TWIN DISC
INCORPORATED

Service Manual

Marine Transmission

Model:
MG-520-1
MG-520-1HP

Document Number: 1015941

NOTICE

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SM-199 SERVICE MANUAL

MODEL MG-520
MARINE TRANSMISSION

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Revision D, April 2006. Added Warranty Statement and added MG520-1HP information. Reference ECN 14075

NOTE: "Flagging" indicates area revised.

TWIN DISC, INCORPORATED
EXCLUSIVE LIMITED WARRANTY
COMMERCIAL MARINE TRANSMISSION

A. Twin Disc, Incorporated warrants all assembled products and parts, (except component products or parts on which written warranties issued by the respective manufacturers thereof are furnished to the original customer, as to which Twin Disc, Incorporated makes no warranty and assumes no liability) against defective materials or workmanship *for a period of twenty-four (24) months from the date of shipment by Twin Disc, Incorporated to original customer, but not to exceed twelve (12) months of service, whichever occurs first.* **This is the only warranty made by Twin Disc, Incorporated and is in lieu of any and all other warranties, express or implied, including the warranties of merchantability or fitness for a particular purpose and no other warranties are implied or intended to be given by Twin Disc, Incorporated.** The original customer does not rely upon any tests or inspections by Twin Disc, Incorporated or on Twin Disc, Incorporated's application engineering.

B. **The exclusive remedy provided by Twin Disc, Incorporated whether arising out of warranty within the applicable warranty period as specified, or otherwise (including tort liability), shall at the sole option of Twin Disc, Incorporated be either the repair or replacement of any Twin Disc, Incorporated part or product found by Twin Disc, Incorporated to be defective and the labor to perform that work and to remove and reinstall (or equivalent credit). In this context, labor is defined as the flat rate labor hours established by Twin Disc, Incorporated in the published Twin Disc Flat Rate Schedule, required to remove, disassemble, inspect, repair, reassemble, reinstall and test the Twin Disc, Incorporated product only. Authorized reasonable travel and living expenses will be considered for payment. Under no circumstances, including a failure of the exclusive remedy, shall Twin Disc, Incorporated be liable for economic loss, consequential, incidental or punitive damages**.

The above warranty and remedy are subject to the following terms and conditions:

1. Complete parts or products upon request must be returned transportation prepaid and also the claims submitted to Twin Disc, Incorporated within sixty (60) days after completion of the in warranty repair.
2. The warranty is void if, in the opinion of Twin Disc, Incorporated, the failure of the part or product resulted from abuse, neglect, improper maintenance or accident.
3. The warranty is void if any modifications are made to any product or part without the prior written consent of Twin Disc, Incorporated.
4. The warranty is void unless the product or part is properly transported, stored and cared for from the date of shipment to the date placed in service.
5. The warranty is void unless the product or part is properly installed and maintained within the rated capacity of the product or part with installations properly engineered and in accordance with the practices, methods and instructions approved or provided by Twin Disc, Incorporated.
6. The warranty is void unless all required replacement parts or products are of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Replacement parts or products not of Twin Disc origin are not warranted by Twin Disc, Incorporated.

C. As consideration for this warranty, the original customer and subsequent purchaser agree to indemnify and hold Twin Disc, Incorporated harmless from and against all and any loss, liability, damages or expenses for injury to persons or property, including without limitation, the original customer's and subsequent purchaser's employees and property, due to their acts or omissions or the acts or omissions of their agents, and employees in the installation, transportation, maintenance, use and operation of said equipment.

D. Only a Twin Disc, Incorporated authorized factory representative shall have authority to assume any cost or expense in the service, repair or replacement of any part or product within the warranty period, except when such cost or expense is authorized in advance in writing by Twin Disc, Incorporated.

E. Twin Disc, Incorporated reserves the right to improve the product through changes in design or materials without being obligated to incorporate such changes in products of prior manufacture. The original customer and subsequent purchasers will not use any such changes as evidence of insufficiency or inadequacy of prior designs or materials.

F. If failure occurs within the warranty period, and constitutes a breach of warranty, repair or replacement parts will be furnished on a no charge basis and these parts will be covered by the remainder of the unexpired warranty which remains in effect on the complete unit.

TWIN DISC, INCORPORATED
FLAT RATE HOUR ALLOWANCE
COMMERCIAL MARINE TRANSMISSION

(Hourly Labor Rate Must be Acceptable to Twin Disc, Incorporated.)

COMMERCIAL MARINE TRANSMISSIONS ALL RATIOS:

MODEL SERIES	R&R	UNIT REBUILD	CLUTCH REPAIR (BOTH PACKS)
• MG502, MG5005, MG5010, MG5011, MG5012, MG5015, MG5020	10.0	8.0	-
• MG506, MG5061, MG5062,MG5065, MG5050,			
• MG5055	10.0	11.0	-
• MG507, MG5081, MG5085, MG5090 MG5075, MG5091	10.0	12.0	-
• MG5112, MG5113, MG5085, MG5090, MG509, MG 5111, MG5114, MGX5114	10.0	17.0	-
• MG514C, MG514M, MG5141, MG514CHP MGX5135, MGX5145, MGX5147	10.0	25.0	6.0
• MG516, MG5161, MG5170	10.0	28.0	8.0
• MG518-1	10.0	32.0	10.0
• MG520-1, MG 5202, MG5203, MG5204, MG5205, MG6449, MG6557	10.0	32.0	10.0
• MG530, MG530M, MG5301,MG6650, MG6690, MG6848, MG6598, MG6600, MG6619, MG6620, MG6984, MG61242, MGX6650, MGX6690, MGX6848	12.0	32.0	16.0
• MG540, MG5506, MG5600	20.0	62.0	20.0
• MGN80, MGN232, MGN233, MGN272, MGN273, MGN332, MGN334, MGN335, MGN432, MGN433, MGN472, MGN493	10.0	32.0	10.0
• MGN650, MGN800, MGN1000, MGN1400, MGN1600	20.0	62.0	40.0
• PUMP (ALL MODELS)	1.0	-	
• VALVE (ALL MODELS)	1.0	.5	

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Section 1.
INTRODUCTION

GENERAL INFORMATION.

Scope.

This publication provides the information necessary for the operation and maintenance of the Twin Disc, Incorporated equipment specified on the cover of this manual. Specific engineering details and performance characteristics can be obtained from the Service Engineering Department of Twin Disc, Incorporated, Racine, Wisconsin, U.S.A.

Operation and maintenance personnel responsible for this equipment should have this manual at their disposal and be familiar with its contents. Applying the information in the manual will result in consistent performance from the unit and help reduce downtime.

Special Tools.

B Engineering drawings are included for the fabrication of special tools that should be used during disassembly and assembly of a unit. Repair of this equipment should not be attempted without special tools. Twin Disc does not manufacture these tools for general use.

REPLACEMENT PARTS.

Parts Lists.

Illustrations with complete parts listings are provided in appropriate sections of the manual to facilitate ordering spare or replacement parts.

WARNING

All replacement parts or products (including hoses and fittings) must be of Twin Disc origin or equal, and otherwise identical with components of the original equipment. Use of any other parts or products will void the warranty and may result in malfunction or accident, causing injury to personnel and/or serious damage to the equipment.

Ordering Parts.

Renewal Parts and Service Parts Kits, may be obtained from any authorized Twin Disc distributor or service dealer. They are listed under POWER TRANSMISSION EQUIPMENT in the Yellow Pages of most metropolitan telephone directories.

NOTE

Do NOT use planographs included in this manual for ordering parts. Parts must be ordered from the bill of material. Bill of material numbers are stamped on the unit's nameplate.

If the bill of material sheet from which part numbers are obtained is unavailable, proceed as follows:

1. Provide the figure number of the illustration containing the part, the item number of the part, the description of the part, and the quantity required.

2. Do not use the word "complete", but state exactly each item wanted.

3. Do not designate the quantity by "sets", but specify the part required.

4. Specify the model, bill of material, and serial number of the unit involved. These numbers are stamped on the unit's nameplate.

Parts Shipment.

Furnish the complete shipping destination and postal address. All parts shipments made from the factory will be F.O.B. factory location, U.S.A. State specifically whether the parts are to be shipped by freight, express, etc. If shipping instructions are not specified on the order, the equipment will be shipped the best way, considering time and expense. Twin Disc, Incorporated will not be responsible for any charges incurred by this procedure.

Twin Disc, Incorporated, having stipulated the bill of material number of the unit's nameplate, absolves itself of any responsibility resulting from any external, internal, or installation changes made in the field without the express written approval of Twin Disc. All returned parts, new or old, emanating from any of the above stated changes will not be accepted for credit. Furthermore, any equipment which has been subjected to such changes will not be covered by a Twin Disc Warranty.

PREVENTIVE MAINTENANCE — TROUBLE SHOOTING.

Frequent reference to the information provided in this manual regarding daily operation and limitations of this equipment will assist in obtaining trouble free operation. Schedules are provided for the recommended maintenance of the equipment, and if observed, minimum repairs, aside from normal wear, will result.

In the event a malfunction does occur, a trouble shooting table is provided to help identify the problem area, and list information that will help determine the extent of the repairs necessary to get a unit back into operation.

LIFTING BOLT HOLES.

Most Twin Disc products have provisions for attaching lifting bolts. The holes provided are always of adequate size and number to safely lift the Twin Disc product.

CAUTION

These lifting points must not be used to lift the complete power unit. Lifting excessive loads at these points could cause failure at the lift point (or points) and result in damage or personal injury.

CAUTION

Select lifting eyebolts to obtain maximum thread engagement with bolt shoulder tight against housing. Bolts should be near but should not contact bottom of bolt hole.

SAFETY.

General.

Safe operating practices should be employed by all personnel servicing this unit. Twin Disc, Incorporated will not be responsible for personal injury resulting from careless use of hand tools, lifting equipment, power tools, or unaccepted maintenance /working practices.

Important Safety Notice.

Because of the possible danger to person(s) or property from accidents which may result from the use of manufactured products, it is important that correct procedures be followed. Products must be used in accordance with the engineering information specified. Proper installation, maintenance, and operation procedures must be observed. Inspection should be made as necessary to assure safe operations under prevailing conditions. Proper guards and other suitable safety devices or procedures that may be desirable or specified in safety codes should be provided. These devices are neither provided by Twin Disc, Incorporated nor are they the responsibility of Twin Disc, Incorporated.

SOURCE OF SERVICE INFORMATION.

Each series of maintenance manuals issued by Twin Disc, Incorporated is current at the time of printing. When required, changes are made to reflect advancing technology and improvements in state of the art.

Individual product service bulletins are issued to provide the field with immediate notice of new service information. These service bulletins are distributed to all the Twin Disc distributorships throughout the United States and in many foreign countries.

For the latest service information on Twin Disc products, contact any Twin Disc Distributor, or write to the Service Engineering Department, Twin Disc, Incorporated, Racine, Wisconsin, U.S.A.

WARRANTY.

Equipment for which this manual was written has a limited warranty. For details of the warranty, contact any Twin Disc Distributor, service dealer, or the Warranty Administration Department, Twin Disc, Incorporated, Racine, Wisconsin, U.S.A.

Section 2
DESCRIPTION AND SPECIFICATIONS

DESCRIPTION.

1. Model MG-520 marine transmissions are reverse and reduction units, available in four ratios in the deep case: 4.49:1, 5.00:1, 6.11:1 and 7.00:1. Four ratios are also available in the shallow case: 2.02:1, 2.97:1, 3.44:1, and 4.03:1.

NOTE

Deep case units are illustrated and discussed throughout this manual. However, the shallow and deep case units are very similar. See specifications for the differences.

2. When shipped from the factory, each unit is designated for use with a particular engine rotation. Figure 2-1 indicates the engine rotation for which a particular unit is designated. Within their rated capacities, these units may be operated continuously in either forward or reverse. The unit can be adapted to either left or right-hand engine rotation. To adapt to opposite engine rotation, a different oil pump and strainer housing are required. Also, the air baffle plate is relocated and the rotation indicator plate changed. For detailed instructions for adapting the unit to an engine with opposite rotation, contact the nearest Twin Disc distributor or the Marine Application Engineering Department, Twin Disc, Incorporated, Racine, Wisconsin U.S.A.

3. This transmission is operated completely hydraulically. See figure 2-2. Both the forward and reverse clutches are operated by main pressure oil supply. The bearings, clutches, and gears are lubricated and cooled with low pressure oil.

DIRECTION OF DRIVE

The forward (input) clutch shaft and driving transfer gear (see Figure 2-3) always rotate in engine direction. The reverse clutch shaft and driven transfer gear always rotate in anti-engine direction because the driven transfer gear is meshed with the driving transfer gear on the forward clutch shaft. When the forward clutch is engaged, the forward input pinion rotates in engine direction. The output gear, which is secured to the output shaft, is meshed with the forward input pinion and the output gear and shaft are driven in anti-engine direction. When the reverse clutch is engaged, the reverse input pinion rotates anti-engine direction. The output gear is meshed with the reverse input pinion and, therefore, the output gear and shaft are driven engine direction.

CONSTRUCTION FEATURES. See Figure 2-4 and 2-5.

Housings.

The MG-520 housings consist of a two-piece case and an SAE No. 0 or No. 1 front housing. The manifold on the rear completes the housing. The two halves of the case and the manifold are sealed with anaerobic plastic gasket compound.

In-Boat Maintenance.

Some repairs such as changing clutch plates, oil seals and seal rings can be made without removing the transmission from the boat. See Section 6 for more details.

Taper Roller Bearings.

The forward, reverse and output shafts have taper roller bearings which require shimming to adjust endplay of the respective shafts.

Oil Pump Drive.

The oil pump is spline-connected and driven by the reverse clutch shaft.

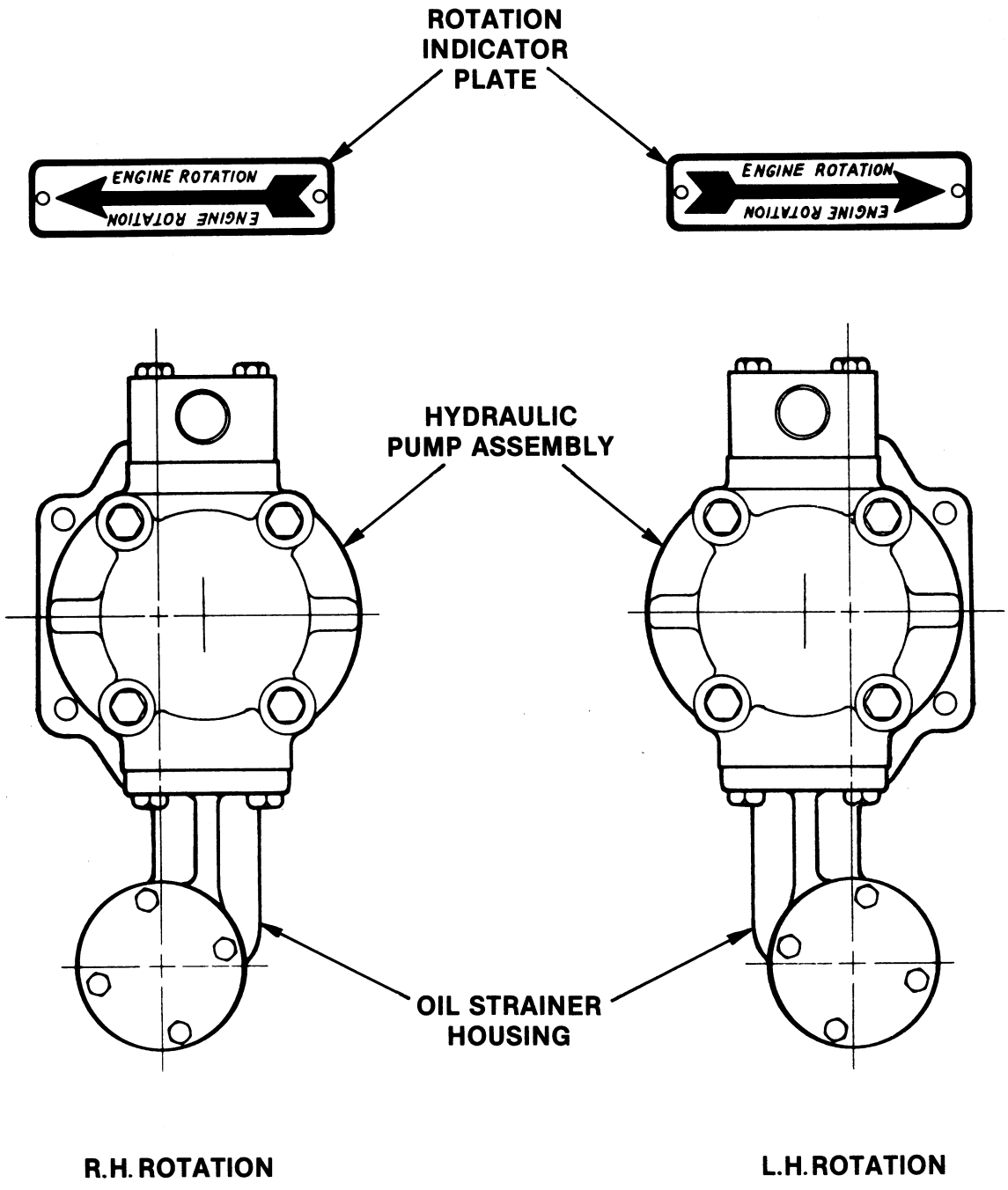


Figure 2-1. Relationship of Rotation Indicator and Pump Suction Strainer for Right and Left-Hand Engine Rotation. Facing Rear View.

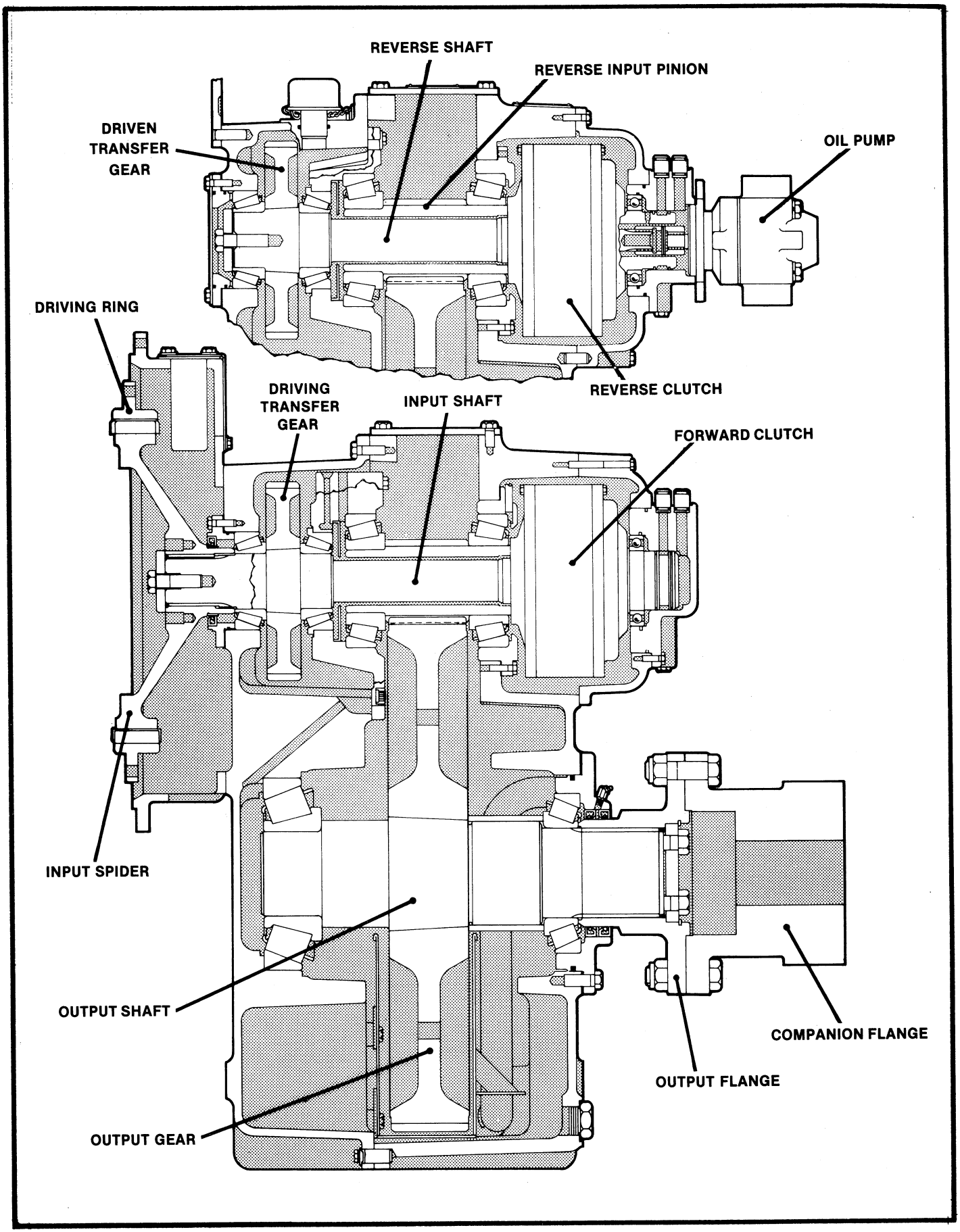


Figure 2-3. MG-520 Marine Transmission — Cross Section.

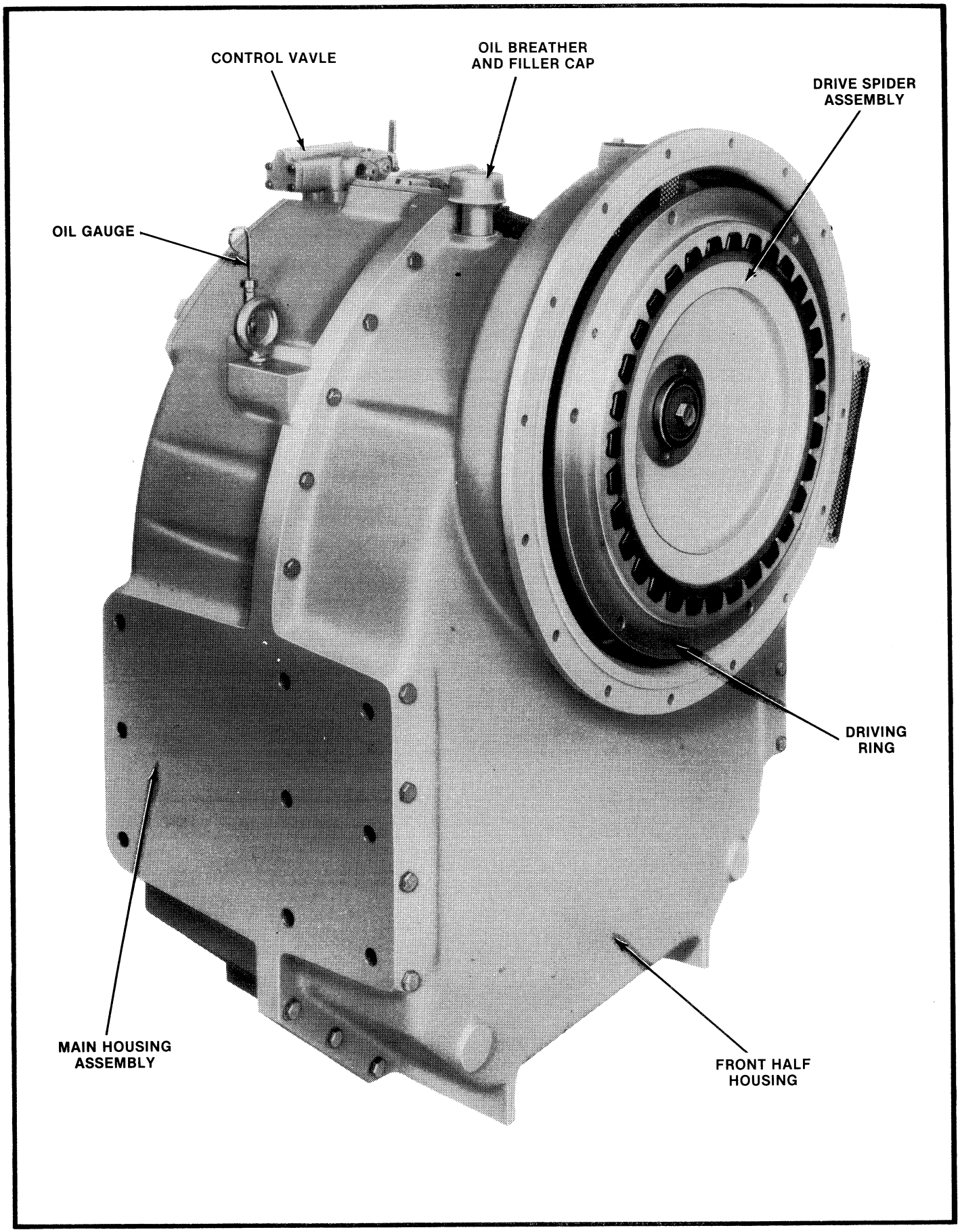


Figure 2-4. MG-520 Marine Transmission — Front View.

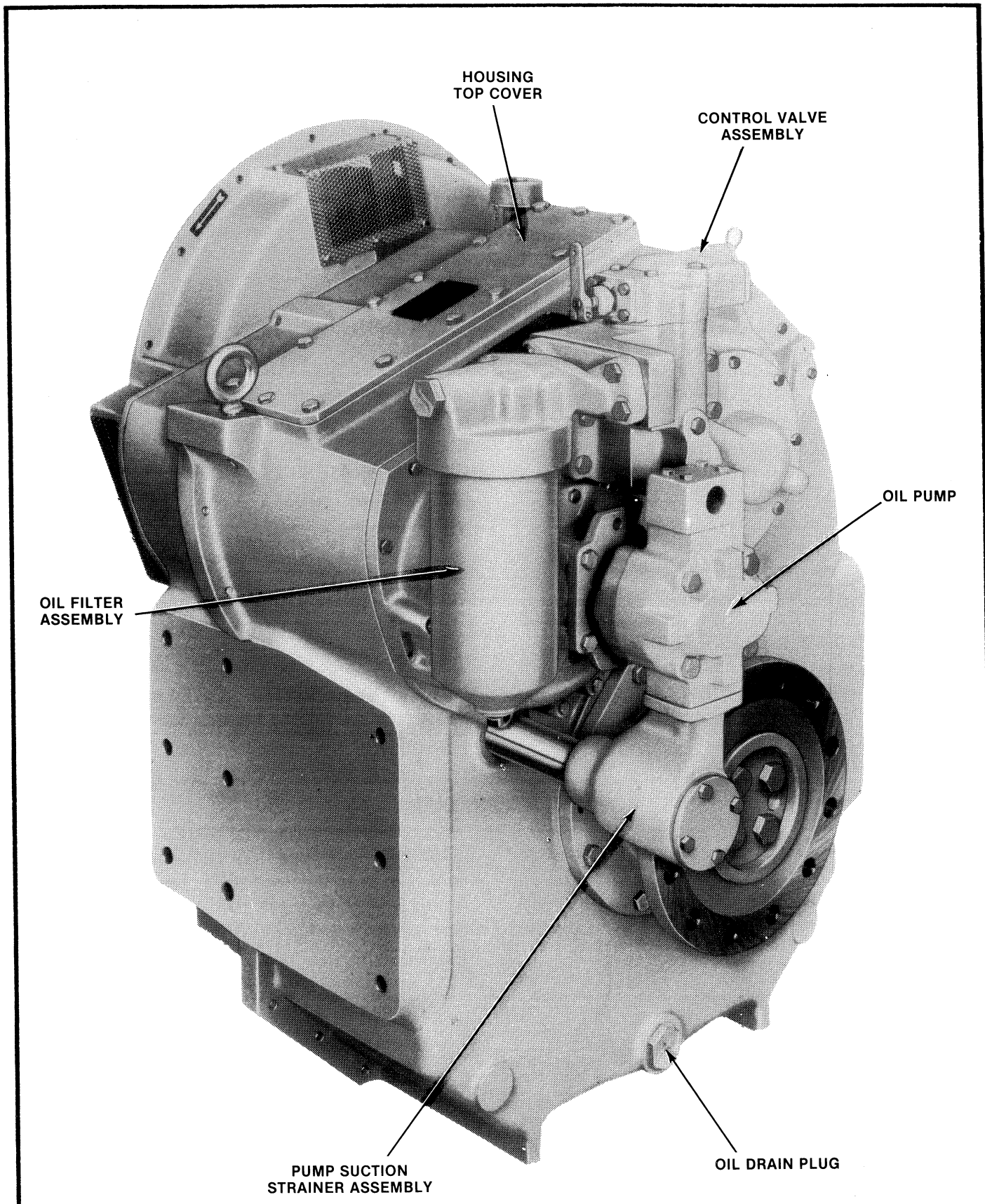


Figure 2-5. MG-520 Marine Transmission — Rear View.

Lubrication Features.

A lube tube extending fore and aft, near the top of the housing, serves as an oil distribution medium. From this tube, oil is directed by ports in the housing to the front roller bearings on the forward and reverse clutch shafts. Oil is also directed from the lube tube and sprayed into smaller tubes to the rear roller bearings on the forward and reverse clutch shafts, and the roller bearings on the forward and reverse pinions. The input pinions are lubed through a small hole in the lube tube.

Suction Strainer.

The unit has a suction strainer mounted to the bottom of the oil pump. The strainer is between the sump and oil pump in the hydraulic circuit.

Filter Assembly.

An external filter assembly is bolted to the valve and filter carrier assembly. The filter element provided has a 25 Micron nominal rating.

Special Construction Features.

The driving and driven transfer gears and the output gear are mounted on keyless tapers.

SPECIFICATIONS.

The following provides operating specifications for the MG-520. Frequent reference to this data and application of the information contained therein will result in better service from the transmission.

Oil Capacity.

19.0 U.S. Gallons, plus hoses and heat exchanger, (Deep case).

10.7 U.S. Gallons, plus hoses and heat exchanger, (Shallow case).

Oil Pump Capacity

30.5 gpm at 2,000 rpm.

Minimum Oil Pressure When cruising.

MG-520-1	**142 psi**
MG-520-1HP	**250 psi**

Maximum Input Speed.

2400 rpm.

Dry Weight.

3401 lb.

TYPE OIL RECOMMENDED.

Use only SAE-API service class CD engine oil which is certified by the company to pass TO-2 or C-3 Test specifications.

Also approved is SAE —API service class CC engine oil, MIL-L-2104B.

NOTE

Multi Viscosity Oils (i.e. 10W-20 etc.) should not be used in Twin Disc Marine Transmissions.

OIL CHANGE INTERVAL.

Check oil level every 10 hours and change oil every six months or 1000 hours, whichever comes first. Drain the oil by removing the oil drain plug (see figure 2-5) on the rear of the transmission.

FILTER CHANGE INTERVAL.

1. With a new transmission, change the filter element within 50 hours service. Change the element after each 1000 hours of service thereafter, or more often if conditions warrant.

2. For a rebuilt transmission, change the oil and filter element after 8 hours operation. Change the element after 1000 hours service, or more often if conditions warrant.

Oil Pressure

The following tables give oil pressure at different speeds and ranges. See Figures 2-6 and 2-7 for location of oil pressure check points.

MG-520-1

INPUT RPM & SHIFT POSITION	X PSI VALVE INLET		Z_F PSI PRIMARY COLLECTOR	Z_R PSI SECONDARY COLLECTOR	G PSI LUBE	
	Min.	Max.	Min.	Min.	Min.	Max.
	a	b	c	c	d	e
1800 RPM						
Primary	142	162	140	0	22	33
Neutral	50	100	0	0	33	50
Secondary	142	162	0	140	22	33
600 RPM						
Primary	122	150	120	0	3	8
Neutral	25	65	0	0	4	10
Secondary	122	150	0	120	3	8

MG-520-1HP

INPUT RPM & SHIFT POSITION	X PSI VALVE INLET		Z_F PSI PRIMARY COLLECTOR	Z_R PSI SECONDARY COLLECTOR	G PSI LUBE	
	Min.	Max.	Min.	Min.	Min.	Max.
	a	b	c	c	d	e
1800 RPM						
Primary	250	270	246	0	22	33
Neutral	50	100	0	0	33	50
Secondary	250	270	0	246	22	33
600 RPM						
Primary	230	260	226	0	3	8
Neutral	37	45	0	0	4	10
Secondary	230	260	0	226	3	8

Oil viscosity

Sump Temperature, also Oil Temperature Into Heat Exchanger		Recommended Oil Viscosisty
During Start-up	Steady Operating Conditions	
	Below 150° F.	This operating conditin is not approved.
35° F. Minimum	150 - 185° F.	SAE viscosity number 40 oil
50° F. Minimum	175 - 200° F	SAE viscosity number 50 oil.
	Above 200° F.	This operating condition is not approved.

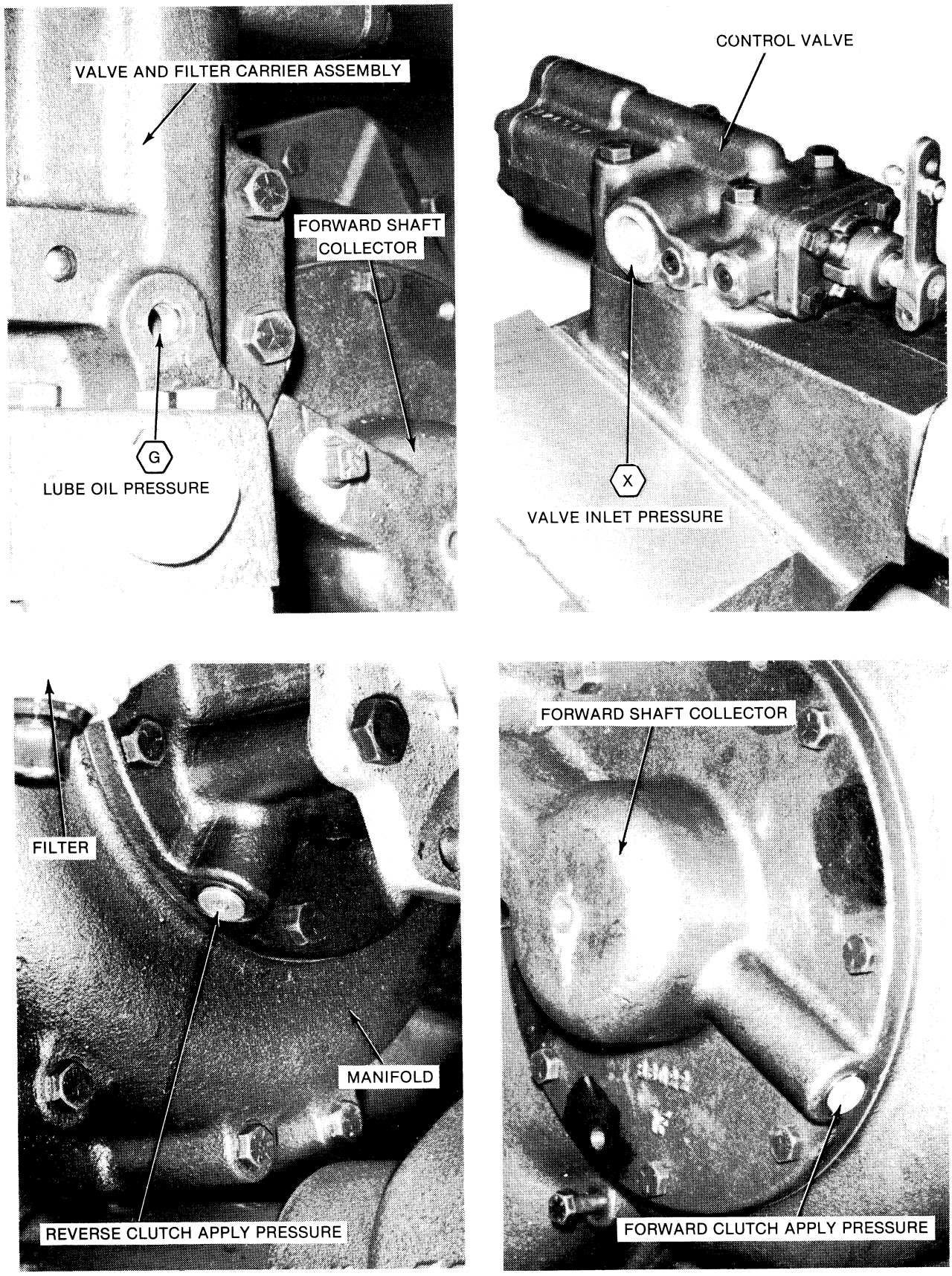


Figure 2-6. Oil Pressure Check Points.

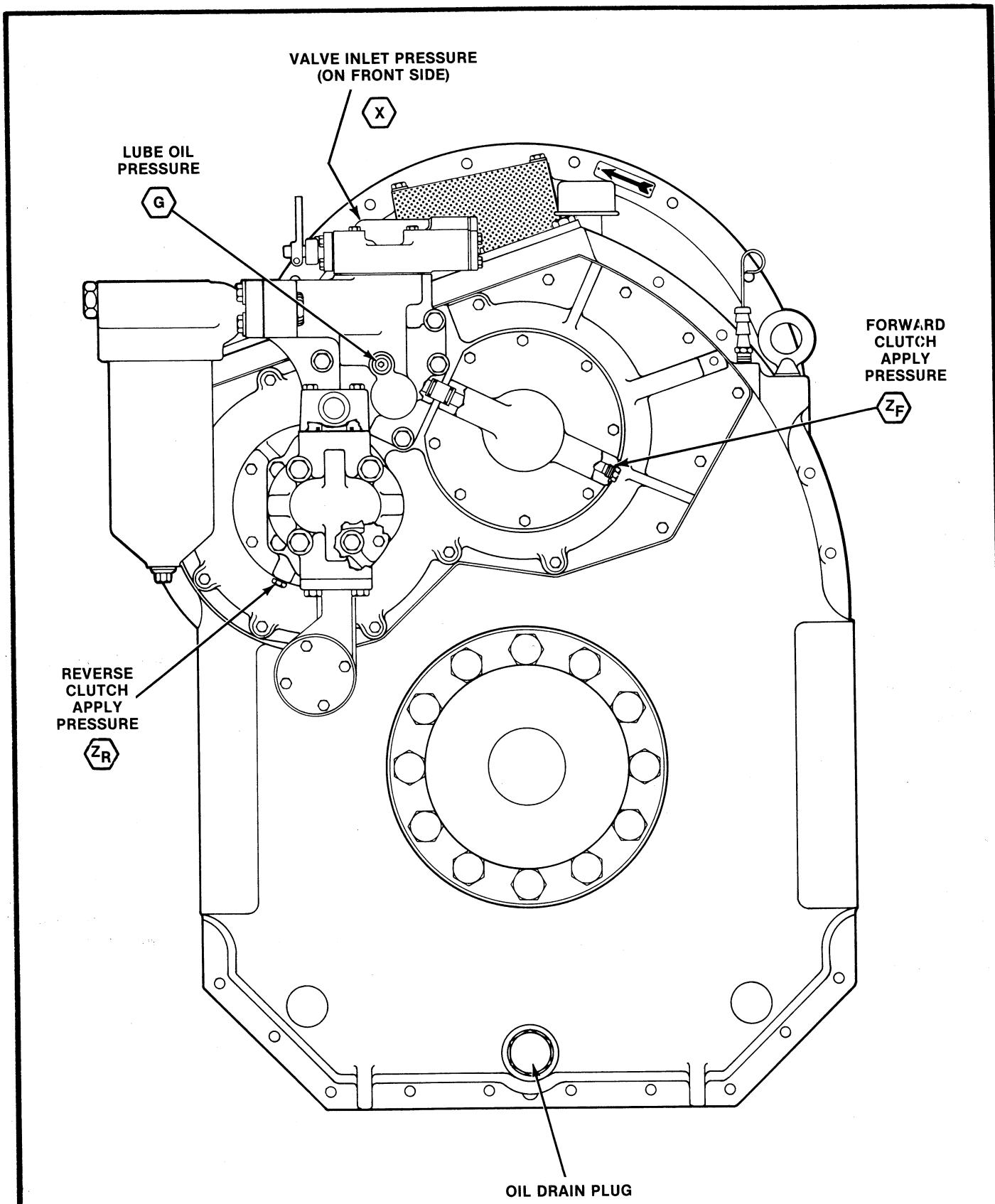


Figure 2-7. Location Of oil Pressure Check Points.

HEAT EXCHANGER (H.E.) REQUIREMENTS

PERMISSIBLE OIL TEMPERATURE INTO H.E.	*200° F. MAX. — 150° F. MIN.*
MIN. HEAT TRANSFER CAPACITY	*BTU PER MIN. PER ENGINE RTD. HP.:*
(MULTIPLY BY 1.25 FOR FRESH WATER) (MULTIPLY BY 2.00 FOR RAW WATER)	*CONTINUOUS DUTY: 1.484* *P.C. & INT. DUTY: 1.272*
APPROXIMATE OIL FLOW TO H.E.	*1.525 G.P.M. PER 100 ENGINE R.P.M.*
PEAK OIL PRESSURE AT H.E. (PROOF TEST H.E. AT 1.5 × P.S.I.)	*285 P.S.I.*
MAX. ALLOWABLE OIL PRESSURE DROP ACROSS H.E. WITH 300 SUS OIL AT RATED ENGINE RPM	*30 P.S.I.*
WATER FLOW TO H.E.	*USE 1.5 TO 3.0 TIMES OIL G.P.M.*
H.E. WATER PRESSURE RATING, MIN.	*= 1.5 × H.E. INLET WATER P.S.I.*

DATA H.E. PURCHASER MUST ALSO TELL VENDOR

STATE IF RAW (OPEN CHANNEL & SEA) OR FRESH (CLOSED ENGINE JACKET & KEEL COOLER) WATER WILL COOL HEAT EXCHANGER

STATE MAX. WATER TEMPERATURE INTO HEAT EXCHANGER

TYPICAL: RAW WATER - 85° F.
KEEL COOLER WATER - 140° F.
ENGINE JACKET WATER - 180° F.

STATE MIN., ALSO MAX. G.P.M. OF WATER FLOW TO HEAT EXCHANGER

H.E. INSTALLATION & SERVICE REQUIREMENTS

OIL LINES, TRANSMISSION TO HEAT EXCHANGER AND RETURN —

(1) MAX. VELOCITY IN FITTINGS, PIPE, HOSE AND TUBES — 25 FT./SEC.
(2) BURST PRESSURE MIN. = 10 × PEAK OIL PRESSURE AT H.E.
(3) HOSE — SAE J517 100R1 MEETING USCG 46CFR 56.60-25(C), 275° F. TEMP. RATING
(4) PROTECT LINES FROM MECHANICAL DAMAGE.
ZINC ANODES PROTECT H.E. RAW WATER PASSAGES FROM CORROSION. CHECK AND REPLACE THEM FREQUENTLY.

B

HOSE-AND-HEAT EXCHANGER KIT.

1. **Heat Exchanger.** The heat exchanger is designed to maintain the oil in the hydraulic system of the marine transmission at the proper temperature by passing coolant from the engine through the heat exchanger. Consequently, the heat exchanger should be installed in a location convenient to both engine coolant and marine transmission oil.

2. Heat exchangers furnished by Twin Disc, to be used for salt water applications, have zinc rods installed at the inlet and outlet heads. See Figure 2-8. These rods must be checked every 90 days. If over 50% of the rod is disintegrated, it should be replaced to provide effective protection.

3. Excessive corrosion of the zinc rod indicates electrolytic action. A careful inspection should be made to determine if this action is caused by a short circuit or external grounded electric current. These conditions must be eliminated to avoid the necessity of frequent replacement of the zinc rods. If these conditions do not exist, it is evident that the corrosion is due to local electrolysis. If rods are corroded with foreign material, they should be cleaned with a wire brush.

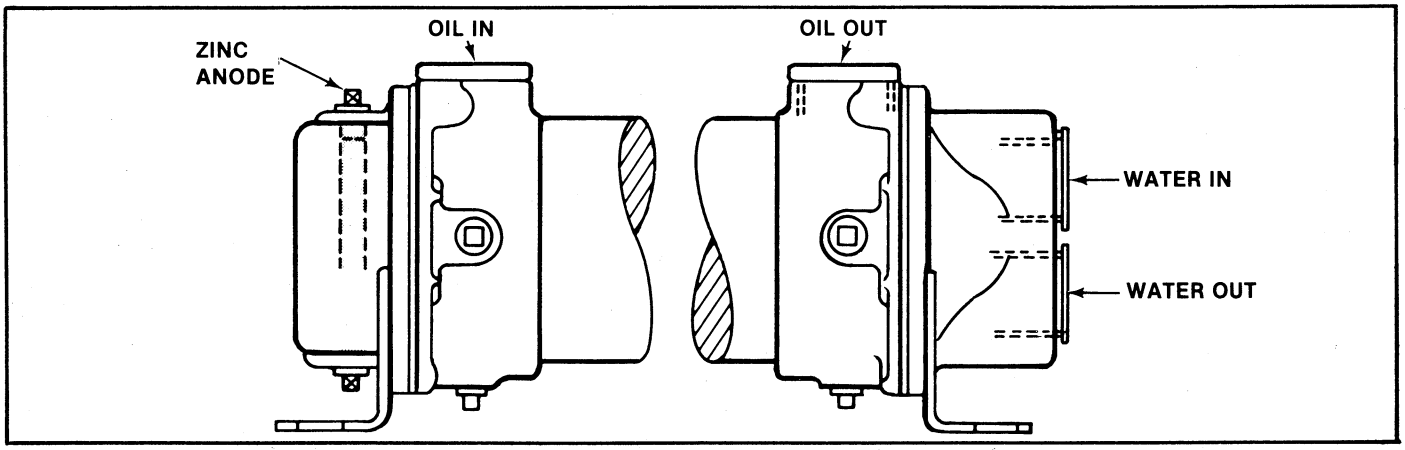


Figure 2-8. Typical Heat Exchanger Plumbing.

Section 3.
OPERATION

GENERAL.

Forward, neutral and reverse positions are obtained by means of the control valve. When these positions are selected, the control valve directs high pressure oil through internal passages to operate the clutches.

HYDRAULIC SYSTEM.

Oil is pumped through the system by the gear-type pump. The oil is taken from the sump through the filter by the pump, and discharged through the heat exchanger to the combination control and pressure regulating valve. The oil enters the pressure regulating area of the valve where main pressure is regulated by cascading excess oil into the lube circuit. Lube oil is distributed through fixed controlled orifices to lubricate bearings and cool the clutches.

In neutral, the inlet ports to the clutches are blocked, the clutches are disengaged, and the area behind the clutch pistons is open to sump. Oil is distributed through the lubrication system.

When the control valve is shifted to engage either clutch, the control valve directs main pressure to engage the selected clutch pack. Oil is also directed through a port in the control valve spool to a fixed orifice in the orifice plate causing a controlled flow of oil to unseat the rate-of-rise piston and move it to seat on a shoulder in the rate-of-rise piston bore compressing the pressure regulator springs. This progressively increases the clutch engaging pressure causing the clutches to engage at a controlled rate. Overage oil becomes lube oil.

The control valve allows only one clutch to be engaged at a time, and the oil from the disengaged clutch is dumped to sump. When a clutch is disengaged, any centrifugal pressure head existing behind the clutch apply piston is relieved to sump by the ball dump valve provided in the transfer gear. This allows the return springs to move the clutch piston to the disengaged position to prevent clutch drag.

CONTROL VALVE ASSEMBLY.

General.

The control valve assembly contains passages and ports for the transmission and direction of pressurized oil within the hydraulic system. The pressure rate control piston within the control valve assembly provides a rapid, yet smooth, pressure rise for the hydraulic system during clutch engagement.

NOTE

The configuration of the valve body in the following illustrations may not be identical to the one used on this transmission; however, it is close enough to illustrate the principle of operation. For explicit details, see the engineering drawings in Section 12.

Control Valve - Neutral. (Figures 3-1 and 3-2)

Oil enters the control valve body through passage A and fills chamber B. The oil causes the pressure regulating piston to partially compress the piston outer and inner springs against the pressure rate control piston. This pressurizes the oil in chamber B. This pressure varies with engine speed.

The movement of the pressure regulation piston against the springs exposes port C in the valve body. Port C directs overage oil to lubrication and clutch cooling system. Passage D (which is the engaging outlet to the forward clutch) and Passage E (which is the engaging outlet to the reverse clutch) are interconnected by slot F in the control valve stem when in the neutral position. The slot is aligned with a drilled hole and cored cavity in the front face of the valve body. The drilled hole and cored cavity are aligned with drilled holes that pass through the valve and filter carrier assembly and the main housing to sump. Therefore, passages D and E are at atmospheric pressure at this time. Also, passage J is at atmospheric pressure since port H interconnects with slot F. This area between the pistons and around the springs is vented to the sump through drilled holes in the front face of the valve body, the valve and filter carrier assembly, and the main housing. This area is at atmospheric pressure at all times permitting the return to sump of any leakage oil past the pistons.

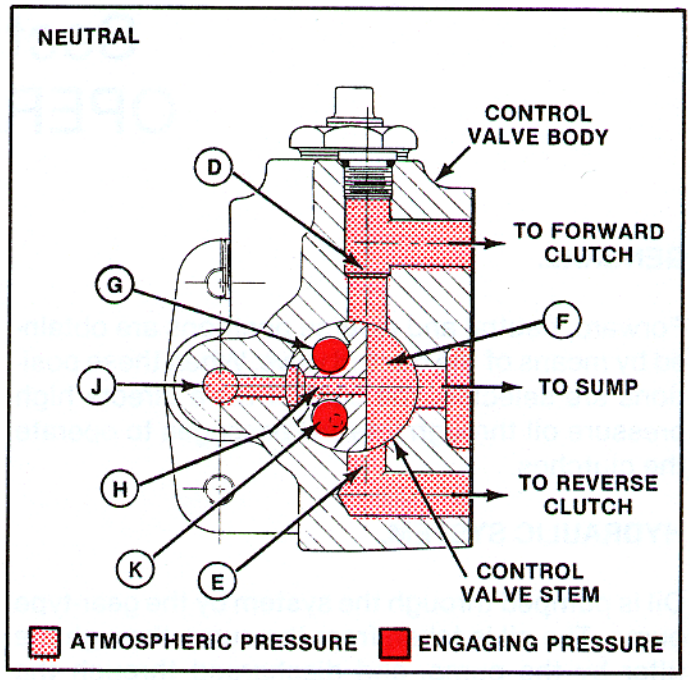


Figure 3-1. Control Valve—Neutral—Sectional View.

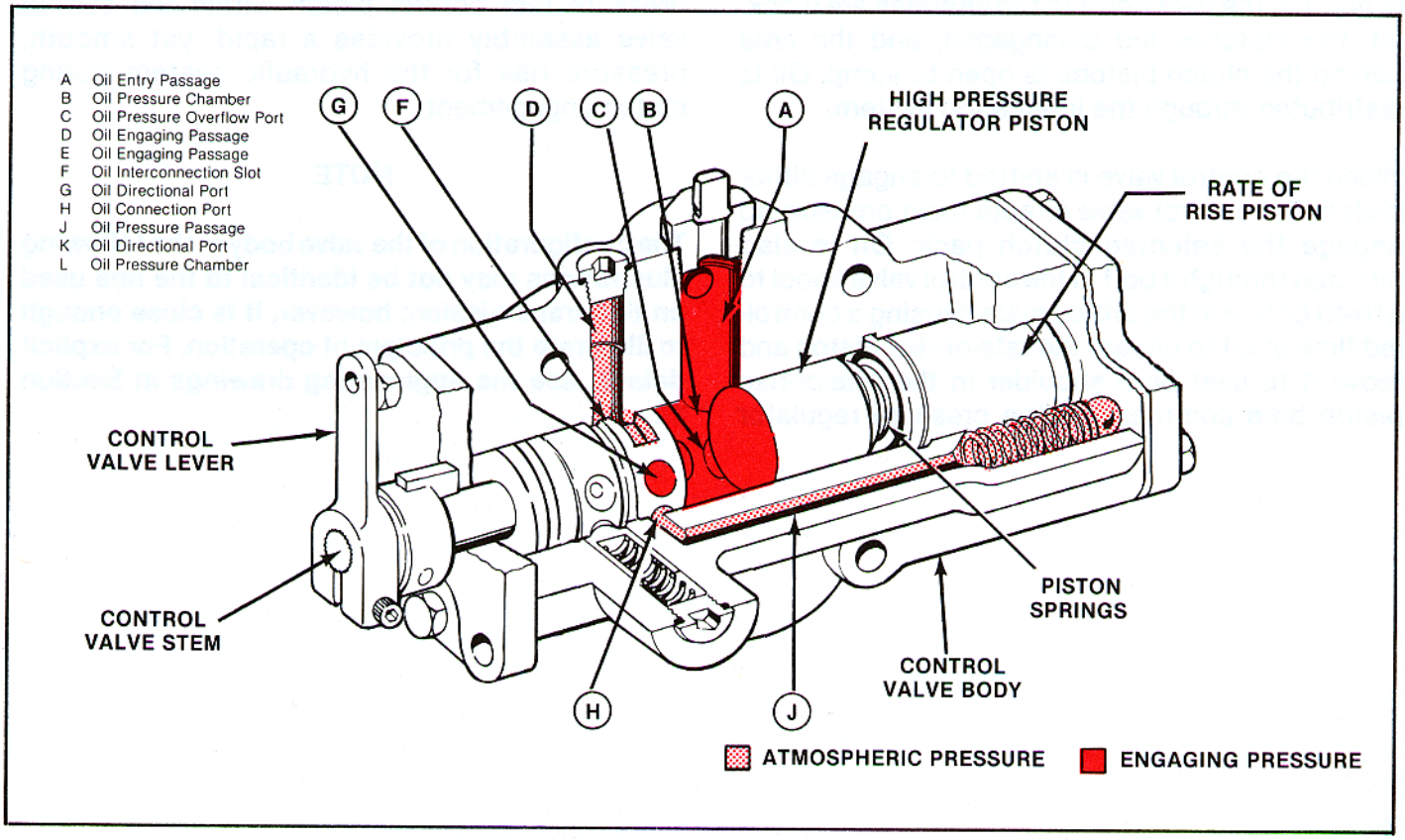


Figure 3-2. Control Valve—Neutral—Cutaway View.

Control Valve - Forward. (Figures 3-3 and 3-4)

When a shift to the forward position is desired, the control valve lever is moved away from the engine. The shift causes the control valve stem to rotate and assume the position indicated in Figures 3-3 and 3-4. The pressurized oil in chamber B is directed through ports G and K to passages D and J. Passage D is aligned with a drilled hole and a channel in the valve and filter carrier directing main pressure to the forward clutch. Pressurized oil from port K travels through passage J and enters chamber L through an orifice in the orifice plate. The orifice in this plate meters the oil for a steady, smooth pressure rise in chamber L. As chamber L fills with oil, the pressure rate control piston moves against the springs until the piston is stopped by a shoulder in the valve body. This causes the pressure in chamber B to rise to clutch engaging pressure. When in forward, passage E remains at atmospheric pressure since slot F remains open to sump.

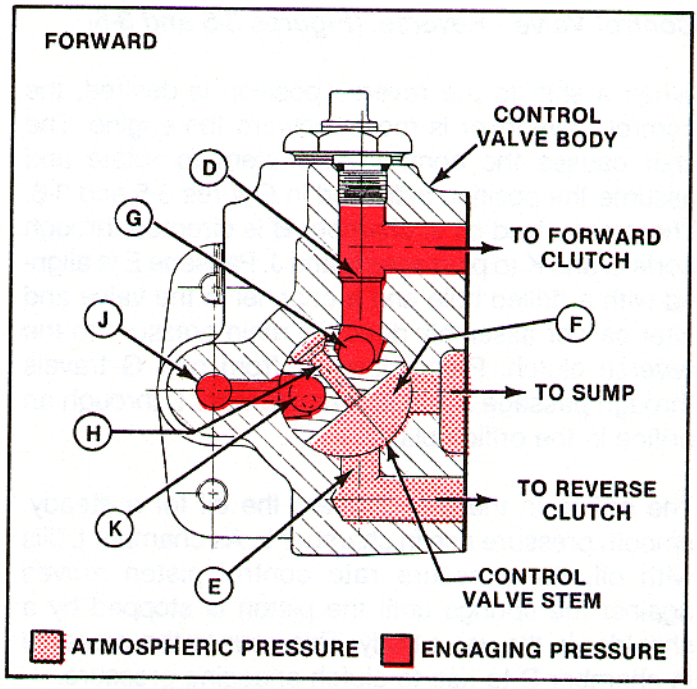


Figure 3-3. Control Valve—Forward—Sectional View.

When a shift is made from forward to neutral, the valve stem is rotated to the position illustrated by Figures 3-1 and 3-2. Under these conditions, passage D is connected to sump by slot F. Passage J also is connected to sump by port H in the valve stem. Since passage D is connected to slot F, oil drains rapidly from the forwaard clutch to sump. Since passage J is now at atmospheric pressure, the oil pressure in chamber L unseats the steel ball against the compression springs, permitting a rapid oil drain from chamber L to sump and allowing the pressure rate control piston to move back against the orifice plate. The forward clutch is now disengaged and main system pressure reduced to neutral.

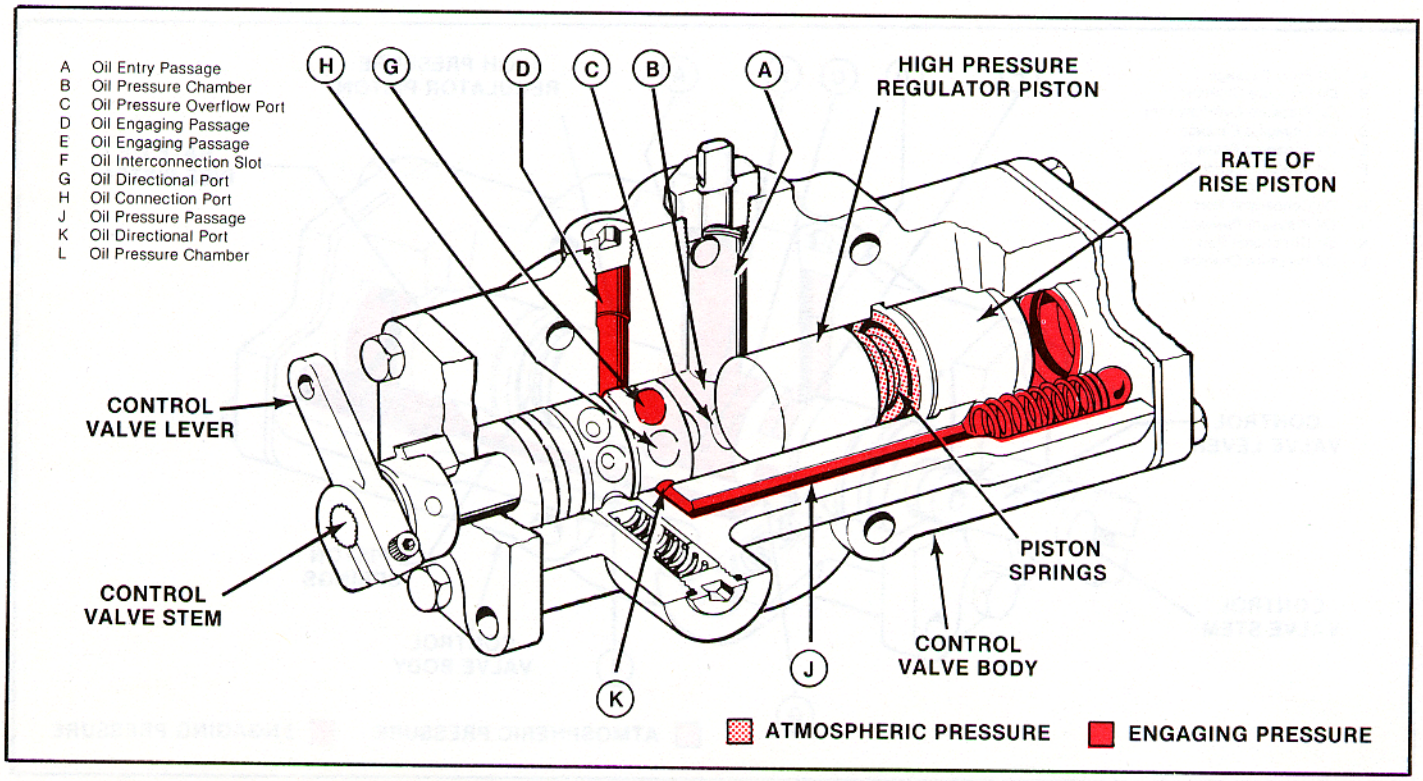


Figure 3-4. Control Valve—Forward—Cutaway View.

Control Valve - Reverse. (Figures 3-5 and 3-6)

When a shift to the reverse position is desired, the control valve lever is moved toward the engine. The shift causes the control valve stem to rotate and assume the position indicated in Figures 3-5 and 3-6. The pressurized oil in chamber B is directed through ports G and K to passages E and J. Passage E is aligned with a drilled hole and a channel in the valve and filter carrier assembly directing main pressure to the reverse clutch. Pressurized oil from port G travels through passage J and enters chamber L through an orifice in the orifice plate.

The orifice in the plate meters the oil for a steady, smooth pressure rise in chamber L. As chamber L fills with oil, the pressure rate control piston moves against the springs until the piston is stopped by a shoulder in the valve body. This causes the pressure in chamber B to rise to clutch engaging pressure.

When in reverse, passage D remains at atmospheric pressure since slot F remains open to sump. When a shift is made from reverse to neutral, the valve stem is rotated to the position illustrated by Figures 3-1 and 3-2. Under these conditions, passage E is connected to sump by slot F. Passage J is also connected to sump by port H in the valve stem. Since passage E is connected to slot F, oil drains rapidly from the reverse clutch to sump. Since passage J is now at atmospheric pressure, the oil pressure in chamber L unseats the steel ball against the compression spring permitting a rapid oil drain from chamber L to sump and allowing the pressure rate control piston to move back against the orifice plate. The reverse clutch is now disengaged and main system pressure reduced to neutral pressure.

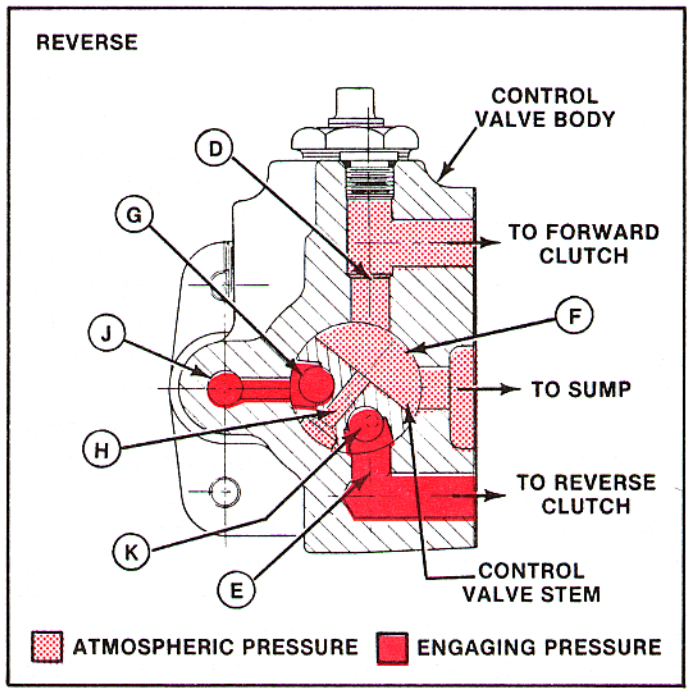


Figure 3-5. Control Valve—Reverse—Sectional View.

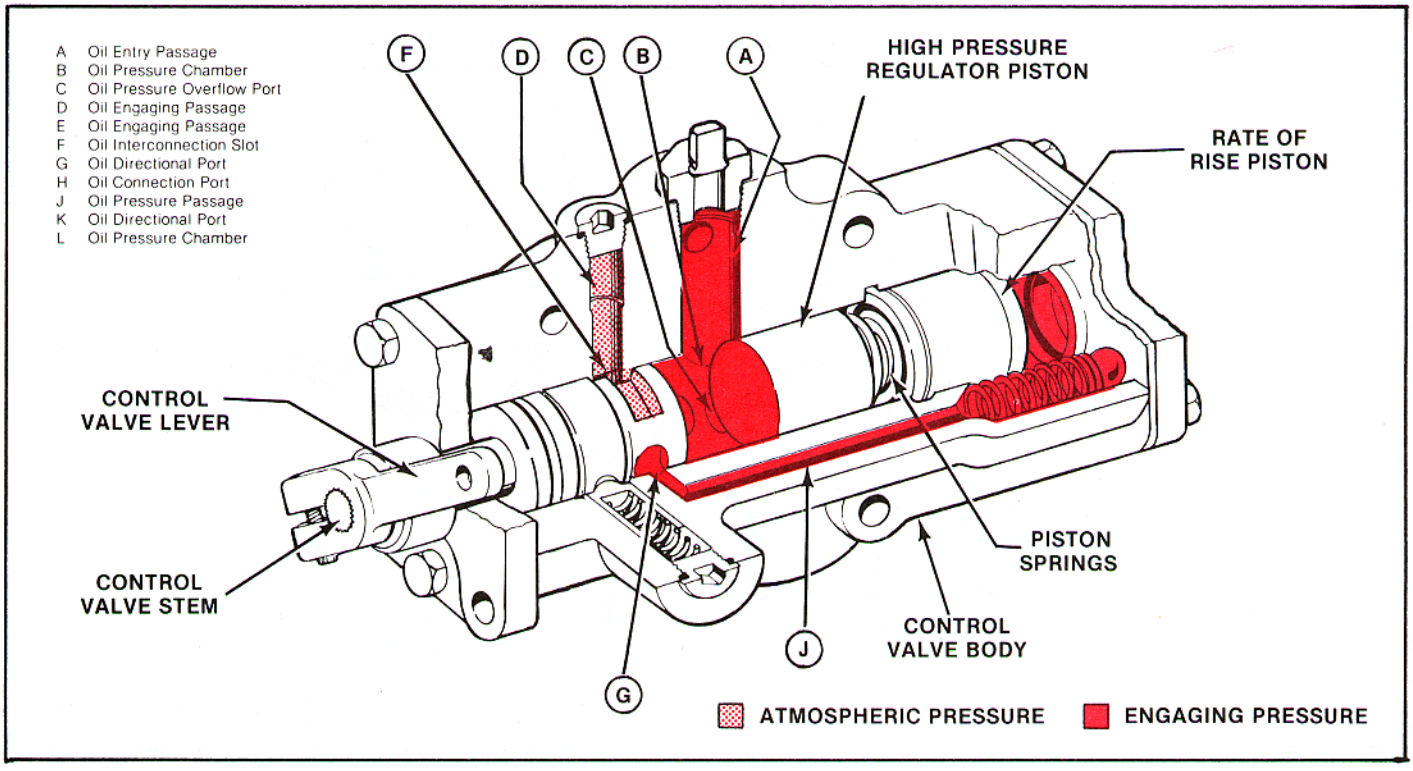


Figure 3-6. Control Valve—Reverse—Cutaway View.

POWER FLOW (See Figure 3-7).

Neutral.

When in neutral, the forward and reverse shafts, transfer gears, and steel clutch plates rotate at engine speed. Other parts including the output shaft do not turn.

Forward.

In forward, the same parts are turning that were turning in neutral. When the forward position is selected, hydraulic pressure is applied to the forward clutch piston clamping the friction and steel clutch plates together. The forward input pinion will then rotate at engine speed and direction, because the friction plates are spline-connected through the clutch drive sleeve to the pinion. Since the forward input pinion is in mesh with the output gear, the output gear and shaft will rotate in anti-engine direction. The reverse input pinion will be back-driven (engine direction) when the unit is in forward.

C

Reverse.

In reverse, the same parts are turning that were turning in neutral. When the reverse position is selected, hydraulic pressure is applied to the reverse clutch piston clamping the friction and steel plates together. The reverse input pinion will then rotate at engine speed and anti-engine direction, because the friction clutch plates are spline-connected through the clutch drive sleeve to the input pinion. Since the reverse input pinion is in mesh with the output gear, the output gear and shaft will rotate in engine direction. The forward input pinion will be back-driven (anti-engine direction) when the unit is in reverse.

BACK DRIVING.

All current production Twin Disc marine transmissions can be back driven (propeller windmilling with dead engine) under the following conditions provided that the vessel speed when back driving the marine transmission does not exceed the normal maximum propulsion speed of the vessel.

Intermittent Back Driving.

Examples:

- Sail boat auxiliary - short trips, less than one day
- Towing purse boats in seining operations
- Twin screw vessel with operation of only one engine for part of the day
- Towing home a boat with engine trouble, short trip - less than a day

1. Start the engine and operate the marine transmission in neutral at normal fluid pressures for a minimum of four minutes, doing this once every 12 hours.

2. Maintain the back driven marine transmission's oil level as for normal propulsion, or use above full oil level.

Continuous Back Driving.

Examples:

- Towing to deliver a boat
- Towing home a boat with engine trouble, long trip
- Sail boat auxiliary - long trips

1. Start the engine if possible and operate the marine transmission in neutral at normal fluid pressures for a minimum of four minutes every 12 to 16 hours. Maintain oil level as above.

2. An alternate would be to lock the propeller shaft to prevent rotation.

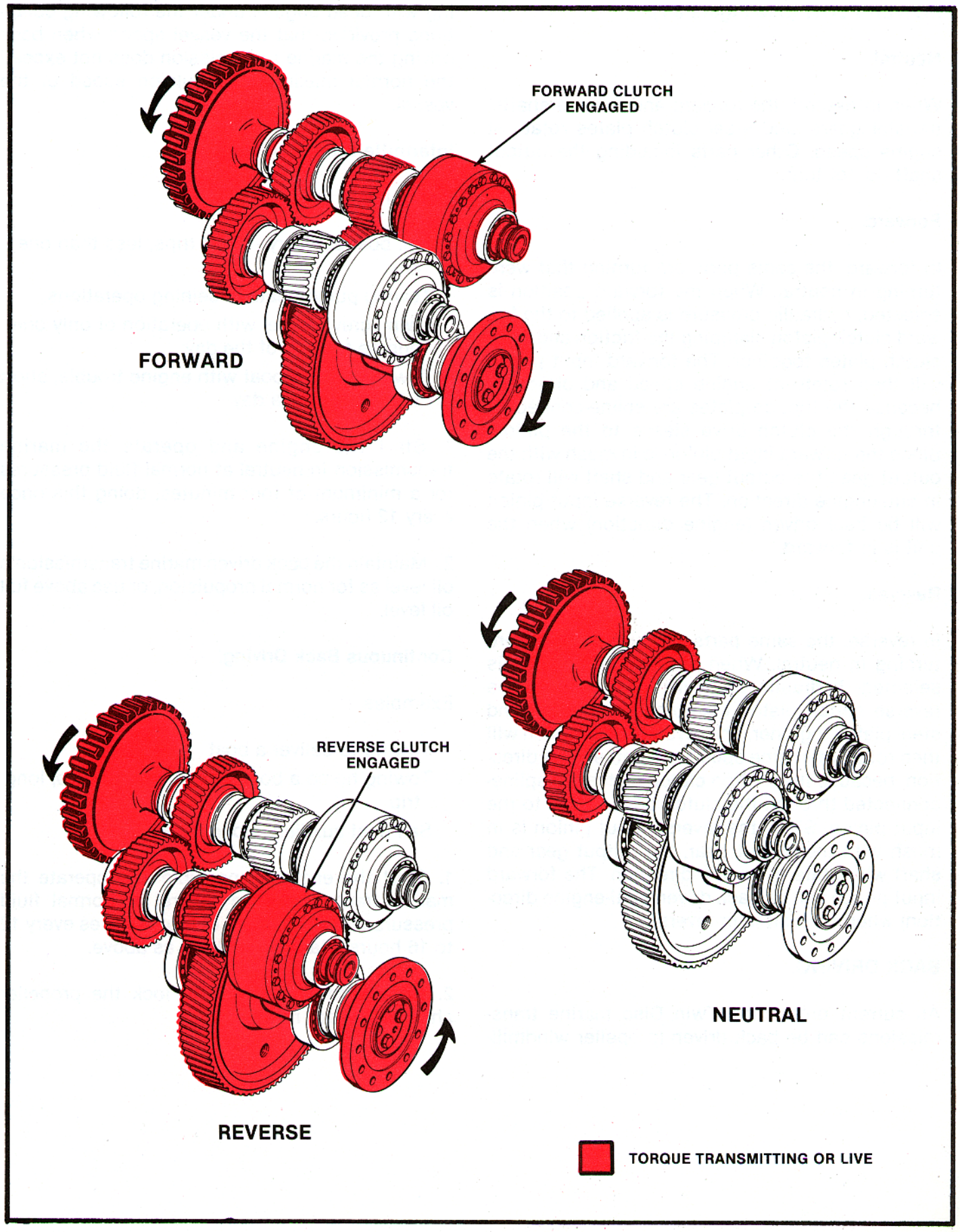


Figure 3-7. Power Flow.

Section 4.
PREVENTIVE MAINTENANCE

GENERAL.

Lubrication.

Grease the oil seals on the output end of the output shaft through the grease fitting with water pump grease. Apply grease once a week if there is water in the bilge. Grease the seals at the same time the oil is changed if the bilge is dry.

No other lubrication is required beyond the daily oil check.

Overhaul Interval.

A complete overhaul of the unit should be made at the same time that the engine is overhauled.

OIL SYSTEM.

Oil Level.

The oil level should be checked daily. Check the oil level with the engine running at low idle and the marine transmission in neutral.

Oil and Filter Change Interval (Maximum).

The oil and oil filter must be changed every 1000 hours of operation or more often if conditions warrant.

Draining.

Drain the transmission by removing the O-ring plug on the rear side at the bottom. See Figure 2-5.

Filling.

1. Remove the breather (see figure 2-4) from the top of the main housing assembly.

2. Pour the oil through the breather opening.

3. Fill the sump with 19 U.S. Gallons for deep case, 10.7 U.S. Gallons for shallow case of the proper weight and type oil. See Section 2 for the proper oil.

4. Start the engine and let it idle with transmission in neutral until oil is circulated throughout the hydraulic system.

5. With the oil at operating temperature, transmission in neutral and the engine running at low idle, check the oil level with the oil gauge (see figure 2-4).

6. Add oil as necessary to bring the oil level up to "FULL" on the oil gauge.

Oil Screen Filter.

Remove and clean the pump suction strainer at every oil change or sooner if necessary. See Figure 4-1 and 4-2.

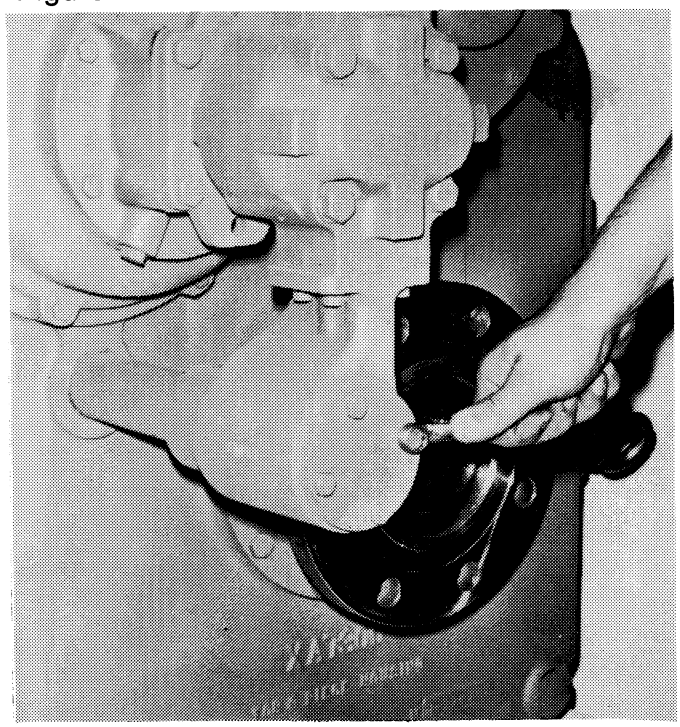


Figure 4-1. Removing or Installing Pump Suction Strainer Cover.

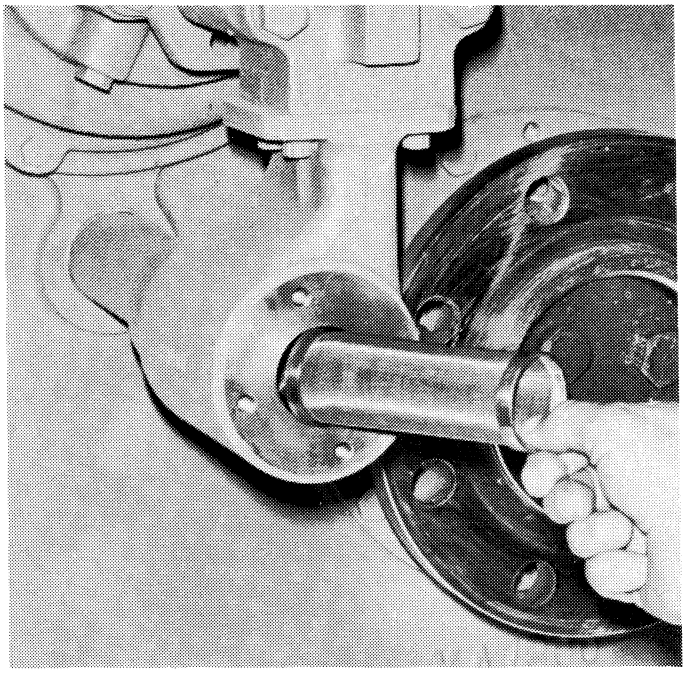


Figure 4-2. Pump Suction Strainer Removed.

PERIODIC VISUAL INSPECTION.

1. Check the mountings for tightness or damage such as cracks. Tighten loose mountings and replace damaged parts.

2. Inspect heat exchanger oil lines for leaky connections, kinks, cracks or other damage. Replace damaged lines.

3. Check pressure and temperature gauges where applicable.

4. Remove the block access cover (Figure 12-6, 4) and inspect the rubber block for wear or damage. Replace worn or damaged rubber blocks.

5. Periodically, inspect the drive line and the input and output shaft oil seals for leakage. Replace parts as required.

Section 5. TROUBLESHOOTING

This section of the maintenance manual has been prepared to assist maintenance personnel in troubleshooting equipment discussed in the manual. When troubleshooting the equipment, always remember to consider the entire power package. The troubleshooting chart (Table 5-1) is organized in three columns. Proper use of the chart will aid in rapid determination and repair of functional difficulties that may occur.

Pressure Test Kit

The Digital Pressure Transducer Kit (BOM 42168) provides two pressure transducers (0 to 500 psi) with hydraulic quick couplings, a power supply box for the transducers, and cables needed to connect the transducers to the power supply box and the signals out of the power supply box to a customer supplied digital volt meter. Contact the Twin Disc Service Department, Racine Wisconsin for specific information concerning this test kit.

One principle of troubleshooting is to start with the simple and move to the more difficult. Check the simple items first. Run the simple test first. Then move to the more difficult.

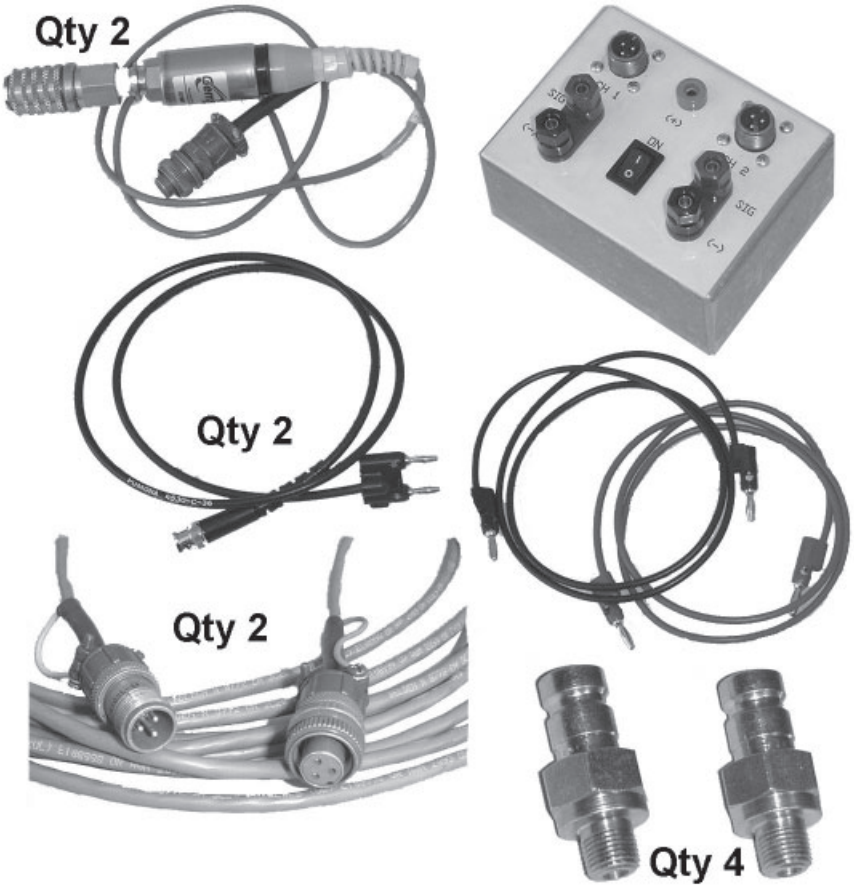


Figure 5-1. Pressure and Flow Test Kit

Table 5-1. Trouble Shooting

Symptom	Cause	Remedy
1. Low oil pressure.	1-1. Partially clogged oil strainer.	1-1. Remove and clean oil strainer. (See Section 6).
	1-2. Stuck pressure regulation piston.	1-2. Disassemble the valve (Section 8) and clean the piston.
	1-3. Broken piston rings on clutch shaft(s).	1-3. Remove the collector (See Section 6) and inspect piston rings. Replace broken piston rings.
	1-4. Damaged worn oil pump assembly.	1-4. Replace damaged or worn oil pump assembly. (See Section 6).
	1-5. Incorrect linkage adjustment to control valve assembly.	1-5. Adjust linkage so that control valve stem is indexed properly by detent.
	1-6. Clogged or plugged orifice in orifice plate of control valve assembly.	1-6. Remove orifice plate cover (See Section 8). Clean parts.
	1-7. Shimming required between inner and outer springs and rate-of-rise piston.	1-7. Shim as required.
2. No oil pressure, or erratic low pressure at control valve tap.	2-1. Oil pump section strainer plugged.	2-1. Remove and clean strainer.
	2-2. Oil Level Low.	2-2. Check oil level and correct.
	2-3. Air leak on suction side of pump.	2-3. Correct cause of air leak.
	2-4. Pump drive on reverse clutch shaft broken.	2-4. Disassemble and repair as required.
	2-5. Regulating valve stuck in open position.	2-5. Remove, disassemble, clean and repair the regulating valve.
	2-6. Oil pump defective.	2-6. Replace oil pump.
3. High main oil pressure.	3-1. Regulating valve stuck.	3-1. Remove and clean regulating valve.
4. High temperature.	4-1. Improper oil level.	4-1. Check and fill with proper oil to the correct level.

Table 5-1. Trouble Shooting

Symptom	Cause	Remedy
	4-2. Faulty heat exchanger (if used).	4-2. Inspect, repair or replace heat exchanger.
	4-3. Clutches slipping.	4-3. Check clutch apply oil pressure. If pressure is normal, remove, disassemble and repair slipping clutch.
	4-4. Bearing failure.	4-4. Overhaul marine transmission.
5. Excessive noise.	51-. Bearing failure.	5-1. Overhaul marine transmission.
	5-2. Worn or damaged rubber blocks.	5-2. Remove marine transmission (see Section 6). Replace worn or damaged rubber blocks.
6. No neutral.	6-1. Clutch plates warped.	6-1. Remove clutch plates. Overhaul unit. See Sections 6, 7, 8, and 9.
	6-2. Control valve incorrectly	6-2. Check and adjust control linkage.
7. Harsh engagement.	7-1. Regulating piston or rate-of-rise piston stuck.	7-1. Disassemble control valve (see Section 8). Clean parts. Replace parts if necessary.
	7-2. Orifice plate ball in control valve not seating properly.	7-2. Remove orifice plate cover (see Section 8). Clean parts. Replace Replace parts if necessary.
8. Low lube oil pressure.	8-1. Pump GPM output too low.	8-1. Replace pump.
	8-2. Pump section strainer plugged.	8-2. Remove, clean, inspect and install the suction screen.
	8-3. Air leak on suction side of pump.	8-3. Inspect for and correct air leak.
	8-4. Lube regulator valve stuck.	8-4. Remove and clean or replace parts as necessary.

Section 6.
REMOVAL AND DISASSEMBLY

IN BOAT MAINTENANCE.

Items listed below can be repaired without removing the transmission from the boat. See Section 6 for disassembly and Section 9 for assembly of these areas.

1. Changing output shaft oil seals.
2. Changing seal rings on the clutch cylinder and piston.
3. Changing clutch plates.

PRIOR TO REMOVAL.

1. Drain the oil from the transmission by removing O-ring plug on the rear side at the bottom. See Figure 2-5.

2. Mark the output flange and companion flange so they will always be assembled identically.

NOTE

The output and companion flanges are match-reamed. Thus, the same holes must be aligned on reassembly.

3. Disconnect the output and companion flanges.

4. Disconnect linkage, wiring, and plumbing and remove any units that would interfere with the removal of the transmission.

5. Support the transmission with a hoist and remove the mounting capscrews.

6. Support the rear of the engine with blocks if necessary.

7. Remove the capscrews that secure the transmission to the engine.

8. Push the transmission away from the engine to separate the drive spider from the driving ring.

REMOVAL OF EXTERNAL PARTS.

1. Remove the four capscrews that secure the control valve to the valve and filter carrier assembly and remove the control valve and gasket. See Figure 6-1.

NOTE

If the transmission is being disassembled due to a failure that would contaminate the oil, the oil filter must be cleaned out and a new filter element installed.

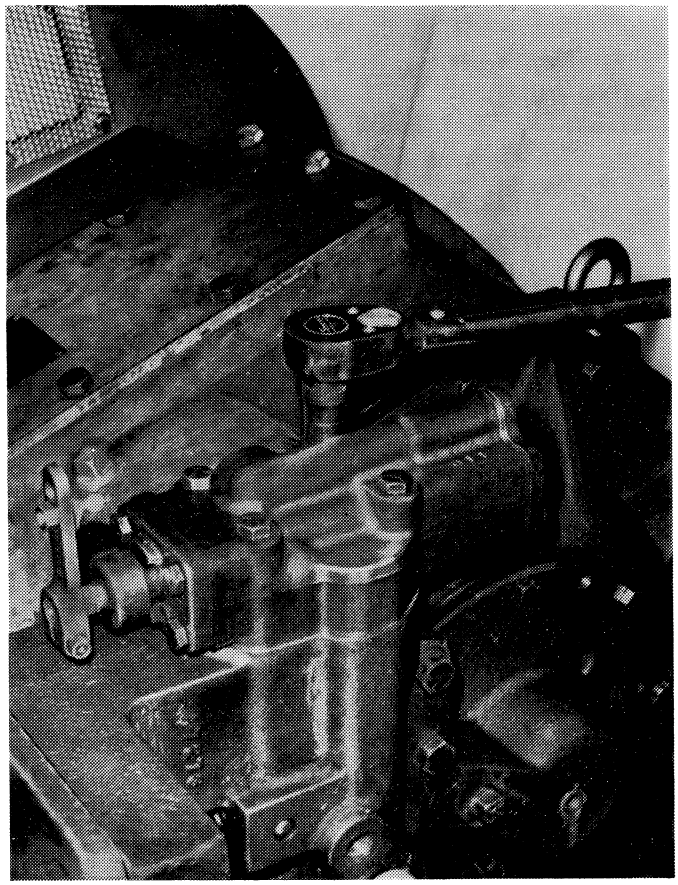


Figure 6-1. Removing or Installing Control Valve.

2. Remove four screws and remove the oil filter assembly and gasket. See Figure 6-2.

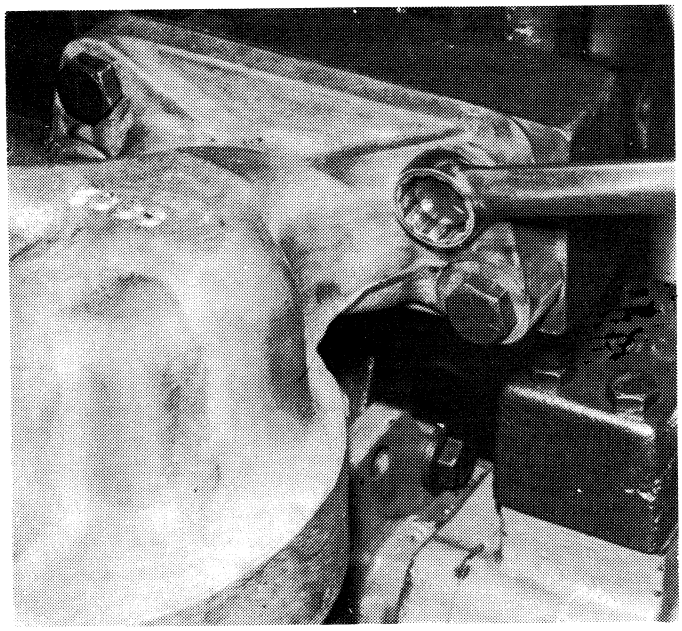


Figure 6-2. Removing or Installing Oil Filter Assembly.

3. Remove the breather assembly. See Figure 2-4.

4. Remove the hex-head capscrews from the top cover and remove the cover and gasket. See Figure 6-3.

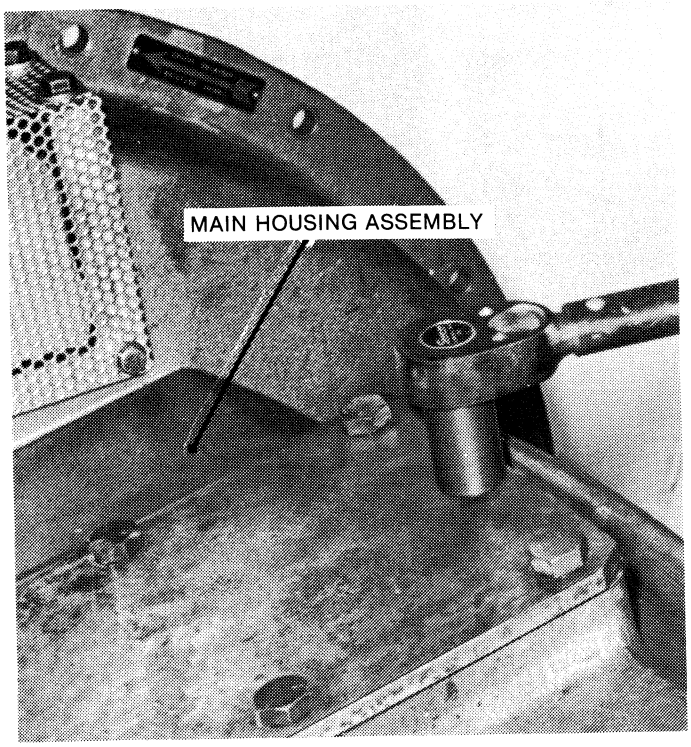


Figure 6-3. Removing or Installing Housing Top Cover.

5. Remove hex-head screw (Figure 12-2, 1), retainer washer (2), and lathe-cut ring (3) from the front of input shaft (16).

6. Use a puller to remove drive spider assembly (6). Do not remove wear sleeve (7) unless parts are being replaced.

7. If the wear sleeve needs replacing, place a dull chisel across the wear sleeve and rap the chisel sharply with a hammer. The wear sleeve should stretch enough to loosen it. If not, turn the drive spider 180 degrees and rap the wear sleeve on the opposite side.

CAUTION

Do not attempt to cut the wear sleeve and carefully avoid marring the shaft under the wear sleeve. If the shaft is marred, an oil leak may occur.

8. Remove twenty hex-head screws (Figure 12-6, 41) from the front housing (37), and use two of the screws as pushers to remove the front housing (43).

NOTE

Do not remove dowel pins (Figure 12-6, 42), block access cover (4), and air baffle (3) from the housing unless parts are being replaced.

9. Remove six hex-head screws (Figure 12-2, 9) and remove the input bearing retainer (10) and shims (11). See Figure 6-4.

10. Remove O-ring (Figure 12-2, 12) from the O.D. and oil seal (8) from the bore of the bearing retainer.

11. Remove six hex-head screws (Figure 12-3, 1) from the reverse shaft cover (2) and remove the cover, O-ring (3), reverse bearing retainer (4), shims (5), and O-ring (6). See Figures 6-5 and 6-6.

12. Remove hex-head screw (Figure 12-3, 7), retainer washer (8), and shims (7) from the front of the reverse shaft (13).

13. Support the unit on a working surface, output side up.

14. Remove four hex-head screws (Figure 12-1, 32) that secure the pump suction strainer housing (30) to the oil pump (21). See Figure 6-7.

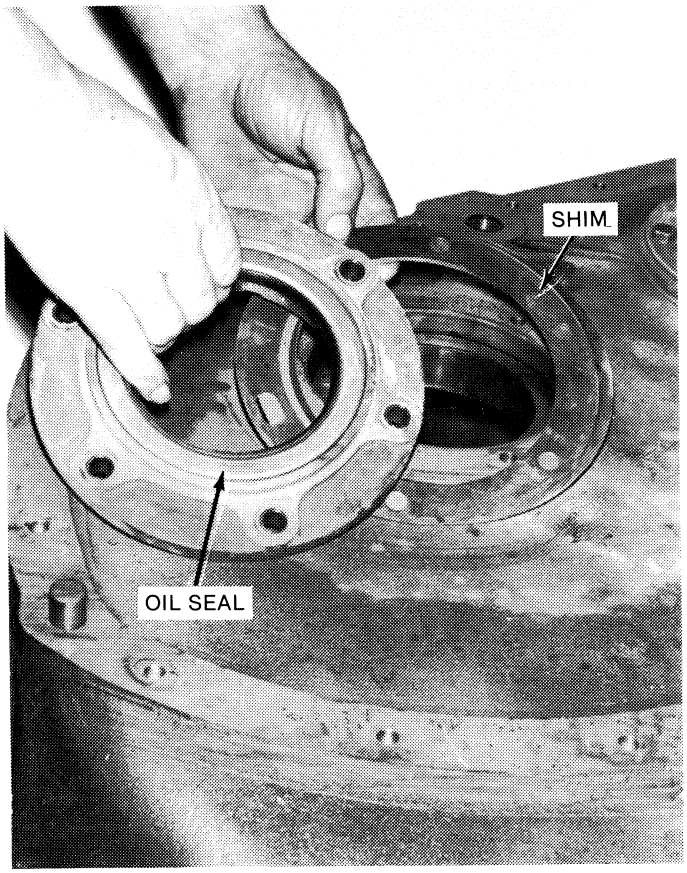


Figure 6-4. Input Bearing Retainer and Shims Removed.

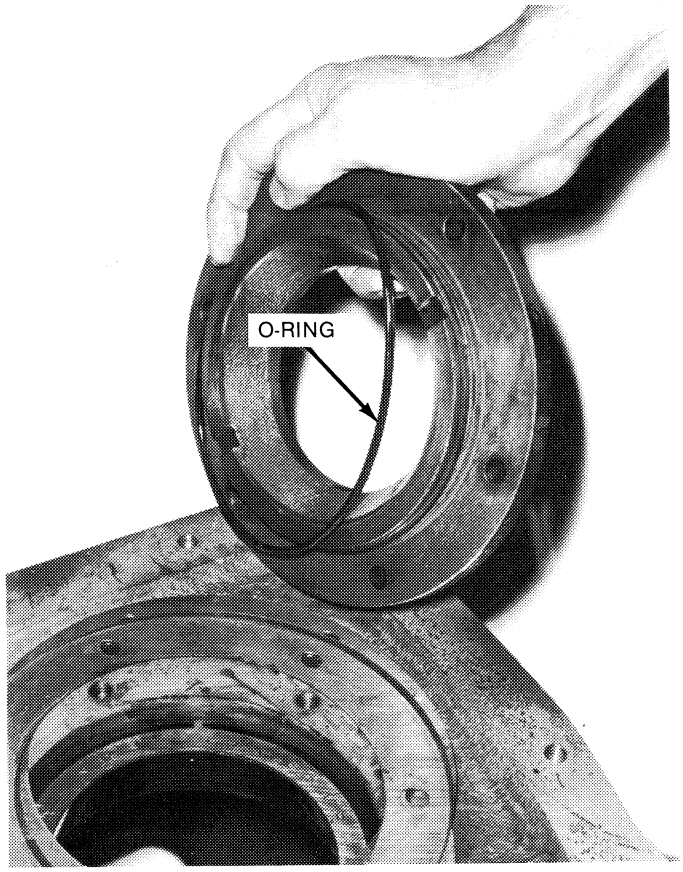


Figure 6-6. Reverse Bearing Retainer and O-ring Removed.

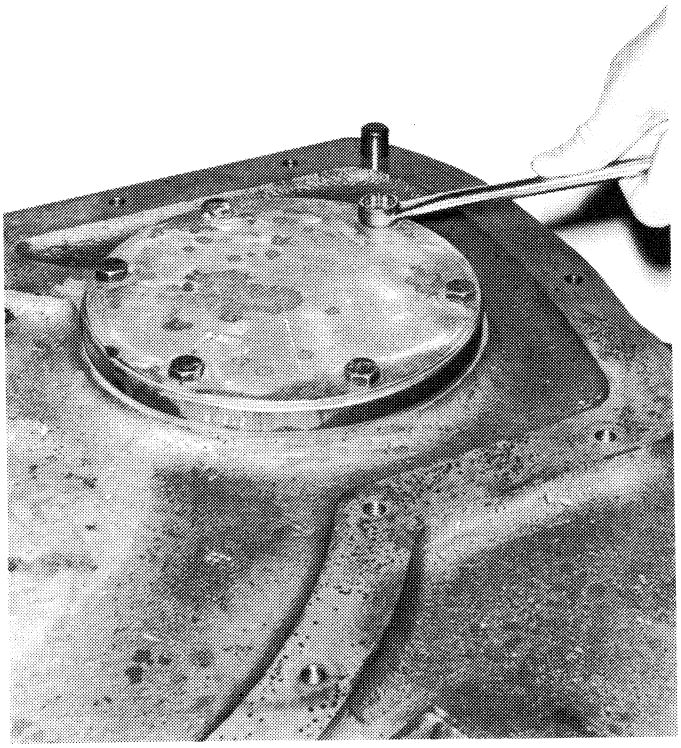


Figure 6-5. Removing or Installing Reverse Shaft Cover.

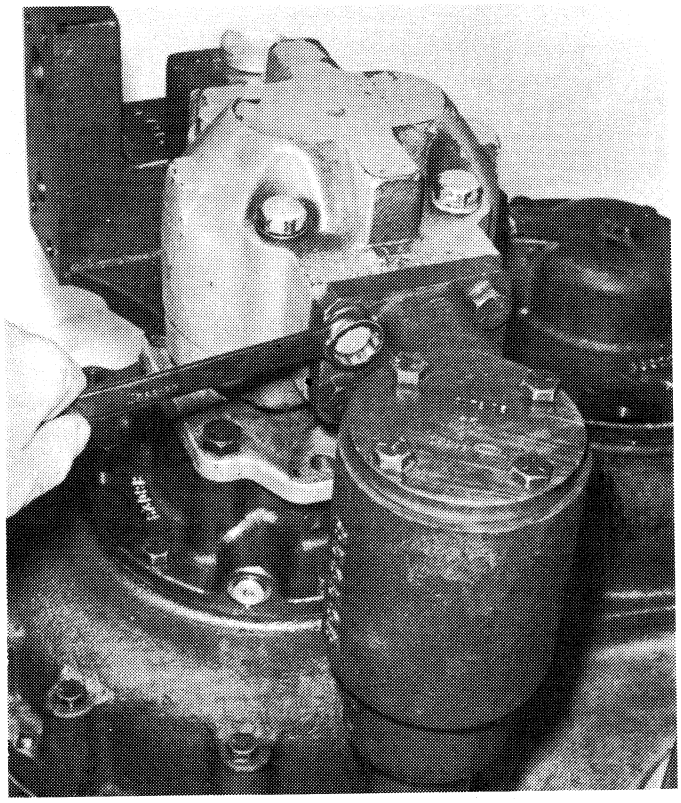


Figure 6-7. Removing or Installing Pump Suction Strainer Assembly.

15. Remove the strainer, sliding it forward off the connector tube. (Figure 12-1, 28).

16. Remove the O-ring (29) from the top of the oil strainer housing (30).

17. Pull the connector tube (28) from the housing and remove the O-rings (27) from the tube. See Figure 6-8.

18. Remove four hex-head screws (Figure 12-1, 23), two washers (22), oil pump (21), and gasket (17). See Figure 6-9.

19. Remove the pump drive coupling assembly from the pump drive shaft. See Figure 6-10.

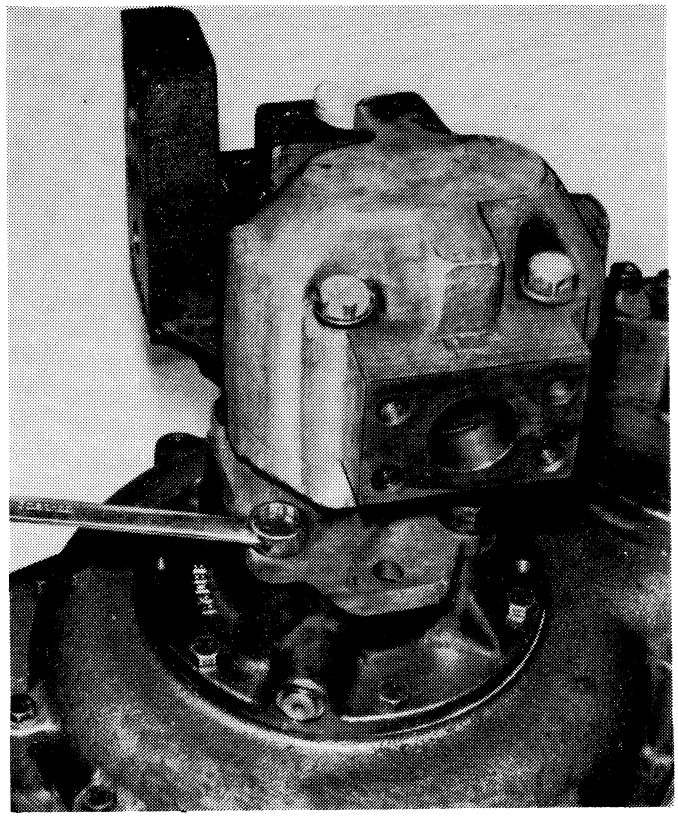


Figure 6-9. Removing or Installing Oil Pump.

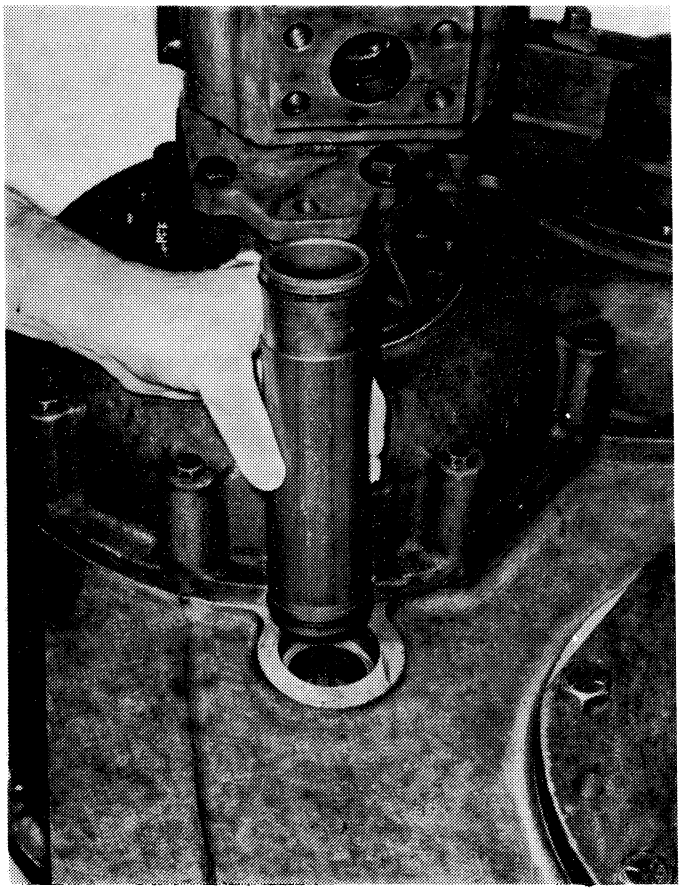


Figure 6-8. Removing or Installing Connector Tube.

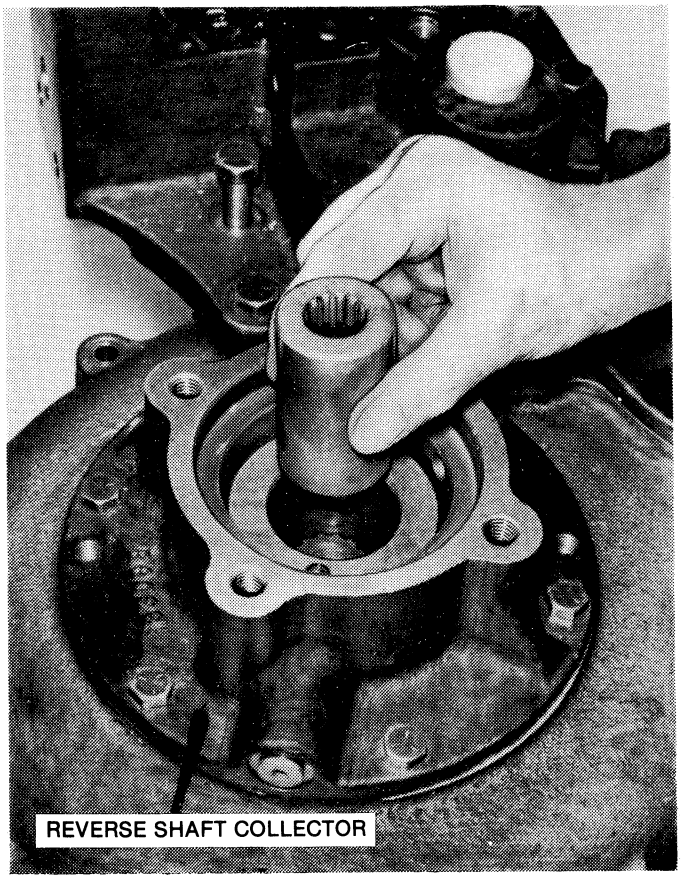


Figure 6-10. Removing or Installing Pump Drive Coupling Assembly.

DISASSEMBLY OF FORWARD AND REVERSE CLUTCHES.

1. Remove five hex-head screws from the valve and filter carrier assembly. See Figure 6-11.

2. Remove the valve and filter carrier assembly. See Figure 6-11.

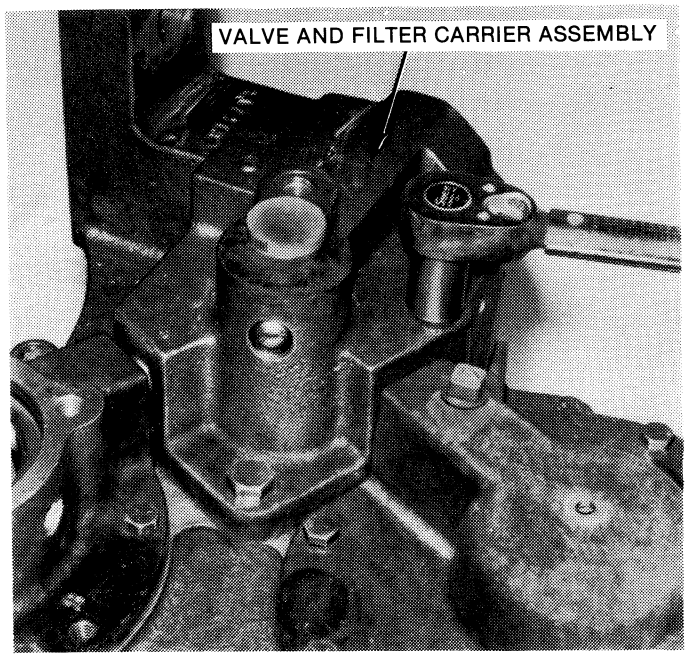


Figure 6-11. Removing or Installing screws on Valve and Filter Assembly.

3. Remove the eight hex-head screws (Figure 12-1, 8) from the forward shaft collector (7). See Figure 6-12.

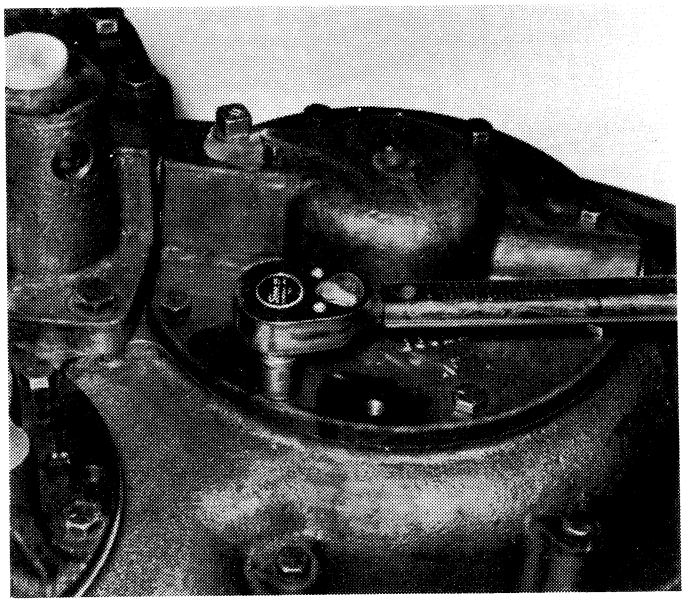


Figure 6-12. Removing or Installing Screws on Forward Shaft Collector.

4. Remove the six hex-head screws (Figure 12-1, 14) from the reverse shaft collector (13).

NOTE

If the transmission is being overhauled or if it has failed internally, remove the lube pressure relief valve from the valve and filter carrier assembly. Remove snap ring (Figure 12-4, 4), guide plate assembly (5), spring (6) and lube valve piston (7).

5. Remove the collector oil tubes. See Figure 6-13.

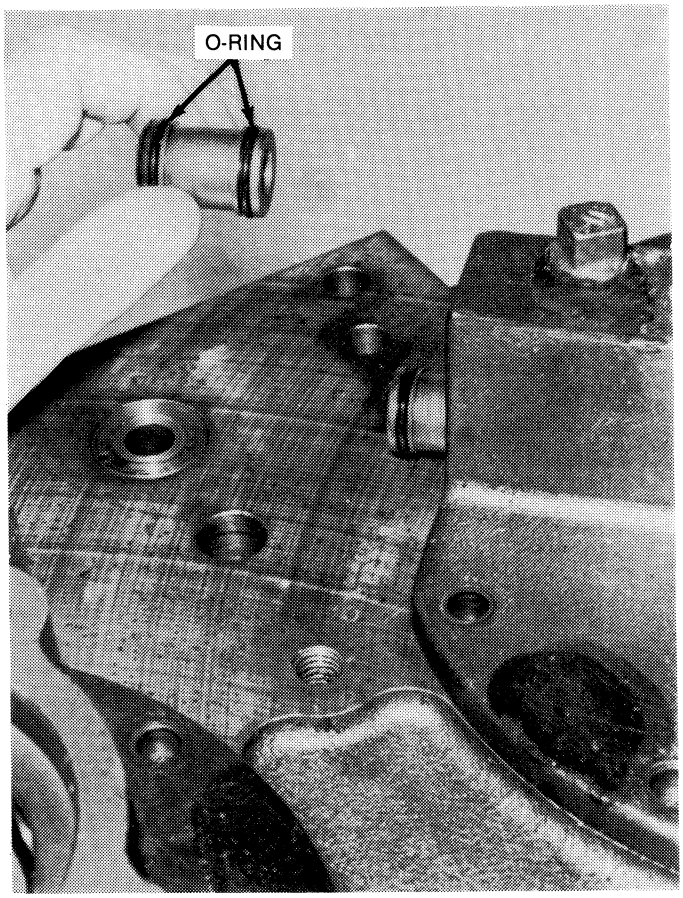


Figure 6-13. Removing or Installing Collector Oil Tube.

6. Remove the O-rings from the collector oil tubes.

7. Remove the lube tube and gasket. Do not remove the rollpin unless parts are being replaced. See Figure 6-14.

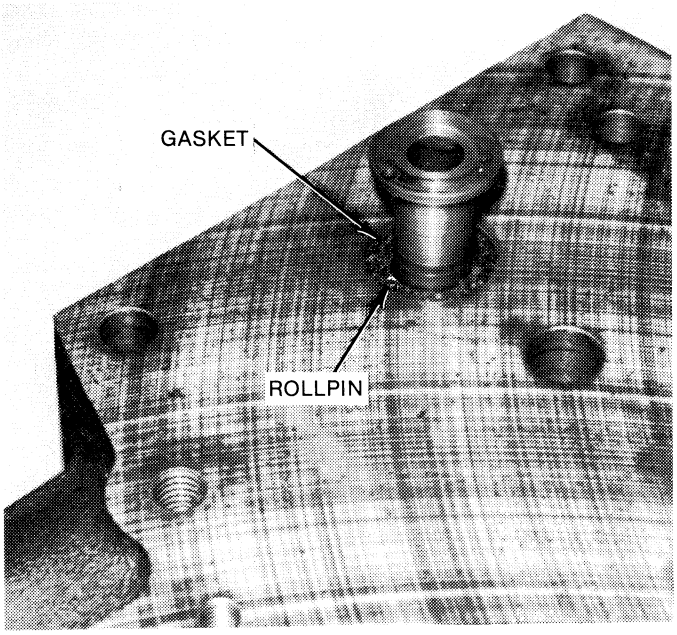


Figure 6-14. Lube Tube Partially Removed.

8. Remove the forward shaft collector. See Figure 6-12.

9. Remove the reverse shaft collector, (Figure 12-1, 13).

10. Remove the hex-head screws from the manifold. See Figure 6-15.

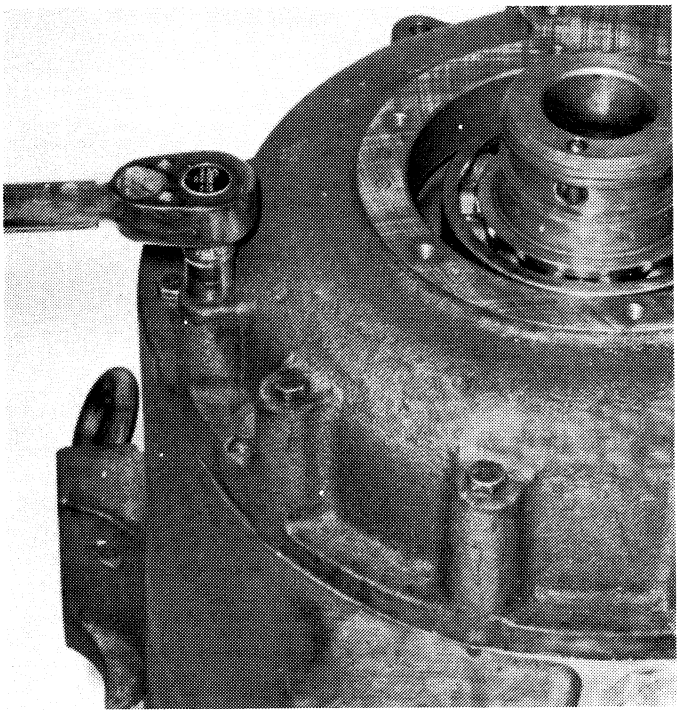


Figure 6-15. Removing or Installing Manifold.

11. Use two of the screws as pushers in the holes provided and remove the manifold. Do not remove the dowel pins (Figure 12-1, 1) unless parts are being replaced.

12. Remove sixteen hex-head screws (Figure 12-2, 39 and Figure 12-3, 36) from the forward and reverse clutch cylinder assemblies and remove the assemblies.

13. Remove the two piston rings from the clutch cylinders. See Figure 6-16.

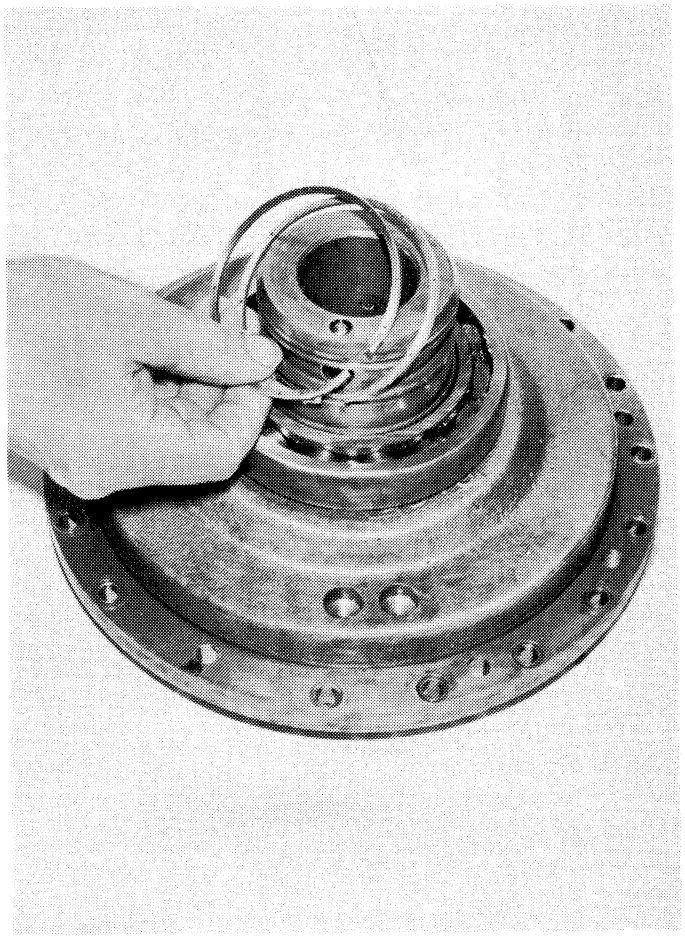


Figure 6-16. Piston Rings Removed from Rear of Clutch Cylinder.

14. If parts are being replaced, use a bearing puller to remove ball bearing (Figure 12-2, 40 and Figure 12-3, 37).

15. Remove four place-head screws (Figure 12-2, 28 and Figure 12-3, 25) from each of the spring retainers (30 and 27).

16. Remove the spring retainers and clamp plates.

17. Remove the clutch release springs. See Figure 6-17.

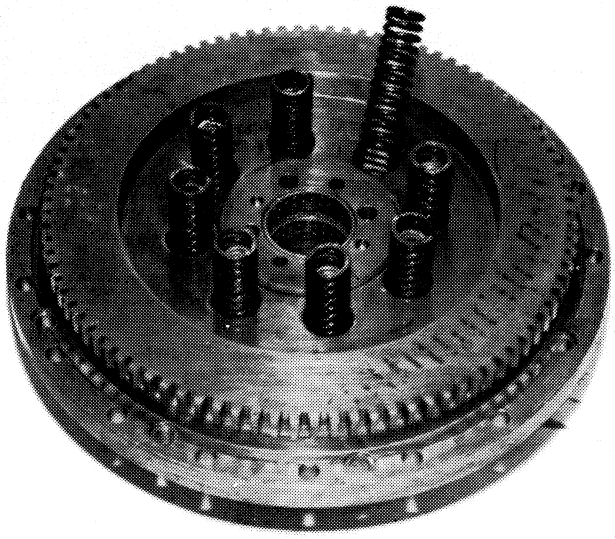


Figure 6-17. Clutch Release Springs.

18. Remove the clutch piston. See Figure 6-18.

19. Remove the seal rings from the outside diameter of the pistons. See Figure 6-18.

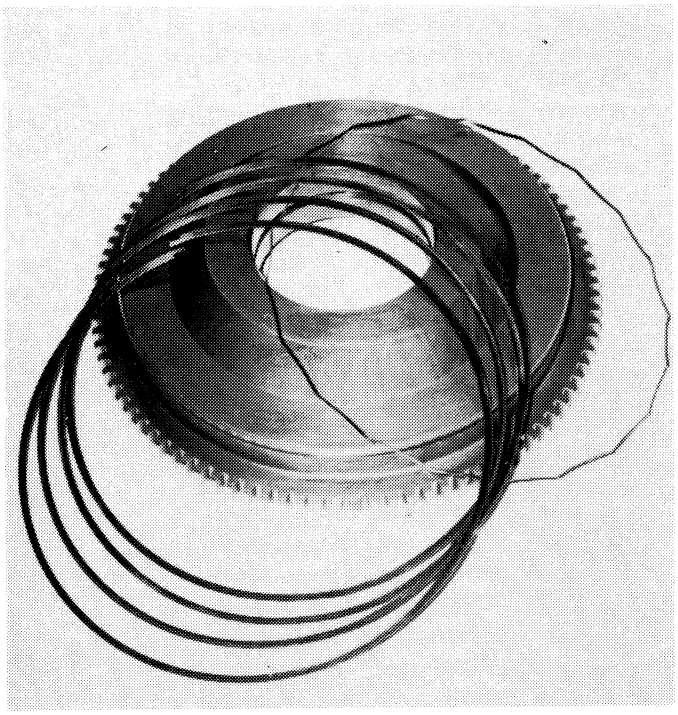


Figure 6-18. Clutch Piston and Seal Ring Removed.

20. Remove the piston rings from the front of the clutch piston hubs. See Figure 6-19.

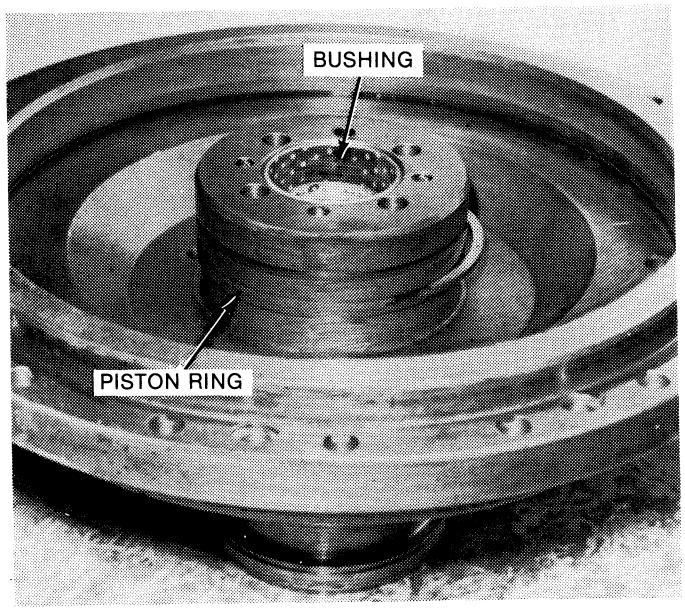


Figure 6-19. Front Side of Clutch Cylinder with Piston Removed.

NOTE

The bushing in the clutch cylinder bore is not a replaceable part.

21. Loosen dowel pin screw (Figure 12-3, 24) on the reverse clutch and (Figure 12-2, 27) on the forward clutch hub. See Figure 6-20. Back the screw out approximately 3/8 inch. Do not remove the screw.

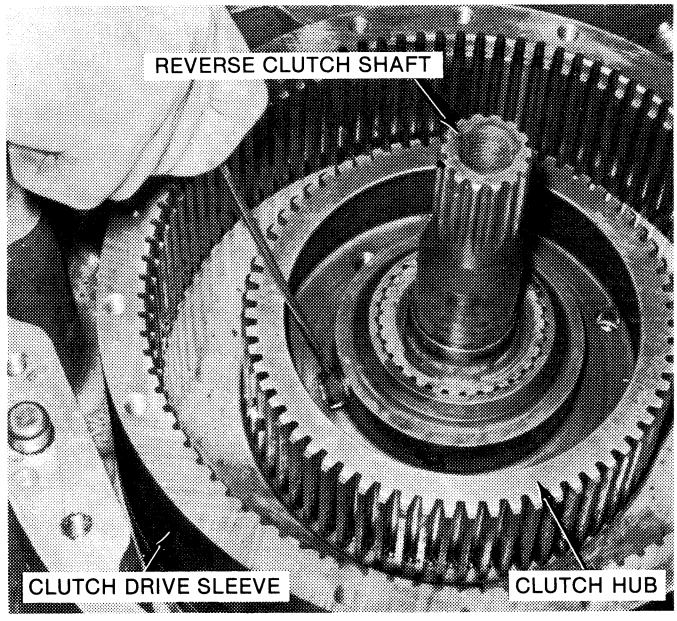


Figure 6-20. Removing or Installing Dowel Pin Screw on Clutch Hub.

22. Remove the clutch hubs. See Figure 6-20. (Reverse clutch hub shown).

23. Remove the clutch release shim (Figure 12-2, 24 and Figure 12-3, 21). Remove clutch plates (Figures 12-2, 22 and 23 and Figure 12-3, 19 and 20).

24. Install special tool T-18638 (see Section 10 for tool identification) onto the forward clutch drive sleeve with a protective disc over the end of the input shaft. Secure the tool to the drive sleeve with two pieces of 5/16-inch threaded stock and nuts.

25. Tighten the jackscrew in the center of the tool to remove the clutch drive sleeve (Figure 12-2, 21) and backplate (20).

26. Repeat steps 24 and 25 above on the reverse clutch.

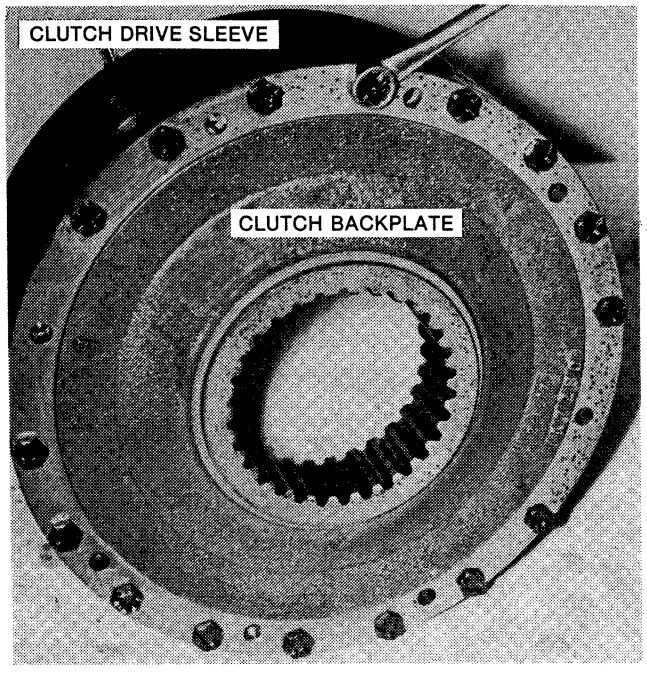


Figure 6-21. Removing or Installing Clutch Backplate.

NOTE

Do not separate the clutch backplates (Figure 12-2, 20 and Figure 12-3, 17) from the clutch drive sleeves (Figure 12-2, 21 and Figure 12-3, 18) unless parts are being replaced.

27. If necessary, separate the clutch drive sleeve and clutch backplates by removing sixteen place-head screws from the forward and reverse clutch backplates. See Figure 6-21.

Note: MG520-1HP has 28 Capscrews.

28. Use two of the screws as pushers and remove the backplates.

29. Remove eight place-head screws (Figure 12-7, 15) from the bearing carriers (14).

30. Use two of the screws as pushers in the holes provided to remove the bearing carriers and roller bearing outer races which will remain in the carriers.

Output Group of Parts.

1. Remove the 12 bolts (Figure 12-5, 21) and nuts (13) and remove the companion flange (20).

2. Remove the snap ring from the bore of the output flange. See Figure 6-22.

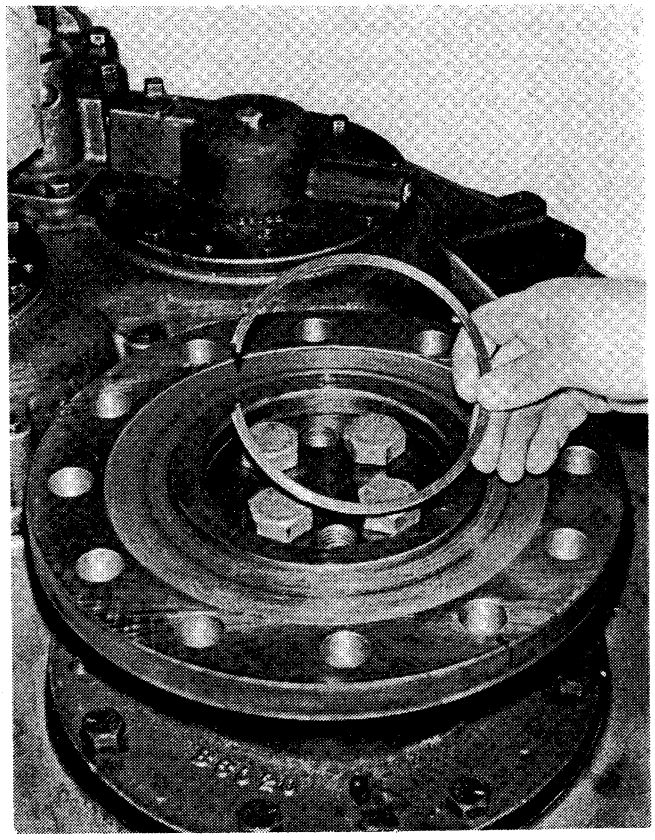


Figure 6-22. Snap Ring Removed from Bore of Output Flange.

17. Remove the clutch release springs. See Figure 6-17.

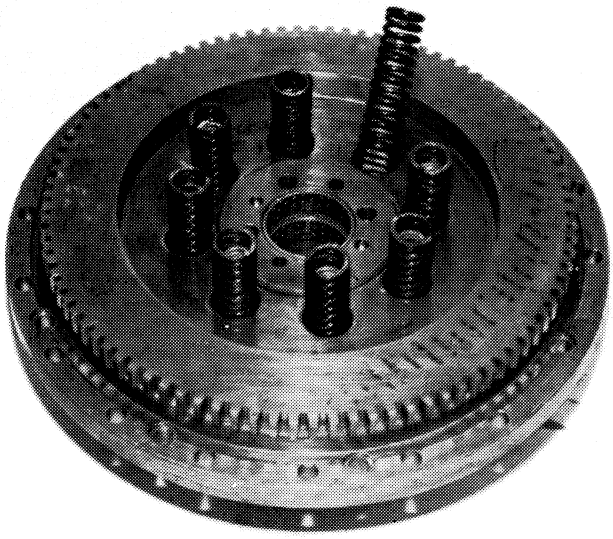


Figure 6-17. Clutch Release Springs.

18. Remove the clutch piston. See Figure 6-18.

19. Remove the seal rings from the outside diameter of the pistons. See Figure 6-18.

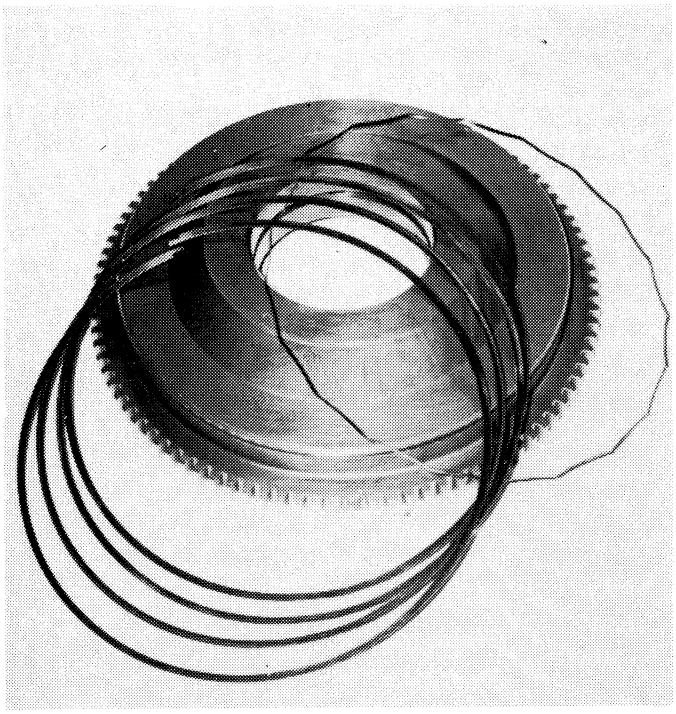


Figure 6-18. Clutch Piston and Seal Ring Removed.

20. Remove the piston rings from the front of the clutch piston hubs. See Figure 6-19.

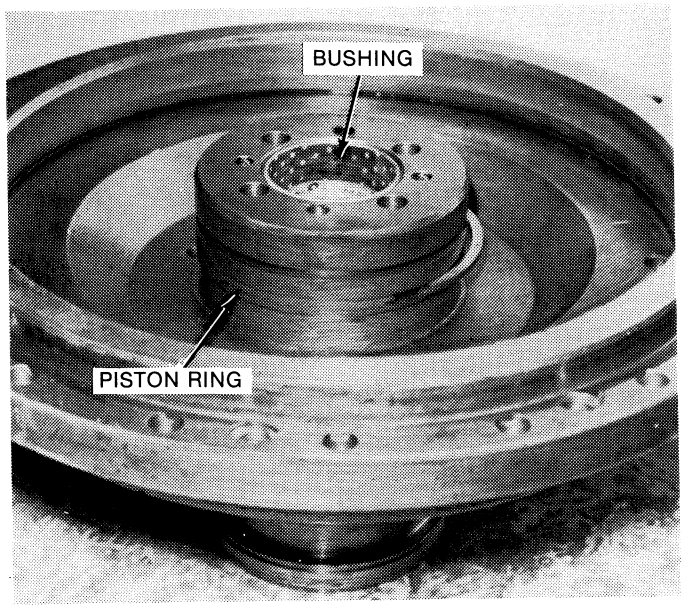


Figure 6-19. Front Side of Clutch Cylinder with Piston Removed.

NOTE

The bushing in the clutch cylinder bore is not a replaceable part.

21. Loosen dowel pin screw (Figure 12-3, 24) on the reverse clutch and (Figure 12-2, 27) on the forward clutch hub. See Figure 6-20. Back the screw out approximately 3/8 inch. Do not remove the screw.

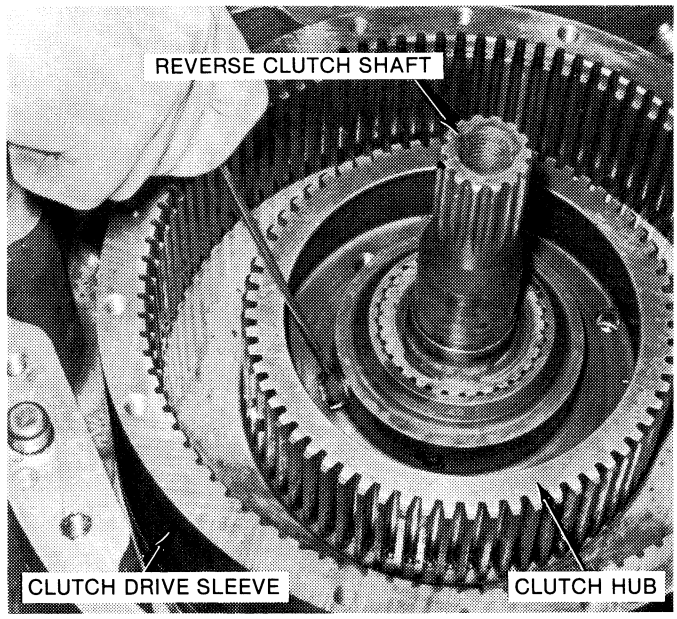


Figure 6-20. Removing or Installing Dowel Pin Screw on Clutch Hub.

22. Remove the clutch hubs. See Figure 6-20. (Reverse clutch hub shown).

23. Remove the clutch release shim (Figure 12-2, 24 and Figure 12-3, 21). Remove clutch plates (Figures 12-2, 22 and 23 and Figure 12-3, 19 and 20).

24. Install special tool T-18638 (see Section 10 for tool identification) onto the forward clutch drive sleeve with a protective disc over the end of the input shaft. Secure the tool to the drive sleeve with two pieces of 5/16-inch threaded stock and nuts.

25. Tighten the jackscrew in the center of the tool to remove the clutch drive sleeve (Figure 12-2, 21) and backplate (20).

26. Repeat steps 24 and 25 above on the reverse clutch.

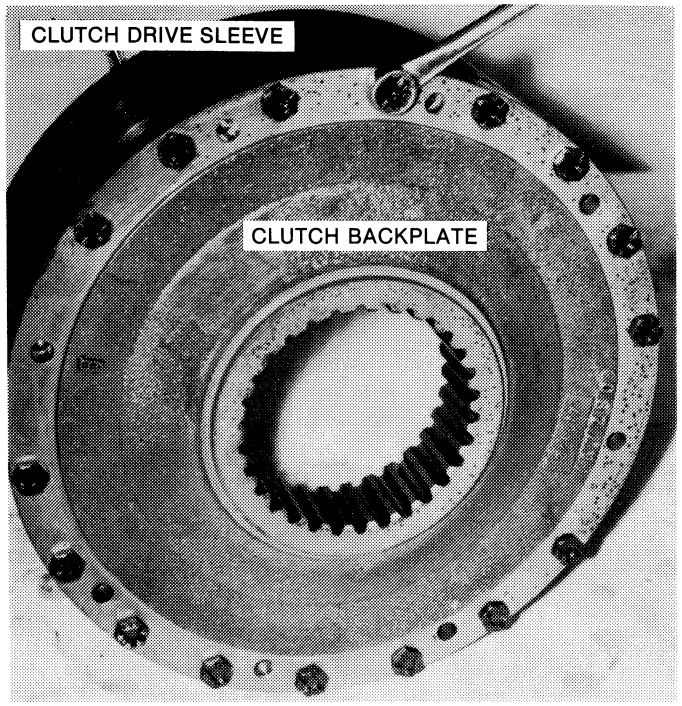


Figure 6-21. Removing or Installing Clutch Backplate.

NOTE

Do not separate the clutch backplates (Figure 12-2, 20 and Figure 12-3, 17) from the clutch drive sleeves (Figure 12-2, 21 and Figure 12-3, 18) unless parts are being replaced.

27. If necessary, separate the clutch drive sleeve and clutch backplates by removing sixteen place-head screws from the forward and reverse clutch backplates. See Figure 6-21.

28. Use two of the screws as pushers and remove the backplates.

29. Remove eight place-head screws (Figure 12-7, 15) from the bearing carriers (14).

30. Use two of the screws as pushers in the holes provided to remove the bearing carriers and roller bearing outer races which will remain in the carriers.

Output Group of Parts.

1. Remove the 12 bolts (Figure 12-5, 21) and nuts (13) and remove the companion flange (20).

2. Remove the snap ring from the bore of the output flange. See Figure 6-22.

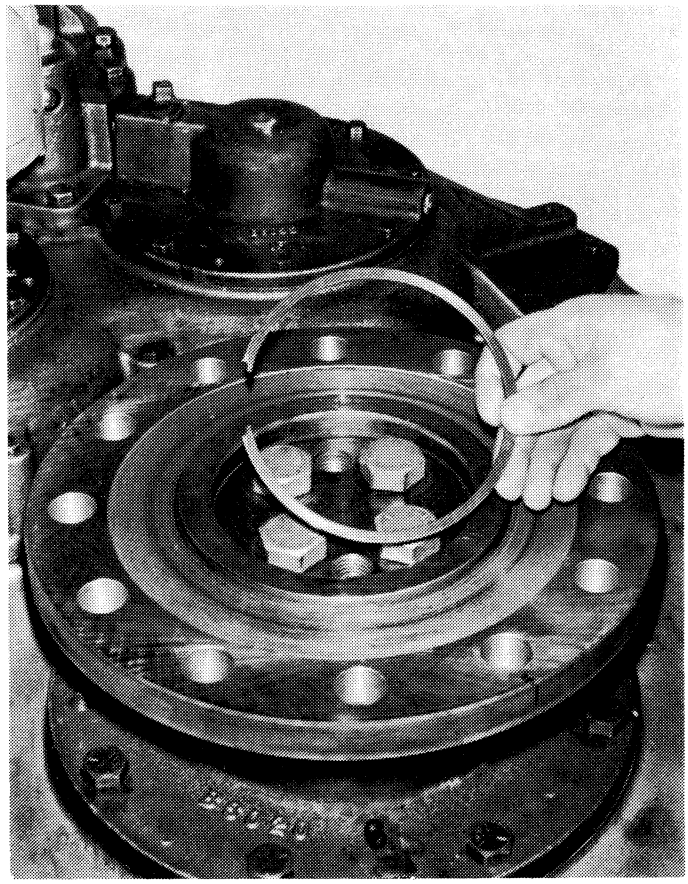


Figure 6-22. Snap Ring Removed from Bore of Output Flange.

3. Remove four hex-head screws from the output flange retainer washer. See Figure 6-23.

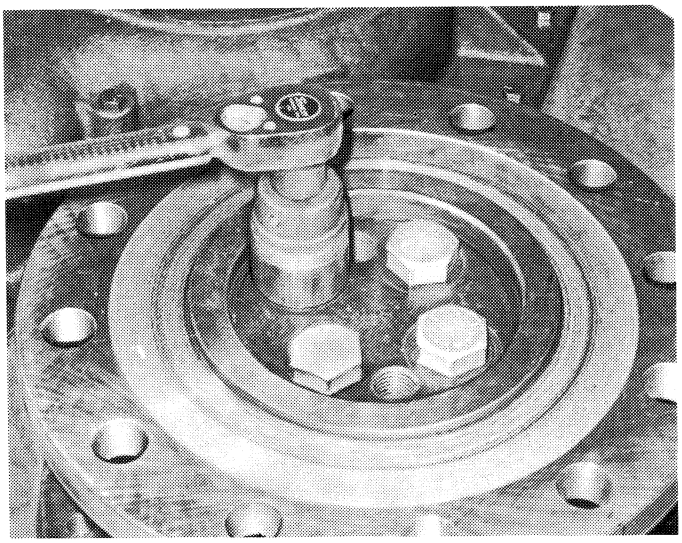


Figure 6-23. Removing or Installing Output Flange Retaining Screws.

4. Remove the retainer washer and shims. See Figure 6-24.

5. Remove O-ring (Figure 12-5, 15).

CAUTION

Output flange (Figure 12-5, 14) is very tight on the splines. Special tool T-16255-3 and a portable hydraulic press are required for removal.

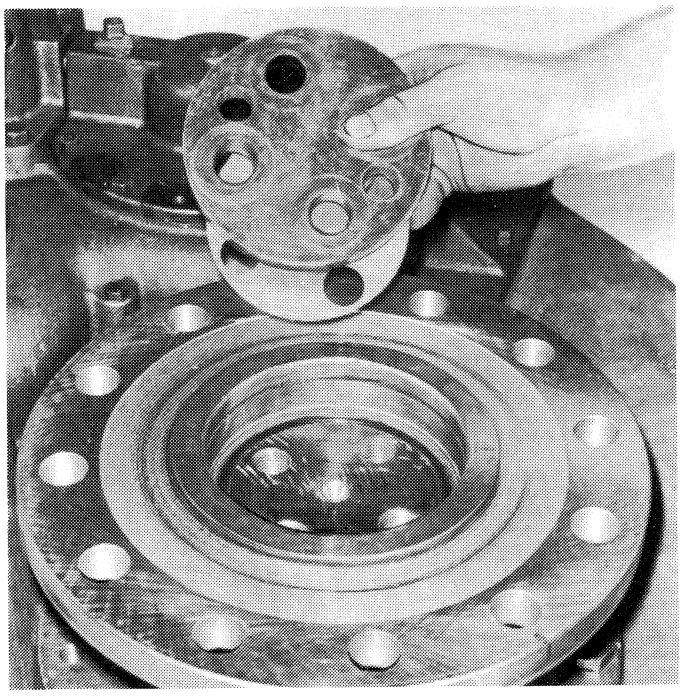


Figure 6-24. Retainer Washer and Shims Removed from Output Flange.

6. Remove the output flange. See Figure 6-25.

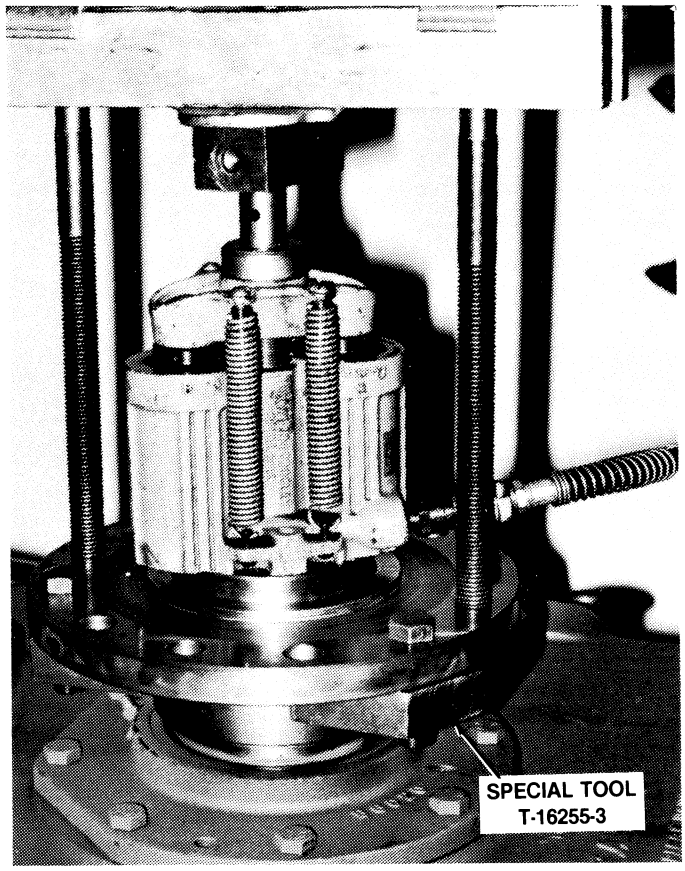


Figure 6-25. Using Hydraulic Press and Special Tool T-16255-3 to Remove Output Flange.

7. Remove hex-head screws (Figure 12-5, 11) from the output seal carrier (9) and remove the seal carrier and shims (8).

8. Remove O-ring (7).

9. Press the two oil seals (12) from the bore of the output seal carrier.

10. If necessary, press the bearing outer race (6) out of the output seal carrier.

11. Do not remove hydraulic fitting (10) unless parts are being replaced.

Removal of Main Housing Assembly.

1. Remove the hex-head screws (Figure 12-6, 36 and 44) that secure the main housing assembly (28) to the front half housing (37). See Figure 6-26.

2. Use two of the screws as pushers to separate the housing halves.

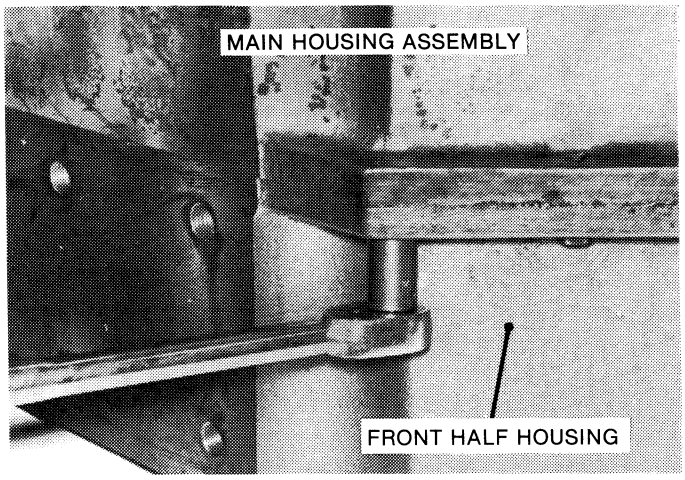


Figure 6-26. Removing or Installing Main Housing Retaining Screws.

3. Hoist the main housing assembly from the front half housing. See Figure 6-27.

4. If necessary, press roller bearing outer races (Figure 12-7, 12) from the bearing carriers.

5. Remove four place-head screws (Figure 12-6, 32) from oil pan (31) and remove the oil pan. See Figure 6-28.

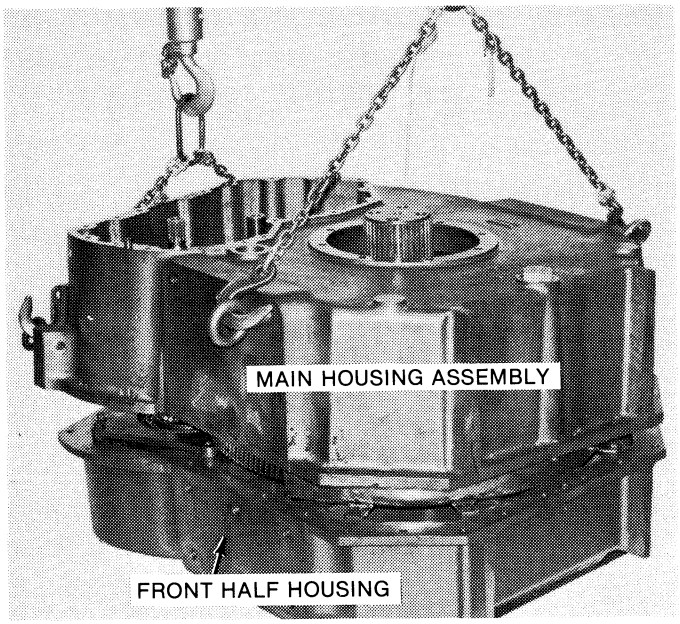


Figure 6-27. Removing or Installing Main Housing Assembly.

NOTE

The forward and reverse input pinions (see Figure 6-29) will be lifted when the output shaft and gear are hoisted. While one person operates the hoist, another must steady the two input pinions. When the output shaft and gear are raised a few inches, the pinions can be separated from the output gear and lowered.

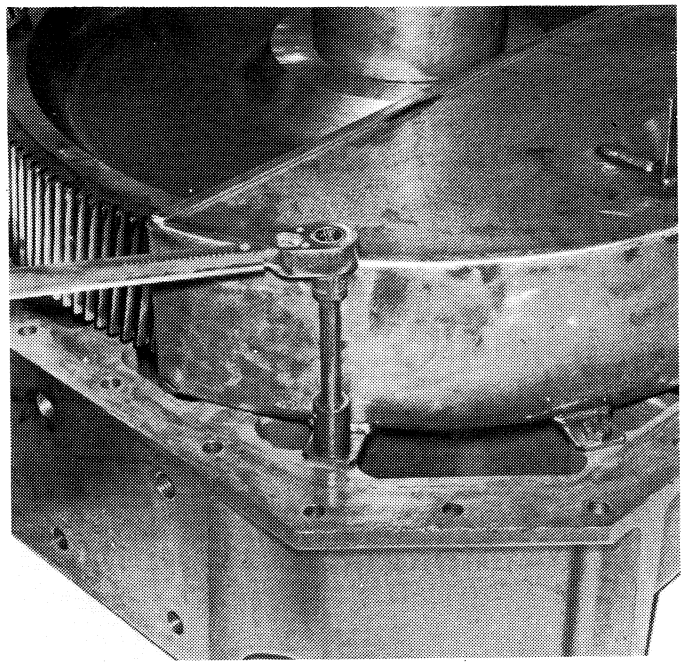


Figure 6-28. Removing or Installing Oil Pan.

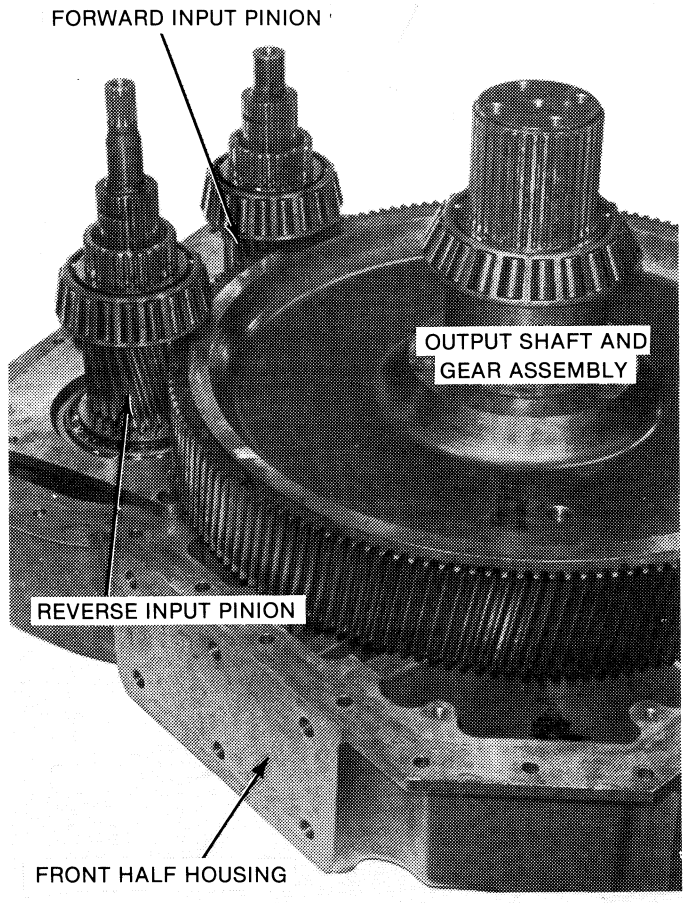
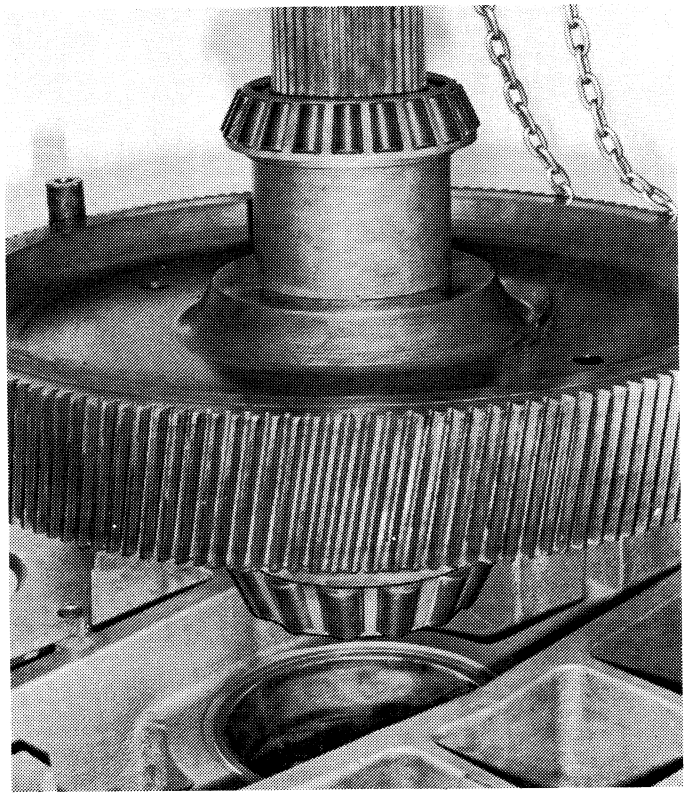


Figure 6-29. Output Group, Forward and Reverse Input Pinions Installed.

6. Attach eyebolts and a hoist to the rear end of the output shaft and gear assembly (Figure 12-5, 3).

7. Remove the output shaft and attached parts. See Figure 6-30.



C **Figure 6-30. Removing or Installing Output Group of Parts.**

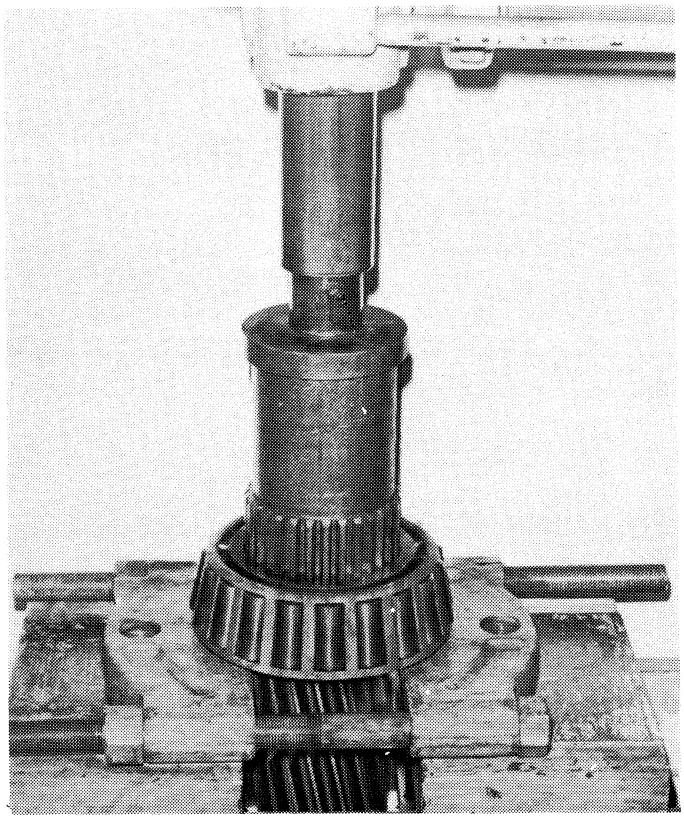


Figure 6-31. Removing Roller Bearing Inner Race from Input Pinion.

8. Remove the input pinions. Do not remove the roller bearing inner races from the input pinions unless parts are being replaced.

9. Remove the bearings, if necessary, with a bearing puller and press. See Figure 6-31.

10. Remove the place-head and 12 point head screws (Figure 12-7, 3 and 2) and remove the bearing carrier (1). See Figure 6-32.

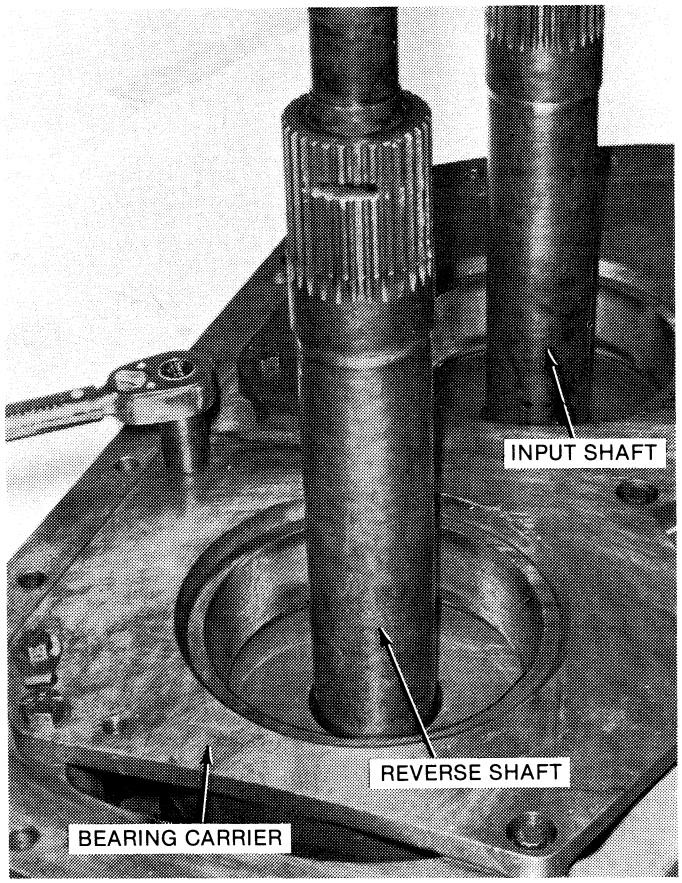


Figure 6-32. Removing or Installing Screws on Bearing Carrier.

11. The place-head screws (Figure 12-7, 6) and clamp plates (5) need not be removed unless parts are being replaced.

NOTE

Do not remove the bearing outer races (Figure 12-2, 18; Figure 12-3, 15; and Figure 12-7, 8) and oil catchers (7) from the bearing carrier (1) unless parts are being replaced.

12. If necessary, remove the bearing outer races using a hook-type bearing puller.

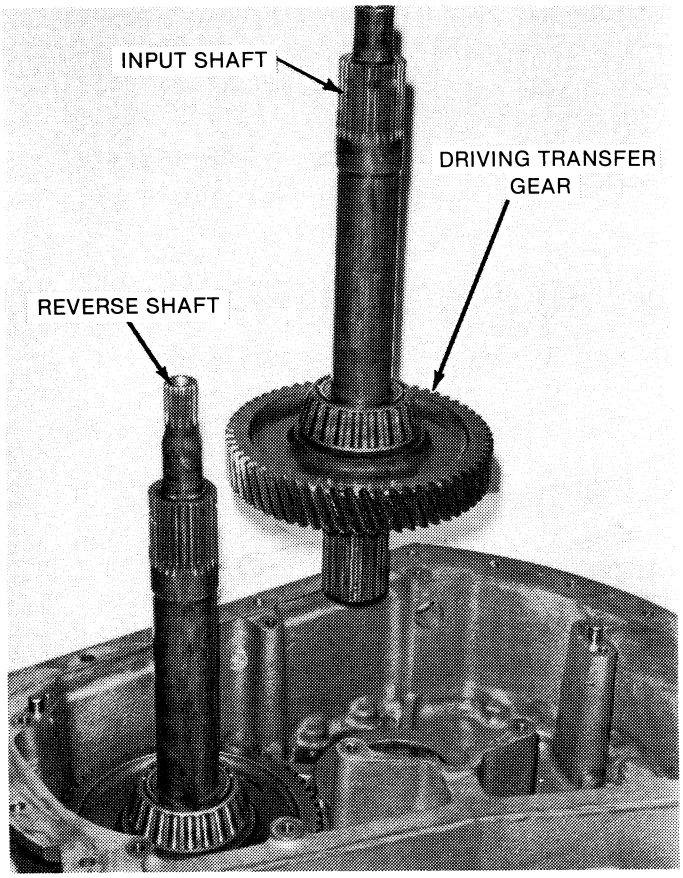


Figure 6-33. Input Shaft and Driving Transfer Gear Removed.

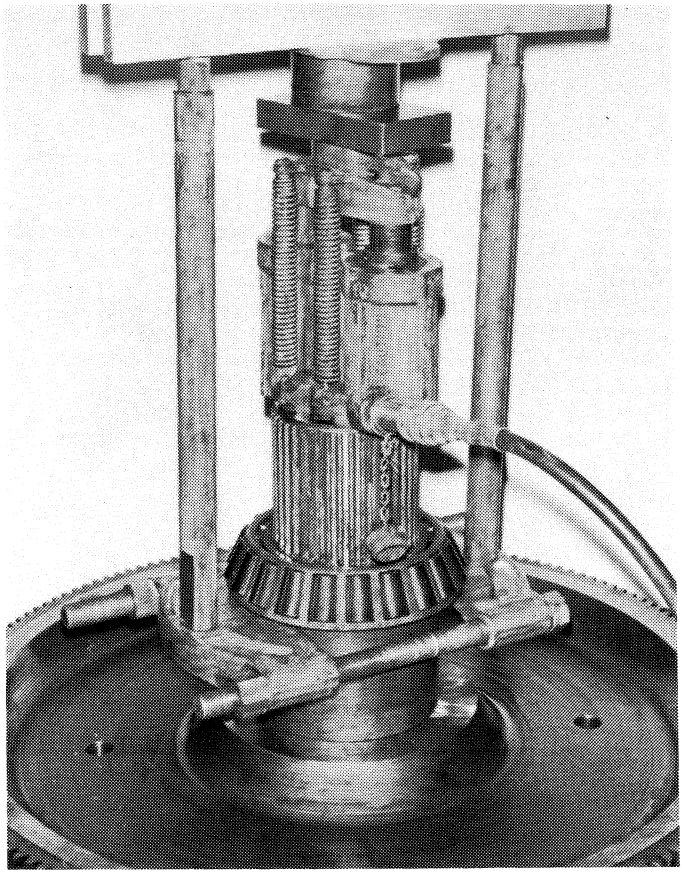


Figure 6-34. Removing Rear Bearing Inner Race from Output Shaft.

NOTE

Exercise care not to damage oil catchers (Figure 12-7, 7) when removing bearing outer races (Figure 12-2, 18; Figure 12-3, 15; and Figure 12-7, 8).

13. Remove the input shaft and driving transfer gear. See Figure 6-33.

NOTE

Do not remove the driving transfer gear (Figure 12-2, 15) and bearing inner races (14 and 17) on each side of the driving transfer gear unless parts are being replaced.

14. If necessary, remove the bearing inner races using a bearing puller.

15. Press the input shaft from the driving transfer gear.

16. Repeat steps 14 and 15 on reverse shaft.

Disassembly of Output Shaft Group.

1. Use a bearing puller to remove the front and rear roller bearing inner races (Figure 12-5, 2 and 5) from the output shaft. See Figure 6-34.

2. Remove the output gear retainer (Figure 12-5, 4).

NOTE

The output shaft and gear are not serviced separately. Do not remove the gear from the shaft.

NOTE

See Section 8 for disassembly and assembly instructions for the control valve assembly.

Section 7.
CLEANING AND INSPECTION

GENERAL.

This section was written to include all Twin Disc products. Therefore, some parts of the section may not apply to your unit.

CLEANING

General.

NOTE

Replace all oil seals, gaskets, O-rings, lock plates, piston rings, seal rings, snap rings, etc., as a part of any maintenance or overhaul procedure. Shims which could be damaged or destroyed in disassembly should also be replaced.

1. Using Stoddard® solvent, or equivalent or steam cleaning, clean all parts. Parts cleaned with solvent or steam cleaned must be dried and oiled immediately.

2. Examine all parts carefully for grit, dirt and abrasives and reclean them if necessary.

3. Clean all oil passages by working a piece of wire back and forth through the passages and then flushing them with cleaning solvent.

4. Use clean solvent to flush oil pumps, valves, etc.

5. Flush all hoses, tubing, coolers, etc., particularly if the unit is being disassembled due to an internal failure.

Cleaning Bearings.

Do not remove grease in which new bearings are packed. Thoroughly wash bearings that have been in service, in clean solvent. Soak bearing in solvent if they are particularly dirty or filled with hardened grease.

CAUTION

Never dry bearing with compressed air. Do not spin bearings while they are not lubricated. Oil bearings with SAE 10 engine oil immediately after cleaning. Be sure bearings are oiled before inspection.

Preventing Entrance of Dirt into Bearings.

Dirt and grit in bearings are aften responsible for bearing failure; consequently, it is important to keep bearings clean. Do not remove grease from new bearings. Keep the wrapper on new bearings until they are to be installed. Do not expose clean bearings if they are not to be assembled at once. Wrap them with a clean lint-free cloth or paper to keep out dust.

Previously Sealed Joints.

1. For previously sealed joints, scrape surfaces to remove old gasket material. Gel-type paint removers containing methylene chloride can be used to wipe off cured sealant.

2. Clean surfaces with 1, 1, 1-trichloroethane to remove oil and grease residue.

3. Test for clean surfaces by applying a few drops of cool water to the surfaces. Parts are sufficiently clean if water covers the surface of the part in a film. If the water puddles or forms beads, use fresh solvent and reclean.

INSPECTION.

Housings, Cast Parts, and Machined Surfaces.

NOTE

Units with matched housings require replacement of both halves. These must be kept in matched halves.

1. Replace cast parts or housings that are cracked.

2. Inspect bores for wear, grooves, scratches and dirt. Remove burrs and scratches with crocus cloth or soft stone. Replace parts that are deeply grooved or scratched.

3. Inspect oil passages for obstructions. If an obstruction is found, remove it with compressed air or by working a wire back and forth through the passage and flushing it with solvent.

4. Inspect machined surfaces for burrs, scratches, nicks and foreign matter. If such defects cannot be removed with crocus cloth or a soft stone, replace the part.

5. Inspect threaded openings for damaged threads. Chase damaged threads with a tap of the correct size.

6. Inspect studs for damaged threads and looseness. Replace defective studs.

7. Inspect dowel pins for wear or damage. Replace defective dowels. This applies where matched set of parts is not involved.

8. Inspect dowel pin holes for wear due to movement between mating parts. If a dowel pin hole is worn, rebore and sleeve the hole when possible. Otherwise, replace the parts. This applies where matched set of parts is not involved.

Valve Seats.

Inspect valve seats for burrs, nicks and scratches. If these defects cannot be removed with a crocus cloth, replace the part. Check to see that the valve is seating properly after reworking the valve seat.

Bearings.

1. Inspect bearings for roughness of rotation. Replace the bearing if the rotation is rough.

2. Inspect bearings for corrosion, scored, scratched, cracked, pitted or chipped races, and for indication of excessive wear of balls or rollers. If one of these defects is found, replace the bearing.

3. Inspect bearing bores and shafts for grooved, burred, or galled conditions that would indicate that the bearing has been turning in its housing or on its shaft. If the damage cannot be repaired with a crocus cloth, replace the part.

Bushings and Sleeves.

Inspect bushings for size and out-of-roundness, scores, burrs, sharp edges, and evidence of overheating. Remove scores with a crocus cloth. If the bushing is out-of-round, deeply scored, or excessively worn, replace it.

Thrust Washers and Spacers.

Inspect thrust washers for distortion, scores, burrs and wear. Rework or replace any defective thrust washers or spacers.

Gears.

1. Inspect gears for scuffed, nicked, burred or broken teeth. If the defect cannot be removed with a soft stone, replace the gear.

2. Inspect gear teeth for wear that may have destroyed the original tooth shape. If this condition is found, replace the gear.

3. Inspect thrust faces of gears for scores, scraches and burrs. If these defects cannot be removed with a soft stone, replace the gear.

Splined Parts.

Inspect splined parts for stripped, twisted, chipped or burred splines. Remove burrs with a soft stone. Replace the part if other defects are found.

Clutch Plates.

1. Inspect the clutch driving plates for cracked or glazed surfaces, or for cracked, worn or broken teeth. Check for excessive wear. Replace damaged or worn driving plates.

2. Inspect the clutch steel plates for discoloration and warpage. Replace damaged steel plates.

Snap Ring.

Replace damaged or distorted snap rings.

Springs.

Inspect springs for broken or distorted coils. Replace the spring if either of these defects are found.

Flexible Hoses.

Inspect all flexible hoses for cracks and sponginess. Replace damaged hoses.

Section 8.
SUBASSEMBLIES

CONTROL VALVE.

Disassembly.

NOTE

MG-520 deep case units with serial numbers 3M0846 and above and MG-520 shallow case units with serial numbers 3M0888 and above have new style control valves (Figure 12-9). This pertains only to those units cited above. The original manual should be retained for units below serial numbers cited above.

NOTE

Steel ball (Figure 12-9, 8) is under pressure from spring (9). Care must be taken when removing cover (10) and orifice plate (12) to prevent loss of steel ball.

C

1. Remove four screws (6), cover (10), orifice plate (12), gaskets (7), steel ball (8) and spring (9).

2. Remove rate-of-rise piston (11), inner spring (14), outer spring (15), and high pressure regulator valve piston (16). Shims (13) are in the spring pocket of piston (11).

3. Remove O-ring plug (29), O-ring (28), detent spring (27), and detent (26).

4. Loosen screw (31) and remove shift lever (33).

5. Drive out roll pin (23) with a drift.

6. Remove four screws (34) and remove valve stem (17). Valve cover (24) and parts (19 through 22) will come off with the valve stem.

7. Press valve stem (17) out of valve cover (24).

8. Remove oil seal (21), and O-ring (20) from valve cover (24). Remove gasket (25).

9. Remove two thrust washers (19) and needle thrust bearing (22) from valve stem (17).

CLEANING AND INSPECTION.

See Section 7.

ASSEMBLY.

1. Install two thrust washers (19) with needle thrust bearing (22) in between them.

2. Install valve stem (17) into valve body (30).

3. Index the recess in the valve stem with the detent hole in the valve body, and install detent (26), detent spring (27), O-ring (28), and O-ring plug (29).

4. Install oil seal (21) into valve cover (24), with lip toward the control lever. Install O-ring (20).

5. Install gasket (25) and valve cover (24). Secure with capscrews (34). Torque the screws 15 ± 2 lb. ft.

6. Install stop collar (32) and roll pin (23).

7. Place the valve on a working surface, bottom side down. Install shift lever (33) so that the lever is parallel with the working surface when the valve is in the neutral position. Note movement of lever when properly positioned in Figure 8-1.

8. Torque screw (Figure 12-9, 31) 11 ± 1 lb. ft.

9. Install high pressure regulator piston (16), inner spring (14), outer spring (15), shims (13), and rate-of-rise piston (11).

10. Install spring (9), steel ball (8), and two gaskets (7) one on each side of orifice plate (12). Install orifice plate (12) and cover (10). Secure with screws (6). Torque the screws 7 ± 1 lb. ft.

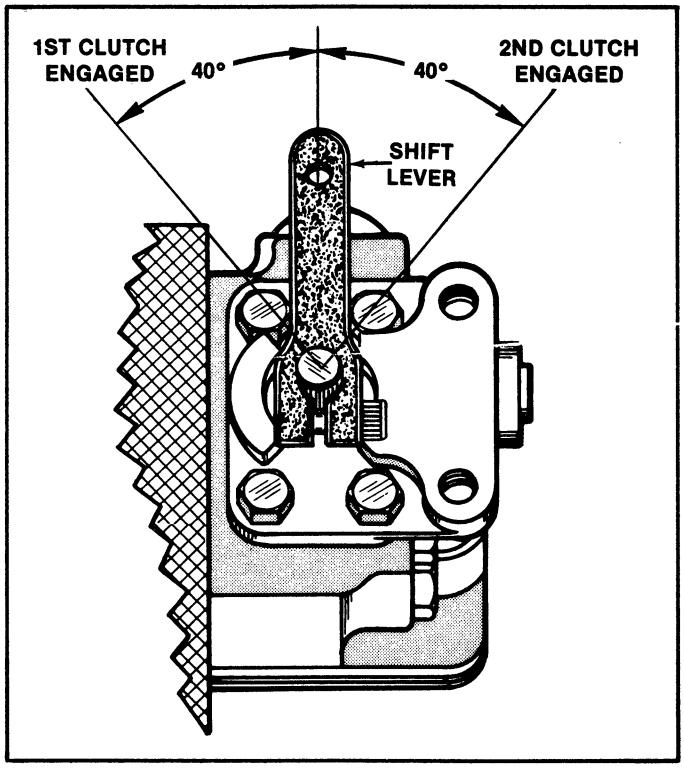


Figure 8-1. Mounting Position for Shift Lever.

Section 9.
UNIT ASSEMBLY AND INSTALLATION

NOTE

Place the inner race of all roller bearings in a 275 degree F. oven for 30 minutes minimum.

CAUTION

Submerge all friction clutch plates in transmission oil for one hour minimum before installing.

NOTE

Oil torque values are given for all screws; therefore, screws should be oiled before installing. See Section 12 for torque value chart.

NOTE

In the discussion that follows, the input side of the transmission is the front and the output side is the rear.

ASSEMBLY (INPUT SHAFT).

1. If the driving transfer gear (Figure 12-2, 15) was removed from the input shaft (16), proceed as follows:

NOTE

Do not heat the gear nor chill the shaft. Gear and shaft must be at room temperature during assembly process.

a. Clean the mating tapered surfaces of the shaft and gear with 1, 1, 1-trichloroethane which meets OSHA requirements.

b. Seat gear on shaft taper using 100-200 lbs. maximum force. This is the ready position. See Figure 9-1.

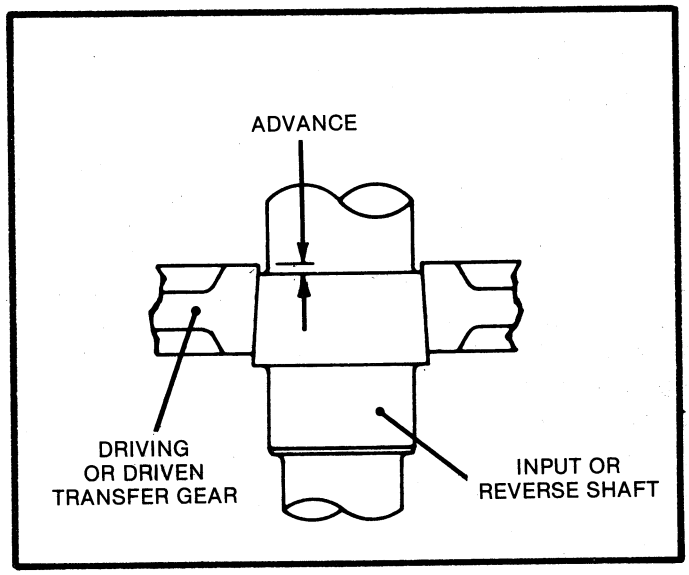


Figure 9-1. Advance of Gear on Shaft.

c. Measure and record the distance from the front end of the shaft to the front face of the gear with the gear in ready position.

d. Advance each gear to within 0.000 to 0.002 inch of shaft shoulder at the small diameter of the taper. A static press force of approximately 68,000 to 102,000 lbs. will be required.

e. The advance must be between 0.089 and 0.133 inch (0.111 nominal expected).

f. If the advance is not within the above tolerances, contact the nearest Twin Disc distributor or the Service Engineering Department, Twin Disc, Incorporated, Racine, Wisconsin U.S.A.

2. Install the heated bearing inner races (Figure 12-2, 14 and 17) onto the input shaft. Seat the bearing inner races flush against the shoulders on the shaft.

3. Install bearing outer race (Figure 12-2, 13) into the front half housing (Figure 12-6, 37). Press the race in flush with the rear end of the bore in the housing.

4. Install bearing outer race (Figure 12-2, 18) into the bore of the bearing carrier (figure 12-7, 1).

5. Press in oil catcher (Figure 12-7, 7), flanged end toward the input side, and seat it in the bore of the bearing carrier (1).

C 6. Install bearing outer race (8) into the bearing carrier.

NOTE

Deep case units with serial numbers above 3L2759 and shallow case units with serial numbers 3L1966 and above will have input shafts adaptable to drive a pump. Units with serial numbers below those cited can be adapted to the pump drive by changing the input shaft to one with part number A-7375.

7. Install the input shaft. See Figure 6-32.

8. Repeat steps 1 through 7 on the reverse shaft and parts.

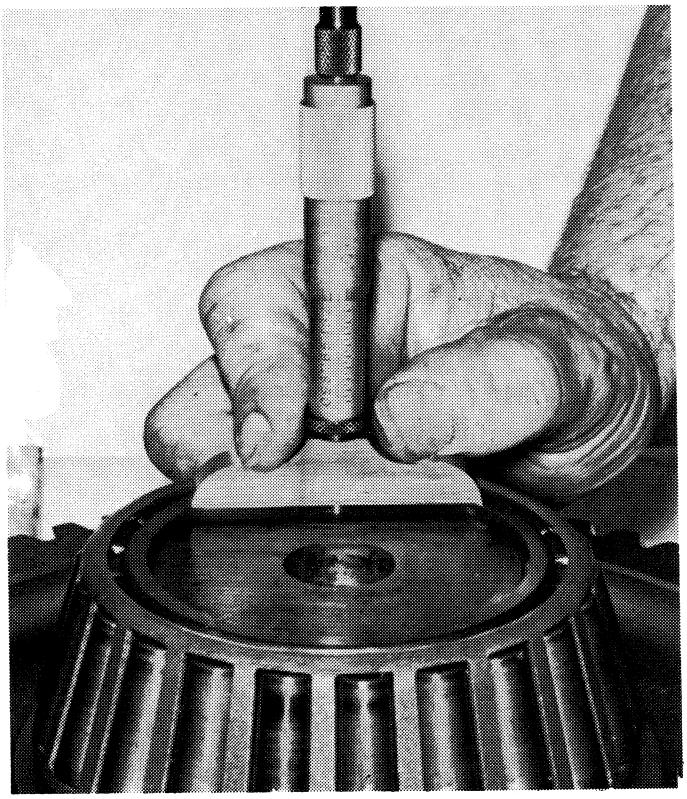


Figure 9-2. Measuring Distance from Front of Front Roller Bearing Inner Race to Front of Reverse Shaft.

NOTE

Measure and record the distance from the bearing cage to the front end of reverse shaft. See Figure 9-2. This measurement is for shimming and it cannot be made as easily after the front half housing is installed.

9. Install bearing carrier (Figure 12-7, 1), aligning the dowel pins (4) and holes, and secure the carrier with four 12-point head screws (2) and five place-head screws (3). Torque the screws 95 lb. ft.

10. Install two clamp plates (5), if removed, over the dowel pins.

11. Secure each clamp plate with a place-head screw (6). Torque the screws 42 lb. ft.

12. Install roller bearing outer race (Figure 12-5, 1) into the front half housing (Figure 12-6, 37).

13. If removed, install roller bearing inner race (Figure 12-5, 2) onto the front of the output shaft and gear assembly (3).

14. Install the output gear retainer (4) onto the shaft so that it fits snugly against the output gear.

15. Install roller bearing inner race (5) snugly against the output gear retainer.

16. Install roller bearing inner races (Figure 12-7, 9 and 11) against the shoulders on the input pinions (10).

17. Install the input pinions.

18. Lower the output shaft and attached parts into place. The input pinions will have to be raised and meshed with the output gear. See Figures 6-28 and 6-29.

19. Install the oil pan (Figure 12-6, 31) over the output gear and secure it to the front half housing with four place-head screws (32). Torque the screws 95 lb. ft.

Assembly of Housing.

1. To join the front and rear halves of the housing with an anaerobic plastic gasket, proceed as follows:

a. For previously sealed joints, scrape surfaces to remove old gasket material. Gel type paint removers containing methylene chloride can be used to wipe off cured sealant.

CAUTION

Follow vendor directions to prevent chemical burns to the skin.

b. Clean surfaces with 1, 1, 1-trichloroethane to remove oil and grease residue.

c. Test the clean surfaces by applying a few drops of cool water to the surfaces. Parts are sufficiently clean if water covers the surface in a film. If the water puddles or forms beads, use fresh solvent and reclean.

d. Use Twin Disc primer MA-579 (LOCQUIC T) or equivalent primer on both mating surfaces. Allow primer to dry. This usually takes three to four minutes. Keep surfaces clean and free of oil and grease from this point on.

e. Apply a 1/16-inch continuous bead of Twin Disc M-2828-A anaerobic plastic sealant to one surface on the side of bolt holes toward fluid being retained. Be certain that narrow overlap areas are covered. It is optional to spread material into a thin film just before mating surfaces are assembled.

2. Install the rear half housing over the front half (see Figure 6-26), aligning the two dowel pins with their holes and being careful not to damage bearings or gears.

3. Install the hex-head screws (see Figure 6-25) that secure the main housing to the front half housing. Torque the screws 68 lb. ft.

4. Allow two hours curing time, at room temperature, for the sealant before filling the unit with oil. If the primer (step d) was not applied, allow 24 hours curing time for the sealant.

NOTE

No oil leakage is permissible. If any leakage is present, the housing must be disassembled and steps 1a through 1e repeated.

5. Install the two clamp plates (Figure 12-6, 34) if removed, over the dowel pins (33). Secure the clamp plates with one hex-head screw (35) each. Torque the screws 30 lb. ft.

6. Adjust the reverse input pinion roller bearings (Figure 12-7, 9 and 11) as follows:

a. Install an 0.080 inch trial shim pack and bearing carrier assembly (Figure 12-7, 14).

b. Secure the bearing carrier assembly with eight hex-head screws (15). Torque the screws 30 lb. ft.

c. To check the endplay, install special fixture T-18642 (See Section 11) over the splines of the input pinion. See Figure 9-3.

d. Place a steel block (approximately 2 x 2 x 2 inches) onto each side of the fixture. Place a piece of 4-inch I.D. steel tubing 9 inches long, over the shaft (forward or reverse) so that the tubing rests solidly on the steel blocks. See Figure 9-3.

e. Apply 300-500 lb. weight to the pinion.

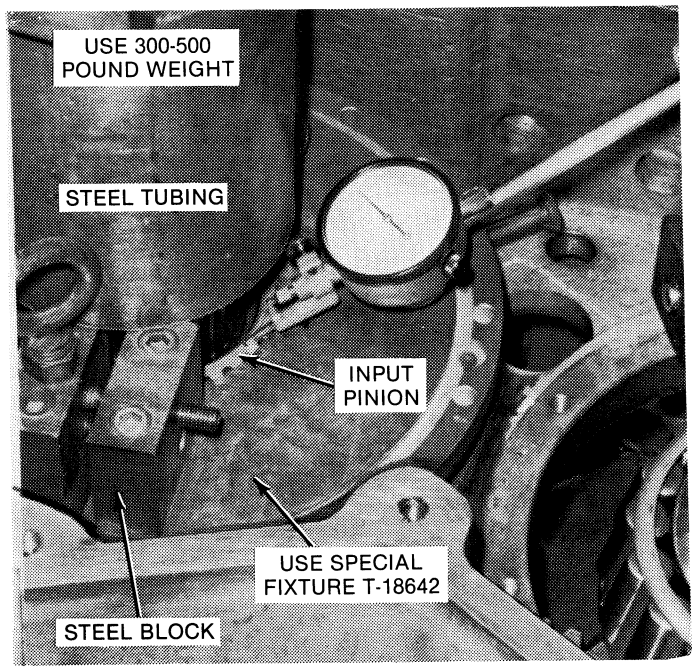


Figure 9-3. Forward Force Applied to Input Pinion.

CAUTION

Partially support the weight with the hoist to prevent it from falling.

f. Rotate the pinion several times.

g. Attach a dial indicator to a machined surface of the housing and rest the indicator finger on the rear end of the input pinion. See Figure 9-3.

h. Zero the indicator and mark the spot where indicator finger rests on the input pinion with a felt tip marker.

i. Remove the thrust and install the 3/8-inch eyebolts into the holes provided in the fixture.

NOTE

Use extreme care not to bump the indicator.

j. Attach a sling to the eyebolts and use a fish scales and hoist to apply 300-500 lb. rearward thrust to the input pinion.

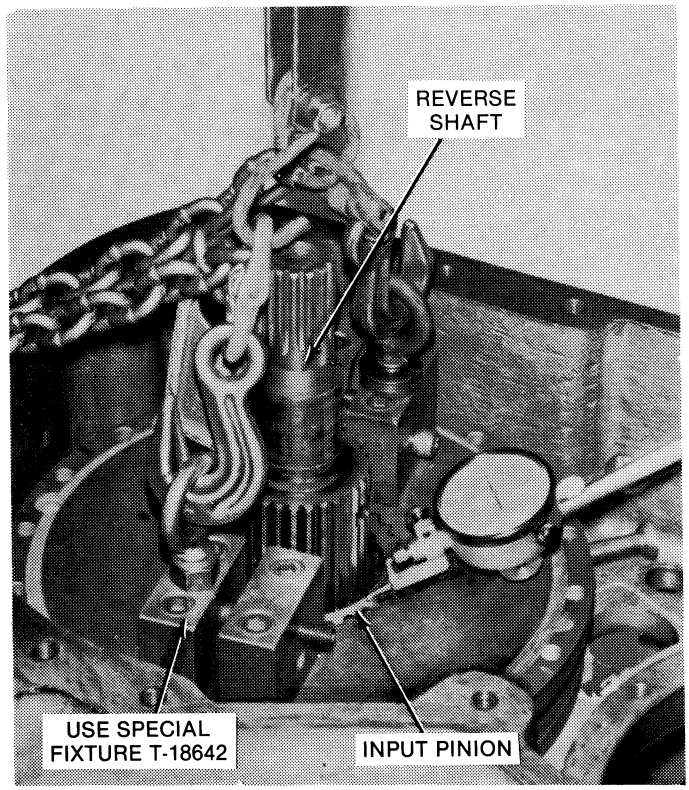


Figure 9-4. Rearward Force Applied to Input Pinion.

k. Oscillate the input pinion several times. Oscillate as far as possible without bumping the indicator. Stop with the finger resting on the spot previously marked.

l. The indicator reading is the endplay.

NOTE

At this point, the endplay should be between 0.010 and 0.020 inch.

m.Remove the shims to reduce the endplay to approximately 0.005 inch. Repeat steps a. through l. above.

n. Remove the shims to adjust the endplay to 0.0005 to 0.0015 inch.

o. Repeat steps a. through l. above.

NOTE

Removal of shims in two steps as in m. and n. above is necessary to prevent false readings due to cocking of the input pinion as the adjustment is being made.

p. The final endplay check must indicate that the endplay is between 0.0005 and 0.0015 inch.

q. Repeat steps a. through p. above on the forward input pinion.

7. Check the endplay of the output shaft as follows:

a. Install the output seal carrier (Figure 12-5, 9) without shims (8), O-ring (7), or oil seals (12), If removed.

b. Secure the carrier with hex-head screws (11) and tighten finger tight.

c. Use a thickness gauge to determine the gap between the output seal carrier and the main housing assembly (Figure 12-6, 28). Measure the gap in four equally spaced places. Take an average of these measurements, and add 0.003 to 0.006 inch to determine the amount of shim for a trial shim pack.

d. Install two oil seals (Figure 12-5, 12) if removed, into the bore of output seal carrier (9). The lip of the forward seal faces forward; the lip of the rear seal faces rearward. Press in the seals so that the forward seal is flush with the front of the bore and the rear seal is flush with the rear of the bore. This leaves a space for grease between the seals.

e. Install calculated shim pack under the output seal carrier and install O-ring (7).

f. Secure with eight hex-head screws (11). Torque the screws 140 lb. ft.

g. Check the endplay by installing two eyebolts into the end of the output shaft and applying 300-900 lb. downward thrust to the output shaft. See figure 9-5.

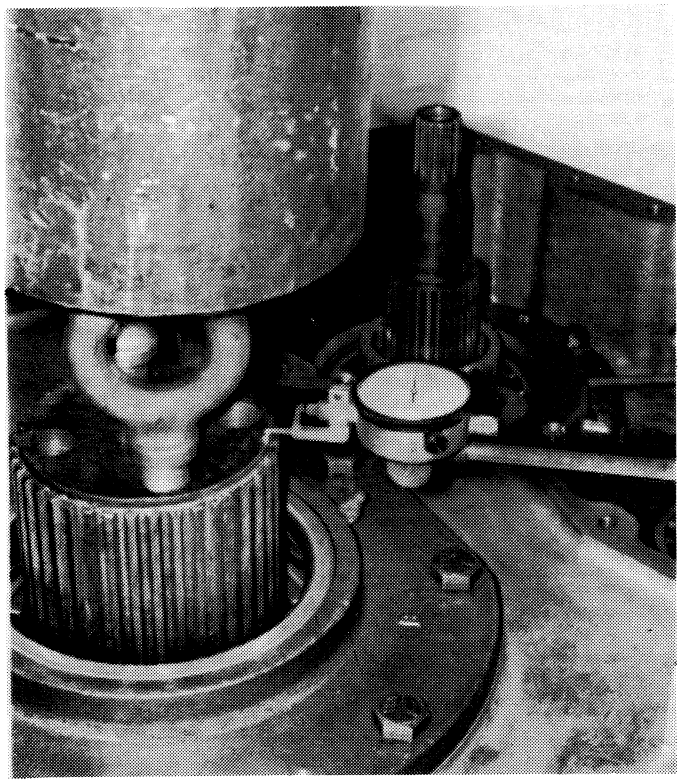


Figure 9-5. Applying Forward Force on Output Shaft.

h. With the thrust applied, rotate the shaft several times in each direction.

i. Install an indicator onto the housing with the finger resting on the rear of the output shaft. See Figure 9-5.

j. Zero the indicator and mark the spot with a felt marker where the reading was taken.

k. Remove the downward thrust.

l. Attach a sling to the eyebolts and use a hoist and fish scales to apply 1500-1700 lb. upward thrust on the shaft. See Figure 9-6.

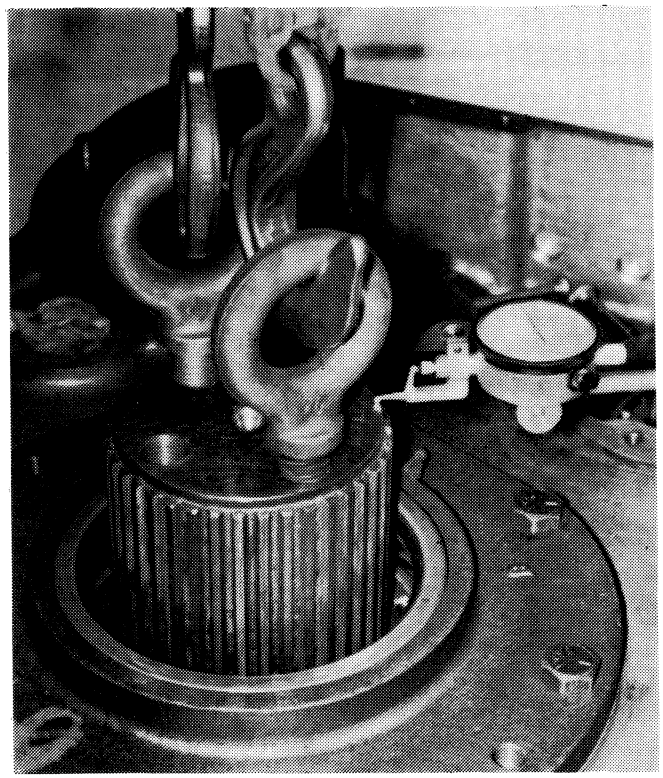


Figure 9-6. Applying Rearward Force on Output Shaft.

m. Rotate the shaft several times in each direction. Stop with the finger on the spot previously marked.

n. The indicator reading is the endplay.

o. Remove or add shims to adjust the endplay to 0.0030 and 0.0060 inch.

p. Recheck endplay using procedure in steps e through n above.

8. Turn the unit over, input side up, and shim the reverse shaft bearings as follows:

a. Install the reverse bearing retainer (Figure 12-3, 4) without shims (5), O-ring (6), cover (2), or O-ring (3).

b. Secure the retainer with three equally spaced screws (1), finger tightened.

c. Determine the established shim pack by measuring the gap between the bearing retainer and the front housing. Measure in three places and average the measurements. Add 0.0025 inch to determine estimated shim pack. See Figure 9-7.

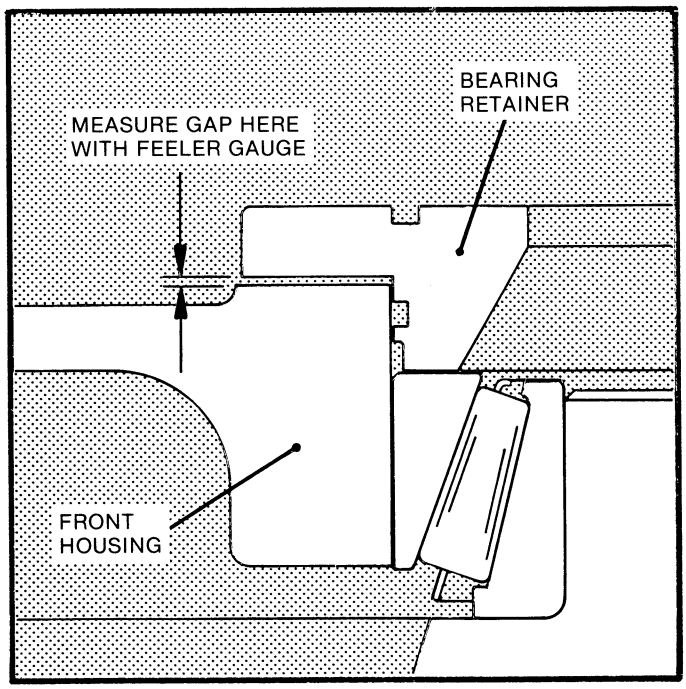


Figure 9-7. Measuring Gap Between Bearing Retainer and Front Housing.

d. Install the estimated shim pack and O-ring (6). Secure the retainer and shims with six hex-head screws (1). Torque the screws 30 lb. ft.

e. Install an eyebolt into the end of the reverse shaft.

f. Apply 300-500 lb. downward thrust onto the reverse shaft. See Figure 9-8.

g. Rotate the shaft several times.

h. With the thrust still applied, install an indicator with the finger resting on the end of the shaft. Zero the indicator and felt tip mark the spot where the reading was taken.

i. Remove the thrust and attach a sling, fish scales, and hoist to the eyebolt. Apply 300-500 lb. upward thrust. See Figure 9-9.

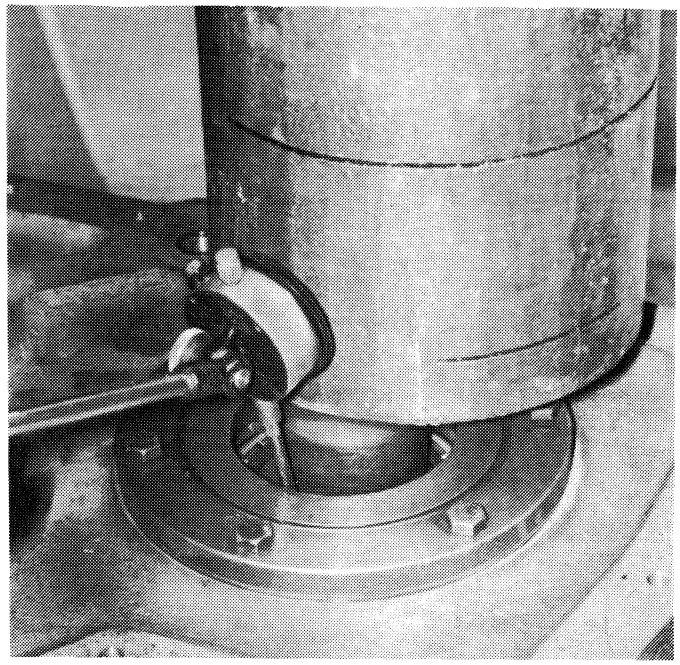


Figure 9-8. Applying Rearward Thrust to Reverse Shaft.

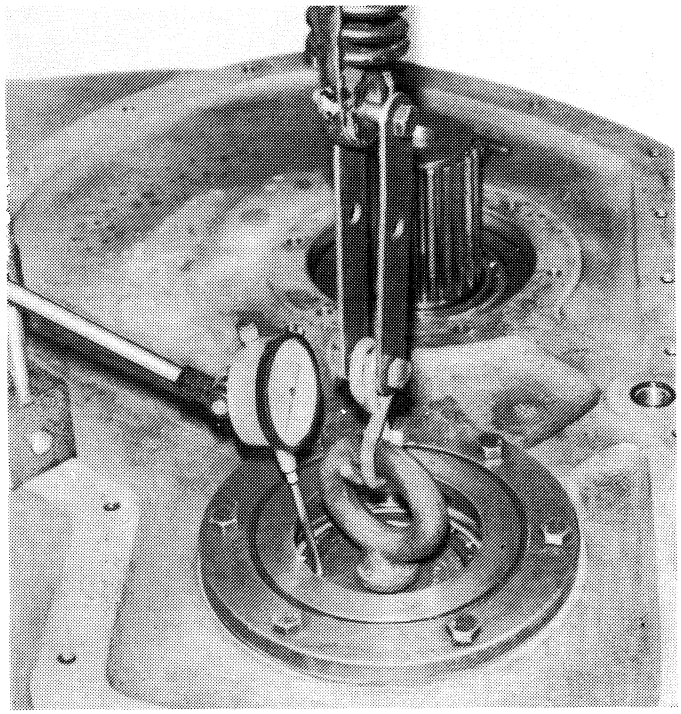


Figure 9-9. Applying Forward Thrust to Reverse Shaft.

j. Rotate the shaft several times and stop with the finger resting on the previously marked spot.

k. The indicator reading is the endplay. Add or remove shims to adjust the endplay to 0.0005 to 0.0025 inch.

l. Recheck the end play by repeating steps d. through k. above.

m. Determine the amount of shims needed for retainer washer (Figure 12-3, 8) from the previous measurement of the gap between the bearing inner race and the front end of the shaft. See Figure 9-2. The shim pack is 0.005-0.010 less than the gap.

n. Install shim pack and retainer washer. Secure with hex-head screw (Figure 12-3, 7). Torque the screw 240 lb. ft.

o. Remove hex-head screws (Figure 12-3, 1) and install O-ring (3) and reverse shaft cover (2). Secure with six hex-head screws (1). Torque the screws 30 lb. ft.

9. Install lip-type oil seal (Figure 12-2, 8) into the input bearing retainer (10) so that the lip is toward the oil being retained.

10. Shim roller bearings (13, 14, 17 and 18) and check endplay of the input shaft as follows:

a. Install input bearing retainer (10) without shims (11) or O-ring (12).

b. Secure the retainer with three hex-head screws (9) evenly spaced and finger tightened.

c. Measure the gap between the retainer and the housing with a thickness gauge. Measure in three places and average the three readings. The estimated thickness of the shim pack is this average plus 0.0025 inch.

d. Install O-ring (12), the estimated shim pack, and input bearing retainer (10). Secure with six hex-head screws (9). Torque the screws 30 lb. ft.

e. Install an eyebolt into the front of the input shaft (16).

f. To check the endplay, apply 300-500 lb. downward thrust onto the front end of the input shaft.

g. Rotate the shaft several times in each direction.

h. With thrust still applied, install an indicator so that the finger rests on the front end of the input shaft.

i. Felt mark the spot where the indicator finger rests and zero the indicator.

j. Remove the downward thrust, and use a sling, fish scales, and hoist to apply 300-500 lb. upward thrust onto the input shaft.

k. Rotate the shaft several times in each direction and stop with the finger resting on the spot previously marked.

l. The indicator reading is the endplay. Add or remove shims to adjust the endplay to 0.0005 to 0.0025 inch. Recheck using procedure in steps d. through l. above.

11. Install the front housing (Figure 12-6, 43) and secure with twenty hex-head screws (41). Torque the screws 30 lb. ft.

12. If wear sleeve (Figure 12-2, 7) was removed from drive spider (6), press on a new one using special tool T-16302 (see Section 11).

13. Install the drive spider assembly. See Figure 9-10.

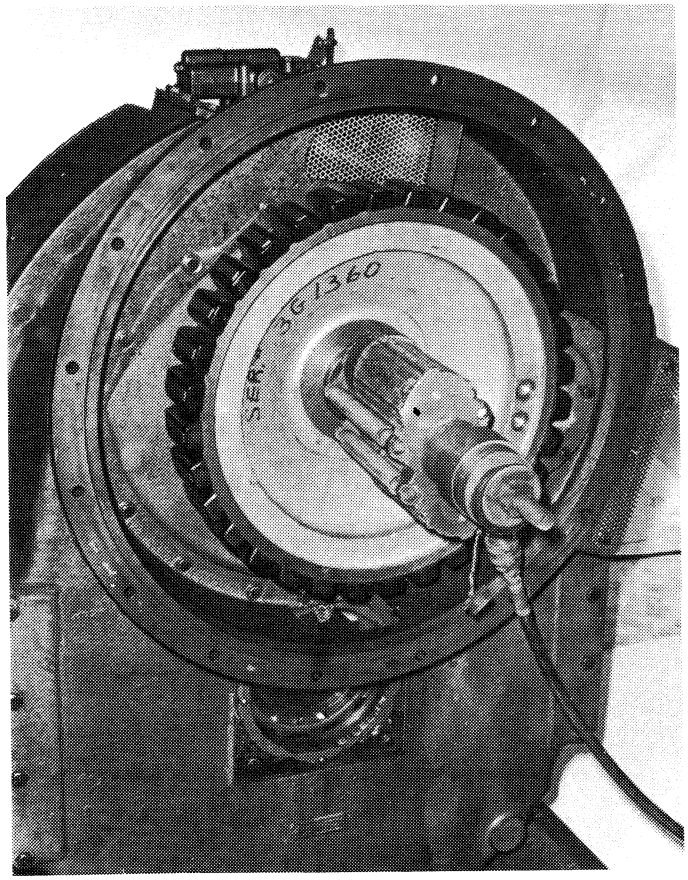


Figure 9-10. Installing Drive Spider Assembly.

14. Measure the gap between the front face of the drive spider and the front end of the input shaft. See Figure 9-11.

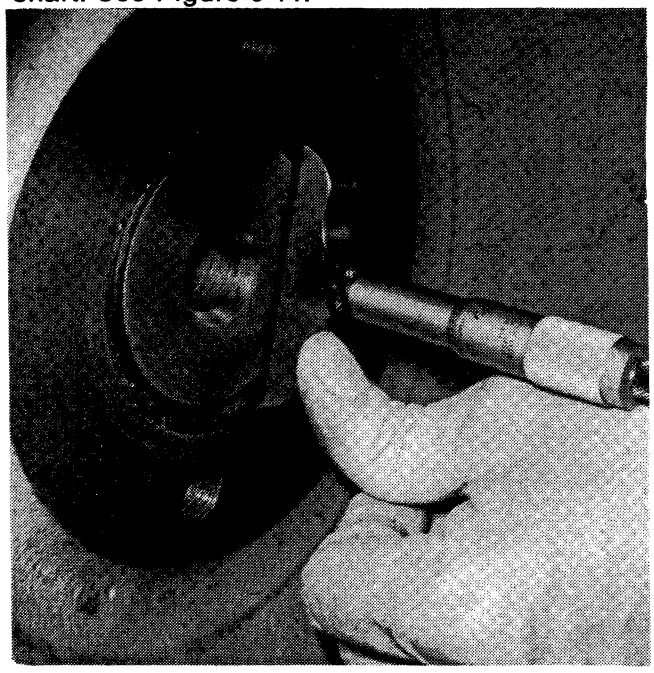


Figure 9-11. Measuring Gap Between Drive Spider and End of Input Shaft.

15. Install lathe cut ring (Figure 12-2, 3).

16. Install shims 0.005 to 0.010 inch thinner than the gap under retainer washer (2). Secure retainer washer and shims with hex-head screw (1). Torque the screw 240 lb. ft.

Assembly of Clutches. (See Figure 9-12).

1. Turn the unit over, output side up. Assemble clutch backplates (Figure 12-2, 20 and Figure 12-3, 17) to the clutch drive sleeves (Figure 12-2, 21 and Figure 12-3, 18).

MG520 has 16 screws.

MG520-1HP has 28 screws.

2. Use a portable hydraulic press to seat the assemblies. See Figure 9-13.

3. Install the clutch hubs (Figure 12-2, 25 and Figure 12-3, 22).

4. Tighten dowel screws (Figure 12-2, 27 and Figure 12-3, 24). See Figure 6-20. Torque the screws 42 lb. ft.

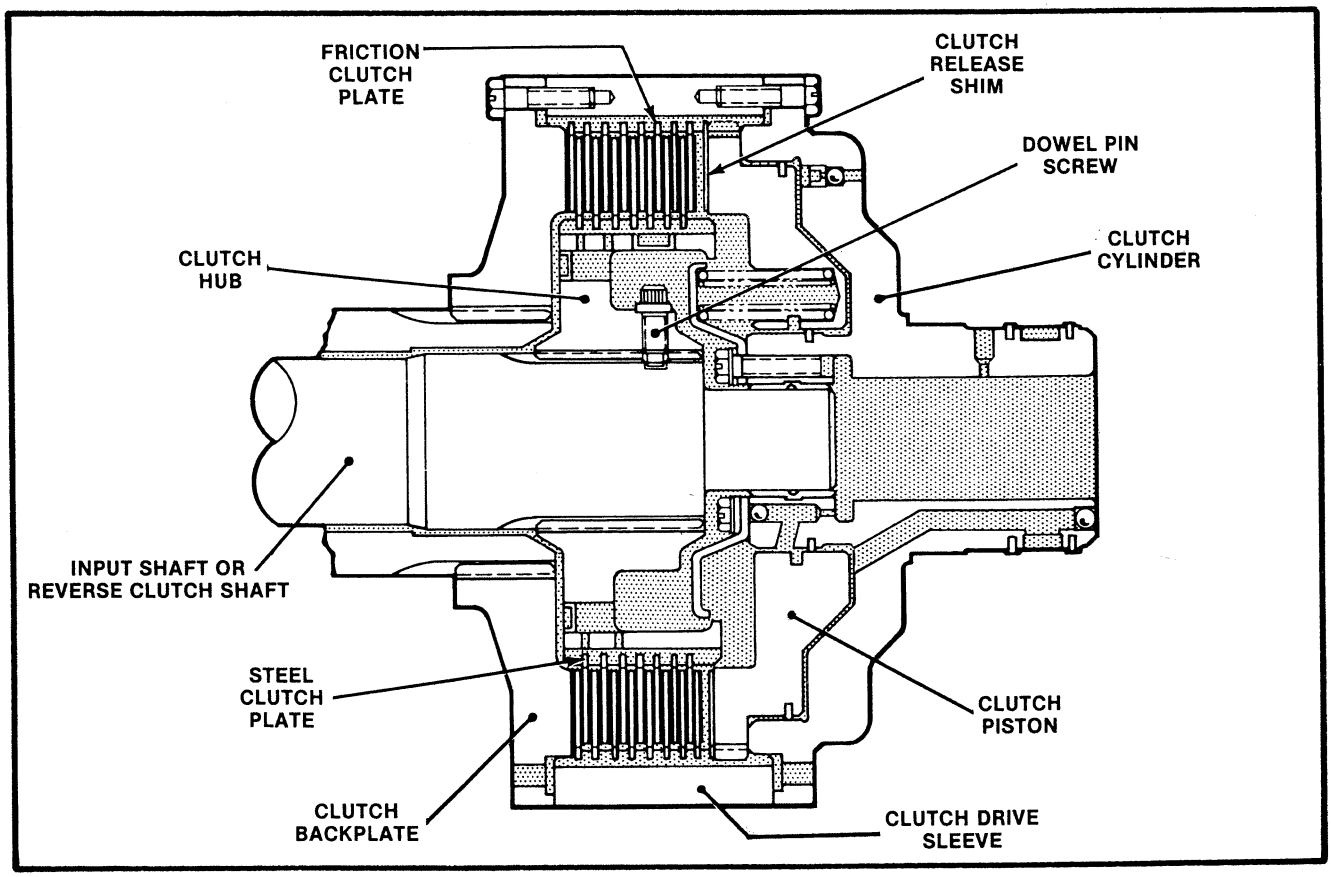


Figure 9-12. Forward or Reverse Clutch.

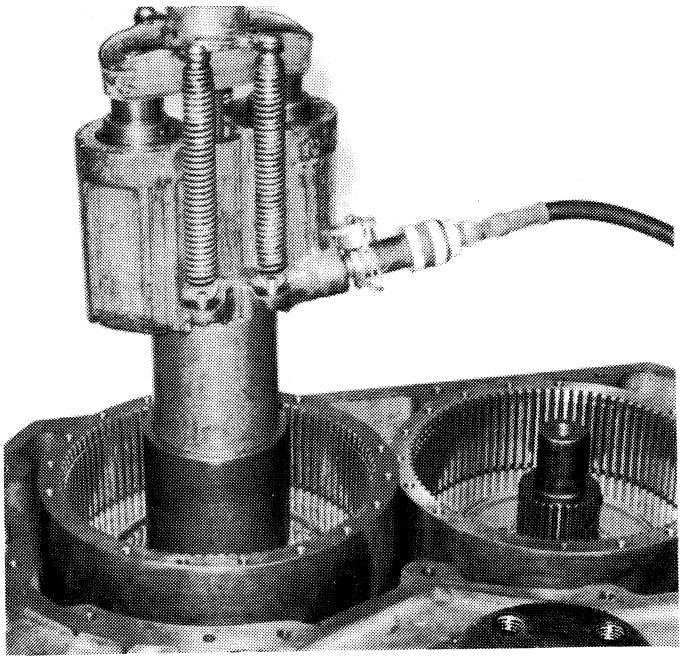


Figure 9-13. Installing Clutch Backplate and Drive Sleeve Assembly.

NOTE

Be sure the dowel screws fit into the slots provided in the input and reverse shafts.

5. Begin with a friction clutch plate and alternate with steel plates to install 8 friction and 7 steel plates onto each clutch hub.

6. Determine the amount of clutch release shims (Figure 12-2, 24 and Figure 12-3, 21) as follows:

a. Measure the distance from the rear of the clutch drive sleeve to the first clutch plate. See Figure 9-14.

b. Measure the distance from the rear of the clutch piston to the flange on the clutch cylinder. See Figure 9-15.

c. The difference between the measurements is the clutch release clearance.

d. Add shims to adjust the clutch release clearance to 0.080 to 0.128 inch. Shims are 0.048 inch nominal.

e. Recheck above measurements after installing shims.

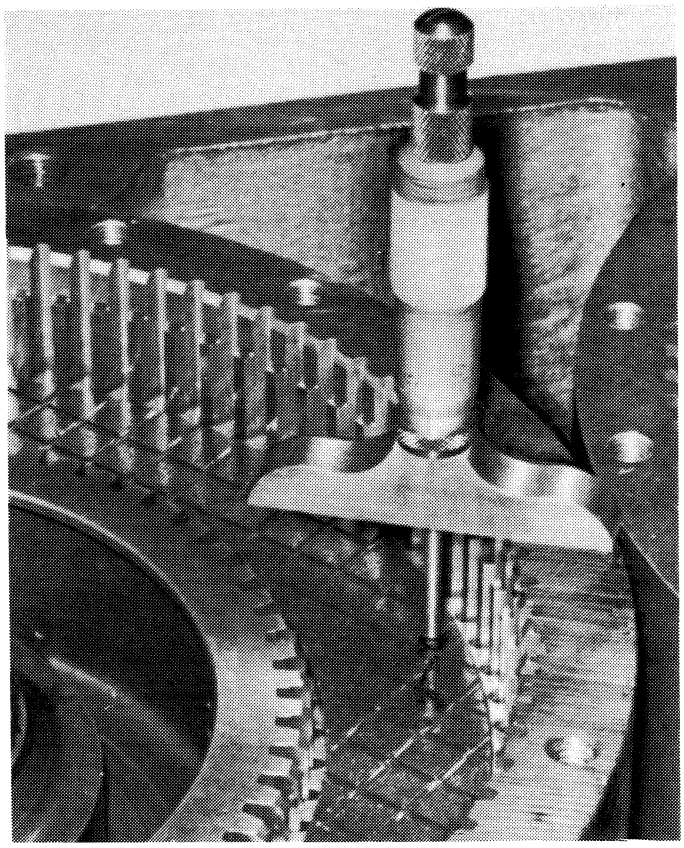


Figure 9-14. Measuring for Clutch Release Shim.

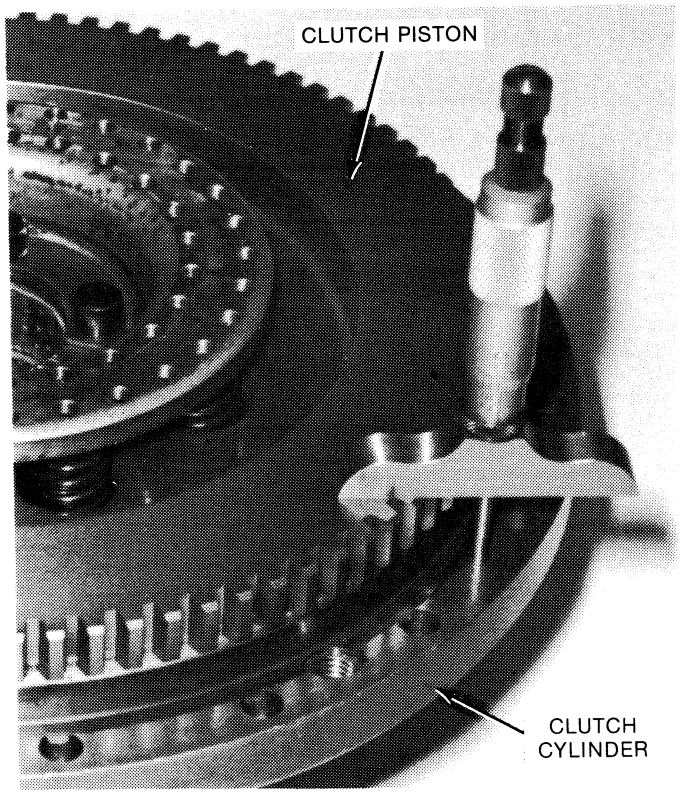


Figure 9-15. Measuring from Rear of Clutch Piston to Flange on Clutch Cylinder.

7. Assemble the clutch cylinder and piston as follows:

a. Install piston ring (Figure 12-2, 35 and Figure 12-3, 32) onto the hub on the front of the clutch cylinder.

b. Install seal rings (Figure 12-2, 34 and Figure 12-3, 31) onto pistons (33 and 30) respectively. See Figure 6-18.

c. Install the piston into the cylinder.

d. Install eight inner and outer clutch release springs in each cylinder assembly. See Figure 6-17.

e. Install clutch spring retainers (Figure 12-2, 30 and Figure 12-3, 27) over the springs.

f. Install clamp plates (29 and 26) and secure with four place-head screws (28 and 25) for each cylinder. Torque the screws 24 lb. ft.

g. Press ball bearings (40 and 37) onto the rear hub of each cylinder.

h. Install the two piston rings (41 and 38) onto the rear hub of each cylinder. See Figure 6-16.

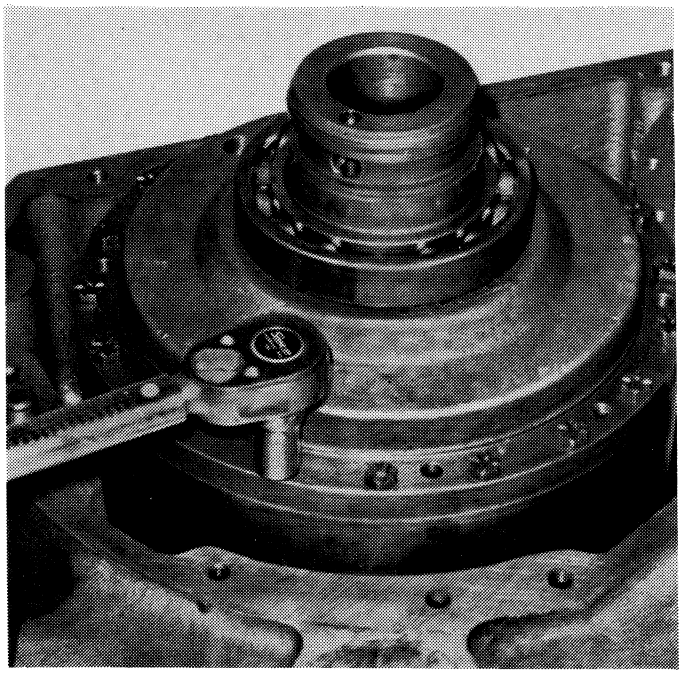


Figure 9-16. Installing Clutch Cylinder Assembly.

8. Install the clutch cylinder and piston assemblies and secure them with 16 place-head screws. Torque the screws 24 lb. ft. See Figure 9-16.

Rear External Parts.

1. To install the manifold (Figure 12-1, 2) with anaerobic plastic gasket, proceed as follows:

a. For previously sealed joints, scrape surfaces to remove old gasket material. Gel type paint remover containing methylene chloride can be used to wipe off cured sealant.

CAUTION

Follow vendor directions to prevent chemical burns to the skin.

b. Clean surfaces with 1, 1, 1-trichloroethane to remove oil and grease residue.

c. Test the clean surfaces by applying a few drops of cool water to the surfaces. Parts are sufficiently clean if water covers the surface in a film. If the water puddles or forms beads, use fresh solvent and reclean.

d. Use Twin Disc primer MA-579 (LOCQUIC T) or equivalent primer on both mating surfaces. Allow primer to dry. This usually takes three to four minutes. Keep surfaces clean and free of oil and grease from this point on.

e. Apply a 1/16-inch continuous bead of Twin Disc M-2828-A anaerobic plastic sealant to one surface on the side of bolt holes toward fluid being retained. Be certain that narrow overlap areas are covered. It is optional to spread material into a thin film just before mating surfaces are assembled.

f. Install the manifold, aligning dowel pins and holes.

2. Secure the manifold with 17 hex-head screws (Figure 12-1, 3 and 4). See Figure 6-15. Torque the screws 30 lb. ft.

3. Install gasket (Figure 12-4, 2) and lube tube (3) indexing the hole in the gasket and lube tube flange with the rollpin.

4. Install O-rings (Figure 12-1, 5, 6, 11 and 12) onto reverse and forward collectors, and install collectors (7 and 13).

NOTE

Do not bolt the collectors in place at this time.

5. Install O-rings (Figure 12-4, 15) onto the collector oil tubes (16) and install the tubes into the forward and reverse collectors.

6. If the lube pressure regulator valve was removed, install lube valve piston (7), spring (6), guide plate assembly (5), and snap ring (4) into the valve and filter carrier assembly.

7. Install the valve and filter carrier assembly (10) and gasket (9). It will be necessary to rotate the forward and reverse collectors to get the collector oil tubes into the holes in the valve and filter carrier.

8. Secure the assembly and gasket with five hex-head screws (14, 17, 20 and 21). See Figure 12-4 for location of different length screws. Torque screws 68 lb. ft.

9. Secure the forward collector (Figure 12-1, 7) with eight hex-head screws (8) and the reverse collector (13) with six hex-head screws (14). Torque the screws on both collectors 30 lb. ft.

10. Install the pump drive coupling assembly (Figure 12-3, 39 and 40) and install the oil pump (Figure 12-1, 21) and gasket (17). Secure the pump and gasket with four hex-head screws (23) and two washers (22). The washers go over the two slotted holes. Torque the capscrews 68 lb. ft.

11. Install O-rings (27) onto the connector tube (28) and install the tube with the end having the shortest distance to the shoulder on the tube inserted into the main housing.

12. If disassembled, install the pump suction strainer (31) into the oil strainer housing (30).

13. Install strainer cover gasket (33) and strainer cover (34). Secure with four hex-head screws (35). Torque the screws 30 lb. ft.

14. Install O-ring (29) into the groove provided in the oil strainer housing.

15. Install the oil strainer housing over the connector tube and secure the housing to the oil pump (21) with four hex-head screws (32). Torque the screws 68 lb. ft.

16. Install the output flange (Figure 12-5, 14). Use a portable hydraulic press to seat the flange.

17. Determine the amount of shims (16) needed for retainer washer (17) by measuring the gap between the shoulder in the bore of the output flange and the end of the output shaft. See Figure 9-17.

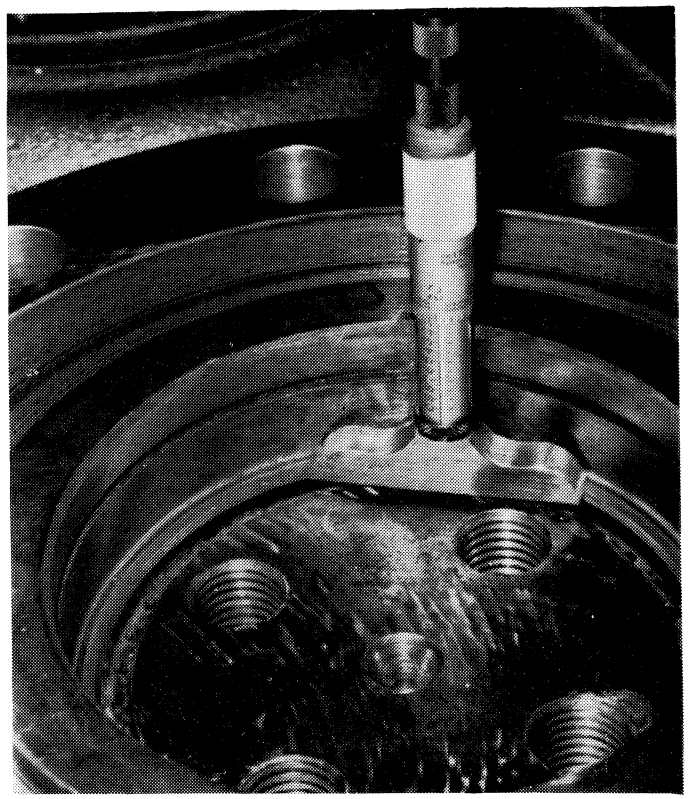


Figure 9-17. Measuring Gap Between Shoulder in Bore of Output Flange and End of Output Shaft.

18. Install O-ring (Figure 12-5, 15).

19. Install shims 0.005 to 0.10 inch thinner than the gap measured in step 17.

20. Install retainer washer (17) and secure with four hex-head screws (18). Torque the screws 505 lb. ft.

21. Install snap ring (19) into the groove provided in the bore of the output flange.

22. Install companion flange (20), aligning match marks on companion flange and output flange. Secure with twelve hex-head screws (21) and locknuts (13). Torque the nuts 545 lb. ft.

23. Install the oil filter assembly (Figure 12-4, 22 thru 35) and gasket (29).

24. Install gasket (Figure 12-6, 19) and top housing cover (18). Secure with fourteen hex-head screws (22). Torque the screws 68 lb. ft.

PRIOR TO INSTALLATION.

CAUTION

Most Twin Disc products mount directly onto the flywheel of the engine. Flywheel-to-driven-component interference is possible due to mismatch of components or other reasons. Therefore, engine crankshaft endplay as well as flywheel alignment checks must be made before the driven component is installed.

After installation of the driven component, crankshaft endplay should be measured again. Endplay at the second measurement should be the same as the first. A difference in these two end play measurements could be an indication of interference. Consequently, the driven component should be removed and the source of interference found and corrected.

Twin Disc will not be responsible for system damage caused by engine to Twin Disc component interference regardless of the cause of interference. This engine crankshaft endplay check is considered mandatory.

GENERAL.

The transmission front housing flange and pilot, and the engine flywheel and flywheel housing must be checked for trueness. Make certain the engine flywheel and the flywheel housing are clean prior to making the tests.

ALIGNMENT.—(Also reference SAE J-1033)

1. Bolt a thousandths increment dial indicator or gauge to the engine flywheel so that the indicator is perpendicular to the face of the engine flywheel housing, and the indicator stem is riding on the face of the flange. See Figure 9-18.

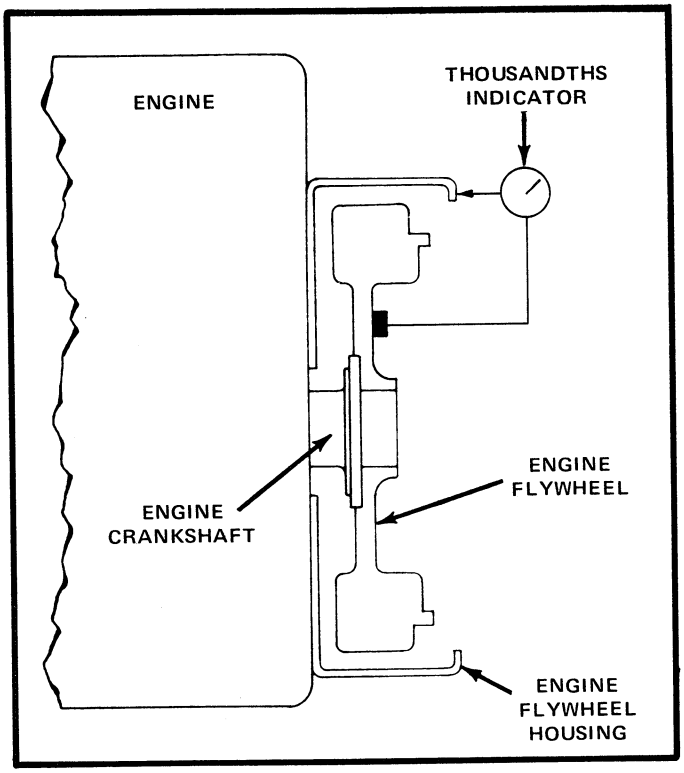


Figure 9-18. Checking the Face of the Engine Flywheel Housing.

Table 9-1. Flywheel Housing Tolerances

All figures are Total Indicator Readings.

SAE Housing No.	Face Deviations	Bore Eccentricity
00	.012	.012
0	.010	.010
½	.010	.010
1	.008	.008
2	.008	.008
3	.008	.008
4	.006	.006
5	.006	.006
6	.006	.006

2. Rotate the engine flywheel, always keeping a thrust in the same direction, and note the face deviation of the engine flywheel housing flange. The face deviation must not exceed the figures given in Table 9-1.

3. With the indicator mounted as in the above paragraph, adjust the indicator stem so that it will ride on the bore of the engine flywheel housing. See Figure 9-19.

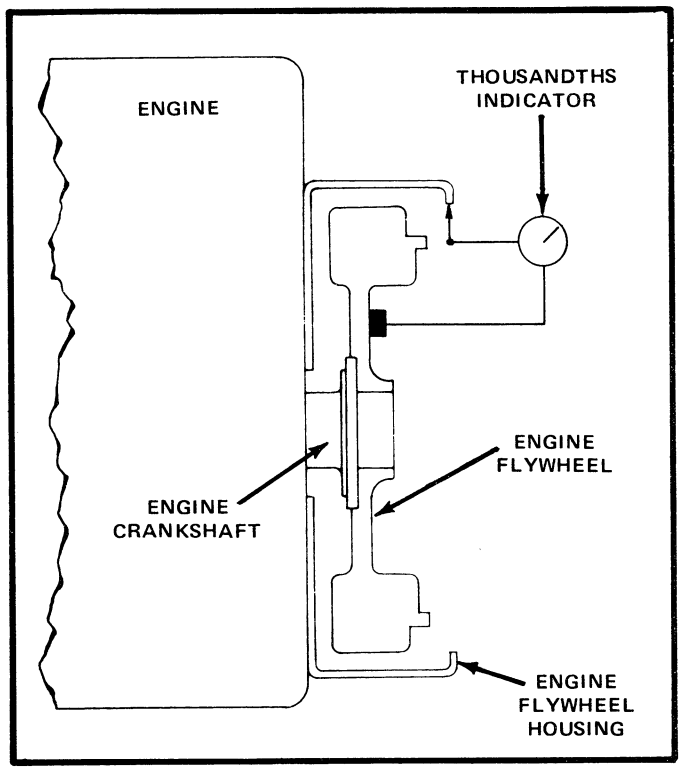


Figure 9-19. Checking the Bore of the Engine Flywheel Housing.

4. Rotate the engine flywheel and note the bore eccentricity of the engine flywheel housing bore. See Table 9-1.

5. Bolt a thousandths dial indicator or gauge to the engine flywheel housing so that the indicator is perpendicular to the engine flywheel, and the indicator stem is riding on the inner face of the flywheel. See Figure 9-20. Rotate the flywheel. The variation of the face runout of the surface to which the driving ring is bolted should not exceed 0.0005 per inch of diameter.

6. With the indicator mounted as in the paragraph above, adjust the indicator stem so that it will ride on the driving ring pilot bore of the engine flywheel. See Figure 9-21. Rotate the flywheel. The driving ring pilot bore eccentricity of the engine flywheel should not exceed 0.005 inch maximum total indicator reading. Thrust on the flywheel should be in one direction at all times to obtain a correct reading.

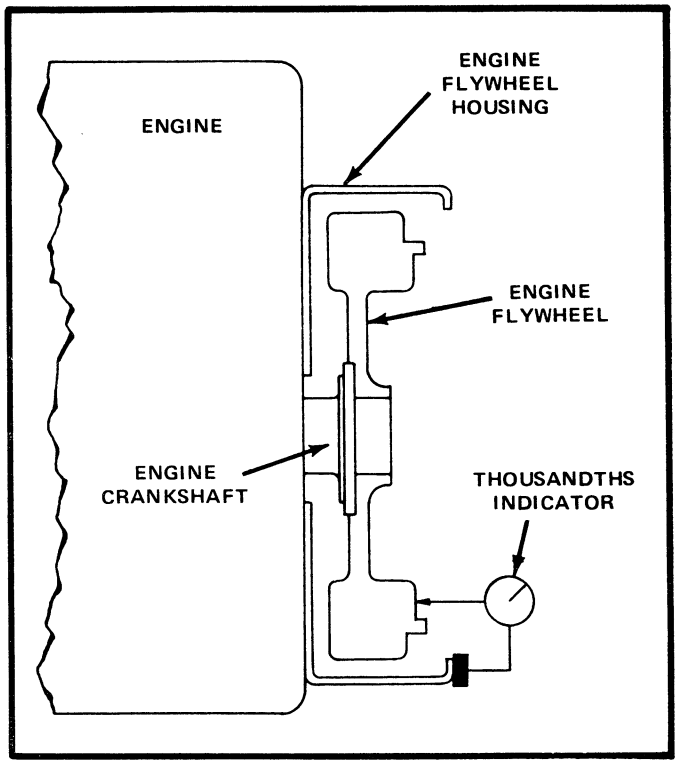


Figure 9-20. Checking the Driving Ring Surface of the Engine Flywheel.

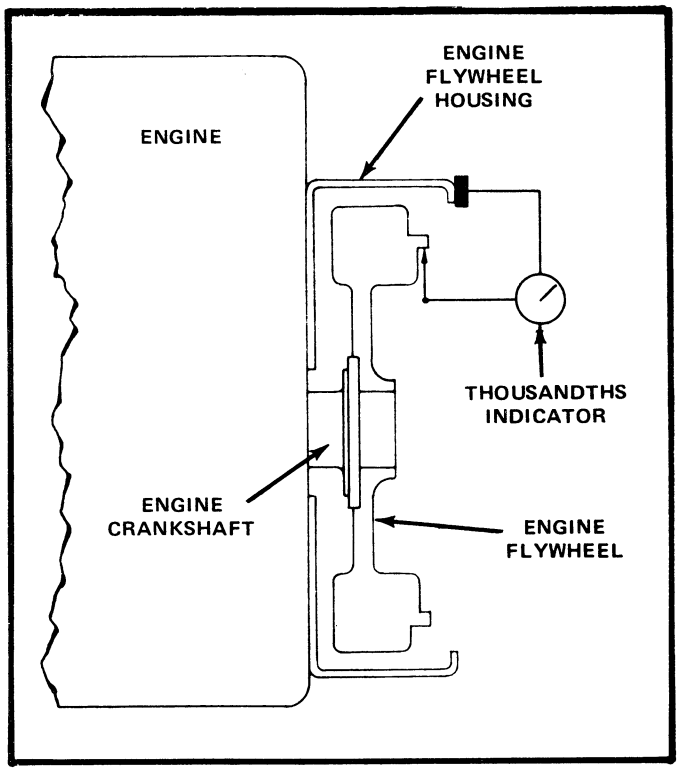


Figure 9-21. Checking the Driving Ring Pilot Bore of the Engine Flywheel.

7. Readjust the indicator so that the stem will ride on the pilot bearing bore of the flywheel. See Figure 9-22. Rotate the flywheel. The eccentricity of the pilot bearing bore should not exceed 0.005 maximum total indicator reading. Eccentricity between the driving ring pilot bore (Figure 9-21) and pilot bearing bore (Figure 9-22) should not exceed 0.009 inch total indicator reading.

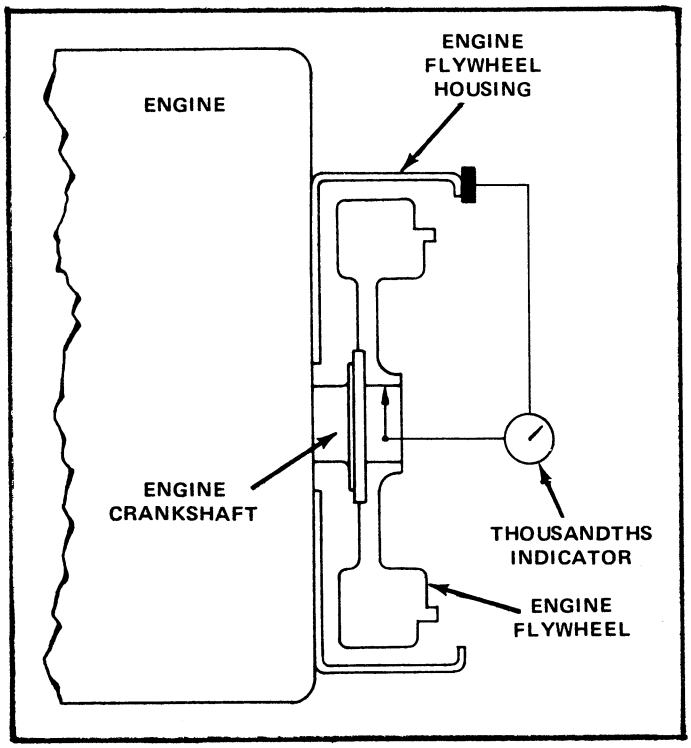


Figure 9-22. Checking Pilot Bearing Bore of Flywheel.

INSTALLATION.

Alignment.

Proper alignment of an engine and marine unit is critical . . . both during the initial installation and at frequent intervals during the life of the boat. It is rather common for a boat to change its form with various loads and with age. A bend is actually formed in the keel which changes the original engine and shaft alignment. The following steps may be taken to secure proper marine transmission alignment.

Propeller Shaft Installation.

1. A wire is run through the shaft log and secured to a brace near the engine bed, giving the wire a position equivalent to the shaft centerline.

2. The stern bearing and stuffing box are installed and bolted into position with the wire passing through each in the exact center of the bore. With the bearing and stuffing box in place, the wire is then removed.

3. The propeller shaft is then installed in its proper position.

4. If an intermediate shaft is used, it is blocked into position and its coupling (see the following section — "Engine and Marine Transmission Alignment"). If there is an intermediate bearing in the line, this is installed and positioned with shims during the alignment process.

5. If a light shaft is used without an intermediate bearing, the shaft must be centered and supported to take out the droop while alignment of the flange couplings are being made.

Engine and Marine Transmission Alignment to Propeller Shaft. See Figure 9-23.

1. It is important to align the engine and transmission, only when the bloat is afloat, and NOT in dry-dock. During this alignment period, it is also advisable to fill the fuel tanks and add any other ballast that will be used when the boat is in service. With the engine and transmission in position on the engine bed, arrangements must be made to have a controlled lifting or lowering of each of the four corners of the engine. If threaded holes are provided in each of the engine mounts, jacking screws can be used in them. The engine can be raised by screwing down, or lowered by backing off the desired amount. Steel plates must be inserted under the jacking screws so that the bolts will not damage the engine bed. Lifting can also be accomplished by the use of chain hoists or properly placed jacks. Adjustable shims also are available and can simplify the whole problem, particularly for future realignment.

2. It will also be necessary to move the engine and transmission from one side or the other on the bed to obtain horizontal alignment. This can be done with a jack placed horizontally between the engine and the foundation. At the same time, a straight edge is laid across the edges of the flanges at the top and side to check the parallel alignment of the coupling edges. See Figure 9-24.

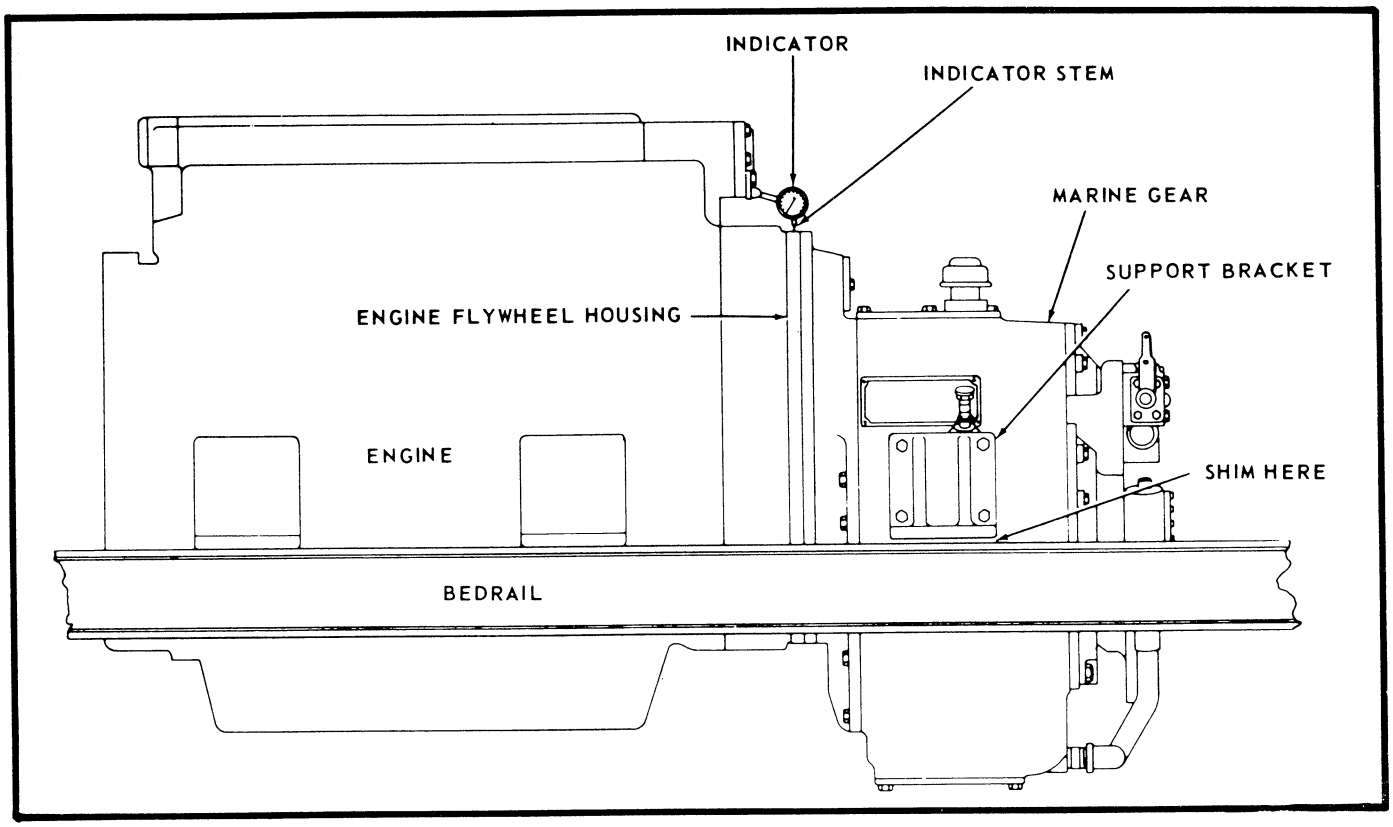


Figure 9-23. Alignment of Engine and Marine Transmission — Schematic View.

C

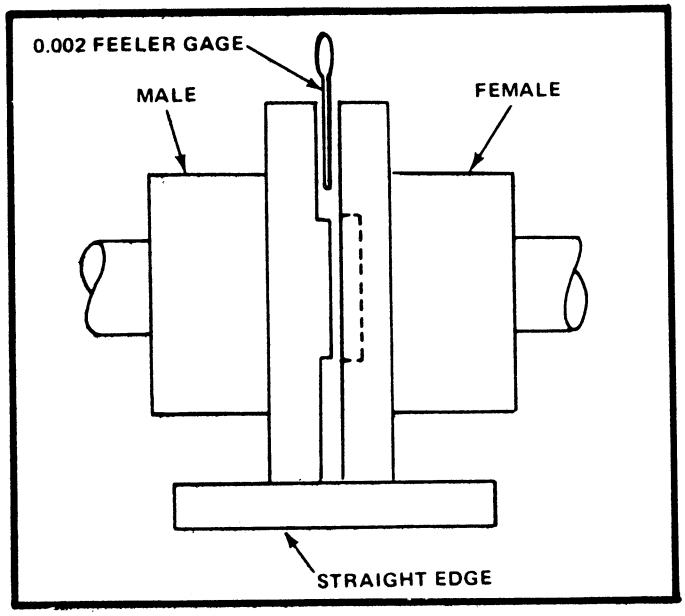


Figure 9-24. Checking Alignment (Parallelism) of Coupling and Propeller Flanges.

3. As the engine and marine transmission comes into its aligned position, it will be possible to match the output flange and propeller coupling, and prepare for bolting together. Care should be taken not to burr or mar this connection because the fit is very critical. Place a 0.002-inch feller gauge between the flanges of the coupling. The feeler gauge is moved (slid) completely around the coupling.

4. Then the marine transmission flange coupling is rotated 90, 180 and 270 degrees with the feeler blade being moved around the flange again in each successive position. If the alignment is correct, the feeler gauge will fit snugly, with the same tension, all around the flange coupling.

5. If the alignment varies during rotation, then further alignment is necessary, or the marine transmission and shaft couplings should be checked for improper face runout. Face runout on the marine transmission output flange can usually be corrected by repositioning the coupling on its spline. Shaft coupling runout is usually due to inaccuracy of taper fit or key interference.

6. Some boats are not structurally rigid and some carry their load in such a way that they will "hog" or go out of normal shape with every loading and unloading. Where this condition exists, it may be necessary to make a compromise

between the top and bottom coupling clearance by leaving a greater clearance at the bottom of the marine transmission output flange and propeller coupling. This clearance might be 0.005 to 0.007-inch while the top would maintain the standard 0.002-inch.

7. During the process of securing final alignment, it may be necessary to shift the engine many times. When it becomes apparent that the alignment is reasonably close, the holes for the lag studs are marked and drilled. Then with final alignment secured, the necessary steel or hardwood shims are made up and the engine and transmission is fastened in place. The alignment is then rechecked, and if satisfactory, the coupling is bolted together.

8. Although it is not as necessary to align a flexible coupling as accurately as a solid coupling, the closer it is in the initial alignment, the more vibration-free it will be. The most accurate method of alignment is to align the shaft on to the marine transmission with flexible coupling out of the system. This can be done with a spacer the same size as the coupling but not flexible in nature. Flexible couplings are used only for noise and vibration dampening . . . and not to correct inadequate alignment.

9. When a heavy boat is dry-docked, it naturally undergoes some bending. Therefore, it is always good practice to unbolt the marine transmission coupling and prevent bending of the shaft.

CAUTION

Be sure the transmission is filled with oil before starting. See Section 4 for proper oil and filling procedure.

RIGGING SHIFT LEVER CONTROLS.

WARNING

Transmission controls must be checked for proper function and alignment after any transmission installation or maintenance procedure to assure that the transmission selector valve is properly indexed in relation to the operator's control lever. Failure to do so could cause control system malfunction, resulting in personal injury and/or damage to equipment and property.

For mechanical controls: Movement of the Operator's selector lever to forward, neutral or reverse must position the transmission selector valve in the forward, neutral or reverse detents.

Power operated controls: Selector valve positioning devices must be installed so that full travel of the actuating cylinder places the transmission selector valve in the detent position for forward or reverse, as selected, without exerting pressure on the rotational stop collar on the selector valve stem. Selection of neutral must place the selector valve in the neutral detent position. Improper installation of power engaging devices could cause failure of the selector valve rotational stop collar permitting improper positioning of the selector valve with resultant control malfunction.

See specific marine transmission installation drawings for detail and dimensional information needed for proper installation of power engaging devices.

C

Section 10.
ACCESSORIES

FORWARD SHAFT DRIVEN PUMP ADAPTER (COLLECTOR).

General.

A combination pump adapter and forward shaft collector (Figure 12-1, 36 to 43) is available for a forward shaft driven pump. The forward shaft on shallow case units with serial numbers 3L2761 and above, and deep case units with serial numbers 3L2762 and above, is splined to accept pump drive coupling (36). Shallow and deep case units with serial numbers below those mentioned above must have a new forward shaft (P/N A-7375) installed which incorporates a pump drive spline at the rear end. See Sections 6, 8 and 9 for instructions on removing and replacing the forward shaft.

Installing Pump Adapter Forward Shaft Collector.

1. To install the pump adapter forward shaft collector (Figure 12-1, 36 to 43), remove the valve and filter carrier (Figure 12-4, 10) and the existing forward shaft collector (Figure 12-1, 7). Note that both of these items must be removed or loosened because of jumper tubes (Figure 12-4, 16) between them. See Figure 10-3.

2. Assemble pump coupling assembly (Figure 12-1, 36) in the order shown in Figure 10-1.

3. Install the pump drive coupling assembly, end without thrust washers first.

4. Install new O-rings (Figure 12-1, 37 and 38). See Figure 10-2.

5. Install forward shaft collector (Figure 12-1, 39).

6. Secure with eight hex-head screws (40). Torque the screws 27 ± 2 lb. ft.

7. If the pump is not being installed immediately, install gasket (41) and cover plate (42). See Figure 10-4. Secure with hex-head screws (Figure 12-1, 43). Torque the screws 65 ± 5 lb. ft.

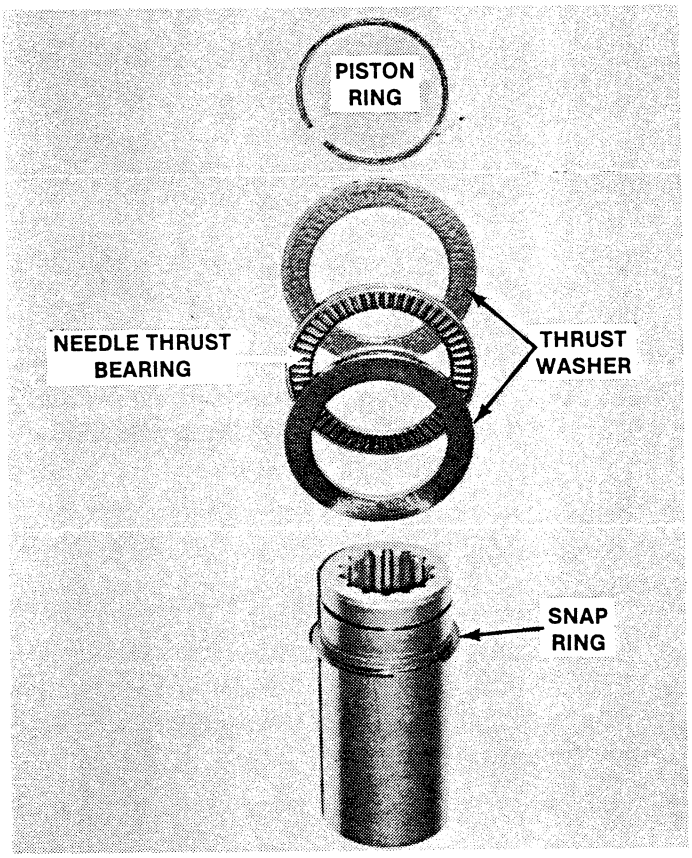


Figure 10-1. Pump Drive Coupling Partially Disassembled.

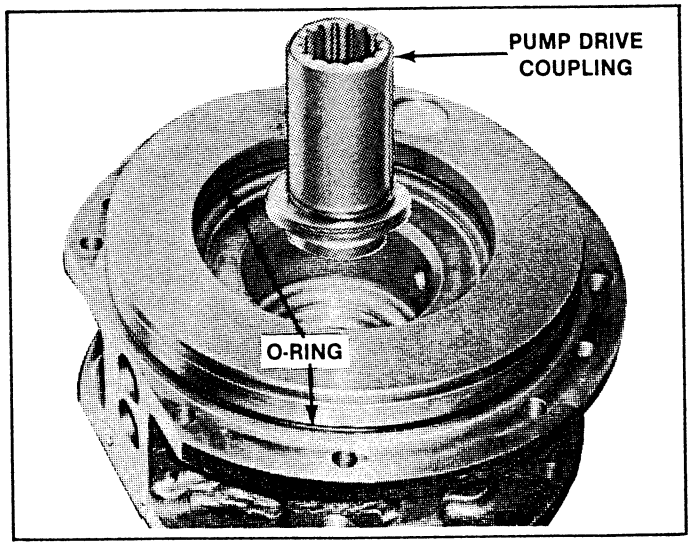


Figure 10-2. Forward Shaft Collector (Pump Adapter).

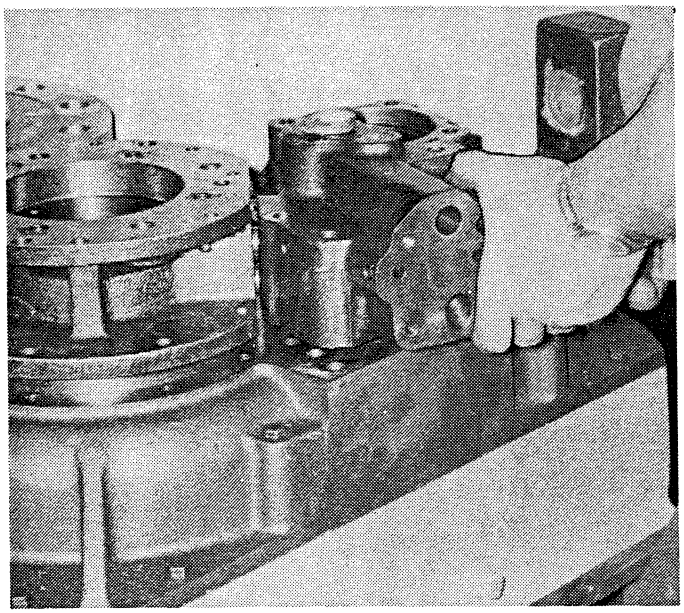


Figure 10-3. Removing or Installing Valve and Filter Carrier Assembly and Forward Shaft Collector.

C

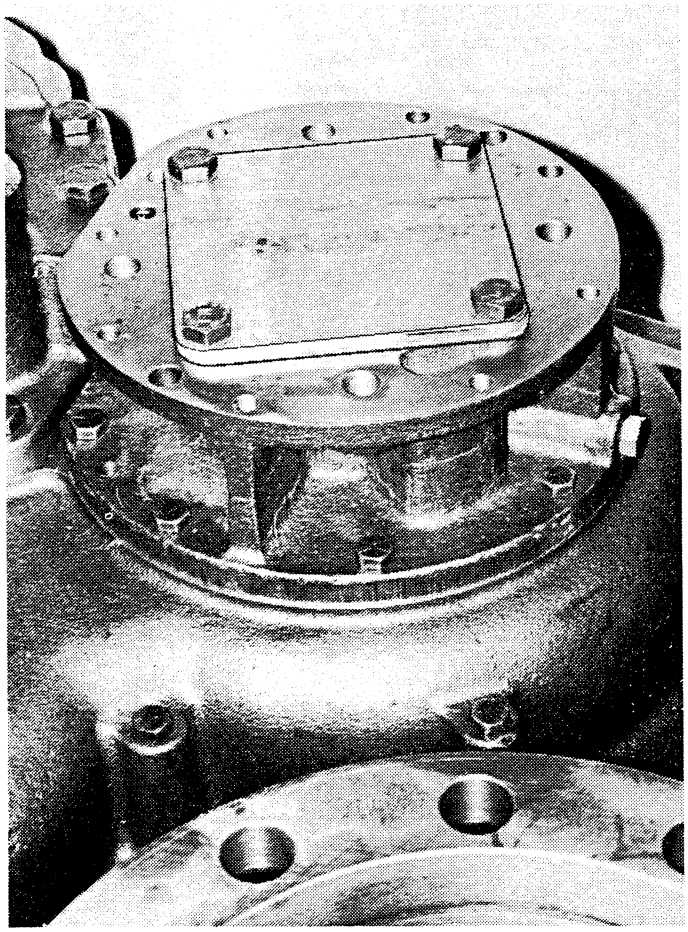
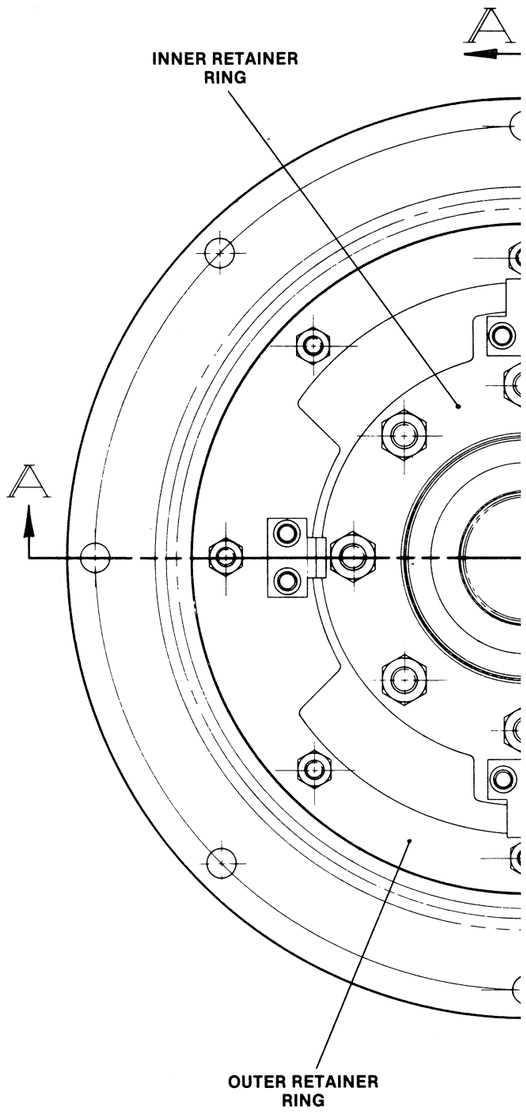
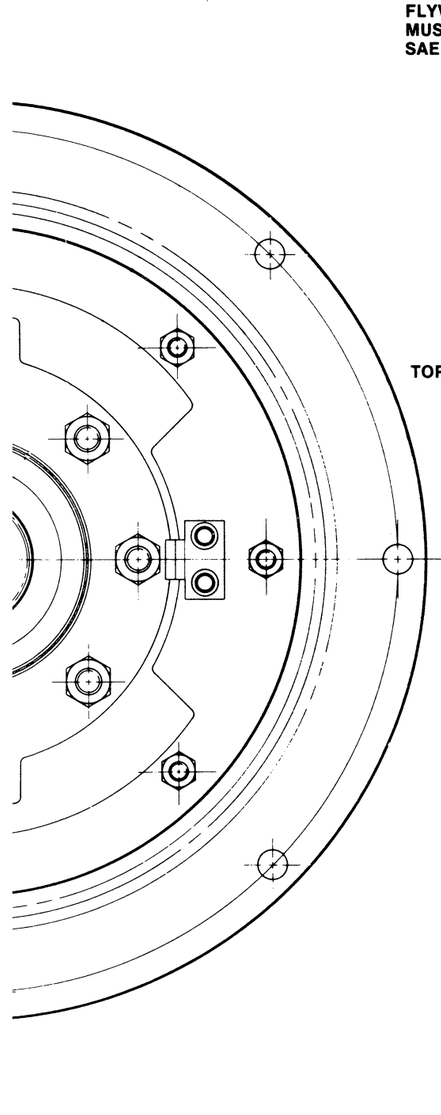


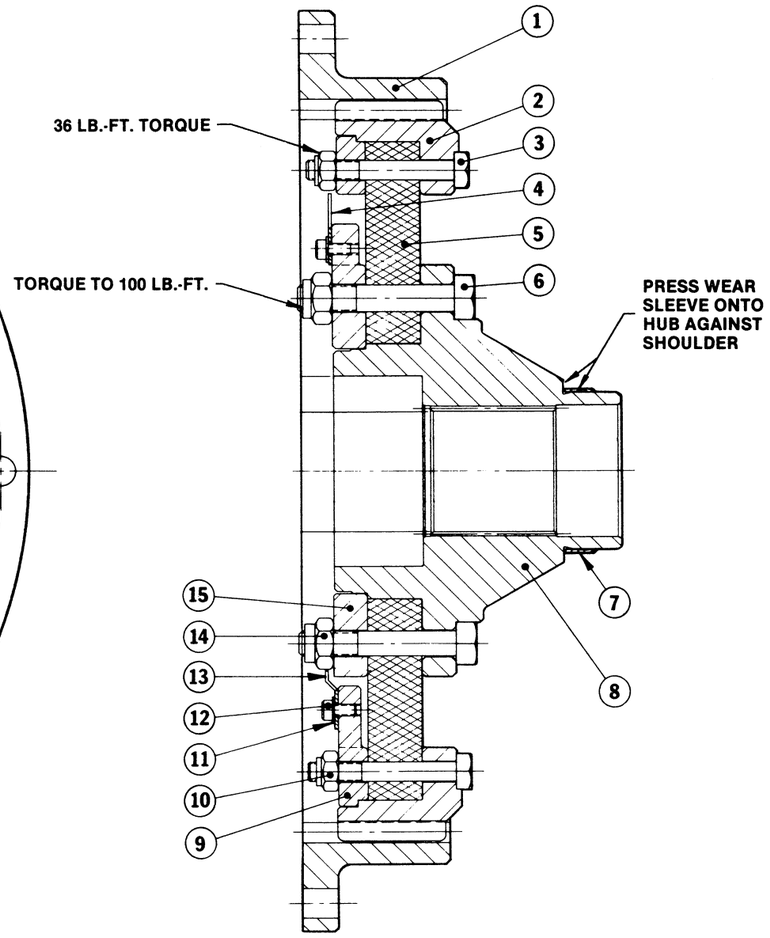
Figure 10-4. Forward Shaft Collector and Cover Plate Installed.

1	FLANGE, SAE No. 14	1
2	HOUSING	1
3	CAPSCREW, Hex-Head	8
4	PLATE, Inner Limit	2
5	ELEMENT, Flexible	1
6	CAPSCREW, Hex-Head	8
7	SLEEVE, Wear	1
8	HUB, Coupling	1
9	RING, Outer Retainer	1
10	LOCKNUT, Hex	8
11	WASHER, Spring	8
12	CAPSCREW, Socket-Head	8
13	PLATE, Outer limit	2
14	LOCKNUT, Hex	8
15	RING, Inner Retainer	1





FLYWHEEL OUTLINE MUST CONFORM TO SAE J620d, No. 14

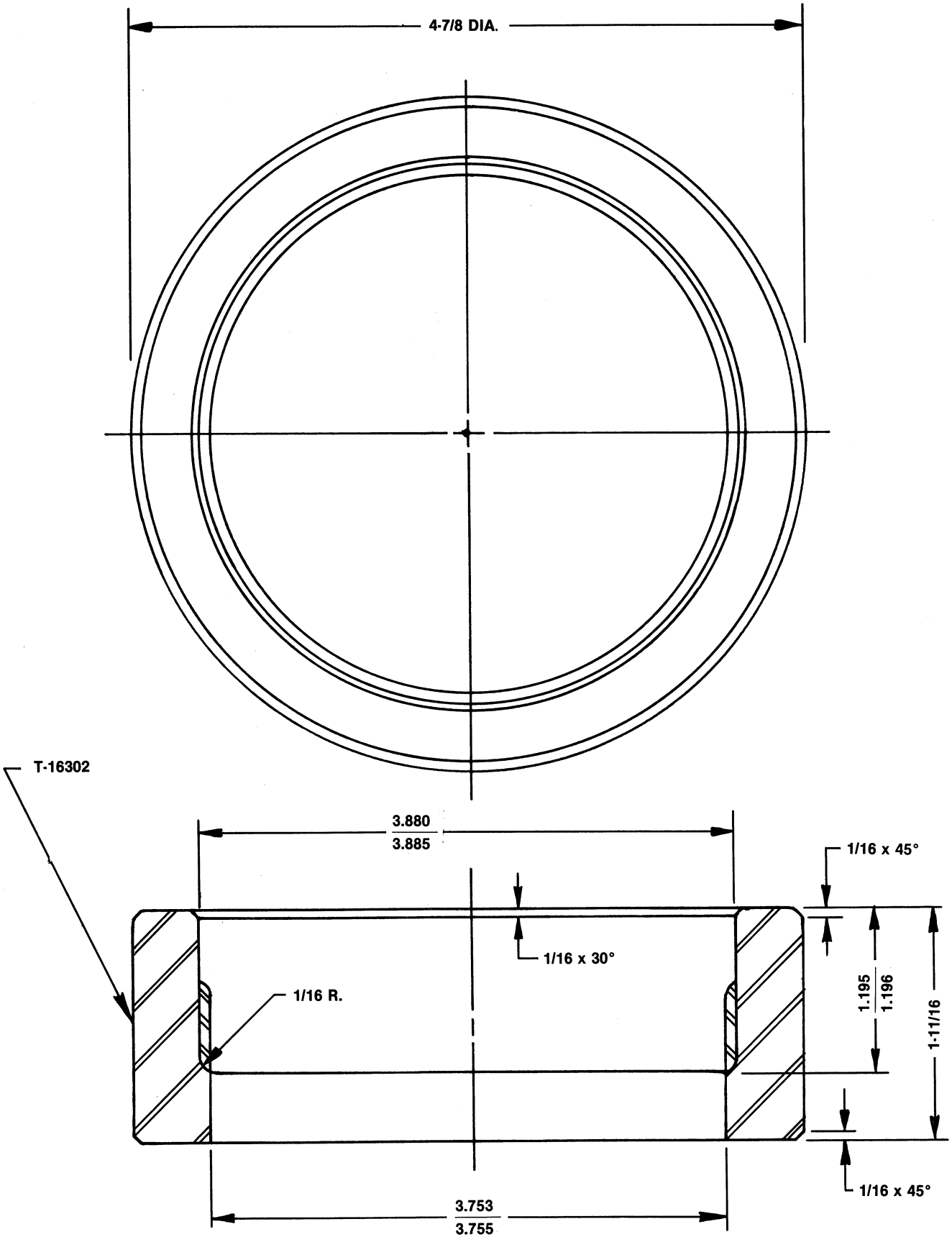


SECTION A-A

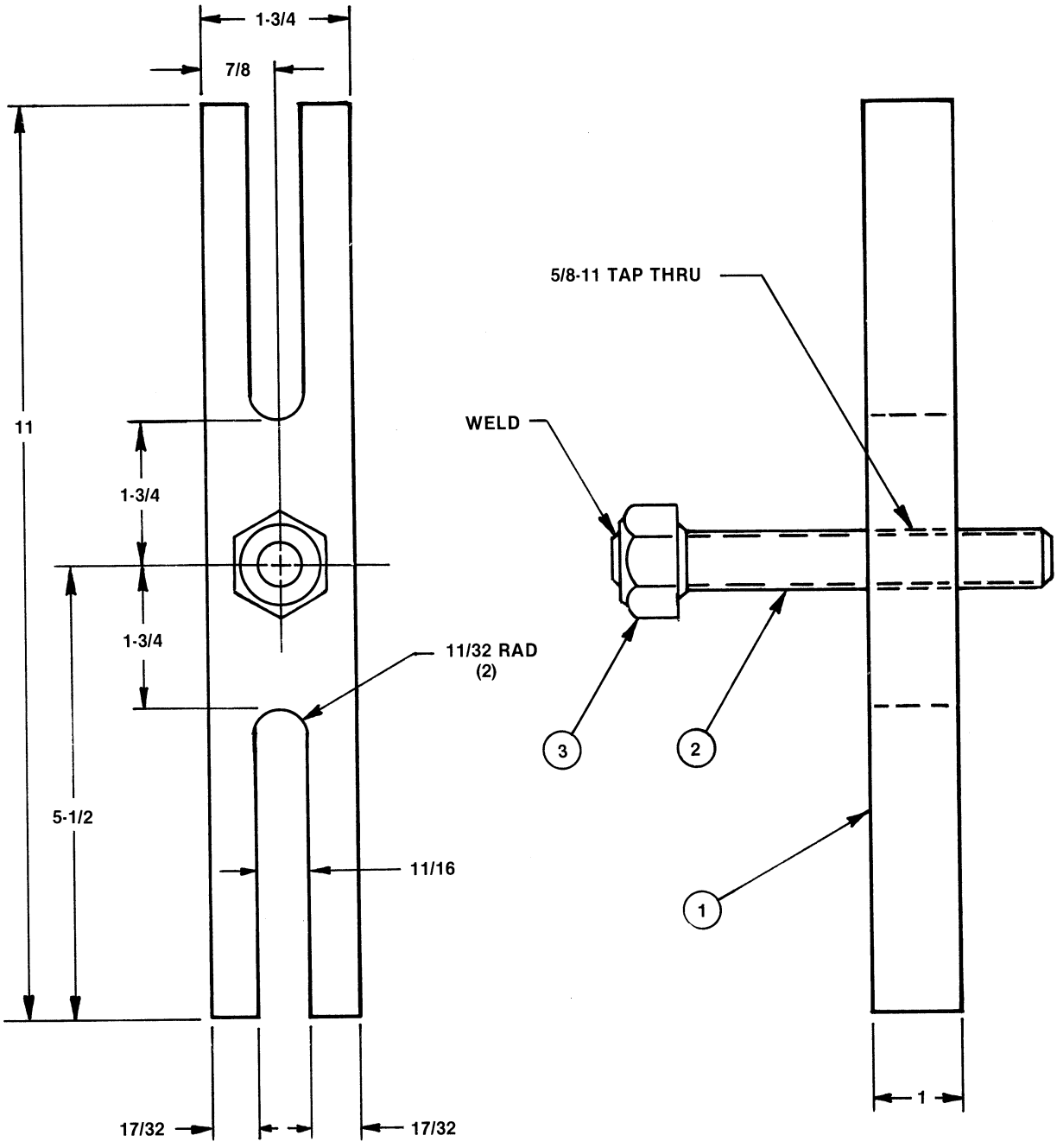
Flexible Coupling. Figure 10-5.

Section 11.
SPECIAL TOOLS

Drawings in this section identify the special tool by tool number. All pertinent information necessary for tool fabrication is shown on each drawing. These tools are intended primarily to make maintenance procedures easier. Twin Disc does not manufacture these tools for general use.

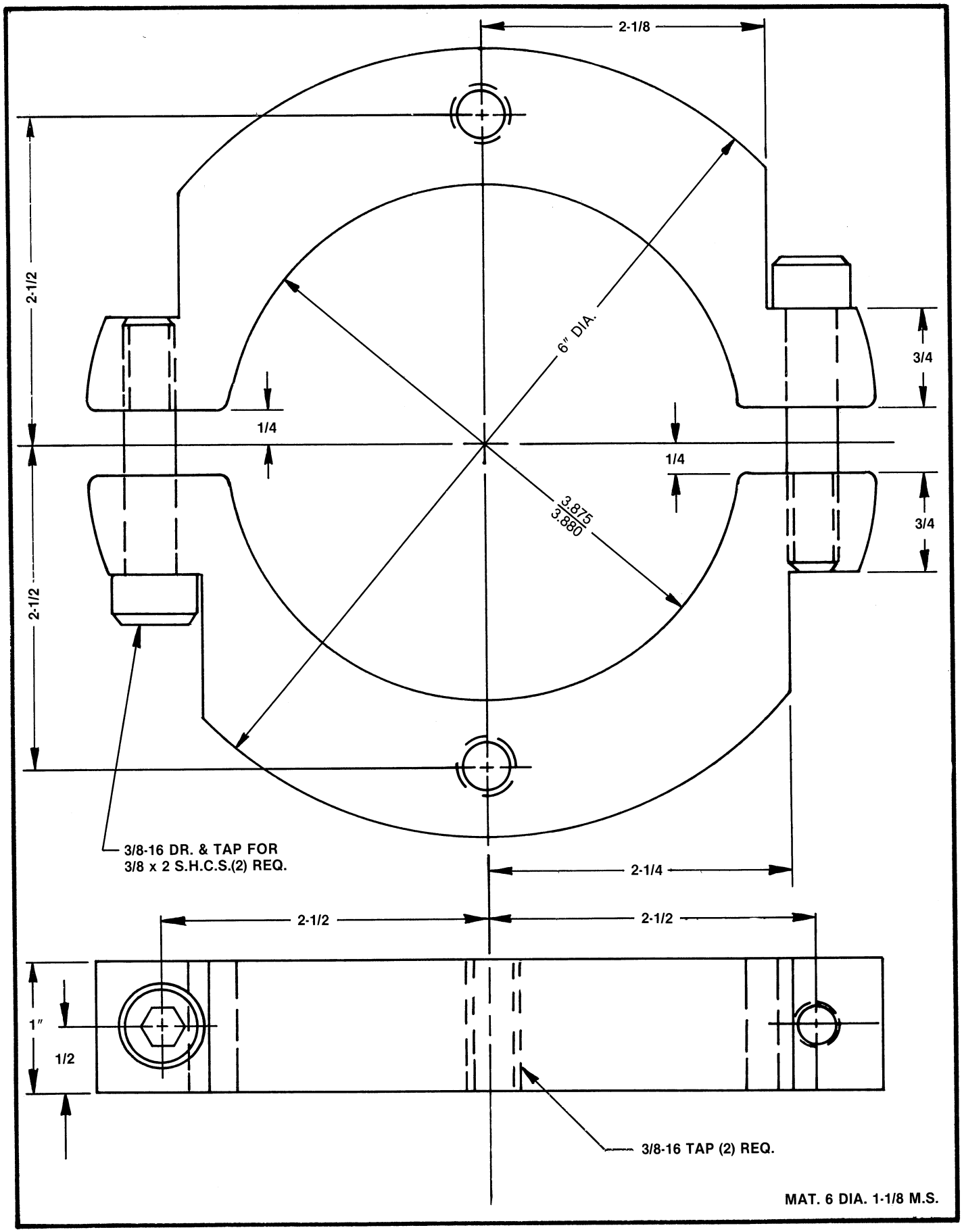


WEAR SLEEVE DRIVER T-16302

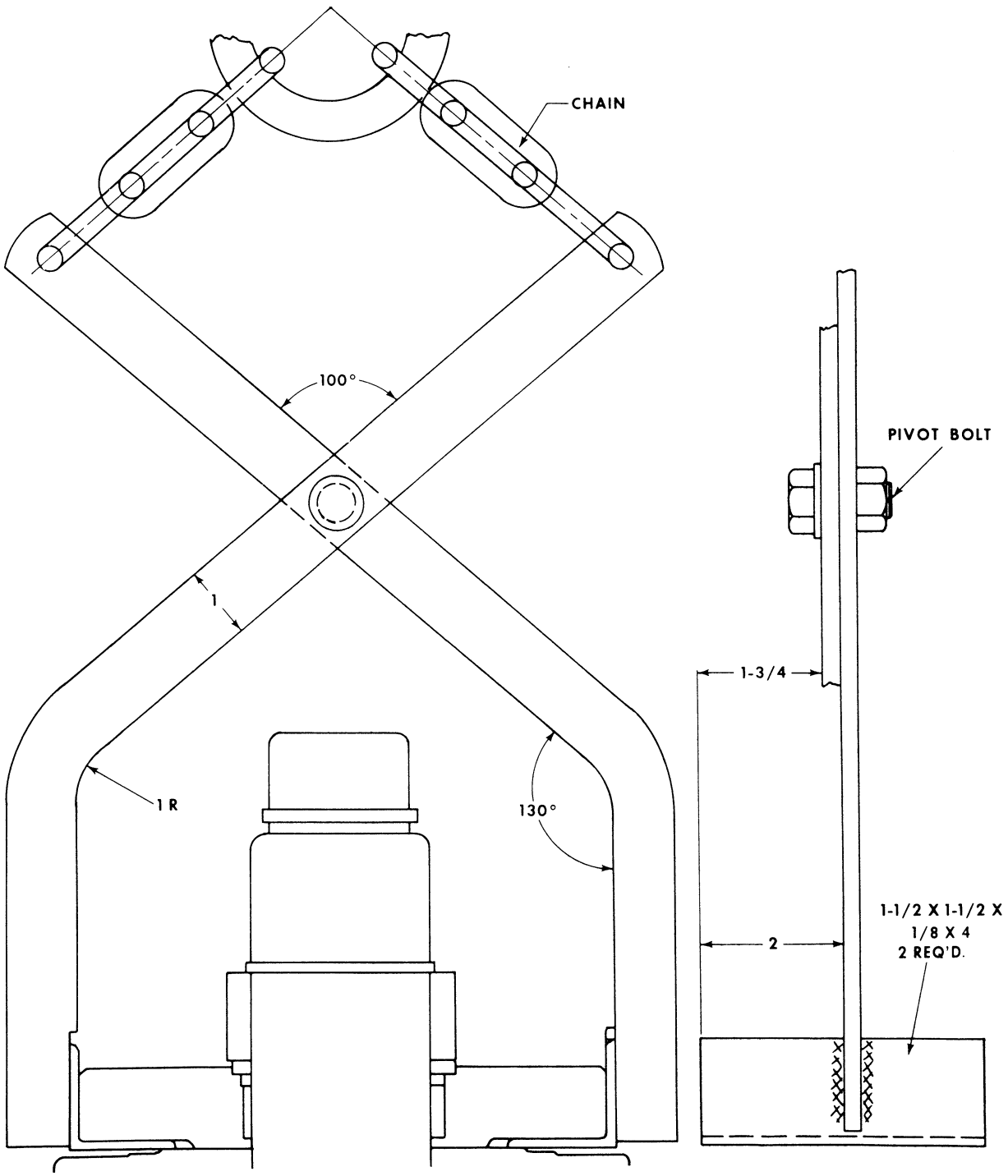


DET.	REQ.	MAT.	DESCRIPTION	STOCK SIZE
1	1	M.S.	BAR	1″ 1-3/4 11
2	1	PUR.	THREADED ST'K.	5/8-11 TH'D. 5-1/2 LG
3	1	PUR.	HEX NUT	5/8-11 THD.

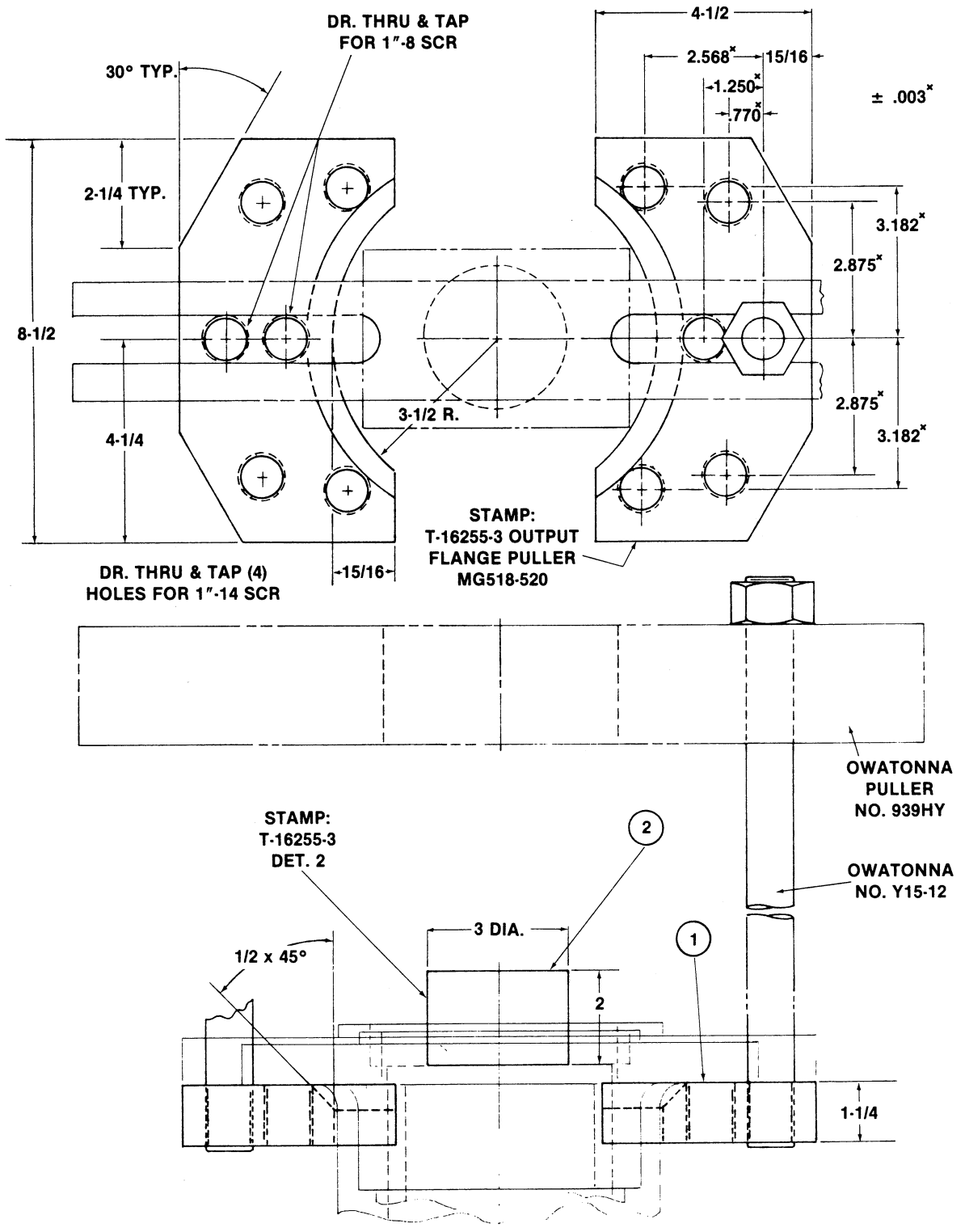
CLUTCH DRIVE PULLER-MG520 T-18638



ENDPLAY CHECKING FIXTURE T-18642



Special Tool T-11599 Lifting Tongs.



DET	REQ.	MAT.	DESCRIPTION	STOCK SIZE
2	3	C.R.S.	SPACERS	3" DIA. x 2-1/8
1	2	M.S.	PULLER	1-1/4 x 4-1/2 x 8-5/8

Output Flange Puller T-16255-3.

Section 12.
ENGINEERING DRAWINGS

The following engineering drawings of the product for which this manual was written are included for your convenience.

A

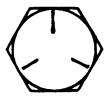
TORQUE VALUES

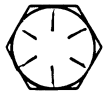
FOR TIGHTENING CAPSCREWS, BOLTS, NUTS, TUBE FITTINGS AND PLUGS.

CAP SCREWS, BOLTS & NUTS

TORQUE (LB. FT.) FOR COURSE AND FINE THREADS (1)

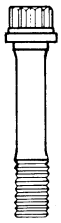
NOMINAL THREAD DIAMETER	SAE GRADE 5		SAE GRADE 8		Screws for Universal Joint Bearing Caps
	AS (2) RECEIVED	LUBRI- (3) CATED	AS (2) RECEIVED	LUBRI- (3) CATED	LUBRI- (3) CATED
1/4	9 ± 1	7 ± 1	14 ± 1	11 ± 1	----
5/16	19 ± 2	15 ± 2	27± 2	22 ± 2	----
3/8	33 ± 3	27 ± 2	46 ± 4	38 ± 3	----
7/16	52 ± 4	40 ± 3	73 ± 6	60 ± 5	64 ± 4
1/2	80 ± 6	65 ± 5	112 ± 8	90 ± 7	100 ± 7
9/16	112 ± 8	90 ± 8	158 ± 12	130 ± 10	----
5/8	158 ±12	130 ± 10	224 ± 16	180 ± 15	190 ± 10
3/4	280 ±20	225 ± 20	390 ± 30	320 ± 25	330 ± 17
7/8	448 ±32	360 ± 30	630 ± 50	510 ± 40	510 ± 25
1	680 ±50	540 ± 45	960 ± 70	775 ± 60	----
1 1/8	850 ±60	675 ± 60	1360 ±100	1100 ± 85	----
1 1/4	1175 ±85	925 ± 75	1850 ±150	1500 ±125	----





(4)

SAE STANDARD HEX BOLT HEAD MARKINGS



12 Pt. Head and Undercut Body

TAPERED PIPE PLUGS

RECOMMENDED TORQUE (LB. FT.)

NPTF SIZE	LUBRICATED (a)	
	In Cast Iron or Steel	In Aluminum
1/16-27	8.5 ± 1.0	5.5 ± 0.7
1/8-27	10.5 ± 1.3	6.5 ± 0.8
1/4-18	25 ± 3	16 ± 2
3/8-18	27 ± 3	17 ± 2
1/2-14	50 ± 6	30 ± 4
3/4-14	54 ± 7	34 ± 4
1 -11 1/2	80 ± 10	50 ± 6
1 1/4-11 1/2	85 ± 10	55 ± 7
1 1/2-11 1/2	85 ± 10	55 ± 7

(a) THE LUBRICANT IS TO BE JOHN CRANE INSOLUBLE PLASTIC LEAD SEAL NO. 2 OR EQUIVALENT OR LOCTITE NO. 92 OR EQUIVALENT AND PLUGS ARE TO BE CAPABLE OF REMOVAL WITHOUT DAMAGE. OVERTIGHTENING MAY CAUSE INITIAL LEAKAGE PLUS POTENTIAL REMOVAL DAMAGE. AN OPTION OF A MAX. OF TWO FULL TURNS AFTER FINGER TIGHTENING THE PLUG MAY BE USED IF REQUIRED AND IF REMOVAL CONDITIONS ARE MET.

(1) THESE TORQUE VALUES APPLY TO USE OF IRONS, STEELS AND ALUMINUM TAPPED HOLES. THE THREAD ENGAGEMENT LENGTH IN ALUMINUM IS TO BE TWICE THE NOMINAL THREAD DIAMETER AND ENGAGEMENT LENGTH RATIO IS TO BE 1.5 FOR IRONS AND SOFT STEEL. WHEN ZINC PLATING IS USED, LUBRICATE THE ZINC PLATED SURFACES OF THE SCREWS AND/ OR NUTS AND USE SPECIAL TORQUE VALUES.

(2) USE FOR ALL CAPSCREWS, BOLTS AND NUTS COATED ONLY WITH THE FASTENER MANUFACTURER'S RUST PREVENTATIVE OIL AND USE FOR PARTS WIPED OR WASHED NEARLY FREE OF OIL. DO NOT USE FOR PLATED PARTS.

(3) USE FOR ALL CAPSCREWS AND NUTS WHOSE THREADS AND WASHER FACE ARE LUBRICATED, ALSO FOR SCREWS OR NUTS WHOSE WASHER FACE IS ASSEMBLED AGAINST A HARDENED WASHER OR SMOOTH FINISHED HARD PART. (R_c40 OR ABOVE AND 40AA MAX.). ALSO USE FOR PLATED SCREWS (EXCEPT ZINC PLATED). LUBRICATING THE THREADS AND SCREW OR NUT FACE WITH SAE 20 OR 30 OIL IS RECOMMENDED FOR BEST RESULTS FOR ALL THE GRADE 8 SCREWS AND IS REQUIRED FOR ALL THE UNIVERSAL JOINT BEARING CAPSCREWS.

DO NOT USE MOLY-DISULFIDE, WHITE LEAD, COPPER FILLED OR OTHER SUCH FILLED LUBRICANTS WITH THESE TORQUE VALUES. SUCH LUBRICANTS REQUIRE SPECIAL TORQUE VALUES.

(4) SOCKET HEAD SCREWS AND 12 POINT HEAD SCREWS WITH FULL BODY ARE GRADE 8 OR BETTER QUALITY AND ARE TO BE ASSEMBLED WITH THE ABOVE TORQUE VALUES.

A

BEARING LOCKNUT TORQUE

Size	M-2012	M-2281	(1) Torque Lb. Ft.	M2012	(1) Torque Lb. Ft.	M-2037	(1) Torque Lb. Ft.
01 03	BC A		15 ± 2 34 ± 5				
04 05 06	B C D	C	46 ± 6 75 ± 10 92 ± 12				
07 08	E F	F	125 ± 16 160 ± 20	AF	230 ± 30	E (3) F	150 ± 20 190 ± 25
09 10 11	G H J	G H J	200 ± 25 240 ± 30 290 ± 40	(2) AG AH AJ	300 ± 40 370 ± 50 440 ± 55	G H J	240 ± 30 290 ± 40 350 ± 45
12 13 14	K L M	K M	350 ± 45 400 ± 50 460 ± 60	AK AL AM	530 ± 70 600 ± 75 710 ± 90	K L M	430 ± 55 490 ± 65 580 ± 75
15 16 17	N P Q	AJ P	550 ± 70 660 ± 85 770 ± 100	AN AP AQ	830 ±110 1000 ±130 1200 ±150	N & AN P Q	680 ± 85 800 ±100 950 ±120
18 19 20	R S T	S & AH	900 ± 120 1000 ± 130 1150 ± 150	AR AS AT	1350 ±170 1500 ±190 1700 ±225	R S T	1100 ±140 1300 ±170 1400 ±180
21 22 24	U V W	V	1300 ± 170 1400 ± 180 1800 ± 225	AU AV AW	2000 ±250 2200 ±275 2700 ±350	U V W	1600 ±200 1800 ±225 2200 ±275
26 28 30	X Y Z	X	2200 ± 275 2600 ± 325 3100 ± 400	AX AY AZ	3300 ±425 4000 ±500 4800 ±600	X Y Z	2700 ±350 3300 ±425 4000 ±500

(1) TORQUE VALUES APPLY TO SOLID SHAFTS.
TORQUE VALUES MAY OR MAY NOT BE SATISFACTORY ON THIN-WALLED SHAFTS.
TORQUE VALUES APPLY TO THREADS LUBRICATED WITH SAE 20 OR 30 OIL.

(2) M-2281-AG IS TO HAVE SAME ASSEMBLY TORQUE AS M-2012-AG.

(3) M-2037-AA IS TO HAVE 120 ±15 LB. FT. ASSEMBLY TORQUE.

C

STRAIGHT THREADED TUBE FITTINGS, HOSE FITTINGS AND PLUGS WITH "O" RINGS.

FOR 37°, 45° AND INVERTED FLARED FITTINGS PER SAE STANDARDS J512, J514, and J516 WITH LATEST SUFFIX. (1)

FOR TAPER PIPE THREADED FITTINGS USE THE PIPE PLUG TORQUE VALUES.

NOMINAL THREAD O.D.	NOMINAL TUBE SIZE	PLUG PART NUMBER (2)	TIGHTENING TORQUE, LB. FT. NUTS & PLUGS	TORQUE LB. IN. EQUIV.
5/16	1/8	– – –	3.6 ± 0.5	43 ± 6
3/8	3/16	M2080G	8.6 ± 1.0	103 ± 12
7/16	1/4	M2080E	12 ± 1.5	144 ± 18
1/2	5/16	M2080C	15 ± 2	180 ± 24
9/16 & 5/8	3/8	M2080A	18 ± 2	216 ± 24
11/16	7/16	– – –	25 ± 3	
3/4	1/2	M2080K	30 ± 4	
7/8	5/8	M2080M	40 ± 5	
1-1/16	3/4	M2080F	55 ± 7	
1-3/16 & 1-1/4	7/8	M2080N	65 ± 8	
1-5/16 & 1-3/8	1	M2080B	80 ±10	
1-5/8	1-1/4	M2080J	100 ±12	
1-7/8	1-1/2	M2080D	120 ±15	
2-1/2	2	M2080X	230 ±30	

C

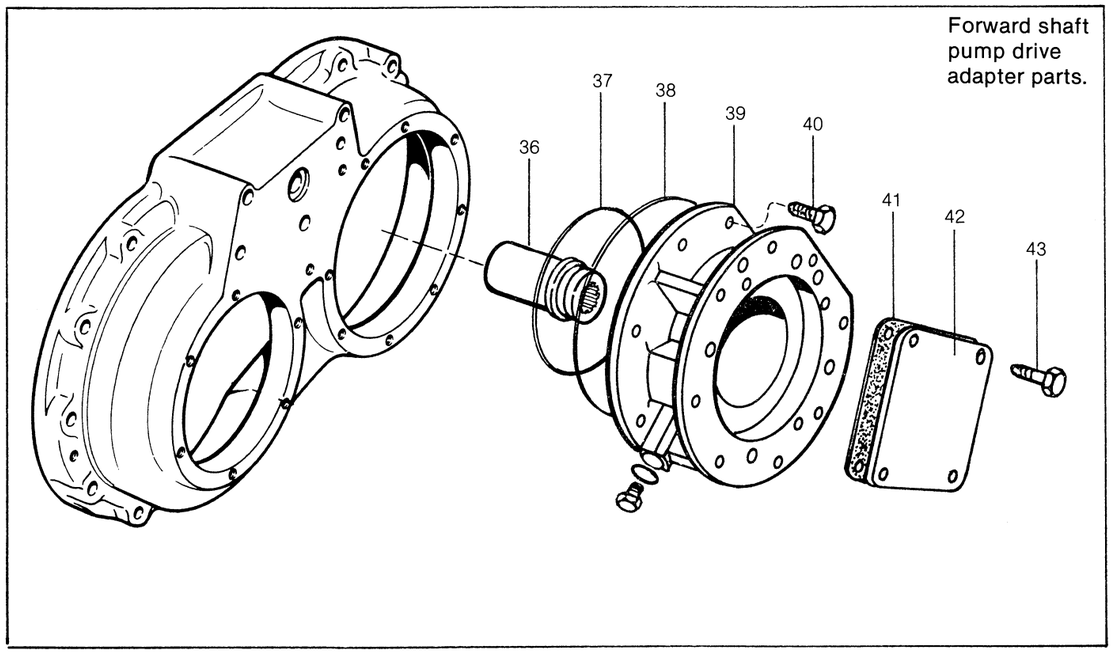
(1) THIS CHART DOES NOT APPLY TO OTHER THAN THE 3 FLARED DESIGNS QUOTED. THUS DO NOT USE THIS DATA FOR SLEEVED COMPRESSION TYPE FITTINGS, REFRIGERATION TUBE FITTINGS, AIR LINE TUBE FITTINGS NOR THE MANY FLARELESS FITTINGS.

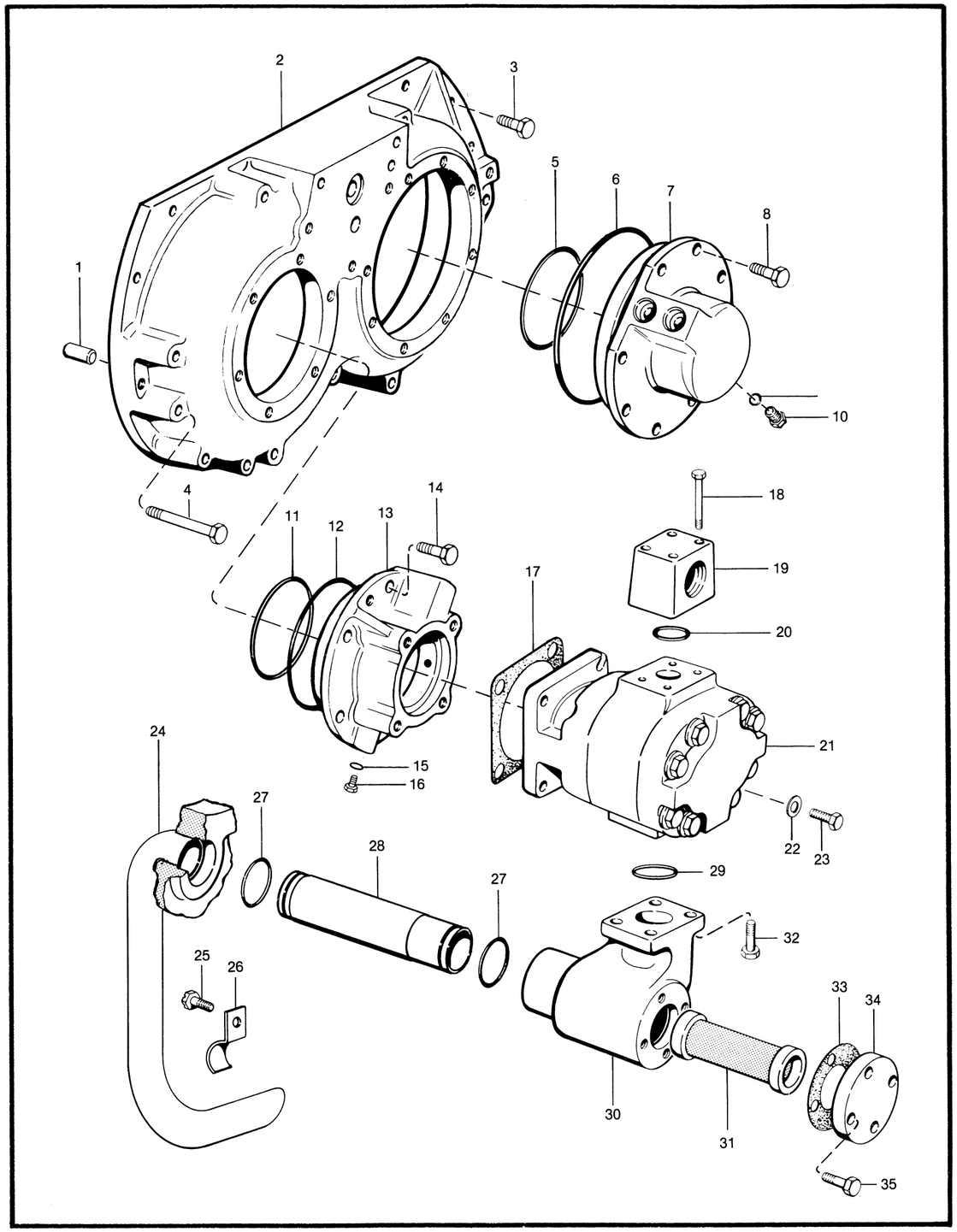
(2) THIS IS A PARTIAL LIST. USE THREAD O.D. TO DETERMINE THE RECOMMENDED ASSEMBLY TORQUE OF THE UNLISTED STRAIGHT THREAD "O" RING PLUGS.

THE FLARELESS FITTINGS ARE BEST ASSEMBLED WITH NUMBER OF TURNS AFTER SOME INITIAL TIGHTENING OR RUNNING TO THE STOP PROVIDED AND THEN TIGHTENING WITH AN ADDITIONAL 5 TO 50 POUNDS FEET OF TORQUE. NO STANDARD DATA HAS BEEN PREPARED FOR THE FLARELESS FITTINGS.

Item	Description	Qty.
1	PIN, Dowel	2
2	MANIFOLD	1
3	SCREW, Hex-Head (3/8 x 1.25)	8
4	SCREW, Hex-Head (3/8 x 3.50)	9
5	O-RING	1
6	O-RING	1
7	COLLECTOR, Forward Shaft	1
8	SCREW, Hex-Head (3/8 x 1.0)	8
9	O-RING	1
10	PLUG, O-Ring	1
11	O-RING	1
12	O-RING	1
13	COLLECTOR, Reverse Shaft	1
14	SCREW, Hex-Head (3/8 x 1.0)	6
15	O-RING	1
16	PLUG, O-Ring	1
17	GASKET	1
18	SCREW, Hex-Head (7/16 x 2.75)	4
19	BLOCK ASSEMBLY, Pump Outlet	1
20	O-RING	1
21	PUMP, Oil	1
22	WASHER	2

Item	Description	Qty.
23	SCREW, Hex-Head (1/2 x 1.25)	4
24	TUBE, Suction	1
25	SCREW, Place-Head (3/8 x 1.50)	1
26	CLAMP, Tube	1
27	O-RING	2
28	TUBE, Connector	1
29	O-RING	1
30	HOUSING, Oil Strainer	1
31	STRAINER, Pump Section	1
32	SCREW, Hex-Head (1/2 x 1.25)	4
33	GASKET, Strainer Cover	1
34	COVER, Strainer	1
35	SCREW, Hex-Head (3/8 x 1.0)	4
36	COUPLING ASSEMBLY, Pump	1
37	O-RING	1
38	O-RING	1
39	COLLECTOR, Forward Shaft	1
40	SCREW, Hex-Head (3/8-16 x 1.12)	8
41	GASKET, Cover Plate	1
42	PLATE, Cover	1
43	SCREW, Hex-Head (1/2-13 x 1.00)	4

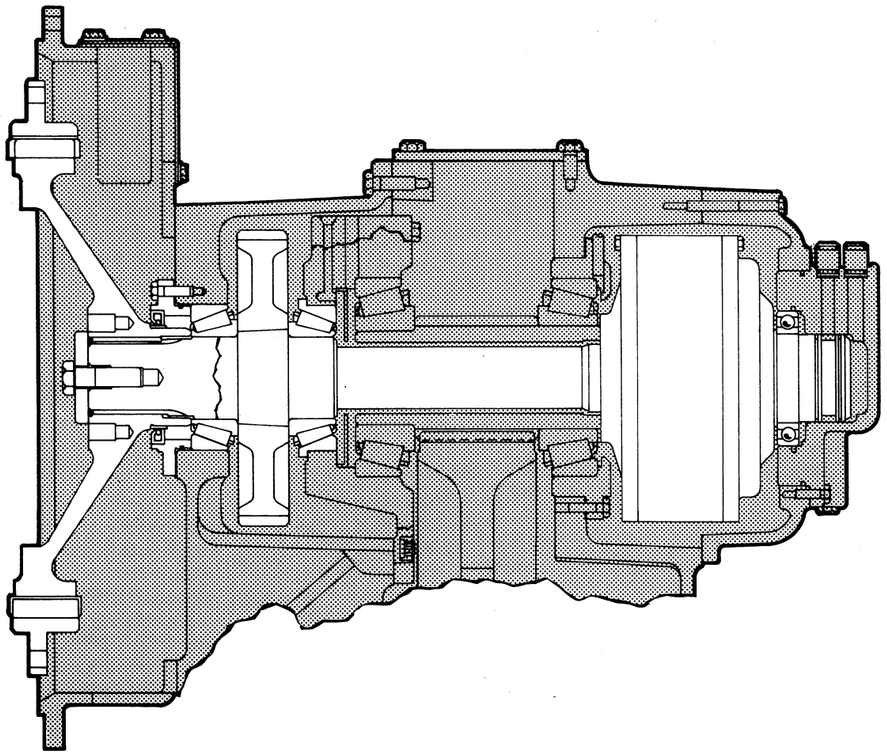


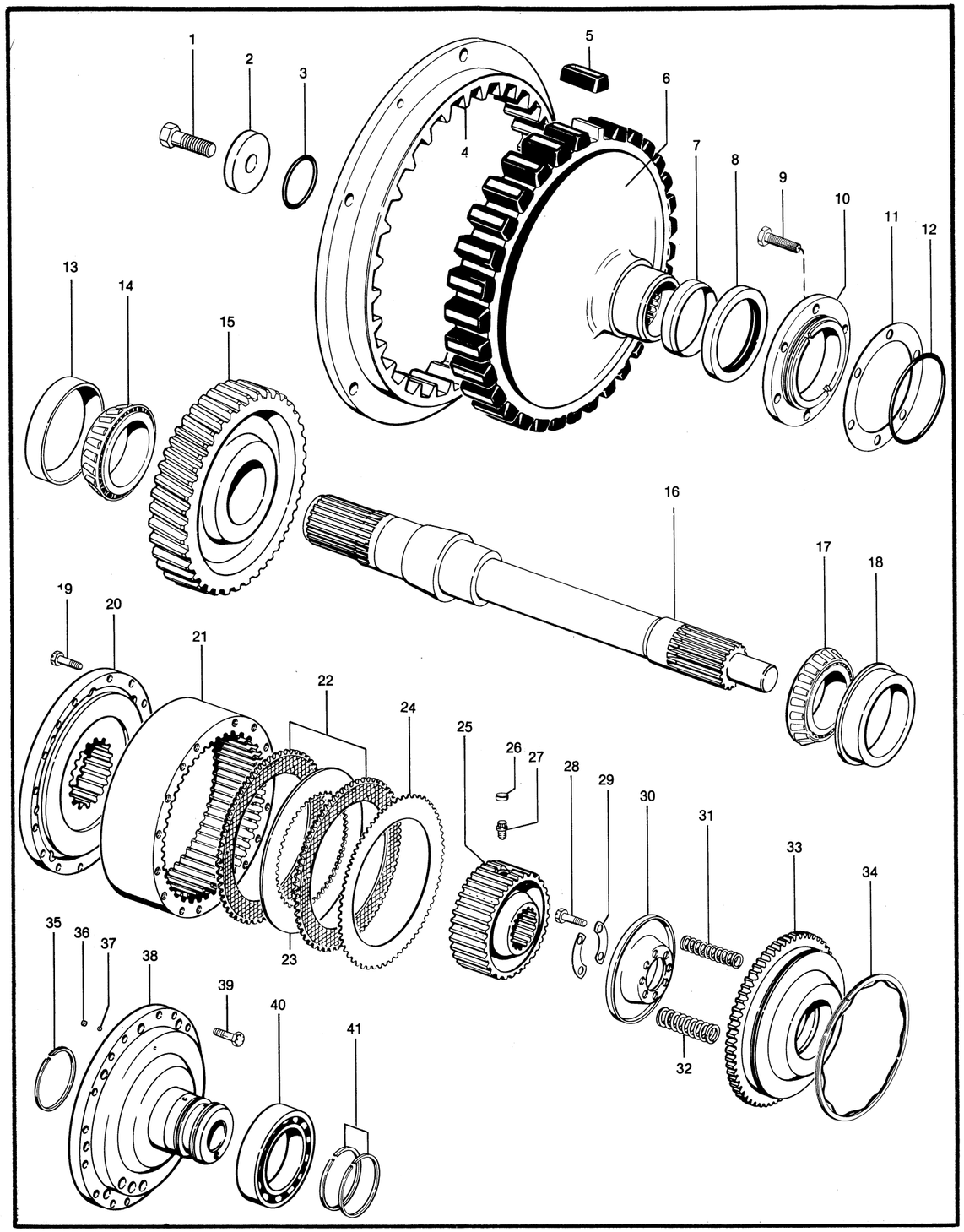


Plumbing Group. Figure 12-1.

Item	Description	Qty
1	SCREW, Hex-Head (3/4 x 2.5)	1
2	WASHER, Retainer	1
3	RING, Lathe Cut	1
4	RING, Driving	1
5	BLOCK, Rubber	32
6	SPIDER ASSEMBLY, Drive	1
7	SLEEVE, Wear	1
8	SEAL, Oil	1
9	SCREW, Hex-Head (3/8 x 1.25)	6
10	RETAINER, Input Bearing	1
11	SHIM	A/R
12	O-RING	1
13	BEARING, Roller, Outer Race	1
14	BEARING, Roller, Inner Race	1
15	GEAR, Driving Transfer	1
16	SHAFT, Input	1
17	BEARing, Roller, Inner Race	1
18	BEARING, Roller, Outer Race	1
19	SCREW, Place-head (4/16 x 1.25)	16
20	BACKPLATE, Clutch	1
21	SLEEVE, Clutch Drive	1

Item	Description	Qty
22	PLATE, Friction Clutch	8
23	PLATE, Steel (Clutch)	7
24	SHIM	A/R
25	HUB, Clutch	1
26	PLUG, Core	1
27	SCREW, Dowel Pin	1
28	SCREW, Place-head (5/16 x 1.25)	4
29	PLATE, Clamp	2
30	RETAINER, Clutch Spring	1
31	SPRING, Clutch Release (Inner)	8
32	SPRING, Clutch Release (Outer)	8
33	PISTON, Clutch	1
34	RING, Seal	1
35	RING, Piston	1
36	PLUG, Retainer	1
37	BALL, Steel	1
38	CYLINGER ASSEMBLY, Clutch	1
39	SCREW, Place-head (5/16 x 1.25)	15
40	BEARING, Ball	1
41	RING, Piston	2

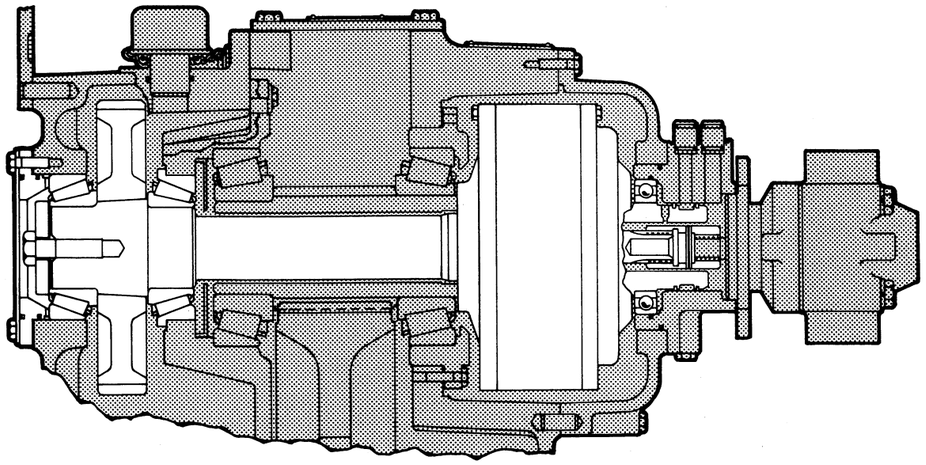


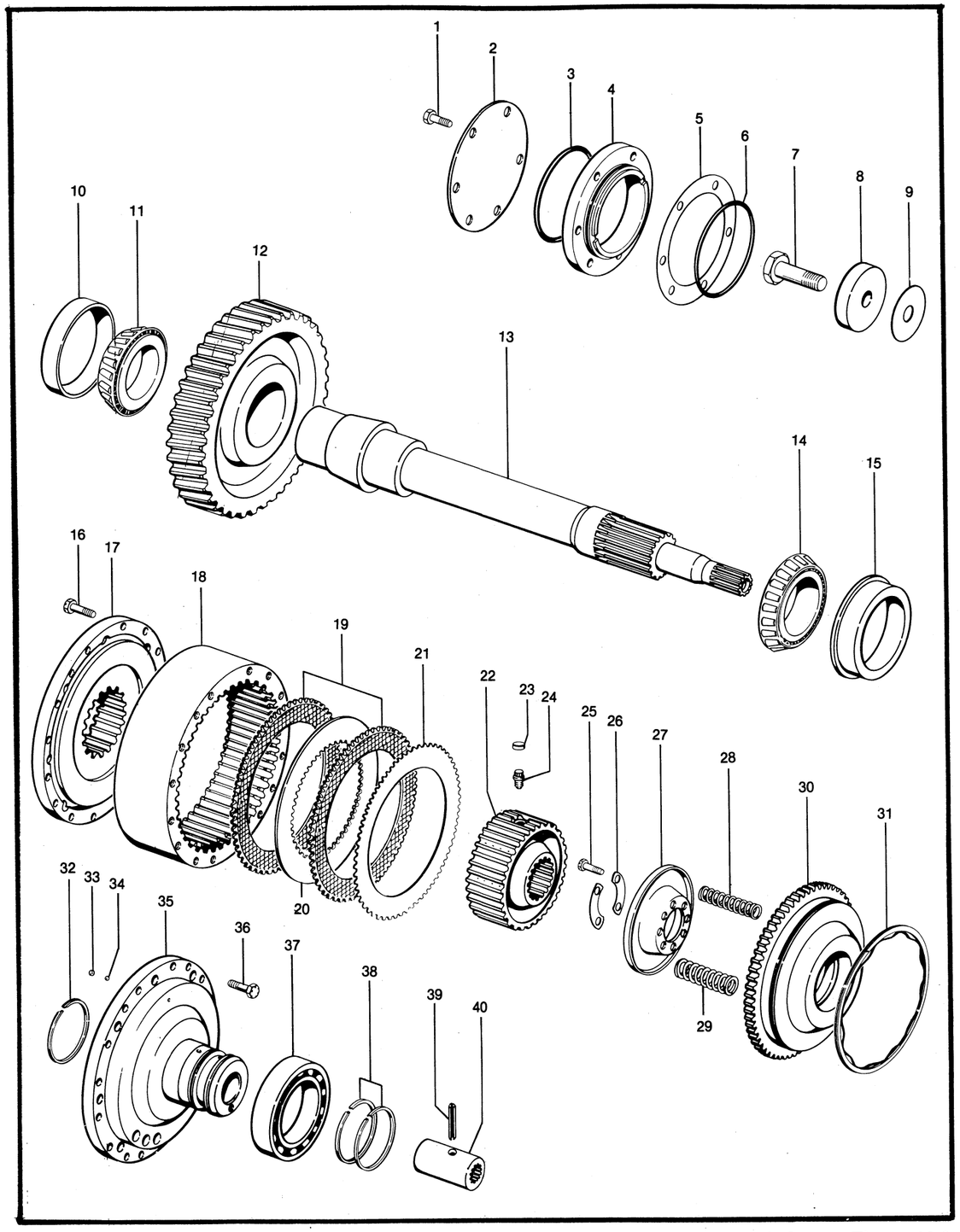


Input Shaft and Forward Clutch. Figure 12-2.

Item	Description	Qty
1	SCREW, Hex-Head (3/8 x 1.25)	6
2	COVER, Reverse Shaft	1
3	O-Ring	1
4	RETAINER, Reverse Bearing	1
5	SHIM	A/R
6	O-RING	1
7	SCREW, Hex-Head (3/4 x 2.50)	1
8	WASHER, Retainer	1
9	SHIM	A/R
10	BEARING, Taper Roller (Outer Race)	1
11	BEARING, Taper Roller (Inner Race)	1
12	GEAR, Driven Transfer	1
13	SHAFT, Reverse	1
14	BEARING, Taper Roller (Inner Race)	1
15	BEARING, Taper Roller (Outer Race)	1
16	SCREW, Place-Head (5/16 x 1.25)	16
17	BACKPLATE, Clutch	1
18	SLEEVE, Clutch Drive	1
19	PLATE, Friction Clutch	8
20	PLATE, Steel	7
21	SHIM, Clutch Release	A/R
22	HUB, Clutch	1

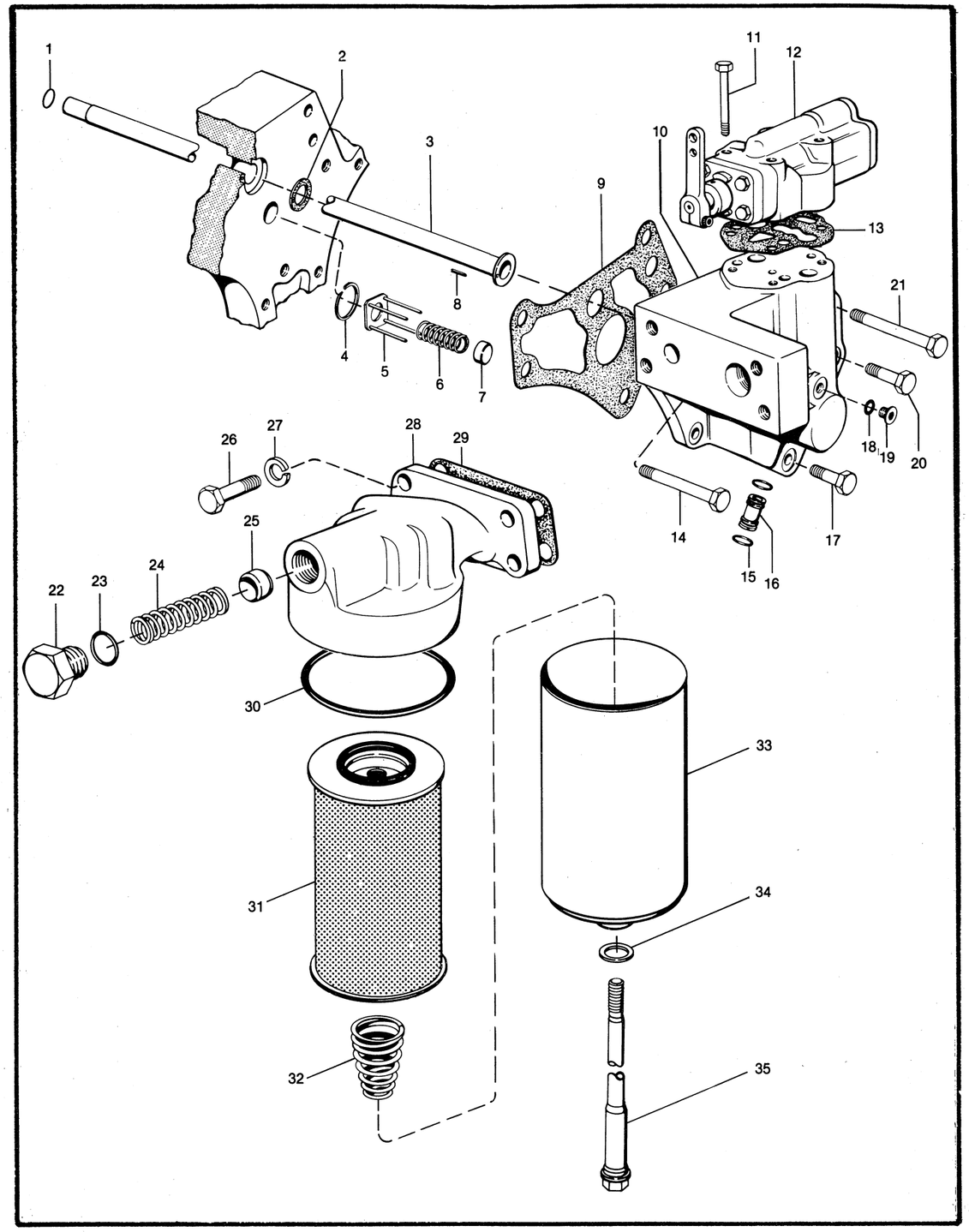
Item	Description	Qty
23	PLUG, Core	1
24	SCREW, Dowel Pin	1
25	SCREW, Place-Head (5/16 x 1.25)	4
26	PLATE, Clamp	2
27	RETAINER, Clutch Spring	1
28	SPRING, Clutch Release (Inner)	8
29	SPRING, Clutch Release (Outer)	8
30	PISTON, Clutch	1
31	RING, Seal	1
32	RING, Piston	1
33	PLUG, Retainer	1
34	BALL, Steel	1
35	CYLINGER ASSEMBLY, Clutch	1
36	SCREW, Place-Head (5/16 x 1.25)	16
37	BEARING, Ball	1
38	RING, Piston	2
39	ROLLPIN	1
40	COUPLING, Pump Drive	1





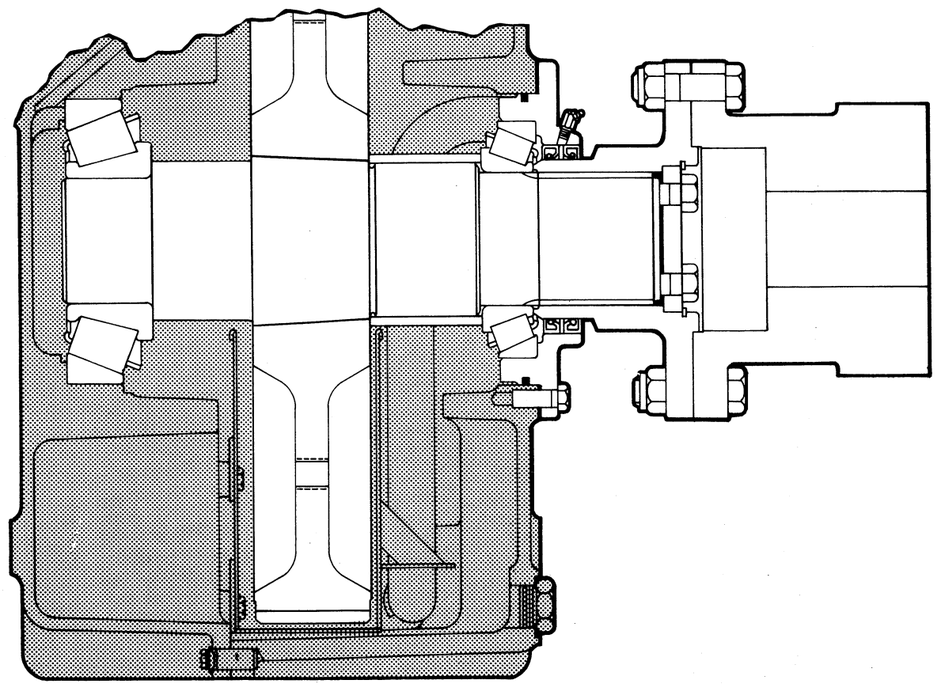
Reverse Shaft and Clutch Group. Figure 12-3.

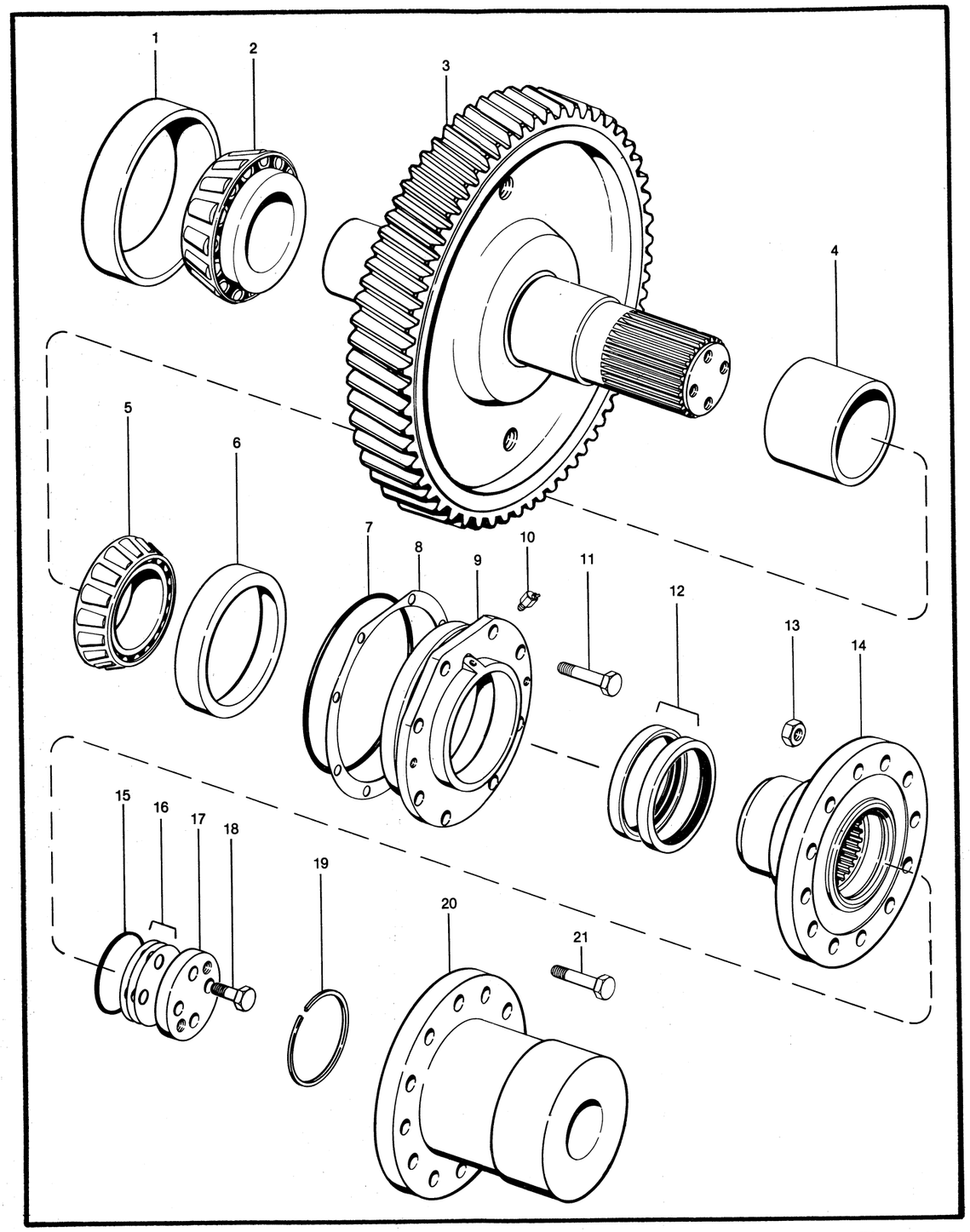
Item	Description	Qty
1	O-RING	1
2	GASKET, Lube Tube	1
3	TUBE, Lube	1
4	RING, Snap	1
5	PLATE ASSEMBLY, Guide	1
6	SPRING, Lube Valve	1
7	PISTON, Lube Valve	1
8	ROLLPIN	1
9	GASKET, Valve and Filter Carrier	1
10	CARRIER ASSEMBLY, Valve and Filter	1
11	SCREW, Hex-Head (3/8 x 2.75)	4
12	VALVE ASSEMBLY, Control	1
13	GASKET, Valve-to-Manifold	1
14	SCREW, Hex-Head (1/2 x 6)	1
15	O-RING	8
16	TUBE, Collector Oil	4
17	SCREW, Hex-Head (1/2 x 1.5)	2
18	O-RING	1
19	PLUG, O-ring	1
20	SCREW, Hex-Head (1/2 x 3.5)	1
21	SCREW, Hex-Head (1/2 x 8)	1
22	PLUG ASSEMBLY	1
23	O-RING	1
24	SPRING, Poppet Valve	1
25	VALVE, Poppet	1
26	SCREW, Hex-Head (1/2 x 1.75)	4
27	WASHER	4
28	HEAD, Filter	1
29	GASKET, Filter Mounting	1
30	O-RING	1
31	ELEMENT, 25 Micron Filter	1
32	SPRING, Hold Down Bolt	1
33	BODY, Filter	1
34	WASHER	1
35	BOLT, Hold Down	1



Lubrication Group of Parts. Figure 12-4.

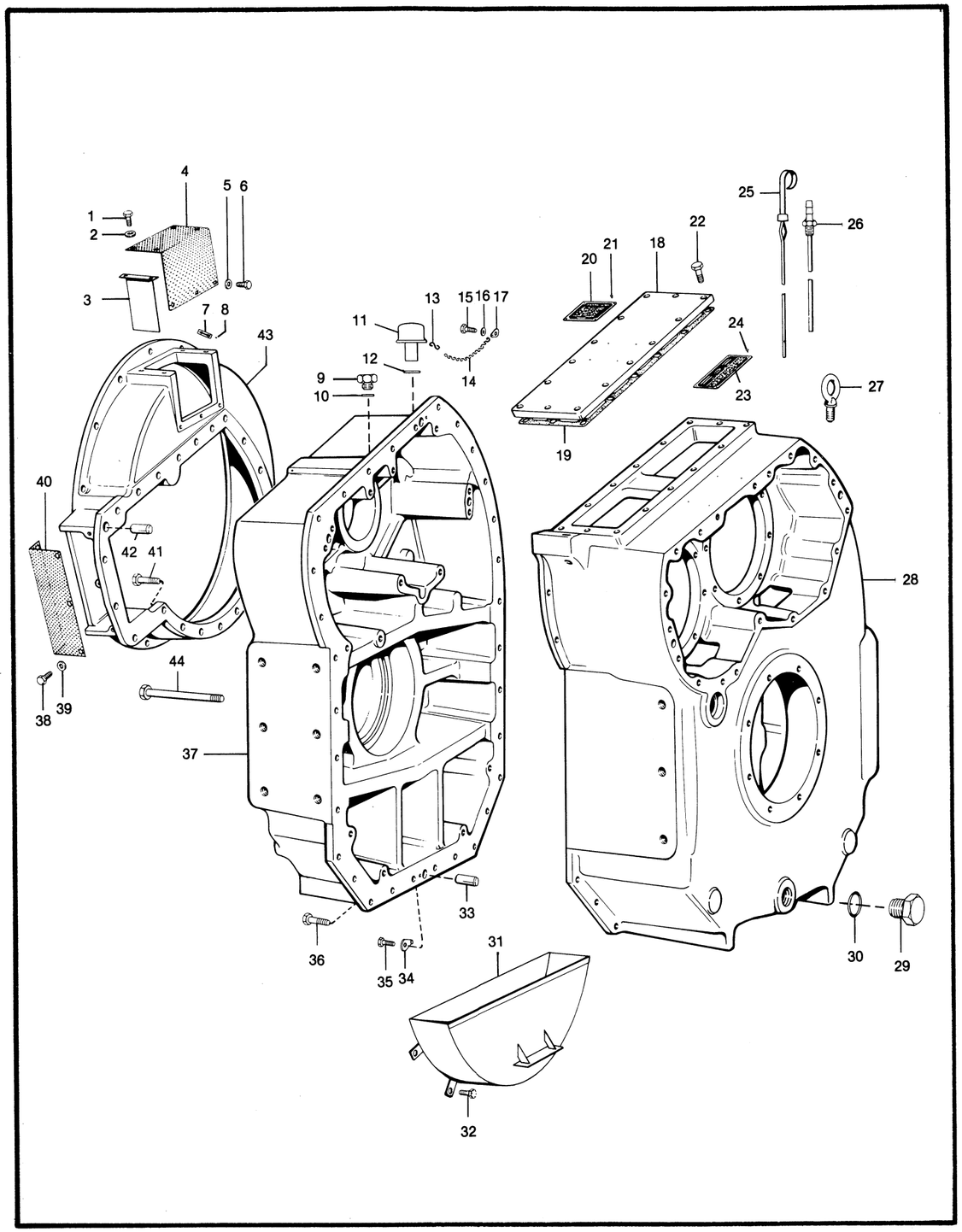
Item	Description	Qty
1	BEARING, Taper Roller (Outer Race)	1
2	BEARING, Raper Roller (Inner Race)	1
3	SHAFT AND GEAR ASSEMBLY, Output	1
4	RETAINER, Output Gear	1
5	BEARING, Taper Roller (Inner Race)	1
6	BEARING, Taper Roller (Outer Race)	1
7	O-RING	1
8	SHIM	A/R
9	CARRIER, Output Seal	1
10	FITTING, Hydraulic	1
11	SCREW, Hex-Head (5/8 x 1.75)	8
12	SEAL, Oil	2
13	NUT, Stop	12
14	FLANGE, Output	1
15	O-RING	1
16	SHIM	A/R
17	WASHER, Retainer	1
18	SCREW, Hex-Head (7/8 x 2.50)	4
19	RING, Snap	1
20	FLANGE, Companion	1
21	SCREW, Hex-Head (1 x 3.5)	12





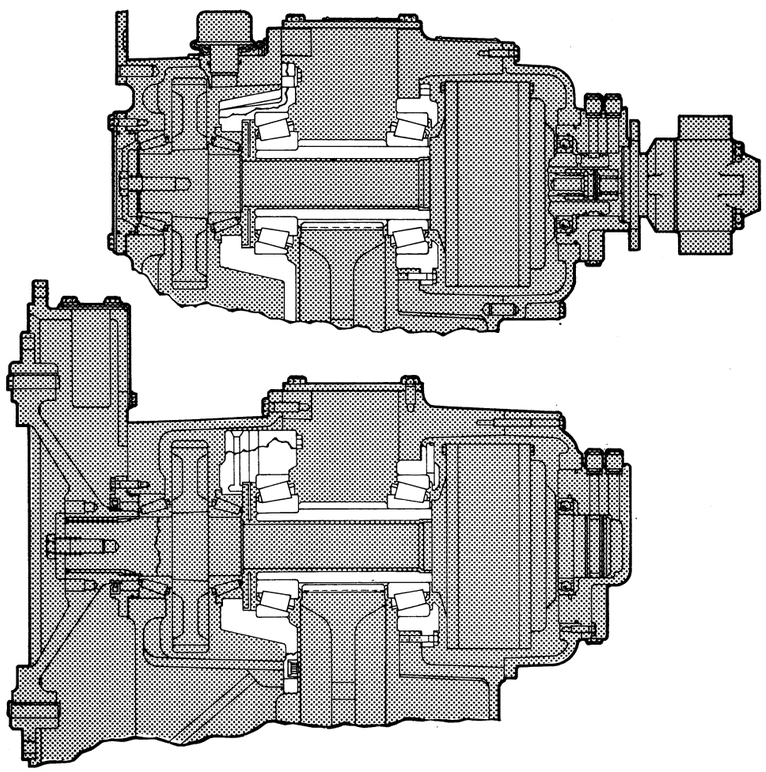
Output Group. Figure 12-5.

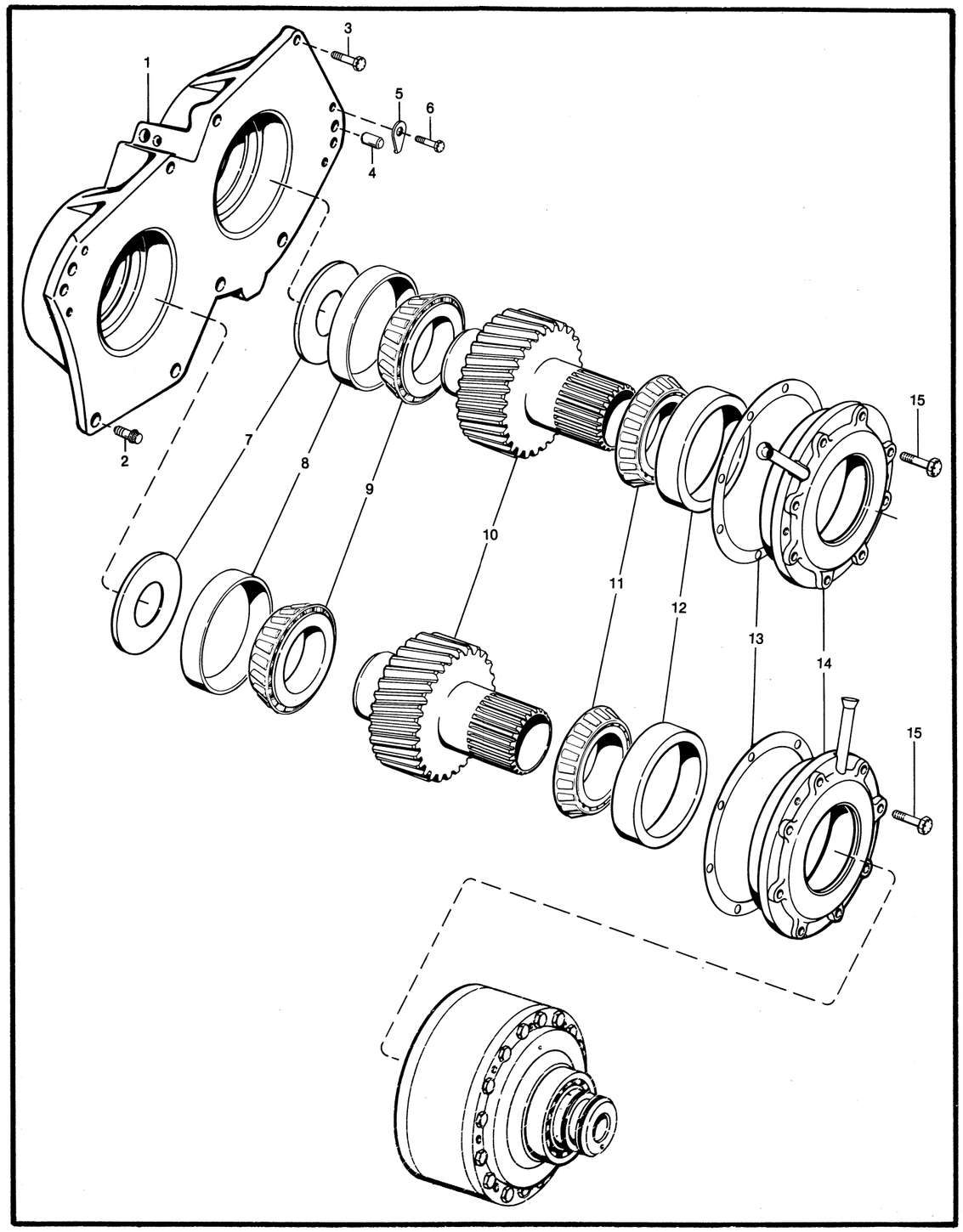
Item	Description	Qty
1	SCREW, Hex-Head (3½8 x 0.875)	4
2	WASHER	4
3	BAFFLE, Air	1
4	COVER, Block Access	1
5	WASHER	3
6	SCREW, Hex-Head (5½16 x 0.62)	3
7	PLATE, Rotation Indicator	1
8	SCREW, Drive	2
9	PLUG, O-ring	1
10	O-RING	1
11	BREATHER ASSEMBLY	1
12	O-RING	1
13	"S" LINK, Breather	1
14	CHAIN, Breather	1
15	SCREW, Hex-Head (1-2 x 1.5)	1
16	WASHER	1
17	CLIP, Breather Chain	1
18	COVER, Housing, Top	1
19	GASKER, Top Cover	1
20	PLATE, Instruction (Lube)	1
21	SCREW, Drive	4
22	SCREW, Hex-Head (1/2 x 1.0)	14
23	PLATE, Instruction	1
24	SCREW, Drive	4
25	GAUGE, Oil	1
26	TUBE, Oil Gauge	1
27	EYEBOLT	2
28	HOUSING, Main (Rear Half)	1
29	PLUG, O-ring	1
30	O-RING	1
31	PAN, Oil	1
32	SCREW, Place-Head (1/2 x 1.0)	4
33	PIN, Dowel	2
34	PLATE, Clamp	2
35	SCREW, Hex-Head (3½8 x 0.75)	2
36	SCREW, Hex-Head (1/2 x 1.5)	23
37	HOUSING, Front Half	1
38	SCREW, Hex-Head (5/16 x 0.62)	9
39	WASHER	9
40	COVER, Ventilating	1
41	SCREW, Hex-Head (3/8 x 1.25)	20
42	PIN, Dowel	2
43	HOUSING, Front	1
44	SCREW, Hex-Head (1/2 x 8.75)	8



Housing Assembly. Figure 12-6.

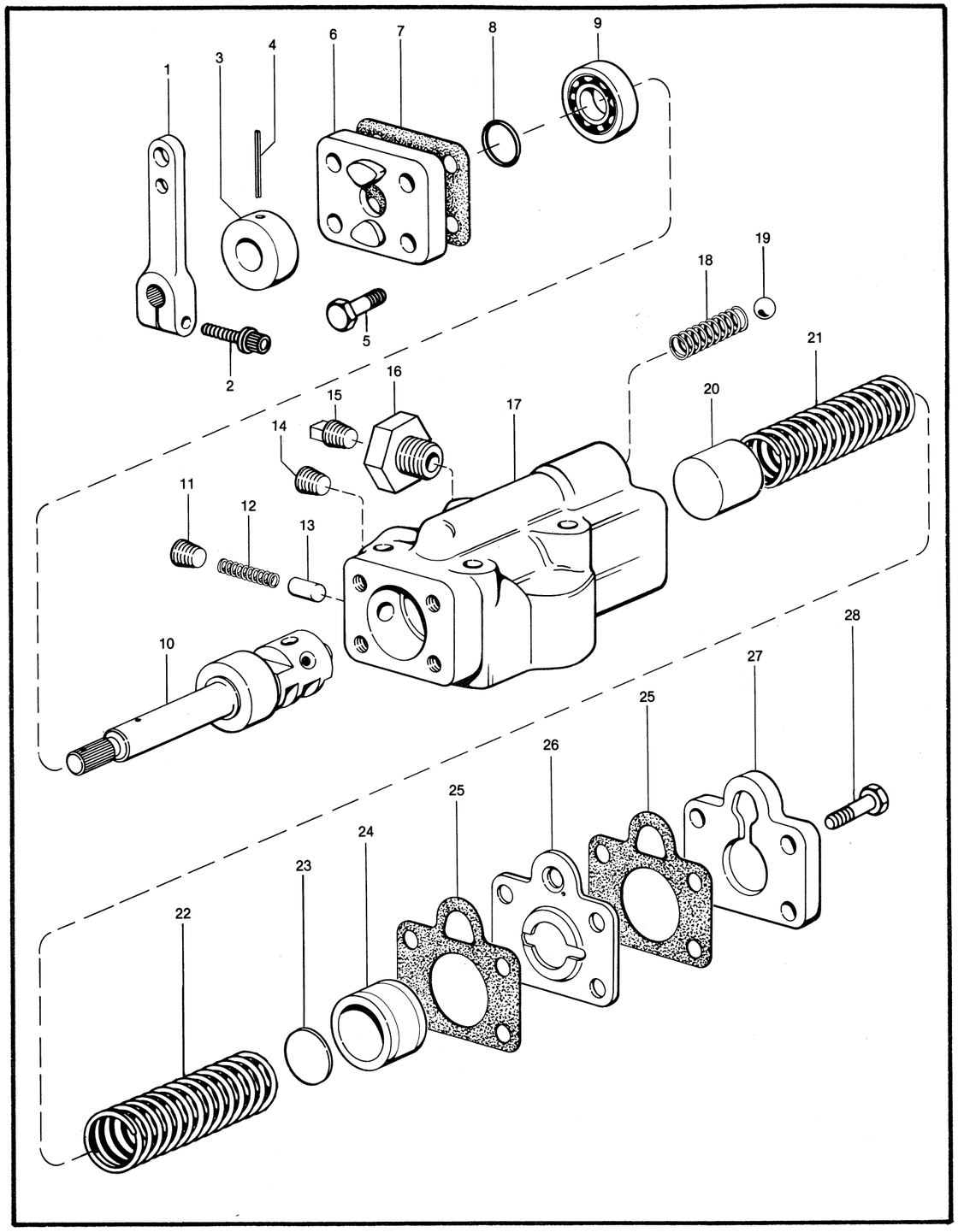
Item	Description	Qty
1	CARRIER, Bearing	1
2	SCREW, 12 Point Head (1/2 x 1.0)	4
3	SCREW, Place-Head (1/2 x 1.5)	5
4	PIN, Dowel	2
5	PLATE, Clamp	2
6	SCREW, Place-Head (3/8 x 1.5)	2
7	CATCHER, Oil	2
8	BEARING, Taper Roller (Outer Race)	2
9	BEARING, Taper Roller (Inner Race)	2
10	PINION, Input	2
11	BEARING, Taper Roller (Inner Race)	2
12	BEARING, Taper Roller (Outer Race)	2
13	SHIM	A/R
14	CARRIER ASSEMBLY, Bearing	2
15	SCREW, Place-Head (3/8 x 1.5)	16





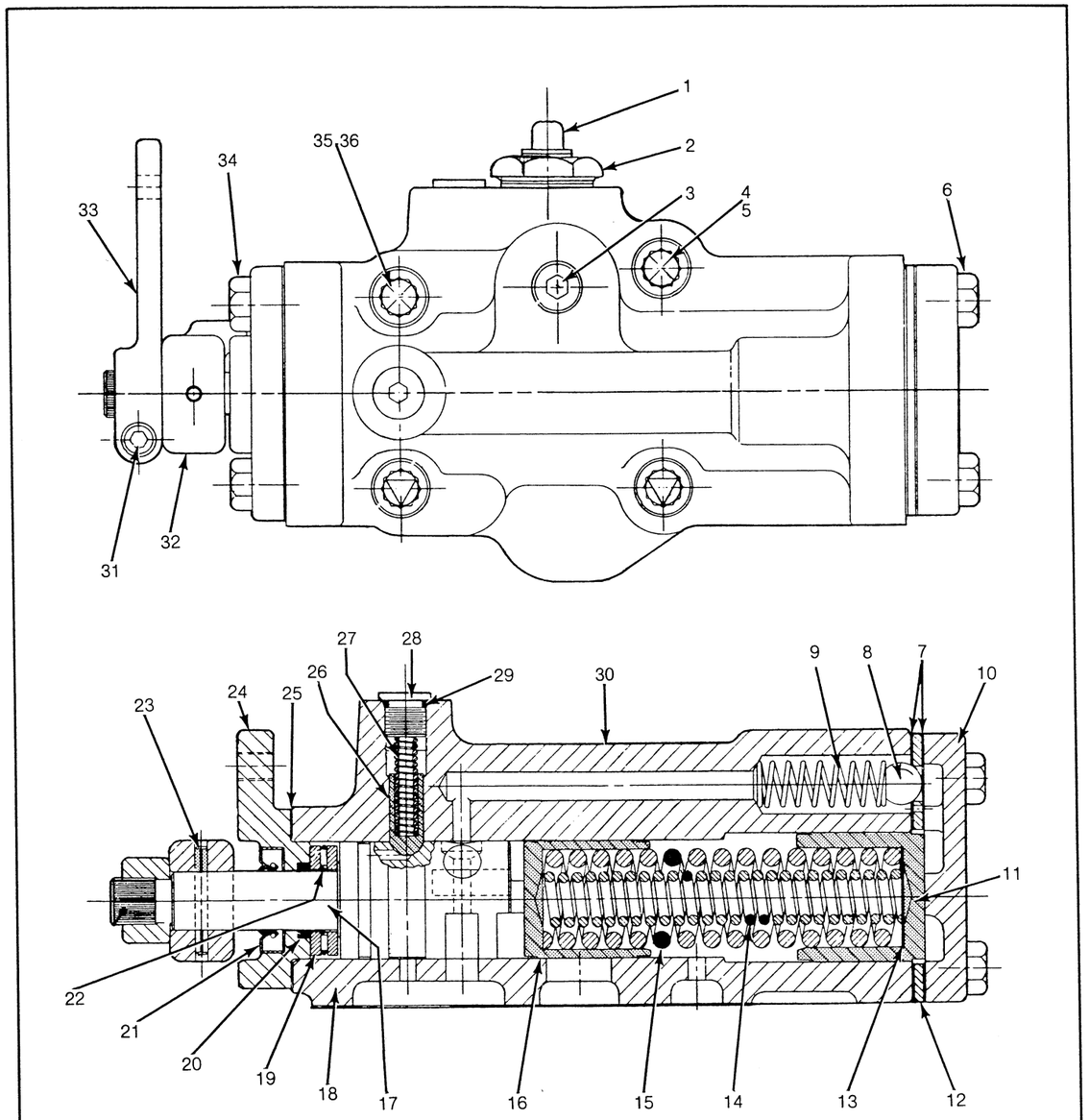
Forward and Reverse Input Pinions. Figure 12-7.

Item	Description	Qty
1	LEVER, Shift	1
2	SCREW, Socket-head (1/4 x 7/8)	1
3	COLLAR, Stop	1
4	ROLLPIN	1
5	SCREW, Hex-Head (5/16 x 1)	4
6	COVER, (Valve)	1
7	GASKET, (Valve Cover)	1
8	O-RING	1
9	BEARING, Ball	1
10	STEM, Valve	1
11	PLUG, Pipe	1
12	SPRING, (Detent)	1
13	DETENT	1
14	PLUG, Pipe	1
15	BUSHING, Reducer	1
16	PLUG, Pipe	1
17	BODY, Valve	1
18	SPRING, (Orifice Plate)	1
19	BALL, (Orifice Plate)	1
20	PISTON (High Pressure Regulation)	1
21	SPRING (Inner)	1
22	SPRING (Outer)	1
23	SHIM	A/R
24	PISTON, (Rate-of-Rise)	1
25	GASKET, (Orifice Plate)	2
26	PLATE, Orifice	1
27	COVER, (Orifice Plate)	1
28	SCREW, Hex-Head (5/16 x 1)	4

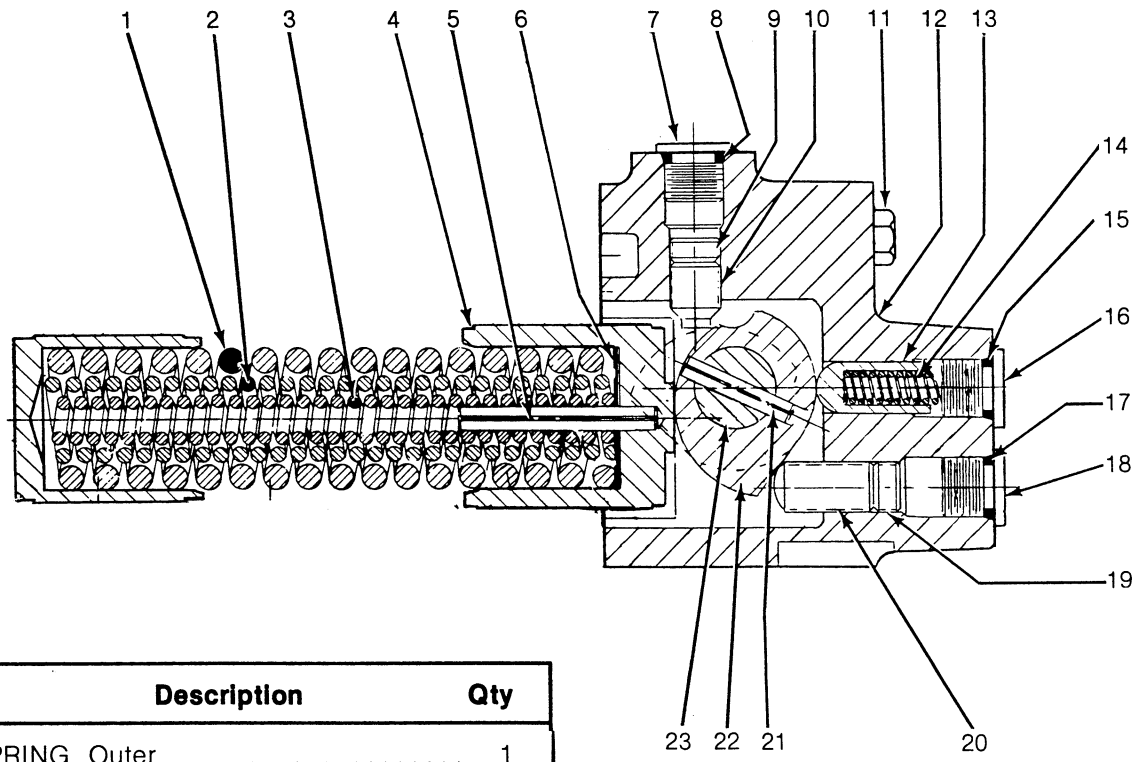


Control Valve. Figure 12-8.

Item	Description	Qty
1	PLUG, Pipe	1
2	BUSHING, Reducer	1
3	PLUG, Pipe	1
4	SCREW, 12-Point Head (3/8-16 x 1.00) (25-29 lb. ft. oiled torque)	3
5	CLOSURE, Plastic	3
6	SCREW, Hex-Head (5/16-18 x 1.00)	4
7	GASKET	2
8	BALL, Steel	1
9	SPRING, Detent	1
10	COVER, Orifice Plate	1
11	PISTON, Rate-of-Rise	1
12	PLATE, Orifice	1
13	SHIM	A/R
14	SPRING, Inner	1
15	SPRING, Outer	1
16	PISTON, High Pressure Regulator	1
17	STEM, Valve	1
18	GASKET, Valve to Manifold	1
19	RACE, Thrust	2
20	O-RING	1
21	SEAL, Oil	1
22	BEARING, Needle Thrust	1
23	PIN, Roll	1
24	COVER, Valve	1
25	GASKET	1
26	DETENT	1
27	SPRING, Detent	1
28	O-RING	2
29	PLUG, O-Ring	2
30	BODY, Valve	1
31	SCREW, Socket-Head (1/4-20 x .875)	1
32	COLLAR, Stop	1
33	LEVER, Shift	1
34	SCREW, Hex-Head (5/16-18 x 1.00)	4
35	SCREW, 12-Point Head (3/8-16 x 3.50) (25-29 lb. ft. oiled torque)	1
36	CLOSURE, Plastic	1



Control Valve. Figure 12-9.



Item	Description	Qty
1	SPRING, Outer	1
2	SPRING, Middle	1
3	SPRING, Inner	1
4	PISTON (Rate-of-Rise)	1
5	PIN, Roll, Piston	1
6	SHIM	A/R
7	PLUG, O-Ring	1
8	O-RING	1
9	SCREW, Lock (3/8 × 0.875)	1
10	SETSCREW, Dog-Point (3/8 × 0.1875)	1
11	SCREW, Hex-Head (5/16 × 3.00)	4
12	COVER ASSEMBLY, Trolling	1
13	DETENT	1
14	SPRING, Detent	1
15	O-RING	1
16	PLUG, O-Ring	1
17	O-RING	1
18	PLUG, O-Ring	1
19	SCREW, Lock (3/8 × 0.875)	1
20	SETSCREW, Cam (3/8 × 0.75)	1
21	PIN, Roll	1
22	CAM	1
23	SHAFT, Trolling Valve	1
24	LEVER, Shift (Trolling Valve)	1
25	SCREW, Hex-Head (1/4 × 1.00)	1
26	NUT, Hex (1/4-20)	1
27	O-RING	1
28	O-RING	1
29	SEAL, Oil	2

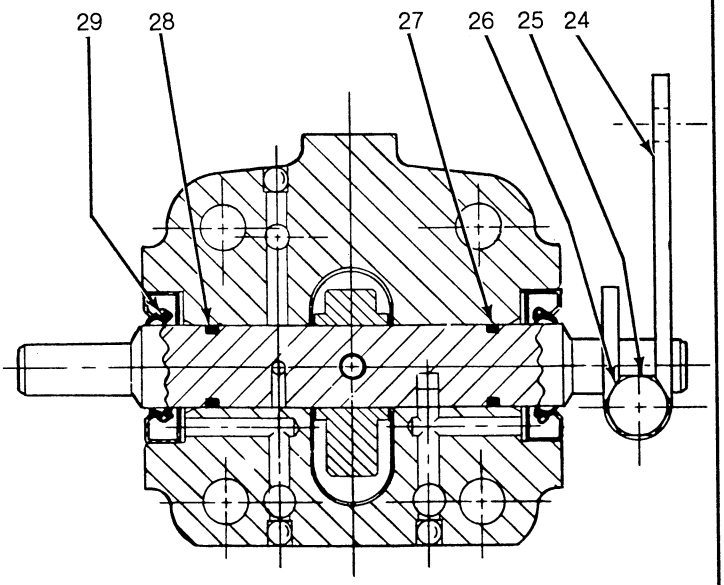


Figure 12-10. Control Valve Parts Optional.

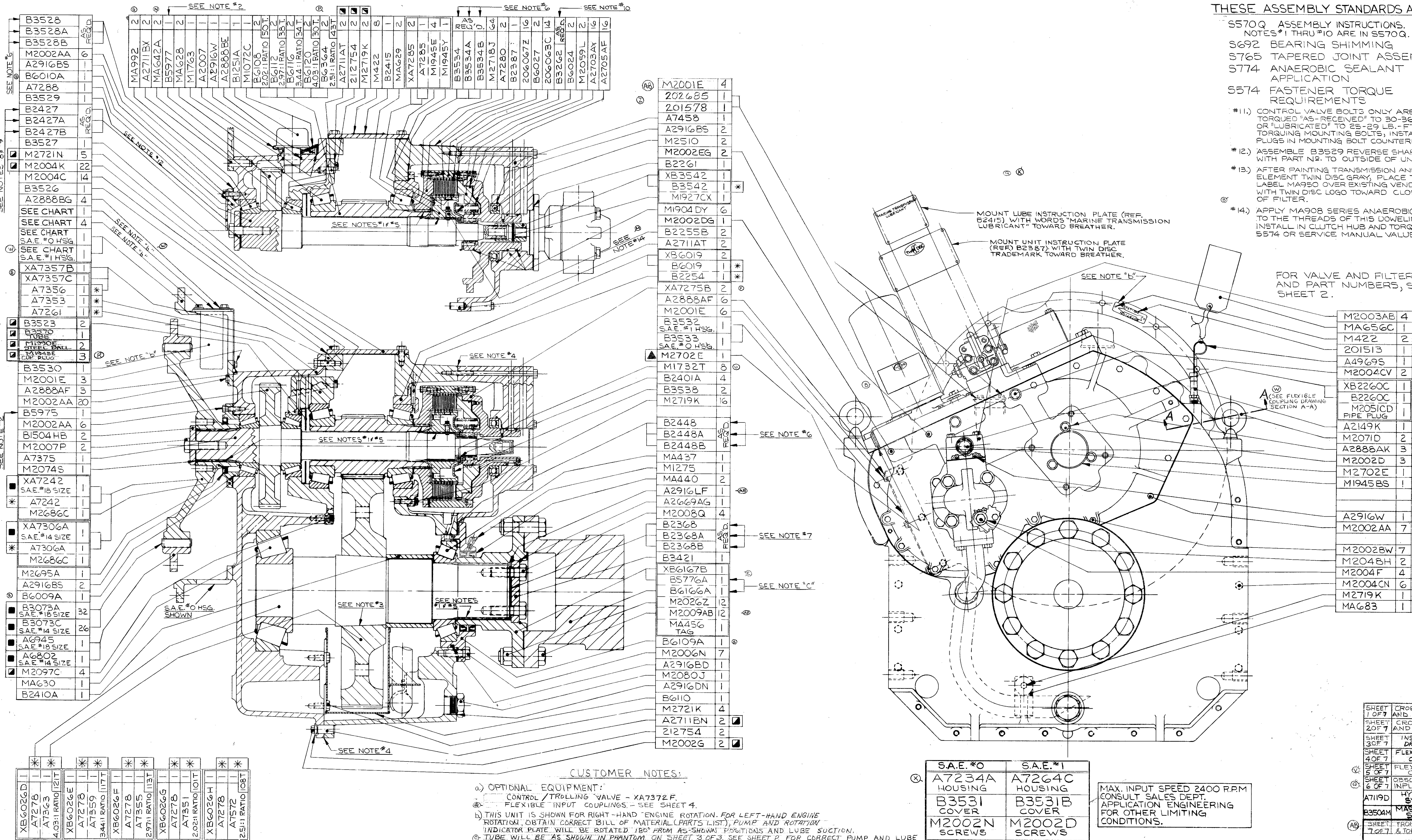
PLANOGRAPH CAUTION

The following planographs are for reference only. Assembly notes on the planographs are referring to general specifications covering all Twin Disc products. Specific information from these general specifications is included in Sections 8 and 9 of this manual. See below.

Planographs are not to be used for ordering parts nor for disassembly and assembly techniques. Use the bill of material for ordering parts and the pertinent sections of the manual for disassembly and assembly techniques.

PLANOGRAPH	REFERENCE NOTES	FUNCTION	PAGE NUMBER
XA-7352 (shallow case) and XA-7255 (deep case)	1	Degreasing taper shafts and bores	9-1
	2	Assembling gears on taper shaft	9-1
	3	Not applicable	
	4	Applying anaerobic plastic gasket compound	9-3
	5	Assembling splined parts	9-11
	6	Tapered bearing adjustment	9-3, 9-4, 9-5
	7	Seating output flange, measuring gap, and shimming retainer washer	9-11
	8	Seating and shimming drive spider	9-8
	9	Measuring gap and shimming reverse shaft	9-2
	10	Assembling clutches	9-8, 9-9, 9-10

B



THESE ASSEMBLY STANDARDS APPLY:

S570Q ASSEMBLY INSTRUCTIONS.
NOTES #1 THRU #10 ARE IN S570Q.

S692 BEARING SHIMMING

S765 TAPERED JOINT ASSEMBLY

S774 ANAEROBIC SEALANT APPLICATION

S574 FASTENER TORQUE REQUIREMENTS

#11.) CONTROL VALVE BOLTS ONLY ARE TO BE TORQUED "AS-RECEIVED" TO 30-36 LB.-FT. OR "LUBRICATED" TO 25-29 LB.-FT. AFTER TORQUING MOUNTING BOLTS, INSTALL M2067Q PLUGS IN MOUNTING BOLT COUNTERBORES.

#12.) ASSEMBLE B3529 REVERSE SHAFT COVER WITH PART No. TO OUTSIDE OF UNIT.

#13.) AFTER PAINTING TRANSMISSION AND FILTER ELEMENT TWIN DISC GRAY, PLACE TWIN DISC LABEL MA950 OVER EXISTING VENDOR LABEL WITH TWIN DISC LOGO TOWARD CLOSED END OF FILTER.

#14.) APPLY MA908 SERIES ANAEROBIC SEALANT TO THE THREADS OF THIS DOWELING SCREW, INSTALL IN CLUTCH HUB AND TORQUE TO S574 OR SERVICE MANUAL VALUES.

FOR VALVE AND FILTER DETAILS AND PART NUMBERS, SEE SHEET 2.

CUSTOMER NOTES:

a.) OPTIONAL EQUIPMENT:
CONTROL / TROLLING VALVE - XA7372F.
FLEXIBLE INPUT COUPLINGS - SEE SHEET 4.

b.) THIS UNIT IS SHOWN FOR RIGHT-HAND ENGINE ROTATION. FOR LEFT-HAND ENGINE ROTATION, OBTAIN CORRECT BILL OF MATERIAL (PARTS LIST), PUMP AND ROTATION INDICATOR PLATE WILL BE ROTATED 180° FROM AS-SHOWN POSITIONS AND LUBE SUCTION. TUBE WILL BE AS SHOWN IN PHANTOM ON SHEET 3 OF 3. SEE SHEET 2 FOR CORRECT PUMP AND LUBE SUCTION TUBE PART NUMBERS. B3530 BAFFLE WILL BE IN THE LEFT PORTION OF THE HOUSING SLOT WHEN VIEWED FROM OUTPUT END OF UNIT FOR RIGHT-HAND ENGINE ROTATION AND ON THE OPPOSITE SIDE FOR LEFT-HAND ENGINE ROTATION.
SEE COUPLING DRAWING FOR ALTERNATE BAFFLE, CAPSCREWS AND VENTILATING COVER.

c.) BEFORE OPERATING IN VESSEL:
OUTPUT FLANGE AND COMPANION FLANGE ARE MATCHED PARTS. ALIGN THEM PROPERLY PER FACTORY MARKINGS.

■ PARTS FOR RUBBER BLOCK DRIVE INPUT.
● PARTS FOR FLEXIBLE COUPLING DRIVE INPUT.
▲ REMOVE BEFORE OPERATING, 2 PLACES, ALUMINUM PLUG.
✱ NOT SERVICEABLE SEPARATELY.
◪ THESE PARTS ARE COMPONENTS OF XA7357 HOUSING ASS'Y. BUT MAY BE PURCHASED SEPARATELY.

S.A.E. #0	S.A.E. #1
A7234A HOUSING	A7264C HOUSING
B3531 COVER	B3531B COVER
M2002N SCREWS	M2002D SCREWS

MAX. INPUT SPEED 2400 R.P.M
CONSULT SALES DEPT.
APPLICATION ENGINEERING
FOR OTHER LIMITING
CONDITIONS.

SHEET 1 OF 7	CROSS SECTION AND PART NUMBERS
SHEET 2 OF 7	CROSS SECTION AND PART NUMBERS
SHEET 3 OF 7	INSTALLATION DRAWING
SHEET 4 OF 7	FLEXIBLE INPUT COUPLINGS
SHEET 5 OF 7	FLEXIBLE INPUT COUPLINGS
SHEET 6 OF 7	OBSOLETE FLEXIBLE INPUT COUPLINGS
A7119D	HYDRAULIC SYSTEM
B3504M	MASS ELASTIC SYSTEM
SHEET 7 OF 7	FRONT, LEFT, RIGHT, & TOP VIEWS OF UNIT

THIS IS NOT A CAD DRAWING

SIMILAR TO: XA7255A

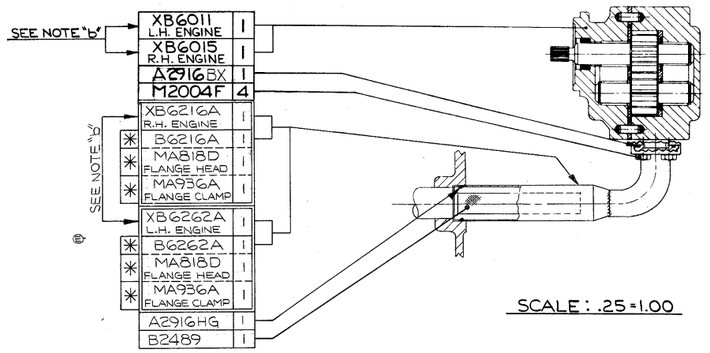
SYM.	ZONE	CHANGE	CH. NO.	DATE	BY	SYM.	ZONE	CHANGE	CH. NO.	DATE	BY	SYM.	ZONE	CHANGE	CH. NO.	DATE	BY
						AD	SHT 2&3	REVISED	28958	1-21-99	WR						
X	B,C-2 F-5	ADDED CHART FOR S.A.E. #0 & #1	26090	5-8-95	JS	AC	C6 SH3	REV'D HE REQUIREMENTS	28719	8-11-98	DMB						
W	B-4 D-1 F-5	ADDED (2) SEE NOTE "b" ADDED SECTION A-A	24681	2-4-94	DM	AB	A1 D6	ADDED BOX INFO REV'D P/N	27808	6-24-97	SWP						
V	A-1 A-2	ADDED SHEET 5 REFERENCES	25071	6-16-93	RM	AA	A1	REV'D. SHT. NOS.	27790	6-5-97	REB						
U	D,E-4 E-5	M1732T WAS M2718J	24293	2-1-93	JS	Z	D6	REV'D P/N	26559	1-4-96	TM	AF	SHT 1 C-3	M2009AB WAS M2009K	29326	5-7-99	AZ
T	A-4	M2051CD WAS M2051AA	24289	1-19-93	RM	Y	A-1	SHEET 1 OF 6 WAS 1 OF 5	26064	5-8-95	DM	AE	SHT 1 C-3	A2916LF WAS A2916G	29289	4-22-99	AZ

A/E 888-036 FORM 159M 300-10-78

NAME: MG520-1 MARINE TRANSMISSION
MATERIAL:
RATIOS: 2.02:1, 2.51:1, 2.97:1, 3.44:1, 4.03:1
ROUGH WT. / FINISH WT.
UNLESS OTHERWISE SPECIFIED ALLOWABLE VARIATION ON MACHINED DIMENSIONS ± —
DATE: 5-23-83
SCALE: .25 = 1.00
DRAWN: KC
CHECKED: REF. JS
APPROVED: BCA

TWIN DISC INCORPORATED
RACINE, WI 53403 — U.S.A.

XA7352A
SHEET 1 OF 7 Rev. AF



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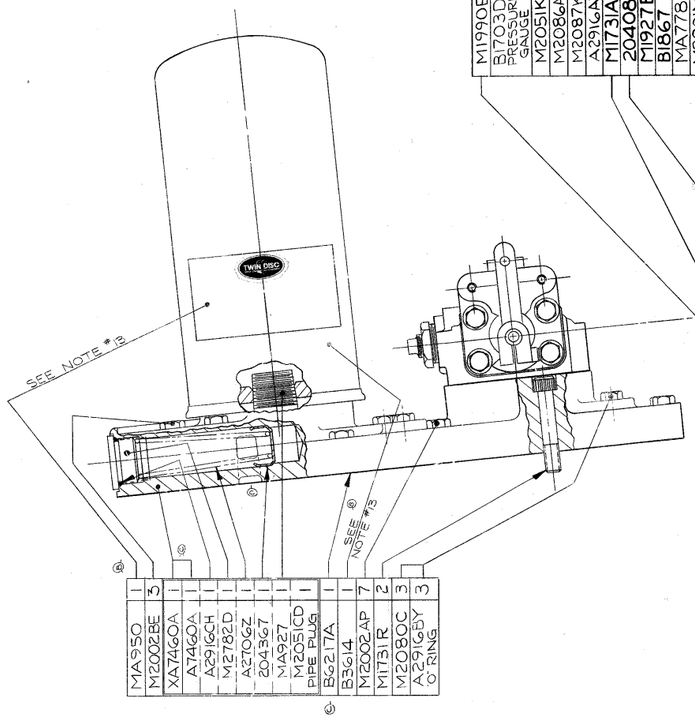
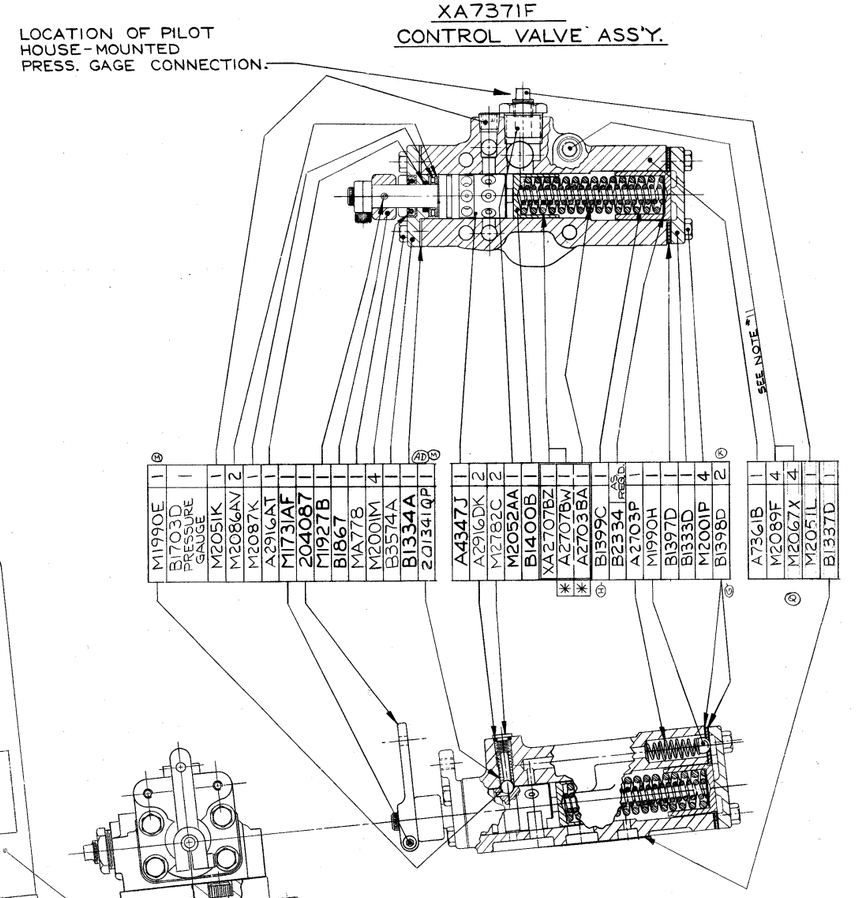




THIS IS NOT A CAD DRAWING

SIMILAR TO: XA7255A

SYM.	Zone	CHANGE	CH. NO.	DATE	BY

SYM.	Zone	CHANGE	CH. NO.	DATE	BY

SYM.	Zone	CHANGE	CH. NO.	DATE	BY

PART: MG520-1 MARINE TRANSMISSION
DATE: 5-23-83
SCALE: .50 = 1.00
DRAWN: KS
CHECKED: JS
APPROVED:

TWIN DISC INCORPORATED RACINE, WI 53403, U.S.A.

XA7352A

SHEET 2 OF 7 REV. AF

FORM 1004M

(OPTIONAL) TROLLING VALVE INSTALLATION AND OPERATING NOTES:

1.) REFER TO VALVE ASSEMBLY DRAWING FOR ADDITIONAL INSTALLATION NOTES. CONTROL HEAD FOR TROLLING VALVE MUST INCLUDE A DEVICE TO LOCK TROLLING VALVE CONTROL LEVER IN THE DETENTED NO-TROLL POSITION DURING MANEUVERING, DOCKING AND OTHER OPERATING CONDITIONS THAT REQUIRE FULL POWER TO THE PROPELLER.

2.) MAXIMUM ENGINE SPEED WHILE TROLLING, 1100 R.P.M. OR 60% OF FULL-LOAD ENGINE SPEED, WHICHEVER IS SMALLER.

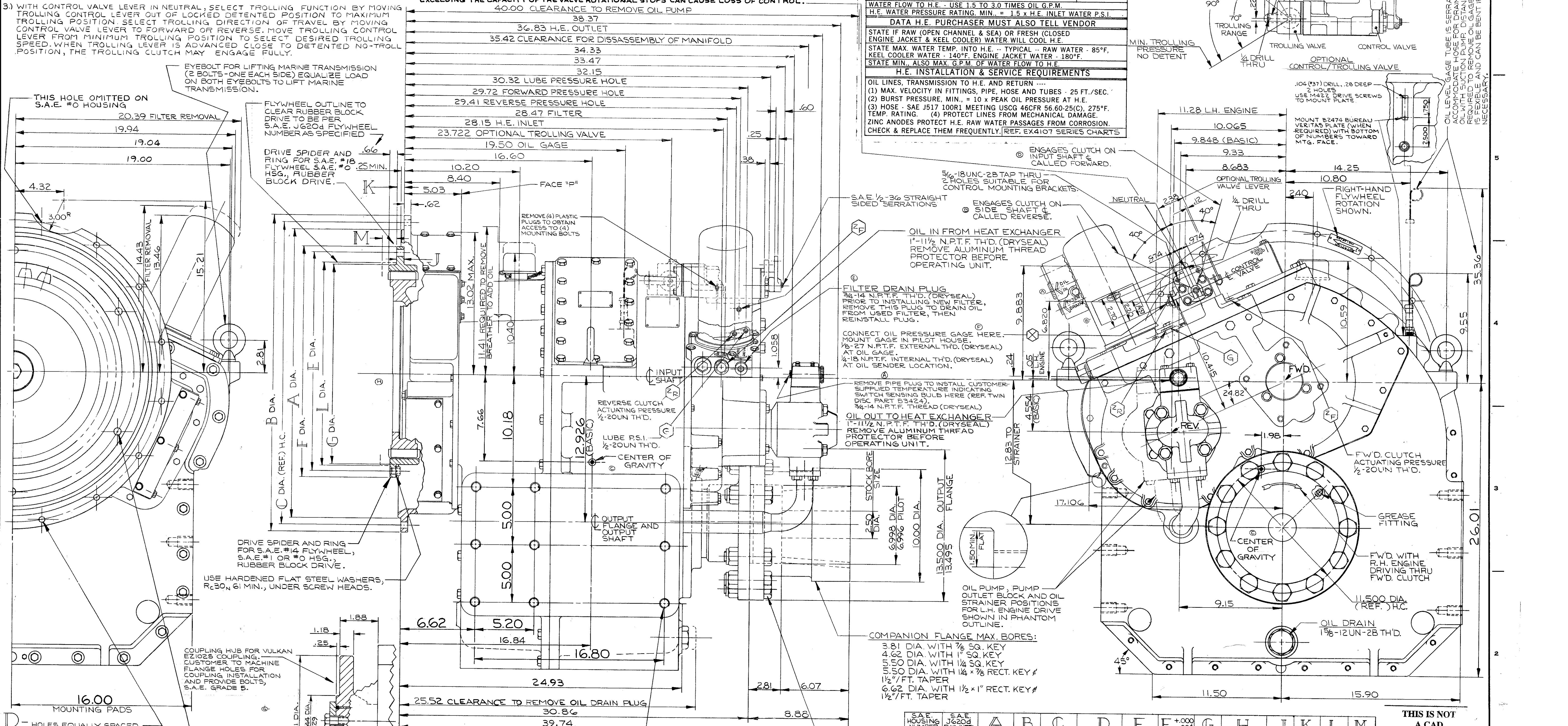
3.) WITH CONTROL VALVE LEVER IN NEUTRAL, SELECT TROLLING FUNCTION BY MOVING TROLLING CONTROL LEVER OUT OF LOCKED DETENTED POSITION TO MAXIMUM TROLLING POSITION. SELECT TROLLING DIRECTION OF TRAVEL BY MOVING CONTROL VALVE LEVER TO FORWARD OR REVERSE. MOVE TROLLING CONTROL LEVER FROM MINIMUM TROLLING POSITION TO SELECT DESIRED TROLLING SPEED. WHEN TROLLING LEVER IS ADVANCED CLOSE TO DETENTED NO-TROLL POSITION, THE TROLLING CLUTCH MAY ENGAGE FULLY.

CONTROL VALVE

(AD) 4-14 LBF. AT THE 2.20R. LOCATION OF THE 1/4 DIA. HOLE IS REQUIRED TO OVERCOME DETENT EFFORT. THE DETENT FEATURE IS PROVIDED IN THE FULL FORWARD, FULL REVERSE AND NEUTRAL LEVER POSITIONS. (THE DETENT SPRING AND PIN MAY BE OMITTED WHEN REMOTE CONTROL SYSTEMS PROVIDE FORWARD, NEUTRAL AND REVERSE DETENTS THAT CORRESPOND EXACTLY WITH VALVE DETENT POSITIONS. FORCE AT THE LEVER HOLE TO OPERATE THE VALVE THEN REDUCES TO 3-7 LBS.). THE REMOTE CONTROL VALVE ACTUATOR MUST PROVIDE ±1.41 LINEAR TRAVEL FROM NEUTRAL AT THE 1/4 DIA. HOLE LOCATION. ROTATIONAL STOPS AT THE STATED VALVE TRAVEL LIMITS HAVE A MAXIMUM CAPACITY OF 100LBS. AT THE 1/4 DIA. HOLE LOCATION. VALVE ACTUATORS WITH FORCE CAPABILITY EXCEEDING THIS LIMIT MUST HAVE SEPARATE STOPPING DEVICES SO CAPACITY OF THE VALVE ROTATIONAL STOPS IS NOT EXCEEDED. EXCEEDING THE CAPACITY OF THE VALVE ROTATIONAL STOPS CAN CAUSE LOSS OF CONTROL.

(AC)

HEAT EXCHANGER (H.E.) REQUIREMENTS		
PERMISSIBLE OIL TEMPERATURE INTO H.E.	200°F. MAX.	150°F. MIN.
MIN. HEAT TRANSFER CAPACITY	BTU PER MIN. PER ENGINE RTD. H.P.	
APPLY APPROPRIATE SERVICE FACTOR FOR FRESH AND RAW WATER	CONTINUOUS DUTY 1.484	P.C. & INT. DUTY 1.272
APPROX. OIL FLOW TO H.E.	1.525 G.P.M. PER 100 ENGINE R.P.M.	
PEAK OIL PRESSURE AT H.E. (PROOF TEST H.E. AT 1.5 x P.S.I.)		285 P.S.I.
MAX. ALLOWABLE OIL PRESSURE DROP ACROSS H.E. WITH 300 SUS OIL AT RATED ENGINE RPM		30 P.S.I.
WATER FLOW TO H.E. - USE 1.5 TO 3.0 TIMES OIL G.P.M.		
H.E. WATER PRESSURE RATING, MIN., = 1.5 x H.E. INLET WATER P.S.I.		
DATA H.E. PURCHASER MUST ALSO TELL VENDOR		
STATE IF RAW (OPEN CHANNEL & SEA) OR FRESH (CLOSED ENGINE JACKET & KEEL COOLER) WATER WILL COOL H.E.		
STATE MAX. WATER TEMP. INTO H.E. -- TYPICAL -- RAW WATER - 85°F, KEEL COOLER WATER - 140°F, ENGINE JACKET WATER - 180°F.		
STATE MIN., ALSO MAX. G.P.M. OF WATER FLOW TO H.E.		
H.E. INSTALLATION & SERVICE REQUIREMENTS		
OIL LINES, TRANSMISSION TO H.E. AND RETURN ---- (1) MAX. VELOCITY IN FITTINGS, PIPE, HOSE AND TUBES - 25 FT./SEC. (2) BURST PRESSURE, MIN., = 10 x PEAK OIL PRESSURE AT H.E. (3) HOSE - SAE J517 100R1 MEETING USCG 46CFR 56.60-25(C), 275°F. TEMP. RATING. (4) PROTECT LINES FROM MECHANICAL DAMAGE. ZINC ANODES PROTECT H.E. RAW WATER PASSAGES FROM CORROSION.		
CHECK & REPLACE THEM FREQUENTLY.	REF. EX4107 SERIES CHARTS	



40.00 CLEARANCE TO REMOVE OIL PUMP
38.37
36.83 H.E. OUTLET
35.42 CLEARANCE FOR DISSASSEMBLY OF MANIFOLD
34.33
33.47
32.15
30.32 LUBE PRESSURE HOLE
29.72 FORWARD PRESSURE HOLE
29.41 REVERSE PRESSURE HOLE
28.47 FILTER
28.15 H.E. INLET
23.722 OPTIONAL TROLLING VALVE
19.50 OIL GAGE
16.60
10.20
8.40
5.03
THIS HOLE OMITTED ON S.A.E. #0 HOUSING
20.39 FILTER REMOVAL
EYEBOLT FOR LIFTING MARINE TRANSMISSION (2 BOLTS-ONE EACH SIDE) EQUALIZE LOAD ON BOTH EYEBOLTS TO LIFT MARINE TRANSMISSION.
FLYWHEEL OUTLINE TO CLEAR RUBBER BLOCK DRIVE TO BE PER S.A.E. J620d FLYWHEEL NUMBER AS SPECIFIED
DRIVE SPIDER AND RING FOR S.A.E. #18 FLYWHEEL S.A.E. #0 HSG., RUBBER BLOCK DRIVE.
FACE "P"
REMOVE (4) PLASTIC PLUGS TO OBTAIN ACCESS TO (4) MOUNTING BOLTS
11.41 REQUIRED TO REMOVE BREATHER TO ADD OIL
REVERSE CLUTCH ACTUATING PRESSURE 1/2-20UN TH'D.
LUBE P.S.I. 1/2-20UN TH'D.
CENTER OF GRAVITY
INPUT SHAFT
OUTPUT FLANGE AND OUTPUT SHAFT
DRIVE SPIDER AND RING FOR S.A.E. #14 FLYWHEEL, S.A.E. #1 OR #0 HSG., RUBBER BLOCK DRIVE.
USE HARDENED FLAT STEEL WASHERS, Rc30N 61 MIN., UNDER SCREW HEADS.
S.A.E. 1/2-36 STRAIGHT SIDED SERRATIONS
OIL IN FROM HEAT EXCHANGER
1"-11 1/2 N.P.T.F. TH'D. (DRYSEAL) REMOVE ALUMINUM THREAD PROTECTOR BEFORE OPERATING UNIT.
FILTER DRAIN PLUG
3/4-14 N.P.T.F. TH'D. (DRYSEAL) PRIOR TO INSTALLING NEW FILTER, REMOVE THIS PLUG TO DRAIN OIL FROM USED FILTER, THEN REINSTALL PLUG.
CONNECT OIL PRESSURE GAGE HERE. MOUNT GAGE IN PILOT HOUSE. 1/8-27 N.P.T.F. EXTERNAL TH'D. (DRYSEAL) AT OIL GAGE. 1/4-18 N.P.T.F. INTERNAL TH'D. (DRYSEAL) AT OIL SENDER LOCATION.
REMOVE PIPE PLUG TO INSTALL CUSTOMER-SUPPLIED TEMPERATURE INDICATING SWITCH SENSING BULB HERE (REF. TWIN DISC PART 53424). 3/4-14 N.P.T.F. THREAD (DRYSEAL)
OIL OUT TO HEAT EXCHANGER
1"-11 1/2 N.P.T.F. TH'D. (DRYSEAL) REMOVE ALUMINUM THREAD PROTECTOR BEFORE OPERATING UNIT.
OIL PUMP, PUMP OUTLET BLOCK AND OIL STRAINER POSITIONS FOR L.H. ENGINE DRIVE SHOWN IN PHANTOM OUTLINE.
COMPANION FLANGE MAX. BORES:
3.81 DIA. WITH 7/8 SQ. KEY
4.62 DIA. WITH 1" SQ. KEY
5.50 DIA. WITH 1 1/4 SQ. KEY
5.50 DIA. WITH 1 1/4 x 7/8 RECT. KEY & 1 1/2"/FT. TAPER
6.62 DIA. WITH 1 1/2 x 1" RECT. KEY & 1 1/2"/FT. TAPER
COUPLING HUB FOR VULKAN EZ1025 COUPLING. CUSTOMER TO MACHINE FLANGE HOLES FOR COUPLING INSTALLATION AND PROVIDE BOLTS, S.A.E. GRADE 5.
16.00 MOUNTING PADS
24.93
25.52 CLEARANCE TO REMOVE OIL DRAIN PLUG
30.86
39.74
7/8-9UNC-2B TH'D., 1.38 DEEP 18 HOLES (9 EACH SIDE) USE ALL EIGHTEEN (18) HOLES FOR MOUNTING UNIT. USE GRADE 5 QUALITY CAPSCREWS PER S.A.E. J429 AND TORQUE TO 5574 OR SERVICE MANUAL VALUES.
THRUST BEAM
RATE OF RISE FUNCTIONS DETENT
MAX. TROLLING PRESSURE NO DETENT
MIN. TROLLING PRESSURE NO DETENT
THE TROLLING LEVER ANGULAR LOCATION MAY BE ADJUSTED SO THAT THE 90° LEVER ROTATION REQUIRED FOR CONTROL FALLS ANYWHERE WITHIN THE 360° RANGE IN WHICH THE LEVER MAY BE ROTATED.
70° TROLLING RANGE
1/4 DRILL THRU
TROLLING VALVE
CONTROL VALVE
OPTIONAL CONTROL/TROLLING VALVE
OIL LEVEL GAGE TUBE IS SERRATED TO ACCOMMODATE HOSE FOR DRAINING OIL WITH SUCTION PUMP. DISTANCE REQUIRED TO REMOVE OIL GAGE. GAGE IS FLEXIBLE AND CAN BE BENT IF NECESSARY.
.104 (#37) DRILL, .28 DEEP - 2 HOLES USE M422 DRIVE SCREWS TO MOUNT PLATE
MOUNT 82474 BUREAU VERITAS PLATE (WHEN REQUIRED) WITH BOTTOM OF NUMBERS TOWARD MTG. FACE.
11.28 L.H. ENGINE
10.065
9.848 (BASIC)
9.33
8.683
14.25
10.80
ENGAGES CLUTCH ON INPUT SHAFT & CALLED FORWARD.
5/16-18UNC-2B TAP THRU - 2 HOLES SUITABLE FOR CONTROL MOUNTING BRACKETS.
ENGAGES CLUTCH ON SIDE SHAFT & CALLED REVERSE.
OPTIONAL TROLLING VALVE LEVER
NEUTRAL
1/4 DRILL THRU
RIGHT-HAND FLYWHEEL ROTATION SHOWN.
CONTROL VALVE
FWD.
REV.
F'W'D. CLUTCH ACTUATING PRESSURE 1/2-20UN TH'D.
GREASE FITTING
CENTER OF GRAVITY
FW'D. WITH R.H. ENGINE DRIVING THRU FW'D. CLUTCH
11.500 DIA. (REF.) H.C.
OIL DRAIN 1 5/8-12UN-2B TH'D.
11.50
15.90

	S.A.E. HOUSING NUMBER	S.A.E. J620d FLYWHEEL	A	B	C	D	E	F +.000 -.004	G	H	J	K	L	M
RUBBER BLOCK DRIVE	0	#18	25.500 25.495	28.00	26.750	15-17/32 DRILL THRU (SEE NOTE)	21.375	22.500	19.31	6-21/32 DRILL THRU	.62	.62	19.50	1.25
RUBBER BLOCK DRIVE	1	#14	20.125 20.120	21.75	20.875	12-15/32 DRILL THRU	17.250	18.375	16.00	8-17/32 DRILL THRU	.50	1.00	16.12	.88

THIS IS NOT A CAD DRAWING

IF THE ORIGINAL OUTPUT FLANGE OR PROPELLER COUPLING FLANGES ARE REPLACED SEPARATELY, OR IF XB6103 SERIES FLANGE ASSEMBLY IS NOT PURCHASED WITH MARINE TRANSMISSION, FLANGES WILL HAVE 15/16 DRILL THRU, 12 HOLES EQUALLY SPACED. CUSTOMER TO DRILL AND LINE REAM .9910-.9895 DIA. TO 63 FINISH WITH MATING FLANGE. IF M2009K FITTED BOLTS ARE USED, OR TO BOLT BODY FIT OF .0005 TIGHT TO .0020 LOOSE IF CUSTOMER'S GRADE 8 BOLTS ARE USED.

D - HOLES EQUALLY SPACED USE GRADE 5 QUALITY CAPSCREWS PER S.A.E. J429 AND TORQUE TO 5574 OR SERVICE MANUAL VALUES.

H - HOLES EQUALLY SPACED USE GRADE 5 QUALITY CAPSCREWS PER S.A.E. J429 AND TORQUE TO 5574 OR SERVICE MANUAL VALUES.

SIMILAR TO: XA7255A

FREESTANDING MARINE TRANSMISSION:

TO OBTAIN A TWIN DISC APPROVAL FOR THE APPLICATION, CUSTOMER TO SUBMIT THE FOLLOWING INFORMATION TO THE TWIN DISC APPLICATION ENGINEERING DEPARTMENT.

1) A TORSIONAL ANALYSIS OF EACH UNIQUE APPLICATION. A TORSIONAL FLEXIBLE COUPLING WILL USUALLY BE REQUIRED.
2) APPROVAL OF THE DRIVELINE INSTALLATION FROM THE DRIVELINE SUPPLIER. "U"-JOINT ANGLES GREATER THAN 5° WILL NOT BE APPROVED BY TWIN DISC.
3) GUARDS TO PREVENT PERSONAL INJURY OR PROPERTY DAMAGE IN THE EVENT OF A DRIVELINE FAILURE.
4) MOUNTING ARRANGEMENT FOR THE MARINE TRANSMISSION. INCLUDE STRUCTURAL STEEL "THRUST BEAM" FASTENED TO BOLT PATTERN ON FACE "P" AND INTO HULL FRAME.

NOTE:
ALL POINTS AVAILABLE FOR TESTING ARE CODED ⬡.
OIL CAPACITY 30.7 L (8.1 GAL.), PLUS VOLUME IN HOSES AND HEAT EXCHANGER.

SYM.	ZONE	CHANGE	CH. NO.	DATE	BY	SYM.	ZONE	CHANGE	CH. NO.	DATE	BY	SYM.	ZONE	CHANGE	CH. NO.	DATE	BY

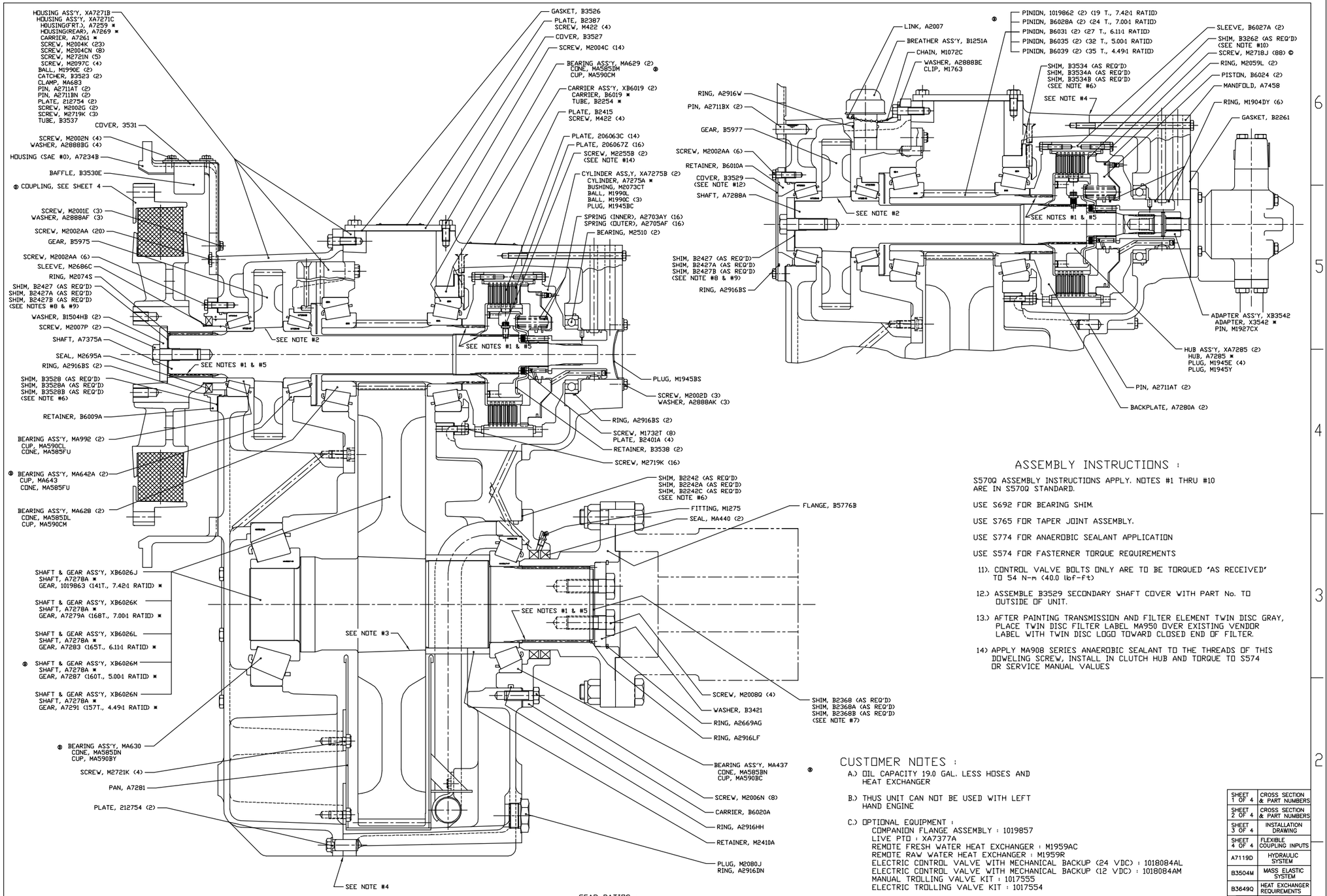
K & E 19-1153 FORM 159M 300-8-74

NAME: (A) MG520-1 MARINE TRANSMISSION			DATE 5-23-83
MATERIAL —	HEAT TREAT —		SCALE .25=1.00
			DRAWN KS
ROUGH WT.	FINISH WT. 3040#	FIRST USED ON ASSEMBLY NO. MODEL NO.	CHECK REB JS
			APPROVED
UNLESS OTHERWISE SPECIFIED ALLOWABLE VARIATION ON MACHINED DIMENSIONS ± —			

TWIN DISC INCORPORATED RACINE, WI. 53403, U.S.A.

XA7352A

SHEET 3 OF 7 REV. AF



ASSEMBLY INSTRUCTIONS :

S570Q ASSEMBLY INSTRUCTIONS APPLY. NOTES #1 THRU #10 ARE IN S570Q STANDARD.

USE S692 FOR BEARING SHIM.

USE S765 FOR TAPER JOINT ASSEMBLY.

USE S774 FOR ANAEROBIC SEALANT APPLICATION

USE S574 FOR FASTERNER TORQUE REQUIREMENTS

11.) CONTROL VALVE BOLTS ONLY ARE TO BE TORQUED "AS RECEIVED" TO 54 N-m (40.0 lbf-ft)

12.) ASSEMBLE B3529 SECONDARY SHAFT COVER WITH PART No. TO OUTSIDE OF UNIT.

13.) AFTER PAINTING TRANSMISSION AND FILTER ELEMENT TWIN DISC GRAY, PLACE TWIN DISC FILTER LABEL MA950 OVER EXISTING VENDOR LABEL WITH TWIN DISC LOGO TOWARD CLOSED END OF FILTER.

14) APPLY MA908 SERIES ANAEROBIC SEALANT TO THE THREADS OF THIS DOWELING SCREW, INSTALL IN CLUTCH HUB AND TORQUE TO S574 OR SERVICE MANUAL VALUES

CUSTOMER NOTES :

⊕ A.) OIL CAPACITY 19.0 GAL. LESS HOSES AND HEAT EXCHANGER

B.) THUS UNIT CAN NOT BE USED WITH LEFT HAND ENGINE

C.) OPTIONAL EQUIPMENT :
COMPANION FLANGE ASSEMBLY : 1019857
LIVE PTO : XA7377A
REMOTE FRESH WATER HEAT EXCHANGER : M1959AC
REMOTE RAW WATER HEAT EXCHANGER : M1959R
ELECTRIC CONTROL VALVE WITH MECHANICAL BACKUP (24 VDC) : 1018084AL
ELECTRIC CONTROL VALVE WITH MECHANICAL BACKUP (12 VDC) : 1018084AM
MANUAL TROLLING VALVE KIT : 1017555
ELECTRIC TROLLING VALVE KIT : 1017554

GEAR RATIOS :
7.42 : 1
7.00 : 1
6.11 : 1
5.00 : 1
4.49 : 1

△ = REMOVE BEFORE OPERATING, 2-PLACES (ALUMINUM PLUG)

✖ = NOT SERVICEABLE SEPARATELY

CONSULT SALES DEPT. APPLICATION ENGINEERS FOR LIMITING OPERATING CONDITIONS

SHEET 1 OF 4	CROSS SECTION & PART NUMBERS
SHEET 2 OF 4	CROSS SECTION & PART NUMBERS
SHEET 3 OF 4	INSTALLATION DRAWING
SHEET 4 OF 4	FLEXIBLE COUPLING INPUTS
A7119D	HYDRAULIC SYSTEM
B3504M	MASS ELASTIC SYSTEM
B3649Q	HEAT EXCHANGER REQUIREMENTS

REV	SHEET ZONE	CH. NO.	DATE
F	2&3	ECN12915	12-14-04
E	4 / 4-1	ECN10206	6-6-01
D	1,4	VAR. ECN10148	5-8-01
C	1 / 4-6	30549	2-2-01
B	1	VAR. 30073	5-18-00
A	4 / 3-2	30063	4-27-00

MATERIAL
HEAT TREAT
SURFACE TREATMENT
WGHT 3435 LBS. | WT LBS. IN²
FIRST USE
ASSY.
MODEL
NAME MG-520-1HP MARINE TRANSMISSION

UNLESS OTHERWISE SPECIFIED
MACHINED DIMENSIONS
XX ±0.030
XXX ±0.010
XXXX ±0.000
ALL ANGULAR TOLERANCES ±1°
GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982

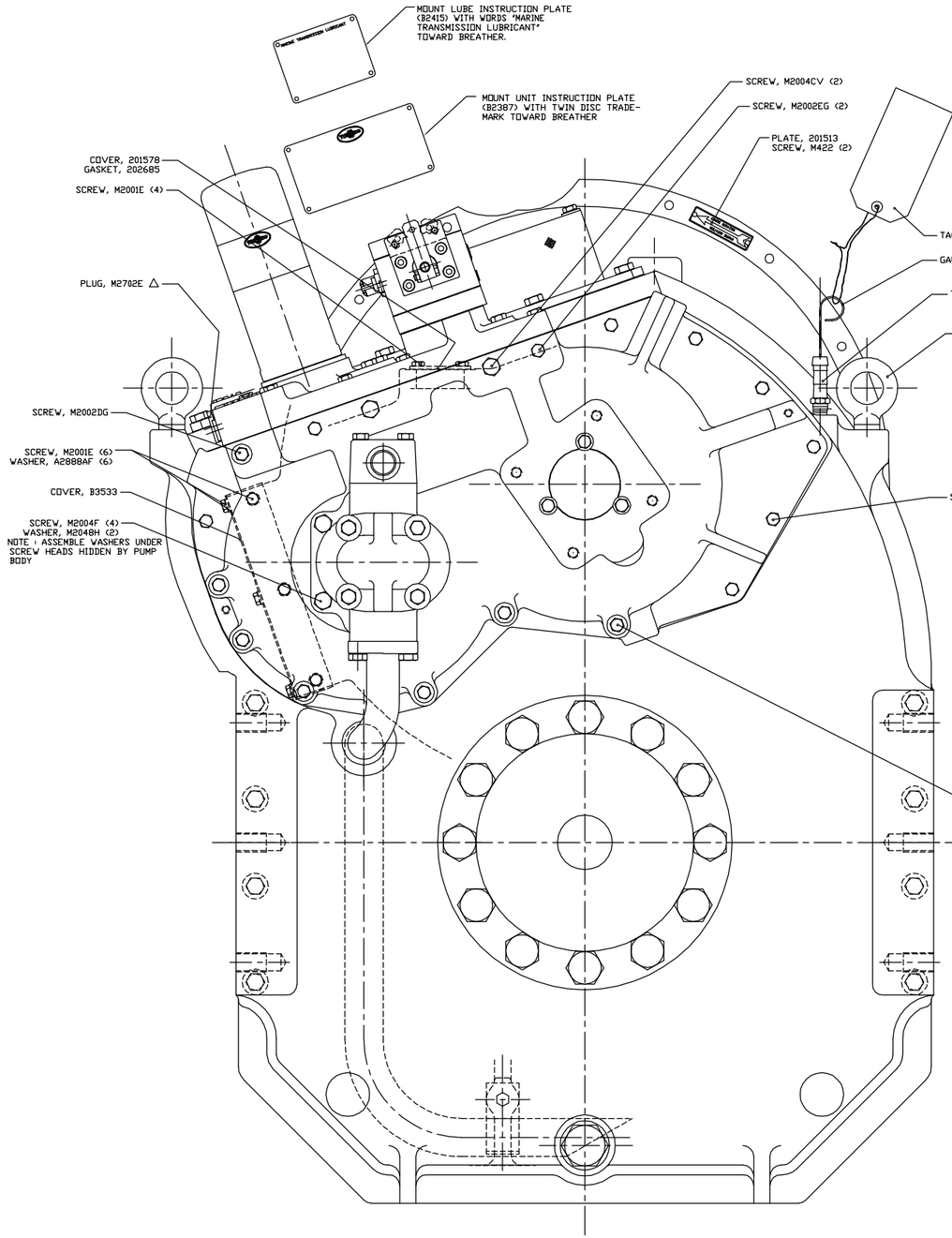
THIRD ANGLE PROJECTION
SIMILAR TO

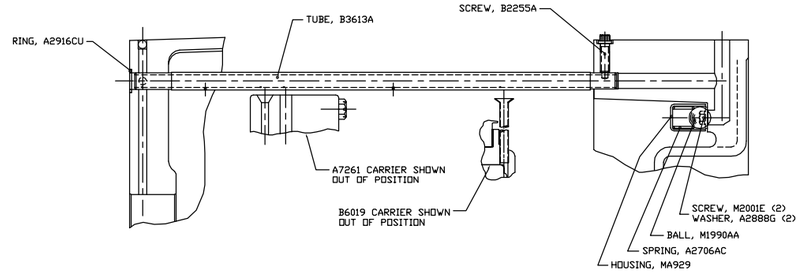
DATE 3-6-00
SCALE 1/5 = 1°
DRN. JR.
CHK. ALC
APPR. DAS

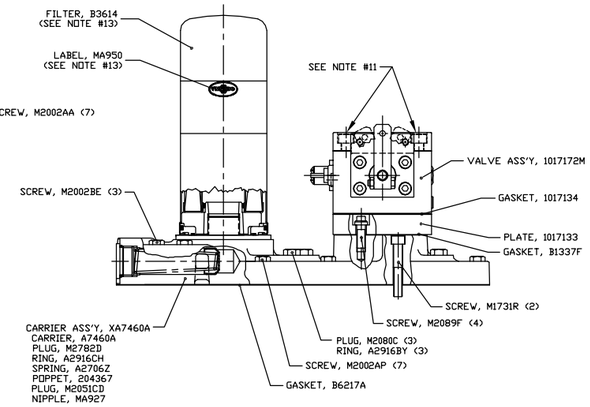
TWIN DISC INCORPORATED RACINE, WI 53403 - USA

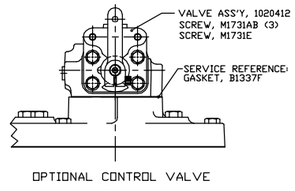
XA7255B

SHEET 1 OF 4 REV F

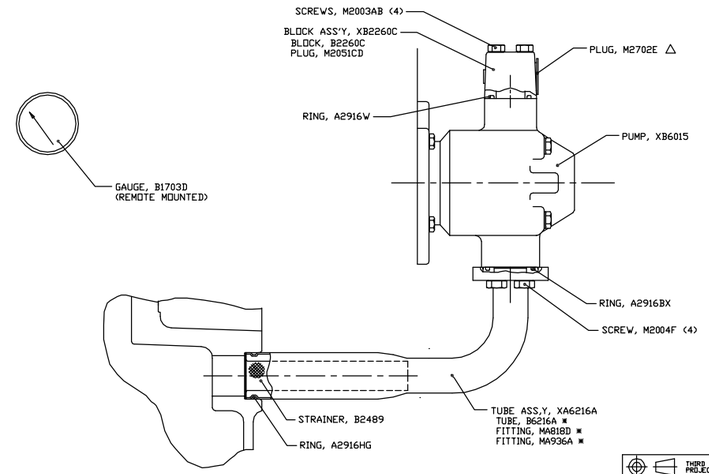








OPTIONAL CONTROL VALVE
Ⓟ



THIRD ANGLE PROJECTION

SIMILAR TO

MATERIAL	WEIGHT LBS. / wt LBS. IN²
HEAT TREAT	FIRST USE
SURFACE TREATMENT	ASSY. MODEL.
NAME	MG-520-1HP MARINE TRANSMISSION

UNLESS OTHERWISE SPECIFIED
MACHINED DIMENSIONS
X/A ±.030
.XX ±.010
.XXX ±.005
ALL ANGULAR TOLERANCES 0°
GEOMETRIC TOLERANCING PER ANSI Y14.5M 1982

DATE	3-7-00
SCALE	1/2"= 1"
DRW.	JR.
CHK.	ALC
APPD.	DAS

TWIN DISC INCORPORATED RACINE, WI 53403 - USA

XA7255B

SHEET 2 OF 4 REV F

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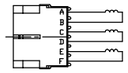
6 5 4 3 2 1

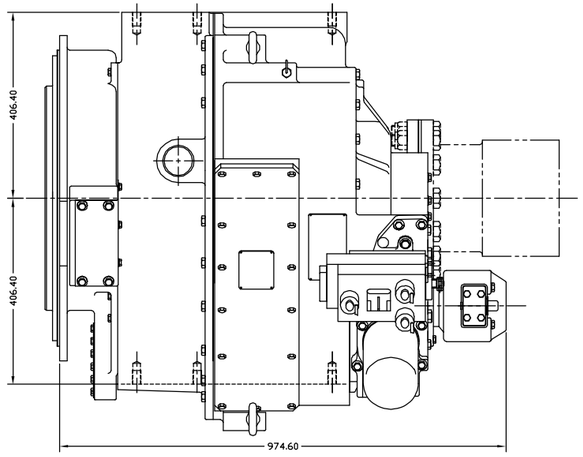
WIRING DIAGRAM:

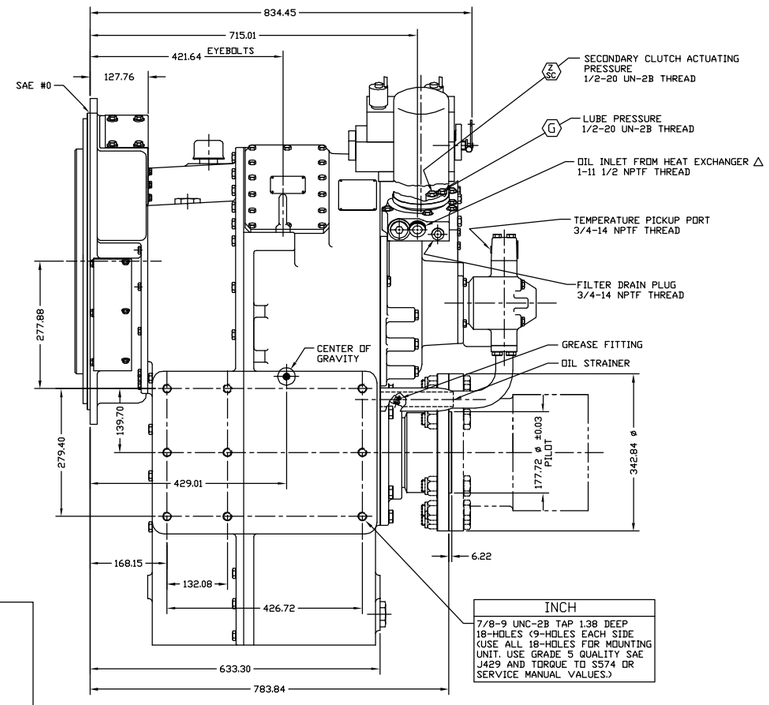
CONNECTOR



SECONDARY CLUTCH SOLENOID
PRIMARY CLUTCH SOLENOID Ⓕ
NEUTRAL SOLENOID (OPTIONAL)

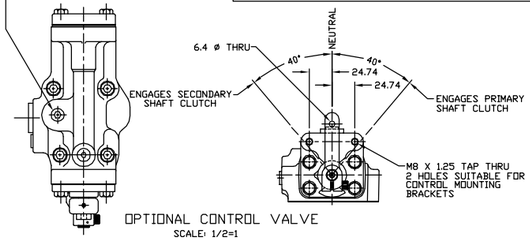
OPTIONAL:
MATING WIRING HARNESS 1017403 SERIES (SPECIFY LENGTH).



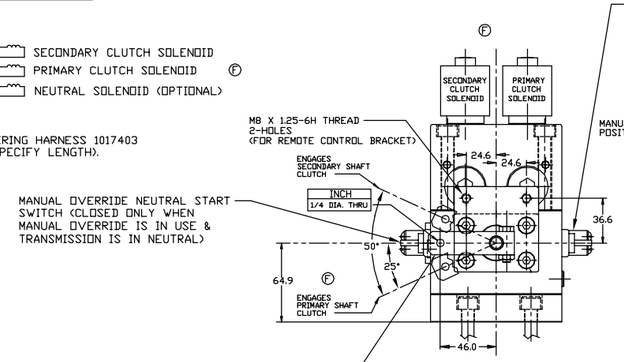


INCH
7/8-9 UNC-2B TAP 1.38 DEEP 18-HOLES (9-HOLES EACH SIDE (USE ALL 18-HOLES FOR MOUNTING UNIT. USE GRADE 5 QUALITY SAE J429 AND TORQUE TO S574 OR SERVICE MANUAL VALUES.)

CONNECT OIL PRESSURE GAGE LINE HERE. M12 X 1.5 THREAD METRIC PORT CONFORMS TO ISO 6149. MOUNT GAGE IN PILOT HOUSE.

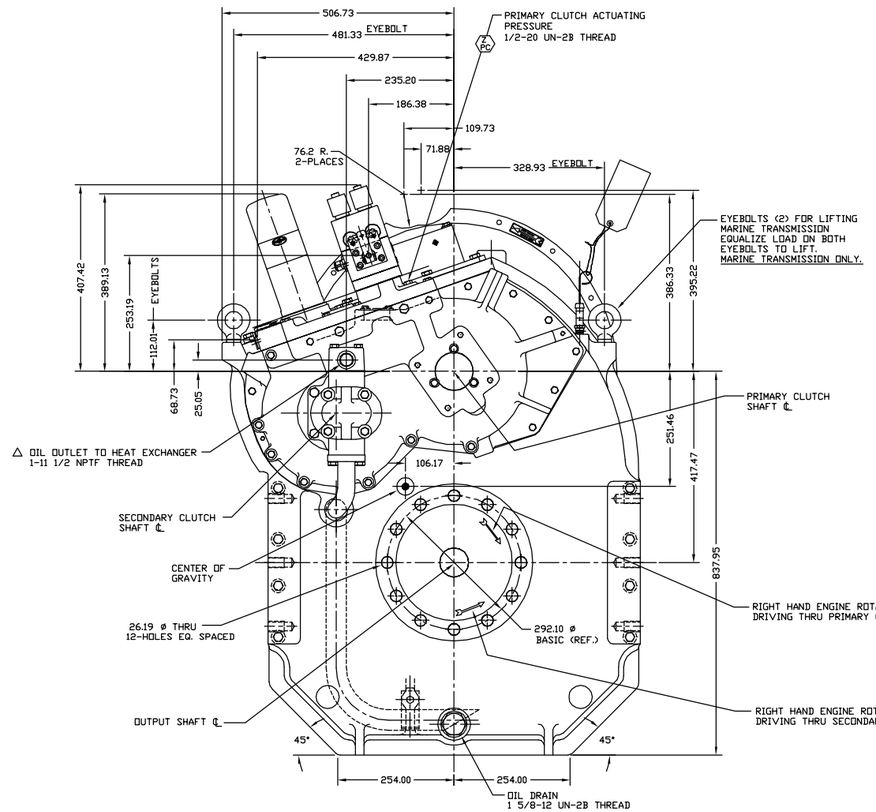


OPTIONAL CONTROL VALVE
SCALE: 1/2=1



NOTE:
LEVER MAY BE LOCATED ANYWHERE ON ITS SHAFT THAT PERMITS FREE MOVEMENT WITHIN THE 50° (TOTAL) ROTATION & 11.4mm AXIAL MOTION REQUIRED FOR CONTROL.

DETAIL OF SELECTOR VALVE



NOTE:
ALL PORTS AVAILABLE FOR TEST ARE CODED ⬡

METRIC
THIRD ANGLE PROJECTION
SIMILAR TO

MATERIAL	
HEAT TREAT	
SURFACE TREATMENT	
WEIGHT kg / lbs	
FIRST USE	
ASSY. MODEL	MG-520-1HP
NAME	MARINE TRANSMISSION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS X.X ±0.25 .XX ±0.13 ALL ANGULAR TOLERANCES ±1° DRAWING INTERPRETATION PER ISO 10209: 1992	
DATE	3-7-00
SCALE	1/4 : 1
DRAW.	J.R.
CHK.	ALC
APPD.	DAS
TWIN DISC INCORPORATED RACINE, WI 53403 - USA	
	XA7255B
SHEET 3 OF 4	REV F

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TWIN DISC, INCORPORATED RACINE, WISCONSIN 53403, U.S.A. 262-638-4000/262-638-4482 (FAX) WWW.TWINDISC.COM