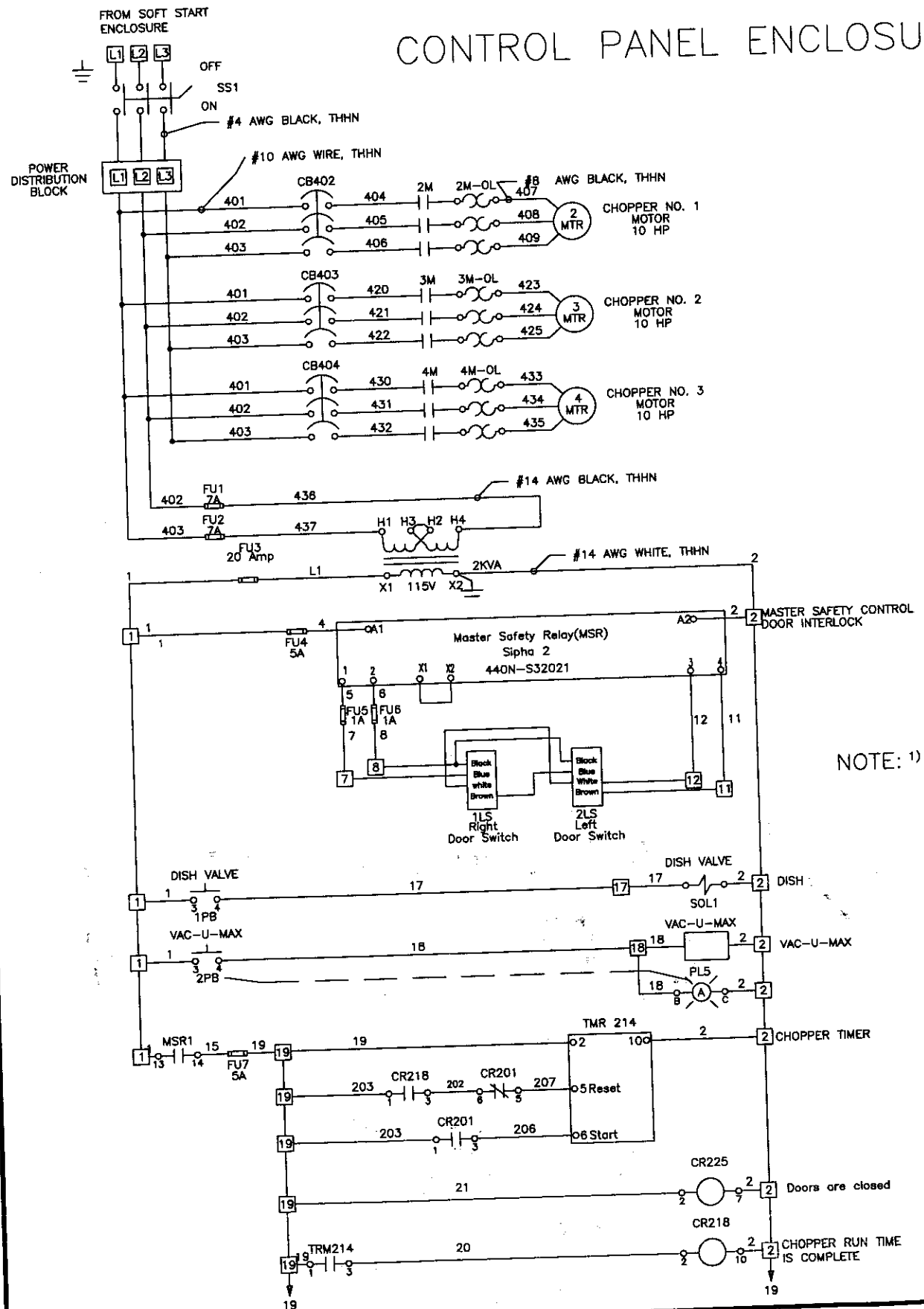
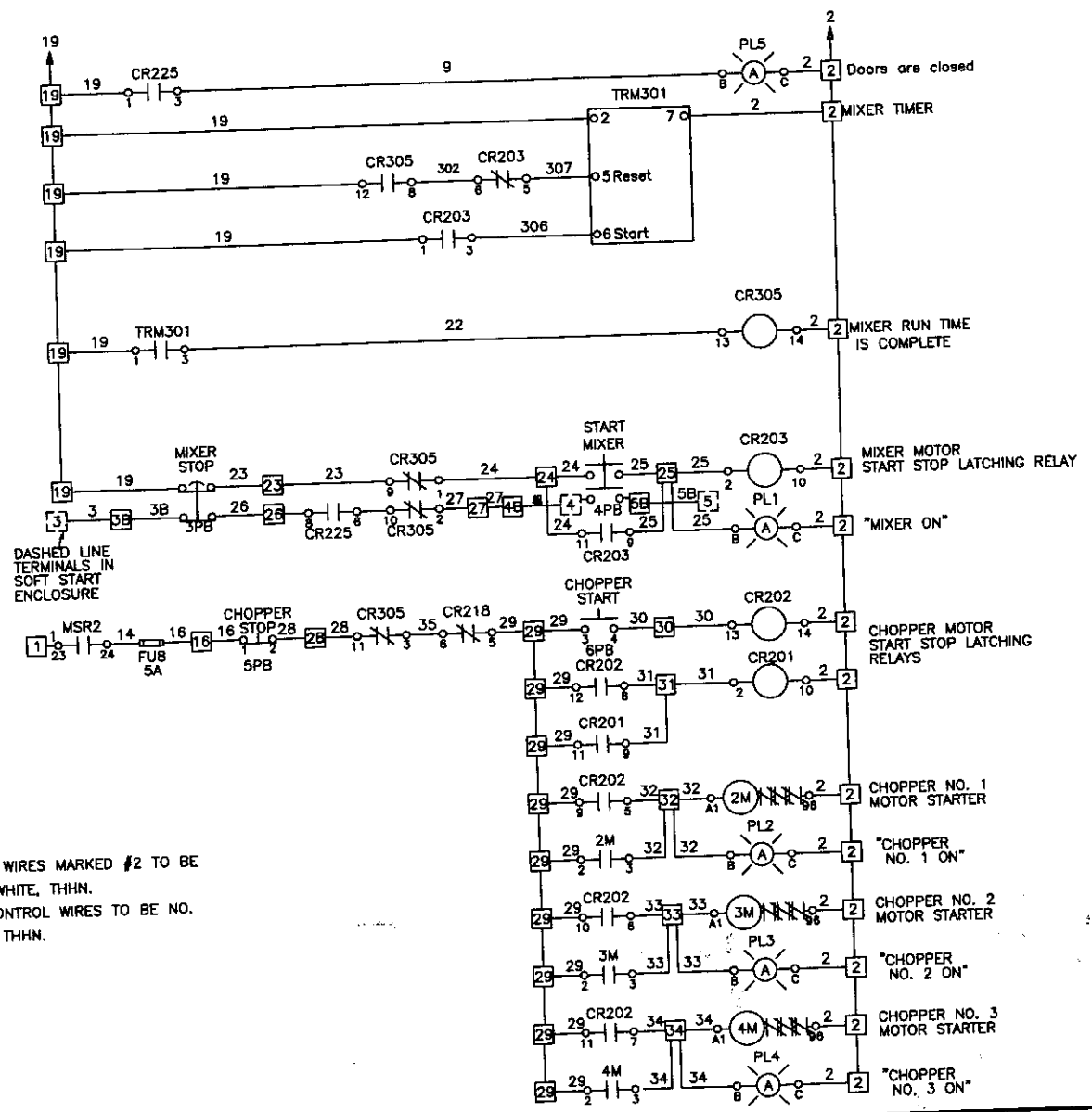
CONTROL PANEL ENCLOSURE

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTE: 1) ALL CONTROL WIRES MARKED #2 TO BE NO. 14 AWG WHITE, THHN. ALL OTHER CONTROL WIRES TO BE NO. 14 AWG RED, THHN.



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ±1/16 .XX± 0.03 ±1° .XXX± 0.015	STERIS Corporation Mentor, Ohio		
	DRAWN BY JAM DATE 1/30/03	SCOTT BLENDER ELECTRICAL SCHEMATIC	
	CHECKED BY DATE		
	APPROVED BY DATE	MATERIAL	FINISH
	REVISION DATE		COLOR
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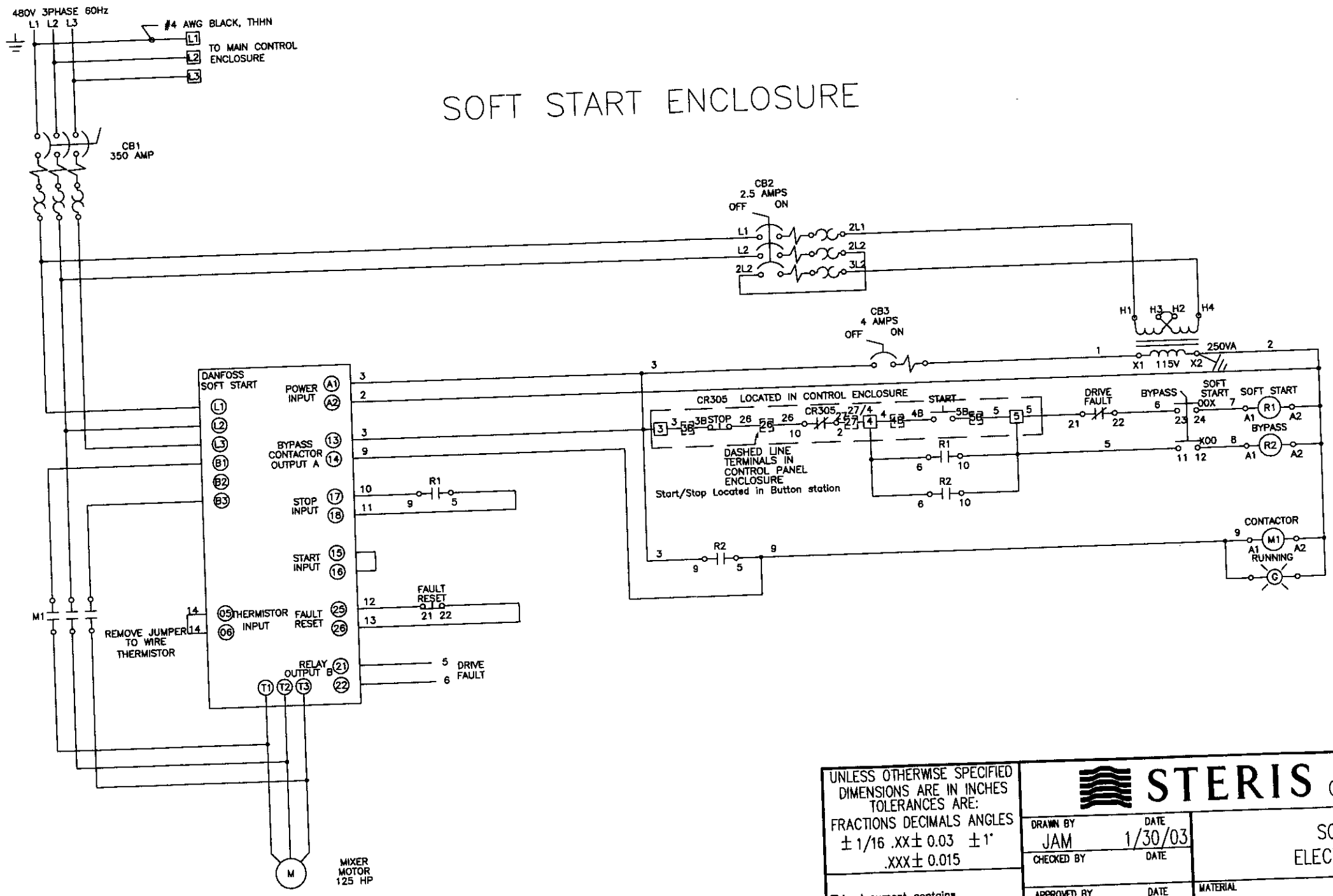
DO NOT SCALE DRAWING	SCALE 1=1		SHEET 1 OF 3

PN 800207 REV A ECO# 1927 9/27/95

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

SOFT START ENCLOSURE



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ±1/16 .XX± 0.03 ±1° .XXX± 0.015	STERIS Corporation Mentor, Ohio		
	DRAWN BY JAM DATE 1/30/03	SCOTT BLENDER ELECTRICAL SCHEMATIC	
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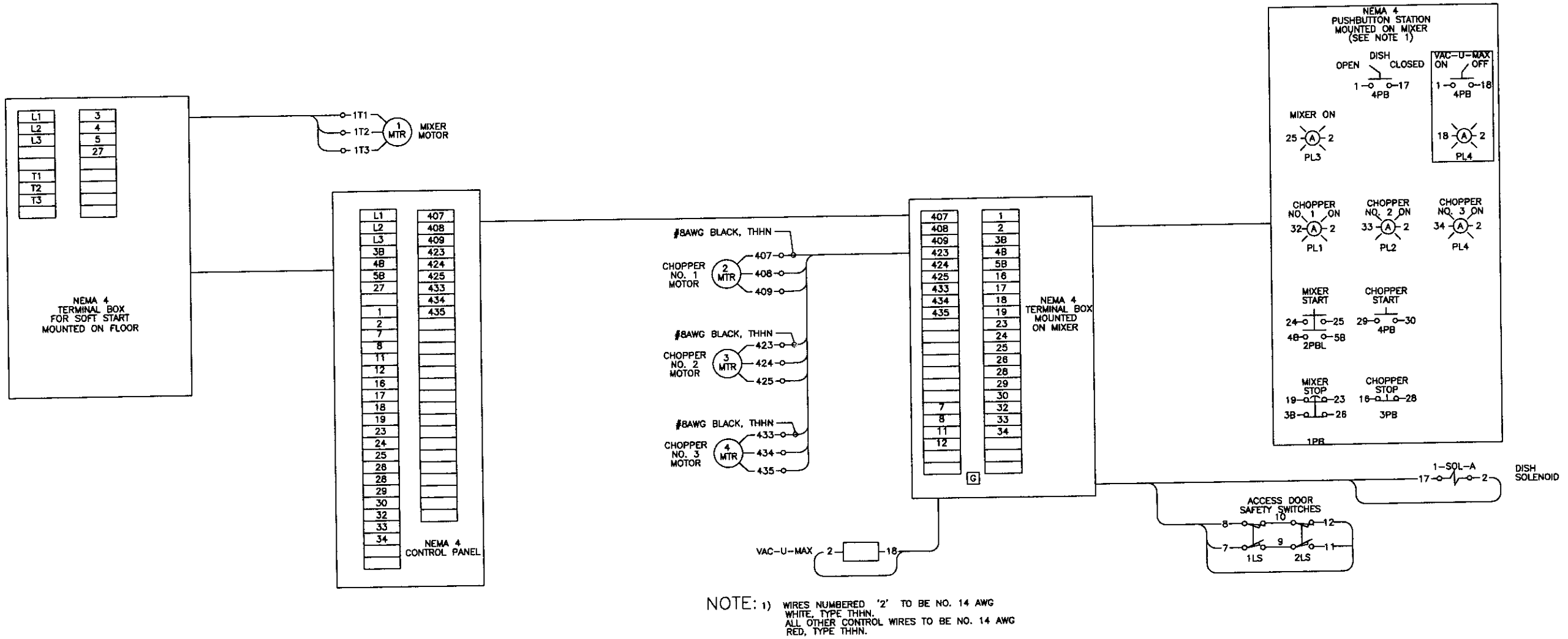
DO NOT SCALE DRAWING	SCALE 1=1		SHEET 2 OF 3

PN 800207 REV A ECO# 1927 9/27/95

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTE: 1) WIRES NUMBERED '2' TO BE NO. 14 AWG WHITE, TYPE THHN. ALL OTHER CONTROL WIRES TO BE NO. 14 AWG RED, TYPE THHN.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ±1/16 .XX± 0.03 ±1° .XXX± 0.015	STERIS Corporation Mentor, Ohio	
	DRAWN BY JAM DATE 1/30/03	SCOTT BLENDER ELECTRICAL SCHEMATIC
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DO NOT SCALE DRAWING	SCALE 1=1	SHEET 3 OF 3

PN 800207 REV A ECO# 1927 9/27/95

5. Fill Fluid Coupling

A. Rotate fluid coupling until fill plug is on top and remove it, (Both fill and drain plugs have metric threads). Either plug may be used to fill coupling except for Size 320 which must use plug nearest sheave.

B. Fill with the required amount of fluid shown on the orange label on the fluid coupling perimeter. Fluid must meet the specifications listed on Page 1. Do not remove the fluid fill label, refer to Factory if label is missing.

C. Before reinstalling fill plug, check fill angle as described in the following step.

6. Check Fill Angle

A. Refer to fluid fill label described in the previous step for required fill angle.

B. Use either a Falk Angle Finder or a bevel protractor with spirit level set for the required fill angle, and place it on flat boss of filler hole as shown in Figure 8.

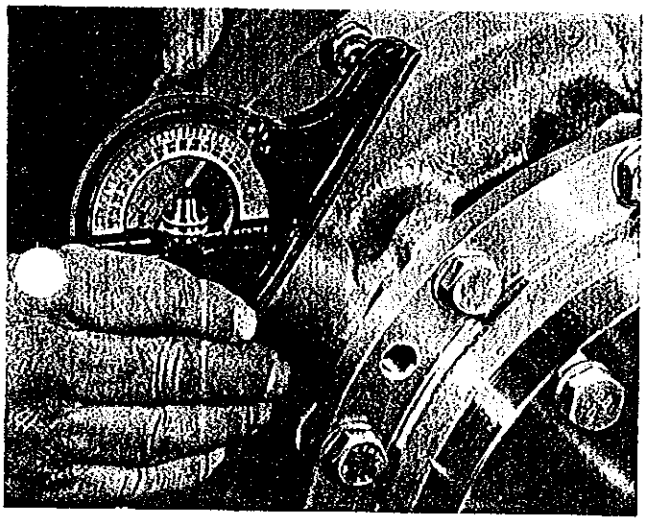

Figure 8

C. Slowly rotate fluid coupling until the required fill angle is achieved, Figure 9. Fluid must appear at the lip of the hole. Add or drain fluid until level is correct. Figure 10 shows fill angle range.

D. Reinstall fill plug with seal ring and tighten to required torque: Sizes 185-270, 22 lb-ft; Sizes 320-420, 33 lb-ft.

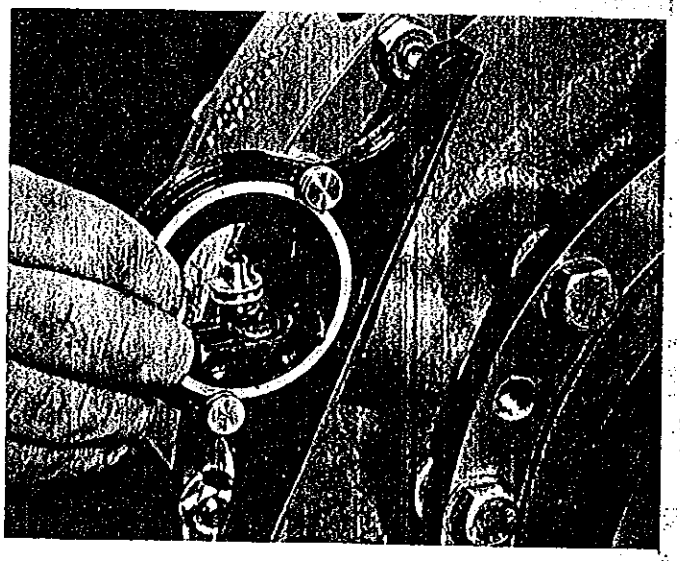

Figure 9

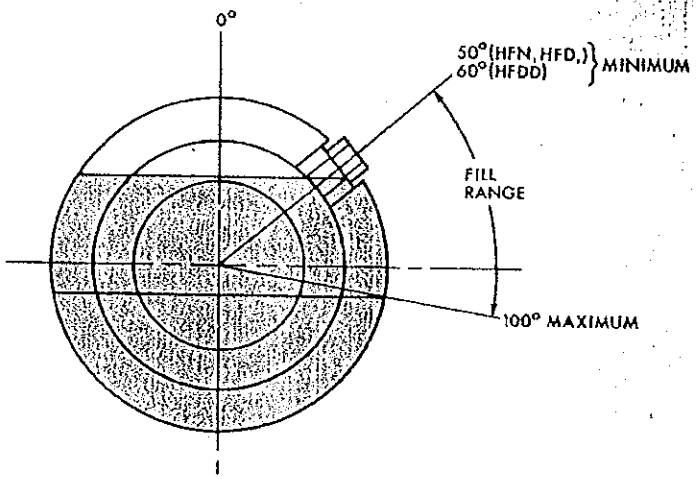

Figure 10

The Falk Corp., subsidiary of Sundstrand Corp.
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-937-4114, Fax: 414-937-4359

3. Install Collet & Coupling

NOTE: Make certain belts will pass over coupling. If not; place them on sheave before assembling.

A. Install cut off key in shaft keyway and slide collet on shaft for maximum engagement. Minimum shaft engagement (Dimension SE) is listed in Table 2.

B. Support fluid coupling weight and slide coupling onto collet taper, being sure proper alignment and engagement is obtained (Figure 4). Be sure collet and key have not moved axially as this could cause the key to ride up the shaft keyway end ramp and cause runout and vibration. Continue to support fluid coupling through steps C & D.

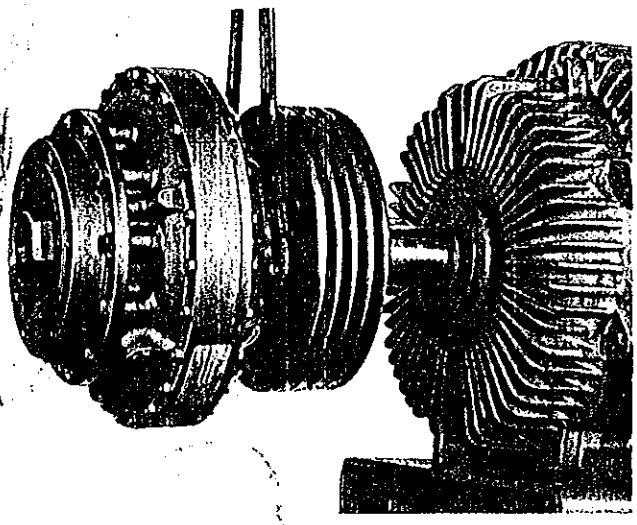

Figure 4

C. Insert collet draw bolt with locking and flat washers through hole in input shaft and thread into tapped hole in collet.

D. Hold input shaft using wrench flats illustrated in Figure 5, and tighten fastener to torque specified in Table 2.

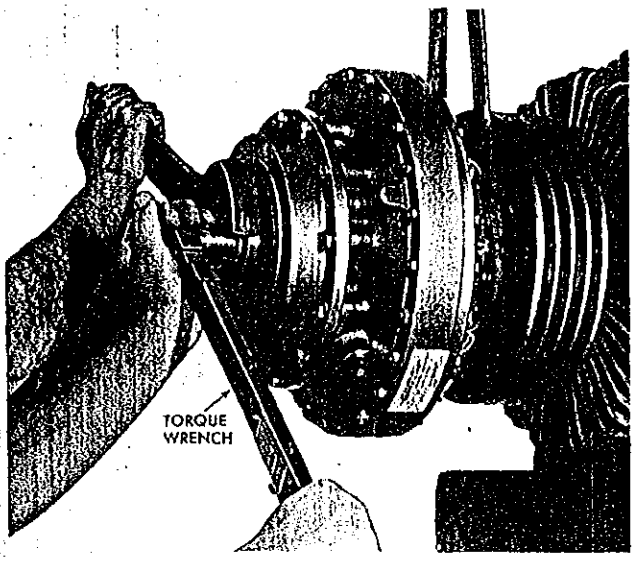

Figure 5

CAUTION: Make certain there is enough clearance between sheave fasteners and driving or driven equipment, Figure 6.

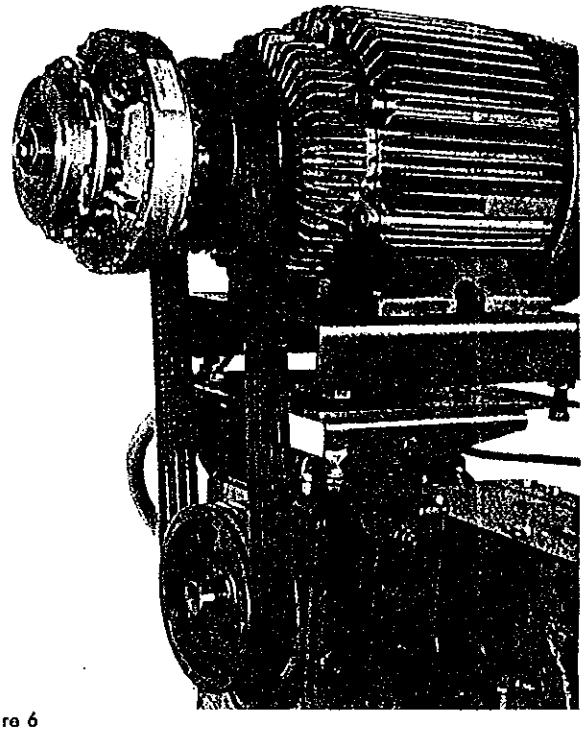

Figure 6

4. Sheave Connection

A. Mount couplings and sheaves as close to drive or motor housing as possible to avoid undue bearing load or shaft deflection.

B. Align sheaves square and parallel by placing a straight edge across the face of the sheaves, Figure 7.

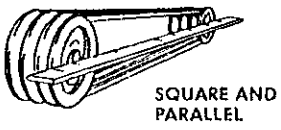

Figure 7

C. Use matched belt sets to prevent belt whip and to provide uniform tension. Adjust belt tension. The ideal tension is the lowest tension at which the belt will not slip under peak load conditions. Check the belt tension frequently during the first 24 to 48 hours of run-in operation. Over tightening belts will shorten belt and bearing life. Keep belts free from foreign material which may cause slippage. Inspect the V-belt drive periodically; retension the belts if they are slipping.

Annual Maintenance

For extreme or unusual operating conditions, check coupling more frequently.

Check fluid annually or more often if it is subject to overheating. Overheated fluid which becomes dark in color and gives off a burnt odor, must be changed. Fluid suppliers can test coupling fluid samples periodically and recommend economical change periods based on the rate of degradation. Continuous operating temperature must not exceed 212°F (100°C).

Lifting

Install sheave as instructed in Step 1 and sling between coupling and sheave using a complete wrap as shown in Figure 2.

CAUTION: Depending upon sheave size the balance will change. Ensure proper balance before lifting.

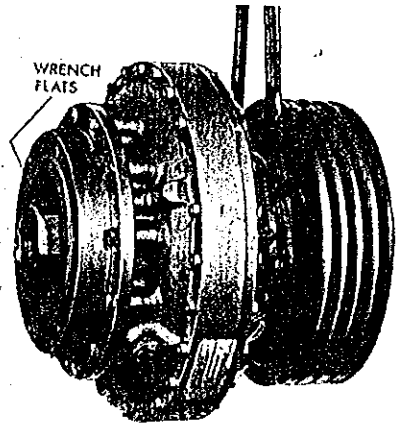

Figure 2

Installation

Only standard mechanics tools, torque wrenches, feeler gauges, straight edges and a bevel protractor with spirit level or Falk Angle Finder are required to install Falk fluid couplings.

1. Install Fluid Coupling

A. Check taper bore in sheave and taper fit on sheave adapter for nicks or burrs.

B. Clean surfaces with a non-flammable solvent.

C. Assemble sheave with fasteners and lockwashers furnished, Figure 3. Tighten fasteners evenly to torque specified in Table 2.

2. Check Collet & Cut Off Key

A. Check shaft, collet bore and taper fits for nicks and burrs.

B. Clean surfaces with a non-flammable solvent.

C. For maximum collet shaft engagement, cut off key per the following instructions:

Type HF41 — Cut motor shaft key to length "L" specified in Table 2. NOTE: Maximum bore collets require flat keys. Dimensions for flat keys are listed in Table 2.

Type HF42 — Assemble collet on driven shaft for maximum engagement without key. Measure length of straight part of collet shaft keyway that is available and cut key to that length.

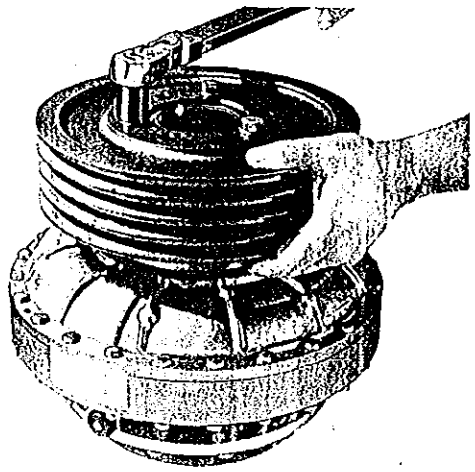

Figure 3

TABLE 2 — Fasteners & Tightening Torque (Dimensions – Inches)

Cplg. Size	Torque (lb-ft)		Removal Bolt UNC Dia x Lgth	SE (Min.)	Type HF41 Only			
	Collet Draw Bolt	Sheave Fasteners			Motor Shaft Size	Key Size		
						Width	Height	Length
185	5-6	9	1/2-13 x 4.00	2.00	.875 1.125 ★	.187 .250	.187 .187	.875 1.125
235	18-20	15	3/4-10 x 5.00	2.50	1.125 1.375 ★	.250 .312	.250 .250	1.125 1.250
270	32-35	30	7/8-9 x 3.75	2.50	1.125 1.375 1.625 1.875 ★	.250 .312 .375 .500	.250 .312 .375 .375	1.125 1.375 1.625 2.000
320	65-80	60	7/8-9 x 6.00	3.12	1.375 1.625 1.875 2.125 ★	.312 .375 .500 .500	.312 .375 .500 .375	1.375 1.625 2.000 2.000
370	130-145	60	1-8 x 6.50	3.75	1.625 1.875 2.125 2.375 ★	.375 .500 .500 .625	.375 .500 .500 .437	1.625 2.000 2.000 2.500
420	200-220	28	1 1/8-7 x 9.50	4.38	1.875 2.125 2.375 2.875 3.375 ★	.500 .500 .625 .750 .875	.500 .500 .625 .750 .625	2.000 2.000 2.500 3.000 4.500

★ Rectangular key required with maximum bore collet.

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How to Use This Manual

This manual applies to standard Types HF41 & 42 couplings.

Sizes 185 thru 370 utilize a QD type sheave assembly (sheave not furnished). The adapter is furnished and assembled by Falk. The collet, sheave fasteners, draw bolt and washers are furnished unassembled.

Sizes 420 and 1420 utilize an integral sheave that is manufactured and assembled at Falk.

This manual provides detailed instructions on installation, maintenance and parts identification. Use the following Table of Contents to locate required information.

Table of Contents

CAREFULLY FOLLOW THE INSTRUCTIONS IN THIS MANUAL FOR OPTIMUM PERFORMANCE AND TROUBLE FREE SERVICE.

Introduction

Type HF couplings are designed for horizontal operation. Refer to Factory for coupling operation other than horizontal. The Type HF41 coupling is designed for mounting on the driving shaft and the Type HF42 coupling is designed for mounting on the driven shaft. Internal construction of these couplings are different and their mounting positions are NOT interchangeable.

Maximize Performance & Life

The performance and life of couplings depend largely upon how you install and maintain them. Before installing couplings, make certain that foundations of equipment to be connected meet manufacturers' requirements. Check for soft foot. The use of stainless steel shims is recommended.

WARNING: Lock out power source and remove external loads from drive before servicing drive or accessories.

WARNING: When opening the drain or filler plug of a warm or hot fluid coupling, place a rag over the drain or filler plug hole and loosen the plug slowly to relieve any internal pressure.

WARNING: Consult applicable local and national safety codes for proper guarding of rotating members. Guard must not restrict free flow of air, but the portion of the guard in line with fusible plugs must be solid construction.

CAUTION: DO NOT PAINT fluid coupling. Painting will reduce fluid coupling thermal heat dissipation characteristics.

Driven equipment must be level.

Identification:

Size and Type are stamped on coupling perimeter. Refer to Factory for replacement parts.

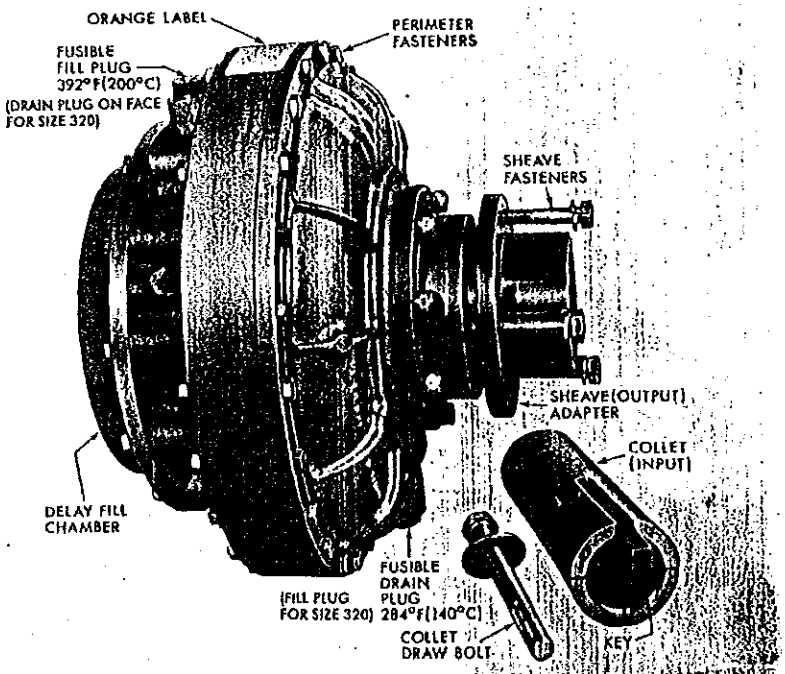

Figure 1

Fluids

The following specifications and fluids listed in Table 1 apply to Falk fluid couplings. Refer to Factory for use of fire resistant fluids. NOTE: Fluids listed are typical products ONLY and should not be construed as exclusive recommendations.

ISO Viscosity Grade — 46

Viscosity at 104°F (40°C) — 46 cSt (215 SSU)

Viscosity Index — 105

Pour Point — Must be 5°F (3°C) lower than minimum starting temperature.

Flash Point — 400°F (204°C)

Specific Gravity — 0.87

Antioxidant and Antifoaming Additives

TABLE 1 — Fluids & Operating Temperatures

Manufacturer	Operating Temperature Greater Than:		
	20°F (–7°C)	–20°F (–29°C)	–50°F (–46°C)
Amoco Oil Co.	American Ind. Oil 46	American Ind. Oil 46	...
Exxon Co., USA	Teresstic 46	...	...
Gulf Oil Corp.	Harmony 46	...	...
Mobil Oil Corp.	DTE Medium	Mobilfluid 423	SHC 624
Shell Oil Co.	Tellus 46	...	...
Texaco Inc.	Rando 46	Rando 46	...
Texaco Canada	Regal R&O 46	...	...
Union Oil Co. of CA	Unax VG 46	Unax VG 46	...

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Assembly • Lubrication • Maintenance

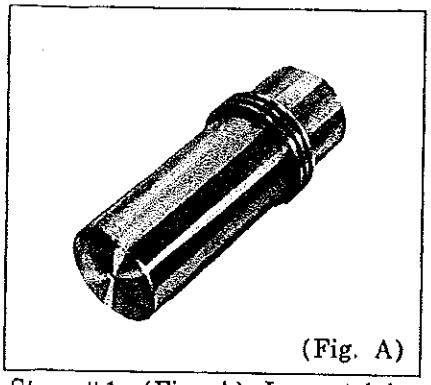
Miether Miether Bearing Products Inc. *An Alco Industries Company*

8720 N. County Road West • Odessa, Texas 79764 • 915/366-3838 • 800/ M-I-E-T-H-E-R
800/ 6 4 3-8 4 3 7

Telefax 915/363-8211

ASSEMBLY INSTRUCTIONS FOR SPHERICAL ROLLER BEARING (ADAPTER MOUNTING)

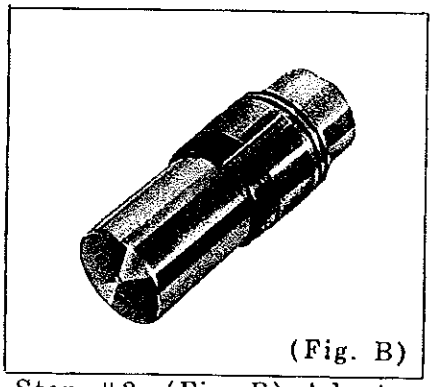
Note: Leave bearing in protective wrapping until you are ready to install it on the shaft . . . do not remove slushing compound, it protects the bearing and will mix with any lubricant you choose.



(Fig. A)

Step #1. (Fig. A) Inner triple seal

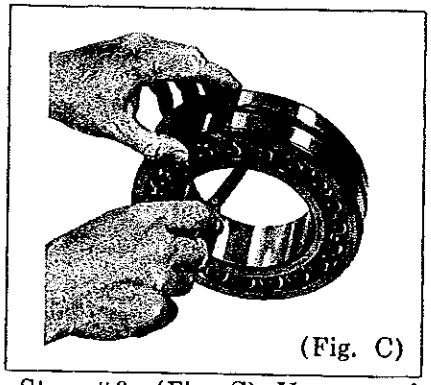
Slide inner triple seal onto shaft. This seal slides freely into position.



(Fig. B)

Step #2. (Fig. B) Adapter Sleeve

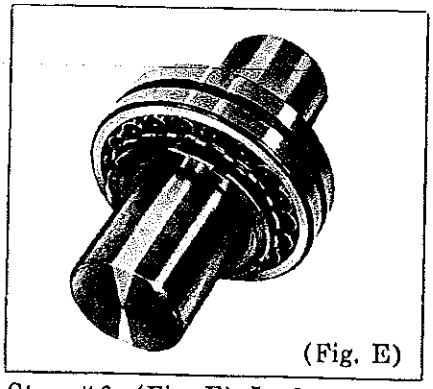
Slide adapter sleeve onto shaft with threads to outside. Locate sleeve where bearing centerline will be. Bearing will be easier to mount and remove if you put micronized or powdered (not flaked) graphite on outer diameter of sleeve.



(Fig. C)

Step #3. (Fig. C) Unmounted clearance

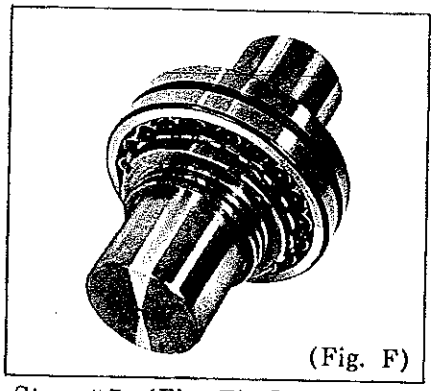
Before you put bearing on shaft determine unmounted internal clearance. Insert progressively larger feeler blades full length of roller between most vertical unloaded roller and outer bearing ring. Slide feeler blade through . . . . do not roll it. Record measurement of largest size blade that slides through. This is the unmounted internal clearance.



(Fig. E)

Step #6. (Fig. E) Locknut and Lockwasher

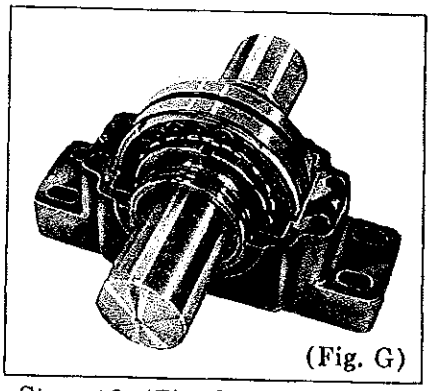
Remove locknut. Mount lockwasher on adapter sleeve with inner prong of lockwasher toward face of bearing and in slot of adapter sleeve. Re-apply locknut until tight. Do not drive bearing farther up adapter sleeve . . . . check to see that clearance has not changed (Refer to Table 1, page 6). Find lockwasher tang nearest a locknut slot. If slot is slightly past tang, don't loosen nut, tighten to meet a washer tang.



(Fig. F)

Step #7. (Fig. F) Outer triple seal

Slide outer triple seal onto shaft. Locate both inner triple seal and outer triple seal to match labyrinths in base section of housing.



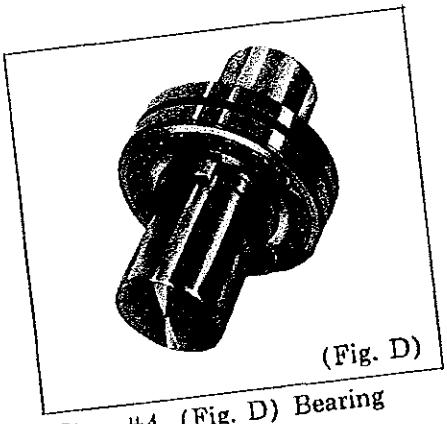
(Fig. G)

Step #8. (Fig. G) Lower half of housing

Remove any paint or burrs from the mating surfaces at the split and thoroughly clean housing. The vertical hole in the lower part of each enclosure groove must be free of any foreign matter for proper lubrication. Set lower half of housing in place and oil bearing seat. Place shaft with bearing into lower half of housing while carefully guiding triple seal rings on the shaft into enclosure grooves. Bolt fixed housing in place.

ASSEMBLY INSTRUCTIONS FOR SPHERICAL ROLLER BEARING (ADAPTER MOUNTING)

Mather

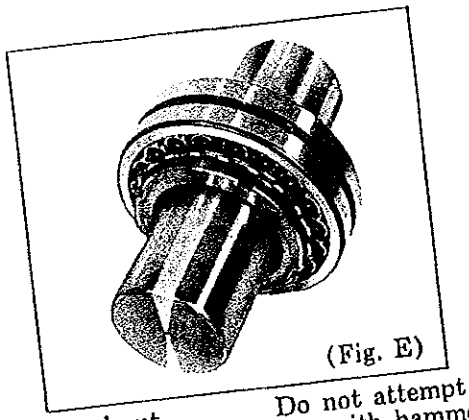


(Fig. D)

Step #4. (Fig. D) Bearing

Mount bearing on adapter sleeve, starting with large bore of inner ring to match taper of adapter. With bearing hand-tight on adapter, locate bearing to proper axial position on the shaft.

Leave lockwasher off until you have finished the next step.



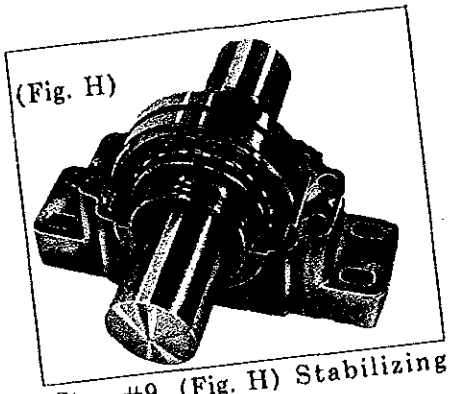
(Fig. E)

Step #5. (Fig. E) Locknut

Put locknut on with chamfered face toward bearing. A coating of graphite on face of locknut where it contacts bearing will make mounting easier.

Large size bearings will require a heavy-duty spanner wrench and extension to obtain required reduction in internal clearance.

Do not attempt to tighten locknut with hammer and drift . . . locknut will be damaged and chips can enter bearing. Tighten locknut and measure internal clearance with feeler blades between most vertical unloaded roller and outer ring until clearance is less than the figure measured in Step #3 above. Refer to tabulation on page 6 Table 1 to determine proper amount of reduction in internal clearance.



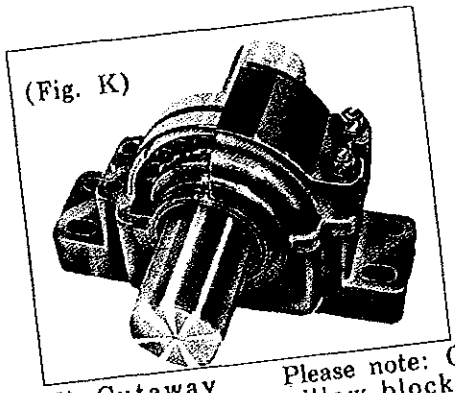
(Fig. H)

Step #9. (Fig. H) Stabilizing Ring

Move shaft axially so that stabilizing ring may be inserted between "Fixed" Bearing outer ring and housing shoulder on locknut side of bearing. Center all other bearings on one shaft in their housing seats.

Please note: There must be only one "Fixed" bearing per shaft. Other bearing(s) must be free to permit shaft expansion.

If the pillow block is to have one closed end, an end plug is supplied which fits snugly into triple seal groove. It is inserted in lower half of housing before upper half is bolted to base. If grease is used as a lubricant it should be applied to the bearing (See Lubrication notes . . . Page 8).



(Fig. K)

Step #10. (Fig. K) Cutaway illustration

Here a section of the housing has been removed to show you the position of all the parts . . . check before you put on cap to see that all parts are in their correct positions.

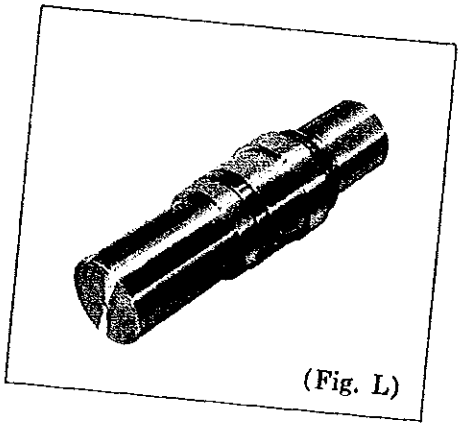
The bearing seat in the upper half of the housing (cap) should be deburred, thoroughly cleaned, oiled and placed over bearing. A sealing compound such as Permatex 2 may be used between the mating surfaces of the cap and base to eliminate lubricant leakage. The two dowel pins will align upper half of housing.

Please note: Caps and bases of pillow blocks are not interchangeable . . . each cap and base must be assembled with its mating part.

Lockwashers and capbolts are then applied and tightened to complete the assembly.

ASSEMBLY INSTRUCTIONS FOR SELF-ALIGNING ROLLER BEARING (CYLINDRICAL BORE MOUNTING)

Mieth



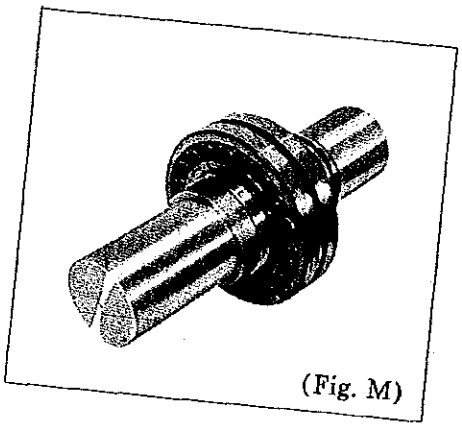
(Fig. L)

Step #1. (Fig. L) Inner triple seal—Cylindrical bore

Slide inner triple seal onto shaft. This seal slides freely into position.

Step #2. Press small bearing onto shaft.

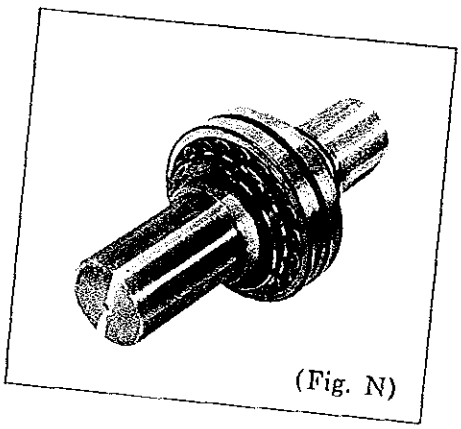
To press small bearings onto a shaft, fit clean pipe over shaft and rest it on inner bearing race. Before pressure is applied to bearing apply a coat of light oil or micronized graphite to the shaft and bearing bore. Be sure bearing is square on shaft and then apply pressure with an arbor press.



(Fig. M)

Step #3. (Fig. M) Bearing with cylindrical bore

To mount larger bearings that are not easily pressed onto a shaft, heat bearing in clean oil to a maximum of 200° F for approximately 15 minutes. Be sure to place supports under bearing to isolate it from bottom of container and prevent overheating the bearing. Mount bearing on shaft firmly against shaft shoulder. Quickly follow through with steps #4 and #5 to prevent bearing's drawing away from its proper position against shaft shoulder.



(Fig. N)

Step #4. (Fig. N) Lockwasher

Mount lockwasher over threads on shaft with inner prong of lockwasher toward face of bearing and in slot in shaft.

Step #5. (Fig. N) Locknut on shaft

Apply locknut with the chamfered face toward the bearing. Tighten with spanner wrench until bearing firmly seated against shaft shoulder. Bend one of the lockwasher tangs into a slot in locknut. If slot is slightly past tang, don't loosen nut, tighten to meet a tang.

To complete the mounting proceed with Steps 7 through 10 as for Adapter mountings.

ASSEMBLY INSTRUCTIONS FOR ONE-PIECE BLOCKS WITH SELF-ALIGNING SPHERICAL ROLLER BEARINGS

Note: Leave bearing in package until ready to assemble. Gather all necessary parts and tools before starting. Clean all parts except bearing. Leave slushing compound on bearing (it will mix with any lubricant you choose). Remove shipping plugs and install lubrication fittings in pillow block.

Step #1: Check shaft for nicks and burrs, correct if necessary and apply a light coat of machine oil. Clean threads of adapter and locknut with stiff brush and apply light coat of lubricant.

Step #2: Bench check unmounted internal clearance of bearing. (See Page 6, Table 1.)

Step #3: Slide inboard end cap and housing body on shaft if space permits; if not, slide inboard end cap on shaft. Mount bearing on adapter with small bore end next to adapter thread. Place lockwasher (used with small bearings only) against bearing with inner prong of lockwasher toward bearing and slot of adapter.

Step #4: Screw locknut on adapter until it contacts the bearing. Do not tighten beyond contact. Slide adapter and bearing, with locknut outboard, onto shaft and locate to correct position on shaft. Tighten locknut on adapter. For large locknuts use a heavy duty spanner wrench and extension. Check bearing internal clearance at intervals during tightening until correct amount of clearance remains. (See Page 6, Table 1.) Peen one tang of lockwasher into one slot of the locknut. On larger bearings: bolt lockplate with tab in adapter slot to face of locknut. Lockwire heads of capscrews.

Step #5: Slide housing body over bearing assembly. Slide outboard end cap onto shaft. Bolt inboard and outboard end caps to housing body.

On closed end pillow blocks the shaft should not extend more than 1/8" beyond bearing locknut to avoid rubbing against end cap.

Use only fixed bearing per shaft.

Bearing may be lubricated with either grease or oil bath. Bearing cavity should be approximately one-half full of grease or filled to the center line of the lowest rollers when oil bath is used. Pillow blocks can also be supplied for air-oil mist or circulating oil.

Cylindrical Mount. Follow same procedures as for adapter mount.

FEATURES OF THE SOLID HOUSING PILLOW BLOCKS

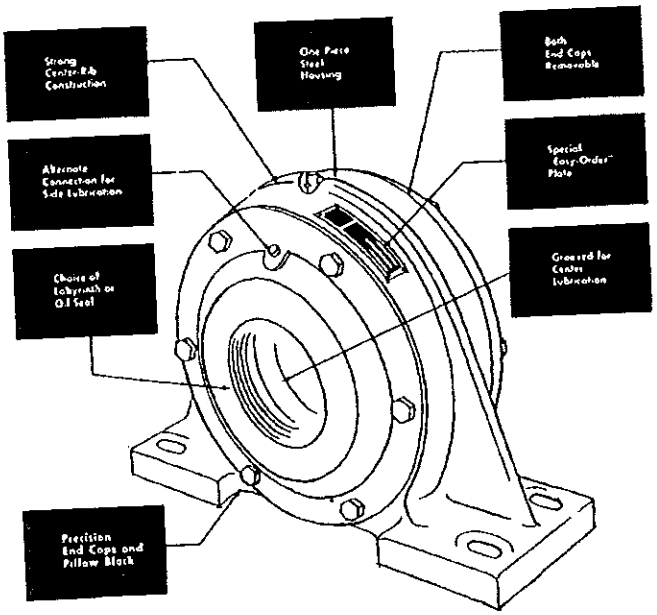


TABLE 1. Recommendation for Mounting a Spherical Roller Bearing on a Tapered Seat

Bearing Bore mm		Decrease in Internal Clearance Inches	Bearing Bore mm		Decrease in Internal Clearance Inches
Over	Incl		Over	Incl	
40	65	.0010	250	315	.005
65	100	.0015	315	355	.006
100	120	.0020	355	400	.007
120	140	.0025	400	500	.008
140	180	.0030	500	560	.009
180	200	.0035	560	630	.010
200	225	.0040	630	710	.012
225	250	.0045	710	800	.013
			800	900	.014

Note: The axial displacement of the bearing is approximately 15 times the clearance decrease.

TABLE 2.
Shaft Tolerance Limits for Pillow Block Mountings

Nominal Diameter Inches		Diameter Tolerance Limits Inches	
Over	Including	S-1	S-2 & S-3
½	1	+.000 —.001	+.000 —.001
1	2	+.000 —.002	+.000 —.002
2	4	+.000 —.003	+.000 —.003
4	6	+.000 —.004	+.000 —.004
6	10	+.000 —.004	+.000 —.004
10	15	+.000 —.005	+.000 —.005
15 UP		+.000 —.005	+.000 —.005

The selection of the proper type of lubricant and lubrication system for spherical roller bearing pillow blocks is based on a combination of several factors depending on operating temperature, speed and design conveniences.

GREASE LUBRICATION

Since the simplest design that will accomplish the job is usually the best design, thought should first be given to the possibility of grease lubrication. Here the factors to be considered are:

1. Operating temperature should be below 200°F.
2. Load and speed should be within the limits shown in the "Load-Capacity" tables.
3. Correct type and grade of grease should be used.
4. Correct quantity of grease should be applied.

Excess grease in a pillow block may result in high induced temperatures; therefore the quantity of grease should be kept at approximately 1/3 to 1/2 of the free air space. A re-greasing schedule based on operating conditions should be drawn up and adhered to. For general purpose applications a grade #2 sodium or lithium soap grease, will provide good service. Because of the variety of oils, bases and additives used in present day greases, it is not good practice to mix greases of different types and makes. Where contamination or other operating conditions are severe the Miether Engineering Department should be consulted.

OIL LUBRICATION

Although oil lubrication will allow roller bearings to run at speeds and temperatures higher than those permissible with grease, is essential that the following points be observed:

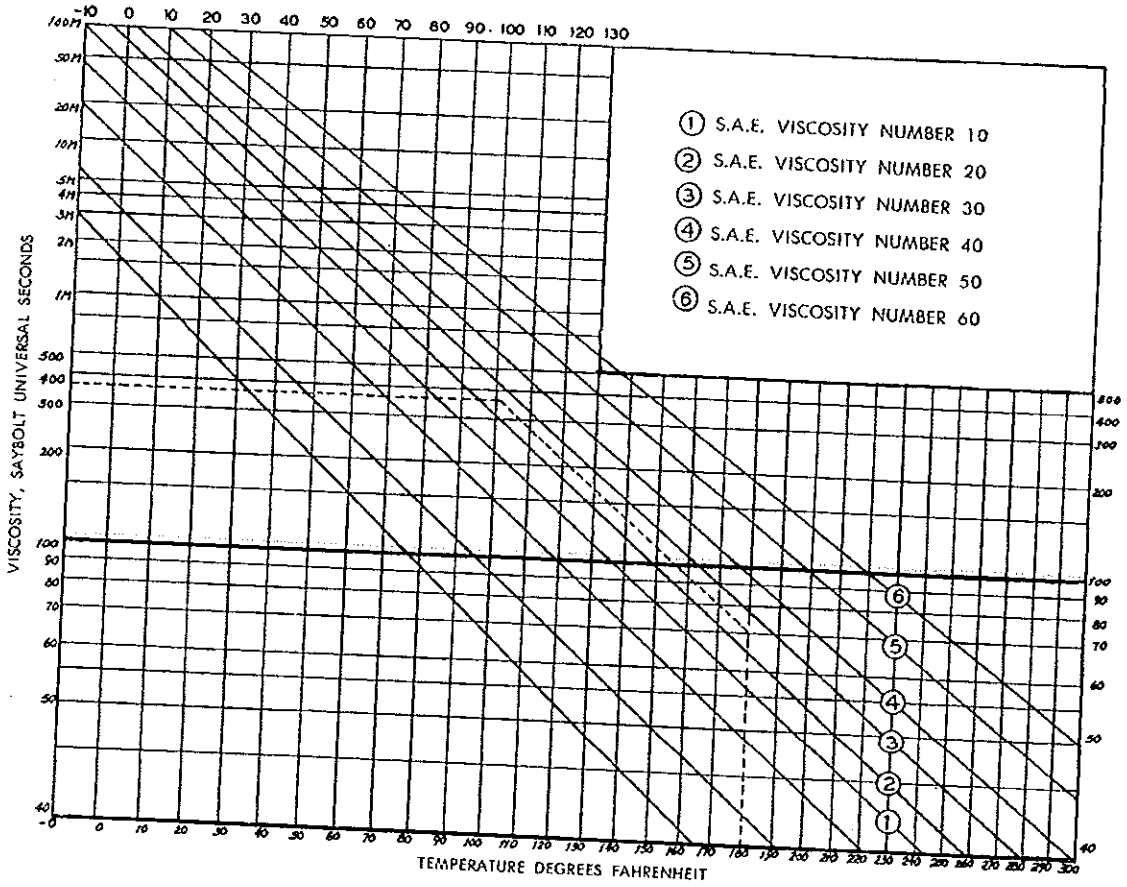
1. Only high quality petroleum oil should be used.
2. The oil should have a minimum viscosity of 100 SUS at the operating temperature.
3. The correct quantity must be applied.

Petroleum oils of poor quality, animal oils and vegetable oils tend to oxidize easily and form sludge deposits on the bearing parts. In order to provide an oil film of the correct shear strength an oil with a minimum viscosity of 100 SUS at the operating temperature should be used. As the viscosity falls below this level the bearing life will be reduced. For example, a bearing running in a fluid with a viscosity of 25 SUS may be expected to have life equal to 1% of calculated life.

The quantity of oil used in roller bearings is quite critical. Too much oil will result in churning and excess heat. Too little oil will not coat the load surfaces adequately and will result in early failures. Where a splash system is used the oil level should be maintained at the mid-point of the lowest roller when the bearing is stationary. Drop feed systems and mist systems should be adjusted on a flow versus operating temperature basis.

The Oil Selection chart on facing page may be used as a guide in selecting the proper oil viscosity. Find the operating temperature on the bottom scale then go up vertically to or past the yellow line until it intersects one of the slanted lines. For example, at 170°F we would have to go past the heavy yellow line to find the first intersecting slanted line to be number "4". Number "4" is SAE 40 oil.

The limiting speed for grease and splash oil are shown in the "Load Rating and Limiting Speed" charts. If a circulating oil system is used, a limiting speed of 150% of the grease limits is used. These limiting speeds are conservative and can be increased with experience on the specific application.



CLEANING DATA

You may have to clean bearings when they have been removed from their positions, during overhaul of equipment or to remove accumulated dirt of deteriorated lubricants.

To clean unmounted bearings use a clean petroleum solvent or kerosene. You may soak the bearings in a hot light oil (200° F max) or if you have extremely oxidized greases you may boil in an emulsifying cleaner. If compressed air is used be sure it is clean . . . do not allow the bearing to spin during blowing. After all solvents have been removed coat bearing with petroleum and reinstall in the pillow block or wrap in clean oil-proof paper while awaiting reassembly.

To clean mounted bearings flush a hot, light oil (180° to 200°) through the housing while rotating the shaft slowly. A hot aqueous emulsion may be used as a flush. When the bearing is clean remove all solvents and flush housing and bearing with a hot light oil. Relubricate with the recommended lubricant. Caution: Solvent should be lower than 200°F flash point.

INSTRUCTION MANUAL FOR DODGE® SETSCREW, ECCENTRIC COLLAR, D-LOK, H, H-E SERIES & EZ-KLEEN MOUNTED BALL BEARINGS

INSTALLATION

WARNING

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

Under certain operating conditions it is possible for a static electric charge to build-up on E-Z KLEEN® Polymer Housings. Do not operate these bearings in any environment where a sudden static discharge may cause either an operating hazard or personnel discomfort.

1. Clean shaft and bearing bore thoroughly. Measure and confirm shaft size and tolerance. File flats on shaft at setscrew locations to permit easy removal of bearing.
2. Slip bearing into position. Be sure that bearing is not on a worn section of the shaft. For tighter fits, tap inner ring face only with soft driver. DO NOT HAMMER ON HOUSING.
3. The bearing outer ring OD is spherical and swivels in the housing to accommodate misalignment. Snug hold-down bolts and use shaft to swivel each bearing until its final position is in the center of free movement top to bottom as well as side to side. Pass shaft through both bearings without forcing. This will prevent preloading of the bearings. Housing slippage depends on the mounting hold-down bolt tightening torque, number of bolts and friction characteristics between mounting surfaces. Auxiliary load carrying devices such as shear bars are advisable for side or end loading of pillow blocks and radial loads for flange units where normal to heavy loading or shock loading is encountered.
   NOTE: On coated and non-metallic housings, hold-down bolts should be tightened carefully with flat washers to prevent damage to the coating. Coated housings have reduced friction characteristics, so auxiliary load carrying devices are even more important in those applications.
4. Tighten hold-down bolts to proper torque (Table 1). Turn shaft by hand. Resistance to turning should be the same as before full tightening of hold-down bolts.
5. For setscrew mounted bearings: **After final alignment of the shaft, tighten both setscrews hand tight**, then the setscrews should be tightened alternately and in small increments to the torque specified in Table 1. After 24 hours operation, the setscrews should be retightened to the torque in Table 1 to assure full locking of the inner race to the shaft. Care should be taken that the socket key or driver is in good condition with no rounded corners and the key is fully engaged in the setscrew and held square with the setscrew to prevent rounding out of the setscrew socket when applying maximum torque. Do not drill through the setscrew holes for spot drilling of the shaft. (Some inner rings have tempered setscrew threads and can be damaged by a drill.) If spot drilling is required, locate bearings on the shaft and center punch through the setscrew hole. Remove bearing and spot drill the shaft, then reassemble over the spot drilled position and assemble as above. Milled or filed flats are preferable to spot drilling.
   NOTE: On all SC Product the setscrews can be re-torqued many times without damage to the bearing system. To achieve maximum shaft holding power it is highly recommended that setscrews be replaced with new hardware after any disassembly operation.
6. For eccentric collar mounted bearings, slide collar against cam end of inner race. Use a punch in the hole provided in the collar, tap collar smartly in the direction of shaft rotation. Tighten setscrews to proper torque (Table 1). To remove bearings, loosen setscrew and tap collar in the direction opposite of shaft rotation.
7. For D-LOK mounted bearings, be sure collar is square and tight against shoulder on inner ring. Tighten cap screw to recommended torque shown in Table 1.
8. For expansion bearings (H-E Series), locate inner unit in housing to allow expansion in the desired direction before locking to the shaft.

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

SETSCREWS					D-LOK			MOUNTING BOLTS					
		Recommended Torque						Metal Housings		EZ-KLEEN Housed Bearings			
	Key	Standard Ball Bearing Insert		Corrosion Resistant-Stainless Steel						2-Bolt PB, 2 & 4-Bolt Flg. And Flg. Brackets		Tapped-Base PB	
Setscrew Size	Hex Across Flats	Min	Max		Cap Screw Size	Recommended Torque	E-Z Kleen Recommended Torque	Bolt Size	Recommended Dry Torque (Grade 2)	Bolt Size	Torque*	Bolt Size	Torque**
(in.)	(in.)	(in-lbs.)	(in-lbs.)	(in-lbs.)	(in.)	(in-lbs.)	(in-lbs.)	(in.)	(in-lbs.)	(in.)	(in-lbs.)	(in.)	(in-lbs.)
#10	3/32	28	33	25	#8-32	58	46	3/8-16	240	3/8-16	225	3/8-16	175
1/4	1/8	66	80	60	#10-32	90	72	7/16-14	384	7/16-14	350	7/16-14	350
5/16	5/32	126	156	117	1/4-28	180	144	1/2-13	600	1/2-13	500	1/2-13	400
3/8	3/16	228	275	206	5/16-24	400	320	5/8-11	1200	9/16-12	650		
7/16	7/32	342	428	321	3/8-24	750	600	3/4-10	1950	5/8-11	1000		
								7/8-9	2890				
(mm)	(mm)	(N-m)	(N-m)	(N-m)	(mm)	(N-m)	(N-m)	(mm)	(N-m)	(mm)	(N-m)	*Torque for Austenitic (18-8) Stainless	
M5	2.5	3.2	3.7	2.8	M4	5.85	4.68	M10	29	M8	15		
M6	3	6.2	7.7	5.8	M5	10.75	8.6	M12	50	M10	25		
M8	4	14.2	17.8	13.4	M6	20.5	16.4	M16	124	M12	50	**Max. torque values published. Do not exceed.	
M10	5	26	31	23	M8	45	36	M20	238	M14	75		
M12	6	46	57	43				M22	322	M16	125		

LUBRICATION

High Speed Operation — In the higher speed ranges, too much grease will cause over-heating. The amount of grease that the bearing will take for a particular high speed application can only be determined by experience. If excess grease in the bearing causes overheating, it will be necessary to remove grease fitting to permit excess grease to escape. The bearing has been greased at the factory and is ready to run. When establishing a relubrication schedule, note that a small amount of grease at frequent intervals is preferable to a large amount at infrequent intervals.

Lubrication Guide

Use a No. 2 Lithium complex base grease or equivalent.*

Hours Run per Day	Suggested Lubrication Period in Weeks							
	1 to 250 RPM	251 to 500 RPM	501 to 750 RPM	751 to 1000 RPM	1001 to 1500 RPM	1501 to 2000 RPM	2001 to 2500 RPM	2501 to 3000 RPM
8	12	12	10	7	5	4	3	2
16	12	7	5	4	2	2	1	1
24	10	5	3	2	1	1	1	1

* For H and H-E series bearings, use Exxon Unirex N3 or equivalent suitable to 300° F.

Lubrication recommendations are intended for standard products applied in general operating conditions. For modified products, high temperature applications, and other anomalous applications contact product engineering at 864-284-5700

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Corporate Headquarters
Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Dodge and Reliance Electric Products
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2/05

IM 499498

Instruction Manual for Dodge Imperial & ISAF Bearing

These instructions must be read thoroughly before installation or operation.

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

Inspection

Inspect shaft to ensure it is smooth, straight, clean, and within commercial tolerances.

Mounting

Install the Non-Expansion unit first.

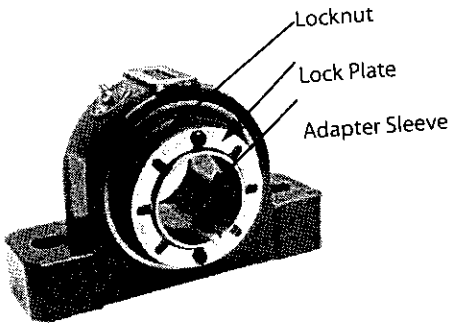

Figure 1

1. Remove lock plate located on the face of the locknut.
2. Turn locknut counter clockwise until bearing will freely slide onto the shaft.
3. Slide bearing to the desired position on the shaft.

NOTE: All Weight Must Be Removed from the Bearing When Obtaining The ZERO Reference Point".

4. The "ZERO Reference Point" is defined as the point when the clearance between the adapter sleeve, shaft and bearing bore has been removed.

   To reach the "ZERO Reference Point" rotate locknut clockwise, using both hands, as tight as possible. When mounting bearing with shaft sizes 3-13/15" and larger, the following TEST must be performed. As a test to insure you have reached the "ZERO Reference Point" tap on the O. D. of the nut with a hammer and attempt to rotate the nut using both hands. If the nut will not rotate then you have reached the "ZERO Reference Point" and you should proceed to step 5. If you can rotate the nut, using both hands, then you have not reached the true "ZERO Reference Point", and should repeat step 4A until "ZERO Reference Point" is obtained.

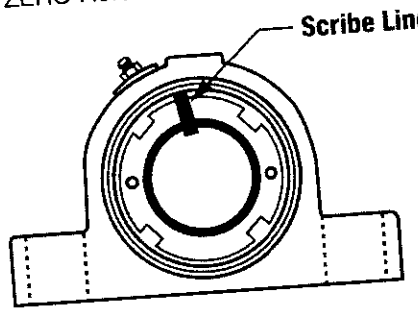

Figure 2

5. Scribe a line through the locknut face and adapter race.
6. Using a Spanner or Drift & Hammer, rotate locknut clockwise by the number of turns shown in Table 1.

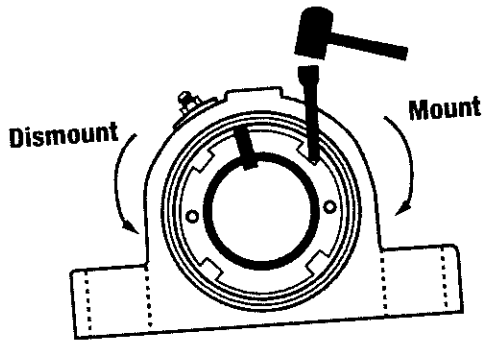

Figure 3

Table 1 - Locknut Rotation from "Zero Reference Point"

Shaft Size (inches)	Locknut Rotation
1 1/8 - 1 7/16	3/4 to 7/8 turn
* 1 1/2	3/4 to 7/8 turn
** 1 1/2	7/8 to 1 turn
1 5/8 - 2	7/8 to 1 turn
2 3/16 - 3	1 to 1 1/4 turns
3 3/16 - 4	1 1/4 to 1 1/2 turns
4 7/16 - 4 1/2	1 1/8 to 1 3/8 turns
4 15/16 - 5 1/2	1 3/8 to 1 5/8 turns
5 15/16 - 6	1 to 1 1/4 turns
6 7/16 - 7	1 1/8 to 1 3/8 turns

* IMPERIAL IP & ISAF
** IMPERIAL IP With Type E Dimensioned Housing

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DODGE®

7. Slide lock plate over shaft and align tang of lock plate with slot in adapter sleeve.
8. TIGHTEN NOT LOOSEN locknut until lock plate slots overlap the two threaded holes on the locknut face.
9. Insert and tighten button head screws to locknut face.
10. Bolt down pillow block or flange unit to the structure.

Install the Expansion Unit

1. Remove lock plate located on the face of the locknut.
2. Turn locknut counter clockwise until bearing will freely slide onto the shaft.
   A. If Locknut Facing Outboard: Align housing mounting holes with substructure mounting holes and snug bolts. Push insert as far as possible in the direction of the fixed bearing.
   B. If Locknut Facing Non-Expansion Bearing: Align housing mounting holes with substructure mounting holes and snug bolts. Position Expansion bearing insert in center of housing (Note: This is necessary because in the process of mounting, the bearing is being drawn toward the locknut.)

Note: All Weight Must be Removed from the Bearing when Obtaining the "ZERO Reference Point".

3. Follow steps 4 through 10 found under mounting of the Non-Expansion bearing.

Dismounting

1. Remove weight off bearing via slings or jacks.
2. Remove mounting bolts from bearing.
3. Remove button head screws and lock plate from locknut.
4. (Figure 3) Rotate locknut counter clockwise until bearing freely slides from the shaft.

Field Conversion of a Non-Expansion Bearing into an Expansion Bearing

Imperial IP

1. Move snap ring opposite collar side, to the outmost snap ring groove.
2. Remove Non-Expansion nameplate and re-label as an Expansion bearing.

ISAF

1. Remove bearing cap.
2. Remove stabilizing ring.
3. Reassemble cap on base and torque cap bolts to values in Table 2.

Table 2 - Cap Bolt Torque for ISAF Grade 6 Bolts

ISAF Shaft Size (inches)	2 Bolt Base		4 Bolt Base	
	Bolt Size	Torque Ft-Lbs.	Bolt Size	Torque Ft-Lbs.
1- 7/16 - 1-11/16	3/8 - 16	24 - 30		
1 - 15/16 - 2- 3/16	7/16 - 14	40 - 50		
2 -7/16 - 2 1/2	1/2 - 13	60 - 75	1/2 - 13	60 - 75
2 -11/16 - 3	5/8 - 11	120 - 150	5/8 - 11	120 - 150
3 - 3/16 - 3 1/2	3/4 - 10	208 - 260	3/4 - 10	208 - 260
3 - 11/16 - 4			3/4 - 10	208 - 260
4 - 7/16 - 4 1/2			7/8 - 9	344 - 430
4 - 15/16 - 7			1 - 8	512 - 640

Grease Lubrication

DODGE IP and ISAF bearings are pre-packed with NLGI #2 Lithium Complex grease. For re-lubrication select a grease that is compatible with a #2 Lithium Complex grease. Re-lubricate in accordance with Table 3.

Table 3 - Re-Lubrication Intervals (Months) Based on 12 hours per day, 150° F M

Shaft Size (inches)	RPM								
	250	500	750	1000	1250	1500	2000	2500	>3000
1 1/8 to 2	4	3	2	2	1	0.5	0.25	0.25	0.25
2 3/16 to 2 1/4	3.5	2.5	1.5	1	0.5	0.5	0.25	0.25	0.25
2 3/8 to 3	3	2	1.5	1	0.5	0.25	0.25	0.25	-
3 3/16 to 3 1/2	2.5	1.5	1	0.5	0.25	0.25	0.25	-	-
3 11/16 to 4 1/2	2	1.5	1	0.5	0.25	0.25	-	-	-
4 15/16 to 5 1/2	1.5	1	0.5	0.25	-	-	-	-	-
5 15/16 to 6	1	0.5	0.5	0.25	-	-	-	-	-
6 7/16 to 7	1	0.5	0.25	-	-	-	-	-	-

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World Headquarters
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Dodge Product Support
6040 Ponders Court, Greenville, SC 29615-4617 U.S.A., Ph: (1) 864.297.4800, Fax: (1) 864.281.2433

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Plow Mixer – Instruction Manual

STERIS CORPORATION
6515 HOPKINS ROAD
MENTOR, OH 44060

Job No.: 96-021

Engineer: R. BOETTCHER

Model No.: PLM4810

Serial No.: 9602009

Plow Mixer Operational Manual

Manufactured by -

SCOTT EQUIPMENT COMPANY
605 4th Ave. N. W.
New Prague, MN. 56071
Phone: #952-758-2591
Toll Free: #1-800-264-9519
Fax: #952-758-4377
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- Mineral
- Pharmaceutical
- Plastic
- Pet Food
- Rendering
- Wood

MAJOR PRODUCTS

Mixing Equipment
Horizontal Paddle Mixer
Horizontal Ribbon Mixer
Plow Mixer
Rotary Drum Mixer
Twin Shaft Batch Mixer

Blending Equipment
High Speed Turbo Blender
Minute Mix 200
Pugmill
Tender Blend Mixer

Size Reduction Equipment
ASM Fine Grinder
Dominator Crusher
Shredder-izer
Turbo Separator
Turbo Grinder

Processing Equipment
AST Dryer (patented)
Cooler

Storage
Smooth-Wall Storage Bins

SERVICES

Testing Facilities

Equipment Rental Program

On-Site Repair Service

Table Of Contents

Introduction

On behalf of Scott Equipment Company, thank you for your recent investment in the Scott product line. Superior quality and service are the backbone of Scott Equipment and we are committed to providing you with durable equipment that is *built for today to last for tomorrow.* Please contact your Scott representative (toll free: 800.264.9519 or e-mail: sales@scotteco.com) if you have any questions or comments; your satisfaction is our priority. For more information on other Scott products, please visit our website at www.scottequipment.com.

Please read this manual before working with this equipment. For personal and system safety and for optimum product performance, make sure you thoroughly understand the contents before installing, using or maintaining this product.

If questions about this product, please call Scott Equipment Company @ 1-800-264-9519 and ask for service dept.

If calling Scott Equipment, please have this information:

Serial Number: 9602009

Model Number: PLM4810

Part Description: _____

Part Number: _____

Quantity required: _____

Pre-start Up Check List

1) If your equipment is supplied with gear speed reducer make sure it is filled with the proper weight and amount of oil. (Gear boxes are shipped **without** oil from the factory.)The recommended level and types of lubricants are listed in the factory manual included in this manual. Running the machine with out oil will cause serious damage to the gearbox *that will not be covered under warranty.*

2) If your equipment is supplied with an oil fluid coupling, make sure it is filled with the proper weight and amount of oil. (Fluid couplings are shipped **without** oil from the factory.) The recommended level and types of lubricants are listed in the factory manual included in this manual. Running the machine with out oil will cause serious damage to the fluid coupling *that will not be covered under warranty.*

3) If your equipment is equipped with a chain drive and or spur gears make sure there is the proper amount of oil in the guards to lubricate the chain or gears. (See manual for proper levels.)

4) If your equipment is equipped with an air operated discharge gate make sure that the compressed air is plumbed to the cylinder correctly and that you are running sufficient air pressure to the gate. (90-110 psi is usually recommended.) A filter/regulator/lubricator is supplied with all air operated gates. Be sure this is plumbed into the air supply line and has the proper lubricating oil in it.

5) If your equipment was supplied with air purge shaft seals make sure air is supplied to each seal (having separate regulators for each seal is recommended.) We recommend 3-5 psi as a starting point for the seal pressure. This air supply may be un-lubricated.

6) Double check machine shaft rotation with the sticker on the outside of machine.

7) On some machines (mainly batch and continuous mixers) there is a short break in period. During this period the inside of the tub and the agitator will polish and become smooth and decrease the amount of drag or friction on the agitator. It may be necessary to run smaller batches until this is accomplished to keep from drawing excessive horsepower.

Safety

1. Precautions have been taken to ensure that machinery is supplied with all necessary safety guards, covers, and warning labels. However, since this equipment is often part of a larger plant process, it is the responsibility of the customer to ensure that the machinery is safely installed in the process.

2. **Always** disconnect and lockout the power before any physical inspection or work is performed.

3. Should one of the safety decals become damaged or illegible, contact Scott Equipment immediately for a replacement.

4. Under **no** circumstances should any attempt be made to override the safety equipment that is supplied on this mixer. Micro switches should never be tampered with so that the machine will operate when the covers and grates are open. If the mixer must be loaded with the cover open, safety grating with a lockout switch must be provided.

5. Under **no** circumstances should any person attempt to put their hand through the discharge of the machine. If the agitator is in operation, amputation of a limb will occur.

6. This machine should only be operated by trained personnel. Proper training includes reading and understanding this manual.

Installation:

Unloading and Placement

1. Upon receipt of machinery, please examine for any damage that may have occurred during shipment. Report damage immediately to the freight carrier and Scott Equipment.

2. Extreme care should be used when unloading and location of the machine in your plant. Do not lift from the underside or tub area. Lifting on the channel base is acceptable, if care is taken. Avoid sudden jarring or dropping. Improper handling could result in misalignment of the machine main shaft with the cylinder and end plates

Wiring

1. All wiring must be performed by a qualified electrician. If problems develop with electrical components supplied by Scott Equipment contact service personnel immediately. Repairs are not to be made without written authorization from Scott Equipment. Failure to comply with this could void the manufacturer's warranty. You will be contacted by the component manufacturer with recommended action.

2. When wiring the motors on the machine, determine that proper electrical support components are being used which match the Voltage and Amperage rating of the motors. All explosion proof motors and components should have UL listings on them. This manual includes a motor manufacturer's installation and maintenance flyer. This will list the proper wiring diagrams, voltage, phase, and frequency requirements. In addition, this information is available on the motor nameplate.

3. Problems can arise due to insufficient voltage and undersized thermal relays. Insist on wiring that is heavy enough such that voltage drop at full load will not exceed 5% of the nameplate voltage.

4. Proper motor rotation is critical. Be sure the motors are wired to rotate in the correct direction. Failure to do so could result in serious damage to the equipment.

Equipment Mounting

1. The equipment should be installed on solid footings. Failure to do so will result in unnecessary vibration. Vibration will result in extensive bearing wear and create unwarranted machinery noise.

2. Make sure all parts of the equipment are properly tightened and in good working order. Guards, pulleys, bearings, and grinding blades could have become loose in shipment. Although the equipment was inspected at the factory before shipment, components may become loose during shipment. Failure to check components could result in severe bodily harm. Please examine the machine closely before start up.

3. Check the rotation. The rotation should move the product to the discharge end of the machine. An arrow located on the drive end of the machine will indicate which direction the machine should run. Wiring diagrams for the motors are given on the motor nameplate.

Installation (continued)

Bearings

1. All bearings have been lubricated at the factory. It is important that the bearings are not over greased. Over greasing could result in bearing seal damage. Included in the manual is a list of recommended lubricants. In addition, the bearing manufacturer's recommended lubrication schedule is included.

2. Bearings should be checked periodically for excessive heat or wear. Bearings that are damaged will overheat or have a grinding noise while the machine is in operation. If either occur, stop the machine immediately. A damaged bearing could seize, causing serious damage to the shaft. Call your local bearing representative or Scott Equipment for replacement or service.

3. Periodically check the setscrews for proper tension. This will ensure that the shaft is not turning about the inside race of the bearing.

Gear Reducer

1. Gear reducers are shipped **without** lubricant to comply with ICC Regulations. Be sure to examine the oil level in the Gear Reducer prior to start up. The recommended level and type of lubricant is included in the purchased parts section of this manual.

Shaft Seals

The shaft seals on your mixer may be one of the several styles listed below, stuffing box, packing gland or a purchased seal from another supplier. Information on purchased seals will be located at the end of this manual with the purchased parts manuals.

Stuffing Box Seals

This is a box style seal with a removable cover on it. The box is filled with an Oakum or Jute packing. The packing is then wet down with oil or gear lubricate. If the seal begins to leak additional oil can be added or the packing may need to be removed and replaced with new material.

Packing Gland Seals

1. Machines equipped with Packing Gland seals will need the packing push ring adjusted if any leaking is sighted during operation. The seals have **not** had their final setting at the factory because the machine needs to be affixed and running for the proper setting. If dust is leaking from the shaft areas of the machine, the seals must be tightened.

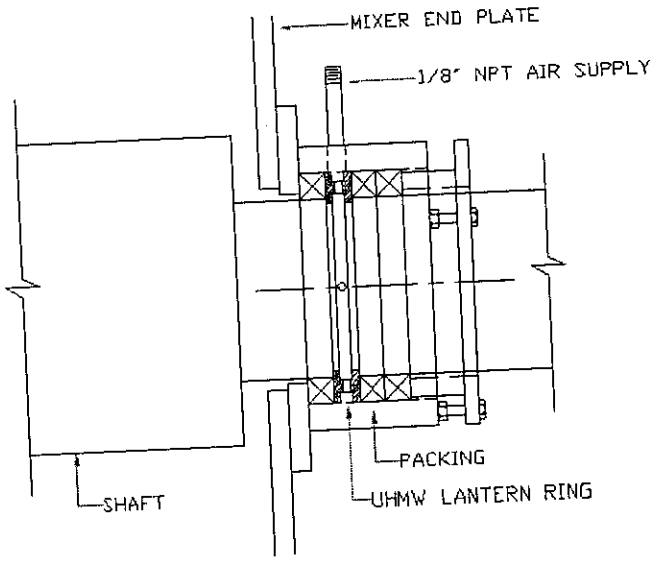
2. Tighten seals slowly until product leaking subsides. CAUTION: Do not over-tighten the seals, as this will cause undue wear and excessive friction on the main shaft. If excessive heat is noticed on the shaft or bearing, loosen the push ring and call Scott Equipment for further discussion.

Installation (continued)

3. Air purge seals are sometimes supplied with the equipment. These seals require 3-5 PSI of clean, dry, filtered air.

Below is a typical arrangement of a Scott 3-ring air purge seal. Other configurations and number of rings of packing may be used as the application requires.

SCOTT AIR PURGE SHAFT SEAL
NOT TO SCALE



Packing replacement:

The braided packing material is a wear item and as such will need to be replaced after time. Begin by removing the old packing and lantern ring (if seal is equipped with an air purge). Keeping track of the amount and order of the packing and lantern ring. If the new packing has come pre-cut proceed with putting it into the seal housing. Rotate the seams of the packing so that they don't line up in the housing. If your packing has come in a long length cut one end at a 45° angle and then wrap the packing around the shaft mark the packing and cut to match the other end. Replace packing and lantern ring in the same order that they were removed. Replace the seal push ring, only snug the bolts at first. The push ring will need to be adjusted as the machine is turning and the packing gets broken in.

Discharge Gates:

For mixers supplied with air operated gates we recommend 90 to 110 psi air pressure. After the mixer is broken in the required air pressure may be less.

Tips for Operation

Loading the Mixer

1. The amount of material in the mixer is very important. The single most important factor in mixing efficiency is not overloading the mixer. The level of material in the mixing chamber should not exceed the rated capacity of the mixer. A rule of thumb is for the product to be below the top of the agitator.

2. If possible, fill the mixer with the agitator in operation. Running the machine during loading will increase the mixing efficiency and decrease the wear on drive components. If operation requires starting the mixer under full load, please ensure that the drive assembly is adequate to handle the increased start up load. Electrical or mechanical devices are available to facilitate such operation.

Loading Sequence

1. The sequence of ingredient addition into the machine is important. Industry experience dictates that the best results are experienced when major ingredients are added to the mixer first. After a short period of mixing, the minor ingredient may be added.

2. Add liquids after the dry ingredients have been added to the mixer. Do not add liquids to an empty mixer, if dry ingredients will be added. Always, if possible, add dry ingredients first. If liquid addition is a major part of the mixing process, periodic inspection and cleaning will be necessary to maintain the sanitation of the mixer.

Chopper operational tips.

1. Wiring – Wire the motor for the proper voltage according to the wiring diagram on the motor. The proper rotation is clockwise when looking at the fan of the motor.

2. The mixer should come with the air ports on the chopper seals pre-plumbed to a mini-regulator mounted on the side of the mixer. Each line should run with approximately 4-8 psi of air pressure. ****Important**: Air must be turned on to these lines whenever the motors are turned on or whenever product is in the machine.

3. Packing seal – **Do not** over tighten the push ring on the packing seal. Excessive heat and damage to the shaft **will** result. Because of the labyrinth design of the chopper head minimal pressure on the packing required to seal the shaft.

Trouble Shooting Operation

Problem: ***Mixer Unable to Pull Load***
Possible Solutions:

1. Check all wiring for loose connections, low voltage, or undersize wiring.
2. Machinery needs cleaning. Build-up on tub and reel must be scraped loose to renew mixing efficiency and reduce power consumption.
3. Mixer is being loaded too full or being loaded with ingredients too heavy for applied horsepower.
4. Amount of liquid being added is too high.
5. Improper lubrication. Check all bearings and make sure they are greased properly according to manufacturer's recommendations. CAUTION: Do not over-grease bearings, seal damage will occur.
6. Check the compression of the packing seals. Over tension will cause excessive friction on the main shaft.
7. Mixer agitator running too close to mixer tub. Agitator may need to be adjusted with shims under main bearings.
8. Mixer agitator running too fast. Standard speed for 48" mixers is 24 RPM.
9. Belt drive slippage. Belts must be properly tensioned.

Problem: ***Gear Reducer Excessively Noisy***
Possible Solutions:

1. Oil level not properly maintained. All gear boxes are shipped without oil. Gear reducers should be filled at the time of installation in accordance with the manufacturer's recommendations.
2. Drain and refill oil in the Gear reducer seasonally.
3. Chain misalignment or improper chain tension can transmit vibration through Gear Reducer.
4. Motor coupling is not properly aligned to input shaft on reducer.

Problem: ***Mixer Agitator Rubbing Tub***
Possible Solutions:

1. Agitator bearings loose on base. Tighten bearings down to bearing shelf.
2. Steel blocks positioning agitator bearing worked loose, allowing agitator to rub tub sides.
3. Set collars on agitator bearings are loose allowing reel to thrust against tub ends. Re-align agitator and tighten set collars.
4. Agitator may have become slightly distorted by:
   a. Relaxing of stress developed during fabrication;
   b. An overloading condition; or
   c. A foreign object becoming lodged between agitator and tub.

Re-adjust agitator as required with shims under the agitator bearings.

Trouble Shooting (continued)

Problem: ***Main Shaft Heating Up***
Possible Solutions:

1. The packing gland seals are set too tight. Loosen and re-tighten seal slowly until the product does not dust through each seal. Do not tighten anymore than required.
2. Bearings are improperly; lubricated. Make sure all the bearings and bearing races are free moving within housing. Check that the shaft is not turning within the inside bearing race, and that all set screws are properly tightened. Ensure that lubrication is according to the bearing manufacturer's recommendation.

Problem: ***Product is Dusting Through Seals***
Possible Solutions:

1. Seal is improperly adjusted. Seals should be re-adjusted periodically to ensure a correct seal is taking place against the main shaft. Tighten seal slowly until the product does not dust through each seal. Do not tighten anymore than required.

General Maintenance

1. Before physical inspection or maintenance is performed on the machinery, **THE POWER MUST BE DISCONNECTED AND LOCKED OUT FROM THE MACHINE.** This should prevent accidental start-up during plant maintenance procedures.

2. The V-belt drive, if applicable, should be checked at least once a month for proper tension and belt condition.

3. All bearings and motors must be inspected and lubricated regularly. Please follow the manufacturer's specifications and schedules contained in this manual. Do not over lubricate the bearings since this could damage the bearing seals.

4. The machine may need to be cleaned regularly depending on the characteristics of the product. Before cleaning, DISCONNECT POWER AND LOCKOUT. Remove covers where applicable for easy access. When complete, replace and properly secure covers.

5. Unusual noises coming from the machine should be investigated immediately. SCOTT EQUIPMENT IS NOT LIABLE FOR DAMAGE DUE TO NEGLECT ON THE PART OF THE OPERATOR. If you are concerned about noise that the machine is making, please shut down and call a Scott Equipment service representative immediately.

6. Packing gland seals need to be inspected every two weeks. Inspection is required because the packing material will eventually wear down. Neglect of the seals can cause undue dusting and leaking of the product from the seal area and wear on the shaft. Do not over tighten the packing in the seal, this will cause wear on the shaft. If you notice the shaft getting too hot, you may have to loosen the seals. It is not usual for the shaft to be too warm for the hand to touch. If the seal is supplied with the air purge option, you should check the air supply. You should have 3 – 5 psi of dry, filtered air supplied to the seal.

7. If your machine is equipped with a chain drive and an oil fluid coupling the flexible gear couplings on each side of the oil fluid coupling **need** to be greased **regularly**. See manufacturer's specifications and schedules contained in this manual.

Warranty and Terms

Should any parts furnished, but not manufactured by, Scott Equipment Company fail while covered under warranty, the following should be followed:

1. Call Scott Equipment service personnel immediately. Your problem will receive prompt attention. You will be notified on what action to take.

2. CAUTION: Many motor manufacturers void the warranty on a motor if repair work is not performed by their own approved service center. To protect your company - do not take the motor to a service center without contacting Scott Equipment Company @ 612-758-2591.

3. For additional information concerning warranty information, the Scott Equipment Guarantee is included on the next page.

Conditions of Sale

"HAZARD CONTROL DEVICES AND EQUIPMENT: Seller furnishes those Hazard Control Devices which are listed on our quotation, acknowledgement, drawings and invoice and which may be further listed in our instruction manuals and other publications. Buyer agrees not to remove or materially alter any of these hazard control devices which are attached to or included with the equipment. Buyer further agrees to connect, use and regularly check for safe operation of all hazard control devices, electrical interlocks, guards, grates, covers and/or cautionary or warning signs, tags or decals. Buyer agrees to properly train his employees in safe operation procedures and to never permit any person to perform any maintenance, adjustment or cleanup of machine until power is turned off and locked out and machine has come to a complete stop. IT IS THE RESPONSIBILITY OF THE BUYER / USER TO MAKE INSPECTIONS AND TAKE WHATEVER ACTION MAY BE NECESSARY TO PREVENT LOSSES, ENFORCE SAFETY PROCEDURES AND ELIMINATE HAZARDOUS CONDITIONS SO AS TO COMPLY WITH ANY FEDERAL, STATE OR LOCAL LAW REGARDING SAFETY OR HEALTH, AND TO PROVIDE A SAFE WORKPLACE FOR HIS EMPLOYEES AND A SAFE ENVIRONMENT FOR ALL PERSONNEL."

Guarantee – Scott Equipment Company

We guarantee all SCOTT EQUIPMENT COMPANY products against defect in workmanship and materials for a period of one year...Should any failure occur within one year from the date of shipment from our factory, and out inspection shows such failure to be caused by defective material or workmanship, the product will be replaced or repaired, at our option, without cost. All such repairs will be made F.O.B. our factory, and we will not assume any payment or expenses for repairs made outside of our factory without proper written authority from us.

Liability will be limited to repairs or replacement of defective parts. The company is not liable for any costs in connection with the removal of alleged defective parts, nor for indirect, special, consequential or liquidated damage or penalties.

We do not guarantee equipment against abrasion, corrosion, or erosion, nor do we guarantee the paint or coating from chipping, scratching, or staining. Our responsibility ceases when equipment is damaged by result of improper storage, handling, faulty installation and erection, or inadequate footings or foundations.

This guarantee does not pertain to products, parts, accessories or attachments which were not manufactured by SCOTT EQUIPMENT COMPANY except to the extent of the guarantee given by the manufacturer.

We do not guarantee any part of the products to meet local, municipal, or state ordinances, laws, or regulations.

The above sets forth the only guarantee upon which any sale is made.

CONDITIONS OF SALE: No representative of ours has any authority to waive, alter, vary, or add to the terms hereof without prior approval in writing signed by an officer of our company.

Stenographic and clerical errors are subject to correction.

Guarantee – Scott Equipment Company

CANCELLATION: Suspension or cancellation of orders may be made only upon our written approval and on terms that will indemnify against all loss.

TAXES: The amount of any sales, excise or other taxes, if any, applicable to the products covered by this order, shall be added to the purchase price and shall be paid by Buyer unless Buyer provides Seller with an exemption certificate acceptable to the taxing authorities.

SHIPMENT: Sellers liability terminates upon safe delivery of goods to the carrier. In case of delay by the purchaser in furnishing any required informat6ion or later change in any of the specifications at the instance of the purchaser, shipment will be extended a reasonable time according to such change or delay and conditions in the sellers works. Seller will make every effort to complete shipment as indicated, but assumes no responsibility or liability for loss or damage due to delay or inability to obtain materials or any other causes of any kind whatever beyond our control.

INSTALLATION: Unless other wise expressly stipulated, all machinery and material herein specified shall be installed, erected, and started by and at the expense of the purchaser.

HAZARD CONTROL DEVICES AND EQUIPMENT: Seller furnishes those Hazard Control Devices which are listed on our quotation, acknowledgment, drawings, and invoice, and which may be further listed in our instruction manuals and other publications. Buyer agrees not to remove or materially alter any of these hazard control devices, electrical interlocks, guards, grates, covers and / or cautionary or warning signs, tags and decals. Buyer agrees to follow instructions provided with equipment by seller, particularly with respect to safe operation of machine or equipment. Buyer agrees to properly train his employees in safe operation procedures and to never permit any person to perform any maintenance, adjustment or cleanup of machine until power is turned off and locked out and machine has come to a complete stop.

IT IS THE RESPONSIBILITY OF THE BUYER / USER TO MAKE INSPECTIONS AND TAKE WHATEVER ACTION MAY BE NECESSAR PREVENT LOSSES, ENFORCE SAFETY PROCEDURES AND ELIMIN HAZARDOUS CONDITIONS SO AS TO COMPLY WITH ANY FEDERA STATE OR LOCAL LAW REGARDING SAFETY OR HEALTH, AND T PROVIDE A SAFE WORKPLACE FOR HIS EMPLOYEES AND A SA ENVIRONMENT FOR ALL PERSONNEL.

PLOW MIXER PARTS LIST

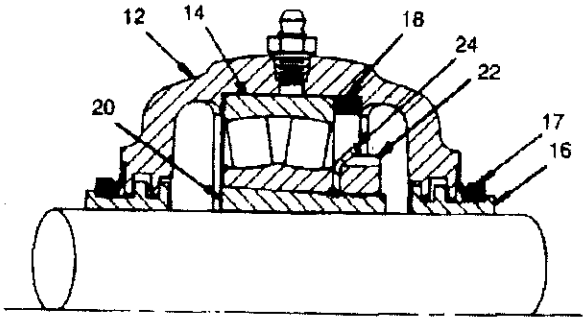
CUSTOMER:	STERIS CORPORATION
SCOTT JOB #:	96-021
CONTRACTOR:	
MIXER TYPE:	48x120 PLOW MIXER
MODEL #:	PL4810
SERIAL #:	9602009

ITEM:	MFG:	DESCRIPTION:	PART NUMBER:	SUGG. * STOCK
Drive assembly:				
Motor:	Marathon	125HP Exp. Proof 3ph/460v/60hz 1800 RPM		
Reducer:	Falk		4507JR25	
Reducer Bushing:	Falk		BU4507J-5.438	
Fluid Coupling:	Falk	65V10.9E – No Bushing	1420-HFN-41 w/ 3 3/8" Collet	
Drive Sheave/ Sprocket:		65V12.50 W/F 2 ¾" Bush.		
Driven Sheave/ Sprocket		(6) 5VX1250		
Belts/ Chain:				
Bearings:				
Drive End Bearing:	Meither	(1) SAF-XT 5 15/16" PBB		
Idle End Bearing:	Meither	(1) SAF-XT 5 15/16" PBB		
Plug Gate Bearings:	Dodge	(2) SCM 2 ½" 4 Blt Flg		(6)
Air System:				
Air Cylinder:	Nopak	4x14 Class 1 Model E		
Soleniod Valve:	Norgren	Nugget 200	CL14X14E	
Flow Control Valve:			K71FA00KS6KX1	
Filter-Reg.-Lub:	Norgren	Filter/Reg./Lub. Combo	076004	
			C74A4AKQD3RMGQ D	
: Drive End	Scott Equip.	5 15/16" 3 Ring Air Purge		
Idle End	Scott Equip.	5 15/16" 3 Ring Air Purge	1/2" Teflon ML2236	
Ring: Drive End	Scott Equip.	5 15/16" UHMW	1/2" Teflon ML2236	(21)
Idle End	Scott Equip.	5 15/16" UHMW	SELAN-50-UH5.93	(21)
rts:			SELAN-50-UH5.03	
tension Shaft:	Marathon	10HP Exp. Proof 3600 Rpm 3ph/230-460v/60hz		
	Scott Equip.	Flat		
	Sepco	3/8" Sq Braided Teflon		
	Scott Equip.	Teflon		
	Scott Equip.	Teflon	3/8" ML2236	
		Mini Filter & Regulator		(24") ea
				(1) ea.
	Alan-Bradly		R07-102-RNEA w/ 9690209	(1) ea.
	Spray-Systems	Vee Jet		
			ABC-871CC5A18	
			H-1/4-H-U-SS-6530	

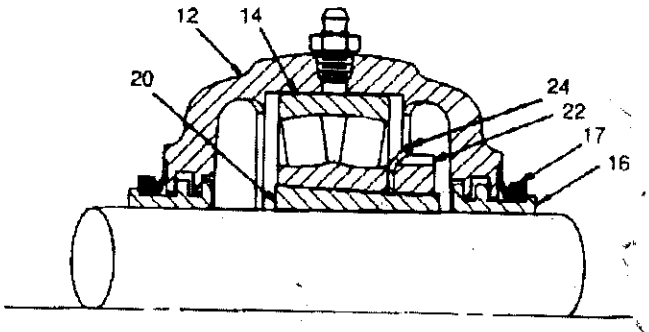
items: Items may have a long lead-time, or are wear/maintenance items; the number listed
amount suggested to keep in inventory. Depending on the nature of your specific process,
ny of the above items should be inventoried.

ERVICE PLEASE CALL

REPLACEMENT PARTS FOR SAFS PILLOW BLOCKS



NON-EXPANSION TYPE
SAFS PILLOW BLOCKS



EXPANSION TYPE
SAFS PILLOW BLOCKS

Ref.	Name of Part	# Req'd.	1-7/16	1-11/16	1-15/16	2-3/16	2-7/16	2-1/2	2-11/16	2-3/4	2-15/16	3	3-3/16	3-7/16	3-1/2	3-15/16	4	4-3/16	4-7/16	4-1/2
	2 Bolt Base Housing Assem. *	1	043995	043996	043997	043998	044000	044000	044198	044198	044010	044010	044199	044020	044020	.....	.....	.....	.....	.....
12	4 Bolt Base Housing Assem. *	1	.....	.....	.....	.....	044003	044003	044007	044007	044013	044013	044114	044023	044023	044025	044025	044202	044031	044031
	2 Bolt Base Housing (SAFS) Assem. *		.....	.....	.....	.....	042425	042425	0424231	0424231	042433	042433	044233	042440	042440	.....	.....	.....	.....	.....
12	4 Bolt Base Housing (SAFS) Assem. *		.....	.....	.....	.....	042428	042428	044232	044232	042436	042436	044234	042443	042443	042450	042450	044235	042455	042455
14	Roller Bearing	1	422134	422137	422123	422124	422001	422001	422003	422003	422005	422005	422007	422009	422009	422011	422011	422013	422015	422015
16	Seal Ring	2	043389	043390	042050	042051	042052	042053	042054	042063	042055	042056	042057	042058	042059	042060	042061	042062	D42073	042064
17	V-Ring Seal	2	042243	042224	042225	042226	042227	042227	042228	042228	04222	042229	042230	042230	042230	042231	042231	042232	042233	042233
18	NorExp. Spacer	1	041987	042335	042315	042316	041174	041174	041172	041172	041175	041175	041173	041176	041176	041177	041177	041185	041178	041178
20	Adapter Sleeve	1	042013	042014	042310	042311	041110	041111	041109	041126	041112	041113	041114	041115	041116	041117	041118	041119	041120	041121
22	Nut	1	419187	419188	419184	419185	460901	460901	460902	460902	460903	460903	460904	460905	460905	460906	460906	041071	041064	041064
24	Lockaslw	1	419180	419181	419182	419183	419150	419150	419152	419152	419154	419154	419156	419158	419158	419160	419160	419162	419164	419164

Ref.	Name of Part	# Req'd.	4-15/16	5	5-3/16	5-7/16	5-15/16	6	6-7/16	6-1/2	6-15/16	7	7-1/2	7-15/16	8	8-7/16	8-1/2	8-15/16	9	
12	4 Boll: Base Housing Assem. *	1	044034	044034	044203	044040	044043	044043	044046	044046	044049	044049	044054	044055	044055	044200	044200	044200	044200	
12	4 Bolt Base Housing (SAFS) Assem. *		042460	042460	044236	042465	042469	042469	042468	042468	042472	042472	044237	042477	042477	.....	.....	.....	.....	
14	Roller Bearing	1	422017	422017	422019	422021	422023	422023	422025	422025	422027	422027	422029	422029	422029	422031	422031	422031	422031	
16	Seal Ring	2	042065	042066	042067	042068	042070	042071	042072	042073	042074	042075	042081	042076	042097	042082	042078	042084	042079	
17	V-Ring Seal	2	042234	042234	042235	042235	042236	042236	042237	042237	042238	042238	042239	042239	042239	042240	042240	042240	042240	
18	Non-Exp. Spacer	1	041179	041179	041186	041180	041181	041181	041184	041184	041182	041182	041183	041183	041183	041161	041161	041161	041161	
20	Adapter Sleeve	1	041122	041123	041124	041125	041127	041128	041129	041130	041132	041133	041145	041137	041138	042319	041078	042320	041079	
22	Nut	1	041065	041065	041072	041066	041067	041067	041070	041070	041068	041068	041069	041069	041069	041074	041074	041074	041074	
24	Lockwasher	1	419166	419166	419168	419170	419172	419172	419174	419174	419176	419176	419178	419178	419178	419177	419177	419177	419177	

Ref.	Name of Part	# Req'd.	9-7/16	10	10-1/2
12	4 Bolt Base Housing Assem. *	1	422542	422560	044201
12	4 Bolt Base Housing (SAFS) Assem. *		.....	.....	.....
14	Roller Bearing	1	422543	422030	422030
16	Seal Ring	2	043496	042086	.....
17	V-Ring Seal	2	422547	042241	.....
18	Non-Exp. Spacer	1	422554•	041213•	041213•
20	Adapter Sleeve	1	042597	041136	422570
22	Nut	1	422539	041073	041073
24	Lockwasher	1	422540‡	419179‡	141917‡

◊ Not shown on drawing.
* Housing assembly consists of cap, base, roll pins, bolts, nuts and spacers.
‡ Locking plate used instead of lockwasher (not shown).
• Two required for these sizes.

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Corporate Headquarters
Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Dodge and Reliance Electric Products
Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433
Europe/Middle East/Africa: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741
Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 6356-9077, Fax: (65) 6356-9011

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions
Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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REPLACEMENT PARTS FOR SAF-XT PILLOW BLOCKS

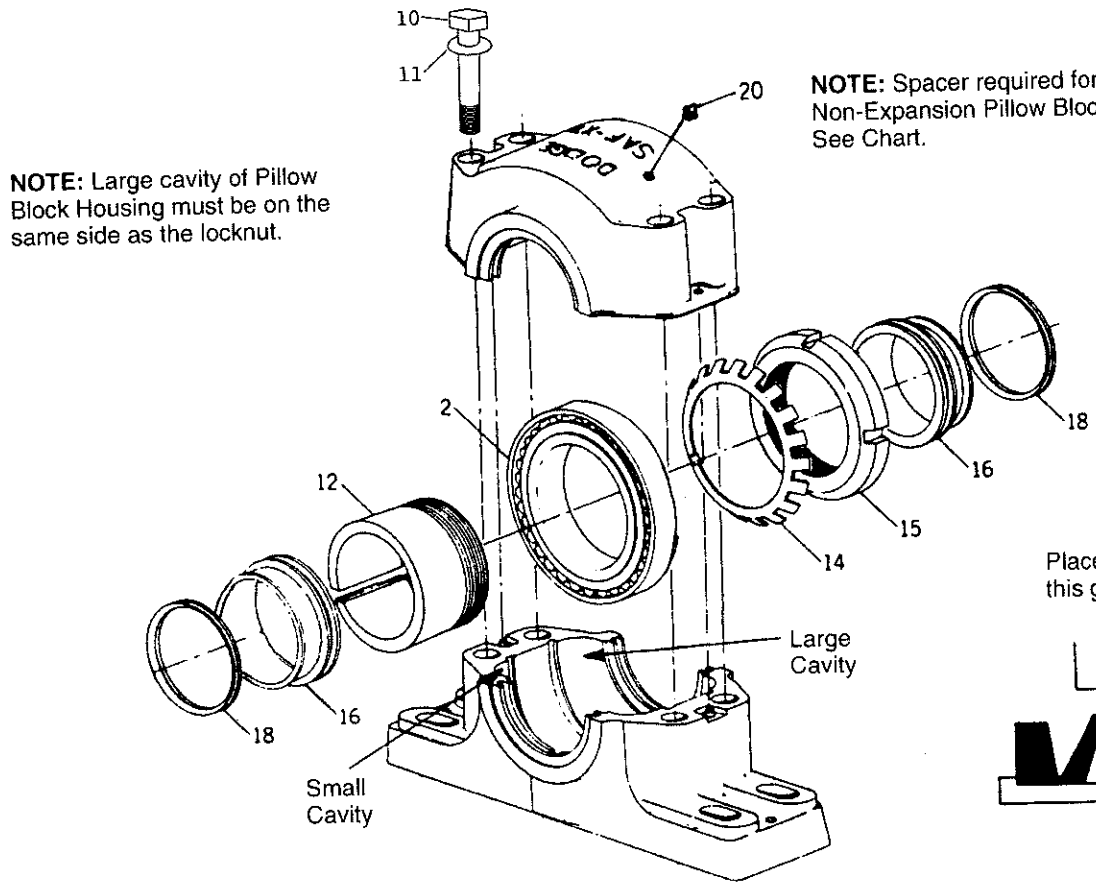


Figure 3

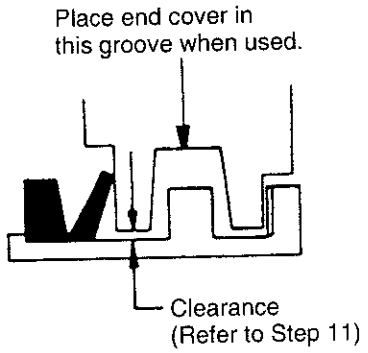


Figure 4

Reference	Name of Part	No. Req'd.	Part Numbers 5-15/16	6	6-7/16	6-1/2	6-15/16	7	7-1/2	7-15/16
2	Bearing	1	422023	422023	422025	422025	422027	422027	422029	422029
	HOUSING ASSEMBLY*	1	042149	042149	042152	042152	042155	042155	042167	042158
10	Housing Bolt	4	411381	411381	411381	411381	411381	411381	411860	411860
11	Lockwasher	4	419020	419020	419020	419020	419020	419020	419024	419024
12	Adapter	1	041127	041128	041129	041130	041132	041133	041145	041137
14	Lockwasher	1	419172	419172	419174	419174	419176	419176	419178	419178
15	Lock Nut	1	041067	041067	041070	041070	041068	041068	041069	041069
16	Seal Ring	2	042070	042071	042072	042073	042074	042075	042081	042076
18	V-Ring Seal	2	042236	042236	042237	042237	042238	042238	042239	042239
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015
↓	Stabilizing Ring	1	041181	041181	041184	041184	041182	041182	041183	041183

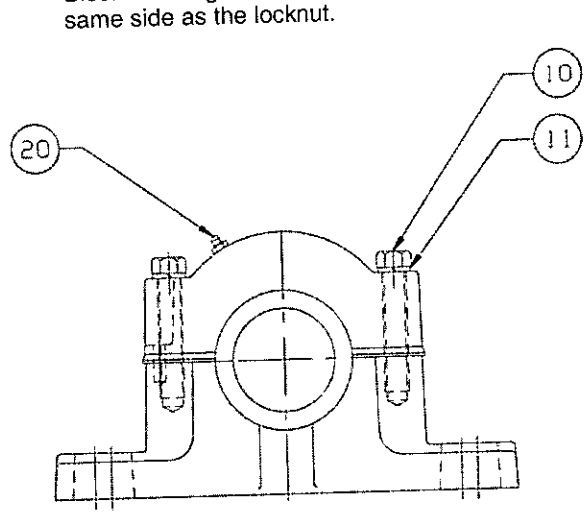
Reference	Nameof Part	No Req'd.	Part Numbers 8	8-7/16	8-1/2	8-15/16	9	9-7/16	9-1/2	9-15/16	10	10-7/16	10-1/2
2	Bearing	1	422029	422031	422031	422031	422031	422543	422543	422030	422030	422030	42203
	HOUSING ASSEMBLY*	1	042158	042161	042161	042161	042161	422555	422555	047378	042164	042379	422572
10	Housing Bolt	4	411860	411860	411860	411860	411860	411860	411860	411864	411864	411864	411864
11	Lockwasher	4	419024	419024	419024	419024	419024	419024	419024	419024	419024	419024	419024
12	Adapter	1	041138	042319	041078	042320	041079	042597	422541	041053	041136	042582	422570
14	Lockwasher	1	419178	419177‡	419177‡	419177‡	419177‡	422540‡	422540‡	419179‡	419179‡	419179‡	419179‡
15	Lock Nut	1	041069	041074	041074	040174	041074	422539	422539	041073	041073	041073	041073
16	Seal Ring	2	042077	042082	042078	042084	042079	043496	422546	042511†	042086†	042036	422573†
18	V-Ring Seal	2	042239	042240	042240	042240	042240	422547	422547	—	042241	—	—
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015
↓	Stabilizing Ring	1	041183	041161	041161	041161	041161	422554	422554	041213	041213	041213	041213

* Housing Assembly consists of cap. base, roll pins, bolts, nuts and spacer(s).
↓ Not shown on drawing. 2 required on sizes 8-7/16 and larger.
Δ 2 Bolt Base.
‡ Locking plate used instead of lockwasher (not shown).
† ER Seals

REPLACEMENT PARTS FOR SAF-XT PILLOW BLOCKS

NOTE: Spacer required for Non-Expansion Pillow Blocks. See Chart.

NOTE: Large cavity of Pillow Block Housing must be on the same side as the locknut.



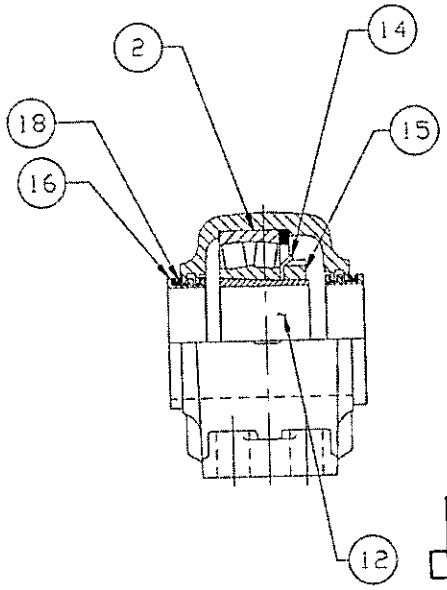


Figure 3

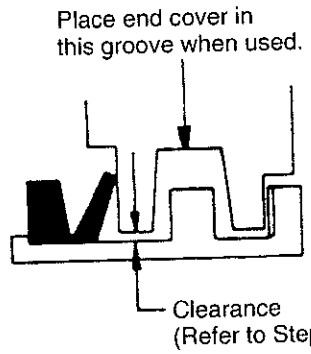


Figure 4

Reference	Name of Part	No. Req'd	Part Numbers														
			1-15/16Δ	2-3/16Δ	2-7/16Δ	2-7/16	2-1/2Δ	2-1/2	2-11/16Δ	2-11/16	2-3/4Δ	2-3/4	2-15/16Δ	2-15/16	3Δ	3	3-3/16Δ
2	Bearing	1	422123	422124	422001	422001	422001	422001	422003	422003	422003	422003	422005	422005	422005	422005	422007
	HOUSING ASSEMBLY*	1	042100	042103	042106	042109	042106	042109	042111	042114	042111	042114	042116	042119	042116	042119	042121
10	Housing Bolt	4	411625	411637	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240
11	Lockwasher	4	419012	419012	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013
12	Adapter	1	042310	042311	041110	041110	041111	041111	041109	041109	041126	041126	041112	041112	041113	041113	041114
14	Lockwasher	1	419182	419183	419150	419150	419150	419150	419152	419152	419152	419152	419154	419154	419154	419154	419156
15	Lock Nut	1	419164	419135	460901	460901	460901	460901	460902	460902	460902	460902	460903	460903	460903	460903	460904
16	Seal Ring	2	042050	042051	042052	042052	042053	042053	042054	042054	042083	042063	042055	042055	042056	042056	042057
18	V-Ring Seal	2	042225	042226	042227	042227	042227	042227	042228	042228	042228	042228	042229	042229	042229	042229	042230
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015
◊	Stabilizing Ring	1	042315	042316	041174	041174	041174	041174	041172	041172	041172	041172	041175	041175	041175	041175	041173

Reference	Name of Part	No. Req'd	Part Numbers														
			3-3/16	3-7/16Δ	3-7/16	3-1/2Δ	3-1/2	3-15/16	4	4-3/16	4-7/16	4-1/2	4-15/16	5	5-3/16	5-7/16	5-1/2
2	Bearing	1	422007	422009	422009	422009	422009	422011	422011	422013	422015	422015	422017	422017	422019	422021	422021
	HOUSING ASSEMBLY*	1	042124	042126	042129	042126	042129	042131	042131	042134	042137	042137	042140	042140	042143	042146	042146
10	Housing Bolt	4	411240	411638	411638	411638	411638	411710	411710	411710	411831	411831	411498	411498	411498	411498	411498
11	Lockwasher	4	419013	419014	419014	419014	419014	419016	419016	419016	419014	419014	419016	419016	419016	419016	419016
12	Adapter	1	041114	041115	041115	041116	041116	041117	041118	041119	041120	041121	041122	041123	041124	041125	042318
14	Lockwasher	1	419156	419158	419158	419158	419158	419160	419160	419162	419164	419164	419166	419166	419168	419170	419170
15	Lock Nut	1	460904	460905	460905	460905	460905	460906	460906	041071	041064	041064	041065	041065	041072	041066	041066
16	Seal Ring	2	042057	042056	042058	042059	042059	042060	042061	042062	042063	042064	042065	042066	042067	042068	042069
18	V-Ring Seal	2	042230	042230	042230	042230	042230	042231	042231	042232	042233	042233	042234	042234	042235	042235	042235
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015
◊	Stabilizing Ring	1	041173	041176	041176	041176	041176	041177	041177	041185	041178	041178	041179	041179	041186	041160	041160

* Housing Assembly consists of cap, base, roll pins, bolts, nuts and spacer(s).
◊ Not shown on drawing. 2 required on sizes 8-7/16 and larger.

Δ 2 Bolt Base.
‡ Locking plate used instead of lockwasher (not shown).

Sizes 5 15/16 to 10 1/2 continued on next page.

Table 6 — Regreasing Intervals (Months)
(Based on 12 hour per day 150°F max.)

Size	RPM									
	250	500	750	1000	1250	1500	2000	2500	3000	3500
1 15/16	8	6	4	3	2	1	.5	.5	.25	.25
2 3/16	7	5	3	2	1	1	.5	.25	.25	
2 7/16-3	6	4	3	2	1	.5	.25	.25		
3 3/16-3 1/2	5	3	2	1	.5	.5	.25			
3 15/16-4 1/2	4	3	2	1	.5	.25				
4 15/16-5 1/2	3	2	1	.5	.25					
5 15/16-7	2	1	1	.5						
7 1/2-9	1	1	.5							
9 7/16-10 1/2	1	.5								

Table 7 — Maximum RPM (Grease Lubrication)

SHAFT SIZE	BASIC BEARING DESCRIPTION	MAX. RPM
1 15/16	22211K	4500
2 3/16	22213K	3600
2 7/16, 2 1/8	22215K	3400
2 11/16, 2 3/4	22216K	3200
2 15/16, 3	22217K	3000
3 3/16	22218K	2600
3 7/16, 3 1/2	22220K	2200
3 15/16, 4	22222K	2000
4 1/16	22224K	1800
4 7/16, 4 1/2	22226K	1700
4 15/16, 5	22228K	1600
5 3/16	22280K	1500
5 7/16, 5 1/2	22282K	1400
5 15/16, 6	22284K	1300
6 7/16, 6 1/2	22236K	1200
6 15/16, 7	22288K	950
7 1/2, 7 15/16, 8	22244K	800
8 7/16, 8 1/2 8 15/16, 9	23048K	800
9 7/16, 9 1/2	23052K	750
9 15/16, 10 10 7/16, 10 1/2	23056K	700

LONG-TERM STORAGE OF PRE-ASSEMBLED BEARINGS

Applications such as conveyor pulleys and fans are shipped to a job site with bearings already mounted to the shafts. Since these units may be stored for long periods of time in unprotected areas subject to rain, dust, etc., bearings should be packed 100% full and so tagged at bearing assembly to prevent contamination or corrosion of the bearings.

Prior to installation on the structure, if the application RPM is greater than 20% of catalog maximum speed, excess grease must be removed to the levels outlined previously. Removal of excess grease must be done in a clean, protected environment.

Table 4 — Bearing ℄ to Housing ℄ Offset — "S" Dimension
(Expansion brg. located at center of expansion)

Size	Non-Expansion	Expansion	Size	Non-Expansion	Expansion
1 15/16	19/64	3/16	5 3/16	3/4	9/16
2 3/16	25/64	1/4	5 7/16-5 1/2	49/64	37/64
2 7/16-2 1/2	17/64	5/32	5 15/16-6	25/32	37/64
2 11/16-2 3/4	3/8	3/16	6 7/16-6 1/2	3/4	35/64
2 15/16-3	3/8	3/16	6 15/16-7	13/16	5/8
3 3/16	31/64	19/64	7 1/2	29/32	23/32
3 7/16-3 1/2	9/16	3/8	7 15/16-8	29/32	23/32
3 15/16-4	35/64	3/8	8 7/16-9	25/32*	25/32
4 3/16	39/64	27/64	9 7/16-9 1/2	45/64*	45/64
4 7/16-4 1/2	41/64	29/64	9 15/16-10 1/2	7/8*	7/8
4 15/16-5	11/16	1/2			

*One spacer on each side of bearing

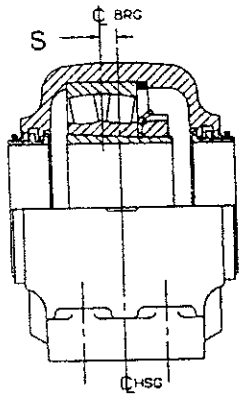


Figure 2

MAINTENANCE

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

Remove housing cap in order to inspect bearing and grease. Before reassembly it is important that the V-ring seals be removed. This will ensure that seal lip will not be damaged while setting cap in place. Reassemble per installation steps 9 thru 11 above.

Seal Replacement — When removing bearing it is recommended that V-ring seals and seal rings be replaced.

Auxiliary Seals — Install per instruction sheet #499665.

GREASE LUBRICATION

SAF-XT and SAFS bearings are specifically designed for dirty, dusty or wet environments. In order to properly protect bearings during installation pack the bearing insert 100% full immediately after having properly mounted bearing on the shaft. If the RPM of the application falls between 20% and 80% of maximum RPM (Table 7), pack the lower half of the housing one-third to one half full. If the RPM of the application is less than 20% of maximum RPM, pack bearing housing cavity 100% full. If the RPM exceeds 80% of maximum RPM, pack 1/3 of the lower half of the housing.

At each regreasing cycle, for applications up to 80% of maximum RPM, slowly add grease until fresh grease is seen purging at the seals.

Regreasing should be done while running. Remote regreasing lines should be added to avoid endangering personnel.

WARNING
Regreasing requires rotating parts to be exposed. Exercise extreme care during such operations. Failure to observe these precautions could result in bodily injury.

If the RPM is greater than 80% of maximum RPM add 4 strokes of a grease gun at each regreasing cycle for bores up to 2". For bores greater than 2" up to 5" add 8 strokes of a handgun at each regreasing cycle. For bores greater than 5" up to 10 1/2" add 16 strokes of a grease gun at each regreasing cycle. For units running above 80% of maximum RPM, running temperature should be monitored. If a drastic change in running temperature is noted, it is recommended to remove the used grease completely and recharge with fresh grease per above instructions.

Table 5 — Viscosity of Oil in the Grease

DN ▲	Viscosity for Loads Up To 18% of Dyn. Cap.* (SUS @ operating temp.)
100	3500
200	3150
300	2750
400	2375
500	2000
600	1750
700	1500
800	1300
900	1075
1000	900

DN ▲	Viscosity for Loads Up To 18% of Dyn. Cap. (SUS @ operating temp.)
1400	625
1800	450
2000	400
3000	300
4000	200
5000	150
6000	130
7000	110
8000	100

▲ DN = Bore Dia. (ins.) x RPM

* For loads above 18% of dynamic capacity an EP grease with the above viscosity oil is recommended

Select a grease with a viscosity at operating temperature which will provide full film lubrication (see Table 5). Assume 50°-100°F increase in bearing temperature above the ambient, depending on RPM and load.

Use Table 6 as a general guide for regreasing the bearings. A small amount of grease at frequent intervals is preferable to a large amount of grease at infrequent intervals.

For special applications involving high speeds, high temperatures or oil lubrication, consult the factory.

f) Seal Ring — Install a second seal ring with large O.D. toward locknut.

g) V-Ring Seal — Slide second V-ring seal onto the shaft, again making certain lip is toward bearing. **NOTE: Do not install V-ring seal on seal ring until housing cap has been set in place and tightened.** See Step 11.

4. Remove any paint, dirt or burrs from the mating surfaces of the housing halves. Thoroughly clean seal grooves on both sides. Set lower half of housing on base with all four cap bolts in place and apply oil to the bearing seats. Apply grease to the seal grooves in the lower housing. **Be sure the housing is positioned as shown in Figure 2 view relative to adapter nut.**

5. Apply grease to the bearings and seal rings. The lubricant should be smeared between the rolling elements (see Grease Lubrication section).

6. Place shaft with bearing into lower half while carefully guiding the seal rings into the housing grooves as shown in **Figure 4**.

7. Bolt lower half of the non-expansion bearing housing to the base. Move shaft endwise so that stabilizing ring can be inserted between the bearing outer ring and the lower half shoulder on same side as the locknut. Make all other bearings on same shaft expansion by centering in the middle of their housing seat. Bolt expansion housings to base. **NOTE: Only one bearing per shaft is non-expansion; other bearings should be expansion.**

Table 2 — Recommended Torque Values, Ft.-Lbs.

	Housing Cap Bolt Size	7/16-14	1/2-13	5/8-11	3/4-10	7/8-9	1-8	1 1/4-7
	Grade 2	28-32	40-50	80-100	140-175	136-170	200-250	400-500
	Grade 5	40-50	60-75	120-150	208-260	344-430	512-640	880-1100
	Grade 8	56-70	88-110	168-210	304-380	480-600	728-910	1456-1820

8. When closed end is required, the end plug supplied should be fit into the center seal ring groove of the housing (see **Figure 4**).

9. Grease the bearing seal grooves in the housing cap and place over the bearing after wiping the mating surfaces. The two dowel pins will align the cap with the lower housing half. **NOTE:** Each cap must be matched with its mating lower half as these parts are not interchangeable.

10. Tighten cap bolts to the recommended torque in Table 2.

11. Assure that there is seal running clearance then install V-ring seals onto the seal rings as shown in **Figure 4 and coat V-ring seals with grease.**

12. Misalignment of pillow blocks must not exceed values shown on Table 3 below.

Table 3 — Static or Dynamic Allowable Misalignment Degrees Spherical Roller Bearings

SHAFT SIZE	BLOCK SIZE	TRIPLE-TECT SEALS	LER	AUXILIARY SEAL
1 15/16	511	1°08'	0°52'	0°35'
2 3/16	513	1°01'	0°55'	0°32'
2 7/16 - 2 1/2	515	0°59'	0°50'	0°28'
2 11/16 - 2 3/4	516	0°52'	0°52'	0°26'
2 15/16 - 3	517	0°48'	0°52'	0°25'
3 3/16	518	1°06'	0°51'	0°32'
3 7/16 - 3 1/2	520	1°03'	0°46'	0°30'
3 15/16 - 4	522	0°55'	0°42'	0°28'
4 3/16	524	0°49'	0°41'	0°27'
4 7/16 - 4 1/2	526	0°56'	0°44'	0°26'
4 15/16 - 5	528	0°55'	0°40'	0°24'
5 3/16	530	—	0°35'	0°22'
5 7/16 - 5 1/2	532	0°47'	0°34'	0°22'
5 15/16 - 6	534	0°43'	0°32'	0°22'
6 7/16 - 6 1/2	536	0°33'	0°23'	0°26'
6 15/16 - 7	538	0°37'	0°27'	0°25'
7 1/2, 7 15/16, 8	544	0°31'	0°24'	0°22'
8 7/16 - 9	048	0°36'	0°25'	0°22'
9 7/16 - 9 1/2	052	0°26'	0°23'	0°33'
9 15/16 - 10 1/2	056	0°28'	0°16'	0°30'

INSPECTION

Inspect shaft. Ensure that the shaft is smooth, straight, clean and within commercial tolerances.

Inspect bearing. Do not allow bearing to be exposed to any dirt or moisture. Do not remove slushing compound as it acts as both a protectant and lubricant and is also compatible with standard greases.

INSTALLATION

WARNING

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

NOTE: Housing caps and bases are not interchangeable, they must be matched with mating half. Install non-expansion bearing first.

1. Apply a light coating of spindle oil to the adapter area of the shaft.

2. Measure the internal clearance of the bearing before mounting. Place the bearing in an upright position as shown in **Figure 1**. Seat the inner ring and roller elements by pressing down firmly on the inner ring bore while rotating the inner ring a few times. Position the roller assemblies so that a roller is at the topmost position on both sides. Press these top rollers inward ensuring contact with center guide flange (above 6 1/2" only). Using a feeler gage measure the clearance for both sides by inserting as far as possible and sliding over top of roller (Figure 1). Write down the measured clearance for use in step 3d. **NOTE:** Do not rotate bearing when moving feeler between roller and outer ring.

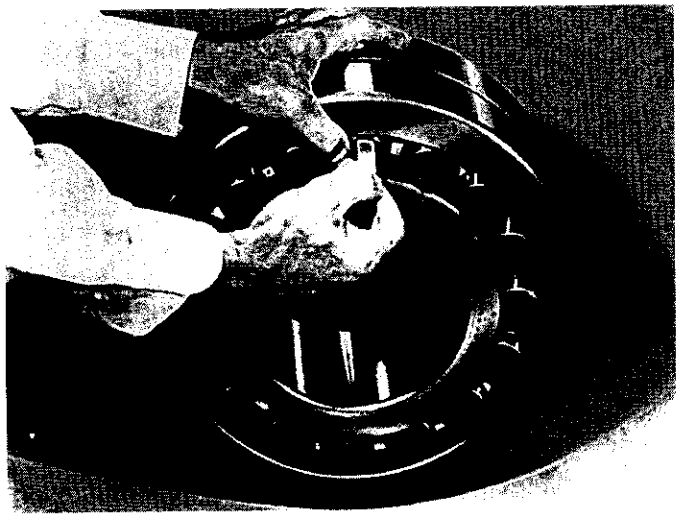


Figure 1 — Internal Clearance

3. Install the bearing parts in the following sequence: (refer to Figure 3). **NOTE:** Bearing can only be correctly installed one way. Refer to **Figure 2** on page 4.

a) V-ring Seal — Slide one of the V-ring seals onto the shaft **making sure lip is toward the bearing.** Set aside until step 11. **NOTE: Do not install V-ring seal on seal ring until housing cap has been set in place and tightened.**

b) Seal Ring — Install a seal ring on shaft with the largest O.D. toward bearing.

c) Adapter — Slide adapter onto the shaft, threaded end outboard to the approximate location of the bearing. Apply light coating of oil to sleeve O.D. **Do not use grease.**

d) Bearing — Make sure that the internal clearance has been written down. Install bearing on adapter sleeve, large end of tapered bore first. Locate bearing in proper position on shaft. Before tightening refer to **Figure 2** and Table 4 on page 4.

e) Lockwasher and Locknut—Install the lockwasher (8" and smaller sizes only) on the adapter with inner prong located in the slot and toward the bearing. Install locknut, chamfered face toward bearing.

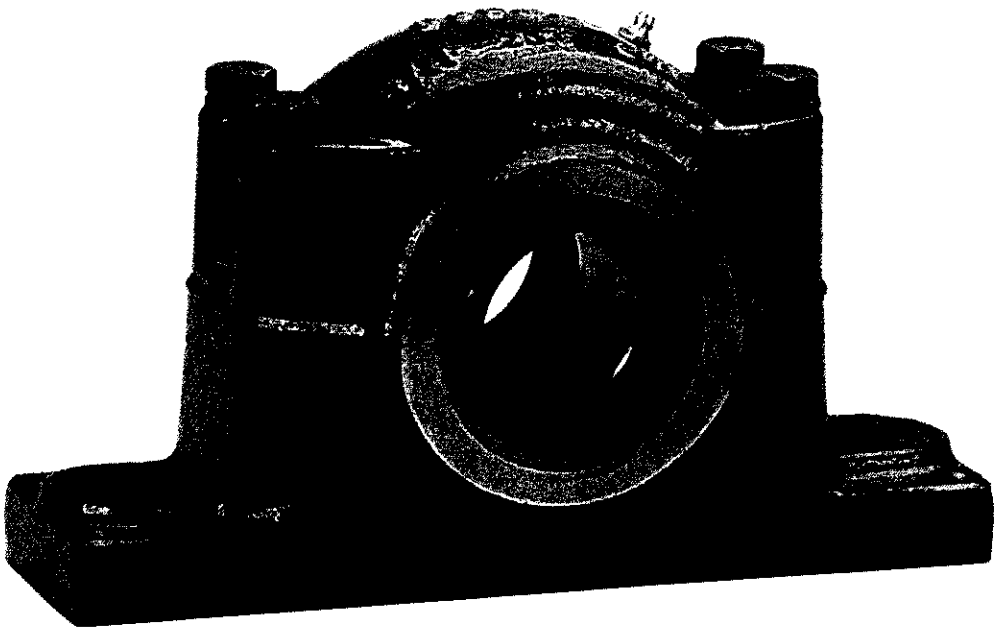
Tighten locknut using a spanner wrench and hammer until clearance noted in step 2 is **reduced by** amount shown in Table 1. During this step shaft should be supported so all weight is off of the bearing.

Find a lockwasher tab that aligns with a locknut slot and bend tab into slot. If slot is past tab then tighten, not loosen, locknut to meet a washer tab. Sizes larger than 8" require a lockplate bolted to the locknut with the inner prong of the plate located in the slot of the adapter sleeve. If necessary, tighten, not loosen, locknut to allow prong to fit in adapter slot. Lock plates for only the 9" must be hand fitted on the job.

Table 1— Internal Clearance Reduction

Shaft Diameter	Reduction in Internal Clearance
1 15/16, 2 3/16	.0012/.0015
2 7/16, 2 1/2, 2 11/16, 2 3/4	.0015/.0020
2 15/16, 3, 3 3/16, 3 7/16, 3 1/2	.0018/.0025
3 15/16, 4, 4 3/16	.0020/.0028
4 7/16, 4 1/2, 4 15/16, 5	.0025/.0035
5 3/16, 5 7/16, 5 1/2	.0030/.0040
5 15/16, 6, 6 7/16, 6 1/2	0030/.0045
6 15/16, 7	.0035/.0050
7 1/2, 7 15/16, 8	.0040/.0055
8 7/16, 8 1/2, 8 15/16, 9	.0045/.0060
9 7/16 - 10 1/2	.0045/.0065

INSTRUCTION MANUAL
FOR
DODGE® SAF-XT & SAFS
Pillow Blocks
All Sizes $1^{15}/_{16}$" through $10^{1}/_{2}$"
2 and 4 Bolt Base



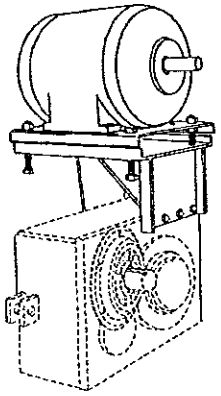
WARNING: Because of the possible danger to person(s) or property from accidents which may result from the improper use of products, it is important that correct procedures be followed: Products must be used in accordance with the engineering information specified in the catalog. Proper installation,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

OSHA V-Belt Guard Installation For Drives With Shaft Fan

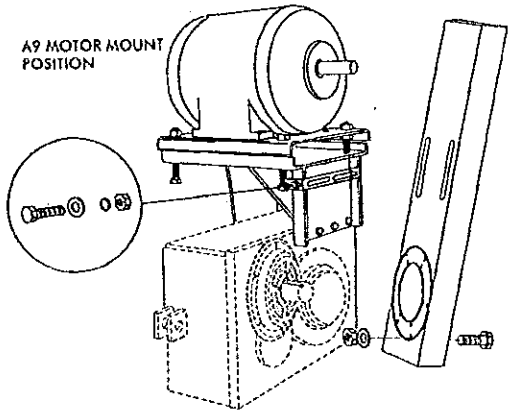
WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.

WARNING: Lock out power source and remove all external loads from drive before servicing drive or accessories.

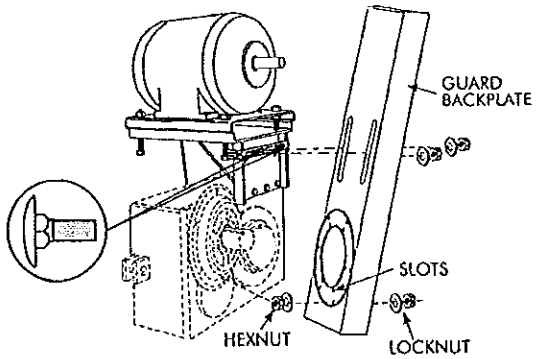
1. ASSEMBLE MOTOR MOUNT AND MOTOR TO DRIVE AS INSTRUCTED IN APPENDIX D



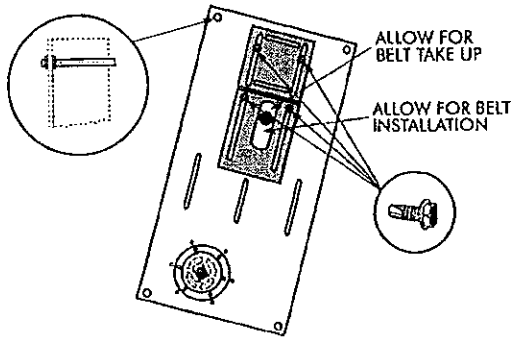
2. ASSEMBLE GUARD MOUNTING BRACKET & ADAPTER TO GUARD BACKPLATE



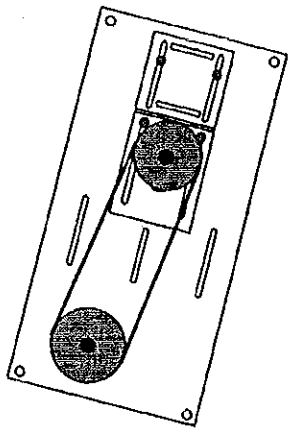
3. ASSEMBLE BACKPLATE WITH ADAPTER TO SHROUD



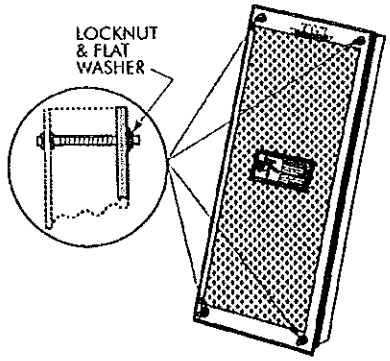
4. ASSEMBLE THREADED RODS TO BACKPLATE & MOUNT SLOT COVER(S) AS REQUIRED



5. MOUNT BELT DRIVE AS INSTRUCTED IN APPENDIX D



6. MOUNT COVER AND APPLY WARNING LABEL



The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

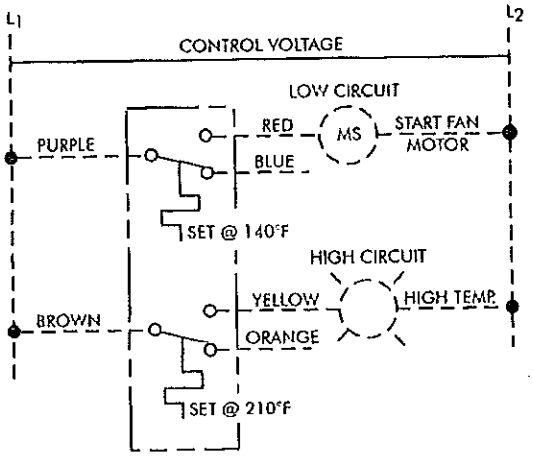
Electric Fan Installation

Introduction

The following instructions apply to the installation of the electric fan. The sump temperature switch is provided as a standard feature.

The sump temperature switch features dual settings for two independent single-pole, double-throw circuits. Only one circuit is used to control the fan. The remaining circuit may be used to control a warning light, an alarm, or a motor shutdown switch if the temperature setting is exceeded. The sump temperature switch wiring diagram is given in Figure 1.

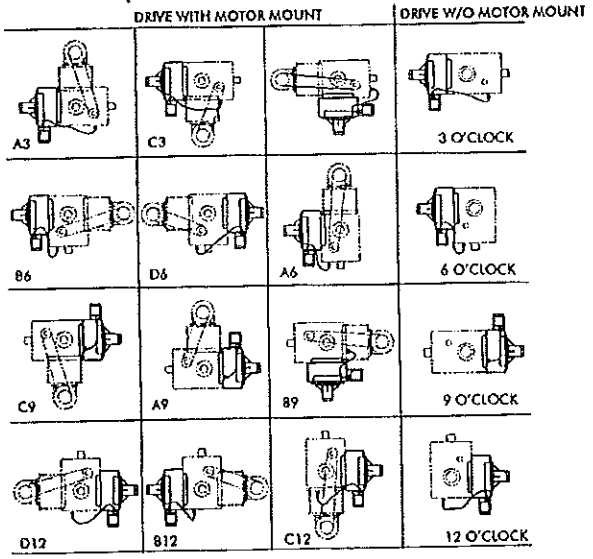
Figure 1



Refer to Figure 2 for electric fan, temperature switch and bulb well standard mounting locations. The bulb well houses the sump temperature probe. These mounting locations are based on drive mounting position.

Figure 2

ELECTRIC FAN, TEMP. SWITCH & BULB-WELL STD. MNTG. LOCATIONS (BASED ON DRIVE CLOCK POSITION)

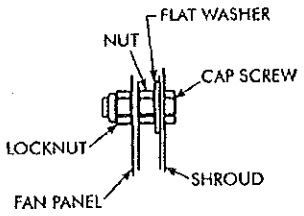


Assembly Instructions

WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.
Lock out power source and remove all external loads from drive before servicing drive or accessories.

1. Drain oil from the drive.
2. ELECTRIC FAN PANEL REWORK — The holes in the electric fan panel must be enlarged to accommodate the fasteners used to mount the electric fan to the shroud. Align the fan panel to the shroud. Locate and drill four 0.4375" (12 mm) diameter clearance holes in line with the pre-drilled holes in the shroud.
3. Insert four 1.25" (32 mm) cap screws through the fan mounting holes in the shroud with the threaded portion of the cap screw away from the drive. Secure the cap screws to the shroud with flat washer (2 washers for 4407) and nut, see Figure 3.

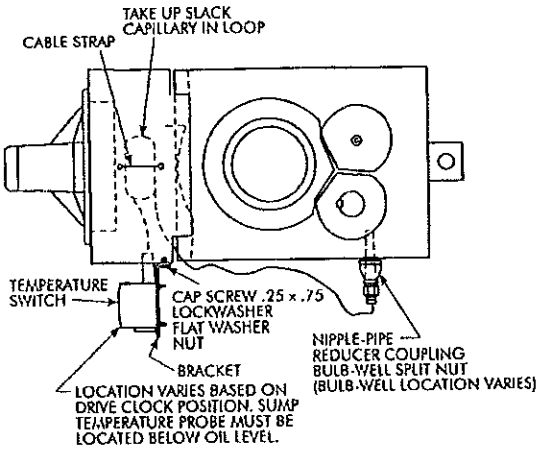
Figure 3



4. Secure the sump temperature switch to the switch mounting bracket. Attach the switch and mounting bracket to the fan shroud, refer to Figure 2 for location.
5. Install the temperature probe bulb well in the designated drain hole as shown in Figure 4. Refer to Figure 2 for bulb well location.

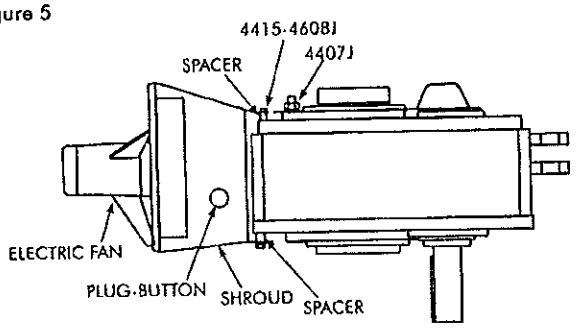
   CAUTION: Sump temperature probe must be located below oil level.

Figure 4



6. Mount the shroud on drive using spacers and hardware, see Figure 5.

Figure 5



7. Place the temperature probe in bulb well and secure capillary to the shroud by using one or two cable straps to remove extra slack, refer to Figure 4.

   CAUTION: *Do not crimp capillary.*

8. Install split nut in the bulb well to retain the temperature probe.
9. Sump temperature switch settings:
   a) Remove the two screws and cover from the top of switch to reveal the sump temperature switch setting wheels. Set the low circuit to turn the electric fan on at 140°F (60°C). Set the high circuit at 210°F (99°C) to engage alarm or main motor cutout.
   b) Remove the four screws and cover from the front of the sump temperature switch to reveal the differential setting wheels. Rotate the wheels to the full clockwise position as viewed from the top of the switch. This is the maximum temperature differential setting of 15°F (9°C). Replace the cover and four screws.
10. Fill drive to oil level specified in Section I with oil specified in Appendix A.
11. Position the electric fan panel on the remaining threaded portion of the cap screws from Step 2 and secure it to the shroud with four locknuts, see Figure 3.
12. Remove the condensation plug from the bottom of the electric fan.
13. Place the button plug in the shroud, see Figure 5.
14. Connect the electric fan to the power source per local and national electrical codes.

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

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The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

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The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

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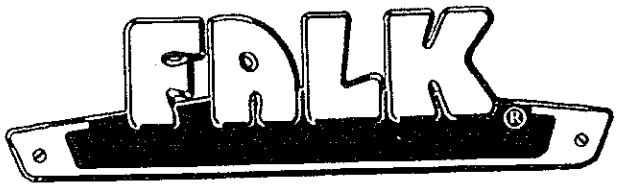

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Drive Shaft Recommendations Using TA Taper Bushing

Figure 2

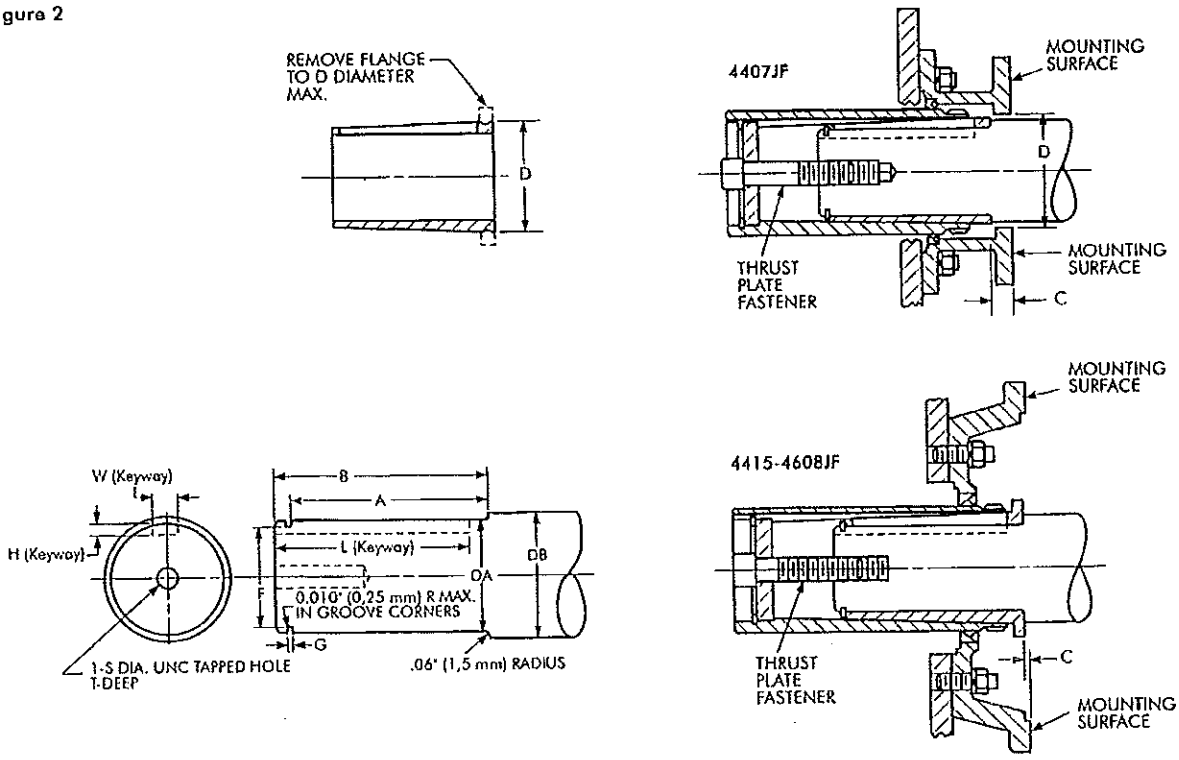


TABLE 3 — Removal & Backing Bolt Size and Tightening Torque

DRIVE SIZE	Removal Bolt Size & Min Length – Inches	Max Tightening Torque lb-ft (Nm)	Backing Bolt Size & Max Length – Inches
4407	1.125-7UNC x 3.00	742 (1006)	1.000-8UNC x 2.50
4415	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.75
4507	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.75
4608	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.75

TABLE 4 — Dimensions For Largest Bore Bushing – Inches (mm) ★

DRIVE SIZE	Thrust Plate Kit †	Thrust Plate Part No.	A ± 0.010 (±0,25)	B ± 0.030 (±0,75)	C ‡	D •	DA ■	DB Min.	Retaining Ring ♦				Keyway *			S	T Min.
									Groove		Spir O Lox		W	H	L Min.		
									F	G	Mfg. No.	Max. O.D.					
4407	TP4407JF	0778780	8.160 (207,26)	8.500 (215,90)	1.384 (35,15) 1.037 (26,34)	5.250 (133,35)	4.4375	4.750 (120,65)	4.059 4.071	0.120 0.125	RSN-425	4.688	1.000	0.5000	7.750 (196,85)	1.000-8	2.75 (69,8)
4415	TP4415JF	0778781	10.100 (256,54)	10.375 (263,52)	0.867 (22,02) 0.520 (13,21)	...	4.9375	5.250 (133,35)	4.616 4.604	0.079 0.084	RS-475	5.125	1.250	0.6250	9.563 (242,90)	1.250-7	3.00 (76,2)
4507	TP4507JF	0778782	10.440 (265,18)	10.750 (273,05)	0.617 (15,67) 0.269 (6,83)	...	5.4375	5.750 (146,05)	5.114 5.100	0.079 0.084	RS-525	5.688	1.250	0.6250	9.875 (250,82)	1.250-7	3.00 (76,2)
4608	TP4608JF	0778783	12.530 (318,26)	13.000 (330,20)	2.639 (67,03) 2.292 (58,22)	...	6.5000	7.000 (177,80)	5.993 5.977	0.174 0.182	RSN-625	6.813	1.500	0.7500	12.625 (320,68)	1.250-7	3.50 (88,9)

★ For metric drive shafts or bushing bores smaller than the maximum, provide the retaining ring groove per manufacturers' recommendations, keyway appropriate for the shaft diameter, and DB minimum of 0.300" (7.62 mm) larger than the bushing bore to provide adequate backing.

† Kit consists of: thrust plate, thrust plate fastener, hollow shaft retaining ring and drive shaft retaining ring.

‡ The range for C dimensions is the variation which may occur due to axial compression and manufacturing tolerances.

• The D dimension is the recommended minimum bore which clears the TA Taper bushing flange.

■ Shaft diameter tolerances are per AGMA as follows: over 2.50" to & including 4.00" = +.000", -.006"; over 4.00" to & including 6.00" = +.000", - .007"; over 6.00" to & including 7.00" = +.000", -.008". Metric drive shafts are to be based on h10 tolerances.

♦ Smalley retaining rings may be used instead of Spir O Lox by substituting WS for RS, WST for RST or WSM for RSN.

* Inch keyway width tolerances are as follows: .500" to & including 1.000" = +.0030", -.0000"; over 1.000" to & including 1.500" = +.0035", -.0000". Metric keyway widths are based on class N9 tolerances. Inch keyway depth tolerance is +.010", -.000". Refer to ISO 773 or DIN 6885 sheet 1 for metric keyway depth tolerances.

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Drive Shaft Recommendations Using (TCB) Kit

INTRODUCTION — These instructions are for use when a screw conveyor 4407JSC drive is to be used and the following conditions exist: Falk standard or 316 stainless steel JSC tapered drive shafts can not be used due to special extension dimensions or materials; or manufacturing a special tapered drive shaft is not feasible. Use this appendix to retrofit existing applications or for outfitting new installations where the above conditions warrant. For tapered shaft recommendations, see Appendix H.

This appendix will allow the use of a straight (non tapered) drive shaft with a special bushing conversion kit on screw conveyor applications. The bushing conversion kit may also be used on flange mounted 4407JF applications where the Falk JSC seal housing is to be used as the mounting flange. This kit provides one bushing bore per drive size as shown in Table 4. Provided in this appendix are dimensions for drive shaft recommendations and instructions for the installation and removal of the assembly.

FIGURE 2 — The hollow shaft of the drive has a tapered bore which accepts the tapered bushing. When the bushing is drawn into the taper, a clamping force is applied to the drive shaft. The drive shaft is drawn into the hollow shaft via a fastener in the thrust plate. The bushing seats against a shoulder on the drive shaft and is drawn into the drive with the shaft. Removal is accomplished by using a jackscrew in the thrust plate and forcing the drive shaft out of the drive. The retaining ring in the drive shaft assures that the bushing will be removed along with the shaft.

DRIVE SHAFT RECOMMENDATIONS — The recommendations for the drive shaft consist of two major features. The first is the shoulder which must be provided in the location shown in Figure 2. This shoulder provides the backing necessary to draw the bushing into the taper. A permanently fixed shoulder must be provided in order for this design to be effective. The shoulder may be a welded collar or an integral step. SET COLLARS ARE NOT ACCEPTABLE. A retaining ring may be used in the drive shaft, to provide the shoulder, but stress concentrations can occur at the groove and therefore shaft stresses must be checked. The second major feature on the shaft is the retaining ring groove in the shaft end. This feature is recommended to ensure positive removal of the bushing when the drive shaft is removed from the drive. The threaded hole in the end of the drive shaft accepts the thrust plate fastener.

WARNING: Lock out power source and remove all external loads from system before servicing drive or accessories.

INSTALLATION PROCEDURE — With the shaft manufactured per the recommendations shown, proceed as follows:

The seal housing may be assembled to the drive before or after the drive shaft is installed into the drive, but if the seal housing is installed to the drive first, the lip type seal (if used) must be installed from the extension end.

Slide the bushing (large end first) onto the drive shaft until it contacts the shoulder on the shaft. Insert the key through the bushing and into the drive shaft keyway. Install the retaining ring into the groove in the drive shaft. Line up the keyway in the drive hollow shaft with the key in the drive shaft and slide shaft/bushing assembly into the hollow shaft. Attach the seal housing to the drive with the fasteners provided. Tighten fasteners to torque given in Table 1. Assemble the thrust plate and retaining ring into the counterbore in the hollow shaft. Insert the thrust plate fastener through the thrust plate and thread into the drive shaft end. Tighten to the torque given in Table 2. Install all covers and guards.

REMOVAL PROCEDURE — Remove low speed shaft input end cover. Remove the thrust plate fastener, retaining ring and thrust plate from the hollow shaft. Refer to Table 3 and select a backing bolt and flat washer and install them into the drive shaft as illustrated in Figure 1. The head of the backing bolt provides a working surface for the removal bolt. Reinsert the thrust plate and retaining ring into the hollow shaft and select a removal bolt from Table 3. Thread the removal bolt into the thrust plate until it contacts the backing bolt head. Tighten the removal bolt to the torque indicated in Table 3. (If the thrust plate rotates in the shaft, align the slot in the plate with the hollow shaft keyway and insert a screwdriver or piece of key stock to prevent rotation of the plate). After torquing the bolt, as instructed, strike the bolt sharply with a hammer and retorque the bolt if separation of the drive from the shaft did not occur. Repeat this procedure, retorquing the bolt after each blow, until separation occurs.

Figure 1

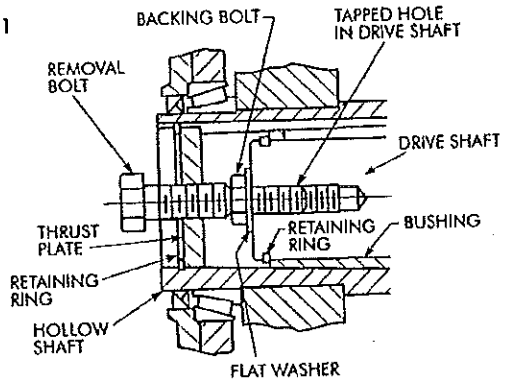


TABLE 1 — Seal Housing Fastener Tightening Torque (Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Max. Tightening Torque lb.-ft.(Nm)
4407	.750-10UNC	330 (447)

TABLE 2 — Thrust Plate Fastener Data (Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade Inches	Max. Tightening Torque lb-ft (Nm)	Min Thread Depth Inches (mm)
4407	1.000- 8UNC x 5.50, GR.8	792 (1074)	2.75 (69,8)

Drive Shaft Recommendations Using (TCB) Kit

Figure 2

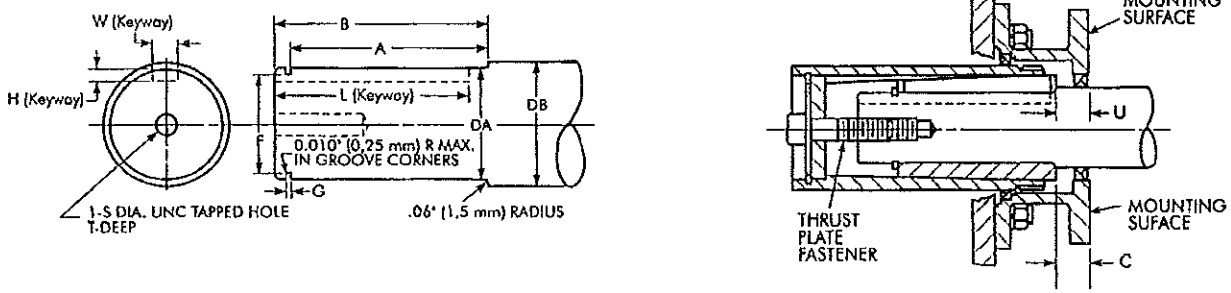


TABLE 3 — Removal & Backing Bolt Size and Tightening Torque

DRIVE SIZE	Removal Bolt Size & Min Length – Inches	Max Tightening Torque lb-ft (Nm)	Backing Bolt Size & Max Length – Inches
4407	1.125- 7UNC x 3.00	742 (1006)	1.000- 8UNC x 2.50

TABLE 4 — Dimensions – Inches (mm)

Taper Conversion Bushing Kit †	(TCB) Kit Part No.	A ± 0.010 (± 0,25)	B ± 0.030 (± 0,75)	C ‡	DA •	DB ■ +0.000, - 0.003 (+0,00, - 0,08)	Retaining Ring ♦ Groove F	Groove G	Mfg. No.	Max. O.D.	Keyway * W	H	L Min.	S	T Min.	Weld/Integral Flange U
TCB4407J-3.438	0786823	7.655 (194,44)	9.500 (241,30)	1.879 (47,73) 1.552 (39,42)	3.4375	3.938 (100,03)	3.263 3.251	0.103 0.108	Spir O Lox RSN-343	...	0.875	0.4375	9.250 (234,95)	1.000-8	2.75 (69,9)	1.500 (38,10)

† Kit consists of: Bushing, thrust plate, fastener, key, retaining ring, and hardware.
‡ The range of C dimension is the variation which may occur due to axial compression and manufacturing tolerances.
• Shaft diameter tolerances are per AGMA as follows: over 2.50" to & including 4.00" = +.000", - .006".
■ If a lip type seal is used, a 32rms finish is recommended.
♦ Smalley retaining rings may be used instead of Spir O Lox by substituting WSM for RSN.
* Inch keyway width tolerances are as follows: over .500" to & including 1.000" = +.0030", -.0000"; 1.000". Inch keyway depth tolerance is +.010", -.000".

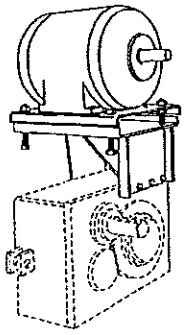
The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

OSHA V-Belt Guard Installation For Drives Without Shaft Fan

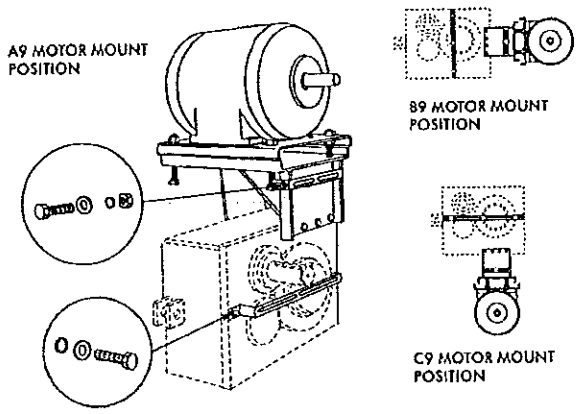
WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.

WARNING: Lock out power source and remove all external loads from drive before servicing drive or accessories.

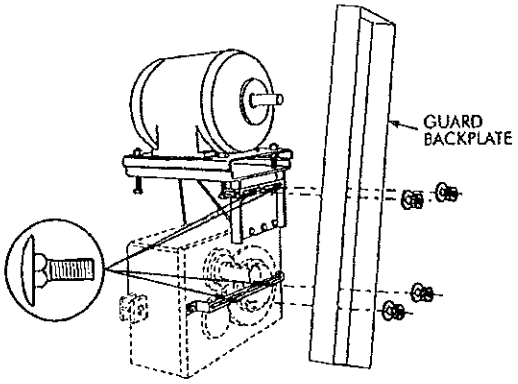
1. ASSEMBLE MOTOR MOUNT AND MOTOR TO DRIVE AS INSTRUCTED IN APPENDIX D



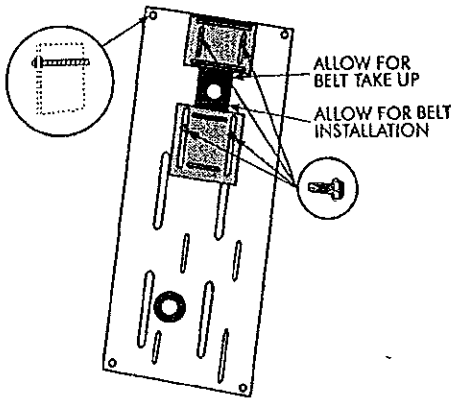
2. ASSEMBLE BELT GUARD BRACKETS TO MOTOR MOUNT



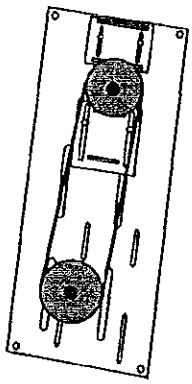
3. ASSEMBLE BACKPLATE TO BRACKETS



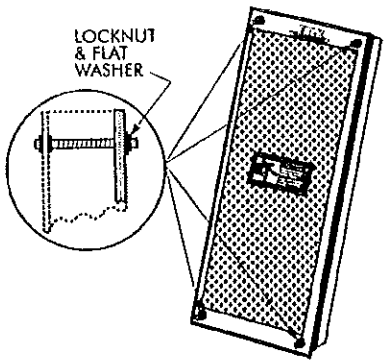
4. ASSEMBLE THREADED RODS TO BACKPLATE & MOUNT SLOT COVER(S) AS REQUIRED



5. MOUNT BELT DRIVE AS INSTRUCTED IN APPENDIX D



6. MOUNT COVER AND APPLY WARNING LABEL



The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Backstop Installation — Sizes 4407/M4407 thru 4507/M4507

Introduction

The following instructions apply to INSTALLATION ONLY of internal backstops in horizontal drives, Sizes 4407 thru 4507 double reduction.

WARNING: If backstop is to be replaced, the high speed shaft must also be replaced. Refer to instructions regarding high speed shaft replacement in Section III.

Remove all external loads from system before servicing drive or accessories, and lock out starting switch of prime mover.

Lubricant

PETROLEUM BASED LUBRICANTS — Use R & O type lubricants which do not contain anti-wear (AW) additives if the drive is equipped with an internal backstop.

CAUTION: Do not use EP lubricants or lubricants with anti-wear additives or lubricant formulations including sulfur, phosphorus, chlorine, lead derivatives, graphite or molybdenum disulfides in drives equipped with internal backstops. Refer to Appendix A for proper selection of petroleum based lubricants. Use of an improper lubricant will contribute to premature wear or malfunction of the backstop.

SYNTHETIC LUBRICANTS — Synthetic lubricants may be used in drives with internal backstops operating in cold temperatures, -30°F to +50°F (-34°C to +10°C) only. DO NOT use synthetic lubricants in drives with backstops operating above +50°F (10°C). Refer to Appendix A for proper selection of synthetic lubricants.

Before installing backstop, check direction of free rotation (overrunning) indicated by the arrow etched on each side of the backstop.

Backstop Application

Backstops are designed to prevent reverse rotation or backrun without backlash in applications such as conveyors, bucket elevators, fans, rotary pumps and kilns. Backstops are not approved for use on systems that are designed for handling of people such as elevators, manlifts, ski tows and ski lifts. DO NOT use a backstop as a substitute for a brake.

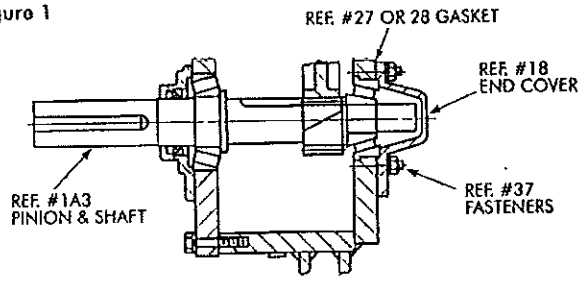
Indexing

DO NOT use the backstop for indexing applications. The backstop is designed to prevent reverse rotation five times or less in eight hours, with one minute or more in overrunning direction between backstopping load applications. If backstopping operations are more frequent, or the time between operations is less than one minute, the backstop is classified as an indexing device and must be referred to the Factory.

Installation

1. Drain oil from the drive. If a backstop is being added to an existing drive, for Sizes 4415 and 4507, remove and discard the original end cover, Ref. #18; fasteners, Ref. #37; and gasket, Figure 1. For Size 4407, remove and discard the original end cover, Ref. #18; gasket and four short studs. Install longer studs, Ref. #38, provided with the kit. The hex nuts removed from original shaft cover assembly will be required for reassembly.

Figure 1



2. If existing backstop is being replaced for Sizes 4407, 4415J14 & 4507, remove cover, Ref. #19; backstop, Ref. #5A1; spacer, Ref. #5A2; and gasket from backstop cage. For Size 4415J25, remove cover, Ref. #19; gasket and backstop cage, Ref. #20, from housing. Remove two (2) retaining rings from bore of backstop cage. Remove backstop, Ref #5A1, from cage. For all drive sizes, note direction of rotation of high speed shaft for proper reassembly. Refer to Section II for shaft and backstop inspection.

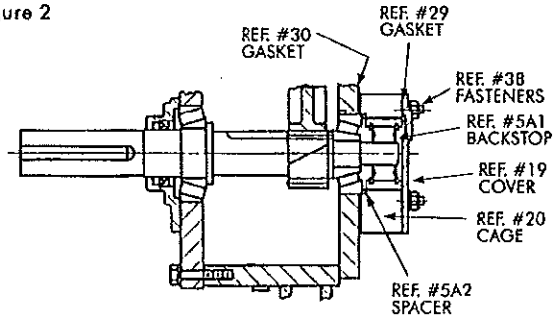
3. Remove backstop, Ref. #5A1, from the kit and wipe off excess lubricant.

4. SIZE 4407 (FIGURE 2) — Assemble backstop cage, Ref. #20, onto studs using one new .015" (.381 mm) shim-gasket, Ref. #30, against the housing. Slide the spacer, Ref. #5A2, into the backstop cage up against the bearing cup. Apply oil to the O.D. of the high speed shaft backstop journal and the sprags inside of the backstop. Insert key Ref #5A4 into backstop keyway. Align the key with the keyway in the backstop cage and carefully slide the backstop into the bore while slowly rotating the high speed shaft. The shaft will only rotate in one direction. DO NOT FORCE OR HAMMER; this may damage the shaft or misalign the sprags.

   Check operation of backstop by turning high speed shaft in required direction of rotation by hand. If the shaft does not rotate in the required direction, remove backstop, reverse it and reinsert it into bore as instructed above. Proceed to Step 9.

Backstop Installation — Sizes 4407/M4407 thru 4507/M4507

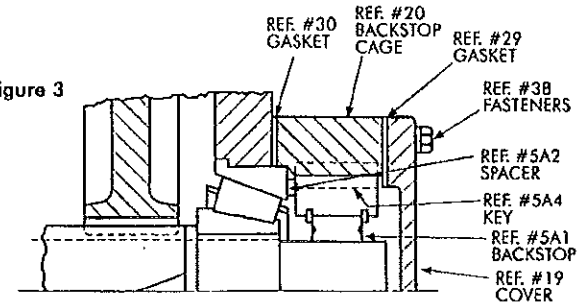
Figure 2



5. **SIZE 4415 THRU 4507** — Install dowel into cage.

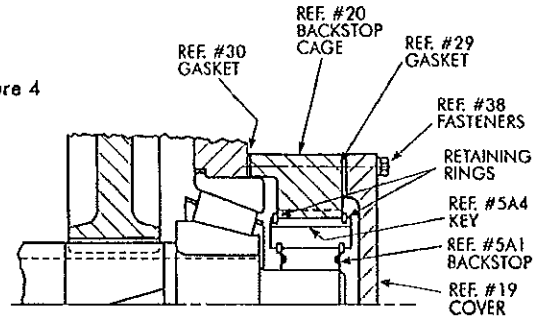
6. **SIZE 4415J14 & 4507 (FIGURE 3)** — Apply oil to the O.D. of the high speed shaft backstop journal and the sprags inside of the backstop. Insert key, Ref #5A4, into backstop keyway. Align the key with the keyway in the backstop cage and carefully slide the backstop into cage, allowing the backstop to protrude 0.25" (6.4 mm). Coat spacer with grease to assist in holding the spacer against the backstop for assembly and slide into housing side of cage. This spacer will fit between bearing cup and backstop.

Figure 3



7. **SIZE 4415J25 (FIGURE 4)** — Install one (1) retaining ring in groove on backstop. Apply oil to the O.D. of the high speed shaft backstop journal and the sprags inside of the backstop. Insert key, Ref #5A4, into backstop keyway. Align the key with the keyway in the backstop cage and carefully slide the backstop into cage. Install second retaining ring on backstop to hold it in the cage.

Figure 4



8. **SIZE 4415 & 4507 (ALL TYPES)** — Place one new .015" (.381 mm) shim-gasket, Ref. #30, against housing. NOTE: Position gaskets, Ref. #30 and spacer, Ref. #5A2, so that the drain back hole is open. Blocking the drain back hole will not allow oil to lubricate backstop sufficiently and could lead to premature wear, resulting in backstop or drive failure. Carefully install the backstop/cage assembly on the oiled shaft extension while slowly rotating the high speed shaft. The shaft will only rotate in one direction.

   DO NOT FORCE OR HAMMER; this may damage the shaft or misalign the sprags.

   Check operation of backstop by turning high speed shaft in required direction of rotation by hand. If the shaft does not rotate in the required direction, remove backstop, reverse it and reinstall as instructed in preceding steps.

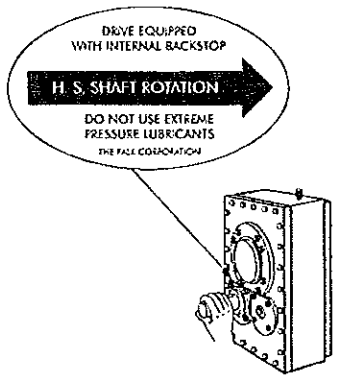
9. Rotate high speed shaft in the required direction of rotation and then reverse the rotation to lock up the backstop. Observe the position of the sprags. All Sprags must be engaged and lay in the same relative position around the shaft. If the sprags are not uniformly positioned, lightly tap the backstop cage to centralize all the sprags around the shaft and cage. If sprags cannot be uniformly positioned in this manner, remove the backstop and run a finger around the sprags in the overrunning direction. Reinstall backstop as instructed in the preceding steps.

   Check the position of the sprags several times by overrunning and locking the sprags. If all sprags move uniformly, hold the backstop in the locked position and proceed to the next assembly step.

10. Install backstop cover, shim-gasket and fasteners, Ref. #19, 29 & 38. NOTE: Position gaskets, Ref. #30, and spacer, Ref. #5A2, so that the drain back hole is open. Blocking the drain back hole will not allow oil to lubricate backstop sufficiently and could lead to premature wear, resulting in backstop or drive failure. Cross-tighten fasteners to 70 lb-ft (95 Nm) for Size 4407, and 28 lb-ft (38 Nm) for Sizes 4415 -4507.

11. Clean housing surface for rotation and warning labels. Affix the rotation indicator next to high speed shaft extension to indicate the free direction of rotation, Figure 5. Fill drive to oil level specified in Section I, with oil specified in Appendix A. Check motor for correct rotation before completing connection to drive.

Figure 5



The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Backstop Installation — Size 4608/M4608

Introduction

The following instructions apply to INSTALLATION ONLY of self-contained, sprag type backstop, externally mounted on the high speed shaft of a horizontally mounted Size 4608 double reduction drive. This backstop is sold only as an accessory for new or existing Falk drives. Do not use for any other application without written approval from The Falk Corporation.

Backstops must not be dismantled or repaired. Backstops are nonserviceable components. Replace damaged backstops with new backstops from factory.

Remove all external loads from system before servicing drive or accessories and lock out starting switch of prime mover.

Backstop Application

Backstops are designed to prevent reverse rotation or backrun without backlash in applications such as conveyors, bucket elevators, fans, rotary pumps and kilns. Backstops are not approved for use on systems that are designed for handling of people such as elevators, manlifts, ski tows and ski lifts. DO NOT use a backstop as a substitute for a brake.

Indexing

DO NOT use the backstop for indexing applications. The backstop is designed to prevent reverse rotation five times or less in eight hours, with one minute or more in overrunning direction between backstopping load applications. If backstopping operations are more frequent, or the time between operations is less than one minute, the backstop is classified as an indexing device and must be referred to the factory.

WARNING: The backstop and normal associated equipment (shaft, pulleys, etc.) involve moving parts; therefore, consult local, state, OSHA and ANSI safety codes for proper guarding of rotating members and possible pinch points.

If Backstop slippage occurs, DO NOT operate. Install a new backstop before resuming operation.

Lubricant

NOTE: Unless specified otherwise, the backstop is furnished filled with grease suitable for operation in an ambient temperature range of -20°F to +125°F (-29°C to +52°C).

Consult factory for lubrication recommendations when ambient temperatures are higher than 125°F (52°C), or when drives are operating in extremely humid, chemical, or dust laden atmospheres.

CAUTION: Do not use greases with molybdenum disulfide or other EP additives in external backstops. Use of an improper grease will contribute to premature wear or malfunction of the backstop.

Relubricate the backstop every 3 months (2 weeks in severe operating conditions). To relubricate, select and clean one grease fitting and pump grease into the backstop until fresh grease appears at both seals.

Refer to manufacturer's service manual (supplied with drive) for detailed maintenance instructions and recommended greases.

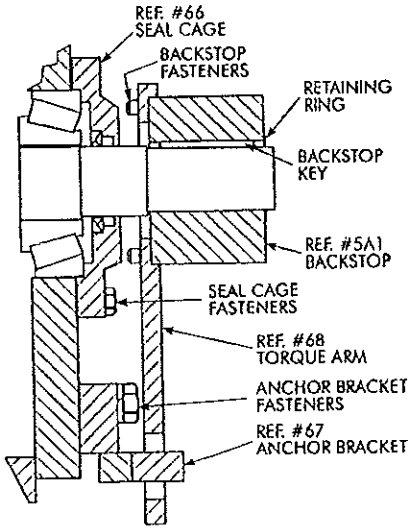
Installation

1. Clean the backstop bore and the shaft on which the backstop will be mounted. Remove and clean shaft key and set aside.

   CAUTION: Refer to direction of rotation arrow on backstop. Before installation, make certain that the direction of rotation is correct. Check backstop size on nameplate and make certain it is correct.

2. Attach anchor bracket, Ref. #67, to housing using fasteners provided with kit, Figure 6. Tighten fasteners to 245 lb-ft (332 Nm).

Figure 6



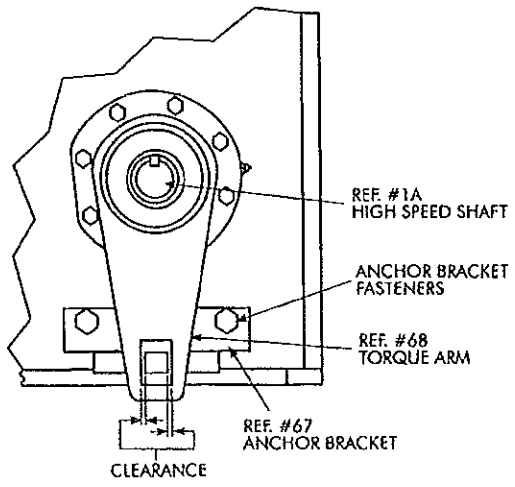
3. Secure backstop, Ref. #5A1, to torque arm, Ref. #68, using fasteners provided with kit, Figure 6. Tighten fasteners to 18 lb-ft (24 Nm). Note: Backstop will fit inside counterbore of torque arm.

4. Install backstop key into keyway on backstop shaft extension.

5. Align key with keyway in bore of backstop and slide backstop/torque arm assembly onto shaft. Apply pressure to end face of the backstop inner race only. Pressure applied to the outer race could preload the backstop bearings, resulting in a premature failure.

   The backstop must slip onto shaft. DO NOT FORCE OR HAMMER backstop on shaft. Allow for clearance between tab on anchor bracket and hole in torque arm so that the tab can pass through the hole, Figure 7.

Figure 7

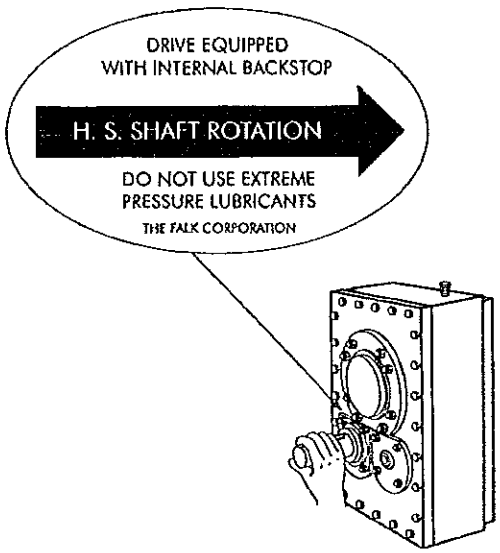


6. Install retaining ring on backstop shaft extension to hold backstop assembly on shaft. NOTE: Clearance between backstop and retaining ring allows for backstop assembly to float axially on shaft.

7. Check free and locked rotation of backstop by turning the high speed shaft in required direction of rotation by hand. If the shaft does not rotate in the required direction, remove backstop assembly from shaft, disassemble backstop, Ref. #5A1, from torque arm, Ref. #68, and reverse backstop. Reassemble backstop assembly as instructed in preceding steps.

8. Clean housing surface for rotation and warning labels. Affix the rotation indicator next to high speed shaft extension to indicate the free direction of rotation, as in Figure 8. Check motor for correct rotation before completing connection to drive.

Figure 8



The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

TA Removal Tool

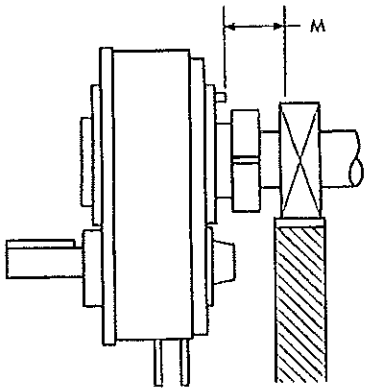
Introduction

The TA removal tool (Patented) offers a positive method for removing a TA Taper equipped Quadrive from the driven shaft. This method uses the torque multiplying characteristic of the drive to separate the drive from the bushing and driven shaft.

The removal tool is available in kit form suitable for use with Sizes 4407 thru 4608. The kit can be ordered from your Falk distributor by specifying "TA Removal Kit -Part 0769407." NOTE: Use of this tool requires a minimum axial clearance ("M" shown in Figure 1 and Table 1), from the seal cage stud.

CAUTION: DO NOT modify the tool in any way OR use it in another manner except to loosen the bushing nut as instructed herein.

Figure 1



Preparation For Removal

TABLE 1 — Minimum Tool Clearance

DRIVE SIZE	M Dimension — Inches (mm)
4407	5.12 (130)
4415	5.12 (130)
4507	5.38 (137)
4608	5.12 (130)

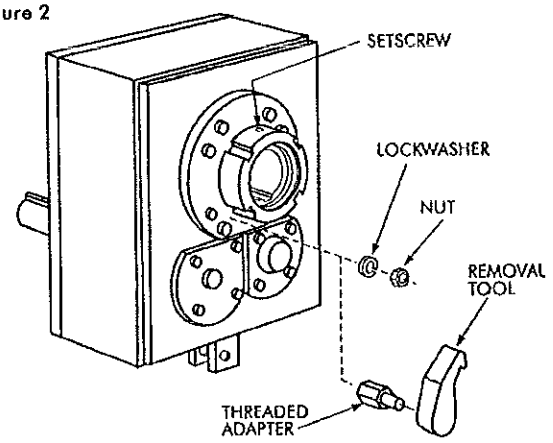
WARNING: Always "lock out" prime mover before working on the Quadrive.

1. Quadrive shafts, high speed and hollow, must be free to rotate.
   a. Remove any external load on the driven shaft.
   b. Remove belts from high speed shaft sheave.
   c. Remove the backstop (if so equipped). Refer to Section II — Step 10, for backstop removal instructions.

WARNING: DO NOT disconnect the drive from its torque arm until the removal process is completed. In addition, the drive must be supported during removal process. Use a sling around the motor mount or as recommended in SECTION I, Step 6. Be sure to take up the slack in the sling before proceeding.

2. Loosen the setscrew on the O.D. of the bushing nut. Remove the most convenient seal cage nut and lockwasher from the stud. Figure 2.

Figure 2



3. Select the proper adapter from the tool kit. (Adapters are marked with the Quadrive Size and part number.) Thread the appropriate adapter onto the stud and apply tightening torque from Table 2.

TABLE 2 — Adapter Tightening Torque

DRIVE SIZE	Part Number	Torque lb-ft (Nm)
4407	2111960	108 (146)
4415	2111960	108 (146)
4507	2111961	120 (163)
4608	2111960	108 (146)

4. Mount the removal tool as illustrated in Figure 3 or 4. It is generally preferable to install the tool in a position where it's weight will tend to keep it engaged into the nut. Rotate the high speed shaft until the tool hook engages one of the slots in the nut.

TA Removal Tool

Figure 3 SIZES 4407, 4415, & 4608

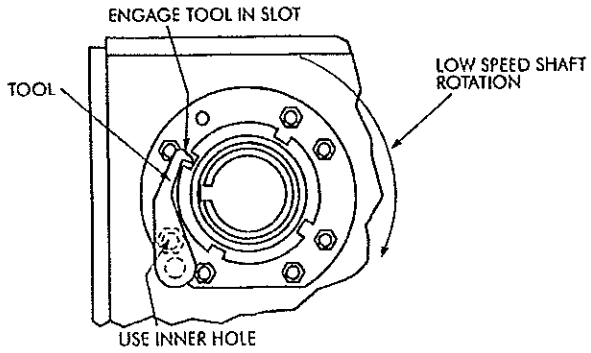
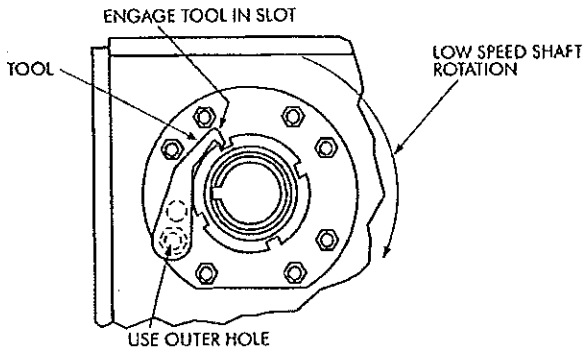


Figure 4 SIZE 4507



Removal Of Quadrive

5. Use a spanner wrench to apply torque through the high speed shaft keyway (Type J05 clockwise; Types J14 or J25 counter-clockwise) to loosen the bushing nut.

   WARNING: Never use the prime mover to produce the torque needed. This could result in severe personal injury or damage to the equipment.

   CAUTION: To avoid damage to the drive or the removal tool, DO NOT exceed the H.S. shaft torque values listed in Table 3.

   NOTE: The nut will rotate freely for approximately 180° as it moves from the locked to the removal position. Resistance will indicate that unseating is occurring. Turn until the nut and bushing are completely free. Now, prepare the drive for lifting by disconnecting the torque arm at the drive end.

6. ALTERNATE METHOD — Torque may be applied to the sheave or sprocket mounted on the high speed shaft.

TABLE 3 — Maximum Torque - High Speed Shaft lb-ft (Nm)

DRIVE SIZE	Drive Reduction		
	J05	J14	J25
4407	843 (1143)	302 (410)	167 (226)
4415	902 (1224)	337 (456)	183 (249)
4507	...	372 (504)	205 (278)
4608	...	422 (572)	230 (312)

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

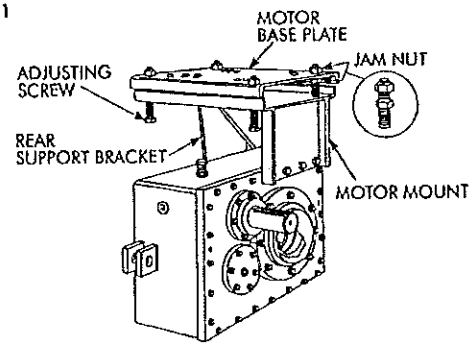
Motor Mount Installation

Introduction

The Falk Equi-Poised Motor Mount is an all-steel weldment that bolts directly to the steel housing of Falk Shaft Mounted (Type JR), Flange Mounted (Type JF) and Screw Conveyor (Type JSC) Drives, as shown in Figure 1.

This modern design provides a simple means of tensioning V-belts or chains with adjusting screws. Motor base plates are available from Factory predrilled for NEMA & IEC standard foot mounted motors within the rated capacity of the drive.

Figure 1



Assembly Instructions

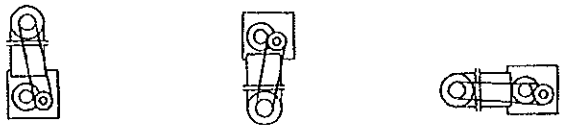
From Figure 2, determine which assembly is required. Drives are shown assembled in the 3 o'clock position, high speed shaft relative to low speed shaft. They can also be mounted in the 6, 9 and 12 o'clock positions after the motor mounts are assembled.

WARNING: Remove all external loads from system before servicing drive or accessories.

Consult applicable local and national safety codes for proper guarding of rotating members.

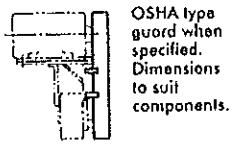
STANDARD ASSEMBLIES

Figure 2



A3 (3 o'clock) C3 (3 o'clock) D3 (3 o'clock)

Letter = Motor Mount Position, Number = Drive H.S.S. Clock Position



Refer to Appendix L for installation of Falk V-belt guards.

1. ASSEMBLE MOTOR MOUNT BRACKET TO DRIVE.

   Remove housing cover fasteners and attach motor mount bracket to housing using longer fasteners provided. Refer to Table 1 for fastener size and tightening torque.

2. ASSEMBLE REAR SUPPORT BRACKET TO DRIVE.

   Refer to Table 1 for fastener size and tightening torque.

   a. SIZE 4407 ALL TYPES (FIGURE 3) — Remove two hex nuts and lockwashers from seal cage studs. Remove the two seal cage studs and replace them with the longer studs provided. Mounting position of drive and motor mount will determine which fasteners need to be removed. Using lockwashers provided with motor mount and hex nuts previously removed, attach rear support bracket to drive, aligning holes in bracket with seal cage studs.

   b. SIZES 4415JR & 4507JR (FIGURE 3) — Remove appropriate hex nuts and lockwashers from seal cage studs. Mounting position of drive and motor mount will determine which fasteners need to be removed. Using hex nuts and lockwashers previously removed, attach rear support bracket to drive, aligning holes in bracket with seal cage studs.

   c. SIZES 4415, 4507 & 4608JF (FIGURE 4) — Attach rear support to flange using mounting fasteners furnished by user (furnished by Falk for Size 4608JF).

   d. SIZE 4608JR (FIGURE 3) — Attach rear support bracket to seal cage pads using fasteners provided.

Figure 3 Sizes: 4407 thru 4507JR 4407JF & JSC 4608JR

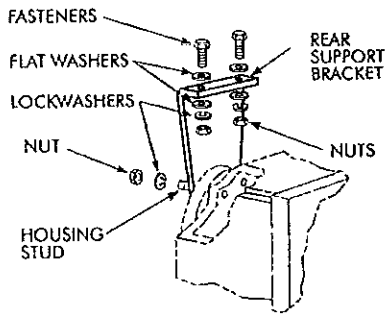
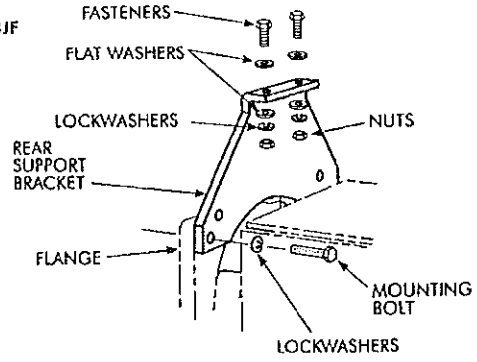
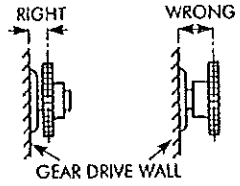


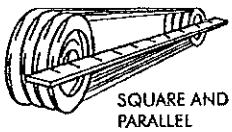
Figure 4 Sizes: 4415 thru 4608JF

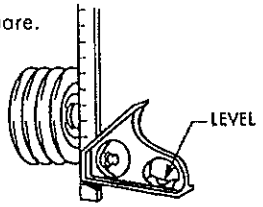


Motor Mount Installation

3. ASSEMBLE SUPPORT BRACKET TO MOTOR MOUNT BRACKET — Use the fasteners provided. Refer to Table 1 for fastener size and tightening torque.
4. ASSEMBLE BASE PLATE TO MOTOR MOUNT BRACKET (FIGURE 1) — Assemble adjusting screws to motor mount bracket and base plate with jam nuts above and below the base plate.
5. MOUNT MOTOR — Position motor on base plate so that all mounting holes are in alignment. Install and tighten motor fasteners.
6. SPROCKET, PULLEY OR SHEAVE CONNECTION — Mount power takeoffs as close to drive and motor housing as possible to avoid undue bearing load and shaft deflection. Align the high speed shaft of drive square and parallel with motor shaft by placing a straightedge across the face of the sprockets or sheaves as illustrated. Check horizontal shaft alignment by placing one leg of a square against the face of the sheave or sprocket with the spirit level on the horizontal leg of the square.







Adjustment of the belt or chain is accomplished by turning adjusting screws evenly. DO NOT over tighten belts or chains. Over tightening belts or chains reduces belt/chain and bearing life. When the required tension is reached, tighten adjusting screw jam nuts to torques listed in Table 1. Adjust chain tension to manufacturers' specifications. Adjust belts as follows:

The ideal belt tension is the lowest tension at which the belt will not slip under peak load conditions. Check belt tension frequently during the first 24 to 48 hours of run-in operation. Keep belts free from foreign material which may cause slippage. Inspect the V-belt drive periodically; retighten belts if they are slipping.

TABLE 1 — Fastener Size and Tightening Torque ★

DRIVE SIZE	Motor Mount to Housing		Support to Seal Cage		Support to Motor Mount		Support to Flange		Adjusting Screws	
	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)
4407	.500-13UNC x 2.25	69 (94)	.750-10UNC	330 (447)	.500-13UNC x 1.75	69 (94)	.750-10UNC	330 (447)	1.250-7UNC †	362 (491)
4415	.500-13UNC x 2.50	69 (94)	.750-10UNC	330 (447)	.500-13UNC x 1.75	69 (94)	1.250-7UNC ‡	1050 (1424)	1.250-7UNC †	362 (491)
4507	.500-13UNC x 2.50	69 (94)	.875-9UNC	533 (723)	.500-13UNC x 1.75 •	69 (94)	1.250-7UNC ‡	1050 (1424)	1.250-7UNC †	362 (491)
4608	.750-10UNC x 3.25	245 (332)	.750-10UNC	330 (447)	.750-10UNC x 1.75	245 (332)	.750-10UNC x 2.00	245 (332)	1.250-7UNC	362 (491)

★ All fasteners are Grade 5.
† Size .625-11UNC x 6.00 fasteners are furnished with motor mount for select motor frame sizes. Tighten these fasteners to 60 lb-ft (81 Nm).
‡ Fasteners furnished by customer.
• Size .750-10UNC x 2.25 fasteners are furnished with motor mount for select motor frame sizes. Tighten these fasteners to 245 lb-ft (332 Nm).

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Vertical Standpipe Installation

Introduction

The following instructions apply to the installation of standpipe kits to standard drives mounted for vertical operation (high speed shaft up or down). Drawings are representative of this series of drives and may not agree in exact detail with all drive sizes.

NOTE: Vertical shaft drives, when filled to the proper oil level, are completely full of oil.

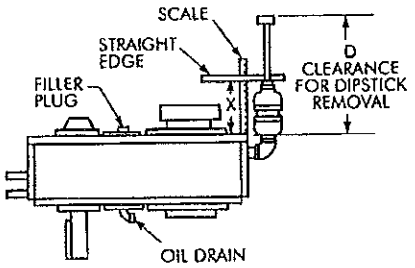
High Speed Shaft Down — Figure 1

1. After installing the drive per the Owners Manual installation instructions, determine which of the upper side plug locations on the drive will provide the best location for the standpipe, observing clearance required to remove dipstick (Dimension D, Table 1). Discard the air vent. When the air vent location is not used for the standpipe, relocate the pipe plug from the selected standpipe location to the air vent location. Recoat pipe plug threads with Permatex #3 or equivalent sealant before reinstalling.
2. Coat all pipe threads of kitted parts with Permatex #3 or equivalent sealant.

TABLE 1 — Dimensions

DRIVE SIZE	Inches (mm)			
	A	B	C	D
4407	0.75 (19)	1.25 (32)	1.75 (44)	24.3 (617)
4415	0.90 (23)	1.40 (36)	1.90 (48)	21.3 (541)
4507	0.92 (23)	1.42 (36)	1.92 (49)	21.3 (541)
4608	1.03 (26)	1.53 (39)	2.03 (52)	20.6 (523)

Figure 1



3. Assemble kitted parts to the drive as illustrated in Figure 1 and then secure the standpipe with an external support to maintain its vertical position.
4. Carefully measure Dimension X as illustrated in Figure 1.
5. From Table 1:

   X + A equals oil level "Full" mark.

   X + B equals oil level "Low" mark.

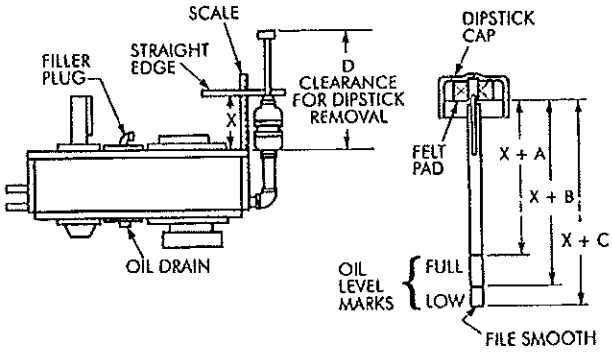
   X + C equals dipstick length.

6. Scribe Dimensions X + A and X + B on the dipstick as illustrated in Figure 1. Make measurements from the felt pad in the dipstick cap.
7. Lightly chisel permanent oil level marks on the scribed lines and cut the dipstick to the length marked. File end of dipstick smooth.
8. Install magnetic drain plug (furnished) in oil drain location.
9. Remove the oil filler plug. Add oil until the oil level reaches the "Full" mark on the dipstick. Coat the filler plug (not vented) with Permatex #3 or equivalent sealant and replace it.
10. Filler plug must always be removed to relieve entrapped air before checking oil level.

High Speed Shaft Up — Figure 2

1. After installing the drive per the Owners Manual installation instructions, determine which of the lower four side plug locations on the drive will provide the best location for the standpipe, observing clearance required to remove dipstick (Dimension D, Table 1). Discard the air vent. When the air vent location is not used for the standpipe, relocate the pipe plug from the selected standpipe location to the air vent location. Recoat pipe plug threads with Permatex #3 or equivalent sealant before reinstalling.

Figure 2



Vertical Standpipe Installation

2. Coat all pipe threads of kitted parts with Permatex #3 or equivalent sealant.
3. Assemble kitted parts to drive as illustrated in Figure 2 and then secure the standpipe with an external support to maintain its vertical position.
4. Carefully measure Dimension X as illustrated in Figure 2.
5. From Table 1:

   X + A equals oil level "Full" mark.

   X + B equals oil level "Low" mark.

   X + C equals dipstick length.
6. Scribe Dimensions X + A and X + B on the dipstick as illustrated in Figure 1. Make measurements from the felt pad in the dipstick cap.
7. Lightly chisel permanent oil level marks on the scribed lines and cut the dipstick to the length marked. File end of dipstick smooth.
8. Install magnetic drain plug (furnished) in oil drain location.
9. Remove the oil filler plug. Add oil until the oil level reaches the "Full" mark on the dipstick. Coat the filler plug (not vented) with Permatex #3 or equivalent sealant and replace it.
10. Filler plug must always be removed to relieve entrapped air before checking oil level.

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Modifications For Non-Standard Mounting Positions

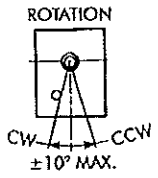
Instructions

For non-standard mountings, modify drives as illustrated below and on Page 38 to assure satisfactory lubrication. For applications that exceed the limits shown, drives that are both rotated AND tilted and drives with backstops, consult the Factory.

CAUTION: Inadequate lubrication will cause damage.

When replacing a pipe plug (P) with a street elbow (E), insert the plug in the elbow (E/P). When replacing a pipe plug (P) with a street elbow (E), pipe nipple (N) and a pipe cap (C), discard the pipe plug. Kits consist of parts for an oil expansion chamber. Pipe fittings and kits tabulated on Page 38 are available from Falk. Pipe fittings may also be purchased locally. Use galvanized pipe fittings.

Remove all pipe plugs and coat them and the added parts, with Permatex #3 or equivalent to prevent leakage. Install parts as illustrated to suit the mounting position. The air vent must be in the top of the drive or in the kit standpipe. Fill drives with oil to the level indicated by the letter "L" in the following drawings.



Standard Drive Mounting Limits

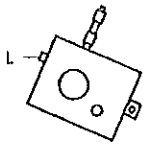
The 10° Max rotation illustrated at the left applies to standard 3, 6, 9 & 12 o'clock mountings. For higher limits, follow the instructions at the left and the drawings below. (6 o'clock illustrated)

CODE
B — Reducing Bushing
C — Cap
E — Street Elbow
L — Oil Level
N — Nipple
P — Pipe Plug
STD — No Modifications

Horizontal Drive Modifications for 10 to 20° Drive Rotation

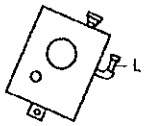
10 to 20° Clockwise Rotation

3 O'Clock — CW Rotation



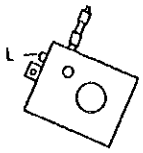
4407 = KIT 0786777
4415 THRU 4608 = KIT 0786778

6 O'Clock — CW Rotation



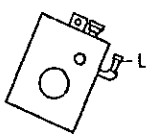
4407 = .750 E/C & .750 x 1.375 N
4415 & 4507 = 1.250 E/C & 1.250 x 1.625 N
4608 = 1.25 E/P

9 O'Clock — CW Rotation



4407 = KIT 0786777
4415 THRU 4608 = KIT 0786778

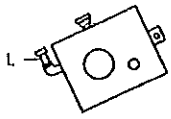
12 O'Clock — CW Rotation



4407 = .750 E/C & .750 x 1.375 N
4415 & 4507 = 1.25 E/C & 1.25 x 1.625 N
4608 = 1.25 E/P

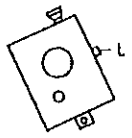
10 to 20° Counterclockwise

3 O'Clock — CCW Rotation



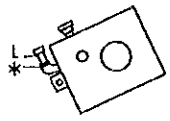
4407 = .750 E/C & .750 x 3.00 N
4415 = 1.250 E/C & 1.250 x 3.00 N
4507 = 1.250 E/C & 1.250 x 3.50 N
4608 = 1.250 E/C & 1.250 x 2.50 N

6 O'Clock — CCW Rotation



4407, 4415, 4507 & 4608 = STD

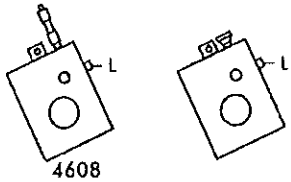
9 O'Clock — CCW Rotation



4407 = .750 E/C & .750 x 1.375 N
4415 & 4507 = 1.250 E/P
4608 = STD

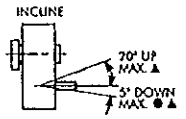
* This oil level applies when only a street elbow with a pipe plug is used.

12 O'Clock — CCW Rotation



4407, 4415 & 4507 = STD
4608 = KIT 0786778

Modifications For Non-Standard Mounting Positions



● 4407 THRU 4507 = 0° INCLINE DOWN ON DRIVES WITH BACKSTOPS IN 9 OR 12 O'CLOCK MOUNTING POSITION.

▲ 4608 = 5° INCLINE ON DRIVES WITH BACKSTOPS IN ALL MOUNTING POSITIONS.

Standard Drive Mounting Limits

The limits illustrated at the left applies to standard 3, 6, 9 & 12 o'clock mountings. For higher limits, follow the instructions on Page 37 and the drawings below. (6 o'clock illustrated)

CODE

C — Cap
E — Street Elbow
L — Oil Level
N — Nipple
P — Pipe Plug
STD — No Modifications

Standard Pipe Fittings ★ — Inches

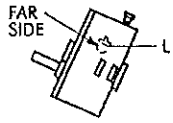
.750-14 NPT	Falk No.	1.25-11.5 NPT	Falk No.
.750 Street Elbow	0915253	1.25 Street Elbow	0915255
.750 Coo	0914804	1.25 Coo	0914806
.750 x 1.375 Nipple	0915824	1.25 x 1.625 Nipple	0915882
.750 x 3 Nipple	0915836	1.25 x 2.5 Nipple	0915885
.750 x .500 Bushing	0914652	1.25 x 3 Nipple	0915886
		1.25 x 3.5 Nipple	0915897
		1.25 x .500 Bushing	0914656

★ Kits: Falk Nos. 738471 . . . . Oil expansion chamber parts.
All pipe fittings are galvanized.

Horizontal Drive Modifications for Inclined H.S. Shaft

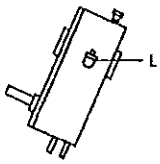
H.S. Shaft Inclined 20 to 30° Up

3 O'Clock H.S.S. Up



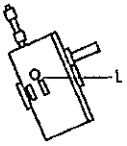
4407 = .750 E/P
4415 & 4507 = 1.25 E/P
4608 = STD

6 O'Clock H.S.S. Up



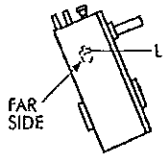
4407 = .750 E/P
4415 & 4507 = 1.25 E/P
4608 = STD

9 O'Clock H.S.S. Up



4407 = KIT 0786777
4415, 4507 & 4608 = KIT 0786778

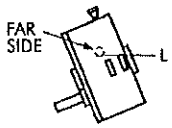
12 O'Clock H.S.S. Up



4407 = .750 E/P, KIT 0786777
4415 & 4507 = 1.25 E/P
4608 = STD

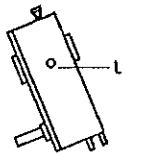
H.S. Shaft Inclined 5 to 30° Down

3 O'Clock H.S.S. Down



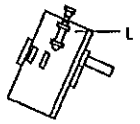
4407 THRU 4608 = STD

6 O'Clock H.S.S. Down



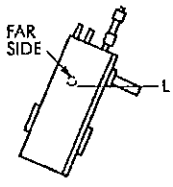
4407, 4415 & 4507 = STD
4608 = 5 - 20° STD
4608 = 21 - 30° 1.250 E/P

9 O'Clock H.S.S. Down



4407 = .750 E/C, .750 x 1.375 N, KIT 0786777
4415 & 4507 = 1.25 E/C & 1.25 x 2.50 N
4608 = 5 - 20° STD
4608 = 21 - 30° 1.250 E/P, KIT 0786778

12 O'Clock H.S.S. Down



4407 = .750 E/P, KIT 0786777
4415 & 4507 = KIT 0786778
4608 = KIT 0786778

NOTE: FOR SIZE 4608 WITH BACKSTOP, MAXIMUM INCLINE IS 5° (ALL CLOCK POSITIONS).

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Retaining Rings For Bushing Nuts And Thrust Plates

JR — Retaining Rings For Bushing Nuts

DRIVE SIZE	Manufacturer Part Number
4407	Truarc N5000-650
4415	Truarc N5000-725
4507	Truarc N5000-775
4608	Truarc N5000-900

JF & JSC — Retaining Rings For Thrust Plate Kits

DRIVE SIZE	Manufacturer Part Number
4407	Truarc N5000-500
4415	Eaton 11550
4507	Truarc N5000-600
4608	Truarc N5000-725

Seal Housing Lip Seal For Type JSC

Type JSC — Seal Housing Lip Seal

DRIVE SIZE	Falk Part No.	Manufacturer Part No.
		Chicago Rawhide
4407	2913658	39320

Tooth Combinations For Vibrations Analysis

Type J05 — Tooth Combinations

DRIVE SIZE	Exact Ratio	Pinion Ref. #3A3	Gear Ref. #4A4
4407	4.938	16	79
4415	5.077	13	66
4507	4.929	14	69
4608	5.000	13	65

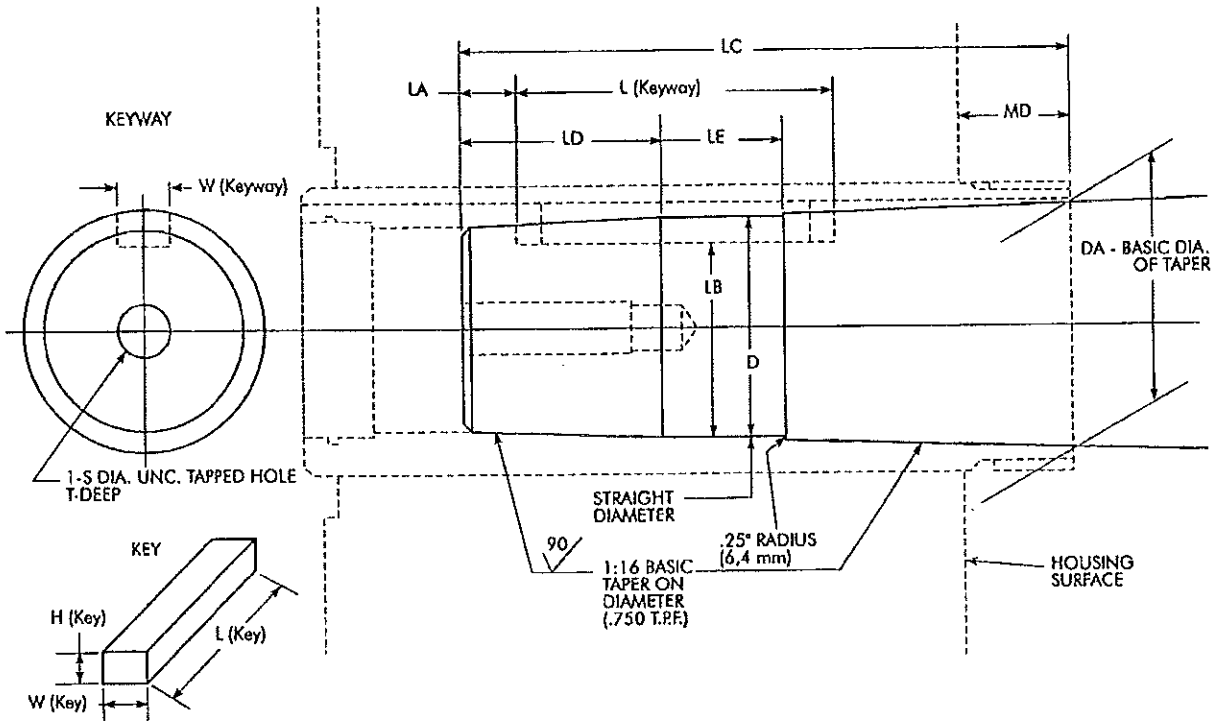
Type J14 — Tooth Combinations

DRIVE SIZE	Exact Ratio	Input		Output	
		Pinion Ref. #1A3	Gear Ref. #1A4	Pinion Ref. #2A3	Gear Ref. #4A4
4407	13.89	16	45	16	79
4415	13.61	25	67	13	66
4507	13.46	26	71	14	69
4608	13.82	17	47	13	65

Type J25 — Tooth Combinations

DRIVE SIZE	Exact Ratio	Input		Output	
		Pinion Ref. #1A3	Gear Ref. #1A4	Pinion Ref. #2A3	Gear Ref. #4A4
4407	25.04	14	71	16	79
4415	26.11	14	72	13	66
4507	24.29	14	69	14	69
4608	25.33	15	76	13	65

Drive Shaft Recommendations for Tapered Drive Shafts



Dimensions – Inches (mm) ★

DRIVE SIZE	Keyway W ‡	Keyway L ±.010 (±0,25)	D • +.000, −.005 (+0,00, −0,13)	DA	LA ±.030 (±.76)	LB +.000, −.010 (+.000, −.250)	LC +.040, −.000 (+1.02, −.00)	LD	LE	MD ■	S	T Min.	Key W	Key H	Key L
4407	1.000 (25,40)	7.000 (177,80)	4.925 (125,10)	5.175 (131,45)	0.500 (12,70)	4.374 (111.10)	9.250 (234.95)	5.25 (133.4)	2.25 (57.2)	2.45 (62.2)	1.000-8	2.75 (69.8)	1.000	0.750	6.00
4415	1.250 (31,75)	8.750 (222,25)	5.455 (138,56)	5.767 (146,48)	1.000 (25,40)	4.864 (123.54)	10.925 (277.50)	6.00 (152.4)	2.50 (63.5)	2.85 (72.4)	1.250-7	2.50 (63.5)	1.250	0.875	7.50
4507	1.250 (31,75)	9.000 (228,60)	6.003 (152,48)	6.327 (160,71)	1.000 (25,40)	5.368 (136.35)	12.020 (305.31)	7.00 (177.8)	2.50 (63.5)	3.10 (78.7)	1.250-7	2.50 (63.5)	1.250	0.875	7.75
4608	1.500 (38,10)	11.500 (292,10)	7.277 (184,84)	7.617 (193,47)	1.000 (25,40)	6.061 (153.95)	13.875 (352.42)	8.50 (215.9)	3.00 (76.2)	3.21 (81.5)	1.250-7	3.00 (76.2)	1.500	1.500	10.00

★ Dimensions are for reference only and are subject to change without notice unless certified.
‡ Inch keyway width tolerances are as follows: over .500" (12,70) to & including 1.000" (25,40) = +.0030" (+0,076), −.0000" (-0,000), over 1.000" (25,40) to & including 1.500" (38,10) = +.0035" (+0,089), −.0000 (-0,000). Inch keyway depth tolerance is +.010" (+0,25), −.000" (-0,00).
• Straight diameter is used to aid in measurement and manufacture of the keyway.
■ Dimension "MD" will vary slightly depending on degree of axial compression during installation and manufacturing tolerances.

The Falk Corp., subsidiary of Sundstrand Corp.
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Drive Shaft Recommendations Using TA Taper Bushing

INTRODUCTION — These instructions are for use when a flange mounted 4407-4608JF drive is to be used and the manufacture of a tapered drive shaft is not feasible. For JF tapered drive shaft recommendations, see Appendix H. Use this appendix to retrofit existing applications or for outfitting new installations. Parts required are the drive, TA Taper bushing and a thrust plate kit.

This appendix will allow the use of a straight drive shaft with the tapered bushing (without spanner nut) on flange mounted applications. Provided are dimensions (Table 4) for shaft recommendations and instructions for the installation and removal of the assembly. All bushing bore sizes, which are available in the standard Quadrive, are possible with this setup.

FIGURE 2 — 4407-4608JF drives are furnished with a flange adapter installed. The hollow shaft of the drive has a tapered bore which accepts the tapered bushing. When the bushing is drawn into the taper, a clamping force is applied to the drive shaft. The drive shaft is drawn into the hollow shaft via a fastener in the thrust plate. The bushing seats against a shoulder on the driven shaft and is drawn into the drive with the shaft. Removal is accomplished by using a jackscrew in the thrust plate and forcing the drive shaft out of the drive. The retaining ring in the drive shaft assures that the bushing will be removed along with the shaft.

DRIVE SHAFT RECOMMENDATIONS — The recommendations for the drive shaft consist of two major features. The first is the shoulder which must be provided in the location shown in Figure 2. This shoulder provides the backing necessary to draw the bushing into the taper. A permanently fixed shoulder must be provided in order for this design to be effective. The shoulder may be a welded collar or an integral step. SET COLLARS ARE NOT ACCEPTABLE. A retaining ring may be used, in the driven shaft, to provide the shoulder, but stress concentrations occur at the groove and therefore shaft stresses must be checked. The second major feature on the shaft is the retaining ring groove in the shaft end. This feature is recommended to ensure positive removal of the bushing when the drive shaft is removed from the drive. The threaded hole in the end of the drive shaft accepts the thrust plate fastener.

WARNING: *Lock out power source and remove all external loads from system before servicing drive or accessories.*

INSTALLATION PROCEDURE — With the drive shaft manufactured per the recommendations shown, and the bushing selected for the proper shaft diameter, remove and discard the retaining ring and spanner nut from the bushing assembly.

4407JF — Use of the tapered bushing requires that the flange of the bushing be removed to clear the adapter, Figure 2. A flangeless bushing is available for the 3.4375" diameter shaft only.

ALL JF DRIVES — Slide the bushing (flange end first) onto the drive shaft until it contacts the shoulder on the shaft. Insert the key through the bushing and into the drive shaft keyway. Install the retaining ring into the groove in the drive shaft. Bring the drive into position, line up the hollow shaft keyway with the key and slide the bushing and drive shaft into the hollow shaft bore.

Attach the drive to the mounting surface with fasteners (not provided). Refer to Table 1 for fastener size and tightening torque. Assemble the thrust plate and retaining ring into the counterbore in the hollow shaft. Insert the thrust plate fastener through the thrust plate and thread into the drive shaft end. Tighten to the torque given in Table 2. Install all covers and guards.

REMOVAL PROCEDURE — Remove hollow shaft cover. Remove the thrust plate fastener, retaining ring and thrust plate from the hollow shaft. Refer to Table 3 and select a backing bolt and flat washer and install them into the drive shaft as illustrated in Figure 1. The head of the backing bolt provides a working surface for the removal bolt. Reinsert the thrust plate and retaining ring into the hollow shaft and select a removal bolt from Table 3. Thread the removal bolt into the thrust plate until it contacts the backing bolt head. Tighten the removal bolt to the torque indicated in Table 3. (If the thrust plate rotates in the shaft, align the slot in the plate with the hollow shaft keyway and insert a screw driver or piece of key stock to prevent rotation of the plate). After torquing the bolt, as instructed, strike the bolt sharply with a hammer and retorque the bolt if separation of the drive from the shaft did not occur. Repeat this procedure, retorquing the bolt after each blow, until separation occurs.

Figure 1

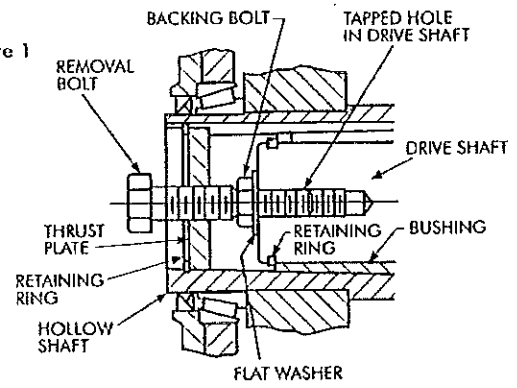


TABLE 1 — JF Drive – Foundation Fastener & Tightening Torque
(Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Max. Tightening Torque lb-ft (Nm)
4407	.750-10UNC, Grade 5	245 (332)
4415	1.250-7UNC, Grade 5	1050 (1424)
4507	1.250-7UNC, Grade 5	1050 (1424)
4608	1.500-6UNC, Grade 5	1842 (2497)

TABLE 2 — Thrust Plate Fastener Data
(Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Max. Tightening Torque lb-ft (Nm)	Min Thread Depth Inches (mm)
4407	1.000-8UNC x 5.50, Grade 8	792 (1073)	2.75 (69,8)
4415	1.250-7UNC x 6.00, Grade 8	1596 (2164)	3.00 (76,2)
4507	1.250-7UNC x 6.00, Grade 8	1596 (2164)	3.00 (76,2)
4608	1.250-7UNC x 8.00, Grade 8	1596 (2164)	3.50 (88,9)

Lubrication

Introduction

Lubricants listed in this manual are typical products ONLY and should not be construed as exclusive recommendations. Industrial type petroleum based rust and oxidation inhibited (R & O) gear lubricants or industrial type sulfur-phosphorus extreme pressure (EP) gear lubricants are the recommended lubricants for ambient temperatures of 15°F to 125°F (-9°C to 52°C).

For drives operating outside the above temperature range, refer to the "Synthetic Lubricants" paragraphs. Synthetic lubricants can also be used in normal climates.

Carefully follow instructions on the drive nameplate, warning tags and installation manuals furnished with the drive.

Viscosity (Important)

The proper viscosity grade for R & O and EP lubricants is found in Table 5. For synthetic lubricant viscosity grades, refer to Table 5 and the "Synthetic Lubricants" paragraphs. Petroleum based lubricant selections must have a pour point at least 10°F (5.5°C) below the expected minimum ambient starting temperature.

TABLE 1 — Petroleum Based R & O Gear Lubricants †

AGMA Viscosity Grade		4	5	6
ISO Viscosity Grade		150	220	320
Viscosity	cSt @ 40°C	135-165	198-242	288-352
	SSU @ 100°F	626-765	918-1122	1335-1632
Manufacturer		Lubricant	Lubricant	Lubricant
Amoco Oil Co. BP Oil Co. Chevron U.S.A., Inc. Citgo Petroleum Corp.		Amer.Ind. Oil 150 ..... Machine Oil AW 150 Citgo Pacemaker 150	Amer.Ind. Oil 220 Energol HLP-HD 220 Machine Oil AW 220 Citgo Pacemaker 220	Amer.Ind. Oil 320 ..... Machine Oil AW 320 Citgo Pacemaker 320
Conoco Inc. Exxon Company, U.S.A. Houghton International, Inc. Imperial Oil Ltd.		Dectol R&O Oil 150 Teresstic 150 Hydro-Drive HP 750 Teresso 150	Dectol R&O Oil 220 Teresstic 220 Hydro-Drive HP 1000 Teresso 220	Dectol R&O Oil 320 Teresstic 320 ..... Teresso 320
Kendall Refining Co. Keystone Lubricants Lyondell Petrochemical (ARCO) Mobil Oil Corp. Petro-Canada Products		Four Seasons AW 150 XLC-40 Duro 150 DTE Oil Extra Heavy Harmony 150 or 1500	..... XLC-50 Duro 220 DTE Oil BB Harmony 220	.... Duro 320 DTE Oil AA Harmony 320
Phillips 66 Co. Shell Oil Co. Shell Canada Limited Texaco Lubricants		Magnus Oil 150 Morlina 150 Tellus 150 Regal Oil R&O 150	Magnus Oil 220 Morlina 220 Tellus 220 Regal Oil R&O 220	Magnus Oil 320 Morlina 320 Tellus 320 Regal Oil R&O 320
Unocal 76 (East) Unocal 76 (West) Valvoline Oil Co		Unax RX 150 Turbine Oil 150 Valvoline AW ISO 150	Unax RX 220 Turbine Oil 220 Valvoline AW ISO 220	Unax AW 320 Turbine Oil 320 Valvoline AW ISO 320

† Minimum viscosity index of 90. Maximum operating temperature of lubricants is 200°F (93°C)

Petroleum Based Lubricants

R & O GEAR LUBRICANTS (TABLE 1) — Industrial type petroleum based rust and oxidation inhibited (R & O) gear lubricants are the most common and readily available general purpose gear lubricants.

EXTREME PRESSURE (EP) LUBRICANTS (TABLE 2) — For highly loaded drives or for drives loaded in excess of original estimates, industrial-type petroleum extreme pressure lubricants are preferred. The EP lubricants currently recommended are of the sulphur–phosphorus type.

TABLE 2 — Petroleum Based Extreme Pressure Lubricants ★

Manufacturer	Lubricant
Amoco Oil Co. BP Oil Co. Chevron U.S.A. Inc. Citgo Petroleum Corp.	Permagear/Amogear EP Energear EP Gear Compounds EP Citgo EP Compound
Conoco Inc. Exxon Co. U.S.A. Houghton Int., Inc. Imperial Oil Ltd.	Gear Oil Spartan EP MP Gear Oil Spartan EP
Kendall Refining Co. Keystone Lubricants Lyondell Petrochemical (ARCO) Mobil Oil Corp.	Kendall NS-MP Keygear Pennant NL Mobilgear
Petro-Canada Products Phillips 66 Co. Shell Oil Co. Shell Canada Limited	Ultima EP Philgear Omala Oil Omala Oil
Sun Oil Co. Texaco Lubricants Unocal 76 (East & West) Valvoline Oil Co.	Sunep Meropa Extra Duty NL Gear Lube AGMA EP

★ Minimum viscosity index of 90. Maximum operating temperature of lubricants is 200°F (93°C).

WARNING: EP LUBRICANTS IN FOOD PROCESSING INDUSTRY — EP lubricants may contain toxic substances and should not be used in the food processing industry without the lubricant manufacturer's approval. Lubricants which meet USDA "H1" classification are suitable for food processing applications.

CAUTION: PETROLEUM BASED LUBRICANTS & INTERNAL BACKSTOPS — Do not use EP lubricants or lubricants with anti-wear additives or lubricant formulations including sulfur, phosphorus, chlorine, lead derivatives, graphite or molybdenum disulfides in drives equipped with internal cartridge type backstops. Some lubricants in Table 1 may contain anti-wear additives. Lubricants in Table 2 do contain several of these additives.

Synthetic Lubricants

Synthetic lubricants of the polyalphaolefin type are recommended for cold climate operation, high temperature applications, extended temperature range (all season) operation and/or extended lubricant change intervals. The proper viscosity grade of synthetic lubricant is given in Table 4.

COLD CLIMATE CONDITIONS — The proper viscosity grade of synthetic lubricant is given in Table 4. Usable temperature ranges can sometimes be widened for synthetic lubricants if specific application conditions are known.

CAUTION: SYNTHETIC LUBRICANTS & INTERNAL BACKSTOPS – Synthetic lubricants may be used in drives with internal backstops operating in cold temperatures –30° to +50°F (–34° to +10°C). Select proper lubricant grade from Table 4. Mobil SHC 624 and SHC 626 provide proper backstop action under these conditions. Other synthetic lubricants may also be acceptable. DO NOT use synthetic lubricants in drives with backstops operating in ambient temperatures above 50° F (10° C).

NORMAL CLIMATE CONDITIONS — For temperatures of 15°F (–9°C) and above, use viscosity grades as recommended in Table 5 for petroleum based lubricants. Petroleum based and synthetic lubricants are suitable for normal climate conditions. Usable temperature ranges can sometimes be widened for synthetic lubricants if specific application conditions are known.

WARNING: SYNTHETIC LUBRICANTS IN FOOD PROCESSING INDUSTRY – Synthetic lubricants may contain toxic substances such as sulfur, phosphorus, chlorine, lead derivatives, graphite or molybdenum disulfides and should not be used in the food processing industry without the lubricant manufacturer's approval. Lubricants which meet USDA "H1" classification are suitable for food processing applications.

Lubricant Changes

OIL ANALYSIS REPORT — Checking oil condition at regular intervals is recommended. In the absence of more specific limits, the guidelines listed below may be used to indicate when to change oil:

1. Water content is greater than 0.05% (500 ppm).
2. Iron content exceeds 150 ppm.
3. Silicon (dust/dirt) exceeds 25 ppm.
4. Viscosity changes more than 15%.

PETROLEUM LUBRICANTS — For normal operating conditions, change gear oils every six months or 2500 operating hours, whichever occurs first. If the drive is operated in an area where temperatures vary with the seasons, change the oil viscosity grade to suit the temperature, refer to Table 1. Lubricant suppliers can test oil from the drive periodically and recommend economical change schedules.

SYNTHETIC LUBRICANTS — Synthetic lube change intervals can be extended to 8000-10,000 hours depending upon operating temperatures and lubricant contamination. Laboratory analysis is recommended for optimum lubricant life and drive performance. Change lube with change in ambient temperature, if required. Refer to Table 4.

Grease Lubricated Seals

All drives are furnished with grease purged seals which minimize the entry of contaminants and abrasive dusts into the drive. Drives are shipped with NLGI #2 grease in the seal housing cavities unless otherwise specified.

Whenever changing oil in the drive, purge the seals with one of the NLGI #2 greases listed in Table 3.

TABLE 3 — Greases For Grease Purged Seals

(0° to 200°F (-18° to 93° C))

Manufacturer	Lubricant
Amoco Oil Co. BP Oil Co. Chevron U.S.A., Inc. Citgo Petroleum Corp.	Amolith Grease No. 2 Energrease LS-EP2 Industrial Grease Medium Premium Lithium Grease No. 2
Conoco Inc. Exxon Company, U.S.A. Houghton Int., Inc. Imperial Oil Ltd.	EP Conolith Grease No. 2 Unirex N2 Cosmofube 2 Unirex N2L
Kendall Refining Co. Keystone Lubricants Lyondell Petrochemical (ARCO) Mobil Oil Corp.	Multi-Purpose Lithium Grease L421 Zeniplex 2 Litholine H EP 2 Grease Mobilith 22
Mobil Oil Corp. Petro-Canada Products Phillips 66 Co. Shell Oil Co.	Mobilith SHC 460 † Multipurpose EP2 Philube Blue EP Alvania Grease 2
Shell Canada Limited Sun Oil Co. Texaco Lubricants	Alvania Grease 2 Ultra Prestige EP2 Premium RB Grease
Unocal 76 (East & West) Valvoline Oil Co.	Unoba EP2 Multilube Lithium EP Grease

† High performance synthetic alternate.

Some of these greases are of the EP type and may contain toxic substances not allowed in the food processing industry. If grease could contaminate the product, as in the food and drug industries, the grease should be removed. A grease that meets the USDA "H1" classification is suitable for food processing applications.

Periodically (at least every six months) depending upon the frequency and degree of contamination, purge contaminated grease from seals by slowly pumping fresh bearing grease thru the seal, WITH HAND GREASE GUN, until fresh grease flows out along the shaft. Wipe off purged grease.

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

TABLE 4 — Synthetic Lubricants – Polyalphaolefin Type ‡

Ambient Temp. Range	–30 to +10°F (–34 to –12°C)	–15 to +50°F (–26 to +10°C)	0 to +80°F (–18 to +27°C)	+10 to +125°F (–12 to +52°C)	+20 to +125°F (–7 to +52°C)
AGMA Viscosity Grade	0S	2S	4S	5S	6S
ISO Viscosity Grade	32	68	150	220	320
Viscosity cSt @ 40°C	28.8-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100°F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	Lubricant				
Chevron U.S.A., Inc.	...	...	...	Clarity Synthetic PM Oil 220 Syn. Gear Lube Tegro 220 ■	...
Conoco Inc.	Syncon R & O 32	Syncon R & O 68 Syncon EP 68 ■	Syncon EP 150 ● ■	Syncon R & O 220 ● Syncon EP 220 ● ■	Syncon EP 320 ● ■
Dryden Oil Co.	Drydene SHL Lubricant 32	Drydene SHL Lubricant 68	Drydene SHL Lubricant 150	Drydene SHL Lubricant 220	Drydene SHL Lubricant 320
Exxon Company, U.S.A.	Teresstic SHP 32	Teresstic SHP 68	Teresstic SHP 150 Spartan Synthetic EP 150 ■	Teresstic SHP 220 Spartan Synthetic EP 220 ■	Teresstic SHP 320 Spartan Synthetic EP 320 ■
Mobil Oil Corp.	SHC 624	SHC 626	SHC 629 Mobilgear SHC 150 ■	SHC 630 mobilgear SHC 220 ■	SHC 632 Mobilgear SHC 320 ■
Pennzoil Products Co.	Pennzgear SHD 32	Pennzgear SHD 68 Super Maxol "S" 68 ■	Pennzgear SHD 150 Super Maxol "S" 150 ■	Pennzgear SHD 220 Super Maxol "S" 220 ■	Pennzgear SHD 320 Super Maxol "S" 320 ■
Petro-Canada Products	...	...	Super Gear Fluid 150EP ■	Super Gear Fluid 220EP ■	Super Gear Fluid 320EP ■
Shell Oil Co.	...	...	...	Hyperia 220 Hyperia S 220 ■	Hyperia 320 Hyperia S 320 ■
Sun Co.	...	...	...	Sunoco Challenge 220 Sunoco challenge eP 220 ■	Sunoco Challenge 320 Sunoco Challenge EP 320 ■
Texaco Lubricants Co.	Pinnacle 32	Pinnacle 68	Pinnacle 150 Pinnacle EP 150 ■	Pinnacle 220 Pinnacle EP 220 ■	Pinnacle 320
Whitmore Manufacturing Co.	...	...	Decathlon 4EP ■	Decathlon 5EP ■	Decathlon 6EP ■

‡ Minimum viscosity index of 130. Consult lubricant supplier/manufacturer for maximum operating temperature.
● Minimum viscosity index of 120.
■ Extreme pressure EP lubricant (contains sulfur-phosphorus).

TABLE 5 — Viscosity Recommendations For Petroleum Based Lubricants ♦

Normal Climates					
+15 to +60°F (–9 to +16°C)		+50 to +90°F (+10 to +32°C)		+70 to 125°F (+21 to +52°C)	
ISO-VG	AGMA	ISO-VG	AGMA	ISO-VG	AGMA
150	4	220	5	320	6

♦ Consult Factory for viscosity recommendations when ambient temperatures are higher than 125°F (52°C), or when drives are operating in extremely humid, chemical, or dust laden atmospheres.

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The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

TABLE 11 — Parts List Of Falk Part Numbers

Ref. No.	Part Description	DRIVE SIZE									
		4407	M4407	4415	M4415	4507	M4507	4608		M4608	
	Rotating Elements - J14 & J25							Without Backstop	With Backstop	Without Backstop	With Backstop
2A	Shaft Assembly - Includes Ref. #2A1 - 2A4	4729131	4729131	4729146	4729146	4729159	4729159	4729183	4729183	4729183	4729183
2A1	Bearing	0921780	0921780	0921556	0921556	0921752	0921752	0921678	0921678	0921678	0921678
2A2	Bearing	0921780	0921780	0921556	0921556	0921530	0921530	0921678	0921678	0921678	0921678
2A3	Pinion & Shaft - Includes Ref. #2A4	4729132	4729132	4729147	4729147	4729160	4729160	4729184	4729184	4729184	4729184
4A	Shaft Assembly - Includes Ref. #4A1 - 4A5	4729133	4729133	4723150	4723150	4729163	4729163	4729189	4729189	4729189	4729189
4A1	Bearing	2905186	2905186	0921861	0921861	0921755	0921755	2905910	2905910	2905910	2905910
4A2	Bearing	2905186	2905186	0921861	0921861	0921755	0921755	2905910	2905910	2905910	2905910
4A3	Hollow Shaft - Includes Ref. #4A5	4729134	4729134	4723149	4723149	4729164	4729164	4729190	4729190	4729190	4729190
4A4	Gear	1238083	1238083	1238033	1238033	1238072	1238072	1237487	1237487	1237487	1237487
4A6	Spacer	...	...	...	...	...	...	1237496	1237496	1237496	1237496
6A	Fan Assembly	0785773	0787257	0785881	0787258	0785893	0787259	0785468	0785468	0785499	0785499
6A1	Fan	4729135	4729200	4729135	4729200	4729165	4729201	4729192	4729192	4729202	4729202
6A2	Guard	4729136	4729136	4729151	4729151	4729166	4729166	4729193	4729193	4729193	4729193
6A3	Backplate	4729137	4729137	4729152	4729152	4729167	4729167	4729194	4729194	4729194	4729194

TABLE 12 — Bearing Cross Reference Numbers

Falk Part Number	Manufacturer's Number
Tapered Roller Bearings ★	
0921349	HM212046/HM212011
0921494	H715336/H715311
0921529	H715345/H715311
0921530	H414249/H414210
0921556	H715332/H715311
0921678	850/832
0921682	HM212049/HM212011
0921751	JH217249/JH217210
0921752	JH415647/JH415610
0921755	JM736149/JM736110
0921780	HM212044/HM212011
0921855	5584/5535
0921857	65212/65500B
0921858	65237/65500B
0921859	65200/65500B
0921860	65225/65500B
0921861	67782/67720
0921863	5565/5535
2905186	LM330448/LM330410
2905910	LM742749/LM742710
2915106	HM807040/HM8070158
2915107	HM807035/HM8070158
2918722	HH814542/HH814510

★ Falk suppliers of Tapered Roller Bearings are: Timken, Bower and Tyson.

TABLE 13 — Seal Cross Reference Number

Falk Part Number	Manufacturer's Number †	
	Chicago Rawhide	National
0912742	70080	...
0912765	64993	...
0912768	85014	...
0912858	29317	...
0912913	24898	471271
2912056	60004	...
2912098	...	415683
2916785	22441	...
2916786	29907	...

† Subject to substitution of equivalent seals without notice.

The Falk Corporation, a Sundstrand Company
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Section III

Drive Reassembly

Refer To Parts Drawing Figure 14.

1. GENERAL
   a. Clean all parts to be reassembled and coat all tapered roller bearing cups and pinion teeth with oil. DO NOT lubricate gear teeth prior to assembly on shaft.
   b. Heat all tapered roller bearing cones in an oven to 275°F (135°C).

      CAUTION: Do not apply flame directly to bearings or rest bearings directly on a heated surface.
   c. Slide or press all bearing cones tight against the shaft shoulder or spacer.

      CAUTION: Do not apply force to the bearing cage or rollers. Apply force against the cone only.
2. ASSEMBLY OF TAPERED ROLLER BEARING CUPS — Where bearings will be reused and where bearing cups were not removed from the housing, skip to Step 3. It is recommended that bearings be replaced whenever drive is disassembled after being in service.

   Install bearing cups only in housing base at this time. Coat bearing cups and housing bores with an SAE 20 (or heavier) oil and drive or press cup squarely into the housing bores until positioned as shown in Figures 15 and 16. Use a flat plate and a brass bar to avoid damaging the bearing cups. NOTE: The exact positioning of the bearings in the bores will be achieved during the bearing adjustment procedure in Step 6.

Figure 15

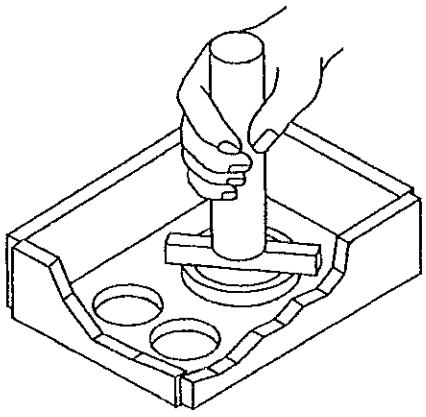
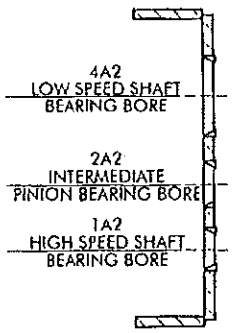


Figure 16



CAUTION: Take care not to allow cups to cock during their installation as this could result in permanent damage to housing.

If cups become cocked in the bores, tap the high side lightly to re-position.

3. Assemble seal cages to housing output side(base) as follows:
   a. Turn housing onto its side being careful that the bearing cups do not fall out of the bores. Assemble low speed seal cage without seal and one .015" (0,38 mm) shim-gasket, Ref. #11 or 12 and 24. Cross tighten fasteners, Ref. #34, to torque specified in Table 14.

      Check to be sure that cages and covers are registered on the bearing cups to avoid hanging up of the cups.

TABLE 14 — Fastener Tightening Torques ★

Location	Fastener Size — Inch Tightening Torque — lb-ft (Nm)			
	.375-16	.500-13	.750-10	.875-9
Low Speed Seal Cage	...	...	330 (447)	533 (723)
Intermediate End Cover	27.5 (37,3)	68.8 (93,2)	...	...
High Speed Seal Cage/End Cover	27.5 (37,3)	68.8 (93,2)	...	...
Housing Cover	...	68.8 (93,2)	245 (332)	...

★ Torques are for non-lubricated fasteners.

   b. Assemble intermediate end cover and one .015" (0,38 mm) shim-gasket, Ref. #15 and 25. Cross tighten fasteners, Ref. #35, to torque specified in Table 14.
   c. Assemble high speed pinion shaft cover or seal cage without seal as follows:

      SIZE 4407-4608 WITHOUT BACKSTOP — Assemble shaft cover and one .015" (0,38 mm) shim-gasket, Ref. #17 and 27. Cross tighten fasteners, Ref. #37, to torque specified in Table 14.

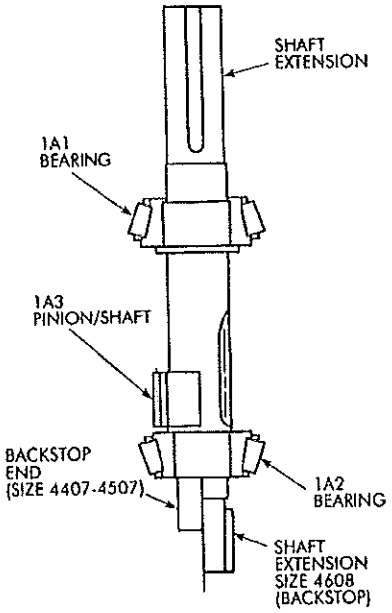
      SIZE 4407-4507 WITH BACKSTOP — Assemble shaft cover, 1st .015" (0,38 mm) shim-gasket, backstop cage and 2nd .015" (0,38 mm) shim-gasket, Ref. #19, 20, 29 and 30. Finger tighten fasteners, Ref. #38. NOTE: The backstop, Ref. #5A will be added later.

      SIZE 4608 WITH EXTERNAL BACKSTOP — Assemble seal cage without seal and one .015" (0,38 mm) shim-gasket, Ref #31and 66. Cross tighten fasteners to torque specified in Table 14. NOTE: The seal, Ref. #64, will be added later.

4. **SHAFT ASSEMBLIES** — Where bearings and gears were not removed from the shafts, skip to Step 5. If bearings and gears were removed from the shafts, reassemble parts on the shaft per Figures 17 thru 20 as follows:
   a. To assemble gear (Ref. #1A4 or 4A4), heat gear in an oven to 325°F (163°C). Install key. Press gear onto the shaft tightly against the shoulder. For Size 4608, be sure to place spacer, Ref. #4A6, Figure 20, in the proper location on shaft assembly, Ref. #4A, before pressing on the bearing.
   b. To assemble bearings, heat bearing cone in an oven to a maximum of 275°F (135°C), then slide or press bearing cone tight against the shaft shoulder or spacer.

   CAUTION: Allow assembly to cool. Apply a coat of oil to the cooled bearings and gear teeth to lubricate & avoid scoring of the working surfaces.

Figure 17 — 1A Shaft Assembly



5. **DRIVE ASSEMBLY** — Turn drive housing base on work bench to allow the shaft assemblies to be lowered into the housing. Block up the housing so that when low speed shaft assembly, Ref. #4A, is in place, the threaded end of the shaft will clear the bench surface. Before assembly, inspect housing and all shaft assemblies to see that all foreign matter has been removed.
   a. **SINGLE REDUCTION** — Lower high speed shaft assembly, Ref. #3A, Figure 18, into housing and tip away from other housing bores. While lowering the low speed shaft assembly, Ref. #4A, Figure 20, into housing tip high speed shaft into the gear mesh of the low speed gear as the shaft nears final position.
   b. **DOUBLE REDUCTION** — Lower high speed shaft assembly, Ref. #1A, Figure 17, into housing and tip away from other bores. Simultaneously lower the intermediate shaft assembly, Ref. #2A, Figure 19, and the low speed shaft assembly, Ref. #4A, Figure 20, into the housing. As shafts approach their final position, tip the high speed shaft pinion into the high speed gear mesh, Ref. #1A4.

Figure 18 — 3A Shaft Assembly

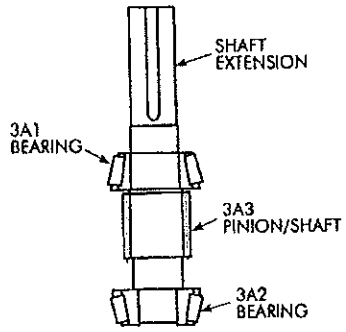


Figure 19 — 2A Shaft Assembly

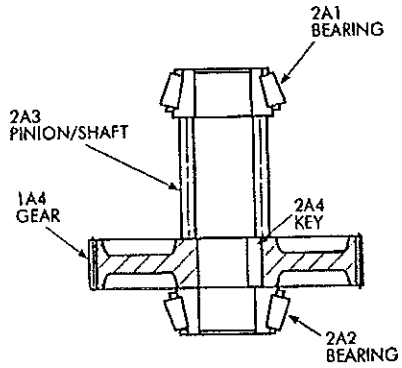
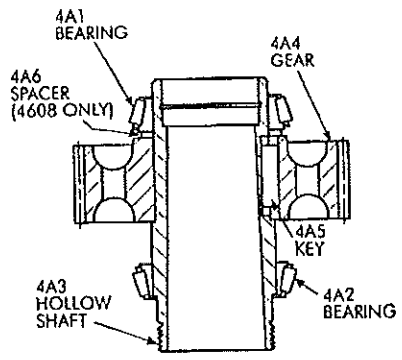


Figure 20 — 4A Shaft Assembly



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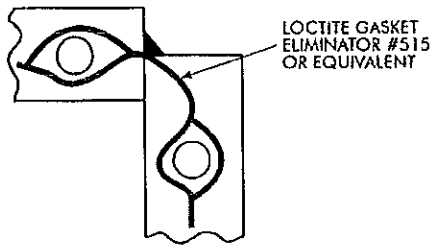
c. Arrange the shaft assemblies to ensure that the gears are in mesh and bearing cones are in the cups.

d. Apply a bead of Loctite Gasket Eliminator #515 or equivalent to housing base as shown in Figure 21. Carefully lower the housing cover (using eyebolts as recommended in Section II, Step 11). Remove eyebolts. Install taper screw dowels through the housing cover into the housing base. NOTE: Be sure the nut on the taper screw dowel is loose so that the nut does not interfere with seating the taper screw dowel. Seat taper screw dowel into housing base by striking the head of the taper screw dowel with a hammer. Install cover fasteners and immediately (within 3 minutes) tighten to torque specified in Table 14.

Figure 21



e. Apply film of oil to housing cover bores and bearing cups & carefully install the bearing cups into the bores as described in Step 2.

f. Install seal cages without seals and covers:

DOUBLE REDUCTION DRIVES — Use the entire shim-gasket kit with the .015" (0,38 mm) shim-gasket against the housing. It is important that the .015" (0,38 mm) shim-gasket be placed against the housing to prevent leakage. Cross tighten fasteners to torques specified in Table 14. Parts involved are as follows:

Low speed seal cage Ref. #11, 24 & 34; shaft cover Ref. #16, 26 & 36; high speed seal cage Ref. #21, 31 & 39.

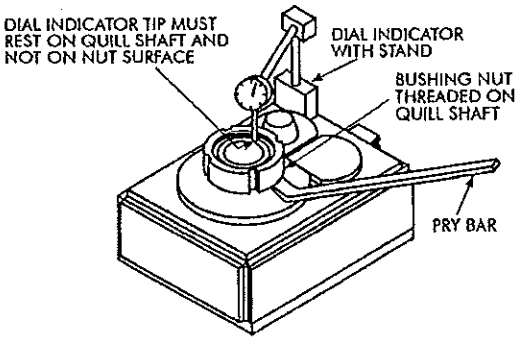
SINGLE REDUCTION DRIVES — Install end cover, Ref. #16, with one .015" (0,38 mm) shim-gasket, Ref. #26, on unused bore. Cross tighten fasteners, Ref. #36, to torque specified in Table 14. For the other seal cages follow instructions from above as described for double reduction drives.

6. BEARING ADJUSTMENT

a. FOR DRIVES EQUIPPED WITH TA TAPER BUSHING — Turn drive over onto the input housing and carefully thread bushing nut onto hollow shaft threads. Rotate the shaft to seat the cone assemblies in the bearing cups. Set up a dial indicator, Figure 22. Rotate and oscillate shaft with axial force applied in both directions to obtain the shaft axial float measurement (upward force can be applied by prying the bushing nut upward). If no float is measured, remove bushing nut and seal cage & add shim-gaskets until float is measurable. Proceed to Step 6(c).

b. FOR DRIVES WITHOUT THE TA TAPER BUSHING — Insert the hollow shaft thrust plate and secure with the retaining ring as illustrated in Section I, Figure 4. Thread a bolt into the thrust plate. Set up a dial indicator on the input housing face with the indicator probe on the end of the hollow shaft. DO NOT indicate from the thrust plate or fastener head. Rotate and oscillate shaft with axial force applied in both directions to obtain the axial float measurement. (Upward force can be applied by prying the head of the thrust plate bolt upward). If no float is measured, remove seal cage and add shim-gaskets until float is measurable.

Figure 22



c. If the axial float from 6(a) or (b) is greater than .010" (0,25 mm), subtract sufficient shims to obtain .001" to .010" (0,03 mm to 0,25 mm) float. Refer to Table 15 for shim thickness. Take into account the compressibility of shim-gaskets from Table 16. Reassemble and repeat Step 6(a) or (b). When float is within .001" to .010" (0,03 mm to 0,25 mm), proceed to Step 6(d).

TABLE 15 — Individual Shim-Gasket Part Numbers

Ref. No.	Shim Thickness Inches (mm)	DRIVE SIZE			
		4407	4415	4507	4608
100	...	0786841	0785587	0786843	0786844
24	0.007 (0,18)	1231144	1220259	1220130	1231222
	0.009 (0,23)	0767761	0757456	0757453	0767802
	0.015 (0,38)	0767762	0757457	0757454	0767803
	0.031 (0,79)	0767763	0757458	0757455	0767804
25	0.015 (0,38)	0755904	0757460	0757460	3200133
26	0.007 (0,18)	1219682	1220540	1220128	0761568
	0.009 (0,23)	0755903	0757459	0755947	0761569
	0.015 (0,38)	0755904	0757460	0755948	3200133
	0.031 (0,79)	0755905	0757461	0755949	...
27 & 28	0.015 (0,38)	0755904	1220129	0757460	0710703
29 & 30	0.015 (0,38)	0755904	1220129	1220129	...
31	0.007 (0,18)	1219682	1220540	1220128	1130518
	0.009 (0,23)	0755903	0757459	0755947	0710702
	0.015 (0,38)	0755904	0757460	0755948	0710703
	0.031 (0,79)	0755905	0757461	0755949	...

TABLE 16 — Falk Shim-Gasket Compressibility

Thickness Inches (mm)	New	0.007 (0,18)	0.009 (0,23)	0.015 (0,38)	0.031 (0,79)
	Compressed	0.006 (0,15)	0.008 (0,20)	0.013 (0,33)	0.028 (0,71)

d. Refer to Table 17 and note the preload specified for bearings Ref. #4A1 and 4A2. Add to the upper and lower limits shown, the axial movement obtained in Step 6(c). This will indicate the thickness of shims to be removed to obtain the specified preload. For example, if the preload in Table 17 is .005" to .007" (0,13 mm to 0,18 mm) and the axial movement was .007" (0,18 mm), removal of shims with a total thickness of .012" to .014" (0,31 mm to 0,36 mm) will produce the desired preload. Table 15 provides shim thicknesses for each shim pack to assist in obtaining the desired results. Take into account the compressibility of shim-gaskets from Table 16.

TABLE 17 — Preload & Axial Settings – Inch (mm)

DRIVE SIZE	Bearings Ref. #4A1 & 4A2	Shaft & Pinion Ref. #2A3	Shaft & Pinion Ref. #1A3 or 3A3
	Bearing Preload	Axial Float	Axial Float
4407 4415 4507 4608	.004-.006 (0,10-0,15) .005-.007 (0,13-0,18) .006-.008 (0,15-0,20) .008-.010 (0,20-0,25)	.001-.003 (0,03-0,08)	.001-.003 (0,03-0,08)

e. Remove seal cage, Ref. #11, and remove shim-gasket(s) as determined in Step 6(d). Reattach the seal cage and cross tighten fasteners to torque specified in Table 14.

f. AXIAL FLOAT ADJUSTMENT, REF. #2A3 — Remove pipe plug from center of shaft cover, Ref. #16, and install a .375-16 x 2" or longer fastener thru the hole in the shaft cover into the threaded hole in the pinion shaft. Turn by hand until snug. Set up a dial indicator with the probe on the fastener head as illustrated in Figure 23. Turn the fastener in a clockwise direction, pushing and pulling the fastener to make certain the bearings are properly seated. Measure the axial float. Subtract from this reading the axial float for Ref. #2A3 shaft found in Table 15. This indicates the thickness of shims to be removed. When removing the shim(s) retain the .015" (0,38 mm) thickness against the drive housing. Retighten fasteners and recheck float. Readjust shimming, if necessary, until proper axial float is achieved (Table 17).

g. AXIAL FLOAT ADJUSTMENT, REF. #1A3 or 3A3 — Refer to Figure 24 and adjust float as follows:

Set up a dial indicator for determining axial movement of the high speed shaft Ref. #1A3 or 3A3. Lift upward with a twisting motion to obtain a reading.

WARNING: *Cover keyway with tape to avoid lacerations to the hand.*

Subtract from this reading the axial float for shaft, Ref. #1A3 or 3A3, found in Table 15. This indicates the thickness of shim(s), Ref. #31, to be removed. When removing the shim(s), retain the .015" (0,38 mm) thick shim against the housing, Ref. #10. Retighten fasteners and recheck float. Readjust shimming, if necessary, until proper float is achieved (Table 17).

7. SEAL INSTALLATION

Seals can be installed after all bearing adjustments have been completed. Refer to Section II, Step 7, to install seals, Ref. #22 & 23. NOTE: When removing a seal cage to install a seal, be sure to replace the same shim-gaskets as removed to assure correct bearing adjustments.

8. BACKSTOP INSTALLATION

If drive will be installed on the driven equipment using the thrust plate and thrust plate fastener, install the backstop at this time. Refer to Appendix B, for installation instructions.

DRIVE IS READY TO INSTALL — Refer to Section I.

Figure 23

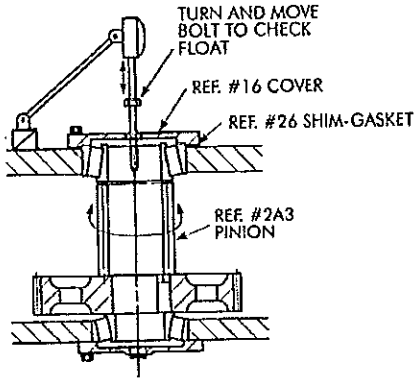
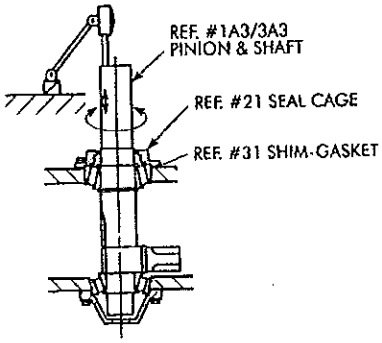


Figure 24



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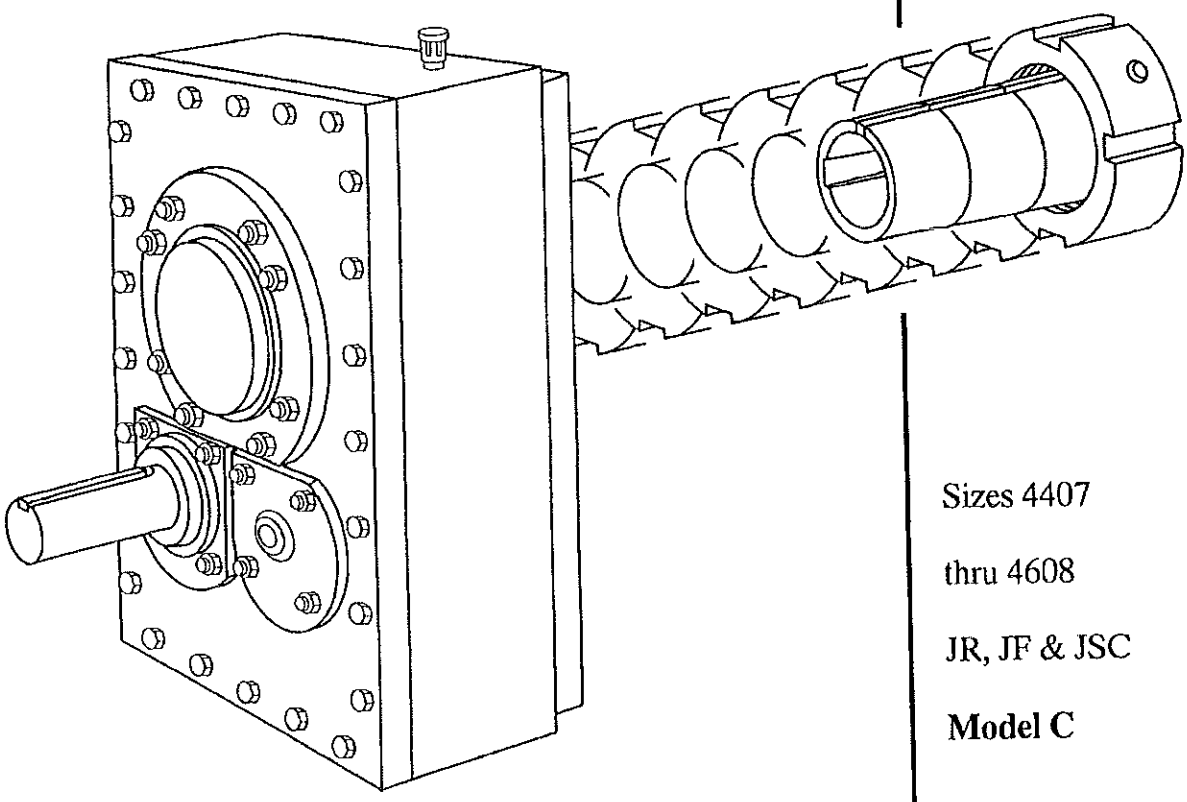
QUADRIVE OWNERS Manual

CAUTION!
Drives are shipped without oil.



Sizes 4407

thru 4608

JR, JF & JSC

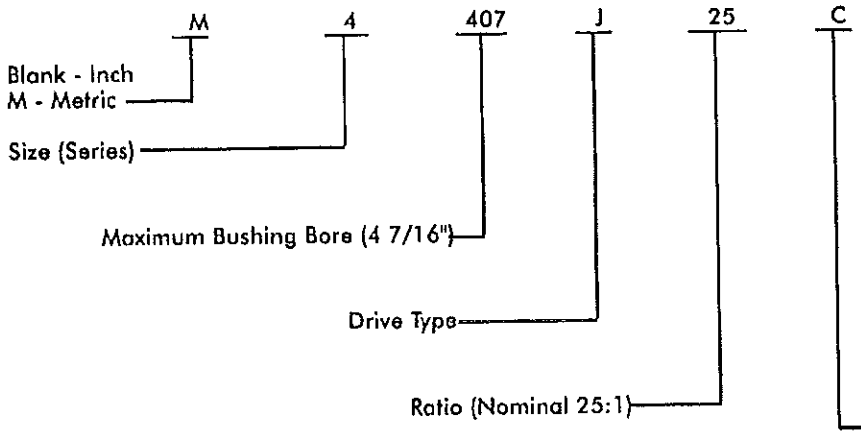
Model C

FALK

PN - 2121097

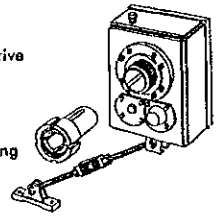
PRICE $2.00

Drive Identification



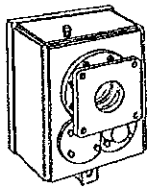
J is the basic drive identification. It can be furnished as a shaft mounted drive JR; a flange mounted drive JF; or a screw conveyor drive JSC(Size 4407 only), as illustrated below. These unique identifiers, JR, JF & JSC, are used throughout this manual to assist you in identifying the instructions which apply to your drive arrangement. The prefix "M" identifies a drive that features a nominal metric high speed shaft extension.

(JR) Shaft Mounted Drive



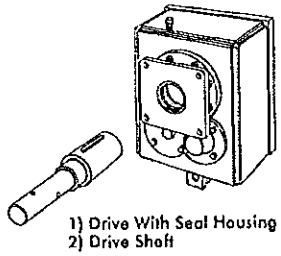
1) Drive
2) Torque Arm
3) TA Taper Bushing

(JF) Flange Mounted Drive



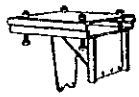
1) Drive With Flange
TA Taper Bushing Optional

(JSC) Screw Conveyor Drive(Size 4407 only)



1) Drive With Seal Housing
2) Drive Shaft

+ Motor Mounts

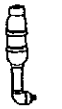


+ Backstops

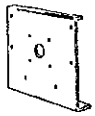
+ Shaft Cooling

+ Electric Cooling

+ Vertical Standpipe

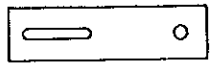


+ Trough Ends

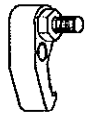


+ Thrust Plate Kits

+ V-Belt Guards



+ TA Removal Tool



NOTE: Use a TA-Taper bushing when mounting these drives on a straight driven shaft (hollow shaft is taper bored).

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Telephone: 414-342-3131, Fax: 414-937-4359

Introduction

WARRANTY — The Falk Corporation (the "Company") warrants that, for a period of one year from the date of shipment, the product described herein will deliver successfully its rated output as indicated on the nameplate, provided, it is properly installed and maintained, correctly lubricated, and operated in the environment and within the limits of speed, torque or other load conditions for which it was sold. Such product is expressly not warranted against failure or unsatisfactory operation resulting from dynamic vibrations imposed upon it by the drive system in which it is installed unless the nature of such vibrations has been fully defined and expressly accepted in writing by the Company as a condition of operation.

WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.
Lock out power source and remove all external loads from drive before servicing drive or accessories.

CAUTION: Do not weld the drive housing or accessories without prior approval from The Falk Corporation. Welding on the drive may cause distortion of the housing or damage to the bearings and gear teeth. Welding without prior approval will void the warranty.

DRIVE RATING — Operate the drive only within the horsepower and output speed for which it was selected and specified in Selection Guide 371-110 for the application. Refer to the nameplate for drive size, ratio and data.

FALK FACTORY REPAIR AND REBUILD — Falk wants to continue to be your primary supplier, and extend our service to you if your equipment is in the need of repair or replacement.

We are able to furnish a fast turn-around on both the quotation and rebuild. Nobody can do the job better than Falk. If you need repair on Falk products . . . just ask.

Contact your local Falk Representative or Falk Distributor for more information.

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Section I — Drive Installation

Section II — Drive Service & Repair

Section III — Drive Reassembly

Appendix

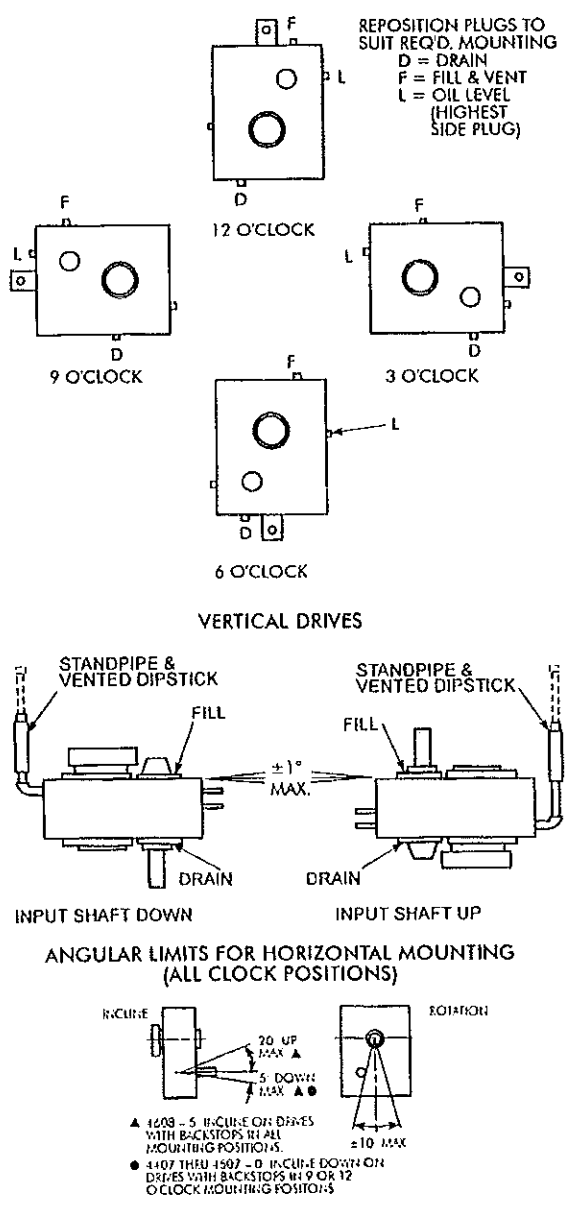
Section I

Drive Installation

Outfitting

1. JR, JF & JSC — Find the desired mounting position in Figure 1 and install air vent and magnetic drain plug (packaged separately with drive). Also note and/or mark the oil level plug location OR in the case of a vertical mounting, refer to Appendix E, for installation of vertical stand pipe. If the mounting angle exceeds the limitations shown in Figure 1, refer to Appendix F, to determine modifications necessary within the limits illustrated therein. DO NOT fill drive with lubricant at this time.

Figure 1



2. JR — The tapered bore hollow shaft is designed for use with a TA Taper bushing for mounting on a driven shaft with a straight outside diameter. Shaft tolerances for driven shafts are shown in Table 1. The minimum and maximum driven shaft engagements, dimension N in Figure 2, are shown in Table 2. The minimum engagement is necessary for full bushing engagement; the maximum engagement is only if a thrust plate will be employed to remove the drive from the driven shaft (See Appendix C for preferred removal method).

TABLE 1 — Driven Shaft Tolerances ★

Shaft Diameter — Inches		Max Undersize (Inches)
Over	Thru	
2.500	4.000	.006
4.000	6.000	.007
6.000	7.000	.008

★ Millimeters - h10 tolerance.

Figure 2

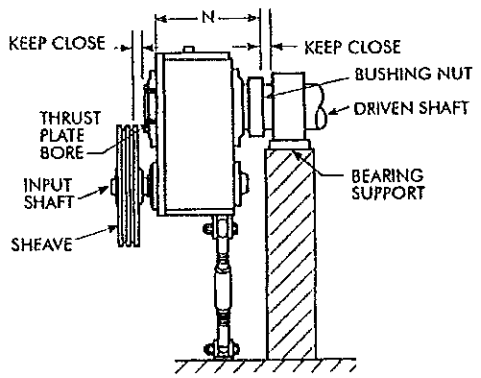


TABLE 2 — N Dimension †

DRIVE SIZE	Minimum Inches (mm)	Maximum Inches (mm)
4407	8.38 (213)	12.40 (314)
4415	10.33 (263)	13.44 (341)
4507	10.66 (271)	14.53 (369)
4608	12.75 (324)	16.35 (415)

† The minimum engagement is necessary for full bushing engagement; the maximum engagement is only if a thrust plate will be employed to remove the drive from the driven shaft.

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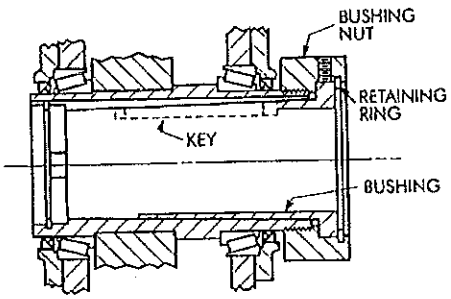
a. THIN WALL BUSHING (with keyway slot through the bushing wall) — With the driven shaft keyway at the 12 o'clock position, slide bushing assembly onto the driven shaft, nut end first, and position the keyway slot over the shaft keyway. The bushing may have to be opened slightly to assist in installation. Insert a screwdriver into the slot in the bushing and very lightly pry open until the bushing slides onto the shaft. Insert the drive key furnished with the bushing into the shaft keyway. Proceed to Step 6.



b. THICK WALL BUSHING (with separate internal and external keyways) — Insert the driven shaft key into the driven shaft keyway. If the driven shaft has an open-ended keyway, stake the keyway, Figure 3, to prevent axial dislocation of the shaft key under operating conditions. Slide the bushing assembly onto the driven shaft. The bushing may have to be opened slightly to assist in installation. Insert a screwdriver into the slot in the bushing and very lightly pry open until the bushing slides onto the shaft. Rotate the shaft so the external keyway in the bushing is at the 12 o'clock position. Insert the drive key, furnished with the bushing, into the keyway. Proceed to Step 6.

Figure 3

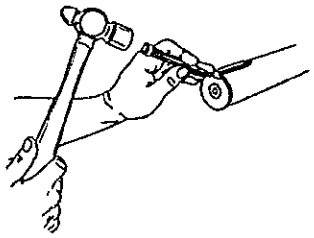
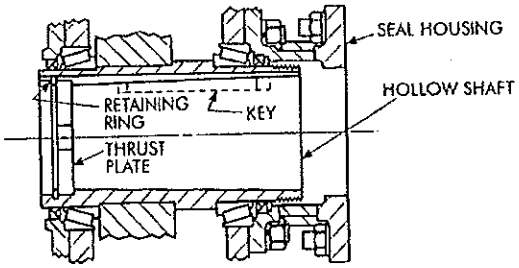


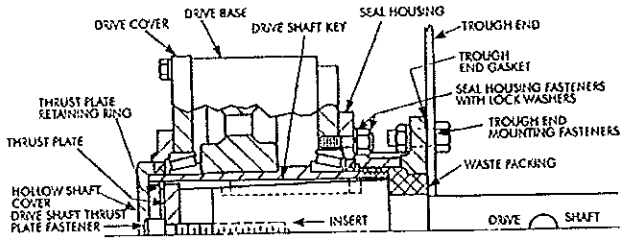
Figure 4



3. JSC(4407 ONLY) — Remove the output cover from the input side of the hollow shaft bore and save. Separate contents from the drive shaft kit. Install thrust plate and retaining ring in the hollow shaft, Figure 4. Insert key into drive shaft. Slide drive shaft thru the seal housing into the hollow shaft and insert the thrust plate fastener thru the thrust plate into the drive shaft. Tighten fastener to 792 lb-ft (1073 Nm). Reinstall hollow shaft cover. Continue outfitting based on the type of trough end seal to be installed: (a) Waste Packing Seal; or (b) Lip Seal.

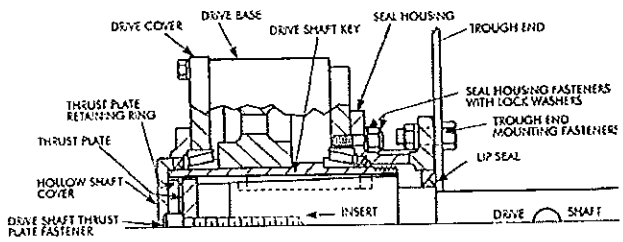
a. WASTE PACKING SEAL (Figure 5) — Pack seal housing with waste packing and proceed to Step 4.

Figure 5



b. LIP SEAL (Figure 6) — Coat outside diameter of seal with Permatex #3 or equivalent. Coat the seal lips with bearing grease. Carefully slide seal over drive shaft extension taking care to not damage the seal lips. Drive seal into seal housing with the spring loaded seal lip toward the trough end side of the seal housing, flush with the seal housing. Proceed to Step 4.

Figure 6



4. JSC — Fasten the trough end to the seal housing using the hex head capscrews included in the drive shaft kit. Refer to Table 3 for torque value. Proceed to Step 6.

TABLE 3 — 4407JSC Trough End Fastener Size & Tightening Torque (Non-lubricated Fasteners)

Drive Shaft Diameter	3.000 & 3.437
Fastener Size	.750-10UNC
Tightening Torque, lb-ft (Nm)	245 (332)

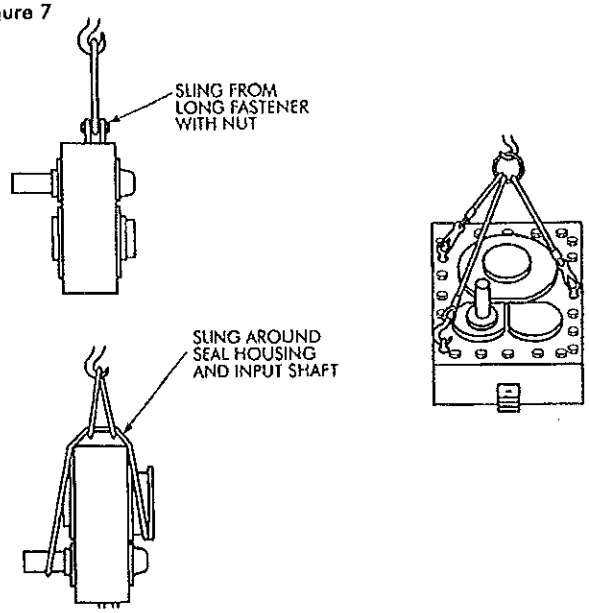
JF — (NOTE: If the driven shaft has not been machined to Falk's taper bore specifications per Manual 377-140 and a straight shaft is to be utilized, refer to Manual 377-144 for instructions).

Install backstop prior to installation of drive (refer to Appendix B). Installation of internal backstops NOT Factory installed may require removal of mounting flange, Ref. #12. Remove cover from input end of hollow shaft bore and save. Install the thrust plate and retaining ring in the hollow shaft (refer to Figure 4). Proceed to Step 6.

Installation

6. JR, JF & JSC — Refer to Figure 7 for recommended lifting method. In order to sling JR & JF drives as illustrated, install the torque arm fastener in the torque arm anchor brackets. Sling the drive from the fastener as shown. For vertical installation, use (3) eyebolts as illustrated. Eyebolt sizes are 1/2" for 4407 thru 4507 and 3/4" for 4608. DO NOT remove sling until drive is secured to shaft. Before lifting the drive into position, rotate the high speed shaft until the hollow shaft keyway will be in position to line-up with the driven shaft key. JF proceed to Step 11; JSC to Step 12.

Figure 7



7. JR — If the drive was received with a backstop installed, the backstop must be temporarily removed to facilitate mounting. Refer to Section II, Step 10 for backstop removal instructions. Proceed to Step 8.

8. JR — Lift the drive into position and slide onto the drive shaft taking care that the driven shaft key seats into the hollow shaft keyway. DO NOT hammer or use excessive force. Refer to Figure 8 for installation of the torque arm. The exact position of the torque arm may vary within the range shown. For torque arm mountings other than shown, refer to the Factory. If it is necessary to shorten the torque arm assembly, cut the excess from either tie rod end.

   The support to which the clevis bracket is to be fastened must sustain the torque reaction shown in Table 4. The maximum load reaction through the torque arm occurs when the torque arm is located in the extreme off angle position. Use Grade 5 fasteners to anchor the clevis bracket; refer to Table 5 for the fastener size and tightening torque.

   Bolt the torque arm to both the clevis bracket and the drive anchor bracket and tighten the bolts until seated against the brackets. DO NOT bend the bracket as clearance between the clevis brackets and tie rod is necessary.

Figure 8 — Torque Arm Mounting Positions
6 O'Clock Mounting Position Shown

DRIVE SIZE	A
4407-4507	30°
4608	25°

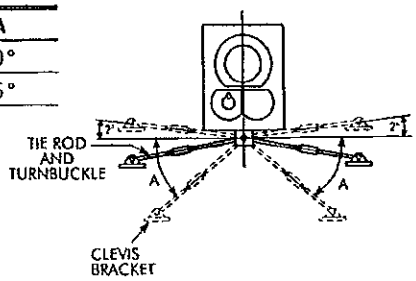


TABLE 4 — Load Reaction Through Tie Rod

DRIVE SIZE	4407	4415	4507	4608
Load ★, lb	20300	26100	32900	40950
Load ★, (N)	(90300)	(116100)	(146300)	(182200)

★ Load includes moment due to motor and motor mount with torque arm at maximum angle.

TABLE 5 — Tie Rod Clevis Bracket Fastener Tightening Torque

DRIVE SIZE	Fastener † Size	Tightening Torque — lb-ft (Nm)	
		Steel Foundation	Concrete Foundation
4407	1.000-8UNC	567 (768)	467 (633)
4415	1.250-7UNC	1050 (1424)	867 (1175)
4507	1.250-7UNC	1050 (1424)	867 (1175)
4608	1.250-7UNC	1050 (1424)	867 (1175)

† Grade 5 fasteners required.

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9. JR — Thread the bushing nut onto the hollow shaft one to two turns. NOTE: The bushing nut threads have been coated with an anti-seize compound at the Factory. This compound should not be removed. Before re-installing a previously used nut, recoat the nut threads only with an anti-seize compound. KEEP THE TAPERED SURFACE OF THE BUSHING AND HOLLOW SHAFT BORE FREE FROM ALL ANTI-SEIZE OR LUBRICATING COMPOUNDS.

   WARNING: Overtightening can fail the internal retaining ring. (See Appendix G, for listing of retaining rings).

   a. PREFERRED METHOD — Use a spanner, chain or pipe wrench to tighten the bushing nut to the torque value indicated in Table 6. NOTE: For applications where external vibratory or transient loads may act on drive and cause the setscrews to become loose, apply Loctite 243 or equivalent to threads of setscrews. Tighten the setscrew on the bushing nut.

   b. ALTERNATE METHOD (TO BE USED WHEN EXACT TORQUE CAN NOT BE MEASURED.) — Use a spanner (Table 6), chain or pipe wrench to tighten the bushing nut just until the drive can no longer be moved by hand axially on the driven shaft. Loosen nut ONLY until it can be turned by hand but do not unseat the taper. Retighten the nut hand tight. Now mark a spot on the bushing nut. Next mark a spot on the driven shaft 180° from the first mark. Use the spanner wrench to tighten the nut until the two marks are aligned i.e., one half turn. NOTE: For applications where external vibratory or transient loads may act on drive and cause the setscrews to become loose, apply Loctite 243 or equivalent to threads of setscrews. Tighten the setscrew on the bushing nut.

TABLE 6 — Spanner Wrench Type and Spanner Nut Tightening Torque

DRIVE SIZE	Adjustable Hook Spanner Wrench		Spanner Nut Tightening Torque lb-ft (Nm)
	Armstrong Tools	Williams	
4407	34-313 6 1/8"-8 3/4"	474B	333 (452)
4415	34-313 6 1/8"-8 3/4"	474B	333 (452)
4507	73-213 ★	CT-15-2 ★	333 (452)
4608	73-213 ★	CT-15-2 ★	333 (452)

★ These are chain wrenches where standard spanner wrenches are not available.

10. JR — Install backstop, motor mount, motor, sheaves (mount sheaves as close to the drive and motor housing as possible), belts and guard. Refer to Appendix D for motor mount installation instructions. Proceed to Step 13.

11. JF (USING TAPERED DRIVE SHAFT) — Put key into the driven shaft. Lift drive into position and slide onto the driven shaft taking care that the driven shaft key seats into the hollow shaft keyway. DO NOT hammer or use excessive force. Secure the drive to the foundation with fasteners using torque values shown in Table 7. Next, secure the drive to the shaft with the thrust plate fastener. Refer to Table 8 for torque value. Reinstall the hollow shaft cover. Install motor mount, motor, sheaves, belts and guard. Refer to Appendix D for motor mount installation instructions. Proceed to Step 14.

12. JSC (4407 ONLY) — Assemble drive to trough end and install drive shaft coupling bolts per screw conveyor manufacturer's instructions. Install motor mount, motor, sheaves, belts and guard. Refer to Appendix D for motor mount installation instructions. Proceed to Step 14.

13. JR — When the torque arm turnbuckle is used for belt tension adjustment, position the motor so that the belt pull will be about 90° to a line through the drive input shaft and hollow shaft as shown in Figure 9. For drives where the motor is moved to adjust belt tension, mount the motor slide base so that the belt tension adjustment is approximately parallel to the belt centers. Refer to Appendix D, for instructions relative to alignment of sheaves and belts. Proceed to Step 14.

TABLE 7 — JF and JSC Drives — Foundation Fastener & Tightening Torque

(Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Torque lb-ft (Nm)
4407	.750-10UNC, Gr. 5	245 (323)
4415	1.250-7UNC, Gr. 5	1050 (1424)
4507	1.250-7UNC, Gr. 5	1050 (1424)
4608	1.500-6UNC, Gr. 5	1842 (2497)

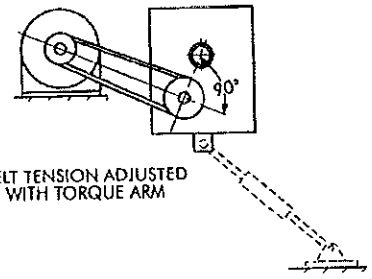
TABLE 8 — Thrust Plate Fastener Data

(Non-Lubricated Fasteners)

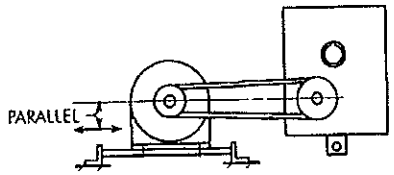
Unit Size	Fastener Size & Grade ★	Torque lb-ft (Nm)	Minimum Thread Depth-Inches (mm)
4407	1.000-8UNCx4.00, Gr. 8	792 (1073)	2.75 (69,8)
4415	1.250-7UNCx4.00, Gr. 8	1596 (2164)	2.50 (63,5)
4507	1.250-7UNCx4.00, Gr. 8	1596 (2164)	2.50 (63,5)
4608	1.250-7UNCx4.00, Gr. 8	1596 (2164)	3.00 (76,2)

★ Fastener lengths given are for applications using tapered drive shafts. Other lengths may be needed for applications using tapered bushings.

Figure 9



BELT TENSION ADJUSTED WITH TORQUE ARM



BELT TENSION ADJUSTED WITH MOVABLE MOTOR

Lubrication

CAUTION: Drives shipped without oil.

14. JR, JF & JSC — Refer to Appendix A for selection of lubricant. Refer to Table 9 for approximate oil capacity of drives.

15. JR, JF & JSC — HORIZONTAL MOUNTING

    Remove air vent and oil level plug (Refer to Step 1). Fill the drive until oil shows in the oil level hole. Coat the air vent and plug threads with Permatex #3 or equivalent thread sealant before replacing.

    JRV, JFV & JSCV — (VERTICAL MOUNTING) - Refer to Figure 1, Step 1.

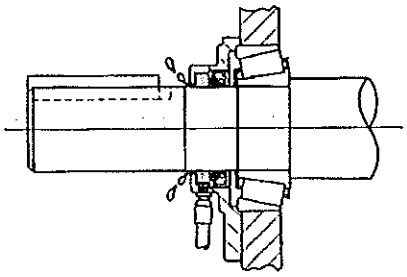
    Remove the fill plug and fill with oil to level marked on the dipstick.

    Coat the plug threads with Permatex #3 or equivalent thread sealant before replacing.

    If stand pipe is used as oil fill, the intermediate cover plug must be removed to eliminate entrapped air.

16. JR, JF & JSC — Where applicable, WITH A HAND GREASE GUN, pump grease into the input seal cover, Figure 10, until fresh grease appears at the shaft. Wipe off excess grease from the shaft. DO NOT use grease where it could contaminate the product e.g., foods, drugs etc.

Figure 10



Start Up

17. JR, JF & JSC — Before operating the drive, check all fasteners, pipe plugs, air vent, etc. which may have been loosened in the course of Outfitting, Installing and Lubricating the drive, to be sure that they have been properly retightened. Check correct rotation of motor & backstop and be sure drive is properly lubricated. After one week of operation repeat check of all external fasteners and pipe plugs.

18. After one month of operation:

    a. Operate the drive until the sump oil reaches normal operating temperature. Shut the drive down and drain immediately.

    b. Immediately flush the drive with an oil of the same type and viscosity grade as the original charge (warmed to approximately 100°F (38°C) in cold weather). Rapidly pour or pump a charge equal to 25-100% of the initial fill thru the drive, or until clean oil flows thru the drain.

    c. Close the drain and refill the drive to the correct level with new or reclaimed oil of the correct type and viscosity. If determined to be in good condition by the supplier, drain oil may be reused if it is filtered thru a 100 micron or finer filter.

TABLE 9 — Approximate Oil Capacity ★

DRIVE SIZE	JR, JF & JSC Gallons (Liters)	JRV & JFV Gallons (Liters)
4407	4.3 (16,3)	6.3 (23,8)
4415	7.0 (26,5)	9.5 (36,0)
4507	10.3 (39,0)	13.3 (50,3)
4608	12.0 (45,4)	19.5 (73,9)

★ Quantities are approximate. Always fill drive to specified level.

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P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-342-3131, Fax: 414-937-4359

Section II

Drive Service & Repair

Preventive Maintenance

PERIODICALLY — Carefully check the oil level of the drive when it is stopped and at ambient temperature, add oil if needed. If the oil level is above the specified level, have the oil analyzed for water content. Moisture in the oil may indicate seal leakage or condensation. If so, correct the defect immediately and change the oil. DO NOT overfill or oil leakage may result. On vertical shaft drives, remove fill plug before filling or checking oil level. If a drive is equipped with a fan, periodically clean accumulated foreign matter from the fan and fan guard to allow adequate air flow.

GREASE PURGED SEALS — Periodically (at least every six months), depending upon the frequency and degree of contamination, purge contaminated grease by slowly pumping fresh bearing grease through the seal cage WITH A HAND GREASE GUN until fresh grease flows out along the shaft. Wipe off the purged grease. Refer to Appendix A.

Oil Changes

PETROLEUM LUBRICANTS — For normal operating conditions, change gear oil every six months or 2500 operating hours, whichever occurs first. If the drive is operated in an area where temperatures vary with the seasons, change the oil viscosity grade to suit the temperature. Where applicable, grease seals when changing oil. Refer to Appendix A.

SYNTHETIC LUBRICANTS — Synthetic lube change intervals can be extended to 8000-10,000 hours depending on operating temperatures and lubricant contamination. Laboratory analysis is recommended for optimum lubricant life and drive performance. Change lube with change in ambient temperature, if required. Refer to Appendix A.

Stored & Inactive Drives

NEW DRIVES WHICH HAVE NOT BEEN OPERATED — Each drive is spin tested with a rust preventive oil that will protect internal parts against rust for a period of 4 months in an outdoor shelter or 12 months in a dry building after shipment from the Factory.

If a drive is to be stored or inactive beyond the above periods, spray all internal parts with a rust preventive oil that is soluble in lubricating oil or add 1 ounce of "Motorstor ★" vapor phase rust inhibitor oil. Seal air vent immediately with pressure sensitive tape.

Before operating drives which have been stored or inactive, remove tape and fill to the proper level with oil meeting specifications given in the Lubrication Recommendation found in Appendix A.

★ Product of the Daubert Chemical Company, Chicago, Illinois. (Formerly known as "Nucal Oil.")

SHUTDOWN OF NEW OR EXISTING DRIVES WHICH HAVE BEEN OPERATED — If a drive is to be stored or inactive for more than 2 months after a period of operation, add 1 ounce of "Motorstor ★" to the oil sump and immediately seal the air vent with pressure sensitive tape. It is not necessary to drain the oil prior to storage if oil is still serviceable and not contaminated.

Before operating drive, remove tape and check oil level.

PERIODICALLY INSPECT STORED OR INACTIVE DRIVES AND SPRAY OR ADD RUST INHIBITOR EVERY SIX MONTHS, OR MORE OFTEN IF NECESSARY. INDOOR DRY STORAGE IS RECOMMENDED.

Drives Ordered for Extended Storage can be treated at the Factory with a special preservative and sealed to rust-proof parts for periods longer than those stated above, if specified on the order.

Repair & Replacement

WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.
Lock out power source and remove all external loads from drive before servicing drive or accessories.

NOTE: Only the seals on the input side (See Figure 12) of 4407-4507 drives and high speed shaft seals of the 4608 drive can be replaced without removing the drive from the driven equipment. All other repairs require removal of the drive from the driven equipment. Proceed to Step 1 for drive removal. Proceed to Step 5 for replacement of seals.

Removal of Drive

See note above if only seal replacement is intended.

1. JR, JF & JSC — Drain the lubricant at this time. Remove safety guards and belts (motor and motor mount, optional). Remove backstop. Refer to Section II, Step 10, for backstop removal instructions.

WARNING: Drive must be supported during removal process. Use a sling around the motor mount or as recommended in Section I, Step 6. Take up the slack in the sling before proceeding.

2. JR — Refer to Appendix C, for instructions for using the TA torque assist removal tool.

   ALTERNATE METHOD — Loosen the setscrew on the bushing nut which is located at the output end of the hollow shaft. Use a spanner, pipe or chain wrench to loosen the bushing nut (Section I, Table 6). Initially, the nut will freely rotate counter clockwise approximately 180° as the nut moves from the locked position to the removal position. At this point anticipate resistance which indicates unseating of the bushing. Continue to turn the nut until it is free from the hollow shaft. Prepare drive for lifting (Figure 7) by disconnecting the torque arm at the drive end. Slide the drive from the bushing. The bushing can be left in place or removed, as required. If bushing will not slide off of the shaft, insert a small prybar into the split of the bushing and pry the split open slightly to loosen the bushing and remove from the shaft. Proceed to Step 5 for replacement of seals only or Step 9 for drive disassembly procedure.

3. JF — Remove the hollow shaft cover, Ref. #14 (Figure 12), from the input end of the hollow shaft. Remove the bolts which fasten the mounting flange to the driven equipment.

   Remove the fastener, retaining ring, and thrust plate from the hollow shaft. Refer to Table 10 and select a backing bolt and flat washer and install them into the drive shaft as illustrated in Figure 11. The bolt head provides a working surface for the removal bolt. Reinsert the thrust plate and retaining ring into the hollow shaft and select a removal bolt from Table 10. Thread the removal bolt into the thrust plate until it contacts the backing bolt head. Torque the removal bolt to the value shown in Table 10. (If the thrust plate rotates in the shaft, align the slot in the plate with the hollow shaft keyway and insert a screw driver or piece of key stock to prevent rotation of the plate.) After torquing the bolt, as instructed, strike the bolt, sharply with a hammer and retorque the bolt if separation of the drive from the shaft did not occur. Repeat this procedure, retorquing the bolt after each blow, until separation occurs.

   CAUTION: Failure to follow this procedure may result in the destruction the threads in the thrust plate. (If the retaining ring becomes damaged, refer to Appendix G, for replacement information.)

   Proceed to Step 5 for replacement of seals only OR Step 9 for drive disassembly procedure.

4. JSC (4407 ONLY) — Remove drive from driven equipment trough end by removing the trough end mounting screws from seal housing. Remove coupling bolts from drive shaft and slide drive with drive shaft away from the driven equipment.

   To remove drive shaft from the drive, remove the hollow shaft cover, Ref. #14 (Figure 12), from the input end of the hollow shaft and then refer to Step 3 above. The procedure to separate the JSC drive from the shaft is the same as for separation of a JF drive from driven equipment shaft.

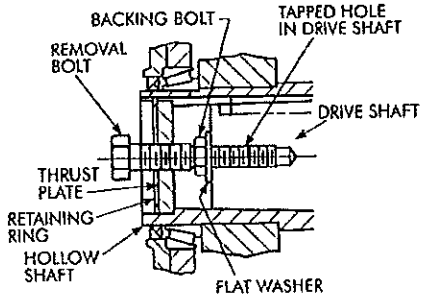
   After separation of the drive and shaft has been achieved, determine the type of seal equipped in the seal housing. If it is a waste packing seal, remove the waste packing material and then remove the loosened drive shaft from the seal housing side of the drive. If equipped with a lip seal, first remove the lip seal following the removal instructions from Step 5. After seal is removed from seal housing, remove the loosened drive shaft from the seal housing side of the drive.

   CAUTION: The seal housing acts as the bearing cage, therefore, DO NOT remove from the drive unless complete drive disassembly is anticipated. Removal of the seal housing will require readjustment of the L.S. bearings, Section III.

TABLE 10 — Removal & Backing Bolt Size and Length

DRIVE SIZE	Removal Bolt Size & Minimum Length – Inches	Maximum Tightening Torque – lb-ft (Nm)	Backing Bolt Size & Maximum Length – Inches
4407	1.125-7UNC x 3.00	742 (1006)	1.000-8UNC x 2.75
4415	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.50
4507	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.50
4608	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 3.00

Figure 11



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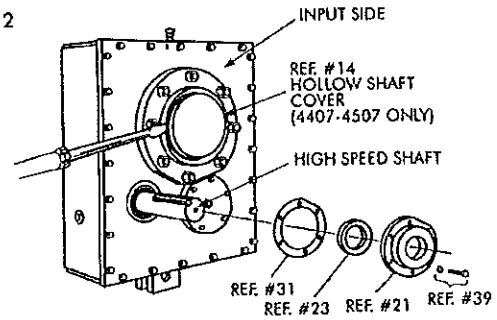
DRIVE DISASSEMBLY — (Refer To Parts Drawing Figure 14)

Prior to initiating any disassembly or repair, clean accumulated dirt and grime from the surface of the drive housing. Clean the exposed portion of the high speed and hollow shafts with a solvent and a non-abrasive cloth. If the seals only are being replaced proceed to Step 5. If the drive will be disassembled for inspection or repair, skip to Step 9.

CAUTION: Do not damage shaft; new seals will leak if seal contacting surface is marred. Do not use abrasive material on shaft seal contacting surface.

Figure 12



5. SEAL REMOVAL — (When drive is to be disassembled, proceed to Step 9.) Seal replacement is recommended after seal removal. When removing seals, maintain shafts in a horizontal plane to prevent any foreign matter from falling into the bearings. Refer to Figures 12, 13 & 14.

   NOTE: Only seals on the input side (See Figure 12) of 4407-4507 drives and high speed shaft seals of the 4608 drive can be replaced if drive is mounted on driven equipment. If drive removal is necessary, proceed to Step 1 for removal instructions.

   If drive removal is not necessary, drain lubricant at this time.

   Depending upon seal(s) being replaced, remove v-belt guard, v-belts, high speed shaft sheave, shaft cooling fan (if so equipped), backstop (4608J only, if so equipped) and other accessories as necessary.

Two seal mounting arrangements are used as follows:

a. Seals are installed into seal cages where seal cage must be removed from drive to remove seals. Removal of these seal cages will require readjustment of the bearings. The following seals use this mounting arrangement:

   4407-4507; All types, H.S. seals.
   4407JF & JSC; L.S. seals (output side).
   4608; All types, H.S. & L.S. seals.

   Refer to Figures 12, 13 & 14 and remove seals with this mounting arrangement as follows:

   (1) Clean shaft extension with solvent and remove all sharp edges. Remove seal cage, Ref. #11, #12, #21 or #66.

   (2) Drive out old seal from seal cage.

   (3) Scrape old Permatex from bore exercising caution not to score the bore.

b. Seals are installed into seal cages where seal cage may remain attached to drive. The following seals use this mounting arrangement:

   4407 JF & JSC; L.S. seals (input side).
   4407-4507JR; L.S. seals (input & output sides).
   4415-4507JF; L.S. seals (input & output sides).

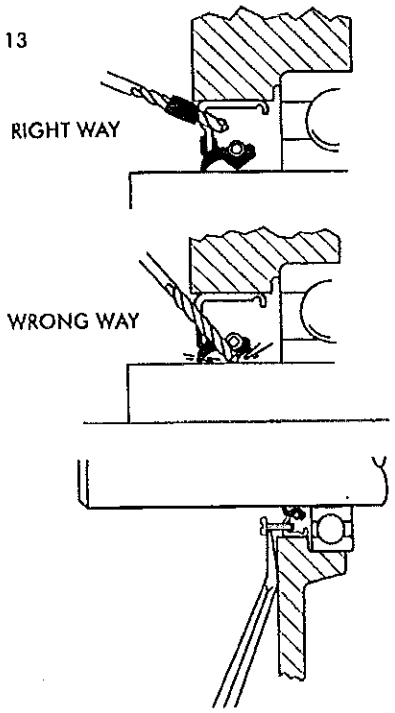
   Refer to Figures 12, 13 & 14. Remove the hollow shaft cover, Ref. #14, on Sizes 4407-4507. Remove seals with this mounting arrangement as follows:

   (1) Clean shaft extension with solvent and remove all sharp edges. Use a sharp center punch to lightly punch the seal case as a guide for the drill. NOTE: DO NOT drive seal into the bore too deep. Seals are not axially retained and disassembly of the drive may be required if the seal is driven too deep.

   (2) Wrap several turns of tape around a .125" (3 mm) diameter drill bit approximately .25" (6 mm) from the drill point to prevent the drill bit from entering too deeply into the housing and damaging the bearing. Grease or magnetize the drill bit to help retain the chips. Drill two .125" (3 mm) diameter holes in the seal case 180° apart. Control the angle of the drill as illustrated in Figure 13 to prevent damage to the shaft.

   (3) Insert two #10-.750" (M5 x 20) sheet metal screws into the seal case leaving .5" (13 mm) of the screw protruding above the seal face. DO NOT drive the screw more than .25" (6 mm) beyond seal face or bearing damage may occur. Use a claw type pry bar under the screw head as shown in Figure 13 and lift the seal out. Remove all metal chips. Use a magnet to remove the metal chips that fall into the

Figure 13



bore. Flush the drive to remove metal chips from the bearing. Remove Permatex from the housing bore.

6. SEAL SURFACE CONDITION — Carefully inspect polished surface of shaft where the seal makes contact. If the seal surface shows any sign of a nick, scratch, spiral swirl or groove, the shaft should be replaced or refurbished to prevent leakage of the lubricant. (In many instances the seal surface can be restored by use of a thin wall wear sleeve. Check with your local seal supplier and follow the manufacturer's instructions for installing the wear sleeve.)

7. SEAL INSTALLATION

   CAUTION: Protect seal lips from sharp edges of the keyway by wrapping thin strong paper (Kraft paper) around the shaft and coating the paper and seal lips with grease before sliding the seal on or off the shaft. Do not expand the seal lips more than .030" (0,75 mm) diameter.

   a. Install seals into seal cages where cages must be removed from drive:

      4407-4507; All types, H.S. seals.
      4407 JF & JSC; L.S. seals (output side).
      4608; All types, H.S. & L.S. seals.

      Shim-gaskets are used behind seal cages and end covers to adjust bearings. The correct shim-gasket pack must be determined prior to seal installation to attain proper bearing adjustment.

      Proceed to Section III, Step 3 for instructions regarding output side seal cages. Proceed to Section III, Step 5f for instructions regarding input side seal cages. Proceed to Section III, Step 6, bearing adjustment instructions to determine the proper shim-gasket pack thickness.

      Remove seal cage and install seal as follows:

      Note: When removing a seal cage to install a seal, be sure to use the shim-gasket pack determined from above to assure correct bearing adjustment.

      Coat O.D. of seal with Permatex #3 or equivalent sealant. Position seal squarely in seal cage with spring loaded lip toward drive. Drive or press seal into cage using a flat faced tool until seated.

      Install the complete seal cage shim pack. Carefully slip seal cage with seal over the shaft. Replace fasteners and cross tighten to torques listed in Table 14, Section III.

   b. Install seals into seal bores where seal cages may remain attached to housing:

      4407 JF & JSC; L.S. seals (input side).
      4407-4507JR; L.S. seals (input & output sides).
      4415-4507JF; L.S. seals (input & output sides).

      Coat O.D. of seal with Permatex #3 or equivalent sealant. Carefully slip seal over shaft and position squarely in seal bore with spring loaded lip toward drive. Use a cylindrical square faced tool to drive or press seal into bore until outer seal wall is seated 0.14" (3.5 mm) inside the seal bore outer wall.

      CAUTION: DO NOT seat seal against bearing; a shoulder is NOT provided for stopping the seal. Measure seal axial runout with a dial indicator mounted on the shaft. If the seal axial runout is more than 0.010" (0,25 mm), tap high side of seal with installation tool until seal axial runout is 0.010" (0,25 mm) or less.

8. DRIVE REPAIR IS COMPLETE — Review instructions in Section I for drive installation.

Drive Disassembly — Continued

9. When seals, Ref. #22 & 23 are to be reused (replacement is recommended), wrap the high speed shaft keyway and hollow shaft threads with masking tape or light weight kraft paper to protect seal lips during disassembly. Cover wrapping with a light coat of grease.

10. Remove backstop parts if so equipped. (For all drives, note direction of rotation of high speed shaft for proper reassembly.)

    For Sizes 4407, 4415J14 & 4507 remove cover Ref. #19, backstop Ref. #5A and appropriate spacers from backstop cage. Re-install cage and cover without the backstop and finger tighten fasteners.

    For Size 4415J25, remove entire backstop cage. Disassemble retaining rings and remove backstop. Re-install cage and cover without the backstop and finger tighten fasteners.

    For Size 4608, remove retaining ring and slide backstop Ref. #5A off of shaft.

11. Lay drive on bench with high speed shaft up. Remove housing cover fasteners, Ref. #33. Tighten the dowel nuts to remove the dowels. Screw capscrews into tapped holes (5/8-11UNC, Sizes 4407-4507; 7/8-9UNC, Size 4608). Tighten capscrews until the seal between the cover plate and base is completely broken. Screw eyebolts into tapped holes diagonally opposite in cover plate. Attach hoist cables and lift cover plate off housing base.

12. Remove the shaft assemblies (J05, Ref. #3A & 4A; J14 or J25, Ref. #1A, 2A & 4A) from output housing, Ref. #10.

13. Turn housing on either narrow side. If tapered roller bearings are being replaced, remove end covers and seal cage from output side of drive and drive bearing cups through the bores. Remove bearing cups from the housing cover in the same manner.

14. Drive seals out from base and cover bores and seal cages if replacement is indicated. Remove gasket material, seal compound and any accumulated foreign matter from seal joints, bores and adjacent sealing surfaces. Use a solvent to clean out the housing covers and shaft assemblies.

15. If drive is equipped with an internal backstop, check the shaft surface and the backstop sprags (inside diameter) for signs of wear. If either component shows evidence of wear, both should be replaced (Assemblies Ref. #1A or 3A and 5A). Also refer to Step 6 for inspection of seal surfaces.

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16. Inspect gear teeth for wear or indications of fatigue; e.g., hairline cracks at the root of the tooth. If one element has undergone severe wear or broken teeth, replace the mating element also.

17. Clean and inspect bearings for wear. Lubricate with light oil before spinning to avoid scoring of working surfaces. Remove any worn bearings with a wheel puller. If tapered roller bearings are being replaced, replace the bearing cups. DO NOT use new cone assemblies with worn (old) cups.

18. If gears are to be replaced, use a wheel puller or press to remove gears Ref. #1A4 or 4A4 from their shaft. Exercise caution to avoid scoring shaft seal diameter with the keyway in the gear.

19. Inspect all fasteners for damage or wear and replace with fasteners of equal grade. Grade 5 fasteners have three (3) radial lines on the head. Fasteners are available in kit form, Ref. #80.

20. If the shaft assemblies can be reused intact (no new parts required), refer to Section III, Steps 5 thru 8, for reassembly procedure. Replace all shim-gaskets with new parts, Kit Ref. #100.

Identifying & Ordering Parts

1. Refer to the parts diagram, Figure 14, and make a list of the parts required by part reference number. For example, Ref. #21, 23, 100, 1A, 2A1, and 2A2. When a gasket joint is separated, always replace with new shim-gaskets. Order Ref. #100 shim-gasket kit.

2. Now refer to the parts list, Table 11, and determine the part description and Falk part number using the part reference number (Step 1) and the drive identification (e.g., 4407J25C) in the column headers of the parts list.

3. Use the part description and Falk part number to order the required parts. In the examples of preceding Steps 1 and 2, Ref. #21, 23, 100, 1A, 2A1 and 2A2 for a 4407J25C, parts would be ordered as follows:

   Ref. #21 — Seal cage 4729121
   Ref. #23 — Seal 0912913
   Ref. #100 — Shim-gasket kit 0786841
   Ref. #1A — Shaft assembly with gear 4729124
   Ref. #2A1 — Bearing. 0921780
   Ref. #2A2 — Bearing. 0921780

4. Tables 12 and 13 converts Falk part numbers to bearing and seal manufacturer's part numbers. Tooth combinations are listed in Appendix G.

5. Place your order with your local Falk Distributor. If you need to locate a distributor, phone (414) 937-4284 in the United States and Canada.

Recommended Spare Parts

1. For non-critical drive applications a complete set of bearings, seals and shim-gaskets is recommended. If stored in their original packaging in a dry, cool location, these parts have a minimum shelf life of 5 years.

2. For critical drive applications (where an outage would create a major production loss), a complete drive is recommended.

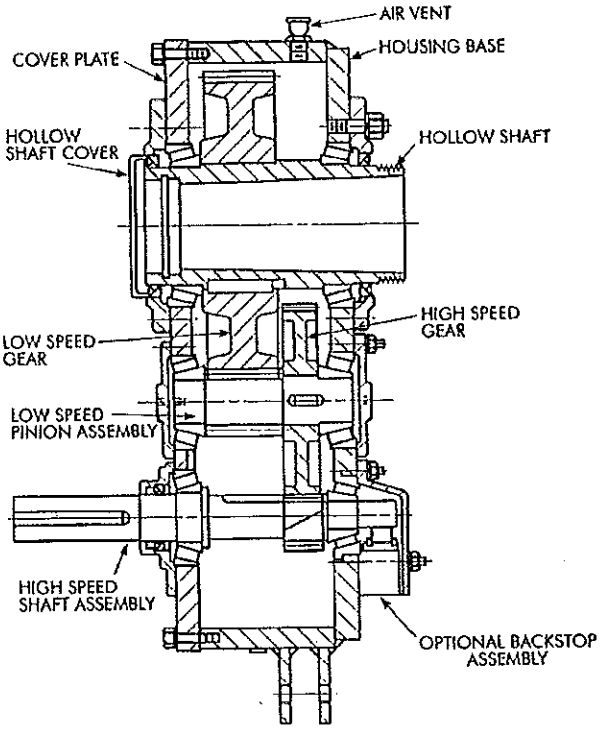

Figure 14 — Sizes 4407 thru 4608

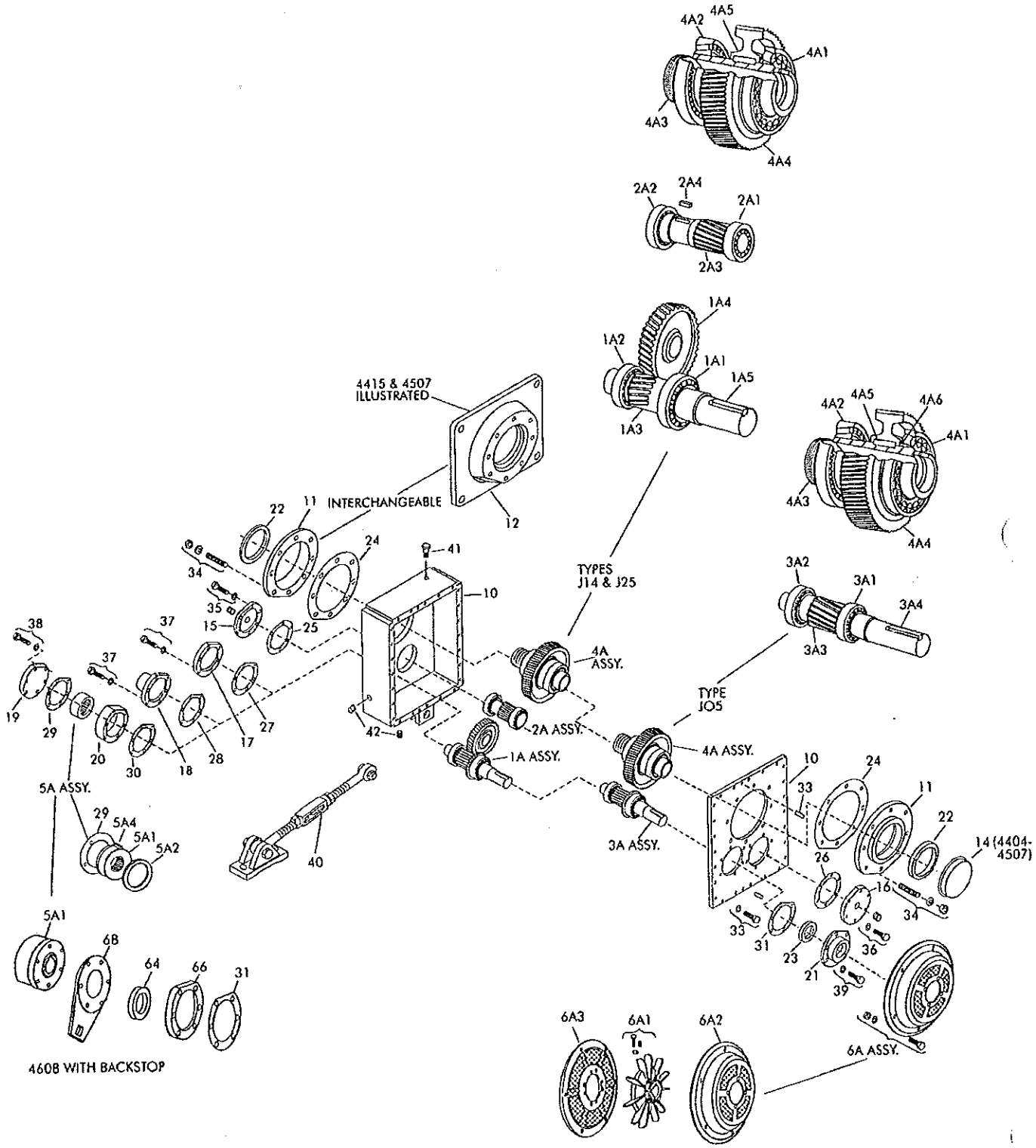

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TABLE 11 — Parts List Of Falk Part Numbers

Ref. No.	Part Description	DRIVE SIZE									
		4407	M4407	4415	M4415	4507	M4507	4608		M4608	
	Housing Components - J05, J14 & J25										
11	Seal Cage	0352865	0352865	0344480	0344480	0344425	0344425	4723185		4723185	
12	Flange – Seal Housing	0352889	0352889	...	...	...	...	...		...	
12	Mounting Flange	...	...	0426963	0426963	0426935	0426935	4723190		4723190	
14	Shaft Cover	2110604	2110604	1191500	1191500	4723160	4723160	...		...	
15	Shaft Cover	4729119	4729119	4729138	4729138	4723142	4723142	4729168		4729168	
16	Shaft Cover	4729119	4729119	4729138	4729138	4723164	4723164	4729168		4729168	
17	Shaft Cover - Type J05	4729120	4729120	0344426	0344426	0344426	0344426	1237503		1237503	
18	Shaft Cover - Type J14 & J25	2110747	2110747	0344426	0344426	0344426	0344426	1237503		1237503	
19	Shaft Cover - Type J14 & J25	1219672	1219672	0344428	0344428	0344428	0344428	...		...	
20	Backstop Cage - Type J14	1231142	1231142	0344429	0344429	0344429	0344429	...		...	
20	Backstop Cage - Type J25	1231142	1231142	0344427	0344427	0344429	0344429	...		...	
21	Seal Cage	4729121	4729121	4723144	4723144	4723165	4723165	4723186		4723186	
22	Seal	2912056	2912056	0912765	0912765	0912742	0912742	0912768		0912768	
22	Seal - 4407IF, JSC	2912098	2912098	...	...	...	...	...		...	
23	Seal	0912913	0912913	0912913	0912913	0912858	0912858	2916786		2916786	
40	Torque Arm Anchor Assembly	0785271	0785271	0785272	0785272	0785272	0785272	0785272		0785272	
41	Air Vent	0914088	0914088	0914088	0914088	0914088	0914088	0914088		0914088	
64	Seal	...	...	...	...	...	...	2916785		2916785	
66	Seal Cage	...	...	...	...	...	...	4729169		4729169	
67	Anchor Bracket	...	...	...	...	...	...	4729191		4729191	
68	Bracket Assembly - Backstop	...	...	...	...	...	...	0785462		0785462	
80	Fastener Kit - Includes Ref. #33 thru 39 & 42	4729122	4729122	4729139	4729139	4729154	4729154	4729170		4729170	
100	Shim-Gasket Kit - Includes Ref. #24 thru 31	0786841	0786841	0785587	0785587	0786843	0786843	0786844		0786844	
	Rotating Elements - J05							**Without Backstop**	**With Backstop**	**Without Backstop**	**With Backstop**
3A	Shaft Assembly - Includes Ref. #3A1 - 3A4	4729129	4729195	4729148	4729196	4729161	4729197	4729185	4729187	4729198	4729199
3A1	Bearing	0921855	0921855	0921494	0921494	0921752	0921752	0921751	0921751	0921751	0921751
3A2	Bearing	0921863	0921863	0921859	0921859	0921858	0921858	2918722	2918722	2918722	2918722
3A3	Pinion & Shaft - Includes Ref. #3A4	4729130	4729223	4729149	4729224	4729162	4729225	4729186	4729188	4729226	4729227
4A	Shaft Assembly - Includes Ref. #4A1 - 4A6	4729133	4729133	4729150	4729150	4729163	4729163	4729189	4729189	4729189	4729189
4A1	Bearing	2905186	2905186	0921861	0921861	0921755	0921755	2905910	2905910	2905910	2905910
4A2	Bearing	2905186	2905186	0921861	0921861	0921755	0921755	2905910	2905910	2905910	2905910
4A3	Hollow Shaft - Includes Ref. #4A5	4729134	4729134	4723149	4723149	4729164	4729164	4729190	4729190	4729190	4729190
4A4	Gear	1238083	1238083	1238033	1238033	1238072	1238072	1237487	1237487	1237487	1237487
4A6	Spacer - 4608	...	...	...	...	...	...	1237496	1237496	1237496	1237496
5A	Backstop Assembly	...	...	...	...	...	...	...	0772696	...	0772696
6A	Fan Assembly - Includes Ref. #6A1 thru 6A3	0785773	0787257	0785881	0787258	0785893	0787259	0785468	0785468	0785499	0785499
6A1	Fan	4729135	4729200	4729135	4729200	4729165	4729201	4729192	4729192	4729202	4729202
6A2	Guard	4729136	4729136	4729151	4729151	4729166	4729166	4729193	4729193	4729193	4729193
6A3	Backplate	4729137	4729137	4729152	4729152	4729167	4729167	4729194	4729194	4729194	4729194
	Rotating Elements - J14							**Without Backstop**	**With Backstop**	**Without Backstop**	**With Backstop**
1A	Shaft Assembly With 1A4 Gear	4729123	4729203	4729140	4729207	4729155	4729211	4729171	4729177	4729215	4729219
1A	Shaft Assembly Without 1A4 Gear	4729125	4729204	4729142	4729208	4729157	4729212	4729172	4729178	4729217	4729220
1A1	Bearing	0921682	0921682	0921529	0921529	0921752	0921752	0921751	0921751	0921751	0921751
1A2	Bearing	2915106	2915106	0921860	0921860	0921858	0921858	2918722	2918722	2918722	2918722
1A3	Pinion & Shaft - Includes Ref. #1A5	4729127	4729228	4729144	4729229	4723179	4729230	4729173	4729181	4729231	4729232
1A4	Gear	1238081	1238081	1238034	1238034	1238073	1238073	0359008	0359008	0359008	0359008
5A	Backstop Assembly - Includes Ref. #5A1 - 5A4	0769170	0769170	0757220	0757220	0757220	0757220	...	0772696	...	0772696
	Rotating Elements - J25							**Without Backstop**	**With Backstop**	**Without Backstop**	**With Backstop**
1A	Shaft Assembly With 1A4 Gear	4729124	4729205	4729141	4729209	4729156	4729213	4729175	4729179	4729218	4729221
1A	Shaft Assembly Without 1A4 Gear	4729126	4729206	4729143	4729210	4729158	4729214	4729176	4729180	4729216	4729222
1A1	Bearing	0921349	0921349	0921494	0921494	0921752	0921752	0921751	0921751	0921751	0921751
1A2	Bearing	2915107	2915107	0921859	0921859	0921857	0921857	2918722	2918722	2918722	2918722
1A3	Pinion & Shaft - Includes Ref. #1A5	4729128	4729233	4729145	4729234	4729153	4729235	4729174	4729182	4729236	4729237
1A4	Gear	1238082	1238082	1238035	1238035	1238074	1238074	0359007	0359007	0359007	0359007
5A	Backstop Assembly - Includes Ref. #5A1 - 5A4	0769170	0769170	0757221	0757221	0757220	0757220	...	0772696	...	0772696

Continued on next page

Drive Shaft Recommendations Using TA Taper® Bushing

Figure 2

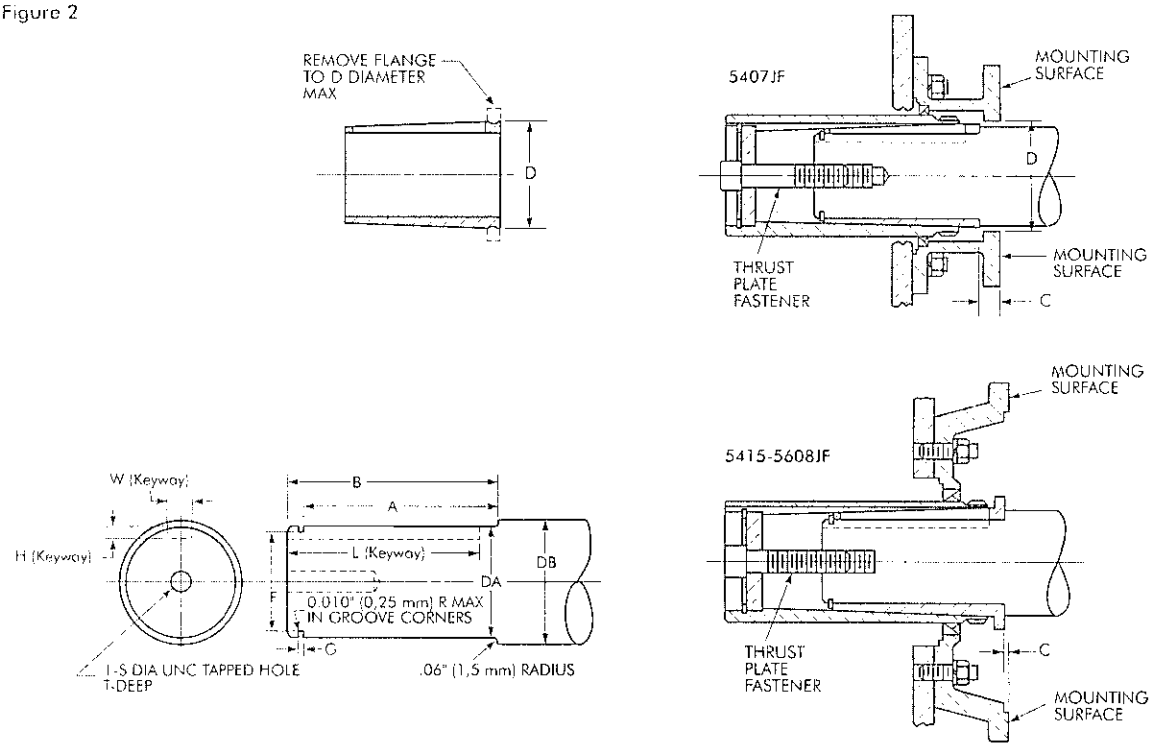


TABLE 3 — Removal & Backing Bolt Size and Tightening Torque

DRIVE SIZE	Removal Bolt Size & Min Length – Inches	Max Tightening Torque lb-ft (Nm)	Backing Bolt Size & Max Length – Inches
5407	1.125-7UNC x 3.00	742 (1006)	1.000-8UNC x 2.50
5415	1.500 6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.75
5507	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.75
5608	1.500 6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.75

TABLE 4 — Dimensions For Largest Bore Bushing – Inches (mm) ★

DRIVE SIZE	Thrust Plate Kit †	Thrust Plate Part No.	A +.010 (+0,25)	B +.030 (+0,75)	C ‡	D •	DA ■	DB Min	Retaining Ring ♦ Groove F	Retaining Ring ♦ Groove G	Retaining Ring ♦ Spir O Lox Mfg No.	Retaining Ring ♦ Spir O Lox Max O.D.	Keyway * W	Keyway * H	Keyway * L Min	S	T Min
5407	TP5407JF	0778780	8.160 (207,26)	8.500 (215,90)	1.384 (35,15) 1.037 (26,34)	5.250 (133,35)	4.4375	4.750 (120,65)	4.059 4.071	0.120 0.125	RSN-425	4.688	1.000	0.5000	7.750 (196,85)	1.000-8	2.75 (69,6)
5415	TP5415JF	0778781	10.100 (256,54)	10.375 (263,52)	0.867 (22,02) 0.520 (13,21)	...	4.9375	5.250 (133,35)	4.616 4.604	0.079 0.084	RS-475	5.125	1.250	0.6250	9.563 (242,90)	1.250-7	3.00 (76,2)
5507	TP5507JF	0778782	10.440 (265,18)	10.750 (273,05)	0.617 (15,67) 0.269 (6,83)	...	5.4375	5.750 (146,05)	5.114 5.100	0.079 0.084	RS-525	5.688	1.250	0.6250	9.875 (250,82)	1.250-7	3.00 (76,2)
5608	TP5608JF	0778783	12.530 (318,26)	13.000 (330,20)	2.639 (67,03) 2.292 (58,22)	...	6.5000	7.000 (177,80)	5.993 5.977	0.174 0.182	RSN-625	6.813	1.500	0.7500	12.625 (320,68)	1.250-7	3.50 (88,9)

★ For metric drive shafts or bushing bores smaller than the maximum, provide the retaining ring groove per manufacturers' recommendations, keyway appropriate for the shaft diameter, and DB minimum of 0.300" (7.62 mm) larger than the bushing bore to provide adequate backing.

† Kit consists of: thrust plate, thrust plate fastener, hollow shaft retaining ring and drive shaft retaining ring.

‡ The range for C dimensions is the variation which may occur due to axial compression and manufacturing tolerances.

• The D dimension is the recommended minimum bore which clears the TA Taper bushing flange.

■ Shaft diameter tolerances are per AGMA as follows: over 2.50" to & including 4.00" = +.000", -.006"; over 4.00" to & including 6.00" = +.000", -.007"; over 6.00" to & including 7.00" = +.000", -.008". Metric drive shafts are to be based on h10 tolerances.

♦ Smalley retaining rings may be used instead of Spir O Lox by substituting WS for RS, WST for RST or WSM for RSN.

* Inch keyway width tolerances are as follows: .500" to & including 1.000" = +.0030", -.0000"; over 1.000" to & including 1.500" = +.0035", -.0000". Metric keyway widths are based on class N9 tolerances. Inch keyway depth tolerance is +.010", -.000". Refer to ISO 773 or DIN 6885 sheet 1 for metric keyway depth tolerances.

Drive Shaft Recommendations Using (TCB) Kit

INTRODUCTION — These instructions are for use when a screw conveyor 5407JSC drive is to be used and the following conditions exist: Falk standard or 316 stainless steel JSC tapered drive shafts can not be used due to special extension dimensions or materials; or manufacturing a special tapered drive shaft is not feasible. Use this appendix to retrofit existing applications or for outfitting new installations where the above conditions warrant. For tapered shaft recommendations, see Appendix H.

This appendix will allow the use of a straight (non tapered) drive shaft with a special bushing conversion kit on screw conveyor applications. The bushing conversion kit may also be used on flange mounted 5407JF applications where the Falk JSC seal housing is to be used as the mounting flange. This kit provides one bushing bore per drive size as shown in Table 4. Provided in this appendix are dimensions for drive shaft recommendations and instructions for the installation and removal of the assembly.

FIGURE 2 — The hollow shaft of the drive has a tapered bore which accepts the tapered bushing. When the bushing is drawn into the taper, a clamping force is applied to the drive shaft. The drive shaft is drawn into the hollow shaft via a fastener in the thrust plate. The bushing seats against a shoulder on the drive shaft and is drawn into the drive with the shaft. Removal is accomplished by using a jackscrew in the thrust plate and forcing the drive shaft out of the drive. The retaining ring in the drive shaft assures that the bushing will be removed along with the shaft.

DRIVE SHAFT RECOMMENDATIONS — The recommendations for the drive shaft consist of two major features. The first is the shoulder which must be provided in the location shown in Figure 2. This shoulder provides the backing necessary to draw the bushing into the taper. A permanently fixed shoulder must be provided in order for this design to be effective. The shoulder may be a welded collar or an integral step. SET COLLARS ARE NOT ACCEPTABLE. A retaining ring may be used in the drive shaft, to provide the shoulder, but stress concentrations can occur at the groove and therefore shaft stresses must be checked. The second major feature on the shaft is the retaining ring groove in the shaft end. This feature is recommended to ensure positive removal of the bushing when the drive shaft is removed from the drive. The threaded hole in the end of the drive shaft accepts the thrust plate fastener.

WARNING: *Lock out power source and remove all external loads from system before servicing drive or accessories.*

INSTALLATION PROCEDURE — With the shaft manufactured per the recommendations shown, proceed as follows:

The seal housing may be assembled to the drive before or after the drive shaft is installed into the drive, but if the seal housing is installed to the drive first, the lip type seal (if used) must be installed from the extension end.

Slide the bushing (large end first) onto the drive shaft until it contacts the shoulder on the shaft. Insert the key through the bushing and into the drive shaft keyway. Install the retaining ring into the groove in the drive shaft. Line up the keyway in the drive hollow shaft with the key in the drive shaft and slide shaft/bushing assembly into the hollow shaft. Attach the seal housing to the drive with the fasteners provided. Tighten fasteners to torque given in Table 1. Assemble the thrust plate and retaining ring into the counterbore in the hollow shaft.

Insert the thrust plate fastener through the thrust plate and thread into the drive shaft end. Tighten to the torque given in Table 2. Install all covers and guards.

REMOVAL PROCEDURE — Remove low speed shaft input end cover. Remove the thrust plate fastener, retaining ring and thrust plate from the hollow shaft. Refer to Table 3 and select a backing bolt and flat washer and install them into the drive shaft as illustrated in Figure 1. The head of the backing bolt provides a working surface for the removal bolt. Reinsert the thrust plate and retaining ring into the hollow shaft and select a removal bolt from Table 3. Thread the removal bolt into the thrust plate until it contacts the backing bolt head. Tighten the removal bolt to the torque indicated in Table 3. (If the thrust plate rotates in the shaft, align the slot in the plate with the hollow shaft keyway and insert a screwdriver or piece of key stock to prevent rotation of the plate). After torquing the bolt, as instructed, strike the bolt sharply with a hammer and retorque the bolt if separation of the drive from the shaft did not occur. Repeat this procedure, retorquing the bolt after each blow, until separation occurs.

Figure 1

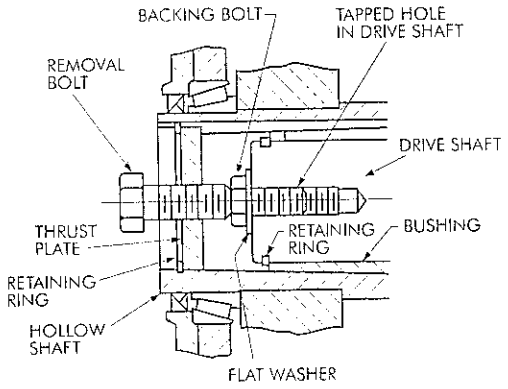


TABLE 1 — Seal Housing Fastener Tightening Torque (Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Max Tightening Torque lb-ft(Nm)
5407	750-10UNC	330 (447)

TABLE 2 — Thrust Plate Fastener Data (Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Max Tightening Torque lb-ft (Nm)	Min Thread Depth Inches (mm)
5407	1.000- 8UNC x 5.50, GR.8	792 (1074)	2.75 (69,8)

Rexnord Industries, LLC., Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

Drive Shaft Recommendations Using (TCB) Kit

Figure 2

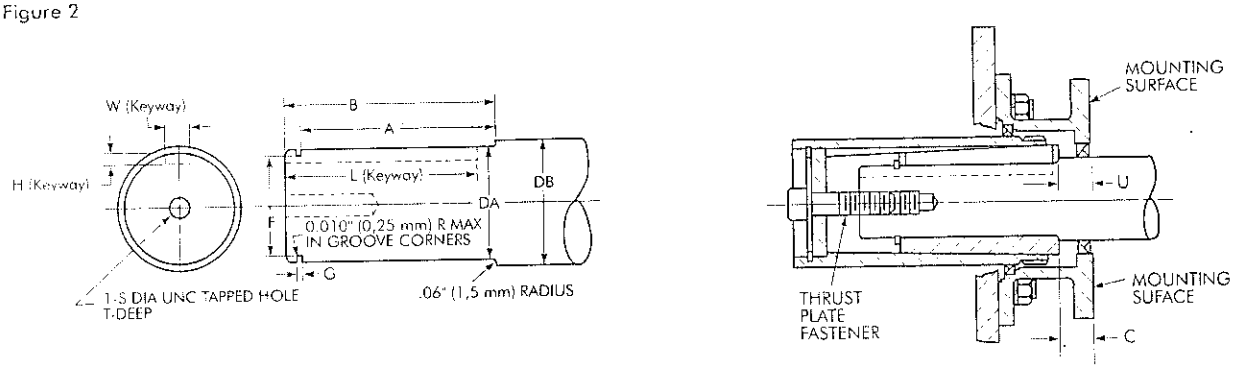


TABLE 3 — Removal & Backing Bolt Size and Tightening Torque

DRIVE SIZE	Removal Bolt Size & Min Length – Inches	Max Tightening Torque lb-ft (Nm)	Backing Bolt Size & Max Length – Inches
5407	1.125- 7UNC x 3.00	742 (1006)	1.000- 8UNC x 2.50

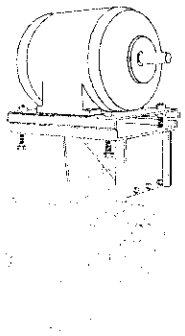
TABLE 4 — Dimensions – Inches (mm)

Taper Conversion Bushing Kit †	(TCB) Kit Part No.	A ± 0.010 (± 0,25)	B ± 0.030 (± 0,75)	C ‡	DA •	DB ■ +0.000, -0.003 (+0,00, -0,06)	Retaining Ring ♦ Groove F	Groove G	Mfg No.	Max O.D.	Keyway * W	H	L Min	S	T Min	Weld/Integral Flange U	V
TCB5407J-3.438	0/86823	7.655 (194,44)	9.500 (241,30)	1.879 (47,73) 1.552 (39,42)	3.4375	3.938 (100,03)	3.263 3.251	0.103 0.108	Spir O Lox RSN-343	...	0.875	0.4375	9.250 (234,95)	1.000-8	2.75 (69,9)	1.500 (38,10)	...

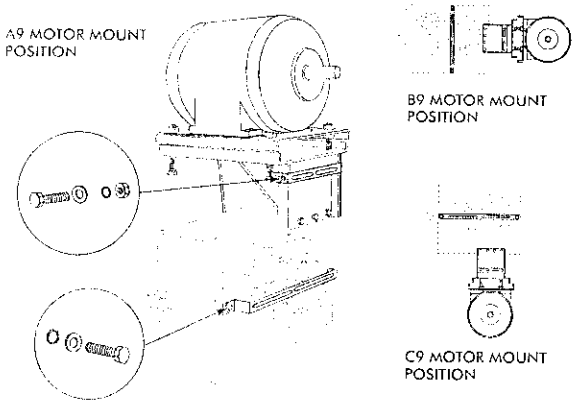
† Kit consists of: Bushing, thrust plate, fastener, key, retaining ring, and hardware.
‡ The range of C dimension is the variation which may occur due to axial compression and manufacturing tolerances.
• Shaft diameter tolerances are per AGMA as follows: over 2.50" to & including 4.00" = + .000, - .006.
■ If a lip type seal is used, a 32rms finish is recommended.
♦ Smalley retaining rings may be used instead of Spir O Lox by substituting WSM for RSN.
* Inch keyway width tolerances are as follows: over .500" to & including 1.000" = + .0030", -.0000"; 1.000" inch keyway depth tolerance is, + .010", -.000".

OSHA V-Belt Guard Installation For Drives Without Shaft Fan

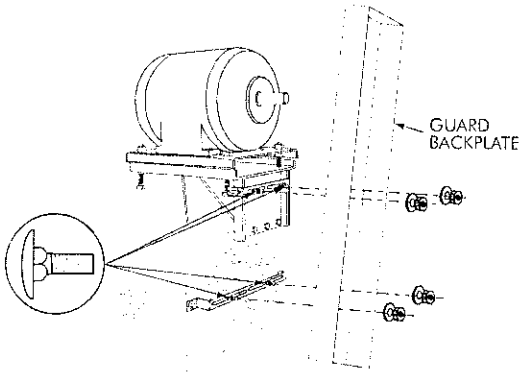
1. ASSEMBLE MOTOR MOUNT AND MOTOR TO DRIVE AS INSTRUCTED IN APPENDIX D



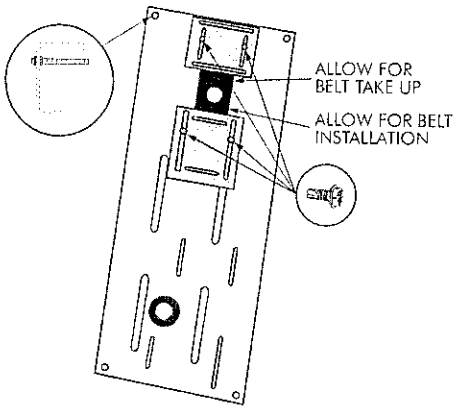
2. ASSEMBLE BELT GUARD BRACKETS TO MOTOR MOUNT



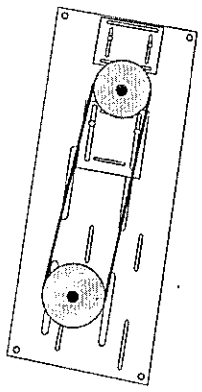
3. ASSEMBLE BACKPLATE TO BRACKETS



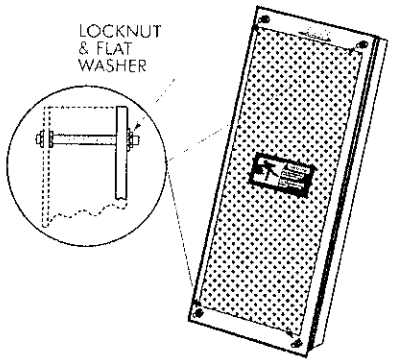
4. ASSEMBLE THREADED RODS TO BACKPLATE & MOUNT SLOT COVER(S) AS REQUIRED



5. MOUNT BELT DRIVE AS INSTRUCTED IN APPENDIX D



6. MOUNT COVER AND APPLY WARNING LABEL



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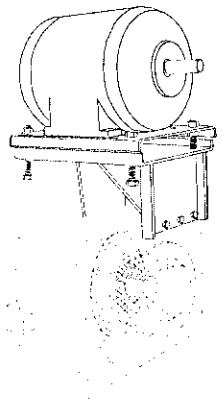
OSHA V-Belt Guard Installation For Drives With Shaft Fan

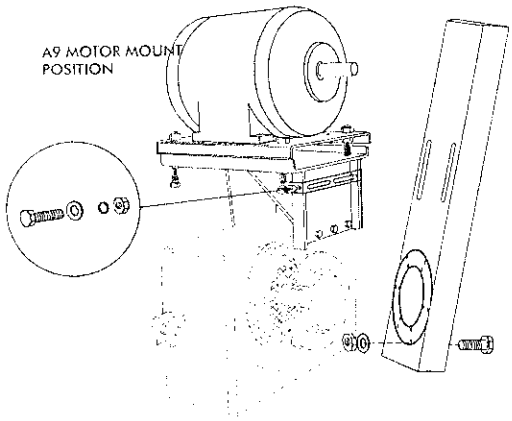
WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.

WARNING: Lock out power source and remove all external loads from drive before servicing drive or accessories

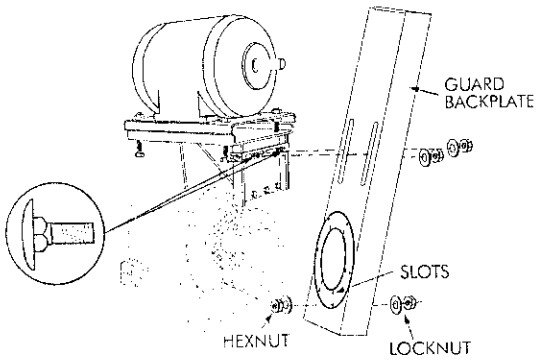
1. ASSEMBLE MOTOR MOUNT AND MOTOR TO DRIVE AS INSTRUCTED IN APPENDIX D



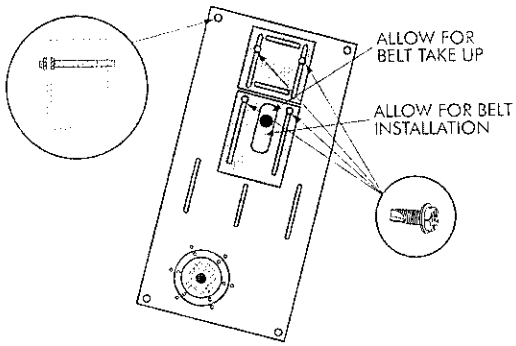
2. ASSEMBLE GUARD MOUNTING BRACKET & ADAPTER TO GUARD BACKPLATE



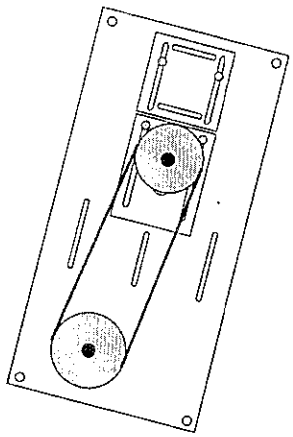
3. ASSEMBLE BACKPLATE WITH ADAPTER TO SHROUD



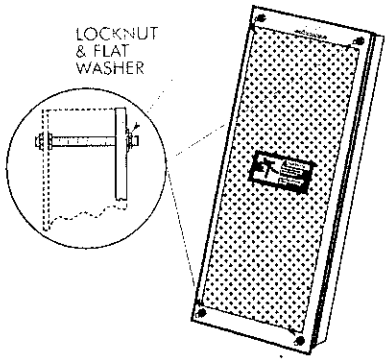
4. ASSEMBLE THREADED RODS TO BACKPLATE & MOUNT SLOT COVER(S) AS REQUIRED



5. MOUNT BELT DRIVE AS INSTRUCTED IN APPENDIX D



6. MOUNT COVER



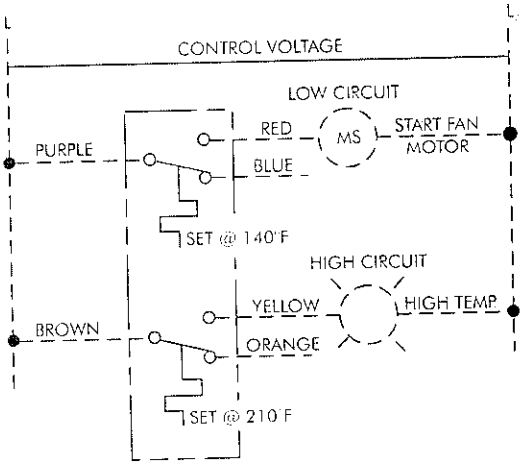
Electric Fan Installation

Introduction

The following instructions apply to the installation of the electric fan. The sump temperature switch is provided as a standard feature.

The sump temperature switch features dual settings for two independent single-pole, double-throw circuits. Only one circuit is used to control the fan. The remaining circuit may be used to control a warning light, an alarm, or a motor shutdown switch if the temperature setting is exceeded. The sump temperature switch wiring diagram is given in Figure 1.

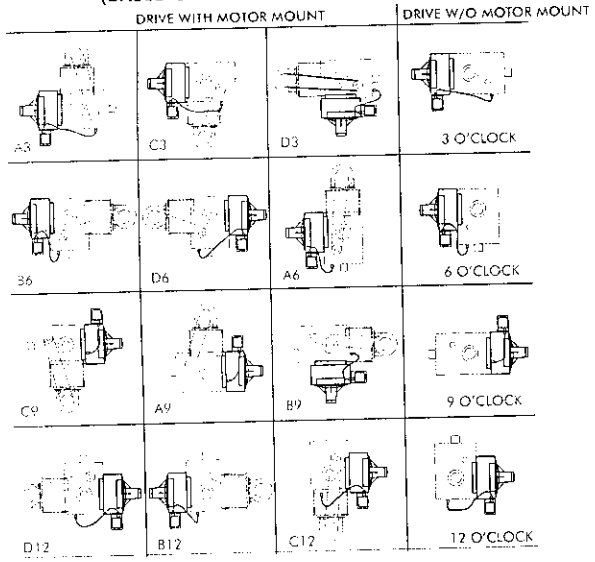
Figure 1



Refer to Figure 2 for electric fan, temperature switch and bulb well standard mounting locations. The bulb well houses the sump temperature probe. These mounting locations are based on drive mounting position.

Figure 2

ELECTRIC FAN, TEMP. SWITCH & BULB-WELL STANDARD LOCATIONS (BASED ON DRIVE MOUNTING POSITION)

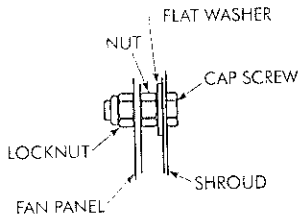


Assembly Instructions

WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.
Lock out power source and remove all external loads from drive before servicing drive or accessories.

1. Drain oil from the drive.
2. ELECTRIC FAN PANEL REWORK — The holes in the electric fan panel must be enlarged to accommodate the fasteners used to mount the electric fan to the shroud. Align the fan panel to the shroud. Locate and drill four 0.4375" (12 mm) diameter clearance holes in line with the pre-drilled holes in the shroud.
3. Insert four 1.25" (32 mm) cap screws through the fan mounting holes in the shroud with the threaded portion of the cap screw away from the drive. Secure the cap screws to the shroud with flat washer (2 washers for 5407) and nut, see Figure 3.

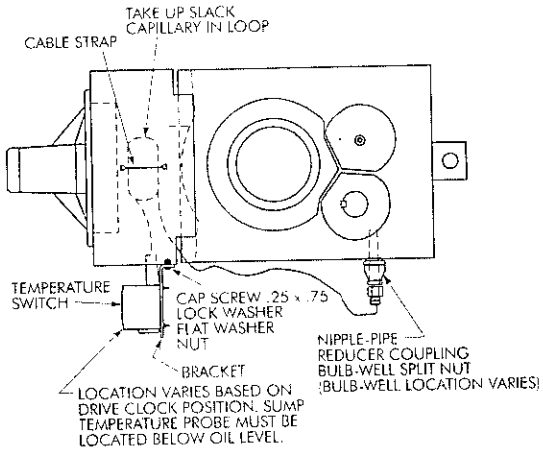
Figure 3



4. Secure the sump temperature switch to the switch mounting bracket. Attach the switch and mounting bracket to the fan shroud, refer to Figure 2 for location.
5. Install the temperature probe bulb well in the designated drain hole as shown in Figure 4. Refer to Figure 2 for bulb well location.

CAUTION: Sump temperature probe must be located below oil level.

Figure 4



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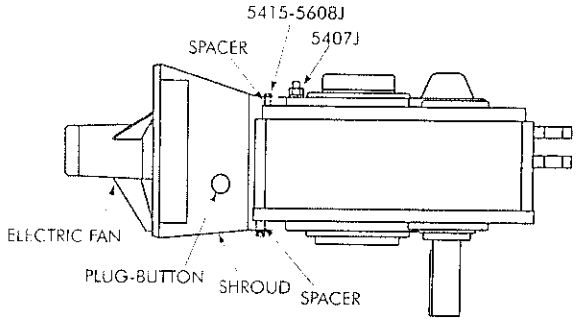
6. Mount the shroud on drive using spacers and hardware, see Figure 5.

Figure 5



7. Place the temperature probe in bulb well and secure capillary to the shroud by using one or two cable straps to remove extra slack, refer to Figure 4.

   CAUTION: Do not crimp capillary.

8. Install split nut in the bulb well to retain the temperature probe.

9. Sump temperature switch settings:

   a) Remove the two screws and cover from the top of switch to reveal the sump temperature switch setting wheels. Set the low circuit to turn the electric fan on at 140°F (60°C). Set the high circuit at 210°F (99°C) to engage alarm or main motor cutout.

   b) Remove the four screws and cover from the front of the sump temperature switch to reveal the differential setting wheels. Rotate the wheels to the full clockwise position as viewed from the top of the switch. This is the maximum temperature differential setting of 15°F (9°C). Replace the cover and four screws.

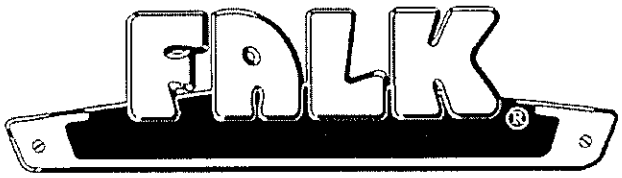
10. Fill drive to oil level specified in Section I with oil specified in Appendix A.

11. Position the electric fan panel on the remaining threaded portion of the cap screws from Step 2 and secure it to the shroud with four locknuts, see Figure 3.

12. Remove the condensation plug from the bottom of the electric fan.

13. Place the button plug in the shroud, see Figure 5.

14. Connect the electric fan to the power source per local and national electrical codes.



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P.O. Box 492
Milwaukee, WI 53201-0492 USA

Vertical Standpipe Installation

Introduction

The following instructions apply to the installation of standpipe kits to standard drives mounted for vertical operation (high speed shaft up or down). Drawings are representative of this series of drives and may not agree in exact detail with all drive sizes.

NOTE: Vertical shaft drives, when filled to the proper oil level, are completely full of oil.

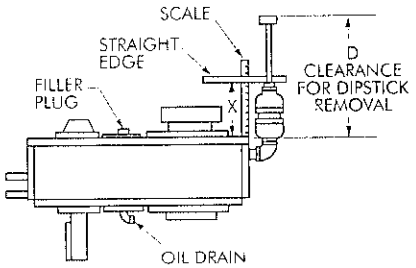
High Speed Shaft Down — Figure 1

1. After installing the drive per the Owners Manual installation instructions, determine which of the upper side plug locations on the drive will provide the best location for the standpipe, observing clearance required to remove dipstick (Dimension D, Table 1). Discard the air vent. When the air vent location is not used for the standpipe, relocate the pipe plug from the selected standpipe location to the air vent location. Recoat pipe plug threads with Permatex #3 or equivalent sealant before reinstalling.
2. Coat all pipe threads of kitted parts with Permatex #3 or equivalent sealant.

TABLE 1 — Dimensions

DRIVE SIZE	Inches (mm)			
	A	B	C	D
5407	0.75 (19)	1.25 (32)	1.75 (44)	24.3 (617)
5415	0.90 (23)	1.40 (36)	1.90 (48)	21.3 (541)
5507	0.92 (23)	1.42 (36)	1.92 (49)	21.3 (541)
5608	1.03 (26)	1.53 (39)	2.03 (52)	20.6 (523)

Figure 1

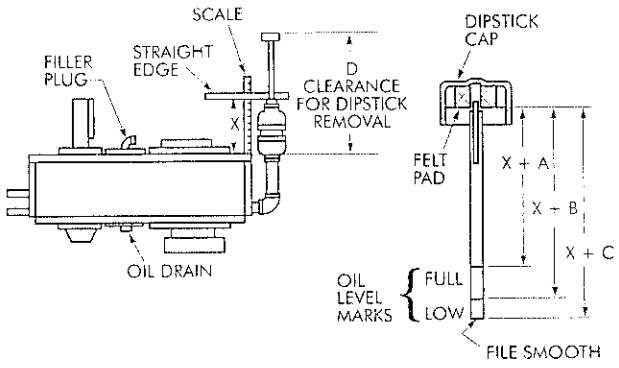


3. Assemble kitted parts to the drive as illustrated in Figure 1 and then secure the standpipe with an external support to maintain its vertical position.
4. Carefully measure Dimension X as illustrated in Figure 1.
5. From Table 1:
   X − A equals oil level "Full" mark.
   X − B equals oil level "Low" mark.
   X − C equals dipstick length.
6. Scribe Dimensions X − A and X − B on the dipstick as illustrated in Figure 1. Make measurements from the felt pad in the dipstick cap.
7. Lightly chisel permanent oil level marks on the scribed lines and cut the dipstick to the length marked. File end of dipstick smooth.
8. Install magnetic drain plug (furnished) in oil drain location.
9. Remove the oil filler plug. Add oil until the oil level reaches the "Full" mark on the dipstick. Coat the filler plug (not vented) with Permatex #3 or equivalent sealant and replace it.
10. Filler plug must always be removed to relieve entrapped air before checking oil level.

High Speed Shaft Up — Figure 2

1. After installing the drive per the Owners Manual installation instructions, determine which of the lower four side plug locations on the drive will provide the best location for the standpipe, observing clearance required to remove dipstick (Dimension D, Table 1). Discard the air vent. When the air vent location is not used for the standpipe, relocate the pipe plug from the selected standpipe location to the air vent location. Recoat pipe plug threads with Permatex #3 or equivalent sealant before reinstalling

Figure 2



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Vertical Standpipe Installation

2. Coat all pipe threads of kitted parts with Permatex #3 or equivalent sealant.
3. Assemble kitted parts to drive as illustrated in Figure 2 and then secure the standpipe with an external support to maintain its vertical position.
4. Carefully measure Dimension X as illustrated in Figure 2.
5. From Table 1:

   X + A equals oil level "Full" mark.

   X – B equals oil level "Low" mark.

   X + C equals dipstick length.
6. Scribe Dimensions X – A and X – B on the dipstick as illustrated in Figure 1. Make measurements from the felt pad in the dipstick cap.
7. Lightly chisel permanent oil level marks on the scribed lines and cut the dipstick to the length marked. File end of dipstick smooth.
8. Install magnetic drain plug (furnished) in oil drain location.
9. Remove the oil filler plug. Add oil until the oil level reaches the "Full" mark on the dipstick. Coat the filler plug (not vented) with Permatex #3 or equivalent sealant and replace it.
10. Filler plug must always be removed to relieve entrapped air before checking oil level.

Modifications For Non-Standard Mounting Positions

Instructions

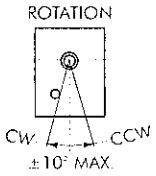
For non-standard mountings, modify drives as illustrated below and on Page 37 to assure satisfactory lubrication. For applications that exceed the limits shown, drives that are both rotated AND tilted and for with backstops, consult Factory.

CAUTION: Inadequate lubrication will cause damage.

When replacing a pipe plug (P) with a street elbow (E), insert the plug in the elbow (E/P). When replacing a pipe plug (P) with a street elbow (E), pipe nipple (N) and a pipe cap (C), discard the pipe plug. Kits consist of parts for an oil expansion chamber. Pipe fittings and kits tabulated on Page 37 are available from Rexnord. Pipe fittings may also be purchased locally. Use galvanized pipe fittings.

Remove all pipe plugs and coat them and the added parts, with Permatex #3 or equivalent to prevent leakage. Install parts as illustrated to suit the mounting position. The air vent must be in the top of the drive or in the kit standpipe. Fill drives with oil to the level indicated by the letter "L" in the following drawings.

Standard Drive Mounting Limits



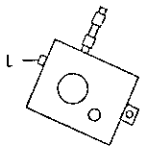
The 10° Max rotation illustrated at the left applies to standard 3, 6, 9 & 12 o'clock mountings. For higher limits, follow the instructions at the left and the drawings below. (6 o'clock illustrated)

CODE
B — Reducing Bushing
C — Cap
E — Street Elbow
K — Oil Expansion Chamber Kit
L — Oil Level
N — Nipple
P — Pipe Plug
STD — No Modifications

Horizontal Drive Modifications for 10 to 20° Drive Rotation

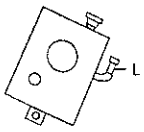
10 to 20° Clockwise Rotation

3 O'Clock — CW Rotation



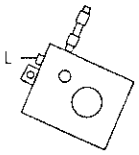
5407 = KIT 0786777
5415 THRU 5608 = KIT 0786778

6 O'Clock — CW Rotation



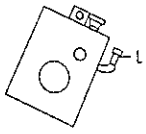
5407 = .750 E/C & .750 x 1.375 N
5415 & 5507 = 1.250 E/C & 1.250 x 1.625 N
5608 = 1.25 E/P

9 O'Clock — CW Rotation



5407 = KIT 0786777
5415 THRU 5608 = KIT 0786778

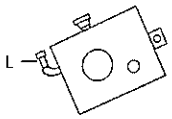
12 O'Clock — CW Rotation



5407 = .750 E/C & .750 x 1.375 N
5415 & 5507 = 1.25 E/C & 1.25 x 1.625 N
5608 = 1.25 E/P

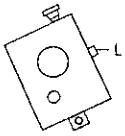
10 to 20° Counterclockwise

3 O'Clock — CCW Rotation



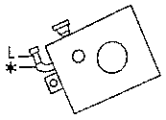
5407 = .750 E/C & .750 x 3.00 N
5415 = 1.250 E/C & 1.250 x 3.00 N
5507 = 1.250 E/C & 1.250 x 3.50 N
5608 = 1.250 E/C & 1.250 x 2.50 N

6 O'Clock — CCW Rotation



5407, 5415, 5507, & 5608 = STD

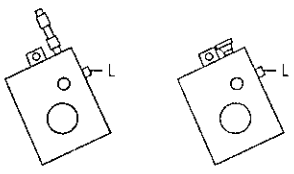
9 O'Clock — CCW Rotation



5407 = .750 E/C & .750 x 1.375 N
5415 & 5507 = 1.250 E/P
5608 = STD

* This oil level applies when only a street elbow with a pipe plug is used.

12 O'Clock — CCW Rotation



5608

5407, 5415 & 5507 = STD
5608 = KIT 0786778

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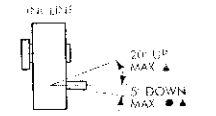
Modifications For Non-Standard Mounting Positions



● 5407 & 5415 – 0° INCLINE DOWN ON DRIVES WITH BACKSTOPS IN 9 OR 12 O'CLOCK MOUNTING POSITION

▲ 5507 & 5608 – 5° INCLINE ON DRIVES WITH BACKSTOPS IN ALL MOUNTING POSITIONS

Standard Drive Mounting Limits

The limits illustrated at the left applies to standard 3, 6, 9 & 12 o'clock mountings. For higher incline limits, follow the instructions on Page 36 and the drawings below. (6 o'clock illustrated)

CODE

C — Cap
E — Street Elbow
K — Oil Expansion Chamber Kit
L — Oil Level
N — Nipple
P — Pipe Plug
STD — No Modifications

Standard Pipe Fittings ★ — Inches

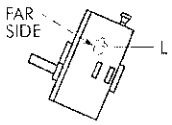
.750-14 NPT	Falk No.	1.25-11.5 NPT	Falk No.
.750 Street Elbow	0915253	1.25 Street Elbow	0915255
.750 Cap	0914804	1.25 Cap	0914806
.750 x 1.375 Nipple	0915824	1.25 x 1.625 Nipple	0915882
.750 x 3 Nipple	0915836	1.25 x 2.5 Nipple	0915885
.750 x .500 Bushing	0914652	1.25 x 3 Nipple	0915886
		1.25 x 3.5 Nipple	0915897
		1.25 x .500 Bushing	0914656

★ Kits: Falk Nos. 738471 . . . . Oil expansion chamber parts.
All pipe fittings are galvanized.

Horizontal Drive Modifications for Inclined H.S. Shaft

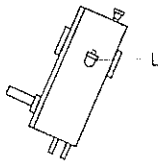
H.S. Shaft Inclined 20 to 30° Up

3 O'Clock H.S.S. Up



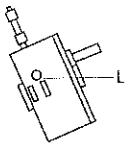
5407 = .750 E/P
5415 & 5507 = 1.25 E/P
5608 = STD

6 O'Clock H.S.S. Up



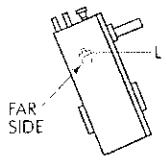
5407 = .750 E/P
5415 & 5507 = 1.25 E/P
5608 = STD

9 O'Clock H.S.S. Up



5407 = KIT 0786777
5415, 5507 & 5608 = KIT 0786778

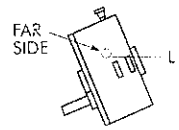
12 O'Clock H.S.S. Up



5407 = .750 E/P, KIT 0786777
5415 & 5507 = 1.25 E/P
5608 = STD

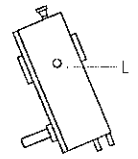
H.S. Shaft Inclined 5 to 30° Down

3 O'Clock H.S.S. Down



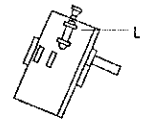
5407 THRU 5608 = STD

6 O'Clock H.S.S. Down



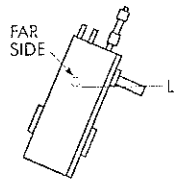
5407, 5415 & 5507 = STD
5608 = 5 - 20° STD
5608 = 21 - 30° 1.250 E/P

9 O'Clock H.S.S. Down



5407 = .750 E/C, .750 x 1.375 N, KIT 0786777
5415 & 5507 = 1.25 E/C & 1.25 x 2.50 N
5608 = 5 - 20° STD
5608 = 21 - 30° 1.250 E/P, KIT 0786778

12 O'Clock H.S.S. Down



5407 = .750 E/P, KIT 0786777
5415 & 5507 = KIT 0786778
5608 = KIT 0786778

NOTE: FOR SIZES 5507 & 5608 WITH BACKSTOP, MAXIMUM INCLINE IS 5° (ALL CLOCK POSITIONS).

Retaining Rings For Bushing Nuts And Thrust Plates

JR — Retaining Rings For Bushing Nuts

DRIVE SIZE	Manufacturer Part Number	
5407	Truarc	N5000-650
5415	Truarc	N5000-725
5507	Truarc	N5000-775
5608	Truarc	N5000-900

JF & JSC — Retaining Rings For Thrust Plate Kits

DRIVE SIZE	Manufacturer Part Number	
5407	Truarc	N5000-500
5415	Eaton	IR550
5507	Truarc	N5000-600
5608	Truarc	N500-725

Seal Housing Lip Seal For Type JSC

Type JSC — Seal Housing Lip Seal

DRIVE SIZE	Falk Part No.	Manufacturer Part No.
		Chicago Rawhide
5407	2913658	39320

Tooth Combinations For Vibrations Analysis

Type J05 — Tooth Combinations

DRIVE SIZE	Exact Ratio	Pinion Ref. #3A3	Gear Ref. #4A4
5407	4.938	16	79
5415	5.077	13	66
5507	4.929	14	69
5608	5.000	13	65

Type J14 — Tooth Combinations

DRIVE SIZE	Exact Ratio	Input		Output	
		Pinion Ref. #1A3	Gear Ref. #1A4	Pinion Ref. #2A3	Gear Ref. #4A4
5407	13.89	16	45	16	79
5415	13.61	25	67	13	66
5507	13.46	26	71	14	69
5608	13.82	17	47	13	65

Type J25 — Tooth Combinations

DRIVE SIZE	Exact Ratio	Input		Output	
		Pinion Ref. #1A3	Gear Ref. #1A4	Pinion Ref. #2A3	Gear Ref. #4A4
5407	25.04	14	71	16	79
5415	26.11	14	72	13	66
5507	24.29	14	69	14	69
5608	25.33	15	76	13	65

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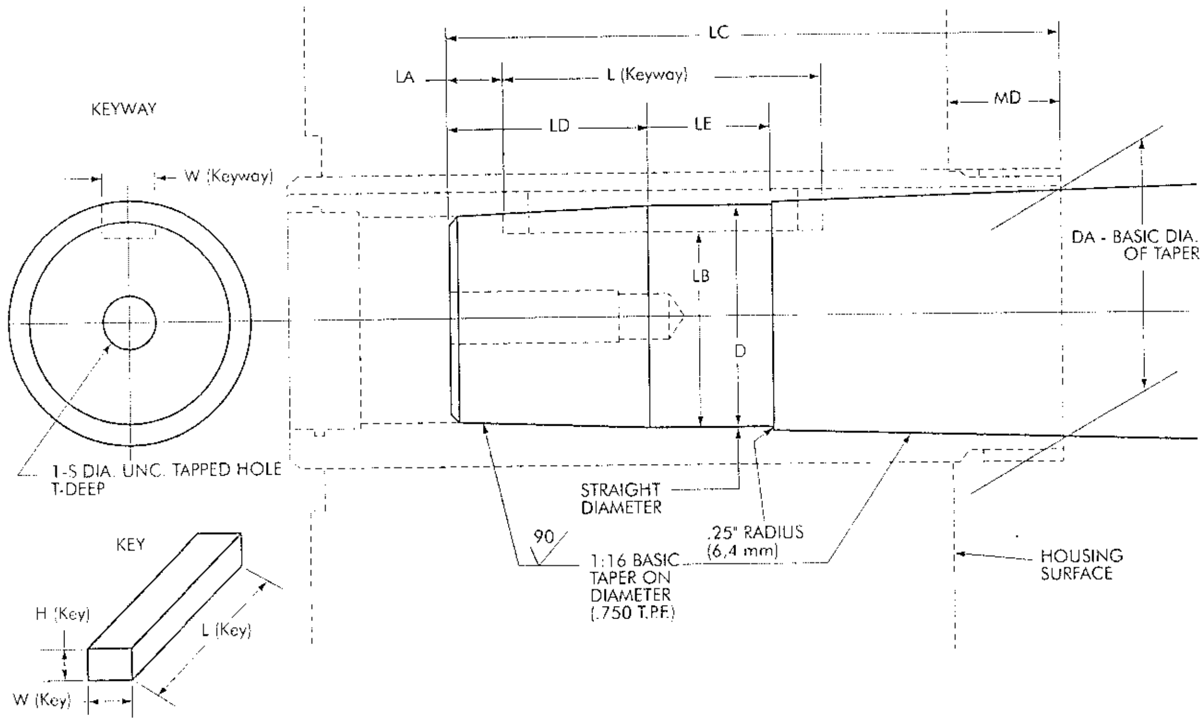
Drive Shaft Recommendations for Tapered Drive Shafts



Dimensions – Inches (mm) ★

DRIVE SIZE	Keyway W †	Keyway L ±.010 (±0,25)	D ◆ +.000, −.005 (+0,00, −0,13)	DA	LA ±.030 (±.76)	LB +.000, −.010 (+.000, −.250)	LC +.040, −.000 (+1.02, −.00)	LD	LE	MD ■	S	T Min	Key W	Key H	Key L
5407	1.000 (25,40)	7.000 (177,80)	4.925 (125,10)	5.175 (131,45)	0.500 (12,70)	4.374 (111.10)	9.250 (234.95)	5.25 (133.4)	2.25 (57.2)	2.45 (62.2)	1.000-8	2.75 (69.8)	1.000	0.750	6.00
5415	1.250 (31,75)	8.750 (222,25)	5.455 (138,56)	5.767 (146,48)	1.000 (25,40)	4.864 (123.54)	10.925 (277.50)	6.00 (152.4)	2.50 (63.5)	2.85 (72.4)	1.250-7	2.50 (63.5)	1.250	0.875	7.50
5507	1.250 (31,75)	9.000 (228,60)	6.003 (152,48)	6.327 (160,71)	1.000 (25,40)	5.368 (136.35)	12.020 (305.31)	7.00 (177.8)	2.50 (63.5)	3.10 (78.7)	1.250-7	2.50 (63.5)	1.250	0.875	7.75
5608	1.500 (38,10)	11.500 (292.10)	7.277 (184,84)	7.617 (193,47)	1.000 (25,40)	6.061 (153.95)	13.875 (352.42)	8.50 (215.9)	3.00 (76.2)	3.21 (81.5)	1.250-7	3.00 (76.2)	1.500	1.500	10.00

★ Dimensions are for reference only and are subject to change without notice unless certified.

† Inch keyway width tolerances are as follows: over .500" (12,70) to & including 1.000" (25,40) = +.0030" (+0,076), -.0000" (-0,000), over 1.000" (25,40) to & including 1.500" (38,10) = +.0035" (+0.089), -.0000 (-0,000). Inch keyway depth tolerance is +.010" (+0,25), -.000" (-0,00).

◆ Straight diameter is used to aid in measurement and manufacture of the keyway.

■ Dimension "MD" will vary slightly depending on degree of axial compression during installation and manufacturing tolerances.

Drive Shaft Recommendations Using TA Taper Bushing

INTRODUCTION — These instructions are for use when a flange mounted 5407-5608JF drive is to be used and the manufacture of a tapered drive shaft is not feasible. For JF tapered drive shaft recommendations, see Appendix H. Use this appendix to retrofit existing applications or for outfitting new installations. Parts required are the drive, TA Taper bushing and a thrust plate kit.

This appendix will allow the use of a straight drive shaft with the tapered bushing (without spanner nut) on flange mounted applications. Provided are dimensions (Table 4) for shaft recommendations and instructions for the installation and removal of the assembly. All bushing bore sizes, which are available in the standard Quadrive, are possible with this setup.

FIGURE 2 — 5407-5608JF drives are furnished with a flange adapter installed. The hollow shaft of the drive has a tapered bore which accepts the tapered bushing. When the bushing is drawn into the taper, a clamping force is applied to the drive shaft. The drive shaft is drawn into the hollow shaft via a fastener in the thrust plate. The bushing seats against a shoulder on the driven shaft and is drawn into the drive with the shaft. Removal is accomplished by using a jackscrew in the thrust plate and forcing the drive shaft out of the drive. The retaining ring in the drive shaft assures that the bushing will be removed along with the shaft.

DRIVE SHAFT RECOMMENDATIONS — The recommendations for the drive shaft consist of two major features. The first is the shoulder which must be provided in the location shown in Figure 2. This shoulder provides the backing necessary to draw the bushing into the taper. A permanently fixed shoulder must be provided in order for this design to be effective. The shoulder may be a welded collar or an integral step. SET COLLARS ARE NOT ACCEPTABLE. A retaining ring may be used, in the driven shaft, to provide the shoulder, but stress concentrations occur at the groove and therefore shaft stresses must be checked. The second major feature on the shaft is the retaining ring groove in the shaft end. This feature is recommended to ensure positive removal of the bushing when the drive shaft is removed from the drive. The threaded hole in the end of the drive shaft accepts the thrust plate fastener.

WARNING: *Lock out power source and remove all external loads from system before servicing drive or accessories.*

INSTALLATION PROCEDURE — With the drive shaft manufactured per the recommendations shown, and the bushing selected for the proper shaft diameter, remove and discard the retaining ring and spanner nut from the bushing assembly.

5407JF — Use of the tapered bushing requires that the flange of the bushing be removed to clear the adapter, Figure 2. A flangeless bushing is available for the 3.4375" (87 mm) diameter shaft only.

ALL JF DRIVES — Slide the bushing (flange end first) onto the drive shaft until it contacts the shoulder on the shaft. Insert the key through the bushing and into the drive shaft keyway. Install the retaining ring into the groove in the drive shaft. Bring the drive into position, line up the hollow shaft keyway with the key and slide the bushing and drive shaft into the hollow shaft bore.

Attach the drive to the mounting surface with fasteners (not provided). Refer to Table 1 for fastener size and tightening torque. Assemble the thrust plate and retaining ring into the counterbore in the hollow shaft. Insert the thrust plate fastener through the thrust plate and thread into the drive shaft end. Tighten to the torque given in Table 2. Install all covers and guards.

REMOVAL PROCEDURE — Remove hollow shaft cover. Remove the thrust plate fastener, retaining ring and thrust plate from the hollow shaft. Refer to Table 3 and select a backing bolt and flat washer and install them into the drive shaft as illustrated in Figure 1. The head of the backing bolt provides a working surface for the removal bolt. Reinsert the thrust plate and retaining ring into the hollow shaft and select a removal bolt from Table 3. Thread the removal bolt into the thrust plate until it contacts the backing bolt head. Tighten the removal bolt to the torque indicated in Table 3. (If the thrust plate rotates in the shaft, align the slot in the plate with the hollow shaft keyway and insert a screw driver or piece of key stock to prevent rotation of the plate). After torquing the bolt, as instructed, strike the bolt sharply with a hammer and retorque the bolt if separation of the drive from the shaft did not occur. Repeat this procedure, retorquing the bolt after each blow, until separation occurs.

Figure 1

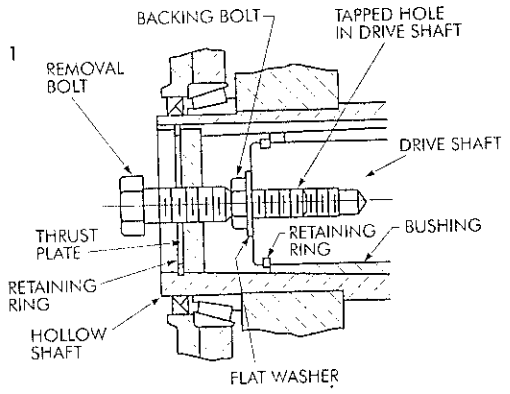


TABLE 1 — JF Drive – Foundation Fastener & Tightening Torque
(Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Max.Tightening Torque lb-ft (Nm)
5407	.750-10UNC, Grade 5	245 (332)
5415	1.250-7UNC, Grade 5	1050 (1424)
5507	1.250-7UNC, Grade 5	1050 (1424)
5608	1.500-6UNC, Grade 5	1842 (2497)

TABLE 2 — Thrust Plate Fastener Data
(Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Max Tightening Torque lb-ft (Nm)	Min Thread Depth Inches (mm)
5407	1.000-8UNC x 5.50, Grade 8	792 (1073)	2.75 (69,8)
5415	1.250-7UNC x 6.00, Grade 8	1596 (2164)	3.00 (76,2)
5507	1.250-7UNC x 6.00, Grade 8	1596 (2164)	3.00 (76,2)
5608	1.250-7UNC x 8.00, Grade 8	1596 (2164)	3.50 (88,9)

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2. JR — Refer to Appendix C, for instructions for using the TA torque assist removal tool.

   ALTERNATE METHOD — Loosen the setscrew on the bushing nut which is located at the output end of the hollow shaft. Use a spanner, pipe or chain wrench to loosen the bushing nut (Section I, Table 6). Initially, the nut will freely rotate counter clockwise approximately 180° as the nut moves from the locked position to the removal position. At this point anticipate resistance which indicates unseating of the bushing. Continue to turn the nut until it is free from the hollow shaft. Prepare drive for lifting (Figure 7) by disconnecting the torque arm at the drive end. Slide the drive from the bushing. The bushing can be left in place or removed, as required. If bushing will not slide off of the shaft, insert a small prybar into the split of the bushing and pry the split open slightly to loosen the bushing and remove from the shaft. Proceed to Step 5 for replacement of seals only or Step 9 for drive disassembly procedure.

3. JF — Remove the hollow shaft cover, Ref. #14 (Figure 12), from the input end of the hollow shaft. Remove the bolts which fasten the mounting flange to the driven equipment.

   Remove the fastener, retaining ring, and thrust plate from the hollow shaft. Refer to Table 10 and select a backing bolt and flat washer and install them into the drive shaft as illustrated in Figure 11. The bolt head provides a working surface for the removal bolt. Reinsert the thrust plate and retaining ring into the hollow shaft and select a removal bolt from Table 10. Thread the removal bolt into the thrust plate until it contacts the backing bolt head. Torque the removal bolt to the value shown in Table 10. (If the thrust plate rotates in the shaft, align the slot in the plate with the hollow shaft keyway and insert a screw driver or piece of key stock to prevent rotation of the plate.) After torquing the bolt, as instructed, strike the bolt, sharply with a hammer and retorque the bolt if separation of the drive from the shaft did not occur. Repeat this procedure, retorquing the bolt after each blow, until separation occurs.

   CAUTION: Failure to follow this procedure may result in the destruction the threads in the thrust plate. (If the retaining ring becomes damaged, refer to Appendix G, for replacement information.)

   Proceed to Step 5 for replacement of seals only OR Step 9 for drive disassembly procedure.

4. JSC (5407 ONLY) — Remove drive from driven equipment trough end by removing the trough end mounting screws from seal housing. Remove coupling bolts from drive shaft and slide drive with drive shaft away from the driven equipment.

   To remove drive shaft from the drive, remove the hollow shaft cover, Ref. #14 (Figure 12), from the input end of the hollow shaft and then refer to Step 3 above. The procedure to separate the JSC drive from the shaft is the same as for separation of a JF drive from driven equipment shaft.

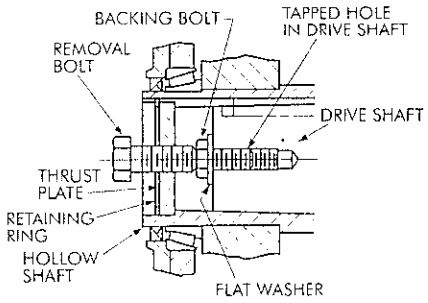
   After separation of the drive and shaft has been achieved, determine the type of seal equipped in the seal housing. If it is a waste packing seal, remove the waste packing material and then remove the loosened drive shaft from the seal housing side of the drive. If equipped with a lip seal, first remove the lip seal following the removal instructions from Step 5. After seal is removed from seal housing, remove the loosened drive shaft from the seal housing side of the drive.

   CAUTION: The seal housing acts as the bearing cage, therefore, DO NOT remove from the drive unless complete drive disassembly is anticipated. Removal of the seal housing will require readjustment of the L.S. bearings, Section III.

TABLE 10 — Removal & Backing Bolt Size and Length

DRIVE SIZE	Removal Bolt Size & Minimum Length – Inches	Maximum Tightening Torque – lb-ft (Nm)	Backing Bolt Size & Maximum Length – Inches
5407	1.125-7UNC x 3.00	742 (1006)	1.000-8UNC x 2.75
5415	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.50
5507	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 2.50
5608	1.500-6UNC x 3.75	1842 (2497)	1.250-7UNC x 3.00

Figure 11



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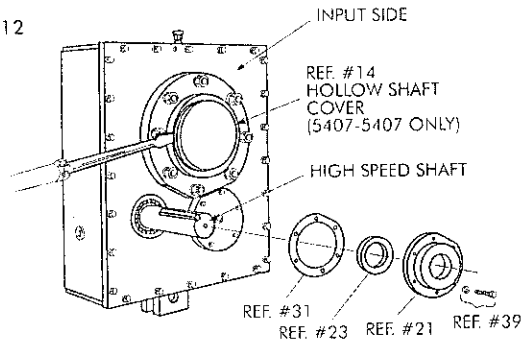
DRIVE DISASSEMBLY — (Refer To Parts Drawing Figure 14)

Prior to initiating any disassembly or repair, clean accumulated dirt and grime from the surface of the drive housing. Clean the exposed portion of the high speed and hollow shafts with a solvent and a non-abrasive cloth. If the seals only are being replaced proceed to Step 5. If the drive will be disassembled for inspection or repair, skip to Step 9.

CAUTION: Do not damage shaft; new seals will leak if seal contacting surface is marred. Do not use abrasive material on shaft seal contacting surface.

Figure 12



5. SEAL REMOVAL — (When drive is to be disassembled, proceed to Step 9.) Seal replacement is recommended after seal removal. When removing seals, maintain shafts in a horizontal plane to prevent any foreign matter from falling into the bearings. Refer to Figures 12, 13 & 14.

   NOTE: Only seals on the input side (See Figure 12) of 5407-5507 drives and high speed shaft seals of the 5608 drive can be replaced if gear drive is mounted on driven equipment. If gear drive removal is necessary, proceed to Step 1 for removal instructions.

   If drive removal is not necessary, drain lubricant at this time.

   Depending upon seal(s) being replaced, remove v-belt guard, v-belts, high speed shaft sheave, shaft cooling fan (if so equipped), backstop (5507 & 5608J only, if so equipped) and other accessories as necessary.

   a. Two seal mounting arrangements are used as follows:

      Seals are installed into seal cages where seal cage must be removed from drive to remove seals. Removal of these seal cages will require readjustment of the bearings. The following seals use this mounting arrangement:

      5407-5507; All types, H.S. seals.
      5407JF & JSC; L.S. seals (output side).
      5608, All types, H.S. & L.S. seals.

      Refer to Figures 12, 13 & 14 and remove seals with this mounting arrangement as follows:

      (1) Clean shaft extension with solvent and remove all sharp edges. Remove seal cage, Ref. #11, #12, #21 or #66.

      (2) Drive out old seal from seal cage.

      (3) Scrape old Permatex from bore exercising caution not to score the bore.

   b. Seals are installed into seal cages where seal cage may remain attached to drive. The following seals use this mounting arrangement:

      5407 JF & JSC; L.S. seals (input-side).
      5407-5507JR; L.S. seals (input & output sides).
      5415-5507JF; L.S. seals (input & output sides).

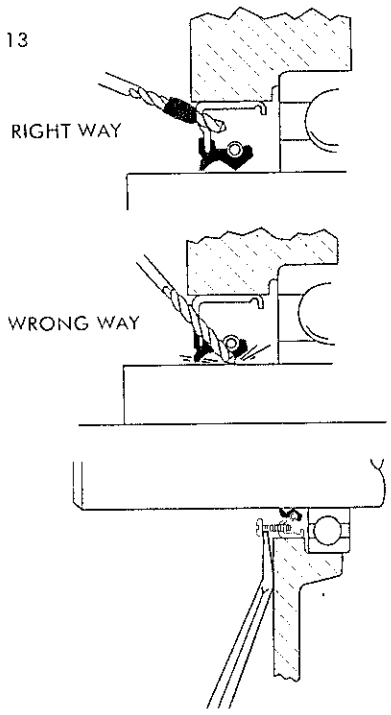
      Refer to Figures 12, 13 & 14. Remove the hollow shaft cover, Ref. #14, on Sizes 5407-5507. Remove seals with this mounting arrangement as follows:

      (1) Clean shaft extension with solvent and remove all sharp edges. Use a sharp center punch to lightly punch the seal case as a guide for the drill. NOTE: DO NOT drive seal into the bore too deep. Seals are not axially retained and disassembly of the drive may be required if the seal is driven too deep.

      (2) Wrap several turns of tape around a .125" (3 mm) diameter drill bit approximately .25" (6 mm) from the drill point to prevent the drill bit from entering too deeply into the housing and damaging the bearing. Grease or magnetize the drill bit to help retain the chips. Drill two .125" (3 mm) diameter holes in the seal case 180° apart. Control the angle of the drill as illustrated in Figure 13 to prevent damage to the shaft.

      (3) Insert two #10-.750" (M5 x 20) sheet metal screws into the seal case leaving .5" (13 mm) of the screw protruding above the seal face. DO NOT drive the screw more than .25" (6 mm) beyond seal face or bearing damage may occur. Use a claw type pry bar under the screw head as shown in Figure 13 and lift the seal out. Remove all metal chips. Use a magnet to remove the metal chips that fall into the

Figure 13



bore. Flush the drive to remove metal chips from the bearing. Remove Permatex from the housing bore.

6. SEAL SURFACE CONDITION — Carefully inspect polished surface of shaft where the seal makes contact. If the seal surface shows any sign of a nick, scratch, spiral swirl or groove, the shaft should be replaced or refurbished to prevent leakage of the lubricant. (In many instances the seal surface can be restored by use of a thin wall wear sleeve. Check with your local seal supplier and follow the manufacturer's instructions for installing the wear sleeve.)

7. SEAL INSTALLATION

CAUTION: Protect seal lips from sharp edges of the keyway by wrapping thin strong paper (Kraft paper) around the shaft and coating the paper and seal lips with grease before sliding the seal on or off the shaft. Do not expand the seal lips more than .030" (0,75 mm) diameter.

a. Install seals into seal cages where cages must be removed from drive:

5407-5507; All types, H.S. seals.
5407 JF & JSC; L.S. seals (output side).
5608; All types, H.S. & L.S. seals.

Shim-gaskets are used behind seal cages and end covers to adjust bearings. The correct shim-gasket pack must be determined prior to seal installation to attain proper bearing adjustment.

Proceed to Section III, Step 3 for instructions regarding output side seal cages. Proceed to Section III, Step 5f for instructions regarding input side seal cages. Proceed to Section III, Step 6, bearing adjustment instructions to determine the proper shim-gasket pack thickness.

Remove seal cage and install seal as follows:

Note: When removing a seal cage to install a seal, be sure to use the shim-gasket pack determined from above to assure correct bearing adjustment.

Coat O.D. of seal with Permatex #3 or equivalent sealant. Position seal squarely in seal cage with spring loaded lip toward drive. Drive or press seal into cage using a flat faced tool until seated.

Install the complete seal cage shim pack. Carefully slip seal cage with seal over the shaft. Replace fasteners and cross tighten to torques listed in Table 14, Section III.

b. Install seals into seal bores where seal cages may remain attached to housing:

5407 JF & JSC; L.S. seals (input side).
5407-5507JR; L.S. seals (input & output sides).
5415-5507JF; L.S. seals (input & output sides).

Coat O.D. of seal with Permatex #3 or equivalent sealant. Carefully slip seal over shaft and position squarely in seal bore with spring loaded lip toward drive. Use a cylindrical square faced tool to drive or press seal into bore until outer seal wall is seated 0.14" (3.5 mm) inside the seal bore outer wall.

CAUTION: DO NOT seat seal against bearing; a shoulder is NOT provided for stopping the seal. Measure seal axial runout with a dial indicator mounted on the shaft. If the seal axial runout is more than 0.010" (0,25 mm), tap high side of seal with installation tool until seal axial runout is 0.010" (0,25 mm) or less.

8. DRIVE REPAIR IS COMPLETE — Review instructions in Section I for drive installation.

Drive Disassembly — Continued

9. When seals, Ref. #22 & 23 are to be reused (replacement is recommended), wrap the high speed shaft keyway and hollow shaft threads with masking tape or light weight kraft paper to protect seal lips during disassembly. Cover wrapping with a light coat of grease.

10. Remove backstop parts if so equipped. (For all drives, note direction of rotation of high speed shaft for proper reassembly.)

For Sizes 5407 & 5415J14 remove cover Ref. #19, backstop Ref. #5A and appropriate spacers from backstop cage. Re-install cage and cover without the backstop and finger tighten fasteners.

For Size 5415J25, remove entire backstop cage. Disassemble retaining rings and remove backstop. Re-install cage and cover without the backstop and finger tighten fasteners.

For Sizes 5507 & 5608, remove retaining ring and slide backstop Ref. #5A off of shaft.

11. Lay drive on bench with high speed shaft up. Remove housing cover fasteners, Ref. #33. Tighten the dowel nuts to remove the dowels. Screw cap screws into tapped holes (5/8-11UNC, Sizes 5407-5507; 7/8-9UNC, Size 5608). Tighten cap screws until the seal between the cover plate and base is completely broken. Screw eyebolts into tapped holes diagonally opposite in cover plate. Attach hoist cables and lift cover plate off housing base.

12. Remove the shaft assemblies (J05, Ref. #3A & 4A; J14 or J25, Ref. #1A, 2A & 4A) from output housing, Ref. #10.

13. Turn housing on either narrow side. If tapered roller bearings are being replaced, remove end covers and seal cage from output side of drive and drive bearing cups through the bores. Remove bearing cups from the housing cover in the same manner.

14. Drive seals out from base and cover bores and seal cages if replacement is indicated. Remove gasket material, seal compound and any accumulated foreign matter from seal joints, bores and adjacent sealing surfaces. Use a solvent to clean out the housing covers and shaft assemblies.

15. If drive is equipped with an internal backstop, check the shaft surface and the backstop sprags (inside diameter) for signs of wear. If either component shows evidence of wear, both should be replaced (Assemblies Ref. #1A or 3A and 5A). Also refer to Step 6 for inspection of seal surfaces.

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16. Inspect gear teeth for wear or indications of fatigue; e.g., hairline cracks at the root of the tooth. If one element has undergone severe wear or broken teeth, replace the mating element also.

17. Clean and inspect bearings for wear. Lubricate with light oil before spinning to avoid scoring of working surfaces. Remove any worn bearings with a wheel puller. If tapered roller bearings are being replaced, replace the bearing cups. DO NOT use new cone assemblies with worn (old) cups.

18. If gears are to be replaced, use a wheel puller or press to remove gears Ref. #1A4 or 4A4 from their shaft. Exercise caution to avoid scoring shaft seal diameter with the keyway in the gear.

19. Inspect all fasteners for damage or wear and replace with fasteners of equal grade. Grade 5 fasteners have three (3) radial lines on the head. Fasteners are available in kit form, Ref. #80.

20. If the shaft assemblies can be reused intact (no new parts required), refer to Section III, Steps 5 thru 8, for reassembly procedure. Replace all shim-gaskets with new parts, Kit Ref. #100.

Identifying & Ordering Parts

1. Refer to the parts diagram, Figure 14, and make a list of the parts required by part reference number. For example, Ref. #21, 23, 100, 1A, 2A1, and 2A2. When a gasket joint is separated, always replace with new shim-gaskets. Order Ref. #100 shim-gasket kit.

2. Now refer to the parts list, Table 11, and determine the part description and Falk part number using the part reference number (Step 1) and the drive identification (e.g., 5407J25C) in the column headers of the parts list.

3. Use the part description and Falk part number to order the required parts. In the examples of preceding Steps 1 and 2, Ref. #21, 23, 100, 1A, 2A1 and 2A2 for a 5407J25C, parts would be ordered as follows:

   Ref. #21 — Seal cage 4729121

   Ref. #23 — Seal 2914622

   Ref. #100 — Shim-gasket kit 0786841

   Ref. #1A — Shaft assembly with gear 4729124

   Ref. #2A1 — Bearing 0921780

   Ref. #2A2 — Bearing 0921780

4. Tables 12 and 13 converts Falk part numbers to bearing and seal manufacturer's part numbers. Tooth combinations are listed in Appendix G.

5. Place your order with your local Rexnord-Falk Distributor. If you need to locate a distributor, phone (414) 342-3131 in the United States and Canada.

Recommended Spare Parts

1. For non-critical drive applications a complete set of bearings, seals and shim-gaskets is recommended. If stored in their original packaging in a dry, cool location, these parts have a minimum shelf life of 5 years.

2. For critical drive applications (where an outage would create a major production loss), a complete drive is recommended.

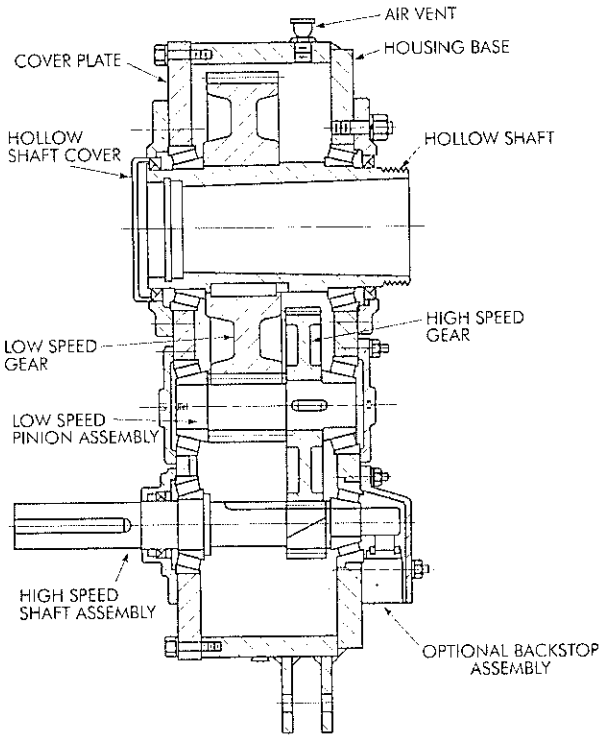


TABLE 11 — Parts List Of Falk Part Numbers

Ref. No.	Part Description	DRIVE SIZE 5407	5415	5507	5608
	Housing Components - J05, J14 & J25				
11	Seal Cage	0352865	0344480	0344425	4723185
12	Flange - Seal Housing	0352889	...	...	...
12	Mounting Flange	...	0426963	0426935	4723190
14	Shaft Cover	2110604	1191500	4723160	...
15	Shaft Cover	4729119	4729138	4723142	4729168
16	Shaft Cover	4729119	4729138	4723164	4729168
17	Shaft Cover - Type J05	4729120	0344426	7392017	1237503
17	Shaft Cover - 5507 J 4 & 25	...	...	7392017	...
18	Shaft Cover - Type J14 & J25	2110747	0344426	7392017	...
19	Shaft Cover - Type J14 & J25	1219672	0344428	...	...
20	Backstop Cage - Type J14	1231142	0344429	...	...
20	Backstop Cage - Type J25	1231142	0344427	...	...
21	Seal Cage	4729121	4723144	4723165	4723186
22	Seal - 2 Required	2922296	913004	2914624	2921418
23	Seal	2914622	2914622	2920284	2921422
40	Torque Arm Assembly - JR Only	0785271	0785272	0785272	0785272
41	Air Vent	0914088	0914088	0914088	0914088
64	Seal - 14	...	...	2917237	2916785
64	Seal - 25	...	...	0912775	2916785
66	Seal Cage - 14	...	...	4729318	4729169
66	Seal Cage - 25	...	...	4729319	4729169
67	Anchor Bracket - J14, 25	...	...	4729320	4729191
68	Torque Arm - Backstop - J14, 25	...	...	4729346	4729346
80	Fastener Kit - Includes Ref. #33 thru 39 & 42	4729122	4729139	4729321	4729170
100	Shim Gasket Kit - Includes Ref. #24 thru 31	0786841	0786842	6720196	0786844
	Rotating Elements - J05			Without Backstop / With Backstop	Without Backstop / With Backstop
3A	Shaft Assembly - Includes Ref. #3A1 - 3A4	4729129	4729148	4729161 / 4729161	4729185 / 4729187
3A1	Bearing	0921855	0921494	0921752 / 0921752	0921751 / 0921751
3A2	Bearing	0921863	0921859	0921858 / 0921858	2918722 / 2918722
3A3	Pinion & Shaft - Includes Ref. #3A4	4729130	4729149	4729162 / 4729162	4729186 / 4729186
4A	Shaft Assembly - Includes Ref. #4A1 - 4A6	4729133	4723150	4729163 / 4729163	4729189 / 4729189
4A1	Bearing	2905186	0921861	0921755 / 0921755	2905910 / 2905910
4A2	Bearing	2905186	0921861	0921755 / 0921755	2905910 / 2905910
4A3	Hollow Shaft - Includes Ref. #4A5	4729134	4723149	4729164 / 4729164	4729190 / 4729190
4A4	Gear	1238083	1238033	1238072 / 1238072	1237487 / 1237487
4A6	Spacer - 5608	...	...	... / ...	1237496 / 1237496
6A	Fan Assembly - Includes Ref. #6A1 thru 6A3	0785773	0785881	0785893 / 0785893	0785468 / 0785468
6A1	Fan	4729135	4729135	4729165 / 4729165	4729192 / 4729192
6A2	Guard	4729136	4729151	4729166 / 4729166	4729193 / 4729193
6A3	Backplate	4729137	4729152	4729167 / 4729167	4729194 / 4729194
	Rotating Elements - J14			Without Backstop / With Backstop	Without Backstop / With Backstop
1A	Shaft Assembly With 1A4 Gear	4729123	4729140	4729324 / 4729325	4729171 / 4729177
1A	Shaft Assembly Without 1A4 Gear	4729125	4729142	4729326 / 4729327	4729172 / 4729178
1A1	Bearing	0921682	0921529	0921752 / 0921752	0921751 / 0921751
1A2	Bearing	2915106	0921860	0921858 / 0921858	2918722 / 2918722
1A3	Pinion & Shaft - Includes Ref. #1A5	4729127	4729144	4729322 / 4729323	4729173 / 4729181
1A4	Gear	1238081	1238034	1238073 / 1238073	0359007 / 0359007
5A	Backstop Assembly	0769170	0757220	... / 6720194	... / 6720194
	Rotating Elements - J25			Without Backstop / With Backstop	Without Backstop / With Backstop
1A	Shaft Assembly With 1A4 Gear	4729124	4729141	4729330 / 4729331	4729175 / 4729179
1A	Shaft Assembly Without 1A4 Gear	4729126	4729143	4729332 / 4729333	4729176 / 4729180
1A1	Bearing	0921349	0921494	0921752 / 0921752	0921751 / 0921751
1A2	Bearing	2915107	0921859	0921857 / 0921857	2918722 / 2918722
1A3	Pinion & Shaft - Includes Ref. #1A5	4729128	4729145	4729328 / 4729329	4729174 / 4729182
1A4	Gear	1238082	1238035	1238074 / 1238074	0359007 / 0359007
5A	Backstop Assembly	0769170	0757221	... / 6720195	... / 6720194

Continued on next page

TABLE 11 — Parts List Of Falk Part Numbers

Ref. No.	Part Description	DRIVE SIZE					
		5407	5415	5507		5608	
	Rotating Elements - J14 & J25			Without Backstop	With Backstop	Without Backstop	With Backstop
2A	Shaft Assembly - Includes Ref. #2A1 - 2A4	4729131	4729146	4729159	4729159	4729183	4729183
2A1	Bearing	0921780	0921556	0921752	0921752	0921678	0921678
2A2	Bearing	0921780	0921556	0921530	0921530	0921678	0921678
2A3	Pinion & Shaft - Includes Ref. #2A4	4729132	4729147	4729160	4729160	4729184	4729184
4A	Shaft Assembly - Includes Ref. #4A1 - 4A5	4729133	4723150	4729163	4729163	4729189	4729189
4A1	Bearing	2905186	0921861	0921755	0921755	2905910	2905910
4A2	Bearing	2905186	0921861	0921755	0921755	2905910	2905910
4A3	Hollow Shaft - Includes Ref. #4A5	4729134	4723149	4729164	4729164	4729190	4729190
4A4	Gear	1238083	1238033	1238072	1238072	1237487	1237487
4A6	Spacer	...	...	...	...	1237496	1237496
6A	Fan Assembly	0785773	0785881	0785893	0785893	0785468	0785468
6A1	Fan	4729135	4729135	4729165	4729165	4729192	4729192
6A2	Guard	4729136	4729151	4729166	4729166	4729193	4729193
6A3	Backplate	4729137	4729152	4729167	4729167	4729194	4729194

TABLE 12 — Bearing Cross Reference Numbers

Falk Part Number	Manufacturer's Number
Tapered Roller Bearings ★	
0921349	HM212046/HM212011
0921494	H715336/H715311
0921529	H715345/H715311
0921530	H414249/H414210
0921556	H715332/H715311
0921678	850/832
0921682	HM212049/HM212011
0921751	JH217249/JH217210
0921752	JH415647/JH415610
0921755	JM736149/JM736110
0921780	HM212044/HM212011
0921855	5584/5535
0921857	65212/65500B
0921858	65237/65500B
0921859	65200/65500B
0921860	65225/65500B
0921861	67782/67720
0921863	5565/5535
2905186	LM330448/LM330410
2905910	LM742749/LM742710
2915106	HM807040/HM807015B
2915107	HM807035/HM807015B
2918722	HH814542/HH814510

★ Each supplier of Tapered Roller Bearings are: Timken, Bower and Tyson.

TABLE 13 — Seal Cross Reference Number

Falk Part Number	Manufacturer's Number †	
	Chicago Rawhide	National
0913004	64998V	...
2914622	24899	...
2914624	70054	...
2920284	29383	...
2921418	85018	...
2921422	29912	415995V
2922296	60013	...

† Subject to substitution of equivalent seals without notice.

Rexnord Industries, LLC, Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

Section III

Drive Reassembly

Refer To Parts Drawing Figure 14.

1. GENERAL

   a. Clean all parts to be reassembled and coat all taper roller bearing cups and pinion teeth with oil. DO NOT lubricate gear teeth prior to assembly on shaft.

   b. Heat all tapered roller bearing cones in an oven to 275°F (135°C).

   CAUTION: Do not apply flame directly to bearings or rest bearings directly on a heated surface.

   c. Slide or press all bearing cones tight against the shaft shoulder or spacer.

   CAUTION: Do not apply force to the bearing cage or rollers. Apply force against the cone only.

2. ASSEMBLY OF TAPERED ROLLER BEARING CUPS — Where bearings will be reused and where bearing cups were not removed from the housing, skip to Step 3. It is recommended that bearings be replaced whenever drive is disassembled after being in service.

   Install bearing cups only in housing base at this time. Coat bearing cups and housing bores with an SAE 20 (or heavier) oil and drive or press cup squarely into the housing bores until positioned as shown in Figures 15 and 16. Use a flat plate and a brass bar to avoid damaging the bearing cups. NOTE: The exact positioning of the bearings in the bores will be achieved during the bearing adjustment procedure in Step 6.

Figure 15

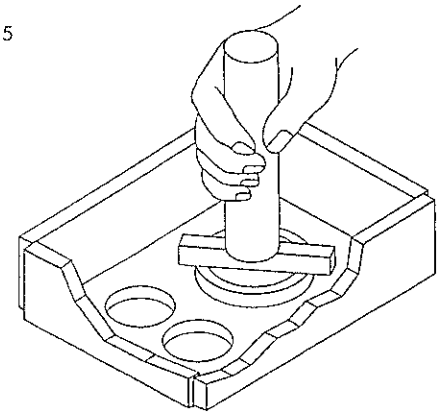
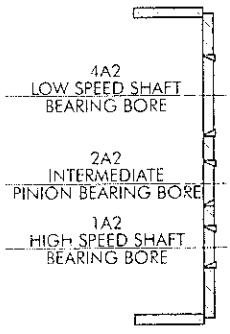


Figure 16



CAUTION: Take care not to allow cups to cock during their installation as this could result in permanent damage to housing.

If cups become cocked in the bores, tap the high side lightly to re-position.

3. Assemble seal cages to housing output side(base) as follows:

   a. Turn housing onto its side being careful that the bearing cups do not fall out of the bores. Assemble low speed seal cage without seal and one .015" (0,38 mm) shim-gasket, Ref. #11 or 12 and 24. Cross tighten fasteners, Ref. #34, to torque specified in Table 14.

   Check to be sure that cages and covers are registered on the bearing cups to avoid hanging up of the cups.

TABLE 14 — Fastener Tightening Torques ★

Location	Fastener Size — Inch Tightening Torque — lb-ft (Nm)			
	.375-16	.500-13	.750-10	.875-9
Low Speed Seal Cage	...	...	330 (447)	533 (723)
Intermediate End Cover	27.5 (37,3)	68.8 (93,2)	...	...
High Speed Seal Cage/End Cover	27.5 (37,3)	68.8 (93,2)	...	...
Housing Cover	...	68.8 (93,2)	245 (332)	...

★ Torques are for non-lubricated fasteners.

   b. Assemble intermediate end cover and one .015" (0,38 mm) shim-gasket, Ref. #15 and 25. Cross tighten fasteners, Ref. #35, to torque specified in Table 14.

   c. Assemble high speed pinion shaft cover or seal cage without seal as follows:

   SIZES 5407-5608 WITHOUT BACKSTOP — Assemble shaft cover and one .015" (0,38 mm) shim-gasket, Ref. #17 and 27. Cross tighten fasteners, Ref. #37, to torque specified in Table 14.

   SIZES 5407 & 5415 WITH BACKSTOP — Assemble shaft cover, 1st .015" (0,38 mm) shim-gasket, backstop cage and 2nd .015" (0,38 mm) shim-gasket, Ref. #19, 20, 29 and 30. Finger tighten fasteners, Ref. #38. NOTE: The backstop, Ref. #5A will be added later.

   SIZES 5507 & 5608 WITH EXTERNAL BACKSTOP — Assemble seal cage without seal and one .015" (0,38 mm) shim-gasket, Ref #31and 66. Cross tighten fasteners to torque specified in Table 14. NOTE: The seal, Ref. #64, will be added later.

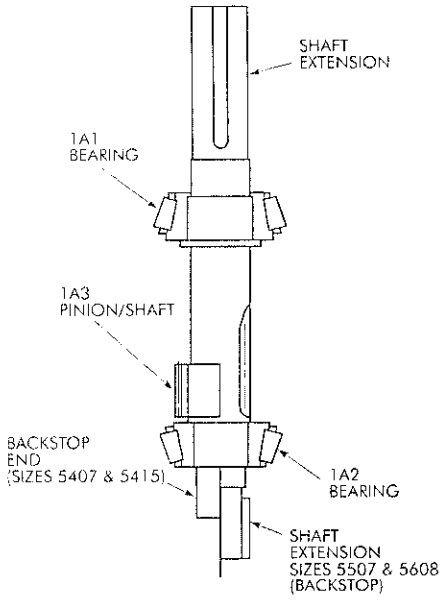
4. SHAFT ASSEMBLIES — Where bearings and gears were not removed from the shafts, skip to Step 5. If bearings and gears were removed from the shafts, reassemble parts on the shaft per Figures 17 thru 20 as follows:

   a. To assemble gear (Ref. #1A4 or 4A4), heat gear in an oven to 325°F (163°C). Install key. Press gear onto the shaft tightly against the shoulder. For Size 5608, be sure to place spacer, Ref. #4A6, Figure 20, in the proper location on shaft assembly, Ref. #4A, before pressing on the bearing.

   b. To assemble bearings, heat bearing cone in an oven to a maximum of 275°F (135°C), then slide or press bearing cone tight against the shaft shoulder or spacer.

   CAUTION: Allow assembly to cool. Apply a coat of oil to the cooled bearings and gear teeth to lubricate & avoid scoring of the working surfaces.

Figure 17 — 1A Shaft



5. DRIVE ASSEMBLY — Turn drive housing base on work bench to allow the shaft assemblies to be lowered into the housing. Block up the housing so that when low speed shaft assembly, Ref. #4A, is in place, the threaded end of the shaft will clear the bench surface. Before assembly, inspect housing and all shaft assemblies to see that all foreign matter has been removed.

   a. SINGLE REDUCTION — Lower high speed shaft assembly, Ref. #3A, Figure 18, into housing and tip away from other housing bores. While lowering the low speed shaft assembly, Ref. #4A, Figure 20, into housing tip high speed shaft into the gear mesh of the low speed gear as the shaft nears final position.

   b. DOUBLE REDUCTION — Lower high speed shaft assembly, Ref. #1A, Figure 17, into housing and tip away from other bores. Simultaneously lower the intermediate shaft assembly, Ref. #2A, Figure 19, and the low speed shaft assembly, Ref. #4A, Figure 20, into the housing. As shafts approach their final position, tip the high speed shaft pinion into the high speed gear mesh, Ref. #1A4.

Figure 18 — 3A Shaft Assembly

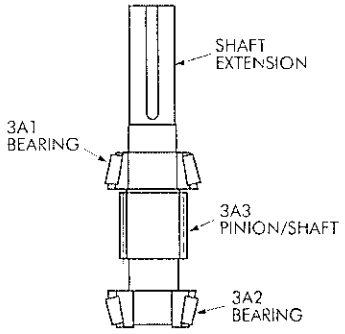


Figure 19 — 2A Shaft Assembly

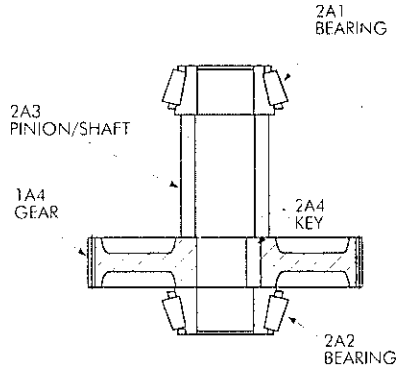
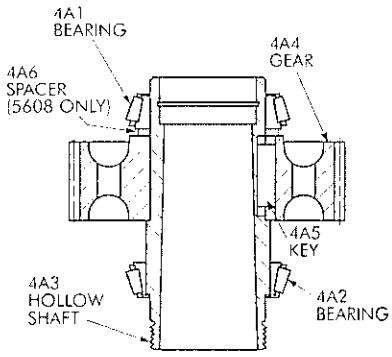


Figure 20 — 4A Shaft Assembly



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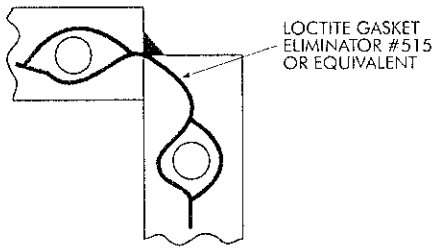
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

c. Arrange the shaft assemblies to ensure that the gears are in mesh and bearing cones are in the cups.

d. Apply a bead of Loctite Gasket Eliminator #515 or equivalent to housing base as shown in Figure 21. Carefully lower the housing cover (using eyebolts as recommended in Section II, Step 11). Remove eyebolts. Install taper screw dowels through the housing cover into the housing base. NOTE: Be sure the nut on the taper screw dowel is loose so that the nut does not interfere with seating the taper screw dowel. Seat taper screw dowel into housing base by striking the head of the taper screw dowel with a hammer. Install cover fasteners and immediately (within 3 minutes) tighten to torque specified in Table 14.

Figure 21



e. Apply film of oil to housing cover bores and bearing cups & carefully install the bearing cups into the bores as described in Step 2.

f. Install seal cages without seals and covers:

DOUBLE REDUCTION DRIVES — Use the entire shim-gasket kit with the .015" (0,38 mm) shim-gasket against the housing. It is important that the .015" (0,38 mm) shim-gasket be placed against the housing to prevent leakage. Cross tighten fasteners to torques specified in Table 14. Parts involved are as follows:

Low speed seal cage Ref. #11, 24 & 34; shaft cover Ref. #16, 26 & 36; high speed seal cage Ref. #21, 31 & 39.

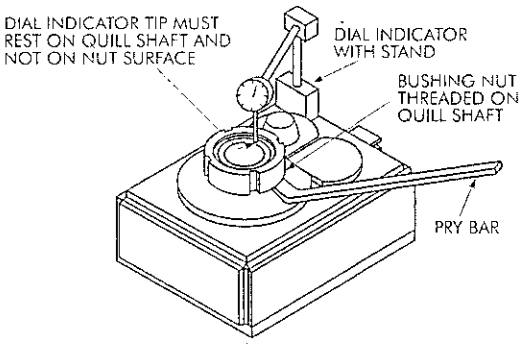
SINGLE REDUCTION DRIVES — Install end cover, Ref. #16, with one .015" (0,38 mm) shim-gasket, Ref. #26, on unused bore. Cross tighten fasteners, Ref. #36, to torque specified in Table 14. For the other seal cages follow instructions from above as described for double reduction drives.

6. BEARING ADJUSTMENT

a. FOR DRIVES EQUIPPED WITH TA TAPER BUSHING — Turn drive over onto the input housing and carefully thread bushing nut onto hollow shaft threads. Rotate the shaft to seat the cone assemblies in the bearing cups. Set up a dial indicator, Figure 22. Rotate and oscillate shaft with axial force applied in both directions to obtain the shaft axial float measurement (upward force can be applied by prying the bushing nut upward). If no float is measured, remove bushing nut and seal cage & add shim-gaskets until float is measurable. Proceed to Step 6(c).

b. FOR DRIVES WITHOUT THE TA TAPER BUSHING — Insert the hollow shaft thrust plate and secure with the retaining ring as illustrated in Section I, Figure 4. Thread a bolt into the thrust plate. Set up a dial indicator on the input housing face with the indicator probe on the end of the hollow shaft. DO NOT indicate from the thrust plate or fastener head. Rotate and oscillate shaft with axial force applied in both directions to obtain the axial float measurement. (Upward force can be applied by prying the head of the thrust plate bolt upward). If no float is measured, remove seal cage and add shim-gaskets until float is measurable.

Figure 22



c. If the axial float from 6(a) or (b) is greater than .010" (0,25 mm), subtract sufficient shims to obtain .001" to .010" (0,03 mm to 0,25 mm) float. Refer to Table 15 for shim thickness. Take into account the compressibility of shim-gaskets from Table 16. Reassemble and repeat Step 6(a) or (b). When float is within .001" to .010" (0,03 mm to 0,25 mm), proceed to Step 6(d).

TABLE 15 — Individual Shim-Gasket Part Numbers

Ref. No.	Shim Thickness Inches (mm)	DRIVE SIZE 5407	5415	5507	5608
100	...	0786841	0785587	0786843	0786844
24	0.007 (0,18)	1231144	1220259	1220130	1231222
	0.009 (0,23)	0767761	0757456	0757453	0767802
	0.015 (0,38)	0767762	0757457	0757454	0767803
	0.031 (0,79)	0767763	0757458	0757455	0767804
25	0.015 (0,38)	0755904	0757460	0757460	3200133
26	0.007 (0,18)	1219682	1220540	1220128	0761568
	0.009 (0,23)	0755903	0757459	0755947	0761569
	0.015 (0,38)	0755904	0757460	0755948	3200133
	0.031 (0,79)	0755905	0757461	0755949	...
27 & 28	0.015 (0,38)	0755904	1220129	0757460	0710703
29 & 30	0.015 (0,38)	0755904	1220129	1220129	...
31	0.007 (0,18)	1219682	1220540	1220128	1130518
	0.009 (0,23)	0755903	0757459	0755947	0710702
	0.015 (0,38)	0755904	0757460	0755948	0710703
	0.031 (0,79)	0755905	0757461	0755949	...

TABLE 16 — Falk Shim-Gasket Compressibility

Thickness Inches (mm)					
	New	0.007 (0,18)	0.009 (0,23)	0.015 (0,38)	0.031 (0,79)
	Compressed	0.006 (0,15)	0.008 (0,20)	0.013 (0,33)	0.028 (0,71)

d. Refer to Table 17 and note the preload specified for bearings Ref. #4A1 and 4A2. Add to the upper and lower limits shown, the axial movement obtained in Step 6(c). This will indicate the thickness of shims to be removed to obtain the specified preload. For example, if the preload in Table 17 is .005" to .007" (0,13 mm to 0,18 mm) and the axial movement was .007" (0,18 mm), removal of shims with a total thickness of .012" to .014" (0,31 mm to 0,36 mm) will produce the desired preload. Table 15 provides shim thicknesses for each shim pack to assist in obtaining the desired results. Take into account the compressibility of shim-gaskets from Table 16.

TABLE 17 — Preload & Axial Settings – Inch (mm)

DRIVE SIZE	Bearings Ref. #4A1 & 4A2	Shaft & Pinion Ref. #2A3	Shaft & Pinion Ref. #1A3 or 3A3
	Bearing Preload	Axial Float	Axial Float *
5407 5415 5507 5608	.004-.006 (0,10-0,15) .005-.007 (0,13-0,18) .006-.008 (0,15-0,20) .008-.010 (0,20-0,25)	.001-.003 (0,03-0,08)	.001-.003 (0,03-0,08)

* NOTE: For Sizes 5407 & 5415 equipped with a backstop, axial float measurement must be within the following range: .001 preload to .001 float.

e. Remove seal cage, Ref. #11, and remove shim-gasket(s) as determined in Step 6(d). Reattach the seal cage and tighten fasteners to torque specified in Table 14.

f. AXIAL FLOAT ADJUSTMENT, REF. #2A3 — Remove pipe plug from center of shaft cover, Ref. #16, and install a .375-16 x 2" or longer fastener thru the hole in the shaft cover into the threaded hole in the pinion shaft. Turn by hand until snug. Set up a dial indicator with the probe on the fastener head as illustrated in Figure 23. Turn the fastener in a clockwise direction, pushing and pulling the fastener to make certain the bearings are properly seated. Measure the axial float. Subtract from this reading the axial float for Ref. #2A3 shaft found in Table 15. This indicates the thickness of shims to be removed. When removing the shim(s) retain the .015" (0,38 mm) thickness against the drive housing. Retighten fasteners and recheck float. Readjust shimming, if necessary, until proper axial float is achieved (Table 17).

g. AXIAL FLOAT ADJUSTMENT, REF. #1A3 or 3A3 — Refer to Figure 24 and adjust float as follows:

Set up a dial indicator for determining axial movement of the high speed shaft Ref. #1A3 or 3A3. Lift upward with a twisting motion to obtain a reading.

WARNING: Cover keyway with tape to avoid lacerations to the hand.

Subtract from this reading the axial float for shaft, Ref. #1A3 or 3A3, found in Table 15. This indicates the thickness of shim(s), Ref. #31, to be removed. When removing the shim(s), retain the .015" (0,38 mm) thick shim against the housing, Ref. #10. Retighten fasteners and recheck float. Readjust shimming, if necessary, until proper float is achieved (Table 17).

7. SEAL INSTALLATION

Seals can be installed after all bearing adjustments have been completed. Refer to Section H, Step 7, to install seals, Ref. #22 & 23. NOTE: When removing a seal cage to install a seal, be sure to replace the same shim-gaskets as removed to assure correct bearing adjustments.

8. BACKSTOP INSTALLATION

If drive will be installed on the driven equipment using the thrust plate and thrust plate fastener, install the backstop at this time. Refer to Appendix B, for installation instructions.

DRIVE IS READY TO INSTALL — Refer to Section I.

Figure 23

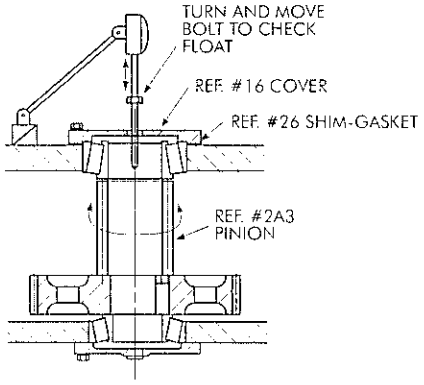
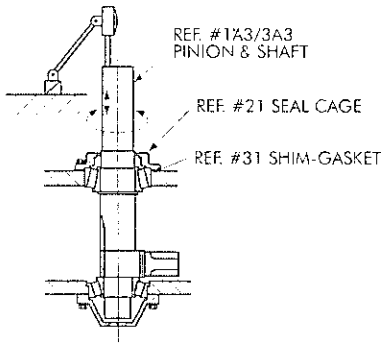


Figure 24



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Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

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Lubrication

Introduction

Lubricants listed in this manual are typical products ONLY and should not be construed as exclusive recommendations. Industrial type petroleum based rust and oxidation inhibited (R & O) gear lubricants or industrial type sulfur-phosphorus extreme pressure (EP) gear lubricants are the recommended lubricants for ambient temperatures of +30°F to 125°F (-1°C to 52°C).

For drives operating outside the above temperature range, refer to the "Synthetic Lubricants" paragraphs. Synthetic lubricants can also be used in normal climates.

Carefully follow instructions on the drive nameplate, warning tags and installation manuals furnished with the drive.

Viscosity (Important)

The proper viscosity grade for R & O and EP lubricants is found in Table 3. For synthetic lubricant viscosity grades, refer to Table 4 and the "Synthetic Lubricants" paragraphs. Petroleum based lubricant selections must have a pour point at least 10°F (5.5 C) below the expected minimum ambient starting temperature.

Petroleum Based Lubricants

R & O GEAR LUBRICANTS (TABLE 3) — Industrial type petroleum based rust and oxidation inhibited (R & O) gear lubricants are the most common and readily available general purpose gear lubricants.

EXTREME PRESSURE (EP) LUBRICANTS (TABLE 3) — For highly loaded drives or for drives loaded in excess of original estimates, industrial-type petroleum extreme pressure lubricants are preferred. The EP lubricants currently recommended are of the sulphur–phosphorus type.

CAUTION: PETROLEUM BASED LUBRICANTS & INTERNAL BACKSTOPS — Do not use EP lubricants or lubricants with anti-wear additives or lubricant formulations including sulfur, phosphorus, chlorine, lead derivatives, graphite or molybdenum disulfides in drives equipped with internal cartridge type backstops. Some lubricants in Table 3 may contain anti-wear additives. EP lubricants in Table 3 do contain several of these additives.

WARNING: EP LUBRICANTS IN FOOD PROCESSING INDUSTRY — EP lubricants may contain toxic substances and should not be used in the food processing industry without the lubricant manufacturer's approval. Lubricants which meet USDA "H1" classification are suitable for food processing applications.

Synthetic Lubricants

Synthetic lubricants of the polyalphaolefin type are recommended for cold climate operation, high temperature applications, extended temperature range (all season) operation and/or extended lubricant change intervals. The proper viscosity grade of synthetic lubricant is given in Table 4. Usable temperature ranges can sometimes be widened if specific application conditions are known.

Rexnord Industries, LLC., Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

NOTE: SYNTHETIC LUBRICANTS & INTERNAL BACKSTOPS – Synthetic lubricants of the Polyalphaolefin Type may be used in drives with internal backstops. Select proper lubricant grade from Table 4.

NORMAL CLIMATE CONDITIONS — For temperatures of 30°F (-1°C) and above, use viscosity grades as recommended in Table 3 for petroleum based lubricants, or see Table 4 for synthetic lubricants.

WARNING: SYNTHETIC LUBRICANTS IN FOOD PROCESSING INDUSTRY — Synthetic lubricants may contain toxic substances such as sulfur, phosphorus, chlorine, lead derivatives, graphite or molybdenum disulfides and should not be used in the food processing industry without the lubricant manufacturer's approval. Lubricants which meet USDA "H1" classification are suitable for food processing applications.

Lubricant Changes

OIL ANALYSIS REPORT — Checking oil condition at regular intervals is recommended. In the absence of more specific limits, the guidelines listed below may be used to indicate when to change oil:

1. Water content is greater than 0.05% (500 ppm).
2. Iron content exceeds 150 ppm.
3. Silicon (dust/dirt) exceeds 25 ppm.
4. Calcium content 50 ppm above normal lubricant amount.
5. Viscosity changes more than 15%.

PETROLEUM LUBRICANTS — For normal operating conditions, change gear oils every six months or 2500 operating hours, whichever occurs first. If the drive is operated in an area where temperatures vary with the seasons, change the oil viscosity grade to suit the temperature, refer to Table 3. Lubricant suppliers can test oil from the drive periodically and recommend economical change schedules.

SYNTHETIC LUBRICANTS — Synthetic lube change intervals can be extended to 8000 hours depending upon operating temperatures and lubricant contamination. Laboratory analysis is recommended for optimum lubricant life and drive performance. Change lube with change in ambient temperature, if required. Refer to Table 4.

TABLE 1 — Approximate Oil Capacity ★

DRIVE SIZE	JR, JF & JSC Gallons (Liters)	JRV & JFV Gallons (Liters)
5407	4.3 (16,3)	6.3 (23,8)
5415	7.0 (26,5)	9.5 (36,0)
5507	10.3 (39,0)	13.3 (50,3)
5608	12.0 (45,4)	19.5 (73,9)

★ Quantities are approximate. Always fill drive to specified level.

Grease Lubricated Seals

All drives are furnished with grease purged seals which minimize the entry of contaminants and abrasive dusts into the drive. Drives are shipped with NLGI #2 grease in the seal housing cavities unless otherwise specified.

Whenever changing oil in the drive, purge the seals with one of the NLGI #2 greases listed in Table 2.

TABLE 2 — Greases For Grease Purged Seals

[0° to 200°F (-18° to 93°C)]

Manufacturer	Lubricant
Amoco Oil Co.	Amolith Grease No. 2
BP Oil Co.	Energrease LS-EP2
Chevron U.S.A., Inc.	Industrial Grease Medium
Citgo Petroleum Corp.	Premium Lithium Grease No. 2
Conoco Inc.	EP Conolith Grease No. 2
Exxon Company, U.S.A.	Unirex N2
Houghton Int., Inc.	Cosmolube 2
Imperial Oil Ltd.	Unirex N2L
Kendall Refining Co.	Multi-Purpose Lithium Grease L421
Keystone Lubricants	Zenigiex 2
Lyondell Petrochemical (ARCO)	Litho ine H EP 2 Grease
Mobil Oil Corp.	Mobilith 22
Mobil Oil Corp.	Mobilith SHC 460 †
Petro-Canada Products	Multipurpose EP2
Phillips 66 Co.	Philube Blue EP
Shell Oil Co.	Alvania Grease 2
Shell Canada Limited	Alvania Grease 2
Sun Oil Co.	Ultra Prestige EP2
Texaco Lubricants	Premium RB Grease
Unocal 76 (East & West)	Unoba EP2
Valvoline Oil Co.	Multi ube Lithium EP Grease

† High performance synthetic alternate.

Some of these greases are of the EP type and may contain toxic substances not allowed in the food processing industry. If grease could contaminate the product, as in the food and drug industries, the grease should be removed. A grease that meets the USDA "H1" classification is suitable for food processing applications.

Periodically (at least every six months) depending upon the frequency and degree of contamination, purge contaminated grease from seals by slowly pumping fresh bearing grease thru the seal, WITH HAND GREASE GUN, until fresh grease flows out along the shaft. Wipe off purged grease.

Table 3 — Petroleum Based Gear Lubricants ★

Ambient Temperature Range		+30 to +90°F -01 to +32°C	+70 to +125°F +21 to +52C
AGMA Viscosity Grade		5	6
ISO Viscosity Grade		220	320
Viscosity	cSt @ 40°C	198 - 242	288-352
	SSU @ 100°F	918 - 1122	1335-1632
Manufacturer		Lubricant	
Amoco Oil Co.		Amer. Ind. Oil 220 Permogear/Amogear EP 220 •	Amer. Ind. Oil 320 Permogear/Amogear EP 320 •
BP Oil Co.		Energol HLP-HD 220 Energear EP 220 •	Energear EP 320
Chevron U.S.A., Inc.		Machine Oil AW 220 Gear Compounds EP 220 •	Machine Oil AW 320 Gear Compounds EP 320 •
Citgo Petroleum Corp.		Citgo Pacemaker 220 Citgo EP Compound 220 •	Citgo Pacemaker 320 Citgo EP Compound 320 •
Conoco Inc.		Dectol R&O Oil 220 Gear Oil 220 •	Dectol R&O Oil 320 Gear Oil 320 •
Exxon Company, U.S.A.		Teresstic 220 Spartan EP 220 •	Teresstic 320 Spartan EP 320 •
Houghton International, Inc.		Hydro - Drive HP 1000 MP Gear Oil 220 •	MP Gear Oil 320 •
Imperial Oil Ltd.		Teresso 220 Spartan EP 220 •	Teresso 320 Spartan EP 320 •
Keystone Lubricants		KLC-50 Keygear 220 •	Keygear 320 •
Lyondell Petrochemical (ARCO)		Duro 220 Pennant NL 220 •	Duro 320 Pennant NL 320 •
Mobil Oil Corp.		DTE Oil BB Mobilgear 220 •	DTE Oil AA Mobilgear 320 •
Petro-Canada Products		Harmony 220 Ultima EP 220 •	Harmony 320 Ultima EP 320 •
Phillips 66 Co.		Magnus Oil 220 Philgear 220 •	Magnus Oil 320 Philgear 320 •
Shell Oil Co.		Morlina 220 Omala Oil 220 •	Morlina 320 Omala Oil 320 •
Shell Canada Limited		Tellus 220 Omala Oil 220 •	Tellus 320 Omala Oil 320 •
Texaco Lubricants		Regal Oil R&O 220 Meropa 220 •	Regal Oil R&O 320 Meropa 320 •
Unocal 76 (East)		Unax RX 220 Extra Duty NG Gear Lube 220 •	Unax AW 320 Extra Duty NG Gear Lube 320 •
Unocal 76 (West)		Turbine Oil 220 Extra Duty NG Gear Lube 220 •	Turbine Oil 320 Extra Duty NG Gear Lube 320 •
Valvoline Oil Co.		Valvoline AW ISO 220 AGMA EP 220 •	Valvoline AW ISO 320 AGMA EP 320 •

★ Minimum viscosity index of 90. Maximum operating temperature of lubricants is 200°F (93°C).
• Extreme Pressure Lubricant (contains sulfur-phosphorus). **DO NOT** use in drives equipped with internal backstop.

Rexnord Industries, LLC., Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

TABLE 4 — Synthetic Lubricants – Polyalphaolefin Type ‡

Ambient Temp. Range	−30 to +10°F (−34 to −12°C)	−15 to +50°F (−26 to +10°C)	0 to +80°F (−18 to +27°C)	+10 to +125°F (−12 to +52°C) ♦	+20 to +125°F (−7 to +52°C)
AGMA Viscosity Grade	0S	2S	4S	5S	6S
ISO Viscosity Grade	32	68	150	220	320
Viscosity cSt @ 40°C	28.8-35.2	61.2-74.8	135-165	198-242	288-352
Viscosity SSU @ 100°F	134-164	284-347	626-765	918-1122	1335-1632
Manufacturer	**Lubricant**				
Chevron U.S.A., Inc.	...	...	...	Clarity Synthetic PM Oil 220 Syn. Gear Lube Tegra 220 ■	...
Conoco Inc.	Syncon R & O 32	Syncon R & O 68 Syncon EP 68 ■	Syncon EP 150 • ■	Syncon R & O 220 • Syncon EP 220 • ■	Syncon EP 320 • ■
Dryden Oil Co.	Drydene SHL Lubricant 32	Drydene SHL Lubricant 68	Drydene SHL Lubricant 150	Drydene SHL Lubricant 220	Drydene SHL Lubricant 320
Exxon Company, U.S.A.	Teresstic SHP 32	Teresstic SHP 68	Teresstic SHP 150 Spartan Synthetic EP 150 ■	Teresstic SHP 220 Spartan Synthetic EP 220 ■	Teresstic SHP 320 Spartan Synthetic EP 320 ■
Mobil Oil Corp.	SHC 624	SHC 626	SHC 629 Mobilgear SHC 150 ■	SHC 630 Mobilgear SHC 220 ■	SHC 632 Mobilgear SHC 320 ■
Pennzoil Products Co.	Pennzgear SHD 32	Pennzgear SHD 68 Super Maxol "S" 68 ■	Pennzgear SHD 150 Super Maxol "S" 150 ■	Pennzgear SHD 220 Super Maxol "S" 220 ■	Pennzgear SHD 320 Super Maxol "S" 320 ■
Petro Canada Products	...	...	Super Gear Fluid 150EP ■	Super Gear Fluid 220EP ■	Super Gear Fluid 320EP ■
Shell Oil Co.	...	...	...	Hyperia 220 Hyperia S 220 ■	Hyperia 320 Hyperia S 320 ■
Sun Co.	...	...	...	Sunoco Challenge 220 Sunoco challenge eP 220 ■	Sunoco Challenge 320 Sunoco Challenge EP 320 ■
Texaco Lubricants Co.	Pinnacle 32	Pinnacle 68	Pinnacle 150 Pinnacle EP 150 ■	Pinnacle 220 Pinnacle EP 220 ■	Pinnacle 320
Whitmore Manufacturing Co.	...	...	Decathlon 4EP ■	Decathlon 5EP ■	Decathlon 6EP ■

‡ Minimum viscosity index of 130. Consult lubricant supplier/manufacturer for maximum operating temperature.

• Minimum viscosity index of 120.

■ Extreme pressure EP lubricant (contains sulfur-phosphorus). DO NOT use in drives equipped with internal backstop.

♦ Drives NOT equipped with internal backstop may widen the ambient temperature range to -25 to +125°F (-32 to +52°C).

Backstop Installation — Sizes 5407 & 5415

Introduction

The following instructions apply to INSTALLATION ONLY of internal backstops in horizontal drives, Sizes 5407 thru 5415 double reduction.

WARNING: Axial float measurement of the high speed shaft must be within the following range: .001 inch preload to .001 inch float. Refer to Section III (Drive Reassembly) Item 6 (Bearing Adjustment) for proper instructions on bearing settings and measuring axial float. If backstop is to be replaced, the high speed shaft must also be replaced. Refer to instructions regarding high speed shaft replacement in Section III.

Remove all external loads from system before servicing drive or accessories, and lock out starting switch of prime mover.

Lubricant

PETROLEUM BASED LUBRICANTS — Use R & O type lubricants which do not contain anti-wear (AW) additives if the drive is equipped with an internal backstop.

CAUTION: Do not use EP lubricants or lubricants with anti-wear additives or lubricant formulations including sulfur, phosphorus, chlorine, lead derivatives, graphite or molybdenum disulfides in drives equipped with internal backstops. Refer to Appendix A for proper selection of petroleum based lubricants. Use of an improper lubricant will contribute to premature wear or malfunction of the backstop.

SYNTHETIC LUBRICANTS — Synthetic lubricants of the polyalphaolefin type may be used in drives with internal backstops.

Before installing backstop, check direction of free rotation (overrunning) indicated by the arrow etched on each side of the backstop.

Backstop Application

Backstops are designed to prevent reverse rotation or backrun without backlash in applications such as conveyors, bucket elevators, fans, rotary pumps and kilns. Backstops are not approved for use on systems that are designed for handling of people such as elevators, manlifts, ski tows and ski lifts. DO NOT use a backstop as a substitute for a brake.

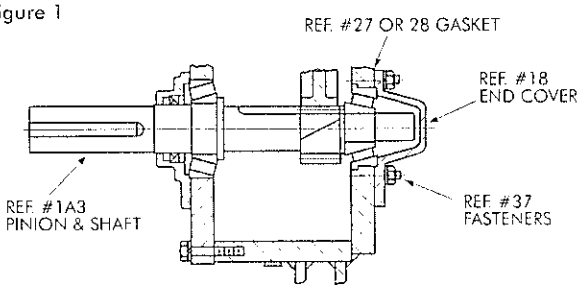
Indexing

DO NOT use the backstop for indexing applications. The backstop is designed to prevent reverse rotation five times or less in eight hours, with one minute or more in overrunning direction between backstopping load applications. If backstopping operations are more frequent, or the time between operations is less than one minute, the backstop is classified as an indexing device and must be referred to the Factory.

Installation

1. Drain oil from the drive. If a backstop is being added to an existing drive, for Size 5415, remove and discard the original end cover, Ref. #18; fasteners, Ref. #37; and gasket, Figure 1. For Size 5407, remove and discard the original end cover, Ref. #18; gasket and four short studs. Install longer studs, Ref. #38, provided with the kit. The hex nuts removed from original shaft cover assembly will be required for reassembly.

Figure 1



2. If existing backstop is being replaced for Sizes 5407 & 5415J14, remove cover, Ref. #19; backstop, Ref. #5A1; spacer, Ref. #5A2; and gasket from backstop cage. For Size 5415J25, remove cover, Ref. #19; gasket and backstop cage, Ref. #20, from housing. Remove two (2) retaining rings from bore of backstop cage. Remove backstop, Ref #5A1, from cage. For all drive sizes, note direction of rotation of high speed shaft for proper reassembly. Refer to Section II for shaft and backstop inspection.

3. Remove backstop, Ref. #5A1, from the kit and wipe off excess lubricant.

4. SIZE 5407 (FIGURE 2) — Assemble backstop cage, Ref. #20, onto studs using one new .015" (.381 mm) shim-gasket, Ref. #30, against the housing. Slide the spacer, Ref. #5A2, into the backstop cage up against the bearing cup. Apply oil to the O.D. of the high speed shaft backstop journal and the sprags inside of the backstop. Insert key Ref #5A4 into backstop keyway. Align the key with the keyway in the backstop cage and carefully slide the backstop into the bore while slowly rotating the high speed shaft. The shaft will only rotate in one direction. DO NOT FORCE OR HAMMER; this may damage the shaft or misalign the sprags.

   Check operation of backstop by turning high speed shaft in required direction of rotation by hand. If the shaft does not rotate in the required direction, remove backstop, reverse it and reinsert it into bore as instructed above. Proceed to Step 9.

Rexnord Industries, LLC., Gear Group.
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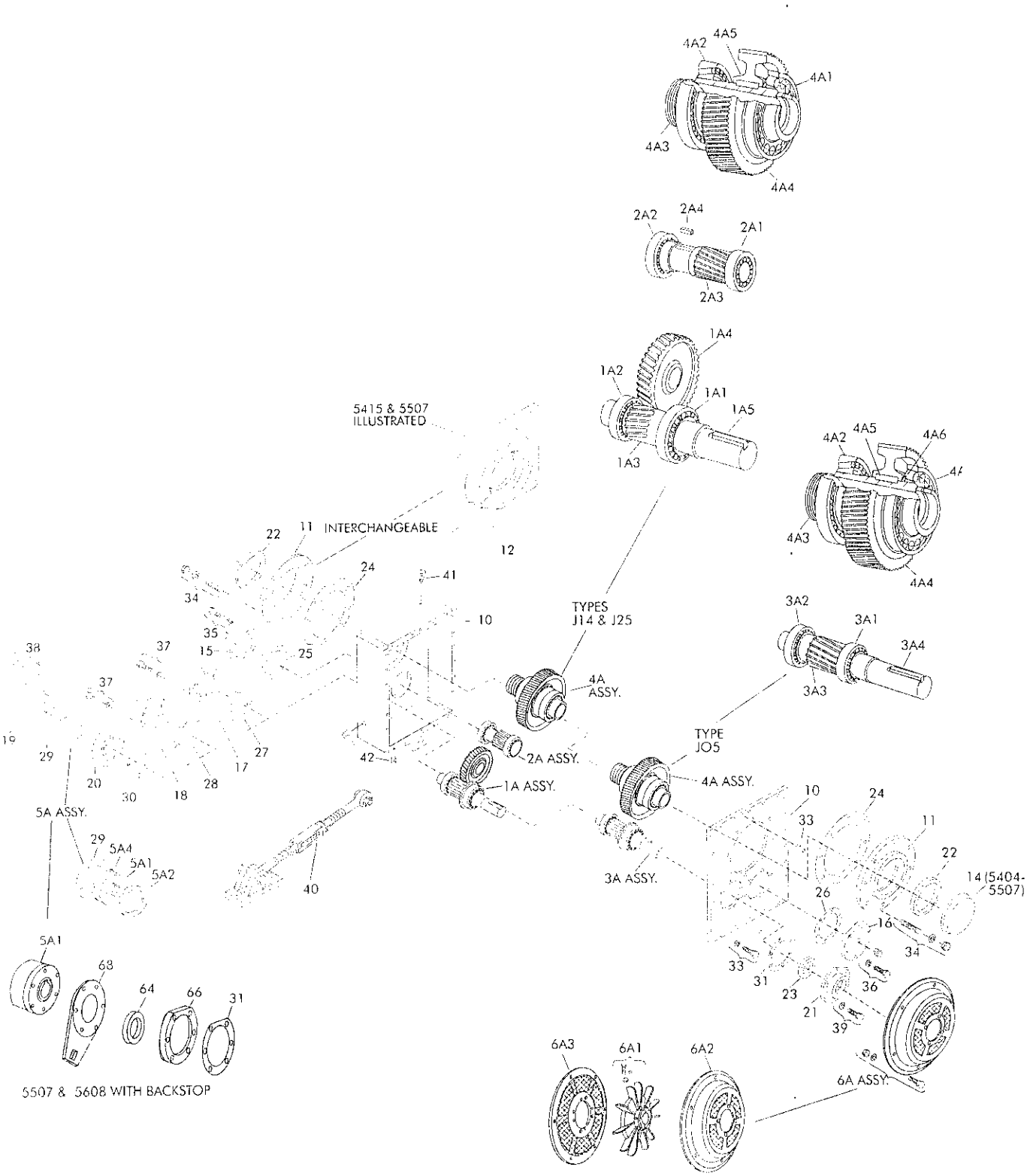
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

Figure 14 — Sizes 5407 thru 5608



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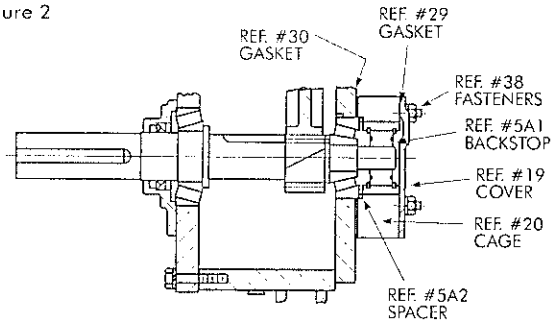
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

Backstop Installation — Sizes 5407 & 5415

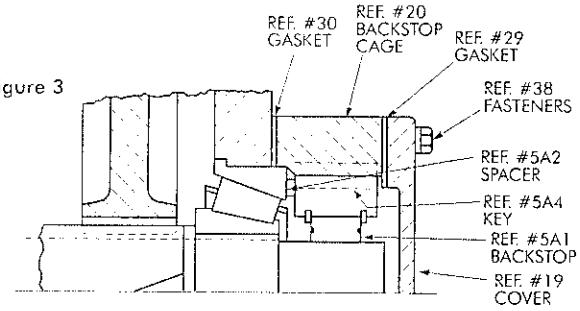
Figure 2



5. SIZE 5415 — Install dowel into cage.

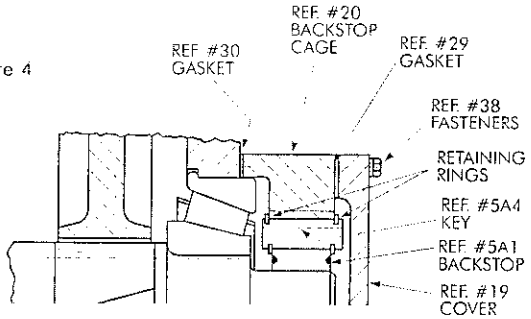
6. SIZE 5415J14 (FIGURE 3) — Apply oil to the O.D. of the high speed shaft backstop journal and the sprags inside of the backstop. Insert key, Ref #5A4, into backstop keyway. Align the key with the keyway in the backstop cage and carefully slide the backstop into cage, allowing the backstop to protrude 0.25" (6.4 mm). Coat spacer with grease to assist in holding the spacer against the backstop for assembly and slide into housing side of cage. This spacer will fit between bearing cup and backstop.

Figure 3



7. SIZE 5415J25 (FIGURE 4) — Install one (1) retaining ring in groove on backstop. Apply oil to the O.D. of the high speed shaft backstop journal and the sprags inside of the backstop. Insert key, Ref #5A4, into backstop keyway. Align the key with the keyway in the backstop cage and carefully slide the backstop into cage. Install second retaining ring on backstop to hold it in the cage.

Figure 4



8. SIZE 5415 (ALL TYPES) — Place one new .015" (.381 mm) shim-gasket, Ref. #30, against housing. NOTE: Position gaskets, Ref. #30 and spacer, Ref. #5A2, so that the drain back hole is open. Blocking the drain back hole will not allow oil to lubricate backstop sufficiently and could lead to premature wear, resulting in backstop or drive failure. Carefully install the backstop/cage assembly on the oiled shaft extension while slowly rotating the high speed shaft. The shaft will only rotate in one direction.

   DO NOT FORCE OR HAMMER; this may damage the shaft or misalign the sprags.

   Check operation of backstop by turning high speed shaft in required direction of rotation by hand. If the shaft does not rotate in the required direction, remove backstop, reverse it and reinstall as instructed in preceding steps.

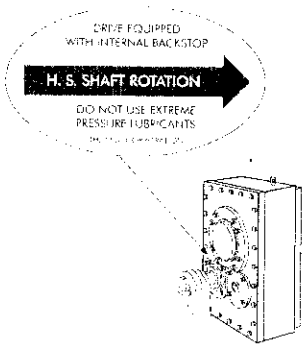
9. Rotate high speed shaft in the required direction of rotation and then reverse the rotation to lock up the backstop. Observe the position of the sprags. All Sprags must be engaged and lay in the same relative position around the shaft. If the sprags are not uniformly positioned, lightly tap the backstop cage to centralize all the sprags around the shaft and cage. If sprags cannot be uniformly positioned in this manner, remove the backstop and run a finger around the sprags in the overrunning direction. Reinstall backstop as instructed in the preceding steps.

   Check the position of the sprags several times by overrunning and locking the sprags. If all sprags move uniformly, hold the backstop in the locked position and proceed to the next assembly step.

10. Install backstop cover, shim-gasket and fasteners, Ref. #19, 29 & 38. NOTE: Position gaskets, Ref. #30, and spacer, Ref. #5A2, so that the drain back hole is open. Blocking the drain back hole will not allow oil to lubricate backstop sufficiently and could lead to premature wear, resulting in backstop or drive failure. Cross-tighten fasteners to 70 lb-ft (95 Nm) for Size 5407, and 28 lb-ft (38 Nm) for Size 5415.

11. Clean housing surface for rotation and warning labels. Affix the rotation indicator next to high speed shaft extension to indicate the free direction of rotation, Figure 5. Fill drive to oil level specified in Section I, with oil specified in Appendix A. Check motor for correct rotation before completing connection to drive.

Figure 5



Backstop Installation — Sizes 5507 & 5608

Introduction

The following instructions apply to INSTALLATION ONLY of externally mounted backstop on the high speed shaft of a horizontally mounted Sizes 5507 & 5608 double reduction drives. This backstop is sold only as an accessory for new or existing Falk drives. Do not use for any other application without written approval from Rexnord Industries.

Backstops must not be dismantled or repaired. Backstops are nonserviceable components. Replace damaged backstops with new backstops from .

Remove all external loads from system before servicing drive or accessories and lock out starting switch of prime mover.

Backstop Application

Backstops are designed to prevent reverse rotation or backrun without backlash in applications such as conveyors, bucket elevators, fans, rotary pumps and kilns. Backstops are not approved for use on systems that are designed for handling of people such as elevators, manlifts, ski tows and ski lifts. DO NOT use a backstop as a substitute for a brake.

Indexing

DO NOT use the backstop for indexing applications. The backstop is designed to prevent reverse rotation five times or less in eight hours, with one minute or more in overrunning direction between backstopping load applications. If backstopping operations are more frequent, or the time between operations is less than one minute, the backstop is classified as an indexing device and must be referred to the Factory.

WARNING: The backstop and normal associated equipment (shaft, pulleys, etc.) involve moving parts; therefore, consult local, state, OSHA and ANSI safety codes for proper guarding of rotating members and possible pinch points.

If backstop slippage occurs, DO NOT operate. Install a new backstop before resuming operation.

Lubricant (Grease) – Backstop P/N 2924040 and 2924041

NOTE: Unless specified otherwise, the backstop is furnished filled with grease oil suitable for operation in an ambient temperature range of -30°F to – 125°F (-34°C to +52°C).

Consult Factory for lubrication recommendations when ambient temperatures are lower than -30°F (-34°C) or higher than 125°F (52°C), or when drives are operating in extremely humid, chemical, or dust laden atmospheres.

CAUTION: Do not use greases with molybdenum disulfide or other EP additives in external backstops. Use of an improper grease will contribute to premature wear or malfunction of the backstop.

Relubricate the backstop after the first week of operation and at one month intervals thereafter to purge any contaminants or burnishing material from the backstop. To relubricate, select and clean an upper grease fitting and pump grease into the backstop until fresh grease appears at both seals. Refer to manufacturer's service manual (supplied with drive) for detailed maintenance instructions and recommended lubricants.

Lubricant (Synthetic Oil – Backstop P/N 2921858 and 2921859

WARNING: Air vent must be installed before operating drive.

NOTE: Unless specified otherwise, the backstop is furnished filled with synthetic oil suitable for operation in an ambient temperature range of -55°F to – 120°F (-48°C to +49°C).

Consult the Factory for lubrication recommendations when ambient temperatures are higher than 120°F (49°C), or when drives are operating in extremely humid, chemical, or dust laden atmospheres.

CAUTION: Do not use lubricant with molybdenum disulfide or other EP additives in external backstops. Use of an improper lubricant will contribute to premature wear or malfunction of the backstop.

Relubricate the backstop every 6 months. Refer to manufacturer's service manual (supplied with drive) for detailed maintenance instructions and recommended lubricants.

Installation

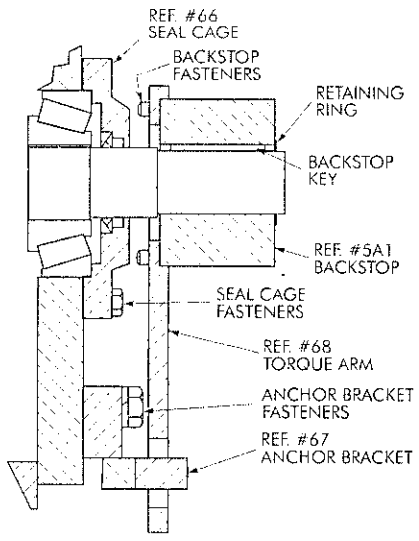
1. Clean the backstop bore and the shaft on which the backstop will be mounted. Remove and clean shaft key and set aside.

   CAUTION: Refer to direction of rotation arrow on backstop. Before installation, make certain that the direction of rotation is correct. Check backstop size on nameplate and make certain it is correct.

2. Attach anchor bracket, Ref. #67, to housing using fasteners provided with kit, Figure 6. Tighten fasteners for Size 5507 to 68.8 lb-ft (94Nm) and Size 5608 to 245 lb-ft (332 Nm).

3. Secure backstop, Ref. #5A1, to torque arm, Ref. #68, using fasteners provided with kit, Figure 6. Tighten fasteners to 22 to 27 lb-ft (30 to 37 Nm). Note: Backstop will fit inside counterbore of torque arm. Oil filled backstops only.

Figure 6



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Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

When assembling torque arm to clutch, clutch should be position so that the fill/vent fitting can be located nearest to the top when backstop is mounted on the shaft. Customer to remove (1) drain plug and replace with fill/vent plug (wired to torque arm) at start up.

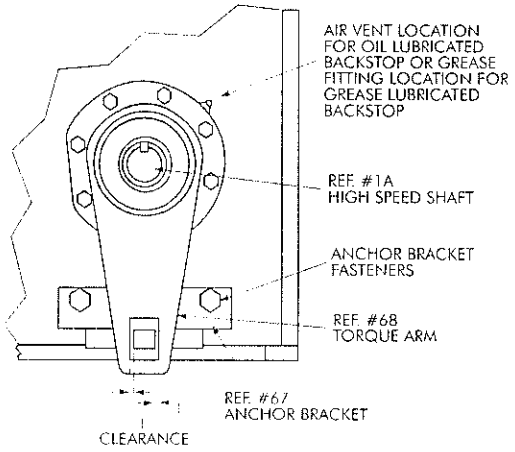
4. Install backstop key into keyway on backstop shaft extension.

5. Align key with keyway in bore of backstop and slide backstop/torque arm assembly onto shaft. Apply pressure to end face of the backstop inner race only. Pressure applied to the outer race could preload the backstop bearings, resulting in a premature failure.

   The backstop must slip onto shaft. DO NOT FORCE OR HAMMER backstop on shaft. Allow for clearance between tab on anchor bracket and hole in torque arm so that the tab can pass through the hole, Figure 7.

6. Install retaining ring on backstop shaft extension to hold backstop assembly on shaft. NOTE: Clearance between backstop and retaining ring allows for backstop assembly to float axially on shaft.

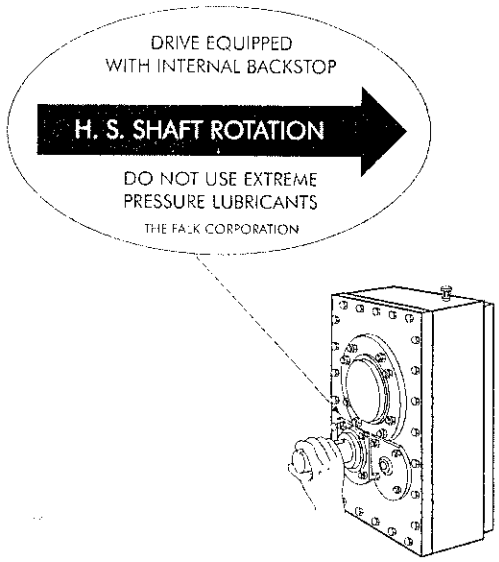
Figure 7



7. Check free and locked rotation of backstop by turning the high speed shaft in required direction of rotation by hand. If the shaft does not rotate in the required direction, remove backstop assembly from shaft, disassemble backstop, Ref. #5A1, from torque arm, Ref. #68, and reverse backstop. Reassemble backstop assembly as instructed in preceding steps.

8. Clean housing surface for rotation and warning labels. Affix the rotation indicator next to high speed shaft extension to indicate the free direction of rotation, as in Figure 8. Check motor for correct rotation before completing connection to drive.

Figure 8



TA Removal Tool

Introduction

The TA removal tool (Patented) offers a positive method for removing a TA Taper equipped Quadrive from the driven shaft. This method uses the torque multiplying characteristic of the drive to separate the drive from the bushing and driven shaft.

The removal tool is available in kit form suitable for use with Sizes 5407 thru 5608. The kit can be ordered from your Rexnord-Falk Distributor by specifying **"TA Removal Kit -Part 0769407."** NOTE: Use of this tool requires a minimum axial clearance ("M" shown in Figure 1 and Table 1), from the seal cage stud.

CAUTION: DO NOT modify the tool in any way OR use it in another manner except to loosen the bushing nut as instructed herein.

Figure 1

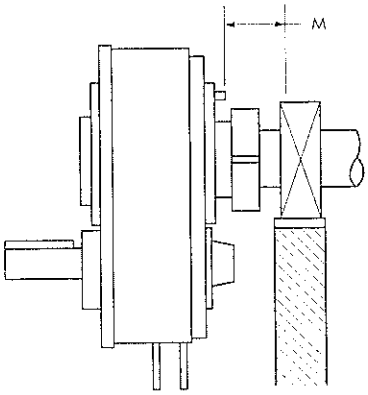


TABLE 1 — Minimum Tool Clearance

DRIVE SIZE	M Dimension — Inches (mm)
5407	5.12 (130)
5415	5.12 (130)
5507	5.38 (137)
5608	5.12 (130)

Preparation For Removal

WARNING: Always "lock out" prime mover before working on the Quadrive.

1. Quadrive shafts, high speed and hollow, must be free to rotate.

a. Remove any external load on the driven shaft.

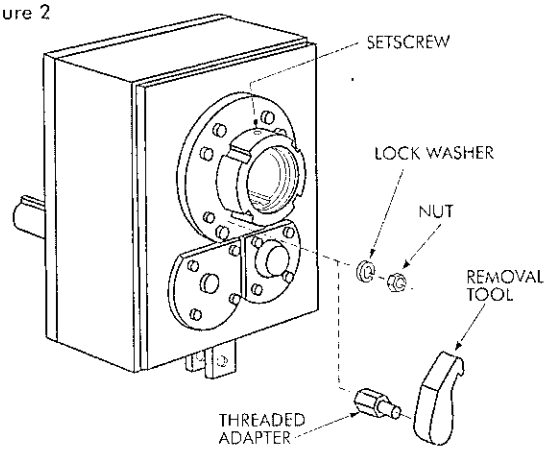
b. Remove belts from high speed shaft sheave.

c. Remove the backstop (if so equipped) when. Refer to Section II — Step 10, for backstop removal instructions.

WARNING: DO NOT disconnect the drive from its torque arm until the removal process is completed. In addition, the drive must be supported during removal process. Use a sling around the motor mount or as recommended in SECTION I, Step 6. Be sure to take up the slack in the sling before proceeding.

2. Loosen the setscrew on the O.D. of the bushing nut. Remove the most convenient seal cage nut and lock washer from the stud. Figure 2.

Figure 2



3. Select the proper adapter from the tool kit. (Adapters are marked with the Quadrive Size and part number.) Thread the appropriate adapter onto the stud anc apply tightening torque from Table 2.

TABLE 2 — Adapter Tightening Torque

DRIVE SIZE	Part Number	Torque lb-ft (Nm)
5407	2111960	108 (146)
5415	2111960	108 (146)
5507	2111961	120 (163)
5608	2111960	108 (146)

4. Mount the removal tool as illustrated in Figure 3 or 4. It is generally preferable to install the tool in a position where it's weight will tend to keep it engaged into the nut. Rotate the high speed shaft until the tool hook engages one of the slots in the nut.

Rexnord Industries, LLC., Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

TA Removal Tool

Figure 3 SIZES 5407, 5415, & 5608

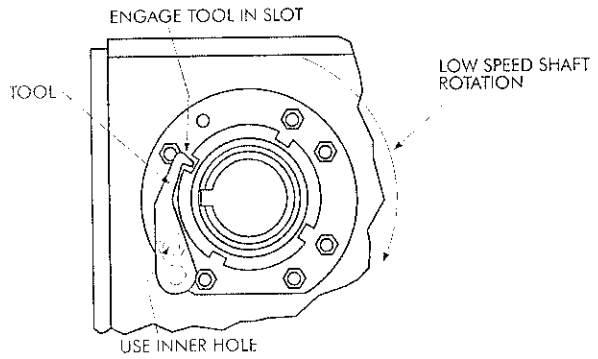
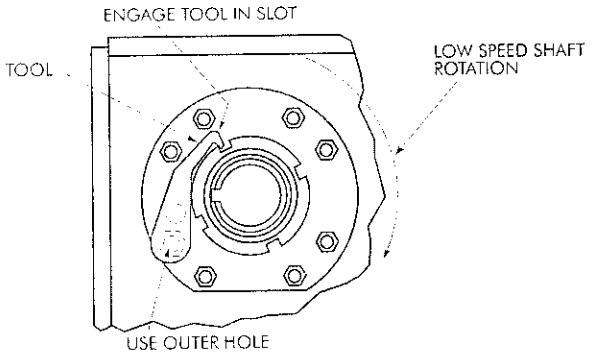


Figure 4 SIZE 5507



Removal Of Quadrive

5. Use a spanner wrench to apply torque through the high speed shaft keyway (Type J05 clockwise; Types J14 or J25 counter-clockwise) to loosen the bushing nut.

   WARNING: Never use the prime mover to produce the torque needed. This could result in severe personal injury or damage to the equipment.

   CAUTION: To avoid damage to the drive or the removal tool, DO NOT exceed the H.S. shaft torque values listed in Table 3.

   NOTE: The nut will rotate freely for approximately 180° as it moves from the locked to the removal position. Resistance will indicate that unseating is occurring. Turn until the nut and bushing are completely free. Now, prepare the drive for lifting by disconnecting the torque arm at the drive end.

6. ALTERNATE METHOD — Torque may be applied to the sheave or sprocket mounted on the high speed shaft.

TABLE 3 — Maximum Torque - High Speed Shaft lb-ft (Nm)

DRIVE SIZE	Drive Reduction		
	J05	J14	J25
5407	843 (1143)	302 (410)	167 (226)
5415	902 (1224)	337 (456)	183 (249)
5507	...	372 (504)	205 (278)
5608	...	422 (572)	230 (312)

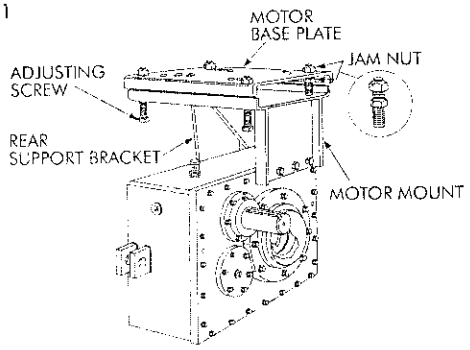
Motor Mount Installation

Introduction

The Falk Equi-Poised Motor Mount is an all-steel weldment that bolts directly to the steel housing of Falk Shaft Mounted (Type JR), Flange Mounted (Type JF) and Screw Conveyor (Type JSC) Drives, as shown in Figure 1.

This modern design provides a simple means of tensioning V-belts or chains with adjusting screws. Motor base plates are available from the Factory predrilled for NEMA & IEC standard foot mounted motors within the rated capacity of the drive.

Figure 1



Assembly Instructions

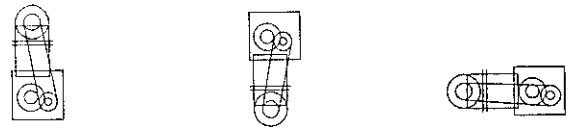
From Figure 2, determine which assembly is required. Drives are shown assembled in the 3 o'clock position, high speed shaft relative to low speed shaft. They can also be mounted in the 6, 9 and 12 o'clock positions after the motor mounts are assembled.

WARNING: Remove all external loads from system before servicing drive or accessories.

Consult applicable local and national safety codes for proper guarding of rotating members.

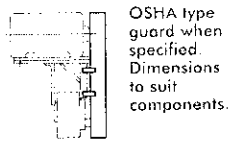
STANDARD ASSEMBLIES

Figure 2



A3 (3 o'clock) C3 (3 o'clock) D3 (3 o'clock)

Letter = Motor Mount Position, Number = Drive H.S.S. Clock



Refer to Appendix L for installation of Falk V-belt guards.

1. ASSEMBLE MOTOR MOUNT BRACKET TO DRIVE.

   Remove housing cover fasteners and attach motor mount bracket to housing using longer fasteners provided. Refer to Table 1 for fastener size and tightening torque.

2. ASSEMBLE REAR SUPPORT BRACKET TO DRIVE.

   Refer to Table 1 for fastener size and tightening torque.

   a. SIZE 5407 ALL TYPES (FIGURE 3) — Remove two hex nuts and lock washers from seal cage studs. Remove the two seal cage studs and replace them with the longer studs provided. Mounting position of drive and motor mount will determine which fasteners need to be removed. Using lock washers provided with motor mount and hex nuts previously removed, attach rear support bracket to drive, aligning holes in bracket with seal cage studs.

   b. SIZES 5415JR & 5507JR (FIGURE 3) — Remove appropriate hex nuts and lock washers from seal cage studs. Mounting position of drive and motor mount will determine which fasteners need to be removed. Using hex nuts and lock washers previously removed, attach rear support bracket to drive, aligning holes in bracket with seal cage studs.

   c. SIZES 5415, 5507, & 5608JF (FIGURE 4) — Attach rear support to flange using mounting fasteners furnished by user (furnished by Falk for Size 5608JF).

   d. SIZE 5608JR (FIGURE 3) — Attach rear support bracket to seal cage pads using fasteners provided.

Figure 3 Sizes: 5407 thru 5507JR 5407JF & JSC 5608JR

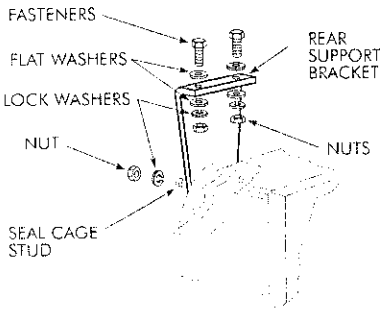
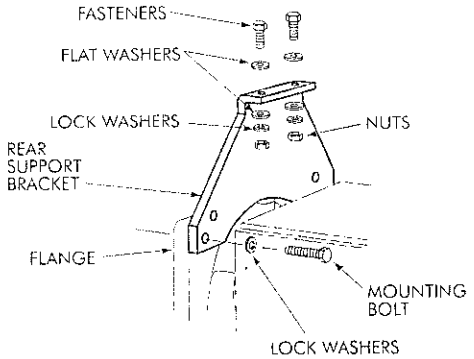


Figure 4 Sizes: 5415 thru 5608JF



Rexnord Industries, LLC., Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

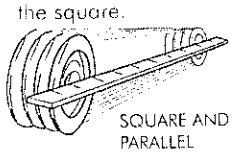
Motor Mount Installation

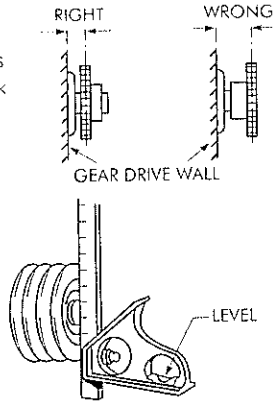
3. ASSEMBLE SUPPORT BRACKET TO MOTOR MOUNT BRACKET — Use the fasteners provided. Refer to Table 1 for fastener size and tightening torque.

4. ASSEMBLE BASE PLATE TO MOTOR MOUNT BRACKET (FIGURE 1) — Assemble adjusting screws to motor mount bracket and base plate with jam nuts above and below the base plate.

5. MOUNT MOTOR — Position motor on base plate so that all mounting holes are in alignment. Install and tighten motor fasteners.

6. SPROCKET, PULLEY OR SHEAVE CONNECTION — Mount power takeoffs as close to drive and motor housing as possible to avoid undue bearing load and shaft deflection. Align the high speed shaft of drive square and parallel with motor shaft by placing a straightedge across the face of the sprockets or sheaves as illustrated. Check horizontal shaft alignment by placing one leg of a square against the face of the sheave or sprocket with the spirit level on the horizontal leg of the square.





Adjustment of the belt or chain is accomplished by turning adjusting screws evenly. DO NOT over tighten belts or chains. Over tightening belts or chains reduces belt/chain and bearing life. When the required tension is reached, tighten adjusting screw jam nuts to torques listed in Table 1. Adjust chain tension to manufacturers' specifications. Adjust belts as follows:

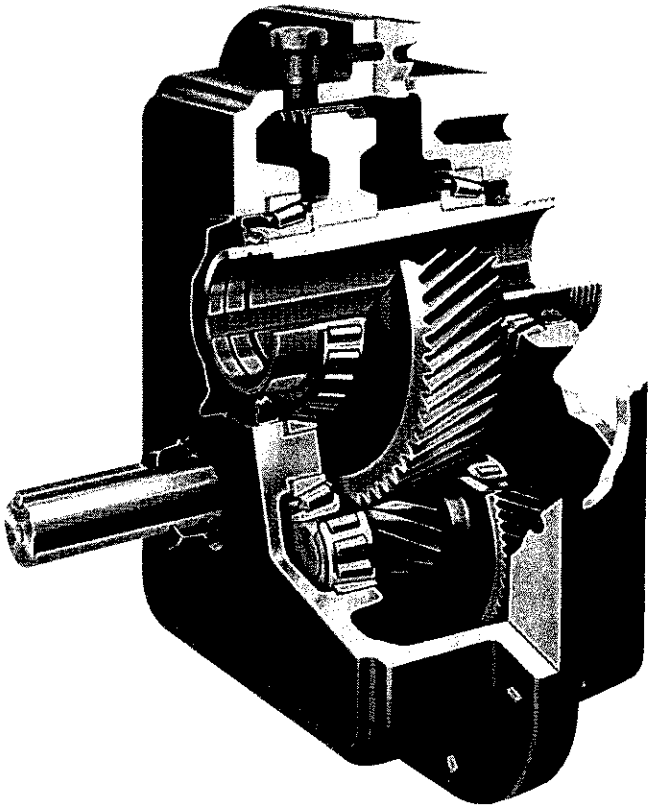
The ideal belt tension is the lowest tension at which the belt will not slip under peak load conditions. Check belt tension frequently during the first 24 to 48 hours of run-in operation. Keep belts free from foreign material which may cause slippage. Inspect the V-belt drive periodically; retighten belts if they are slipping.

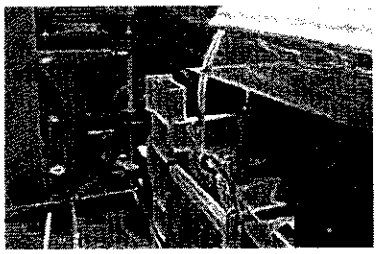
TABLE 1 — Fastener Size and Tightening Torque ★

DRIVE SIZE	Motor Mount to Housing		Support to Seal Cage		Support to Motor Mount		Support to Flange		Adjusting Screws	
	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)	Size	Torque lb-ft (Nm)
5407	.500-13UNC x 2.25	69 (94)	.750-10UNC	330 (447)	.500-13UNC x 1.75	69 (94)	.750-10UNC	330 (447)	1.250-7UNC †	362 (491)
5415	.500-13UNC x 2.50 ‡	69 (94)	.750-10UNC	330 (447)	.500-13UNC x 1.75	69 (94)	1.250-7UNC ‡	1050 (1424)	1.250-7UNC †	362 (491)
5507	.500-13UNC x 2.50 ‡	69 (94)	.875-9UNC	533 (723)	.500-13UNC x 1.75 ●	69 (94)	1.250-7UNC ‡	1050 (1424)	1.250-7UNC †	362 (491)
5608	.750-10UNC x 3.25	245 (332)	.750-10UNC	330 (447)	.750-10UNC x 1.75	245 (332)	.750-10UNC x 2.00	245 (332)	1.250-7UNC	362 (491)

★ All fasteners are Grade 5.
† Size .625-11UNC x 6.00 fasteners are furnished with motor mount for select motor frame sizes. Tighten these fasteners to 60 lb-ft (81 Nm).
‡ Fasteners furnished by customer.
● Size .750-10UNC x 2.25 fasteners are furnished with motor mount for select motor frame sizes. Tighten these fasteners to 245 lb-ft (332 Nm).

Falk™ Quadrive® Shaft Mounted Drive | Interchange Guide





REXNORD

Falk Quadrive – Easiest On, Easiest Off...Guaranteed

It's a simple fact. The heavy duty, shaft-mounted Falk Quadrive features a completely unique design that makes it the easiest, quickest shaft-mounted drive to install and remove.

Quadrive is built to stand up to continuous rough duty. And now, with new higher ratings, you may be able to downsize the drive, saving money right up front.

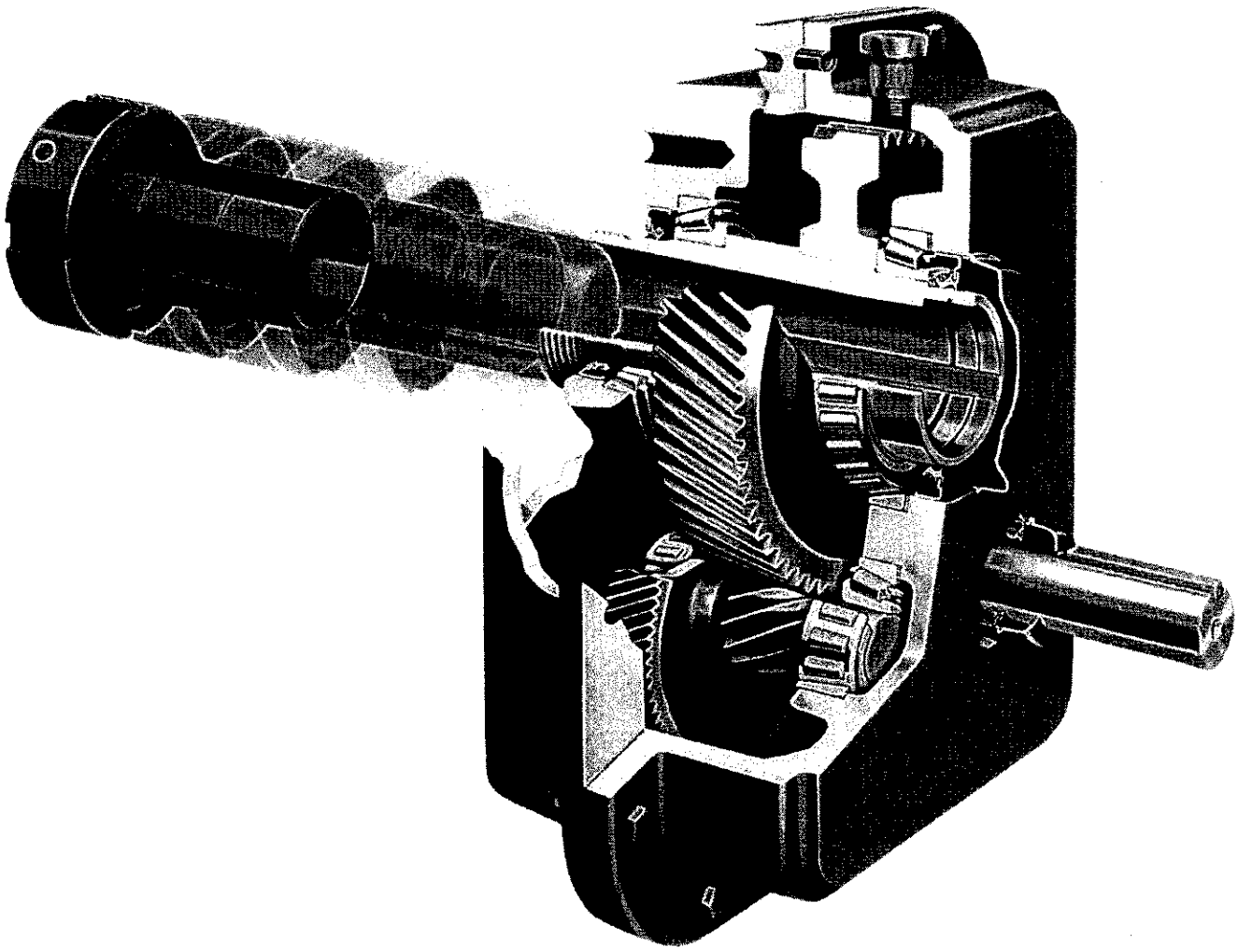
The Falk TA Taper Bushing design makes sure that drive removal is not only simple, but don't damage the drive, or driven equipment.

You don't need extra time. You don't need extra tools. And you're assured safe, worry-free operation.

In a game where there are so few sure things, Falk Quadrive is the right shot to take.

Lifetime Removal Guarantee

Due to the unique properties of the TA Taper Bushing, Quadrive is guaranteed to come off the shaft, regardless of length of service or operation conditions, or we'll replace it FREE. That's a promise no other shaft-mounted drive can make.



Interchange Guide 371-810, March 2006

Contents

THREE YEAR HEAVY DUTY WARRANTY

Factory Warranty We're so confident in the performance and reliability of these Falk gear drives that we're backing this comprehensive offering with the best standard warranty in the business. Our full, 3-year Heavy-Duty Warranty provides "shaft-to-shaft" protection on all Falk components – including bearings and seals. It's an industry first... and one more powerful reason why Rexnord is your ultimate bottom-line value. ★

★ Warranty extends for 3 years from date of shipment.

Introduction

How to Make an Interchange

Example 1: Your customer wants to replace a Dodge TXT 425 with a taper bushed design. However, the available driven shaft length (2 7/16" diameter) is only 6 1/2". Select a Falk Quadrive replacement drive.

Step 1 — From Page 7, Table 1, a Size 5207J with a 25:1 nominal ratio is the correct interchange for a Dodge Size 4.

Step 2 — For a Size 5207JR shaft mounted drive a 2 7/16" TA Taper bushing requires a minimum 6.11 inch driven shaft length. Your customer will require a new sheave or sheave bushing (1.5" diameter vs. 1.437" diameter high speed shaft) and may need to adjust the motor and tie rod position.

Step 3 — Components Required:

5207J25A Basic Drive . . . . . PN 0794381
BU4207J Bushing 2.438 . . . . . PN 0769105
TR4207J Tie Rod . . . . . PN 0738515

Optional Accessories (which can be factory installed):

BS4207J25 Backstop . . . . . PN 0738517
MM4207J-1 Motor Mount . . . . . PN 0738718
Belt Guard . . . . . PN 0783738

Features & Benefits

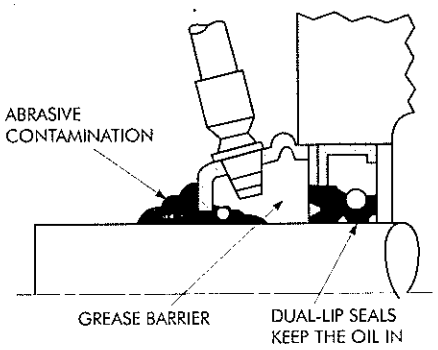
Quadrive is the fifth generation of heavy duty shaft mounted drives from Falk. Built for exceptional value, the Quadrive benefits from the latest in manufacturing and design technology.

The Economic Advantage Cellular manufacturing and modular components result in low drive costs. And the TA Taper bushing design means a simple, cost-effective installation.

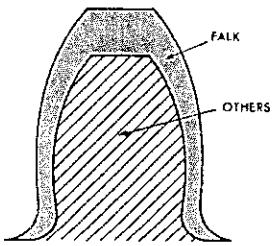
Honest Warranty A three year heavy duty warranty which includes all bearings and seals — the best in the industry!

Standard Bearings & Viton Seals with published manufacturers' numbers are available locally to minimize replacement downtime.

Severe-Duty Grease Purged Seals on high speed shafts prevent leakage and subsequent drive failure. A grease barrier traps abrasive contaminants before they can groove the shaft or enter the gear drive.



Traditional Long Life Gearing Falk's high hardness, surface finished, helical design features large teeth and wider face for maximum load carrying capacity.



"Torque Assist" TA Taper Bushing

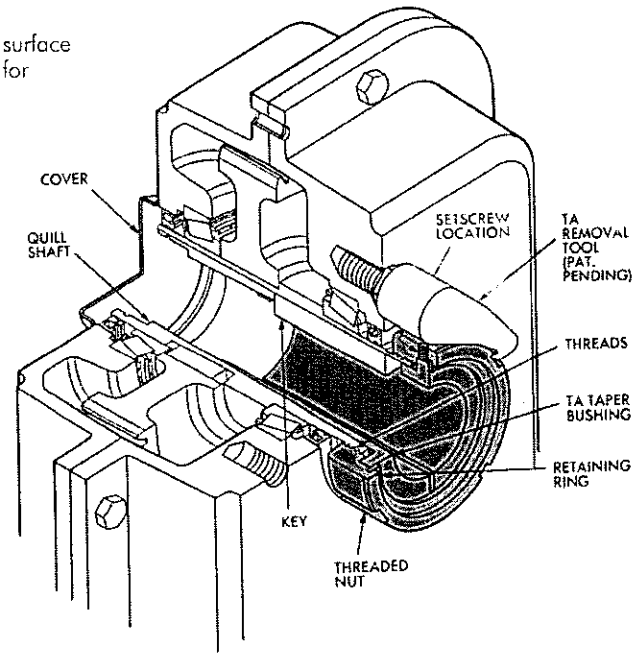
- Unique torque assist design provides easiest removal. Fast installation too!
- Eliminates binding common to twin-taper and single-flanged bushings.
- Concentric operation minimizes wobble even on worn shafts.
- Quill cover keeps out contaminants and protects outboard low speed shaft seal.
- Minimal shaft engagement requirement allows for easy retrofits.
- Inboard bushing location saves high speed bearings by minimizing sheave overhang.

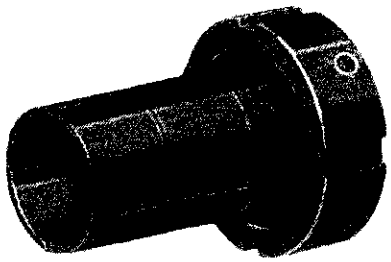
Easiest On . . .

To Install, simply place the TA Taper bushing assembly onto the driven shaft. Slide the drive onto the bushing and tighten the threaded nut and setscrew. Falk's TA Taper design provides a uniform draw onto the taper with less difficulty than twin-taper or single-flanged bushings.

. . . And Easiest Off!

To remove, loosen the bushing setscrew, back off the bushing nut and the drive dismounts. It's that easy . . . only with Falk! In fact, Falk's Quadrive is guaranteed to come off the shaft, regardless of length of service or operating conditions, or WE'LL REPLACE IT FOR FREE!





Not all shaft mounted drives are created equal; when it comes down to ruggedness, life expectancy, cost, and accessories... Falk is the industry leader. Couple these features with the TA Bushing system and you have a real winner! But the really big difference is how they mount to your headshaft.

Compare Mounting Benefits:

Falk's simple, yet highly effective, single tapered bushing, mounted on the output side of the drive with the others you have been using or are considering.

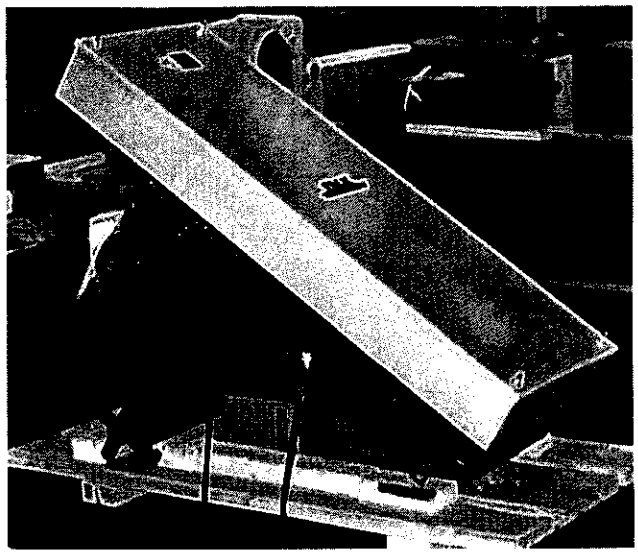
- **NO** cap screws to tighten, lose, torque, corrode in place, or break off when trying to remove them.
- **NO** numerous snap rings, "stabilizer" sleeves or bronze bushings to install, lose, or break.
- **NO** worries about having enough head shaft extension, since only the length of the Falk TA Taper Bushing needs to be engaged.
- **NO** special tools are required to install or remove your Quadrive. Readily available pipe and spanner wrenches are already in your tool room. You don't even need a torque wrench!
- **NO** large mounting distances from your head shaft bearings are required. Since there are no axial cap screws to tighten, the Falk Quadrive can be positioned right next to the headshaft bearing, reducing overhung loads.
- **NO** additional "lifts" will be required when installing; Falk's Quadrive is unique, in that you can install your sheaves, belts, motor mount, motor and belt guard before installing the drive. This will allow you to complete the whole installation with one lift to the headshaft. Your installer only needs to take the TA Taper Bushing, key and a pipe or spanner wrench up to install the drive. (Your maintenance people will thank you on those cold, windy days, 80 feet off the ground!)

The Falk Quadrive starts out with Falk's exclusive **3-year Heavy Duty Warranty**, which by the way, **includes oil seals and bearings — a true, shaft to shaft drive warranty!** Falk's unique TA Torque Assist Taper Bushing System eliminates binding found with twin-taper and single-flange bushing designs. Concentric operation minimizes wobble, even on worn shafts. A quill cover keeps contaminants out and protects the outboard shaft seal. The inboard bushing location minimizes sheave overhang, reducing overhung load on high-speed bearings. Minimal shaft engagement is required for retrofits.

Using **Standard Bearings and Seals, with published part numbers, and Falk's TA Torque Assist Taper Bushing System,** you are getting the best drive available. Standard high speed severe duty grease-purged seals are also included. They prevent leakage and ultimate drive failure. The grease barrier traps abrasive contaminants **before** they can groove the shaft or enter the drive.

Assemble your sheaves, belts, motor mount, motor, align them properly, add a belt guard and the lubricating oil **all in your shop!** Take your TA Taper Bushing and shaft key, along with your pipe or spanner wrench, out to the job-site and install your new Falk Quadrive. Hook up your motor and torque arm and you are ready to start running product! It couldn't be easier!

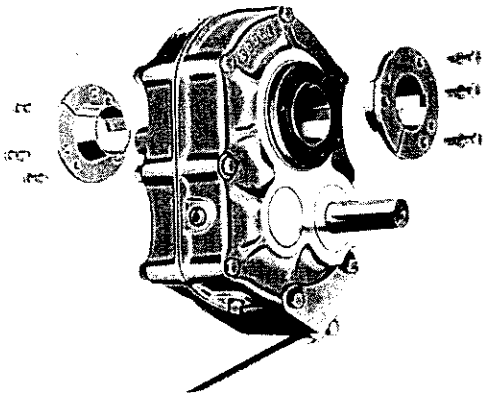
What happens when this particular drive has been running for 5 or 6 years and the head shaft bearing behind the drive fails? Is it going to take 2 or 3 hours to get the drive off, so you can get at that bearing? Not with a Falk Quadrive! Disconnect your drive motor, loosen the bushing setscrew, take your pipe or spanner wrench and back off the bushing nut. The Falk Quadrive will disengage itself immediately...**Falk's Quadrive is guaranteed to come off the shaft, regardless of length of service or operating conditions, or we'll replace it — FREE!**



Let's look at how the "others" install their drives:

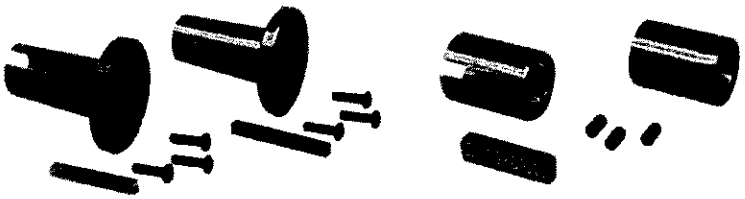
Dodge TXT

- The drive is mounted between two opposing tapered bushings.
- The minimum distance from the head shaft bearing required for cap screw clearance ranges from 1 $^{1}/_{4}$" to 2 $^{11}/_{16}$".
- The head shaft must extend completely through the drive to engage the second bushing.
- Cap screws in both bushings must be set to the proper torque to complete installation.
- Installation of sheaves, belts, and belt guard must be done after the drive is installed on the headshaft.



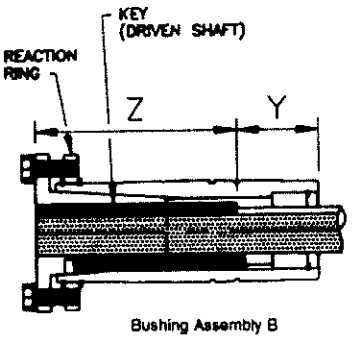
Dodge TAII

- Torque Arm II shaft mounts still use dual opposing 8° ductile iron taper bushings.
- New with this drive is the "Short-Shaft Twin Taper Bushing Kit" which consists of:
  - ✓ One standard bushing
  - ✓ One long bushing with insertable wedge
  - ✓ Two back-up plates, with snap rings
  - ✓ Hardware and key
- Housings—Still use cast iron for all sizes.
- All new motor mounts, backstops,CEMA bolt-on-adapters, and tapered screw conveyor shafts. None of these accessories are compatible with the previous TXT, SCXT, HXT, or HSCXT model drives.
- Installation of sheaves, belts, and belt guard must **STILL** be done **after** the drives are installed on the headshaft.
- Another system, using multiple small components, which can easily be misplaced, dropped, and/or lost.

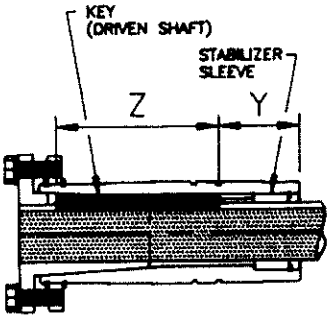


Browning

- The Browning drive is mounted with a single tapered bushing from the low speed (output) side.
- Requires a long head shaft extension to fully engage the bushing.
- A minimum distance is required for installation and removal of bushing axial retaining cap screws. Cap screws must be set to the proper torque to finish installation.
- Now the installation of sheaves, belts, and belt guard can begin.



Bushing Assembly B



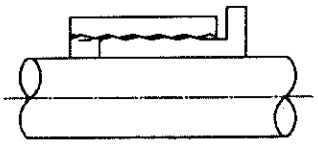
Bushing Assembly C

Link-Belt

- The Link-Belt drive is mounted with a single tapered bushing from the high speed (input) side.
- Requires stabilizer sleeves, bronze bushings and numerous snap ring installations before the drive is ready to mount. (There are numerous small parts to drop and/or lose.)
- Cap screws must be set to the proper torque to tighten bushing and finish installation.
- Now the installation of sheaves, belts, and belt guard can begin.

Fenner

- The Fenner drive is mounted with a single, modified keyless, tapered bushing from either input or output side.
- The bushing must be screwed into the drive and then cap screws are inserted, tightened and torqued to specifications. If the bushing is inserted from the output side, axial clearance is required. If the bushing is installed from the input side, mounting the sheaves, belts, and belt guard needs to be installed after the cap screws are torqued down.



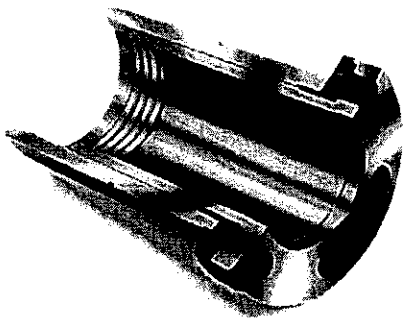


Table 1 — Selections Based Upon 1.0 Service Factor

HP & RPM	Falk 5000	Falk 4000	Browning	Dodge TXT	Dodge TA II	Sumitomo/ Fenner	Link Belt	Dorris
5hp/15rpm	5207J25A	4207J25C	207SMT25	TXT425	TA4207H25	215 G	207FX25	215TR
10hp/20rpm	5215J25A	4215J25C	215SMT25	TXT525	TA5215H25	307 H	215FX25	307TR
15hp/20rpm	5307J25A	4307J25C	307SMT25	TXT625	TA5215H25	315 J	307FX25	315TR
25hp/20rpm	5315J25A	4315J25C	315SMT25	TXT725	TA7315H25	407 S	315FX25	407TR
40hp/24rpm	5407J25A	4407J25C	407SMT25	TXT825	TA8407H25	415 K	407FX25	407TR
60hp/30rpm	5415J25A	4415J25C	415SMT25	TXT926	TA8407H25	507 L	415FX25	415TR
75hp/30rpm	5507J25A	4507J25C	507SMT25	TXT1024	TA9415H25	507 L	507D24	507TR
100hp/18rpm	5608J25A	4608J25C	608SMT25	TXT1225	TA12608H25	N/A	608D24	700TR

Table 2 — AGMA Size Comparison

Max Bore (in)	AGMA	Falk 5000	Falk 4000	Browning	Dodge TXT	Doge TA II	Sumitomo/ Fenner	Link Belt	Dorris
1 7/16	107	5107J	4107J	107SMT	TXT1	TA0107	107 C	107FX	107TR
1 15/16	115	5115J	4115J	115SMT	TXT2	TA2115	115 D	115FX	115TR
2 3/16	203	5203J	4203J	203SMT	TXT3	TA3203	203 E	203FX	203TR
2 7/16	207	5207J	4207J	207SMT	TXT4	TA4207	207 F	207FX	207TR
2 15/16	215	5215J	4215J	215SMT	TXT5	TA5215	215 G	215FX	215TR
3 7/16	307	5307J	4307J	307SMT	TXT6	TA6307	307 H	307FX	307TR
3 15/16	315	5315J	4315J	315SMT	TXT7	TA7315	315 J	315FX	315TR
4 7/16	407	5407J	4407J	407SMT	TXT8	TA8407	407 S	407FX	407TR
4 15/16	415	5415J	4415J	415SMT	TXT9	TA9415	415 K	415FX	415TR
5 7/16	507	5507J	4507J	507SMT	TXT10	TA10507	507 L	507D	507TR
6 1/2	608	5608J	4608J	608SMT	TXT12	TA12608	608 M	608D	608TR

Table 3 — Minimum Recommended Shaft Engagements (Inch)

AGMA Sizes	Falk	Browning	Dodge TXT	Dodge TA II	Dodge TA II Short Shaft Bushing	Sumitomo/ Fenner	Link Belt	Dorris
107	5.00	6.125	8.344	6.95	4.42	5.551	4.880	6.25
115	5.55	6.625	8.563	7.81	4.79	6.142	5.180	6.88
203	5.53	7.125	10.281	8.62	5.45	6.653	5.960	7.88
207	6.11	7.625	11.500	8.94	5.64	7.165	6.900	8.38
215	7.08	8.250	12.031	10.33	6.35	8.425	7.910	9.00
307	7.39	9.750	13.313	10.84	6.70	9.409	8.960	11.00
315	7.92	11.063	14.875	11.86	7.63	9.606	9.680	11.00
407	8.38	10.500	16.126	12.81	8.11	10.345	10.800	13.50
415	10.33	12.875	16.844	13.75	8.55	11.693	11.800	14.88
507	10.66	14.500	17.781	15.47	9.66	13.583	13.500	15.50
608	12.75	15.250	21.156	18.33	11.50	15.551	15.250	20.25

Shaded values show where cost savings can be achieved.

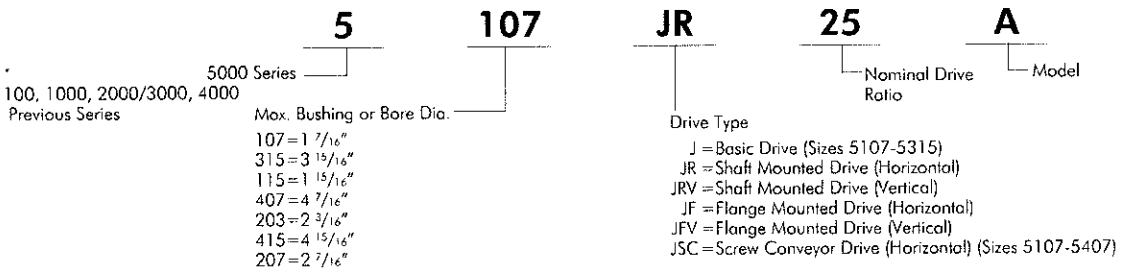
Table 4 — Oil Capacity Comparison (U.S. Quarts) – Horizontal Mounting w/HS Shafts @ 12:00 o'clock Position

FALK ♦	Quarts	Browning	Quarts	Dodge TXT	Quarts	Dodge TA II	Quarts	Sumitomo/Fenner	Quarts	Link Belt	Quarts	Dorris	Quarts
5107J25A	2.0	107SMT25	1.00	TXT125	0.750	TA1107H	1.7	107 C	0.63	107FX25	1.00	107TR25	1.50
5115J25A	3.0	115SMT25	1.25	TXT225	1.000	TA2115H	2.6	115 D	1.27	115FX25	1.25	115TR25	3.00
5203J25A	3.5	203SMT25	3.00	TXT325	2.125	TA3203H	4.0	203 E	1.90	203FX25	2.00	203TR25	3.75
5207J25A	5.5	207SMT25	3.50	TXT425	1.750	TA4207H	7.3	215 G	3.59	207FX25	3.50	207TR25	4.25
5215J25A	9.0	215SMT25	5.50	TXT525	4.000	TA5215H	12.9	307 H	5.28	215FX25	5.00	215TR25	7.00
5307J25A	13.0	307SMT25	8.00	TXT625	5.000	TA6307H	15.8	315 J	11.62	307FX25	10.25	307TR25	12.25
5315J25A	15.0	315SMT25	10.00	TXT725	9.250	TA7315H	22.0	407 S	15.32	315FX25	12.00	315TR25	15.50
5407J25A	17.2	407SMT25	12.50	TXT825	8.500	TA8407H	25.1	415 K	25.36	407FX25	17.50	407TR25	18.50
5415J25A	28.0	415SMT25	16.00	TXT926	14.250	TA9415H	33.2	507 L	26.42	415FX25	16.50	415TR25	34.00
5507J25A	41.2	507SMT25	22.00	TXT1024	18.750	TA10507H	53.5	507 L	26.42	507D24	22.00	507TR25	38.00
5608J25A	100.0	608SMT25	33.00	TXT1225	36.500	TA12608H	70.7	N/A	N/A	608D24	30.00	608TR25	N/A

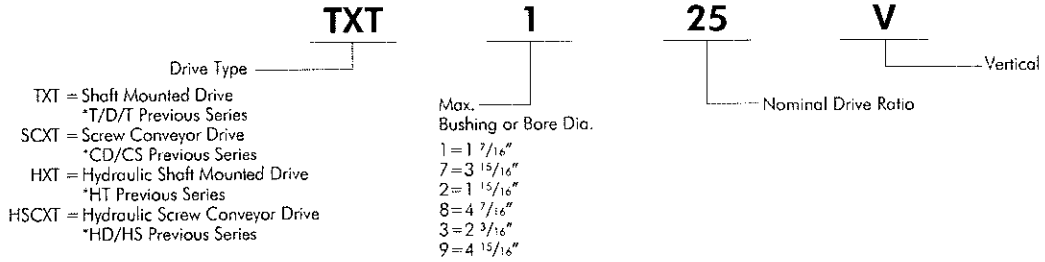
♦ Falk's oil level ensures bearings are lubricated during start-up.

Nomenclature Guide

FALK QUADRIVE



DODGE



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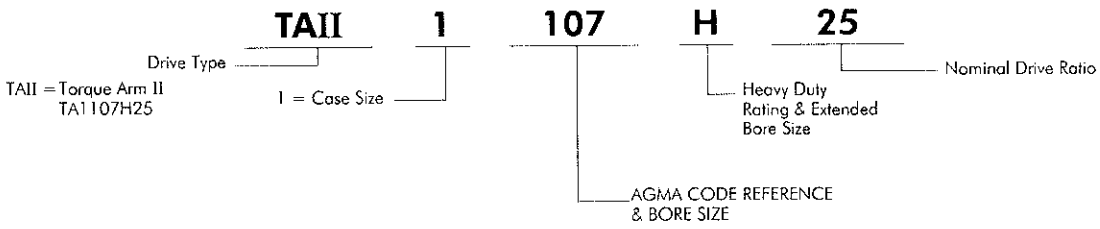
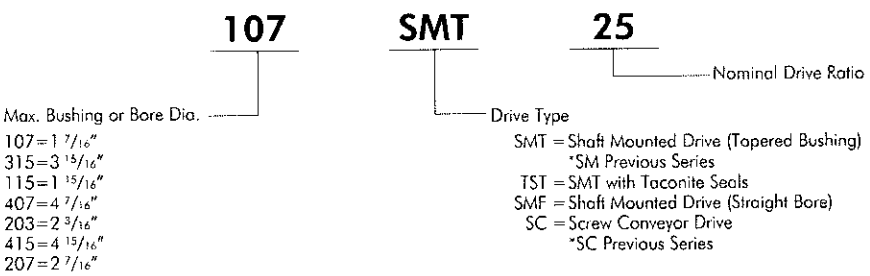


BROWNING



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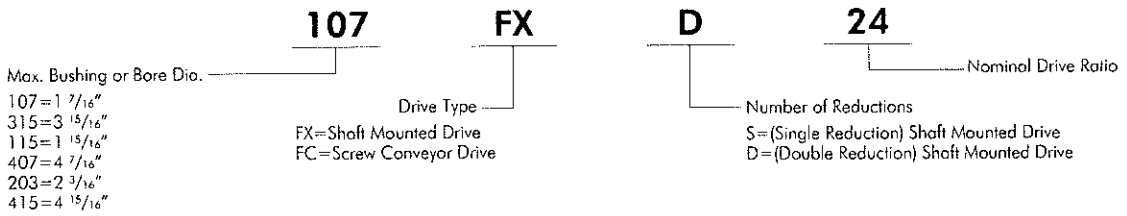
LINK BELT



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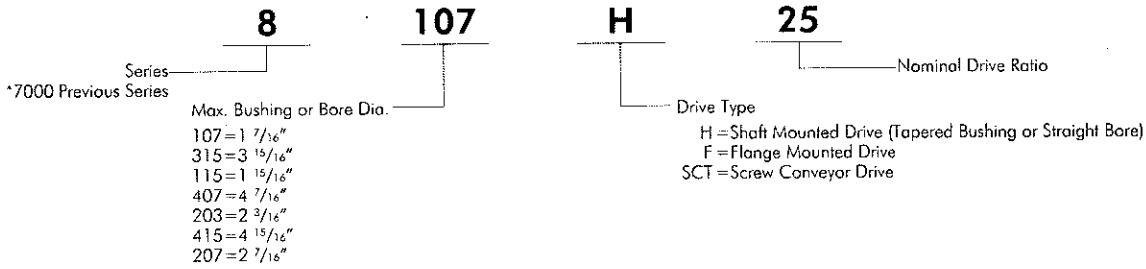
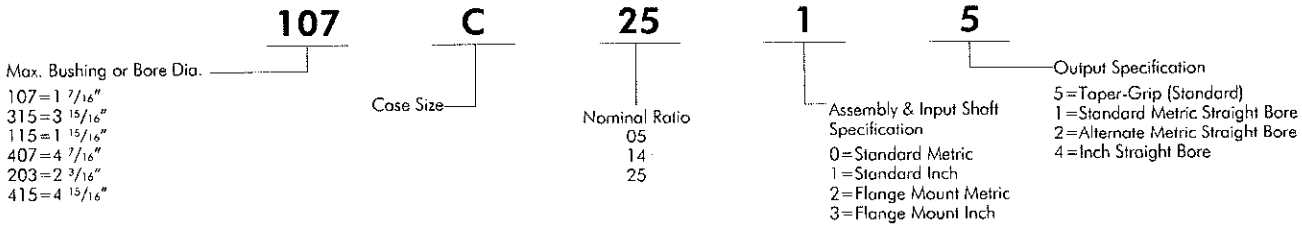


SUMITOMO/FENNER



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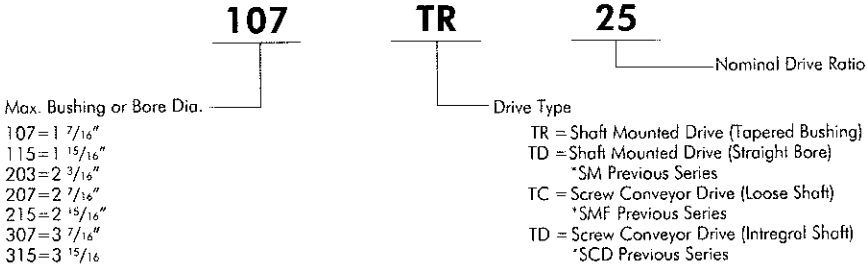

Engineering Information

Table 6 — Load Classifications * . . . Electric Motor Driven Applications

Recommendations are minimum and normal conditions are assumed.

APPLICATION	Service 3 to 10 Hour	Service Over 10 Hour
AGITATORS		
Paper Mill (Mixers)	II	II
Pure Liquids	I	II
Semi-Liquids, Variable Density	II	II
APRON CONVEYORS		
Uniformly Loaded	I	II
Heavy Duty	II	III
ASSEMBLY CONVEYORS		
Uniformly Loaded	I	II
Heavy Duty	II	II
BELT CONVEYORS		
Uniformly Loaded	I	II
Heavy Duty	II	II
BREWING & DISTILLING		
Bottling Machinery	I	II
Brew Kettles, Continuous	...	II
Can Filling Machines	I	II
Cookers, Continuous	...	II
Mash Tubs, Continuous	...	II
Scale Hoppers, Frequent Starts	II	II
BUCKET		
Conveyors Heavy Duty	II	II
Elevators, Uniform Load	I	II
Elevators, Heavy Duty	II	III
CAN FILLING MACHINES	I	II
CAR		
Dumpers	III	...
Pullers	Refer to Factory	
CLARIFIERS	I	II
CLASSIFIERS	II	II
CLAY WORKING MACHINERY		
Brick Presses	III	III
Briquette Machines	III	III
Extruders & Mixers	II	III
CONVEYORS—UNIFORMLY LOADED OR FED ‡		
Apron and Assembly	I	II
Belt	I	II
Flight	II	II
Oven	I	II
Live Roll (Package)	I	II
Screw	I	II
Table—See Metal Mills	...	...
CONVEYORS—HEAVY DUTY —NOT UNIFORMLY FED ‡		
Apron	II	III
Assembly	II	II
Belt	II	II
Bucket or Pan	II	II
Flight	II	II
Live Roll	Refer to Factory	
Oven	II	II
Reciprocating	III	III
Screw	II	II
Table—See Metal Mills	...	...
CRANES & HOISTS ‡		
Bridge and Trolley Drive	II	II
CUTTER HEAD DRIVES	Refer to Factory	
DISTILLING — See Brewing	...	...
DRYERS & COOLERS, ROTARY	II	III
ELEVATORS		
Bucket—Uniform Load	I	II
Bucket—Heavy Load	II	III
Escalators	Not Approved	
Freight	Not Approved	
Man lifts, Passenger	Not Approved	
FLIGHT CONVEYORS		
Uniformly Loaded	II	II
Heavy Duty	II	II
FOOD INDUSTRY		
Beet Slicers	II	II
Can Filling Machines	I	II
Cereal Cookers	I	II
Dough Mixers	II	II
Meat Grinders	II	II
LAUNDRY		
Washers, reversing	Refer to Factory	
Tumblers	II	III
LINE SHAFTS		
Uniform Load	I	II
Heavy Load	II	II
LIVE ROLL CONVEYORS		
Uniformly Loaded, Package	I	II
Heavy Duty	Refer to Factory	
MACHINE TOOLS		
Auxiliary Drives	I	II
Main Drives Uniform Load	II	II
Main Drives Heavy Load	III	III
METAL MILLS		
Table Conveyors, Non Reversing	II	III
Reversing	Refer to Factory	
Wire Drawing & Flattening Machines	II	III
MILLS (See Metal Mills)		
Pebble	II	III
MIXERS (See Agitators)		
Concrete, Continuous	II	III
Concrete, Intermittent	II	...
Constant Density	I	II
Variable Density	II	II
Liquid	I	II
Paper Mill (Agitators)	II	II
Semi-Liquid	II	II
OVEN CONVEYORS		
Uniformly Loaded	I	II
Heavy Duty	II	II
PAN CONVEYORS		
Heavy Duty	II	II
PAPER MILLS		
Agitators (Mixers)	II	II
Bleachers	I	II
Calenders	...	III
Cylinders	...	II
Felt Stretchers	...	II
Winders	...	II
PEBBLE MILLS	II	III
PUMPS		
Proportioning		
Refer to Factory		
Reciprocating, open Discharge	I	II
Double Acting Multi-Cylinder	II	III
Single Cylinder		
Refer to Factory		
Rotary (Gear Type)		
Constant Density	I	II
Variable Density	II	II
RECIPROCATING		
Conveyors	III	III
RUBBER INDUSTRY		
Tire Building Machines	II	II
Tire & Tube Press Openers	I	I
SCREENS		
Air Washing	I	II
Rotary, Stone or Gravel	II	II
Traveling Water Intake	I	II
Shaker	II	III
SCREW CONVEYORS		
Uniformly Loaded	I	II
Heavy Duty	II	II
SKI TOWS & LIFTS Not Approved		
SKIP HOISTS ‡	II	...
STOKERS	...	II
TEXTILE INDUSTRY		
Batchers	II	II
Calenders	II	II
Card Machines	III	III
Dry Cans	II	II
Dyeing Machinery	II	II
Looms		
Refer to Factory		
Mangles, Nappers & Soapers	II	II
Spinners	II	III
Tenter Frames	II	II
TUMBLING BARRELS	III	III

* LOAD CLASSIFICATIONS FOR ENGINE-DRIVEN APPLICATIONS — Multi-Cylinder Engines: Use the next higher Service Class than the one given in Table 6 for the same application when motor driven. (Example: A motor-driven uniformly loaded belt conveyor for 10 hour service is Class I; the same conveyor driven by a multi-cylinder engine would be Class II). For applications which require Class III when motor driven, consult the Factory for recommendations on engine drives. **Single Cylinder Engines:** Consult the Factory.

‡ Selection of Rexnord products for applications whose primary purpose is the transportation of people is not approved. This includes such applications as freight or passenger elevators, escalators, man lifts, fork lift platforms and ski tows and ski lifts. If the primary purpose of the application is material conveyance and occasionally people are transported, the Factory warranty may remain in effect provided the design load conditions are not exceeded and certification to the appropriate safety codes and load conditions has been obtained by the system designer or end user from the appropriate enforcement authorities.

Motor Ratings and Dimensions are in accordance with NEMA standards

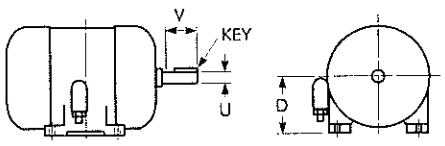

TABLE 7 — 1964 (Type T) NEMA Motor Standards †

MOTOR SPEED AND FRAME SIZE													MOTOR SHAFT DIMENSIONS – INCHES													
Motor hp	1800 rpm	1200 rpm	900 rpm	Motor hp	1800 rpm	1200 rpm	900 rpm	Motor hp	1800 rpm	1200 rpm	900 rpm	Motor Frame	D	U	V	Key (Sq)	Motor Frame	D	U	V	Key (Sq)	Motor Frame	D	U	V	Key (Sq)
½	56	56	143	7½	213	254	256	50	326	365	404	56	3 ½	5/8	2	3/16	215	5 ¼	1 3/8	3 1/8	5/16	326	8	2 1/8	5	½
¾	56	143	145	10	215	256	284	60	364	404	405	143	3 ½	7/8	2	3/16	254	6 ¼	1 5/8	3 ¾	3/8	364	9	2 3/8	5 5/8	5/8
1	143	145	182	15	254	284	286	75	365	405	...	145	3 ½	7/8	2	3/16	256	6 ¼	1 5/8	3 ¾	3/8	365	9	2 3/8	5 5/8	5/8
1 ½	145	182	184	20	256	286	324	100	404	...	...	182	4 ½	1 1/8	2 ½	¼	284	7	1 7/8	3/8	½	404	10	2 7/8	7	¾
2	145	184	213	25	284	324	326	125	405	...	...	184	4 ½	1 1/8	2 ½	¼	286	7	1 7/8	3/8	½	405	10	2 7/8	7	¾
3	182	213	215	30	286	326	364	150	444	...	...	213	5 ¼	1 3/8	3 1/3	5/16	324	8	1/8	5	½	444	11	3 3/8	8 ¼	7/8
5	184	215	254	40	324	364	365	200	445	...	...	...	...	...	...	...	...	...	...	...	...	445	11	3 3/8	8 ¼	7/8

† Frame numbers listed are for 110, 208, 220/440 and 550 volts. Falk Motor Mounts are pre-drilled for rerated 1964 NEMA standard foot-mounted motors.

Table 8 — 5000J Model A Mechanical Input Horsepower & Output Torque (lb-in) Ratings ★

Nom Ratio †	Output Speed rpm ‡	DRIVE SIZE 5107 Hp ●	5107 Output Torque (lb-in) ■	5107 Min HSS Sheave Pitch Dia (in.) ♦	5115 Hp ●	5115 Output Torque (lb-in) ■	5115 Min HSS Sheave Pitch Dia (in.) ♦	5203 Hp ●	5203 Output Torque (lb-in) ■	5203 Min HSS Sheave Pitch Dia (in.) ♦	5207 Hp ●	5207 Output Torque (lb-in) ■	5207 Min HSS Sheave Pitch Dia (in.) ♦	5215 * Hp ●	5215 * Output Torque (lb-in) ■	5215 * Min HSS Sheave Pitch Dia ♦ w/o Shaft Fan (in.)	5215 * Min HSS Sheave Pitch Dia ♦ with Shaft Fan (in.)	5307 Hp ●	5307 Output Torque (lb-in) ■	5307 Min HSS Sheave Pitch Dia ♦ w/o Shaft Fan (in.)	5307 Min HSS Sheave Pitch Dia ♦ with Shaft Fan (in.)
25:1	5	0.357	4494	2.1	0.652	8219	2.6	1.04	13078	4.0	1.65	20832	5.0	2.76	34821	6.0	6.0	4.48	56529	7.0	7.0
	7	0.499	4494	2.1	0.913	8219	2.6	1.45	13078	4.0	2.31	20832	5.0	3.87	34821	6.0	6.0	6.29	56529	7.0	7.0
	10	0.713	4494	2.1	1.30	8219	2.6	2.08	13078	4.0	3.31	20832	5.0	5.52	34821	6.0	6.0	8.97	56529	7.0	7.0
	15	1.07	4494	2.1	1.96	8219	2.6	3.11	13078	4.0	4.96	20832	5.0	8.29	34821	6.0	6.0	13.5	56529	7.0	7.0
	20	1.43	4494	2.1	2.61	8219	2.6	4.15	13078	4.0	6.61	20832	5.0	11.1	34821	6.0	6.0	17.9	56529	7.0	7.0
	25	1.79	4494	2.1	3.26	8219	2.6	5.19	13078	4.0	8.26	20832	5.0	13.8	34821	6.0	6.0	22.4	56529	7.0	7.0
	30	2.14	4494	2.1	3.91	8219	2.6	6.23	13078	4.0	9.92	20832	5.0	16.6	34821	6.0	6.0	26.9	56529	7.0	7.0
	35	2.50	4494	2.1	4.56	8219	2.6	7.26	13078	4.0	11.6	20832	5.0	19.3	34821	6.0	6.0	31.4	56529	7.0	7.0
	40	2.85	4494	2.1	5.22	8219	2.6	8.30	13078	4.0	13.2	20832	5.0	22.1	34821	6.0	6.0	35.9	56529	7.0	7.0
	50	3.56	4494	2.1	6.52	8219	2.6	10.4	13063	4.0	15.5	20832	5.0	27.6	34821	6.0	6.0	44.9	56529	7.0	7.0
	60	4.28	4494	2.1	7.82	8219	2.6	11.8	12367	4.0	19.8	20832	5.0	33.2	34821	6.0	6.0	53.8	56529	7.0	7.0
	70	4.99	4494	2.1	9.13	8219	2.6	13.1	11808	4.0	23.1	20832	5.0	38.7	34821	6.0	6.0	62.8	56529	7.0	7.0
14:1	71	4.79	4254	1.7	9.07	8052	2.0	14.7	13078	4.0	23.5	20832	6.5	39.2	34821	6.0	6.6	63.7	56529	7.0	8.3
	80	5.40	4254	1.7	10.2	8052	2.0	16.6	13078	4.4	26.4	20832	7.4	44.2	34821	6.0	7.2	71.8	56529	7.0	8.6
	90	6.08	4254	1.7	11.5	8052	2.0	18.3	12838	4.6	29.2	20421	8.0	49.7	34821	6.1	8.0	80.7	56529	7.2	9.2
	100	6.75	4254	1.7	12.8	8052	2.0	19.7	12439	4.7	31.4	19786	8.0	55.3	34821	6.8	8.9	89.7	56529	7.7	9.8
	110	7.43	4254	1.7	14.1	8052	2.0	21.1	12088	4.6	33.6	19228	8.0	60.8	34821	7,5	9.8	98.1	56227	8.1	10.4
	120	8.10	4254	1.7	15.3	8052	2.1	22.4	11777	4.6	35.7	18732	7.9	66.3	34821	8.4	10.9	104	54778	8.1	10.4
	125	8.44	4254	1.7	16.0	8052	2.1	23.1	11633	4.6	36.7	18504	7.9	69.1	34821	8.9	11.5	107	54112	8.1	10.4
9:1	126	8.56	4317	2.6	15.0	7509	2.6	22.0	11027	12.0	35.3	17634	15.0	68.4	34220	9.5	12.5	75.1	37545	14.1	18.0
	130	8.90	4317	2.5	15.5	7509	2.6	22.5	10904	12.0	36.0	17438	15.0	70.6	34220	9.8	12.9	76.8	37211	14.1	18.0
	140	9.59	4317	2.4	16.7	7509	2.7	23.7	10647	12.0	37.9	17076	15.0	76.0	34220	10.7	13.9	80.8	36362	14.1	18.0
	150	10.3	4317	2.3	17.9	7509	2.8	24.9	10453	12.0	39.8	16725	15.0	81.3	34163	11.5	14.9	84.8	35625	14.1	18.0
	160	11.0	4317	2.2	19.1	7509	3.0	26.0	10265	12.0	41.6	16383	15.0	85.1	33504	11.5	15.0	88.7	34846	14.1	18.0
	170	11.6	4317	2.2	20.3	7509	3.1	27.1	10059	12.0	43.5	16114	15.0	88.8	32923	11.5	15.0	92.6	34313	14.1	18.0
	180	12.3	4317	2.2	21.4	7509	3.2	28.3	9906	12.0	45.3	15843	15.0	92.4	32344	11.5	15.0	96.4	33750	14.1	18.0
	190	13.0	4317	2.2	22.6	7509	3.3	29.4	9740	12.0	47.0	15572	15.0	96.0	31826	11.5	15.0	100	33203	14.1	18.0

Nom Ratio †	Output Speed rpm ‡	DRIVE SIZE 5315 Hp ●	5315 Output Torque (lb-in) ■	5315 Min HSS Sheave Pitch Dia ♦ w/o Shaft Fan (in.)	5315 Min HSS Sheave Pitch Dia ♦ with Shaft Fan (in.)	5407 * Hp ●	5407 * Output Torque (lb-in) ■	5407 * Min HSS Sheave Pitch Dia ♦ w/o Shaft Fan (in.)	5407 * Min HSS Sheave Pitch Dia ♦ with Shaft Fan (in.)	5415 Hp ●	5415 Output Torque (lb-in) ■	5415 Min HSS Sheave Pitch Dia ♦ w/o Shaft Fan (in.)	5415 Min HSS Sheave Pitch Dia ♦ with Shaft Fan (in.)	5507 Hp ●	5507 Output Torque (lb-in) ■	5507 Min HSS Sheave Pitch Dia ♦ w/o Shaft Fan (in.)	5507 Min HSS Sheave Pitch Dia ♦ with Shaft Fan (in.)	5608 Hp	5608 Output Torque (lb-in) ■	5608 Min HSS Sheave Pitch Dia ♦ w/o Shaft Fan (in.)	5608 Min HSS Sheave Pitch Dia ♦ with Shaft Fan (in.)
25:1	5	5.72	72122	7.0	7.0	8.52	107421	7.0	7.0	11.1	140422	8.0	8.0	17.5	220560	8.0	8.0	25.9	325993	9.5	10.1
	7	8.01	72092	7.0	7.0	11.9	107366	7.0	7.0	15.6	140348	8.0	8.0	24.5	220423	8.0	8.0	36.2	325765	9.5	10.2
	10	11.4	72046	7.0	7.0	17.0	107286	7.0	7.0	22.3	140238	8.0	8.0	34.9	220219	8.0	8.0	51.6	325423	9.5	10.2
	15	17.1	71968	7.0	7.0	25.5	107152	7.0	7.0	33.3	140054	8.0	8.0	52.3	219879	8.0	8.0	77.3	324853	9.5	10.2
	20	22.8	71891	7.0	7.0	34.0	107018	7.0	7.0	44.4	139869	8.0	8.0	69.7	219538	8.0	8.0	103	324283	9.5	10.2
	25	28.5	71813	7.0	7.0	42.4	106883	7.0	7.0	55.4	139684	8.0	8.0	86.9	219917	8.0	8.0	128	323713	9.5	10.1
	30	34.1	71736	7.0	7.0	50.8	106749	7.0	7.0	66.4	139500	8.0	8.0	104	218857	8.0	8.0	154	323143	9.5	10.1
	35	39.8	71659	7.0	7.0	59.2	106614	7.0	7.0	77.4	139315	8.0	8.0	123	218516	8.0	8.0	179	322573	9.5	10.1
	40	45.4	71581	7.0	7.0	67.6	106480	7.0	7.0	88.3	139130	8.0	8.0	138	218176	8.0	8.0	204	322003	9.5	10.2
	50	56.7	71427	7.0	7.0	84.3	106212	7.0	7.0	110	138762	8.0	8.0	173	217495	8.0	8.0	253	318702	9.5	12.0
	60	67.9	71272	7.0	7.0	101	105604	7.0	7.0	132	138393	8.0	8.0	206	216813	8.0	8.0	299	314493	10.0	14.0
	70	79.0	71118	7.0	7.0	116	104709	7.0	7.0	153	137878	8.0	8.0	240	216132	8.0	8.0	345	310283	11.4	16.1
14:1	71	80.1	71102	11.0	13.3	112	99193	7.0	8.5	155	137987	8.0	12.3	243	216064	8.3	16.2	294	261388	9.5	12.0
	80	90.1	70963	12.4	14.9	126	99193	7.0	8.5	175	137654	8.0	12.2	273	215452	9.0	16.1	332	261388	9.5	13.0
	90	101.1	70808	14.2	17.0	142	99193	7.0	8.5	196	137286	8.0	12.2	307	214771	9.8	16.1	373	261388	10.0	14.2
	100	110	69525	15.0	18.0	157	99193	7.0	8.5	217	136916	8.0	12.2	335	211443	10.2	15.8	415	261388	10.8	15.3
	110	118	67577	15.0	18.0	173	99193	7.0	9.0	238	136547	8.0	12.1	359	205482	10.2	15.4	456	261388	11.7	16.5
	120	125	65860	15.0	18.0	189	99193	7.0	9.6	259	136179	8.0	12.1	381	200188	10.2	15.0	498	261388	12.7	17.8
	125	129	65025	15.0	18.0	197	99193	7.0	9.9	270	135994	8.0	12.1	392	197750	10.2	14.8	518	261388	13.2	18.5
9:1	126	109	54286	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	130	111	53790	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	140	117	52594	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	150	123	51525	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	160	128	50554	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	170	134	49632	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	180	139	48781	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	190	145	48019	14.8	18.0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

★ Refer 5507J14 with backstop applications to the Factory.
† Maximum output speed per nominal ratio based on 1750 input rpm.
‡ Refer to Manual 377-114 for maximum output speeds and vertical mounting.
● Check required up (without service factor) against the application adjusted thermal capacity.
■ Convert required torque (without service factor) to hp and check against the application adjusted thermal capacity.
♦ Values are for V-belt drives and load applied one shaft diameter from seal cage or fan if so equipped. For minimum sheave diameters for other axial locations, refer to load location factor table in Selection Guide 371-110. Multiply values by 0.66 when using timing belt or chain drives.
* 5215J09 backstop torque limit 34220 lb-in, 5407J14 backstop torque limit 99193 lb-in.

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Fax: 55-51-579-8029

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LATIN AMERICA
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Phone: 1-414-643-2366
Fax: 1-414-643-3222
E-mail: international2@rexnord.com

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Queretaro, Qro.
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Fax: 52-.442-218-1090

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(1-866-739-6673)
Fax: 1-614-675-1898
E-mail: rexnordcs(state)@rexnord.com
Example: rexnordcsohio@rexnord.com

ALL COUNTRIES NOT LISTED
Rexnord International
Milwaukee, Wisconsin
Phone: 1-414-643-2366
Fax: 1-414-643-3222
E-mail: international1@rexnord.com

REXNORD

Rexnord Industries, LLC - Geared Products Group, 3001 West Canal Street, Milwaukee, WI 53208-4200 USA
Phone: 414-342-3131 Fax: 414-937-4359

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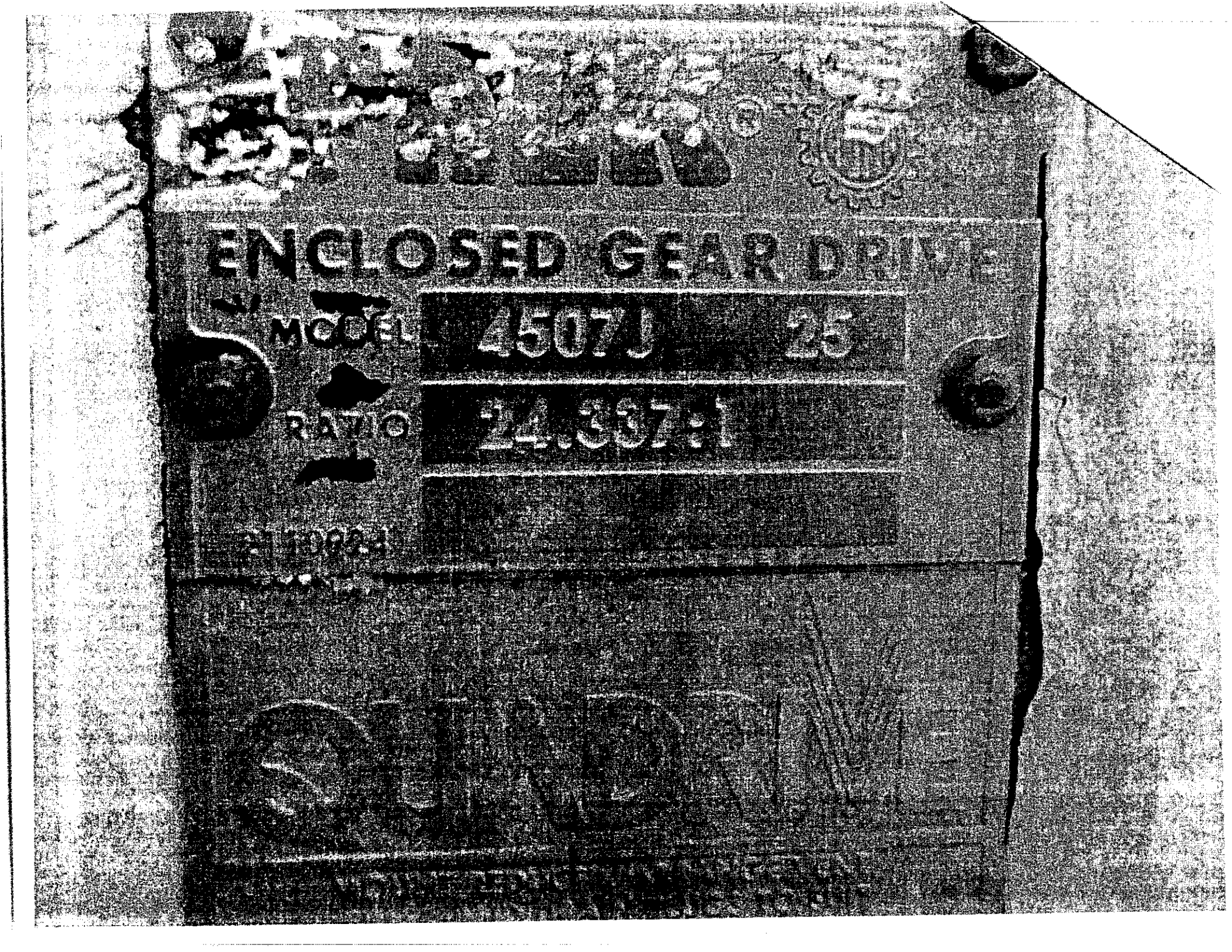
ENCLOSED GEAR DRIVE
MODEL
RATIO

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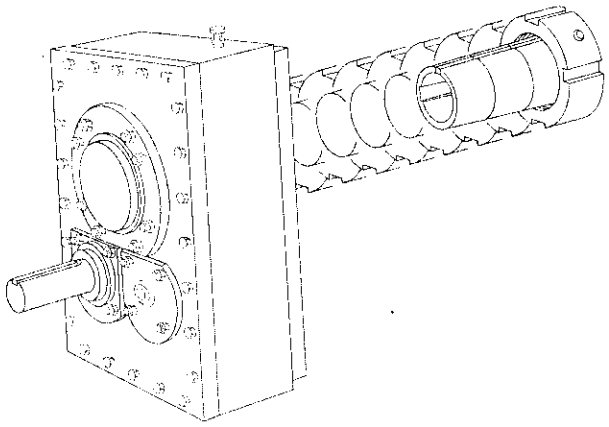

Rexnord Industries, LLC, Gear Group.
3050 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

Introduction

WARRANTY

Rexnord Industries, LLC (the "Company") warrants that Quadrive Shaft Mounted gear drives (I) conform to Company's published specifications, and (II) are free from defects of material for three years from the date of shipment.

Company does not warrant any non-Company branded products or components (manufacturer's warranty applies) or any defects in , damage to, or failure of products caused by: (I) dynamic vibrations imposed by the drive system in which such products are installed unless the nature of such vibrations has been defined and accepted in writing by Company as a condition of operation; (II) failure to provide suitable installation environment; (III) use for purposes other than those for which designed, or other abuse or misuse; (IV) unauthorized attachments, modifications or disassembly, or (V) mishandling during shipping.

WARNING: *Consult applicable local and national safety codes for proper guarding of rotating members.*
Lock out power source and remove all external loads from drive before servicing drive or accessories.

CAUTION: *Do not weld the drive housing or accessories without prior approval from Rexnord Gear Group. Welding on the drive may cause distortion of the housing or damage to the bearings and gear teeth. Welding without prior approval will void the warranty.*

DRIVE RATING — Operate the drive only within the horsepower and output speed for which it was selected and specified in Selection Guide 371-110 for the application. Refer to the nameplate for drive size, ratio and data.

FACTORY REPAIR AND REBUILD — Falk/Renew wants to continue to be your primary supplier, and extend our service to you if your equipment is in the need of repair or replacement.

We are able to furnish a fast turn-around on both the quotation and rebuild. Nobody can do the job better than Falk. If you need repair on Falk products . . . just ask.

Contact your local Rexnord account executive or Rexnord-Falk Distributor for more information.

Rexnord Industries, LLC, Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
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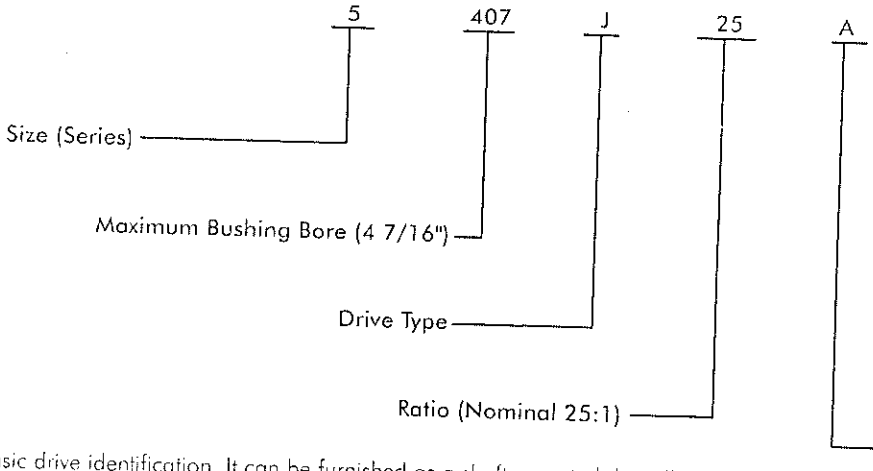
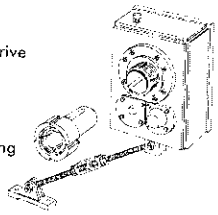
Drive Identification



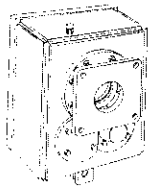
J is the basic drive identification. It can be furnished as a shaft mounted drive JR; a flange mounted drive JF; or a screw conveyor drive JSC(Size 5407 only), as illustrated below. These unique identifiers, JR, JF & JSC, are used throughout this manual to assist you in identifying the instructions which apply to your drive arrangement.

(JR) Shaft Mounted Drive



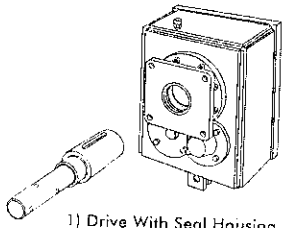
1) Drive
2) Torque Arm
3) TA Taper Bushing

(JF) Flange Mounted Drive



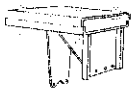
1) Drive With Flange
TA Taper Bushing Optional

(JSC) Screw Conveyor Drive(Size 5407 only)



1) Drive With Seal Housing
2) Drive Shaft

+ Motor Mounts



+ Backstops

+ Shaft Cooling

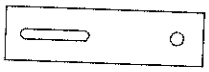
+ Electric Cooling

+ Vertical Standpipe

+ Trough Ends

+ Thrust Plate Kits

+ V-Belt Guards



+ TA Removal Tool

NOTE: Use a TA-Taper bushing when mounting these drives on a straight driven shaft (hollow shaft is taper bored).

Section I

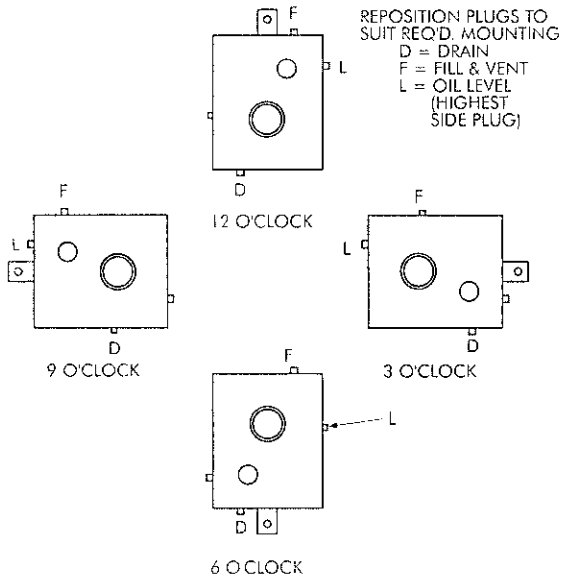
Drive Installation

Outfitting

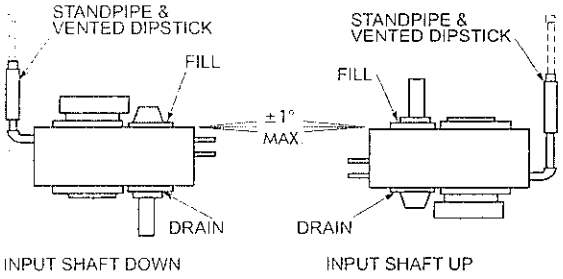
1. JR, JF & JSC — Find the desired mounting position in Figure 1 and install air vent and magnetic drain plug (packaged separately with drive). Also note and/or mark the oil level plug location OR in the case of a vertical mounting, refer to Appendix E, for installation of vertical stand pipe. If the mounting angle exceeds the limitations shown in Figure 1, refer to Appendix F, to determine modifications necessary within the limits illustrated therein. DO NOT fill drive with lubricant at this time.

2. JR — The tapered bore hollow shaft is designed for use with a TA Taper bushing for mounting on a driven shaft with a straight outside diameter. Shaft tolerances for driven shafts are shown in Table 1. The minimum and maximum driven shaft engagements, dimension N in Figure 2, are shown in Table 2. The minimum engagement is necessary for full bushing engagement; the maximum engagement is only required if a thrust plate will be employed to remove the drive from the driven shaft (See Appendix C for preferred removal method).

Figure 1 HORIZONTAL DRIVES



VERTICAL DRIVES



ANGULAR LIMITS FOR HORIZONTAL MOUNTING (ALL CLOCK POSITIONS)

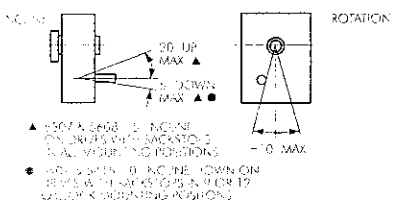


TABLE 1 — Driven Shaft Tolerances ★

Shaft Diameter — Inches		Max Undersize (Inches)
Over	Thru	
2.500	4.000	.006
4.000	6.000	.007
6.000	7.000	.008

★ Millimeters - h10 tolerance.

Figure 2

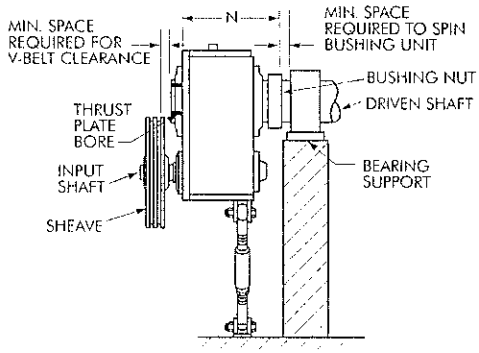


TABLE 2 — N Dimension †

DRIVE SIZE	Minimum Inches (mm)	Maximum Inches (mm)
5407	8.38 (213)	12.40 (314)
5415	10.33 (263)	13.44 (341)
5507	10.66 (271)	14.53 (369)
5608	12.75 (324)	16.35 (415)

† The minimum engagement is necessary for full bushing engagement; the maximum engagement is only if a thrust plate will be employed to remove the drive from the driven shaft.

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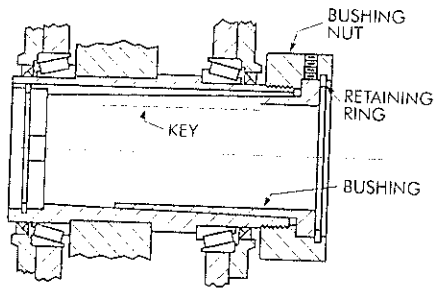
a. THIN WALL BUSHING (with keyway slot through the bushing wall) — With the driven shaft keyway at the 12 o'clock position, slide bushing assembly onto the driven shaft, nut end first, and position the keyway slot over the shaft keyway. The bushing may have to be opened slightly to assist in installation. Insert a screwdriver into the slot in the bushing and very lightly pry open until the bushing slides onto the shaft. Insert the drive key furnished with the bushing into the shaft keyway. Proceed to Step 6.



b. THICK WALL BUSHING (with separate internal and external keyways) — Insert the driven shaft key into the driven shaft keyway. If the driven shaft has an open-ended keyway, stake the keyway, Figure 3, to prevent axial dislocation of the shaft key under operating conditions. Slide the bushing assembly onto the driven shaft. The bushing may have to be opened slightly to assist in installation. Insert a screwdriver into the slot in the bushing and very lightly pry open until the bushing slides onto the shaft. Rotate the shaft so the external keyway in the bushing is at the 12 o'clock position. Insert the drive key, furnished with the bushing, into the keyway. Proceed to Step 6.

Figure 3

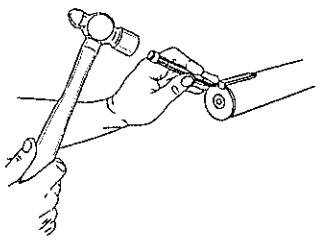
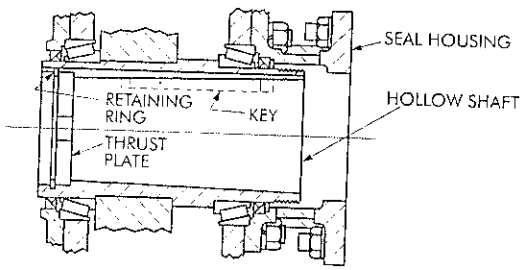


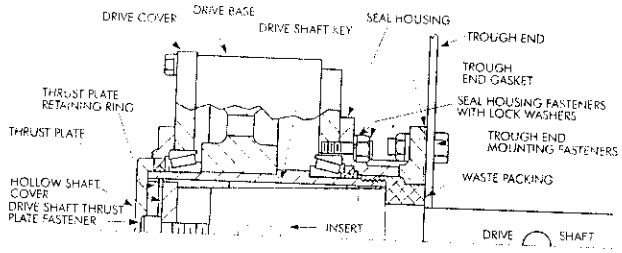
Figure 4



3. JSC(5407 ONLY) — Remove the output cover from the input side of the hollow shaft bore and save. Separate contents from the drive shaft kit. Install thrust plate and retaining ring in the hollow shaft, Figure 4. Insert key into drive shaft. Slide drive shaft thru the seal housing into the hollow shaft and insert the thrust plate fastener thru the thrust plate into the drive shaft. Tighten fastener to 792 lb-ft (1073 Nm). Reinstall hollow shaft cover. Continue outfitting based on the type of trough end seal to be installed: (a) Waste Packing Seal; or (b) Lip Seal.

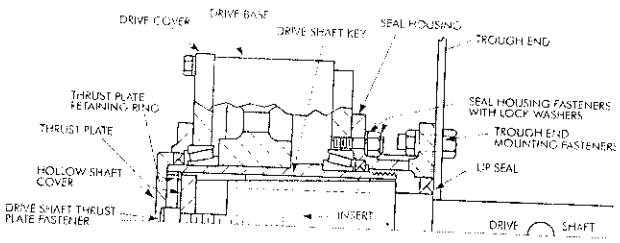
a. WASTE PACKING SEAL (Figure 5) — Pack seal housing with waste packing and proceed to Step 4.

Figure 5



b. LIP SEAL (Figure 6) — Coat outside diameter of seal with Permatex #3 or equivalent. Coat the seal lips with bearing grease. Carefully slide seal over drive shaft extension taking care to not damage the seal lips. Drive seal into seal housing with the spring loaded seal lip toward the trough end side of the seal housing, flush with the seal housing. Proceed to Step 4.

Figure 6



4. JSC — Fasten the trough end to the seal housing using the hex head cap screws included in the drive shaft kit. Refer to Table 3 for torque value. Proceed to Step 6.

TABLE 3 — 5407JSC Trough End Fastener Size & Tightening Torque (Non-lubricated Fasteners)

Drive Shaft Diameter	3.000 & 3.437
Fastener Size	.750-10UNC
Tightening Torque, lb-ft (Nm)	245 (332)

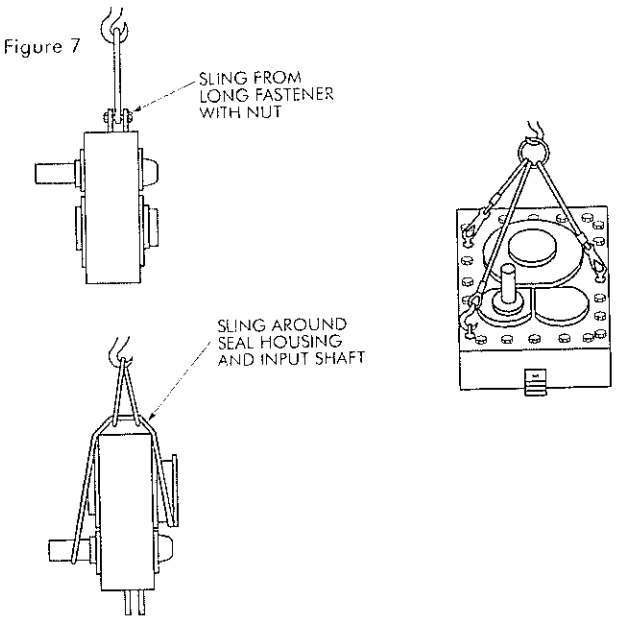
5. JF — (NOTE: If the driven shaft has not been machined to Falk's taper bore specifications per Manual 377-140 and a straight shaft is to be utilized, refer to Manual 377-144 for instructions).

   Install backstop prior to installation of drive (refer to Appendix B). Installation of internal backstops NOT Factory installed may require removal of mounting flange, Ref. #12. Remove cover from input end of hollow shaft bore and save. Install the thrust plate and retaining ring in the hollow shaft (refer to Figure 4). Proceed to Step 6.

Installation

6. JR, JF & JSC — Refer to Figure 7 for recommended lifting method. In order to sling JR & JF drives as illustrated, install the torque arm fastener in the torque arm anchor brackets. Sling the drive from the fastener as shown. For vertical installation, use (3) eyebolts as illustrated. Eyebolt sizes are 1/2" for 5407 thru 5507 and 3/4" for 5608. DO NOT remove sling until drive is secured to shaft. Before lifting the drive into position, rotate the high speed shaft until the hollow shaft keyway will be in position to line-up with the driven shaft key. JF proceed to Step 11; JSC to Step 12.

Figure 7



7. JR — If the drive was received with a backstop installed, the backstop must be temporarily removed to facilitate mounting. Refer to Section II, Step 10 for backstop removal instructions. Proceed to Step 8.

8. JR — Lift the drive into position and slide onto the drive shaft taking care that the driven shaft key seats into the hollow shaft keyway. DO NOT hammer or use excessive force. Refer to Figure 8 for installation of the torque arm. The exact position of the torque arm may vary within the range shown. For torque arm mountings other than shown, refer to Factory. If it is necessary to shorten the torque arm assembly, cut the excess from either tie rod end.

   The support to which the clevis bracket is to be fastened must sustain the torque reaction shown in Table 4. The maximum load reaction through the torque arm occurs when the torque arm is located in the extreme off angle position. Use Grade 5 fasteners to anchor the clevis bracket; refer to Table 5 for the fastener size and tightening torque.

   Bolt the torque arm to both the clevis bracket and the drive anchor bracket and tighten the bolts until seated against the brackets. DO NOT bend the bracket as clearance between the clevis brackets and tie rod is necessary.

Figure 8 — Torque Arm Mounting Positions
6 O'Clock Mounting Position Shown

DRIVE SIZE	A
5407-5507	30
5608	25

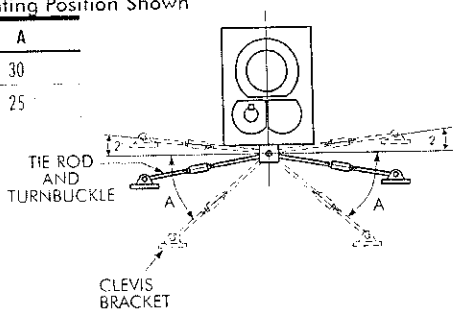


TABLE 4 — Load Reaction Through Tie Rod

DRIVE SIZE	5407	5415	5507	5608
Load ★, lb	21840	26120	32940	40930
Load ★, (N)	(97130)	(116170)	(146500)	(182060)

★ Load includes moment due to motor and motor mount with torque arm at maximum angle.

TABLE 5 — Tie Rod Clevis Bracket Fastener Tightening Torque

DRIVE SIZE	Fastener † Size	Tightening Torque — lb-ft (Nm) Steel Foundation	Concrete Foundation
5407	1.000-8UNC	567 (768)	467 (633)
5415	1.250-7UNC	1050 (1424)	867 (1175)
5507	1.250-7UNC	1050 (1424)	867 (1175)
5608	1.250-7UNC	1050 (1424)	867 (1175)

† Grade 5 fasteners required

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3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

9. JR — Thread the bushing nut onto the hollow shaft one to two turns. NOTE: The bushing nut threads have been coated with an anti-seize compound at the Factory. This compound should not be removed. Before re-installing a previously used nut, recoat the nut threads only with an anti-seize compound. KEEP THE TAPERED SURFACE OF THE BUSHING AND HOLLOW SHAFT BORE FREE FROM ALL ANTI-SEIZE OR LUBRICATING COMPOUNDS.

   WARNING: Overtightening can fail the internal retaining ring. (See Appendix G, for listing of retaining rings).

   a. PREFERRED METHOD — Use a spanner, chain or pipe wrench to tighten the bushing nut to the torque value indicated in Table 6. Apply Loctite 243 or equivalent to threads of setscrews. Tighten the setscrew on the bushing nut to 19 lb-ft (26 Nm) torque.

   b. ALTERNATE METHOD (TO BE USED WHEN EXACT TORQUE CAN NOT BE MEASURED.) — Use a spanner (Table 6), chain or pipe wrench to tighten the bushing nut just until the drive can no longer be moved by hand axially on the driven shaft. Loosen nut ONLY until it can be turned by hand but do not unseat the taper. Retighten the nut hand tight. Now mark a spot on the bushing nut. Next mark a spot on the driven shaft 180° from the first mark. Use the spanner wrench to tighten the nut until the two marks are aligned i.e., one half turn. Apply Loctite 243 or equivalent to threads of setscrews. Tighten the setscrew on the bushing nut to 19 lb-ft (26 Nm) torque.

TABLE 6 — Spanner Wrench Type and Spanner Nut Tightening Torque

DRIVE SIZE	Adjustable Hook Spanner Wrench		Spanner Nut Tightening Torque lb-ft (Nm)
	Armstrong Tools	Williams	
5407	34-313 6 1/8"-8 3/4"	474B	333 (452)
5415	34-313 6 1/8"-8 3/4"	474B	333 (452)
5507	73-213 ★	CT-15-2 ★	400 (542)
5608	73-213 ★	CT-15-2 ★	400 (542)

★ These are chain wrenches where standard spanner wrenches are not available

10. JR — Install backstop, motor mount, motor, sheaves (mount sheaves as close to the drive and motor housing as possible), belts and guard. Refer to Appendix D for motor mount installation instructions. Proceed to Step 13.

11. JF (USING TAPERED DRIVE SHAFT) — Put key into the driven shaft. Lift drive into position and slide onto the driven shaft taking care that the driven shaft key seats into the hollow shaft keyway. DO NOT hammer or use excessive force. Secure the drive to the foundation with fasteners using torque values shown in Table 7. Next, secure the drive to the shaft with the thrust plate fastener. Refer to Table 8 for torque value. Reinstall the hollow shaft cover. Install motor mount, motor, sheaves, belts and guard. Refer to Appendix D for motor mount installation instructions. Proceed to Step 14.

12. JSC (5407 ONLY) — Assemble drive to trough and install drive shaft coupling bolts per screw conveyor manufacturer's instructions. Install motor mount, motor, sheaves, belts and guard. Refer to Appendix D for motor mount installation instructions. Proceed to Step 14.

13. JR — When the torque arm turnbuckle is used for belt tension adjustment, position the motor so that the belt pull will be about 90° to a line through the drive input shaft and hollow shaft as shown in Figure 9. For drives where the motor is moved to adjust belt tension, mount the motor slide base so that the belt tension adjustment is approximately parallel to the belt centers. Refer to Appendix D, for instructions relative to alignment of sheaves and belts. Proceed to Step 14.

TABLE 7 — JF and JSC Drives — Foundation Fastener & Tightening Torque

(Non-Lubricated Fasteners)

DRIVE SIZE	Fastener Size & Grade	Torque lb-ft (Nm)
5407	.750-10UNC, Gr. 5	245 (323)
5415	1.250-7UNC, Gr. 5	1050 (1424)
5507	1.250-7UNC, Gr. 5	1050 (1424)
5608	1.500-6UNC, Gr. 5	1842 (2497)

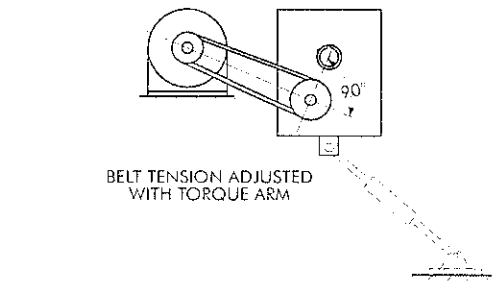
TABLE 8 — Thrust Plate Fastener Data

(Non-Lubricated Fasteners)

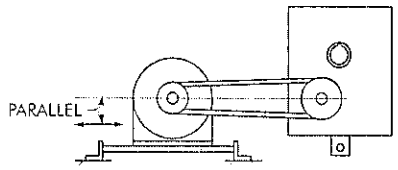
DRIVE SIZE	Fastener Size & Grade ★	Torque lb-ft (Nm)	Minimum Thread Depth-Inches (mm)
5407	1.000-8UNCx4.00, Gr. 8	792 (1073)	2.75 (69,8)
5415	1.250-7UNCx4.00, Gr. 8	1596 (2164)	2.50 (63,5)
5507	1.250-7UNCx4.00, Gr. 8	1596 (2164)	2.50 (63,5)
5608	1.250-7UNCx4.00, Gr. 8	1596 (2164)	3.00 (76,2)

★ Fastener lengths given are for applications using tapered drive shafts. Other lengths may be needed for applications using tapered bushings.

Figure 9



BELT TENSION ADJUSTED WITH TORQUE ARM



BELT TENSION ADJUSTED WITH MOVABLE MOTOR

Lubrication

CAUTION: DRIVES SHIPPED WITHOUT OIL.

14. JR, JF & JSC — Refer to Appendix A for selection of lubricant. Refer to Table 9 for approximate oil capacity of drives.

15. JR, JF & JSC — HORIZONTAL MOUNTING

Remove air vent and oil level plug (Refer to Step 1). Fill the drive until oil shows in the oil level hole. Coat the air vent and plug threads with Permatex #3 or equivalent thread sealant before replacing.

JRV, JFV & JSCV — (VERTICAL MOUNTING) - Refer to Figure 1, Step 1.

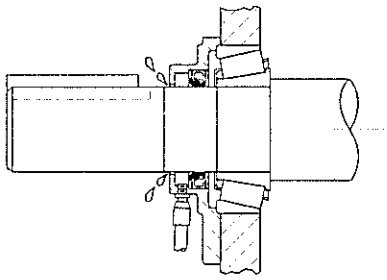
Remove the fill plug and fill with oil to level marked on the dipstick.

Coat the plug threads with Permatex #3 or equivalent thread sealant before replacing.

If stand pipe is used as oil fill, the intermediate cover plug must be removed to eliminate entrapped air.

16. JR, JF & JSC — Where applicable, WITH A HAND GREASE GUN, pump grease into the input seal cover, Figure 10, until the grease appears at the shaft. Wipe off excess grease from the shaft. DO NOT use grease where it could contaminate the product e.g., foods, drugs etc.

Figure 10



Start Up

17. JR, JF & JSC — Before operating the drive, check for any fasteners, pipe plugs, air vent, etc. which may have been loosened in the course of Outfitting, Installing and Lubricating the drive, to be sure that they have been properly retightened. Check correct rotation of motor & backstop and be sure drive is properly lubricated. After one week of operation repeat check of all external fasteners and pipe plugs.

18. After one month of operation:

a. Operate the drive until the sump oil reaches normal operating temperature. Shut the drive down and drain immediately.

b. Immediately flush the drive with an oil of the same type and viscosity grade as the original charge (warmed to approximately 100°F (38°C) in cold weather). Rapidly pour or pump a charge equal to 25-100% of the initial fill thru the drive, or until clean oil flows thru the drain.

c. Close the drain and refill the drive to the correct level with new or reclaimed oil of the correct type and viscosity. If determined to be in good condition by the supplier, drain oil may be reused if it is filtered thru a 100 micron or finer filter.

TABLE 9 — Approximate Oil Capacity ★

DRIVE SIZE	JR, JF & JSC Gallons (Liters)	JRV & JFV Gallons (Liters)
5407	4.3 (16,3)	6.3 (23,8)
5415	7.0 (26,5)	9.5 (36,0)
5507	10.3 (39,0)	13.3 (50,3)
5608	12.0 (45,4)	19.5 (73,9)

★ Quantities are approximate. Always fill drive to specified level.

Rexnord Industries, LLC, Gear Group.
3001 W. Canal St., Milwaukee, WI 53208-4200 USA Telephone: 414-342-3131
Fax: 414-937-4359 e-mail: info@rexnord.com web: www.rexnord.com

Section II

Drive Service & Repair

Preventive Maintenance

PERIODICALLY — Carefully check the oil level of the drive when it is stopped and at ambient temperature, add oil if needed. If the oil level is above the specified level, have the oil analyzed for water content. Moisture in the oil may indicate seal leakage or condensation. If so, correct the defect immediately and change the oil. DO NOT overfill or oil leakage may result. On vertical shaft drives, remove fill plug before filling or checking oil level. If a drive is equipped with a fan, periodically clean accumulated foreign matter from the fan and fan guard to allow adequate air flow.

GREASE PURGED SEALS — Periodically (at least every six months), depending upon the frequency and degree of contamination, purge contaminated grease by slowly pumping fresh bearing grease through the seal cage WITH A HAND GREASE GUN until fresh grease flows out along the shaft. Wipe off the purged grease. Refer to Appendix A.

Oil Changes

PETROLEUM LUBRICANTS — For normal operating conditions, change gear oil every six months or 2500 operating hours, whichever occurs first. If the drive is operated in an area where temperatures vary with the seasons, change the oil viscosity grade to suit the temperature. Where applicable, grease seals when changing oil. Refer to Appendix A.

SYNTHETIC LUBRICANTS — Synthetic lube change intervals can be extended to 8000-10,000 hours depending on operating temperatures and lubricant contamination. Laboratory analysis is recommended for optimum lubricant life and drive performance. Change lube with change in ambient temperature, if required. Refer to Appendix A.

Stored & Inactive Drives

NEW DRIVES WHICH HAVE NOT BEEN OPERATED — Each drive is spin tested with a rust preventive oil that will protect internal parts against rust for a period of 4 months in an outdoor shelter or 12 months in a dry building after shipment from the Factory.

If a drive is to be stored or inactive beyond the above periods, spray all internal parts with a rust preventive oil that is soluble in lubricating oil or add 1 ounce of "Motorstor ★" vapor phase rust inhibitor oil. Seal air vent immediately with pressure sensitive tape.

Before operating drives which have been stored or inactive, remove tape and fill to the proper level with oil meeting specifications given in the Lubrication Recommendation found in Appendix A.

★ Product of the Daubert Chemical Company, Chicago, Illinois. (Formerly known as "Nox-Rust")

SHUTDOWN OF NEW OR EXISTING DRIVES WHICH HAVE BEEN OPERATED — If a drive is to be stored or inactive for more than 2 months after a period of operation, add 1 ounce of "Motorstor ★" to the oil sump and immediately seal the air vent with pressure sensitive tape. It is not necessary to drain the oil prior to storage if oil is still serviceable and not contaminated.

Before operating drive, remove tape and check oil level.

PERIODICALLY INSPECT STORED OR INACTIVE DRIVES AND SPRAY OR ADD RUST INHIBITOR EVERY SIX MONTHS, OR MORE OFTEN IF NECESSARY. INDOOR DRY STORAGE IS RECOMMENDED.

Drives Ordered for Extended Storage can be treated at the Factory with a special preservative and sealed to rust-proof parts for periods longer than those stated above, if specified on the order.

Repair & Replacement

WARNING: Consult applicable local and national safety codes for proper guarding of rotating members.
Lock out power source and remove all external loads from drive before servicing drive or accessories.

NOTE: Only the seals on the input side (See Figure 12) of 5407-5507 drives and high speed shaft seals of the 5608 drive can be replaced without removing the drive from the driven equipment. All other repairs require removal of the drive from the driven equipment. Proceed to Step 1 for drive removal. Proceed to Step 5 for replacement of seals.

Removal of Drive

See note above if only seal replacement is intended.

1. JR, JF & JSC — Drain the lubricant at this time. Remove safety guards and belts (motor and motor mount, optional). Remove backstop. Refer to Section II, Step 10, for backstop removal instructions.

WARNING: Drive must be supported during removal process. Use a sling around the motor mount or as recommended in Section I, Step 6. Take up the slack in the sling before proceeding.

INTEROFFICE MEMORANDUM

TO: W.A. O'RIORDAN **DATE: October 30,1995**

FROM: M.F.JUSEK MFJ.

SUBJECT: BLENDER SELECTION

Bill,

I am recommending the purchase of a SCOTT Plow mixer, for our Blending operation, at the Hopkins #123 facility. The decision to switch from Patterson-Kelley, "V" blenders is based on the evaluation of both makes. P/K's production history, at STERIS, was weighed against the information and test blends performed on the SCOTT. Attached are two sheets , illustrating some key points of the evaluation. Initial purchase prices are similar, but,ongoing operation costs with the SCOTT are substantially lower.

- Performance capabilities will be nearly double, compared to the P/K.
- All blending "action" takes place INTERNALLY, versus the full shell rotation of the P/K . This is a distinct Safety factor and a cost savings, as there is no need for a full, three- sided mezzanine. A commercial, heavy- duty, rolling platform will work.
- Liquid feed is provided by five spray nozzles that perform liquid feed in approximately 1/10th the time and disperse a uniform spray over the powders.
- SCOTT does not have a intensifier bar, eliminating the need to remove and maintain this heavy item from the blender. This is also a cost savings as a replacement, or spare, bar ($18,000) is not required.
- Fewer moving parts decrease the "spare parts inventory".

STERIS Corporation
Blender justification
October 1995

ITEM	75 CU. FT. SCOTT / PLOW MIXER	75 CU. FT. PATTERSON-KELLEY "V"
BLEND QUALITY	passed Q.A. testing at Plant #23 Lab. All parameters, in spec.	Acceptable - currently used at Plant #23.
COST - items listed indiviually.		
MIXER	$114,786	$105,359.00
CONTROLS	N/C	N/C
SANITARY CLEAN-OUT VALVE.	$1,200	N/A
MOTOR STARTERS	STERIS to supply	STERIS to supply
	$115,986	$105,359
SPARE PARTS		
INTENSIFIER BAR	N/A	$18,000
CHOPPER BLADES-set	$450	$200
BEARINGS-main	$1,977	$1,450
SEALS	$155	$175
V-BELTS	$35	$57
TOTAL	$118,603	$125,241
PERFORMANCE		
BLEND TIME (estimates)	15-20 min. run time	85-90 min. run time
TOTAL estimated time, incl'dg. weigh/charge/ liquid feed and discharge	1.1 hrs.	2.15 hrs.
# of batches, per 7.5 hours.	6.82 *	3.49 *
#batches = _____ cases	3600/shift	1800/shift

* fractional time would accomodate "clean-up" time.

NOTE: times for both, are based on the use of a Vacuum weigh/transfer system (approximately $75,000) currently being quoted for proposal.

SAFETY/ERGONOMICS		
Blending Action	All internal SAFETY GATE- NOT REQ'D.	Intensifier bar - internal "V" shell - rotates externally. SAFETY GATE- REQUIRED
Access	Vacuum to top hatch - approx. height is 8-9 ft., located at center of mixer. 4.5 ft.platform will be ordered.	Vacuum to hatch - approx. height is 9-10 ft. Access from mezzanine duplicate of Plant #23.
Agitator maintenance	Access hatches in front of unit. Agitator shaft is "fixed". Blades on shaft are replaced,as needed.	Access through "V" hatches. Remove 2 piece bar (60lbs.ea.)
Clean-Up	Spray into hatches, from ground level. Run water thru liquid mix system and spray nozzles. Turn on mixer for wash and dispense.	Spray into hatches, from mezzanine. Attach hose to liquid feed, run hot water and activate intensifier bar.

OPERATIONAL SPECIFICATIONS
BLENDER/MIXER PROCESS

The following items are essential specifications that a Blender/Mixer must meet, for consideration of purchase, by STERIS Corporation. These are to be considered, minimum acceptance criteria, and must be met (or a equivalent alternative noted) in the Vendors quote.

- Stainless steel shell. Internal finish: Satin / Semi-lustre polished finish, all weld seams ground smooth. External finish: Stainless steel, glass-beaded finish, with weld seams cleaned and wire brushed. ALL corners, inside shell, will be radiused.
- Shell and entire system is capable of handling materials with bulk density of 100 lbs. per square foot.
- Working capacity of system is 75 cu. ft.
- All parts, inside shell, will be stainless steel ; or, proved to be chemically resistant to STERIS ingredients.
- Seals and all internal moving parts shall be addressed, in regard to, protection from excessive chemical build-up .
- System is equipped to distribute liquid feed, in a uniform manner, throughout the shell. All fittings, nozzles and hardware to attach liquid line to be listed.
- Air feed items to be located in a safe location, away from operator traffic.
- Access covers large enough to permit loading, manually, of 50 lb. bags and for safe, easy clean-out.
- Motor - Explosion proof TEFC; 460 volt/ 3 phase.
  Drive - All belts and gear drive systems will be guarded.
- Discharge location must be , a minimum, of 38" from floor level.
- Product inlet shall be accomodating to pneumatic conveying.
- A representative mixer/blender (demo) will produce a STERIS blend, within all acceptable Q.A. specifications. Test report to be furnished.

cont'd.

952-758-0120
ROGER

PLOW MIXER PARTS LIST

COMPANY NAME:	STERIS CORPORATION
SCOTT JOB #	96-21
MACHINE TYPE AND SIZE:	48 x120 PLOW MIXER
MODEL #	PL4810
SERIAL #	9602009
BEARINGS	
DRIVE END BEARING:	MEITHER SAF-XT 5 15/16" P.B.B. NICKEL PLATED
IDLE END BEARINGS:	MEITHER SAF-XT 5 15/16" P.B.B. NICKEL PLATED
PLUG GATE BEARINGS:	DODGE SCM 2 1/2" 4 BLT FLANGE NICKEL PLATED
DRIVE ASSEMBLY	
MOTOR:	MARATHON 125HP EXP. PROOF 3ph/460v/60hz
REDUCER:	FALK 4507JR25
REDUCER BUSHING:	FALK BU4507J-5.438
FLUID COUPLING:	FALK 1-420-HFN-41
DRIVE SHEAVE:	6G-5V10.90 W/E 3 3/8" BUSHING
DRIVEN SHEAVE:	6G-5V12.50 W/F 2 3/4" BUSHING
BELTS:	6-5VX1250
AIR SYSTEM	
AIR CYLINDER:	NOPAK MOD E CLASS I 4X14
SOLENOID VALVE:	NUGGET 200
FILTER-REG.-LUB.	NORGREN COMBO
PARKER AIR VALVE	PL50
LIMIT SWITCHES:	ALAN-BRADLY ABC-871CC5A18
MISC: CHOPPER MOTORS	(3) MARATHON 3600 RPM 10HP C-FACE 3B215TTC57020A

SPARE PARTS

SCOTT BLENDER

PART NO.	DESCRIPTION	QUANTITY
5VX1250	6 — DRIVE BELT (GATES)(SUPER HC)	7
05-15	2 — SPINDLE (MIETHER SNW34)	2
22234	2 — BEARING (SKF CCK/C3W3)	2
LER-140	4 — SPACER	4
C-534-B	2 — PILLOW BLOCK (LOWER)(MIETHER)	2
SAF-534	2 — PILLOW BLOCK (UPPER)(MIETHER)	2
95-169	8 — MOUNTING BOLT (K-T 307B)	8
S4672	2 — LANTERN RING (5 15/16")	4
1347AF	20ft — ½" TEFLON ROPE (PALMETTO)(McMASTERCARR)	8 ft.
8630S1C28	2 — WHITE HIGH-GRADE FDA BUNA RUBBER 12"X24"	

RELAY	SQ D	KP12V20	(1)
RELAY	OMRON	LY4	(2)
RELAY	OMRON	MK3P5-S	(3)
POWER SUPPLY	A-B	EN 60204-1	(1)
MOTOR STARTER	CUTLER HAMMER	AN16DN0	(3)
MOTOR CIRCUIT PROTECTER	"	A302LN	(3)
TRANSFORMER	ACME	FS-2-2000	(1)
FUSE	FUSETRON	FNM-5	(8)
TIMER	CORUZET	TOP 948	(2)
SWITCH P.B. BLK	AB	800T-PT16	(1)
IL. LAMP (GREEN)	AB	800T-A	(1)
ROCKER SW. LOCKABLE	AB	194E-E80-1753	(1)
MOTOR CONTROLLER	DANFOSS	MCD 3000	(1)
CIRCUIT BREAKER	MOELLER	ZM-400-N2M-10-NA	(1)
MOTOR STATER	MOELLER	DIL-M185	(1)
TRANSFORMER	IMPERVITRAN	B250ST213JK	(1)
SWITCH	MOELLER	PK2M0-25	(1)
CIRCUIT BREAKER	MOELLER	FAZ-C4	(1)
RELAY	ACI	95L5A1203	(2)
BYPASS SW			(1)
SW PB	MOELLER		(2)

CHOPPER MOTOR	MARATHON	3B 215 TTCS 7024 CPL	(3)
PSI GAUGE 0-30	ASHCROFT	1X768 (GRANGER)	(8)
AIR REG.	SPEED AIR	42M15 (")	(8)
AIR FLOW GAUGE	~~SPEED AIR~~ DWYER	RMB-57-SSV	(5)
AIR FILTER	SPEEDAIR 42L50	42L350	(1)
NORPAK AIR CYL. (DUMP)	NORPAK	9602689-G	(1)
MAIN DRIVE MOTOR	MARATHON	2S444TTGS703CJTW	(1)
DRIVE BELT		6-5VX1250	

Equipment Report (Full List)

Steris Corp.

1/27/2004

Equipment No.	Scott Blender	Sott Blender	
Equipment Type	BLENDER	Person Responsible	
Serial No.	9602009	Location	Hopkins Facility
Model No.	PL4810	Sub-location 1	Plant 123
Priority		Sub-location 2	Blend Room
Operating Status		Sub-location 3	-
In Service	Yes		

Manufacturer	SCOTT	General Ledger No.	
Vendor ID	SCOTT	Asset No.	
Cost Center		Service Code	
Department	CHEM	User-defined Field 1	
Purchase Date		User-defined Field 2	
Startup Date		User-defined Field 3	
Warranty Expiration Date		User-defined Field 4	
Life (months)		User-defined Field 5	
Original Cost		User-defined Field 6	
Replacement Cost		User-defined Field 7	
Labor Cost	$0.00	User-defined Field 8	
Material Cost	$0.00	User-defined Field 9	
Spare-parts Code	SCOTT	User-defined Field 10	

ROW END.

Item No.	Description	Qty	Site
SCT05-15	Scott Spindle (Miether SNW34)	1.00	MAINTSTKCAGE
SCT1347AF	Scott Teflon Rope 1/2" (Palmetto)	8.00	MAINTSTKCAGE
SCT194E-E80-1753	Scott Power Switch (Lockable)	1.00	MAINTSTKCAGE
SCT1X768	Scott Air Pressure Gauge 0-30 PSI	8.00	MAINTSTKCAGE
SCT22234	Scott Bearing (SKF CCK/C3W3)	2.00	MAINTSTKCAGE
SCT2J444TTGS7036JTW	Scott Maine Drive Motor	1.00	MAINTSTKCAGE
SCT3B215TTCS70240PL	Scott Chopper Motor	3.00	MAINTSTKCAGE
SCT4ZL50	Scott Air Filter	1.00	MAINTSTKCAGE
SCT4ZM15	Scott Air Regulator	8.00	MAINTSTKCAGE
SCT6-5VX1250	Scott Drive Belts		MAINTSTKCAGE
SCT800T-A	Scott Lamp (Green) 800T-A	1.00	MAINTSTKCAGE
SCT800T-PT16	Scott Switch P.B. (Blk.) 800T-PT16	1.00	MAINTSTKCAGE
SCT95-169	Scott Mounting Bolt (K-T-307B)	8.00	MAINTSTKCAGE
SCT9568A1203	Scott Relay 9568A1203	2.00	MAINTSTKCAGE
SCT9602689-6	Scott Norpak Air Cylinder (Dump)	1.00	MAINTSTKCAGE
SCTA302LN	Scott Motor Circuit Protector	3.00	MAINTSTKCAGE
SCTAN16DN0	Scott Motor Starter AN16DN0	3.00	MAINTSTKCAGE
SCTB250BT213JK	Scott Transformer B250BT213JK	1.00	MAINTSTKCAGE
SCTC-534-B	Scott Pillow Block, Lower (Miether)	2.00	MAINTSTKCAGE
SCTDIL-M185	Scott Motor Starter (Moeller)	1.00	MAINTSTKCAGE
SCTEN60204-1	Scott Power Supply EN60204-1	1.00	MAINTSTKCAGE
SCTFAZ-C4	Scott Circuit Breaker (Moeller)	1.00	MAINTSTKCAGE
SCTFNM-5	Scott Fuse FNM-5	8.00	MAINTSTKCAGE
SCTFS-2-2000	Scott Transformer Acme FS-2-2000	1.00	MAINTSTKCAGE
SCTKP12V20	Scott Relay	1.00	MAINTSTKCAGE
SCTLER-140	Scott Spacer	4.00	MAINTSTKCAGE
SCTLY4	Scott Relay Omron LY4	2.00	MAINTSTKCAGE
SCTMK3P5-S	Scott Relay Omron MK3P5-S	3.00	MAINTSTKCAGE
SCTMLD-3000	Scott Motor Controler (Danfoss)	1.00	MAINTSTKCAGE
SCTPK2M0-25	Scott Switch (Moeller)	1.00	MAINTSTKCAGE
SCTRMB-57-SSV	Scott Air Flow Gauge (Dwyer)	5.00	MAINTSTKCAGE
SCTS4672	Scott Lantern Ring (5-15/16)	4.00	MAINTSTKCAGE
SCTSAF-534	Scott Pillow Block, Upper (Miether)	2.00	MAINTSTKCAGE
SCTTOP-948	Scott Coruzet Timer TOP-948	2.00	MAINTSTKCAGE
SCTZM-400-NZM-10-NA	Scott Circuit Breaker (Moeller)	1.00	MAINTSTKCAGE

Component Equipment No./Description

Safety Note

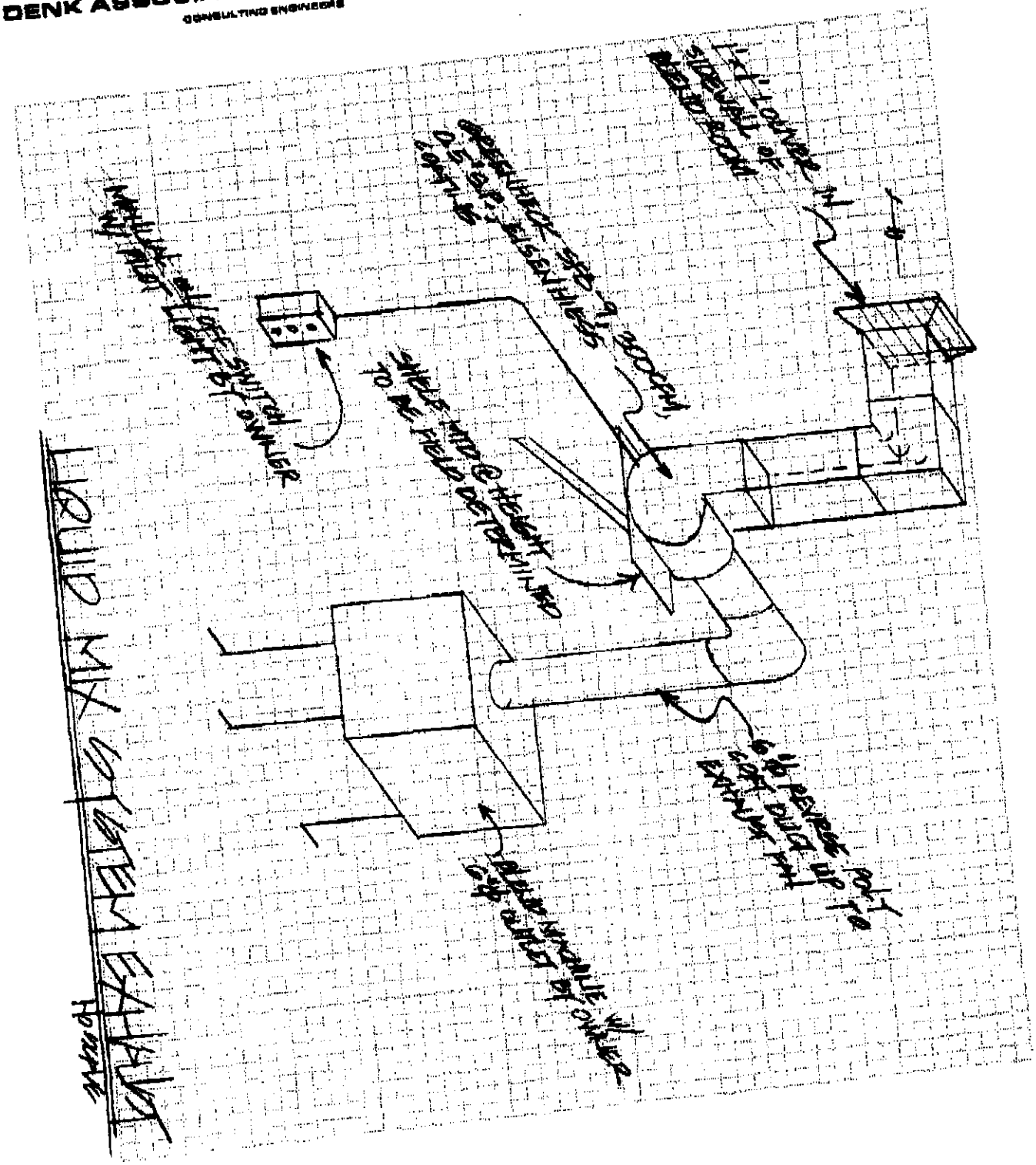
Nameplate Information

Additional items to purchase, for blender operations. These items are required, for either blender, except where noted.

ITEM	EST'D. COST - ea.	# required	TOTAL
PUMP-liquid fill	$800	2	$1,600
TUBING-liquid fill * 1 Box = 12 mo. supply	300	1	300
ST.STEEL TANK	1,400	1	1,400
SCALE	12,000	1	12,000
ST. STEEL PANS	80	4	320
PLASTIC TOTES -21 cu.ft. * * due to increased ,floor to discharge heighth, of SCOTT...larger sized totes are being pursued.	888	36	31,968
PLATFORM- 4' h. x 4'w. x 6' d. * replaces 3 side mezzanine, w/ 2 ladders @ $9600.	2,700	1	2,700
INSTALL/SET-UP	6,000	1	6,000
DUST CONTROL- discharge/weigh-up	15,000	1	15,000
ROLLER DOLLY/TOTES	1,825	1	1,825
VACUUM SYSTEM- loads mixer with pre-weighed products, thru a sifter.	75,000	1	75,000
LIFT TRUCK	20,000	1	20,000
			168,113
		+blender	$286,716

DENK ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT _____
NAME _____
DATE _____
PAGE ____ OF ____



SCOTT
BUILT FOR TODAY
TO LAST FOR TOMORROW

MANUFACTURERS OF PROCESSING EQUIPMENT FOR:
• AGRICULTURE • INDUSTRIAL
• CHEMICAL • FOOD

QUOTATION NUMBER: 95-1624

QUOTATION DATE: 9/ 8/95
(valid for 30 days)

TERMS: 1/3 - Downpayment w/order
1% - 10 Days
Net - 30 Days

SOLD TO: STERIS CORPORATION
9450 Pineneedle Drive
Mentor, OH 44060

ATTN: Mike Jusek

SALESMAN: David Grimes/siw

REF:

SCOTT EQUIPMENT COMPANY proposes to supply a Control Panel for the proposed Plow Blender.

Panel rated NEMA 4 and includes (3) green illuminated start buttons and (3) red illuminated stop buttons. (1) set is for the 125 HP plow blender, (1) set for the 10 HP choppers and (1) set of spares, if ever needed.

Omron timers are included for both the blender motor and the chopper motors. The face is exposed through the panel case for timer setting.

Starters are not included in this panel.

SELLING PRICE.....$1,772.00

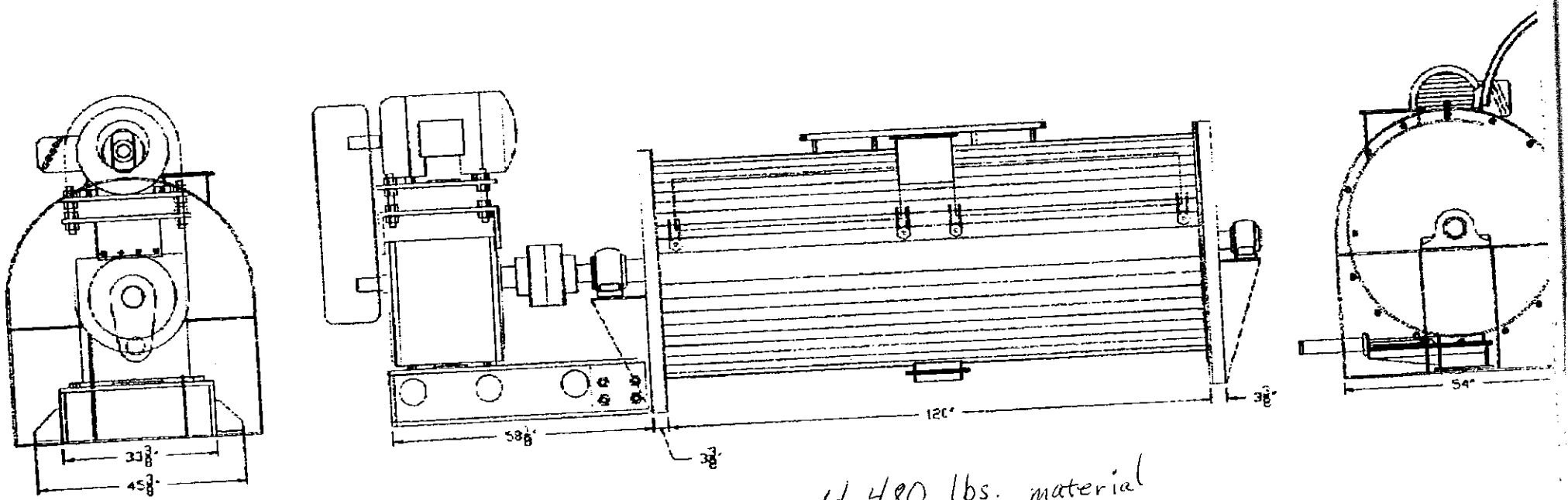
NOTE: If starters are to be included.....add $ 8,760.00

DELIVERY: 10 to 12 weeks after receipt of approval drawings
Time for approval drawings is 1 to 2 weeks

cc: ROBERTSON EQUIPMENT COMPANY
Dean Robertson

F.O.B. New Prague, Minnesota

COPY



4,480 lbs. material

5/batches per shift = 22,402 lbs.

= 3,000 cs.

STERIS CORPORATIO

SCOTT QUOTATION #95-324

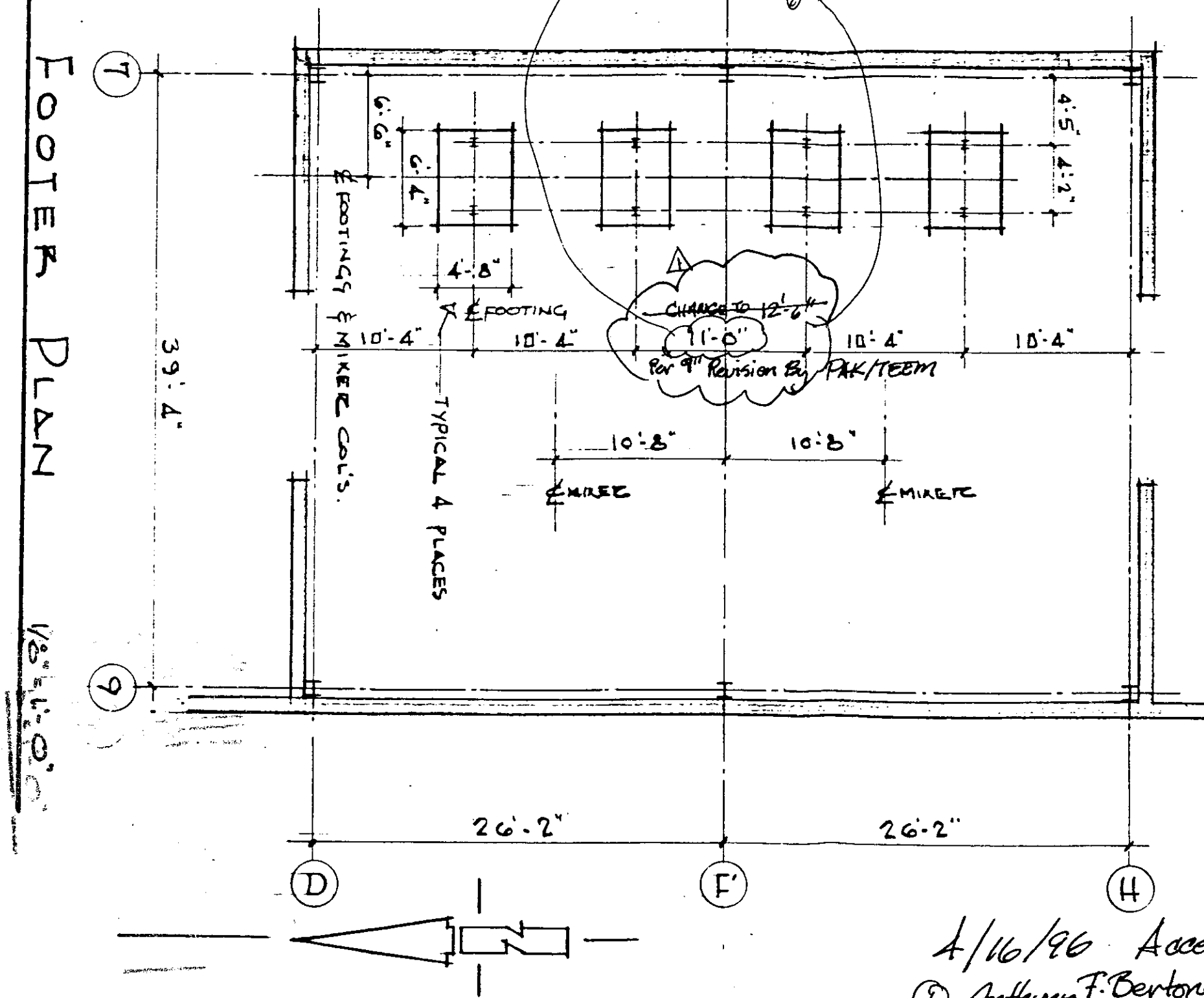
Rev 2 [signature] -4/16/96

Rev 2 [signature] 4-18-96

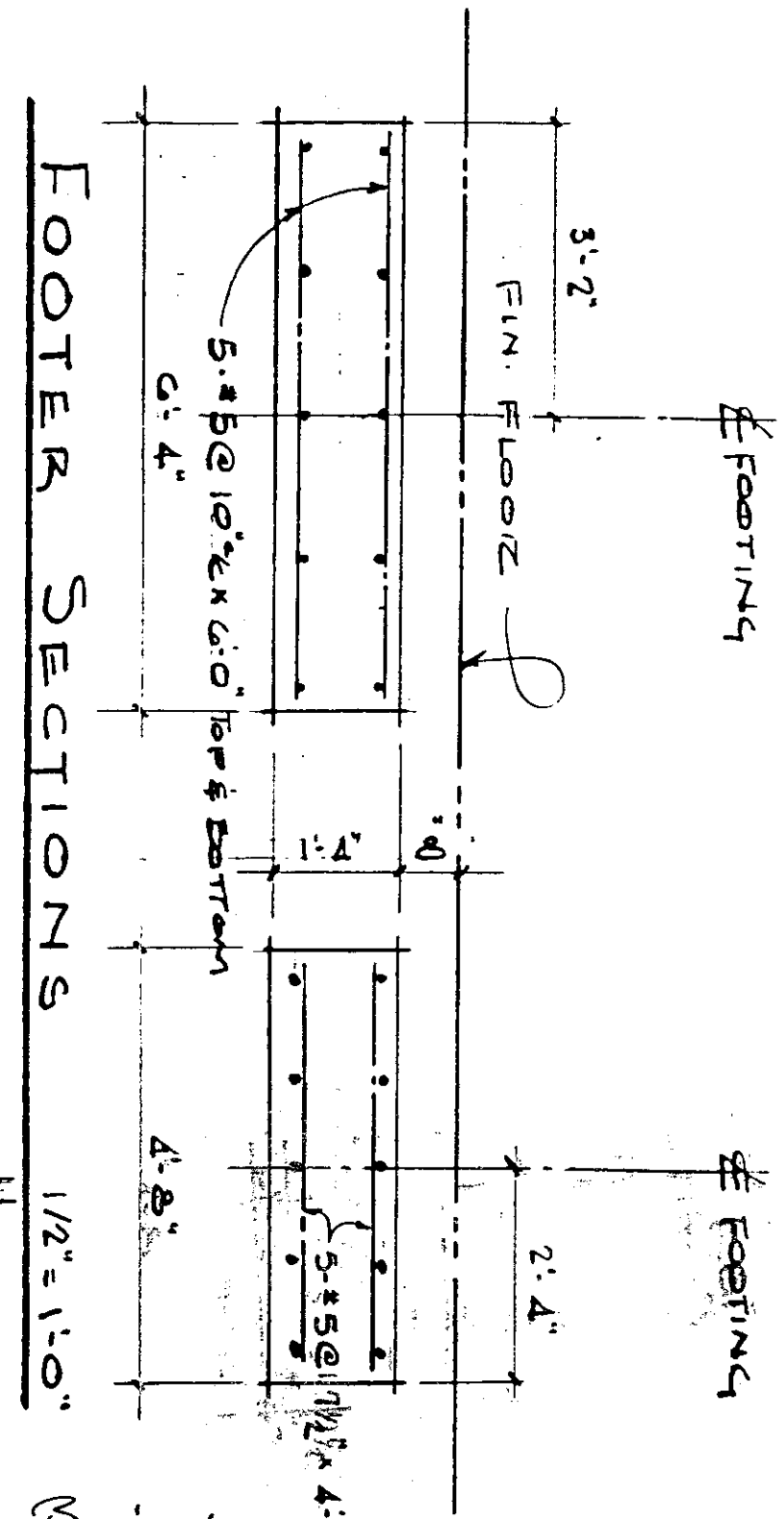
REV. 2 [signature]

GO BACK TO ORIG. DWG

FOOTER PLAN



FOOTER SECTION



4/16/96 Accepted By:

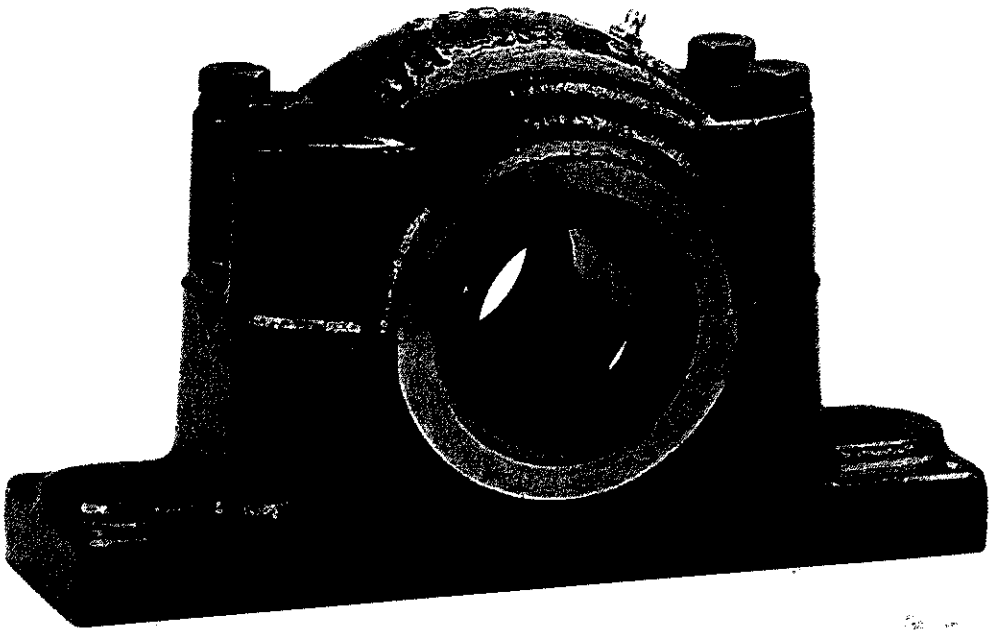
1. Anthony F. Bertone 4/16/96
2. John A. Rawor
4. [signature] 4-16-96

Scott-Mixer Footings - Steris Corporation

Sketch 1 of 1 4/8/96

[signature] 4-16-96

INSTRUCTION MANUAL
FOR
DODGE® SAF-XT & SAFS
Pillow Blocks
All Sizes $1^{15}/_{16}$" through $10^{1}/_{2}$"
2 and 4 Bolt Base



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

INSPECTION

Inspect shaft. Ensure that the shaft is smooth, straight, clean and within commercial tolerances.

Inspect bearing. Do not allow bearing to be exposed to any dirt or moisture. Do not remove slushing compound as it acts as both a protectant and lubricant and is also compatible with standard greases.

INSTALLATION

WARNING

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

NOTE: Housing caps and bases are not interchangeable, they must be matched with mating half. Install non-expansion bearing first.

1. Apply a light coating of spindle oil to the adapter area of the shaft.

2. Measure the internal clearance of the bearing before mounting. Place the bearing in an upright position as shown in **Figure 1**. Seat the inner ring and roller elements by pressing down firmly on the inner ring bore while rotating the inner ring a few times. Position the roller assemblies so that a roller is at the topmost position on both sides. Press these top rollers inward ensuring contact with center guide flange (above 6 1/2" only). Using a feeler gage measure the clearance for both sides by inserting as far as possible and sliding over top of roller (Figure 1). Write down the measured clearance for use in step 3d. **NOTE:** Do not rotate bearing when moving feeler between roller and outer ring.

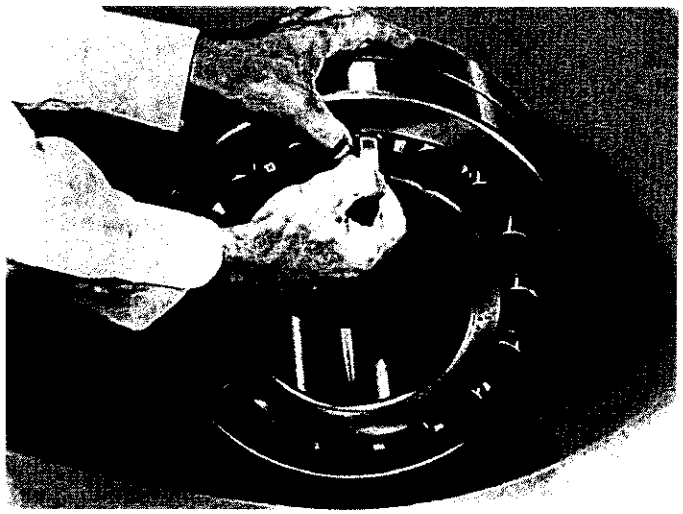


Figure 1 — Internal Clearance

3. Install the bearing parts in the following sequence: (refer to Figure 3). **NOTE:** Bearing can only be correctly installed one way. Refer to **Figure 2** on page 4.

a) V-ring Seal — Slide one of the V-ring seals onto the shaft **making sure lip is toward the bearing.** Set aside until step 11. **NOTE: Do not install V-ring seal on seal ring until housing cap has been set in place and tightened.**

b) Seal Ring — Install a seal ring on shaft with the largest O.D. toward bearing.

c) Adapter — Slide adapter onto the shaft, threaded end outboard to the approximate location of the bearing. Apply light coating of oil to sleeve O.D. **Do not use grease.**

d) Bearing — Make sure that the internal clearance has been written down. Install bearing on adapter sleeve, large end of tapered bore first. Locate bearing in proper position on shaft. Before tightening refer to **Figure 2** and Table 4 on page 4.

e) Lockwasher and Locknut—Install the lockwasher (8" and smaller sizes only) on the adapter with inner prong located in the slot and toward the bearing. Install locknut, chamfered face toward bearing.

Tighten locknut using a spanner wrench and hammer until clearance noted in step 2 is **reduced by** amount shown in Table 1. During this step shaft should be supported so all weight is off of the bearing.

Find a lockwasher tab that aligns with a locknut slot and bend tab into slot. If slot is past tab then tighten, not loosen, locknut to meet a washer tab. Sizes larger than 8" require a lockplate bolted to the locknut with the inner prong of the plate located in the slot of the adapter sleeve. If necessary, tighten, not loosen, locknut to allow prong to fit in adapter slot. Lock plates for only the 9" must be hand fitted on the job.

Table 1— Internal Clearance Reduction

Shaft Diameter	Reduction in Internal Clearance
1 15/16, 2 3/16	.0012/.0015
2 7/16, 2 1/2, 2 11/16, 2 3/4	.0015/.0020
2 15/16, 3, 3 3/16, 3 7/16, 3 1/2	.0018/.0025
3 15/16, 4, 4 3/16	.0020/.0028
4 7/16, 4 1/2, 4 15/16, 5	.0025/.0035
5 3/16, 5 7/16, 5 1/2	.0030/.0040
5 15/16, 6, 6 7/16, 6 1/2	0030/.0045
6 15/16, 7	.0035/.0050
7 1/2, 7 15/16, 8	.0040/.0055
8 7/16, 8 1/2, 8 15/16, 9	.0045/.0060
9 7/16 - 10 1/2	.0045/.0065

f) Seal Ring — Install a second seal ring with large O.D. toward locknut.

g) V-Ring Seal — Slide second V-ring seal onto the shaft, again making certain lip is toward bearing. **NOTE: Do not install V-ring seal on seal ring until housing cap has been set in place and tightened.** See Step 11.

4. Remove any paint, dirt or burrs from the mating surfaces of the housing halves. Thoroughly clean seal grooves on both sides. Set lower half of housing on base with all four cap bolts in place and apply oil to the bearing seats. Apply grease to the seal grooves in the lower housing. **Be sure the housing is positioned as shown in Figure 2 view relative to adapter nut.**

5. Apply grease to the bearings and seal rings. The lubricant should be smeared between the rolling elements (see Grease Lubrication section).

6. Place shaft with bearing into lower half while carefully guiding the seal rings into the housing grooves as shown in **Figure 4**.

7. Bolt lower half of the non-expansion bearing housing to the base. Move shaft endwise so that stabilizing ring can be inserted between the bearing outer ring and the lower half shoulder on same side as the locknut. Make all other bearings on same shaft expansion by centering in the middle of their housing seat. Bolt expansion housings to base. **NOTE: Only one bearing per shaft is non-expansion; other bearings should be expansion.**

Table 2 — Recommended Torque Values, Ft.-Lbs.

	Housing Cap Bolt Size	7/16-14	1/2-13	5/8-11	3/4-10	7/8-9	1-8	1 1/4-7
	Grade 2	28-32	40-50	80-100	140-175	136-170	200-250	400-500
	Grade 5	40-50	60-75	120-150	208-260	344-430	512-640	880-1100
	Grade 8	56-70	88-110	168-210	304-380	480-600	728-910	1456-1820

8. When closed end is required, the end plug supplied should be fit into the center seal ring groove of the housing (see **Figure 4**).

9. Grease the bearing seal grooves in the housing cap and place over the bearing after wiping the mating surfaces. The two dowel pins will align the cap with the lower housing half. **NOTE:** Each cap must be matched with its mating lower half as these parts are not interchangeable.

10. Tighten cap bolts to the recommended torque in Table 2.

11. Assure that there is seal running clearance then install V-ring seals onto the seal rings as shown in **Figure 4 and coat V-ring seals with grease.**

12. Misalignment of pillow blocks must not exceed values shown on Table 3 below.

Table 3 — Static or Dynamic Allowable Misalignment Degrees Spherical Roller Bearings

SHAFT SIZE	BLOCK SIZE	TRIPLE-TECT SEALS	LER	AUXILIARY SEAL
1 15/16	511	1°08'	0°52'	0°35'
2 3/16	513	1°01'	0°55'	0°32'
2 7/16 - 2 1/2	515	0°59'	0°50'	0°28'
2 11/16 - 2 3/4	516	0°52'	0°52'	0°26'
2 15/16 - 3	517	0°48'	0°52'	0°25'
3 3/16	518	1°06'	0°51'	0°32'
3 7/16 - 3 1/2	520	1°03'	0°46'	0°30'
3 15/16 - 4	522	0°55'	0°42'	0°28'
4 3/16	524	0°49'	0°41'	0°27'
4 7/16 - 4 1/2	526	0°56'	0°44'	0°26'
4 15/16 - 5	528	0°55'	0°40'	0°24'
5 3/16	530	—	0°35'	0°22'
5 7/16 - 5 1/2	532	0°47'	0°34'	0°22'
5 15/16 - 6	534	0°43'	0°32'	0°22'
6 7/16 - 6 1/2	536	0°33'	0°23'	0°26'
6 15/16 - 7	538	0°37'	0°27'	0°25'
7 1/2, 7 15/16, 8	544	0°31'	0°24'	0°22'
8 7/16 - 9	048	0°36'	0°25'	0°22'
9 7/16 - 9 1/2	052	0°26'	0°23'	0°33'
9 15/16-10 1/2	056	0°28'	0°16'	0°30'

Table 4 — Bearing ℄ to Housing ℄ Offset — "S" Dimension (Expansion brg. located at center of expansion)

Size	Non-Expansion	Expansion	Size	Non-Expansion	Expansion
1 15/16	19/64	3/16	5 3/16	3/4	9/16
2 3/16	25/64	1/4	5 7/16-5 1/2	49/64	37/64
2 7/16-2 1/2	17/64	5/32	5 15/16-6	25/32	37/64
2 11/16-2 3/4	3/8	3/16	6 7/16-6 1/2	3/4	35/64
2 15/16-3	3/8	3/16	6 15/16-7	13/16	5/8
3 3/16	31/64	19/64	7 1/2	29/32	23/32
3 7/16-3 1/2	9/16	3/8	7 15/16-8	29/32	23/32
3 15/16-4	35/64	3/8	8 7/16-9	25/32*	25/32
4 3/16	39/64	27/64	9 7/16-9 1/2	45/64*	45/64
4 7/16-4 1/2	41/64	29/64	9 15/16-10 1/2	7/8*	7/8
4 15/16-5	11/16	1/2			

*One spacer on each side of bearing

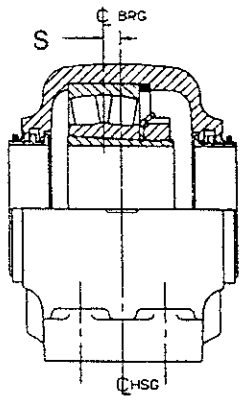


Figure 2

MAINTENANCE

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

Remove housing cap in order to inspect bearing and grease. Before reassembly it is important that the V-ring seals be removed. This will ensure that seal lip will not be damaged while setting cap in place. Reassemble per installation steps 9 thru 11 above.

Seal Replacement — When removing bearing it is recommended that V-ring seals and seal rings be replaced.

Auxiliary Seals — Install per instruction sheet #499665.

GREASE LUBRICATION

SAF-XT and SAFS bearings are specifically designed for dirty, dusty or wet environments. In order to properly protect bearings during installation pack the bearing insert 100% full immediately after having properly mounted bearing on the shaft. If the RPM of the application falls between 20% and 80% of maximum RPM (Table 7), pack the lower half of the housing one-third to one half full. If the RPM of the application is less than 20% of maximum RPM, pack bearing housing cavity 100% full. If the RPM exceeds 80% of maximum RPM, pack 1/3 of the lower half of the housing.

At each regreasing cycle, for applications up to 80% of maximum RPM, slowly add grease until fresh grease is seen purging at the seals.

Regreasing should be done while running. Remote regreasing lines should be added to avoid endangering personnel.

WARNING
Regreasing requires rotating parts to be exposed. Exercise extreme care during such operations. Failure to observe these precautions could result in bodily injury.

If the RPM is greater than 80% of maximum RPM add 4 strokes of a grease gun at each regreasing cycle for bores up to 2". For bores greater than 2" up to 5" add 8 strokes of a handgun at each regreasing cycle. For bores greater than 5" up to 10 1/2" add 16 strokes of a grease gun at each regreasing cycle. For units running above 80% of maximum RPM, running temperature should be monitored. If a drastic change in running temperature is noted, it is recommended to remove the used grease completely and recharge with fresh grease per above instructions.

Table 5 — Viscosity of Oil in the Grease

DN ▲	Viscosity for Loads Up To 18% of Dyn. Cap.* (SUS @ operating temp.)	DN ▲	Viscosity for Loads Up To 18% of Dyn. Cap. (SUS @ operating temp.)
100	3500	1400	625
200	3150	1800	450
300	2750	2000	400
400	2375	3000	300
500	2000	4000	200
600	1750	5000	150
700	1500	6000	130
800	1300	7000	110
900	1075	8000	100
1000	900		

▲ DN = Bore Dia. (ins.) x RPM

* For loads above 18% of dynamic capacity an EP grease with the above viscosity oil is recommended

Select a grease with a viscosity at operating temperature which will provide full film lubrication (see Table 5). Assume 50°-100°F increase in bearing temperature above the ambient, depending on RPM and load.

Use Table 6 as a general guide for regreasing the bearings. A small amount of grease at frequent intervals is preferable to a large amount of grease at infrequent intervals.

For special applications involving high speeds, high temperatures or oil lubrication, consult the factory.

Table 6 — Regreasing Intervals (Months)
(Based on 12 hour per day 150°F max.)

Size	RPM									
	250	500	750	1000	1250	1500	2000	2500	3000	3500
1 15/16	8	6	4	3	2	1	.5	.5	.25	.25
2 3/16	7	5	3	2	1	1	.5	.25	.25	
2 7/16-3	6	4	3	2	1	.5	.25	.25		
3 3/16-3 1/2	5	3	2	1	.5	.5	.25			
3 15/16-4 1/2	4	3	2	1	.5	.25				
4 15/16-5 1/2	3	2	1	.5	.25					
5 15/16-7	2	1	1	.5						
7 1/2-9	1	1	.5							
9 7/16-10 1/2	1	.5								

Table 7 — Maximum RPM (Grease Lubrication)

SHAFT SIZE	BASIC BEARING DESCRIPTION	MAX. RPM
1 15/16	22211K	4500
2 3/16	22213K	3600
2 7/16, 2 1/8	22215K	3400
2 11/16, 2 3/4	22216K	3200
2 15/16, 3	22217K	3000
3 3/16	22218K	2600
3 7/16, 3 1/2	22220K	2200
3 15/16, 4	22222K	2000
4 1/16	22224K	1800
4 7/16, 4 1/2	22226K	1700
4 15/16, 5	22228K	1600
5 3/16	22280K	1500
5 7/16, 5 1/2	22282K	1400
5 15/16, 6	22284K	1300
6 7/16, 6 1/2	22236K	1200
6 15/16, 7	22288K	950
7 1/2, 7 15/16, 8	22244K	800
8 7/16, 8 1/2 8 15/16, 9	23048K	800
9 7/16, 9 1/2	23052K	750
9 15/16, 10 10 7/16, 10 1/2	23056K	700

LONG-TERM STORAGE OF PRE-ASSEMBLED BEARINGS

Applications such as conveyor pulleys and fans are shipped to a job site with bearings already mounted to the shafts. Since these units may be stored for long periods of time in unprotected areas subject to rain, dust, etc., bearings should be packed 100% full and so tagged at bearing assembly to prevent contamination or corrosion of the bearings.

Prior to installation on the structure, if the application RPM is greater than 20% of catalog maximum speed, excess grease must be removed to the levels outlined previously. Removal of excess grease must be done in a clean, protected environment.

REPLACEMENT PARTS FOR SAF-XT PILLOW BLOCKS

NOTE: Large cavity of Pillow Block Housing must be on the same side as the locknut.

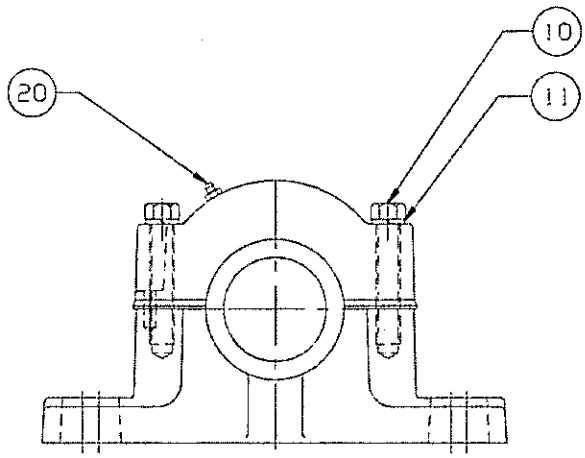
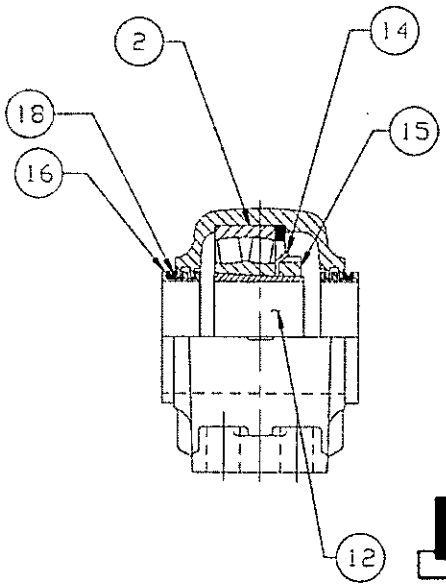


Figure 3

NOTE: Spacer required for Non-Expansion Pillow Blocks. See Chart.



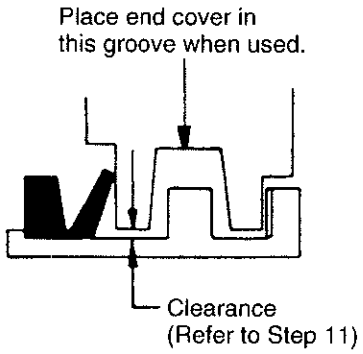


Figure 4

Refer-ence	Name of Part	No. Req'd	Part Numbers														
			1-15/16Δ	2-3/16Δ	2-7/16Δ	2-7/16	2-1/2Δ	2-1/2	2-11/16Δ	2-11/16	2-3/4Δ	2-3/4	2-15/16Δ	2-15/16	3Δ	3	3-3/16Δ
2	Bearing	1	422123	422124	422001	422001	422001	422001	422003	422003	422003	422003	422005	422005	422005	422005	422007
	HOUSING ASSEMBLY*	1	042100	042103	042106	042109	042106	042109	042111	042114	042111	042114	042116	042119	042116	042119	042121
10	Housing Bolt	4	411625	411637	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240	411240
11	Lockwasher	4	419012	419012	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013	419013
12	Adapter	1	042310	042311	041110	041110	041111	041111	041109	041109	041126	041126	041112	041112	041113	041113	041114
14	Lockwasher	1	419182	419183	419150	419150	419150	419150	419152	419152	419152	419152	419154	419154	419154	419154	419156
15	Lock Nut	1	419164	419135	460901	460901	460901	460901	460902	460902	460902	460902	460903	460903	460903	460903	460904
16	Seal Ring	2	042050	042051	042052	042052	042053	042053	042054	042054	042083	042063	042055	042055	042056	042056	042057
18	V-Ring Seal	2	042225	042226	042227	042227	042227	042227	042228	042228	042228	042228	042229	042229	042229	042229	042230
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015
◊	Stabilizing Ring	1	042315	042316	041174	041174	041174	041174	041172	041172	041172	041172	041175	041175	041175	041175	041173

Refer-ence	Name of Part	No. Req'd	Part Numbers														
			3-3/16	3-7/16Δ	3-7/16	3-1/2Δ	3-1/2	3-15/16	4	4-3/16	4-7/16	4-1/2	4-15/16	5	5-3/16	5-7/16	5-1/2
2	Bearing	1	422007	422009	422009	422009	422009	422011	422011	422013	422015	422015	422017	422017	422019	422021	422021
	HOUSING ASSEMBLY*	1	042124	042126	042129	042126	042129	042131	042131	042134	042137	042137	042140	042140	042143	042146	042146
10	Housing Bolt	4	411240	411638	411638	411638	411638	411710	411710	411710	411831	411831	411498	411498	411498	411498	411498
11	Lockwasher	4	419013	419014	419014	419014	419014	419016	419016	419016	419014	419014	419016	419016	419016	419016	419016
12	Adapter	1	041114	041115	041115	041116	041116	041117	041118	041119	041120	041121	041122	041123	041124	041125	042318
14	Lockwasher	1	419156	419158	419158	419158	419158	419160	419160	419162	419164	419164	419166	419166	419168	419170	419170
15	Lock Nut	1	460904	460905	460905	460905	460905	460906	460906	041071	041064	041064	041065	041065	041072	041066	041066
16	Seal Ring	2	042057	042056	042058	042059	042059	042060	042061	042062	042063	042064	042065	042066	042067	042068	042069
18	V-Ring Seal	2	042230	042230	042230	042230	042230	042231	042231	042232	042233	042233	042234	042234	042235	042235	042235
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015
◊	Stabilizing Ring	1	041173	041176	041176	041176	041176	041177	041177	041185	041178	041178	041179	041179	041186	041160	041160

* Housing Assembly consists of cap, base, roll pins, bolts, nuts and spacer(s).
◊ Not shown on drawing. 2 required on sizes 8-7/16 and larger.
Δ 2 Bolt Base.
‡ Locking plate used instead of lockwasher (not shown).

Sizes $5^{15}/_{16}$ to $10^{1}/_{2}$ continued on next page.

REPLACEMENT PARTS FOR SAF-XT PILLOW BLOCKS

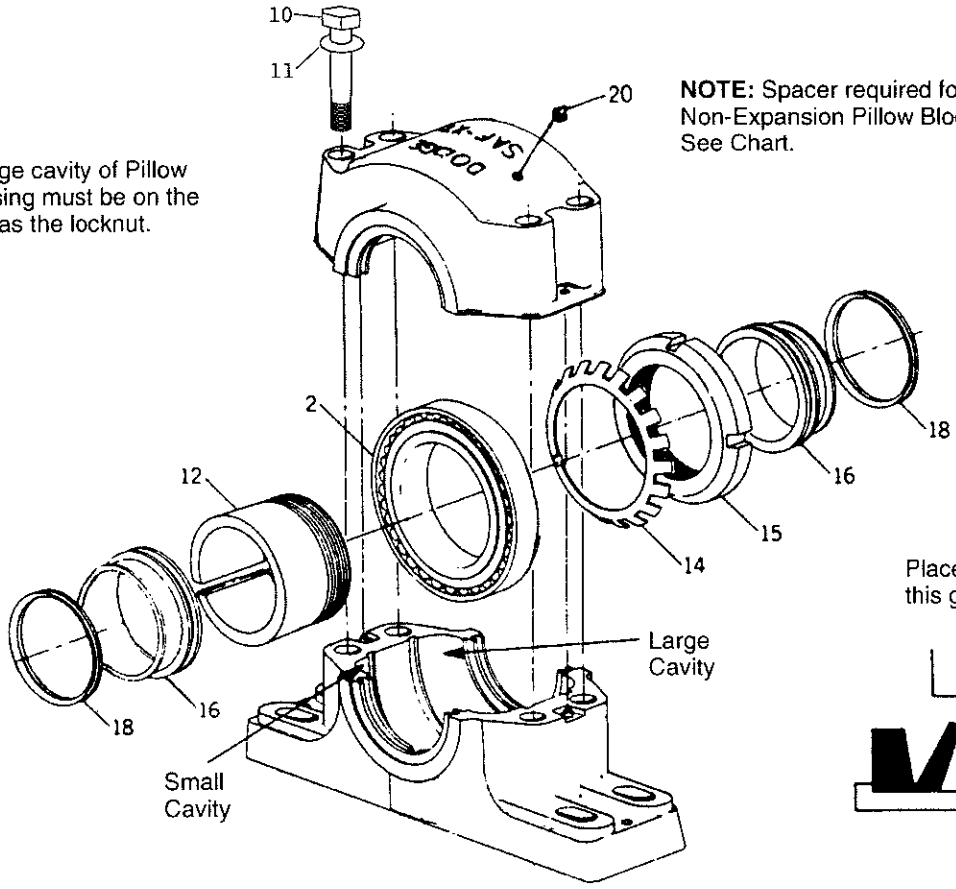


Figure 3

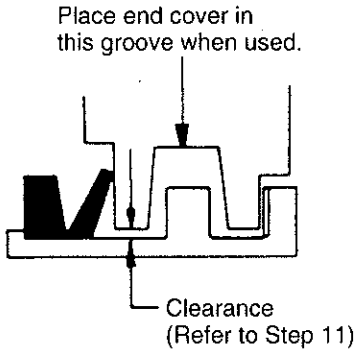


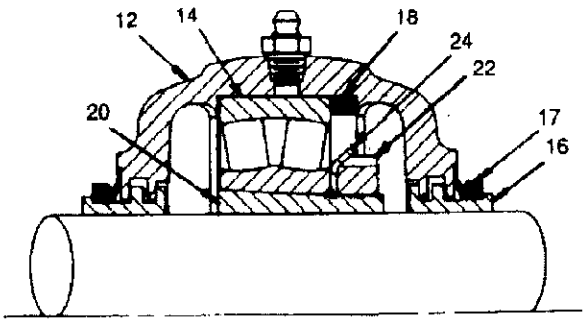
Figure 4

Reference	Name of Part	No. Req'd.	Part Numbers 5-15/16	6	6-7/16	6-1/2	6-15/16	7	7-1/2	7-15/16
2	Bearing	1	422023	422023	422025	422025	422027	422027	422029	422029
	HOUSING ASSEMBLY*	1	042149	042149	042152	042152	042155	042155	042167	042158
10	Housing Bolt	4	411381	411381	411381	411381	411381	411381	411860	411860
11	Lockwasher	4	419020	419020	419020	419020	419020	419020	419024	419024
12	Adapter	1	041127	041128	041129	041130	041132	041133	041145	041137
14	Lockwasher	1	419172	419172	419174	419174	419176	419176	419178	419178
15	Lock Nut	1	041067	041067	041070	041070	041068	041068	041069	041069
16	Seal Ring	2	042070	042071	042072	042073	042074	042075	042081	042076
18	V-Ring Seal	2	042236	042236	042237	042237	042238	042238	042239	042239
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015
↓	Stabilizing Ring	1	041181	041181	041184	041184	041182	041182	041183	041183

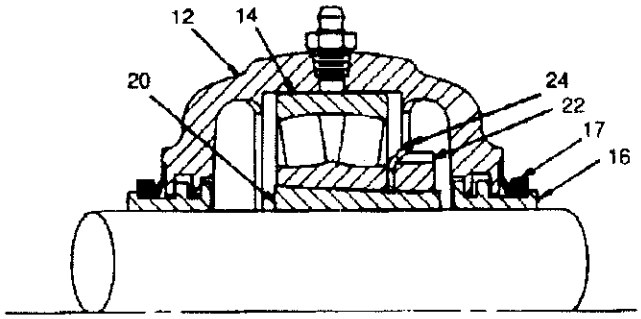
Reference	Nameof Part	No Req'd.	Part Numbers 8	8-7/16	8-1/2	8-15/16	9	9-7/16	9-1/2	9-15/16	10	10-7/16	10-1/2
2	Bearing	1	422029	422031	422031	422031	422031	422543	422543	422030	422030	422030	42203
	HOUSING ASSEMBLY*	1	042158	042161	042161	042161	042161	422555	422555	047378	042164	042379	422572
10	Housing Bolt	4	411860	411860	411860	411860	411860	411860	411860	411864	411864	411864	411864
11	Lockwasher	4	419024	419024	419024	419024	419024	419024	419024	419024	419024	419024	419024
12	Adapter	1	041138	042319	041078	042320	041079	042597	422541	041053	041136	042582	422570
14	Lockwasher	1	419178	419177‡	419177‡	419177‡	419177‡	422540‡	422540‡	419179‡	419179‡	419179‡	419179‡
15	Lock Nut	1	041069	041074	041074	040174	041074	422539	422539	041073	041073	041073	041073
16	Seal Ring	2	042077	042082	042078	042084	042079	043496	422546	042511†	042086†	042036	422573†
18	V-Ring Seal	2	042239	042240	042240	042240	042240	422547	422547	—	042241	—	—
20	Grease Fitting	1	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015	405015
↓	Stabilizing Ring	1	041183	041161	041161	041161	041161	422554	422554	041213	041213	041213	041213

* Housing Assembly consists of cap. base, roll pins, bolts, nuts and spacer(s).
↓ Not shown on drawing. 2 required on sizes 8-7/16 and larger.
Δ 2 Bolt Base.
‡ Locking plate used instead of lockwasher (not shown).
† ER Seals

REPLACEMENT PARTS FOR SAFS PILLOW BLOCKS



NON-EXPANSION TYPE
SAFS PILLOW BLOCKS



EXPANSION TYPE
SAFS PILLOW BLOCKS

Ref.	Name of Part	# Req'd.	1-7/16	1-11/16	1-15/16	2-3/16	2-7/16	2-1/2	2-11/16	2-3/4	2-15/16	3	3-3/16	3-7/16	3-1/2	3-15/16	4	4-3/16	4-7/16	4-1/2
	2 Bolt Base Housing Assem. *	1	043995	043996	043997	043998	044000	044000	044198	044198	044010	044010	044199	044020	044020	.....	.....	.....	.....	.....
12	4 Bolt Base Housing Assem. *	1	.....	.....	.....	.....	044003	044003	044007	044007	044013	044013	044114	044023	044023	044025	044025	044042	044031	044031
	2 Bolt Base Housing (SAFS) Assem. *		.....	.....	.....	.....	042425	042425	042423‡	042423‡	042433	042433	044233	042440	042440	.....	.....	.....	.....	.....
12	4 Bolt Base Housing (SAFS) Assem. *		.....	.....	.....	.....	042428	042428	044232	044232	042436	042436	044234	042443	042443	042450	042450	044235	042455	042455
14	Roller Bearing	1	422134	422137	422123	422124	422001	422001	422003	422003	422005	422005	422007	422009	422009	422011	422011	422013	422015	422015
16	Seal Ring	2	043389	043390	042050	042051	042052	042053	042054	042083	042055	042056	042057	042058	042059	042060	042061	042062	D42073	042064
17	V-Ring Seal	2	042243	042224	042225	042226	042227	042227	042228	042228	04222	042229	042230	042230	042230	042231	042231	042232	042233	042233
18	NorExp. Spacer	1	041987	042335	042315	042316	041174	041174	041172	041172	041175	041175	041173	041176	041176	041177	041177	041185	041178	041178
20	Adapter Sleeve	1	042013	042014	042310	042311	041110	041111	041109	041126	041112	041113	041114	041115	041116	041117	041118	041119	041120	041121
22	Nut	1	419187	419188	419184	419185	460901	460901	460902	460902	460903	460903	460904	460905	460905	460906	460906	041071	041064	041064
24	Lockaslw	1	419180	419181	419182	419183	419150	419150	419152	419152	419154	419154	419156	419158	419158	419160	419160	419162	419164	419164

Ref.	Name of Part	# Req'd.	4-15/16	5	5-3/16	5-7/16	5-15/16	6	6-7/16	6-1/2	6-15/16	7	7-1/2	7-15/16	8	8-7/16	8-1/2	8-15/16	9
12	4 Bolt Base Housing Assem. *	1	044034	044034	044203	044040	044043	044043	044046	044046	044049	044049	044054	044055	044055	044200	044200	044200	044200	
12	4 Bolt Base Housing (SAFS) Assem. *		042460	042460	044236	042465	042469	042469	042468	042468	042472	042472	044237	042477	042477	.....	.....	.....	.....	
14	Roller Bearing	1	422017	422017	422019	422021	422023	422023	422025	422025	422027	422027	422029	422029	422029	422031	422031	422031	422031	
16	Seal Ring	2	042065	042066	042067	042068	042070	042071	042072	042073	042074	042075	042081	042076	042097	042082	042078	042084	042079	
17	V-Ring Seal	2	042234	042234	042235	042235	042236	042236	042237	042237	042238	042238	042239	042239	042239	042240	042240	042240	042240	
18	Non-Exp. Spacer	1	041179	041179	041186	041180	041181	041181	041184	041184	041182	041182	041183	041183	041183	041161	041161	041161	041161	
20	Adapter Sleeve	1	041122	041123	041124	041125	041127	041128	041129	041130	041132	041133	041145	041137	041138	042319	041078	042320	041079	
22	Nut	1	041065	041065	041072	041066	041067	041067	041070	041070	041068	041068	041069	041069	041069	041074	041074	041074	041074	
24	Lockwasher	1	419166	419166	419168	419170	419172	419172	419174	419174	419176	419176	419178	419178	419178	419177	419177	419177	419177	

Ref.	Name of Part	# Req'd.	9-7/16	10	10-1/2
12	4 Bolt Base Housing Assem. *	1	422542	422560	044201
12	4 Bolt Base Housing (SAFS) Assem. *		.....	.....	.....
14	Roller Bearing	1	422543	422030	422030
16	Seal Ring	2	043496	042086	.....
17	V-Ring Seal	2	422547	042241	.....
18	Non-Exp. Spacer	1	422554•	041213•	041213•
20	Adapter Sleeve	1	042597	041136	422570
22	Nut	1	422539	041073	041073
24	Lockwasher	1	422540‡	419179‡	141917‡

◊ Not shown on drawing.
* Housing assembly consists of cap, base, roll pins, bolts, nuts and spacers.
‡ Locking plate used instead of lockwasher (not shown).
• Two required for these sizes.

www.rockwellautomation.com **www.ptplace.com** **www.dodge-pt.com** **www.reliance.com** **www.ptplace.ca**

Corporate Headquarters
Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Dodge and Reliance Electric Products
Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433
Europe/Middle East/Africa: Rockwell Automation, Brühlstraße 22, D-74834 Elztal-Dallau, Germany, Tel: (49) 6261 9410, Fax: (49) 6261 17741
Asia Pacific: Rockwell Automation, 55 Newton Road, #11-01/02 Revenue House, Singapore 307987, Tel: (65) 6356-9077, Fax: (65) 6356-9011

POWER Plus PERFORMANCE
DODGE RELIANCE ELECTRIC

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions
Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation SA/NV, Vorstlaan/Boulevard du Souverain 36, 1170 Brussels, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, 27/F Citicorp Centre, 18 Whitfield Road, Causeway Bay, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

3/04 1M-K

CITGO PREMIUM LITHIUM EP GREASES

Date 1/09

DESCRIPTION: CITGO Premium Lithium EP Greases are premium quality, lithium-12 greases containing extreme pressure, antiwear, antioxidant and anticorrosion additives. These greases are formulated with high quality base stocks. They do not contain Molydenum Disulfide (moly).

CITGO Premium Lithium EP Greases are available in NLGI Grades 0, 1 and 2 and as a Semifluid.

BENEFITS: The smooth, buttery texture of the grease in conjunction with high quality mineral oil provides excellent pumpability over a wide temperature range. The extreme pressure agent provides the protection required to handle severe conditions characterized by high shock loads. Oxidation and corrosion inhibitors, and a high quality soap yield a product with excellent shear stability, load carrying properties, corrosion resistance and oxidation stability. The combination of these properties makes CITGO Premium Lithium EP Greases extremely versatile, thereby reducing the number of products required. Substantial reductions in storage and handling costs are possible with these universal products, while at the same time reducing potential of costly equipment failures associated with misapplication of product.

The service temperature range of these greases is 5°F to 250°F continuous, with peak intermittent temperatures up to 300°F.

APPLICATIONS: CITGO Premium Lithium EP Greases are recommended for the lubrication of both journal and anti-friction bearings in a wide variety of applications such as gear couplings, metallurgical industry equipment and general industrial machinery.

CITGO Premium Lithium EP Greases are particularly adaptable for centralized lubrication systems and for bulk handling systems, both for bulk truck delivery and portable containers.

They are approved under Chrysler Specification MS-3701 and Cincinnati Lamb P-64/P-72.

NLGI Grades 1 and 2 meet the ASTM D 4950 requirements for Chassis Grease Category LB. Cartridge labels will display the NLGI Certification Mark for Chassis Lubricant shown here.

NLGI
AUTOMOTIVE CHASSIS LUBRICANT
LB

(Continued)

CITGO PREMIUM LITHIUM EP GREASES

Date 1/09 - (Continued)

TYPICAL PROPERTIES:

CITGO PREMIUM LITHIUM EP GREASES

Name	**Semi-Fluid**	**EP-0**	**EP-1**	**EP-2**
NLGI Grade	**00-000**	**0**	**1**	**2**
Material Code	655771001	655210001	655211001	655212001
Soap	Lithium	Lithium	Lithium	Lithium
Texture	Buttery	Buttery	Buttery	Buttery
Color	Dark Amber	Dark Amber	Dark Amber	Dark Amber
Dropping Point, ASTM D 566, °F (°C)	–	–	350 (177)	375 (191)
Penetration at 77°F, ASTM D 217				
Worked 60 strokes	425-455	355-385	310-340	265-295
Rust Prevention, ASTM D 1743	Pass	Pass	Pass	Pass
Copper Corrosion, ASTM D 4048	1b	1b	1b	1b
Timken OK Load, ASTM D 2509, lbs.	40	40	40	40
Four-Ball EP, Weld, ASTM D 2596, kgf	250	250	250	250
Base Fluid Viscosities				
Viscosity, ASTM D 445, cSt at 40°C	173	173	173	173
cSt at 100°C	14.9	14.9	14.9	14.9
Viscosity Index	83	83	83	83

CITGO Premium Lithium EP-2 Grease
Material Safety Data Sheet

CITGO Petroleum Corporation
P.O. Box 4689
Houston, TX 77210

MSDS No. 655212001
Revision Date 8/1/2008

IMPORTANT: This MSDS is prepared in accordance with 29 CFR 1910.1200. Read this MSDS before transporting, handling, storing or disposing of this product and forward this information to employees, customers and users of this product.

Hazard Rankings

	HMIS	NFPA
Health Hazard	1	1
Fire Hazard	1	1
Reactivity	0	0

* = Chronic Health Hazard

Protective Equipment

Minimum Recommended
See Section 8 for Details

Emergency Overview

Physical State Semi-solid to solid (Smooth texture)
Color Dark amber. **Odor** Mild petroleum odor

WARNING:
Injection under the skin can cause severe injury.
Most damage occurs in the first few hours.
Initial symptoms may be minimal.
Hot grease will cause thermal burns upon contact.
Spills may create a slipping hazard.

SECTION 1. PRODUCT IDENTIFICATION

Trade Name CITGO Premium Lithium EP-2 Grease
Product Number 655212001
CAS Number Mixture.

Product Family Lubricating grease
Synonyms Lubricating grease;
CITGO® Material Code: 655212001

Technical Contact (800) 248-4684
Medical Emergency (832) 486-4700
CHEMTREC Emergency (United States Only) (800) 424-9300

SECTION 2. COMPOSITION

Component Name(s)	CAS Registry No.	Concentration (%)
Highly-refined petroleum lubricant oils	Various	60 - 100
Hydrogenated castor oil, lithium salt soap	Proprietary Mixture	7 - 13
Sulfurized olefin	Proprietary	<1
Zinc and zinc compounds	Proprietary	<1
Asphalt (Petroleum, Bitumen)	8052-42-4	<1

SECTION 3. HAZARDS IDENTIFICATION

Also see Emergency Overview and Hazard Ratings on the top of Page 1 of this MSDS.

Major Route(s) of Entry Skin contact.

Signs and Symptoms of Acute Exposure

Inhalation	No significant adverse health effects are expected to occur upon short-term exposure at ambient temperatures. At elevated temperatures, product vapor may cause respiratory tract irritation. Repeated or prolonged overexposure to product mists can result in respiratory tract inflammation and an increased risk of infection.
Eye Contact	This product can cause transient mild eye irritation with short-term contact with liquid sprays or mists. Symptoms include stinging, watering, redness, and swelling.
Skin Contact	This material can cause mild skin irritation from prolonged or repeated skin contact. Injection under the skin can cause inflammation and swelling. Injection of pressurized hydrocarbons can cause severe, permanent tissue damage. Initial symptoms may be minor. Injection of petroleum hydrocarbons requires immediate medical attention. Skin contact with hot material may result in severe burns.
Ingestion	This material can cause a laxative effect. If swallowed in large quantities, this material can obstruct the intestine.
Chronic Health Effects Summary	This product contains a petroleum-based mineral oil. Prolonged or repeated skin contact can cause mild irritation and inflammation characterized by drying, cracking, (dermatitis) or oil acne. Repeated or prolonged inhalation of petroleum-based mineral oil mists at concentrations above applicable workplace exposure levels can cause respiratory irritation or other pulmonary effects.
Conditions Aggravated by Exposure	Disorders of the following organs or organ systems that may be aggravated by significant exposure to this material or its components include: Skin
Target Organs	May cause damage to the following organs: skin.
Carcinogenic Potential	This product is not known to contain any components at concentrations above 0.1% which are considered carcinogenic by OSHA, IARC or NTP.

OSHA Hazard Classification is indicated by an "X" in the box adjacent to the hazard title. If no "X" is present, the product does not exhibit the hazard as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200).

OSHA Health Hazard Classification				OSHA Physical Hazard Classification					
Irritant		Sensitizer		Combustible		Explosive		Pyrophoric	
Toxic		Highly Toxic		Flammable		Oxidizer		Water-reactive	
Corrosive		Carcinogenic		Compressed Gas		Organic Peroxide		Unstable	

SECTION 4. FIRST AID MEASURES

Take proper precautions to ensure your own health and safety before attempting rescue or providing first aid. For more specific information, refer to Exposure Controls and Personal Protection in Section 8 of this MSDS.

Inhalation	Vaporization is not expected at ambient temperatures. This material is not expected to cause inhalation-related disorders under anticipated conditions of use. In case of overexposure, move the person to fresh air.
Eye Contact	Check for and remove contact lenses. Flush eyes with cool, clean, low-pressure water while occasionally lifting and lowering eyelids. Seek medical attention if excessive tearing, redness, or pain persists.
Skin Contact	If burned by hot material, cool skin by quenching with large amounts of cool water. For contact with product at ambient temperatures, remove contaminated shoes and clothing. Wipe off excess material. Wash exposed skin with mild soap and water. Seek medical attention if tissue appears damaged or if pain or irritation persists. Thoroughly clean contaminated clothing before reuse. Clean or discard contaminated leather goods. If material is injected under the skin, seek medical attention immediately.

Ingestion	Do not induce vomiting unless directed to by a physician. Rinse out mouth with water. Never give anything by mouth to a person who is not fully conscious. Allow small quantities to pass through the digestive system. If large amounts are swallowed or irritation or discomfort occurs, seek medical attention immediately.
Notes to Physician	SKIN: In the event of injection in underlying tissue, immediate treatment should include extensive incision, debridement and saline irrigation. Inadequate treatment can result in ischemia and gangrene. Early symptoms may be minimal. INGESTION: Check for possible bowel obstruction with ingestion of large quantities of material.

SECTION 5. FIRE FIGHTING MEASURES

NFPA Flammability Classification	NFPA Class-IIIB combustible material.
Flash Point	Open cup: >150°C (>302°F) (Estimated.).
Lower Flammable Limit	No data. **Upper Flammable Limit** No data.
Autoignition Temperature	Not available.
Hazardous Combustion Products	Carbon dioxide, carbon monoxide, smoke, fumes, unburned hydrocarbons and oxides of sulfur, phosphorus, zinc and/or nitrogen.
Special Properties	Fight the fire from a safe distance in a protected location. Open any masses with a water stream to prevent reignition due to smoldering. Cool surface with water fog. Molten material can form flaming droplets if ignited. Water or foam can cause frothing. Use of water on product above 100° C (212° F) can cause product to expand with explosive force. Do not allow liquid runoff to enter sewers or public waters.
Extinguishing Media	Use dry chemical, foam, carbon dioxide or water fog. Water or foam may cause frothing. Carbon dioxide and inert gas can displace oxygen. Use caution when applying carbon dioxide or inert gas in confined spaces.
Protection of Fire Fighters	Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Take proper precautions to ensure your own health and safety before attempting spill control or clean-up. For more specific information, refer to the Emergency Overview on Page 1, Exposure Controls and Personal Protection in Section 8 and Disposal Considerations in Section 13 of this MSDS.

Do not touch damaged containers or spilled material unless wearing appropriate protective equipment. Slipping hazard; do not walk through spilled material. Stop leak if you can do so without risk. For small spills, absorb or cover with dry earth, sand, or other inert non-combustible absorbent material and place into waste containers for later disposal. Contain large spills to maximize product recovery or disposal. Prevent entry into waterways or sewers. In urban area, cleanup spill as soon as possible. In natural environments, seek cleanup advice from specialists to minimize physical habitat damage. This material will float on water. Absorbent pads and similar materials can be used. Comply with all laws and regulations.

SECTION 7. HANDLING AND STORAGE

Handling

If this product is stored or applied in high-pressure systems such as grease guns or hydraulic lines, there is the potential for accidental injection into the skin and underlying tissues. Hydrocarbons injected into skin or underlying tissues are not readily removed by body fluids and can cause pain, swelling, chemical irritation, infection and tissue destruction. Early symptoms may be minimal. Workers must be aware of the significant hazards associated with a hydrocarbon injection injury. In the event of an injection injury, workers should seek medical treatment immediately. Avoid water contamination and elevated temperatures to minimize product degradation. Empty containers may contain product residues that can ignite with explosive force. Do not pressurize, cut, weld, braze solder, drill, grind or expose containers to flames, sparks, heat or other potential ignition sources. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers and/or waste residues of this product.

Storage

Keep container tightly closed. Store in a cool, dry, well-ventilated area. Store only in approved containers. Do not store with strong oxidizing agents. Do not store at elevated temperatures. Avoid storing product in direct sunlight for extended periods of time. Storage area must meet OSHA requirements and applicable fire codes. Consult appropriate federal, state and local authorities before reusing, reconditioning, reclaiming, recycling or disposing of empty containers or waste residues of this product.

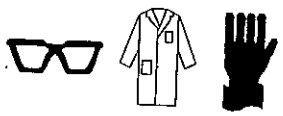
SECTION 8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Engineering Controls

Ventilation controls are not normally required under anticipated conditions of use. Provide exhaust ventilation or other engineering controls if airborne mists or vapors concentrations exceed recommended occupational exposure limits listed below. An eye wash station and safety shower should be located near the work-station.

Personal Protective Equipment

Personal protective equipment should be selected based upon the conditions under which this material is used. A hazard assessment of the work area for PPE requirements should be conducted by a qualified professional pursuant to OSHA regulations. The following pictograms represent the minimum requirements for personal protective equipment. For certain operations, additional PPE may be required.



Eye Protection

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Wear goggles if splashing or spraying is anticipated. Wear goggles and face shield if material is heated above 125°F (51°C). Have suitable eye wash water available.

Hand Protection

None required for incidental contact. Use gloves constructed of chemical resistant materials such as heavy nitrile rubber if frequent or prolonged contact is expected. Use heat-protective gloves when handling product at elevated temperatures.

Body Protection

Use clean protective clothing if splashing or spraying conditions are present. Protective clothing may include long-sleeve outer garment, apron, or lab coat. If significant contact occurs, remove oil-contaminated clothing as soon as possible and promptly shower. Launder contaminated clothing before reuse or discard. Wear heat protective boots and protective clothing when handling material at elevated temperatures.

Respiratory Protection

The need for respiratory protection is not anticipated under normal use conditions and with adequate ventilation. If elevated airborne concentrations above applicable workplace exposure levels are anticipated, a NIOSH-approved organic vapor respirator equipped with a dust/mist prefilter should be used. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134).

General Comments Use good personal hygiene practices. Wash hands and other exposed skin areas with plenty of mild soap and water before eating, drinking, smoking, use of toilet facilities, or leaving work. DO NOT use gasoline, kerosene, solvents or harsh abrasives as skin cleaners. Since specific exposure standards/control limits have not been established for this product, the "Oil Mist, Mineral" exposure limits shown below are suggested as minimum control guidelines.

Occupational Exposure Guidelines

Substance	Applicable Workplace Exposure Levels
Distillates, petroleum, hydrotreated heavy naphthenic	**ACGIH (United States).** TWA: 5 mg/m^3 STEL: 10 mg/m^3 **OSHA (United States).** TWA: 5 mg/m^3
Asphalt (Petroleum; Bitumen) fume	**ACGIH (United States, 2000).** TWA: 0.5 mg/m^3

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (TYPICAL)

Physical State	Semi-solid to solid (Smooth texture)	**Color**	Dark amber.	**Odor**	Mild petroleum odor
Specific Gravity	0.91 (Water = 1)	**pH**	Not applicable.	**Vapor Density**	>10 (Air = 1)
Boiling Range	Not available.			**Melting/Freezing Point**	Not available.
Vapor Pressure	<0.01 kPa (<0.1 mm Hg) (at 20°C)			**Volatility**	Negligible volatility.
Solubility in Water	Negligible solubility in cold water.			**Viscosity (cSt @ 40°C)**	Not available.
Flash Point	Open cup: >150°C (>302°F) (Estimated.).				
Additional Properties	NLGI Grade: 2 Thickener: Lithium Texture: Smooth				

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability Stable. **Hazardous Polymerization** Not expected to occur.

Conditions to Avoid Keep away from extreme heat, sparks, open flame, and strongly oxidizing conditions.

Materials Incompatibility Strong oxidizers.

Hazardous Decomposition Products No additional hazardous decomposition products were identified other than the combustion products identified in Section 5 of this MSDS.

SECTION 11. TOXICOLOGICAL INFORMATION

For other health-related information, refer to the Emergency Overview on Page 1 and the Hazards Identification in Section 3 of this MSDS.

Toxicity Data

Highly-refined petroleum lubricant oils

ORAL (LD50): Acute: >5000 mg/kg [Rat].
DERMAL (LD50): Acute: >2000 mg/kg [Rabbit].

Mineral oil mists derived from highly refined oils are reported to have low acute and sub-acute toxicities in animals. Effects from single and short-term repeated exposures to high concentrations of mineral oil mists well above applicable workplace exposure levels include lung inflammatory reaction, lipoid granuloma formation and lipoid pneumonia. In acute and sub-acute studies involving exposures to lower concentrations of mineral oil mists at or near current work place exposure levels produced no significant toxicological effects. In long term studies (up to two years) no carcinogenic effects have been reported in any animal species tested.

Grease:
Injection of pressurized hydrocarbons under the skin, in muscle or into the blood stream can cause irritation, inflammation, swelling, fever and mild central nervous system depression. Injection of pressurized hydrocarbons can cause severe, permanent tissue damage.

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity Ecotoxicity data are not available for this product.

Environmental Fate An environmental fate analysis is not available for this specific product. Plants and animals may experience harmful or fatal effects when coated with petroleum products. Petroleum-based (mineral) lubricating oils normally will float on water. In stagnant or slow-flowing waterways, an oil layer can cover a large surface area. As a result, this oil layer might limit or eliminate natural atmospheric oxygen transport into the water. With time, if not removed, oxygen depletion in the waterway may be sufficient to cause a fish kill or create an anaerobic environment. This material contains phosphorus which is a controlled element for disposal in effluent waters in most sections of North America. Phosphorus is known to enhance the formation of algae. Severe algae growth can reduce oxygen content in the water possibly below levels necessary to support marine life.

SECTION 13. DISPOSAL CONSIDERATIONS

Hazard characteristic and regulatory waste stream classification can change with product use. Accordingly, it is the responsibility of the user to determine the proper storage, transportation, treatment and/or disposal methodologies for spent materials and residues at the time of disposition.

Conditions of use may cause this material to become a "hazardous waste", as defined by federal or state regulations. It is the responsibility of the user to determine if the material is a "hazardous waste" at the time of disposal. Transportation, treatment, storage, and disposal of waste material must be conducted in accordance with RCRA regulations (see 40 CFR 260 through 40 CFR 271). State and/or local regulations may be more restrictive. Contact your regional US EPA office for guidance concerning case specific disposal issues. Empty drums and pails retain residue. DO NOT pressurize, cut, weld, braze, solder, drill, grind, or expose this product's empty container to heat, flame, or other ignition sources. DO NOT attempt to clean it. Empty drums and pails should be drained completely, properly bunged or sealed, and promptly sent to a reconditioner.

SECTION 14. TRANSPORT INFORMATION

The shipping description below may not represent requirements for all modes of transportation, shipping methods or locations outside of the United States.

US DOT Status Not regulated by the U.S. Department of Transportation as a hazardous material.

Proper Shipping Name Not regulated.

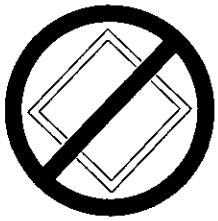
Hazard Class Not regulated.

Packing Group Not applicable.

UN/NA Number Not regulated.

Reportable Quantity A Reportable Quantity (RQ) has not been established for this material.

Placard(s)



Emergency Response Guide No. Not applicable.

MARPOL III Status Not a DOT "Marine Pollutant" per 49 CFR 171.8.

Oil: The product(s) represented by this MSDS is (are) regulated as "oil" under 49 CFR Part 130. Shipments by rail or highway in packaging having a capacity of 3500 gallons or more or in a quantity greater 42,000 gallons are subject to these requirements. In addition, mixtures containing 10% or more of this product may be subject to these requirements.

SECTION 15. REGULATORY INFORMATION

TSCA Inventory This product and/or its components are listed on the Toxic Substances Control Act (TSCA) inventory.

SARA 302/304 Emergency Planning and Notification The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to Subparts 302 and 304 to submit emergency planning and notification information based on Threshold Planning Quantities (TPQs) and Reportable Quantities (RQs) for "Extremely Hazardous Substances" listed in 40 CFR 302.4 and 40 CFR 355. No components were identified.

SARA 311/312 Hazard Identification The Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III requires facilities subject to this subpart to submit aggregate information on chemicals by "Hazard Category" as defined in 40 CFR 370.2. This material would be classified under the following hazard categories:

No SARA 311/312 hazard categories identified.

SARA 313 Toxic Chemical Notification and Release Reporting This product contains the following components in concentrations above *de minimis* levels that are listed as toxic chemicals in 40 CFR Part 372 pursuant to the requirements of Section 313 of SARA: No components were identified.

CERCLA The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) requires notification of the National Response Center concerning release of quantities of "hazardous substances" equal to or greater than the reportable quantities (RQ's) listed in 40 CFR 302.4. As defined by CERCLA, the term "hazardous substance" does not include petroleum, including crude oil or any fraction thereof which is not otherwise specifically designated in 40 CFR 302.4. Chemical substances present in this product or refinery stream that may be subject to this statute are:
Zinc and Zinc Compounds, Concentration: <1%

Clean Water Act (CWA) This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

California Proposition 65	This product is not known to contain any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.
New Jersey Right-to-Know Label	Petroleum Oil
Additional Remarks	No additional regulatory remarks.

SECTION 16. OTHER INFORMATION

Refer to the top of Page 1 for the HMIS and NFPA Hazard Ratings for this product.

REVISION INFORMATION

Version Number	5.1
Revision Date	8/1/2008

ABBREVIATIONS

AP: Approximately EQ: Equal >: Greater Than <: Less Than NA: Not Applicable ND: No Data NE: Not Establishe

ACGIH: American Conference of Governmental Industrial Hygienists

IARC: International Agency for Research on Cancer

NIOSH: National Institute of Occupational Safety and Health

NPCA: National Paint and Coating Manufacturers Association

NFPA: National Fire Protection Association

AIHA: American Industrial Hygiene Associatior

NTP: National Toxicology Program

OSHA: Occupational Safety and Health Administration

HMIS: Hazardous Materials Information System

EPA: US Environmental Protection Agency

DISCLAIMER OF LIABILITY

THE INFORMATION IN THIS MSDS WAS OBTAINED FROM SOURCES WHICH WE BELIEVE ARE RELIABLE. HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESSED OR IMPLIED REGARDING ITS CORRECTNESS. SOME INFORMATION PRESENTED AND CONCLUSIONS DRAWN HEREIN ARE FROM SOURCES OTHER THAN DIRECT TEST DATA ON THE SUBSTANCE ITSELF. THIS MSDS WAS PREPARED AND IS TO BE USED ONLY FOR THIS PRODUCT. IF THE PRODUCT IS USED AS A COMPONENT IN ANOTHER PRODUCT, THIS MSDS INFORMATION MAY NOT BE APPLICABLE. USERS SHOULD MAKE THEIR OWN INVESTIGATIONS TO DETERMINE THE SUITABILITY OF THE INFORMATION OR PRODUCTS FOR THEIR PARTICULAR PURPOSE.

THE CONDITIONS OR METHODS OF HANDLING, STORAGE, USE, AND DISPOSAL OF THE PRODUCT ARE BEYOND OUR CONTROL AND MAY BE BEYOND OUR KNOWLEDGE. FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS, DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.

***** END OF MSDS *****

- Motors to have timer controls, with system adaptable for automated "batch weigh/transfer" system. Allen-Bradley controls, preferred.

- Blend times established, to provide for Packaging usage of 2,000lbs./hr. (minimum 3 batches, per 8 hr. shift)

- Vendor to supply STERIS with approval drawings, for review,revision and acceptance prior to construction.

- Vendor will supply full documentation with system, to include: Equipment Manual, Equipment Drawings, Bill of Material, Electrical Schematics of Machine and Controls, and a Full Recommended Spare Parts List. Also provided, is the Manufacturers Suggested Maintenance Procedures.

- Quote will list Services available,through vendor such as Repairs, Training and System set-up.

- System will provide finished product that duplicates or improves quality of current blends.

PURCHASE REQUISITION

STERIS Corporation

[ ] CHECK REQUEST
[X] PURCHASE ORDER
[ ] ACCOUNT CHARGE

[ ] CONFIRMING DO NOT REORDER

REQ #_ _ _

VENDOR ID# _ _ _ _ _ _ _

REQ REC _/_

ACT # 52016 - 5021

REQUESTED BY: [signature]

DATE: 12-7-95

PURPOSE: New Blender FOR HOPKINS FACILITY

VENDOR: ROBERTSON EQUIP.
ADDRESS: 24700 CENTER RIDGE Rd
WESTLAKE, OH. 44145
CONTACT: DEAN ROBERTSON
PHONE: 899-0222

CHECK # DATE

QT	PRC UNTS	CAT # ST P/N	DESCRIPTION	PRICE	TOTAL
1	EA	4810	SCOTT PLOW MIXER,		
			48" X 120", 75 cu.ft		
			of MIXING CAPACITY.		
			END PLATES 1/2" PLATE,		
w/ contingent per			3/8" MIXER TUB WALLS.		
memo from MAK			WITH ALL FEATURES		
to WAO.			LISTED ON QUOTATION		
			# 95-3244 (attached)	sub	$114,786.00

[ ] SALES TAX EXEMPT

TOTAL ESTIMATED PRICE: cont'd. thru pg 3

NOTES: SHIP TO MENTOR, OH. — ADDRESS TO BE PROVIDED w/ APPROVAL DRAWINGS.

DATE: 12/7/95
AUTHORIZED BY: [signatures]

DATE: 12/8/95
APPROVED BY: [signature] 1/8/96

**** PURCHASING USE ONLY ****

PURCHASE ORDER #_ _ _ _ _ _ _

COMMITTED SHIP DATE:

PURCHASE ORDER DATE: / /
DELIVER TO:

FOB TERMS:
CASH TERMS:

SHIP VIA:
[ ] TRUCK
[ ] PICK UP
[ ] OTHER
[ ] UPS
[ ] FED EXP

PURCHASE REQUISITION

STERIS Corporation

[ ] CHECK REQUEST [ ] PURCHASE ORDER [ ] ACCOUNT CHARGE	[ ] CONFIRMING DO NOT REORDER	REQ #_ _ _
	VENDOR ID# _ _ _ _ _ _ _	REQ REC _/_
ACT # _ _ _ _ - _ _ _ _	REQUESTED BY:	DATE:

PURPOSE: _____

CHECK # _____ DATE _____

VENDOR: ROBERTSON EQUIP.
ADDRESS: _____
CONTACT: _____
PHONE: _____

QT	PRC UNTS	CAT # ST P/N	DESCRIPTION	PRICE	TOTAL
			including SPARE PARTS,		
			as follows:		
2	EA		5 15/16" NICKEL PLATED TYPE	1977.00	3954
			"E" BEARINGS.		
4	EA		INTERNAL SEAL PACKS	155.00	465.00
6	EA		V-BELTS for 125 H.P. DRIVE	35.00	210.00
	AND		OPTIONAL SANITARY BALL VALVE for		
			CLEAN OUT OF MIXER	1200.00	1200.00

[ ] SALES TAX EXEMPT — TOTAL ESTIMATED PRICE:

NOTES:

DATE: 12/8/95 AUTHORIZED BY: M A Frank

DATE: / / APPROVED BY: _____

**** PURCHASING USE ONLY ****

PURCHASE ORDER #_ _ _ _ _ _ _ — COMMITTED SHIP DATE:

PURCHASE ORDER DATE: / /
DELIVER TO: _____
FOB TERMS: _____
CASH TERMS: _____

SHIP VIA:

[ ] TRUCK [ ] UPS
[ ] PICK UP [ ] FED EXP
[ ] OTHER _____

PURCHASE REQUISITION

STERIS Corporation

[ ] CHECK REQUEST [ ] PURCHASE ORDER [ ] ACCOUNT CHARGE	[ ] CONFIRMING DO NOT REORDER VENDOR ID# _ _ _ _ _ _ _	REQ #_ _ _ REQ REC _/_
ACT # _ _ _ _ - _ _ _ _	REQUESTED BY:	DATE:

PURPOSE: _____

VENDOR: _____
ADDRESS: _____

CONTACT: _____
PHONE: _____

CHECK # _____ DATE _____

QT	PRC UNTS	CAT # ST P/N	DESCRIPTION	PRICE	TOTAL
	INCLUDES		CONTROL PANEL (QUOTATION #95-1624)		
W/	NEMA 4		PANEL, LIGHTS, SPARES AND TIMERS		@ 1,772.00
		SCOTT TO	PROVIDE RECOMMENDED STARTERS		
	APPROVAL		DRWGS - 1 TO 2 WKS after P.O.		
			DELIVERY 10 TO 12 WKS after		
RECEIPT	OF	APPROVAL	DRWINGS		
		TERMS:	1/3 DOWN W/ORDER, 1%-		
			10 DAYS, NET 30 DAYS		

[ ] SALES TAX EXEMPT — TOTAL ESTIMATED PRICE: $ 122,387

NOTES:

DATE: 12 8 95 — AUTHORIZED BY: _____

DATE: 12/19/95 — APPROVED BY: _____

**** PURCHASING USE ONLY ****

PURCHASE ORDER #_ _ _ _ _ _ _ — COMMITTED SHIP DATE:

PURCHASE ORDER DATE: / /

DELIVER TO: _____

FOB TERMS: _____

CASH TERMS: _____

SHIP VIA:

[ ] TRUCK [ ] UPS
[ ] PICK UP [ ] FED EXP
[ ] OTHER _____

scott
BUILT FOR TODAY
TO LAST FOR TOMORROW

MANUFACTURERS OF PROCESSING EQUIPMENT FOR:
• AGRICULTURE • INDUSTRIAL
• CHEMICAL • FOOD

QUOTATION DATE: 9/ 8/95
(valid for 30 days)

QUOTATION NUMBER: 95-1624

TERMS: 1/3 - Downpayment w/order
1% - 10 Days
Net - 30 Days

SOLD TO: STERIS CORPORATION
9450 Pineneedle Drive
Mentor, OH 44060

ATTN: Mike Jusek

SALESMAN: David Grimes/siw

REF:

SCOTT EQUIPMENT COMPANY proposes to supply a Control Panel for the proposed Plow Blender.

Panel rated NEMA 4 and includes (3) green illuminated start buttons and (3) red illuminated stop buttons. (1) set is for the 125 HP plow blender, (1) set for the 10 HP choppers and (1) set of spares, if ever needed

Omron timers are included for both the blender motor and the chopper motors. The face is exposed through the panel case for timer setting.

Starters are not included in this panel.

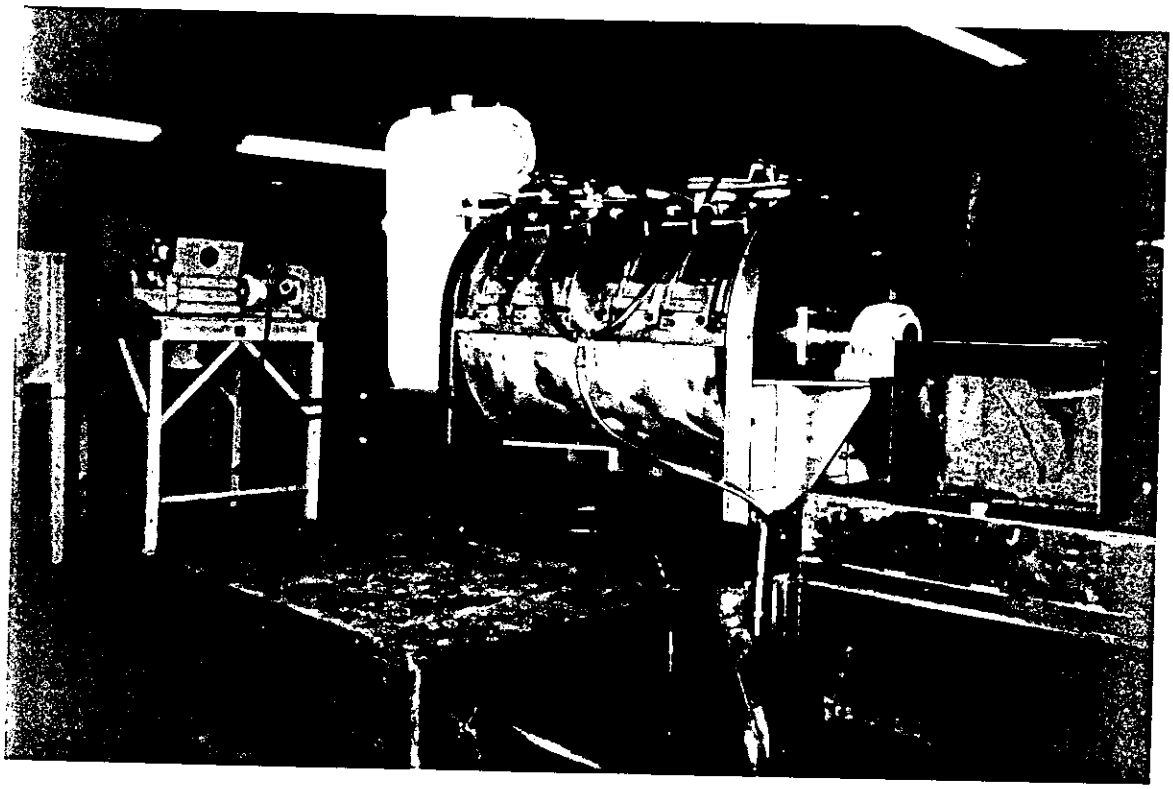
SELLING PRICE.....$1,772.00

NOTE: If starters are to be included.....add $ 8,760.00

DELIVERY: 10 to 12 weeks after receipt of approval drawings
Time for approval drawings is 1 to 2 weeks

cc: ROBERTSON EQUIPMENT COMPANY
Dean Robertson

F.O.B. New Prague, Minnesota



SCOTT Plow Mixer

The Scott Plow Mixer incorporates high intensity plows to deliver a fluidize mixing zone. This design uses wedge shaped mixing implements to create the fluidized bed. The mixer shaft operates at higher speeds than a traditional batch mixer and when incorporated with the cylindrical vessel design delivers excellent mixing results.

The Scott Plow Mixer, is constructed with a horizontal mixing chamber, cylindrical in shape, that has a solid shaft with the mixer elements welded or bolted to the support posts. This mixer is available with all of the necessary sanitary features to meet USDA, FDA, and 3A requirements.

The fluidized bed created by the mixing agitator is ideal for mixing solids to solids, solids to liquids and liquids to solids. A wide variety of process industries have successfully used the plow style mixer to meet their mixing requirements.

In applications where heating or cooling the product is necessary, the fluidization created by the mixing action, offers the product excellent surface area coverage on the mixer cylinder. This action greatly increases the efficiency of the unit to act as a drying or cooling vessel.

The Scott Plow Mixer is available with high speed choppers, high pressure jacket and vacuum design that allows the mixer to be used as a full process vessel.

STERIS

FAX TRANSMITTAL COVER SHEET

Date: SEPT. 11, 1995

Number of Pages (including this one): 6

To: DR. CECIL W. PROPST

Company: MFG. CHEMISTS / TELTECH

FAX Number: 1-317-823-6411

From: MICHAEL JUSEK - Chem. Pckg. Mgr.

STERIS Corporation
Plant 23
Phone: 216-639-8066
FAX: 216-639-8653

Comments: DR. PROPST, THANK YOU FOR YOUR ASSISTANCE AND INFORMATION. SHEET #4 IS A COPY OF TEST RESULTS (from plow mixer). READINGS ARE VERY SIMILAR TO THOSE FROM V-BLENDER. ADVANTAGES SEEM TO BE QUICKER BATCH TIMES, DRIER POWDER, LESS MOVING PARTS (replacement). I'M INTERESTED IN YOUR OPINION / CONCERNS.

THANK YOU,

Michael Jusek

SCOTT
BUILT FOR TODAY
TO LAST FOR TOMORROW

MANUFACTURERS OF PROCESSING EQUIPMENT FOR:
• AGRICULTURE • INDUSTRIAL
• CHEMICAL • FOOD

October 19, 1995

Mr. Mike Jusek
STERIS CORPORATION
9450 Pineneedle Drive
Mentor, OH 44060

REFERENCE: **OUR REVISED QUOTATION NUMBER 95-3244 REV #2**

Dear Mr. Jusek:

Enclosed please find the revised quotation you requested we send you for the **MODEL 4810 PLOW MIXER**. The basic specifications are enclosed with pricing details.

For pumps and metering equipment, please contact Mike Lynch at Controls & Meters at 612-944-3666.

Please review and contact us with any questions or additional information required at **1-800-264-9519**.

Regards.

SCOTT EQUIPMENT COMPANY

Dave Lucas
Vice President Sales

DL:siw
enclosure

cc: **ROBERTSON EQUIPMENT COMPANY, INC.**
Dean Robertson
24700 Center Ridge Road, Suite 11
Westlake, OH 44145
Ph: 216-899-0222
Fax: 216-899-0226

SCOTT
BUILT FOR TODAY
TO LAST FOR TOMORROW

MANUFACTURERS OF PROCESSING EQUIPMENT FOR:
• AGRICULTURE • INDUSTRIAL
• CHEMICAL • FOOD

QUOTATION DATE: 10/19/95
(valid for 30 days)

QUOTATION NUMBER: 95-3244
REV #2

TERMS: 1/3 - Downpayment w/order
1% - 10 Days
Net - 30 Days

SOLD TO: STERIS CORPORATION
9450 Pineneedle Drive
Mentor, OH 44060

ATTN: Mike Jusek

SALESMAN: Dave Lucas/siw

REF:

(1) SCOTT MODEL 4810 PLOW MIXER, 48" x 120", 75 cu. ft. of mixing cap. Endplates 1/2" plate, 3/8" mixer tub.

CONSTRUCTION: All welded construction with 316SS provided on all product contact points. Exterior of mixer finished with a glass bead satin finish. Interior of mixer finished with a 120 grit sanitary finish. Corners radiused for easy cleaning. (3) 10 HP choppers to disperse lumps. Choppers are mounted through the tub wall on the upward rotation side. Liquid manifold in mixer cylinder with (5) inlets into cylinder. Nozzles are shielded from direct product contact.

AGITATOR: 7" solid 316SS main shaft with welded 2" thick support post.

DOORS: Hinged access doors allow for entry and service. Doors are protected by limit switches to prevent opening during operation.

PRODUCT INLET: Inlet supplied for filling with pneumatic conveyor.

SHAFT SEALS: Sanitary hand disassemble air purge packing gland seals with (3) rings of teflon packing and (1) UHMW lantern ring.

DISCHARGE: Air actuated 14" flush mount plug gate at the center of the mixer. ~~36"~~ 44" legs provided for discharge clearance. Legs made of tubular carbon steel painted with white food grade epoxy paint.

BEARINGS: Set outboard w/heavy duty 5 15/16" nickel plated pillow block bearings on drive end of mixer and 5 15/16" nickel plated pillow block bearings on idle end of mixer.

DRIVE ASSEMBLY: FINAL MIXER SPEED.....62 RPM
125 HP belt drive. 1.7 service factor provided on drive. Drive is complete with 304SS OSHA guard.
125 HP reducer, Falk gearhead type 1.4 service factor on reducer.
125 HP explosion proof motor, 3 phase 460 volt with Carbon steel motor mount.

SELLING PRICE.....$114,786.00

OPTION: Sanitary ball valve for draining mixer after clean out..**add $1,200.00**

NOTE: Controls included (less starters)

DELIVERY: 10 to 12 weeks after receipt of approval drawings
Time for approval drawings is 1 to 2 weeks

cc: **ROBERTSON EQUIPMENT COMPANY**
Dean Robertson

F.O.B. Jobsite

SCOTT
BUILT FOR TODAY
TO LAST FOR TOMORROW

MANUFACTURERS OF PROCESSING EQUIPMENT FOR:
• AGRICULTURE • INDUSTRIAL
• CHEMICAL • FOOD

QUOTATION DATE: 10/20/95
(valid for 30 days)

QUOTATION NUMBER: 95-3244
REV. 2

SOLD TO: STERIS CORPORATION
9450 Pineneedle Drive
Mentor, OH 44060

SALESMAN: Terry Lijewski/js

ATTN: Mike Jusek

As a follow-up to my conversation with Dean Robertson of Robertson Equipment Company, the following is a recommended spare parts list for the Scott Model 4810 Plow Mixer:

Bearings: 5 15/16" nickel plated type E.....**cost $1,977.00 each**

Internal Seal Pack: (3) rings of teflon packing and (1) UHMW lantern ring.....**cost $ 155.00 each**

V-Belt: 125 HP Drive.....**cost $ 35.00 each**

If there are additional questions, please call.

Regards,

Chopper Blades..... $125.00 ea.

SCOTT EQUIPMENT COMPANY

Terry

Terry Lijewski

TL:js

Enclosure

cc: **Dean Robertson**
ROBERTSON EQUIPMENT COMPANY
24700 Center Ridge Road, Suite 11
Westlake, OH 44145
Tel: 216-899-0222
Fax: 216-899-0226

F.O.B. New Prague, Minnesota

PAK/
TEEM,
INC.

11500 Rockfield Court
Cincinnati, Ohio
45241-1919
513-772-4777
(FAX) 513-772-6950

TO: William A. O'Riordan DATE: 11/30/95

FROM: Jim Wilkinson JW

SUBJECT: **Powders Making - PAK/TEEM Proposal #95221**

INTRODUCTION

The following proposal is based on the system depicted on the flowsheet developed by Ed Ackell utilizing data provided by Mike Jusek. The definition phase of the project should further define the system as we better understand the product formulation and capacity requirements.

SCOPE OF WORK

The system shown on our flowsheet No. 4132PFD3-A has the following major components:

1. Super Sack Dumping Station
2. Pre-Weigh/Bag Dumping Station
3. Vacuum Receiver/Vacuum Producer
4. Rotary Airlock
5. Vibratory Sifter
6. Scott Plow Mixer
7. Liquid Mix Tank with Agitator on Load Cells
8. Metering Pump
9. Ventilation System for Liquids
10. Dust Control System for Powders

PAK/TEEM will provide specifications for each of the major components and inquiry documents for vendor bidding and selection.

PAK/TEEM will provide sufficient layout and detail drawing information for the necessary equipment supports and access platforms.

PAK/TEEM will provide piping drawings, flowsheets and specifications sufficient for the procurement of all ancillary equipment (diverters, piping, ducting).

PAK/TEEM will provide vendor liaison during equipment fabrication and final inspection before shipment.

PAK/TEEM will provide two people for one week each for start up support.

CLARIFICATIONS

The controls system should be relatively simple with regards to system operation but until we better understand the data acquisition we have not included any effort beyond vendor requirements.

The proposal is based on the best data provided to date. The definition phase could simplify or complicate the task. Change management will be utilized for additions or deletions to the Engineering or System scope.

The validation protocol is not included as part of this proposal. It is identified in another proposal, in this package, that includes the total process.

COST AND SCHEDULE

PAK/TEEM has estimated our labor cost to be $32,000 plus expenses estimated to be $8,000 for a total cost of $40,000. We are prepared to initiate the project with your verbal concurrence of our proposal. The schedule will be developed as the initial activity of the project.

TERMS AND CONDITIONS

PAK/TEEM's standard terms and conditions are attached.

ROBERTSON EQUIPMENT COMPANY
OHIO ● 800-788-0456
24700 Center Ridge Road. Suite 11, Westlake, Ohio 44145
216-899-0222
FAX ● 216-899-0226

February 14, 1996

Mr. Mike Jusek
Steris Corp.
9450 Pineneedle Dr.
Mentor, OH 44060

Quote #4097

Dear Mr. Jusek,

We are pleased to quote the following lab mixer as a scale down of what has been purchased:

(1) SCOTT MODEL 203 PLOW MIXER, 20" x 36", 1 1/2 cu. ft. of capacity, mixing capacity. End plates 1/4" plate, 1/4" mixer tub. Tub is cylindrical in design.

CONSTRUCTION: All welded construction with 304SS provided on all product contact points. Exterior of mixer finished with 120 grit sanitary finish.

AGITATOR: 3" main shaft with plow mixing elements welded.

SHAFT SEALS: Air purge packing gland seals with (3) rings teflon packing and (1) UHMW lantern ring. Hand disassemble style.

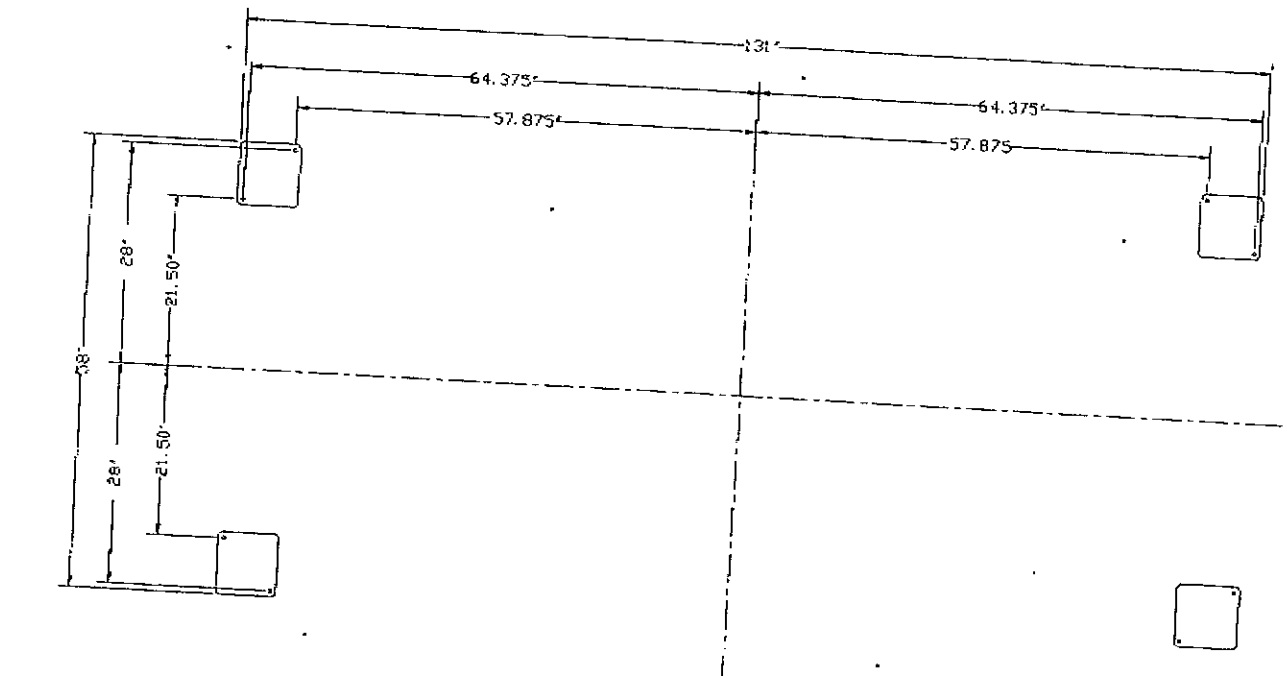
DISCHARGE: Manually actuated 6" pivot gate at the center of the mixer. 36" carbon steel legs provided for discharge clearance.

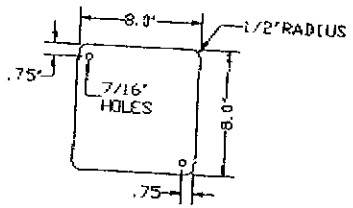
BEARINGS: Set outboard with heavy duty 2 7/16" pillow block bearings on drive end of mixer and 2 7/16" on idle end of mixer.

DRIVE ASSEMBLY: **FINAL MIXER SPEED.....120 RPM**
10 HP V-belt drive. 1.7 service factor provided on belt drive. Drive is complete with carbon steel OSHA guard.
10 HP reducer, shaft mount type 1.4 service factor on reducer.
10 HP TEFC motor, 3 phase 460 volt with carbon steel motor mount.

Price.....$25,687.00

OPTION: (1) 3 HP H.S. Chopper ADD.....$ 3,911.00





BASE PAD DETAIL
2X SCALE

FOR STERIS CORP.

SCOTT EQUIPMENT CO.
NEW PRAGUE, MN. 56071

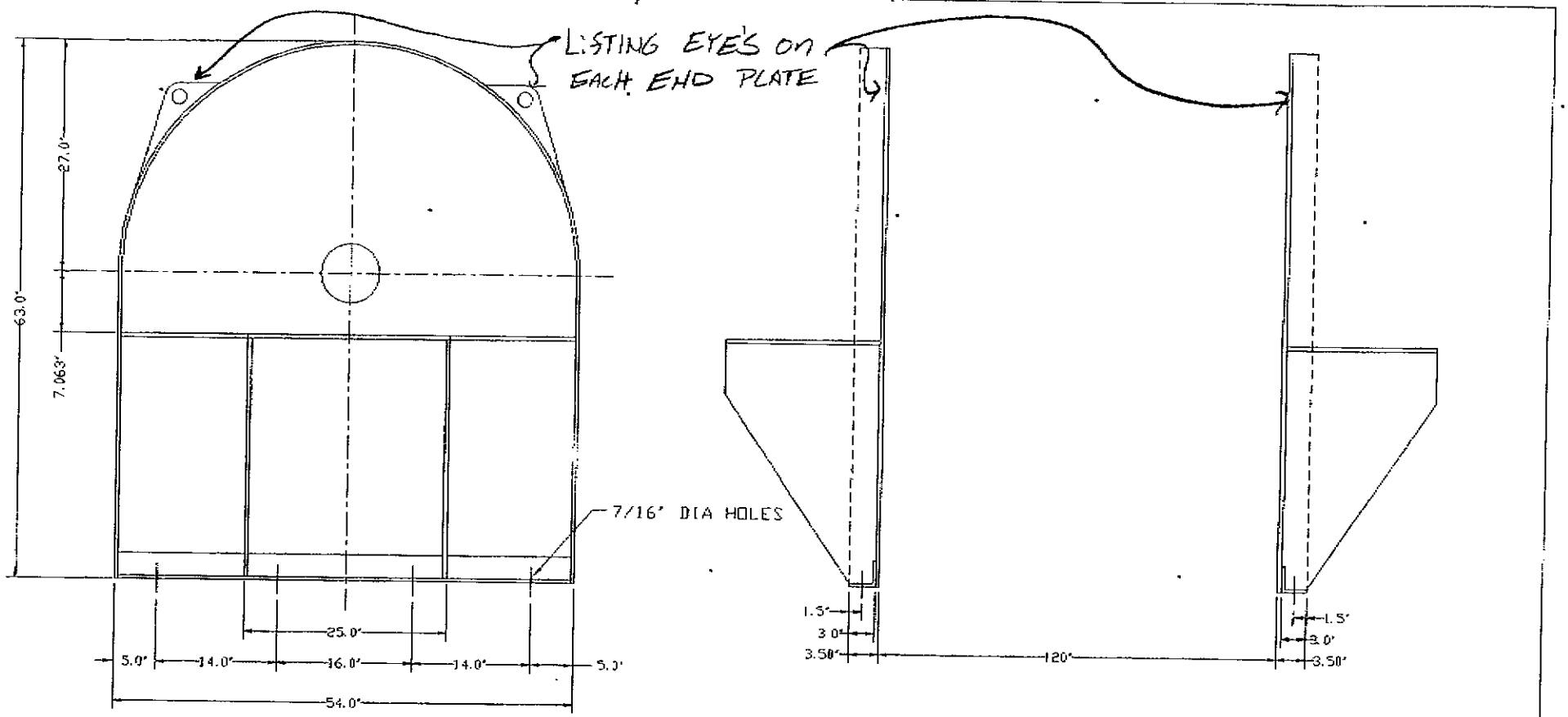
SCALE 3/4"=12"	DRWN RJB	REVISIONS	
DATE	CKD.		

-639-8653

ATTN: MIKE SEXTON

2 of 2

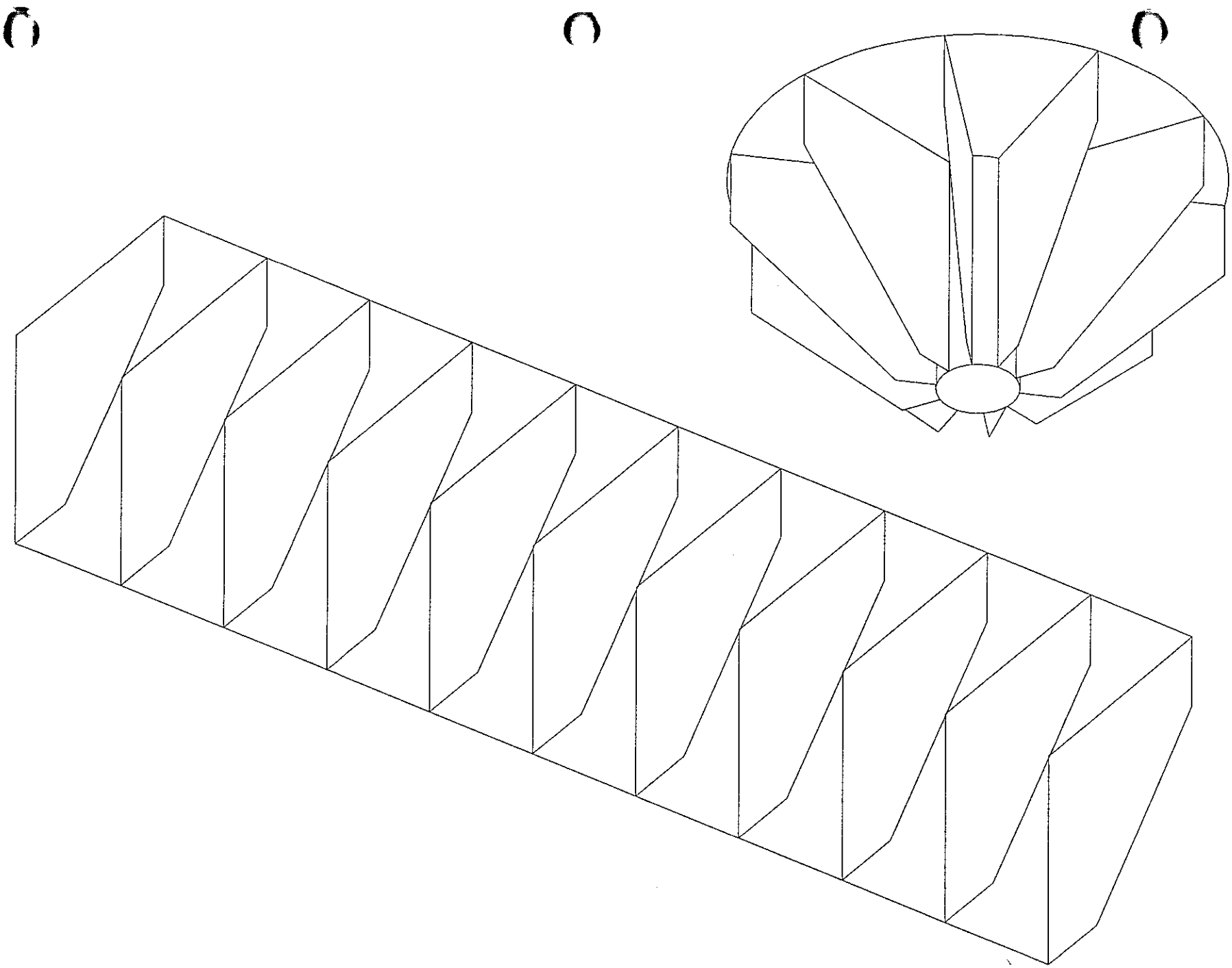
14,000 TOTAL MACH WGT.



SCOTT EQUIPMENT CO.
NEW PRAGUE, MN. 56071

SCALE 1"=12"	DR'N RJB	REVISIONS	BY	DATE
DATE	CK'D			

TITLE END PLATE BOLT PATTERN NO.



STERIS

PROJECT FAX

PAK/TEEM, INC.

TO: JIM DIMMICK
COMPANY: STERIS
PHONE: (216) 639-8066
FAX: (216) 639-8653

Date: 04/15/96

FROM: STAN LOCKWOOD
COMPANY: PAK/TEEM, INC.
PHONE: (513)-772-4777
FAX: (513)-772-6950

PAGES INCLUDING COVER PAGE: 2

SUBJECT: POWDER MAKING, SCOTT MIXER

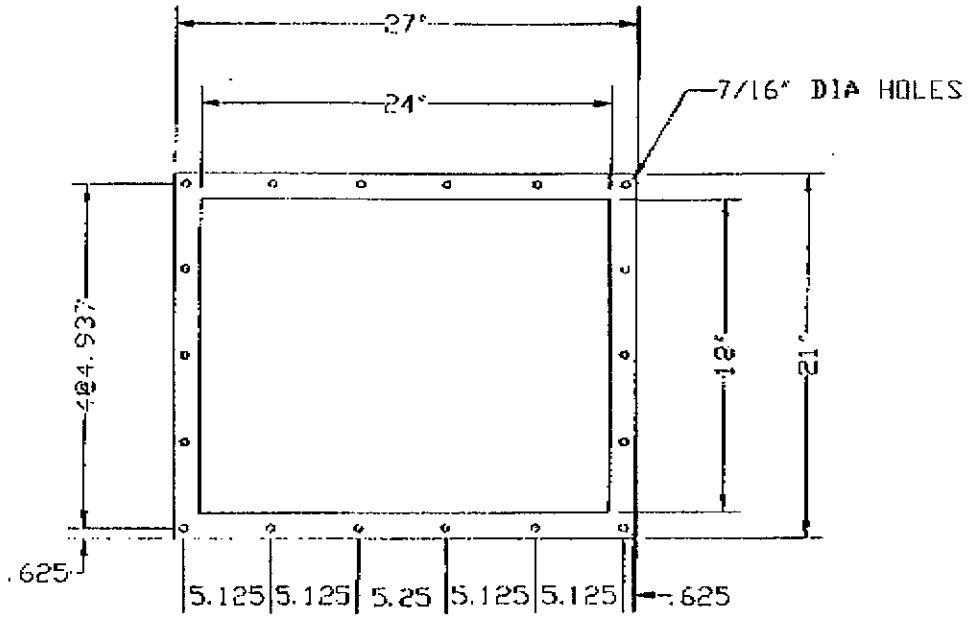
At our meeting on 4/3/96, we concluded that we would use the Scott plug gate valve which was purchased for the discharge, however, we would add a knife gate valve below their plug gate that could be closed during tote exchanges. I have requested dimensional information from Roger Boettcher at Scott Equipment for a hopper that would clear their plug gate. They have supplied the attached sketch, and proposed to furnish the hopper for $1850.00 I believe it would be best for Scott to build this hopper, because they would then be responsible for non-interference with their plug gate. If Steris agrees to purchase this hopper from Scott, it needs to be added to the purchase order as soon as possible.

We also discussed the support legs which Scott has already built. There is structural bracing that is in the way, and they are too short to get a tote under. If you would like, Scott will also quote on a new leg design to meet our requirements, or Pak/Teem can design new legs to be fabricated by others.

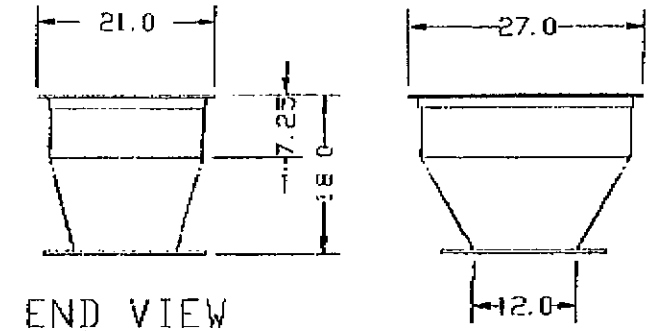
In these discussions with Scott, they inform me that Steris has not yet authorized the other changes that we agreed upon on 4/3/96:

1. Drain valve moved to top for vent.
2. Jog button on the controls

They also tell me that they recommended a fluid coupling to allow start-ups under load, but that requires authorization. They want something in writing.



DISCHARGE FLANGE DETAIL
2X SCALE



END VIEW

SIDE VIEW

HOPPER DIMENSIONS

LIQ. MIX TANK

ROBERTSON EQUIPMENT COMPANY
OHIO ● 800-788-0456

24700 Center Ridge Road, Suite 11, Westlake, Ohio 44145
216-899-0222
FAX ● 216-899-0226

April 22, 1996

Mr. Stan Lockwod
PAK/TEEM, Inc.
11500 Rockfield Ct.
Cincinnati, OH 45241

Quote #4220

Dear Mr. Lockwood,

We are pleased to submit the following quotation for a stainless steel mix tank, per your request:

1 - SHARPSVILLE EVT 100 316 stainless steel vertical tank. 15 degree cone bottom. 2B mill finish. Includes hinged cover.

Price.....$2,350.00

F.O.B. - Sharpsville, PA
Delivery - 5-6 weeks
Terms - net 30 days

Thank you for this opportunity to quote. We look forward to receiving your valued order. If there are any questions, or if we may be of any further help, please call.

Sincerely,

ROBERTSON EQUIPMENT CO.

Dean Robertson

DR/md
Enclosures
cc: SCC

STERIS

VIA FED-EX

February 21, 1996

Mr. Roger Boetcher
Scott Equipment Company
605 4th Avenue, NW
New Prague, Minnesota
56071

Dear Mr. Boetcher,

Enclosed is the approved blueprint of Scott Model 4810 Plow Mixer drawn specifically for STERIS Corporation.

If you have any questions or require further information, please do not hesitate to call.

Sincerely,

STERIS Corporation

John A. Rawot
Manager, Continuing Engineering

cc: W. A. O'Riordan
J. A. Dimmick

STERIS

FILE

FAX TRANSMITTAL COVER SHEET

Date: Aug. 8, 1995

Number of Pages (including this one): 4

To: MR. DAVID LUCAS, V.P.

Company: SCOTT EQUIPMENT CO.

FAX Number: 1-612-758-4377

From: MICHAEL TUSEK, PLANT MGR.
STERIS Corporation
Plant 23
Phone: 216-639-8066
FAX: 216-639-8653

Comments: Mr. Lucas, I am interested in evaluating your blender vs. the Patterson-Kelly, V-Blenders currently used. Please sign and return (fax) the following Agreement, a Hard Copy is on the way. We look forward to setting up a Test Blend. Our Rep., Dean Robertson will also be involved. Thank You,
Michael Tusek

STERIS®

CONFIDENTIALITY AGREEMENT

This Agreement is effective August 7, 1995, between STERIS Corporation ("STERIS"), with offices at 5960 Heisley Road, Mentor, Ohio, 44060, and Scott Equipment, 605 Fourth Avenue, N.W., New Prague, Minnesota 56071, hereafter, ("RECIPIENT").

It is proposed and understood that STERIS, either directly or through others, will disclose to RECIPIENT certain information on its proprietary sterile processing, cleaning, and decontamination technology, systems, and business which STERIS considers to be of a confidential nature in order that RECIPIENT may evaluate providing certain services and products to STERIS and/or propose a possible business relationship involving the use of the technology and/or systems.

In general, the information involved relates to the technology, design, chemistry formulation, and commercialization of sterilizing, decontamination, and cleaning products, systems, and accessories ("products"). Since the products are in ongoing stages of development and commercialization, it is essential to STERIS that information on the products and all technology and business details be retained in strict confidence; provided, however, RECIPIENT may disclose the same to any parent of RECIPIENT (which owns directly or indirectly at least 80% of the outstanding stock of RECIPIENT) or any subsidiary of RECIPIENT (at least 80% of the outstanding stock of which is owned directly or indirectly by RECIPIENT) (an "Affiliate") for the limited purpose of having the Affiliate assist RECIPIENT in their evaluation, if, and only if, in each such instance of disclosure to an Affiliate, RECIPIENT, before the disclosure, (1) procures from the Affiliate a signed confidentiality agreement for the benefit of STERIS containing all of the provisions of this Agreement (other than this proviso) and (2) forwards that signed confidentiality agreement to STERIS, to the attention of Bill R. Sanford, President. In the event of any such disclosure to any Affiliate,

CONFIDENTIALITY AGREEMENT

Page 2

RECIPIENT shall be responsible for any prohibited disclosure or use of the information by the Affiliate. RECIPIENT hereby acknowledges that any unauthorized disclosure or use of the confidential information will cause irreparable injury to STERIS.

Therefore, in consideration of making a disclosure to RECIPIENT, RECIPIENT hereby agrees, and this document will serve as a formal acceptance of that obligation, that (1) any such disclosure made to RECIPIENT by STERIS, either directly or indirectly, will be retained in strict confidence and will not be used or disclosed, other than in connection with this Agreement, without the prior written consent of STERIS, and (2) RECIPIENT shall not, alone or in combination with others, utilize any confidential information received from STERIS in any attempt to undertake to develop, manufacture, or market any manual or automated sterilization, decontamination, and/or cleaning system(s) or product(s).

The foregoing obligation of confidentiality and non-use shall cease to apply only if the information disclosed to RECIPIENT (a) is or becomes generally available to the public, through no act or failure to act by RECIPIENT or by any person or organization controlled by RECIPIENT, (b) was known to RECIPIENT prior to the disclosure by STERIS hereunder, as evidenced by RECIPIENT's prior written records, (c) is subsequently disclosed to RECIPIENT on a non-confidential basis by a third party not having a confidential relationship with STERIS, or (d) is hereafter independently developed by an employee of RECIPIENT who is shown not to have received or have available to him, directly or indirectly, orally, in writing, or in any other medium, any such information, as documented by the RECIPIENT's written records. For the purpose of this paragraph, "RECIPIENT" shall include all Affiliates.

STERIS CORPORATION ▪ 5960 Heisley Road ▪ Mentor, Ohio 44060 ▪ 216-354-2600

CONFIDENTIALITY AGREEMENT

Page 3

This Agreement shall terminate five (5) years after the last date on which STERIS makes any disclosure to RECIPIENT hereunder. The termination of this Agreement shall not affect any rights STERIS may have with respect to confidential information that are independent of this Agreement.

STERIS CORPORATION

By: _____ CFO

Michael A. Keresman, III
Chief Financial Officer

Date: 8/7/95

SCOTT EQUIPMENT

(RECIPIENT)

By: _____

David Lucas, Vice President

Date: 8/8/95

INTEROFFICE MEMORANDUM

TO: Mike Jusek DATE: August 24, 1995

FROM: Roxana Williams

SUBJECT: Trial Blend (10 cu.ft. Blender)

Observations:

1. The pour density increased from 0.90 to 0.97g/ml with the increase in blending time.

2. The Benzotriazole stayed constant at 4.6%, which indicates good mixing. Normally we average 4.8 to 5.0 %, but the mean specification is 4.7%.

3. The pH values, both without and with acid, dropped slightly, with increased blending time, but are still in spec.

8:30 Total Run Min
7:00 min wet

SUMMARY OF DATA FOR QUALITY ASSURANCE OF STERIS 20™ STERILANT CONCENTRATE BUILDERS

05-A-001.3(a)

Lot No.: A Sample Date: 8-23-95

Test Method		Assay Values			Specifications
SOP 41-D-014.1	(Benzotriazoles)	4.690			3.2 - 6.2%
SOP 41-D-006.1	(Dissolution time)	0:50	1:02		< 8 min.
		drum 1	drum 5	drum 9	
SOP 41-D-003.1	(pH without acid)	7.7	7.7	7.7	40.1°C 7.4 - 7.9
SOP 41-D-004.1	(pH with acid)	6.4	6.4	6.4	6.3 - 6.7
SOP 41-D-005.2	(Pour density)	/	0.90	/	.92 - 1.20 g/ml

Description: white granular powder; yellow surface cast

Comments: "chunks" took longer to dissolve

Peracetic Acid (≥ 35%) lot no.: 50728
Ammonium Hydroxide lot no.: F11-04-000
Dilute NH_4OH made: 8-7-95 by: DK
10% Silver Nitrate soln. lot no.: F31-04-001

Benzotriazoles:

Sample Wt.	Filter or Crucible Wt.	Filter or Crucible + PPT	PPT Wt.
1.5438	0.0770	0.2107	0.1337

ppt.wt. x 52.71 / sample wt. = % benzotriazoles 4.569%

Pour Density:

Drum 1: 89.1 90.1 89.5 Mean = 89.6 ÷ 100 = 0.90 gm/ml
Drum 5: _____ _____ _____ Mean = _____ ÷ 100 = _____ gm/ml
Drum 9: _____ _____ _____ Mean = _____ ÷ 100 = _____ gm/ml

[ ] ACCEPTED Hold [ ] REJECTED R. Williams signature 8-24-95 date

Disposition: _____

9:30 min Total Run
7:00 min wet

SUMMARY OF DATA FOR QUALITY ASSURANCE OF STERIS 20™ STERILANT CONCENTRATE BUILDERS

05-A-001.3(a)

Lot No.: B Sample Date: 8-23-95

Test Method		Assay Value	Specifications
SOP 41-D-014.1	(Benzotriazoles)	4.59%	3.2 - 6.2%
SOP 41-D-006.1	(Dissolution time)	0:42 1:05	< 8 min.

		drum 1	drum 5	drum 9		
SOP 41-D-003.1	(pH without acid)	7.7	7.6	7.6	39.9°C	7.4 - 7.9
SOP 41-D-004.1	(pH with acid)	6.4	6.4	6.4		6.3 - 6.7
SOP 41-D-005.2	(Pour density)	/	0.96	/		.92 - 1.20 g/ml

Description: white granular powder; yellow surface cast

Comments: "Chunks" took longer to dissolve

Peracetic Acid (≥ 35%) lot no.: 50728
Ammonium Hydroxide lot no.: F11-04-000
Dilute NH_4OH made: 8-7-95 by: DK
10% Silver Nitrate soln. lot no.: F31-04-001

Benzotriazoles:

Sample Wt.	Filter or Crucible Wt.	Filter or Crucible + PPT	PPT Wt.
1.5503	0.0772	0.2102	0.1330

ppt.wt. x 52.71 / sample wt. = % benzotriazoles 4.52%

Pour Density:

Drum 1	96.9	95.3	96.1	Mean = 96.1	÷ 100 = 0.96	gm/ml
Drum 5				Mean =	÷ 100 =	gm/ml
Drum 9				Mean =	÷ 100 =	gm/ml

[ ] ACCEPTED [Hold] REJECTED R Williams signature 8-24-95 date

Disposition:

10:00 min
Total Run

0:00 min
wet

SUMMARY OF DATA FOR QUALITY ASSURANCE OF STERIS 20™ STERILANT CONCENTRATE BUILDERS

05-A-001.3(a)

Lot No.: C   Sample Date: 8-23-95

Test Method		Assay Values			Specifications
SOP 41-D-014.1	(Benzotriazoles)	4.6%			3.2 - 6.2%
SOP 41-D-006.1	(Dissolution time)	0:40	0:45		< 8 min.
		drum 1	drum 5	drum 9	
SOP 41-D-003.1	(pH without acid)	7.5	7.5	7.5 40°C	7.4 - 7.9
SOP 41-D-004.1	(pH with acid)	6.3	6.4	6.3	6.3 - 6.7
SOP 41-D-005.2	(Pour density)	—	0.97	—	.92 - 1.20 g/ml

Description: white granular powder; yellow surface cast

Comments:

Peracetic Acid (≥ 35%) lot no.: 50728
Ammonium Hydroxide lot no.: F11-04-000
Dilute NH_4OH made: 8-7-95 by: DK
10% Silver Nitrate soln. lot no.: F31-04-001

Benzotriazoles:

Sample Wt.	Filter or Crucible Wt.	Filter or Crucible + PPT	PPT Wt.
1.4725	0.0771	0.2046	0.1275

$\frac{\text{ppt.wt. x 52.71}}{\text{sample wt.}}$ = % benzotriazoles 4.56%

Pour Density:

Drum 1	96.0	97.3	96.7	Mean = 96.7	÷ 100 =	0.97 gm/ml
Drum 5				Mean =	÷ 100 =	gm/ml
Drum 9				Mean =	÷ 100 =	gm/ml

[ ] ACCEPTED HOLD [ ] REJECTED   R. Williams signature   8-24-95 date

Disposition:

15:00 min Total Run

7:00 min. wet

COPY COPY

SUMMARY OF DATA FOR QUALITY ASSURANCE OF STERIS 20™ STERILANT CONCENTRATE BUILDERS

05-A-001.3(a)

Lot No.: D Sample Date: 8-23-95

Test Method		Assay Values			Specifications
		drum 1	drum 5	drum 9	
SOP 41-D-014.1	(Benzotriazoles)	4.69%			3.2 - 6.2%
SOP 41-D-006.1	(Dissolution time)	0:35	0:44		< 8 min.
SOP 41-D-003.1	(pH without acid)	7.5	7.5	7.5 41.1C	7.4 - 7.9
SOP 41-D-004.1	(pH with acid)	6.4	6.3	6.4	6.3 - 6.7
SOP 41-D-005.2	(Pour density)	—	0.97	—	.92 - 1.20 g/ml

Description: white granular powder; yellow surface cast

Comments:

Peracetic Acid (≥ 35%) lot no.: ~~F31-04~~ AW 50731

Ammonium Hydroxide lot no.: FA-04-000

Dilute NH_4OH made: 8-7-95 by: DK

10% Silver Nitrate soln. lot no.: F31-04-001

Benzotriazoles:

Sample Wt.	Filter or Crucible Wt.	Filter or Crucible + PPT	PPT Wt.
1.5324	0.0771	0.2121 JK	0.1350

ppt.wt. x 52.71 / sample wt. = % benzotriazoles 4.64%

Pour Density:

Drum 1	96.5	96.4	97.5	Mean = 96.8	÷ 100 = 0.97	gm/ml
Drum 5				Mean =	÷ 100 =	gm/ml
Drum 9				Mean =	÷ 100 =	gm/ml

[ ] ACCEPTED [Hold] REJECTED R. Williams signature 8-24-95 date

Disposition:

STERIS

FAX TRANSMITTAL COVER SHEET

Date: 8/15/95

Number of Pages (including this one): 6

To: MR. DAVID GRIMES

Company: SCOTT EQUIP. CO.

FAX Number: 612-758-4377

From: MIKE JUSEK

STERIS Corporation
Plant 23
Phone: 216-639-8066
FAX: 216-639-8653

Comments: DAVE, These sheets are for 50cu. BLENDER. I'VE ADJUSTED ALL WEIGHTS TO 10 cu ft batch. DOES your site have DEIONIZED WATER? WE'LL NEED 13.2 lbs. of it (see WEIGH SHEET #2, pt.# 900000) for liquid blend. RECEIVED DIRECTIONS, THANKS.

STERIS CORP.
5960 HEISLEY Rd.
MENTOR, OH 44060

Mike

CONFIDENTIAL

STERIS Corporation
CHEMICAL MANUFACTURING METHOD SHEET
REVISION RECORD

Number: M915020 Rev F Rev Date: 11/14/94

Title: Compounding Procedure
STERIS 20 50 Cubic Foot Blend Part/Assembly #: N/A

Written By: David J. Silvestro Date: 11/23/93

Approved By: [signature] Date: 11/30/94

DATE	REV	REVISION RECORD	A/B	APPROVED BY/DATE
12/10/93	A	RELEASE # 746	DJS	ARW 12/15/93
12/17/93	B	ERO # 1526	DJS	ARW 12/17/93
12/22/93	C	ERO # 1529	DJS	ARW 12/22/93
12/29/93	D	ERO # 1532	DJS	ARW 12/29/93
02/01/94	E	ERO # 1548	DJS	NLS 02/02/94
11/14/94	F	ERO #1614	DJS	[signature] 11/30/94

MASTER COPY

NOTE: Pre-weighed components may be charged while other components are being weighed. Ensure the charge components are evenly dispersed to both sides of the blender as they are added.

CONFIDENTIAL

NOTE: Reference method sheet # M915017 " Pre-weighing Charge Components" while performing step 4 of this procedure.

3. Remove and lock out power to the blender.

4. Ensure the blender dispenser valve is in the closed and locked position.

5. Weigh all charge components one at a time, document form 800078, and position the pre-weighed charge components on the transport pallet.

6. Position the transport pallet on the mezzanine.

7. Install the loading chute (D-601026) in the hatch used for charging the blender.

NOTE: Ensure the twin air flow gauges on the blender read 10 cfh.

8. Dispense the pre-weighed charge of component 900110 into the blender via the hatch furthest from the blender control panel.

9. Dispense the pre-weighed charge of component 900215 into the blender via the hatch furthest from the blender control panel.

10. Dispense the pre-weighed charge of component 900333 into the blender via the hatch furthest from the blender control panel.

11. Dispense the pre-weighed charge of component 900147 into the blender via the hatch furthest from the blender control panel.

12. Dispense the pre-weighed charge of component 900162 into the blender via the hatch furthest from the blender control panel.

13. Dispense the pre-weighed charge of component 900286 into the blender via the hatch furthest from the blender control panel.

14. Dispense the pre-weighed charge of component 900394 into the blender via the hatch furthest from the blender control panel.

15. Install and lock the blender lids. Ensure the filter caps are serviceable prior to the installation of the lids.

16. Reference method sheet # M915018 "Preparing The Caustic Solution" and begin the caustic solution preparation. Document Form 800079 while performing this procedure.

17. Install the intensifier bar feed tube and connect the solution container hardware to the pump plumbing.
Set the pump as follows:

Tension: 2.5
Speed : 3

18. Remove the blender power lock-out and apply main power.

19. Begin the 2 minute 50 second pre-blend by selecting jog on the control panel and depressing the start button.

20. After completion of the pre-blend, apply power to the intensifier bar, remove the solution container plug, open the valve and position the pump direction switch to rev. The liquid addition procedure should take approximately 30 minutes.

21. Position the pump direction switch to the off position. The caustic solution container can now be cleaned per method sheet M915022.

22. Stop the intensifier bar and allow the blender 1 additional rotation.

23. Select time on the control panel. The left display should read 40:00 and the right display should read 13:50.

Note: Use of the timers is optional. If a stopwatch is to be used, the intensifier bar must run for 13:50 and the blender for 40:00.

24. Depress the start button and intensifier start button. Both displays should begin to count down.

25. After the additional 13 minute, 50 second time frame, rotate the blender to the vertical position and manually stop it.

26. After the blender stops, allow it to rotate to the vertical position.

27. Remove power from the blender and lock it out.

28. Reference Method Sheet # M915021, " Unloading the Blender". Dispense the blend into the barrels one at a time.

29. Clean the blender and blend area per method sheet M915022.

B

STERIS Corporation
CHEMICAL MANUFACTURING

CAUSTIC CHARGE CERTIFICATION ~~50~~ 10^3 cft.

CONFIDENTIAL

DATE: _____

BLEND LOT NUMBER: _____

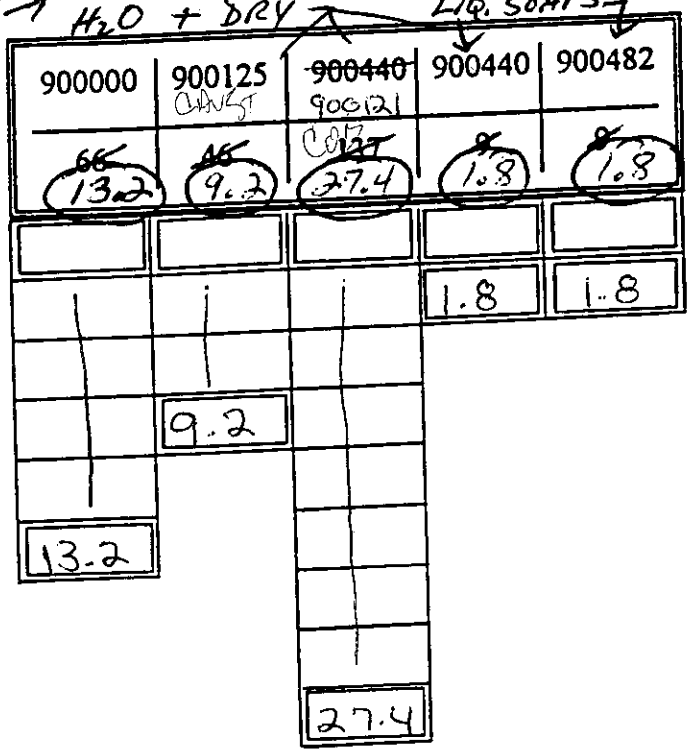
CERTIFIED BY: D.M. M.J.

SHIFT SUPERVISOR: _____

LIQUID / DRY → COMPONENTS and WEIGHT IN POUNDS

H_2O + DRY → LIQ. SOAPS →

900000	900125 CANST	~~900440~~ 900121 COST	900440	900482
~~66~~ 13.2	~~46~~ 9.2	~~COST~~ 27.4	~~8~~ 1.8	~~8~~ 1.8



COMPONENT	LOT NUMBER
900125	K224
900121	1031
900440	MI5E029191
900482	MI4G023476

TARGET: 267 lbs.

ACTUAL: _____ lbs.

B

STERIS Corporation
CHEMICAL MANUFACTURING

BLENDER CHARGE CERTIFICATION ~~50~~ 10³ cft.

DATE: _____ **CONFIDENTIAL**

BLEND LOT NUMBER: _____

BLENDER OPERATORS: D. M. M. J. and _____

CERTIFIED BY: _____

SHIFT SUPERVISOR : _____

LAB VERIFICATION OF LOT NUMBER: _____

ALL POWDER → COMPONENTS and WEIGHT IN POUNDS

900110	900215	900333	900147	900007	900162	900286	900394
~~1750~~	~~351~~	~~169.5~~	~~43.5~~	~~267~~	~~169.5~~	~~85~~	~~85~~
(350)	(70.2)	(33.9)	(8.7)	53.4	(33.9)	(17)	(17)
352				TOTAL OF ALL LISTED "WET BLEND ITEMS" TO BE FED TO DRY MIX			
− 3	50.45		8.7				
349	− 1.5					17	
+ 1	46.95						
350	121.25	33.9			33.9		17
	70.2						

COMPONENT	
900110	T 153590 62995
900215	B 484G R005
900333	2389
900147	B571G 2018
900162	507 P145008-119
900286	411532/791
900394	3506143

TARGET: ~~2655.5~~ lbs. + CAUSTIC TARGET: ~~267~~ lbs. = 2920.5 lbs.

ACTUAL: 530.6 lbs. + CAUSTIC WEIGHT: ___ lbs. = 53.4 lbs.

584.1

STERIS Corporation
CHEMICAL MANUFACTURING

A

BLENDER CHARGE CERTIFICATION ~~50~~ 10³ cft.

DATE: _____

CONFIDENTIAL

BLEND LOT NUMBER: _____

BLENDER OPERATORS: DM, MJ. and _____

CERTIFIED BY: _____

SHIFT SUPERVISOR : _____

LAB VERIFICATION OF LOT NUMBER: _____

ALL POWDER → COMPONENTS and WEIGHT IN POUNDS

900110	900215	900333	900147	900007	900162	900286	900394
~~1750~~	~~351~~	~~169.5~~	~~43.5~~	~~267~~	~~169.5~~	~~85~~	~~85~~
(350)	(70.2)	(33.9)	(8.7)	53.4	(33.9)	(17)	(17)
353				TOTAL OF ALL LISTED "WET BLEND ITEMS" TO BE FED TO DRY MIX			
-3	71.50		8.7				
	-1.5					17	
350	70.00 +.2	33.9					
	70.2				33.9		17

COMPONENT	
900110	T 1535906 2995
900215	B484G R005
900333	2389
900147	B571G P018
900162	507P145008-119
900286	4115321791
900394	3506143

TARGET: ~~2653.5~~ lbs. + CAUSTIC TARGET: ~~267~~ lbs. = 2920.5 lbs.

ACTUAL: 530.6 lbs. + CAUSTIC WEIGHT: ___ lbs. = 53.4 lbs.

A

STERIS Corporation
CHEMICAL MANUFACTURING

CAUSTIC CHARGE CERTIFICATION ~~50~~ 10^3 cft.

CONFIDENTIAL

DATE: _____

BLEND LOT NUMBER: _____

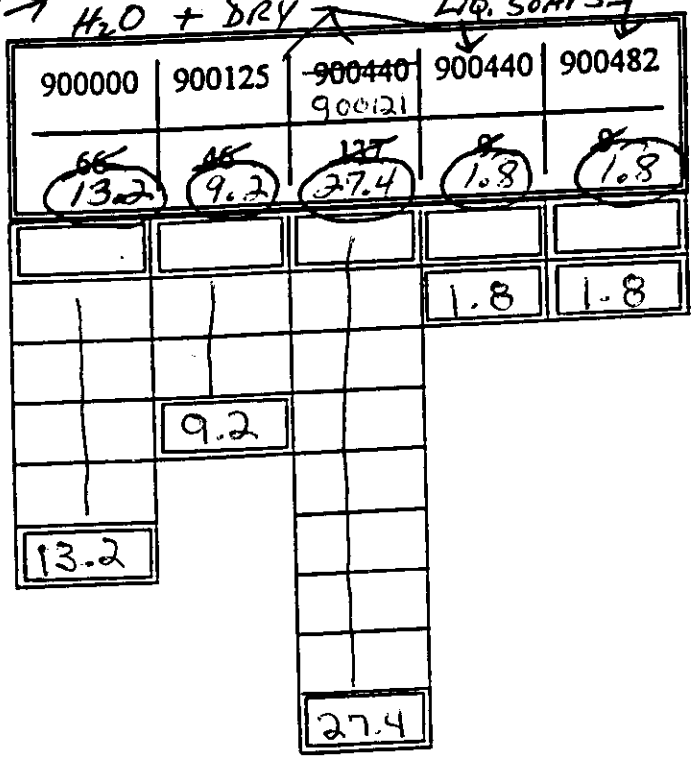
CERTIFIED BY: D. M. ; M. J.

SHIFT SUPERVISOR: _____

LIQUID / DRY → COMPONENTS and WEIGHT IN POUNDS

(H_2O + DRY) ↑ ↓ LIQ. SOAPS

900000	900125	~~900440~~ 900121	900440	900482
~~66~~ 13.2	~~46~~ 9.2	~~137~~ 27.4	~~9~~ 1.8	~~9~~ 1.8



COMPONENT	LOT NUMBER
900125	K224
900121	1031
900440	MI5E029191
900482	MI4G023476

TARGET: 267 lbs.

ACTUAL: _____ lbs.

Validation 50 cu. ft. Blender P.K

SUMMARY OF DATA FOR QUALITY ASSURANCE
OF STERIS 20™ STERILANT CONCENTRATE BUILDERS

05-A-001.3(a)

Lot No.: B1293V6 Sample Date: 12-28-93

Test Method		Assay Values	Specifications
SOP 41-D-014.1	(Benzotriazoles)	4.6% 4.5% 4.7%	3.2 - 6.2%
SOP 41-D-006.1	(Dissolution time)	1:07 1:58	< 8 min.

		drum 1	drum 6	drum 7	
SOP 41-D-003.1	(pH without acid)	7.7	7.7	7.7	7.4 - 7.9
SOP 41-D-004.1	(pH with acid)	6.5	6.5	6.5	6.3 - 6.7
SOP 41-D-005.2	(Pour density)	1.02	1.02	1.02	0.92 - 1.20 g/ml

Description: white granular powder; yellow surface cast

Comments: _____

Peracetic Acid (≥ 35%) lot no.: 31215
Ammonium Hydroxide lot no.: E95-07-009
Dilute NH_4OH made: 12-17-93 by: R.W.
10% Silver Nitrate soln. lot no.: F93-50-019

Benzotriazoles:

	Sample Wt.	Crucible Wt.	Crucible + PPT	PPT Wt.	
Dr. 1	1.5537	33.3424	33.4784	0.1360	4.61%
Dr. 6	1.5026	38.3146	38.4432	0.1286	4.51%
Dr. 7	1.5304	34.3298	34.4637	0.1369	4.72%

$\frac{\text{ppt.wt.} \times 52.71}{\text{sample wt.}}$ = % benzotriazoles

Pour Density:

Drum 1	103.4	101.4	102.4	Mean = 102.4	+ 100 =	1.02	gm/ml
Drum 6	101.7	101.3	101.9	Mean = 101.7	+ 100 =	1.02	gm/ml
Drum 7	103.1	101.3	102.1	Mean = 102.1	+ 100 =	1.02	gm/ml

[✓] ACCEPTED [ ] REJECTED R. Williams signature 12-28-93 date

Disposition: _____ Joyce M. Landon 12-28-93

STERIS

317 823-6411
Dr Probst

FAX COVER SHEET

DATE: 9-11-95

NO. OF PAGES: 8
(Including Cover Page)

TO: Mike Jusek

COMPANY:

FAX TELEPHONE: 639-8653
(Area Code)

FROM: Chris Fricker
STERIS Corporation

NOTES: Your user ID is FO7A424
These are the expert for mixing.
Call if you have questions.

If you do not receive all of the pages in this transmission, please call 216-354-2600 immediately.

Teltech®
Expert
Service

September 8, 1995

Expert: Mixing equipment selection

For:
Mr. Chris Fricker
STERIS Corporation
5960 Heisley Road
Mentor, OH 44060

Comment: Here are the biographies of three experts who might be able to help you. If you have any questions or comments please give me a call.

Searcher: Jennifer Bailey
Phone: 1-800-367-8358 **Ext:** 7568

DATE : 09/08/95

TIME : 16:19:56

TO : Mr. Chris Fricker

PAGE : 7

FROM : Jennifer Bailey

MESSAGE :

(1)

Dr. Cecil W. Propst 317-823-6878 IN

TABLETING. Dr. Propst (prefers Cecil) has developed tableting systems and products in the areas of pharmaceuticals, diagnostics, high-protein snack products, chlorine tablets, chlorine removal tablets, over the counter antacids, and vitamins.

POWDER MIXING. He has set up mixing systems using Vee mixers of 1, 3, and 100 cubic feet in size, using double cone mixes to 30 cubic feet, Nauta mixers 7 to 20 cubic feet, an air mixer to 30 cubic feet, and a fluid bed to 300 liters. He has conducted and written validation protocols, optimization designs, and simplex searches, as well as developed, and conducted training sessions.

PHARMACEUTICAL MANUFACTURING. Cecil has set up and validated two liquid manufacturing areas, including a deionized water treatment system. He set up and is currently in the process of validating a tablet and capsule manufacturing facility.

IMPACT MILLING. Cecil is currently developing a 2 1/2 day course on milling. His experie is with cone mills, hammer mills, pancake type, and opposing stream type jet mills. He has designed a lump breaker, as well as screen impellers for a cone mill.

QUALITY ASSURANCE. Cecil developed a corrective information database during his 20+ years in the Quality Assurance area of the pharmaceutical industry. Currently, he is installing one in a drug firm.

OPTIMIZATION. Cecil's Ph.D. thesis is in the area of optimization. He has applied these techniques to three liquid products and seven solid dosage forms with good success. He wrote an optimization program called "ORTHO" that is a part of his thesis. He currently has two active projects in this area, a capsule and a tablet formulation.

EMPLOYMENT:

1994... PRESIDENT, MANUFACTURING CHEMISTS
1991-94 GMP Facility Director, University of Maryland
1976... DIRECTOR, POWDER TECHNOLOGY, CENTER FOR PROFESSIONAL ADVANCEMENT
1990-91 Director Technical Development, Stellar Manufacturing
1974-91 Faculty, Industrial Pharmacy, St. Louis College of Pharmacy
1964-89 Smith Kline Beecham Company
1987-89 Director of Quality Compliance, Beecham Products
1981-87 Director of QA & QC, Norcliff Thayer

VENDOR KNOWLEDGE:
Cecil has experience locating vendors of:
* Solid processing equipment
* Optimization software.

He has access to industry contacts in the U.S. and Europe for assistance in vendor location.

AFFILIATIONS & ACCOMPLISHMENTS:
Cecil is a member of the Center for Professional Advancement and the So armacists in Industry (Board member).

EDUCATION:
1989 PhD Industrial Engineering, Kennedy Western Univereity
1967 BS Pharmacy, St. Louis College of Pharmacy

HOBBIES:
Cecil enjoys time with his children in Boy Scout activities and building science projects. He is an avid skier and tennis player, and also enjoys reading and investment strategies.

CALLING INFORMATION:
This expert is open to taking phone calls from attorneys.
This expert is open to serving as an expert witness in lawsuits.
This expert is open to performing on-site consulting.

PHONE NUMBERS:	EXT:	LOCATION:	COVERAGE:
USA 317-823-6878		Office	Secretary

What to do next:
* Call the expert at the above number. Identify yourself as a Teltech user, provide your personal ID, and discuss your issue.

What to expect:
* An expert eager to quickly provide confidential answers to your questions.
* A discussion of your issue typically concluded within about 30 minutes involving one or two telephone conversations.
* A return call from the expert if he/she is not immediately available. (Leave a message identifying yourself as a Teltech user. The expert will make every effort to get back to you within one business day.)

If you encounter any difficulty in the matching or calling process, call a Knowledge Analyst at 1-800-367-8358 (7:00am - 7:00pm Central).

Dr. Isaac J. Wahba 708-948-9521 IL

FOOD INGREDIENT TECHNOLOGY. Throughout Dr. Wahba's long academic, industrial, and consulting career, he has acquired considerable knowledge of the functional properties of all of the major, and most of the minor, food ingredients. He has used this expertise in the selection and successful application of these ingredients in a wide variety of food products. Ingredient areas in which he has considerable working experience include: starch and starch hydrolysates (corn syrup and maltodextrin), sugars and sugar alcohols, flour, proteins (such as gelatin, egg, and dairy proteins), fats and emulsifiers, high potency sweeteners, fat substitutes, and bulking agents. He has also had significant knowledge and experience in the following ingredient areas: gums and other stabilizers, foaming and leavening agents, acidulants, and humectants.

FOOD PRODUCT DEVELOPMENT. A considerable portion of Dr. Wahba's career has been spent in the development of a wide variety of food products, both in the dry and moist forms and the regular, reduced calorie, low sugar, or low fat versions. Areas of major involvement include baked goods and allied bakery items (such as icings and fillings), refrigerated and frozen desserts, foam products, fruit spreads (jams, jellies, and preserves), and various dry food and beverage mixes. Other areas of active involvement for Dr. Wahba include dairy products, breakfast and snack items, and margarine spreads.

FOOD PROCESSING TECHNOLOGY. Dr. Wahba works with a wide variety of food items, and has acquired considerable knowledge and experience in several established processing technologies. He was also successful in the development and application of new technology. The process activities in which he was most frequently involved include dry/wet mixing or dispersion, homogenization, emulsification, aeration and foaming, baking, freezing, coating, and encapsulation.

FOOD INDUSTRY PROBLEM SOLVING. Over many years, Dr. Wahba has developed expertise in food product development, ingredient technology, and process technology. This has greatly enhanced his capability of solving a wide variety of technical problems in the areas of ingredient application and food processing, storage, and quality control. For a considerable portion of his career, Dr. Wahba has held the positions of internal and outside food consultant.

EMPLOYMENT:
1991... INDEPENDENT CONSULTANT/PRINCIPAL, LJW ASSOCIATES
1982-92 Technology Services Manager, The NutraSweet Company
1977-82 Senior Research Associate/Senior Research Specialist, Kitchens of Sara Lee
1964-76 Group Leader/Internal Consultant, General Mills, Inc.
1961-64 Research Specialist, Cornell University
1959-61 Post-Doc. Fellow/Teaching and Research, Food Science Department, Rutgers - The State University
1954-59 International Consulting Services

VENDOR KNOWLEDGE:
Dr. Wahba has experience locating vendors of:
* Sources of food products, ingredients, and equipment
* Sources of technical services and information

He has access to the following resources:
* Personal contacts
* Commercial literature

* Reference manuals
* Ingredient and supplier directories.

AFFILIATIONS & ACCOMPLISHMENTS:
Dr. Wahba holds several patents for cakes and frostings. He has published extensively on the subjects of pectin, polymer irradiation, meat packaging, and NutraSweet applications. He has also authored technical manuals regarding carbohydrate sweeteners, bulking agents, milk replacers, gum, shortenings and emulsifiers, fruit spreads, sugar-free product formulations, and food colors. Dr. Wahba is a member of the Institute of Food Technologists, the American Association of Cereal Chemists, and various honor societies.

EDUCATION:
1954 PhD Food Crop Production, University of Missouri
1953 MS Food Crop Production, University of Missouri
1952 MS Food & Agriculture Chemistry, University of Missouri
1951 BS Agricultural Engineering, University of California
1949 AB Letters, University of California

CALLING INFORMATION:
This expert is open to taking phone calls from attorneys.
This expert is open to serving as an expert witness in lawsuits.
This expert is open to performing on-site consulting.

PHONE NUMBERS:	EXT:	LOCATION:	COVERAGE:
USA 708-948-9521		Home/Office	Secretary/Answering Machine

What to do next:
* Call the expert at the above number. Identify yourself as a Teltech user, provide your personal ID, and discuss your issue.

What to expect:
* An expert eager to quickly provide confidential answers to your questions.
* A discussion of your issue typically concluded within about 30 minutes involving one or two telephone conversations.
* A return call from the expert if he/she is not immediately available. (Leave a message identifying yourself as a Teltech user. The expert will make every effort to get back to you within one business day.)

If you encounter any difficulty in the matching or calling process, call a Knowledge Analyst at 1-800-367-8358 (7:00am - 7:00pm Central).

Mr. John O. Blixrud 612-545-3034 MN

CEREAL PROCESSING; COOKIE PRODUCTION. Mr. Blixrud's (prefers John) expertise is in the production and processing of foods. During his almost 30 years at General Mills, John was engaged in a variety of projects, involving major cereal processing systems, bulk ingredient handling, dust collection, baking mix, and cracker-cookie production. He is familiar with the development of final flow concepts for new consumer food products.
Related areas in which John has expertise include food drying and mixing, food cookers, sifting, agglomeration, pumping, and food packaging. He also has experience in both equipment selection and procurement and the start-up of new installations.

EMPLOYMENT:
1983... VICE PRESIDENT, FIRST ENGINEERING, INC.
1953-82 Principal Process Engineer, General Mills, Inc.
1950-53 Development Engineer, 3M Corporation
1949-50 Machine Designer, Cherry-Burnell, Inc.

AFFILIATIONS & ACCOMPLISHMENTS:
John is a Registered Professional Engineer in the State of Minnesota and he is the holder of three patents.

EDUCATION:
1949 BS Mechanical Engineering, University of Minnesota

HOBBIES:
John has a collection of 8000 color slides taken in all of the 50 States, 10 Canadian Provinces, and six other countries. Other interests include house projects and reading of history, biography, geography, and novels.

CALLING INFORMATION:
This expert is open to taking phone calls from attorneys.
This expert is open to serving as an expert witness in lawsuits.
This expert is open to performing on-site consulting.

PHONE NUMBERS:	EXT:	LOCATION:	COVERAGE:
USA 612-545-3034		Office	Secretary
USA 800-835-8324		Teltech	Help Staff

What to do next:
* Call the expert at the above number. Identify yourself as a Teltech user, provide your personal ID, and discuss your issue.

What to expect:
* An expert eager to quickly provide confidential answers to your questions.
* A discussion of your issue typically concluded within about 30 minutes involving one or two telephone conversations.
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If you encounter any difficulty in the matching or calling process, call a Knowledge Analyst at 1-800-367-8358 (7:00am - 7:00pm Central).

Steris Corp.

F.O.B. - New Prague, MN
Delivery - 8-10 weeks after receipt of approval drawings
Time for approval drawings is 1-2 weeks
Terms - 1/3 down payment with order, balance net 30 days

Thank you for this opportunity to quote. We look forward to receiving your valued order. If there are any questions, or if we may be of any further help, please call.

Sincerely,

ROBERTSON EQUIPMENT CO.

Dean Robertson

Dean Robertson

DR/md
cc: Scott Equipment

TEST NO. 95-1102-B

TEST DATE: 9/25/95

COMPANY: Steris Inc.

MATERIAL TO BE TESTED: 8 different powders and 1 liquid

PURPOSE OF THE TEST: Pre-blend the 8 powders and mix with the liquid. To check for quality of mixture and to check its bulk density.

TEST EQUIPMENT: 30" x 40" plow mixer with a chopper.

THE TEST: We made 1 batch run. The total length of the run was 17.90 minutes. The proper amount of the eight powders were put into the plow mixer. The plow mixer and the chopper were turned on and the powders were mixed for 90 sec. The liquid was added in 1.4 minutes while the plow mixer was operating. When we began to add the liquid, the watch was started.

The mixer was stopped and samples were taken at T=3-4 minutes, T=8.40 minutes, T=13.4 minutes and T=16.40 minutes. Between T=8.4 and T=13.4 the bulk density of the mixture became less. At T=16.40 the bulk density of the mixture was even lower. All of the test material and the samples were returned to the customer.

SCOTT EQUIPMENT COMPANY

605 4TH AVENUE N.W.
NEW PRAGUE, MN 56071

MIXING & AGGLOMERATING TEST DATA SHEET

w/chopper

TEST # 95-1102-T-B TEST EQUIPMENT 30x40 plow mixer DATE 9/25/95

COMPANY Steris Corp MATERIAL

	Sample A	Sample B After Liq Adding	Sample B	Sample C	Sample D	Sample E
RUN #	1	2 Liq	B	C	D	E
RPM	116	116	116	116	116	116
230 volt NL AMPS	16.8	16.8	16.8	16.8	16.8	16.8
LOAD AMPS	47.2	58.1	55.0	55.0	56.2	57.8
HORSE POWER	20					
FEEDER #1	Batch					
FEEDER #1 RPM	mix					
POUNDS						
TIME	90 sec.					
LBS/HR	mixed for					
FEED #1 °F			TOTAL	TOTAL	TOTAL	TOTAL
LIQUID °F		Liq	Time	Time	Time	Time
TIME		Added	3.40	8.40	13.40	16.40
LBS/GPM		1.40 sec	2.00 min mix	5 min mix	5 min mix	3 min mix
LIQUID °F						
5 HP Chopper FEED #2	5HP					
Chopper FEEDER #2 RPM	1740					
230 volt POUNDS NL	6.3	6.3	6.3	6.3	6.3	6.9
TIME LOAD		7.2	7.0	7.0	7.0	7.1
LBS/HR	Liq Temp After Soap Added	191.2°F				
FEED #2 °F		175.1°F				
ROOM °F		58.6°F				
PRODUCT °F						120° final product temp

5 HP Chopper 1740 RPMS
230 volt NL 6.3

CONTINUED ON BACK SIDE

Load Sample A Blend Dry materials

2-6530 Nozzels 1/4 = 9/64 or.

22.7 Hz Threw mono Pump gave us 13# water
threw each nozzel or 26# Total/1 min

INTEROFFICE
MEMORANDUM

To: Mike A. Keresman **Date:** December 21, 1995

From: W. A. O'Riordan

Subject: **AUTOMATION OF CHEMICAL PACKAGING**

Mike,

Attached is a proposal from Mike Jusek and Jim Dimmick for the purchase of a new SCOTT Blender to be used in the automated chemical packaging facility. As you know, we have traditionally used the Patterson-Kelly "V" blenders to blend our inert ingredients. Research by the Chemical Packaging Management Team has determined that SCOTT Blender is a better option for several reasons and so we are officially making the recommendation to move our business from Patterson-Kelly to SCOTT.

I have attached the recommendation from Mike Jusek in its entirety for your review and have additionally attached the proposed equipment costs budget for the Hopkins facility. As you will see from the budget, the proposed cost of $122,387 is favorable to a projected cost of $153,500 by $31,113.

Michael, please call if I can provide any additional information from either a technical or financial standpoint concerning the above. Thank you.

WAO/lms
Attachments

To MIKE LEIGH —

PLEASE REVIEW THE ATTACHED & LET'S DISCUSS. ARE YOU COMFORTABLE WITH THIS? YES HAS SUFFICIENT TESTING BEEN DONE TO ENSURE IT WILL WORK? ~

P. / 1/4

Memorandum

To: P.A. Zamecnik

From: M.J. Leigh

Date: January 2, 1996

Subject: Request for Scott Blender

The following are my observations relative to Production's request for a Scott blender to use at the new chemical packaging facility. Attached are the related test data.

Scott vs. Patterson-Kelly

The Scott is a plow mixer, while the PK is a vee-blender. There are numerous different types of blenders. All have the strong and weak points, and each is, in a sense, capable of making our product. The choice depends on the materials used and the capabilities of the particular blender. Our materials have not shown a particular tendency to segregate or fry. They should work in either.

As Mike points out, the blend times associated with vee-blenders is relatively long compared to other types of blenders.

(NOTE: when MJ reports doubling performance capabilities, he is referring to the time required to produce X pounds of blend. He is not reporting a doubling of process capabilities, cPk)

Blend Results

Two blends were made in a 30"x40" blender at Scott. This size is equivalent to a batch made in a 10 cu.ft. PK blender. This is insufficient data to predict process capabilities, but we can gain some general indications.

During the first batch, samples were taken at various blend times to see the effect of longer mixing. The STERIS lab results A through D relate to the Scott data sheet samples B through E. As we have seen with the PK blender, longer mix times result in higher densities. No other characteristics are usually affected, although in this case the dissolution times went steadily down. It's also interesting to note that the load amps increased along with the density. I would be curious if this could be used reliably to control the end of mixing (as opposed to a simple time).

The second batch was run for seven minutes and only one sample taken. Its density matches that of the previous batch at that length of blending.

The % Benzotriazole results are normal. This shows that the liquid feed system delivered all (or almost all) of the liquid preblend into the powders. The liquid was at a lower temperature than normally observed here, but evidently did not cause any problems in pumping.

All results are normal for a batch of STERIS 20 blend, if the Scott is run at least ten minutes to bring the density up. All results are within the current control limits for the PK process.

Conclusion

More development work should be done to determine exact mixing times. This can be done while we develop our procedures for using the equipment. We will want to do a complete checkout and validation on this system when installed. I see no reason, though, that the Scott would not be capable of producing STERIS 20 blend.

As with all our blends, each production blend will be tested as part of normal procedures. Therefore the focus of our selection and validation is on creating a reliable, effecient system. The product quality will remain protected.

You asked if sufficient testing has been done to ensure it will work. As I pointed out, insufficient testing has been done to determine any process capability or calculatable degree of confidence in future results. For example, there are not two populations to compare. At least fifteen such blends would have to be produced to begin to make that strong an assertion. Having said that, these two results do demonstrate a basic ability that I am comfortable with.

At least one checkout blend will need to be produced to develop our procedures and exact blend times. If you would like to build a little more confidence in this decision before we buy, it might be possible to do that blend at Scott. This would give us one more test point that should be more representative of future blends.

c: M. Jusek
W. O'Riordan

Memorandum

To: P.A. Zamecnik

From: M.J. Leigh

Date: January 2, 1996

Subject: Request for Scott Blender

The following are my observations relative to Production's request for a Scott blender to use at the new chemical packaging facility. Attached are the related test data.

Scott vs. Patterson-Kelly

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> (NOTE: when MJ reports doubling performance capabilities, he is referring to the time required to produce X pounds of blend. He is not reporting a doubling of process capabilities, cPk)

Blend Results

Two blends were made in a 30"x40" blender at Scott. This size is equivalent to a batch made in a 10 cu.ft. PK blender. This is insufficient data to predict process capabilities, but we can gain some general indications.

During the first batch, samples were taken at various blend times to see the effect of longer mixing. The STERIS lab results A through D relate to the Scott data sheet samples B through E. As we have seen with the PK blender, longer mix times result in higher densities. No other characteristics are usually affected, although in this case the dissolution times went steadily down. It's also interesting to note that the load amps increased along with the density. I would be curious if this could be used reliably to control the end of mixing (as opposed to a simple time).

The second batch was run for seven minutes and only one sample taken. Its density matches that of the previous batch at that length of blending.

The % Benzotriazole results are normal. This shows that the liquid feed system delivered all (or almost all) of the liquid preblend into the powders. The liquid was at a lower temperature than normally observed here, but evidently did not cause any problems in pumping.

All results are normal for a batch of STERIS 20 blend, if the Scott is run at least ten minutes to bring the density up. All results are within the current control limits for the PK process.

Conclusion

More development work should be done to determine exact mixing times. This can be done while we develop our procedures for using the equipment. We will want to do a complete checkout and validation on this system when installed. I see no reason, though, that the Scott would not be capable of producing STERIS 20 blend.

c: M. Jusek
W. O'Riordan

INTEROFFICE MEMORANDUM

DATE: January 8, 1996

TO: W. A. O'Riordan

FROM: M. A. Keresman

SUBJECT: Purchase of Scott Blender

It appears the process to determine if the Scott blender is an adequate substitute for our current "V" blender technology has been completed. As you know, both Mike Leigh and Paul Zamecnik reviewed the proposal, and the data generated by the trial runs, and they meet our criteria and standards. There should be one final step in a due diligence process, and that is to actually have the blender installed and used, and then the routine output verified. My suggestion would be that the purchase order contain a 90-day money back guarantee that the output of the blender will meet our standards and specifications. To give the vendor some comfort, those specifications should be stated exactly in the purchase order or a side letter. Again the only contingency would be based upon that blender not being able to perform as it is designed to.

To change manufacturing methodologies shows that we are looking at the horizon and addressing our production needs in a direct fashion. We do have to be careful that a change is at least as good as our current process. This added contingency would insure that end, and provide us with the comfort that we would not have made a significant financial expenditure without a guarantee that it would work.

If you have any questions regarding this please let me know.

MAK:lb

WED, JAN-31-96 3:15PM

ATTN: Dick [illegible]

BLEND.

COPY

Mr. Michael Jusek
Steris Corp.
Mentor, OH

May 16, 1994

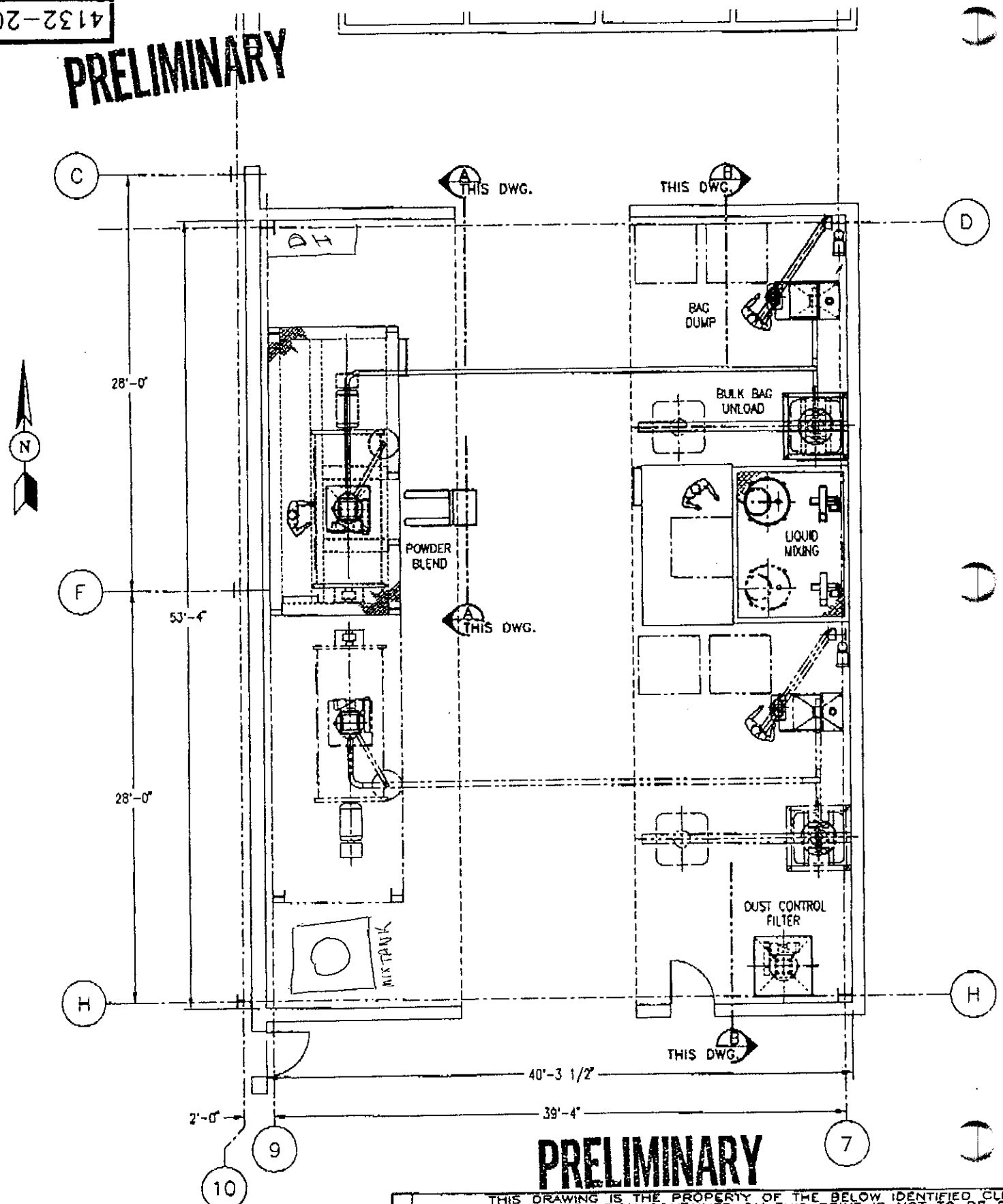
Quote #2273

ATTACHMENT "A"

ITEM	QTY.	PART NO.	DESCRIPTION
1	4	104122A-04	VAC-U-MAX Basic type bulk bag unloader with heavy duty 3" square tube frame with standard 54" floor clearance, bag receiving cone, and enclosed integral discharge transition with chisel bottom screw discharger. Screw discharger complete with variable frequency drive and flow-thru adaptor for 3" convey line. Also includes bag access door and capped dust collection port. Unit to be mounted on (4) 1500# load cells with summing box. Construction of frame is carbon steel with white epoxy paint and all product contact parts are 304 stainless steel.
2	1	104122C-04	VAC-U-MAX Bulk bag unloader with activator feature. Generally constructed as specified above with the following additions: Activator assembly with control manifold, level control as part of the discharge transition, and screw discharger will feature the flexwall design for better product flow.
3	2	104122A-04	VAC-U-MAX Basic type bulk bag unloader as specified with the following exceptions: At the discharge point, a standard pickup adaptor will be used in place of

4132-2C

PRELIMINARY



PRELIMINARY

A	ISSUED FOR REVIEW & COMMENT		

ACAD V.12

STERIS

April 26, 1996

Mr. Roger Boettcher
Scott Equipment Company
605 4th Avenue, N.W.
New Prague, Minnesota 56071

REF: YOUR LETTER OF APRIL 23, 1996 CONCERNING REQUESTED MODIFICATION TO THE MIXER

Dear Roger,

Response to your points in the above referenced letter is as follows:

1. Scope change is approved. It is assumed that this includes a scissor gate and gate mechanism.
2. Scope change to reduce bracing is approved.
3. Scope change to raise height is approved.
4. Scope change to change vent location is approved.
5. Scope change for jog switch is approved. Discussion of control configuration will follow.
6. Maintain ability to start underload.

If you have any questions, please do not hesitate to call.

Sincerely,

STERIS Corporation

John A. Rawot
Manager, Continuing Engineering

JAR/lms
cc: W. A. O'Riordan
J. A. Dimmick
E. Ackels (Pak/Teem)

SCOTT
BUILT FOR TODAY
TO LAST FOR TOMORROW

MANUFACTURERS OF PROCESSING EQUIPMENT
• AGRICULTURE • INDUSTRIAL
• CHEMICAL • FOOD

April 23, 1996

John Rawot

STERIS Corp.
9450 Pineneedle Drive
Mentor, OH 44060

Dear Mr. Rawot,

There are several issue's concerning your plow mixer that we need to resolve in order for production to continue. I have been talking to Stan Lockwood about some changes and additions to the mixer and I need someone to give written conformation on which one's are to be done.

1. Addition of a discharge transition hopper. Hopper to be 316ss material with a 120 grit interior finish. Cost is $1850.00.

2. Revise mixer stand by removing front bracing to allow tote's to go under the discharge gate. We would also add corner bracing to the stand. Cost is $225.00.

3. Build a new stand to raise the mixer height to 62" at the mixer end plates. The existing stand would not used. Cost is $1085.00.

May be same issue.

4. Move the sanitary ball valve to the top of the mixer to be used as a vent. No charge.

5. Add a jog switch to the start/stop box. Cost is $50.00.

I would like the name of someone that my electrical vendor can contact to go over the details of the wiring with. There are several ways in which the timers can be wired in, and we would like to know what will work best for you. I currently have the box on hold until these question get answered.

6. An oil fluid coupling has been added to the drive of the mixer to allow it to be started under load. No charge.

I will be out of the office as of Thursday the 25th until approximately May 3rd. If you could please respond A.S.A.P. it will help keep things moving along. Please contact Dave Kostecka during my absents and he will take care of things.

Thank you,

Roger Boettcher

cc: Stan Lockwood

SCOTT

SCOTT EQUIPMENT COMPANY
605 4th AVENUE N.W.
NEW PRAGUE, MINNESOTA 56071
PHONE: (612)758-2591
FAX: (612)758-4377

FAX TRANSMITTAL SHEET

DATE: 4-23-96 TIME: _____

DELIVER TO: John Rawot FROM: Roger Brotherton

COMPANY: STERIS

SUBJECT: Scott Model 4810 Plow Mixer.

I ALSO need some info on the Flow hose on the Liquid manifold. What type will work with the Chem. being added? OR would Steris what to provide them?

Thank you,

Roger Brotherton

TOTAL NUMBER OF PAGES INCLUDING THIS SHEET: 2

IF YOU DO NOT RECEIVE ALL OF THESE PAGES, PLEASE CONTACT US!

STERIS

PROJECT FAX

PAK/TEEM, INC.

TO: JIM DIMMICK
COMPANY: STERIS
PHONE: (216) 639-8066
FAX: (216) 639-8653

Date: 04/29/96

FROM: STAN LOCKWOOD
COMPANY: PAK/TEEM, INC.
PHONE: (513)-772-4777
FAX: (513)-772-6950

PAGES INCLUDING COVER PAGE: 1

SUBJECT: POWDER BLENDING

Following is a list of unresolved questions for the Powder Blending Room:

1. What are the gases released from the liquid mix? What volume of gas is released? What hazards do these gasses present to personnel? Will it be acceptable to just vent these gases into the room? Through the roof? Should a fan be used to positively exhaust the vapors through the roof? Is there an environmental issue requiring that the fumes be scrubbed?

2. Pak/Teem requires some viscosity data for the liquid mix to correctly specify the spray-on pump.

3. Scott Equipment copied me on Friday, a letter sent to John Rawot, indicating that they were still waiting for confirmation on several issues to complete the mixer. Pak/Teem can not fabricate the discharge hopper or new longer legs for any less than the quotations from Scott. Therefore, I still recommend that these items be supplied from Scott. This has the additional advantage of making Scott responsible for correct fitup.

4. Pak/Teem has been looking at the dust control issue around partial bag pre-weighing. We have determined that there are no regulatory issues which require that any of the powder ingredients be isolated in a dust free environment, however, Pak/Teem believes it would be good hygiene practice to contain pre-weigh operations inside a ventilated hood. A hood like that would add significantly to the air requirement and size of the dust collector. Is Steris agreeable with this clean design concept to

as powder pre weighing in a ventilated hood.

We are also looking at dust control requirements for the powder filling machine. Pak/Teem needs concurrence that Steris agrees that all dust control requirements should go to one dust collector rather that separate collectors for blending and filling. Additionally, how much future capacity should be designed into the dust collector.

STERIS

PROJECT MEMO

PAK/ TEEM, INC.

To: JIM DIMMICK **Date:** 05/22/96

From: STAN LOCKWOOD

Subject: POWDER BLENDING EQUIPMENT QUOTATIONS

Attached are copies of vendor information and a spreadsheet of equipment quotations for the Powder Blending System for your information and acceptance. On the spreadsheet, Pak/Teem's recommendations are marked with (*). As instructed by Steris, Vac-u-max via Robertson Equipment is a sole source vendor (**) and no other quotations were solicited. The Torit dust collector is not the low bid, but Pak/Teem recommends them based on quality.

We still need your viscosity to verify the size of the liquid mix pump. Some of these quotes have expired. With your acceptance, Pak/Teem will firm up prices and request a purchase order. Resolution on these selections is required to prevent schedule slip of delivery dates.

Stan

Project 4194	STERIS POWDER BLENDING	EQUIPMENT QUOTATIONS	5/22/96

VENDOR	Robertson Eq.	Cintron (Toledo)	RA Mueller	Surkamp & Rowe	United Dairy Machinery	Corporate Equipment	Controls & metering
CONTACT	Dean Robertson	Bruce Rhodes	Jim Freeburg	Gary Westphal	Gary Neely	Jim Cartwright	Mike Lynch
PHONE	216-899-0222	513-874-5333	513-489-5200	513-489-2850	716-674-0500	513-771-6696	612-944-3666
FAX	216-899-0226	513-874-5849	513-247-5330	513-489-2854	716-674-0511	513-771-0334	612-944-2689
Liq Mix Tank	5·6 * $2,350						
Liq Mix Scale		3·4 * $7,175	$14,167	$3,142	$14,583		
Liq Tank Mixer			$889	* $677			
Dry Add Hopper				$1,989	$2,679		
Spray-on Pmp			$3,747		$5,992	6·8 * $3,781	$3,971
			package $44,225				

VENDOR	Robertson Eq.	Burke Process	Air/Pro (Seneca)	Donaldson (Torit)	Seneca
CONTACT	Dean Robertson	Cristopher Pitstick	Roger Ruehl	Patrick Hutchins	Denise Harple
PHONE	216-899-0222	606-341-6600	513-469-2000	513-577-7711	419-447-1282
FAX	216-899-0226	606-578-4713	513-469-2310	513-563-6455	419-448-4048
Dust Collector			$8927, $12042, $13843	$9117, $11029, $14129	$10694, $15378, $20445
Vac Loader	* ** $41,500			5 WKS *	2-4 WKS
BBC Dump	10·12 Included	$22,234			
Bag Dump		$3,854			
Vac LiftAssist	6·8 * * $7,725				

R & M MACHINERY

* Pak/Teem Recommendation

** Sole Source per Steris

INTEROFFICE MEMORANDUM

TO: C. FRICKER **DATE: JULY 15, 1996**

FROM: J. DIMMICK

SUBJECT: 75 CUBIC FOOT BLENDER

Chris,

Please review the weights of the STERIS 20™ blend I have attached. These are weights that have been calculated for use in the new 75 cubic foot blender. Unfortunately, I do not know how these weights were arrived at. It is obvious that the weights we currently use were increased by 50% to fill the 75 cubic foot blender. Liquid #1 and #2 are 1.5 pounds under weight however, with the larger mix.

I need confirmation of the following:

1) Does our chemistry allows us to increase our recipe in this proportional manner?
2) Are Liquid #1 and #2 calculated weights on the attached sheet correct? If not, what should they be?
3) What are the tolerances for each ingredient? For example, is powder #1 $\pm$ 3 pounds?
4) Will the material quantities listed on the attached sheet equate to less than 75 cubic feet?

We need to know tolerances because we will use a vacuum transfer system to charge the blender. Material loss should be minimal but, we need limits for this variable.

Please feel free to call me with any questions.

JD

copy: J. Rawot
M. Cocca

STERIS

PROJECT FAX

PAK/TEEM, INC.

TO: Jim Dimmick
COMPANY: STERIS
PHONE: 216-639-8066
FAX: 216-639-8653

Date: 08/01/96

FROM: Kent Stephens
COMPANY: PAK/TEEM, INC.
PHONE: (513)-772-4777
FAX: (513)-772-6950

PAGES INCLUDING COVER PAGE: 3

SUBJECT: Powders Blend Room

Jim -

Please find attached:

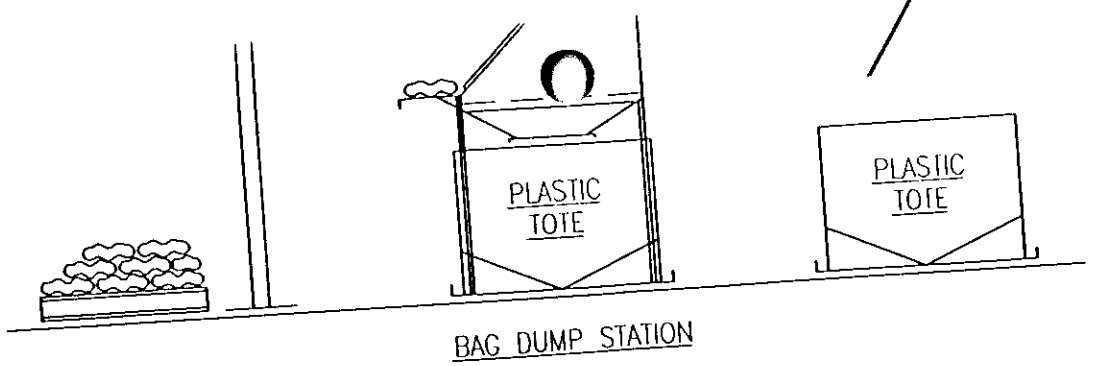
1). Equipment Status Memorandum - This represents all equipment ordered by PAK/TEEM. Delivery dates are taken from quotes and reflect "worse case". i.e. 10 - 12 weeks, 12 weeks is shown. Additionally, I received a check yesterday (7/31) for the Robertson order. I phoned Dean yesterday and told him "checks in the mail".....

The Drawing Received column is our projected date (worse case) when we would expect to have reviewed the approval drawings. We will turn these around in 24 hours.

2). Fabrication & Installation Schedule - The significant milestone here is approval to proceed (by 8/5/). If not, we can plan on a week for week schedule slip. Note that I moved a week of the installation up into September. By this time we should have taken delivery of the Dust Collector, Knife Gate and Vac-U-Hoist systems. Our folks could be installing these items and prepping for the remainder of the installation (i.e. compressed air, piping, etc.).

As we proceed, I will develop detailed installation plans. This will maximize our installing technicians time on-site.

P.S. - Do you have an internal equipment numbering system?



BAG DUMP STATION

POWDER MIX

	1	2
	SUPER SACKS	BAGS
POWDER #1 POWDER #2 POWDER #3 POWDER #4 POWDER #5 POWDER #6 POWDER #7	2625 lbs. (2 S.S.) @ 1312	526.50 lbs. (10.5 BAGS) 254.25 lbs. (5 + BAGS) 65.25 lbs. (1.3 BAGS) 254.25 lbs. (5 + BAGS) 127.50 lbs. (2.5 BAGS) 127.50 lbs. (2.5 BAGS)
	2625 lbs. (2 S.S.) @ 1312	1355.25 lbs. (27 BAGS)

LIQUID MIX

	3	4
WATER POWDER #8 POWDER #9 LIQUID #1 LIQUID #2	99 lbs. (11.83 GAL.)	69 lbs. (1.38 BAGS) 205.5 lbs. (4.11 BAGS) 12 lbs. ← 13.5 12 lbs. ← 13.5
	99 lbs. (11.83 GAL.)	298.5 lbs.

LEGEND:

PROCESS

FUTURE

400.5

4380.75

POWDER BATCH	LIQUID BATCH	TOTAL
3980.25 lbs.	397.5 lbs.	4377.75 lbs./BATCH 2.5 HOURS

AutoCAD V.12

REVISION:	DESCRIPTION:
A	1ST DRAFT
B	ISSUE FOR REVIEW & COMMENT

FILENAME: 4132PFD3 PLOTTED: 04/16/96 15:04

3 2 1

K J H G

STERIS

EQUIPMENT STATUS MEMORANDUM

POWDERS BLENDING

PAK/TEEM, INC.

EQUIPMENT NUMBER	DESCRIPTION	QUOTE DATE	P.O.# VENDOR	DRAWING RECEIVED	DELIVERY DATE	DELIVERY LOCATION	COSTS	COMMENTS
	DUST COLLECTOR	7/3/96	P6013-5050 DONALDSON	8/9/96	9/9/96	STERIS	$17,524.00	
	VAC-U-HOIST	7/2/96	P6011-5049 R&M MACHINERY	N/A	8/26/96	STERIS	$11,347.00	
	LIQUID MIX SCALE	7/2/96	P6009-5047 CINTRON	N/A	8/26/96	PAK/TEEM	$ 7,025.00	
	LIGHTNIN AGITATOR	6/17/96	P6008-5046 SURKAMP&ROWE	N/A	8/12/96	PAK/TEEM	$ 725.00	
	SPRAY-ON PUMP	7/19/96	P6010-5048 CORPORATE	N/A	9/2/96	PAK/TEEM	$ 3,781.00	
	KNIFE GATE VALVE	7/3/96	P6014-5051 RAWDON MEYERS	N/A	8/19/96	STERIS	$ 1,945.00	
	VAC-U-MAX	4/18/96	P6012-5052 ROBERTSON	8/19/96	10/14/96	STERIS	$42,500.00	
	LIQUID MIX TANK	4/22/96	P6015-5053 ROBERTSON	8/19/96	9/9/96	PAK/TEEM	$ 2,350.00	
	MATEER-BURT FILLER	1/22/96	P6001-5054 MATEER-BURT	8/19/96	10/4/96	PAK/TEEM	$33,682.00	Powders Packing Line

* EFFECTIVE EQUIPMENT ORDER DATE: 7/29/96

STERIS Corporation — **PURCHASE REQUISITION**

[ ] CHECK REQUEST
[ ] PURCHASE ORDER
[ ] ACCOUNT CHARGE

[ ] CONFIRMING DO NOT REORDER

VENDOR ID # _____

REQ # _____

REQ REC __ / __

ACCT # 50116 - 8500

REQUESTED BY: MIKE COCCA

DATE: 8/12/96

PURPOSE: BLEND ROOM FLOOR SCALE.

CHECK # _____ DATE _____

VENDOR: ELING SCALE CO.
ADDRESS: 1500 ENTERPRISE PKWY
TWINSBURG, OH 44087
CONTACT: STEVE SMITH
PHONE: 216-425-3092

QTY	PRCH UNITS	CAT # ST P/N	DESCRIPTION	PRICE /UNIT	TOTAL PRICE
1	@	KN1500	METTLER/TOLEDO HIGH PRECISION FLOOR SCALE	$13,015.00	
10	@		50LB CLASS F CAST IRON TEST WEIGHTS, SERIALIZED	$890.00	
1	@		LETTER OF CERTIFICATION	$40.00	

[ ] SALES TAX EXEMPT

TOTAL ESTIMATED PRICE: $13,945

NOTES: DELIVERY TO PLANT #123
Anticipate delivery Mid October. 9/12/96

DATE: 8/12/96
AUTHORIZED BY: Michael C. Cocca

DATE: / /
APPROVED BY: _____

****** PURCHASING USE ONLY ******

PURCHASE ORDER # _____

COMMITTED SHIP DATE: __ / __ / __

PURCHASE ORDER DATE: __/__/__
DELIVER TO: _____

FOB TERMS: _____
CASH TERMS: _____

SHIP VIA:

[ ] TRUCK [ ] UPS
[ ] PICK UP [ ] FED EXPRESS
[ ] OTHER _____

Filing Scale Co.

SCALES FOR INDUSTRY

CORPORATE OFFICE: 1500 ENTERPRISE PARKWAY
TWINSBURG, OHIO 44087
AKRON — (216) 650-0730
CLEVELAND — (216) 425-3092
FAX — (216) 425-8905

QUOTATION #QS109

AUGUST 12, 1996

STERIS CORPORATION
6515 HOPKINS ROAD
MENTOR OH 44060

ATTENTION: MICHAEL COCCA

Dear Mr. Cocca:

We are pleased to quote the following:

One (1) Mettler/Toledo High Precision Low Profile Floor Scale
Model: KN1500
Capacity: 3000LB x .05LB
Platform Size: 59" x 49"
Base Construction: Mild Steel Painted
Load Plate and Ramp Construction: CRN1
Stainless Steel
Instrument: (1) 8530
Enclosure: GP Desk
Options Added: (1) High Resolution Board

Total Cost: $13,015.00
Delivery: 6-8 Weeks
Estimated Installation Cost: $300.00

Ten 50LB Class F Cast Iron Test Weights, serialized
Individual Cost: $89.00
Total Cost: $890.00
Letter of Certification: $40.00
Total: $930.00

One (1) 500LB Class F Cast Iron Test Weight Includes serialization

Cost: $800.00
Letter of certification: $160.00
Total Cost: $960.00

Terms: Net 30 Days
FOB: Factory
Tax: Additional if applicable

Thank you for this opportunity to submit this quotation if you have any questions please do not hesitate to contact me.

Sincerely,
FILING SCALE COMPANY

Steven Smith
Sales Engineer

ROBERTSON EQUIPMENT COMPANY 24700 Center Ridge Road, Suite 11, Westlake, Ohio 44145
OHIO • 800-788-0456 216-899-0222 FAX • 216-899-0226

FACSIMILE TRANSMISSION COVER SHEET

DATE: 8-12-96

SENT TO: STERIS PLT # 23

ATTENTION: JIM DIMMICK

FROM: DEAN ROBERTSON

NUMBER OF PAGES TRANSMITTED INCLUDING THIS PAGE: 1

PLEASE CALL IF THERE ARE ANY PROBLEMS WITH THIS TRANSMISSION.

JIM,

I TALKED WITH KENT STEPHENS @ PAKTECH AND HANK KADER @ VAC-U-MAK.

MATEER-BURT IS SUPPLYING LEVEL CONTROLS TO TURN VAC-U-MAK SYSTEM ON/OFF.

SO WE ARE GOING TO PROVIDE FILL MACHINE ADAPTORS, SIMILAR TO THE ONES FOR MIKE JUSEK'S PROJECT, IN PLACE OF THE LEVEL CONTROLS AT AN EVEN EXCHANGE.

ANY QUESTIONS, PLEASE LET ME KNOW.

THANKS -

DEAN

STERIS

PROJECT FAX

PAK/TEEM, INC.

TO: MIKE COCCA
COMPANY: STERIS
PHONE: 216-639-8066
FAX: 216-205-5015

Date: 08/28/96

FROM: ED ACKELL
COMPANY: PAK/TEEM, INC.
PHONE: (513)-772-4777
FAX: (513)-772-6950

PAGES INCLUDING COVER PAGE: 2

SUBJECT: UTILITY REQUIREMENTS

Utility Requirements for Powder Blending

	POWER	AIR
Vacuum loading system		
Blower in mechanical room	20 hp, 460v/3 ph	
Vacuum receiver above mixer	110v circuit	10 CFM
Super sack dump station	2 hp ?	
Manipulator pads	?	?
Scott plow mixer	125 hp, 460v/3ph	
Discharge valve		1 CFM
Vent valve		1 CFM
Lift assist vacuum blower	5 hp, 460v/3ph	
Liquid spray-on pump	3 hp, 460v/3ph	
Scale on pre-weigh bench	110v circuit	
Bag dump station floor scale	110v circuit	
Liquid mix tank scale	110v circuit	
Dust filter	15 hp, 460v/3ph	15 CFM
Agitator liquid mix tank		10 CFM

Discharge slide gate on mixer	1 CFM
Tote seals (2)	1 CFM

This information is preliminary pending additional information from the vendors.

Control and Metering

Control and Metering Limited
6500 Kestrel Road
Mississauga, Ontario, Canada L5T 1Z6

Telephone: 905.795.9696
Facsimile: 905.795.9654
Internet: sales@cml.onramp.ca

August 14, 1996

Steris
5960 Heisley Rd.
Mentor, OH, 44060

Attn: **James Dimmick**
Manager Chemical Packaging

Dear James Dimmick:

We were delighted to see you in our booth at the Powder Bulk and Solids 1996 Show. Enclosed, please find the literature you requested.

Established in 1937, Control and Metering Limited is a leader in the design, manufacture, installation and service of bulk material handling equipment and related process controls systems. We are proud to be affiliated with Brabender Technologie, Germany and Flomat/Bagfilla, U.K.

Our clients operate in a variety of industries, including plastics, energetics, food and pharmaceutical.

Bulk Bag Fillers
Our filling machines are designed for safe and easy operation. They can fill lined or unlined bags accurately. Model A presents an economical solution to filling bags with granular products which need some compaction. For more difficult to compact materials our Model B filler with a patented coned table, produces a dense, straight sided, stable bag. You save on wastage, storage, transport and labor costs.

Bulk Bag Dischargers
A steep sided hopper, among other features, ensures safety while promoting complete bag discharge. We offer a variety of models which accommodate different styles of bags. We have refined methods of handling lined bags, including a completely sealed system suitable for the food and pharmaceutical industries.

Feeders
Control and Metering offers the widest selection of feeders on the market. Our versatile volumetric and loss-in-weight FlexWall feeder meets most process needs, and for more specialized requirements we offer high and low capacity feeders, along with modular and single and twin screw models. Our popular weigh belt feeder is frequently applied in low headroom situations, or used as a prefeeder.

Controls and Product Integration
Controls for single and multiple feeders are available together with a variety of operator interface units. Our team of industrial process engineers provide a systems integration capability unmatched by our competitors. Take advantage of our experience and superior design capabilities to optimize your process.

Hebden, Schilbe & Smith, Inc., 412-942-5858 our Representative in your area will contact you to provide further assistance. Thank you for your interest in Control and Metering Limited..

Yours very truly,
Control and Metering

Don Mackrill
Regional Sales Manager

enclosures:

STERIS

PROJECT FAX

PAK/TEEM, INC.

TO: Scott Fultz
COMPANY: STERIS
PHONE: 216-639-8066
FAX: 216-639-8653

Date: 09/03/96

FROM: Kent Stephens
COMPANY: PAK/TEEM, INC.
PHONE: (513)-772-4777
FAX: (513)-772-6950

PAGES INCLUDING COVER PAGE: 2

SUBJECT: Powders Blending Manufacturing Change Request (MCR)

Scott,

Please find attached the MCR that Keith Sumey (Mfg. Mgr.) developed. These modifications to the scope of work are based on our conference call of 8/29.

Please sign as approved and fax me back a copy to insure no schedule impact.

Please call with any questions.

PAK/TEEM, Inc.
Manufacturing Change Request Form

PTCR # 01

Client: STERIS

Date 9/3/96

Client P.O. #: 38632

Originator(s): K. STEPHENS

PAK/TEEM Project #: P4319

Project Title: STERIS POWDERS BLEND INSTALL.

Original P.O. Amount $ 64,000

Previous Changes: $ 0

Amount this Change: $ 3,090

New Total Project Value: $ 67,090

Manufacturing Description Change

Item		Material Cost	Effort Cost
1	GRAVITY GATE ON UPPER PLATFORM	$500	$960
2	HANDRAIL ON LIQUID SKID	$100	$320
3	SPACERS ON LIQUID SKID	$20	$80
4	HAND RAIL ON WEIGH BENCH PLATFORM	$150	$960
5			
		Additional Mfg. Cost	$3,090

Schedule Impact
NO SCHEDULE IMPACT IF APPROVAL OF CHANGE REQUEST IS RECEIVED BY 9/6/96.

Comments/Attachments:

Approval Manufacturing

Mfg. Department Mgr.

Client

Date

ECS
ENVIRONMENTAL CONDITIONING SYSTEMS
7567 Tyler Boulevard, Mentor, Ohio 44060 • (216) 946-7823 • FAX (216) 269-1933

Proposal

October 4, 1996

Proposal Submitted to:

Steris Corporation
5960 Heisley Road
Mentor, Ohio 44060

Attn: Mike Cocca

Liquid Mix Exhaust

Job Reference:

We hereby submit specifications and estimates for:

Installation of new Eisenheiss loaded exhaust fan with reverse polycoat duct, per sketch provided by Denk Associates.

Not Included: Electrical feeds or on/off switch with pilot light.

TOTAL COST: $3,500.00

Terms: Net 30 days; Past due accounts are subject to a service charge of 1.5% per month (18% annually).

ECS Authorized Signature: _____

Acceptance of Proposal: The above prices, specifications and conditions are satisfactory and hereby accepted. You are authorized to do the work as specified. Payment will be made as outlined above.

Date of Acceptance: _____ Signature: _____

Please return original to service company.
Retain copy for your records.

DENK ASSOCIATES, INC.

CONSULTING ENGINEERS

September 26, 1996

Mr. Michael Cocca
Steris Corporation
5960 Heisley Road
Mentor, Ohio 44060

RE: Plant #123 - Liquid Mix System Exhaust

Dear Mike:

Attached is the sketch of the exhaust we spoke of on the referenced piece of equipment.

As you stated, a minimum amount of exhaust is required as well as a protective coating on any components which are in the air stream. The attached includes an eisenheiss coating on the fan. The system is designed to exhaust approximately 300 CFM.

If you have any questions, please let me know.

Sincerely,

Michael T. Denk

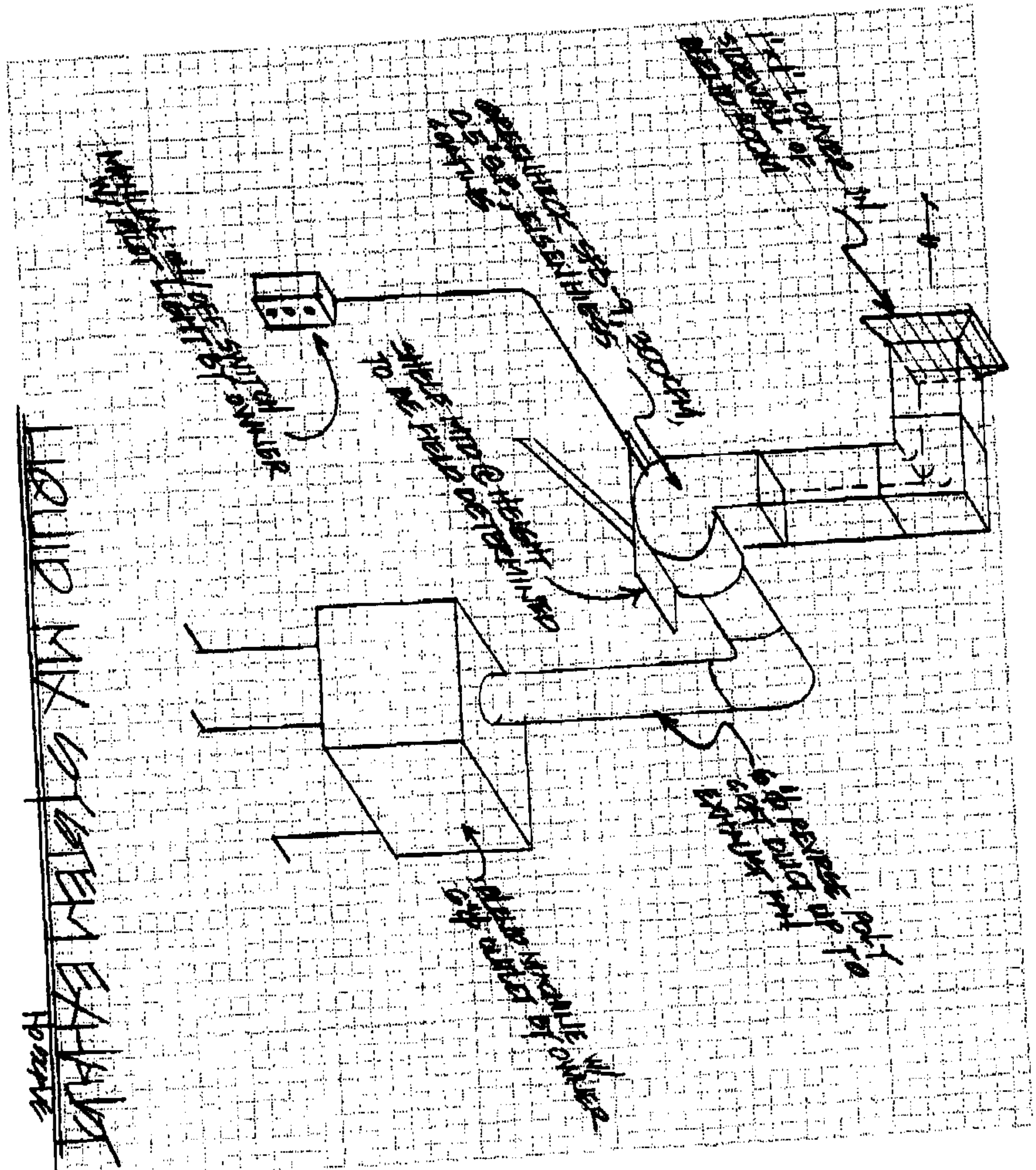
Michael T. Denk

/sm

603 EAST 200TH STREET CLEVELAND, OHIO 44119-1573 216/531-5060 FAX: 216/531-5144

DENK ASSOCIATES, INC.
CONSULTING ENGINEERS

PROJECT ____________
NAME ____________
DATE ____________
PAGE ____ OF ____



STERIS

PROJECT FAX

PAK/TEEM, INC.

TO: Scott Fultz
COMPANY: STERIS
PHONE: 216-639-8066
FAX: 216-639-8653

Date: 10/31/96

FROM: Kent Stephens
COMPANY: PAK/TEEM, INC.
PHONE: (513)-772-4777
FAX: (513)-772-6950

PAGES INCLUDING COVER PAGE: 3

SUBJECT: Powders Blend Installation Update

STERIS

PROJECT MEMO

PAK/TEEM, INC.

To: Scott Fultz

Date: 10/31/96

From: Kent Stephens

Subject: Powders Blend Installation Status

Work Complete:

Week of 10/21

Dust Collector rigged and set. The factory shipped the incorrect damper with the unit. The new damper is being shipped directly to plant 123.

Dust Collector ductwork started and 80% complete.

Vac-U-Hoist mounted and piped. Final operator hose/attachment assembly remaining.

Work Remaining:

Bag dust collector unit

Compressed air routings

Liquid Mix Transfer final assembly

VAC-U -MAX

Knife Gates

Final Equipment Anchor

Issues:

Per our conversation yesterday, I sat down with Keith Sumey (Manufacturing Mgr.) to review in detail the construction schedule. As you noted, the schedule called for equipment turnover to STERIS the week of 10/28. Unfortunately this milestone was keyed off of the delivery of the Vac-U-Max system (originally promised 10/14 and not under PAK/TEEM's control)). We have been clear that we need 2 weeks after delivery to complete our effort. This delay has caused a conflict with other commitments our manufacturing group has for the months of November and December. These conflicts are both schedule and cost issues. These issues are centered around shuffling the existing resources/workloads to complete the powders effort in Nov./Dec. Our original scope was to provide two separate trips, each one week in duration. The schedule slip forced us to re-staff our resources to other assignments where we were unable to allocate them to the powders installation.

Specifically the slip has caused us:

Estimated Impacts From Week #2

• Not to send the 4 resources we had planned	80 E.H.	$3,440
	16 E.H.	$ 880
• Rental of lift equipment (Forklift/manlift)		$1,000

Estimated Impacts for Week #3

• All expenses	$1,250
• Rental equipment	$ 500

Estimated Impacts for Week #4

• All expenses	$1,250

Estimated Loss of resource applied time based on schedule slip (this includes Internal re-work loops, and overall continuity/efficiency) 80 E.H. $3,440

Total Impact **$11,760**

Maintaining our key resources will require premium time. Currently , our staffing situation will require us to work a third and fourth week. Work associated with powders blending will most probably be in addition to our folks normal 40 hour week, plus the additional travel expenses, rental of equipment (equipment was available at the original proposal writing), etc. are financial impacts that were not included in our original scope.

Based on the above we would like for STERIS to consider an adjustment to our purchase order to cover these additional costs.

PAK/TEEM Inc.

Facsimile Cover Sheet

Project # 4132

To: Scott Fultz
Company: STERIS
Phone:
Fax: 216-639-8653

From: Kent Stephens
Company: PAK/TEEM Inc.
Phone: (513) 772-4777
Fax: (513) 772-6950

Date & Time: 11-5-96 4:30 P.M.
Pages including this cover page: 3

Subject:

PAK/TEEM, INC.

P:\Standard\Forms\FAXCOVER.DOC

STERIS

PROJECT MEMO

PAK/TEEM, INC.

To: Scott Fultz **Date:** 11/05/96

From: Kent Stephens

Subject: Powders Blend Revised Schedule

Scott -

Please see attached revised completion schedule for powders blending.

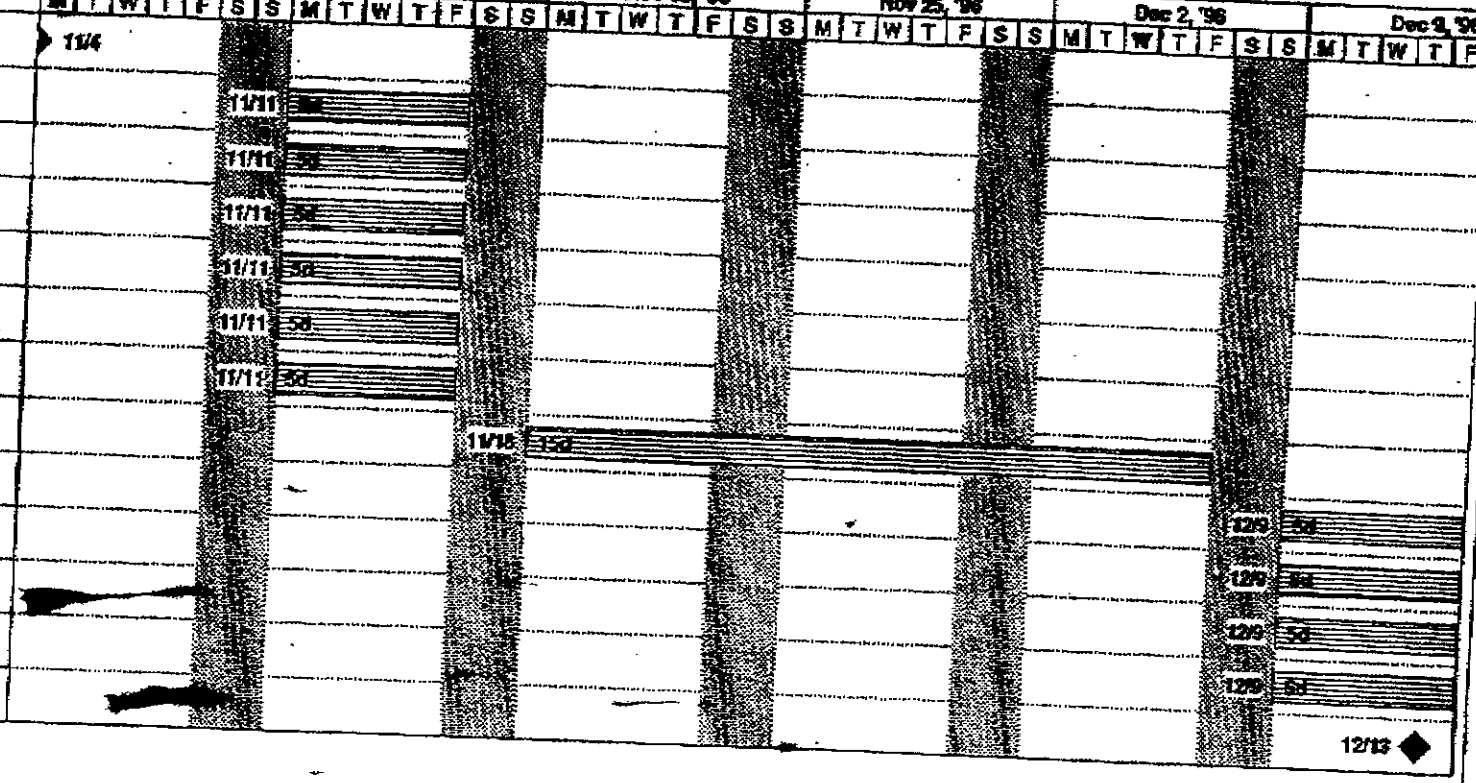
John Tesdahl and Rob Hill are planning on working Tuesday through Saturday (10 hr days). I will be up with Stan Lockwood and Terry Williams Wed. & Thurs.

I have also faxed a copy to Mr. Anderson at THOR ELECTRIC. I have told him I'll meet with him to discuss any un-resolved issues.

STERIS SCHEDULE P4319

REVISED : 11-4-96

ID	Task Name
1	VAC-U-MAX AT STERIS
2	INSTALL VAC-U-MAX
3	SET-UP BLOWER
4	SET-UP SUPER SACK
5	ROUTE PNEUMATIC TUBING
6	CONTINUATION OF VACUUM PIPING
7	LIQUID SPRAY
8	ELECTRICAL PHASE: MCC'S & POWER AND
9	CONSTRUCTION CHECK OFF
10	DRY IRON EQUIPMENT
11	IQ
12	OQ
13	SYSTEM TURNOVER



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11/5/96

STERIS

PROJECT FAX

PAK/TEEM, INC.

TO: Scott Fultz
COMPANY: STERIS
PHONE: 216-639-8066
FAX: 216-205-5015

Date: 01/27/97

FROM: Kent Stephens
COMPANY: PAK/TEEM, INC.
PHONE: (513)-772-4777
FAX: (513)-772-6950

PAGES INCLUDING COVER PAGE: 1

SUBJECT: Powders Blend

Scott -

Ed Ackell and Terry will be up tomorrow afternoon. We will have a new fabricated spool piece to stop the leakage at the VAC-U-MAX/Lance transition.

I have spoken to Darrel at THOR Electric around the static grounding for the transfer hose.

Typically, the seals on a mixer shaft (or choppers) are not adjusted at the factory. Ed and Terry will take a look tomorrow and see what needs to be done.

Would you like them to do anything else?

Kent

STERIS

PROJECT MEMO

PAK/TEEM, INC.

To: Scott Fultz **Date:** 02/04/97

From: K. Stephens

Subject: POWDERS BLEND START-UP

Scott - referring to the items we discussed this morning over the phone:

1). Cobra solidifying in bottom of tank prior to being completely mixed or transferred.

This could be symptomatic of the operational procedure. Is the material added in slow increments to facilitate mixing versus a "dumping" of all material into the vortex of the liquids. Perhaps the material should be fed from the outside edges versus into the vortex. The mixer RPM is adjustable and various blades can be purchased.

PAK/TEEM was never really involved in the liquids/powders addition aspect. We were always concerned that the product might solidify prior to being fully pumped to the mixer. Early on, we were working with Jim Dimick and a woman from your laboratory to determine final viscosity numbers to size the pump/pipe. I recall that exact numbers did not exist. As a final thought, remove the strainer at the bottom of the tank and try another batch. Perhaps the strainer itself is limiting flow into the pump, causing solidification.

2). Black "grease like" substance leaking or coming from the lower knife gate. The knife gate is sandwiched between an upper and lower Teflon seat. These seats are a hard material that would potentially leave flakes or specs, but not a grease. No grease or oil is used in the vacinity. The knife is supplied with a mechanical packing at the rear to prevent product leakage. It can be adjusted (tightened) if this occurs.

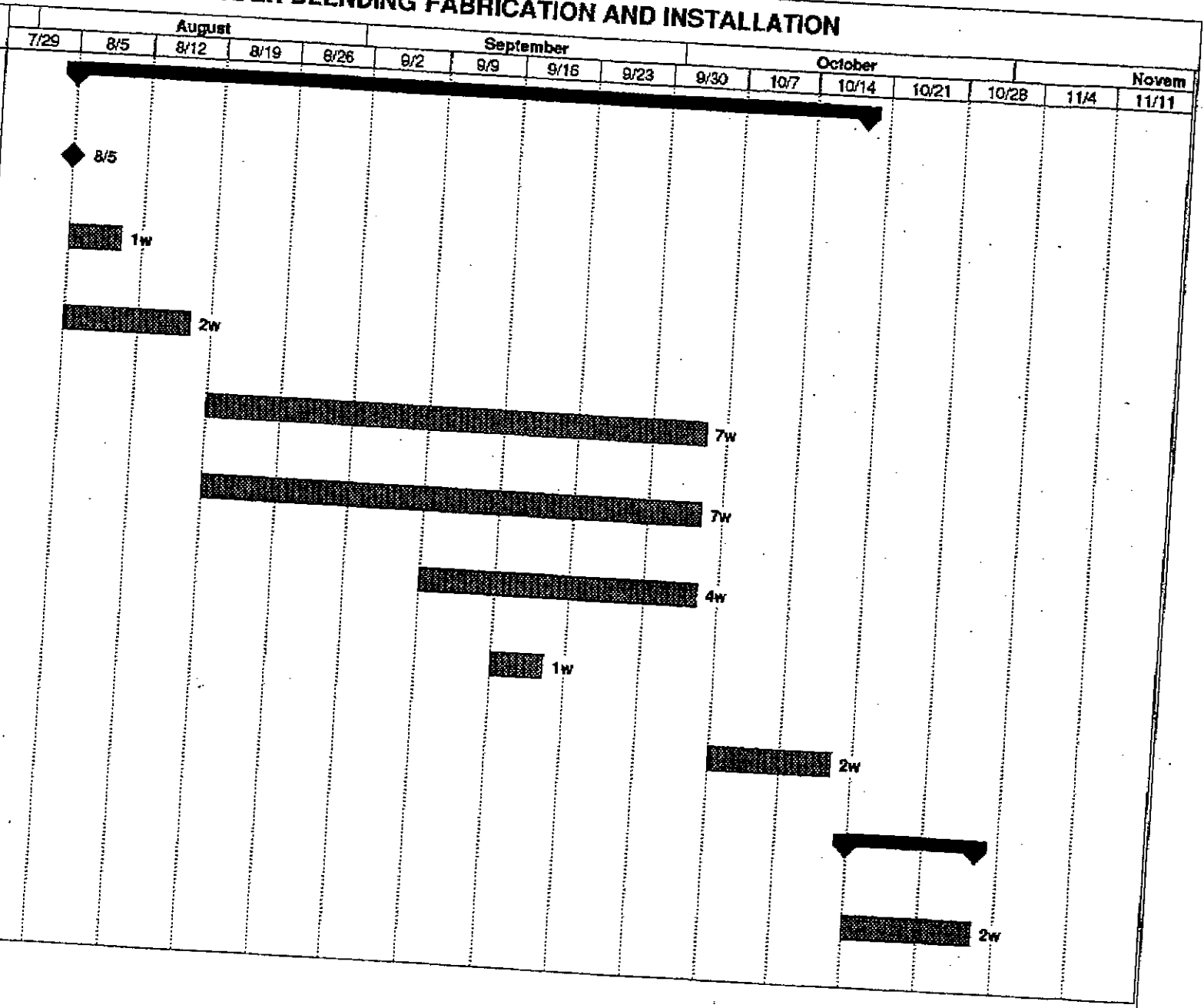
I would suspect that this substance is related to the liquid mix itself. It may be blackening due to the shearing action of the mixer. What color does the liquid mix start out as?.

3). VAC-U-MAX transfer / Static Electricity. This is an extremely common problem. As we have discussed, the vendors hose is supplied with a grounding wire. Even the best installations have trouble insuring a total ground. We typically always use an external wire wrap (8-10 Ga. THNN wire).

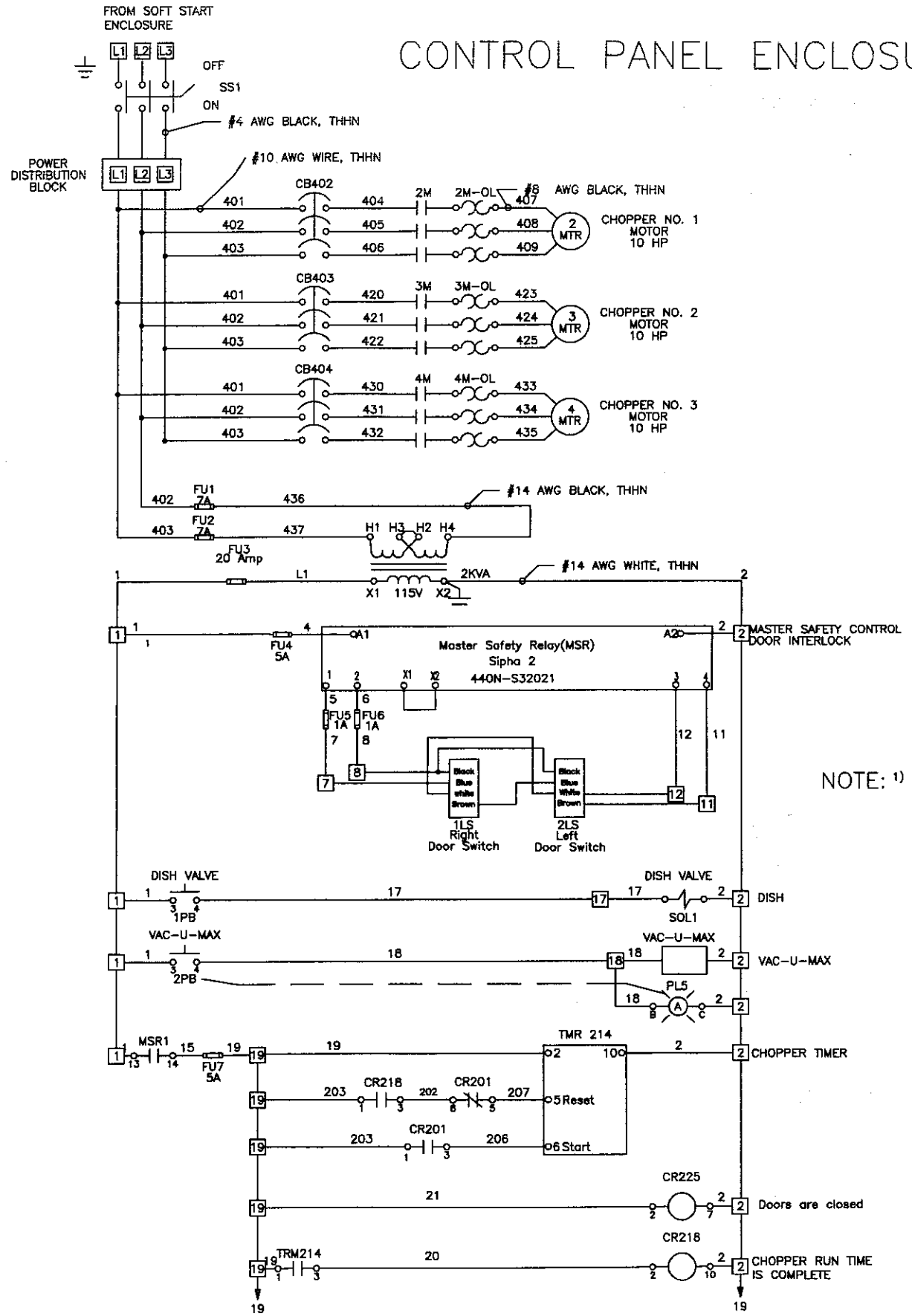
After our discussions I believe you have pinpointed the area and have addressed the corrective action.

STERIS POWDER BLENDING FABRICATION AND INSTALLATION

ID	Task Name
1	**FABRICATION AND INSTALLATION**
2	RECEIVE PURCHASE ORDER
3	ORDER MATERIALS
4	DEVELOP INSTALLATION PACKAGE
5	PLATFORM FABRICATION
6	LIQUID MIX ASSEMBLY FABRICATION
7	SHEET METAL (STAINLESS) FABRICATION
8	INITIAL FIELD INSTALLATION
9	2ND FIELD INSTALLATION
10	**START UP AND VALIDATION**
11	START UP AND VALIDATION SUPPORT

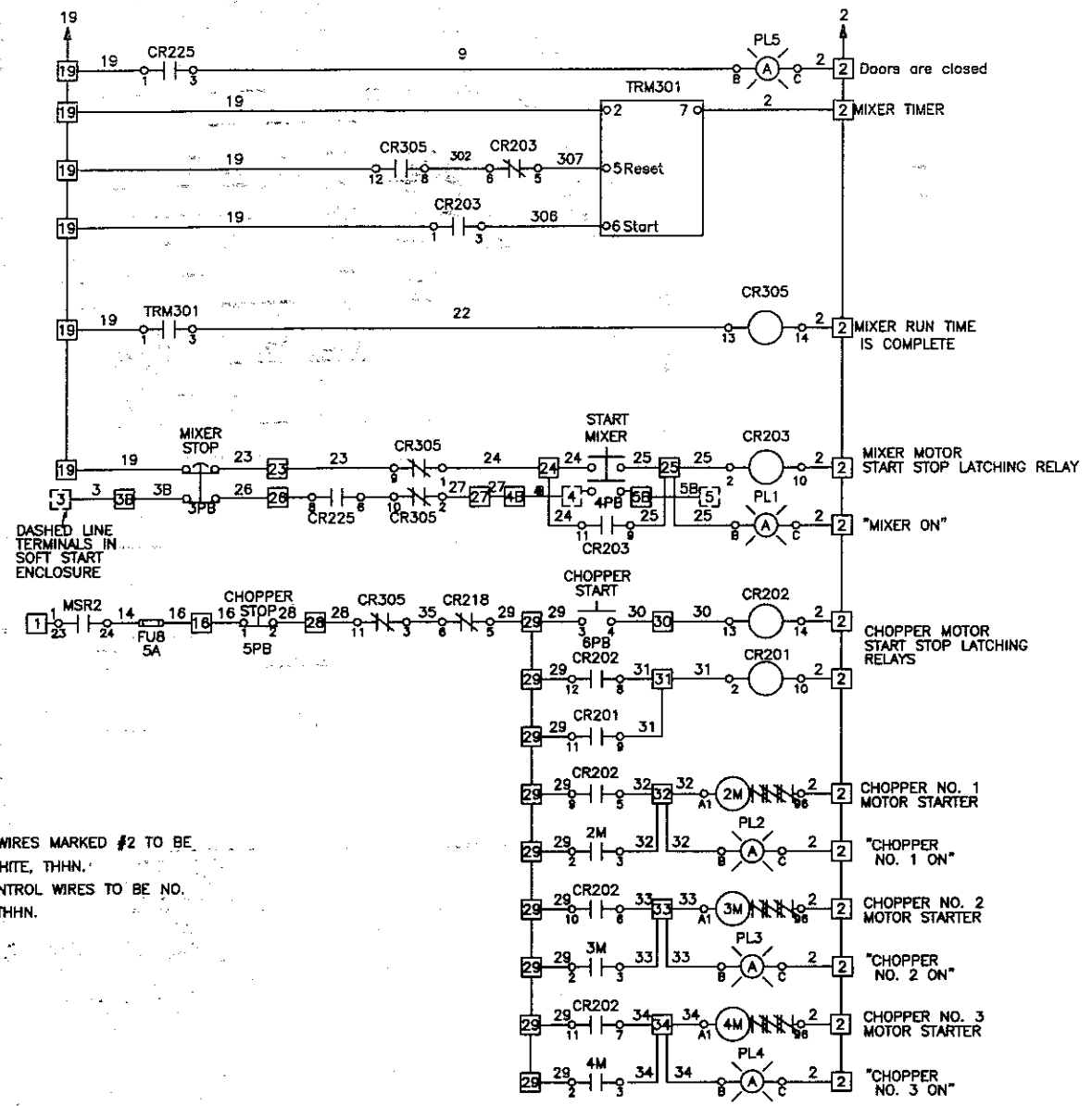


CONTROL PANEL ENCLOSURE



NOTE: 1) ALL CONTROL WIRES MARKED #2 TO BE NO. 14 AWG WHITE, THHN. ALL OTHER CONTROL WIRES TO BE NO. 14 AWG RED, THHN.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ±1/16 .XX± 0.03 ±1° .XXX± 0.015	STERIS Corporation Mentor, Ohio		
	DRAWN BY JAM	DATE 1/30/03	SCOTT BLENDER ELECTRICAL SCHEMATIC
	CHECKED BY	DATE	
	APPROVED BY	DATE	MATERIAL / FINISH
	REVISION	DATE	COLOR
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DO NOT SCALE DRAWING	SCALE 1=1		SHEET 1 OF 3

PN 800207 REV A ECO# 1927 9/27/95

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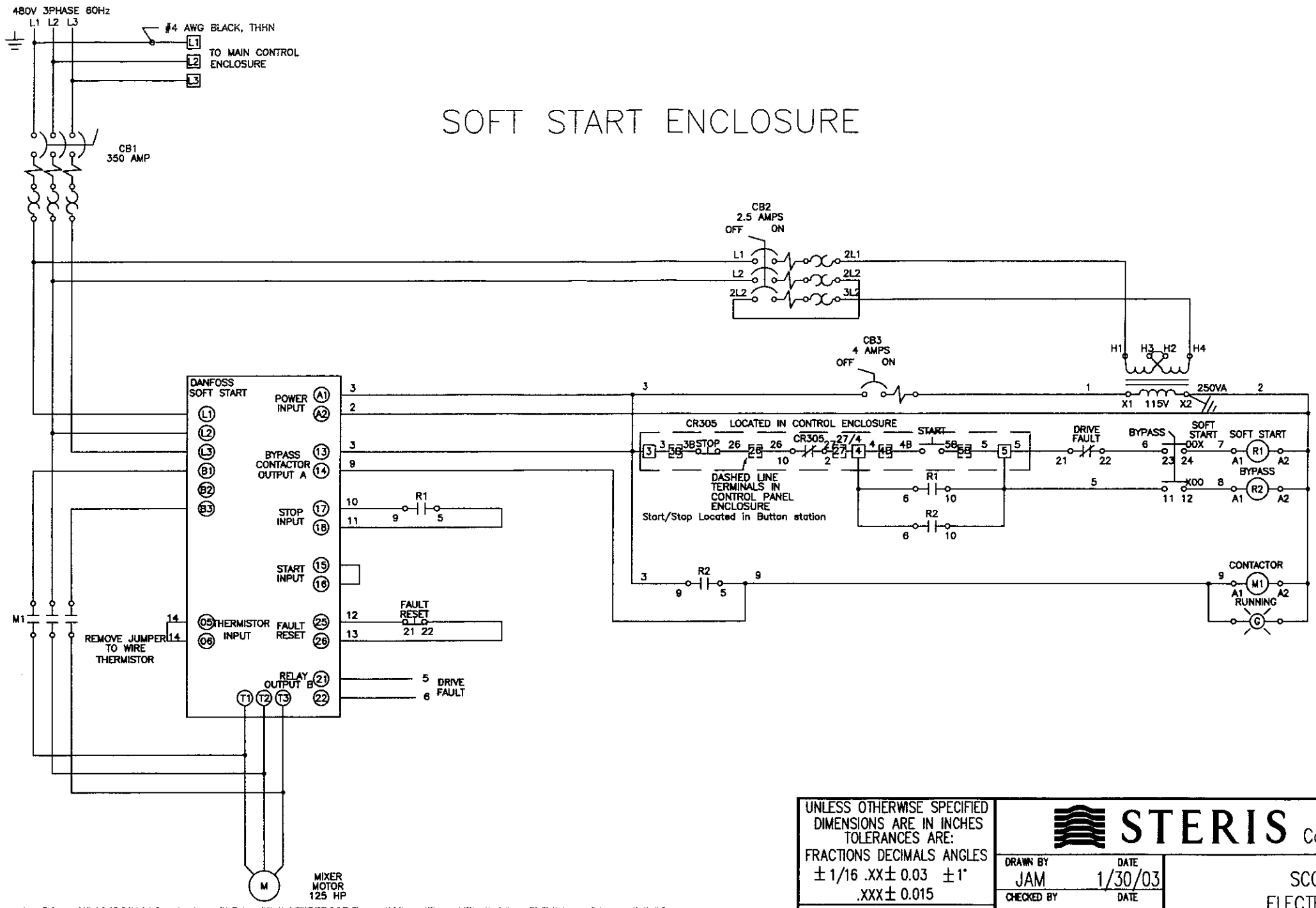
ZONE	LTR	DESCRIPTION	DATE	APPROVED

SOFT START ENCLOSURE



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	DRAWN BY JAM DATE 1/30/03	SCOTT BLENDER ELECTRICAL SCHEMATIC	
	CHECKED BY DATE		
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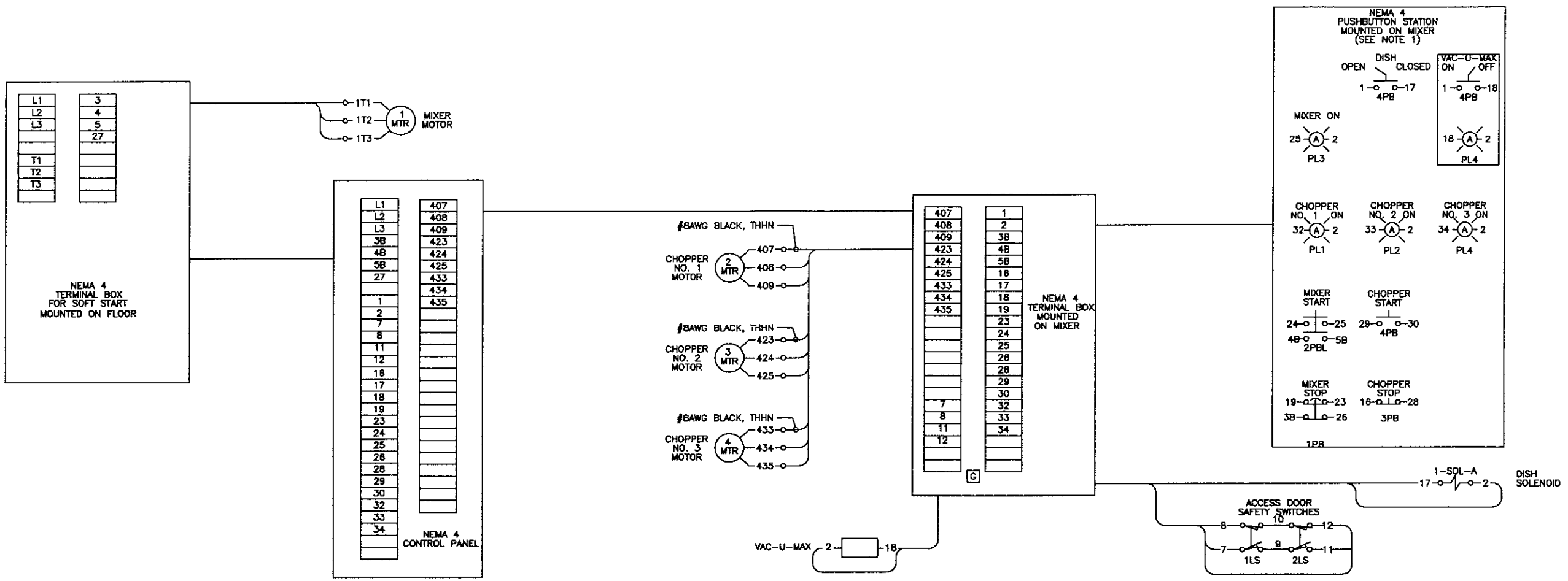
	REVISION DATE		COLOR
	SIZE B PROJECT NO.	PART NO.	REV. A
DO NOT SCALE DRAWING	SCALE 1=1		SHEET 2 OF 3

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



NOTE: 1) WIRES NUMBERED '2' TO BE NO. 14 AWG WHITE, TYPE THHN. ALL OTHER CONTROL WIRES TO BE NO. 14 AWG RED, TYPE THHN.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS DECIMALS ANGLES
±1/16 .XX± 0.03 ±1°
.XXX± 0.015

DO NOT SCALE DRAWING

STERIS Corporation Mentor, Ohio

DRAWN BY JAM	DATE 1/30/03
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REVISION	DATE

SCOTT BLENDER
ELECTRICAL SCHEMATIC

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REVISIONS				
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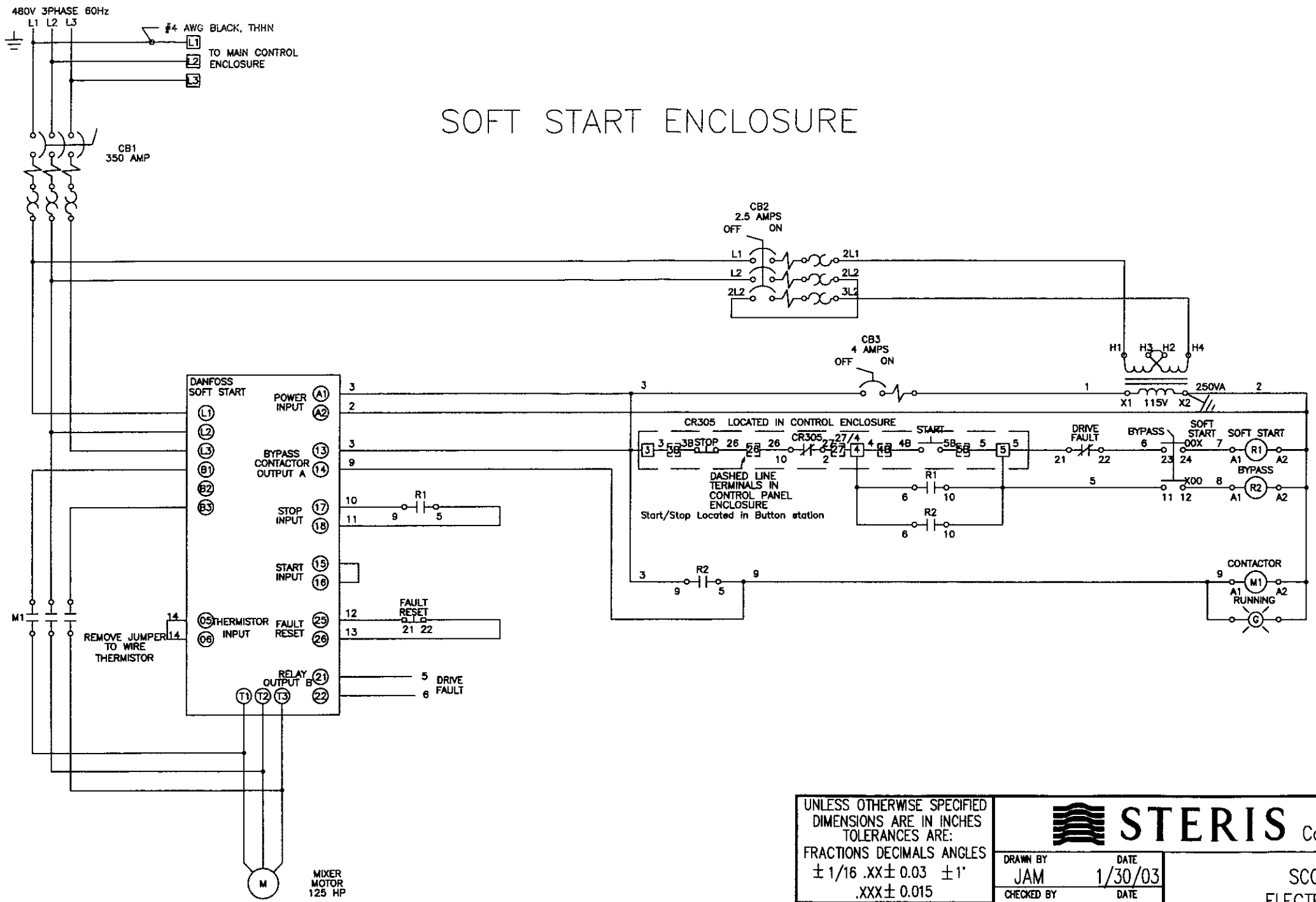
SOFT START ENCLOSURE



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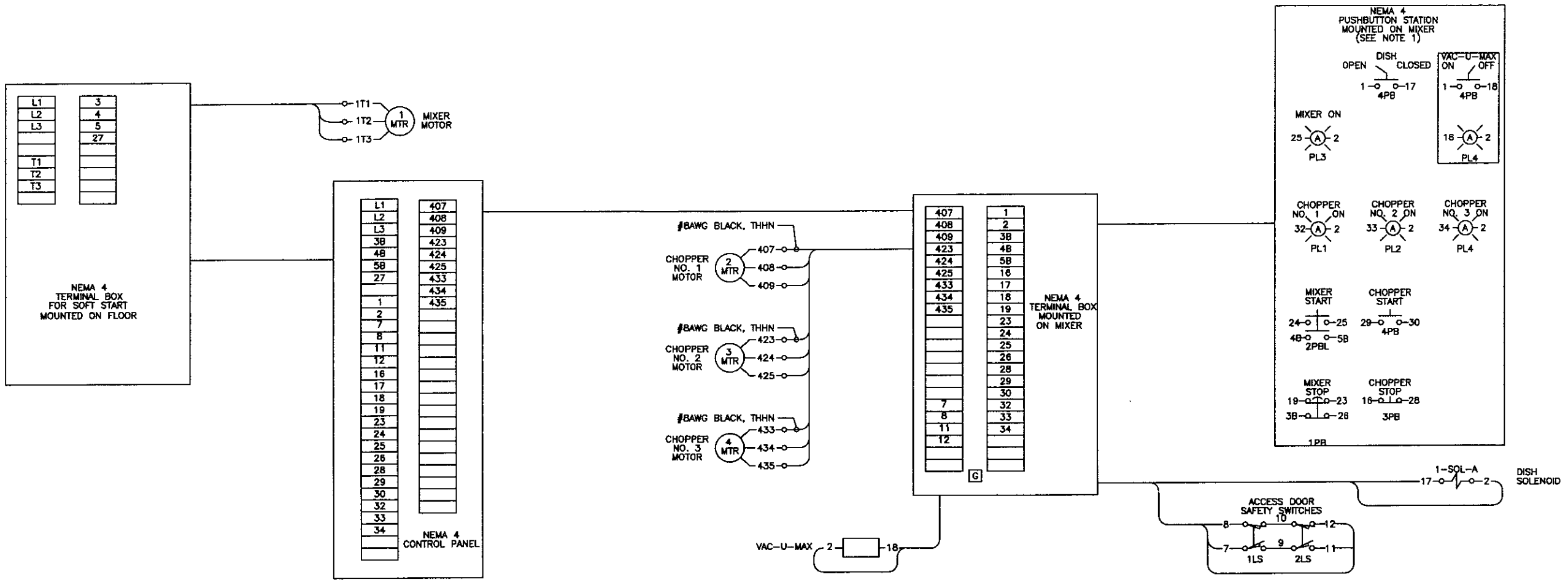
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



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±1/16 .XX± 0.03 ±1°
.XXX± 0.015

DO NOT SCALE DRAWING

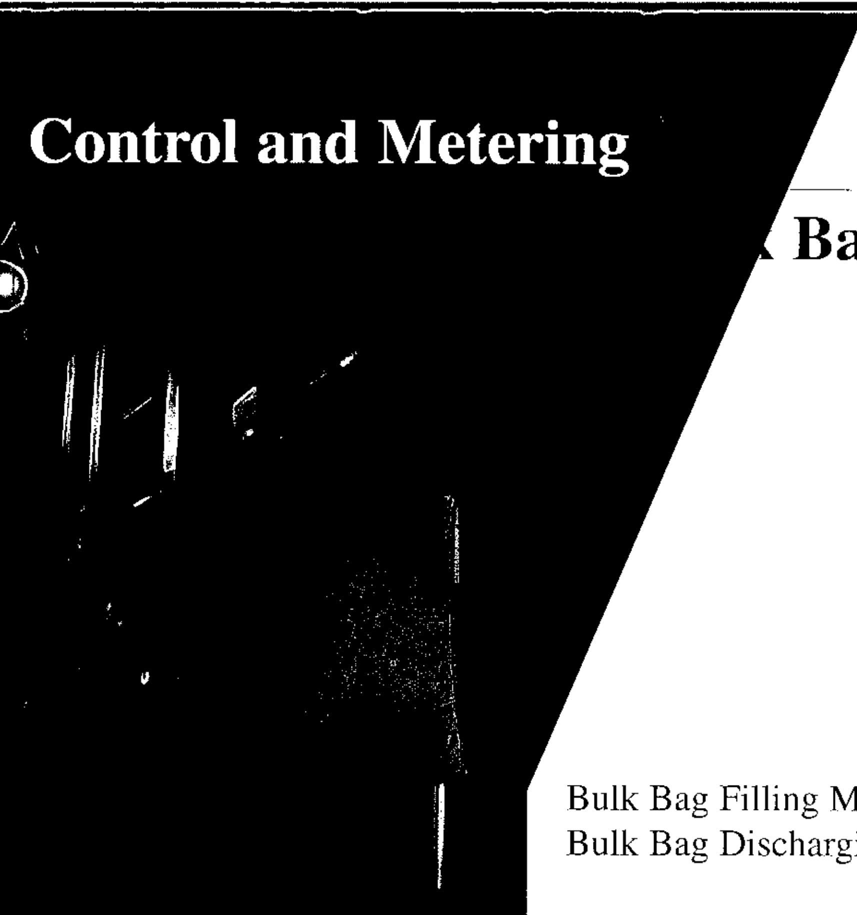
STERIS Corporation Mentor, Ohio

DRAWN BY JAM	DATE 1/30/03
CHECKED BY	DATE
APPROVED BY	DATE
REVISION	DATE

SCOTT BLENDER
ELECTRICAL SCHEMATIC

SIZE B	PROJECT NO.	PART NO.	REV. A
SCALE 1=1			SHEET 3 OF 3

MATERIAL | FINISH | COLOR



Control and Metering

[illegible] Bag Handling Systems

Bulk Bag Filling Machines
Bulk Bag Discharging Machines

Control and Metering is a leading manuf[illegible] comprehensive selection of high performance bulk bag [illegible]ss solutions to handling easy flowing ingredients thro[illegible]

Control and Metering offers four standard [illegible] [illegible]llers are specifically designed for filling functions. Our machines use [illegible] [illegible]coned lift table and vibrating tables. Control and Metering filling machines [illegible] [illegible]ce the most stable, dense and square package to suit your requirements. [illegible] [illegible]are also available.

The bulk bag discharging machines from Control and Metering [illegible] [illegible]wing, non-dusty ingredients to sanitary or hazardous requirements that demand [illegible]

Recognized as pioneers of bulk bag handling in North America, [illegible] possibilities of bulk bag use.

Filling Machines

Our fillers are designed to safely secure the bag during filling and produce a stable, accurately weighed package.

Model A	for ingredients requiring no densification, such as pellets and granules
Model A/V	for ingredients such as pellets and granules needing some compaction; available with automatic bag removal
Model B	for all ingredients, especially those needing maximum compaction; fork truck removal of filled bag
Model C	adds automatic height adjustment for different sized bags & automatic bag removal to Model B

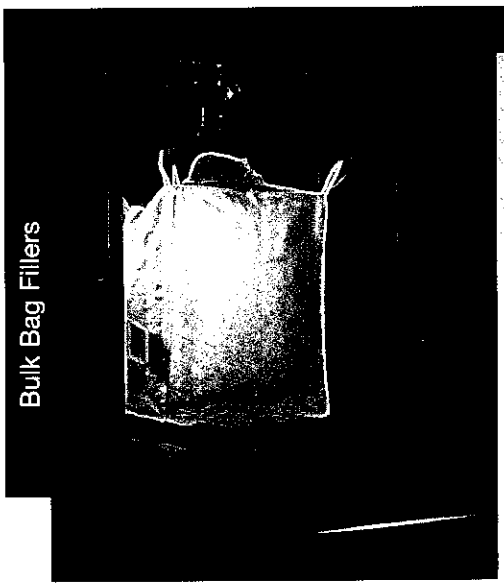
Discharging Machines

Our dischargers [illegible]port hoppers designed for operator safety, easy outlet [illegible] 70° slope to promote complete emptying.

Flo-Easy	for free-flowing, non-dusty ingredients
Flo-Spout	for unlined bags with outlet spout
Flo-Knife	for unlined bags with a sealed bottom
Flo-Liner	for lined bags with outlet spout
Flo-Clean	for lined bags with porthole outlet
Flo-Super Clean	for lined bags with extended liner spout to seal outlet and contain dust

Control and Metering

Bulk Bag Fillers



Model A

This filling machine is ideal for ingredients that do not require compaction. The bottom of the bag is supported on a pallet during the entire filling cycle. Model A can fill bags between 45" and 80" max. height and 3,000 lbs. max. weight.

Model Numbers (Numerals indicate max. bag height): **A-72**

Model A/V

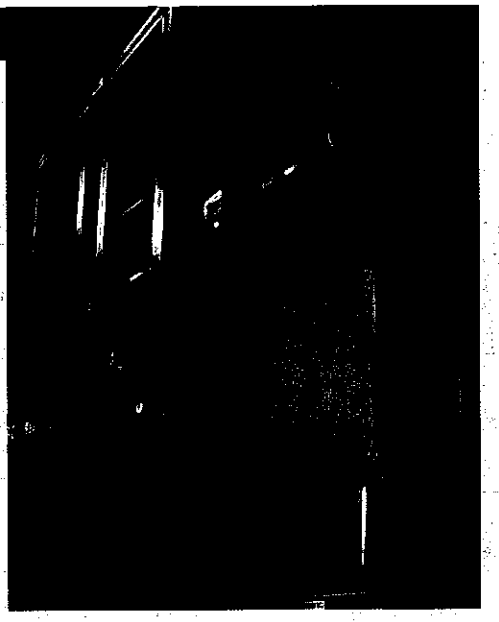
This economic model is designed to fill ingredients which require some compaction. Model A/V includes bag stretch and weighing. It features a grid vibration table which vibrates the bottom of the bag on a pallet and is available with a take-away conveyor to eliminate the need for a dedicated fork lift truck.

- relatively low headroom requirement
- twin tube filling head with inflatable collar secures bag with inlet spout and provides vent for displaced dusty air
- can be fully automated to dispense pallets & slip sheets, and take away filled bags

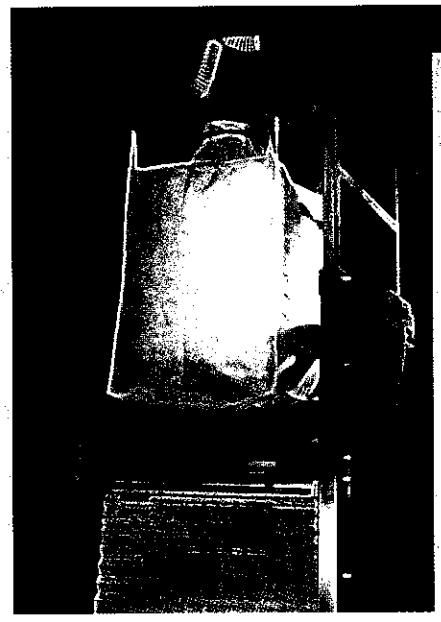
Model B

Model B is selected for filling applications where bags require the full capabilities of Control and Metering's patented densification system and where filled bags are removed from the filling machine on a pallet with a fork lift truck. The bottom activated coned table is automatically cycled to fill the bag and densify the ingredient. Hang filling stretches the bag to its final shape and provides accurate weighing. There are 3 standard models to fill bags of max. height between 55" and 80" and a max. weight of 3,000 lbs.

Model Numbers (Numerals indicate max. bag height): **B-55, B-65, B-80**



- hang fill stretches the bag fabric and produces straight bag sides
- coned lift table produces maximum compaction
- hang weigh for high resolution, accurate bag weighing
- liner inflation via slip ring filling head for no tearing or folding
- operator is positioned to easily perform rigging functions at chest level
- filling specific controls increase ease of operation, accuracy
- adjustable for different bag heights



Model C

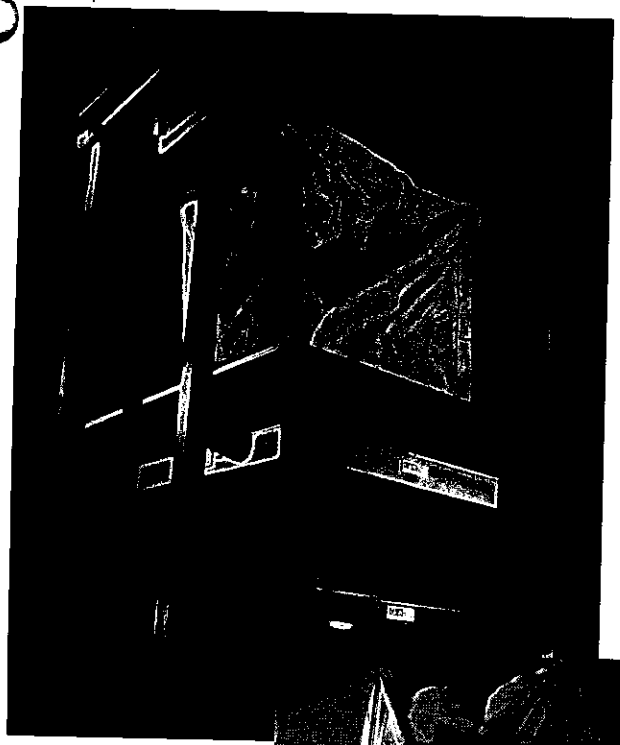
Model C adds automatic bag height adjustment and automatic bag removal to the patented densification system of the Model B. Also, the Model C can be configured to allow bags to be stacked 2 high within the machine. Models fill max. bag height of 12" to 80", max. bag weight 4,000 lbs.

Model Numbers (Numerals indicate max. bag height):
C-60, C-75, C-93, C-55-ABR, C-70-ABR, C-88-ABR, C-48-ABR-CONV, C-62-ABR-CONV, C-80-ABR-CONV

- automatic bag height adjustment
- automatic bag removal for quick positioning of next bag, conveyor for increased transport and storage flexibility

Control and Metering is a leader in the field of discharging bulk bags. Our dischargers can empty your bulk bags safely, and efficiently. We have a model to suit every application, whether you are emptying free-flowing, non-dusty ingredients or whether you have to protect your operators and working environment by discharging in a completely sealed system. Each model of discharger can be loaded by fork lift (F), hoist (H) or monorail (M). Sanitary designs are available.

Flo-Spout



Flo-Clean

- Steep sloped hopper for maximum flow
- Operator access door for easy operation and safety
- Dust membrane to reduce dust
- Vibration applied to the hopper to promote flow
- Liner tensioner holds liner in place without risk of tearing or liner discharging with ingredient
- Sealed system for direct discharge into downstream process
- Innovative options including Flo-Choke and Bag Folder

All features do not apply to all models. See descriptions. Control and Metering will help you select the model best suited to your needs.

Flo-Easy

This low cost model is designed to empty free-flowing, non-dusty ingredients from unlined bags with an outlet spout.

Model Numbers: FE-F, FE-H, FE-M

Flo-Spout

Thoughtful design ensures that this discharger empties unlined bags with outlet spouts quickly and effectively. It features a steeply sloped hopper, vibration and a dust seal. Popular options include Flo-Choke which closes a partially emptied bag.

Model Numbers: FS-F, FS-H, FS-M

Flo-Knife

Designed to discharge unlined bags with no outlet spout, this machine is an ideal solution for low head-room sites. Flo-Knife punctures the bag at the bottom with a six blade knife. It provides a steeply sloped hopper, a dust seal and vibration.

Model Numbers: FK-F, FK-H, FK-M

Flo-Liner

This model empties lined bulk bags with an outlet spout quickly and easily. A specially designed liner tensioner and positioner holds the liner in place and prevents it escaping downstream.

Model Numbers: FL-F, FL-H, FL-M

Flo-Clean

Intended for lined bags with a porthole oulet, this model employs a four bladed knife to puncture the liner. It also holds the liner in place with a liner tensioner and positioner.

Model Numbers: FC-F, FC-H, FC-M

Flo-Super Clean

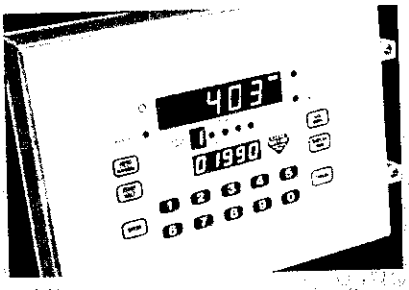
The perfect model for situations where the operator or operating environment must have no contact with the ingredient being discharged. This model meets the challenging demands of the food and pharmaceutical industries by providing a closed system. The liner is clamped to ensure no dust escapes from the system. A heavy duty liner tensioner tightens the liner to completely empty the liner of ingredient.

Model Numbers: FSC-F, FSC-H, FSC-M

Fillers, Special Features

Filling Controls

Dedicated filling machine controllers are microprocessor based and operator friendly. For Models B, C, the load cells are attached to the upper machine frame and only the bag and the arms from which it is hung are weighed. This hang weighing technique ensures better weighing resolution and control accuracy. Control parameters include: empty bag tare, target weight, fast/dribble feed rate, liner inflation, compaction timing, lift table operation and filling stop.



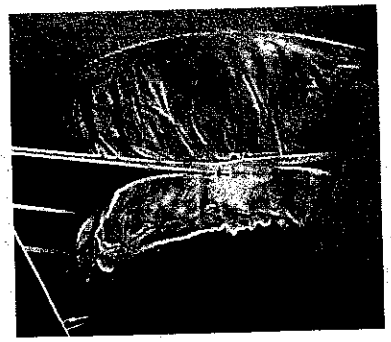
Filling Heads

To protect the bag or liner from tearing and to maximize ease of operation, Control and Metering offers an inflatable bladder type fill head for unlined bags and a slip ring device for lined bags. The slip ring also allows the operator to correctly position the liner avoiding folds at the bottom of the bag which prevent proper discharge.

Carousel

For situations where a high output of filled bags is necessary, a multi-station carousel is available. Two operators can process up to 70 x 1000 kg bulk bags per hour. The carousel is capable of filling lined and unlined bags. It hang fills, features a coned lift table for compaction, and conveys the filled bags away from the station.

Discharger Options

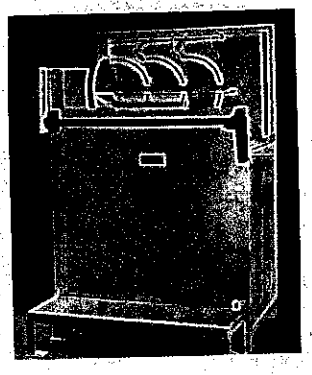


Flo-Choke

This device allows the operator to shut off flow while discharging a bag, tie it off and unload the partially filled bag from the discharger for storage and later reuse. Also Flo-Choke can be used to empty bags in "manual batches".

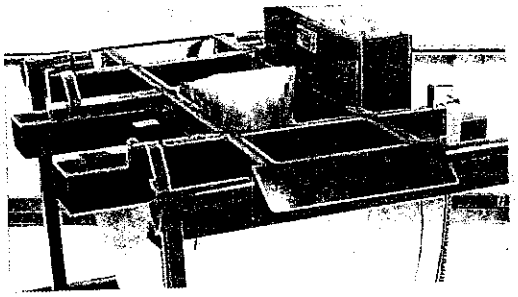
Bulk Bag Folder

The Bulk Bag Folder permits the easy folding of bags after discharge. It eliminates dust problems and promotes convenient bag reuse and recycling.



Liner Tensioner

Two models of liner tensioners are available, one to position the liner and to provide the tension to completely empty the liner. The second model also retracts the liner for easy disposal.



Control and Metering is affiliated with Bagfilla//Flomat. We manufacture and provide application engineering, training and customer support services in North America. Outside of North America, please contact Bagfilla/Flomat Ltd., Glossop, England. All information herein to be used as a general guide only. Improvements and modifications may occur. For current specifications, please contact your local Sales Representative.

1-800-736-5739

Internet: sales@cml.onramp.ca

Control and Metering Ltd.
6500 Kestrel Road
Mississauga, Ontario L5T 1Z6
Telephone: 905. 795. 9696
Facsimile: 905. 795. 9654

Control and Metering

1/96 supersedes none

SCOTT
BUILT FOR TODAY
TO LAST FOR TOMORROW

MANUFACTURERS OF PROCESSING EQUIPMENT FOR:
• AGRICULTURE • INDUSTRIAL
• CHEMICAL • FOOD

QUOTATION DATE: 8/30/95
(valid for 30 days)

QUOTATION NUMBER: 95-3244
REV #1

SOLD TO: STERIS CORPORATION
9450 Pineneedle Drive
Mentor, OH 44060

ATTN: Mike Jusek

TERMS: 1/3 - Downpayment w/order
1% - 10 Days
Net - 30 Days

SALESMAN: David Grimes/siw

REF:

(1) SCOTT MODEL 4810 PLOW MIXER, 48" x 120", 75 cu. ft. of mixing cap. Endplates 1/2" plate, 3/8" mixer tub.

CONSTRUCTION: All welded construction with 316SS provided on all product contact points. Exterior of mixer finished with a glass bead satin finish. Interior of mixer finished with a 120 grit sanitary finish. Corners radiused for easy cleaning. (3) 10 HP choppers to disperse lumps. Choppers are mounted through the tub wall on the upward rotation side.

AGITATOR: 7" solid 316SS main shaft with welded 2" thick support post.

DOORS: Hinged access doors allow for entry and service. Doors are protected by limit switches to prevent opening during operation.

PRODUCT INLET: Inlet supplied for filling with pneumatic conveyor.

SHAFT SEALS: Sanitary hand disassemble air purge packing gland seals with (3) rings of teflon packing and (1) UHMW lantern ring.

DISCHARGE: Air actuated 14" flush mount plug gate at the center of the mixer. 36" legs provided for discharge clearance. Legs made of tubular carbon steel painted with white food grade epoxy paint.

BEARINGS: Set outboard w/heavy duty 5 15/16" nickel plated pillow block bearings on drive end of mixer and 5 15/16" nickel plated pillow block bearings on idle end of mixer.

DRIVE ASSEMBLY: FINAL MIXER SPEED.....62 RPM
125 HP belt drive. 1.7 service factor provided on drive. Drive is complete with 304SS OSHA guard.
125 HP reducer, Falk gearhead type 1.4 service factor on reducer.
125 HP explosion proof motor, 3 phase 460 volt with Carbon steel motor mount.

SELLING PRICE.....$114,786.00

OPTION: Sanitary ball valve for draining mixer after clean out..**add $1,200.00**

DELIVERY: 10 to 12 weeks after receipt of approval drawings
Time for approval drawings is 1 to 2 weeks

cc: ROBERTSON EQUIPMENT COMPANY
Dean Robertson

F.O.B. New Prague, Minnesota

Conditions of Sale

Prices quoted are net unless otherwise stated. Prices quoted do not include Federal, State, Municipal or other Government excise, sales, use, occupational or other like taxes now in force or to be enacted. Should such taxes be assessed upon this transaction, Scott Equipment (hereinafter called the seller, hereby reserves the right to invoice for same).

All items or services furnished as a result of this job write-up shall be subject to the terms and conditions specified herein, including warranty, which may not be added to, modified, or altered notwithstanding any terms or conditions that may be contained in any purchase order, invoice, or form of purchaser unless expressly accepted by written agreement executed by an authorized agent of the selling company.

All agreements or unfulfilled portions thereof are contingent upon strikes, lockouts, accidents, fires, war, governmental action, embargoes, inability to obtain supplies or labor, and in event that performance in whole or in part is prevented or hindered or abnormally increased in cost by any or the causes names, or by any other cause whatsoever beyond our control, whether or not similar to any of the causes specifically enumerated we shall have the right to cancel without any liability on our part contracts or portions thereof thereby affected.

Acknowledged prices are firm for completion date stated unless otherwise specified. Prices subject to escalation when completion date is extended for reasons beyond our control.

Orders canceled by Purchaser are subject to a cancellation charge. Within first 30 days from acknowledgment date charge is 15%, thereafter charge is 50%.

Seller retains title to and shall have a security interest in the equipment until final payment is received. Purchaser represents to seller that Purchaser is solvent.

Typographical and stenographic errors subject to correction.

Purchaser assumes liability for patent and copyright infringement when goods are made to Purchaser's specifications.

Conditions not specifically stated herein shall be governed by established trade customs.

Terms inconsistent with those stated herein which appear on Purchaser's formal order will not be binding on the seller.

WARRANTY AND LIMITATION OF LIABILITY

The Seller warrants the equipment manufactured by the Seller to be free of defects in material and workmanship for a period of one year from the date of shipment. Seller agrees to repair or replace at factory, at its option, any parts found defective in the opinion of the Seller. Seller is not liable for any costs in connection with the removal, shipment, or installation of said parts. This warranty does not apply to abrasion, corrosion or erosion.

THIS WRITING CONTAINS THE ENTIRE AGREEMENT BETWEEN THE BUYER AND THE SELLER. THERE ARE NOT WARRANTIES, EXPRESS OR IMPLIED, OR MERCHANTABILITY, FITNESS OR OTHERWISE, WHICH EXTEND BEYOND THE DESCRIPTION OF THE FACE HEREOF.

THE SELLER SHALL HAVE NO LIABILITY FOR ANY SPECIAL INDIRECT OR CONSEQUENTIAL DAMAGES ARISING FROM LOSSES OWING TO FAILURE OF THE PRODUCTS MANUFACTURED OR SOLD BY THE SELLER, WHETHER BASED ON CONTRACT, NEGLIGENCE OR OTHERWISE WITH RESPECT TO SAID PRODUCTS.

Purchaser agrees to look solely to the warranty, if any, of the manufacturer or supplier of equipment manufactured by others and supplied to the seller for any alleged defects in such equipment and for any damages or injuries caused there or as a result there. PURCHASER SHALL BE RESPONSIBLE FOR COMPLIANCE WITH ELECTRICAL MANUFACTURER RECOMMENDATIONS, UNDERWRITER'S CODE AND ALL SAFETY PRECAUTIONS.

The only warranty extended under this agreement is the above express warranty and there are no other warranties of merchantability, fitness for a particular purpose or otherwise which extend beyond the face hereof. The seller and its dealers shall not in any event be liable for consequential or incidental damages and this agreement provides purchaser's sole and exclusive remedy. Any actions for breach of this agreement or warranty must be commended within one year after the cause of action has accrued.

PROPOSAL SUBJECT TO ACCEPTANCE BY SELLER. This proposal does not constitute an offer and no contract shall exist until this proposal has been accepted by the Purchaser and thereafter accepted by the seller at its New Prague office.

Prices quoted are firm for 30 days. After 30 days, be advised, all prices are based on costs and conditions existing on date of quotation and are subject to change by the seller before final acceptance.

TABLE 5 — Startup & Trouble Shooting

Problem	Possible Cause	Solution
Driven shaft fails to reach specified speed.	Drive motor defective or incorrectly connected.	Check motor connection, speed, amperage draw and power draw.
	Driven machine jammed.	Check driven machine and remove jam.
	Power consumption exceeds coupling capacity at specified fill angle.	*
	Coupling over or under filled.	Re-check fill angle per Step 6.
	Coupling leaking.	Correct source of leakage and re-check fill angle per Step 6.
	1000 Series — Orifice plug hole plugged	Clean orifice plug hole or use larger hole.
Fusible plugs melt.	Coupling under filled.	Re-check fill angle per Step 6.
	1000 Series — Orifice plug hole too small or plugged.	Enlarge orifice hole size (See Table 3 for estimated start time reduction) or clean plugged hole.
	Coupling leaking.	Correct source of leakage and re-check fill angle per Step 6.
	Driven machine jammed.	Check driven machine and remove jam.
	Power consumption exceeds coupling capacity at specified fill angle.	*
Coupling vibration exceeds acceptable limits.	Fluid coupling runout due to improper assembly of collet and fluid coupling.	Re-install fluid coupling and collet per Step 3. Check fluid coupling shaft for runout near wrench flats.
	Incorrect coupling or belt alignment.	Re-align per instructions in service manual.
	Bent motor shaft.	Replace motor.
	Loose foundation, coupling or adapter fasteners.	Check and tighten fasteners accordingly.
	Damaged fluid coupling bearing.	Return fluid coupling to Factory for bearing replacement.

* Increase fluid fill by decreasing fill angle in 5° increments to a minimum of 50° for HFD or 60° for HFDD. If drive shaft still does not reach specified speed, consult the Factory.

TABLE 6 — Drive Data Records

Equipment Identification .....

Motor/Brake Hp ..... @ ..... Input RPM .....

Fluid Coupling Size .....

Fill Angle ..... Degrees. Fill Volume ..... Fl. Oz.

Falk Master Order Number ..... Date Installed .....

The Falk Corp., subsidiary of Sundstrand Corp.
P.O. Box 492, Milwaukee, WI 53201 USA
Telephone: 414-937-4114, Fax: 414-937-4359

7. 1000 Series Couplings

The 1000 Series fluid couplings contain three orifice plugs (metric threaded) located near the outer part of the casing. They are located behind three metric hex socket seal plugs (see Figure 11). The function of these orifice plugs is to meter the fluid exiting from the delay fill chamber into the working circuit of the fluid coupling. These plugs are initially drilled with a 2.5mm hole (Size 1420) which results in acceptable starting times for most applications. Should your application require increased or reduced starting times, refer to Table 3 below for other orifice hole sizes and their estimated affect on starting time. These estimates are based on the change in flow rate for the fluid to exit the delay fill chamber.

CAUTION: *Increasing the starting time can result in overheating the fluid coupling and blowing the fusible plugs.* Refer to Table 4 for orifice and seal plug sizes and required hex "Allen" wrench sizes.

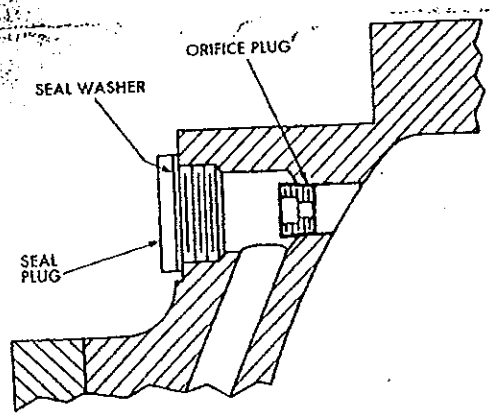


TABLE 3 — Fluid Coupling Starting Times

Orifice Hole Diameter	Estimated Starting Time - % of Original
	1420HF
3/64" (0.0469)	440
1/16" (0.0625)	250
5/64" (0.0781)	160
3/32" (0.0937)	110
2.5 mm (0.0984)	100
7/64" (0.1094)	80
1/8" (0.1250)	60
3.5 mm (0.1380)	50
5/32" (0.1562)	40
3/16" (0.1875)	30

TABLE 4 — Orifice and Seal Plug Sizes

Cplg Size	Orifice Plug DIN906		Seal Plug DIN908		Seal Washer DIN 7603 Type "A" Copper
	Thread Size	Hex Key Size	Thread Size	Hex Key Size	
1420	1/8R BSPT	5 mm	18 x 1.5 mm	10 mm	18 x 22 x 1.5 mm

8. Fusible Plugs

A. Fusible plugs in the fill or drain holes have solder cores that melt at the temperatures shown in Figure 1, Page 1. One extra 284°F (140°C) plug is furnished with each coupling.

B. If solder in fusible plug melts due to overheating from stalling or overloading, refer to Table 3, Page 6 and correct the cause of overheating.

CAUTION: DO NOT replace fusible plugs with solid plugs. Use of solid plugs can result in coupling failure from overheating unless used in conjunction with a thermal trip switch. Refer to Factory for recommendation.

C. Replace fusible plugs as instructed in Step 6D.

D. Refill coupling with clean fluid as instructed in Steps 5 & 6.

9. Coupling Removal

A. Remove belts and support coupling with a sling as shown in Figure 2.

B. Loosen collet draw bolt until washers are free and complete one more turn. Sharply strike the bolt head to break loose taper fit.

C. If Step B does not work; remove collet draw bolt and refer to Table 2 for "Removal Bolt" dimensions. Insert removal bolt and tighten. Strike bolt sharply with hammer to break loose taper fit, Figure 12.

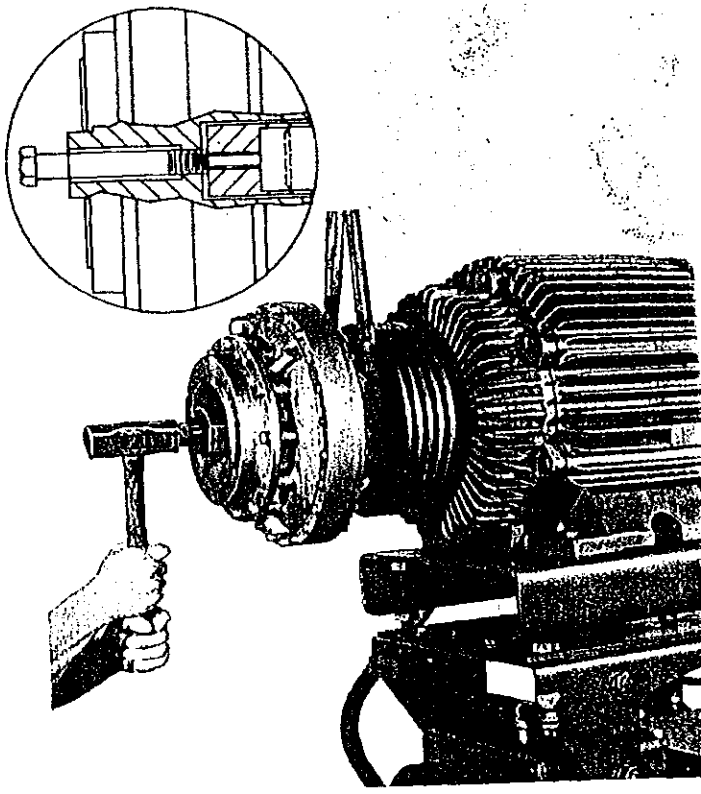


Figure 12