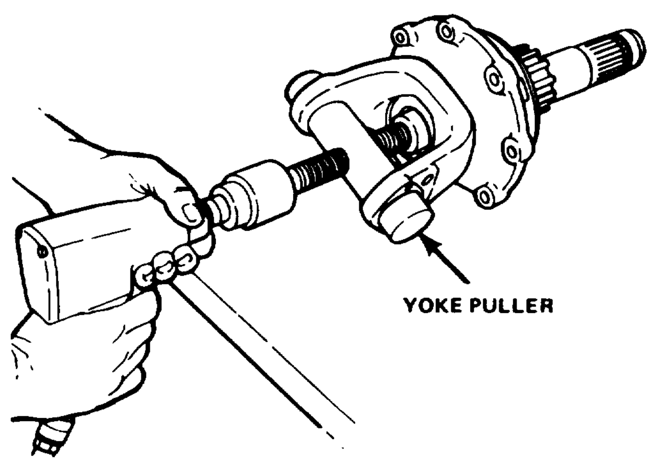


Figure 11-67. Yoke or Flange Nut Removal

This will free the input bearing cage. Lift cage off shaft (Figure 11-68).

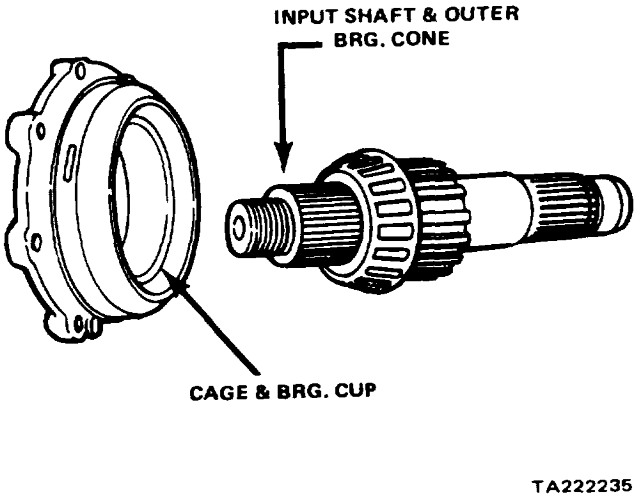


Figure 11-68. Input Bearing Cage Removal

NOTE

The bearing cup will remain seated in the cage while the bearing cone will remain on the input shaft.

H. Remove the bearing cage to carrier "O" ring from groove in cage outside diameter. Inspect the "O" ring for breaks, cracks, etc. If damaged in any way, discard. If "O" ring is reusable, set aside for reassembly.

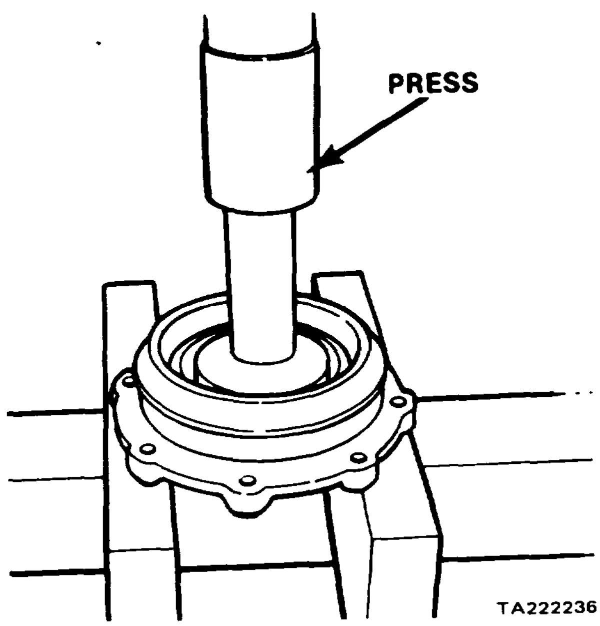


Figure 11-69. Oil Seal Removal

I. Remove the oil seal from bearing cage by using a press and suitable sleeve. If a press is not available, use a drift or mallet to tap out seal, being careful not to damage the cage inside surface. Discard seal (Figure 11-69).

J. Inspect the outer input bearing, cup and cone, for excessive wear or damage. Refer to "Inspect Tapered Roller Bearings" section on page 11B-22.

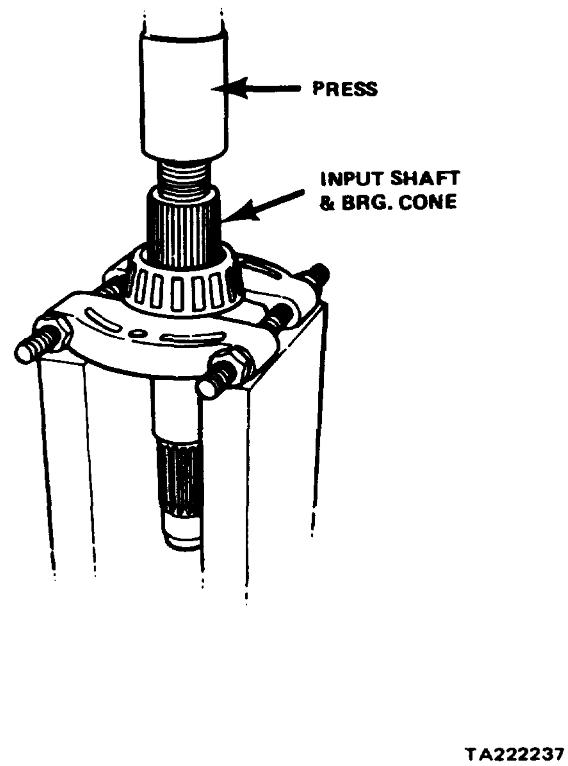
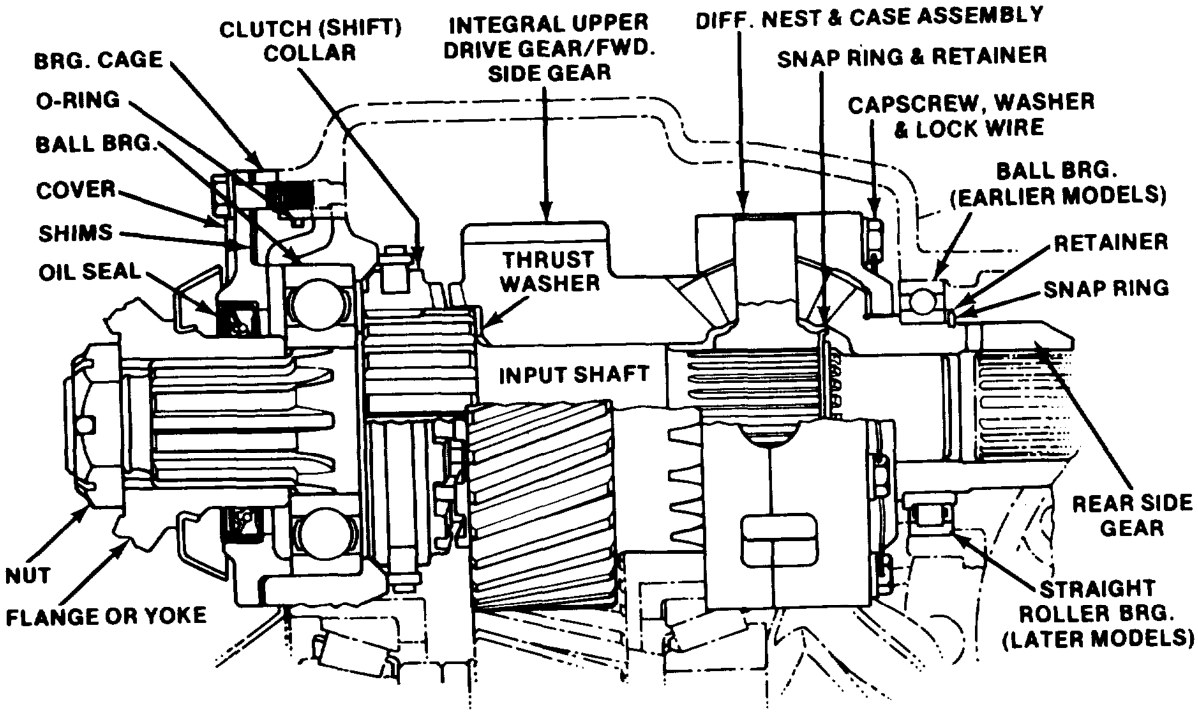


Figure 11-70. Outer Bearing Cup and Cone Removal

If bearing requires replacement, remove the cup from cage and the cone from input shaft. Use a press and suitable sleeves or bearing pullers (Figure 11-70).

ORIGINAL MODEL FIGURE 11-71 BALL AND ROLLER BEARING AXLE.



(SHOWN ASSEMBLED IN CARRIER)

Figure 11-71. Original Model with Ball and Roller Bearings

A. If a ball bearing is employed at the inter-axle differential rear side gear, first bend back the snapring retainer tabs from top of snapring. Remove the snapring and retainer from side gear (Figure 11-72).

B. Cut and remove the inter-axle case bolt lockwire, if used. Remove the case bolts and washers. Center punch each case half for identification before separating to insure correct alignment at reassembly.

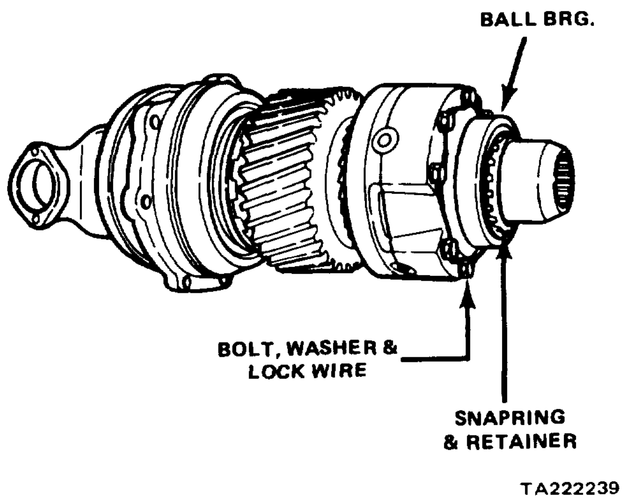


Figure 11-72. Rear Side Gear Assembly

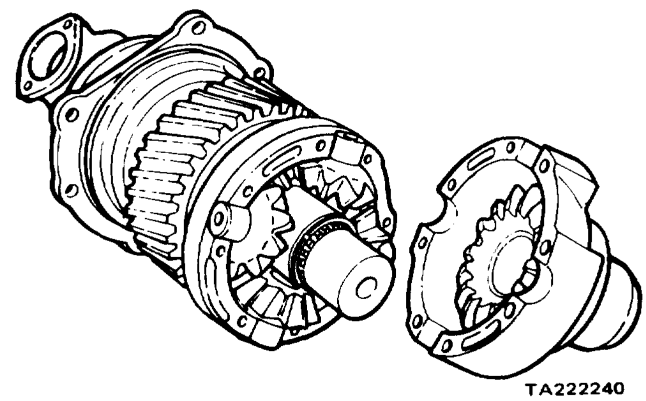


Figure 11-73. Inter-Axle Differential Case

C. Separate the inter-axle differential case halves (Figure 11-73).

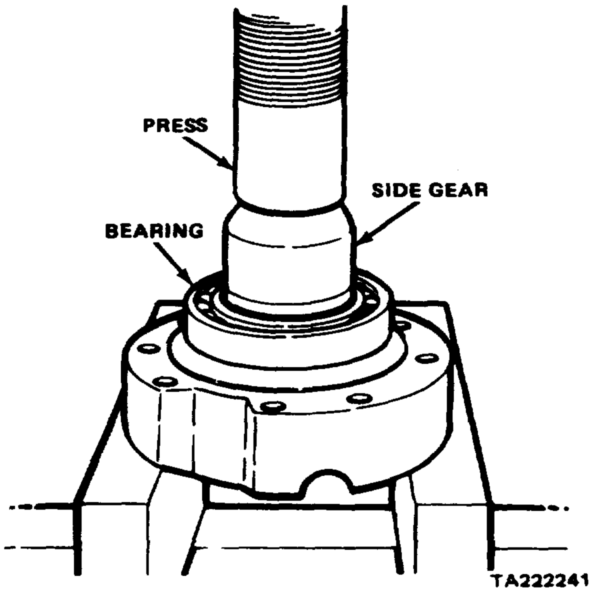


Figure 11-74. Side Gear Removal

D. Position the rear inter-axle differential case half with side gear and bearing in a press, gear teeth facing down, Press the side gear out through the ball bearing or straight roller bearing inner rape and case half (Figure 11-74).

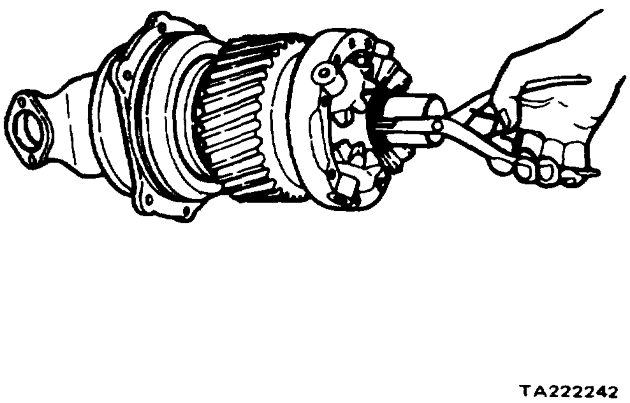


Figure 11-75. Removing Snapring Retainer

E. Push the inter-axle differential spider and snapring retainer forward on the input shaft to relieve tension and remove the snapring from groove in shaft. Slide off retainer.

F. Slide spider, pinion and thrust washer assembly off shaft splines (Figure 11-75).

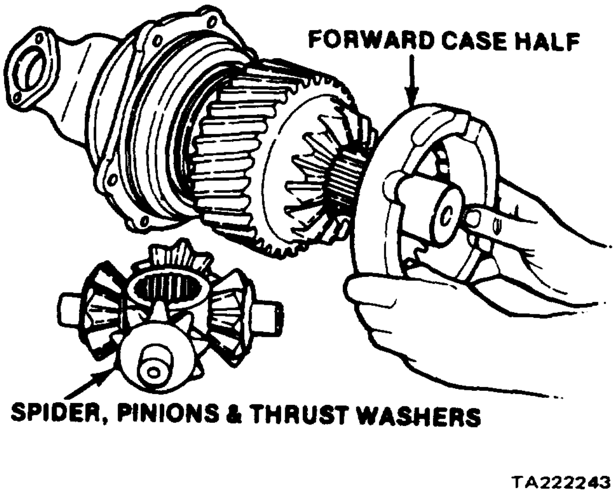


Figure 11-76. Forward Case Half Removal

G. Remove the inter-axle differential forward case half (Figure 11-76).

H. Separate the inter-axle differential pinions and thrust washers from spider.

I. Remove the transfer gear and thrust washer from input shaft (transfer gear and forward side gear are integral.) (Figure 11-77).

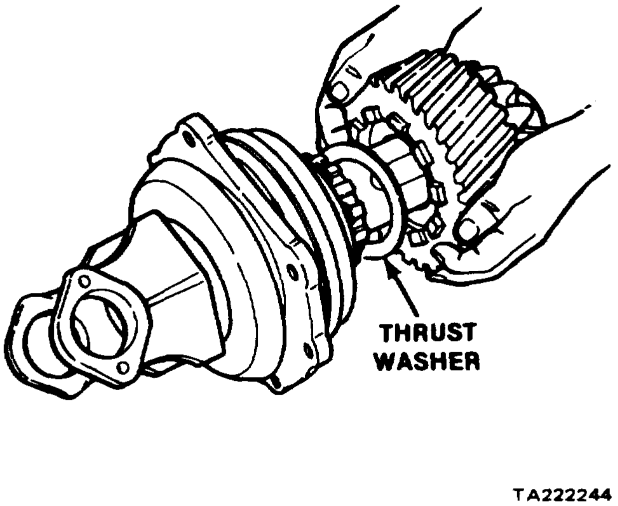


Figure 11-77. Transfer Gear and Thrust Washer Removal

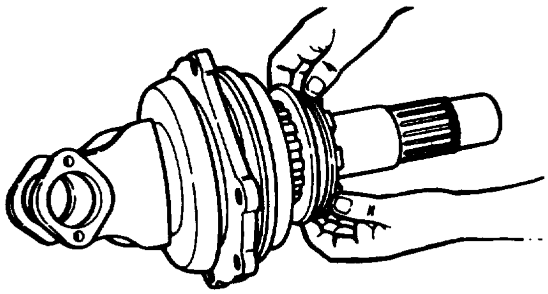


Figure 11-78. Clutch Collar Removal

J. Slide off the clutch collar from input shaft (Figure 11-78).

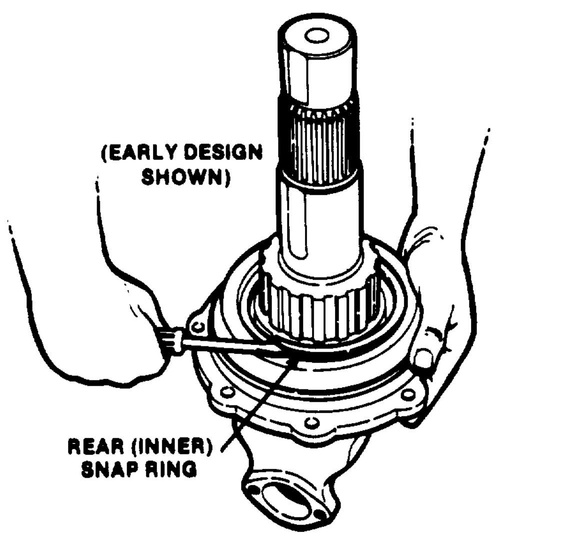


Figure 11-79. Removing Snapring

K. If bearing retainer snaprings and the one piece cage is used, remove the rear or inner snapring from groove in cage, as shown above in Figure 11-79.

NOTE

Early models employed a one piece input bearing cage. This type of cage retained the oil seal assembly and along with snaprings retained the input ball bearing. Later models employed a two piece bearing cage/cover. The input ball bearing is retained by press fit in the cage while the cover retains the oil seal. Shims between the cover and the bearing cage partially control bearing seat-tightness in the cage.

L. Remove the input shaft nut and remove yoke or flange with suitable puller.

Further, if a two piece cage/cover is employed, remove the cover and seal assembly and shims from the input bearing cage. Wire shims together and retain for reassembly.

M. Remove the bearing cage to carrier “O” ring from groove in cage outside diameter. Inspect “O” ring for breaks, cracks, etc. If damaged in any way, discard. If “O” ring is reusable, set aside for reassembly.

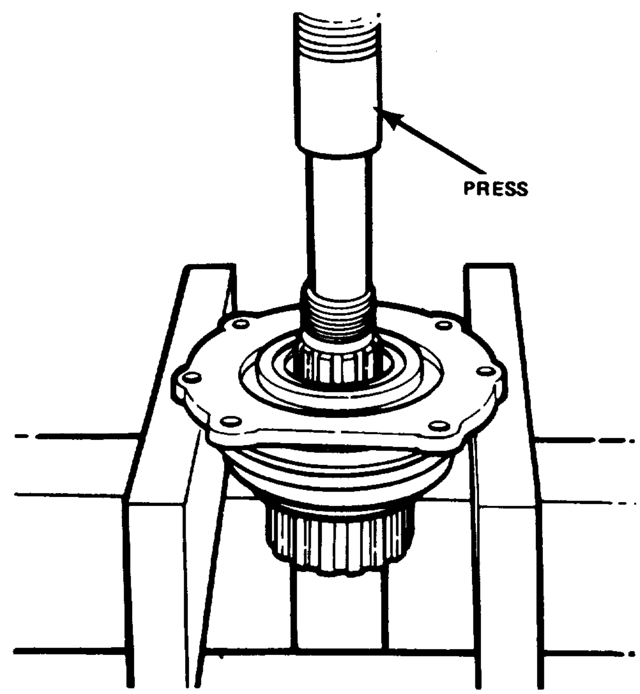


Figure 11-80. Input Shaft Removal

N. Place the input shaft and cage assembly in a press with the threaded end of shaft pointing up. Press shaft out from cage (Figure 11-80). If a press is not available, place the assembly in a vise with soft metal jaw covers, clamping at the cage outside diameter. Tap out shaft using a rawhide mallet.

CAUTION

Do not strike the input shaft directly with a steel hammer. Damage to shaft will result. Use a brass hammer.

NOTE

With earlier one piece cages, the ball bearing will remain on the input shaft. With later two piece cage/covers, the ball bearing will remain seated in the cage.

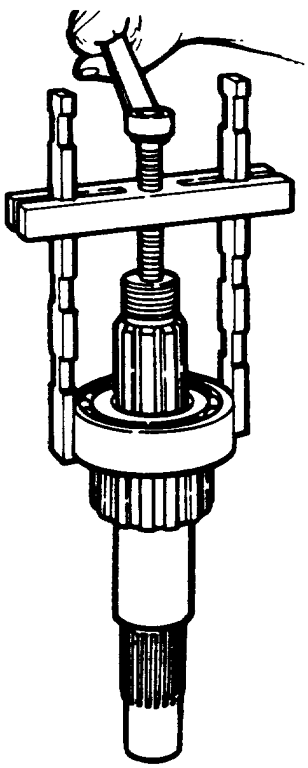


Figure 11-81. Ball Bearing Removal

O. If the bearing remains on input shaft, remove by using a press or a suitable bearing puller equipped with fingers that seat against the bearing race, as shown above in Figure 11-81.

If the bearing remains seated in cage, remove by using a press and sleeve that seats against the bearing outer race. If a press is not available, place the cage in a vise with soft metal jaw covers, clamping on cage outside surface. Tap the bearing out from cage using a rawhide mallet and a sleeve seated against bearing outer race.

CAUTION

Do not strike the bearing directly with a steel hammer. Damage will result. Use a brass hammer.

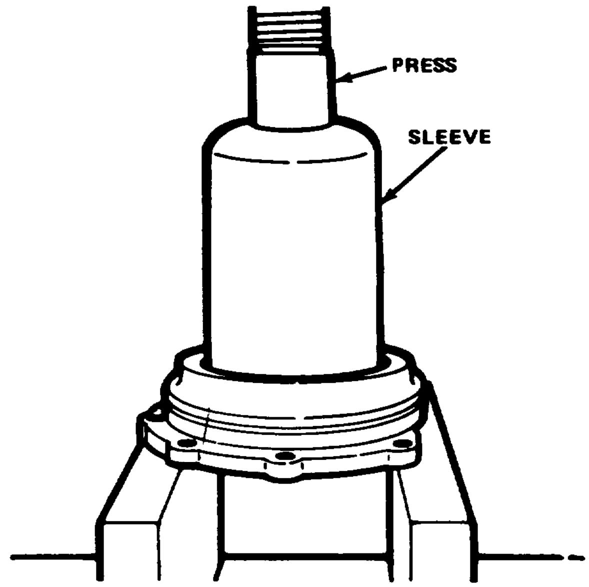


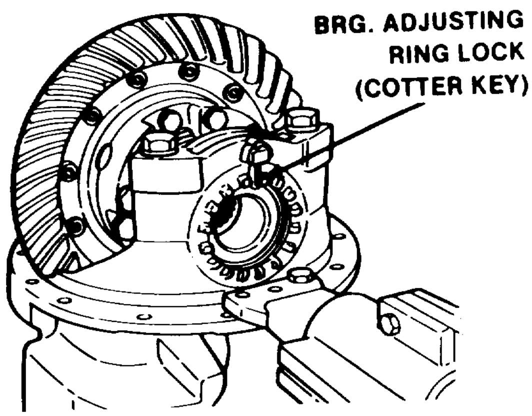
Figure 11-82. Oil Seal Removal

P. Remove the front or outer bearing retainer snapring from groove in inside diameter of the earlier one piece cages. Press out the oil seal with a suitable sleeve as shown above in Figure 11-82. Discard seal. With later models, press out oil seal from the input cage cover. If a press is not available use a drift and mallet to tap out seal. Be careful not to damage the cage or cover inside surface. Discard seal.

Q. If the rear input or inter-axle differential straight roller bearing of later models requires replacement, remove the outer race and rollers from carrier using a suitable puller.

REMOVE MAIN DIFFERENTIAL AND GEAR ASSEMBLY

A. Remove both differential bearing adjusting ring locks from carrier caps. Original models employ a plate type lock attached to the cap with capscrews and lockwire. Later models do not employ lockwire. The current model has cotter key locks (Figure 11-83).



TA222250

Figure 11-83. Adjusting Ring Lock

B. Center punch one differential carrier leg and bearing cap to identify for proper reassembling (Figure 11-84).

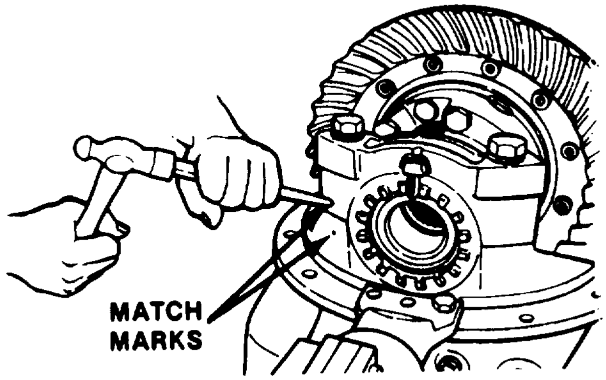


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Figure 11-84. Center Punch Match Marks

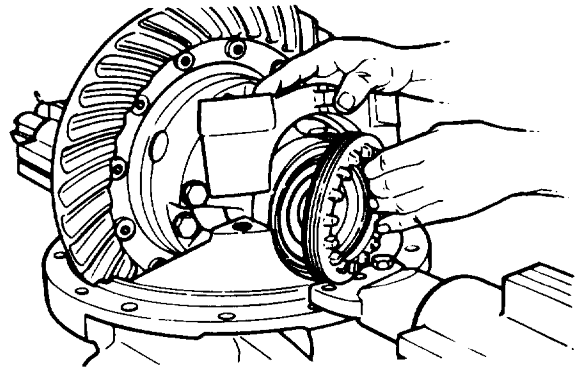

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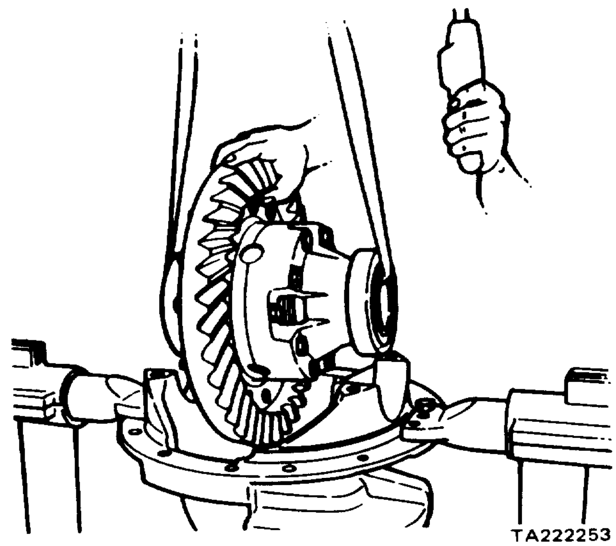
Figure 11-85. Bearing Cap Removal

C. Remove the bearing cap to carrier capscrews, washers, caps and adjusting rings from carrier. Original models also employ lockwire between capscrews (Figure 11-85).



TA222253

Figure 11-86. Removing Differential and Gear Assembly

D. Using a suitable and safe lifting fixture, lift out the main differential and gear assembly from carrier (Figure 11-86).

NOTE

The bearings (cups and cones) will be removed along with the differential assembly. The cups will be loose, while the cones remain seated on the case halves.

DISASSEMBLE MAIN DIFFERENTIAL CASE AND GEAR ASSEMBLY

A. If original identification marks are not clear, mark differential case halves with a punch or chisel for correct alignment when reassembling (Figure 11-87).

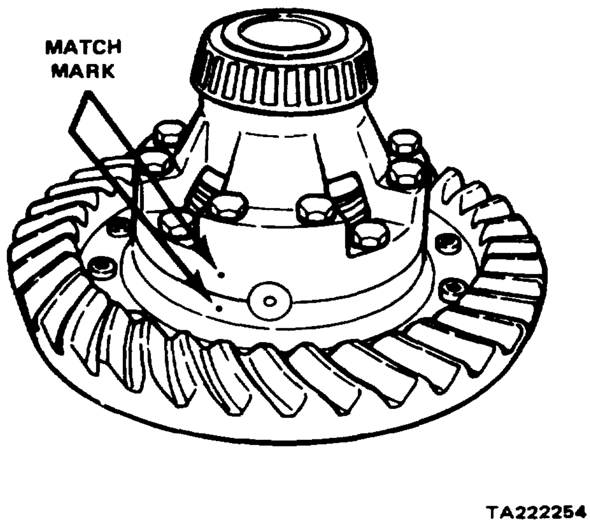


Figure 11-87. Identification Marks

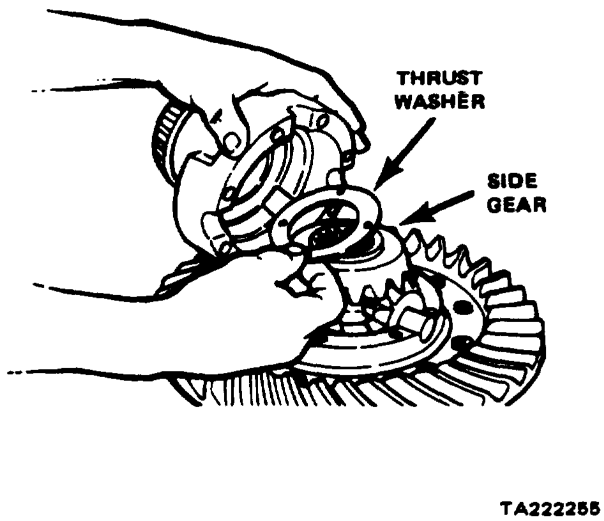


Figure 11-88. Separating Case Halves

B. Cut lockwire, if used, remove bolts and separate case halves. Current models do not employ lockwire (Figure 11-88).

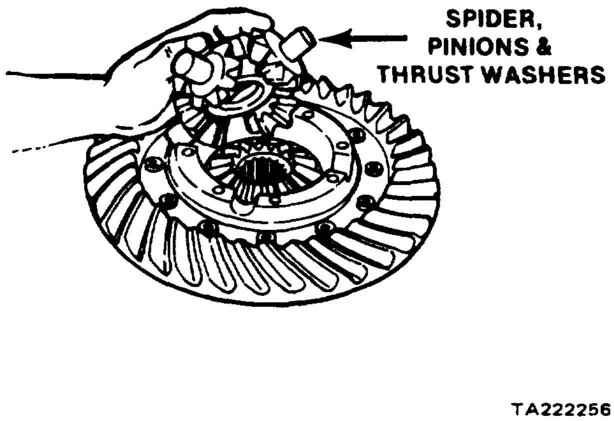


Figure 11-89. Spider and Pinion Disassembly

C. Remove spider, pinions, side gears and thrust washers (Figure 11-89).

D. If ring gear is riveted to the case half, remove rivets and separate gear and case as follows:

1. Carefully center punch rivets in center of head on gear side.

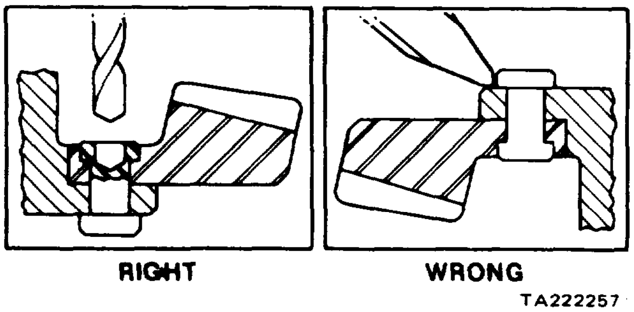


Figure 11-90. Drilling Out Rivets

2. Use drill 1/32" smaller in diameter than body of rivet to drill through head.

3. Press out rivets (Figure 11-90).

CAUTION

Do not chisel or pry rivet heads off. Damage to case half will result.

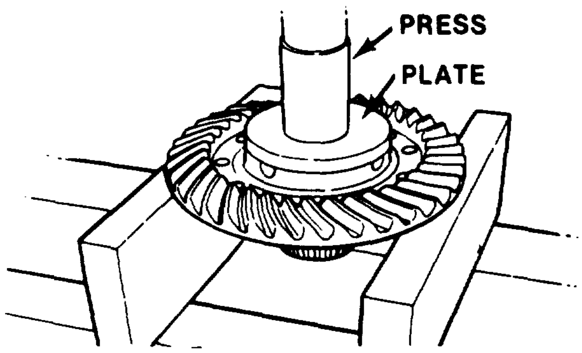


Figure 11-91. Press Case from Gear

4. Place the gear and case assembly in a press with gear teeth facing upward. Block up the assembly under gear with supports. Press the case half from gear using a suitable sleeve or flat metal plate at the case (Figure 11-91).

If a press is not available, position the assembly, gear teeth facing down, on a piece of wood. To avoid damaging the gear the wood "bed" must extend past the gear diameter. A two foot square piece of 3/4" plywood is best. Block up the case half with wood, high enough to allow gear removal. Using a hammer and brass drift, strike the gear alternately at several equally spaced points to drive the gear from case half (Figure 11-92).

E. If ring gear is nut and bolted to case half, remove nuts, washers and bolts and separate the parts as described in step "4".

F. Inspect both differential bearings (cups and cones) for excessive wear or damage. Refer to "Inspect Tapered Roller Bearings" section on page 11B-22. If bearings require replacement, remove cones from differential case halves using a suitable bearing puller (Figure 11-93).

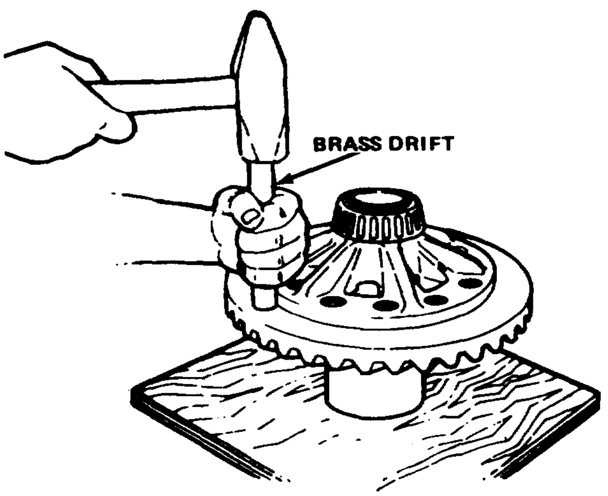


Figure 11-92. Gear Removal from Case

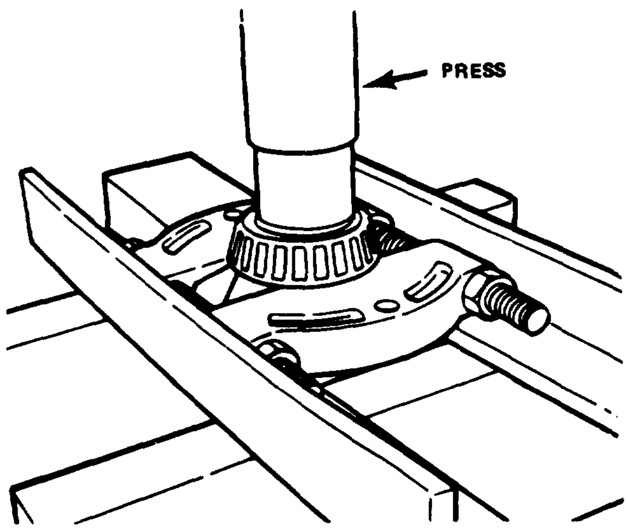


Figure 11-93. Removing Cone

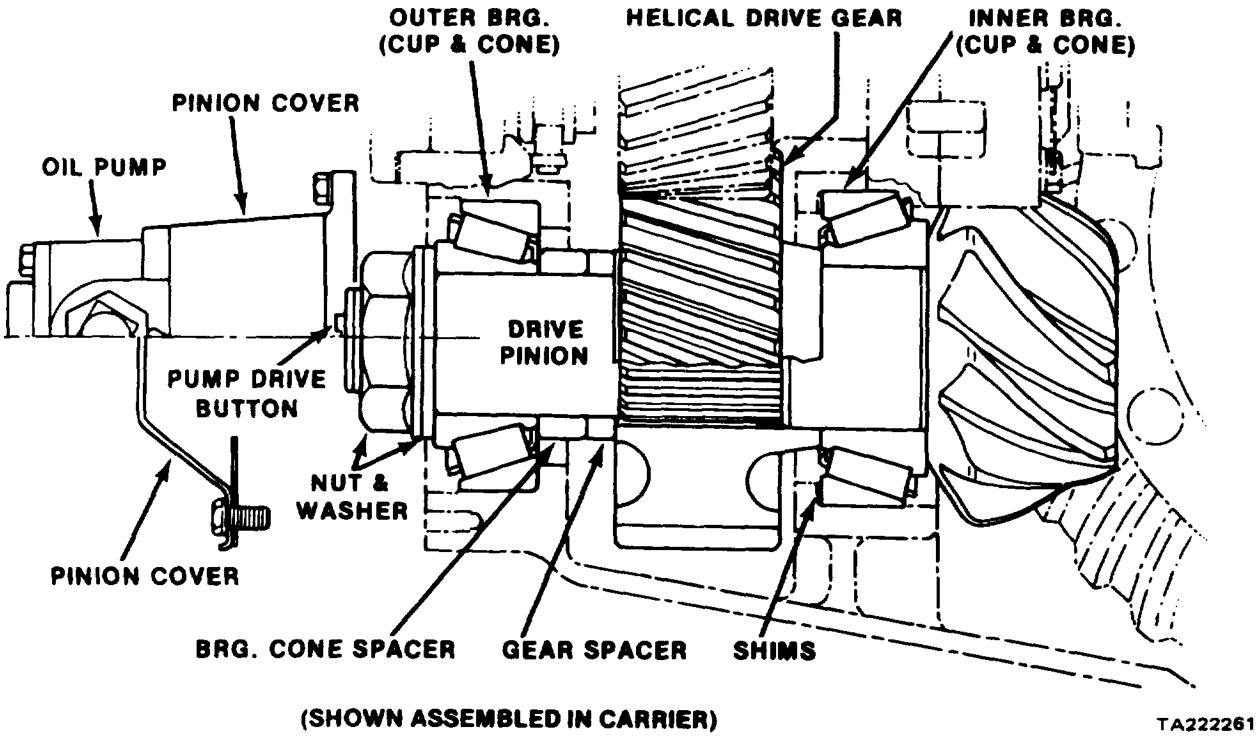


Figure 11-94. Drive Pinion Assembly

REMOVE AND DISASSEMBLE DRIVE PINION ASSEMBLY

A. Position the carrier with drive pinion in a press sup ported by press plates under the carrier housing mounting flange (Figure 11-94).

B. Remove the pinion nut (previously loosened) and washer.

C. Press the pinion shaft through the outer (forward) pinion bearing cone and helical drive gear (Figure 11-95).

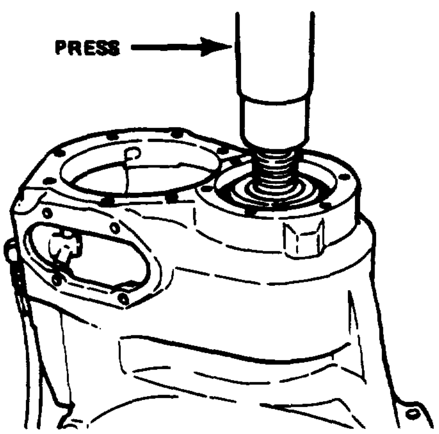


Figure 11-95. Pressing Out Pinion Shaft

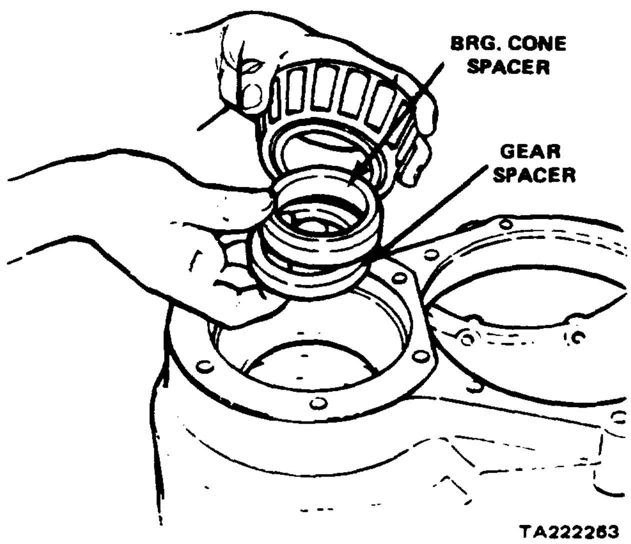


Figure 11-96. Removing Pinion Shaft Components

D. Lift out the outer pinion bearing cone, two spacers and helical drive gear from carrier (Figure 11-96). With some original models, also remove the helical gear inner spacer from the pinion shaft.

E. Inspect both the inner and outer pinion bearings, cups and cones, for excessive wear or damage. Refer to "Inspect Tapered Roller Bearings" section on page 11B-22.

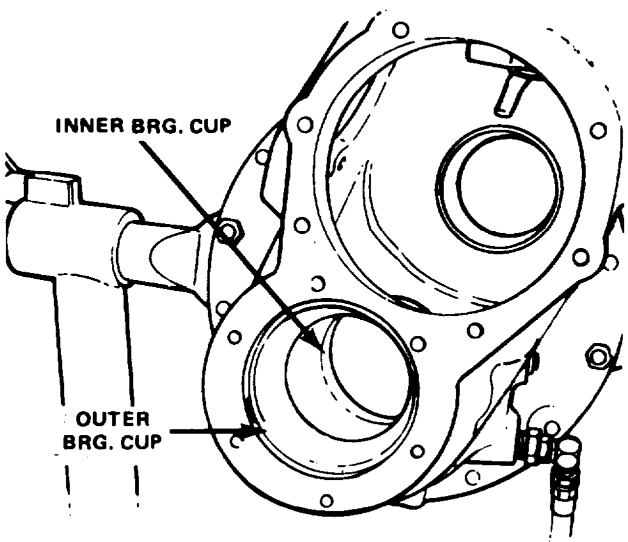


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Figure 11-97. Inner and Outer Bearing Cups

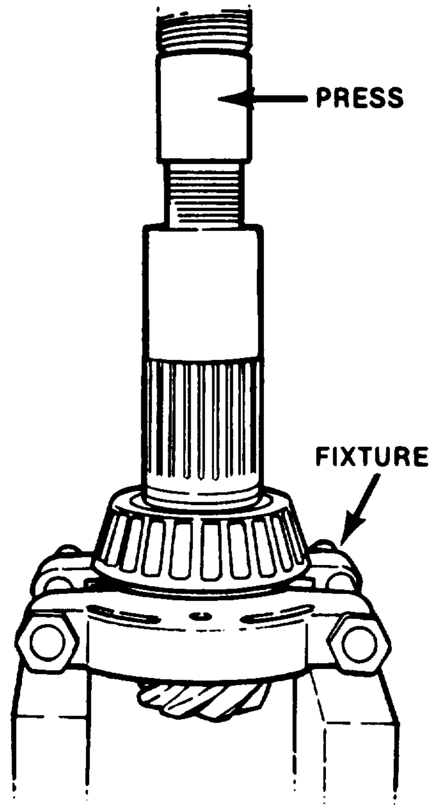

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Figure 11-98. Rear Pinion Bearing Removal

If bearings require replacement, remove the inner and outer bearing cups from carrier using a long brass drift and hammer. Also remove the shims that seat between the inner cup and carrier. Some original models employ shims and a bearing cup spacer, remove both parts (Figure 11-97).

F. Wire the shims and, if used, the spacer together and retain for reassembly.

G. To remove the rear pinion bearing, use a suitable puller against bearing inner race or press pinion through with a fixture that supports inner race (Figure 11-98).

CAUTION

When removing and disassembling the oil valve components. be careful so as not to damage fitting threads, bevel seats, "O" rings or oil lines (Figure 11-99).

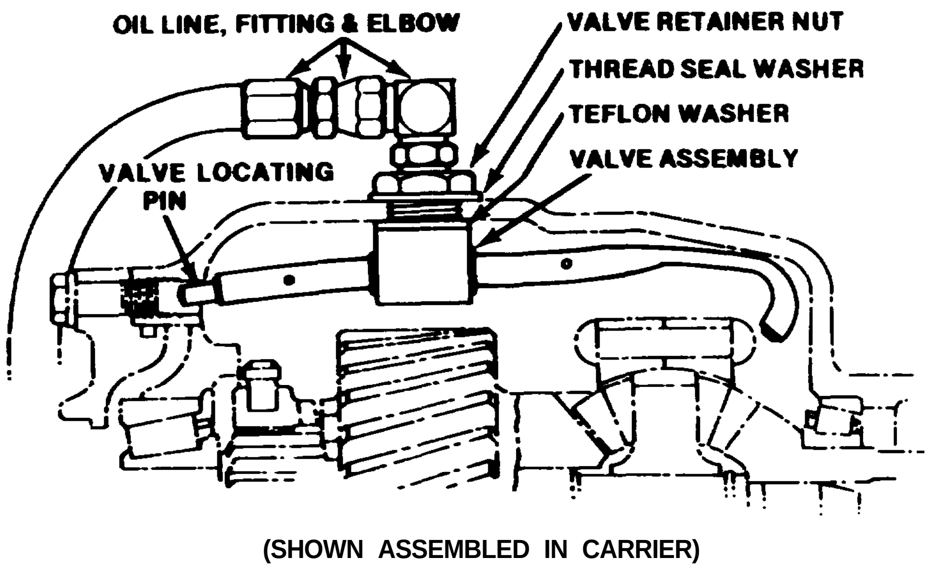

Figure 11-99. Oil Valve Assembly

REMOVE AND DISASSEMBLE OIL VALVE ASSEMBLY

A. Disconnect the oil line from elbow at top of carrier by holding the nipple (middle hex or fitting) stationary while loosening the fitting adapter from elbow (Figure 11-100).

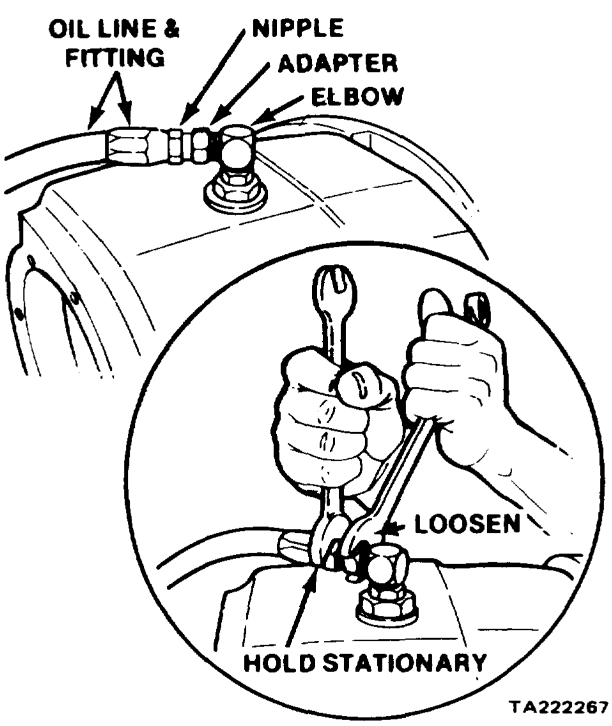

Figure 11-100. Disconnecting the Oil Lines

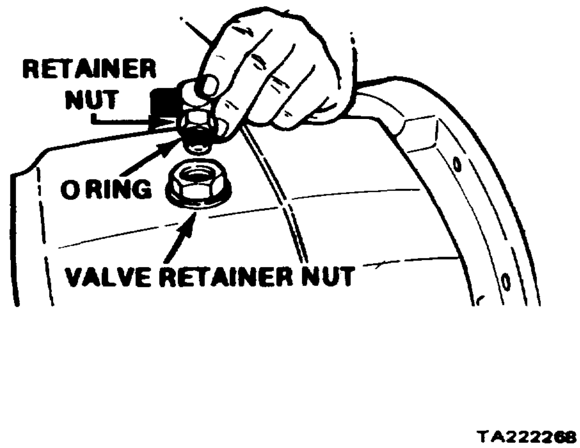

Figure 11-101. Oil Line Elbow Removal

B. Remove the elbow from valve by first loosening the retainer nut (small hex below elbow). Thread out the elbow from inside diameter of valve tube. Inspect the “O” ring at elbow seat for breaks, cracks, etc. If damaged in any way, discard (Figure 11-101).

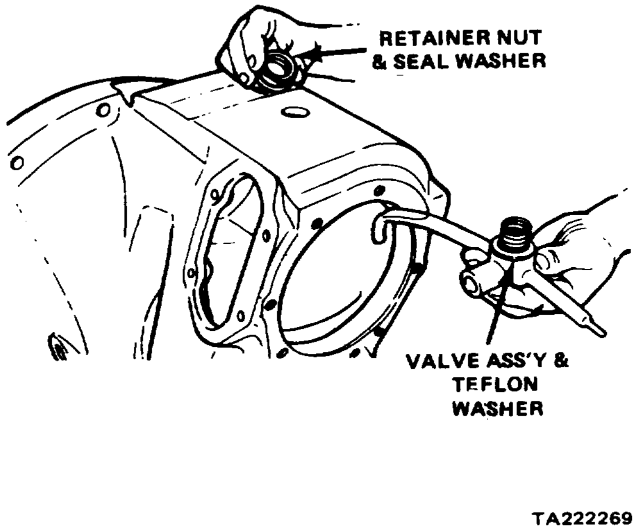

Figure 11-102. Carrier Oil Valve Removal

C. Remove the oil valve from carrier by unthreading the large retainer nut from valve tube. As the nut is loosened and removed, hold the valve in position inside carrier to prevent the assembly from dropping. Along with nut, also remove the thread seal washer. Pull the valve assembly and teflon washer down and out from seat inside the carrier (Figure 11-102).

CAUTION

Inspect thread seal washer. If seal element inside surface is damaged in any way, discard. Also, check the teflon washer, if it is deformed in any way, discard.

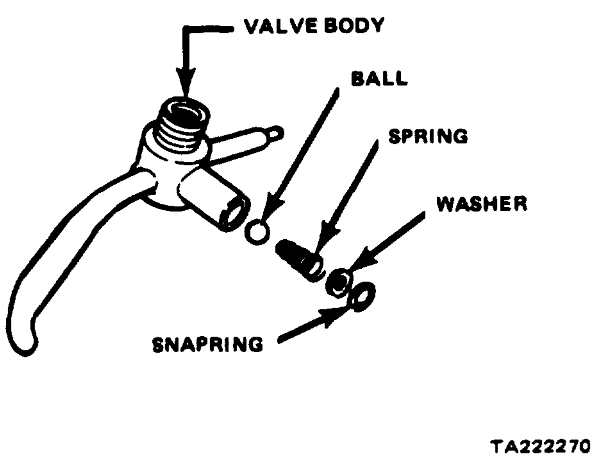

Figure 11-103. Oil Valve Disassembly

D. Disassemble the oil valve (pressure relief) only if required. Use the following procedure. Remove the retainer snapring from valve body opening and remove the washer, spring and ball (Figure 11-103).

REMOVE OIL FILTER SCREEN ASSEMBLY

CAUTION

When removing the oil filter screen components, be careful so as not to damage fitting threads, bevel seats, "O" rings or oil lines.

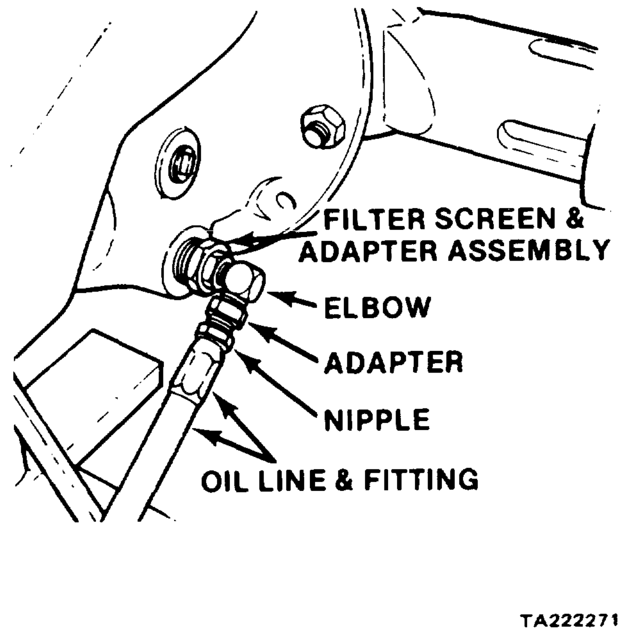

Figure 11-104. Removing Oil Line

A. Disconnect the oil line from elbow located at lower left side of carrier. Hold the nipple (middle hex of fitting) stationary while loosening the fitting adapter from elbow (Figure 11-104).

B. Remove the tube adapter and filter screen assembly. and elbow as a unit by unthreading the adapter (large hex under elbow) from carrier (Figure 11-105).

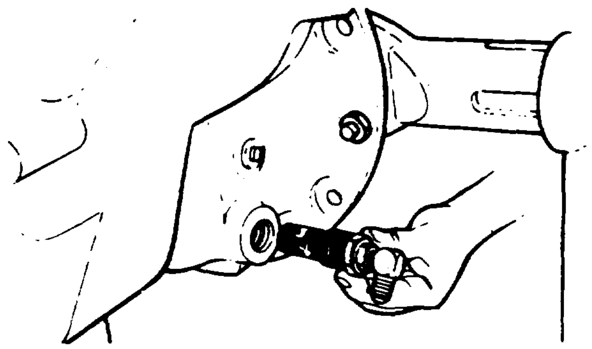

Figure 11-105. Tube Adapter and Related Parts

C. If it is necessary to disassemble the elbow from adapter, loosen the retainer nut (small hex below elbow) and thread out the elbow from adapter. Inspect the “O” ring at elbow seat for breaks, cracks, etc. If damaged in any way. discard (Figure 11-106).

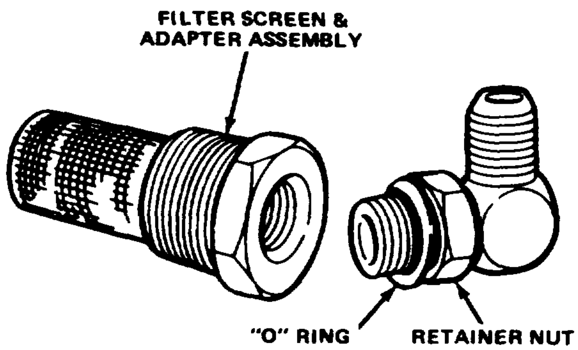

Figure 11-106. Elbow and Adapter Assembly

D. Make a visual check of the filter screen. If screen is damaged in any way, discard and replace at reassembly. Otherwise, set it aside for cleaning.

SERVICING THE OIL PUMP ASSEMBLY

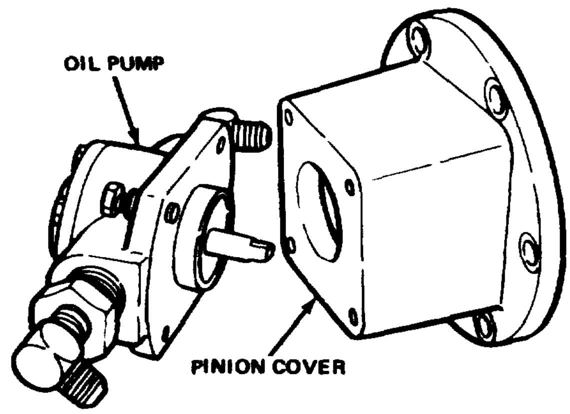

Figure 11-107. Oil Pump Removal

A. Disassemble the oil pump from the pinion cover by removing four attaching capscrews and washers. Also remove the pump to cover gasket and discard if found defective in any way (Figure 11-107).

NOTE

Do not disassemble the oil pump assembly unless required. Further, if the pump is not functioning properly, it is recommended to replace the unit as a complete assembly, under Rockwell part No. A-3303-H-8. Also, for current parts information on the complete drive axle, refer to the Rockwell International parts list No. SP-7646-1. Tuthill pump model 2RFD-1.

PREPARE FOR REASSEMBLY - CLEAN, INSPECT AND REPAIR

WARNING

Exercise care to avoid skin rashes, fire hazards and inhalation of vapors when using solvent typecleaners.

CLEAN

Parts having ground and polished surfaces, such as gears, bearings, shafts and collars, should be cleaned in solvent P-D-680 (SD II).

Clean all mating surfaces where fiber or liquid gasket material is used. It may be necessary to use a scraper to completely remove gasket materials. Be careful not to damage mating surfaces.

GASOLINE SHOULD NOT BE USED.

DO NOT clean these parts in a hot solution tank or with water and alkaline solutions, such as sodium hydroxide, orthosilicates or phosphates.

We DO NOT recommend steam cleaning assembled drive units after they have been removed from the housing. When this method of cleaning is used, water is trapped in the cored passages of the castings and in the close clearances between parts, as well as on the parts. This can lead to corrosion (rust) of critical parts of the assembly and the possibility of circulating rust particles in the lubricant. Premature failure of bearings, gears and other parts can be caused by this practice. Assembled drive units cannot be properly cleaned by steam cleaning, dipping or slushing. Complete drive unit disassembly is a necessary requisite to thorough cleaning.

ROUGH PARTS

Rough parts, such as differential carrier castings, cast brackets and some brake parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts are not ground or polished. The parts should remain in the tank long enough to be thoroughly cleaned and heated through. This will aid the evaporation of the rinse water. The parts should be thoroughly rinsed after cleaning to remove all traces of alkali.

WARNING

Exercise care to avoid skin rashes and inhalation of vapors when using alkali cleaners.

COMPLETE ASSEMBLIES

Completely assembled axles, torque dividers and transfer cases may be steam cleaned on the outside only, to facilitate initial removal and disassembly, providing all openings are closed. Breathers, vented shift units, and all other openings should be tightly covered or closed to prevent the possibility of water entering the assembly.

DRYING

Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless absorbent paper towels or wiping rags free of ‘abrasive material, such as lapping compound, metal filings or contaminated oil. Bearings should never be dried by spinning with compressed air.

CORROSION PREVENTION

Parts that have been cleaned, dried, inspected and are to be immediately reassembled should be coated with light oil to prevent corrosion. If these parts are to be stored for any length of time, they should be treated with a good rust preventive and wrapped in special paper or other material designed to prevent corrosion.

INSPECT

It is impossible to overstress the importance of careful and thorough inspection of drive unit parts prior to reassembly. Thorough visual inspection for indications of wear or stress, and the replacement of such parts, as are necessary, will eliminate costly and avoidable drive unit failure.

TAPERED ROLLER BEARINGS

Inspect all bearings, cups and cones, including those not removed from parts of the drive unit, and replace if rollers or cups are worn, pitted or damaged in any way. Remove parts needing replacement with a suitable puller or in a press with sleeves.

If any of the following bearing conditions exist, bearings must be replaced:

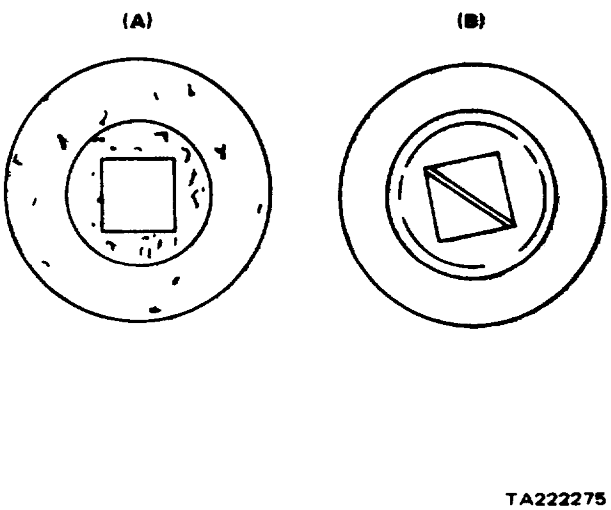

Figure 11-108. Worn Rollers

1. Large ends of rollers worn flush to the recess (Figure 11-108A). or the radii at the large ends of the rollers worn sharp (Figure 11-108B).

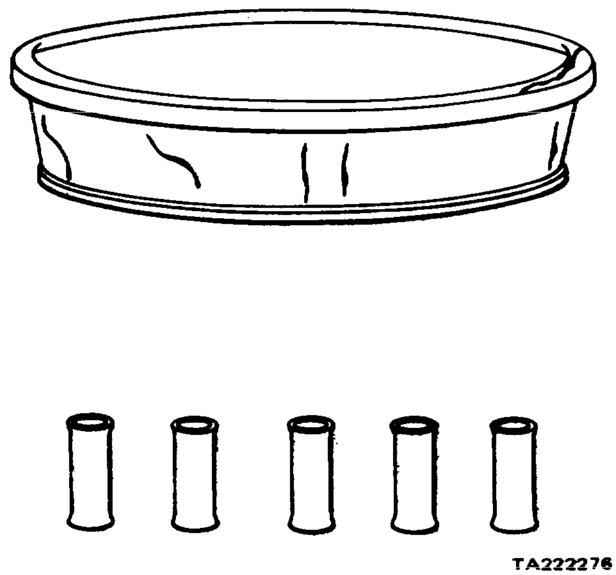

Figure 11-109. Roller Track, Bearing CUP Wear

2. (a.) Visible step wear, particularly at the small end of the roller track (Figure 11-109).

(b.) Deep indentations, cracks or breaks in the bearing cup and/or cone surfaces (Figure 11-109).

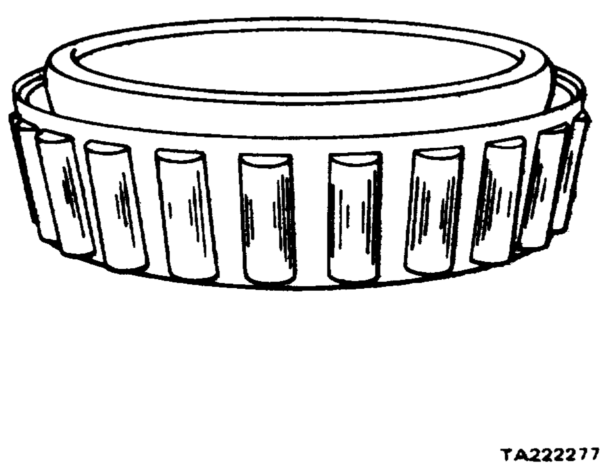

Figure 11-110. Bearing Cage Rubbing Marks

3. Bright rubbing marks on the dark phosphate surfaces of the bearing cage (Figure 11-110).

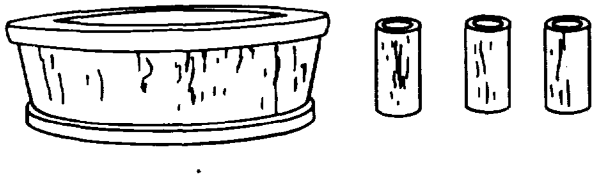

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Figure 11-111. Etching or Pitting

4. Etching or pitting on functioning surfaces (Figure 11-111).

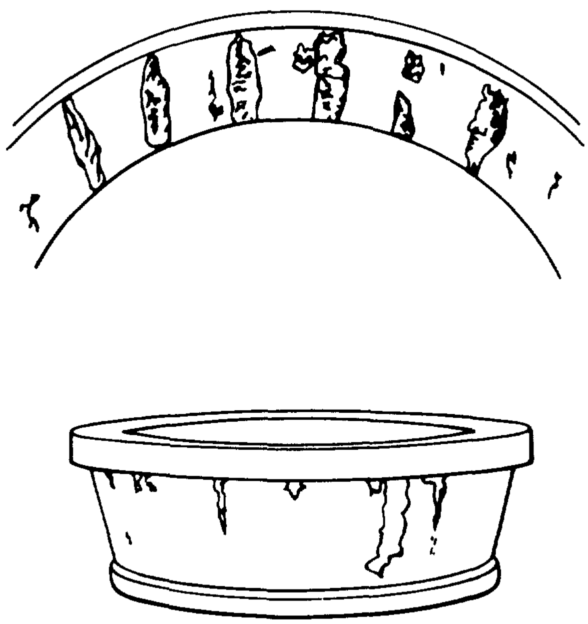

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Figure 11-112. Spalling or Flaking

5. Spalling or flaking on the bearing cup and/or cone surfaces (Figure 11-112).

DRIVE PINION AND RING GEARS

Inspect hypoid gears for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced. When it is necessary to replace either the pinion or gear of a hypoid set, the entire gear set must be replaced.

DIFFERENTIAL NEST, BEVEL GEARS

Inspect the differential assembly for the following:

1. Pitted, scored or worn thrust surfaces of differential case halves, thrust washers, spider trunnions and differential gears. Thrust washers must be replaced in sets. The use of a combination of old and new washers will result in premature failure.

2. Wear or damage to the differential pinion and side gear teeth. Always replace differential pinions and side gears in sets.

HELICAL SPUR GEARS

Inspect spur gears of the transfer train for wear or damage. Gears which are worn, ridged, pitted or scored, should be replaced.

AXLE SHAFTS

Inspect axle shafts for signs of torsional fractures or other indication of impending failure.

REPAIR

A. Replace all worn or damaged parts. Hex nuts with rounded corners, all washers if damaged, oil seals and gaskets or silicone gasket material should be replaced at the time of overhaul.

Use only genuine Rockwell replacement parts for satisfactory service. For example, using gaskets of foreign material generally leads to mechanical trouble due to variations in thickness and the inability of certain materials to withstand compression or oil.

B. Remove nicks, mars and burrs from machined or ground surfaces. Threads must be clean and free to obtain accurate adjustment and correct torque. A fine mill file or India stone is suitable for this purpose. Studs must be tight prior to reassembling the parts.

C. When assembling component parts, use a press where possible.

D. Tighten all the nuts to the specified torque. (Refer to torque chart at end of manual).

E. DO NOT REPAIR WELD - In the interest of safety and preserving the service life of axle assemblies, Rockwell International recommends that axle assemblies NOT be repair welded. Repair welding can detract from the structural integrity of a component, particularly as to heat-treated parts where the benefit of heat-treatment may be nullified by the welding.

Since it can be extremely hazardous and detrimental to repair weld components of any kind, repair welding can be approved only where stringent controls are imposed and equipment, customarily located only at manufacturing facilities, is employed, so as to minimize the potentially detrimental effects of repair welding.

In deciding whether to repair or scrap any damaged part, always keep in mind that we, as manufacturers, never hesitate to scrap any part which is in any way doubtful.

If it becomes necessary to attach brackets or other components to drive axle housings by means of welding, you must refer to the Rockwell International Technic Aid, section 2, aid #95 on “Drive Axle Welding Recommendations”.

SILICONE (RTV) GASKET APPLICATION

NOTE

Where silicone RTV gasket material is used, Dow Silastic No. RTV-732 Black and General Electric No. RTV-1473 Black meet our requirements.

SERVICE

Removal of all gaskets including silicone RTV is accomplished by peeling or scraping the used gasket off both mating surfaces.

Application of silicone RTV gasket material is as follows:

1. Remove dirt, grease or moisture from both mating surfaces.

2. Dry both surfaces.

3. Apply a continuous thin bead, approximately 3/16” diameter completely around one mating surface and around the edge of all fastener holes to assure complete sealing and prevent leakage.

WARNING

Minor concentrations of acetic acid vapor may be produced during application. Adequate ventilation should be provided when silicone RTV is applied in confined areas.

Further, eye contact with these silicone RTV gasket materials may cause irritation; if eye contact takes place, flush eyes with water for 15 minutes and have eyes examined by a doctor.

4. Assemble the components immediately to permit silicone RTV gasket material to spread evenly.

When rebuilding any assembly, always use torque values on fasteners as specified by either Rockwell or the vehicle manufacturer.

CAUTION

Failure to use appropriate gasket material will cause axle to leak.

REASSEMBLE AND INSTALL DRIVE UNIT

NOTE

If a new gear set (drive pinion and ring gear) is being installed into the carrier, refer to the following gear set information before starting reassembly.

GEAR SET IDENTIFICATION (Figure 11-113)

The following information is marked on current drive pinion and gear sets, and will be used for identifying, matching and adjusting procedures.

The items listed are keyed to the following illustration.

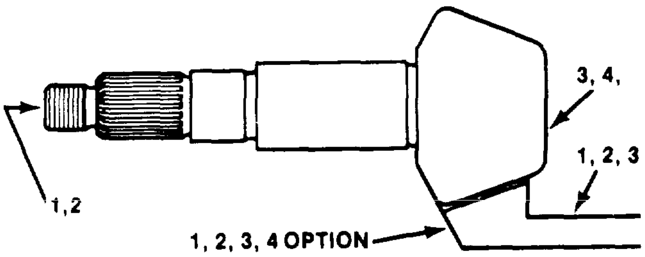

Figure 11-113. Gear Set Identification

1. Part Number

2. Tooth Combination Number

The Part Number and Tooth Combination Number are found on the shank or threaded end of all pinions. On the ring gears the numbers are normally found on the front face of the gear. However, as an option, they may be located at the gear outside diameter. For any given pinion and gear set the ring gear always has an even part number (i.e. 36786) and the matched pinion has the odd number (i.e. 36787).

The tooth combination number (i.e. 5-37) indicates the gear set has a 5 tooth pinion and a 37-tooth ring gear, the equivalent of a 7.4 to 1 gear ratio.

Always refer to the Part Number and Tooth Combination Number before starting the reassembly. Check to be certain the pinion and gear match.

3. Gear Set Matching Numbers

All Rockwell drive pinion and gear sets are manufactured and sold only in matched sets. Both pieces of the set have a matching number such as “M29” or any combination of a letter and number.

On most pinions the number is usually marked on the head end. However, on pinions with parallel-sided splines the number may be marked on the top flat one of the splines.

On the ring gear the number is usually found on the front face of the gear, although sometimes it may be on the gear outside diameter.

A gear and pinion which do not have the same matching numbers must not be run together. If either a pinion or a ring gear should require replacement both must be replaced in a matched set.

4. Pinion Cone Variation Number

Each pinion has a Pinion Cone (P.C.) Variation Number which indicates variations (in thousandths of an inch) from the nominal mounting distance. This Pinion Cone Variation Number is necessary because pinion and gear sets for a specific series of axles cannot be manufactured exactly alike, and there may be slight differences in the Mounting Distance of the individual gear sets. This P.C. Variation Number must be used to modify the Nominal Pinion Gauging Dimension when using a pinion setting gauge or when calculating pinion cage shim pack thickness.

The Pinion Cone Variation Number (i.e. P.C. +3 or P.C. -5) is normally found on the pinion head end: however, it may sometimes be located on a spline of a pinion with the larger parallel-sided-type splines or on the ring gear outside diameter.

NOTE

The nominal pinion mounting distance is not marked on current gear sets. However, for the SHD, THD and UHD model series pinions it is 8.750”

(222.25mm). This dimension indicates the nominal distance from the center of the ring gear to the bearing shoulder of the pinion head.

Further, the gear set backlash of this series of drive units is .005" - .015" (.13 - .39mm).

The drive pinion depth in the carrier is controlled by the thickness of shims located between the

CAUTION

If a change in pinion depth is required after establishing bearing preload, a like change in the gear spacer thickness must be made to retain the correct bearing period. For example, when adding .003" to the shim thickness between the pinion inner bearing cup and carrier, an increase of .003" to the gear spacer thickness is also required to retain the estab-

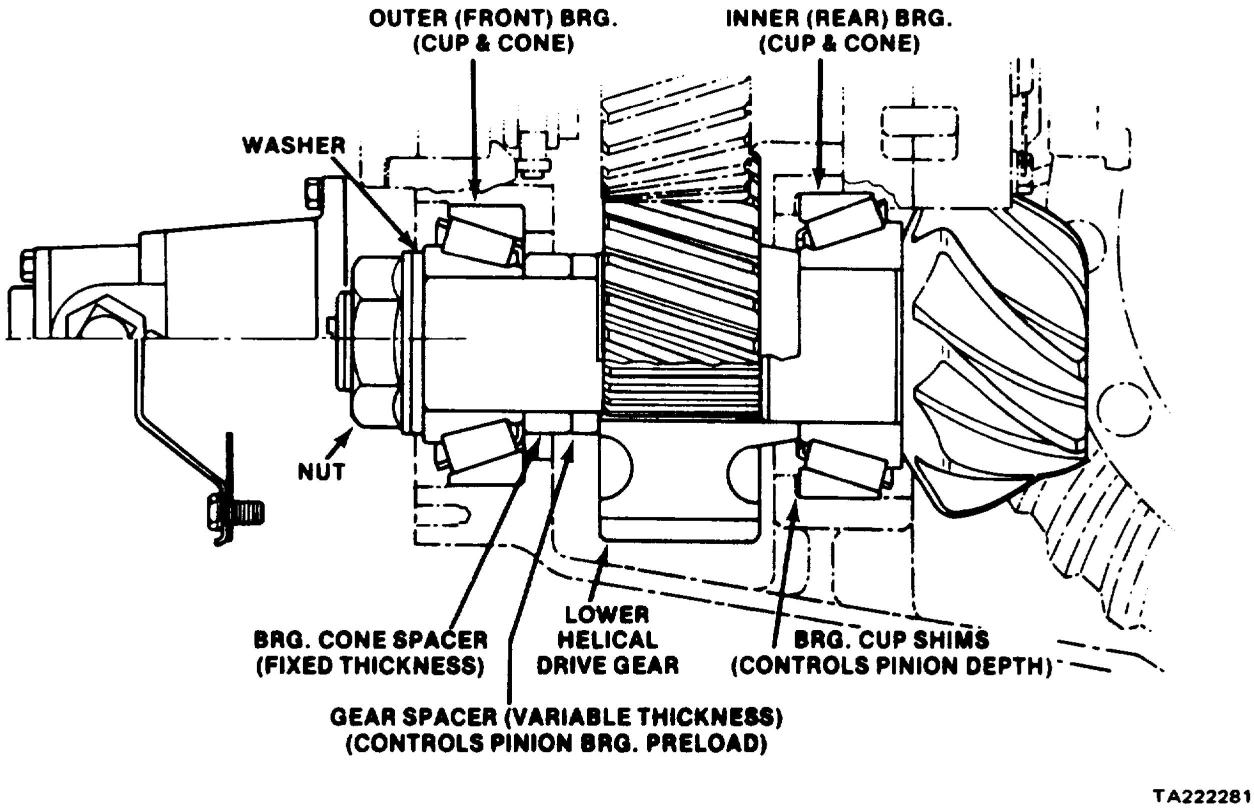

Figure 11-114. Hypoid Drive Pinion Assembly

pinion inner bearing cup and carrier. Correct depth adjustment is established by increasing shim thickness to increase pinion depth or decreasing thickness to decrease pinion depth.

Further, pinion bearing preload is controlled by the stack-up of the lower helical drive gear, a gear spacer (variable in thickness) and a cone spacer, all of which are mounted on the pinion shaft between the bearing cones. Correct bearing preload adjustment is established by using a thicker gear spacer to decrease preload or a thinner gear spacer to increase preload (Figure 11-114).

lished bearing preload. The inverse is true when decreasing the shim thickness at the pinion inner bearing cup.

If the original gear set is to be reinstalled into the carrier, temporarily install the drive pinion as follows:

A. Coat both the pinion bearings (cups and cones) with the recommended axle lubricant.

B. Press the inner (rear) bearing cone squarely against the pinion head. Use a suitable sleeve that will bear against the cone (inner) race (Figure 11-115).

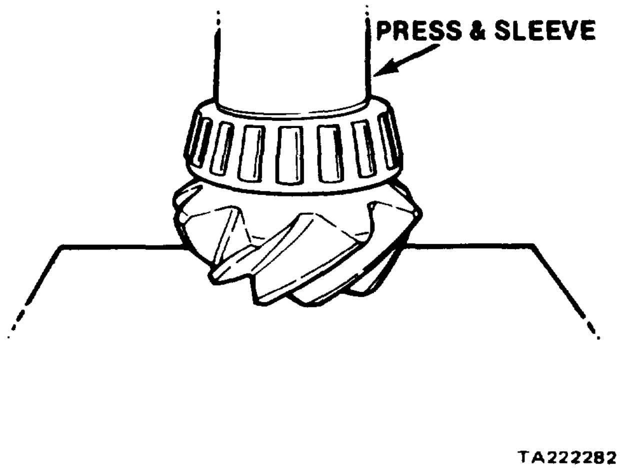

Figure 11-115. Inner Bearing Cone

C. Place the carrier in a press with carrier legs facing upward. Position the original pinion inner bearing cup shims into the bearing bore of carrier and position cup over bore (Figure 11-116).

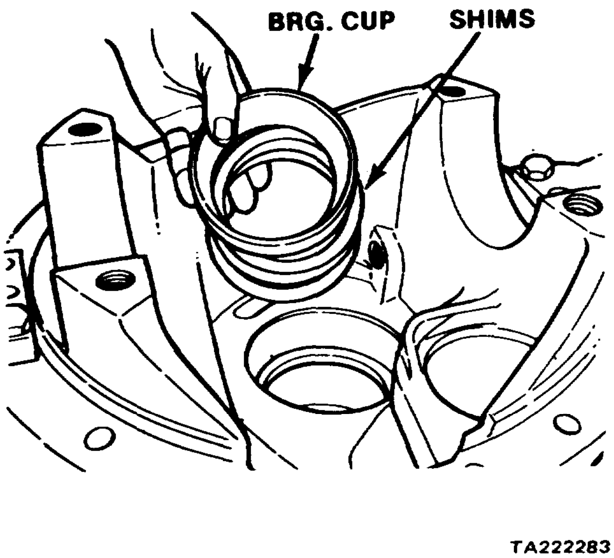

Figure 11-116. Bearing Cup and Shims

NOTE

Some original models also employ a thick spacer along with the bearing cup shim. Install the shim first, then the spacer.

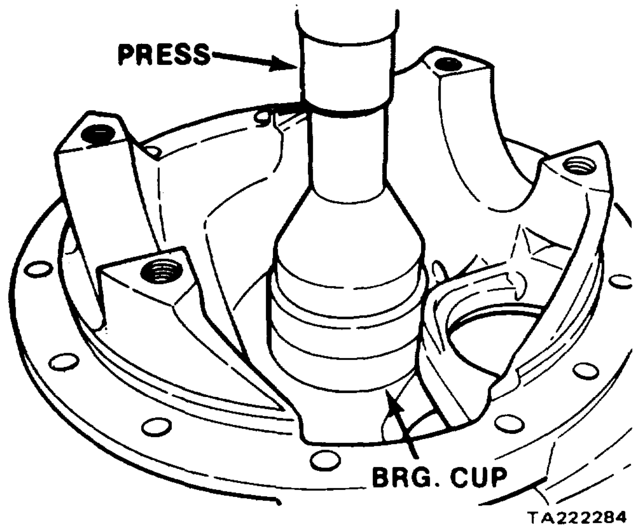

Figure 11-117. Installing Bearing Cup

D. Block up the carrier in a safe manner and press the inner (rear) bearing cup into bore against shim or shim and spacer combination using a suitable sleeve. If a press is not available use a brass drift and mallet to tap the bearing cup into position (Figure 11-117).

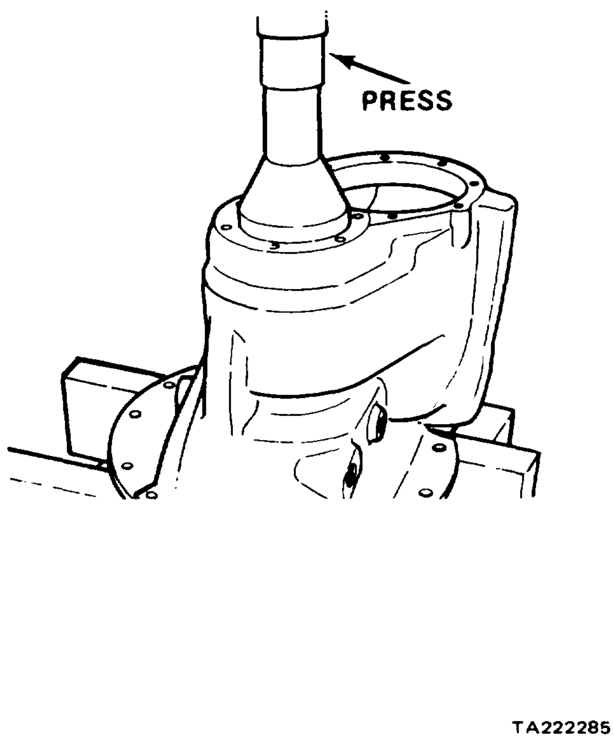

Figure 11-118. Installing Bearing Cup into Carrier

E. Reposition the carrier in press with carrier legs facing downward and block up in a safe manner. Using a suitable sleeve, press the outer pinion bearing cup into bore of carrier until it bottoms. If a press is not available, use a sleeve or brass drift and mallet to tap the cup into position (Figure 11-118).

F. Install the drive pinion into carrier, up through the inner and outer bearing cups. Safely support the carrier and block up the pinion under pinion head, high enough to allow the inner bearing cone and cup to be in contact.

G. Press the outer bearing cone onto the pinion shaft using a suitable sleeve that bears against the cone (inner) race. Press cone in place with two (2) tons pressure to seat rollers (Figure 11-119).

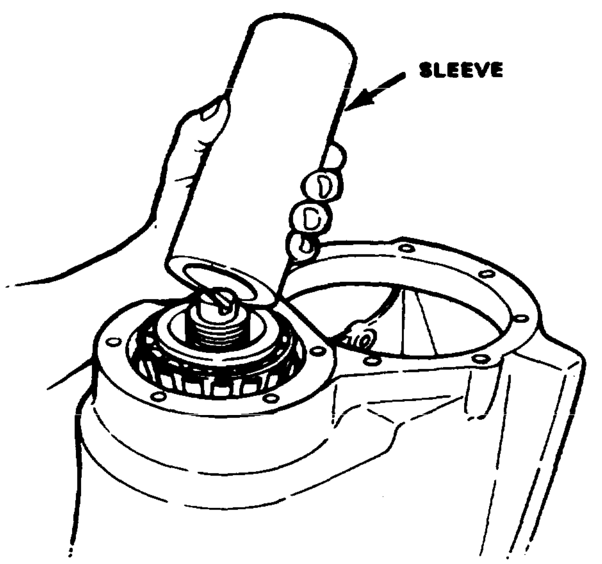

Figure 11-119. Pressing Bearing Cone with Sleeve

H. Assemble the pinion washer and nut, applying only 100 lb. ft. torque to nut at this time. Hold the pinion from rotating while tightening nut by placing hardwood block between the pinion teeth and carrier wall.

NOTE

Continue with assembling and installing the main differential, adjusting the hypoid gear backlash and checking gear tooth contacts to determine if any alteration to the shim thickness between the pinion inner bearing cup and carrier is required.

Final reassembly of the drive pinion will be done after checking gear tooth contacts.

If a new gear set is being installed into the carrier, use the following procedures:

ADJUSTING PINION DEPTH (SHIM THICKNESS) WITH A PINION SETTING GAUGE (Figure 11-120)

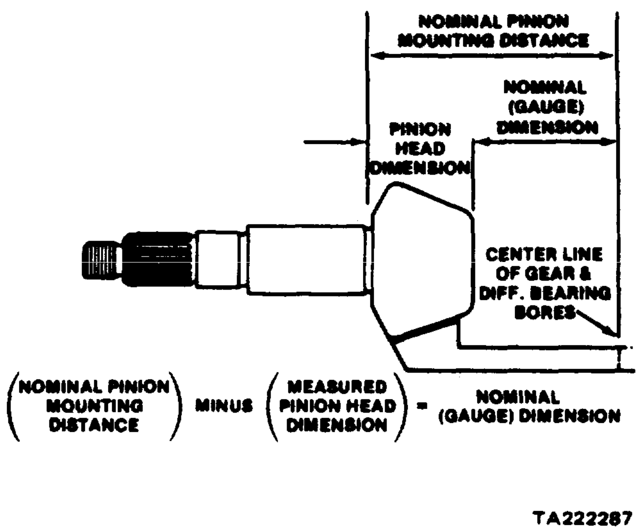

Figure 11-120. Installing and Adjusting Pinion

The correct use of a pinion setting gauge will simplify the accurate installation of the pinion and cage assembly into the carrier. When using the pinion setting gauge, never use the nominal pinion mounting distance without first modifying it to a workable value. The Nominal Pinion Mounting Distance 8.750” (222.25mm) indicates the proper distance from the center of the ring gear to the bearing shoulder on the pinion.

However, because the pinion setting gauge measures the distance from the ring gear center to the nose of the pinion, rather than the bearing shoulder, it becomes necessary to subtract the length of the pinion head from the Nominal Pinion Mounting Distance in order to establish the correct nominal or gauge dimension to work with.

To accurately install and adjust the pinion using a pinion setting gauge, follow these procedures:

1. Record the Nominal Pinion Mounting Distance and the original shim pack thickness from between the inner bearing cup and carrier for future reference.

2. With a micrometer or vernier scale, measure the length of the pinion head from its nose to its bearing shoulder.

EXAMPLE: 3.219" (81.76mm)

Mark the spot on the pinion nose from which this measurement was taken. Later, when using the pinion setting gauge, measure to or clamp step plate to this same spot for consistency in the calculations.

3. Subtract the measured pinion head length from the Nominal Pinion Mounting Distance to establish the pinion nominal gauge dimension.

EXAMPLE: 8.750" - 3.219" = 5.531"
(222.25mm - 81.76mm = 140.49mm)

The remainder 5.531" (140.49mm) is the basic value or nominal gauge dimension used for calculation, when using the pinion setting gauge.

4. Modify the nominal gauge dimension 5.531" (140.49 mm) by the pinion cone variation number marked on the ring gear or pinion (i.e. P.C. +3 or P.C. -5). This P.C. number indicates the variation in thousandths of an inch from the nominal mounting distance of that specific gear set. Add or subtract this value as indicated by its sign from the nominal gauge dimension established in Step 3. This will give the corrected pinion gauge dimension.

EXAMPLE: P.C. = +3
5.531" + .003" = 5.534"
(140.49mm + .076mm = 140.566mm) or

EXAMPLE: PC. = -5
5.531" - .005" = 5.526"
(140.49mm - .127mm = 140.363mm)

5. Temporarily install into carrier the drive pinion, pinion inner and outer bearings and the original shim or shim and spacer combination that was removed when the unit was disassembled. Refer to pages 11B-27 and 11B-28, steps "A" through "H", disregarding the "NOTE" after step "H" on page 11B-28.

6. Assemble the pinion setting gauge and step plate (if required) into the differential bearing bores using proper adapter discs (Figure 11-121).

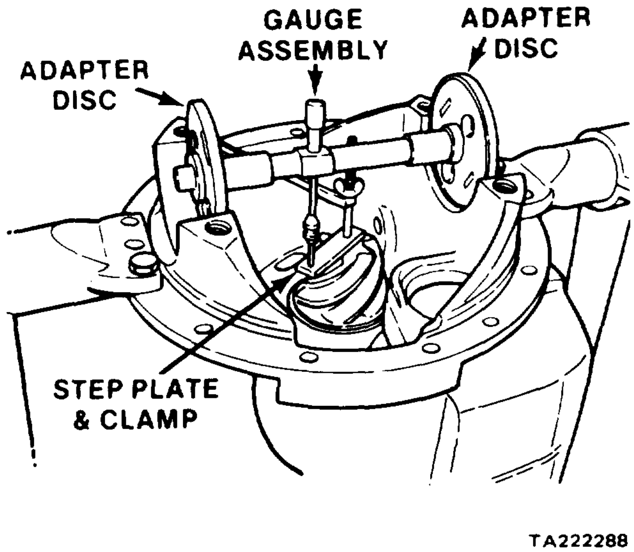

Figure 11-121. Pinion Setting Gauge Assembly

Refer to Technic Aid Section 8, Aid #19 for specifics on adapter discs. Adjust the micrometer arbor so it is directly over and at a 90° angle to the pinion nose or step plate.

7. Run the micrometer down to measure the distance to the pinion or step plate. Make note of this measurement.

EXAMPLE: 5.106" (129.69mm)

Use the following procedures to calculate for correct shim thickness.

If a step plate is required, subtract its thickness (.400") from the corrected pinion gauge dimension calculated in Step 4.

EXAMPLE:

Corrected Nominal Gauge Dimension (5.531" - .005")	5.526"	140.36mm
Step Plate Thickness	- .400"	- 10.16mm
Corrected Micrometer Distance (Final measurement to be obtained)	5.126"	130.20mm

Initial Micrometer Reading (Using original Shim).	- 5.106"	- 129.69mm
Shim Thickness Correction (To be subtracted).	.020"	.51mm

NOTE

If the corrected micrometer distance is greater than the initial micrometer reading, reduce shim thickness, as required, to move pinion out. If the correct micrometer distance is less than the initial micrometer reading, increase shim thickness as required, to move pinion in.

8. After measurements have been taken and noted, remove the pinion setting gauge. Next, remove the pinion nut and washer and press out pinion and inner bearing cup from the carrier.

9. Make the required correction to shim thickness and install new shim, inner bearing cup and pinion into carrier. Refer to pages 11B-27 and 11B-28, steps "A" through "H" for procedures.

After components are installed, recheck the micrometer measurement to be certain the pinion depth adjustment is correct.

NOTE

Continue with "Assemble Main Differential and Ring Gear" on page 11B-34.

Final reassembly of the drive pinion will be done after checking gear tooth contact&

ADJUSTING PINION DEPTH (SHIM THICKNESS) WITHOUT A PINION SETTING GAUGE

A second means of accurately installing a new pinion into the carrier is to mathematically calculate the proper pinion cage shim pack thickness.

The following are the procedures to use:

1. Measure the thickness of the original shim used with the gear set being replaced. Use a micrometer or vernier gauge. Record this measurement for future use.

2. Observe the pinion cone or variation number on the original pinion being replaced. Add or subtract this number as indicated by the variation sign (+ add or - subtract) from the original shim measurement taken in item "1". Make a note of this value.

NOTE

The value calculated in item "2" will establish a "standard shim thickness", without a variation. This value will be used in calculating the shim thickness used with a new pinion and gear set.

3. Observe the pinion cone or variation number on the new pinion or ring gear. If this number is a plus (+) value, subtract it from the calculated "standard shim thickness" determined in item "2". If the variation number is a minus (-) value, add it to the "standard shim thickness" in item "2".

The resulting answer indicates the thickness (in thousandths) of the new shim to be used. Refer to the following examples which cover all the possible combinations of + or - original and new pinion cone variations.

EXAMPLES OF CALCULATION

		METRIC
EXAMPLE NO. ?		
Original Shim Thickness	.030"	.762mm
Original Variation (PC + 2) . .	+ .002"	+ .050mm
Standard Shim Thickness . . .	.032"	.812mm
New Variation (PC + 5)	- .005"	- .127mm
New Shim Thickness	.027"	.685mm
EXAMPLE NO. 2		
Original Shim Thickness	.030"	.762mm
Original Variation (PC - 2). .	- .002"	- .050mm
Standard Shim Thickness . . .	.028"	.712mm
New Variation (PC + 5)	- .005"	- .127mm
New Shim Thickness	.023"	.585mm
EXAMPLE NO. 3		
Original Shim Thickness. . . .	.030"	.762mm
Original Variation (PC + 2) . .	+ .002"	+ .050mm
Standard Shim Thickness . . .	.032"	.812mm
New Variation (PC - 5)	+ .005"	+ .127mm
New Shim Thickness	.037"	.939mm
EXAMPLE NO. 4		
Original Shim Thickness. . . .	.030"	.762mm
Original Variation (PC - 2). .	- 002"	- .050mm

Standard Shim Thickness . . .	.028”	.712mm
New Variation (PC - 5)	+ .005”	+ .127mm
New Shim Thickness	.033”	.839mm

After calculating the shim thickness, install the new shim, pinion bearings and new drive pinion into carrier. Refer to pages 11B-27 and 11B-28, steps “A” through “l-l” for procedures.

NOTE

Remember that all Rockwell drive pinion and gear sets are manufactured and sold only in matched sets. Therefore, if either a pinion or a ring gear should require replacement both must be replaced in a matched set.

ASSEMBLE MAIN DIFFERENTIAL AND RING GEAR ASSEMBLY

A. Proper service replacement of the differential ring gear into the differential case half is necessary for correct gear adjustment and longer drive unit service life. For correct installation, Rockwell recommends heating the ring gear in water to approximately 160° - 180°F for about ten minutes before assembly. This will allow an easier fit of the gear over the differential case pilot, without the use of a press, and without damaging the case and ring gear mating surfaces.

The gear should not be pressed or driven on the case, as this would cause excessive metal particles to lodge between the gear and case, thus resulting in gear runout. Proper installation should, therefore, incorporate preheating the gear as described above to assure correct interference fit and to eliminate metal pick-up.

B. Rivet the gear to the case half with new rivets. Rivets should not be heated, but always upset cold. When the correct rivet is used, the head being formed will be at least 1/8” larger in diameter than the rivet hole. The head will then be approximately the same height as the preformed head.

The following tonnage required for squeezing 5/8” cold annealed steel rivets is approximate and may be adjusted to suit individual working conditions.

DIAMETER OF RIVET	TONNAGE REQUIRED
5/8”	45

After installing rivets, check for proper fit between gear and case half. Using a feeler gauge .003” maximum thickness, check for gap between back face of gear and case flange. Check at four equally spaced locations around the assembly. If gauge can be inserted more than one half the distance between the flange outside diameter and gear pilot diameter, the gear must be removed. Check for cause, correct and reassemble gear onto case half.

Optional differential case and gear bolts are also available for service replacement of rivets. The use of bolts greatly facilitates servicing these units in the field and eliminates the need for special equipment necessary to correctly cold upset rivets.

If nuts and bolts are used to attach the ring gear to case half, assemble all bolts through the gear side and secure with washers and locknuts on case side.

C. If new bearings are to be used, press squarely and firmly on differential case halves with suitable sleeve (Figure 11-122).

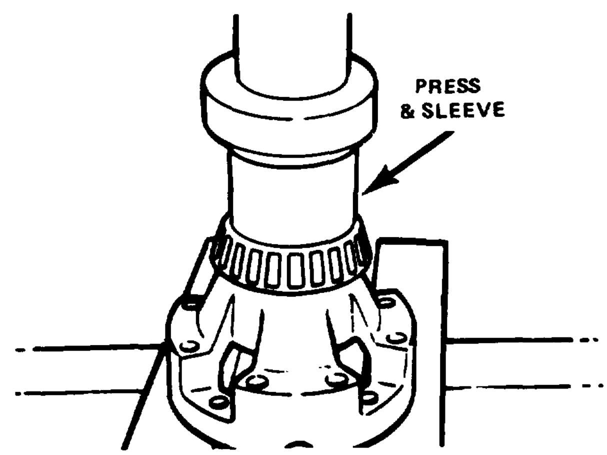

Figure 11-122. Installing Differential Case Bearing

D. Pre-lubricate differential case inner walls and all component parts with the recommended axle lubricant.

E. Position thrust washer and side gear in gear case half.

F. Place spider with pinions and thrust washers in position (Figure 11-123).

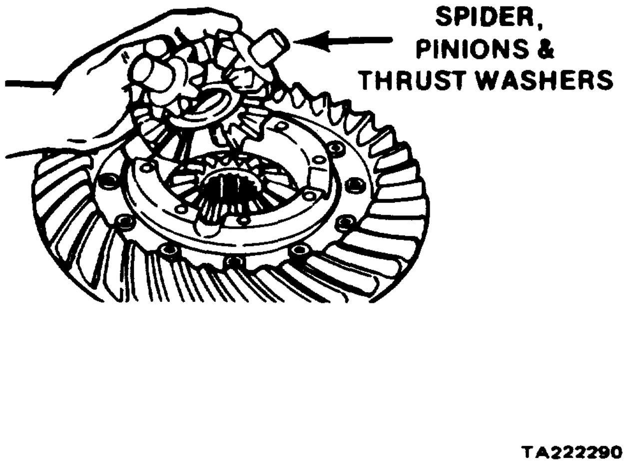

Figure 11-123. Installing Spider with Pinions

G. Install second side gear and thrust washer (Figure 11-124).

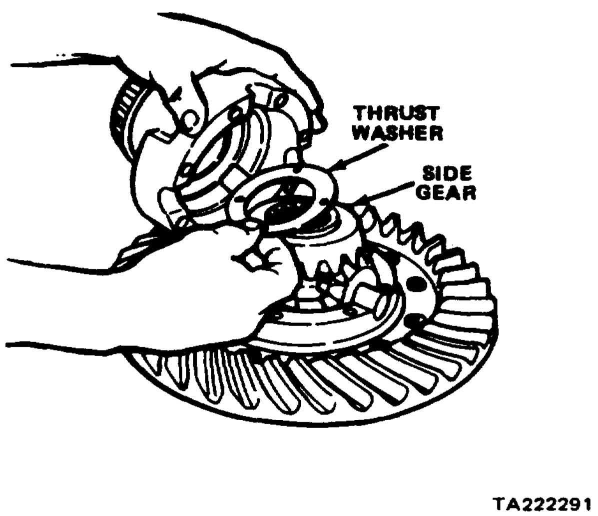

Figure 11-124. Installing Side Gear Thrust Washer

H. Position other case half over assembly, aligning match marks of both halves. Draw the assembly together with three (3) equally spaced capscrews and washers.

NOTE

Rockwell International recommends using new Dri-Loc fasteners or applying Rockwell Liquid Adhesive (Loctite #277) in fastener holes to secure the main differential case halves together. However, do not use these type fasteners or apply Liquid Adhesive to threaded holes until after the differential nest rolling resistance check has been made. At this time, use only regular fasteners without adhesive coatings.

I. Install remaining capscrews and washers and tighten to correct torque. Refer to Torque Chart at the end of this manual. Continue with rolling resistance check.

ROLLING RESISTANCE CHECK OF DIFFERENTIAL NEST (Figure 11-125)

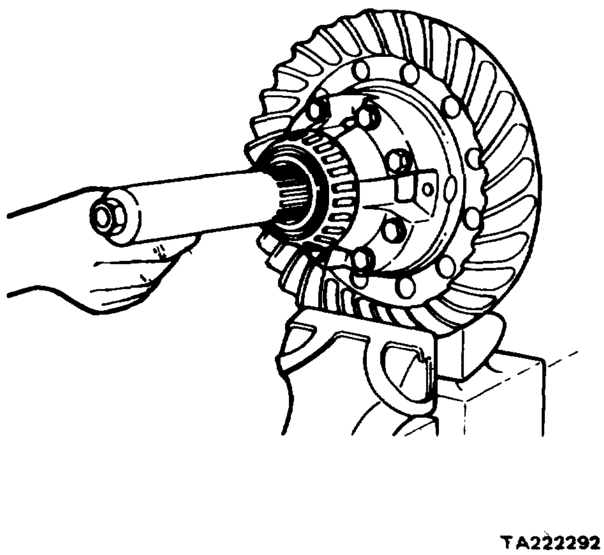

Figure 11-125. Differential Nest Checking Tool

A. Place differential and ring gear assembly in a vise.

CAUTION

Use soft metal covers over vise jaws to protect ring gear.

B. Insert checking tool (made from splined axle shaft end) into differential nest. Allow splines of tool to engage with spline of one side gear only.

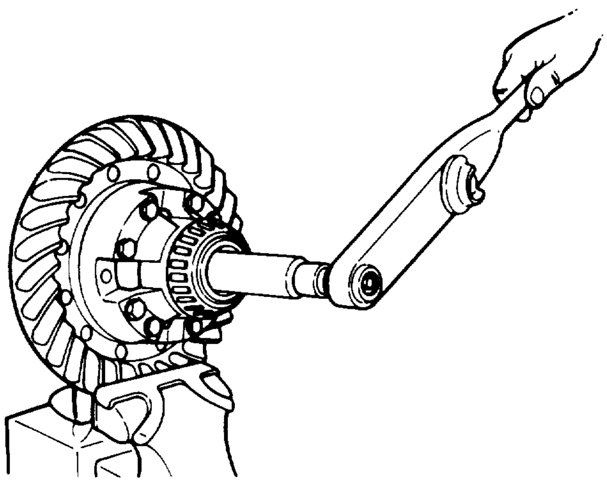

Figure 11-126. Torquing Differential Nest

C. Using a suitable socket and torque wrench, rotate differential nest while observing scale on torque wrench (Figure 11-126).

The differential rolling resistance must be less than 50 lb. ft. when applied to one side gear. Correct, if necessary, before continuing.

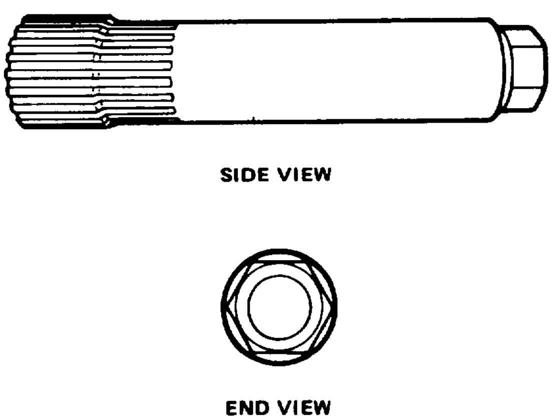

Figure 1 I-127. Rolling Resistance Checking Tool

3. A suitable checking tool can be made by cutting an axle shaft to an appropriate length and welding a nut on the end to accept a wrench socket (Figure 11-127).

E. If Dri-Loc fasteners or Rockwell Liquid Adhesive application are to be used, remove the existing fasteners from case halves and use the following procedures.

USE OF DRI-LOC FASTENERS AND ROCKWELL LIQUID ADHESIVE 2297-C-3747 (LOCTITE #277)

New Dri-Loc Fasteners

1. Wipe excess oil and any residue from the threaded holes. The holes should be relatively oil free, however, no special cleaning is required.

2. Assemble the components using the new Dri-Loc fasteners. DO NOT APPLY ROCKWELL LIQUID ADHESIVE OR ANY OTHER TYPE OF FASTENER RETAINER MATERIAL, SEALANT OR ADHESIVE ON NEW DRI-LOC FASTENERS OR IN THE THREADED HOLES.

3. Tighten the Dri-Loc fasteners to the specified torque value. Refer to Fastener Torque Chart at end of manual.

NOTE

No cure time is required for Dri-Loc fasteners prior to rebuilding the axle and returning it to service.

REUSE OF DRI-LOC FASTENERS AND ROCKWELL LIQUID ADHESIVE 2297-C-3747 (LOCTITE #277) APPLICATION

1. Wipe excess oil residue from the fasteners and threaded holes. The fasteners and holes should be relatively oil free. Special cleaning is not required. When reusing Dri-Loc fasteners, it is not necessary to remove the Dri-Loc residue from threads.

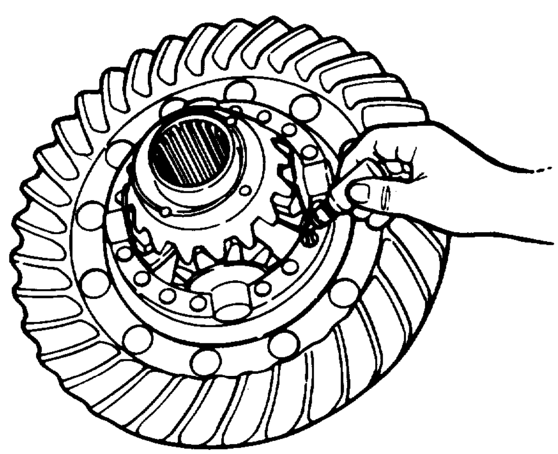

Figure 11-128. Applying Liquid Adhesive

2. Apply Rockwell Liquid Adhesive to the threaded holes only, by letting four or five drops run down the side of each hole. Before threading in the fasteners, visually check to make sure that the adhesive has contacted the threads (Figure 11-128).

CAUTION

Do not apply adhesive to the fastener, since trapped air in the hole will create back pressure and "blow out" the adhesive as the fastener advances.

3. Tighten the fasteners to the specific torque value recommended for that size fastener. Rockwell Liquid Adhesive will not alter the torque requirement. Refer to the Fastener Torque Chart at end of manual.

NOTE

No cure time is required for Rockwell Liquid Adhesive prior to rebuilding the axle and returning it to service.

IMPORTANT: When servicing drive units assembled with Dri-Loc fasteners or for Rockwell Liquid Adhesive in threaded holes where the fasteners do not require removal - check each fastener for tightness by applying the minimum amount of torque specified for that size fastener. If the fastener does not rotate, it is satisfactory. If the fastener rotates to any degree, it must be removed from the component and adhesive must be applied to the threaded hole. Use the procedures under "Reuse of Dri-Loc Fasteners and Rockwell Liquid Adhesive 2297-C-3747 (Loctite #277) Application"

Further, if fastener removal becomes difficult due to worn heads or unusually high breakaway torques, the locking strength of either Rockwell Liquid Adhesive or Dri-Loc can be reduced by heating. Heat the fastener for only a few seconds at a time while trying to loosen it.

CAUTION

DO NOT EXCEED 350°F (+177°C) maximum. Heating should be done slowly to avoid thermal stresses in other components. Application of heat reduces the strength of the adhesive and Dri-Loc below recommended installation torque.

Rockwell does not recommend removing fasteners with an impact wrench or by striking with a hammer.

INSTALL MAIN DIFFERENTIAL AND GEAR ASSEMBLY

A. Before installing the differential and gear assembly, temporarily install the bearing cups, threaded adjusting rings and bearing caps in the correct location as marked. Install the cap capscrews and washers and tighten to specified torque value (Figure 11-129).

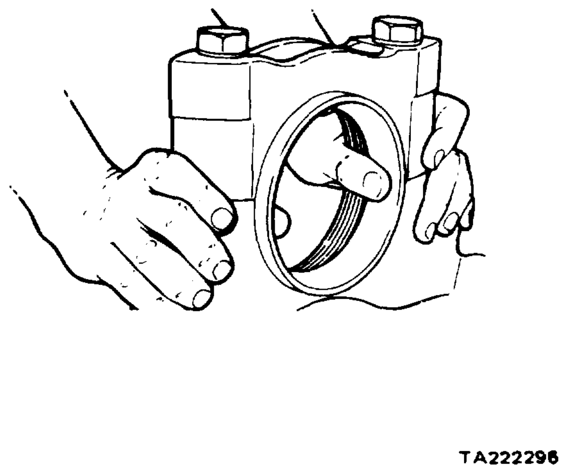

Figure 11-129. Fitting Bearing Cup

8. The bearing cups must be of a hand push fit in the bores, otherwise the bores must be reworked with a scraper or emery cloth until a hand push fit is obtained. Use a blued bearing cup as a gauge and check the fits as work progresses.

C. After checking related parts, coat the differential bearing cones and cups with the recommended axle lubricant.

D. Place the bearing cups over the assembled differential bearing cones, then position the differential assembly in the carrier (Figure 11-130).

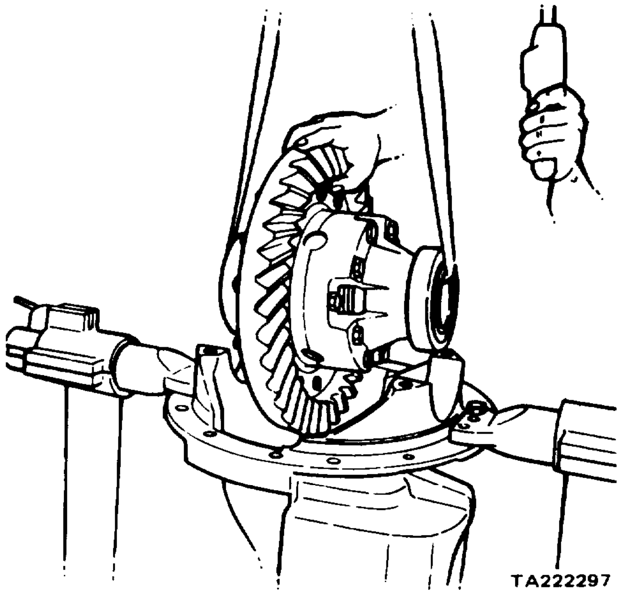

Figure 11-130. Installing Differential Assembly

E. Insert bearing adjusting rings and turn hand tight against bearing cups (Figure 11-131).

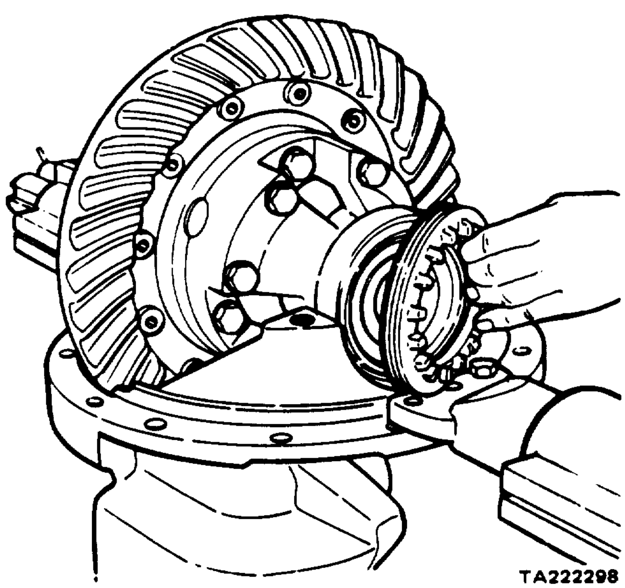

Figure 11-131. Installing Bearing Adjusting Rings

F. Install bearing caps in the correct location, as marked, and tap lightly into position (Figure 11-132).

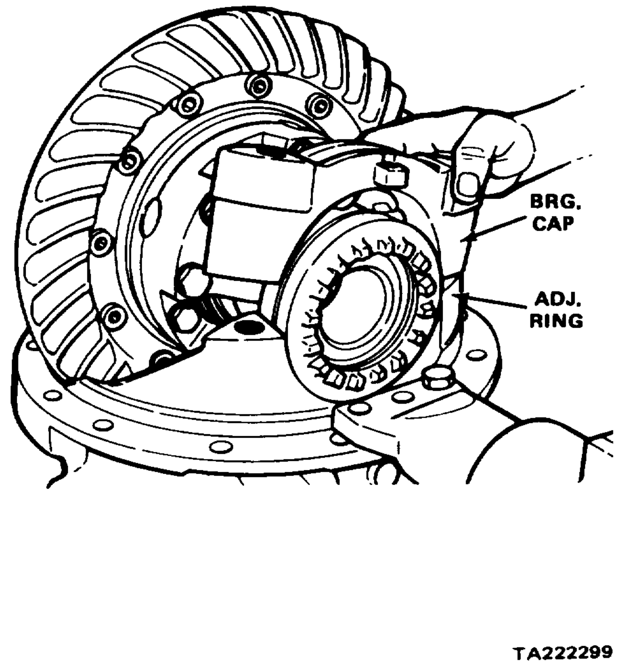

Figure 11-132. Installing Bearing Caps

CAUTION

If bearing caps do not position properly, adjusting nuts might be cross-threaded. Remove caps and reposition the adjusting rings. Forcing caps into position will result in irreparable damage to the carrier housing or bearing caps.

G. Install carrier leg capscrews and washers and tighten to required torque. Install adjusting ring cotter keys after final adjustments are made.

ADJUST MAIN DIFFERENTIAL BEARING PRELOAD (Figures 11-133 and 11-134)

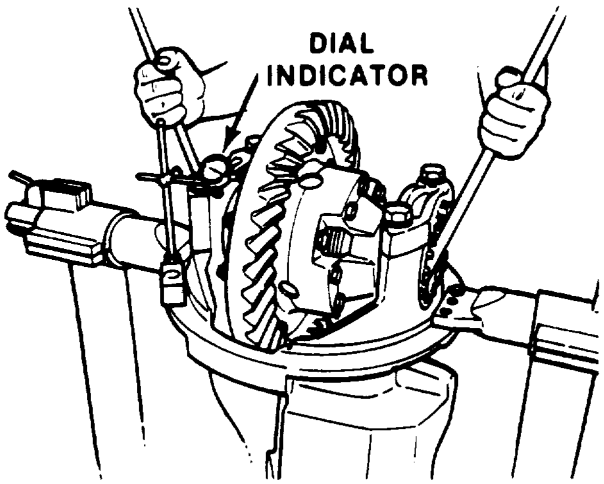

Figure 11-133. Preloading Differential Bearings

A. Using dial indicator at backface of gear, loosen the beering adjusting ring on the side opposite gear only. Loosen enough to notice end play on the indicator.

B. Tighten the same adjusting ring enough to obtain .000 end play.

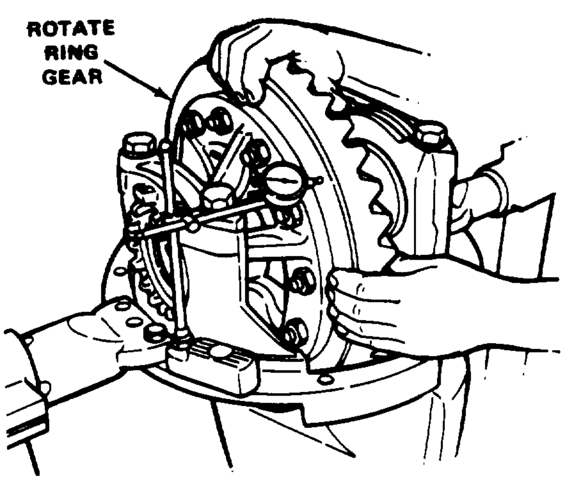

Figure 11-134. Checking Gear Runout

C. Using the dial indicator, check the drive gear for excessive runout. If runout exceeds .008" remove the differential and gear assembly from carrier and check for cause and correct (Figure 11-134).

D. Next, tighten each bearing adjusting ring one or two notches from .000 end play to preload differential bearings.

An alternate method or a means of checking the preload adjustment is to tighten the adjusting rings until the carrier legs are spread .006" to .010" (15 - 35 Lb. In. rolling resistance). When measuring for carrier leg spread, use a large micrometer or vernier gauge and measure at legs diagonally opposed (Figure 11-135).

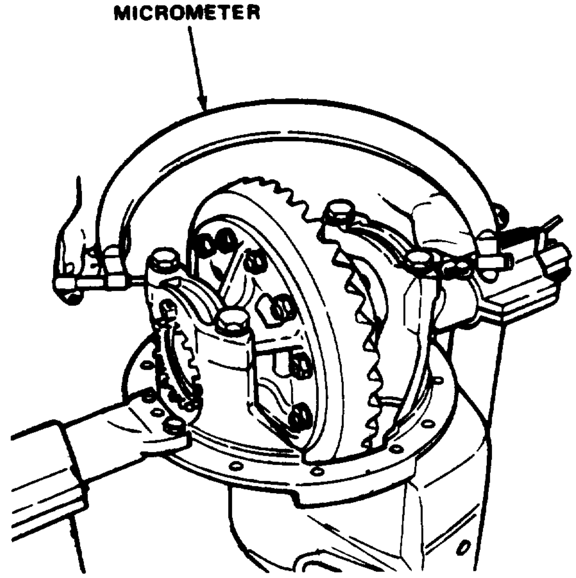

Figure 11-135. Measuring Carrier Leg Spread

ADJUST HYPOID GEAR BACKLASH (Figure 11-136)

If the original drive pinion and gear are used, adjust the backlash to the established setting recorded before disassembly.

If a new gear set is used, the backlash should be initially adjusted to .010" (.250mm).

NOTE

After correct tooth contact is established, the backlash may be altered, if required, within the limits of .005" - -015" (.127mm - .381mm). Refer to tooth contact section.

To adjust backlash use the following procedures:

A. Attach a dial indicator to the carrier mounting flange. Position the indicator plunger against a tooth surface (drive side) of the ring gear.

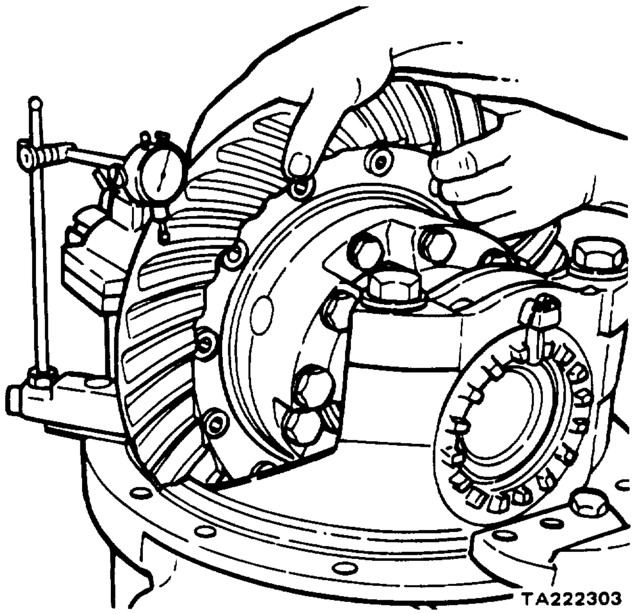

Figure 11-136. Adjusting Backlash

B. While observing the dial indicator, rotate the ring gear slightly in both directions against the pinion teeth. It may be desired to hold the drive pinion stationary when rotating gear. Make a note of reading.

C. Adjust backlash, as required, by backing off one differential bearing adjusting ring and advancing the opposite ring the same amount.

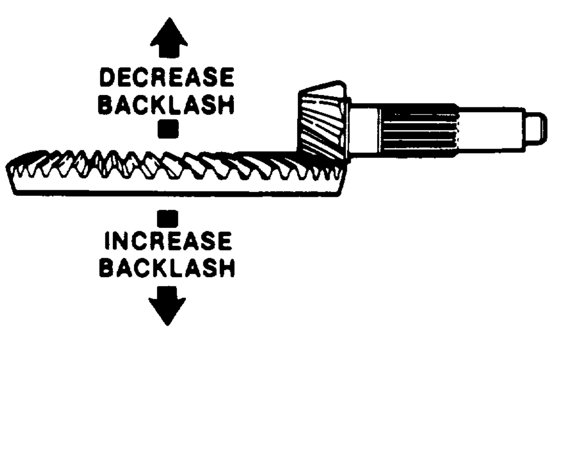

Figure 11-137. Changing Backlash Adjustment

Moving the gear toward the pinion will decrease backlash (Figure 11-137).

Moving the gear away from the pinion will increase backlash.

CAUTION

Adjust the backlash by moving the ring gear ONLY. DO NOT MOVE THE PINION.

CHECK TOOTH CONTACT

Apply oiled red lead gear marking compound lightly to the hypoid gear teeth. When the pinion is rotated, the red lead is squeezed away by the contact of the teeth, leaving bare areas the exact size, shape and location of the contacts.

Sharper impressions may be obtained by applying a small amount of resistance to the gear with a flat steel bar and using a wrench to rotate the pinion. When making adjustments, check the drive side of the gear teeth. Coast side should be automatically correct when drive side is correct. As a rule, coating about twelve teeth is sufficient for checking purposes.

After obtaining a satisfactory tooth contact, especially in relation to the top and bottom of the tooth, the backlash can be altered within the limits of .005" - .015" (.127mm - .381mm) to obtain a better contact position relative to the length of the tooth.

A high backlash setting can be used to keep the contact from starting too close to the toe, and a low backlash setting can be used to keep the contact from starting too far away from the toe.

After correct tooth contact has been established, install adjusting ring locks (cotter pins).

Correct Tooth Contact Assures Longer Gear Life

With adjustments properly made (pinion at correct depth and backlash set at .010") the contacts shown below will be obtained. The area of contact favors the toe and is centered between the top and bottom of the tooth.

Satisfactory Tooth Contact (Gears Unloadad) (Figure 11-138)

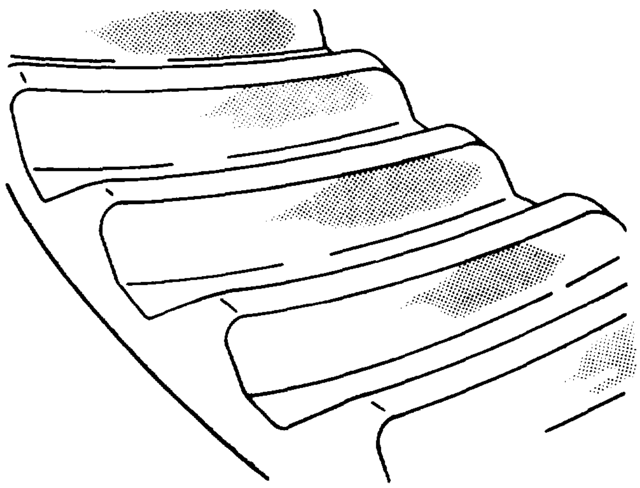

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Figure 11-138. Proper Tooth Contact (Gears Unloaded)

The hand rolled pattern, shown above, (gears unloaded) will result in a pattern centered on the length of the tooth when the gears are under load, shown below. The loaded pattern will be almost full length and the top of pattern will approach the top of the gear.

Satisfactory Tooth Contact (Gears Loaded) (Figure 11-139)

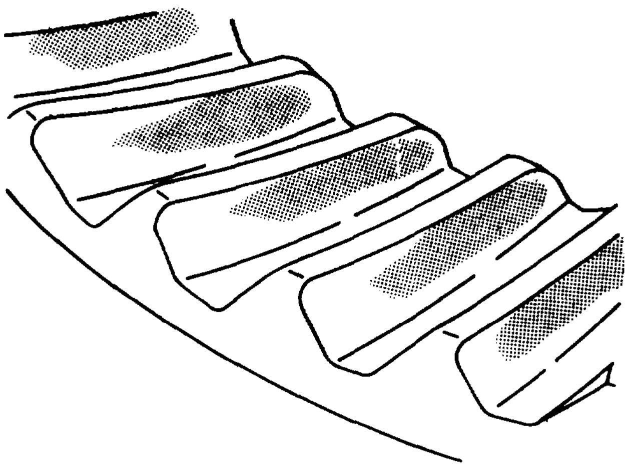

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Figure 11-139. Proper Tooth Contact (Gears Loaded)

The pattern on the coast side of teeth will appear the same width as the drive side; however, the over-all length will be centered between the toe and heel of gear tooth.

If the correct contact location shown cannot be established with a backlash of .010" (.25mm), adjust the backlash as required between the limits of .005" - .015" (.127mm - .381mm).

Set used hypoid gears so the teeth contacts match existing wear patterns. Hand rolled patterns of used gears will be smaller in area and should be at the toe end of wear patterns.

Incorrect Tooth Contacts (Figure 11-140)

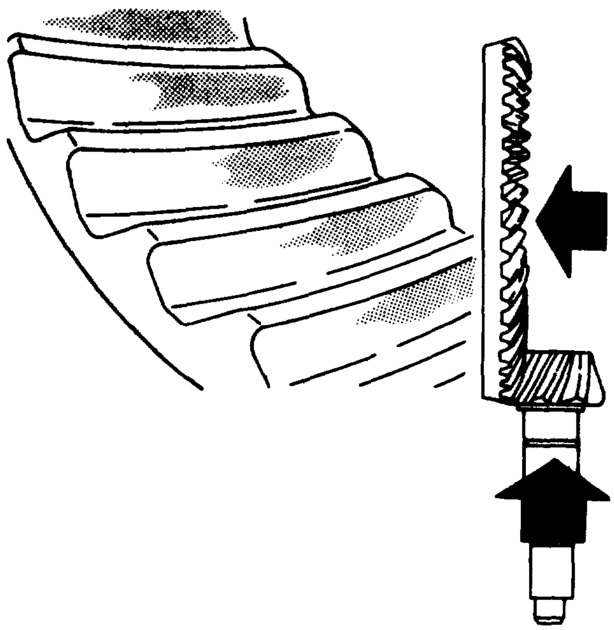

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Figure 11-140. Poor Tooth Contact

A high contact indicates pinion is too far out. Set the pinion to the correct depth by increasing thickness of shim between pinion inner bearing cup and carrier.

Slight outward movement of hypoid gear may be necessary to maintain correct backlash .005" - .015" (.127mm - .381mm).

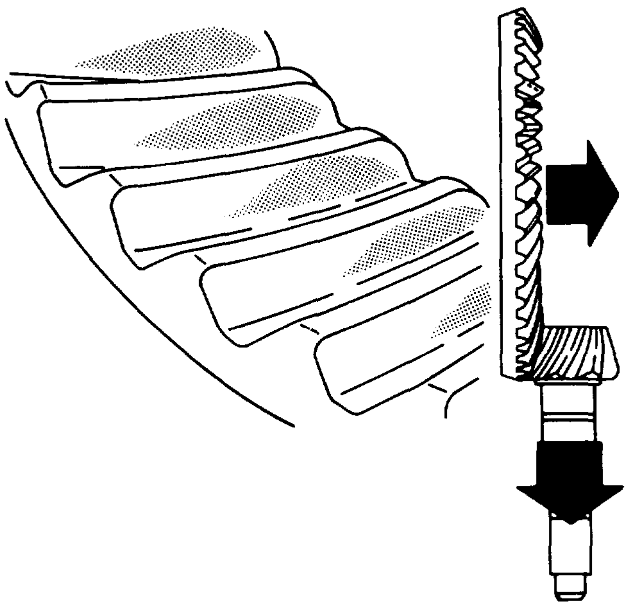


Figure 11-141. Low Pinion Contact

A low contact indicates pinion is too deep. Set the pinion to the correct depth by decreasing thickness of shim between pinion inner bearing cup and carrier (Figure 11-141).

Slight inward movement of the hypoid gear may be necessary to maintain correct backlash .005" - .015" (.127mm - .381mm).

After establishing the correct gear teeth contacts, continue with adjusting pinion bearing preload.

ADJUST PINION BEARING PRELOAD (Figure 11-142)

After the proper tooth contacts and shim thickness for the inner bearing cup have been established, determine the pinion bearing preload as follows. However, before continuing, make a note of the backlash setting.

NOTE

The pinion bearing preload is controlled by the thickness of the gear spacer or spacer combination along with the lower helical gear and cone spacer, mounted on the drive pinion shaft, between the inner and outer bearings.

Correct preload for new bearings is 5 to 25 inch pounds and 5-15 inch pounds for reused bearings. Preload specifications must be measured while rotating the bearings.

A. Remove the main differential and gear assembly and associated parts from the carrier. Also remove the pinion nut and washer.

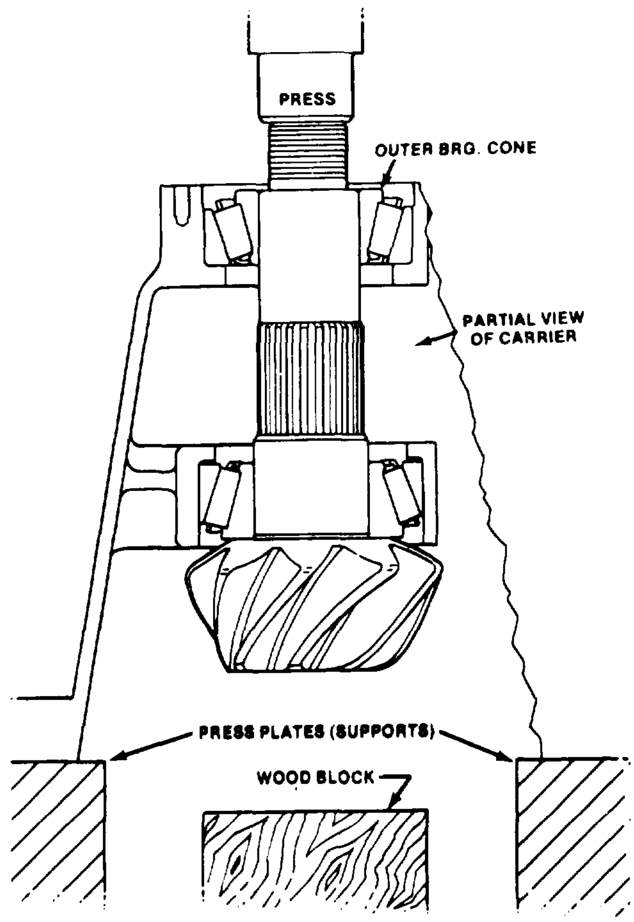


Figure 11-142. Setting Pinion Bearing Preload

B. Place the carrier in a press with the pinion shaft (threaded end) pointing upward. Support the carrier with press plates under the carrier to housing flange and place a block of wood below the pinion head. Press the pinion out through the outer bearing cone and remove the cone from carrier.

C. Reposition the carrier in press with the carrier legs facing upward and block up the assembly in a safe manner.

D. Place the lower helical drive gear in position in carrier, with the long hub pointing up. Some original models employ an inner bearing cone spacer. If the cone spacer is used, position it over the long gear hub.

E. Reinstall the drive pinion into carrier, aligning splines of the helical gear and pinion shaft. Index parts as required (Figure 11-143).

F. Press the pinion shaft through the cone spacer, if used, and the helical gear until the inner bearing cone on pinion contacts the bearing cup in carrier. It should be noted at this time that the helical gear is not completely seated on the pinion shaft.

CAUTION

Do not exert pressure after the bearing cone and cup make contact, damage to bearing may result.

G. Reposition the carrier in press with carrier legs facing downward. Support the carrier with press plates under the carrier to housing flange. Block up the pinion under pinion head, high enough to allow the inner bearing cone and cup to be in contact.

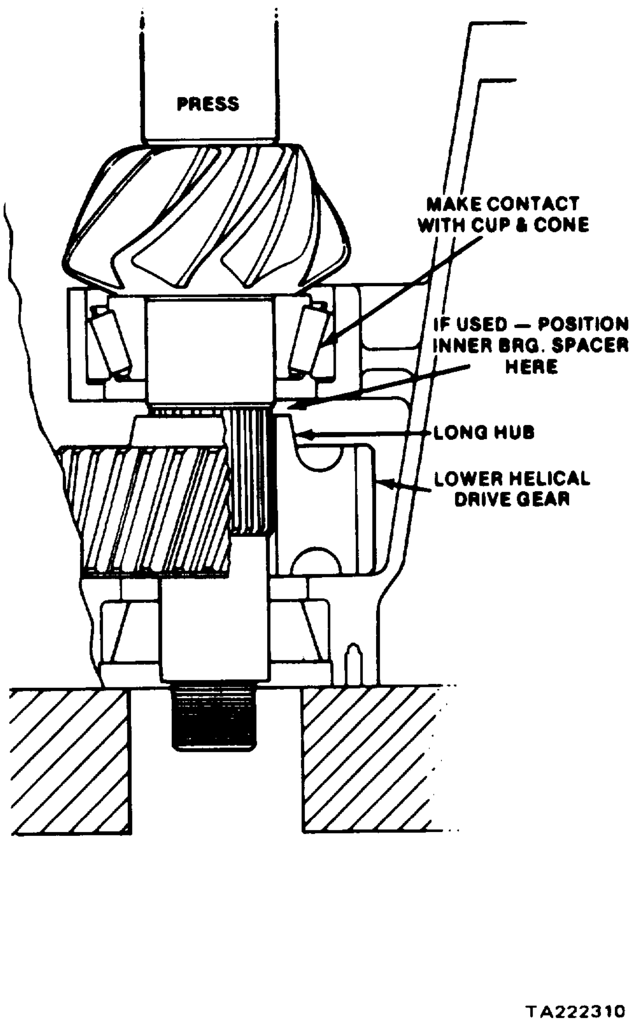


Figure 11-143. Installing Drive Pinion

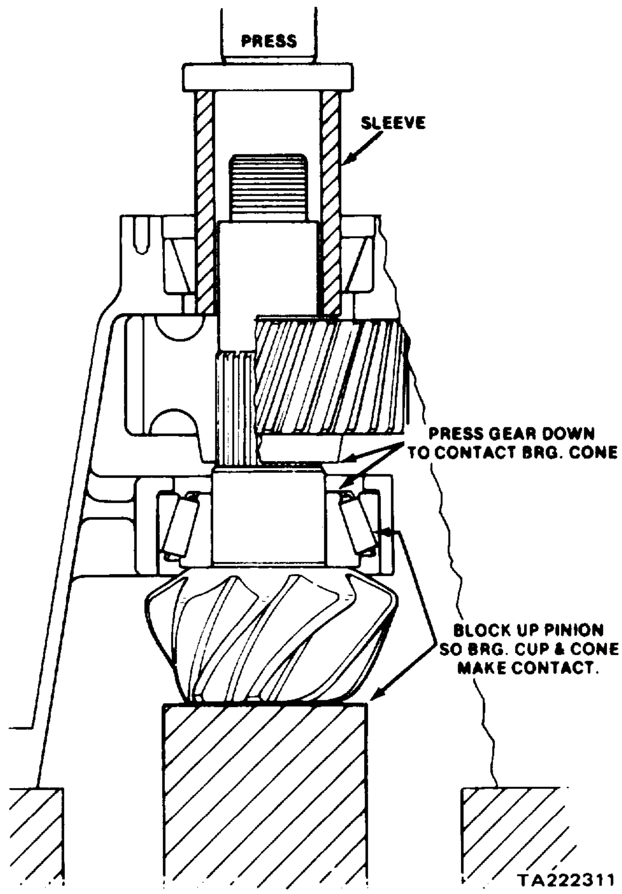


Figure 11-144. Installing Helical Gear

H. Press the helical gear completely onto the splined portion of the pinion shaft. Continue pressing on the gear until contact with the inner bearing cone or spacer, if used, is achieved. Use a suitable sleeve that will slip over the pinion shaft and bear against the gear hub (Figure 11-144).

I. Install the thick (fixed) outer bearing cone spacer onto the pinion shaft and against the helical gear hub. Do not install the variable gear spacer at this time.

J. Cut two lengths of bar lead or solder approximately 9/16" long and 5/8" thick. The lead pieces will be used as gauge blocks in determining the thickness of the gear spacer required for proper pinion bearing preload.

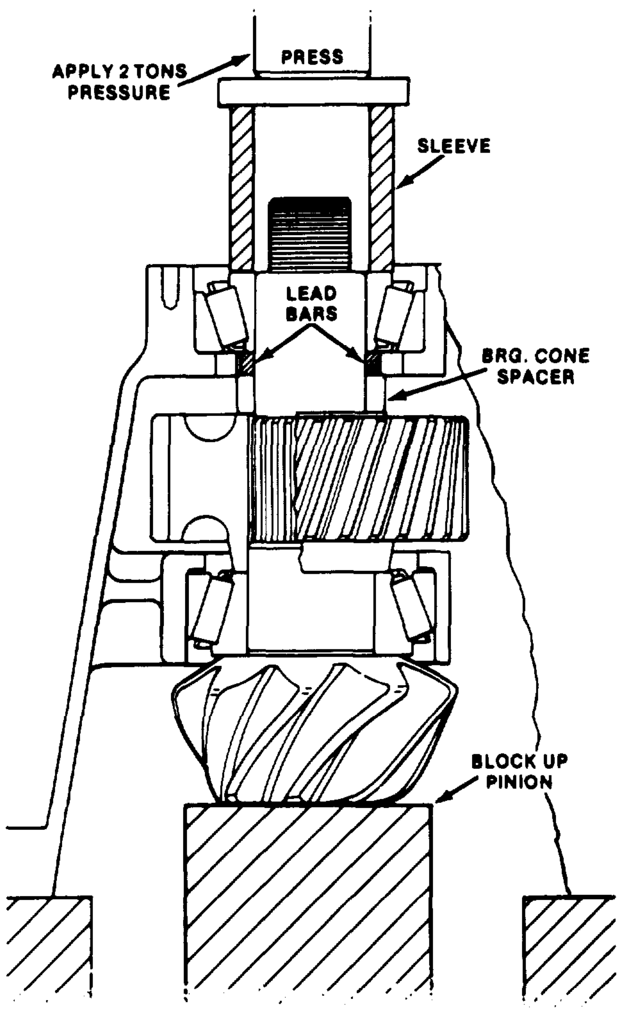


Figure 11-145. Setting Helical Gear Preload

K. Position both pieces of lead on top of the cone spacer, 180° apart. Position the outer bearing cone over the pinion shaft and press in place against lead pieces with two (2) tons pressure. Use a suitable sleeve that will bear against the cone (inner) race. The pressure applied will compress the lead pieces to a specific thickness.

L. Remove the block from under pinion head and press the pinion shaft down through the outer bearing cone only. Do not press the shaft through the helical gear.

M. Remove the outer baring cone, both pieces of lead, and the outer bearing cone spacer from the pinion shaft,

N. Measure the thickness of the compressed pieces of lead with a micrometer and calculate the average value of both pieces. Add .004" to the average value to determine the thickness required for the variable gear spacer to obtain the proper pinion bearing preload (Figure 11-145).

EXAMPLE:

Lead thickness No. 1 =	.504"				
Lead thickness No. 2 =	+ .506"				
	1.010" Total				
Average thickness =	1.010"	÷	2	=	.505"
Add .004" =					+ .004"
Thickness of gear spacer =					.509"

O. Block up the pinion under pinion head, high enough to allow the inner bearing cone and cup to be in contact. Press the helical gear completely onto the pinion shaft until contact with the inner bearing cone or spacer, if used, is achieved. Use a suitable sleeve that will slip over the pinion shaft and bear against the gear hub.

P. Install the new gear spacer or spacer combination of the proper thickness as determined in step "N" and the fixed outer cone spacer onto the pinion shaft.

CAUTION

The gear spacer must be assembled first onto the pinion shaft and against the helical drive gear.

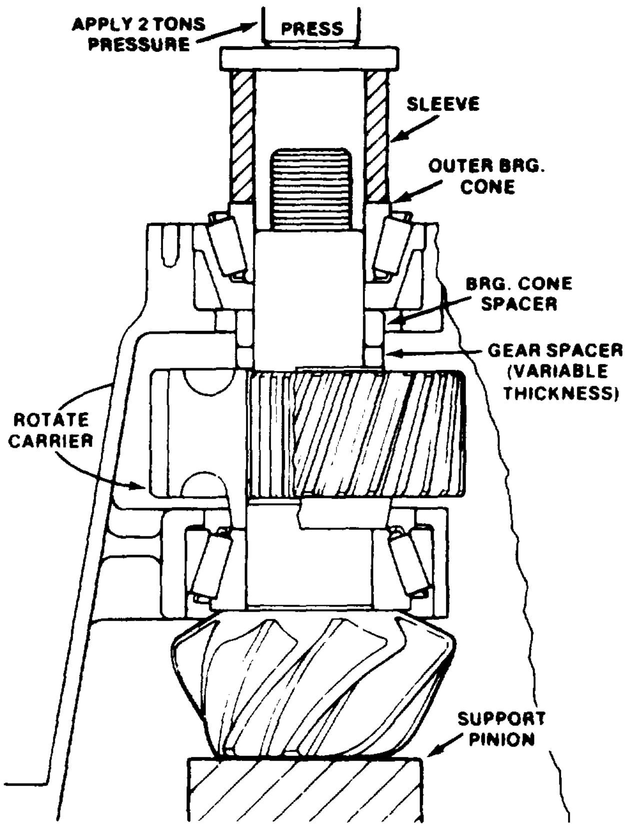


Figure 11-146. Seating Bearings Properly

Continue to support the pinion under head and press the outer bearing cone onto the pinion shaft (Figure 11-146).

Use a suitable sleeve that will bear against the cone (inner) race and apply press pressure of approximately two (2) tons. As pressure is applied, rotate the carrier in both directions to properly seat the bearings.

R. Remove the carrier from press and mount in a repair stand. Assemble the washer and nut onto the pinion. Place a hardwood block between the pinion head and carrier wall to hold the pinion stationary and tighten nut to the specified torque value. Refer to torque chart at end of manual.

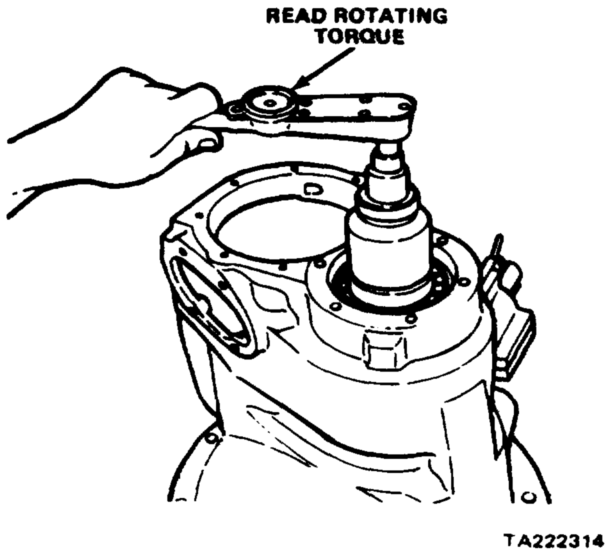


Figure 11-147. Checking Pinion Bearing Preload

S. Make a check for proper pinion bearing preload by installing an appropriate wrench socket over the pinion nut and attaching a pound inch torque wrench to socket (Figure 11-147).

Rotate the drive pinion with torque wrench and observe the reading on dial. Use rotating torque, not starting torque.

Correct bearing preload is 5 - 25 lb. ins. for new bearings or 5 - 15 lb. ins. for reused bearings.

T. A second method of checking preload rotating torque is as follows (Figure 11-148):

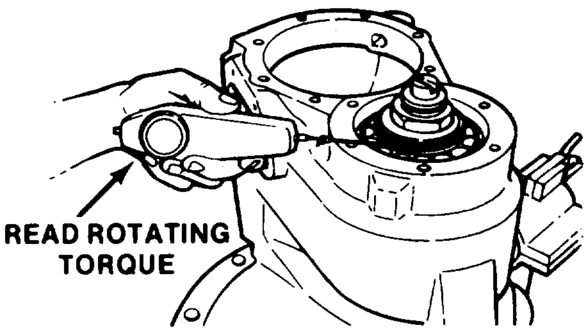


Figure 11-148. Alternate Pinion Preload Check

Wrap a cord around the pinion nut washer. Attach a common pound scale to end of cord and while observing reading and pulling scale out on a horizontal line.

Next, calculate for radius of washer by measuring the outer diameter of washer and dividing by two (2). Multiply the pound reading from scale by the washer radius (in inches) to obtain the pound inch torque value.

EXAMPLE:

Assume O.D. of washer to be 3 inches and pounds pull to be 9.

Washer Radius = 3" ÷ 2 = 1.5"

Torque Value = 1.5" x 9 lbs. = 13.5 lb. ins.

If the pinion bearing rotating torque value is within correct limits, continue with the balance of reassembly. However, if the torque is not within correct limits, remove the outer bearing cone, cone spacer, and gear spacer from the pinion shaft. Use step "L" as reference for disassembly. install a thicker or thinner gear spacer as required.

Use a thicker gear spacer to decrease the preload, or a thinner gear spacer to increase preload.

CAUTION

If a change in pinion depth is required after establishing bearing preload, a like change in the gear spacer thickness must be made to retain the correct bearing preload. When increasing the thickness of shim between the pinion inner bearing cup and carrier, increase the thickness of the gear spacer a like amount. The inverse is true when decreasing thickness.

U. Reassemble parts onto the pinion shaft and recheck bearing preload following steps "P" through T".

V. After establishing correct pinion bearing preload, install the main differential and gear assembly back into the carrier. Adjust the differential bearing preload, hypoid gear backlash and recheck gear tooth contacts. Refer to pages 118-38 through 11B-41 respectively.

If the drive unit does not employ an oil pump, continue with reassemble inter-axle differential assembly procedures on pages 11b-49 and 11b-59.

Oil Valve Assembly Installation (Figure 11-149)

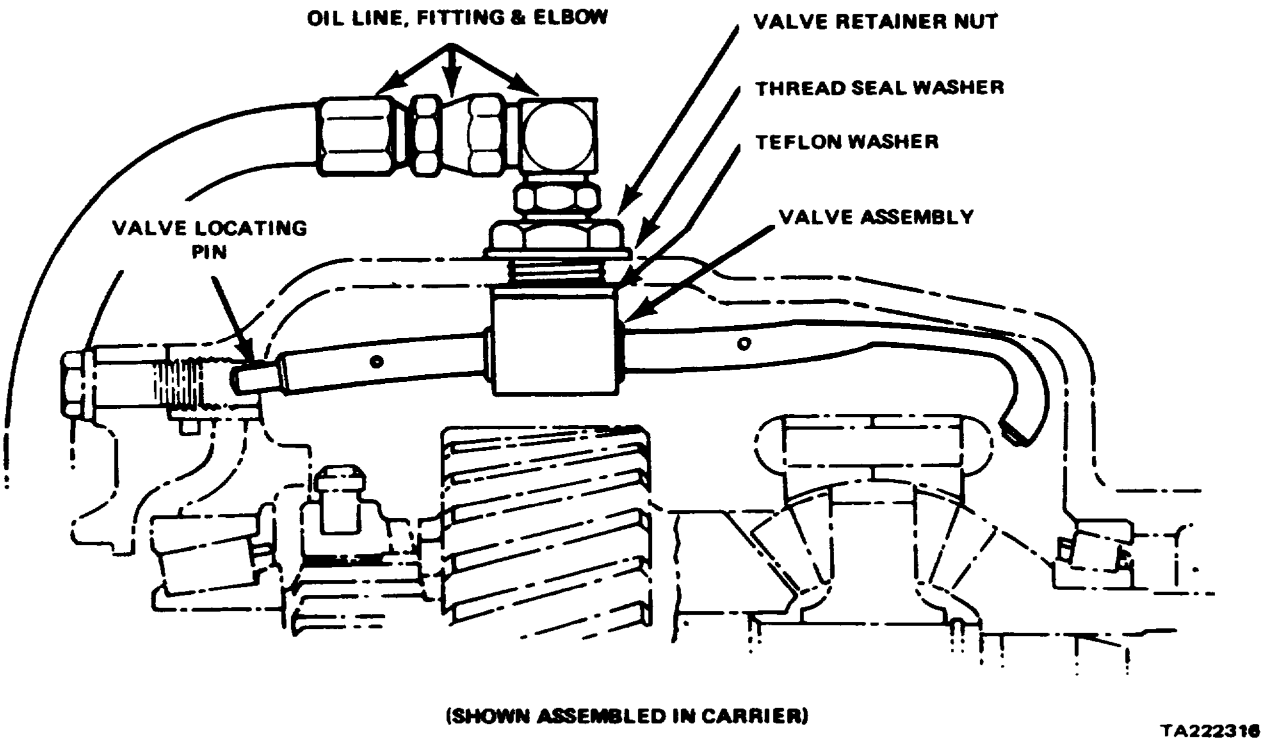


Figure 11-149. Oil Valve in Carrier

REASEMBLE AND INSTALL OIL VALVE ASSEMBLY

NOTE

if the oil valve assembly was not disassembledMed. start with step "B" for installation into carrier.

CAUTION

When reassembling and installing the oil valve components, be careful so as not to damage fitting threads, bevel seats, "0" rings or oil lines.

A. Install the ball into valve body opening and insert spring, small diameter first, against ball. Install washer against spring and secure all parts in valve with the retaining snapring. Also position the teflon washer over threaded portion of valve body (Figure 11-150).

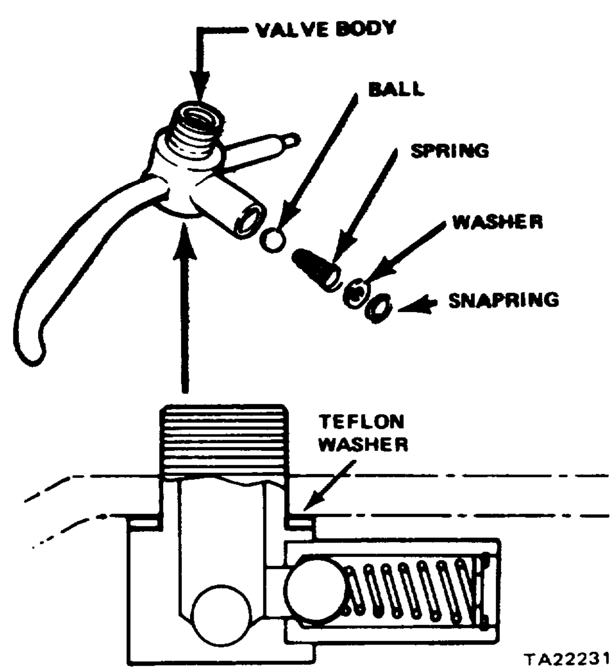


Figure 11-150. Valve Body Parts

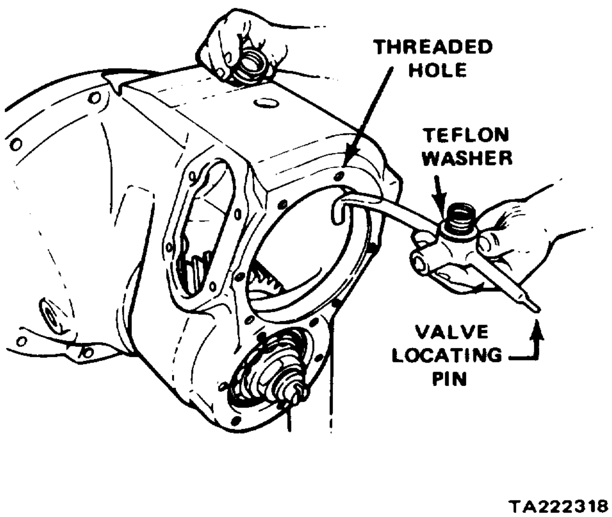


Figure 11-151. Installing Valve Body

B. Working from inside the carrier housing, insert the valve locating pin of oil tube into threaded capscrew hole at front of carrier and the threaded portion of valve body through hole in top of carrier. Hold the valve in this position and install the thread seal washer and large retainer nut onto the valve body. Tighten nut to specified torque value. Refer to torque chart at end of manual (Figure 11-151).

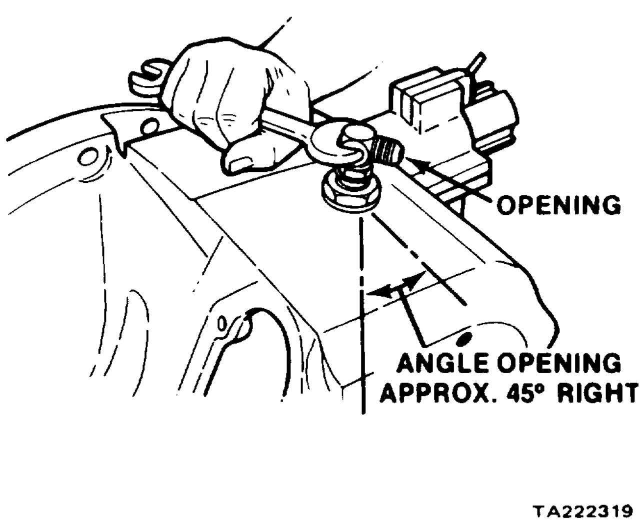


Figure 11-152. Installing Elbow

C. Install the elbow fitting by threading it into valve body until bottomed. Back out the elbow until opening faces right front of carrier (shift unit side) at approximately 45°. Secure elbow to valve body with retaining nut. Tighten nut to the specified torque value. Refer to torque chart at end of manual (Figure 11-152).

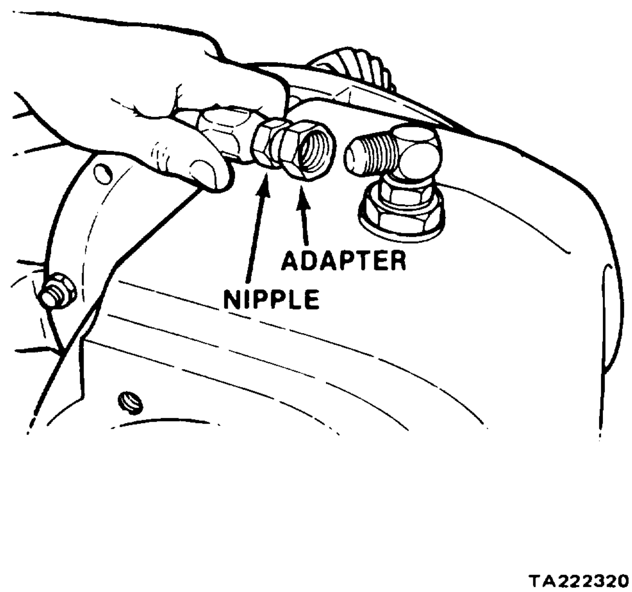


Figure 11-153. Connecting Oil Line

D. Connect the oil line to elbow by threading the adapter fitting of line onto elbow opening. Final tightening is accomplished by holding the nipple (middle hex of fitting) stationary while tightening the adapter to the specified torque value. Refer to torque chart at end of manual (Figure 11-153).

INSTALL OIL FILTER SCREEN ASSEMBLY

CAUTION

When installing the oil filter screen components, be careful so as not to damage fitting threads, bevel seats, "O" rings or oil lines.

NOTE

If the elbow fitting was removed from the tube adapter and filter screen assembly, install it after the adapter and filter screen assembly is threaded into the carrier.

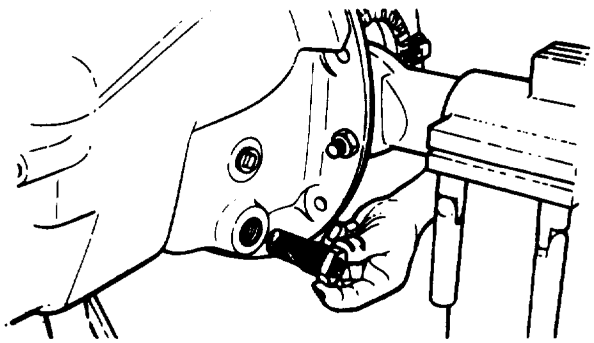


Figure 11-154. Installing Filter Screen Assembly

A. Install the tube adapter and filter screen assembly into the bottom left side of carrier. Use a wrench at the large hex to tighten the assembly to the specified torque value. Refer to torque chart at end of manual (Figure 11-154).

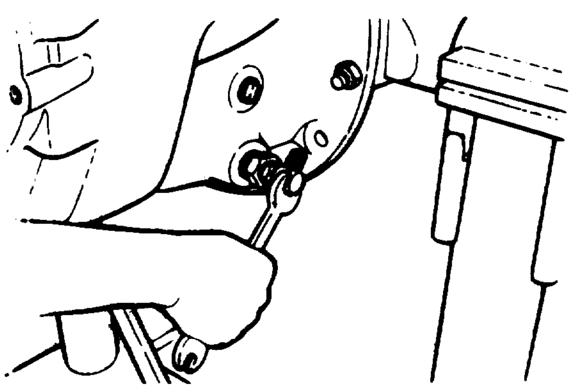


Figure 11-155. Installing Elbow Fitting

B. If the elbow fitting was removed, thread it into the tube adapter (large hex) until bottomed. Back out the elbow until opening is horizontal and faces the front of carrier. Secure elbow to adapter by tightening the retainer nut against adapter hex to the specified torque value. Refer to torque chart at end of manual (Figure 11-155).

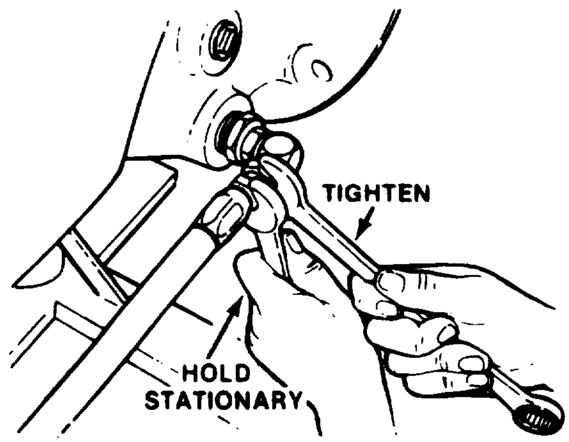


Figure 11-156. Connecting Oil Line to Elbow

C. Connect the oil line to elbow by threading the adapter fitting of line onto elbow opening (Figure 11-156).

Final tightening is accomplished by holding the nipple (middle hex of fitting) stationary while tightening the adapter to the specified torque value. Refer to torque chart at end of manual.

INSTALL OIL PUMP ASSEMBLY

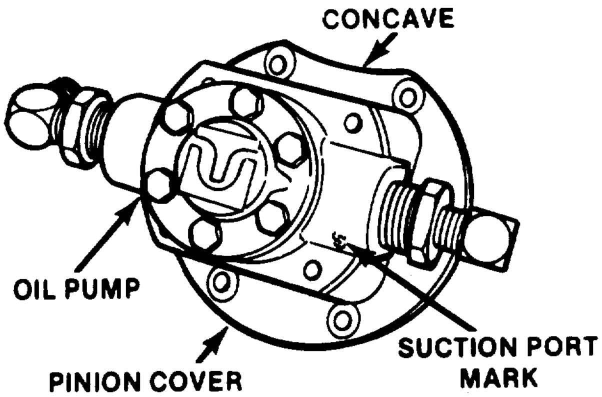


Figure 11-157. Pump Assembly, Oil

A. If removed, reassemble the oil pump and gasket onto the pinion cover. Hold the pinion cover with the concave surface of mounting flange O.D. at top and position the pump over cover with the input port, marked "SUCTION" or "S" pointing to the right (Figure 11-157).
Secure the pump and gasket to cover with capscrews and washers. Tighten capscrews to specified torque value. Refer to torque chart at end of manual.

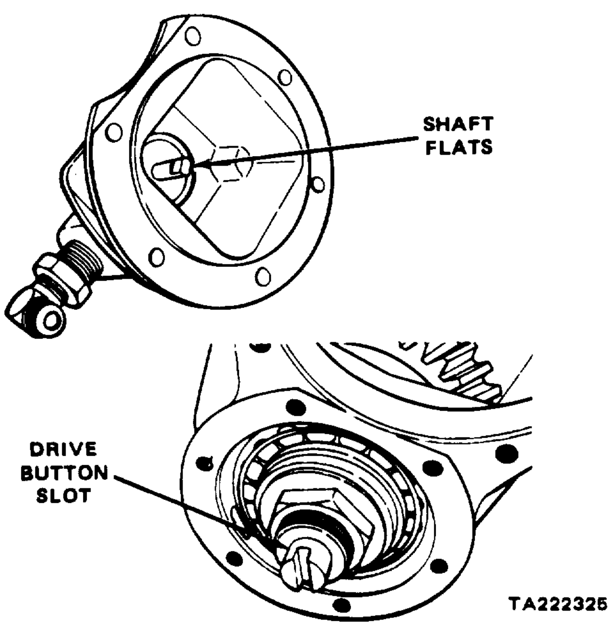


Figure 11-158. Pump Shaft Alignment

B. Position the fiber gasket (if used) and the pump/cover assembly over the drive pinion, engaging the flats (Figure 11-158) of pump shaft in slot of drive button in end of pinion. Rotate the cover as required until the concave surface of flange is adjacent to the cage bore in carrier. Secure the assembly to carrier with capscrews and washers. Tighten capscrews to specified torque value. Refer to torque chart at end of manual.

NOTE

If a fiber gasket is not used between the pinion cover and carrier, apply silicone gasket material to one mating surface, referring to procedures on page 118-33.

C. Connect both oil lines to respective ports in pump. Each line is connected to the elbows in the same manner as follows (Figure 11-159).
Thread the adapter fitting onto elbow opening. Final tightening is accomplished by holding the nipple (middle hex of fitting) stationary while tightening the adapter to the specified torque value. Refer to torque chart at end of manual.

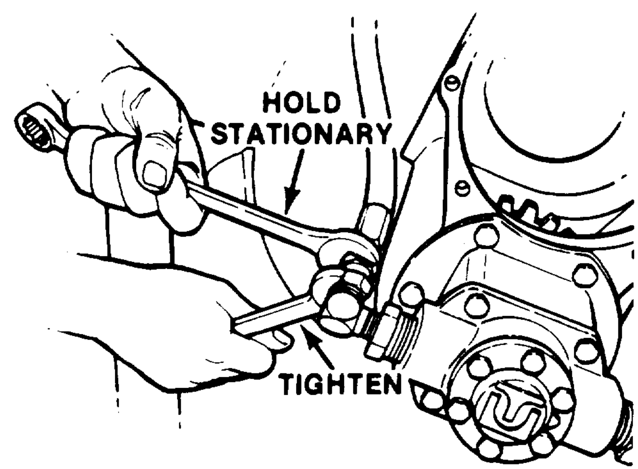


Figure 11-159. Proper Line Tightening

NOTE

Make a visual check from front of carrier to make sure the pump input port, marked "SUCTION" or "S', is pointing to the right and is connected to the filter screen assembly. The opposite side (output) of pump should be connected to the oil valve assembly at top of carrier.

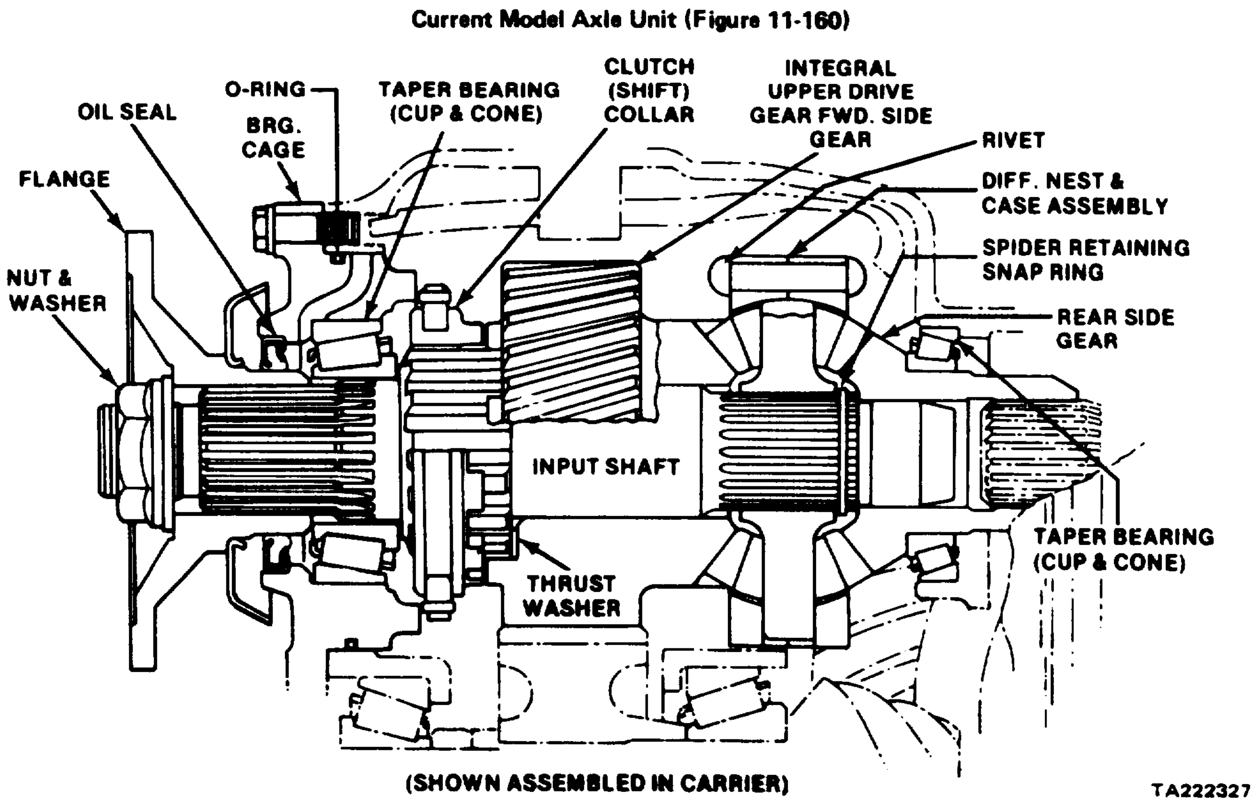


Figure 11-160. Current Models Employing Tapered Roller Bearings

NOTE

Except where otherwise specified, coat all parts of the inter-axle differential assembly with the recommended axle lubricant. This can be done as the individual parts are being assembled.

REASSEMBLE INTER-AXLE DIFFERENTIAL ASSEMBLY

A. Press the input shaft forward (outer) bearing cone onto the input shaft and against shoulder. Use a suitable sleeve that bears against the inner race only.

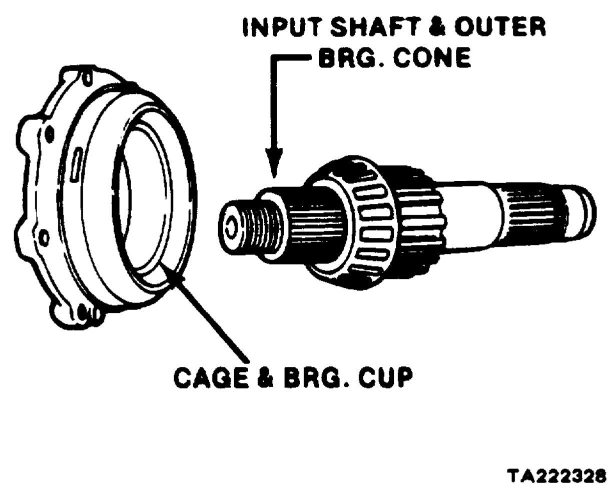


Figure 11-161. Bearing Cone and Cage Assembly

B. Press the input shaft forward bearing cup into the bearing cage until it bottoms in bore. Use a suitable sleeve against backface of cup (Figure 11-161).

C. Using a suitable sleeve, press the oil seal into bore in front of bearing cage until outer surface of seal is flush with face of cage. If a press is not available, use a sleeve and mallet to tap the seal into position.

D. Coat the seal elements with the recommended seal lubricant, Rockwell part No. 1199-R-1474 (Fiske Brothers Lubriplate #5555) and if removed, install the cage to carrier "O" ring in groove of cage outside diameter.

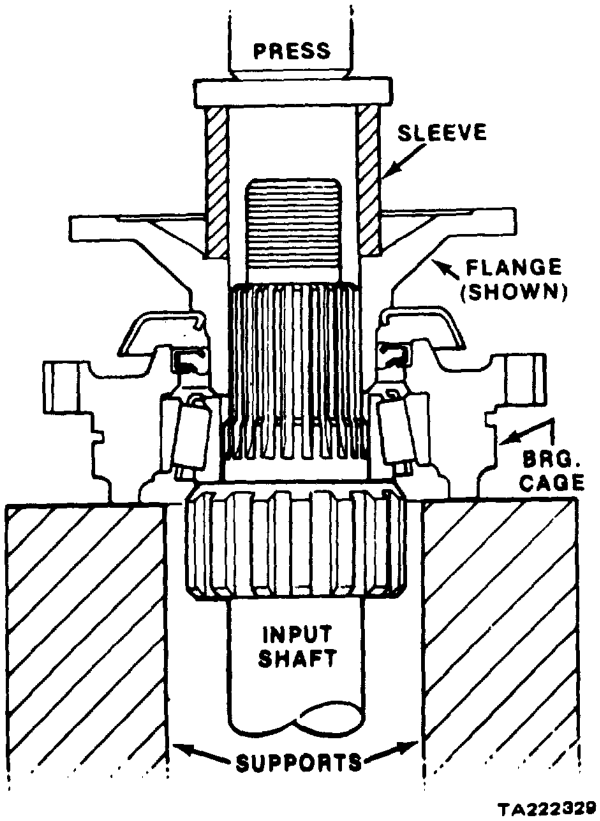


Figure 11-162. Yoke or Flange Installation

E. Position the cage over the input shaft, against the forward bearing cone and install the yoke or flange onto shaft (Figure 11-162).

Most current models employ interference fit splines on yokes, flanges and shafts. With this type of spline carefully align both parts, indexing splines as required, and use only a press and sleeve for installation. Be careful not to damage the oil seal. Secure the yoke or flange onto shaft with nut and washer. Tighten nut hand tight against yoke or flange.

CAUTION

Do not use hammers or mallets to drive the yoke or flange onto shaft. Damage to splines will result.

F Install the clutch collar onto the input shaft splines with the clutch teeth facing the rear of shaft, smooth side next to bearing cone (Figure 11-163).

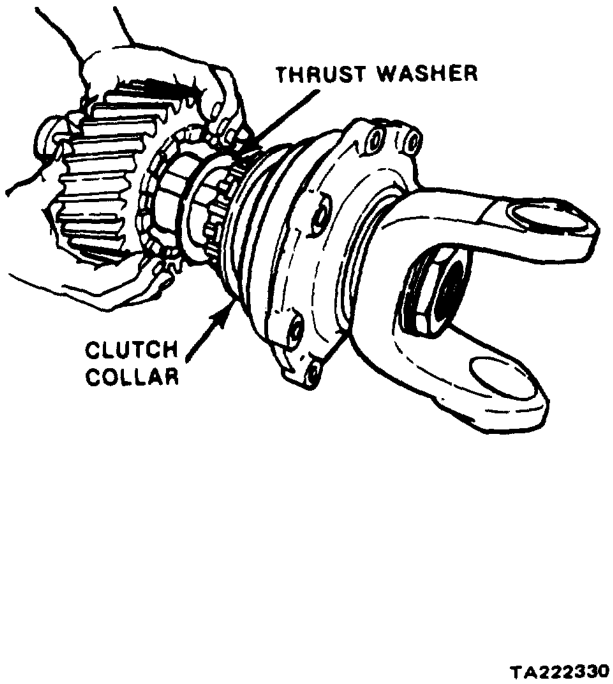


Figure 11-163. Installing Clutch Collar

G. Position the helical drive gear thrust washer into pilot bore of the gear. Install both parts onto the input shaft with the washer against shaft shoulder.

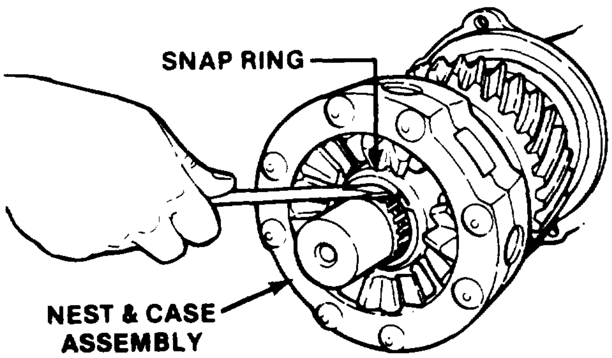


Figure 11-164. Snapring Installation

H. If it was determined earlier through inspection that the complete inter-axle differential case and nest assembly must be replaced, install a new riveted assembly onto the input shaft. Engage the teeth of pinions with the teeth of forward side gear (integral with helical drive gear). Retain the assembly on the input shaft by installing the snapring into groove of shaft (Figure 11-164).

I. If the inter-axle differential case and nest assembly (Figure 11-165) was disassembled, rebuild the unit as follows using service replacement bolts, nuts and washers. Do not re-rivet.

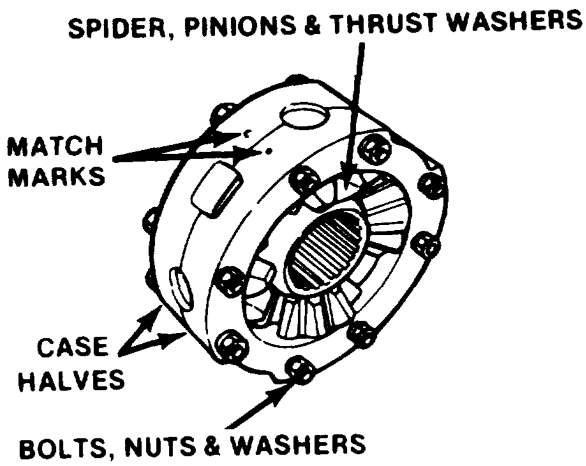


Figure 11-165. Case and Nest Assembly

Place the spider, pinions and thrust washers into position in one case half (Figure 11-166). Place the second case half over the assembly, aligning match marks of both halves. Draw the assembly together with three (3) equally spaced bolts, nuts and washers, placing washers under nuts. Install the remaining fasteners and washers and tighten to the specified torque value. Refer to torque chart at end of manual.

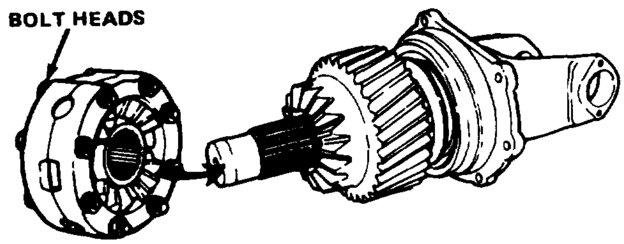


Figure 11-166. Installing Case and Nest Assembly

With the bolt heads facing the rear, install the case and nest assembly onto the input shaft in the same manner as discussed in step "H" above.

J. Press the input shaft rear (inner) bearing cone onto the hub portion of the inter-axle differential rear side gear until it bottoms against shoulder. Use a suitable sleeve that bears against the inner race only.

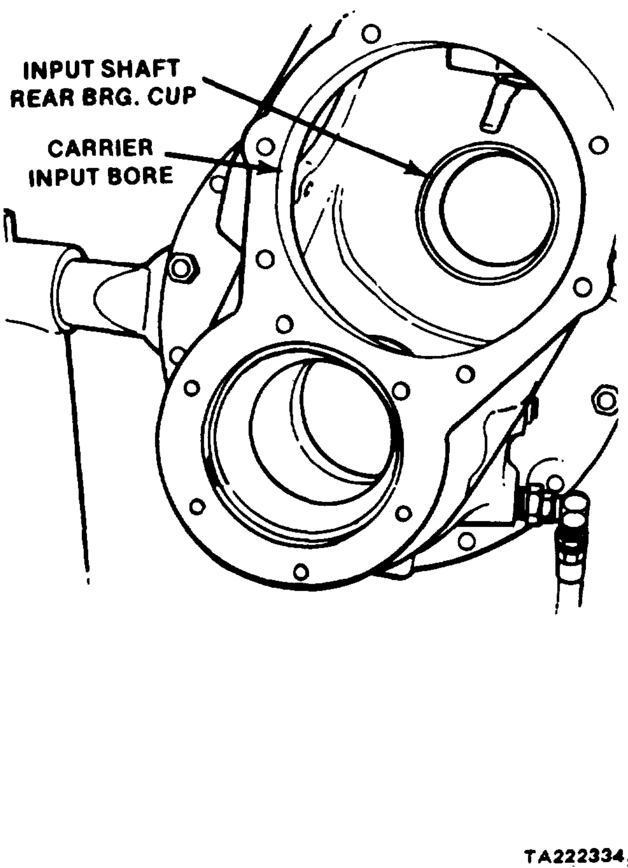


Figure 11-167. Installing Rear Bearing Cup

K. Press the input shaft rear bearing cup into respective bore in carrier until bottomed. If a press is not available, use a sleeve or long drift and mallet to tap the bearing cup into position (Figure 11-167).

To install the inter-axle differential into the carrier, refer to procedures on page 11B-54.

ORIGINAL MODEL UNIT (Figure 11-168)

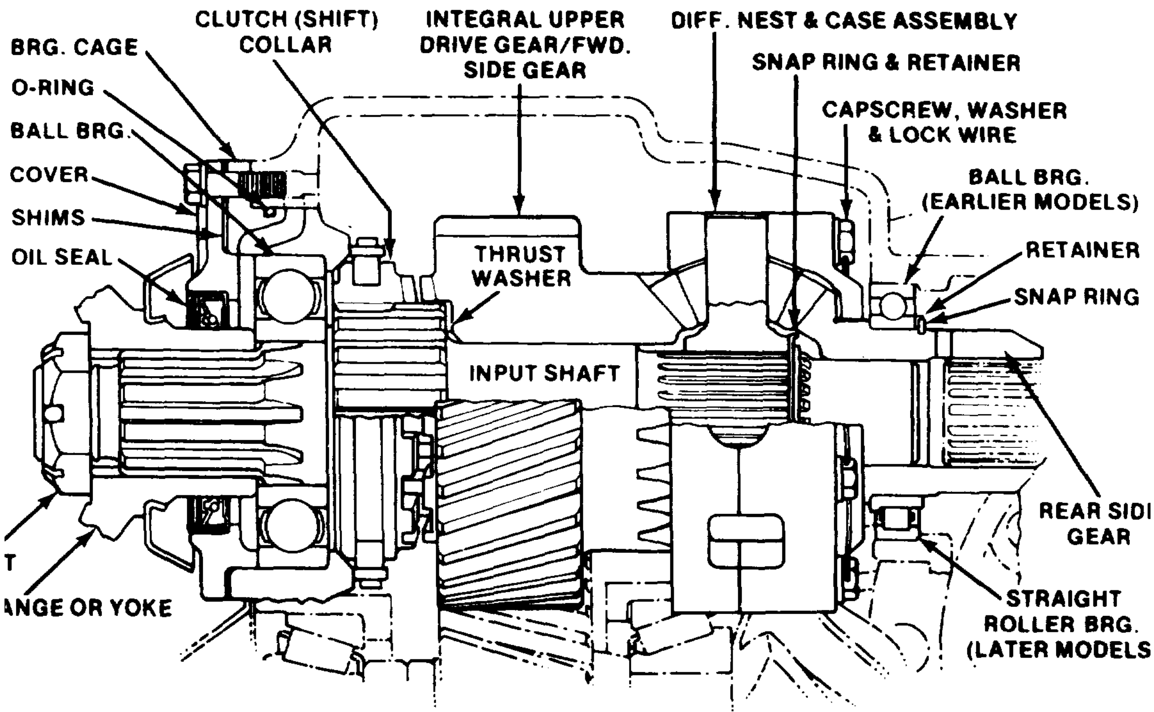


Figure 11-168. Ball and Straight Roller Bearings (Original Models)

NOTE

Except where otherwise specified, coat all parts of the inter-axle differential assembly with the recommended axle lubricant. This can be done as the individual parts are being assembled.

ASSEMBLY

A. If a one piece input shaft bearing cage is used, install the bearing inner retainer snapring into respective groove in cage inside diameter.

B. Press the input ball bearing into cage from the forward side using a suitable sleeve that bears against the outer race. Press in bearing until contact with the inner snap ring is made, then release pressure.

If a two piece cage/cover is used, press the bearing into cage by the outer race until it bottoms in bore.

CAUTION

Do not exert pressure after bearing contacts snapring or bottoms in cage. Damage to component parts will result.

C. With the one piece cage, install the bearing outer retainer snapring at this time, in groove of cage inside diameter.

D. With both types of bearing cages, press the cage and bearing assembly onto the input shaft forward end using suitable sleeve that bears against the bearing inner race. Continue to apply pressure until the bearing seats squarely against shoulder of shaft.

E. If a one piece cage is used, place the oil seal over shaft and press into position against the outer snapring in cage inside diameter. Use a suitable sleeve that bears against the seal retainer/cover to install seal.

If a two piece cage/cover is used, press the oil seal into cover until seal bottoms in bore.

CAUTION

Do not exert pressure after seal bottoms in cage cover or against snapring. Damage to component parts will result.

F. Coat the seal elements with the recommended seal lubricant, Rockwell part No. 1199-R-1474 (Fiske Brothers Lubriplate #5555).

G. If removed, install the cage to carrier "O" ring in groove of cage outside diameter.

H. If the two piece cage/cover is used, place the cover and oil seal assembly, less shims, over the bearing cage.

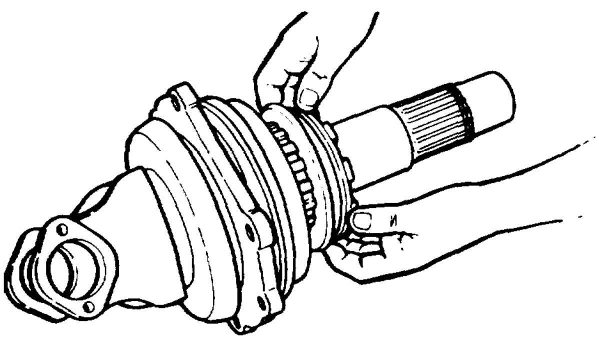
I. Install the yoke or flange onto the input shaft splines and push against the ball bearing. Be careful not to damage the oil seal. If it is difficult to install the yoke or flange by hand, use a press and suitable sleeve.

Some later models employ interference fit splines on yokes, flanges and shafts. With this type of spline, carefully align both parts and use only a press and sleeve for installation.

Secure the yoke or flange onto the input shaft with nut and washer (if used). Tighten the nut hand tight against the yoke or flange. Final tightening will be done later when the assembly is mounted in the carrier.

CAUTION

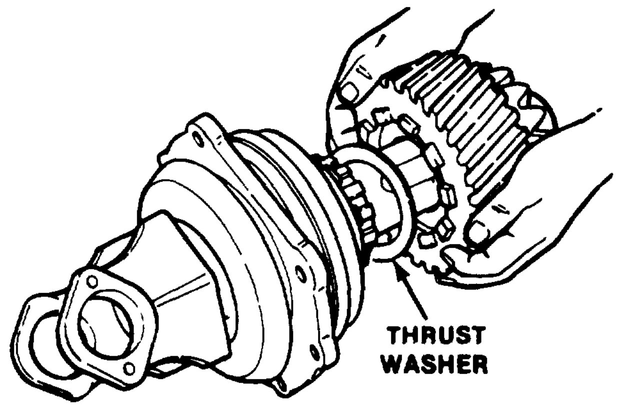
Do not use hammers or mallets to drive the yoke or flange onto shaft. Damage to splines will result.



TA222336

Figure 11-169. Installing Clutch Collar

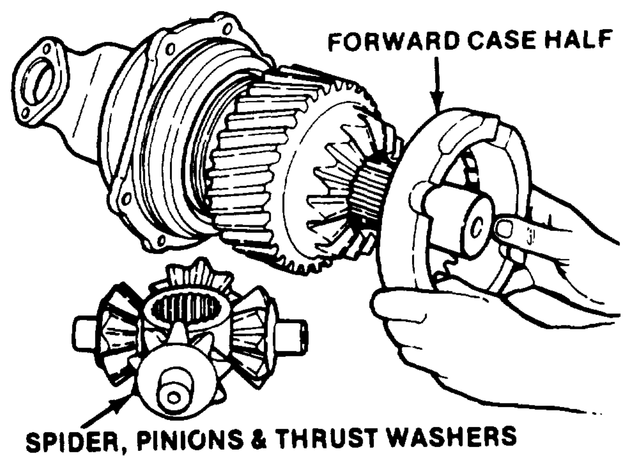
J. Install the clutch collar onto input shaft splines with the smooth side next to cage (Figure 11-169).



TA222337

Figure 11-170. Thrust Washer and Transfer Gears

K. Install the transfer gear thrust washer and transfer gear onto the input shaft, against shoulder. The side gear portion of transfer gear must be facing out (Figure 11-170).



TA222338

Figure 11-171. Positioning Forward Case Half

L. Position the inter-axle differential forward case half over the forward side gear portion of transfer gear. Also assemble the pinions and thrust washers onto the spider (cross) (Figure 11-171).

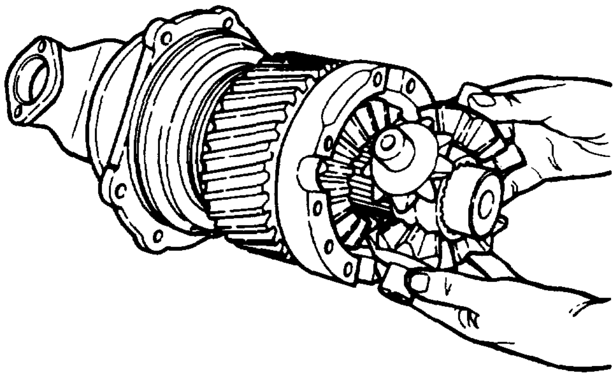


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Figure 11-172. Installing Spider Assembly

M. Place the spider, with pinions and thrust washers, onto the input shaft splines. Rotate the forward case half to align trunnion holes with spider trunnions and slide the assembly into case half (Figure 11-172).

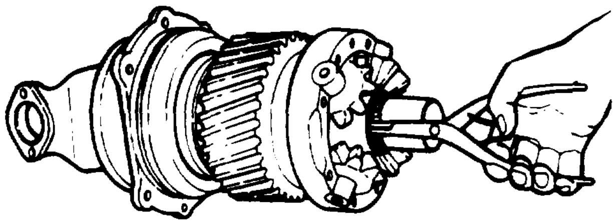

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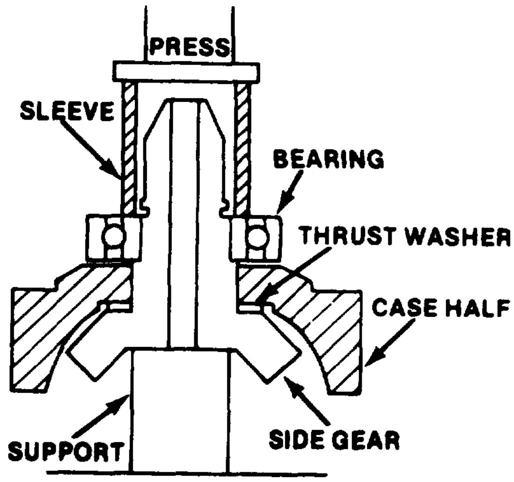
Figure 11-173. Installing Snapring Retainer

N. Position the snapring retainer onto the shaft against the spider and install the snapring into groove of input shaft (Figure 11-173).

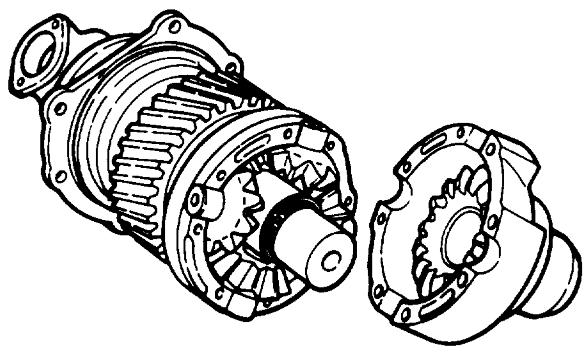
O. Assemble the rear inter-axle differential side gear, thrust washer and case half together and place in a press with gear teeth facing down. Support the side gear and case half with a piece of round steel stock positioned at the gear hub inner shoulder. The support must be high enough to allow the case half to seat against the back side of gear (Figure 11-174).



TA222341

Figure 11-174. Pressing Bearing on Side Gear

Press either the straight roller bearing inner race or ball bearing (whichever is used) onto the side gear hub squarely against the shoulder. Use a suitable sleeve that bears against the inner race.



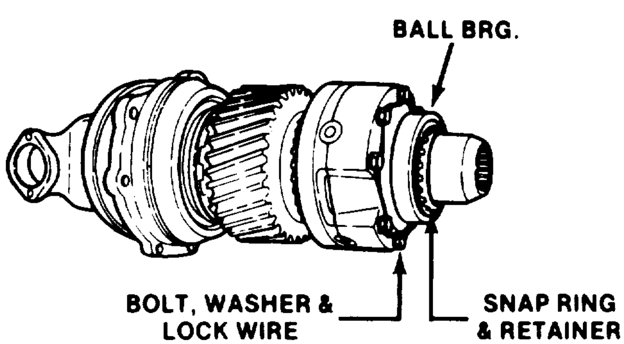
TA222342

Figure 11-175. Rear Case Assembly

P. Position the rear case half, side gear and bearing assembly onto the input shaft and rotate to align match marks of both case halves and secure with capscrews and washers. Tighten capscrews to the specified torque value. Refer to torque chart at end of manual. Install lock wire, if used, through capscrew heads (Figure 11-175).

NOTE

If Dri-Loc fasteners or Liquid Adhesive applications are to be used to secure case halves together, refer to procedures on page 11B-43.



TA222343

Figure 11-176. Installing Outer Snapring

Q. If a ball bearing is employed at the inter-axle differential rear side gear, place the snap ring retainer onto gear hub, against bearing. Install the snapring into groove of gear hub outside diameter and bend retainer tabs over snapring to secure into position (Figure 11-176).

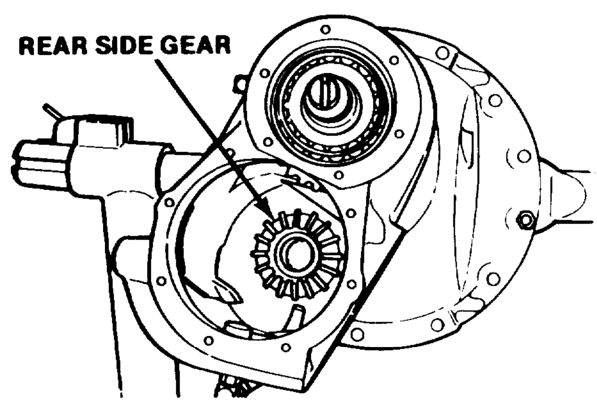
R. If a straight roller bearing is used at the inter-axle differential rear side gear, press the bearing outer race with rollers into bore of carrier. Use a sleeve that bears only against the outer race.

To install the inter-axle differential into the carrier, refer to the following procedures.

INSTALL INTER-AXLE DIFFERENTIAL INTO CARRIER (Figure 11-177)

A. Place the carrier in a repair stand, turning it to a vertical position with the drive pinion nut facing upward.

B. If the carrier is an original design, employing a ball bearing input, place a new cage to carrier gasket over the input bore of carrier. If a fiber gasket is not used, apply silicone gasket material to one mating surface, referring to procedures on page 11B-51. Current model carriers do not employ a gasket at this location.



TA222344

Figure 11-177. Installing Inter-Axle Differential

C. With current model carriers, place the inter-axle differential rear side gear with bearing cone into carrier against bearing cup previously installed.

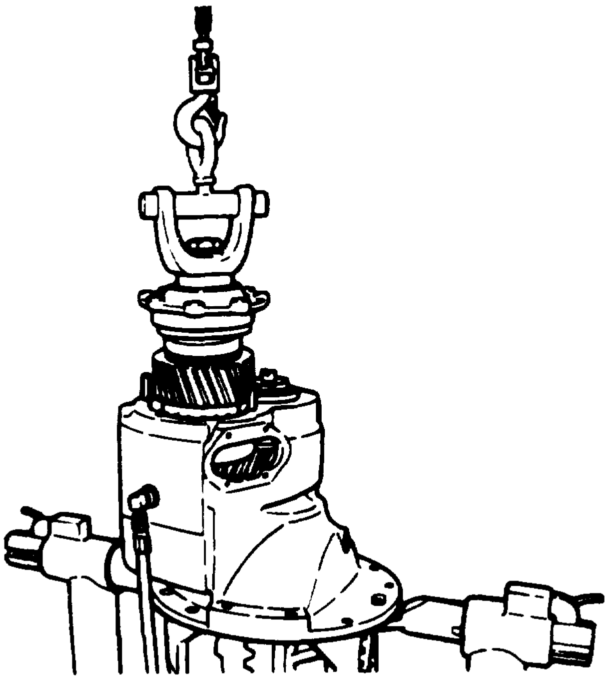


Figure 11-178. Axle on Lifting Fixture

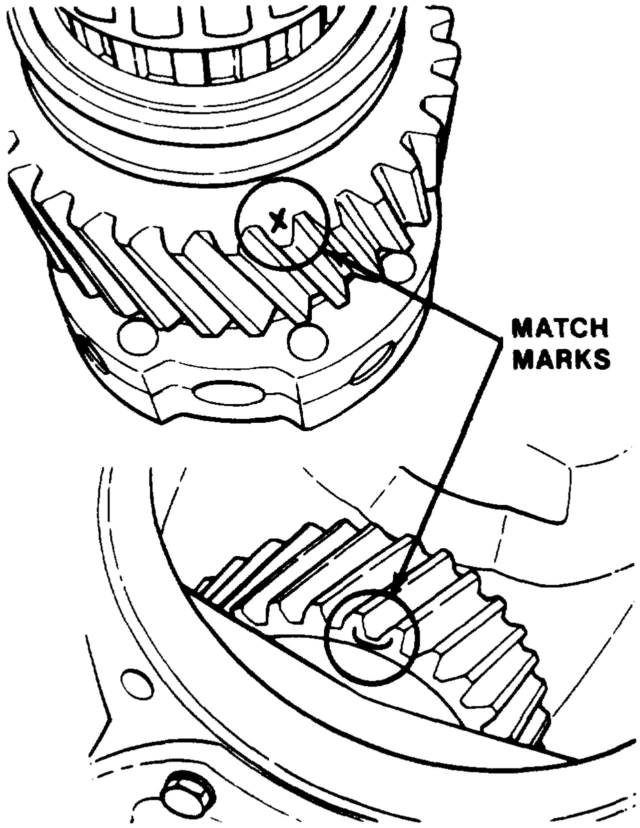


Figure 11-179. Gear Match Marks

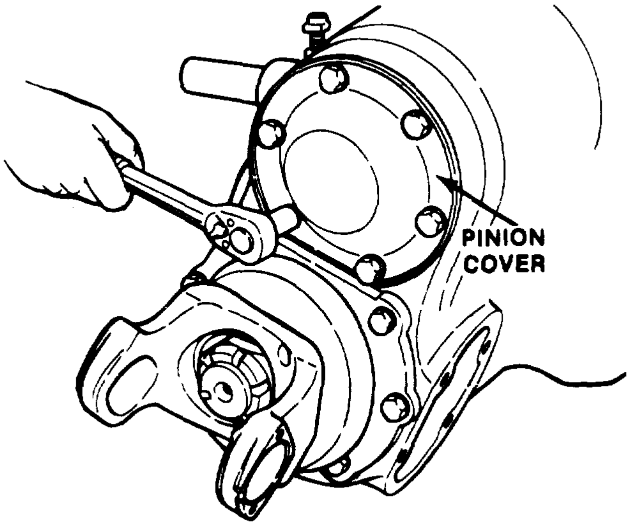
D. Attach a lifting fixture and/or a chain fall to the input yoke (as shown above) or flange and carefully lower the inter-axle differential assembly into the carrier. As the assembly is lowered align the match marks of both helical gears. This can be done by viewing and rotating the gears through the shift unit opening at side of carrier (Figure 11-178).

CAUTION

The production drive and driven helical gears are mated and match marked (Figure 11-179). at time of lapping. One gear tooth is marked with an "X" and one gear tooth space is marked with a corresponding symbol "U". These marks must be aligned at reassembly for correct gear contact.

E. If the input bearing cage is the original one piece design with a ball bearing, secure the cage to carrier with capscrews and washers. Tighten capscrews to the specified torque value. Refer to torque chart at end of manual.

However, if the bearing cage is the two piece type or current one piece with a taper bearing, install capscrews to finger tight only at this time. Continue with adjusting the input bearing cage shim pack thickness.



TA222347

Figure 11-180. Securing Pinion Cover

F. If the drive unit does not employ an external mounted oil pump, install the drive pinion cover and gasket after input shaft adjustment. If a fiber gasket is not used, apply silicone gasket material to one mating surface, referring to procedures on page 11B-24.

Secure the pinion cover to carrier with capscrews and washers (Figure 11-180). Tighten capscrews to the specified torque value. Refer to torque chart at end of manual.

INPUT SHAFT AND BEARING ADJUSTMENT

CURRENT DESIGN - ONE PIECE INPUT CAGE WITH TAPERED BEARING AND ORIGINAL DESIGN -TWO PIECE INPUT CAGE WITH BALL BEARING.

Correct shaft and bearing adjustments:

Current design = .001" - .007" end play.

Original design = .003" - .006" tight.

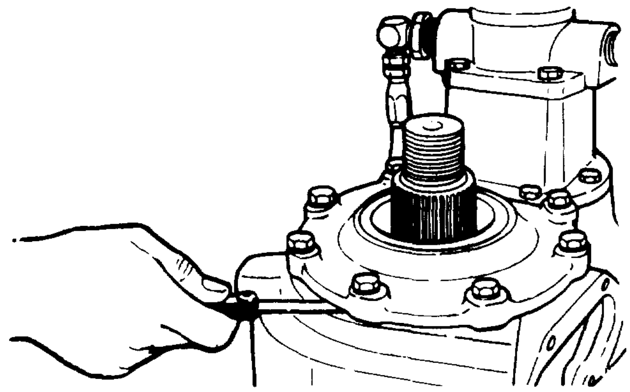
A. Remove the yoke or flange from input shaft using a suitable puller.

CAUTION

Do not use a hammer or mallet to drive off the yoke or flange from shaft. Excessive runout and damage to splines will result.

B. Install all input cage to carrier capscrews. Washers are not required at this time. Tighten capscrews to finger tight only.

As capscrews are tightened, rotate the input shaft several revolutions in both directions to seat bearings. Keep the hypoid ring gear from rotating by blocking the gear with a wood wedge.



TA222348

Figure 11-181. Measuring Cage Gap

C. Using a feeler gauge, measure the gap (Figure 11-181) between the bearing cage and carrier face of current models or between the cover and cage of original models. Measure the gap at three (3) or four (4) locations around the cage assembly and calculate the average gap measurement. Make a note of this value.

With the current design (tapered bearings) add .001" to the gap measurement. With the original design (ball bearing) subtract .006" from the gap measurement. After determining the dimension, select a new shim pack to correspond to this value.

EXAMPLE: Current design (tapered bearing)

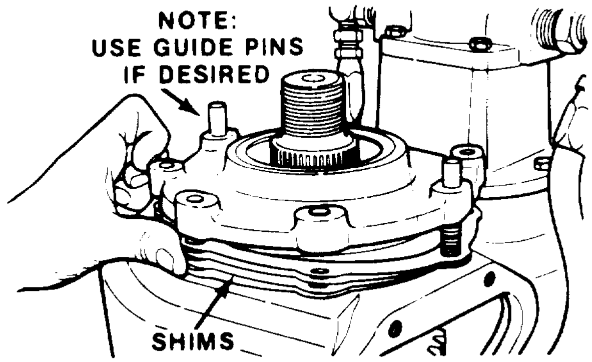
Measurement No. 1 =	.030"
Measurement No. 2 =	.033"
Measurement No. 3 =	+ .031"
	.094" total
Average measurement =	.094" + 3 = .0313"
Average measurement =	.031"
	+ 001"
Thickness of shim pack =	.032"

EXAMPLE: Original design (ball bearing)

Measurement No. 1 =	.060”
Measurement No. 2 =	.065”
Measurement No. 3 =	+ .061”
	.186” total
Average measurement =	.186” ÷ 3 = .062”
Average measurement =	.062”
	- ,006”
Thickness of shim pack =	.056”

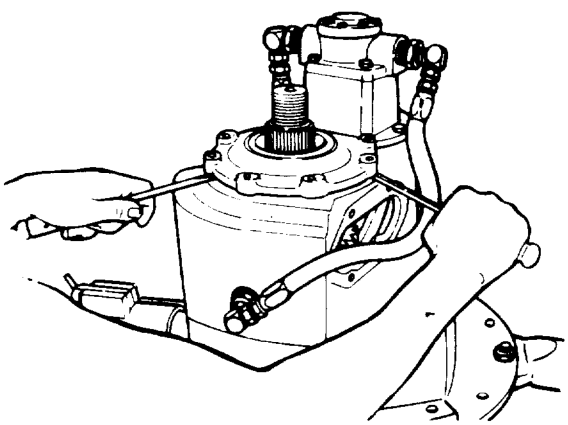
NOTE

Use a minimum of three shims in the pack with the thinnest shims positioned at both sides to allow pack to compress for sealing.



TA222350

Figure 11-183. Installing Shims



TA222349

Figure 11-182. Cage Cover Removal

D. To install the shim pack, first remove the cage to carrier capscrews (Figure 11-182). Remove the bearing cage of current models or cage cover of original models from carrier, being careful not to damage the oil seal.

NOTE

The shims may be split. With split shims, it is not necessary to completely remove the cage.

E. Install the proper shim pack, as determined in step “C”, between the bearing cage and carrier or cover and bearing cage, depending on design used. Re-install the cage or cover onto the carrier, being careful not to damage the oil seal (Figure 11-183).

F. With the original ball bearing design, secure the cover and bearing cage to carrier with capscrews and washers. Tighten capscrews to the specified torque value. Refer to torque chart at end of manual. Continue with step “F” of “Install Inter-Axle Differential Into Carrier” on page 11B-54.

NOTE

The balance of input shaft adjustment procedures are for the current, tapered bearing design.

G. With the current design, secure the cage to carrier with capscrews and washers. Tighten capscrews to 60 - 75 lb. ft. torque. As capscrews are tightened, rotate the input shaft several revolutions in both directions to seat the bearings.

H. Install the yoke or flange onto the input shaft and secure with washer and nut. Using a suitable fixture to hold the yoke or flange from rotating, tighten the nut to specified torque value. Refer to torque chart at end of manual.

CAUTION

If yokes or flanges and shafts employ interference fit splines, a press or the three piece installation tool must be used. Refer to procedures on this page, "Installation of Interference Fit Yokes or Flanges."

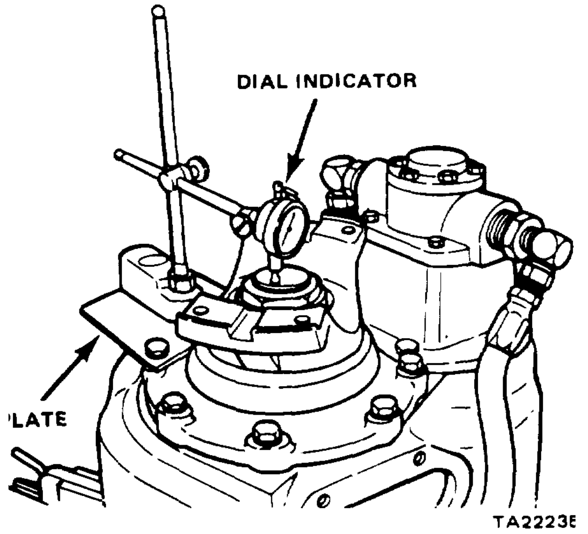


Figure 11-184. Mounting Dial Indicator

I. Fasten a plate to the cage using one of the attaching capscrews. Mount a dial indicator (Figure 11-184) onto the plate with the pointer (plunger) seated against the end of the input shaft. Turn the input shaft in both directions while pushing inward. Set the dial indicator to zero.

WARNING

Secure pry bar to minimize slippage.

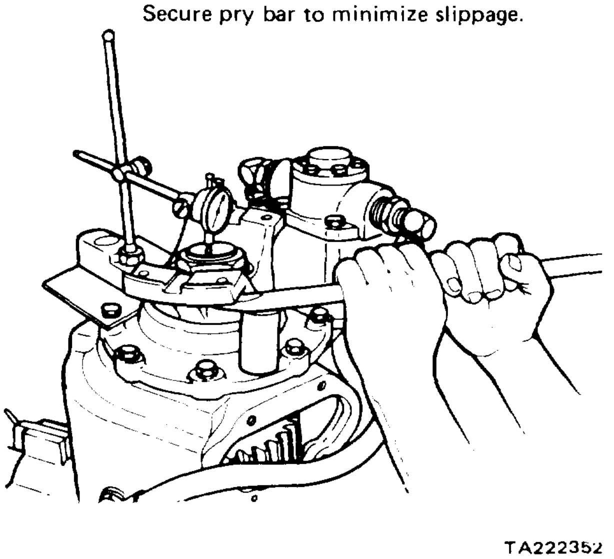


Figure 11-185. Measuring Input Shaft End Play

J. Using a pry bar and support under the yoke or flange, push the input shaft outward while observing the dial indicator. Take note of reading. Final end play must be .001l" - .007". If end play is not within correct range, adjust shim pack by adding or removing shims as required between cage and carrier. Adding shims will increase end play, while removing shims will decrease end play. If shim pack requires further adjustment repeat steps "D" thru "J", excluding step "F" (Figure 11-185).

K. After correct end play has been established, assemble the remaining capscrews and washers. Tighten capscrews to 60 - 75 lb. ft. torque.

L. Install the yoke or flange onto the input shaft. Refer to step "H" on this page.

INSTALLATION OF INTERFERENCE FIT YOKES OR FLANGES

On current model carriers with interference fit yokes, installation will require the use of a press or the three-piece installation tool and the following procedures:

CAUTION

If a press is not available, the three-piece tool must be used to avoid damaging parts. DO NOT DRIVE YOKE ON BY STRIKING IT WITH A HAMMER.

A. Clean all parts thoroughly, i.e., splines of yoke, shaft, seals and wiping area on yoke, etc.

B. Coat the yoke seal elements with the recommended seal lubricant. Also, ensure that there are no burrs or nicks on the yoke wiper surface or any surfaces that will pass through the seal during installation.

C. Thread the yoke installation shaft onto the input, output or through-shaft until the installation shaft bottoms.

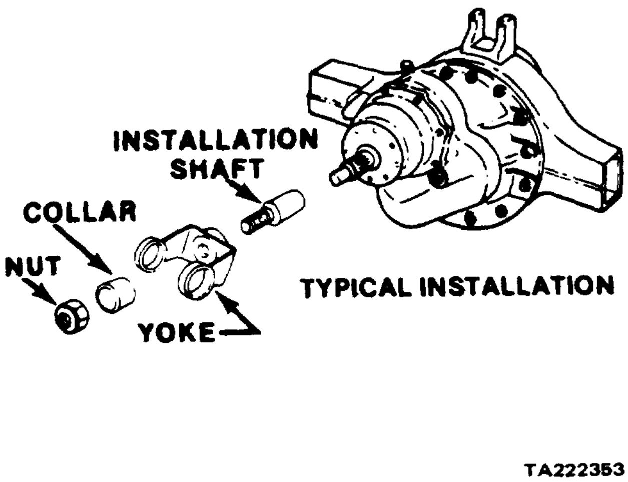


Figure 11-186. Yoke Installation

D. Slide the yoke over the installation shaft, aligning the yoke and shaft splines of the drive unit (Figure 11-186).

E. Place the installation collar over the installation shaft, against the yoke.

F. Thread the nut onto the installation shaft, against the collar. Continue threading the nut against the collar until the yoke seats against the bearing. A torque value of 200 lb. ft. on the nut may be required to properly install and seat the yoke.

CAUTION

Do not use the drive unit input or output nut to install the yoke. Use only the nut furnished with tool.

G. Remove all parts of the installation tool from the drive unit.

H. Install the input or output washer (if employed) and nut. Tighten the nut to specified torque value. Refer to torque chart at end of manual.

INSTALL RING GEAR THRUST SCREW OR ADJUSTING SCREW AND BLOCK

NOTE

Current carrier models employ only the thrust screw, which replaces the original adjusting screw and block combination. Correct adjustment for both types are .010" - .020" clearance from ring gear. If a thrust block is not used, disregard steps A through C.

A. If a thrust block is to be installed, position the carrier in repair stand with backface of the ring gear facing upward.

B. Remove the adjusting screw and locknut from carrier.

C. Coat face of thrust block with grease and place it on the backface of the ring gear. Rotate the gear until the hole in thrust block is aligned with the adjusting screw hole in carrier.

D. With original models, install the adjusting screw and locknut into carrier and tighten the screw and block firmly against the back face of ring gear.

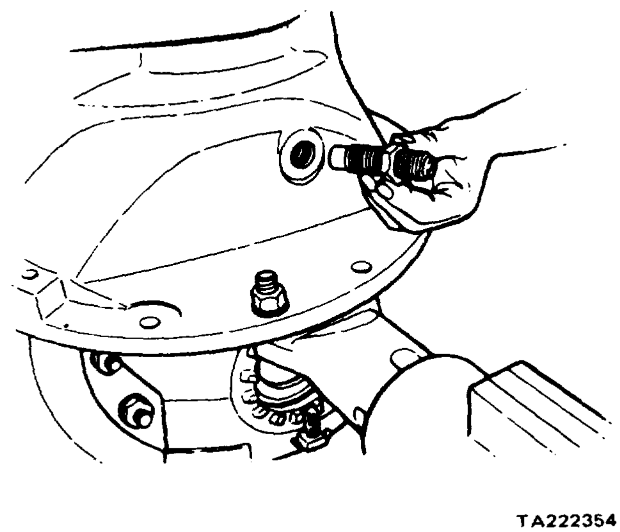


Figure 11-187. Installing Thrust Screw

With current models, install the thrust screw into carrier and tighten directly against the ring gear (Figure 11-187).

E. To secure the correct adjustment of .010" - .020" clearance, loosen thrust or adjusting screw 1/4 turn and lock into position with nut. Tighten nut to 145 - 190 lb. ft. torque.

CLEAN AND INSPECT HOUSING, INSTALL DRIVE UNIT

A. Remove any accumulation of dirt, grit or gum from housing bowl and sleeves. Clean housing thoroughly with solvent and blow dry with compressed air.

B. Inspect housing for cracks, loose studs, nicks, and burrs at machined surfaces. Remove nicks and burrs with stone or file. Make all necessary repairs or parts replacement before installing drive unit in housing.

CAUTION

Do not repair weld - refer to page 11B-32, repair section, item "E".

C. Apply silicone RTV gasket material to the housing. Use Silicone RTV Gasket Application procedures on page 11B-24.

D. Roll the carrier into position on a roller jack. Start the carrier into housing with four equally spaced washers and stud nuts or stud nut and capscrew combinations.

CAUTION

Do not drive carrier into housing with a hammer or mallet at the mounting flange. The flange may be distorted and cause severe oil leakage.

E. Tighten the four fasteners alternately to draw carrier squarely into axle housing.

F. Install the balance of carrier to housing fasteners and washers. Tighten the stud nuts and capscrews to specified torque value. Refer to torque chart at end of manual.

NOTE

After the inter-axle differential shift unit has been installed and adjusted, continue with items "G" through "I".

G. Connect universal at the input shaft.

H. Install axle shafts.

I. Connect air line to shift unit chamber.

PREPARATION FOR STORAGE

In the event the carrier is a spare and may not be immediately installed, all gears and bearings should be thoroughly oiled and the carrier placed in a dustproof container.

Original Model Design Output Shaft and Bearing Cage Assembly (Figure 11-188)

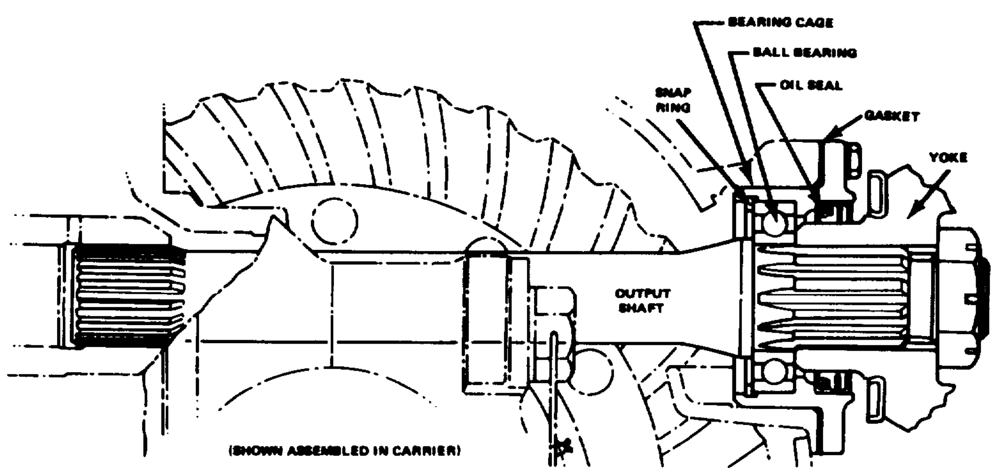


Figure 11-188. Output Shaft and Bearing Cage Assembly (Original Model)

NOTE

Except where otherwise specified, coat all parts of the output (through) shaft and bearing cage assembly with the recommended axle lubricant. This can be done as the individual parts are being assembled (Figure 11-189).

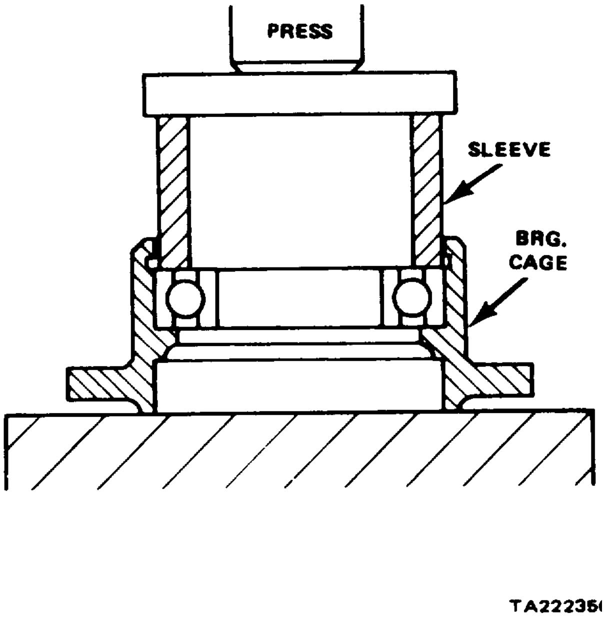


Figure 11-189. Cage Bearing Installation

A. Install the output (through) shaft ball bearing into cage (end opposite mounting flange) using a press and sleeve if required.

Press the bearing into position against cage shoulder using a sleeve that bears against outer race only.

B. Secure the bearing in cage by installing the snapring into groove in cage inside diameter.

C. Press the cage and bearing assembly over splines of threaded end of output shaft. Press the assembly squarely against shoulder using a sleeve that bears against inner race only (Figure 11-190).

D. Install the oil seal into bore of cage using a mallet and suitable sleeve. Tap the seal into position until it bottoms in bore.

CAUTION

Do not exert pressure against seal after it bottoms. Damage will result from excessive pressure.

E. Coat the seal elements with seal lubricant.

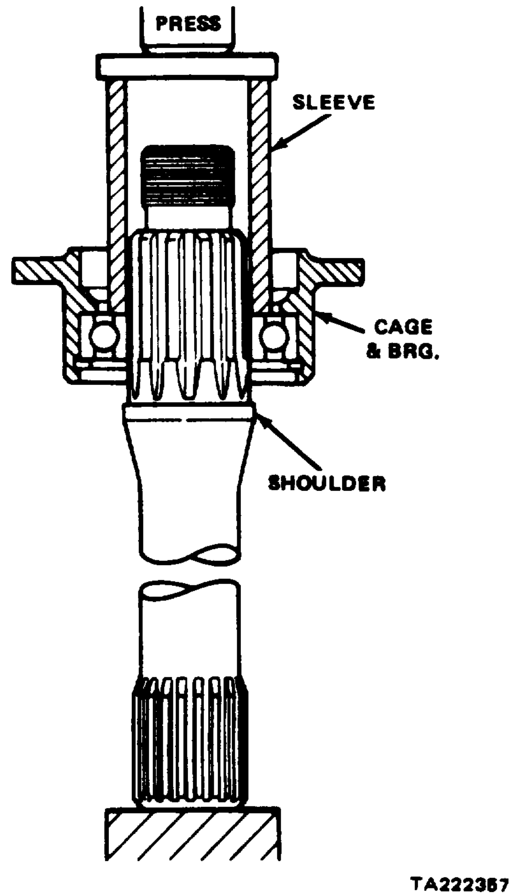


Figure 11-190. Installing Cage Assembly

Tapered Bearing Design (Figure 11-191)

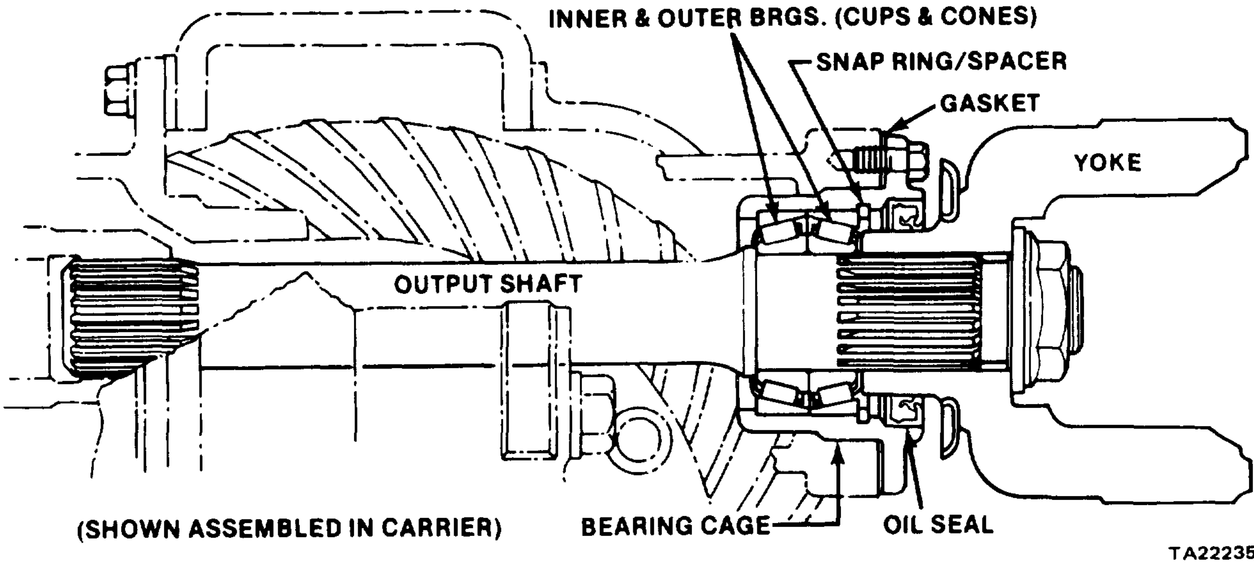


Figure 11-191. Current Model Tapered Bearings

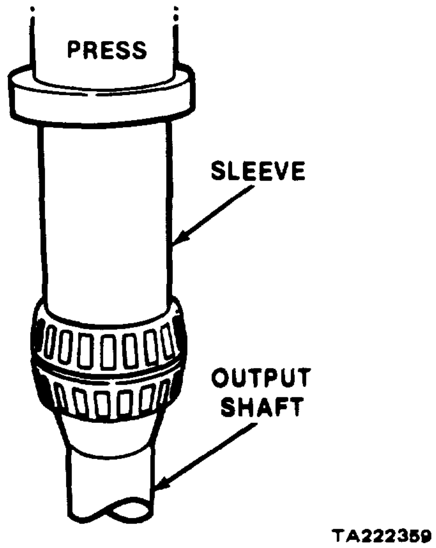


Figure 11-192. Installing Inner and Outer Cones

NOTE

Except where otherwise specified, coat all parts of the output (through) shaft and bearing cage assembly with the recommended axle lubricant. This can be done as the individual parts are being assembled.

A. If removed, press both inner and outer cones onto the output shaft against bearing shoulder (Figure 11-192). Use a sleeve of the correct diameter that will bear against the bearing inner race only.

B. Press the inner bearing cup into cage against shoulder using a suitable sleeve (Figure 11-193).

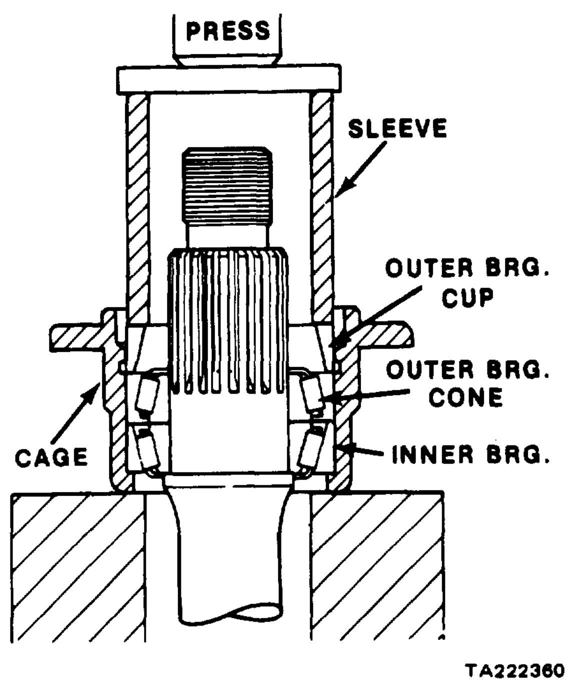


Figure 11-193. Installing Outer Bearing Cup

C. Position the output shaft into the bearing cage until the inner cone seats against the cup. Using a press and sleeve, install the outer bearing cup into cage against the outer cone.

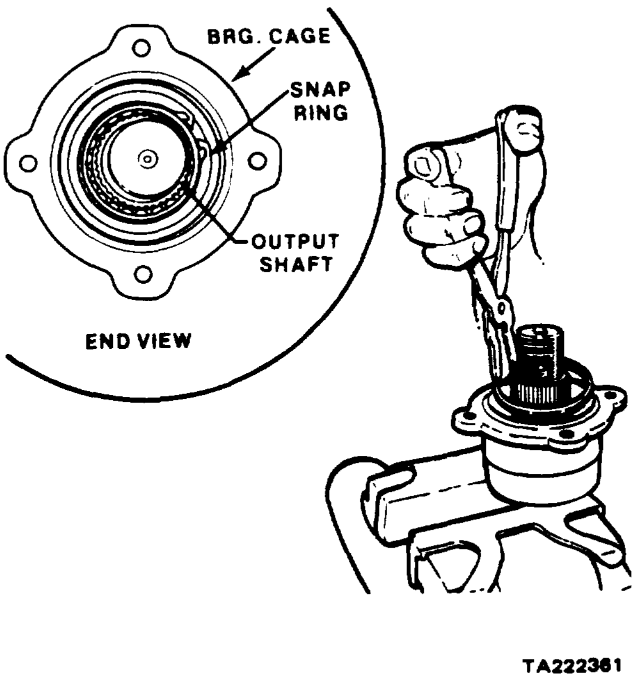


Figure 11-194. Installing Bearing Retainer

D. Install bearing retainer snapring in groove of cage I.D. and adjust shaft and bearings as follows (Figure 11-194):

OUTPUT (THROUGH) SHAFT AND BEARING ADJUSTMENT - CURRENT MODEL, TAPERED BEARINGS ONLY (Figure 11-195).

The thickness of the bearing retaining snapring controls the output bearing preload/end play adjustment.

Correct adjustment is:

10 lb. in. preload to .0030" end ploy.

1. Place the output shaft and cage assembly in a vise with soft metal jaw covers. Secure the assembly by the shaft.

2. Assemble the yoke and yoke spacer onto the output shaft against the outer bearing. If shaft and yoke employ interference fit splines, refer to procedures on page 11B-58, "Installation of Interference Fit Yokes or Flanges".

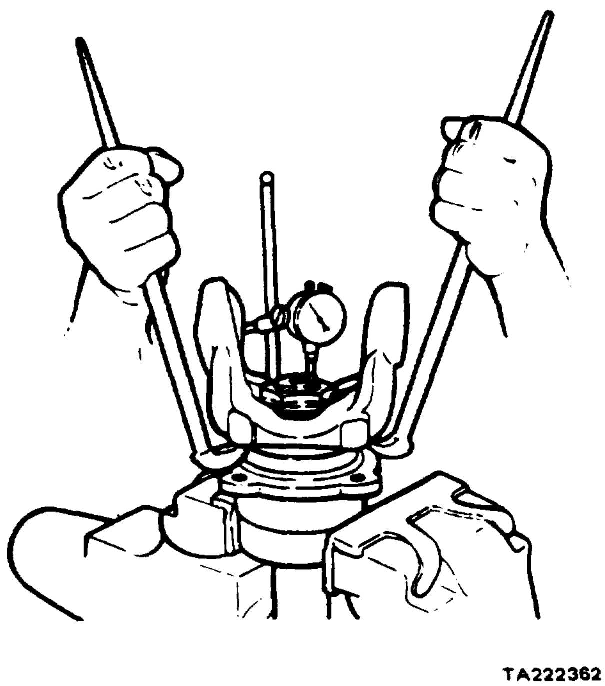
NOTE

Do not install the oil seal into bearing cage at this time.

3. While using a suitable fixture to hold the yoke stationary, thread the yoke nut onto output shaft and tighten to the specified torque value. Refer to torque chart at end of manual.

4. Reposition the shaft and cage assembly in vise, clamping on the cage outside diameter. Mount a dial indicator onto the cage flange area with the pointer stem against the output shaft threaded (nut) end.

5. Holding the yoke, rack in the bearings while turning the yoke side to side to seat bearings. Set the indicator to zero (0).



WARNING

Do not pry on yoke - Pull

Figure 11-195. Checking Output Shaft End Play

6. While observing the dial indicator, pull the yoke outward using pry bars under yoke. Make note of reading.

If end play is indicated, it must not exceed .0030" otherwise further adjustment will be required. Refer to important note below. If .0030" or less is indicated, adjustment is within correct limits. Continue with step "7".

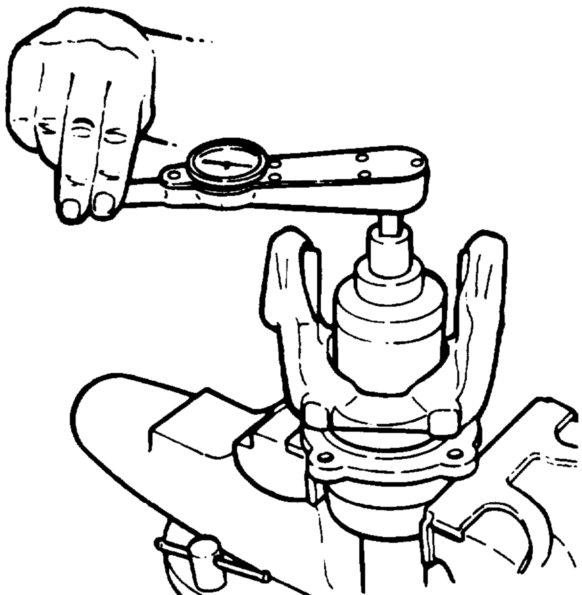


Figure 11-196. Reading Rotating Torque

However, if no shaft end play is present, it will be necessary to check for bearing preload. Attach a wrench socket and pound inch torque wrench to the shaft nut. While observing the scale on wrench, rotate the shaft and bearings within the cage. Read rotating torque, not starting torque. Make a note of reading (Figure 11-196).

Bearing preload must not exceed 10 lb. in., otherwise further adjustment will be required. Refer to important note below. If 10 lb. in. or less is indicated, adjustment is within correct limits.

NOTE

If the shaft and bearing adjustment is not within the correct limits of 10 lb. in. preload to .0030" end play, install a thicker or thinner bearing retainer snapring as required. A thicker snapring will decrease end play or increase preload, while a thinner snapring will increase end play or decrease preload.

7. After correct adjustment has been established, remove the yoke from shaft using a suitable puller.

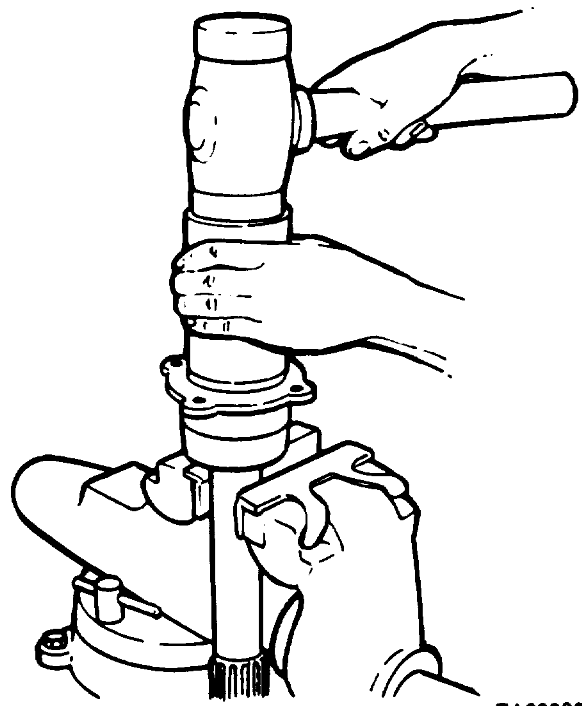


Figure 11-197. Tapping in Seal with Mallet

Press the oil seal into cage bore using a press and sleeve or seal driver and mallet as shown above. Press or tap in seal until it is flush with the outside face of bearing cage (Figure 11-197).

8. Coat the seal elements with the recommended seal lubricant, Rockwell part No. 1199-R-1474 (Fiske Brothers Lubriplate #5555).

9. The output yoke or flange may be reinstalled into the shaft at this time if desired, or after the shaft and cage assembly has been installed into the housing and carrier. Refer to procedures on page 118-58, "Installation of Interference Fit Yokes or Flanges".

10. Before installing the output shaft and cage assembly into the housing and carrier, squirt an adequate amount of the recommended axle lubricant through the front and rear of the bearing cage. Rotate the bearings to insure lubrication.

INSTALL OUTPUT (THROUGH) SHAFT AND CAGE ASSEMBLY INTO HOUSING AND CARRIER

A. Insert the output shaft and cage assembly, with new cage gasket, into cage bore in rear of the axle housing. Push in the shaft until the forward splined end is completely seated into the inter-axle differential rear side gear. It may be necessary to rotate the shaft to index the splines (Figure 11-198).

B. Secure the cage and shaft assembly to housing with capscrews and washers. Tighten capscrews to specified torque value. Refer to torque chart at end of manual (Figure 11-203).

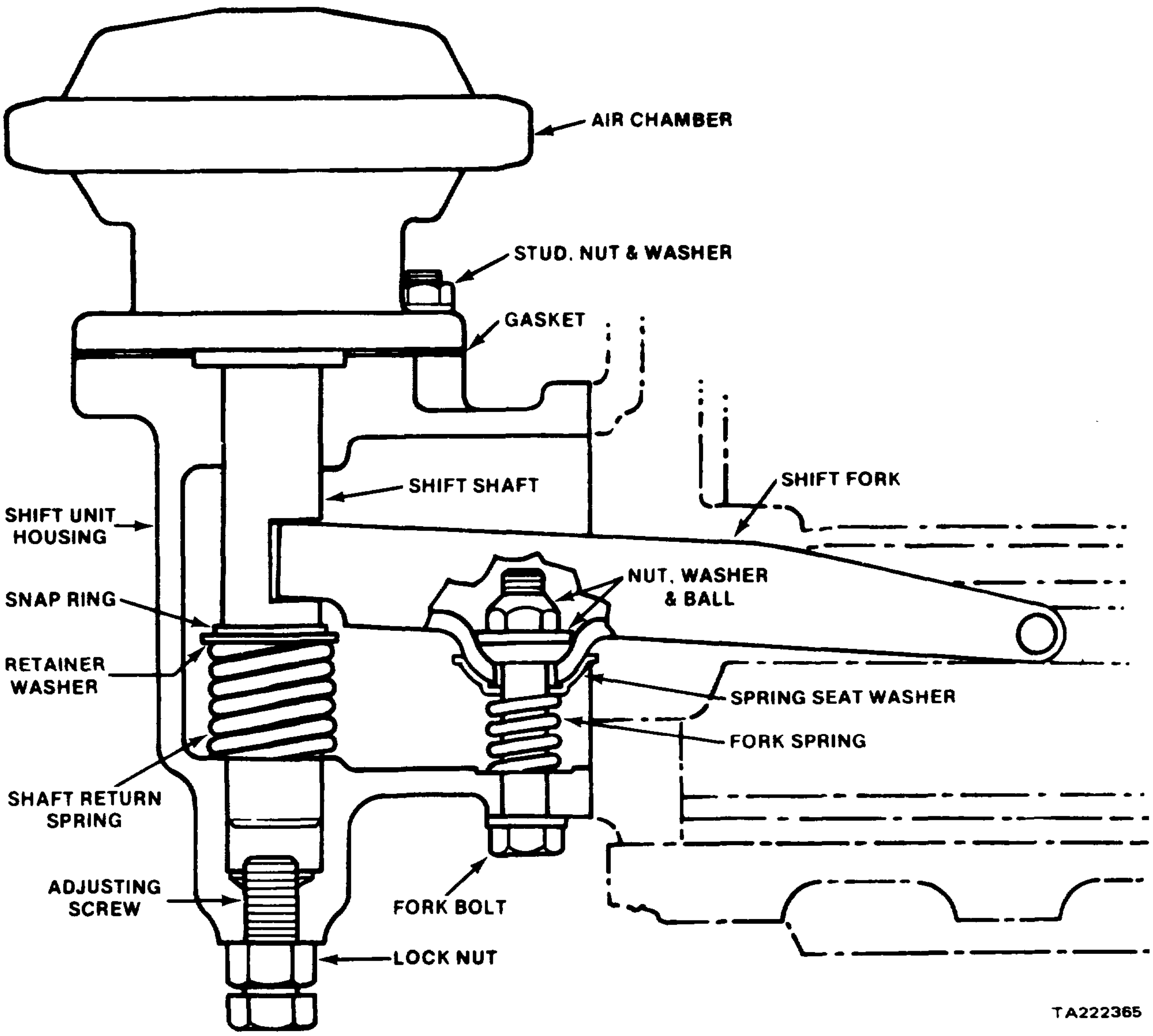


Figure 11-198. Inter-Axle Differential Shift Unit

REASSEMBLE AND INSTALL INTER-AXLE DIFFERENTIAL SHIFT UNIT

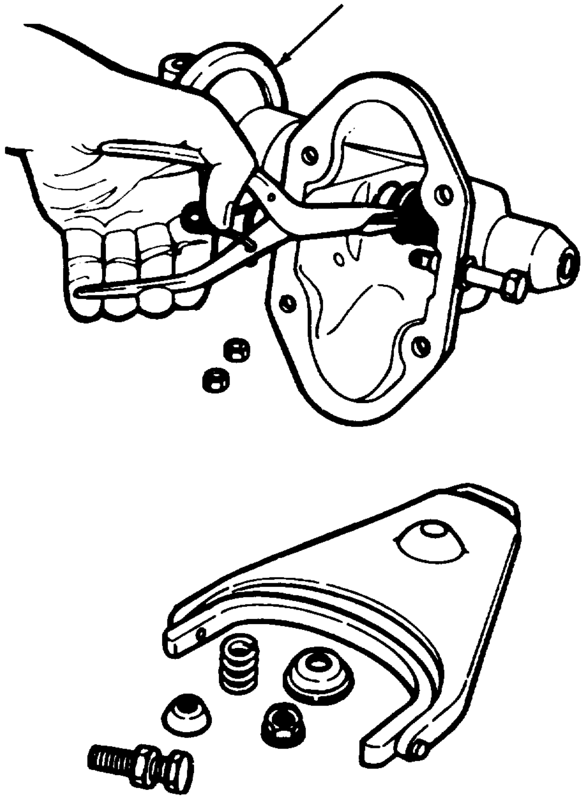


Figure 11-199. Installing Chamber Assembly

A. Place a new air chamber gasket over the chamber mating surface and studs of shift unit housing.

B. Partially install the chamber and shaft into the shift unit housing. As the shaft enters the inside of housing, slide the snapring over shaft and install into groove. Slide the spring retainer washer and spring onto shaft against snapring (Figure 11-199).

C. Proceed with inserting the shaft completely into housing until the chamber mates with housing studs and gasket. Secure the chamber to housing with washers and nuts. Tighten nuts to the specified torque value. Refer to torque chart at end of manual.

D. Install the shift shaft adjusting screw and locknut into the end of housing. Adjustment of shaft and fork is done after the complete unit is reassembled and installed into the carrier. Refer to "Shift Shaft and Fork Adjustment" procedures on pages 11B-65 and 11B-66.

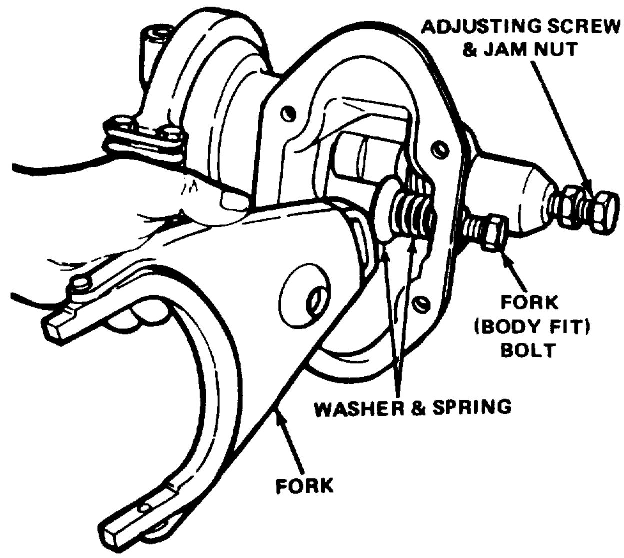


Figure 11-200. Installing Shift Fork

E. install the fork (body fit) bolt partially into housing. From inside of housing, slide the spring, spring seat washer, shift fork and fork ball onto the bolt. Make sure the end of fork engages with slot in shift shaft (Figure 11-200).

F. While holding the components in position, tap the bolt completely into housing. Secure all parts in housing with nut tightened to specified torque value and cotter key if used. Current models employ a locknut only. Refer to torque chart at end of manual (Figure 11-203).

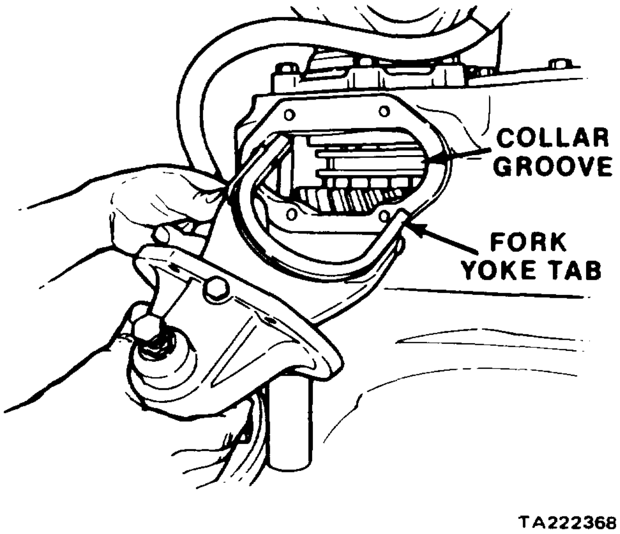


Figure 11-201. Installing Shift Unit Assembly

G. Install the shift unit assembly and new gasket onto the carrier (Figure 11-201). As the shift fork enters the carrier, exercise care to properly locate the fork yoke tabs into the clutch (shift) collar groove. Secure the shift unit assembly to carrier with capscrews and washers. Tighten capscrews to specified torque value. Refer to torque chart at end of manual.

SHIFT SHAFT AND FORK ADJUSTMENT
(Figure 11-202)

A. Attach a 60 P.S.I. auxiliary air supply to the shift unit air chamber.

B. Back off the shift shaft adjusting screw and locknut enough to allow the shaft to move back to its maximum stroke when air pressure is applied.

C. Apply and hold 60 P.S.I. to the shift unit air chamber. This will engage the clutch (shift) collar teeth with the upper transfer (drive) gear.

NOTE

To be certain of complete engagement between collar and gear, rotate either the input or output shaft as air pressure is applied. A clap sound and resistance to shaft rotation will indicate complete engagement.

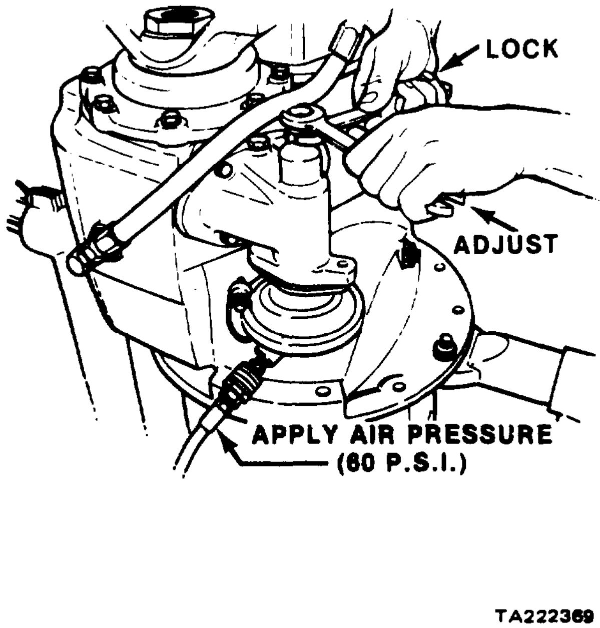


Figure 11-202. Shift Shaft and Fork Adjustment

D. As air pressure is held, turn in the adjusting screw finger tight against the end of the shift shaft. After contact with shaft is made, continue turning in the adjusting screw 3/4 to 1¼ revolutions more. This will center the fork tabs in shift collar groove.

E. Secure the adjusting screw in this position by holding the screw stationary and tightening the locknut to specified torque value against housing. Refer to torque chart at end of manual (Figure 11-203).

F. Check for proper disengagement of the clutch collar and upper transfer gear by first releasing the air pressure to chamber. Hold the input shaft stationary while turning the output shaft. If the shift unit is properly adjusted the output shaft will turn freely.

G. Double check for complete shift by repeating steps "C" and "F". If any problems occur, check for cause and repeat adjusting procedures "A" through "G". After check is made, remove the auxiliary air supply from the carrier.

LUBRICATION

"Standard" S.A.E. 140 viscosity lubricants (Rockwell specifications 0-76, 0-76-A and 0-76-B) are to be used in drive units that operate under average conditions, except where atmospheric temperatures require the use of the "optional", lower viscosity lubricants.

"Optional" S.A.E. 90, 80 and 75 viscosity lubricants (Rockwell specifications 0-76-C. 0-76-D. 0-76-F and 0-76-J) should be used when starting or storage temperatures fall below the channel point of the particular S.A.E. 140 viscosity lubricant being used.

However, experience has shown that the use of an S.A.E. 140 viscosity grade lubricant will result in longer gear life. Generally speaking, the "standard" lubricants will render satisfactory service in most areas of the continental United States.

CAUTION

The design of hypoid gear teeth, which mesh with a sliding action, enables them to withstand higher unit pressures. Therefore, the lubricant should have extreme pressure properties. Only hypoid gear lubricants with S.A.E. designation A.P.I.-GL-5 meet these requirements and are recommended.

Unusual temperature or operating conditions may require other or more specific lubricant recommendations. Automotive operations of Rockwell International will review these circumstances upon request, and make optional gear oil or grease recommendations. It is essential that all details of vehicle operation, loads, area temperatures, etc., are clearly and completely stated when applying to our Engineering Department for an optional lubricant recommendation.

NEW AND RECONDITIONED AXLE SERVICE

With new axles, the original rear axle lubricant should be drained at 1,000 miles, but not later than 3,000 miles. Drain the lubricant initially used in the assembly following reconditioning at the same interval. Completely drain the lubricant while the unit is warm. Flush well with clean flushing oil and thoroughly drain. Axles should not be flushed with any solvent such as kerosene.

All new and reconditioned axles should be checked for correct oil level before being placed into service.

For reconditioned axles, follow the same procedures as above after overhaul.

OIL CAPACITY

With the vehicle sitting level, fill the axle with 34 pints of the recommended lubricant through the tarrier.

REGULAR AXLE SERVICE

Refer to Section III, "Lubrication", page 3-10 of this TM for recommended service intervals.

Completely drain the lubricant while the unit is warm. Flush well with clean flushing oil and thoroughly drain. Fill the axle with the recommended type and amount of fresh lubricant.

After filling the new or rebuilt carrier and housing assembly with lubricant, as specified, drive the vehicle, unloaded, for one to two miles at speeds not to exceed 25 miles per hour to thoroughly circulate the lubricant throughout the assembly.

MAGNETIC DRAIN PLUGS

Magnetic drain plugs perform the vital function of trapping small metallic particles that circulate in the lubricant causing rapid wear and premature failure. The magnet must be strong enough to firmly hold the particles under service conditions. We recommend plugs with elements having a minimum pickup capacity of 1.5 pounds (.7 kg) of low carbon steel in plate or bar form. For further details refer to the Rockwell Field Maintenance Manual No. 1, "Lubrication".

Spare clean plugs should be kept on hand for replacement at regular intervals. The change schedule can easily be established by periodic plug examination.

TANDEM AND TRIDEM AXLE TIRE MATCHING

Unmatched tires on either Tandem Drive Units or Tridem Drive Units will cause tire wear and scuffing and possible damage to the drive units. Consequently we recommend the tires be matched to within 1/8" of the same rolling radius, 3/4" of the same rolling circumference.

TANDEM UNITS:

CAUTION

The four largest tires should never be installed on one driving axle or the four smallest tires on the other driving axle. Such tire mounting will cause an inter-axle "fight", unusually high axle lubricant temperatures that result in premature lubricant breakdown and possible costly axle service.

In addition to matching individual tire rolling radii or rolling circumference, we recommend matching, as nearly as possible, the total tire circumference of one driving axle to the total tire circumference of the other driving axle. This will usually result in satisfactory tandem axle lubricant temperatures that lengthen drive unit service with higher tire mileage.

TRIDEM UNITS:

When three driving axles are "hooked" together in a Tridem Series, unmatched tires will compound the problems described in the preceding paragraphs.

Therefore, we recommend matching, as nearly as possible, the total tire circumference of each of the three driving axles. Use the following procedures:

The vehicle should be on a level floor, carrying a correctly distributed rated capacity load. Be sure all tires are the same size (measure new tires to be sure they will be correctly matched).

1. Inflate all tires to the same pressure.

2. Carefully measure the rolling circumference of each tire with a steel tape.

3. Mark the size on each tire with chalk and arrange them in order of size, largest to smallest.

4. Mount the two largest tires on one side of one axle and mount the two smallest on the opposite side of the same axle.

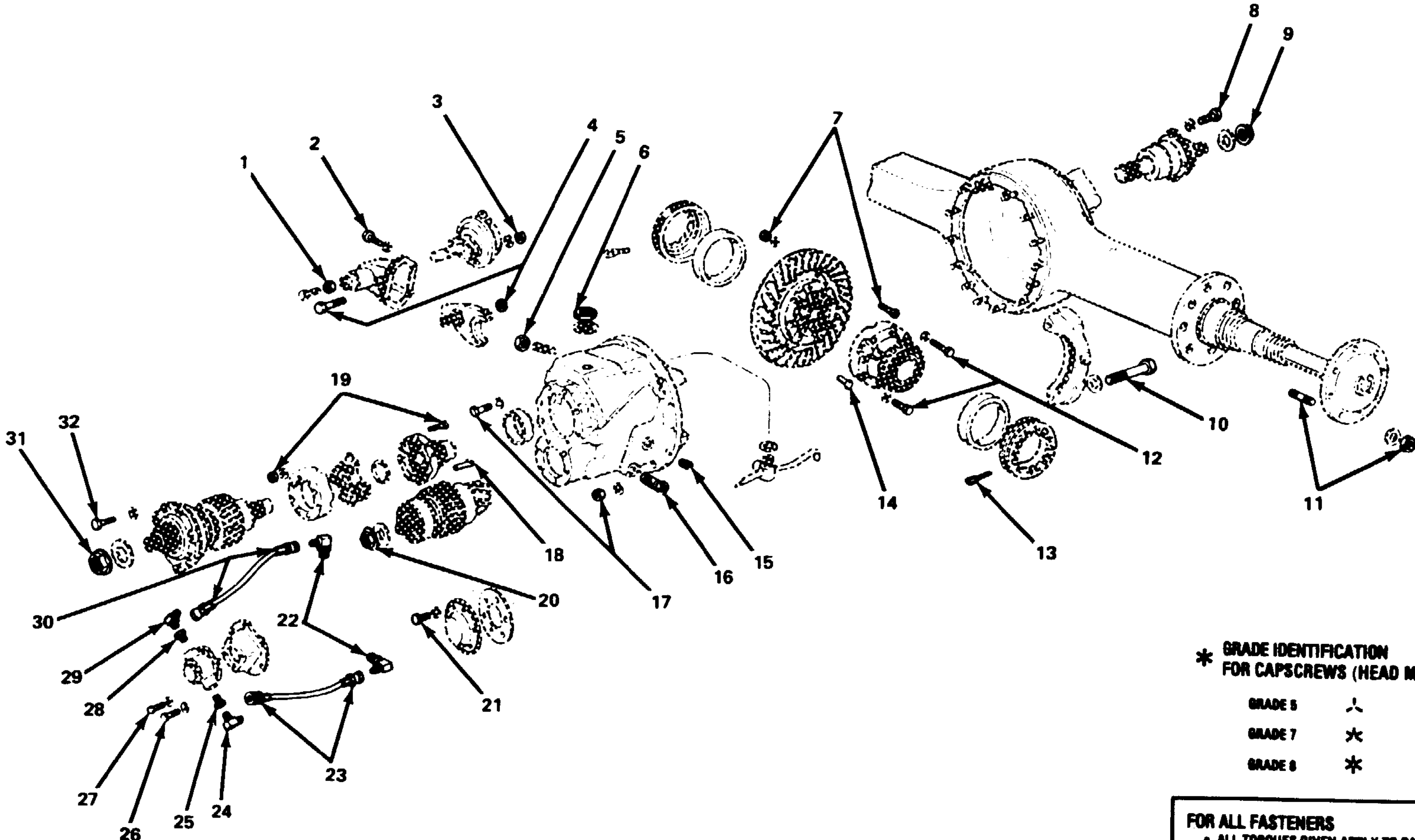
5. Mount the four other tires on the other axle in the same manner.

6. Test run the vehicle to get accurate rear axle lubricant temperature readings on the two axle lubricant temperature gauges.

7. Vary tire air pressure, within the tire manufacturer's recommended range, so the lubricant temperature of both axles is within 30°F of each other and not in excess of 200°F. This will usually result in uniform tire loading and good tire life.

Follow the same procedure (Items #1 through #7) for matching tires on a Tridem Unit. Arrange the tires in order of size. The two largest and two smallest go on one axle, the next two largest and smallest on the second axle, and the remaining four on the third axle.

UNLESS OTHERWISE SPECIFIED THE FASTENER TORQUE VALUES LISTED ON THIS CHART ARE FOR BOTH ORIGINAL AND CURRENT MODELS. (CURRENT MODEL IS ILLUSTRATED) *



*** GRADE IDENTIFICATION FOR CAPSCREWS (HEAD MARKINGS)**

GRADE 5	⅄
GRADE 7	⋇
GRADE 8	*

FOR ALL FASTENERS

- ALL TORQUES GIVEN APPLY TO PARTS LIGHTLY COATED WITH RUST PREVENTATIVE TYPE OIL.
- FOR DRY PARTS — INCREASE TORQUES 10%
- FOR PARTS HEAVILY COATED WITH OIL DECREASE TORQUES 10%

TA222370

Figure 11-203. Fastener Torque Chart

1 SHIFT SHAFT ADJUSTING SCREW LOCK NUT
1/2"-20 40-55 LB. FT.

2 SHIFT HOUSING TO CARRIER CAPSCREW
*GRADE 5 SCREW
3/8"-16 25-35 LB. FT.
*GRADE 8 SCREW (current)
3/8"-16 35-50 LB. FT.

3 AIR CHAMBER TO SHIFT HOUSING STUD NUT
GRADE 5 NUT
3/8"-24 30-40 LB. FT.
GRADE 8 NUT (current)
3/8"-24 35-50 LB. FT.

4 SHIFT FORK NUT AND BOLT
WITH COTTER PIN
Tighten nut to seat sperical washer against shoulder-
Back off if necessary to line up with cotter pin hole.
WITH LOCK NUT (current)
3/8"-24 20-30 LB. FT.

5 THRUST SCREW LOCK NUT
7/8"-14 150-190 LB. FT.

6 OIL VALVE RETAINER NUT
(current models-optional)
1"-14 40-65 LB. FT.

7 GEAR TO CASE BOLT AND NUT
(current models-optional or service repl.)
SOCKET (ALLEN) HEAD BOLT AND LOCK NUT
5/8"-18 160-230 LB. FT.
(original models)
WITH PLAIN NUT
5/8"-11 180-230 LB. FT.
WITH LOCK NUT
5/8"-11 150-190 LB. FT.

8 OUTPUT BEARING CAGE CAPSCREW
*GRADE 5 SCREW
3/8"-16 25-35 LB. FT.
3/8"-24 30-40 LB. FT.
7/16"-14 40-55 LB. FT
*GRADE 8 SCREW
3/8"-18 35-50 LB. FT.
3/8"-24 40-55 LB. FT.
7/16"-14 60-75 LB. FT.

9 OUTPUT (THROUGH) SHAFT YOKE OR FLANGE NUT
WITH COTTER PIN
1 1/2"-18 300-400 LB. FT.
WITH LOCK NUT (current)
1 1/2"-18 450-600 LB. FT.

10 DIFF. BEARING CAP TO CARRIER CAPSCREW
7/8"-9 470-550 LB. FT.
1"-14 470-550 LB. FT.
Note: Original models employed drilled capscrew heads and lock wire (not shown).

11 AXLE SHAFT TO HUB STUDS AND NUTS
(hub not shown)
STUD NUTS PLAIN
7/18"-20 60-75 LB. FT.
1/2"-20 85-115 LB. FT.
9/16"-18 130-165 LB. FT.
5/8"-18 180-230 LB. FT.
STUD NUTS – LOCK (current)
7/16"-20 50-65 LB. FT.
1/2"-20 75-100 LB. FT.
9/16"-18 110-145 LB. FT.
5/8"-18 150-190 LB. FT.
STUDS – ALL
Thread coarse end of stud into hub and tighten to last scratch (thread).

12 MAIN DIFF. CASE CAPSCREW LONG AND SHORT
9/16"-12 130-165 LB. FT.
5/8"-11 180-230 LB. FT
Note: Original models employed drilled capscrew heads and lock wire (not shown).

13 COTTER PIN ADJUSTING RING LOCK
(current models)
Some original models employed a plate type lock with capscrews (not shown).
LOCK PLATE TO BRG. CAP CAPSCREWS
WITH LOCKWIRE
5/16"-18 15-20 LB. FT.
WITHOUT LOCKWIRE
5/16"-18 20-30 LB. FT.

14 RING GEAR TO CASE HALF
RIVET (standard current production fastener)

15 OIL FILL HOLE PLUG
Thread into carrier and allow one thread standout
3/4"-14 35 LB. FT. minimum

16 ADAPTER AND FILTER SCREEN ASS'Y. ELBOW TO CARRIER
(current models-optional)
1"-11 1/2 NPTF 80 LB. FT. minimum

17 CARRIER TO HOUSING CAPSCREWS OR STUDS AND NUTS
CAPSCREWS
7/16"-14 50-75 LB. FT.
1/2"-13 75-115 LB. FT.
9/16"-12 110-165 LB. FT.
5/8"-11 150-230 LB. FT.
3/4"-10 270-400 LB. FT.

STUD – PLAIN NUTS		STUD – LOCKNUTS	
7/16"-20	50-75 LB. FT	7/16"-20	40-65 LB. FT.
1/2"-20	75-115 LB. FT.	1/2"-20	65-100 LB. FT.
9/16"-18	110-165 LB. FT.	9/16"-18	100-145 LB. FT.
5/8"-18	150-230 LB. FT.	5/8"-18	150-190 LB. FT.
3/4"-16	270-400 LB. FT.	3/4"-16	230-350 LB. FT.

STUDS – ALL
Thread coarse end of stud into axle housing and tighten to last scratch (thread).

18 INTER-AXLE DIFF. CASE RIVET
(current production fastener)
Do not use rivets to reassemble-
Use nut and bolt service repl.

19 INTER-AXLE DIFF. CASE BOLT, LOCK NUT AND WASHER
(current models-service repl.)
7/16"-14 50-65 LB. FT.
CAPSCREW ONLY
(original models)
7/16"-14 60-75 LB. FT.
1/2"-20 100-130 LB. FT.

20 PINION SHAFT NUT
WITH COTTER PIN
1 3/4"-12 800-1100 LB. FT.
WITH LOCK NUT (current)
1 3/4"-12 900-1200 LB. FT.

21 PINION COVER TO CARRIER CAPSCREW
(standard cover)
*GRADE 5 SCREW
3/8"-16 25-35 LB. FT.
*GRADE 8 SCREW (current)
3/8"-16 35-50 LB. FT.

22 ELBOWS-OIL VALVE AND FILTER SCREEN
(current models-optional)
3/4"-16 20-30 LB. FT.

23 OIL LINE ADAPTER
(current models-optional)
3/4"-16 20-30 LB. FT.

24 PUMP ELBOW
(current models-optional)
3/8"-18 NPTF 20 LB. FT. minimum

25 ADAPTER-ELBOW TO PUMP
(current models-optional)
1"-11 1/2 NPTF 80 LB. FT. minimum

26 PINION COVER TO CARRIER CAPSCREW
(current models, pump mount-optional)
3/8"-16 35-50 LB. FT.

27 OIL PUMP TO PINION COVER CAPSCREW
(current models-optional)
5/16"-18 20-30 LB. FT.

28 ADAPTER-ELBOW TO PUMP
(current models-optional)
1"-11 1/2 NPTF 80 LB. FT minimum

29 PUMP ELBOW
(current models-optional)
3/8"-18 NPTF 20 LB. FT. minimum

30 OIL LINE ADAPTER
(current models-optional)
3/4"-16 20-30 LB. FT.

31 INPUT SHAFT YOKE OR FLANGE NUT
WITH COTTER PIN
1 3/4"-12 300-400 LB. FT.
WITH LOCK NUT (current)
1 3/4"-12 450-600 LB. FT.

32 INPUT BEARING CAGE CAPSCREW
7/16"-14 60-75 LB. FT.

Call Out Reference For Figure 11-203

TABULATION OF ADJUSTMENTS PAGE

Adjustment	Page
Nominal Pinion Mounting Distance - 8.750”	118-27 & 11B-29
Pinion Depth - Shim as required between pinion inner bearing cup and carrier	11B-29 & 11B-30
Main Differential Nest Rolling Resistance - Nest to rotate with 50 lb. ft. maximum or less applied to one side gear	118-35 & 11B-36
Main Differential Bearing Preload - Tighten bearing adjusting rings one or two notches each from .000 end play or spread carrier legs .006” to .010” or 15 to 35 lb. ins. rolling resistance.	11B-39
Drive (Ring) Gear Runout- .008” maximum..	11B-39 & 11B-40
Hypoid Gear Backlash - .005” to .015”	11B-39 & 11B-40
Pinion Bearing Preload - Use gear spacer as required, New Bearings - 5 to 25 lb. ins. Reused Bearings - 5 to 15 lb. ins.	11B-42 & 11B-43
Input Shaft and Bearing Adjustment - Current Design, Tapered Bearings, shim between cage and carrier - .001” to .007” end play Original Design, Ball Bearing, shim between cover and cage - .003” to .006” tight.	11B-55, 11B-56 & 11B-57
Thrust Screw or Adjusting Screw and Block - .010” to .020” clearance - Turn in screw against back of ring gear - back out screw 1/4 turn and lock into position	118-59
Output (Through) Shaft and Bearing Adjustment - Current Design, Tapered Bearings only, Use bearing retainer snapring/spacer as required - 10 lb. ins. preload to .0030” end play	11B-62 & 11B-63
Shift Unit Shaft and Fork Adjustment - Hold clutch (shift) collar in locked position - Turn in adjusting screw finger tight against shaft - Continue turning in adjusting screw 3/4 to 11/4 revolution more and lock into position	11B-65 & 11B-66

By Order of the Secretary of the Army

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General, United States Army
Chief of Staff

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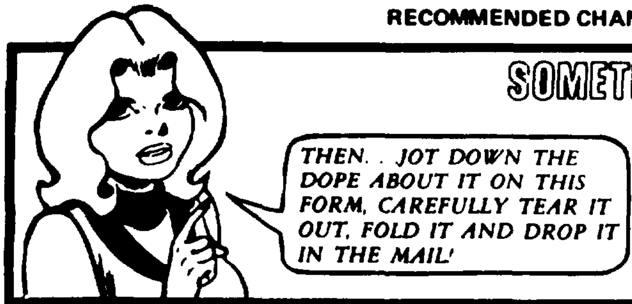

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105	3-12			This paragraph says to refer to chapter 6 for repair of auxiliary engine, but procedures are not in chapter 6. Please add procedures or give correct reference.

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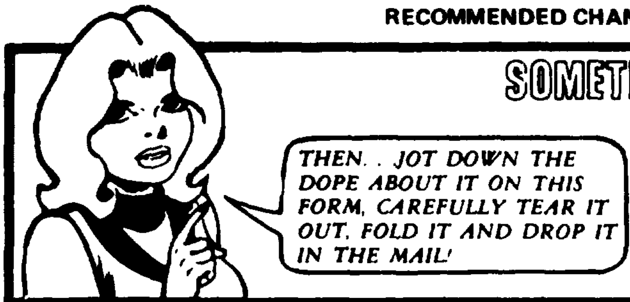

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'EIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

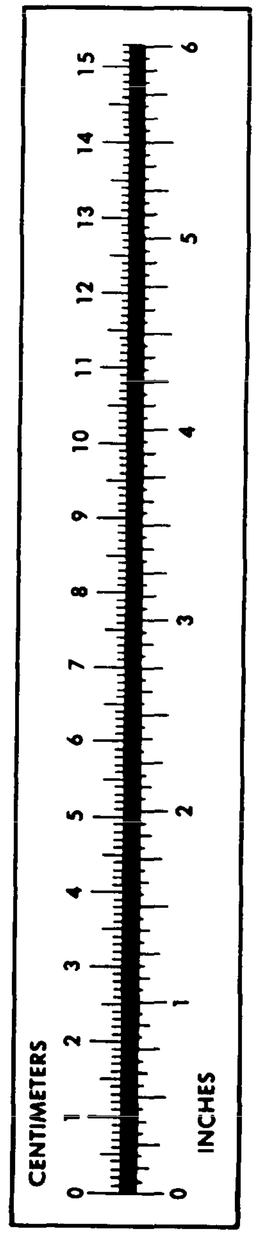
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
'ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
'lometers per Liter	Miles per Gallon	2.354
ometers per Hour	Miles per Hour	0.621



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