



Leaders in Separation Technology

Lab Model 10-M2S Pressure Gravity Separator

Specifications

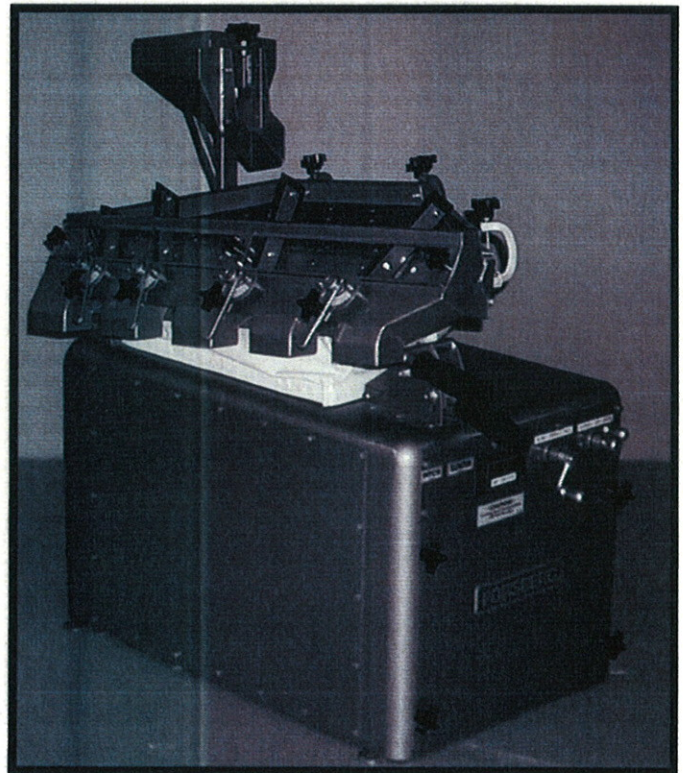
Length: 46 inches - Horsepower: 1
Width: 31 inches - Capacity: Varies
Height: 39 inches - Weight: 340 pounds
Deck Area: 2.9 Square Feet

Efficient Laboratory Separation

The Model 10-M2S Pressure Gravity Separator is a half scale model of the production Model 10-MS Pressure Gravity Separator.

The 10-M2S is a complete miniature gravity separator, constructed of all steel, and designed with the capability to accurately duplicate the separations of Forsberg's large production machines which have the reputation of being the most accurate separators available.

Even with its small size, the 10-M2S has the same exclusive features, including vibration-free counterbalanced drive system, continuous product flow, and accurate deck and air controls.



Model 10-M2S Pressure Gravity Separator

Half Scale Model Gravity Separator For
Laboratory and Small Lot Processing

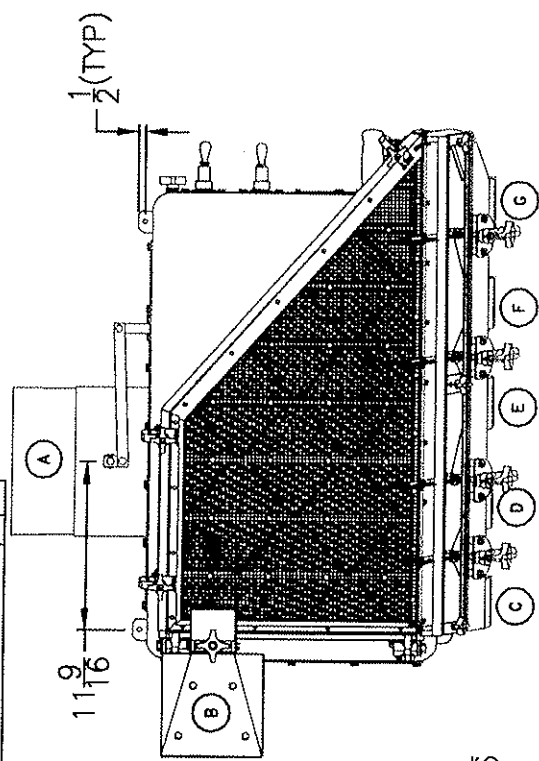
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CAUTION

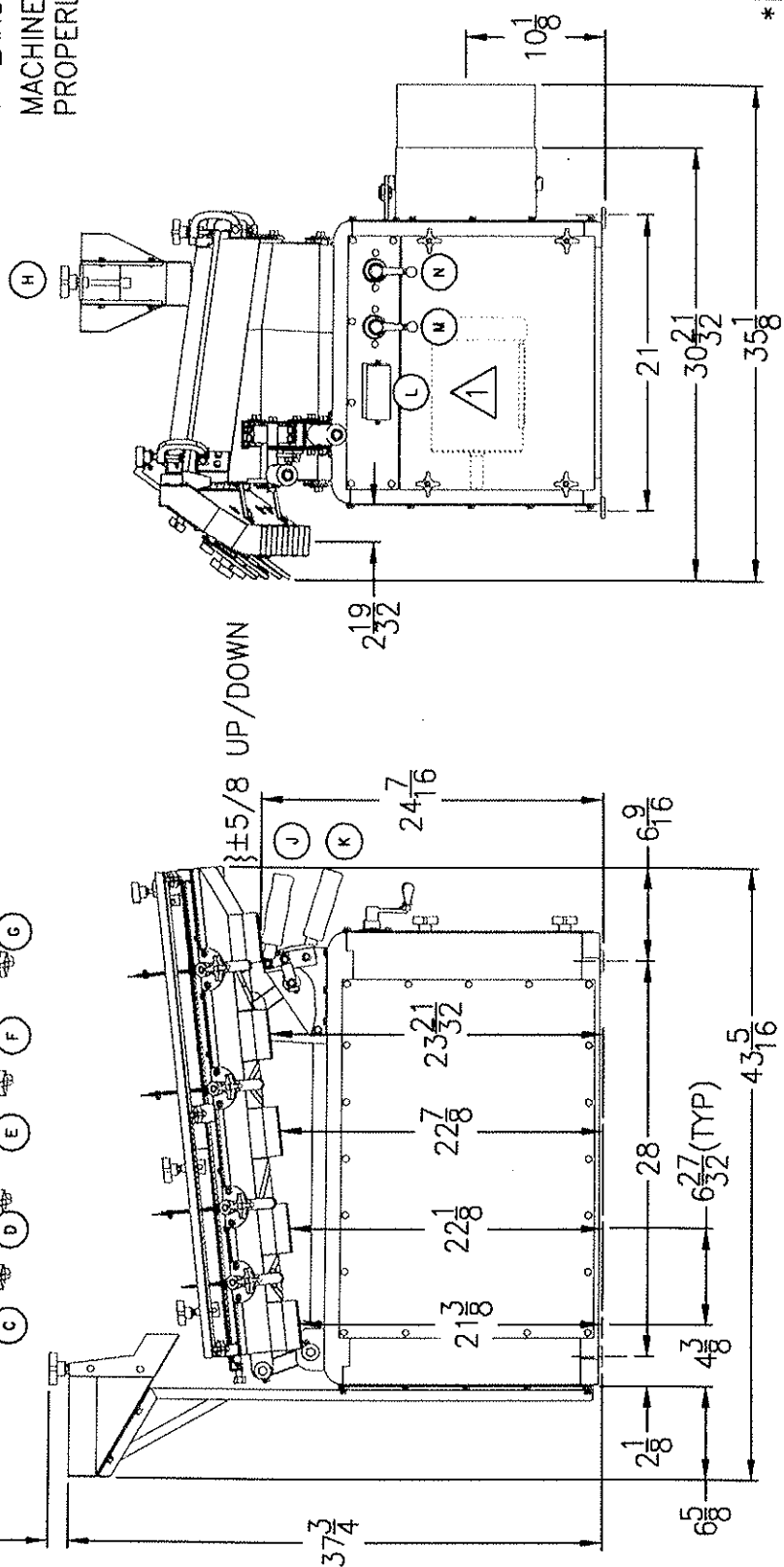
THIS IS A VIBRATING MACHINE. A SUITABLE CONCRETE BASE OR A SUBSTANTIAL FLOOR MUST BE USED. FLOORS MUST BE OF SOLID CONCRETE OR A SOLID STRUCTURAL BASE. FLOORS WILL ABSORB AND TRANSMIT VIBRATIONS THROUGHOUT THE BUILDING.

- (A) AIR INTAKE Ø10"
- (B) FEED INLET 7" x 7"
- (C) LIGHT MATERIAL DISCHARGE 3-1/2 x 2
- (D) INTERMEDIATE DISCHARGE 3-1/2 x 2
- (E) INTERMEDIATE DISCHARGE 3-1/2 x 2
- (F) INTERMEDIATE DISCHARGE 3-1/2 x 2
- (G) HEAVY DISCHARGE 3-1/2 x 2
- (H) FEED CONTROL
- (J) PITCH CONTROL
- (K) ELEVATION CONTROL
- (L) OPTIONAL TACHOMETER
- (M) SPEED CONTROL
- (N) AIR CONTROL

1 H.P. MOTOR - 1725 R.P.M.
 PROVIDE FLEXIBLE CONNECTION

NOTE:

MAKE ALL RECEIVING SPOUTS 1" LARGER ALL AROUND. MACHINE MUST BE SHIMMED PROPERLY BEFORE RUNNING.



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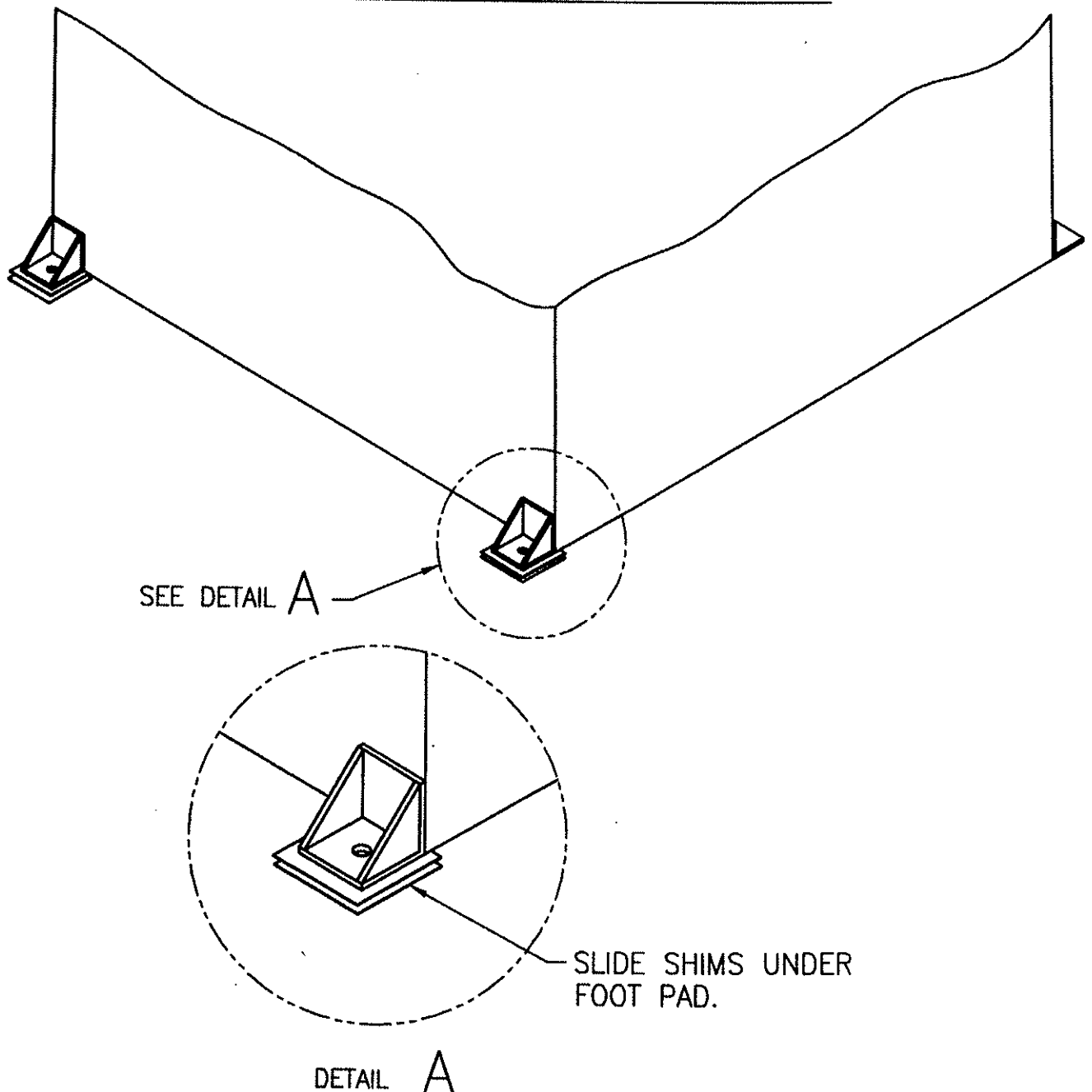
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DESIGNED BY: [Signature]	CHECKED BY: [Signature]
DATE: 10-1-02	BY: [Signature]
DRAWING NO. 4-1821	
SHEET 1 OF 1	

10-MZS PRESSURE GRAMMY STANDARD

SHIMMING INSTRUCTIONS

After the machine has been set in place on solid concrete or a solid structural base, and prior to bolting the machine down – THE MACHINE MUST BE SHIMMED PROPERLY! to do this, check all four mounting locations and make sure there is equal pressure between the mounting pads of the machine and the floor. If there is difference, SHIMMING MUST BE DONE! shimming might be as light as 22 GA. or a 24 GA. SHIM, BUT IT IS NECESSARY!!!

POSSIBLE SHIMMING APPLICATION



**FORSBERGS INC.
SEPARATION SYSTEMS**

NOTE:

**ANY ALTERATIONS TO
THIS MACHINE WITHOUT
FACTORY APPROVAL
VOIDS WARRANTY!**

DIRECTIONS FOR INSTALLATION AND OPERATION

Of The

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

* * *

INSTALLATION

LOCATION:

Machine should be located under a bin with sufficient capacity to assure steady flow of material to the machine. The machine is normally mounted solidly to the floor.

FOUNDATION:

No special foundation is required if the floor is sound and free from vibration. The machine should be fastened to the floor with either bolts or lag screws. When the machine is mounted on a stand it is absolutely essential that there is no vibration of this base. A factory-made stand is recommended.

LEVEL THE MACHINE:

The machine is designed to operate when the main frame of the Gravity Table is level. Use a long level and level in both directions, and more importantly, shim the floor mounting pads until they all have equal pressure before bolting.

ACCESS TO MACHINE:

Allow enough room around the machine to allow for easy removal of the deck. Check this point before bolting the machine to the floor by testing the removal of the deck. Allow enough spare room around the machine for the operator to comfortably access the controls.

FEED:

There are various methods of feeding a Vacuum Gravity Separator, depending on the type of product being processed. All of these feature some means of maintaining an air lock and providing a positive means of controlling the flow of material on to the machine. Feed the machine from a bin when possible to help maintain a steady and even feed. Whatever feed device is used, it should provide ample and consistent feed to the Gravity at all times.

PIPING:

Use at least 18 gauge metal to prevent collapsing of pipe. If lighter gauge metal is used, it should be banded at intervals between the joints. Avoid sharp turns. Where a 90 degree turn must be made, refer to PIPING INSTRUCTIONS. Any banding, if necessary would apply only on the suction side of the fan.

FILTERS:

Most Forsberg Gravity Separators are built to accommodate filters in the base of the machine. It is essential that these filters be cleaned periodically. **PLUGGED FILTERS WILL CAUSE POOR SEPARATIONS.**

CYCLONES:

These must be properly sized. Too small of a cyclone will cause back pressures and loss of air movement to the extent that a poor separation is the result. Too large of a cyclone does a poor job of settling out the dirt. Factory will make recommendations as to size.

KEEP THE DECK CLEAN:

Clean the deck as required by using a brush and air hose. Periodically the deck should be removed and given a thorough cleaning since it is difficult to make sure the underside of the screen is clean when it is in the machine. This is where a spare deck comes in handy. If you are using Urethane coated deck covers, do not use a pressure washer or a wire brush since these tools may strip the coating off the wire mesh. It is recommended to use compressed air.

* * *

OPERATING INSTRUCTIONS

The specific gravity separator classifies material according to density or specific gravity. A mixture of material to be separated is metered at a uniform rate at the back of the deck. The slant of the deck and its oscillating motion moves the material over the deck. Air forced up through the porous deck from the equalizing chamber forms thousands of small jets which causes the material to stratify into layers of different densities. The oscillating motion of the deck "walks" the heavy material uphill nearly parallel to the discharge edge, and the air "floats" the light material downhill. As the material travels from the feed point on the deck to the discharge edge, a gradation of material takes place ranging from light material on the lower side of the deck to heavy material on the upper side. By means of movable dividers, the discharge can be divided into any number of density fractions.

ADJUSTMENTS:

On the Forsberg 10-M2S Pressure Gravity Separator, there are several adjustments that have to be made initially, generally never requiring resetting, unless the product changes. Once the machine has been set, the action is controlled by slight changes at four points, namely the Air, the Feed, the Speed and the Elevation of the deck. When making any of these adjustments, it is very important that enough time be allowed for the table to react to each adjustment (30 seconds) before making any further changes.

AIR:

Distribution of the air through the deck is controlled by a unique feathering system built into the deck. This requires no adjustment and is permanently set at the factory. The Volume of Air is adjusted using the Air Crank Handle located at the front end of the machine. Air volume should be adjusted so that the material is freely agitated on the deck and caused to "bubble" without allowing the "bubbles" to break. Too much "bubbling" action prevents the stratification of material. Too much air will cause the bed of material to shift to the lower end; too little air will cause the bed of material to pile up near the upper end of the deck. Maintain a fully covered deck with uniform depth of material.

FEED:

The feed input to the separator must be adjusted so that a uniform flow is maintained at all times. The rate of feed will depend upon the type of material being separated. The important thing is to maintain a fully covered deck and to avoid piling up of product in any area.

SPEED:

Using the Speed Control Crank Handle controls the Deck Speed. This adjustment works together with the Air, Feed, and Deck Elevation. As these are increased, the speed must also be stepped up to maintain a level load on the deck. This adjustment, once set for a particular type of product, will very seldom need changing. Too high of speed will cause the material to pile up along the Heavy Discharge Spouts and too thin at the low end of the deck. Too slow of speed will cause too deep of a pile at the input end and thinning at the high end.

WARNING: Speed should never exceed 540 R.P.M.! Excessive speed voids warranty!

DECK ELEVATION AND PITCH:

Deck Elevation and Pitch Controls are located at the front (pointy end) of the machine. The adjustments are made by loosening the respective elevation/pitch lock nut and rotating the respective handle to cause the deck elevation to go up/down and/or the pitch to increase/decrease (larger/smaller perpendicular angle in relative to the deck). Make sure that after adjusting these controls or any control on the machine to re-tighten all lock nuts securely.

A reminder: When adjusting the pattern on the deck with these adjustments (or any adjustment) be sure to make only a little adjustment at a time and allow the pattern on the deck time to readjust itself as previously mentioned. Raising the deck in will tend to thin the material out at the heavy/high end and may have to be compensated for by either an increase in speed or decrease in air. Lowering the elevation adjustment will cause the material to move more rapidly to the heavy end and may have to be compensated for by decreasing speed or increasing air. Properly adjusted elevation will result in the material being fairly uniform across entire deck with slightly more product at heavy end of deck.

REAR ADJUSTMENT POSTS (2):

Posts are located at the rear corners of the deck. When the base of the post is set as far forward as possible, the deck at that point is lowered slightly and the degree of throw at that point is increased. Adjusting these posts to opposite settings imparts a slight torque to the deck and causes the material to travel in an arc. A normal setting for the Feed rear post, located under the feed, is to have the base very near the extreme forward position and the Cull rear post under the "lights" discharge spouts very near to the extreme rear position. Once these posts are set in this position, they will probably never be changed.

DECK RUN-OFF ADJUSTMENT:

Located here on the back side of the deck (opposite the discharge side), these adjustments control the rate of run-off. These controls raise and lower the side of the deck to increase or decrease the flow over the run-off board. Once set, these are seldom changed, unless feed rates into the machine change or the particular type of product needs more residence time on the deck for proper separation. Excessive run-off moves the material across the deck too quickly not allowing enough time for the material to be properly separated, and in turn adjusting the run-off too flat will cause the material to pile up on the feed side reducing capacity considerably.

START UP:

Familiarize yourself with the operation of each adjustment control by starting the machine and making adjustments, one at a time, just to see the reaction of the material on the deck to each change of a particular adjustment control.

To start the machine, set the rear adjustment posts with the Feed rear post very near to the extreme forward position and the Cull rear post very near to the extreme backward position. Lock the posts into position by tightening the lock nut. Set the elevation of the front deck post to about mid-way and the pitch also in a mid-way position.

Lock both settings into position. Open the air volume mid-way and start the machine. Start feeding the machine and allow material to cover the deck. If it tends to pile up at the feed input end, increase speed (initially allow sufficient time for product to begin to fill the deck before resorting to a quick speed adjustment). After the deck has been covered, increase or decrease air flow to bring about proper bubbling effect. Check to see that the deck is loaded uniformly at all points. If the material piles up at the point end of the deck, increase elevation of the deck. Make only slight adjustment and allow machine to operate at least 30 seconds before making any further changes. Should the material still be piled at the point and applying more air causes excessive stratification or bubbling, then decrease the pitch on the front post. Check samples from both high and low discharge spouts. Move dividers to cut material at proper point. **MAKE ONLY SLIGHT ADJUSTMENTS AT ANY ONE TIME AND ALLOW THE MACHINE TO RE-FORM A PATTERN BETWEEN EACH ADJUSTMENT.**

PREPARATION OF PRODUCT - GENERAL:

The quality of all gravity separations is greatly increased when the product is sized to a certain degree of uniformity ahead of the Gravity Table. For most separations it is highly recommended that the product be aspirated and screened when heavy concentrations of light materials are present in order to remove a good portion of the airborne impurities and also to remove the fine dust and dirt that could cause plugging of the Gravity Table screen cover.

THE IMPORTANCE OF CLEAN AIR:

The importance of clean air cannot be over-emphasized. 90% of all separation problems are usually related to air problems. For example, a fine mesh deck may become plugged on the underside. Result - not enough air or no air at all passing through the deck; therefore, poor separations. All filters, filtration systems, or any other of the components involved in the handling of air must be maintained in good condition. If not, poor separations could result.

DECKS:

Many different kinds of decks are available, depending on the type of product being separated. It is advisable to keep a spare deck on hand to avoid down-time and to provide for scheduled maintenance.

MAINTENANCE:

Even though Forsberg Gravity Separators are well known for their low maintenance costs, every good machine does need a certain amount of housekeeping and care. The bearings in the machine are one of the most vital parts and as such they should receive proper attention. The bearings are factory lubricated and sealed and require only very small amounts of grease. The manufacturer's specifications are enclosed and should be read and followed closely. The drive belt on the motor should occasionally be checked to make sure that it is kept tight to prevent any variation of speed. Also the Bellows and Product Discharge Airlocks must be inspected occasionally so there is no air leakage thru them.

FORSBERG VACUUM GRAVITY SEPARATOR (Air Table)

A: PRINCIPLES OF OPERATION

The specific gravity separator classifies material according to density or specific gravity. Component parts of the gravity separator are a vacuum fan, an air-equalizing chamber, a perforated deck, variable speed eccentric, deck rocker arms, a feeding or metering device, a deck end-raise adjustment, and a deck side-tilt adjustment. The end-raise adjustment varies the inclination of the discharge edge. The side-tilt adjusts the deck so that the back is higher than the front. One end of the deck is the discharge edge and the sides are the banking rails.

A mixture to be separated is metered at a uniform rate to the back of the deck. The slant of the deck and its oscillating motion move the material over the deck. Air forced up through the porous deck from the equalizing chamber forms thousands of small jets which cause the material to stratify into layers of different densities. The oscillating motion of the deck "walks" the heavy material uphill nearly parallel to the discharge edge, and the air "floats" the light material downhill. As the material travels from the feed point on the deck to the discharge edge, a gradation of material takes place ranging from light material on the lower side of the deck to heavy material on the upper side. By means of movable splitters, the discharge can be divided into any number of density fractions.

The deck can be called the "heart" of the gravity machine and the deck covering plays an important role. Separation efficiency is dependent on the air distribution through the deck, and on inclination and movement of the deck. About three or four types of deck coverings are needed to handle a range of materials. Coverings that have been used satisfactorily are linen, other cloth of various weaves, small-hole perforated metal, plastic, and wire mesh.

The main job of the deck covering is to help stratify material above the deck, yet adequately restrict airflow to build up static pressure within the air chamber and insure uniform air distribution. For instance, a closely woven covering gives best results for small particles, while a coarser weave is required for large pieces. It is imperative that the deck covering be made from material that will withstand abrasion and is free of lint, which would collect dust particles and clog openings, preventing uniform air distribution.

B: FEATURES

1. Three basic rules of gravity separation:
 - a. Particles of the same size, but different densities can be separated.
 - b. Different size particles of the same density can be separated.
 - c. A mixture of particles of different sizes and densities cannot be separated.
2. Rate of material entering gravity deck greatly affects operation efficiency. Optimum rates vary according to the difference in density or specific gravity of the mixture components.
3. Gravity separation is one of most effective cleaners.
4. This machinery requires monitoring of product flow and subsequent adjustments. Non-uniformity in lots to be cleaned causes high loss or poor finished quality.

FOR FURTHER INFORMATION CONTACT...

Forsbergs, Inc.

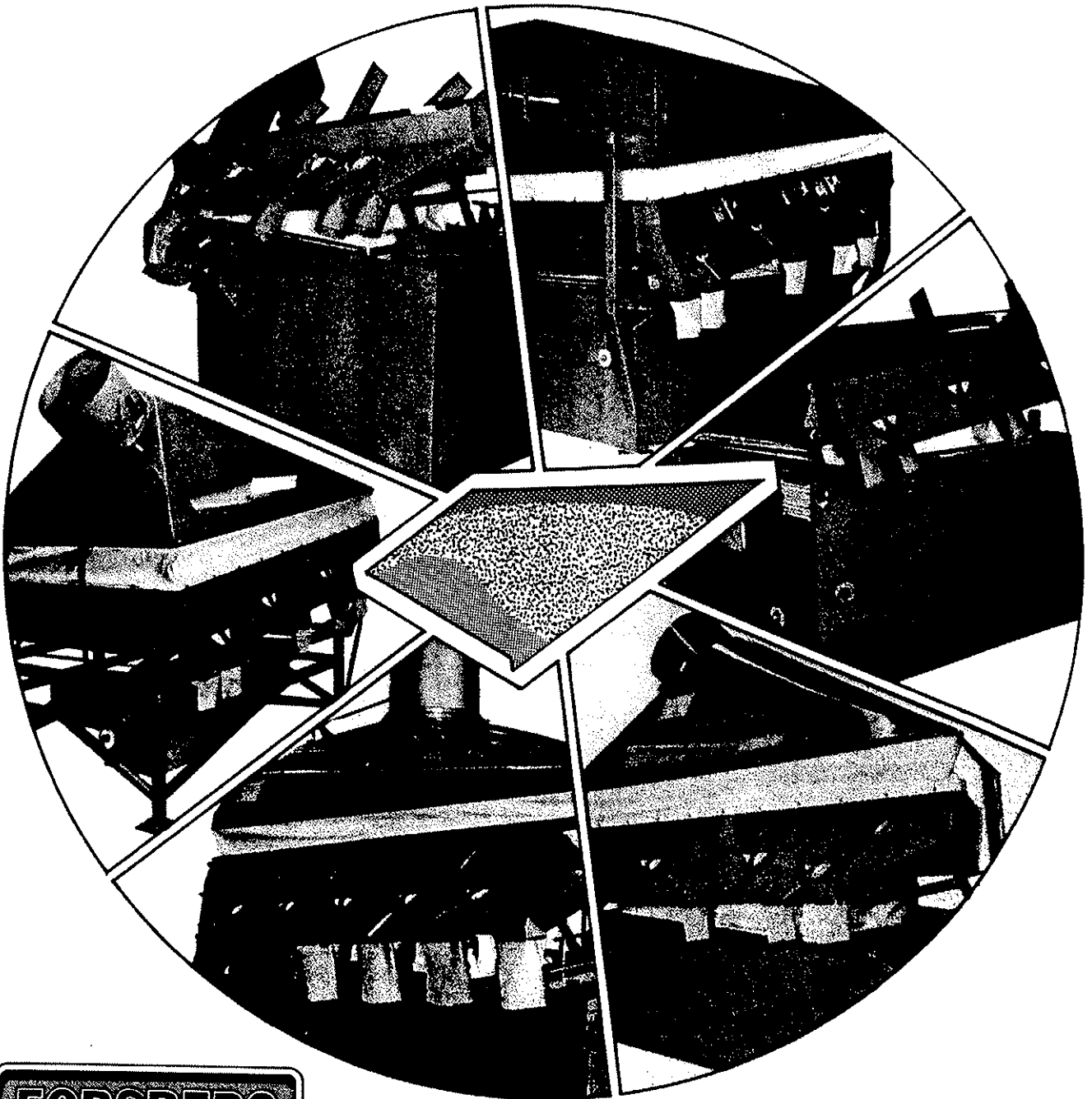
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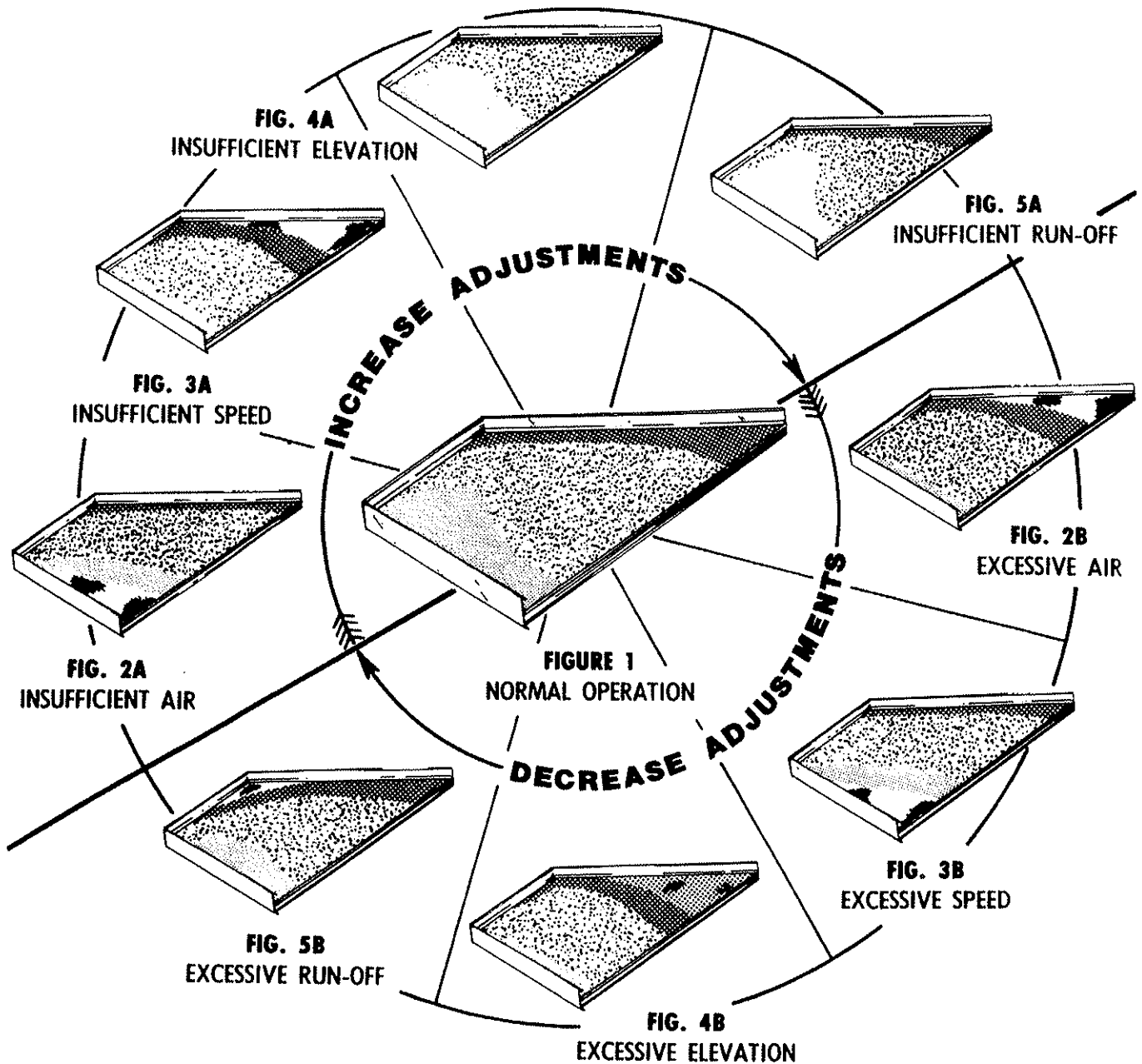
FORSBERG GRAVITY SEPARATOR ADJUSTMENT CHART



FORSBERG

PRESSURE AND VACUUM GRAVITIES

GRAVITY ADJUSTMENT CHART



***STARTING ADJUSTMENTS:** Read and follow all instructions supplied in the **INSTALLATION** and **OPERATION MANUAL**.

Before starting the machine, the following settings must be made:

- Set the base of the left rear adjustment post as far forward as possible.
- Set the base of the right rear adjustment post as far back as possible.

Set the front post's elevation about midway and the base of the front post (thrust setting) also at its midway setting.

Open the air control to a middle setting for small light material and wider for larger, heavier material.

(A) **START-UP:** Start the machine and feed the material onto the deck allowing it to cover the deck and form a constant pattern of distribution.

(B) **NORMAL OPERATION: Figure 1 —**

The material will flow over the deck surface gradually moving toward the discharge side. The heavier material will also move upward to the "point" of the deck while the lighter material curves downward to the lower "cull" corner. This stratified mass (bed) of material will appear to be freely agitated and bubbling evenly over the deck's entire surface and a distinct pattern of material movement should be evident.

Compare the material's pattern with the figures in the chart for achieving ideal or optimum separation.

(C) **ADJUSTMENT CORRECTIONS:** Correct errors of adjustment in the order given below.

1. **AIR ADJUSTMENT — Figure 2A —** Too little air will cause the bed of material to pile up near the upper end of the deck and bare the deck screen on the lower end.

Figure 2B — Too much air will cause the bed of material to have an extremely active bubbling action preventing proper stratification and cause it to shift toward the lower end baring the deck screen on the upper end. The idea is to maintain a fully covered deck with uniform depth of material.

2. **MACHINE MOVEMENT — Figure 3A —** Too slow of speed (deck movement) will cause the material to pile-up in the input area and gradually be thinner in other areas, especially at the point where the screen may become visible.

Figure 3B — Too much speed will cause the material to pile-up along the head board and become thin at the lower end of the deck where the screen may become visible.

3. **ELEVATION OF DECK — Figure 4A —** A low elevation setting will cause the material to be thicker at the upper end and thinner in a larger than normal area at the lower end.

Figure 4B — A high elevation setting will cause the material to shift to the lower end and be thinner in a larger than normal area at the upper end.

4. **DECK RUN-OFF (Level Control) — Figure 5A —** Insufficient (low) run-off setting will cause a heavy pile-up of material along the back side (opposite the discharge) of the deck. The lighter material will move further up toward the point before curving down to the lower corner.

Figure 5B — An excessive (high) run-off setting will cause the material to move directly toward the discharge side and head board. Because of this faster movement toward the discharge, the deck screen will become bare of material at the hip area.

The run-off adjustment seldom needs to be changed once properly set; exception would be if feed rate into the machine is changed.

NOTE: MAKE ONLY SLIGHT ADJUSTMENTS, ONE AT A TIME AND ALLOW TIME FOR THE PATTERN TO REFORM ON THE DECK BEFORE ANY FURTHER ADJUSTING.

ATTENTION

CLEANING INSTRUCTIONS:

USE COMPRESSED AIR ONLY
WHEN CLEANING A URETHANE DECK COVER.

DON'T USE A PRESSURE WASHER OR A WIRE BRUSH
ON URETHANE COVERED DECKS.

TROUBLE SHOOTING GUIDE

When separations deteriorate from former performance, there is always a reason. A general procedure to locate trouble would be to first of all re-check your machine adjustments, then re-check the entire air system and lastly check the machine for mechanical failure. A few example problems and procedures for correction are listed below.

(1) POOR SEPARATION - LIGHT MATERIAL COMING OUT HIGH ON THE TABLE

Cause: Probably a plugged deck. Run material off deck with the Air Damper closed. Remove deck, check and clean thoroughly. Replace deck and start up again.

(2) MATERIAL RIDES TOO HIGH ON DECK AND CROWDS THE HEAVY DISCHARGE SPOUTS

Cause: Probably any one or any combination of the following -- not enough air, plugged deck, machine running too fast, machine has too much pitch, or the deck is too low at the heavy/high end.

To correct, apply more air and raise the heavy/high end of the deck somewhat. If this produces no result, the deck is probably plugged. If the deck is not plugged and the air is almost wide open then check the rest of the air system such as piping, filters (make sure the filters are not plugged), cyclones, etc. to make sure that are no unusual back pressures.

(3) MATERIAL RIDES TOO LOW ON DECK, HEAVY/HIGH END OF DECK NOT COVERED

Cause: Too much air, machine running too slow, not enough feed to cover deck completely or point of deck raised too high.

Take obvious corrective action allowing the deck time to re-adjust its pattern between corrections. On machines with over a year of service it would do well to check the surface of the deck covering to make sure it has not worn smooth. It is the roughness of the wire or the dimpling in the deck covering that makes the heavy particles move up to the top.

(4) NOT ENOUGH AIR TO GET THE DESIRED CLEANING

Cause: Air Leakage in Upper Bellows or Product Discharge Airlocks.

Make sure the Product Discharge Airlocks are in place and in good condition. Make sure the Upper Bellows is in good condition.

The above examples are some of the common causes of problems encountered and are quite easily correctable. It should also be noted that any major change in the composition of the material being fed into the machine will obviously affect the amount of finished product coming off the spill board.

MECHANICAL TROUBLE CHART

Before making any repairs or looking for trouble with the gravity separator, check over the machine for correct rotation of the motor and fan, any obstructions to the air intake, that the machine has a steady and uniform feed from an overhead surge bin and not directly from and elevator leg, that the machine is sitting on a firm and level foundation, that it is securely fastened to the floor.

TROUBLE

UNSTEADY OR VARIATION OF PRODUCT UPON DECK

"DEAD SPOTS" ON DECK WHERE PRODUCT BECOMES UNEVEN

POSSIBLE REMEDY

Check for product input blockages. Be sure the feed control linkages are properly working. Check for changes in product consistency and environmental changes.

Remove deck and clean thoroughly with brush and air hose if possible. Check air intake and filters for possible obstructions or plugged filters.

TROUBLE

UNABLE TO MAKE PRODUCT CARRY ALL THE WAY UP ON DECK OR ALL THE WAY DOWN ON THE DECK

TOO MUCH VIBRATION IN DECK OR FRONT OF DECK NOT TRAVELING TRUE

UNABLE TO ATTAIN A STEADY SPEED ON DECK

EXCESSIVE VIBRATION IN BODY OF MACHINE

POUNING OR THUMPING NOISE IN MACHINE

POSSIBLE REMEDY

Check speed changer pulley and make sure that it is working freely. Check eccentric bearings and pillow blocks and make sure they are not stuck or loose. Check rear adjustment posts and make sure they are tight and working.

Check front and rear posts making sure that none of the rubber bushings/slats have become worn. On older machines check for worn pins and bushings on the front and rear posts. On very old style machines check fabric pads on the eccentrics and make sure they are tight, replace only with a pad and not rubber.

Check motor for low voltage; check all belts making sure there is no slippage; check speed changer making sure it is working freely; check to see if speed adjustment is locked.

Check the frame of the machine and make sure it is resting firmly on the floor at all points and is securely fastened and shimmed. Make sure that the floor is not wobbly and if there is vibration, the floor must be supported.

Check all bearings and slats making sure they are all tight and all set-screws are securely tightened

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BALL BEARING INSTALLATION INSTRUCTIONS SET SCREW, SKWEZLOC

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

BEARINGS IN BOLT-ON HOUSINGS (UNITS)

- CHECK AREA**- Clean and organize bearing installation area, keep well lit. Be sure mounting surfaces are clean and flat.
- CHECK SHAFT** - Shaft should be within tolerance range shown in Table #1, clean, and free of nicks and burrs. Mount bearing on unused section of shafting or repair/replace shafting as required.

TABLE #1

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

- INSTALL UNIT** - Slide unit onto shaft. If it is difficult to mount bearing on shaft, use a piece of emery cloth to reduce any high spots on shaft. Do not hammer on any component of the bearing.
 - FASTEN UNIT IN PLACE** - Install housing mounting bolts, check and align bearing and tighten mounting bolts to recommended fastener torques. Exercising extreme caution and safety, rotate shaft slowly to center bearing.
- 5.1 **SET SCREW INSERTS**
- Set screws in a multiple bearing application should be aligned.
 - Torque first set screw to one half recommended torque in Table #2. Torque second set screw to full torque. Torque first set screw to full torque.

5.2 DOUBLE LOCK SET SCREW INSERTS

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

TABLE #2

SET SCREW TIGHTENING				
SCREW SIZE	HEX. SIZE	TORQUE		
		(in.-lbs.)	(ft.-lbs.)	(N-m)
1/4-28	1/8	65 - 85	-	7 - 10
5/16-24	5/32	125 - 165	-	15 - 18
3/8-24	3/16	230 - 300	-	25 - 34
7/16-20	7/32	350 - 450	30 - 40	40 - 55
1/2-20	1/4	500 - 650	40 - 55	55 - 75
5/8-18	5/16	100 - 1440	90 - 120	120 - 165

5.3 SKWEZLOC INSERTS

- Be sure that the SKWEZLOC collar is fitted square and snug against the shoulder on the inner ring.
- Torque the SKWEZLOC collar cap screw to torque recommended in Table #3.

TABLE #3

SKWEZLOC COLLAR TIGHTENING			
English Screw Size	Hex Size	Torque	
		(in.-lbs.)	(N-m)
#8-32	T-25	65 - 70	7 - 8
#10-24	T-27	80 - 90	9 - 10
1/4-20	T-30	160 - 180	18 - 20
5/16-18	T-45	360 - 400	40 - 45

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

CYLINDRICAL OD INSERTS & INSERTS IN CYLINDRICAL OD HOUSINGS

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

SPHERICAL O.D. & (AR) EXPANSION INSERTS

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

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

FOR SPHERICAL OD:

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

FOR EXPANSION TYPE:

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

CAUTION Failure to observe safety precautions could cause personal injury or equipment damage.

RELUBRICATION INSTRUCTIONS

Any good quality lithium or lithium complex base grease, using mineral oil, conforming to NLGI grade 2 consistency, and an oil viscosity of 455-1135 SUS at 100°F (100-250 cSt at 40°C) may be used for relubrication.

READ CAREFULLY

Compatibility of grease is critical, therefore consult with SEALMASTER Application Engineering and your grease supplier for current grease specifications to insure greases are compatible.

Relubricatable SEALMASTER bearings are supplied with grease fittings or zerks for ease of lubrication with hand or automatic grease guns. Always wipe the fitting and grease nozzle clean.

CAUTION

For safety, stop rotating equipment. Add one half the recommended amount shown in Table #5. Start bearing, and run for a few minutes. Stop bearing and add the second half of the recommended amount. A temperature rise, sometimes 30°F (1°C), after relubrication is normal. Bearing should operate at temperatures less than 200°F (94°C) and should not exceed 225°F (107°C) for intermittent operation. For a relubrication schedule see Table #4. For any applications that are not in the ranges of the table, contact SEALMASTER Application Engineering.

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

TABLE #4

RELUBRICATION INTERVALS Use NLGI #2 Lithium or Lithium Complex Grease			
Speed	Temperature	Cleanliness	Relub. Intervals
100 rpm	Up to 120°F (50 C)	Clean	6 to 12 Months
500 rpm	Up to 150°F (65 C)	Clean	2 to 6 Months
1000 rpm	Up to 210°F (100°C)	Clean	2 Weeks to 2 Months
1500 rpm	Over 210°F (100°C) - 250°C)	Clean	Weekly
Above 1500 rpm	Up to 150°F (65° C)	Dirty/Wet	1 Week to 1 Month
Max Catalog Rating	Over 150°F (65°C) - 250°F (120°C) Above 250°F (120°C)	Dirty/Wet	Daily to 2 Weeks Contact SEALMASTER

TABLE #5

RECOMMENDED RELUBRICATION GREASE CHARGE			
Shaft Size (in)	oz.	Shaft Size	grams
1/2 to 3/4	0.03	20 mm	0.85
7/8 to 1 3/16	0.10	25-30mm	2.84
1 1/4 to 1 1/2	0.15	35-40mm	4.25
1 11/16 to 1 15/16	0.20	45-50mm	5.67
2 to 2 7/16	0.30	55-60mm	8.51
2 1/2 to 2 15/16	0.50	65-70mm	15.59
3 to 3 7/16	0.85	75-80mm	24.10
3 1/2 to 4	1.50	85-105mm	42.53

TECHNICAL PRODUCT ASSISTANCE:

Phone: 630-898-9620 ext. 2
Sealmaster.Engineering@Emerson-ept.com

CAUTION Failure to observe safety precautions could cause personal injury or equipment damage.

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EMERSON POWER TRANSMISSION
AURORA, IL 60507
Phone: 630-898-9620

1. Introduction

The rolling-contact bearing is an element of machinery with a very important role, and it dominates the performance of the machine. If one of the bearings breaks or seizes, not only the machine but also the assembly line may stop. If one of the axle bearings of an automobile or a railway car breaks down, a serious accident could occur.

To avoid trouble, every bearing manufacturer should make efforts to assure the highest quality for each bearing, and should emphasize that the user carefully handle and maintain all bearings.

Every bearing becomes unserviceable in the course of time even if it is installed correctly and operated properly. The raceway surfaces and the rolling contact surfaces of the rolling elements are repeatedly subjected to compressive loads, and the surfaces eventually flake.

The life of a rolling-contact bearing is defined as the total number of revolutions (or the number of operation hours at a given constant speed) before flaking occurs.

The bearing may also become unserviceable because of seizing, breakage, wear, false brinelling, corrosion, etc.

These problems are caused by improper selection or handling of the bearing. The problems are avoidable by correct selection, proper handling and maintenance, and are distinguished from the fatigue life of the bearing.

However, breakdowns due to improper application, bearing design, and maintenance are more frequent than flaking due to rolling fatigue in the field.

2. Inspection of Bearings

Inspection of a machine's bearings during operation is important to prevent unnecessary bearing failure. The following methods are generally adopted to inspect the bearing.

(1) Check of bearings in operation

Included are the check of bearing temperature, noise, and vibration, and the examination of the properties of lubricant to determine when lubricant should be replenished or exchanged.

(2) Inspection of bearings after operation

Any change of the bearing is carefully examined after operation and during periodic inspections so as to take measures to prevent recurrence.

It is important for proper bearing maintenance to determine inspection requirements and intervals, according to the importance of the system or machine, and adhere to the established schedule.

3. Inspection When Machine is Running

3.1 Bearing Temperature

Bearing temperature generally rises with start-up and stabilizes at a temperature slightly lower than at start-up (normally 10 to 40°C higher than room temperature) in a certain time. The time before stabilizing depends on the size, type, speed, and lubrication system of the bearing and the heat dissipation condition around the bearing. It ranges from about 20 minutes to as long as several hours. If bearing temperature does not stabilize but continues to rise, the causes shown in Table 3.1 are conceivable. Operation should be stopped and an appropriate corrective action should be taken.

High bearing temperature is not desirable in view of maintaining an adequate service life and preventing lubricant deterioration. A desirable bearing temperature is generally below 100°C.

Table 3.1 Major causes of high bearing temperature

-
- | | |
|-----|---|
| (1) | Extremely insufficient or excessive lubricant |
| (2) | Poor installation of the bearings |
| (3) | Extremely small bearing clearance or extremely heavy load |
| (4) | Extremely high friction between lip and seal groove |
| (5) | Improper lubricant type |
| (6) | Creep between the fitting surfaces |
-

3.2 Operating Sound of Bearing

The following Table 3.2 lists typical abnormal bearing sounds and their causes. Please note that the description of some of these sounds is rather subjective and thus could vary considerably from person to person.

Table 3.2 Typical Abnormal Bearing Sounds and Their Causes

Sound	Features	Causes
Hiss	Small Bearings	Raceway, ball or roller surfaces are rough.
Buzz to Roar	Loudness and pitch change with speed.	Resonation Poor fit (Poor shaft shape) Bearing rings deformed. Vibration of raceways, balls, or rollers (For large bearings, if this sound is minor, then this is considered normal). Brinelling
Crunch	Felt when the bearing is rotated by hand.	Scoring of raceway surface (regular). Scoring of balls or rollers (irregular). Dust/Contamination Deformed bearing ring (partial interference clearance).
Hum Chatter	Disappears when power supply is switched off. Noticeable at low speeds. Continuous at high speeds.	Electromagnetic sound of motor. Bumping in cage pockets (insufficient lubricant)(Eliminated by clearance reduction or pre-loading. Rollers bumping into each other on full-roller bearing.
Clang/Clatter	Metallic, loud bumping sound. Thin section large bearing (TTB) at low speeds.	Bearing ring deformed. Grating of key.
Screech/Howl	Occurs mainly on cylindrical roller bearings. Sound changes with speed. Loud metallic sound that disappears temporarily when grease is added.	Large radial clearance. Poor lubrication/grease consistency.
Squeak	Metal-to metal spalling sound. High pitch	Spalling of roller and rib of roller bearing. Small clearance Poor lubrication
Squeal	Generated irregularly due to grating.	Slip on fitting surfaces. Grating on mounting seat, of key, etc.
Faint tinkle	Irregular (not changing with speed). Primarily on small bearings.	Dust in bearing.
Rustle	Sound quality remains the same even if speed changes (Dirt). Sound quality changes with speed (Scoring).	Dirt Raceway, ball, or roller surfaces are rough.
Rustle	Generated intermittently at regular intervals.	Chafing at the labyrinth. Contact of cage and seal.
Rustle patter	Regular and continuous at high speed.	Generated by retainer. Normal if sound is clear. Grease is inadequate If sound is generated at low temperatures (Use soft grease). Wear of cage pockets. Insufficient lubricant. Low bearing load.
Growl	Continuous at high speeds.	Scoring on raceway, balls, or rollers.
Quiet Fizzing/Popping	Generated irregularly on small bearings.	Bursting sound of bubbles in grease.
Large Sound Pressure	Large Sound Pressure	Rough raceway, roller, or ball surfaces. Raceway, rollers, or balls are deformed by wear. Large clearance due to wear.

3.3 Vibration of Bearing

Damage to the bearing can be detected early by measuring the vibration of the machine. The degree of damage is inferred from quantitative analysis of the amplitude and frequency of the vibration. However, values measured differ depending on the measuring point and the operating condition of the bearing. It is desirable to accumulate measurement data and establish evaluation criteria for each machine.

3.4 Lubricant Selection

The purpose of lubrication the bearing is to cover the rolling contact surfaces and sliding contact surfaces with a thin oil film to avoid direct metal-to-metal contact. Effective lubrication of the rolling-element bearing has the following effects.

- (1) Reduces friction and abrasion
- (2) Transports heat generated by friction
- (3) Prolongation of service life
- (4) Prevents rust (corrosion)
- (5) Keeps foreign objects (or contamination) away from rolling elements and raceways

For these purposes, a lubricant should be selected by referring to the following criteria:

(1) Grease lubrication

Grease is generally used for lubricating rolling-element bearings because it is easy to handle and simplifies the sealing system.

Carefully examine the type and properties of the base oil, thickener and additives of the grease, and select a grease appropriate for the operating condition of the bearing. The general relation between consistency of grease and the application of the bearing is given in Table 3.3. The types and properties of greases are given in the bearing section of the NTN general catalog.

Table 3.3 Consistency of Grease

NLGL consistency No.	JIS(ASTM) consistency after 60 workings	Application
0	355-385	Centralized lubrication
1	310-340	Centralized lubrication
2	265-295	General, prelubricated bearing
3	220-250	General, high temperature
4	175-205	Special applications

(2) Oil lubrication

Oil lubrication is generally suitable for high speed or high temperature operations. It is also suitable for carrying heat away from the bearing.

Oil viscosities required for the operating temperatures of bearings are given in Table 3.4.

Carefully study the viscosity, viscosity index, oxidation resistance, corrosion resistance, foaming resistance, etc. to select an oil. Table 3.5 gives a guide for selecting viscosity.

Fig. 3.1 shows the variation of viscosity with temperature for several lubrication oils. Use Table 3.5 to select an oil with an adequate viscosity for the operating temperature of the bearing.

Table 3.4 Viscosities Required for Operating Temperature of Bearings

Bearing Type	Kinematic viscosity mm ² /s
Ball, cylindrical roller and needle roller bearings	13
Self-aligning roller bearings, tapered roller bearings and thrust needle roller bearings	20
Self-aligning thrust roller bearings	30

3.5 Relubrication

In grease lubrication, the lubricating characteristic of grease deteriorates with operating hours, thus requiring relubrication of the bearing at appropriate intervals. Relubrication intervals of grease depend on the type, dimensions, and speed of the bearing, and the type of grease.

A line diagram serving as a rough guide of grease relubrication intervals, is given in the bearing section of the NTN general catalog.

For oil lubrication, oil changing intervals depend on the operating condition of the machine and the type of lubrication system (a rough guide to oil changing intervals and for oil analysis intervals is given in Tables 3.6 and 3.7).

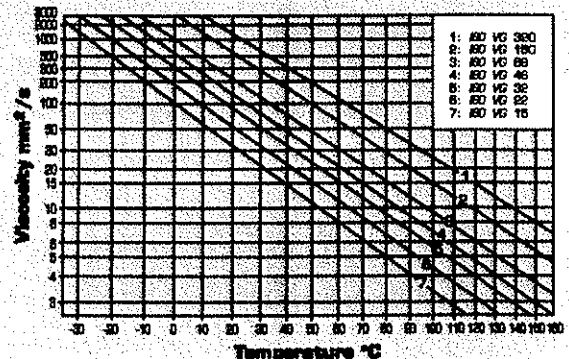


Fig. 3.1 Lubrication oil viscosity-temperature line diagram

Table 3.5 Selection Guide For Lubrication Oil Viscosity

Bearing operating temperature °C	dn value x10 ⁴	ISO viscosity grade of oil (VG)		Applicable bearing types
		Normal load	Heavy or impact load	
-30~0	Up to allowable speed	22 32	46	All types
0~60	~ 1.5	46 68	100	All types
	1.5~8	32 46	68	All types
	8~15	22 32	32	Except for thrust ball bearings
	15~50	10	22 32	Single row radial ball bearings Cylindrical roller bearings
60~100	~1.5	150	220	All types
	1.5~8	100	150	All types
	8~15	68	100 150	Except for thrust ball bearings
	15~50	32	68	Single row radial ball bearings Cylindrical roller bearings
100~150	Up to allowable speed	320		All types
0~60	Up to allowable speed	46	68	
60~100	Up to allowable speed	150		Self-aligning roller bearings

Remarks

1. The table above is applicable to oil bath lubrication and recirculation lubrication.
2. Consult NTN if your operating condition is not shown in the table.

Table 3.6 Lubrication Oil Properties and Serviceable Limits

Property	Serviceable limit		Remarks
	Circulating oil	Gear oil	
Viscosity Deterioration mm ² /s	Less than 10%	25% max., 10 to 15% is preferable	Caused by oxidation or mixing with different type of oil.
Water content in volume %	0.2 max.	0.2 max.	May be reusable after water removal
Insoluble matter in weight	0.2 max.	1.0 max.	Additive carbon particles Dust
	Pentane %	0.9 max.	
	Benzene %	0.5 max.	
Sedimentation value ml/10ml	0.1 max.		Contaminants such as water and dust, or worn metal particles.
Total acid value KOHmg/g	2 to 3 times that of new oil		Adopt higher value according to additives
Ash %	---	0.2 max.	
Iron content in ash %	---	0.1 max.	

DITAK 8 - ADJUSTABLE TIMEBASE 5-DIGIT RATE INDICATOR

- LCD, POSITIVE REFLECTIVE OR NEGATIVE TRANSMISSIVE WITH YELLOW/GREEN OR RED BACKLIGHTING
- 0.6 INCH (15.2 mm) HIGH DIGITS
- ADJUSTABLE TIMEBASE FROM 4 MSEC TO 32 SEC
- INTERNAL LITHIUM BATTERY PROVIDES OVER 7 YEARS OF CONTINUOUS OPERATION
- NEMA 4X/IP65 SEALED FRONT PANEL BEZEL
- ACCEPTS MAGNETIC OR LOGIC TYPE SIGNAL INPUTS
- WIRE CONNECTIONS MADE VIA SCREW CLAMP TYPE TERMINALS



DESCRIPTION

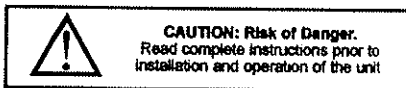
The Ditak 8 is a self-powered rate indicator which features selectable Timebase Increments by setting the appropriate DIP switches on the rear of the unit. The internal 3.0 VDC lithium battery will operate continuously for at least 7 years. It has a 5-digit LCD display with 0.6 inch (15.2 mm) high digits. The displays are available in positive image reflective (black digits, reflective background) or negative image transmissive (illuminated digits, dark background) with red or yellow/green backlighting. Backlight version units require power from an external 9 to 28 VDC supply.

The unit is constructed of a lightweight, high impact plastic case with a clear viewing window. The sealed front panel meets NEMA 4X/IP65 specifications for wash-down and/or dusty environments, when properly installed.

The optional Micro Line/Sensor Power Supply (MLPS1000) is designed to attach to the rear of an installed Ditak 8. The optional supply can be powered from 85 to 250 VAC, and can provide power for the backlighting of a unit and most sensors.

SAFETY SUMMARY

All safety related regulations, local codes and instructions that appear in the manual 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.



SPECIFICATIONS

- DISPLAY:** 5-Digit LCD, 0.6" (15.2 mm) high digits.
- POWER SOURCE:** Internal 3.0 V lithium battery provides over 7 years of continuous service (battery life is dependent upon usage).
- BACKLIGHT POWER REQUIREMENTS:** 9 to 28 VDC @ 35 mA. Above 26 VDC, derate operating temperature to 50°C. Must use the MLPS1 or a Class 2 or SELV rated power supply.
- SIGNAL INPUT:** 0 to 10 KHz from a magnetic or bi-polar output (with a 50% duty cycle). Min. input sensitivity is 0.9 V. Max. input = 28 VDC.
- TIMEBASE:** Adjustable in 1/256 sec (3.906 msec) increments via DIP switches located at the rear of the unit. Timebase ranges from 3.906 msec to 31.998 sec; 0.01% ± 1 digit accuracy.
- ENVIRONMENTAL CONDITIONS:**
 - Operating Temperature:** 0 to 60°C (Above 50°C derate backlight operating voltage to 26 VDC max.)
 - Storage Temperature:** -40 to 80°C
 - Operating and Storage Humidity:** 85% max. (non-condensing) from 0°C to 60°C.
 - Altitude:** Up to 2000 meters
- CONSTRUCTION:** High impact plastic case with clear viewing window (Panel gasket and mounting clip included). Installation Category I, Pollution Degree 2.

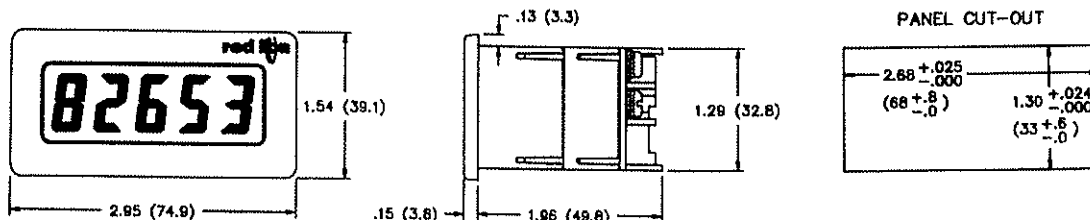
ORDERING INFORMATION

MODEL NO.	DESCRIPTION	PART NUMBER
DT8	Adjustable Timebase Tachometer	DT800000
	Adjustable Timebase Tachometer with Yellow/Green Backlighting	DT800010
	Adjustable Timebase Tachometer with Red Backlighting	DT800020
MLPS	Micro Line Sensor/Power Supply	MLPS1000

For more information on Pricing, Enclosures & Panel Mount Kits refer to the RLC Catalog or contact your local RLC distributor.

DIMENSIONS In inches (mm)

Note: Recommended minimum clearance (behind the panel) for mounting clip installation is 2.15" (54.6) H x 3.00" (76.2) W.



SPECIFICATIONS (Cont'd)

8. CERTIFICATIONS AND COMPLIANCES:

SAFETY

IEC 1010-1, EN 61010-1: Safety requirements for electrical equipment for measurement, control, and laboratory use, Part 1.

IP65 Enclosure rating (Face only), IEC 529

Type 4X Enclosure rating (Face only), UL50

ELECTROMAGNETIC COMPATIBILITY

Emissions and Immunity to EN 61326

Immunity:

Electrostatic discharge	EN 61000-4-2	Criterion B 4 kV contact discharge 8 kV air discharge
Electromagnetic RF fields	EN 61000-4-3	Criterion A 10 V/m
Fast transients (burst)	EN 61000-4-4	Criterion B 2 kV power 2 kV signal
Surge	EN 61000-4-5	Criterion A 1 kV L-L, 2 kV L&N-E power 1 kV signal
RF conducted interference	EN 61000-4-6	Criterion A 3 V/rms
Voltage dip/interruptions	EN 61000-4-11	Criterion A 0.5 cycle

Emissions:

Emissions	EN 55011	Class B
-----------	----------	---------

Notes:

1. Criterion A: Normal operation within specified limits.
2. Criterion B: Temporary loss of performance from which the unit self-recovers.

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

9. WEIGHT: 3.4 oz (96.4 g)

EMC INSTALLATION GUIDELINES

Although this unit is 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 the unit may be different for various installations. In extremely high EMI environments, additional measures may be needed. Cable length, routing and shield termination are very important and can mean the difference between a successful or a troublesome installation. Listed below are some EMC guidelines for successful installation in an industrial environment.

1. Use shielded (screened) cables for all Signal and Control inputs. The shield (screen) pigtail 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 only at the panel where the unit is mounted to earth ground (protective earth).
 - b. Connect the shield to earth ground at both ends of the cable, usually when the noise source frequency is above 1 MHz.
 - c. Connect the shield to common of the unit and leave the other end of the shield unconnected and insulated from earth ground.
2. Never run Signal or Control cables in the same conduit or raceway with AC power lines, conductors feeding motors, solenoids, SCR controls, and heaters, etc. The cables should be run in metal conduit that is properly grounded. This is especially useful in applications where cable runs are long and portable two-way radios are used in close proximity or if the installation is near a commercial radio transmitter.
3. 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. In extremely high EMI environments, the use of external EMI suppression devices, such as ferrite suppression cores, is effective. Install them on Signal and Control cables as close to the unit as possible. Loop the cable through the core several times or use multiple cores on each cable for additional protection. Install line filters on the power input cable to the unit to suppress power line interference. Install them near the power entry point of the enclosure. The following EMI suppression devices (or equivalent) are recommended:

Ferrite Suppression Cores for signal and control cables:

Fair-Rite # 0443167251 (RLC #FCOR0000)

TDK # ZCAT3035-1330A

Steward #28B2029-0A0

Line Filters for input power cables:

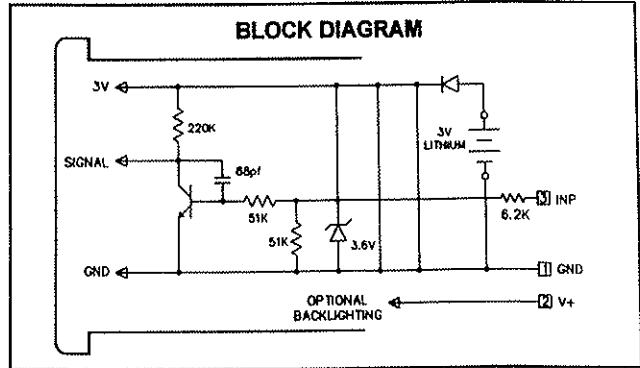
Schaffner # FN610-1/07 (RLC #LFIL0000)

Schaffner # FN670-1.8/07

Corcom #1VR3

Note: Reference manufacturer's instructions when installing a line filter:

5. Long cable runs are more susceptible to EMI pickup than short cable runs. Therefore, keep cable runs as short as possible.

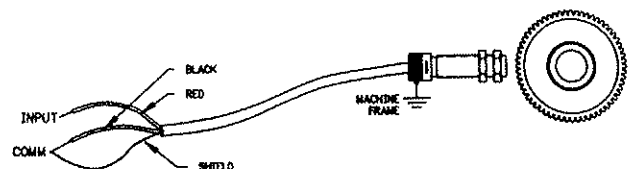


WIRING CONNECTIONS

The electrical connections are made via rear screw-clamp terminals located on the back of the unit. All conductors should meet voltage and current ratings for each terminal. Also cabling should conform to appropriate standards of good installation, local codes and regulations. It is recommended that power supplied to the unit (AC or DC) be protected by a fuse or circuit breaker. When wiring the unit, use the label to identify the wire position with the proper function. Strip the wire, leaving approximately 1/4" bare wire exposed (stranded wires should be tinned with solder). Insert the wire into the screw-clamp terminal and tighten the screw until the wire is clamped tightly. Each terminal can accept up to two #14 AWG wires.

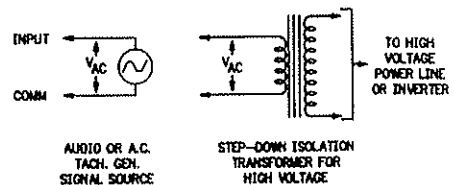
The backlighting for a backlight version unit is powered between Terminal 2 (V+) and Terminal 1 (GND).

Variable Frequency AC Inputs, Signal Source Powered

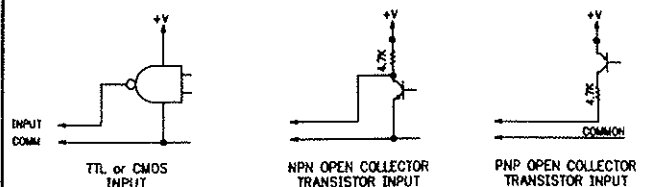


Variable Frequency AC Inputs, Signal Source Powered

Minimum V_{AC} for operation is 0.9 V peak.

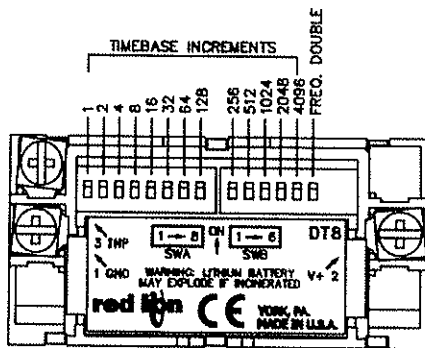


Logic Pulse Inputs From Other Circuits & Sensors



REAR PANEL DIP SWITCHES

When viewing the Ditak 8 from the rear, there are two banks of DIP switches located along the top edge of the PC board. The bank of eight switches to the left is labeled SWA and the bank of six switches to the right is labeled SWB. All of the SWA switches and five of the SWB switches are used to select the desired Timebase. The remaining switch of SWB is used to select Frequency Doubling.



WARNING: Lithium battery may explode if incinerated.

FREQUENCY DOUBLING

DIP switch SWB 6 is the "Frequency Doubling" switch. When it is in the "ON" position, frequency doubling is disabled. When set to the "OFF" position, it is enabled and twice the number of input pulses are registered in the unit. This doubling of the input rate allows the Timebase Increment Total to be halved, thus allowing a faster update time for a given display value.

TIMEBASE SELECTION

The Ditak 8 has a Timebase selection range from 3.906 msec to 31.998 sec. SWA 1 is set to the "ON" position for the minimum Timebase setting. SWA 1 through SWB 5 are set to the "ON" position for the maximum Timebase setting. A specific Timebase setting is achieved by adding the appropriate individual Timebase increments.

SWITCH	TIMEBASE INCREMENTS	SWITCH	TIMEBASE INCREMENTS
SWA 1	1	SWB 1	256
SWA 2	2	SWB 2	512
SWA 3	4	SWB 3	1024
SWA 4	8	SWB 4	2048
SWA 5	16	SWB 5	4096
SWA 6	32	SWB 6	FREQ. DBL.
SWA 7	64		
SWA 8	128		

The Timebase increment total is computed according to the following formula

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{\text{DR} \times 15,361}{\text{RPM} \times \text{PPR} \times \text{FQ.DBL.}}$$

WHERE:

DR	=	Desired Reading
RPM	=	Revolutions Per Minute
PPR	=	Pulses Per Revolution
FQ.DBL.	=	Frequency Doubling disable (times 1 switch on, times 2 switch off)

Example: Find the appropriate Timebase DIP switch setting for desired parameters.

Desired Readout (DR)	=	2500
Revolutions Per Minute (RPM)	=	1250
Pulses Per Revolution (PPR)	=	50
FQ.DBL.	=	ON (times 1 switch on)

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} = \frac{2500 \times 15,361}{1250 \times 50 \times 1}$$

$$\text{TBIT} = 614.44$$

$$\text{TBIT} = 614 \text{ (round to the nearest whole number)}$$

$$\text{TBIT} = 614$$

DIP SWB 2	-	<u>512</u>	-	Needed
		102		
DIP SWA 7	-	<u>64</u>	-	Needed
		38		
DIP SWA 6	-	<u>32</u>	-	Needed
		6		
DIP SWA 3	-	<u>4</u>	-	Needed
		2		
DIP SWA 2	-	<u>2</u>	-	Needed
		0		

Note: If no timebase switches are turned on, the Ditak 8 will default to 3.906 msec timebase.

DIP switches SWA 2, 3, 6, 7, and SWB 2 are all set to the "ON" position for a Timebase Increment Total of 614. If it is desired to know what the approximate Timebase is in seconds, use the following formula:

$$\begin{aligned} \text{TBIT} \times 0.003906 &= \text{Time in seconds} \\ 614 \times 0.003906 &= 2.398 \text{ sec.} \end{aligned}$$

TYPICAL APPLICATION

CONVEYOR BELT SPEED INDICATOR

It is desired to display the rate of a conveyor belt used to carry PC Boards through an infrared soldering chamber that is variable from 0 to 10 feet per minute. The rate must be adjusted depending on the size of the boards being soldered. The display of the rate indicator must read in feet per minute. The shaft of the variable speed motor contains a keyway. A speed of 100 RPM will produce a belt speed of 10 ft/min. A proximity sensor is used to monitor the speed of the shaft. The Ditak 8 can be used to display the belt speed in this application. The output signal of the sensor is connected to the Ditak 8 Terminal 3 (INP). The sensor common and shield are connected to the Ditak 8 Terminal 1 (GND). The Timebase setting is to be determined by using the formula.

$$\text{TIMEBASE INCREMENT TOTAL (TBIT)} =$$

$$\frac{\text{DR} \times 15,361}{\text{RPM} \times \text{PPR} \times \text{FQ.DBL.}} = \frac{10 \times 15,361}{100 \times 1 \times 1}$$

Desired Reading	=	10
MAX RPM Of Shaft	=	100
Pulses Per Revolution	=	1
FQ.DBL.	=	ON (times 1 switch on)

$$\text{TBIT} = 1536.1$$

$$\text{TBIT} = 1536 \text{ (round to the nearest whole number)}$$

$$\text{TBIT} = 1536$$

DIP SWB 3	-	<u>1024</u>	-	Needed
		512		
DIP SWB 2	-	<u>512</u>	-	Needed
		0		

With these DIP switch settings, the Timebase would be approximately 5.99 sec (1536 x 0.003906 = 5.995). To reduce the display update time, the "Frequency Doubling" switch can be enabled (set to the "OFF" position). Therefore, only half the Timebase will be necessary (768 x 0.003906 = 2.99 sec.).

$$\text{TBIT} = 768$$

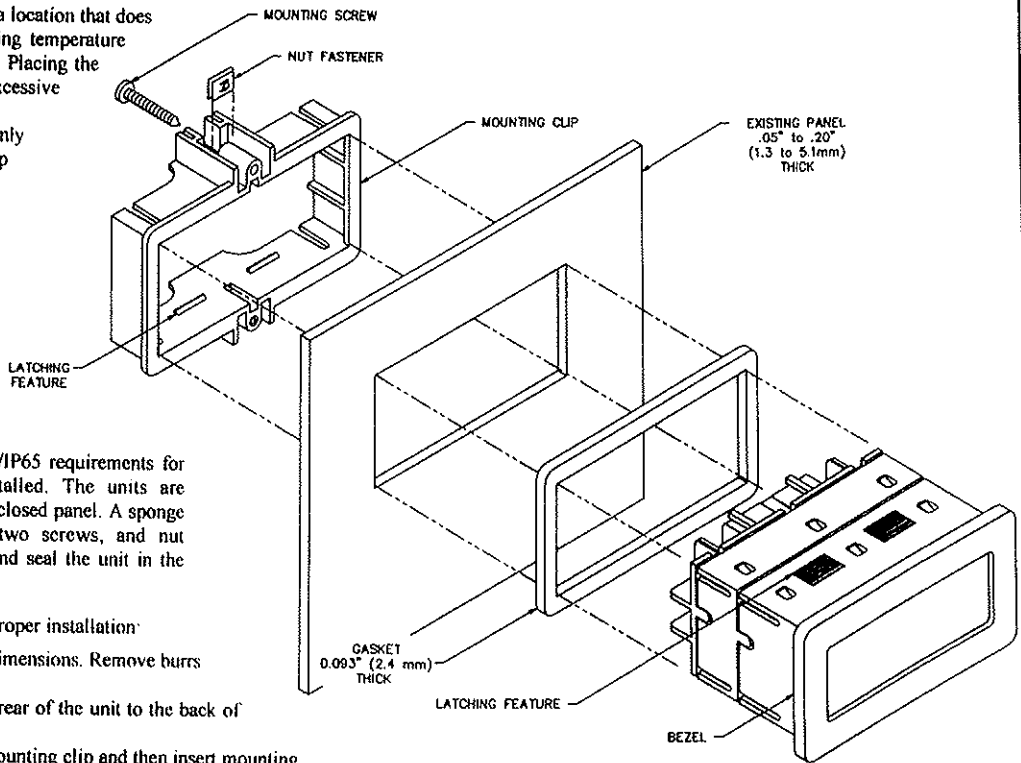
DIP SWB 2	-	<u>512</u>	-	Needed
		256		
DIP SWB 1	-	<u>256</u>	-	Needed
		0		
DIP SWB 6	-	OFF	-	Frequency Doubling Enabled

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.



INSTALLATION

The Ditak 8 meets NEMA 4X/IP65 requirements for indoor use, when properly installed. The units are intended to be mounted into an enclosed panel. A sponge rubber gasket, mounting clip, two screws, and nut fasteners are provided to install and seal the unit in the panel cut-out.

The following procedure assures proper installation:

1. Cut panel opening to specified dimensions. Remove burrs and clean panel opening.
2. Slide the panel gasket over the rear of the unit to the back of the bezel.
3. Slide nut fastener into slot on mounting clip and then insert mounting screw through nut on both sides of mounting clip. Tip of mounting screw should NOT project through hole on clip.
4. Install Ditak unit through panel cut-out.
5. Slide mounting clip over rear of unit until clip is against back of panel. The mounting clip and Ditak housing have a latching feature to hold the unit in place until tightened.

Note: Hold the Ditak front bezel in place when sliding the mounting clip into position.

6. Alternately tighten each mounting screw to ensure uniform gasket pressure. Visually inspect the gasket for proper seal. The gasket should be compressed approximately 75 to 80% of its original thickness.
7. If the gasket is not adequately compressed and the mounting screws cannot be tightened any further, loosen mounting screws and insure that the clip is latched as close as possible to the panel.
8. Repeat step #6 for tightening the mounting screws.

TROUBLESHOOTING

For further technical assistance, contact technical support at the appropriate company numbers listed.

LIMITED WARRANTY

The Company warrants the products it manufactures against defects in materials and workmanship for a period limited to two years from the date of shipment, provided the products have been stored, handled, installed, and used under proper conditions. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

The customer agrees to hold Red Lion Controls harmless from, defend, and indemnify RLC against damages, claims, and expenses arising out of subsequent sales of RLC products or products containing components manufactured by RLC and based upon personal injuries, deaths, property damage, lost profits, and other matters which Buyer, its employees, or sub-contractors are or may be to any extent liable, including without limitation penalties imposed by the Consumer Product Safety Act (P.L. 92-573) and liability imposed upon any person pursuant to the Magnuson-Moss Warranty Act (P.L. 93-637), as now in effect or as amended hereafter.

No warranties expressed or implied are created with respect to The Company's products except those expressly contained herein. The Customer acknowledges the disclaimers and limitations contained herein and relies on no other warranties or affirmations.

Red Lion Controls
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#06-04/05 TechLink
Singapore 417818
Tel +65 6744-6613
Fax +65 6743-3360

INSTRUCTIONS FOR ORDERING

PLEASE BE SURE TO GIVE THE FOLLOWING INFORMATION WHEN ORDERING— *TYPE OF MACHINE, MODEL NUMBER AND SERIAL NUMBER.*

	THE FORSBERG LINE <i>"DRY GRANULAR SEPARATORS"</i>	
	TYPE. <input type="text"/>	TYPE OF MACHINE
	MODEL <input type="text"/>	
MODEL NO. (I.E. 50-VMS, P-8, 34-4800, ETC.)	SER. NO. <input type="text"/>	SERIAL NO.
	FORSBERG'S INC. THIEF RIVER FALLS, MINNESOTA, U.S.A.	

BE SURE TO GIVE PART NO., ITEM NO., & PLATE NO.
THIS INFORMATION IS VERY IMPORTANT TO
INSURE PROMPT SERVICE.

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

SUGGESTED SPARE PARTS LIST

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
27	Counterweight Slat	185-008-17	1
30	Shoe Slat	185-008-16	1
44	Drive Belt	12-442-2270	1
49	Fan Belt	12-442-2360	1
110	Carrylink Slat	185-008-15	6
135	Deck Cover (Indicate Mesh Size When Ordering)	185-0124-B	1
150	Lower Bellows	185-016	1

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED

Forsbergs, Inc.

P.O. Box 510, 1210 Pennington Ave.

Thief River Falls, MN 56701

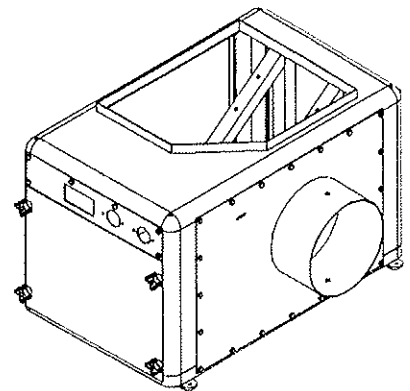
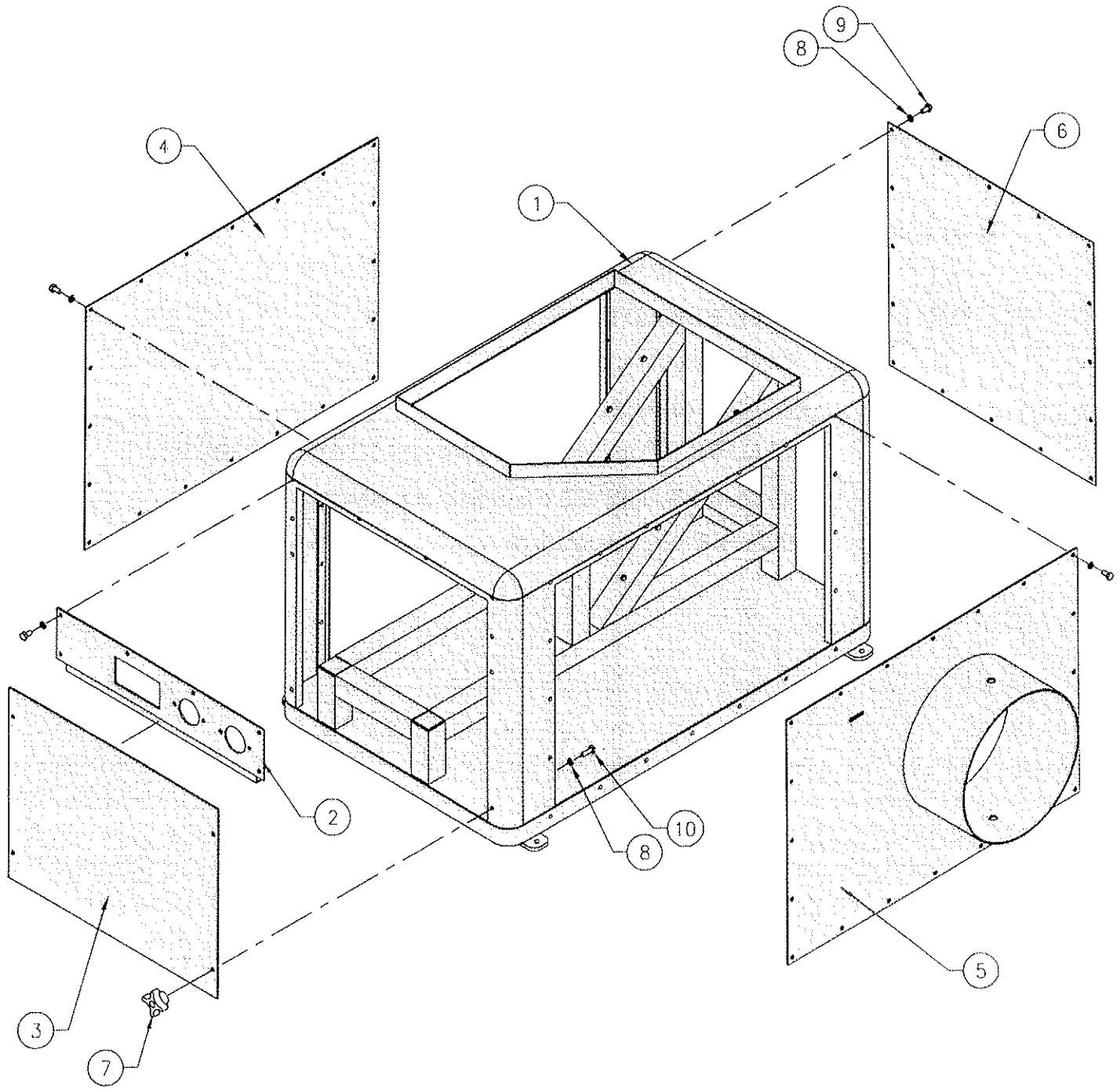
PH: 1-218-681-1927 TOLL FREE: 1-800-654-1927 FAX: 1-218-681-2037

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

INDEX OF MACHINE ASSEMBLIES

<u>PLATE NO.</u>	<u>DESCRIPTION</u>
1	BOX BODY ASSEMBLY
2	DRIVE & SPEED CHANGER ASSEMBLY
3	AIR CONTROL ASSEMBLY
4	FRONT & REAR POST ASSEMBLY
5	BELLOWS, SHOE, DECK & DECK HOLD DOWN ASSEMBLY
6	DISCHARGE DELIVERY HOPPER ASSEMBLY
7	FEED HOPPER ASSEMBLY

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED
FORSBERGS, INC.
THIEF RIVER FALLS, MN 56701



10-M2S PRESSURE GRAVITY
BOX BODY ASSEMBLY
PLATE 1

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

BOX BODY ASSEMBLY

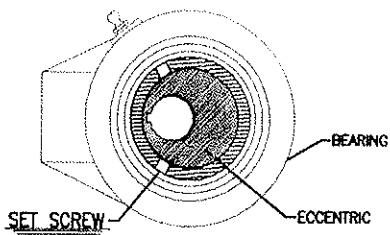
Plate 1

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
1	Box & Drive Frame	185-002-B	1
2	Front Control Panel	185-005-A	1
3	Front Panel / Access Door	185-005-3	1
4	Side Panel	185-005-1	1
5	Side Panel with Air Control Inlet	185-007-F	1
6	Back Panel	185-005-4	1
7	4-Prong Knob	12-684-54	4
8	Lock Washer	12-114-4R	66
9	Hex Bolt	12-123-1	62
10	Hex Bolt	12-123-3	4

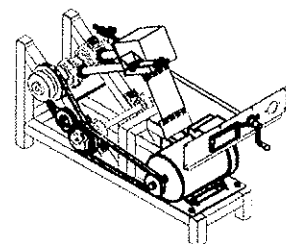
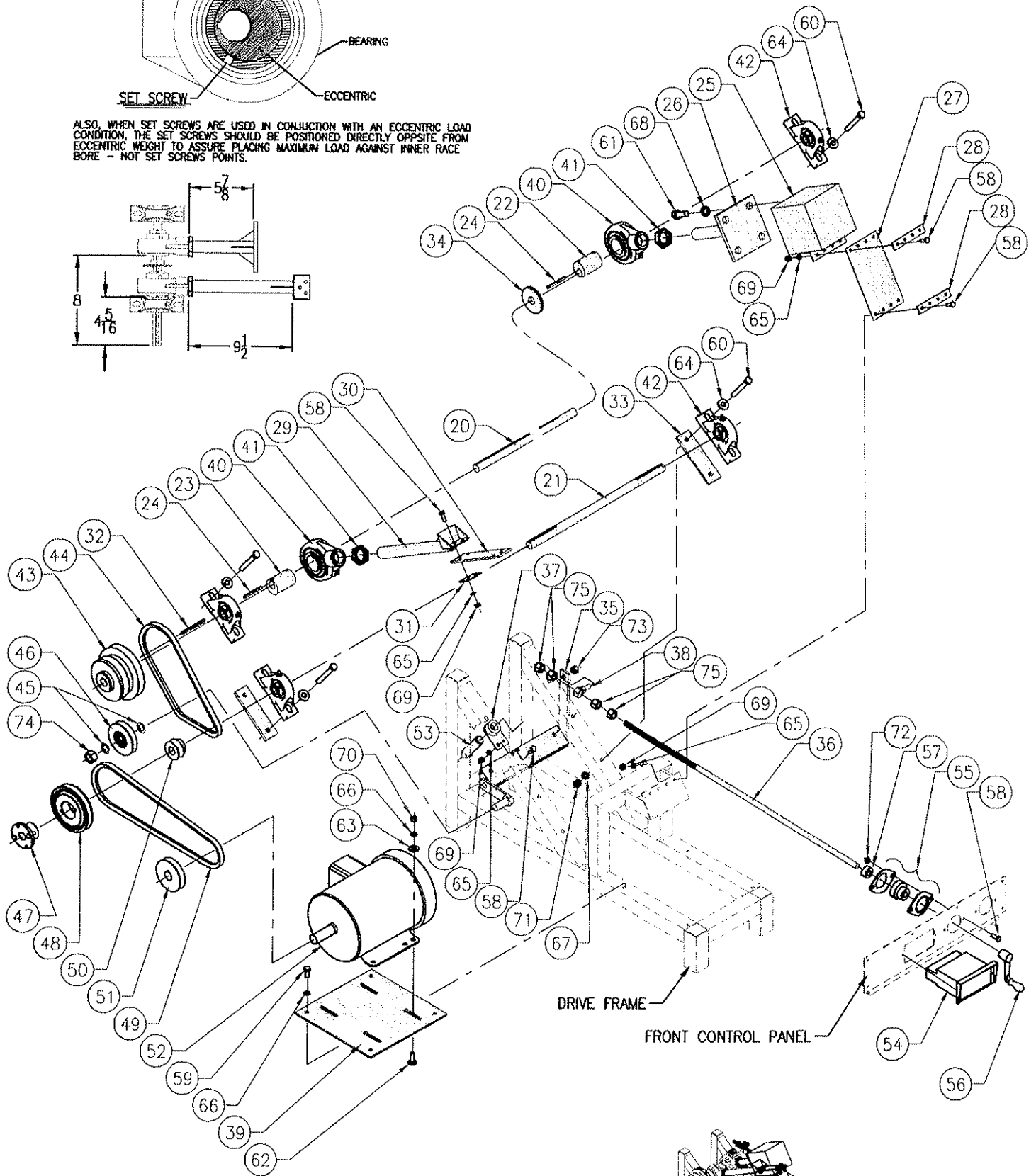
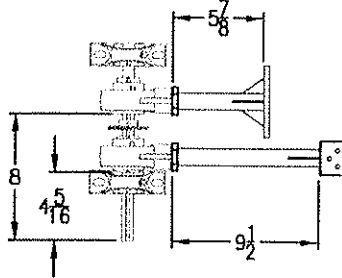
WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED

FORSBERGS, INC.

THIEF RIVER FALLS, MN 56701



ALSO, WHEN SET SCREWS ARE USED IN CONJUNCTION WITH AN ECCENTRIC LOAD CONDITION, THE SET SCREWS SHOULD BE POSITIONED DIRECTLY OPPOSITE FROM ECCENTRIC WEIGHT TO ASSURE PLACING MAXIMUM LOAD AGAINST INNER RACE BORE - NOT SET SCREWS POINTS.



**10-M2S PRESSURE GRAVITY
DRIVE & SPEED CHANGER ASSEMBLY
PLATE 2**

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

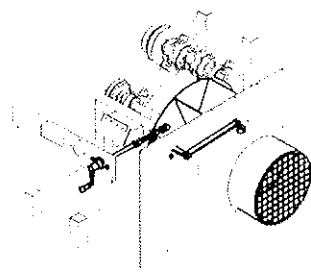
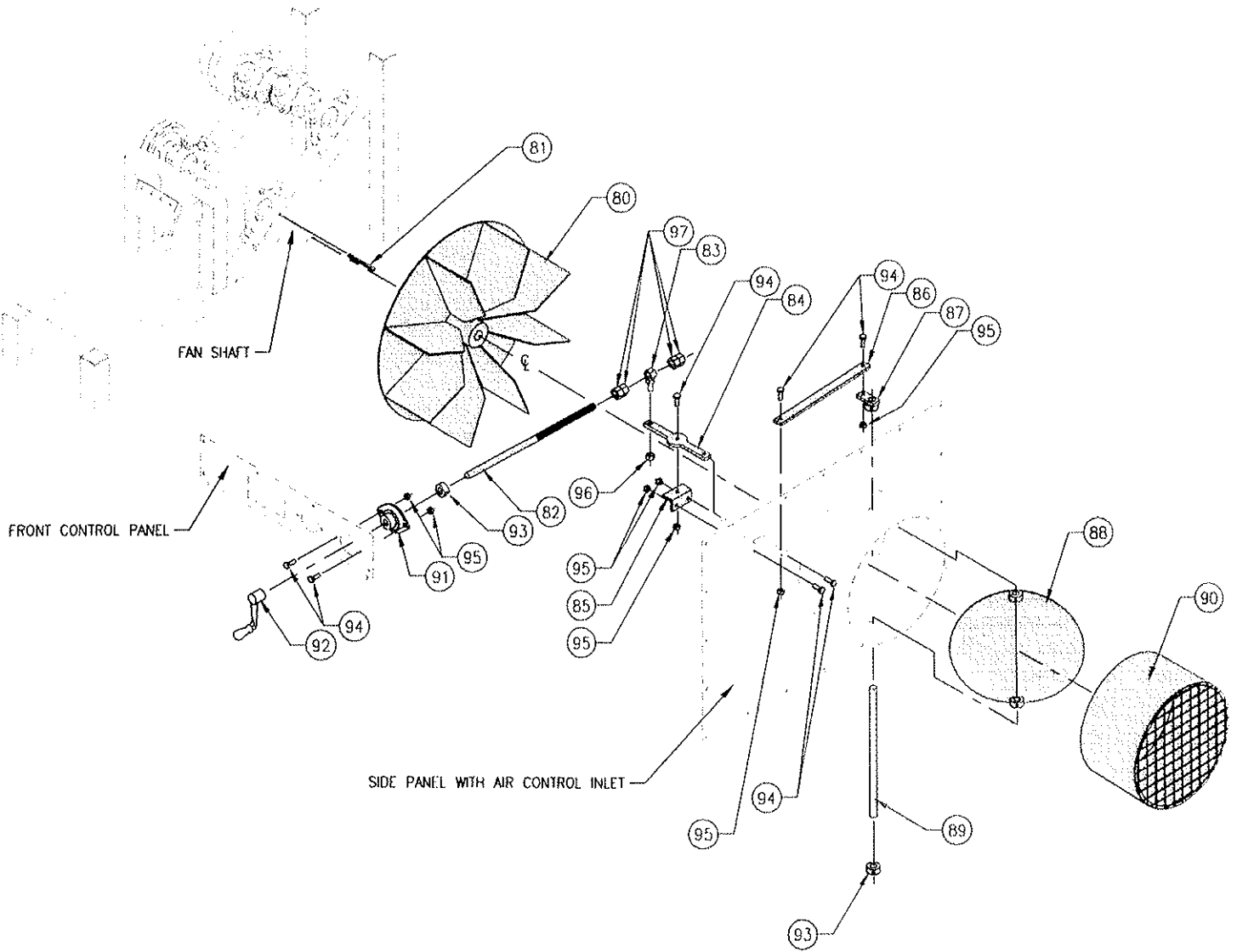
DRIVE & SPEED CHANGER ASSEMBLY

Plate 2

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>	<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
20	Shaft - Eccentric	185-003-3	1	57	Set Collar	12-125-08	1
21	Shaft - Fan	185-003-4	1	58	Hex Bolt	12-123-3	15
22	Eccentric - Counter Weight	185-003-1	1	59	Hex Bolt	12-123-28	4
23	Eccentric - Shoe	185-003-2	1	60	Hex Bolt	12-123-63	8
24	Eccentric Key - Counter Weight & Shoe	185-003-6	2	61	Hex Bolt	12-123-102	4
25	Counter Weight	185-008-A	1	62	Carriage Bolt	12-151-5-5	4
26	Counter Weight Drive Rod	185-008-B	1	63	Flat Washer	12-122-5	4
27	Counter Weight Slat	185-008-17	1	64	Flat Washer	12-122-6	8
28	Counter Weight Slat - Retainer	185-008-3	2	65	Lock Washer	12-114-4R	13
29	Shoe Drive Rod	185-008-C	1	66	Lock Washer	12-114-5R	8
30	Shoe Slat	185-008-16	1	67	Lock Washer	12-114-6R	8
31	Shoe Slat Retainer	185-008-4	1	68	Lock Washer	12-114-8R	4
32	Variable Speed Pulley Key	185-003-7	1	69	Hex Nut	12-120-4C	13
33	Bearing Spacer	185-002-12	2	70	Hex Nut	12-120-5C	4
34	Tachometer Gear	185-003-5	1	71	Hex Nut	12-120-6C	8
35	Speed Changer	185-006-A	1	72	Lock Nut	12-159-4C	2
36	Speed Changer Rod	185-006-B	1	73	Lock Nut	12-159-6C	1
37	Tachometer Sensor Bracket	185-006-C	1	74	Lock Nut	12-159-10C	1
38	Speed Changer Linkage	185-006-D	1	75	ACME Nut	12-160-08-10P	4
39	Motor Base Plate	185-006-1	1				
40	Eccentric Bearing	12-169-24	2				
41	Malleable Nut	12-145-12	2				
42	Pillow Block Bearings	12-431-12	4				
43	Variable Speed Pulley	12-861-12	1				
44	Drive Belt	12-442-2270	1				
45	Shim Washer	12-829	2				
46	Speed Changer Pulley	12-563	1				
47	Fan Pulley Hub	12-109-12-H	1				
48	Fan Pulley	12-216-4612	1				
49	Fan Belt	12-442-2360	1				
50	Jack Shaft Pulley	12-217-1712	1				
51	Motor Pulley	12-217-3012	1				
52	*Drive Motor (Optional)	12-411-1- 1725-143T	1				
53	Tachometer Probe Sensor	12-420-1	1				
54	Tachometer	12-420-400	1				
55	Stamped Flange Bearing	12-162-B08	1				
56	Crank Handle	12-069-2	1				

*Optional: Motor Application May Vary – Contact Factory when ordering replacement motor.

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED
FORSBERGS, INC.
THIEF RIVER FALLS, MN 56701



**10-M2S PRESSURE GRAVITY
AIR CONTROL ASSEMBLY
PLATE 3**

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

AIR CONTROL ASSEMBLY

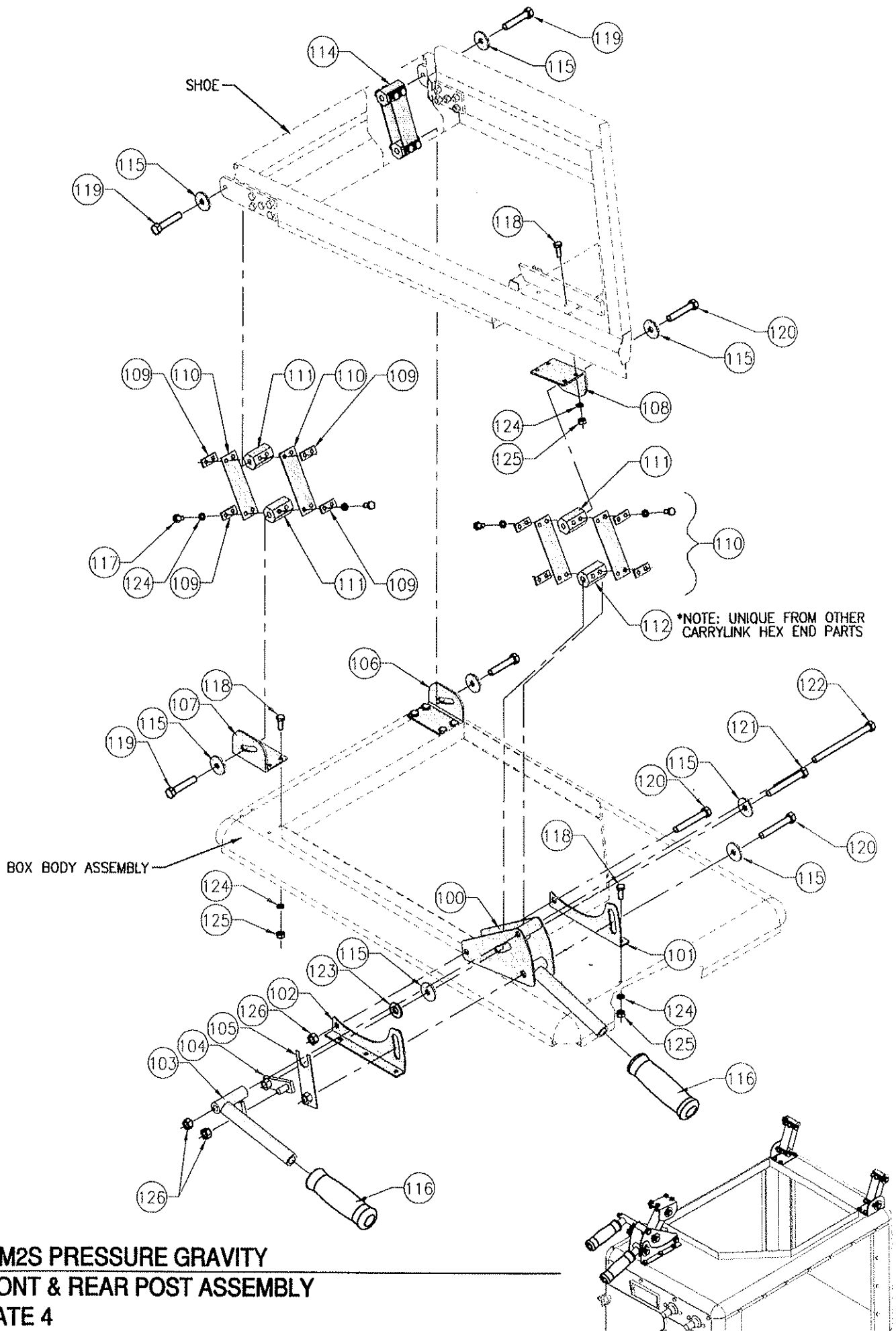
Plate 3

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
80	Fan Wheel	185-004	1
81	Fan Wheel Key	185-003-8	1
82	Air Control Rod	185-007-C	1
83	Pivot Linkage	185-007-E	1
84	Swivel Arm	185-007-3	1
85	Swivel Bracket	185-007-6	1
86	Air Damper Control Arm	185-007-4	1
87	Air Damper Linkage	185-007-D	1
88	Air Damper	185-007-B	1
89	Air Damper Rod	185-007-7	1
90	Inlet Trash Screen (Optional)	185-017	1
91	Stamped Flange Bearing	12-162-B08	1
92	Crank Handle	12-069-2	1
93	Set Collar	12-125-08	2
94	Hex Bolt	12-123-3	7
95	Lock Nut	12-159-4C	7
96	Lock Nut	12-159-6C	1
97	ACME Nut	12-160-08-10P	4

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED

FORSBERGS, INC.

THIEF RIVER FALLS, MN 56701



**10-M2S PRESSURE GRAVITY
FRONT & REAR POST ASSEMBLY
PLATE 4**

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

FRONT & REAR POST ASSEMBLY

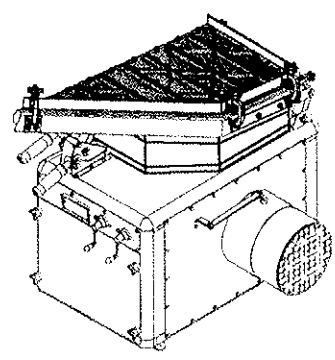
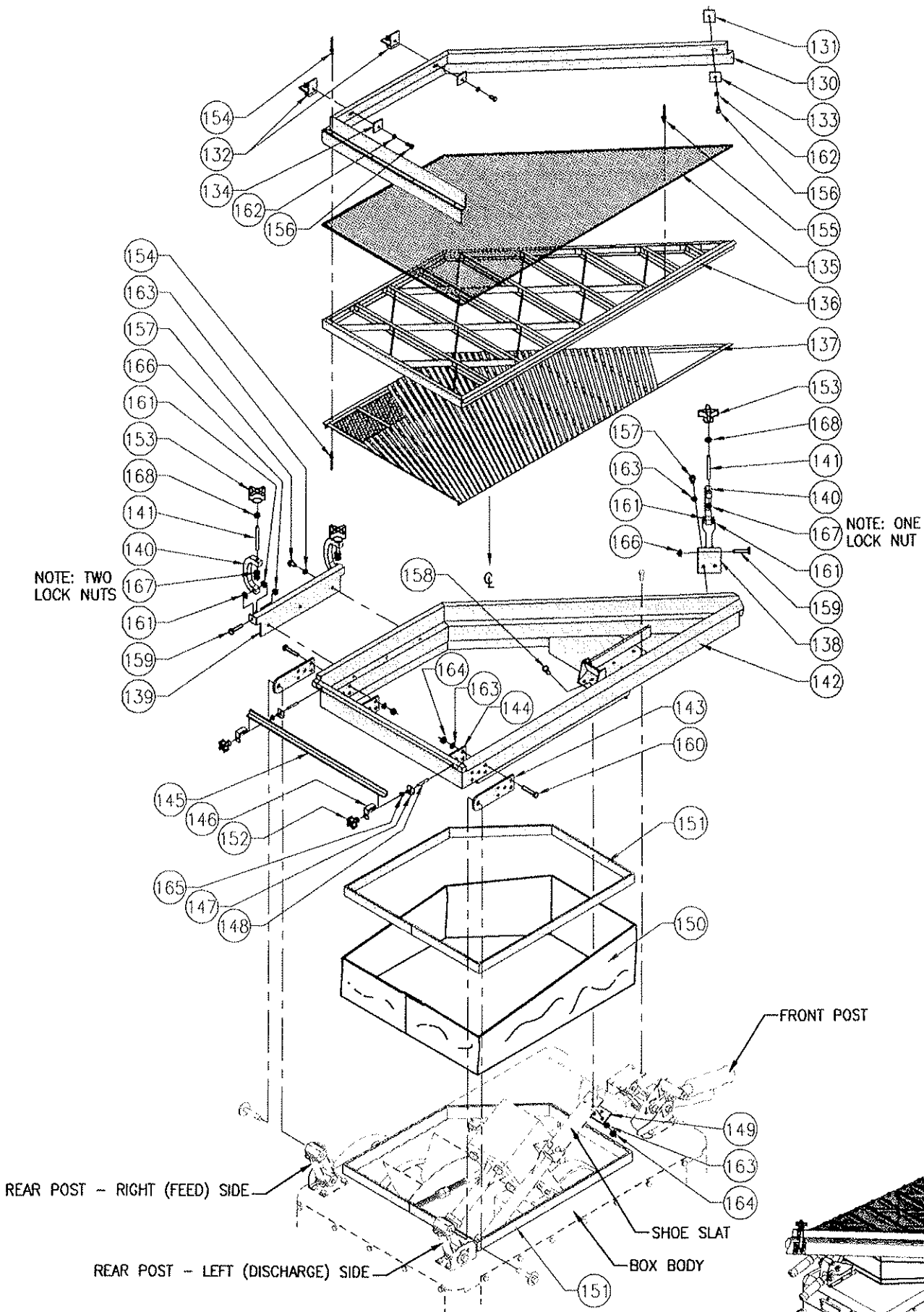
Plate 4

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
100	Elevation Control Handle	185-009-A	1
101	Front Post Lower Bracket – Right Side	185-009-1R	1
102	Front Post Lower Bracket – Left Side	185-009-1L	1
103	Pitch Control Handle	185-009-B	1
104	Pitch Control Linkage	185-009-C	1
105	Pitch Control Brace	185-009-D	1
106	Rear Post Lower Mounting Bracket – Right Side	185-010-20R	1
107	Rear Post Lower Mounting Bracket – Left Side	185-010-20L	1
108	Front Post Upper Shoe Bracket	185-009-10	1
109	Carrylink Slat Retainer	185-008-5	12
110	Carrylink Slat	185-008-15	6
111	Carrylink Ends (Rear Post & Front Post Top)	185-008-14	5
112	Carrylink End (Front Post Bottom Only)	185-008-13	1
113	Front Post Carrylink (Complete)	185-008-DF	1
114	Rear Post Carrylink (Complete)	185-008-DR	2
115	Washer	185-008-11	8
116	Bell Foam Grip Handle	12-863	2
117	Hex Bolt	12-123-1	24
118	Hex Bolt	12-123-3	18
119	Hex Bolt	12-123-59	4
120	Hex Bolt	12-123-61	3
121	Hex Bolt	12-123-63	1
122	Hex Bolt	12-123-69	1
123	Flat Washer	12-122-6	1
124	Lock Washer	12-114-4R	42
125	Hex Nut 1/4	12-120-4C	18
126	Lock Nut 3/8	12-159-6C	3

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED

FORSBERGS, INC.

THIEF RIVER FALLS, MN 56701



**10-M2S PRESSURE GRAVITY
 BELLOWS, SHOE, DECK & DECK HOLD DOWN ASSEMBLY
 PLATE 5**

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

BELLOWS, SHOE, DECK & DECK HOLD DOWN ASSEMBLY

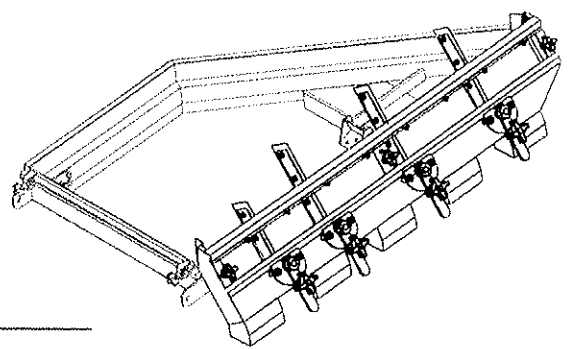
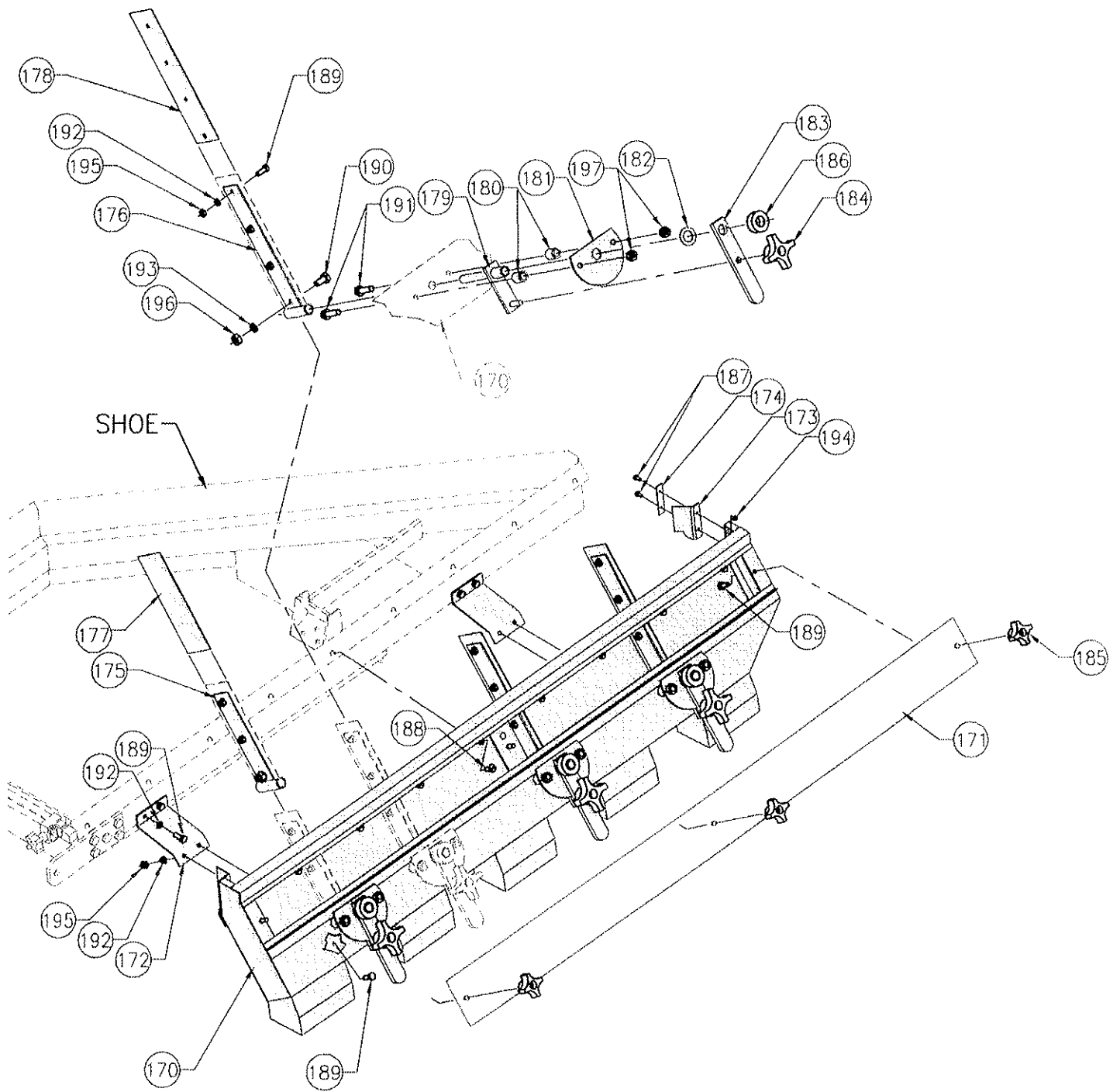
Plate 5

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
130	Deck Hold Down	185-012-E	1
131	Deck Hold Down Bracket - Front	185-013-6	1
132	Deck Hold Down Bracket - Side	185-013-C	2
133	Deck Hold Down Bracket Retainer - Front	185-013-10	1
134	Deck Hold Down Bracket Retainer - Side	185-013-9	2
135	Deck Cover – Indicate Mesh Size When Ordering	185-0124-B	1
136	Deck Grid	185-012-B	1
137	Air Baffle	185-012-A	1
138	Shoe Hold Down Bracket – Front	185-013-B	1
139	Shoe Hold Down Bracket – Side	185-013-A	1
140	Hold Down “C” Bracket	185-013-7	3
141	Hold Down Threaded Rod	185-013-8	3
142	Shoe	185-010-B	1
143	Shoe Carrylink Bracket	185-010-19	2
144	Shoe Carrylink Bracket Retainer	185-010-21	2
145	Deck Tightener Bar	185-010-22	1
146	Deck Tightener Bar Outer Bracket	185-010-15	2
147	Deck Tightener Bar Inner Bracket	185-010-14	2
148	Deck Tightener Bar Threaded Rod	185-010-23	2
149	Shoe Slat Retainer	185-008-4	1
150	Lower Bellows	185-016	1
151	Hook Velcro	12-361-72	2
152	4 Prong Knob	12-684-142	2
153	4 Prong Knob	12-684-54	3
154	Rivet	12-139-P48	22
155	Rivet	12-139-L48	31
156	Machine Screw	12-175-08	3
157	Hex Bolt	12-123-1	5
158	Hex Bolt	12-123-3	3
159	Hex Bolt	12-123-6	3
160	Hex Bolt	12-123-7	10
161	Flat Washer	12-122-3	6
162	Lock washer	12-114-3R	3
163	Lock Washer	12-114-4R	18
164	Hex Nut	12-120-4C	13
165	Hex Nut	12-184-10C	2
166	Lock Nut	12-118-4C	3
167	Lock Nut	12-159-4C	5
168	Jam Nut	12-110-4C	3

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED

FORSBERGS, INC.

THIEF RIVER FALLS, MN 56701



**10-M2S PRESSURE GRAVITY
DISCHARGE DELIVERY HOPPER ASSEMBLY
PLATE 6**

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

DISCHARGE DELIVERY HOPPER ASSEMBLY

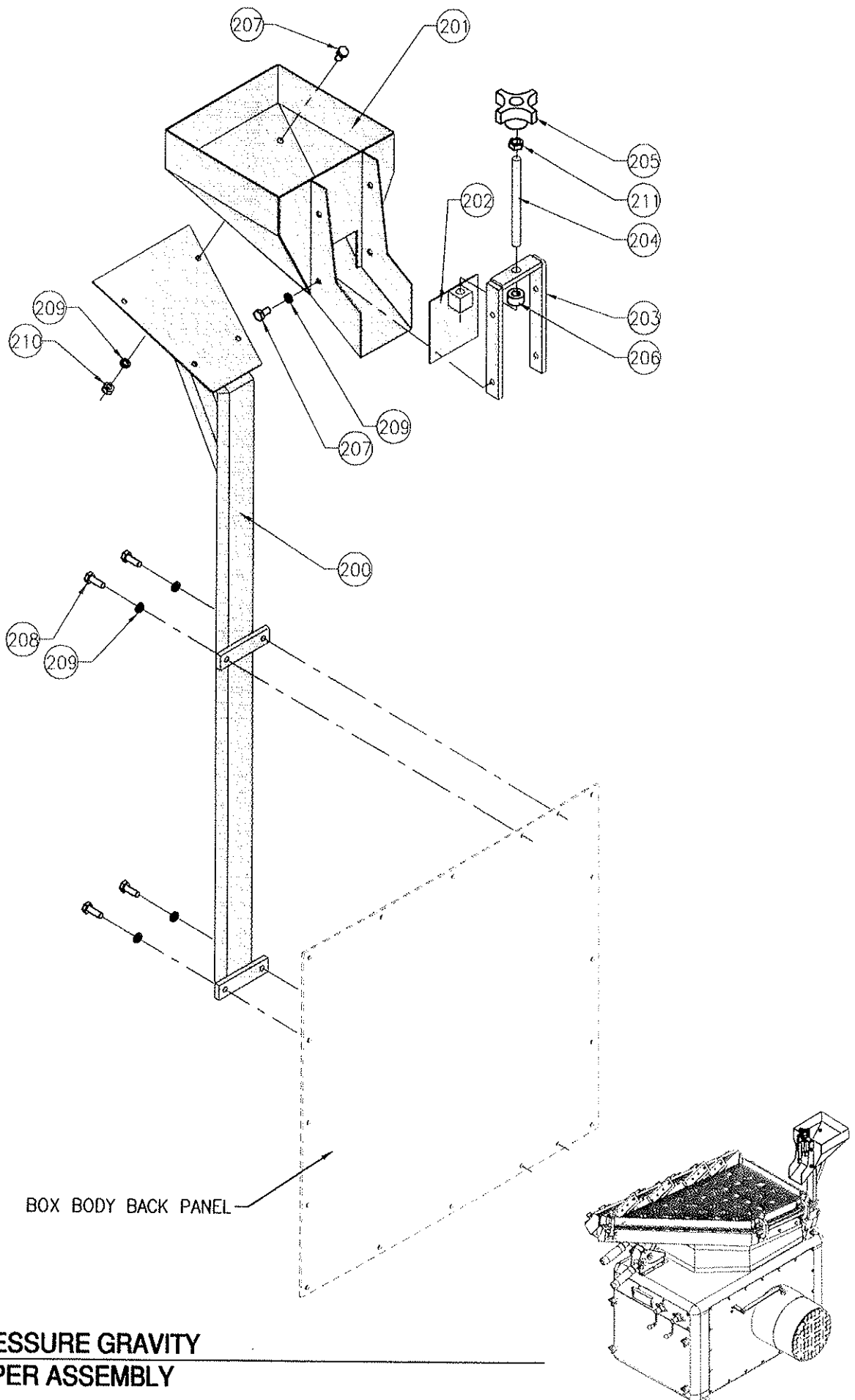
Plate 6

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
170	Delivery Hopper	185-011-A	1
171	Hopper Inspection Window	185-011-26	1
172	Delivery Hopper Mounting Bracket	185-011-27	2
173	Deck Seal	185-011-28	2
174	Deck Seal Retainer	185-011-29	2
175	Short Divider	185-011-C	1
176	Long Divider	185-011-B	3
177	Short Divider Seal	185-011-22	1
178	Long Divider Seal	185-011-23	3
179	Quadrant Control Bracket	185-011-D	4
180	Quadrant Control Spacer	185-011-19	8
181	Quadrant Control Face Plate	12-706	4
182	Quadrant Control Shim Washer	185-011-21	4
183	Quadrant Control Handle	185-011-14	4
184	Four Prong Knob	12-684-54	4
185	Four Prong Knob	12-684-655	3
186	Set Collar	12-125-06	4
187	Machine Screw	12-439-0632-08	4
188	Machine Screw	12-258-06-08	9
189	Machine Screw	12-175-08	22
190	Hex Bolt	12-123-1	4
191	Hex Bolt	12-123-5	8
192	Lock Washer	12-114-3R	19
193	Lock Washer	12-114-4R	4
194	Hex Nut	12-184-6C	4
195	Hex Nut	12-120-3C	15
196	Hex Nut	12-120-4C	4
197	Lock Nut	12-159-4C	8

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED

FORSBERGS, INC.

THIEF RIVER FALLS, MN 56701



**10-M2S PRESSURE GRAVITY
FEED HOPPER ASSEMBLY
PLATE 7**

FORSBERG MODEL 10-M2S PRESSURE GRAVITY

FEED HOPPER ASSEMBLY

Plate 7

<u>ITEM NO.</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QTY.</u>
200	Feed Hopper Post	185-014-A	1
201	Feed Hopper Bin	185-015-A	1
202	Door	185-015-C	1
203	Door Bracket	185-015-B	1
204	Door Rod	185-015-9	1
205	Four Prong Knob	12-684-87	1
206	Set Collar	12-125-06	1
207	Hex Bolt	12-123-1	6
208	Hex Bolt	12-123-3	4
209	Lock Washer	12-114-4R	10
210	Hex Nut	12-120-4C	4
211	Jam Nut	12-110-6C	1

WHEN ORDERING PARTS, SERIAL NUMBER OF MACHINE MUST BE INCLUDED
FORSBERGS, INC.
THIEF RIVER FALLS, MN 56701

DAMAGE CLAIMS AND WARRANTY

A. Damage Claims

1. Thoroughly examine the enclosure as soon as it is received. If damaged, write on the face of the freight bill a complete and detailed description of the damage. Have the carrier's agent sign the description.
2. Immediately notify the delivering carrier of the damage or loss. This notification may be given either in person or by telephone. Written confirmation must be mailed within 48 hours. Railroads and motor carriers are understandably reluctant to make adjustments for damaged merchandise unless inspected and reported promptly.
3. Risk of loss of, or damage to merchandise remains with the buyer. It is the buyer's responsibility to file a claim with the carrier involved.
4. Immediately advise your FORSBERG representative, distributor, or the factory so that we may assist you.

B. Warranty and Conditions

1. **WARRANTY.** We Warrant that this product will be free from defects in material and workmanship for a period of one year from the date of shipment thereof or the product's total rated life, whichever first occurs. Within the warranty period we shall repair or replace such products which are returned us with shipping charges prepaid and which are determined by us to be defective. This warranty will not apply to any product which has been subject to misuse, negligence, or accident; or misapplied or modified or repaired by unauthorized persons; or improperly installed.
2. **INSPECTION.** Buyer shall inspect the product promptly after receipt and shall notify us at office in writing of any claims, including claims of breach of warranty, within thirty days after the buyer discovers or should have discovered the facts upon which the claim is based. Failure of the buyer to give written notice of a claim within the time period shall be deemed to be a waiver of such claim.
3. **DISCLAIMER.** The provisions of paragraph 1 are our sole obligation and exclude all other remedies or warranties, expressed or implied, including warranties of **MERCHANTABILITY** and **FITNESS FOR A PURPOSE**, whether or not purposes or specifications are described herein. We further disclaim any responsibility whatsoever to the customer or to any person for injury to person or damage to or loss of property or value caused by any product which has been subject to misuse, negligence, or accident; or misapplied; or modified or repaired by unauthorized persons; or improperly installed.
4. **LIMITATION OF LIABILITY.** Under no circumstances shall the company be liable for any incidental, consequential or special damages, losses, or expenses, arising from the contract for this product, or in connection with the use of, or inability to use, our product for any purpose whatsoever.

Forsbergs, Inc., P.O. Box 510, 1210 Pennington Ave., Thief River Falls, MN 56701

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