



502-T2-004

SERVICE MANUAL

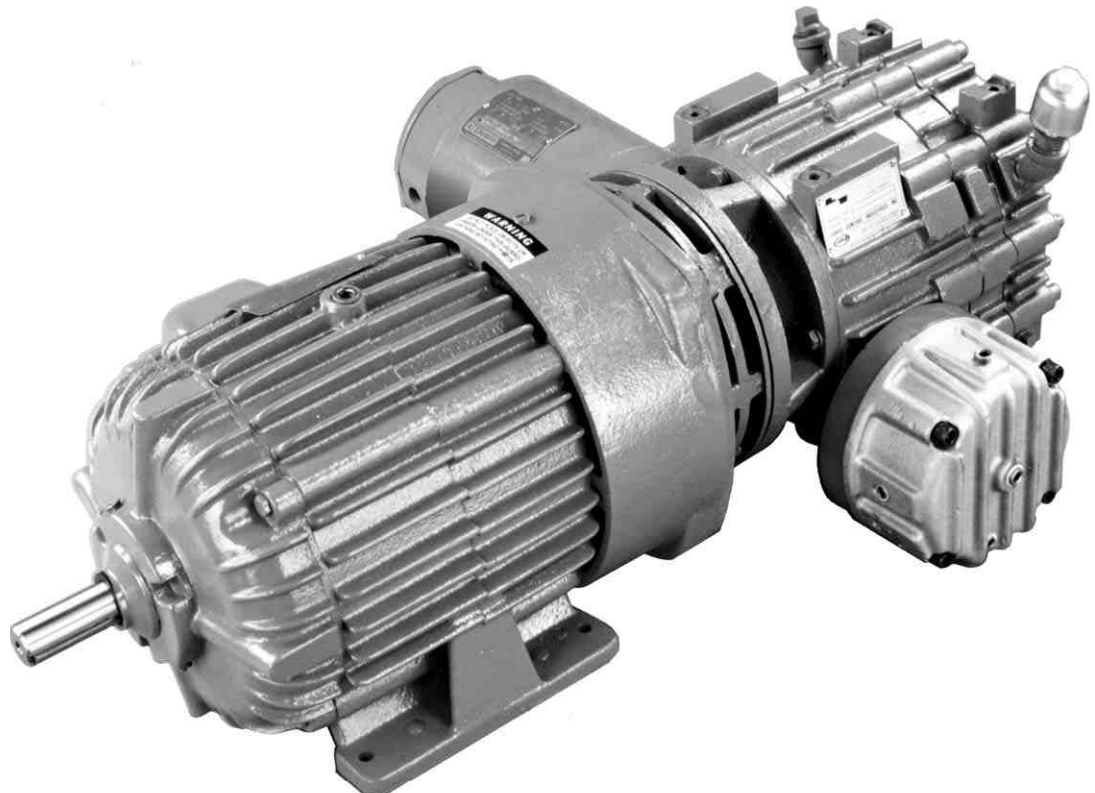
AND

REPAIR PARTS

FOR

TWO SPEED DRIVE II

(TSDrII)



WARNING - Read this manual before any installation, maintenance and operation.



FORCE CONTROL INDUSTRIES, INC.

**MANUFACTURERS OF MECHANICAL AND
ELECTRICAL POWER TRANSMISSION EQUIPMENT**

LIMITED WARRANTY

SPECIAL 24 MONTH WARRANTY

Upon written approval of the application by Force Control Industries, Inc. the Standard Warranty period will be extended to 24 months.

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Table of Contents

Section 1 - Description & Operation

1-1	Module Description	1
	Item A - Main Drive Motor	1
	Item B - Main Drive Motor Mounting Adapter	1
	Item C - TSDrII Clutch and Brake	1
	Item D - Feed Motor Drive	1
	Item E - Feed Drive Motor	2
1-2	The Oil Shear Principle	2
1-3	Clutch and Brake Description	2
1-4	Clutch and Brake Operation	3

Section 2 - Specifications

2-1	Performance Specifications	4
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Section 3 - Installation

3-1	Receiving The Drive	5
3-3	Mounting The Complete Drive	5
3-2	Mounting The TSDrII To An Existing Main Motor	5
3-4	Wiring Specifications	6
3-5	Pneumatics	6
3-6	Start Up	6

Section 4 - Lubrication

4-1	Checking The Oil Level	6
4-2	Changing The Oil	6
4-3	Type Of Oil	6

Section 5 - Operational Checks

5-1	TSDrII Clutch and Brake	7
5-2	Drive Motors	7
5-3	Pneumatic Control	7

Section 6 - Troubleshooting

6-1	Clutch/Brake Troubleshooting Chart	8
	Clutch/Brake Troubleshooting Chart (Concluded)	9
	Pneumatic System Troubleshooting Chart	10
	Typical Pneumatic Schematic	10

Section 7 - Disassembly

7-1	General Information	11
7-2	Feed Motor Removal	11
7-3	Piston Housing Subassembly Removal	11
7-4	Disassembly of Piston Housing Subassembly	12
7-5	Main Drive Motor Removal	12
7-6	Disassembly of Input Subassembly	12
7-7	Brake Removal and Disassembly	13
7-8	Worm Shaft Removal	13
	(Belt Drive Only)	13
	(C-Face Drive Only)	14
7-9	Main Housing Disassembly	14

Section 8 - Cleaning and Inspection

8-1	Cleaning and Inspection	15
8-2	Repair and Replacement	15

Section 9 - Reassembly

9-1	General Instructions	16
9-2	Input Subassembly	16
9-3	Main Housing Subassembly	17
9-4	Worm Shaft Replacement	17
	(Belt Drive Only)	17
	(C-Face Drive Only)	18
9-5	Mounting Main Housing To Main Motor	
	C-Face Adapter	18
9-6	Piston Housing Assembly	18
9-7	Clutch Stack	19
9-8	Bolting Piston Housing Assembly To Main Housing	19
9-9	Brake Hub Installation	19
	(Belt Drive Only)	19
	(C-Face Drive Only)	20
9-10	Brake Stack and End Housing Subassembly	20
9-11	Feed Motor Installation	21
9-12	Final Reassembly Procedure	21
	Belt Drive Feed Motor Installation	22
	A. Top Mounting	22
	B. Bottom Mounting	22
	C. Rear Mounting	23

Section 10 - Ordering Repair Parts

10-1	General Information	25
10-2	Factory Rebuild Service	25
10-3	Drive Motors	25
10-4	Ordering Replacement Parts	25
	Name Plate Information	25
	Model Numbers	26
	Assembly Configuration Options	26
	A. Main Motor Mounting	26
	B. Foot Mounted Feed Motor	27
	C. C-Face Mounted Feed Motor	27
	Repair Parts List	28
	Figure 10.1 - Two Speed Drive II	29

Section 1

DESCRIPTION & OPERATION

The Force Control Two Speed Drive II (*TSDrII*) is built from five separate modules. Each module offers several choices, making a complete unit essentially tailor-made specifically for each application.

1-1 MODULE DESCRIPTION

(See Figures 1-1 and 1-2)

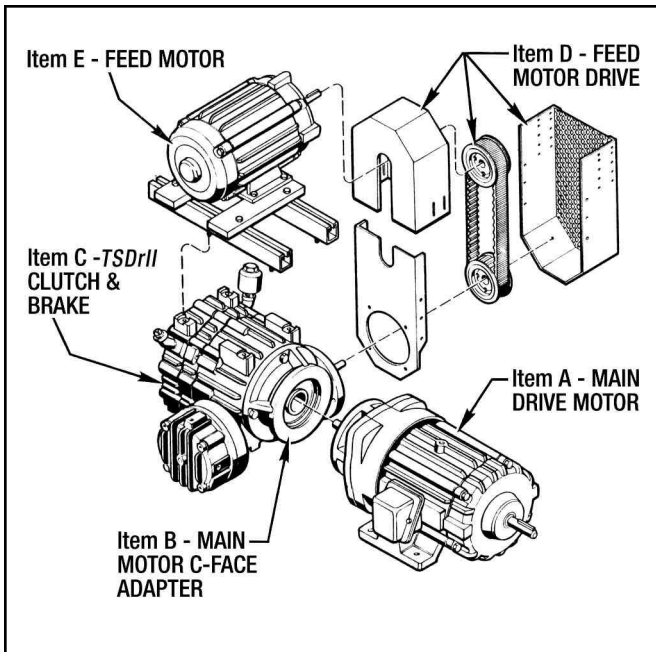


Figure 1.1 - Belt Drive Modules

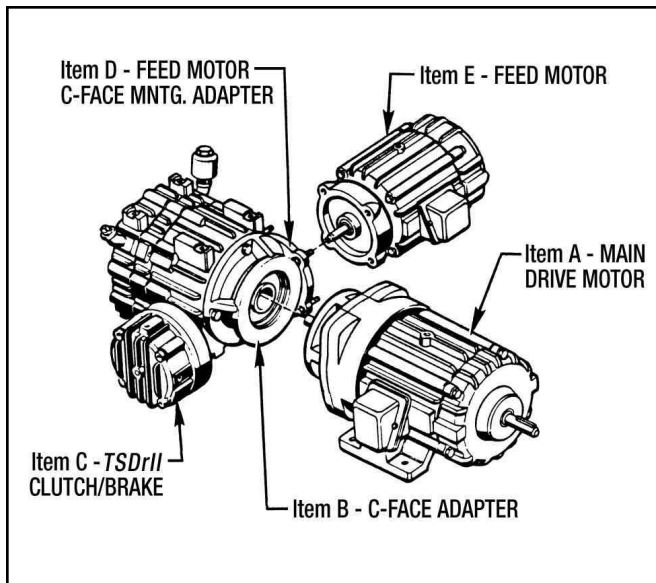


Figure 1.2 - C-Face Drive Modules

Item A - MAIN DRIVE MOTOR

The High Speed Main Drive Motor provides acceleration and running torque to the driven machine. U-line motors are normally used, while others are available for special needs. The most common base speed of the main drive motor is 1800 rpm. Horsepowers available are from 1 to 7-1/2. All motors are supplied T.E.F.C. unless otherwise specified.

Item B - MAIN DRIVE MOTOR C-FACE MOUNTING ADAPTER

The C-Face Adapter, as shown in *Figures 1.1 and 1.2*, connects the main housing of the *TSDrII* to the accessory end of the main drive motor. It is mounted to the main drive motor via a standard NEMA C-Face pilot. The Adapter is available with NEMA C -Face pilot diameters of 4-1/2" and 81/2".

Item C - TSDrII CLUTCH and BRAKE

As noted above, the *TSDrII* is mounted to the main drive motor with a C-Face Adapter. Torque is transmitted from the motor to the drive, by mating the accessory shaft of the main motor with a female hub in the drive. The male shaft of the motor is then locked to the female hub of the drive with a tapered locking element.

The *TSDrII* Clutch and Brake are of the spring set, air release type. This means that if no air is supplied to the drive, by the control valve or because of power failure, the clutch and the brake will be set by spring pressure. To release the clutch and/or the brake, air pressure must be supplied to the clutch and/or brake ports. (**See Section 1-4**)

The *TSDrII* has a built in gear reducer. This offers the advantage of being more compact and easier to maintain than a drive with an external bolt on gear reducer. The gear reducer is of the worm and gear type and runs in the same oil as the *TSDrII*.

Item D - FEED MOTOR DRIVE

The Feed Drive Motor can be belt driven to the drive, as in *Figure 1.1*, or can be C-Face coupled to the drive, as in *Figure 1.2*. If the Feed Motor is belt driven, the ratio of the belt drive can be varied. By varying the belt drive ratio along with the gear reducer ratio, a wide range of feed speeds can be realized. Speeds from 119 RPM all the way down to 18 RPM are possible by using different combinations of gear reducer and belt drive ratios. A

synchronous belt drive is used for a positive transmission of motor torque to the drive.

Different mounting arrangements are available to suit different space requirements. See pages 24 and 25 for Belt Drive Mounting Arrangements.

The Feed Drive Motor can also be C-Face coupled to the *TSDrII*. The motor is attached to the drive with a C-Face adapter that uses a NEMA C-Face pilot diameter of 4-1/2 inches. The shaft of the feed motor mates with a keyed female shaft in the drive to transmit torque to the *TSDrII*. However, the range different feed speeds is limited with this method. Only the gear reducer ratio can be changed to obtain different speeds as opposed to the belt feed drive.

NOTE

The C-Face arrangement cannot be used when reversing loads are transmitted to the Feed Motor.

Item E - FEED DRIVE MOTOR

The Feed Drive is either foot mounted or C-Face mounted to the *TSDrII*. Standard feed drive motors are 1800 RPM and range from 1/4 to 1-1/2 horsepower.

1-2 THE OIL SHEAR PRINCIPLE

Conventional clutches and brakes depend on the friction between solid surfaces operating in air to transmit torque. Friction does the job, but produces a great amount of heat and wear. The *TSDrII* Clutch and Brake units are oil shear drives, with the friction surfaces operating in a constantly replenished film of oil. The oil molecules tend to cling to each other and to the friction surfaces. As moving and stationary elements are brought together, a thin but positive film of oil is maintained between them, controlled by the clamping pressure and carefully designed grooves in the elements. Torque is transmitted from one element to the other through the viscous shear of the oil film. So long as there is relative motion between the elements, they are protected by the oil, thus greatly reducing wear. The constantly replenished oil film also effectively transmits heat away from the friction elements.

1-3 CLUTCH and BRAKE DESCRIPTION

In the *TSDrII* Clutch and Brake, the friction surfaces consists of alternate carbon steel Drive Plates and a resilient paper based friction material bonded to steel discs. These are called Friction Discs. The oil control

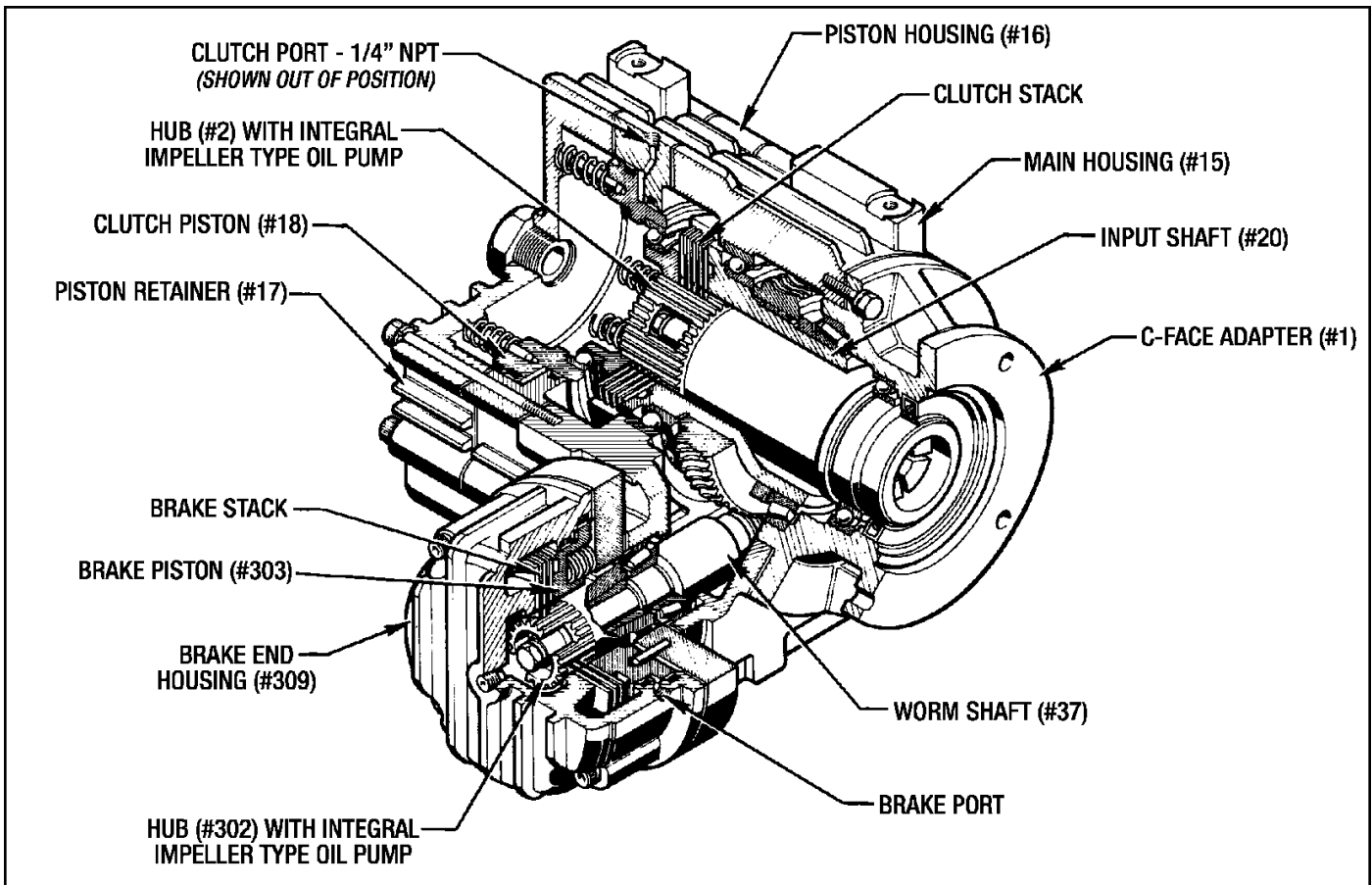


Figure 1.3 - TSDr II Clutch and Brake Assembly

grooves are machined into the friction discs. The discs have internal teeth which mate with a spline on the hubs for both clutch and brake applications. The steel plates are keyed to the input shaft in the clutch and to the housing for the brake. The splined sections of the hubs contain centrifugal impellers to maintain a positive flow of oil between the discs and plates.

1-4 CLUTCH and BRAKE OPERATION

The *TSDrill* Clutch and Brake cross section, *Figure 1.4*, shows the unit in the off position with the clutch and brake engaged. This is the normal position when air and electrical services are off.

In the drive, springs are used to force the brake piston against the brake disc pack. The force of the piston is great enough to lock the disc pack solid which in turn keeps the worm shaft and the input shaft from turning. The clutch works in the same manner except its purpose is to couple and uncouple the input shaft to the hub. So that in *Figure 1.4*, with both the clutch and brake engaged, the input shaft is coupled to the hub and neither is free to turn.

The main Drive Motor is coupled to the hub and with the *TSDrill* in the off position it is not free to run. To run, air is applied to the clutch port. The air pressure overcomes the spring pressure to move the piston away from the clutch disc pack. With the clutch disc pack unclamped, the hub is uncoupled from the input shaft allowing the main drive motor to run freely. To stop the main motor the brake is left engaged and air is exhausted from the clutch port. The clutch piston is then forced by springs to clamp the clutch disc pack. This again couples the hub to the input shaft, which is locked by the brake, thus stopping the main drive motor.

To run the feed drive motor, the main drive motor is brought to a stop or near stop as described above. Air is applied to the brake port to overcome the spring pressure and move the piston away from the brake disc pack. With the brake disc pack released, the feed motor is free to run the worm shaft. Torque is transmitted from the worm shaft, to the worm gear to the input shaft. Since the clutch disc pack is clamped, torque is transmitted from the input shaft, thru the disc pack, to the hub and out to the main drive motor. This would complete a full cycle.

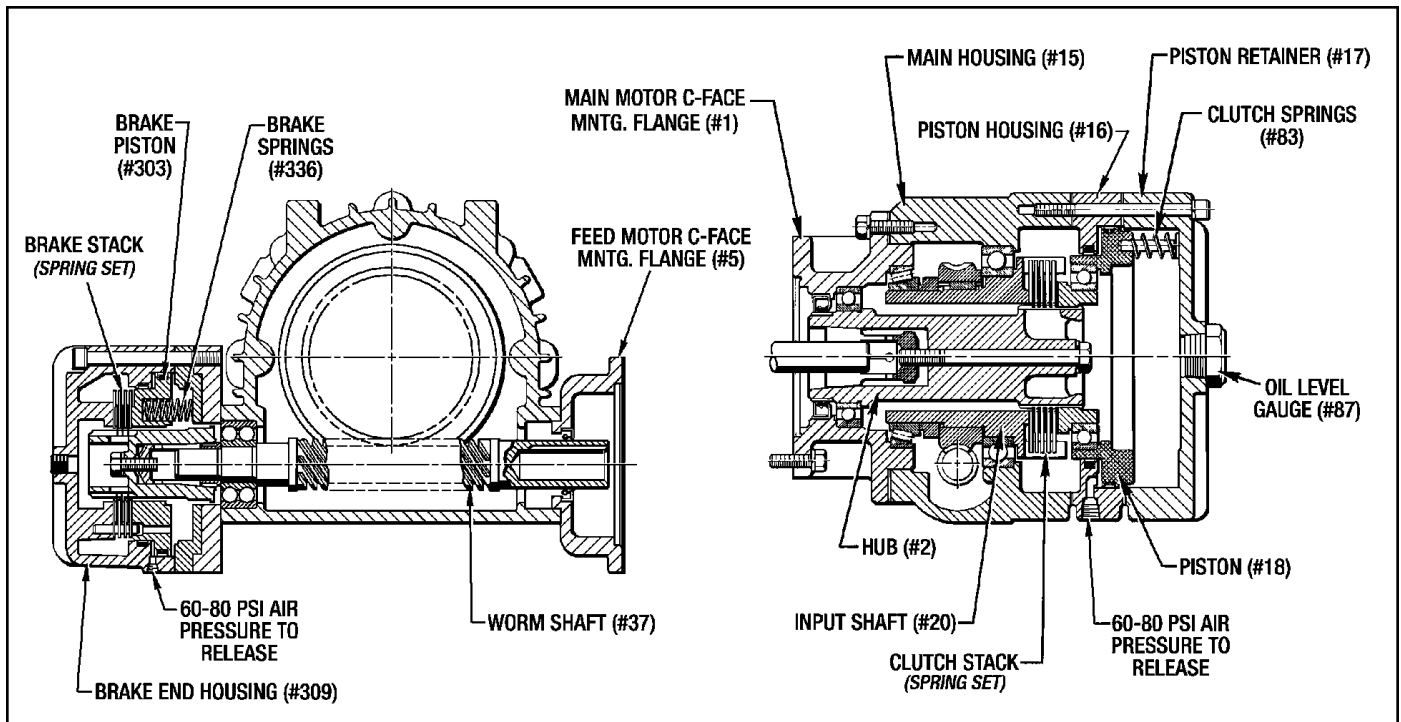


Figure 1.4 Clutch and Brake Cross Section

Section 2 SPECIFICATIONS

2-1 PERFORMANCE SPECIFICATIONS

MAIN DRIVE MOTOR				TOTAL DRIVE CYCLIC INERTIA (Lb. Ft. ²)	DRIVE NO LOAD STARTS PER MINUTE	SPRING SET CLUTCH TORQUE (Lb. Ft.)	SUGGESTED INCHING MOTOR HORSE POWER ***	MAXIMUM REFLECTED INERTIA MAIN MOTOR CAN START (Lb. Ft. ²)
HORSE POWER	RPM	MOTOR FRAME	CYCLIC INERTIA (Lb. Ft. ²)					
1	1200	184U	0.29	0.34	32.4	77*	.75	15
1.5	1200		0.31	0.36	55.1			23
2	1200	213U	0.36	0.41	43.0			30
3	1200	215U	0.48	0.53	42.5			44
5	1200	254U	2.05	2.10	20.5		1	71
7.5	1200	256U	2.73	2.78	19.6			104
1	1800	182U	0.24	0.29	12.4		.75	5.8
1.5	1800	184U	0.22	0.27	15.4			8.6
2	1800		0.26	0.31	33.5			11
3	1800	213U	0.39	0.44	32.7			17
5	1800	215U	0.47	0.52	28.9	27		
7.5	1800	254U	1.16	1.21	11.5	1		39
10	1800	256U	1.34	1.39				51

* Drive will be shipped with this torque unless otherwise specified on the order.

** The Clutch Torque also dictates the Braking Torque.

*** With 10:1 speed difference from high to low speed.

To Determine the Starts per Minute capability of the TSDr// when installed, use the following formula:

$$S / M1 = \frac{WK_D^2}{WK_D^2 + WK_L^2} \times S / M$$

S/M1 = Starts per Min. capability of installed drive.

WK_D² = Inertia of Two Speed Drive from Specification Table.

WK_L² = Inertia of driven load reflected to Two Speed Drive.

S/M = No Load Starts per Minute rating from Specification Table.

Section 3

INSTALLATION

IMPORTANT SAFETY PRECAUTIONS

The Two Speed Drive units described in this manual must not be installed in any manner except as specified herein, and must not be operated at speeds, horsepower loads or temperatures other than those specified in the manual. Failure to limit operation of the Drive to the conditions specified could damage the units and may cause malfunction or damage to interconnected equipment and void the warranty.

Suitable guards for rotating shafts and couplings must be used at all times when operating equipment and is the responsibility of the customer.

WARNING

Before installation and attempting any repairs to the drive, open the disconnects to both motors, shut off air supply to the drive and lock them out to avoid possibility of personal injury. Bleed off pressure trapped in the pneumatic system.

3-1 RECEIVING THE DRIVE

Check the drive for shortage or damage immediately after arrival. Prompt reporting to the carrier's agent, with notations made on the freight bill, will expedite satisfactory adjustment by the carrier. When unloading or handling the drive, keep it upright. All Drives are filled with oil, ready to run, when shipped. However, before placing the unit in service or storage, check the oil level to make sure none has spilled out in transit. Add oil if necessary (refer to **Section 4 LUBRICATION**). If the drive is not to be installed and operated soon after arrival, store it in a clean, dry place having a slow, moderate change in ambient temperature. Actuate pistons and rotate shafts once a month to re-lubricate working surfaces.

3-2 MOUNTING THE *TSDrII* TO AN EXISTING MAIN DRIVE MOTOR

The Two Speed Drive II may come partially filled with oil, so after installation to the Main Drive Motor is complete, you will need to check the oil level and add oil as described in **Section 4 - LUBRICATION**.

1. Make sure that the mounting surfaces on both the motor and *TSDrII* unit are thoroughly cleaned and suitable for mounting.
2. Attach an overhead hoist and appropriate sling to the unit and slide it over the motor shaft until the pilot is snug against the motor register.
3. Loosely attach the Clutch and Brake Unit with (4) Mounting Bolts (#142) and (4) Lockwashers (#169) to the motor face. **DO NOT TIGHTEN THESE BOLTS YET.**
4. Remove the Sight Gauge (#87) from the rear of the Piston Retainer (#17).
5. Back the Clutch and Brake Unit **1/32"** off the motor face. **Use a 1/32" shim to verify this.**
6. Insert a 3/8" Socket Torque Wrench into the sight gauge hole, long enough to reach the head of the Collet Bolt (#143). **Torque to 75 Ft. Lbs.**
7. This tightening procedure will pull the unit back against the motor face. **Torque the (4) Mounting Bolts (#142) to 60 Ft.Lbs.**
8. Replace the Sight Gauge (#87) and fill with fresh oil as described in **Section 4 - LUBRICATION**.

3-3 MOUNTING THE COMPLETE DRIVE

Installation of the Drive should be made in much the same manner, and receive the same care as for a precision gear reducer. Standard Drives are designed for horizontal operation. Note the following precautions when mounting the drive.

1. The Drive should be mounted on a firm, level base or foundation.
2. Use socket head cap screws or SAE grade 5 bolts to bolt the drive securely in place. Before tightening down the bolts, check alignment with driven machinery, then re-check after tightening.
3. If the Main Motor Shaft is to be directly coupled, use only a flexible coupling (with horsepower service factor 3 to 1) to take care of maximum torque requirements. Make sure that the shafts to be coupled are concentric within the coupling manufacturers' specifications. Check for horizontal, vertical or angular misalignment. Use shims as necessary to correct any misalignment.

CAUTION

Do not drive couplings or bushings on shaft, as this may damage the bearings.

If the motor drives a belt, coat shaft with heavy oil before installing pulley. See cautionary note above. Mount pulley as close to motor bearing as possible, and align to run true.

CAUTION:

Excessive belt tension will damage bearings.

4. Before shipment, the air breather (#88) is removed and a pipe plug put in its place. This is to prevent oil spillage during shipment. In most cases this will be a red plastic plug. This plug **MUST** be removed and the breather (#88) installed to prevent damage to the drive. The breather is taped to the drive for shipment.
5. After the machinery has been in operation for a few hours, make sure that all mounting bolts are tight and recheck the alignment of all components.
6. After machinery has been in operation for 40 hours check the mounting bolts and tighten if necessary.

3-4 WIRING SPECIFICATIONS

(See Motor Plate)

3-5 PNEUMATICS

For the least delay in actuation use 3/8" tube or hose and mount the valve as close to the drive as possible. Use of bottom air ports, with valve lower than ports will prevent accumulation of airline moisture in the *TSDrII* (See *Figure 6.1* on page 11).

3-6 START UP

1. Lock out machine and air. Verify that power is OFF to avoid personal injury.
2. Re-check all air connections for tightness and check to see that they are correct as shown in the Pneumatic Schematic (*Figure 6.1*).
3. Set air regulators to: 60 PSI minimum, 80 PSI maximum
4. Unlock main disconnect.
5. Check out slow speed mode for proper rotation and adjust all limit switches as needed.
6. Check operation of main motor.

Section 4 LUBRICATION

4-1 CHECKING THE OIL LEVEL

When the drive is installed and weekly thereafter, or until experience dictates otherwise, check the oil level in the *TSDrII* clutch and brake. Always check the oil level with the drive at room temperature and while it's not running.

The *TSDrII* has an oil sight gauge located at the end of the drive. The oil level is to show at the center of the gauge.

4-2 CHANGING THE OIL

Every three months completely drain the oil from the drive using the drain plugs provided. If the oil sight gauge is dirty it should be removed and cleaned.

Reinstall the drain plugs and refill the drive to the center of the sight gauge with fresh oil.

CAUTION

Do not overfill the *TSDrII*. Excess oil will cause the unit to overheat.

4-3 TYPE OF OIL

Use only Mobil Automatic Transmission Fluid type ATF-210 or Type "F". Always use the type of oil specified on the name plate.

Section 5

OPERATIONAL CHECKS

5-1 *TSDrill* CLUTCH and BRAKE

CAUTION

Make operational checks with the drive shut down. Do not remove plugs while drive is Running.

Provisions for manual operational checks are to be made if the unit has been removed for repair. Set up temporary manually controlled air connections to the drive for the required 60 to 80 PSI air supply.

Manually apply valve air pressure to the clutch port. Observe the clutch piston and check that it actuates quickly and smoothly. If the piston action is irregular, or if it tends to stick or bind, internal damage may be indicated. Also, listen for air leaks and look for air bubbles in the oil that would indicate damage to the piston seals.

Exhaust clutch air pressure and check to see that the piston moves to engage the clutch stack.

Check brake operation by applying 80 psi to the brake port and manually turn the worm shaft. If the worm shaft can be turned by hand then the brake piston has been actuated. If after applying air pressure to the brake port the worm shaft cannot be turned by hand then damage to the piston seals would be indicated.

5-2 DRIVE MOTORS

Check wiring connections against the diagram on the motor nameplate. "Bump" the motor and check the direction of rotation. Check for tightness of connections.

5-3 PNEUMATIC CONTROL

The typical pneumatic control for the *TSDrill* will not supply air to the drive when electrical power is off. In this mode the brake and clutch stacks are clamped so that the main and feed motors can not run. With a 60 PSI minimum air supply to the valve, the clutch is released by energizing the valve solenoid for the clutch. With the clutch valve solenoid energized, the clutch piston will move away from the clutch stack. De-energizing the clutch valve solenoid will allow the piston to move back to engage the clutch stack.

The brake is released in the same manner as the clutch. The brake valve solenoid is energized, at which time air will be applied to the brake port. The air will move the piston away from the brake stack. Again the valve should be supplied with a 60 PSI minimum air supply. Air pressures should be checked at the clutch and brake ports with diagnostic pressure gauges.

Section 6 TROUBLESHOOTING

6-1 CLUTCH/BRAKE TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE	REMEDY
<p>Section A</p> <p>Both clutch and/or brake fail to engage properly.</p>	<ul style="list-style-type: none"> • Electrical control circuit. • Air supply pressure regulator or piping. • Worn friction surfaces. • Piston sticking - broken return spring. 	<ul style="list-style-type: none"> • Check control circuit. • Check diagnostic pressure gauges. • Check for improper operation or leaks. • Check parts for wear and replace if necessary. • Disassemble to the extent necessary and inspect for damaged parts.
<p>Section B</p> <p>Picks up load too quickly.</p>	<ul style="list-style-type: none"> • Air pressure too high. • Low oil level. 	<ul style="list-style-type: none"> • Reduce air pressure • Check oil level and add if necessary.
<p>Section C</p> <p>Clutch fails to disengage properly.</p>	<ul style="list-style-type: none"> • Electrical control circuit. • Valve not functioning properly. • Low air pressure. 	<ul style="list-style-type: none"> • Check control circuit. • Check valve operation. Replace if necessary. • Increase air pressure to 60 PSI min.
<p>Section D</p> <p>Noise and vibration.</p>	<ul style="list-style-type: none"> • Mounted on poor foundation. • Misaligned couplings. • Damaged bearing. 	<ul style="list-style-type: none"> • Improve installation. • Tighten mounting foot bolts. • Recheck alignment and realign. • Disassemble to the extent necessary and inspect for damaged parts.
<p>Section E</p> <p>Noise: High pitch whine</p>	<ul style="list-style-type: none"> • Clutch engaged with main motor running. 	<ul style="list-style-type: none"> • Check control circuit.

6-1 CLUTCH/BRAKE TROUBLESHOOTING CHART *(Concluded)*

TROUBLE	POSSIBLE CAUSE	REMEDY
<p>Section F Brake fails to disengage properly.</p>	<ul style="list-style-type: none"> • Electrical control circuit. • Valve not functioning properly. • Low air pressure. 	<ul style="list-style-type: none"> • Check control circuit. • Check valve operation. Replace if necessary. • Increase air pressure to 60 PSI min.
<p>Section G Drive overheats. (Max. 225°)</p>	<ul style="list-style-type: none"> • Clutch or brake fails to engage properly causing excessive slippage. • Inertia or resistance changed. • Improper oil level. 	<ul style="list-style-type: none"> • Refer to Sections A, B & G • Check with Force Control engineering. • Check oil level. Add or drain oil, as necessary.
<p>Section H Oil leakage.</p>	<ul style="list-style-type: none"> • Oil seals. • Gaskets. • Poor ventilation. • Seal retainers. 	<ul style="list-style-type: none"> • Disassemble and replace. • Tighten all external bolts. • Remove breather and clean. • Tighten if loose.
<p>Section I Oil leakage out breather.</p>	<ul style="list-style-type: none"> • Damaged seal around piston. • Oil level too high. 	<ul style="list-style-type: none"> • Disassemble and repair. • Drain excess oil.
<p>Section J Shaft end play excessive. (.020" Max.)</p>	<ul style="list-style-type: none"> • Bearings damaged. 	<ul style="list-style-type: none"> • Disassemble and replace.
<p>Section K Clutch or brake does not repeat.</p>	<ul style="list-style-type: none"> • Air pressure changed. • Oil temperature changed. • Resistance in machine changed. 	<ul style="list-style-type: none"> • Check air pressure. • Check temperature. • Lubricate machine bearings

6-2 PNEUMATIC SYSTEM TROUBLESHOOTING CHART

TROUBLE	POSSIBLE CAUSE	REMEDY
Section A Excessive water in exhaust.	<ul style="list-style-type: none"> Wet air supply. 	<ul style="list-style-type: none"> Check supply line.
Section B Brake or clutch fails to disengage properly.	<ul style="list-style-type: none"> Low air pressure. Valves. 	<ul style="list-style-type: none"> Increase one regulator at a time in steps until satisfactory air pressure is attained. Check valve operation. Replace if necessary.
Section C Slow response of clutch/brake.	<ul style="list-style-type: none"> Air supply starvation. Exhaust muffler. Air supply Oil in exhaust. 	<ul style="list-style-type: none"> Insufficient air supply. Add accumulator tank before valves. (150 Cu. In. per Min.) Remove and clean. Valves too far from drive. Air lines too small. Use 3/8" or 1/2" lines with adapters to 1/4" Check drive for piston leakage. Check air line for source. (Lubricated air is not recommended.)
Section D Brake engages improperly.	<ul style="list-style-type: none"> Control signal. 	<ul style="list-style-type: none"> Check limit switch.

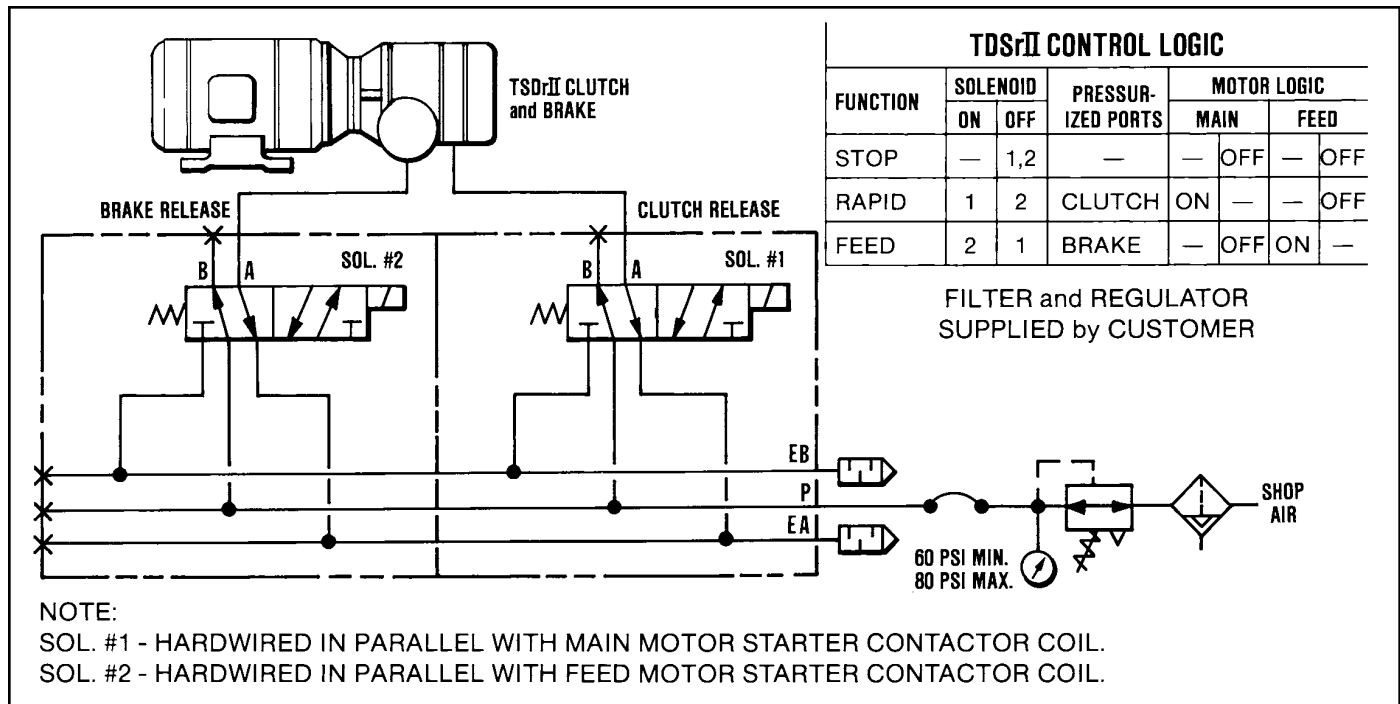


Figure 6.1 - Typical Pneumatic Schematic

Section 7 DISASSEMBLY

7-1 GENERAL INFORMATION

When disassembling the Two Speed Drive, remove only enough to gain access to the modular unit that requires repair.

Unless the drive is to be completely overhauled, the modules should be disassembled only to the extent necessary to gain access to worn or damaged parts.

CAUTION

Supporting the parts of drive as they are removed by use of an overhead crane and soft sling is recommended, as required.

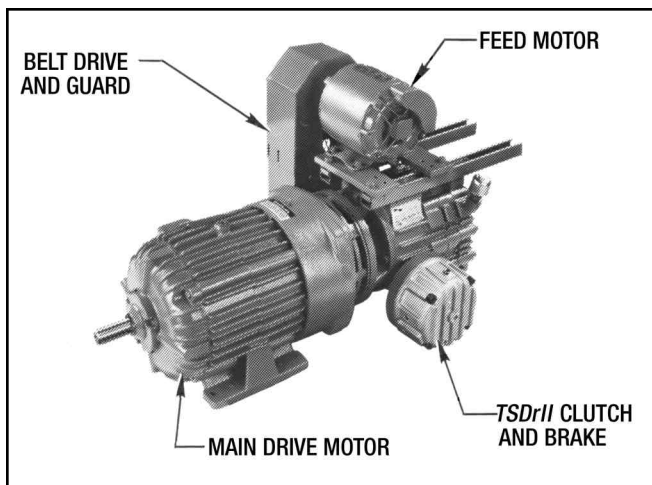


Figure 7.1 - Belt Drive

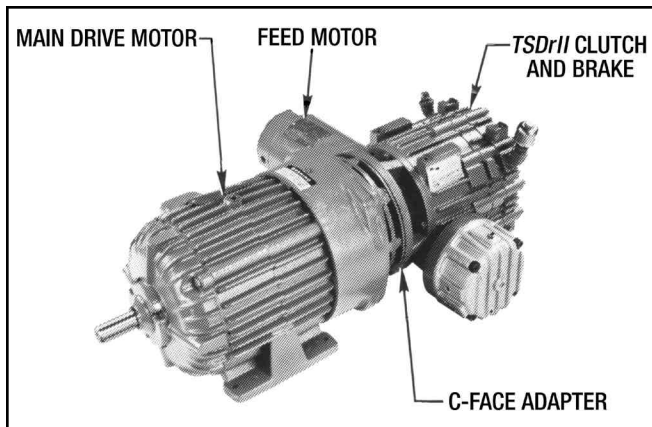


Figure 7.2 - C-Face Drive

7-2 FEED MOTOR REMOVAL

If the Feed Motor is foot mounted, first remove the Belt Guard Cover (#105). Loosen Cap Screws (#153) which bolt the motor to the mounting base. Next slide the motor on its mounting base until there is enough slack in the Belt (#106) to remove it. Unscrew socket set screws holding the Pulley (#101) to its bushing and remove the pulley and bushing from the motor shaft. Remove loosened Cap Screws (#153) and lift the motor from its mounting base. (See pages 26 and 27 for different motor mounting arrangements.)

If the motor is C-face mounted, remove Cap Screws (#154) which bolts the motor to the C-face adapter. With the bolts removed, slide the motor backwards and out of the C-face adapter.

TSDrill Clutch and Brake

7-3 PISTON HOUSING SUBASSEMBLY REMOVAL

1. Drain all of the oil from the drive.
2. Removal of (7) Cap Screws (#144) will allow the piston housing subassembly to be separated from the main housing subassembly.

CAUTION

Piston Housing (#16) and Piston Retainer (#17) are under spring pressure. Do not remove Cap Screws (#180) as shown in Figure 7.3.

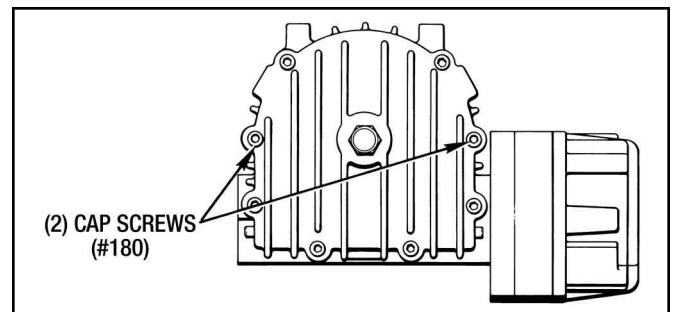


Figure 7.3 - End View Of Piston Retainer (#17)

3. Once the piston housing subassembly has been removed from the main housing subassembly, the Clutch Friction Discs (#12) and the Clutch Drive Plates (#13) can be removed for inspection. (See Section 8 for removal, cleaning and inspection procedure of the drive plates and friction discs.)

7-4 DISASSEMBLY- PISTON HOUSING SUBASSEMBLY

1. Evenly back out (2) Cap Screws (#180)

CAUTION

The Piston Housing Subassembly is under spring pressure and care must be taken to avoid personal injury when removing these (2) cap screws.

2. Piston (#18), Clutch Thrust Plate (#19) and Bearing (#51) can be removed as an assembly from the piston bore for inspection.
3. Remove (2) O-Rings (#75) and Liner (#80) from the Piston (#18) (See Figure 7-4).

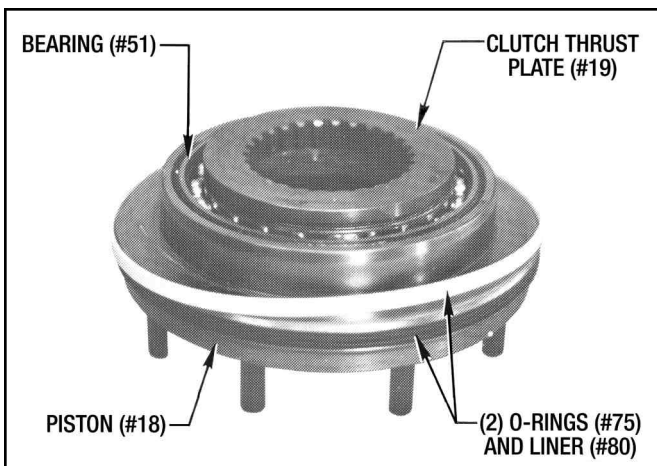


Figure 7.4 - Piston Subassembly

4. Remove O-Ring (#76) and Liner (#81) from Piston Housing (#16) (See Figure 7-5).

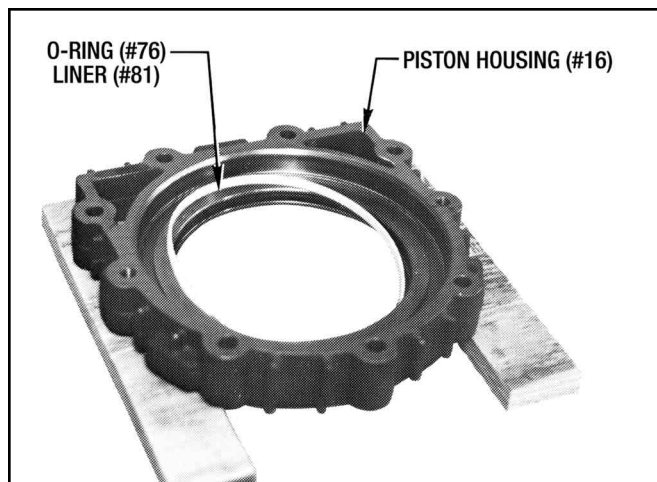


Figure 7.5 - Piston Housing

5. Use an arbor press to remove Bearing (#51) from Clutch Thrust Plate (#19) and Piston (#18) if necessary.

NOTE

Do not attempt removal of Bearing (#51) unless replacement is required.

Roll Pins (#85) are permanently pressed into the piston and should not be removed. Consult factory if replacement is necessary.

7-5 MAIN DRIVE MOTOR REMOVAL

1. Remove (4) Cap Screws (#141) and separate the Main Housing Subassembly from the Input Subassembly. Jack screw holes are located in the C-Face Adapter (#1) to aid in separation.
2. Next remove (4) Cap, Screws (#142), which bolts the Motor to the C-Face Adapter (#1).
3. Remove Cap Screw (#143) from the Hub (#2). Insert a 1/2"-13 x 4-1/2" Lg. Threaded Rod into the Collet (#6) so that there is still approximately 1/4" of thread left in the end of the Hub (#2). Install a 5/8"-11 x 2" Lg. Hex Hd. Screw into the Hub (#2). Tighten the Hex Hd. Screw to loosen the Hub on the Collet. (See Figure 7.6)

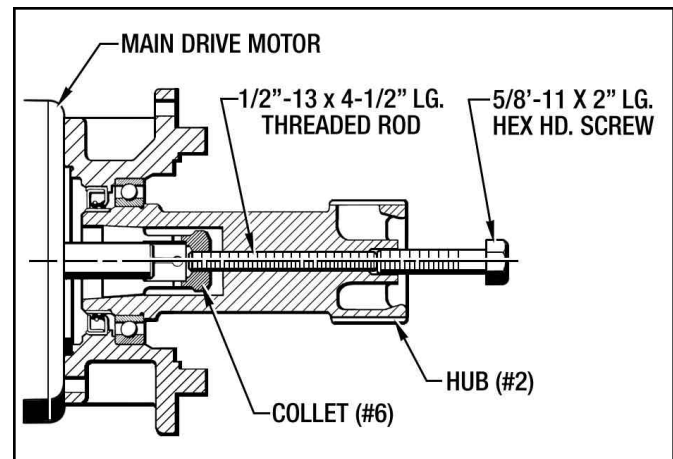


Figure 7.6 - Removing Hub From Main Motor Shaft

4. After Hub (#2) has been loosened from the Main Motor Shaft, slide the entire Input Subassembly back from the Main Motor.

7-6 DISASSEMBLY - INPUT SUBASSEMBLY

Disassemble the Input Subassembly as required, noting the following:

1. Use an arbor press to remove Bearing (#50) and Hub #2) from the C-Face adapter (#1), if necessary.

NOTE:

Do not remove the Bearing (#50) unless it has to be replaced.

- The Bearing Cup (#54) and the Oil Seal (#62) will remain with the C-Face Adapter (#1) when disassembled. **Remove these only if replacement is necessary.**

7-7 BRAKE REMOVAL & DISASSEMBLY

If the Brake needs to be removed or inspected, disassemble as required, noting the following.

- To remove the Brake Assembly, remove (2) Cap Screws (#352) and (2) Lockwashers (#327).
- Remove the Adapter Plate (#900) from the back of the brake by taking out the (2) Screws (#255) and (2) Lockwashers (#328).

CAUTION - This Adapter Plate (#900) is under spring pressure so back-out the (2) Screws (#255) in an even manner.

- Remove and discard Gasket (#322).
- Remove Piston (#303) from end housing bore for access to the Drive Plates (#12), Friction Discs (#313), O-Rings (#339, #340) and Liners (#342, #343). **See Section 8 for removal, cleaning and inspection of the Drive Plates and Friction Discs.**
- Remove O-Rings (#339, #340) and Liners (#342, #343) from the End Housing (#309).
- Remove Screw (#351). It may be necessary to apply heat to the screw to release the bond of the Loctite. Install a 3/8"-16 x 1/2" Lg. Soc. Set Screw into the Collet (#306). Then install a 1/2"-13 X 2" Lg. Hex Hd. Screw into the Hub (#2). Tighten the Hex Hd. Screw to loosen the Hub off of the Collet as shown in *Figure 7.7*.

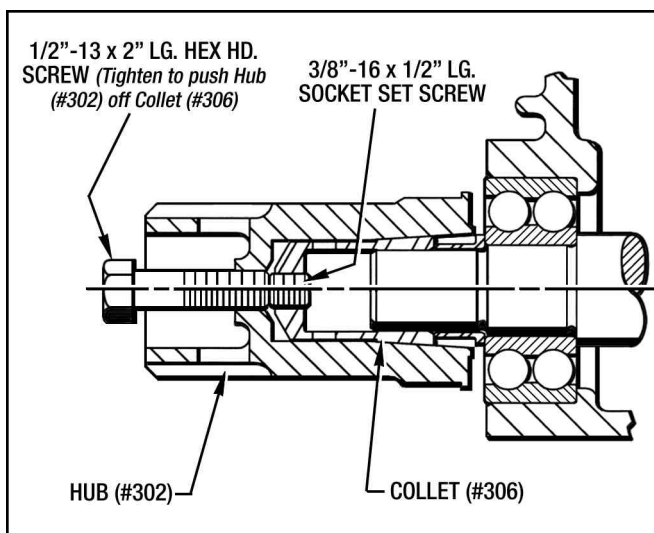


Figure 7.7 - Removing Hub off of Collet

7-8 WORM SHAFT REMOVAL (Belt Drive Only)

Remove the Worm Shaft only if it becomes necessary to replace it or the bearings. Also if the Main Housing Subassembly is to be disassembled.

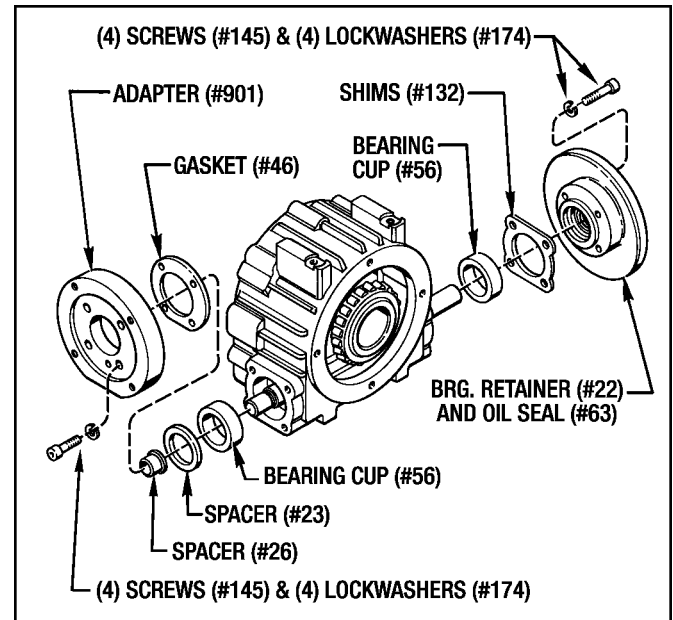


Figure 7.8 - Belt Drive Worm Shaft Removal

- If the Worm Shaft (#37) has an external key-way, place masking tape over key way to protect the Oil Seal (#63).
- Take out (4) Cap Screws (#145) and (4) Lockwashers (#174) and remove Bearing Retainer (#22).
- Remove Shims (#132). **These must be saved to be used again at reassembly.**
- Remove Adapter (#901) by removing (4) Cap Screws (#145) and (4) Lockwashers (#174). Also remove Gasket (#46).
- Remove the Bearing Spacers (#23, #26) and both Bearing Cups (#56) from the bearing bores in the Main Housing.
- Use an arbor press to remove the Worm Shaft (#37) from the Main Housing. An internal lip on the drive side will catch and remove the Bearing Cone (#55) located on the drive side of the Worm Shaft. The remaining Bearing Cone (#55) on the brake side can be pressed off with an arbor press.

(C-Face Drive Only)

1. Take out (4) Cap Screws (#145) and (4) Lockwashers (#174) to remove C-Face Adapter (#5).
2. The Oil Seal (#64) and the Gasket (#46) can be removed if necessary. Discard the Gasket (#46).
3. Remove Adapter (#901) by taking out (4) Cap Screws (#145) and (4) Lockwashers (#174). Remove gasket (#46) on this side and discard.

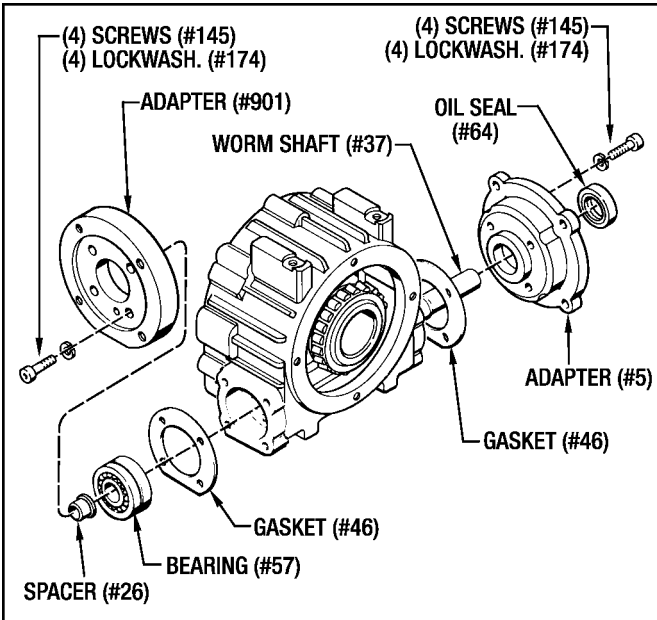


Figure 7.9 - Belt Drive Worm Shaft Removal

4. Pull the Bearing Spacer (#26) off the Worm shaft (#37).
5. The Worm Shaft (#37) can manually be pushed out of the Main Housing to the brake side. Bearing (#57) will be retained on the Worm Shaft during removal.
6. Use an arbor press to remove Bearing (#57) from the Worm Shaft, if necessary.

NOTE:

Only remove this Bearing if replacement is required.

7-9 MAIN HOUSING DISASSEMBLY

Disassemble the Main Housing as required for inspection or repair as required, noting the following:

1. Manually remove the Input Shaft Subassembly from the main housing bore. This Subassembly consists of Input Shaft (#20), Bearing (#52), Bearing Cone (#53), Spacer (#21) and Worm Gear (#38).

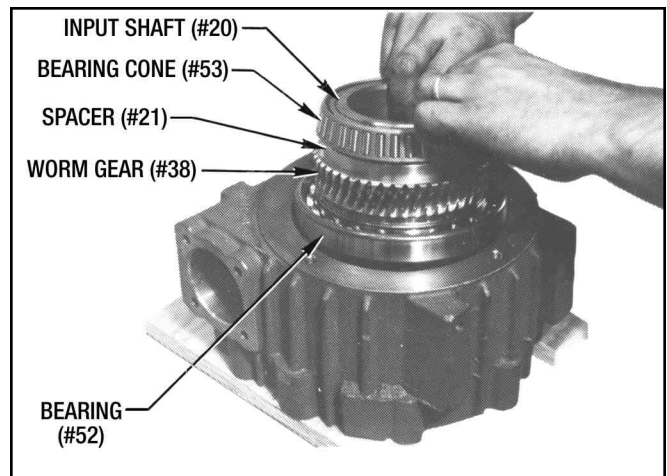


Figure 7.10 - Main Housing Disassembly

2. After removal of the Input Shaft Subassembly, remove Shims (#137) from the Main Housing. These shims must be saved for reassembly.
3. If necessary, use an arbor press to remove the bearings, spacer and worm gear from the input shaft.

NOTE:

Do not attempt removal of Bearings (#52, #53), Spacer (#21) and Worm Gear (#38) unless replacement is necessary.

This completes the disassembly procedure for the Two Speed Drive II Unit.

Section 8

CLEANING & INSPECTION

WARNING

Petroleum-base cleaning solvents are flammable and open flames or smoking by personnel in the vicinity of these solvents is extremely hazardous and must not be permitted.

4. Pay particular attention to Wear Sleeve (#67) and shafts in the area of rotary seals. Check for nicks, scratches or other damage which would cause leakage. Replace any damaged parts.
5. It is not necessary to remove the ball bearings to check their operation. Slowly rotate the free race of each bearing by hand checking to see if it turns freely without rough or flat spots.

8-1 CLEANING AND INSPECTION

Clean metal parts in a suitable solvent and dry in a stream of low pressure compressed air. Clean the clutch and brake plates and discs one at a time, keeping parts in the same order as they were when removed. After cleaning, inspect parts for cracks, distortion, scoring, nicks, burrs or other damage which would affect serviceability. **Pay particular attention to the following:**

1. Check the disc wear surfaces for scoring, galling or evidence of uneven wear.
2. Check the clutch and brake plates for scoring or galling. Make sure they are flat. If a perceptible ridge is worn in any of the drive plates, replace all of the drive plates and friction discs as a complete set.
3. Carefully check the piston and bore surfaces for nicks, scratches, scoring or other damage which would affect operation or cause leakage.

8-2 REPAIR AND REPLACEMENT

A fine stone or crocus cloth may be used to remove minor surface defects from parts so long as the operating or sealing action of the part is not affected. The use of coarser abrasives or other machining methods should not be attempted. Otherwise, damaged parts should be replaced. **Replacement is recommended also for the following, as applicable:**

1. Replace all O-rings, liners, gaskets and oil seals removed during the course of disassembly.
2. Replace clutch or brake discs and drive plates in complete sets only.

Section 9

REASSEMBLY

9-1 GENERAL INSTRUCTIONS

Note the following general reassembly instructions, as applicable:

1. Lubricate O-rings and the lips of oil seals with oil (the same as used in the assembled unit) immediately before assembly and installation of mating parts.
2. O-ring liners will be easier to install if heated in an oven to 200° F maximum.
3. The installation of press-fitted parts can be eased by heating the outside parts in an oven. Heat bearings to 250° F maximum.

WARNING

Use Suitable Gloves When Handling Heated Parts.

9-2 INPUT SUBASSEMBLY

1. Place a light coating of Permatex Form-A-Gasket in oil seal bore of C-Face Adapter (#1) and press Oil Seal (#62) into bore. (See Figure 9-1)

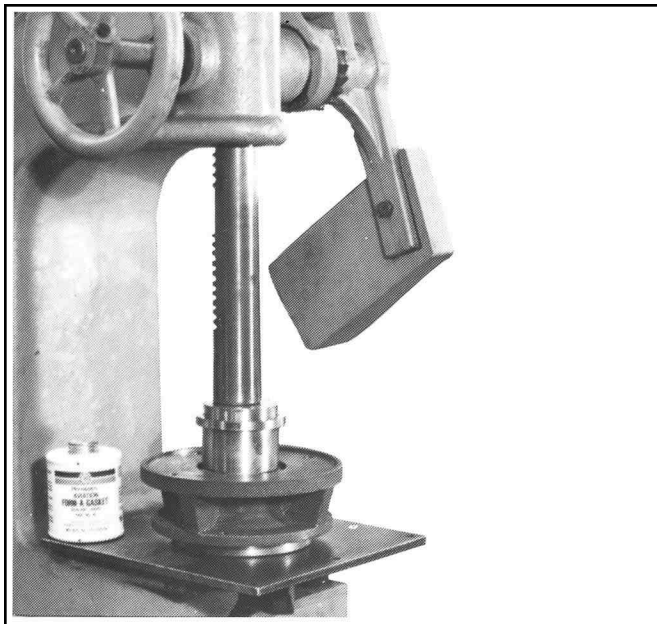


Figure 9.1 - Pressing Oil Seal (#62) Into Bore

2. Place a light coating of Loctite RC/680 on the outside of Bearing Cup (#54) and press it into the bore of C-Face Adapter (#1). Bolt C-Face Adapter to motor flange with (4) Washers (#169) and (4) Screws (#142).

3. Press Bearing (#50) on to Hub (#2).
4. Place a light coating of Loctite #2717 on the inside of Wear Sleeve (#67) and press it on to Hub (#2).
5. Insert Collet (#6) into bore of Hub (#2). Apply a coat of Loctite Threadlocker #271 to threads of Cap Screw (#143). Install Cap Screw (#143) along with Seal Washer (#43) by inserting it into Hub (#2) and threading it into Collet (#6) one or two turns. Do not tighten Cap Screw (#143) as the collet must be loose in its bore at this point. (See Figure 9-2.)

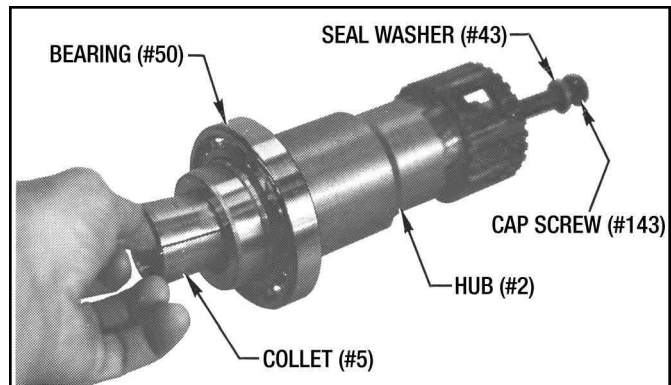


Figure 9.2 - Inserting Collet (#6) Into Hub Bore

6. Place Hub Assembly (#2) onto the motor shaft by passing it thru C-Face Adapter (#1) and tapping it thru Oil Seal (#62) with a rubber mallet. Torque Cap Screw (#143) to 75 Lb/Ft. (See Figure 9-3.) Be sure not to preload Bearing (#40).

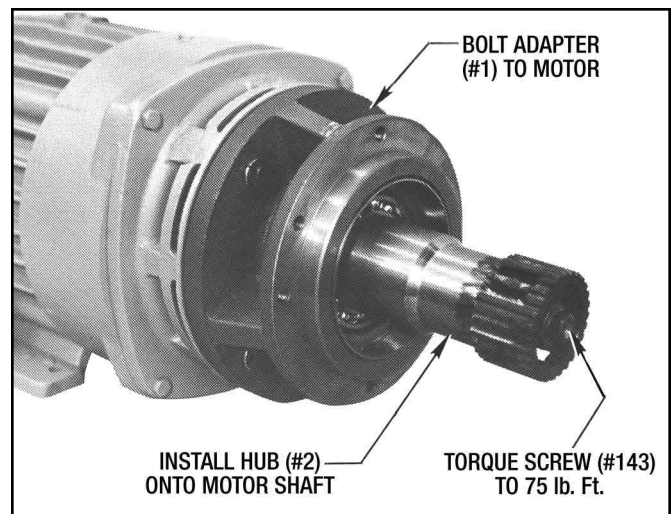


Figure 9.3 - Installing Input Subassembly On Motor

9-3 MAIN HOUSING SUBASSEMBLY

1. Press Bearing (#52), Worm Gear (#38), Key (#39), Spacer (#21) and Bearing Cone (#53) onto the Input Shaft (#20).
2. To determine Shim (#137) thickness, measure from **Surface 'A' to Surface 'B'**, (See Figure 9.4).

Subtract the dimension from 2.144". The result is the required Shim thickness.

If the dimension from 'A' to 'B' is found to be **2.135"** then $2.144" - 2.135" = .009"$ (Shim thickness required).

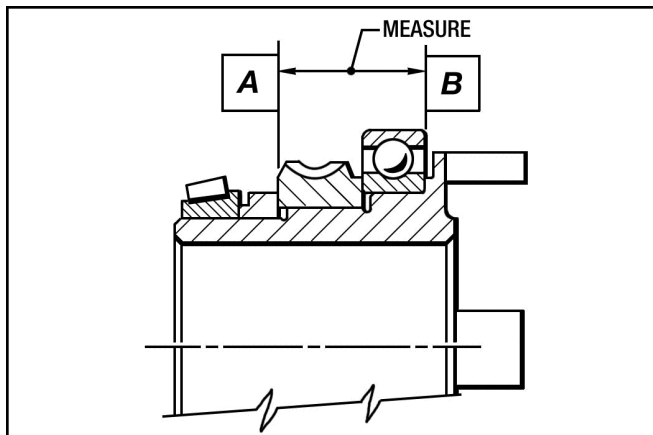


Figure 9.4 - Measuring For Shim Thickness

3. Add Shim(s) into the bore of the main housing. Bearing end play is .002" to .004".
4. Install the assembled Input Shaft into the main housing.

9-4 WORM SHAFT REPLACEMENT

(Belt Drive Only)

1. Press (1) Bearing Cone (#55) onto the brake side of the Worm Shaft (#37) and slide the Worm Shaft (#37) into the main housing bore. (See Figure 9.5.)

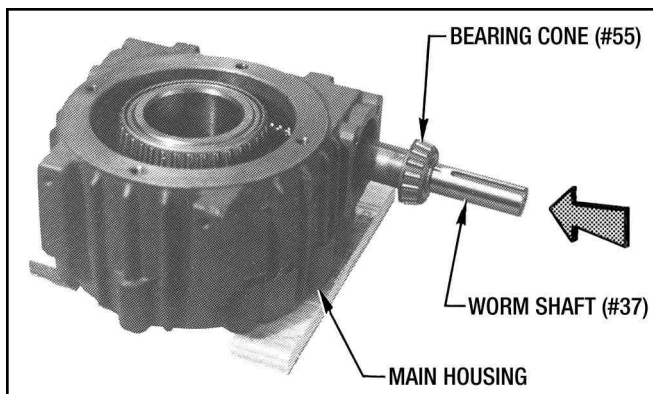


Figure 9.5 - Inserting Worm Shaft Into Main Housing

2. Press the other Bearing Cone (#55) onto the drive side of the worm shaft with an arbor press. (See Figure 9.6).

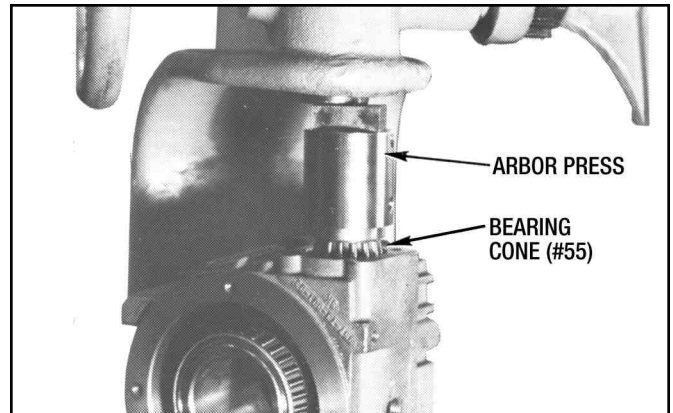


Figure 9.6 - Pressing Bearing Cone (#55) On To Worm Shaft

3. Press Bearing Cups (#56) into bearing bores of the main housing.
4. Place Spacer (#23) into the brake side bearing bore of the main housing and slide the Spacer (#26) on to the Worm Shaft. (See Figure 9.7)

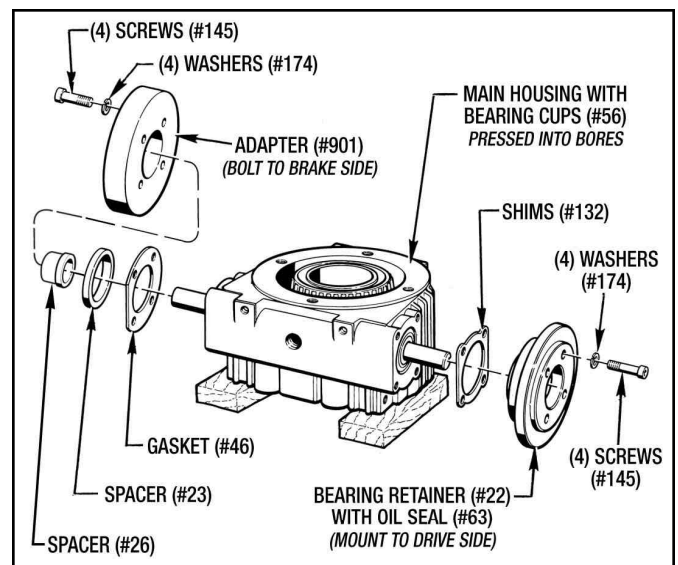


Figure 9.7 - Worm Shaft Assembly

5. Install Gasket (#46) and bolt Adapter (#901) to the brake side of main housing with (4) Washers (#174) and (4) Screws (#145). (See Figure 9.7)
6. Press Oil Seal (#63) into Bearing Retainer (#22). Place Shims (#132) over the pilot of the bearing retainer and bolt the Bearing Retainer (#22) to the drive side of the main housing with (4) Washers (#174) and (4) Screws (#145). If the worm shaft has an external keyway, place masking tape over the keyway to prevent damage to the Oil Seal (#63) during installation of the Bearing Retainer (#22). (See Figure 9.7)

7. Check the worm shaft after installation for end play. This can be done by setting a Dial Indicator on the end of the worm shaft and manually pushing the shaft in and out while rotating it. The End-Play should be between .002"-.004". Add or subtract Shims (#132) as needed. (See Figure 9.8)

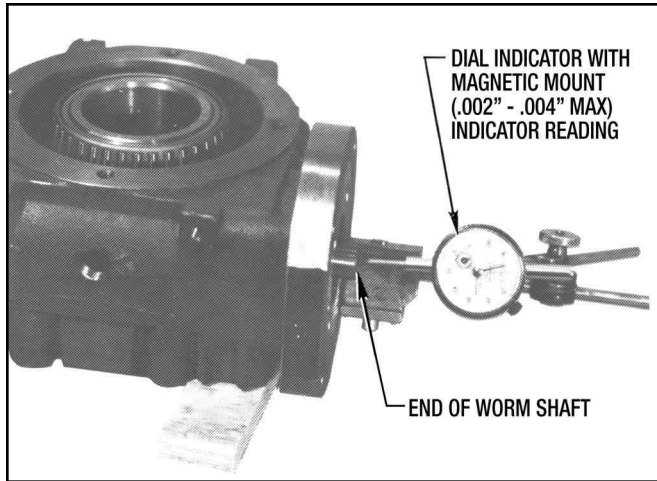


Figure 9.8 - Checking Worm Shaft End Play

(C-Face Drive Only)

1. Press Bearing (#57) onto Worm Shaft (#37).
2. Insert Worm Shaft and Bearing into Main Housing.
3. Install Gasket (#46) onto the brake side of Main Housing. Bolt Adapter (#901) to Main Housing with (4) Washers (#174) and (4) Screws (#145).
4. Insert Collet (#306), Screw (#351) along with the Seal Washer (#334) into the Hub (#302). Place Hub Subassembly onto the Worm Shaft and tighten Screw (#351) to a snug fit. (See Figure 9.9)

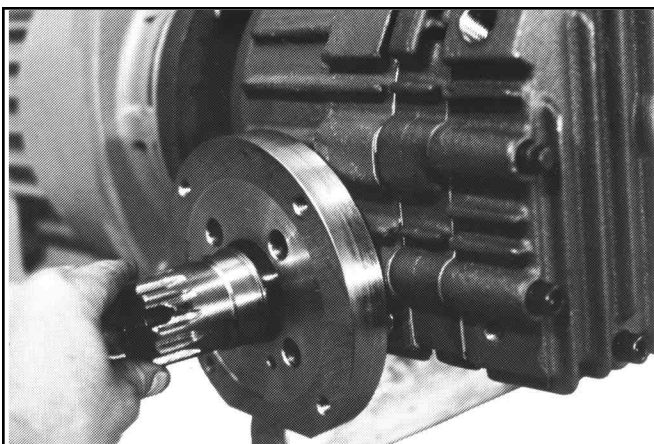


Figure 9.9 - Installing Hub (#302) Onto Worm Shaft

NOTE

Do not torque screw (#351) to the required 25 Lb./Ft. at this time.

5. Press Oil Seal (#64) into the C-Face Adapter (#5). Replace Gasket (#46). Slide the C-Face Adapter over the Worm Shaft, being careful not to damage the Oil Seal Lip. Bolt to the Main Housing with (4) Washers (#174) and (4) Screws (#145).

9-5 MOUNTING MAIN HOUSING TO MAIN MOTOR C-FACE ADAPTER

1. Bolt the C-Face Adapter to the Main Housing using (4) Washers (#170) and (4) Screws (#141).
2. Snug bolts up evenly. Using feeler gages measure the gap between C-Face Adapter and Main Housing. Add .003" to the Feeler Gauge Dimension to get the required Shim Thickness. (See Figure 9.10)

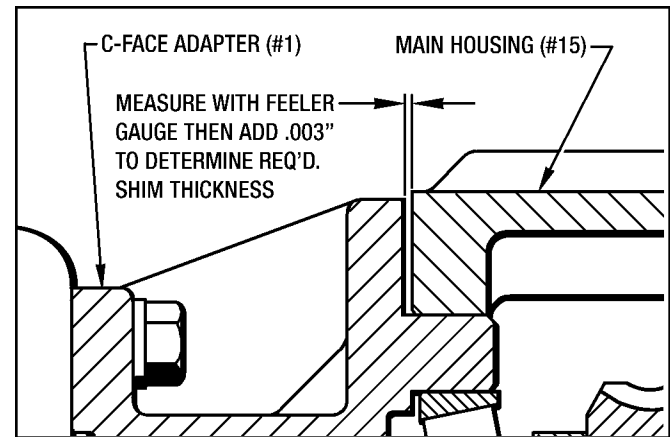


Figure 9.10 - Measuring For Shim Thickness

9-6 PISTON HOUSING ASSEMBLY

1. Press the Clutch Thrust Plate (#19) into Bearing (#51). Apply Loctite RC/680 to the outside diameter of Bearing (#51) and press the bearing and thrust plate into Piston (#18).

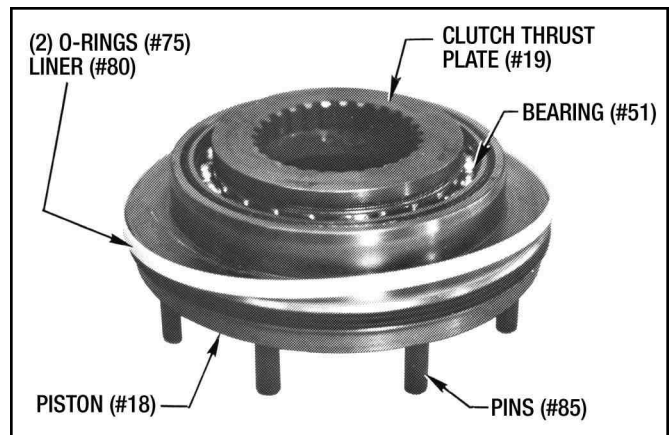


Figure 9.11 - Piston Subassembly

CAUTION

Do not support the Piston (#18) on Pins (#85) when pressing the bearing into it,

2. Replace O-Rings (#75) and Liner (#80) into the piston grooves. (See Figure 9.11.)

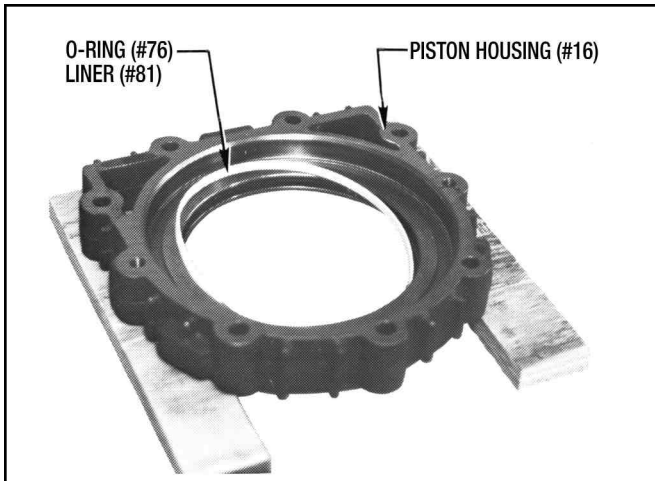


Figure 9.12 - Piston Housing

3. Install O-Ring (#76) and Liner (#81) into the Piston Housing (#16). (See Figure 9.12)
4. Push the Piston Subassembly into the Piston Housing.

CAUTION

Lubricate the liners with white Petrolatum (USP), or equivalent, before installation. Use care when installing mating parts not to cut or damage the Piston Liners, (See Figure 9.13.)

5. Place (8) Springs (#83) on the (8) Pins (#85). (See Figure 9.13)

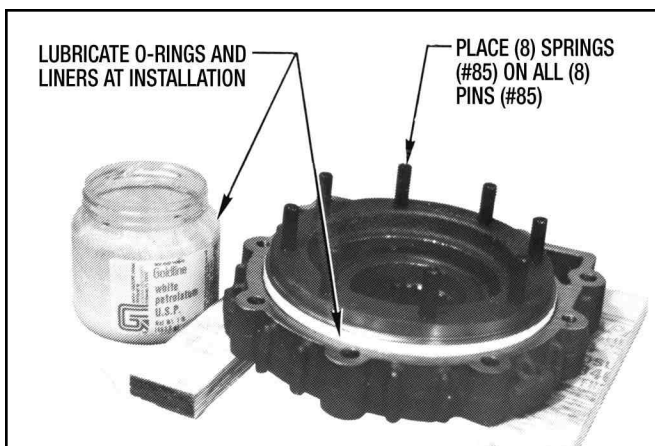


Figure 9.13 - Piston Housing Subassembly

6. Place Gasket (#45) between Piston Housing (#16) and Piston Retainer (#17). Bolt these two housings together using the two special Cap Screws (#180). (See Figure 9.14)

9-7 CLUTCH STACK

There will be (5) Drive Plates (#13) and (5) Friction Discs (#12) in the Clutch Stack. Install the Clutch Stack as described below. (See Figure 9.14)

1. Mate notches in the Drive Plates (#13) with the lugs of the Input Shaft (#20).
2. Mate the teeth of the Friction Discs (#12) with the spline on Hub (#2).
3. Alternate Drive Plates and Friction Discs, starting with a Drive Plate and ending with a Friction Disc.

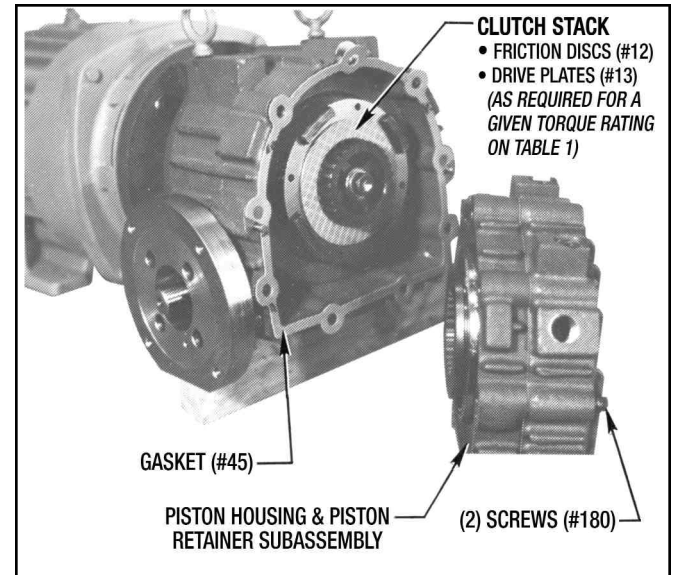


Figure 9.14 - Clutch Stack Assembly

9-8 BOLTING PISTON HOUSING ASSEMBLY TO MAIN HOUSING

1. Install Gasket (#45) to Main Housing.
2. Bolt the Piston Housing Assembly to the Main Housing, using (7) Washers (#174) and (7) Screws (#144). Make sure that the spline of Clutch Thrust Plate (#19) and the spline of Hub (#2) mate properly during assembly.

9-9 BRAKE HUB INSTALLATION

(Belt Drive Only)

1. Drop Collet (#306) into Hub (#302). Apply a coat of **Loctite Threadlocker #271** to Screw (#351) and thread it, along with Seal Washer (#334), into the Hub and Collet only one or two turns. **DO NOT TIGHTEN SCREW (#351) AT THIS TIME.**
2. Place the assembled Brake Hub on the Worm Shaft and torque screw (#351) to 25 Lb. Ft. (See Figure 9.15)

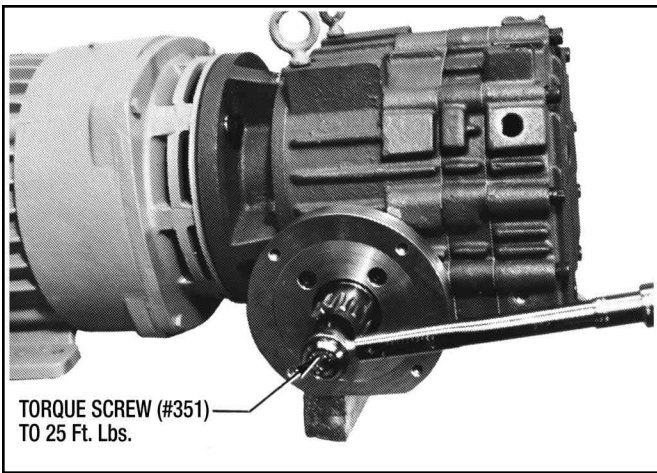


Figure 9.15 - Brake Hub Installation

(C-Face Drive Only)

1. Remove previously installed Screw (#351) from the Hub (#302) and apply **Loctite Thread Locker #271** to the screw threads. Reinstall Screw (#351) and Seal Washer (#334) back into Hub and torque to **25 Lb. Ft.** (See Figure 9.15)

9-10 BRAKE STACK AND END HOUSING SUBASSEMBLY

1. Using Friction Discs (#313) and Drive Plates (#312) build up the Brake Stack, noting the following: (See Figure 9.16)
 - a. Align the Drive Plates (#312) so that the dowel pins (#357) pass through the holes in the Drive Plates.
 - b. Center Friction Discs (#313) on the drive plates and align the teeth of the discs as you stack them together.
 - c. Alternate between drive plates and friction discs, beginning and ending with a drive plate.

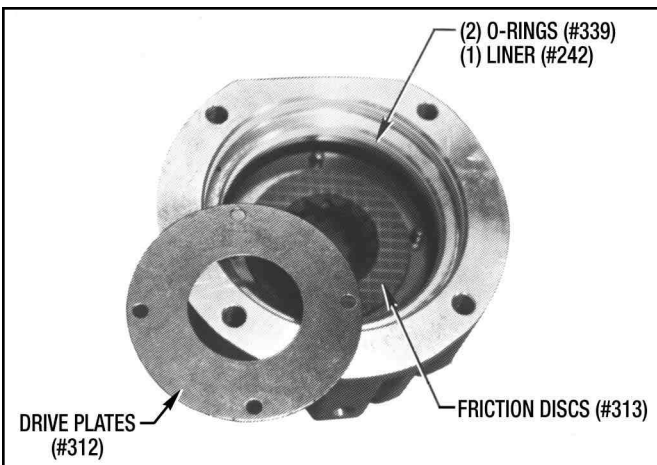


Figure 9.16 - End Housing Subassembly

2. Install O-Rings (#339, #340) and Liners (#342, #343) into End Housing (#309).
3. Push Piston (#303) into the bore of End Housing (#309). Be careful not to damage Liners (#342 and #343) during installation of the piston.
4. Install Springs (#336) into Piston (#303). (See Figure 9.17)

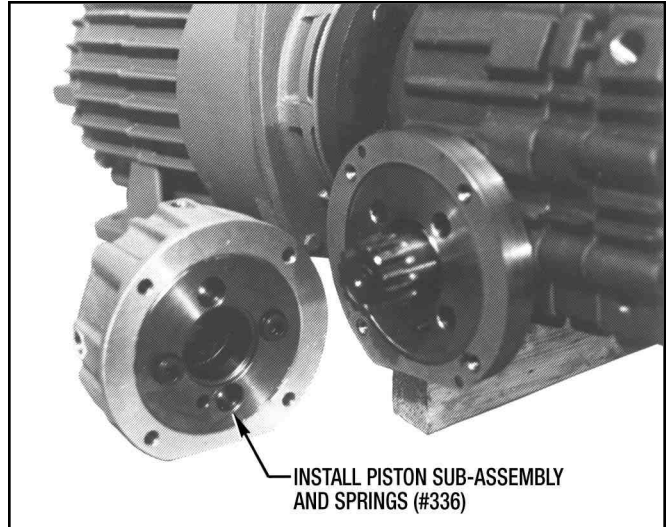


Figure 9.17 - Installing Brake Piston and Springs

5. Bolt End Housing (#309) to Adapter (#900) using (4) Washers (#327) and (4) Screws (#352). Make sure that the teeth of the Friction Discs (#313) properly engages the spline of Hub (#302).
6. Reinstall all pipe plugs, air breather and fittings removed at disassembly. (See Figure 9.18)

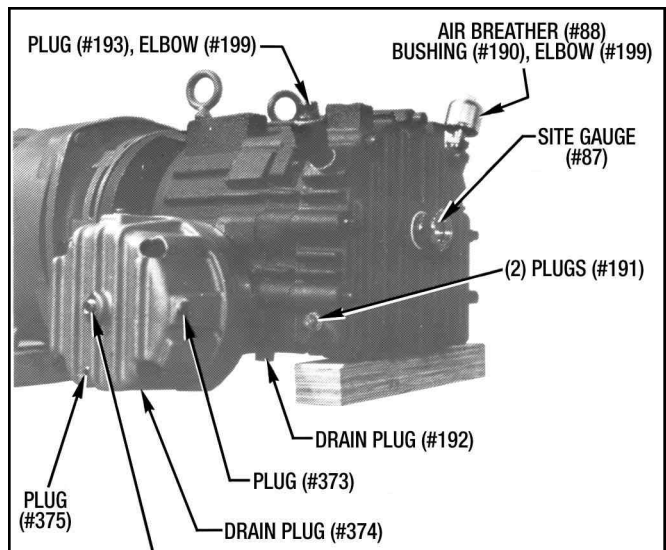


Figure 9.18 - Completing Reassembly Procedure

9-11 FEED MOTOR INSTALLATION

(C-Face Drive Only)

1. Slide Motor Shaft into end of Worm Shaft (#37) aligning key with internal keyway. Using (4) Washers (#172) and (4) Screws (#154), bolt Feed Motor to C-Face Adapter (#5) using (4) Washers (#172) and (4) Screws (#154).

(Belt Drive Only)

There are three basic mounting arrangements for belt driven units and they are:

- A. Top Mounting (See Figure 9.20)
- B. Bottom Mounting (See Figure 9.21)
- C. Rear Mounting (See Figure 9.22)

1. Attach (2) Mounting Channels (#125) to Drive Unit with (4) Washers (#172) and (4) Screws (#146) and also (4) Flat Washers (#163) placed between channels and Drive Unit.
2. Attach (2) Mounting Bases (#126) to Feed Motor with (4) Washers (#173) and (4) Screws (#153).
3. Set Feed Motor onto Mounting Channels (#125). Insert (2) Mounting Bars (#127) into Channels and attach Motor Bases with (4) Washers (#171) and (4) Screws (#152).

NOTE

Do not tighten (4) Screws (#152) at this time because the motor position has to be adjusted for proper Timing Belt Tension.

4. Attach lower section of Belt Guard (#105) to Bearing Retainer (#22) with (4) Machine Screws (#181).
5. General Installation Procedure for Timing Belt Pulleys and "Taper Lock" Bushings.

IMPORTANT

To insure satisfactory performance it is necessary that you follow all these instructions very carefully.

- a. Clean shaft, bore and O.D. of bushings and pulley bore of all oil and dirt.
- b. Insert bushing into pulley, matching set screw holes as shown in Figure 9.19.
- c. Slide the assembled bushing and pulley onto the shaft.
- d. Oil set screws and thread into holes A and C as shown in Figure 9.19.
- e. Alternately torque the (2) set screws to 55 Lb. Ft.

f. Using a block or sleeve and a rubber mallet, tap the large end of the bushing. **DO NOT TAP DIRECTLY ON THE BUSHING.**

g. Repeat steps "e" and "f" until torque wrench reading is the same before and after tapping on the bushing.

6. As per General Instructions in Step 5, install Pulley (#100) and Bushing (#102) on Worm Shaft(#37) 1/8" from Bearing Retainer (#22) as shown in Figure 9.19.

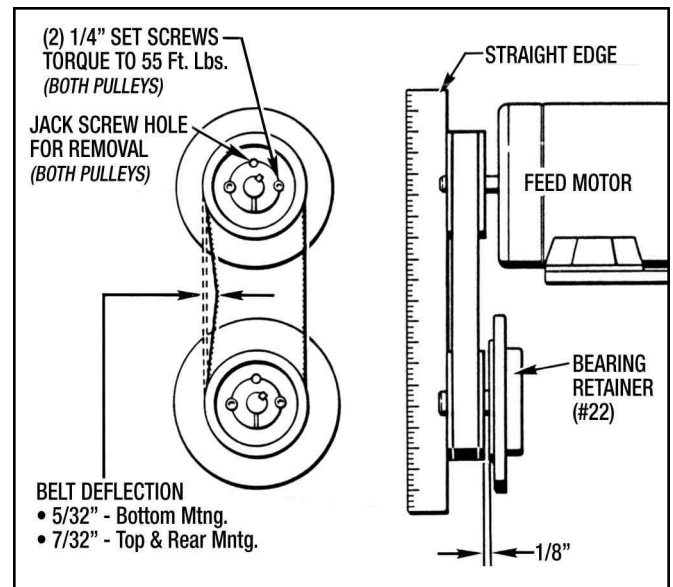


Figure 9.19 - Timing Belt & Pulley Installation

7. As per General Instructions in Step 5 install Pulley (#101) and Bushing (#103) onto the Feed Motor Shaft. Use a straight edge for alignment as shown in Figure 9-19.
8. Slip Timing Belt (#106) onto the pulleys and adjust the motor position for proper Belt Tension Deflection as shown in Figure 9-19. Tighten down Screws (#152).
9. Attach upper and outer sections of Belt Guard (#105).

9-12 FINAL REASSEMBLY PROCEDURE

After complete reassembly, fill the unit with the proper amount and type of fresh oil. **Refer to Section 4 - Lubrication.**

Before placing the drive back in service, check out its Operation as described in **Section 5 - Operational Checks.**

A BELT DRIVE (FEED MOTOR-TOP MOUNTING)

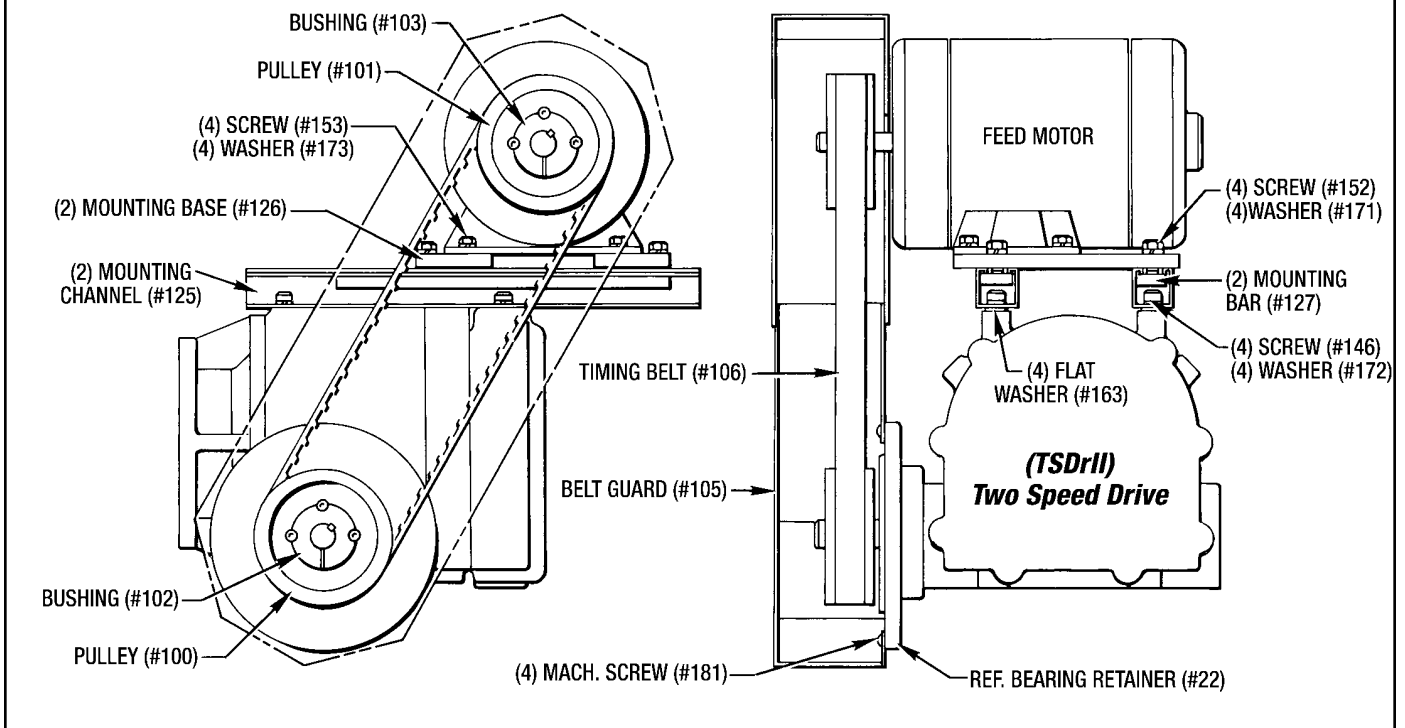


Figure 9.20 - Belt Drive (Top Mounted Feed Motor)

B BELT DRIVE (FEED MOTOR-BOTTOM MOUNTING)

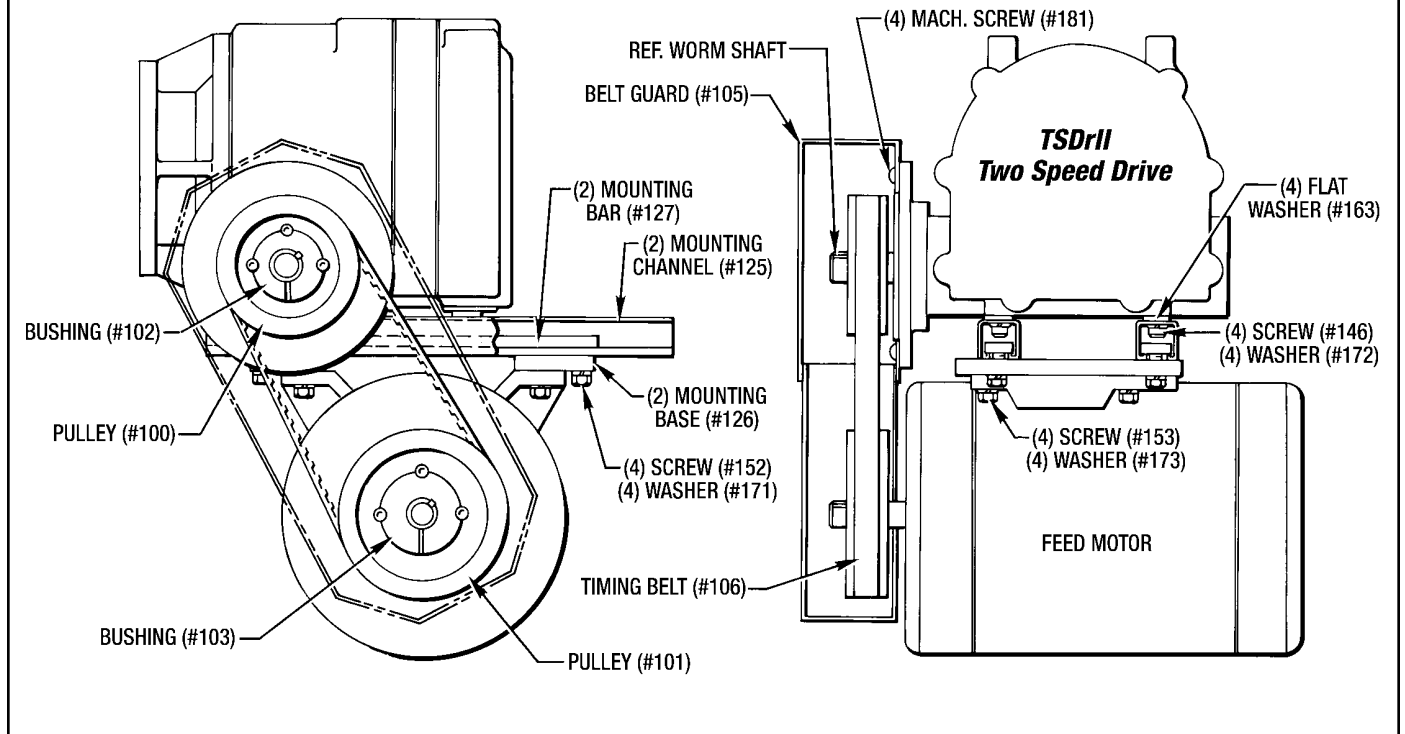


Figure 9.21 - Belt Drive (Bottom Mounted Feed Motor)

C BELT DRIVE (FEED MOTOR-REAR MOUNTING)

(TSDr11) Two Speed Drive

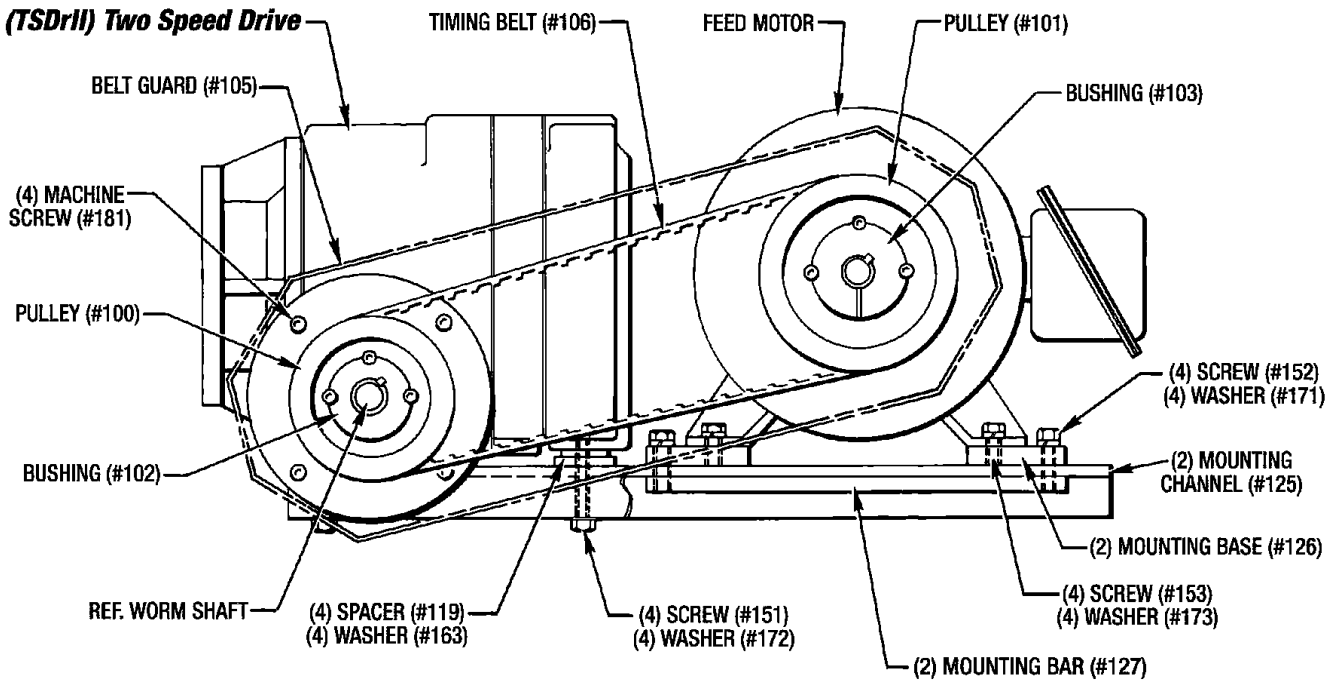


Figure 9.22 - Belt Drive (Rear Mounted Feed Motor)

NOTES

Section 10

ORDERING REPAIR PARTS

10-1 GENERAL INFORMATION

This section illustrates, lists and describes available repair parts for the Force Control (TSDrII) Two Speed Drive. Exploded views with numbers are used to identify the various parts of the (TSDrII) Two Speed Drive. These numbers are listed in the parts list along with the part name and quantity used.

10-2 FACTORY REBUILD SERVICE

Reconditioning service of TSDrII Drives is offered by Force Control Industries at the factory. Unless major parts (such as housings, shafts, piston, etc.) are damaged, the cost of a complete factory rebuild will be 50% of the cost of a new unit. Before returning a unit for this service, however, be sure to first contact the Force Control Industries Service Sales Department for authorization and shipping instructions. Force Control Industries cannot be responsible for units returned to the factory without prior notice and authorization.

Care must be given to the packaging of returned drives. Always protect mounting feet by attaching to a skid. Shipment-damage drives always delay repairs. It is usually impossible to recover damage costs from the carrier. When possible, describe the problem experienced on your shipping papers.

Return to:

Force Control Industries, Inc.
3660 Dixie Highway
Fairfield, Ohio 45014

Telephone: 513-868-0900

Fax: 513-868-2105

E-Mail: info@forcecontrol.com



10-3 DRIVE MOTORS

The motors used with Force Control's Two Speed Drives are standard and may be repaired by any qualified motor rebuild facility.

10-4 ORDERING REPLACEMENT PARTS

When ordering replacement parts, please specify all of the following information:

1. Drive Model Number (on the nameplate).
2. Drive Serial Number (on the nameplate).
3. Part Reference Number or Letter.
4. Part Name (from the parts list).
5. Quantity.
6. Complete Shipping Information.

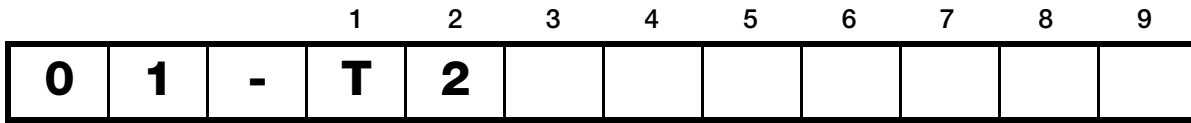
Failure to include information for items 1 thru 5 will only delay your parts order. Unless another method is specified for item 6, parts less than 70 pounds will be shipped United Parcel Service. Parts over 70 pounds will be shipped motor freight. Air freight and other transportation services are available, but only if specified on your order.

10-5 NAME PLATE INFORMATION

(See Pages 26 & 27 for Model Number Information)

	Force Control Two Speed Drive
MODEL NO.	<input style="width: 100%;" type="text"/>
SERIAL NO.	<input style="width: 100%;" type="text"/>
FORCE CONTROL INDUSTRIES, INC.	
<small>FAIRFIELD, OHIO 45014</small>	
<small>SEE INSTRUCTION MANUAL FOR OIL SPECIFICATIONS</small>	

10-6 MODEL NUMBERS



Two Speed Drive II (1, 2)

Feed Speed (3, 4, 5)

Revision (9)
By Force Control

Feed Motor (8)

- 5** = Foot Mounted, 5/8" Shaft
- 6** = C-Face, 5/8" Shaft
- 7** = Foot Mounted, 7/8" Shaft
- 8** = C-Face, 7/8" Shaft

Assembly Configuration (7)
(See Below & Next Page)

Main Motor C-Face Mtng.(6)

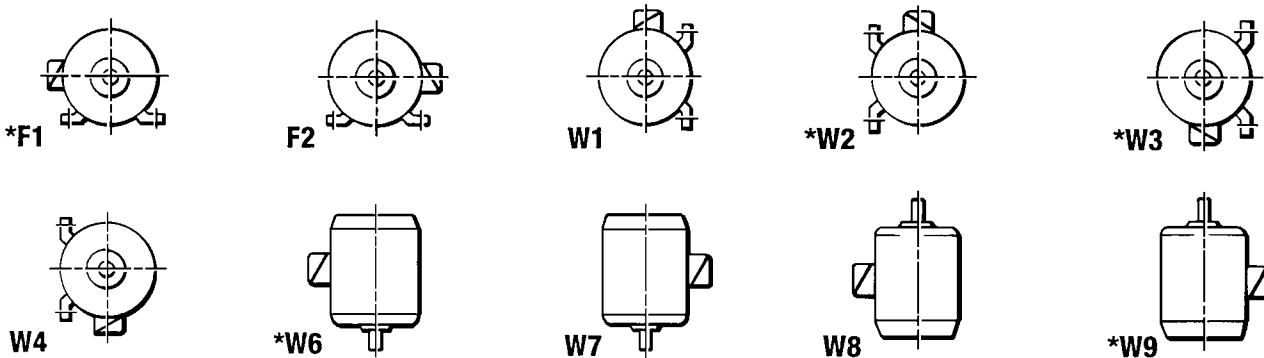
AVAILABLE FEED SPEEDS (RPM)							
Foot Mounted Feed Motor							C-Face Mntd. Feed Motor
*013	029	049	073	099	133	†182	029
*014	030	050	074	100	134	†185	036
*015	031	051	075	101	135	†190	044
*016	032	053	076	102	136	†194	058
*017	033	054	077	106	146	†198	073
*018	034	055	080	107	†156	†204	087
019	036	058	081	108	†157	†209	117
020	037	059	082	109	†159	†211	146
021	038	061	087	117	†160	†219	
022	040	062	088	119	†166		
023	041	063	090	122	†168		
024	044	064	092	124	†171		
025	045	066	093	125	†172		
026	046	067	095	127	†175		
027	047	068	097	128	†179		

	SHAFT DIA. (FU)	TENON DIA. (FAH)
A	7/8"	4-1/2"
B	7/8"	8-1/2"
C	1-1/8"	8-1/2"
D	1-3/8"	8-1/2"

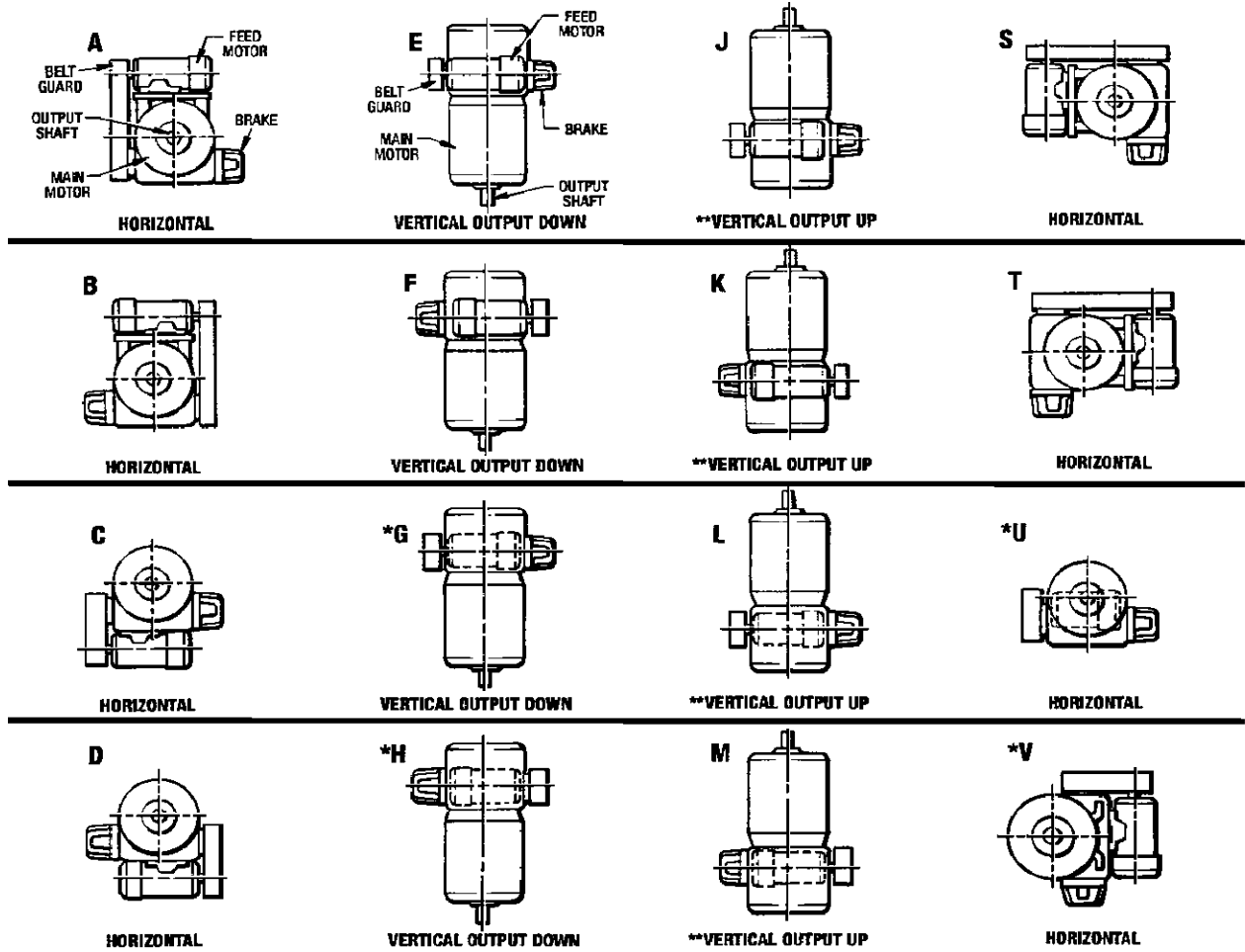
* Indicates 1200 RPM Feed Motor † Indicates Feed Motor must be rated above required torque rating.

Assembly Configuration Options (7)

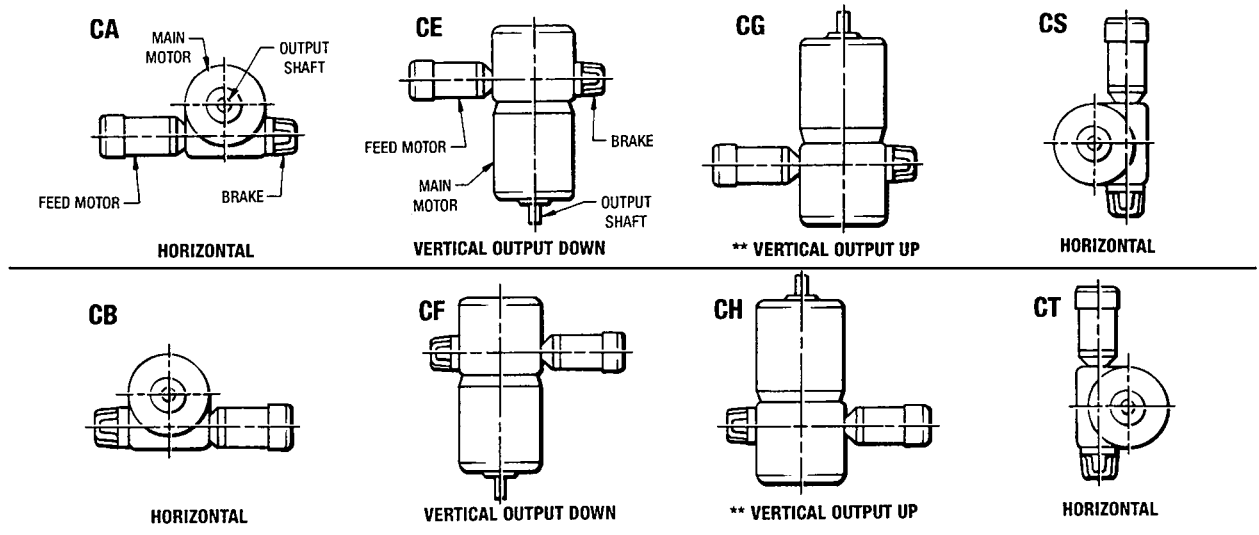
A. Main Motor Mounting



B. Foot Mounted Feed Motor Mounting



C. C-Face Feed Motor Mounting



Parts List - Figure 10.1

REF. No.	PART NAME	QTY.	REF. No.	PART NAME	QTY.
1	C-Face Adapter	1	143	Hex Hd. Screw, 3/8"-16 x 5" Lg	1
2	Hub	1	144	Soc. Hd. Screw, 3/8"-16 x 4-1/2" Lg	7
5	Motor Mounting Flange	1	145	Soc. Hd. Screw, 3/8"-16 x 1-1/2" Lg	4
6	Collet	1	150	Soc. Hd. Screw, #10-24 x 1-1/4" Lg	2
*12	Friction Disc	5	154	Hex Hd. Screw, 3/8"-16 x 1" Lg	4
*13	Drive Plate	5	169	Lockwasher, Med. 1/2"	4
15	Main Housing	1	170	Lockwasher, Med. 3/8"	4
16	Piston Housing	1	172	Lockwasher, Hi Collar, 3/8"	4
17	Piston Retainer	1	174	Lockwasher, Hi Collar, 3/8"	13
18	Piston	1	177	Lockwasher, Hi Collar, #10"	2
**19	Thrust Plate, Clutch	1	180	Ferry Hd. Screw, 3/8"-16 x 3" Lg	2
20	Input Shaft	1	190	Reducer Bushing, 1/2" x 1/4" NPT	1
21	Spacer	1	191	Pipe Plug, Mag. Sq. Hd., 1/4" NPT	2
22	Bearing Retainer (Belt Drive Only)	1	192	Pipe Plug, Mag. Sq. Hd., 1/2" NPT	1
23	Bearing Spacer (Belt Drive Only)	1	193	Pipe Plug, Sq. Hd., 1/2" NPT	1
26	Spacer	1	197	Pipe Plug, C-Sunk, 1/4" NPT	3
27	Spacer	1	199	45° Street Elbow, 1/2" NPT	2
37	Worm Shaft	1	233	Oil, Mobil ATF-210 (Quart)	4 Qt.
38	Worm Gear	1	237	Warning Tag (Not shown)	1
39	Key, 3/16" Sq. x 3/4" Lg.	1	302	Hub (Collet)	1
*43	Copper Washer, 1/2"	1	303	Piston	1
*44	Shim	AR	306	Collet, 7/8" Shaft	1
*45	Gasket	1	309	End Housing	1
*46	Gasket	AR	*312	Drive Plate	4
*50	Bearing	1	*313	Friction Disc	3
*51	Ball Bearing	1	*322	Gasket	1
*52	Ball Bearing	1	327	Lockwasher, Hi Collar, 3/8"	2
*53	Bearing Cone	1	328	Lockwasher, Hi Collar, 5/16"	2
*54	Bearing Cup	1	*336	Spring	2
*55	Bearing Cone (Belt Drive Only)	2	*339	O-Ring	2
*56	Bearing Cup (Belt Drive Only)	2	*340	O-Ring	2
*57	Bearing (C-Face Drive Only)	1	*342	Liner, Teflon	1
*62	Oil Seal	1	*343	Liner, Teflon	1
*63	Oil Seal (Belt Drive Only)	1	349	Pipe Plug, C-Sunk, 1/4" NPT	2
*64	Oil Seal (C-Face Drive Only)	1	351	Hex Hd. Screw, 3/8"-16 x 1" Lg	1
*67	Wear Sleeve	1	352	Soc. Hd. Screw, 3/8"-16 x 3-1/4" Lg	2
*75	O-Ring	2	353	Heli-Coil Insert	2
*76	O-Ring	1	355	Soc. Hd. Screw, 5/16"-18 x 1-1/2" Lg	2
*80	Liner, OD Sealing	1	356	Heli-Coil Insert	2
*81	Liner, ID Sealing	1	357	Dowel Pin, 1/4" Dia. x 1" Lg.	4
*83	Spring	8	373	Pipe Plug, C-Sunk, 3/8" NPT	1
85	Roll Pin, 3/8" x 1/2"	8	374	Pipe Plug, Mag. Sq. Hd., 1/8" NPT	1
**87	Sight Gauge	1	375	Pipe Plug, C-Sunk, 1/8" NPT	1
**88	Breather	1	*386	Wear Sleeve	1
132	Shim (Belt Drive Only)	AR	900	Adapter	1
141	Hex Hd. Screw, 3/8"-16 x 1-1/4" Lg	4	901	Adapter	1
142	Hex Hd. Screw, 1/2"-13 x 1-1/4" Lg	4	*902	Gasket	1

* - Indicates parts in Minor Overhaul Kit.

** - Indicates parts in Major Overhaul Kit. (This Major Overhaul Kit also includes all parts in the Minor Overhaul Kit.)

AR - As Required

Two Speed Drive II (TSDrII)

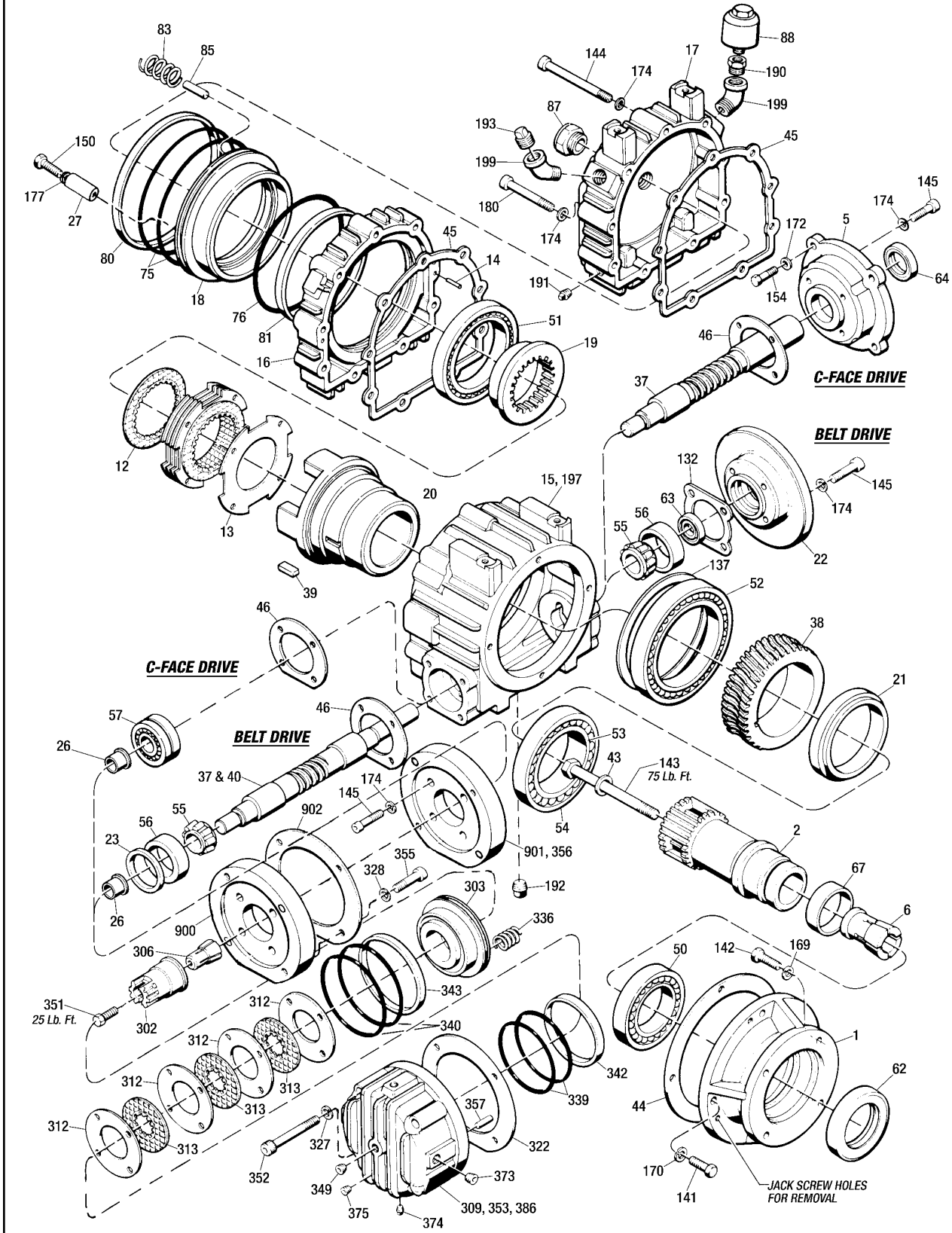


Figure 10.1 - Two Speed Drive II (TSDrII)

Manual Revision & Printing History

Two Speed Drive II (TSDrII)

REVISION NUMBER	REVISION DATE <i>(Mo./Yr.)</i>	PRINTING DATE <i>(Mo./Yr.)</i>	REVISION/ACTION DESCRIPTION	REVISION BY: <i>(Initial)</i>
502-T2-002	-----	4/91	Printed	-----
502-T2-003	2/97	-----	Changed both clutch and brake procedure to remove splined hubs from motor shaft.	-----
	-----	3/97	Printed	-----
502-T2-004	10/03	-----	Created complete digital file for web. Updated manual format. New cover and back. Added Warranty info. Added Performance Charts to Section 2 from APC. Added mounting procedure to existing Main Motor in Section 3. Expanded Model Number Info. and added Assembly Configurations from APC. Removed Detroit address.	JB

FORCE CONTROL INDUSTRIES, INC.

Worldwide Leader in Oil Shear Technology.

*Providing today's industries
with Oil Shear Clutch and
Brake Drives that delivers:
Flexibility • Efficiency
Endurance • Performance
Dependability*

“Built to Last - Guaranteed to Perform”



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