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### Manual History

Rev. 102213 Major overall revisions of previous release  
Rev. 091415 Added accumulator section and manual history  
Rev. 043018 Added break in for new rolls comment under operatoin

# **WARRANTY**

**The A. T. Ferrell Company, Inc. Manufacturer's Warranty for the following product lines:**

## **FERRELL-ROSS**

Roller Mills, Flaking Mills, Cereal Mills, Industrial Mills, Flake and Pellet Coolers, Crumblers, Grain Cleaners, Steam Chests, Roll Feeders, Vibratory Feeders and Conveyers, Loss in Weight Feeders, Mixers and Blenders.

**(“FERRELL-ROSS” IS A REGISTERED TRADEMARK OF THE A. T. FERRELL COMPANY, INC.)**

The A. T. Ferrell Company, Inc. warrants each new product of its manufacture when purchased from an authorized representative for a period of one year from the date of shipment. This warranty shall apply to all parts and workmanship (except products or components not manufactured by The A. T. Ferrell Company, Inc.), which shall appear to A. T. Ferrell Company to have been defective in manufacture. The A. T. Ferrell Company's sole and entire obligation under such warranty shall be satisfied by shipment to the Purchaser-User, without charge, (except for transportation costs, which shall be paid by the Purchaser-User) of the part or parts returned for inspection and parts intended to replace those acknowledged by The A. T. Ferrell Company, Inc. to be defective.

This warranty shall not apply and shall be void under the following conditions:

1. If the product is transported from original installation site.
2. If any part of the product has been altered, modified, or changed, except at The A. T. Ferrell Company, Inc. factory or is authorized in by The A. T. Ferrell Company, Inc. in writing.
3. If attachments or devices unsuitable to the product have been used on or in conjunction with the product.
4. If the product has not been installed, used, operated, handled, or serviced in accordance with the appropriate instruction manual.

The A. T. Ferrell Company, Inc. reserves the right to make changes in design or improvements in its products without obligation whatsoever to prior Purchaser-User of such products.

The A. T. Ferrell Company, Inc. will pass on to a Purchaser-User only such warranty as it shall receive on products or components not of its manufactured from the manufacturer or supplier thereof.

We will not be liable for any consequential damages, loss or expenses arising in connection with the use or inability to use the product for any purpose whatever. Our maximum liability shall not in any case exceed the cost of replacing defective parts if returned to us within one year from date of shipment. No salesman, manufacturer's representative or other person may make or has the authority to make any guarantees or warranties expressed or implied on behalf of A. T. Ferrell Company, Inc. which are inconsistent with these terms and conditions or any catalogue or other publication of A. T. Ferrell Company, Inc.

Claims for warranty should be directed to our sales department, 1440 South Adams Street, Bluffton, IN 46714 or phone (260) 824-3400. The machine serial number and description of the type of failure is required to file a claim.

Contact our sales department before returning warranty items for a RMO (Returned Material Order) which must accompany all returned items. All returned items are to be shipped freight pre-paid and credit will be issued after inspection and acknowledgement of warranty defect. A. T. Ferrell Company, Inc. will pass on to the purchaser/user only such warranty as it shall receive on products or components not of its manufacture from the manufacturer or supplier thereof.

# BE A SAFE OPERATOR

## AVOID ACCIDENTS



This safety alert symbol identifies important safety messages in this manual. When you see this symbol, be alert to the possibility of personal injury and carefully read the message that follows. Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safe-guarded against without interfering with reasonable accessibility and efficient machine operation. A careful operator is the best insurance against an accident.



Carefully read and understand the operators' manual before operating the machine. Do not attempt to install, connect power to, operate or service machine without proper instruction and until you have been thoroughly trained in its use by your employer.



Keep children, visitors and all untrained personnel away from machine while in operation.



Make certain all electric motors and control panels are properly grounded.



**Danger** - Do not attempt to work on, clean or service this equipment or open or remove any protective cover, guard, or grate until power has been turned off and mechanically locked out and the machine has come to a complete stop.



**Danger** - Keep hands, feet and clothing clear from rotating belts, pulleys, rolls and gears when machine is operating. Failure to do so will cause severe injury or death.



**Danger** - Never operate machine without protective covers, guards, or grates properly installed.



**Do not** obscure or remove safety decals from the equipment. Replacement decals are available from the manufacturer.



This equipment was manufactured in compliance with existing OSHA regulations. It is the responsibility of the owner/user to maintain OSHA compliance when operating the equipment.



When performing work on the hydraulic system, check all hoses, ensure that they are in good condition and all connections are tight.



**Never use your bare hands to locate a hydraulic leak.** Use a small piece of wood or cardboard. Hydraulic fluid escaping under pressure can penetrate the skin. Openings in the skin and minor cuts are susceptible to infection from hydraulic fluid.



**If injured by escaping fluid, see a doctor at once.**



**Replace all guards and shields after servicing and before starting up the machine.**



**Do not clean, lubricate or adjust equipment while it is in operation.**

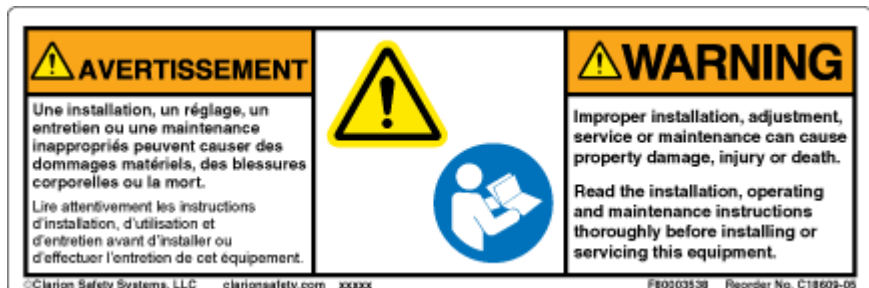
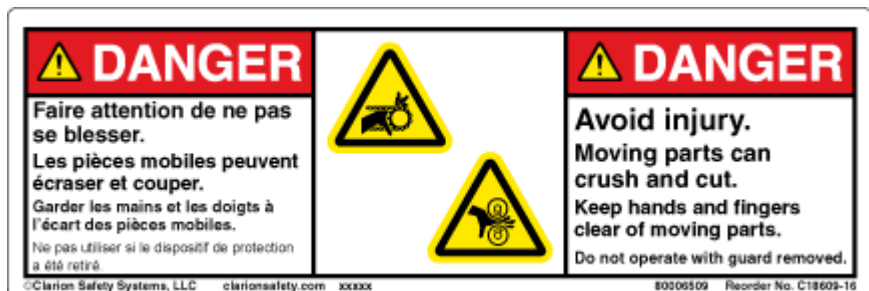
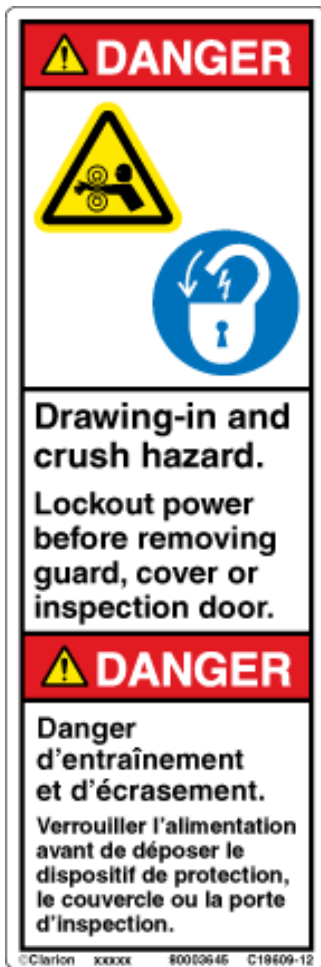
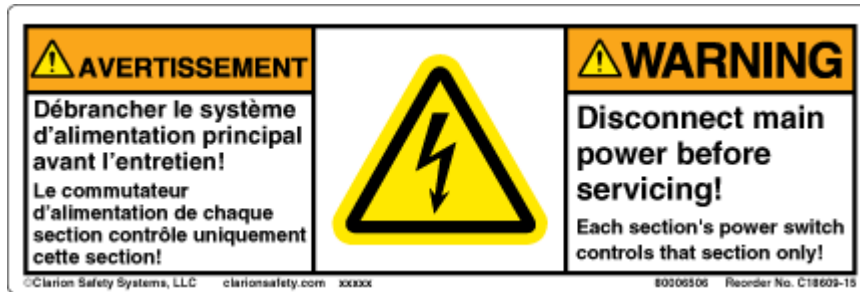


**After servicing, make sure all tools, parts and service equipment are removed from the machine.**



**Do not start the machine until you are sure that everyone is clear.**

# TYPICAL SAFETY DECALS



## **FORWARD**

Many years of experience and engineering background have gone into the design of your extremely rugged **Ferrell-Ross** flaking mill. Each **Ferrell-Ross** mill is a precision built machine, constructed from durable materials to close tolerance specifications. There is not another roller mill in the milling industry that compares with the outstanding features, workmanship, or durability that is built into each **Ferrell-Ross** mill.

We prepared this booklet for our 24 x 56 Dual Drive Flaking Mill to help you install, operate and maintain your mill to the highest standard and to obtain the greatest efficiency.

Every mill is thoroughly tested and inspected at the factory before shipment. However, it will be necessary to make minor adjustments to your mill after it has been installed to get the performance you desire.

If a commercial carrier shipped your mill, ensure that you check all parts carefully to see if there is any damage in the shipping. If damage is found, make a notation of such and make certain that your local agent makes a similar note on your freight bill, before you accept shipment. This is necessary to support your claim.

Do not hesitate to accept damaged equipment after the agent has made the notation on the freight bill. You will be reimbursed when you present your claim.

We assume no responsibility for loss or damages after the equipment leaves our dock, but we will gladly render our services to assist you in adjusting your claim.

Determine the parts you require, submit an order to us and we will prepare an invoice. Upon receiving our invoice you will be in a position to file a claim against the shipping company.

There are drawings and parts lists in the back of this booklet to assist you in ordering spare parts. When you order spare parts specify the mill serial number, mill size, part number, description and quantity to assure prompt and correct replacements.

# Ferrell-Ross

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Division of A. T. Ferrell Company, Inc.

## PARTS ORDERING INFORMATION

1. Order replacements parts through your local sales representative or direct from Ferrell Ross.

A. T. Ferrell Company, Inc.  
1440 S. Adams St.  
Bluffton, IN 46714  
Phone: (260) 824-3400 (800) 248-8318  
Fax: (260) 824-5463  
Website: [www.ATFerrell.com/Ferrell-Ross](http://www.ATFerrell.com/Ferrell-Ross)  
E-Mail: [info@atferrell.com](mailto:info@atferrell.com)

2. To expedite the order process, please have your machine description, model number, and serial number available.
3. Use the part numbers and descriptions furnished in this manual.



# SECTION 1 - GENERAL INFORMATION

## 1.1 INTRODUCTION

A **Roller Mill** achieves particle reduction by passing material through counter-rotating corrugated rolls to grind and cut a product to a specific particle size. While “Flaking/Crimping” mills are roller mills, they acquire their name because of a similar process but, instead of grinding and cutting, these mills flatten or “FLAKE” the product. The primary difference between flaking and crimping is the degree of thickness or (thinness) of the end product.

Size reduction in a “roller” mill, depends on the material, the roll speed differential, the corrugation type, the roll gap setting, the volume of material fed to the rolls, and the number of stages of reduction. In a Flaking mill these conditions are also present as well as a combination of the following, either singularly or in combination:

1. Plumpness of the kernel, “shape”.
2. Toughness of the seed coat, “hull”.
3. Moisture content of the seed.
4. Amount of conditioning, when steam is used.
5. Thinness of flake or crimped grain desired.
6. The amount of foreign material in the grain, “FM”. (Particularly rocks)

The capacity can be increased somewhat if the quality of the final product is not critical, but refer to the individual product charts to find a general guide line for product qualities and conditioning requirements.

The gap setting for **Flaking Mills** are variable depending on the desired flake thinness and this too will affect the mills capacity. As a general rule of thumb, the rolls are set farther apart when rolling corn because of the larger kernel size and closer together for small grains. You will need to fine-tune this adjustment after achieving proper conditioning of the product and then adjust the mills spring and hydraulic pressures to maintain the gap setting desired.

**NOTE:** Do not allow the rolls to run together when making adjustments.  
Damage to the rolls may result.

# **SECTION 2**

# **OPERATION**

## SECTION 2 - OPERATIONS

### 2.1 INSTALLATION AND INITIAL CHECKS

#### GENERAL ARRANGEMENT

See the general dimension drawing for inlet, outlet, and overall dimensions.

As shipped, the mill has a feeder installed at the mill inlet. For the best mill operation, the user must provide a uniform flow of material across the width of the mill. A spout with a minimum of restrictions will be necessary to provide adequate material flow. Direct the feed stream as near as possible to the center of the mill inlet to assure uniform end to end material flow through the mill. Poor mill performance and irregular roll wear results from improper feeding of the rolls.

Provide adequate access space for mill maintenance and main drive motor adjustment and service. Allow a minimum of 24" on the sides and rear of the mill and additional space in front of the mill for roll removal.

Provide some means to lift the front panel, the rolls, the sheaves and the roll housing. Because the mill parts are heavy, use adequately rated hoists and trolleys for servicing the rolls.

#### RECEIVING INSPECTIONS

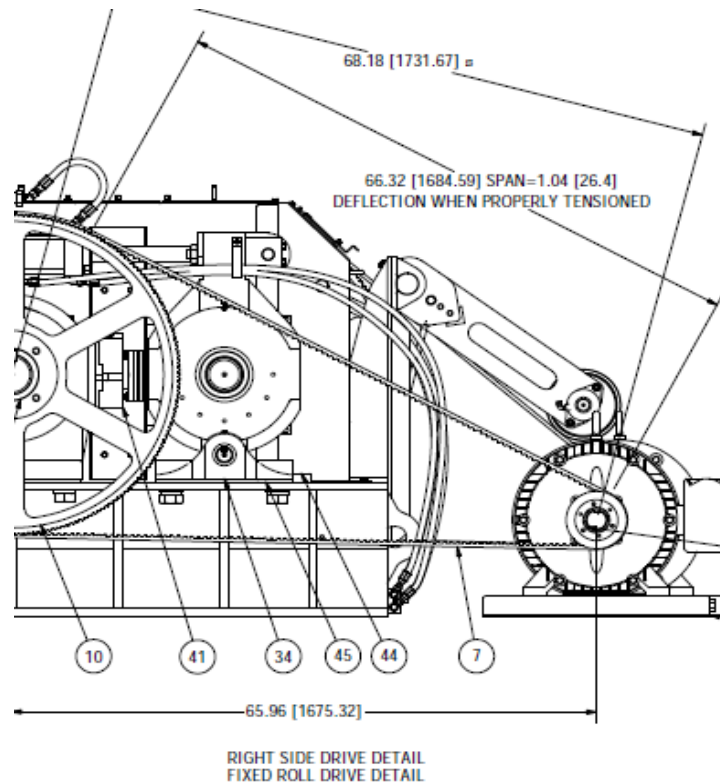
When the mill arrives, carefully inspect all items for damage or loss that occurred in transit. Notify the carrier immediately and file a claim WITH THE CARRIER for any loss or damage. Please note, A. T. Ferrell is not responsible for damage or loss incurred in shipping. Contact A. T. Ferrell for assistance with any claim settlement for damage or loss incurred in shipping.

**Please complete these checks before continuing:**

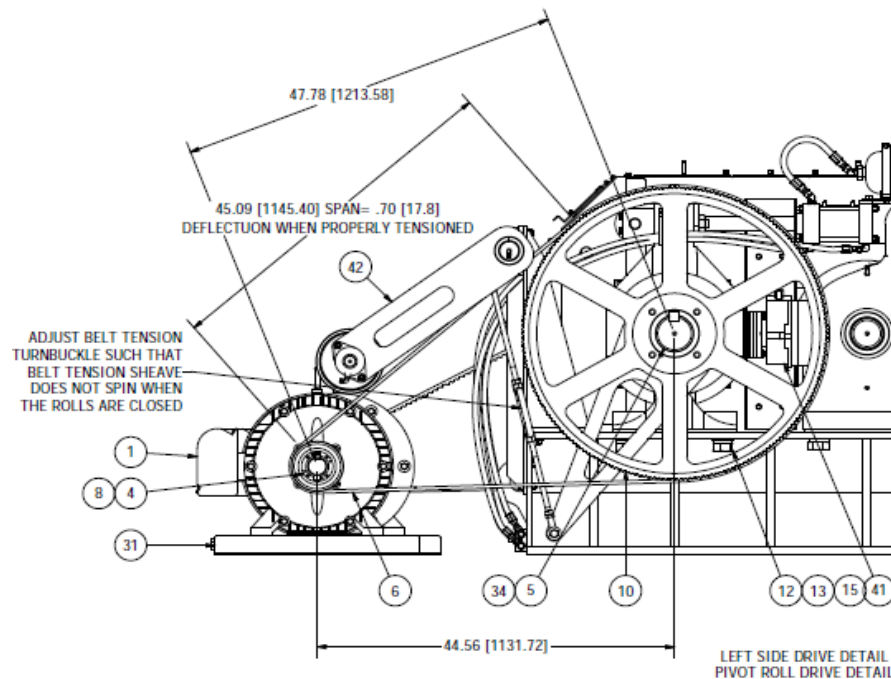
- \_\_\_ Make visual inspection of all painted and stainless steel surfaces for signs of damage. Report this information to the carrier.
- \_\_\_ Make visual inspection of the hydraulic system including hoses and tubing for signs of damage or coming loose.
- \_\_\_ Check motors and junction boxes for any signs of damage.
- \_\_\_ Check that all hardware is tight and has not loosened in shipping.

## 2.2 MILL AND MAIN DRIVE INSTALLATION

1. Install the mill on a flat, level foundation or base suitable for the weight of the equipment, the weight of the inlet spouting, and possibly the weight of the feed material.
2. Secure the mill to its base using the bolt holes provided in the frame. Use bolts to match the size and number of holes in the frame. Where needed, install a vibration damping pad under the mill to seal the outlet connection and minimize noise and vibration.
3. Mount the hydraulic power pack conveniently close to the mill, but not on the mill. Connect an air supply of 60 - 150 psi (4.5 CFM) to the air filter on the power unit. Use the 2 3/8" hydraulic hoses provided with the mill to connect the power unit to the mill. Hydraulic connections on the unit are labeled "A CYL". Hydraulic connections on the mill are located at the mill base.
4. Close the rolls.
5. Before making any electrical connections, inspect the interior of the mill for loose parts and foreign materials.
6. The mill will arrive with the motor base and motor requiring installation. Please refer to drawing K000-02456 for specific detail on correct positioning. Since adjustment of the motor base is used to correctly install and tighten the drive belts, it is imperative that proper dimensions and alignment are followed. Make sure the distance between each roll journal center and motor shaft center is correct. Make sure the motor sheave and roll sheave are aligned properly.



- Place the motor over the bolts on the motor base or rails and install the washers and nuts. Do not tighten the motor bolts completely down.



- Make sure the motor guard back-plate is in place. Place the motor sheave and sheave taper lock bushing on the shaft. Tighten the bushing screws evenly until reaching the specified torque for the taper lock screws. See Table 1 on page 25 for correct torque requirements.

## CAUTION

DO NOT OVER-TIGHTEN TAPER LOCK BUSHINGS OR DAMAGE TO THE BUSHING OR SHEAVE COULD RESULT.

9. Make sure the motor sheave and the mill sheaves are aligned. Gauge the sheave alignment with a straight edge or a piece of string. Slide the motor far enough ahead so the belt can be placed over the sheaves by hand. Install the belt on the drive.

## CAUTION

NEVER "ROLL" A BELT OVER A SHEAVE OR DAMAGE TO THE CORDS IN THE BELT COULD RESULT IN POOR BELT PERFORMANCE AND SHORT LIFE.

10. Turn the adjusting screws at the rear of the motor vase to draw the belt tight.
11. To keep the sheaves in proper alignment the adjusting screw away from the belt may have to be loosened to offset the pull of the belt when tension is applied.
12. Tighten the nuts holding the motor in place after the belts are tensioned, and check the sheave alignment again.
13. After setting the correct tension, lock the motor base adjusting screws and install the main drive guard cover.
14. The belt tension assembly needs the turnbuckle (part number K200-06056) assembled to the unit. Please refer to drawing K100-02429.
15. With the rolls closed, adjust the belt tension assembly with the turnbuckle so the sheave is as close to the belt as possible without touching and turning. When the rolls are opened, this assembly will keep the proper tension on the belt by taking up the slack produced by reduction of the center distance.
16. The discharged flaked grain is hot and moist when a steamer is used. The moisture in the grain is very corrosive; therefore, proper conveyor selection is very important. If the grain is to be stored, proper cooling before storage is required.
17. The connection of electrical utilities should only be preformed by a qualified electrician. A lockout switch should be installed with the mill in series with the mill motor control circuit. The lockout switch should be located within reach of the mill. NOTE: Each mill contains 3 motors. One for each roll and one for the feeder.
18. Protect the mill inlet and discharge opening to prevent accidental entry by personnel.
19. Install all guards. Make sure that belt guards are in place and securely fastened.

20. When wiring is complete, check for correct motor rotation. Make sure the lockout switch and maintenance cover interlock switch are adjusted and function correctly. The rolls always turn inward, or toward the center.
21. Install supply and finished product take-away system interlock switches to prevent equipment damage or material backups in the event any component stops functioning.

## 2.3 OPERATION GUIDELINES

Careful operation assures optimum machine performance and roll life. Use the following general rules to operate this equipment.

- Always start the mill with the rolls clear. Open rolls completely to allow any material in the nip to pass.
- Adjust the rolls carefully. Check the roll stop adjustment regularly to insure positive protection against roll contact.
- Maintain a full hopper in the feeder when operating to insure uniform feeding across the rolls.
- Increase the feed rate carefully. Ease up to full motor load rather than engaging the feeder at high rates. **DO NOT EXCEED FULL MOTOR AMPS AS DAMAGE TO MAIN AND INTER-ROLL DRIVE COMPONENTS MAY RESULT.**
- Check the product coming from the mill by sampling through the bottom sample door provided. For a thinner product, adjust the rolls closer; for a coarser product, open the rolls slightly. It normally takes an adjustment of .005".127mm or more to change the appearance of the product.

Note: Please see Roll Adjustment Procedure in Section 3.4

- To make a more exact measurement of the flake, use a micrometer to measure the thickness. Make your roll adjustment course to begin with and finer as you approach the desired flake quality.
- Check the roll alignment by examining product samples from both ends of the rolls. Different product sizing at opposite roll ends indicates a roll alignment problem or excessive feeding towards one end of the rolls. Use the roll adjustment procedure described in section 3.4 for roll alignment.
- Visually check through the feeder sight door to make sure the feed material is passing directly through the rolls. Do not allow materials to back up in the roll nip. Processing materials directly through the rolls gives the optimum machine capacity, efficiency, and roll life.
- **NEVER** attempt to start the machine with material in the roll nip.

- **NEVER** allow the rolls to grind together; rapid wear of the corrugations will result.
- **NEVER** operate at amperage loads greater than full rated motor load or damage to drive components may result.
- **NEVER** operate at more than 100% motor load.
- **NEVER** allow feed materials to back up in the roll nip; excessive roll wear and reduced capacity will result.

**Break in period for new flaking rolls.** Some suggest a break in period for new flaking rolls to reduce the generation of fines. Typical settings on flaked grain for animal feed would be about a 31 to 32 pound flake per bushel for a few days and then start closing the gap a bit each day until reaching your goal. Normally ending at about a 27 to 28 pound flake after a week or two.

## 2.4 START-UP SEQUENCE

Use the following sequence to start a processing operation.

1. Start the hydraulic pump.
2. Clear the rolls (open to .500" \ 13.2mm) by moving the hydraulic valve to the open position (moves rolls apart).
3. Start the product take-away system.
4. Start one of the mill motors allowing the roll to come up to speed before the second motor is engaged. This prevents heavy surge currents during startup.
5. Carefully adjust the rolls to their normal operating position, by moving the hydraulic valve to close position (moves rolls together). The beginning hydraulic pressure should be approximately 800 psi \ 56 sq cm, adjustment for this is done with the pressure control valve on the power unit.
6. When the mill rolls comes up to speed, turn on the feeder and adjust the feed rate to desire setting by adjusting the feed gate.
7. Bring the feed rate up slowly by opening the feed gate on the feeder. The feed rate of the mill is adjusted using the SCR speed controlled motor on the feeder. Do not exceed the mill motor's rated amperage.
8. As the feed rate increases, inspect the product thickness. In order to reach full mill capacity it will be necessary to increase the hydraulic pressure to compensate for roll separation due to increased feed rate. (We recommend that you do not exceed 1800 psi \ 126.56 kg/sq cm. The conditioning of the product will have a direct effect upon the quality of the flake produced.



9. Check samples from the rolls by inserting a sample scoop through the sample door provided at the front of the mill below the rolls. Examine samples at each end of the mill and in the center to determine mill performance. Adjust the rolls as necessary to obtain the desired results.
10. To adjust the roll gap setting use the following procedure.
  - a. Close the feed gate on the feeder and turn off the feeder motor.
  - b. Turn off the mill motors and any conveyor equipment that may cause injury. Lock out power.
  - c. The rolls must be stopped, not moving, before checking the roll gap measurement. Once the rolls have stopped, close the rolls until they reach the fixator stops. See drawing K100-02424.

### **WARNING**

**DO NOT PROCEED UNTIL THE UNIT HAS BEEN PROPERLY LOCKED OUT BY A TRAINED AND QUALIFIED INDIVIDUAL. REMEMBER THAT MULTIPLE LOCKOUTS MY BE REQUIRED PER MILL.**

**NEVER INSERT HANDS OR ANY OBJECT INTO THE ROLL AREA WITHOUT PROPER LOCKOUTS APPLIED AS PERSONAL INJURY OR DEATH MAY RESULT.**

- d. With a feeler gauge measure the gap between the rolls across the full length of the rolls. This gap is the current setting the mill has been operating in. It is important that the gap be the same across the rolls to maintain flake quality. If the roll gap needs to be adjusted:
  1. Using the supplied gap adjustment socket wrench, turn the nut on the fixator clockwise to increase the roll gap, or counter clockwise to decrease the roll gap. One full turn of the fixator adjustment bolt provides .014 gap change.
  2. Once you have completed your adjustments, measure your roll gap setting at both ends of the rolls to ensure proper alignment of the rolls for even flaking and to prevent possible roll damage. **Remember that the rolls must never be allowed to touch during operation.**
11. Check the feeder operation through the feeder inspection door. Visually verify that the feed stream is uniform along the entire length of the rolls and material is not backing up in the roll nip.
12. Adjust scrapers on each roll as necessary to maintain a slight contact with the rolls. Scraper wear is to be expected especially after initial start-up as

the square edge wears to match the roll. Buildup of material on the roll will occur if the scrapers are not adjusted correctly. See section 2.6 Scraper Knife Assembly Adjustment for further information.

## 2.5 SHUTDOWN SEQUENCE

1. Shutdown feeder motor at motor control. This will prevent material from being fed into mill, but will not affect material being fed into the feeder above it.
2. Close feed gate on mill.
3. Shutdown mill drive motors. Allow rolls to completely stop.
4. Shutdown product take-away system.
5. Open the rolls.

## 2.6 SCRAPER KNIFE ASSEMBLY ADJUSTMENT

**Note: Please refer to Drawing K100-02416 for Detail**

1. It is necessary to make initial adjustment of the knife assembly prior to operation to ensure contact of the knife to the roll. Adjustment of each knife is made by adjustment knobs found at the base of the mill opposite the motors. The top two knobs is for the scraper on the front roll, the bottom two knobs is for the scraper on the back roll.
2. With the rolls stopped, you can push and pull on each knob to bounce the scraper on that side against the roll. Turning the adjustment knob will allow a slight contact to be made with the roll. Giving another  $\frac{1}{4}$  turn will allow the spring tension to maintain that slight contact.

Note: Do not over tighten as this excessive contact will create excessive wear on the scraper blades and excessive noise during operation.

3. Equally adjust the knife holder so that the knife contacts the entire roll surface.
4. Scraper wear is to be expected especially after initial start-up as the square edge wears to match the roll.
5. Buildup of material on the roll will occur if the scrapers are not adjusted correctly

# **SECTION 3**

# **MAINTENANCE**

## **SECTION -3 MAINTENANCE**

### **3.1 LUBRICATION**

Satisfactory long-term performance of a mill requires proper maintenance and lubrication. The factory filled all gearboxes with the appropriate lubricants, and greased all bearings before shipping the mill.

Use the following lubrication recommendations for proper maintenance of the mill working components.

Use high quality multipurpose grease, such as Sunoco Prestige, Philube 1B & RB, Mobilux 2, or Gold Pillow Lube. As some additives may not be compatible, do not mix different grease types. When changing grease types, completely flush the unit to prevent cross contamination between the different grease types.

Use care to clean fittings off before applying the grease gun to prevent contamination of the bearings. Use a hand-operated grease gun rather than an air powered unit to reduce the possibility of blown grease lines and seals.

The mill design allows lubrication of all bearings while the mill is in operation. Follow the lubrication schedule, but do not over grease as excess lubricant can get into the belts and cause premature belt failure.

Several of the bearings on the mill employ remote grease fittings and poly grease lines to ease lubrication on the go. Periodically check these lines for integrity to verify that grease is being supplied to the bearings.

Follow the motor manufacturer's specifications for the lubrication of all motors. Motors require less frequent lubrication than other mill components.

On mills with inter-roll drive shaft mounted gear reducers, the use of Mobil SHC 629 synthetic oil is recommended.

#### **NOTE**

**DO NOT SUBSTITUTE ANY PETROLEUM BASED LUBRICANTS FOR THE SYNTHETIC OIL LISTED.**

Follow the lubrication schedule for the shaft mounted reducers.

Flush the gear boxes with kerosene and drain completely before refilling. Do not over fill the gearbox. Over filling will result in oil being discharged through the vent plug.

Drain and refill the roll feeder drive with SAE 80W-90 gear lube.

## LUBRICATION CHART

The following lubricants have been recommended for use with the various parts of your roller mill. You should check with your local lubricant supplier to find suitable alternatives.

FEEDER BEARINGS ROLL/PIN - ROLL ECCENTRICS/ADJ. SCREW - FEED GATE

LUBRICANT	SUPPLIER
Phillube 1B & RP	Phillips Petroleum Co.
Andok 280	Imperial Oil Co.
Amolith #1	Standard Oil Co.
Sunoco 844-X	Sun Oil Co.
F-925	New York & New Jersey Oil
Keystone 44-h	Keystone Lubricating
Lubriko M-21	Masters Lubricant Co.
Nerita 2	Shell Oil Co.
Andok B	Standard Oil (NJ)
Mobilux 2	Mobile Oil Co.
Atlantic 54	Atlantic Refining Co.

These bearings have been greased at the factory, no additional grease should be required to start the machine. Lubricate at intervals suggested on the Lubrication Chart. Grease should be added slowly with shaft rotating if possible, until grease can be seen coming out through the pressure relief hole in the grease fitting. Use caution when using a high-pressure, high volume grease gun.

## ROLL CHILL BEARINGS

LUBRICANT	SUPPLIER
Philube L #1	Phillips Petroleum Co.
Atlantic 62	Atlantic Refining
Amolith #1	Standard Oil Co.
Molibux #1	Mobile Oil Co.
Lubriko M-3 Spec.	Masters Lubricants
Andok 28	Imperial Oil
Sunoco 844-X	Sun Oil Co.

These bearings have been packed with grease before completion of assembly. Re-lubricate according to the Lubrication Chart time interval. Greasing is accomplished through the grease zerk found on the bearing plate cover.

Ambient Conditions		Operating Conditions		Bearing Operating Temperature		Suggested Greasing Interval**	Use these greases or equivalent
Dirt	Moisture	Load	Speed	Low	High		
Clean	Dry	Light to Medium	Slow to Medium	0	120	2-6 months	High quality NLGI #1 or 2 Multi-purpose bearing greases are generally satisfactory. Consultation with a reputable lubricant supplier is recommended.
				120	200	1-12 months	
Moderate to Dirty	Dry	Light to Medium	Slow to Medium	0	200	1-4 weeks	
				120	200	1-7 days	
Extreme Dirt	Dry	Light to medium	Slow to Medium	120	200	Daily flushing out dirt	
	High humidity Direct water splash	Light to Heavy	Slow to medium	32	300	1-4 weeks grease at shutdowns	
		Heavy to very heavy	Slow	0	200	1-8 weeks	
				-20	120	1-8 weeks	
		Light	High Speed	100	200	1-8 weeks	Imperial Oil & Grease Co., Molub-Alloy # 2 Gulf Oil Corp., Gulfcrown #2 Texaco Inc. Molytex # 2
	Possible frost	Light to heavy	Slow to medium	-65	250	1-4 weeks grease at shutdown	Esso, Beacon 325 Texaco Ubc, m 2346EP Low Temp Shell Oil Co., Aeroshell 7A
Clean to moderate	Dry	Light to medium	Slow to medium	80	250	1-8 weeks	Union Oil Co., Unoba EP2 Texaco Inc., 1999 Hi Temp
Clean to dirty	Dry	Light	Slow	80	300	1-4 weeks	Dow Chemical Co., DC44 Keystone Lubricants Co., No 89

## LUBRICANT CHART

\*\*Suggested starting interval for maintenance program. Check grease condition or oiliness and dirt and adjust greasing frequency accordingly. Watch operating temperatures. Sudden rises may show need for grease or indicate over lubrication on higher speed applications.



# CHEVRON DELO<sup>®</sup> GREASES EP

## NLGI 00, 0, 1, 2

### CUSTOMER BENEFITS

Chevron Delo Greases EP deliver value through:

- **Extreme pressure high load carrying capacity**
- **Excellent corrosion and wear protection**
- **Excellent water resistance**
- **Excellent high temperature stability**
- **Outstanding low temperature pumpability**

### FEATURES

Chevron Delo Greases EP are technically advanced, extreme pressure greases for a wide variety of on- and off-road applications.

They are formulated with ISOSYN<sup>®</sup> base stocks, a lithium complex thickener, rust and oxidation inhibitors, and extreme pressure and tackiness additives. They are blue in color with a tacky texture.

They are engineered to minimize friction and wear with a thick, velvety coating for excellent load carrying protection.

Chevron Delo Greases EP are specially formulated for extreme pressure wheel bearing and chassis applications including the steering drag links, king pins, transmission cross shaft spring pins, shackle pins, brake cam shafts, and fifth wheel faceplates and pivots operating under high and low temperature conditions.

The high viscosity index base oil makes these products perfect for the centralized lubrication systems found on today's mobile equipment.

These products are formulated to perform in unusually demanding conditions of high and low temperatures. The lithium complex thickener in Chevron Delo Greases EP elevates the dropping point to approximately 266°C (510°F). This high dropping point equates to excellent high temperature stability up to 177°C (350°F).

Chevron Delo Greases EP have the proper base oil viscosity to meet NLGI GC-LB requirements for low temperature operation. **NLGI 1** and **2** are recommended for applications operating in the temperature range of -18°C to 177°C (0°F to 350°F).

**NLGI 00** and **0** can be used at temperatures as low as -34°C (-30°F).

Chevron Delo Greases EP exceed the requirements of NLGI GC-LB for EP protection and rust protection, making them well suited for the most severe applications.



### APPLICATIONS

Chevron Delo Greases EP are designed for extreme duty in a wide variety of on- and off-highway vehicle and equipment applications.

**On-highway heavy duty trucks** — These lubricants are perfect for a wide variety of Class 8 trucks in all chassis and wheel bearing applications ranging from automatic centralized greasing systems to wheel bearings operating near the high temperatures of disc brakes. This product is for all applications, from owner/operators to fleets (especially those considering extended service intervals).

**Off-highway vehicles** — Whether the application is in construction, logging, mining, agriculture or utilities, these greases will perform. Use them in haul trucks, loaders, tractors, cherry pickers or any of a number of other off-highway vehicles.

**Medium- and light-duty trucks and buses** — As with their heavy duty counterparts, the Class 7 and Class 6 vehicles and buses require an extreme duty grease. Chevron Delo Greases EP will provide that performance.

**Automobiles** — Chevron Delo Greases EP are exceptional lubricants for high temperature wheel bearings and other high performance automotive applications.

**NLGI 1** and **2** are approved for the NLGI Certification Mark GC-LB.

Chevron Delo Greases EP meet the requirements of the Mack MG-C grease specification.



**TYPICAL TEST DATA**

<b>NLGI Grade</b>	<b>00</b>	<b>0</b>	<b>1</b>	<b>2</b>
<i>Product Number</i>	235212	235211	235209	235208
<i>MSDS Number</i>	6818	6818	6818	6818
Operating Temperature, °C(°F)				
Minimum <sup>1</sup>	-40(-40)	-40(-40)	-40(-40)	-40(-40)
Maximum <sup>2</sup>	132(270)	132(270)	177(350)	177(350)
Penetration (Worked 60 Strokes), at 25°C (77°F)	415	370	325	280
Dropping Point, °C(°F)	n/a	235(455)	255(491)	265(509)
Four Ball Weld Point, kg	400	400	400	400
Four Ball Wear Scar, mm	0.45	0.45	0.45	0.45
Timken OK Load, lb	60	60	70	70
Water Washout, wt%	n/a	15	10	5
Water Spray-off, wt%	n/a	n/a	30	20
Lincoln Ventmeter, psig at 30 s, at				
75°F	—	—	—	—
30°F	50	100	200	250
0°F	50	150	450	700
-22°F	100	450	1250	1400
Copper Corrosion	1b	1b	1b	1b
Bearing Rust, 5% Synthetic Sea Water	Pass	Pass	Pass	Pass
Thickener, % Type	4.0 Lithium Complex	5.8 Lithium Complex	8.0 Lithium Complex	11.0 Lithium Complex
ISO Viscosity Grade Base Oil Equivalent	220	220	220	220
Viscosity, Kinematic*				
cSt at 40°C	189	189	189	189
cSt at 100°C	17.5	17.5	17.5	17.5
Viscosity, Saybolt*				
SUS at 100°F	992	992	992	992
SUS at 210°F	90	90	90	90
Viscosity Index	100	100	100	100
Flash Point, °C(°F)*	274(525)	274(525)	274(525)	274(525)
Oil Separation, wt%	n/a	5	4	2
Texture	Tacky	Tacky	Tacky	Tacky
Color	Blue	Blue	Blue	Blue

Typical test data are average values only. Minor variations which do not affect product performance are to be expected in normal manufacturing.

- 1 Minimum operating temperature is the lowest temperature at which a grease, already in place, could be expected to provide lubrication. Most greases cannot be pumped at these minimum temperatures.
  - 2 Maximum operating temperature is the highest temperature at which the grease could be used with frequent (daily) relubrication.
- \* Determined on mineral oil extracted by vacuum filtration.



## Re-lubrication intervals for SKF 22228 CCK/W33

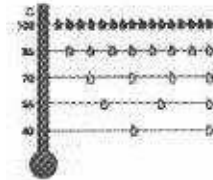
Relubrication interval in operating hours for the bearing when it is grease lubricated, operating temperature is below 70°C (158°F) and operating conditions are “normal”. In many cases the re-lubrication interval may be longer than stated here. For more detailed information, see the *SKF Interactive Engineering Catalogue* or contact your SKF representative.

Speed rating for grease lubrication: **1700 r/min**

Rotational speed, r/min operating hours	Re-lubrication interval,
340 (20 % of speed rating)	<b>6400</b>
850 (50 % speed rating)	<b>1900</b>
1360 (80 % of speed rating)	<b>810</b>

Grease quantity to be used when re-lubricating: **3 ounce**

At bearing temperatures over 70°C (158°F), the re-lubricating interval should be reduced by half for each 15°C (27°F) increase in temperature. Intervals may be extended for temperatures less than 70°C (158°F).



It is necessary to lubricate more frequently in applications where there is a risk of heavy contamination. The same applies to bearings in wet environments. For bearing on vertical shafts the intervals should be halved.



The *SYSTEM 24* automatic grease dispenser secures the supply of lubricant to the bearing and is especially suitable in locations that are difficult to access.

**TABLE 1 - BOLT TORQUE SPECIFICATIONS**

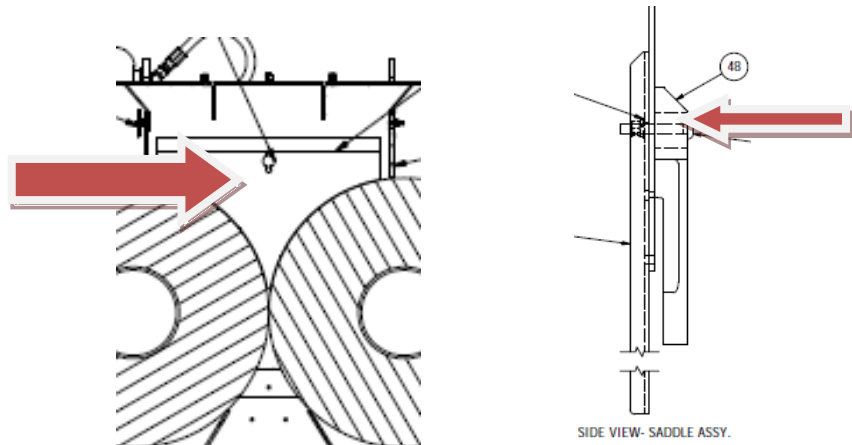
Use the following guide for torque specifications of sheave bushing screws.

<b>SCREW</b>	<b>TORQUE (IN-LB)</b>	<b>(FT-LB)</b>
5/16-18	120-180	10-15
3/8-16	240-360	20-30
1/2-20	480	40
1/2-13	720	60
9/16-12	600-900	50-75
5/8-11	1080-1620	90-135
3/4-12	1800	150
3/4-10	2700	225
7/8-9	2400-3600	200-300
1-8	3600-5400	300-450

## ROLL SADDLES

### 3.2 ROLL END BLOCKS (SADDLES)

The roll ends are chamfered during corrugation and remaining chamfer leaves a small opening where material could pass without being crushed. The roll end block effectively seals this opening to prevent anything from getting past the end of the roll unprocessed.



The roll end blocks or saddles are “V” shaped blocks made from aluminum or UHMW polyethylene. These are relatively soft materials and prevent damage to the roll ends should contact take place.

The roll end blocks will require periodic maintenance, as the point of the “V” will wear with use. The roll end blocks are usually serviced when the rolls are corrugated. If wear dictates, service the roll end blocks prior to roll removal.

Use the following procedure to service the roll end blocks.

### CAUTION

**MAKE SURE THE POWER IS SHUT OFF AND LOCKED OUT BEFORE SERVICING THE ROLL END BLOCKS.**

Please refer to drawing K000-02456. Access the roll end blocks on the flaking models by removing the maintenance cover at the front of the mill from above the rolls being serviced. Remove the roll drive covers to gain access to the roll end block bolts on the differential and drive end of the mill.

To adjust the roll end blocks, move the rolls to their fully closed position. Loosen the nut on the roll end block bolt and hold the roll end block directly in the nip as the nut is tightened.

To replace the roll end block, remove the nut from the roll end block bolt and pull the roll end block out. Insert the new roll end block and bolt through the holes in the roll end plate and through the slot in the mill frame. Replace the nut and tighten it.

### 3.3 BELT DRIVE ADJUSTMENT

The mills have two motors, one per roll. Each motor has one belt that drives a roll. The belts need to be correctly installed and tensioned at installation. However belts need to be checked periodically for proper tightness. It is not uncommon for belts to loosen after the first few days of operation. This section discusses the proper method of adjusting the drive belts, and how to verify they are the proper tightness.

#### CAUTION

**MAKE SURE THE POWER IS SHUT OFF AND LOCKED OUT BEFORE PERFORMING ANY MAINTENANCE OR SERVICE ON THE FLAKING MILL DRIVES. THIS MUST BE DONE PRIOR TO REMOVAL OF THE DRIVE GUARDS THAT GIVE ACCESS TO THE DRIVE BELTS.**

**NEVER "ROLL" A BELT OVER A SHEAVE OR DAMAGE TO THE CORDS IN THE BELT COULD RESULT IN POOR BELT PERFORMANCE AND SHORT LIFE**

Drive belt tension is set by the position of the motor base for that drive. After setting the correct tension, re-install the main drive guard covers.

#### TENSIONING BELT DRIVES

Without exception, the most important factor in the successful operation of a belt drive is proper belt-tensioning. To increase total tension, merely increase the center distance. Before attempting to tension any drive it is imperative that the sheaves be properly installed and aligned. Add to the tension by increasing the center distance. Never apply belt dressing as this will cause early failure.

It is common for belts to stretch over time especially during the initial week or two of operation. Be sure to check and adjust the belt tension during the first week and again the first couple months of operation.

#### BELT INSTALLATION CHECKLIST

- |  |  |
|--|--|
| <input type="checkbox"/> 1) Lock out power source                                  | <input type="checkbox"/> 8) Inspect belts for wear patterns.                       |
| <input type="checkbox"/> 2) Observe all safety procedures                          | <input type="checkbox"/> 9) Inspect and clean drive components                     |
| <input type="checkbox"/> 3) Follow manufacturer guidelines                         | <input type="checkbox"/> 10) Inspect sheave grooves for wear. Replace if necessary |
| <input type="checkbox"/> 4) Remove belt guard                                      | <input type="checkbox"/> 11) Check sheave alignment (1 <sup>st</sup> check)        |
| <input type="checkbox"/> 5) Loosen belt by adjusting the motor base for that drive | <input type="checkbox"/> 12) Verify replacement belts                              |
| <input type="checkbox"/> 6) Shorten center distance                                | <input type="checkbox"/> 13) Install new belts                                     |
| <input type="checkbox"/> 7) Remove old belts                                       | <input type="checkbox"/>   |

14) Tension belts

15) Check sheave alignment (2nd check)

16) Replace guard

17) Start drive (look & listen)

18) Re-tension after 24 hours

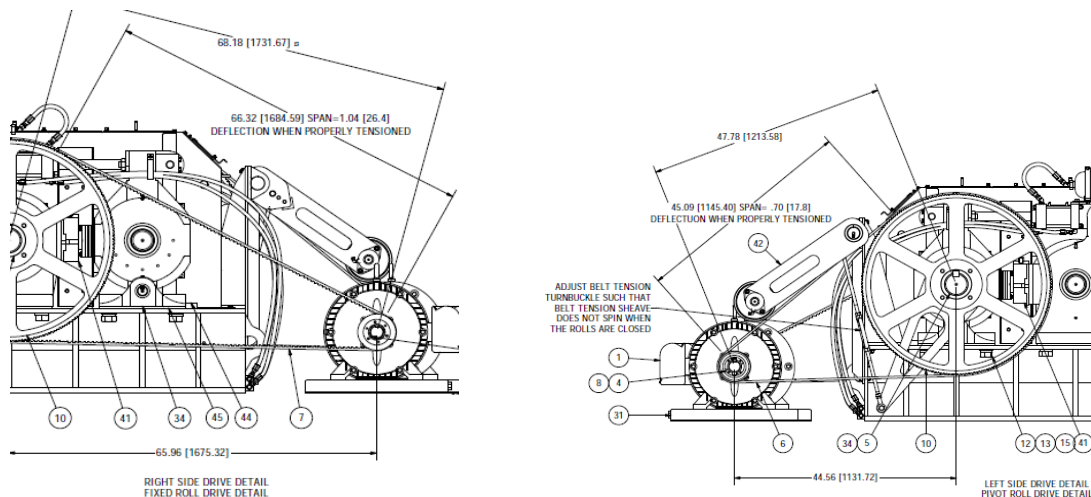
## FORCE DEFLECTION METHOD

This method should be used only for tensioning drives on which the grade of belt, rated belt capacity, service factor, design horsepower, etc. are known. If the drive has been designed in strict accordance with the procedures, instructions, and horsepower ratings in Wood's current catalog, the force deflection values are valid. However, if the drive was designed from editions dated prior to 1980 or using information other than that contained in these catalogs, excessive loads on bearings or excessive shaft deflections may result. Refer to drawing K00-02456 for detail of the illustrations below.

Step 1: Install belts per Step 1 of General Method above. Measure span length (t) in inches as shown in figure 2, or calculate using formula.

Step 2: From figure 2 the deflection height (h) is always  $1/64$ " per inch of span length (t). For example, a 32" span length would require a deflection of  $32/64$ " or  $1/2$ ".

Step 3: Determine the minimum, maximum, and initial recommended pounds force using table 1 or calculate based on the required Static Strand Tension (T). Note: The initial recommended force is used only for installing new belts which have not seated themselves into the sheave grooves and where initial belt stretch has not taken place.



Step 4: Using a spring scale, apply a perpendicular force to any ONE of the belts at the midpoint of the span as shown in figure 2. Compare this deflection force with the values found in Step 3.

- a. If the deflection force is below the minimum, the belts are too loose and the tension should be increased by increasing the center distance.
- b. If the deflection force is higher than the maximum, the belts are too tight and the tension should be decreased.

When new belts are installed on a drive the INITIAL tension will drop rapidly during the first few hours. Check tension during the first 24 hours of operation. Subsequent re-tensioning should fall between the minimum and maximum force.

To determine the deflection distance from normal position, use a straightedge or stretch a cord from sheave to sheave to use as a reference line. On multiple-belt drives an adjacent un-deflected belt can be used as a reference.

Minimum deflection force values shown in table 1 are based on assumed average static tensions for drives having multiple belts or more than one V-band, thus eliminating calculations. (For drives using only one belt or one V-band, deflection force must be determined by use of engineering formulas.)

Find the minimum recommended deflection force for the belt section and type based upon the small sheave diameter, speed and drive ratio. For intermediate sheave diameters and/or drive ratio combinations the minimum deflection force may be interpolated.

MAXIMUM Deflection Force = Minimum times 1.5

INITIAL Deflection Force = Minimum times 2.0

For Ultra-V Band, Premium V-Band and Torque-Flex banded belts multiply the minimum deflection force from table 1 by the number of belts in the band. Where larger values make use of the Force Deflection Method impractical, use the elongation Method to tension V-bands.

Belt Section		Small Sheave		Drive Ratio			
		Speed Range	Dia.	1.0	1.5	2.0	4.0 & over
Sure-Grip Premium	AP	1800-3600	3.0	2.0	2.3	2.4	2.6
		1800-3600	4.0	2.6	2.8	3.0	3.3
		1800-3600	5.0	3.0	3.3	3.4	3.7
		1800-3600	3.5	3.5	3.7	3.8	4.3
	BP	1200-1800	4.6	3.7	4.3	4.5	5.0
		1200-1800	5.0	4.1	4.6	4.8	5.6
		1200-1800	6.0	1.8	5.3	5.5	6.3
		1200-1800	8.0	5.7	6.2	6.4	7.2
	CP	900-1800	7.0	6.5	7.0	8.0	9.0
		900-1800	9.0	8.0	9.0	10.0	11.0
		900-1800	12.0	10.0	11.0	12.0	13.0
		700-1500	16.0	12.0	13.0	13.0	14.0
DP	900-1500	12.0	13.0	15.0	16.0	17.0	
	900-1500	15.0	16.0	18.0	19.0	21.0	
	700-1200	18.0	19.0	21.0	22.0	24.0	
	700-1200	22.0	22.0	23.0	24.0	26.0	
Torque-Flex	AX	1800-3600	3.0	2.5	2.8	3.0	3.3
		1800-3600	4.0	3.3	3.6	3.8	4.2
		1800-3600	5.0	3.7	4.1	4.3	4.6
		1800-3600	7.0	4.3	4.6	4.8	5.3
	BX	1200-1800	4.6	5.2	5.8	6.0	6.9
		1200-1800	5.0	5.4	6.0	6.3	7.0
		1200-1800	6.0	6.0	6.4	6.7	7.7
		1200-1800	8.0	6.6	7.1	7.5	8.2
	CX	900-1800	7.0	10.0	11.0	12.0	13.0
		900-1800	9.0	11.0	12.0	13.0	14.0
		900-1800	12.0	12.0	13.0	13.0	14.0
		700-1500	16.0	13.0	14.0	14.0	15.0
	DX	900-1500	12.0	16.0	18.0	19.0	20.0
		900-1500	15.0	19.0	21.0	22.0	24.0
		700-1200	18.0	22.0	24.0	25.0	27.0
		700-1200	22.0	25.0	27.0	28.0	30.0

### 3.4 ROLL ADJUSTMENT PROCEDURE

Use the following procedure to set the parallel alignment of the rolls.

#### **WARNING**

**DO NOT PROCEED UNTIL THE UNIT HAS BEEN PROPERLY LOCKED OUT BY A TRAINED AND QUALIFIED INDIVIDUAL. REMEMBER THAT MULTIPLE LOCKOUTS MY BE REQUIRED PER MILL.**

**NEVER INSERT HANDS OR ANY OBJECT INTO THE ROLL AREA WITHOUT PROPER LOCKOUTS APPLIED AS PERSONAL INJURY OR DEATH MAY RESULT.**

1. Shut off power to the mill and lock out all motors.
1. To adjust the roll gap setting use the following procedure.
  - a. Close the feed gate on the feeder and turn off the feeder motor.
  - b. Turn off the mill motors and any conveyor equipment that may cause injury. Lock out power.
  - c. The rolls must be stopped, not moving, before checking the roll gap measurement. Once the rolls have stopped, close the rolls until they reach the fixator stops. See drawing K100-02424.
  - d. With a feeler gauge measure the gap between the rolls across the full length of the rolls. This gap is the current setting the mill has been operating in. It is important that the gap be the same across the rolls to maintain flake quality. If the roll gap needs to be adjusted:
    1. Using the supplied gap adjustment socket wrench, turn the nut on the fixator clockwise to increase the roll gap, or counter clockwise to decrease the roll gap. One full turn of the fixator adjustment bolt provides .014 gap change.
    2. Once you have completed your adjustments, measure your roll gap setting at both ends of the rolls to ensure proper alignment of the rolls for even flaking and to prevent possible roll damage. Remember that the rolls must never be allowed to touch during operation.
2. Adjust the fixators on each end until the rolls are parallel within the 0.005” end to end clearance. This is the minimum roll gap setting recommended for set up and initial operation. This minimum roll gap setting of 0.005”, will never allow roll to roll contact. To keep the rolls parallel while making the adjustment, we recommend that you alternate the turns on the



adjusting nuts from one side of the mill to the other and make the same amount of rotation on the nuts with each adjustment.

### **3.5 ROLL RE-CORRUGATION**

Roll wear depends on the material being processed, the tons processed, the material reduction achieved, the accuracy of the roll adjustment, and any impurities in the material stream. Maintaining a uniform flow of clean material across the width of the rolls assures maximum roll life.

The rolls have a hardened chill depth of approximately 5/8" to 3/4". The corrugations are cut into this hardened area of the roll. Re-corrugating extends the useful life of the rolls. With each re-corrugation, a reduction in roll diameter and hardened chill thickness occurs. Depending on the number of re-corrugation, and the corrugation contractor's equipment, rolls usually can be re-corrugated 4-8 times before they are too small or soft for rework.

When returning the rolls to Ferrell Ross for re-corrugation, the bearings do not have to be removed from the rolls. If the user has spare replacement rolls, fitting the spare rolls with bearings and housings rather than trying to change bearings back and forth assures minimum mill downtime.

Make sure the return shipping container is suitable for the weight and the handling the rolls will receive while in transit.

**SECTION 4**

**ROLL CHILL**

**INSTALLATION**  
**&**  
**Removal**

## SECTION 4 - ROLL CHILL REMOVAL AND INSTALLATION

NOTE: Please refer to Drawing Number K100-02412 and K100-02413.

### 4.1 PRECAUTIONS:

- A. MOUNT THE BEARINGS IN A CLEAN ENVIRONMENT. HOUSINGS, SHAFTS AND OTHER COMPONENTS OF THE BEARING ARRANGEMENT SHOULD BE CHECKED FOR CLEANLINESS.
- B. THE BEARINGS SHOULD BE LEFT IN THEIR ORIGINAL PACKAGES UNTIL IMMEDIATELY BEFORE MOUNTING, SO THAT THEY DO NOT BECOME DIRTY.
- C. USE LIFTING EQUIPMENT TO FACILITATE THE HANDLING OF THE BEARING. SPRING SUSPENSION CAN SIMPLIFY BEARING POSITIONS.

### 4.2 INSTALLATION OF RECORRUGATED ROLLS

- A. INSTALL A DUST SEAL OVER EACH JOURNAL SLIDING UP TO THE ROLL END.
- B. GENTLY DRIVE THE INNER OIL SEAL INTO BOTH BEARING HOUSING COVERS BY TAPPING EQUALLY AROUND THE SEAL WITH A RUBBER Mallet UNTIL FLUSH WITH THE HOUSING.
- C. SLIDE THE BEARING HOUSING COVERS OVER EACH JOURNAL, UP TO THE ROLL END.
- D. WIPE THE PRESERVATIVE FROM THE BORE AND OUTSIDE DIAMETER OF THE BEARING.



- E. HEAT THE BEARING USING AN INDUCTION HEATER. AN ELECTRIC OVEN MAY BE USED IF BEARING PLACED ON SUPPORTS SO THAT AIR CAN MOVE FREELY AROUND BEARING.



- F. NORMALLY A BEARING TEMPERATURE OF 144 TO 162 °F [80 TO 90 °C] ABOVE THAT OF THE SHAFT IS SUFFICIENT FOR MOUNTING. NEVER HEAT A BEARING GREATER THAN 257 °F [125 °C], OR USING AN OPEN FLAME.



- G. USE CLEAN PROTECTIVE GLOVES TO HANDLE THE HOT BEARING.

- H. PUSH THE BEARING ALONG THE ROLL JOURNAL TO ITS ABUTMENT AND HOLD IN PLACE WITH THE BEARING LOCK NUT UNTIL THE BEARING COOLS AND GRIPS THE JOURNAL. REMOVE THE LOCK NUT.



- I. SLIDE THE BEARING LOCK WASHER AGAINST THE OUTSIDE OF THE BEARING. LOCK WASHER FINGERS POINT AWAY FROM THE BEARING. LOCK WASHER INNER TONGUE FITS INTO JOURNAL KEYWAY.
- J. FIRMLY TIGHTEN THE LOCK NUT, CHAMFER TOWARD THE LOCK WASHER. USE A SPANNER WRENCH OR SOFT METAL ROD AND HAMMER.
- K. LOCK THE NUT BY BENDING ONE OF THE LOCK WASHER TABS DOWN INTO ONE OF THE SLOTS IN THE NUT.
- L. CHECK THAT THE BEARING OUTER RACE ROTATES WITHOUT ANY DISTURBANCES AND THAT THE INNER RACE IS HELD IN PLACE.
- M. PACK THE BEARINGS WITH GREASE INJECTING THE GREASE INTO THE RACE.
- N. POSITION THE ROLL UP OFF OF THE FLOOR ON SADDLE BLOCKS.
- O. USE A PAIR OF C-CLAMPS TO DRAW THE BEARING HOUSING OVER THE BEARING. CLAMP THE COVER TO THE OUTSIDE OF THE HOUSING AND DRAW IN EQUALLY. LOCATE THE HOUSING MOUNTING HOLES 6.50 [165.10] FROM THE ROLL END.
- P. GENTLY DRIVE THE SEAL ADAPTER INTO THE DIFFERENTIAL JOURNAL BEARING HOUSING BY TAPPING EQUALLY AROUND THE ADAPTER WITH A RUBBER Mallet UNTIL FLUSH WITH THE HOUSING.
- Q. GENTLY DRIVE THE OUTER OIL SEAL INTO THE DRIVE JOURNAL BEARING HOUSING BY TAPPING EQUALLY AROUND THE SEAL WITH A RUBBER Mallet UNTIL FLUSH WITH THE HOUSING.
- R. REPEAT STEP 'N' FOR INSTALLING OUTER SEAL INTO ADAPTER.
- S. FASTEN TO THE BEARING HOUSING WITH 1/2" FASTENERS.
- T. MOUNT THE STATIONARY ROLL FIRST. SLING THE STATIONARY ROLL WITH HOUSINGS MOUNTED. **ENSURE ADEQUATE LIFTING METHOD AND EQUIPMENT TO FACILITATE TOTAL WEIGHT.** KEEP ROLLS LEVEL WITH BEARING HOUSING HELD VERTICLE WITH THE HYDRAULIC CYLINDER CONNECTIONS TO THE TOP.
- U. START THE BOLTS THAT HOLD THE HOUSINGS AND ROLL IN PLACE WHILE SUSPENDED ABOVE THE MILL. THIS WILL AID IN ALIGNMENT. MAKE SURE THE HOUSINGS ARE HELD PARALLEL TO THE BASE AS THE HOUSINGS ARE SET DOWN NEXT TO EACH STOP PLATE AND THE BOLTS ARE HAND TIGHTENED.

- V. FOLLOW THE SAME PROCESS FOR THE PIVOT ROLL AND HOUSINGS.
- W. GENTLY MOVE THE ROLLS TOGETHER UNTIL THEY TOUCH. ADJUSTMENT OF THE FIXATOR ON EACH SIDE OF THE UNIT MAY BE NECESSARY. MAKE SURE EACH HOUSING IS SQUARE WITH THE BASE
- X. WITH BOTH ROLLS IN PLACE, INSTALL THE HYDRAULIC CYLINDARS. PROPER ALIGNMENT OF THE ARMS ENSURES THE HOUSINGS ARE PROPERLY POSITIONED TO THE BASE. THE ARMS SHOULD NEVER BE FORCED INTO ALIGNMENT, BUT RATHER THE HOUSINGS MUST BE SHIFTED FOR THIS TO TAKE PLACE.
- Y. THE ROLLS SHOULD BE IN PARALLEL ACROSS THE LENGTH OF THE ROLLS.
- Z. TIGHTEN ALL FOUR HOUSINGS TO THE BASE FIRMLY.
- AA. REINSTALL FRONT AND REAR ROLL COVERS AND GUARD ASSEMBLIES.
- BB. WRAP THE THREADS OF THE STINGER WITH PIPE TAPE AND SCREW INTO THE ROTARY UNION.
- CC. WRAP THE EXTERNAL THREADS OF THE ROTARY UNION WITH PIPE TAPE AND SCREW INTO THE STUB JOURNAL.
- DD. FOLLOW THE ROLL ADJUSTMENT PROCEDURE FOUND IN SECTION 3 OF THIS MANUAL.
- EE. FOLLOW THE SADDLE ADJUSTMENT PROCEDURE FOUND IN SECTION 3 OF THIS MANUAL.
- FF. FOLLOW THE SCRAPPER BLADE ADJUSTMENT PROCEDURE FOUND IN SECTION 2 OF THIS MANUAL.

### 4.3 REMOVAL OF RECORRUGATED ROLLS

- A. REMOVE FRONT AND REAR ROLL GUARDS AND COVERS.
- B. REMOVE HYDRAULIC CYLINDER ASSEMBLIES.
- C. SLING THE PIVOT ROLL WITH HOUSINGS FIRST. **ENSURE ADEQUATE LIFTING METHOD AND EQUIPMENT TO FACILITATE TOTAL WEIGHT.**
- D. REMOVE BASE BOLTS HOLDING HOUSINGS IN PLACE. KEEP ROLLS LEVEL WITH BEARING HOUSING HELD VERTICLE WITH THE HYDRAULIC CYLINDER CONNECTIONS TO THE TOP.
- E. POSITION THE ROLL UP OFF OF THE FLOOR ON SADDLE BLOCKS.
- F. REMOVE THE FIXED ROLL FROM THE UNIT IN THE SAME MANNER.
- G. REMOVE THE 1/2" FASTENERS HOLDING THE COVER TO THE BEARING HOUSING.
- H. THE BEARING HOUSING WILL SLIDE OFF OVER THE BEARING.
- I. DISENGAGE THE TAB OF THE BEARING LOCK WASHER FROM THE BEARING LOCK NUT.
- J. LOOSEN (TURN COUNTERCLOCKWISE) THE BEARING LOCK NUT WITH A SPANNER WRENCH OR SOFT METAL BAR AND HAMMER. REMOVE THE LOCK NUT AND LOCK WASHER.
- K. REMOVE THE BEARING FROM THE JOURNAL WITH A BEARING PULLER.
- F. REMOVE THE COVER FROM THE JOURNAL.

## **4.5 Hydraulic Accumulator Operation and Pre-Charge Levels**

Industrial flaking mills can experience severe mechanical and hydraulic shocks when foreign material such as a bolt is passed between the rolls. This foreign material will cause a sudden buildup of pressure in the hydraulic system called shock pressure, that if not relieved will cause excessive operating pressures and possible damage to mill components. The hydraulic accumulators on the mill serve to remedy this situation.

### **What is an accumulator?**

An accumulator is an energy storage device. It stores energy when the increase in hydraulic pressure compresses nitrogen gas held in its container. The accumulator contains a bladder or piston that provides a barrier between the nitrogen and hydraulic fluid to prevent intermixing. When shock pressure is generated, the hydraulic fluid compresses the nitrogen gas in the accumulator allowing the pivot roll to open and the foreign material to pass. After the rolls are clear the stored energy in the accumulators will be applied back into the hydraulic system forcing the rolls closed again.

There are two types of accumulators commonly used today. The first uses a bladder and the second uses a piston. The bladder type uses nitrogen contained in an elastic bladder mounted inside its shell. The shell acts as a pressure container for both the gas and hydraulic fluid. The piston style uses a cylinder with a floating piston. The cylinder serves as the pressure container for both the nitrogen gas and fluid, while the piston provides the barrier between the gas and oil to prevent intermixing. Note that oxygen is never used as it can be explosive when mixed with oil under high pressure.

### **Sizing of an Accumulator**

The size of an accumulator is critical when applying it to a piece of equipment. An accumulator sized too small will not have enough capacity to handle the volume of oil required during a shock pressure event. An oversized accumulator does not have a fast enough reaction rate and will respond too slowly. Either may result in damage to mill components.

A properly sized accumulator that matches the hydraulic capacities of your mill will provide the most effective means of providing protection. All Ferrell-Ross

mills have been designed and equipped with the properly sized accumulators to provide the proper capacity and reaction rate required.

### **Setting the Pre-Charge Level of Accumulators**

Having the pressure of the nitrogen gas pre-charged to the correct level is critical to proper operation. This is determined by the amount of hydraulic pressure set at the pump to control the hydraulic cylinders. The pre-charge level of the accumulator should be set to 65% of this level.

For example: If the output pressure of your hydraulic pump is set at 1000 psi or 69 bar, the pre-charge level of the two accumulators on that mill should be set to 650 psi or 45 bar each. Use the following quick reference chart to guide you on the proper settings for your unit.

800 psi / 55 bar pump operating pressure = 520 psi / 36 bar accumulator pre-charge level  
1000 psi / 69 bar pump operating pressure = 650 psi / 45 bar accumulator pre-charge level\*  
1200 psi / 83 bar pump operating pressure = 780 psi / 54 bar accumulator pre-charge level  
1500 psi 103 bar pump operating pressure = 975 psi 67 bar accumulator pre-charge level

\* Accumulators are pre-charged from the factory to 650 psi / 45 bar to operate with hydraulic pump pressure output of 1000 psi / 69 bar.

Keep in mind that if the pressure of the pump is adjusted from these settings, it is necessary to reset the pre-charge level of the accumulators. This will ensure proper operation of the hydraulic system.

A tag containing these settings is attached to each accumulator. Please update the tag if changes are made. If no tag is present you can use the sample tags on the following page.

### **Accumulator Charging Kits**



An accumulator charge kit is available from Ferrell-Ross for the correct testing and pressurization of your accumulators. All you need to add is nitrogen from a local supplier to maintain your system. Reference Ferrell-Ross part number K980-000002 for pricing.

**DO NOT REMOVE**

Accumulator pre-charge pressure should be set to approximately 65% of operating hydraulic pump pressure. This will ensure optimum shock pressure protection on your mill. Both accumulators must be set accordingly:

800 psi / 55 bar pump operating pressure = 520 psi / 36 bar accumulator pre-charge level

1000 psi / 69 bar pump operating pressure = 650 psi / 45 bar accumulator pre-charge level

1200 psi / 83 bar pump operating pressure = 780 psi / 54 bar accumulator pre-charge level

1500 psi 103 bar pump operating pressure = 975 psi 67 bar accumulator pre-charge level

Operating pump pressure on this mill: \_\_\_\_\_ psi / bar

Accumulator pre-charge pressure set to: \_\_\_\_\_ psi / bar

Date accumulator pre-charge set: \_\_\_\_\_ Completed by \_\_\_\_\_ (initials)

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**NO REMOVER**

La presión de pre-carga del acumulador deberá estar ajustada en aproximadamente 65% de la presión de operación de la bomba hidráulica. Esto asegurará la protección óptima de choque de presión en su molino. Ambos acumuladores deben estar como se indica a continuación:

800 psi / 55 bar presión de operación de la bomba = 520 psi / 36 bar nivel de pre-carga del acumulador

1000 psi / 69 bar presión de operación de la bomba = 650 psi / 45 bar nivel de pre-carga del acumulador

1200 psi / 83 bar presión de operación de la bomba = 780 psi / 54 bar nivel de pre-carga del acumulador

1500 psi 103 bar presión de operación de la bomba = 975 psi 67 bar nivel de pre-carga del acumulador

Presión de operación de la bomba en este molino: \_\_\_\_\_ psi / bar

Presión del acumulador pre-cargada a: \_\_\_\_\_ psi / bar

Fecha de pre-carga del acumulador: \_\_\_\_\_ Completado por \_\_\_\_ (iniciales)

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**SECTION 5**

**PARTS**

**AND**

**ASSEMBLY**

