RM-99
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Installation, Operation, and Maintenance

ERIEZ RevX-E® 1.0M/1.2M/1.5M LT2/ST2/ST22 EDDY CURRENT SEPARATOR STYLE NO. 201300967

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SECTION 1.

INSTALLATION, OPERATION, AND MAINTENANCE REV X-E ECS

Installation, Operation and Maintenance Instructions

ERIEZ EDDY CURRENT SEPARATORS

RevX-E® LT2/ST2/ST22

ERIEZ MAGNETICS **HEADQUARTERS: 2200 ASBURY ROAD, ERIE, PA 16506-1440 U.S.A.**
WORLD AUTHORITY IN ADVANCED TECHNOLOGY FOR MAGNETIC, VIBRATORY and METAL DETECTION APPLICATIONS

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Eriez REV X-E ECS

Warning

PROVISION MUST BE MADE TO SHUT DOWN THE USER FEED CONVEYOR BEFORE STOPPING THE EDDY CURRENT SEPARATOR. THIS WILL PREVENT MATERIAL FROM LYING ON THE SEPARATOR CONVEYOR BELT WITH THE ROTOR STILL COASTING. STRAY FERROUS LYING IN THE ROTOR AREA COULD HEAT UP AND CAUSE DAMAGE TO THE BELT AND ROTOR.

SAFETY STATEMENT

CAUTION - STRONG MAGNET

This equipment includes one or more extremely powerful magnetic circuits. The magnetic field may be much stronger than the Earth's background field at a distance several times the largest dimension of the equipment.

- **If you use a heart pacemaker of similar device you must never approach the equipment because your device may malfunction in the magnetic field, with consequences up to and including death.**
- **To avoid serious pinch type injuries caused by objects attracted to the magnet, keep all steel and iron objects well away from the equipment. Do not allow hands, fingers, and other body parts to be caught between the equipment and "workpiece" being lifted.**
- **Keep credit cards, computer disks, and other magnetic storage devices away from the equipment because magnetically stored information may be corrupted by the magnetic field.**
- **Keep electronic devices, such as computers or monitors, away from the equipment because exposure to the magnetic field may result in malfunction or permanent damage to such devices.**

Contact Eriez if you have a question regarding these precautions.

CAUTION

Safety labels must be affixed to this product. Should the safety label(s) be damaged, dislodged or removed, contact Eriez for replacement.

Principles of Operation

The 'RevX-E' non-ferrous metallic separator consists of an external drum, an internal eccentric permanent magnetic rotor, a drive, and a belt conveyor.

The external drum shell of non-metallic composite material rotates at conventional speed. The internal, smaller diameter magnetic rotor is offset near the top of the drum shell. This rare earth alternating-polarity rotor turns at a much higher rotational speed than the external shell.

Through the induction of eddy currents and the resulting repelling forces, the alternating magnetic field selectively repels the non-ferrous metals and physically separates them from other materials with minimum product loss.

General Description

The RevX-E Eddy Current Separator (ECS) is furnished with a 16" diameter eddy current drum with eccentric rotor, a tail pulley, pillow block bearings, conveyor belt side guides, a protective hood, and product discharge hoppers with splitter assembly. The frame is of welded structural steel construction.

The rotor drive consists of an electric motor, coupled to the rotor by sheaves and matched v-belts with a fully enclosed belt guard. The rotor speed can be of fixed or variable speed depending on options purchased.

The conveyor belt drive consists of an electrical motor, with a shaft mounted gear reducer on the tail pulley shaft. The belt speed can be fixed or variable speed depending on options purchased.

The ECS is shipped with conveyor assembled to hood. Splitter chute flaps must be assembled onto splitter in the field. (See Installation)The optional pan feeder and control are separate and require hook-up.

The Eddy Current Separator is designed to operate with a minimum amount of ferrous material in the waste stream. If necessary, Eriez drum, pulleys, and belt magnets should be placed upstream to remove this material.

Eddy Current Separator Application

RE Type ECS: Majority of Applications including, ASR Shredder Fluff, MRF, MSW, Plastic, Glass, Ash, Foundry, Computer Scrap

Installation

Take care when uncrating to avoid damage to the equipment. Unit has been adjusted and tested at the factory prior to shipment. Pulleys have been installed with care to provide alignment of shafts and bearings.

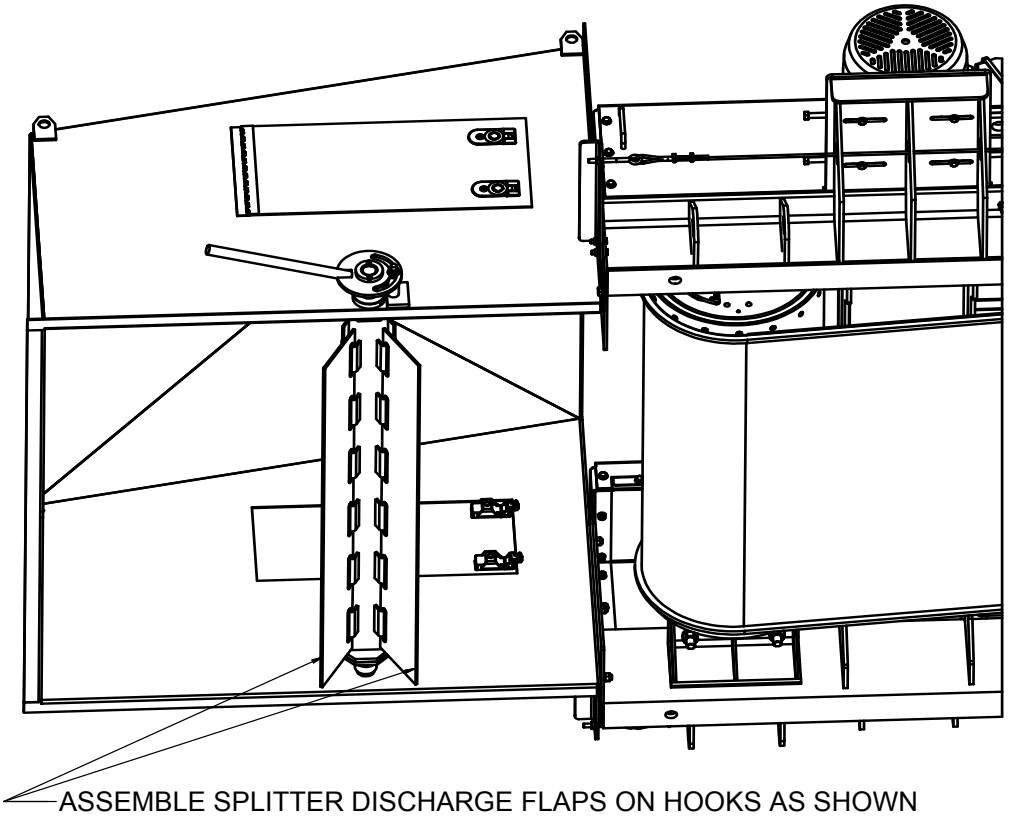
If there is a question of damage to the separator from rough handling in shipment, shaft alignment and belt adjustment should be checked prior to startup.

When preparing to bolt the unit in the installation, shims should be used underneath the frame in the regions of the mounting holes to ensure that the frame is sitting on a firm and level surface.

The ECS should be leveled square. Do not pull bolts to frame by tightening, but shim from mounting surface to frame, preventing any twisting of the frame when hold down bolts are tightened. Note that the frame should be supported rigidly from below.

Optional feeder shall be shipped either loose or secured on frame work. If loose, feeder shall be lifted and placed onto mounting pads. If on frame work, release securing cables/straps that hold feeder.

Assemble splitter discharge flaps on hooks of splitter as shown in the following view:



ASSEMBLE SPLITTER DISCHARGE FLAPS ON HOOKS AS SHOWN AT JOB SITE (FLAPS ARE SHIPPED 'LOOSE')

Operation

Clear the installation area of any loose tools or other materials which may be attracted to the magnetic rotor.

The main disconnect and Eddy Current Separator hatch panels, if supplied, must be closed.

The Emergency Stop switch must be pulled out.

1. Manual Mode (Local)

The hand mode of operation is primarily intended for maintenance. The rotor will not run in this mode as it is possible to damage the shell or conveyor belt if the rotor is running with the conveyor off.

Move the auto-hand selector switch into the hand mode. Push the conveyor start button to start the conveyor belt. Note that the conveyor start/stop push buttons only work in this mode.

Momentarily start the conveyor drive in the "Hand Mode" and observe the direction of the belt. If belt rotation is incorrect, check the motor leads. If belt adjustment is necessary, due to misalignment during shipping, reposition the bearings on the tail pulley by take-up screws on either side of the pulley. Do not over tighten, as it is possible to pull the rotor shell into the rotor. It may be necessary to loosen one side rather than tighten the other to track the belt. The belt should only be tightened enough to allow the belt to run and track properly.

Check the guides along the lower edges of the side guide. They should be within 1/8" of the belt. Improperly adjusted guides can cause damage to the belt.

2. Auto Mode (Local)

Push System Start push button. The conveyor starts first followed by the rotor.
Note: The start button must be held for a second or two for the speed switch to close.

With the conveyor tracked and running, observe the direction of rotation of the rotor. If the rotation is wrong, check motor leads.

To stop, push the Emergency Stop Button.

3. Automatic Mode (Remote)

The system operates the same as in Local Automatic.

The system will not run in remote mode if the hand-auto selector switch is in the hand mode.

Splitter and Rotor Position Setting Adjustment

A. Rotor Position Adjustment (two persons required)
   1. Remove belt guard cover and front side covers.
   2. Provide slack in v-belts by loosening mounting and adjustment bolts for the rotor motor.
   3. Loosen bolts connecting both rotor end plates to rotor mounting plates.
   4. Slide a 1” diameter lifting bar across the conveyor through the slots in both index brackets.
   5. Pull spring-loaded tee handles on both sides of unit to disengage pins from index brackets.
   6. Move lifting bar upward to rotate rotor forward, and downward to move backward.
   7. Re-engage tee handle pins in both index brackets. Ensure the pin engages the same hole location on both sides.
   8. Remove lifting bar.
   9. Tighten bolts connecting both rotor end plates to rotor mounting plates.
   10. Adjust rotor motor for proper v-belt tension, and tighten bolts.
   11. Re-install front side covers and belt guard cover.

B. Splitter Adjustment

   The splitter angle can be adjusted by rotating its handle. The splitter length can be changed by adjusting the position of the extension plate.

C. Settings

   The splitter and rotor position settings will vary depending on material being sent to the machine. Ideally a factory representative should be present during start-up to establish these settings and explain the various adjustments that may be required to optimize recovery.

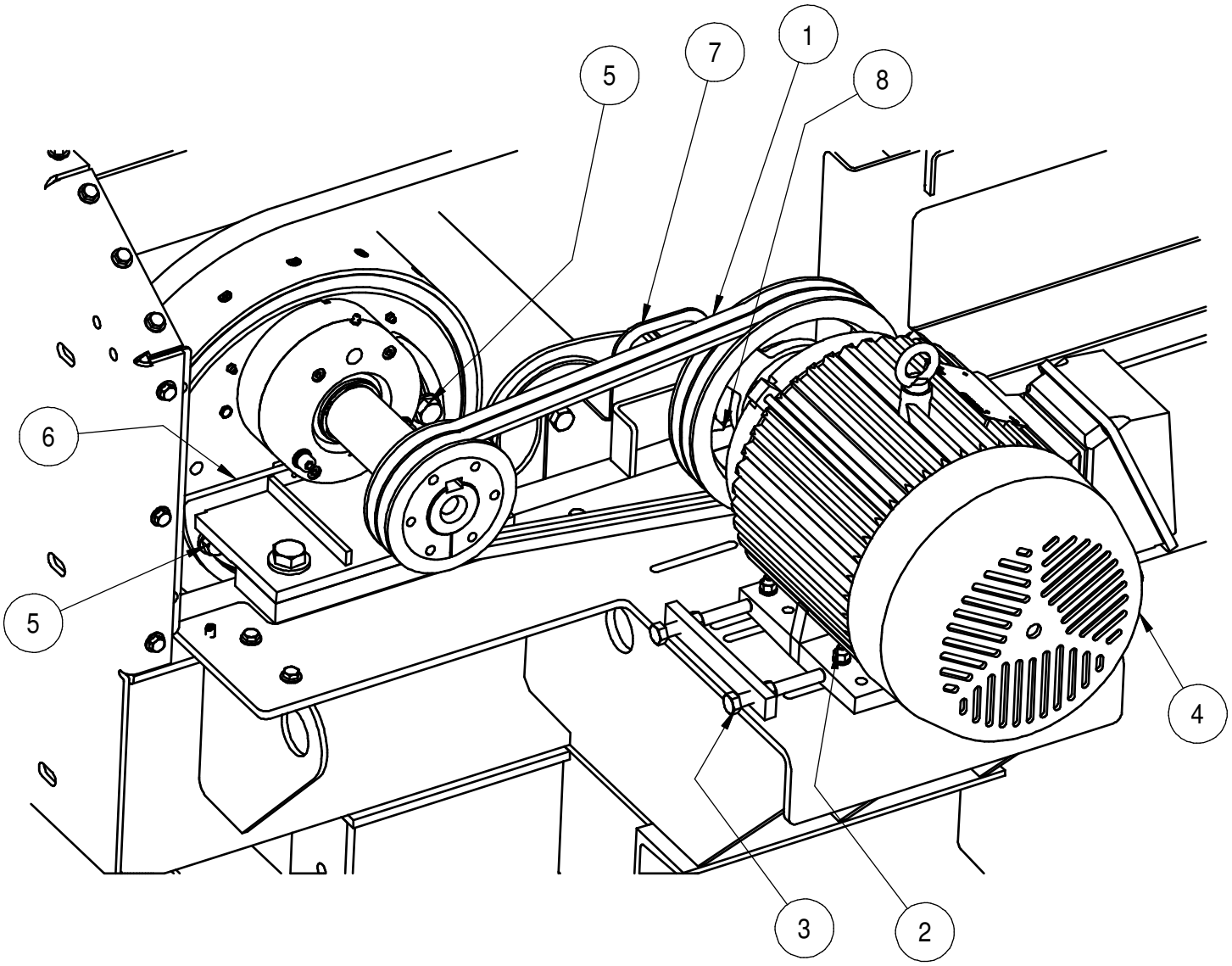
   Method 1: If a factory representative is not present and you are dealing with MSW or mixed recyclables, start with the splitter set 20" horizontally from the rotor surface and vertically set at the rotor centerline. Then, start with the rotor position set near its full forward setting. Fine tune the settings from this point. The typical splitter gap for aluminum beverage cans is 20 - 24”.

   Method 2: Run product on conveyor with rotor off, and set splitter approximately 1 - 2" in front of material trajectory.

(SEE ATTACHED)

ROTOR POSITIONING

ITEM	DESCRIPTION
1	V-BELTS
2	MOUNTING BOLTS
3	ADJUSTMENT BOLTS
4	ROTOR MOTOR
5	BOLTS CONNECTING END PLATES TO ROTOR MOUNTING PLATES
6	ROTOR MOUNTING PLATE
7	INDEX BRACKET
8	TEE HANDLE



Maintenance

1. Pulleys and Rotor

The 'RevX-E' Eddy Current Separator is designed to operate with a minimum amount of ferrous material in the feed. For this reason, the **rotor shell must be checked daily** for any metallic particles stuck to the shell surface. This is done by turning the machine off, removing the front side covers, and rotating the rotor shell by hand to view the entire circumference. Remove any foreign matter immediately. Serious damage to the rotor shell will occur if cleaning is not done on a regular basis.

The magnetic rotor in an Eriez RevX-E Eddy Current Separator incorporates high strength permanent magnets arranged in a special circuit. These magnets are bonded to the rotor hub and are then wrapped under tension using a proprietary process. Eriez has analyzed and tested the bonding and wrapping processes and the resulting rotor structure to assure the integrity of the complete assembly. Because the rotor operates at high speed in close proximity to personnel and other equipment, failure could result in severe damage and/or personnel injury or death. It is important that the rotor structural integrity not be compromised by third party repairs. Any repair affecting the structural integrity of the ECS high speed rotor should be carried out only by Eriez or Eriez technicians.

CAUTION!

NEVER ATTEMPT TO CLEAN THE MACHINE WHILE IT IS RUNNING!

2. Conveyor Belt

Check the conveyor belt daily for holes, cuts, etc. that go all the way through. Patch immediately as fine materials will go through to the shell and cause severe damage. Worn areas of the belt should also be repaired to prevent the eventual formulation of holes.

Belt Repair - The ECS is furnished with a urethane conveyor belt with cleats and sidewalls. Most rips, punctures, cuts, etc. can be quickly repaired with the optional belt repair kit which includes heat gun, urethane, fabric, tools, clamps, instructions and plastic case. The kit is **highly recommended**.

Check the guides along the lower edges of the side guides daily. They should be within 1/8" of the belt. If they have been damaged or are full of material, clean and readjust or replace. Improperly adjusted guides can allow contaminants to work into the rotor assembly causing damage.

Observe the belt tracking daily, while the machine is warm and running. If necessary adjust.

Note: An endless belt is supplied with the unit. If replaced with a spliced belt, make sure the lacing is non-metallic and is covered both top and bottom with a flexible flap cold vulcanized to the belt. Exact replacement endless belts are available from Eriez.

3. Shell

The Eddy Current Separator is designed to operate with a minimum amount of ferrous material in the feed. For this reason, **the rotor shell must be checked daily** for any metallic particles stuck to the outside surface. This is done by turning the machine off, removing the front side covers, and rotating the rotor shell by hand to view the entire circumference. Remove any foreign matter immediately. Serious damage to the rotor shell and belt will occur if cleaning is not done on a regular basis.

4. Bearings

a) Tail Pulley Pillow Blocks: **Lubricate every month** with a Sealmaster® GoldplexTM-HP grease. The bearings should be lubricated while rotating and the grease pumped in slowly until a slight bead forms around the seals.

b) Rotor Bearings: **Lubricate every month** with Mobilith Polyrex EM or equivalent. The bearings should be lubricated while rotating using the top offset grease fitting. Add .6 ounces of grease. After 1 year of monthly lubrication, remove the rotor bearing cap and remove all of the old grease. Plug the purge hole in the bearing cap and refill the housing full of grease (approximately 6 ounces). When the housing is full the grease will purge at the bottom of the bearing housing just above the shoulder bolt. Once the grease has purged, remove the cap again and remove half the grease in the cap. Reassemble the housing.

c) Inner Shell Bearing: The inner shell bearing grease purge chamber incorporates grease fittings. The actual bearings are lubed and sealed for life. The grease injected through the fitting in the purge chamber is intended to provide an additional seal to prevent damage from contamination. The grease will purge out around the head, likewise purging contaminants. **Check the head in this area at least every month** for visible grease. If no grease is visible, clean the area between the head and shell support ring and add only Mobilith Polyrex EM or equivalent grease through the fitting until grease is discharged around the head.

5. Sheaves and V-Belts: Check for shiny spots on belts and sheaves which indicate belt slip. Tension belts as necessary. If frays or splits in belts from wear or rubbing occur replace belts as required.

6. Gear Reducer: Refer to individual section for manufactures instructions.

7. Daily Preventative Maintenance: See decal on ECS, a copy of which is shown on the following page.

REQUIRED MAINTENANCE
ERIEZ EDDY CURRENT SEPARATOR

IMPORTANT! TURN OFF AND LOCK OUT POWER TO THE EDDY CURRENT SEPARATOR WHILE CARRYING OUT ALL PROCEDURES WHICH INVOLVE CONTACT WITH THE MACHINE. FAILURE TO DO THIS MAY RESULT IN SERIOUS PERSONAL INJURY OR DAMAGE TO THE EDDY CURRENT SEPARATOR.

DAILY:

- Check for and remove any metal particles stuck to the belt or the outer surface of the rotor shell.
- Check for and remove debris build-up on and around the motors.
- Check for and remove debris build-up on the splitter and discharge chutes.
- Check for and patch holes and worn spots on the conveyor belt.
- Adjust rubber side guides for 1/8” clearance to the conveyor belt. Remove any material build-up if present.
- Observe and adjust conveyor belt tracking after the machine warms up.
- Check the feeder tray (if any) for material build-up and clean as required.

MONTHLY:

- Add Mobilith Polyrex EM or equivalent at the fittings at the end of the rotor until grease is discharged between head and shell support ring.
- Check and lube the tail pulley bearings as specified in the IOM.

CAUTION!
Door must be closed while unit is running. Failure to observe this precaution may result in damage to the machine and/or serious personal injury.

IMPORTANT!
With unit turned off check rotor shell for ferrous contamination on a daily basis

MAXIMUM ROTOR SPEED
3000 RPM

REVX-E ECS TROUBLESHOOTING CHECKLIST

ALWAYS FOLLOW THE INSTRUCTIONS AND WARNINGS WITHIN THE IOM!

PROBLEM

1 **POOR RECOVERY OF METALS :**

- Verify proper feed and good spread of material onto the conveyor belt.
- Remove any metal particles stuck to the conveyor belt. (Refer to Maintenance Section of IOM)
- Check splitter adjustment setting. (Refer to this section of IOM)
- Check rotor adjustment setting. (Refer to this section of IOM)
- Verify FPM speed of conveyor belt.
- Verify RPM speed of rotor.
- Verify that splitter discharge flaps are properly installed. (Refer to Installation Section of IOM)
- Verify that the thickness of the conveyor belt is correct. (.12" for LT2 & ST2; .05" for ST22)

2 **POOR CONVEYOR BELT TRACKING :**

- Verify that conveyor belt has no particles stuck to it. (Refer to Maintenance Section of IOM)
- Verify that rotor shell has no particles stuck to it. (Refer to Maintenance Section of IOM)
- Verify that tail pulley has no particles stuck to it. (Refer to Maintenance Section of IOM)
- Verify that distance from tail pulley axis to rotor axis is nearly the same on both left & right sides of ECS.
- Verify that one side of the belt is not longer than the other side. (poor belt quality)

3 **DAMAGE TO CONVEYOR BELT OR ROTOR SHELL :**

- Eliminate ferrous material being fed to ECS.
  Verify proper operation/performance of MAGNETIC SEPARATOR that is upstream of ECS.
- Remove any metal particles stuck to the rotor shell, and verify that rotor shell is clean.
  (Refer to Maintenance Section of IOM)
- Remove any metal particles stuck to the conveyor belt, and verify that conveyor belt is clean. (Refer to Maintenance Section of IOM)
- Verify that any holes, cuts, punctures, etc. through the conveyor belt have been patched and repaired. (Refer to Maintenance Section of IOM)
- Repair minor damage to belt before it becomes major damage. Patch holes and cuts immediately, otherwise fine particles will go through to the shell and cause severe damage. (Refer to Maintenance Section of IOM)
- Verify that rubber side guides have no damage and are adjusted to within 1/8" of the belt. Improper adjusted or damaged rubber side guides can allow contaminants to work into the rotor assembly causing damage. (Refer to Maintenance Section of IOM)

Bearing Replacement

The REV-X incorporates three pairs of bearings: The rotor bearings (Item 11 in attached drawing 4N-201303401), the inner shell bearings (Item 5 in attached drawing 4N-201303401), and the tail pulley pillow block bearings. Each has its own lubrication requirements. See Bearing Maintenance for Lubrication Schedule.

REPLACEMENT OF ROTOR BEARINGS

CAUTION: The ECS rotor has a very strong permanent magnet field present on the shell surface that will quickly attract magnetic tools and items to the shell surface. Extreme care must be taken to keep all magnetically attractive items away from the rotor to avoid injury or shell damage.

If the ECS rotor is removed from the equipment, use extreme care to keep all metal items away from the rotor.

1. Loosen and remove the "V" belts, rotor drive sheave, and shaft guard on the shaft. Remove the snap ring (ITEM 13) and seal (ITEM 14).

2. Remove the bearing covers items 10 and 16 by removing the socket head cap screws (ITEM 19).

3. Remove socket head cap screws (ITEM 19) fastening the bearing housing (ITEM 15) from the drive (ITEM 9) and non-drive (ITEM 8) heads.

4. Loosen the set screw(s) in the locking nut (ITEM 18) and remove with spanner wrench.

5. There is no way to remove the rotor bearing (ITEM 11) without imparting some damage or destroying it. Using a bearing puller, pull on the outside race to remove it from the shaft. **Discard the bearing and in no instance should the bearing be reused.**

6. After bearing is removed, allow the shaft to cool (if heat was applied) and inspect shaft surfaces for nicks or burrs. Lightly file off any imperfections that would inhibit proper bearing installation onto the shaft. Remove all of the old grease from the bearing housing

7. Install the new bearing onto the shaft. Never hit the bearing races directly with a hammer, and never tap on the outside bearing race. Use a soft aluminum tube that fits over the shaft and only contacts the inside race. Use a brass or dead weight hammer to impact the tube to drive the bearing onto the shaft. The bearing can be heated via a bearing heater or an oven to 200F to reduce the press fit on the shaft to assist in driving the bearing on the shaft.

8. Reinstall the spanner nut (item 18) and tighten any set screws in the nut.

9. Install the bearing housing and covers in the reverse order that they were removed. Always take care not to impact or adversely load the bearing races during re-assembly.

10. NOTE: The bearing housing (ITEM 15) will only fit in one orientation. The grease purge slot is always oriented toward the shoulder bolt below the rotor bearing.

11. Reinstall the rotor mounting brackets and the belt on the rotor assembly.

12. Grease the rotor and shell bearings using the greasing procedure in the maintenance section of this manual.

13. Clean the drive side shaft and install the drive side shaft seal (ITEM 13) and snap ring (ITEM 14). Place a small amount of grease between the bearing housing and the shaft seal to keep dirt from entering the labyrinth seal in the bearing cover.

REPLACEMENT OF INNER SHELL BEARINGS

1. Remove the rotor-shell assembly from the machine. Loop a sling around each bearing grease cover, and lift slowly evenly, pulling the indexing pin on the frame out, so the torque arm does not bind inside the frame. Lower the rotor onto a soft nonferrous work surface such as wood.

   The rotor can also be lifted using the holes in the drive side (ITEM 10) and non-drive side bearing covers (ITEM 16). The thread in these holes is M20x2.5.

2. Remove the torque arm assembly by removing the two bolts that mount it to the end flanges.

3. Remove the bearing covers items 10 and 16 by removing the socket head cap screws (ITEM 19).

4. Remove socket head cap screws (ITEM 19) fastening the bearing housing (ITEM 15) from the drive (ITEM 9) and non-drive (ITEM 8) heads.

5. Loosen the set screw(s) in the locking nut (ITEM 18) and remove with spanner wrench.

6. There is no way to remove the rotor bearing (ITEM 11) without imparting some damage or destroying it. Using a bearing puller, pull on the outside race to remove it from the shaft. **Discard the bearing and in no instance should the bearing be reused.**

7. After bearing is removed, allow the shaft to cool (if heat was applied) and inspect shaft surfaces for nicks or burrs. Lightly file off any imperfections that would inhibit proper bearing installation onto the shaft. Remove all of the old grease from the bearing housing

8. Remove the drive head (ITEM 9) and non-drive head (ITEM 8) from the assembly

9. Remove flat head socket screws (items 20) from the bearing shell support ring (item 3).

10. Drive the shell support ring (item 3) out of the shell with a hammer and piece of wood from the opposite side. Do not use anything metallic material, in order to prevent injury and damage to rotor wrap or shell.

11. Remove 10 MM bolts (item 7) and remove the bearing retainer plate (item 4).

12. Tap the bearing(s) out from the backside of the shell support ring (item 3). Heating the ring will assist in the bearing removal.

13. Install the new bearing by heating the shell support ring (item 3) and inserting the new shell bearing into the ring. To ease assembly, if a there is a freezer available place the new shell bearings into the freezer for an hour before installing. The bearing should drop in against the shoulder in the ring. If the bearing is snug use a brass punch and hammer on the outside race to set the bearing tight against the shoulder. Reinstall the bearing retainer plate (item 4).

14. Reinstall both shell support rings (items 3) into the shell. Fasten the rings in place using flat head socket screws (item 20) with some thread locking compound. Loctite 242 is recommended.

15. Install the rotor bearings as described in step 13 of “Replacement of Rotor Bearings” and lubricate bearings as described in bearing maintenance section.

TAIL PULLEY PILLOW BLOCKS

To remove or replace a bearing loosen the setscrews on its collar and pull it from the shaft. When installing new bearings, ensure the inner race of the bearing and tail pulley are located in about the same position as when they were removed. Be sure to track the conveyor belt and observe tracking for roughly 30 minutes to prevent belt damage.

SHELL REPLACEMENT

To replace the shell, the ECS rotor should be removed from the machine and taken to a clean work area.

1. Remove rotor bearings, heads, and shell support rings (Items 3).

   Do not try to slide the rotor through the shell bearings. The bearings and shell support rings are magnetic and will stick to the magnetic rotor.

2. Using a pipe that will fit around the drive end of the rotor support the rotor on blocks so it is not resting inside the shell. Slide the shell over top of the pipe and support both ends of the rotor.

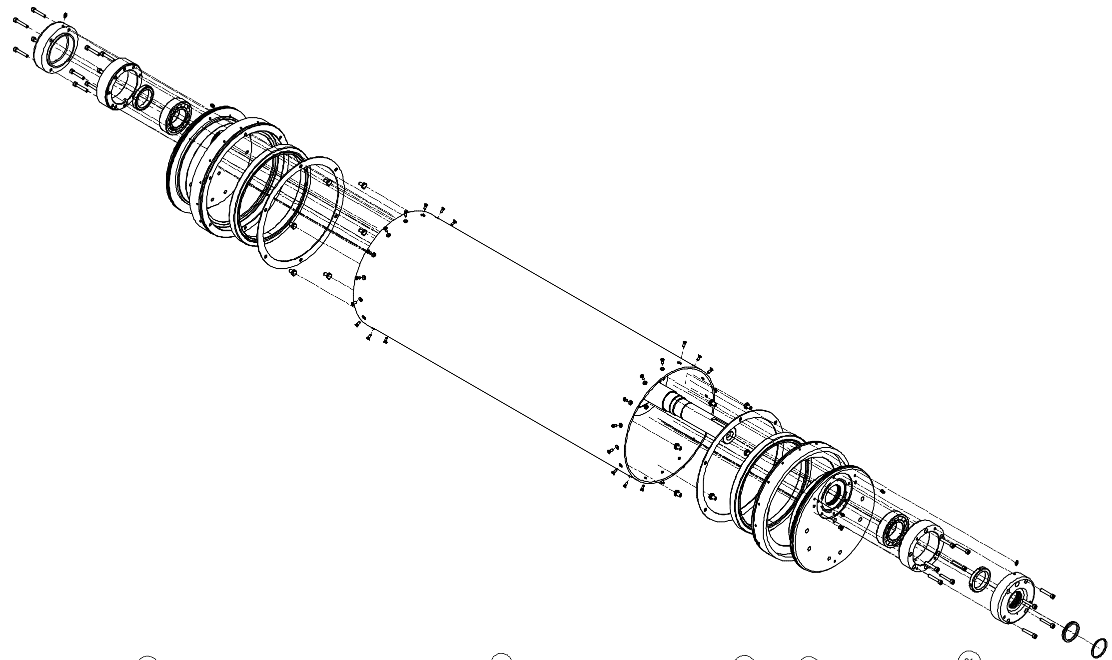
3. Slip the pipe off of the shaft, remove the old shell, and replace a new shell on the pipe.

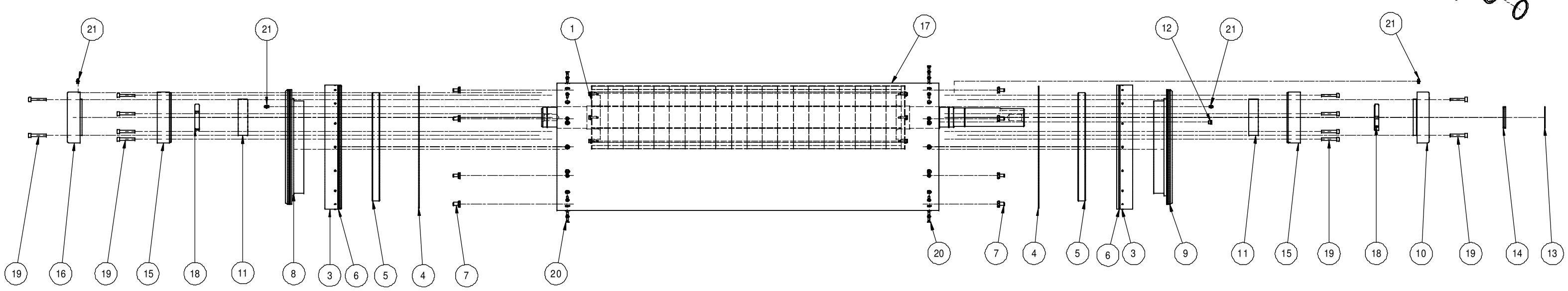
4. Clean and inspect the rotor for damage, Small lines or grooves in the carbon fiber wrap are acceptable. However, wrap damage greater than a ½ inch groove should be brought to the attention of Eriez Magnetics Service Department for consultation.

5. Slip the pipe back on the shaft, lift the rotor and slide the new shell over the rotor.

6. Follow the instructions for replacing the inner shell bearings and rotor pillow block bearings in the respective sections in this guide. Eriez recommends that new bearings be used if bearings were removed from their housings. Reinstall the rotor in the machine and reinstall the belt over the tail pulley in the reverse order that the belt was removed from the tail pulley. Re-install the slider bed and all guards in the reverse order that they were removed.

#	SHEET TITLE	REV





REQ'D.	ITEM NO.	STOCK NO. DWG. NO.	GROUP NO.	DESCRIPTION OF PART	SPECIFICATION	SXF
6	21	406692		FITTING ZERK 1/4-28 SS		N
32	20	432517		SCREW FLAT HD SS M6-1 X 16MM AXS		N
20	19	226122		SCREW SOC CAP M8-1.25 X 50MM	91290A448 MCMASTER CARR	N
2	18	462358		NUT LOCK KMK 13 SKF	M65 X 2	N
1	17			SHELL		N
1	16	2N-201208594		BEARING COVER NON DRIVE SIDE		N
2	15	2N-201208579		SHAFT BEARING HOUSING		N
1	14	462389		SEAL V-RING SKF 60 V A R		N
1	13	462388		CIRCLIP EXTERNAL INVERTED ND3108 SIZE CODE 060		N
1	12	416724		BREATHER FILTER VENT 1/8 NPT 9833K21 MCMASTER CARR		N
2	11	451991		BEARING SKF 2213 ETN9		N
1	10	4N-201208861		BEARING COVER DRIVE SIDE		N
1	9	4N-201208841		ROTOR END PLATE		N
1	8	4N-201208759		ROTOR END PLATE FLOAT SIDE		N
6	7	424122		BOLT HEX HD M10-1.5 X 16MMAXS		N
1	6	457897		O-RING 399.4MM ID X 4 BUNA-NITRILE (70 SHORE)		N
1	5	462284		BEARING REALI SLIM KAYDON	12"IDX14"OD JG120CPO	N
1	4	2N-201208865		SHELL BEARING RETAINER PLATE		N
1	3			SHELL SUPPORT RING		N
2	2			SHELL SUPPORT ASSY		N
1	1			ROTOR		N

GR. NO.

ERIEZ

WORLD AUTHORITY IN ADVANCED TECHNOLOGY FOR MAGNETIC, VIBRATORY AND METAL DETECTION APPLICATIONS
WORLD HEADQUARTERS, ERIE, PA, USA

GROUP DESCRIPTION

TITLE: EXPLOSION OF ROTOR ASSY
SHEET TITLE

FOR: REVX-E LT2, ST2, & ST22 ROTOR ASSY, 1.0M, 1.2M AND 1.5M

DR. BY KAR	ORDER #	NEXT ASS'M		SHEET 1 OF 1
SCALE 1:8	E.R. #	PRIOR REF		
DATE 04/02/13	NOTICE - THIS DRAWING AND THE PRINCIPLE OF DESIGN ARE THE PROPERTY OF AND PROPRIETARY TO ERIEZ			
CHKD. BY -	DRAWING NUMBER 4N-201303401			REVISION A

DIM SHOWN AS	TOL.
X.XX	± 0.01
X.XXX	± 0.005
X.XXXX	± 0.0005

REV	CHANGE MADE	SHEET	BY	DATE	ORDER #
A	REMOVED P/NS FOR ITEMS 2, 3, & 17; REVISED TITLE BLOCK 'FOR' WAS REVX-E ROTOR ASSY, LT2 1.0M	1	CCK	09/17/14	FILE

Welding Kit

Contains all the necessary tools and materials required to splice all styles of conveyor belting endless by heat welding.

Description	Quantity
1. **NOVITANE** Welding Procedure Manual	1 only
2. 16 Gauge Galvanized Steel (4" wide x 8" long)	2 each
3. **NOVITANE** Welding Rod - 3 sizes	
1/8" Round	75 Ft.
5/32" Triangular	50 Ft.
1/4" Triangular	50 Ft.
4. Steinel Hot Air Gun #HG-2000-E with a 9 mm nozzle.	1 only
5. Welding Trial Belt Samples	
IG-120/85-COS (12)	3 each
FG-90/85 K (8)	3 each
6. Teflon Coated Glass Fabric (.010" x 72" wide x 12" long)	1 only
7. Spring Clamps (2" opening x 6" long)	4 each
8. Cutting Pliers	1 only
9. Roller (1" wide x 1" diam.)	1 only
10. Angle Head Utility Knife	1 only
11. Carrying Case	1 only

Belt Change Procedure

Figure 1

Figure 2

Figure 3

- Disconnect the front safety straps on the rear isolators and all safety straps on the front isolators.

Figure 4

- Raise the feeder until the discharge is 12 inches above its normal installed position.

Figure 5

- The 12 inch increase on the nose of the feeder equates to a 7 inch increase in height at the front isolator. Support the feeder in this position so it will safely stay inclined throughout the belt change procedure. A good way to do this is to get two pipes roughly 4 inch diameter and 13 inches long and replace the front isolators with these pipes. Then lower the feeder onto pipes.

Figure 6

- Remove drive side panels.

Figure 7

- Remove non-drive side panels.

Figure 8

- Remove non-drive side pull cord emergency stop switch and bracket.
- Remove side guide cross piece.

Figure 9

- Remove drive side pull cord emergency stop switch and bracket.
- Remove side guide cross piece.
- Cut the old belt and remove it.

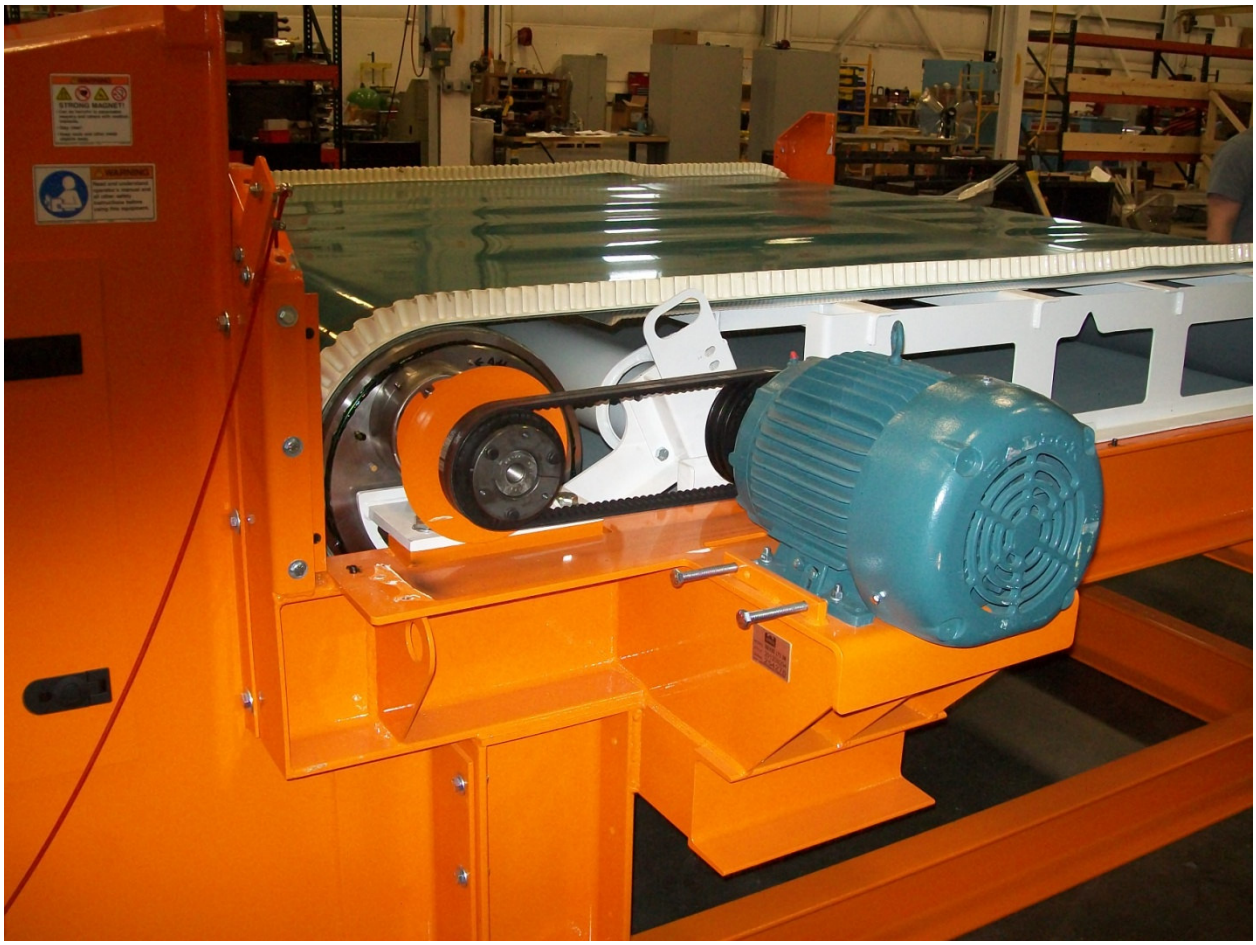


Figure 10

- Remove belt guard.

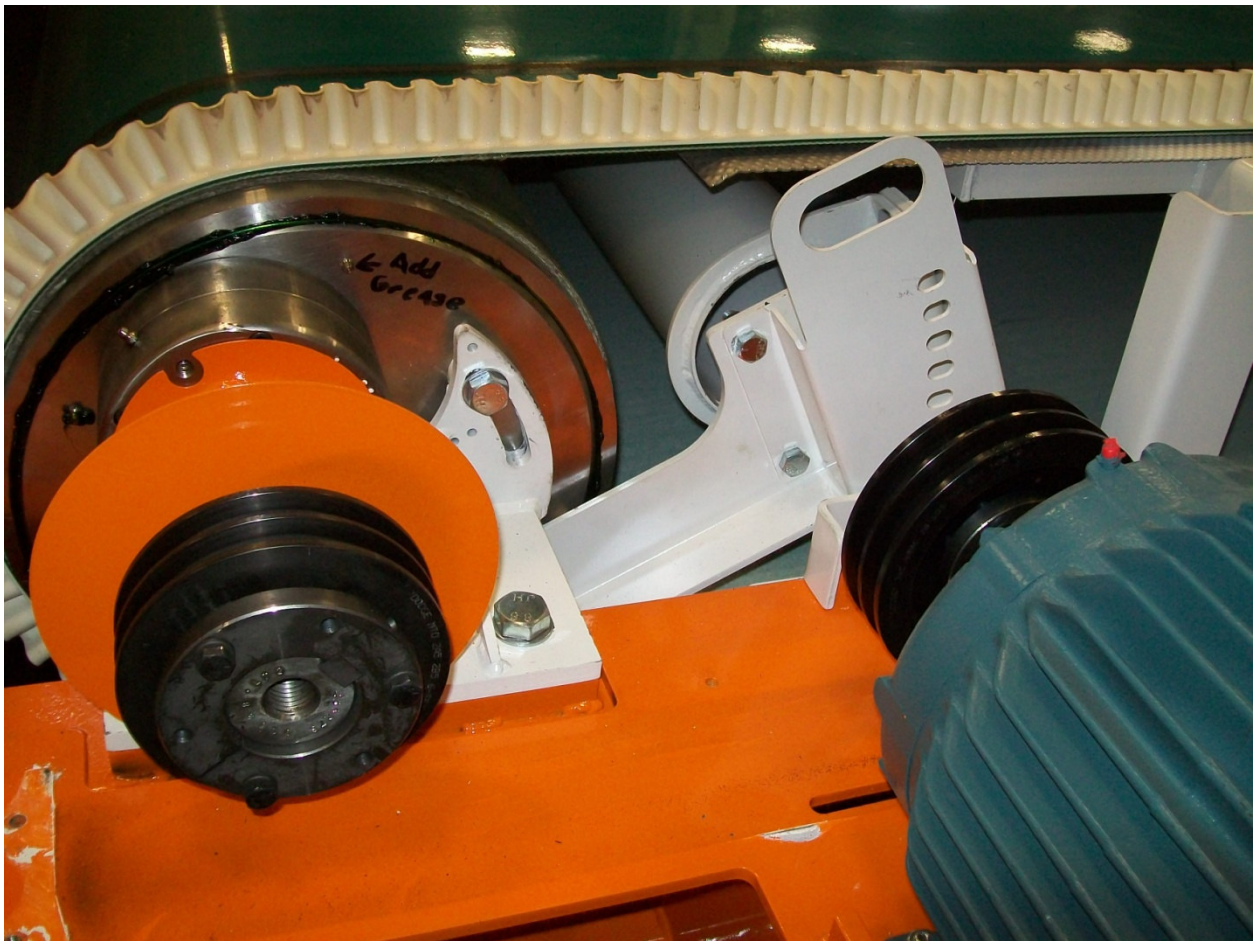


Figure 11

- Loosen but do not remove the motor mounting bolts.
- Relieve tension in v-belts by turning motor jack bolts.
- Remove V-Belts.

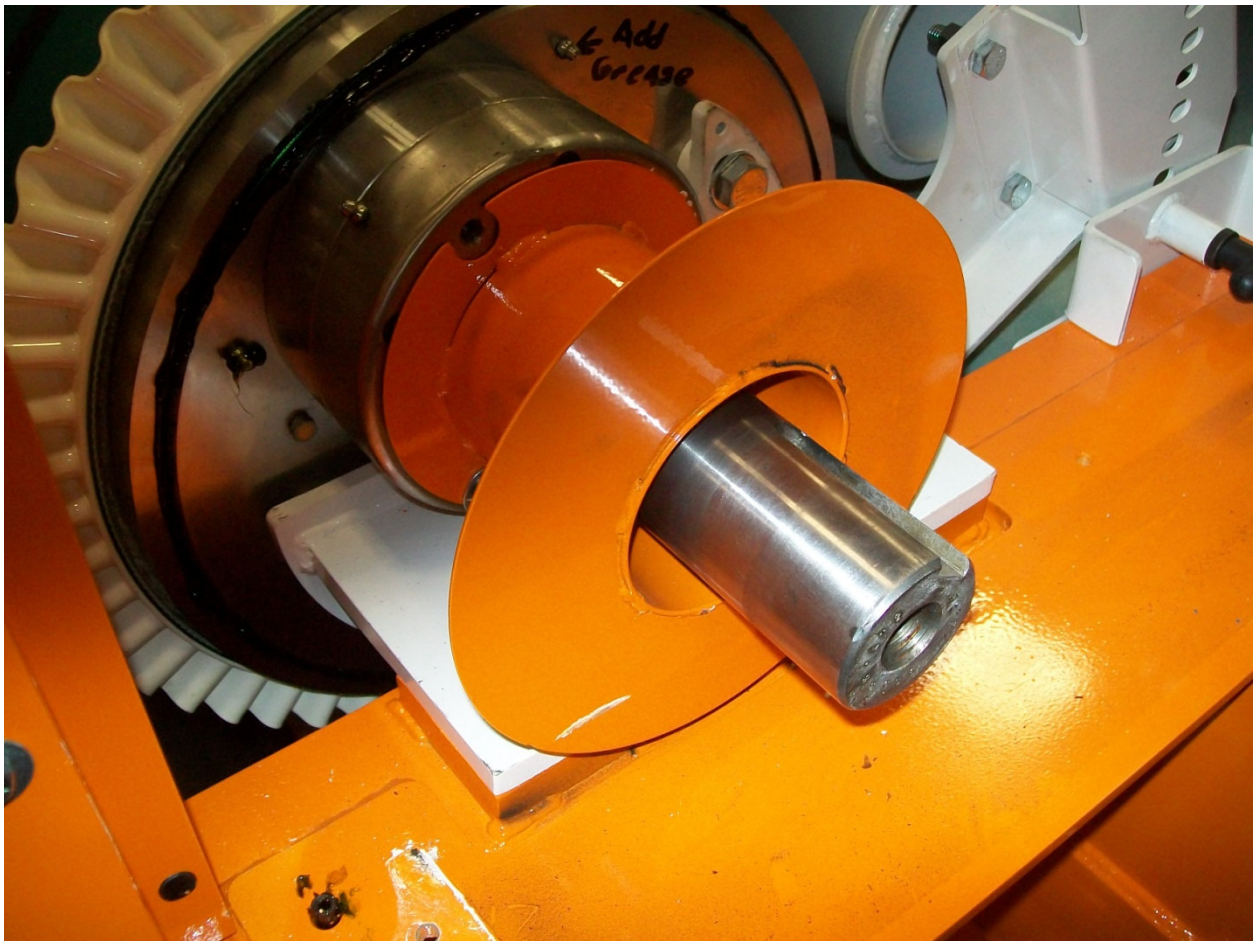


Figure 12

- Remove driven sheave.
- Remove rotor drive shaft guard.

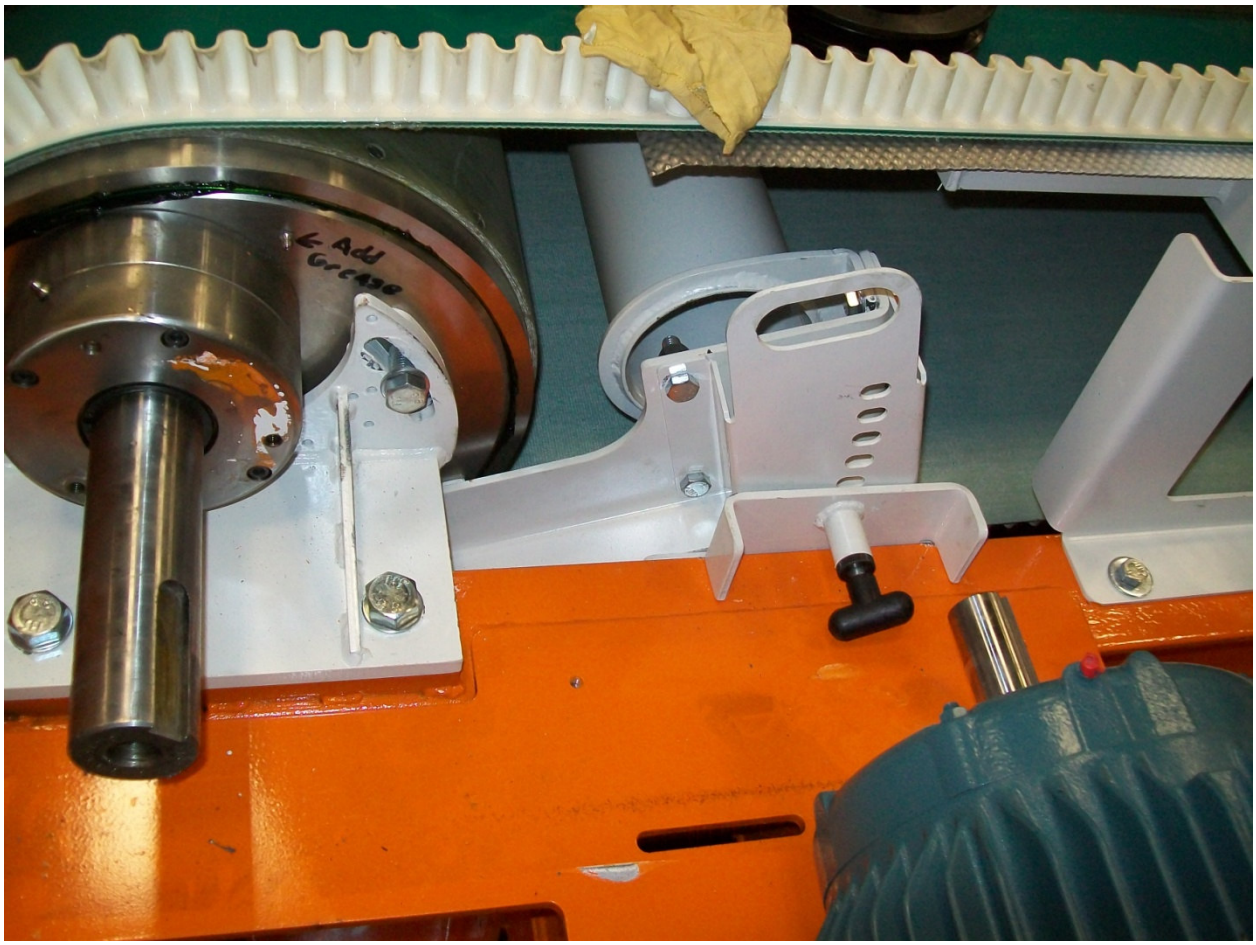


Figure 13

- Remove drive sheave.
- Loosen rotor head bolts and pivot rotor until indexing pin lines up with the 5 slot from the bottom of the bracket.

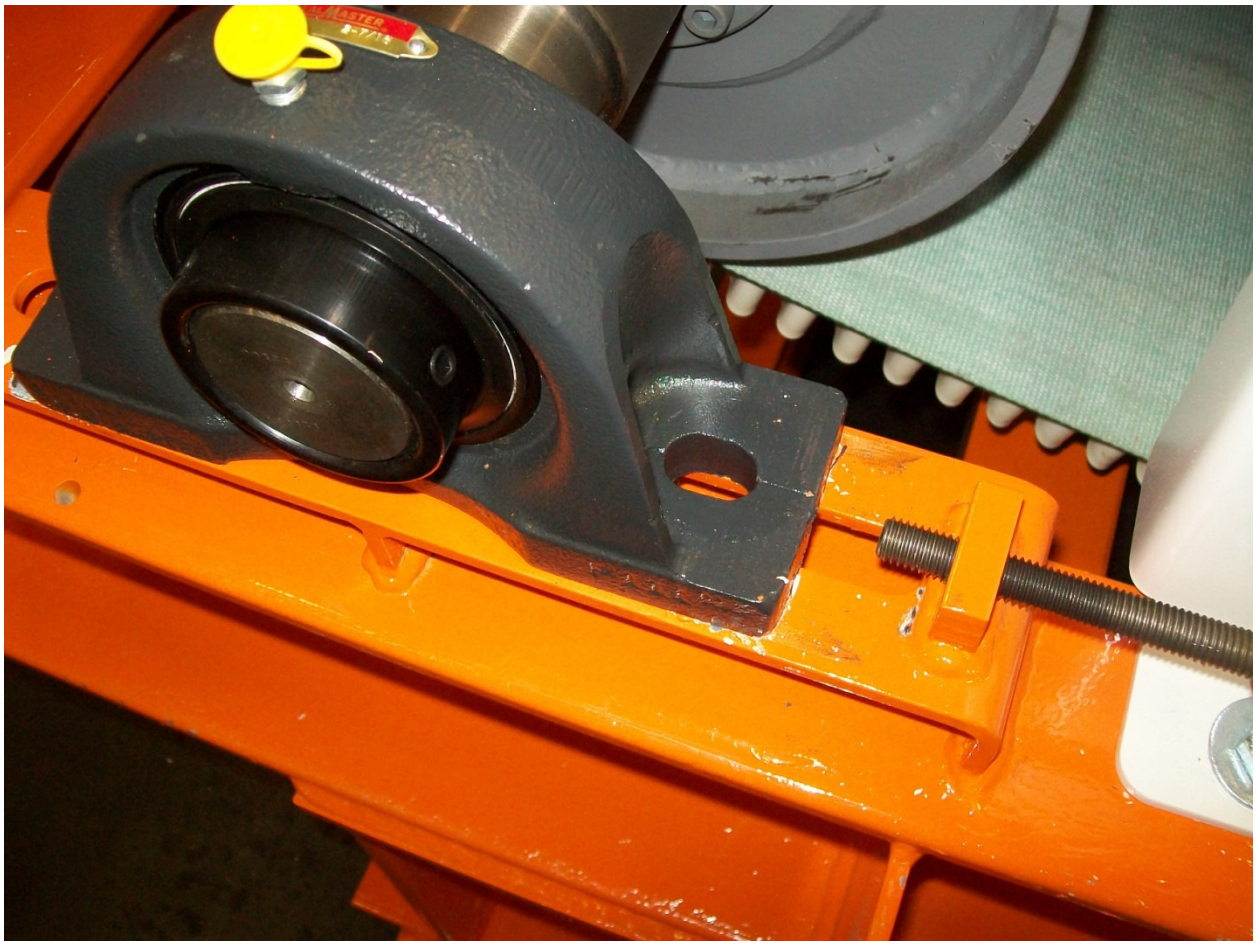


Figure 14

- Slide tail pulley forward as far as possible to relieve tension in conveyor belt. The bolts can be loosened or removed at this point.

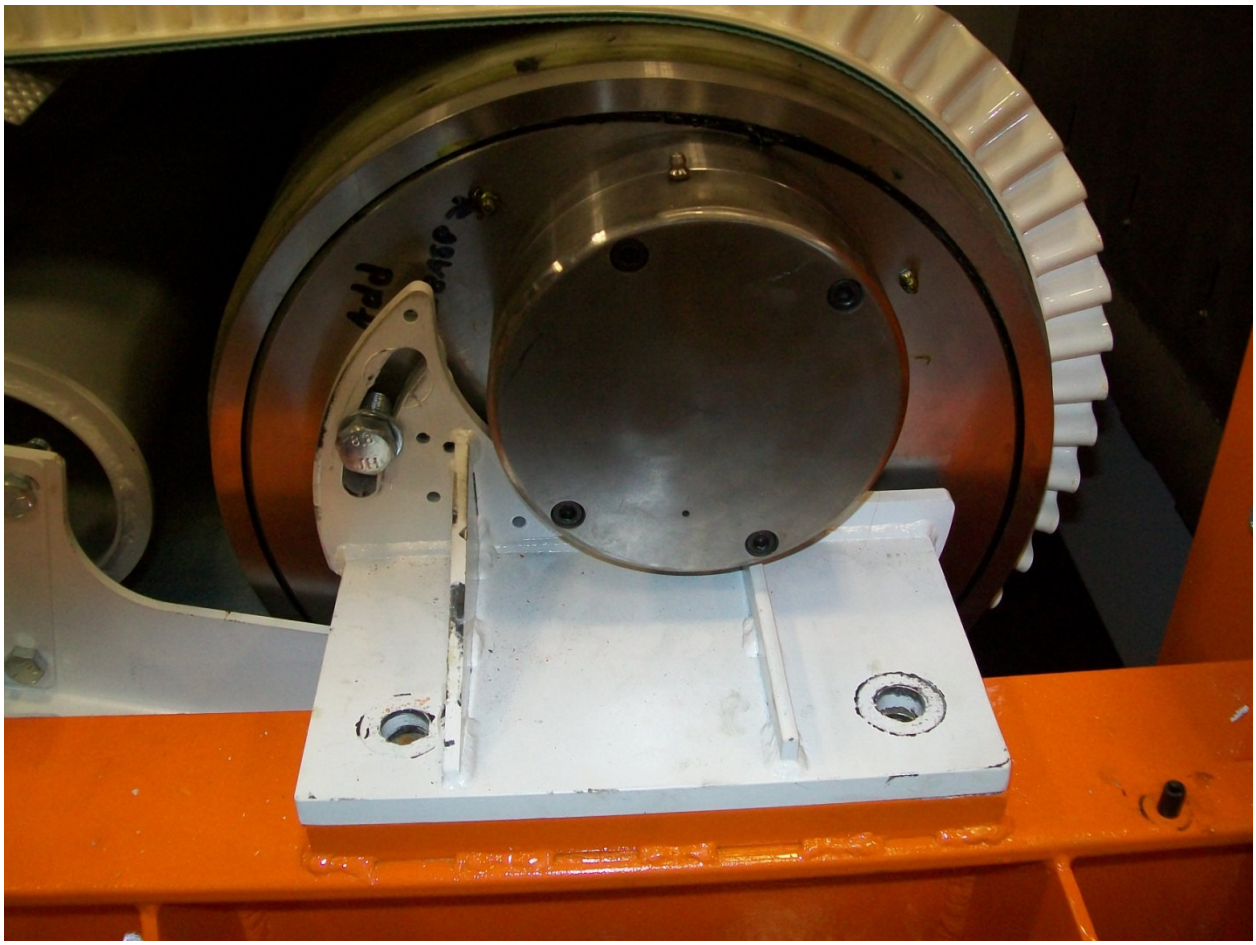


Figure 15

- Remove non-drive side rotor mounting bolts.

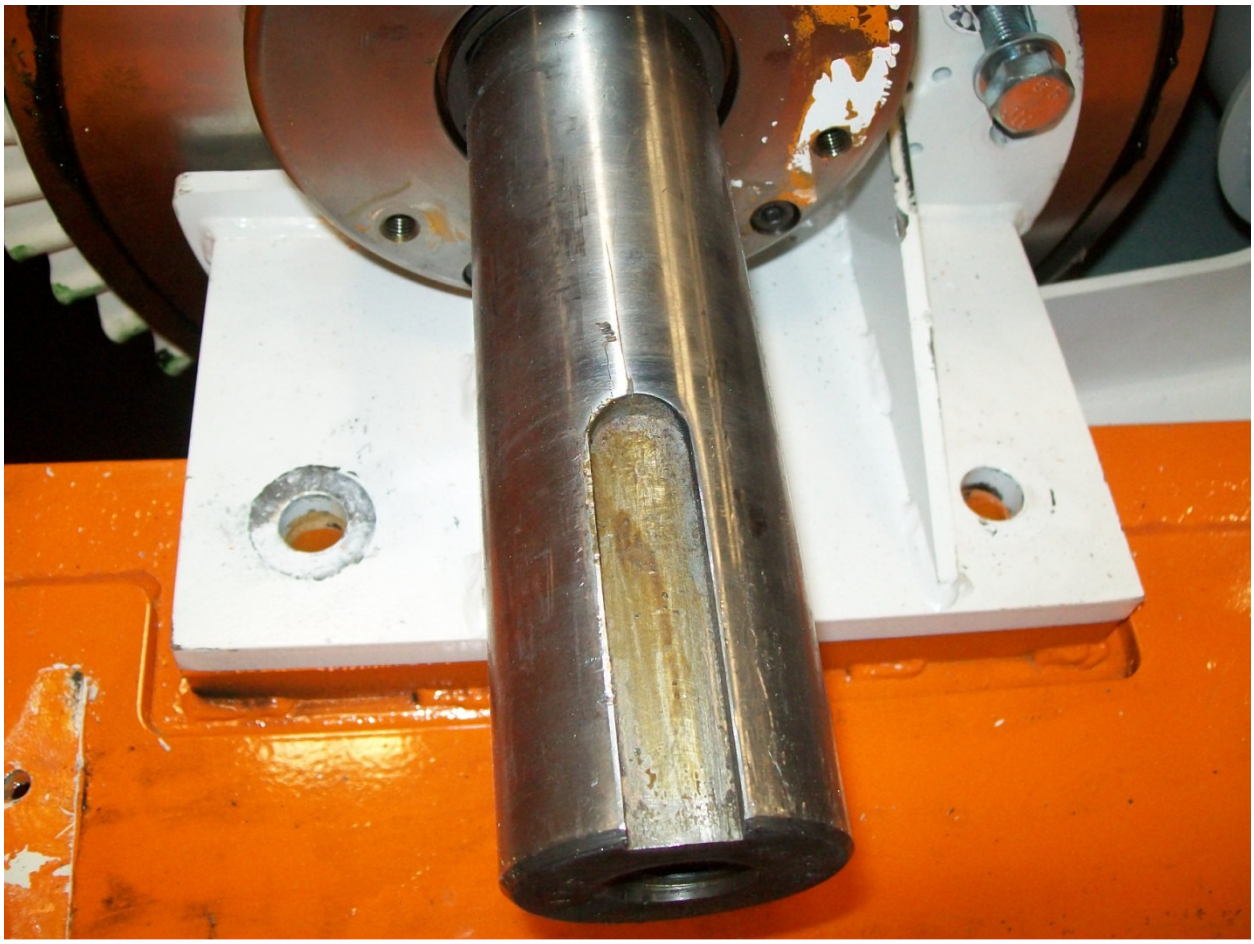


Figure 16

- Remove drive side rotor mounting bolts.

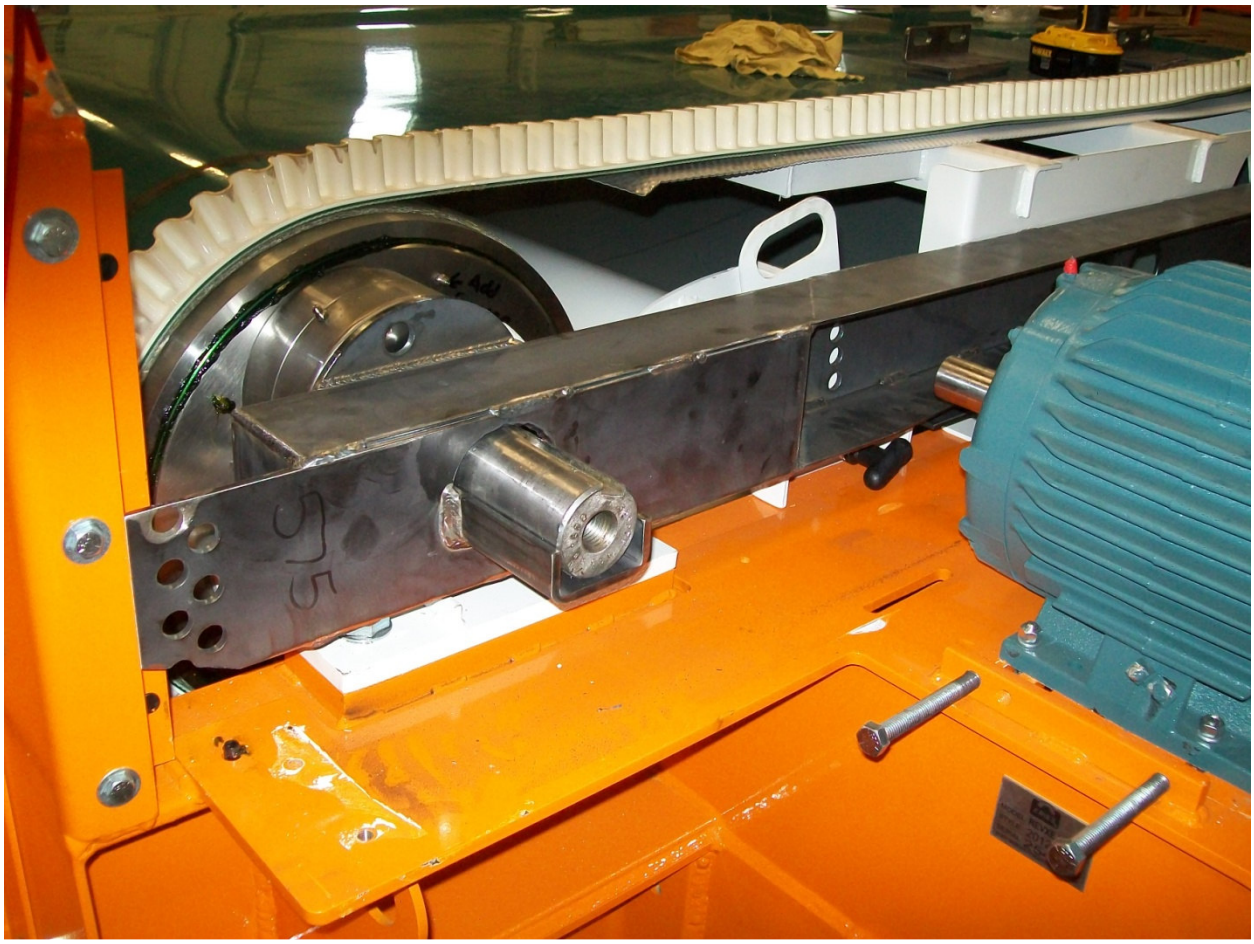


Figure 17

- Remove torque arm from tail pulley gear reducer and motor.
- Install drive side belt change fixture.

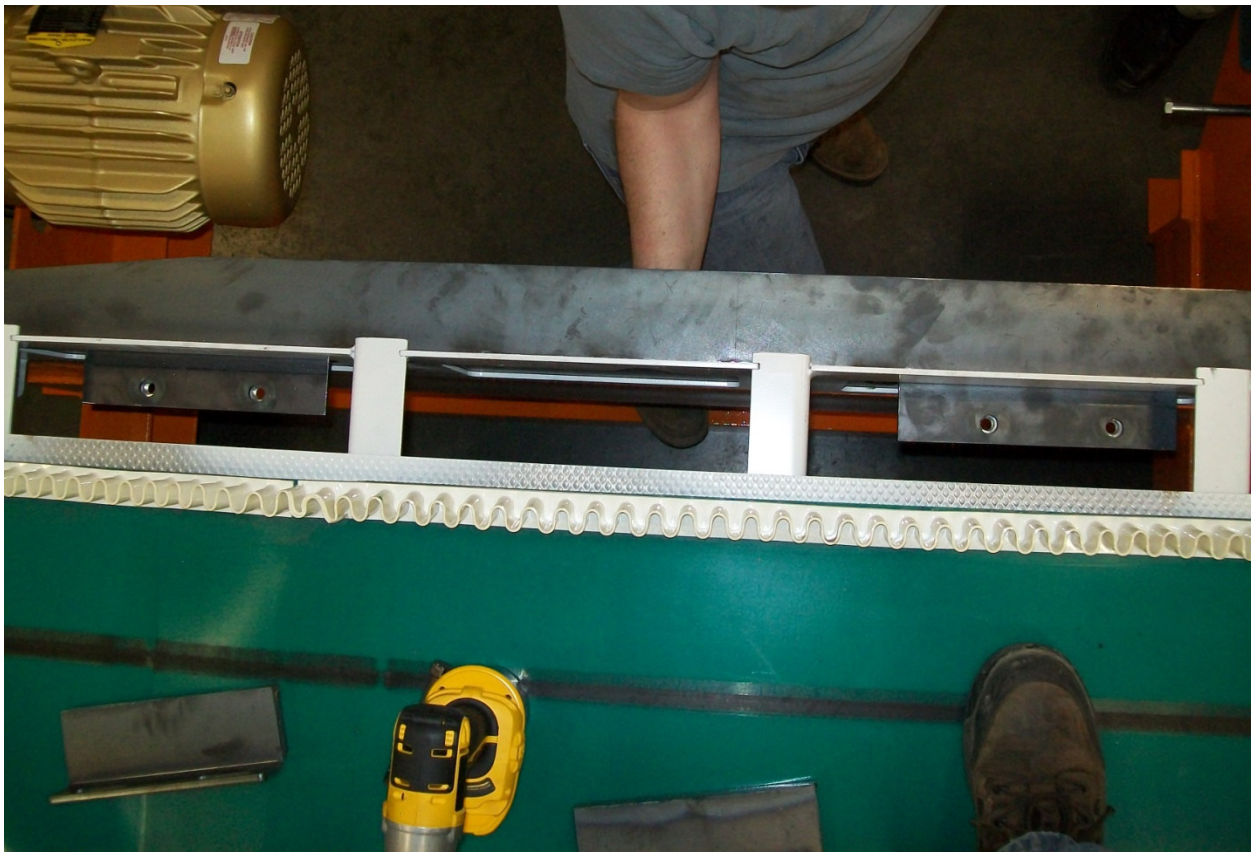


Figure 18

- Ensure fixture fits flat against slider bed.

Figure 19

- Install slider bed clamps.
- Using ½-13 X 2” bolts.

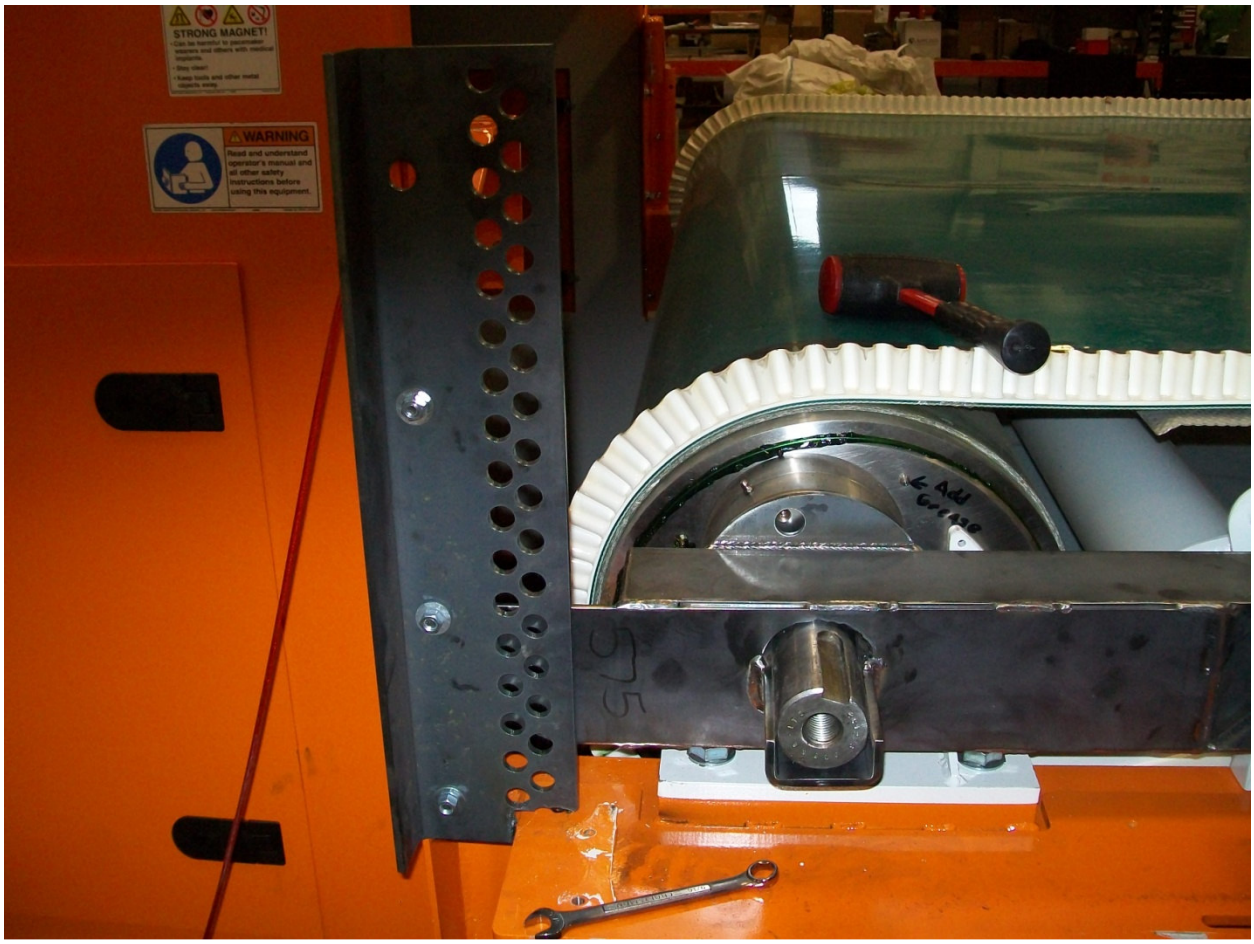


Figure 20

- Remove door bumpers and install fixture indexing plate using 3/8-16 x 1 ½" bolts.
- Ensure indexing holes are in line with holes in fixture.

Figure 21

- Remove rear non-drive door bumper and install rear indexing plate 3/8-16 x 1 ½" bolts.

Figure 22

- Install tail pulley lift assembly Using ½-13 x 2” bolts.
- Lift motor and install gearbox support. Using either the front or rear holes on the gearbox will support the gear box and motor.
- Rest gearbox support on belt change fixture.

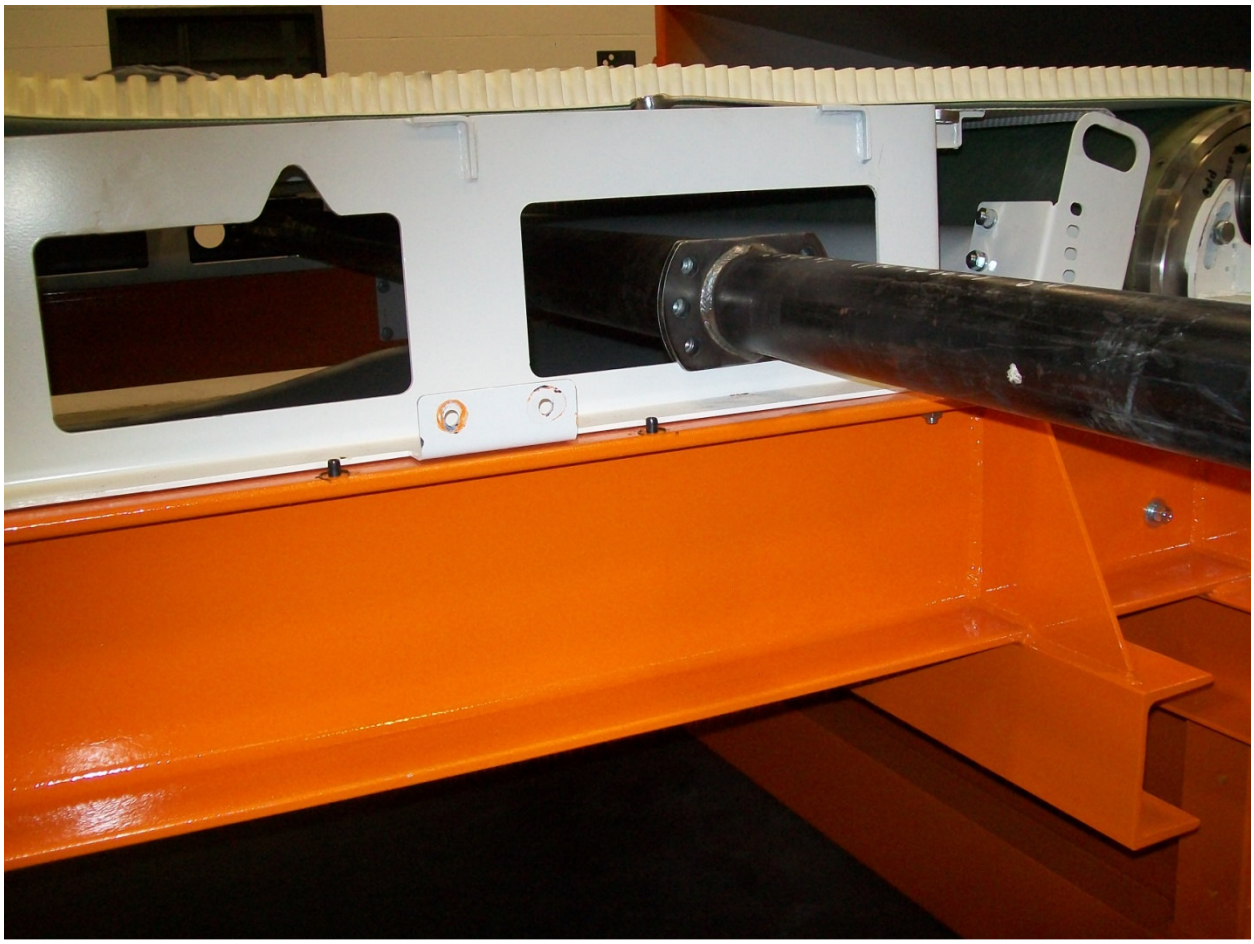


Figure 23

- Using the cross tube extension install the cross tube using ½ -13 bolts.

Figure 24

Figure 25

- Bolt the cross tube to the drive side belt change fixture using ½-13 bolts.
- Remove the cross tube extension. The drive side fixture will support the cross tube.

Figure 26

- Install non-drive belt change fixture.
- Install slider bed clamps.
- Use ½-13 x 2 bolts.

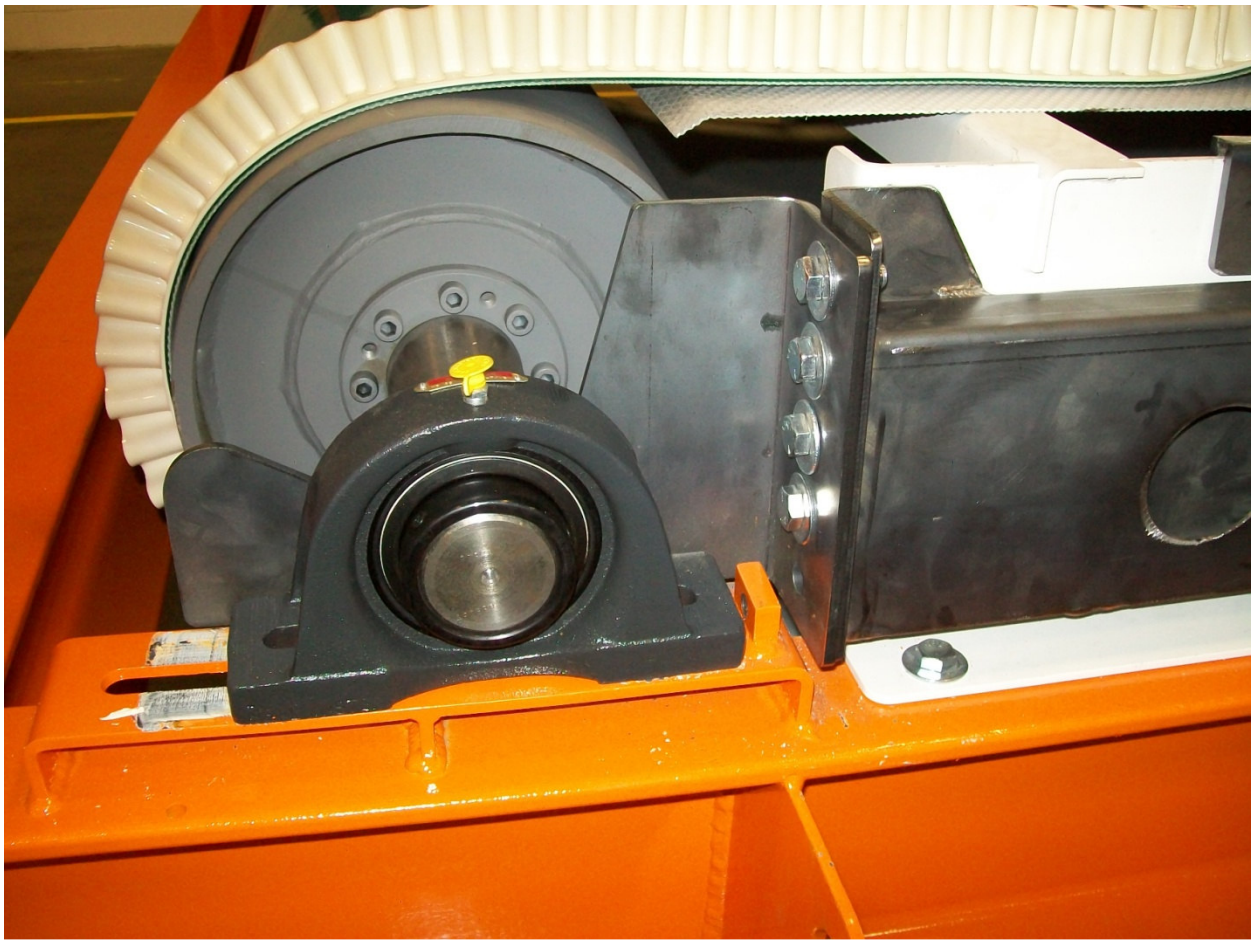


Figure 27

- Install the tail pulley bracket using ½-13 x 2” bolts.

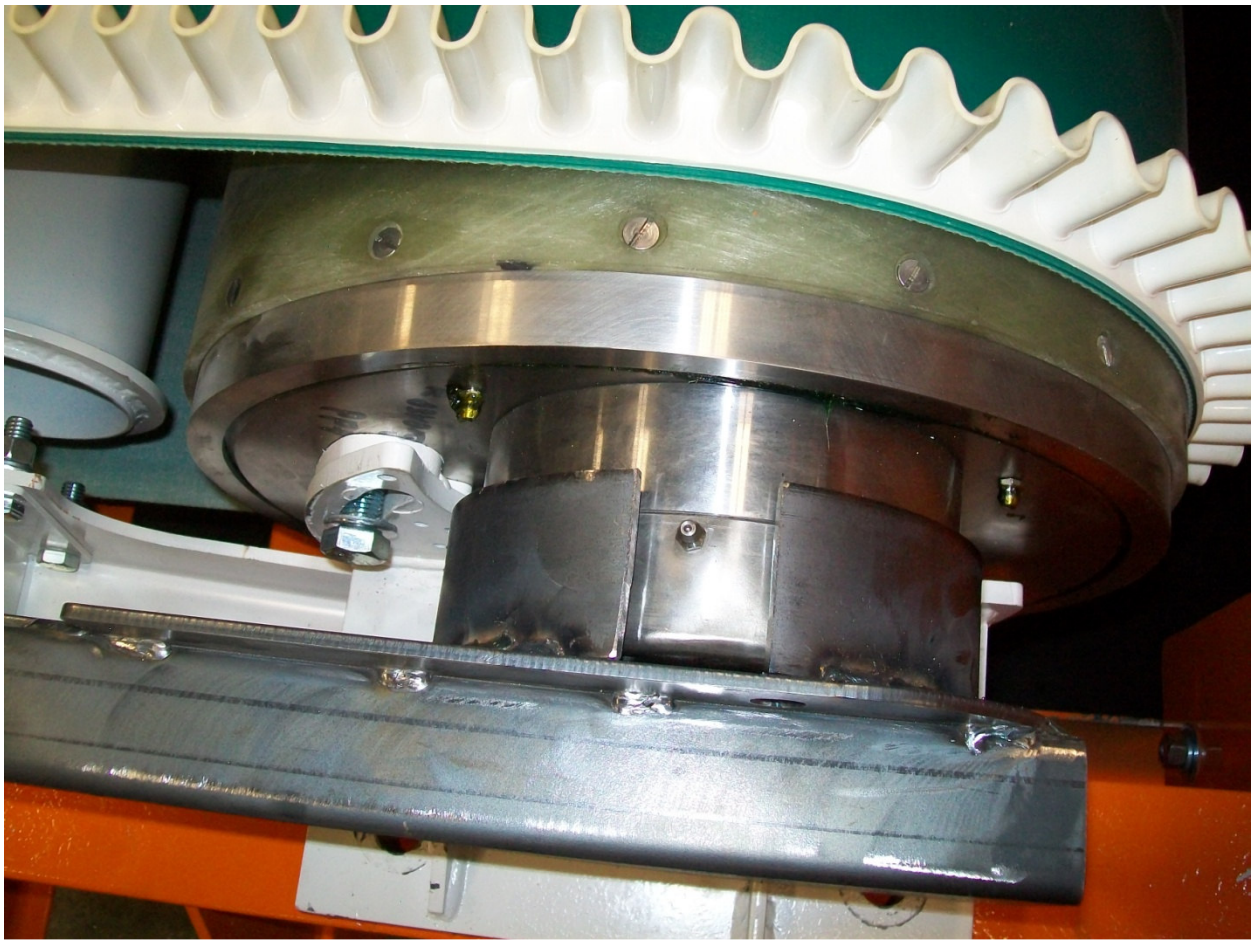


Figure 28

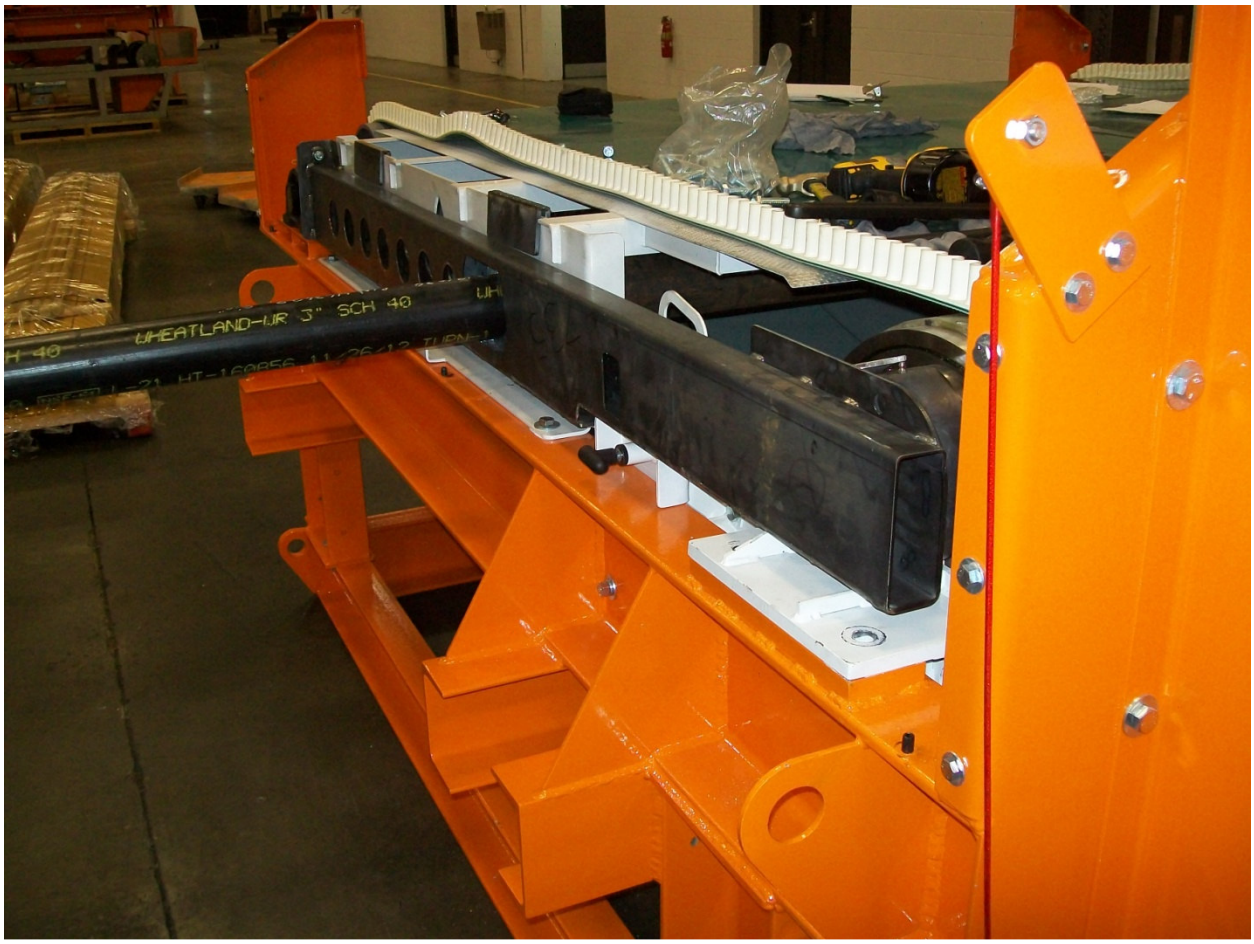


Figure 29

- Shown here, is the complete fixture shown fully installed. At this point, slide the new belt on to the cross tube extension.
- Remove slide plate mounting holes.
- Using 3/8-16 x 2 ½" bolts fix the rotor torque arm to the belt change fixture to ensure the rotor does not rotate when lifted.

Figure 30

- New belt installed on cross tube extension.

Figure 31

- Jack the drive side up using a jack under the rotor drive shaft and tail pulley lift assembly. Pin the fixture in place using a 3/8 diameter bolt and nut. Elevate the jack a few holes then move to the rear jack point.

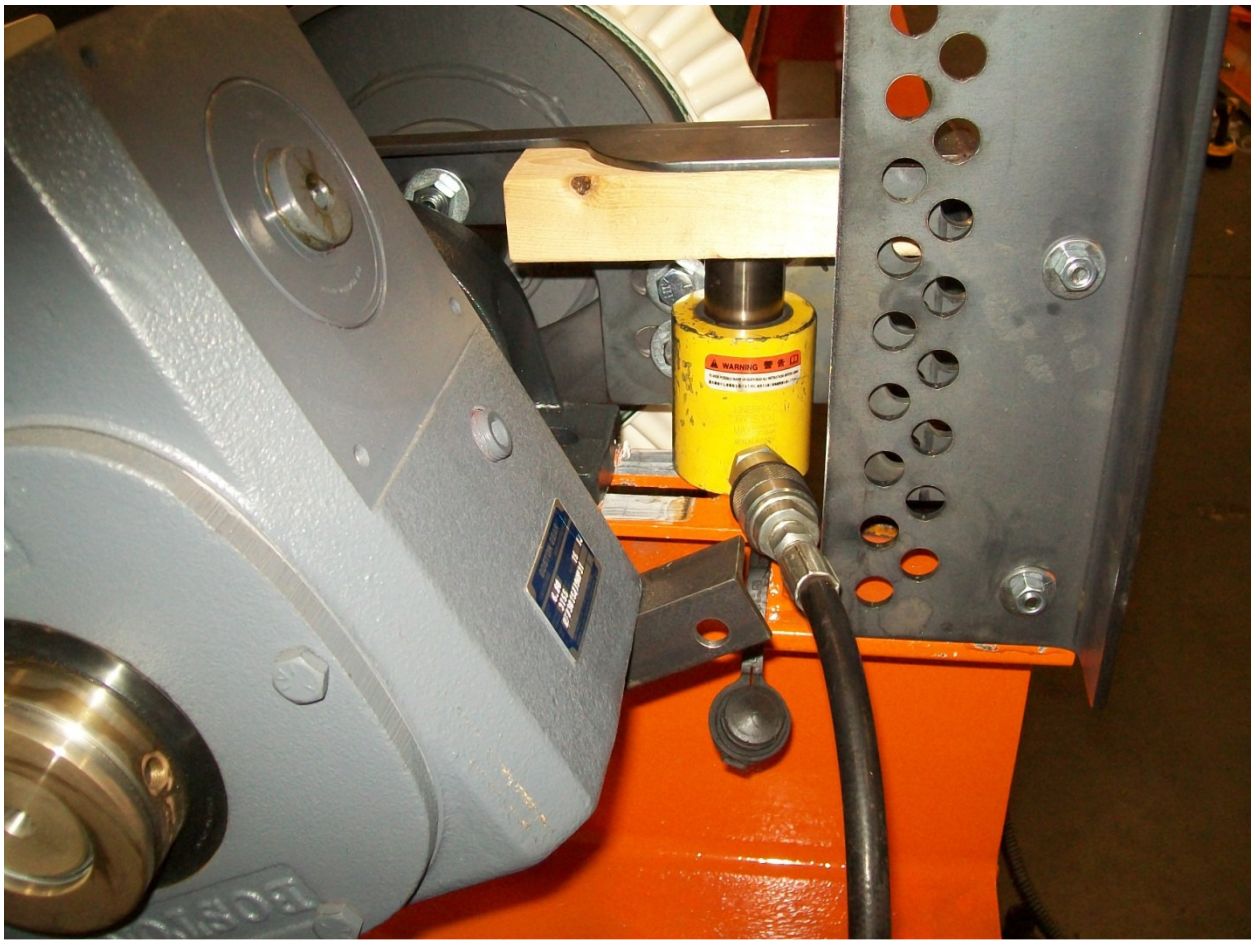


Figure 32

- Raise the tail pulley a few holes and pin the fixture in place using a 3/8 diameter bolt and nut.
- Raise the non-drive tube by lifting the cross tube extension. As the drive side is raised the non-drive side should be raised evenly otherwise the torque arm will bind inside the frame. Raise the non-drive side using a forklift, crane, chain fall, or come along.

Figure 33

- Once the assembly has been raised high enough for the belt to slide in under the rotor torque arm, slide the belt onto the machine.
- Complete reassembly in the opposite order and lower the feeder back to its original position. Ensure all guards, safety straps, and safety switches are reinstalled.
- Lower the feeder back down to its normal installed position and reinstall isolator straps.

SECTION 2.

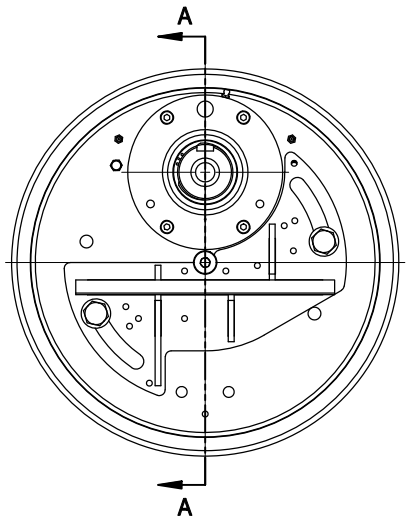
SPARE PARTS LISTS

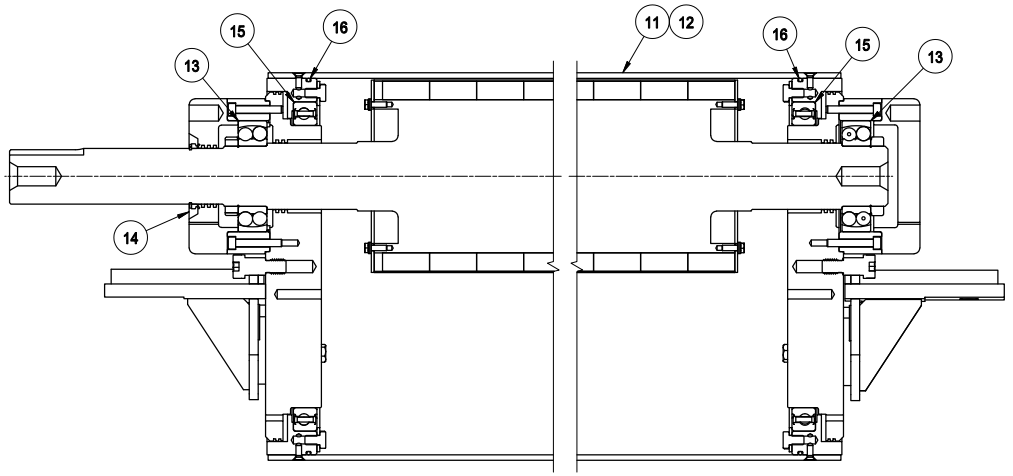
ATTENTION!

THIS MANUAL CONTAINS SPARE PARTS LISTS FOR SEVERAL MODELS AND SIZES OF ERIEZ EDDY CURRENT SEPARATORS.

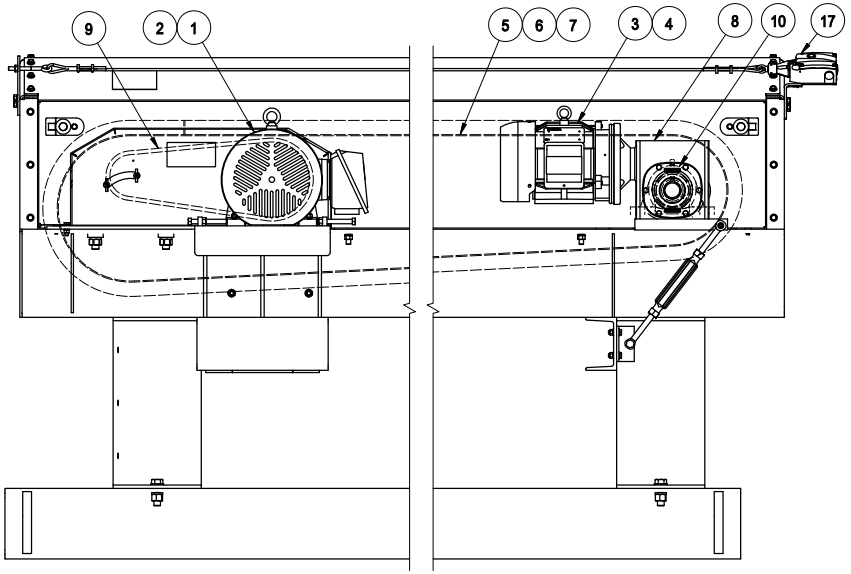
PLEASE SEE BELOW TO SELECT THE PROPER PARTS LIST:

System Width	Rotor Type	Parts List / Group #
1.0 M (40 Inches)	LT2	3P-201303095 / 1 or 2
1.0 M (40 Inches)	ST2	3P-201303095 / 3 or 4
1.0 M (40 Inches)	ST22	3P-201303095 / 5 or 6
1.2 M (48 Inches)	LT2	3P-201304568 / 1 or 2
1.2 M (48 Inches)	ST2	3P-201304568 / 3 or 4
1.2 M (48 Inches)	ST22	3P-201304568 / 5 or 6
1.5 M (60 Inches)	LT2	3P-201302802 / 1 or 2
1.5 M (60 Inches)	ST2	3P-201302802 / 3 or 4
1.5 M (60 Inches)	ST22	3P-201302802 / 5 or 6





SECTION A-A
SCALE 1 / 4



REQD.	REQD.	REQD.	REQD.	REQD.	REQD.	ITEM NO.	STOCK NO. / DWG. NO.	GROUP NO.	DESCRIPTION OF PART	SPECIFICATION	DXF
2	2	2	2	2	2	17	3N-201211203		CABLE-PULL SWITCH ASSEMBLY		
2	2	2	2	2	2	16	457897		O-RING		
2	2	2	2	2	2	15	462284		BEARING		
1	1	1	1	1	1	14	462389		SEAL V-RING		
2	2	2	2	2	2	13	451991		BEARING		
1	1	-	-	-	-	12	4N-201300723	1	SHELL ST22		
-	-	1	1	1	1	11	4N-201211187		SHELL		
2	2	2	2	2	2	10	401396		BEARING		
2	2	2	2	2	2	9	410389		V-BELT		
1	1	1	1	1	1	8	459148		GEARBOX		
1	1	-	-	-	-	7	463628		BELT CONVEYOR ST22		
-	-	1	1	-	-	6	462657		BELT CONVEYOR ST2		
-	-	-	-	1	1	5	461254		BELT CONVEYOR LT2		
1	-	1	-	1	-	4	463087		MTR 3 1800/575/6/3 TEFC		
-	1	-	1	-	1	3	459147		MTR 3 1800/23/46/6/3 TEFC		
1	-	1	-	1	-	2	463086		MTR 7.5 1800/575/6/3 TEFC		
-	1	-	1	-	1	1	459146		MTR 7.5 1800/46/6/3 TEFC		

GR. NO.	GROUP DESCRIPTION
6	575V ST22
5	230/460V ST22
4	575V ST2
3	230/460V ST2
2	575V LT2
1	230/460V LT2

REV	CHANGE MADE	SHEET	BY	DATE	ORDER #
1	INVO. LT2 DESCRIPTION, LT-4 WAS 2N-201201935, LT-5 WAS 3N-201105853, ADDED 11, 14 & 15	1	JW	5-15-13	260239
B	ADDED GROUP NOS.	1	DD	8/19/2014	DCR REV

ERIEZ
WORLD AUTHORITY IN ADVANCED TECHNOLOGY FOR MAGNETIC, VIBRATORY AND METAL DETECTION APPLICATIONS
WORLD HEADQUARTERS, ERIE, PA. USA

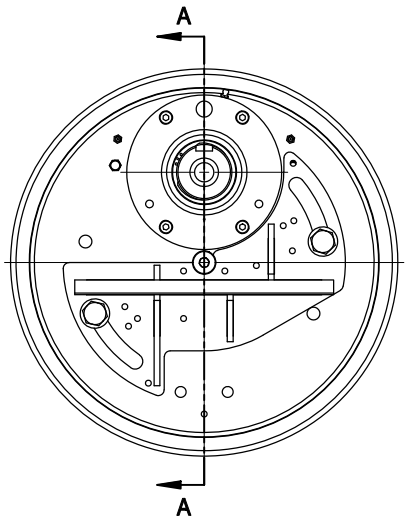
TITLE: SPARE PARTS LIST (STANDARD)
SHEET TITLE:
FOR: **ECS REVX-E-1.0M**

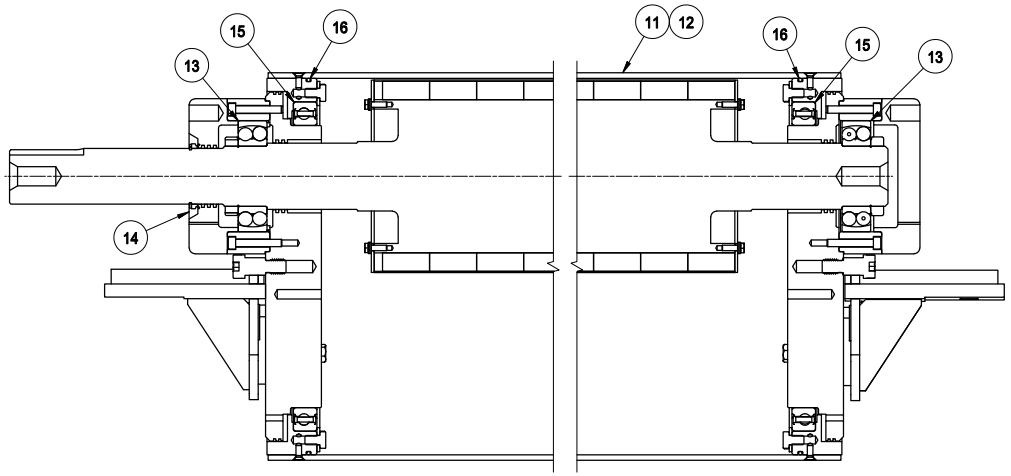
DR. BY JW	ORDER # 260239	NEXT ASS'M 201303068	SHEET 1 OF 1
SCALE 5/16:1	E.R. #	PRIOR REF 201302802	
DATE 03-25-13			
CHKD. BY -			

DIM SHOWN AS	TOL.
X.XX	± 0.01
X.XXX	± 0.005
X.XXXX	± 0.0005

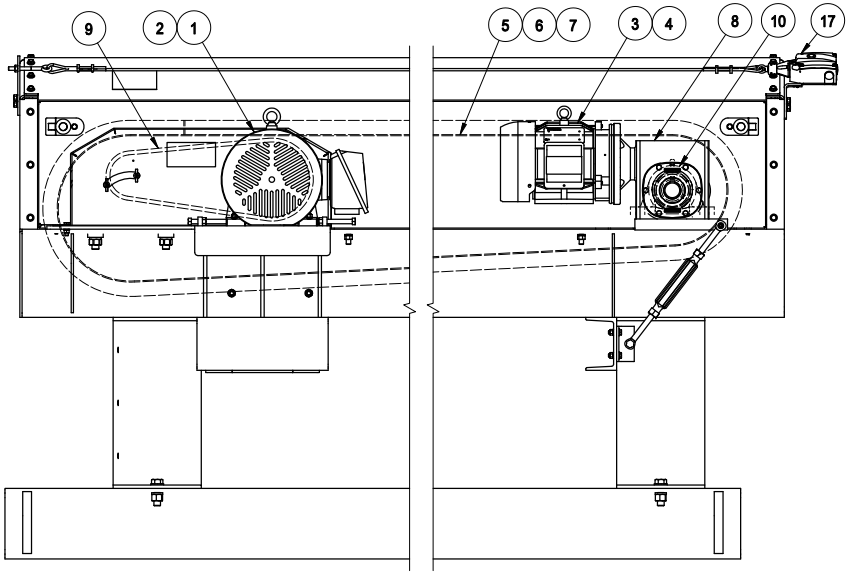
TOLERANCES (NON-ACCUMULATIVE) UNLESS OTHERWISE SPECIFIED:
WHOLE OR FRACTIONAL DIM < 30 : ± 1/16"
WHOLE OR FRACTIONAL DIM ≥ 30 : ± 1/8"
ANGULAR: ±0 DEG - 30 MIN.
MAX. T.I.R. .0020
ALSO SPEC. SEE DRAWING

DRAWING NUMBER: **3P-201303095**
REVISION: B
DSIZE|2011





SECTION A-A
SCALE 1 / 4



REQD.	REQD.	REQD.	REQD.	REQD.	REQD.	ITEM NO.	STOCK NO. / DWG. NO.	GROUP NO.	DESCRIPTION OF PART	SPECIFICATION	DXF
2	2	2	2	2	2	17	3N-201211203		CABLE-PULL SWITCH ASSEMBLY		
2	2	2	2	2	2	16	457897		O-RING		
2	2	2	2	2	2	15	462284		BEARING		
1	1	1	1	1	1	14	462389		SEAL V-RING		
2	2	2	2	2	2	13	451991		BEARING		
1	1	-	-	-	-	12	4N-201300723	2	SHELL ST22		
-	-	1	1	1	1	11	4N-201209680		SHELL		
2	2	2	2	2	2	10	401396		BEARING		
2	2	2	2	2	2	9	410389		V-BELT		
1	1	1	1	1	1	8	459148		GEARBOX		
1	1	-	-	-	-	7	464398		BELT CONVEYOR ST22		
-	-	1	1	-	-	6	464397		BELT CONVEYOR ST2		
-	-	-	-	1	1	5	463636		BELT CONVEYOR LT2		
1	-	1	-	1	-	4	463087		MTR 3 1800/575/6/3 TEFC		
-	1	-	1	-	1	3	459147		MTR 3 1800/23/46/6/3 TEFC		
1	-	1	-	1	-	2	463086		MTR 7.5 1800/575/6/3 TEFC		
-	1	-	1	-	1	1	459146		MTR 7.5 1800/46/6/3 TEFC		

GR. NO.	GROUP DESCRIPTION
6	575V ST22
5	230/460V ST22
4	575V ST2
3	230/460V ST2
2	575V LT2
1	230/460V LT2

REV	CHANGE MADE	SHEET	BY	DATE	ORDER #
A	ADDED GROUP NOS.	1	DD	8/19/2014	DCR REV

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WORLD HEADQUARTERS, ERIE, PA. USA

TITLE: SPARE PARTS LIST (STANDARD)
SHEET TITLE:
FOR: **ECS REVX-E-1.2M**

DR. BY: JW
SCALE: 5/16:1
DATE: 5-15-13
CHKD. BY: -

ORDER # 261746
E.R. #
NEXT ASS'M 201303246
PRIOR REF 201302802

SHEET 1 OF 1

NOTICE--THIS DRAWING AND THE PRINCIPLE OF DESIGN ARE THE PROPERTY OF AND PROPRIETARY TO ERIEZ

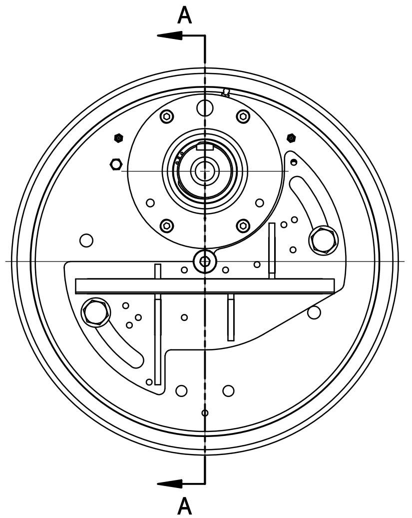
DRAWING NUMBER: **3P-201304568**

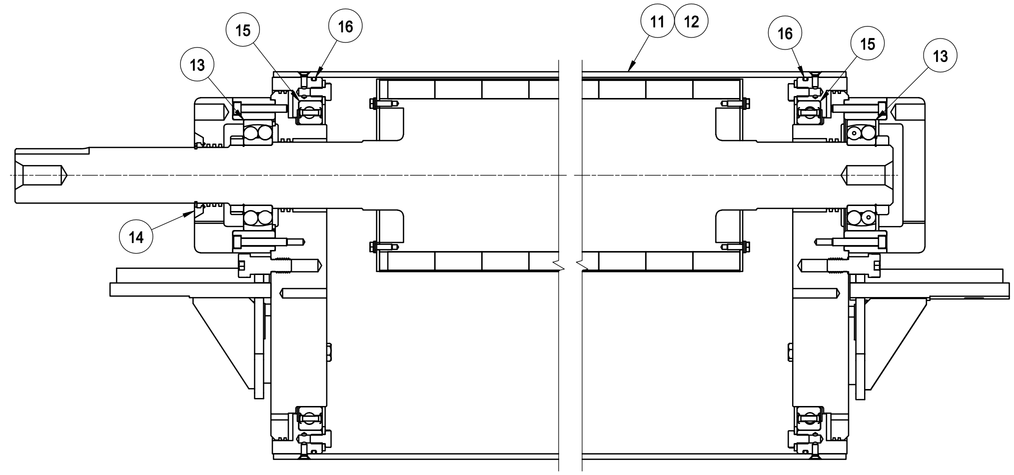
REVISION: A

DSIZE|2011

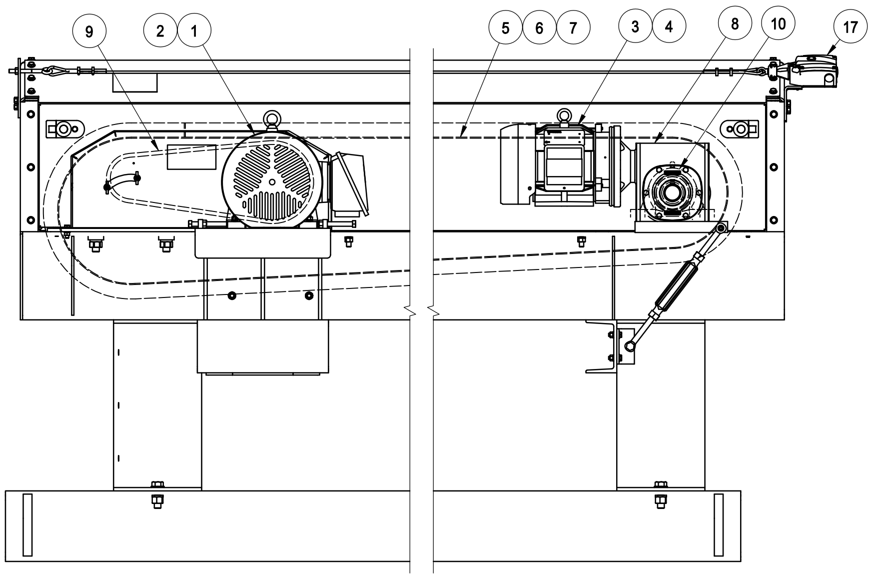
DIM SHOWN AS	TOL.
X.XX	± 0.01
X.XXX	± 0.005
X.XXXX	± 0.0005

TOLERANCES (NON-ACCUMULATIVE)
UNLESS OTHERWISE SPECIFIED:
WHOLE OR FRACTIONAL DIM < 30 : ± 1/16"
WHOLE OR FRACTIONAL DIM ≥ 30 : ± 1/8"
ANGULAR: ±0 DEG - 30 MIN.
MAX. T.I.R. 0.020
ALSO SPEC. SEE DRAWING





SECTION A-A
SCALE 1 / 4



REQD. (6)	REQD. (5)	REQD. (4)	REQD. (3)	REQD. (2)	REQD. (1)	ITEM NO.	STOCK NO. / DWG. NO.	GROUP NO.	DESCRIPTION OF PART	SPECIFICATION	DXF
2	2	2	2	2	2	17	3N-201211203		CABLE-PULL SWITCH ASSEMBLY		
2	2	2	2	2	2	16	457897		O-RING		
2	2	2	2	2	2	15	462284		BEARING		
1	1	1	1	1	1	14	462389		SEAL V-RING		
2	2	2	2	2	2	13	451991		BEARING		
1	1	-	-	-	-	12	4N-201300723	3	SHELL ST22		
-	-	1	1	1	1	11	4N-201208962		SHELL		
2	2	2	2	2	2	10	401396		BEARING		
2	2	2	2	2	2	9	410389		V-BELT		
1	1	1	1	1	1	8	459148		GEARBOX		
1	1	-	-	-	-	7	464364		BELT CONVEYOR ST22		
-	-	1	1	-	-	6	462656		BELT CONVEYOR ST2		
-	-	-	-	1	1	5	462993		BELT CONVEYOR LT2		
1	-	1	-	1	-	4	463087		MTR 3 1800/575/6/3 TEFC		
-	1	-	1	-	1	3	459147		MTR 3 1800/23/46/6/3 TEFC		
1	-	1	-	1	-	2	463086		MTR 7.5 1800/575/6/3 TEFC		
-	1	-	1	-	1	1	459146		MTR 7.5 1800/46/6/3 TEFC		

GR. NO.	GROUP DESCRIPTION
6	575V ST22
5	230/460V ST22
4	575V ST2
3	230/460V ST2
2	575V LT2
1	230/460V LT2

DIM SHOWN AS	TOL.
X.XX	± 0.01
X.XXX	± 0.005
X.XXXX	± 0.0005

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WORLD AUTHORITY IN ADVANCED TECHNOLOGY FOR MAGNETIC, VIBRATORY AND METAL DETECTION APPLICATIONS
WORLD HEADQUARTERS, ERIE, PA, USA

TITLE: SPARE PARTS LIST (STANDARD)
SHEET TITLE:
FOR: **ECS REVX-E-1.5M**

DR. BY: JSZUMIGALA | ORDER # 260239 | NEXT ASS'M: 201301785 | SHEET 1 OF 1
SCALE: 5/16:1 | E.R. # | PRIOR REF: 201301122
DATE: 03-15-13
CHKD. BY: -

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WHOLE OR FRACTIONAL DIM ≥ 30" : ±1/8"
ANGULAR ±0 DEG - 30 MIN.
MAX. T.I.R. 0.020
ALSO SPEC. SEE DRAWING

DRAWING NUMBER: **3P-201302802**
REVISION: B
DSIZE (2011)

REV	CHANGE MADE	SHEET	BY	DATE	ORDER #
1	RMVD. LT2 DESCRIPTION,IT.4 WAS 2N-201211239, IT.6 WAS 3N-201103653, ADDED IT. 14 & 15, 201301785 WAS 201302802	1	JW	5-15-13	260239
B	ADDED GROUP NOS.	1	DD	8/19/2014	DCR REV

SECTION 3.

MSDS Sheets

MATERIAL SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **MOBIL POLYREX EM**
Product Description: Base Oil and Additives
Product Code: 2015A020G010, 641688-00, 97Y278
Intended Use: Grease

COMPANY IDENTIFICATION

Supplier: **EXXON MOBIL CORPORATION**
3225 GALLOWS RD.
FAIRFAX, VA. 22037 USA

24 Hour Health Emergency	609-737-4411
Transportation Emergency Phone	800-424-9300
ExxonMobil Transportation No.	281-834-3296
Product Technical Information	800-662-4525, 800-947-9147
MSDS Internet Address	http://www.exxon.com, http://www.mobil.com

SECTION 2 COMPOSITION / INFORMATION ON INGREDIENTS

Reportable Hazardous Substance(s) or Complex Substance(s)

Name	CAS#	Concentration*
AMINES, C12-14-ALKYL, ISOOCTYL PHOSPHATES	68187-67-7	1 - 5%

* All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

SECTION 3 HAZARDS IDENTIFICATION

This material is not considered to be hazardous according to regulatory guidelines (see (M)SDS Section 15).

POTENTIAL HEALTH EFFECTS

Low order of toxicity. Excessive exposure may result in eye, skin, or respiratory irritation. High-pressure injection under skin may cause serious damage.

NFPA Hazard ID:	Health:	0	Flammability:	1	Reactivity:	0
HMIS Hazard ID:	Health:	0	Flammability:	1	Reactivity:	0

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 4 FIRST AID MEASURES

INHALATION
Under normal conditions of intended use, this material is not expected to be an inhalation hazard.

SKIN CONTACT
Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT
Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION
First aid is normally not required. Seek medical attention if discomfort occurs.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA
Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight Streams of Water

FIRE FIGHTING
Fire Fighting Instructions: Evacuate area. Prevent runoff from fire control or dilution from entering streams, sewers, or drinking water supply. Firefighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Hazardous Combustion Products: Smoke, Fume, Aldehydes, Sulfur oxides, Incomplete combustion products, Oxides of carbon

FLAMMABILITY PROPERTIES
Flash Point [Method]: >204C (399F) [EST. FOR OIL, ASTM D-92 (COC)]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES
In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations. US regulations require reporting releases of this material to the environment which exceed the applicable reportable quantity or oil spills which could reach any waterway including intermittent dry creeks. The National Response Center can be reached at (800)424-8802.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders. For emergency responders: Respiratory protection: respiratory protection will be necessary only in special cases, e.g., formation of mists. Half-face or full-face respirator with filter(s) for dust/organic vapor or Self Contained Breathing Apparatus (SCBA) can be used depending on the size of spill and potential level of exposure. If the exposure cannot be completely characterized or an oxygen deficient atmosphere is possible or anticipated, SCBA is recommended. Work gloves that are resistant to hydrocarbons are recommended. Gloves made of polyvinyl acetate (PVA) are not water-resistant and are not suitable for emergency use. Chemical goggles are recommended if splashes or contact with eyes is possible. Small spills: normal antistatic work clothes are usually adequate. Large spills: full body suit of chemical resistant, antistatic material is recommended.

SPILL MANAGEMENT

Land Spill: Scrape up spilled material with shovels into a suitable container for recycle or disposal.

Water Spill: Stop leak if you can do it without risk. Confine the spill immediately with booms. Warn other shipping. Skim from surface.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid contact with skin. Prevent small spills and leakage to avoid slip hazard.

Static Accumulator: This material is not a static accumulator.

STORAGE

Do not store in open or unlabelled containers.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

NOTE: Limits/standards shown for guidance only. Follow applicable regulations.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Control measures to consider:

No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:

No protection is ordinarily required under normal conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapor warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:

Chemical resistant gloves are recommended. If contact with forearms is likely wear gauntlet style gloves.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:

Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping.

ENVIRONMENTAL CONTROLS

See Sections 6, 7, 12, 13.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Typical physical and chemical properties are given below. Consult the Supplier in Section 1 for additional data.

GENERAL INFORMATION

Physical State: Solid

Form: Semi-fluid
Color: Blue
Odor: Characteristic
Odor Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 C): 0.884
Flash Point [Method]: >204C (399F) [EST. FOR OIL, ASTM D-92 (COC)]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D
Boiling Point / Range: > 330C (626F) [Estimated]
Vapor Density (Air = 1): N/D
Vapor Pressure: < 0.013 kPa (0.1 mm Hg) at 20 C [Estimated]
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): > 3.5 [Estimated]
Solubility in Water: Negligible
Viscosity: 95 cSt (95 mm2/sec) at 40 C
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: >250°C (482°F)
DMSO Extract (mineral oil only), IP-346: < 3 %wt
Decomposition Temperature: N/D

NOTE: Most physical properties above are for the oil component in the material.

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

MATERIALS TO AVOID: Strong oxidizers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

ACUTE TOXICITY

Route of Exposure	Conclusion / Remarks
Inhalation	
Toxicity: No end point data.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data.	Negligible hazard at ambient/normal handling temperatures. Based on assessment of the components.
Ingestion	
Toxicity (Rat): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar

	materials.
Skin	
Toxicity (Rabbit): LD50 > 5000 mg/kg	Minimally Toxic. Based on test data for structurally similar materials.
Irritation (Rabbit): Data available.	Mildly irritating to skin with prolonged exposure. Based on assessment of the components.
Eye	
Irritation (Rabbit): Data available.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.

CHRONIC/OTHER EFFECTS

Contains:

Base oil severely refined: Not carcinogenic in animal studies. Representative material passes IP-346, Modified Ames test, and/or other screening tests. Dermal and inhalation studies showed minimal effects; lung non-specific infiltration of immune cells, oil deposition and minimal granuloma formation. Not sensitizing in test animals.

Additional information is available by request.

The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = NTP CARC	3 = IARC 1	5 = IARC 2B
2 = NTP SUS	4 = IARC 2A	6 = OSHA CARC

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data available for the material, the components of the material, and similar materials.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

MOBILITY

Base oil component -- Low solubility and floats and is expected to migrate from water to the land. Expected to partition to sediment and wastewater solids.

PERSISTENCE AND DEGRADABILITY

Biodegradation:

Base oil component -- Expected to be inherently biodegradable

BIOACCUMULATION POTENTIAL

Base oil component -- Has the potential to bioaccumulate, however metabolism or physical properties may reduce the bioconcentration or limit bioavailability.

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products.

REGULATORY DISPOSAL INFORMATION

RCRA Information: The unused product, in our opinion, is not specifically listed by the EPA as a hazardous waste (40 CFR, Part 261D), nor is it formulated to contain materials which are listed as hazardous wastes. It does not exhibit the hazardous characteristics of ignitability, corrositivity or reactivity and is not formulated with contaminants as determined by the Toxicity Characteristic Leaching Procedure (TCLP). However, used product may be regulated.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (DOT): Not Regulated for Land Transport

LAND (TDG): Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

OSHA HAZARD COMMUNICATION STANDARD: When used for its intended purposes, this material is not classified as hazardous in accordance with OSHA 29 CFR 1910.1200.

Complies with the following national/regional chemical inventory requirements:: TSCA, KECI, AICS, IECSC

Special Cases:

Inventory	Status
ELINCS	Restrictions Apply
NDSL	Restrictions Apply

EPCRA: This material contains no extremely hazardous substances.

SARA (311/312) REPORTABLE HAZARD CATEGORIES: None.

SARA (313) TOXIC RELEASE INVENTORY: This material contains no chemicals subject to the supplier notification requirements of the SARA 313 Toxic Release Program.

The following ingredients are cited on the lists below:

Chemical Name	CAS Number	List Citations
DIPHENYLAMINE	122-39-4	5, 18

--REGULATORY LISTS SEARCHED--

1 = ACGIH ALL	6 = TSCA 5a2	11 = CA P65 REPRO	16 = MN RTK
2 = ACGIH A1	7 = TSCA 5e	12 = CA RTK	17 = NJ RTK
3 = ACGIH A2	8 = TSCA 6	13 = IL RTK	18 = PA RTK
4 = OSHA Z	9 = TSCA 12b	14 = LA RTK	19 = RI RTK
5 = TSCA 4	10 = CA P65 CARC	15 = MI 293	

Code key: CARC=Carcinogen; REPRO=Reproductive

SECTION 16 OTHER INFORMATION

N/D = Not determined, N/A = Not applicable

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:

Revision Changes:
Section 04: First Aid Skin was modified.
Section 06: Notification Procedures - Header was modified.
Section 11: Skin Irritation Conclusion was modified.
Section 01: Product Code was modified.
Section 10 Stability and Reactivity - Header was modified.
Section 13: Disposal Recommendations - Note was modified.
Section 09: Boiling Point C(F) was modified.
Section 09: n-Octanol/Water Partition Coefficient was modified.
Section 08: Personal Protection was modified.
Section 08: Hand Protection was modified.
Section 09: Vapor Pressure was modified.
Section 07: Handling and Storage - Handling was modified.
Section 11: Dermal Lethality Test Data was modified.
Section 11: Oral Lethality Test Data was modified.
Section 11: Inhalation Lethality Test Data was modified.
Section 05: Hazardous Combustion Products was modified.
Section 06: Accidental Release - Spill Management - Water was modified.
Section 09: Relative Density - Header was modified.
Section 09: Flash Point C(F) was modified.
Section 09: Viscosity was modified.
Section 08: Hand Protection was modified.

Section 08: Skin and Body Protection was modified.
Section 14: Sea (IMDG) - Header was modified.
Section 14: Air (IATA) - Header was modified.
Section 14: LAND (TDG) - Header was modified.
Section 14: LAND (DOT) - Header was modified.
Section 15: List Citation Table - Header was modified.
Section 14: LAND (DOT) - Default was modified.
Section 14: LAND (TDG) Default was modified.
Section 14: Sea (IMDG) - Default was modified.
Section 14: Air (IATA) - Default was modified.
Section 15: National Chemical Inventory Listing - Header was modified.
Section 15: National Chemical Inventory Listing was modified.
Section 16: Code to MHCs was modified.
Section 08: Exposure limits/standards was modified.
Section 15: OSHA Hazard Communication Standard was modified.
Section 15: Special Cases Table was modified.
Hazard Identification: OSHA - May be Hazardous Statement was modified.
Section 06: Notification Procedures was modified.
Section 09: Oxidizing Properties was modified.
Section 01: Company Contact Methods Sorted by Priority was modified.
Section 06: Protective Measures was added.
Section 06: Accidental Release - Protective Measures - Header was added.
Section 09: Decomposition Temperature was added.
Section 09: Decomposition Temp - Header was added.

Internal Use Only

MHC: 0B, 0B, 0, 0, 2, 0 PPEC: A

DGN: 2031547XUS (1008419)

Material Safety Data Sheet

Product name: **KLUBERSYNTH UH1 6-460 (#096060)**
Date: February 9, 2006
Replaces: September 24, 2005

Section 1 - Product and Company Identification

Company: Klüber Lubrication North America L.P.
32 Industrial Dr.
Londonderry, N.H. 03053
Phone: (603) 647-4104
Fax: (603) 647-4105

Emergency telephone #.: 1-800-424-9300 (Chemtrec)

Product Use: Lubricating oil
Note: This product is classified as an H1 lubricant in compliance to the regulations of the U.S. Department of Agriculture.

Section 2 - Composition/Information on Ingredients

Ingredient	TLV	PEL
Polyalkylene Glycol Oil	N/Ap	N/Ap

Section 3 - Hazards Identification

Eye Contact: May cause mild irritation upon immediate contact.
Skin contact: Prolonged or repeated contact may cause the removal of skin oils, possibly leading to irritation or dermatitis.
Inhalation: Vapor pressure is very low. However, the inhalation of vapors (generated at high temperature only) may irritate the respiratory tract.
Ingestion: Minute amounts aspirated into the lungs during ingestion or vomiting may cause mild to severe pulmonary injury. Large amounts may cause irritation to the digestive tract, nausea, vomiting, and diarrhea.

Section 4 - Emergency and First Aid Procedures

After contact with eyes: Flush eyes with plenty of water for 20 minutes. If irritation persists, or if an infection develops, seek medical attention.
After contact with skin: Wash off with soap and plenty of water. Apply skin cream if necessary. Seek medical attention if irritation or infection occurs. Remove contaminated clothing and wash before reuse.
After inhalation: If overcome by product vapor heated to extreme temperatures, or aerosolized mists, immediately move from exposure. If breathing is irregular, start resuscitation and get medical attention.
After ingestion: If large amounts are swallowed, do not induce vomiting. Get medical attention.
Advice to doctor: Treat symptomatically.

Section 5 - Exposure Controls

Eye protection: Wear safety goggles if splashes may occur**.** Do not wear contact lenses when using chemicals.
Hand protection: Wear chemical resistant gloves.
Body protection: Wear clean, body-covering clothing to minimize dermal exposure.
Ventilation: Under normal conditions of use, no special ventilation is required. However, if vaporized or misted, use local exhaust if possible.
Respiratory protection: No special respiratory protection is required. However, if product is overheated beyond conditions of normal use, or misted, wear the appropriate NIOSH-approved respiratory protection.
Other protection measures: Safety showers, eye wash fountains, and washing facilities should be readily available.

Section 6 - Fire Fighting Measures

Flash point: >280°C (Method Used: DIN ISO 2592)
Lower explosion limit: N/Av
Upper explosion limit: N/Av
Extinguishing media: In fire situation, use all appropriate fire fighting media.
Unusual fire and explosion hazards: Product itself does not burn. Exposure to heat may build up pressure in container. Cool with water spray.
Special fire Fighting Procedures: If leak or spill has not ignited, use water spray to disperse any vapor and to flush spills away from ignition sources. Use self-contained breathing apparatus for enclosed or confined spaces or as otherwise needed. Do not use direct stream of water, material may float and re-ignite.

Section 7 - Accidental Release Measures

If product leaks or is inadvertently spilled, eliminate ignition sources and isolate surrounding spill area with the proper containment system to prevent the spill from reaching waterways. Add absorbent and soak up the product. Collect product and absorbent, place in a chemical waste container for proper disposal.

Section 8 - Handling and Storage

Avoid contact with skin and remove soiled or soaked clothing. Wash hands with soap and water before eating, drinking, and/or smoking. Clean skin thoroughly after work and if necessary, apply skin cream.

Store product under normal temperature and pressure.

Store product away from heat sources and food products.

Section 9 - Physical and Chemical Properties

Boiling Point: >200°C (decomposes)
Pour point: <-30°C (DIN ISO 3016)
Vapor Pressure (mm Hg.): <0.001
Vapor Density (Air = 1): N/Av
Solubility in Water: 10% at 20°C
Density: ~1.05 g/cm^3 (DIN ISO 51757)
Evaporation rate (ether = 1): N/Av
Appearance and odor: yellow, liquid with a characteristic odor.

Section 10 - Stability and Reactivity

Stability: Stable

Conditions to avoid: Open flames and other sources of heat

Materials to avoid: Strong oxidizing agents such as pure oxygen and mineral acids.

Hazardous decomposition products: Fumes, smoke, carbon monoxide, carbon dioxide.

Hazardous polymerization: Will not occur

Section 11 - Toxicological Information

Acute Toxicity: N/Av

Chronic toxicity: N/Av

Section 12- Disposal Considerations

Under RCRA, it is the user's responsibility to determine, at the time of disposal, whether the product meets any of the criteria for a hazardous waste defined in 40 CFR 261 Subpart C. As a new product it would not be considered RCRA hazardous waste.

Section 13- Transportation Information

Proper Shipping Name	Hazard Class or Division	UN ID	Packing Group
N/Ap			

Section 14 – Regulatory Information

All product components comply with all applicable rules and orders under the Toxic Substance Control Act (TSCA).

Section 15 - Additional Information

HMIS Rating: Health: 0 Flammability: 1 Reactivity: 0 Personal Protection: A

Unk. = Unknown N/Ap = Not Applicable N/Av = Not Available ~ = Approximately

SEALMASTER GOLDPLEX™-HP

Material Safety Data Sheet

Section 1

Product Name or Number
GOLDPLEX™-HP

Formula
Lithium Complex

Product Use
Lubricating Grease

Manufacturer's Name
Emerson Power Transmission/SealMaster

Emergency Phone Number
(219)465-2200

Address
909 N. Lafayette, IN 46383

Telephone
(219)465-2200

NFPA Rating	Health 1	Flammability 1	Reactivity 0	Special	N/A
HMIS Rating	Health 1	Flammability 1	Reactivity 0	Personal Protection	B

Section 2 – Hazardous Ingredients Information

Chemical Identity	OSHA PEL	ACGIH TLV	Other Limits	Percent (Optional)	CA Number
Petroleum Distillate	5 mg/m^3	5 mg/m^3	N/A	70-80	64742-4-7

Section 3 – Health Hazard Data

Routes of Entry

Skin Contact	Yes
Skin Absorption	No
Eye	Yes
Inhalation	Not likely under normal usage
Ingestion	Not likely under normal usage
Acute Over Exposure Effects	May cause reversible eye and skin irritation
Chronic Over Exposure Effects	Prolonged or repeated skin contact may cause skin irritation

Carconogenicity Non carcinogenic
NTP Not listed
IARC Monographs Not listed
OSHA Regulated Not listed

Symptoms of Exposure
Health studies have shown that many petroleum and synthetic lubricants pose potential human and health risks which vary from person to person. As a precaution, exposure to liquids, vapors, mists or fumes should be minimized.

Specific First Aid Procedures

Eye Contact If splashed into eyes, flush with clear water for 15 minutes or until irritation subsides. If irritation persists, call a physician.

Skin Contact In case of contact, remove any contaminated clothing and wash the skin thoroughly with soap and water.

Inhalation Vapor pressure is very low and inhalation at room temperature is normally not a problem. If overcome by vapor from hot product, immediately remove from exposure and call a physician.

Ingestion If ingested, DO NOT induce vomiting; call physician immediately.

Section 4 – Physical Data

Boiling Point	Vapor Pressure (mm Hg)	Vapor Density (air =1)
Not determined	Less than 0.10 mm Hg @ 20°C	Greater than 5
Solubility in Water	**Appearance and Odor**	**Specific Gravity (H20=1)**
Negligible; less than 0.1%	Gold/Mild odor	.89 @ 60° F
Melting Point	**Evaporation Rate (Butyl Acetate =1)**	**pH (neat)**
Not determined	Negligible	Not applicable

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SEALMASTER GOLDPLEX™-HP

Material Safety Data Sheet – Page 2

Section 5 – Fire and Explosion Data

Flashpoint and Method of Determination
500° F COC, Base Oil

Lower Explosion Limit (% by Vol.)
Not determined

Upper Explosion Limit (% by Vol.)
Not determined

Explosion Data
Not determined

Extinguishing Media
Use water spray, dry chemical, foam or carbon dioxide. Water or foam may cause frothing.
Use water to keep fire-exposed containers cool. Water spray may be used to flush spills away from exposures. Minimized breathing gasses, vapor, fumes, or decomposit ion products. Use supplied-air breathing equipment for enclosed or confined spaces, or as otherwise needed.

Special Fire Fighting Instructions
Self-contained breathing equipment and chemical resistant clothing recommended.

Section 6 – Reactivity Data

Chemical Stability
This product is stable and will not react violently with water.

Conditions of Reactivity
Not determined

Hazardous Decomposition Products
Not determined

Hazardous Polymerization
Will not occur

Polymerization Avoid
Not applicable

Incompatible Materials
Strong oxidants such as liquid chlorine concentrated oxygen, sodium hypochlorite or calcium hypochlorite.

Section 7 – Precautions for Safe Handling and Use

Leak and Spill Procedure
Remove free product. Add sand, earth or other suitable absorbent to spill area. Minimize skin contact. Keep product out of sewers and watercourses by diking or impounding. Advise authorities if product has entered or may enter sewers, watercourses or extensive land areas. Assure conformity with applicable governmental regulations.

Waste Disposal
Spilled material, unused contents and empty containers must be disposed of in accordance with local, state and federal regulations.

Handling Procedures and Equipment
Do not store or mix with strong oxidizers. Keep out of eyes.

Storage Requirements
Do not store sealed containers near extreme heat. Do not reuse container.

Precautionary Measures
Always wash hands well before touching face or eating.

Section 8 – Control Measures

Respiratory Protection
Not normally required if adequate ventilation.

Mechanical Exhaust
Not required

Local Exhaust
Use local exhaust to capture vapor, mists or fumes, if needed.

Special Ventilation
Not applicable

Other Ventilation
Not applicable

Protective Gloves
Use oil-resistant gloves (neoprene or plastic), if needed to avoid prolonged or repeated skin contact.

Eye Protection
Use splash goggles or face shield when eye contact may occur.

Other Protective Equipment
Use chemical resistant apron or other impervious clothing, if needed, to avoid contaminating regular clothing which could result in prolonged or repeated skin contact.

Section 9 – Regulatory Information

U.S. DOT Classification	N/A
SARA Title III	
Section 313 Toxic Chemicals	Contains 2.5% antimony compounds and 0.5% zinc compounds
TSCA Inventory Status	Chemical components listed on TSCA inventory

Section 313 Supplier Notification

GOLDPLEX™- HP contains the following EPCRA section 313 chemical subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372):

CAS Number	Chemical Name	Percent by Weight
NA	Antimony Compounds	2.5 %

Prepared by SEALMASTER (219) 465-2200 **10/10/03**
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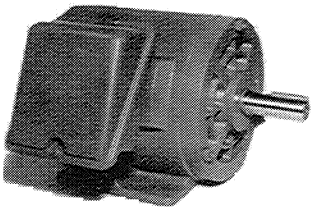
SECTION 4.

Catalogue Information

TOSHIBA

A Quality Product for World Energy



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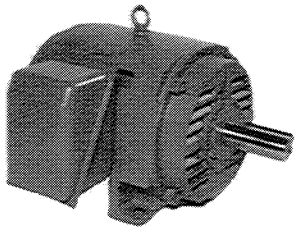

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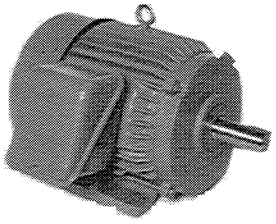

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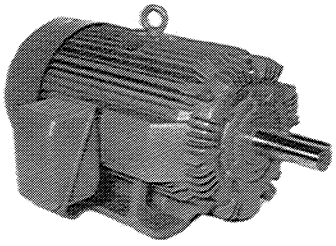
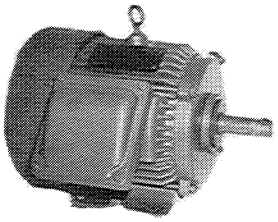
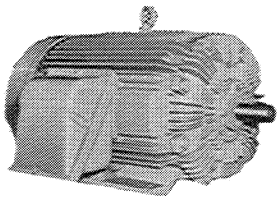


TEFC Frames 444T–N587UZ



XP Frames 143T–256T



XP Frames 404T–447TZ

INSTRUCTIONS:

Installation and Maintenance For 50 & 60 Hertz Motors

Toshiba World Energy Motors
Polyphase motors

- Frames 143T through 507UZ Dripproof
- Frames 143T through N587UZ Totally-Enclosed Fan-Cooled
- Frames 143T through 447TZ Explosion- Proof.

STORAGE

(1) Store motor in a clean, dry and cover completely with (Leave opening for ventilation)
(2) Motor must be thoroughly dry before applying power.
(3) Every six months, give winding a megger test. A minimum of 10 megohms are recommended.
(4) Also, every six months, rotate shaft and add grease as needed.

READ CAREFULLY BEFORE INSTALLING AND STARTING

RECEIVING"

(1) Check nameplate
(2) Check whether any damage has occurred during transportation. (Motors are normally shipped F.O.B. factory. Freight claims must be submitted by the consignee to the carrier.)
(3) When supplied -Be sure to remove bearing lock plate before start-up.
(4) Turn shaft by hand to check that it turns freely.

LOCATION

(1) All motors should be located in an area where ventilation is not restricted and affects the operation of the motor.
(2) Dripproof Motors are designed for installation in a well ventilated place where the atmosphere is reasonably free of dirt and moisture.
(3) Totally enclosed motors may be installed where dirt, moisture (not running water) and corrosion are present, or in outdoor locations.
(4) Explosion Proof motors are designed and built for hazardous duty. Listed by U L for Class 1, Group D; and Class 11, Groups E, F and G. Also listed by C S A.

MOUNTING

(1) Mount motor securely on a firm, flat base. All ball and roller bearing normal thrust motors may be mounted in any position.
(2) Align motor accurately, using a flexible coupling if possible. For drive recommendations consult with drive or equipment manufacturer, or Toshiba. See additional information on pages 3 and 4.
(3) V-belt Sheave Pitch Diameters should not be less than the following Table 1, values (NEMA recommended values).
(4) Tighten belts only enough to prevent slippage. Belt speed should not exceed 5000 ft. per min.
(5) Motors must not be subjected to vibration exceeding 0.5 G force. (Motors should not be mounted to shaker screens)

POWER SUPPLY & CONNECTIONS

(1) Nameplate voltage and frequency should agree with power supply. Motor will operate satisfactorily on line voltage within 10% of nameplate value; or frequency within 5%; combined ariation not to exceed 10%. 230 Volt motors can be used on 208-volt network systems, but with slightly modified performance characteristics.
(2) Dual voltage and single voltage motors can be connected for the desired voltage by following connection diagram shown on nameplate. Alternate starting connections are shown in the conduit box or connection diagrams on pages 5 and 6.
(3) Explosion Proof motors have Temperature Limiting Devices in the motor enclosure to prevent excessive external surface temperature of the motor in accordance with U L standards. Terminals of thermal protectors (P1, P2) should be connected to the motor control equipment.
(4) Wiring of motor and control, overload protection and grounding should be in accordance with National Electrical Code and local building codes.
(5) Disconnect motor from power supply before opening conduit box or working on motor.
(6) Megger test before energizing. A minimum of 10 megohms are recommended.

Table 1. V-belt Sheave Pitch Diameters (MG 1 -14.42)

Frame No.	Horsepower at Speed Range			V-belt Sheave (inches)			
				Conventional A, B, C, D and E		Narrow 3V, 5V and 8V	
	2 Pole	4 Pole	6 Pole	Min. Pitch Diameter	Max Width*	Min. Outside Diameter	Max Width**
143T	1 1/2	1	3/4	2.2	4.250	2.2	2.250
145	2-3	1 1/2 - 2	1	2.4	4.250	2.4	2.250
182T	3	3	1 1/2	2.4	5.250	2.4	2.750
182T	5	–	–	2.6	5.250	2.4	2.750
184T	–	–	2	2.4	5.250	2.4	2.750
184T	5	–	–	2.6	5.250	2.4	2.750
184T	7 1/2	5	–	3.0	5.250	3.0	2.750
213T	7 1/2 - 10	7 1/2	3	3.0	6.500	3.0	3.750
215T	10	–	5	3.0	6.500	3.0	3.750
215T	15	10	–	3.8	6.500	3.8	3.750
254T	15	–	7 1/2	3.8	7.750	3.8	4.000
254T	20	15	–	4.4	7.750	4.4	4.000
256T	20 - 25	–	10	4.4	7.750	4.4	4.000
256T	–	20	–	4.6	7.750	4.4	4.000
284T	–	–	15	4.6	9.000	4.4	4.250
284T	–	25	–	5.0	9.000	4.4	4.250
286T	–	30	20	5.4	9.000	5.2	4.250
324T	–	40	25	6.0	10.250	6.0	5.250
326T	–	50	30	6.8	10.250	6.8	5.250
364T	–	–	40	6.8	11.500	6.8	5.250
364T	–	60	–	7.4	11.500	7.4	5.250
365T	–	–	50	8.2	11.500	8.2	5.500
365T	–	75	–	9.0	11.500	8.6	5.500
404T	–	–	60	9.0	14.250	8.0	7.250
404T	–	100	–	10.0	14.250	8.6	7.250
405T	–	–	75	10.0	14.250	10.0	7.250
405T	–	100	–	10.0	14.250	8.6	7.250
405T	–	125	–	11.5	14.250	id.5	7.250
444T	–	–	100	11.0	16.750	10.0	8.500
444T	–	125	–	11.0	16.750	9.5	8.500
444T	–	150	–	–	–	10.5	8.500
445T	–	–	125	12.5	16.75.0	12.0	8.500
445T	–	150	–	–	–	10.5	8.500
445T	–	200	–	–	–	13.2	8.500

*** Max sheave width - 2 (N-W)-1/4". **Max. sheave width = N-W.**

Sheave ratios greater than 8:1 and center-to-center distance less than the diameter of the large sheave should be referred to the company. Sheaves must be mounted close to the shaft shoulder.

Fig. 1 SHAFT EXTENSION LOADS DUE TO TRANSMISSION OF POWER

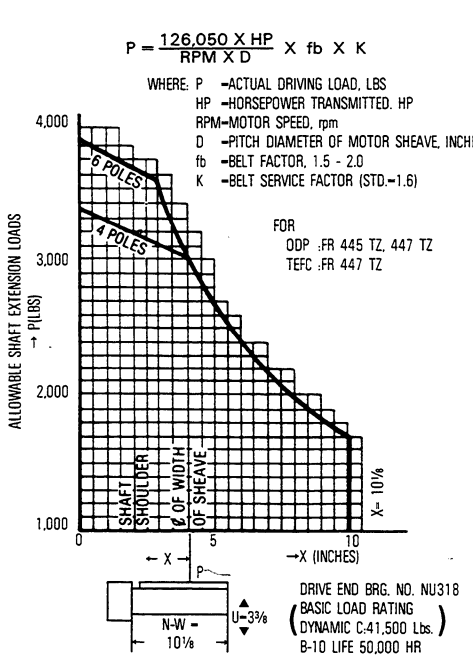
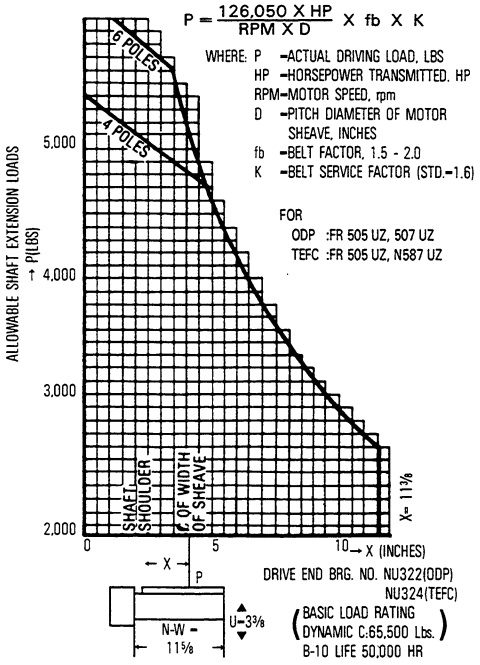


Fig. 2 SHAFT EXTENSION LOADS DUE TO TRANSMISSION OF POWER



ALIGNMENT PROCEDURES

MOTOR LEVELING & COUPLING ALIGNMENT

When the base has been adjusted, leveled, and grouted, the correct motor leveling and coupling alignment are obtained with the aid of shims between the motor and the base. To give the motor proper support, it is important that the base and shims extend under the motor.

RIGID COUPLING

Extreme care must be taken to obtain correct alignment when using rigid couplings. Circular concentric peripheral surfaces of the two coupling halves must indicate correct alignment within 0.0005 in. to 0.001 in. when the two coupling halves are rotated together. The separation between the faces of the two coupling halves must also be maintained within the same tolerance.

The alignment may be checked by utilizing a dial indicator as shown in Fig. 3 or with the aid of a straight-edge and thickness gauge or feelers as shown in Fig. 4.

The preferred method of checking alignment is with the dial indicator. Bolt the indicator to one of the coupling halves and indicate the position of the dial button on ihe opposite coupling half with a chalk mark. Set the indicator dial to zero at the first position and then rotate both halves of the coupling to a new position where a check reading is to be made. All readings must be made with the dial button located at the chalk mark, and not less than six different sets of readings should be taken. A variation in the dial reading at different positions of coupling rotation will indicate whether the machine has to be raised, lowered, or moved to one side or another to obtain alignment of the circular concentric peripheral surfaces of the two coupling halves within the specified tolerance.

In addition to the above check, a check of the separation of the coupling faces must be made to establish correct alignment. The separation between the faces of the coupling may be checked with a dial indicator fastened to one coupling half and a reference surface fastened to the other coupling half. Mark the location of the dial button on the reference surface and make all readings with the indicator in this position. Set the dial of the indicator to zero for the first reading and use this as the reference. Be sure to rotate both halves of the coupling the same amount, aligning the button of the indicator and the mark on the reference surface for each of six readings. A variation of the readings at different positions will indicate how the machine has to be adjusted to obtain correct alignment. After each adjustment of the motor, repeat the above procedure to be certain that correct alignment and leveling have been obtained.

FLEXIBLE COUPLING

Units coupled through flexible couplings should be aligned as accurately as possible. As a suggested limit, the two halves should indicate correct alignment within 0.002 in. on both the circular concentric peripheral surfaces and the separation between faces. Although most flexible couplings will withstand greater misalignment than rigid couplings, extreme misalignment can cause vibration possibly resulting in failure of motor bearings and/or shaft.

If the method shown in Fig. 4 is used to check alignment of the machines, correct alignment exists -- if the peripheries of the coupling halves are true circles of the same diameter and if the faces are flat -- when the separation between the faces is held to within the specified tolerance at all points and a straight-edge lies squarely across the rims at any point. Non-parallel faces will be indicated by a variation in separation of the coupling halves as they are rotated, and a difference in height of the coupling halves will be indicated by the straight-edge and feeler gauge test.

When the coupling halves have been correctly aligned with the motor feet bolted in position, place temporary bolts in two coupling holes for clamping the halves together. Then, ream for a light drive fit through bolt halves for regular coupling bolts.

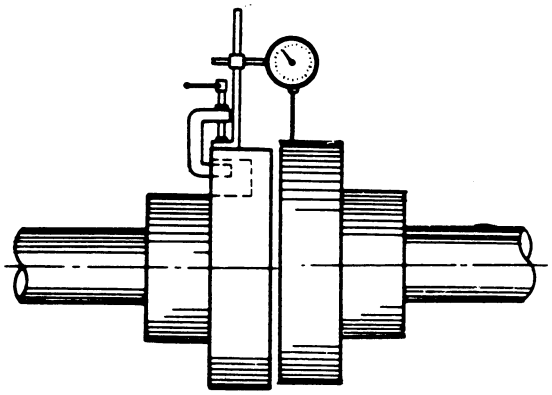
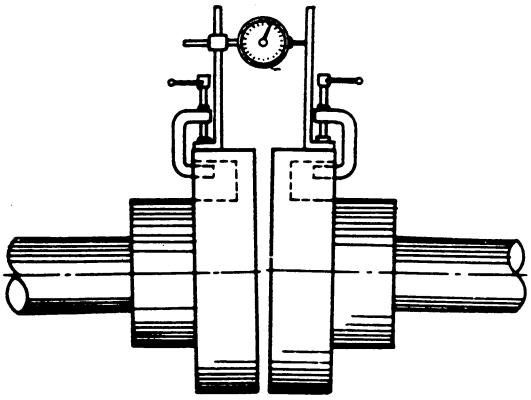


Fig. 3. The preferred method of measuring coupling alignment is with a dial indicator.

A. Clamp the dial indicator to the coupling as indicated above to measure the circular concentric peripheral surfaces of the coupling halves for parallel alignment.

B. Clamping a reference surface to the opposite coupling half allows the dial indicator to be used for measuring the separation of the coupling halves for axial alignment as shown below.



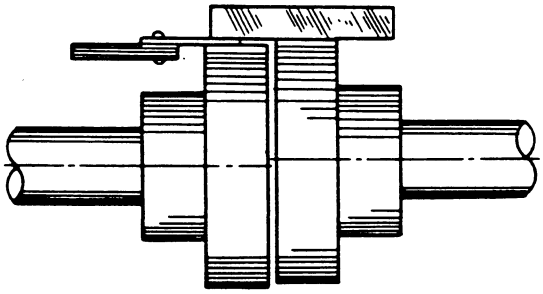
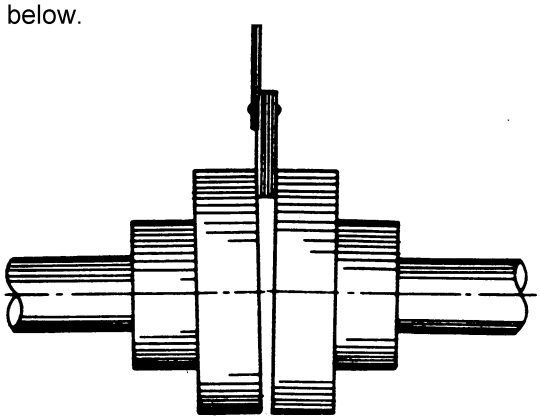


Fig. 4. The straight-edge or thickness gauge or feeler gauge is an alternative method of measuring coupling adjustment.

A. Use a straight-edge and thickness gauge or feeler gauge to check the alignment of the circular concentric peripheral surfaces of the coupling halves as shown above.

B. The separation between the faces of the coupling halves can be measured as shown below.



Rigid Coupling tolerances 0.0005 in. to 0.001 in.
Flexible Coupling tolerance: 0.0015 in.

BALANCE (DIRECT COUPLED UNITS)

TOSHIBA motors are balanced at the factory to standard NEMA commercial tolerances. However, if direct coupling units have been disassembled in the field, an apparent unbalance may occur if the units are not reassembled with the shafts in the same relative position as they were originally. Should this occur, disconnect the coupling halves and rotate one shaft 900 with respect to the other shaft. Re-connect the coupling and run the unit.

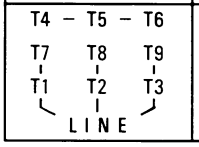
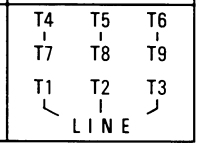
If the unbalance has not disappeared, repeat the above procedure until it does.

CONNECTION DIAGRAMS

A. Wye-connected Dual Voltage (low/high voltage)
(9 Leads)

POLE	ODP	TEFC & EXP
2P	1 ½ HP-7 ½HP	1 ½ HP-5HP
4P	1HP-5HP	1HP-5HP
6P	¾ HP-5HP	¾ HP-5HP
8P	¾ HP-5HP	¾ HP-5HP

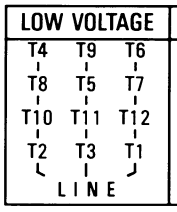
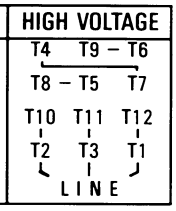
A-1 Across the Line Starting

LOW VOLTAGE	HIGH VOLTAGE
	

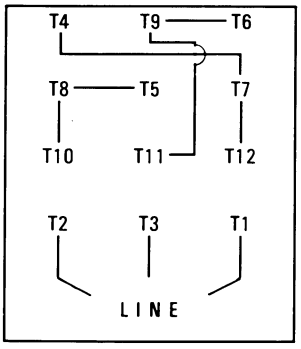
B. Delta-connected Dual Voltage
(12 Leads)

POLE	ODP	TEFC & EXP
2 P	10HP-250HP	7½HP-150HP
4 P	7½HP-200HP	7½HP-150HP
6 P	7½HP-125HP	7½HP-125HP
8 P	7½HP-100HP	7½HP-100HP

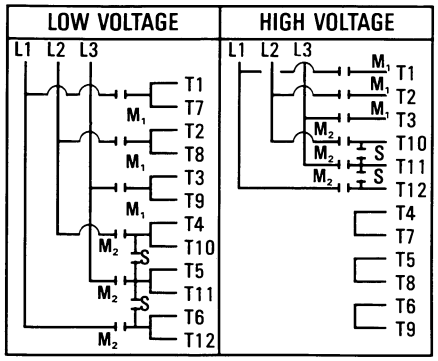
B-1 Across the Line Starting

LOW VOLTAGE	HIGH VOLTAGE
	

B-2 575 Volt Connection (see Note 1)

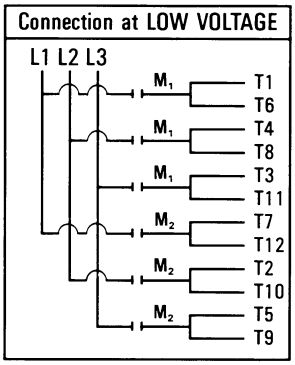


B-3 Wye Start Delta Run



	Start	Run
M_1	Close	Close
M_2	Open	Close
S	Close	Open

B-4 Part Winding Starting (see Note 2)



	Start	Run
M_1	Close	Close
M_2	Open	Close

M_2 should be energized within 2 seconds after M_1 is energized.

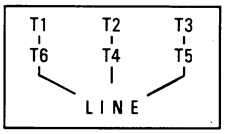
NOTES:

1. 230/460 Volt Motors can be used on 575 Volt network in accordance with B-2 connection.
2. 4 pole and 6 pole motors are satisfactory for Part Winding starting at low voltage.

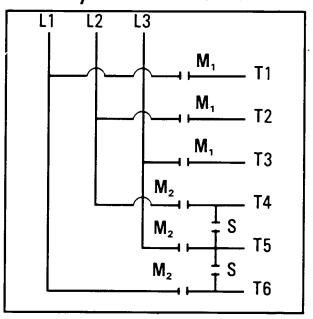
C. Delta-connected Single Voltage
(6 Leads)

POLE	ODP	TEFC & EXP
2 P	300HP-350HP	200HP-300HP
8 P	125HP-250HP	125HP-250HP

C-1 Across the Line Starting



C-2 Wye Start Delta Run



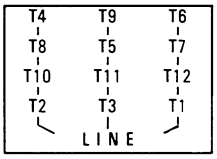
	Start	Run
M_1	Close	Close
M_2	Open	Close
S	Close	Open

CONNECTION DIAGRAMS CONT.

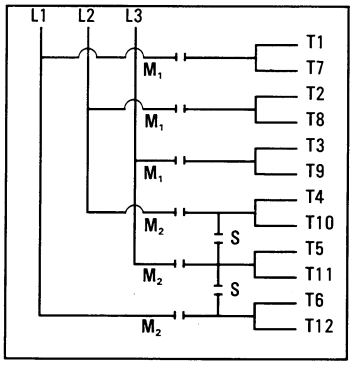
D. Delta-connected Single Voltage (12 Leads)

POLE	ODP	TEFC & EXP
2 P	400HP-600HP	———
4 P	250HP-400HP	200HP-400HP
6 P	150HP-300HP	150HP-300HP

D-1 Across the Line Starting

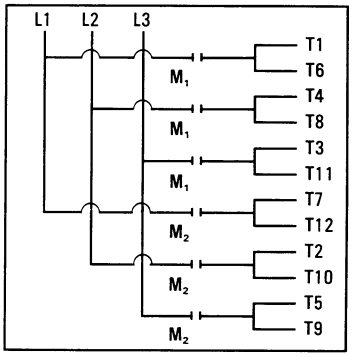


D-2 Wye Start Delta Run



	Start	Run
M_1	Close	Close
M_2	Open	Close
S	Close	Open

D-3 Part Winding Starting (4 pole and 6 pole motors)



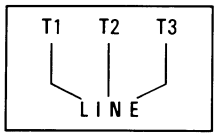
	Start	Run
M_1	Close	Close
M_2	Open	Close

M_2 should be energized within 2 seconds after M_1 is energized.

E. Wye-connected 575 Volt Motors (3 Leads)

POLE	ODP	TEFC & EXP
2 P	1½HP-7½HP	1½HP-5HP
4 P	1HP-5HP	1HP-5HP
6 P	¾HP-5HP	¾HP-5HP
8 P	¾HP-5HP	¾HP-5HP

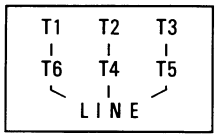
E-1 Across the Line Starting



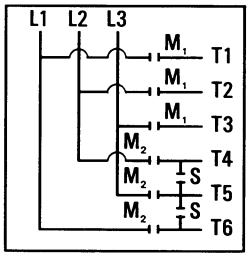
F. Delta-connected 575 Volt Motors (6 Leads)

POLE	ODP	TEFC & EXP
2 P	10HP-500HP	7½HP-300HP
4 P	7½HP-400HP	7½HP-400HP
6 P	7½HP-300HP	7½HP-300HP
8 P	7½HP-250HP	7½HP-250HP

F-1 Across the Line Starting



F-2 Wye Start Delta Run

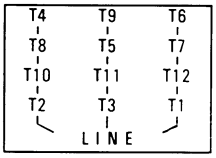


	Start	Run
M_1	Close	Close
M_2	Open	Close
S	Close	Open

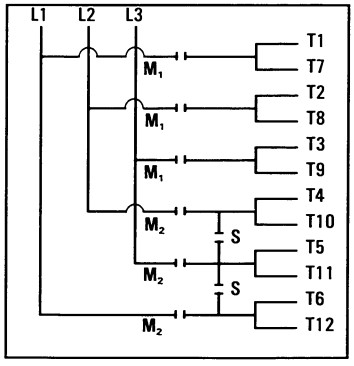
G. Delta-connected 575 Volt Motors (12 Leads)

POLE	ODP
2 P	600HP

G-1 Across the Line Starting



G-2 Wye Start Delta Run



	Start	Run
M_1	Close	Close
M_2	Open	Close
S	Close	Open

WARNINGS

Motors built F-1 Assembly will be standard counter clockwise rotation facing non drive end of motor. Motors built F-2 Assembly will have clockwise rotation facing non drive end of motor. With the exception of low voltage TEFC 400T through N587UZ Frame motors, whose rotation will remain counter clockwise.

WARNING
BEFORE STARTING MOTOR, REMOVE ALL UNUSED SHAFT KEYS AND LOOSE ROTATING PARTS TO PREVENT THEM FROM FLYING OFF.

CAUTION: Check direction of motor rotation before coupling motor to load.

WARNING
ROTATING PARTS, SUCH AS COUPLINGS, PULLEYS, EXTERNAL FANS, AND UNUSED SHAFT EXTENSIONS, SHOULD BE PERMANENTLY GUARDED AGAINST ACCIDENTAL CONTACT WITH HANDS OR CLOTHING. THIS IS PARTICULARLY IMPORTANT WHERE THE PARTS HAVE SURFACE IRREGULARITIES SUCH AS KEYS, KEYWAYS OR SET SCREWS.

WARNING
WHEN A LIFTING MEANS IS PROVIDED FOR HANDLING THE MOTOR OR GENERATOR, IT SHOULD NOT BE USED TO LIFT THE MOTOR OR GENERATOR PLUS ADDITIONAL EQUIPMENT SUCH AS GEARS, PUMPS, COMPRESSORS, OR OTHER DRIVEN EQUIPMENT.

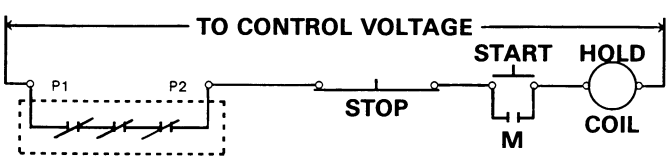
WARNING
THE FRAMES AND OTHER METAL EXTERIORS OF MOTORS AND GENERATORS (EXCEPT FOR INSULATED PEDESTAL BEARINGS) USUALLY SHOULD BE GROUNDED TO LIMIT THEIR POTENTIAL TO GROUND IN THE EVENT OF ACCIDENTAL CONNECTION OR CONTACT BETWEEN LIVE ELECTRICAL PARTS AND THE METAL EXTERIORS.

WARNING
WHEN CAREFUL CONSIDERATION OF THE HAZARDS INVOLVED IN A PARTICULAR APPLICATION INDICATE THE MACHINE FRAMES SHOULD NOT BE GROUNDED OR WHEN UNUSUAL OPERATING CONDITIONS DICTATE THAT A GROUNDED FRAME CANNOT BE USED, THE INSTALLER SHOULD MAKE SURE THE MACHINE IS PERMANENTLY AND EFFECTIVELY INSULATED FROM GROUND. IN THOSE INSTALLATIONS WHERE THE MACHINE FRAME IS INSULATED FROM GROUND, IT IS RECOMMENDED THAT APPROPRIATE WARNING LABELS OR SIGNS BE PLACED ON OR IN THE AREA OF THE EQUIPMENT BY THE INSTALLER.

WARNING FOR EXPLOSION-PROOF MOTOR

Disconnect power before working on motor driven equipment. This motor is equipped with an automatic temperature-limiting device. The National Electrical Code and Underwriter's Laboratories require connection of leads P1 and P2 into the control circuit of a manual reset starter per following diagram.

KLIXON TYPE	AC VOLT	VOLT AMP RATING
9700K	120-600V	720 VA



(NC) MOTOR THERMOSTATS

NOTE:
Frame 256T and smaller has two thermostats.

MAINTENANCE

1 INSPECTION

Inspect motor at regular intervals. Keep motor clean and vent openings clear.

2. LUBRICATION

a) **Frames 143T thru 256T** are furnished with double sealed or shielded ball bearings, prelubricated prior to installation. Grease fittings are not supplied and bearings are designed for average 100,000 hours operation under standard conditions. (See table 2 below.)

b) **Frames 284T thru N587UZ** are furnished with double shielded or open ball or roller bearings. (Depending on HP size and/or speed.) It is necessary to relubricate anti-friction bearing motors periodically. (See table 2 below.) These motors are supplied with provision for greasing and have been lubricated prior to test, however before start-up it is recommended to apply approximately 30 grams (1 oz.) of grease because of possible settling of grease during storage and handling. However, oil leakage around bearing caps indicate overpacking and excess grease should be purged out by operating motor temporarily with relief open.

Table 2. Frequency of Relubrication

Speed Range	Frame Range	Standard Duty	Severe Duty
2 Pole	143T-256T	*5 Years	* 3 Years
	284TS-286TS	12 Mos.	4 Mos.
	324TS-N587USS	9 Mos.	3 Mos.
4 Pole	143T-256T	*7 Years	* 3 Years
	284T-326T	4 Years	1. 5 Years
	364T-365T	2.5 Years	10 Mos.
	404T-447TZ	2 Years	8 Mos.
	505US-N587UZ	1. 5 Years	6 Mos.
6 Pole & Slower	143T-256T	*7 Years	3 Years
	284T-326T	4 Years	1.5 Years
	364T-447TZ	3 Years	1 Year
	505US-N587UZ	2 Years	8 Mos.

* The above table shows typical regreasing schedules to be used unless otherwise specified by the motors grease nameplate.

SERVICE CONDITIONS

STANDARD DUTY	Eight hours per day, light to normal loading, clean condition free from dust.
SEVERE DUTY	Twenty-four hours per day, or light to normal shock loading vibration, exposure to dirt or dusty conditions. For very severe conditions where the motor is subject to high vibration or heavy shock loading and vibration use 1/3 of the value shown in the severe duty table.

Remarkit is recommended to change bearings after the time shown in Table 2.

3. INSTRUCTIONS FOR LUBRICATING

Toshiba motors (284T-N587UZ) are furnished with grease fittings. Before greasing, be sure fittings are clean and free from dirt. Remove grease relief plug or plate and using a low pressure grease gun, pump in the required grease. Do not overgrease. Relubrication intervals are specified in Table 2 above. After relubricating, allow motor to run for 10 minutes before replacing relief hardware.

4. RECOMMENDED GREASES FOR STANDARD APPLICATIONS

Use the following greases listed for the given temperature range, unless otherwise shown by the motors grease nameplate.

OPERATING AMBIENT TEMP. -30*C to 50*C

CHEVRON SRI	CHEVRON
EXXON UNIREX #2	EXXON CORP.
EXXON POLYREX	EXXON CORP.
SHELL DOLIUM R	SHELL OIL CO

5. RECOMMENDED GREASES FOR SPECIAL APPLICATIONS

The following greases are recommended for special applications only and should be used only for motors specifically built for such conditions.

MIN. AMBIENT TEMP. –60°C
BEACON 325 EXXON CORP.

MAX. AMBIENT TEMP. 90°C
DOW CORNING 44
DOW CORNING CORP.
EXXON LINIREX S2
EXXON CORP.

WARNING: In general it is not recommended to mix greases of different brands. The mixing of different types of thickeners may destroy the composition and physical properties of the grease. In the event that a different grease is required by the end user, the following steps can be taken. Using the instructions for lubrication, open grease outlet and purge the system as much as possible of the old or unwanted grease. Repeat this same operation after 1 week of service. Consult TOSHIBA/HOUSTON Engineering for further recommendations on grease compatibility.

WARRANTY

Generally, TOSHIBA will correct at it's option, by repair or replacement (f.o.b. a TOSHIBA-AUTHORIZED SERVICE SHOP), any defect in material and workmanship when properly used for a period of one year after installation or 18 months after shipment, whichever comes first. TOSHIBA is not responsible for apparatus returned without proper authorization and identification, improper handling or storage, misapplication of the motor or the driven equipment, defects in the driven equipment or device, or improper circuit protection. The amount of liability shall not exceed the purchase price of the product. In no event shall TOSHIBA have any liability for commercial loss, claims for labor, removal and installation charges or consequential damages of any type. It is expressly agreed that Buyer's remedies expressed in this paragraph are Buyer's exclusive remedies.

RENEWAL PARTS

1. Use only genuine TOSHIBA renewal parts.
2. When ordering, specify complete information (at least Model Number and Serial Number) of the motor. Specify quantity and describe part.
3. For information and service refer to the nearest TOSHIBA INTERNATIONAL CORPORATION office.

WARNING

EXPLOSION-PROOF MOTORS are constructed to comply with the UL Label Service Procedure Manual. Repairs of EXPLOSION PROOF MOTORS must be made by the manufacturer or U L listed service center to maintain the U L Listing.

FOR FURTHER INFORMATION CONTACT TOSHIBA INTERNATIONAL CORPORATION
Industrial Equipment Division 13131 W. LITTLE YORK RD., P.O. BOX 40906, HOUSTON, TEXAS 77041

TOSHIBA INTERNATIONAL CORPORATION
Industrial Division / Houston Motor Plant

Motor Operation Procedure

INDEX	MDS-O-0001
SHEET NO.	1 of 3
ISSUED	01/24/96
SUPERSEDES	NEW
REVISION	0
WRITTEN BY	I. MARQUEZ
APPROVED BY	J. Bugbee

REFERENCE USE ONLY WHEN ISSUED BY MOTOR MKTG.

Motor Lubrication

Dist: Mktg.
QC

1. SCOPE

To give recommended guidelines for electric motor relubrication.

2. START UP

Toshiba motors are properly greased at the time of manufacture. It is recommended that if a motor has been stored for a period of six months or more, it should be lubricated prior to starting (See Fig. 1) using a standard hand held grease gun.

Fig. 1

FRAME SIZE	QUANTITY of PUMPS
143 ~ 256	2 to 3 strokes
284 ~ 405	4 to 5 strokes
444 and Larger	6 to 10 strokes

It should be noted that grease leakage around the shaft hole could indicated over-packing. Excess grease should be purged out by operating the motor temporarily with the relief open.

Lubrication of electric motors should be done as a part of a planned maintenance program.

Before greasing, be sure fittings are clean and free from dirt. Always relubricate using grease that is fresh and free from contamination.

Toshiba motors may be equipped with an automatic grease relief fitting, grease plug or grease cover plate for the outlet.

It should be noted that it may be necessary to remove an automatic type fitting due to hardening of grease. Motors utilizing a grease plate may require the scraping out of old grease a minimum of once every two years.

3. STANDARD SERVICE

1. Select the proper service condition from Fig. 2.
2. Select the frequency and volume from Fig. 3.
3. Before greasing be sure fittings are clean and free from dirt.

3. STANDARD SERVICE (*-cont.)*

5. Remove relief plug or plate and using a low pressure hand held grease gun, pump the required amount of grease.

6. For Frames 143T to 365T allow motor to run for 20 to 30 minutes and for Frames 405T and larger allow motor to run for 30 to 60 minutes before replacing hardware.

7. Grease may not relieve from drain. Use volumes recommended to avoid overgreasing.

Fig. 2

SERVICE CONDITIONS	
Standard Duty	Eight hours per day; Light to normal loading; Clean condition, free from dust.
Severe Duty	24 hours per day; Light to normal shock loading, vibration; Exposure to dirt or dusty conditions.
Very Severe Duty	24 hours per day; High ambient; Normal to high shock loading, vibration; Dusty conditions; Confined mounting conditions

4. RECOMMENDED GREASES:

Confirm if the motor nameplate has specified the grease used.

Standard, Severe Duty and 841 motors greased at the factory will use:

Grease Name:	Chevron SRI
Manufactured By:	Chevron U.S.A., Inc.
Operating Ambient Temp.:	-30°C to 50°C

5. RECOMMENDED GREASES for STANDARD APPLICATIONS

Use the following greases listed for the given temperature range, unless otherwise shown by the motors grease nameplate:

Operating Ambient Temp. -30°C to 50°C	
Chevron SRI	Chevron U.S.A., Inc.
Exxon Unirex #2	Exxon Corp.
Exxon Polyrex	Exxon Corp.
Shell Dolium R	Shell Oil Co.
Polystar RB 2	Texaco

Fig. 3

SYNC. RPM RANGE	FRAME SIZE	TYPE OF SERVICE: STANDARD DUTY	SEVERE DUTY	VERY SEVERE DUTY
3600	143T-256T	8 Mos.	4 Mos.	1 Mo.
1800 ~ 900	143T-256T	30 Mos.	12 Mos.	4 Mos.
Bearing Size		Periodic Grease Amount		
6205/6206		3 Grams		
6207/6208/6305		5 Grams TAILPULLY		
6306		10 Grams		
6308/6309		20 Grams ROTOR		
3600	284T-365T	8 Mos.	4 Mos.	1 Mo.
1800 ~ 900	284T-365T	24 Mos.	12 Mos.	4 Mos.
Bearing Size		Periodic Grease Amount		
6211		10 Grams		
6309		20 Grams		
6310/6312		30 Grams		
6314		50 Grams		
3600	404T-447T	8 Mos.	4 Mos.	1 Mo.
1800 ~ 900	404T-447T	18 Mos.	8 Mos.	3 Mos.
Bearing Size		Periodic Grease Amount		
6216		20 Grams		
6313/NU317		30 Grams		
NU318/NU320		50 Grams		
6317/6318		80 Grams		
6320/6322/6324		80 Grams		
NU322/NU324		80 Grams		
NU328/NU2228		100 Grams		

NOTES:

1. When relubricating roller bearings divide the monthly service time by two.
2. See Fig. 2 for definitions of Service Conditions.
3. Gram quantity when using a typical low pressure hand grease gun equals (4 pumps = 5 grams)

6. RECOMMENDED GREASES FOR SPECIAL APPLICATIONS

The following greases are recommended for special applicaitons only and should be used only for motors specifically built for such conditions.

Minimum Ambient Temp. -60°C	
Beacon 325	Exxon Corp.
Maximum Ambient Temp. 90°C	
DOW Corning 44	DOW Corning Corp.
Exxon Unirex S2	Exxon Corp.

WARNING: In general it is not recommend to mix greases of different brands. The mixing of different types of thickeners may destroy the composition and physical properties of the grease. In the event that a different grease is required by the end user, the following steps can be taken. Using the instructions for lubrication, open grease outlet and purge the system as much as possible of the old or unwanted grease. Repeat this same operation after 1 week of service. Consult TOSHIBA/HOUSTON Engineering for further recommendations on grease compatibility.

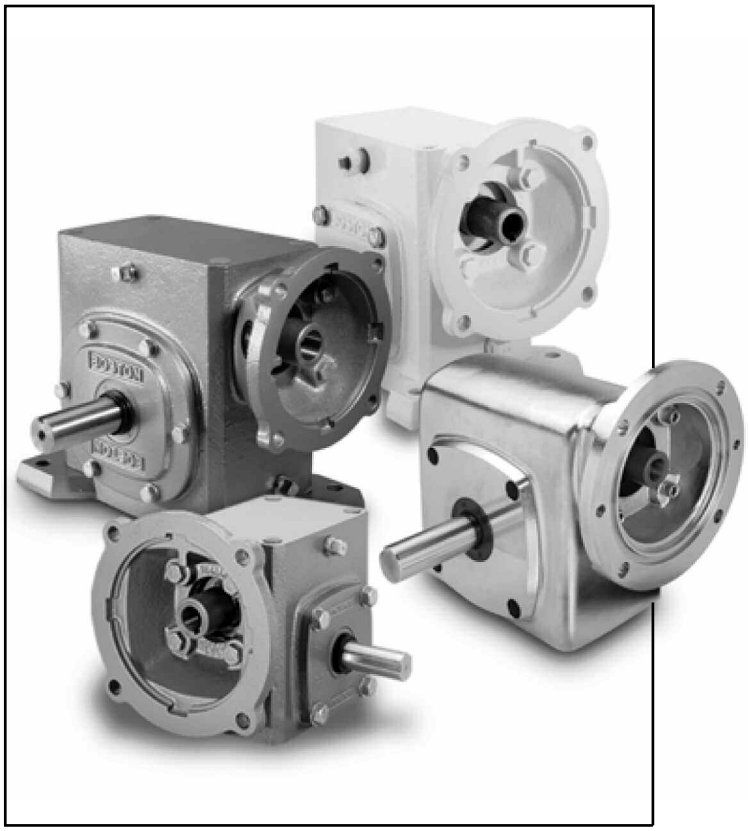
Boston Gear®

Worm Gear Speed Reducers

P-3009-BG *Installation and Operation*

Doc. No. 57746

700 Series
Single and Double
Reductions



Boston Gear

An Altra Industrial Motion Company

Inadequate lubrication is by far the largest contributor to premature failures of worm gear drives, applied within proper selection practice.

While lubricant selection is important to all gear reducers, it is critical for the worm gear type. Sliding action at the tooth mesh dictates use of a relatively high viscosity oil with special characteristics. A recent survey indicated improper lubricants were used in two-thirds of the applications. Although lightly loaded drives may survive, optimum performance is not obtained.

Boston Gear now offers Klubersynth UH1 6-460 Synthetic Lubricating Oil as a premium lubricant with many outstanding benefits for worm gear applications.

- Reduction in maintenance costs due to extended time between oil changes.
- Increased ratings providing for smaller drive selection or longer gear life.
- Lower energy consumption from improved efficiency.
- Broad ambient temperature range due to high viscosity temperature.
- Longer seal life, based on lower operating temperature.
- Multi-purpose application, including most other types of gear drives.

Lubrication Instructions

⚠WARNING Boston Gear speed reducers are normally shipped without lubricant. They must be filled to the proper level with the recommended lubricant for your application before operation.

The recommended lubricant table indicates the type and viscosity of lubricant suitable for reducers operating at various temperatures.

Lubrication and maintenance instructions are provided with each speed reducer. These instructions should be followed for best results. It is important that the proper type of oil be used since many oils are not suitable for the lubrication of gears. Various types of gearing require different types of lubricants.

The lubricant must remain free from oxidation and contamination by water or debris, since only a very thin film of oil stands between efficient operation and failure. To assure long service life, the reducer should be periodically drained (preferably while warm) and refilled to the proper level with a recommended gear oil. Under normal environmental conditions oil changes are suggested after the initial 250 hours or every 6 months.

Synthetic lubricants will allow extended lubrication intervals due to its increased resistance to thermal and oxidation degradation. It is suggested that the initial oil change be made at 1500 hours and, thereafter, at 5000 hour intervals.

During the initial period of operation, higher than normal operating temperatures may be seen. This is due to the initial break-in of the worm gear set. The temperature of Double Reduction Worm Gear Reducers may reach 160°F and Single Reduction Worm Gear Reducers approximately 225°F.

These instructions must be read thoroughly before installing or operating speed reducers. File instructions for future reference and for ordering of replacement parts.

General Instructions

1. Align all shafts accurately. Improper alignment can result in failure. Use of flexible couplings is recommended to compensate for slight misalignment.

2. When mounting, use maximum possible bolt size and secure reducer to a rigid foundation. Periodic inspection of all bolts is recommended.

3. Auxiliary drive components (such as sprockets, gears and pulleys) should be mounted on the shafts as close as possible to the housing to minimize effects of overhung loads. Avoid force fits that might damage bearings or gears.

4. For hollow-shaft speed reducers, place speed reducer as close as possible to supporting bearing on drive shaft. Spot-drill driven shaft for setscrews in severe applications. See kit instructions for reaction rod assembly.

5. Check and record gear backlash at installation and again at regular intervals. This should be done by measuring the rotary movement of the output shaft (rotating alternately clockwise and counterclockwise) at a suitable radius while holding the input shaft stationary. Gears should be replaced when the backlash exceeds four times the measurement taken at installation.

6. Gear drives are rated for 1750 input RPM and Class I Service (Service Factor 1.0), using Klubersynth UH1 6-460 synthetic lubricant. For lower input speeds or for different service classes or lubricants, see catalog selection pages for rating information.

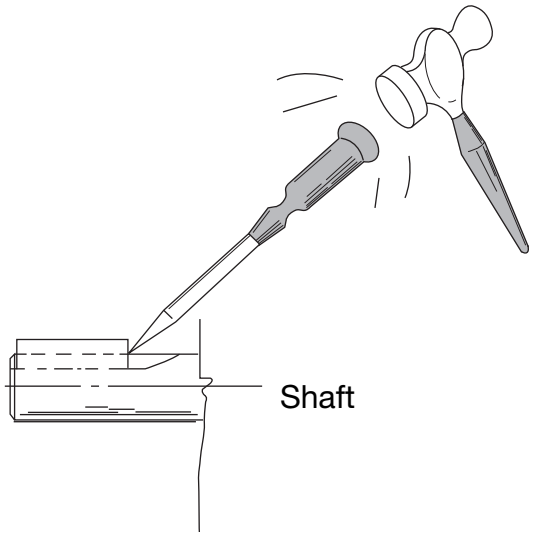
7. Initial operating temperatures may be higher than normal during the break-in period of the gear set. FOR MAXIMUM LIFE, DO NOT ALLOW THE SPEED REDUCER TO OPERATE CONTINUOUSLY ABOVE 225°F AT THE GEAR CASE. In the event of overheating, check for overloads or high ambient temperatures. Keep shafts and vent plugs clean to prevent foreign particles from entering seals or gear housing.

8. All reducers should be checked to see if they have been lubricated. Prelubed 700 Series reducers will have a solid plug in the vent hole which must be replaced by the vent plug at time of installation.

⚠CAUTION If the motor does not readily seat itself, check to determine if key has moved axially along motor shaft, causing interference. Staking of the keyway adjacent to the motor key will facilitate this procedure.

Key Staking Instructions

Lightly tap area of keyway adjacent to key. This will upset material and not allow key to move axially when assembling to speed reducer.



⚠CAUTION

- **For safe operation of any gear drive, all rotating shafts and auxiliary components must be shielded to conform with applicable safety standards. You must consider overall operational system safety at all times.**

- **When using a speed reducer to raise or lower a load, such as in hoisting applications, provision must be made for external braking. Under no conditions should a speed reducer be considered self-locking.**

- **Mounting of speed reducers in overhead positions may be hazardous. Use of external guides or supports is strongly recommended for overhead mounting.**

Instructions for Flanged Models

F700 (Quill Type Input)

1. Assemble the key to the motor shaft and coat the shaft with anti-seize compound. Insert the motor shaft into the reducer input shaft.

2. Rotate the motor to proper position and firmly secure to flange with four hex-head cap screws.

RF700 (Coupling Input – 3-Jaw Type)

1. Coat reducer input and motor shaft with anti-seize compound.
2. Position coupling half on input shaft with shaft flush to end of coupling bore.
3. Locate remaining half on motor shaft, with 1/32" clearance between jaw surfaces.
4. Tighten setscrews securely. For reversing applications, a thread-locking compound is recommended.
5. Install coupling insert and position motor. Rotate motor to proper position and firmly secure to flange.

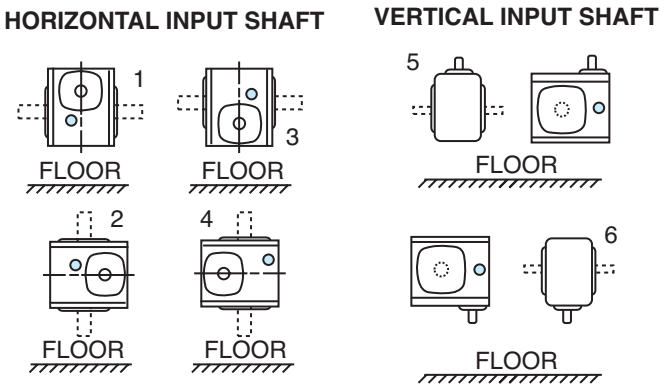
QC700 (Coupling Input-3-Jaw Quick Connect Type)

1. Coat motor shaft with anti-seize compound.
2. Install motor coupling half onto motor shaft. Use a straight edge to align coupling jaw top end flush with motor shaft except 738-B9 which will be flush with bottom of jaw. Secure with set screw.
3. Install urethane spider insert on motor coupling half.
4. Insert D-Bore coupling half into urethane spider element.
5. Rotate reducer input shaft so “milled flats” are either vertical or parallel. Rotate motor coupling D-Bore to match the reducer milled flats. Coat “D” flats with anti-seize compound furnished with speed reducer.
6. Insert motor assembly into reducer flange assembly. Minor rotating of the motor may be necessary to facilitate D-Bore alignment.
7. Once aligned, push motor towards reducer until properly seated against the face of the reducer flange.
8. Insert (4) hex head cap screws into the designated locations and securely tightened.

Oil Capacities

Single Reduction Models Only

Oil Levels for typical mounting positions



⚠CAUTION Avoiding those positions where the high speed oil seal is immersed in oil will provide greater security against high speed input seal wear.

Oil Capacity in Fluid Ounces

Unit Size	Positions				
	1	2	3	4	5 & 6
710	2.2	3.3	3.3	3.3	3.3
713	5.5	7.0	7.0	7.0	5.5
715	10.0	15.0	15.0	13.5	13.5
718	12.0	16.0	18.5	16.0	16.0
721	15.0	20.5	20.5	19.0	19.0
724	18.0	24.5	28.5	24.5	24.5
726	28.0	36.0	43.0	36.0	36.0
730	44.0	60.0	67.0	60.0	60.0
732	58.0	84.0	90.0	80.0	80.0
738	85.0	120.0	130.0	120.0	107.0
752	204.0	240.0	245.0	240.0	215.0
760	330.0	400.0	415.0	400.0	370.0

Note: SS718, SS721, SS726, SS732 models are filled to position one (1) only and are listed on Page 6.

Double Reduction Models

The variety of mounting possibilities for double reduction drives makes it impractical to illustrate positions for these models. In general, the vent filler is at the uppermost plug position, and the drain plug at the lowest possible position. The oil level must be at the approximate centerline of the uppermost gear.

Recommended Lubricants

Enclosed Worm Gear Reducers

Ambient (Room) Temperature 1.00 SF	Recommended Oil (or equivalent)	Viscosity Range SUS @ 100°F	Lubricant AGMA No.	ISO Viscosity Grade No. +
-30° to 225°F** (-34° to 107°C)	Klubersynth* UH1 6-460 Synthetic	1950/2500	-----	460
30° to 225°F (-34° to 107°C)	Mobil SHC634 Synthetic	1950/2500	-----	320/460

Worm Gear Lubricants Available from Boston Gear

Order By Item Code

Type	Klubersynth	Mobil SHC634
Size	QT.	QT.
Item Code	65159	51493

⚠CAUTION Relubricate more frequently if drive operated in high ambient temperatures or unusually contaminated atmosphere. High loads and operating temperatures will also require more frequent lubrication.

***Food Grade Synthetic recommendation is exclusively for Klubersynth UH1 6-460.**

+Other lubricants corresponding to AGMA/ISO numbers are available from all major oil companies.

****The synthetic lubricant will perform at temperatures considerably higher than 225°F. However, the factory should always be consulted prior to operating at higher temperatures as damage may occur to oil seals and other components.**

Lubricant Interchange

Lubricants are compounded for use in worm gears. Some contain non-corrosive, extreme pressure additives. DO NOT USE lubes that contain sulphur and/or chlorine which are corrosive to bronze gears. Extreme pressure lubes, in some cases contain materials that are toxic. Avoid use of these lubes where they can result in harmful effects. If in doubt, consult your lube supplier.

Manufacturer	Lubricant Name	AGMA Rating
Getty Refining Co.	Veedol Asreslube 98	8 EP
Getty Refining Co.	Veedol Asreslube 95	7 EP
Getty Refining Co.	Veedol Asreslube 90	6 EP
Lubrication Engr. Inc.	Almasol 609	8
Lubrication Engr. Inc.	Almasol 608	7
Mobil Oil Corp.	Mobilgear 634	8 EP
Mobil Oil Corp.	Mobil Extra Hecla Super	8
Mobil Oil Corp.	Mobil Cylinder 600W	7
Shell Oil Co.	Omala 460	7 EP
Shell Oil Co.	Valvala J460	7
Shell Oil Co.	Omala 680	8 EP
Shell Oil Co.	Valvala J680	8
Texaco Inc.	Meropa 680	8 EP
Texaco Inc.	Meropa 460	7 EP

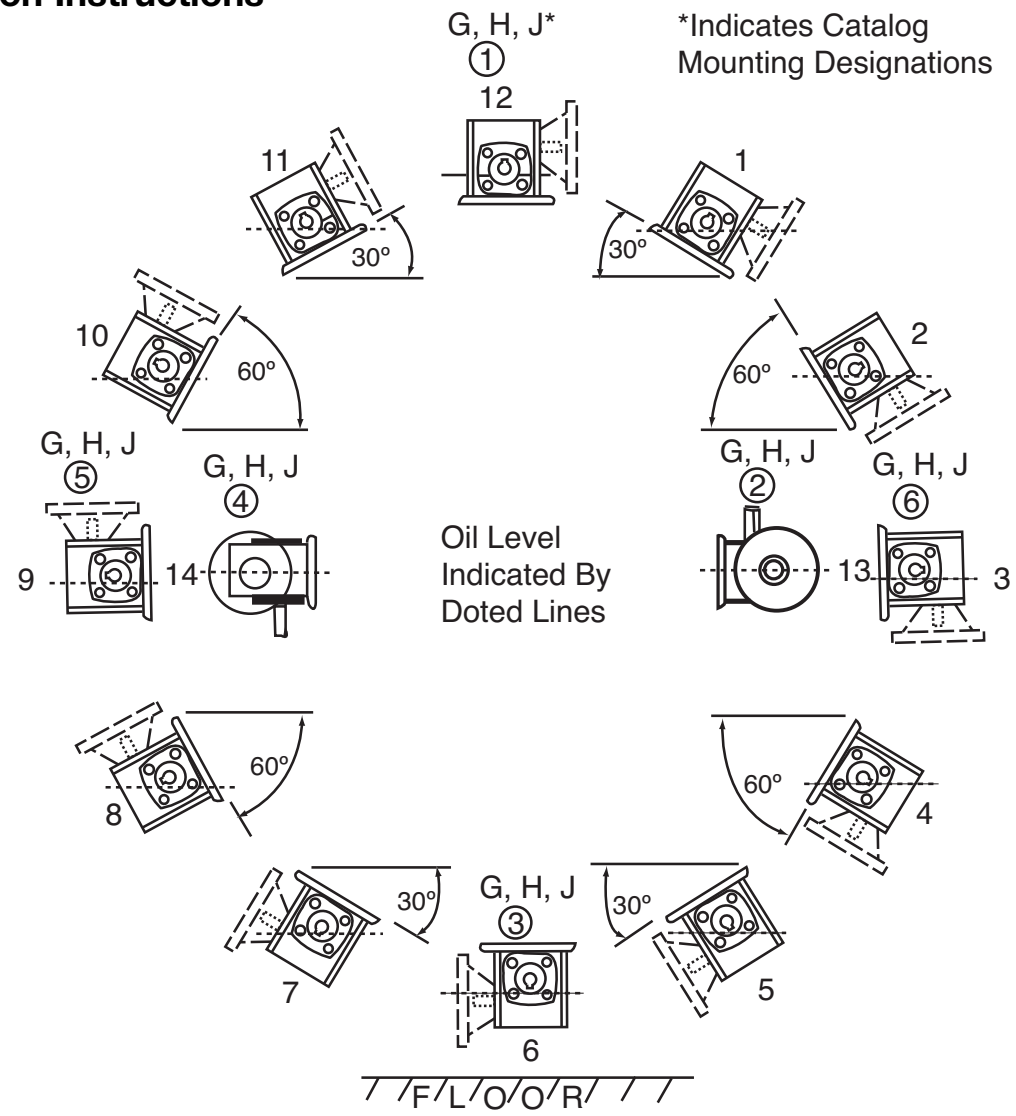
PosiVent® Option

Units supplied with this option are Lubed-for-Life and do not require oil change.

These units are factory filled with Klubersynth UH1 6-460 for universal mounting. To ensure that the system operates properly, DO NOT REMOVE THE VENT PLUG.

SS718-SS732 models are factory-filled with Klubersynth UH1 6-460 for universal mounting and are non-vented and sealed for life.

Lubrication Instructions

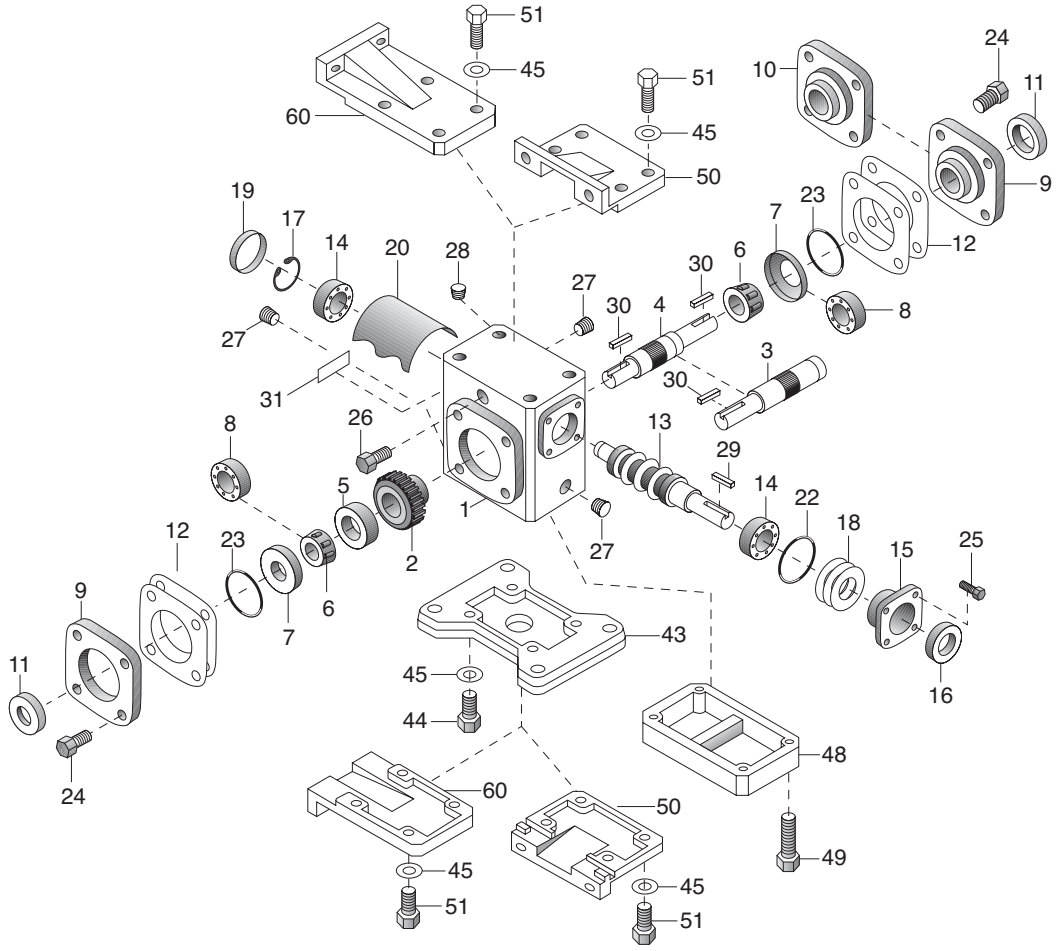


For Single Reduction Only: Refer To Lubrication & Installation Instructions

Oil Capacity In Ounces	Unit Size											
Position	710	713	715	718	721	724	726	730	732	738	752	760
1	3.00	6.37	9.30	12.85	14.04	16.97	28.50	42.60	56.80	71.60	162.0	255.7
2	3.30	7.16	9.25	15.04	16.81	19.93	32.00	50.00	67.30	79.70	195.2	265.9
3	3.30	5.50	13.50	16.00	19.00	24.50	36.00	60.00	80.00	107.0	215.0	370.0
4	3.55	7.98	12.06	18.00	20.28	24.95	37.70	57.00	77.10	102.0	209.5	321.7
5	3.98	8.18	12.30	18.69	21.45	26.95	40.00	60.40	80.90	106.7	192.0	357.0
6	3.30	7.00	15.00	18.50	20.50	28.50	43.00	67.00	90.00	130.0	245.0	415.0
7	3.98	8.18	12.30	18.69	21.45	26.95	40.00	60.40	80.90	106.7	192.0	357.0
8	3.55	7.96	12.06	18.00	20.28	24.95	37.70	57.00	77.10	102.0	209.5	321.7
9	3.30	5.50	13.50	16.00	19.00	24.50	36.00	60.00	80.00	107.0	215.0	370.0
10	3.31	7.16	9.25	15.04	16.81	19.93	32.00	50.00	67.30	79.70	195.2	265.9
11	3.00	6.37	9.30	12.85	14.04	16.97	28.50	42.60	56.80	71.60	162.0	255.7
12	2.20	5.50	10.00	12.00	15.00	18.00	28.00	44.00	58.00	85.00	204.0	330.0
13	3.30	7.00	15.00	16.00	20.00	24.50	36.00	60.00	84.00	120.0	240.0	400.0
14	3.30	7.00	13.50	16.00	19.00	24.50	36.00	60.00	80.00	120.0	240.0	400.0

Notes: PosiVent® Models are factory-filled with Klubersynth UH1 6-460 for multi-positional mounting.
For Models SS718 through SS732, see page 22.

Parts List – Single Reduction Models



Part No.	Description
1	HOUSING
2*	WORM GEAR
3*	SINGLE PROJECTING OUTPUT SHAFT
4*	DOUBLE PROJECTING OUTPUT SHAFT
5*	GEAR SPACER
6*	OUTPUT BEARING (CONE) – MODELS 713-760
7	OUTPUT BEARING (CUP) – MODELS 713-760
8	OUTPUT BEARING – MODEL 710 ONLY
9	BEARING CARRIER (OPEN)
10	BEARING CARRIER (CLOSED)
11*	OUTPUT OIL SEAL
12*	ADJUSTMENT SHIMS
13	INPUT WORM SHAFT
14	INPUT BEARING – MODELS 710-730
15	INPUT BEARING RETAINER
16	INPUT OIL SEAL – MODELS 710-760
17	RETAINING RING
18	ADJUSTMENT SHIMS
19	BORE PLUG – MODELS 710-730
20	INTERNAL BAFFLE – MODELS 713-732
22	INPUT “O” RING
23*	OUTPUT “O” RING
24	HEX HEAD CAP SCREW
25	HEX HEAD CAP SCREW
26**	VENT PLUG - 2 PIECE

Part No.	Description
27	PIPE PLUG
28	PROTECTIVE CAP PLUG
29	INPUT KEY
30	OUTPUT KEY
31	NAMEPLATE
32	INPUT BEARING (CUP) – MODELS 732-760
33	INPUT BEARING (CONE) – MODELS 732-760
34	GREASE CUPS – MODELS 732-760
35	HEX HEAD CAP SCREW
37	OUTPUT SHAFT KEY – MODELS 730-760
38	RETAINING RING – MODELS 710-738
39	MOTOR SHAFT – MODELS 710-738
40	MOTOR FLANGE – MODELS 710-738
41	OIL SEAL – MODELS 710-738
42	HEX HEAD CAP SCREW
43	HORIZONTAL BASE
44	HEX HEAD CAP SCREW
45	LOCKWASHER
46	2 PIECE FC COUPLING – WITH INSERT
47	RETAINING MOTOR FLANGE
48	RISER BLOCK
49	HEX HEAD CAP SCREW
50	VERTICAL BASE (HIGH OR LOW)
51	HEX HEAD CAP SCREW

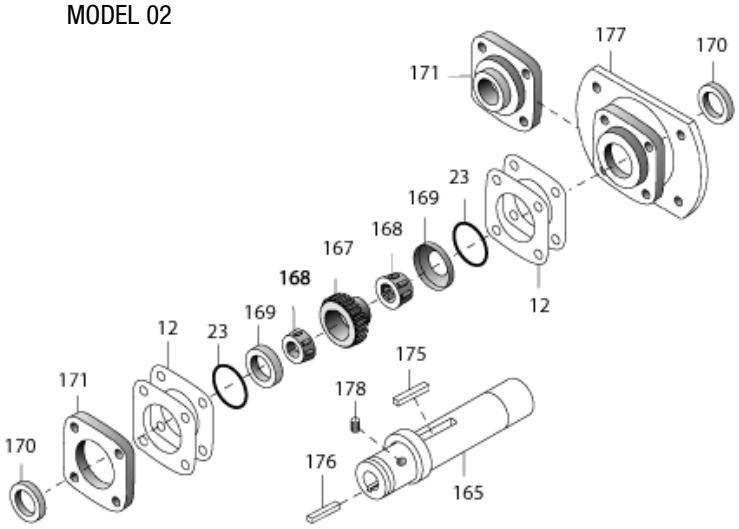
Part No.	Description
60	VERTICAL BASE (X & Y ASSEMBLY)
101	FAN
102	SPACER
103	HEX HEAD CAP SCREW
104	FAN GUARD
105	HEX HEAD CAP SCREW
106	WASHER
165	HOLLOW OUTPUT SHAFT (S VERSION ONLY)
166	HOLLOW OUTPUT SHAFT (H VERSION ONLY)
167	WORM GEAR
168	OUTPUT BEARING (CONE)
169	OUTPUT BEARING (CUP)
170	OIL SEAL
171	BEARING CARRIER
172	HOLLOW SHAFT MTG. BRACKET
173	HEX HEAD CAP SCREW
174	LOCKWASHER
175	KEY (INTERNAL)
176	KEY (EXTERNAL)
177	“V” TYPE BASE-MODEL 718, 721, 726, 732)
178	SOCKET SETSCREW

*For Models 710 to 726, these parts are available as complete assemblies. See Part Ordering Information, page 8.
**Extension not required on single reduction Models 713 through 732.

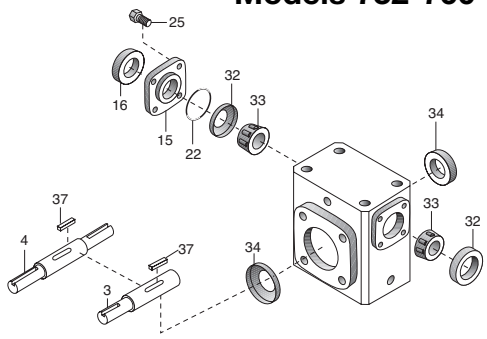
Options & Accessories – Single Reduction Models

Hollow Output Shaft Models S and SF718-732*

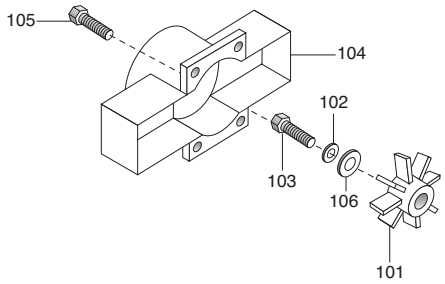
MODEL 02



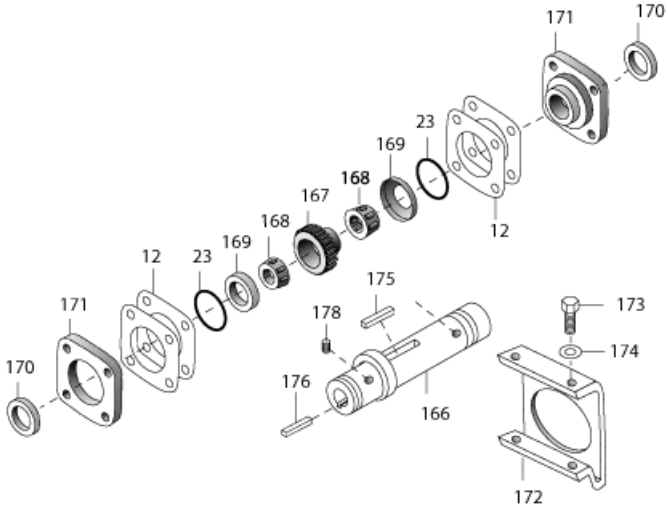
Models 732-760



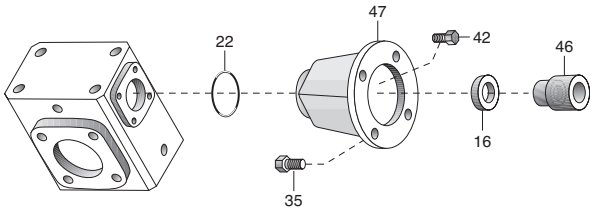
Fan kit for models 732-760



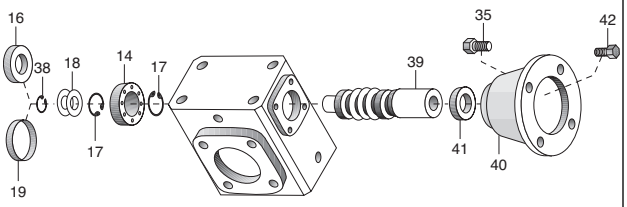
HOLLOW OUTPUT Shaft Models H, HF, and HQC713-738



Models QC710-QC738, RF752-RF760



Models F710-F738

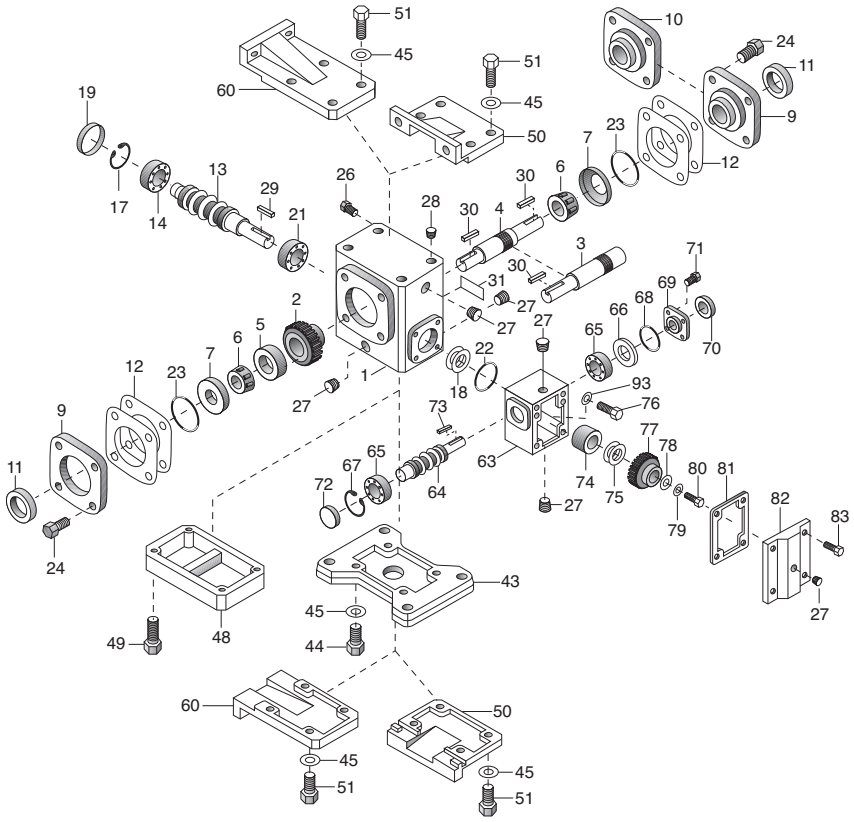


Part ordering information

1. Be sure to provide complete Boston Gear catalog number from speed reducer nameplate, along with part description and number. For example, “One output oil seal, Part No. 11, for RF718-30-B5-G”.
2. Output shaft components for Boston Gear models 710 through 726 are available only as complete assemblies that include Parts 2, 3, 5, 6, 11, 12 and 23 for single projecting shafts; and Parts 2, 4, 5, 6, 11, 12 and 23 for double projecting shafts. When ordering, specify “output shaft assembly” and full Boston Gear catalog number from nameplate.

* Not available in the 730 center distance, see H series.

Parts List – Double Reduction Models



Part No.	Description
1	HOUSING
2*	WORM GEAR
3*	SINGLE PROJECTING OUTPUT SHAFT
4*	DOUBLE PROJECTING OUTPUT SHAFT
5*	GEAR SPACER
6*	OUTPUT BEARING (CONE)
7	OUTPUT BEARING (CUP)
9	BEARING CARRIER (OPEN)
10	BEARING CARRIER (CLOSED)
11*	OUTPUT OIL SEAL
12*	ADJUSTMENT SHIMS
13	INTERMEDIATE WORM SHAFT
14	INTERMEDIATE BEARING–MODELS W713-W730
15	INTER. BEARING RETAINER–MODELS W732-W760
16	INTER. OIL SEAL – MODELS W732-W760
17	RETAINING RING – MODELS W713-W730
18	ADJUSTMENT SHIMS
19	BORE PLUG – MODELS W713-W730
21	INTERMEDIATE BEARING
22	INTERMEDIATE "O" RING
23*	OUTPUT "O" RING
24	HEX HEAD CAP SCREW
25	HEX HEAD CAP SCREW
26	VENT PLUG – 2 PIECE
27	PIPE PLUG
28	PROTECTIVE CAP PLUG
29	INTERMEDIATE KEY
30	OUTPUT KEY

Part No.	Description
31	NAMEPLATE
32	INTER. BEARING (CUP) – MODELS W732-W760
33	INTER. BEARING (CONE) – MODELS W732-W760
34	GREASE CUPS – MODELS W732-W760
35	HEX HEAD CAP SCREW
37	OUTPUT SHAFT KEY – MODELS W730-W760
43	HORIZONTAL BASE
44	HEX HEAD CAP SCREW
45	LOCKWASHER
48	RISER BLOCK
49	HEX HEAD CAP SCREW
50	VERTICAL BASE (HIGH OR LOW)
51	HEX HEAD CAP SCREW
60	VERTICAL BASE (ASSEMBLY X & Y)
63	ATTACHMENT HOUSING
64	INPUT WORM SHAFT
65	INPUT BEARING
66	ADJUSTMENT SHIMS
67	RETAINING RING
68	"O" RING
69	BEARING RETAINER
70	OIL SEAL
71	HEX HEAD CAP SCREW
72	BORE PLUG – MODELS W713-W738
73	INPUT WORM SHAFT KEY
74	GEAR SPACER
75	ADJUSTMENT SHIMS
76	HEX HEAD CAP SCREW
77	INTERMEDIATE WORM GEAR

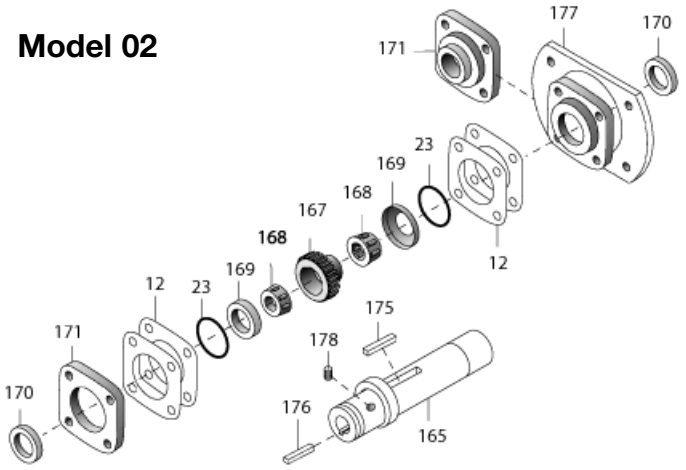
Part No.	Description
78	WASHER
79	LOCKWASHER
80	HEX HEAD CAP SCREW
81	ATTACHMENT COVER GASKET
82	ATTACHMENT COVER
83	HEX HEAD CAP SCREW
84	INPUT BEARING (CONE) – MODEL W760 ONLY
85	INPUT BEARING (CUP) – MODEL W760 ONLY
86	TWO PIECE FC COUPLING WITH INSERT
87	MOTOR FLANGE
88	HEX HEAD CAP SCREW
89	MOTOR FLANGE
90	INPUT WORM SHAFT
91	EXTERNAL RETAINING RING
92	OIL SEAL – MODELS FW713-FW738
93	WASHER
165	HOLLOW OUTPUT SHAFT (S VERSION ONLY)
166	HOLLOW OUTPUT SHAFT (H VERSION ONLY)
167	WORM GEAR
168	OUTPUT BEARING (CONE)
169	OUTPUT BEARING (CUP)
170	OIL SEAL
171	BEARING CARRIER
172	HOLLOW SHAFT MTG. BRACKET
173	HEX HEAD CAP SCREW
174	LOCKWASHER
175	KEY (INTERNAL)
176	KEY (EXTERNAL)
177	"V" TYPE BASE MODEL (718, 721, 726, 732)
178	SOCKET SETSCREWS

*For Models 710 to 730, these parts are available as complete assemblies. See Part Ordering Information, Page 10.

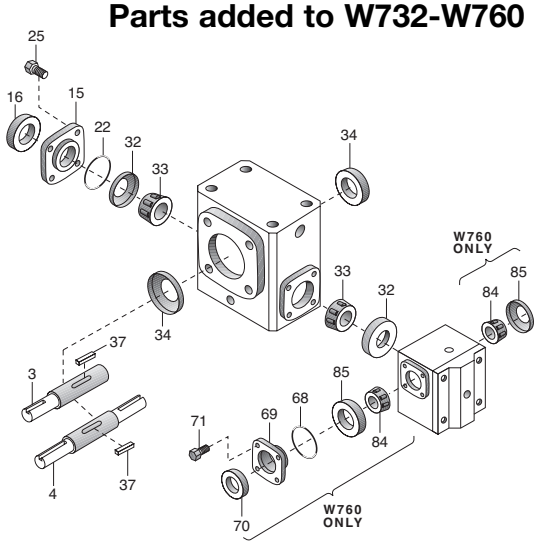
Options & Accessories – Double Reduction Models

Hollow Output Shaft Models SW, SFW, and SRFW718-732*

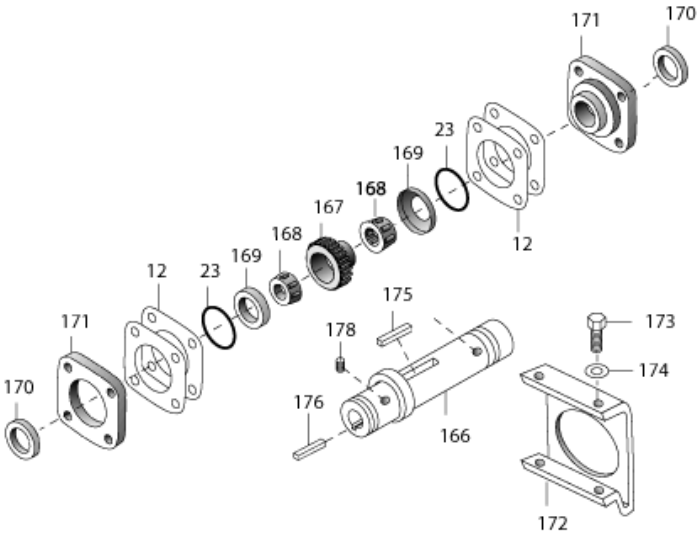
Model 02



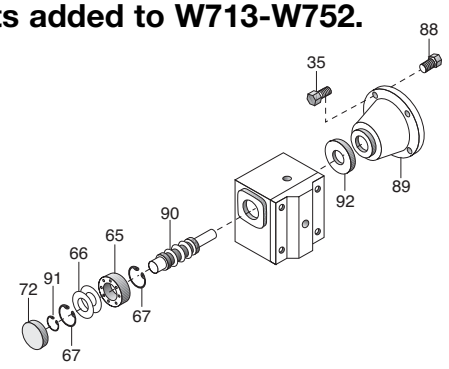
Models W732-W760 Parts added to W732-W760



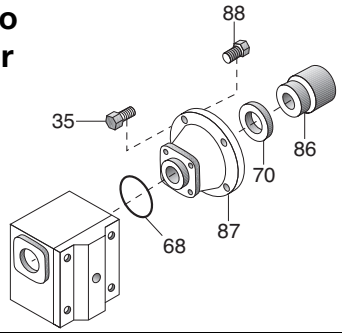
Hollow Output Shaft Models HW, HFW, and HQCW713-738



Models FW713-FW752 Parts added to W713-W752.



Models QCW713-QCW760 Parts added to W713-W726 or W732-W760. These parts available in kit form.



Part ordering information

1. Be sure to provide complete Boston Gear catalog number from speed reducer nameplate, along with part description and number. For example, “One output oil seal, Part No. 11, for W713-150-G”.
2. Output shaft components for Boston Gear models 710 through 726 are available only as complete assemblies that include Parts 2, 3, 5, 6, 11, 12 and 23 for single projecting shafts; and Parts 2, 4, 5, 6, 11, 12 and 23 for double projecting shafts. When ordering, specify “output shaft assembly” and full Boston Gear catalog number from nameplate.

* Not available in 730 center distance, see H series.

F700 Series

Disassembly and Reassembly Procedures

(For Item Identification, Refer To Exploded View)

Output Shaft Disassembly

1. Remove vented filler (Item 26), and the most convenient pipe plug (Item 27) and completely drain oil.

2. Remove bearing carrier screws (Item 24) from projecting shaft bearing carrier (Item 9). Remove carrier by CAREFULLY sliding it over the projecting shaft diameter.

3. Output shaft assembly (Items 2, 3, 5 & 6) can now be removed from the unit. Exercise care not to nick or scratch worm gear or shaft diameters.

4. Visually examine the output shaft assembly. Check tapered roller bearings (Item 6) for signs of metallic contamination or discoloration. Rollers should have continuously smooth action and should not bind or exhibit “flat-spots”.

5. Note that replacement parts for output gear (Item 2) will include an output shaft assembly (Items 3 OR 4) for sizes F710 through F726. Also included are items 5, 6, 11, 12 and 23.

Input Shaft Disassembly

Models F710 through F730

1. With a screwdriver or suitable tool, pierce the bore plug (Item 19) and remove from the housing bore.

Models F732 and F738 only

2. Remove fan guard (Item 104). Remove fan retaining screw (Item 103), fan (Item 101) and spacer. With a screw-driver or suitable tool, pierce and fan end oil seal (Item 16) and remove from the housing bore.

3. Remove the outboard retaining ring (Item 17) from the housing bore. Remove the metal shims (Item 18), located between the retaining ring and the ball bearing (Item 14).

4. Remove four (4) screws (Item 42) from the motor flange (Item 40) and remove the flange from the housing.

5. Remove the input worm assembly (Items 14, 38 and 39) through the bore opposite the flange side. Remove the oil seal (Item 41) from the housing.

6. Check the condition of the ball bearing (Item 14). The bearing should roll smoothly and not bind. If the bearing needs replacement, remove the snap ring (Item 38) and press the shaft through the bearing. Install new bearing onto the shaft and re-assemble the snap ring. If the bearing is not pre-packed with grease, pack at least 50% full with Mobilux EP #2 All Purpose Grease or equivalent.

Input Shaft Reassembly

Models F710 through F738

1. Insert input worm assembly in the housing. Seat the ball bearing against the inner retaining ring (Item 17).

2. Install the metal shims (Item 18) and assemble outboard snap ring (Item 17).

3. Clean the housing bore(s) in the area where oil seals will be installed.

4. Coat the oil seals as follows:

   A. Rubber Clad Oil Seals - Apply ALL-PURPOSE grease (NLGI #2 consistency) to the I.D.

   B. Steel Clad Oil Seals - Apply ALL-PURPOSE grease to the ID and coat the bore evenly with Permatex Form-A-Gasket #3 sealant or equivalent.

5. Insert the new oil seal (Item 41) over the shaft until it contacts the housing. CARE MUST BE TAKEN NOT TO DAMAGE THE OIL SEAL LIP.

6. With a small hammer, tap around the face of the oil seal casing - near the outside diameter. Locate the seal as shown in Figure 2 Page 19. Use a suitable driving tool.

Model F710 through F730

7. Install a new bore plug (Item 19). Coat the bore with PERMATEX FORM-A-GASKET #3 OR EQUIVALENT SEALANT. Using a small hammer, lightly tap around the plug face near the outside diameter. CAUTION should be exercised not to distort or cock the bore plug.

Model F732 and F738

8. Install new oil seal on the fan end (Item 16). With a small hammer, tap around the face of the oil seal casing - near the outside diameter. Use a suitable tool to assure squareness of the seal to the bore. Drive the seal flush to 1/16th inch projection. Reinstall fan spacer, fan, washer, lockwasher, and bolt. Tighten the bolt per the chart in Figure 5, Page 20. Reinstall the fan guard and tighten the screws per chart in Figure 5.

Worm Gear Replacement

Model F710 through F726

1. Replace the entire output assembly.

Model F730 through F760

2. Place the output gear assembly into a pressing fixture and remove the worm gear from the shaft.

3. With the gear key assembled in the shaft key seal, press the new gear onto the shaft to the dimension shown in Figure 1, Page 19.

4. Install the shaft spacer (Item 5) and grease cups (Item 34).

5. Press the bearing cones (Item 6) onto the shaft making sure that the assembly is tight (no space between items).

6. Remeasure from the end of the shaft to the gear face as shown in Figure 1, Page 19. Readjust, if necessary, by pressing on the bearing cone until desired dimension is achieved.

7. Where grease cups are used, pack with Mobilux EP #2 All Purpose Grease or equivalent.

Output Shaft reassembly into Housing

1. Remove the existing oil seal (Item 11) from the bearing carrier (Item 9).

2. Coat the gear teeth with blue or red Dykme mixture or similar coating and install the output assembly into the housing.

3. Slide the bearing carrier over the projecting shaft and bolt the carrier to the housing, making sure the metal shims (Item 12) are between the carrier and the housing. Rotate the input shaft to properly seat the tapered bearings.

4. Shim adjustment must be made at this time. If the output shaft is excessively loose, measure the endplay of the output shaft and remove shims evenly from BOTH carriers until the endplay is within the limits shown in Figure 3, Page 20.

   If the carrier does NOT meet the housing face, measure the gap and add shims evenly to BOTH carrier locations until the endplay is within the limits specified.

5. ASSEMBLE THE MOTOR TO THE UNIT. Check the worm gear centrality. Apply a slight load on the output shaft then rotate the input shaft for one to two minutes. Remove the bearing carrier and remove the gear shaft assembly. Check the gear teeth for correct bearing pattern as shown in Figure 6, Page 21.

6. If adjustment is required, all adjustments MUST be made to the carrier which is located on the side OPPOSITE the GEAR HUB. All adjustment for centrality must be made from the TOTAL shim pack which has already been determined.

   Example: If a shim is REMOVED from the centralized side, it must be ADDED to the opposite side.

7. When a good bearing pattern has been established, assemble carrier(s) to the unit. Replace all O-rings (Item 23) where required. (Install all shims on the carriers BEFORE installing O-rings.) If replacement O-rings are not available, apply a large bead of Permatex FORM-A-GASKET #3 or equivalent on the pilot diameter and flange.

8. Install a new oil seal (Item 11) into the carrier bore. Use procedures as described above. Press the seal flush to 1/16th inch projecting. Install the carrier over the projecting shaft (recommend placing masking tape over the sharp edges of the shaft keyseat to prevent cutting the oil seal lip).

9. Tighten all screws as shown in Figure 5, Page 20.

10. Fill the unit to the proper oil level with the recommended lubricant.

11. Install the vent plug (Item 26) and the drain pipe plug (Item 27).

700 and RF700 Series Flanged

Disassembly and Reassembly Procedures

(For Item Identification, Refer To Exploded View)

Output Shaft Disassembly

1. Remove vented filler (Item 26) and the most convenient pipe plug (Item 27) and completely drain oil.

2. Remove bearing carrier screws (Item 24) from projecting shaft bearing carrier (Item 9). Remove carrier by CAREFULLY sliding it over the projecting shaft diameter.

3. Output shaft assembly (Items 2, 3, 5 & 6) can now be removed from the unit. Exercise care not to nick or scratch worm gear or shaft diameters.

4. Visually examine the output shaft assembly. Check tapered roller bearings (Item 6) for signs of metallic contamination or discoloration. Rollers should have continuously smooth action and should not bind or exhibit “flat-spots”.

5. Note that replacement parts for output gear (Item 2) will include an output shaft (Items 3 OR 4) for sizes RF/710 through RF/726.

Input Shaft Disassembly

Model RF/710 through RF/730

1. With a screwdriver or suitable tool, pierce the bore plug (Item 19) and remove from the housing.

2. Remove the snap ring (Item 17) from the housing. Remove the retainer at the projecting shaft (Item 15) and the shims (Item 18).

3. With a soft mallet, tap lightly on the projecting shaft, removing the shaft assembly from the bore plug end.

4. Check the condition of the ball bearings (Item 14). The bearing should roll smoothly and not bind. If the bearing needs replacement, press the shaft through the bearing. Install new bearings on the shaft. Install bearings so that the shields face inward. If the bearing is not prepacked with grease, pack at least 50% full with Mobilux EP #2 All Purpose Grease or equivalent.

Model RF/732 through RF/760

5. Remove the fan guard (Item 104). Remove the fan retaining screw (Item 103), fan (Item 101), and spacer. Remove the retainer(s) (Item 15) at both ends, if applicable or remove the motor flange (Item 47) and shims (Item 18) and O-ring (Item 22).

6. With a soft mallet, tap lightly on the projecting shaft, removing the bearing cup and input shaft through the fan end.

7. Remove the bearing cup from the projecting shaft end.

8. Check the conditions of the bearing cones and cups (Items 32 and 33). The rollers should not exhibit pitting. The cage should show no wear or distortion. The bearings, when supported in the cups, should run smoothly with no binding.

9. If the bearings need replacement, press the shaft through the bearing. Hand-pack the new cones with grease and install onto the shafts.

Input Shaft Reassembly

Model RF/710 through RF/730

1. Install the retaining ring (Item 17) in the outboard housing groove. Install the input shaft assembly through the projecting shaft end of the housing. Tap lightly to seat the bearing against the snap ring retainer.

2. Remove the old oil seal (Item 16) from the bearing retainer (Item 15). Using a small hammer, install a new oil seal by tapping around the face of the seal casing - near the outside diameter. The seal should be flush to 1/16th inch projection above the retainer surface.

3. Install the bearing cup (Item 32) and shims (Item 18), the bearing retainer (Item 15) and the O-ring (Item 22). If no replacement O-ring is available, apply a heavy bead of PERMATEX FORM-A-GASKET #3 or equivalent in the housing groove and also form a fillet at the retainer pilot diameter and flange. It is recommended to protect the oil seal lip by using masking tape on the keyseat edges.

Model RF/732 through RF/760

4. Install a new oil seal in the far retainer (Item 16). With a small hammer, tap around the face of the oil seal casing - near the outside diameter. Use a suitable tool to assure squareness of the seal to the bore. Drive the seal flush to 1/16th inch projection.

5. Repack the roller bearings (Items 32 and 33) or replace if required.

6. Reinsert the input shaft assembly, assuring that the far bearing cup (Item 32) is in place. Lightly tap the end of the projecting shaft to seat the bearing.

7. Insert the front bearing cup (Item 32) and the shim pack. Replace the front oil seal in the retainer as per step #4 above.

8. Reinstall the front retainer using the O-ring or Permatex. Tighten all bolts per table Figure 5, Page 20.

9. Rotate the shaft several times to seat the bearings and check for shaft endplay per Figure 4, Page 20. Adjust if required.

10. Replace fan and fan guard. Tighten bolts per Figure 5, Page 20.

Worm Gear Replacement

Model RF/710 through RF/726

1. Replace the entire output assembly.

Model RF/730 through RF/760

2. Place the output gear assembly into a pressing fixture and remove the worm gear from the shaft.

3. With the gear key assembled in the shaft key seat, press the new gear onto the shaft to the dimension shown in Figure 1, Page 19.

4. Install the shaft spacer (Item 5) and grease cups (Item 34).

5. Press the bearing cones (Item 6) onto the shaft making sure that the assembly is tight (no space between items).

6. Remeasure from the end of the shaft to the gear face as shown in Figure 1, Page 19. Readjust, if necessary, by pressing on the bearing cone until desired dimension is achieved.

7. Where grease cups are used, pack with Mobilux EP #2 All Purpose Grease or equivalent.

Output Shaft Reassembly into Housing

1. Remove the existing oil seal (Item 11) from the bearing carrier (Item 9).

2. Coat the gear teeth with blue or red Dykme mixture or similar coating and install the output assembly into the housing.

3. Slide the bearing carrier over the projecting shaft and bolt the carrier to the housing, making sure the metal shims (Item 12) are between the carrier and the housing. Rotate the input shaft to properly seat the tapered bearings.

4. Shim adjustment must be made at this time. If the output shaft is excessively loose, measure the endplay of the output shaft and remove shims evenly from BOTH carriers until the endplay is within the limits shown in Figure 4. If the carrier does NOT meet the housing face, measure the gap and add shims evenly to BOTH carrier locations until the endplay is within the limits specified.

5. Check the worm gear centrality. Apply a slight load on the output shaft and rotate the input shaft for one to two minutes. Remove the bearing carrier and remove the gear shaft assembly. Check the gear teeth for correct bearing pattern as shown in Figure 6, Page 21.

6. If adjustment is required, all adjustments MUST be made to the carrier which is located on the side OPPOSITE the GEAR HUB. All adjustment for centrality must be made from the TOTAL shim pack which has already been determined.

Example: If a shim is REMOVED from the centralized side, it must be ADDED to the opposite side.

7. When a good bearing pattern has been established, assemble carrier(s) to the unit. Replace all O-rings (Item 23) where required. (Install all shims on the carriers BEFORE installing O-rings). If replacement O-rings are not available, apply a large bead of Permatex FORM-A-GASKET #3 or equivalent on the housing face and also form a fillet at the carrier pilot diameter and flange.

8. Install a new oil seal (Item 11) into the carrier bore. Use procedures as described above. Press the seal flush to 1/16th inch projecting. Install the carrier over the projecting shaft (recommend placing masking tape over the sharp edges of the shaft keyseat to prevent cutting the oil seal lip).

9. Tighten all screws as shown in Figure 5, Page 20.

10. Fill the unit to the proper oil level with the recommended lubricant.

11. Install the vent plug (Item 26) and the drain pipe plug (Item 27).

FW713 - FW752 Series

Disassembly and Reassembly Procedures

(For item identification, refer to exploded view)

FW713 - FW752 Series

Output Shaft Disassembly

1. Remove vented filler (Item 26), and the most convenient pipe plug (Item 27) and completely drain oil.

2. Remove bearing carrier screws (Item 24) from both bearing carriers (Items 9 & 10). Remove both carriers.

Note: Carefully slide open carrier (Item 9) over projecting shaft diameter.

3. Output shaft assembly (Items 2, 3, 5 & 6) can now be removed from unit. Exercise care not to nick or scratch worm gear or shaft diameters.

4. Output shaft assembly can now be visually examined. Check tapered roller bearings (Item 6) for signs of any metallic contamination or discoloration. Rollers should have continuously smooth action and should not bind or exhibit “flat-spots”.

Intermediate Worm Shaft Disassembly

Models FW713 - FW730

1. With a screwdriver or other similar tool, pierce input bore plug (Item 19) and remove from housing bore.

Models FW732 - FW752

Remove bearing retainer screws (Item 25) and remove bearing retainer (Item 15).

Models FW713 - FW752

2. Remove outboard retaining ring (Item 17) from housing bore.

Models FW713 - FW738

3. Remove four (4) screws (Item 83) from attachment cover (Item 82) and remove from housing.

4. Remove screw (Item 80), lock washer (Item 79) and washer (Item 78).

5. Remove intermediate worm assembly (Item 13) through bore opposite attachment housing.

Models FW713 - FW730

6. Check condition of ball bearings (Items 14 & 21). Bearings should roll smoothly and not bind. If bearings need replacement, press shaft through bearings. Install new bearings onto shaft. If not already packed with grease, bearings should be packed at least 50% full with Mobilux EP #2 All Purpose Grease or equivalent.

Models FW732 - FW752

Check tapered roller bearings (Items 32 & 33) for signs of any metallic contamination or discoloration. Rollers should have continuously smooth action and should not bind or exhibit “flat-spots”. Repack bearings with Mobilux EP #2 All Purpose or equivalent.

Intermediate Worm Gear

Now that intermediate shaft has been removed, intermediate gear (Item 77) may be removed from attachment housing. Shims (Item 75) and gear spacer (Item 74) should be set aside for reassembly.

Note: Do not attempt to remove intermediate worm gear (Item 77) prior to removal of intermediate shaft as gear teeth will be damaged from being pried out from under the engaged worm threads.

Input Shaft Disassembly

1. With a screwdriver or other similar tool, pierce input bore plug (Item 72) and remove from housing bore.

2. Remove outboard retaining ring (Item 67) from housing bore. Remove metal shims (Item 66) located between snap ring and ball bearing (Item 65).

3. Remove four (4) screws (Item 88) from motor flange (Item 89) and remove flange from housing.

4. Remove input worm assembly (Item 90) through bore opposite flange side. Remove oil seal (Item 92) from housing bore. Inboard retaining ring (Item 67) will remain in housing.

5. Check condition of ball bearing (Item 65). Bearing should roll smoothly and not bind. If bearings need replacement, remove snap ring (Item 91) and press shaft through bearing.

Install new bearing onto shaft and reassemble snap ring (Item 91). If not already packed with grease, bearing should be packed at least 50% full with Mobilux EP #2 All Purpose Grease or equivalent.

Input Shaft Reassembly

1. Insert input worm shaft assembly (Item 90) into housing with retaining ring (Item 67) used to seat ball bearing.

2. Install metal shims (Item 66) and assemble outboard snap ring (Item 67).

3. Clean housing bore(s) in area where oil seal is to be inserted.

4. Oil Seal Assembly:

   A. Rubber Clad Oil Seal

      Apply All Purpose Grease (NLGI #2 consistency) to I.D. and O.D.

   B. Steel Clad Oil seal

      Lightly apply All Purpose Grease to I.D. only and coat bore evenly with Permatex “Aviation FORM-A-GASKET” #3 or equivalent.

5. Insert new oil seal (Item 92) over the shaft (care must be taken not to damage oil seal lip) until it contacts the housing.

6. With small hammer, tap around the face of seal casing near the outside diameter. Oil seal location as follows:

Flange end oil seal - Refer to Figure (2) Page 19 (use suitable driving tool to recess seal).

7. Install new bore plug (Item 72). Coat bore with PERMATEX “Aviation FORM-A-GASKET” #3 or equivalent sealant. If rubber clan O.D. no sealant is required. Using small hammer, lightly tap around plug face near the outside diameter. Caution should be exercised not to distort or cock plug during installation.

8. Assemble motor flange (Item 89).

Intermediate Worm Reassembly

1. Insert intermediate worm assembly (Item 13) through bore opposite attachment housing.

Note: Spacer (Item 74) and shims (Item 75) should be put on shaft and worm gear (Item 77) held in mesh with input worm (Item 90) while sliding intermediate worm assembly into position.

2. Assemble attachment cover (Item 82).

Models FW713 - FW730

3. Install new bore plug (Item 19). Coat bore with PERMATEX “Aviation FORM-A-GASKET” #3 or equivalent sealant. If rubber clad O.D. no sealant is required. Using small hammer, lightly tap around plug face near the outside diameter. Caution should be exercised not to distort or cock plug during installation.

Models FW732 - FW752

Assemble intermediate bearing retainer (Item 15).

Worm Gear Replacement

Models FW713 - FW726

1. Replace entire output assembly.

Models FW730 - FW752

1. Place output gear assembly (Item 2) into a pressing fixture and remove worm gear from shaft.

2. With gear key assembled in shaft keyseat, press new gear onto shaft to dimension shown in Figure 1, Page 19.

3. Install shaft spacer (Item 5) and grease cups (Item 34) when applicable.

4. Press bearing cones (Item 6) onto shaft making sure the assembly is tight.

5. Remeasure from end of shaft to worm gear face as shown in Figure 1, Page 19. If adjustment is necessary, press bearing cone (Item 6) until required dimension is achieved.

6. Where grease cups are used, pack with Mobilus EP #2 All Purpose Grease or equivalent.

Output Shaft Reassembly into Housing

1. Remove existing oil seal (Item 11) from bearing carrier (Item 9).

2. Coat gear teeth (Item 3) with red-lead mixture or similar coating and install output gear assembly into housing.

3. Slide bearing carrier (Item 9) over projecting shaft (Item 4) diameter and bolt carrier to housing. Make sure metal shims (Item 12) are between carrier and housing face. Rotate input shaft to properly seat tapered roller bearings.

4. Adjustments of shims (Item 12) must be made at this time. If output shaft is excessively loose, measure endplay of output shaft and remove shims (Item 12) evenly from both carriers (Items 9 and 10) until endplay is within limits specified on Figures 3 or 4, Page 20.

   If bearing carrier (Item 9) does not meet housing face, measure gap and add shims (Item 12) evenly to each side (Items 9 and 10).

5. Assemble motor to unit. Check worm gear centrality. Apply slight load to output shaft and rotate input shaft for 1 or 2 minutes. Remove output bearing carrier (Item 9) and remove output gear assembly. Check gear teeth for bearing pattern. Optimum bearing pattern is shown in Figure 3, Page 20.

   If gear requires adjustment for centrality, all adjustments must be made from side opposite gear hub.

Note: All adjustment for gear centrality to be made from the already established total shim pack (Ref. - Step 4). For example - If a shim is removed from centralized side, it must be added to the opposite side.

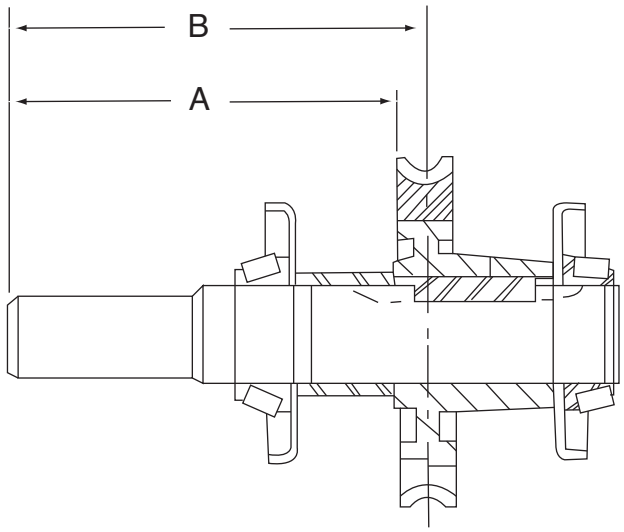
6. When good bearing pattern or gear teeth is established, assemble carriers(s) to unit. Apply PERMATEX “Aviation FORM-A-GASKET” #3 or equivalent sealant to form fillet at pilot diameter of carrier. Install new oil seal (Item 12) into bearing carrier bore. Seal assembly same as shown in “Input Shaft Reassembly” - Steps 4, 5 and 6. (Recommend masking tape over sharp keyseat edges so seal lip is not cut or damaged.) Oil seal to be flush with carrier face.

7. Fill unit to proper level with recommended gear lubrication. (Ref. Page 5.)

8. Install vent (Item 26) and pipe plug (Item 27).

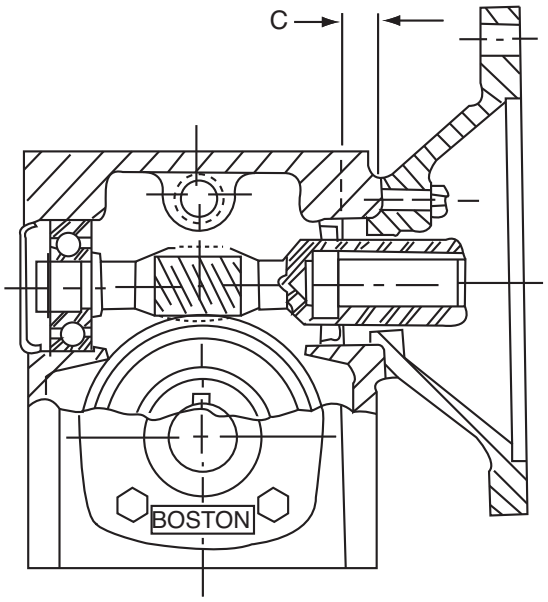
Important: All screw tightening torques listed in Figure 5, Page 20.

Note: For RFW and W700 Series Ref. to Single Reduction Instructions for 700/RF Series Input Disassembly and reassembly Page 13.



Unit	"A" ± 1/64	"B" Ref. Only
730	6.310	6-3/4
732	7.469	7-1/16
738	7.25	7-3/4
752	8.44	9-1/16
760	9.28	10

Figure No. 1



Unit Size	"C" Dimension
F710/FW713 FW718	5/16
F713/FW721 FW726	3/8
F715	3/8
F718/FW732	3/8
F721/FW738	3/8
F724	3/8
F726	3/8
F730	3/8
F732	5/8
F738	5/8

Figure No. 2

Note: "C" Dimensions shown are original oil seal locations. When seal is replaced add or subtract 1/16th of an inch to dimension shown. This will allow seal to wear on a new surface for extended life.

ENDPLAY - FLANGED REDUCTOR

UNIT SIZE	INPUT SHAFT ENDPLAY	OUTPUT SHAFT ENDPLAY
F710, F713	.0005 to .0075 Max.	.0005 to .003 Max.
F715 Through F730	.0005 to .009 Max.	.0005 to .003 Max.
F732 Through F738	.0005 to .003 Max.	.0005 to .003 Max.

Figure No. 3

ENDPLAY - REDUCTOR & RF TYPE

UNIT SIZE	INPUT SHAFT ENDPLAY	OUTPUT SHAFT ENDPLAY
710, 713	.0005 to .002 Max.	.0005 to .003 Max.
715 Through 730	.0005 to .003 Max.	.0005 to .003 Max.
732 Through 738	.0005 to .005 Max.	.0005 to .003 Max.

Figure No. 4

Note: Endplays adjusted by:
1. Input Shaft - Adding or subtracting metal shims (Item 18)
2. Output Shaft - Adding or subtracting metal shims (Item 12)

SCREW TIGHTENING TORQUES* (IN-LBS.)

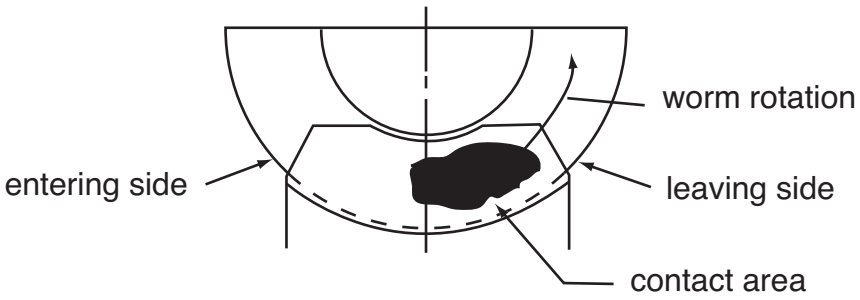
UNIT SIZE	CARRIER SCREW	FLANGE SCREW	FAN GUARD SCREW	FAN ATTACH. SCREW	PIPE PLUG
F710	40-65	45-65			90
F713	132-156	132-156			132
F715	264-312	264-312			132
F718	264-312	264-312			132
F721	264-312	264-312			132
F724	264-312	264-312			132
F726	264-312	264-312			132
F730	264-312	264-312			132
F732	264-312	264-312	85-105	140-160	240
F738	480-552	264-312	85-105	140-160	240
F752	840-948	840-948	132-156	140-160	240
F760	1200-1368	840-948	132-156	140-160	240

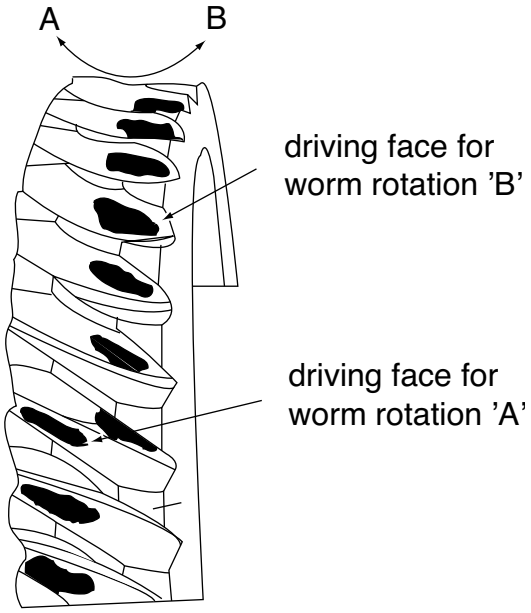
Figure No. 5

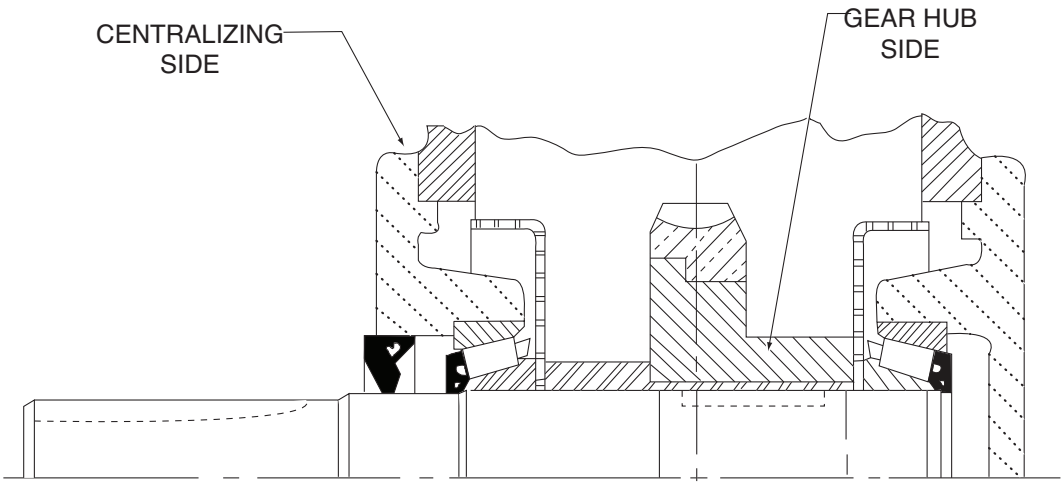
Note: Does not apply to SSF or SSHF reducers

IDEAL POSITIONING OF WORM GEAR CONTACT

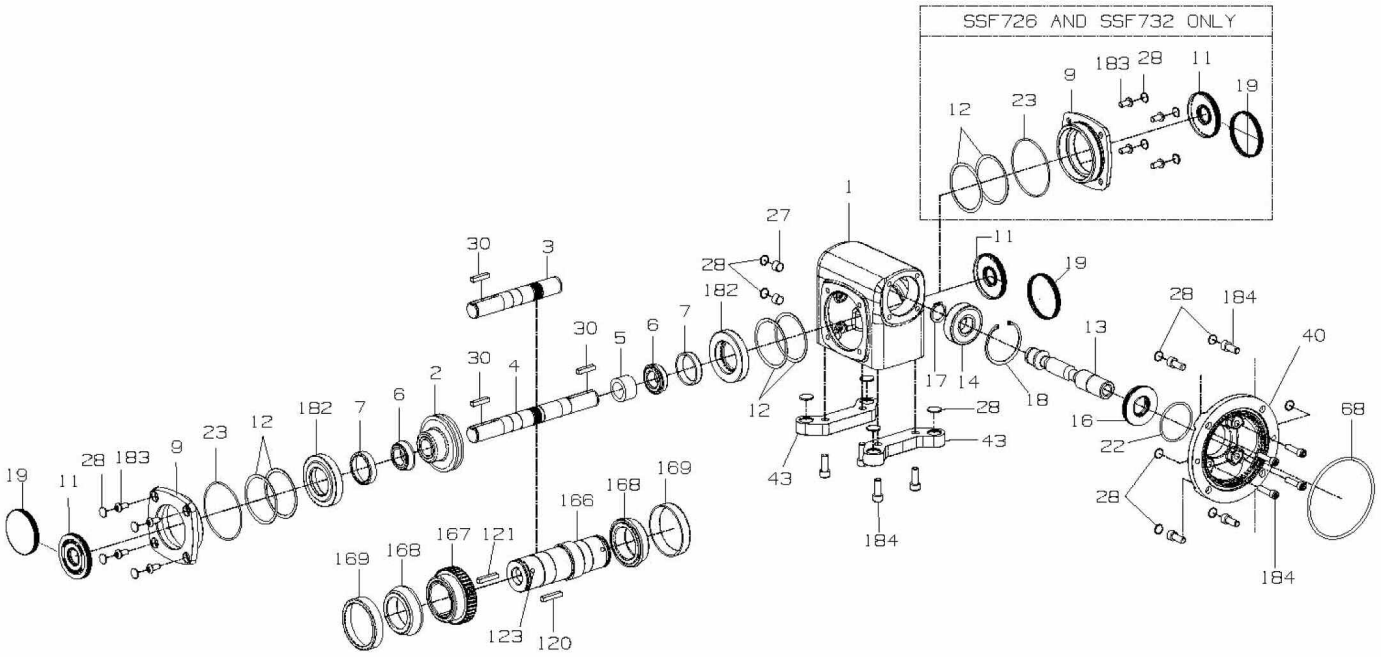
Figure No. 6







PARTS LIST - STAINLESS STEEL MODELS SSF AND SSHF



Part No.	Description
1	HOUSING
2	WORM GEAR
3	SINGLE POJECTING OUTPUT SHAFT
4	DOUBLE PROJECTING OUTPUT SHAFT
5	GEAR SPACER
6	OUTPUT BEARING (CONE)
7	OUTPUT BEARING (CUP)
9	BEARING CARRIER (OPEN)
11	OUTPUT OIL SEAL
12	ADJUSTMENT SHIMS
13	INPUT WORM SHAFT
14	INPUT BEARING
16	INPUT OIL SEAL
17	RETAINING RING (EXTERNAL)
18	RETAINING RING (INTERNAL)
19	BORE PLUG
22	INPUT “O” RING
23	OUTPUT “O” RING
27	PIPE PLUG

Part No.	Description
28	PROTECTIVE CAP PLUG
30	OUTPUT KEY
40	MOTOR FLANGE
43	HORIZONTAL BASE
68	MOTOR FLANGE “O” RING
120	KEY (EXTERNAL)
121	KEY (INTERNAL)
123	SOCKET SETSCREW
166	HOLLOW OUTPUT SHAFT (H) VERSION ONLY
167	WORM GEAR
168	OUTPUT BEARING (CONE)
169	OUTPUT BEARING (CUP)
182	REDUCER BUSHING (MODELS 718 & 721 SOLID SHAFT ONLY)
183	HSBHCS
184	SHCS

Oil Capacity	
Unit Size	**Fluid Oz.**
SSF718	11.2
SSHF718	10.5
SSF721	16.3
SSHF721	15.2
SSF726	32.9
SSHF726	31.1
SSF732	71.4
SSHF732	67.4

700 Series Single Reduction Catalog Number Explanation

HQC 7 32 R - 30 Z F P - B7 H 3 - P20

HQC

STYLE
- Blank - Projecting I/P & O/P shafts (No flange)
- H - Projecting I/P, BostMount hollow O/P shaft, (No flange)
- S - Projecting I/P, hollow O/P shaft (No flange)
- F - Flanged reducer (Quill type), projecting O/P shaft
- HF - Flanged reducer (Quill type), BostMount hollow O/P shaft
- SF - Flanged reducer (Quill type), hollow O/P shaft
- QC - Flanged reducer (Coupling type), projecting O/P shaft
- HQC - Flanged reducer (Coupling type), BostMount hollow O/P shaft
- RF - Flanged reducer (Coupling type), Projecting O/P shaft, 752-760 sizes only
- SSF*- Stainless Flanged reducer (Quill type), Projecting O/P shaft
- SSHF* - Stainless flanged reducer (Quill type) BostMount hollow O/P shaft
- C Prefix - Cast iron flange and base

(* SSF/SSHF sizes 718, 721, 726, 732 only)

7 — 700 SERIES

32 — CENTER DISTANCE (inches)
10 - 1.00
13 - 1.33
15 - 1.54
18 - 1.75
21 - 2.06
24 - 2.38
26 - 2.62
30 - 3.00
32 - 3.25
38 - 3.75
52 - 5.16
60 - 6.00

R — BASE
Blank - No base kit required
A - Horizontal base – Worm under
B - Horizontal base – Worm over
C - Vertical High base – I/P right
D - Vertical Low base – I/P right
E - Vertical High base – I/P left
F - Vertical Low base – I/P left
R/L - BostMount Output Bracket
X - Input Vertical Up
Y - Input Vertical Down
V - Hollow O/P with base – I/P left
W - Hollow O/P with base – I/P right
M - Hollow O/P with CFA-I/P left
N - Hollow O/P with CFA-I/P right

30 — REDUCTION RATIO TO 1
5
10
15
20
25
30
40
50
60

Z — LUBRICATION
Blank - No Lube
Z - PosiVent® (factory filled with Klubersynth UH1 6-460)
K - Klubersynth UH1 6-460

F — FAN (732-760 sizes only)
Blank - No fan
F - Fan kit

P — P-Pressure Relief

B7 — NEMA MOUNTING

BORE CODE	NEMA MOUNTING	INPUT BORE	KEYWAY
B4	42CZ	.500"	1/8 x 1/16
B5	56C	.625	3/16 x 3/32
B7	140TC/180C	.875	3/16 x 3/32
B9	180TC/210C	1.125	1/4 x 1/8
B11	210TC/250UC	1.375	5/16 x 5/32
B13	250TC	1.625	3/8 x 3/16

H — OUTPUT SHAFT ASSEMBLY (When facing Input)
G* - O/P Projection – Left
H* - Double O/P Projection
J* - O/P Projection – Right

* Add "S" after letter for Stainless Steel Shaft (ex. GS, HS, JS)

3 — MOUNTING POSITIONS
Blank -No Lubrication Supplied

For Factory Prelubrication Indicate Mounting Position

1 -Standard Mounting
2-6 -Refer to Mounting Positions in Catalog

P20 — H SERIES OUTPUT BORE CODE
For H700 Series only. Specified in 1/16" increments. See Worm Gear Drives Catalog for complete offering.
Example:
1-1/4" = P20

700 Series Double Reduction Catalog Number Explanation

HQCWA 7 26 B 100 Z F P - B5 H 3 - P20

HQCWA

STYLE
- WA - Parallel shafts, projecting I/P & O/P
- HWA - Parallel shafts, projecting I/P, BostMount Hollow O/P
- SWA - Parallel shafts, projecting I/P, hollow O/P
- WC - Right Angle shafts, projecting I/P & O/P
- HWC - Right Angle shafts, projecting input, BostMount hollow output shaft.
- SWC - Right Angle shafts, projecting I/P, hollow O/P
- FWA - Parallel shafts, Quill type I/P, projecting O/P
- HFWA - Parallel shafts, Quill type I/P, BostMount Hollow O/P
- SFWA - Parallel shafts, Quill type I/P, hollow O/P
- FWC - Right Angle shafts Quill type I/P, projecting O/P
- HFWC - Right Angle shafts, Quill type input, BostMount hollow output shaft
- SFWC - Right Angle shafts, Quill type I/P, hollow O/P
- QCWA - Parallel shafts, Coupling type I/P, projecting O/P
- HQCWA - Parallel shafts, Coupling type I/P, BostMount hollow O/P
- QCWC - Right Angle shafts, Coupling type I/P, projecting O/P
- HQCWC - Right Angle shafts, Coupling type input, BostMount hollow output shaft
- C Prefix - Cast iron flange and base

7 — 700 SERIES

26 — CENTER DISTANCE (inches)
13 - 1.33
18 - 1.75
21 - 2.06
26 - 2.62
30 - 3.00
32 - 3.25
38 - 3.75
52 - 5.16
60 - 6.00

B — BASE
Blank - No base kit required
A & B - Horizontal bases
C & E - Vertical High bases
D & F - Vertical Low bases
R/L - BostMount Output Bracket
X - Input Vertical Up
Y - Input Vertical Down
V/W - Hollow O/P with base
M/N - Hollow O/P with CFA

100 — REDUCTION RATIO TO 1

100	1200
150	1800
200	2000
300	2400
400	3000
600	3600
900	

Z — LUBRICATION
Blank - No Lube
Z - PosiVent® (factory filled with Klubersynth UH1 6-460)
K - Klubersynth UH1 6-460

F — FAN (732 - 760 only)
Blank - No Fan
F - Fan Kit
E - End Cap available 732 and 738 only, when no fan is used

P — P - Pressure Relief

B5 — NEMA MOUNTING

BORE CODE	NEMA MOUNTING	INPUT BORE	KEYWAY
B4	42CZ	.500"	1/8 x 1/16
B5	56C	.625	3/16 x 3/32
B7	140TC/180C	.875	3/16 x 3/32
B9	180TC/210C	1.125	1/4 x 1/8

H — OUTPUT SHAFT ASSEMBLY (When facing Input)
G* - O/P Projection – Left
H* - Double O/P Projection
J* - O/P Projection – Right
* Add "S" after letter for Stainless Steel Shaft (ex. GS, HS, JS)

3 — MOUNTING POSITIONS
Blank - No Lubrication Supplied

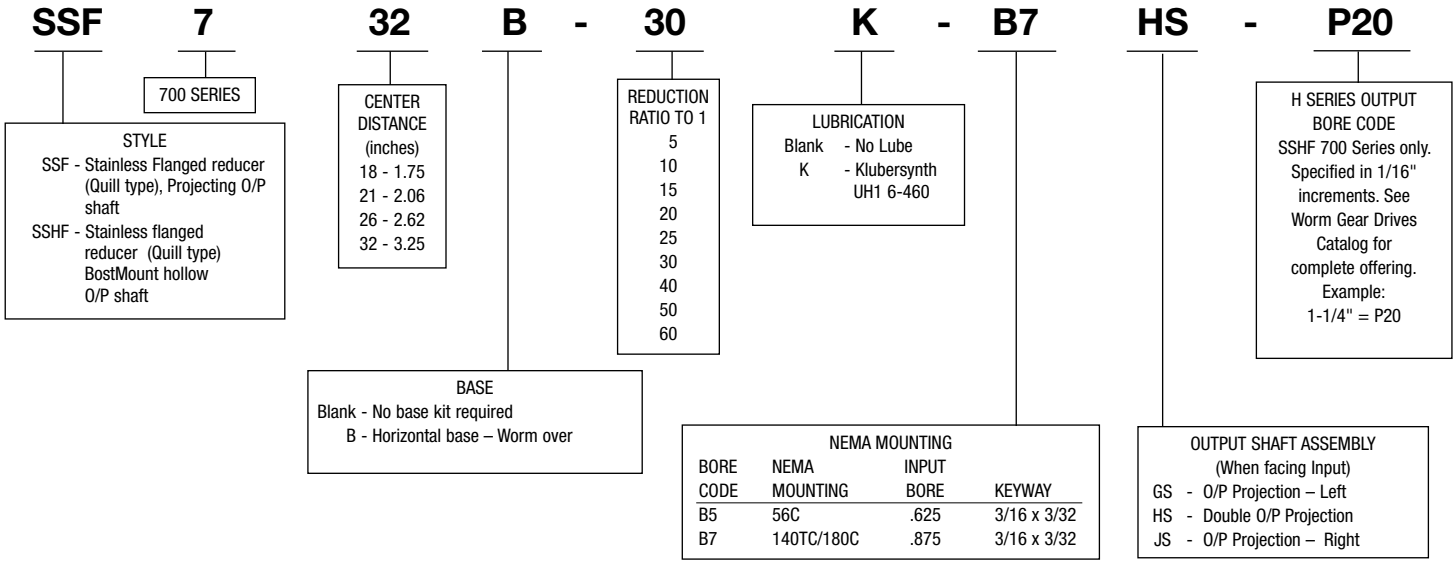
For Factory Prelubrication Indicate Mounting Position

1 - Standard Mounting
2 - 6 - Refer to Mounting Positions in Catalog

P20 — H SERIES OUTPUT BORE CODE*
For H700 Series only. Specified in 1/16" increments See Worm Gear Drives Catalog for complete offering.
Example:
1-1/4" - P20
*H Series Only

Note: Contact factory for other model numbers.

Stainless Steel 700 Series Single Reduction Catalog Number Explanation



Warranty

The Company warrants that all 700 Series speed reducers will be free from defects in material and workmanship over the lifetime of the product.

Oil seals are considered to be replaceable maintenance items.

Any products which shall be proved to the Company's satisfaction to have been defective at the time of delivery in these respects will be replaced or repaired by the Company at its option. Freight is the responsibility of the customer. The Company's liability under this warranty is limited to such replacement or repair and it shall not be held liable in any form of action for direct or consequential damages to property or person. THE FOREGOING WARRANTY IS EXPRESSLY MADE IN LIEU OF ALL OTHER WARRANTIES WHATSOEVER, EXPRESS, IMPLIED AND STATUTORY AND INCLUDING WITHOUT LIMITATION THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. No employee, agent, distributor, or other person is authorized to give additional warranties on behalf of Boston Gear, nor to assume for Boston Gear any other liability in connection with any of its products, except an officer of Boston Gear by a signed writing.

Boston Gear

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SEALMASTER®

BALL BEARING INSTALLATION INSTRUCTIONS SET SCREW, SKWEZLOC®

Emerson Power Transmission
909 N. Lafayette Street
VALPARAISO, IN 46383
Phone: 219-465-2211
www.emerson-ept.com

FORM
PN 784106
PS-740-0001
Revision 04
March, 2004

These instructions cover the set screw and Skwezloc® style ball bearings. It is important that they be read in their entirety before attempting installation or removal. The procedures indicated should be carefully followed. Failure to do so can result in mis-installation which could cause bearing performance problems as well as serious personal injury.

BEARINGS IN BOLT-ON HOUSINGS (UNITS)

1. CHECK AREA- Clean and organize bearing installation area, keep well lighted. Be sure mounting surfaces are clean and flat.

2. CHECK SHAFT - Shaft should be within tolerance range shown in Table #1, clean, and free of nicks and burrs. Mount bearing on unused section of shafting or repair/replace shafting as required.

TABLE #1

SHAFTING			
Shaft Dia.		**Shaft Tolerance**	
1/2 - 1 15/16 in.	(12 - 49 mm)	+0 to -.0005 in.	(+0 to -.0125 mm)
2 - 3 3/16 in.	(50 - 80 mm)	+0 to -.0010 in.	(+0 to -.025 mm)
3 1/4 - 4 15/16 in.	(82 - 125 mm)	+0 to -.0015 in.	(+0 to -.040 mm)

3. INSTALL UNIT - Slide unit onto shaft. If it is difficult to mount bearing on shaft, use a piece of emery cloth to reduce any high spots on shaft. **Do not hammer on any component of the bearing.**

4. FASTEN UNIT IN PLACE - Install housing mounting bolts, check and align bearing and tighten mounting bolts to recommended fastener torques. Exercising extreme caution and safety, rotate shaft slowly to center bearing.

5.1 SET SCREW INSERTS

a) Set screws in a multiple bearing application should be aligned.
b) Torque first set screw to one half recommended torque in Table #2. Torque second set screw to full torque. Torque first set screw to full torque.

5.2 DOUBLE LOCK SET SCREW INSERTS

a) Set screws in a multiple bearing application should be aligned.
b) On one end of the inner ring, torque first set screw to one half the recommended torque in Table #2. Torque second set screw to full torque. Torque first set screw to full torque.
c) Repeat step 5b on opposite end of inner ring.

TABLE #2

SET SCREW TIGHTENING				
SCREW SIZE	HEX. SIZE	TORQUE		
		(in-lbs.)	(ft.-lbs.)	(N-m)
1/4-28	1/8	65 - 85	-	7 - 10
5/16-24	5/32	125 - 165	-	15 - 18
3/8-24	3/16	230 - 300	-	25 - 34
7/16-20	7/32	350 - 450	30 - 40	40 - 55
1/2-20	1/4	500 - 650	40 - 55	55 - 75
5/8-18	5/16	1100 - 1440	90 - 120	120 - 165

5.3 Skwezloc® Inserts

a) Be sure that the Skwezloc® collar is fitted square and snug against the shoulder on the inner ring.
b) Torque the Skwezloc® collar cap screw to torque recommended in Table #3.

TABLE #3

SKWEZLOC® COLLAR TIGHTENING			
English Screw Size	**Hex Size**	**Torque**	
		(in-lbs.)	(N-m)
#8-32	T-25	65 - 70	7 - 8
#10-24	T-27	90 - 100	10 - 11
1/4-20	T-30	220 - 240	25 - 27
5/16-18	T-45	450 - 495	51 - 56

6. MONITOR INSTALLED BEARING*- After bearing has been run for several minutes, and again after several hours, check bearing for excessive noise or vibration. Shutdown machine and check housing temp: typical applications operate at 100°F - 150°F (38°C - 66°C) (Similar feel to household hot tap water temp). Tighten all locking devices after 500 hours or 3 months, which ever comes first.

CYLINDRICAL OD INSERTS & INSERTS IN CYLINDRICAL OD HOUSINGS

INSTALL INSERT- Be sure housing bore is clean and free of debris. Press bearing into housing by applying force to face of outer ring. **Do not hammer on any component of the bearing or apply force to inner ring.** Proceed with Step #1-6 above. For recommended housing bore tolerance, consult Sealmaster® catalog or phone Sealmaster® application engineering*.

SPHERICAL O.D. & (AR) EXPANSION INSERTS

IMPORTANT: Replacement Sealmaster® bearing inserts are intended for use in Sealmaster® housings. Housings should be thoroughly inspected for damage such as cracks, excessive wear or galling of the spherical seat, obstruction of grease port, etc. prior to installation.

INSTALL INSERT - Housing bearing seat should be wiped clean. Check grease port and clean free of debris. Wet housing bearing seat with oil or grease. Secure housing in a vise.

FOR SPHERICAL OD:

a) Place bearing insert into housing load slot, positioning the insert outer race dimple and lube hole in line with the casting lube port.
b) Using a bar slipped into the insert bore as a lever, swing insert into place within the casting. Insert should have a snug fit in housing bore. ***Do not hammer***. (Note: If insert can be made to swivel by hand in the housing bore, fit is too loose - REPLACE ENTIRE UNIT. If heavy force is required, fit is too tight - REPLACE ENTIRE UNIT).
c) Insure alignment of housing grease port hole and bearing dimple and lube hole.
d) Place locking pin into lube port and thread lubrication fitting into threaded lube port hole. Grease fitting adjustment is critical (overtightening or undertightening can result in poor bearing performance), snug fit with wrench, then loosen 1/4 turn. Proceed with steps 1-6 above.

FOR EXPANSION TYPE:

a) Slide bearing into housing. ***Do not hammer.***
b) Insure alignment of housing grease port hole, brass ring lube hole, and bearing dimple.
c) Place locking pin into housing grease port hole, brass ring lube hole, and bearing dimple. Thread lubrication fitting into threaded housing grease port hole. Grease fitting adjustment is critical (overtightening or undertightening can result in poor bearing performance), snug fitting with wrench, then loosen 1/4 turn. Axial positioning is critical.
d) Position bearing insert to maximize axial expansion. Proceed with steps 1-6 above.

RELUBRICATION INSTRUCTIONS

Sealmaster® GoldPlex™-HP has been developed based on the performance characteristics of Sealmaster® brand bearings. Sealmaster® brand bearings are factory filled with GoldPlex™-HP and do not need to be greased upon initial installation. GoldPlex™-HP is a lithium complex base, petroleum oil, NLGI grade 2 consistency. If not using GoldPlex™-HP grease, Table #5 is given as a very general recommendation for typical lithium or lithium complex, petroleum oil, NLGI#2 greases. Contact the grease supplier for a more specific lubrication schedule.

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EMERSON™ Industrial Automation

RELUBRICATION INSTRUCTIONS(Continued)

Relubricatable Sealmaster® brand bearings are supplied with grease fittings or zerks for ease of lubrication with hand or automatic grease guns. Always wipe the fitting and grease nozzle clean. **For safety, stop rotating equipment.** Add one half the recommended amount shown in Table #6. Start bearing, and run for a few minutes. Stop bearing and add the second half of the recommended amount. A temperature rise, sometimes 30°F, after relubrication is normal. Bearing temperatures should not exceed 250°F (121°C). For any applications that are not in the ranges of the table, contact Sealmaster® for suffix modified bearings that can handle temperatures up to 400°F (204°C).

Note: The tables below state general lubrication recommendations based on our experience and are intended as suggested or starting points only. For best results, specific applications should be monitored regularly and lubrication intervals and amounts adjusted accordingly.

TABLE #4 Lubrication Schedule for Sealmaster® GoldPlex™-HP

Contamination Level - Clean to Light			
Bearing Temperature	**0-500 RPM**	**500 RPM to 75% of Max Catalog Speed**	**75% of Max Catalog to Max Catalog speed**
-50°F to -30°F	12-24 Months	12-24 Months	12-18 Months
-30°F to 120°F	12-24 Months	12-24 Months	8-18 Months
120°F to 180°F	8-12 Months	6-12 Months	4-8 Months
180°F to 250°F	4-8 Months	3-6 Months	2-4 Months
Contamination Level - Medium			
Bearing Temperature	**0-500 RPM**	**500 RPM to 75% of Max Catalog Speed**	**75% of Max Catalog to Max Catalog speed**
-50°F to -30°F	1 Week-1 Month	1 Week-1 Month	1 Week-1 Month
-30°F to 120°F	1 Week-1 Month	1 Week-1 Month	1 Week-1 Month
120°F to 180°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
180°F to 250°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
Contamination Level - Heavy			
Bearing Temperature	**0-500 RPM**	**500 RPM to 75% of Max Catalog Speed**	**75% of Max Catalog to Max Catalog speed**
-50°F to -30°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
-30°F to 120°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
120°F to 180°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
180°F to 250°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks

TABLE #5 General Lubrication Schedule

Contamination Level - Clean to Light			
Bearing Temperature	**0-500 RPM**	**500 RPM to 75% of Max Catalog Speed**	**75% of Max Catalog to Max Catalog speed**
-50°F to -30°F	Not recommended	Not recommended	Not recommended
-30°F to 120°F	6-12 Months	6-12 Months	4-8 Months
120°F to 180°F	1-3 Months	1-3 Months	Monthly
180°F to 250°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
Contamination Level - Medium			
Bearing Temperature	**0-500 RPM**	**500 RPM to 75% of Max Catalog Speed**	**75% of Max Catalog to Max Catalog speed**
-50°F to -30°F	Not recommended	Not recommended	Not recommended
-30°F to 120°F	1 Week-1 Month	1 Week-1 Month	1 Week-1 Month
120°F to 180°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
180°F to 250°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
Contamination Level - Heavy			
Bearing Temperature	**0-500 RPM**	**500 RPM to 75% of Max Catalog Speed**	**75% of Max Catalog to Max Catalog speed**
-50°F to -30°F	Not recommended	Not recommended	Not recommended
-30°F to 120°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
120°F to 180°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks
180°F to 250°F	Daily-2 Weeks	Daily-2 Weeks	Daily-2 Weeks

Compatibility of grease is critical, therefore, if not using Sealmaster® GoldPlex™-HP, consult your grease supplier to ensure compatibility. GoldPlex™-HP is a lithium complex base grease, petroleum oil, NLGI grade 2 consistency.

NOTE: Sealmaster® brand bearings with the RM suffix are Reduced Maintenance Bearings (ex. NP-16 RM). Sealmaster® brand reduced maintenance bearings are designed to run with the standard factory fill of GoldPlex™-HP Grease. Units are designed not to be lubricated.

TABLE #6	RECOMMENDED RELUBRICATION GREASE CHARGE		
Shaft Size (in)	**oz.**	**Shaft Size**	**grams**
1/2 to 3/4	0.03	20	0.85
7/8 to 1 3/16	0.10	25-30	2.84
1 1/4 to 1 1/2	0.15	35-40	4.25
1 11/16 to 1 15/16	0..20	45-50	5.67
2 to 2 7/16	0..30	55-60	8.51
2 1/2 to 2 15/16	0.50	65-70	15.59
3 to 3 7/16	0.85	75-80	24.10
3 1/2 to 4	1.50	85 - 105	42.53

APPLICATION ASSISTANCE:

Please contact Application Engineering at:

Phone: (219) 465-2211
Fax: (219) 465-2263
Email: sealmaster.engineering@emerson-ept.com

Sealmaster® brand ball bearings now incorporate a unique, color-coding system to help identify the type of grease in the bearings. Each relubricatable Sealmaster® brand bearing features a colored fitting cap to help indicate the type of grease used in the individual bearings. Below is a list of the colored fitting caps and the type of grease they represent.

Yellow - Yellow grease fitting caps indicate that bearings are filled with Sealmaster® GoldPlex™-HP high performance mounted bearing grease.

Red - Red grease fitting caps indicate that bearings are filled with factory standard high-temperature grease. (Lithium complex base with synthetic hydrocarbon oil)

White - White grease fitting caps indicate that bearings are filled with factory standard food grade grease. (Aluminum complex with synthetic oil)

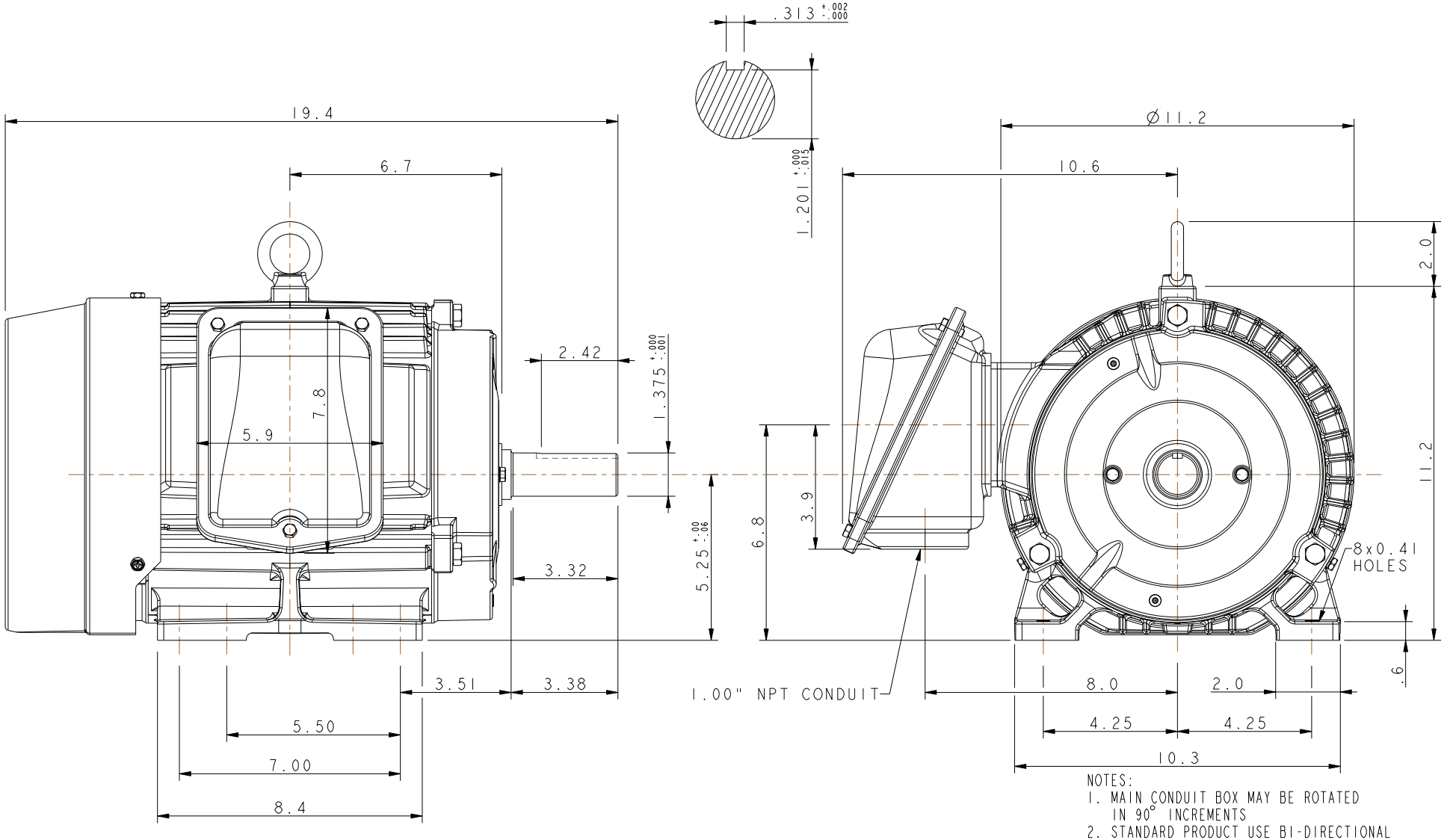
Black - Black grease fitting caps indicate that bearings are filled with a non-standard grease.

Printed in U.S.A.

SECTION 5.

Motor Data Sheets

ROTOR MOTOR



NOTES:
1. MAIN CONDUIT BOX MAY BE ROTATED IN 90° INCREMENTS
2. STANDARD PRODUCT USE BI-DIRECTIONAL FAN. OPPOSITE ROTATION AVAILABLE ONLY BY CONNECTION CHANGE.
3. KEY DIMENSIONS EQUAL 0.313" x 0.313" x 2.38" (MOTOR SUPPLIED WITH KEY)

UNITS: INCHES

210T TEFC FRAME F1 ASSEMBLY

MDSLV001-03

TOSHIBA
TOSHIBA INTERNATIONAL CORPORATION

TOLERANCES	
.X	.1
.XX	.03
.XXX	.005
.XXXX	.0005

MAXIMUM MOTOR WEIGHT
186 lbs.
84 kgs.

NO	REVISION	DRAWN BY	DATE	CHECK
1	ADDED KEY DIMENSIONS	S. CLANCY	08/08/12	
0	FIRST ISSUE	N. MOMIN	09/01/10	

EQP Global SD
XT SERIES

DRAWN BY: N. MOMIN
CHECK BY:
APPROVED BY:

www.toshiba.com/ind

TOSHIBA INTERNATIONAL CORPORATION
Industrial Division / Houston Motor Plant

SQUIRREL CAGE INDUCTION MOTOR
PERFORMANCE SPECIFICATIONS

INDEX	MPCF-1033
SHEET NO.	1 of 1
ISSUED	11/08/96
SUPERSEDES	10/06/95
REVISION	1
WRITTEN BY	R. EVANS
APPROVED BY	Jay Bugbee

Customer Tag:

CUSTOMER:
TIC SR No.:
Customer PO:

MOTOR NAMEPLATE DATA

H.P.: **7.5**	VOLTS: **230/460**	3 Ø / **60** Hz		S. RPM: **1800**
FRAME: **213T**	ENCL: **TEFC**	FLAMPS: **19.6/9.8**		FLRPM: **1760**
FORM: **FBK1**	S.F.: **1.15**	NEMA DESIGN: **B**		INSUL CLASS: **F**
TYPE: **IKKH**	AMB.: **40C**	CODE: **H**		DUTY: **CONT.**
MODEL No.: **Y754SDSR41A-P**		kW: **5.5**		Serial No.:
NOM. EFF.: **91.7**	MIN. EFF.:	P.F.:**79.0**		

AMPERAGE	**TORQUES**	** **BEARINGS:**
Locked Rotor: **127/63.5**	FULL LOAD (lb-ft.): **22.4**	Drive End: **6308ZZC3**
	LOCKED ROTOR (%): **271**	Opposite Drive End: **6308ZZC3**
	BREAK DOWN (%): **344**	

EFFICIENCY (%)	**POWER FACTOR (%)**
FULL LOAD: **91.8**	FULL LOAD: **79.9**
3/4 LOAD: **90.9**	3/4 LOAD: **75.3**
1/2 LOAD: **88.5**	1/2 LOAD: **65.8**

ALL CHARACTERISTICS ARE AVERAGE EXPECTED VALUES BASED UPON RATED VOLTAGE, FREQUENCY AND SINEWAVE POWER INPUT.

* TEMPERATURE RISE WILL BE CONSISTENT WITH INSULATION, AMBIENT AND SERVICE FACTOR AS DEFINED BY NEMA-MG-12.43 OR -20.40.

** BEARINGS ARE THE ONLY RECOMMENDED SPARE PART(S).

CERTIFIED BY:
DATE:

TOSHIBA INTERNATIONAL CORPORATION
Industrial Division / Houston Motor Plant

SQUIRREL CAGE INDUCTION MOTOR
PERFORMANCE SPECIFICATIONS

INDEX	MPCF-1033
SHEET NO.	1 of 1
ISSUED	11/08/96
SUPERSEDES	10/06/95
REVISION	1
WRITTEN BY	R. EVANS
APPROVED BY	Jay Bugbee

Customer Tag:

CUSTOMER:
TIC SR No.:
Customer PO:

MOTOR NAMEPLATE DATA

H.P.: **7.5**	VOLTS: **190/380**	3 Ø / **50**	Hz	S. RPM: **1500**
FRAME: **213T**	ENCL: **TEFC**	FLAMPS:		FLRPM: **1450**
FORM: **FBK1**	S.F.: **1**	NEMA DESIGN:		INSUL CLASS: **F**
TYPE: **IKKH**	AMB.: **40C**	CODE: **H**		DUTY: **CONT.**
MODEL No.: **Y754SDSR41A-P**		kW: **5.5**		Serial No.:
NOM. EFF.: **90.2**	MIN. EFF.:	P.F.:**81.5**		

AMPERAGE
Locked Rotor:

TORQUES
FULL LOAD (lb-ft.): **0.0**
LOCKED ROTOR (%):
BREAK DOWN (%):

** **BEARINGS:**
Drive End: **6308ZZC3**
Opposite Drive End: **6308ZZC3**

EFFICIENCY (%)
FULL LOAD: **91.8**
3/4 LOAD: **91.8**
1/2 LOAD: **90.5**

POWER FACTOR (%)
FULL LOAD: **77.0**
3/4 LOAD: **72.8**
1/2 LOAD: **63.7**

ALL CHARACTERISTICS ARE AVERAGE EXPECTED VALUES BASED UPON RATED VOLTAGE, FREQUENCY AND SINEWAVE POWER INPUT.

* TEMPERATURE RISE WILL BE CONSISTENT WITH INSULATION, AMBIENT AND SERVICE FACTOR AS DEFINED BY NEMA-MG-12.43 OR -20.40.

** BEARINGS ARE THE ONLY RECOMMENDED SPARE PART(S).

CERTIFIED BY:
DATE:

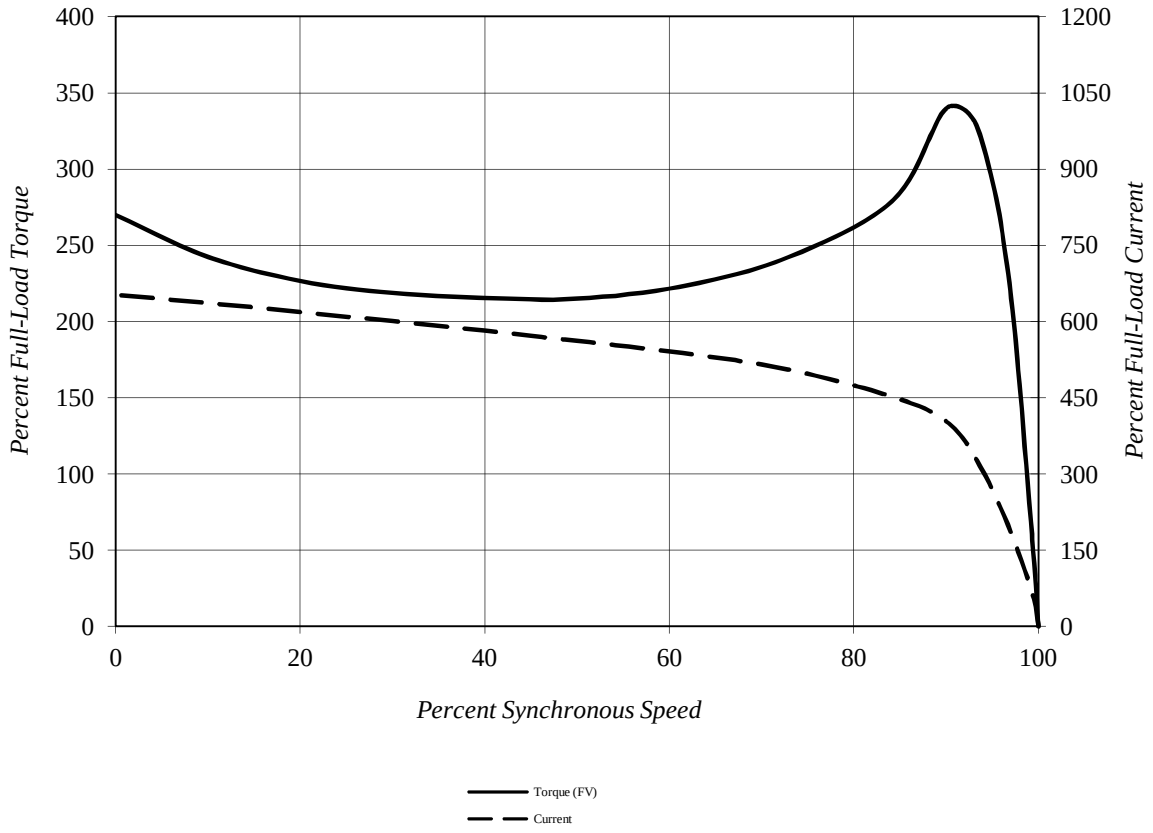
TOSHIBA INTERNATIONAL CORPORATION

Speed Torque/Current Curve

Model #:	Y754SDSR41A-P			***FLAmps:***	9.8
Enclosure:	TEFC	***Voltage:***	460 V	***Frame:***	213T
Pole:	4	***Frequency:***	3 PH / 60 Hz	***Ins. Class:***	F
HP:	7.5	***Rotor Inertia:***	1.2 lb-ft²	***Date:***	10-Dec-2012
FLRPM:	1760	***Load Inertia:***	N/A	***File:***	KH4Y75

Locked Rotor Amps:	64	***Load Type:***	N/A
Locked Rotor Torque:	270%	***Starting at:***	N/A
Breakdown Torque:	340%	***Accel. Time:***	N/A
Rated Torque:	22.4 lb-ft		

Design Values



Comments: _____

D.E.Curve #: _____

Prepared by: Van Truong	***Checked by:***

TOSHIBA Reliability in Motion

TOSHIBA INTERNATIONAL CORPORATION
INDUSTRIAL DIVISION
PO BOX 40906
HOUSTON TX 77240 (800) 231-1412
(713) 466-0277 FAX (713) 466-8773

SPARE PARTS (RECOMMENDED)

OTHER THAN THE GREASE USED FOR RE-GREASABLE BEARINGS, TOSHIBA ADVISES THAT THERE ARE NO "USE" PARTS. THE ONLY INSURANCE SPARES THAT TOSHIBA SUGGESTS FOR THESE SQUIRREL CAGE INDUCTION MOTORS ARE INDUSTRY STANDARD, AND COMMERCIALLY AVAILABLE ANTI-FRICTION BEARINGS, AS NOTED BELOW.

MOTOR COMPONENTS (SUCH AS TERMINAL BOXES, FAN COVERS, MACHINED PARTS) ARE AVAILABLE UPON SPECIAL REQUEST. IN THIS CASE, PLEASE ADVISE OUR ORDER ENTRY DEPARTMENT THE MODEL AND SERIAL NUMBERS (FOUND ON THE MOTOR NAMEPLATE) , AND A DESCRIPTION OF THE COMPONENT REQUIRED. THEY WILL THEN FURNISH THE CURRENT PART NUMBER, PRICE AND AVAILABILITY.

(NOTE: OUR INTERNAL PART NUMBERS ARE SUBJECT TO CHANGE WITHOUT NOTICE, AND ARE NOT PUBLISHED).

PLEASE ADVISE IF YOU HAVE ANY QUESTIONS.

CUSTOMER:
PURCHASE ORDER #
Customer Tag:

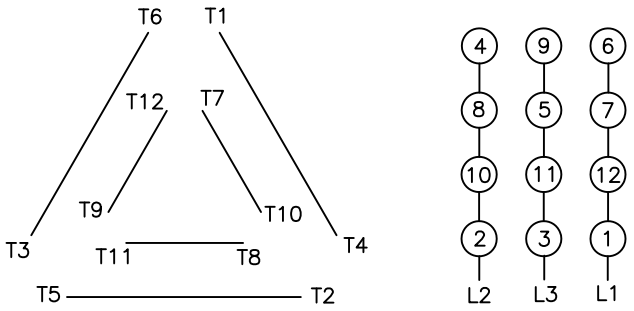
TOSHIBA FILE #
MODEL # **Y754SDSR41A-P**
HP / RPM / ENCL / FRAME: **7.5** / **1800** / **TEFC** / **213T**
DRIVE END BEARING: **6308ZZC3**
OPPOSITE DRIVE END BEARING: **6308ZZC3**

Prepared By:
Date:

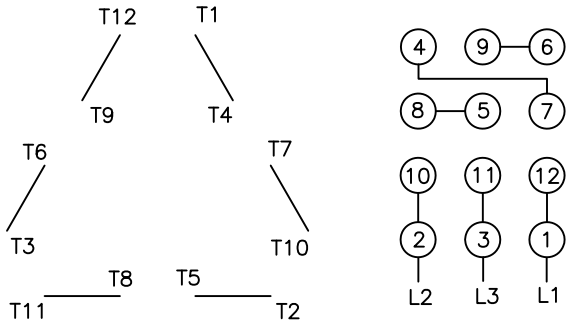
Motor Connection Diagrams
12 Leads

Across-the-Line Starting / Running Connections

Low Voltage Delta



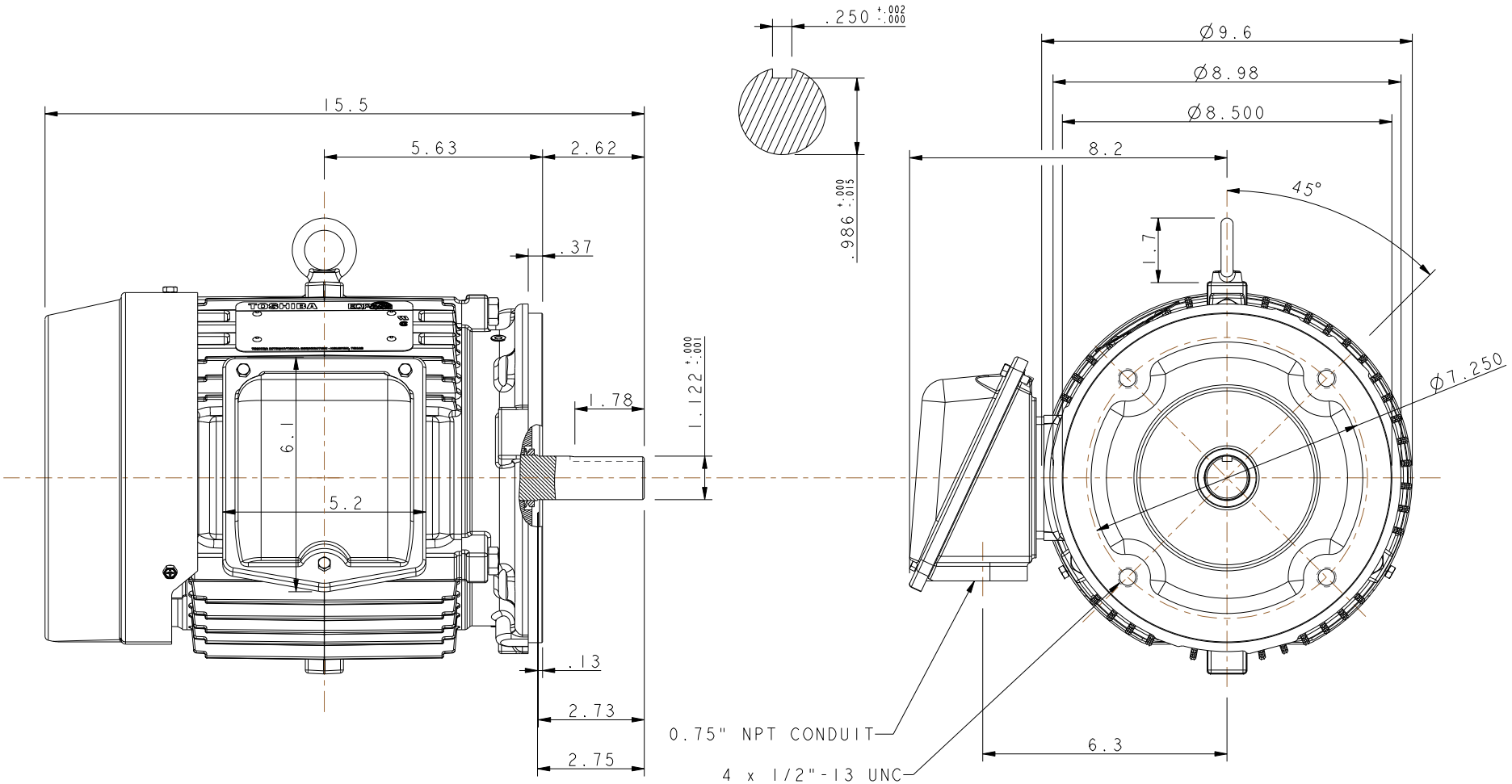
High Voltage Delta



Switch L1 and L2 to reverse rotation

Suitable for Wye–Delta Starting and Limited Part–Winding–Starting.
Please Contact Toshiba International for specific connections.

CONVEYOR / TAIL PULLEY MOTOR



NOTES:
1. MAIN CONDUIT BOX MAY BE ROTATED IN 90° INCREMENTS
2. STANDARD PRODUCT USE BI-DIRECTIONAL FAN. OPPOSITE ROTATION AVAILABLE ONLY BY CONNECTION CHANGE.
3. KEY DIMENSIONS EQUAL 0.750" x 0.750" x 1.75" (MOTOR SUPPLIED WITH KEY)

UNITS: INCHES

180TC TEFC ROUND BODY FRAME F1 ASSEMBLY

MDSLV205-02

TOSHIBA
TOSHIBA INTERNATIONAL CORPORATION

TOLERANCES	
.X	.1
.XX	.03
.XXX	.005
.XXXX	.0005

MAXIMUM MOTOR WEIGHT
97 lbs.
44 kgs.

NO	REVISION	DRAWN BY	DATE	CHECK
1	ADDED KEY DIMENSIONS	S. CLANCY	08/08/12	
0	FIRST ISSUE	N. MOMIN	03/17/11	

EQP Global SD
XT SERIES

DRAWN BY: N. MOMIN
CHECK BY:
APPROVED BY:
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TOSHIBA INTERNATIONAL CORPORATION
Industrial Division / Houston Motor Plant

INDEX	MPCF-1033
SHEET NO.	1 of 1
ISSUED	11/08/96
SUPERSEDES	10/06/95
REVISION	1
WRITTEN BY	R. EVANS
APPROVED BY	Jay Bugbee

SQUIRREL CAGE INDUCTION MOTOR PERFORMANCE SPECIFICATIONS

Customer Tag:

CUSTOMER:
TIC SR No.:
Customer PO:

MOTOR NAMEPLATE DATA

H.P.: **3**	VOLTS: **230/460**	3 Ø / **60**	Hz	S. RPM: **1800**
FRAME: **182TC**	ENCL: **TEFC**	FLAMPS: **8/4.0**		FLRPM: **1760**
FORM: **FCKL1**	S.F.: **1.15**	NEMA DESIGN: **B**		INSUL CLASS: **F**
TYPE: **IKH**	AMB.: **40C**	CODE: **K**		DUTY: **CONT.**
MODEL No.: **0034SDSR44A-P**		kW: **2.2**		Serial No.:
NOM. EFF.: **89.5**	MIN. EFF.:	P.F.:**79.0**		

AMPERAGE
Locked Rotor: **64/32**

TORQUES
FULL LOAD (lb-ft.): **8.9**
LOCKED ROTOR (%): **270**
BREAK DOWN (%): **394**

**** BEARINGS:**
Drive End: **6306ZZC3**
Opposite Drive End: **6306ZZC3**

EFFICIENCY (%)
FULL LOAD: **89.5**
3/4 LOAD: **88.9**
1/2 LOAD: **86.7**

POWER FACTOR (%)
FULL LOAD: **79.6**
3/4 LOAD: **75.0**
1/2 LOAD: **65.3**

ALL CHARACTERISTICS ARE AVERAGE EXPECTED VALUES BASED UPON RATED VOLTAGE, FREQUENCY AND SINEWAVE POWER INPUT.

* TEMPERATURE RISE WILL BE CONSISTENT WITH INSULATION, AMBIENT AND SERVICE FACTOR AS DEFINED BY NEMA-MG-12.43 OR -20.40.

** BEARINGS ARE THE ONLY RECOMMENDED SPARE PART(S).

CERTIFIED BY:
DATE:

TOSHIBA INTERNATIONAL CORPORATION
Industrial Division / Houston Motor Plant

SQUIRREL CAGE INDUCTION MOTOR
PERFORMANCE SPECIFICATIONS

INDEX	MPCF-1033
SHEET NO.	1 of 1
ISSUED	11/08/96
SUPERSEDES	10/06/95
REVISION	1
WRITTEN BY	R. EVANS
APPROVED BY	Jay Bugbee

Customer Tag:

CUSTOMER:
TIC SR No.:
Customer PO:

MOTOR NAMEPLATE DATA

H.P.: **3**	VOLTS: **190/380**	3 Ø / **50**	Hz	S. RPM: **1500**
FRAME: **182TC**	ENCL: **TEFC**	FLAMPS:		FLRPM: **1440**
FORM: **FCKL1**	S.F.: **1**	NEMA DESIGN:		INSUL CLASS: **F**
TYPE: **IKH**	AMB.: **40C**	CODE: **K**		DUTY: **CONT.**
MODEL No.: **0034SDSR44A-P**		kW: **2.2**		Serial No.:
NOM. EFF.: **85.5**	MIN. EFF.:	P.F.: **84.0**		

AMPERAGE	**TORQUES**	** **BEARINGS:**
Locked Rotor:	FULL LOAD (lb-ft.): **0.0**	Drive End: **6306ZZC3**
	LOCKED ROTOR (%):	Opposite Drive End: **6306ZZC3**
	BREAK DOWN (%):	

EFFICIENCY (%)	**POWER FACTOR (%)**
FULL LOAD: **88.8**	FULL LOAD: **79.0**
3/4 LOAD: **88.8**	3/4 LOAD: **74.5**
1/2 LOAD: **87.3**	1/2 LOAD: **64.9**

ALL CHARACTERISTICS ARE AVERAGE EXPECTED VALUES BASED UPON RATED VOLTAGE, FREQUENCY AND SINEWAVE POWER INPUT.

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** BEARINGS ARE THE ONLY RECOMMENDED SPARE PART(S).

CERTIFIED BY:
DATE:

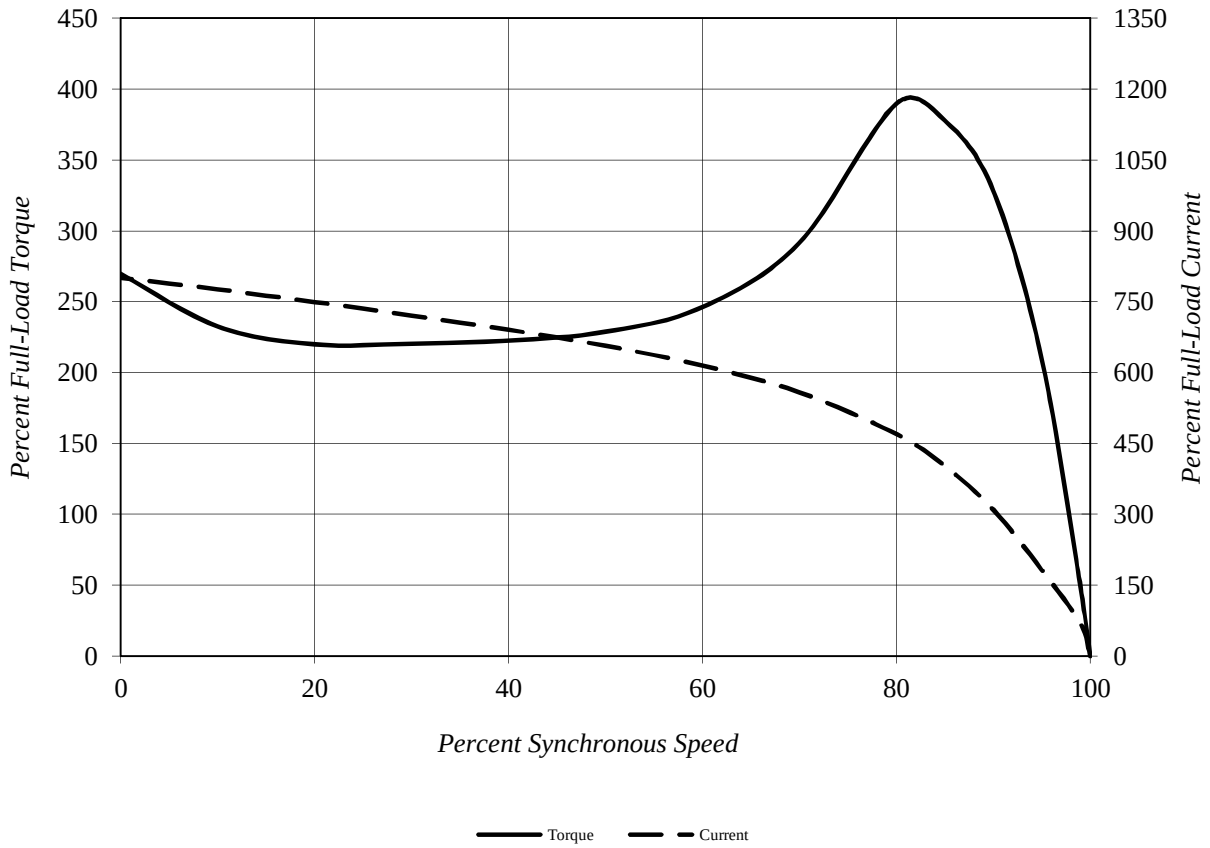
TOSHIBA INTERNATIONAL CORPORATION

Speed Torque/Current Curve

Model #:	0034SDSR44A-P			***FLAmps:***	4
Enclosure:	TEFC	***Voltage:***	460 V	***Frame:***	182TC
Pole:	4	***Frequency:***	3 PH / 60 Hz	***Ins. Class:***	F
HP:	3	***Rotor Inertia:***	0.37 lb-ft²	***Date:***	22-Aug-2011
FLRPM:	1760	***Load Inertia:***	N/A	***File:***	KH4003

Locked Rotor Amps:	32	***Load Type:***	N/A
Locked Rotor Torque:	270%	***Starting at:***	N/A
Breakdown Torque:	390%	***Accel. Time:***	N/A
Rated Torque:	9 lb-ft		

Design Values



Comments: _____

D.E.Curve #: _____

Prepared by: Van Truong	Checked by:

TOSHIBA Reliability in Motion

TOSHIBA INTERNATIONAL CORPORATION
INDUSTRIAL DIVISION
PO BOX 40906
HOUSTON TX 77240 (800) 231-1412
(713) 466-0277 FAX (713) 466-8773

SPARE PARTS (RECOMMENDED)

OTHER THAN THE GREASE USED FOR RE-GREASABLE BEARINGS, TOSHIBA ADVISES THAT THERE ARE NO "USE" PARTS. THE ONLY INSURANCE SPARES THAT TOSHIBA SUGGESTS FOR THESE SQUIRREL CAGE INDUCTION MOTORS ARE INDUSTRY STANDARD, AND COMMERCIALLY AVAILABLE ANTI-FRICTION BEARINGS, AS NOTED BELOW.

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(NOTE: OUR INTERNAL PART NUMBERS ARE SUBJECT TO CHANGE WITHOUT NOTICE, AND ARE NOT PUBLISHED).

PLEASE ADVISE IF YOU HAVE ANY QUESTIONS.

CUSTOMER:
PURCHASE ORDER #
Customer Tag:

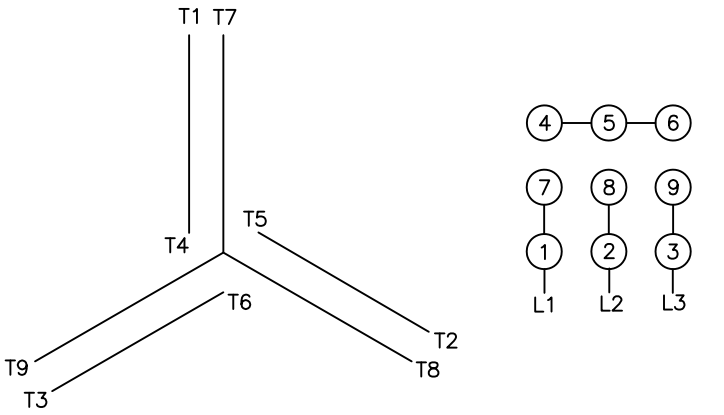
TOSHIBA FILE #
MODEL # **0034SDSR44A-P**
HP / RPM / ENCL / FRAME: **3** / **1800** / **TEFC** / **182TC**
DRIVE END BEARING: **6306ZZC3**
OPPOSITE DRIVE END BEARING: **6306ZZC3**

Prepared By:
Date:

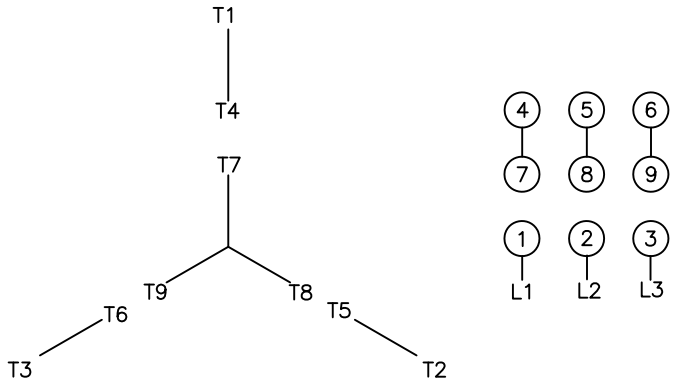
Motor Connection Diagrams
9 Leads

Across-the-Line Starting / Running Connections

Low Voltage Wye



High Voltage Wye



Switch L1 and L2 to reverse rotation

By: R. Murillo	Date: 4/9/08	Checked: MDC	Date: 5/17/11	Revision 0

SECTION 6.

INSTALLATION, OPERATION, AND MAINTENANCE FOR CONTROL

Tel +1 (717) 767-6511
Fax +1 (717) 764-0839
www.redlion.net

Bulletin No. PAX-L
Drawing No. LP0545
Released 08/12

MODEL PAX – 1/8 DIN ANALOG INPUT PANEL METERS

c UL US LISTED
IND. CONT. EQ.
51EB

CE

- *PROCESS, VOLTAGE, CURRENT, TEMPERATURE, AND STRAIN GAGE INPUTS*
- *5-DIGIT 0.56" RED SUNLIGHT READABLE DISPLAY*
- *VARIABLE INTENSITY DISPLAY*
- *16 POINT SCALING FOR NON-LINEAR PROCESSES*
- *PROGRAMMABLE FUNCTION KEYS/USER INPUTS*
- *9 DIGIT TOTALIZER (INTEGRATOR) WITH BATCHING*
- *OPTIONAL CUSTOM UNITS OVERLAY W/BACKLIGHT*
- *FOUR SETPOINT ALARM OUTPUTS (W/OPTION CARD)*
- *COMMUNICATION AND BUS CAPABILITIES (W/OPTION CARD)*
- *RETRANSMITTED ANALOG OUTPUT (W/OPTION CARD)*
- *CRIMSON® PROGRAMMING SOFTWARE*
- *NEMA 4X/IP65 SEALED FRONT BEZEL*

GENERAL DESCRIPTION

The PAX® Analog Panel Meters offer many features and performance capabilities to suit a wide range of industrial applications. Available in five different models to handle various analog inputs, including DC Voltage/Current, AC Voltage/Current, Process, Temperature, and Strain Gage Inputs. Refer to pages 4 through 6 for the details on the specific models. The optional plug-in output cards allow the opportunity to configure the meter for present applications, while providing easy upgrades for future needs.

The meters employ a bright 0.56" LED display. The unit is available with a red sunlight readable or a standard green LED. The intensity of display can be adjusted from dark room applications up to sunlight readable, making it ideal for viewing in bright light applications.

The meters provide a MAX and MIN reading memory with programmable capture time. The capture time is used to prevent detection of false max or min readings which may occur during start-up or unusual process events.

The signal totalizer (integrator) can be used to compute a time-input product. This can be used to provide a readout of totalized flow, calculate service intervals of motors or pumps, etc. The totalizer can also accumulate batch weighing operations.

The meters have four setpoint outputs, implemented on Plug-in option cards. The Plug-in cards provide dual FORM-C relays (5A), quad FORM-A (3A), or either quad sinking or quad sourcing open collector logic outputs. The setpoint alarms can be configured to suit a variety of control and alarm requirements.

Communication and Bus Capabilities are also available as option cards. These include RS232, RS485, Modbus, DeviceNet, and Profibus-DP. Readout values and setpoint alarm values can be controlled through the bus. Additionally, the meters have a feature that allows a remote computer to directly control the outputs of the meter. With an RS232 or RS485 card installed, it is possible to configure the meter using a Windows® based program. The configuration data can be saved to a file for later recall.

A linear DC output signal is available as an optional Plug-in card. The card provides either 20 mA or 10 V signals. The output can be scaled independent of the input range and can track either the input, totalizer, max or min readings.

Once the meters have been initially configured, the parameter list may be locked out from further modification in its entirety or only the setpoint values can be made accessible.

The meters have been specifically designed for harsh industrial environments. With NEMA 4X/IP65 sealed bezel and extensive testing of noise effects to CE requirements, the meter provides a tough yet reliable application solution.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in this literature or on equipment must be observed to ensure personal safety and to prevent damage to either the instrument or equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Do not use this unit to directly command motors, valves, or other actuators not equipped with safeguards. To do so can be potentially harmful to persons or equipment in the event of a fault to the unit.

CAUTION: Risk of Danger
Read complete instructions prior to installation and operation of the unit.

CAUTION: Risk of electric shock.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.1" (53.4) H x 5.0" (127) W.

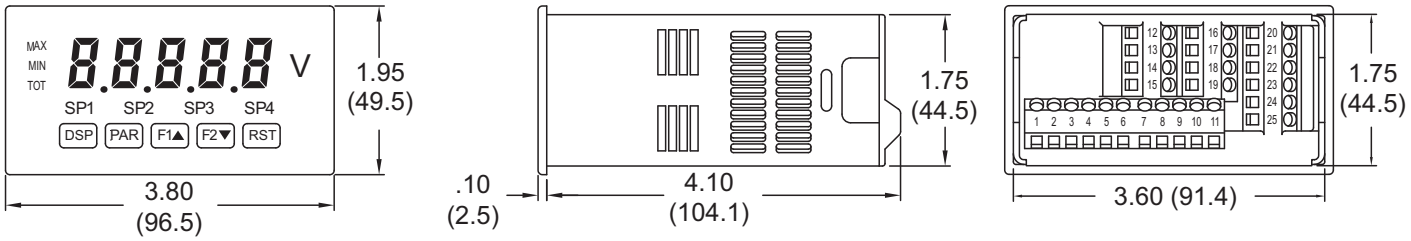
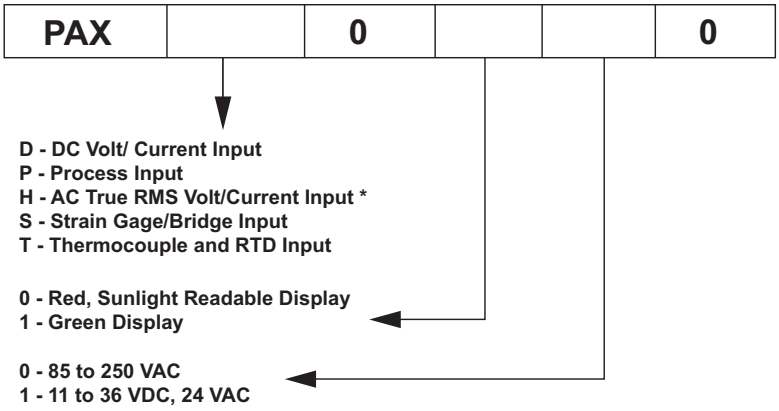


TABLE OF CONTENTS

ORDERING INFORMATION

Meter Part Numbers



*** PAXH is only available with 85-250 VAC power supply.**

Option Card and Accessories Part Numbers

TYPE	MODEL NO.	DESCRIPTION	PART NUMBER
Optional Plug-In Cards	PAXCDS	Dual Setpoint Relay Output Card	PAXCDS10
		Quad Setpoint Relay Output Card	PAXCDS20
		Quad Setpoint Sinking Open Collector Output Card	PAXCDS30
		Quad Setpoint Sourcing Open Collector Output Card	PAXCDS40
	PAXCDC	RS485 Serial Communications Card with Terminal Block	PAXCDC10
		Extended RS485 Serial Communications Card with Dual RJ11 Connector	PAXCDC1C
		RS232 Serial Communications Card with Terminal Block	PAXCDC20
		Extended RS232 Serial Communications Card with 9 Pin D Connector	PAXCDC2C
		DeviceNet Communications Card	PAXCDC30
		Modbus Communications Card	PAXCDC40
		Extended Modbus Communications Card with Dual RJ11 Connector	PAXCDC4C
		Profibus-DP Communications Card	PAXCDC50
	PAXCDL	Analog Output Card	PAXCDL10
	PAXUSB	PAX USB Programming Card (Not included in PAX product UL E179259 file)	PAXUSB00
Accessories	CBLUSB	USB Programming Cable Type A-Mini B	CBLUSB01
	ICM8	Ethernet Gateway	ICM80000
	PAXLBK	Units Label Kit Accessory (Not required for PAXT)	PAXLBK10
	SFCRD *	Crimson PC Configuration Software for Windows 98, ME, 2000 and XP	SFCRD200

* Crimson® software is available for free download from http://www.redlion.net/

GENERAL METER SPECIFICATIONS

1. **DISPLAY**: 5 digit, 0.56" (14.2 mm) red sunlight readable or standard green LEDs, (-19999 to 99999)
2. **POWER**:
   AC Versions:
   AC Power: 85 to 250 VAC, 50/60 Hz, 15 VA
   Isolation: 2300 Vrms for 1 min. to all inputs and outputs.
   DC Versions (Not available on PAXH):
   DC Power: 11 to 36 VDC, 11 W
   (derate operating temperature to 40° C if operating <15 VDC and three plug-in option cards are installed)
   AC Power: 24 VAC, ± 10%, 50/60 Hz, 15 VA
   Isolation: 500 Vrms for 1 min. to all inputs and outputs (50 V working).
3. **ANNUNCIATORS**:
   MAX - maximum readout selected
   MIN - minimum readout selected
   TOT - totalizer readout selected, flashes when total overflows
   SP1 - setpoint alarm 1 is active
   SP2 - setpoint alarm 2 is active
   SP3 - setpoint alarm 3 is active
   SP4 - setpoint alarm 4 is active
   Units Label - optional units label backlight
4. **KEYPAD**: 3 programmable function keys, 5 keys total
5. **A/D CONVERTER**: 16 bit resolution
6. **UPDATE RATES**:
   A/D conversion rate: 20 readings/sec.
   Step response: 200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)
   700 msec. max. (digital filter disabled, internal zero correction enabled)
   PAXH Only: 1 sec max. to within 99% of final readout value (digital filter disabled)
   Display update rate: 1 to 20 updates/sec.
   Setpoint output on/off delay time: 0 to 3275 sec.
   Analog output update rate: 0 to 10 sec
   Max./Min. capture delay time: 0 to 3275 sec.
7. **DISPLAY MESSAGES**:
   "OLOL" - Appears when measurement exceeds + signal range.
   "ULUL" - Appears when measurement exceeds - signal range
   PAXT: "SHrt" - Appears when shorted sensor is detected. (RTD only)
   PAXT: "OPEN" - Appears when open sensor is detected.
   ". . . ." - Appears when display values exceed + display range.
   "- . . ." - Appears when display values exceed - display range.
   "E . . ." - Appears when Totalizer exceeds 9 digits.
   "h . . ." - Denotes the high order display of the Totalizer.
8. **INPUT CAPABILITIES**: See specific product specifications, pages 4-6
9. **EXCITATION POWER**: See specific product specifications, pages 4-6
10. **LOW FREQUENCY NOISE REJECTION**: (Does not apply to PAXH)
    Normal Mode: > 60 dB @ 50 or 60 Hz ±1%, digital filter off
    Common Mode: >100 dB, DC to 120 Hz
11. **USER INPUTS**: Three programmable user inputs
    Max. Continuous Input: 30 VDC
    Isolation To Sensor Input Common: Not isolated. (Not PAXH)
    PAXH: Isolation to Sensor Input Common: 1400 Vrms for 1 min.
    Working Voltage: 125 V
    Response Time: 50 msec. max.
    Logic State: Jumper selectable for sink/source logic

INPUT STATE	SINKING INPUTS 22 KΩ pull-up to +5 V	SOURCING INPUTS 22 KΩ pull-down
Active	V_{IN} < 0.9 VDC	V_{IN} > 3.6 VDC
Inactive	V_{IN} > 3.6 VDC	V_{IN} < 0.9 VDC

12. **TOTALIZER**:
    Function:
    Time Base: second, minute, hour, or day
    Batch: Can accumulate (gate) input display from a user input
    Time Accuracy: 0.01% typical
    Decimal Point: 0 to 0.0000
    Scale Factor: 0.001 to 65.000
    Low Signal Cut-out: -19,999 to 99,999
    Total: 9 digits, display alternates between high order and low order readouts
13. **CUSTOM LINEARIZATION**:
    Data Point Pairs: Selectable from 2 to 16
    Display Range: -19,999 to 99,999
    Decimal Point: 0 to 0.0000
    PAXT: Ice Point Compensation: user value (0.00 to 650.00 µV/°C)
14. **MEMORY**: Nonvolatile E^2PROM retains all programmable parameters and display values.
15. **ENVIRONMENTAL CONDITIONS**:
    Operating Temperature Range: 0 to 50°C (0 to 45°C with all three plug-in cards installed)
    Vibration According to IEC 68-2-6: Operational 5 to 150 Hz, in X, Y, Z direction for 1.5 hours, 2 g.
    Shock According to IEC 68-2-27: Operational 25 g (10 g relay), 11 msec in 3 directions.
    Storage Temperature Range: -40 to 60°C
    Operating and Storage Humidity: 0 to 85% max. RH non-condensing
    Altitude: Up to 2000 meters
16. **CERTIFICATIONS AND COMPLIANCES**:
    SAFETY
    UL Recognized Component, File #E179259, UL61010A-1, CSA C22.2 No. 61010-1
    PAXT Only: File # E156876, UL873, CSA C22.2 No. 24
    Recognized to U.S. and Canadian requirements under the Component Recognition Program of Underwriters Laboratories, Inc.
    UL Listed, File # E137808, UL508, CSA C22.2 No. 14-M95
    LISTED by Und. Lab. Inc. to U.S. and Canadian safety standards
    Type 4X Enclosure rating (Face only), UL50
    IECEE CB Scheme Test Report #04ME11209-20041018
    Issued by Underwriters Laboratories, Inc.
    IEC 61010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part I
    IP65 Enclosure rating (Face only), IEC 529
    IP20 Enclosure rating (Rear of unit), IEC 529
    ELECTROMAGNETIC COMPATIBILITY
    Emissions and Immunity to EN 61326:2006: Electrical Equipment for Measurement, Control and Laboratory use.
    Immunity to Industrial Locations:

Electrostatic discharge	EN 61000-4-2	Criterion A 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A[4] 10 V/m (80 MHz to 1 GHz) 3 V/m (1.4 GHz to 2 GHz) 1 V/m (2 GHz to 2.7 GHz)
Fast transients (burst)	EN 61000-4-4	Criterion B 2 kV power 1 kV I/O signal 2 kV I/O signal connected to power
Surge	EN 61000-4-5 power signal	Criterion A 1 kV L to L, 2 kV L to G 1 kV
RF conducted interference	EN 61000-4-6	Criterion A 3 Vrms
Power freq magnetic fields	EN 61000-4-8	Criterion A 30 A/m
AC power	EN 61000-4-11	
Voltage dip		Criterion A 0% during 1 cycle 40% during 10/12 cycle 70% during 25/30 cycle
Short interruptions		Criterion C 0% during 250/300 cycles

    Emissions:

Emissions	EN 55011	Class A

Notes:
1. Criterion A: Normal operation within specified limits.
2. Criterion B: Temporary loss of performance from which the unit self-recovers.
3. Criterion C: Temporary loss of function where system reset occurs.
4. Self-recoverable loss of performance during EMI disturbance at 10 V/m:
   Measurement input and/or analog output signal may deviate during EMI disturbance.
   For operation without loss of performance:
   Unit is mounted in a metal enclosure (Buckeye SM7013-0 or equivalent)
   I/O and power cables are routed in metal conduit connected to earth ground.
   Refer to EMC Installation Guidelines section of the bulletin for additional information.

17. **CONNECTIONS**: High compression cage-clamp terminal block
    Wire Strip Length: 0.3" (7.5 mm)
    Wire Gage: 30-14 AWG copper wire
    Torque: 4.5 inch-lbs (0.51 N-m) max.
18. **CONSTRUCTION**: This unit is rated for NEMA 4X/IP65 outdoor use. IP20 Touch safe. Installation Category II, Pollution Degree 2. One piece bezel/case. Flame resistant. Synthetic rubber keypad. Panel gasket and mounting clip included.
19. **WEIGHT**: 10.4 oz. (295 g)

MODEL PAXD - UNIVERSAL DC INPUT

- *FOUR VOLTAGE RANGES (300 VDC Max)*
- *FIVE CURRENT RANGES (2A DC Max)*
- *THREE RESISTANCE RANGES (10K Ohm Max)*
- *SELECTABLE 24 V, 2 V, 1.75 mA EXCITATION*

PAXD SPECIFICATIONS

INPUT RANGES:

INPUT RANGE	ACCURACY* (18 to 28°C)	ACCURACY* (0 to 50°C)	IMPEDANCE/ COMPLIANCE	MAX CONTINUOUS OVERLOAD	RESOLUTION
±200 μADC	0.03% of reading +0.03 μA	0.12% of reading +0.04μA	1.11 Kohm	15 mA	10 nA
±2 mADC	0.03% of reading +0.3 μA	0.12% of reading +0.4 μA	111 ohm	50 mA	0.1 μA
±20 mADC	0.03% of reading +3μA	0.12% of reading +4 μA	11.1 ohm	150 mA	1 μA
±200 mADC	0.05% of reading +30 μA	0.15% of reading +40 μA	1.1 ohm	500 mA	10 μA
±2 ADC	0.5% of reading +0.3 mA	0.7% of reading +0.4 mA	0.1 ohm	3 A	0.1 mA
±200 mVDC	0.03% of reading +30 μV	0.12% of reading +40 μV	1.066 Mohm	100 V	10 μV
±2 VDC	0.03% of reading +0.3 mV	0.12% of reading +0.4 mV	1.066 Mohm	300 V	0.1 mV
±20 VDC	0.03% of reading +3 mV	0.12% of reading +4 mV	1.066 Mohm	300 V	1 mV
±300 VDC	0.05% of reading +30 mV	0.15% of reading +40 mV	1.066 Mohm	300 V	10 mV
100 ohm	0.05% of reading +0.03 ohm	0.2% of reading +0.04 ohm	0.175 V	30 V	0.01 ohm
1000 ohm	0.05% of reading +0.3 ohm	0.2% of reading +0.4 ohm	1.75 V	30 V	0.1 ohm
10 Kohm	0.05% of reading +1 ohm	0.2% of reading +1.5 ohm	17.5 V	30 V	1 ohm

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

EXCITATION POWER:

Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.
Reference Voltage: 2 VDC, ± 2%
Compliance: 1 kohm load min. (2 mA max.)
Temperature coefficient: 40 ppm/°C max.
Reference Current: 1.75 mADC, ± 2%
Compliance: 10 kohm load max.
Temperature coefficient: 40 ppm/°C max.

MODEL PAXP - PROCESS INPUT

- *DUAL RANGE INPUT (20 mA or 10 VDC)*
- *24 VDC TRANSMITTER POWER*

PAXP SPECIFICATIONS

SENSOR INPUTS:

INPUT (RANGE)	ACCURACY* (18 to 28°C)	ACCURACY* (0 to 50°C)	IMPEDANCE/ COMPLIANCE	MAX CONTINUOUS OVERLOAD	DISPLAY RESOLUTION
20 mA (-2 to 26 mA)	0.03% of reading +2 μA	0.12% of reading +3 μA	20 ohm	150 mA	1 μA
10 VDC (-1 to 13 VDC)	0.03% of reading +2 mV	0.12% of reading +3 mV	500 Kohm	300 V	1 mV

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28°C and 10 to 75% RH environment; and accuracy over a 0 to 50°C and 0 to 85%RH (non-condensing environment). Accuracy over the 0 to 50°C range includes the temperature coefficient effect of the meter.

EXCITATION POWER:

Transmitter Power: 24 VDC, ±5%, regulated, 50 mA max.

MODEL PAXH - AC TRUE RMS VOLT AND CURRENT

- *FOUR VOLTAGE RANGES (300 VAC Max)*
- *FIVE CURRENT RANGES (5 A Max)*
- *ACCEPTS AC OR DC COUPLED INPUTS*
- *THREE WAY ISOLATION: POWER, INPUT AND OUTPUTS*

PAXH SPECIFICATIONS

INPUT RANGES:

Isolation To Option Card Commons and User Input Commons: 125 Vrms
Isolation To AC Power Terminals: 250 Vrms

INPUT RANGE	ACCURACY*	IMPEDANCE (60 Hz)	MAX CONTINUOUS OVERLOAD	MAX DC BLOCKING	RESOLUTION
200 mV	0.1% of reading +0.4 mV	686 Kohm	30 V	±10 V	0.01 mV
2 V	0.1% of reading +2 mV	686 Kohm	30 V	±50 V	0.1 mV
20 V	0.1% of reading +20 mV	686 Kohm	300 V	±300 V	1 mV
300 V	0.2% of reading +0.3 V	686 Kohm	300 V	±300 V***	0.1 V
200 μA	0.1% of reading +0.4 μA	1.11 Kohm	15 mA	±15 mA	0.01 μA
2 mA	0.1% of reading +2 μA	111 ohm	50 mA	±50 mA	0.1 μA
20 mA	0.1% of reading +20 μA	11.1 ohm	150 mA	±150 mA	1 μA
200 mA	0.1% of reading +0.2 mA	1.1 ohm	500 mA	±500 mA	10 μA
5 A	0.5% of reading +5 mA	0.02 ohm	7 A**	±7 A***	1 mA

*Conditions for accuracy specification:
- 20 minutes warmup
- 18-28°C temperature range, 10-75% RH non-condensing
- 50 Hz - 400 Hz sine wave input with 1.414 crest factor
- 1% to 100% of range

For conditions outside the above listed:
Temperature from 0-18 and 28-50°C: Add 0.1% reading + 20 counts error
Crest factors:
1-3: Add 0.2% reading + 10 counts error
3-5: Add 1% reading
DC component: Add 0.5% reading + 10 counts
20-50 Hz and 400-10 KHz: Add 1% reading + 20 counts error

** Non-repetitive surge rating: 15 A for 5 seconds

*** Inputs are direct coupled to the input divider and shunts. Input signals with high DC component levels may reduce the usable range.

MAX CREST FACTOR (Vp/VRMS): 5 @ Full Scale Input
INPUT COUPLING: AC or AC and DC
INPUT CAPACITANCE: 10 pF
COMMON MODE VOLTAGE: 125 VAC working
COMMON MODE REJECTION: (DC to 60 Hz) 100 dB

MODEL PAXS - STRAIN GAGE INPUT

- *LOAD CELL, PRESSURE AND TORQUE BRIDGE INPUTS*
- *DUAL RANGE INPUT: ±24 mV OR ±240 mV*
- *SELECTABLE 5 VDC OR 10 VDC BRIDGE EXCITATION*
- *PROGRAMMABLE AUTO-ZERO TRACKING*

PAXS SPECIFICATIONS

SENSOR INPUTS:

INPUT RANGE	ACCURACY* (18 to 28 °C)	ACCURACY* (0 to 50 °C)	IMPEDANCE	MAX CONTINUOUS OVERLOAD	RESOLUTION
±24 mVDC	0.02% of reading +3 μV	0.07% of reading +4 μV	100 Mohm	30 V	1 μV
±240 mVDC	0.02% of reading +30 μV	0.07% of reading +40 μV	100 Mohm	30 V	10 μV

* After 20 minute warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28 °C and 10 to 75% RH environment; and accuracy over a 0 to 50 °C and 0 to 85% RH (non-condensing environment). Accuracy over the 0 to 50 °C range includes the temperature coefficient effect of the meter.

CONNECTION TYPE: 4-wire bridge (differential)
2-wire (single-ended)
COMMON MODE RANGE (w.r.t. input common): 0 to +5 VDC
Rejection: 80 dB (DC to 120 Hz)
BRIDGE EXCITATION :
Jumper Selectable: 5 VDC @ 65 mA max., ±2%
10 VDC @ 125 mA max., ±2%
Temperature coefficient (ratio metric): 20 ppm/°C max.

MODEL PAXT - THERMOCOUPLE AND RTD INPUT

- *THERMOCOUPLE AND RTD INPUTS*
- *CONFORMS TO ITS-90 STANDARDS*
- *CUSTOM SCALING FOR NON-STANDARD PROBES*
- *TIME-TEMPERATURE INTEGRATOR*

PAXT SPECIFICATIONS

READOUT:
Resolution: Variable: 0.1, 0.2, 0.5, or 1, 2, or 5 degrees
Scale: F or C
Offset Range: -19,999 to 99,999 display units

THERMOCOUPLE INPUTS:
Input Impedance: 20 MΩ
Lead Resistance Effect: 0.03μV/ohm
Max. Continuous Overvoltage: 30 V

INPUT TYPE	RANGE	ACCURACY* (18 to 28 °C)	ACCURACY* (0 to 50 °C)	STANDARD	WIRE COLOR	
					ANSI	BS 1843
T	-200 to 400°C -270 to -200°C	1.2°C **	2.1°C	ITS-90	(+) blue (-) red	(+) white (-) blue
E	-200 to 871°C -270 to -200°C	1.0°C **	2.4°C	ITS-90	(+) purple (-) red	(+) brown (-) blue
J	-200 to 760°C	1.1°C	2.3°C	ITS-90	(+) white (-) red	(+) yellow (-) blue
K	-200 to 1372°C -270 to -200°C	1.3°C **	3.4°C	ITS-90	(+) yellow (-) red	(+) brown (-) blue
R	-50 to 1768°C	1.9°C	4.0°C	ITS-90	no standard	(+) white (-) blue
S	-50 to 1768°C	1.9°C	4.0°C	ITS-90	no standard	(+) white (-) blue
B	100 to 300°C 300 to 1820°C	3.9°C 2.8°C	5.7°C 4.4°C	ITS-90	no standard	no standard
N	-200 to 1300°C -270 to -200°C	1.3°C **	3.1°C	ITS-90	(+) orange (-) red	(+) orange (-) blue
C (W5/W26)	0 to 2315°C	1.9°C	6.1°C	ASTM E988-90***	no standard	no standard

*After 20 min. warm-up. Accuracy is specified in two ways: Accuracy over an 18 to 28 °C and 15 to 75% RH environment; and Accuracy over a 0 to 50 °C and 0 to 85% RH (non condensing) environment. Accuracy specified over the 0 to 50 °C operating range includes meter tempco and ice point tracking effects. The specification includes the A/D conversion errors, linearization conformity, and thermocouple ice point compensation. Total system accuracy is the sum of meter and probe errors. Accuracy may be improved by field calibrating the meter readout at the temperature of interest.

** The accuracy over the interval -270 to -200 °C is a function of temperature, ranging from 1 °C at -200 °C and degrading to 7 °C at -270 °C. Accuracy may be improved by field calibrating the meter readout at the temperature of interest.

*** These curves have been corrected to ITS-90.

RTD INPUTS:
Type: 3 or 4 wire, 2 wire can be compensated for lead wire resistance
Excitation current: 100 ohm range: 165 μA
10 ohm range: 2.6 mA
Lead resistance: 100 ohm range: 10 ohm/lead max.
10 ohm range: 3 ohms/lead max.
Max. continuous overload: 30 V

INPUT TYPE	RANGE	ACCURACY* (18 to 28 °C)	ACCURACY* (0 to 50 °C)	STANDARD ***
100 ohm Pt alpha = .00385	-200 to 850°C	0.4°C	1.6°C	IEC 751
100 ohm Pt alpha = .003919	-200 to 850°C	0.4°C	1.6°C	no official standard
120 ohm Nickel alpha = .00672	-80 to 260°C	0.2°C	0.5°C	no official standard
10 ohm Copper alpha = .00427	-100 to 260°C	0.4°C	0.9°C	no official standard

CUSTOM RANGE: Up to 16 data point pairs
Input range: -10 to 65 mV
0 to 400 ohms, high range
0 to 25 ohms, low range
Display range: -19999 to 99999

INPUT TYPE	RANGE	ACCURACY* (18 to 28 °C)	ACCURACY* (0 to 50 °C)
Custom mV range	-10 to 65mV (1 μV res.)	0.02% of reading + 4μV	0.12% of reading + 5μV
Custom 100 ohm range	0 to 400 Ω (10 MΩ res.)	0.02% of reading + 0.04 Ω	0.12% of reading + 0.05 Ω
Custom 10 ohm range	0 to 25 Ω (1 MΩ res.)	0.04% of reading + 0.005 Ω	0.20% of reading + 0.007 Ω

ACCESSORIES

UNITS LABEL KIT (PAXLBK) - Not required for PAXT

Each meter has a units indicator with backlighting that can be customized using the Units Label Kit. The backlight is controlled in the programming.

Each PAXT meter is shipped with °F and °C overlay labels which can be installed into the meter's bezel display assembly.

EXTERNAL CURRENT SHUNTS (APSCM)

To measure DC current signals greater than 2 ADC, a shunt must be used. The APSCM010 current shunt converts a maximum 10 ADC signal into 100.0 mV. The APSCM100 current shunt converts a maximum 100 ADC signal into 100.0 mV. The continuous current through the shunt is limited to 115% of the rating.

PROGRAMMING SOFTWARE

The Crimson software is a Windows based program that allows configuration of the PAX meter from a PC. Crimson offers standard drop-down menu commands, that make it easy to program the meter. The meter's program can then be saved in a PC file for future use. A PAX serial plug-in card or PAX USB programming card is required to program the meter using the software. Crimson can be downloaded at www.redlion.net.

OPTIONAL PLUG-IN OUTPUT CARDS

Adding Option Cards

The PAX and MPAX series meters can be fitted with up to three optional plug-in cards. The details for each plug-in card can be reviewed in the specification section below. Only one card from each function type can be installed at one time. The function types include Setpoint Alarms (PAXCDS), Communications (PAXCDC), and Analog Output (PAXCDL). The plug-in cards can be installed initially or at a later date.

PAXH Isolation Specifications For All Option Cards

Isolation To Sensor Commons: 1400 Vrms for 1 min.
Working Voltage: 125 V
Isolation to User Input Commons: 500 Vrms for 1 min.
Working Voltage 50 V

COMMUNICATION CARDS (PAXCDC)

A variety of communication protocols are available for the PAX and MPAX series. Only one of these cards can be installed at a time. When programming the unit via Crimson, a Windows® based program, the RS232, RS485, or USB Cards must be used.

PAXCDC10 - RS485 Serial (Terminal)
PAXCDC1C - RS485 Serial (Connector)
PAXCDC20 - RS232 Serial (Terminal)
PAXCDC2C - RS232 Serial (Connector)
PAXUSB00 - USB (Mini B)
PAXCDC30 - DeviceNet
PAXCDC40 - Modbus (Terminal)
PAXCDC4C - Modbus (Connector)
PAXCDC50 - Profibus-DP

SERIAL COMMUNICATIONS CARD

Type: RS485 or RS232
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Data: 7/8 bits
Baud: 300 to 19,200
Parity: No, Odd or Even
Bus Address: Selectable 0 to 99, Max. 32 meters per line (RS485)
Transmit Delay: Selectable for 2 to 50 msec or 50 to 100 msec (RS485)

DEVICENET™ CARD

Compatibility: Group 2 Server Only, not UCMM capable
Baud Rates: 125 Kbaud, 250 Kbaud, and 500 Kbaud
Bus Interface: Phillips 82C250 or equivalent with MIS wiring protection per DeviceNet™ Volume I Section 10.2.2.
Node Isolation: Bus powered, isolated node
Host Isolation: 500 Vrms for 1 minute (50 V working) between DeviceNet™ and meter input common.

MODBUS CARD

Type: RS485; RTU and ASCII MODBUS modes
Isolation To Sensor & User Input Commons: 500 Vrms for 1 minute. Working Voltage: 50 V. Not isolated from all other commons.
Baud Rates: 300 to 38400.
Data: 7/8 bits
Parity: No, Odd, or Even
Addresses: 1 to 247.
Transmit Delay: Programmable; See Transmit Delay explanation.

PROFIBUS-DP CARD

Fieldbus Type: Profibus-DP as per EN 50170, implemented with Siemens SPC3 ASIC
Conformance: PNO Certified Profibus-DP Slave Device
Baud Rates: Automatic baud rate detection in the range 9.6 Kbaud to 12 Mbaud
Station Address: 0 to 125, set by rotary switches.
Connection: 9-pin Female D-Sub connector
Network Isolation: 500 Vrms for 1 minute (50 V working) between Profibus network and sensor and user input commons. Not isolated from all other commons.

PAXUSB PROGRAMMING CARD

Type: USB Virtual Comms Port
Connection: Type mini B
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Baud Rate: 300 to 19.2k
Unit Address: 0 to 99; only 1 meter can be configured at a time

WARNING: Disconnect all power to the unit before installing Plug-in cards.

SETPOINT CARDS (PAXCDS)

The PAX and MPAX series has 4 available setpoint alarm output plug-in cards. Only one of these cards can be installed at a time. (Logic state of the outputs can be reversed in the programming.) These plug-in cards include:

PAXCDS10 - Dual Relay, FORM-C, Normally open & closed
PAXCDS20 - Quad Relay, FORM-A, Normally open only
PAXCDS30 - Isolated quad sinking NPN open collector
PAXCDS40 - Isolated quad sourcing PNP open collector

DUAL RELAY CARD

Type: Two FORM-C relays
Isolation To Sensor & User Input Commons: 2000 Vrms for 1 min.
Working Voltage: 240 Vrms
Contact Rating:
One Relay Energized: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 HP @120 VAC, inductive load.
Total current with both relays energized not to exceed 5 amps
Life Expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

QUAD RELAY CARD

Type: Four FORM-A relays
Isolation To Sensor & User Input Commons: 2300 Vrms for 1 min.
Working Voltage: 250 Vrms
Contact Rating:
One Relay Energized: 3 amps @ 240 VAC or 30 VDC (resistive load), 1/10 HP @120 VAC, inductive load.
Total current with all four relays energized not to exceed 4 amps
Life Expectancy: 100K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads

QUAD SINKING OPEN COLLECTOR CARD

Type: Four isolated sinking NPN transistors.
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Rating: 100 mA max @ V_{SAT} = 0.7 V max. V_{MAX} = 30 V

QUAD SOURCING OPEN COLLECTOR CARD

Type: Four isolated sourcing PNP transistors.
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Rating: Internal supply: 24 VDC ± 10% , 30 mA max. total
External supply: 30 VDC max., 100 mA max. each output

ALL FOUR SETPOINT CARDS

Response Time: 200 msec. max. to within 99% of final readout value (digital filter and internal zero correction disabled)
700 msec. max. (digital filter disabled, internal zero correction enabled)

LINEAR DC OUTPUT (PAXCDL)

Either a 0(4)-20 mA or 0-10 V retransmitted linear DC output is available from the analog output plug-in card. The programmable output low and high scaling can be based on various display values. Reverse slope output is possible by reversing the scaling point positions.

PAXCDL10 - Retransmitted Analog Output Card

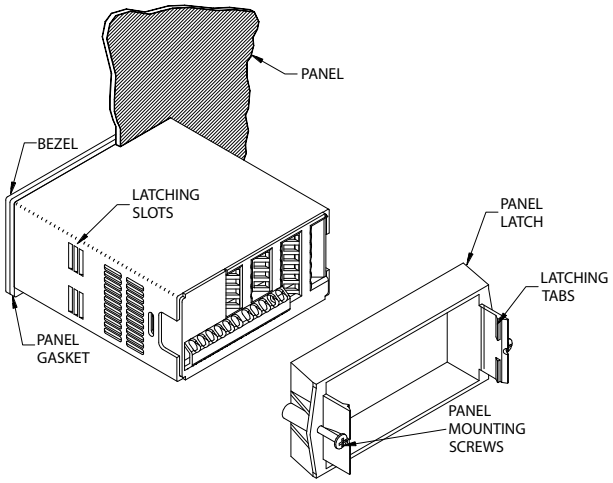
ANALOG OUTPUT CARD

Types: 0 to 20 mA, 4 to 20 mA or 0 to 10 VDC
Isolation To Sensor & User Input Commons: 500 Vrms for 1 min.
Working Voltage: 50 V. Not Isolated from all other commons.
Accuracy: 0.17% of FS (18 to 28 °C); 0.4% of FS (0 to 50 °C)
Resolution: 1/3500
Compliance: 10 VDC: 10 KΩ load min., 20 mA: 500 Ω load max.
Update time: 200 msec. max. to within 99% of final output value (digital filter and internal zero correction disabled)
700 msec. max. (digital filter disabled, internal zero correction enabled)

1.0 Installing the Meter

Installation

The PAX meets NEMA 4X/IP65 requirements when properly installed. The unit is intended to be mounted into an enclosed panel. Prepare the panel cutout to the dimensions shown. Remove the panel latch from the unit. Slide the panel gasket over the rear of the unit to the back of the bezel. The unit should be installed fully assembled. Insert the unit into the panel cutout.



While holding the unit in place, push the panel latch over the rear of the unit so that the tabs of the panel latch engage in the slots on the case. The panel latch should be engaged in the farthest forward slot possible. To achieve a proper seal, tighten the latch screws evenly until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

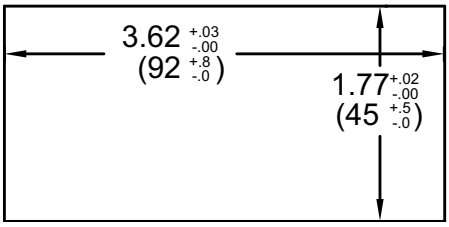
Installation Environment

The unit should be installed in a location that does not exceed the maximum operating temperature and provides good air circulation. Placing the unit near devices that generate excessive heat should be avoided.

The bezel should be cleaned only with a soft cloth and neutral soap product. Do NOT use solvents. Continuous exposure to direct sunlight may accelerate the aging process of the bezel.

Do not use tools of any kind (screwdrivers, pens, pencils, etc.) to operate the keypad of the unit.

PANEL CUT-OUT



2.0 Setting the Jumpers

The meter can have up to four jumpers that must be checked and / or changed prior to applying power. The following Jumper Selection Figures show an enlargement of the jumper area.

To access the jumpers, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower the latch below the case slot (which is located just in front of the finger tabs). It is recommended to release the latch on one side, then start the other side latch.

Input Range Jumper

This jumper is used to select the proper input range. The input range selected in programming must match the jumper setting. Select a range that is high enough to accommodate the maximum input to avoid overloads. The selection is different for each meter. See the Jumper Selection Figure for appropriate meter.

Excitation Output Jumper

If your meter has excitation, this jumper is used to select the excitation range for the application. If excitation is not being used, it is not necessary to check or move this jumper.

User Input Logic Jumper

This jumper selects the logic state of all the user inputs. If the user inputs are not used, it is not necessary to check or move this jumper.

PAXH:

Signal Jumper

This jumper is used to select the signal type. For current signals, the jumper is installed. For voltage signals, remove the jumper from the board. (For 2 V inputs, this removed jumper can be used in the "2 V only" location.)

Couple Jumper

This jumper is used for AC / DC couple. If AC couple, then the jumper is removed from the board. If DC couple is used, then the jumper is installed.

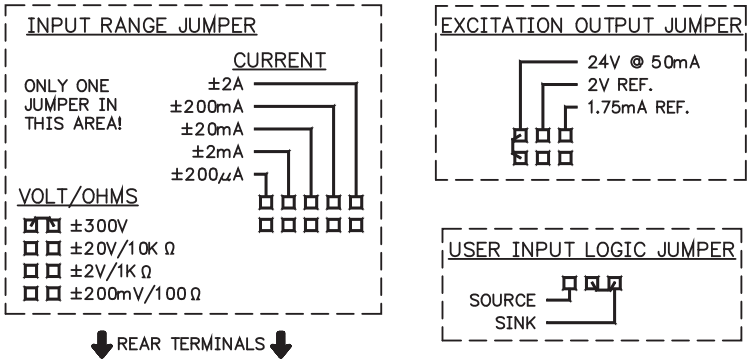
PAXD Jumper Selection

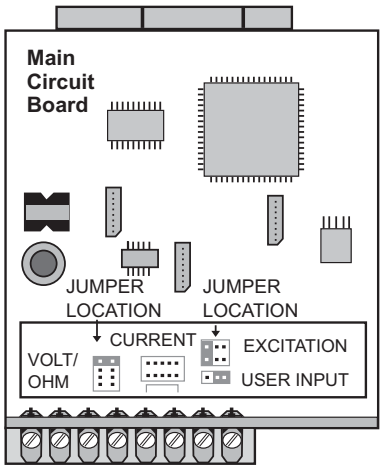
Input Range Jumper

One jumper is used for voltage/ohms or current input ranges. Select the proper input range high enough to avoid input signal overload. Only one jumper is allowed in this area. Do not have a jumper in both the voltage and current ranges at the same time. Avoid placing the jumper across two ranges.

JUMPER SELECTIONS

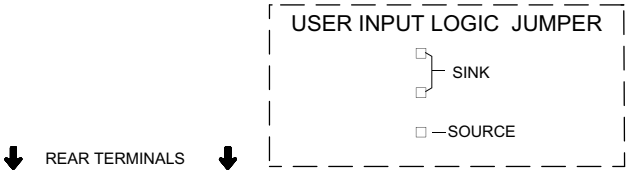
The ⌒ indicates factory setting.

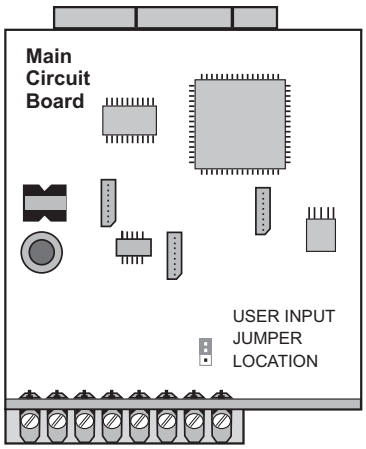




PAXP Jumper Selection

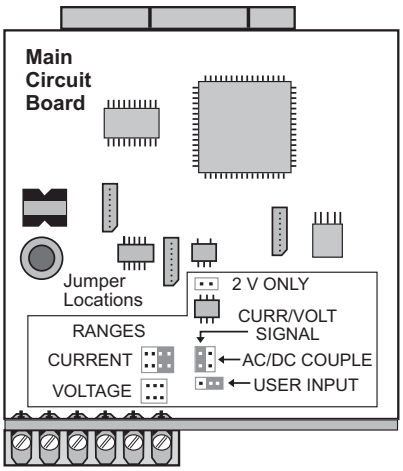
JUMPER SELECTIONS
The ⌒ indicates factory setting.





PAXH Jumper Selection

CAUTION: To maintain the electrical safety of the meter, remove unneeded jumpers completely from the meter. Do not move the jumpers to positions other than those specified.



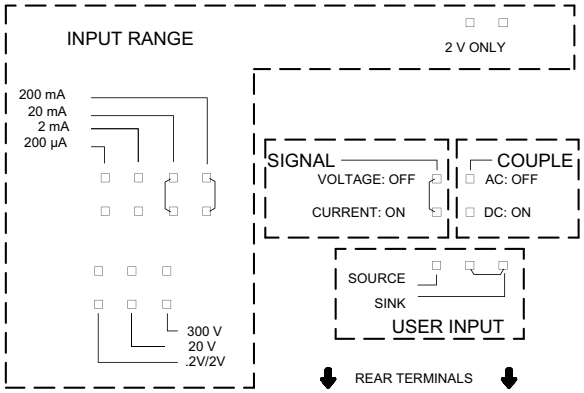
Signal Jumper

One jumper is used for the input signal type. For current signals, the jumper is installed. For voltage signals, remove the jumper from the board. (For 2 V inputs, this removed jumper can be used in the "2 V only" location.)

Couple Jumper

One jumper is used for AC / DC couple. If AC couple is used, then the jumper is removed from the board. If DC couple is used, then the jumper is installed.

JUMPER SELECTIONS
The ⌒ indicates factory setting.



Input Range Jumper

For most inputs, one jumper is used to select the input range. However, for the following ranges, set the jumpers as stated:

5 A: Remove all jumpers from the input range.

2 V: Install one jumper in ".2/2V" position and one jumper in "2 V only".

All Other Ranges: One jumper in the selected range only.

Do not have a jumper in both the voltage and current ranges at the same time. Avoid placing a jumper across two ranges.

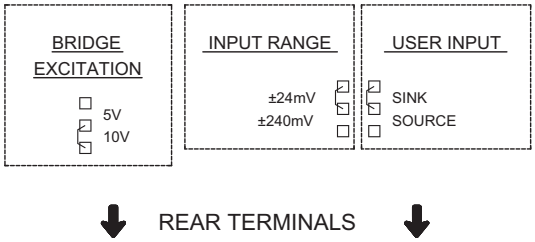
PAXS Jumper Selection

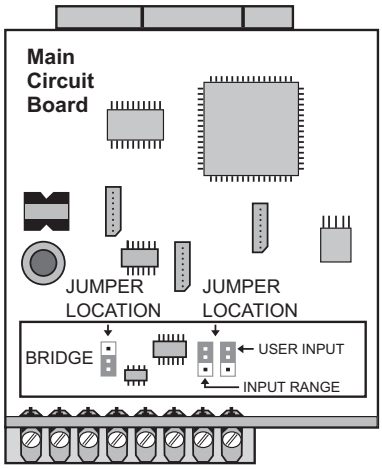
Bridge Excitation

One jumper is used to select bridge excitation to allow use of the higher sensitivity 24 mV input range. Use the 5 V excitation with high output (3 mV/V) bridges. The 5 V excitation also reduces bridge power compared to 10 V excitation.

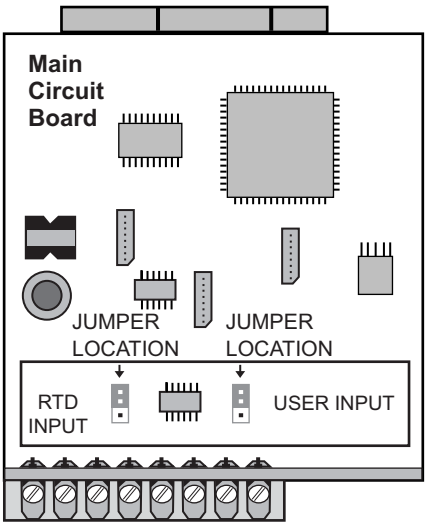
A maximum of four 350 ohm load cells can be driven by the internal bridge excitation voltage.

JUMPER SELECTIONS
The ⌒ indicates factory setting.





PAXT Jumper Selection

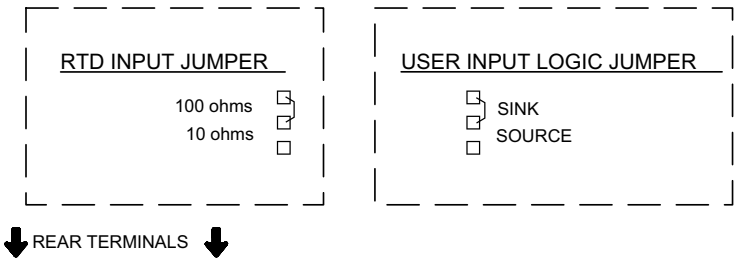


RTD Input Jumper

One jumper is used for RTD input ranges. Select the proper range to match the RTD probe being used. It is not necessary to remove this jumper when not using RTD probes.

JUMPER SELECTIONS

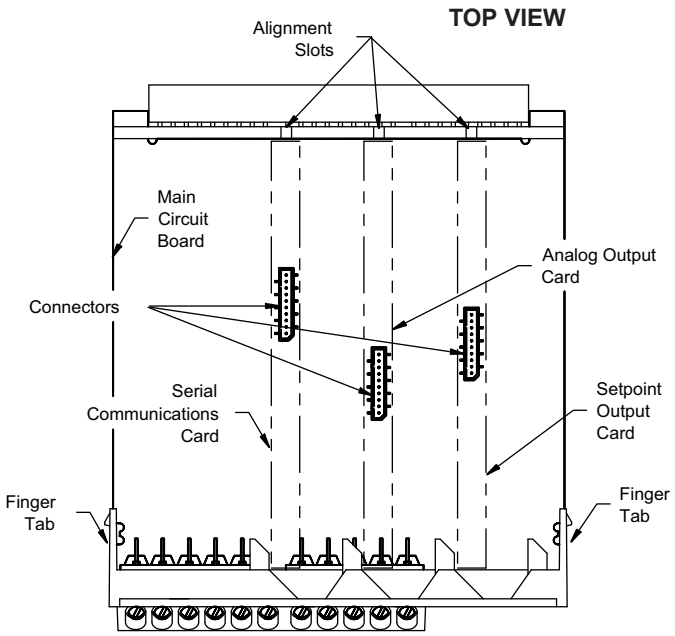
The ◠ indicates factory setting.



3.0 Installing Plug-In Cards

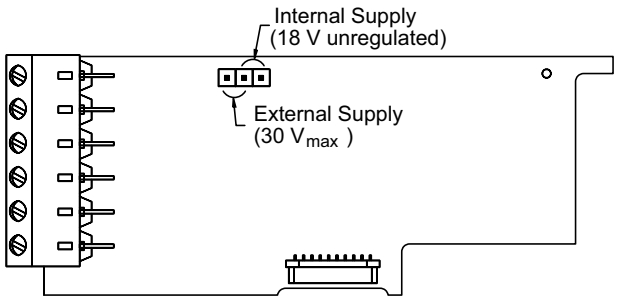
The plug-in cards are separately purchased optional cards that perform specific functions. These cards plug into the main circuit board of the meter. The plug-in cards have many unique functions when used with the PAX.

CAUTION: The plug-in card and main circuit board contain static sensitive components. Before handling the cards, discharge static charges from your body by touching a grounded bare metal object. Ideally, handle the cards at a static controlled clean workstation. Also, only handle the cards by the edges. Dirt, oil or other contaminants that may contact the cards can adversely affect circuit operation.



To Install:

1. With the meter removed from the case, locate the plug-in card connector for the card type to be installed. The types are keyed by position with different main circuit board connector locations. When installing the card, hold the meter by the rear terminals and not by the front display board.
   If installing the Quad sourcing Plug-in Card (PAXCDS40), set the jumper for internal or external supply operation before continuing.



2. Install the plug-in card by aligning the card terminals with the slot bay in the rear cover. Be sure the connector is fully engaged and the tab on the plug-in card rests in the alignment slot on the display board.
3. Slide the meter base back into the case. Be sure the rear cover latches fully into the case.
4. Apply the plug-in card label to the bottom side of the meter in the designated area. Do Not Cover the vents on the top surface of the meter. The surface of the case must be clean for the label to adhere properly.

4.0 WIRING THE METER

WIRING OVERVIEW

Electrical connections are made via screw-clamp terminals located on the back of the meter. All conductors should conform to the meter's voltage and current ratings. All cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the meter (DC or AC) be protected by a fuse or circuit breaker.

When wiring the meter, compare the numbers embossed on the back of the meter case against those shown in wiring drawings for proper wire position. Strip the wire, leaving approximately 0.3" (7.5 mm) bare lead exposed (stranded wires should be tinned with solder). Insert the lead under the correct screw-clamp terminal and tighten until the wire is secure. (Pull wire to verify tightness.) Each terminal can accept up to one #14 AWG (2.55 mm) wire, two #18 AWG (1.02 mm), or four #20 AWG (0.61 mm).

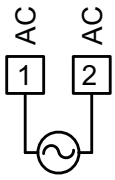
EMC INSTALLATION GUIDELINES

Although this meter is designed with a high degree of immunity to Electro-Magnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, its source or the method of coupling into the unit may be different for various installations.Listed below are some EMC guidelines for successful installation in an industrial environment.

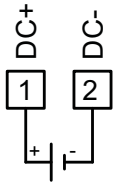
1. The meter should be mounted in a metal enclosure, which is properly connected to protective earth.
2. With use of the lower input ranges or signal sources with high source impedance, the use of shielded cable may be necessary. This helps to guard against stray AC pick-up. Attach the shield to the input common of the meter. Line voltage monitoring and 5A CT applications do not usually require shielding.
3. To minimize potential noise problems, power the meter from the same power branch, or at least the same phase voltage as that of the signal source.
4. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
5. Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
6. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:
   Ferrite Suppression Cores for signal and control cables:
   Fair-Rite # 0443167251 (RLC #FCOR0000)
   TDK # ZCAT3035-1330A
   Steward #28B2029-0A0
   Line Filters for input power cables:
   Schaffner # FN610-1/07 (RLC #LFIL0000)
   Schaffner # FN670-1.8/07
   Corcom #1VR3
   Note: Reference manufacturer's instructions when installing a line filter.
7. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.
8. Switching of inductive loads produces high EMI. Use of snubbers across inductive loads suppresses EMI.
   Snubber: RLC#SNUB0000.

4.1 POWER WIRING

AC Power
Terminal 1: VAC
Terminal 2: VAC



DC Power
Terminal 1: +VDC
Terminal 2: -VDC

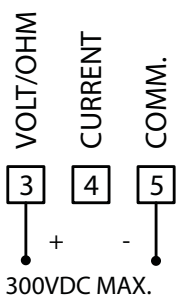


4.2 INPUT SIGNAL WIRING

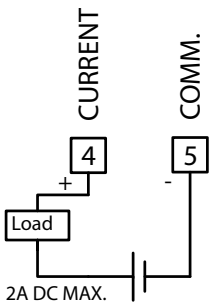
PAXD INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper and Excitation Jumper should be verified for proper position.

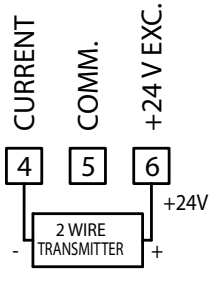
Voltage Signal (self powered)
Terminal 3: +VDC
Terminal 5: -VDC



Current Signal (self powered)
Terminal 4: +ADC
Terminal 5: -ADC

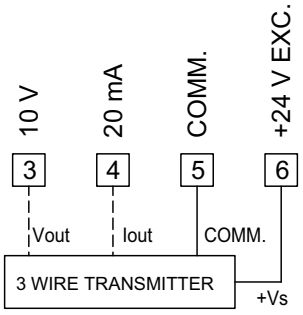


Current Signal (2 wire requiring excitation)
Terminal 4: -ADC
Terminal 6: +ADC
Excitation Jumper: 24 V



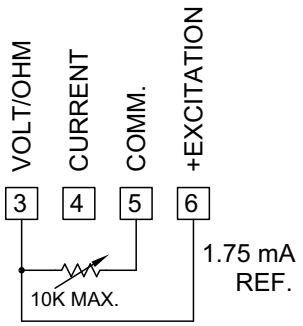
Current Signal (3 wire requiring excitation)
Terminal 4: +ADC (signal)
Terminal 5: -ADC (common)
Terminal 6: +Volt supply
Excitation Jumper: 24 V

Voltage Signal (3 wire requiring excitation)
Terminal 3: +VDC (signal)
Terminal 5: -VDC (common)
Terminal 6: +Volt supply
Excitation Jumper: 24 V



Resistance Signal (3 wire requiring excitation)

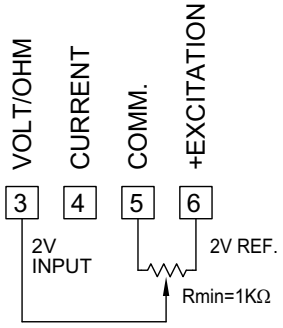
Terminal 3: Resistance
Terminal 5: Resistance
Terminal 6: Jumper to terminal 3
Excitation Jumper: 1.75 mA REF.



Potentiometer Signal (3 wire requiring excitation)

Terminal 3: Wiper
Terminal 5: Low end of pot.
Terminal 6: High end of pot.
Excitation Jumper: 2 V REF.
Input Range Jumper: 2 Volt
Module 1 Input Range: 2 Volt

Note: The Apply signal scaling style should be used because the signal will be in volts.

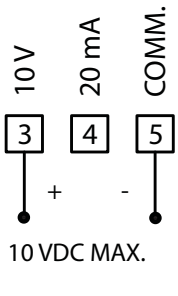


CAUTION: *Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common; and the common of the isolated plug-in cards with respect to input common.*

PAXP INPUT SIGNAL WIRING

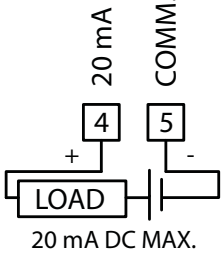
Voltage Signal (self powered)

Terminal 3: +VDC
Terminal 5: -VDC



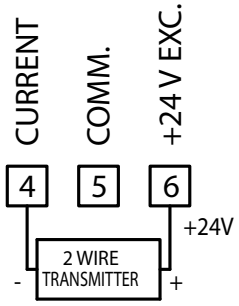
Current Signal (self powered)

Terminal 4: +ADC
Terminal 5: -ADC



Current Signal (2 wire requiring excitation)

Terminal 4: -ADC
Terminal 6: +ADC

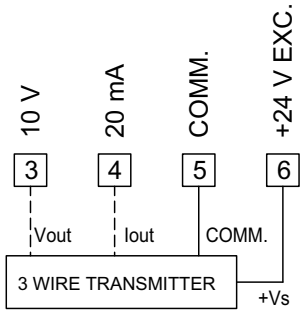


Current Signal (3 wire requiring excitation)

Terminal 4: +ADC (signal)
Terminal 5: -ADC (common)
Terminal 6: +Volt supply

Voltage Signal (3 wire requiring excitation)

Terminal 3: +VDC (signal)
Terminal 5: -VDC (common)
Terminal 6: +Volt supply

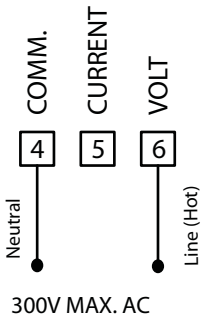


CAUTION: *Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common; and the common of the isolated plug-in cards with respect to input common.*

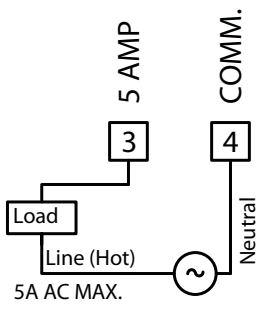
PAXH INPUT SIGNAL WIRING

Before connecting signal wires, the Signal, Input Range and Couple Jumpers should be verified for proper position.

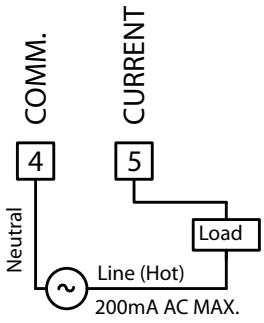
Voltage Signal



Current Signal (Amps)



Current Signal (Milliamps)



CAUTION*: Connect only one input signal range to the meter. Hazardous signal levels may be present on unused inputs.*

CAUTION*: The isolation rating of the input common of the meter with respect to the option card commons and the user input common Terminal 8 (If used) is 125 Vrms; and 250 Vrms with respect to AC Power (meter Terminals 1 & 2). To be certain that the ratings are not exceeded, these voltages should be verified by a high-voltage meter before wiring the meter.*

CAUTION*:*

1. Where possible, connect the neutral side of the signal (including current shunts) to the input common of the meter. If the input signal is sourced from an active circuit, connect the lower impedance (usually circuit common) to the input signal common of the meter.

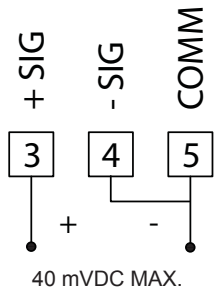
2. For phase-to-phase line monitoring where a neutral does not exist, or for any other signal input in which the isolation voltage rating is exceeded, an isolating potential transformer must be used to isolate the input voltage from earth. With the transformer, the input common of the meter can then be earth referenced for safety.

3. When measuring line currents, the use of a current transformer is recommended. If using external current shunts, insert the shunt in the neutral return line. If the isolation voltage rating is exceeded, the use of an isolating current transformer is necessary.

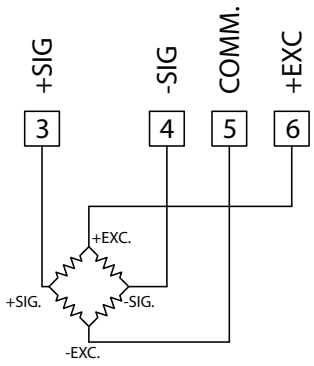
PAXS INPUT SIGNAL WIRING

Before connecting signal wires, the Input Range Jumper should be verified for proper position.

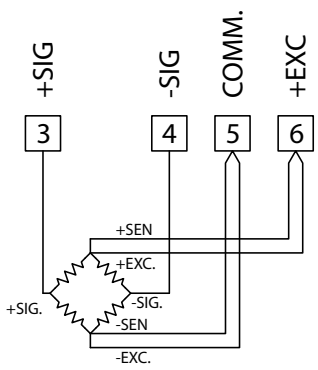
2-Wire Single Ended Input



4-Wire Bridge Input



6-Wire Bridge Input



DEADLOAD COMPENSATION

In some cases, the combined deadload and liveload output may exceed the range of the 24 mV input. To use this range, the output of the bridge can be offset a small amount by applying a fixed resistor across one arm of the bridge. This shifts the electrical output of the bridge downward to within the operating range of the meter. A 100 K ohm fixed resistor shifts the bridge output approximately -10 mV (350 ohm bridge, 10 V excitation).

Connect the resistor between +SIG and -SIG. Use a metal film resistor with a low temperature coefficient of resistance.

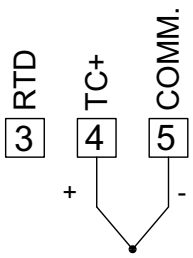
BRIDGE COMPLETION RESISTORS

For single strain gage applications, bridge completion resistors must be employed externally to the meter. Only use metal film resistors with a low temperature coefficient of resistance.

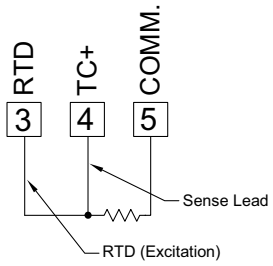
Load cells and pressure transducers are normally implemented as full resistance bridges and do not require bridge completion resistors.

PAXT INPUT SIGNAL WIRING

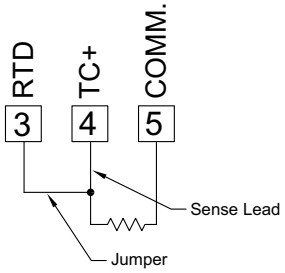
Thermocouple



3-Wire RTD



2-Wire RTD



CAUTION: *Sensor input common is NOT isolated from user input common. In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltages; or input common must be at protective earth ground potential. If not, hazardous live voltage may be present at the User Inputs and User Input Common terminals. Appropriate considerations must then be given to the potential of the user input common with respect to earth common; and the common of the isolated plug-in cards with respect to input common.*

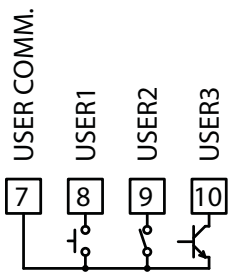
4.3 USER INPUT WIRING

Before connecting the wires, the User Input Logic Jumper should be verified for proper position. If not using User Inputs, then skip this section. Only the appropriate User Input terminal has to be wired.

Sinking Logic

Terminal 8-10: } Connect external switching device between
Terminal 7: } appropriate User Input terminal and User Comm.

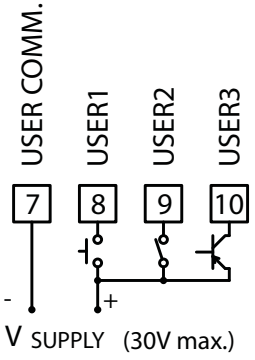
In this logic, the user inputs of the meter are internally pulled up to +5 V with 22 K resistance. The input is active when it is pulled low (<0 .9 V).



Sourcing Logic

Terminal 8-10: + VDC thru external switching device
Terminal 7: -VDC thru external switching device

In this logic, the user inputs of the meter are internally pulled down to 0 V with 22 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.

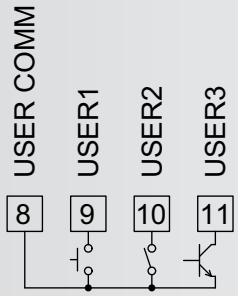


PAXH ONLY

Sinking Logic

Terminals 9-11 } Connect external switching device between appropriate User Input terminal and User Comm.
Terminal 8 }

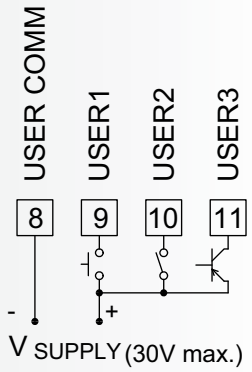
In this logic, the user inputs of the meter are internally pulled up to +5 V with 22 K resistance. The input is active when it is pulled low (<0 .9 V).



Sourcing Logic

Terminals 9-11:
+ VDC through external switching device
Terminal 8:
-VDC through external switching device

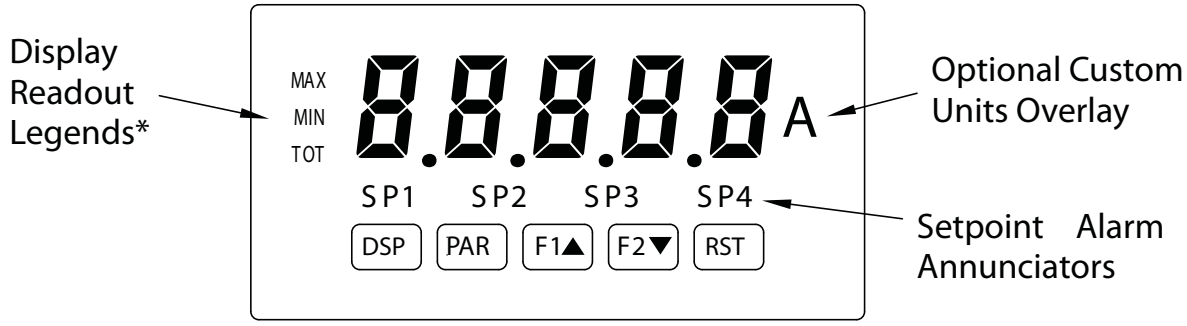
In this logic, the user inputs of the meter are internally pulled down with 22 K resistance. The input is active when a voltage greater than 3.6 VDC is applied.



4.4 SETPOINT (ALARMS) WIRING
4.5 SERIAL COMMUNICATION WIRING
4.6 ANALOG OUTPUT WIRING

See appropriate plug-in card bulletin for details.

5.0 REVIEWING THE FRONT BUTTONS AND DISPLAY



KEY	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
DSP	Index display through max/min/total/input readouts	Quit programming and return to display mode
PAR	Access parameter list	Store selected parameter and index to next parameter
F1▲	Function key 1; hold for 3 seconds for Second Function 1**	Increment selected parameter value
F2▼	Function key 2; hold for 3 seconds for Second Function 2**	Decrement selected parameter value
RST	Reset (Function key)**	Hold with F1▲, F2▼ to scroll value by x1000

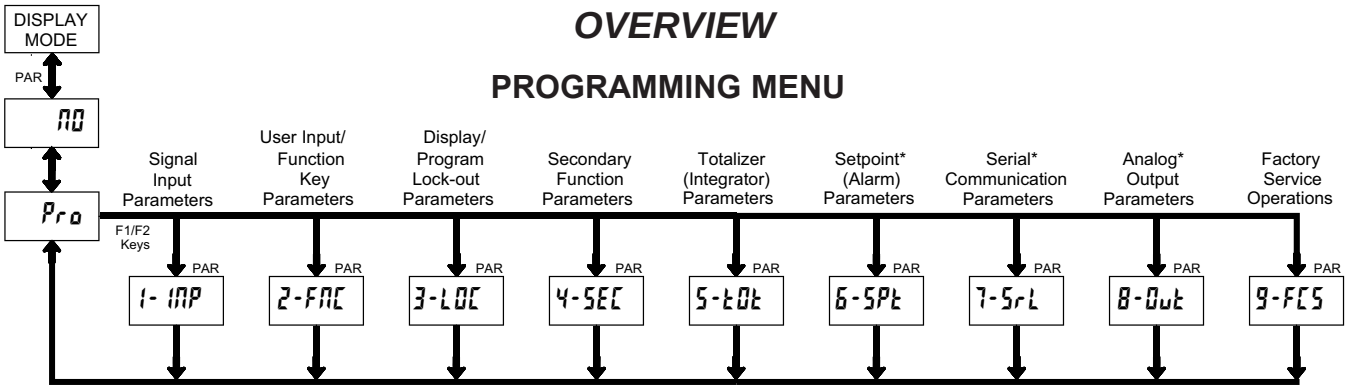
* Display Readout Legends may be locked out in Factory Settings.

** Factory setting for the F1, F2, and RST keys is NO mode.

6.0 PROGRAMMING THE METER

OVERVIEW

PROGRAMMING MENU



* Only accessible with appropriate plug-in card.

DISPLAY MODE

The meter normally operates in the Display Mode. In this mode, the meter displays can be viewed consecutively by pressing the **DSP** key. The annunciators to the left of the display indicate which display is currently shown; Max Value (MAX), Min Value (MIN), or Totalizer Value (TOT). Each of these displays can be locked from view through programming. (See Module 3) The Input Display Value is shown with no annunciator.

PROGRAMMING MODE

Two programming modes are available.

Full Programming Mode permits all parameters to be viewed and modified. Upon entering this mode, the front panel keys change to Programming Mode operations. This mode should not be entered while a process is running, since the meter functions and User Input response may not operate properly while in Full Programming Mode.

Quick Programming Mode permits only certain parameters to be viewed and/or modified. When entering this mode, the front panel keys change to Programming Mode operations, and all meter functions continue to operate properly. Quick Programming Mode is configured in Module 3. The Display Intensity Level "d-LEv" parameter is available in the Quick Programming Mode only when the security code is non-zero. For a description, see Module 9—Factory Service Operations. Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming Mode.

PROGRAMMING TIPS

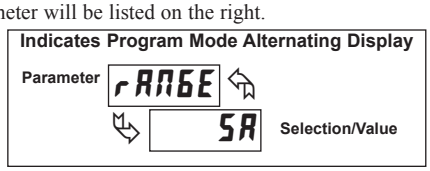
The Programming Menu is organized into nine modules (See above). These modules group together parameters that are related in function. It is recommended to begin programming with Module 1 and proceed through each module in sequence. Note that Modules 6 through 8 are only accessible when the appropriate plug-in option card is installed. If lost or confused while programming, press the **DSP** key to exit programming mode and start over. When programming is complete, it is recommended to record the meter settings on the Parameter Value Chart and lock-out parameter programming with a User Input or lock-out code. (See Modules 2 and 3 for lock-out details.)

FACTORY SETTINGS

Factory Settings may be completely restored in Module 9. This is a good starting point if encountering programming problems. Throughout the module description sections which follow, the factory setting for each parameter is shown below the parameter display. In addition, all factory settings are listed on the Parameter Value Chart following the programming section.

ALTERNATING SELECTION DISPLAY

In the module description sections which follow, the dual display with arrows appears for each programming parameter. This is used to illustrate the display alternating between the parameter (top display) and the parameter's Factory Setting (bottom display). In most cases, selections or value ranges for the parameter will be listed on the right.



STEP BY STEP PROGRAMMING INSTRUCTIONS:

PROGRAMMING MODE ENTRY (PAR KEY)

The Programming Mode is entered by pressing the **PAR** key. If this mode is not accessible, then meter programming is locked by either a security code or a hardware lock. (See Modules 2 and 3 for programming lock-out details.)

MODULE ENTRY (ARROW & PAR KEYS)

Upon entering the Programming Mode, the display alternates between Pro and the present module (initially no). The arrow keys (**F1▲** and **F2▼**) are used to select the desired module, which is then entered by pressing the **PAR** key.

PARAMETER (MODULE) MENU (PAR KEY)

Each module has a separate parameter menu. These menus are shown at the start of each module description section which follows. The **PAR** key is pressed to advance to a particular parameter to be changed, without changing the programming of preceding parameters. After completing a module, the display will return to Pro no. From this point, programming may continue by selecting and entering additional modules. (See **MODULE ENTRY** above.)

PARAMETER SELECTION ENTRY (ARROW & PAR KEYS)

For each parameter, the display alternates between the parameter and the present selection or value for that parameter. For parameters which have a list of selections, the arrow keys (**F1▲** and **F2▼**) are used to sequence through the list until the desired selection is displayed. Pressing the **PAR** key stores and activates the displayed selection, and also advances the meter to the next parameter.

NUMERICAL VALUE ENTRY (ARROW, RST & PAR KEYS)

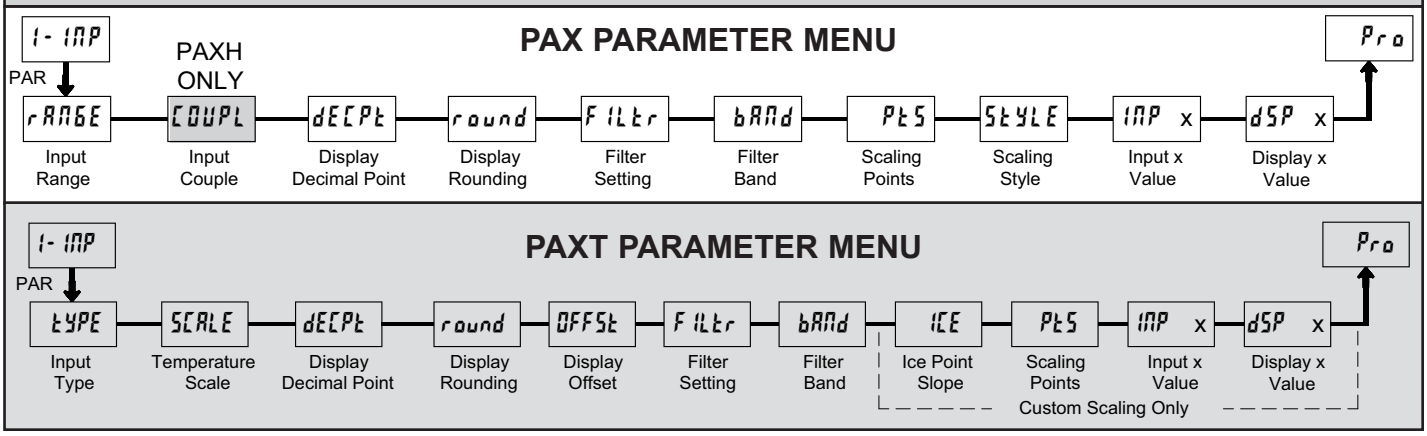
For parameters which require a numerical value entry, the arrow keys can be used to increment or decrement the display to the desired value. When an arrow key is pressed and held, the display automatically scrolls up or scrolls down. The longer the key is held, the faster the display scrolls.

The **RST** key can be used in combination with the arrow keys to enter large numerical values. When the **RST** key is pressed along with an arrow key, the display scrolls by 1000's. Pressing the **PAR** key stores and activates the displayed value, and also advances the meter to the next parameter.

PROGRAMMING MODE EXIT (DSP KEY or PAR KEY at Pro no)

The Programming Mode is exited by pressing the **DSP** key (from anywhere in the Programming Mode) or the **PAR** key (with Pro no displayed). This will commit any stored parameter changes to memory and return the meter to the Display Mode. If a parameter was just changed, the **PAR** key should be pressed to store the change before pressing the **DSP** key. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

6.1 MODULE 1 - SIGNAL INPUT PARAMETERS (1-INP)



Refer to the appropriate Input Range for the selected meter. Use only one Input Range, then proceed to Display Decimal Point.

PAXD INPUT RANGE

rANGE → 300u

SELECTION	RANGE RESOLUTION	SELECTION	RANGE RESOLUTION
200uA	±200.00 µA	2u	±2.0000 V
0.002A	±2.0000 mA	20u	±20.000 V
0.02A	±20.000 mA	300u	±300.00 V
0.2A	±200.00 mA	100o	100.00 ohm
2A	±2.0000 A	1000o	1000.0 ohm
0.2u	±200.00 mV	10Ko	10000 ohm

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

PAXP INPUT RANGE

rANGE → 0.02A

SELECTION	RANGE RESOLUTION
0.02A	20.000 mA
10u	10.000 V

Select the input range that corresponds to the external signal.

PAXH INPUT RANGE

rANGE → 5A

SELECTION	RANGE RESOLUTION	SELECTION	RANGE RESOLUTION
0.2u	200.00 mV	0.002A	2.0000 mA
2u	2.0000 V	0.02A	20.000 mA
20u	20.000 V	0.2A	200.00 mA
300u	300.0 V	5A	5.000 A
200uA	200.00 µA		

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

PAXH INPUT COUPLE

COUPL → AC

AC or dC

The input signal can be either AC coupled (rejecting the DC components of the signal) or DC coupled (measures both the AC and DC components of the signal). The coupling jumper and the setting of this parameter must match.

PAXS INPUT RANGE

rANGE → 0.02u

SELECTION	RANGE RESOLUTION
0.02u	±24 mV
0.2u	±240 mV

Select the input range that corresponds to the external signal. This selection should be high enough to avoid input signal overload but low enough for the desired input resolution. This selection and the position of the Input Range Jumper must match.

PAXT INPUT TYPE

tYPE → tC-J

SELECTION	TYPE	SELECTION	TYPE
tC-t	T TC	tC-C	C TC
tC-E	E TC	Pt385	RTD platinum 385
tC-J	J TC	Pt392	RTD platinum 392
tC-K	K TC	n,672	RTD nickel 672
tC-r	R TC	Cu427	RTD copper 10 Ω
tC-S	S TC	CS-tC	Custom TC
tC-b	B TC	CS-rH	Custom RTD High
tC-n	N TC	CS-rL	Custom RTD Low

Select the input type that corresponds to the input sensor. For RTD types, check the RTD Input Jumper for matching selection. For custom types, the Temperature Scale parameter is not available, the Display Decimal Point is expanded, and Custom Sensor Scaling must be completed.

PAXT TEMPERATURE SCALE

SCALE → oF

oF oC

Select the temperature scale. This selection applies for Input, MAX, MIN, and TOT displays. This does not change the user installed Custom Units Overlay display. If changed, those parameters that relate to the temperature scale should be checked. This selection is not available for custom sensor types.

DISPLAY DECIMAL POINT

dECPt → 0

0 0.0 0.00 0.000 0.0000

For the PAXT, these are only available with Custom Scaling.

Select the decimal point location for the Input, **MAX** and **MIN** displays. (The **TOT** display decimal point is a separate parameter.) This selection also affects round, dSP1 and dSP2 parameters and setpoint values.

DISPLAY ROUNDING*

round → 1

1 2 5 10 20 50 100

These bottom selections are not available for the PAXT.

Rounding selections other than one, cause the Input Display to 'round' to the nearest rounding increment selected (ie. rounding of '5' causes 122 to round to 120 and 123 to round to 125). Rounding starts at the least significant digit of the Input Display. Remaining parameter entries (scaling point values, setpoint values, etc.) are not automatically adjusted to this display rounding selection.

PAXT: TEMPERATURE DISPLAY OFFSET*

OFFSt → 0 — -19999 to 99999

The temperature display can be corrected with an offset value. This can be used to compensate for probe errors, errors due to variances in probe placement or adjusting the readout to a reference thermometer. This value is automatically updated after a Zero Display to show how far the display is offset. A value of zero will remove the affects of offset.

FILTER SETTING*

FiLtr → 1.0 — 0.0 to 25.0 seconds

The input filter setting is a time constant expressed in tenths of a second. The filter settles to 99% of the final display value within approximately 3 time constants. This is an Adaptive Digital Filter which is designed to steady the Input Display reading. A value of '0' disables filtering.

FILTER BAND*

bAnd → 10 — 0.0 to 25.0 display units

The digital filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the digital filter disengages. When the variation becomes less than the band value, the filter engages again. This allows for a stable readout, but permits the display to settle rapidly after a large process change. The value of the band is in display units. A band setting of '0' keeps the digital filter permanently engaged.

For the PAXT, the following parameters only apply to Custom Sensor Scaling.

PAXT: ICE POINT SLOPE

ICE → 0.00 — 0 to 650.00 µV/°C

This parameter sets the slope value for ice point compensation for the Custom TC range (CS-tc) only. The fixed thermocouple ranges are automatically compensated by the meter and do not require this setting. To calculate this slope, use µV data obtained from thermocouple manufacturers' tables for two points between 0°C and 50°C. Place this corresponding µV and °C information into the equation:

$$\text{slope} = (\mu V_2 - \mu V_1)/(°C_2 - °C_1).$$

Due to the nonlinear output of thermocouples, the compensation may show a small offset error at room temperatures. This can be compensated by the offset parameter. A value of 0 disables internal compensation when the thermocouple is externally compensated.

* *Factory Setting can be used without affecting basic start-up.*

SCALING POINTS*

PtS → 2 — 2 to 16

Linear - Scaling Points (2)

For linear processes, only 2 scaling points are necessary. It is recommended that the 2 scaling points be at opposite ends of the input signal being applied. The points do not have to be the signal limits. Display scaling will be linear between and continue past the entered points up to the limits of the Input Signal Jumper position. Each scaling point has a coordinate-pair of Input Value (inP) and an associated desired Display Value (dSP).

Nonlinear - Scaling Points (Greater than 2)

For non-linear processes, up to 16 scaling points may be used to provide a piece-wise linear approximation. (The greater the number of scaling points used, the greater the conformity accuracy.) The Input Display will be linear between scaling points that are sequential in program order. Each scaling point has a coordinate-pair of Input Value (inP) and an associated desired Display Value (dSP). Data from tables or equations, or empirical data could be used to derive the required number of segments and data values for the coordinate pairs. In the SFPAX software, several linearization equations are available.

SCALING STYLE

This parameter does not apply for the PAXT. Scaling values for the PAXT must be keyed-in.

StyLE → KEY — KEY key-in data; APLY apply signal

If Input Values and corresponding Display Values are known, the Key-in (KEY) scaling style can be used. This allows scaling without the presence or changing of the input signal. If Input Values have to be derived from the actual input signal source or simulator, the Apply (APLY) scaling style must be used. After using the Apply (APLY) scaling style, this parameter will default back to KEY but the scaling values will be shown from the previous applied method.

INPUT VALUE FOR SCALING POINT 1

inP 1 → 0.00 — -19999 to 99999

For Key-in (KEY), enter the known first Input Value by using the arrow keys. The Input Range selection sets up the decimal location for the Input Value. With 0.02A Input Range, 4mA would be entered as 4.000. For Apply (APLY), apply the input signal to the meter, adjust the signal source externally until the desired Input Value appears. In either method, press the **PAR** key to enter the value being displayed.

Note: APLY style - Pressing the **RST** *key will advance the display to the next scaling display point without storing the input value.*

DISPLAY VALUE FOR SCALING POINT 1

dSP 1 → 0.00 — -19999 to 99999

Enter the first coordinating Display Value by using the arrow keys. This is the same for KEY and APLY scaling styles. The decimal point follows the dECPt selection.

INPUT VALUE FOR SCALING POINT 2

inP 2 → 100.00 — -19999 to 99999

For Key-in (KEY), enter the known second Input Value by using the arrow keys. For Apply (APLY), adjust the signal source externally until the next desired Input Value appears. (Follow the same procedure if using more than 2 scaling points.)

DISPLAY VALUE FOR SCALING POINT 2

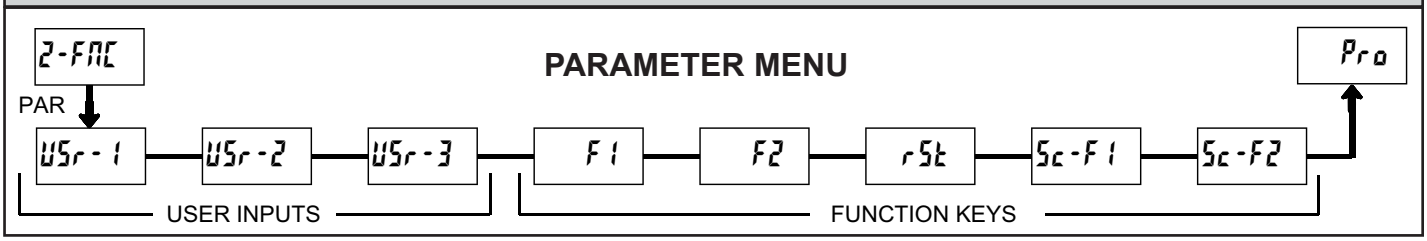
- 19999 to 99999

Enter the second coordinating Display Value by using the arrow keys. This is the same for KEY and APLY scaling styles. (Follow the same procedure if using more than 2 scaling points.)

General Notes on Scaling

1. Input Values for scaling points should be confined to the limits of the Input Range Jumper position.
2. The same Input Value should not correspond to more than one Display Value. (Example: 20 mA can not equal 0 and 10.)
   This is referred to as read out jumps (vertical scaled segments).
3. The same Display Value can correspond to more than one Input Value. (Example: 0 mA and 20 mA can equal 10.)
   This is referred to as readout dead zones (horizontal scaled segments).
4. The maximum scaled Display Value spread between range maximum and minimum is limited to 65,535. For example using +20 mA range the maximum +20 mA can be scaled to is 32,767 with 0 mA being 0 and Display Rounding of 1. (Decimal points are ignored.) The other half of 65,535 is for the lower half of the range 0 to -20 mA even if it is not used. With Display Rounding of 2, +20 mA can be scaled for 65,535 (32,767 x 2) but with even Input Display values shown.
5. For input levels beyond the first programmed Input Value, the meter extends the Display Value by calculating the slope from the first two coordinate pairs (INP 1 / dSP 1 & INP2 / dSP2). If INP 1 = 4 mA and dSP 1 = 0, then 0 mA would be some negative Display Value. This could be prevented by making INP 1 = 0 mA / dSP 1 = 0, INP2 = 4 mA / dSP2 = 0, with INP3 = 20 mA / dSP3 = the desired high Display Value. The calculations stop at the limits of the Input Range Jumper position.
6. For input levels beyond the last programmed Input Value, the meter extends the Display Value by calculating the slope from the last two sequential coordinate pairs. If three coordinate pair scaling points were entered, then the Display Value calculation would be between INP2 / dSP2 & INP3 / dSP3. The calculations stop at the limits of the Input Range Jumper position.

6.2 MODULE 2 - USER INPUT AND FRONT PANEL FUNCTION KEY PARAMETERS (2-FNC)



The three user inputs are individually programmable to perform specific meter control functions. While in the Display Mode or Program Mode, the function is executed the instant the user input transitions to the active state.

The front panel function keys are also individually programmable to perform specific meter control functions. While in the Display Mode, the primary function is executed the instant the key is pressed. Holding the function key for three seconds executes a secondary function. It is possible to program a secondary function without a primary function.

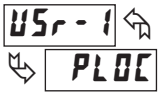
In most cases, if more than one user input and/or function key is programmed for the same function, the maintained (level trigger) actions will be performed while at least one of those user inputs or function keys are activated. The momentary (edge trigger) actions will be performed every time any of those user inputs or function keys transition to the active state.

Note: *In the following explanations, not all selections are available for both user inputs and front panel function keys. Alternating displays are shown with each selection. Those selections showing both displays are available for both. If a display is not shown, it is not available for that selection.* USr-1 *will represent all three user inputs.* F1 *will represent all five function keys.*

NO FUNCTION

No function is performed if activated. This is the factory setting for all user inputs and function keys. No function can be selected without affecting basic start-up.

PROGRAMMING MODE LOCK-OUT



Programming Mode is locked-out, as long as activated (maintained action). A security code can be configured to allow programming access during lock-out.

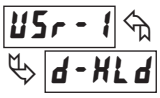
ZERO (TARE) DISPLAY

The Zero (Tare) Display provides a way to zero the Input Display value at various input levels, causing future Display readings to be offset. This function is useful in weighing applications where the container or material on the scale should not be included in the next measurement value. When activated (momentary action), rESEt flashes and the Display is set to zero. At the same time, the Display value (that was on the display before the Zero Display) is subtracted from the Display Offset Value and is automatically stored as the new Display Offset Value (OFFSt). If another Zero (tare) Display is performed, the display will again change to zero and the Display reading will shift accordingly.

RELATIVE/ABSOLUTE DISPLAY

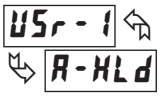
This function will switch the Input Display between Relative and Absolute. The Relative is a net value that includes the Display Offset Value. The Input Display will normally show the Relative unless switched by this function. Regardless of the display selected, all meter functions continue to operate based on relative values. The Absolute is a gross value (based on Module 1 **DSP** and **INP** entries) without the Display Offset Value. The Absolute display is selected as long as the user input is activated (maintained action) or at the transition of the function key (momentary action). When the user input is released, or the function key is pressed again, the input display switches back to Relative display. Abs (absolute) or rEL (relative) is momentarily displayed at transition to indicate which display is active.

HOLD DISPLAY



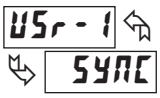
The shown display is held but all other meter functions continue as long as activated (maintained action).

HOLD ALL FUNCTIONS



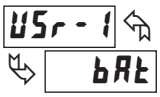
The meter disables processing the input, holds all display contents, and locks the state of all outputs as long as activated (maintained action). The serial port continues data transfer.

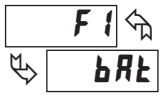
SYNCHRONIZE METER READING



The meter suspends all functions as long as activated (maintained action). When the user input is released, the meter synchronizes the restart of the A/D with other processes or timing events.

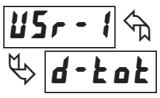
STORE BATCH READING IN TOTALIZER





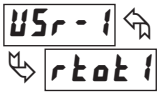
The Input Display value is one time added (batched) to the Totalizer at transition to activate (momentary action). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. When this function is selected, the normal operation of the Totalizer is overridden.

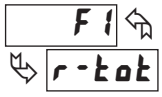
SELECT TOTALIZER DISPLAY



The Totalizer display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The **DSP** key overrides the active user input. The Totalizer continues to function including associated outputs independent of being displayed.

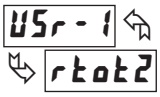
RESET TOTALIZER





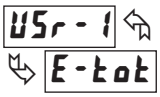
When activated (momentary action), rESEt flashes and the Totalizer resets to zero. The Totalizer then continues to operate as it is configured. This selection functions independent of the selected display.

RESET AND ENABLE TOTALIZER



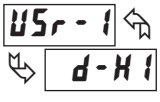
When activated (momentary action), rESEt flashes and the Totalizer resets to zero. The Totalizer continues to operate while active (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

ENABLE TOTALIZER



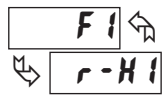
The Totalizer continues to operate as long as activated (maintained action). When the user input is released, the Totalizer stops and holds its value. This selection functions independent of the selected display.

SELECT MAXIMUM DISPLAY



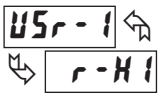
The Maximum display is selected as long as activated (maintained action). When the user input is released, the Input Display returns. The **DSP** key overrides the active user input. The Maximum continues to function independent of being displayed.

RESET MAXIMUM



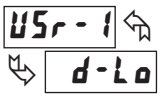
When activated (momentary action), rESEt flashes and the Maximum resets to the present Input Display value. The Maximum function then continues from that value. This selection functions independent of the selected display.

RESET, SELECT, ENABLE MAXIMUM DISPLAY



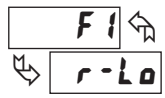
When activated (momentary action), the Maximum value is set to the present Input Display value. Maximum continues from that value while active (maintained action). When the user input is released, Maximum detection stops and holds its value. This selection functions independent of the selected display. The **DSP** key overrides the active user input display but not the Maximum function.

SELECT MINIMUM DISPLAY



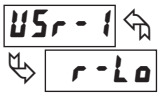
The Minimum display is selected as long as activated (maintained action). When the user input is released, the Input Display is returned. The **DSP** key overrides the active user input. The Minimum continues to function independent of being displayed.

RESET MINIMUM



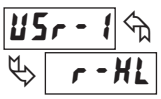
When activated (momentary action), rESEt flashes and the Minimum reading is set to the present Input Display value. The Minimum function then continues from that value. This selection functions independent of the selected display.

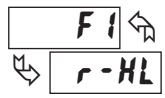
RESET, SELECT, ENABLE MINIMUM DISPLAY



When activated (momentary action), the Minimum value is set to the present Input Display value. Minimum continues from that value while active (maintained action). When the user input is released, Minimum detection stops and holds its value. This selection functions independent of the selected display. The **DSP** key overrides the active user input display but not the Minimum function.

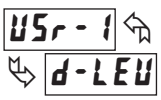
RESET MAXIMUM AND MINIMUM

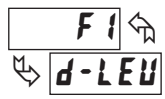




When activated (momentary action), rESEt flashes and the Maximum and Minimum readings are set to the present Input Display value. The Maximum and Minimum function then continues from that value. This selection functions independent of the selected display.

CHANGE DISPLAY INTENSITY LEVEL





When activated (momentary action), the display intensity changes to the next intensity level (of 4). The four levels correspond to Display Intensity Level (d-LEu) settings of 0, 3, 8, and 15. The intensity level, when changed via the User Input/ Function Key, is not retained at power-down, unless Quick Programming or Full Programming mode is entered and exited. The meter will power-up at the last saved intensity level.

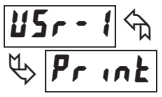
SETPOINT SELECTIONS

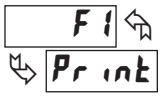
The following selections are accessible only with the Setpoint plug-in card installed. Refer to Module 6 for an explanation of their operation.

Setpoint Card Only

- **LISt - Select main or alternate setpoints**
- **r-1 - Reset Setpoint 1 (Alarm 1)**
- **r-2 - Reset Setpoint 2 (Alarm 2)**
- **r-3 - Reset Setpoint 3 (Alarm 3)**
- **r-4 - Reset Setpoint 4 (Alarm 4)**
- **r-34 - Reset Setpoint 3 & 4 (Alarm 3 & 4)**
- **r-234 - Reset Setpoint 2, 3 & 4 (Alarm 2, 3 & 4)**
- **r-ALL - Reset Setpoint All (Alarm All)**

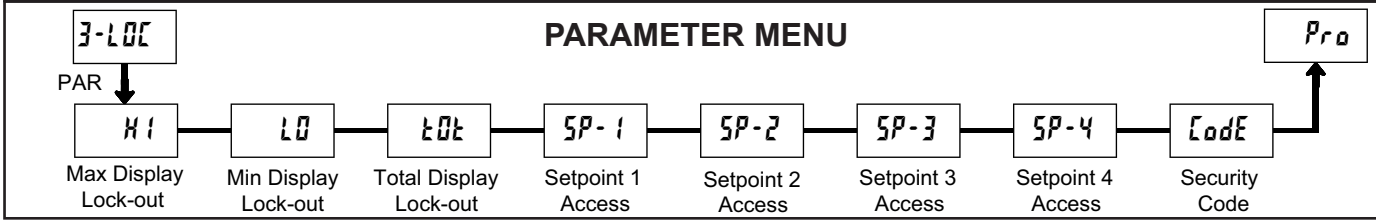
PRINT REQUEST





The meter issues a block print through the serial port when activated. The data transmitted during a print request is programmed in Module 7. If the user input is still active after the transmission is complete (about 100 msec), an additional transmission occurs. As long as the user input is held active, continuous transmissions occur.

6.3 MODULE 3 - DISPLAY AND PROGRAM LOCK-OUT PARAMETERS (3-LOC)



Module 3 is the programming for Display lock-out and "Full" and "Quick" Program lock-out.

When in the Display Mode, the available displays can be read consecutively by repeatedly pressing the **DSP** key. An annunciator indicates the display being shown. These displays can be locked from being visible. It is recommended that the display be set to LOC when the corresponding function is not used.

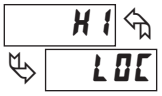
SELECTION	DESCRIPTION
rEd	Visible in Display Mode
LOC	Not visible in Display Mode

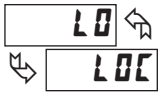
"Full" Programming Mode permits all parameters to be viewed and modified. This Programming Mode can be locked with a security code and/or user input. When locked and the **PAR** key is pressed, the meter enters a Quick Programming Mode. In this mode, the setpoint values can still be read and/or changed per the selections below. The Display Intensity Level (d-LEU) parameter also appears whenever Quick Programming Mode is enabled and the security code is greater than zero.

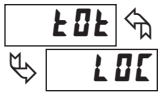
SELECTION	DESCRIPTION
rEd	Visible but not changeable in Quick Programming Mode
Ent	Visible and changeable in Quick Programming Mode
LOC	Not visible in Quick Programming Mode

* *Factory Setting can be used without affecting basic start-up.*

MAXIMUM DISPLAY LOCK-OUT*
MINIMUM DISPLAY LOCK-OUT*
TOTALIZER DISPLAY LOCK-OUT*

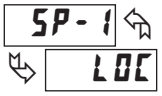


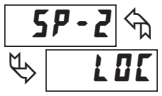


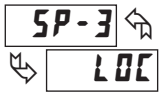


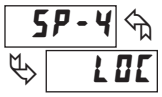
These displays can be programmed for LOC or rEd. When programmed for LOC, the display will not be shown when the **DSP** key is pressed regardless of Program Lock-out status. It is suggested to lock-out the display if it is not needed. The associated function will continue to operate even if its display is locked-out.

SP-1 SP-2 SP-3 SP-4 SETPOINT ACCESS*



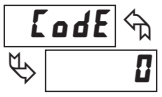






The setpoint displays can be programmed for LOC, rEd or Ent (See the following table). Accessible only with the Setpoint plug-in card installed.

PROGRAM MODE SECURITY CODE*



0 to 250

By entering any non-zero value, the prompt CodE 0 will appear when trying to access the Program Mode. Access will only be allowed after entering a matching security code or universal code of 222. With this lock-out, a user input would not have to be configured for Program Lock-out. However, this lock-out is overridden by an inactive user input configured for Program Lock-out.

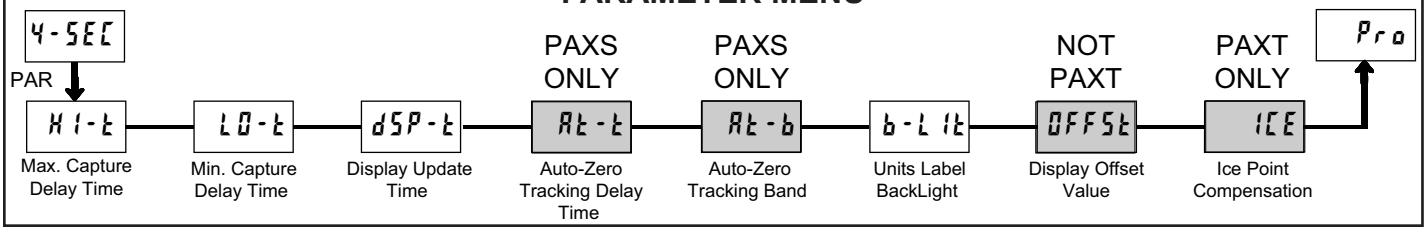
PROGRAMMING MODE ACCESS

SECURITY CODE	USER INPUT CONFIGURED	USER INPUT STATE	WHEN PAR KEY IS PRESSED	"FULL" PROGRAMMING MODE ACCESS
0	not PLOC	————	"Full" Programming	Immediate access.
>0	not PLOC	————	Quick Programming w/Display Intensity	After Quick Programming with correct code # at CodE prompt.
>0	PLOC	Active	Quick Programming w/Display Intensity	After Quick Programming with correct code # at CodE prompt.
>0	PLOC	Not Active	"Full" Programming	Immediate access.
0	PLOC	Active	Quick Programming	No access
0	PLOC	Not Active	"Full" Programming	Immediate access.

Throughout this document, Programming Mode (without Quick in front) always refers to "Full" Programming (all meter parameters are accessible).

6.4 MODULE 4 - SECONDARY FUNCTION PARAMETERS (4-SEC)

PARAMETER MENU



MAX CAPTURE DELAY TIME*

HI-t / 0.0 — 0.0 to 3275.0 sec.

When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

MIN CAPTURE DELAY TIME*

LO-t / 0.0 — 0.0 to 3275.0 sec.

When the Input Display is below the present MIN value for the entered delay time, the meter will capture that display value as the new MIN reading. A delay time helps to avoid false captures of sudden short spikes.

DISPLAY UPDATE RATE*

dSP-t / 2 — 1 2 5 10 20 updates/sec.

This parameter determines the rate of display update. When set to 20 updates/second, the internal re-zero compensation is disabled, allowing for the fastest possible output response.

PAXS: AUTO-ZERO TRACKING

At-t / 0 — 0 to 250 sec.

PAXS: AUTO-ZERO BAND

At-b / 0.02 — 1 to 4095

The meter can be programmed to automatically compensate for zero drift. Drift may be caused by changes in the transducers or electronics, or accumulation of material on weight systems.

Auto-zero tracking operates when the readout remains within the tracking band for a period of time equal to the tracking delay time. When these conditions are met, the meter re-zeroes the readout. After the re-zero operation, the meter resets and continues to auto-zero track.

The auto-zero tracking band should be set large enough to track normal zero drift, but small enough to not interfere with small process inputs.

For filling operations, the fill rate must exceed the auto-zero tracking rate. This avoids false tracking at the start of the filling operation.

$$\text{Fill Rate} \geq \frac{\text{tracking band}}{\text{tracking time}}$$

Auto-zero tracking is disabled by setting the auto-zero tracking parameter = 0.

UNITS LABEL BACKLIGHT*

b-LIt / OFF — ON OFF

The Units Label Kit Accessory contains a sheet of custom unit overlays which can be installed in to the meter's bezel display assembly. The backlight for these custom units is activated by this parameter.

DISPLAY OFFSET VALUE*

This parameter does not apply for the PAXT.

OFFSt / 0.00 — -19999 to 19999

Unless a Zero Display was performed or an offset from Module 1 scaling is desired, this parameter can be skipped. The Display Offset Value is the difference from the Absolute (gross) Display value to the Relative (net) Display value for the same input level. The meter will automatically update this Display Offset Value after each Zero Display. The Display Offset Value can be directly keyed-in to intentionally add or remove display offset. See Relative / Absolute Display and Zero Display explanations in Module 2.

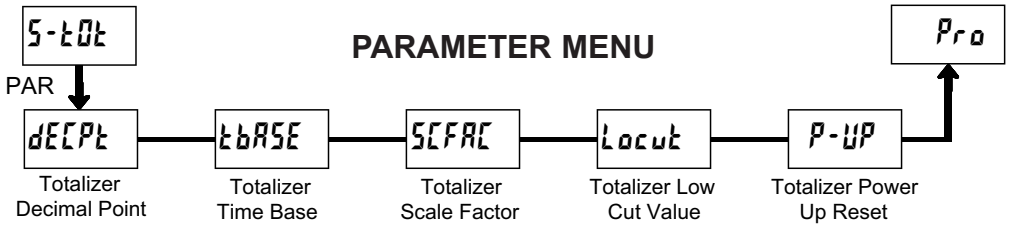
PAXT: ICE POINT COMPENSATION*

ICE / ON — ON OFF

This parameter turns the internal ice point compensation on or off. Normally, the ice point compensation is on. If using external compensation, set this parameter to off. In this case, use copper leads from the external compensation point to the meter. If using Custom TC range, the ice point compensation can be adjusted by a value in Module 1 when this is yes.

* *Factory Setting can be used without affecting basic start-up.*

6.5 MODULE 5 - TOTALIZER (INTEGRATOR) PARAMETERS (5-tOt)



The totalizer accumulates (integrates) the Input Display value using one of two modes. The first is using a time base. This can be used to compute a time-temperature product. The second is through a user input or function key programmed for Batch (one time add on demand). This can be used to provide a readout of temperature integration, useful in curing and sterilization applications. If the Totalizer is not needed, its display can be locked-out and this module can be skipped during programming.

TOTALIZER DECIMAL POINT*

dECPt / 0.00 — 0 0.0 0.00 0.000 0.0000

For most applications, this matches the Input Display Decimal Point (dECPt). If a different location is desired, refer to Totalizer Scale Factor.

TOTALIZER TIME BASE

tbASE / .1M — SEC - seconds (÷ 1) hour - hours (÷ 3600) .1M - minutes (÷ 60) dAY - days (÷ 86400)

This is the time base used in Totalizer accumulations. If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

TOTALIZER SCALE FACTOR*

SCFAC / 1.000 — 0.001 to 65.000

For most applications, the Totalizer reflects the same decimal point location and engineering units as the Input Display. In these cases, the Totalizer Scale Factor is 1.000. The Totalizer Scale Factor can be used to scale the Totalizer to a different value than the Input Display. Common possibilities are:

1. Changing decimal point location (example tenths to whole)
2. Average over a controlled time frame.

Details on calculating the scale factor are shown later.

If the Totalizer is being accumulated through a user input programmed for Batch, then this parameter does not apply.

TOTALIZER LOW CUT VALUE*

Locut / -19999 — -19999 to 99999

A low cut value disables Totalizer when the Input Display value falls below the value programmed.

TOTALIZER POWER UP RESET*

P-UP / nO

nO Do not reset buffer
rSt Reset buffer

The Totalizer can be reset to zero on each meter power-up by setting this parameter to reset.

* *Factory Setting can be used without affecting basic start-up.*

TOTALIZER HIGH ORDER DISPLAY

When the total exceeds 5 digits, the front panel annunciator **TOT** flashes. In this case, the meter continues to totalize up to a 9 digit value. The high order 4 digits and the low order 5 digits of the total are displayed alternately. The letter "h" denotes the high order display. When the total exceeds a 9 digit value, the Totalizer will show "E . . ." and will stop.

TOTALIZER BATCHING

The Totalizer Time Base and scale factor are overridden when a user input or function key is programmed for store batch (bAt). In this mode, when the user input or function key is activated, the Input Display reading is one time added to the Totalizer (batch). The Totalizer retains a running sum of each batch operation until the Totalizer is reset. This is useful in weighing operations, when the value to be added is not based on time but after a filling event.

TOTALIZER USING TIME BASE

Totalizer accumulates as defined by:

$$\frac{\text{Input Display} \times \text{Totalizer Scale Factor}}{\text{Totalizer Time Base}}$$

Where:
Input Display - the present input reading
Totalizer Scale Factor - 0.001 to 65.000
Totalizer Time Base - (the division factor of tbASE)

Example: The input reading is at a constant rate of 10.0 gallons per minute. The Totalizer is used to determine how many gallons in tenths has flowed. Because the Input Display and Totalizer are both in tenths of gallons, the Totalizer Scale Factor is 1. With gallons per minute, the Totalizer Time Base is minutes (60). By placing these values in the equation, the Totalizer will accumulate every second as follows:

$\frac{10.0 \times 1.000}{60} = 0.1667$ gallon accumulates each second

This results in:
10.0 gallons accumulates each minute
600.0 gallons accumulates each hour

TOTALIZER SCALE FACTOR CALCULATION EXAMPLES

1. When changing the Totalizer Decimal Point (dECPt) location from the Input Display Decimal Point (dECPt), the required Totalizer Scale Factor is multiplied by a power of ten.

Example:

Input (dECPt) = 0

Totalizer dECPt	Scale Factor
0.0	10
0	1
x10	0.1
x100	0.01
x1000	0.001

Input (dECPt) = 0.0

Totalizer dECPt	Scale Factor
0.00	10
0.0	1
0	0.1
x10	0.01
x100	0.001

Input (dECPt) = 0.00

Totalizer dECPt	Scale Factor
0.000	10
0.00	1
0.0	0.1
0	0.01
x10	0.001

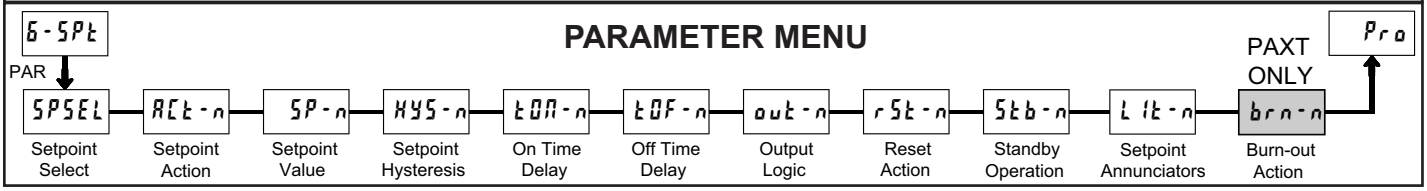
(x = Totalizer display is round by tens or hundreds)

2. To obtain an average reading within a controlled time frame, the selected Totalizer Time Base is divided by the given time period expressed in the same timing units.

Example: Average temperature per hour in a 4 hour period, the scale factor would be 0.250. To achieve a controlled time frame, connect an external timer to a user input programmed for rtAt2. The timer will control the start (reset) and the stopping (hold) of the totalizer.

6.6 MODULE 6 - SETPOINT (ALARM) PARAMETERS (6-SPt) ∇

PARAMETER MENU

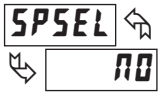


∇ - A setpoint card must be installed in order to access this module.

Depending on the card installed, there will be two or four setpoint outputs available. For maximum input frequency, unused Setpoints should be configured for **OFF** action.

The setpoint assignment and the setpoint action determine certain setpoint feature availability.

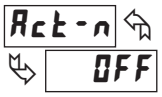
SETPOINT SELECT



n0 SP-1 SP-2 SP-3 SP-4

Enter the setpoint (alarm output) to be programmed. The **n** in the following parameters will reflect the chosen setpoint number. After the chosen setpoint is completely programmed, the display will return to **SPSEL n0**. Repeat step for each setpoint to be programmed. The **n0** chosen at **SPSEL** will return to **PRO n0**. The number of setpoints available is setpoint output card dependent.

SETPOINT ACTION



OFF Ab-H1 Ab-LO Au-H1 Au-LO
dE-H1 dE-LO bAnd totLo totH1

Enter the action for the selected setpoint (alarm output). See Setpoint Alarm Figures for a visual detail of each action.

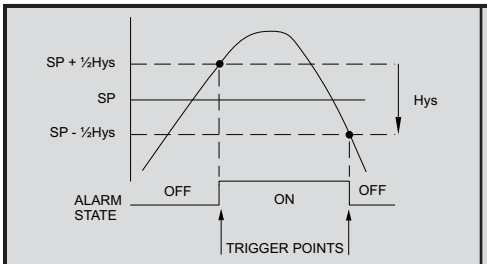
- **OFF** = Setpoint always off, (returns to SPSEL NO)
- **Ab-H1** = Absolute high, with balanced hysteresis
- **Ab-LO** = Absolute low, with balanced hysteresis
- **Au-H1** = Absolute high, with unbalanced hysteresis
- **Au-LO** = Absolute low, with unbalanced hysteresis
- **dE-H1** = Deviation high, with unbalanced hysteresis *
- **dE-LO** = Deviation low, with unbalanced hysteresis *
- **bAnd** = Outside band, with unbalanced hysteresis *
- **totLo** = Lower Totalizer absolute high, unbalance hysteresis**
- **totH1** = Upper Totalizer absolute high, unbalance hysteresis**

* Deviation and band action setpoints are relative to the value of setpoint 1. It is not possible to configure setpoint 1 as deviation or band actions. It is possible to use setpoint 1 for an absolute action, while its value is being used for deviation or band.

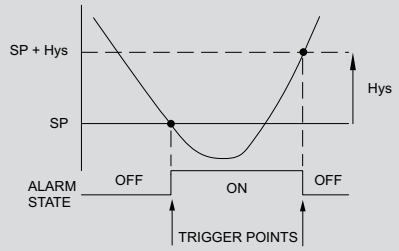
** The lower Totalizer action **totLo** allows setpoints to function off of the lower 5 digits of the Totalizer. The upper Totalizer action **totH1** allows setpoints to function off of the upper 4 digits of the Totalizer. To obtain absolute low alarms for the Totalizer, program the **totLo** or **totH1** output logic as reverse.

Setpoint Alarm Figures

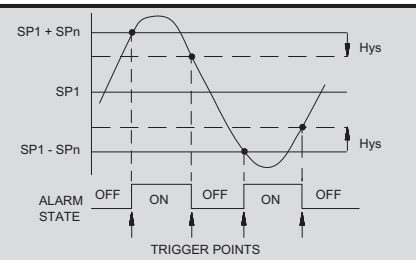
With reverse output logic **rEu**, the below alarm states are opposite.



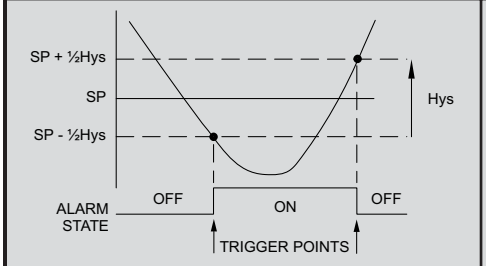
Absolute High Acting (Balanced Hys) = **Ab-H1**



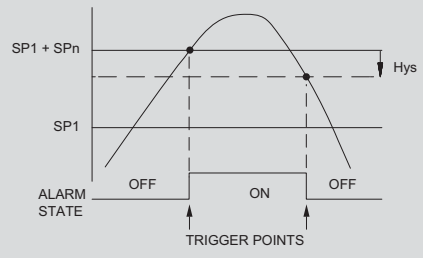
Absolute Low Acting (Unbalanced Hys) = **Au-Lo**



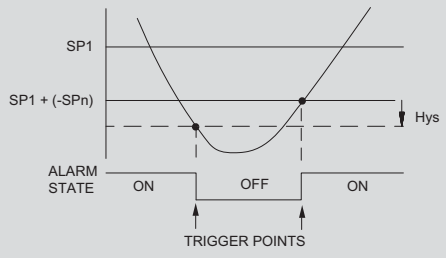
Band Outside Acting = **bAnd**



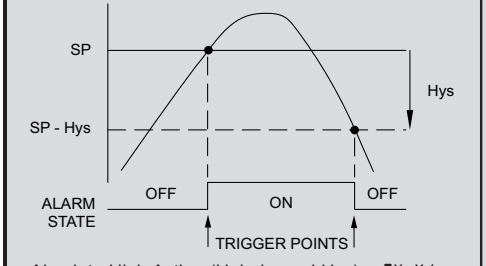
Absolute Low Acting (Balanced Hys) = **Ab-Lo**



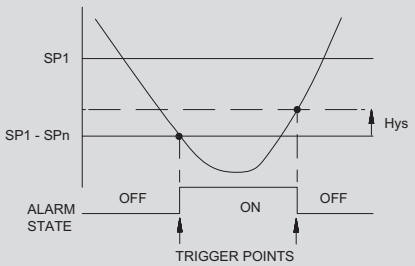
Deviation High Acting (SP > 0) = **dE-H1**



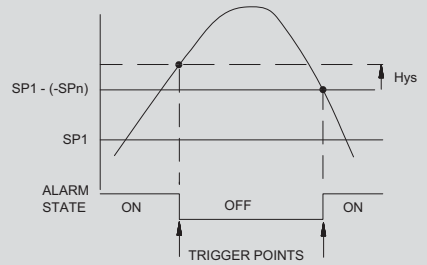
Deviation High Acting (SP < 0) = **dE-H1**



Absolute High Acting (Unbalanced Hys) = **Au-H1**
This is also for Totalizer alarms: **tot lo**, **totH1**



Deviation Low Acting (SP > 0) = **dE-Lo**



Deviation Low Acting (SP < 0)= **dE-Lo**

SETPOINT VALUE

SP-n
10.00

-19999 to 99999

Enter desired setpoint alarm value. These setpoint values can also be entered in the Display Mode during Program Lock-out when the setpoint is programmed as Ent in Parameter Module 3. When a setpoint is programmed as deviation or band acting, the associated output tracks SP1 as it is changed. The value entered is the offset, or difference from SP1.

HYSTERESIS VALUE

HYS-n
0.02

1 to 65000

Enter desired hysteresis value. See Setpoint Alarm Figures for visual explanation of how setpoint alarm actions (balance and unbalance) are affected by the hysteresis. When the setpoint is a control output, usually balance hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the high side for low acting setpoints and functions on the high side for low acting setpoints.

Note: Hysteresis eliminates output chatter at the switch point, while time delay can be used to prevent false triggering during process transient events.

ON TIME DELAY

tON-n
0.0

0.0 to 3275.0 sec.

Enter the time value in seconds that the alarm is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the alarm status per the response time listed in the Specifications. When the output logic is rEu, this becomes off time delay. Any time accumulated at power-off resets during power-up.

OFF TIME DELAY

tOF-n
0.0

0.0 to 3275.0 sec.

Enter the time value in seconds that the alarm is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the alarm status per the response time listed in the Specifications. When the output logic is rEu, this becomes on time delay. Any time accumulated at power-off resets during power-up.

OUTPUT LOGIC

out-n
nor

nor rEu

Enter the output logic of the alarm output. The nor logic leaves the output operation as normal. The rEu logic reverses the output logic. In rEu, the alarm states in the Setpoint Alarm Figures are reversed.

RESET ACTION

rSt-n
Auto

Auto LAtC1 LAtC2

Enter the reset action of the alarm output.

Auto = Automatic action; This action allows the alarm output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Alarm Figures. The "on" alarm may be manually reset (off) immediately by a front panel function key or user input.The alarm remains reset off until the trigger point is crossed again.

LAtC1 = Latch with immediate reset action; This action latches the alarm output on at the trigger point per the Setpoint Action shown in Setpoint Alarm Figures. Latch means that the alarm output can only be turned off by front panel function key or user input manual reset, serial reset command or meter power cycle. When the user input or function key is activated (momentary or maintained), the corresponding "on" alarm output is reset immediately and remains off until the trigger point is crossed again. (Previously latched alarms will be off if power up Display Value is lower than setpoint value.)

LAtC2 = Latch with delay reset action; This action latches the alarm output on at the trigger point per the Setpoint Action shown in Setpoint Alarm Figures. Latch means that the alarm output can only be turned off by front panel function key or user input manual reset, serial reset command or meter power cycle. When the user input or function key is activated (momentary or maintained), the meter delays the event until the corresponding "on" alarm output crosses the trigger off point. (Previously latched alarms are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous Latch 2 reset if it is not activated at power up.)

STANDBY OPERATION

Stb-n
no

no YES

When YES, the alarm is disabled (after a power up) until the trigger point is crossed. Once the alarm is on, the alarm operates normally per the Setpoint Action and Reset Mode.

SETPOINT ANNUNCIATORS

Lit-n
nor

OFF nor rEu FLASH

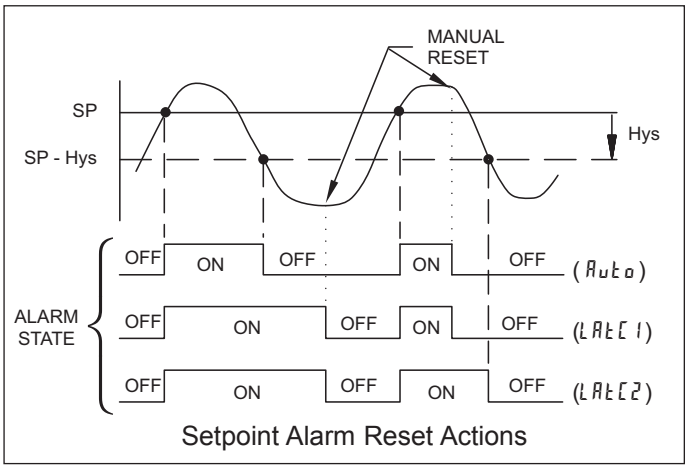
The OFF mode disables display setpoint annunciators. The nor mode displays the corresponding setpoint annunciators of "on" alarm outputs. The rEu mode displays the corresponding setpoint annunciators of "off" alarms outputs. The FLASH mode flashes the corresponding setpoint annunciators of "on" alarm outputs.

PROBE BURN-OUT ACTION (PAXT ONLY)

brn-n
oFF

On OFF

Enter the probe burn-out action. In the event of a temperature probe failure, the alarm output can be programmed to go on or off.



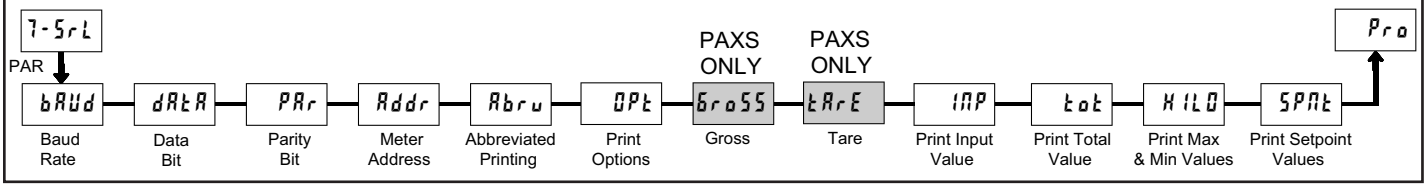
Setpoint Alarm Reset Actions

Alternate Setpoints

An Alternate list of setpoint values can be stored and recalled as needed. The Alternate list allows an additional set of setpoint values. (The setpoint numbers nor rear terminal numbers will change in the Alternate list.) The Alternate list can only be activated through a function key or user input programmed for LISt in Module 2. When the Alternate list is selected, the Main list is stored and becomes inactive. When changing between Main and Alternate, the alarm state of Auto Reset Action alarms will always follow their new value. Latched "on" alarms will always stay latched during the transition and can only be reset with a user input or function key. Only during the function key or user input transition does the display indicate which list is being used.

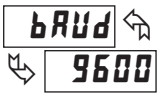
6.7 MODULE 7 - SERIAL COMMUNICATIONS PARAMETERS (7-SrL) ∇

PARAMETER MENU



∇ - A communication card must be installed in order to access this module.

BAUD RATE



300 1200 4800 19200
600 2400 9600

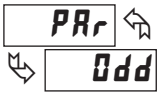
Set the baud rate to match that of other serial communications equipment. Normally, the baud rate is set to the highest value that all of the serial communications equipment is capable of transmitting.

DATA BIT

7 8

Select either 7 or 8 bit data word lengths. Set the word length to match that of other serial communication equipment. Since the meter receives and transmits 7-bit ASCII encoded data, 7 bit word length is sufficient to request and receive data from the meter.

PARITY BIT



Odd EVEN no

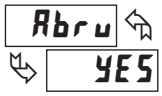
Set the parity bit to match that of the other serial communications equipment used. The meter ignores the parity when receiving data, and sets the parity bit for outgoing data. If no parity is selected with 7-bit word length the meter transmits and receives data with 2 stop bits. (For example: 10 bit frame with mark parity)

METER ADDRESS

0 to 99

Enter the serial node address. With a single unit on a bus, an address is not needed and a value of zero can be used (RS232 applications). Otherwise, with multiple bussed units, a unique address number must be assigned to each meter. The node address applies specifically to RS485 applications.

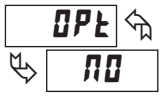
ABBREVIATED PRINTING



YES no

Select abbreviated transmissions (numeric only) or full field transmission. When the data from the meter is sent directly to a terminal for display, the extra characters that are sent identify the nature of the meter parameter displayed. In this case, select no. When the data from the meter goes to a computer, it may be desirable to suppress the node address and mnemonic when transmitting. In this case, set this parameter to YES.

PRINT OPTIONS



YES no

YES - Enters the sub-menu to select those meter parameters to appear in the block print. For each parameter in the sub-menu select YES for the parameter to appear with the block print, and no to disable the parameter.

*Setpoints 1-4 are setpoint plug-in card dependent.

Gross Value (PAXS Only)	GroSS	YES	no
Tare Value (PAXS Only)	tArE	YES	no
Input Value	InP	YES	no
Max and Min Values	HILO	YES	no
Total Value	tot	YES	no
Setpoint values*	SPAt	YES	no

Sending Commands and Data

When sending commands to the meter, a string containing at least one command character must be constructed. A command string consists of a command character, a value identifier, numerical data (if writing data to the meter) followed by a the command terminator character * or $.

Command Chart

Command	Description	Notes
N	Node Address Specifier	Address a specific meter. Must be followed by one or two digit node address. Not required when node address = 0.
T	Transmit Value (read)	Read a register from the meter. Must be followed by register ID character.
V	Value change (write)	Write to register of the meter. Must be followed by register ID character and numeric data.
R	Reset	Reset a register or output. Must be followed by register ID character
P	Block Print Request (read)	Initiates a block print output. Registers are defined in programming.

Register Identification Chart

ID	Value Description	Register ID	Applicable Commands/Comments	
A	Input	INP	T, P, R	(Reset command [Ver2.5+] zeros the input [“REL” or Tare])
B	Total	TOT	T, P, R	(Reset command resets total to zero)
C	Max Input	MAX	T, P, R	(Reset command resets MAX to current reading)
D	Min Input	MIN	T, P, R	(Reset command resets MIN to current reading)
E	Setpoint 1	SP1	T, P, V, R	(Reset command resets the setpoint output)
F	Setpoint 2	SP2	T, P, V, R	(Reset command resets the setpoint output)
G	Setpoint 3	SP3	T, P, V, R	(Reset command resets the setpoint output)
H	Setpoint 4	SP4	T, P, V, R	(Reset command resets the setpoint output)
I	Analog Output Register	AOR	T, V	(Applies to manual mode)
J	Control Status Register	CSR	T, V	
L	Absolute (gross) input display value	ABS GRS †	T, P	
Q	Offset/Tare (PAXS)	OFS TAR †	T, P, V	(Ver 2.5+)

† -Register ID for the PAXS.

Command String Construction

The command string must be constructed in a specific sequence. The meter does not respond with an error message to illegal commands. The following procedure details construction of a command string:

1. The first 2 or 3 characters consist of the Node Address Specifier (N) followed by a 1 or 2 character node address number. The node address number of the meter is programmable. If the node address is 0, this command and the node address itself may be omitted. This is the only command that may be used in conjunction with other commands.
2. After the optional address specifier, the next character is the command character.
3. The next character is the register ID. This identifies the register that the command affects. The P command does not require a register ID character. It prints according to the selections made in print options.
4. If constructing a value change command (writing data), the numeric data is sent next.
5. All command strings must be terminated with the string termination characters * or $. The meter does not begin processing the command string until this character is received. See timing diagram figure for differences of * and $ terminating characters.

Command String Examples:

1. Node address = 17, Write 350 to Setpoint 1, response delay of 2 msec min
   String: N17VE350$
2. Node address = 5, Read Input value, response delay of 50 msec min
   String: N5TA*
3. Node address = 0, Reset Setpoint 4 output, response delay of 50 msec min
   String: RH*

Sending Numeric Data

Numeric data sent to the meter must be limited to 5 digits (-19,999 to 99,999). If more than 5 digits are sent, the meter accepts the last 5. Leading zeros are ignored. Negative numbers must have a minus sign. The meter ignores any decimal point and conforms the number to the scaled resolution. (For example: the meter’s scaled decimal point position = 0.0 and 25 is written to a register. The value of the register is now 2.5 In this case, write a value = 25.0).

Note: Since the meter does not issue a reply to value change commands, follow with a transmit value command for readback verification.

Receiving Data

Data is transmitted by the meter in response to either a transmit command (T), a print block command (P) or User Function print request. The response from the meter is either a full field transmission or an abbreviated transmission. In this case, the response contains only the numeric field. The meter response mode is established in programming.

Full Field Transmission

Byte	Description
1, 2	2 byte Node Address field [00-99]
3	<SP> (Space)
4-6	3 byte Register Mnemonic field
7-18	12 byte data field; 10 bytes for number, one byte for sign, one byte for decimal point (The T command may be a different byte length)
19	<CR> carriage return
20	<LF> line feed
21	<SP>* (Space)
22	<CR>* carriage return
23	<LF>* line feed

** These characters only appear in the last line of a block print.*

The first two characters transmitted are the node address, unless the node address assigned =0, in which case spaces are substituted. A space follows the node address field. The next three characters are the register ID (Serial Mnemonic).

The numeric data is transmitted next. The numeric field is 12 characters long (to accommodate the 10 digit totalizer), with the decimal point position floating within the data field. Negative value have a leading minus sign. The data field is right justified with leading spaces.

The end of the response string is terminated with a carriage return <CR> and <LF>. When block print is finished, an extra <SP><CR> <LF> is used to provide separation between the blocks.

Abbreviated Transmission

Byte	Description
1-12	12 byte data field, 10 bytes for number, one byte for sign, one byte for decimal point
13	<CR> carriage return
14	<LF> line feed
15	<SP>* (Space)
16	<CR>* carriage return
17	<LF>* line feed

** These characters only appear in the last line of a block print.*

The abbreviated response suppresses the node address and register ID, leaving only the numeric part of the response.

Meter Response Examples:

1. Node address = 17, full field response, Input = 875
   17 INP 875 <CR><LF>
2. Node address = 0, full field response, Setpoint 2 = -250.5
   SP2 -250.5<CR><LF>
3. Node address = 0, abbreviated response, Setpoint 2 = 250, last line of block print
   250<CR><LF><SP><CR><LF>

SERIAL COMMANDS FOR PAX SOFTWARE

(CSR) Control Status Register

The Control Status Register is used to both directly control the meter's outputs (setpoints and analog output), and interrogate the state of the setpoint outputs. The register is bit mapped with each bit position within the register assigned to a particular control function. The control function are invoked by writing to each bit position. The bit position definitions are:

bit 0: Setpoint 1 Output Status
- 0 = output off
- 1 = output on

bit 1: Setpoint 2 Output Status
- 0 = output off
- 1 = output on

bit 2: Setpoint 3 Output Status
- 0 = output off
- 1 = output on

bit 3: Setpoint 4 Output Status
- 0 = output off
- 1 = output on

bit 4: Manual Mode
- 0 = automatic mode
- 1 = manual mode

bit 5: Always stays 0, even if 1 is sent.

bit 6: Sensor Status (PAXT only)
- 0 = sensor normal
- 1 = sensor fail

bit 7: Always stays 0, even if 1 is sent.

Although the register is bit mapped starting with bit 7, HEX < > characters are sent in the command string. Bits 7 and 5 always stay a zero, even if a "1" is sent. This allows ASCII characters to be used with terminals that may not have extended character capabilities.

Writing a "1" to bit 4 of CSR selects manual mode. In this mode, the setpoint outputs are defined by the values written to the bits b0, b1, b2, b3; and the analog output is defined by the value written to the AOR. Internal control of these outputs is then overridden.

In automatic mode, the setpoint outputs can only be reset off. Writing to the setpoint output bits of the CSR has the same effect as a Reset command (R). The contents of the CSR may be read to interrogate the state of the setpoint outputs and to check the status of the temperature sensor (PAXT only).

Examples:

1. Set manual mode, turn all setpoints off:

		7	6	5	4	3	2	1	0:bit location
VJ<30>* or VJ0*	ASCII 0 =	0	0	1	1	0	0	0	0 or <30>

V is command write, J is CSR and * is terminator.

2. Turn SP1, SP3 outputs on and SP2, SP4 outputs off:

		7	6	5	4	3	2	1	0:bit location
VJ<35>* or VJ5*	ASCII 5 =	0	0	1	1	0	1	0	1 or <35>

3. Select Automatic mode:

		7	6	5	4	3	2	1	0:bit location
VJ<40>* or VJ@*	ASCII @ =	0	1	0	0	0	0	0	0 or <40>

Note: Avoid writing values <0A> (LF), <0D> (CR), <24> ($) and <2E> (*) to the CSR. These values are interpreted by the meter as end of command control codes and will prematurely end the write operation.

(AOR) Analog Output Register

The Analog Output Register controls the analog output of the meter. The manual mode must first be engaged by setting bit 4 of the Control Status Register. The range of values of this register is 0 to 4095, which corresponds to 0 mA, 0 V and 20 mA, 10 V; respectively. The table lists correspondence of the output signal with the register value.

Register Value	Output Signal*	
	I (mA)	V (V)
0	0.000	0.000
1	0.005	0.0025
2047	10.000	5.000
4094	19.995	9.9975
4095	20.000	10.000

**Due to the absolute accuracy rating and resolution of the output card, the actual output signal may differ 0.15% FS from the table values. The output signal corresponds to the range selected (20 mA or 10 V).*

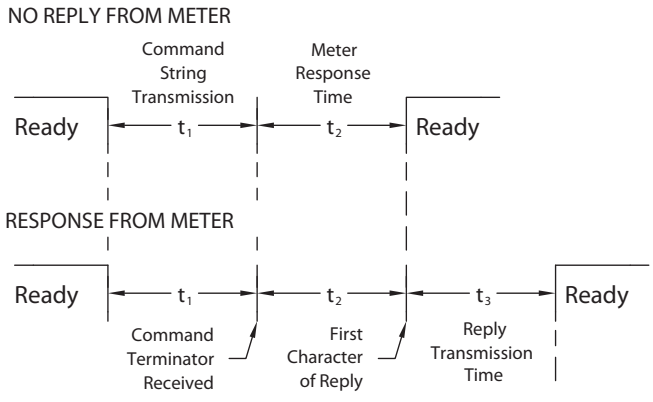
Writing to this register while the meter is in the manual mode causes the output signal to update immediately. While in the automatic mode, this register may be written to, but the output will not update until the meter is placed in manual mode.

Examples:

1. Set output to full scale:
   VI4095*
2. Set output to zero scale:
   VI0*

Command Response Time

The meter can only receive data or transmit data at any one time (half-duplex operation). The meter ignores commands while transmitting data, but instead uses RXD as a busy signal. When sending commands and data to the meter, a delay must be imposed before sending another command. This allows enough time for the meter to process the command and prepare for the next command.



Timing Diagram Figure

At the start of the time interval t_1, the computer program prints or writes the string to the com port, thus initiating a transmission. During t_1, the command characters are under transmission and at the end of this period, the command terminating character (*) is received by the meter. The time duration of t_1 is dependent on the number of characters and baud rate of the channel.

t_1 = (10 * # of characters) / baud rate

At the start of time interval t_2, the meter starts the interpretation of the command and when complete, performs the command function. This time interval t_2 varies from 2 msec to 50 msec. If no response from the meter is expected, the meter is ready to accept another command.

If the meter is to reply with data, the time interval t_2 is controlled by the use of the command terminating character. The standard command line terminating character is '*'. This terminating character results in a response time window of 50 msec minimum and 100 msec maximum. This allows sufficient time for the release of the sending driver on the RS485 bus. Terminating the command line with '$' results in a response time window (t_2) of 2 msec minimum and 50 msec maximum. The faster response time of this terminating character requires that sending drivers release within 2 msec after the terminating character is received.

At the beginning of time interval t_3, the meter responds with the first character of the reply. As with t_1, the time duration of t_3 is dependent on the number of characters and baud rate of the channel. t_3 = (10 * # of characters) / baud rate. At the end of t_3, the meter is ready to receive the next command.

The maximum serial throughput of the meter is limited to the sum of the times t_1, t_2 and t_3.

Communication Format

Data is transferred from the meter through a serial communication channel. In serial communications, the voltage is switched between a high and low level at a predetermined rate (baud rate) using ASCII encoding. The receiving device reads the voltage levels at the same intervals and then translates the switched levels back to a character.

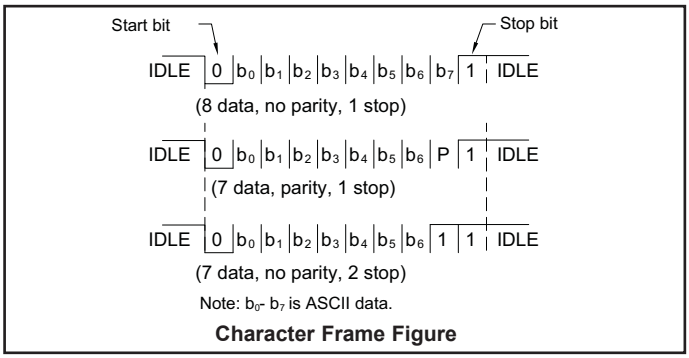
The voltage level conventions depend on the interface standard. The table lists the voltage levels for each standard.

LOGIC	INTERFACE STATE	RS232*	RS485*
1	mark (idle)	TXD,RXD; -3 to -15 V	a-b < -200 mV
0	space (active)	TXD,RXD; +3 to +15 V	a-b > +200 mV
* Voltage levels at the Receiver			

Data is transmitted one byte at a time with a variable idle period between characters (0 to ∞). Each ASCII character is "framed" with a beginning start bit, an optional error detection parity bit and one or more ending stop bits. The data format and baud rate must match that of other equipment in order for communication to take place. The figures list the data formats employed by the meter.

Start bit and Data bits

Data transmission always begins with the start bit. The start bit signals the receiving device to prepare for reception of data. One bit period later, the least significant bit of the ASCII encoded character is transmitted, followed by the remaining data bits. The receiving device then reads each bit position as they are transmitted. Since the sending and receiving devices operate at the same transmission speed (baud rate), the data is read without timing errors.



Character Frame Figure

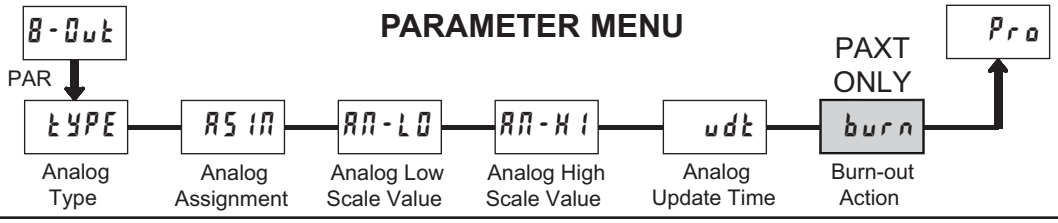
Parity bit

After the data bits, the parity bit is sent. The transmitter sets the parity bit to a zero or a one, so that the total number of ones contained in the transmission (including the parity bit) is either even or odd. This bit is used by the receiver to detect errors that may occur to an odd number of bits in the transmission. However, a single parity bit cannot detect errors that may occur to an even number of bits. Given this limitation, the parity bit is often ignored by the receiving device. The PAX meter ignores the parity bit of incoming data and sets the parity bit to odd, even or none (mark parity) for outgoing data.

Stop bit

The last character transmitted is the stop bit. The stop bit provides a single bit period pause to allow the receiver to prepare to re-synchronize to the start of a new transmission (start bit of next byte). The receiver then continuously looks for the occurrence of the start bit.

6.8 MODULE 8 - ANALOG OUTPUT PARAMETERS (8-Out) ∇



∇ - An analog output card must be installed in order to access this module.

ANALOG TYPE

tYPE → 4-20

SELECTION	RANGE
0-20	0 to 20 mA
4-20	4 to 20 mA
0-10	0 to 10 V

Enter the analog output type. For 0-20 mA or 4-20 mA use terminals 18 and 19. For 0-10 V use terminals 16 and 17. Only one range can be used at a time.

ANALOG ASSIGNMENT

rS in → inP

inP Hi Lo tot

Enter the source for the analog output to retransmit:
inP = Display Input Value
Hi = Maximum Display Input Value
Lo = Minimum Display Input Value
tot = Totalize Display Value

ANALOG LOW SCALE VALUE

An-Lo → 0.00

-19999 to 99999

Enter the Display Value that corresponds to 0 mA (0-20 mA) , 4 mA (4-20 mA) or 0 VDC (0-10 VDC).

ANALOG HIGH SCALE VALUE

An-Hi → 100.00

-19999 to 99999

Enter the Display Value that corresponds to 20 mA (0-20 mA) , 20 mA (4-20 mA) or 10 VDC (0-10 VDC).

ANALOG UPDATE TIME

udt → 0.0

0.0 to 10.0

Enter the analog output update rate in seconds. A value of 0.0 allows the meter to update the analog output at a rate of 20/sec.

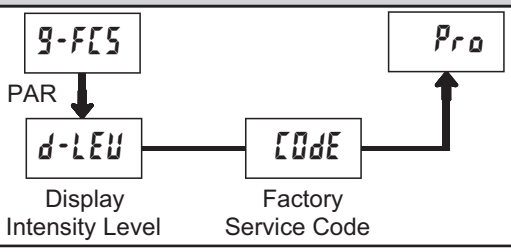
PROBE BURN-OUT ACTION (PAXT ONLY)

burn → Lo

Lo Hi

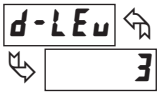
Enter the probe burn-out action. In the event of a temperature probe failure, the analog output can be programmed for low or high scale.

6.9 MODULE 9 - FACTORY SERVICE OPERATIONS (9-FCS)



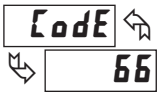
PARAMETER MENU

DISPLAY INTENSITY LEVEL



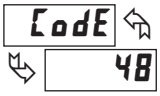
Enter the desired Display Intensity Level (0-15) by using the arrow keys. The display will actively dim or brighten as the levels are changed. This parameter also appears in Quick Programming Mode when enabled.

RESTORE FACTORY DEFAULTS



Use the arrow keys to display **CodE 66** and press **PAR**. The meter will display **rESEt** and then return to **CodE 50**. Press **DSP** key to return to Display Mode. This will overwrite all user settings with the factory settings.

CALIBRATION



The meter has been fully calibrated at the factory. Scaling to convert the input signal to a desired display value is performed in Module 1. If the meter appears to be indicating incorrectly or inaccurately, refer to Troubleshooting before attempting to calibrate the meter.

When recalibration is required (generally every 2 years), it should only be performed by qualified technicians using appropriate equipment. Calibration does not change any user programmed parameters. However, it may affect the accuracy of the input signal values previously stored using the Apply (**APLY**) Scaling Style.

Calibration may be aborted by disconnecting power to the meter before exiting Module 9. In this case, the existing calibration settings remain in effect.

PAXD - Input Calibration

WARNING: *Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better. Resistance inputs require a resistance substitution device with an accuracy of 0.01% or better.*

Before starting, verify that the Input Ranger Jumper is set for the range to be calibrated. Also verify that the precision signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter. **no** and **PAR** can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:

1. Use the arrow keys to display **CodE 48** and press **PAR**.
2. Choose the range to be calibrated by using the arrow keys and press **PAR**.
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage ranges: dead short applied
   - Current ranges: open circuit
   - Resistance ranges: dead short with current source connected
4. Press **PAR** and **----** will appear on the display for about 10 seconds.
5. When the top range limit appears on the display, apply the appropriate:
   - Voltage ranges: top range value applied (The 300 V range is the exception. It is calibrated with a 100 V signal.)
   - Current ranges: top range value
   - Resistance ranges: top range value (The ohms calibration requires connection of the internal current source through a resistance substitution device and the proper voltage range selection.)
6. Press **PAR** and **----** will appear on the display for about 10 seconds.
7. When **no** appears, press **PAR** twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.

PAXP - Input Calibration

WARNING: *Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.*

Before starting, verify that the precision signal source is connected to the correct terminals and ready. Allow a 30 minute warm-up period before calibrating the meter. **no** and **PAR** can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:

1. Use the arrow keys to display **CodE 48** and press **PAR**.
2. Choose the range to be calibrated by using the arrow keys and press **PAR**. (**no** and **PAR** can be chosen to exit the calibration mode without any changes taking place.)
3. When the zero range limit appears on the display, apply the appropriate:
   - Voltage range: dead short applied
   - Current range: open circuit
4. Press **PAR** and **----** will appear on the display for about 10 seconds.
5. When the top range limit appears on the display, apply the appropriate:
   - Voltage range: 10 VDC
   - Current range: 20 mADC
6. Press **PAR** and **----** will appear on the display for about 10 seconds.
7. When **no** appears, press **PAR** twice.
8. If the meter is not field scaled, then the input display should match the value of the input signal.
9. Repeat the above procedure for each input range to be calibrated.

PAXH - Input Calibration

WARNING: *In the PAXH, DC signals are used to calibrate the AC ranges. Calibration of the PAXH requires a DC voltmeter with an accuracy of 0.025% and a precision DC signal source capable of:*

1. *+1% of full scale, DC*
2. *-1% of full scale, DC*
3. *+100% of full scale, DC; (300 V range = +100 V calibration)*
4. *-100% of full scale, DC; (300 V range = -100 V calibration)*

Before starting, verify the Input Range and Signal Jumpers are set for the range to be calibrated and the Couple jumper is installed for DC. Also verify the DC signal source is connected and ready. Allow a 30 minute warm-up period before calibrating the meter. **no** and **PAR** can be chosen to exit the calibration mode without any changes taking place.

Then perform the following procedure:

1. Press the arrow keys to display **CodE 48** and press **PAR**.
2. The meter displays **CAL**. Use the arrow keys to select the range that matches the Signal Jumper setting. Press **PAR**.
3. Apply the signal matching the meter prompt.
4. Press **PAR** and **-----** will appear on the display, wait for next prompt.
5. Repeat steps 3 and 4 for the remaining three prompts.
6. When **no** appears, press **PAR** twice.
7. If the meter is scaled to show input signal, the Input Display should match the value of the input signal in the Display Mode.
8. Repeat the above procedure for each range to be calibrated or to recalibrate the same range. It is only necessary to calibrate the input ranges being used.
9. When all desired calibrations are completed, remove the external signal source and restore original configuration and jumper settings. If AC is being measured, continue with AC Couple Offset Calibration.

AC Couple Offset Calibration - PAXH

It is recommended that Input Calibration be performed first.

1. With meter power removed, set the Input Range Jumper for 20 V, the Couple Jumper for DC, and set the Signal Jumper for voltage by removing the jumper.
2. Connect a wire (short) between Volt (terminal 6) and COMM (terminal 4).
3. Apply meter power.
4. In Module 1, program as follows: Range: 20u; Couple: dC; Decimal Point: 0; Round: 1; Filter: 0.5; Band: 20; Points: 2; Style: KEY; INP1: 0.000; DSP1: 0; INP2: 20.000; DSP2: 20000
5. In Module 4, program as follows: Hi-t: 0.0; Lo-t: 32767
6. Press **PAR** then **DSP** to exit programming and view the Input Display.
7. The readout displays the DC coupled zero input, record the value.
8. Remove the meter power and set the Couple Jumper to AC by removing the jumper.
9. Maintaining the short between terminals 4 and 6, reapply the meter power.
10. Keeping all programming the same, view the Input Display.
11. The readout now displays the AC coupled zero input, record the value.
12. In Module 9, Use the arrow keys to display CodE 48 and press **PAR**.
13. Press the down arrow key twice to AC-OF and press **PAR**.
14. Calculate the offset OFFSt using the following formula:
    OFFSt = AC coupled reading (step 11) - DC coupled reading (step 7)
15. Use the arrow keys to enter the calculated OFFSt.
16. Press **PAR** three times, to exit programming.
17. Remove the meter power and remove the short from terminals 4 and 6.
18. Restore the original jumper and configuration settings.

PAXS - Input Calibration

WARNING: Calibration of this meter requires a signal source with an accuracy of 0.01% or better and an external meter with an accuracy of 0.005% or better.

Before starting, connect -SIG (terminal 4) to COMM (terminal 5). This allows a single ended signal to be used for calibration. Connect the calibration signal to +SIG (terminal 3) and -SIG (terminal 4). Verify the Input Range jumper is in the desired position. Allow a 30 minute warm-up period before calibrating the meter. no and **PAR** can be chosen to exit the calibration mode without any changes taking place. Perform the following procedure:

1. Press the arrow keys to display CodE 48 and press **PAR**.
2. Choose the range to be calibrated by using the arrow keys and press **PAR**.
3. When the zero range limit appears on the display, apply 0 mV between +SIG and -SIG.
4. Press **PAR** and ---- will appear, wait for next prompt.
5. When the top range limit appears on the display, apply the corresponding +SIG and -SIG voltage (20 mV or 200 mV).
6. Press **PAR** and ---- will appear, on the display for about 10 seconds.
7. When nO appears, press **PAR** twice to exit programming.
8. Repeat the above procedure for each range to be calibrated or to recalibrate the same range. It is only necessary to calibrate the input ranges being used.
9. When all desired calibrations are completed, remove -SIG to COMM connection and external signal source.
10. Restore original configuration and jumper settings.

PAXT - Input Calibration

Warning: Calibration of this meter requires precision instrumentation operated by qualified technicians. It is recommended that a calibration service calibrates the meter.

Before selecting any of the calibration procedures, the input to the meter must be at 0 mV or 0 ohms. Set the digital filer in Module 1 to 1 second. Allow a 30 minute warm-up period before calibrating the meter. The no and **PAR** can be chosen to exit calibration mode without any changes taking place.

10 OHM RTD Range Calibration

1. Set the Input Range Jumper to 10 ohm.
2. Use the arrow keys to display CodE 48 and press **PAR**. Then choose r-10 and press **PAR**.
3. At 0 r, apply a direct short to input terminals 3, 4 and 5 using a three wire link. Wait 10 seconds, then press **PAR**.
4. At 15 r, apply a precision resistance of 15 ohms (with an accuracy of 0.01% or better) using a three wire link, to input terminals 3, 4 and 5. Wait 10 seconds, then press **PAR**.
5. Connect the RTD, return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat calibration.

100 OHM RTD Range Calibration

1. Set the Input Range Jumper to 100 ohm.
2. Use the arrow keys to display CodE 48 and press **PAR**. Then choose r-100 and press **PAR**.
3. At 0 r, apply a direct short to input terminals 3, 4 and 5 using a three wire link. Wait 10 seconds, then press **PAR**.
4. At 300 r, apply a precision resistance of 300 ohms (with an accuracy of 0.01% or better) using a three wire link, to terminals 3, 4 and 5. Wait 10 seconds, press **PAR**.
5. Connect the RTD, return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat calibration.

THERMOCOUPLE Range Calibration

1. Use the arrow keys to display CodE 48 and press **PAR**. Then choose tC and press **PAR**.
2. At 0.0 u, apply a dead short or set calibrator to zero to input terminals 4 and 5. Wait 10 seconds, then press **PAR**.
3. At 50.0 u, apply 50.000 mV input signal (with an accuracy of 0.01% or better) to input terminals 4 and 5. Wait 10 seconds, then press **PAR**.
4. Return to the Display Mode.
5. Continue with Ice Point Calibration.

ICE POINT Calibration

1. **Remove all option cards or invalid results will occur.**
2. The ambient temperature must be within 20°C to 30°C.
3. Connect a thermocouple (types T, E, J, K, or N only) with an accuracy of 1°C or better to the meter.
4. Verify the readout Display Offset is 0, Temperature Scale is °C, Display Resolution is 0.0, and the Input Range is set for the connected thermocouple.
5. Place the thermocouple in close thermal contact to a reference thermometer probe. (Use a reference thermometer with an accuracy of 0.25°C or better.) The two probes should be shielded from air movement and allowed sufficient time to equalize in temperature. (A calibration bath could be used in place of the thermometer.)
6. In the Normal Display mode, compare the readouts.
7. If a difference exists then continue with the calibration.
8. Enter Module 9, use the arrow keys to display CodE 48 and press **PAR**. Then choose ICE and press **PAR**.
9. Calculate a new Ice Point value using: existing Ice Point value + (reference temperature - Display Mode reading). All values are based on °C.
10. Enter the new Ice Point value.
11. Return to the Display Mode and verify the input reading (with 0 Display Offset) is correct. If not correct repeat steps 8 through 10.

ANALOG OUTPUT CARD CALIBRATION

Before starting, verify that the precision voltmeter (voltage output) or current meter (current output) is connected and ready. Perform the following procedure:

1. Use the arrow keys to display CodE 48 and press **PAR**.
2. Use the arrow keys to choose OUt and press **PAR**.
3. Using the chart below, step through the five selections to be calibrated. At each prompt, use the PAX arrow keys to adjust the external meter display to match the selection being calibrated. When the external reading matches, or if this range is not being calibrated, press **PAR**.

SELECTION	EXTERNAL METER	ACTION
0.0_A	0.00	Adjust if necessary, press **PAR**
4.0_A	4.00	Adjust if necessary, press **PAR**
20.0_A	20.00	Adjust if necessary, press **PAR**
0.0u	0.00	Adjust if necessary, press **PAR**
10.0u	10.00	Adjust if necessary, press **PAR**

4. When nO appears remove the external meters and press **PAR** twice.

TROUBLESHOOTING

PROBLEM	REMEDIES
NO DISPLAY	CHECK: Power level, power connections
PROGRAM LOCKED-OUT	CHECK: Active (lock-out) user input ENTER: Security code requested
MAX, MIN, TOT LOCKED-OUT	CHECK: Module 3 programming
INCORRECT INPUT DISPLAY VALUE	CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level, Module 4 Display Offset is zero, press DSP for Input Display PERFORM: Module 9 Calibration (If the above does not correct the problem.)
"OLOL" in DISPLAY (SIGNAL HIGH)	CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level
"ULUL" in DISPLAY (SIGNAL LOW)	CHECK: Module 1 programming, Input Range Jumper position, input connections, input signal level
JITTERY DISPLAY	INCREASE: Module 1 filtering, rounding, input range CHECK: Wiring is per EMC installation guidelines
MODULES or PARAMETERS NOT ACCESSIBLE	CHECK: Corresponding plug-in card installation
ERROR CODE (Err 1-4)	PRESS: Reset KEY (If cannot clear contact factory.)
DISPLAY ZERO'S AT LEVELS BELOW 1% OF RANGE	PROGRAM: Module 4 as Hi-t: 0.0 LO-t: 3271.1 (to disable zero chop feature)

For further assistance, contact technical support at the appropriate company numbers listed.

PARAMETER VALUE CHART Programmer _____ Date _____
PAX MODEL NUMBER _____ Meter# _____ Security Code _____

1- INP Signal Input Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
rANGE	MODEL DEPENDENT		
tYPE	PAXT: INPUT TYPE	tc-J	
SCALE	PAXT: TEMPERATURE SCALE	°F	
COUPL	PAXH: INPUT COUPLE	AC	
dECPt	* DISPLAY RESOLUTION	0	
round	DISPLAY ROUNDING INCREMENT	1	
OFFSt	PAXT: DISPLAY OFFSET	0	
FILtr	FILTER SETTING - PAXH 0.5	1.0	
bAND	FILTER ENABLE BAND - PAXH 0.020	10	
ICE	PAXT: ICE POINT SLOPE	0.00	
PtS	SCALING POINTS	2	
StYLE	SCALING STYLE - NOT PAXT	LEY	
INP 1	* INPUT VALUE 1	0.000	
dSP 1	* DISPLAY VALUE 1	0	
INP 2	* INPUT VALUE 2	1.000	
dSP 2	* DISPLAY VALUE 2	1000	
INP 3	* INPUT VALUE 3	0.000	
dSP 3	* DISPLAY VALUE 3	0	
INP 4	* INPUT VALUE 4	0.000	
dSP 4	* DISPLAY VALUE 4	0	
INP 5	* INPUT VALUE 5	0.000	
dSP 5	* DISPLAY VALUE 5	0	

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
INP 6	* INPUT VALUE 6	0.000	
dSP 6	* DISPLAY VALUE 6	0	
INP 7	* INPUT VALUE 7	0.000	
dSP 7	* DISPLAY VALUE 7	0	
INP 8	* INPUT VALUE 8	0.000	
dSP 8	* DISPLAY VALUE 8	0	
INP 9	* INPUT VALUE 9	0.000	
dSP 9	* DISPLAY VALUE 9	0	
INP 10	* INPUT VALUE 10	0.000	
dSP 10	* DISPLAY VALUE 10	0	
INP 11	* INPUT VALUE 11	0.000	
dSP 11	* DISPLAY VALUE 11	0	
INP 12	* INPUT VALUE 12	0.000	
dSP 12	* DISPLAY VALUE 12	0	
INP 13	* INPUT VALUE 13	0.000	
dSP 13	* DISPLAY VALUE 13	0	
INP 14	* INPUT VALUE 14	0.000	
dSP 14	* DISPLAY VALUE 14	0	
INP 15	* INPUT VALUE 15	0.000	
dSP 15	* DISPLAY VALUE 15	0	
INP 16	* INPUT VALUE 16	0.000	
dSP 16	* DISPLAY VALUE 16	0	

* Decimal point location is model and programming dependent.

2-FnC User Input and Function Key Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
USr-1	USER INPUT 1	no	
USr-2	USER INPUT 2	no	
USr-3	USER INPUT 3	no	
F1	FUNCTION KEY 1	no	
F2	FUNCTION KEY 2	no	
rSt	RESET KEY	no	
Sc-F1	2nd FUNCTION KEY 1	no	
Sc-F2	2nd FUNCTION KEY 2	no	

3-LOC Display and Program Lockout Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
HI	MAX DISPLAY LOCKOUT	LOC	
LO	MIN DISPLAY LOCKOUT	LOC	
tOt	TOTAL DISPLAY LOCKOUT	LOC	
SP-1	SETPOINT 1 ACCESS	LOC	
SP-2	SETPOINT 2 ACCESS	LOC	
SP-3	SETPOINT 3 ACCESS	LOC	
SP-4	SETPOINT 4 ACCESS	LOC	
CodE	SECURITY CODE	0	

4-SEC Secondary Function Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
HI-t	MAX CAPTURE DELAY TIME	0.0	
LO-t	MIN CAPTURE DELAY TIME	0.0	
dSP-t	DISPLAY UPDATE TIME	2	
Az-t	PAXS: AUTO-ZERO DELAY	0	
Az-b	PAXS: AUTO-ZERO BAND	0.02	
b-LIt	UNITS LABEL BACKLIGHT - PAXT on	OFF	
OFFSt	DISPLAY OFFSET - NOT PAXT	0.00	
ICE	PAXT: ICE POINT COMPENSATION	on	

5-tOt Totalizer (Integrator) Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
dECPt	* TOTALIZER DECIMAL POINT	0	
tbASE	TOTALIZER TIME BASE	.1M	
SCFAC	TOTALIZER SCALE FACTOR	1.000	
Locut	* TOTALIZER LOW CUT VALUE	-19999	
P-UP	TOTALIZER POWER-UP RESET	no	

7-SrL Serial Communication Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
bAUd	BAUD RATE	9600	
dAtA	DATA BIT	7	
PAr	PARITY BIT	Odd	
Addr	METER ADDRESS	0	
Abru	ABBREVIATED PRINTING	YES	
OPt	ENTER PRINT OPTIONS	no	
GroSS	PAXS: PRINT GROSS OFFSET	no	
tArE	PAXS: PRINT TARE OFFSET	no	
InP	PRINT INPUT VALUE	YES	
tot	PRINT TOTAL VALUE	YES	
HILO	PRINT MAX & MIN VALUES	YES	
SPnt	PRINT SETPOINT VALUES	no	

8-Out Analog Output Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
tYPE	ANALOG TYPE	4-20	
AS IN	ANALOG ASSIGNMENT	InP	
An-LO	* ANALOG LOW SCALE VALUE	0	
An-HI	* ANALOG HIGH SCALE VALUE	1000	
udt	ANALOG UPDATE TIME	0.0	
burn	PAXT: PROBE BURN-OUT ACTION	LO	

9-FCS Factory Setting Parameters

DISPLAY	PARAMETER	FACTORY SETTING	USER SETTING
d-LEu	DISPLAY INTENSITY LEVEL	3	

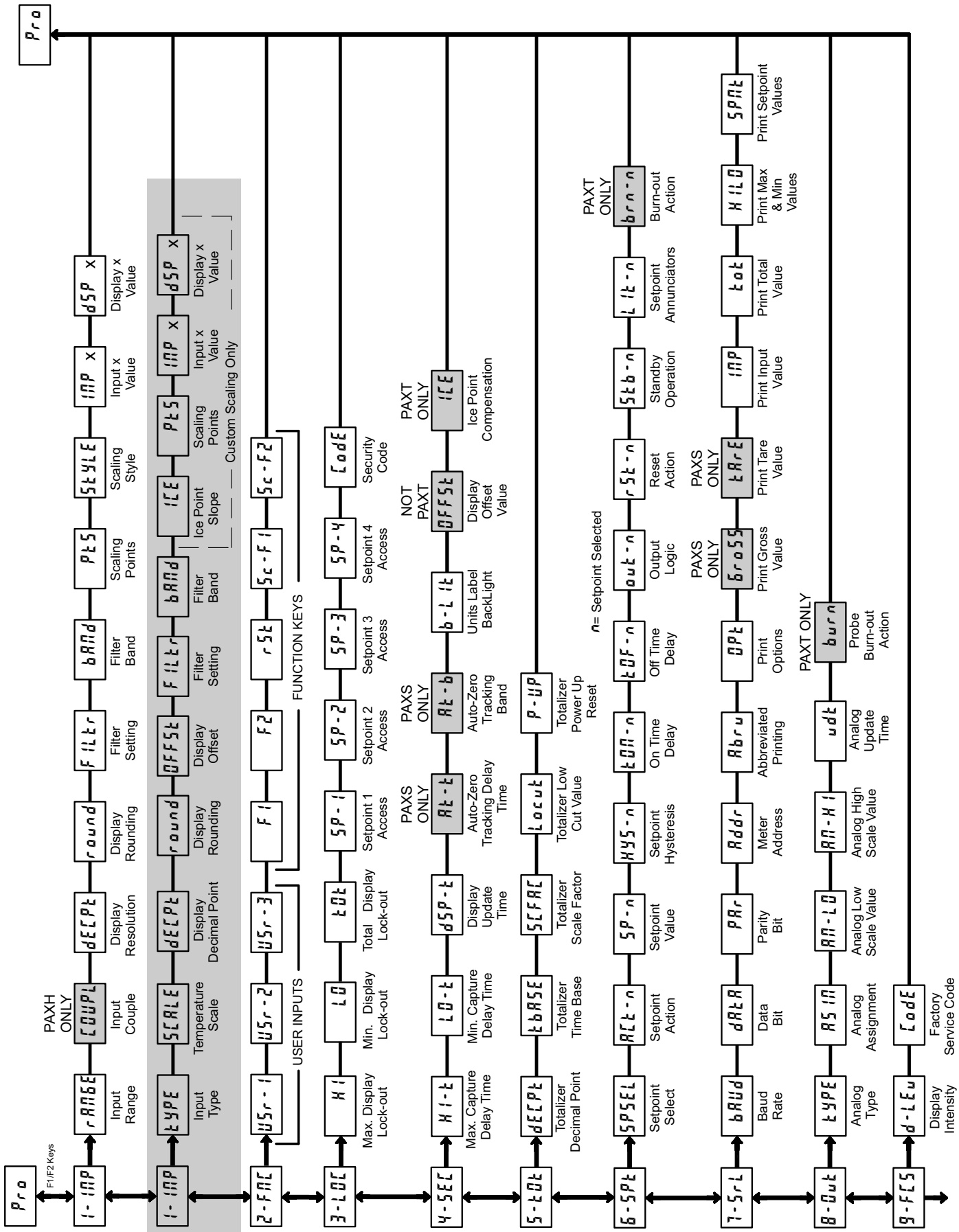
6-SPt Setpoint (Alarm) Parameters

DISPLAY	PARAMETER	SP-1 FACTORY SETTING	SP-1 USER SETTING	SP-2 FACTORY SETTING	SP-2 USER SETTING	SP-3 FACTORY SETTING	SP-3 USER SETTING	SP-4 FACTORY SETTING	SP-4 USER SETTING
ACt-n	SETPOINT ACTION	OFF		OFF		OFF		OFF	
SP-n	* SETPOINT VALUE (main)	100		200		300		400	
	* SETPOINT VALUE (alternate) †	100		200		300		400	
HYS-n	* SETPOINT HYSTERESIS	2		2		2		2	
tON-n	ON TIME DELAY	0.0		0.0		0.0		0.0	
tOF-n	OFF TIME DELAY	0.0		0.0		0.0		0.0	
out-n	OUTPUT LOGIC	nor		nor		nor		nor	
rSt-n	RESET ACTION	AUto		AUto		AUto		AUto	
Stb-n	STANDBY OPERATION	no		no		no		no	
LIt-n	SETPOINT ANNUNCIATORS	nor		nor		nor		nor	
brn-n	PAXT: PROBE BURN-OUT ACTION	OFF		OFF		OFF		OFF	

† Select alternate list to program these values.

* Decimal point location is model and programming dependent.

PAX PROGRAMMING QUICK OVERVIEW



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LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

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SECTION 7.

Lubrication Chart

LUBRICATION POINT	LUBRICANT SPECIFICATION	FREQUENCY OF RELUBRICATION	CHANGE	REMARKS
Rotor Motor	Mobil Polyrex EM	20 grams yearly		Using a typical low pressure grease gun, 16 pumps = 20 g
Conveyor Motor	Mobil Polyrex EM	5 grams yearly		Using a typical low pressure grease gun, 4 pumps = 5 g
Inner Shell Bearing	Mobil Polyrex EM	MONTHLY (UNTIL RING IS PURGED OF CONTAMINANTS)		REFERENCE IOM GREASING PROCEDURE
Rotor Bearings	Mobil Polyrex EM	.6 FLUID OZ (17g) PER MONTH	ONCE A YEAR REFERENCE IOM GREASING PROCEDURE	Using a typical low pressure grease gun, 14 pumps = 17 g
Tail Pulley Pillow Block Bearings	SEALMASTER GOLD PLEX HP	MONTHLY		REFERENCE IOM GREASING PROCEDURE
Tail Pulley Gearbox	KLUBERSYNTH UH1 6-460 Synthetic Lubricating Oil	FIRST OIL CHANGE 1500 HRS OF OPERATION	After 5000 hrs of operation	

SECTION 8.

Outline Drawings

The outline drawing has been prepared and selected for the specific equipment. It has been supplied separately by Eriez.