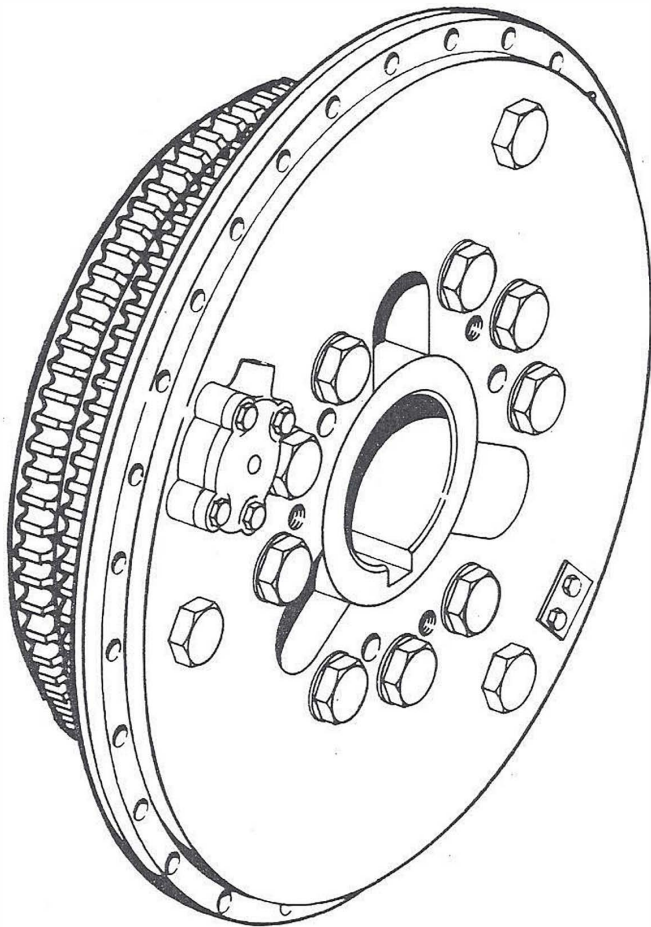


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# SERVICE MANUAL

## SM - 210



## MODEL P0-214

### AIR OPERATED CLUTCH

# TWIN DISK

INCORPORATED

Administrative Offices - Racine, Wisconsin • Rockford Works, Rockford, Illinois

MODEL PO-214  
AIR CLUTCH

REISSUED SEPTEMBER 1978

Revision B, January 1982.

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Twin Disc, Incorporated

1328 Racine Street

Racine, Wisconsin, U.S.A.

Printed in U.S.A.

# TABLE OF CONTENTS

Section 1.	INTRODUCTION .....	1-1
Section 2.	DESCRIPTION AND SPECIFICATIONS .....	2-1
Section 3.	OPERATION .....	3-1
Section 4.	PREVENTIVE MAINTENANCE .....	4-1
Section 5.	TROUBLE SHOOTING .....	5-1
Section 6.	REMOVAL AND UNIT DISASSEMBLY .....	6-1
Section 7.	CLEANING AND INSPECTION .....	7-1
Section 8.	SUBASSEMBLIES .....	8-1
Section 9.	UNIT ASSEMBLY AND INSTALLATION .....	9-1
Section 10.	ACCESSORIES AND OPTIONAL EQUIPMENT .....	10-1
Section 11.	SPECIAL TOOLS .....	11-1
Section 12.	ENGINEERING DRAWINGS AND DATA .....	12-1

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# Section 1.

## INTRODUCTION

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### 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.

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.

### RENEWAL PARTS AND KITS.

#### Parts Lists.

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

#### Ordering Parts.

Renewal Parts and Service Parts Kits, may be obtained from an 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 (formally specifications). 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 (formally specifications), 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 materials (formally specifications) number on 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 a 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.

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# Section 2. DESCRIPTION AND SPECIFICATIONS

## GENERAL.

The model PO-214 air clutch is a two-plate, air-actuated, spring-released axial clutch. The engine output torque is transmitted to the driving ring (1) or drive spider to which the driving plates (Figure 9-3, 3 and 5) are meshed. During clutch engagement, the driving plates are clamped with the center plate (4) to the hub-and-back plate (2). The hub-and-back plate, spline connected to the pressure plate (10), transmits the torque through its hub-and-shaft key to the output shaft. The drive-through is on a common center axis with the input.

Air cooling passages are provided from the plate area through and around the release spring chambers and plate separators through cored holes in the front cover plate.

Synthetic rubber, molded on a nylon fabric, comprises the material for the quality diaphragm used. The note "Assemble with This Side Up" is molded on the diaphragm to insure proper assembly.

## OPERATING SPECIFICATIONS.

### Maximum Allowable Speed.

#### WARNING

**These speeds are not to be exceeded by more than 8% including governor overrun.**

2500 rpm with cast iron driving ring and solid driving plates.

1950 rpm with cast iron driving ring and split driving plates.

2650 rpm with steel or nodular iron driving ring and solid driving plates.

2650 rpm with steel or nodular iron driving ring and split driving plates.

### Torque

Slipping 7500 lbs. ft. at 130 psi air pressure.  
Working 5625 lbs. ft. at 130 psi air pressure.

### Horsepower Rating.

Normal Duty - 200 hp.  
Heavy Duty - 125 hp.

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# Section 3. OPERATION

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## CLUTCH OPERATION.

When the control valve is in the "ON" position, air is routed from the shaft through lines supplied by the user to the quick release valve (Figure 3-1, B). The first small volume of air admitted closes the quick release valve allowing air pressure to build-up behind the diaphragm (D). The pressure moves insulator plate (E) and pressure plate (F) to the left, clamping driving plates (H) against center plate (G) and the hub-and-back plate (K). Pressure plate movement compresses release springs (J) and the clutch is engaged. With the proper air pressure (130 psi maximum) and volume, the clutch will engage in less than one second.

Clutch release is the reverse of engagement previously described. The release of apply air pressure, permits the clutch release springs (J), which were compressed, to expand with the following action. The plate separators (L) are hooked behind the center plate (G) and shouldered against the pressure plate (F). When the plate separators (L) are pushed by the release springs (J), the pressure plate (F) and diaphragm (D) are moved toward the front cover plate (M) releasing the driving plates (H). The purpose of the plate separators (L) is to prevent drag. The air present in the diaphragm chamber, is quickly released through the exhaust ports of the two quick release valves (B). The quick release valves, through the action of their valve release springs, are opened to exhaust the diaphragm chamber air, as soon as apply air pressure is released by the operating valve. The clutch release time is less than one second.

## EMERGENCY CLUTCH OPERATION.

The design incorporates a mechanical means to engage the clutch for emergency operation should conditions warrant. Three special short capscrews (Figure 9-3, 20) are removed from the front cover plate (19), and three main capscrews (25) (See Figure 3-2 for the location of these screws) are transferred to the short capscrew holes, and tightened in position.

This forces the diaphragm (17) and pressure plate (10) to clamp the driving plates (3 and 5) and center plate (4) to the hub-and-back plate (2), engaging the clutch. (See Planograph X-9657).

This will make a solid drive with no release. Do not use air at this time.

## NOTE

After the lockup feature is used, the clutch must be disassembled, the insulator plate (12) inspected for roughness which could cause chafing, and a new diaphragm (17) installed.

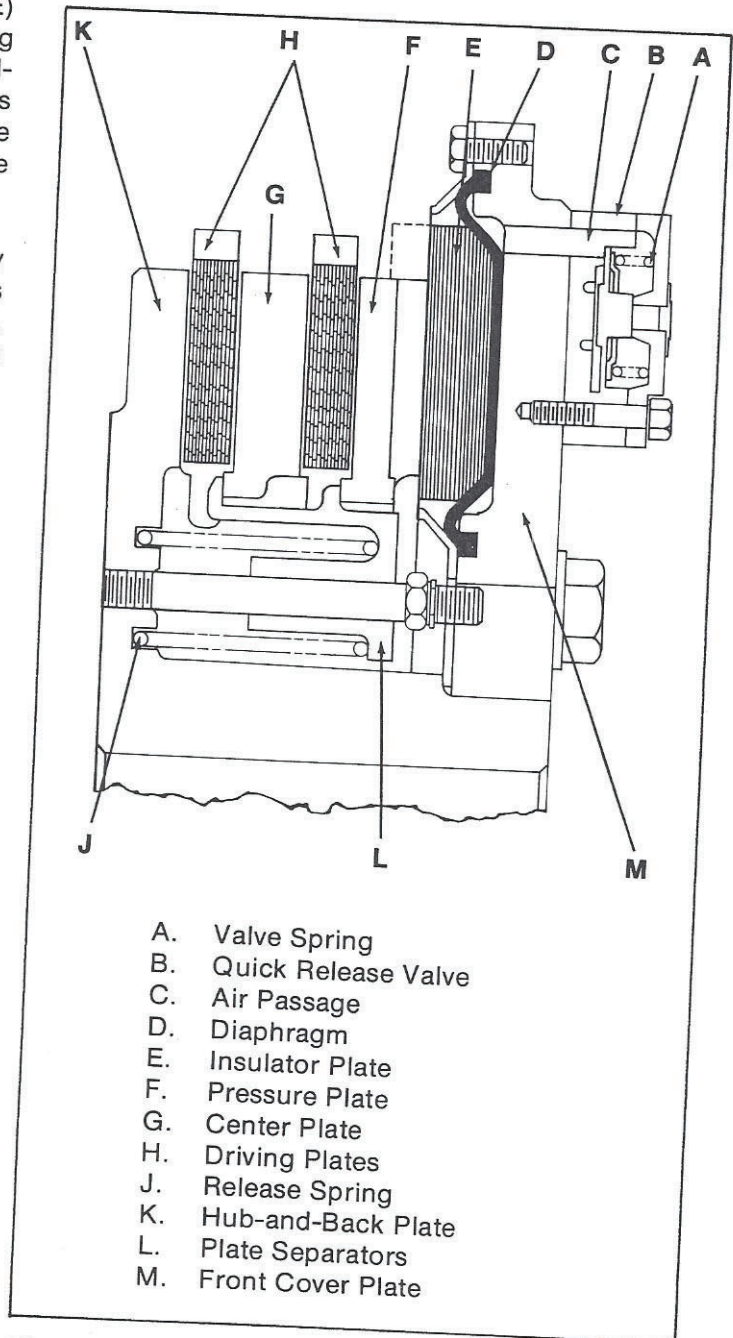


Figure 3-1. Clutch Operation.

FOR EMERGENCY MECHANICAL  
CLUTCH LOCK-UP, REMOVE THESE THREE  
SCREWS AND INSERT THREE SCREWS  
MARKED

- ①
- ②
- ③

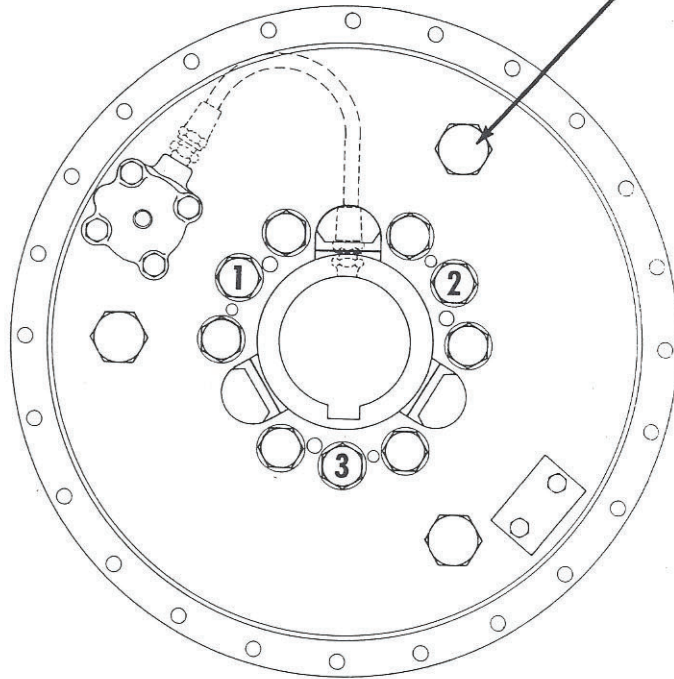


Figure 3-2. Emergency Mechanical Clutch Lockup.

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## Section 4. PREVENTIVE MAINTENANCE

1. Routinely check the following:
  - a. Be sure no dirt or foreign matter has collected in the driving ring or spider which would prevent the driving plates from working freely.
  - b. Check pressure plate and insulator plate for complete release travel.
2. If operating in cold weather, the air lines may be restricted due to freezing of the moisture in the air lines or system. The addition of denatured alcohol or Ethylene Glycol in the air received will eliminate this problem.
3. Avoid the use of all rust inhibitors or commercial anti-freeze.

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# Section 5.

## TROUBLE SHOOTING

### CLUTCH SLIPPAGE.

#### NOTE

Maximum allowable travel of insulator plate (0.56 inch) with the clutch engaged, (see Figure 5-1) indicates the clutch driving plates are worn and should be replaced.

1. Air pressure at the clutch must be 60 to 130 psi depending on the amount of torque being transmitted. Put a tee at the point where the air enters the Deublin seal assembly to take this reading.
2. Inspect the entire air line installation for any restrictions or leaks which could decrease the air supply to the clutch.
3. Check the operating valve for full opening.
4. Carefully inspect the clutch for possible air leakage at the diaphragm.
5. If operating in cold weather, the air lines may be restricted due to freezing of the moisture in the air

lines or system. The addition of denatured alcohol or Ethylene Glycol in the air system will eliminate moisture freezing. Avoid the use of all rust inhibitors or commercial anti-freeze.

6. Check for grease on the clutch plates. Disassemble and clean the clutch plates if they are greasy.

### CLUTCH OVERHEATING.

1. Check all points listed previously under "Clutch Slippage."
2. Check alignment as described in Section 2. If misalignment exists, the clutch may not be completely disengaging.
3. Be sure no dirt or foreign matter has collected in the driving ring or spider which would prevent the driving plate from operating freely.
4. Check the pressure plate and insulator plate for complete release travel.

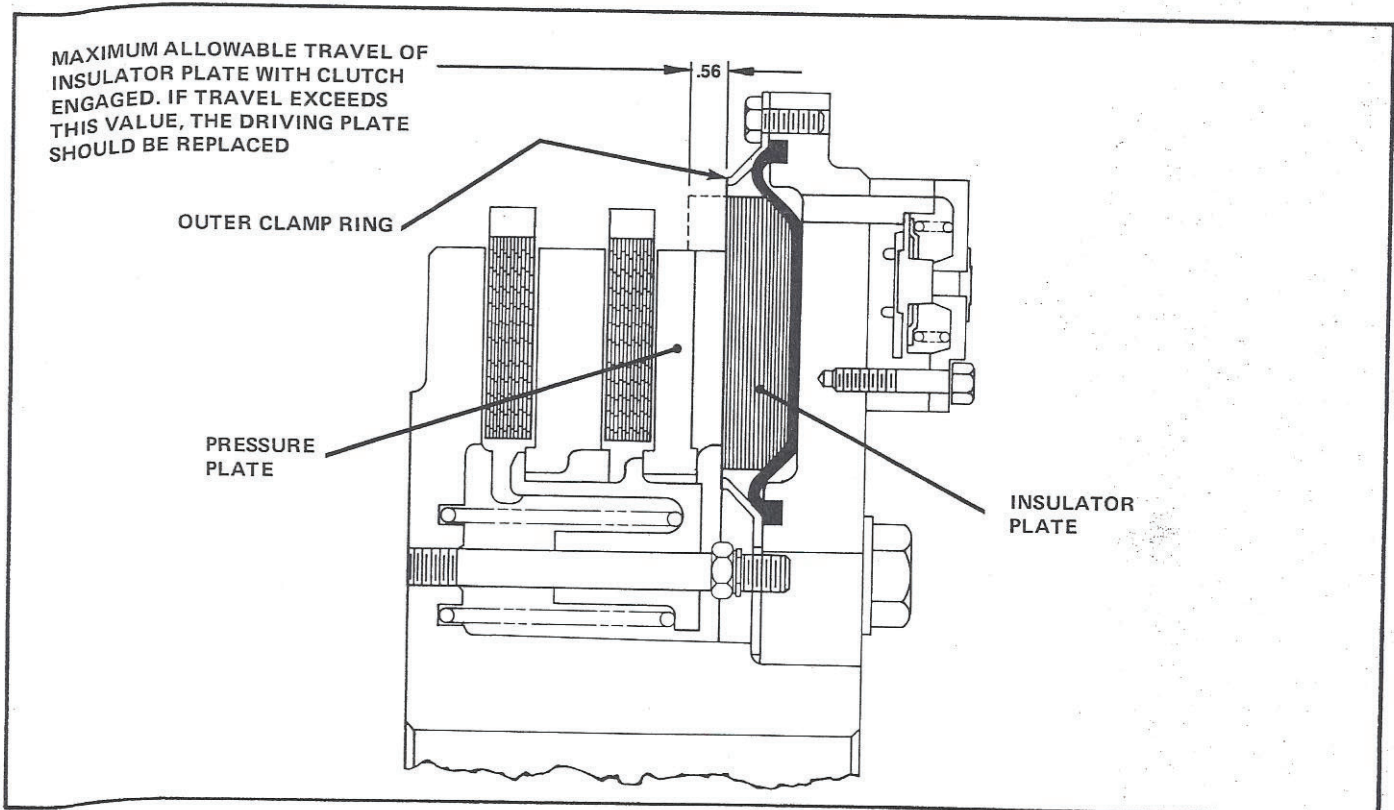


Figure 5-1. Clutch Plate Wear Limits.

# Section 6.

## REMOVAL AND UNIT DISASSEMBLY

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### GENERAL.

See OEM manual for removal instructions.

### NOTE

Wear on the clutch driving plates is determined by measuring the travel of the insulator plate with the clutch engaged (See Figure 5-1). This is measured before disassembly. If wear exceeds 0.56 inch, replace the driving plates.

Using suitable lifting equipment, place the clutch on a working surface, hub-and-back plate down and disassemble the clutch as follows:

### RELEASE VALVES. (One Described).

1. Remove the air lines attached to the quick release valve (Figure 9-3, 18), and remove the four hex-head capscrews (18k), and plain washers (18h) attaching the quick release valve (18) to the cover plate (19).

2. Remove the quick release valve (18) and gasket (18a) from the front cover plate (19).

3. Remove the valve cover (18g), gasket (18f), and spring (18e) from the valve body (18b).

4. Remove the spring seat (18d), and diaphragm (18c) from the valve body (18b).

### CLUTCH.

1. Remove the nine hex-head capscrews (25) and washers (24) from the front cover plate (19). Use three 3/8-16 thread pusher screws in the holes provided in the front cover plate (19) to separate the front cover plate from the hub-and-back plate (2).

2. Remove the pusher screws and install eyebolts in the pusher screw holes. Use a chain hoist to lift front cover plate (19) from hub-and-back plate (2).

3. Set the front cover plate (19) and diaphragm assembly on the working surface with the diaphragm side facing up.

4. Remove the insulator plate (12) with the pressure plate (10). The insulator plate (12) and the pressure plate (10) are doweled together with eight rollpins (11).

5. Remove the release spring nuts (6) from the release spring studs (7).

6. Remove driving plate (5), center plate (4), and driving plate (3) from the hub-and-back plate (2). The plate separators (8) are removed at the same time.

7. Remove the release springs (9) from release spring studs (7) in the hub-and-back plate (2).

8. Remove the release spring studs (7) from the hub-and-back plate (2) only if replacement of parts is necessary.

9. Pry the insulator plate (12) from the pressure plate (10) only if replacement of parts is necessary.

10. Remove the eight rollpins (11) from the pressure plate (10) only if replacement of parts is necessary.

### NOTE

**The diaphragm need not be removed from the clutch assembly if clutch driving plate replacement is all that is required. If the diaphragm must be replaced, proceed with steps 11, 12, and 13.**

11. Remove the three hex-head capscrews (13) which secure the inner clamp ring (14) to the front cover plate (19) to retain the inner bead of the diaphragm. Remove the inner clamp ring (14).

12. Remove the twenty-four hex-head capscrews (15) which secure the outer clamp ring (16) to the front cover plate (19) retaining the outer bead of the diaphragm (17).

13. Remove the diaphragm (17) from the front cover plate (19).

14. Remove the four drivescrews (26), and remove the nameplate (27) only if replacement of parts is necessary.

15. Remove the three tapered dowel pins (21) from the front cover plate (19) only if replacement of parts is necessary.

16. Remove the three special capscrews (20) only if

replacement of parts is necessary.

17. Remove the two capscrews (22) and counterbalance block (23) only if replacement of parts is necessary.

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# Section 7.

## CLEANING AND INSPECTION

### CLEANING.

Thoroughly clean all parts with suitable cleaning agents. After cleaning, dry with compressed air. Lubricate all machined surfaces with clean oil. Examine each part after cleaning to make certain all foreign matter has been removed.

### INSPECTION.

1. Inspect castings for cracks. Replace cracked castings. Inspect tapped holes for damaged threads. Chase damaged threads with a standard tap of the correct size. Replace all castings that cannot be repaired properly.

2. Inspect the teeth of the driving ring if one is used. Replace a damaged driving ring.

3. Inspect all flexible hoses for cracks, sponginess, or other damage. Replace a damaged hose.

4. Inspect the diaphragm for surface cracks and hardening. Replace a damaged or questionable diaphragm.

5. Inspect all gear teeth for cleanliness and damage. Foreign particles tend to collect in the root of the gear teeth. Clean thoroughly and repair minor nicks with a fine file. Replace parts with gear teeth that cannot be repaired.

6. It is very important that all orifices be clean and clear.

7. Inspect the driving plates for cracks, nicks or chips. Replace damaged driving plates.

8. Inspect for cracked or warped pressure plate. Replace the plate if it is damaged.

9. Inspect center plates for heat checks, cracks or warpage. Replace damaged center plates.

10. Inspect release valves to insure proper operation. Replace faulty release valves.

11. Replace return springs as standard practice after any clutch failure.

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# Section 9.

## UNIT ASSEMBLY AND INSTALLATION

### NOTE

Oiled torque values are used throughout.

### CLUTCH.

1. Place front cover plate (Figure 9-3, 19) on a working surface with the diaphragm side up.
2. Set the diaphragm (17) in position on the front cover plate (19) so the note "Assemble This Side Up" faces up. Press the outer and inner beads of the diaphragm (17) into their mounting grooves in the front cover plate (19).
3. Install the outer clamp ring (16) in position over the outer bead of the diaphragm (17) and onto the front cover plate (19). Secure the outer clamp ring with twenty-four hex-head capscrews (15). Torque the capscrews to 30 lbs. ft.
4. Position the inner clamp ring (14) over the inner bead of the diaphragm (17) on the front cover plate (19), and secure the inner clamp ring to the front cover plate (19) with three hex-head capscrews (13). Torque the capscrews (13 and 15) to 30 lbs. ft.

### NOTE

If tapered dowel pins (Figure 9-3, 21) have been removed, or if a new front cover plate (19) is being installed, be sure tapered dowel pin holes in the inner clamp ring (14) align with those in the front cover plate.

5. Set the hub-and-back plate (2) on a working surface with the splined hub up.
6. Install the release spring studs (7) into the hub-and-back plate (2). Make sure stud threads bottom in the hub-and-back plate.

7. Install the three release springs (9) over the release spring studs (7), and onto the seats provided in the hub-and-back plate (2).

8. Install the driving plate (3) onto the hub-and-back plate (2).

9. Install the three plate separators (8) along with the center plate (4) onto the hub-and-back plate (2) and over the release spring studs (7) and release springs (9).

10. Install the three hex nuts (6) onto release spring studs (7). Tighten hex nuts to the bottom of the threads on the studs, or to a point where the upper ledge on plate separators (8) are approximately 1/8 inch below top of splines on the hub-and-back plate (2) and the center plate (4) rests evenly on the lower ledge of the plate separators (8).

11. Install the second driving plate (5) against the center plate (4).

12. Install the eight rollpins (11) into the pressure plate (10) if they were removed during disassembly.

13. Install the insulator plate (12) over the rollpins (11) onto the pressure plate (10). Use a rubber mallet and seat the insulator plate (12) against the pressure plate (10).

14. Install the assembled pressure and insulator plate onto the hub-and-back plate (2). Lower the pressure plate (10) onto the driving plate (5), or until the compression of the release springs (9) support the weight of the pressure plate assembly.

15. Position the front cover plate assembly (19) onto the hub-and-back plate (2), aligning the tapered dowel pins (21) with their holes (if not removed) in the hub of the hub-and-back plate. If the tapered dowel pins were removed, align the tapered dowel pin holes.

16. Secure the front cover plate (19) to the hub-and-back plate (2) with nine hex-head capscrews (25) and washers (24). Torque the capscrews evenly to 240 lbs. ft.

17. If hub-and-back plate (2) or front cover plate (19) were replaced, proceed as follows:

Rework a No. 8 tapered pin reamer as indicated in Figure 11-1. Ream the three tapered dowel pin holes with the reworked reamer. Drive the three tapered dowel pins (Figure 9-3, 21) into place.

#### RELEASE VALVES. (One Described).

1. Position the flat gasket (18a) and release valve body (18b) aligned properly with the air inlet port and capscrew holes onto the front cover plate (19).

2. Install the diaphragm (18c), spring seat (18d), spring (18e), gasket (18f), and cover (18g) onto the valve body (18b).

3. Secure the quick release valve assembly (18) to the front cover plate (19) with four hex-head capscrews (18k) and flat washers (18h). Torque the capscrews to 17 lbs. ft.

4. Install the air lines previously removed from the quick release air valves.

#### GENERAL.

1. Install the name plate (27) to the front cover plate (19) with four drivescrews (26).

2. Apply a small amount (2 or 3 drops) of M-2828 anaerobic plastic sealant to the threads of the three special capscrews (20).

#### CAUTION

Do not allow the sealant to get onto the diaphragm.

3. Install the three capscrews (20) and torque them 120 lbs. ft.

4. Attach counter-balance block (23) to the front cover plate (19) with two hex-head capscrews (22). Torque the capscrews 17 lbs. ft.

#### CAUTION

Prior to installation, make certain that the clutch driving plates turn without resistance when the clutch is released. If there is resistance, the clutch must be disassembled and the cause of the resistance corrected.

#### INSTALLATION.

##### General.

There are many possible installation configurations for air operated clutches. The scope of this service manual does not permit providing specific information on runout checks for each installation. Consequently, information covering two typical installations is provided; a variation of these two will include most installations. If additional information is required concerning specific installations not covered herein, contact the Twin Disc Service Engineering Department, Racine, Wisconsin, 53403.

#### CAUTION

Most Twin Disc air operated clutches are made to mate with the customer's driving component (i.e. drive gear on a machine, engine flywheel, etc.). It is possible due to mismatch of components to have driving-component to air operated clutch interference. If interference is detected, the clutch should be removed and the interference corrected. The following listed runout checks will indicate interference if it exists.

Twin Disc will not be responsible for system damage caused by driving-component to air operated clutch interference regardless of the cause of the interference.

## Alignment.

If the driving ring is bolted directly to the face of the driving component as illustrated in Figure 9-1, proceed as follows:

1. Thoroughly clean the surface of the driving component that mates with the air operated clutch.
2. With a thousandths indicator mounted to the output shaft, check the bore of the driving

component for concentricity by rotating the output shaft. See Figure 9-1. The bore should be concentric to within 0.005 inch total indicator reading.

Check the driving component face. The variations of face runout of the surface to which the driving ring is bolted should not exceed 0.0005 inch per inch of checked diameter.

If the driving component connects to the air operated clutch by means of a spider drive, the angular alignment between the input and output shafts must be checked. See Figure 9-2. This alignment, both vertically and horizontally, must be within 0.001 inch per inch of shaft length. Since there are many different applications of the air operated clutch, the methods of making these checks should be determined by the user to best suit the specific application.

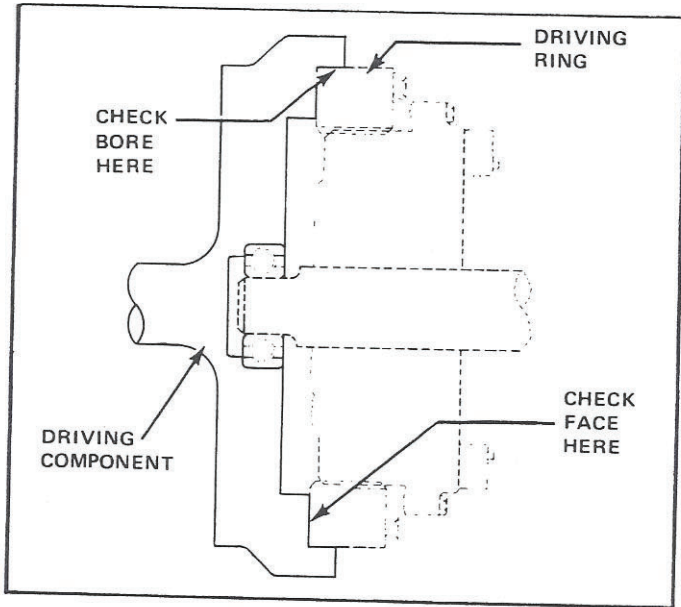


Figure 9-1. Air Operated Clutch with Driving Ring Bolted to the Driving Component (Typical Installation).

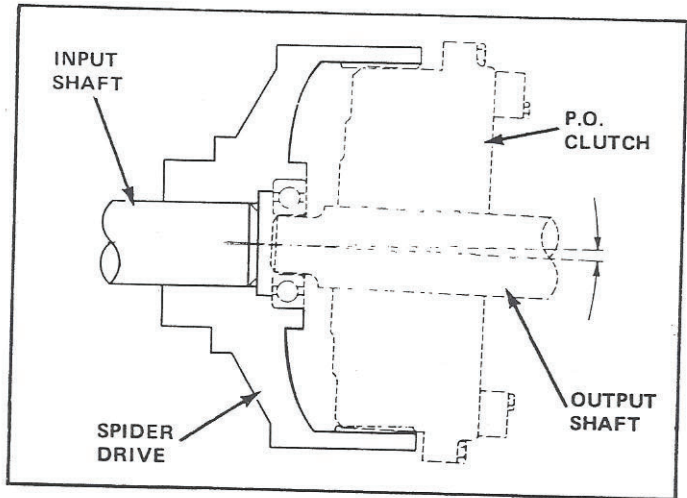





Figure 9-2. Angular Misalignment.

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# 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 RECEIVED (2)	LUBRI-CATED (3)	AS RECEIVED (2)	LUBRI-CATED (3)	LUBRI-CATED (3)
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	----
3 DASHES 120° APART		6 DASHES 60° APART		 (4) 12 Pt. Head and Undercut Body	
					
SAE STANDARD HEX BOLT HEAD MARKINGS					

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<sub>c</sub> 40 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.

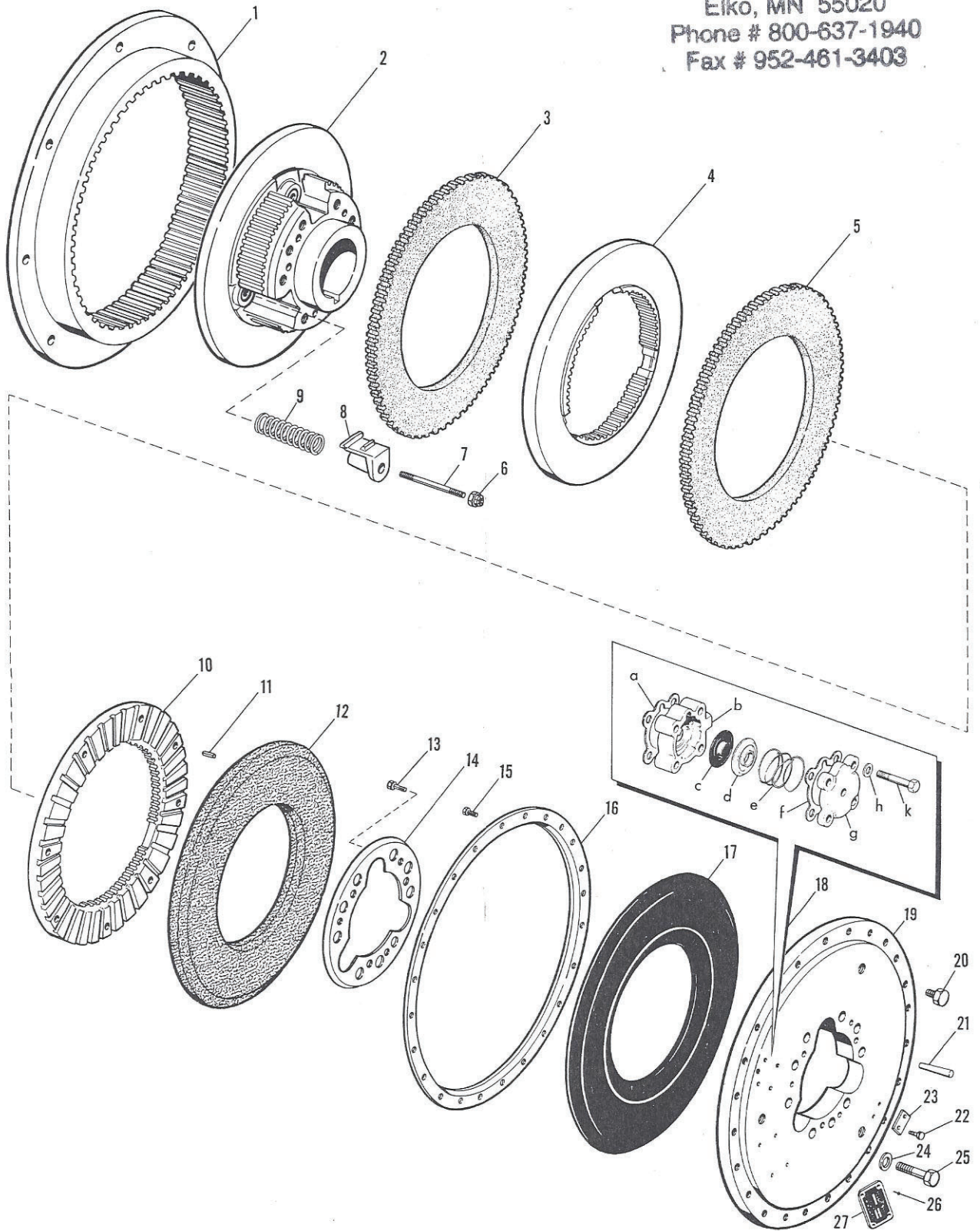
DO NOT USE MOLY-DISULFIDE, WHITE LEAD, COPPER FILLED OR OTHER SUCH FILLED LUBRICANTS WITH THESE TORQUE VALUES. SUCH LUBRICANTS REQUIRE SPECIAL TORQUE VALUES.

(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.

ITEM	DESCRIPTION	QUANTITY
1	RING, driving	1
2	PLATE, hub-and-back	1
3	PLATE, driving	1
4	PLATE, center	1
5	PLATE, driving	1
6	NUT	3
7	STUD, release spring (1/2 x 4-5/8)	3
8	SEPARATOR, plate	3
9	SPRING, release	1
10	PLATE, pressure	1
11	ROLLPIN	8
12	PLATE, insulator	1
13	CAPSCREW, hex-head (3/8-16 x 3/4)	3
14	RING, inner clamp	1
15	CAPSCREW, hex-head (3/8-16 x 3/4)	24
16	RING, outer clamp	1
17	DIAPHRAGM	1
18	VALVE, quick release	1
a	GASKET	1
b	BODY, valve	1
c	DIAPHRAGM	1
d	SEAT, spring	1
e	SPRING	1
f	GASKET	1
g	COVER	1
h	WASHER	4
k	CAPSCREW, hex-head (5/16-18 x 1-3/4)	4
19	PLATE, front cover	1
20	CAPSCREW, hex-head (3/4-10 x 3/4)	3
21	PIN, tapered dowel	3
22	CAPSCREW, hex-head (5/16-18 x 1-1/2)	2
23	BLOCK, counter-balance	1
24	WASHER, plain (3/4)	9
25	CAPSCREW, hex-head (3/4-10 x 3)	9
26	DRIVESCREW	4
27	NAMEPLATE	1

**N.D.S. Drilling Supply**  
**26041 Newton Circle**  
**Elko, MN 55020**  
**Phone # 800-637-1940**  
**Fax # 952-461-3403**

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PO-214 Air Operated Clutch. Figure 9-3.

**NOTE: FOR EMERGENCY MECHANICAL CLUTCH LOCK-UP REMOVE THESE THREE SCREWS AND INSERT THREE SCREWS MARKED ① ② ③**

③ O.D. TUBING (OR EQUIVALENT) TO BE FURNISHED BY CUSTOMER

①-18 DRYSEAL N.P.T. TAP

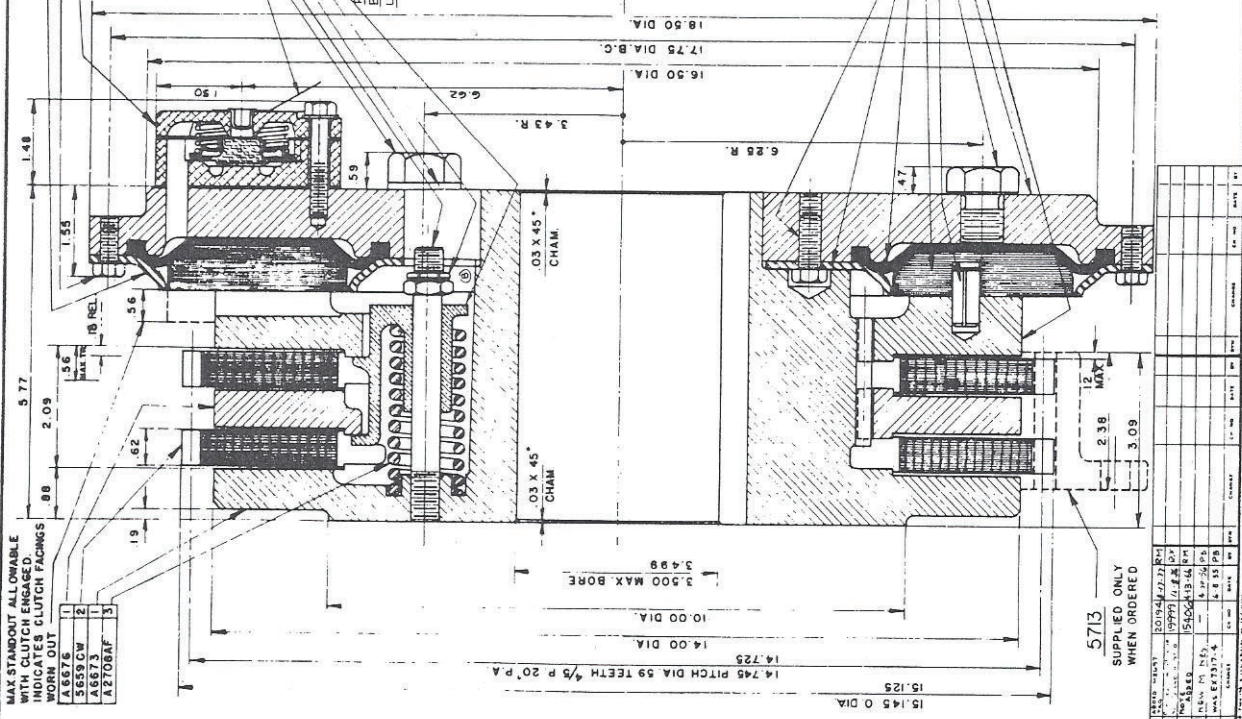
REMOVE 2 PLUGS BEFORE OPERATING UNIT

MAX STANDOUT ALLOWABLE  
CLUTCH ENGAGED.  
INDICATE CLUTCH PACKINGS  
WORN OUT

A6676	1
A6677	2
A6678	3
A2708AF	3

A6672	1
M2002G	2
X44255	2
A4255	1
A4257	1
M1979	1
M1980	1
M1981	1
M1981 SPR BEAT	1
B1302	2
1395 WASHERS	4
M2001W	4
M2007A	1
M2007B	1
M2007C	1
M2007D	1
M2007E	1
M2007F	1
M2007G	1
M2007H	1
M2007I	1
M2007J	1
M2007K	1
M2007L	1
M2007M	1
M2007N	1
M2007O	1
M2007P	1
M2007Q	1
M2007R	1
M2007S	1
M2007T	1
M2007U	1
M2007V	1
M2007W	1
M2007X	1
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M2094	1
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M2097	1
M2098	1
M2099	1
M2100	1

M2002G	3
A4409	1
A6671	1
A6670	1
M1927E	8
M2007A	3
A6661	1
A6675	1
M1258	1
M1601D	3

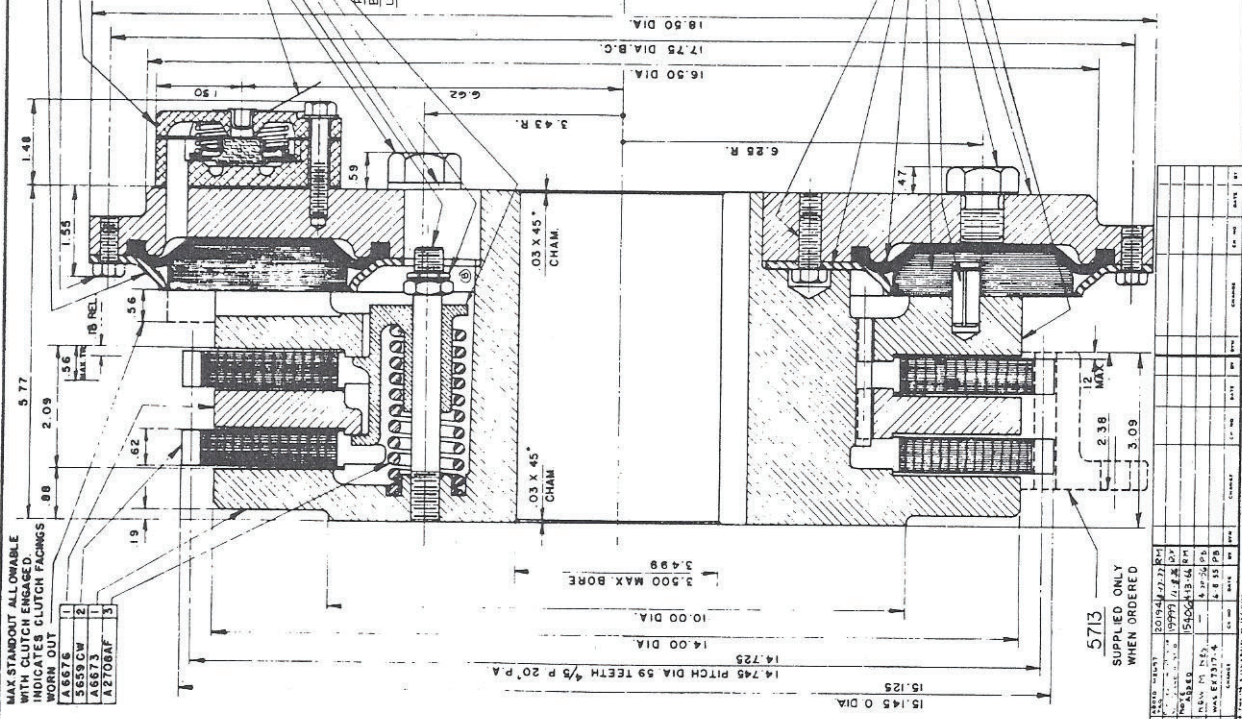


MAX STANDOUT ALL OWAIBLE  
CLUTCH ENGAGED.  
INDICATE CLUTCH PACKINGS  
WORN OUT

A6676	1
A6677	2
A6678	3
A2708AF	3

A6672	1
M2002G	2
X44255	2
A4255	1
A4257	1
M1979	1
M1980	1
M1981	1
M1981 SPR BEAT	1
B1302	2
1395 WASHERS	4
M2001W	4
M2007A	1
M2007B	1
M2007C	1
M2007D	1
M2007E	1
M2007F	1
M2007G	1
M2007H	1
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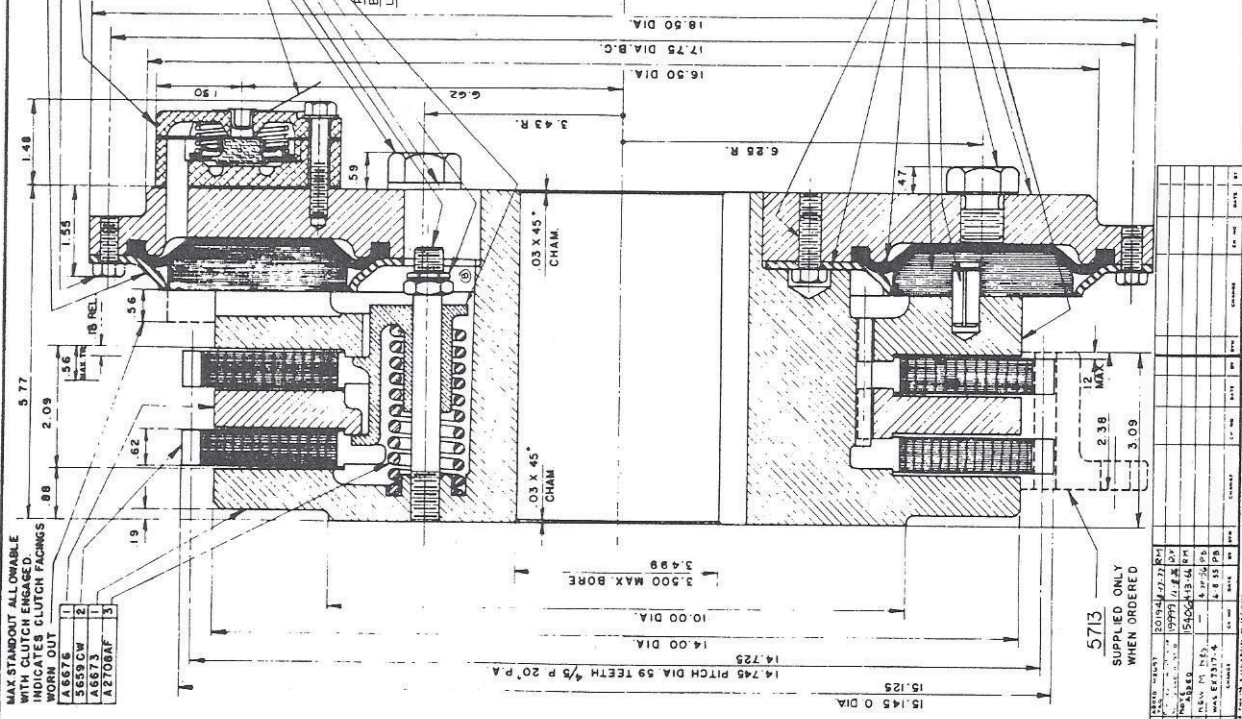


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