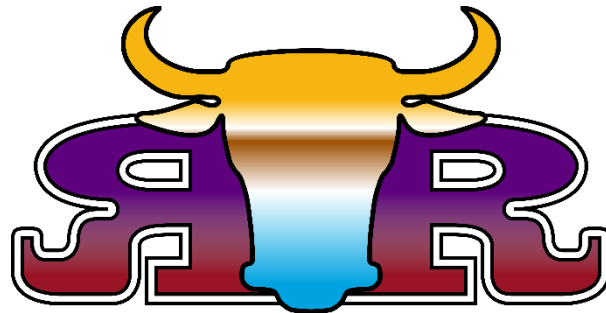


R & R Machine Works Inc.



We really appreciate you making this purchase from us and we hope the equipment meets your expectations. We strive to sell equipment that will make your business as well as ours, prosper. When you have future equipment or service needs please think of us first!

If we can be of further services to you or your company,
please call us at (806) 244-5686.

Sincerely,

Owners and Management
Dalhart R&R Machine Works, Inc.

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Introduction

Your new flaker is a quality flaking mill that will give you many years of low cost operation if given the proper amount of care and maintenance.

Your mill has been engineered and designed with simplicity of operation in mind, but first and foremost to give the best quality product at maximum operating capacity.

Your flaker manufacturer stands ready to serve you at any time with service, whether it be in the form of maintenance and operating instructions, or on location with help performed by a qualified factory representative.

Your flaker manufacturer has on hand at all times any replacement part for your mill that you will need, and also a supply of rolls corrugated and journaled to fit your mill and your operation.



Safety

Remember, YOU are the key to safety. Good safety practices not only protect you, but also the people around you. Make these practices a working part of your safety program. Be certain that everyone operating this equipment is familiar with the recommended operating and maintenance procedures and follows all the safety precautions. Most accidents can be prevented. Do not risk injury or death by ignoring good safety practices.

OPERATING SAFETY

1. Read and understand the Operator's Manual and all safety signs before using.
 2. Before servicing, adjusting, repairing, or maintaining unit, ensure that unit power source is completely shut down, and cannot start-up (locked out).
 3. Do not operate when any guards are damaged or removed. Install and secure guards before starting.
 4. Keep hands, feet, clothing, and hair away from all moving and/or rotating parts.
 5. Wear appropriate ear protection when operating for long periods of time.
 6. Review safety items with all personnel routinely.
- **DO NOT** modify the equipment in any way. Unauthorized modification will affect the warranty and may impair the function and / or safety and could affect the life of the equipment.
 - **DO NOT** make any adjustments or repairs on the equipment while the machine is running.
 - On a dual drive machine, tighten HTD belts **ONLY** when rolls are **CLOSED**.

SIGNAL WORDS:

Note the use of the signal words DANGER, WARNING, and CAUTION with the safety messages. The appropriate signal word for each message has been selected using the following guidelines:

DANGER - Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations, typically for machine components that, for functional purposes, cannot be guarded.

WARNING - Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury and includes hazards that are exposed when guards are removed. It may be also used to alert against unsafe practices.

CAUTION - Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may be also used to alert against unsafe practices.





**KEEP HANDS CLEAR
WHEN
EQUIPMENT
IS RUNNING**



**NO ACERQUE
LAS MANOS
CUANDO EL EQUIPO
ESTE FUNCIONANDO**



CAUTION

**DO NOT OPERATE
THIS MACHINE
WITHOUT GUARDS
IN PLACE**

PRECAUCION

**NO MANEJE
ESTA MÁQUINA
SIN GUARDIAS
EN POSICIÓN**

DANGER

**LOCK-OUT
BEFORE WORKING
ON EQUIPMENT**

PELIGRO

**CERRAR CON LLAVE
ANTES DE TRABAJAR
EN EL EQUIPO**

SAFETY SIGN REPLACEMENT

1. Keep safety signs clean and legible always.
2. Replace safety signs that are missing or have become illegible.
3. Replaced parts that displayed a safety sign should also display the current sign.
4. Safety signs are available from R and R Machine.



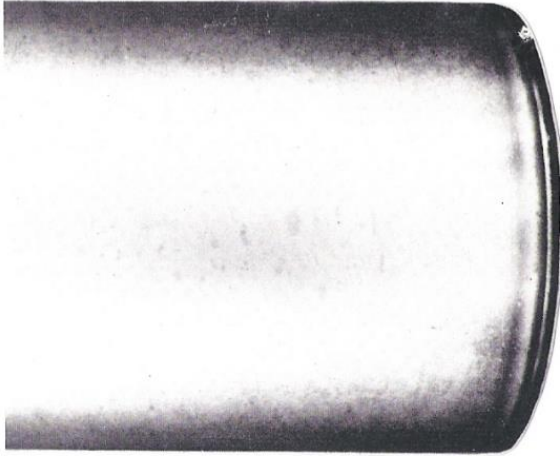
Operating Instructions for Feed Rolls

Feed Mill Rolls have a long life provided they are carefully maintained.

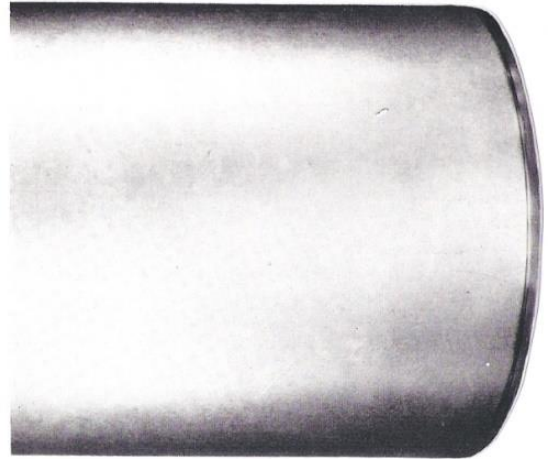
The following instructions should be observed:

1. The material to be crushed must be evenly distributed over the whole barrel length of the roll to avoid excessive wear on any surface. If, because of uneven wear or other factors, there is a direct metal to metal roll pressure, the specific load at such points may be so high as to result in work hardening. This may eventually lead to cracks and spalling at the barrel edges. Optimum performance is only obtained if the roll body wears equally all over and if local pressure applications are avoided, especially at points near the barrel edges.
2. The saddle parts should never be placed tightly on the rolls. This would result in frictional heat which might damage the roll surface. It is important to provide a clearance between the saddle and the roll which correspond approximately to the size of a flake.
3. Mineral impurities in the grain such as sand, stones and metallic components, increase the wear or can even destroy the barrel surface. For this reason, it is important to clean the grain before processing.
4. The mill should be started up and shut down with feed material in the roll gap. If this is not possible, metal to metal running should take place for the shortest possible period only. Metallic contact under pressure between revolving rolls may lead to high specific compression loads at certain points of the roll surface.
5. The mill should be stopped immediately if the supply of grain is interrupted.
6. To avoid spalling, it is helpful to chamfer the roll edges slightly. This should be carried out over a minimum length of 2". This process alone, however, does not provide adequate protection against damage to the barrel ends.
7. Regrinding of rolls should be done at regular intervals, the frequency of which will depend on the type and rate of feed and the volume of impurities.
8. It is essential that the rolls in operation should be inspected regularly. Before spalling or cracks appear, the surface becomes shiny. At that point it is absolutely essential to regrind the roll edges in the roll frame or to remove the rolls and regrind them on a special grinding lathe.
9. Damaged rolls should be repaired only by a specialist company.

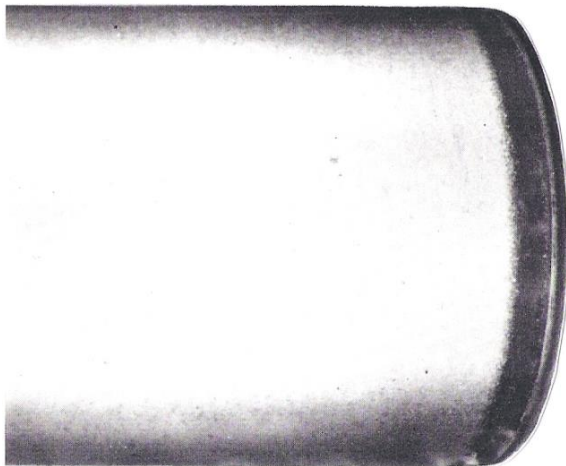




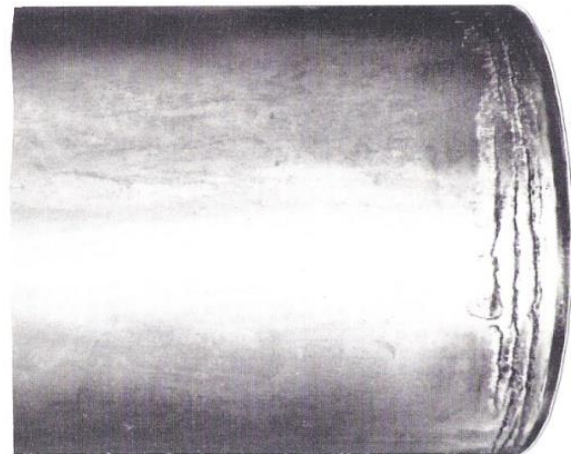
Pictured above: Chilled cast iron Roll after a certain operation time. This body surface indicates well aligned and uniform wear.



Shining areas and worn out saddles This indicates that the roll has not run in proper alignment.



The shining barrel end indicates metal to metal running. Regrinding is necessary otherwise.....



...spalling will appear as in the above picture.



Steam Flake Processing

There are four basic criteria that are controlled by the milling operator that have a significant effect on grain processing. They are:

1. Grain Moisture
2. Cook Time (time in the steam cabinet)
3. Grain Temperature
4. Grain Flake Bushel Weight

Each of the areas must be addressed in order to assure proper and adequate grain processing, regardless of grain involved.

GRAIN MOISTURE –Moisture is required within the grain kernel in order to provide steam expansion of the kernel during the cooking process and maximize the gelatinization of starch when passing through the rolls. The desired moisture level of the grain after processing is 21 percent. Because endogenous moisture varies depending on time in storage, harvest conditions, etc., the moisture addition through conditioning must be monitored regularly, and changes made if grain becomes too wet or too dry.

It is normally anticipated that we will pick up three to four percent moisture from steam in the cabinet when boiler pressure is 80 to 90 pounds. Based on the moisture of incoming grain, the grain conditioner should be calibrated accordingly.

COOKING TIME –The time spent in the steam cabinet at steam temperature, which is about 206 deg. F, at 3800 feet elevation, is necessary to improve the starch availability. It is this portion of the process that determines the improved conversion of starch to glucose in the rumen. For most grain, specifically corn or milo, the “cook time” necessary is about 45 minutes. Excessive cooking time (more than one hour) is not harmful but may cause some mechanical problems such as wrapping. The time spent cooking will be determined based on run time and total tons processed.

GRAIN TEMPERATURE –Grain in the steam cabinet will equilibrate at the aforementioned steam temperature of about 206-210 deg. F. The primary purpose of the steam is to heat the grain. When grains are extremely wet, i.e. right after harvest, the boiler pressure may be increased to provide the same temperature with less water (dry steam). That can be accomplished around 90 to 100 psi boiler pressure.

The grain should be heated for about 15 minutes prior to the start of the rolls. Maximum effectiveness is not reached until 30 to 40 minutes into the rolling process, after the rolls have heated and the process becomes uniform and consistent. Once temperatures are reached throughout the system, adjustments to high and low steam injection can be made (reduced) to improve the cost efficiency of boiler operation.



FLAKE BUSHEL WEIGHT –Without this final process all the foregoing effort is for naught. The rolling process finalizes the gelatinization process and makes it irreversible. And, in the case of milo, disrupts the protein matrix that surrounds the starch granule. Without the roller process, the grain would dry and return to its pretreatment status with no improvement in utilization of starch.

Flake bushel weight can be measured directly from beneath the rolls. The flake weight for corn should be from 27 to 28 pounds per bushel and the flake weight for milo should be 24 to 26 pounds per bushel. Weights above these levels will not produce the desired percentage of starch gelatinization and weights below these values will not appreciably improve utilization and will only result in added roll wear.

Flake weights must be determined to each side of the rolls since they are independently adjustable. There should be no more than two pounds per bushel difference between the sides.

The rolls are corrugated specifically for the grain to be processed. The corn rolls normally have 14 corrugations per inch and the milo rolls normally have 16 corrugations per inch. If we determine that milo will be the only grain processed through a particular set of rolls, we may suggest an 18 corrugation.

Maintaining maximum recommended amps on the rolls during processing provides for maximum tonnage production.

In summary, the objectives of grain processing are:

1. Maintain flake moisture at 21 percent.
2. Maintain a minimum cook time of 45 minutes.
3. Maintain maximum temperature, 206-208 degrees F.
4. Produce desirable flake bushel weight for the grain processed:

Flaked Weight

Corn – 27-28 lbs/bu

Milo -25-26 lbs/bu

Barley-26-27 lbs/bu

Wheat-30-33 lbs/bu

By doing these four things consistently, you will experience a marked improvement in efficiency of feed utilization and increased profit for both the feed yard and the cattle feeders.

The installation of your grain cleaner should be carefully planned and well-engineered.



Installation

The installation of your flaking mill should be carefully planned and well-engineered.

The following points should be followed to get the most out of your roller mill, both in capacity and quality:

1. There should be sufficient space around the machine for adjustments, repairs and removal of rolls for recorrugation.
2. The mill should be installed on a level surface capable of withstanding the weight of the mill. Micro/Level Isolators are ideal to place between the mill and the floor or stand that the mill is to be mounted on.
3. If the surface is not level, shims or grout should be used to avoid warping or binding the frame.
4. Install motor and drive as recommended by the factory. If the motor base or rails are not mounted, the motor must be fastened securely and the V –Belt aligned with the available space to tighten belts at a later time.
5. Provisions should be made to adequately feed the Mill.
6. Provisions must be adequate to take the product from the Mill. This is usually done by any of several methods.
7. The discharged grain is hot and moist when a steamer is used. This moisture in the grain is very corrosive, therefore, proper conveying is very important. If the grain is to be stored, proper cooling is a must.
8. Rolls must be kept in TRAM at all times. It is especially important when rolls are changed.

RECOMMENDED LIST OF SPARE PARTS:

1. If operating more than one mill, or in a case where a shut down for recorrugation hampers the overall operation, a spare set of rolls is recommended.
2. It is not necessary, but if a spare set of rolls is equipped with housings, bearings and adapters, a roll change can be made in less than $\frac{1}{4}$ of the normal time.
3. Belts, hydraulic cylinders or other closure system parts.



Pre-Operational Checklist

1. The rolls have been preset at the factory with a clearance of .015 when the rolls are drawn together.
2. All points requiring lubrication should be noted. Your mill has been lubricated at all points before leaving the factory.
3. Check all bolts for tightness.
4. Check all V-Belts for tightness.
5. Adjust SCR control at different settings to become familiar with its features.
6. Open and close the rolls several times to become acquainted with the mechanisms.

Tips on operating your roller mill

The Roller Mill was designed to efficiently produce a high quality of commercial grade flaked grain. The capacity of your mill will be dependent on the following conditions, either singly or in combination:

1. Plumpness of kernel
2. Toughness of hull
3. Moisture content
4. Amount of conditioning, when steam is used
5. Thinness of flake desired
6. Foreign material in grain, particularly rocks
7. Corrugation on rolls
8. The RPM of your feeder bar

The capacity can be increased somewhat if the quality of the final product is not critical.

The rolls are usually set further apart when rolling corn because of the large kernel size. It may be necessary to adjust the roll clearance to obtain your desired final product.

As the corrugation begins to wear off you will notice a decrease in capacity at first, but as the corrugation becomes extremely dull, the capacity will be greatly reduced.



To remove rolls from frame

1. Empty steam chest of grain to remove pressure from center section.
2. Remove all guards, belts, sheaves, and hubs.
3. Remove front roll cover.
4. Remove four grease fittings from front brackets. (two on each side).
5. Remove four 1" bolts from bottom front brackets on each side.
6. Remove four bolts on each side holding front bracket to front roll.
7. Remove four 1" bolts from top front brackets on each side.
8. Remove both front brackets.
9. Remove four 1" bolts from top brackets on each side.
10. Remove both top brackets.
11. Remove front roll.
12. Remove center section sides,
13. Loosen bold scraper assemblies,
14. Unscrew alignment nut from end chrome shaft.
15. Remove four bolts that hold cylinder shaft brackets to bearing housing,
16. Remove back roll.



Install rolls into frame

1. Retract hydraulic cylinders completely.
2. Reverse removal process until front cover is installed with the exception of #13. (Leave scrapers loose at this time).
3. Turn hand wheel counterclockwise until it bottoms out. Then turn clockwise for 12 complete turns. This is an approximate midway point of fixator, which will give plenty of adjustment throughout corrugation life.
4. Push rolls together using hydraulic cylinders and pump.
5. Fill gap between fixator pad and spacer bracket until spacers fill in entire gap.
6. Turn hand wheel clockwise to adjust roll gap to .015 prior to flaking.
7. Replace all hubs, sheaves, belts, and guards.
8. Set scrapers following start-up procedures on page [18 \(Click Here\)](#).



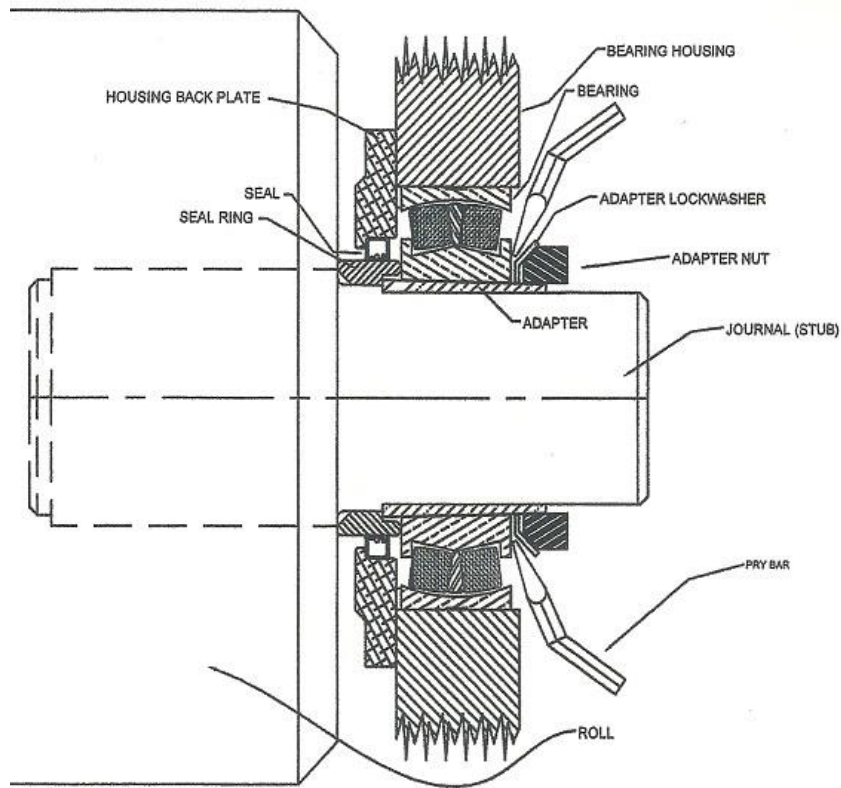
Instructions for installation of re-corrugated rolls

Note: Before starting, make sure all parts are very clean.

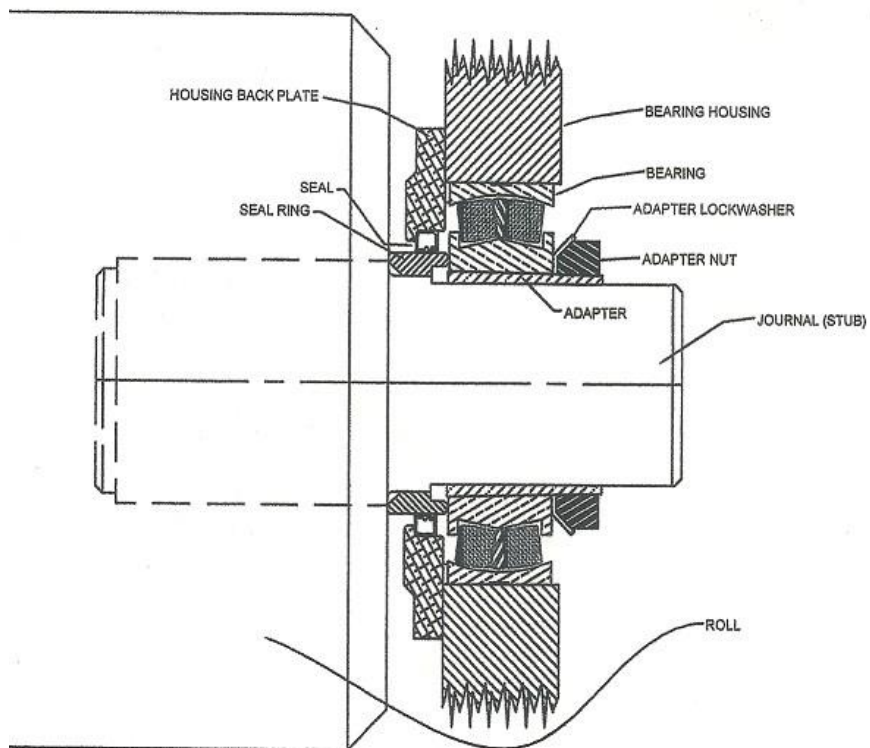
1. Install the grease seal on back side of bearing housing.
2. Install bearing in bearing housing with large end of tapered bore toward back side of bearing housing.
3. To insure proper clearance for the installation of the bearing cap, and to prevent bearing from falling out of bearing housing, a lug needs bolted to the cap end of the bearing housing.
4. Clean journal, making sure the seal collar is well cleaned and install the dust shield. Install bearing adapter on journal with slotted nut and lock washer still attached. After adapter is fully under the collar, remove slotted nut and lock washer.
5. Spray a light coat of lubricant all over the adapter, slip bearing and housing over adapter making certain adapter stays under the seal collar. Slip lock washer on, then screw nut on snugly, but not tight.
6. Prepare other three journals up to this point.
7. Hoist rolls onto frame of the mill, secure with bolts and tighten bolts at this point.
8. Center the rolls inside the base of the mill and then wedge boards on each side of rolls to keep them from slipping during the next step.
9. Loosen adapter nuts the distance of three or four threads. Place two screwdrivers or 18" spoon bars behind the lock rings and pry the adapters out as far as possible. This causes the bearings to be drawn snugly into position and pulls adapter from under the shaft collar.
*Caution should be exercised at this stage to prevent distortion of the threads on the adapter by the prying bars.
10. Use a spanner wrench and hammer to tighten slotted nuts, then bend tang of lock washer in to slot of lock nut.
11. Remove lugs installed in step 3.
12. Blow compressed air into the bearing to further clean it.
13. Use a grease gun with a flat tip to stick in between the balls of the bearing, pumping grease through to the backside of bearing until all the balls are packed with grease.
14. Install grease seal in bearing cap and half fill concave portion of bearing cap with grease, then bolt in place. You may place a small amount of silicone around the edges of the cap to help prevent water or foreign particles from entering the bearing.
15. Install front and back roll covers.
16. Install roll adjusting components. (i.e. hydraulic cylinder or tension rod assembly)



Bearing Installation Illustration



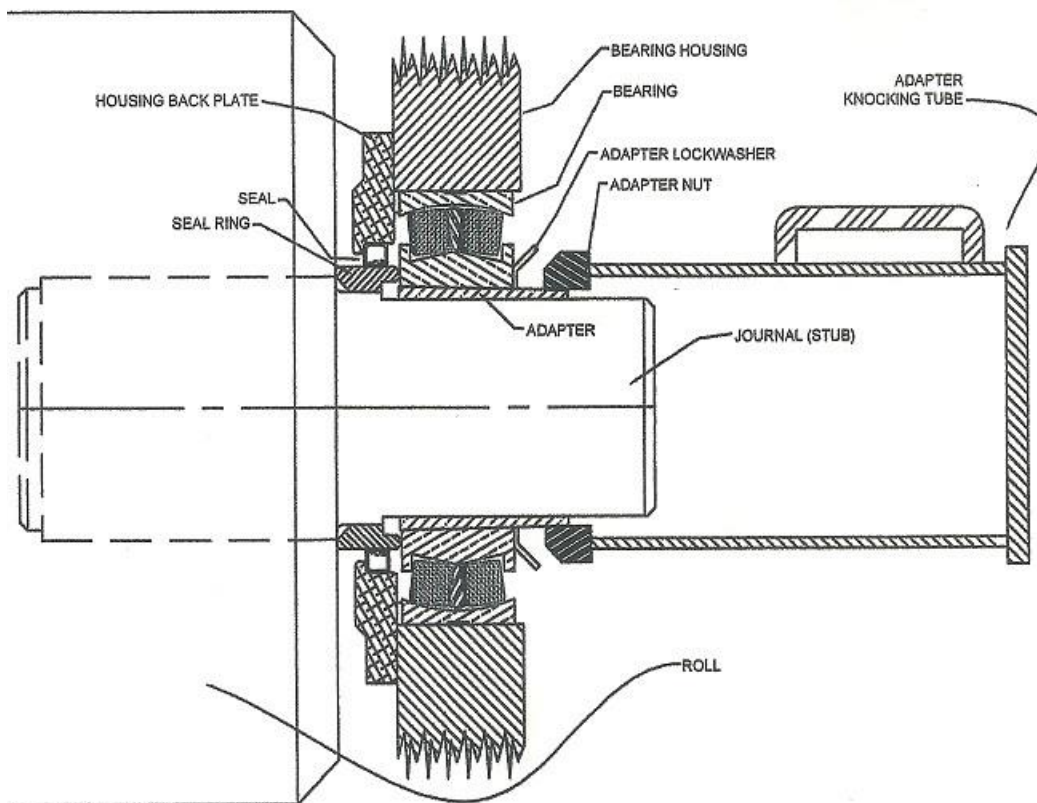
Bearing Installed Illustration



Instructions for removing tapered roller bearings and adapters

CAUTION: Do not use a standard bearing puller because this will force the bearing on the journal tighter.

1. Remove the bearing housing cover plate.
2. Clean the excess grease off the slotted nut so the tangs of the lock washer can be bent clear of the lock slots so the nut may be loosened.
3. The nut is then loosened in the following manner:
 - a. The nut has right hand threads so it must be loosened in a counterclockwise direction.
 - b. A soft steel bar or a spanner wrench is placed in one of the nut slots.
 - c. Strike the bar or a spanner wrench with several sharp blows using a hammer.
 - d. Loosen the nut until approximately three-fourths (3/4) of the threads are still in contact with the adapter.
 - e. The factory uses a Bearing Kocker that is manufactured at the factory.
 - f. Strike the Bearing Kocker on the end squarely with a sledgehammer and this will force the bearing adapter inside the shaft collar.
 - g. Then the bearing housing, bearing and adapter will slip easily off the journal



To Install Bushings

1. Remove all paint, oil, grease, etc. from tapered surface of bushing and bore of mating part.
2. If bushing has a keyway, install shaft key. (Note: If a rectangular key is required, one will be furnished with the bushing.)
3. Select **standard** or **reverse** mounting assembly. See figures 1 and 2.

Note: If bushing does not slide freely on shaft, wedge a screwdriver blade into the saw cut at the flange OD to open the bore of the bushing. Caution: Excessive wedging will split the bushing.

4. **Standard Mount** –Slide bushing on shaft, flange first. If using the setscrew, snug it against the key. Excessive Torque will cause mating part to be eccentric. Position mating part in place on bushing aligning drilled holes in mating parts with tapped holes in bushing flange. Using lock washers, install cap screws thru the mating hub into the bushing flange. (Note: M thru S Bushings can only be Standard Mounted. Be sure the two tapped holes in the mating hub do not align near the bushing saw cut. If they do, rotate the bushing 90 degrees.)
5. **Reverse Mount**-Place mating part over and onto shaft as far as possible with large bore end of taper outward. Slide bushing onto shaft so tapered end will engage into the mating part. Tighten setscrew, align drilled holes in bushing flange and into the mating hub.
6. **Use A Torque Wrench**-Tighten all cap screws evenly and progressive in rotation to the torque value listed in the table. **Excessive wrench torque, closing the gap between the bushing flange and mating hub, or the use of lubricants will break the mating hub.**

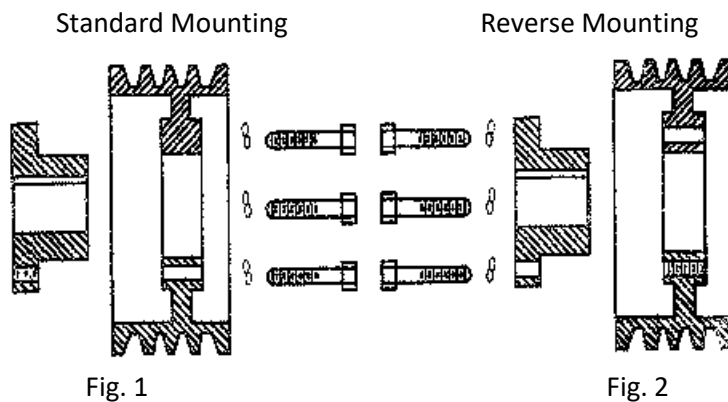


To Remove Bushings

1. Loosen and remove all cap screws.
2. For Standard Mount, thread cap screws into tapped holes in mating part to jack against bushing flange for Reverse Mount, thread cap screws into tapped holes in bushing flange to jack against mating hub. Tighten bolts evenly and progressively in rotation to separate the two components.
3. Loosen setscrew to slide bushing from shaft.

Screw Tightening Information

Tapered Bushing	Size & Thread of Cap screw	Ft- Lbs. To Apply With Torque Wrench
QT	1/4-20	9
JA	No. 10-24	5
SH,SDS,SD	1/4-20	9
SK	5/16-18	15
SF	3/8-16	30
E	1/2-13	60
F	9/16-12	110
J	5/8-11	135
M	3/4-10	225
N	7/8-9	300
P	1-8	450
W	1-1/8-7	600
S	1-1/4-7	750



To Start Up Your Mill

1. Blow all return steam lines to rid system of water.
2. Fill steam cabinets with grain.
3. Start rolls, airlift and augers.
4. To avoid pulling boilers too low, steam only two cabinets at one time.
5. Turn all steam valves to full open, when top and bottom gauges reach 205 degrees close valves and go to next machine, using same process on all machines.
6. When all cabinets are heated to 205 degrees, start first machine; set SCR 50% of regular use; open steam valves slightly; check to see if feed is getting to rolls; engage rolls.
7. Go to next machine with same process until all are running.
8. Return to first machine, raise SCR speed to 75% and adjust steam.
9. Repeat previous process on all machines but increasing SCR to desired setting.
10. After all machines are operating at desired speed for one-hour check and record flake weight and appearance, also check and record bearing temperature.
11. Use all steam laterals; usually the top valve will run full open, next at $\frac{3}{4}$, next at $\frac{1}{2}$, and bottom cracked slightly. If you get steam out of the top of the cabinet, or too much on bottom, adjust accordingly.
12. Record flake and bearing temperature every two to four hours.

To Shut Down Your Mill

1. Close gates from grain bin to steam cabinet, leave steam on until grain drops below each lateral.
2. When grain gets below bottom sight glass, watch closely so that grain does not run out with rollers engaged.
3. Roller man needs to monitor peg feeder regularly to see that rolls do not run dry.
4. Always release rolls before turning off feeder.
5. Turn off peg feeder bar and rolls.
6. Make sure peg feeder bar and rolls have completely stopped turning.
7. Shut off power and lock-out electrical box.
8. Clean peg feeder and inside of roll covers



**NEVER LET ROLLS RUN TOGETHER, AS THIS WILL DESTROY
CORRUGATION QUICKLY AND CAN CREATE FLAT SPOTS.**

Set Roll Scrapers

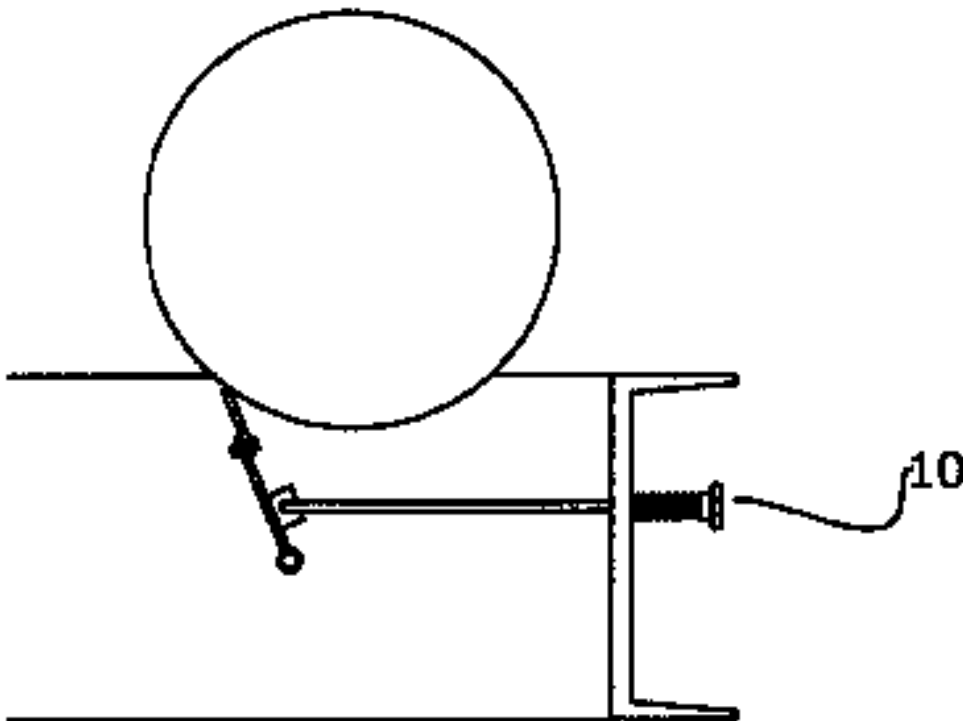
1. The roll scraper is designed to prevent chipping of the rolls and product buildup on the roll, which would cause them to bounce and thus yield an inconsistently milled grain.
2. It is intended this scraper has contact with the roll. A small amount of tension between the roll and scraper is desired.

To Increase Tension

- A. Adjust both sides simultaneously.
- B. Turn the scraper adjusting knob #10 clockwise or inward, bringing it close to the roll.

To Reduce Tension

- A. Adjust both sides simultaneously.
- B. Turn the scraper adjusting knob #10 counterclockwise or outward, bringing the scraper away from the roll.



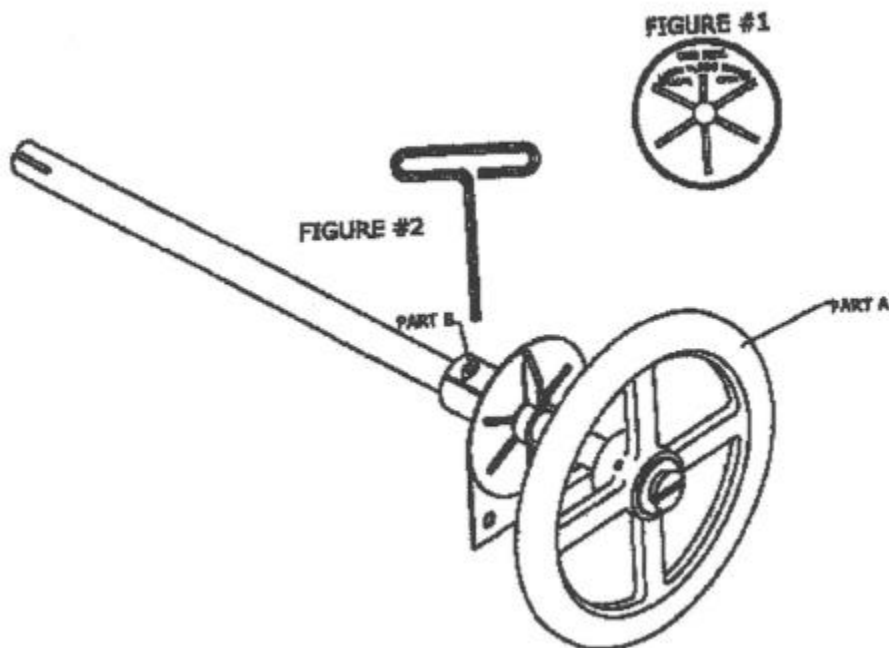
Setting the Flake Weight:

The R&R 24" Flaking Mill is simply adjusted by the hand wheel (Fig. 2) located on each side of the front of the mill. The rolls can continue to flake as the flake weight is adjusted.

Turning the hand wheel clockwise (open) will produce a heavier flake and turning the hand wheel counterclockwise (close) will produce a lighter flake. One complete turn of the hand wheel will move the roll back approximately .006 of an inch towards whichever direction the hand wheel is turned. Each side of the mill can be adjusted separately to enable the rolls to be set to exact customer specifications.

To move the handwheel:

1. Loosen the set screw (Fig 2. Part B)
2. Turn hand wheel desired direction (Fig. 2 Part A)
3. Tighten the set screw (Fig 2. Part B).



Maintenance of the Mill

1. Lubrication- Depending on mill conditions, lubrication methods will vary. Contact your grease representative or mill technician for the correct method. Main roll bearings should be greased every day. Grease manufacturer, "Lincoln", recommends .07 cu. Inches of grease every 4 hours be applied to a 22234k or a 22330 bearing which are the bearings used in R&R 24" Mills. Other factors to consider in determining lube requirements are (1) Extreme Heat, (2) High Speed, (3) Shock loading, (4) product contamination, and (5) dirt or water.
2. Roll tension—950 to 1500 psi in normal pressure for quality flaking with this flaker.
3. Check fixator for current adjustment.
4. Check all bolts periodically for tightness.
5. Check all shims for current adjustment.
6. Check bearings for roughness and excessive heat.
7. Check V-Belt for tightness and wear.
8. Check mill for level periodically.
9. Keep V-block adjusted to prevent whole grain from slipping between the face of the roll and the hood of the mill.
10. Do not run rolls together without grain.
11. Rolls should be re-corrugated as needed to ensure against low capacity and inconsistent quality. An even wear improves roll life.
12. Keep scraper blades adjusted to assure rolls are being cleaned properly. Slight tension on the rolls is all that is needed.
13. Excessive vibration may be caused by rough or worn bearings. These bearings should be replaced. By continuing use of worn bearings, shaft breakage chances are greatly increased.



Hydraulic Pumps and Intensifiers - Air Driven

Hydronic Corporation Installation, Use, and Maintenance

Contents

Introduction, Guarantee and Identification Plate
Description, Start up Procedures
Description of Working Parts, Storage and Disposal
Fault Finding, Maintenance and Weights
Spare Parts

Hydronic Corporation, 32613 Folsom, Farmington Hills, MI 48336, (248) 477 2288, (248) 478 3689

Hydronic Air Driven Pumps & Intensifiers 820 Installation, Use and Maintenance Booklet 01-01-99



Introduction

This handbook is intended to give the operator the basic instructions for the use and maintenance of the pump. The air hydraulic pump operator must read this handbook before putting the pump into operation. After correctly installing the pump, keep this manual stored in a safe place. If you have difficulty in understanding any part of this handbook, contact Hydronic Corporation. Regular servicing and correct use of the pump are fundamental in obtaining optimum performance over its life. When contacting our service center, specify the pump model and serial number; this will help us to respond quickly and effectively.

Guarantee

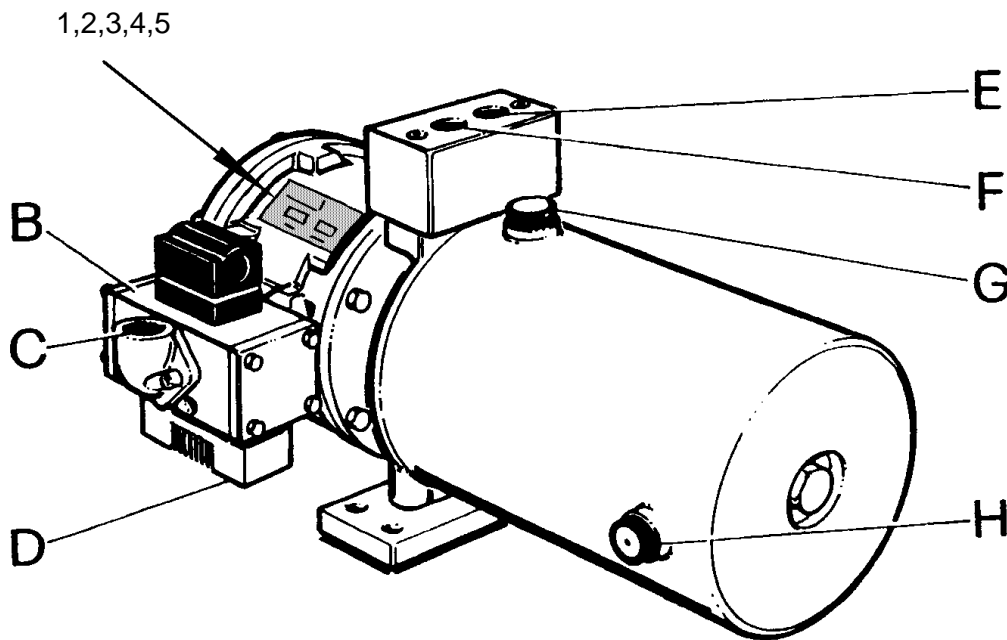
Hydronic pumps are guaranteed both for the quality of materials used and for overall design. The warranty runs for six months of normal use at eight hours per day and five days per week. The warranty itself does not cover seals or defects arising out of operating with unsuitable fluids or at pressures above the specified maximum. The guarantee cannot cover pumps that may have been tampered with. Defective goods must be sent to Hydronic Corporation at Farmington Hills or to the distributor covering the area, freight pre-paid in either case. Any pump returned to us must be accompanied by a full written description of such faults or defects as have been discovered. Please also ensure that the pump's serial number is attached to the paperwork.

Identification Plate

Description of the standard pump components

- 1 Pump model and multiplication ratio
- 2 Serial number pump
- 3 Maximum air pressure
- 4 Maximum working oil pressure allowed
- 5 Year of construction

- B Air valve
- C Air inlet 1/2" NPT
- D Air silencer
- E Oil outlet #8 SAE
- F Oil return #8 SAE
- G Oil filler plug
- H Oil level sight glass



Installation Guide

Pumps may be installed in a horizontal or vertical position for optimum functioning of suction and delivery valves. The round reservoir may be used horizontally and it is advised that the breather and sight glass be interchanged and/or the reservoir rotated to allow the breather to remain uppermost. The suction and return tubes inside the reservoir may also be rotated to ensure fluid is taken from, and returned to, the bot-tom of the reservoir in any given position.

The air inlet connection can be rotated at 90 ° and piping of not less than 3/8" bore should be used. 1/2" should be used if the pump is to be run at higher speeds for greater flows.

It is advisable to use or maintain :

- Hydraulic oil having viscosity of 150 to 250 SSU
- Oil temperature 32° F to 150° F
- Air temperature 40° F to 100° F
- Room temperature 40° F to 100° F

Obstructive icing of the silencer may occur under certain temperature/humidity conditions. This can be remedied by the addition of antifreeze oil for pneumatic equipment to a mist lubricator

Compressed Air System

It will be advisable to fit an air filter/regulator unit having minimum flow capacity of 50 scfm plus a pressure gauge in order to ensure the pump has sufficient air energy to work correctly and provide the hydraulic performance you expect

Hydraulic System

Valves, pipes, hoses and accessories should all correspond to maximum working pressure of the pump used and be of a size that will fulfill flow requirements

Application

Hydronic air driven hydraulic pumps are designed for operating oil hydraulic circuits and to cover the wid-est range of requirements to the best advantage.

The pump itself operates quite simply, using a known pressure intensification principle. A piston with a large surface area is actuated by compressed air. Attached to it is a piston with a smaller surface area, which is driven in a hydraulic chamber generating a high level of hydraulic pressure. The continuous pumping ac-tion is produced by the compressed air being switched by a special seal less valve. By regulating the compressed air supply pressure from 30 psi to 100 psi, the maximum hydraulic pressure can be adjusted by the ratio of the pump used. As the hydraulic load of the circuit increases and the oil pressure rises, the pump will slow down and eventually stop. In this way, the maximum load of the circuit will be maintained without air consumption.

Storage

If the pump is to be kept out of use for a long period, clean the pump in general and drain the oil from the tank. Cover the pump and store it in a dry, well-protected place. It is advisable to wrap the pump in a plastic film. To put back into service, check all parts, fill tank with oil and try the pump out to ensure that it working properly. This operation must be carried out by qualified personnel.

Disposal

If the pump is to be scrapped, treat as a special type of waste. Dismantle it and divide it into materials of the same type and dispose of them in accordance with the local laws and regulations in your state.



Starting - Up

Oil pressure can be determined by regulation of the compressed air, bearing in mind of course the multiplication ratio pre-selected for the pump itself.

The models are :

- P820 RATIO 1:5
- P820 RATIO 1:10
- P820 RATIO 1:20
- P820 RATIO 1:30
- P820 RATIO 1:40

For instance, when supplied with compressed air at 80 psi, the P820-5 will produce oil pressure of 80 x ratio, 400 psi. It should be remembered however, that real efficiency produced by the pump is slightly less than given by the above theoretical calculation. This difference will not be noticed by a hydraulic gauge.

Having connected the compressed air supply at a low pressure, allow the pump to operate slowly until primed and oil comes through to the output port. Now shut off the air supply to the pump and securely connect the hydraulic circuit. Switch on the air supply again and allow the pump to run in order to bleed any air out of the hydraulic circuit.

Pump components:

- Standard block with oil output and return line.
- Modular block for optional mounting D03 valve. Other accessories are available.
- Minimum internal diameter of air supply line is 3/8".
- Optional rotation of the air inlet C in four positions.
- Maximum oil pressure can be preset by regulating the air supply at point C between 30 psi and 100 psi.
- The air exhaust and silencer are mounted to one side at point D.
- The oil outlet is positioned to one side at point E and the return at point F.
- The pump itself works automatically and operates by way of a special valve.
- The hydraulic section comprises a pump casing, piston and dynamic rod-seal assembly.
- The suction side of the pump is equipped with spring-loaded check valve. A spring-loaded outlet ball type check valve is incorporated in the hydraulic piston.



Fault Finding Chart

Fault	Cause	Remedy
1] Pump does not cycle or runs slowly	1.1] Low pressure in compressed air line. 1.2] Formation of ice on the exhaust side. 1.3] Accumulation of waste in the silencer. 1.4] Blocked element in air filter/regulator	1.1] Clear any blockage or restriction on the air line. 1.2] Shut off pump for a short time and drain off water from the filter 1.3] Remove silencer, clean and replace 1.4] Close down air supply, dismantle and clean filter.
2] Pump loses air from silencer when stalled	2.1] Worn valve or seal	2.1] Replace seal or valve
3] Excess oil leakage from air silencer	3.1] Worn hydraulic seal	3.1] Replace seal
4] Pump cycles without pumping oil	4.1] Blocked oil intake 4.2] Bad connection on suction line	4.1] Clean out filter 4.2] Check for bad connections or air leaks on suction line
5] Pump functions but only generates low pressure and does not stall at maximum pressure	5.1] Internal leakage 5.2] Suction valve seats damaged and leaking 5.3] Output valve seats damaged and leaking 5.4] Worn oil seal	5.1] Find heat source and change valve 5.2] Replace suction valve parts 5.3] Replace output valve parts 5.4] Replace seal



Maintenance

Periodically release the condensation from the air filter. Replace the hydraulic oil every 1500 hours or whenever the oil is polluted.

Warning: Remember that repair work can only be made when pneumatic and hydraulic pressure has been released and you are sure that no pressure remains in the circuit.

Delivery of the pump

Transport

All the material shipped, including the detached parts, has been thoroughly checked before being consigned to the forwarding agent. The pump is shipped in double corrugated cardboard packaging, which assures protection of the product.

Unpacking

On receipt of the product, open the packaging and remove the pump. Take care not to damage any part of the pump. Make an initial check on the pump for damage in transit. In case of damage or if in doubt, do not use the pump and contact Hydronic Corporation or your distributor. The packaging [plastic bags, expanded polystyrene, nails, screws, wood, etc.] must not be left within reach of children since they are potential source of danger. Be sure to dispose of pollutant or non biodegradable materials in the correct way. Materials must be disposed of in accordance with the laws in force.

Gross weight

P820 standard reservoir 33 lbs.

P828 Large reservoir 44 lbs.

Contents of the package

The packaging will always contain the following:

1 x air driven hydraulic pump

1 x installation, use and maintenance manual



Original spare parts

Parts orders must always be accompanied by the following information:

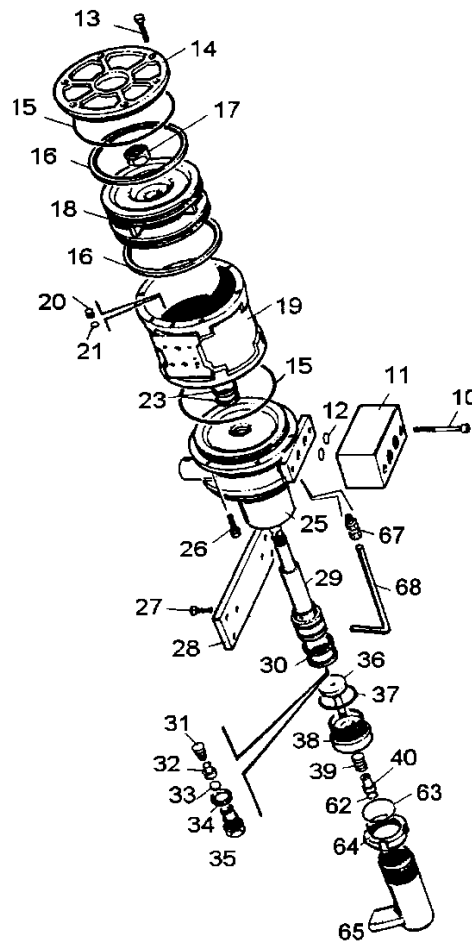
A] The pump model B] The pump serial number C] The pump year of construction
(all this data is given on the nameplate)

D] The part numbers E] The quantity required F] The name of the part
(All this data is given in the parts list)

A clear and correct statement of this data will allow our after-sales service to respond quickly and appropriately. Every spare part must be replaced by professionally qualified staff. The manufacturer declines all responsibility for malfunctions or accidents deriving from any failure of the product when unqualified persons have made any attempt at repair.

Wall Mounted Version

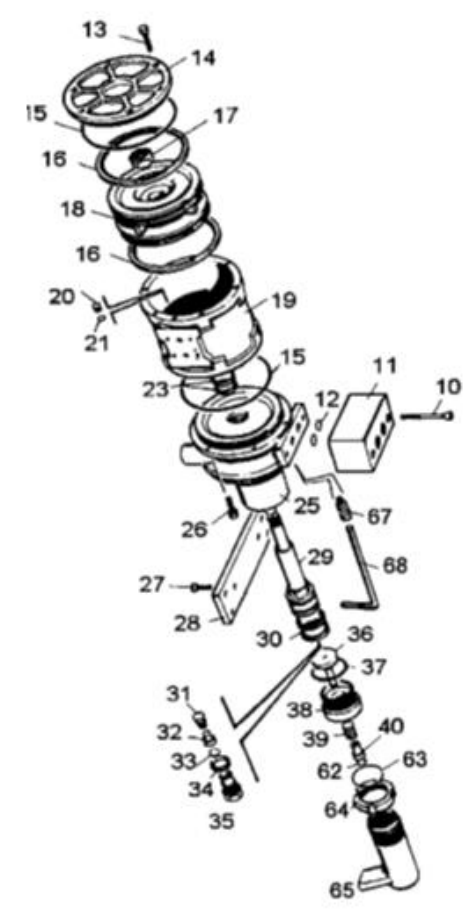
Number	Description	Code #	Quantity
10	Screw	3.94.010	2
11	Distributor body	5.65.004	1
12	O-ring	3.51.109	2
13	Screw+washer	3.94.207	6
14	Cylinder head	5.86.006	1
15	O-ring	3.51.075	2
16	Slip ring	3.51.076	2
	O-ring	3.51.077	2
17	Locknut	3.45.204	1
18	Piston	5.68.045	1
19	Cylinder barrel	5.18.030	1
20	Plug	5.84.002	2
21	O-ring	3.51.083	2
23	O-ring+Slip Ring (ratio)		
	1:5	3.51.089+3.51.088	2
	1:10	3.51.086+3.51.087	2
	1:20	3.51.085+3.51.014	2
	1:30	5.50.019+3.51.057	2
	1:40	3.51.011+3.51.010	2
25	Pump Body (ratio)		
	1:5	5.28.030	1
	1:10	5.28.029	1
	1:20	5.28.028	1
	1:30	5.28.057	1
	1:40	5.28.027	1
26	Screw+Washer	3.94.208+3.72.104	6
27	Screw	3.94.013	2
28	Clamping Plate	5.65.003	1
29	Piston (ratio)		
	1:5	5.68.049	1
	1:10	5.68.048	1
	1:20	5.68.047	1
	1:30	5.68.177	1
	1:40	5.68.046	1



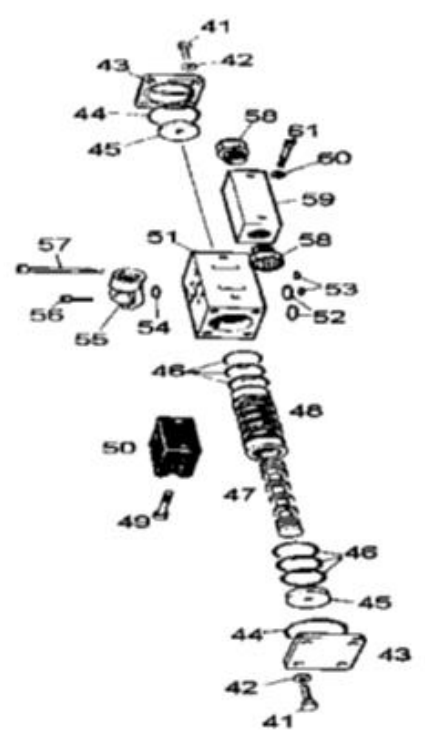
Hydraulic Air Driven Pumps & Intensifiers P820 Installation, Use and Maintenance Booklet 01-01-99



Number	Description	Code #	Quantity
30	O-ring+Slip Ring (ratio)		
	1:5	3.51.096+3.51.097	2
	1:10	3.51.094+3.51.095	2
	1:20	3.51.092+3.51.093	2
	1:30	3.51.173+3.51.033	2
	1:40	3.51.091+3.51.090	2
31	Spring (ratio)		
	1:5+1:10	5.46.028	1
	1:20+1:30+1:40	5.46.029	1
32	Center (ratio)		
	1:5+1:10	5.46.007	1
	1:20+1:30+1:40	5.46.006	1
33	Ball (ratio)		
	1:5+1:10	3.76.006	1
	1:20+1:30+1:40	3.76.002	1
34	Washer (ratio)		
	1:5+1:10	3.52.010	1
	1:20+1:30+1:40	3.52.003	1
35	Valve Connector (ratio)		
	1:5+1:10	5.94.303	1
	1:20+1:30+1:40	5.94.302	1
36	Valve Rod	5.66.011	1
37	O-ring (ratio)		
	1:5+1:10	3.51.127	1
	1:20+1:30+1:40	3.51.055	1
38	Valve Body (ratio)		
	1:5+1:10	5.28.032	1
	1:20+1:30+1:40	5.28.031	1
39	Spring	5.64.030	1
40	Guide	5.13.008	1
62	Collets	3.06.006	2
63	O-ring	3.51.079	1
64	Lock Nut	3.45.212	1
65	Suction Tube	6.90.003	1
65/1	Suction Strainer	3.41.002	1
65/2	Bush	5.08.014	1
65/3	O-ring	3.51.084	1
66	Pipe	5.90.004	1
67	Connector	3.70.006	1
41	Screw	3.94.206	8
42	Washer	3.72.102	8
43	Cover	5.27.001	2
44	O-ring	3.51.080	2
45	Plate	5.08.013	2
46	O-ring	3.51.081	6
47	Floating spool	5.66.012	1
48	Sleeve	5.14.016	1
49	Screw	3.94.205	2
50	Pilot valve	4.91.002	1
51	Valve body	5.28.026	1
52	O-ring	3.51.082	2
53	O-ring	3.51.002	2
54	O-ring	3.51.025	1
55	Connector	3.70.005	1
56	Screw	3.94.008	2
57	Screw	3.94.018	3
58	Silencer	3.70.004	2
59	Block	5.65.014	1
60	Washer	3.72.102	2
61	Screw	3.94.205	2

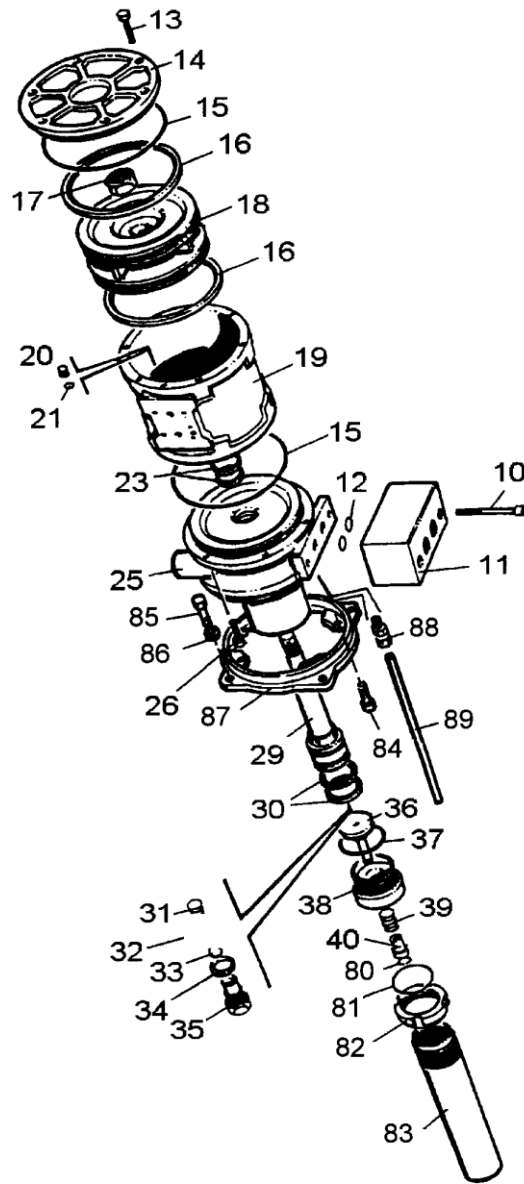


Pilot Valve



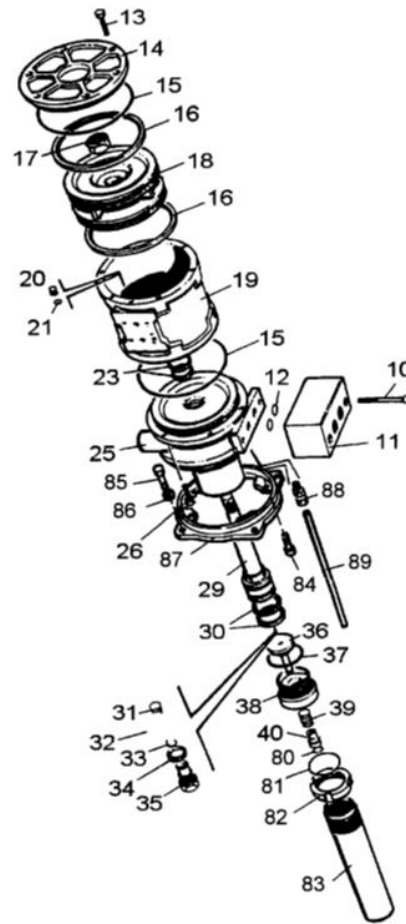
Tank Mounted Version

Number	Description	Code #	Quantity
10	Screw	3.94.010	2
11	Distributor body	5.65.004	1
12	O-ring	3.51.109	2
13	Screw+washer	3.94.207	6
14	Cylinder head	5.86.006	1
15	O-ring	3.51.075	2
16	Slip ring	3.51.076	2
	O-ring	3.51.077	2
17	Locknut	3.45.204	1
18	Piston	5.68.045	1
19	Cylinder barrel	5.18.030	1
20	Plug	5.84.002	2
21	O-ring	3.51.083	2
23	O-ring+Slip Ring (ratio)		
	1:5	3.51.089+3.51.088	2
	1:10	3.51.086+3.51.087	2
	1:20	3.51.085+3.51.014	2
	1:30	5.50.019+3.51.057	2
	1:40	3.51.011+3.51.010	2
25	Pump Body (ratio)		
	1:5	5.28.030	1
	1:10	5.28.029	1
	1:20	5.28.028	1
	1:30	5.28.057	1
	1:40	5.28.027	1
26	Screw+Washer	3.94.208+3.72.104	6
27	Screw	3.94.013	2
28	Clamping Plate	5.65.003	1
29	Piston (ratio)		
	1:5	5.68.049	1
	1:10	5.68.048	1
	1:20	5.68.047	1
	1:30	5.68.177	1
	1:40	5.68.046	1
30	O-ring+Slip Ring (ratio)		
	1:5	3.51.096+3.51.097	2
	1:10	3.51.094+3.51.095	2
	1:20	3.51.092+3.51.093	2
	1:30	3.51.173+3.51.033	2
	1:40	3.51.091+3.51.090	2
31	Spring (ratio)		
	1:5+1:10	5.46.028	1
	1:20+1:30+1:40	5.46.029	1
32	Center (ratio)		
	1:5+1:10	5.46.007	1
	1:20+1:30+1:40	5.46.006	1
33	Ball (ratio)		
	1:5+1:10	3.76.006	1
	1:20+1:30+1:40	3.76.002	1
34	Washer (ratio)		
	1:5+1:10	3.52.010	1
	1:20+1:30+1:40	3.52.003	1
35	Valve Connector (ratio)		
	1:5+1:10	5.94.303	1
	1:20+1:30+1:40	5.94.302	1
36	Valve rod	5.66.011	1
37	O-ring(ratio)		
	1:5+1:10	3.51.127	1
	1:20+1:30+1:40	3.51.055	1



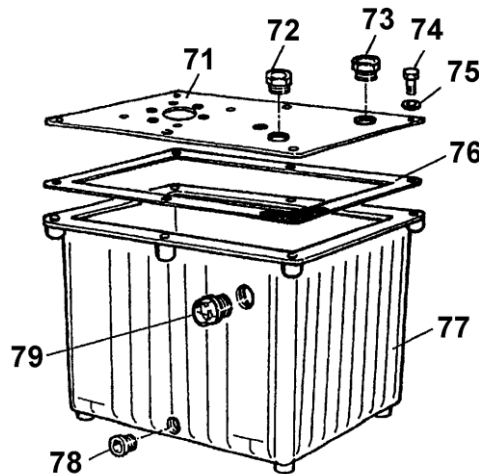
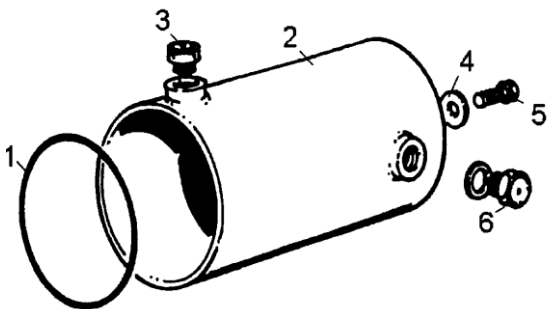
Tank Mounted Version

Number	Description	Code #	Quantity
38	Valve body(ratio)		
	1:5+1:10	2.28.032	1
	1:20+1:30+1:40	5.28.031	1
39	Spring	5.64.030	1
40	Guide	5.13.008	1
71	Reservoir Lid	5.055.0150	1
72	Filler/breather	OQ10003A	1
73	Discontinued		
74	Screw (and washer)	3.094.0203	4
75	Washer	3.072.0103	4
76	Gasket	5.050.0006	1
77	Reservoir	3.074.0009	1
78	Plug (and washer)	3.069.0203	1
79	Sight level glass	OQ10004A	1
80	Collet	3.06.006	2
81	O-ring	3.51.079	1
82	Locknut	3.45.212	1
83	Suction tube	6.90.003	1
83/1	Filter	3.41.0021	1
83/2	Bush	5.08.014	1
83/3	O-ring	3.51.084	1
83/5	Self-locking nut	3.31.053	1
84	Screw	3.94.008	4
85	Screw+47	3.94.023	4
86	Washer	3.72.104	4
87	Flange	5.42.002	1
88	Tube	5.90.017	1
89	Connector	3.70.006	1



Seal Kits

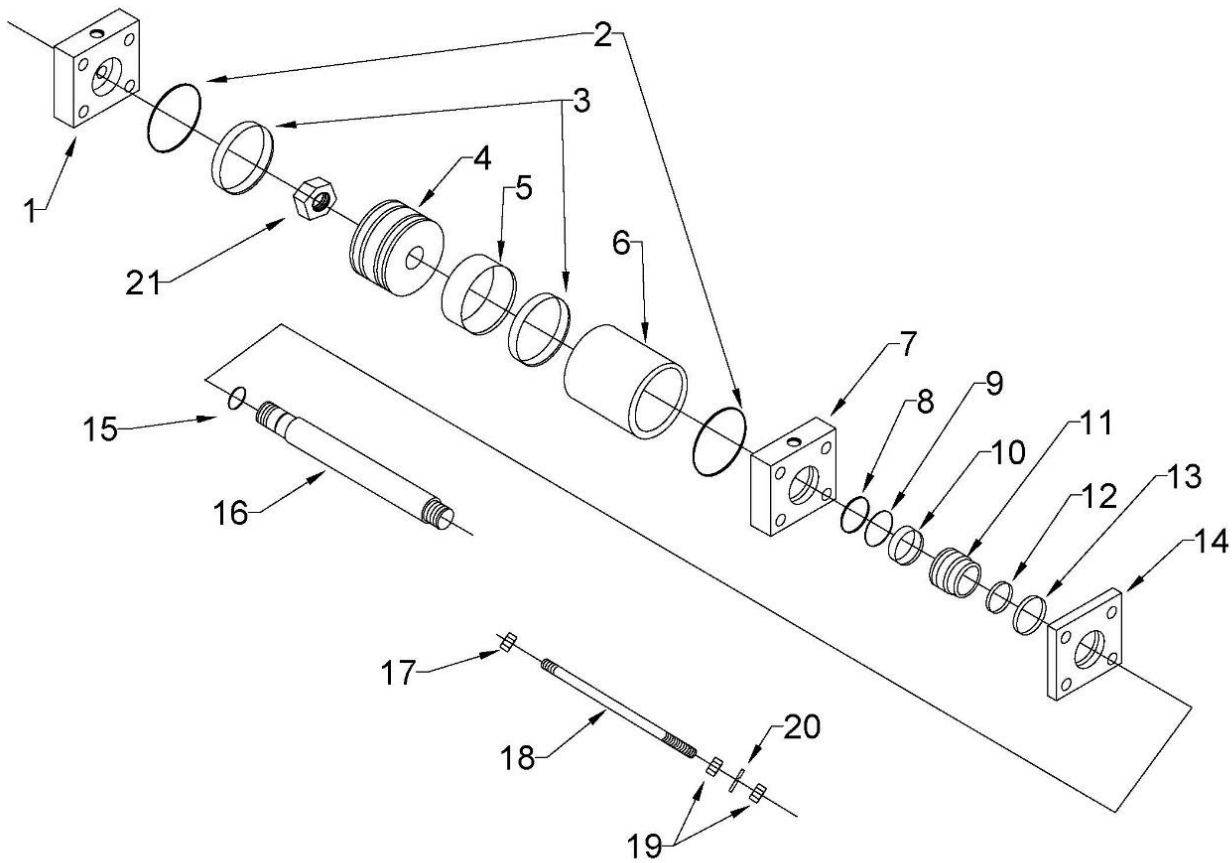
Ratio	Code #
1:5	3.54.028
1:10	3.54.029
1:20	3.54.030
1:30	3.54.080
1:40	3.54.034



Hydraulic Cylinder

Hydraulic Cylinder Assembly - 6 Inch R&R

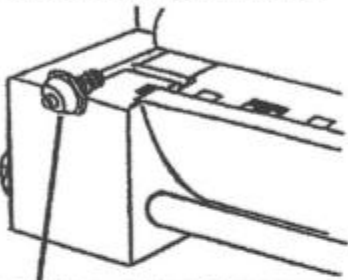
ITEM	ITEM #	PART DESCRIPTION	ITEM	ITEM #	PART DESCRIPTION
1	HY24REB	6 " END BLOCK	12	HYU212234	U-CUP
2	HY0258	O-RING	13	HYW2123	WIPER
3	HYU5386	PISTON U-CUP	14	HY24REB2	6" RETAINER PLATE
4	HY24RRP6	6 INCH PISTON	15	HYO030	O-RING
5	HYWR634	NYLON WEAR RING	16	HY24CSRR6T	6" R&R CHROME
6	HY24NP6B	BARREL	17	N1FTSL	1" FT STOVER NUT
7	HY24REB1	6 " ROD END BLOCK	18	BOL1X1758S	TIE BOLT
8	HYO235	O-RING	19	N1FT	1" FT NUT
9	HYO235B	BACKUP	20	W1	1" LOCK WASHER
10	HYU2123A	ROD BEARING	21	HY24RR6N	PISTON LOCKNUT
11	HY24RRG	ROD GLAND	22	HY24R&R6SK	FULL SEAL KIT CONTAINS 2-#2, 2-#3, 1-#5, 1-#8, 1-#9, 1-#10, 1-#12, & 1-#13



NOPAK Hydraulic Cylinder

NOPAK HIGH PRESSURE SQUARE-HEAD CLASS 3 HYDRAULIC CYLINDERS

IMPROVED CUSHION ADJUSTMENT – Newly designed needle valve is interchangeable with current design and offers improved sealing characteristics.



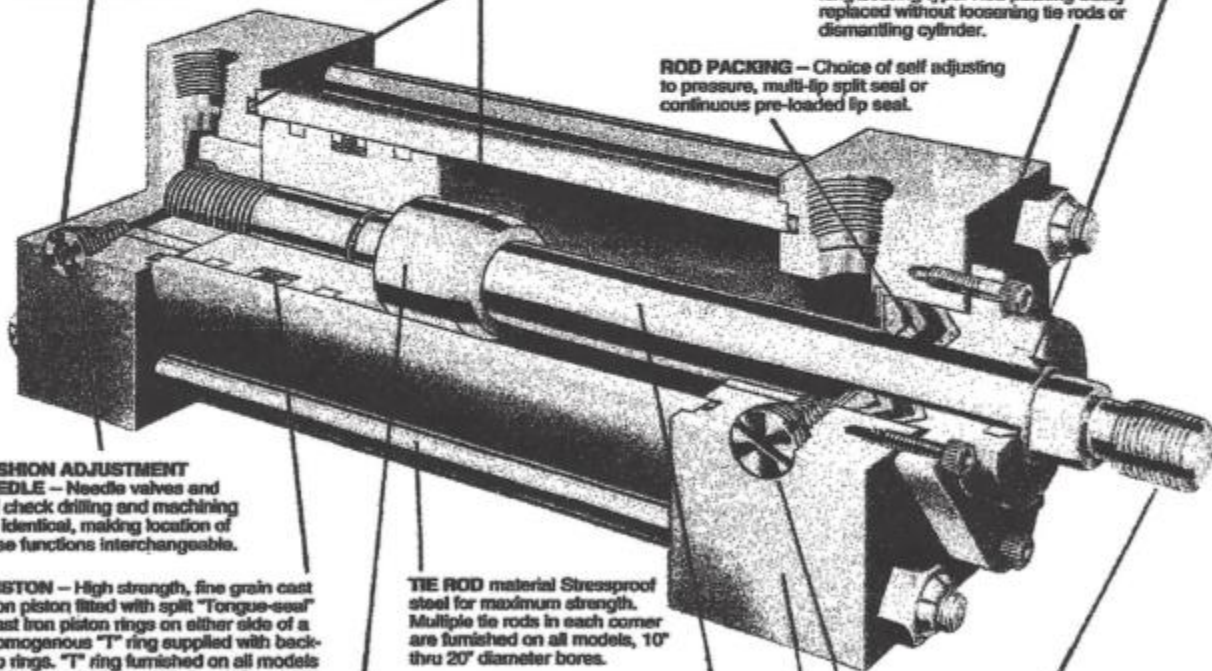
HEAVY WALL steel tubing, precision honed with extra long stones to provide over-lap and eliminate a spiral condition detrimental to long stroke cylinders. The resulting ultra-smooth finish provides maximum seal life.

TUBE SEAL – Two-Step Pilot Recess Grooves afford Positive Controlled Squeeze on Pressure Sealed O-Ring, while Tubing locates concentrically against End Cap.

ROD WIPER – Wipes rod clean and dry. Keeps foreign matter from entering cylinder, extending packing life.

PACKING GLAND – Readily removable long bearing type. Rod packing easily replaced without loosening tie rods or dismantling cylinder.

ROD PACKING – Choice of self adjusting to pressure, multi-lip split seal or continuous pre-loaded lip seal.



CUSHION ADJUSTMENT NEEDLE – Needle valves and ball check drilling and machining are identical, making location of these functions interchangeable.

PISTON – High strength, fine grain cast iron piston fitted with split "Tongue-seal" cast iron piston rings on either side of a homogenous "T" ring supplied with back-up rings. "T" ring furnished on all models and bores 1 1/2" thru 16" dia., 18" and 20" fitted with piston rings. Other designs on application. The outboard piston rings effectively seal off initial shock loads and allow the "T" ring to seal any by-pass fluid to provide a leak-proof piston seal with maximum life.

TIE ROD material Stressproof steel for maximum strength. Multiple tie rods in each corner are furnished on all models, 10" thru 20" diameter bores.

PISTON ROD is high tensile 100,000 psi minimum yield stressproof steel, ground, polished, and flash chrome plated .0003/.0005 to provide a hard, long-wearing surface with low friction, but not corrosion resistant. Consult factory for special applications.

ROD END THREADING – Choice of standard catalog male and female thread types plus standard wrench flats.

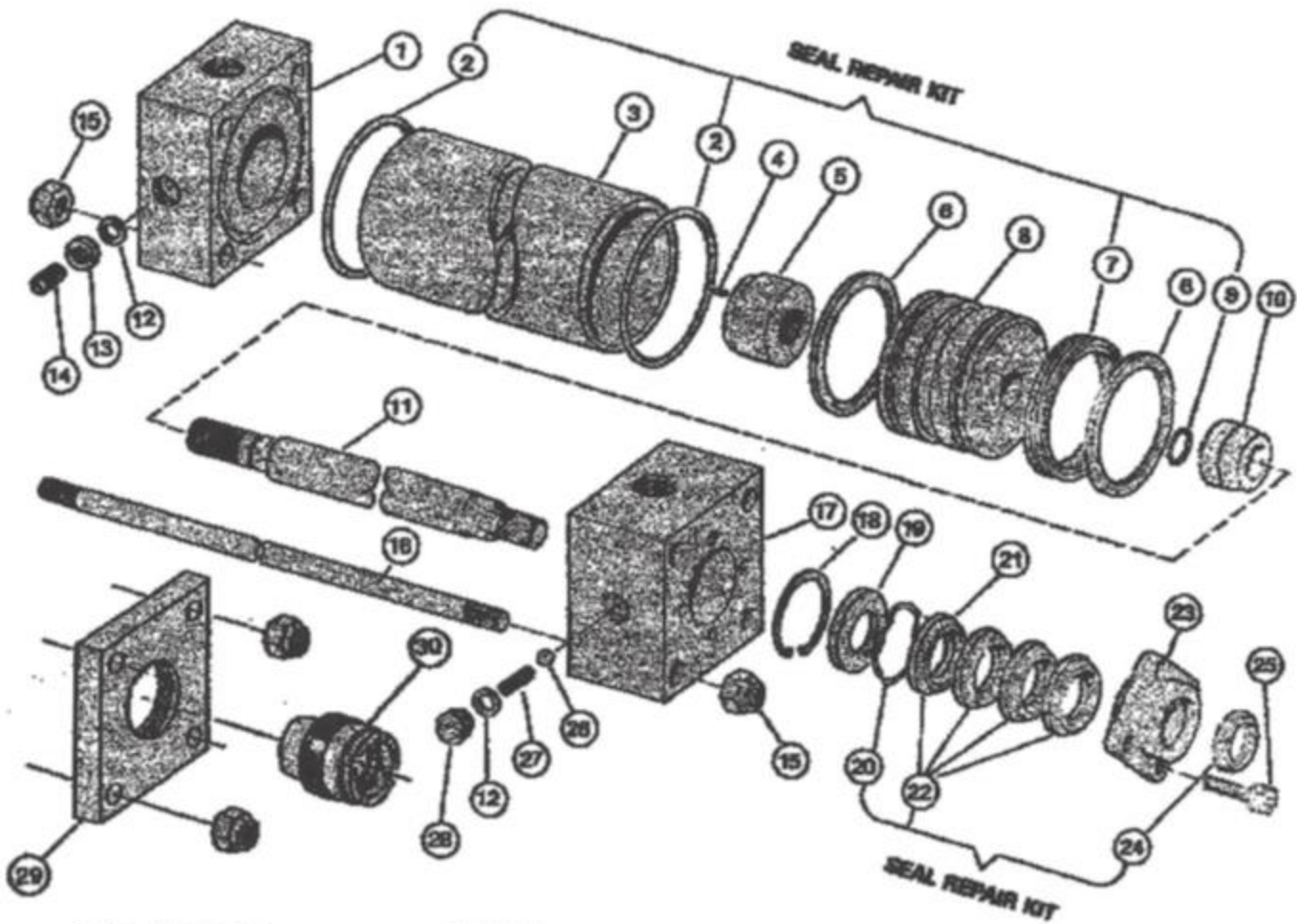
CUSHION BALL CHECK assures quick starting under full power; pressure acts on full piston area instantaneously.

CUSHION SLEEVES precision fitted with predetermined taper to provide a gradual deceleration and reduce shock.

END CAPS (Cylinder Heads) – Precision Broached Steel Blocks



REPLACEMENT PARTS



- 1. Blind End Head
- 2. Tube Seal★
- 3. Tube
- 4. Lock Screw
- 5. Lock Sleeve
- 6. Piston Ring
- 7. "T" Seal and Back-Ups††
- 8. Piston
- 9. Piston O-Ring★
- 10. Cushion Sleeve – Rod End
- 11. Piston Rod

- 12. Seal
- 13. Cushion Adjusting Screw Gland
- 14. Cushion Adjusting Screw
- 15. Tie Rod Nut
- 16. Tie Rod
- 17. Rod End Head
- 18. Snap Ring††
- 19. Packing Spacer††
- 20. Wave Spring††
- 21. Bottom Adapter Ring††
- 22. Rod Packing††

- 23. Packing Gland††
- 24. Rod Wiper★
- 25. Packing Gland Cap Screw
- 26. Check Ball
- 27. Ball Check Spring
- 28. Ball Check Plug

IF APPLICABLE:
 29. Head Plate
 30. Screw Gland

† "T" Seal used thru 16" dia. bore 18" and 20" fitted with piston rings.
 †† For 7" dia. rods and larger.
 Parts 18, 19, 20, and 21 are eliminated
 Part 22 replaced by a U-cup style seal
 Part 23 replaced by a rod bearing and a multi-bolt gland retainer.

★ Items are included in seal repair kits.
 See page 5 for ordering information.
 ☆ Item 21 is metallic for high temp applications.

When ordering replacement parts be sure to specify:
 -- Part by name and item number
 -- Bore, stroke, mounting, and Serial number shown on Hopak label

NOTE: Isometric view of DOUBLE ROD cylinders available at N/C.
 Consult factory or our authorized distributor.



HYDAC

OPERATING AND INSTALLATION INSTRUCTIONS FOR HYDAC ACCUMULATORS

HYDAC CORPORATION
2280 City Line Road
Bethlehem, PA 18017
Telephane: (610) 264-9503
Telefax: (610) 264-9519



Operating and Installation Instructions for HYDAC Accumulators

1. General:

Prior to installation and during the operation of hydraulic accumulators, the regulations governing accumulators in the place of installation must be observed. In the USA and Canada accumulators are subject to ASME Pressure Vessel Code. In addition, HYDAC suggests a thorough inspection, including a pressure test, every 5 to 10 years depending upon the application.

HYDAC recommends the use of mounting components to minimize the risk of failure due to system vibrations; refer to HYDAC Mounting Components brochure #02071834.

As part of the commissioning process, vent all air from the system piping once the hydraulics have been connected.



WARNING!

Hydraulic accumulators are pressurized vessels and only qualified technicians should perform repairs. **Never** weld, braze, or perform any type of mechanical work on the accumulator shell. **Never lift the accumulator by the gas valve.** Always drain the fluid completely from the accumulator before performing any work, such as recommended repairs (*see Maintenance Instructions*) or connecting pressure gauges.

Always observe the maximum working pressure, operating temperature range, pressure ratio, recommended flow rate, and mounting position. For details refer to specific HYDAC product literature. Never use car tire valve cores in accumulators. All defective parts should be replaced with original HYDAC parts.

2. Precharging The Accumulator:

Precharge new or repaired accumulators with dry nitrogen gas to the proper gas precharge pressure (P_0) prior to applying hydraulic system pressure.

2.1 Recommended Gas Precharge Pressure (P_0):

FOR ENERGY STORAGE	$P_0 = 0.9 \times P_1$
FOR SHOCK ABSORPTION	$P_0 = (0.6 \text{ to } 0.9) \times P_m$
FOR PULSATION DAMPENING	$P_0 = (0.6 \text{ to } 0.8) \times P_m$
P_1 = minimum working pressure	P_m = median working pressure

2.2 Procedure

Remove valve protection and valve seal caps (where applicable). Attach appropriate HYDAC charging and gauging unit (*type FPS for HYDAC gas valve version 4, type FPK for HYDAC gas valve version 1 and type FPK with adapter FPK/SB for top repairable bladder accumulators*) to the accumulator by following the instructions in the HYDAC Charging and Gauging Units brochure # 02071833. Once attached, slowly open the shut-off valve on the commercially available nitrogen bottle and allow the gas to slowly enter the accumulator. The first 20 to 25 PSI should take 2 to 3 minutes.

If gas precharge pressure is too low, continue charging; refer to HYDAC Charging and Gauging Units brochure #02071833.

If gas precharge is too high, it can be reduced by carefully opening the manual bleed valve and relieving some pressure. Once the proper gas precharge pressure has been reached, disconnect the charging and gauging unit from the accumulator by following the instructions in the HYDAC Charging and Gauging Units brochure. Check for leaks; NONE are permissible. Torque valve seal cap (*see torque requirements below*) and hand tighten valve protection cap (*where applicable*).



Notes:

- 1) When using FPK unit **DO NOT** use the "T"-handle in the charging and gauging unit to loosen the socket head cap screw; use a 6 mm Allen wrench.
- 2) HYDAC diaphragm accumulators with gas port version E2 are factory precharged and sealed with a welded steel plug. The gas precharge pressure **CANNOT** be adjusted.

Torque Requirements:

Gas Valve Version 1	- socket head cap screw	- 20 Nm (15 lb-ft)
	- valve protection cap	- hand tighten (<i>where applicable</i>)
Gas Valve Version 4	- gas valve core	- 0.5 Nm (0.4 lb-ft)
	- valve seal cap	- 30 Nm (22 lb-ft)
	- valve protection cap	- hand tighten (<i>where applicable</i>)



CAUTION

GAS CHARGING

Pressurized Vessel -

Use Dry Nitrogen Only!

HYDAC CORPORATION • Accumulator Division

2280 City Line Road • Bethlehem, PA 18017

Phone (610) 266-0100 • Fax (610) 264-7529

www.hydacusa.com

2.3 Temperature Effects:

To ensure that the recommended gas precharge pressure is maintained, even at relatively low or high operating temperatures, the gas precharge pressure should be adjusted for temperature; refer to HYDAC Charging and Gauging Units brochure #02071833. When adjusting an existing gas precharge pressure allow 5 to 10 minutes for the gas precharge pressure to reach equilibrium. When precharging for the first time or after performing maintenance work, allow 20 to 30 minutes for the gas precharge pressure to reach equilibrium.

3. Checking Gas Precharge Pressure:

The gas precharge pressure on gas port version E2 can only be checked using the method described in paragraph 3.2.

3.1 Measuring Gas Precharge Pressure on the Gas Side:

To check precharge pressure, attach HYDAC charging and gauging unit by following the instructions in the HYDAC Charging and Gauging Units brochure #02071833. Once attached, turn "T" handle until pressure registers on gauge. Adjust gas precharge pressure if necessary (*refer to paragraph 2*).

3.2 Measuring Gas Precharge Pressure on the Fluid Side:

This method requires that a pressure gauge be installed on the safety and shut-off block (*fig. 1, item 2*) or similar device, which is connected directly to the accumulator. The procedure utilizing the SAB Block is as follows:

- Using hydraulic system pressure fill accumulator with fluid.
- Close shut-off valve (*fig. 1, item 3*).
- Discharge fluid slowly, by opening the manual bleed valve (*fig. 1, item 4*).
- While draining the fluid, monitor the pressure gauge closely. The pressure in the gauge will suddenly drop to zero; the pressure indicated immediately prior to this sudden drop is the gas precharge pressure.

3.3 Intervals Between Checking:

The gas precharge pressure should be checked at least once during the first week of operation. If there is no loss of gas precharge pressure, it should be rechecked in 3 to 4 months. Thereafter, it should be checked at least once a year.



4. Safety Equipment:

HYDAC recommends that the following safety equipment be used in conjunction with accumulators:

4.1 Safety and Shut-off Block:

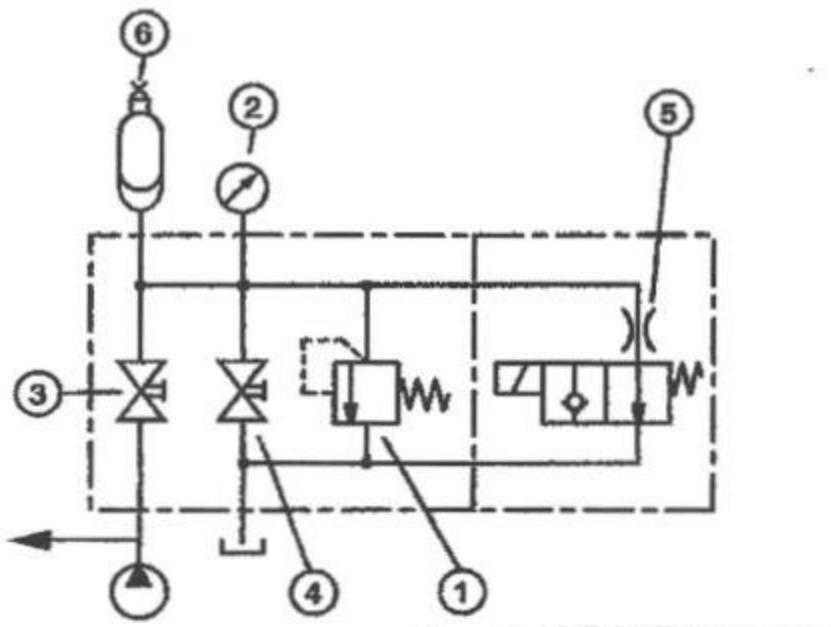
The Hydac safety and shut-off block (see fig. 1) was designed to incorporate the following safety features:

- Pressure measurement device.
- Pressure relief device.
- Shut-off device.
- Bleed down device (*manual or electric operation*).
- Locking device

4.2 Thermal Fuse Cap:

In addition to the above, HYDAC also recommends the use of its Thermal Fuse Cap to release gas pressure in the event of a fire.

Fig. 1; Schematic of a HYDAC Safety and Shut-off Block:



- 1 - pressure relief valve
- 2 - pressure gauge (*optional*)
- 3 - shut-off valve
- 4 - manual bleed valve
- 5 - solenoid operated bleed valve (*optional*)
- 6 - thermal fuse cap (*optional*)

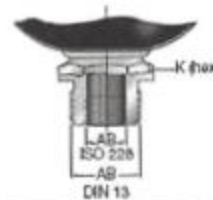
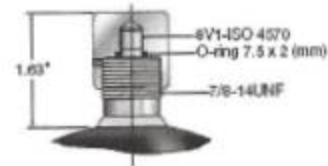
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SBO Series

Non-Repairable Welded Diaphragm Accumulators

Version E1 Version E2 Version E4



Series	Max. p_1, p_2	Size (liters)	Effective Gas Vol in ³	MAWP psi/(bar)	Weight	A	ϕD^2	F Thread				K (hex)	Q gpm
								CK (SAE)	AK (ISO 228)	AB (ISO 228)	AB (DIN 13)		
SBO 250	8 : 1	0.075	5	3600 (250)	1.5 (0.7)	2.68 (68)	2.52 (64)	9/16-18 UNF	G 1/2	N/A	N/A	1.18 (30)	10
SBO 210	8 : 1	0.16	10	2600/(180) ¹	1.8 (0.8)	3.15 (80)	2.91 (74)	9/16-18 UNF	G 1/2	N/A	N/A	1.18 (30)	10
				3000/(210)									
SBO 210	8 : 1	0.32	20	2400/(160) ¹	2.9 (1.3)	3.66 (93)	3.66 (93)	3/4-18 UNF	G 1/2	N/A	N/A	1.42 (36)	25
				3000/(210)									
SBO 210	8 : 1	0.5	30	3000 (210)	3.7 (1.7)	4.35 (124)	4.13 (105)	3/4-18 UNF	G 1/2	N/A	N/A	1.42 (36)	25
SBO 330	8 : 1	0.6	36	4700 (330)	7.3 (3.3)	5.04 (128)	4.53 (115)	3/4-18 UNF	G 1/2	G 1/2	M33 x 1.5	1.42 (36)	25
SBO 210	8 : 1	0.75	45	2000/(140) ¹	6.2 (2.8)	4.88 (124)	4.76 (121)	3/4-18 UNF	G 1/2	G 1/2	M33 x 1.5	1.42 (36)	25
				3000/(210)									
SBO 330	8 : 1	0.75	45	4700 (330)	8.9 (4.0)	4.78 (122)	4.96 (126)	3/4-18 UNF	G 1/2	G 1/2	M33 x 1.5	1.42 (36)	25
SBO 200	8 : 1	1	60	3000 (210)	7.9 (3.6)	5.39 (137)	5.35 (136)	3/4-18 UNF	G 1/2	G 1/2	M33 x 1.5	1.42 (36)	25
SBO 140	8 : 1	1.4	85	2000 (140)	8.6 (3.9)	5.91 (150)	5.71 (145)	3/4-18 UNF	G 1/2	G 1/2	M33 x 1.5	1.42 (36)	25
SBO 210	8 : 1	1.4	85	3000 (210)	11.9 (5.4)	6.14 (156)	5.91 (150)	3/4-18 UNF	G 1/2	G 1/2	M33 x 1.5	1.42 (36)	25
SBO 330	8 : 1	1.4	85	4700 (330)	16.6 (7.5)	6.33 (160)	6.1 (155)	3/4-18 UNF	G 1/2	G 1/2	M33 x 1.5	1.42 (36)	25
SBO 100	8 : 1	2	120	1500/(100) ²	8.8 (4.0)	6.57 (167)	6.30 (160)	1 1/16-12 UNF	G 3/4	G 3/4	M45 x 1.5	1.81 (46)	40
				1500/(100)									
SBO 210	8 : 1	2	120	3000 (210)	14.6 (6.6)	6.81 (173)	6.57 (167)	1 1/16-12 UNF	G 3/4	G 3/4	M45 x 1.5	1.81 (46)	40
SBO 330	8 : 1	2	120	4700 (330)	17.7 (8.0)	7.12 (180)	6.77 (172)	1 1/16-12 UNF	G 3/4	G 3/4	M45 x 1.5	1.81 (46)	40
SBO 210	4 : 1	2.8	170	3000 (210)	18.0 (8.2)	8.94 (227)	6.57 (167)	1 1/16-12 UNF	G 3/4	G 3/4	M45 x 1.5	1.81 (46)	40
SBO 250	4 : 1	3.5	230	3000 (210)	24.6 (11.2)	11.14 (283)	6.69 (170)	1 1/16-12 UNF	G 3/4	G 3/4	M45 x 1.5	1.81 (46)	40
SBO 330	4 : 1	3.5	230	4700 (330)	30.6 (13.8)	10.78 (274)	6.77 (172)	1 1/16-12 UNF	G 3/4	G 3/4	M45 x 1.5	1.81 (46)	40

Dimensions are for general information only, all critical dimensions should be verified.

Dimensions are in inches/mm and lbs/kg

1) Stainless steel version for chemical, water, and oil service

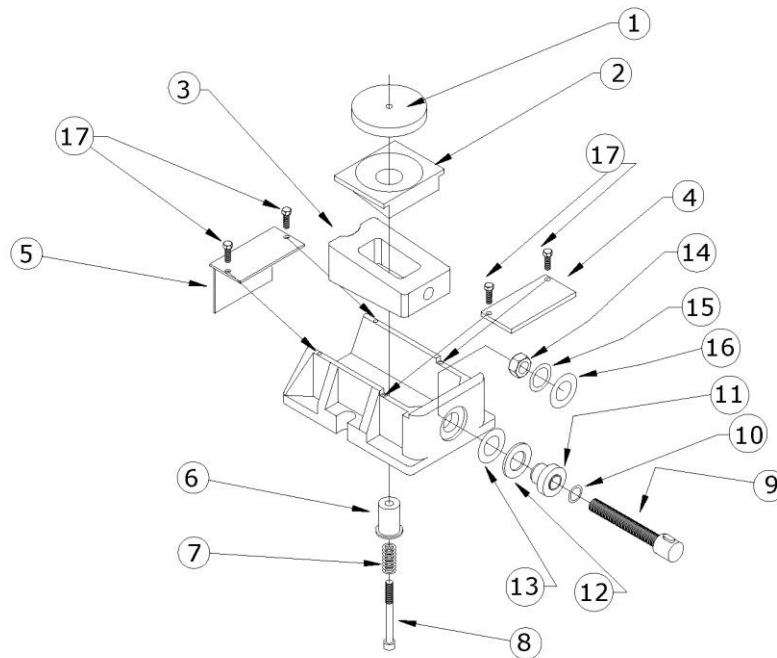
2) Diameter at electron beam weld may be up to +0.150" larger

3) May be supplied with adapter



Fixator Parts Assembly

ITEM	ITEM #	DESCRIPTION
1	24FIX13	SPHERICAL BEARING PLATE
2	24FIX11	SLIDE MEMBER
3	24FIX10	WEDGE
4	24FIX12	CASING COVER
5	24FIX14	STAINLESS STEEL COVER
6	24FIX08	SPRING BUSHING
7	24FIX07	SPRING
8	24FIX06	8 MM ALLEN HEAD BOLT
9	24FIX01R	R&R SET SCREW
10	24FIX15	SPACER WASHER
11	24FIXATB	ALL THREAD BUSHING
12	24FIX03	BRASS THRUST WASHER
13	24FIX03A	MACHINE WASHER
14	24FIX02	LOCK NUT
15	24FIX04	5/8" x 1" BEVELED WASHER
16	24FIX05	7/8" x 1" BEVELED WASHER
17	BOL6X12MM	6MM X 12 MM BOLT
9-10-12-13-14-15-16	24FIXAT	ALL THREAD ASSEMBLY
6-7-8	24FIXHD	FIXATOR HOLD DOWN KIT
—	24FIXRK	BOTH 24FIXAT-24FIXHD
—	24FIX	R&R FIXATOR ASSEMBLY



RK FIXATOR® TECHNICAL SPECIFICATIONS

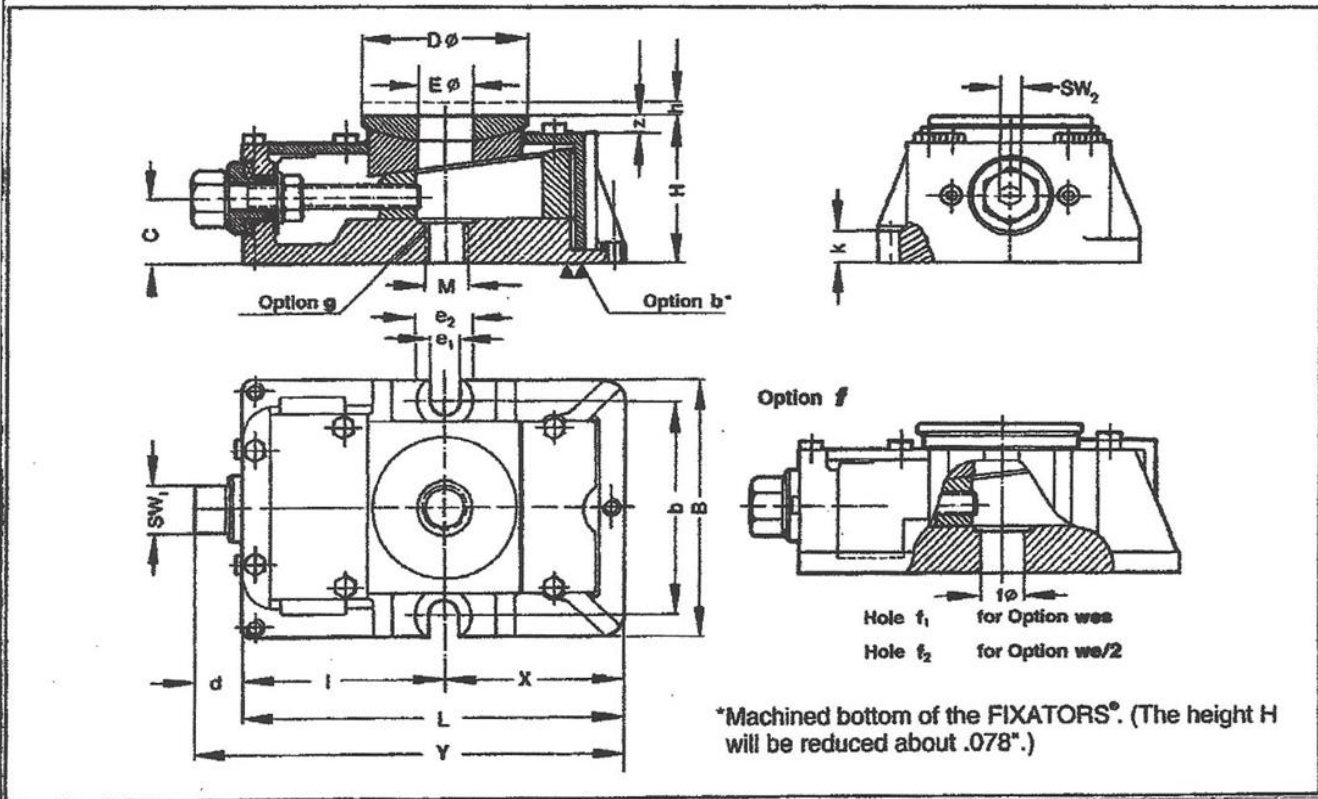
RK2

DESCRIPTION	Dim.	RK I	RK II	RK III	RK IV	RK V
Recommended machine dead weight	lbs.	Contact Factory	4,400	8,800	13,200	26,400
Maximum allowable lifting load per FIXATOR®	lbs.	Contact Factory	26,500	53,000	80,000	155,000
Spring constant	lb./in.	Contact Factory	22,800,000	37,100,000	45,700,000	79,900,000
Vertical adjustment per revolution of height adjusting screw	in.	0.010	0.010	0.012	0.014	0.017
Maximum vertical adjustment	in.	0.20	0.20	0.24	0.32	0.40
Approximate torque required to turn adjusting screw	ft. lb./1000 lbs. load	1.0	1.0	1.3	1.5	1.8
Maximum allowable torque on adjusting screw	ft. lb.	22	29	73	117	294
Thread dimensions	M x S metric	16 x 2 mm	20 x 2.5 mm	24 x 3 mm	30 x 3.5 mm	36 x 4 mm
Approximate torque on anchor bolt nut at yield point of bolt	ft. lb.	116	217	376	723	1300
Approximate tension on anchor bolt at yield point	lbs.	Contact Factory	19,800	28,600	44,000	66,000
Weight of Basic Unit	lbs.	8.8	12.1	25.3	46.2	92.4

DIMENSIONS*

SIZE RK	M	L	B	H	DØ	SW ₁	SW ₂	EØ	d	c	z	h	l	b	e ₁	e ₂	k	x	Y	f ₁ Ø	f ₂ Ø
I	M12	6.89	4.13	2.17	2.36	19 mm	—	.80	.63	.93	.39	.20	3.62	3.54	.55	1.02	.55	3.27	7.52	.67	.75
II	M20	6.89	4.72	2.95	2.95	19 mm	—	1.00	.63	1.30	.51	.20	3.66	3.94	.55	1.02	.59	3.23	7.52	.83	.98
III	M24	8.66	5.91	3.74	3.54	24 mm	—	1.25	.81	1.61	.55	.24	4.63	5.12	.71	1.26	.91	4.03	9.47	.98	1.22
IV	M30	10.89	7.09	4.53	4.33	32 mm	17 mm	1.55	1.26	2.09	.71	.32	5.61	6.30	.94	1.50	1.10	5.22	12.09	1.22	1.46
V	M36 M42	13.58	9.06	5.31	5.91	36 mm	19 mm	1.80	1.38	2.52	.79	.40	7.09	8.07	1.10	1.81	1.50	6.49	14.96	1.46	1.73

*CASTING DIMENSIONS MAY VARY



LED Thermometers for Steam Chest



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 www.redlion.net

Bulletin No. PAXLT-A
 Drawing No. LP0750
 Released 04/13

MODEL PAXLT - PAX LITE TEMPERATURE METER



- 5 DIGIT, 0.56" HIGH RED LED DISPLAY
- DISPLAYS °C OR °F WITH 1° OR 0.1° RESOLUTION
- BACKLIGHT OVERLAYS INCLUDED (°C AND °F)
- MAX AND MIN READING MEMORY
- TC COLD JUNCTION COMPENSATION (ON/OFF)
- PROGRAMMABLE TEMPERATURE OFFSET
- PROGRAMMABLE USER INPUT
- DUAL 5 AMP FORM C RELAYS
- UNIVERSALLY POWERED
- NEMA 4X/IP65 SEALED FRONT BEZEL
- THERMOCOUPLE AND RTD INPUTS
- CONFORMS TO ITS-90 STANDARDS



For Model No. PAXLT0U0 Only

GENERAL DESCRIPTION

The PAXLT is a versatile meter that accepts a variety of thermocouple and RTD inputs and provides a temperature display in Celsius or Fahrenheit. The readout conforms to ITS-90 standards, with 1° or 0.1° resolution. The 5-digit display has 0.56" high digits with adjustable intensity. Backlight overlay labels for °F and °C are included.

The meter features a Maximum and Minimum 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. Either value can be displayed if desired. The display can be toggled manually or automatically between the selected values.

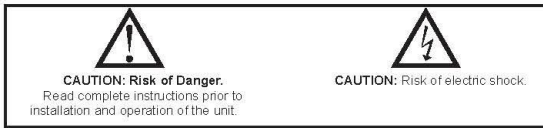
Other features include thermocouple cold junction compensation, display offset and a programmable user input to perform a variety of meter control functions. Two setpoint outputs are provided, each with a Form C relay. Output modes and setup options are fully programmable to suit a variety of control requirements.

The PAXLT can be universally powered from a wide range of AC or DC voltage. The meter has been specifically designed for harsh industrial environments. With a NEMA 4X/IP65 sealed bezel and extensive testing to meet CE requirements, the meter provides a tough yet reliable application solution.

SAFETY SUMMARY

All safety regulations, local codes and instructions that appear in this and corresponding 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 meter 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 meter



SPECIFICATIONS

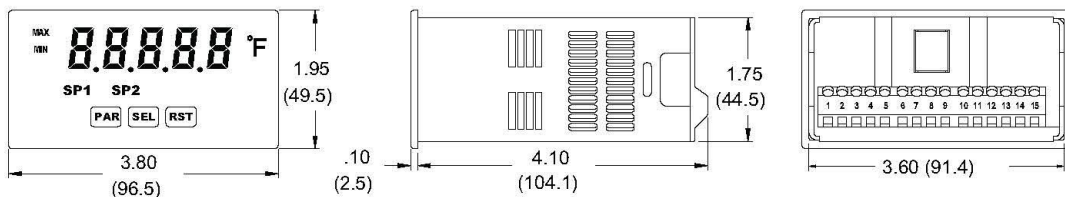
1. DISPLAY: 5 digit, 0.56" (14.2 mm) intensity adjustable Red LED
2. POWER REQUIREMENTS:
 AC POWER: 50 to 250 VAC 50/60 Hz, 12 VA
 Isolation: 2300 Vrms for 1 min. to all inputs and outputs
 DC POWER: 21.6 to 250 VDC, 6 W
3. READOUT:
 Display Range: -19999 to 99999
 Scale: °F or °C
 Resolution: 1° or 0.1°
 Response Time: 500 msec min.
 Display Overrange/Underrange Indication: "....." / "-...."
 Input Overrange/Underrange Indication: \overline{UL} / \underline{LL}

ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
	TC/RTD Temperature Meter with Dual Relay Output	PAXLT000
PAXLT	UL Listed TC/RTD Temperature Meter with Dual Relay Output	PAXLT0U0

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.



4. THERMOCOUPLE INPUTS:

Input Impedance: 20 MΩ

Max. Continuous Overvoltage: 30 VDC

Failed Sensor Indication: *DPEF*

TC TYPE	RANGE	ACCURACY @ 23°C ±°C *	ACCURACY @ 0 to 50°C ±°C *	WIRE COLOR	
				ANSI	BS 1843
T	-200 to 400°C -328 to 752°F	2.3	5.8	(+) blue (-) red	(+) white (-) blue
E	-200 to 871°C -328 to 1600°F	2.7	4.9	(+) purple (-) red	(+) brown (-) blue
J	-200 to 760°C -328 to 1400°F	1.9	4.3	(+) white (-) red	(+) yellow (-) blue
K	-200 to 1372°C -328 to 2502°F	2.3	5.8	(+) yellow (-) red	(+) brown (-) blue
R	-50 to 1768°C -58 to 3214°F	4.5	15.0	no standard	(+) white (-) blue
S	-50 to 1768°C -58 to 3214°F	4.5	15.0	no standard	(+) white (-) blue
B	200 to 1820°C 392 to 3308°F	9.1<540°C 4.5>540°C	42.6<540°C 15.0>540°C	no standard	no standard
N	-200 to 1300°C -328 to 2372°F	2.8	8.1	(+) orange (-) red	(+) orange (-) blue
C (W5/W26)	0 to 2315°C 32 to 4199°F	1.9	6.1	no standard	no standard
mV	-10.00 to 65.00	0.02 mV	0.08 mV	no standard	no standard

*After 20 min. warm-up. Accuracy is specified in two ways: Accuracy at 23°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 tempo and cold junction tracking effects.

The specification includes the A/D conversion errors, linearization conformity, and thermocouple cold junction 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.

5. RTD INPUTS:

Type: 2, 3 or 4 wire

Excitation Current:

100 ohm range: 165 μA; 10 ohm range: 2.5 mA

Lead Resistance:

100 ohm range: 10 Ω/lead max.; 10 ohm range: 3 Ω/lead max.

Balanced Lead Resistance: Automatically compensated up to max per lead

Unbalanced Lead Resistance: Uncompensated

Max. Continuous Overvoltage: 30 VDC

Failed Sensor Indication: *DPEF* or *Shrk*

RTD TYPE	RANGE	ACCURACY* @ 23°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 = .00392	-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

*After 20 min. warm-up. Accuracy is specified in two ways: Accuracy at 23°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 tempo effects.

The specification includes the A/D conversion errors and linearization conformity. 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.

6. USER INPUT: Programmable input

Software selectable for active logic state: active low, pull-up (24.7 KΩ to +5 VDC) or active high, pull-down resistor (20 KΩ).

Trigger levels: $V_{IL} = 1.0$ V max; $V_{IH} = 2.4$ V min; $V_{MAX} = 28$ VDC

Response Time: 10 msec typ.; 50 msec debounce (activation and release)

7. MEMORY: Nonvolatile E²PROM retains all programming parameters and max/min values when power is removed.

8. OUTPUTS:

Type: Dual Form C contacts

Isolation to Sensor & User Input Commons: 1400 Vrms for 1 min.

Working Voltage: 150 Vrms

Contact Rating: 5 amps @ 120/240 VAC or 28 VDC (resistive load), 1/8 H.P. @ 120 VAC (inductive load)

Life Expectancy: 100 K cycles min. at full load rating. External RC snubber extends relay life for operation with inductive loads.

Response Time: Turn On or Off: 4 msec max.

9. ENVIRONMENTAL CONDITIONS:

Operating temperature: 0 to 50 °C

Storage temperature: -40 to 70 °C

Operating and storage humidity: 0 to 85% max. RH (non-condensing)

Vibration to IEC 68-2-6: Operational 5 to 150 Hz, 2 g.

Shock to IEC 68-2-27: Operational 30 g (10 g relay).

Altitude: Up to 2,000 meters

10. CONNECTIONS: High compression cage-clamp terminal block

Wire Strip Length: 0.3" (7.5 mm)

Wire Gauge: 30-14 AWG copper wire

Torque: 4.5 inch-lbs (0.51 N-m) max.

11. 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.

12. CERTIFICATIONS AND COMPLIANCES:

CE Approved

EN 61326-1 Immunity to Industrial Locations

Emission CISPR 11 Class A

IEC/EN 61010-1

RoHS Compliant

Type 4X Outdoor Enclosure rating (Face only)

IP65 Enclosure rating (Face only)

IP20 Enclosure rating (Rear of unit)

For Model No. PAXLT0U0 Only: UL Listed: File #E137808

Refer to EMC Installation Guidelines section of the bulletin for additional information.

13. WEIGHT: 10.4 oz. (295 g)

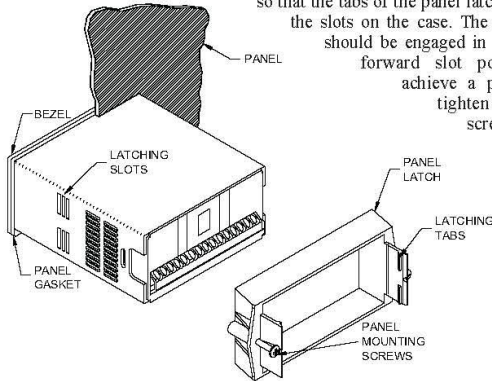


1.0 INSTALLING THE METER

Installation

The PAX Lite 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



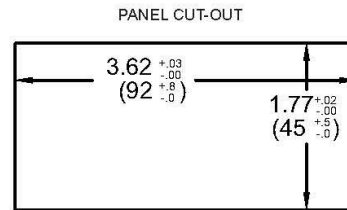
until the unit is snug in the panel (Torque to approximately 7 in-lbs [79N-cm]). Do not over-tighten the screws.

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.

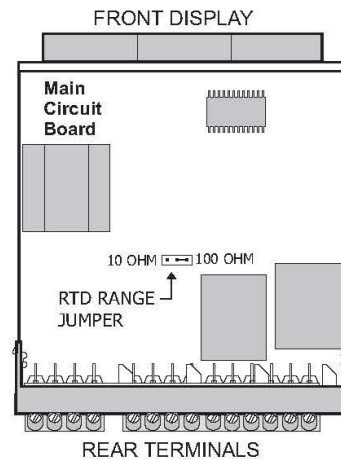


2.0 SETTING THE JUMPER

INPUT RANGE JUMPER (RTD ONLY)

This jumper is used to select the proper input range for the RTD probe being used (10 ohm or 100 ohm). For thermocouple inputs, this jumper has no effect and can be left in either position.

To access the jumper, remove the meter base from the case by firmly squeezing and pulling back on the side rear finger tabs. This should lower 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 on the other side latch.



3.0 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 the 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.)

EMC INSTALLATION GUIDELINES

Although Red Lion Controls Products are designed with a high degree of immunity to Electromagnetic Interference (EMI), proper installation and wiring methods must be followed to ensure compatibility in each application. The type of the electrical noise, source or coupling method into a unit may be different for various installations. Cable length, routing, and shield termination are very important and can mean the difference between a successful or troublesome installation. Listed are some EMI guidelines for a successful installation in an industrial environment.

1. A unit should be mounted in a metal enclosure, which is properly connected to protective earth.
2. Use shielded cables for all Signal and Control inputs. The shield connection should be made as short as possible. The connection point for the shield depends somewhat upon the application. Listed below are the recommended methods of connecting the shield, in order of their effectiveness.



- a. Connect the shield to earth ground (protective earth) at one end where the unit is mounted.
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is over 1 MHz.
3. 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 through 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. Also, Signal or Control cables within an enclosure should be routed as far away as possible from contactors, control relays, transformers, and other noisy components.
 4. Long cable runs are more susceptible to EMI pickup than short cable runs.
 5. In extremely high EMI environments, the use of external EMI suppression devices such as Ferrite Suppression Cores for signal and control cables is effective. The following EMI suppression devices (or equivalent) are recommended:
 - Fair-Rite part number 0443167251 (RLC part number FCOR0000)
 - Line Filters for input power cables:
 - Schaffner # FN2010-1/07 (Red Lion Controls # LFIL0000)
 6. To protect relay contacts that control inductive loads and to minimize radiated and conducted noise (EMI), some type of contact protection network is

normally installed across the load, the contacts or both. The most effective location is across the load.

- a. Using a snubber, which is a resistor-capacitor (RC) network or metal oxide varistor (MOV) across an AC inductive load is very effective at reducing EMI and increasing relay contact life.
- b. If a DC inductive load (such as a DC relay coil) is controlled by a transistor switch, care must be taken not to exceed the breakdown voltage of the transistor when the load is switched. One of the most effective ways is to place a diode across the inductive load. Most RLC products with solid state outputs have internal zener diode protection. However external diode protection at the load is always a good design practice to limit EMI. Although the use of a snubber or varistor could be used.
 - RLC part numbers: Snubber: SNUB0000
 - Varistor: ILS11500 or ILS23000

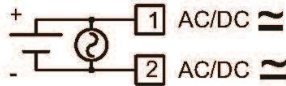
7. Care should be taken when connecting input and output devices to the instrument. When a separate input and output common is provided, they should not be mixed. Therefore a sensor common should NOT be connected to an output common. This would cause EMI on the sensitive input common, which could affect the instrument's operation.

Visit RLC's web site at <http://www.redlion.net/Support/InstallationConsiderations.html> for more information on EMI guidelines, Safety and CE issues as they relate to Red Lion Controls products.

3.1 POWER WIRING

Power

Terminal 1: VAC/DC +
Terminal 2: VAC/DC -

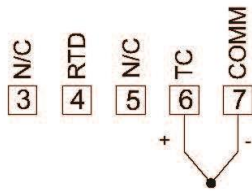


3.2 INPUT SIGNAL WIRING

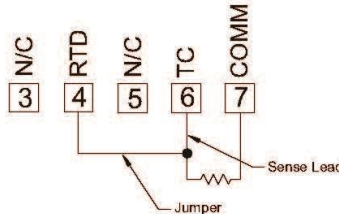


CAUTION: Sensor input common (Terminal 7) is NOT isolated from user common (Terminal 9). In order to preserve the safety of the meter application, the sensor input common must be suitably isolated from hazardous live earth referenced voltages; or input common and user common must be at protective earth ground potential. If not, hazardous live voltage may be present at the user input and user common terminals. Appropriate considerations must then be given to the potential of the sensor input common and the user common with respect to earth ground.

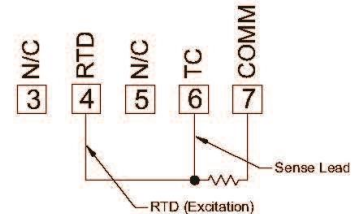
THERMOCOUPLE



2-WIRE RTD



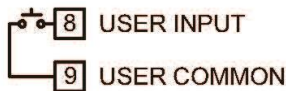
3-WIRE RTD



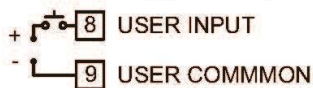
3.3 USER INPUT WIRING

Terminal 8: User Input
Terminal 9: User Common

Current Sinking (Active Low Logic)

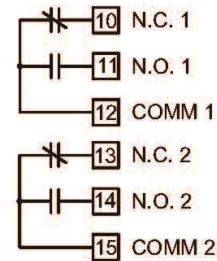


Current Sourcing (Active High Logic)



3.4 SETPOINT (OUTPUT) WIRING

Terminal 10: NC 1
Terminal 11: NO 1
Terminal 12: Relay 1 Common
Terminal 13: NC 2
Terminal 14: NO 2
Terminal 15: Relay 2 Common



4.0 REVIEWING THE FRONT BUTTONS AND DISPLAY



BUTTON	DISPLAY MODE OPERATION	PROGRAMMING MODE OPERATION
PAR	Access Programming Mode	Store selected parameter and index to next parameter
SEL	Index display through enabled values	Advance through selection list/select digit position in parameter value
RST	Resets values (min/max) or outputs	Increment selected digit of parameter value

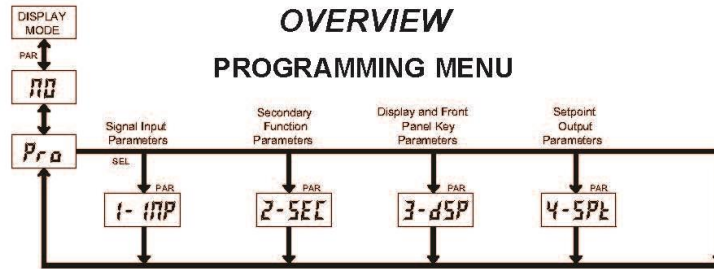
OPERATING MODE DISPLAY DESIGNATORS

MAX - Maximum display capture value
 MIN - Minimum display capture value

"SP1" - Indicates setpoint 1 output activated.
 "SP2" - Indicates setpoint 2 output activated.

Pressing the **SEL** button toggles the meter through the selected displays. If display scroll is enabled, the display will toggle automatically every four seconds between the enabled display values.

5.0 PROGRAMMING THE METER



PROGRAMMING MODE ENTRY (PAR BUTTON)

It is recommended all programming changes be made off line, or before installation. The meter normally operates in the Display Mode. No parameters can be programmed in this mode. The Programming Mode is entered by pressing the **PAR** button. If it is not accessible, then it is locked by either a security code or a hardware lock.

MODULE ENTRY (SEL & PAR BUTTONS)

The Programming Menu is organized into four modules. These modules group together parameters that are related in function. The display will alternate between **Pr0** and the present module. The **SEL** button is used to select the desired module. The displayed module is entered by pressing the **PAR** button.

MODULE MENU (PAR BUTTON)

Each module has a separate module menu (which is shown at the start of each module discussion). The **PAR** button 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 **Pr0**. Programming may continue by accessing additional modules.

SELECTION / VALUE ENTRY

For each parameter, the display alternates between the present parameter and the selections/value for that parameter. The **SEL** and **RST** buttons are used to move through the selections/values for that parameter. Pressing the **PAR** button, stores and activates the displayed selection/value. This also advances the meter to the next parameter.

For numeric values, the value is displayed with one digit flashing (initially the right most digit). Pressing the **RST** button increments the digit by one or the user can hold the **RST** button and the digit will automatically scroll. The **SEL** button will select the next digit to the left. Pressing the **PAR** button will enter the value and move to the next parameter.

PROGRAMMING MODE EXIT (PAR BUTTON)

The Programming Mode is exited by pressing the **PAR** button with **Pr0** displayed. This will commit any stored parameter changes to memory and return the meter to the Display Mode. (If power loss occurs before returning to the Display Mode, verify recent parameter changes.)

PROGRAMMING TIPS

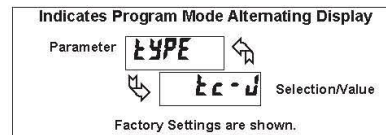
It is recommended to start with Module 1 and proceed through each module in sequence. When programming is complete, it is recommended to record the parameter programming and lock out parameter programming with the user input or programming security code.

FACTORY SETTINGS

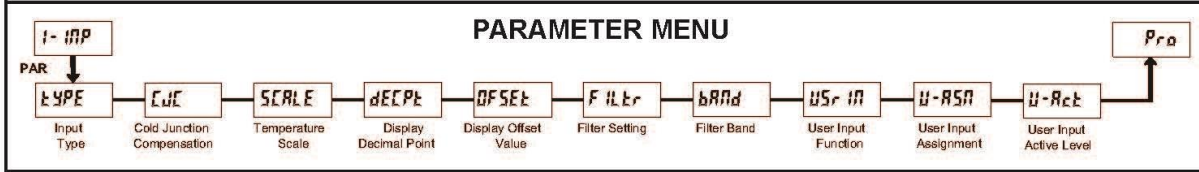
Factory Settings may be completely restored in Module 2. This is useful when encountering programming problems.

ALTERNATING SELECTION DISPLAY

In the explanation of the modules, the following dual display with arrows will appear. This is used to illustrate the display alternating between the parameter on top and the parameter's Factory Setting on the bottom. In most cases, selections and values for the parameter will be listed on the right.



5.1 MODULE 1 - INPUT SETUP PARAMETERS (1-IMP)



INPUT TYPE

SELECTION	INPUT TYPE	SELECTION	INPUT TYPE
tc-t	T	tc-n	N
tc-E	E	tc-C	C
tc-J	J	u01t	mV
tc-K	K	Pt 385	Platinum 385 100 Ω
tc-R	R	Pt 392	Platinum 392 100 Ω
tc-S	S	Ni 672	Nickel 672 100 Ω
tc-b	B	cu 427	Copper 427 10 Ω

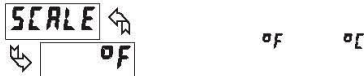
Select the thermocouple or RTD type used for the application. For RTDs, position the Input Range Jumper to match the RTD type (10Ω or 100Ω). Selecting **u01t** displays a millivolt signal readout with 10 μV resolution.

COLD JUNCTION COMPENSATION



This parameter enables or disables internal cold junction compensation for thermocouples. For most applications, cold junction compensation should be enabled (ON). This parameter only appears for thermocouple input selections.

TEMPERATURE SCALE



Select the desired temperature scale. This selection applies for the Input, MAX and MIN displays. This parameter does not appear when mV or RTD resistance display is enabled.

DISPLAY DECIMAL POINT



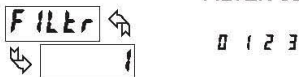
Set the decimal point for the desired display resolution. This selection applies for the Input, MAX and MIN displays, and also affects the Setpoint and Display Offset values. For mV or RTD resistance displays, the decimal point location is fixed and this parameter does not appear.

DISPLAY OFFSET VALUE



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.

FILTER SETTING

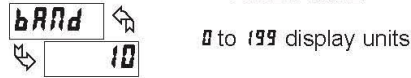


If the displayed temperature is difficult to read due to small process variations or noise, increased levels of filtering will help to stabilize the display.

Software filtering effectively combines a fraction of the current input reading with a fraction of the previous displayed reading to generate the new display.

Filter values represent no filtering (0), up to heavy filtering (3). A value of 1 for the filter uses 1/4 of the new input and 3/4 of the previous display to generate the new display. A filter value of 2 uses 1/8 new and 7/8 previous. A filter value of 3 uses 1/16 new and 15/16 previous.

FILTER BAND



The filter will adapt to variations in the input signal. When the variation exceeds the input filter band value, the 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, independent of the Display Decimal Point position. A band setting of '0' keeps the filter permanently engaged at the filter level selected above.

USER INPUT FUNCTION



DISPLAY MODE	DESCRIPTION
NO	No Function User Input disabled.
P-Loc	Program Mode Lock-out See Programming Mode Access chart (Module 3).
rESEt	Reset * Reset the assigned value(s) to the current input value.
d-Hld	Display Hold Holds the assigned display, but all other meter functions continue as long as activated (maintained action).
d-SEL	Display Select * Advance once for each activation.
d-LEU	Display Intensity Level * Increase intensity one level for each activation.
rSE-1	Setpoint 1 Reset * Reset setpoint 1 output.
rSE-2	Setpoint 2 Reset * Reset setpoint 2 output.
rSE-2	Setpoint 1 and 2 Reset * Reset both setpoint 1 and 2 outputs.

* Indicates Edge Triggered function. All others are Level Active functions.

USER INPUT ASSIGNMENT



Select the value(s) to which the User Input Function is assigned. The User Input Assignment only applies if a selection of reset or display hold is selected in the User Input Function menu.

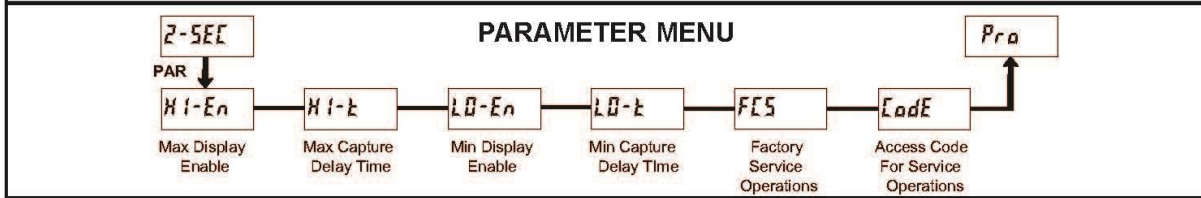
USER INPUT ACTIVE LEVEL



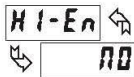
Select whether the user input is configured as active low or active high.



5.2 MODULE 2 - SECONDARY FUNCTION PARAMETERS (2-5EE)

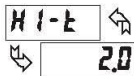


MAX DISPLAY ENABLE



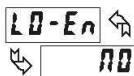
Enables the Maximum Display Capture capability.

MAX CAPTURE DELAY TIME



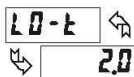
When the Input Display is above the present MAX value for the entered delay time, the meter will capture that display value as the new MAX reading. A delay time helps to avoid false captures of sudden short spikes.

MIN DISPLAY ENABLE



Enables the Minimum Display Capture capability.

MIN CAPTURE DELAY TIME



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.

FACTORY SERVICE OPERATIONS



Select 4E5 to perform any of the Factory Service Operations shown below.

RESTORE FACTORY DEFAULT SETTINGS



Entering Code 66 will overwrite all user settings with the factory settings. The meter will display rESEt and then return to CodE 00. Press the PAR button to exit the module.

VIEW MODEL AND VERSION DISPLAY



Entering Code 50 will display the version (x.x) of the meter. The display then returns to CodE 00. Press the PAR button to exit the module.

TOGGLE RTD INPUT DISPLAY MODE

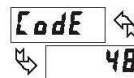


Entering Code 85 toggles the selected RTD input display mode between a temperature or resistance readout. The resistance readout is useful for diagnostic purposes before and after calibration, or to display the measured resistance of a connected RTD probe.

For RTD type Lu421 (Input Range Jumper in 10Ω position), resistance is displayed in 0000 ohms resolution. For all other RTD types (100Ω position), resistance is displayed in 000 ohms resolution.

Upon entering Code 85, the meter displays either d5P-t or d5P-r to indicate temperature or resistance readout selected. The display then returns to CodE 00. Press the PAR button to exit the module.

CALIBRATION



The PAXLT uses stored calibration values to provide accurate temperature measurements. Over time, the electrical characteristics of the components inside the meter could slowly change, with the result being that the stored calibration values may no longer accurately define the input circuit. For most applications, recalibration every 1 to 2 years should be sufficient.

Calibration for thermocouple inputs involves a voltage calibration and a cold junction calibration. It is recommended that both calibrations be performed. The voltage calibration must precede cold junction calibration.

Calibration of the meter should only be performed by persons experienced in calibrating electronic equipment. Allow a minimum 30 minute warm up before performing any calibration procedures. The following procedures should be performed at an ambient temperature of 15 to 35°C (59 to 95°F).

CAUTION: The accuracy of the calibration equipment will directly affect the accuracy of the meter.

10 OHM RTD Range Calibration

1. Set the Input Range Jumper to 10 ohm position.
2. With the display at CodE 48, press the PAR key. Unit displays rRL 00.
3. Press SEL to select 10 ohm range. Display reads rRL r 00.
4. Press PAR. Display reads 00r.
5. Apply a direct short to terminals RTD (4), TC (6) and COMM (7) using a three wire link. Press PAR. Display reads rRL r for about 10 seconds.
6. When the display reads 150r, apply a precision resistance of 15 ohms (with an accuracy of 0.01% or better) to terminals RTD, TC and COMM using a three wire link. Press PAR. Display reads rRL r for about 10 seconds.
7. When display reads rRL 00, press PAR twice to exit calibration and return to the normal display mode.

100 OHM RTD Range Calibration

1. Set the Input Range Jumper to 100 ohm position.
2. With the display at CodE 48, press the PAR key. Unit displays rRL 00.
3. Press SEL twice to select 100 ohm range. Display reads rRL r 00.
4. Press PAR. Display reads 00r.
5. Apply a direct short to terminals RTD (4), TC (6) and COMM (7) using a three wire link. Press PAR. Display reads rRL r for about 10 seconds.
6. When the display reads 3000r, apply a precision resistance of 300 ohms (with an accuracy of 0.01% or better) to terminals RTD, TC and COMM using a three wire link. Press PAR. Display reads rRL r for about 10 seconds.
7. When display reads rRL 00, press PAR twice to exit calibration and return to the normal display mode.



THERMOCOUPLE Voltage Calibration

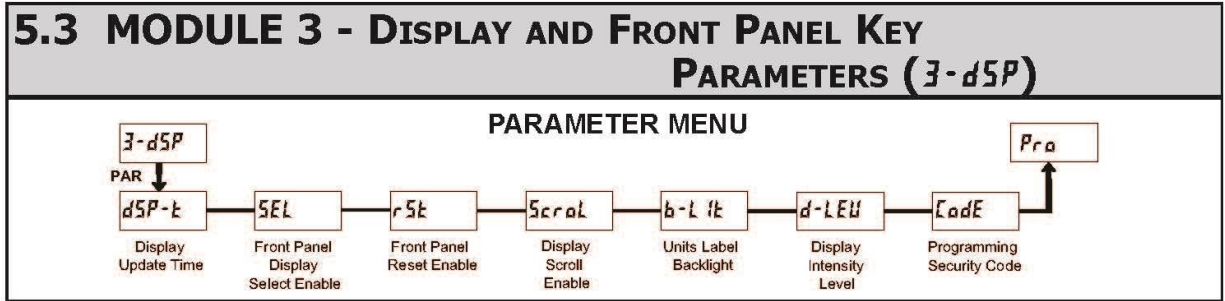
1. Connect a precision DC voltage source with an accuracy of 0.01% or better to the TC and COMM terminals. Set the voltage source to zero.
2. With the display at **Code 48**, press the **PAR** key. Unit displays **RL RD**.
3. Press **SEL** until the display reads **RL tE** to select thermocouple input.
4. Press **PAR**. Display reads **DD**.
5. With the voltage source set to zero, press **PAR**. Display reads **RLt** for about 6 seconds.
6. When the display reads **DD**, set the voltage source output to 60.000 mV. Press **PAR**. Display reads **RLt** for about 6 seconds.
7. When display reads **RL RD**, press **PAR** twice to exit calibration and return to the normal display mode. Proceed to Cold Junction Calibration.

THERMOCOUPLE Cold Junction Calibration

1. The ambient temperature must be between 20°C and 30°C.
2. Connect a thermocouple (types T, E, J, K or N only) with an accuracy of 1°C or better to the meter.
3. Enter programming mode and verify the following settings in Module 1:

TYPE = thermocouple type connected to the meter
CLt = 00; **SCALE** = °C; **dECT** = 00; **DFSEt** = 00

4. 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 of known temperature could be used in place of the thermometer.)
5. Compare the unit display with the reference temperature indicator (or calibration bath). If a difference of more than +/- 1.0°C exists, note the difference (CJ Error) and continue with cold junction calibration.
 $CJ\ Error = Reference\ Temperature - Unit\ Display$
6. Enter programming mode and proceed through Module 2 to the Service Access Code. Select **Code 48** and press **PAR**. Unit displays **RL RD**. Press **RST** to select **CLt**.
7. Press **PAR**. Display reads **CLt** followed by the current cold junction value. Calculate a new cold junction value as follows:
 $New\ cold\ junction = Current\ cold\ junction + CJ\ Error$ (noted above)
8. Press **PAR** and set the display to the new cold junction value. Press **PAR** to enter the new value. Display reads **RLt** for 6 seconds and returns to **RL RD**.
9. Press **PAR** twice to exit calibration and return to the normal display mode. Verify the input reading is correct. If not, repeat steps 5 through 9.



DISPLAY UPDATE TIME

dSP-t 05 1 2 seconds

This parameter sets the display update time in seconds.

DISPLAY INTENSITY LEVEL

d-LEU 3 1 to 5

Enter the desired Display Intensity Level (1-5). The display will actively dim or brighten as levels are changed.

FRONT PANEL DISPLAY SELECT ENABLE (SEL)

SEL NO YES

The **YES** selection allows the **SEL** key to toggle through the enabled displays.

FRONT PANEL RESET ENABLE (RST)

RSt NO LO dSP

This selection allows the **RST** button to reset the selected value(s).

DISPLAY SCROLL ENABLE

Scrol NO YES

The **YES** selection allows the display to automatically scroll through the enabled displays. The scroll rate is every 4 seconds. This parameter only appears when the MAX or MIN displays are enabled.

UNITS LABEL BACKLIGHT

b-Lt ON OFF

The PAXLT includes two units overlay labels (°C and °F) which can be installed into the meter's bezel display assembly. The backlight for the units label is activated by this parameter.

PROGRAMMING SECURITY CODE

Code 0 to 999

The Security Code determines the programming mode and the accessibility of programming parameters. This code can be used along with the Program Mode Lock-out (**P-Loc**) in the User Input Function parameter (Module 1). Two programming modes are available. Full Programming mode allows all parameters to be viewed and modified. Quick Programming mode permits only user selected values to be modified, but allows direct access to these values without having to enter Full Programming mode.

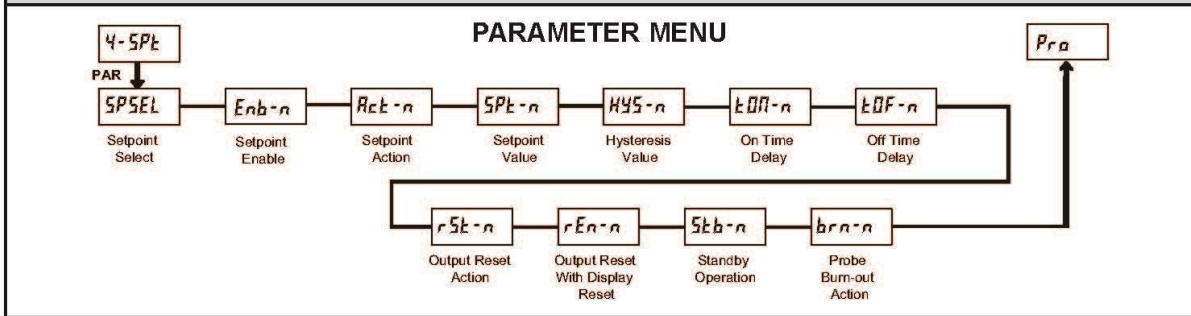
Entering a Security Code from 1-99 enables Quick Programming mode, and displays a sublist to select which values appear in the Quick Programming menu. Values set to **YES** in the sublist are accessible in Quick Programming. These values include the Setpoints (**SP-1**, **SP-2**) and Display Intensity (**d-LEU**). Programming any Security Code other than 0, requires this code to be entered at the **Code** prompt in order to access Full Programming mode. Quick Programming mode, if enabled, is accessed before the **Code** prompt appears.

USER INPUT FUNCTION	USER INPUT STATE	SECURITY CODE	MODE WHEN "PAR" BUTTON IS PRESSED	FULL PROGRAMMING MODE ACCESS
not P-Loc	---	0	Full Programming	Immediate Access
		1-99	Quick Programming	After Quick Programming with correct code entry at Code prompt *
		100-999	Code prompt	With correct code entry at Code prompt *
P-Loc	Active	0	Programming Lock	No Access
		1-99	Quick Programming	No Access
		100-999	Code prompt	With correct code entry at Code prompt *
	Not Active	0-999	Full Programming	Immediate Access

* Entering Code 222 allows access regardless of security code.



5.4 MODULE 4 - SETPOINT OUTPUT PARAMETERS (4-SPt)



SETPOINT SELECT



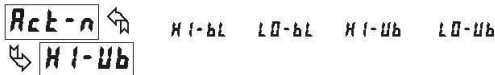
Select the Setpoint Output to be programmed, starting with Setpoint 1. The “n” in the following parameters reflects the chosen Setpoint number. After the selected setpoint is completely programmed, the display returns to **SPSEL**. Repeat steps for Setpoint 2 if both Setpoints are being used. Select **n0** to exit the Setpoint programming module.

SETPOINT ENABLE



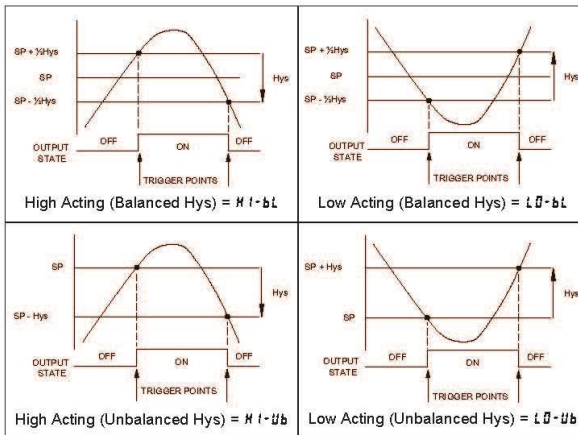
Select **YES** to enable Setpoint *n* and access the setup parameters. If **n0** is selected, the unit returns to **SPSEL** and Setpoint *n* is disabled.

SETPOINT ACTION



Enter the action for the selected setpoint (output). See Setpoint Output Figures for a visual detail of each action.

- H1-bL** = High Acting, with balanced hysteresis
- L0-bL** = Low Acting, with balanced hysteresis
- H1-Ub** = High Acting, with unbalanced hysteresis
- L0-Ub** = Low Acting, with unbalanced hysteresis



SETPOINT VALUE



Enter the desired setpoint value. The decimal point position for the setpoint and hysteresis values follow the selection set in Module 1.

HYSTERESIS VALUE



Enter desired hysteresis value. See Setpoint Output Figures for visual explanation of how setpoint output actions (balanced and unbalanced) are affected by the hysteresis. When the setpoint is a control output, usually balanced hysteresis is used. For alarm applications, usually unbalanced hysteresis is used. For unbalanced hysteresis modes, the hysteresis functions on the low side for high 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



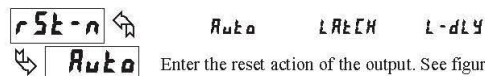
Enter the time value in seconds that the output is delayed from turning on after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OFF TIME DELAY



Enter the time value in seconds that the output is delayed from turning off after the trigger point is reached. A value of 0.0 allows the meter to update the output status per the response time listed in the Specifications.

OUTPUT RESET ACTION



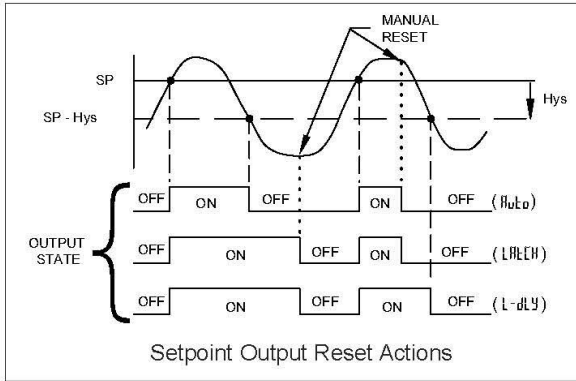
Enter the reset action of the output. See figure for details.

Auto = Automatic action; This action allows the output to automatically reset off at the trigger points per the Setpoint Action shown in Setpoint Output Figures. The “on” output may be manually reset (off) immediately by the front panel **RST** button or user input. The output remains off until the trigger point is crossed again.



L-RST = Latch with immediate reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel **RST** button or user input manual reset, or meter power cycle. When the user input or **RST** button is activated (momentary action), the corresponding "on" 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.)

L-dLY = Latch with delay reset action; This action latches the output on at the trigger point per the Setpoint Action shown in Setpoint Output Figures. Latch means that the output can only be turned off by the front panel **RST** button or user input manual reset, or meter power cycle. When the user input or **RST** button is activated (momentary action), the meter delays the event until the corresponding "on" output crosses the trigger off point. (Previously latched outputs are off if power up Display Value is lower than setpoint value. During a power cycle, the meter erases a previous **L-dLY** reset if it is not activated at power up.)



OUTPUT RESET WITH DISPLAY RESET



This parameter enables the **RST** button or user input to reset the output when the display is reset.

Note: For this parameter to operate, the **RST** button or User Input being used must be set to **dSP** and the Input value must be displayed. If these conditions are not met, the output will not reset.

STANDBY OPERATION



When **YES**, the output is disabled (after a power up) until the trigger point is crossed. Once the output is on, the output operates normally per the Setpoint Action and Output Reset Action.

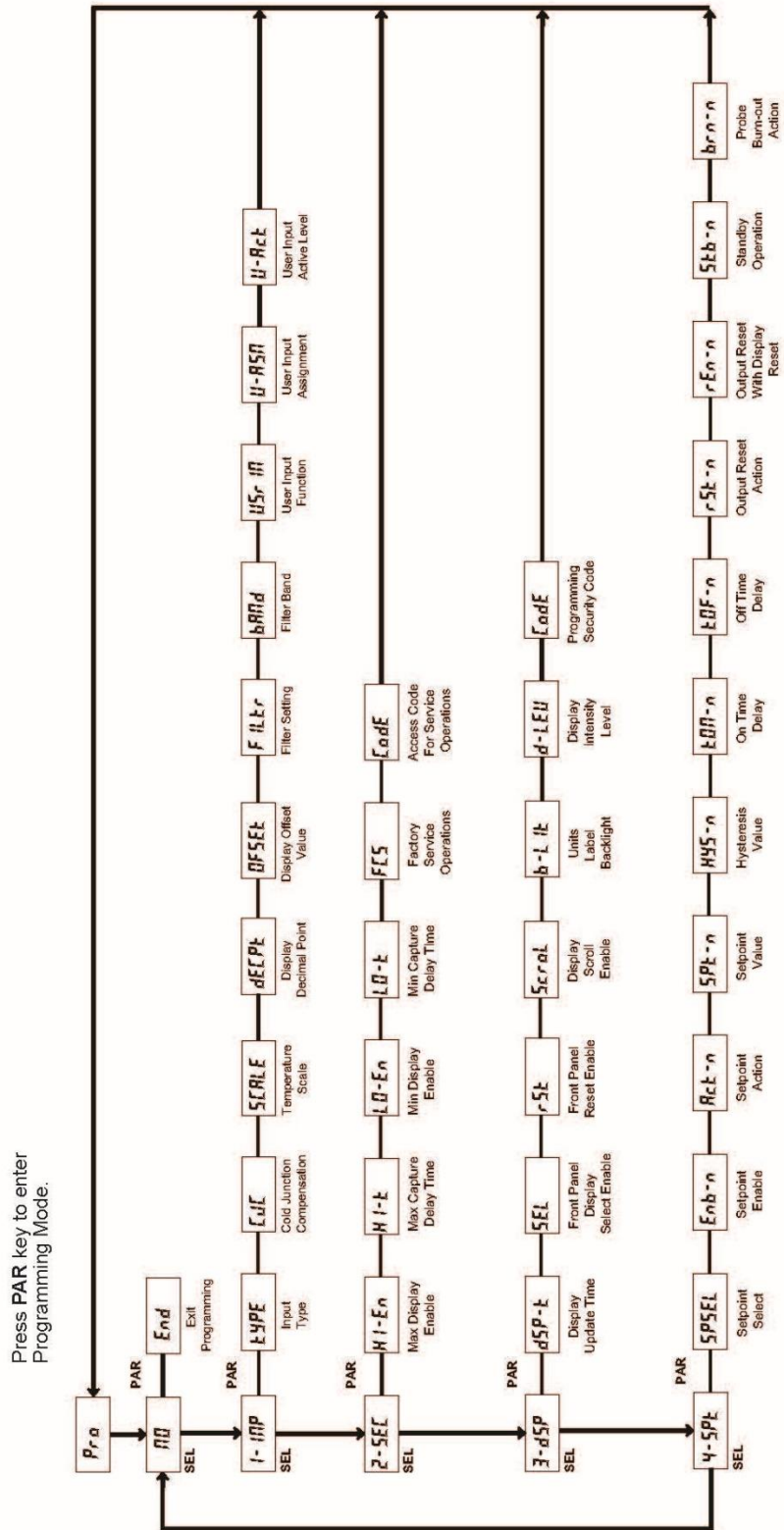
PROBE BURN-OUT ACTION



Enter the probe burn-out action. In the event of a temperature probe failure (TC open; RTD open or short), the output can be programmed to be on or off.



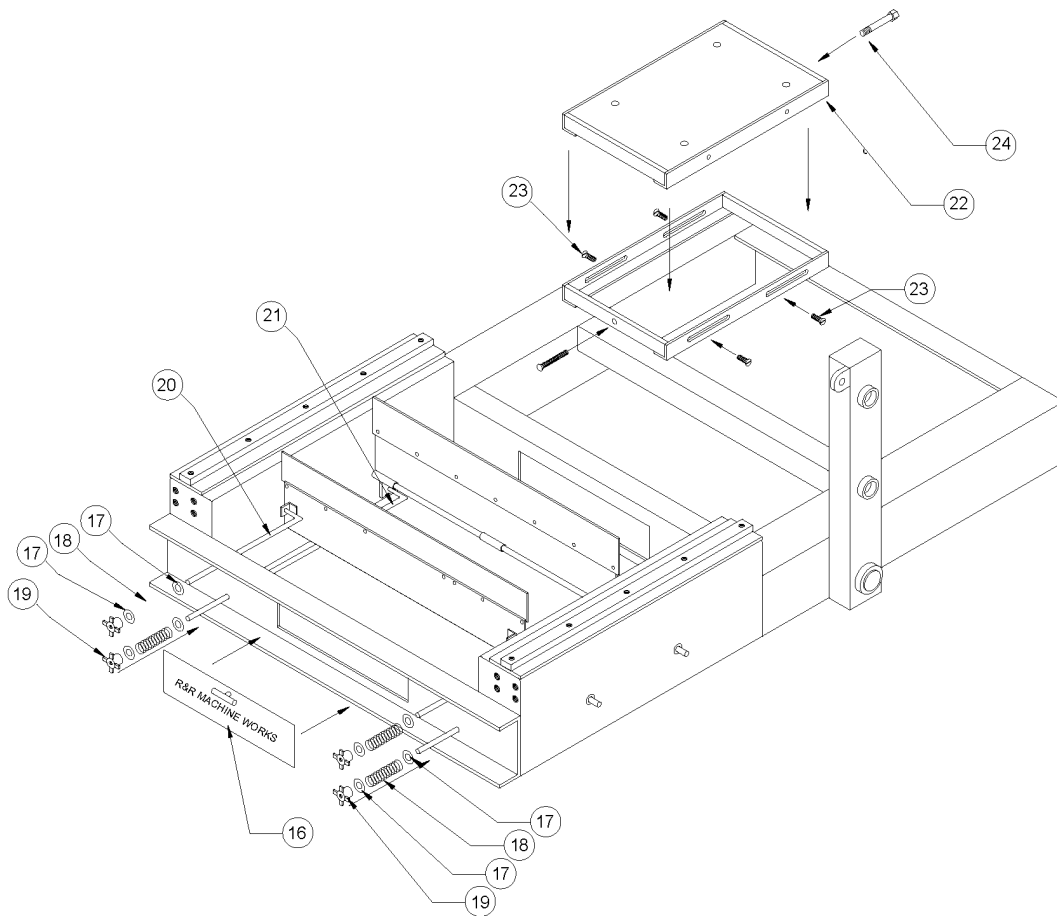
PAXLT PROGRAMMING QUICK OVERVIEW



PARTS GUIDE – 24 X 48 Flaking Machine

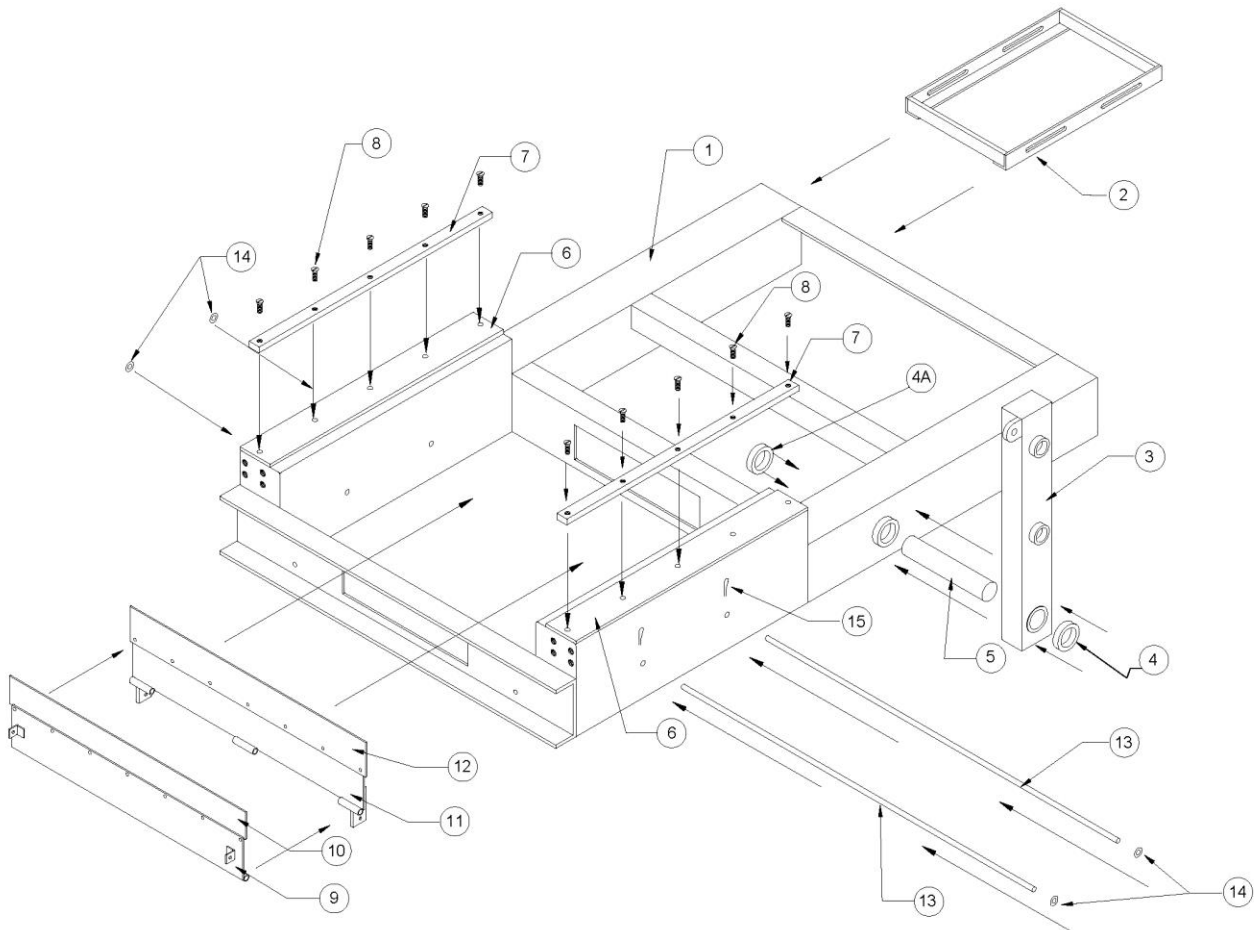
24 x 48 FRAME ASSEMBLY

ITEM	ITEM #	PART DESCRIPTION
16	DOR0024	FRAME INSPECTION DOOR
17	WF12	1/2" FLAT WASHER
18	SCR1804	SPRING FOR SCRAPER ADJUSTING ROD
19	SCR1803	STAR KNOB FOR SCRAPER TENSION ROD
20	SCR24FTRA	FRONT (SHORT) TENSION ROD ONLY
21	SCR24RTRA	REAR (LONG) TENSION ROD ONLY
22	MTRMT125	MOTOR MOUNT
23	BOL58X2	5/8" X 11 X 2" GR5 BOLT
24		MOTOR MOUNT ADJUSTING BOLT



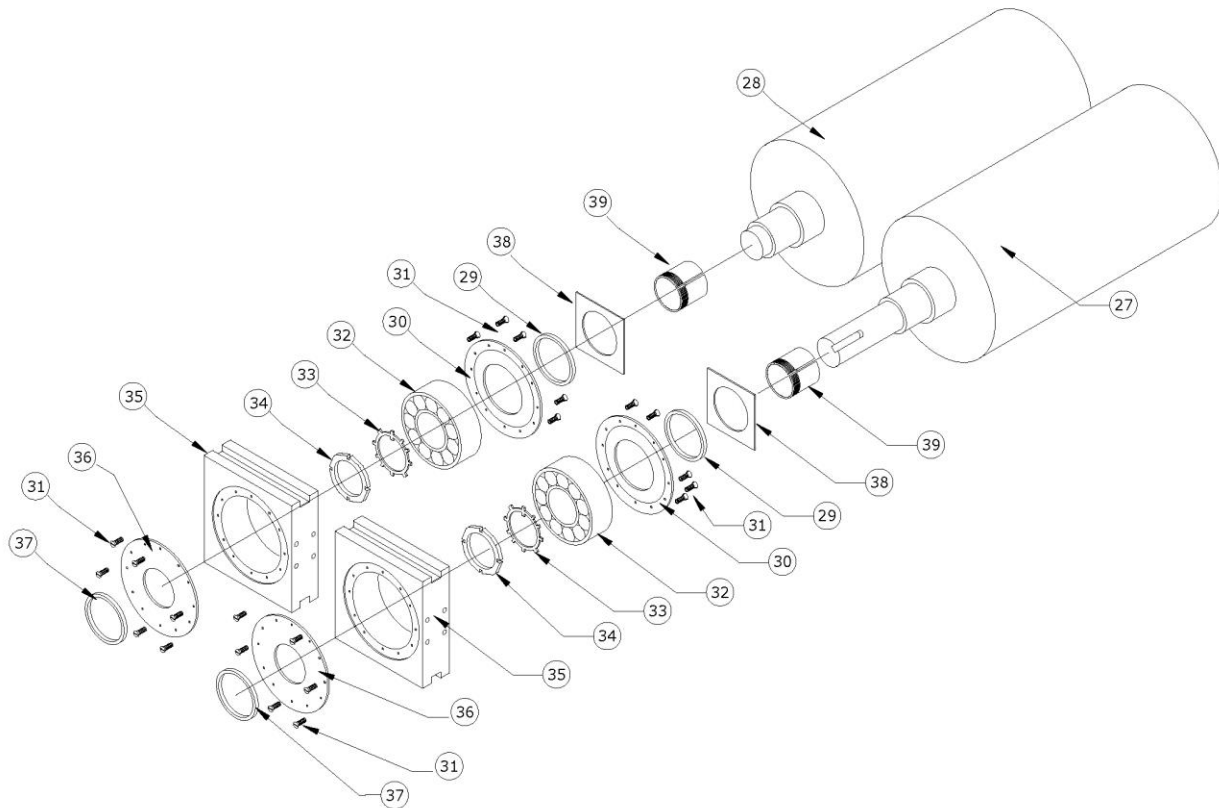
24 x 48 Conventional Frame Assembly

ITEM	ITEM #	PART DESCRIPTION
1	FR24CF	24x48 CONV. ROLLER FRAME
3	IDL24AA	IDLER ARM ASSEMBLY
4	IDL2404B	1" TOPLOCK COLLAR
4A	IDL2404	FRAME IDLER BUSHING
5	IDL2405	BOTTOM IDLER SHAFT
6	FR2406	HOUSING WEAR PLATE
7	FR2407	HOUSING GUIDE
8	BOL58X212FHSC	5/8" X 2 1/2" FHSC BOLT
9	SCR24BRF	FRONT SCRAPER BRACKET
10	SCR4801	ALUMINUM SCRAPER BLADE
11	SCR24BRR	REAR SCRAPER BRACKET
13	SCR24ROD	S/S SUPPORT ROD
14	WF78	7/8" FLAT WASHER
15	KYP4	1/4" X 4" COTTER KEY



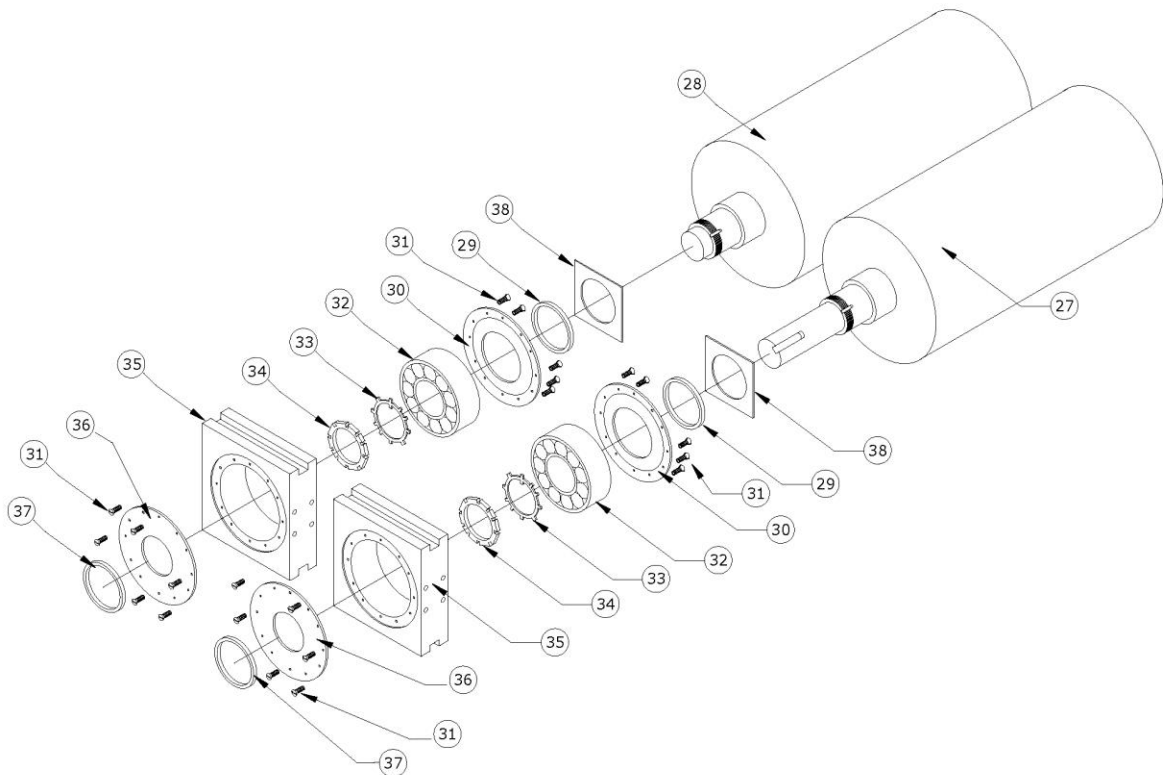
24 x 48 Conventional Bearing Assembly with Adapter

ITEM	ITEM #	PART DESCRIPTION
27	R2448CDK	CONVENTIONAL DRIVE ROLL
28	R2448CFK	CONVENTIONAL FOLLOW ROLL
27/28	R2448CDDK	DUAL DRIVE ROLL
29	SL416044	HOUSING BACKPLATE SEAL
30	HSGR232	HOUSING BACKPLATE
31	BOL12X112	1/2" X 1 1/2" CT BOLT
32	BRG2234K	SPHERICAL BEARING
33	W34	ADAPTER LOCK WASHER
34	NAN34	ADAPTER NUT
35	HSGR202SMI	BEARING HOUSING
36	HSGR242	HOUSING OUTER CAP
37	SL415066	HOUSING OUTER CAP SEAL
38	DS1178SQ	PLASTIC DUST SHIELD
39	ADS34	BEARING ADAPTER



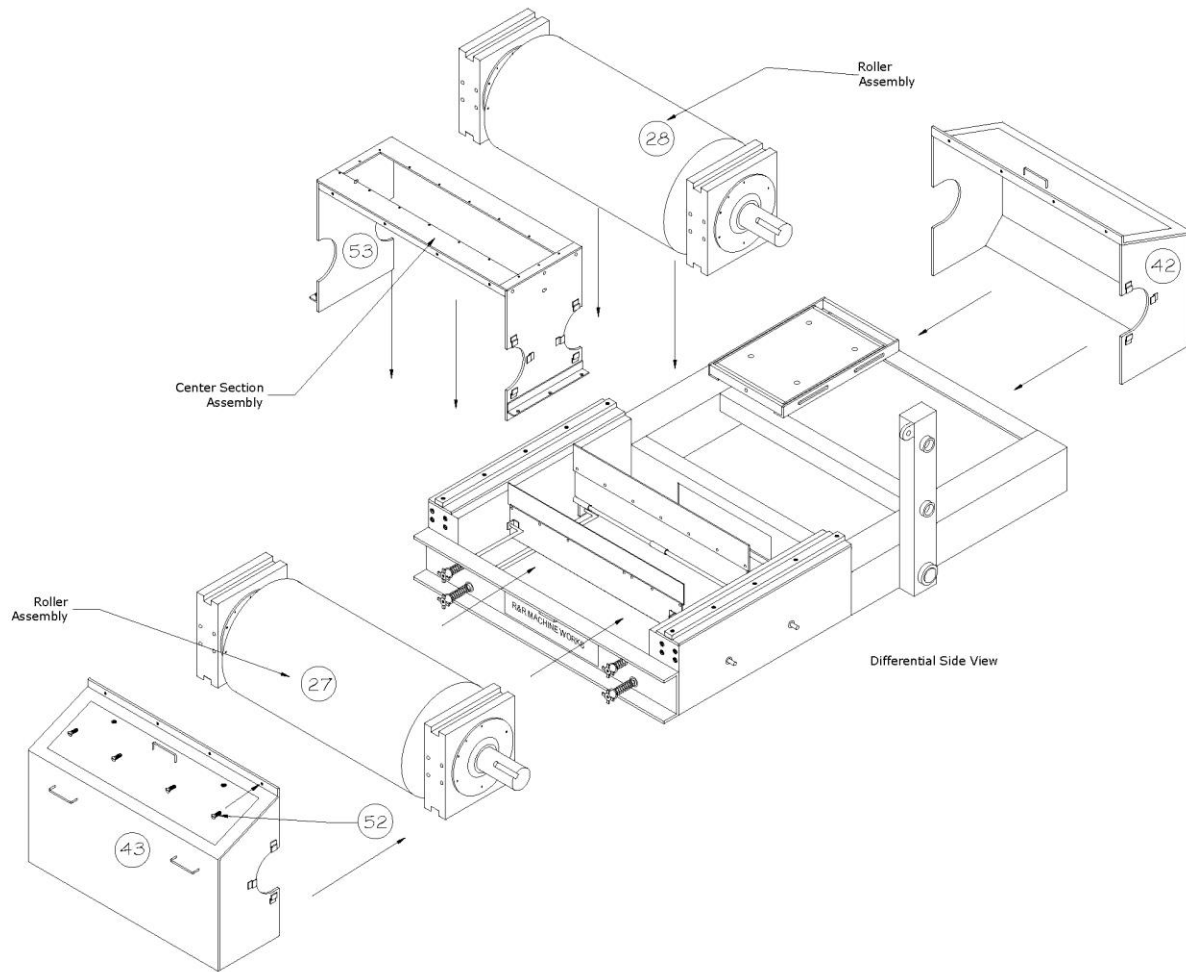
24 x 48 Conventional Bearing Assembly with Straight Bore

ITEM	ITEM #	PART DESCRIPTION
27	R2448CD	DRIVE ROLL
28	R2448CF	FOLLOW ROLL
29	SL416044	HOUSING BACKPLATE SEAL
30	HSGR231	HOUSING BACKPLATE
31	BOL12X112	1/2" X 1 1/2" CT BOLT
32	BRG2330S	SPHERICAL BEARING
33	W30	BEARING LOCK WASHER
34	NAN30	BEARING LOCKNUT
35	HSGR201SMI	BEARING HOUSING
36	HSGR241	HOUSING OUTER CAP
37	SL415066	HOUSING OUTER CAP SEAL
38	DS1178SQ	PLASTIC DUST SHIELD



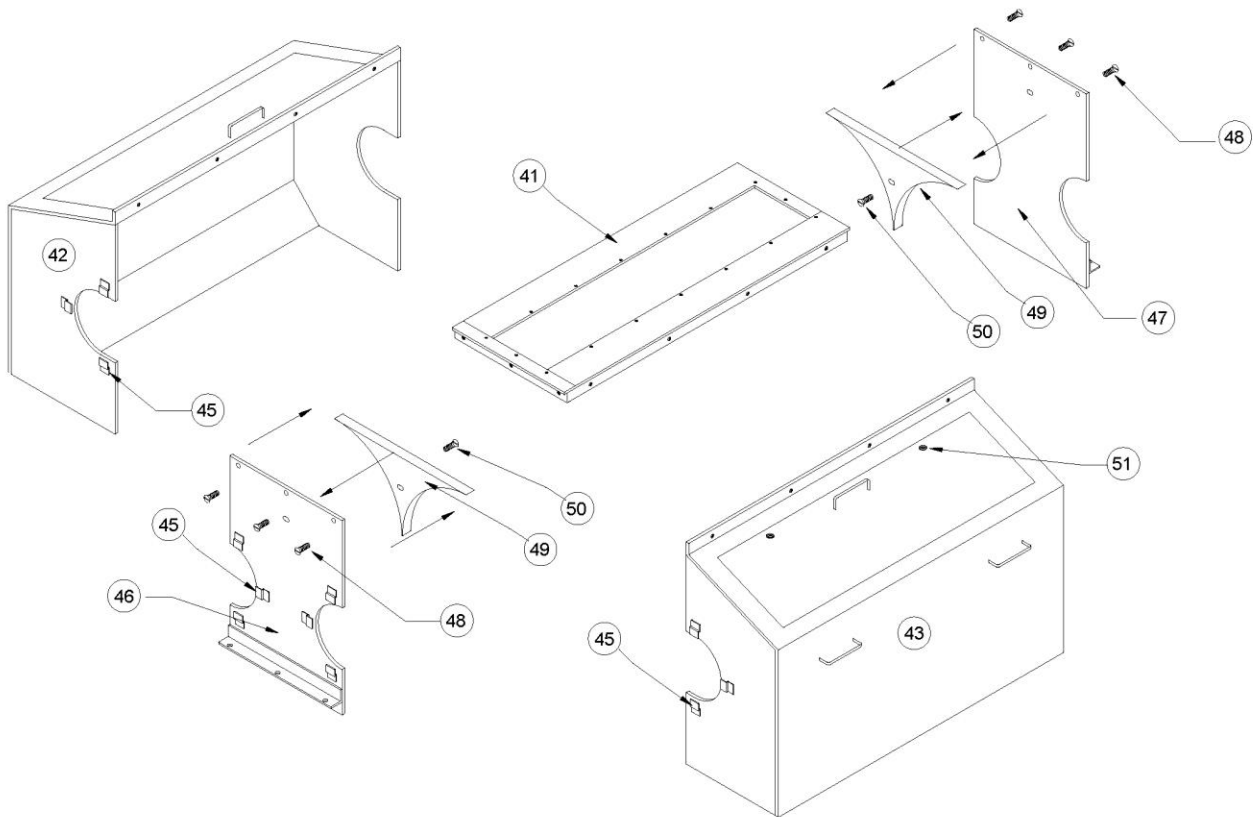
Roll Assembly

ITEM	ITEM #	PART DESCRIPTION
27		DRIVE ROLL
28		FOLLOW ROLL
42	COV0S24DR	REAR ROLL COVER W/DOOR
43	COV0S24DF	FRONT ROLL COVER W/DOOR
52	BOLSS12X1	1/2" X 1" S/S BOLT
53	FR24CSS	S/S CENTER SECTION ASSY.



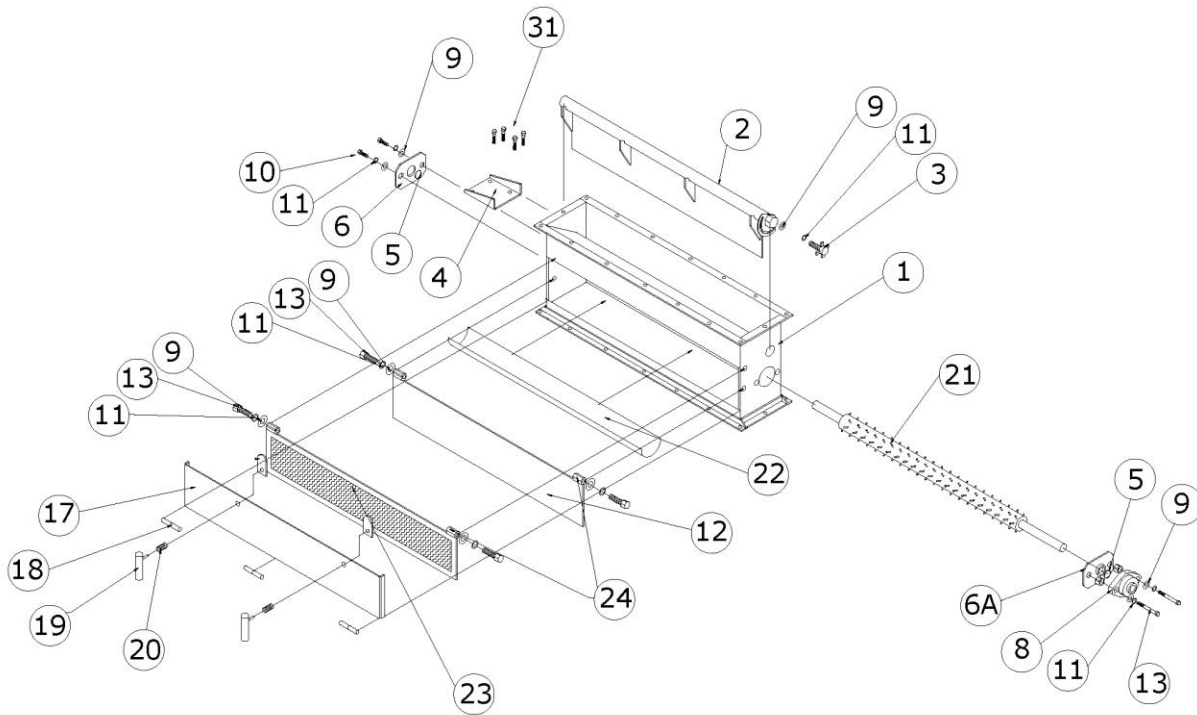
Cover Assembly

ITEM	ITEM #	PART DESCRIPTION
41	FR24CST	S/S CENTER SECTION TOP
42	COV0S24DR	REAR ROLL COVER W/ DOOR
43	COV0S24DF	FRONT ROLL COVER W/ DOOR
45	COV0050	DUST SHIELD CLIPS
46	FR24CSL	CENTER SECTION LEFT SIDE
47	FR24CSR	CENTER SECTION RIGHT SIDE
48	BOLSS12X1	1/2" - 13 X 1" S/S BOLT
49	SAD24	ALUMINUM SADDLE
50	BOL12X3	1/2" - 13 X 3 GR5 BOLT
51	MAGS38	3/8" STAR KNOB



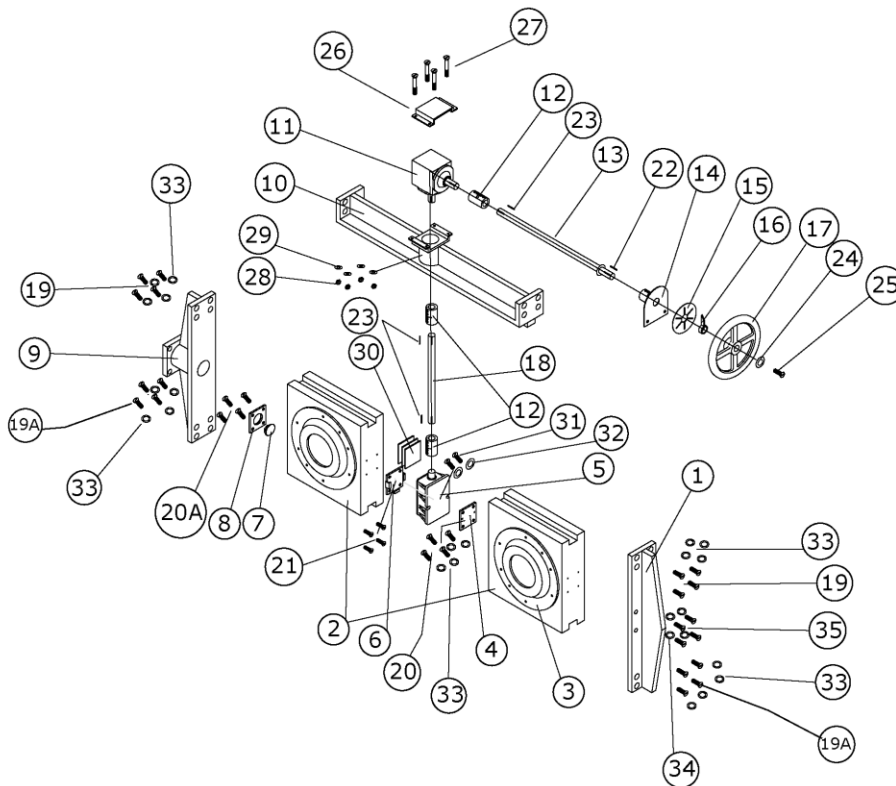
Peg Feeder

ITEM	ITEM #	PART DESCRIPTION	ITEM	ITEM #	PART DESCRIPTION
1	PFCAB24	FEEDER CABINET	12	PFFGT48	DIRECTIONAL GATE
2	PFGS24N	SHUTOFF GATE	13	BOLSS12X112	1/2" X 1 1/2" S/S BOLT
3	PFKNB	TENSION KNOB	17	PFDR24	FEEDER CABINET DOOR
4	PFGBEB	GEAR BOX BRACKET	18	DORS18L	S/S WELD ON HINGE (LARGE)
5	HYU171611516	WIPER	19	PFDRH	S/S DOOR HANDLE
6	PFGBE031	ROD GLAND	20	DOR0018S	SPRING FOR HANDLE
6A	PFFL	S/S BEARING FLANGE	21	PFBAR242	PEG FEEDER BAR
8	BRG1716UIA	1 7/16" UHMW BEARING	22	PFPAN46	FEEDER TROUGH
9	WF12SS	1/2" S/S FLATWASHER	23	PFFG24	FINGER GUARD
10	BOLSS12X1	1/2" X 1" S/S BOLT	24	PFFH	1/2" COUPLING NUT
11	WL12SS	1/2" S/S LOCKWASHER			



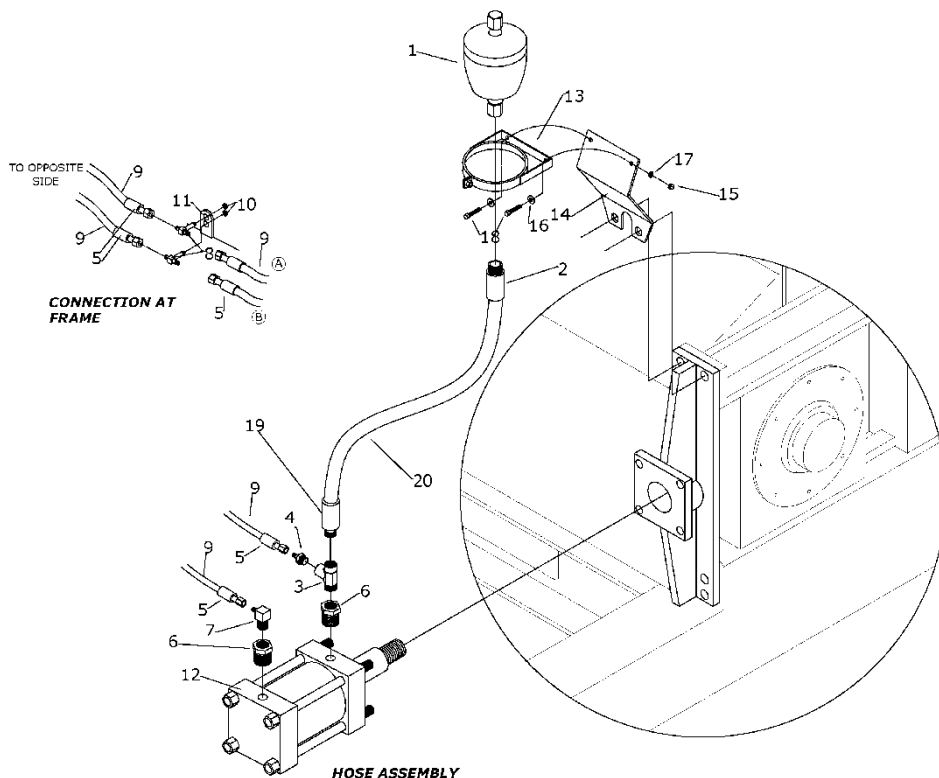
Closure Assembly

ITEM	ITEM #	PART DESCRIPTION	ITEM	ITEM #	PART DESCRIPTION
1	FR24BRF	FRONT HOUSING	19A	BOL1X312GR8	1" X 3 1/2" GR8 BOLT
2	HSGR202SMI	34K BEARING HOUSING	19	BOL1X212GR8	1" X 2 1/2" GR8 BOLT
3	HSGR242	34K OUTER CAP 24 x 48	20	BOL58X2FHSC	5/8" X 2" FHSC
4	FR24FB	FIXATOR BRACKET	20A	BOL58X2	5/8" X 2 BOLT
5	24FIX	R&R FIXATOR	22	KY25X2	1/4" X 2" KEYSTOCK
6	FR24SB	FIXATOR SPACER	23	KY25X1	1/4" X 1" KEYSTOCK
7	HY24AN6	6" ALIGNMENT NUT	24	WF38	3/8" FLAT WASHER
8	HY24AP	ALIGNMENT PLATE	25	BOL38X1	3/8" X 1" BOLT
9	FR24BRRH	6" REAR HYD BRACKET	26	FR24RABR	TOP GEARBOX BRACKET
10	FR24BRTD	TOP DRIVE HOUSING	27	BOL12X612	1/2" X 6 1/2" BOLT
11	24RAGB21	RIGHT ANGLE GEARBOX	28	N12CT	1/2" NUT
12	24COUP	SHAFT COUPLING	29	WL12	1/2" LOCK WASHER
13	24CLLS	1" X 23" CHROME SHAFT	30	FR24S	FIXATOR SPACER
14	24CLCCA	CLAMP COLLAR DIAL	31	BOL58X2F12	FIXATOR BOLT
15	24DPL	DIAL PLATE	32	WL58	5/8" LOCK WASHER
16	24CLR1A	SET COLLAR W/ POINTER	33	WL1	1" LOCK WASHER
17	24CLAW	HAND WHEEL	34	WF58	5/8" FLAT WASHER
18	24CLSS	1" X 6" CHROME SHAFT	35	BOL58X212GR8	5/8" X 2 1/2" GR8 BOLT



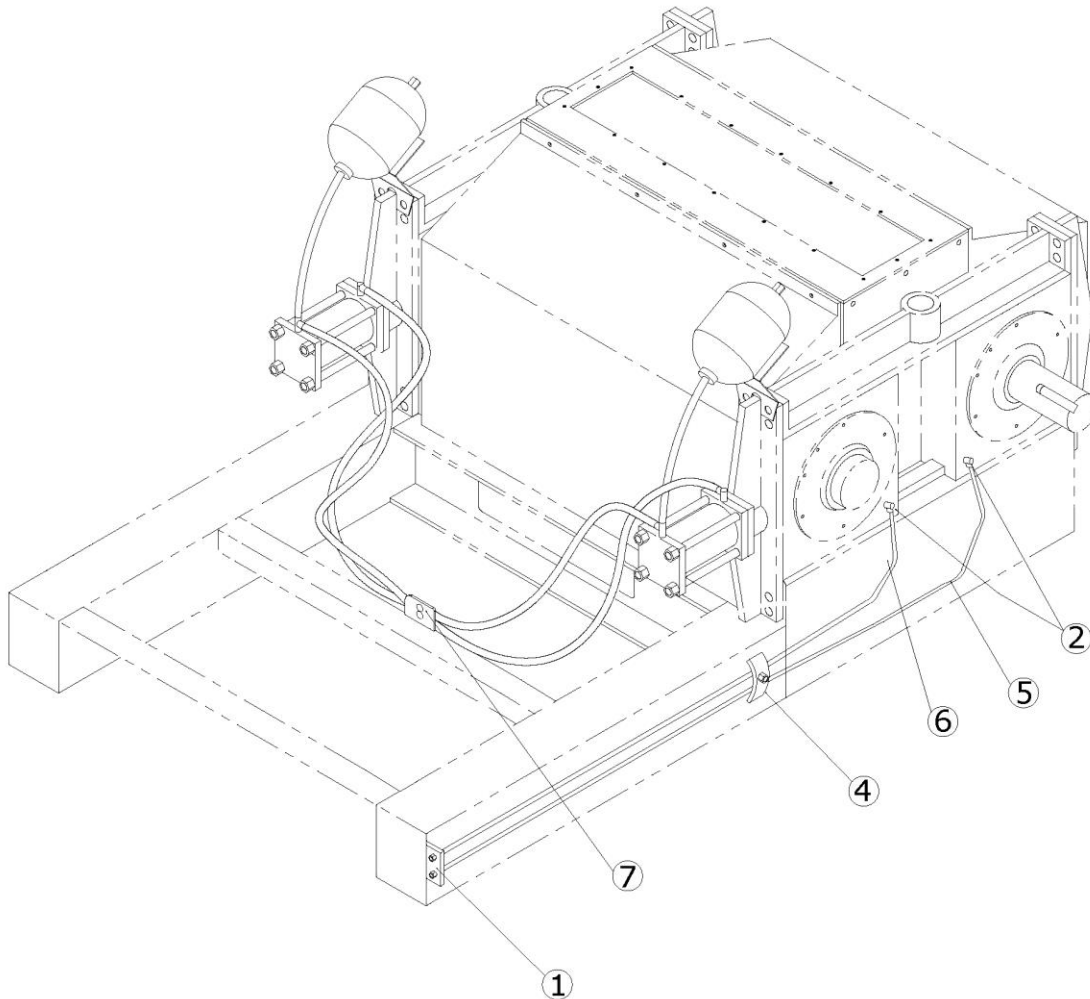
Accumulator / Hydraulic Assembly

ITEM	ITEM #	PART DESCRIPTION
1	24ACC2L	LARGE ACCUMULATOR
2	HYFT12G12MB	12G-12MB FITTING
3	HYFT12FP12MPT	12FP-12FP-12MPT
4	HYFT6MJ12MP	6MJ-12MP FITTING
5	HYFT6G6FJX	6G-6FJX FITTING
6	HYFT16MP12FP	16MP-12FP FITTING
7	HYFT6MJ12MP90	6MJ-12MP-90 FITTING
8	HYFT6MJBH6MJT	6MJBH-6MJT
9	HYFT38HS	6M 3K HYD. HOSE
10	HYFT6LN	6LN BULKHEAD NUT
11	HYFTBRKTT	FRAME BRACKET
12	HY24RR6	6" R&R CYLINDER
13	24ACCB	ACC. MOUNTING CLAMP
14	24ACCB3	MOUNTING PLATE
15	N38CT	3/8" CT NUT
16	WF38	3/8" FLAT WASHER
17	WL38	3/8" LOCK WASHER
18	BOL38X1	3/8" x 1" BOLT
19	HYFT12G12MPX	12G-12MPX FITTING
20	24ACC2H2	LARGE ACCUMULATOR HOSE



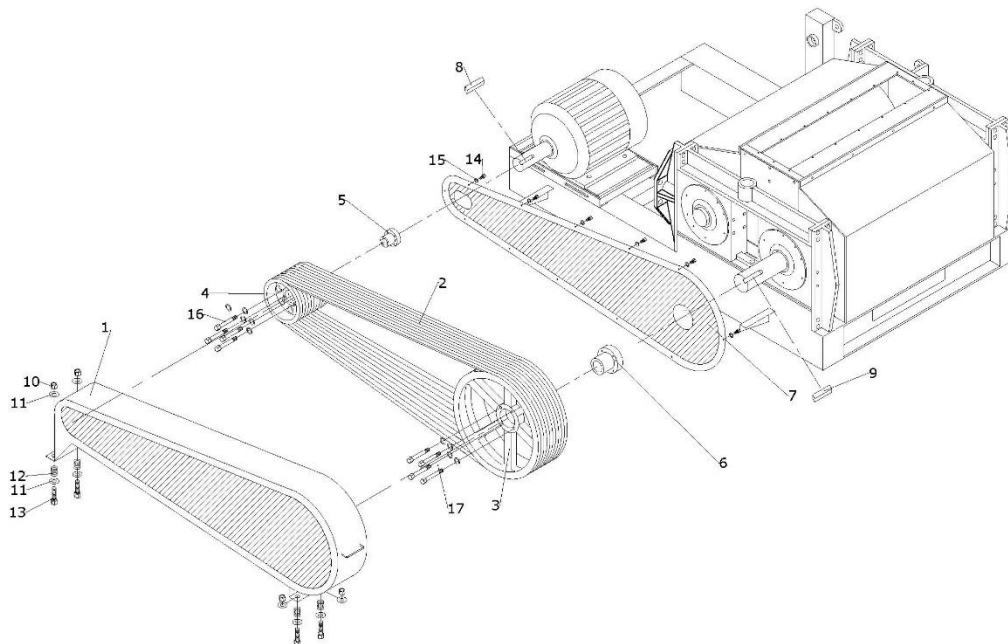
Grease Lines

ITEM	ITEM #	PART DESCRIPTION
1	GRSB	2 HOSE GREASE LINE BRACKET
2	HYFT2MP2FP90	2MP-2FPX 90 DEG.
4	HYFT24BRK	HOSE HOLDER
5	HYFT14HS	4M 3K 1/4" 108"
6	HYFT14HS	4M 3K 1/4" 108"
7	HYFTBRKTT	TEE BRACKET



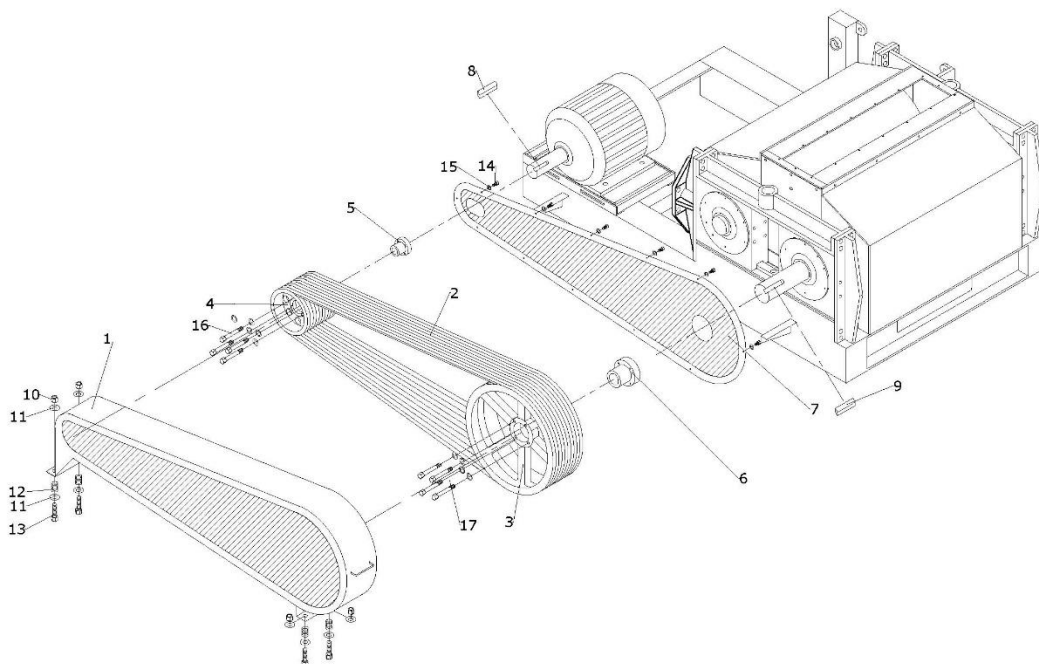
Belt / Sheave Assembly - Conventional 1200 RPM

ITEM	ITEM #	PART DESCRIPTION
1	GAR24D	DRIVE GUARD TOTALLY ENCLOSED INCLUDES 1 AND 7
2	BLTC225	10 C225 DRIVE BELTS
3	SH10C36	10 C36 M SHEAVES
4	SH10C10	10 C10.0 J SHEAVES
5	HBJ338	J X 3 3/8" HUB
6	HBM434	M X 4 3/4" HUB
8	KY78	7/8" X 5" KEYSTOCK
9	KY125	1 1/4" X 6 KEYSTOCK
10	N12CTNL	1/2" NYLOCK NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHJ	BOLT KIT FOR J HUB
17	BOLHM	BOLT KIT FOR M HUB



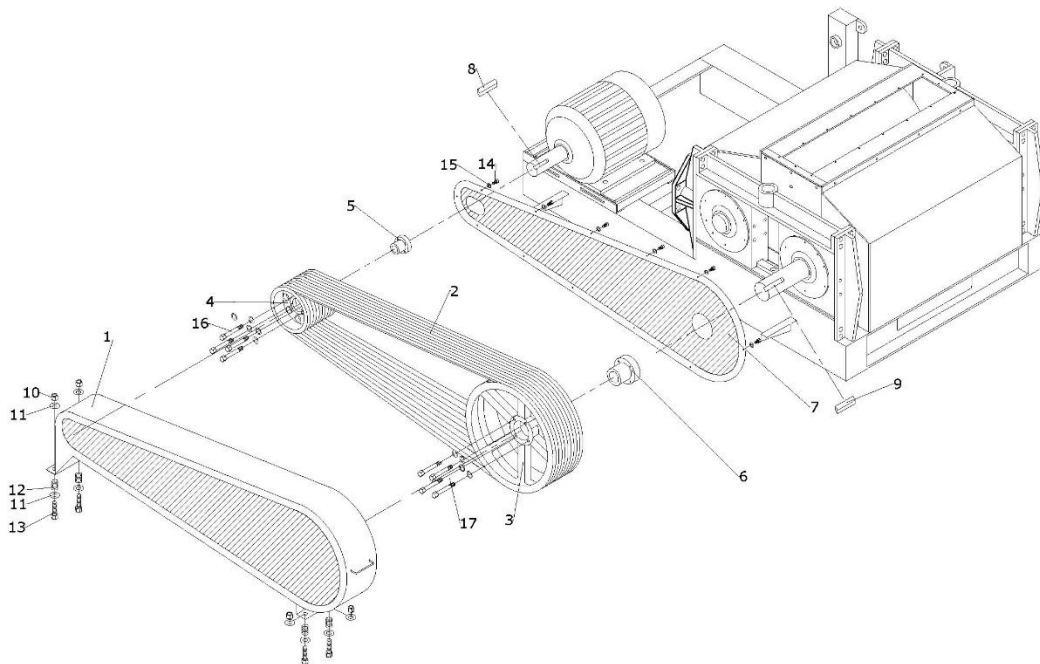
Belt / Sheave Assembly - Conventional 1440 RPM

ITEM	ITEM #	PART DESCRIPTION
1	GAR24D	DRIVE GUARD TOTALLY ENCLOSED INCLUDES 1 AND 7
2	BLTC225	10 C225 DRIVE BELTS
3	SH10C36	10 C36 M SHEAVES
4	SH10C8	10 C8.0 E SHEAVES
5	HBE70	70 MM HUB
6	HBM434	M X 4 3/4 HUB
8	KY58	5/8 X 3 KEYSTOCK
9	KY125	1 1/4" X 6 KEYSTOCK
10	N12CTNL	1/2" NYLOCK NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHM	BOLT KIT FOR M HUB



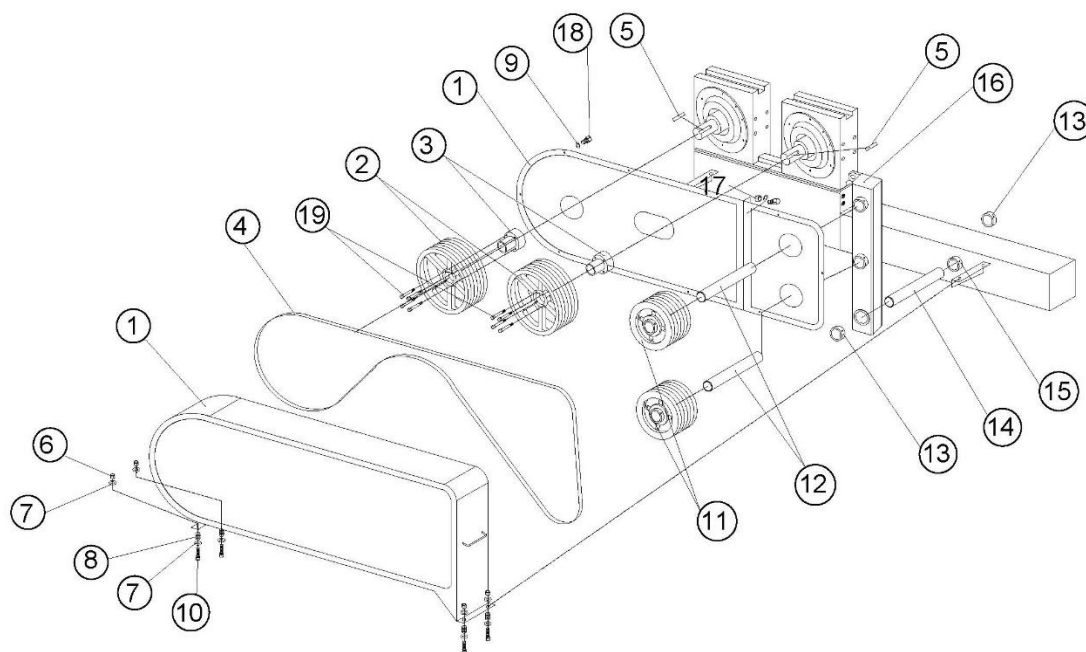
Belt / Sheave Assembly - Conventional 1800 RPM

ITEM	ITEM #	PART DESCRIPTION
1	GAR24DM	DRIVE GUARD TOTALLY ENCLOSED INCLUDES 1 AND 7
2	BLTC240	10 C240 DRIVE BELTS
3	SH10C44	10 C44 SHEAVE
4	SH10C8	10 C8.0 E SHEAVE
5	HBE338	E X 3 3/8 HUB
6	HBM434	M X 4 3/4 HUB
8	KY7858	7/8 X 5/8 X 5 KEYSTOCK
9	KY125	1 1/4" X 6 KEYSTOCK
10	N12CTNL	1/2" NYLOCK NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHM	BOLT KIT FOR M HUB



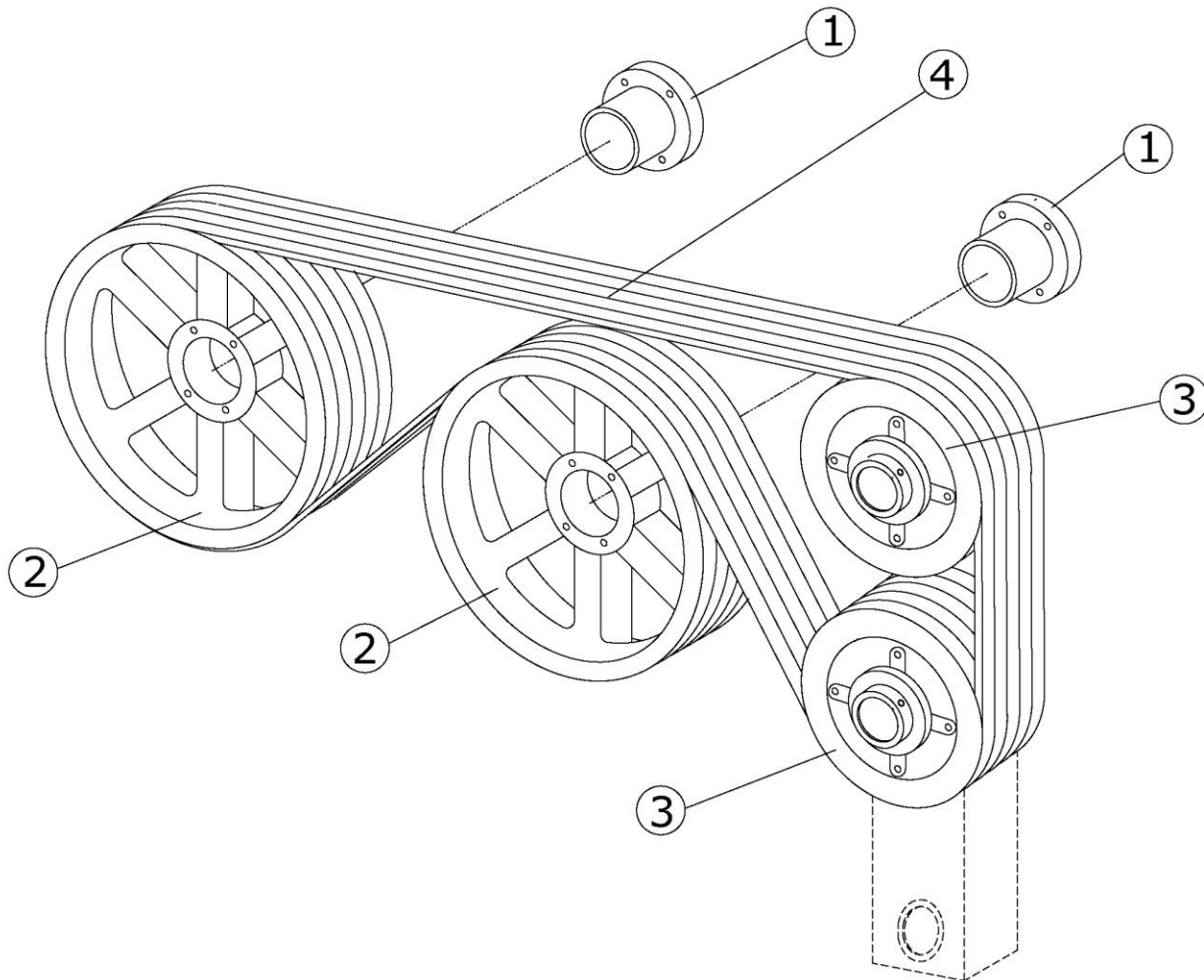
24 X 48 Conventional Idler Assembly

ITEM	ITEM #	PART DESCRIPTION
1	GAR24I	IDLER GUARD TOTALLY ENCLOSED
2	SH6C20	6 C 20.0 F. SHEAVES
3	HBF3716	F X 3 7/16 HUB
4	BLTCC180	6 CC180 BELTS
5	KY7858	5/8" X 7/8" KEYSTOCK
6	N12CTNL	1/2" NYLOCK NUT
7	WF12	1/2" LOCKWASHER
8	GARSPR80	GUARD VIBRATION SPRING
9	WL38	3/8" LOCKWASHER
10	BOL12X312	1/2" X 3 1/2" BOLT
11	IDL24MHB	IDLER SHEAVE ASSEMBLY
12	IDL2405SS	2 3/16" IDLER SHEAVE SHAFT
13	IDL2404B2	1 1/2" TOPLOCK COLLAR
14	IDL2405	BOTTOM IDLER SHAFT
15	IDL2404	FRAME IDLER BUSHING
16	IDL24AA	IDLER ARM W/ BUSHINGS
17	N38CT	3/8" NUT
18	BOL38X34	3/8" X 3/4" BOLT
19	BOLHF	F HUB BOLT KIT
—	BOLSTS38X112SQ	SET SCREWS FOR ALL LOCK COLLARS



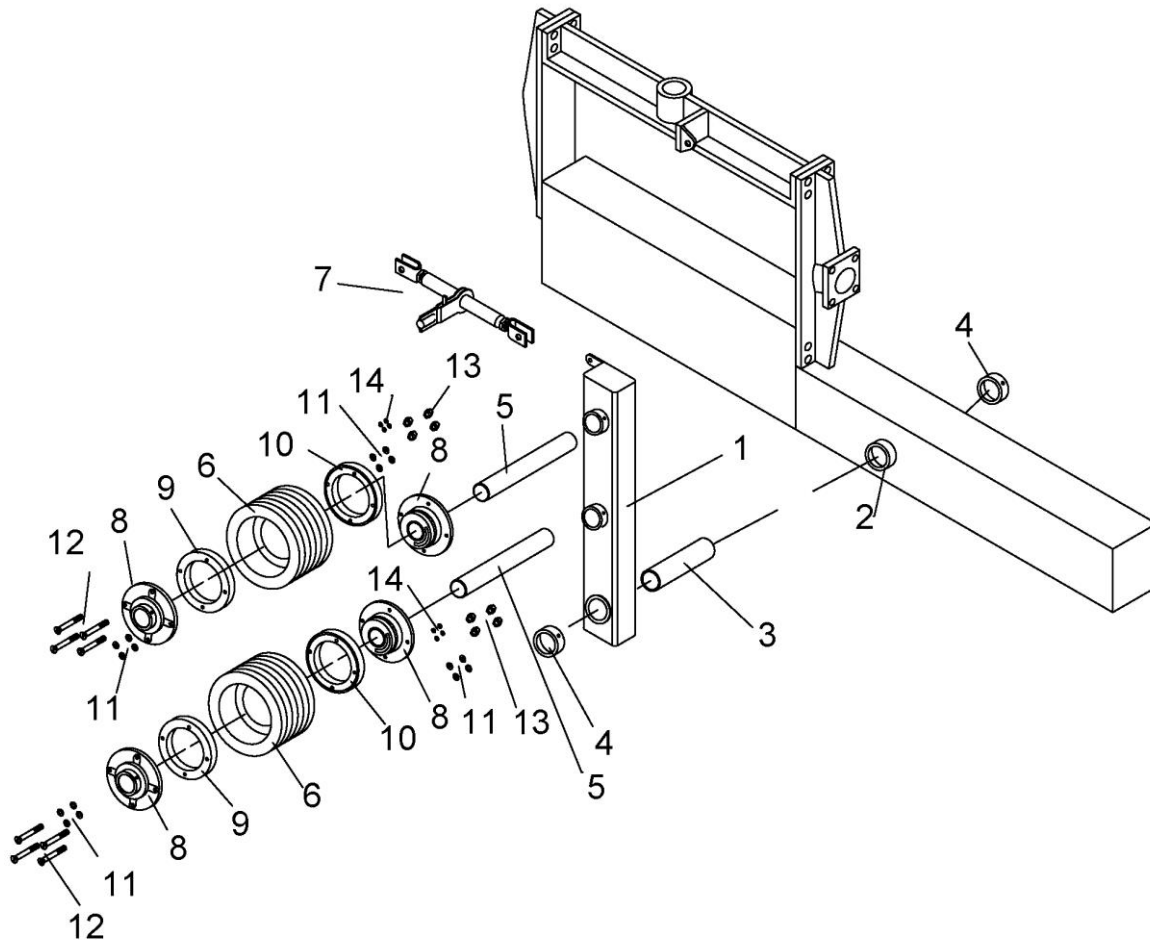
24 X 48 Conventional Idler Sheave Assembly

ITEM	ITEM #	PART DESCRIPTION
1	HBF3716	F X 3 7/16" HUB
2	SH6C20	6 C20 F SHEAVES
3	IDL24MHB	IDLER SHEAVE ASSEMBLY
4	BLTCC180	6 CC180 BELTS



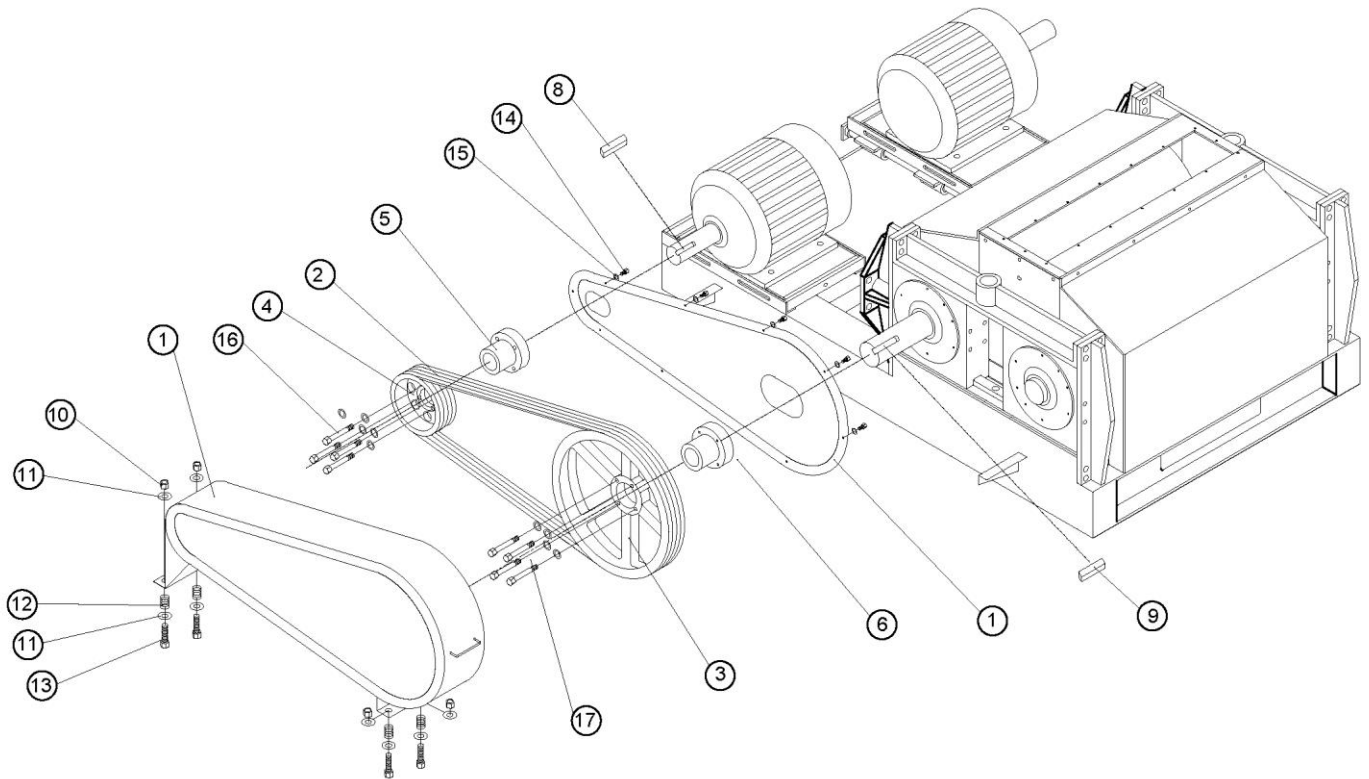
Idler Arm Assembly

ITEM	ITEM #	PART DESCRIPTION
1	IDL24AA	IDLER ARM W/ BUSHINGS
2	IDL2404	FRAME BUSHING
3	IDL2405	BOTTOM IDLER SHAFT
4	IDL2404B2	1 1/2" TOP LOCK COLLAR
5	IDL2405SS	2 3/16" IDLER SHEAVE SHAFT
6	SH6C20	6 C20.0 F IDLER SHEAVES
7	IDL24RJ	RACHET JACK WITH PINS
8	BRG2316F4QM	4 BOLT FLANGE BEARING 2 3/16"
9	IDL24MHA	1 1/2" SHEAVE FLANGE
10	IDL24MH	2" SHEAVE FLANGE
11	WF12	1/2" FLAT WASHER
12	BOL12X612	1/2" X 6 1/2" CT BOLT
13	N12CT	1/2" CT NUTS
14	WL12	1/2" LOCK WASHER



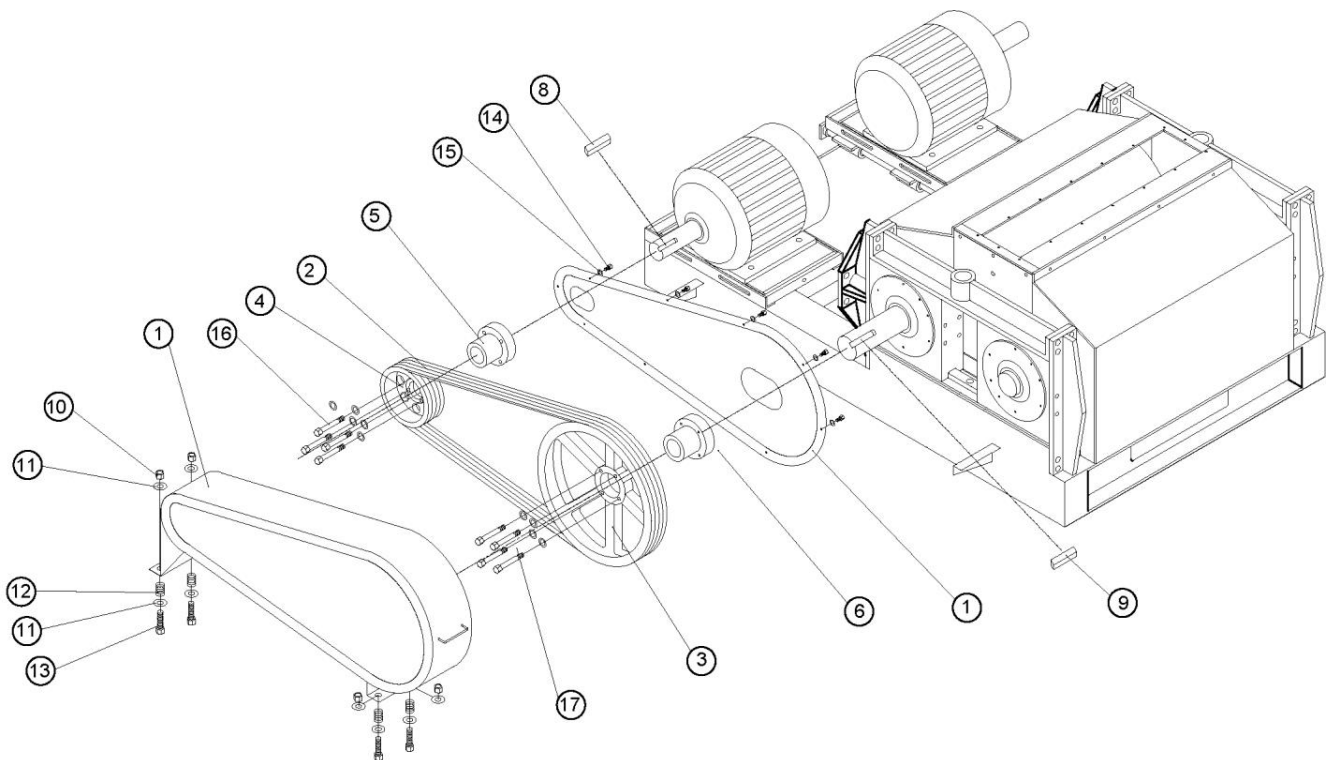
Belt / Sheave Assembly – Dual Motor Moveable Roll 1200 RPM

ITEM	ITEM #	PART DESCRIPTION
1	GAR24DDB	SMALL DUAL DRIVE GUARD
2	BLTCX195	5 CX195 BELTS
3	SH5C36	5 C36.0 J SHEAVES
4	SH5C10	5 C10.0 E SHEAVES
5	HBE278	E X 2 7/8" HUB
6	HBJ3716	J X 3 7/16" HUB
8	KY58	5/8" X 3" KEYSTOCK
9	KY78	7/8" X 6" KEYSTOCK
10	N12CTNL	1/2" NYLON NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHJ	BOLT KIT FOR J HUB



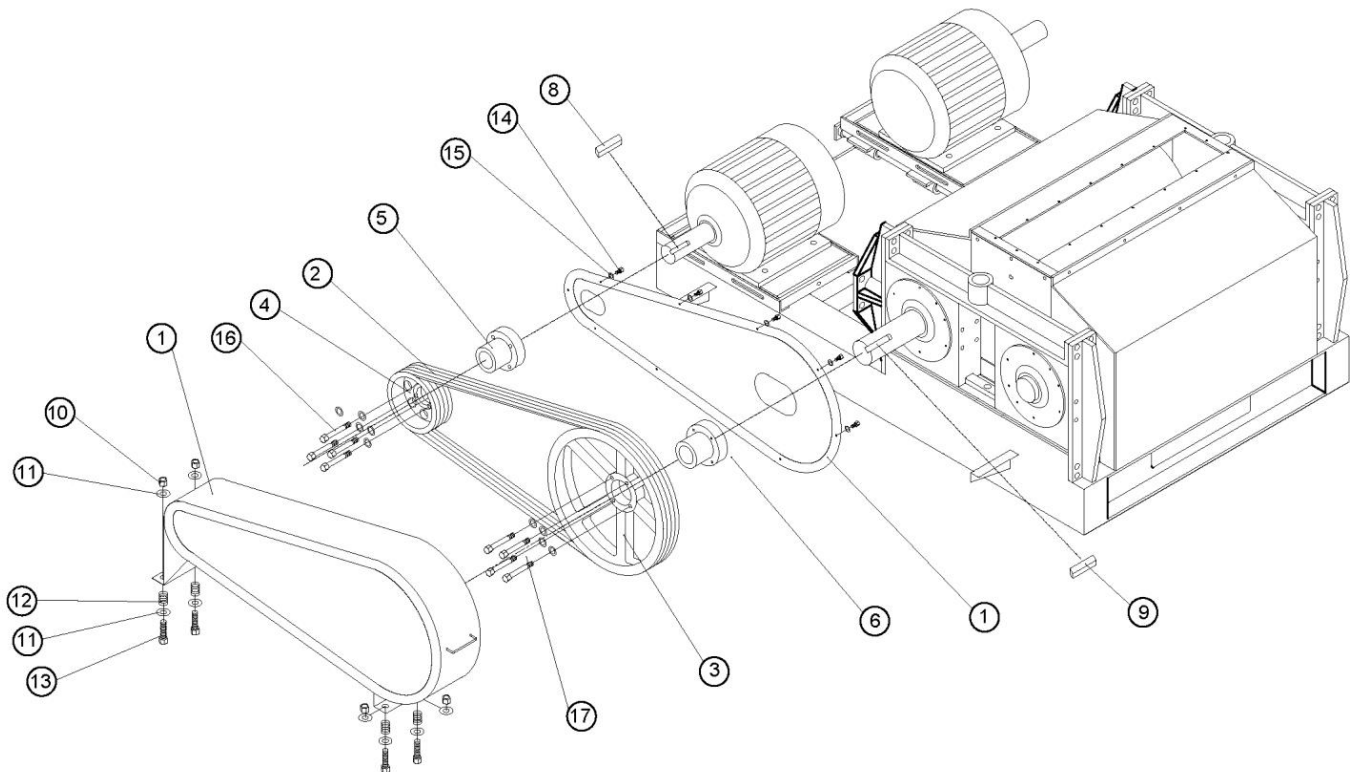
Belt / Sheave Assembly – Dual Motor Moveable Roll 1440 RPM

ITEM	ITEM #	PART DESCRIPTION
1	GAR24DDB	SMALL DUAL DRIVE GUARD
2	BLTCX195	5 CX195 BELTS
3	SH5C36	5 C36.0 J SHEAVES
4	SH5C8	5 C8.0 E SHEAVES
5	HBE55	E X 55 MM HUB
6	HBJ3716	J X 3 7/16" HUB
8	KY58	5/8" X 3" KEYSTOCK
9	KY78	7/8" X 6" KEYSTOCK
10	N12CTNL	1/2" NYLON NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHJ	BOLT KIT FOR J HUB



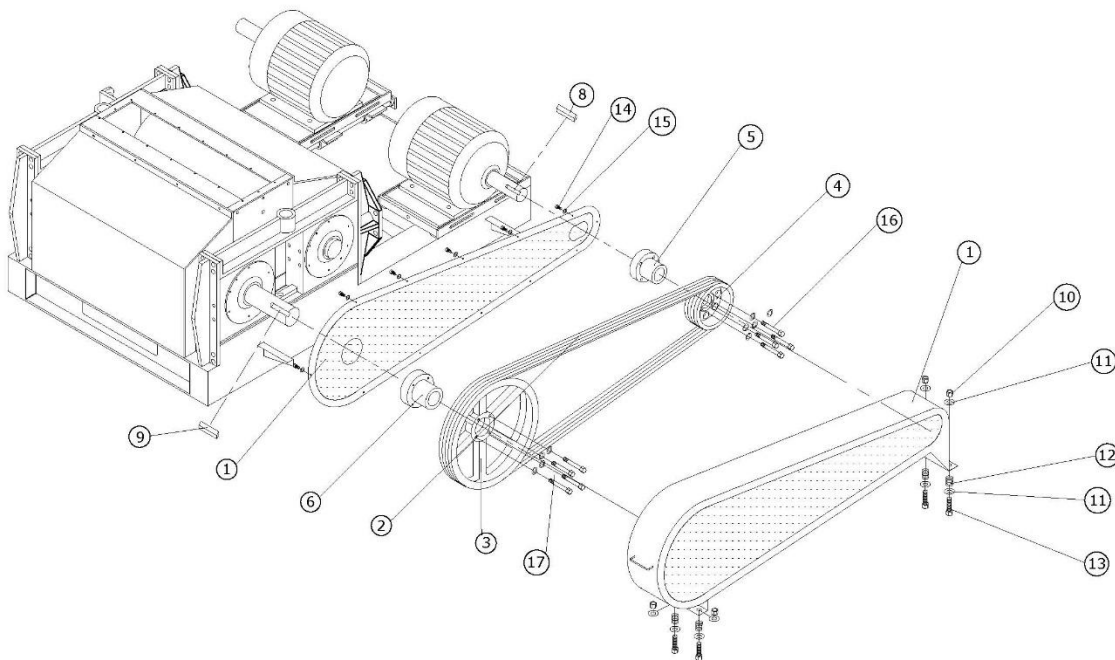
Belt / Sheave Assembly – Dual Motor Moveable Roll 1800 RPM

ITEM	ITEM #	PART DESCRIPTION
1	GAR24DDBM	SMALL DUAL DRIVE GUARD
2	BLTCX195	5 CX195 BELTS
3	SH5C44	5 C44.0 J SHEAVES
4	SH5C8	5 C8.0 E SHEAVES
5	HBE238	E X2 3/8" HUB
6	HBJ3716	J X 3 7/16" HUB
8	KY58	5/8" X 3" KEYSTOCK
9	KY78	7/8" X 6" KEYSTOCK
10	N12CTNL	1/2" NYLON NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCKWASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHJ	BOLT KIT FOR J HUB </td



Belt / Sheave Assembly – Dual Motor 1200 RPM

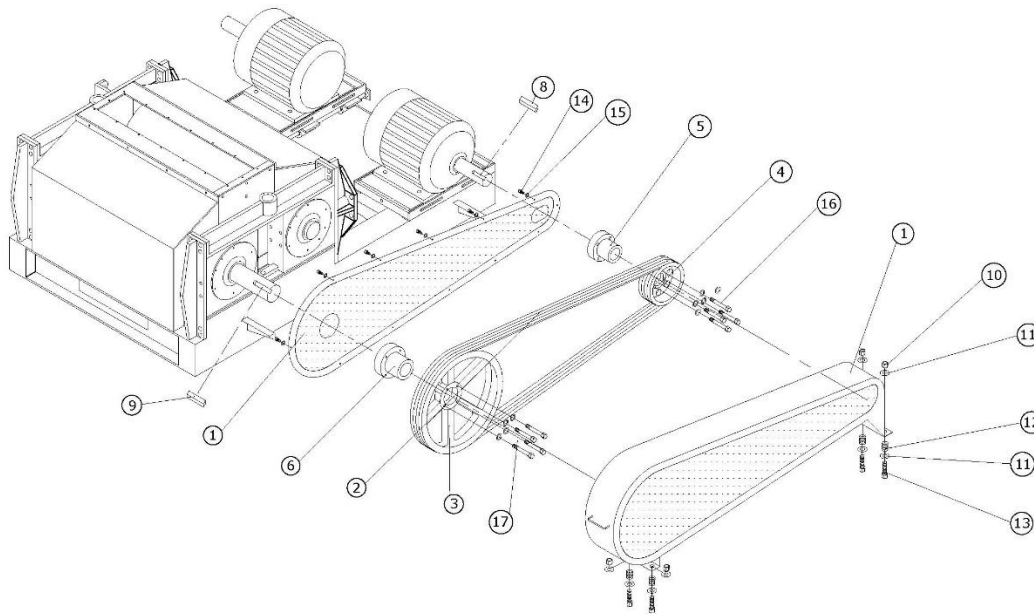
ITEM	ITEM #	PART DESCRIPTION
1	GAR24DDA	LARGE DUAL DRIVE GUARD
2	BLTCX240	5 CX 240 BELTS
3	SH5C36	5 C36.0 J SHEAVES
4	SH5C10	5 C10.0 E SHEAVES
5	HBE278	E X 2 7/8" HUB
6	HBJ3716	J X 3 7/16" HUB
8	KY58	5/8 X 3" KEYSTOCK
9	KY78	7/8 X 5" KEYSTOCK
10	N12CTNL	1/2" NYLON NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHJ	BOLT KIT FOR J HUB



Belt / Sheave Assembly – Dual Motor

1440 RPM

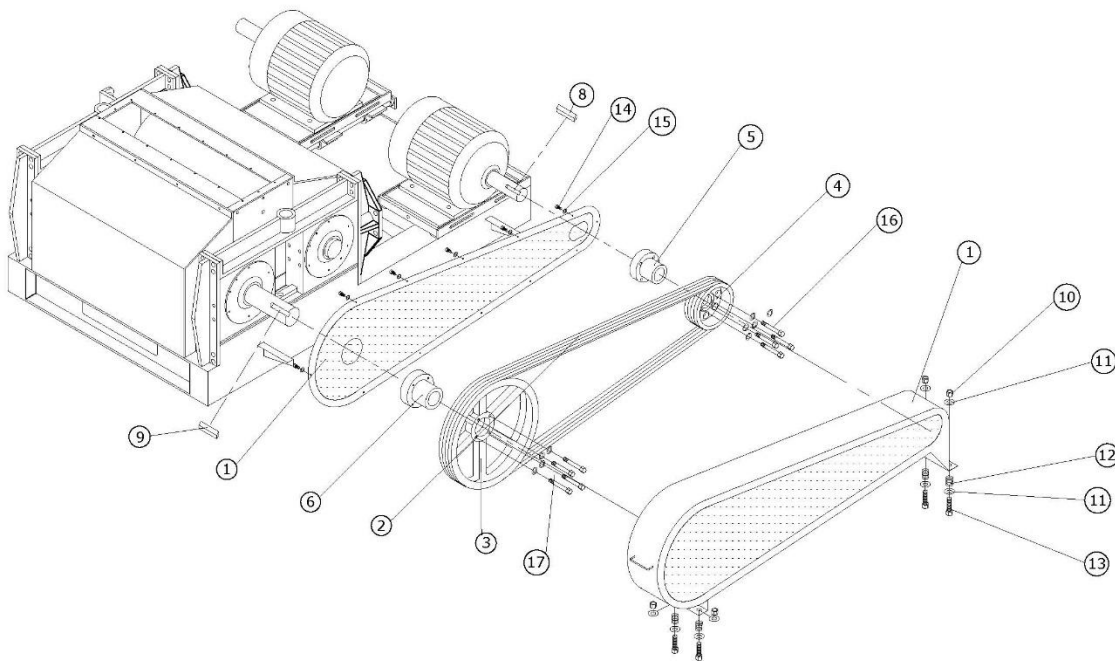
ITEM	ITEM #	PART DESCRIPTION
1	GAR24DDA	LARGE DUAL DRIVE GUARD
2	BLTCX240	5 CX 240 BELTS
3	SH5C36	5 C36.0 J SHEAVES
4	SH5C8	5 C8.0 E SHEAVES
5	HBE55	E X 55 MM HUB
6	HBJ3716	J X 3 7/16" HUB
8	KY58	5/8 X 3" KEYSTOCK
9	KY78	7/8 X 5" KEYSTOCK
10	N12CTNL	1/2" NYLON NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHJ	BOLT KIT FOR J HUB



Belt / Sheave Assembly – Dual Motor

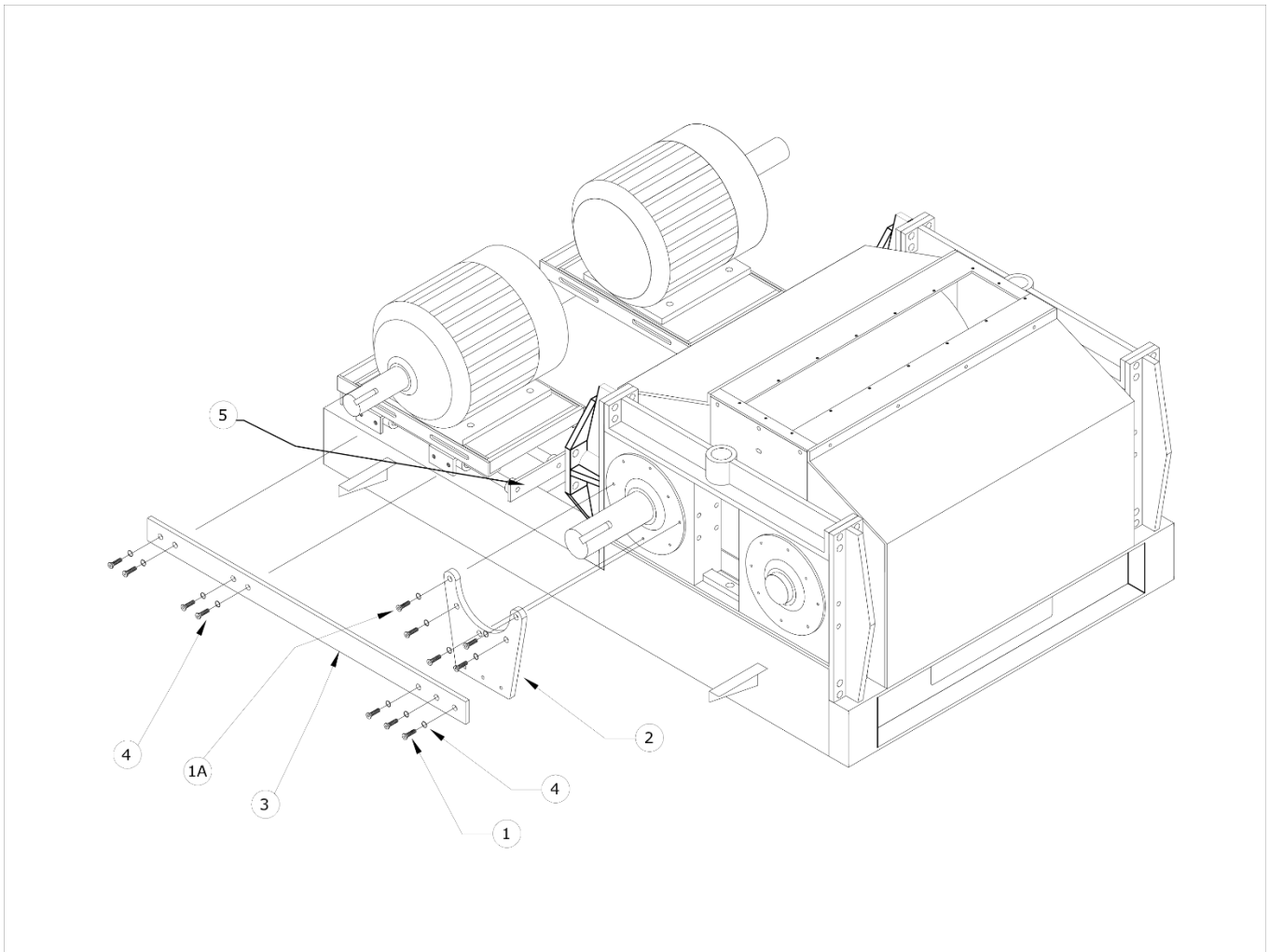
1800 RPM

ITEM	ITEM #	PART DESCRIPTION
1	GAR24DDAM	LARGE DUAL DRIVE GUARD
2	BLTCX240	5 CX 240 BELTS
3	SH5C44	5 C44.0 J SHEAVE
4	SH5C8	5 C8.0 E SHEAVE
5	HBE238	E X 2 3/8" HUB
6	HBJ3716	J X 3 7/16" HUB
8	KY58	5/8 X 3" KEYSTOCK
9	KY78	7/8 X 5" KEYSTOCK
10	N12CTNL	1/2" NYLON NUT
11	WF12	1/2" FLAT WASHER
12	GARSPR80	GUARD VIBRATION SPRING
13	BOL12X312	1/2" X 3 1/2" BOLT
14	BOL38X34	3/8" X 3/4" BOLT
15	WL38	3/8" LOCK WASHER
16	BOLHE	BOLT KIT FOR E HUB
17	BOLHJ	BOLT KIT FOR J HUB



Dual Motor Yoke Assembly

ITEM	ITEM #	PART DESCRIPTION
1	BOL58X112	5/8" X 1 1/2" GR 5 BOLT
1A	BOL12X212	1/2" X 2 1/2" CT BOLT
2	MTRHY	HOUSING YOKE
3	MTRCS	CONNECTING BAR
4	WL58	5/8" LOCK WASHER
5	MTRSL24	24" GREASABLE MTR MOUNT SLIDE



Limited Warranty

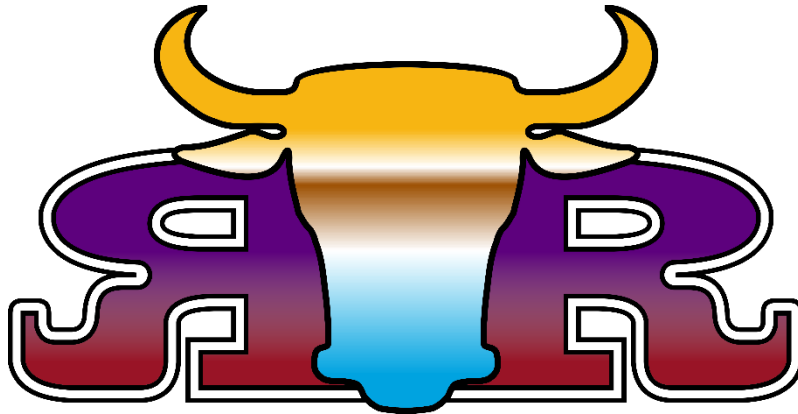
The manufacturer warrants this equipment to the original user against material or workmanship for a period of 30 days from the date of purchase on repair parts and labor. The manufacturer's responsibility under this warranty is limited to the repair or replacement of defective part or parts.

The manufacturer reserves the right to determine whether the part or parts failed because of material, workmanship, or other causes. Failure caused by accident, alteration, or misuse is not covered by this warranty.

A DALHART R&R MACHINE WORKS, INC. representative must perform all warranty repairs. Any repair to the equipment other than by this authorized facility voids this warranty. The rights under this warranty are limited to the original user and may not be transferred to subsequent owners.

The warranty is in lieu of all other warranties, expressed or implied, including warranties for a specific purpose.





24 X 48 Dual Motor Flaker Operator's Manual and Parts Guide

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