THERMO BLACK CLAWSON INC.

A Thermo Fibertek company

605 Clark Street
Middletown, Ohio 45042-2117 USA
Tel: 1+513-424-7400 Fax: 1+513-420-8210

ULTRASORTER™ REJECT PROCESSOR MANUAL

Installation, Operation, Maintenance, and Service Parts
Model 30
October 15, 1997

Deliver manuals to:

US Gypsum Company
6825 Evergreen Avenue
Jacksonville, FL 32208

Attention: Kevin Turk

Prepared for: US Gypsum Company

Mill: Jacksonville, FL

Customer order number: 22522619 Number of manuals: (4)

Shop order number	Serial number
4871991	97-US30-0124
4874591	97-US30-0125

Read this manual carefully to learn how to operate and service your equipment correctly; failure to do so could result in personal injury or equipment damage. Keep this manual readily accessible and legible to anyone doing maintenance on or operating this equipment.

Thank you for purchasing a Thermo Black Clawson product.

UltraSorter

Contents

Read This First
- General 1-1
- Guidelines 1-2
- Safety Practices 1-3
- Signs 1-4

Equipment Identification
- Nameplate Location 2-1

Introduction
- General Information 3-1
- Description 3-2
- Specifications 3-3
- Features 3-4

Shipment Check
- Shipment/Receiving 4-1
- Unloading/Handling 4-2

Storage
- General Information 5-1

Installation
- Safety Precautions 6-1
- Site Preparation 6-2
- Equipment Setup 6-3

Operations
- Pre-checkout 7-1
- Operation 7-2
- Control Information 7-3
- Control Guidelines 7-4

Maintenance
- Routine 8-1
- When & Why 8-2
- Hood 8-3
- Rotor/Vanes 8-4
- Cylinder 8-5
- V-Belt Drive 8-6

Service Parts
- Spares 9-1

Hardware Instructions
Purchased Parts

SKF Split-Housing Pillow Block Bearings
- Installation 10-1

Procedure for measuring Radial Clearance
- SKF Bearings 10-2

This manual is for General Information and Guidance

For specific information concerning parts or items refer to the certified print of the equipment.

The instructions contained in this manual are recommended procedures for installing, operating and maintaining your unit.

This unit was designed to meet a definite set of specifications.

It will provide many years of dependable service when installed, operated and maintained according to our recommended procedures.

We wish to stress the importance of erecting the unit correctly. Reasonable operation and maintenance will not compensate for poor installation.

All information, illustrations, and specifications in this manual are based on the latest information available at the time of publication. THE RIGHT IS RESERVED TO MAKE CHANGES AT ANY TIME WITHOUT NOTICE.

SHARTLE DIVISION
605 Clark St., Middletown, OH 45042-0160
Phone: (513) 424-7400
TOLL FREE 24 HOUR EMERGENCY SERVICE
1-800-448-5422

This information provides the reader with information to install, operate and maintain your BLACK CLAWSON Unit

Use this information as a guide in the care and operation of your BC equipment. The contents of this manual are not to be considered the only way to perform an operation. It is to be used as a guide for safe and trouble - free production.

Training and instruction of personnel in the safe method of operation is the customer's responsibility.

NOTE:

Black Clawson offers, as service to you, qualified field service instructors for training of your operators and maintenance personnel.

Refresher sessions covering safety, operation and maintenance procedures are recommended periodically throughout the usage life of your BC equipment. You may improve and revise these procedures to suit your needs, as your production requirements demand greater efficiency and continued safe operation.

Safe Operation of your BC Unit benefits: you, your employees, and the production life of the equipment.

FOLLOW THE SAFETY INFORMATION CONTAINED IN THIS MANUAL.

RECOGNIZE SAFETY INFORMATION
This is the international SAFETY-ALERT SYMBOL
When you see this symbol on your equipment or in this manual, be alert to the potential for personal injury.

Follow recommended precautions and safe operating practices.

UNDERSTAND SIGNAL WORDS

A signal word - DANGER / or WARNING / or CAUTION - is used with the Safety-Alert Symbol.

DANGER - Immediate hazards which will result in severe personal injury or loss of life.

WARNING - Hazards or unsafe practices which could result in severe personal injury or loss of life.

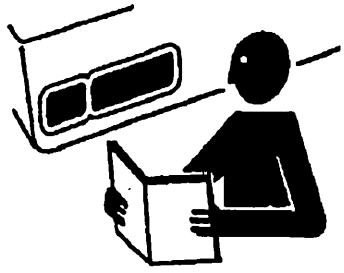
CAUTION - Hazards or unsafe practices which could result in minor injury or product or property damage.

FOLLOW SAFETY INSTRUCTIONS

Carefully READ all safety messages in this manual and on your machine safety signs.

Keep SAFETY SIGNS in good condition.

Replace missing or damaged safety signs.



Learn how to operate the machine and how to use controls properly.

DO NOT let anyone operate the machine without instruction.

Keep your machine in proper working condition.

UNAUTHORIZED MODIFICATIONS
may impair the function, shorten the machine life and / or render built-in safety features useless.

INSPECT BEFORE STARTING UNIT

All guards and covers are in good condition and fastened in place.

Check for loose, worn, damaged or missing parts.

All personnel are clear of the equipment.

PRACTICE SAFE MAINTENANCE

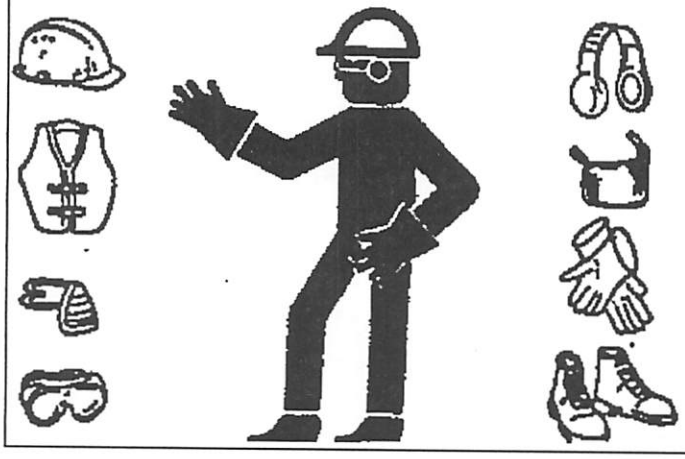
Keep all equipment parts in good condition and properly installed.

Understand service procedures before you do the work.

Replace worn, broken or missing parts.

DO NOT OPERATE damaged equipment - fix damage immediately.

KEEP EQUIPMENT AREA **CLEAN & DRY.**



PROTECTIVE CLOTHING

Wear close fitting clothing and safety equipment appropriate to the job.

Consult applicable Federal, State and Local codes for proper installation and guarding.

IMPORTANT

SAFETY GUIDELINES

Preventing Equipment Problems Improves USER SAFETY.

Do not proceed until you read and understand these guidelines and instructions for your BC equipment.

If you have any questions, contact your supervisor.

The following SYMBOLS are used to help you recognize safety related information.

PAY ATTENTION TO THESE SYMBOLS AND HEED THEIR MESSAGES.

UNDERSTAND SIGNAL WORDS

A signal word - Danger / or Warning/ or Caution - is used with the Safety-Alert Symbol.

⚠ DANGER	**Immediate hazards which** WILL result in severe or personal injury or loss of life
⚠ WARNING	**Hazards or unsafe practices which** COULD result in severe personal injury or loss of life.
⚠ CAUTION	**Hazards or unsafe practices which** COULD result in minor personal injury or equipment damage.
NOTE:	**Notes contain important information** that is set off from the text for you to pay special attention to about the care of your unit.

IMPORTANT
SAFETY GUIDELINES
Preventing Equipment Problems Improves USER SAFETY.

DO NOT PROCEED until YOU READ and UNDERSTAND these guidelines and instructions for your BC equipment.

If you have any questions, CONTACT YOUR SUPERVISOR.

WHAT TO LOOK FOR	WHAT COULD HAPPEN	HOW TO PREVENT IT
Stock Leaks pipe connection(s) blind flange(s) body joint(s) Other Sources Cylinder Shower Water Inlet Dilution Water Open Access Door(s)	Skin Irritation or Scalding skin contact with stock may result in chemical or thermal skin reaction	**Lockout** Isolate unit - follow shut down and start up guidelines in the maintenance section of this manual. Tighten/or replace loose, leaking connections. Be sure you have locked out all energy sources.
Valve(s) air and electrical operated	Amputation or Severe Injury finger(s) hand(s) forearm(s)	**Lockout** Valve(s) and their energy source(s) **Do Not** insert finger(s), hand(s), arm(s), head or any appendage into such device(s). **NOTE: Controls may not be independent.** Extreme care must be used when isolating power source(s). Be sure of what will shut down when energy source(s) are locked out. Other automatic equipment connected to source will, also shut down.
Motor/Drive Unit(s) cleaning	Electrical Shock severe personal injury	**Do Not** mix water with electrical current Be sure unit is shut down and lockouts are in place before cleaning unit(s)
Cover(s), Hood & Guard(s) V-Belt/Sheave(s) Rotor Reject View Port	Amputation or Severe Injury finger(s) hand(s) arm(s) or other body parts	**Do Not** operate unit with Cover(s), Hood & Guards removed. Be sure unit is shut down and lockouts are in place before installing removed items. **Note:** Manual rotation or rotor may be required when hood is removed. Be sure all personnel is clear of unit before manually rotating rotor.

BLACK CLAWSON has provided a Safety Instruction Tag for this unit

POST on/or NEAR THE EQUIPMENT

⚠WARNING

IMPORTANT
SAFETY
INSTRUCTIONS
for
Stock
Preparation
and
Pulp Mill
Equipment

FAILURE TO FOLLOW THESE SAFETY INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY

DO NOT PROCEED until you **READ** and **UNDERSTAND** these instructions:

1. **READ** and **UNDERSTAND** the machine's instruction/operation manual and **ALL** the applicable OSHA regulations (29CFR1910.261).
2. **FOLLOW** the **SHUT DOWN PROCEDURE** in the manual.
3. **ALL SERVICE** to the machine must be **LOCKED OUT** with **YOUR PADLOCK BEFORE** any maintenance, inspection, cleaning, adjusting or servicing is performed.
   a) The **MOTOR MAIN POWER DISCONNECT** switch must be **LOCKED OUT.**
   b) **CHECK DISCONNECT** - try to start motor **BEFORE** proceeding further.
   c) **ALL SOURCES OF POWER AND FLOW OF MATERIAL** must be **SHUT OFF** including **BLEEDING OFF** of pressure and **LOCKING OUT ALL:**

PNEUMATICS — STEAM SYSTEMS
HYDRAULICS — ELECTRICAL CIRCUITS
CHEMICAL and/or GAS SYSTEMS
FLOW of MATERIAL STOCK

WARNING!!! NEVER REMOVE another person's lockout (padlock) or tag.
DO NOT assume the machine is locked out. **ALWAYS** check yourself.

NOTE: If services are not independent of the main supply **DO NOT PROCEED** - Contact your Supervisor.

   d) Place or attach a **"DANGER - PERSONNEL WORKING"** sign near lockout.
   e) **BLOCK** any rotating elements to prevent accidental rotation.

4. **DO NOT ENTER** vessel or unit unless you have at least **ONE OTHER PERSON OUTSIDE** the vessel or unit at all times. Certain vessels require use of harness, gas masks and other specialized safety equipment.
   BEFORE ENTERING ANY VESSEL CHECK WITH SUPERVISOR FOR CORRECT SAFETY PROCEDURE. See OSHA 1910.261(b)(5).
5. Upon completion, follow the **START UP PROCEDURE** in the manual.
6. **NEVER START** the machine **UNLESS:**
   a) All personnel are clear of the machine.
   b) All doors and hatches are closed.
   c) All guards and covers are in place.

If you have any questions, contact your supervisor.

Black Clawson
The Black Clawson Company — Shartle Division
Middletown, Ohio 45042 Phone (513) 424-7400
Toll Free 24 Hour Emergency Service 1-800-446-5422

Processors
No attempt should be made to do any work on the unit while it is in operation. Most enclosed units of this type have some sort of mechanical screening assist (i.e. rotating tackle) to aid in the stock cleaning process.

Processor safety considerations should include:
- Feed system which permits stock by-pass
- Do Not work on an operating unit

When it becomes necessary to open an enclosed unit:
- Close out/divert stock
- Activate and post lock-out devices
- Completely drain and clean unit.

Make sure rotor has stopped rotating before opening

Extreme care should be taken when dismantling.

- Use mechanical assists when working on the cylinder in the machine.

Under no circumstances should any part of the body be introduced in the machine.

Each time a unit is opened for maintenance a careful inspection should be made of the internal equipment. Any damage or wear should be corrected immediately as this may contribute to future failure and possible unsafe operation.

Start-up procedures should be followed carefully.

Black Clawson accepts no responsibility for use or misuse of its products other than that the specific usage application for which the product was originally designed....any usage other than the products intended application will render Black Clawson free and harmless from any safety and/or liability claims that may result from the misapplication or deviation from the product's intended usage.

READ SAFETY SIGNS

and

Follow recommended precautions and safe operating practices

The Black Clawson Company furnishes a series of Safety Signs with each piece of equipment purchased by our customers.

These Signs are factory installed and should remain on the Unit for the Life of the Machine.

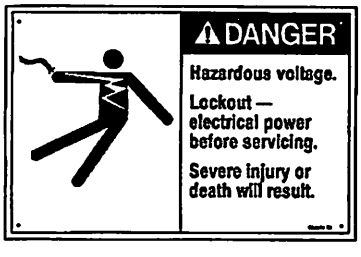
Do Not Remove the Signs unless Replacement Signs are in hand and installed immediately after old signs are removed.

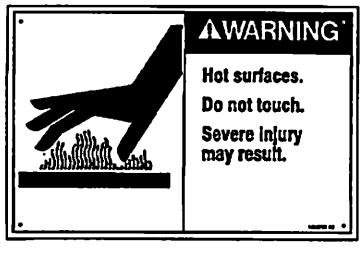
Our experience indicates that the vast majority of mill equipment has been and continues to be operated Safely.

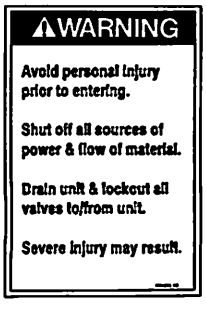
It is the unforeseen lapses in Safety Observance that can be significantly prevented by the appropriate Posting of the Visual Warnings.

Black Clawson does not assume any responsibility for the effect or non-effect of the signs.

One or more of these Safety Signs are attached to the Unit



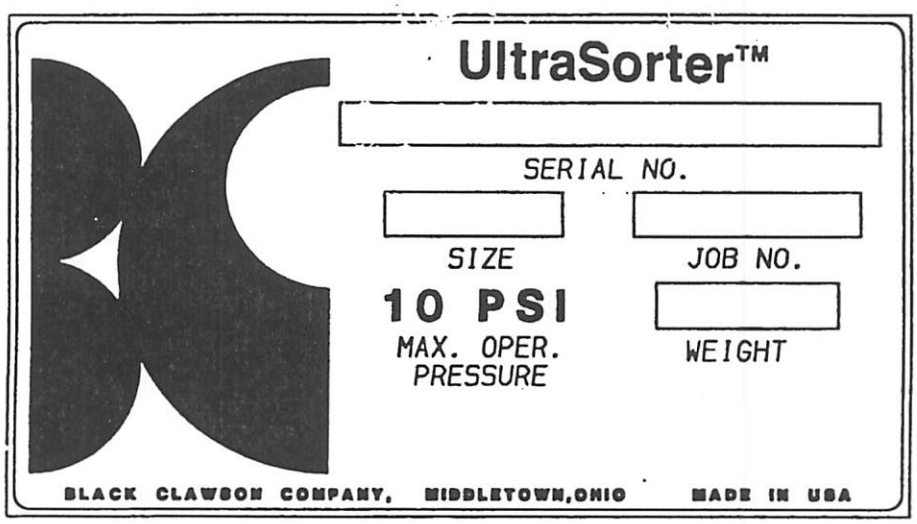




PRODUCT IDENTIFICATION NUMBERS

Are Provided to help in tracing this Unit
should it need servicing

Black Clawson, also, needs these numbers when you order parts.



Your Black Clawson Unit is designed to give trouble free operation with minimum maintenance required. However, certain precautions and procedures must be observed in handling, installing, operating and servicing the unit in order to obtain optimum performance.

The information in this manual should cover most situations.

Should questions arise that are not covered in this manual, additional information can be obtained by contacting:

Customer Service
The Black Clawson Company
Shartle Division
Middletown, OH 45042
(513) 424-7400

Jim Winiker
513-229-8110-165
Jim FAUST

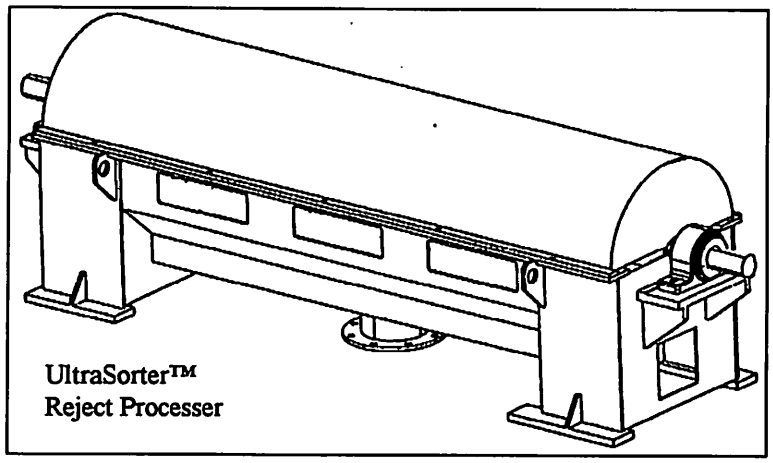
Serial Numbers
Serial Numbers are assigned at the Shartle Division.

This identifying number will be found on the nameplate. It will, also, appear on the certified drawings which you receive pertaining to your unit.

When inquiring about service or maintenance problems, ALWAYS STATE SERIAL NUMBER, as well as, SIZE and TYPE of UNIT.

Renewal Parts
Orders for renewal parts should state the serial number(s) and include the item number, description and part number as shown on the parts list of the certified drawings.

Part Numbers are not specified in this manual.
Refer to your certified drawings for corresponding part numbers.



UltraSorter™
Reject Processer

The unit consists of a fabricated body assembly, which carries the screen plate, the rotor, the accept trough, the reject discharge trough and the support frame. The body assembly is installed horizontally. The unit is driven by a sheave and belt assembly that attaches to either end of the unit and the motor is placed adjacent to the unit.

The rotor is constructed of a long cylinder with paddles attached to the unit. These paddles are at a prescribed angle to the rotor and are designed for optimum performance of the unit. The driven sheave can be mounted on either end of the unit because of the shaft design. The rotor is supported on both sides of the unit by bearings attached to the housing.

The hood of the unit is designed for easy removal and access to the internal parts of the unit. The inlet does not have to be disconnected nor the sheave removed when viewing the rotor or screen plate. The hood has non-stringing baffles to prevent axial short-circuiting of fluid and solids, but all directional movement is created by the rotor.

The accept pan and rejects discharge chute are all part of the uni-body construction. The accept pan is designed to stiffen the unit and collect all filtrate water from the unit. The reject chute is located in the leg opposite the inlet end.

The screen plate itself is a half cylinder with perforations. It has a radius of approximately 8 inches and operates with various hole sizes depending on the application. The screen plate is bolted into the housing.

The UltraSorter is constructed of 316L stainless steel on all wetted parts including the screening plate, the rotor, the accept trough. The hood is constructed of lightweight non-metallic material. The unit's frame is constructed of 316L stainless steel.

APPLICATIONS

- Paper machine approach flow systems
- Secondary fiber screening system
- Pulp mill screening systems
- Anywhere a vibrating screen can be used

General Specifications

The unit consists of a horizontal shaft rotor and screen plate designed for fiber recovery from rejects streams heavily contaminated with plastics, flakes or other light debris. Included are the following features:

- All wetted parts are 316L stainless steel, except hood
- 150 lb. Drilled 6" inlet plate flange
- 150 lb. Drilled 8" accepts plate flange
- Special rotor designed for 600 RPM
- Screen plate with conically drilled holes
- Two (2) accept chamber shower nozzles
- Four (4) feed chamber shower nozzles
- Shaft seal via contact lip seals
- Drive parts, including V-Belts, sheaves and OSHA guard
- Pillow block mounted shaft bearings
- Inspection ports for accept stock area
- Approximately 3400 lb. operating weight
- Approximately 3000 lb. shipping weight

To Be Supplied By Customer

- 50hp, 1200 rpm or 1800 rpm motor
- Inlet flow box (preferred), or other control method to regulate incoming flow
- Shower water, 50 GPM (maximum) at 30 psi

The UltraSorter Reject Processor is a non-vibrating, low attrition, totally enclosed tailing screen that removes debris normally found in the coarse screening loop. It is also well suited for processing rejects from a Black Clawson Float Purger™ Stock Cleaning System. The UltraSorter can be installed in secondary fiber, paper machine approach flow, and pulp mill screening systems.

FEATURES/BENEFITS

- Rejects virtually fiber-free with less retained water, reducing handling and disposal costs.
- Low attrition rotor maintains debris integrity - achieves maximum operating efficiency.
- Reduced horsepower lowers operating costs.
- Baffled hood regulates flow for smooth operation.
- Side feed - saves time and cost by eliminating the need to remove piping to clean or clear screen.
- Hood provides easy access to rotor or screen plate, reducing maintenance costs.
- Access doors on side, permit accept quality to be checked while machine is operating.
- All 316L stainless construction - improves durability, reduces maintenance costs.
- Ability to drive from either end assures installation flexibility.
- Symmetrical screen basket increases wear life.

DESIGN FEATURES INCLUDE:

1. Totally enclosed operation for optimum cleanliness - No messy rejects accumulating around machine.

2. High reject discharge consistency - Consistencies in the range of 30% - 55%.

3. Easy access into unit for maintenance - Allows easy access to all internals without disconnecting inlet pipe.

4. Non-vibrating rotary screen - Eases installation.

5. High efficiency - Small holes and atmospheric operation insure clean accepts that can be sent forward in many applications.

6. Handles high inlet consistency. Can handle inlet consistencies up to 4.0%.

7. Moderate operating speeds - Results in longer bearing life and does not degrade rejects.

Inspect the shipment and the condition of the unit
before unloading from the carrier's equipment (truck/trailer).

Any apparent shipment damage should be noted and discussed, immediately, with the Carrier or his representative before you unload the unit or sign receipt form(s).

The shipping document(s) and bill of lading must match the equipment being received before you unload the shipment.

The packing list is your key to the contents of a particular shipment.

Weight(s)
Equipment and any components packed in containers or on skids in the shipment.

Contents
Items- This Shipment

Back Order
List of items not in this shipment.

Any missing item(s) must be noted
with the Carrier and Black Clawson immediately.

Carrier
Black Clawson units and accessory equipment are shipped by truck on an open flat bed trailer.

Shipping Papers
One set of shipping papers is attached to the shipment in a place where it is easily seen by the men who unload it. A copy of these papers were mailed to your receiving department. Check weights shown on shipping papers and determine if your crane or hoist can lift the heaviest item safely.

Check-Off
As each part is unloaded, check it off shipping papers. Report shortages to Black Clawson within twenty-four hours. File damage claims against transportation company within twenty-four hours.

Unloading Pattern
Trucks are generally unloaded from back to front. Crane operator must be sure of a clear lift or piece being lifted may swing against other parts and cause damage.

Protective Covers
Waterproofed coverings are used to protect the unpainted surfaces during shipment. Remove these covers before unloading.

If shipment is to be stored outdoors, replace covers after shipment is moved to storage area.

Wood Boxes (Crates)
Clamps, bolts, nuts, cap screws, eyebolts, and other small parts are shipped in one or more wood boxes.

NOTE: Do not store these boxes outdoors.

Bracing Material
Leave wood blocks, steel strapping and other bracing materials in place until hoisting sling is in place and piece is ready to be lifted.

Lifting
- Check to be certain eyebolts and hooks are attached securely.

- Straighten sling as slack is removed and make a test lift by allowing weight of piece to be supported by crane while piece itself is not more than an inch or two above the truck bed.

- Lift pieces carefully and smoothly; with cast parts, the flanges will break next to the cored holes if pieces are jerked suddenly by the crane.

Do Not Lift The Unit By:

- Chaining or slinging around shaft journals or the main body.
- Handles on the hood.

NOTE: Unit is skidded and fork truck entry is provided. Overall tare weight will permit a fork truck to lift the unit .... providing lift is made under the skid.

⚠ **CAUTION:** Damage to discharge pan can result from lifting unit by inserting forks on fork truck directly under discharge pan.

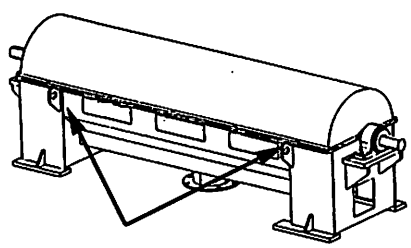
Shipping Weight
3000 lb.
1360 kg.

Lift your UltraSorter by making your lift connection at the four (4) points located at each corner of upright frame.

Check with your shipping department for lifting equipment

Spreader Bar Required
Damage to the unit can occur if not used.

Four (4) lifting lugs are provided on upright framework. These are to be used for lifting of the unit, however, care should be taken not to damage the sides of the machine by the chains or cables. When lifting be cautious to maintain a level position of the unit.



Lifting Lugs

THE UNIT IS SHIPPED WITHOUT THE FOLLOWING ITEMS INSTALLED
•Guard •Belt •Sheaves •Motor (if supplied)

These items are crated/skidded as separate items to minimize shipping/handling damage. The unit is ready, as received, to go directly to the job site for installation without any disassembly work being required .... other than removing the unit from the skid.

If long term outside storage is planned,
we recommend the unit be covered with a protective covering.

Outside storage - should include the following:
No water should be allowed to stand or accumulate in/or on the unit.

Especially, if the weather conditions (climate)
approach near freezing (32 degrees F.) or below.

The mild steel extensions of the shaft journals should be coated and protected with a rust inhibitor or rust preventitive substance

The bearings should be flooded with a non-oxidizing lubricant.

Items such as
valves, cylinders, switches, etc.
can be damaged by adverse weather conditions.
Do not store these components outside.

Black Clawson assumes no liability as to specific storage requirements for Equipment or Components.

Black Clawson Units are designed
for Operator and Maintenance personnel SAFETY.

Unauthorized Modification(s)
may impart the function,
shorten the machine life and can render
built-in safety features useless.

DO NOT PROCEED Until YOU
READ and UNDERSTAND
the PRECAUTIONS for your BC UNIT.

If you have any questions,
Contact your Supervisor.

NEVER START the machine UNLESS

A.) All personnel are clear of the machine.

B.) All doors and/or hatches are closed.

C.) All guards and covers are in place.

If you have any questions, contact your Supervisor.

Maximum Feed Pressure - 10 PSI

LOCK OUT
Zero Mechanical State (ZMS)
All service to the machine must be
Locked Out with your Padlock BEFORE and during installation and/or before any maintenance, inspection, cleaning, adjusting or servicing is performed.

A.) The Main Power DISCONNECT SWITCH must be locked out.

B.) CHECK DISCONNECT - Try to start MOTOR before proceeding further:

C.) All SOURCES of POWER and FLOW of MATERIAL must be Shut Off including Bleeding Off of Pressure and Locking Out ALL:

Pneumatic Steam Systems Hydraulics
Electrical Circuits Chemical and/or Gas Systems
Flow of Material/or Stock

WARNING
NEVER REMOVE
another person's lockout
(padlock) or tag.

DO NOT assume the machine is Locked Out.
ALWAYS CHECK
to be sure for Your Own SAFETY.

NOTE

If services are not independent of the main supply, DO NOT PROCEED - Contact your Supervisor.

FOLLOW
Installation and maintenance procedures
in this Manual.

Valves used on this Unit must be designed for LOCK OUT/OR TAGGING.

The unit is furnished to You with V-Belts Guarded. **Never Operate the unit without the Guard(s).**

Sheave Bushing(s)
Follow Manufacturer's suggested
TIGHTENING Specifications.

ALL Attachment(s)
Factory installed are Tightened to
Industry Standard Torque Specifications.

NOTE
Check the Torque(s) Prior to Start-up.
(Tack welding of Bolt Heads is an Accepted Industry Practice.)

CAUTION
Do Not Exceed Maximum Torque Specification(s) Over Stressed Conditions can result in Failure of bolt(s) and other attachment(s).

Installation Make-Ready of a unit and its accessories
Involves preliminary preparations which may be performed before the unit arrives at your mill. It will save time if all possible preliminary arrangements are completed before the unit is received. This section may be used as a check list for preparations prior to erection.

The following information will be helpful to the millwright because:

- It shows what tools, equipment and materials must be available for installation.

- It explains the use of information supplied with the unit.

In addition to the shipment, you will also receive:
-Accessory Equipment when ordered
-Owners Manual
-Certified Drawings

Accessory equipment is generally shipped at the same time, but on a separate truck. However, when one truck can accommodate the unit and its accessories will be shipped together.

Certified Drawings are prepared by our engineering department upon receipt of the following:

-Your purchase order
-Return of approval drawings

Certified Drawings are mailed to you as soon as available and well ahead of the equipment shipment.

Shipping List accompany each shipment and copies, mailed the day of the shipment is made, generally arrive at your mill ahead of the shipment.

Some of the following items listed
Must be considered and completed before the unit can be installed. Other items are not involved until the time of installation. In general, the installation will progress better if all items are considered before the installation is started.

Equipment Location
Exact location and position of the unit is shown on our Certified Drawings. These drawings are based on information supplied by you regarding the space available, location of other equipment in the system, obstructions to be avoided and any unusual limitations which might effect operating efficiency.

We recommend
Checking the Certified Drawings to determine if any unusual clearance problems will arise while moving the unit through your mill. Adequate equipment clearances must be considered in your equipment layout.

Foundation
When ample space is available, such as in a basement room, large accessory equipment may be brought in for assembly as needed. When these items have to be lowered through an opening in the floor above, be sure they are in approximate foundation position before the unit is erected. The Certified Installation Drawing will give the live load for each support column and for the drive. The elevation of the foundations and allowances for grout are also given.

Electrical Requirements
Check to be sure power cables and control cables can be routed to unit with a minimum of bends and turns. Check also to be certain that electricity available is correct for the equipment it is to operate.

Water Requirements
Check pipe sizes shown on Certified Drawings to be certain correct sizes of pipe, fittings and adapters are on hand when piping is to be installed.

Weight Limits
Check weights shown on shipping lists and determine if unit can be lifted safely with hoist or crane on hand. If not, it will be necessary to lease lifting equipment or contract for the services of a rigger.

Leveling Instruments
Use a sensitive, graduated tube spirit level reading to 10 seconds per graduation (.006 inch per foot). One provided with screw adjustment is best. The level in an ordinary machinist's square is not accurate enough.

Piping
It is essential that all piping be well supported so that no strain is placed on the unit.

Piping must not be connected to the unit until the grout has thoroughly hardened and the foundation bolts have been tightened.

When handling liquid at elevated temperatures, it is suggested that expansion loops or joints be properly installed in the inlet and outlet lines to allow linear expansion of the piping.

The use of check valves is recommended in all of the water service lines to the unit.

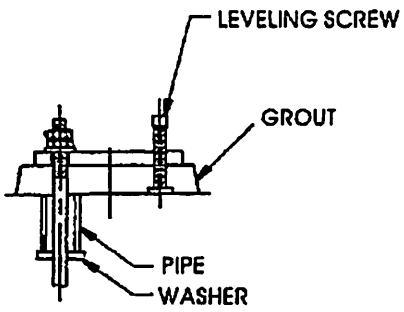
Black Clawson Company assumes no responsibility for the type of site construction and/or preparation required for the installation of the unit. An adequate foundation, determined from machine weight and floor loading conditions, must be provided.

Maintaining "As Built" specifications during the erection of this unit is the responsibility of the customer's erecting force and/or agents.

Report any excessive deviation from required specifications to the Black Clawson Field Service Department.

The establishment of general guidelines are suggested in this manual for those parties (persons) involved in scheduling and installing the unit.

FOUNDATION AND ANCHOR BOLTS
The Customer is to furnish all
Foundations, anchor bolts, piping, etc.
Refer to the Quotations and Certified Drawings
for a complete listing of parts and hardware
furnished by Black Clawson



Your Certified Prints call out the anchor bolt(s) sizes, typical spacing and layout.

Black Clawson recommends that anchor bolts be encased by using sleeves (as shown) to make allowance for minor deviations in mounting hole location(s). Several sleeve types are commercially available.

All grout design and placement of grout is the responsibility of the customer. Deviations from standard grouting practice, such as hollow, could result in structural failure.

Foundation tops
shall be cleaned of all loose concrete chips or dust.

Anchor bolt pockets
should be cleaned and free of particles and dust.

Bolts should be of sufficient length to project through the nuts approximately 1/4" after allowance has been made for grouting, bedplate thickness and nut thickness.

Leveling and Alignment

Refer to your Certified Drawings for correct placement and orientation of the unit on the foundation.

Black Clawson Company assumes no responsibility for the type of site construction and/or preparation required for the installation of the unit. An adequate foundation, determined from machine weight and floor loading conditions, must be provided. All grout design and placement of grout is the responsibility of the customer. Deviations from standard grouting practice, such as hollows, could result in structural failure.

Place a 3" x 3" x 1/2" (thick) steel plate on the floor to provide a solid surface for the leveling screw to bear against during leveling of the unit.

Leveling screws should be removed after anchor bolts are secured.

NOTE: Shims are permanent & remain in place during & after grouting is in place.

Recommended Leveling Procedure
Check for level in two (2) directions - generally this is done in line with the corners on the unit. Adjust the leveling screws on the base mounting pads to obtain a level condition of within 1/16" in both directions.

The foot pads are provided with anchor bolt holes and tapped holes for leveling screws.

In adjusting the base, care should be taken not to bow or twist the base in order to maintain true alignment. Steel plates should be placed under the end of the leveling screws to prevent them from sinking into the foundation. Sufficient space must be provided under the foot pads to allow room for the grout.

Use a precision level on a machined surface to check for level both in the lengthwise direction, as well as the crosswise machine direction. To maintain the level position, make up a set of steel shim blocks to place next to each anchor bolt. With the shim packs securely in place, remove the leveling screws and tighten the anchor bolts. Check for level to see if the original setting has changed. If there is a change, adjust the shim pack as necessary. Take care to avoid a "soft foot" which will cause mis-alignment. The leveling screws may now be removed. The unit is now supported by the steel shims.

- **Be sure to make adjustments to the shims as the unit is being leveled.**
- It is standard practice to torque down the anchor bolts before grouting is in place.

TORQUE REQUIREMENTS will vary with screw thread & sizes used.

- Recheck the unit for level and be sure the unit is supported on the shims.
- **Be sure the unit is not supported by the leveling screws.**
- If no noticeable change has occurred, grouting can be placed and allowed to cure according to the manufacturer's recommendations.

A typical 3" x3" shim pack should consist of the following combination of sizes:
Material Thickness - 1" (1.000) - 1/2" (0.500) - 1/4" (0.125) - 1/16" (0.062) - 1/32" (0.031) - 1/64" (0.0156)

A first time Checkout before start-up
should include the following equipment check:

- Remove all tools, scaffolding and other loose objects from inside and around the unit..
- Check the drive.

Drive

- The unit is equipped with a V-belt drive. Check the sheave alignment and adjust the motor bracket for proper belt tension.
- Check the instructions for proper lubrication of the drive unit.
- Check the voltage rating of the motor. Be sure it is wired properly.
- Units with Belt Drive - Check the belts for alignment and tension.
- Grease the bearings and couplings. Follow the bearing manufacturers' lubrication instructions.

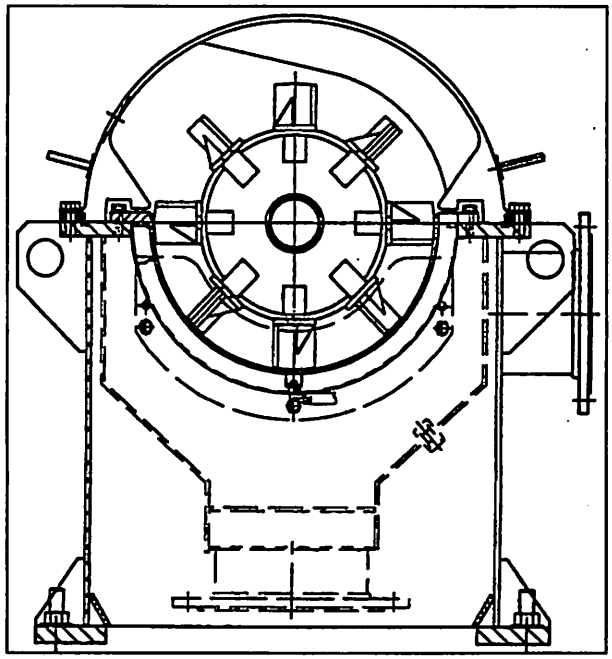
Rotor

The direction of rotation is important for proper operation of the unit. Looking at the unit from the discharge end, it should rotate in a clockwise direction.

There should be enough clearance between the rotor and the cylinder to allow for proper operation. If there should be metal to metal contact, there will be increased wear and shorter life for the components.

- Start the drive motor and check the rotation of the rotor. The correct rotation is shown on the Certified Installation Drawing.
- Check the unit and motor drive for excessive vibrations.

The UltraSorter consists of a perforated screen plate rolled in the shape of a half cylinder and mounted in a housing. The furnish enters through an inlet port mounted on the side of the unit. The paddles mounted on the rotor first transport and then retard the movement of the material down the length of the machine. The rotor also sweeps the surface of the screen plate to allow more fiber and water to pass. Static, non-stringing baffles in the volute housing above the rotor prevents short-circuiting of material in the unit. Showers are installed below the surface of the screen plate to clean the surface if necessary. The accept flow moves through the screen plate into a trough integral to the housing of the unit where this flow is atmospherically discharged. The rejects are concentrated along the length of the screen plate and are discharged through a chute, which is integral to the housing structure and located at the opposite end from the inlet. The result is near fiber free rejects that are discharged at a consistency of 30 to 55% depending on condition of the rejects. The accepts have very low reject debris and, in many instances, are sent forward.



The above pictorial is as the unit would appear when viewed from the Reject Discharge End.

GENERAL APPLICATION

The UltraSorter must be operated with a proper feed consistency and within a flow range as determined at the time of purchase. Changes in inlet consistency or flow rate to the unit will reflect in the throughput tonnage and may vary the accepts stock fiber content.

The amount of reject processing which can be obtained is determined by several factors.

1. Freeness or drainage rate of material being screened.
2. Consistency of inlet stock.
3. Pressure head of the inlet stock.
4. Diameter of perforations in cylinder.

FEED ARRANGEMENT

Some typical arrangements for feeding stock to the UltraSorter are as follows:

a. Gravity feed through a regulating box where the operating head is controlled by an adjustable dam or gate.

b. Gravity feed through a standpipe with a fixed level.

c. Direct pumping with flow controls.

STOCK DISCHARGE

The discharge of rejects from the unit is by gravity down a chute. Care must be taken to insure that the reject discharge flow is unrestricted. Keeping the discharge chute clear of reject debris will prevent rejects from backing up in the rotor/cylinder screening section and contaminating the accept stock flow.

Review the Pre-Operation checks in the Installation section before starting the unit.

Start Up Procedure

1. Turn on shower, dilution and packing seal water supply lines.
2. Energize the motor.
3. Open the inlet valve gradually.
4. Check the amperage reading for possible over-load conditions.
5. Check for proper flow of discharged stock - both accepts and reject debris.

Normal Operation

Since the RPM of the rotor is fixed, minimal operator attention is required as long as the inlet consistency and operating head remain constant.

Shut-Down Procedure

For a short duration shut-down:

1. Close the inlet valve.
2. Allow the unit to run until the system is cleared of stock and debris.
3. De-energize the drive motor.
4. Shut off shower, dilution and packing seal water lines.

For a shut-down of prolonged duration:

1. Close the inlet valve.
2. Open the fresh water or white water valve.
3. Allow the unit to run until the system is cleared of stock.
4. Close fresh water or white water valve and de-energize the motor.
5. Shut off shower, dilution and packing seal water lines.

EMERGENCY STOP

1. De-energize drive motor.
2. Immediately close all sources of stock flow to the unit.

Operating Problems

Plugging

Plugging occurs when excessive dewatering of the stock takes place. Indications that plugging is developing could be that the motor tends to overload, discharge consistency rises or discharge volume decreases.

When plugging starts, add additional dilution water to dilute the stock until the operation returns to normal.

If the unit becomes completely plugged and stalls the motor, the hood must be removed, and the dry compacted stock removed.

Metal to Metal Contact

When rubbing or metal to metal contact occurs, the unit should be shut down to avoid unnecessary wear and the cause corrected. This could be caused by a worn bearing or loose rotor vanes.

Hood Removal

Important safety requirements prior to hood removal are:

1.) Be sure to turn off and lock out all sources of energy. The unit must be at zero mechanical state (ZMS) before proceeding with hood removal.
2.) Inlet stock flow diverted or shut off with valving locked out.
3.) Dilution water turned off and locked out.
4.) Shower water turned off and locked out.

Continue running the unit for up to approximately two (2) minutes after shut down procedure is completed. This will help drain the unit of stock in the chamber and inlet stand pipe, as well as, clearing the unit of trapped reject debris.

⚠ **CAUTION:** Be sure unit is completely drained prior to hood removal.

1.) Turn off and lock out the motor main disconnect.
2.) Check disconnect. Try to start motor before proceeding further.

⚠ **WARNING:** Never remove another person's lock out (padlock.)

SAFETY CONSIDERATIONS

Safety considerations are an important element of proper trouble shooting procedures. Actively thinking about safety of yourself and others, as well as the condition of your equipment is of primary importance. Several safety areas are discussed below.

Power Supplies

Before working on a power supply, always remove the AC power source at the main disconnect switch. When using more than one power supply, be sure to disconnect all of them.

Main Power Disconnect

The main power disconnect switch should be located where operators and maintenance personnel have quick and easy access to it. Ideally, the disconnect switch is mounted on the outside of the enclosure so that it can be accessed without opening the enclosure. In addition to disconnecting electrical power, all other sources of power (pneumatic and hydraulic) should be de-energized before working on a panel controlled machine or process.

Activating Devices when Trouble Shooting

When trouble shooting, never reach into the machine to actuate a device. Unexpected machine motion could occur.

Stand Clear of Machine

When trouble shooting any control panel problem have all personnel remain clear of the machine. The problem could be intermittent and sudden unexpected motion could occur. Have someone ready to operate an emergency stop switch in case it becomes necessary to shut off power to the machine.

Program Alteration

There are several causes of alteration to the user program, including extreme environmental conditions, electromagnetic interference (EMI), improper grounding, improper wiring connections and unauthorized tampering. If you suspect the memory has been altered, check the program against an approved version such as on the EEPROM memory module.

Hardware Redundancy

Circuits installed on the machine for safety reasons like overtravel limit switches, stop push buttons and interlocks should always be hard-wired in series so that when any one device opens, the master control relay is de-energized thereby removing power to the machine. Never alter these circuits to defeat their function. Serious injury or machine damage could occur.

Safety Recommendations for Maintenance Personnel

All maintenance work should be done by qualified personnel familiar with construction, operation and hazards involved with the equipment.

The appropriate work practices of NFPA 70E should be followed.

Make-Do test devices such as incandescent lamps have low impedance; the low impedance of these devices can effectively change a voltage level from logic "1" condition to a logic "0" condition when attempting to make a measurement. Unexpected machine motion can result if an output to a controlled device is energized as a result. Neon lamps do not respond to voltages typically used in logic circuits (e.g. 32 VDC or less.) Use of a neon lamp tester could lead to false conclusions about the voltage present in a circuit.

High input impedance meters are required to obtain accurate voltage measurements in high impedance circuits. Unless otherwise specified by the manufacturer, a meter with an input impedance of ten (10) megohms or greater is recommended for making voltage measurements. The meter must also have sufficient sensitivity to measure logic level voltages; some meters do not respond to low voltages.

Safety
The control panels are designed using all Nema and/or U.L. approved components suited for the environment in which it is being placed. Every effort is made to adhere to the N.E.C., OSHA, ANSI and mill standards as they apply to your application.

The power feed should include an equipment grounding conductor to bond the enclosure to building earth ground.

⚠ WARNING Contact with AC line potentials may cause injury to personnel.

Power feed should have a disconnect or breaker capable of being locked in the open position.

All field devices should be wired per Certified Installation Drawings furnished with the control panel.

The field wiring should be routed in such a way as to separate the AC from the DC and/or low level signals.

All the electronic instruments were factory programmed to a fail safe state (if a component failure occurs.) The panel include a power push button that when pushed will power down the main processor closing all valves.

Education and Knowledge Leads to Safety
Planning for an effective solid state circuit requires enough knowledge to make basic decisions that will render the system safe as well as effective. Everyone who works with a solid state control should be educated in its capabilities and limitations. This includes in-plant installers, operators, service personnel and system designers.

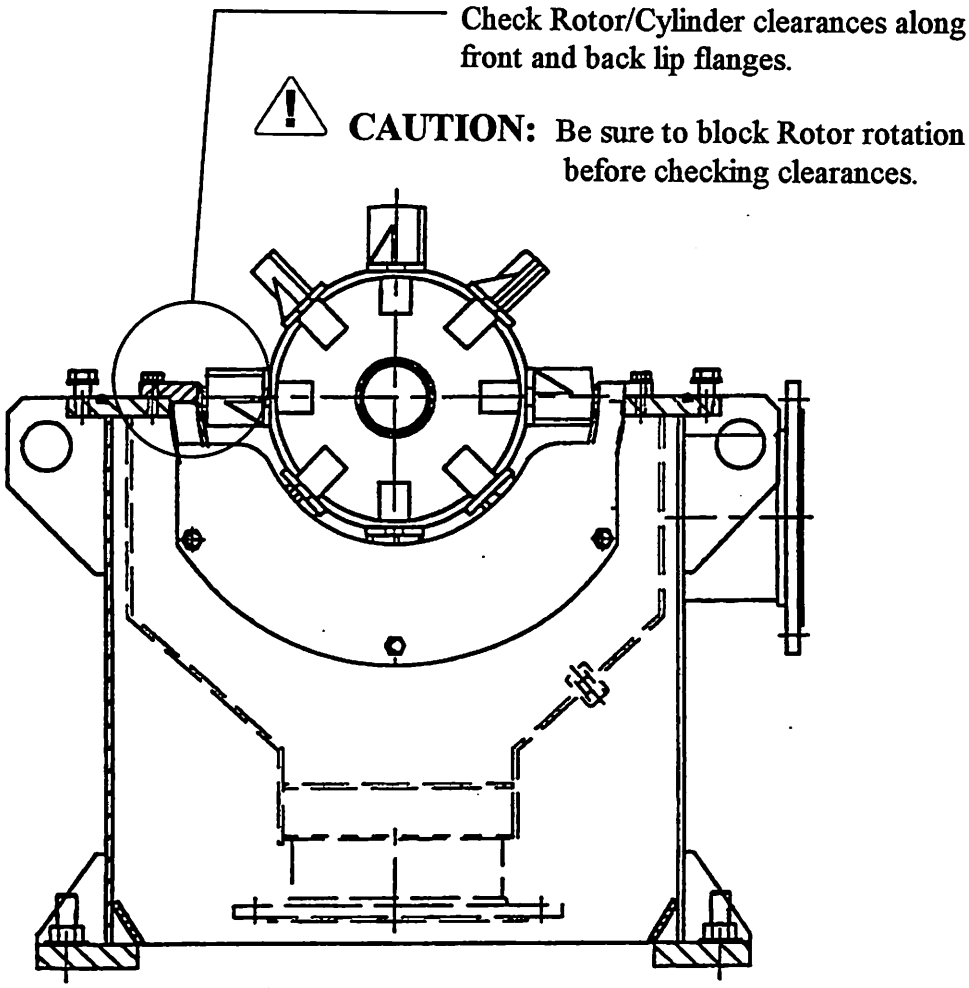
ROTOR/SCREEN CLEARANCE

The initial rotor gap is 2.0/2.5 mm or 0.08/0.10 inch. The blades are manufactured to a height to give the proper gap. In time the gap will become excessive and the blade must be replaced. The blade hold down bolts are torqued to 75 ft. lbs. at the factory and the heads are tack welded.

NOTE: Hood must be removed to check Rotor/Cylinder clearance.

WARNING: Be sure all lockouts are in place. This should include:

- Motor controls lock out
- Dilution water lock out and shut off
- Shower water locked out and shut off.



A general inspection of the unit needs to be performed a minimum of every three months or after 1000 hours of running time. Locating and eliminating minor repairs will extend the service life of the unit.

Periodic Inspection
A general inspection and tightening of the machine should be performed twice a year. Locating and eliminating minor problems will assure long and dependable service. In many instances, it eliminates costly shut-downs and delays.

> **⚠ WARNING**
>
> To prevent accidental starting while inspecting or servicing the unit, follow your prescribed safety procedures and those listed in this manual

To prepare for a maintenance check, start by emptying the unit completely. Wash down the rotor and cylinder chamber.

Component(s) requiring routine maintenance:

V-Belt Drive	-	Check Sheave Alignment Check Belt Tension Check both Sheaves (Drive &Driven) for wear
Bearings	-	Grease Lubrication (weekly) Check Bearing Temperature Check Rotor Rotation (Bearing Freeness) Check Rotor for End Play - Loose Non-Expansion Bearing Shaft Fit
Motor	-	Check Power Consumption (Ammeter)
Hood	-	Check Inside Surface for Abnormal or Excessive Wear
Rotor	-	Check Vanes for loose or missing attaching socket head cap screws. - Check Vane Face and Tip Wear - Check for broken or missing Vanes - Check for end play
Rotor Shaft Seals	-	Check for Stock Leakage - Check for damaged or missing Seals - Check Seal area on Shaft Journal for wear.

Having Trouble?

Black Clawson recognizes downtime on a piece of equipment as a cost factor not only to you, the customer, but ultimately the continued dependable operation of our unit(s) is important to both of us. Emergency situations call for quick response and generally someone remembering "What was done the last time". With this in mind, we have compiled a check list for you to refer to in time of need. Many times these situations result in only finding out what is not wrong with the equipment. Generally the problem is a cause/effect condition and can be isolated if you know how to identify the condition.

Condition	Check
Excessive Noise	- Rotor Vane/Cylinder Contact - Mechanical Failure ... Bearings, loose or missing vane(s), Motor and V-Belt Drive
Low Power Consumption	- Low Rotor RPM ... Motor/V-Belt slippage or failure
High Power Consumption	- Build up/plugging of Cylinder - Stock Consistency Too High - Reject Discharge blocked/plugged - Rotor Vanes contacting Cylinder - Mechanical Failure .... Bearings, Vane/Cylinder, Motor and V-Belt Drive
Excessive/Abnormal Vibration	- Rotor ... Unbalanced unit or jamming of rotor - Surging feed - Motor/V-Belt ... Loose hold down bolts, Bearing clearance excessive
Little or No Accept Flow (Excessive Fiber Loss)	- Plugged Cylinder holes - Shower Water Pressure or GPM to low .. Possible clogged nozzles - Dilution Water Line blocked or plugged - Discharge End Plate Adjustment
Little or No Reject Discharge	- Stock feed rate/flow - Low stock consistency - Discharge end plate adjustment - Shower water flow to high - Dilution water ratio to stock consistency too high - Shaft End Seals for leakage
V-Belt Slippage	- Rotor jamming - Loose belts
High Debris content in Accept	- Discharge End Plate Adjustment - Shower water pressure or GPM too high - Dilution water ratio too high - Broken cylinder section or sections - Worn cylinder

The UltraSorter Hood is constructed of light weight non-metallic materials and can easily be removed from the unit by hand.. Total hood weight is less than 100 lbs.

The lifting off or placing on of the hood requires a minimum two (2) maintenance people. Handles for lifting are provided at each end of the hood.

NOTE: Proper placement of the hood is critical to the operation of the unit. Please note the hood's replacement prior to removal from the unit for reference positioning when hood is placed back on the unit.

Hood Removal

Important safety requirements prior to hood removal are

1.) Be sure to turn off and lock out all sources of energy. The unit must be at zero mechanical state (ZMS) before proceeding with hood removal.

2.) Inlet stock flow diverted or shut off with valving locked out.

3.) Dilution water turned off and locked out.

4.) Shower water turned off and locked out.

Continue running the unit for up to approximately two (2) minutes after shut down procedure is completed.

⚠ **CAUTION:** Be sure unit is completely drained prior to hood removal.

1.) Turn off and lock out the motor main disconnect.

2.) Check disconnect. Try to start motor before proceeding further.

⚠ **WARNING:** Never remove another person's lockout (padlock.)

3.) Open one of the access doors and visually check for continued stock flow drainage and look at window in discharge end for reject debris.
- Little or no stock flow - proceed with removal.
- Stock flow less than a trickle

Do Not Proceed

Recheck: Stock inlet Valve
Dilution Valve
Shower Water Valve

4.) Loosen and remove all hex head cap screws and washers.

5.) Hood can now be lifted off and placed adjacent to the unit.

⚠ **CAUTION:** Do not set hood directly on the floor. Use clean wood blocks to support the hood off the floor.

Before the inspection or repairs are made to the internal components of the unit, the hood internal surfaces should be sprayed and washed to remove any stock or debris. Next check the hood for any internal wear patterns or damaged surfaces.

NOTE: If any of the above conditions are present, contact Black Clawson.

At this point, the rotor assembly and cylinder can be checked for wear, proper clearance setting, loose or broken rotor vanes, bearing conditions, worn or damaged cylinder.

Depending on inspection results and accessibility to components for repair/replacement, if any are required. Complete removal of the rotor may not be required.

The hood is then assembled back on the unit in the same position as it was removed. The sequence of steps for installation should be in reverse order of hood removal.

Follow guidelines for Start-Up of unit as listed in the Control Information Sections 7-3-1 and 7-3-2.

Be sure to follow shut down procedures as listed in the hood removal section 8-3-1 as well as guideline steps to remove the hood.

At this point the hood has been removed.

NOTE: Repairs to the rotor assembly should be done with the rotor removed from the unit.

⚠CAUTION: Relocation of motor/drive may require changing expansion / nonexpansion bearing location on rotor shaft. Check with Black Clawson Engineering Department to confirm if bearing relocation will be required.

Reasons For Removing Rotor

- Rotor/Cylinder not within tolerance range
- Loose, broken or missing rotor vanes
- Replacement of rotor vanes due to wear
- Access to cylinder is required to:
  - Clear clogged accept holes
  - Repair or replacement of cylinder due to damage or excessive wear beyond factory recommendations
  - Check wear pattern of entire inner surface of cylinder. Removal and turning cylinder may be required to extend cylinder life.

Rotor Removal Procedure

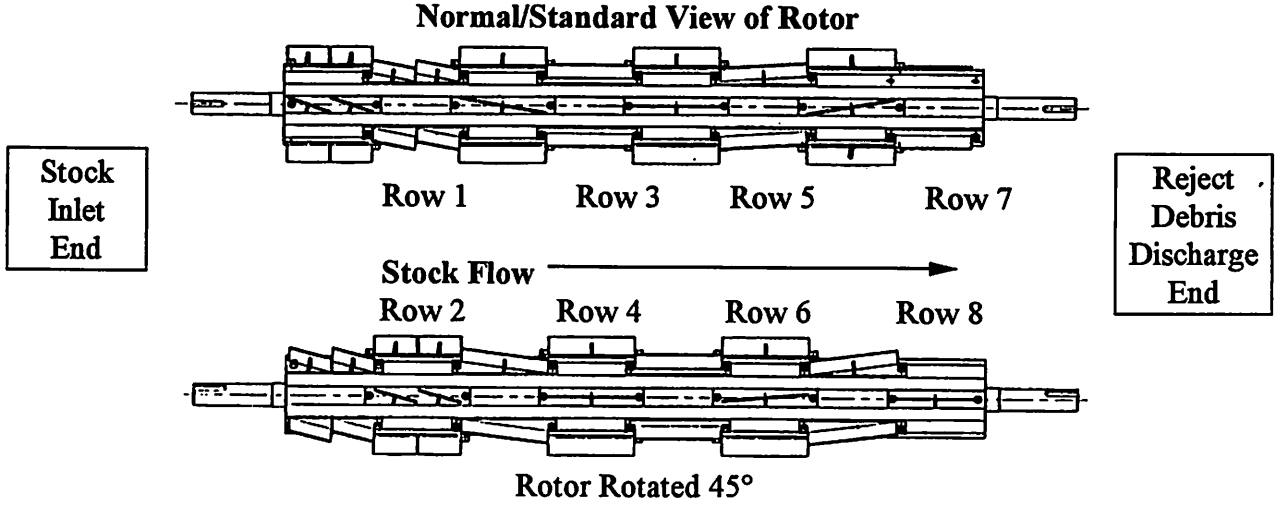
1.) Remove belt guard and shaft guard. Loosen motor mounting bolts to provide slack in belt drive.
2.) Remove belts.
3.) Remove end seal caps - both ends.
4.) Remove top half of both pillow block bearing housings.
NOTE: Removal of sheave and cartridge bearings is not required at this time.
5.) Attach nylon slings to the rotor shafts and lift rotor out of unit.
NOTE: Recommend using a spreader bar for lift.

⚠CAUTION:
- Do not use chains or cables to remove cylinder. Damage to the cylinder can result.
- Do not set rotor on floor . Damage to vanes can result.

V-Block supports are recommended and will permit rotation of rotor during repair/replacement of vanes.

Once the rotor is removed and securely supported, proceed as follows:

CAUTION: Do not attempt vane replacement with rotor in the unit. Personal injury can occur.



Rotor vanes are attached in radial circumferential rows as matched sets. Each vane is attached with (2) bolts. Bolt heads are tack welded in place to prevent loosening during operation.

Removal of attaching bolts can proceed by hand grinding of tack weld holding bolts in place.

NOTE: Do not reuse bolts. New attaching bolts are provided with replacement vane sets.

Attach replacement vanes one row at a time. This means as vanes are replaced bolts are torqued and bolt heads tack welded before going onto next vane in each row.

NOTE: Vane replacement of all rows may not be required.

Check and replace as required, the following before placing repaired rotor back in the unit.

- Condition of both drive and driven sheaves
- Condition of belts
- Clean bearing cartridges and replace if conditions requires
- Condition of cylinder may require clearing of clogged accept holes, as well as, clearing of shower nozzles.

  NOTE: Verify shower nozzles are not clogged.
- Condition of cylinder surface may reveal wear patterns requiring removal and turning cylinder end for end in the unit.
- Accept and reject outlets should also be cleared and free from stock build-up or reject debris.

Place the rotor back into the unit in the same position as it was removed. The sequence of steps for rotor installation should be in reverse order of rotor removal.

Reasons to access cylinder are as follows:

- Clogged accept holes in cylinder will not permit stock to flow through to accepts outlet and efforts to clear blockage have been unsuccessful to this point.
- Shower nozzles have little or no flow. No apparent blockage or cause for malfunction.
- Change in cylinder hole size to meet new or additional stock requirements.
- Wear patterns dictate turning cylinder end for end.

If any of the above conditions exist, hood and rotor removal is required. Follow guidelines as listed in Hood Removal Section 8-3-1 and the Rotor Vane Removal Secton 8-4-1.

1.) Shower water lines must be disconnected at connections on accept side of cylinder. These connections are easily disconnected and are reachable through access doors located on tending side of the unit.

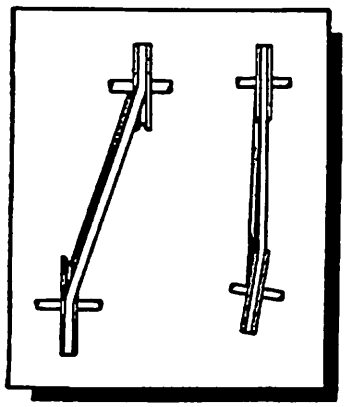
2.) Remove bolts attaching cylinder flanges to frame. In order to lift cylinder out of frame work of unit. Install (4) eyebolts in tapped holes.

NOTE: Eyebolts are not supplied with the unit and are considered a customer supplied item.

Cylinder will lift free from frame in most cases. Severe or heavy duty usage may require eyebolts to be tightened and used as jack screws to break free the flange fit.

- If the original cylinder is being turned end for end for the first time and is within acceptable wear allowance, be sure the cylinder is not placed back in the framework in it's original position.
- If the cylinder is a replacement or a new cylinder with different size accept holes. Be sure to record this information in the unit's records for future reference to determine the cylinder status.

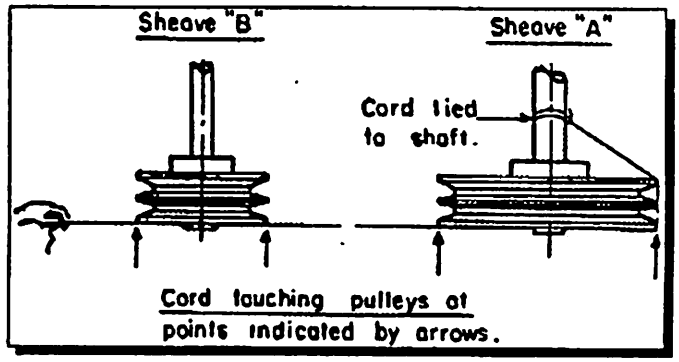
Place the cylinder back into the unit. The sequence of steps for the cylinder installation should be in reverse order as described in the removal procedure.

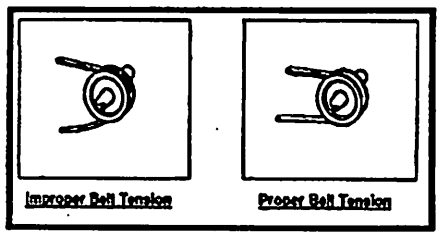


Misapplied or incorrectly assembled belts can over-load to cause overheating of the windings or the bearings. Follow instructions of the V-belt manufacturer carefully. A noisy drive should be corrected at once. Visual inspections are, also, helpful in finding trouble before a breakdown occurs. Rubber and some other belts are affected by oil and other liquids. For oily locations, use oil resistant belts. If the location is oily or dirty, use belts which are resistant to all petroleum derivatives. In case of overheating or bearing failures in the motor or drive shaft pillow block bearings, check the belts as a possible cause.

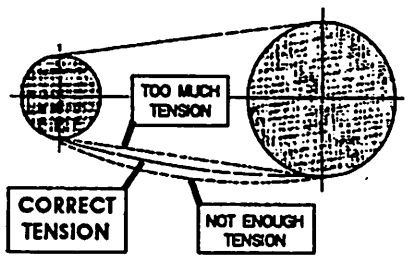
When more than one belt is used on the same sheave they must all be matched (as to length). If one belt fails, the complete set of belts must be replaced with a set of matched belts. This is necessary to distribute the load among all the belts. Bearing overloading results from the use of belts of varying lengths on the same sheaves. It is possible to pull belts so tight that quick failure of the bearings or shafts will result. Sheave must be in line to keep from overloading the motor, as well as to get satisfactory service life from the equipment.

When a suitable straight edge is not available, misalignment of sheaves can be detected readily with the aid a cord by the method shown below. Assuming that the shafts are parallel, as they should be, a light strong cord secured around one shaft and stretched tightly along the sides of both sheaves should touch at all points if held straight and tight and that it just barely touches the sheaves at the indicated points. By rotating each sheave can be checked by noting whether or not the rim contact of either the sheave with the cord is disturbed. A pulling away of either of the inner rim contacts will indicate misalignment which must be corrected to obtain expected belt and equipment life.





Belt tension's number one job is to provide full grip around sheaves. While a V-belt does not depend on tension to provide grip, it is dependent on tension for the extent of its grip. As you can see from the diagrams, inadequate tension allows a V-belt to hang down away from the bottom of a shave reducing the arc of contact. A properly taut V-belt on the other hand, is wrapped around the sheave in a full arc. The importance of contact is illustrated by the fact that horsepower ratings for the different sizes of V-belts are based on a 180 degree arc contact. Actually of course, this arc varies from one drive to another and allowance is made for the variation when the drive is engineered.



So, when a properly engineered drive is delivered to you, it is assumed proper tension and proper contact arc will be maintained. Otherwise, belt slip will happen. As the average mill has no equipment for measuring equipment in terms of pounds pull, it is generally measured by rule of thumb. Some of these rules are more superstition than science. Some are good. Perhaps the best one is this:

"A slack V-belt feels dead when you thump it with your hand; a properly taut V-belt has alive springiness."

V-Belt - Condition/Check List

Condition	Cause	-To Correct
Belt slip (sidewalls glazed)	• Not enough tension	– Replace belts – Correct tension
Belt turned over	• Broken cord caused by prying	– Replace belts correctly
	• Impulse loads	– Apply proper tension
	• Misalignment	– Realign drive
	• Worn Sheave grooves	– Replace sheaves
	• Excessive vibration	– Check drive and equipment mounting – Consider banded belts
Mismatched belts	• New belts installed with old	– Replace belts in matched sets
	• Sheave grooves worn unevenly; improper groove angle	– Replace sheaves
	• Shafts not parallel	– Align drive
Belt breaks	• Shock loads	– Apply proper tension
	• Heavy starting loads	– Apply proper tension – Use compensator starting
	• Belt pried over sheaves	– Replace belts correctly
	• Foreign objects in drive	– Provide drive shroud
Belt wear	• Sheave grooves worn	– Replace sheaves
	• Mismatched belts	– Replace with matched belts
	• Belt slips	– Increase tension
	• Sheaves misaligned	– Align sheaves
	• Oil or heat condition	– Eliminate oil – Ventilate drive

Suggested Spare Parts for your Mill Stock Room

We recommend you keep and maintain the **following components** on hand for repairing and/or maintaining your unit.

Recommended Spares - UltraSorter - Model 30	
1.) V-Belt - Matched set of (3)	1 each per unit
2.) Bearing-Pillow Block (non-expansion)	1 each per unit
3.) Bearing-Pillow Block (Expansion)	1 each per unit
4.) Shim Pack (Brg. Ht. Adjustment)	2 each per unit
5.) Cylinder	1 each per unit
6.) "O" Ring	2 each per unit
7.) "O" Ring	2 each per unit
8.) Seal, Single Lip (Split)	4 each per unit
Note: All rotor vanes are 316L material and must be purchased in matched sets. New attachment bolts are included with vane sets.	
⚠ **CAUTION:** Do not use removed bolts.	
9.) Vane - Feeder (Row #1)	1 set of 4 vanes per unit
10.) Vane - Feeder (Row #2)	1 set of 4 vanes per unit
11.) Vane - Feeder (Row #3)	1 set of 4 vanes per unit
12.) Vane - Feeder (Row # 4 & 5)	2 sets of 4 vanes per unit
13.) Vane - Feeder (Row #6)	1 set of 4 vanes per unit
14.) Vane - Feeder (Row #7)	1 set of 4 vanes per unit
15.) Vane - Feeder (Row #8)	1 set of 2 vanes per unit

Refer to you CERTIFIED DRAWINGS for Specific Part No.'s

IMPORTANT

When ordering spare parts, refer to the Certified Prints and give the item number, drawing number, and part description, along with the serial number (or S.O. number) and model number of the unit.

SECTION 10

Purchased parts having instructions on maintenance and repair are attached in this section for your convenience and are inserted as a reference only.

SKF

640-810 May 1989
Supersedes April 1981

Read All Instructions Carefully Before Assembling

Mounting Procedure for SKF Split-Housing Pillow Blocks

Assembly Instructions for SKF Spherical Roller Bearings (Adapter Mounting)

Stabilizing rings that are included may or may not be required at assembly. "Held" bearings require stabilizing rings while "Free" bearings *must not* use stabilizing rings.

NOTE: Do not remove slushing compound from bearing as it will mix with any petroleum grease or oil.

Step #1. Check Shaft Tolerance

Shaft Tolerance Limits for Adapter Mountings (Values in Inches)

Nominal Diameter		Diameter Tolerance Limits
Over	Incl.	
½	1	+0 −.002
1	2	+0 −.003
2	4	+0 −.004
4	8	+0 −.005
8	10	+0 −.006

Step #2. (Fig. 1) Inner Triple Seal
Slide inboard triple seal on shaft. This seal will slide freely into position.

Step #3. (Fig. 2) Adapter Sleeve — Clean Bore & O. Dia.
Position adapter sleeve on shaft, threads outboard as indicated, to approximate location with respect to required bearing centerline. Micronized or powdered (not flaked) graphite or light oil applied to the sleeve outside diameter surface, results in easier bearing mounting and removal.

Step #4. (Fig. 3) Unmounted Radial Internal Clearance
Measure the unmounted radial internal clearance in the bearing by inserting progressively larger feeler blades the full length of the roller between the most vertical unloaded roller and the outer ring sphere. Do not roll the feeler blade through the clearance: slide it through. Record the measurement of the largest size blade that will slide through. This is the unmounted radial internal clearance.

Step #5. (Fig. 4) Bearing — Clean Bearing Bore
Mount bearing on adapter sleeve, starting with the large bore of the inner ring to match the taper of the adapter. With the bearing hand tight on the adapter, locate bearing to the proper axial position on the shaft. (Do not apply lockwasher at this time because drive up procedure may damage lockwasher.)

Step #6. (Fig. 5) Locknut
Apply the locknut with the chamfered face toward the bearing. Use a lubricant on the threads and face of the locknut where it contacts the inner ring face of the bearing to make easier mounting for larger sizes. LARGER SIZE BEARINGS

For Shaft Diameter		Reduction in Radial Internal Clearance			
Inches		millimetres		Inches	
over	including	min.	max.	min.	max.
1¼	1¾	0.025	0.031	0.0010	0.0012
1¾	2¼	0.031	0.038	0.0012	0.0015
2¼	2¾	0.038	0.051	0.0015	0.0020
2¾	3½	0.046	0.064	0.0018	0.0025
3½	4¼	0.051	0.071	0.0020	0.0028
4¼	5	0.064	0.089	0.0025	0.0035
5	5½	0.076	0.102	0.0030	0.0040
5½	6½	0.076	0.114	0.0030	0.0045
6½	7¼	0.089	0.127	0.0035	0.0050
7¼	8	0.102	0.140	0.0040	0.0055
8	9	0.114	0.152	0.0045	0.0060
9	10½	0.114	0.165	0.0045	0.0065
10½	11	0.127	0.191	0.0050	0.0075
11	12½	0.152	0.216	0.0060	0.0085
12½	14	0.165	0.229	0.0065	0.0090

WILL REQUIRE A HEAVY DUTY SPANNER WRENCH AND SLEDGE HAMMER TO OBTAIN THE REQUIRED REDUCTION IN RADIAL INTERNAL CLEARANCE. **Do not** attempt to tighten the locknut with hammer and drift. The locknut will be damaged and chips can enter the bearing. In larger bearing sizes it will be impossible to tighten the locknut far enough with a drift. If lower half of housing is in position, support the shaft such that the bearing outer ring is free to rotate. This will prevent internal damage to the bearing during tightening of the locknut. Remeasure internal radial clearance at this time. Tighten locknut and measure radial internal clearance with feeler blades between the most vertical unloaded roller and the outer ring sphere or at the 6:00 position if the bearing is hanging free on the shaft, until the radial internal clearance is less than the measurement in Step 3 by the amount shown in the following tabulation:

EXAMPLE: Determine the amount to reduce the radial internal clearance for a 3 7/16" diameter shaft mounting.

A. Unmounted radial internal clearance from Step 3 was 0.102 mm (0.004").

B. Reduction in radial internal clearance from above table is a minimum of 0.046 mm (0.0018") and a maximum of 0.064 mm (0.0025").

C. Final mounted radial internal clearance will range from:

Minimum	Maximum
0.102 mm (0.004")	0.102 mm (0.004")
-0.064 mm (0.0025")	-0.046 mm (0.0018")
0.038 mm (0.0015")	0.056 mm (0.0022")

Step #7. (Fig. 6) Locknut and Lockwasher
Remove locknut and mount lockwasher on adapter sleeve with inner prong of lockwasher toward the face of the bearing and located in the slot of the adapter sleeve. Reapply locknut until tight. (Do not drive bearing further up the taper as this will reduce the radial internal clearance previously secured. Check to make certain clearance has not changed.) Find lockwasher tang that is nearest a locknut slot. Bend one of the lockwasher tangs into a slot in the nut. If slot is slightly past tang, don't loosen nut, but tighten to meet a washer tang.

Step #8. (Fig. 12) Outer Triple Seal
Slide outer triple seal onto the shaft. Locate both inner and outer triple seals to match labyrinths in the housing.

PURCHASED PARTS

Step #9. (Fig. 13) Lower Half of Housing
Remove any paint and burrs from the mating surfaces at the split and thoroughly clean the housing. The vertical hole at the bottom of each enclosure groove must be free of foreign matter. Set lower halves of housings on base and oil the bearing seats. Place shaft with bearings into lower halves of housings, carefully guiding triple seals into the seal grooves and being certain that the bearing outer rings sit squarely in the pillow block bearing seats. Bolt the held housing securely in place. [The free bearing housing(s) will be located and bolted after completing Step #10 and centering the free bearing(s) in the free pillow block bearing seat(s).]

Step #10. (Fig. 14) Stabilizing Ring (If required)
A stabilizing ring should be used only if the bearing is to be held. Move shaft axially so that the stabilizing ring can be inserted between the "held" bearing outer ring and housing shoulder on the locknut side of bearing, where practical. Center all other bearings on one shaft in their housing seats.

NOTE: ***There must be only one "held" bearing per shaft. Other bearing or bearings 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 the triple seal housing groove in place of the triple seal. It is inserted in the lower half of the housing before the upper half is bolted to the base. If grease is used as a lubricant it should be applied before the upper half is secured and in accordance with the Lubrication Notes on back page.*

Step #11. (Fig. 15) Upper Half of Housing (CAP)
The bearing seat in the upper half of the housing (cap) should be checked for burrs, thoroughly cleaned, oiled and placed over the bearing. Especially with oil lubrication, use of a sealing compound must be applied sparingly: wipe a thin film near the outer edges. Excessive amounts are forced not only out but also in between the housing bore and bearing O.D. and this can pinch an outer ring or make a free bearing actually held. The two dowel pins will align the upper half of the housing.

NOTE: ***Caps and bases of pillow blocks are not interchangeable. Each cap and base must be assembled with its mating part.***

Lockwashers and cap bolts are then applied and properly torqued to complete assembly.

If shimming is required, only shims which cover the full mounting surface of the pillow block are recommended.

Step #12. (Fig. 16) Cutaway Illustration
Here a section of the housing has been removed to show the relative position of all the parts.

Assembly Instructions for SKF Self-Aligning Ball Bearings (Adapter Mounting)

NOTE: Do not remove slushing compound from bearing as it will mix with any petroleum grease or oil

Step #1. Check Shaft Tolerance
(See Table on Page 1, Step #1)

Step #2. (Fig. 1) Inner Triple Seal
Slide inboard triple seal on shaft. This seal will slide freely into position.

Step #3. (Fig. 2) Adapter Sleeve — Clean Bore & O. Dia.
Position adapter sleeve on shaft, threads outboard as indicated, to approximate location with respect to required bearing centerline. Micronized or powdered (not flaked) graphite or light oil applied to the sleeve outside diameter surface, results in easier mounting and removal.

Step #4. (Fig. 4) Clean Bearing Bore
Mount bearing on adapter sleeve, starting with the large bore of the inner ring to match the taper of the adapter. With the bearing hand tight on the adapter, locate bearing to the proper axial position on the shaft. (Do not apply lockwasher at this time because drive up procedure may damage lockwasher.)

Step #5. (Fig. 5) Locknut
Apply the locknut with chamfered face toward the bearing after lubricating the face of the locknut next to the bearing. Hand tighten the nut with a spanner wrench until the adapter sleeve can neither be moved axially nor rotated on the shaft. Then with a hammer drive the spanner wrench until the locknut has been turned 90° or ¼ turn on the adapter sleeve. CAUTION: A loose adapter sleeve can lead to the inner ring turning on the adapter sleeve and/or the adapter sleeve turning on the shaft. To insure that the nut is not excessively tight, make certain the outer ring of the bearing rotates freely. When mounting a normal fit bearing, swiveling the outer ring will result in a slight drag. If the bearing is a C3 fit, the outer ring will swivel freely.

Step #6. (Fig. 6) Locknut and Lockwasher
Remove locknut and mount lockwasher on adapter sleeve with inner prong of lockwasher toward the face of the bearing and located in the slot of the adapter sleeve. Reapply locknut until tight. (Do not drive bearing further up the taper as this will reduce the radial internal clearance previously secured.) Find lockwasher tang that is nearest a locknut slot. Bend one of the lockwasher tangs into a slot in the nut. If slot is slightly past tang, don't loosen nut, but tighten to meet a washer tang.

Step #7. (Fig. 12) Outer Triple Seal
Slide outer triple seal onto the shaft. Locate both inner and outer triple seals to match labyrinths in the housing.

Step #8. (Fig. 13) Lower Half of Housing
Remove any paint and burrs from the mating surfaces at the split and thoroughly clean the housings. The vertical hole at the bottom of each enclosure groove must be free of foreign matter. Set lower halves of housings on base and oil the bearing seats. Place shaft with bearings into lower halves of housings, carefully guiding triple seals into the seal grooves and being certain that the bearing outer rings sit squarely in the pillow block bearing seats. Bolt the held housing securely in place. [The free bearing housing(s) will be located and bolted after completing Step #9 and centering the free bearing(s) in the free pillow block bearing seat(s).]

Step #9. (Fig. 14) Stabilizing Ring (If required)
A stabilizing ring should be used only if the bearing is to be held. Move shaft axially so that the stabilizing ring can be inserted between the "held" bearing outer ring and housing shoulder on the locknut side of bearing, where practical. Center all other bearings on one shaft in their housing seats.

NOTE: ***There must be only one "held" bearing per shaft. Other bearing or bearings 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 the triple seal housing groove in place of the triple seal. It is inserted in the lower half of the housing before the upper half is bolted to the base. If grease is used as a lubricant it should be applied before the upper half is secured and in accordance with the Lubrication Notes on back page.*

PURCHASED PARTS

SKF Split Pillow Block Assembly Procedure

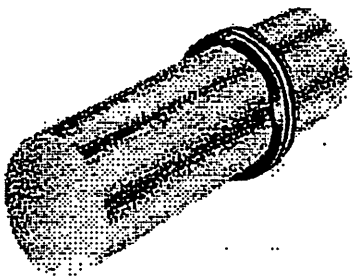


Fig. 1. Inner Triple Seal

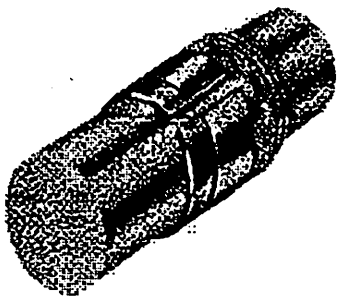


Fig. 2. Adapter Sleeve

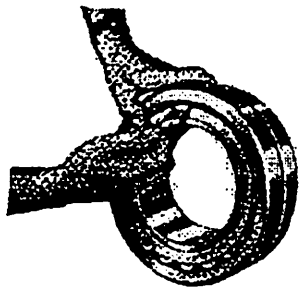


Fig. 3. Unmounted Clearance

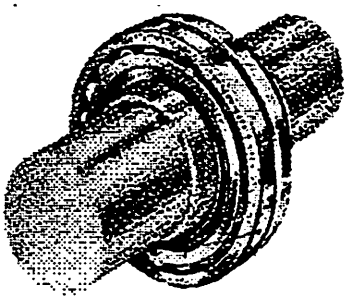


Fig. 4. Bearing

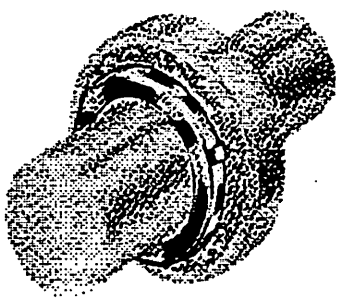


Fig. 5. Locknut

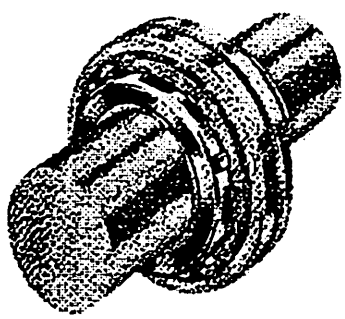


Fig. 6. Locknut & Lockwasher

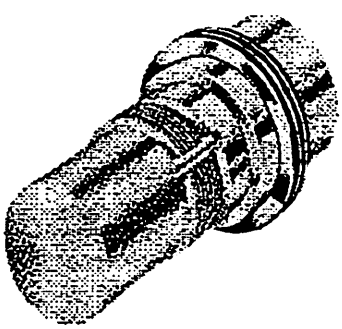


Fig. 7. Inner Triple Seal — Cylindrical Bore

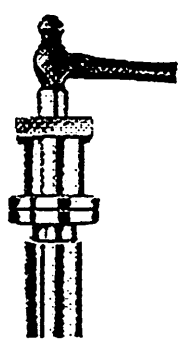


Fig. 8. Press Small Bearing on Shaft

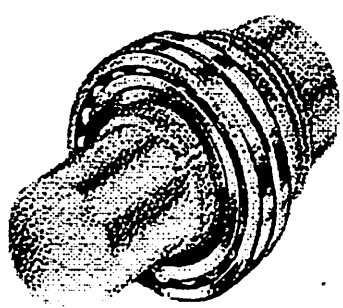


Fig. 9. Bearing w. Cylindrical Bore

PURCHASED PARTS

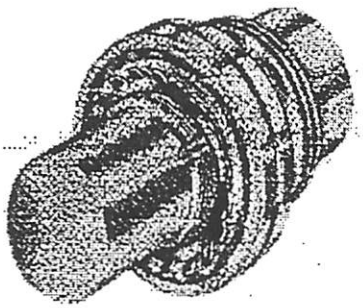


Fig. 10. Lockwasher

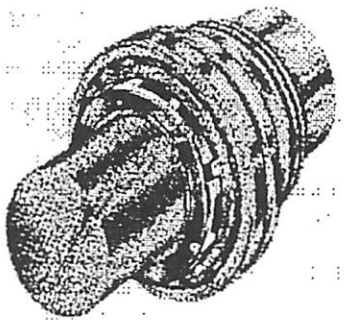


Fig. 11 Locknut on Shaft

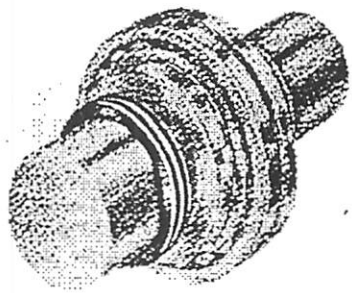


Fig. 12. Outer Triple Seal

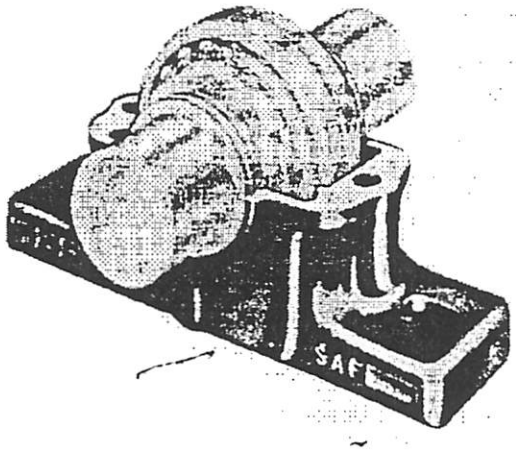


Fig. 13. Lower Half of Housing

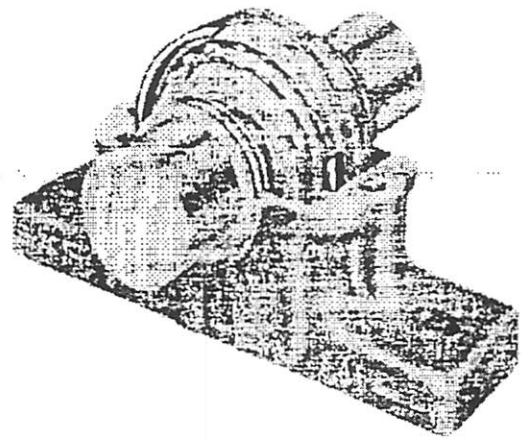


Fig. 14. Stabilizing Ring
(Only for Held Bearing)

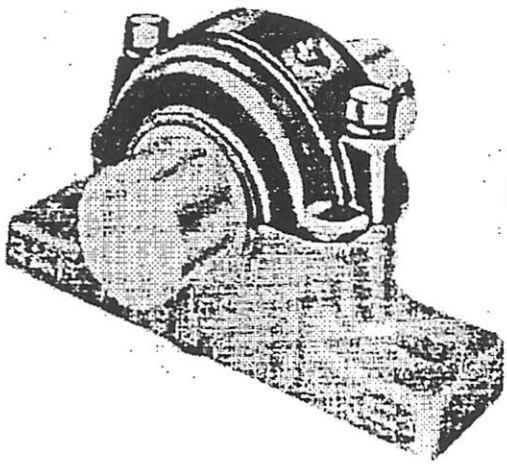


Fig. 15. Upper Half of Housing (CAP)

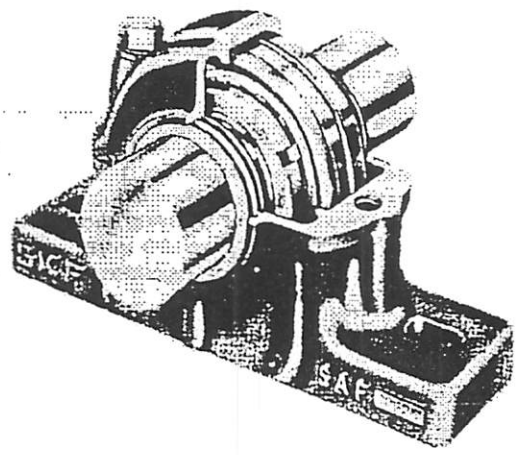


Fig. 16. Cutaway Illustration

Step #10. (Fig. 15) Upper Half of Housing (CAP)
The bearing seat in the upper half of the housing (cap) should be checked for burrs, thoroughly cleaned, oiled and placed over the bearing. Especially with oil lubrication, use of a sealing compound such as Permatex No. 2 at the split surfaces is helpful. Sealing compound must be applied sparingly: wipe a thin film near the outer edges. Excessive amounts are forced not only out but also in between the housing bore and bearing O.D. and this can pinch an outer ring or make a free bearing actually held. The two dowel pins will align the upper half of the housing.

NOTE: *Caps and bases of pillow blocks are not interchangeable. Each cap and base must be assembled with its mating part.*

Lockwashers and cap bolts are then applied and properly torqued to complete the assembly.

If shimming is required, only shims which cover the full mounting surface of the pillow block are recommended.

Step #11. (Fig. 16) Cutaway Illustration
Here a section of the housing has been removed to show the relative position of all the parts.

Assembly Instructions for SKF Self-Aligning Ball or Roller Bearings (Cylindrical Bore Mounting)

NOTE: Do not remove slushing compound from bearing as it will mix with any petroleum grease or oil

Step #1. (Fig. 7) Inner Triple Seal - Cylindrical Bore
Slide inboard triple seal on shaft. This seal will slide freely into position.

Step #2. (Fig. 8) Press Small Bearing on Shaft
To press small bearings on a shaft, fit a clean pipe over the shaft and rest it on the inner ring. Before pressure is applied to the bearing, apply a coat of light oil or micronized graphite to the shaft and bearing bore. Be sure bearing is square on the shaft and then apply pressure using a hammer or an arbor press.

Step #3. (Fig. 9) Bearing with Cylindrical Bore
To mount larger bearings that are not as easily pressed on shaft, heat the bearing to a maximum temperature of 121°C (250°F). Be sure to place supports under the bearing to isolate it from the bottom of the container to prevent overheating the bearing. The bearing may be heated in clean oil or in a 15% emulsion of soluble oil for 30 minutes to one hour depending on bearing size. Alternately a temperature controlled oven may be used to heat the bearing but only long enough to enlarge the bearing bore for mounting and in no case for more than 4 hours. A hot plate may be used to heat the oil bath. In no case should the bearing be heated with an open flame. Mount the bearing on the shaft firmly against the shaft shoulder. Quickly follow through with Steps 4 and 5 to prevent the bearing drawing away from its proper position against the shaft shoulder.

Step #4. (Fig. 10) Lockwasher
Mount lockwasher over threads on shaft with inner prong of lockwasher toward the face of the bearing and located in the slot of the shaft.

Step #5. (Fig. 11) Locknut on Shaft
Apply the locknut with chamfered face toward the bearing. Tighten with a spanner wrench and hammer until the bearing is firmly seated against the shaft shoulder. Bend one of the lockwasher tangs into a slot in the nut. It may be necessary to further tighten the nut in order to engage the lockwasher tang. A very slight movement of the nut will align a slot with a tang.

Step #6. (Fig. 12) Outer Triple Seal
Slide outer triple seal onto the shaft. Locate both inner and outer triple seals to match labyrinths in the housing.

Step #7. (Fig. 13) Lower Half of Housing
Remove any paint and burrs from the mating surfaces at the split and thoroughly clean the housings. The vertical hole at the bottom of each enclosure groove must be free of foreign matter. Set lower halves of housings on base and oil the bearing seats. Place shaft with bearings into lower halves of housings, carefully guiding triple seals into the seal grooves and being certain that the bearing outer rings sit squarely in the pillow block bearing seats. Bolt the held housing securely in place. [The free bearing housing(s) will be located and bolted after completing Step #8 and centering the free bearing(s) in the free pillow block bearing seat(s).]

Step #8. (Fig. 14) Stabilizing Ring (If required)
A stabilizing ring should be used only if the bearing is to be held. Move shaft axially so that the stabilizing ring can be inserted between the "held" bearing outer ring and housing shoulder on the locknut side of bearing, where practical. Center all other bearings on one shaft in their housing seats.

NOTE: *There must be only one "held" bearing per shaft. Other bearing or bearings 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 the triple seal housing groove in place of the triple seal. It is inserted in the lower half of the housing before the upper half is bolted to the base. If grease is used as a lubricant it should be applied before the upper half is secured and in accordance with the Lubrication Notes on back page.*

Step #9. (Fig. 15) Upper Half of Housing (CAP)
The bearing seat in the upper half of the housing (cap) should be checked for burrs, thoroughly cleaned, oiled and placed over the bearing. Especially with oil lubrication, use of a sealing compound such as Permatex No. 2 at the split surfaces is helpful. Sealing compound must be applied sparingly: wipe a thin film near the outer edges. Excessive amounts are forced not only out but also in between the housing bore and bearing O.D. and this can pinch an outer ring or make a free bearing actually held. The two dowel pins will align the upper half of the housing.

NOTE: *Caps and bases of pillow blocks are not interchangeable. Each cap and base must be assembled with its mating part.*

Lockwashers and cap bolts are then applied and properly torqued to complete the assembly.

If shimming is required, only shims which cover the full mounting surface of the pillow block are recommended.

Step #10. (Fig. 16) Cutaway Illustration
Here a section of the housing has been removed to show the relative position of all the parts.

PURCHASED PARTS

Lubrication Notes

GENERAL

The upper half of the housing usually has two tapped holes 30° from the vertical line. One hole is in the center of the housing; the other is to the side. Lubricate through the center hole for spherical roller bearings with W33 feature (with grooves and 3 holes around the outer ring) and lubricate through the side holes for self-aligning ball bearings and spherical roller bearings without W33 feature (without groove and 3 holes around the outer ring.) *THIS IS IMPORTANT! THE LUBRICANT WILL NOT GET TO THE BEARING IF IT IS APPLIED THROUGH THE CENTER HOLE WHEN A BEARING WITHOUT THE GROOVED OUTER RING IS USED.*

GREASE LUBRICATION: If grease is used as a lubricant it should be smeared between the rolling elements and worked in. The lower half of the housing should be packed 1/3 to 1/2 full.

Ball Bearings: Use NLGI[2] grade 2 or 3 channeling grease as shown below.

Roller Bearings: Use NLGI[2] grade 0, 1, 2 or non-channeling grease as shown below.

GREASE CLASSIFICATION

Class	Type of Base[1,9]	Oil Viscosity Centistokes (Approx.) (Saybolt Second Approx.)		NLGI[2] Grade of Grease	
		@ 38°C (100°F)	@ 99°C (210°F)	Ball Bearings	Roller Bearings
A	Lithium, Clay or Synthetic	43-108 (200-500)	8.7-8.8 (48-55)	2	0
B	Lithium, Clay or Synthetic	86-130 (400-600)	8.5-12.4 (50-65)	2 or 3	1
C	Lithium, Clay or Synthetic	173-216 (800-1000)	14.2-16.0 (75-83)	2 or 3	1
D	Lithium, Clay or Synthetic	173-216 (800-1000)	14.2-16.0 (75-83)		2

TYPE OF GREASE & RELUBE CYCLE RECOMMENDED

Operating Temp. of Brg.[4] °C(°F)	Grease Class Requirement (From Above Chart) For Different Speeds[3]						
	Low[5]		Medium		High		
	Ball Bearing	Roller Bearing	Ball Bearing	Roller Bearing	Ball Bearing	Roller Bearing	Suggested[6,10] Relube Cycle
-18° to 21° C (0° to 70° F)	A	A or B[7]	A	A or B			6 - 12 months
21° to 49° C (70° to 120° F)	A	B or C[7]	A	B or C			6 - 12 months
49° to 71° C (70° to 120° F)	B or C[7]	B or C[7]	B or C	C or D	C	D[8]	2 - 3 weeks
71° to 82° C (160° to 180° F)	C	C	C	C or D	C	D[8]	1 - 4 weeks

[1] Calcium Complex Greases Not Recommended

[2] National Lubricating Grease Institute Consistency Code

[3] Definition of speed categories:
- Low — Up to ¼ of catalog speed rating for static oil lubrication
- Medium — ¼ to ½ catalog speed rating for static oil lubrication
- High — ½ to full catalog speed rating for static oil lubrication

[4] Consult SKF Applications Engineering if temperature is below -18°C (0°F) or above 82°C (180°F).

[5] Extremely slow speed, will require special consideration if loads are high.*

[6] Clean-Dry application only.
For moderate conditions of dirt and/or moisture use cycle of 1 to 2 months.
For extreme conditions of dirt and/or moisture, use cycle of 1 week.
Vertical applications normally require shorter than normal relube cycles.

[7] Use class "C" where load is heavy, 15,000 hours rating life or less and/or speeds are less than 100 rpm.

[8] Consult SKF Applications Engineering-Grease lube not normally recommended under this combination of operating conditions.

[9] Never mix greased with unlike bases.

[10] Remove old grease at least once a year.

*Under all conditions, application should be checked using the Life Adjustment Factor for Lubrication found in the SKF Engineering Data or A Guide to Better Bearing Lubrication.

OIL LUBRICATION: If oil is used as a lubricant and the bearing operating conditions are not known, it is a good rule to select an oil that will have at least the following viscosities at the operating temperature.

Ball Bearings: 13 Centistokes (70 Saybolt Sec.)

Spherical Roller Bearings: 20 Centistokes (100 Saybolt Sec.)

It should be kept in mind that the above recommendations are general and if bearings are required to operate over a wide range of temperatures and under various combinations of speeds and loads, a reputable lubricant manufacturer should be consulted.

Static Oil Lubrication: When oil lubrication is used, pillow blocks can be furnished with fittings to control the proper oil level. Additional oil should be added as required.

Static Oil Lubrication

1. Use only highest quality mineral oil.
2. Use oil with minimum viscosity of 20 cSt (100 SUS) at the bearing operating temperature.**
3. The static oil level to be at the center of the lower most rolling element. **(DO NOT OVER FILL.)**
4. Static oil operating temperature should not exceed 82°C (180°F). If temperature exceeds 82°C (180°F) consult SKF Applications Engineering.
5. Complete lubricant change should be made annually — more frequent if contamination or heat is severe.

**Under all conditions, application should be checked using the Life Adjustment Factor for Lubrication found in the SKF Engineering Data or A Guide to Better Bearing Lubrication.

Circulating Oil: If circulating oil is used as a lubricant and a W33 bearing is used, (with groove and 3 holes around outer ring) entry can be made through the center hole in the cap. The exit of lubricant should be made from both sides of the lower half of the block, to prevent possible flooding, or too much lubricant accumulating in the bearing housing.

If circulating oil is used as a lubricant and a bearing other than W33 type is used, (without groove and 3 holes around the outer ring) entry and exit of the lubricant should be on opposite sides of the bearing. The exit in the lower half of the block should be larger than supplied with the standard pillow block, to prevent possible flooding or too much lubricant accumulating in the housing.

CAUTION: *Do not over lubricate bearings as too much lubricant will result in higher than normal temperature.*

For further assistance consult SKF Applications Engineering.

PURCHASED PARTS

SKF USA Inc., 1200 First Avenue, King of Prussia, PA 19406-1352

Reg. No. 473 12/761 ATI/PI7677-42M-12/89 Printed in U.S.A.

PROCEDURE FOR MEASURING RADIAL CLEARANCE IN SKF SPHERICAL ROLLER BEARINGS

I. IMPORTANCE OF RADIAL INTERNAL CLEARANCE

Radial internal clearance is defined as the total distance through which one bearing ring can move radially relative to the other. Clearance is important in spherical roller bearings because, for the vast majority of applications, sphericals require radial clearance to be present within the bearing for proper functioning. Distinguishing between mounted and unmounted clearance is also important. When either ring is mounted with an interference fit, the bearing's internal clearance is reduced. In the case of tapered bore bearings, it is this reduction in clearance that is used to determine when the inner ring has been driven up the journal sufficiently and the proper interference fit established.

There are two main reasons for measuring the radial internal clearance in spherical roller bearings. These are:

1. Inspection: Verify that the internal clearance in the bearing is within the manufacturer's specification.

2. Mounting: Determination of starting clearance and clearance reduction when mounting.

    a) Initial reading taken with the bearing on the journal prior to drive up.

    b) Readings taken during the drive up procedure to determine when drive up is complete.

The inspection reading is strictly a verification of the correctness of manufacture by checking if the proper clearance is indeed present in the bearing. In order to do this, the bearing clearance should be measured with the bearing upright on a flat surface, as this is the way the clearance is verified in the factory.

For smaller bearings (bore diameter of 200 mm or less), an inspection reading taken on a flat bench may be assumed to be equal to the reading taken with the bearing suspended from the journal. With larger bearings, particularly those of the thinner series, this assumption may not be valid. When a large bearing sits upright, both the inner and outer rings sag and deform under their own weight. Since both rings deflect in the same direction, the effect of the deflection of one ring on internal clearance tends to be negated by the deflection of the other. However, when the bearing is suspended from a journal, the inner ring is prevented from sagging by the journal. The result is that measurements taken on bearings suspended from journals may be many thousandths of an inch greater than those taken with bearing standing on a bench. This means that the assumption that bench inspection clearance is equal to undriven mounted clearance is incorrect for larger bearings.

Therefore, neither the inspection nor initial mounted rating may be ignored. The internal clearance of the bearing should be verified as to its correctness with the bearing sitting upright and the clearance should also be taken once the bearing is placed on the journal prior to drive up. Both of the readings are important but are taken for two different reasons.

II. BENCH (INSPECTION) MEASUREMENT PROCEDURE

1. Place bearing on clean, flat surface.
2. Unwrap bearing. Protective slush need not be removed.
3. Oscillate the inner ring circumferentially to seat lowermost rollers.
4. Align the inner and outer rings so that side faces are aligned.
5. Alternately push top dead center rollers of both rows back and forth to free up the roller in the cage pocket and center the guide ring. (Appropriate for bearings with bore diameter greater than 200 mm.)
6. Select feeler blade with thickness approximately equal to minimum value of clearance range.
7. Blade length must be longer than roller.
8. With one roller at top dead center of the bearing, place feeler blade between rollers and attempt to pass it between the top dead center roller and the outer ring.
9. Measure only one row at a time.
10. Use a slight sawing motion with the blade while pushing it over the roller.
11. While sawing the blade over the roller, apply slight pressure to the end of the top dead center roller to keep it centered.
12. Gradually increase the thickness of the blade until a thickness is reached that will not pass between the roller and ring.
13. For most accurate readings, repeat the procedure for the other row and at several other places around the bearing. All readings should be taken at the top dead center (12 o'clock) position.
14. For very large, thin bearings (series 238 and 239), the use of a dial indicator with magnetic base is recommended. Place the base on the inner ring and the indicator over the top dead center roller. As feeler blade thickness is increased, a large jump in indicator reading will indicate when ring deflection occurs rather than blade passing cleanly through the clearance.

III. INITIAL PRE-DRIVE UP CLEARANCE MEASUREMENT PROCEDURE

For bearings with bore diameter less than 8", the initial internal clearance with the bearing suspended from the journal but prior to drive up may be assumed to be equal to the bench clearance.

For all other bearings, the initial clearance must be taken once the bearing has been placed on the journal. Two options exist:

Option 1 (Preferred): Using a small jack (hydraulic or pneumatic or mechanical) and a block of wood placed between the jack and the bearing, raise the bearing outer ring and measure clearance as is specified for the bench inspection procedure.

Option 2: Measure clearance between the lowermost roller and the outer ring. The same basic procedure applies except that additional force will be required to pass the feeler blade between the roller and outer ring because the roller weight will resist the passage of the blade.

Regardless of the option used, the bearing is then driven up the journal until the specified minimum amount of clearance is removed. Estimates of axial drive up distance, clearance removal figures and initial bench clearance may be found on SKF publication 310-890, "*Recommended Clearance Reduction Values For Tapered Bore Spherical Roller Bearings.*"

The bearing should be driven up the journal slowly with the aim of removing the minimum amount of clearance as stated on SKF publication 310-890. When the bearing is believed to have been driven up the journal sufficiently, the clearance should then be rechecked by the same person using the same method. Calculate the amount of clearance removed from the bearing. Assuming that the clearance removed is equal to or slightly greater than the minimum amount specified, the drive up procedure is complete.