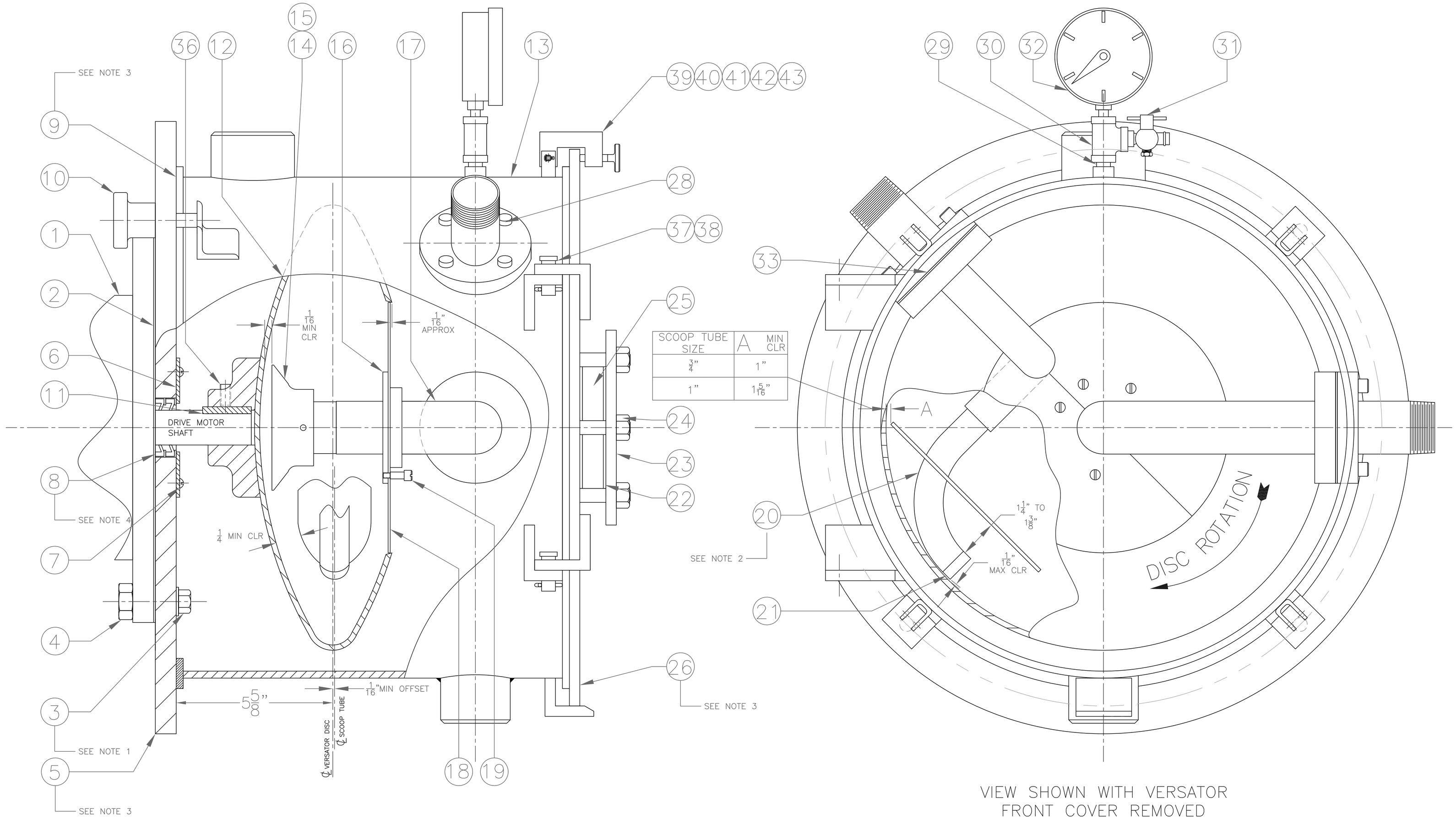


VIEW SHOWN WITH VERSATOR
FRONT COVER REMOVED

ITEM	QTY	DESCRIPTION	MATERIAL
43	8	COTTER PIN 1/16" DIA x 1/2" LONG	S.S.
42	4	HINGE PIN	S.S.
41	4	COVER CLAMP	S.S.
40	4	CLAMP HINGE	S.S.
39	4	HANDKNOB, FRONT	S.S.
38	2	HINGE PIN	S.S.
37	2	COTTER PIN 1/8" DIA x 1" LONG	S.S.
36	2	SCREW, HEX SOCKET SET – CUP POINT 3/8–16 NC x 3/4" LONG	S.S.
35	–	---	---
34	–	---	---
33	2	GASKET, FEED/DISCHARGE FLANGE 4" x 2"	FIBER
32	1	VACUUM GAUGE (0–30" HG VACUUM) 3 1/2" DIA. – 1/4NPT BOTTOM CONNECTION	---
31	1	VACUUM RELIEF PETCOCK 1/4–18 NPT – STRAIGHT NOSE	BRASS
30	1	FEMALE TEE 1/4–18 NPT – 150#	S.S.
29	1	CLOSE NIPPLE 1/4–18 NPT – SCH 40	S.S.
28	8	SCREW, SOCKET HEAD CAP 3/8–16NC x 1 1/4" LONG	S.S.
27	–	---	---
26	1	VERSATOR CHAMBER FLAT FRONT COVER	S.S.
25	1	SIGHT GLASS	PYREX
24	6	HEX NUT 1/2–13 NC	S.S.
23	1	FLANGE, SIGHT GLASS	S.S.
22	2	GASKET, SIGHT GLASS 5" x 3 7/8" x 3/32" THICK	BLACK NEOPRENE
21	1	SCOOP TUBE TIP – 3/4"	CARBIDE
20	1	SCOOP TUBE ASSEMBLY – 3/4"	S.S.
19	4	SCREW, SLOTTED HEAD SHOULDER 10–32 NF x 1/2" LONG	S.S.
18	1	DISC COVER PLATE ASSEMBLY	S.S.
17	1	FEED ASSEMBLY	S.S.
16	1	DISC COVER PLATE RETAINER	S.S.
15	4	SCREW, HEX SOCKET SET – CUP POINT 1/4–20 NC x 1/2" LONG	S.S.
14	1	SPREADER RING	S.S.
13	1	VERSATOR CHAMBER – STANDARD	S.S.
12	1	DISC HUB ASSEMBLY	S.S.
11	1	KEY, MOTOR 1/4" SQUARE x 1 1/2" LONG	S.S.
10	4	HANDKNOB, REAR	S.S.
9	2	GASKET, FRONT COVER/REAR BODY 18 3/4" O.D. x 16 3/4" I.D. x 1/4" THICK	BLACK NEOPRENE
8	2	VACUUM SHAFT SEAL LIP TYPE	BUNA
7	4	SCREW, ROUND HEAD MACHINE 10–32 NF x 1/2" LONG	S.S.
6	1	SEAL COVER PLATE	S.S.
5	1	ADAPTER PLATE	S.S.
4	4	SPECIAL NUT FOR "D" FLANGE	S.S.
3	4 EACH	SCREW, HEX HEAD CAP WITH FLAT WASHER 1/2–13 NC x 1 3/4" LONG	S.S.
2	1	GASKET, MOTOR FLANGE "D" 14" x 11" x 1/16" THICK	FIBER
1	1	VARIABLE SPEED MOTOR	---

NOTES

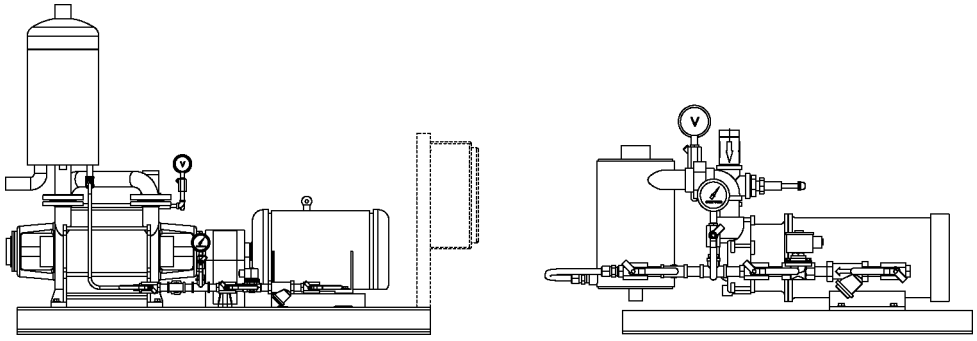
1) APPLY DOW CORNING NO. 732, COLOR WHITE, MULTI–PURPOSE SEALANT TO ITEM 3 TO MAKE A VACUUM TIGHT CONNECTION WHEN MOTOR PLATE IS REMOVED FOR NEW SEAL INSTALLATION.
2) FOR NEW SCOOP TUBE INSTALLATION ONLY: CUSTOMER TO LINE UP SCOOP TUBE AND FLANGE TO DIMENSIONS SHOWN. SECURE 1/4–20 NC SET SCREWS IN FLANGE AND REMOVE ASSEMBLY FROM BODY. TRIM TO SUIT THEN FILLET WELD AS SHOWN. DO NOT OPERATE VERSATOR BEFORE SCOOP TUBE WELDING.
3) APPLY SUPERWEATHERSTRIP ADHESIVE 3M BRAND PART NO. 08001 TO ITEMS 5 & 9 AND 26 & 9 TO SECURE GASKET TO PLATE.
4) PACK SEALS WITH TEXACO PREMIUM RB GREASE OR EQUAL.

BILL OF MATERIAL

THE CORNELL MACHINE COMPANY
45 BROWN AVENUE SPRINGFIELD, NJ 07081–2992
TEL: (973) 379–6860 INFO@CORNELLMACHINE.COM
FAX: (973) 379–6854 WWW.CORNELLMACHINE.COM

DRAWN BY: AJH 3/25/2011		TITLE: CUSTOMER OPERATION MANUAL D–16EH VERSATOR – STANDARD
CAD FILE: D16EH–7509–3.DWG		
SCALE: NTS	REV: – – –	SIZE: D
		DRAWING: D16EH–7509–3

XBA Vacuum Packages



Installation, Operation & Maintenance

The pump model number, serial number and stock number are stamped on the pump nameplate located on the pump casing (see right). For inquiries regarding replacement parts or service, record all three pump ID numbers, and submit them along with any requests.

SIHI Pumps, Inc. 303 Industrial Drive, Grand Island, NY 14072 Phone:: (716) 773-6450 Fax: (716) 773-2330	Document Number **IOM031207**	**SIHI Pumps Limited** 225 Speedvale Ave. W., Guelph, ON N1H6L8 Phone:: (519) 824-4600 Fax: (519) 824-7250

Part Number **606038**

Introduction to SIHI Liquid Ring Vacuum Pumps

SIHI's liquid ring pumps offer efficient compression of condensable vapors and gases in the rough vacuum field with a capability of up to 29" Hg vacuum (depending on the application and pump type used).

SIHI pumps use the liquid ring principle to ensure maximum safety in compression of hazardous mixtures. Reliability is ensured through the use of only one rotating assembly with no internal metal to metal contact.

Should you need any further information or assistance, contact the SIHI office or SIHI Agent of your choice. Major locations appear on back cover of this manual.

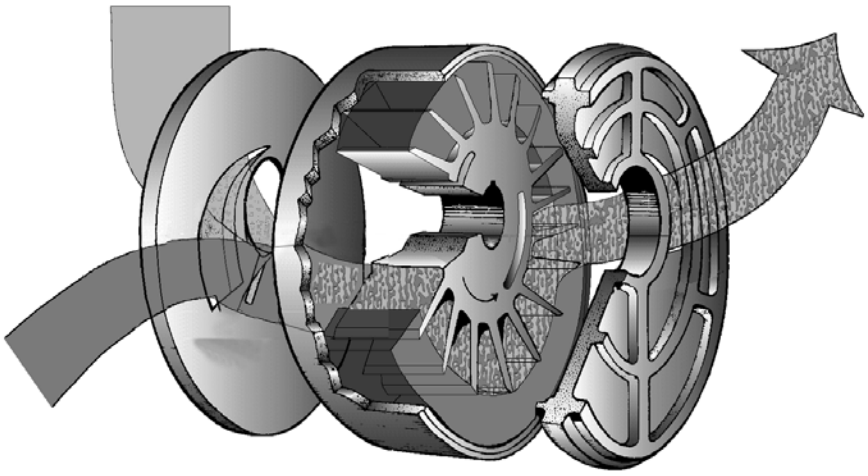


Figure 1

The Liquid Ring Principle

The "liquid ring" pump takes its name from its principle of operation. A cool liquid is introduced into a round casing and, due to centrifugal force when rotated, forms a nearly concentric ring around the pump casing.

The impeller is eccentrically mounted in the casing. Hence, at one side, the cells formed by the impeller blades and the boundary of the liquid ring increase in size; and on the other side, they decrease in size.

A suction port is positioned in the area where the cell size is increasing. This port ducts the gas from the pump inlet into the lower pressure cells.

The gas introduced into the cells is then compressed by the operating liquid in the area where the cell size is decreasing. A discharge port is positioned to duct the compressed gas to the pump discharge.

Since the liquid absorbs the heat generated during compression, a small quantity of fresh cooling liquid is continually introduced via the service liquid supply port, and the resulting excess warm liquid discharges with the gas to a downstream gas/liquid separator.

The liquid used as compressant allows the liquid ring pump to perform cool, reliable compression of virtually all gases and condensable vapors while easily handling liquid and soft solid carryover.

1.0 Safety

This operating manual gives basic instructions which are to be observed during installation, operation and maintenance of the XBA package. It is therefore imperative that this manual is read by the responsible personnel prior to installation, start-up and operation. It must always be kept available at the installation site. Not only the general safety instructions contained in this chapter "Safety" must be observed, but also the specific information provided under the other chapters.

1.1 Identification of safety notices in the operating instructions

Non compliance with the safety notices given in these operating instructions which would affect safety, are identified by the following symbols:

⚠ DANGER — **DANGER** Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING — **WARNING** Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION — **CAUTION** Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE — **NOTICE** is used to address practices not related to personal injury.

⚠ DANGER

Receiving, handling, installation, operation and maintenance (routine or otherwise) shall be performed by competent personnel specifically trained to perform the operations to be undertaken. These technicians should be licensed and fully aware of local laws, restrictions, safety procedures and directives. Failure to use suitably trained and licensed personnel may result in personal injury or death.

NOTICE

Failure to follow the directions for installation and operation of this equipment may result in equipment failure or mis-operation not covered by manufacturer's limited warranty.

1.2 Unauthorized alterations and production of spare parts

Any unauthorized modification of the unit will result in absolving SIHI of any liability. In such cases the operator of the machine assumes responsibility for safe operation of the unit.

Using spare parts and accessories authorized by the manufacturer is in the interests of safety. Use of other parts may absolve the manufacturer of any liability.

1.3 Unauthorized methods of operation

The reliability of the machine supplied will only be guaranteed if it is used in the manner intended and in accordance with the instructions of this manual. The specified operational limits must not be exceeded in any circumstances.

1.4 Safety instructions relevant for operation

If hot or cold components of the unit involve hazards, they must be guarded by the user against accidental contact. Guards for moving parts (e.g. couplings) must not be removed from the machine while in operation. Any leakage of hazardous (e.g. explosive, toxic, hot) fluids (e.g. from the shaft seal) must be drained away so as to prevent any risk occurring to persons or the environment. Statutory regulations are to be complied with. Hazards resulting from electricity are to be eliminated by the user.

1.5 Warranty

SIHI guarantees long term, satisfactory operation if: the package is installed and operated in compliance with these instructions and under conditions approved by SIHI. No modifications are undertaken without SIHI's written agreement.

2.0 Equipment Handling

NOTICE

Shipment is normally provided FCA manufacturer's plant. Damage during shipment is the responsibility of the shipping company not the manufacturer and must be reported on the day of receipt to ensure insurance validation.

⚠ WARNING

Follow all applicable handling and safety rules! Always use proper lifting and handling devices. Failure to do so may result in serious personal injury or damage to equipment.

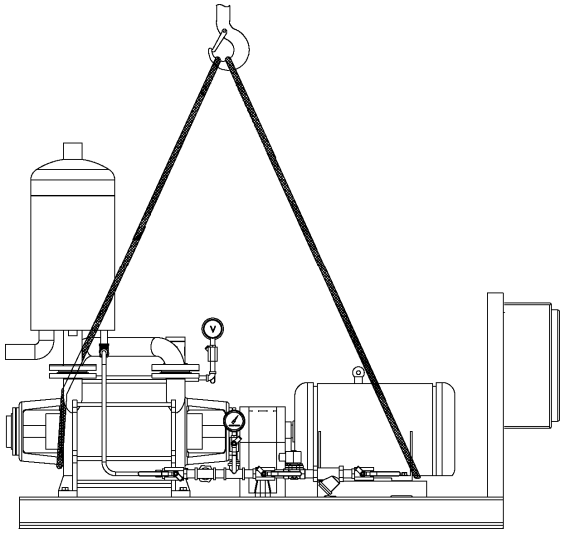


Figure 2

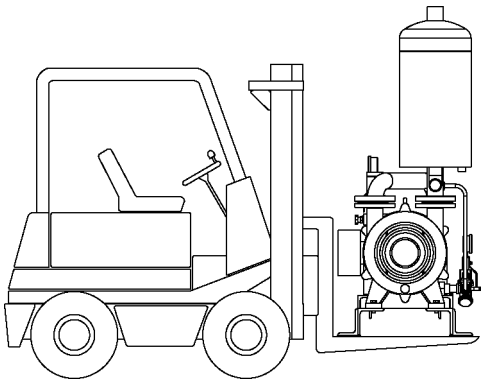


Figure 3

2.1 Loading and unloading

With equipment located in a safe area capable of supporting equipment weight, visually inspect crating for damage occurring during shipment.

2.1.1 Report all damage immediately to the shipping company in writing.

2.1.2 Remove protective packaging materials and inspect equipment visually for damage.

2.1.3 Verify shipment is received complete and intact as required by the purchase order and shipping documentation supplied.

2.1.4 Lift equipment as indicated in figures 2 & 3 maintaining horizontal position using suitable tools. Refer to shipping documents for actual shipping weights.

NOTICE

The vacuum pumps on XBA packages are supplied with preservatives suitable for a maximum 2 months of storage. Once installed, the XBA package should be placed in immediate operation. If not properly stored, equipment failure will occur. If storing for periods longer than 2 months, refer to Chapter 6 Long Term Storage.

2.2 Preparation for Mounting

2.2.1 Before mounting any unit it is necessary to determine the requirements of the application. Liquid ring pumps require a system that provides service liquid to the pump (normally water) but most liquids with similar viscosity, specific gravity and vapor pressure characteristics; can be employed. Before proceeding with any mounting or operation of equipment, refer to Chapter 4 for details of system design that must be included if the pump is to perform as required.

2.2.2 General Notes

⚠ WARNING

Ensure equipment foundation is capable of supporting operating weights including starting torques and all associated equipment. Failure to adequately support equipment may cause serious personal injury, and or equipment failure.

2.2.3 Before performing any installation ensure all piping within the mounting area is suitably isolated, leak free, and drained as required. Be sure to pay strict attention to site safety rules & procedures. Avoid allowing the presence of untrained personnel whenever performing work on this equipment.

2.3 Mounting

2.3.1. In preparation for mounting the location should be prepared to support the entire XBA package base and should be flat and level.

NOTICE

XBA packages are designed for mounting on a rigid, flat and level, support frame or foundation.

Flexible coupled packages are trial aligned at the factory prior to shipment. Final field alignment must be performed after base mounting or shortened equipment life will be experienced.

LEM close coupled pump packages do not require field alignment of pump and motor.

⚠ WARNING

NEVER operate the unit without the coupling guard installed. Failure to comply could result in serious injury.

2.3.2 Flexible coupled units:

Rotate pump shaft manually to ensure shaft is capable of turning. Pump size (rotor inertia) and friction of seals or packing, may make hand rotation difficult. Rotation may require the aid of a suitable pipe wrench

2.3.3. Close Coupled units:

Remove knock-out plug from the motor fan shroud and rotate motor shaft by hand, using a screwdriver inserted through the shroud, and engaging the slotted end of the motor shaft. No undue binding or scraping noises should be heard from inside the pump. Pump size (rotor inertia) and friction of seals may make hand rotation difficult.

Call the factory for information if rotation cannot be accomplished.

2.4 Alignment of pump and motor (Flexible Coupled Units only)

⚠ WARNING

When checking rotation or beginning alignment procedure, be certain equipment is locked out of service and cannot be started!

Failure to ensure equipment is positively locked out can result in serious personal injury.

Never start a pump unit before checking rotation by hand!

2.4.1 The pump and motor unit must be aligned using either a double dial gauge method or a reverse dial gauge or laser alignment tool as available. Alignment tolerances are indicated in the table below.

Acceptable alignment limits:

Double dial gauge:	less than 0.002” (0.05mm) T.I.R. (Total Indicator Runout)
Reverse dial Gauge or laser alignment	

NOTICE

Improper alignment is a major contributing factor to pump noise, vibration and premature failure.

2.4.2 Alignment methods

Preferred – Dial Guage The service life of the pump is dependent on good coupling alignment. Flexible couplings will not compensate for shaft misalignment. If the motor was mounted by SIHI, the pump and motor were aligned prior to shipment from the factory. Since baseplates are not perfectly rigid, handling during

shipment, pipe loading and foundation stresses mandate an alignment check prior to start-up. Changes to alignment should be made by adding shims, as necessary, under the motor feet.

The dial indicator method for checking coupling alignment is preferred (refer to figures 4 and 5). To measure parallel misalignment, attach dial indicator to one coupling hub, or mount on one shaft end with the indicator button resting on the O. D. of the other coupling hub (figure 4) or shaft. To measure angular misalignment, the indicator button rests on the face of the other coupling hub near the O. D. (figure 5). Measure misalignment by rotating the shaft and dial indicator one full revolution; the other shaft remains stationary. Record the Total Indicator Runout (T.I.R.). Parallel and angular misalignment should be limited to ±0.002" T.I.R.

If a dial indicator is not available, an adequate alignment is possible using a straight edge, feeler gauge, micrometer or caliper. This method should be used as a last resort only.

NOTE: Reverse dial indicator alignment, or laser optical alignment, can be used satisfactorily. Contact the factory if details are required.

For maximum pump life, keep misalignment values as near to zero as possible.

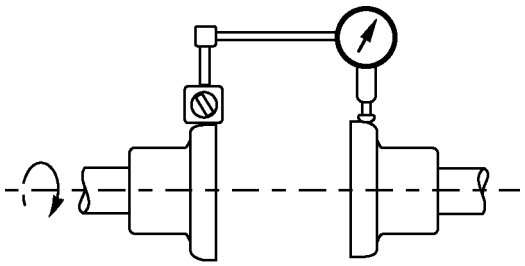


Figure 4

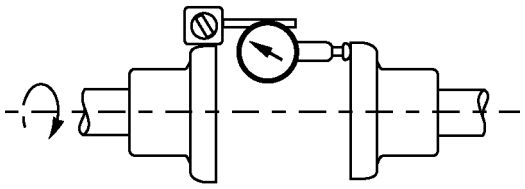


Figure 5

2.5 Piping Installation:

⚠ WARNING

Service liquid supply and system integration with USER'S process is the responsibility of the USER and his engineering team. SIHI Standard XBA packages are not designed for hazardous or toxic gas service. Should there be any chance of this occurring contact local safety authorities and SIHI for information.

2.5.1 General:

As a minimum, SIHI XBA packages are supplied with the accessories noted for once through and partial recirculation. Refer to Chapter 4 for system assistance. Contact the factory or your local SIHI Agent for information if required.

⚠ WARNING

Failure to isolate pump from pipe strain due to improper assembly design or temperature variations; can result in leakage or failure of the equipment leading to serious personal injury or environmental damage.

Never use mechanical equipment to draw piping to the pump connection!

Pipe stresses can be a major source of equipment failure, reduced pump life, and safety concerns. All pipes should be supported close to package connections and hand aligned to the applicable connection point. Do not use tools to lever piping into position!

2.5.2 Inlet piping

Ensure piping slopes to the pump continuously from the preceding drain point.

2.5.2.1 When installing inlet connections, a temporary inlet screen should be used to prevent entry of weld slag and other debris into the pump body. Conical type screens in the inlet are recommended to prevent ingress of trapped solids during removal.

Be careful to check operation when screen is installed since debris can foul the screen and result in cavitation. Do not leave temporary screens installed as they can

lead to failure due to plugging, deterioration and loss in performance.

2.5.2.2 Ensure all inlet piping is at least equal in cross sectional area to the package inlet size being installed If multiple pumps are employed ensure line size cross sectional area is equal to the sum of all pump inlet nozzles to be employed on the same line. Also, if long pipe runs are expected pipe sizes may need to be increased to ensure efficient pump operation.

NOTICE

Liquid traps must be avoided in the inlet lines to prevent the possibility of slug carryover to the equipment.

2.5.3 Discharge Piping from the XBA Separator:

⚠ DANGER

Ensure pump discharge system as a whole is designed to prevent pressure buildup exceeding pump, accessories or piping design. Failure to do so will result in serious personal injury or death, as well as equipment damage. Positive isolation valves in the discharge are to be avoided.

2.5.3.1 Gas discharge from the separator must be vented to an external non atmospheric vent fitted with suitable screen to prevent foreign objects from entering the equipment. Water separator overflow and drain must be piped with negative slope to a vented drain, Refer to Appendix 1 for line sizes and locations.

2.5.3.2 Gas discharge piping must be at least the same diameter as the separator discharge connection. Refer to Appendix 1 for size and location.

2.5.3.3 Avoid the connection of multiple pump units to the same discharge manifold unless suitable line sizes are employed. Cross sectional area must be equal or greater than the total discharge cross sectional area of all operating equipment using the same manifold. Contact the factory for information as required.

2.6 Service liquid:

2.6.1 The standard XBA package is designed to use cool clean water as the service liquid either on a once through basis or a partial recirculated basis. Refer as detailed in Chapter 4 for general descriptions and Appendix 1 for package connection sizes and locations.

2.6.2 Connect fresh water supply to the service liquid connection using suitable gasket compound on all connections. Refer to Appendix 1 for line sizes and locations.

3.0 Prior to Operation

The following warnings must be observed before proceeding with equipment start-up.

⚠ DANGER

- **XBA Packages cannot be used for hazardous or toxic fluids. Contact factory if this is a concern. The use of hazardous or toxic fluids should not be used for once through or partial service liquid supply unless the systems were properly designed and engineered for these fluids and USERS fully understand the operation and safety guidelines to be followed.**
- **Electrical connections and installations must be performed by trained personnel who are well versed in the NEC and NFPA Electrical Codes. Strict supervision and inspection in accordance with all Local, State, and National Codes and Standards must be provided and followed.**
- **Personnel must positively lock-out equipment while performing installation, pre-start up or mechanical checks.**
- **Equipment must never be operated without proper equipment guards in place.**
- **Where explosion hazards exist, coupling guards must be non-sparking such as, aluminum, brass or other non-sparking materials.**

Failure to follow any instructions and equipment warnings will result in death, serious personal injury, damage to equipment and the environment.

NOTICE

Operation of the pump dry will result in shaft seal failure leading to leakage.

3.1. Preparation for Operation

⚠ DANGER

Static Electricity - Potential

The operator must ensure that if the unit is used in an explosion hazard area, that potential for static discharges is eliminated by ensuring proper grounding.

The insulating effects of paint coatings must also be considered.

Failure to do so will result in death, serious personnel injury, and equipment damage.

Prior to start-up, half fill the pump with service liquid (do not overfill) prior to operation. This will ensure that the seals (if installed) are not damaged by dry operation.

3.2. Connect the motor and any electrically controlled accessories such as service liquid solenoid valves as required. Ensure motor speeds, voltages and frequencies agree with the supply and the equipment requirements.

3.3. Recheck alignment done previously, then install suitable coupling guard on flexible coupled units.

3.4. Ensure suction and discharge lines are properly attached to the system. Suction valves are half closed and discharge valves are fully open.

3.5. Jog the pump motor and check pump rotation. Arrows are provided on the pump cover. Should there be any confusion, call the factory before operating the unit.

4.0 Service Liquid Supply: General Notes

The operation of the liquid ring pump depends on a continuous supply of cool, clean service liquid, entering the pump at the service liquid supply port and discharging with the compressed gas via the discharge connection. The volume supplied to the pump should be regulated for optimum performance.

The service liquid flowing through the pump serves to carry away the heat generated by compression of the gas. The temperature rise from inlet to discharge normally is approximately 7°F (4°C).

NOTE: Actual temperature rises may be higher depending on:

1. Operating pressure
2. Quantity of service liquid supplied
3. Gas characteristics
4. Service liquid properties.

Systems for service liquid supply include once-through, partial recirculation and total recirculation. The P&I drawings for these are provided in Figures 6 & 7. In each instance, different accessory items are indicated.

The attached information details the most usual requirements for non-hazardous or toxic conditions and is supplied for reference. Your process may require added or alternative devices (especially if fluids handled are toxic or hazardous).

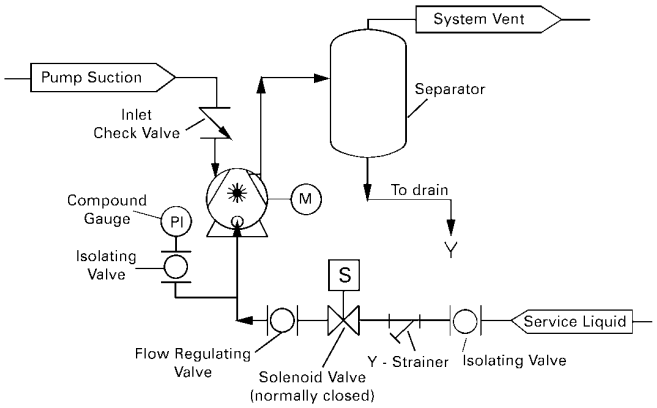
⚠ WARNING

Process integration is the USERS responsibility and must be performed by the user's trained, competent personnel.

Failure to adequately adjust the system to the process may result in severe personal injury or damage to the equipment, facilities and the environment.

Refer to Appendix 1 for pipe sizes and locations, Appendix 2 for the effects of service water vapor pressure, and Appendix 3 for recommended service liquid flow rates for each pump model.

4.1 System 1 – Once Through



Once Through System - Figure 6

Once through service liquid supply requires liquid to be available at some positive pressure to the liquid supply accessories prior to the pump.

Normal accessories for once through operation include: inlet check valve, discharge gas/liquid separator, compound gauge, flow regulating orifice (or flow regulating valve), normally closed solenoid valve, 'Y' pattern strainer and manual isolating valve all piped as shown in Figure 6.

4.1.1 Once Through - service liquid supply normal operation

4.1.1.1 The normally closed solenoid valve should be wired to open in conjunction with motor start.

4.1.1.2 Ensure all protective guards are in place prior to proceeding and also ensure service fluid is available to the pump supply line.

4.1.1.3 Jog the motor while observing the compound gauge. A variation in the pressure should occur if the solenoid valve is opening. If no variation occurs, check the solenoid and the supply line for closed valves or plugs.

4.1.1.4 Start the unit and monitor the service liquid pressure on the compound gauge. With the pump operating in the normal operating range, adjust the liquid flow using the manual flow control valve. The correct flow will occur when compound gauge reads approximately zero. However, the optimal setting occurs with valve set at the minimum opening possible, providing the pump runs smoothly and gas water discharge temperatures are satisfactory.

4.1.1.5 After setting the flow, mark the reading on the compound gauge.

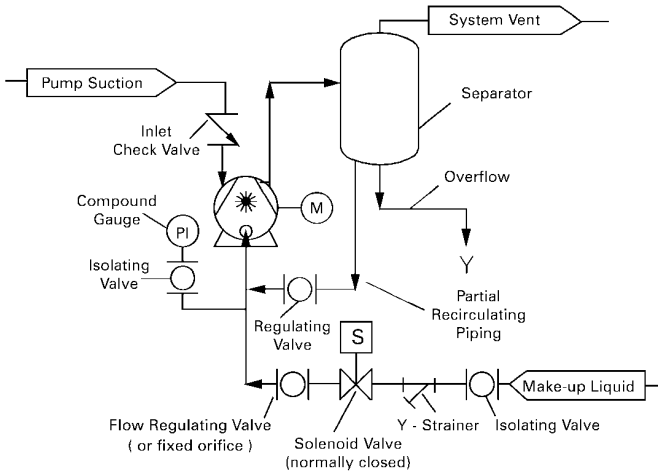
4.1.1.6 Monitor the service liquid pressure routinely to ensure variations are not occurring and pump operation is satisfactory.

If in the course of normal operation it is necessary to shut the unit off, ensure that the solenoid valve closes. If pressure is indicated on the compound gauge, the solenoid valve is not closing and the pump may be flooded. Check solenoid operation and drain pump to shaft centerline before restarting.

NOTICE

Starting liquid ring pumps flooded can result in high staring torques leading to pump failure or to motor shut down due to overload. Contact your local SIHI Agent or the factory for assistance.

4.2 System 2 – Partial Recirculation



Partial Recirculation System Figure 7

Partial recirculation can be employed in instances where make-up liquid is available at a temperature lower than the service liquid design temperature. Service liquid enters the pump and is discharged at a higher temperature to the separator. A portion of the liquid (still at higher than the design temperature), is then mixed with the cool make up liquid to return the pump liquid to design operating temperature.

The quantity of make up is determined by the difference in temperature between the design service liquid temperature and the temperature of the cool make up liquid available.

In many instances it is possible to reduce the fresh liquid flow to 50% or less of the normal flow. The excess liquid is drained from the separator via the normal overflow.

Normal accessories for partial recirculation include: inlet check valve, SIHI XBa type discharge separator (or similar liquid reservoir), make up line accessories including flow regulating valve (or orifice), normally closed solenoid valve, 'Y' strainer, shut-off valve and compound gauge, piped as shown in figure 7.

4.2.1 Operation of Partial Recirculation systems <u>with automatic fixed flow control orifice in the make up line</u>

4.2.1.1 The normally closed solenoid valve should be wired to open in conjunction with motor start.

4.2.1.2 Ensure all protective guards are in place prior to proceeding and also ensure service fluid is available to the make up line.

4.2.1.3 Close recirculation line control valve approximately half way.

4.2.1.4 Jog the motor while observing the compound gauge. A variation in the pressure should occur if the solenoid valve is opening. If no variation occurs, check the solenoid and the supply line for closed valves or plugs.

4.2.1.5 Start the unit and monitor the service liquid pressure on the compound gauge with pump operating in the normal operating range.

4.2.1.6 Adjust the recirculated liquid flow using the manual valve in the recirculation line until compound gauge shows approximately zero. Once the system is operating under normal conditions, check to ensure the pump runs smoothly and that pump temperature stabilizes. If pump operating temperature does not stabilize at a temperature where pump operates smoothly without cavitation, liquid make-up rate is not satisfactory. Re-check for plugs in the fresh liquid supply and open the manual recirculation valve slightly.

NOTICE

Do not continue to operate the unit if temperature continues to rise or pump operates with cavitation noise or premature equipment failure will occur.

4.2.2 Operation of Partial Recirculation system with manual make up flow regulating valve (without fixed orifice)

This arrangement allows the service liquid make up to be optimized to match system needs. Partial recirculation always requires introduction of some cool liquid to maintain stable operating service liquid temperature. However, the actual quantity required varies, depending on the system conditions and operating requirements.

The optimum make-up rate is the minimum flow rate required to maintain a stable service liquid supply temperature at the lowest operating pressure (highest vacuum) required, ensuring the pump operates smoothly and quietly.

4.2.2.1 The normally closed solenoid valve should be wired to open in conjunction with motor start.

4.2.2.2 Ensure all protective guards are in place prior to proceeding and also ensure service fluid is available to the make up line.

4.2.2.3 Close recirculation line control valve approximately half way and ensure manual make up flow control valve is open approximately half way.

4.2.2.4 Jog the pump while observing the compound gauge. A variation in the pressure should occur if the solenoid valve is opening. If no variation occurs, check the solenoid and the supply line for closed valves or plugs.

NOTICE

SIHI recommends a minimum of 10% fresh make-up in most instances, since the separators used have relatively small liquid volumes. Leakage or evaporation could quickly result in failure, from running dry. Should it be desired to reduce make-up liquid rates further, consult the factory, or consider installing a SIHI complete recirculation system.

4.2.2.5 Start the pump and monitor the system inlet pressure until pump operates at the desired vacuum. Reduce the liquid make-up setting until the pump is just capable of maintaining system vacuum with a stable service liquid temperature.

4.2.2.6 Monitor the system in operation for a period of time to ensure temperatures are stable and pump operates smoothly and quietly. Remove flow control valve handle and wire it to the line to prevent loss and ensure availability.

NOTICE

Since the service liquid regulation was reduced to a low value per item 4.2.2.5 the service liquid supply volume may not be adequate to maintain performance if the ambient conditions or vacuum requirements change. Monitor the pump operation from time to time to ensure, temperatures are stable and equipment is operating normally (no objectionable change in vacuum levels, vibration or noise levels). Service liquid make up rate increase may be necessary if**:** water temperatures increase, vacuum requirements increase, or make up supply pressure changes to the control valves occur.

5.0 Routine Maintenance / Operation Checks

5.1 General:

SIHI liquid ring pumping equipment is designed for continuous use. Routine maintenance is minimal, however, as with all equipment some precautionary checks should be made.

5.2 Lubrication

5.2.1 Lubrication (Pump Bearings)

Lubrication: Grease bearing every 3000 hours with lithium based bearing grease to NLGI – 3 specifications, where applicable. Some pumps are fitted with bearings sealed for life. Pumps so fitted do not have grease nipples and are not to be greased.

If the pump is operating in a harsh (i.e. dusty or hot) environment, the re-greasing intervals could be considerably shorter. Adjust re-greasing intervals accordingly.

NOTICE

Do not mix bearing greases as some grease additives are not compatible between brands, which could cause premature equipment failure.

5.2.2 Lubrication (Motor Bearings)

See motor manufacturer for motor lubrication details.

5.2.3 Lubrication (Close Coupled LEM Motor)

This is a ball bearing motor. Lubrication prior to startup is not required. The bearings have been lubricated at the factory.

Close Coupled LEM Relubrication Intervals:
The following intervals are suggested as a guide:

Hours of Service per Year	H.P. Range	Suggested Relube Interval
6,000	1/8 to 7 – ½	6 years
Continuous Normal Applications	10 to 15	1 year
Seasonal Service Motor is idle for 6 Months or More	All	1 year (beginning of season)
Continuous High Ambients, Dirty or Moist Locations, High Vibrations, or Where Shaft End is Hot (Pumps-Fans)	1/8 to 40	6 months

Insulation Class	Consistency	Type	Typical Grease
A/B/F & H	Medium	Polyurea	Polyrex EM Texaco Polystar Rykon Premium #2 Pennzoil Pen 2 Lube Chevron SRI

Procedure:

If motor is equipped with zirk fitting, clean tip of fitting and apply grease gun. Use 1 to 2 full strokes on motors in NEMA 215 frame and smaller. On motors having drain plugs, remove grease drain plug and operate motor for 20 minutes before replacing drain plug.

Explosion Proof motors must be regreased by UL approved repair shops.

5.3 Process /Pump Operating Conditions:

5.3.1 Cavitation

Cavitation results from collapse of vapor bubbles formed during the compression stroke of operation. The bubbles formed exist only temporarily and almost immediately collapse as the gas is compressed. This collapse causes the formation of a tiny jet of liquid which impinges on the surfaces of the pump's internal parts.

Cavitation is a condition usually detected by a crackling or sound which is described as a "grinding" noise.

Slight Intermittent cavitation can be withstood for some period of time however continuous or heavy grinding cavitation will severely shorten pump life and can lead to catastrophic pump failure. Should you detect cavitation: refer to the trouble shooting section or call SIHI service at your discretion.

⚠ DANGER

Continuous operation of pump in excess of 4 mils vibration, may result in death, serious personal injury, environmental damage, and/or premature pump failure.

Cavitation erodes the materials and sets up vibrations in the rotors of liquid ring pumps, resulting in the noises heard. These vibrations if not corrected, can lead to impeller blade failure from fatigue or erosion. Pump failures resulting from cavitation and abrasion damage are not covered by warranty.

5.3.2 Abrasive Particle Carryover

NOTICE

All liquid ring pumps can have their effective lives shortened due to abrasive particle carryover. If abrasive particle carryover is suspected, a knockout vessel should be employed and/or a suitable inlet filters or service liquid filtration system used.

Abrasive particle damage results in erosion of clearances leading to declining vacuum typically followed by leakage from the casing at final failure. Pump failures resulting from cavitation and abrasion damage are not covered by warranty.

5.3.3 Scaling

Liquid ring pumps used in areas where water has a high level of calcium carbonate or iron scale may become fouled, leading to seize-up, high motor loads and possible shaft seal leakage.

Abrasive water or dirty water should be avoided whenever possible.

Extremely hard water may result in the formation of scale deposits within the liquid ring pump.

Scale deposits can be removed by periodic treatment or installing a water treatment system.

Guidelines for water quality for liquid ring pumps are as follows:

- Hardness - maximum 200 PPM
- Dissolved solids – maximum 200 PPM
- PH Value – minimum 7
- Chlorides – maximum 10 PPM

NOTICE

In these instances, pump should be periodically flushed with a descalant as frequently as necessary to ensure scale build-up is removed. Recommended descalant is “Rydlyme”. Call your local SIHI Agent or SIHI Factory Service for information.

6.0 Long Term Storage

6.1. General

Cast iron pumps should be installed and put into service as soon as possible. In the event storage or installation followed by inactivity is possible, prepare the pump for storage as follows.

Storage Prior to Installation

NOTICE

Pumps are supplied with preservatives suitable for a maximum 2 months of storage. If storing for periods exceeding 2 months, anti-rust preservative must be added, and shaft should be rotated at least once per month.

Special care must be taken if the units are installed where freezing is possible. Ensure that the preservative remains liquid. Be aware that if the preservative solidifies and expands such as water does, cracking of the pump parts may occur. In addition, starting pumps with frozen fluids in the case will cause catastrophic failures not covered by warranty.

Store in a clean, dry, location protected from freezing or excessive heat and humidity.

Plug all miscellaneous connections securely to prevent leakage.

Fill pumps completely using inlet or outlet connections with a suitable rust preventative (such as a suitable biodegradable, automotive type, rust inhibited-anti freeze solution).

NOTICE

Ensure the solution used is acceptable to the process or process contamination leading to failures not covered by pump manufacturer's warranty may occur when installed.

6.2.1 Rotate shaft by hand from time to time during filling to ensure all areas are flooded. Refer to 2.3.4

6.2.2 Cap connections securely to prevent leakage.

6.2.3 Apply suitable anti-corrosion protection (wax based preferred, PDRP or equivalent) to shaft extension to prevent rusting.

6.2.4 Rotate shaft weekly to ensure they turn freely and to limit the possibility of bearing flat spotting leading to premature bearing failure in operation.

6.3 Storage After Installation

⚠ WARNING

Ensure pumps are positively locked out before proceeding with long term storage. Failure to prevent un-supervised starting or operation could result in personal injury or environmental damage.

6.3.1 Isolate the pump from the process.

6.3.2 Open a connection which will allow the introduction of a suitable process compatible anti rust preservative into the pump unit.

6.3.3 Drain all liquids from the casing using pump drain connections.

⚠ WARNING

Before draining operating fluids ensure any fluids introduced are not toxic or hazardous in nature or personnel injury and environmental damage could occur.

6.3.4 While draining rotate pump shaft by hand to ensure maximum draining occurs.

6.3.5 Reinstall drain plugs. Fill the pump completely with the chosen preservative. Close all connections securely.

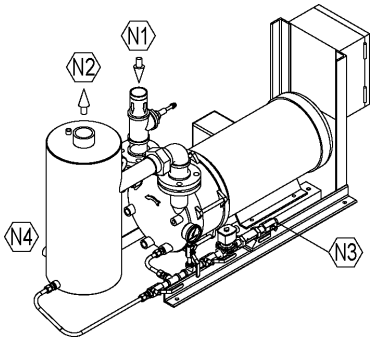
6.3.6 Grease bearings if possible to ensure they are adequately sealed and prevented from exposure to the atmosphere.

6.3.7 Rotate shaft by hand weekly to prevent possible bearing damage.

APPENDIX 1

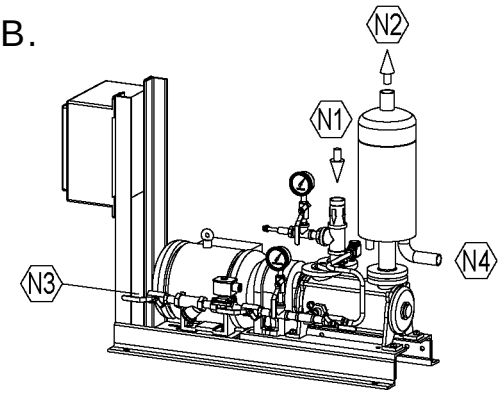
PIPING ARRANGEMENT TABLES – STANDARD CLOCKWISE DRIVEN PUMPS ONLY

A.



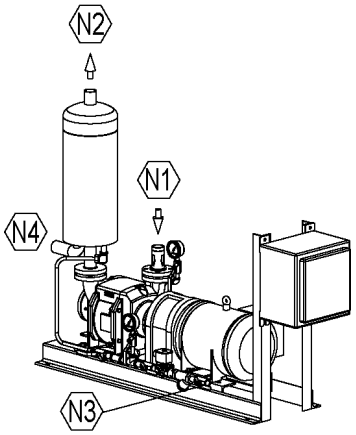
System Model Applicable	Weight	Nozzle Schedule - Size/Rating			
		N1 Suction	N2 Vent	N3 Serv. Liquid	N4 Overflow
XBAR 15	124	1" MNPT	3/4" FNPT	1/2" FNPT	1/2" FNPT
XBAR 20	129	1" MNPT	3/4" FNPT	1/2" FNPT	1/2" FNPT
XBAR 40	154	1-1/4 MNPT	1-1/2" FNPT	1/2" FNPT	1" FNPT
XBAR 60	180	1-1/4 MNPT	1-1/2" FNPT	1/2" FNPT	1" FNPT
XBAR 110	264	1-1/2" F-MNPT	1-1/2" FNPT	1/2" FNPT	1" FNPT
XBAR 170	319	1-1/2" F-MNPT	1-1/2" FNPT	1/2" FNPT	1" FNPT
XBAR 250	494	2" MNPT	2" FNPT	1/2" FNPT	1-1/2" FNPT

B.



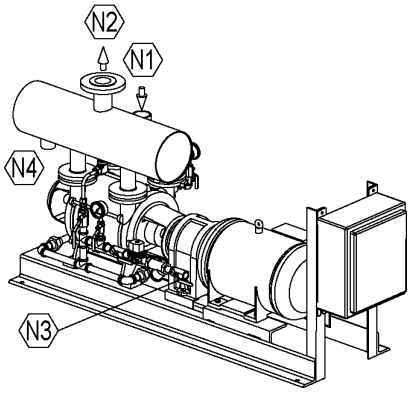
System Model Applicable	Weight	Nozzle Schedule - Size/Rating			
		N1 Suction	N2 Vent	N3 Serv. Liquid	N4 Overflow
XBAR 20103	219	1-1/4 FNPT	1-1/4 MNPT	1/2" FNPT	1" MNPT
XBAR 20105	220	1-1/4 FNPT	1-1/4 MNPT	1/2" FNPT	1" MNPT
XBAR 20107	272	1-1/4 FNPT	1-1/4 MNPT	1/2" FNPT	1" MNPT
XBAR 25003	223	1-1/4 FNPT	1-1/4 MNPT	1/2" FNPT	1" MNPT
XBAR 25007	291	1-1/4 FNPT	1-1/4 MNPT	1/2" FNPT	1" MNPT

C.



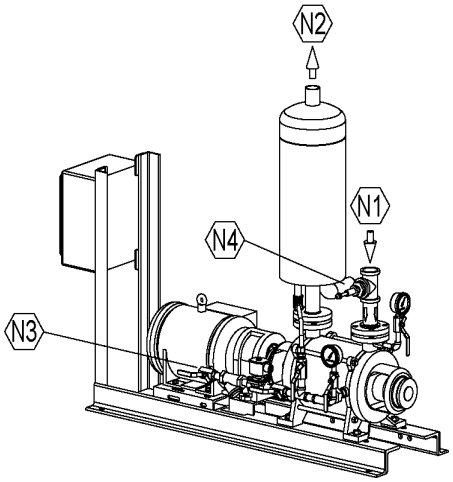
System Model Applicable	Weight	Nozzle Schedule - Size/Rating			
		N1 Suction	N2 Vent	N3 Serv. Liquid	N4 Overflow
XBAR 40412	500	1-1/2" FNPT	1-1/2" MNPT	1/2" FNPT	1-1/2" MNPT
XBAR 40517	580	2" FNPT	2" MNPT	1/2" FNPT	1-1/2" MNPT

D.



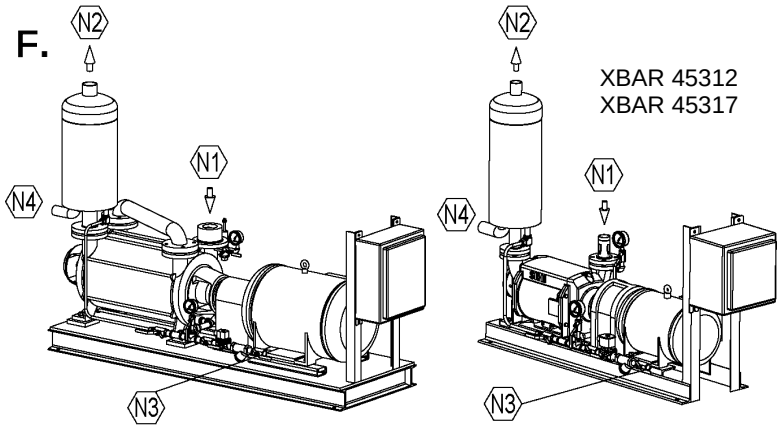
System Model Applicable	Weight	Nozzle Schedule - Size/Rating			
		N1 Suction	N2 Vent	N3 Serv. Liquid	N4 Overflow
XBAR 50518	824	2-1/2" FNPT	2-1/2" 150#RF	3/4" FNPT	1-1/2" MNPT
XBAR 50523	918	2-1/2" FNPT	2-1/2" 150#RF	3/4" FNPT	1-1/2" MNPT
XBAR 60520	1218	4" 150#RF FLG	4" 150#RF FLG	3/4" FNPT	1-1/2" MNPT
XBAR 60527	1478	4" 150#RF FLG	4" 150#RF FLG	3/4" FNPT	1-1/2" MNPT
XBAR 70123	2490	4" 150#RF FLG	4" 150#RF FLG	1-1/2" FNPT	2" MNPT
XBAR 70530	2894	5" 150#RF FLG	5" 150#RF FLG	1-1/2" FNPT	2" MNPT
XBAR 70540	3089	5" 150#RF FLG	5" 150#RF FLG	1-1/2" FNPT	2" MNPT

E.



System Model Applicable	Weight	Nozzle Schedule - Size/Rating			
		N1 Suction	N2 Vent	N3 Serv. Liquid	N4 Overflow
XBAR 3404	397	1-1/2" FNPT	1-1/2" MNPT	1/2" FNPT	1-1/2" MNPT
XBAX 3408	414	1-1/2" FNPT	1-1/2" MNPT	1/2" FNPT	1-1/2" MNPT
XBAR 3704	436	1-1/2" FNPT	1-1/2" MNPT	1/2" FNPT	1-1/2" MNPT
XBAX 3708	498	1-1/2" FNPT	1-1/2" MNPT	1/2" FNPT	1-1/2" MNPT

F.

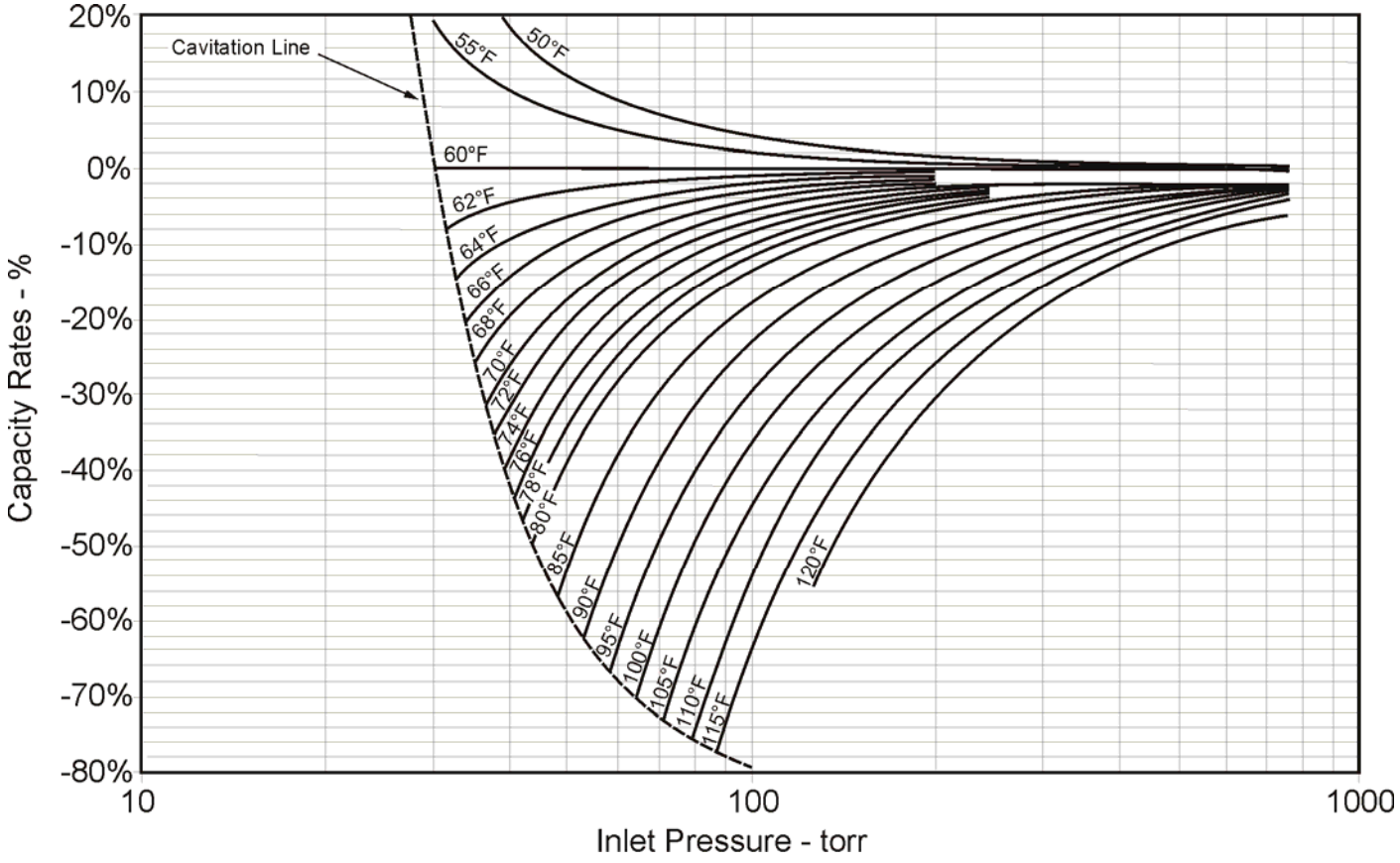


System Model Applicable	Weight	Nozzle Schedule - Size/Rating			
		N1 Suction	N2 Vent	N3 Serv. Liquid	N4 Overflow
XBAR 45312	559	1-1/2" FNPT	1-1/2" MNPT	1/2" FNPT	1-1/2" MNPT
XBAR 45317	620	1-1/2" FNPT	1-1/2" MNPT	1/2" FNPT	1-1/2" MNPT
XBAR 55312	890	2" FNPT	2" 150# RF	3/4" FNPT	1-1/2" MNPT
XBAR 55316	908	2" FNPT	2" 150# RF	3/4" FNPT	1-1/2" MNPT
XBAR 55320	1025	2" FNPT	2" 150# RF	3/4" FNPT	1-1/2" MNPT
XBAR 65320	1392	2-1/2" 150# RF FLG	2-1/2" MNPT	3/4" FNPT	1-1/2" MNPT
XBAR 65327	1594	2-1/2" 150# RF FLG	2-1/2" MNPT	3/4" FNPT	1-1/2" MNPT
XBAR 75320	2854	4" 150# RF	6" 150# RF	1-1/2" FNPT	3" 150# RF
XBAR 75330	3139	4" 150# RF	6" 150# RF	1-1/2" FNPT	3" 150# RF
XBAR 75340	3737	4" 150# RF	6" 150# RF	1-1/2" FNPT	3" 150# RF

APPENDIX 2

EFFECTS OF SERVICE WATER TEMPERATURE

Single Stage Liquid Ring Vacuum Pumps



SERVICE LIQUID TEMPERATURES

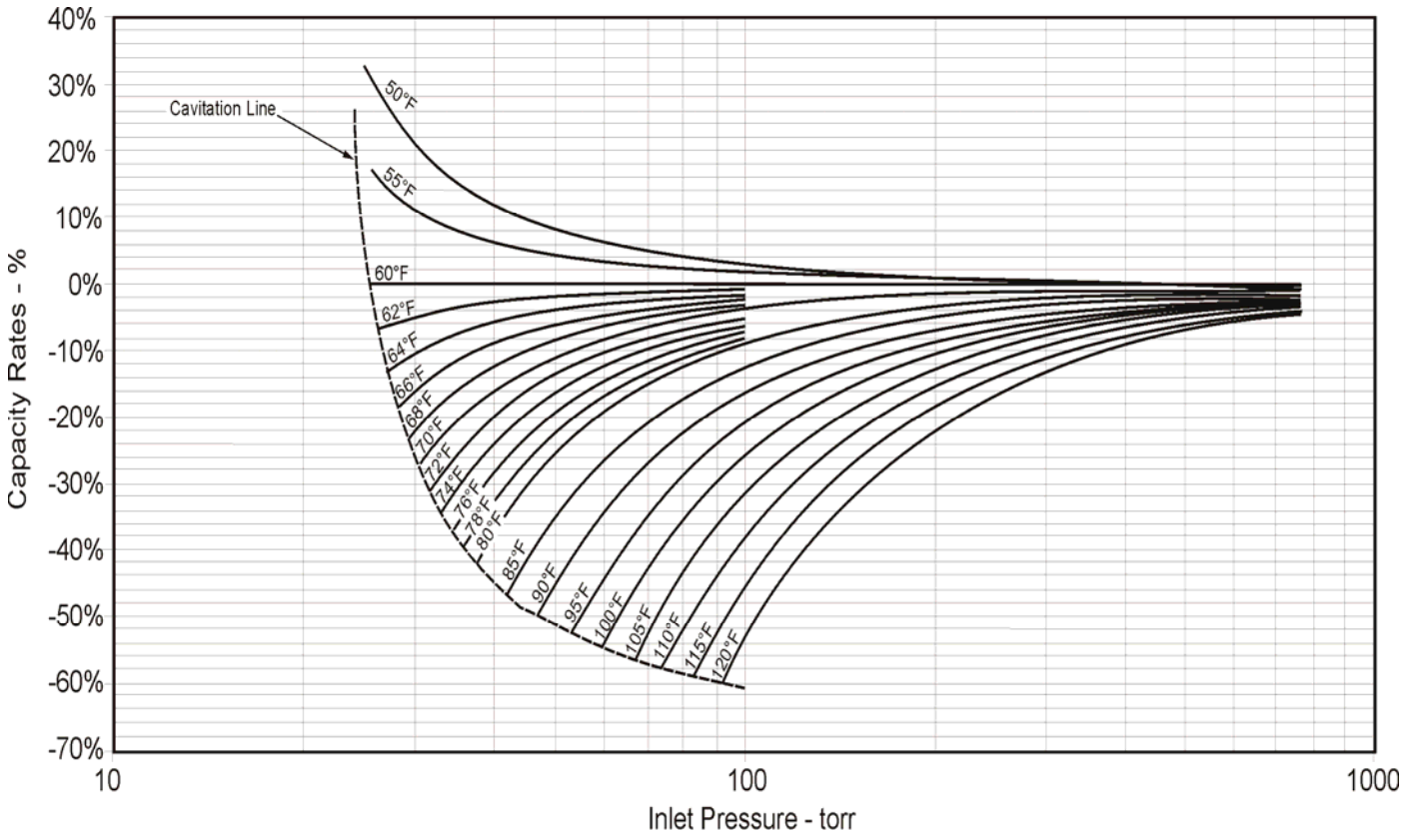
Service liquid temperatures affect pump performance. Increasing temperatures result in higher vapor pressures and reduction in effective pump performance.

SIHI standard capacity data is based on water @ 59°F (15°C). Corrections for higher temperatures are obtained from the curves above.

If liquids with vapor pressures different than water are used, effects are obtained by finding the temperature at which water has the same vapor pressure as the liquid used and applying the water correction factor for that temperature.

EFFECTS OF SERVICE WATER TEMPERATURE - continued

Two Stage Liquid Ring Vacuum Pumps



SERVICE LIQUID TEMPERATURES

Service liquid temperatures affect pump performance. Increasing temperatures result in higher vapor pressures and reduction in effective pump performance.

SIHI standard capacity data is based on water @ 59°F (15°C). Corrections for higher temperatures are obtained from the curves above.

If liquids with vapor pressures different than water are used, effects are obtained by finding the temperature at which water has the same vapor pressure as the liquid used and applying the water correction factor for that temperature.

APPENDIX 3 – SERVICE LIQUID REQUIREMENTS

NOTE: For all tables in this appendix, refer to the end of each section for description of columns A, B, and C.

CLOSE COUPLED PUMP TABLES

PUMP MODEL - LEM 15

Pump Speed	12" Hg 455 torr			16" Hg 354 torr			20" Hg 252 torr			24" Hg 150 torr			28" Hg 49 torr		
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
3500	0.75	0.20	0.10	0.75	0.20	0.10	0.75	0.20	0.10	0.75	0.20	0.10	0.75	0.20	0.10
2900															

PUMP MODEL - LEM 20

3500	1.0	0.34	0.20	1.0	0.34	0.20	1.0	0.34	0.20	1.0	0.34	0.20	1.0	0.28	0.16
2900		0.26	0.15		0.26	0.15		0.27	0.16		0.27	0.16		0.20	0.11

PUMP MODEL - LEM 40

3500	1.5	0.5	0.3	1.5	0.5	0.3	1.5	0.5	0.3	1.5	0.5	0.3	1.5	0.4	0.2
2900															

PUMP MODEL - LEM 60

3500	1.5	0.7	0.5	1.5	0.8	0.5	1.5	0.8	0.5	1.5	0.7	0.5	1.5	0.7	0.4
2900		0.6	0.4		0.6	0.4		0.6	0.4		0.6	0.4		0.6	0.3

PUMP MODEL - LEM 110

1750	1.8	1.1	0.7	2.3	1.2	0.8	3.1	1.5	1.0	3.5	1.5	1.0	3.9	1.3	0.8
1450															

PUMP MODEL - LEM 170

1750	3.1	1.7	1.2	3.8	1.9	1.3	3.8	2.0	1.3	4.4	2.0	1.3	4.4	1.8	1.1
1450		1.4	0.9		1.6	1.0		1.7	1.1		1.7	1.1		1.4	0.8

PUMP MODEL - LEM 250

1750	3.3	1.7	1.3	3.8	2.0	1.4	4.3	2.2	1.5	4.7	2.4	1.6	5.2	2.2	1.4
1450		1.0	0.6		1.7	1.1		1.9	1.2		2.0	1.3		1.7	1.0

Column A is the flow in USGPM required - once through.

Column B is the make-up flow required when make-up water is 5°C (9°F) cooler than service water.

Column C is the make-up flow when make-up water is 10°C (18°F) cooler than service water.

SINGLE STAGE PUMP TABLES

		4" Hg 658 torr			16" Hg 354 torr			20" Hg 252 torr			24" Hg 150 torr		
Model	**RPM**	A	B	C	A	B	C	A	B	C	A	B	C
LPHR 3404	1750	1.0	0.5	0.3	3.0	0.8	0.5	3.8	1.0	0.5	4.4	1.0	0.6
	1450		0.4	0.2		0.7	0.4		0.8	0.4		0.9	0.5
LPHR 3408	1750	1.0	0.6	0.4	3.0	1.2	0.8	3.8	1.4	0.9	4.4	1.5	0.9
	1450		0.5	0.4		1.1	0.7		1.3	0.8		1.4	0.8

		8" Hg 557 torr			16" Hg 354 torr			20" Hg 252 torr			25.4" Hg 115 torr		
Model	**RPM**	A	B	C	A	B	C	A	B	C	A	B	C
LPHR 20103	3500	0.7	0.3	0.2	1.0	0.4	0.3	1.2	0.4	0.3	1.3	0.5	0.3
	2900		0.2	0.1		0.3	0.2		0.3	0.2		0.4	0.2
LPHR 20105	3500	0.7	0.4	0.2	1.0	0.5	0.3	1.2	0.5	0.3	1.3	0.6	0.4
LPHR 20107	3500	0.7	0.4	0.3	1.0	0.5	0.3	1.2	0.6	0.4	1.5	0.7	0.4
	2900		0.3	0.2		0.4	0.3		0.5	0.3		0.5	0.3

		8" Hg 557 torr			16" Hg 354 torr			20" Hg 252 torr			24" Hg 100 torr		
Model	**RPM**	A	B	C	A	B	C	A	B	C	A	B	C
LPHR 40412	1750	1.4	0.9	0.7	2.5	1.4	1.0	3.2	1.6	1.1	3.9	1.8	1.2
	1450		0.8	0.6		1.2	0.8		1.4	0.9		1.5	1.0
LPHX 40412	1750	1.4	0.9	0.7	2.5	1.4	1.0	3.2	1.6	1.1	3.9	1.8	1.2
	1450		0.8	0.6		1.2	0.8		1.4	0.9		1.5	1.0
LPHR 40517	1750	2.0	1.3	0.9	6.0	2.5	1.6	7.0	2.7	1.7	7.3	2.7	1.7
	1450		1.2	0.8		2.2	1.3		2.3	1.4		2.4	1.4
LPHX 40517	1750	2.0	1.3	0.9	6.0	2.5	1.6	7.0	2.7	1.7	7.3	2.7	1.7
	1450		1.2	0.8		2.2	1.3		2.3	1.4		2.4	1.4
LPHR 50518	1750	4.8	2.7	1.7	7.8	3.7	2.4	9.0	4.0	2.6	10.5	4.3	2.7
	1450		2.3	1.3		3.1	1.9		3.4	2.7		3.5	2.7

SINGLE STAGE PUMP TABLES – SERVICE LIQUID RATES (Cont.)

		8" Hg 577 torr			16" Hg 354 torr			20" Hg 252 torr			26" Hg 100 torr		
Model	**RPM**	A	B	C	A	B	C	A	B	C	A	B	C
LPHR 50523	1750	3.1	2.2	1.7	6.5	3.8	2.6	8.4	4.3	2.9	10.2	4.6	3.0
	1450		2.0	1.4		3.2	2.1		3.7	2.4		3.9	2.4
LPHX 50523													
LPHR 60520	1750	4.8	3.1	2.3	6.4	4.0	2.9	8.0	4.7	3.4	10	5.5	3.8
	1450		2.7	1.9		3.5	2.4		4.1	2.8		4.7	3.1
LPHR 60527	1750	5.2	3.6	2.7	7.5	4.9	3.7	8.6	5.5	4.0	11	6.4	4.5
	1450		3.3	2.4		4.4	3.1		4.9	3.4		5.6	3.8
LPHX 60527													
LPHR 70123	1150	5.0	3.7	3.0	9.3	6.2	4.7	13	7.8	5.6	14	8.2	5.8
	975		3.5	2.7		5.6	4		6.9	4.7		7.2	4.9
	880		3.3	2.5		5.4	3.8		6.6	4.4		6.8	4.5
LPHR 70530	1150	8.5	6.0	4.6	15	9.2	6.7	19	11	7.5	22	12	8.2
	975		5.4	3.9		8.2	5.6		9.5	6.4		10	6.7
	880		5.1	3.6		7.7	5.2		9.0	5.9		9.7	6.2
LPHR 70540	1150	9.0	6.8	5.5	17	11	8.3	21	13	9.4	24	14	10
	975		6.1	4.6		9.9	6.9		11	7.8		12	8.3
	880		5.9	4.3		9.5	6.6		11	7.4		12	7.9

Column A (Once through) shows the amount of service liquid required by the pump, in U.S. gallons per minute. When installed with partial recirculation, part of this water is reused. The amount of make-up liquid for this kind of operation is shown in columns B and C.

Column B amount of make-up when service liquid at pump is approximately 9°F (5°C) warmer than the make-up temperature.

Column C amount of make-up when service liquid at pump is approximately 18°F (10°F) warmer then the make-up temperature.

TWO STAGE PUMP TABLES – SERVICE LIQUID RATES

		20" Hg 252 torr			25" Hg 125 torr			27" Hg 75 torr			28.9" Hg 25 torr		
Model	**RPM**	A	B	C	A	B	C	A	B	C	A	B	C
LPHR 25003	3500	1.2	0.5	0.3	1.35	0.5	0.3	1.4	0.6	0.4	1.5	0.6	0.4
	2900		0.4	0.2		0.4	0.2		0.4	0.2		0.4	0.2
LPHR 25007	3500	1.2	0.6	0.4	1.35	0.6	0.4	1.4	0.7	0.4	1.5	0.7	0.4
	2900		0.5	0.3		0.5	0.3		0.6	0.4		0.6	0.4
LPHR 3704	1750	3.7	1.2	0.8	4.4	1.3	0.8	4.7	1.4	0.8	5.0	1.4	0.8
	1450		1.0	0.6		1.1	0.7		1.2	0.7		1.2	0.7
LPHR 3708	1750	4.7	1.7	1.1	5.5	1.7	1.0	5.7	1.7	1.0	6.0	1.7	1.0
	1450		1.4	0.9		1.5	0.9		1.5	0.8		1.4	0.8
LPHX 45008													
LPHR 45312	1750	3.2	1.7	1.2	3.4	1.6	1.1	3.5	1.6	1.0	3.5	1.5	1.0
	1450		1.4	0.9		1.4	0.9		1.3	0.8		1.3	0.8
LPHX 45312	1750	3.2	1.7	1.2	3.4	1.6	1.1	3.5	1.6	1.0	3.5	1.5	1.0
	1450		1.4	0.9		1.4	0.9		1.3	0.8		1.3	0.8
LPHR 45317	1750	3.3	1.9	1.4	3.8	2.0	1.4	3.9	2.0	1.4	4.1	2.0	1.3
	1450		1.6	1.1		1.7	1.1		1.7	1.1		1.6	1.0
LPHX 45317	1750	3.3	1.9	1.4	3.8	2.0	1.4	3.9	2.0	1.4	4.1	2.0	1.3
	1450		1.6	1.1		1.7	1.1		1.7	1.1		1.6	1.0
LPHR 55312	1750	8.5	4.2	2.7	9.0	4.0	2.5	9.8	4.0	2.5	12.0	4.2	2.6
	1450		3.2	1.9		3.2	1.9		3.2	1.9		3.3	1.9
LPHX 55312													
LPHR 55316	1750	9.0	4.4	2.9	10.0	4.5	2.9	10.9	4.4	2.8	13.5	4.7	2.8
	1450		3.7	2.0		3.7	2.3		3.5	2.1		3.7	2.7
LPHX 55316													

TWO STAGE PUMP TABLES – SERVICE LIQUID RATES (Cont.)

		20" Hg 252 torr			25" Hg 125 torr			27" Hg 75 torr			28.9" Hg 25 torr		
Model	**RPM**	A	B	C	A	B	C	A	B	C	A	B	C
LPHR 55320	1750	10.0	4.9	3.2	12.0	5.3	3.4	13.2	5.4	3.4	16.0	5.6	3.4
	1450		4.2	2.7		4.4	2.7		4.4	2.7		4.4	2.5
LPHX 55320													
LPHR 65320	1750	7.3	4.7	3.5	8.8	5.4	3.9	9.4	5.3	3.7	10.2	5.6	3.8
	1450		4.3	2.9		4.6	3.1		4.5	3.0		4.7	3.0
LPHX 65320													
LPHR 65327	1750	7.3	5.1	3.9	8.8	5.8	4.3	9.4	5.7	4.1	10.2	6.0	4.2
	1450		4.5	3.3		4.9	3.4		4.9	3.3		5.0	3.3
LPHX 65327													
LPHR 75320	1150	14	8.8	6.5	18	10	7.3	20	10.7	7.3	23	11	7.5
	975		7.7	5.4		8.6	5.6		9.1	5.9		9.0	5.6
	880		7.4	5.1		8.3	5.4		8.4	5.3		8.8	5.4
LPHR 75330	1150	16	11	7.8	19	12	8.3	21	12.2	8.6	24	13	8.8
	975		9.6	6.8		10	7.2		10.7	7.2		11	7.2
	880		8.7	5.9		9.5	6.3		9.8	6.4		10	6.5
LPHR 75340	1150	16	11	8.7	20	13	9.8	23	14.1	10.3	26	15	11
	975		9.9	7.2		11	7.8		11.9	8.0		12	8.0
	880		9.7	6.9		11	7.5		11.4	7.6		12	7.7

Column A shows the amount of service liquid required by the pump, in U.S. gallons per minute.
When installed with partial recirculation, part of this water is reused. The amount of make-up liquid for this kind of operation is shown in columns B, C, and D.

Column B shows amount of make-up when service liquid at pump is approximately 9°F (5°C) warmer than the make-up temperature.

Column C shows amount of make-up when service liquid at pump is approximately 18 °F (10°C) warmer than the make-up temperature.

Appendix 4 - Troubleshooting Liquid Ring Pumps and Process Systems

Problem 1 Insufficient Vacuum (too high inlet pressure)

General Description: Liquid ring pumps are normally useful at vacuum levels said to be in the rough vacuum field. Technically the rough vacuum field is defined as absolute pressures between 1 and 760 torr. Of this range liquid ring pumps by themselves are theoretically possible of operation from 0 in. Hg V, (760 torr) to 29 in. Hg V, (25 torr) with water as service liquid at 60°F or theoretically to 29.5 in. Hg V (approximately15 torr) with very low vapor pressure service fluids.

Failure to reach the required operating vacuum levels in a process can be further split into three major areas of concern: 1) Measurement equipment inaccuracies, 2) Process or design concerns, and 3) Pump wear.

Cause 1: Incorrect gauges, or low atmospheric pressure when using vacuum gauges.

Solution: Calibrate gauges and measure the absolute pressure at the site. Use one gauge as the reference gauge for all positions.

Cause 2: Insufficient pump capacity due to process conditions, leading to pump under-sizing. Process difficulties could include: excessive non-condensable carryover or leakage, pre-condenser condensable carryover due to high coolant temperature, improper coolant flows, fouled heat transfer surfaces, and or fouled condensate drains from condenser lading to hot condensate carryover.

Solution: Check design conditions especially gas and liquid temperatures at the pump. Perform dry sealed system leak test after tightening all flanges and threaded connections. Check for proper gasket installation and condenser drain conditions.

Cause 3: Inlet line plugs or excessive pressure drop.

Solution: Measure vacuum at the pump casing and compare to other monitoring points in the system. Remove or reduce excessive pressure drops (plugs, valves, check valves, improper piping, etc.)

Cause 4: Service liquid vapor pressure too high due to insufficient cooling, contamination and/or wrong service liquid.

Solution: Check design conditions and rectify cooling problem as required.

Cause 5: High discharge pressure caused by plugged or fouled lines, improper installation of separator (vertical rise between separator and pump discharge too high) or poor plumbing practices.

Solution: Check discharge lines for causes of discharge pressure. Contact SIHI if discharge pressure cannot be changed (have design data available when calling). Check installation details per Chapter 4, figures 6, and 7.

Cause 6: Low rotational speed.

Solution: Check motor details. Check rotational speed and direction.

Cause 7: Pump damage or shaft not turning (contact SIHI for information).

Solution: Listen for improper noise or monitor vibration levels. Check internal clearances. Check to ensure pump inlet shaft rotates.

Problem 2 High motor amperage

Cause 1: High motor speed – wrong motor installed.

Solution: Check motor nameplate and confirm proper selection with SIHI representative and/or with purchase order or specifications.

Cause 2: Improper discharge piping installation (too small, or too much vertical rise from discharge connection to separator or plugged separator vent connections).

Solution: Check piping details, refer to installation notes in Chapter 2.

Cause 3: High discharge pressure caused by plugged vents, flooded separators, or high vent pressures.

Solution: Check for properly opened vent lines, open overflow from separators and or proper vented drain connection from separator drain and overflow.

Remove the offending condition. If pressure cannot be lowered, check design conditions with SIHI. Replacement motor may be required.

Cause 4: Excessive service liquid or carryover from the system.

Solution: Reduce service liquid flow and/or install knockout system prior to the pump. Attach continuous drain connections to drain or to separator. When possible, reduce excess liquid. If carryover is continuous from the system, note rates and contact SIHI for information on required motor sizing.

Cause 5: Improper motor sizing as a result of service liquid viscosity or density.

Solution: Determine design conditions and contact SIHI for information and proper selection details.

Problem 3 Noise

Cause 1: Most SIHI equipment operates at less than 85 dba at 3 to 5' when installed depending on pump size.
Cavitation (or grinding noises) in the pump casing caused by insufficient non-condensable flow. This can result from operation at too high vacuum, too high service liquid temperature, too little service flow, or too much condensable vapor.

Solution: Compare operating service flow rate with data in Appendix 3, and adjust accordingly.

Compare service water temperature with the data in Appendix 2.

Regulate inlet pressures and/or decrease service water temperatures as required. If partially recirculated service liquid is being used increase the make-up rate.

If pump is pulling from condenser, check condenser discharge temperature and pressure. Reduce condenser discharge gas temperature if possible by increasing coolant flow or cleaning condenser as applicable. Increase condenser pressure if lower than design.

In two stage pumps install air bleed valve in center intermediates or crossover manifold cover plug and bleed air into pump to reduce cavitation noise. **NOTE: it is suggested air be piped from the discharge separator vent not from atmosphere and care must be taken to ensure bleed does not result in problems due to increased oxygen content).** In single stage pumps bleed air in the suction as required or as possible.

Cause2: Slipping belts on V-belt drive-units or bearing problems (described usually as high pitched noises such as squealing).

Problem 4 Vibration

Cause: Typical vibration levels should be less than 2-3 mils displacement on any plane.

Vibration is usually caused by misalignment in direct driven units. Other sources are bearing failures, internal mechanical failures or inlet slug conditions.

Solution: Properly align pumps per Chapter 2.4 Alignment of pump and motor. Check and replace bearings as required, check shaft run out with dial gauge if necessary.

If inlet slug conditions exist, install a knockout or flow equalizer system as required. Contact SIHI for information.

Notes

XBA Vacuum Packages

Installation, Operation & Maintenance

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Web: www.filtration.eaton.com

Installation, Operation & Service Manual

All Metal Bag Filter Housings

Read all instructions before installation or operation of equipment. Failure to comply with these instructions could result in bodily injury or property damage.

IMPORTANT: Before installing the bag filter housing, check that the piping system operating conditions do not exceed their maximum pressure and temperature rating limit of the filter. Also make certain that the product which will be flowing through the filter vessel are chemically compatible with the materials used for the filter housing including the O-rings and the filter bag media.

Table of Contents

Introduction

Eaton bag filter housings are intended to be installed in pipeline systems to remove unwanted solids from fluids. All Eaton filters systems are designed to withstand rated pressures and are manufactured under an authorized ISO 9001:2000 program. Single bag and multi-bag filter housings should be installed only in systems where the flow can be interrupted in order to change the filter bags. Duplexed housings allow bag change out without shutting down the flow.

For additional information regarding Bag Filter Housings visit out website at:

www.filtration.eaton.com.com

Receiving

Inspect the vessel after unpacking for damage that might have occurred during transit. Report any damage to the carrier and vendor immediately. Remove instructions and all temporary packaging materials.

Filter Housing Installation

Remove the plastic protective caps from the flanges and/or threads. Position the filter so that the fluid enters the inlet connection. Support the housing by mounting legs or brackets (included with some models, or available as an option), or use pipeline hangers. Connect inlet and outlet piping, along with any gauges, valves, or vents, using industry standards for proper thread or flange connection.

Filter Bag Installation

Filter housings are not delivered with the filter bags installed, they must be installed as follows: Open the cover. Remove the bag hold down ring (s). If opening the housing for the first time remove restrainer basket and clean the inside of the housing to remove any shipping dust or packing debris. Inspect all O-rings, lubricate with compatible lubricant. Place the restrainer basket (if not already installed) into the filter housing. If the filter housing is fitted with an O-ring under the top lip of the restrainer basket, particular attention should be paid to ensure that this O-ring is correctly positioned prior to closing the housing.

Insert the filter bag into the restrainer basket after first removing the label from the bag. Be certain that the filter bag is pushed to the bottom of the basket* and that the collar of the filter bag is pushed into the rim of the restrainer basket so as to achieve a tight seal.

**Consider ordering a reusable filter bag positioning device to assure that the bag is easily and properly seated in the restrainer basket. Also consider ordering SENTINEL® welded filter bags, SENTINEL Filter Bags fit securely into place, providing the perfect seal.*

Single Bag Housings: The bag hold down ring should then be placed into the vessel.

Filter Bag Installation...Continued

Multi-Bag Housings: Place the bag hold down rings over each basket and turn to secure under the hold down clips.

Before closing the cover, ensure that the sealing surfaces along with the cover O-ring are clean and damage free.

V-Clamp Adjustment

If the vessel has a V-Clamp, it should be opened and tightened by hand (single bag housings: turn handle counterclockwise to open and clockwise to close).

Swing Bolts

If the housing has a swing bolt cover closure, to avoid misalignment of the cover, tighten cover bolts in the sequence indicated in Figures 2 or 3.

Start-Up

WARNING: The piping system should be purged of air before full pressure is applied.

1. Close the valve on the outlet of the bag filter.
2. Open the bag filter vent.
3. Slowly and partially open the valve on the inlet of the bag filter.
4. Carefully vent all the air from the bag filter. Close the vent when liquid begins to discharge.
5. Fully open the inlet valve.
6. Fully open the outlet valve.

The system is now in operation.

Maintenance

The filter housing does not require any special maintenance other than cleaning with normal use. All parts should be regularly checked for corrosion and other damage. Install a new filter bag at every product change or if the bag becomes blinded. Differential pressure (the difference in pressure before and after the filter) will reveal if blinding has occurred. Eaton recommend changing the filter bag at a differential pressure of 20 psi; higher levels cause inefficient operation of the filter system and may force particulate through the filter bag material and contaminate the downstream liquid.

Shut-Down
Tightly close the valves near the inlet and outlet of the filter, release the pressure in the housing by opening the vent or drain valve. Open the cover carefully, and remove the filter bag. Attention should always be given to the O-rings and sealing surfaces, ensuring that they are clean and undamaged. Damaged O-rings should be replaced. Eaton recommends that O-rings be replaced each time the pressurized housing is opened. Reused O-rings may result in a faulty seal. Leaks from damaged O-rings or gaskets in no way indicate defects in the system.

Multi-Bag Housing Spring Lift
The cover lifting spring mechanism is maintenance free. If the mechanism starts to emit noise, remove dust cover and spray in a small amount of oil. The mechanism is balanced at the factory for the weight of the cover. Additional fixtures, such as gauges, can increase the weight and make a re-adjustment necessary. Remove the dust cover from the bottom of the spring cover; loosen the two lock nuts. Adjust the spring tension by simultaneously turning the two adjusting nuts that are located above each lock nut. Turn the nuts clockwise to increase the tension and increase the lifting capacity. Turn the nuts counterclockwise to decrease the tension and lifting capacity. After making adjustments, re-tighten the lock nuts and replace the dust cover.

CAUTION: Despite the ease with which the cover is lifted, the cover is very heavy. Do not place any part of your body under the cover while it is moving. The cover should always be in the fully opened position before changing the filter bag.

Typical Design

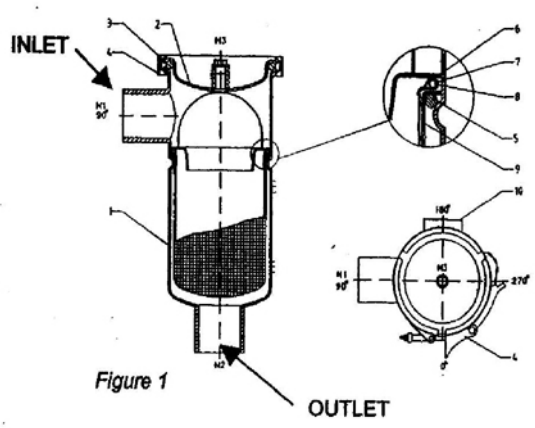
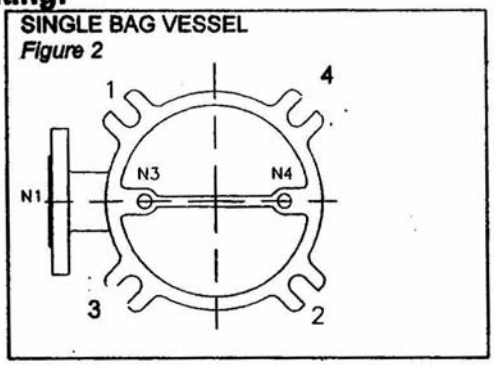


Figure 1

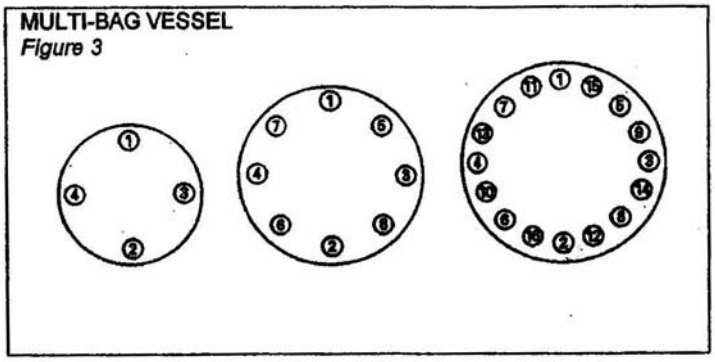
1. Filter housing body
2. Cover
3. Cover O-Ring
4. Closure
5. O-ring/gasket (not all models)
6. Filter bag hold down
7. Filter bag (not included)
8. Filter bag ring (part of filter bag)
9. Restrainer basket

Bolting:

SINGLE BAG VESSEL
Figure 2



MULTI-BAG VESSEL
Figure 3



1. Place the O-ring on the surface to be sealed.
2. Bring the sealing surface into contact with the O-ring.
3. Clean bolts and lubricate them with suitable lubricant.
4. Position the bolts and finger tighten the nuts.
5. Follow bolting sequence suggested in sketches above.
6. During the initial tightening sequence, do not tighten any bolts more than 30%. Doing so may cause misalignment of the flange and the O-ring maybe be crushed.
7. Continue bolt tightening (following sequence) until tight, making certain that the bolts have been stressed evenly.

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Eaton provides the most complete range of standard cast pipeline strainers for coarse filtration available from any manufacturer. These include Simplex, Duplex and Y Type Strainers, in Iron, Bronze, Carbon and Stainless Steel. For ultra-pure applications, strainers of all plastic construction are available. Cast Pipeline Strainers range in size from 1/2" to 36" and larger.

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With Eaton Filter Housings you have your choice of high grade investment cast construction or engineered fabricated construction in stainless steel or carbon steel. Or, for extremely corrosive or ultra-pure services, you can choose all-plastic construction. You can be sure Eaton Filter Housings will meet specifications because they are all made to ISO 9001:2000 Standards. Eaton has representatives in over 40 countries, experienced professionals to provide the filtration help you need, when and where you need it.

Choosing the correct filter bag is critical to the success of you application. Don't trust anything less than a filter bag from Eaton. They're made under ISO 9001:2000 Standards to ensure the consistent, reliable performance that you demand. Eaton Filter Bags fit all Eaton Filter Housings and the housings of most other manufacturers as well.

Find out more on the web at:
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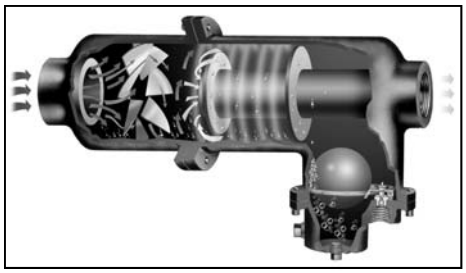

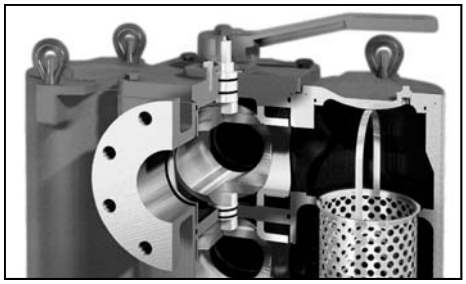

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INSTALLATION, OPERATION AND MAINTENANCE FOR SIZES: 300, 400, 500, 600

WARNING: Because of the possible danger to person(s) or property which may result from improper use of products, it is important that correct procedures be followed. Products must be used in accordance with the Engineering information specified in the catalog. Proper installation, operation and maintenance procedures must be observed. The instructions in the instruction manuals must be followed. Inspections should be made as necessary to assure safe operation under prevailing conditions. Proper guards and other suitable safety devices or procedures as may be desirable or as may be specified in safety codes should be provided, and are neither provided by Master Power Transmission nor are the responsibility of Master Power Transmission. This unit and its associated equipment must be installed, adjusted and maintained by qualified personnel who are familiar with the construction and operation of all the equipment in the system and the potential hazards involved. When risk to persons or property may be involved, a failsafe device must be an integral part of the driven equipment beyond the speed reducer output shaft.

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TABLE OF CONTENTS

NOTE: In the case sizes 300 and 400, the reference to MOTO DRIVE implies MOTO DRIVE and/or MAS-51 Drive, as applicable.

IMPORTANT REMINDERS

1. Change MOTO DRIVE unit speeds only when the unit is running.
2. REEVES MOTO DRIVE units are assembled to operate under requirements of the unit assembly number. MOTO DRIVE units with reducers should not be changed to a different assembly number without factory approval.
3. Some MOTO DRIVE units with reducers are shipped with reducers drained. *Do not operate unit before adding proper amount of lubricating oil.*
4. REEVES reducers are effectively vented. Do not allow reducer vent to become clogged.
5. Check your power supply with motor nameplate rating before making electrical connections.

DRIVE IDENTIFICATION

When inquiring about or ordering replacement parts for a REEVES MOTO DRIVE unit, aways specify the drive ID number and other nameplate information.

NOTE: If the nameplate is unreadable or missing, the MOTO DRIVE unit original ID number is stamped into the beltcase underneath one of the inspection plates.

INSTALLATION

> **WARNING**
>
> **To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.**

1. A rigid base is essential for mounting the MOTO DRIVE unit.
2. Mount and fasten the MOTO DRIVE unit into positior so that the output (variable speed) shaft of the MOTO DRIVE unit is in alignment with the driven shaft of the equipment. Use shims, when necessary, to obtain alignment. MOTO DRIVE shafts should turn freely when the unit is secured to the mounting.
3. Connect the MOTO DRIVE unit output shaft to the driven shaft of the equipment by desired method. Accurate alignment of the shafts is very important when couplings or gears are used. In addition to accurate shaft alignment, sprocket or pulley alignment on the shafts is important for chain or belt connections.
4. Lubricate the MOTO DRIVE unit as detailed in the lubrication section. (Lubrication instructions are also shown on the MOTO DRIVE nameplate.)
5. Connect electrical power to the MOTO DRIVE unit.

> **DANGER**
>
> **The user is responsible for conforming with the National Electrical Code and all other applicable local codes. Wiring practices, grounding, disconnects and overcurrent protection are of particular importance. Failure to observe these precautions could result in severe bodily injury or loss of life.**

6. REEVES VARI-SPEED MOTO DRIVE unit is set for the specified speed range and tested at the factory. Following complete lubrication, MOTO DRIVE unit is ready for immediate use.
7. **NOTE:** Before placing unit with any reducer into operation, check to see that all instructions covering vent plug and oil level plugs have been completed.

NOTE: Change speeds only when unit is running.

OPERATION AND CARE

1. Keep belt contact surfaces of the discs clean.
2. When a MOTO DRIVE unit is not to be operated for a period of 30 days or more, before final stopping of the unit, shift into low speed position. (Tension spring will then place minimum pressure on the belt.) See long-term storage instructions.
3. Correct lubrication is essential to good MOTO DRIVE unit operation as is periodically shifting the unit through its range to distribute the lubricant.

MOTOR AND PULLEY LUBRICATION

Use only a properly refined neutral mineral grease, free of acid, alkali and sulphur with a consistency corresponding to No. 1 NLGI. Type and grade of lubricants suitable for MOTO DRIVE units are suggested by the following list:

MOBIL OIL CORP. MOBILTEMP NO. 1; TEXACO NOVATEX NO. 1; SINCLAIR GREASE NO. 1; AMERICAN OIL CO. AMOLITH GREASE NO. 1; SHELL ALVANIA NO. 1.

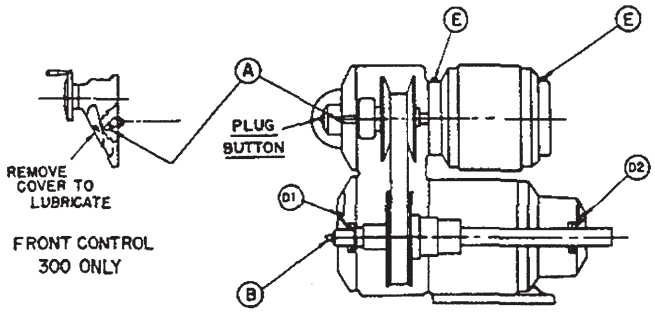


Diagram No. 1 MOTO DRIVE Lubrication Points

The following lubrication instructions apply to MOTO DRIVE units operating under normal conditions (40 to 60 hours a week, dry-dust free atmosphere).

1. Lubricate sliding discs at least at two-week intervals. Apply two or three effective grease gun strokes to lubrication fittings at points A and B, Dia. 1. Shift the drive through its entire speed range to distribute lubricant.

NOTE: An effective grease gun stroke is defined as that stroke of the grease gun after resistance to the flow of lubricant is experienced. This will ensure the lubricant is working through the system and that all voids will be filled with fresh clean lubricant.

2. Lubricate motor bearings at point (E) and MOTO DRIVE variable shaft bearings at points (D1) and (D2,) Diagram 1, in accordance with users general plant practice for lubricating ball bearing motors or at least once each 6 months for most installations. Apply lubricant until grease shows around the shaft at the bearing plates. Plugs at points (D1), (D2) and (E) must be removed and lubrication fitting installed to apply lubricant.

NOTE "C" FLOW UNITS WITH REDUCERS
Lubricate at (D1). No lubrication required at (D2).

"Z" FLOW UNITS WITH REDUCERS
Lubricate at (D2). No lubrication required at (D1).

3. The thrust bearing on the constant speed disc assembly is pre-lubricated and requires no further lubrication.

4. Shift unit completely through its speed range to distribute lubricant.

To ensure correct lubrication when operating under conditions other than normal, the drive should have added protection as recommended by the factory.

PARALLEL REDUCER LUBRICATION

CAUTION

NOTE: REEVES parallel reducers are shipped without oil and must be filled before use! Failure to fill the reducer will result in damage to the reducer and void the warranty!

Fill reducer with a good grade of non-detergent oil. Select the proper viscosity based on ambient temperature from the following chart:

Ambient Temp	SAE Crankcase	SAE Gear	ISO Viscosity
Degrees F	Oil Grade	Oil Grade	Grade
100 to 140	50	90	220
40 to 100	40	85W	150
0 to 40	20	80W	68
Below 0	Consult Factory		

Oil level is indicated by red oil level plug. Remove red level plug and fill reducer slowly until oil runs out of level hole. Verify oil level every 60 days by removing red level plug. Refill as required.

All reducers are vented. Double and triple stage parallel reducers are shipped with a black plastic plug in the vent hole. Remove this plug and replace with vent plug attached to red lube tag. Single parallel reducers have pin vents installed in the gearhead. Ensure that all vents are free and clear.

Drain and refill gearbox with new oil every 6 months under normal factory environments. Hot, wet or dirty conditions may require more frequent changes.

RIGHT ANGLE REDUCER LUBRICATION

1. The gear case is shipped with a solid plug in the vent hole. This plug must be removed and the attached vented plug installed according to location described in diagrams on attached lubrication tag.

2. A run-in period of about one (1) week operation should be sufficient before the original lubricant is drained and refilled with new lubricant of recommended viscosity.

3. Lubricate right angle reducers with a type and grade of oil suitable for worm gear reducers as suggested by the following chart.

RECOMMENDED LUBRICANTS

AMBIENT TEMP.	LUBRICANT VISCOSITY GROUP				
	OUTPUT SHAFT SPEED				
	Up to 300 R. P. M.			Over 300 R. P. M.	
- 65°F. to 0°F.*	318.59				
- 45°F. to + 20°F.*	318.60			318.59	
- 5°F. to + 55°F.	318.61			318.60	
+ 15°F. to +110°F.	318.62			318.62	
+ 100°F. to +165°F.	318.63			318.63	
VISCOSITY GROUP 318	**59**	**60**	**61**	**62**	**63**
AMOCO OIL CO. AMOCO PREMAGEAR EP AMOCO				460 WORM GEAR OIL	
ALTANTIC RICHFIELD CO. ARCO MINERAL GEAR OIL			90	140	
CARR OIL LUB 733 EP				140	
DARMEX IND. CORP. GEAR BOX OIL				DX-9140	
DUBOIS CHEMICAL CO. E.G.O. EP			90	140	
FISK F. BROTHERS LUBRIPLATE APG			90	140	
GULF OIL CO. TRANSGEAR LUBE			220	460	680
E. F. HOUGHTON CO. MP GEAR OIL			90	140	
KEYSTONE LUB CO.				WG-A	
MOBIL OIL CORP. AVREX MOBIL FLUID EXTRA HECLA MOBILUBE CYLINDER OIL	903	423	HD90	600W	SHC634 SUPER CYLIN-DER
PHILLIPS PET. CO. PHILUBE			90	140	
SHELL OIL CO. AEROSHELL FLUID	4	5-L			
TEXACO VANGUARD				460	
ULTRA CHEM CHEM LUBE				140	

* For temperatures below 10° special oil seals are required. All Group 63 Lubes must be changed after 300 hours of high temperature operation.

4. Lubricant should be drained and the gear case refilled every 750 hours of normal daily use; every 500 hours if operated continuously or in high temperatures. Group 63 lubricants must be changed very 300 hours of high temperature operations.

5. All bearings, operating above the oil level that are provided with a plug, should be lubricated with a good grade of ball bearing grease when changing gear lubricant. DO NOT OVER-LUBRICATE GREASE PACKED BEARINGS.

6. Right angle reducers are shipped with oil in the unit.

BELT REPLACEMENT

REEVES VARI-SPEED MOTO DRIVE unit is designed for easy servicing and replacement of belts.

Identify your MOTO DRIVE unit by style—"C" flow, Diagram No. 2 or "Z" flow, Diagram No. 4. Follow instructions given below that apply to your unit.

FOR "C" FLOW STYLE MOTO DRIVE units and for alternate "Z" flow style MOTO DRIVE assembly numbers 100-A, 100-AL, 100-AR, 111-A and 112-A. Unit assembly number is on MOTO DRIVE nameplate.

1. If MOTO DRIVE belt is in operating condition, shift MOTO DRIVE unit while running, to high speed position.

2. Disconnect electrical service to unit.

WARNING

To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

3. Remove side inspection plate (1), Diagram No. 2.

4. Remove four cap screws holding control assembly (2), and remove control assembly from the MOTO DRIVE unit, Diagram No. 2.

5. Remove sliding disc (3), Diagram No. 2 (thrust bearing and thrust bearing housing (11) is attached to (3), Diagram No. 3. Do not disturb position of the fixed disc on motor shaft.

NOTE: On No 600 MOTO DRIVE units only, remove control adaptor ring (6) from belt case before removing sliding disc assembly (3). Units with front control, see Item 12C.

6. Pull upper loop of the belt over the end of the fixed disc hub, see Diagram No. 3. On some units additional spreading of the variable shaft discs may be necessary to gain enough belt slack for the belt to clear the fixed disc hub.

7. Remove variable shaft bearing plate (4) after belt is free from fixed disc hub.

8. Free the belt from the variable discs (5) and remove from the case.

9. Place the new belt into the case, positioned loosely around the variable speed discs (5) and replace bearing plate (4).

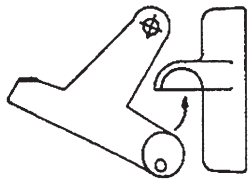
10. Spread the variable speed discs (5) and position the belt between the discs deep enough to secure belt slack; then loop the belt over the fixed disc hub.

11. Replace sliding disc (3) with attached thrust bearing and housing onto fixed disc hub.

11A. Replace control adaptor ring (6) (No. 600 only).

12. **(300 MOTO DRIVE units only)** Replace control assembly (2). Prongs on the shifting yoke can be properly positioned in the lugs on the thrust bearing housing (11), only when the housing lugs are below the prongs. (Ref. Part No. 42, Pg. 12) see pg. 22.

12A. **NOTE:** On No. 400 MOTO DRIVE units, the housing lugs will be above the prongs.



SIZE 400 ONLY

NOTE: Yoke may have pins or lugs to prevent improper engagement.

12B. **(500-600 MOTO DRIVE units only)** Replace control assembly (2) by inserting rollers into milled slots of thrust bearing housing (11) and guide pin into slot provided in control housing. (Ref. Part No. 42, Page 12.)

On the 500 front control the sliding disc and thrust bearing housing will be removed and replaced along with the complete control assembly.

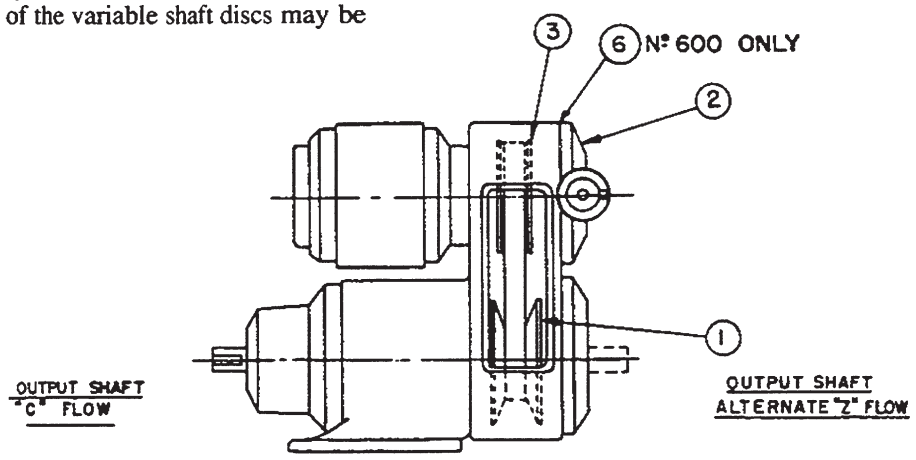


Diagram No. 2. Belt changing procedure, "C" flow

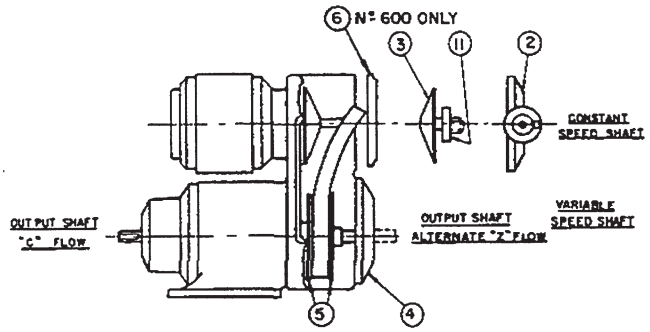


Diagram No. 3. Belt changing procedure, "C" flow

12C. On the 600 front control, separate the control and the disc assembly by removing the two fulcrum screws holding the shifting yoke to the thrust bearing housing. The control adaptor ring (6) may now be removed, followed by the disc assembly (3).
Reverse this procedure in assembly.
Bolt control housing to case.

NOTE: No additional adjustment is required for correct belt alignment.

13. Replace inspection plate (1).

14. Lubricate constant speed disc assembly at point "A," Diagram No. 1, and MOTO DRIVE is ready for operation.

15. Reconnect electrical service.

FOR "Z" FLOW STYLE MOTO DRIVE units except as noted for alternate "Z" flow style assemblies shown under "C" flow style MOTO DRIVE instructions.

1. If MOTO DRIVE belt is in operating condition, shift *MOTO DRIVE unit while running, to high speed* position.

2. Disconnect the electrical service to unit.

WARNING

To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

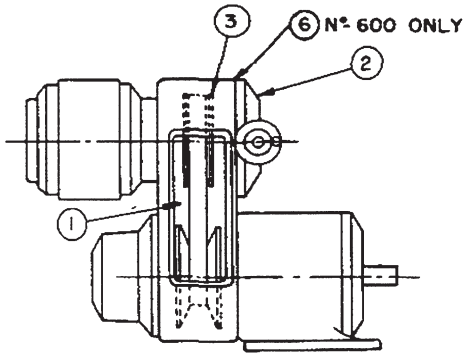


Diagram No. 4. Belt changing procedure, "Z" flow

3. Remove side inspection plates (1), Diagram No. 4.

4. Remove four cap screws holding control assembly (2) and remove control assembly from the MOTO DRIVE unit, Diagram No. 4.

NOTE: On No. 600 MOTO DRIVE units only, remove control adaptor ring (6) from belt case before removing sliding disc (3). Units with front control, see Item 13C.

5. Remove the sliding disc (3), Diagram No. 4. (Thrust bearing and thrust housing is attached to (3), Diagram No. 5. Do not disturb position of the fixed disc on motor shaft.

6. Pull upper loop of the belt over the end of the fixed disc hub, Diagram No. 5. On some units additional spreading of the variable shaft discs may be necessary to gain enough belt slack for the belt to clear the fixed disc hub.

7. Remove the variable shaft bearing plate (4) after belt is freed from fixed disc hub (Diagram No. 5).

8. Remove the following parts from the variable shaft, Diagram No. 5:
(7)—Collar and bearing. Mark position of bearing on variable shaft.

WARNING

Extreme care must be used in removing the spring cartridge assembly. Inspect for clearance between spring cartridge and retaining ring. If there is no clearance, DO NOT PROCEED. The spring cartridge may be ruptured. Do not attempt to remove the retaining ring. Reassemble unit and send to RELIANCE Service Center for repair. Failure to observe these precautions could result in bodily injury.

(8)—Retaining ring

WARNING

Extreme care must be used in removing spring cartridge assembly. Cartridge can separate resulting in uncontrolled release of spring, resulting in severe personal injury or death. Keep all body parts and personnel clear of projection path should sudden release occur. See safety instructions for removal and disposal of spring cartridge.

(9)—Spring and cartridge assembly
(10)—Sliding disc.

9. Remove old belt from the case.

10. Place new belt into the case, positioned loosely around the variable shaft and replace sliding disc (10), spring and cartridge assembly (9), retaining ring (8), collar and bearing (7), and bearing plate (4). If unit is equipped with collar and bearing assembly, be sure to secure collar on eccentric part of bearing and secure with the set screws. Eccentric collar end of bearing goes on variable shaft first. Position bearing to mark.

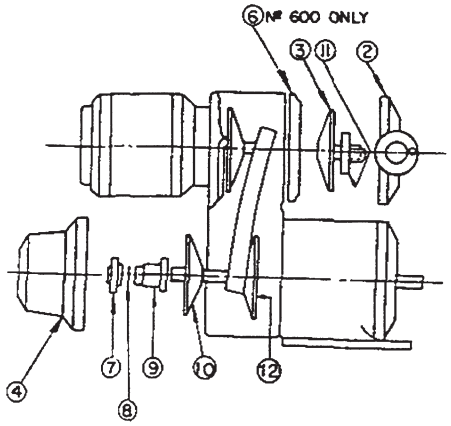


Diagram No. 5. Belt changing procedure "Z" flow

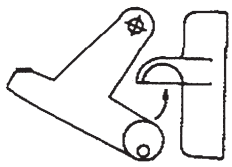
11. Spread the variable speed discs (10) and (12), (Diagram No. 5,) and position the belt between the discs deep enough to secure slack; then loop the belt over the fixed disc hub.

12. Replace sliding disc (3) with thrust bearing and housing, onto fixed disc hub.

12A. Replace control adaptor ring (6). (No. 600 only.)

13. **(300 MOTO DRIVE units only)** Replace control assembly (2). Prongs on the shifting yoke can be properly positioned in the lugs on the thrust bearing housing (11), only when the housing lugs are below the prongs. (Ref. Part No. 42, Pg. 13) see pg. 22.

13A. **NOTE:** On No. 400 MOTO DRIVE units, the housing lugs will be above the prongs.



SIZE 400 ONLY

13B. **(500-600 MOTO DRIVE units only)** Replace control assembly (2) by inserting rollers into milled slots of thrust bearing housing (11) and guide pin into slot provided in control housing. (Ref. Part No. 42, Pg. 13).

On the 500 front control the sliding disc and thrust bearing housing will be removed and replaced along with the complete control assembly.

13C. On the 600 front control, separate the control and the disc assembly by removing the two fulcrum screws holding the shifting yoke to the thrust bearing housing. The control adaptor ring (6) may now be removed, followed by the disc assembly (3). Reverse this procedure in assembly. Bolt control housing to case.

NOTE: No additional adjustment is required for correct belt alignment.

14. Replace inspection plate (1).

15. Lubricate constant speed disc assembly at point (A), Diagram No. 1, and MOTO DRIVE unit is ready for operation.

16. Reconnect electrical service.

AVAILABLE HANDWHEEL POSITIONS		
MOTO DRIVE MODELS	STANDARD POSITIONS	OPTIONAL POSITIONS
VERTICAL	W	NW,N,NE, & E
45° RIGHT	E	SE,NE,N, & NW
45° LEFT	W	SW,NW,N & NE
HORIZ. RIGHT	N	NW & W
HORIZ. LEFT	N	NE & E

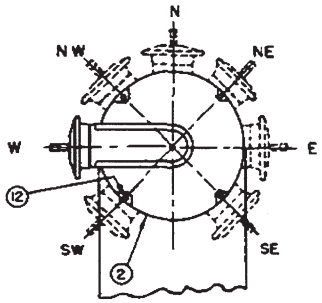


Diagram No. 6 Available handwheel positions

CHANGING HANDWHEEL LOCATION

Unless otherwise specified each MOTO DRIVE unit is shipped with the control assembly positioned so that the control handwheel is in the standard position according to the unit model.

Changing the control handwheel location is a simple procedure.

1. Remove four cap screws (12), Diagram No. 6.
2. Rotate the control housing (2), without separating the control assembly from the case, so that the handwheel is in the desired position.
3. Replace four cap screws.

NOTE: If the control housing becomes separated from the case, refer to Item 12 (300 MOTO DRIVE units) or Item 12A (for 400), 12B (500-600 MOTO DRIVE units) for "C" flow assemblies or Item (13 for 300), (13A for 400) 13B (500-600 MOTO DRIVE units) for "Z" flow assemblies.

DISC REMOVAL—CONSTANT SPEED

Removal of Constant Speed Disc Assembly.

1. Follow steps 1-6 of belt changing instructions.
2. Loosen two set screws that secure fixed disc to motor shaft.

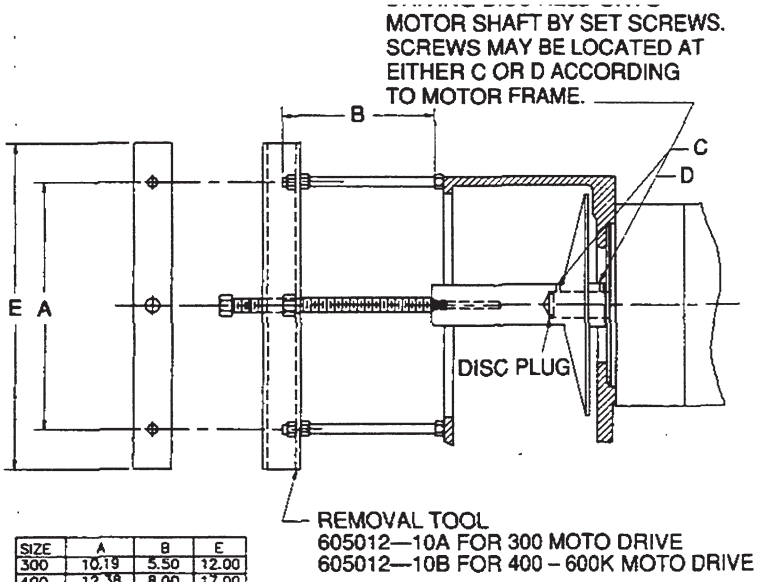
NOTE: On units using a motor adaptor, it will be necessary to remove the small steel plate secured to the adaptor with two (2) screws. This will allow access to the set screws located on the short hub of the fixed disc.

3. Remove fixed disc.

NOTE: This may be accomplished with the aid of a pulling device as shown in Diagram 7. Special Disc Pullers are available thru Renewal Parts.

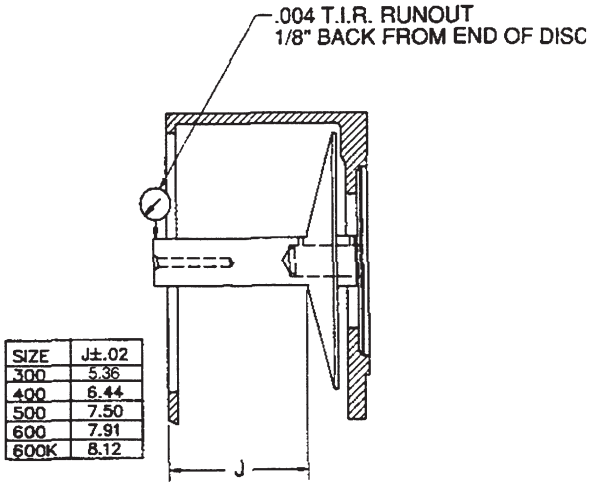
Size 050-300 PN 605012-10A
Size 400-600 PN 605012-10B

NOTE: Do not lose the disc plug (see Diagram 7) as this will be needed during reassembly.



SIZE	A	B	E
300	10.19	5.50	12.00
400	12.38	8.00	17.00
500	15.06	8.00	17.00
600	15.06	8.00	17.00
600K	15.06	8.00	17.00

CONSTANT DISC REMOVAL
DIAGRAM 7



SIZE	J±.02
300	5.36
400	6.44
500	7.50
600	7.91
600K	8.12

CONSTANT DISC INSTALLATION
SETTING "J" DIMENSION

DISC INSTALLATION—CONSTANT SPEED

1. Apply a small amount of heavy grease in the bottom of the disc bore. This is to provide a holding effect on the disc plug.
2. Insert disc plug into disc bore.
3. Check to be sure that motor shaft key is in proper position and that it is "staked" into keyway to prevent it walking back into the feathered area of motor shaft keyway.
4. Install fixed disc onto motor shaft and set proper "J" dimension for the respective size unit, see diagram above.
5. Tighten the two set screws to secure fixed disc to motor shaft.
6. Use dial indicater to measure radial runout of fixed disc hub. If TIR exceeds .004, loosen setscrews, remove and reinstall disc (set J dimension), tighten set screws and recheck.
7. Follow steps 11 through 15 of belt changing instructions to complete this installation.

DISC REMOVAL—VARIABLE SPEED ("C" Flow Unit)

1. Follow belt changing instructions steps 1 through 7.
2. Remove variable shaft bearing (78), (Diagram 8).
3. With belt removed, check for free movement between fixed disc and sliding disc.

WARNING

Extreme care must be used in removing the spring cartridge assembly. Inspect for clearance between spring cartridge and retaining ring. If there is no clearance, DO NOT PROCEED. The spring cartridge may be ruptured. Do not attempt to remove the retaining ring. Reassemble unit and send to RELIANCE Service Center for repair. Failure to observe these precautions could result in bodily injury.

4. Remove the retaining ring (73) (Diagram 8), washer and spring cartridge assembly.
5. Remove fixed disc (65), sliding disc (66) and spring cartridge (154).
6. Inspect spring cartridge for wear, corrosion, etc. Replace if necessary. See safety instructions for disposal of spring cartridge assembly.

NOTE: The spring cartridge may come off with the sliding disc. This is acceptable as they can be separated as required later.

WARNING

Extreme care must be used in removing spring cartridge assembly. Cartridge can separate resulting in uncontrolled release of spring, resulting in severe personal injury or death. Keep all body parts and personnel clear of projection path should sudden release occur. See safety instructions for removal and disposal of spring cartridge.

DISC INSTALLATION—VARIABLE SPEED ("C" Flow Unit)

1. Check to see that the retaining ring (70) is properly seated in its groove on the variable shaft.
2. Install the spring cartridge over the variable shaft. Smaller end of the cartridge goes on the shaft first.
3. Check to see that the lubrication grooves in the sliding disc are free from hard caked grease or other foreign materials. Hand pack this disc to ensure proper lubrication of the disc prior to start up.

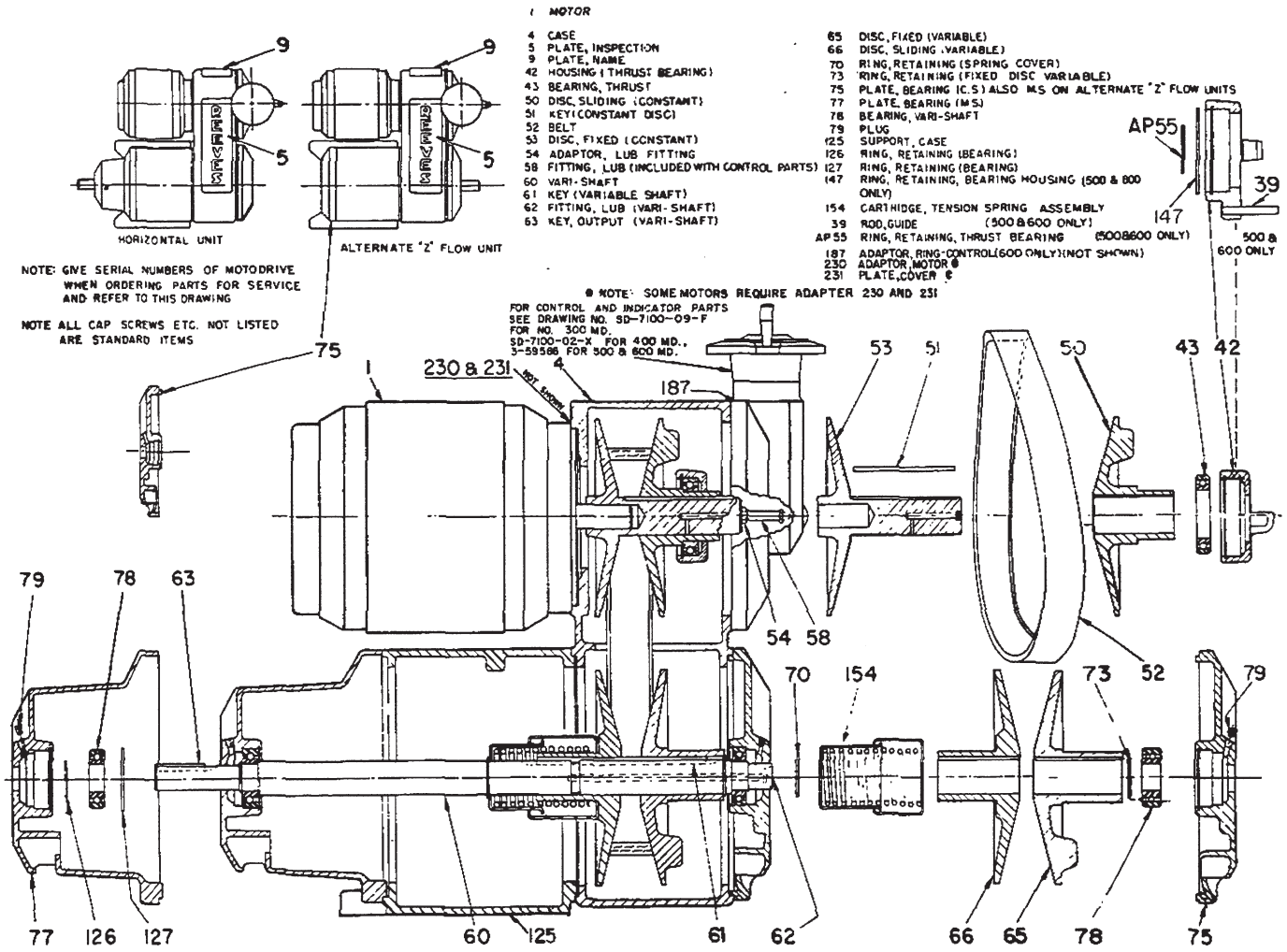


Diagram 8

4. Install sliding disc (66) onto variable shaft. See that the spring cartridge is properly seated onto the extended hub portion of this disc.
5. Wipe any excess grease from the sliding disc face.
6. Install the belt over the variable shaft and put into the belt case.
7. Install fixed disc (65).
8. Insert the retaining ring (73) into its groove in the variable shaft.
9. Install a new bearing on the variable shaft. Be careful not to damage the bearing during installation.
10. Install the bearing plate (75).
11. Refer to the belt changing instructions 10 through 15 to complete this reassembly.

DISC REMOVAL—VARIABLE SPEED ("Z" Flow Unit)

Refer to belt changing instructions for "Z" flow unit on page 6, steps 1-9. At this point, the fixed disc (65), diag. 8, may be removed.

DISC INSTALLATION—VARIABLE SPEED ("Z" FLOW UNIT)

1. Check to be sure retaining ring (73) is in its proper position on variable shaft (60) and seated in the retaining ring groove.
2. Slide V/S fixed disc (65) over variable shaft and up against the retaining ring.
3. Place belt (52) into belt case loosely around variable shaft.
4. Slide V/S sliding disc (66) over variable shaft and against the fixed disc. Hand pack disc with proper lubricant prior to installing over variable shaft.
5. Install spring cartridge (154), retaining ring (70), collar and/or bearing as required.

If the unit is equipped with collar and bearing assembly, be sure to secure collar on eccentric part of bearing and secure with the set screws. Eccentric collar goes on variable shaft first and then the bearing.

The spring cartridge is properly installed when the large end is placed over the sliding disc hub, making contact with the shoulder on the disc.

6. Install bearing plate.
7. Place the belt between the two discs and pull down toward the variable shaft. This is necessary so that sufficient belt slack is available to loop belt over the constant speed fixed disc hub.
8. Proceed as in steps 12 through 16 of the belt changing instructions to complete this reassembly.

SAFETY INSTRUCTIONS SPRING CARTRIDGE STORAGE AND DISPOSAL

> WARNING
>
> **Cartridge contains spring under compression. When not installed in drive, handle with extreme care. Ensure that uncontrolled expansion will not result in bodily injury!**

STORAGE: Store with some method of axial retention to prevent uncontrolled expansion.

DISPOSAL: Preferred method is to dispose of spring in free (uncompressed) state. However, do not attempt to remove compressed spring from cartridge without piloted press fixture or a long (5 times cartridge length minimum) threaded rod with oversize end plates and nuts. Use such fixture to carefully compress cartridge, then remove steel can and expand spring to free length.

Alternatively, dispose of cartridge with chain or threaded rod fastened through center hole to prevent uncontrolled expansion of spring.

ADDITIONAL SERVICE INFORMATION

For assistance, contact the DODGE MASTER REEVES Service Department, Regional Service Centers or your local authorized service shop.

RECOMMENDATIONS FOR LONG-TERM STORAGE OF REEVES MOTO DRIVE

> CAUTION
>
> **REEVES MOTO DRIVE units require preparation for long-term storage or storage in a condensing environment. In order to ensure serviceability after such storage, the unit must be protected in accordance with instructions included in the appropriate instruction manual under the heading "LONG-TERM STORAGE." Evidence of problems caused by improper storage conditions will void the warranty. Failure to observe this precaution can result in damage to, or destruction of the equipment.**

GENERAL

Consult RELIANCE Electric Service Bulletin A-8013 ("Recommendations for Long-term Storage of Gearmotors, MOTO DRIVES and Motors") for general storage instructions and instructions specific to motors and gear reducers. Also see Service Bulletin B-8078 for additional information on motors.

Follow all general recomendations for motors and reducers in addition to the following instructions specific to REEVES MOTO DRIVE unit.

MOTO DRIVE

1. Where long-term storage is expected, a MOTO DRIVE unit should be ordered with Chromalife discs.
2. For storage of all MOTO DRIVE units, remove the variable speed belt and store in a relaxed condition, Consult "Belt Replacement Instructions" section of appropriate service manual supplied with unit. This will prevent distortion and crushing of the belt from spring force. Coat disc faces and other exposed metal surfaces with corrosion-resistant coating. On size 300-600K, grease discs per instruction manual procedures.

   Tag unit to indicate belt must be reinstalled at startup.
3. Loosen screws on belt inspection plates and insert ¼" spacers to allow ventilation of belt, bearings and seals during storage.
4. Prepare motor and reducer per referenced instructions.
5. Cover units and store, preferably in a heated and dry (non-condensing) area.

RETURN TO SERVICE:

1. Dissassemble MOTO DRIVE unit, thoroughly clean all corrosion resistant coatings form disc faces and shafts. Inspect all parts (disc, bearings, control and linkages, etc.) for free movement.
2. Reinstall variable speed belt.
3. Where applicable, grease discs per instruction manual.
4. Drain and refill reducer with recommended lubricant. Clean vents.
5. After start-up, check bearing temperatures for indication of excessive heating indicating lubricant contamination or oxidation.
6. For detailed handling, installation and maintenance instructions, see manuals furnished with individual units. All safety precautions must be followed.

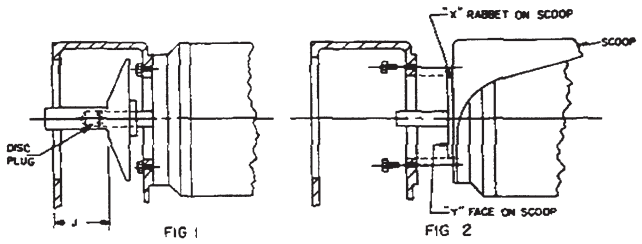


FIG 1 FIG 2

SIZE	300	400	500	600	600K
J	$5\frac{23}{64}$	$6\frac{7}{16}$	$7\frac{1}{2}$	$7\frac{29}{32}$	$8\frac{1}{8}$

All are $\pm$ 1/64

"C" FACE MOUNTING

1. Disconnect electrical service to unit.

WARNING

To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

2. Refer to Belt Replacement Instructions for removal of control and constant speed sliding disc assembly.
3. Loosen two set screws and remove the fixed disc from motor shaft.

NOTE: Do not lose disc plug as this will be needed during assembly.

4. Remove motor by removing four motor mounting screws from inside the case.

WARNING

Equipment being removed may be too heavy to control manually. Support it by external means. Failure to observe these precautions could result in bodily injury.

CAUTION:

Be sure motor shaft key is tightly in place in motor shaft keyway.

5. Place new motor into position and secure with four motor mounting screws to the MOTO DRIVE case.

NOTE: On units where a motor adaptor is used be sure the adaptor is installed properly between the case and motor before securing motor.

6. Replace constant speed fixed disc on motor shaft; be sure disc plug is in disc bore; locate position of disc as shown in Fig. 1 above, set "J" dimension and secure to motor shaft with the two set screws.
7. Refer to Belt Replacement Instructions for replacing constant speed sliding disc assembly and control.

SCOOP MOUNTING

1. Disconnect electrical service to unit.

WARNING

To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.

2. Refer to Belt Replacement Instructions for removal of control and constant speed sliding disc assembly.
3. Loosen two set screws and remove the fixed disc from motor shaft.

NOTE: Do not lose disc plug as this will be needed during assembly.

WARNING

Equipment being removed may be too heavy to control manually. Support it by external means. Failure to observe these precautions could result in bodily injury.

4. Remove scoop by removing four mounting screws from inside the case.
5. Remove motor from scoop by removing four mounting screws from motor feet.

CAUTION

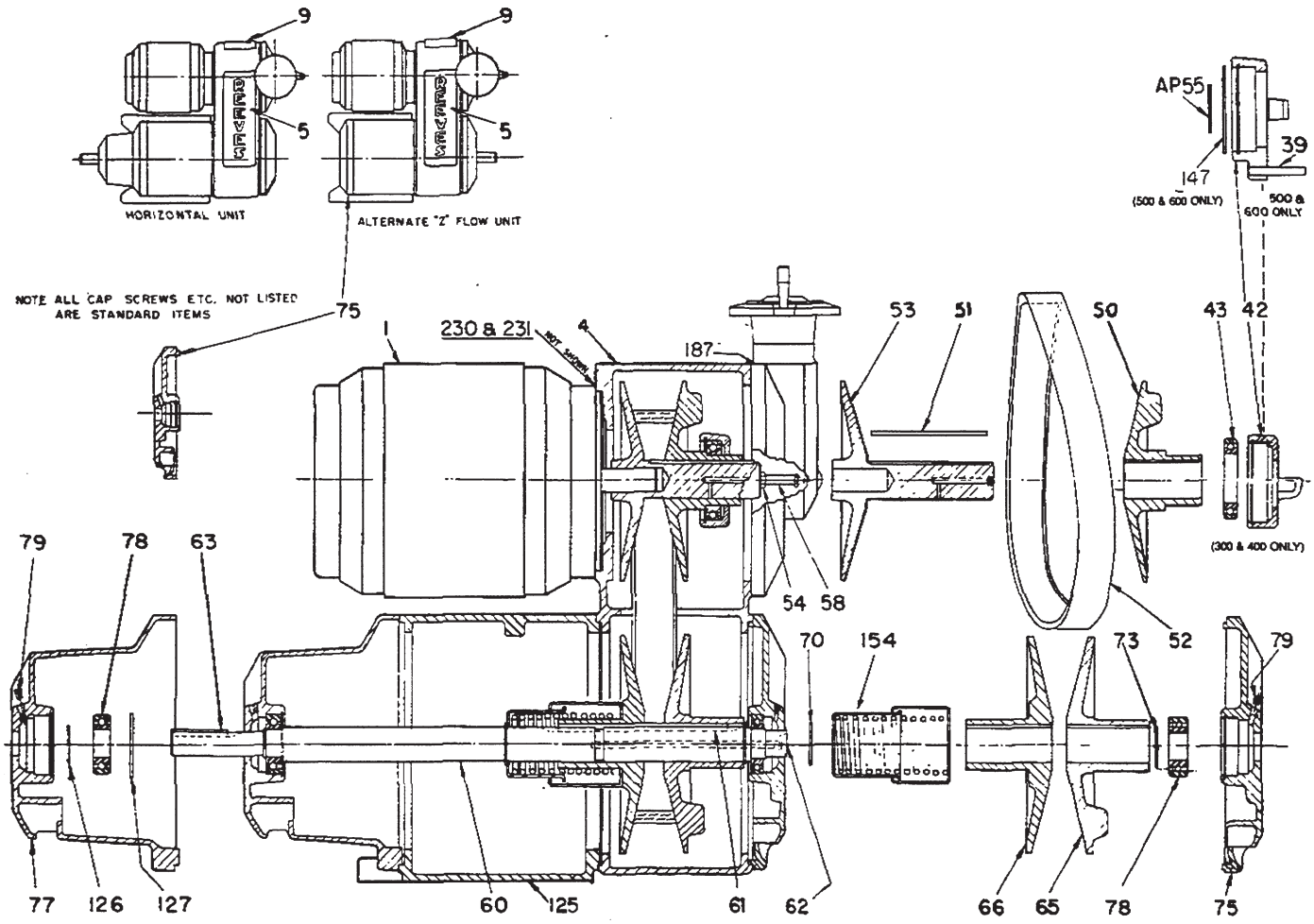
Be sure motor shaft key is tightly in place in motor shaft keyway.

6. Place motor on mounting pads of scoop. Secure motor to scoop with cap screws provided.
7. See Fig. 2 above. Place dial indicator on the motor shaft and indicate surfaces "X" (mounting rabbet on scoop) and "Y" (the face of mounting scoop). The total indicator reading in either case should not exceed .004 inches.

   Use shim stock under motor feet to align motor with mounting rabbet or scoop. The shim stock under the motor feet should not exceed .060 under any one foot.
8. When the motor has been aligned properly and secured in place, drill the two front feet and pin in place with tapered pins.
9. Mount scoop and motor as a unit on the MOTO DRIVE case.
10. Replace constant speed fixed disc on motor shaft: be sure disc plug is in place in disc bore; locate position of disc as shown in Fig. 1 above and secure to motor shaft with two set screws.
11. Refer to belt replacement instructions for replacing constant speed sliding disc assembly and control.

PARTS LIST — FOR SIZES - 300 - 400 - 500 - 600 REEVES VARI-SPEED MOTO DRIVE UNITS

"C" Flow Style — Vertical, 45° and Horizontal Models



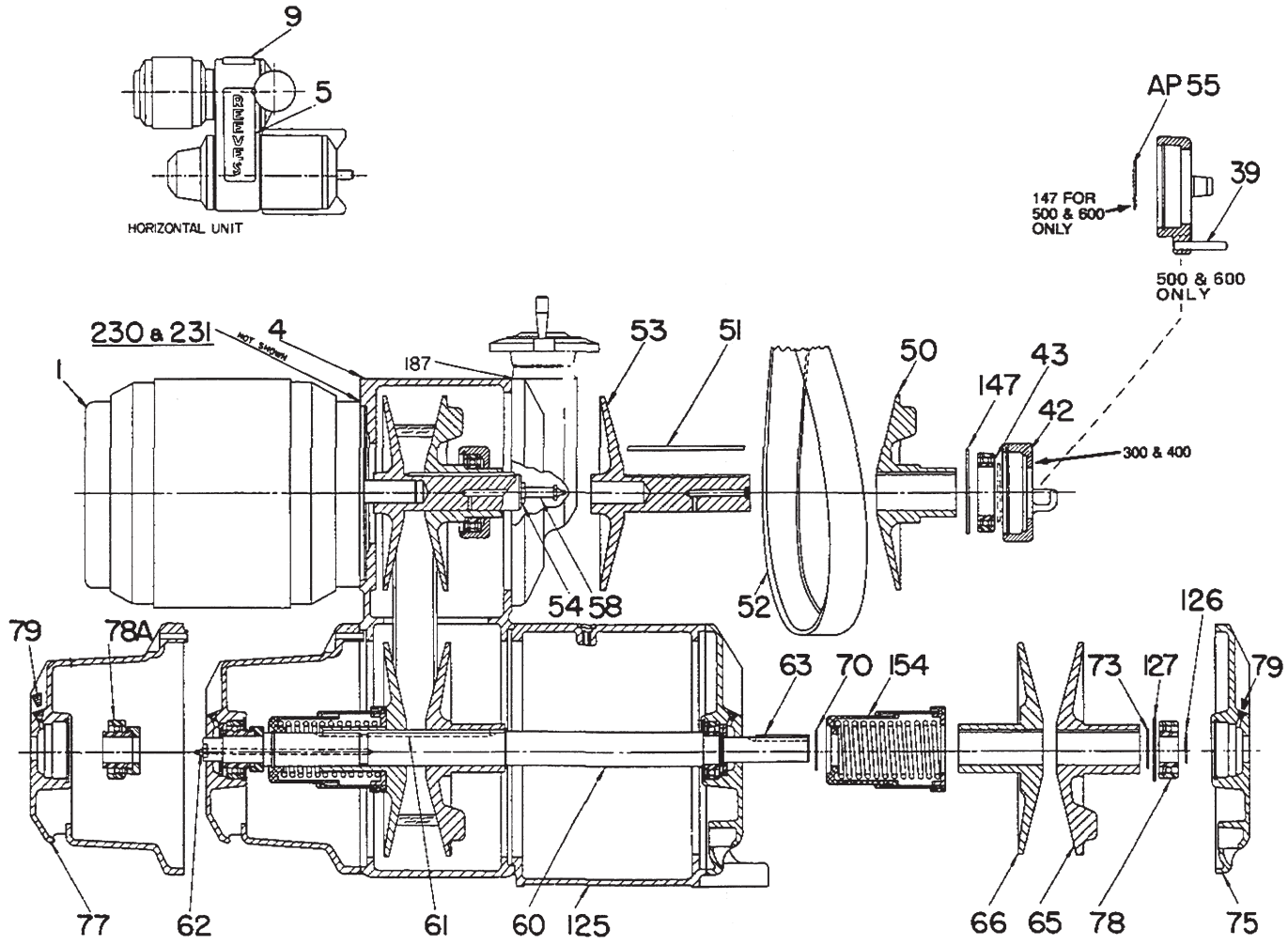
1	MOTOR
4	CASE
5	PLATE, INSPECTION
9	PLATE, NAME
39	ROD,GUIDE (500 & 600 ONLY)
42	HOUSING (THRUST BEARING)
43	BEARING, THRUST
50	DISC, SLIDING (CONSTANT)
51	KEY (CONSTANT DISC)
52	BELT
53	DISC, FIXED (CONSTANT)
54	ADAPTOR, LUB FITTING
58	FITTING, LUB (INCLUDED WITH CONTROL PARTS)
60	VARI-SHAFT
61	KEY(VARIABLE SHAFT)
62	FITTING, LUB (VARI-SHAFT)
63	KEY, OUTPUT (VARI-SHAFT)
65	DISC, FIXED (VARIABLE)
66	DISC, SLIDING, (VARIABLE)
70	RING, RETAINING (SPRING COVER)
73	RING, RETAINING (FIXED DISC VARIABLE)
75	PLATE, BEARING (C.S.) ALSO M.S. ON ALTERNATE "Z"FLOW UNITS
77	PLATE, BEARING (M.S.)
78	BEARING, VARI-SHAFT
79	PLUG
125	SUPPORT, CASE
126	RING, RETAINING (BEARING)
127	RING, RETAINING (BEARING)
147	RING, RETAINING, BEARING HOUSING (500 & 600 ONLY)
151	PLUG, BUTTON CASE SUPPORT
154	CARTRIDGE, TENSION SPRING ASSEMBLY
AP 55	RING, RETAINING, THRUST BEARING (500 & 600 ONLY)
187	ADAPTOR, RING-CONTROL(600 ONLY)(NOT SHOWN)
230	ADAPTOR, MOTOR (1)
231	PLATE, COVER (1)

(1) NOTE: SOME MOTORS REQUIRE ADAPTOR 230 AND PLATE 231

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST—FOR SIZES - 300 - 400 - 500 - 600 REEVES VARI-SPEED MOTO DRIVE UNITS

"Z" Flow Style—Vertical, 45° and Horizontal Models



1 MOTOR
4 CASE
5 PLATE, INSPECTION
9 PLATE, NAME
39 ROD, GUIDE (500 & 600 ONLY)
42 HOUSING (THRUST BEARING)
43 BEARING, THRUST
50 DISC, SLIDING (CONSTANT)
51 KEY (CONSTANT DISC)
52 BELT
53 DISC, FIXED (CONSTANT)
54 ADAPTOR, LUB FITTING
58 FITTING, LUB INCLUDED WITH CONT. PARTS
60 VARI-SHAFT
61 KEY (VARIABLE SHAFT)
62 FITTING, LUB (VARI-SHAFT)
63 KEY, OUTPUT (VARI-SHAFT)
65 DISC, FIXED (VARIABLE)
66 DISC, SLIDING (VARIABLE)
70 RING, RETAINING (SPRING COVER)
73 RING, RETAINING (FIXED DISC VARIABLE)
75 PLATE, BEARING (C.S.)
77 PLATE, BEARING (M.S.)
78 BEARING, VARI-SHAFT
78A BEARING & COLLAR (VARI-SHAFT)
79 PLUG
125 SUPPORT, CASE
126 RING, RETAINING (BEARING)
127 RING, RETAINING (BEARING)
147 RING, RETAINING, BEARING HOUSING (500 & 600 ONLY)
154 CARTRIDGE, TENSION SPRING ASSEMBLY
187 ADAPTOR, RING-CONTROL (600 ONLY)(NOT SHOWN)
230 ADAPTOR,MOTOR (1)
231 PLATE, COVER (1)

AP 55 RING, RETAINING, THRUST BEARING (500 & 600 ONLY)

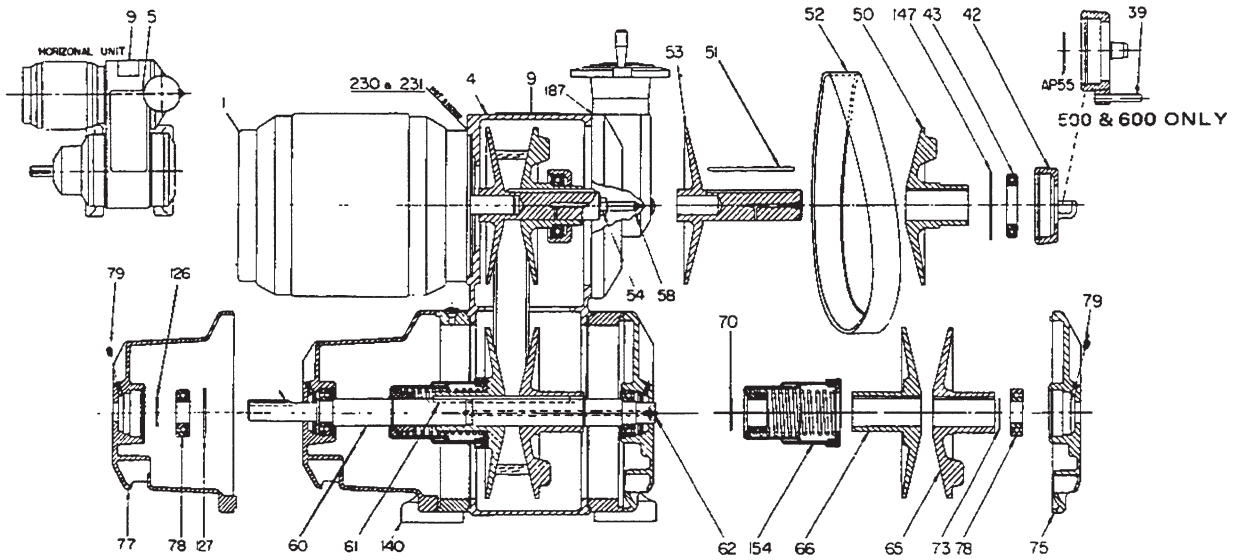
NOTE: ALL CAP SCREWS ETC. NOT LISTED ARE STANDARD ITEMS.

(1) NOTE SOME MOTORS REQUIRE ADAPTOR 230 & PLATE 231

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST—FOR SIZES - 300 - 400 - 500 - 600 REEVES VARI-SPEED MOTO DRIVE UNITS

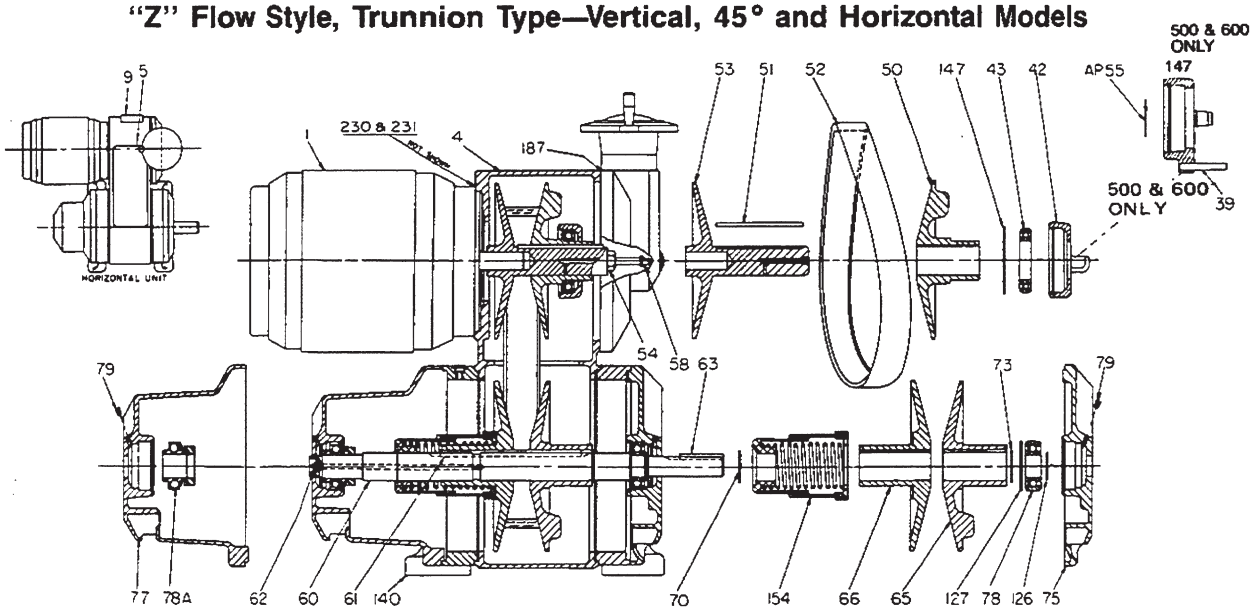
"C" Flow Style, Trunnion Type — Vertical, 45° and Horizontal Models



1	MOTOR	52	BELT	66	DISC, SLIDING (VARIABLE)	147	RING, RETAINING (THRUST BEARING) (500 & 600 ONLY)
4	CASE	53	DISC, FIXED (CONSTANT)	70	RING, RETAINING (SPRING COVER)	154	CARTDRIDGE, TENSION SPRING ASSEMBLY
5	PLATE, INSPECTION	54	ADAPTOR, LUB FITTING	73	RING, RETAINING (FIXED DISC VARIABLE)	AP55	RING, RETAINING THRUST BEARING (500 & 600 ONLY)
9	PLATE, NAME	58	FITTING, LUB (INCLUDING WITH CONT. PARTS)	75	PLATE, BEARING (C.S.)	187	ADAPTOR, RING-CONTROL (600 ONLY)(NOT SHOWN)
39	ROD, GUIDE (500, 600 ONLY)	60	VARI-SHAFT	77	PLATE, BEARING (M.S.)	230	ADAPTOR, MTR (1)
42	HOUSING (THRUST BEARING)	610	KEY(VARIABLE SHAFT)	78	BEARING, VARI-SHAFT	231	PLATE, COVER (1)
43	BEARING, THRUST	62	FITTING, LUB (VARI-SHAFT)	79	PLUG		
50	DISC, SLIDING (CONSTANT)	63	KEY, OUTPUT (VARI-SHAFT)	126	RING, RETAINING (BEARING)		
51	KEY (CONSTANT DISC)	65	DISC, FIXED (VARIABLE)	127	RING, RETAINING (BEARING)		
				140	ADAPTOR, TRUNNION		

(1) NOTE SOME MOTORS REQUIRE ADAPTOR 230 & 231

"Z" Flow Style, Trunnion Type—Vertical, 45° and Horizontal Models



1	MOTOR	60	VARI-SHAFT	126	RING, RETAINING, BEARING
4	CASE	61	KEY (VARISHAFT)	127	RING, RETAINING BEARING
5	PLATE, INSPECTION	62	FITTING LUB (VARI-SHAFT)	140	ADAPTOR, TRUNNION
9	PLATE, NAME	63	KEY OUTPUT (VARI-SHAFT)	147	RING, RETAINING, BEARING HOUSING (500 & 600 ONLY)
39	ROD, GUIDE (500 & 600 ONLY)	65	DISC, FIXED (VARIABLE)	154	CARTRIDGE, TENSION SPRING ASSEMBLY
42	HOUSING (THRUST BEARING)	66	DISC SLIDING (VARIABLE)	AP 55	RING, RETAINING THRUST BEARING (500 & 600 ONLY)
43	BEARNG THRUST	70	RING, RETAINING (SPRING COVER)	187	ADAPTOR, RING CONTROL (600 ONLY) (NOT SHOWN)
50	DISC SLIDING CONSTANT	73	RING, RETAINING (FIXED DISC VARIABLE)	230	ADAPTOR, MOTOR (MAX RANGE) (1)
51	KEY CONSTANT DISC	75	PLATE (BEARING) (C.S.)	231	PLATE, COVER (MAX RANGE) (1)
52	BELT	77	PLATE (BEARING) (M.S.)		
53	DISC, FIXED (CONSTANT)	78	BEARING (VARI-SHAFT)		
54	ADAPTOR LUB FITTING	78A	BEARING & COLLAR (VARI-SHAFT)		
58	FITTING, LUB (Included w/control parts)	79	PLUG		

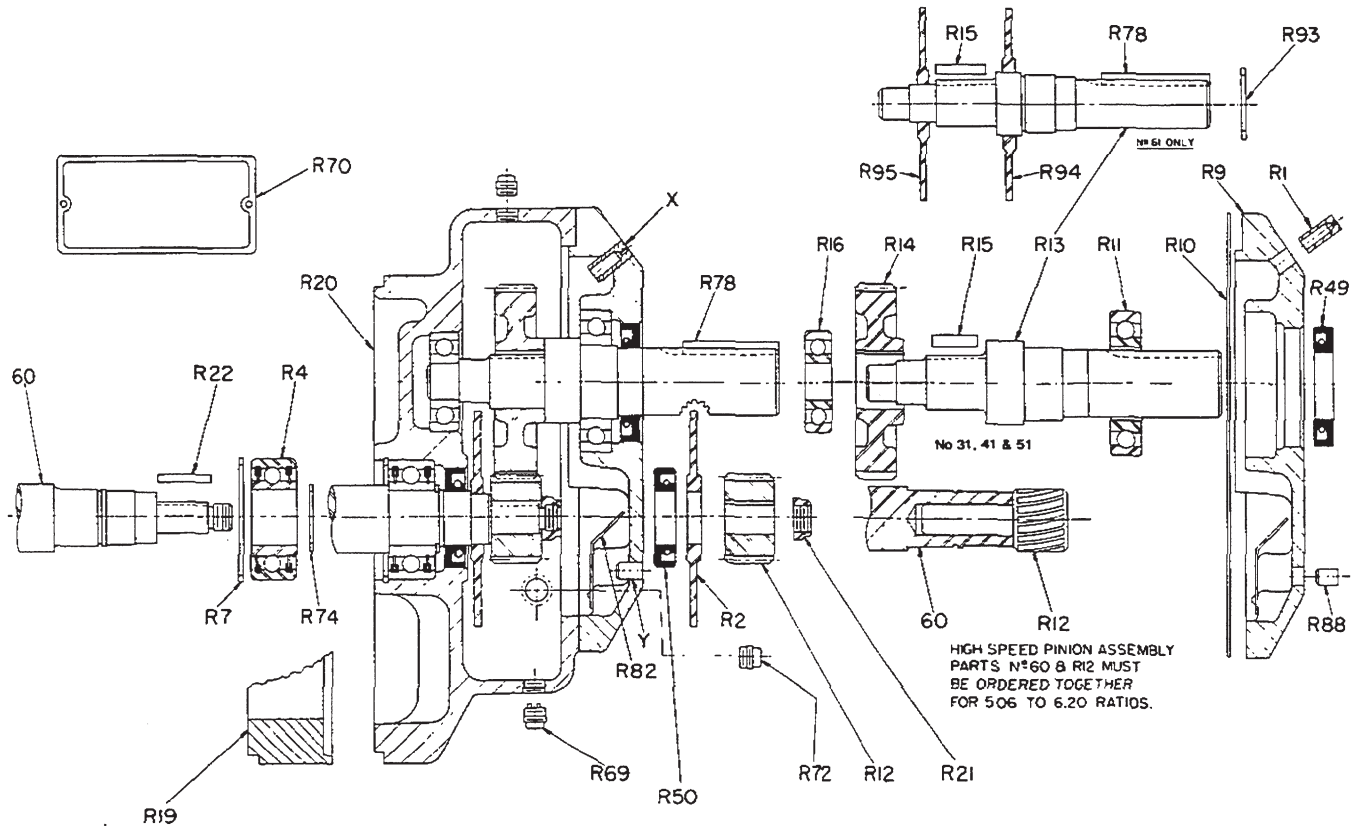
NOTE: ALL CAP SCREW ETC. NOT LISTED ARE STANDARD ITEMS.

(1) NOTE SOME MOTORS REQUIRE ADAPTOR 230 & PLATE 231

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST—FOR SINGLE REDUCTION REDUCERS—SIZES 31, 41, 51, and 61

(300 - 400 - 500 - 600 size Moto Drive units)



60 SHAFT, VARIABLE
R1 PIN, VENT
R2 SLINGER, OIL (OUTPUT SHAFT UP ON ALL REDUCERS)
(OUTPUT SHAFT UP RIGHT & LEFT ON 51 REDUCER)
R4 BEARING, HIGH SPEED
R7 RING, RETAINING (HIGH SPEED BEARING)
R9 HEAD, GEARBOX
R10 GASKET, HEAD
R11 BEARING, OUTER (LOW SPEED)
R12 PINION, HIGH SPEED
R13 SHAFT, OUTPUT
R14 GEAR, LOW SPEED
R15 KEY (LOW SPEED GEAR)
R16 BEARING-INNER (LOW SPEED)
R19 ADAPTOR, RING (USE WITH RED. M.S.TRUN. TYPE ONLY)
R20 HOUSING, GEAR
R21 NUT, HIGH SPEED SHAFT
R22 KEY, HIGH SPEED PINION
R49 SEAL, OIL (LOW SPEED)
R50 SEAL, OIL (HIGH SPEED)
R69 PLUG, DRAIN (MAGNETIC)
R70 PLATE, RATIO & LUBRICATION
R72 PLUG, OIL LEVEL
R74 RING, RETAINING (HIGH SPEED BEARING)
R78 KEY, OUTPUT SHAFT
R82 GUARD, SPLASH
R88 PIN, PLUG
R93 RING, RETAINING
R94 SLINGER, OIL (OUTPUT SHAFT TO R.,L., & DOWN ON 51 & 61 REDUCER)
R95 SLINGER, OIL (OUTPUT SHAFT TO R.,L., & DOWN ON NO 61 REDUCER
(OUTPUT SHAFT DOWN ON NO. 51 REDUCER)

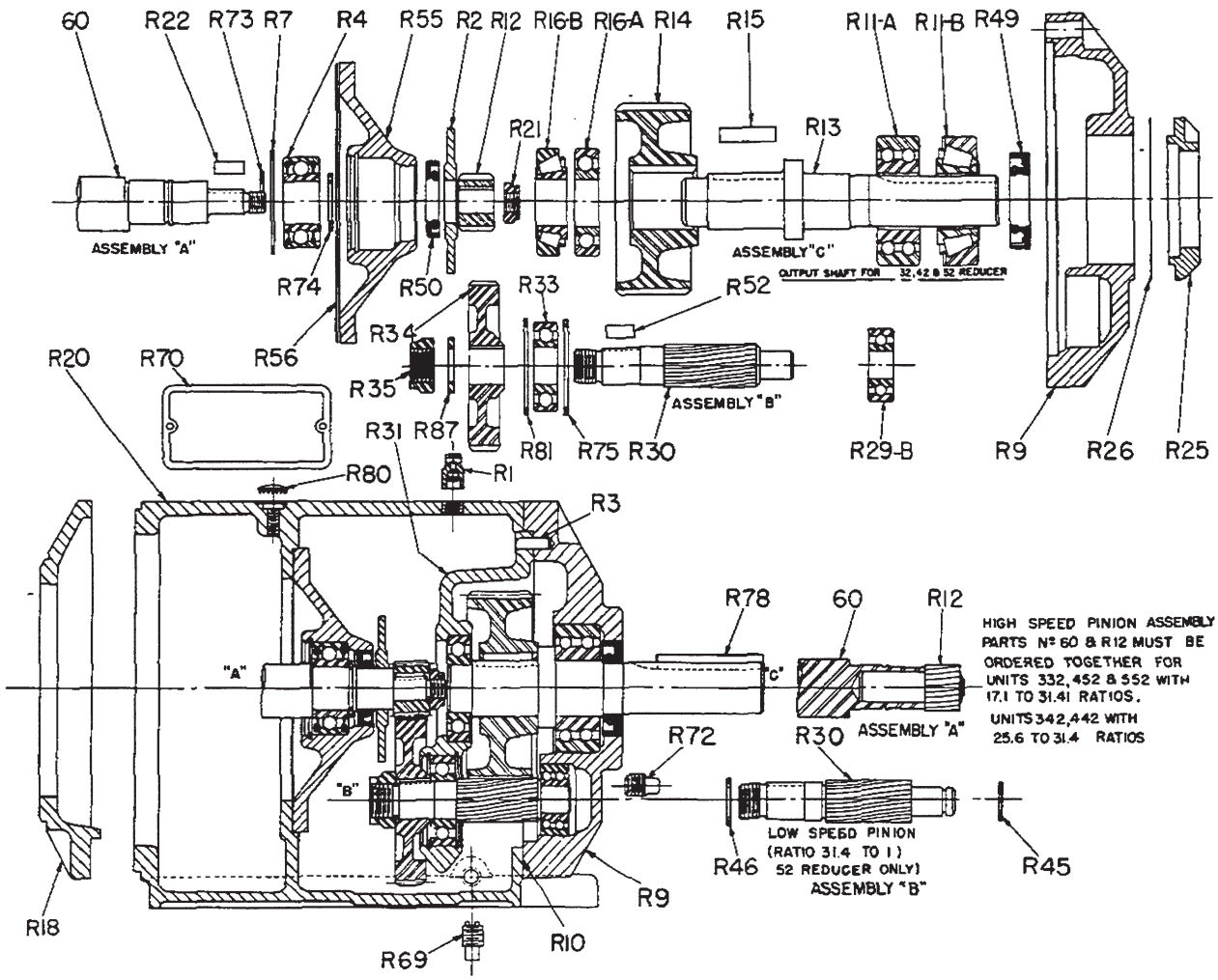
NOTE: ALL CAP SCREWS ETC., NOT LISTED ARE STANDARD ITEMS.

NOTE: VENT PIN WILL BE LOCATED AT EITHER "X" OR "Y" DEPENDING ON ASSEMBLY OF UNIT.

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST—FOR DOUBLE REDUCTION REDUCERS—SIZES 32, 42, 52 and 52H

(300 - 400 - 500 - 600 size Moto Drive units)



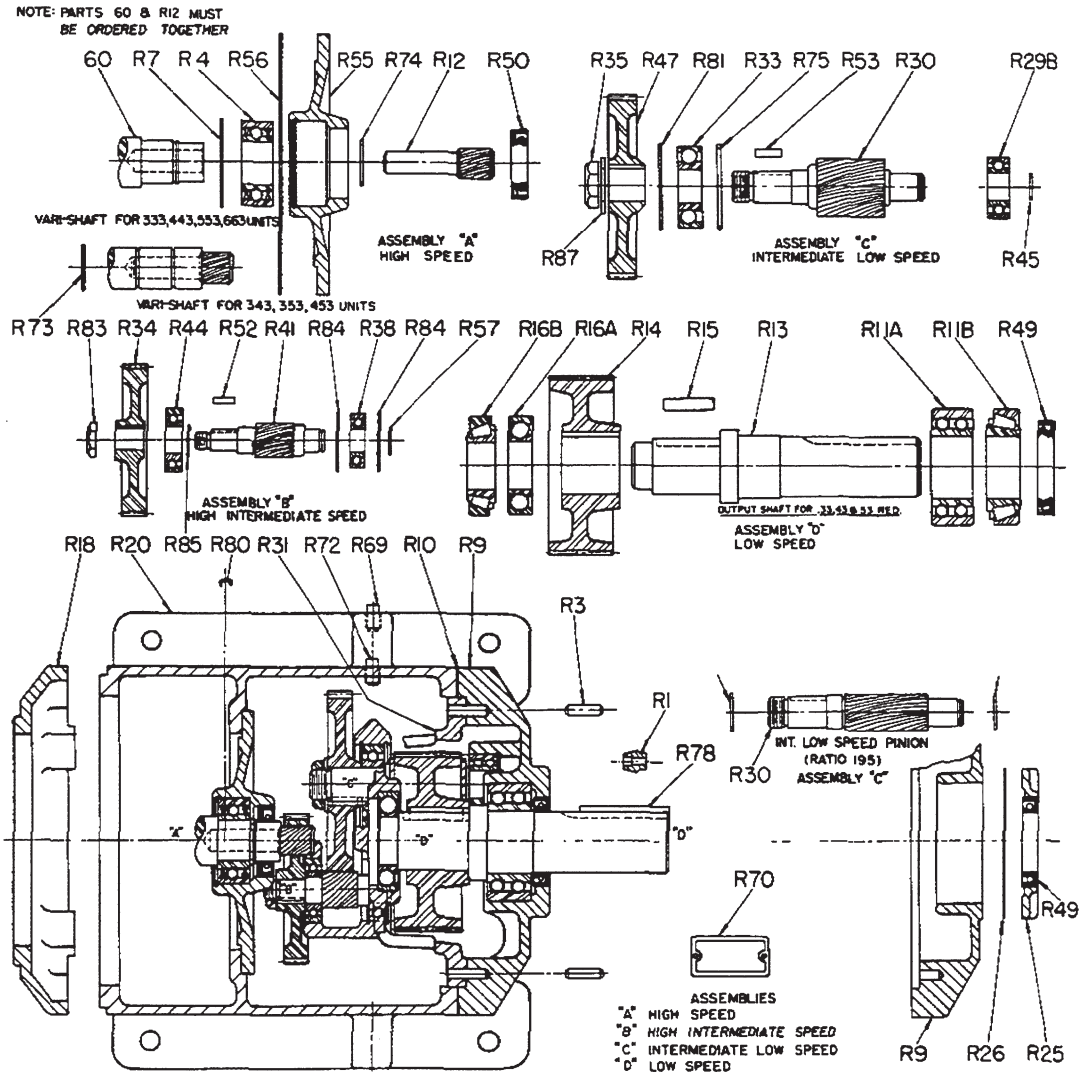
60	SHAFT, VARIABLE	R20	HOUSING, CASE SUPPORT	R69	PLUG, DRAIN (MAGNETIC)
R1	PLUG, VENT	R21	NUT, HIGH SPEED PINION	R70	PLATE, RATIO & LUBRICATION
R2	SLINGER, OIL (CEILING MTD. UNITS ONLY)	R22	KEY, HIGH SPEED PINION	R72	PLUG, OIL LEVEL
R3	PIN, DOWEL	R25	RETAINER, BEARING (42, 52 RED. ONLY)	R73	RING, RET. INNER H.S. BRG. (342,452 RED.)
R4	BEARING, HIGH SPEED	R26	SHIM, BEARING RETAINER (42, 52 RED ONLY)	R74	RING, RETAINING, OUTER H.S. BEARING
R7	RING, RET. H. S. BRG.	R29-B	BEARING, OUTER L.S. PINION	R75	RING, RETAINING, OUTER LOW SPEED PINION BEARING (42, 52 RED ONLY)
R9	HEAD, GEAR BOX	R30	PINION, LOW SPEED	R78	KEY, OUTPUT SHAFT
R10	GASKET, HEAD	R31	CENTERPIECE, GEAR	R80	PLUG, BUTTON (HOUSING, CASE SUPPORT)
R11-A	BRG. OUTER L. S. (32 RED. ONLY)	R33	BEARING, INNER L.S. PINION	R81	RING, RETAINING, INNER L.S. PINION BEARING
R11-B	BEARING,OUTER,LOW SPEED (42, 52,RED. ONLY)	R34	GEAR, HIGH SPEED	R87	WASHER, GEAR HIGH SPEED (52 RED. ONLY)
R12	PINION, HIGH SPEED	R35	NUT, LOW SPEED PINION		
R13	SHAFT, OUTPUT	R45	RING, RETAINING (42, 52 RED. ONLY)		
R14	GEAR, LOW SPEED	R46	RING, RETAINING (52 RED. RATIO 31.4 ONLY)		
R15	KEY, LOW SPEED GEAR	R49	SEAL, OIL-LOW SPEED		
R16-A	BEARING, INNER, LOW SPEED (32 RED. ONLY)	R50	SEAL,OIL-HIGH SPEED		
R-16B	BEARING, INNER, LOW SPEED (42, 52 RED. ONLY)	R52	KEY, HIGH SPEED GEAR		
R18	ADAPTOR, RING	R55	PLATE, BEARING (INTERNAL)		
		R56	GASKET, BEARING PLATE (INTERNAL)		

NOTE: ALL CAP SCREWS ETC., NOT LISTED ARE STANDARD ITEMS.

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST—FOR TRIPLE REDUCTION REDUCERS—SIZES 33, 43, 53 and 53H

(300 - 400 - 500 - 600 size Moto Drive units)



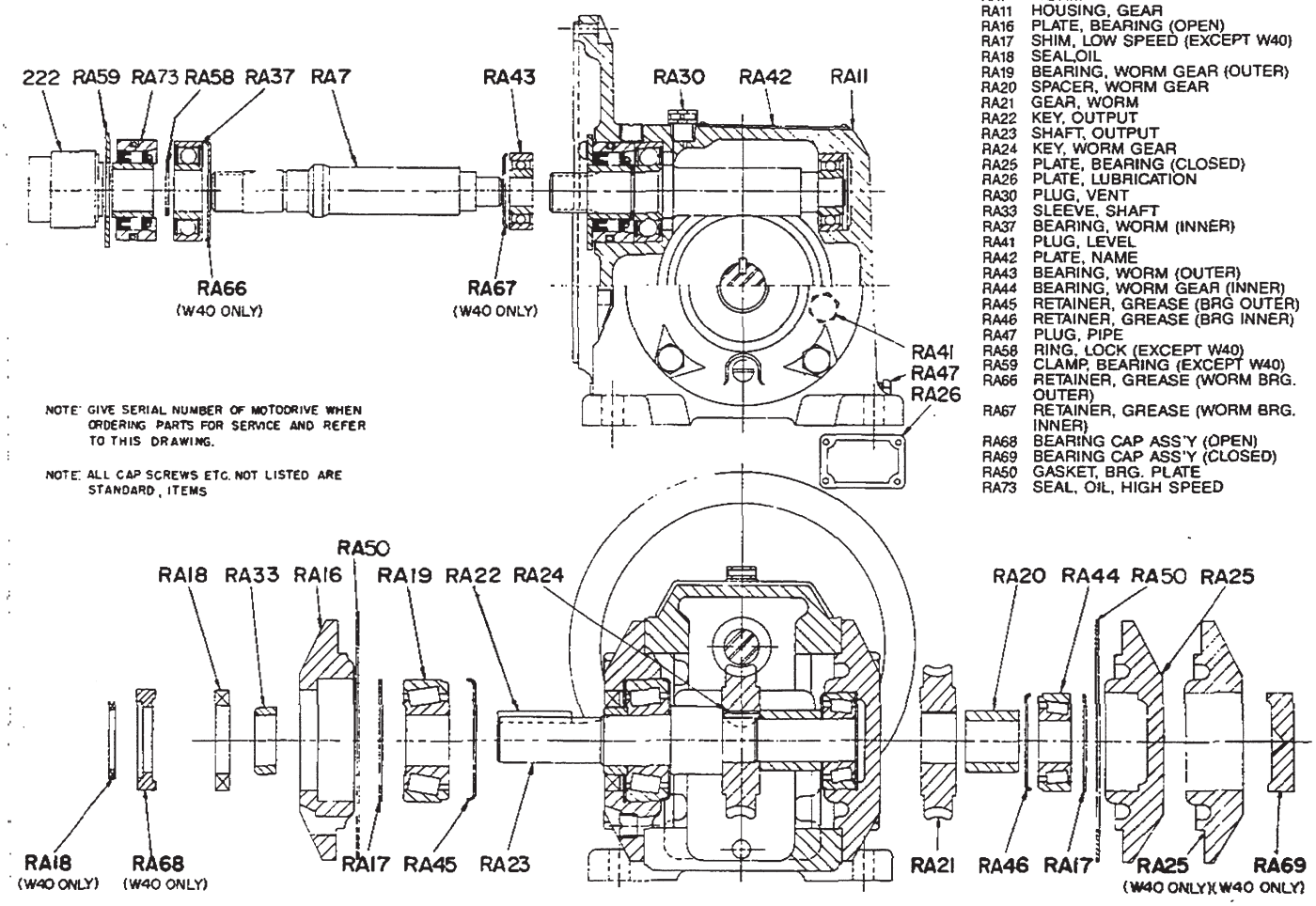
60 SHAFT, VARIABLE
R1 PLUG, VENT (ON TOP OF CASE SUPPORT HOUSING)
R3 PIN, DOWEL
R4 BEARING, HIGH SPEED
R7 RING, RETAINING, HIGH SPEED BEARING
R9 HEAD, GEARBOX
R10 GASKET, HEAD
R11A BEARING, OUTER LOW SPEED (33 RED. ONLY)
R11B BEARNG, OUTER LOW SPEED (43, 53 RED. ONLY)
R12 PINION, HIGH SPEED
R13 SHAFT, OUTPUT
R14 GEAR, LOW SPEED
R15 KEY, LOW SPEED GEAR
R16A BEARING, INNER LOW SPEED 33 RED. ONLY)
R16B BEARING, INNER LOW SPEED 43, 53 " " RED. ONLY)
R18 ADAPTOR, RING
R20 HOUSING, CASE SUPPORT
R25 RETAINER, BEARING (43, 53 RED. ONLY)
R26 SHIM BEARING RETAINER (43, 53 RED. ONLY)
R29B BEARING, OUTER LOW SPEED PINION
R30 PINION, LOW SPEED
R31 CENTERPIECE, GEAR
R33 BEARING, INNER, LOW SPEED PINION
R34 GEAR, HIGH SPEED
R35 NUT, LOW SPEED PINION
R38 BEARING, OUTER, INTERMEDIATE
R41 PINION, INTERMEDIATE
R44 BEARING, INNER, INTERMEDIATE
R45 RING, RETAINING, LOW SPEED PINION (43, 53 RED.)
R46 RING, RETAINING, INNER LOW SPEED PINION 53 REDUCERS
R47 GEAR, INTERMEDIATE
R49 SEAL, OIL LOW SPEED
R50 SEAL, OIL, HIGH SPEED
R52 KEY, HIGH SPEED GEAR
R53 KEY, INTERMEDIATE GEAR
R55 PLATE, BEARING (INTERNAL)
R56 GASKET, BEARING PLATE (INTERNAL)
R57 RING, RETAINING, INT. PINION, OUTER
R69 PLUG, DRAIN (MAGNETIC)
R70 PLATE, RATIO & LUBRICATION
R72 PLUG, OIL LEVEL
R73 RING, RETAINING, INNER H.S. BEARING (343, 353, 453)
R74 RING, RETAING, OUTER H S. BEARING
R75 RING, RETAINING, OUTER L.S. PINION BEARING (43, 53 RED. ONLY)
R78 KEY, OUTPUT SHAFT
R80 PLUG, BUTTON (HOUSING, CASE SUPPORT)
R81 RING, RETAINING, INNER L.S PINION BEARING
R83 NUT, HIGH SPEED INTERMEDIATE GEAR
R84 RING, RETAINING, OUTER, INTERMEDIATE PINION BEARING (53 REDUCER 1 ONLY)
R85 RING, RETAINING, INNER, INTERMEDIATE PINION BEARING (43 & 53 RED. RA.159-195)
R87 WASHER, GEAR, INTERMEDIATE LOW SPEED (53 REDUCER ONLY)

NOTE:ALL CAP SCREWS ETC. NOT LISTED ARE STANDARD ITEMS.

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST — W28 - W40 RIGHT ANGLE REDUCER

FOR No. 300-400 MOTO DRIVE UNITS



NOTE: GIVE SERIAL NUMBER OF MOTODRIVE WHEN ORDERING PARTS FOR SERVICE AND REFER TO THIS DRAWING.

NOTE: ALL CAP SCREWS ETC. NOT LISTED ARE STANDARD, ITEMS

222	COUPLING ASSEMBLY
RA7	WORM
RA11	HOUSING, GEAR
RA16	PLATE, BEARING (OPEN)
RA17	SHIM, LOW SPEED (EXCEPT W40)
RA18	SEAL,OIL
RA19	BEARING, WORM GEAR (OUTER)
RA20	SPACER, WORM GEAR
RA21	GEAR, WORM
RA22	KEY, OUTPUT
RA23	SHAFT, OUTPUT
RA24	KEY, WORM GEAR
RA25	PLATE, BEARING (CLOSED)
RA26	PLATE, LUBRICATION
RA30	PLUG, VENT
RA33	SLEEVE, SHAFT
RA37	BEARING, WORM (INNER)
RA41	PLUG, LEVEL
RA42	PLATE, NAME
RA43	BEARING, WORM (OUTER)
RA44	BEARING, WORM GEAR (INNER)
RA45	RETAINER, GREASE (BRG OUTER)
RA46	RETAINER, GREASE (BRG INNER)
RA47	PLUG, PIPE
RA58	RING, LOCK (EXCEPT W40)
RA59	CLAMP, BEARING (EXCEPT W40)
RA66	RETAINER, GREASE (WORM BRG. OUTER)
RA67	RETAINER, GREASE (WORM BRG. INNER)
RA68	BEARING CAP ASS'Y (OPEN)
RA69	BEARING CAP ASS'Y (CLOSED)
RA50	GASKET, BRG. PLATE
RA73	SEAL, OIL, HIGH SPEED

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST — FOR C21 - C28 - C40 RIGHT ANGLE REDUCER

FOR No. 300 - 400 MOTO DRIVE UNITS

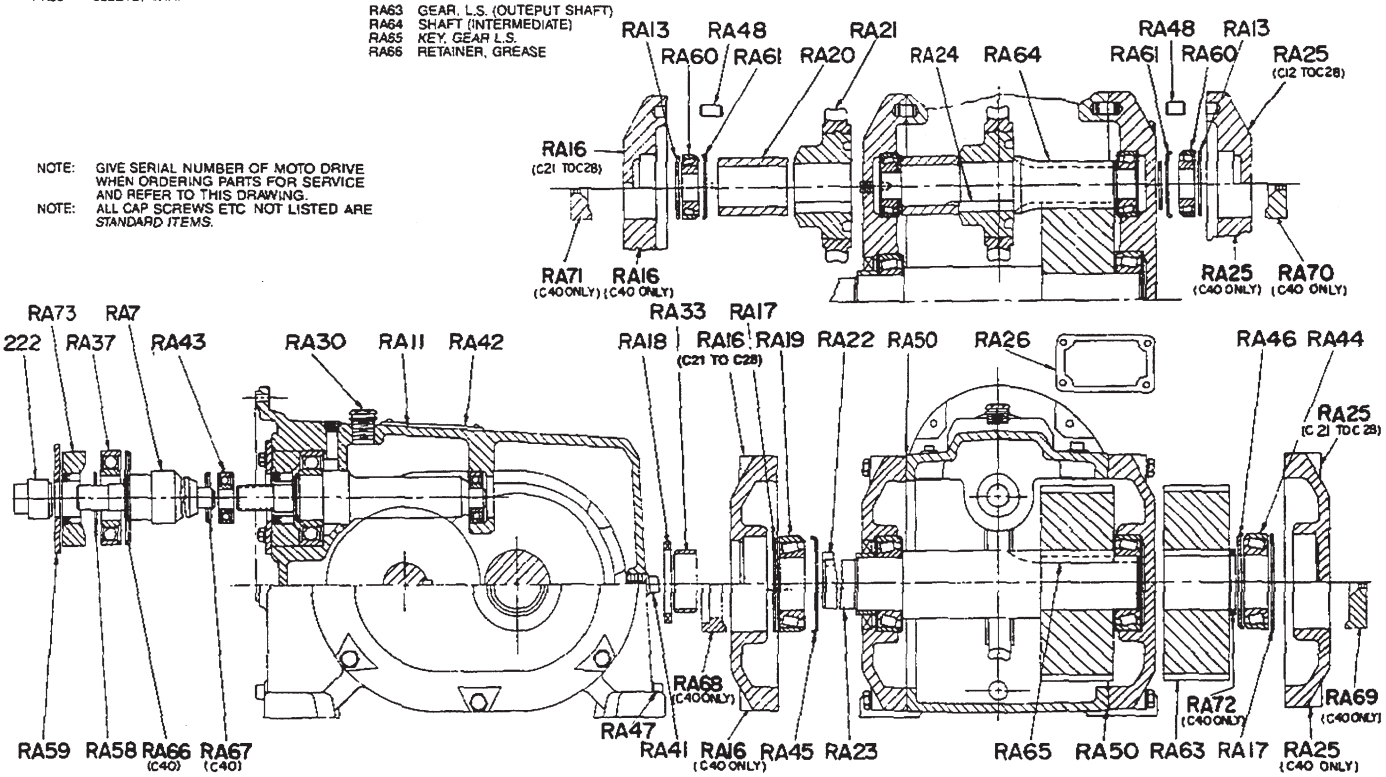
222 COUPLING ASSEMBLY
RA7 *WORM*
RA11 HOUSING, GEAR
RA13 SHIM, HIGH SPEED (EXCEPT C40)
RA16 PLATE, BEARING (OPEN)
RA17 SHIM, LOW SPEED (EXCEPT C40)
RA18 SEAL (OIL)
RA19 BEARING (OUTPUT SHAFT)
RA20 SPACER, WORM SHAFT (EXCEPT C40)
RA21 GEAR, WORM
RA22 *KEY, OUTPUT SHAFT*
RA23 SHAFT, OUTPUT
RA24 KEY, WORM GEAR
RA25 PLATE, BEARING (CLOSED)
RA26 PLATE, LUBRICATION
RA30 PLUG, VENT
RA33 SLEEVE, SHAFT

RA37 BEARING, WORM, INNER
RA41 *PLUG, LEVEL SQ. HEAD*
RA42 PLATE, NAME
RA43 BEARING, WORM, OUTER
RA44 BEARING, (OUTPUT SHAFT)
RA45 GREASE SEAL, BEARING OUTER
RA46 GREASE SEAL, BEARING INNER
RA47 PLUG, PIPE SQ. HEAD
RA48 PIN, DOWEL
RA50 GASKET, BRG. PLATE
RA58 *RING, LOCK (EXCEPT C40)*
RA59 CLAMP, BEARING (EXCEPT C40)
RA60 BEARING, INTERMEDIATE GEAR
RA61 GREASE SEAL BRG. (INTERMEDIATE GEAR)

RA63 GEAR, L.S. (OUTEPUT SHAFT)
RA64 SHAFT (INTERMEDIATE)
RA65 *KEY, GEAR L.S.*
RA66 RETAINER, GREASE

RA 67 RETAINER, GREASE.
RA 68 *BEARING CAP ASS'Y (OPEN)*
RA 69 BEARING CAP ASS'Y (CLOSE)
RA 70 BEARING CAP ASS'Y (INTERMEDIATE CO' SHAFT)
RA 71 BEARING CAP ASS'Y (INTERMEDIATE CO' SHAFT)
RA 72 SPACER, GEAR
RA 73 SEAL, OIL, HIGH SPEED

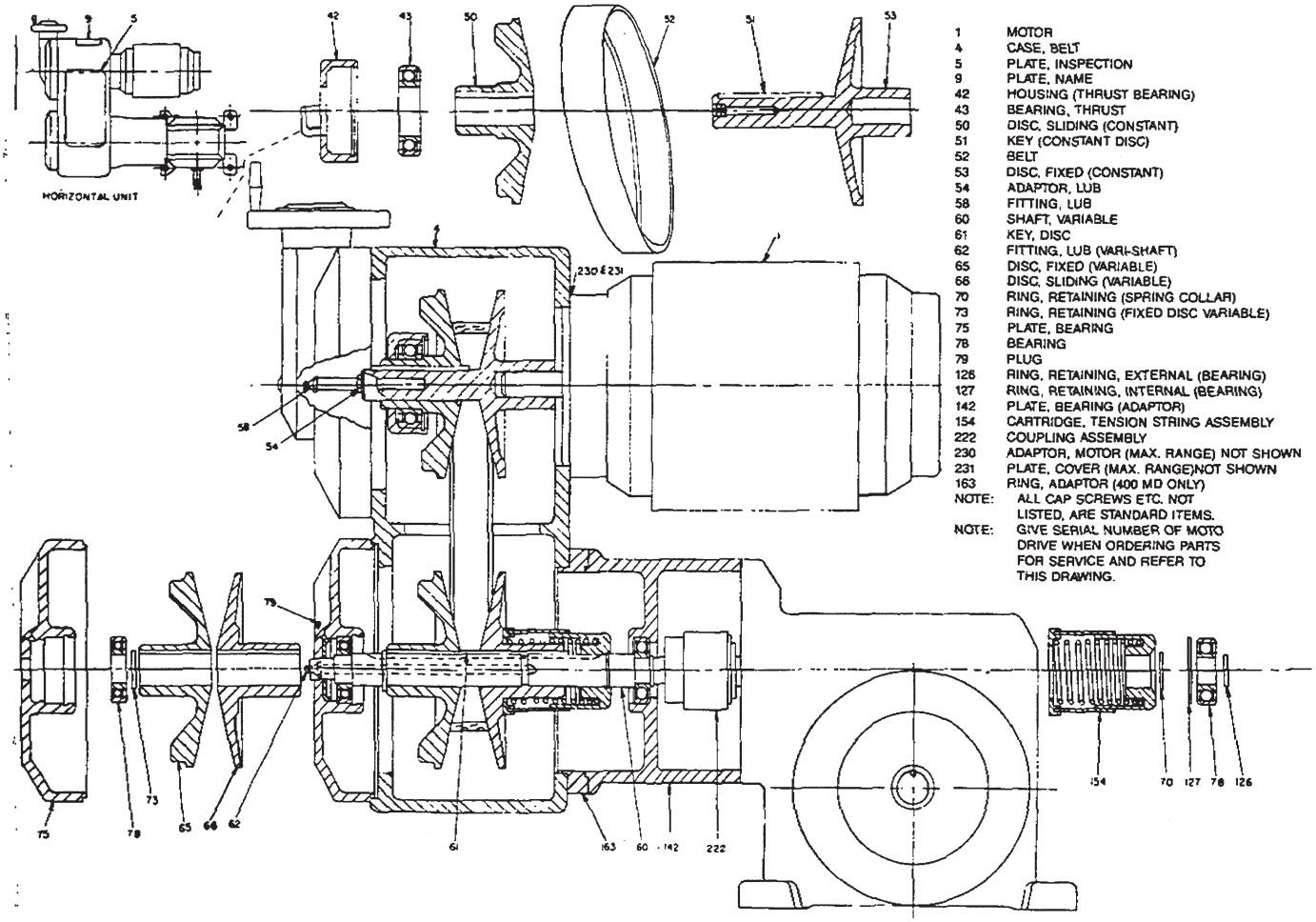
NOTE: GIVE SERIAL NUMBER OF MOTO DRIVE WHEN ORDERING PARTS FOR SERVICE AND REFER TO THIS DRAWING.
NOTE: ALL CAP SCREWS ETC NOT LISTED ARE *STANDARD ITEMS.*



When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST — FOR "C" FLOW FOR USE WITH "XL" RIGHT ANGLE REDUCER

FOR No. 300 - 400 MOTO DRIVE UNITS



1	MOTOR
4	CASE, BELT
5	PLATE, INSPECTION
9	PLATE, NAME
42	HOUSING (THRUST BEARING)
43	BEARING, THRUST
50	DISC, SLIDING (CONSTANT)
51	KEY (CONSTANT DISC)
52	BELT
53	DISC, FIXED (CONSTANT)
54	ADAPTOR, LUB
58	FITTING, LUB
60	SHAFT, VARIABLE
61	KEY, DISC
62	FITTING, LUB (VARI-SHAFT)
65	DISC, FIXED (VARIABLE)
66	DISC, SLIDING (VARIABLE)
70	RING, RETAINING (SPRING COLLAR)
73	RING, RETAINING (FIXED DISC VARIABLE)
75	PLATE, BEARING
78	BEARING
79	PLUG
126	RING, RETAINING, EXTERNAL (BEARING)
127	RING, RETAINING, INTERNAL (BEARING)
142	PLATE, BEARING (ADAPTOR)
154	CARTRIDGE, TENSION STRING ASSEMBLY
222	COUPLING ASSEMBLY
230	ADAPTOR, MOTOR (MAX. RANGE) NOT SHOWN
231	PLATE, COVER (MAX. RANGE)NOT SHOWN
163	RING, ADAPTOR (400 MD ONLY)
NOTE:	ALL CAP SCREWS ETC. NOT LISTED, ARE STANDARD ITEMS.
NOTE:	GIVE SERIAL NUMBER OF MOTO DRIVE WHEN ORDERING PARTS FOR SERVICE AND REFER TO THIS DRAWING.

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

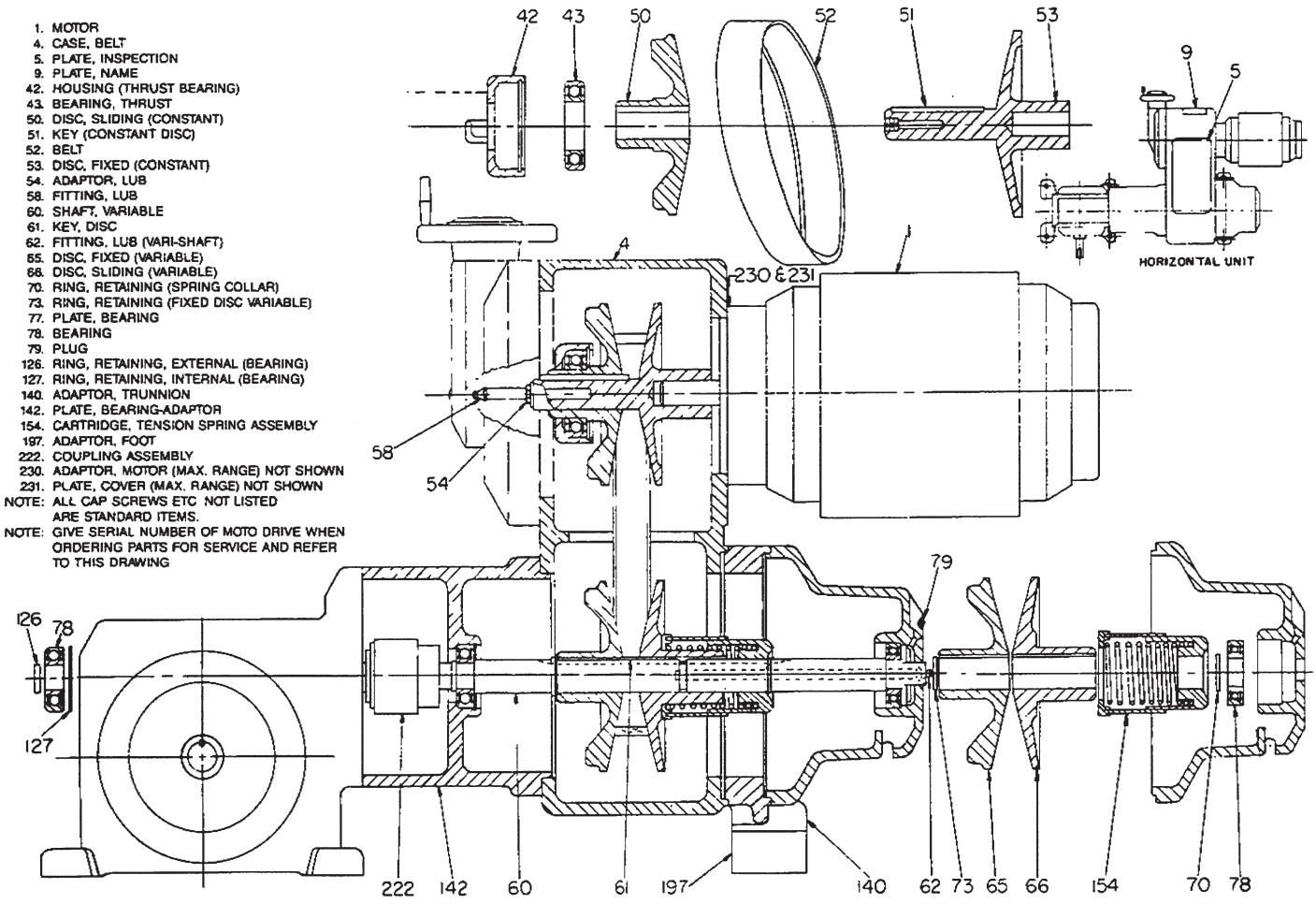
PARTS LIST — FOR "Z" FLOW FOR USE WITH "XL" RIGHT ANGLE REDUCER

FOR No. 300 - 400 MOTO DRIVE UNITS

1. MOTOR
4. CASE, BELT
5. PLATE, INSPECTION
9. PLATE, NAME
42. HOUSING (THRUST BEARING)
43. BEARING, THRUST
50. DISC, SLIDING (CONSTANT)
51. KEY (CONSTANT DISC)
52. BELT
53. DISC, FIXED (CONSTANT)
54. ADAPTOR, LUB
58. FITTING, LUB
60. SHAFT, VARIABLE
61. KEY, DISC
62. FITTING, LUB (VARI-SHAFT)
65. DISC, FIXED (VARIABLE)
66. DISC, SLIDING (VARIABLE)
70. RING, RETAINING (SPRING COLLAR)
73. RING, RETAINING (FIXED DISC VARIABLE)
77. PLATE, BEARING
78. BEARING
79. PLUG
126. RING, RETAINING, EXTERNAL (BEARING)
127. RING, RETAINING, INTERNAL (BEARING)
140. ADAPTOR, TRUNNION
142. PLATE, BEARING-ADAPTOR
154. CARTRIDGE, TENSION SPRING ASSEMBLY
197. ADAPTOR, FOOT
222. COUPLING ASSEMBLY
230. ADAPTOR, MOTOR (MAX. RANGE) NOT SHOWN
231. PLATE, COVER (MAX. RANGE) NOT SHOWN

NOTE: ALL CAP SCREWS ETC NOT LISTED ARE STANDARD ITEMS.

NOTE: GIVE SERIAL NUMBER OF MOTO DRIVE WHEN ORDERING PARTS FOR SERVICE AND REFER TO THIS DRAWING

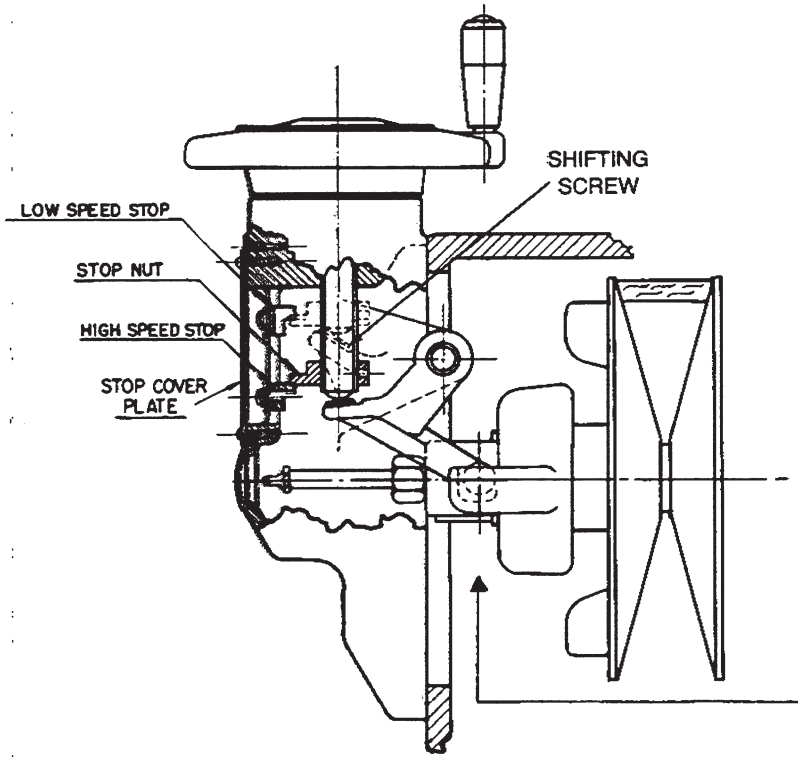


When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

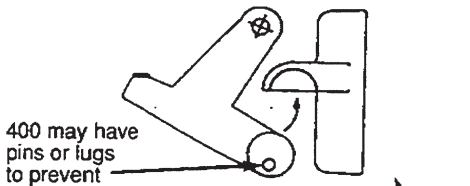
INSTRUCTIONS FOR SETTING MAXIMUM AND MINIMUM SPEED STOPS

STANDARD HANDWHEEL CONTROL

SIZE 300 and 400

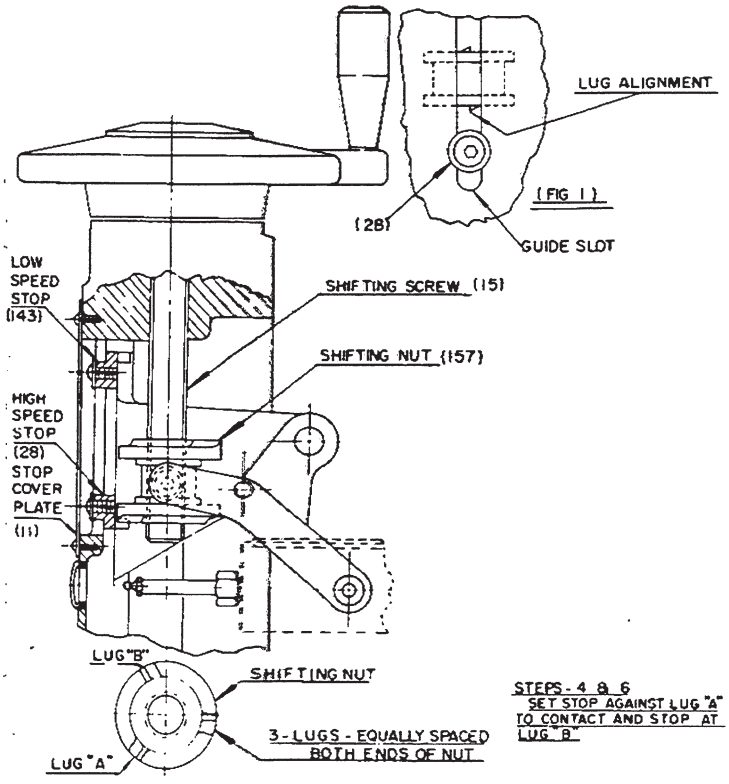


1. REMOVE STOP COVER PLATE FOR ACCESS TO SPEED CONTROL STOPS.
2. LOOSEN HIGH AND LOW SPEED STOPS; AND SPREAD THE STOPS TO MAXIMUM SEPARATION IN THE GUIDE SLOT.
3. INSPECT THE STOP NUT LOCATION ON THE SHIFTING SCREW. RE-POSITION IF NECESSARY, SO THAT APPROXIMATELY THREE FULL THREADS SHOW AT END OF SCREW.
4. START MOTO DRIVE UNIT AND ADJUST TO REQUIRED MAXIMUM OUTPUT SPEED.
5. SLIDE THE HIGH SPEED STOP INTO THE POSITION WHERE CONTACT BETWEEN THE STOP AND STOP NUT OCCURS. AND SECURE IN PLACE. NOTE. TWO GROOVES IN THE SHIFTING SCREW, AND THREE SET SCREW HOLES, IN THE STOP NUT, PERMIT SMALL POSITION CHANGES OF THE STOP NUT TO GIVE A MORE EXACT SPEED CONTROL SETTING.
6. ADJUST MOTO DRIVE UNIT TO REQUIRED MINIMUM OUTPUT SPEED.
7. SLIDE THE LOW SPEED STOP INTO THE POSITION WHERE CONTACT WITH THE STOP NUT OCCURS; AND SECURE IN PLACE.
8. BE SURE SCREWS HOLDING HIGH AND LOW SPEED STOPS AND STOP NUTS ARE TIGHT.
9. REPLACE STOP COVER PLATE.



NOTE: Size 300 shown.
On size 400, the Housing Lugs will be **above** the Yoke ears.

SIZES 500 and 600



1. REMOVE STOP COVER PLATE (11) FOR ACCESS TO SPEED CONTROL STOP.
2. LOOSEN BOTH HIGH (28) AND LOW (143) SPEED STOPS. SPREAD THE STOPS TO MAXIMUM SEPARATION IN THE GUIDE SLOT. TIGHTEN THE STOPS SLIGHTLY.

HIGH SPEED SETTING

3. START MOTO DRIVE AND SHIFT UNIT TO DESIRED **MAXIMUM OUTPUT SPEED.**
4. IMPORTANT. REVERSE SHIFTING SCREW ROTATION UNTIL THE NEXT LUG ON THE SHIFTING NUT IS IN ALIGNMENT WITH THE GUIDE SLOT AS INDICATED IN (FIG. 1). SLIDE THE HIGH SPEED STOP UPWARD UNTIL IT CONTACTS THE LUG AT THE THICKEST POINT ON THE SHIFTING NUT. SECURE STOP IN PLACE.

   NOTE THE SHIFTING NUT HAS THREE EQUALLY SPACED LUGS AT EACH END TO PERMIT A CLOSE SPEED CONTROL SETTING. THEREFORE, CAUTION MUST BE TAKEN TO INSURE PROPER CONTACT BETWEEN THE STOPS AND THE LUG ON THE SHIFTING NUT.

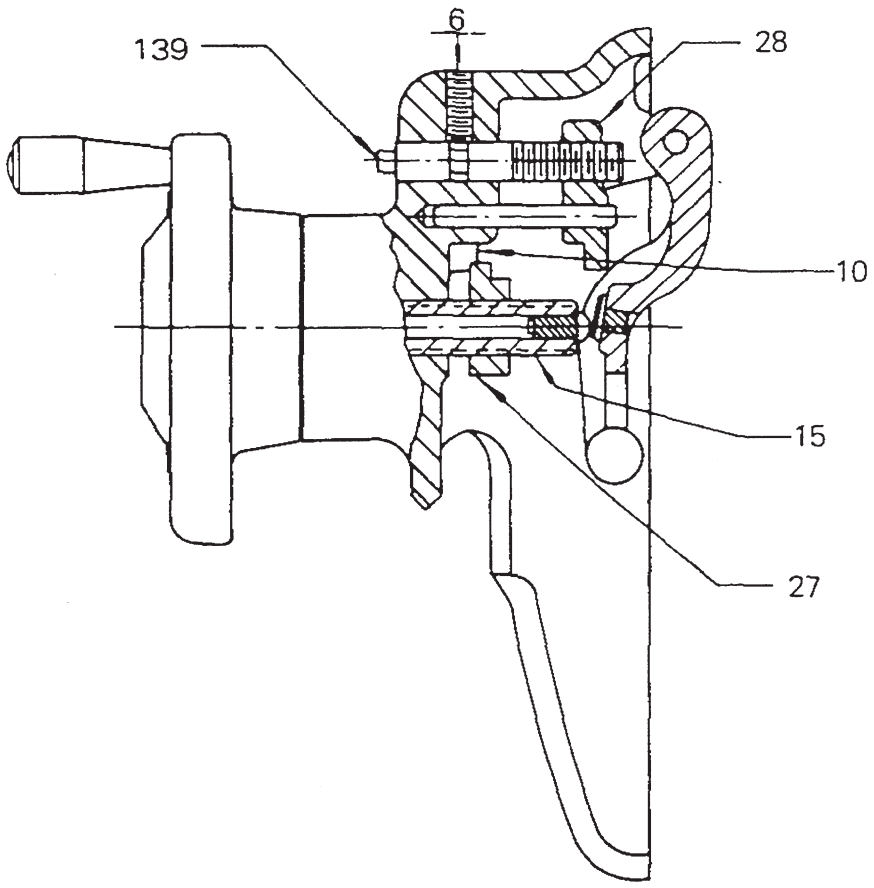
LOW SPEED SETTING

5. SHIFT MOTO DRIVE UNIT TO REQUIRED **MINIMUM OUTPUT SPEED.**
6. **IMPORTANT.** REVERSE SHIFTING SCREW ROTATION UNTIL THE NEXT LUG ON THE SHIFTING NUT IS IN ALIGNMENT WITH THE GUIDE SLOT AND DIRECTLY BELOW THE LOW SPEED STOP. SLIDE THE LOW SPEED STOP DOWNWARD UNTIL IT CONTACTS THE LUG ON THE SHIFTING NUT AT THE THICKEST POINT AND SECURE IN PLACE. USE THE SAME PRECAUTIONS AS USED IN SETTING THE HIGH SPEED STOP.
7. SHIFT UNIT THROUGH SPEED RANGE WITH CARE TO BE SURE THE STOPS ARE CONTACTING CORRECTLY AND SECURE TIGHTLY.
8. THE STOPS ARE SET CORRECTLY WHEN THE LUG ON THE SHIFTING NUT HITS THE STOP NUT BY APPROXIMATELY $\frac{1}{32}$".
9. REPLACE STOP COVER PLATE.

INSTRUCTIONS FOR SETTING MAXIMUM AND MINIMUM SPEED STOPS

FRONT HANDWHEEL CONTROL

SIZE 300



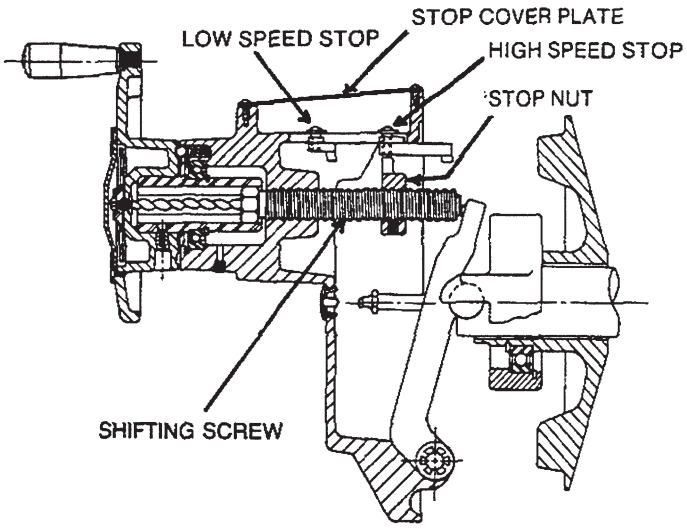
1. THE MINIMUM SPEED STOP MAY BE SET BY FIRST LOOSENING THE SET SCREW IN THE STOP NUT (27). SHIFT MOTO DRIVE TO THE DESIRED MINIMUM SPEED. TURN THE STOP NUT (27) ON THE SHIFTING SCREW (15) UNTIL IT COMES IN CONTACT WITH THE BUILT IN LOW SPEED STOP (10). TIGHTEN THE SET SCREW IN THE STOP NUT (27).

   NOTE: THERE ARE TWO GROOVES IN THE SHIFTING SCREW AND THREE SET SCREW HOLES IN THE STOP NUT WHICH PERMIT SMALL POSITION CHANGES OF THE STOP NUT TO OBTAIN A MORE EXACT SPEED CONTROL SETTING.

2. TO SET THE MAXIMUM SPEED STOP LOOSEN THE SET SCREW (6) IN THE TOP OF THE CONTROL HOUSING WHICH HOLDS THE ADJUSTABLE SCREW (139) IN PLACE.

NOTE: LOOSEN SCREW ONLY ENOUGH TO ENABLE THE ADJUSTABLE SCREW TO BE TURNED. FACING THE CONTROL TURN THE ADJUSTABLE SCREW (139) CLOCKWISE AND AT THE SAME TIME SHIFT THE MOTO DRIVE UNIT TO THE DESIRED MAXIMUM SPEED. THE STOP NUT (27) ON THE SHIFTING SCREW SHOULD CONTACT THE HIGH SPEED STOP (28) AT MAXIMUM SPEED. TIGHTEN SET SCREW (6) IN POSITION.

INSTRUCTIONS FOR SETTING MAXIMUM AND MINIMUM SPEED STOPS
FRONT HANDWHEEL CONTROL
SIZE 400



1. REMOVE STOP COVER PLATE FOR ACCESS TO SPEED CONTROL STOPS.
2. LOOSEN HIGH AND LOW SPEED STOPS; AND SPREAD THE STOPS TO MAXIMUM SEPARATION IN THE GUIDE SLOT.
3. INSPECT THE STOP NUT LOCATION ON THE SHIFTING SCREW. RE-POSITION IF NECESSARY SO THAT STOP NUT IS LOCATED APPROX. 3/4 INCH FROM END OF SHIFTING SCREW
4. START MOTO DRIVE UNIT AND ADJUST TO REQUIRED MAXIMUM OUTPUT SPEED.
5. SLIDE THE HIGH SPEED STOP INTO THE POSITION WHERE CONTACT BETWEEN THE STOP AND STOP NUT OCCURS AND SECURE IN PLACE. NOTE: TWO GROOVES IN THE SHIFTING SCREW AND THREE SET SCREW HOLES, IN THE STOP NUT, PERMIT SMALL POSITION CHANGES OF THE STOP NUT TO GIVE A MORE EXACT SPEED CONTROL SETTING.
6. ADJUST MOTO DRIVE UNIT TO REQUIRED MINIMUM OUTPUT SPEED.
7. SLIDE THE LOW SPEED STOP INTO THE POSITION WHERE CONTACT WITH THE STOP NUT OCCURS; AND SECURE IN PLACE
8. BE SURE SCREWS HOLDING HIGH AND LOW SPEED STOPS AND STOP NUTS ARE TIGHT.
9. REPLACE STOP COVER PLATE.

SIZES 500 and 600

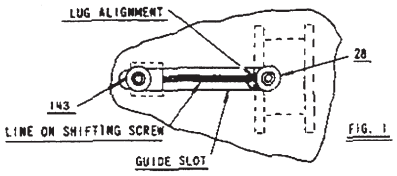


FIG. 1

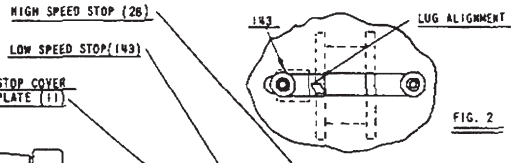
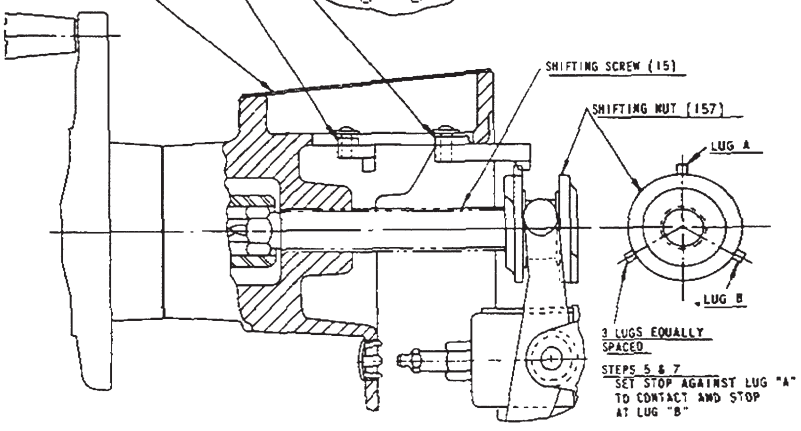


FIG. 2



1. REMOVE STOP COVER PLATE (11) FOR ACCESS TO SPEED CONTROL STOPS.
2. LOOSEN BOTH HIGH (28) AND LOW (143) SPEED STOPS. SPREAD THE STOPS TO MAXIMUM SEPARATION IN THE GUIDE SLOT. TIGHTEN THE STOPS SLIGHTLY.

HIGH SPEED SETTING

3. START MOTO DRIVE AND SHIFT UNIT SO THAT SHIFTING NUT IS LOCATED UNDER HIGH SPEED STOP SCREW AS SHOWN IN FIG. 1. ALIGN LUG ON SHIFTING NUT WITH GUIDE SLOT. USE A CHINA MARKING PENCIL AND DRAW A STRAIGHT LINE ON THE SHIFTING SCREW THREADS STARTING AT THE SHIFTING NUT LUG AND EXTENDING IT TOWARD THE LOW SPEED STOP AS FAR AS POSSIBLE. ROTATE SHIFTING SCREW AND REPEAT THIS PROCEDURE TO LOCATE THE OTHER TWO SHIFTING NUT LUGS. THESE LINES MUST BE LOCATED AS ACCURATE AS POSSIBLE IN ORDER TO CORRECTLY POSITION THE LUGS IN STEP 5.
4. SHIFT UNIT TO DESIRED **MAXIMUM OUTPUT SPEED.** CHECK AND DETERMINE IF LINES ON SHIFTING SCREW ARE VISABLE. IF NOT, SHIFT TOWARD LOW SPEED UNTIL LINES ARE VISABLE THROUGH GUIDE SLOT. EXTEND LINES PER STEP 3. AND THEN SHIFT UNIT TO DESIRED MAXIMUM SPEED.
5. **IMPORTANT** REVERSE SHIFTING SCREW ROTATION UNTIL THE NEXT LINE ON THE SHIFTING SCREW IS IN ALIGNMENT WITH THE GUIDE SLOT AS INDICATED IN FIG. 1. SLIDE THE HIGH SPEED STOP TOWARD THE CENTER OF THE SLOT UNTIL IT CONTACTS THE LUG ON THE SHIFTING NUT. SECURE STOP IN PLACE. MAKING CERTAIN STOP REMAINS IN CONTACT WITH LUG AS THE SCREW IS TIGHTENED.

NOTE: THE SHIFTING NUT HAS THREE EQUALLY SPACED LUGS TO PERMIT A CLOSE SPEED CONTROL SETTING. THEREFORE, CARE MUST BE TAKEN TO ENSURE PROPER CONTACT BETWEEN THE STOPS AND THE LUG ON THE SHIFTING NUT. IF THE ABOVE INSTRUCTIONS ARE FOLLOWED CAREFULLY THE CORRECT CONTACT SHOULD BE OBTAINED.

LOW SPEED SETTING

6. SHIFT MOTO DRIVE UNIT TO REQUIRED **MINIMUM OUTPUT SPEED.**
7. IMPORTANT. REVERSE SHIFTING SCREW ROTATION UNTIL THE NEXT LUG ON THE SHIFTING NUT OR LINE ON THE SHIFTING SCREW IS IN ALIGNMENT WITH THE GUIDE SLOT AS INDICATED IN FIG. 2. SLIDE THE LOW SPEED STOP TOWARD THE CENTER OF THE GUIDE SLOT UNTIL IT CONTACTS THE LUG ON THE SHIFTING NUT AT THE THICKEST POINT AND SECURE IN PLACE. USE THE SAME PRECAUTIONS AS USED IN SETTING THE HIGH SPEED STOP.
8. SHIFT UNIT THROUGH SPEED RANGE WITH CARE TO BE SURE THE STOPS ARE CONTACTING CORRECTLY AND SECURED TIGHTLY.
9. THE STOPS ARE SET CORRECTLY WHEN THE LUG ON THE SHIFTING NUT HITS THE STOP NUT BY APPROXIMATELY 1/32".
10. REPLACE STOP COVER PLATE.

ELECTRIC REMOTE CONTROL FOR 300 MOTO DRIVE UNITS

DISASSEMBLY

> **WARNING**
> **To ensure that drive is not unexpectedly started, turn off and lock out or tag power source before proceeding. Failure to observe these precautions could result in bodily injury.**

1. See Parts List, Page 30.
2. Remove hex head cap screws and washers and remove complete control assembly from MOTO DRIVE unit.
3. Remove four hex head machine screws and washers.
4. Remove gearmotor housing cover (E170.)
5. Remove the two limit switch cams (E98) from the cam shaft (E186).
6. Remove the socket head screws and washers from mounting plate (E95). The complete mounting plate assembly may now be removed.

NOTE: The motor (E1), capacitor (E92), limit switches (E82), terminal block (E100) are all attached to the mounting plate. These can be removed as required by simply removing the necessary hardware for the specific item.

7. Remove control pinion (E187) from gearmotor housing (E188).

NOTE: There is a washer on the control pinion. Do not lose this item.

8. Loosen hex nut and remove cam shaft (E186) and washer.
9. Remove shifting gear (103).

NOTE: Before proceeding to step 10, note position of the cam (105). Mark the cam in such a way as to insure reassembly in exactly the same position. If the cam is installed upside down, the control will operate backwards.

10. Remove button head screw and washer from shifting shaft (15).
11. Remove cam (105).
12. Remove collar (56). This will permit removal of the shifting shaft.
13. Remove yoke pin (130) and yoke (23) if required.

REASSEMBLY

NOTE: Apply a light coat of lubricant (NLGI No. 1) to the shifting shaft (15).

1. Insert shifting (15) into control housing (10).
2. Install the collar (56) onto shifting shaft.
3. Install cam (105).

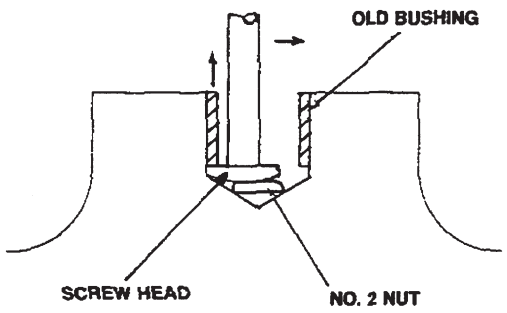
NOTE: Be sure cam is installed as indicated by markings in accordance with the note after step 9 of the disassembly instructions.

4. Secure cam with the washer and screw.
5. If gearmotor housing (E188) was previously removed, reinstall at this time and secure with the screws and washers.
6. Install shifting gear (103) and secure with the cam shaft (E186), jam nut and washer.

NOTE: When replacing shifting gear 103, replace pinion pilot bushing E196 (supplied) in order to maintain proper gear mesh alignment. Remove the old bushing, drive the new bushing in flush. Grease bushing and gear teeth.

To remove old bushing on ERC's with bushing set in blind hole:

Pry old bushing out with rivet head, hook or No. 6 screw head ground to ¼" O.D. Insert through bushing bore and pry bushing out. It may be necessary to drop a No. 2 nut into hole to pry against. (See drawing)



7. With washer installed on control pinion, insert this assembly into the gearmotor housing (E188).

NOTE: Apply light coat of lubricant (NLGI No. 1) to gear teeth.

8. If the component's motor (E1), capacitor (E92), terminal block (E100), and/or limit switches (E82) and the limit switch spacers (E81) were previously removed from the mounting plate (E95), reassemble at this time.
9. Reassemble the mounting plate assembly (E95) (complete) to the gearmotor housing (E188).
10. Install limit switch cams (E98).
11. Install yoke (23) and yoke pin (130).

NOTE: Apply light coat of lubricant (NLGI No. 1) to cam surface.

12. Reinstall complete control assembly onto the MOTO DRIVE unit.
13. Adjust limit switch cams in accordance with speed limit switch adjustment instructions.
14. Secure gearmotor housing cover (E170). Apply light coat of RTV between cover and housing.

NOTE: See appropriate wiring diagram at the end of this manual for correct connections.

LIMIT SWITCH ADJUSTMENT HEAVY DUTY CONTROL 300 SIZE ONLY

Refer to Parts List on Page 30.

1. Remove gearmotor housing cover (E170).
2. Limit switch cams (E98) can be positioned by rotating on shaft. (Slight interference fit).
3. Check data plate on the unit for minimum and maximum rpm.

NOTE: Limit switches may be set for any speed within the limits as noted on the data plate.

4. Start unit and adjust the speed electrically to the minimum data plate rpm.

NOTE: Observe direction of cam shaft (E186) so that the cam may be adjusted on the correct side of the switch lever. The cam shaft should turn CCW for lower speed and CW for high speed.

5. Adjust the top limit switch cam (E98) so that the limit switch just actuates.

NOTE: A very faint click may be heard that would indicate opening and closing of limit switch.

> **CAUTION:**
>
> ***Be sure cam is on correct side of switch arm for proper operation in direction selected. See note after step 4 above.***

6. Adjust speed toward high speed slightly and then return control to low speed. This will check previous setting.
7. Adjust the speed of the unit to the desired high speed limit not exceeding data plate speed.

NOTE: If the unit is being adjusted under a no load condition, *multiply desired rpm by 1.05 and adjust to this figure.* This will allow for pull down under load.

8. Adjust the lower limit switch cam as in steps 5 and 6.

NOTE: When this cam is properly adjusted it should be approaching its respective limit switch from the opposite direction of that of the upper cam.

9. After rechecking both limits for proper adjustment, reinstall gearmotor housing cover (E170). Apply light coat of RTV between cover and housing.

HEAVY DUTY ERC WITH MASTER MOTOR FOR 400-600K MOTO DRIVE INSTRUCTIONS FOR ADJUSTING FRICTION CLUTCH

Refer to parts breakdowns on pages 31 & 32

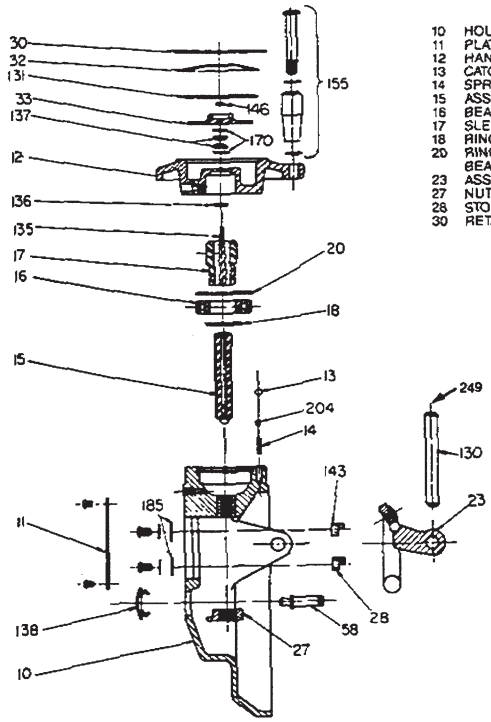
To adjust friction clutch:

1. *Friction clutch may be adjusted by removing gear* guard cover (E21).
2. Check friction washers (E11). Replace if worn.
3. To adjust, tighten spring nut (E13) until clutch will shift MOTO DRIVE unit running under no load. Turn (E13) clockwise to tighten clutch.
4. Tighten spring nut (E13) an additional ¼ turn.
5. Tension is correct when clutch will not slip while shifting MOTO DRIVE unit under load, but slips *when shifting screw hits high or low speed stops.*

NOTE: This is a dry clutch—do not fill housing (E20) with oil or grease! A small amount of grease should be applied to teeth of gears (E25) and (E27), but grease must be kept away from clutch.

PARTS LIST — FOR SIZES 300 and 400 REEVES VARI-SPEED MOTO DRIVE UNITS

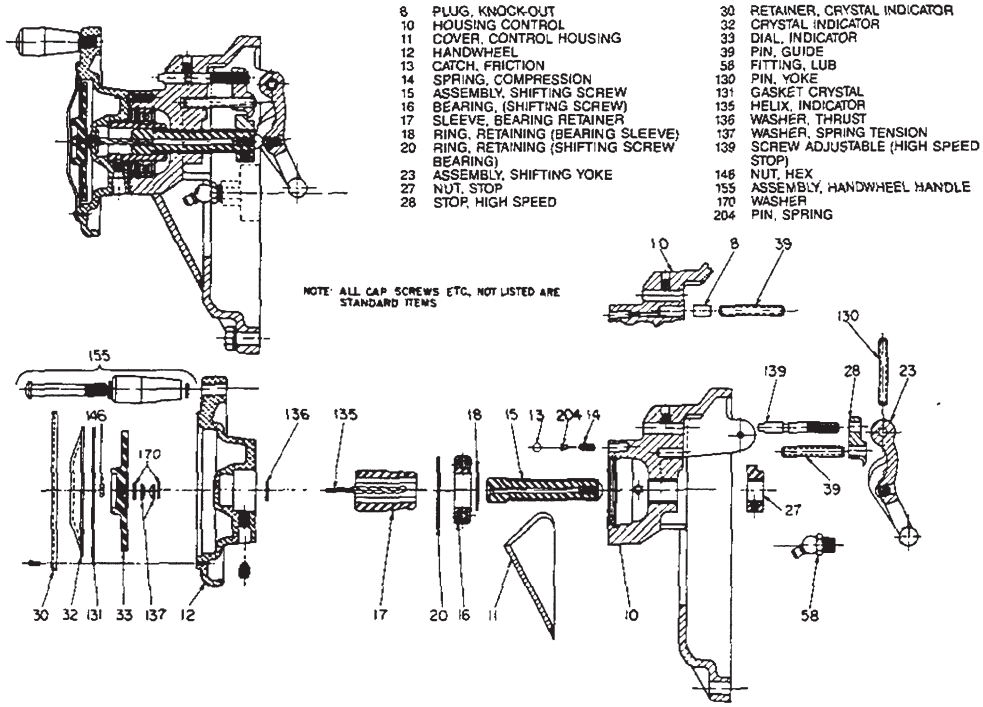
Standard Handwheel Control and Indicator



10	HOUSING, CONTROL	32	CRYSTAL, INDICATOR
11	PLATE, COVER	33	DIAL, INDICATOR
12	HANDWHEEL	58	FITTING, LUB
13	CATCH, FRICTION	130	PIN, YOKE
14	SPRING, COMPRESSION	131	GASKET, CRYSTAL
15	ASSEMBLY, SHIFTING SCREW	135	HELIX, INDICATOR
16	BEARING (SHIFTING SCREW)	136	WASHER, THRUST
17	SLEEVE, BEARING RETAINER	137	SPRING, TENSION WASHER
18	RING, RETAINING (BEARING SLEEVE)	138	PLUG, BUTTON
20	RING, RETAINING (SHIFTING SCREW BEARING)	143	STOP, LOW SPEED
23	ASSEMBLY, SHIFTING YOKE	146	NUT, HEX
27	NUT, STOP	155	ASSEMBLY, HANDWHEEL HANDLE
28	STOP, HIGH SPEED	170	WASHER
30	RETAINER, CRYSTAL (INDICATOR)	185	WASHER, EVERLOCK
		204	PIN, SPRING
		249	RING, CIRCULAR (400 ONLY)

SIZE 300

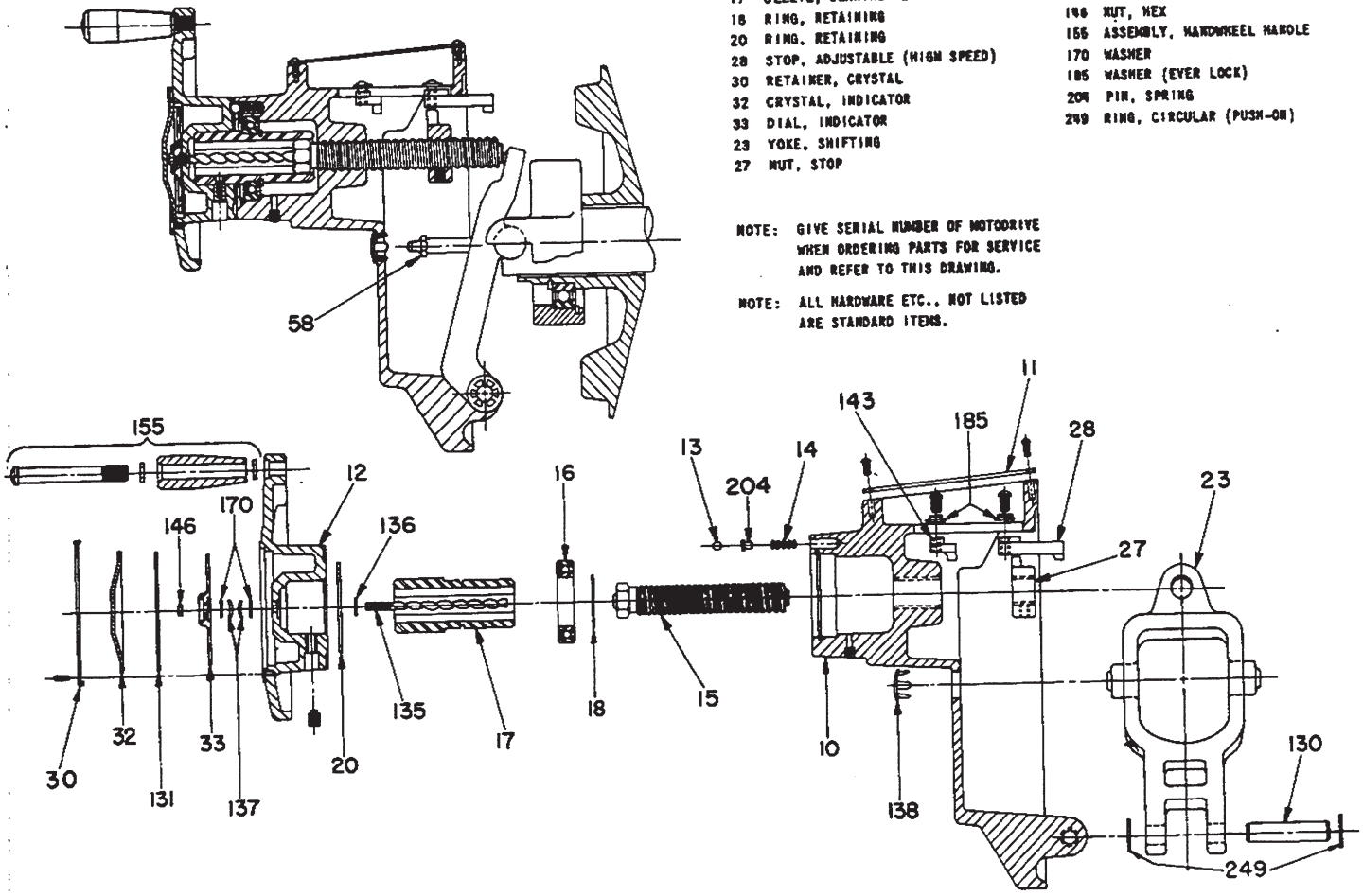
Front Handwheel Control and Indicator



8	PLUG, KNOCK-OUT	30	RETAINER, CRYSTAL INDICATOR
10	HOUSING CONTROL	32	CRYSTAL INDICATOR
11	COVER, CONTROL HOUSING	33	DIAL, INDICATOR
12	HANDWHEEL	39	PIN, GUIDE
13	CATCH, FRICTION	58	FITTING, LUB
14	SPRING, COMPRESSION	130	PIN, YOKE
15	ASSEMBLY, SHIFTING SCREW	131	GASKET CRYSTAL
16	BEARING, (SHIFTING SCREW)	135	HELIX, INDICATOR
17	SLEEVE, BEARING RETAINER	136	WASHER, THRUST
18	RING, RETAINING (BEARING SLEEVE)	137	WASHER, SPRING TENSION
20	RING, RETAINING (SHIFTING SCREW BEARING)	139	SCREW ADJUSTABLE (HIGH SPEED STOP)
23	ASSEMBLY, SHIFTING YOKE	146	NUT, HEX
27	NUT, STOP	155	ASSEMBLY, HANDWHEEL HANDLE
28	STOP, HIGH SPEED	170	WASHER
		204	PIN, SPRING

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

SIZE 400
Front Handwheel Control and Indicator



10 HOUSING, CONTROL
11 COVER, STOP NUT
12 HANDWHEEL
13 CATCH, FRICTION
14 SPRING, COMPRESSION
15 ASSEMBLY, SHIFTING SCREW
16 BEARING (SHIFTING SCREW)
17 SLEEVE, BEARING RET.
18 RING, RETAINING
20 RING, RETAINING
28 STOP, ADJUSTABLE (HIGH SPEED)
30 RETAINER, CRYSTAL
32 CRYSTAL, INDICATOR
33 DIAL, INDICATOR
23 YOKE, SHIFTING
27 NUT, STOP

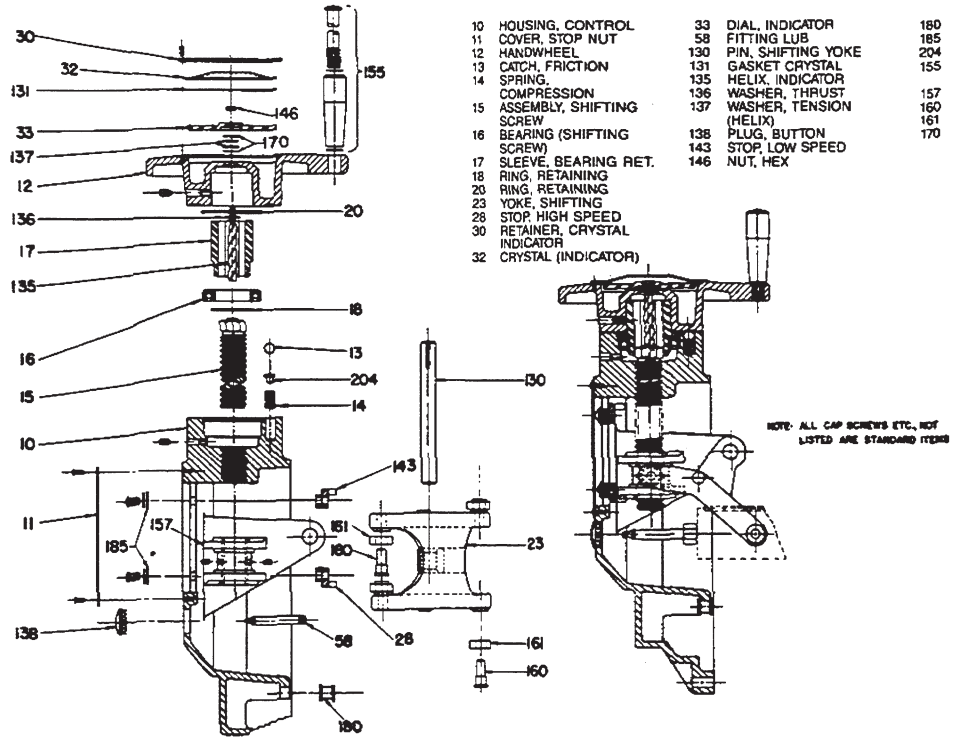
58 FITTING, LUB
130 PIN, SHIFTING YOKE
131 GASKET, CRYSTAL
135 HELIX, INDICATOR
136 WASHER, THRUST
137 WASHER, TENSION (HELIX)
138 PLUG, BUTTON
143 STOP, ADJUSTABLE (LOW SPEED)
146 NUT, HEX
155 ASSEMBLY, HANDWHEEL HANDLE
170 WASHER
185 WASHER (EVER LOCK)
204 PIN, SPRING
249 RING, CIRCULAR (PUSH-ON)

NOTE: GIVE SERIAL NUMBER OF MOTODRIVE WHEN ORDERING PARTS FOR SERVICE AND REFER TO THIS DRAWING.

NOTE: ALL HARDWARE ETC., NOT LISTED ARE STANDARD ITEMS.

PARTS LIST — FOR SIZES 500 and 600 REEVES VARI-SPEED MOTO DRIVE UNITS

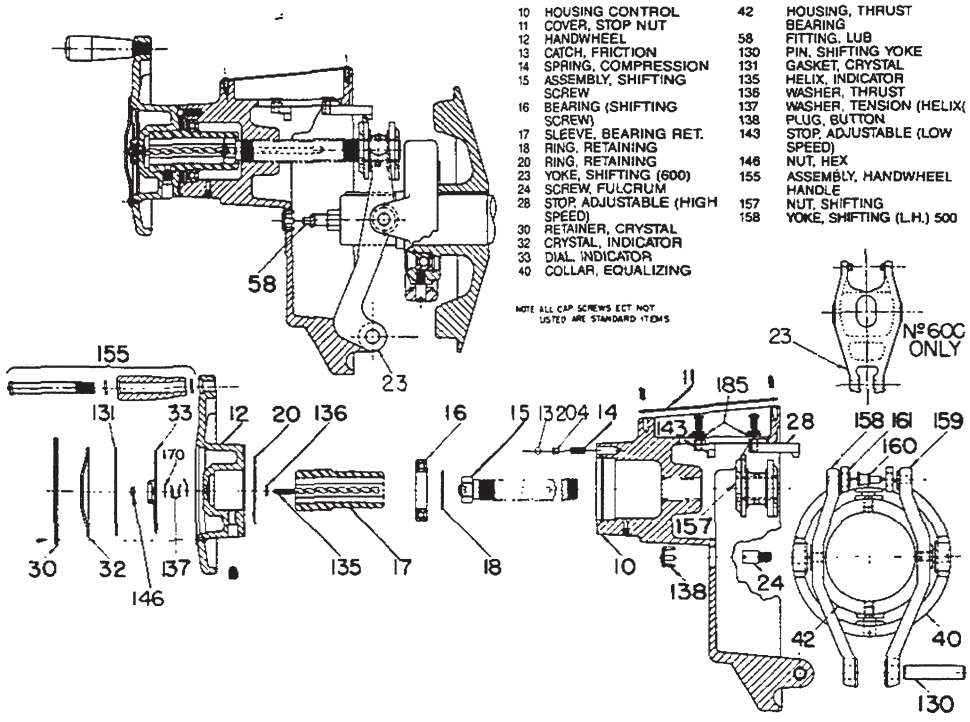
Standard Handwheel Control and Indicator



10 HOUSING, CONTROL
11 COVER, STOP NUT
12 HANDWHEEL
13 CATCH, FRICTION
14 SPRING, COMPRESSION
15 ASSEMBLY, SHIFTING SCREW
16 BEARING (SHIFTING SCREW)
17 SLEEVE, BEARING RET.
18 RING, RETAINING
20 RING, RETAINING
23 YOKE, SHIFTING
28 STOP, HIGH SPEED
30 RETAINER, CRYSTAL INDICATOR
32 CRYSTAL (INDICATOR)
33 DIAL, INDICATOR
58 FITTING LUB
130 PIN, SHIFTING YOKE
131 GASKET CRYSTAL
135 HELIX, INDICATOR
136 WASHER, THRUST
137 WASHER, TENSION (HELIX)
138 PLUG, BUTTON
143 STOP, LOW SPEED
146 NUT, HEX
180 BUSHING, NYLON
185 WASHER, EVERLOCK
204 PIN, SPRING
155 ASSEMBLY, HAND-WHEEL HANDLE
157 NUT, SHIFTING
160 PIN, FULCRUM
161 ROLLER, LINKAGE
170 WASHER

NOTE- ALL CAP SCREWS ETC., NOT LISTED ARE STANDARD ITEMS

Front Handwheel Control and Indicator

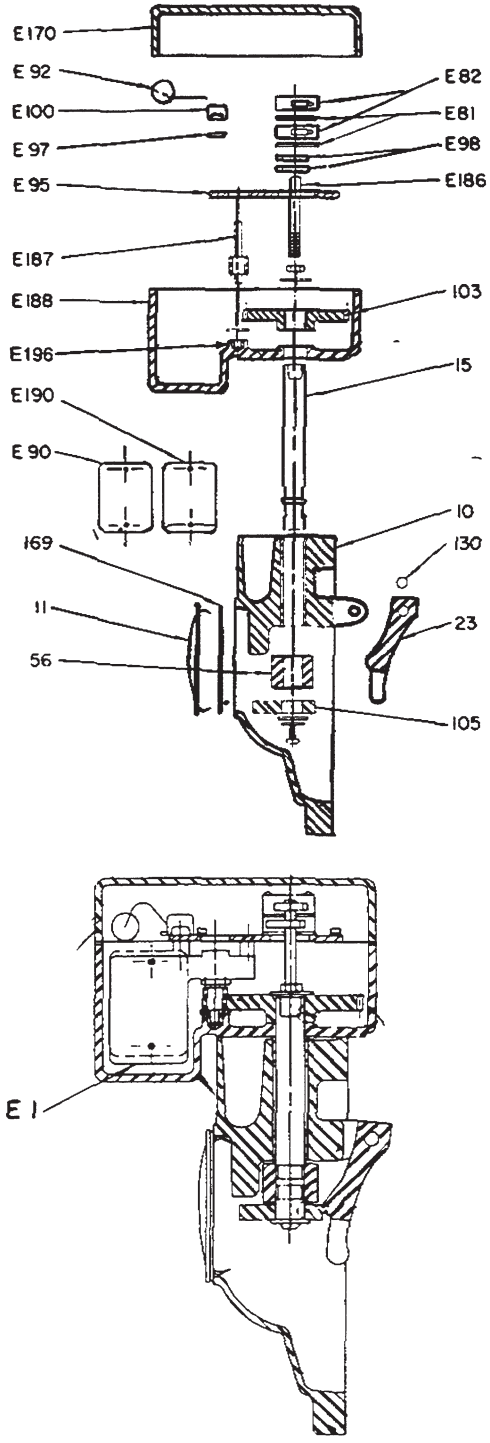


10 HOUSING CONTROL
11 COVER, STOP NUT
12 HANDWHEEL
13 CATCH, FRICTION
14 SPRING, COMPRESSION
15 ASSEMBLY, SHIFTING SCREW
16 BEARING (SHIFTING SCREW)
17 SLEEVE, BEARING RET.
18 RING, RETAINING
20 RING, RETAINING
23 YOKE, SHIFTING (600)
24 SCREW, FULCRUM
28 STOP, ADJUSTABLE (HIGH SPEED)
30 RETAINER, CRYSTAL
32 CRYSTAL, INDICATOR
33 DIAL, INDICATOR
40 COLLAR, EQUALIZING
42 HOUSING, THRUST BEARING
58 FITTING, LUB
130 PIN, SHIFTING YOKE
131 GASKET, CRYSTAL
135 HELIX, INDICATOR
136 WASHER, THRUST
137 WASHER, TENSION (HELIX(
138 PLUG, BUTTON
143 STOP, ADJUSTABLE (LOW SPEED)
146 NUT, HEX
155 ASSEMBLY, HANDWHEEL HANDLE
157 NUT, SHIFTING
158 YOKE, SHIFTING (L.H.) 500
159 YOKE, SHIFTING (R.H.) 500
160 PIN, FULCRUM
161 ROLLER, LINKAGE
170 WASHER
185 WASHER (EVER LOCK)
204 PIN, SPRING

NOTE ALL CAP SCREWS ECT NOT LISTED ARE STANDARD ITEMS

When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST—FOR SIZE 300 ERC



E 1 MOTOR
10 HOUSING, CONTROL
11 COVER, STOP NUT
15 SHAFT, SHIFTING
23 YOKE, SHIFTING
56 COLLAR, SHAFT
E81 INSULATOR
E82 SWITCH, LIMIT
E90 COVER, CONNECTION
E92 CAPACITOR, MOTOR
E95 PLATE, MOUNTING
E97 MARKER, STRIP
E98 CAM, LIMIT SWITCH
E100 BLOCK, TERMINAL
103 GEAR, SHIFTING
105 CAM, SHIFTING
130 PIN, YOKE
169 GASKET, COVER STOP NUT
E170 COVER, GEARMOTOR
E186 SHAFT, CAM
E187 PINION, CONTROL
E188 HOUSING, GEARMOTOR
E190 GASKET, COVER, CONNECTION
E196 BUSHING, PINION PILOT

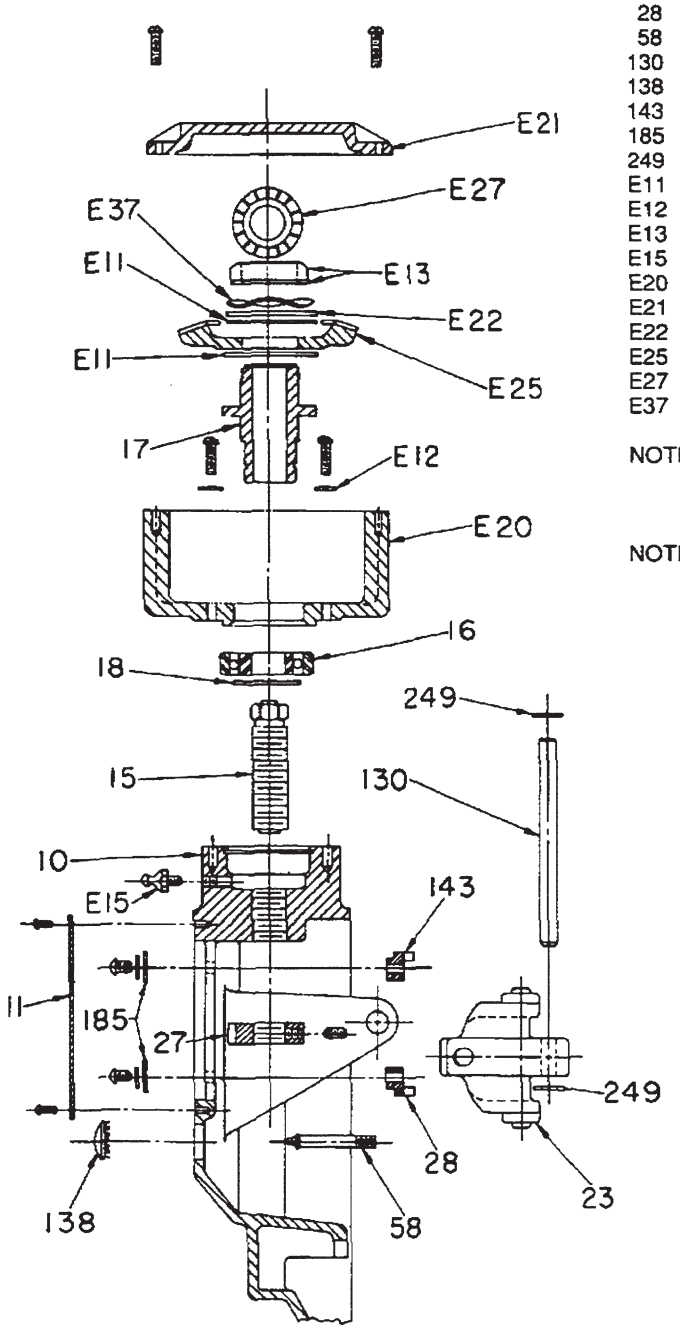
NOTE: GIVE IDENTIFICATION NUMBER & SIZE WHEN ORDERING PARTS FOR SERVICE AND REFER TO THIS DRAWING.

NOTE: ALL HARDWARE, ETC. NOT LISTED ARE STANDARD ITEMS.

ERC FOR 300 MOTO DRIVE

PARTS LIST FOR ELECTRIC REMOTE CONTROL FOR REEVES® MOTO DRIVE® SIZE 400

(WITH EXPLOSION PROOF MASTER® GEARMOTOR)



10	HOUSING, CONTROL
11	COVER, STOP NUT
15	SCREW, SHIFTING
16	BEARING, HUB
17	HUB, CLUTCH-FRICTION
18	RING, RETAINING
23	YOKE, SHIFTING (ASSEMBLY)
27	NUT, STOP
28	STOP, HIGH SPEED
58	FITTING, LUB
130	PIN, YOKE
138	PLUG, BUTTON
143	STOP, LOW SPEED
185	WASHER, EVERLOCK
249	RING, CIRCULAR (PUSH-ON)
E11	DISC, FRICTION
E12	SPRING, TENSION WASHER
E13	NUT & WASHER, LOCK
E15	FITTING, LUB
E20	BRACKET, MOTOR
E21	COVER, GEAR
E22	PLATE, PRESSURE
E25	GEAR, BEVEL
E27	PINION, BEVEL
E37	SPRING, TENSION WASHER

NOTE: GIVE SERIAL NUMBER OF MOTO DRIVE WHEN ORDERING REPLACEMENT PARTS AND REFER TO THIS DRAWING NUMBER.

NOTE: ALL HARDWARE NOT LISTED ARE STANDARD ITEMS.

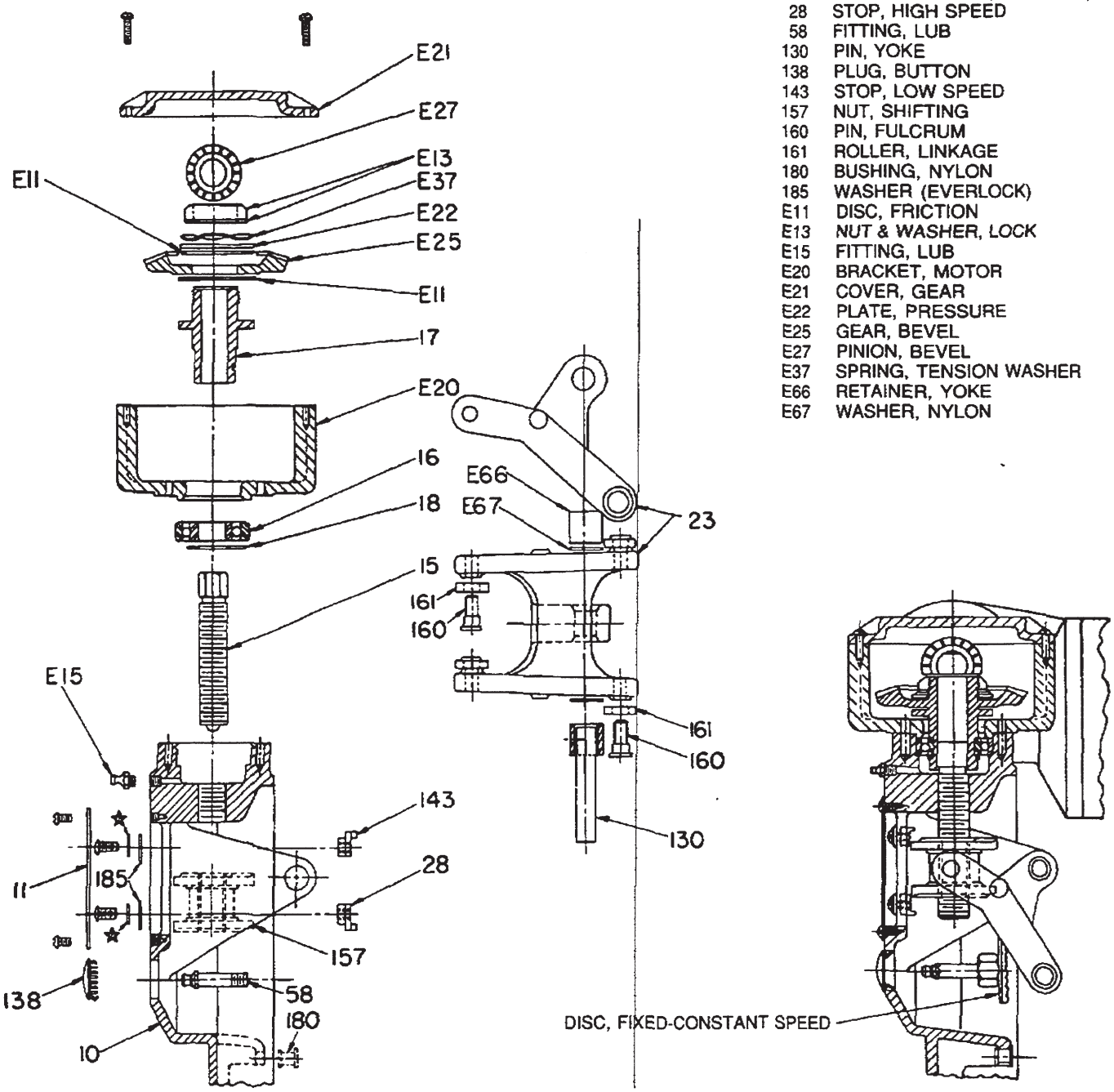
When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST FOR ELECTRIC REMOTE CONTROL FOR 500 & 600 MOTO DRIVE

GIVE SERIAL NUMBER OF MOTO DRIVE WHEN ORDERING REPLACEMENT PARTS AND REFER TO THIS DRAWING NUMBER.

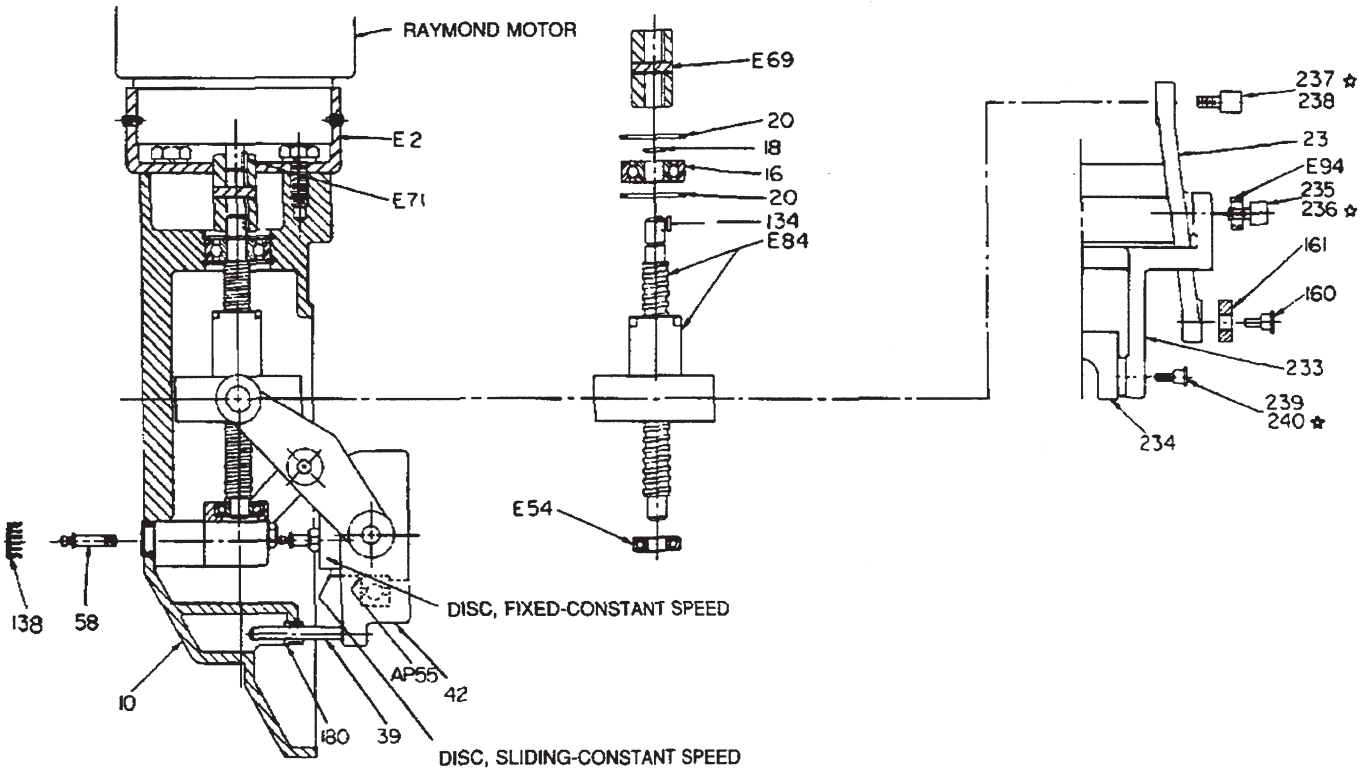
ALL CAP SCREWS ETC., NOT LISTED, ARE STANDARD ITEMS.

10	HOUSING, CONTROL
11	COVER, STOP NUT
15	SCREW, SHIFTING
16	BEARING, HUB
17	HUB, CLUTCH-FRICTION
18	RING, RETAINING
23	YOKE, SHIFTING (ASSEMBLY)
28	STOP, HIGH SPEED
58	FITTING, LUB
130	PIN, YOKE
138	PLUG, BUTTON
143	STOP, LOW SPEED
157	NUT, SHIFTING
160	PIN, FULCRUM
161	ROLLER, LINKAGE
180	BUSHING, NYLON
185	WASHER (EVERLOCK)
E11	DISC, FRICTION
E13	NUT & WASHER, LOCK
E15	FITTING, LUB
E20	BRACKET, MOTOR
E21	COVER, GEAR
E22	PLATE, PRESSURE
E25	GEAR, BEVEL
E27	PINION, BEVEL
E37	SPRING, TENSION WASHER
E66	RETAINER, YOKE
E67	WASHER, NYLON



When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

PARTS LIST FOR ELECTRIC REMOTE CONTROL (BALL SCREW) WITH RAYMOND MOTOR FOR 400-600 MOTO DRIVE



10	HOUSING, CONTROL	160	PIN, FULCRUM	238	PIN, FULCRUM L.H.
*16	BEARING, HOUSING	161	ROLLER, LINKAGE	239	PIN, FULCRUM, R.H.
18	RING, RETAINING (EXTERNAL)	180	BUSHING, NYLON	240	PIN, FULCRUM L.H.
20	RING, RETAINING (INTERNAL)	232	LINK, SHIFTING	E2	BRACKET, MOTOR
23	YOKE, SHIFTING	233	YOKE, RETAINING	*E54	BEARING, SHIFT. SCREW
39	ROD, GUIDE	234	BRACKET, YOKE	E69	COUPLING
*42	HOUSING, THRUST BRG.	235	PIN, FULCRUM R.H.	E71	KEY, MOTOR
58	FITTING, LUB	236	PIN, FULCRUM L.H.	*E94	BEARING, NEEDLE
134	KEY, SHIFTING SCREW	237	PIN, FULCRUM R.H.	AP56	RING, RETAINING
138	PLUG, BUTTON				

☆NOTE: PARTS NOT SHOWN

* RECOMMENDED SPARE PARTS

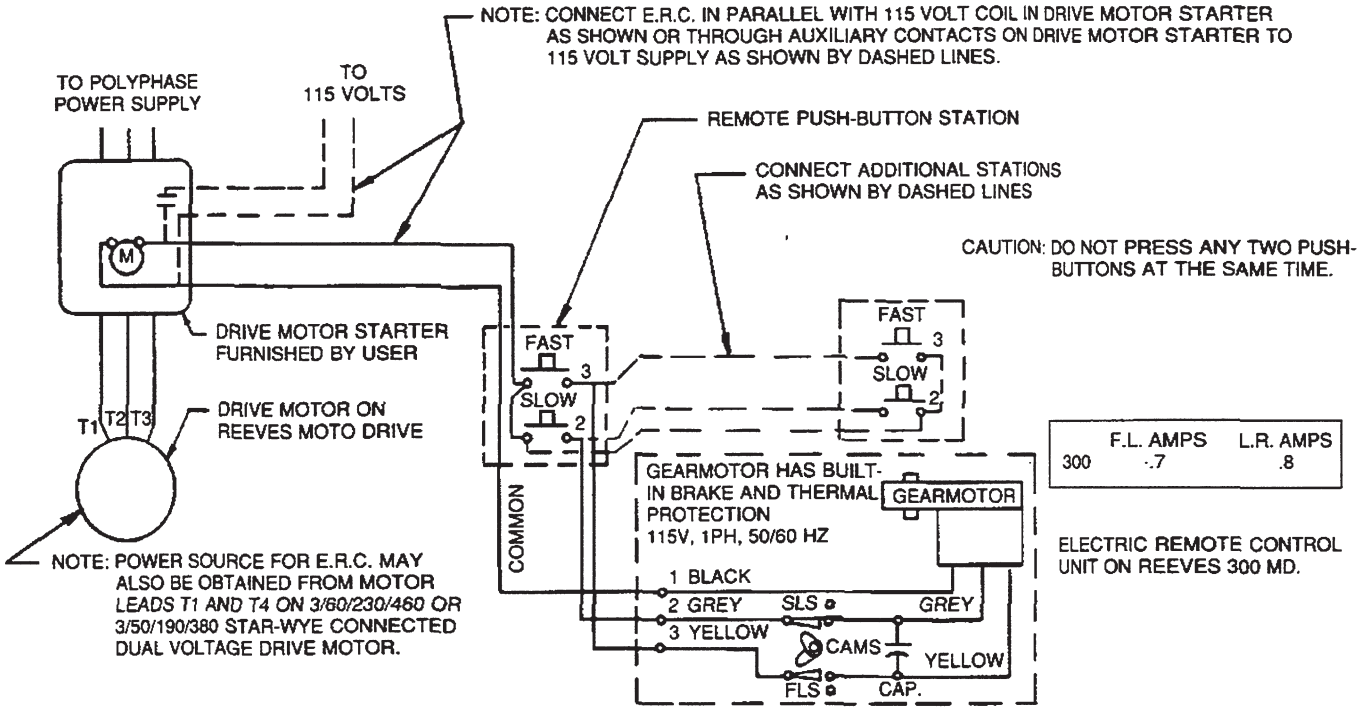
GIVE SERIAL NUMBER OF MOTO DRIVE WHEN ORDERING REPLACEMENT PARTS AND REFER TO THIS DRAWING NUMBER.

ALL CAP SCREWS ETC., NOT LISTED, ARE STANDARD ITEMS.

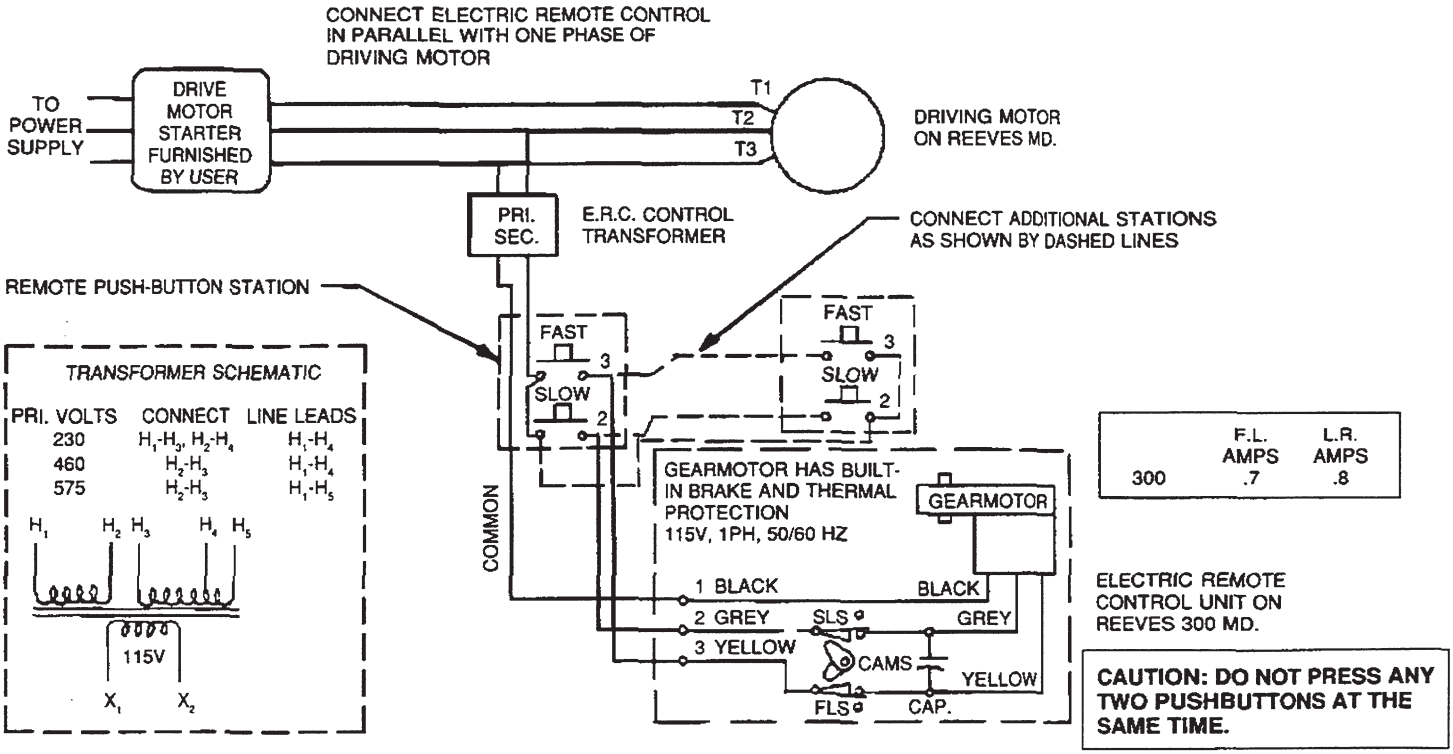
When ordering MOTO DRIVE replacement parts refer to this bulletin number and give serial number, assembly number, and unit size number.

ERC WIRING DIAGRAMS

Size 300 ERC

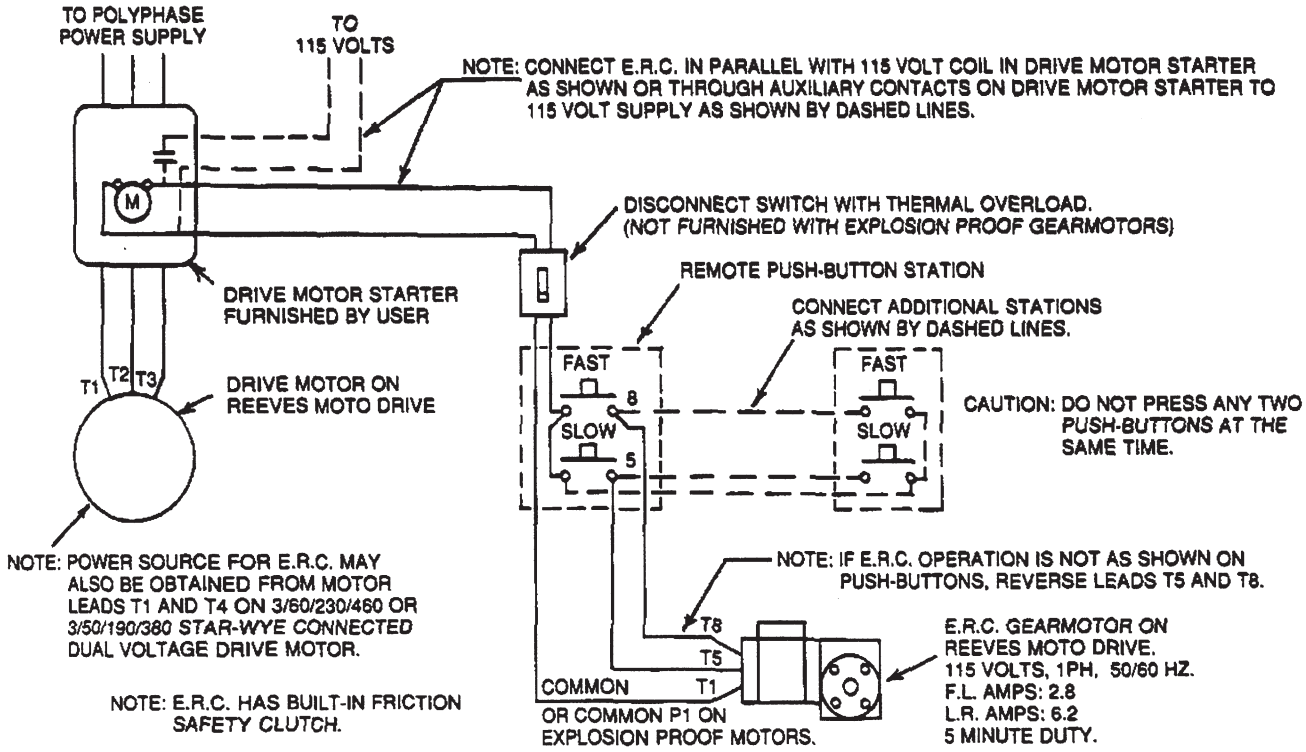


Size 300 ERC with Transformer

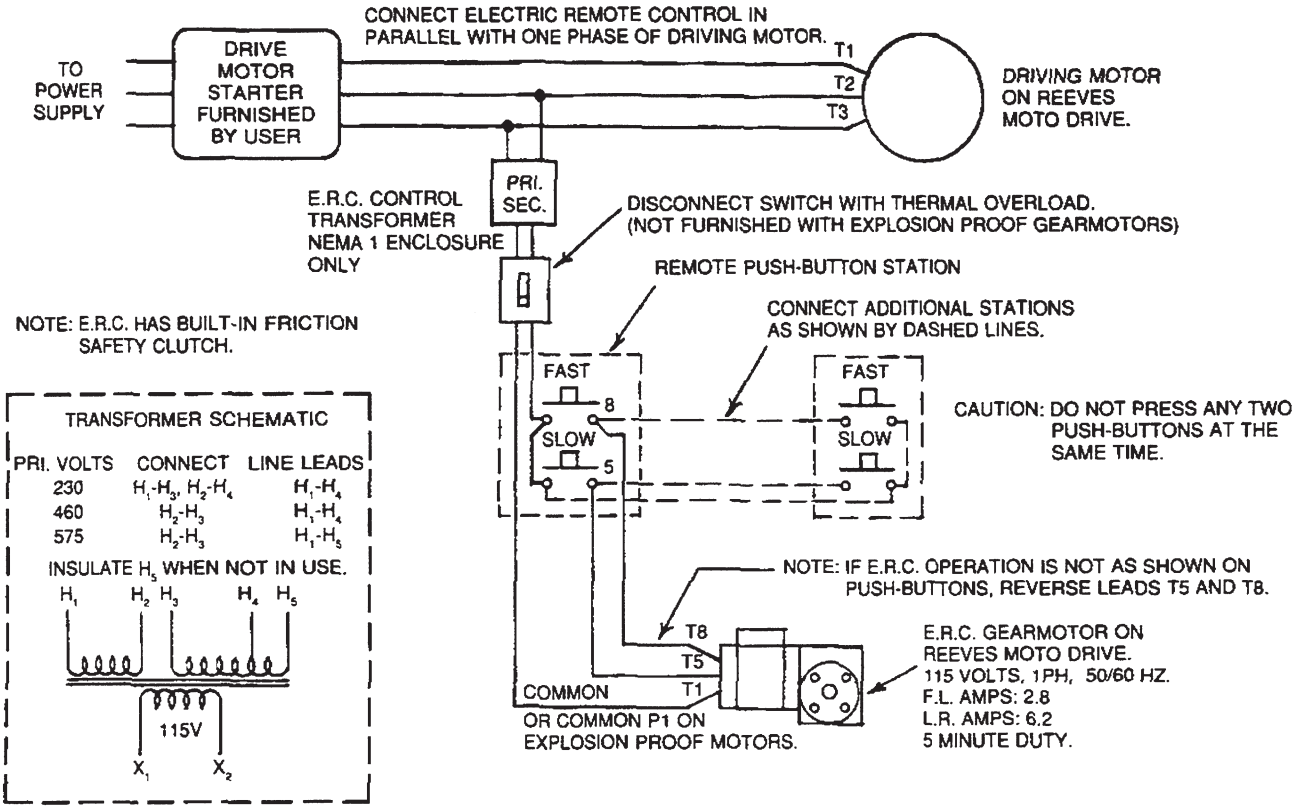


ERC WIRING DIAGRAMS

Size 400-600 ERC with MASTER Motor

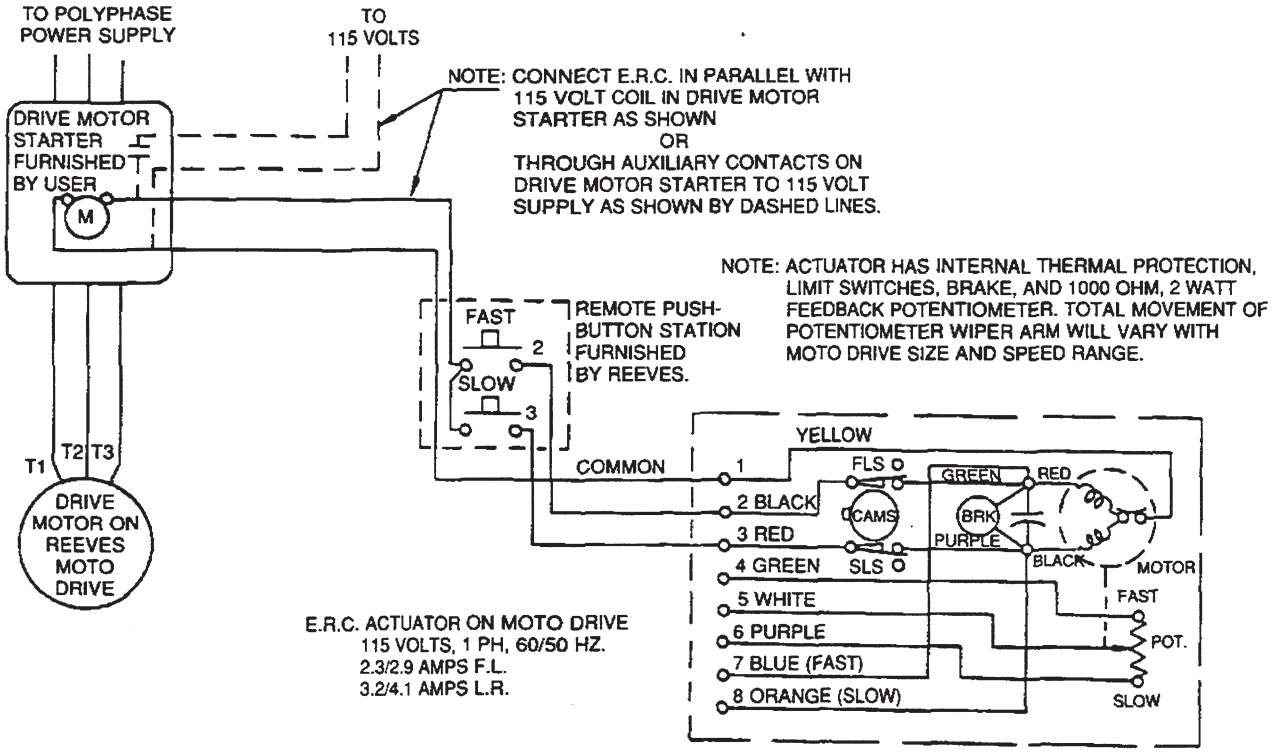


Size 400-600 ERC with MASTER Motor and Transformer

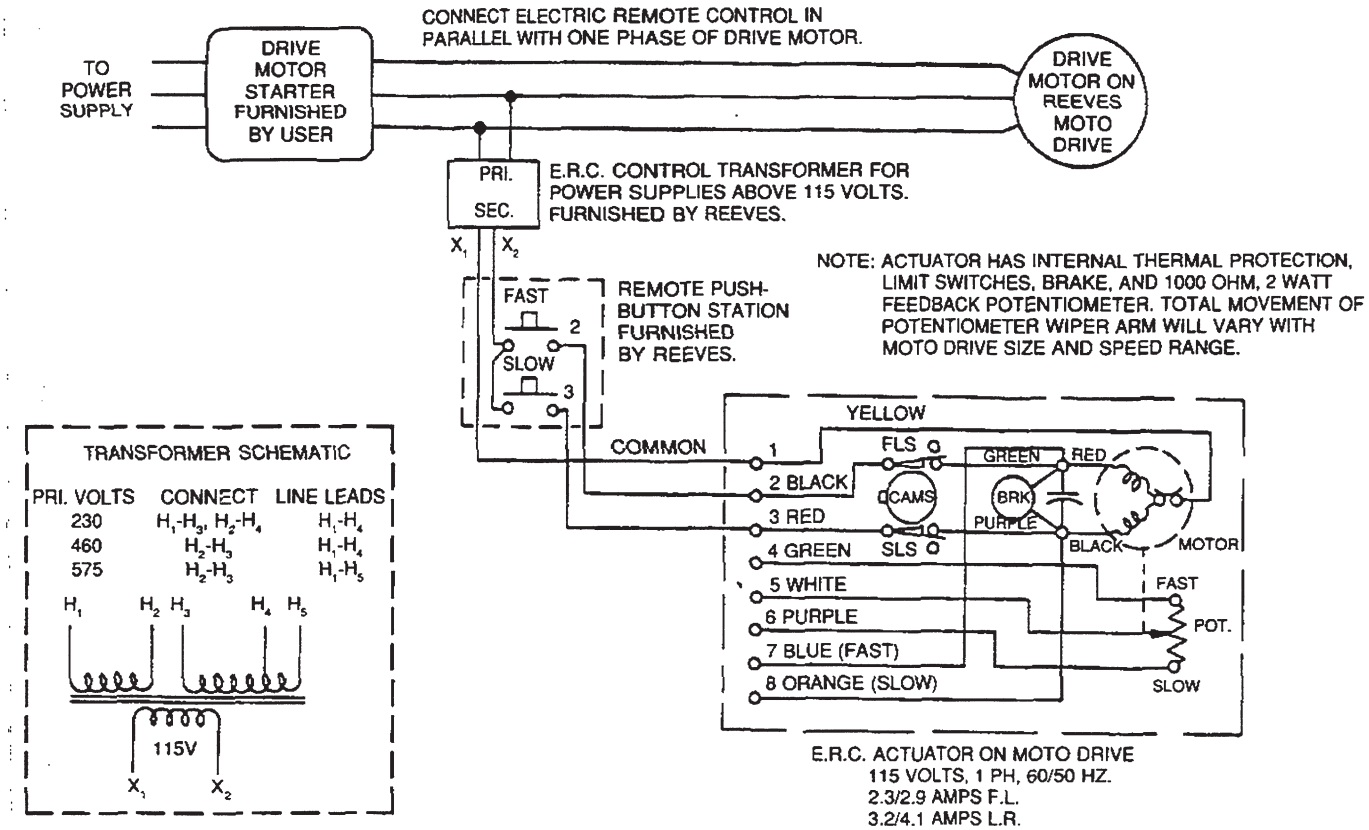


ERC WIRING DIAGRAMS

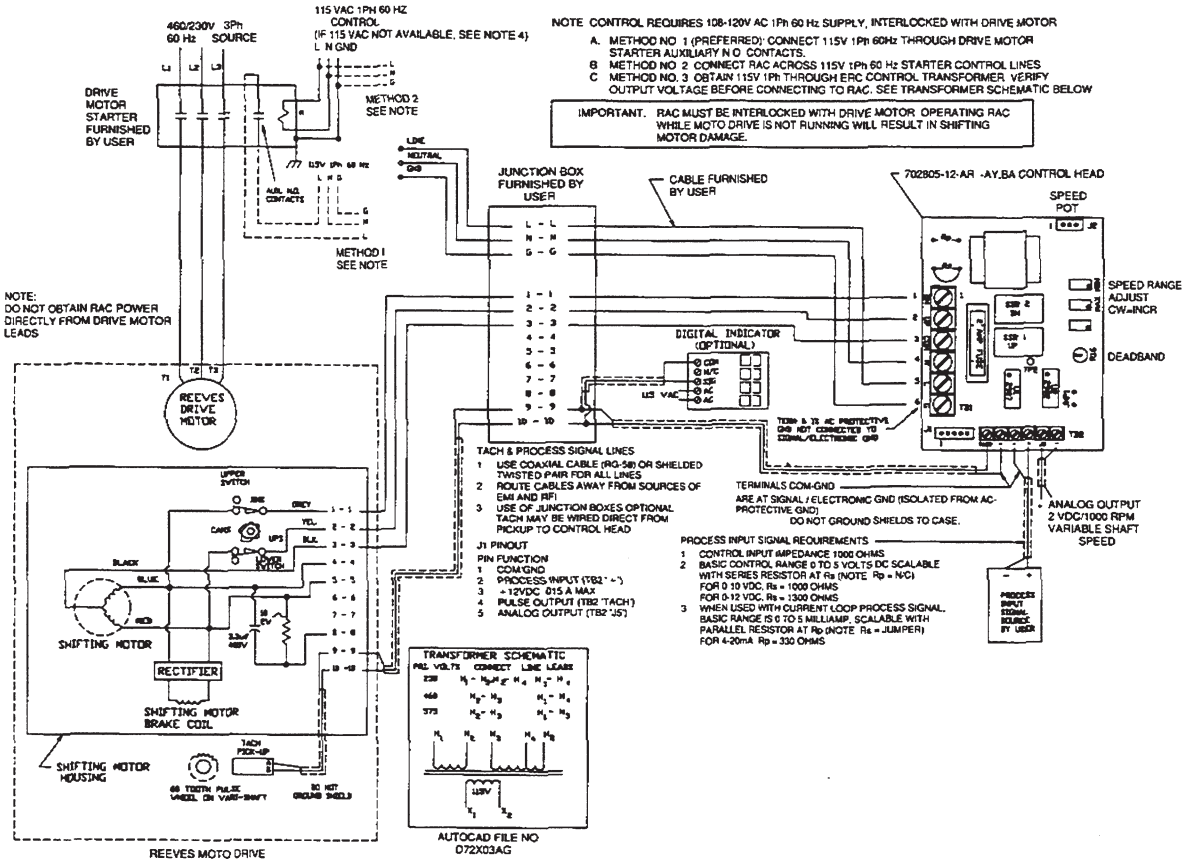
Size 400 thru 600 Ball Screw ERC with Raymond Actuator



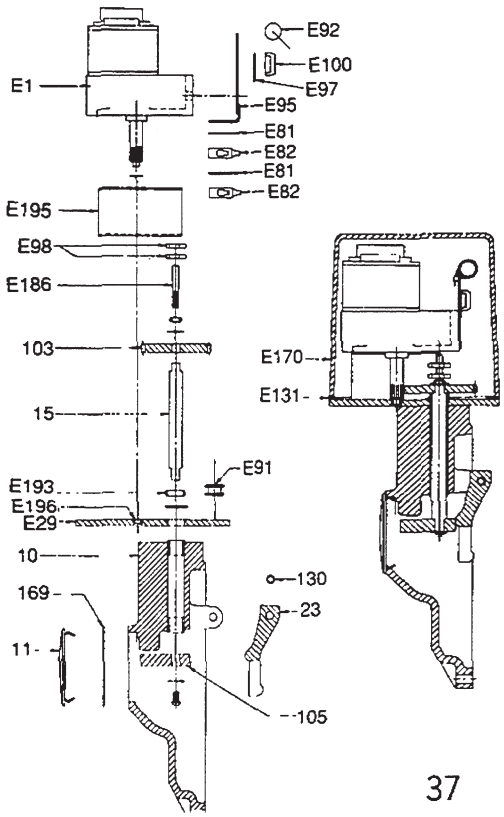
Size 400 thru 600 Ball Screw ERC with Raymond Actuator and Transformer



SIZE 300 RAC CONTROL SYSTEM WIRING DIAGRAM



PARTS LIST FOR 300 MOTO DRIVE® RAC SHIFTING MOTOR

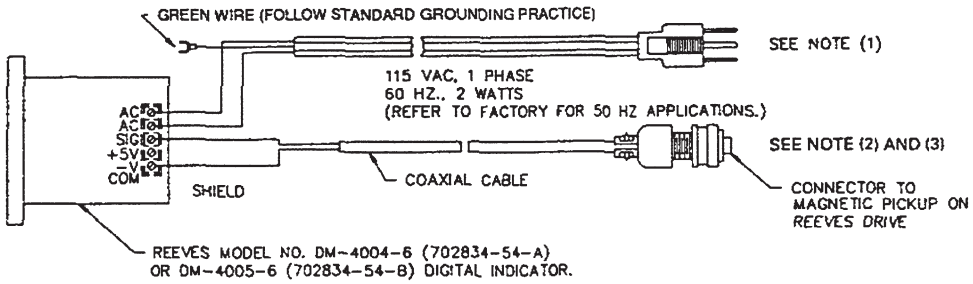


E1	MOTOR
10	HOUSING, CONTROL
11	COVER, STOP NUT
15	SHAFT, SHIFTING
23	YOKE, SHIFTING
E29	PLATE, BASE
E81	INSULATOR
E82	SWITCH, LIMIT
E92	CAPACITOR, MOTOR
E95	PLATE, MOUNTING
E97	STRIP, MARKER
E98	CAM, LIMIT SWITCH
E100	BLOCK, TERMINAL
103	GEAR, SHIFTING
105	CAM, SHIFTING
130	PIN, YOKE
E131	GASKET, COVER
169	GASKET, COVER, STOP NUT
E170	COVER, GEAR
E186	SHAFT, CAM
E193	SPACER, MOTOR
E195	PLATE, MOUNTING MOTOR
E196	BUSHING, PINION PILOT
E91	GROMMET, RUBBER

NOTE: GIVE IDENT. NUMBER AND SIZE WHEN ORDERING PARTS FOR SERVICE AND REFER TO THIS DRAWING

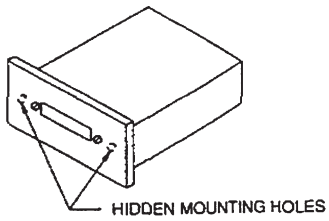
NOTE: ALL HARDWARE, ETC. NOT LISTED ARE STANDARD ITEMS.

DIGITAL INDICATOR CONNECTION DIAGRAM



CAUTION:

DO NOT CONNECT ANY OTHER POWER SOURCE TO THE *+5V SUPPLY TERMINAL.*

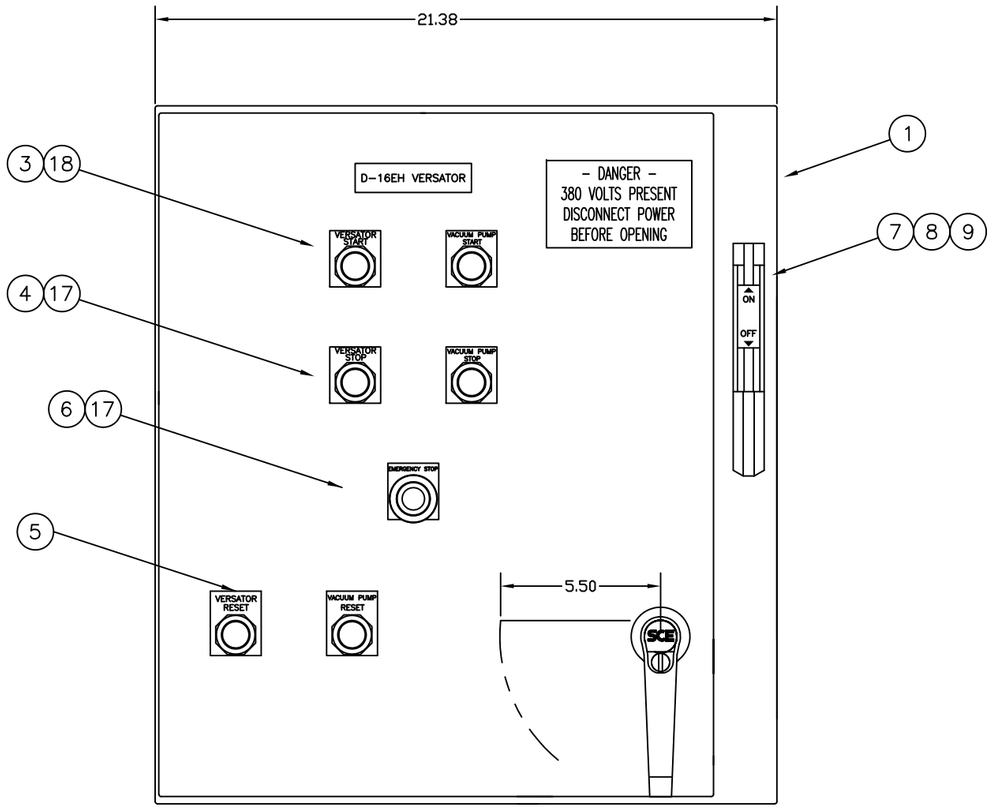


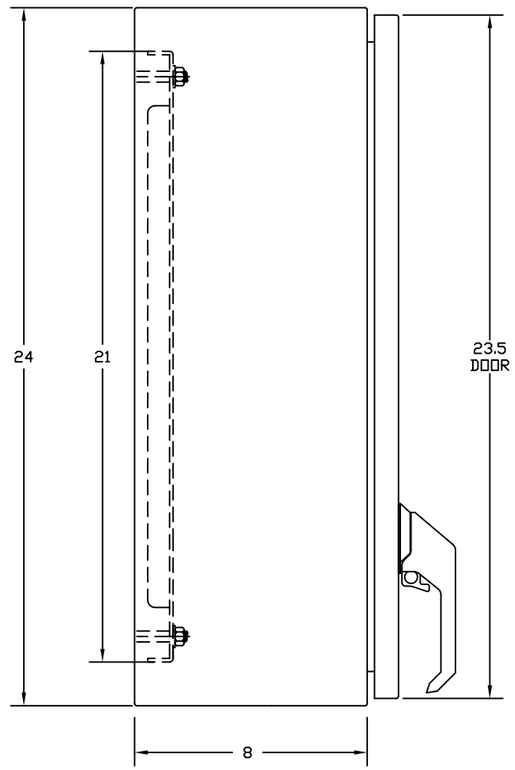
REMOVE 2-SCREWS FROM FRONT OF LENS.
REMOVE LENS TO EXPOSE TWO HIDDEN MOUNTING HOLES.

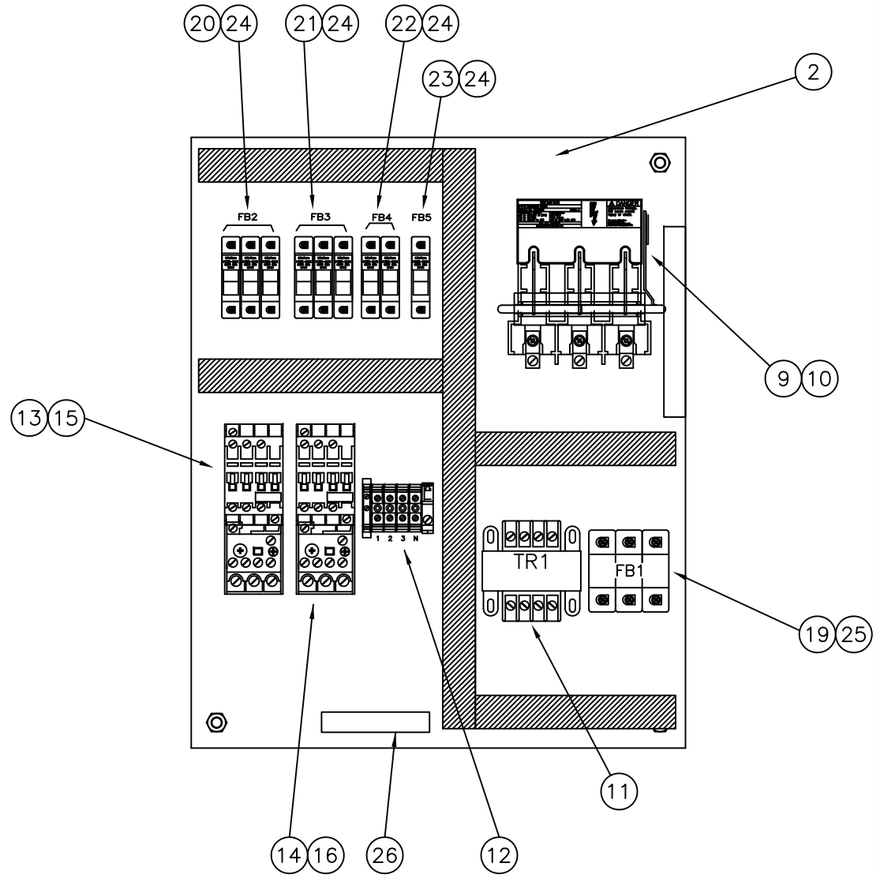
REF.: D42000-39-J INSTRUCTIONS & SD-7100-10-B DIMENSION SHEET.

NOTE:

1. 6 FT. OF 3-WIRE POWER CORD AND 3-PRONG PLUG. FOLLOW PROPER GROUNDING PRACTICE. POWER CORD IS NOT PROVIDED ON INDICATORS FURNISHED IN NEMA 4X OR EXPLOSION PROOF HOUSINGS.
2. STANDARD CONNECTOR FOR NON-EXPLOSION PROOF PICKUPS SHOWN. AMPHENOL TYPE MS 3106A-10SL-4S.
3. EXPLOSION PROOF PICKUP HAS 3-18" WIRE LEADS AND 1/2" INTERNAL PIPE THREAD. WIRE PER CODE AND APPROVED XP WIRING PRACTICE. CONNECT WIRES: WHITE TO "SIGNAL," BLACK TO "COM," GREEN TO PROTECTIVE GROUND.







ITEM	DESCRIPTION	MANUFACTURER	PART NUMBER	QTY
1	24x21x8 NEMA4 DISCONNECT ENCLOSURE	SAGINAW	SCE-24XEL2108LP	1
2	24X20 SUBPANEL	SAGINAW	SCE-24P20	1
3	FLUSH GREEN START PUSH BUTTON	LOVATO	8LM2T B103	2
4	EXTENDED RED STOP PUSH BUTTON	LOVATO	8LM2T B204	2
5	BLUE RESET PUSH BUTTON	LOVATO	8LM2T R1006	2
6	PUSH PULL E-STOP	LOVATO	8LM2T B6244	1
7	DISCONNECT OPERATOR	SIEMENS	FHOSO6R	1
8	DISCONNECT HANDLE	SIEMENS	FHOHS4	1
9	DISCONNECT CABLE	SIEMENS	FHOECO36	1
10	60A FUSIBLE DISCONNECT	SIEMENS	MCS606R	1
11	100VA TRANSFORMER	SIEMENS	MT0100I	1
12	TERMINAL BLOCKS	SIEMENS	8WA1 011	4

ITEM	DESCRIPTION	MANUFACTURER	PART NUMBER	QTY
13	VERSATOR OVERLOAD (8A-12A)	GE	RTN1N	1
14	VACUUM PUMP OVERLOAD (8A-12A)	GE	RTN1N	1
15	VERSATOR CONTACTOR	GE	CL25A310TJ	1
16	VACUUM PUMP CONTACTOR	GE	CL25A310TJ	1
17	N/C CONTACT	LOVATO	8LM2T C01	5
18	N/O CONTACT	LOVATO	8LM2T C10	2
19	35 AMP DISCONNET FUSE (FB1)	LITTELFUSE	CCMR35	3
20	20 AMP VERSATOR FUSE (FB2)	LITTELFUSE	CCMR20	3
21	15 AMP VACUUM PUMP FUSE (FB3)	LITTELFUSE	CCMR15	3
22	1/2 AMP TRANSFORMER INPUT FUSE (FB4)	LITTELFUSE	KLDR 1/2	2
23	1 AMP TRANSFORMER OUTPUT FUSE (FB5)	LITTELFUSE	KLDR 1	1
24	FINGERSAFE FUSEBLOCK	LITTELFUSE	LPSC000#ZXID	4
25	30A-60A FUSEBLOCK	LITTELFUSE	LFC600603CID	1
26	GROUND BAR	HOFFMAN	DG19	1

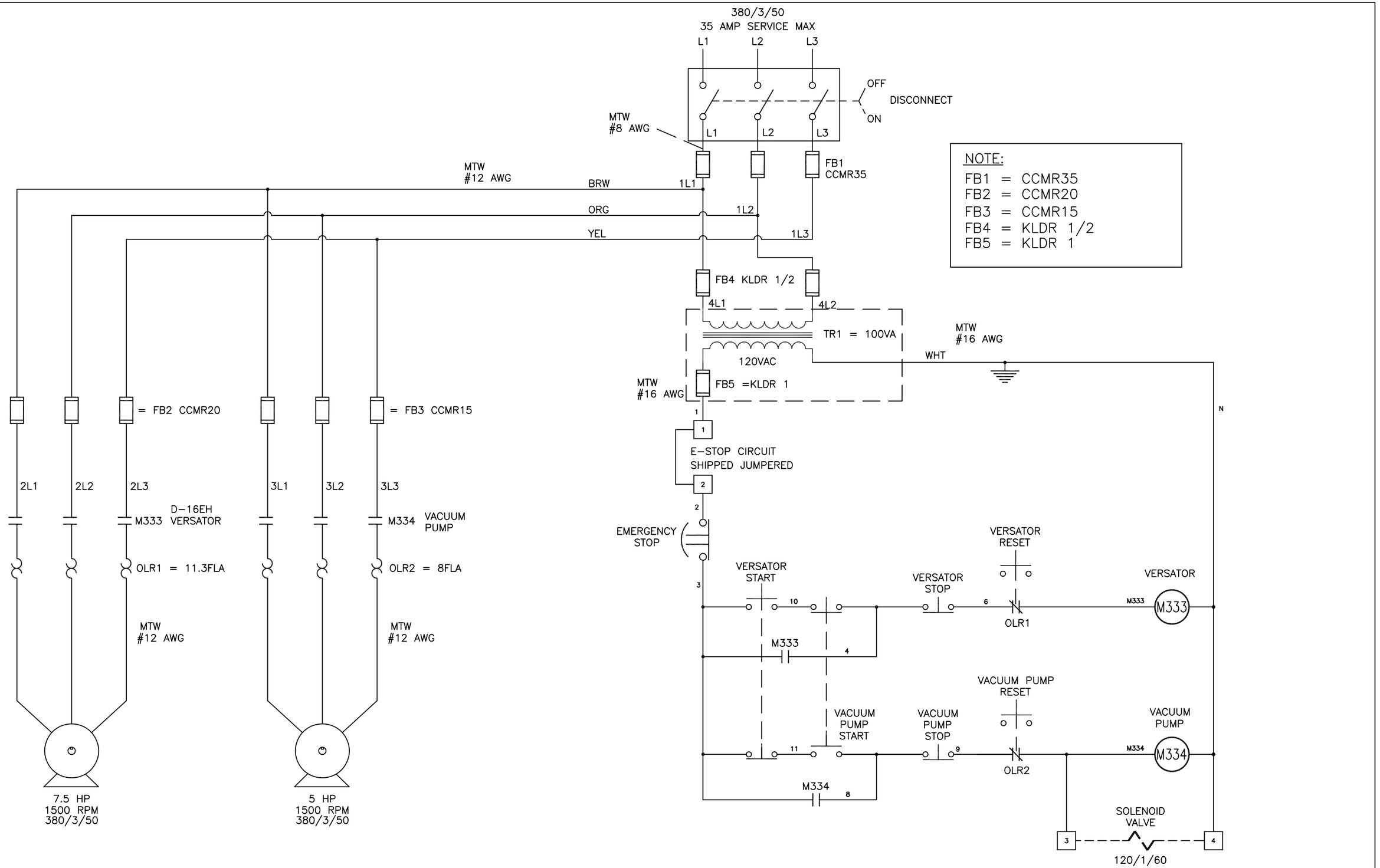
walker US
2111 Herbertsville Road, Point Pleasant, New Jersey
732-899-2550 www.walker-us.com info@walker-us.com

CUSTOMER: CORNELL MACHINE

DESCRIPTION: ENCLOSURE LAYOUT

NO.	DATE	REVISION DETAILS	BY
4			
3			
2	04-30-19	AS BUILT	JRL
1	03-25-19	RELEASED	JRL

DATE: 03-25-19
SCALE: NO SCALE
DRAWN: JRL
F.O.#: 10400
DRAWING NO. E22776-1
1 OF 2
REV 2



NOTE:

FB1 = CCMR35
FB2 = CCMR20
FB3 = CCMR15
FB4 = KLDR 1/2
FB5 = KLDR 1

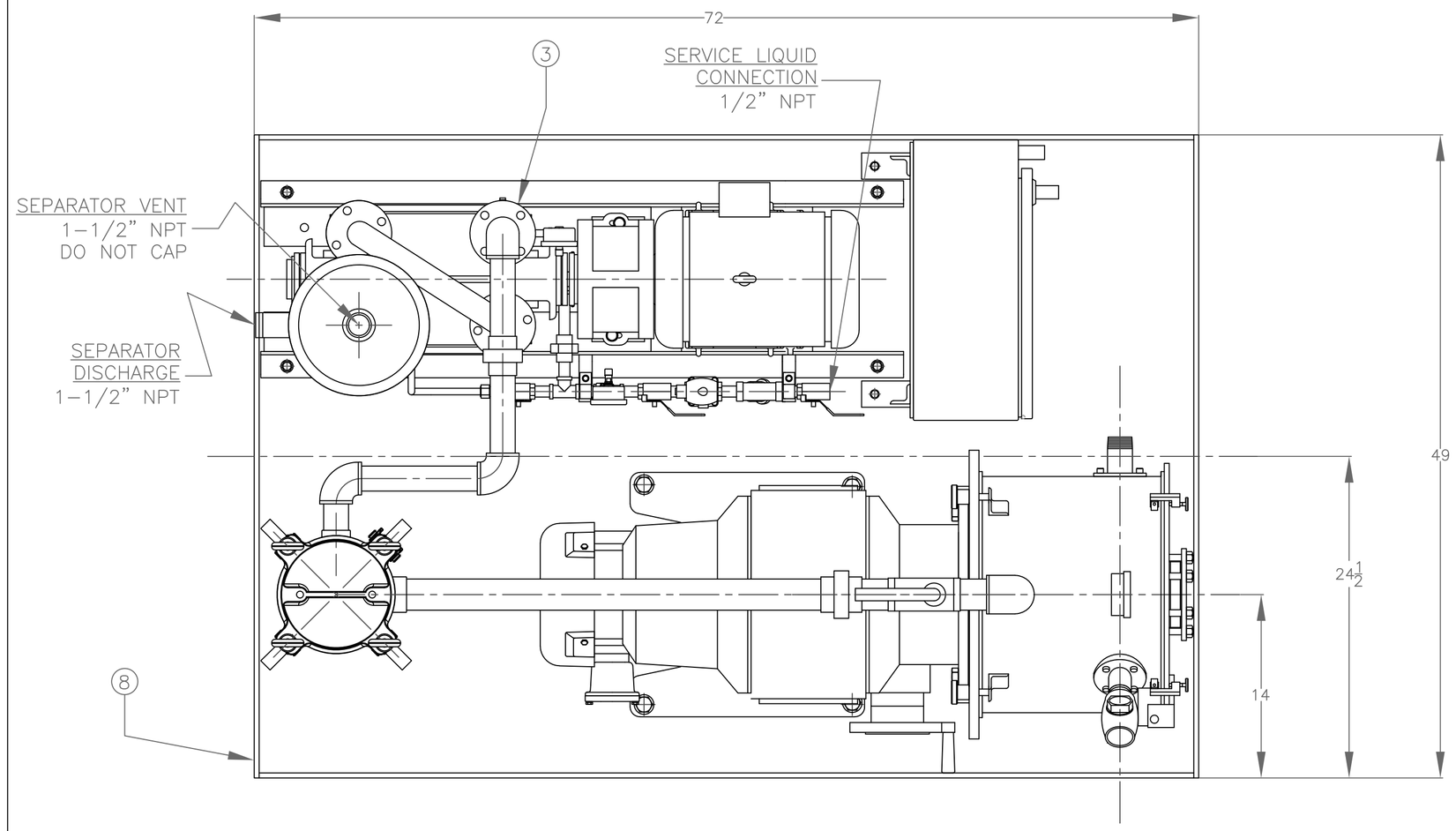
walker US
2111 Herbertsville Road, Point Pleasant, New Jersey
732-899-2550 www.walker-us.com info@walker-us.com

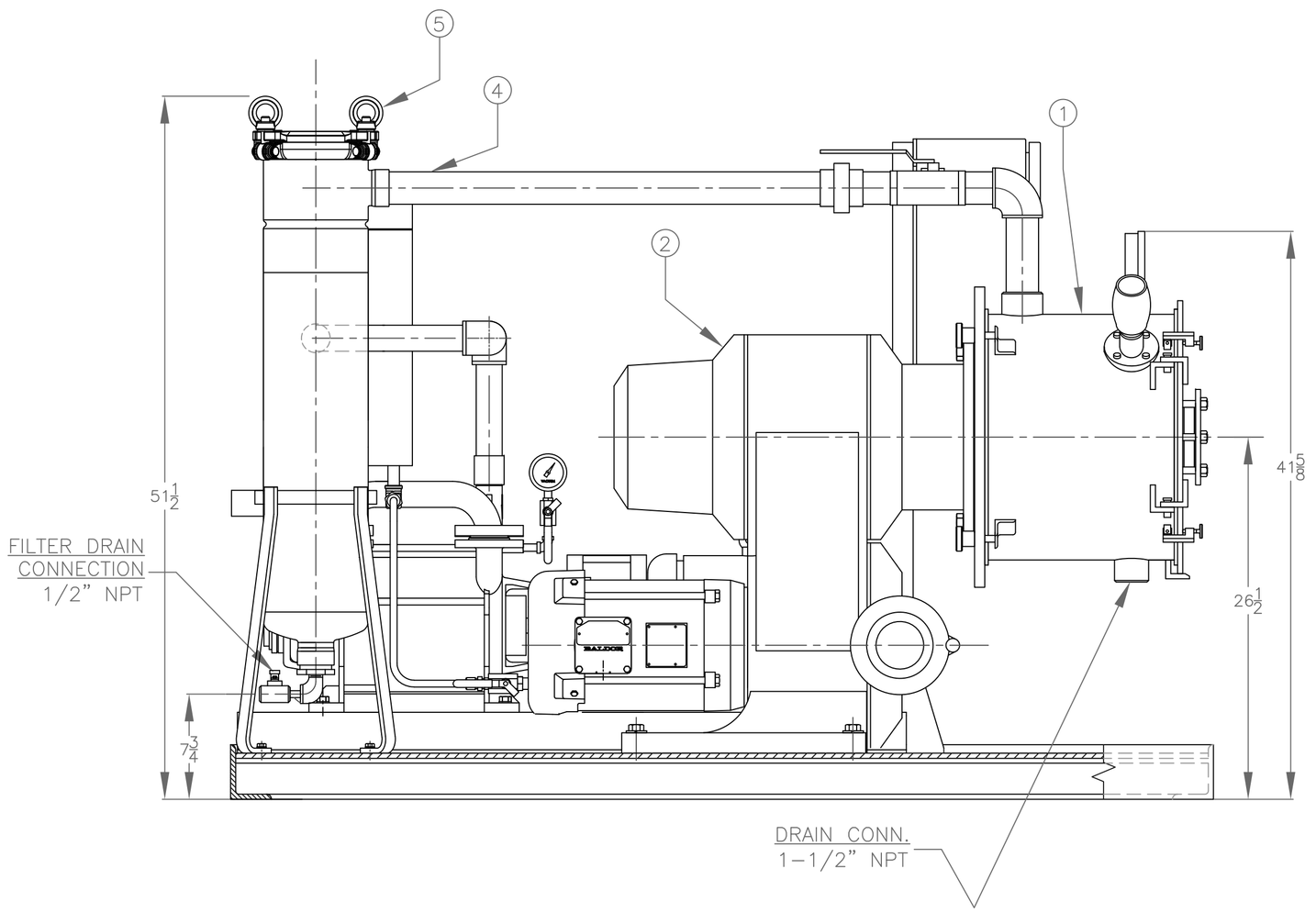
CUSTOMER: CORNELL MACHINE

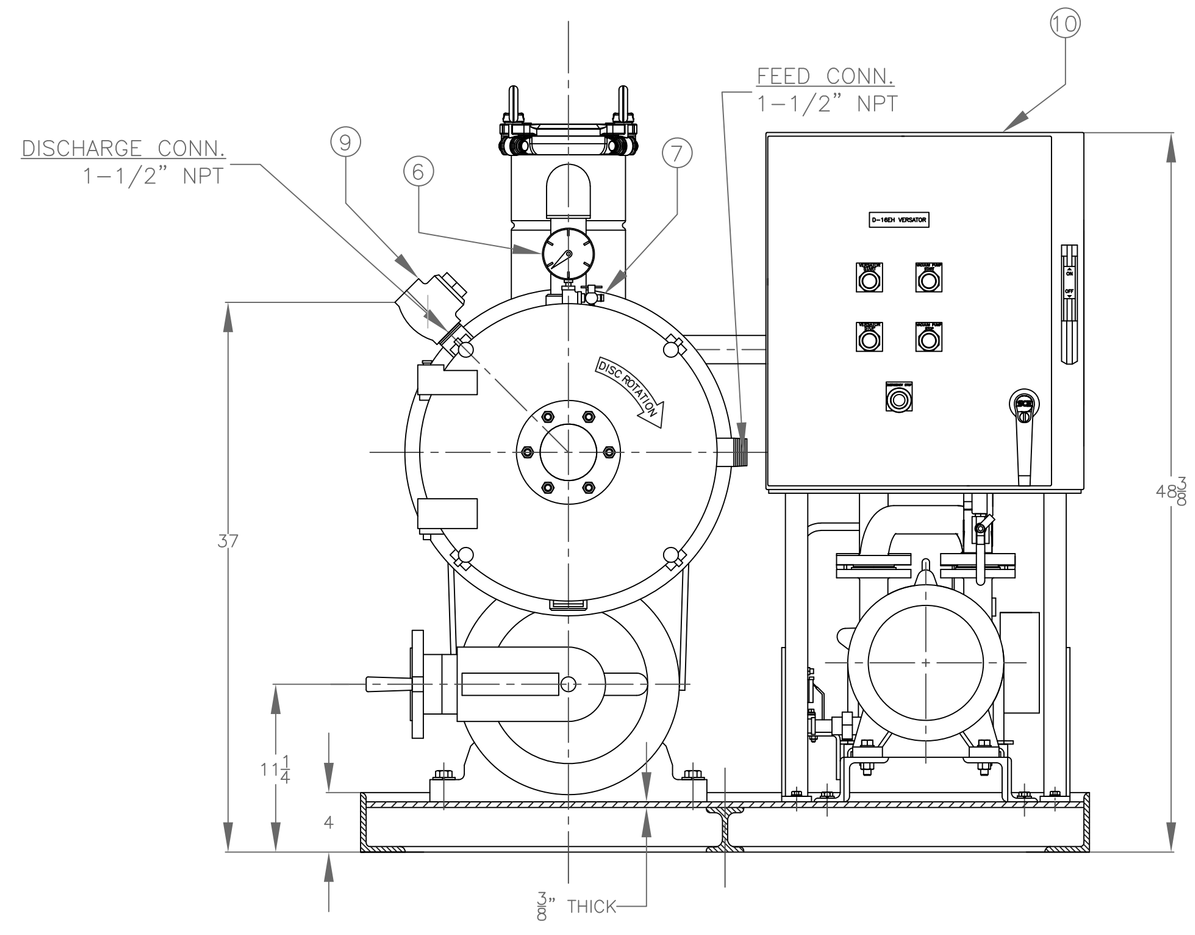
DESCRIPTION: D-16EH VERSATOR CONTROL

NO.	DATE	REVISION DETAILS	BY
4			
3			
2	04-30-19	AS BUILT	JRL
1	03-25-19	RELEASED	JRL

DATE: 03-25-19
DRAWN: JRL
SCALE: NO SCALE
F.O.#: 10400
DRAWING NO. E22776-2
2 OF 2
REV 2







NOTES
1) SEE OPERATION MANUAL FOR ALL TECHNICAL INFORMATION REGARDING THIS EQUIPMENT.
2) ALL DIMENSIONS ARE APPROXIMATE.

ITEM	QTY	DESCRIPTION	MATERIAL
10	1	ELECTRICAL CONTROL PANEL 380V 3P 50HZ	NEMA 12
9	1	CHECK VALVE – 1-1/2" NPT	S.S.
8	1	BASE-PLATE – STANDARD	C.S.
7	1	PETCOCK (VACUUM RELIEF)	BRONZE
6	1	VACUUM GAUGE (0-30 IMV)	STD
5	1	VACUUM LINE KNOCK-OUT FILTER WITH FLOOR STAND AND DRAIN ASSEMBLY	S.S.
4	1	VACUUM PIPING	S.S.
3	1	SIHI LPHR-45312 VACUUM PUMP LIQUID RING (WATER-SEALED)	---
2	1	7.5HP REEVES SIZE 400 MOTODRIVE 380V 3P 50HZ MOTOR	---
1	1	D-16EH VERSATOR STANDARD CONSTRUCTION	S.S.

BILL OF MATERIAL

THE CORNELL MACHINE COMPANY
45 BROWN AVENUE SPRINGFIELD, NJ 07081-2992
TEL: (973) 379-6860 INFO@CORNELLMACHINE.COM
FAX: (973) 379-6854 WWW.CORNELLMACHINE.COM

DRAWN BY: AJH 3/8/2019			TITLE: DIMENSIONAL OUTLINE D-16EH VERSATOR PACKAGE
CAD FILE: D-9765.DWG			
SCALE:	REV:	SIZE:	DRAWING: D-9765
NTS	---	---	