



LA-5300

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I. Description

The LA-5300 Series are bi-directional, electric linear actuators. They can be mounted on sliding stem valves or installed in other applications requiring a high-thrust linear actuator.

The LA-5300 Series can produce up to 12,000 pounds force at stroke lengths up to 5.25 inches.

The actuator may be used either for indoor or outdoor installations. The high strength aluminum alloy housing will withstand most adverse environmental conditions and can be mounted in any position. When used in outdoor applications or where actuator is subjected to wide ambient temperature variations or humid areas, the optional heater and thermostat must be ordered to prevent condensation in the limit switch/feedback compartment.

The actuator can be supplied with either a 230/460 Vac, a three phase motor (LA-5310), or a 90 Vdc motor (LA-5360).

Various position feedback types are available to match the actuator process requirements.

The actuator is supplied with both position limit switches and thrust limit switches. The position limit switches are independently adjustable to electrically limit the stroke of the unit. The thrust limit switches are factory set to electrically stop the actuator when the load on the output shaft exceeds the thrust rating of the unit.

The actuator may be operated in the electrical (AUTO) mode by applying motor power or in the handcrank (MANUAL) mode by depressing the push button on the side of the actuator near the handcrank --- WITHOUT MOTOR POWER BEING APPLIED.

The push button will cause an internal latch to engage and turning the handcrank will then cause the actuator to move. The valve and actuator are protected from overload damage when handcranking with a shear pin located in the handcrank handle. Upon application of motor power, the motor will cause the actuator to disengage from the handcrank and the motor will position the output shaft.

II. Mounting

The outline dimensions for a standard unit are shown on the installation print supplied with the actuator. The rear cover must have enough clearance so that it may be swing open for adjustments and interconnect wiring. Mounting may be in any position convenient to the driven load. When mounting the actuator to a valve or other device, be sure that the shafts are properly aligned and that the mounting does not create side loading to the output shaft or the valve shaft.

The actuator and its mount are not to be used as a step or mount/support for any other device.

III. Storage

If the actuator will not be installed immediately, it should be stored in a clean dry area where the ambient temperature is not less than -20° F. The actuator should not be stored in a corrosive environment.

IV. Description of Operation

Electric power is applied to the motor which is mounted on the power gear housing. A motor pinion gear and clutch release weight assembly are attached to the motor shaft. The pinion gear is engaged with a pair of gears thru friction discs and causes the entire clutch to rotate which in turn rotates the intermediate gear assembly (item 15). The intermediate gears in turn rotate the screw shaft assembly (item 15). The screw shaft is supported between two screw thrust housing assemblies (items 18 and 59) and under normal conditions only rotates and does not move axially against the thrust packs. A drive nut fixed in a carrier assembly rides along the screw shaft and thru its pivot bearings causing the arms of the pivot shaft assembly (item 11) to rotate a maximum of 90° with the pivot shaft. The pivot shaft assembly thru its link causes linear movement of the output shaft. The output shaft can move up to 2 5/8" each side of the center when the pivot shaft arms are straight up to the screw shaft. This mechanism is a scotch yoke device and has its lowest thrust value at the center of travel with an increase of thrust of approximately 1.67 time the center of travel thrust at the maximum ends of travel.

In the event of an output overload or valve seating, the pivot action stops and with the motor still running the screw shaft moves axially against the spring force in one of the screw thrust housings.

IV. Description of Operation cont.

The axial movement of the screw shaft is detected by linkage which trips on the thrust limit switches. This trip must be detected by the external motor control circuit and cause motor power to be shut off. As these actuators are built with either a 3 PH ac or 90 Vdc motor, the switches are not wired directly into the motor power wires. Proper interconnect wiring must be done to insure motor power is shut off when the appropriate switch is tripped.

The rotation of the pivot shaft assembly causes rotation of the position limit switch assembly thru a set of gears driven by the pivot shaft.

The actuator is equipped with a manual handcrank. To use this manual function, the motor power must be turned off. If the motor is controlled with an amplifier, such as the AD-7300, the power to the amplifier must be turned off or else handcranking will be detected as a position error and the amplifier will turn on the motor disengaging the handcrank.

Handcrank engagement is accomplished by depressing the button on the side of the gear housing near the handcrank. This causes a yoke mechanism to separate the friction discs in the clutch from the faces of the pair of gears driven from the motor pinion gear. Once the button is depressed, a latching lever holds the yoke in the handcrank mode. A slight rotation of the handcrank may be required to allow latching and engagement of the handcrank to occur. Output overloads are protected during handcranking with a shear pin located in the handcrank handle. The actuator will remain in the handcrank mode until motor power is restored at which time the spinning of the motor shaft will cause two centrifugal weights to hit the latch lever, unlatching the yoke and returning the clutch to the motor drive mode of operation.

External visual indication of thrust overload is detected by a shaft extending out of or retracting into the screw thrust housing on the handcrank end of the actuator. When there is no overload, the end of the shaft is flush with the end of the housing. In the event of an overload, the shaft will extend out of or retract into the housing, depending on the output shaft direction of travel at that time. If this occurs while handcranking, stop cranking in the direction of the overload and determine why this condition is occurring.

Continued cranking in the direction of the overload will cause the shear pin in the handcrank to break.

V. Mounting Actuator to Valve If Not Supplied

The actuator is supplied with all the necessary hardware to mount it to the valve. Prior to mounting the actuator to the valve, engage the actuator in the handcrank mode and turn the crank to retract the output shaft adaptor coupling to the stop collars closest to the actuator. The stop collars on either side of the coupling have been pre-set at the factory to the stroke specifications of your valve. Remove the split coupling from the actuator shaft. Mount the valve to the actuator valve plate with the appropriate user supplied valve hardware. Either by handcranking or by moving the valve stem, move the two shafts close together and install the valve stem lock nut, indicator plate, and split coupling. Tighten the coupling bolts to 30-35 ft. lbs. Handcrank the actuator with the valve attached to the valve full closed position. If the valve does not reach its full closed or seated position prior to the coupling, hit the stop collars furthest from the actuator. The stop collars will have to be repositioned, allowing the valve to reach its full closed or seated position.

Crank the actuator to the valve full open position and adjust the stop collars closest so they the actuator to just touch the coupling. The use of the stop collars is dependent upon the application. You may or may not wish to have the actuator stop against the collars before fully seating the valve. Adjust the stop collars furthest from the actuator to seat against the coupling for position limited valve set-ups. Allow for a 1/32" gap equally between the coupling and both stop collars furthest from the actuator for torque seats valve applications. After the actuator and valve are mechanically aligned to each other, position the indicator plate on the side of the mounting shafts to indicate the open-closed positions of the valve in relation to the indicator plate on the valve side of the coupling which is held against the coupling with a nut on the valve stem.

Position limit switch adjustments and feedback signal adjustments must now be made prior to motor power being applied.

VI. Limit Switch Adjustment

The key lock limit switch assembly may be supplied with up to four switches. The outer most switch on the assembly is always position limit switch #1. Refer to the LIMIT SWITCH ASSEMBLY page for parts.

1. Manually crank the actuator to the valve full open position. At the full open position, switch #1 should have activated with the lever just dropping off of the 100% end of the cam. Cam shaft key (3) should be keyed in switch cam #1 at the 0 (zero) position. If it is not keyed at zero, pull the key out of the assembly, rotate cam #1 to line up the 0 mark with the key slot on the cam shaft, and re-insert the key. Switch plate key (item 5) should be inserted in switch plate #1 at the 0 (zero) position. If it is not, remove the key by turning it counter clockwise until it is screwed out of the switch holders. Re-insert it in the zero position of switch plate #1, and screw it back into its threaded hole.
2. Loosen two 1/4-20 set screws (item 1) in the cam shaft. Rotate the cam shaft assembly clockwise until switch #1 just activates with the lever dropping off of the 100% end of the cam. Tighten the set screws.

Note: *Ignore steps 3, 4, and 5 if closed position limit switch is not present or bypassed.*

3. Handcrank the actuator to the valve full closed position.
4. Limit switch #2 should have activated at the closed position with the cam just tripping limit switch #2 activating lever. If switch #2 has not tripped, remove key 3 from the cam shaft and rotate cam #2 counter clockwise until the switch lever rides up the cam at the 0 end and trips the switch. Re-insert key 3.
5. Handcrank the actuator toward the valve open position enough to reset switch #2. After the switch resets, crank the actuator to close the valve until switch #2 activates. If the switch activates too soon, remove key 5 and re-insert it into switch holder #2 at a higher number. Limit switches 3 and 4, if supplied, may be set for any position between the settings of switches 1 and 2.

VII. Feedback Potentiometer Alignment

If the actuator is equipped with a 1000 ohm pot, it may be necessary to re-align the pot in relation to valve stroke. The potentiometer will be wired to terminals 20, 21, and 22. When the actuator shaft retracts (valve opens), the resistance across terminals 21 and 20 will decrease. When the actuator shaft extends (valve closes), the resistance across terminals 21 and 20 increases and the resistance across terminals 21 to 22 decreases. The pot must be adjusted with the valve at either the full open or full closed position. Depending on how the feedback signal is used determines which end of travel is going to be considered as the zero end. If the actuator is being controlled with an amplifier, an increasing signal to the amplifier usually is used to open the valve. If this is the case, the valve closed position is referred to as the zero point and the potentiometer should be adjusted for about 50 ohms across terminals 21 to 22 with the valve closed. To do so, crank the actuator to the valve closed position, measure the resistance across terminals 21 to 22, loosen the three pan head screws holding the pot mounting disc in place, and rotate the body of the pot with the disc until the proper resistance is obtained. Tighten the three screws. Crank the actuator to the valve full open position while monitoring the resistance across terminals 21 to 22, and the resistance should increase steadily without interruption.

VIII. Thrust Limit Switches

The actuator is supplied with thrust limit switches for the valve open and valve closed directions for travel. Upon exceeding the output thrust rating, one or the other thrust limit switch will trip depending on the direction of travel. The switches are factory set and field adjustment is not necessary. Activation of a thrust limit switch can be visually observed by looking at the end of the screw thrust housing nearest the handcrank. In the center of the housing is an indicator rod. If the indicator has retracted into the housing, the actuator is seeing a thrust limit condition in the valve open direction.

IX. Electrical Connections

The limit switch and feedback area of the actuator depend on the cover to maintain cleanliness and operational function. The cover should only be opened when actual work is being performed in this area and closed immediately after with all screws being put back in.

A wiring diagram is supplied with the actuator and shows the interconnect wiring connections for the unit supplied. The drawing may show the arrangement with torque limit switches, position limit switches, feedback signal device, and heater. To meet special requirements, certain items shown may not be supplied and in that case, the terminals will be blank. In all instances, the wiring diagram appropriate to the actuator will be supplied with it. Barrier type terminal strips are located in the switch/feedback area and conduit entries are located on the ends of the actuator for connection. Any unused conduit entries must be plugged to keep the actuator's insides clean.

X. Maintenance

Under normal service conditions the motor, gearing, bearing, and parts are all pre-lubricated and should not require periodic maintenance. If for any reason the actuator is disassembled in the field, all bushings should be saturated with a SAE 20 non-detergent oil and all gearing should be cleaned and coated with AMOCO Rykon Premium Grease #2 or equal. The screw shaft must be clean and lubricated with Allex EP-1L Grease.

A. Motor Replacement

1. Remove all power from the actuator.
2. Remove the load from the actuator output shaft.
3. Remove all of the bolts holding the power gear housing.
4. Remove the power gear housing cover. This cover is located next to the gear housing with two dowel pins.
5. Disconnect the wires and conduit at the motor.
6. Remove the 4 bolts holding the motor to the power gear housing from inside the gear housing.
7. Install new motor with motor pinion and clutch cam assembly already on it using a new motor to gear the housing gasket.

8. Clean and grease gearing. Install new gear housing cover gasket. Install cover and bolts.
9. Install motor wires and conduit connections.

B. Limit Switch Replacement

1. Remove all power from actuator.
2. Open feedback cover to gain access to switches.
3. Remove 2 screws mounting the switch. Install new switch. Transfer wires from old switch to new. Close cover and install all cover screws.

C. Feedback Potentiometer Replacement

The feedback potentiometer is located on the feedback mounting plate near the position limit switch assembly.

1. Remove 3 pan head screws holding the pot mounting disc in place.
2. Remove the pot and disc from the actuator.
3. Measure the location of the gear which is attached to the pot shaft.
4. Loosen the two set screws in the gear hub and remove the gear from the shaft.
5. Remove the retaining nut holding the pot to the disc and remove the pot from the disc.
6. Carefully cut the shaft of the new pot to the same length as the original and remove any burrs.
7. Mount the pot on the mounting disc and relocate the gear to the same position that was measured in step 3. Tighten the set screws in the gear hub.
8. Mount the pot and disc in the actuator making sure the gear is properly engaged with the gear that drives it.
9. Transfer the wires from the old pot to the new pot one at a time to be sure it is wired properly.
10. Align the potentiometer following the feedback potentiometer alignment instruction.

D. Gearing Replacement

1. Disconnect all power from the actuator.
2. Disconnect the load from the output shaft.
3. Remove all of the cover screws from the power gear housing cover and remove the cover.
4. The clutch gear assembly and the intermediate gear assembly can now be removed and replaced.
5. The screw shaft gear is pinned to the screw shaft and should be replaced as an assembly if needed.
6. To replace the screw shaft assembly, perform the following:
 1. Remove the 4 bolts holding the screw thrust housing on the end of the actuator opposite the power gear housing.
 2. Remove the bearing adaptor on the end of the screw shaft.
 3. From the gear case end of the actuator with the intermediate gear assembly and drag brake removed, turn the screw gear counter clockwise to unscrew it from the drive nut in the pivot shaft assembly. It is sometimes easier if the front cover is also removed because it may be necessary for putting it back together.
 4. Reverse the procedure to install a new screw shaft and lubricate the screw with Alex EP-1L Grease when installed.

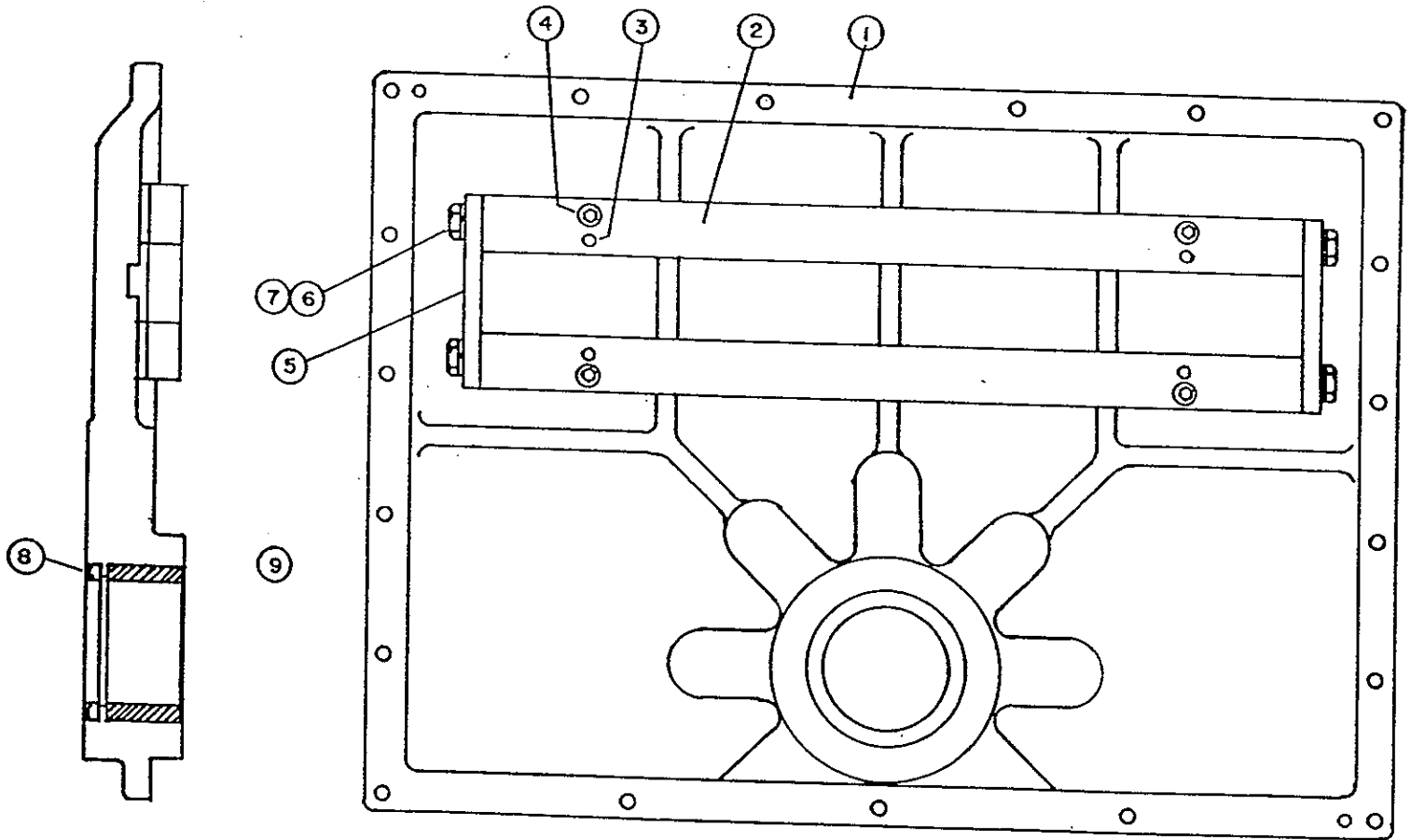
5. Shim washers may have to be added or removed to properly space the screw within the actuator. This will eliminate any end play or prevent pre-loading of the springs in the thrust housings.

E. Screw Nut Replacement

1. Follow all of the steps for gearing replacement and screw shaft replacement.
2. The front cover must be removed.
3. With the screw removed from the drive nut, lift the nut carrier out of the pivot arm assembly.
4. Remove one of the retaining rings holding the nut in the carrier.
5. Pull or press the drive nut out of the carrier.
6. Push the new nut into the carrier against the retaining ring left in the carrier. The nut must also be aligned with the keyway so the key can be reinstalled.
7. Place a nut spacer on the end of the nut and install the retaining ring.
8. Install the nut carrier assembly between the pivot arms and the pivot bearing into the rear rails.
9. Install the screw shaft and lubricate with Alex EP-1L Grease.
10. The remainder of the actuator may now be put back together, lubricating all gearing and replacing all gaskets.

Front Cover Assembly

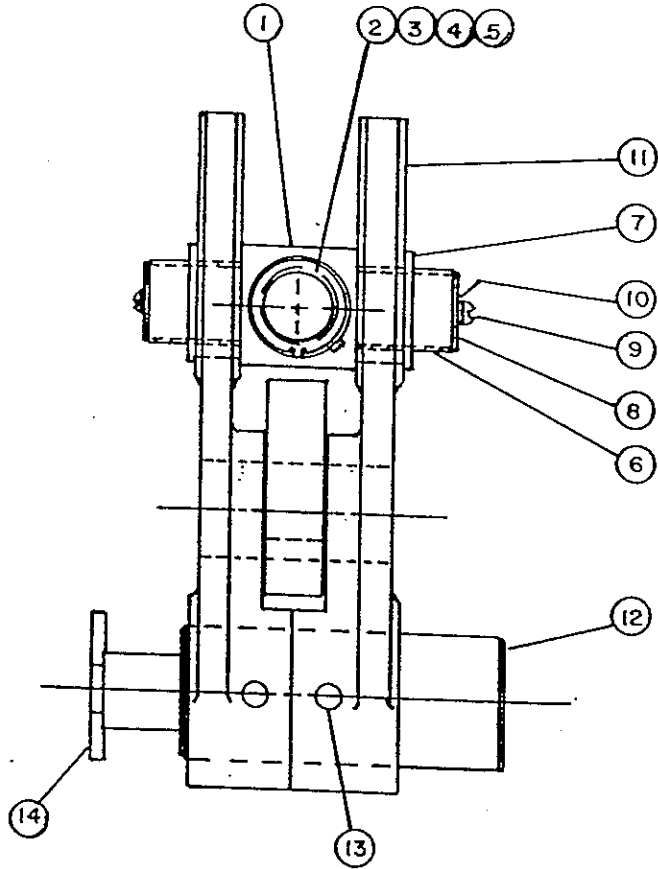
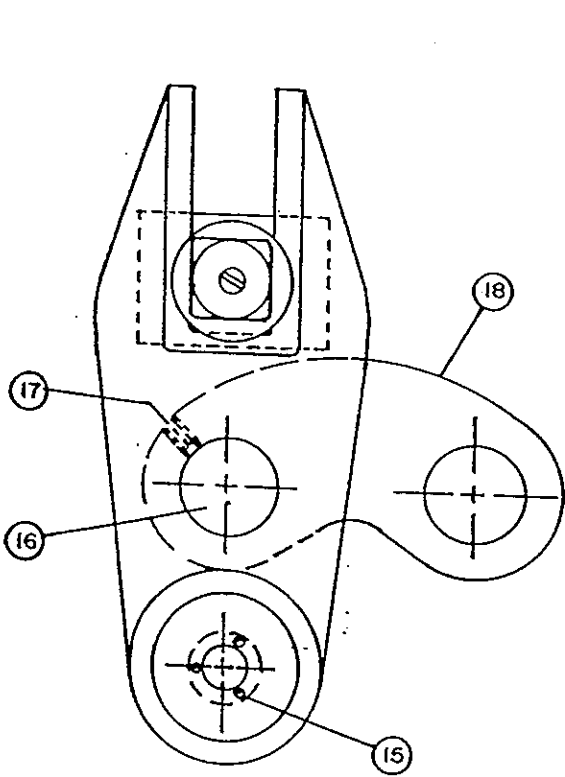
<u>ITEM</u>	<u>DESCRIPTION</u>
1	Front Cover
2	Support Rail
3	Dowel Pin
4	Soc. Hd Screw 3/8 -16 x .88
5	End Block
6	Hex Hd Screw 3/8-16 x 1.0
7	Lockwasher 3/8
8	Lip Seal
9	Bearing



Pivot Shaft Assembly

ITEM	DESCRIPTION
1	Nut Carrier
2	Retaining Ring
3	Drive Nut
4	Key .250 Sq. x 3.00 lg
Nut Spacer	
6	Bearing
7	Spacer
8	Bearing Retainer
9	Rd. Hd Screw 1/4-20 x .50

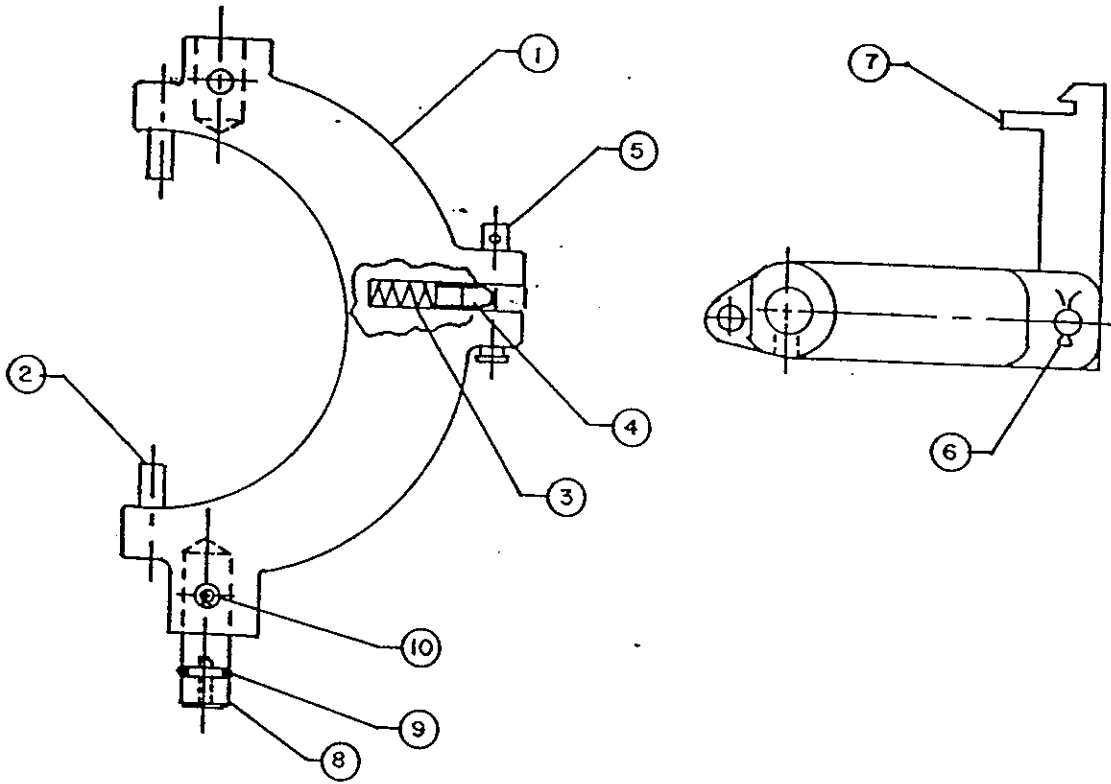
ITEM	DESCRIPTION
10	Lockwasher 1/4"
11	Pivot Arm
12	Pivot Shaft
13	Dowel Pin .500 dia x 2.0 lg
14	Feedback Gear
15	Ft. Hd Screw 6-32 x .50 lg
16	Pin 4.25 lg
17	Setscrew 3/8-16 x .50 lg
18	Link



Clutch Yoke Assembly

ITEM	DESCRIPTION
1	Clutch Yoke
2	Dowel Pin .250 dia x 1.0 lg
3	Spring
4	Latch Pin
5	Clevis Pin

ITEM	DESCRIPTION
6	Cotter Pin 3/32 dia x .50 lg
7	Latch
8	Yoke Shaft
9	O-Ring
10	Roll Pin 1/4 dia x 1.0 lg

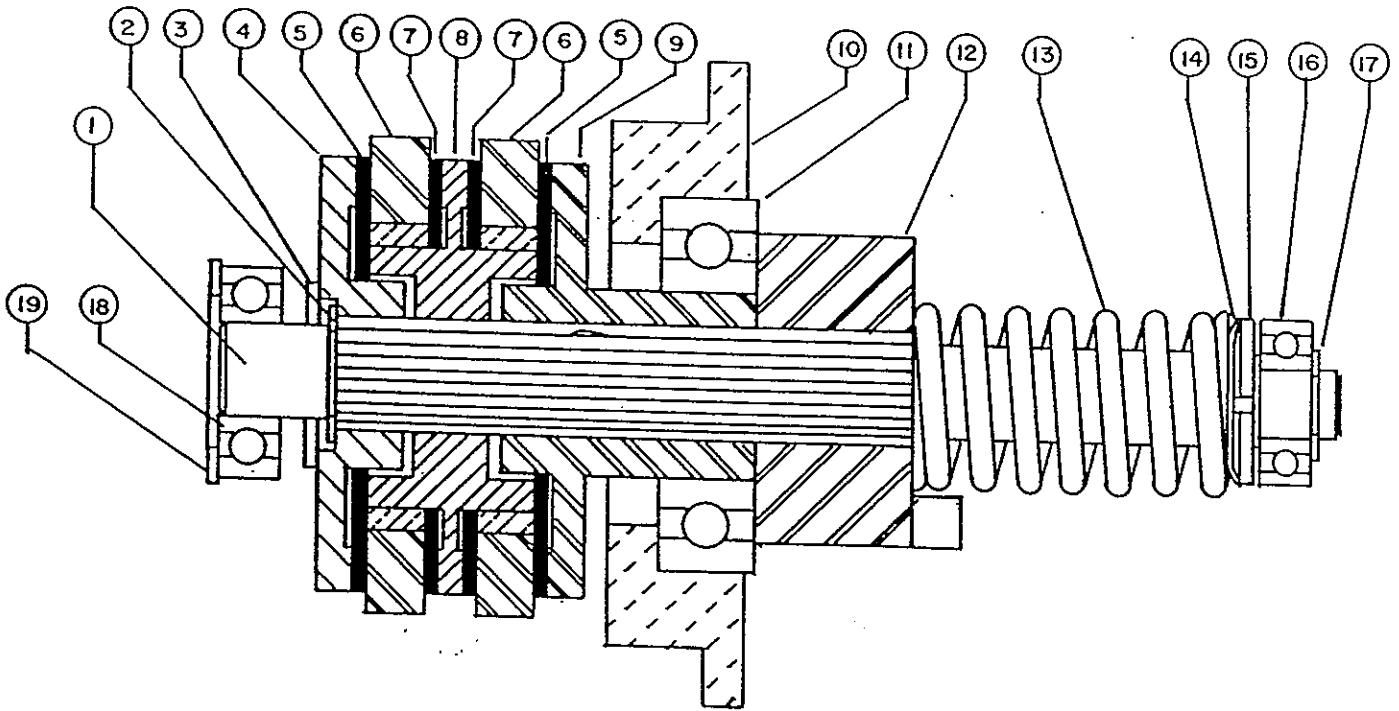


Clutch Assembly

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>ITEM</u>	<u>DESCRIPTION</u>
1	Clutch Shaft	10	Throwout Slider
2	Retaining Ring	11	Bearing
3	Thrust Washer	12	Clutch Pinion Gear
4	Clutch Disc	13	Spring
5	Friction Disc	14	Lockwasher
6	Gear 62T-20P (47 sec)	15	Locknut
7	Gear 49T-20P (23 sec)	16	Bearing
8	Gear Idler Drum	17	Retaining Ring
9	Clutch Drum	18	Bearing
		19	Retaining Ring

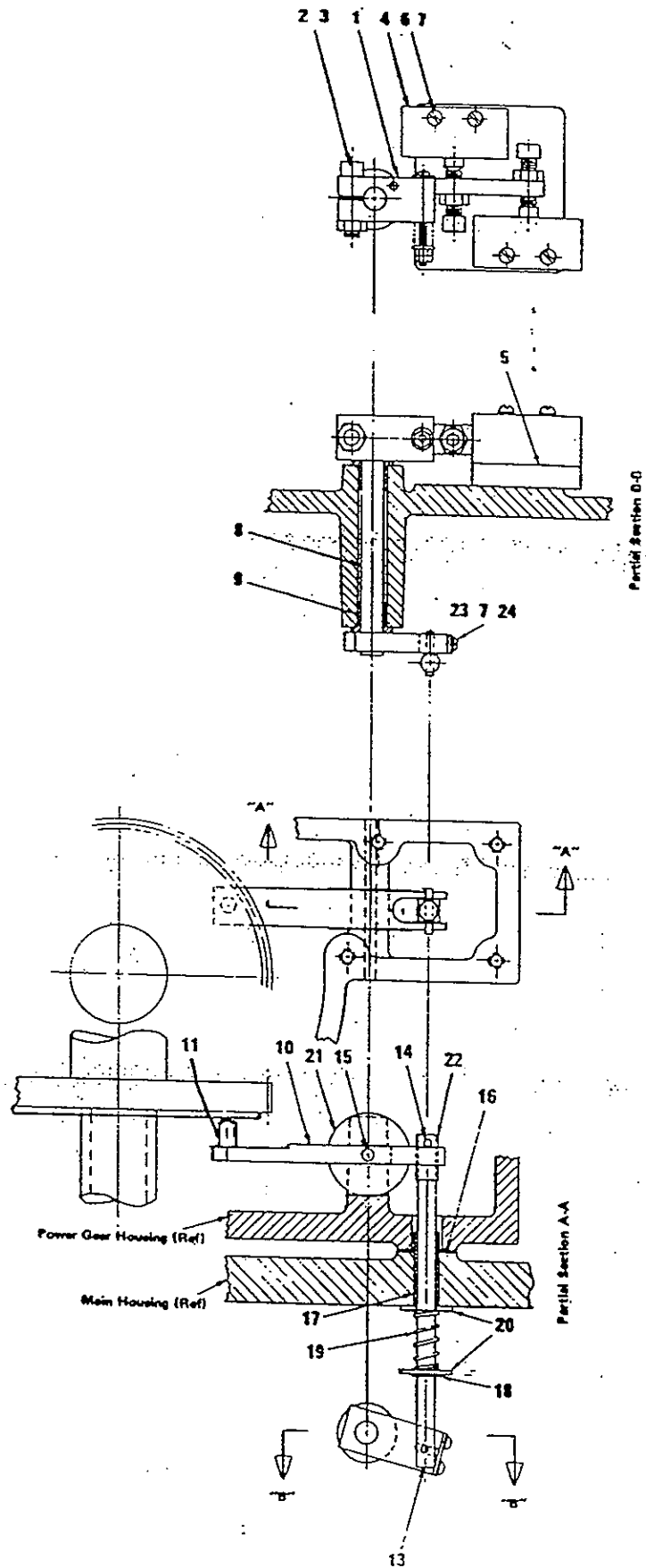
Notes: After clutch is assembled, the clutch should be torque tested by holding pinion gear 12 and rotating clutch gears 6 together. Forty - seven second shift rate clutch should be adjusted to slip at $150 \pm 10\%$ in lbs. Twenty - three second shift rate clutch should be adjusted to slip at $75 \pm 10\%$ in lbs. (Approx. 6 in. lbs per Turn of locknut 15)

Clutch shaft and all sliding parts must be lightly greased before assembly - keeping grease off of friction faces.



Torque Limit Switch Assembly

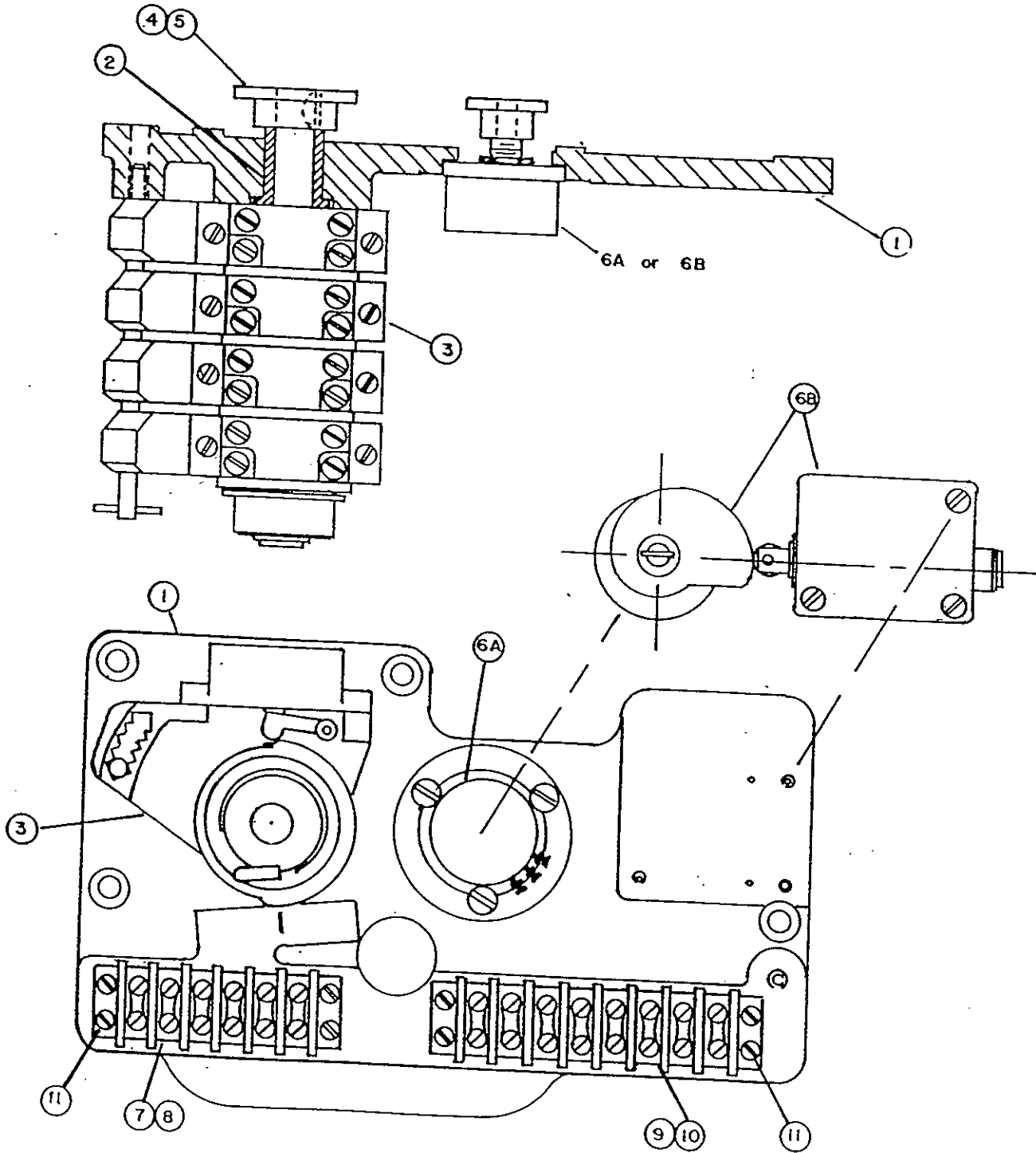
ITEM	DESCRIPTION
1	Switch Actuating Arm
2	Soc Hd Cap Screw 1/4-20 x 1"
3	1/4-20 Jam Nut
4	Limit Switch
5	Limit Switch (Hi Pressure)
6	Rd. Hd Screw #6-32 x 1.38 lg
7	#6 Lockwasher
8	Arm & Shaft Assembly
9	Bushing
10	Lever
11	Button
13	Sliding Shaft Assembly
14	Roll Pin .125 dia x .75 lg
15	Dowel Pin .188 dia x 1-1/4 lg
16	Gasket
17	Sleeve Bearing
18	Retaining Ring
19	Spring
20	Plain Washer
21	Insulator
22	Anti-Rotation block
23	Retainer
24	Rd. Hd. Screw #6-32 x .38 lg



Feedback Plate Assembly

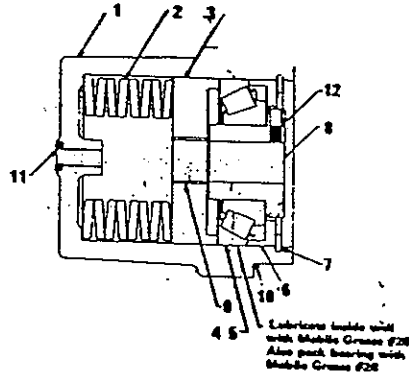
ITEM	DESCRIPTION
1	Feedback Mtg Plate
2	Bushing
3	Switch Assembly
4	Gear 76T-48P
5	Setscrew 10-24 x .10 lg
6a	Potentiometer

ITEM	DESCRIPTION
6b	Characterized Pot Assembly
7	Terminal block (6 term)
8	Insulator
9	Terminal block (8 term)
10	Insulator
11	Rd. Hd. Screw 8-32 x .50 lg



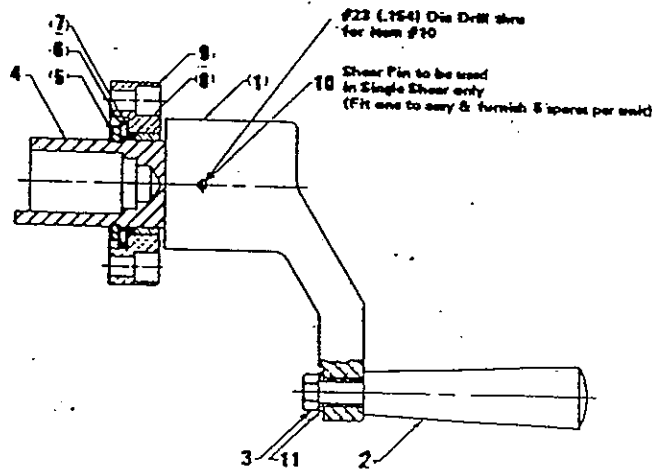
Screw Thrust Housing Assembly

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Screw Thrust Housing	7	Retaining Ring
1	Screw Thrust Housing w/ hole	8	Thrust Sleeve
2	Bellville Washer	8	Thrust Sleeve
3	Spacer Assembly	10	O-Ring
4	Roller Bearing Cone	11	Bushing
5	Roller Bearing Cup	12	Setscrew 5/16-18 x .38 lg
6	Spacer	13	Seal



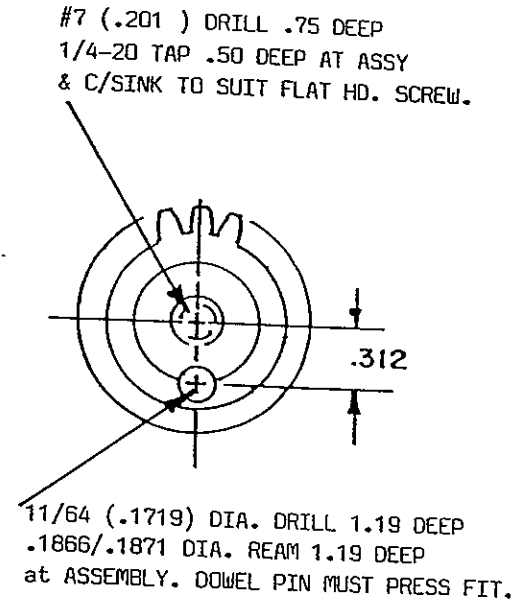
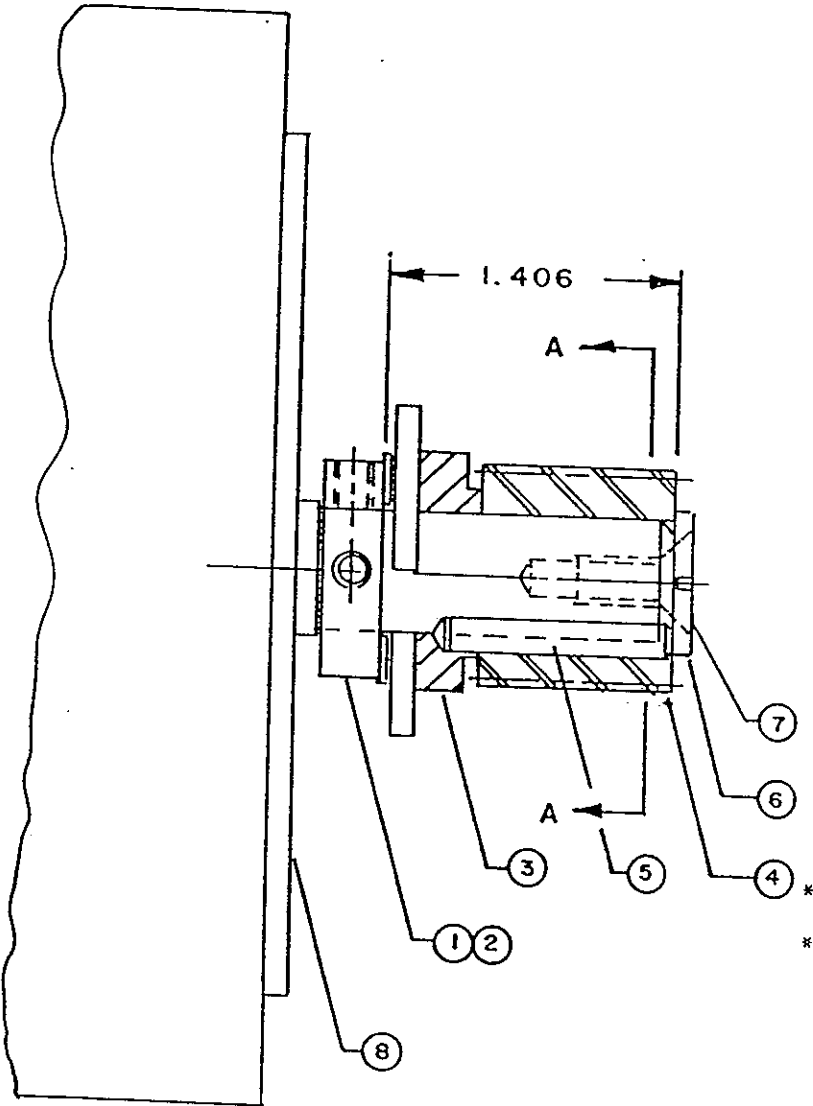
Handcrank Assembly

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Handcrank	6	Thrust Race
1	Handcrank (painted)	7	Needle Thrust Bearing
2	Handle	8	O-Ring
3	Hex Hd Screw 3/8-16 x 1.5 lg	9	Cap Assembly
4	Manual Override Shaft	9	Cap Assembly (painted)
5	Retaining Ring	10	Shear Pin (single Shear)
		11	Bushing



Motor, Pinion & Clutch Release Cam Assembly

ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Collar	5	Dowel Pin .188 dia x 1.13 lg
2	Setscrew 10-24 x .19 lg	6	Washer
3	Clutch Release Cam Assembly	7	Fl. Hd Screw 1/4-20 x .50 lg
4	Pinion Gear 21T (47 sec)	8	Motor, 230/460 Vac 3 ph
4	Pinion Gear 34T (23 sec)	8	Motor, 90 Vdc



* GEAR TO BE FLUSH WITH END OF MOTOR SHAFT.

Drag Brake Assembly

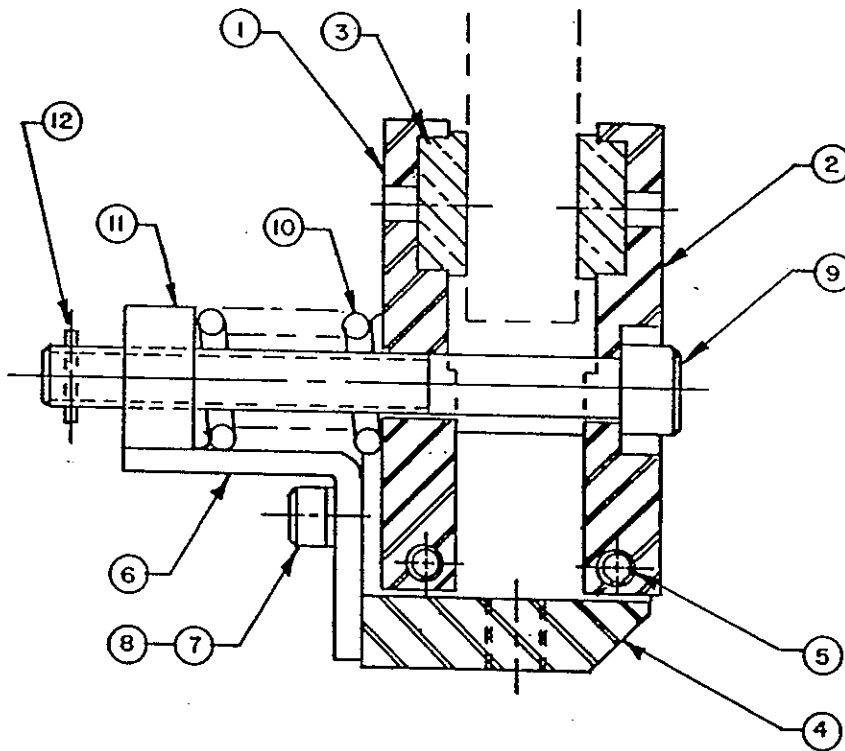
ITEM DESCRIPTION

- 1 Brake Arm
- 2 Brake Arm
- 3 Friction Disc
- 4 Brake Block
- 5 Roll Pin .188 dia x 1.50 lg
- 6 Bracket

ITEM

DESCRIPTION

- 7 #10 Lockwasher
- 8 Soc. Hd Screw 10-24 x .50 lg
- 9 Soc. Hd Screw 5/16-18 x 3.0 lg
- 10 Spring
- 11 Nut
- 12 Roll Pin 1/16 dia x .50 lg



Limit Switch Assembly

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>ITEM</u>	<u>DESCRIPTION</u>
1	Setscrew 1/4-20 x .38	8	Switch
2	Cam Shaft	9	Screw 6-32 x .75
3	Key	10	Lockwasher #6
4	Cam	11	Retaining Ring
5	Key	12	Retaining Ring
6	Switch Plate	13	Inner Shaft
7	Switch Actuator	14	Woodruff Key (not shown)

